PJM Update to ISAC

Suzanne Glatz,

Director Strategic Initiatives &Interregional Planning

Presented to Independent State Agencies Committee (ISAC)

November 22, 2021

PJM©2021

Agenda

- Reliability
- Generation Deactivation
- Market Efficiency

PJM©2021

2021 RTEP

PJM©2021

2021 Proposal Window 1

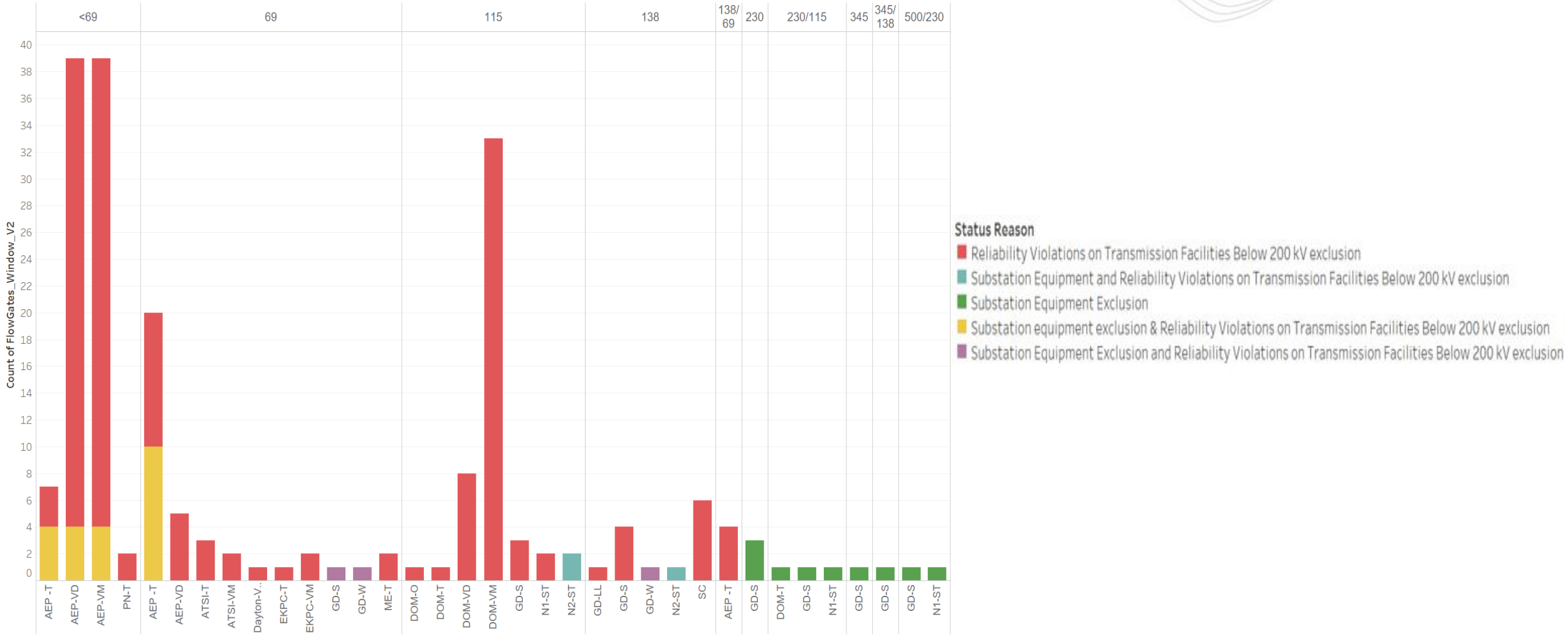
PJM©2021

2021 RTEP Window 1

- Window opened on 7/02/2021
- Window closed on 8/31/2021
- For this Window, PJM seeks technical solutions, also called proposals, to resolve potential reliability criteria violations on facilities identified below in accordance with all applicable planning criteria (PJM, NERC, SERC, RFC, and Local Transmission Owner criteria).
- 57 total proposals submitted from 10 different entities
  - 21 Greenfield
  - 36 Upgrades
- Cost Estimates: Approximate range from $600K to $136M
- 15 Proposals identified with Cost Containment
- 577 flowgates were addressed

PJM©2021

2021 RTEP Window 1 Exclusions Chart



PJM©2021

2021 RTEP Re-tool

- PJM has reviewed changes which have occurred since the original 2021 RTEP violations were identified
- The significant changes include, deactivations, withdrawal of deactivations, and execution of Interconnection Service Agreements by Interconnection Customers
- The re-tool has resulted in some changes to results, reducing and eliminating the violations previously identified – all changes have been posted in an update on the Competitive Planning page
  - One item of note is that flowgate GD-S30 was eliminated – this is specifically called out here as there were 10 proposals received that will not be evaluated for this flowgate, and there was a potential interaction with the Market Efficiency window
  - A review of these proposals in relation to the Market Efficiency window will continue

PJM©2021

Proposal Window 1 – Status of evaluation by Cluster

- PJM presented the results of the analysis and evaluation of the proposals for majority of posted violations
- Project recommendations are included in the Appendix for the recommended solutions.
- One flowgate from Proposal Window 1 (Cluster 7) was eliminated
- Project Details provided in Appendix A of this presentation
- Initial review & Screening for clusters are posted on the TEAC page

https://www.pjm.com/committees-and-groups/committees/teac.aspx

PJM©2021

2021 Proposal Window 2

PJM©2021

ComEd Transmission Zone: 2026 Winter Sensitivity

- FGs GD-W193 and GD-W194 were placed on hold in the 2021 Window 1 as generator deactivations in ComEd not originally included in the 2026 case would relieve the overloads
- As part of a re-tool, PJM evaluated the impacts of recent deactivations requests and deactivations request withdrawals in the 2026 winter case
- PJM ran generator deliverability test using the revised 2026 winter case, and the table below shows facilities now overloaded in the updated case:

Fr Bus	Fr Name	To Bus	To Name	CKT	kVs	Areas	ContType	Rate B (MVA)	Rate C (MVA)	Final DC %LD	Final AC %LD	AC Final Flow
274750	CRETE EC ;BP	255112	17STJOHN	1	345	217/222	Single	1557	1772	114.3	118.08	1838.4
270716	DRESDEN ; B	275179	DRESDEN ;1M	1	345/138	222	Breaker	480	530	114.54	117.3	563
275179	DRESDEN ;1M	271337	DRESDEN ; R	1	138	222	Breaker	480	530	114.51	115.13	552.6

- PJM opened a window to address these issues on November 3, 2021 and will close the window on January 12, 2022 (Greater than 60 days due to holiday time period)
- Notice was sent to the TEAC list when window opened and materials are posted

PJM©2021

2021 Proposal Window 3

PJM©2021

PSEG Transmission Zone

- The following violations are identified for PSEG FERC Form 715.

  https://www.pjm.com/-/media/planning/planning-criteria/pseg-planning-criteria.ashx

  – Athenia 230/138 kV transformer 220-1 → Aging
  – Fairlawn 230/138 kV transformer 220-1 → Aging
  – Lawrence 230/69 kV transformer 220-4 → Aging
- PJM opened a window to address these issues on November 3, 2021 and will close the window on December 8, 2021 (Greater than 30 days due to holiday time period)
- Notice was sent to the TEAC list when window opened and materials are posted

PJM©2021

Future 2021 Proposal Window 4

(November 2 TEAC Update)

PJM©2021

PSEG Transmission Zone

- The following violation is identified for PSEG FERC Form 715.
  - Customer load increase in West Windsor area requiring additional source
    - Current source 69kV
    - Loss of ≥20MW for >24 Hours
    - Immediate need due to required in-service date of January 1, 2023
- PJM anticipates opening a window to address these issues on December 2, 2021 and close the window on January 12, 2022 (Greater than 30 days due to holiday time period)
- Notice will be sent to the TEAC list when window is opened and materials are posted

PJM©2021

2021 SAA Proposal Window to Support NJ OSW

PJM©2021

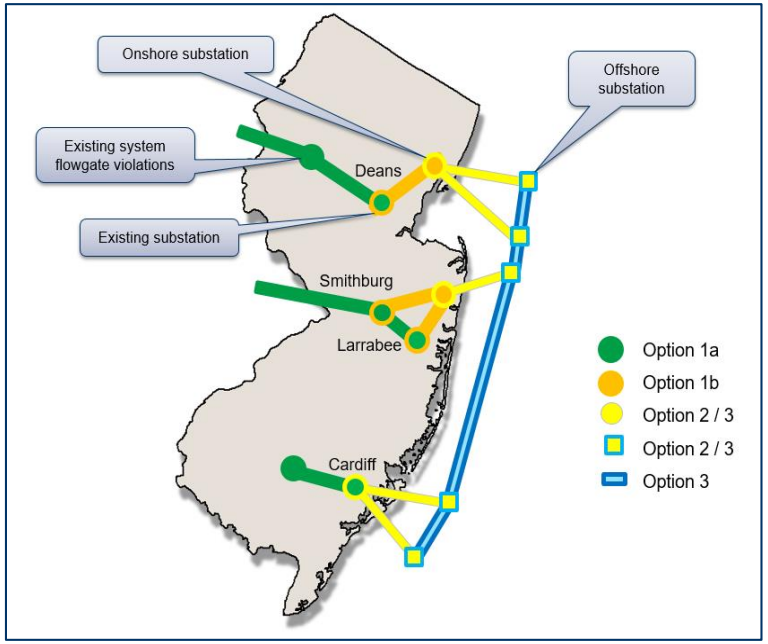
2021 SAA Proposal Window Scope

- Following a request from New Jersey BPU, PJM opened an RTEP proposal window to solicit submissions to build the necessary transmission to meet New Jersey's goal of facilitating the delivery of a total of 7,500 MW of offshore wind through 2035
  - Schedule
    - Open Window April 15
    - Close Window September 17

PJM©2021

Current Status to Review 2021 SAA Proposal Window for NJ OSW

- The proposal window received a robust response from both incumbent and non-incumbent entities
- Proposals span the breadth of the requested submissions - (Option 1a, Option 1b, Option 2, & Option 3)
- Proposals for Option 1a include both upgrades to the existing system as well as greenfield upgrades



Note: Option designations refer to the four portions of the requested proposal as outlined in the *PJM RTEP – 2021 NJ OFFSHORE WIND TRANSMISSION SAA PROPOSAL WINDOW OVERVIEW* document

PJM©2021

Current Status to Review 2021 SAA Proposal Window for NJ OSW

- Proposals received include multiple combinations of the individual proposals which expand the number of possible combinations beyond the number of proposals received

- NJBPU has issued a guidance document indicating certain processes which will be employed going forward during evaluations – This document can be found on the NJBPU website (link below), is referenced in the notice to the TEAC on 9/24, and is also contained in the non-encrypted link for materials associated with the window on PJM's competitive planning page

NJBPU guidance document: https://www.nj.gov/bpu/pdf/ofrp/SAA%20Process%20Overview.pdf

PJM©2021

Current Status to Review 2021 SAA Proposal Window for NJ OSW

- Proposal evaluations are ongoing and additional details are expected to be available for the November TEAC
- Total number of individual proposals received: 80
- Total number of proposals with Cost Commitment provisions: 57

	Option 1a	Option 1b	Option 2	Option 3
Number of proposals addressing individual options	45	22	26	8

PJM©2021

Entities That Provided Proposals for 2021 SAA Proposal Window for NJ OSW

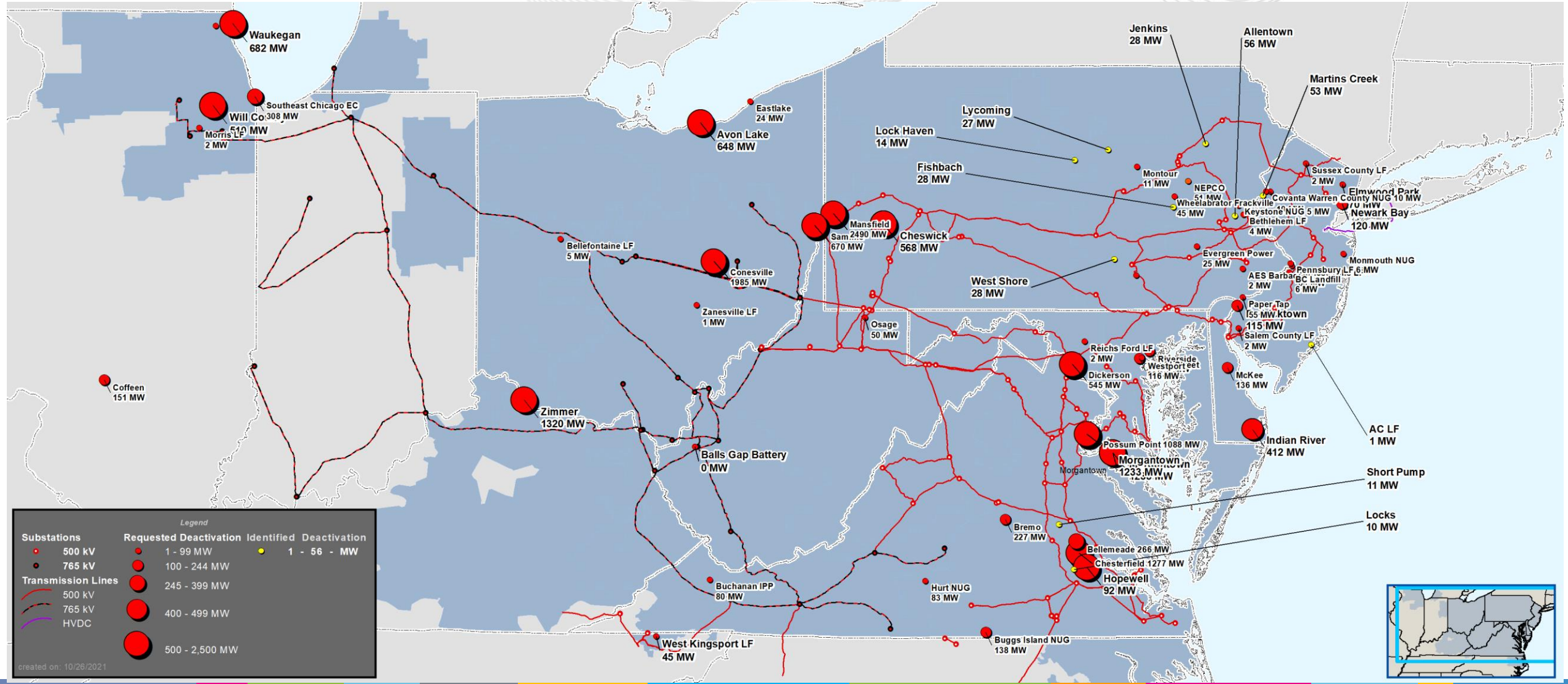
- Anbaric Development Partners, LLC
- Atlantic City Electric Company
- Atlantic Power Transmission (APT), a Blackstone Infrastructure Partners portfolio company
- Con Edison Transmission, Inc.
- Jersey Central Power & Light Company
- LS Power Grid Mid-Atlantic, LLC
- Mid-Atlantic Offshore Development, LLC, a joint venture of EDF Renewables North America (EDFR) and Shell New Energies US, LLC (Shell New Energies)
- NextEra Energy Transmission MidAtlantic Holdings, LLC
- Outerbridge New Jersey, LLC, a subsidiary of Rise Light & Power, LLC
- PPL Electric Utilities
- PSEG Renewable Transmission LLC and Orsted N.A. Transmission Holding, LLC
- Public Service Electric & Gas Company
- Transource Energy, LLC

PJM©2021

Generation Deactivation Notification Update

PJM©2021

Generation Deactivation Announcements 2018-2021



PJM©2021

Deactivation Status

Unit(s)	Transmission Zone	Requested Deactivation Date	PJM Reliability Status
Pedricktown - 115.3 MW	AEC	5/31/2022	Reliability analysis complete. New baseline resolves identified impact. Units can retire as scheduled.
Newark Bay - 120.2 MW	PSEG	5/31/2022	
Zimmer 1 - 1320 MW	DEOK	5/31/2022	Reliability analysis complete. New and existing baselines resolve identified impacts. Unit can retire as scheduled.
Glendon LF- 1.3 MW	METED	12/01/2021	Reliability analysis complete. No reliability violation identified.
AC Landfill 1 and 2- 2.9 MW	ACE	12/09/2021	Reliability analysis underway

PJM©2021

PECO Transmission Zone

Problem Statement: Generation Deliverability Violation – Pedriktown and Newark Deactivations

- Thermal violation: Croydon – Burlington 230 kV line
- Contingency: N-2

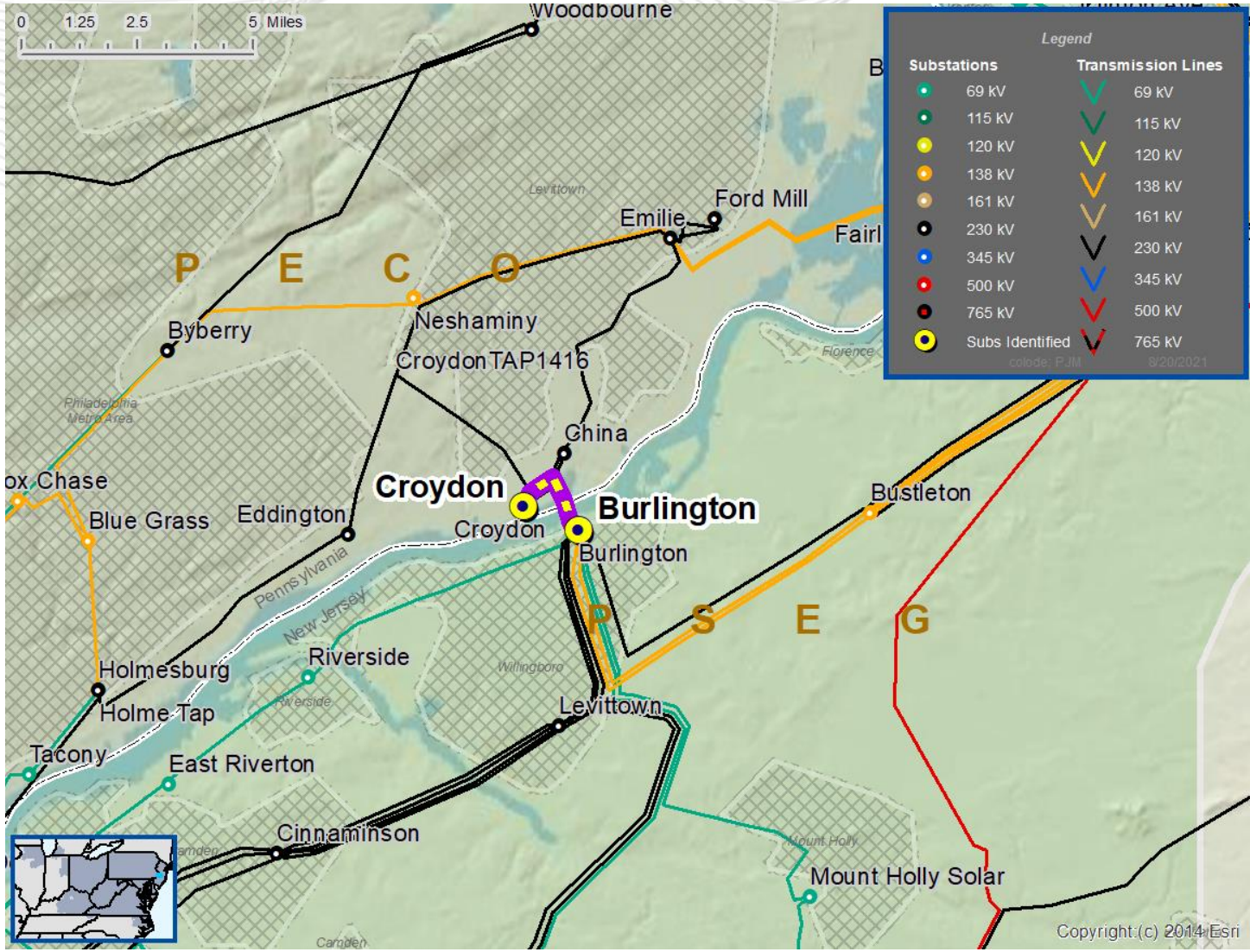
Recommended Solution:

- New baseline b3335 – New baseline b3335 – Reconductor a 0.76 mile portion of the Croydon-Burlington 230 kV line
- Current Rating: 752 MVA SN/ 906 MVA SE
- New Rating: 851 MVA SN/ 995 MVA SE

Estimated Cost: $ 500K
Required IS Date: 06/01/2022
Projected IS Date: 06/01/2023

Required IS Date: 06/01/2022

* Operating measures identified to mitigate reliability impacts in interim.



Deactivation Status

Unit(s)	Transmission Zone	Requested Deactivation Date	PJM Reliability Status
AC Landfill 1 and 2 -2.9 MW	ACE	12/9/2021	Reliability analysis complete. No reliability violation identified.
WILLIAMSPORT 1 and 2 - 26.6 MW	PPL	4/1/2022	Reliability analysis complete. No reliability violation identified.
WEST SHORE 1 and 2 -28 MW	PPL	4/1/2022	Reliability analysis complete. No reliability violation identified.
MARTINSC 1,2, and 3 - 57.3 MW	PPL	6/1/2022	Reliability analysis complete. No reliability violation identified.
LOCKHAVEN 1 -14 MW	PPL	4/1/2022	Reliability analysis complete. No reliability violation identified.
JENKINS 1 and 2 -17.6MW	PPL	4/1/2022	Reliability analysis complete. No reliability violation identified.
HARRISBURG 1,2 and 3 -41.1.MW	PPL	6/1/2022	Reliability analysis complete. No reliability violation identified.
FISHBACH 1 and 2 -28MW	PPL	4/1/2022	Reliability analysis complete. No reliability violation identified.
ALLENTOWN 1,2,3, and 4 -56MW	PPL	6/1/2022	Reliability analysis complete. No reliability violation identified.

PJM©2021

Deactivation Status

Unit(s)	Transmission Zone	Requested Deactivation Date	PJM Reliability Status
ROCKVILLE DIESEL -4MW	Dominion	6/1/2023	Reliability analysis complete. No reliability violation identified.
LANIER DIESEL -7MW	Dominion	6/1/2023	Reliability analysis complete. No reliability violation identified.
WEAKLEY DIESEL-7MW	Dominion	6/1/2023	Reliability analysis complete. No reliability violation identified.
DINWIDDIE DIESEL-3MW	Dominion	6/1/2023	Reliability analysis complete. No reliability violation identified.

PJM©2021

Market Efficiency Update

PJM©2021

2020/21 Long-Term Window 1

PJM©2021

2020/21 Long-Term Window 1 - Retooled ME Base Case

- The retooled Market Efficiency economic model for the 2020/21 Long-Term Window 1 has been posted on the Market Efficiency secure page.
  - Retooled market efficiency base case files for all study years, (XML format compatible with PROMOD 11.3).
  - Updated FSA sensitivity.

- Retooled data include
  - Updated Generation Expansion Plan
    - Recently requested generator deactivations, including the deactivation withdrawals of Byron and Dresden units.
    - Updated queued generator status changes (withdrawals, suspension or execution of Interconnection Service Agreements).
  - Powerflow Updates
    - Implemented network upgrades associated with the changes to the Generation Expansion Plan.
  - Event file Updates
    - Updated reactive interface ratings based on PV Analysis on the 2026 RTEP load flow cases.
    - Added couple of flowgates identified during analysis of proposals.

PJM©2021

Cluster Analysis Status

- Cluster No. 1 (APS) - French's Mill to Junction 138 kV
  - Analysis in progress.
- Cluster No. 2 (PECO) - Plymouth Meeting to Whitpain 230 kV
  - Analysis completed: Proposal 704, terminal equipment upgrades at the Plymouth Meeting and Whitpain 230 kV substations, selected as the preferred solution.
- Cluster No. 3 (PPL) - Juniata to Cumberland 230 kV
  - Analysis completed: Proposal 218, reconductor the Juniata-Cumberland 230 kV line, selected as the preferred solution.
- Cluster No. 4 (DOM) - Charlottesville to Proffit 230 kV
  - Constraint was posted as a reliability violation but eliminated after the re-tool.
  - The reliability proposals received for the Charlottesville to Proffit 230 kV violation were also reviewed for market efficiency benefits.
  - Analysis completed: Proposal 651, series reactor on the Charlottesville-Proffit 230 kV line, selected as the preferred solution.

PJM©2021

2020/21 Long-Term Window
1st Read

PJM©2021

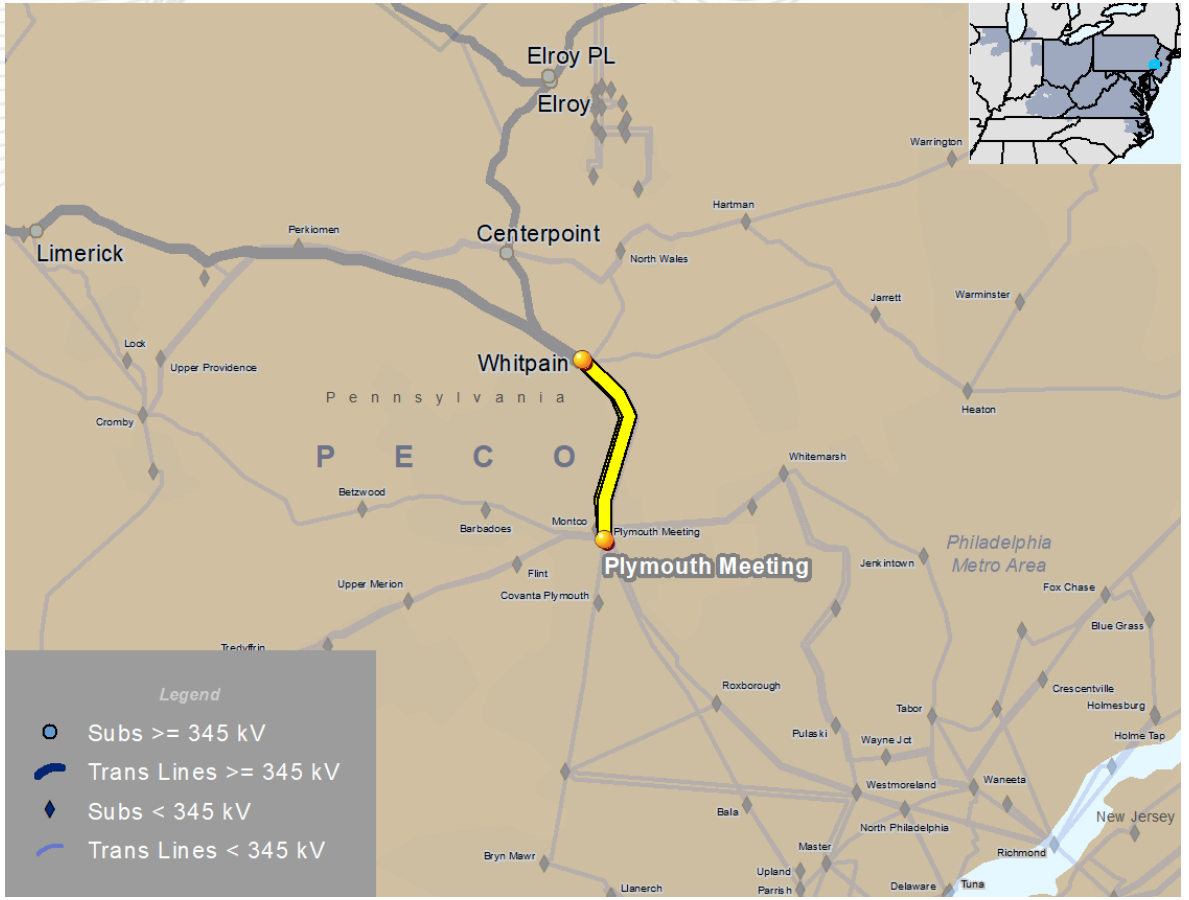
Cluster 2: Plymouth Meeting - Whitpain 230 kV (PECO)

- Completed comprehensive analysis considering economic benefits, reliability and operational impacts of the proposals.
- Proposal 704, terminal equipment upgrades at the Plymouth Meeting and Whitpain 230 kV substations, selected as the preferred solution:
  - Highest B/C Ratio: 75.30
  - Lowest Cost: $0.62 million
  - Addresses the target congestion
  - Passes all PROMOD sensitivity scenarios
  - Reliability analysis has been completed and no reliability violations identified
- PJM staff intends to submit Proposal 704 to be approved by the PJM Board for inclusion in the Regional Transmission Expansion Plan.

PJM©2021

Proposal No. 704 (Plymouth-Whitpain 220-13, 220-14 Terminal Upgrades)

Project ID: 202021_704
Proposed Solution: Replace station conductor and metering inside Whitpain and Plymouth substations.
Project Type: Upgrade
kV Level: 230 kV
In-Service Cost ($M): $0.62
In-Service Year: 2025
B/C Ratio = 75.30
Target Zone: PECO
ME Constraints: Plymouth Meeting to Whitpain 230 kV
Notes: Redacted Public Proposal 704



PJM©2021

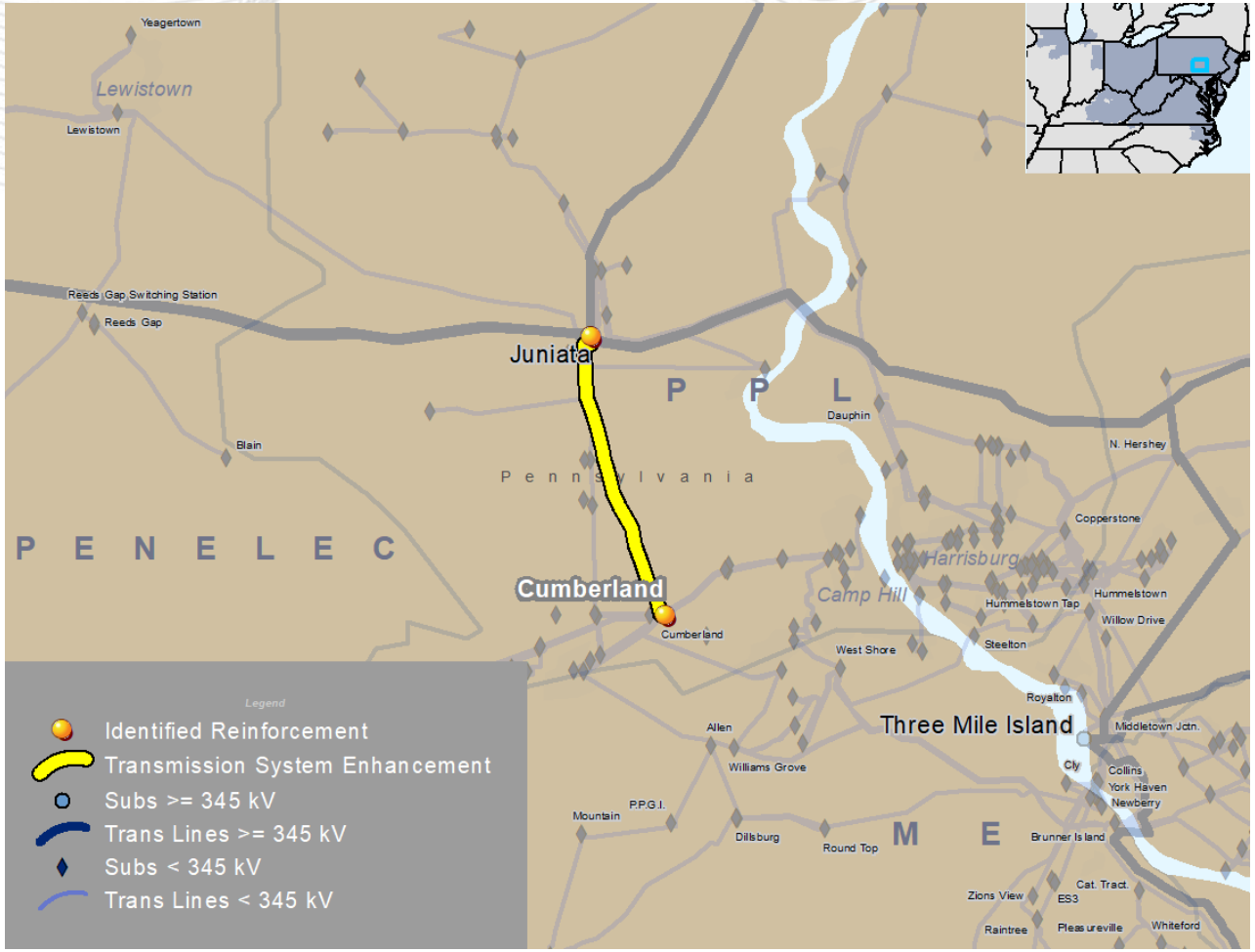
Cluster 3: Juniata-Cumberland 230 kV (PPL)

- Completed comprehensive analysis considering economic benefits, reliability and operational impacts of the proposals.
- Proposal 218, reconductor the Juniata-Cumberland 230 kV line, selected as the preferred solution:
  - High B/C Ratio: 11.28
  - Low Cost: $9.00 million
  - Fully addresses the target congestion driver Juniata-Cumberland 230 kV
  - Passes all PROMOD sensitivity scenarios
  - Reliability analysis has been completed and no reliability violation identified
- PJM staff intends to submit Proposal 218 to be approved by the PJM Board for inclusion in the Regional Transmission Expansion Plan.

PJM©2021

Proposal No. 218 (Juniata - Cumberland 230 kV Line Reconductor)

Project ID: 202021_218
Proposed Solution: Reconductor the Juniata - Cumberland 230kV line.
Project Type: Upgrade
kV Level: 230 kV
In-Service Cost ($M): $9.00
In-Service Year: 2023
B/C Ratio = 11.28
Target Zone: PPL
ME Constraints: Cumberland to Juniata 230 kV
Notes: Redacted Public Proposal 218



PJM©2021

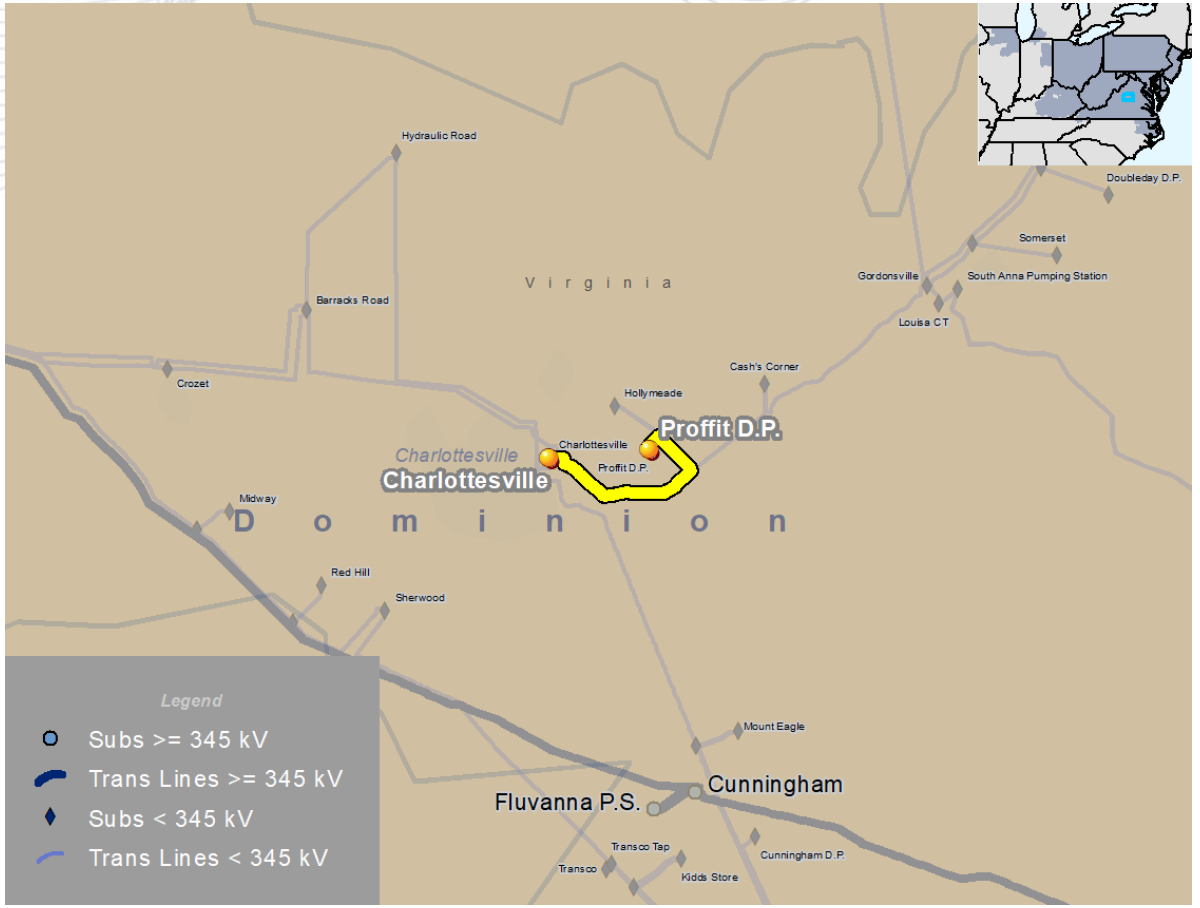
Cluster 4: Charlottesville-Proffit 230 kV (DOM)

- Completed comprehensive analysis considering economic benefits, reliability and operational impacts of the proposals.
- Proposal 651, series reactor on the Charlottesville-Proffit 230 kV line, selected as the preferred solution:
  - High B/C Ratio: 16.05
  - Low Cost: $11.38 million
  - Fully addresses target congestion driver Charlottesville-Proffit 230 kV
  - Passes all PROMOD sensitivity scenarios
  - Reliability analysis has been completed and no reliability violation identified
- PJM staff intends to submit Proposal 651 to be approved by the PJM Board for inclusion in the Regional Transmission Expansion Plan.

PJM©2021

Proposal No. 651 (Series Reactor Charles - Proffit)

Project ID: 202021_651
Proposed Solution: Install series reactor on the Charlottesville – Proffit Rd. 230 kV line.
Project Type: Upgrade
kV Level: 230 kV
In-Service Cost ($M): $11.38
In-Service Year: 2023
B/C Ratio = 16.05
Target Zone: DOM
ME Constraints: Charlottesville to Proffit Rd Del Pt 230 kV
Notes: Redacted Public Proposal 651



PJM©2021

Next Steps

- Finalize analysis for Cluster No. 1 (APS) - French's Mill to Junction 138 kV.
- 2nd read for Clusters No. 2 (PECO), No. 3 (PPL), and No. 4 (DOM).
- Final recommendation to the PJM Board for review and approval.
- Appendix B includes detail of all proposals and B/C analysis

PJM©2021

Contact

SME/Presenter:
Sue Glatz,
Suzanne.Glatz@pjm.com

Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com

PJM©2021

Appendix A
Reliability Projects Proposal Window 1

PJM©2021

First Read

Baseline Reliability Projects

PJM©2021

ATSI Transmission Zone: Baseline
Hayes 345/138 kV xfmr#2

Process Stage: First Read

Criteria: Generation Deliverability

Assumption Reference: 2026 RTEP assumption

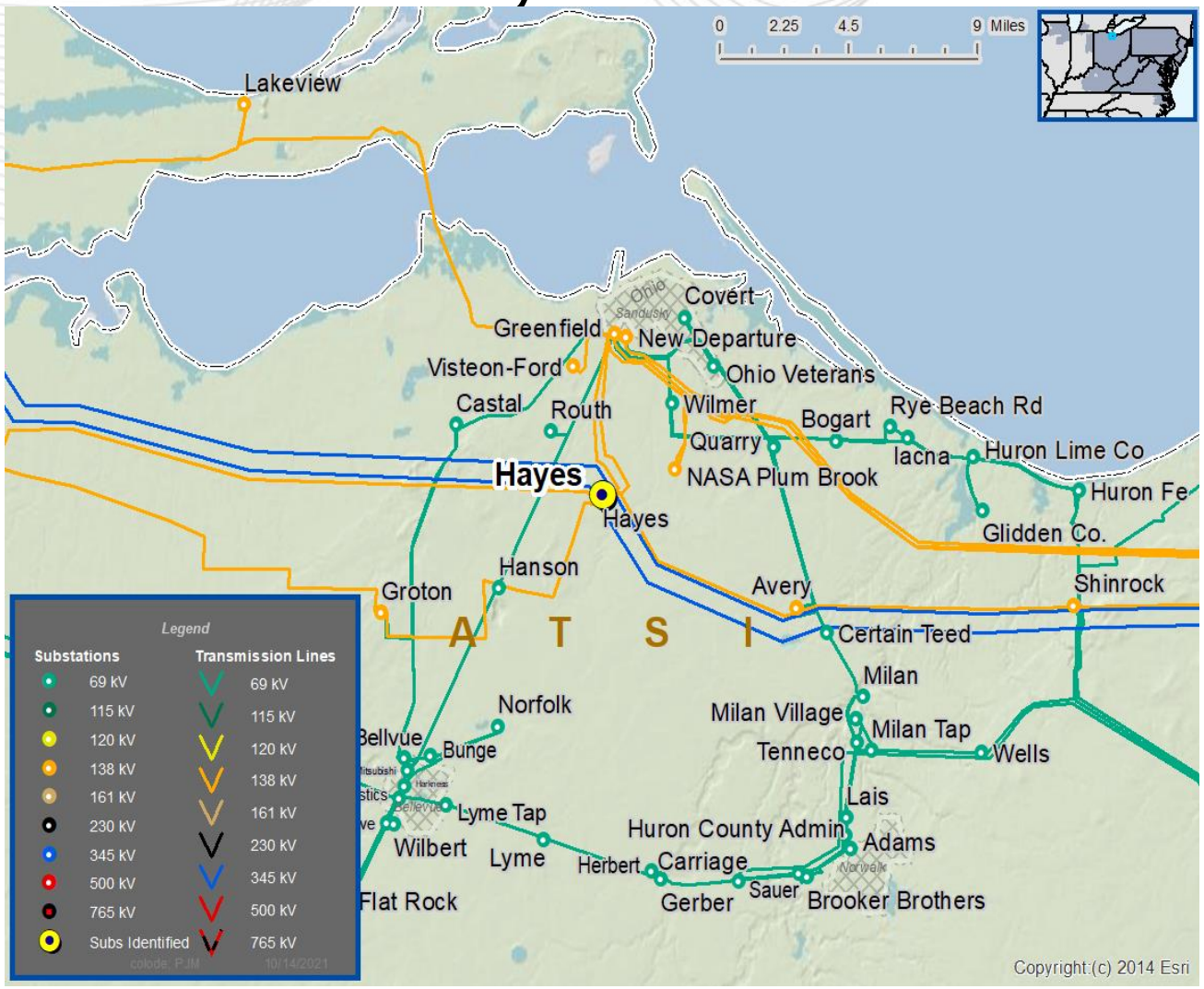
Model Used for Analysis: 2026 RTEP Summer case

Proposal Window Exclusion: None

Problem Statement:

GD-S712

In 2026 RTEP summer case, the Hayes 345/138 kV xfmr # 1 is overloaded due to a tower contingency.



PJM©2021

ATSI Transmission Zone: Baseline

Hayes 345/138 kV Tr#2

Proposed solution:

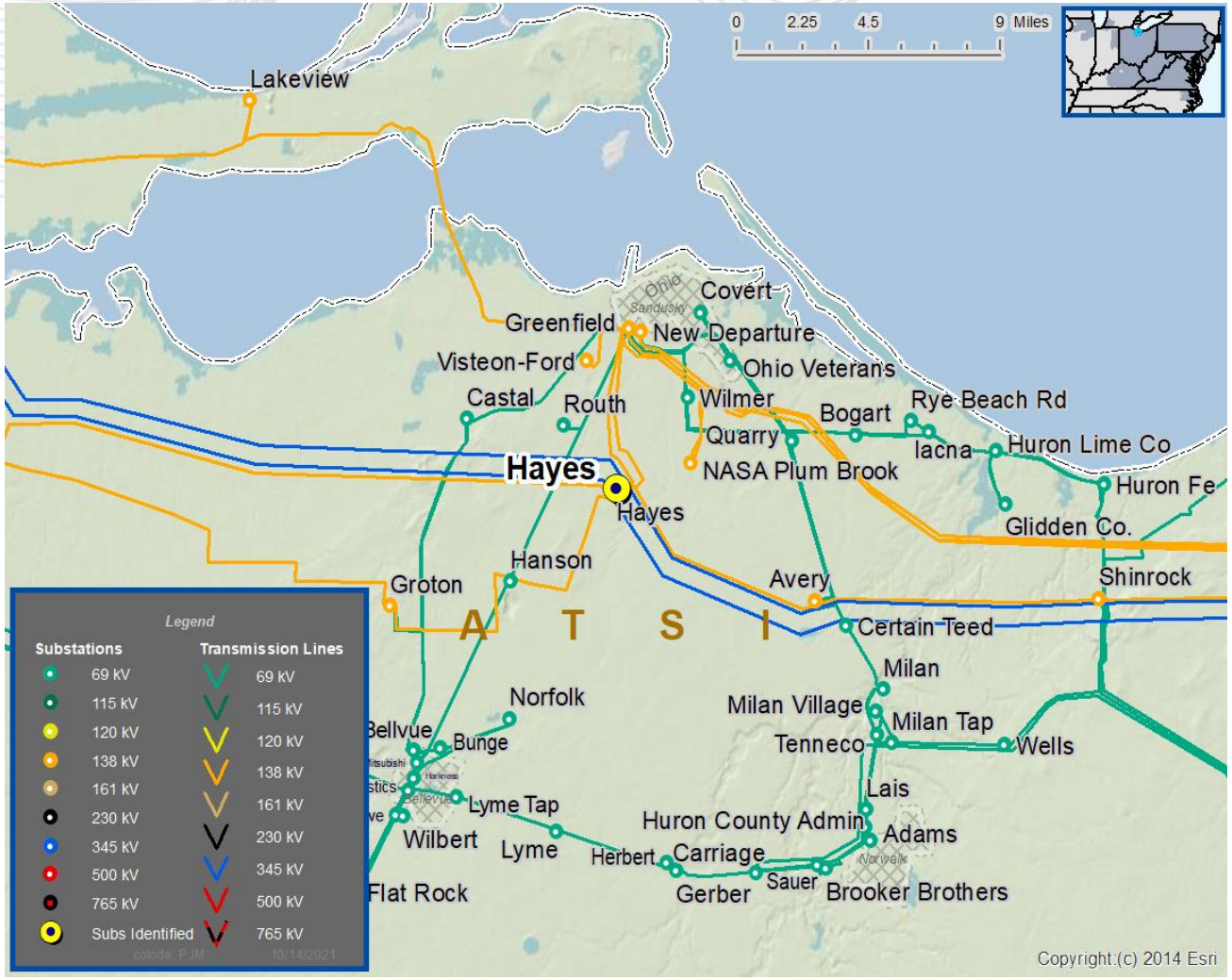
Install a second 345/138 kV transformer at Hayes, 448 MVA nameplate rating. Add one 345 kV circuit breaker (3000A) to provide transformer high side connection between breaker B-18 and the new breaker. Connect the new transformer low side to the 138 kV bus. Add one 138 kV circuit breaker (3000A) at Hayes 138 kV substation between B-42 and the new breaker. Relocate the existing 138 kV No. 1 capacitor bank between B-42 and the new breaker. Protection Per FE standard.

Additional Benefits: Mitigates the thermal overload on the Hayes No1 345/138 kV Transformer and provides additional capacity.

Total Estimated Cost: $7.59M

Required IS Date: 06/01/2026

Projected IS Date: 06/01/2026



PJM©2021

AEP Transmission Zone: Baseline
Delphos Area

Process Stage: First Read

Criteria: AEP FERC 715 Criteria

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP cases

Proposal Window Exclusion: None

Problem Statement:

AEP -T15, AEP -T16, AEP -T17, AEP -T18, AEP -T19, AEP -T20, AEP -T21, AEP -T22, AEP -T23, AEP -T24, AEP -T25, AEP -T26, AEP -T27, AEP -T28, AEP -T47, AEP -T48, AEP -T49, AEP -T50, AEP -T51, AEP -T52, AEP -T53, AEP -T54, AEP -T55, AEP -T56, AEP -T57, AEP -T58, AEP -T73, AEP -T74, AEP -T75, AEP -T76

In 2026 RTEP summer, winter and light load cases, the North Delphos – East Delphos 69kV line and the East Delphos – Elida Road 69kV line are overloaded for multiple N-1-1 contingency pairs. The North Delphos – East Delphos 69kV line and the Delphos – South Delphos are overload for a N-1-1 contingency pair.

Branch	SN/SE/WN/WE (MVA)
05N DELPHO – 05E DELPHO 69KV	46/46/56/56
05E DELPHO – 05ELIDA ROAD 69KV	46/46/56/56
05DELPHO – 05S DELPHO 69KV	50/50/63/63
05N DELPHO – 05S DELPHO 69KV	54/54/76/76

SN / SE / WN / WE: Summer Normal / Summer Emergency / Winter Normal / Winter Emergency

PJM©2021

AEP Transmission Zone: Baseline
Delphos Area

As part of the 2021 RTEP Window #1, the projects listed in the table below are proposed to address the following violations: AEP -T15, AEP -T16, AEP -T17, AEP -T18, AEP -T19, AEP -T20, AEP -T21, AEP -T22, AEP -T23, AEP -T24, AEP -T25, AEP -T26, AEP -T27, AEP -T28, AEP -T51, AEP -T52, AEP -T53, AEP -T54, AEP -T73, AEP -T74, AEP -T75, AEP -T76

(NOTE: Proposal 202 and 786 additionally addresses: AEP -T47, AEP -T48, AEP -T49, AEP -T50, AEP -T55 , AEP -T56, AEP -T57, AEP -T58)

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost ($M)
202	AEP	Delphos Area Line Rebuilds	8.871
786	AEP	Haviland Sectionalizing Addition (Plus convert s2389 to baseline)	1.309 (plus $65.36M for s2389 conversion)
503	CNTLTM	LS Rockford - LS West Van Wert 69kV Transmission Project	14.415

Proposed Solution: Proposal #2021_1-202

- Rebuild approximately 3.5 miles of overloaded 69 kV line between North Delphos-East Delphos-Elida Road switch. This includes approximately 1.1 miles of double circuit line that makes up a portion of the North Delphos-South Delphos 69 kV line and the North Delphos-East Delphos 69 kV line. Approximately 2.4 miles of single circuit line will also be rebuilt between the double circuit portion to East Delphos station and from East Delphos to Elida Road Switch. Estimated cost: $8.434M
- Replace the line entrance spans at South Delphos to eliminate the overloaded 4/0 Copper and 4/0 ACSR conductor. Estimated cost: $0.437M

Total Estimated Cost: $8.871M

PJM©2021

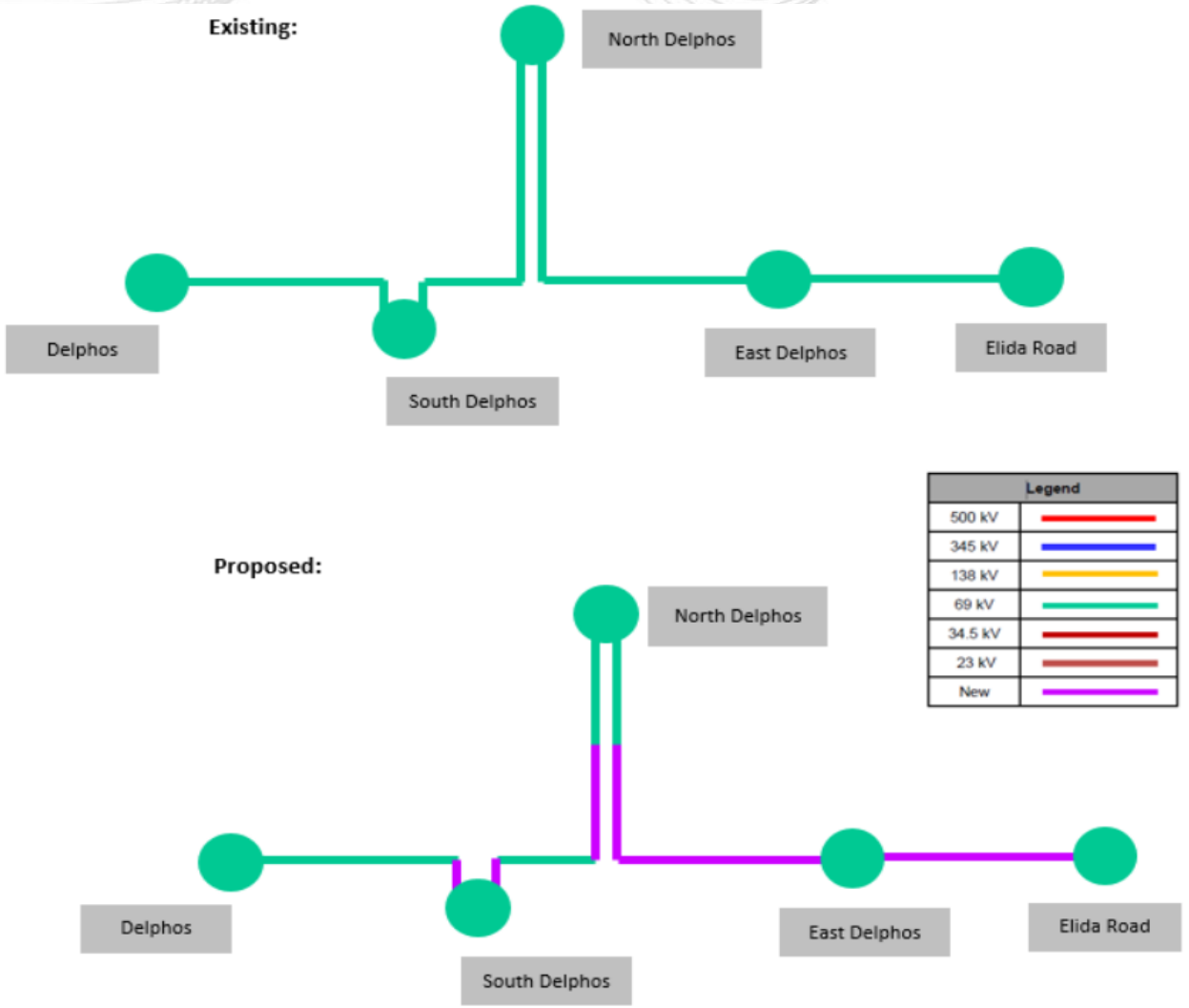
AEP Transmission Zone: Baseline
Delphos Area

Additional Benefit: The lines that are will addressed on the proposal include: One mile of the 5.26 mile North Delphos – South Delphos 69kV line asset consists of 22 wood pole structures, originally installed in 1943 primarily with 2/0 COPPER 7 (20COP) conductor. The line asset is part of two circuits: North Delphos – Van Wert 69kV and North Delphos-West Moulton 69kV circuits. There are currently 7 open conditions specifically affecting the 1 mile section of the line The Delphos Junction – East Delphos 69kV Line asset is 2.29 miles long and consists of wood pole structures, originally installed in 1939 primarily with 2/0 COPPER 7 (2/0COP) conductor. There are 40 structures with at least one open condition, which relates to 74% of the structures on the line. There are 36 open conditions related to broken or missing ground lead wires which could lead to the poor lightning performance. There are currently 9 structure related open conditions specifically affecting the Knee/Vee Brace (broken/rot).

Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05N DELPHO – 05E DELPHO 69KV	68/71/71/71
05E DELPHO – 05ELIDA ROAD 69KV	82/90/107/113
05DELPHO – 05S DELPHO 69KV	73/73/91/91
05N DELPHO – 05S DELPHO 69KV	68/73/90/91

Required IS Date: 6/1/2026
Required IS Date: 6/1/2026



SN / SE / WN / WE: Summer Normal / Summer Emergency / Winter Normal / Winter Emergency

PJM©2021

AEP Transmission Zone: Baseline
Dehue Area

Process Stage: First Read

Criteria: AEP FERC 715 Criteria

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP cases

Proposal Window Exclusion: None

Problem Statement:

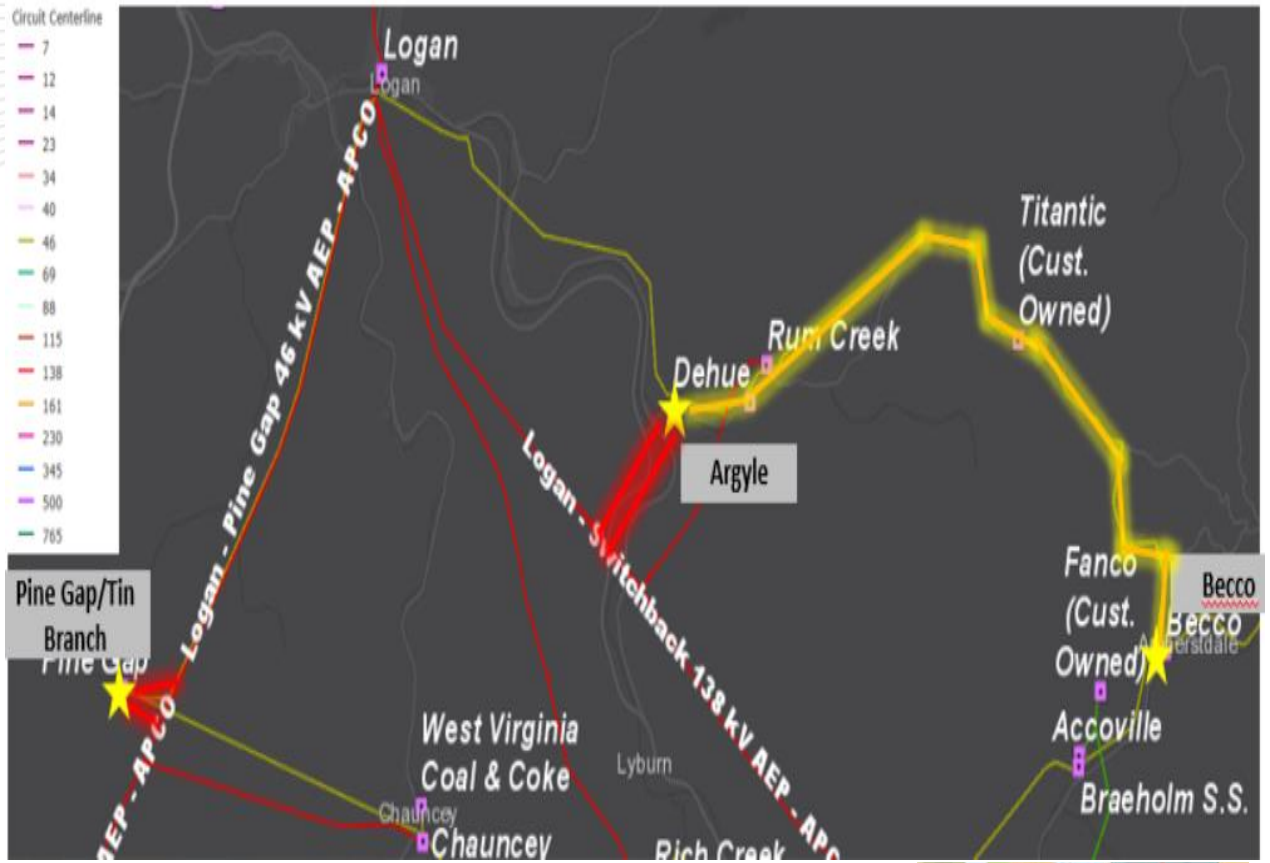
AEP -T6, AEP -T7, AEP -T8

In 2026 RTEP light load case, the Becco – Slagle 46kV line, the Dehue – Pine Gap 46kV line and Dehue – Slagle 46kV line are overload for a N-1-1 contingency pair.

AEP-VM1, AEP-VM2, AEP-VM3, AEP-VM4, AEP-VM5, AEP-VM6, AEP-VM7, AEP-VM8, AEP-VM9, AEP-VD1, AEP-VD2, AEP-VD3, AEP-VD4, AEP-VD5, AEP-VD6, AEP-VD7, AEP-VD8, AEP-VD9 (excluded from Window due to <200KV exclusion).

Low voltage and voltage drop violations at Three Fork, Toney Fork, Cyclone, Pardee, Crane,, Latrobe, Becco, Slagle, Dehue 46kV buses

Branch	SN/SE/WN/WE (MVA)
05BECCO – 05SLAGLE 46KV	23/23/32/32
05DEHUE– 05SLAGLE 46KV	23/23/32/32
05DEHUE – 05PINE GAP 46KV	27/27/34/34



SN / SE / WN / WE: Summer Normal / Summer Emergency / Winter Normal / Winter Emergency

PJM©2021

AEP Transmission Zone: Baseline
Dehue Area

As part of the 2021 RTEP Window #1, the projects listed in the table below are proposed to address the following violations: AEP -T6, AEP -T7, AEP -T8, AEP-VM1, AEP-VM2, AEP-VM3, AEP-VM4, AEP-VM5, AEP-VM6, AEP-VM7, AEP-VM8, AEP-VM9, AEP-VD1, AEP-VD2, AEP-VD3, AEP-VD4, AEP-VD5, AEP-VD6,

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost ($M)
365	AEP	Accoville-Becco 69 kV	13.048
310	AEP	Becco-Pine Gap Rebuild	50.191
488	AEP	Dehue Expansion and Line Rebuilds	65.798

Proposed Solution: Proposal #2021_1-488

- Construct a 138kV single bus station (Tin Branch) consisting of a 138kV box bay with a distribution transformer and 12kV distribution bay. Two 138kV lines will feed this station (from Logan and Sprigg Stations), and distribution will have one 12kV feed. Install two 138 kV circuit breakers on the line exits. Install 138 kV circuit switcher for the new transformer. Estimated cost: $5.584M
- Construct a new 138/46/12 kV Argyle station to replace Dehue station. Install a 138kV ring bus using a breaker-and-a-half configuration, with an autotransformer with a 46kV feed and a distribution transformer with a 12kV distribution bay. Two 138kV lines will feed this station (from Logan and Wyoming Stations). There will also be a 46kV feed from this station to Becco Station. Distribution will have two 12kV feeds. Retire Dehue station in its entirety. Estimated cost: $9.996M
- Bring the Logan - Sprigg #2 138kV circuit in and out of Tin Branch station by constructing approximately 1.75 miles of new overhead double circuit 138kV line. Double circuit T3 series lattice towers will be used along with 795,000cm ACSR 26/7 conductor. One shield wire will be conventional 7 #8 ALUMOWELD and one shield wire will be OPGW. Estimated cost: $8.578M
- Logan - Wyoming No. 1 circuit in and out of the proposed Argyle Station. Double circuit T3 series lattice towers will be used along with 795,000cm ACSR 26/7 conductor. One shield wire will be conventional 7 #8 ALUMOWELD and one shield wire will be OPGW. Estimated cost: $7.702M
- Rebuild approximately 10 miles of 46 kV line between Becco and the new Argyle substation. Retire approximately 16 miles of 46 kV line between the new Argyle substation and Chauncey station. Estimated cost: $33.705M
- Adjust relay settings due to new line terminations and retirements at Logan, Wyoming, Sprigg, Becco, and Chauncey stations. Estimated cost: $0.233M

Total Estimated Cost: $65.798M

PJM©2021

AEP Transmission Zone: Baseline
Dehue Area

Additional Benefit:

- This project will also address the needs reviewed with stakeholders under need number AEP-2020-AP044 in the November 20, 2020 W-SRRTEP.
- This project will also address the asset performance, condition, and risk needs on the Chauncey - Pine Gap 46kV Line which is a 1937 vintage wood pole line with 29 open structure conditions with 59% of the structures along the line with at least one open condition.
- This proposal, by constructing approximately 3.5 miles of greenfield 138 kV line and two new stations, allows for the retirement of over 15 miles of deteriorating 46 kV line in very challenging territory, helping to reduce future rebuild investment required to address asset renewal needs on the 46 kV system.
- This project will also address the asset performance, condition, and risk needs at Pine Gap 46kV station:
    - Transformer #1 is a 46/12kV 1949s vintage bank. The transformer has high levels of acetylene, decreasing and low interfacial tension (IFT), and high and rising moisture levels. These levels indicate increased decomposition of the paper insulating materials and indicate that electrical discharges have been occurring within the main tank. The insulation is shrinking and weakening. This is an indication of an aged oil with polar contaminants and oxidation byproducts. The values of IFT and moisture indicate the dielectric strength of the insulation system (oil and paper) is in poor condition. The oil containment is extremely deteriorated with the lining visible above the station stone.
    - Pine Gap Substation currently deploys 16 relays, implemented to ensure the adequate protection and operation of the substation. Currently, all 16 relays are in need of replacement. All 16 of these are of the electromechanical and static type which have significant limitations with regards to spare part availability and fault data collection and retention. In addition, these relays lack vendor support. The existing control house lacks enough panel space to accommodate new relaying.

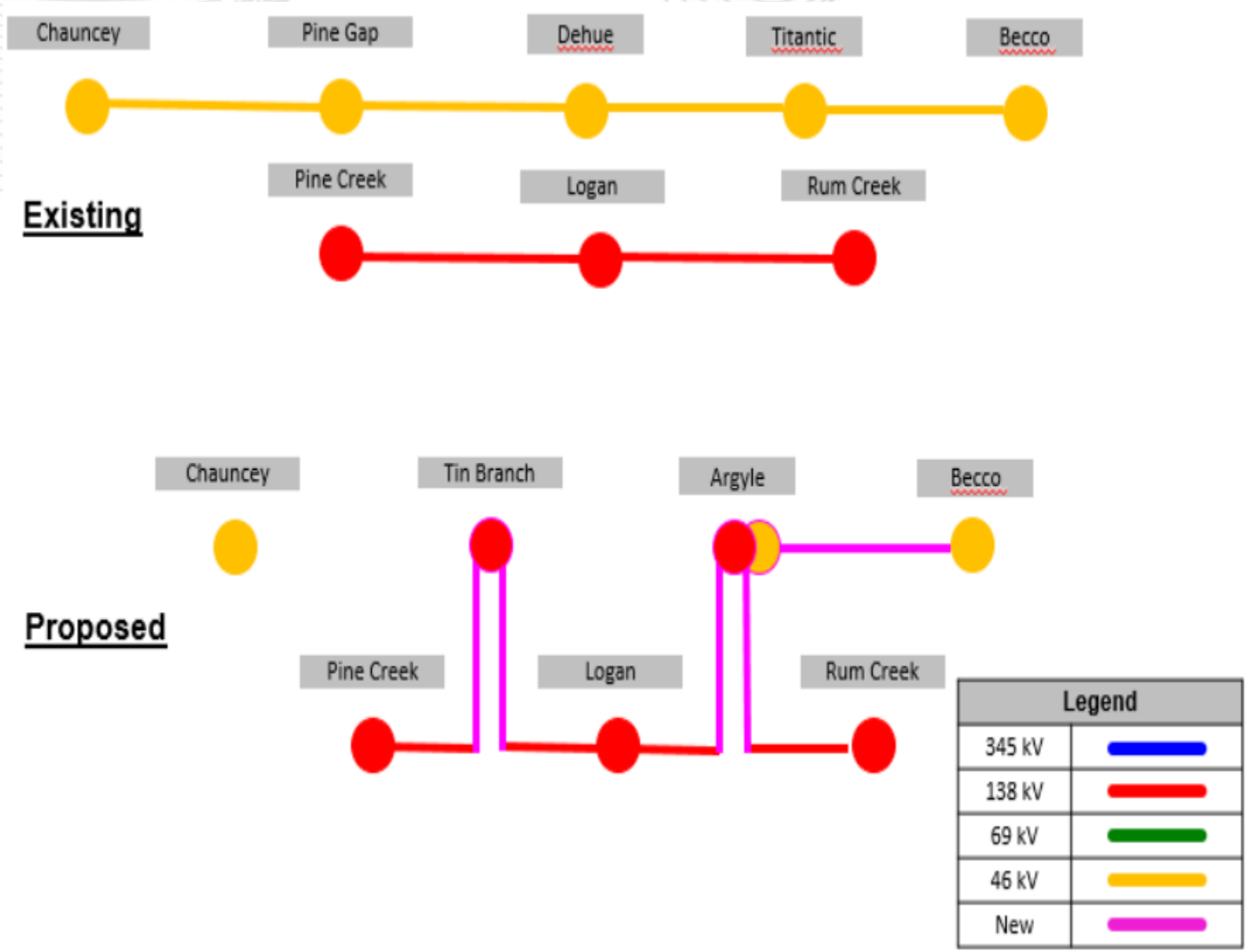
PJM©2021

AEP Transmission Zone: Baseline
Dehue Area

Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05LOGAN1– 05ARGYLE 138KV	257/360/325/404
05RUMCKZ – 05ARGYLE 138KV	257/360/325/404
05ARGYLE 138/69/46KV 1st winding	90/90/90/90
05ARGYLE 138/69/46KV 2nd winding	90/90/90/90
05ARGYLE 138/69/46KV 3rd winding	60/60/60/60

Required IS Date: 11/1/2026
Projected IS Date: 6/30/2026



SN / SE / WN / WE: Summer Normal / Summer Emergency / Winter Normal / Winter Emergency

PJM©2021

APS Transmission Zone: Baseline
Shingletown 230 kV

Process Stage: First Read

Criteria: PJM N-1-1 Criteria

Assumption Reference: 2026 RTEP assumption

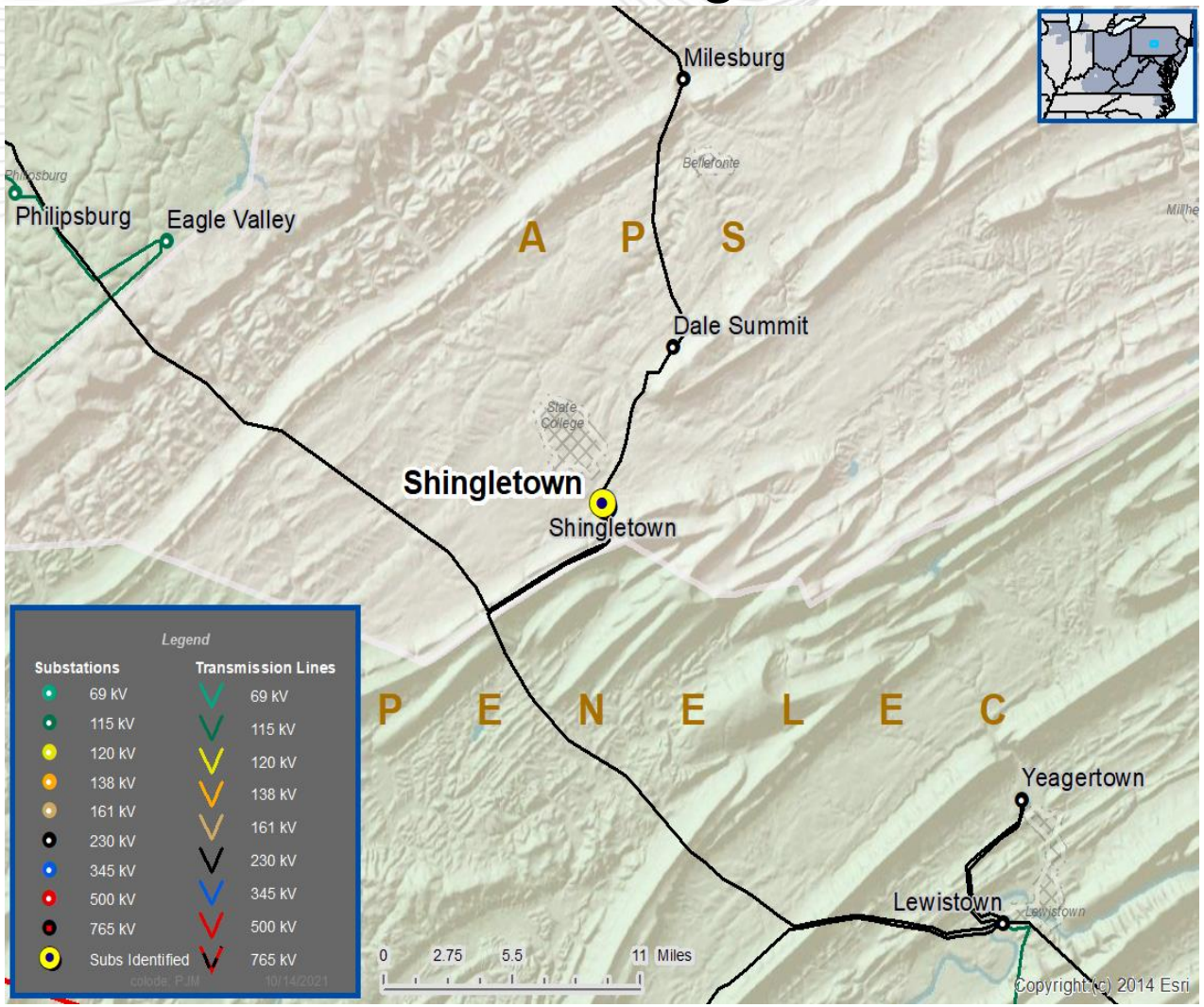
Model Used for Analysis: 2026 RTEP Summer case

Proposal Window Exclusion: None

Problem Statement:

APS-VD45 & APS-VD46

In 2026 RTEP summer case, the Shingletown 230 kV voltage drop violation occurs due to a N-1-1 contingency.



PJM©2021

APS Transmission Zone: Baseline

Shingletown 230 kV

As part of the 2021 RTEP Window # 1, the projects listed below are proposed to address the voltage drop APS-VD45 & APS-VD46 violations.

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost ($M)
919	West Penn	Upgrade the Shingletown #82 230-46 kV Transformer Circuit by installing a 230 kV breaker.	1.66
779	West Penn	Convert Shingletown 230 kV Substation into a six-breaker ring bus.	11.92
608	CNTLTM	Tapping the Dale - Milesburg 230kV transmission line and creating a new substation named Persia. Connect the new Persia substation to the Yeagertown substation by creating a new 230 kV line.	77.59
560	CNTLTM	Tapping the Dale - Milesburg 230kV transmission line and creating a new substation named Persia. Connect the new Persia substation to the Elimsport substation by creating a new 230 kV line.	135.54

Upgrade the Shingletown #82 230-46 kV Transformer Circuit by installing a 230 kV breaker and disconnect switches, removing existing 230 kV switches, replacing 46 kV disconnect switches, replacing limiting substation conductor, and installing/replacing relays.

Total Estimated Cost: $1.66M

Required IS Date: 06/01/2026

Projected IS Date: 06/01/2025

PJM©2021

Dominion Transmission Zone: Baseline Remington CT - Gainesville

Process Stage: First Read

Criteria: Generator Deliverability, N-1

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP cases

Proposal Window Exclusion: None

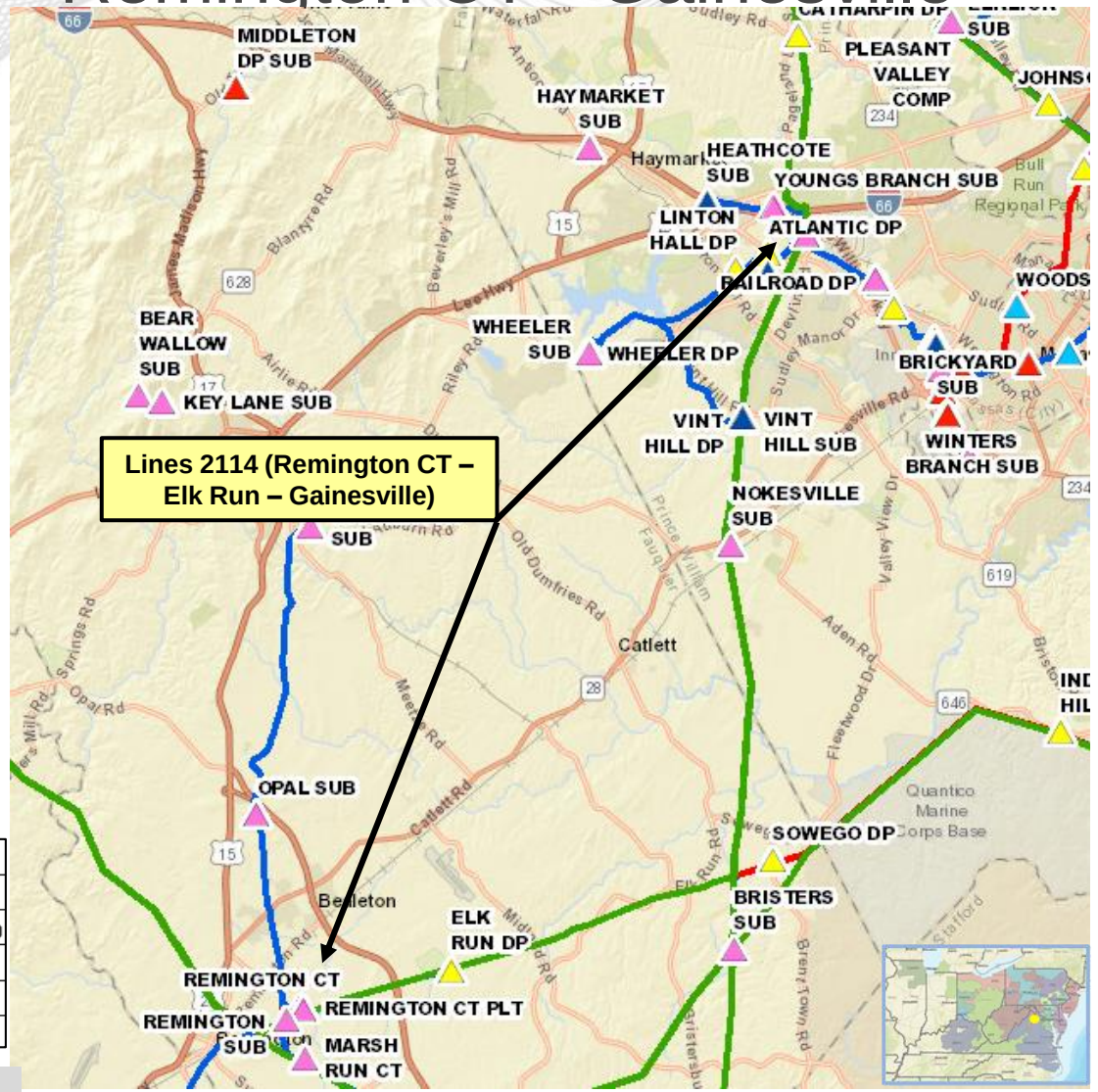
Problem Statement:

GD-S12, GD-S17, GD-S715, GD-S37, GD-S717, N1-ST49

In the 2026 RTEP summer case, 230kV Line #2114 Remington CT – Gainesville is overloaded for a tower contingency under N-1 and a single & tower contingencies under Generator Deliverability.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
6REMNGCT– 6ELK RUN 230kV	1047/1047/1160/1160
6ELK RUN – 6GAINSVL 230kV	1047/1047/1160/1160



COLOR	VOLTAGE	TRANSMISSION LINE NUMBER
	500 KV.	500 thru 599
	230 KV.	200 thru 299 & 2000 thru 2099
	115 KV.	1 thru 199
	138 KV.	AS NOTED
	69 KV.	AS NOTED

Continued on next slide….

SN / SE / WN / WE: Summer Normal / Summer Emergency / Winter Normal / Winter Emergency

PJM©2021

Dominion Transmission Zone: Baseline Remington CT - Gainesville

As part of the 2021 RTEP Window #1, the following projects were proposed to address violations on 230kV Line #2114:

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost ($M)
445	Dominion	Line #2114 Remington CT to Gainesville full reconductor. Upgrade wave trap and substation conductor at both terminals. Upgrade Brambleton breakers.	30.680
333	Dominion	Line #2114 Remington CT to Gainesville full reconductor. Upgrade terminal equipment at both ends to include 230kV circuit breakers, switches and leads to achieve 4000A rating. Upgrade Brambleton breakers.	39.693
298(1)	TRNSRC	Construct greenfield Lee District 500 kV station with 6-breaker ring bus.	72.876

(1)Proposal 298 also addresses Generator Deliverability violation GD-S30. (This flowgate was eliminated as a result of the 2021 RTEP re-tool).

Proposed Solution: Proposal #2021_1-445

- Reconductor approximately 24.42 miles of 230kV Line #2114 Remington CT - Elk Run - Gainesville to achieve a summer rating of 1574 MVA by fully reconductoring the line and upgrading the wave trap and substation conductor at Remington CT and Gainesville. **Estimated cost: $28.988M**
- Replace 230 kV breakers SC102, H302, H402, and 218302 at Brambleton substation with 4000A 80kA breakers and associated equipment including breaker leads as necessary to address breaker duty issues identified in short circuit analysis. **Estimated cost: $1.692M**

Total Estimated Cost: $30.680M

Required IS Date: 6/1/2026

PJM©2021

Dominion Transmission Zone: Baseline Cub Run - Walney

Process Stage: First Read

Criteria: N-1

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP cases

Proposal Window Exclusion: None

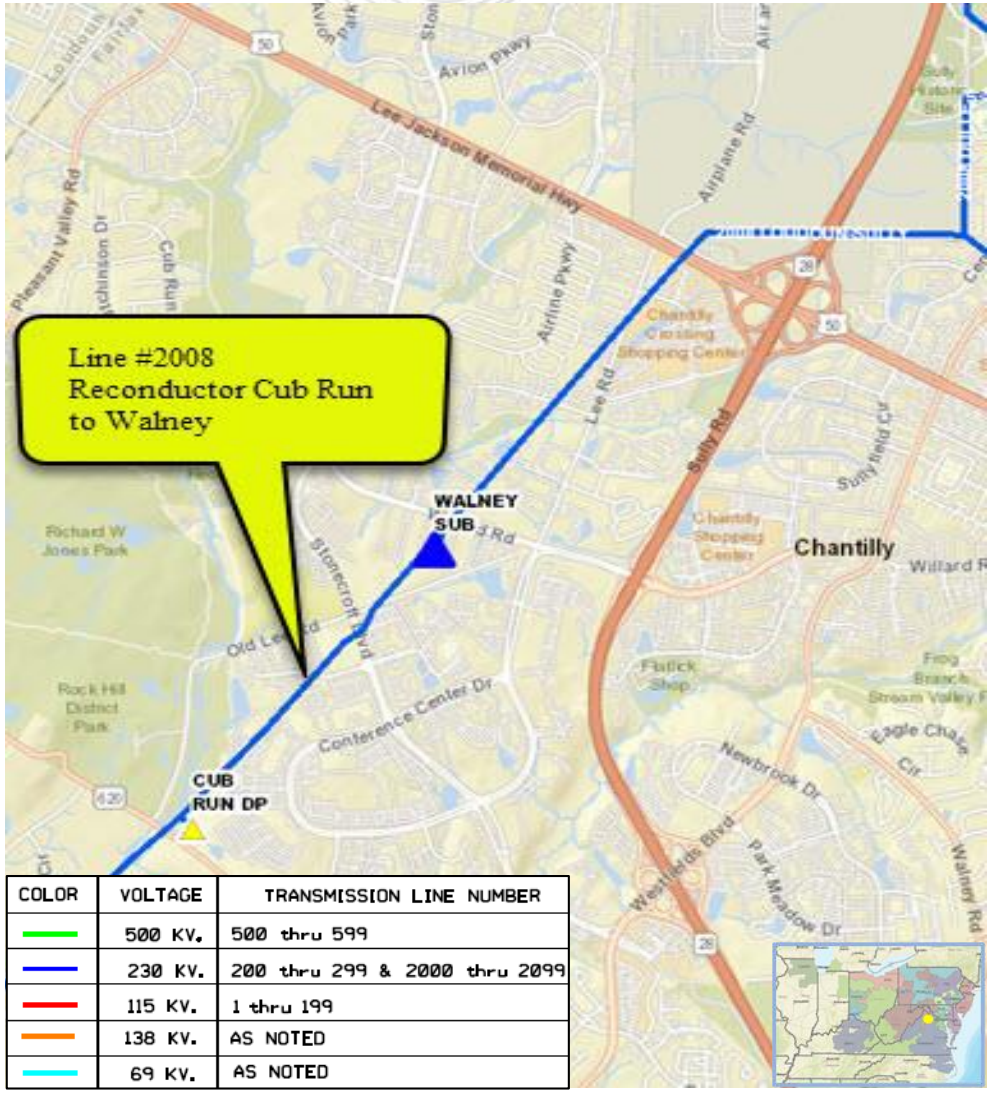
Problem Statement:

N1-ST33

In the 2026 RTEP summer case, 230kV Line #2008 Cub Run to Walney is overloaded for a breaker contingency under N-1.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
6CUBRUN – 6WALNEY 230kV	823/823/944/944



Continued on next slide….

SN / SE / WN / WE: Summer Normal / Summer Emergency / Winter Normal / Winter Emergency

PJM©2021

Dominion Transmission Zone: Baseline Cub Run - Walney

As part of the 2021 RTEP Window #1, the following project was proposed to address violations on 230kV Line #2008:

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost ($M)
600	Dominion	Line #2008 Cub Run to Walney reconductor. Replace line switch 200826 with a 4000A switch.	1.934

Proposed Solution: Proposal #2021_1-600

- Reconductor approximately 1.07 miles of 230kV Line #2008 segment from Cub Run – Walney to achieve a summer rating of 1574 MVA. Replace line switch 200826 with a 4000A switch.

Total Estimated Cost: $1.934M

Required IS Date: 6/1/2026

PJM©2021

Dominion Transmission Zone: Baseline Lakeview - Carolina

Process Stage: First Read

Criteria: Generator Deliverability

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP cases

Proposal Window Exclusion: None

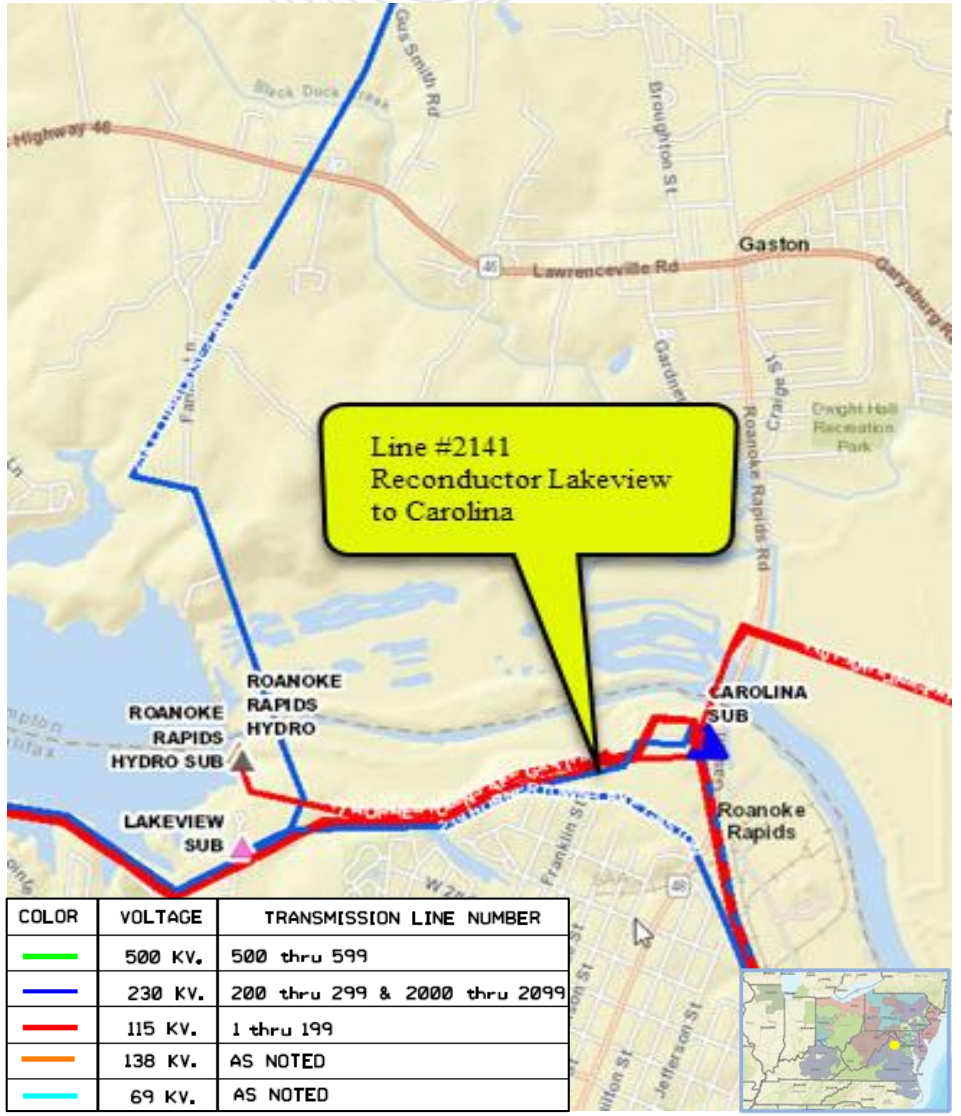
Problem Statement:

GD-S19

In the 2026 RTEP summer case, 230kV Line #2141 Lakeview to Carolina is overloaded for a single contingency under Generator Deliverability.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
6LAKEVEW – 6CAROLNA 230kV	399/399/505/505



Continued on next slide….

SN / SE / WN / WE: Summer Normal / Summer Emergency / Winter Normal / Winter Emergency

PJM©2021

Dominion Transmission Zone: Baseline Lakeview - Carolina

As part of the 2021 RTEP Window #1, the following project was proposed to address violations on 230kV Line #2141:

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost ($M)
414	Dominion	Line #2141 Lakeview to Carolina reconductor	1.185

Proposed Solution: Proposal #2021_1-414

- Reconductor approximately 1.4 miles of 230kV Line #2141 from Lakeview – Carolina to achieve a summer rating of 1047 MVA.

Total Estimated Cost: $1.185M

Required IS Date: 6/1/2026

PJM©2021

Dominion Transmission Zone: Baseline Elmont - Chickahominy

Process Stage: First Read

Criteria: FERC Form 715 (C.2.9 End-of-Life Criteria)

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP cases

Proposal Window Exclusion: None

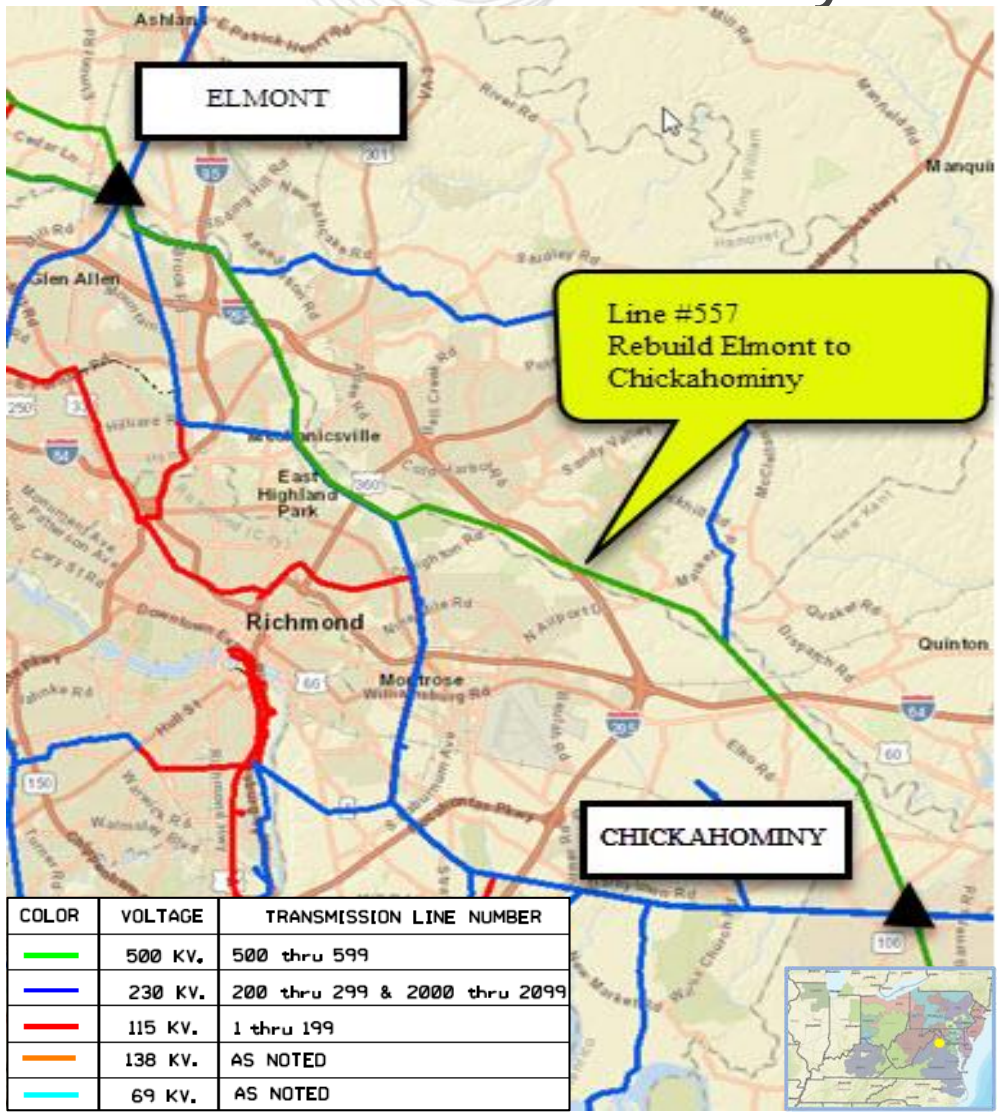
Problem Statement:

DOM-O2

500kV Line #557 Elmont to Chickahominy was constructed in 1971 with ACAR conductor and 5-series Corten towers that need to be rebuilt to current standards based on Dominion's End-of-Life Criteria.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
8ELMONT – 8CHCKAHM 230kV	2598/2598/2988/3014



Continued on next slide….

SN / SE / WN / WE: Summer Normal / Summer Emergency / Winter Normal / Winter Emergency

PJM©2021

Dominion Transmission Zone: Baseline Elmont - Chickahominy

As part of the 2021 RTEP Window #1, the following projects was proposed to address violations on 500kV Line #557:

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost ($M)
124	Dominion	Line #557 Elmont to Chickahominy reconductor	58.155

Proposed Solution: Proposal #2021_1-124

- Rebuild approximately 27.7-miles of 500 kV transmission line from Elmont to Chickahominy with current 500 kV standards construction practices to achieve a summer rating of 4330 MVA.

Total Estimated Cost: $58.155M

Required IS Date: 6/1/2026

PJM©2021

Dominion Transmission Zone: Baseline Lexington & Bath County 500kV

Process Stage: First Read

Criteria: N-1 Voltage Magnitude & Drop

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP cases

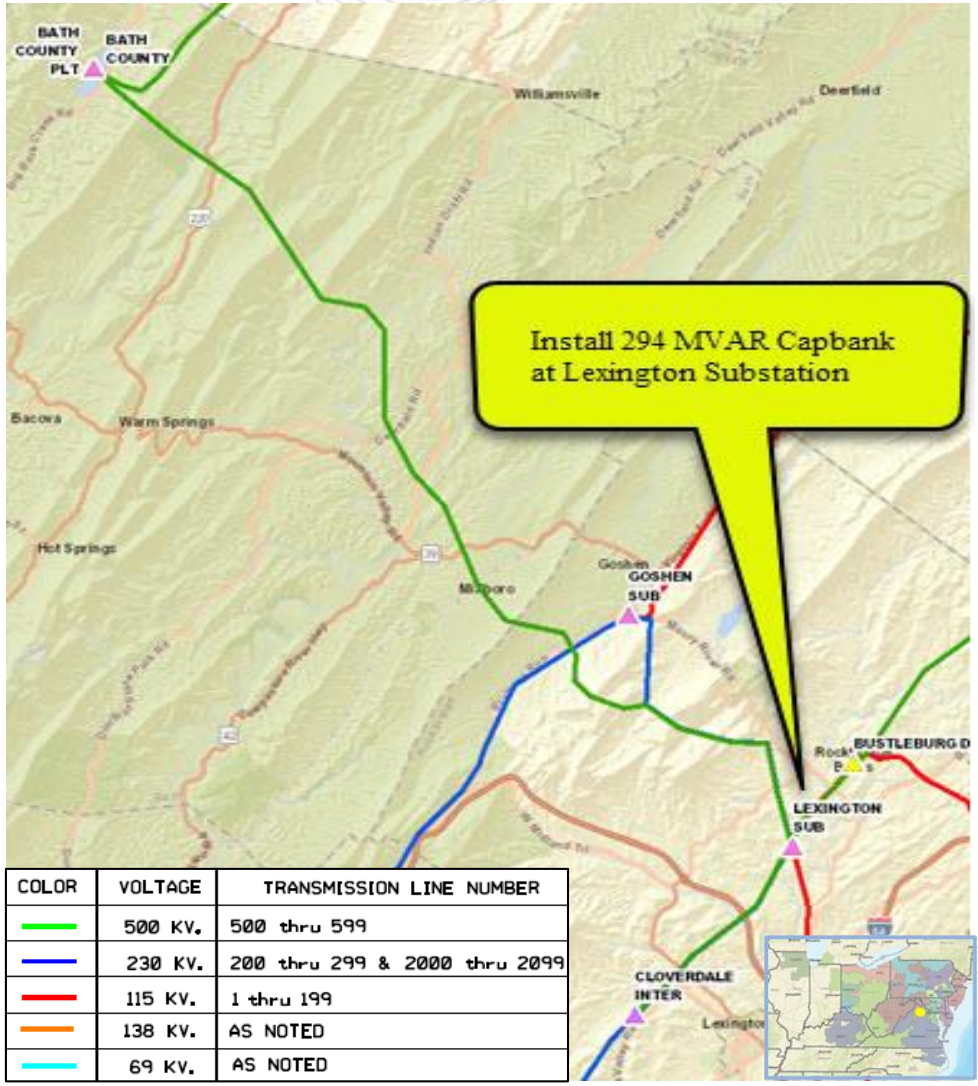
Proposal Window Exclusion: None

Problem Statement:

N1-LLVM1, N1-LLVM2, N1-LLVM3, N1-LLVM4, N1-LLVM5, N1-LLVM6, N1-LLVM7, N1-LLVM8, N1-LLVD1, N1-LLVD2, N1-LLVD3

In the 2026 RTEP light load case, there are voltage magnitude and voltage drop violations at the 500kV buses of Lexington and Bath County for single and breaker contingencies under N-1.

Continued on next slide….



PJM©2021

Dominion Transmission Zone: Baseline Lexington & Bath County 500kV

As part of the 2021 RTEP Window #1, the following project was proposed to address violations at Lexington and Bath County 500kV:

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost ($M)
722	Dominion	Install 294 MVar Cap Bank at Lexington substation	5.860

Proposed Solution: Proposal #2021_1-722

- Expand substation and install approximately 294 MVar cap bank at 500kV Lexington substation along with a 500kV breaker. Adjust the tap positions associated with the two 230/69kV transformers at Harrisonburg to neutral position and lock them.

Total Estimated Cost: $5.860M

Required IS Date: 6/1/2026

SN / SE / WN / WE: Summer Normal / Summer Emergency / Winter Normal / Winter Emergency

PJM©2021

Dominion Transmission Zone: Baseline Ox 500/230kV Transformers

Process Stage: First Read

Criteria: FERC Form 715 (C.2.1.3 Critical Stress Case)

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP cases

Proposal Window Exclusion: None

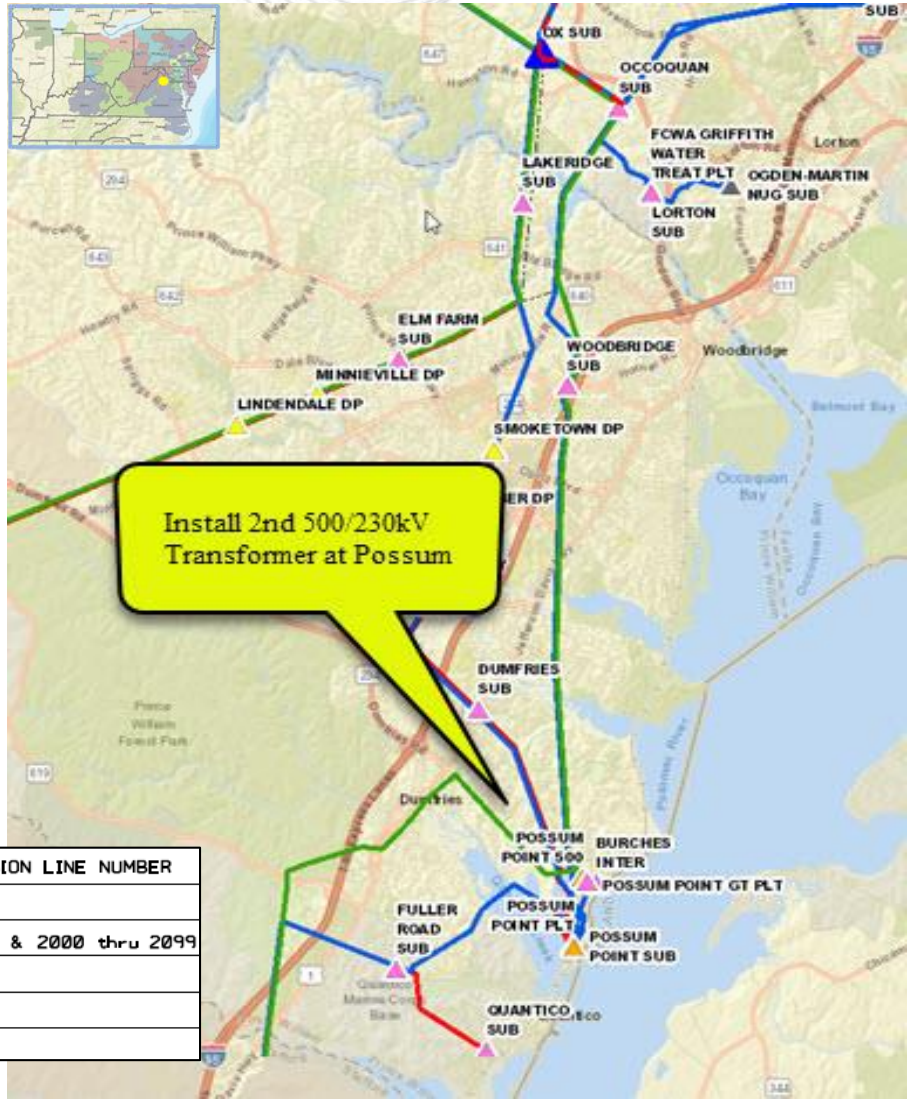
Problem Statement:

DOM-T3, DOM-T4

In the 2026 RTEP summer case, the Ox 500/230kV transformer #1 & Ox 500/230kV transformer #2 are overloaded under Dominion stress case criteria. (Outage of the most critical generator followed by single contingency: N-1-1).

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
8OX – 6OX #1 500/230kV	931.9/963.8/1198.8/1242.3
8OX – 6OX #2 500/230kV	909.3/951.9/1167.6/1220.4



COLOR	VOLTAGE	TRANSMISSION LINE NUMBER
	500 KV.	500 thru 599
	230 KV.	200 thru 299 & 2000 thru 2099
	115 KV.	1 thru 199
	138 KV.	AS NOTED
	69 KV.	AS NOTED

Continued on next slide….

SN / SE / WN / WE: Summer Normal / Summer Emergency / Winter Normal / Winter Emergency

PJM©2021

Dominion Transmission Zone: Baseline Ox 500/230kV Transformers

As part of the 2021 RTEP Window #1, the following projects were proposed to address violations on 500/230kV transformer #1 & #2 at Ox:

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost ($M)
57(1)	Dominion	Install 2nd 500/230kV transformer at Possum Point	24.539
319	Dominion	Replace both 500/230kV transformers at Ox	63.768
637	Dominion	Expand Occoquan substation via the installation of a 500kV GIS ring bus, 1-1100MVA 500/230kV transformer and 230kV breaker-and-a-half bus arrangement.	75.389

(1) Proposal 57 corresponds to baseline B2443.6 that was canceled. (Adding 2nd 500/230kV transformer at Possum Point.)

Proposed Solution: Proposal #2021_1-57

- Install a 2nd 500kV-230kV 840MVA transformer bank at Possum Point 500kV yard, a 0.8 mile long 230kV line extension between Possum Point 500kV and Possum Point 230kV substation, and a new 230kV breaker at Possum 230kV yard to terminate the extension. Note: Possum Point 500kV Substation and Possum Point 230kV Substation are separated by approximately 0.85 miles.

Total Estimated Cost: $24.539M

Required IS Date: 6/1/2026

PJM©2021

Dominion Transmission Zone: Baseline Fredericksburg/Carson/Hopewell Area

Process Stage: First Read

Criteria: Generator Deliverability, FERC Form 715 (C.2.1.3 Critical Stress Case) & N-1

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP cases

Proposal Window Exclusion: None

Problem Statement:

In the 2026 RTEP summer case:

Fredericksburg (Group 1: N2-SLD1, N2-SLD2, GD-S16, GD-S467, DOM-T5)

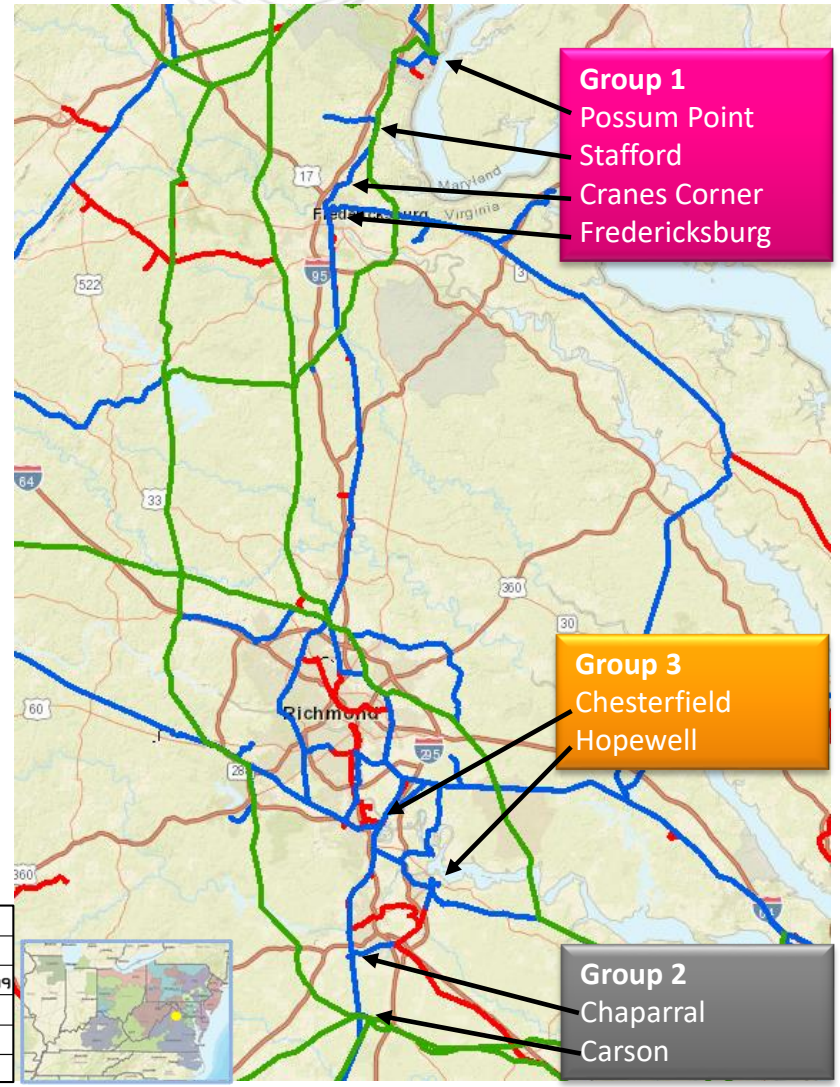
- 230kV Line #2104 Cranes Corner to Stafford is overloaded for a single and breaker contingency under Generator Deliverability and is also overloaded under Dominion stress case criteria.
- Load loss of 307 MW under N-1-1.

Carson (Group 2: GD-S465, GD-S39)

- Carson 500/230kV transformer #2 is overloaded for a breaker contingency under Generator Deliverability.
- 230kV Line #249 Carson to Chaparral is overloaded for a single contingency under Generator Deliverability.

Hopewell (Group 3: GD-S18, GD-S33, GD-S436)

- 230kV Line #211 is overloaded for a single contingency under Gen
- 230kV Line #228 is overloaded for a single and breaker contingenc Deliverability.



COLOR	VOLTAGE	TRANSMISSION LINE NUMBER
	500 KV.	500 thru 599
	230 KV.	200 thru 299 & 2000 thru 2099
	115 KV.	1 thru 199
	138 KV.	AS NOTED
	69 KV.	AS NOTED

Continued on next slide….

PJM©2021

Dominion Transmission Zone: Baseline Fredericksburg/Carson/Hopewell Area

Existing Facility Rating:

Area	Branch	SN/SE/WN/WE (MVA)
Fredericksburg	6CRANES – 6STAFORD 230kV	722/722/914/914
Carson	8CARSON – 6CARSON 500kV	928.1/961.6/1192.8/1238.1
Carson	6CARSON – 6CHAPARRAL T 230kV	595/595/659/659
Carson	6LOCKS – 6CHAPARRAL T 230kV	595/595/659/659
Carson	6LOCKS – 3HARROWG 115kV	147/147/185/185
Hopewell	6HOPEWLL – 6CHESTF A 230kV	478/478/606/606
Hopewell	6HOPEWLL – 6CHESTF B 230kV	478/478/606/606

As part of the 2021 RTEP Window #1, the following project was proposed to address violations at Fredericksburg, Carson and Hopewell:

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost ($M)
224	Dominion	**Fredericksburg**: Convert 115kV Line #29 to 230 kV; Reconductor 230kV Line #2104 Cranes Corner to Aquia Harbor. Feed Quantico via Fuller Road Substation **Carson**: Energize Carson 500/230kV Tx#1; Reconductor 230kV Line #249 Carson to Locks; Partial Rebuild 115kV Line #100 Locks to Harrowgate **Hopewell**: Partial rebuild 2.9 miles of double circuit 230kV Lines #211/228	93.412

Continued on next slide….

PJM©2021

Dominion Transmission Zone: Baseline Fredericksburg/Carson/Hopewell Area

Proposed Solution: Proposal #2021_1-224

Fredericksburg

- Convert Line #29 Aquia Harbor to Possum Point to 230 kV (Extended Line #2104) and swap Line #2104 and converted Line #29 at Aquia Harbor backbone termination. Upgrade terminal equipment at Possum Point to terminate converted Line 29 (now extended Line #2104). (Line #29 from Fredericksburg to Aquia Harbor is being rebuilt under baseline b2981 to 230kV standards.) **Estimated cost: $9.386M**

- Upgrade Aquia Harbor terminal equipment to not limit 230kV Line #9281 conductor rating. **Estimated cost: $0.631M**

- Upgrade Fredericksburg terminal equipment by rearranging 230 kV bus configuration to terminate converted Line 29 (now becoming 9281). The project will add a new breaker at the 230kV bay and reconfigure line termination of 230kV Lines #2157, #2090, and #2083. **Estimated cost: $2.725M**

- Reconductor/rebuild approximately 7.6 miles of 230kV Line #2104 Cranes Corner – Stafford to achieve a summer rating of 1047 MVA(1). Reconductor/rebuild approximately 0.34 miles of 230kV Line #2104 Stafford – Aquia Harbor to achieve a summer rating of 1047 MVA. Upgrade terminal equipment at Cranes Corner to not limit the new conductor rating. **Estimated cost: $19.596M**

- Upgrade wave trap and line leads at 230kV Line #2090 Ladysmith CT terminal to achieve 4000A rating. **Estimated cost: $0.152M**

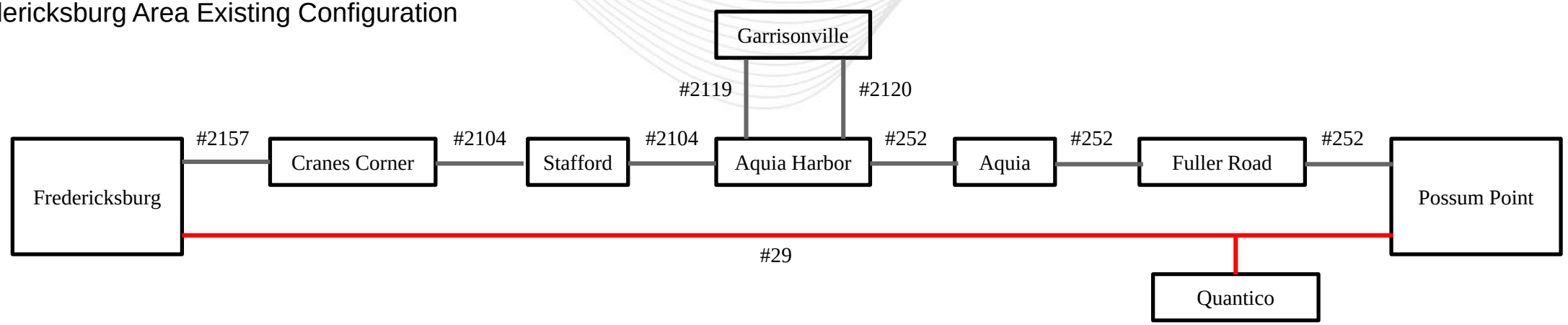
- Upgrade Fuller Road substation to feed Quantico substation via 115 kV radial line. Install four breaker ring and break 230kV Line #252 into two new lines: 1) #252 between Aquia Harbor to Fuller Road and 2) #9282 between Fuller Road and Possum Point. Install a 230/115 kV transformer which will serve Quantico substation. **Estimated cost: $24.159M**

(1) This portion of the project will be addressed by baseline b3321 as it overlaps the violation associated with the deactivation of Morgantown 1 and 2 presented at the 8/31 TEAC.

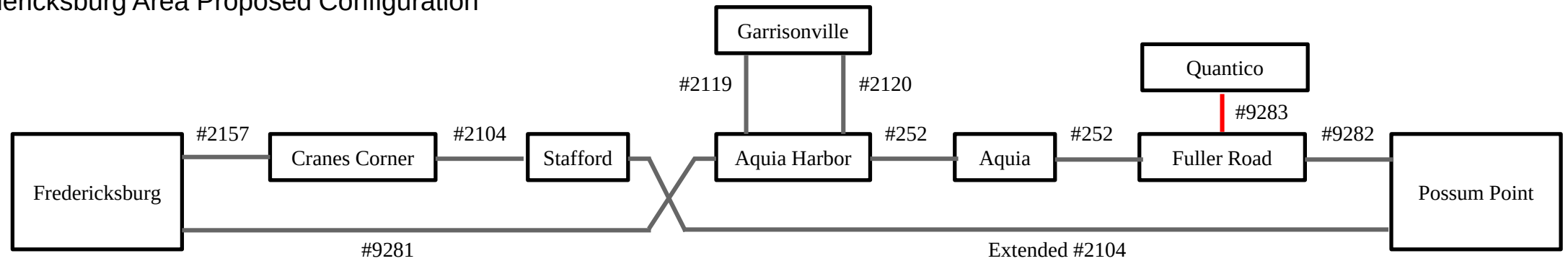
PJM©2021

Dominion Transmission Zone: Baseline Fredericksburg/Carson/Hopewell Area

Fredericksburg Area Existing Configuration



Fredericksburg Area Proposed Configuration



Continued on next slide….

PJM©2021

Dominion Transmission Zone: Baseline Fredericksburg/Carson/Hopewell Area

Proposed Solution: Proposal #2021_1-224

Carson

- Energize in-service spare 500/230kV Carson Tx#1
- Partial wreck and rebuild 10.34 miles of 230kV Line #249 Carson - Locks to achieve a minimum summer emergency rating of 1047 MVA. Upgrade terminal equipment at Carson and Locks to not limit the new conductor rating. **Estimated cost: $15.365M**
- Wreck and rebuild 5.4 miles of 115kV Line #100 Locks - Harrowgate to achieve a minimum summer emergency rating of 393 MVA. Upgrade terminal equipment at Locks and Harrowgate to not limit the new conductor rating and perform Line #100 Chesterfield terminal relay work. **Estimated cost: $9.097M**

Hopewell

- Reconductor approximately 2.9 miles of 230 kV Line #211 Chesterfield – Hopewell to achieve a minimum summer emergency rating of 1046 MVA. **Estimated cost: $4.914M**
- Reconductor approximately 2.9 miles of 230 kV Line #228 Chesterfield - Hopewell to achieve a minimum summer emergency rating of 1046 MVA. **Estimated cost: $4.914M**
- Upgrade equipment at Chesterfield substation to not limit ratings on Lines 211 and 228. **Estimated cost: $0.759M**
- Upgrade equipment at Hopewell substation to not limit ratings on Lines 211 and 228. **Estimated cost: $1.714M**

Total Estimated Cost: $93.412M

Required IS Date: 6/1/2026

PJM©2021

Second Review

Baseline Reliability Projects

PJM©2021

AEP Transmission Zone: Baseline
Muskingum-Waterford 345 kV Bus/Riser Upgrades

Process Stage: Second Review

Criteria: Generator Deliverability

Assumption Reference: 2026 RTEP assumption

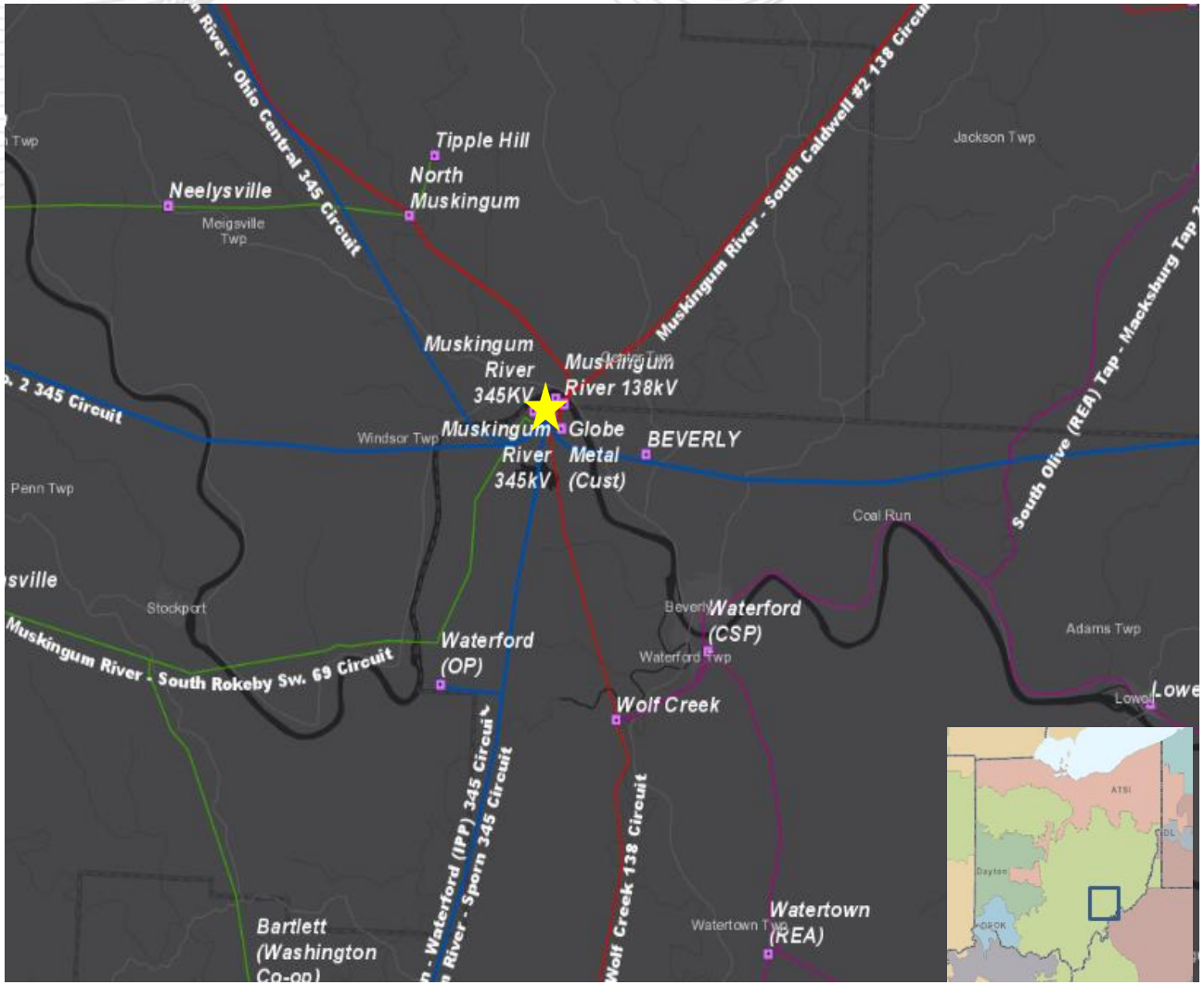
Model Used for Analysis: 2026 RTEP cases

Proposal Window Exclusion: Substation Equipment Exclusion

Problem Statement:
FG: GD-S419
In 2026 Summer Gen Deliv test, the Waterford – Muskingum 345kV line is overloaded for a breaker contingency.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05WATERFORD – 05MUSKNG 345KV	1025/1318/1298/1522 for certain contingencies



PJM©2021

AEP Transmission Zone: Baseline Muskingum-Waterford 345 kV Bus/Riser Upgrades

Recommended Solution:
Replace the 2156 ACSR & 2874 ACSR bus and risers with 2-bundled 2156 ACSR at Muskingum River 345 kV station to address loading issues on Muskingum - Waterford 345 kV line. (**B3342**)
Total Estimated Cost: $0.53M

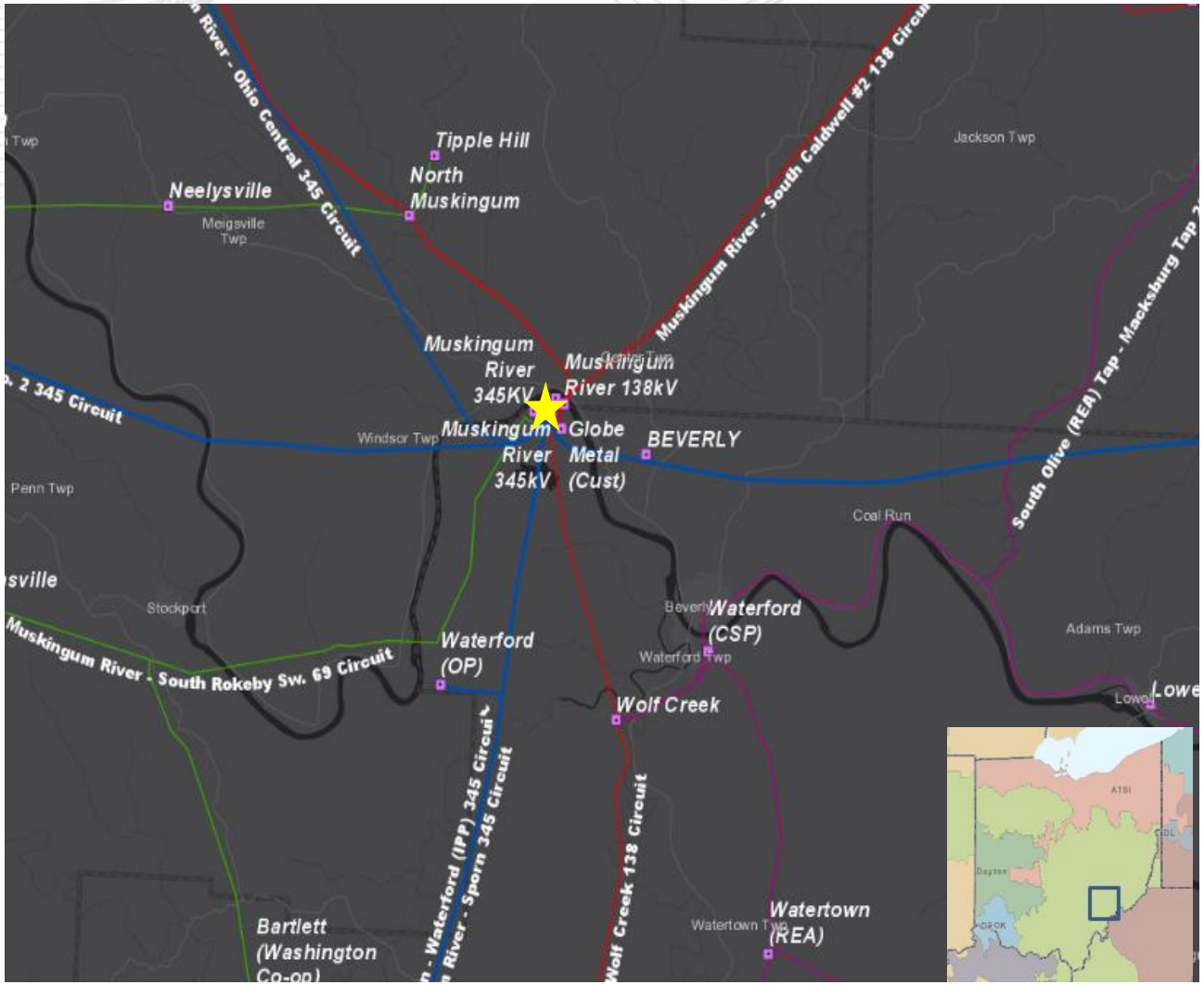
Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05WATERFORD – 05MUSKNG 345KV	1868/1868/2315/2315

Ancillary Benefit: This proposal also addresses a portion of supplemental need AEP-2020-AEP001

Required IS date: 6/1/2026
Projected IS date: 9/1/2025

Previously Presented: 10/5/2021



PJM©2021

AEP Transmission Zone: Baseline
Albion-Kendallville Rebuild

Process Stage: Second Review
Criteria: AEP FERC 715 Criteria
Assumption Reference: 2026 RTEP assumption
Model Used for Analysis: 2026 RTEP cases
Proposal Window Exclusion: None

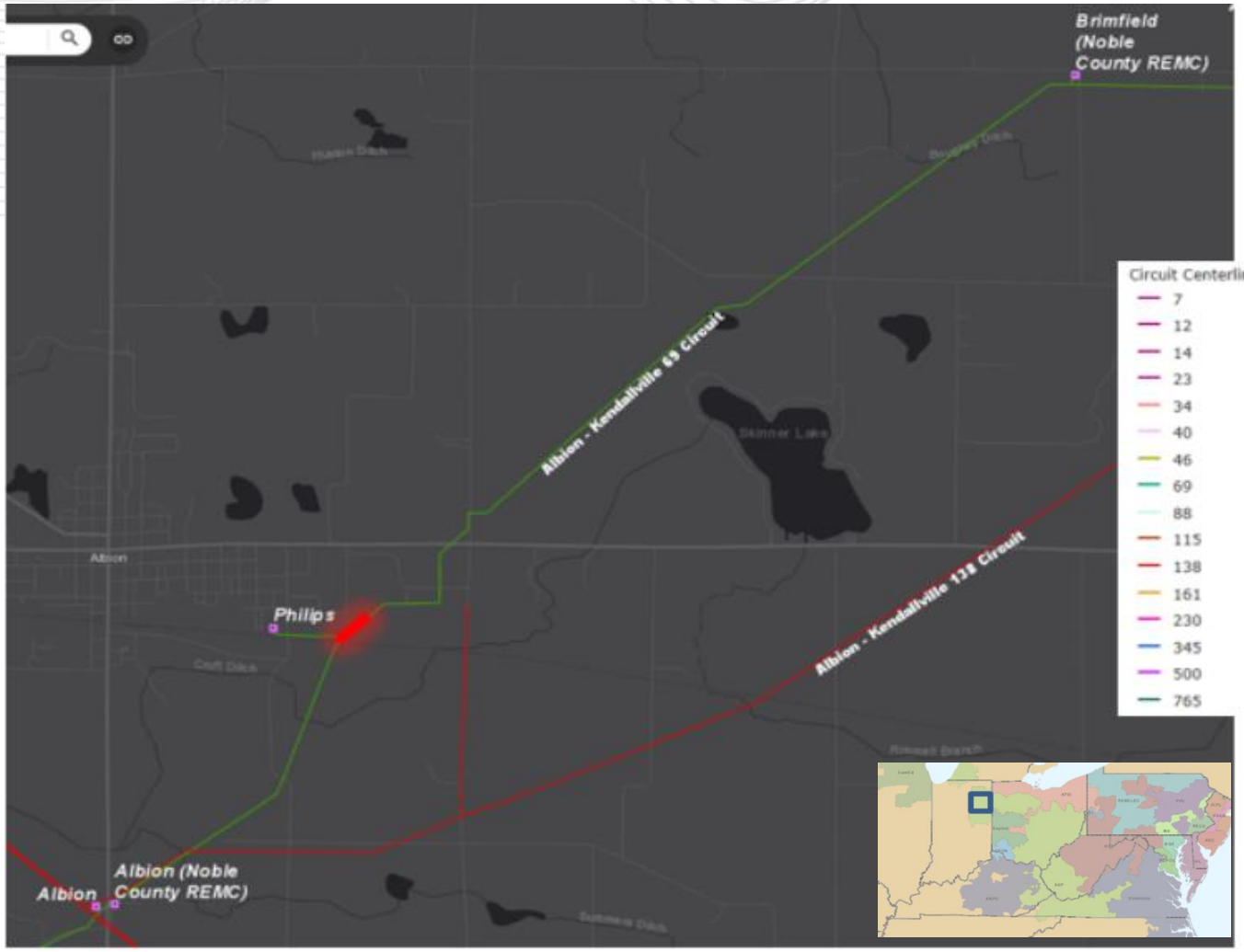
Problem Statement:

AEP-T43, AEP-T44, AEP-T45, AEP-T46

In 2026 RTEP summer case, the Albion - Philips Switch and Philips Switch - Brimfield Switch 69kV line are overloaded for multiple N-1-1 contingency pairs.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05BRIMFLD8 – 05PHILOPSZ 69KV	50/50/63/63
05PHILOPSZ – 05ALBION Z 69KV	50/50/63/63



SN / SE / WN / WE: Summer Normal / Summer Emergency / Winter Normal / Winter Emergency

PJM©2021

AEP Transmission Zone: Baseline Albion-Kendallville Rebuild

As part of the 2021 RTEP Window #1, the projects listed in the table below are proposed to address the following violations: AEP-T43, AEP-T44, AEP-T45, AEP-T46

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost ($M)
25	AEP	Albion-Kendallville Rebuild	0.61

Recommended Solution: Proposal #2021_1-25: Rebuild approximately 0.3 miles of overloaded 69 kV line between Albion - Philips Switch and Philips Switch - Brimfield Switch with 556 ACSR conductor. (**B3343**)

Estimated Cost: $0.61M

Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05BRIMFLD8 – 05PHILOPSZ 69KV	82/90/107/113
05PHILOPSZ – 05ALBION Z 69KV	82/90/107/113

Required IS Date: 6/1/2026

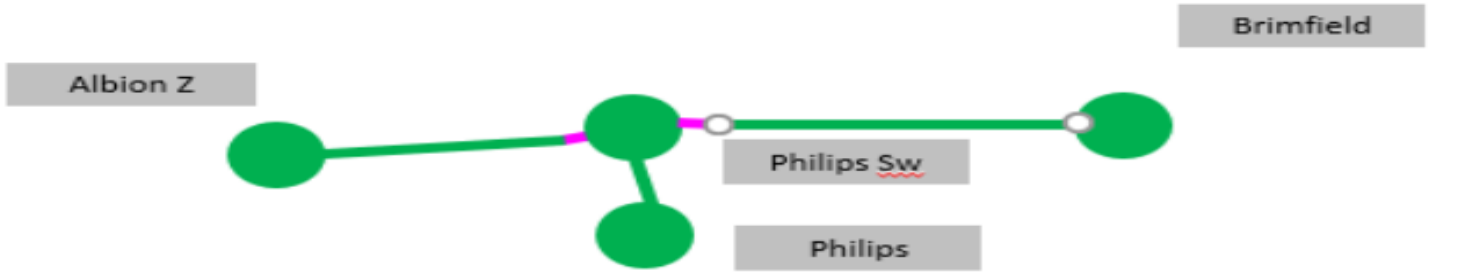
Required IS Date: 6/1/2026

Previously Presented: 10/5/2021

SN / SE / WN / WE: Summer Normal / Summer Emergency / Winter Normal / Winter Emergency

PJM©2021

AEP Transmission Zone: Baseline Albion-Kendallville Rebuild



Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

PJM©2021

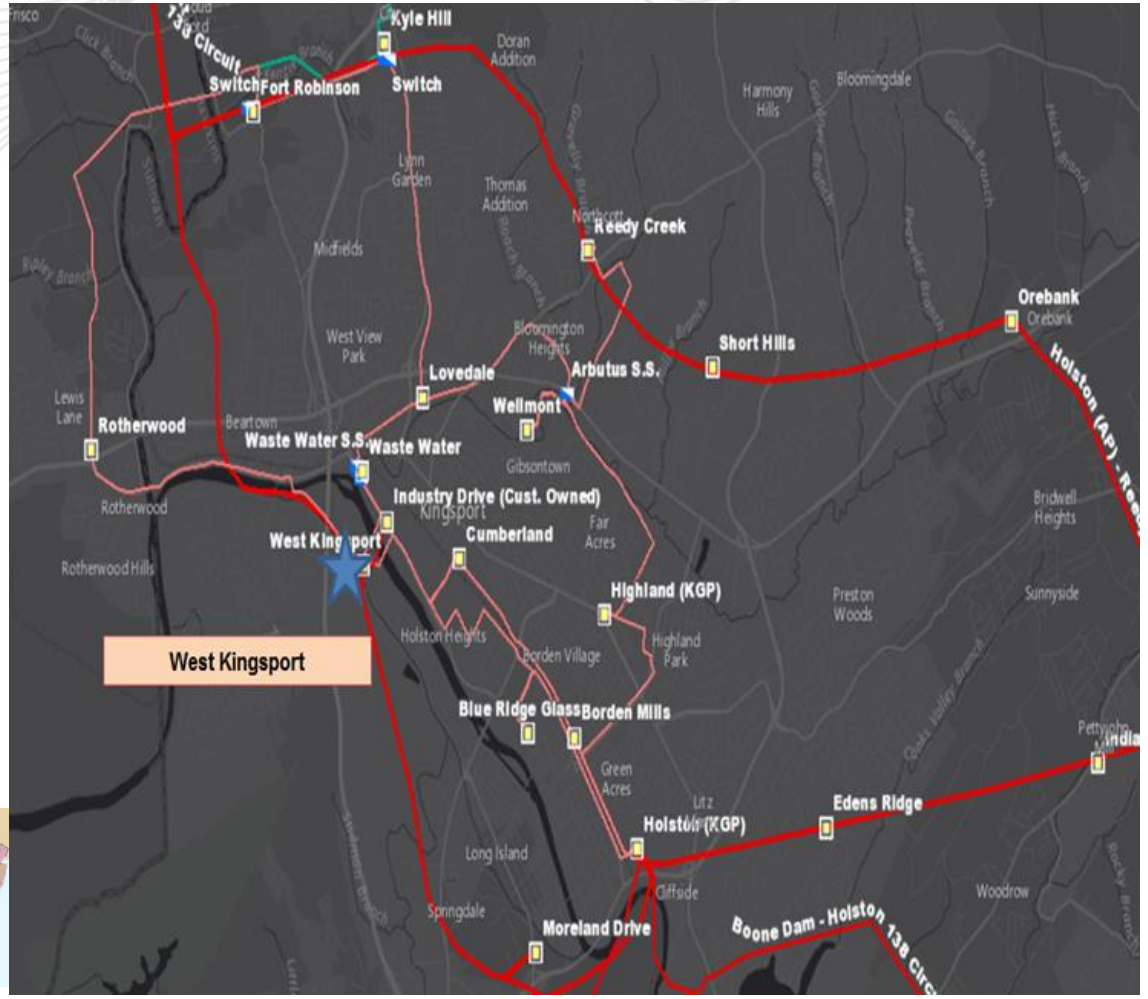
AEP Transmission Zone: Baseline
West Kingsport Area

Process Stage: Second Review
Criteria: AEP FERC 715 Criteria
Assumption Reference: 2026 RTEP assumption
Model Used for Analysis: 2026 RTEP cases
Proposal Window Exclusion: None

Problem Statement:

AEP -T1, AEP -T2, AEP -T3, AEP -T4, AEP -T5

In 2026 RTEP light load case, the Lovedale – Sewage 34.5kV line and the Sewage – West Kingsport 34.5kV lines are overloaded for the N-1-1 contingency pair; and the West Kingsport transformer is overloaded for multiple N-1-1 contingency pairs.



PJM©2021

AEP Transmission Zone: Baseline
West Kingsport Area

As part of the 2021 RTEP Window #1, the projects listed in the table below are proposed to address the following violations: AEP-T1, AEP-T1, AEP-T3, AEP-T4, AEP-T5

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost ($M)
19	AEP	West Kingsport Line Cut In	2.907
909	AEP	West Kingsport Transformer Replacement and Line Rebuilds	7.425

Recommended Solution: Proposal #2021_1-19

- Install two (2) 138 KV circuit breakers in the M and N strings in the breaker-and-a half configuration in West Kingsport station 138 KV yard to allow the Clinch River – Moreland Dr. 138 KV to cut in the West Kingsport station (**B3344.1**), Estimated Cost: $1.846 M
- Upgrade remote end relaying at Riverport 138kV station due to the line cut in at West Kingsport station (**B3344.2**), Estimated Cost: $0.251M

Total Estimated Cost: $2.097M

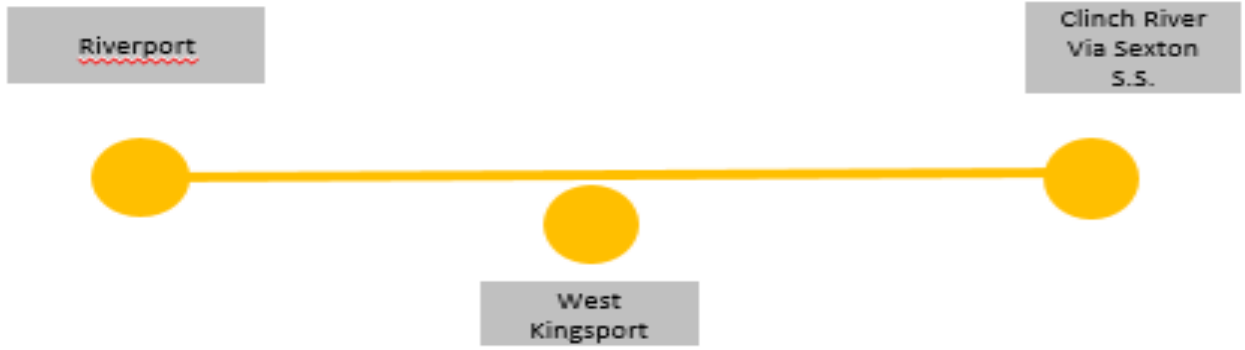
Required IS Date: 11/1/2026
Required IS Date: 11/1/2026
Previously Presented: 10/5/2021

PJM©2021

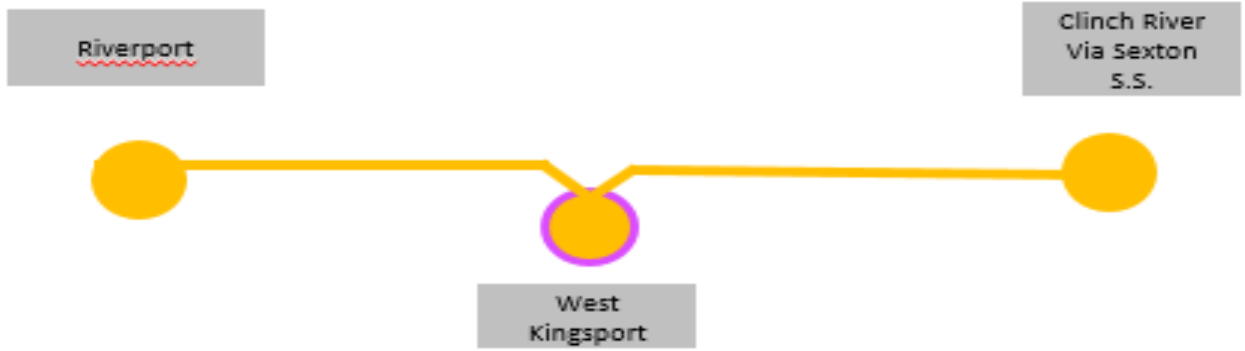
AEP Transmission Zone: Baseline
West Kingsport Area

Existing:

Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	



Proposed:



PJM©2021

AEP Transmission Zone: Baseline
Leatherwood – Salt Fork 69kV line

Process Stage: Second Review
Criteria: AEP FERC 715 Criteria
Assumption Reference: 2026 RTEP assumption
Model Used for Analysis: 2026 RTEP cases
Proposal Window Exclusion: None

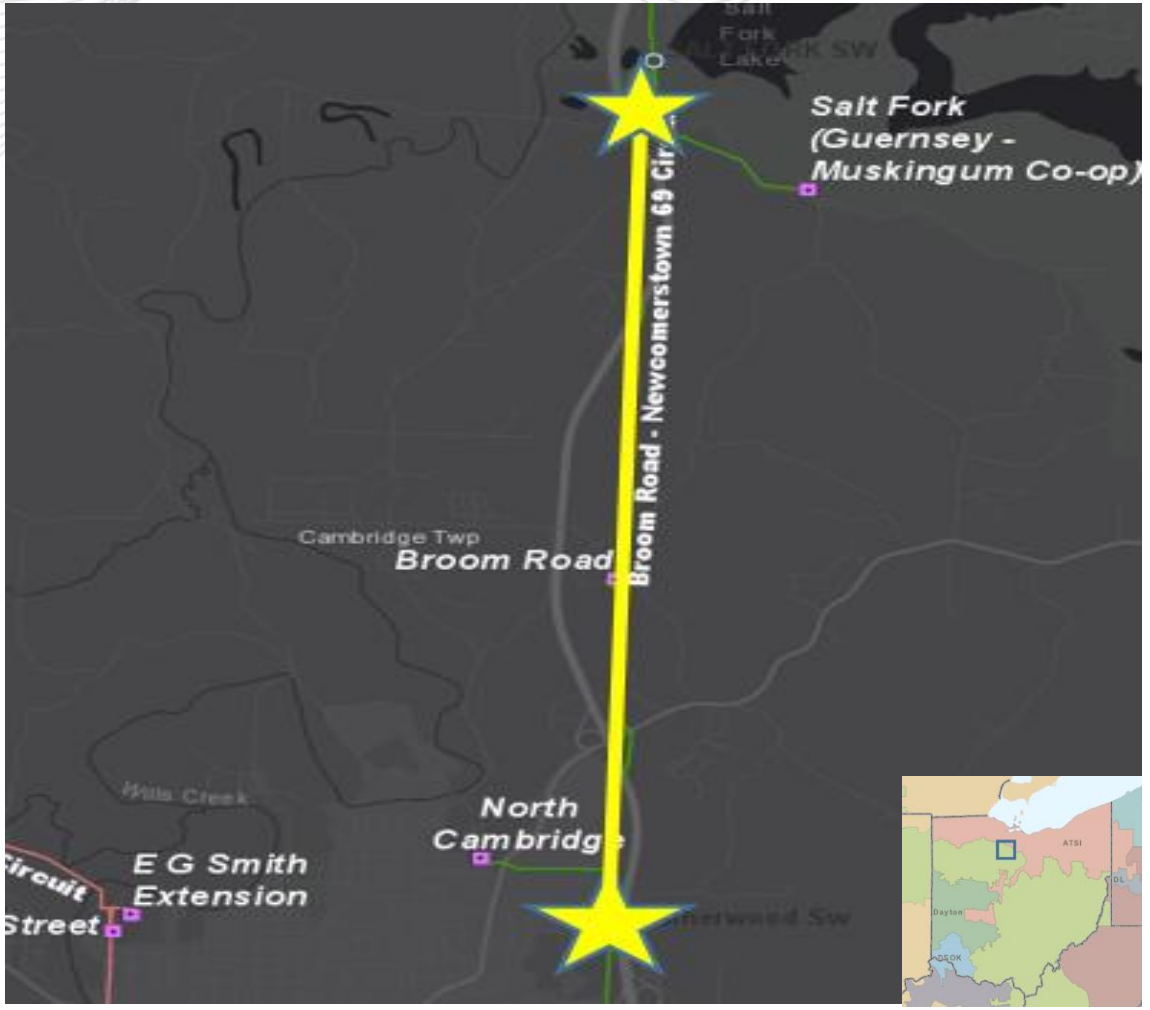
Problem Statement:

AEP-T39, AEP-T40, AEP-T41, AEP-T42

In 2026 RTEP summer case, the Leatherwood – Broom Road 69kV line and Broom Road – Salt Fork 69kV line are overloaded for a N-1-1 contingency pair.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05LEATHERW – 05BROOMRD 69KV	46/46/60/60
05BROOMRD – 05SALTFRKZ 69KV	46/46/60/60



SN / SE / WN / WE: Summer Normal / Summer Emergency / Winter Normal / Winter Emergency

PJM©2021

AEP Transmission Zone: Baseline Leatherwood – Salt Fork 69kV line

As part of the 2021 RTEP Window #1, the projects listed in the table below are proposed to address the following violations: AEP-T39, AEP-T40, AEP-T41, AEP-T42

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost ($M)
115	AEP	Salt Fork-Leatherwood Rebuild	9.101
920	AEP	West Cambridge Transformer Addition	4.953

Recommended Solution: Proposal #2021_1-115

- Rebuild ~4.2 miles of overloaded sections of the 69 kV line between Salt Fork Switch and Leatherwood Switch with 556 ACSR. (**B3345.1**) Estimated cost: $9.062M
- Update relay settings at Broom Road station. (**B3345.2**) Estimated cost: $0.039M

Estimated Cost: $9.101M

Additional Benefit: Addresses part of the supplemental need AEP-2021-OH006 (presented in 2/17/2021 W-SRRTEP)

Branch	SN/SE/WN/WE (MVA)
05LEATHERW – 05BROOMRD 69KV	73/90/91/106
05BROOMRD – 05SALTFRKZ 69KV	73/73/91/91

Required IS Date: 6/1/2026

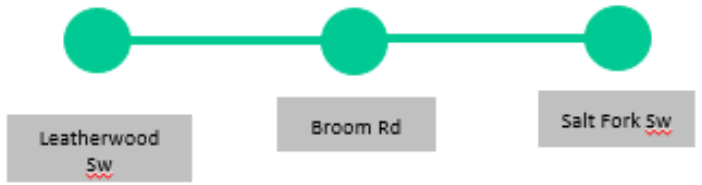
Required IS Date: 6/1/2026

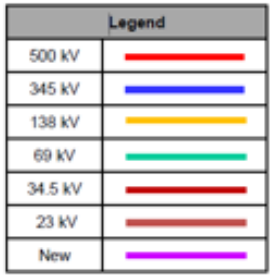
SN / SE / WN / WE: Summer Normal / Summer Emergency / Winter Normal / Winter Emergency

PJM©2021

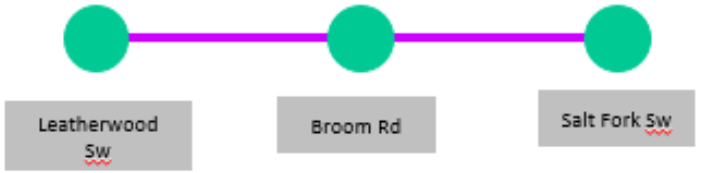
AEP Transmission Zone: Baseline
Leatherwood – Salt Fork 69kV line

Existing:





Proposed:



PJM©2021

AEP Transmission Zone: Baseline Bancroft-Milton 69kV line

Process Stage: Second Review

Criteria: AEP FERC 715 Criteria

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP cases

Proposal Window Exclusion: None

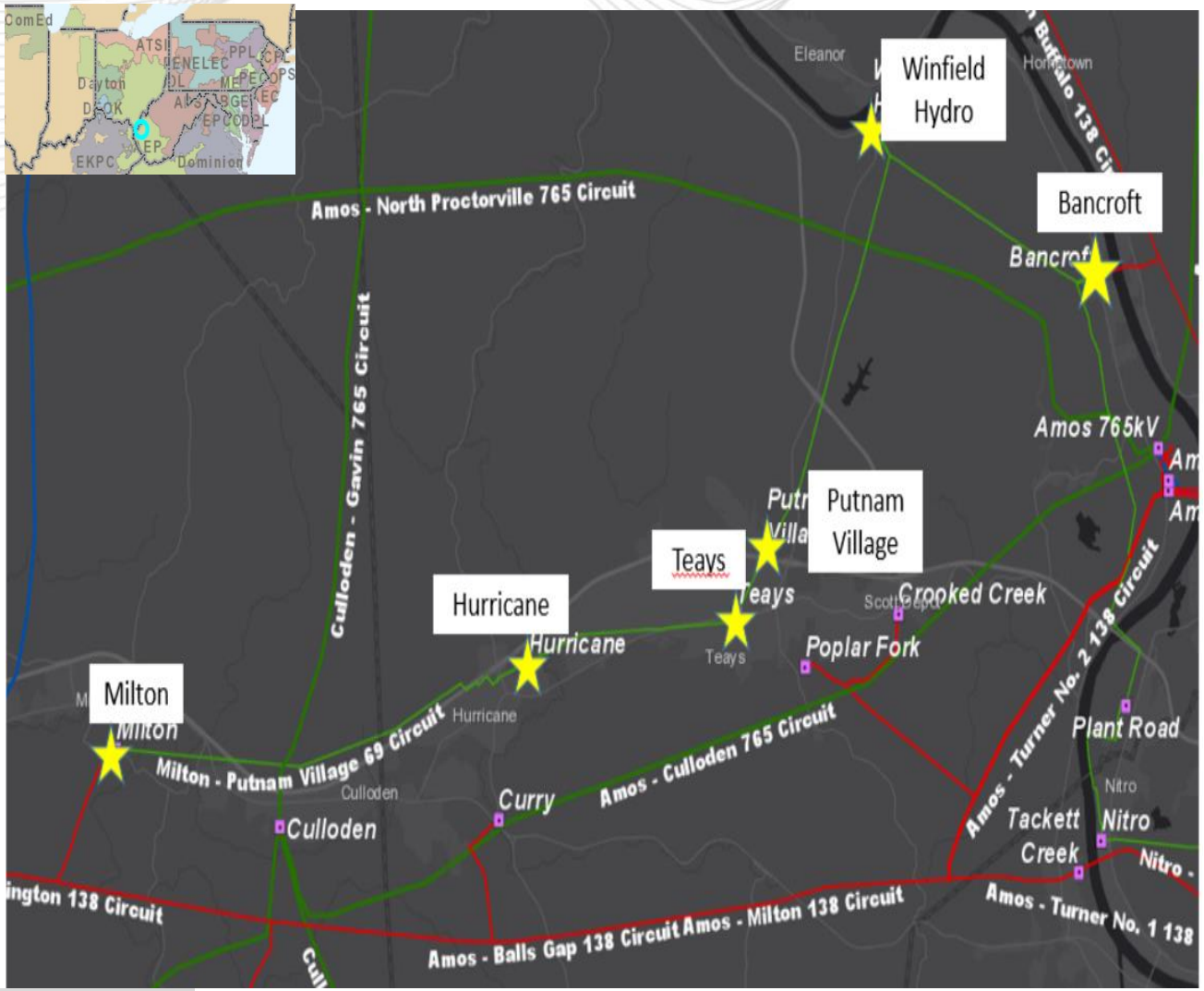
Problem Statement:

AEP -T9, AEP -T10, AEP -T11, AEP -T12, AEP -T13, AEP -T14

In 2026 RTEP light load case, the Bancroft – Putnam Village 69kV line, the Putnam Village – Winfield 69kV line, the Putnam Village – Teays 69kV line and the Hurrican – Milton 69kV line are overload for a N-1-1 contingency pair, and the Hurrican – Teays 69kV line is overload for multiple N-1-1 contingency pairs.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05HURRICAN – 05MILTON 69KV	40/40/56/56
05HURRICAN – 05TEAYS 69KV	40/40/56/56
05TEAYS – 05PUTNAM VLG 69KV	50/50/63/63
05WINFIELD – 05PUTNAM VLG 69KV	50/50/63/63
05BANCROFT – 05PUTNAM VLG 69KV	50/50/63/63



SN / SE / WN / WE: Summer Normal / Summer Emergency / Winter Normal / Winter Emergency

PJM©2021

AEP Transmission Zone: Baseline Bancroft-Milton 69kV line

As part of the 2021 RTEP Window #1, the projects listed in the table below are proposed to address the following violations: AEP -T9, AEP -T10, AEP -T11, AEP -T12, AEP -T13, AEP -T14

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost ($M)
116	AEP	Bancroft-Milton Rebuild	56.729
336	AEP	Cabell Station Expansion and Cut In	13.684

Recommended Solution: Proposal #2021_1-116

- Rebuild approximately 20 miles of line between Bancroft and Milton stations with 556 ACSR conductor. (**B3347.1**) Estimated cost: $56.553M
- Replace the jumpers around Hurricane switch with 556 ACSR. (**B3347.2**) Estimated cost: $0.014M
- Replace the jumpers around Teays switch with 556 ACSR.. (**B3347.3**) Estimated cost: $0.014M
- Winfield Station Relay Settings: Update relay settings to coordinate with remote ends on line rebuild. (**B3347.4**) Estimated cost: $0.047M
- Bancroft Station Relay Settings: Update relay settings to coordinate with remote ends on line rebuild. (**B3347.5**) Estimated cost: $0.027M
- Milton Station Relay Settings: Update relay settings to coordinate with remote ends on line rebuild. (**B3347.6**) Estimated cost: $0.027M
- Putnam Village Station Relay Settings: Update relay settings to coordinate with remote ends on line rebuild. (**B3347.7**) Estimated cost: $0.047M

Total Estimated Cost: $56.729M

PJM©2021

AEP Transmission Zone: Baseline Bancroft-Milton 69kV line

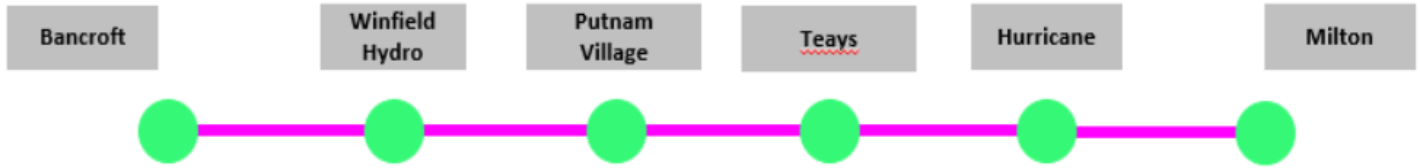
Additional Benefit: The Bancroft - Milton 69 kV line is mostly comprised of 1920s and 1930s steel lattice construction and has experienced 28 momentary outages and 10 permanent outages since 2015, resulting in 840,000 CMI. Any supplemental needs not addressed in this proposal will go through the M-3 process as needed.

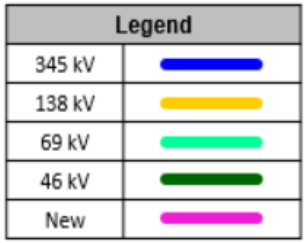
Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05HURRICAN – 05MILTON 69KV	102/142/129/159
05HURRICAN – 05TEAYS 69KV	102/142/129/159
05TEAYS – 05PUTNAM VLG 69KV	102/142/129/159
05WINFIELD – 05PUTNAM VLG 69KV	102/142/129/159
05BANCROFT – 05PUTNAM VLG 69KV	102/142/129/159

Existing

Proposed





Required IS Date: 11/1/2026
Projected IS Date: 6/30/2026
Previously Presented: 10/5/2021

SN / SE / WN / WE: Summer Normal / Summer Emergency / Winter Normal / Winter Emergency

PJM©2021

PECO Transmission Zone: Baseline

Process Stage: Second Review

Criteria: Summer Generator Deliverability

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP Summer case

Proposal Window Exclusion: None

Problem Statement:

The PECO portion of the Croydon – Burlington 230 kV circuit is overloaded for multiple contingencies.

Violations were posted as part of the 2021 Window 1: FG# GD-S485, GD-S674 and GD-S486

Existing Facility Rating: 752SN/906E, 840WN/996WE MVA

Proposed Facility Rating: 851SN/995SE, 892WN/1020WE MVA

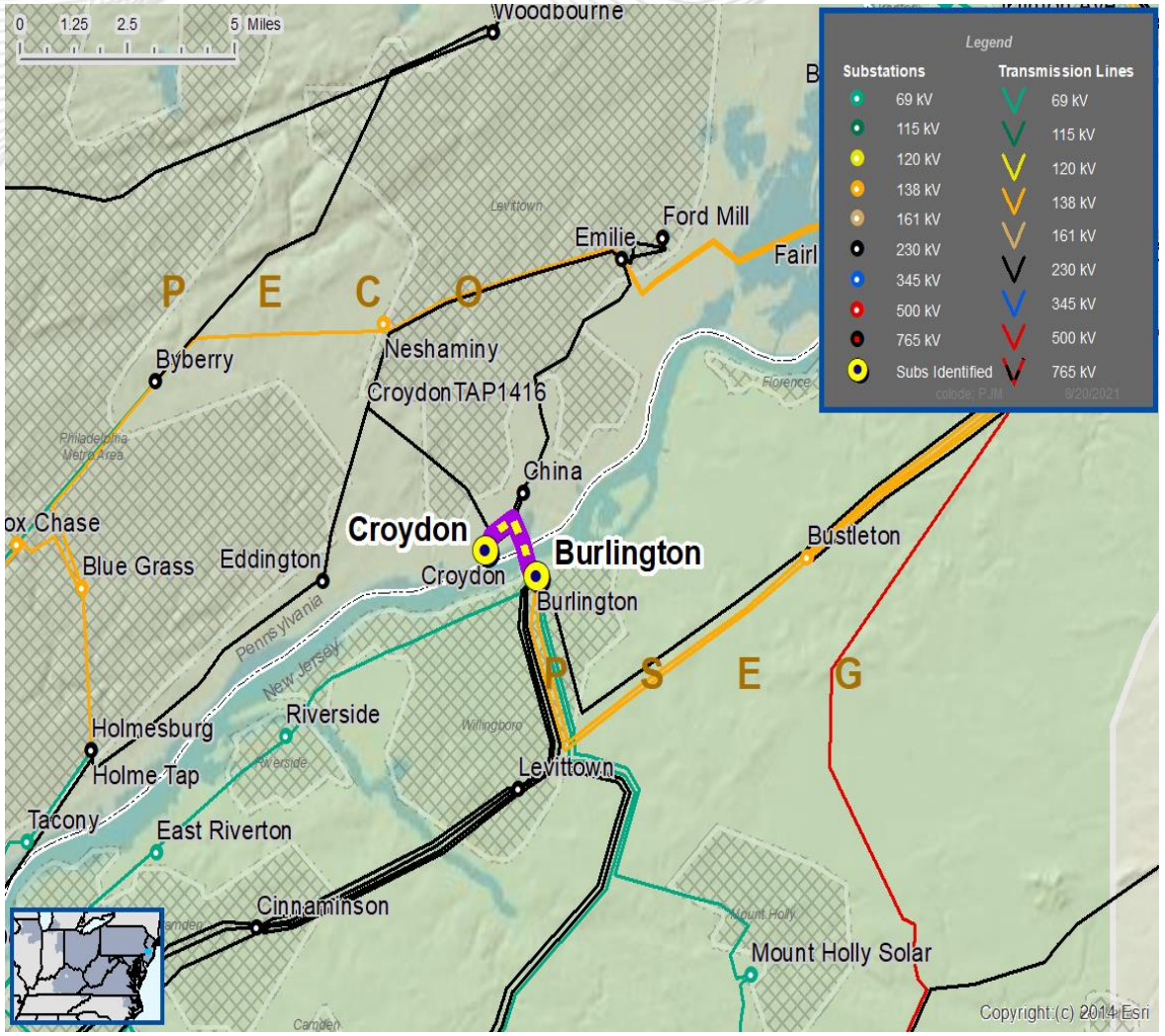
Recommended Solution:

Proposal ID 88- Replace a 0.76 mile length of the Croydon-Burlington 230 kV line conductor. The existing conductor is 1590 kcmil ACSR and will be replaced by 1622 kcmil ACSS/TW. **(B3335**)
Note: The upgrade overlaps with a deactivation study.
Estimated Cost: $0.794 M

Alternatives: N/A

Required In-Service: 6/1/2026

Projected In-Service: 6/1/2023



PJM©2021

PPL Transmission Zone: Baseline

Process Stage: Second Review

Criteria: Summer N-1 and Generator Deliverability

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP Summer case

Proposal Window Exclusion: Substation Equipment

Problem Statement:

The Juniata 500/230 kV transformer #2 is overloaded for line fault stuck breaker contingency.

Violations were posted as part of the 2021 Window 1: FG# N1-ST31 and GD-S429

Existing Facility Rating: 685SN/814SE, 842WN/911WE MVA

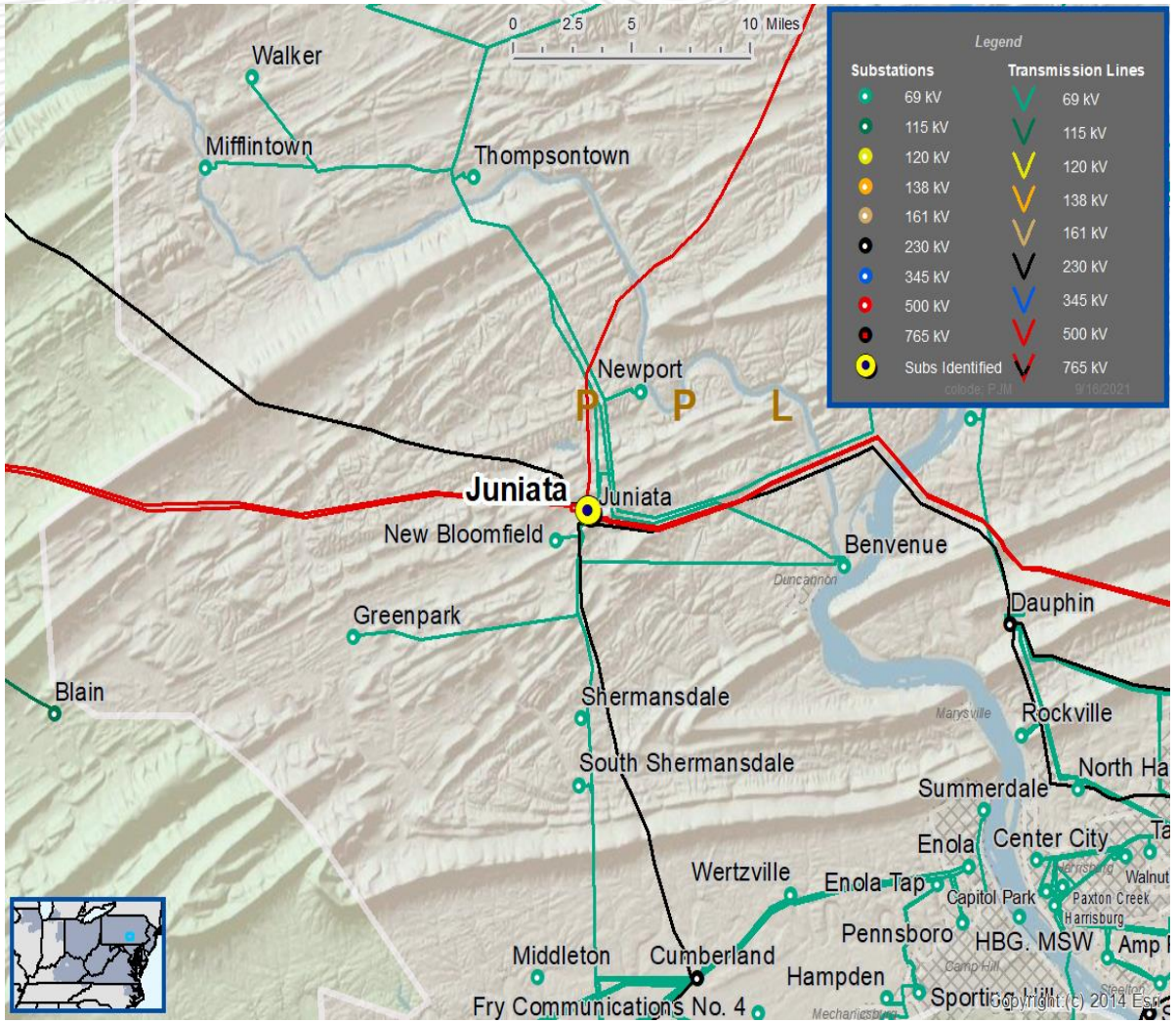
Proposed Facility Rating: 776SN/1010SE, 971WN/1040WE MVA

Recommended Solution:
Juniata: Replace the limiting 230kV T2 transformer leads, bay conductor and bus conductor with double bundle 1590 ACSR . Replace the limiting 1200A MODs on the Bus tie breaker with 3000A MODs. **(B3664**)
Note: If the S0945.1 (Rebuild Juniata 230 kV station) moves forward and construction is completed prior to 6/1/2026, the baseline project may not be needed and may be canceled.

Estimated Cost: $0.684 M

Alternatives: N/A

Required In-Service: 6/1/2026



Penelec Transmission Zone: Baseline

Process Stage: Second Review
Criteria: Summer Generator Deliverability
Assumption Reference: 2026 RTEP assumption
Model Used for Analysis: 2026 RTEP Summer case
Proposal Window Exclusion: Substation Equipment

Problem Statement:

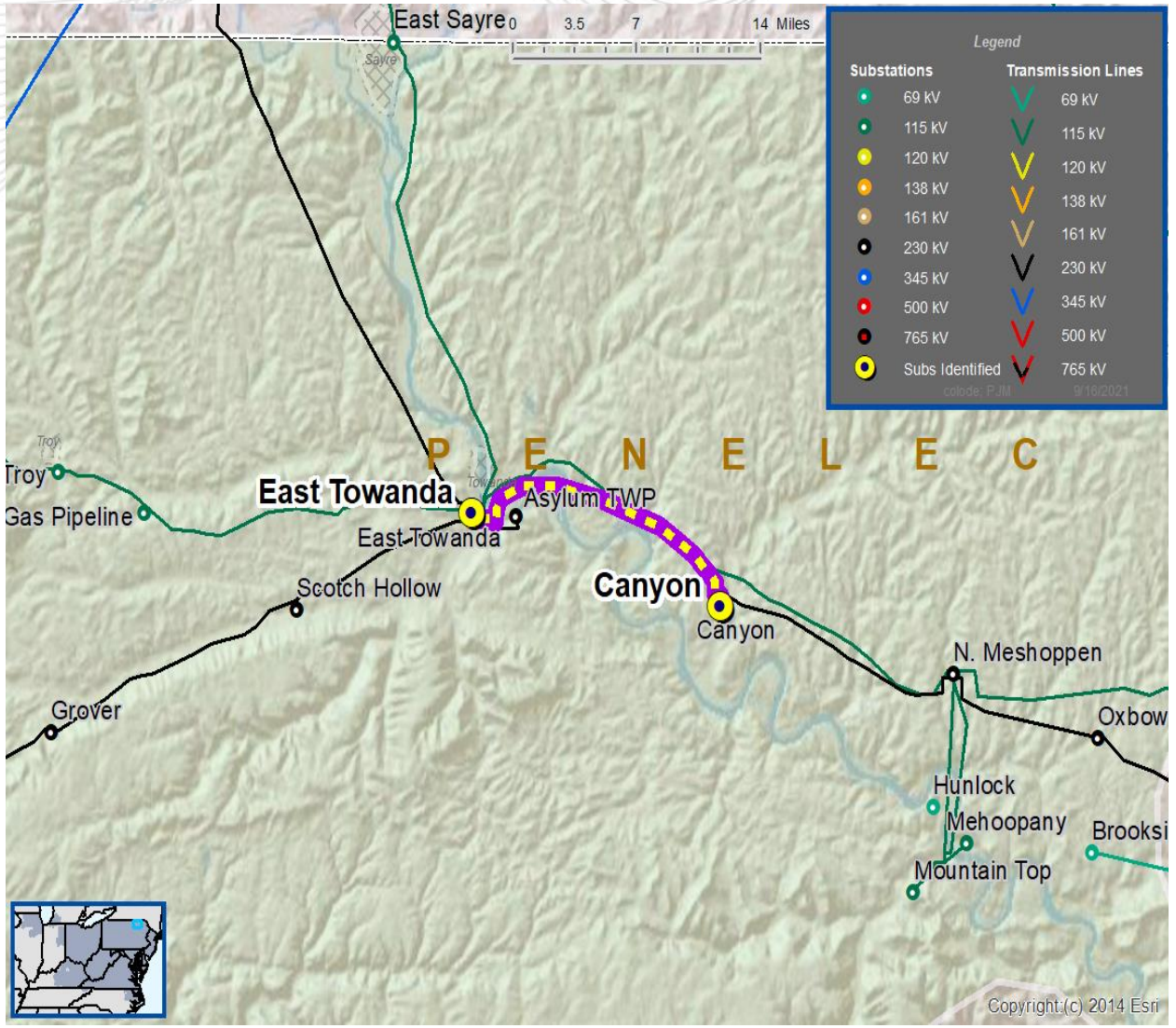
East Towanda - Canyon 230 kV is overloaded for pre-contingency plus multiple contingencies.

Violations were posted as part of the 2021 Window 1: GD-S14, GD-S15, GD-S38

Existing Facility Rating: **:** 515SN/615SE, 619WN/703WE MVA
Proposed Facility Rating: 546SN/666SE, 619WN/790WE MVA.

Recommended Solution :
Replace several pieces of 1033.5 AAC substation conductor at East Towanda 230 kV. **(B3665)**

Estimated Cost: $0.407 M
Alternatives: N/A
Required In-Service: 6/1/2026



PJM©2021

Penelec Transmission Zone: Baseline

Process Stage: Second Review

Criteria: Summer and Winter, N-1 and N-1-1 Voltage

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP Summer case

Proposal Window Exclusion: None

Problem Statement: Post-contingency high voltage violation in Penelec, Grover area. Potential voltage violation at the Grover and surrounding 230 kV stations for N-1, N-1-1 contingencies.

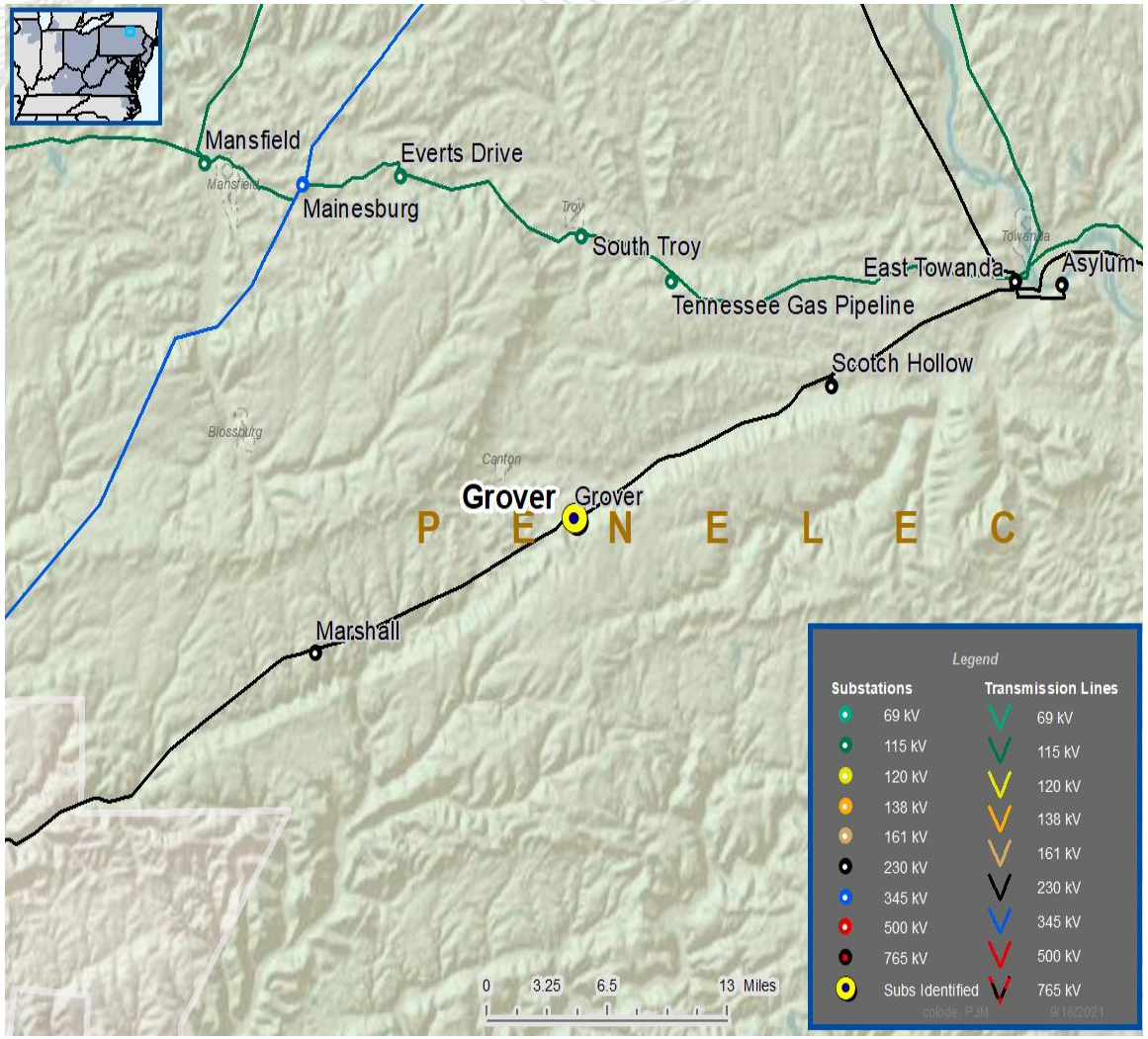
Violations were posted as part of the 2021 Window 1: (N1-SVM1, N1-SVM2, N2-SVM1, N2-SVM2, N2-SVM3, N2-SVM4, N2-SVM5, N2-SVM6, N2-SVM7, N1-WVM1, N1-WVM2, N1-WVM3, N1-WVM4, N2-WVM1, N2-WVM2, N2-WVM3, N2-WVM4, N2-WVM5, N2-WVM6, N2-WVM7, N2-WVM8, N2-WVM9)

Existing Facility Rating: N/A

Recommended Solution :
Proposal ID 745 - Marshall 230 kV Substation: Install dual reactors and expand existing ring bus **. (B3666)**
Estimated Cost: $5.83 M

Alternatives:
Proposal ID 634 - Grover 230 kV Substation: Install dual reactors and convert the station to a ring bus. $16.32
Proposal ID 498 - Grover Substation: Install two reactors and install line breakers. $5.11 M

Required In-Service: 6/1/2026



PJM©2021

Penelec Transmission Zone: Baseline

Process Stage: Second Review

Criteria: Summer N-1-1 Voltage

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP Summer case

Proposal Window Exclusion: None

Problem Statement: Post-contingency voltage magnitude and voltage drop violation in Penelec, Mansfield area. Potential voltage violation at the Mansfield and surrounding 115 kV stations for N-1-1 contingencies.

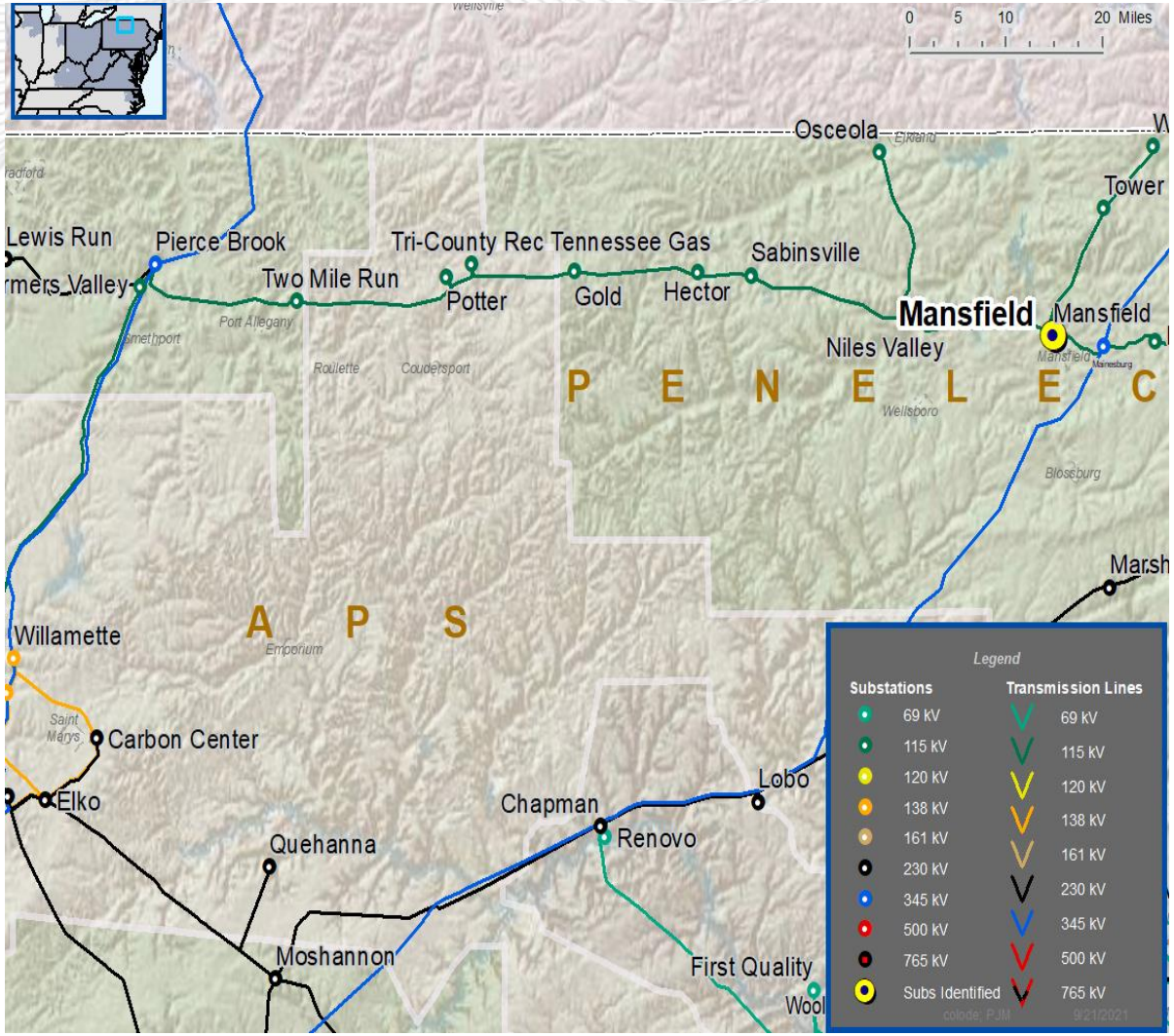
Violations were posted as part of the 2021 Window 1: (N2-SVM48, N2-SVM49, N2-SVM50, N2-SVD19, N2-SVD20, N2-SVD21, N2-SVD22, N2-SVD23, N2-SVD24, N2-SVD25, N2-SVD26, N2-SVD27, N2-SVD28, N2-SVD29)

Existing Facility Rating: N/A

Recommended Solution:
Proposal ID 101 - Pierce Brook Substation: Install second 230/115 kV transformer. **(B3667)**

Estimated Cost: $5.07 M

Alternatives: N/A
Required In-Service: 6/1/2026



PJM©2021

Appendix B
2020/21 Long Term Window 1 Market Efficiency
B/C Ratios
Clusters No. 2 (PECO), No. 3 (PPL), and No.4 (DOM)

PJM©2021

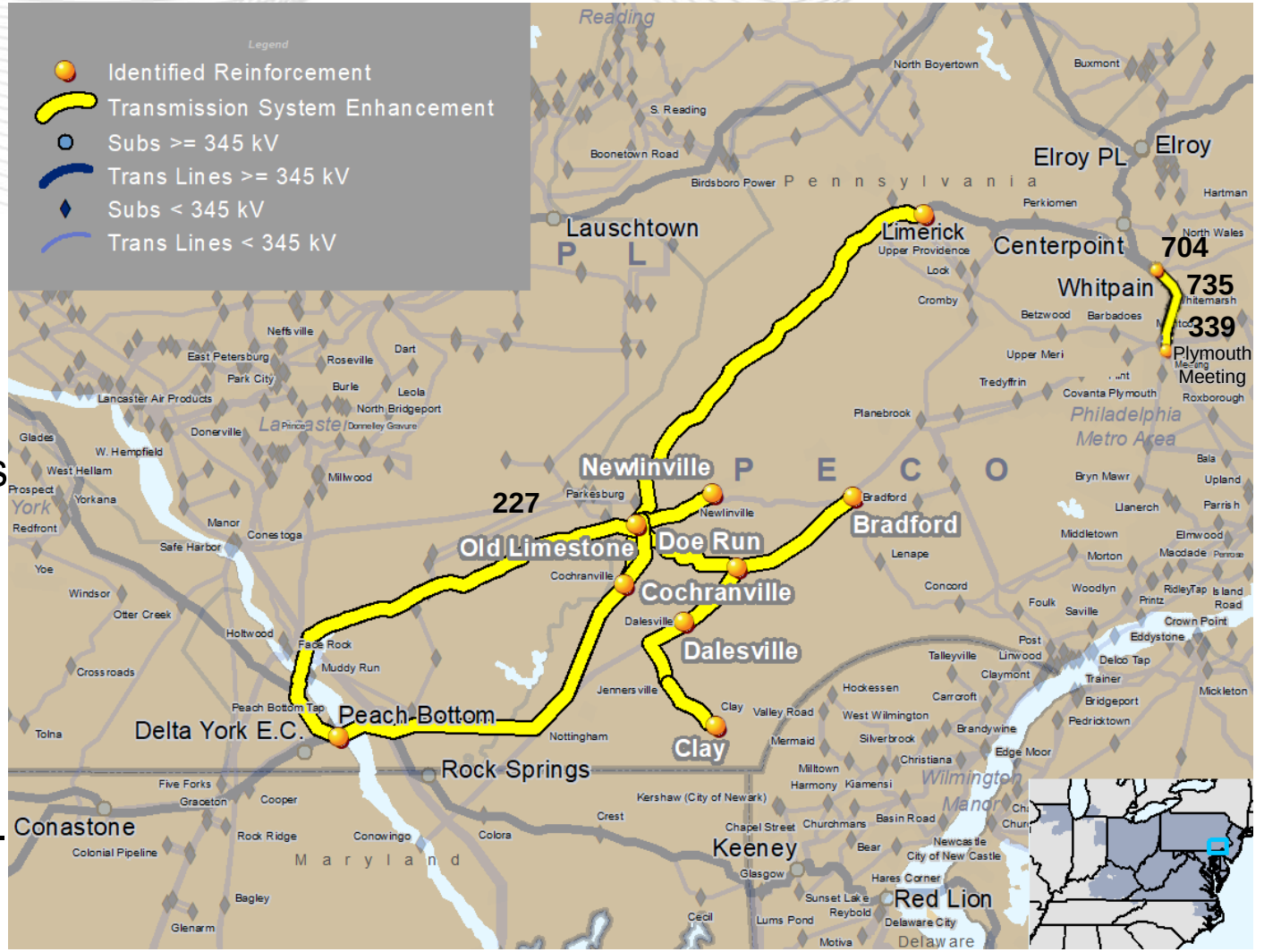
Cluster No. 2 (PECO) - Market Efficiency Proposals

- 227: Interconnect Peach Bottom - Limerick 500kV and Cochranville - Newlinville 230kV lines via new Old Limestone 500/230 kV substation. Build new 230 kV Doe Run substation and interconnect Daleville - Bradford and Clay Tap - Bradford 230kV lines. Build new Old Limestone to Doe Run line.

- 399: Install Smart Wires device in series with the 220-13 and 220-14 Whitpain-Plymouth 230 kV lines and upgrade terminal equipment at Whitpain and Plymouth substations.

- 704: Upgrade terminal equipment at Whitpain and Plymouth substations.

- 735: Reconductor the 220-13 and 220-14 Whitpain-Plymouth 230 kV lines.



PJM©2021

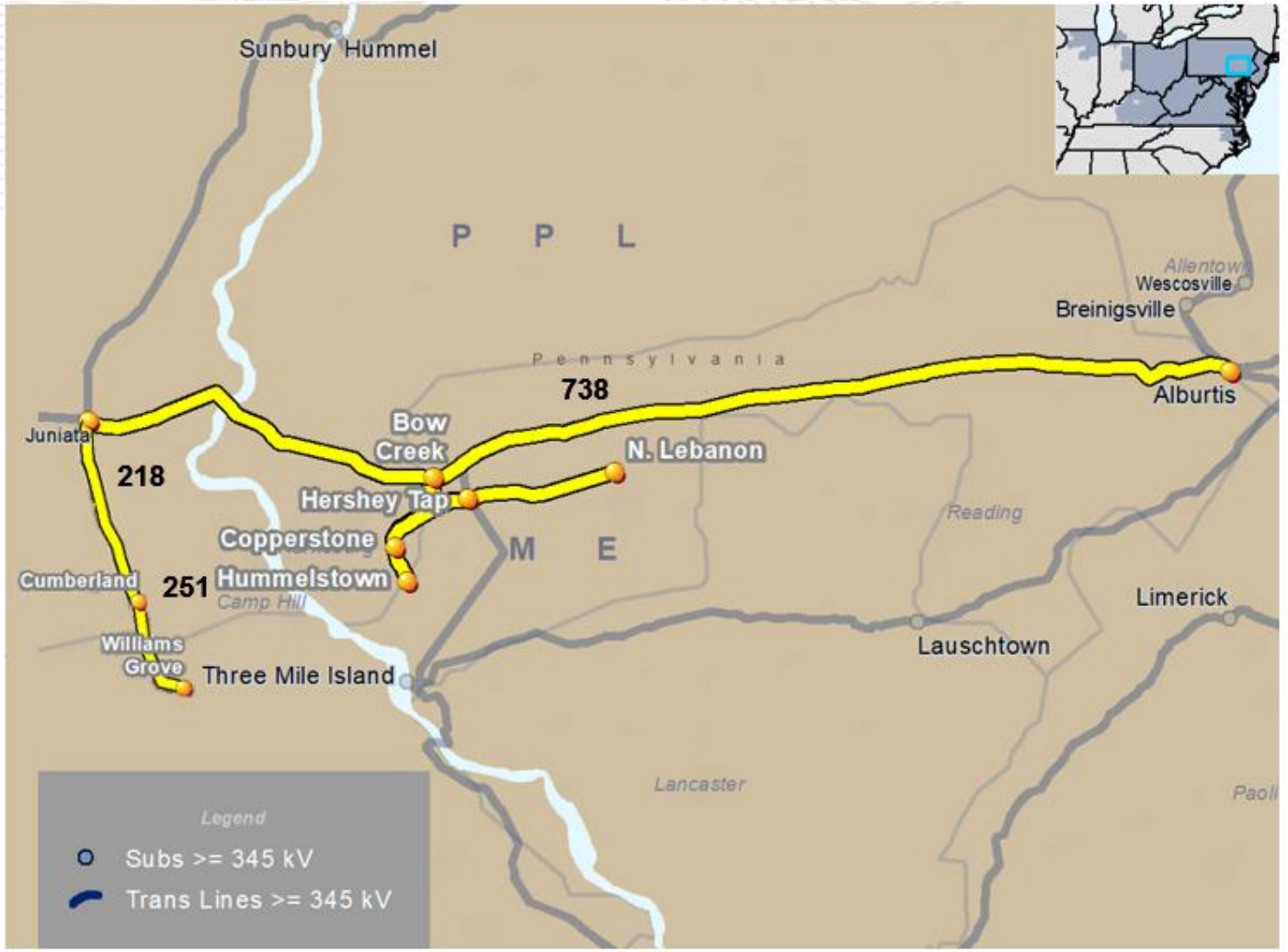
Cluster No. 2 (PECO) - Final B/C Ratios: Base Case and Sensitivities

Proposal ID	227	399	704	735
Proposal Description	Old Limestone - Doe Run 500/230kV New line	Plymouth-Whitpain 220-13, 220-14 SmartWires	Plymouth-Whitpain 220-13, 220-14 Terminal Upgrades	Rebuild Plymouth-Whitpain 220-13, 220-14 Circuits
Project Type	Greenfield	Upgrade	Upgrade	Upgrade
B/C Ratio Metric	Lower Voltage	Lower Voltage	Lower Voltage	Lower Voltage
In-Service Cost ($MM)	$73.51	$8.42	$0.62	$14.98
Cost Containment	Yes	No	No	No
In-Service Year	2025	2025	2025	2025
% Cong Driver Mitigated	99.80%	100%	99.91%	100%
2025 Shifted Cong ($MM)	No significant shift	No significant shift	No significant shift	No significant shift
15-Yr NPV NLP Benefit ($MM)	$85.09	$47.49	$49.41	$51.23
Base Case B/C Ratio	1.09	5.33	75.30	3.23
No9A Sens. B/C Ratio	N/A	6.21	72.73	3.08
FSA Sens. B/C Ratio	N/A	1.58	17.76	0.56
Low Load B/C Ratio	N/A	3.97	63.33	2.64
High Load B/C Ratio	N/A	9.18	111.17	5.00
Low Gas B/C Ratio	N/A	3.36	43.33	2.20
High Gas B/C Ratio	N/A	3.01	36.75	1.53

PJM©2021

Cluster No. 3 (PPL) - Market Efficiency Proposals

- 102*: Capacitor bank at Reston 230 kV substation
- 218: Reconductor the Juniata - Cumberland 230 kV line.
- 251: Rebuild the existing single circuit Juniata - Cumberland 230 kV section to double circuit. Upgrade the Cumberland to William Grove 230 kV line.
- 540*: Capacitor bank at Bull Run 230 kV substation
- 738: Build new 500/230 kV Bow Creek tap substation on Juniata – Alburtis 500kV line to interconnect North Hershey - Hummelstown and North Lebanon – Copperstone 230kV lines.



** Proposals 102 and 540, capacitor banks at Reston and Bull Run 230 kV, are not show on the map*

PJM©2021

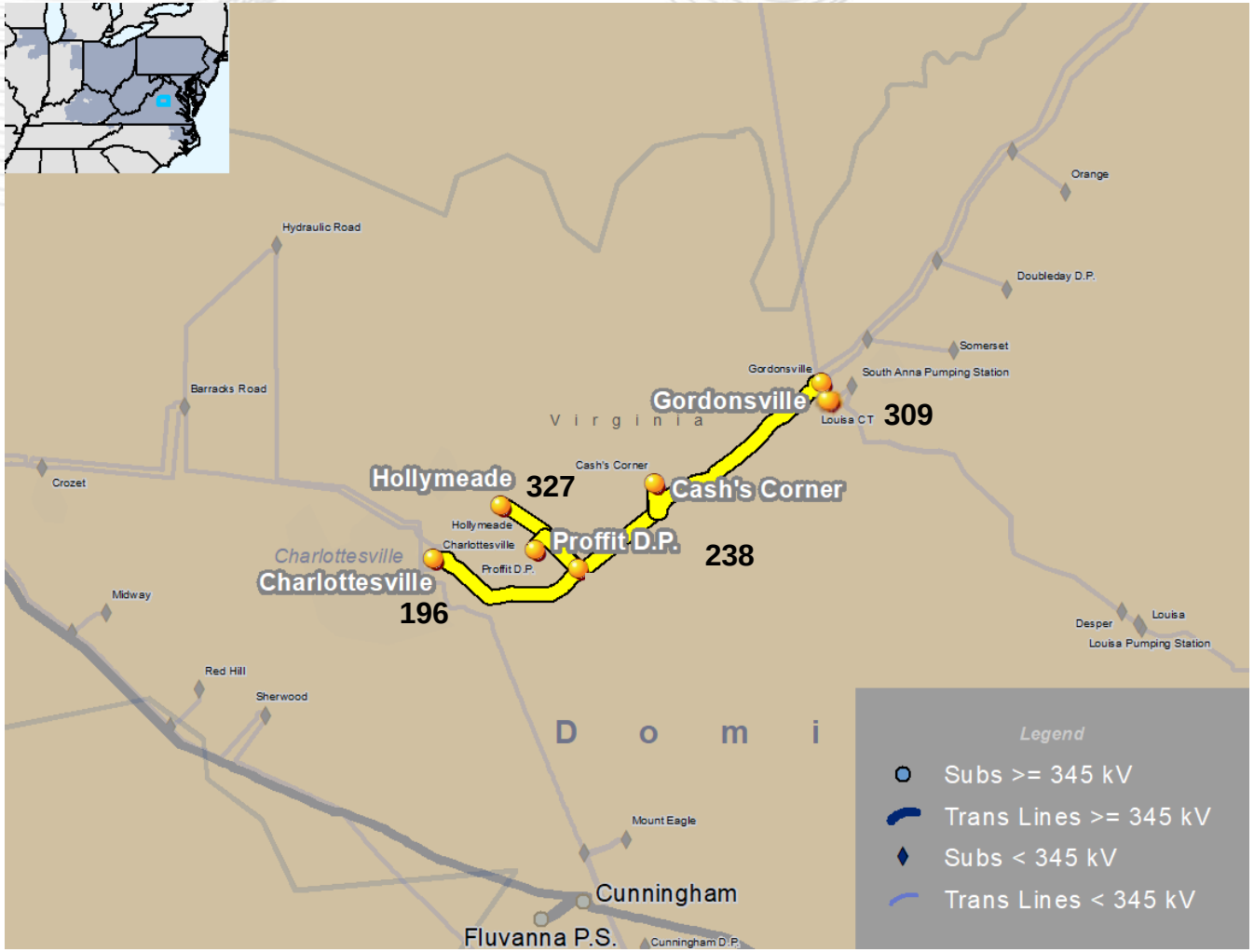
Cluster No. 3 (PPL) - Final B/C Ratios: Base Case and Sensitivities

Proposal ID	102	218	251	540	738
Proposal Description	Reston 230kV Capacitor	Juniata - Cumberland 230 kV Line Reconductor	Juniata - Cumberland 230 kv Double Circuit Rebuild	Bull Run 230kV Capacitor	Bow Creek 500/230kV Project
Project Type	Upgrade	Upgrade	Upgrade	Upgrade	Greenfield
B/C Ratio Metric	Lower Voltage	Lower Voltage	Lower Voltage	Lower Voltage	Lower Voltage
In-Service Cost ($M)	$1.89	$9.00	$49.05	$5.73	$55.05
Cost Containment	No	Yes	No	No	Yes
In-Service Year	2022	2023	2024	2023	2025
% Cong Driver Mitigated	0%	100%	100%	0%	97.83%
2025 Shifted Cong ($MM)	N/A	No significant shift	No significant shift	N/A	No significant shift
15-Yr NPV NLP Benefit ($MM)	N/A	$107.41	$106.57	N/A	$125.03
Base Case B/C Ratio	N/A	11.28	2.05	N/A	2.15
No9A Sens. B/C Ratio	N/A	10.65	2.28	N/A	2.48
FSA Sens. B/C Ratio	N/A	15.22	3.07	N/A	3.19
Low Load B/C Ratio	N/A	6.48	1.34	N/A	1.13
High Load B/C Ratio	N/A	18.10	3.43	N/A	3.15
Low Gas B/C Ratio	N/A	14.71	3.19	N/A	3.00
High Gas B/C Ratio	N/A	13.17	2.80	N/A	2.15

PJM©2021

Cluster No. 4 (DOM) - Market Efficiency Proposals

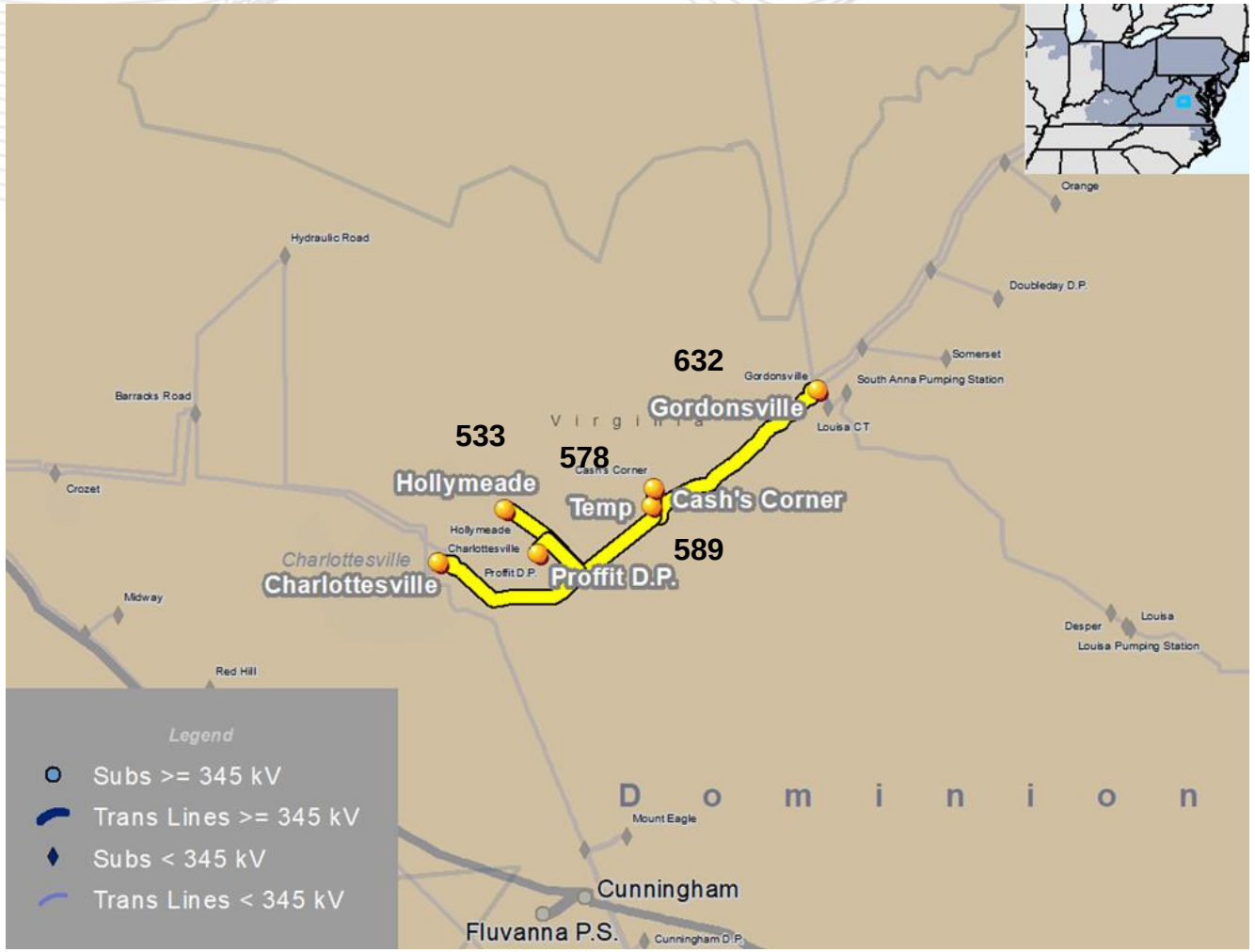
- 196: Charlottesville-Proffit 230kV Line Rebuild.
- 238: Charlottesville-Gordonsville 230kV Greenfield Line.
- 309: 5 MW Battery Energy Storage System at Louisa CT substation.
- 327: New Hollymeade Tap 230kV Substation. Charlottesville-Hollymeade Tap-Cash's Corner-Gordonsville 230kV Line Rebuild.



PJM©2021

Cluster No. 4 (DOM) - Market Efficiency Proposals (cont.)

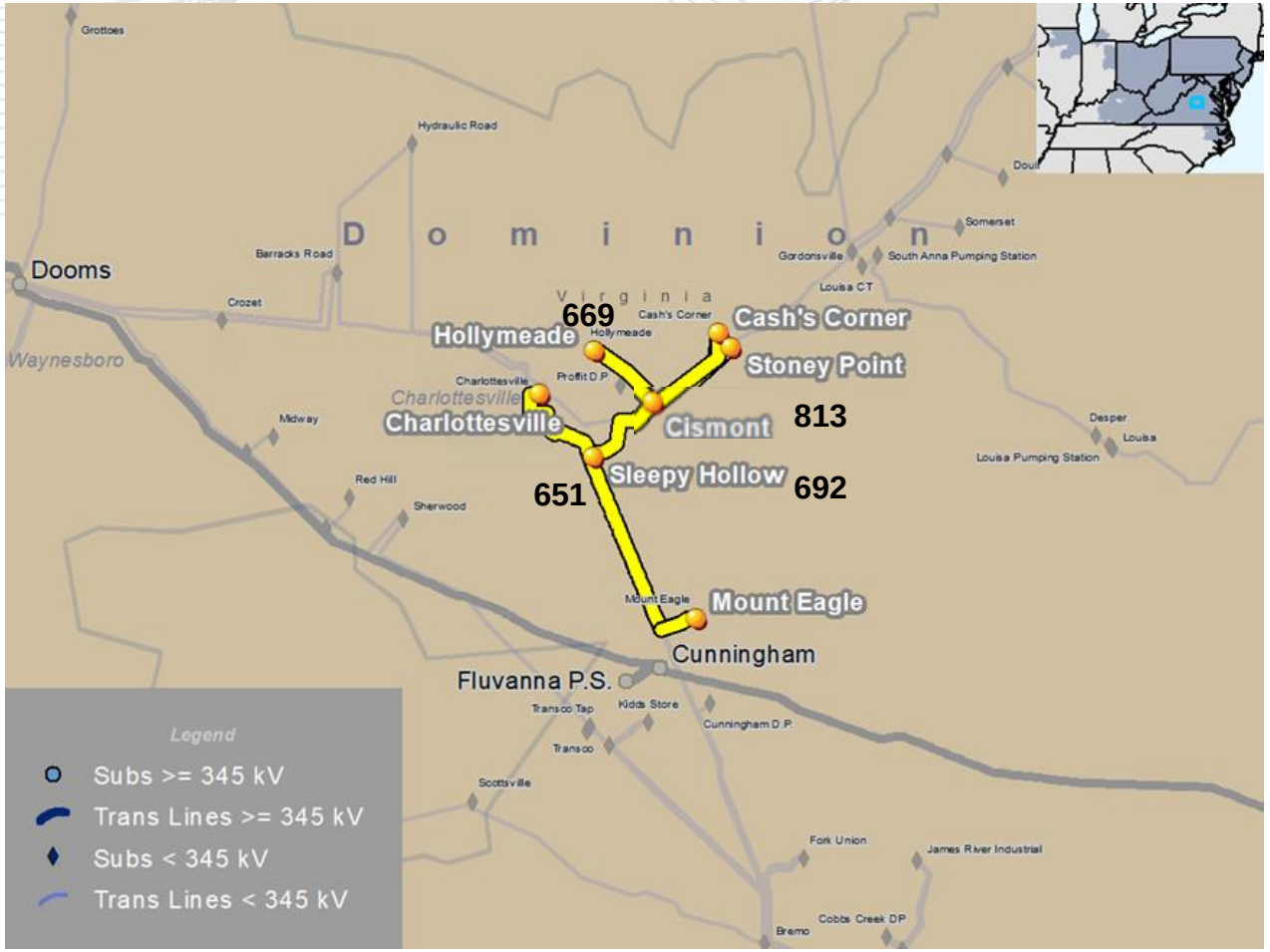
- 533: 10 MW Battery Energy Storage System at Hollymeade substation.
- 578: New Hollymeade Tap 230kV Substation.
- 589: Build Second Charlottesville-Gordonsville 230kV Line. Upgrade terminal equipment from Hollymeade to Gordonsville 230 kV.
- 632: 5 MW Battery Energy Storage System at Gordonsville Substation.



PJM©2021

Cluster No. 4 (DOM) - Market Efficiency Proposals (cont.)

- 651: Charlottesville-Proffit 230kV Line Series Reactor.
- 669: 5 MW Battery Energy Storage System at Hollymeade Substation.
- 692: Sleepy Hollow-Stoney Point 230kV Greenfield Project.
- 813: New Cismont 230kV Substation. Charlottesville-Hollymeade Tap-Cash's Corner-Gordonsville 230kV Line Rebuild.



PJM©2021