



Reliability Analysis Update

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Transmission Expansion Advisory Committee

October 4, 2022

First Review

Baseline Reliability Projects

Process Stage: First Read

Criteria: Summer Generator Deliverability

Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 RTEP Summer case

Proposal Window Exclusion: None

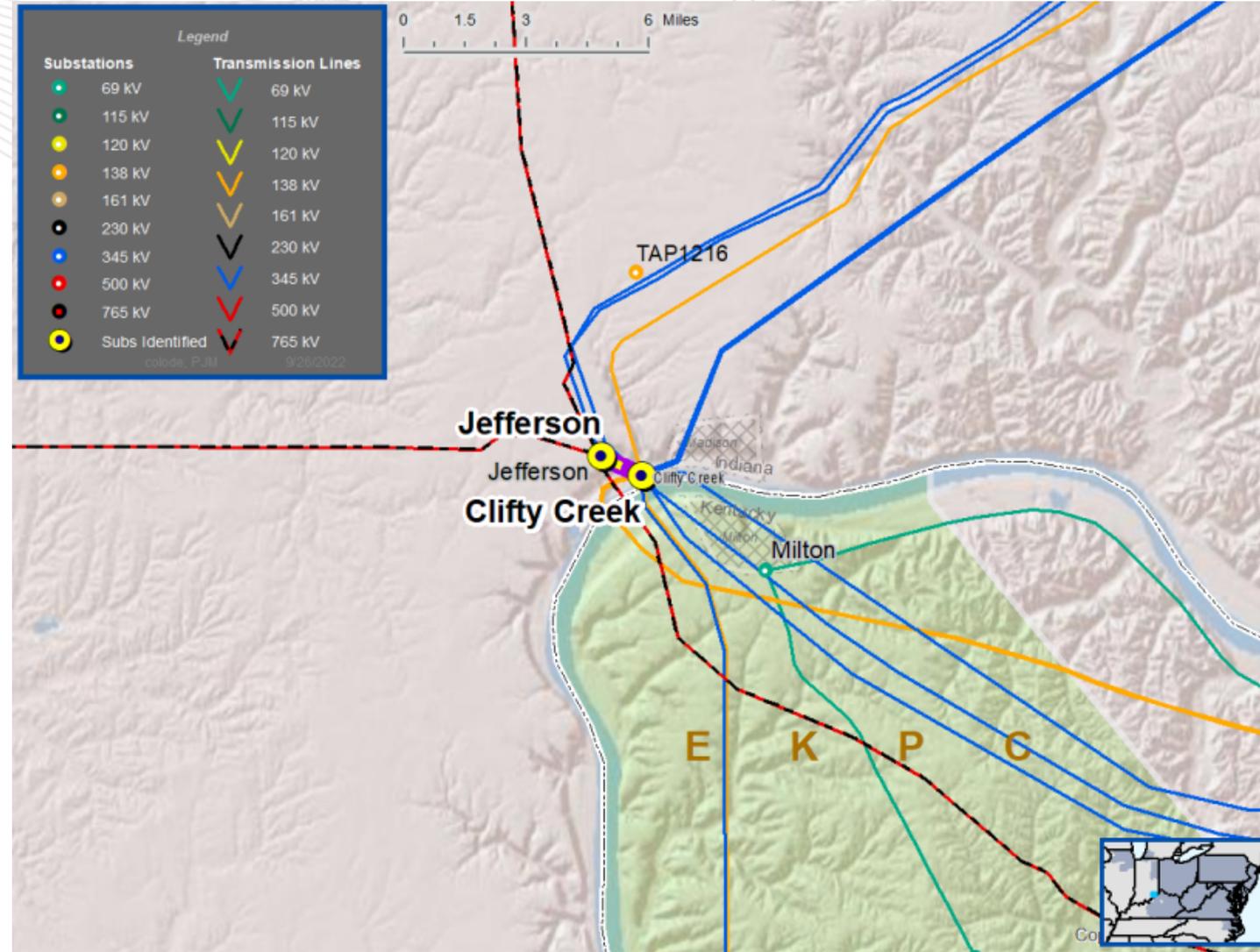
Problem Statement:

2022W1-GD-S632

In 2027 RTEP Summer case, The Jefferson – Clifty 345KV line is overload for a N-2 contingency in generator deliverability test.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05JEFRSO – 06CLIFTY 345kV	2056/2255/2669/2833





AEP Transmission Zone: Baseline Clifty Creek Switch Replacements

As part of the 2022 RTEP Window #1, the project listed in the table below are proposed to address the following violations: 2022W1-GD-S632

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost (\$M)
965	AEP	Replace four Clifty Creek 345 kV 3000 A switches with 5000 A 345 kV switches. Anticipated SN/SE rating for the branch section to be addressed (242865 to 248000) by the project is 2354/2354 MVA.	0.852

Proposed Solution: Proposal #2022_W1-965

Replace four Clifty Creek 345 kV 3000 A switches with 5000 A 345 kV switches.

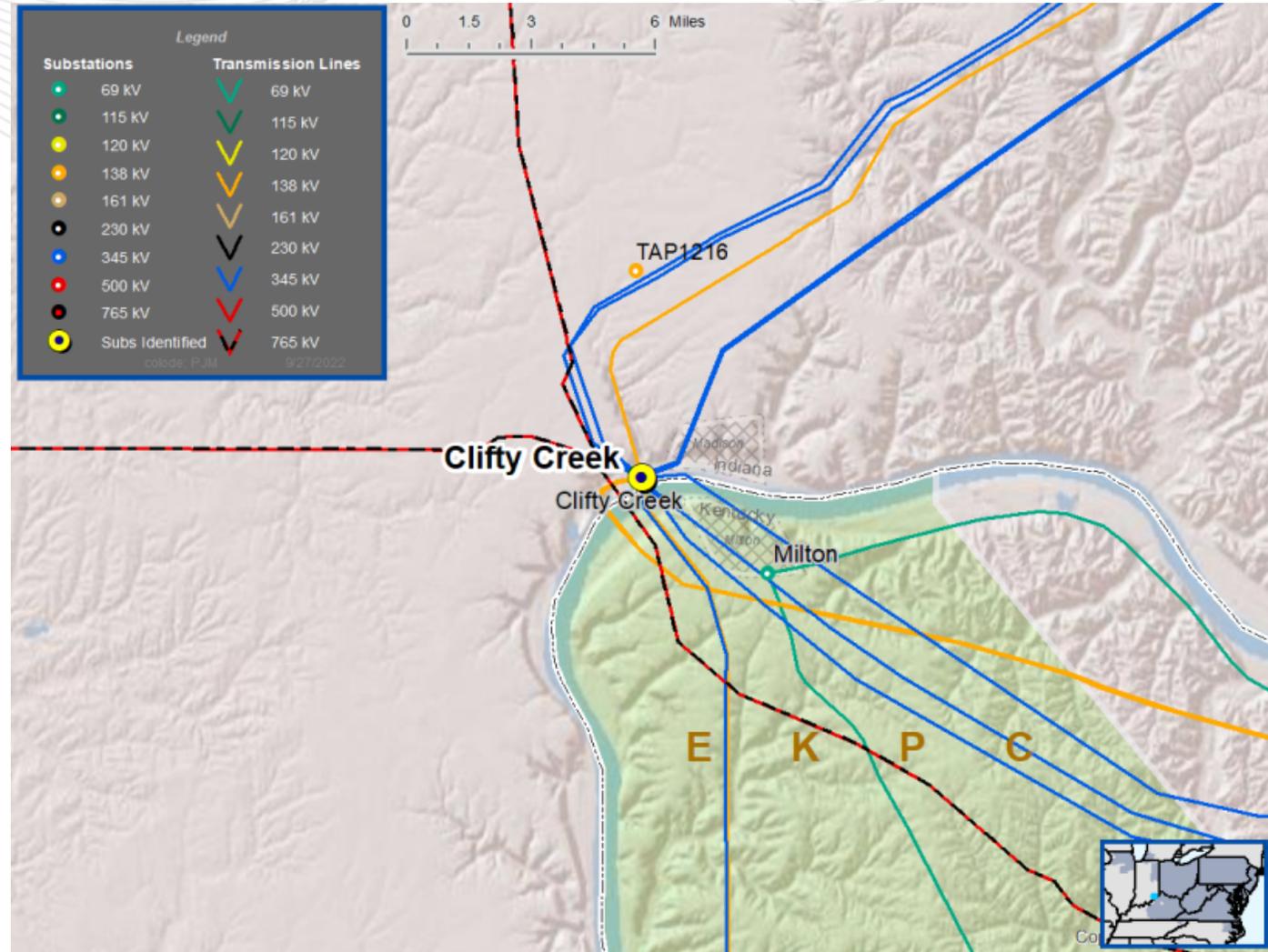
Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
05JEFRSO – 06CLIFTY 345kV	2354/2354/2991/2991

Estimated Cost: \$0.852M

Required IS Date: 6/1/2027

Projected IS Date: 6/30/2024



Process Stage: First Review

Criteria: Summer and Winter N-1-1 baseline Analysis

Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 RTEP winter case

Proposal Window Exclusion: None

Problem Statement:

2022W1-N2-SVD1 through 2022W1-N2-SVD41, 2022W1-N2-VM1 through 2022W1-N2-VM198

In the 2027 RTEP Summer and Winter case, there are several Voltage drop violations at the Black Oak 500 kV substation.





APS Transmission Zone: Baseline Black Oak Substation

As part of the 2021 RTEP Window #1, the project listed in the table below are proposed to address the following violations: 2022W1-N2-SVD1 through 2022W1-N2-SVD41, 2022W1-N2-VM1 through 2022W1-N2-VM198

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost (\$M)
21	APS	Black Oak 500 kV Substation: Install New Bay Position for SVC and Install Transformer High Side Breaker	17.37

Proposed Solution: Proposal #2022_21

- Install two new 500 kV breakers on the existing open SVC string to create a new bay position. Relocate & Re-terminate facilities as necessary to move the 500 kV SVC into the new bay position.
- Install a 500 kV breaker on the 500/138 kV #3 transformer. Upgrade relaying at Black Oak Substation.

Total Estimated Cost: \$17.37M

Required IS Date: 6/1/2027

Projected IS Date: 6/1/2027

Process Stage: First Review

Criteria: Winter Generator Deliverability

Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 RTEP Winter case

Proposal Window Exclusion: Substation Equipment

Problem Statement:

The Peach Bottom – Conastone 500 kV circuit is overloaded for multiple contingencies.

Violations were posted as part of the 2022 Window 1: FG# GD-W35, GD-W39, GD-W53, GD-W57 and GD-W60

Existing Facility Rating: 2828SN/3526E, 3464WN/3700WE MVA

Proposed Facility Rating: 2920SN/3620SE, 3592WN/4290WE

Proposed Solution:

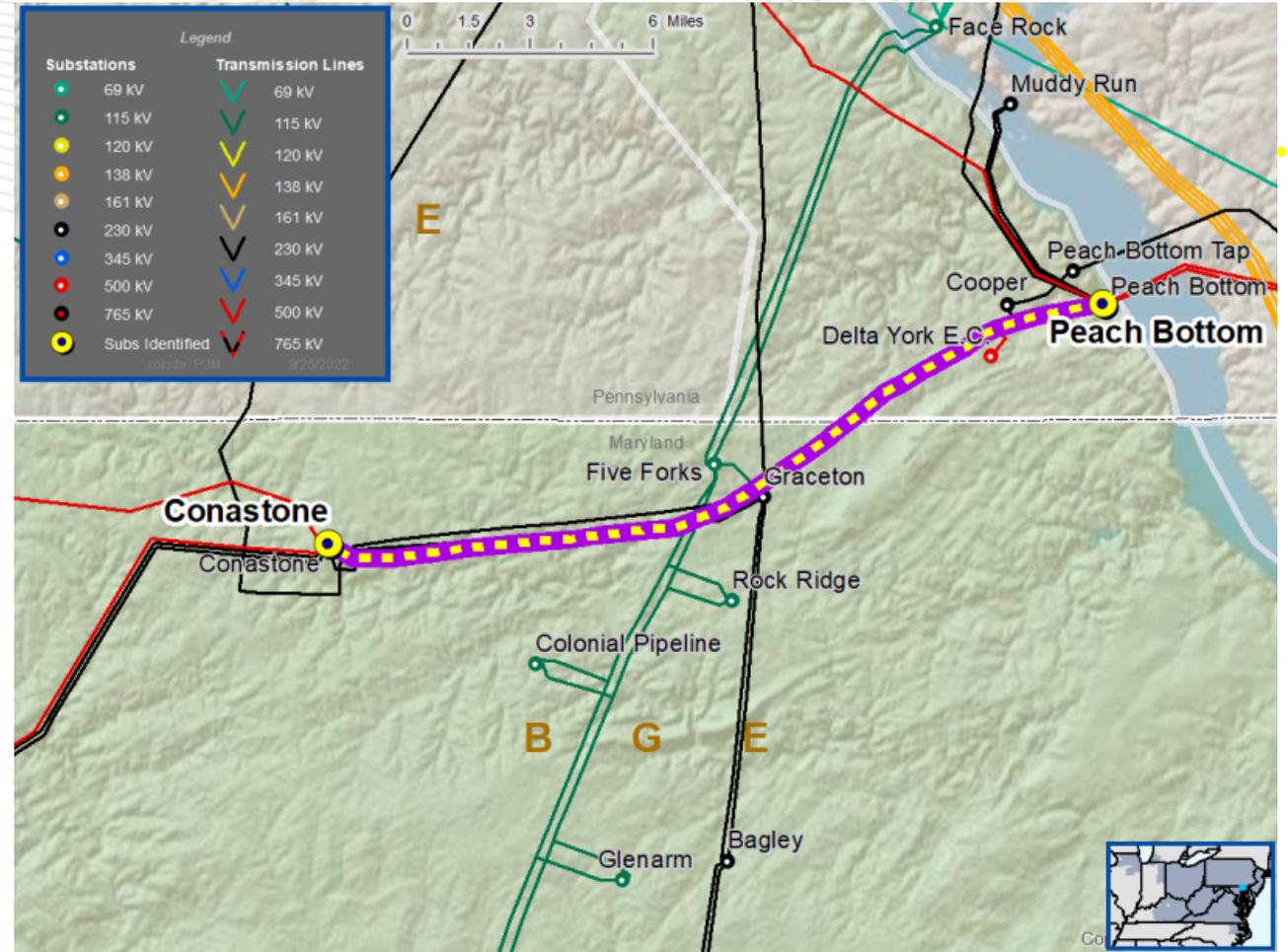
BGE: - Upgrade two Breaker bushings on the 500kV Line 5012 (Conastone – Peach Bottom) at Conastone Substation.

PECO: Replace 4 meters and bus work inside Peach Bottom substation on the 500 kV Line 5012 (Conastone – Peach Bottom).

Estimated Cost: \$5.8 M

Alternatives: N/A

Required In-Service: 12/1/2027



Process Stage: First Review

Criteria: Summer Generator Deliverability

Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 RTEP Summer case

Proposal Window Exclusion: None

Problem Statement:

The Conowingo – Colora 230 kV circuit is overloaded for single contingency.

Violations were posted as part of the 2022 Window 1: FG# GD-S36

Existing Facility Rating: 420SN/536E, 485WN/604WE MVA

Proposed Facility Rating: 462SN/5590SE, 520WN/636WE

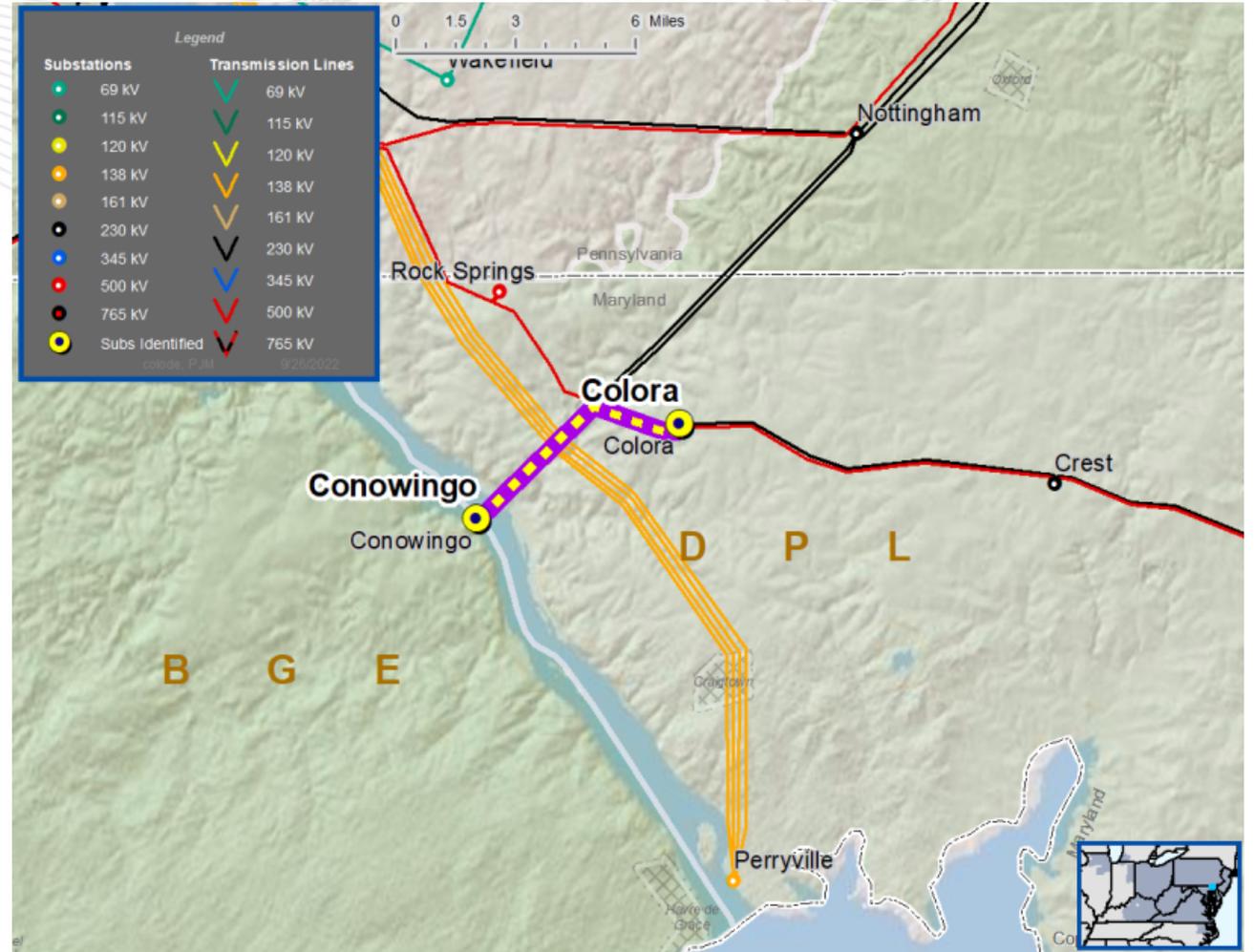
Proposed Solution:

To increase the Maximum Operating Temperature of DPL Circuit 22088 from 125 C to 140 C, cable shunts will be installed on each phase, on each side of four (4) dead-end structures. Existing insulator bells will be replaced.

Estimated Cost: \$0.2625 M

Alternatives: N/A

Required In-Service: 6/1/2027



Process Stage: First Review

Criteria: Summer Generator Deliverability

Assumption Reference: 2027 RTEP assumption

Model Used for Analysis: 2027 RTEP Summer case

Proposal Window Exclusion: None

Problem Statement:

The Lackawanna 500/230 kV transformer # T3 is overloaded for line fault stuck breaker contingency.

Violations were posted as part of the 2022 Window 1: FG# GD-S595

Proposed Solution:

Proposal ID 127: Reterminate the Lackawanna T3 and T4 500 / 230 kV transformers on the 230 kV side to remove them from the 230 kV buses and bring them into dedicated bay positions that are not adjacent to one another.

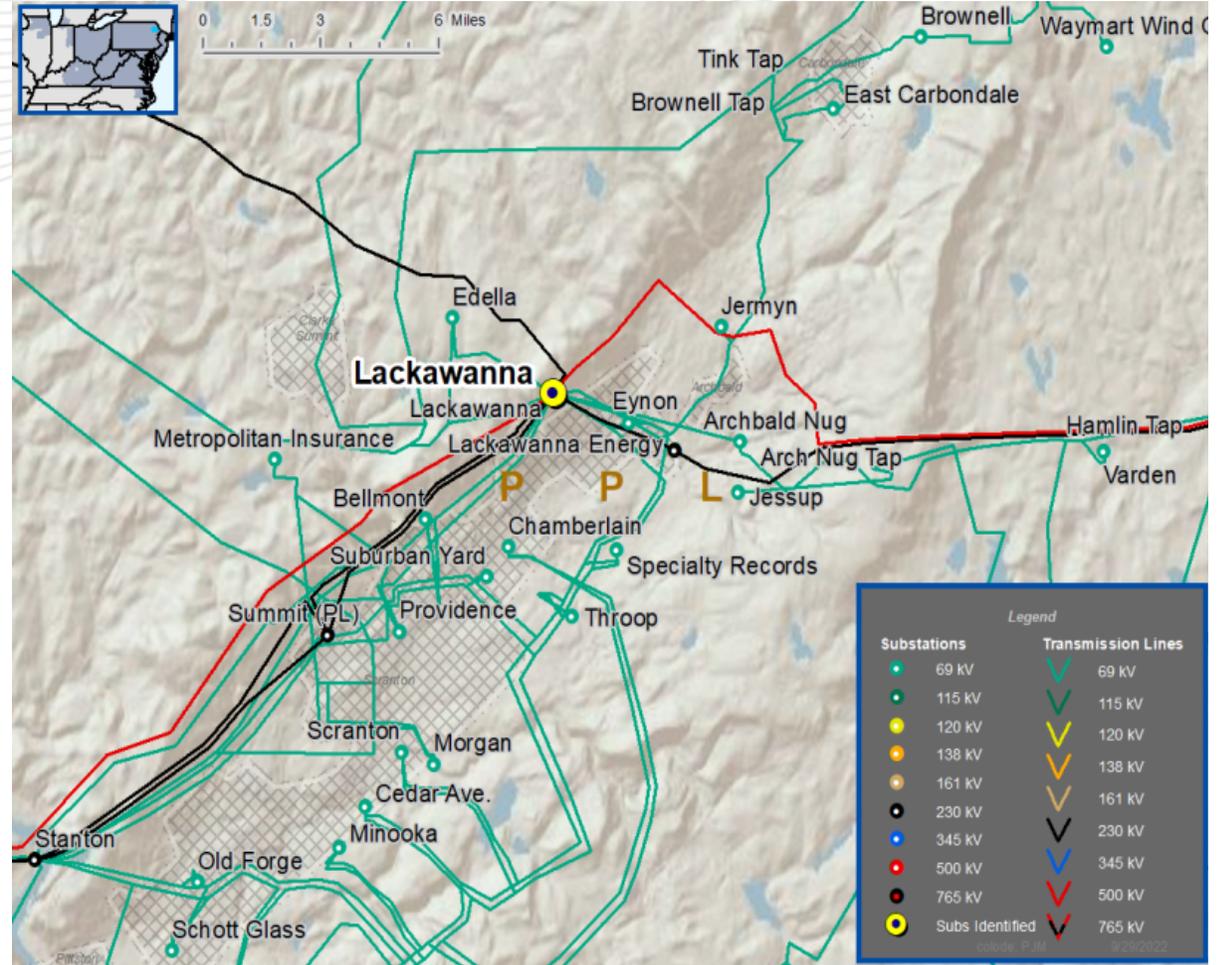
Estimated Cost: \$10.7 M

Alternatives:

Proposal ID 553: Replace the existing Lackawanna 500/230 kV T3 and T4 transformers with larger 1250 MVA units. Upgrade bay equipment to accommodate the new higher rated transformers. (Cost Estimate: \$55.97 M)

Proposal ID 907: Re-terminate the Lackawanna Energy from 230 kV to 500 kV through new 500/230 kV transformer. (Cost Estimate: \$51.48 M)

Required In-Service: 6/1/2027



Second Review

Baseline Reliability Projects



2022 Multi-Driver Proposal Window 1

- Window opened on 6/7/2022
- Window closed on 8/8/2022
- For this Window, PJM seeks technical solutions, also called proposals, to resolve potential reliability criteria violations on multi-driver facilities identified below in accordance with all applicable planning criteria (PJM, NERC, SERC, RFC, and Local Transmission Owner criteria).
- 14 total proposals submitted from 3 different entities (includes 3 carry-over proposals from 2021 Proposal Window 2)
 - 8 Greenfields
 - 6 Upgrades
- Cost Estimates: Approximate range from \$215K – 127M
- **4 Proposals identified with cost containment**
- Redacted public proposals are available:

<https://pjm.com/planning/competitive-planning-process/redacted-proposals>

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Reliability Analysis Update



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Version No.	Date	Description
1	9/30/22	<ul style="list-style-type: none">• Original slides posted

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Appendix



2022 RTEP Window 1 Proposals

Proposal ID #	Project Type	Project Description	Cost Estimate (\$M)	kV Level	Zone	Analysis	Flowgate(s)	Cluster
476	Greenfield	Rebuild the Hunterstown – Carroll 115/138 kV Corridor as Double Circuit using 230kV construction standards. New circuit will be operated at 230kV. Existing circuit to remain at 115/138kV. Construct a new 230 kV Ring Bus at Carroll (PE) and add a new 230 kV Breaker to the Hunterstown 230 kV Substation.	148.83	230	MetEd	Gen Deliv	2022W1-GD-S14, 2022W1-GD-W33, 2022W1-GD-S578, 2022W1-GD-W391, 2022W1-GD-W37, 2022W1-GD-S10, 2022W1-GD-S570, 2022W1-GD-W376	#2
236	Upgrade	Upgrade dead end structures on Conowingo - Colora line in DPL to increase the line ratings	0.26	230	PECO/DPL	Gen Deliv	2022W1-GD-S36	N/A
21	Upgrade	Install two new 500 kV breakers on the existing open SVC string to create a new bay position. Relocate & Re-terminate facilities as necessary to move the 500 kV SVC into the new bay position. Install a 500 kV breaker on the 500/138 kV #3 transformer. Upgrade relaying at Black Oak Substation.	17.37	500	APS	Thermal	2022W1-N2-SVD1 through 2022W1-N2-SVD41, 2022W1-N2-VD1 through 2022W1-N2-VD198	N/A
209	Upgrade	Rebuild/Reconductor the Germantown - Lincoln 115 kV Line. Approximately 7.6 miles. Upgrade limiting terminal equipment at Lincoln, Germantown and Straban.	17.36	115	MetEd	Gen Deliv	2022W1-GD-S14, 2022W1-GD-W33, 2022W1-GD-S578, 2022W1-GD-W391, 2022W1-GD-W37, 2022W1-GD-S10, 2022W1-GD-S570, 2022W1-GD-W376	#2
94	Upgrade	Reconductor two (2) 230 kV circuits from Conastone to Northwest #2.	37.76	230	BGE	Gen Deliv	2022W1-GD-W42, 2022W1-GD-S38	#2
633	Greenfield	The Proposed Solution consists of: (1) the IEC West Portion, which is comprised of approximately 29 miles of new double-circuit 230 kV AC overhead transmission line between the existing Potomac Edison Ringgold Substation in Washington County, Maryland to a new Rice Substation in Franklin County, Pennsylvania; and (2) the reconfigured IEC East Portion, which is primarily comprised of adding 230 kV AC overhead transmission lines between a new Furnace Run Substation in York County, Pennsylvania, and the existing BGE Conastone (via Baltimore County) and Graceton Substations in Harford County, Maryland.	386.73	230	BGE/PN/PECO/MetEd/PPL/APS	Gen Deliv	2022W1-GD-S14, 2022W1-GD-W53, 2022W1-GD-S38, 2022W1-GD-W33, 2022W1-GD-W55, 2022W1-GD-W36, 2022W1-GD-W391, 2022W1-GD-W35, 2022W1-GD-W57, 2022W1-GD-S10, 2022W1-GD-W411, 2022W1-GD-S651, 2022W1-GD-S578, 2022W1-GD-S634, 2022W1-GD-S570, 2022W1-GD-W376, 2022W1-GD-S1043, 2022W1-GD-W42, 2022W1-GD-S29, 2022W1-GD-S558, 2022W1-GD-S559, 2022W1-GD-W60, 2022W1-GD-W623, 2022W1-GD-W37, 2022W1-GD-W39, 2022W1-GD-W388, 2022W1-GD-W387	#2
880	Upgrade	Install second 500/230kV Transformer with additional 500 and 230 bus expansions.	30.19	500/230	MetEd	Gen Deliv	2022W1-GD-S29, 2022W1-GD-W36, 2022W1-GD-S634	#2
912	Upgrade	Rebuild 1.4 miles of existing single circuit 230 kV tower line between BGE's Graceton substation to the PPL tie-line at the MD/PA state line to double circuit steel pole line with one (1) circuit installed to uprate 2303 circuit.	8.4	230	PPL/BGE	Gen Deliv	2022W1-GD-S1043, 2022W1-GD-W411, 2022W1-GD-W623, 2022W1-GD-W55	#2



2022 RTEP Window 1 Proposals

Proposal ID #	Project Type	Project Description	Cost Estimate (\$M)	kV Level	Zone	Analysis	Flowgate(s)	Cluster
994	Greenfield	Build a new 138 kV 3-breaker ring station called "Johnson Fork" just North of the existing Wesley SW 138 kV station (AEP). Bring the existing Tanners Creek–College Corner 138 kV line (AEP) "in and out" of Johnson Fork. Build a new 138 kV line from Johnson Fork (AEP) to Willey (Duke) stations (13 miles). Install 2 breakers at Willey to terminate the new line.	25.52	138	AEP/DEOK	Gen Deliv	2022W1-GD-S586, 2022W1-GD-W377	#1
446	Greenfield	Build a new 138 kV 4-breaker ring station called "Pribble." Bring the existing Tanners Creek–College Corner (AEP) & Miami Fort–Hubbell (Duke) 138 kV lines "in and out" of Pribble station. Rebuild Tanners Creek–Pribble 138 kV (5 miles) and upgrade station equipment at Tanners Creek 138 kV. Rebuild Pribble–Miami Fort 138 kV (6 miles).	39.7	138	AEP/DEOK	Gen Deliv	2022W1-GD-S586, 2022W1-GD-W377	#1
893	Greenfield	Build a new 345 kV line from Tanners Creek station (AEP) to Miami Fort (Duke) station (11.4 miles). Rebuild a portion of the existing Tanners Creek – Hanna 345 kV and Greendale – Miami Fort 138 kV lines to double circuit (4 & 3 miles respectively) to facilitate construction of the new line. Install 1 breaker at Tanners Creek and 2 breakers at Miami Fort to terminate the new line.	58.11	138	AEP/DEOK	Gen Deliv	2022W1-GD-S586, 2022W1-GD-W377	#1
965	Upgrade	Replace four Clifty Creek 345 kV 3000 A switches with 5000 A 345 kV switches. Anticipated SN/SE rating for the branch section to be addressed (242865 to 248000) by the project is 2354/2354 MVA.	0.85	345	AEP/OVEC	Gen Deliv	2022W1-GD-S632	N/A
289	Upgrade	At West Bellaire 345kV, the M1 breaker will be moved to the N breaker string, becoming N1. The Tidd circuit will connect to the N string, between N1 and N. Jumpers/conductor will be installed in the place of old breaker M1, to complete the M string. Station protection and SCADA updates will be completed. The Tidd 345kV T-Line will need shifted slightly, to connect to the new station bay to the east.	2.53	345	AEP	Thermal	2022W1-N1-LLVM2, 2022W1-N1-LLVM1, 2022W1-N1-LLVD1, 2022W1-N1-LLVD2	N/A
27	Upgrade	Install at Tanners Creek a 345 kV 5000 A 63 kA circuit breaker "R" and move the Tanners Creek - East Bend 345 kV circuit from the "T" and "T1" line position to the "R and "R1" line position, thus mitigating the College Corner - Collinsville 138 kV overload by eliminating the contingency causing the issue.	3.07	345	AEP/DEOK	Gen Deliv	2022W1-GD-S586, 2022W1-GD-W377	#1
127	Upgrade	Reterminate the Lackawanna T3 and T4 500 / 230 kV transformers on the 230 kV side to remove them from the 230 kV buses and bring them into dedicated bay positions that are not adjacent to one another.	10.65	230	PPL	Gen Deliv	2022W1-GD-S595	#3



2022 RTEP Window 1 Proposals

Proposal ID #	Project Type	Project Description	Cost Estimate (\$M)	kV Level	Zone	Analysis	Flowgate(s)	Cluster
553	Upgrade	Replace the existing Lackawanna 500/230 kV T3 and T4 transformers with larger 1250 MVA units. Upgrade bay equipment to accommodate the new higher rated transformers.	55.97	500/230	PPL	Gen Deliv	2022W1-GD-S595	#3
907	Greenfield	Install a new 1500 MVA 500/230 kV transformer at Lackawanna substation. Tie into bay #1 in the Lackawanna 500 kV yard. Install four single phase transformer units (one on-site spare). Install bus work necessary to facilitate restoration with the onsite spare. Install MODs on the high and low-side of the 500/230 kV transformer. Install a 230 kV dead-end for termination of the Lackawanna Energy 230kV lead line. The 500/230 kV transformer will have double-bundle 1590 ACSR leads on the high-side. Re-terminate the Lackawanna - Lackawanna Energy 230kV line into the dead-end for the new 500/230 kV transformer at Lackawanna utilizing triple bundle 1590 45/7 ACSR conductor and dual 144 OPGW.	51.48	500	PPL	Gen Deliv	2022W1-GD-S595	#3