



Regional Transmission Expansion Planning Update

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& Interregional Planning

Presented to ISAC

July 25, 2022

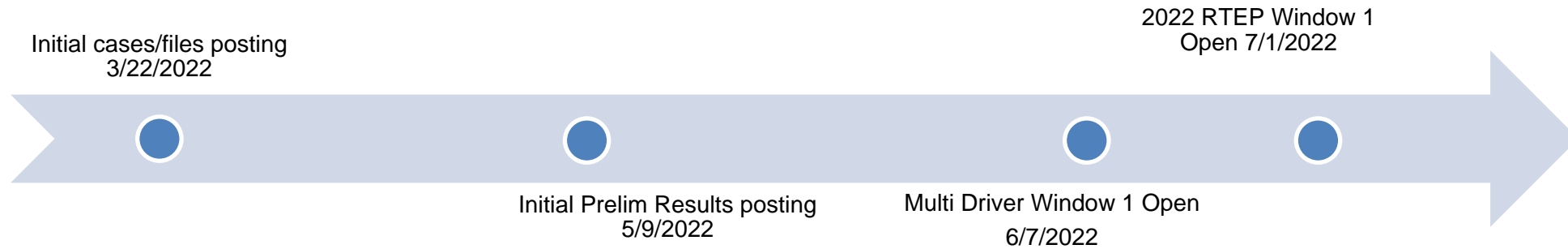
- Reliability Update
 - 2021
 - 2022
- Market Efficiency Update
- Interregional Planning
- NJ Offshore SAA Window Update

Reliability Update

2021 RTEP

- In July 2022, PJM Board approved 18 baseline reliability projects, which resolves all needs identified as part of the 2021 RTEP cycle.
- The details of the projects approved at the July meeting of the PJM Board are included in the appendix

2022 RTEP

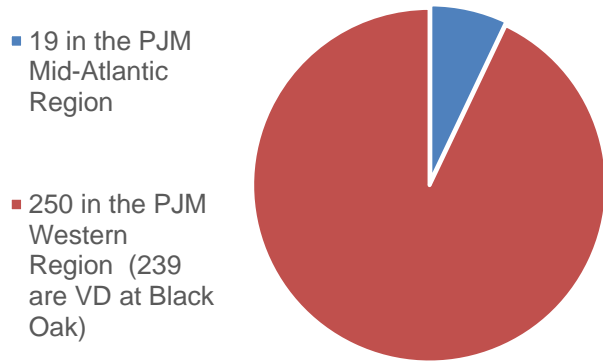


2022 RTEP Reliability Window 1 will close on August 30, 2022.

Overview of 2027 Results

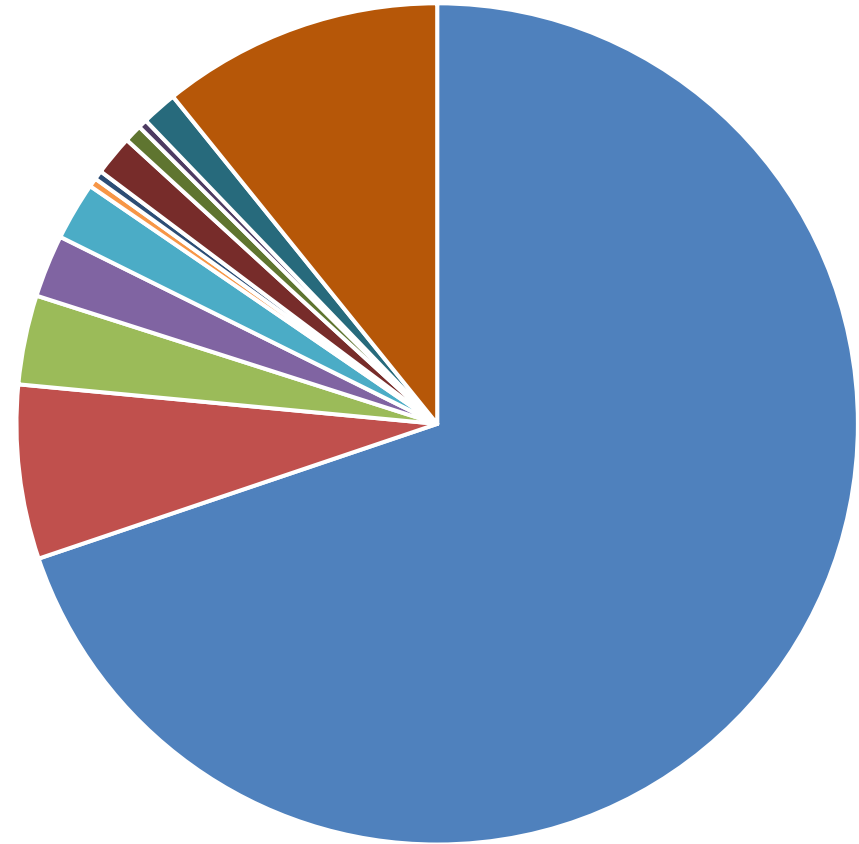
Total of **852** flowgates identified at this point (239 flowgates are N-1-1 Voltage drop issues at Black Oak 500KV bus)

269 Competitive FGs

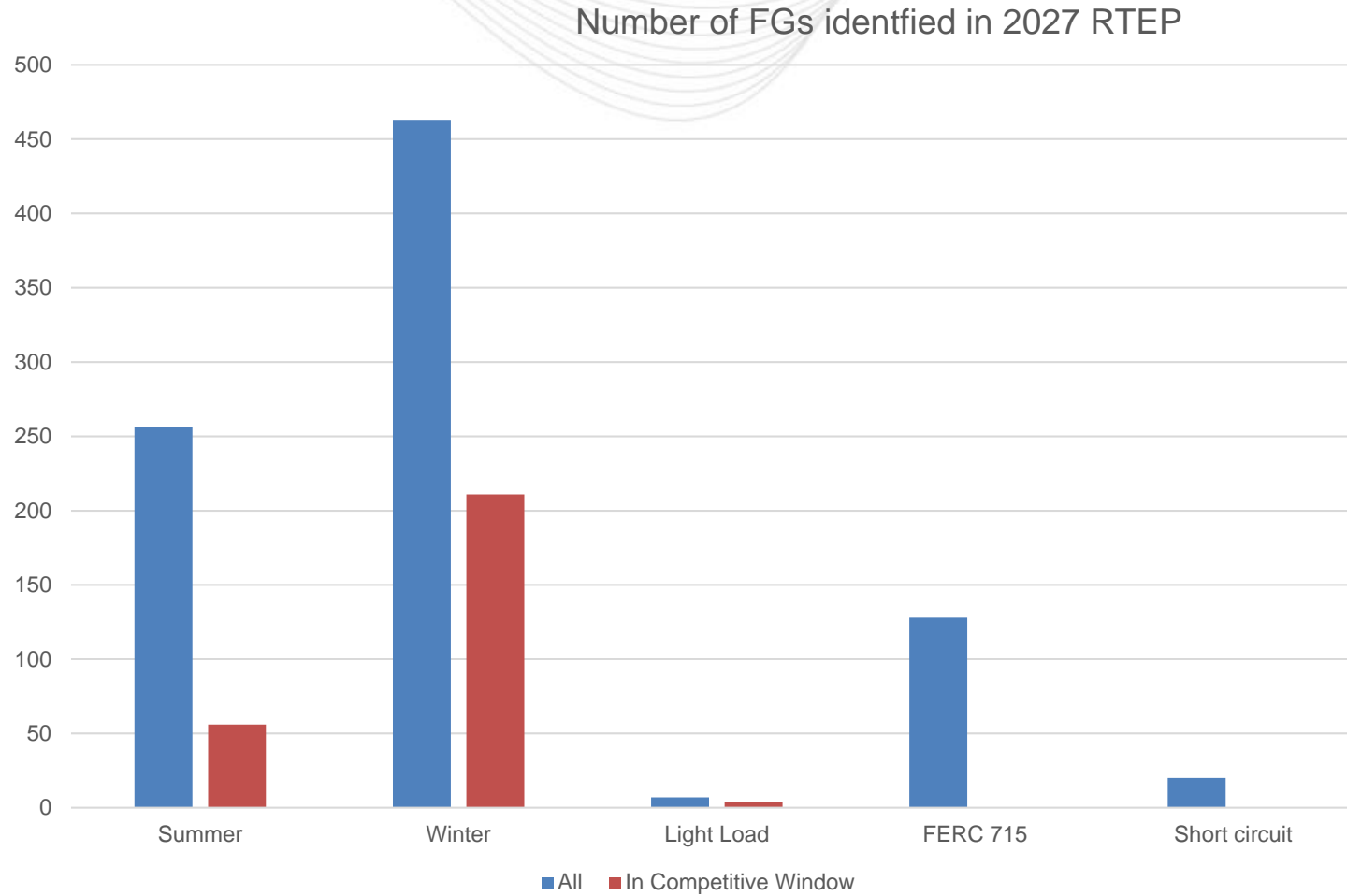


583 Non-competitive FGs

- 407 due to the below 200kv exclusion
- 39 due to Substation Equipment Exclusion
- 20 due to Immediate Need Exclusion
- 14 existing baseline fixes
- 13 addressed in multi driver window 1
- 2 Non PJM Facility
- 2 pending on queue studies
- 9 due to suspended queue
- 4 will be addressed by re-scope of existing baseline project
- 2 not an issue with recent withdrawn queue
- 8 will be addressed in Generation Deactivation
- 63 in DOM are Delayed, pending on immediate need solution study



Overview of 2027 Results: By Type



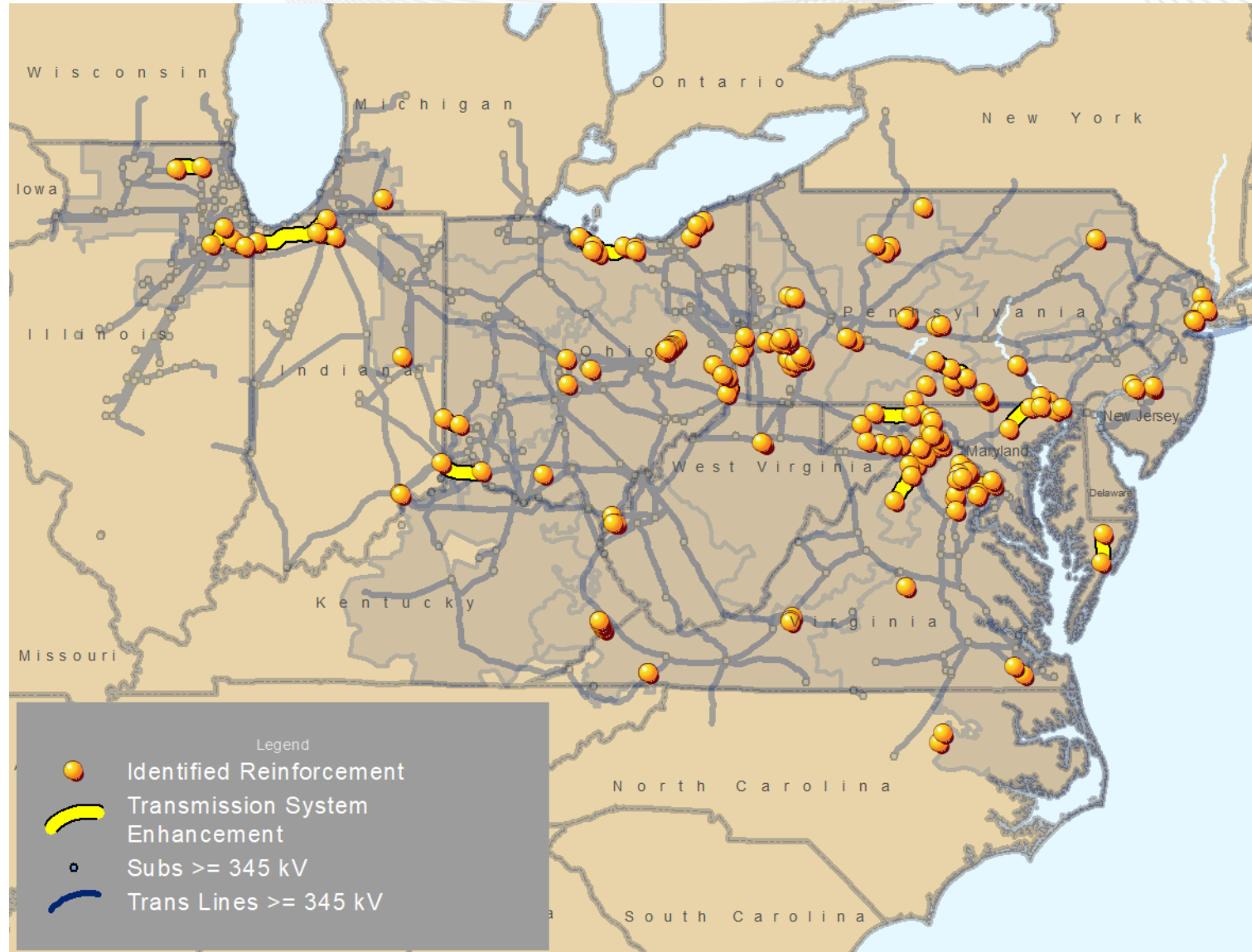


Overview of 2027 Results: By Voltage Level

# of FGs	Thermal			Voltage		Short Circuit	
KV Level	Comp	Non-Comp	Delayed	Comp	Non-Comp	Comp	Non-Comp
34.5	0	0	0	0	37	0	0
40	0	0	0	0	0	0	1
46	0	1	0	0	44	0	0
69	0	11	0	0	32	0	0
115	8	121	4	0	0	0	0
138	6	69	0	0	158	0	12
230	7	3	49	0	0	0	0
345	1+13	5	0	4	0	0	8
500	4	5	2	239	0	0	0

# of facilities	Thermal			Voltage		Short Circuit	
KV Level	Comp	Non-Comp	Delayed	Comp	Non-Comp	Comp	Non-Comp
34.5	0	0	0	0	10	0	0
40	0	0	0	0	0	0	1
46	0	1	0	0	9	0	0
69	0	6	0	0	14	0	0
115	2	7	1	0	0	0	0
138	2	30	0	0	24	0	12
230	3	2	11	0	0	0	0
345	1+4	3	0	2	0	0	8
500	2	1	1	1	0	0	0

- ❖ Green for Multi Driver window
- ❖ Not include 8 FGs for load loss in DOM

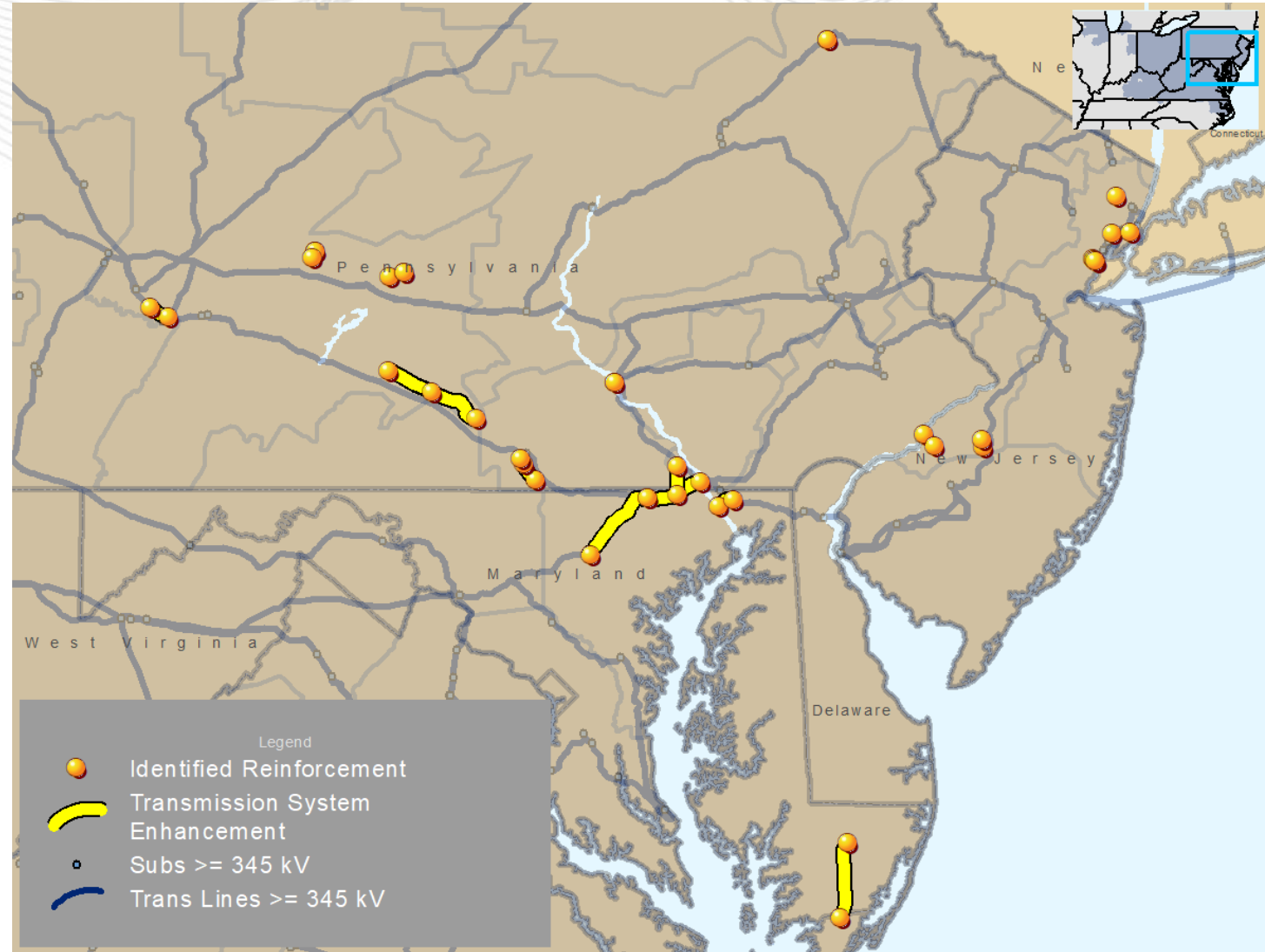


19 Eligible Flowgates

- 10 Summer Generation Deliverability
- 9 Winter Generation Deliverability

161 Excluded from the Window

- 2 FERC 715 Thermal
- 7 FERC 715 Voltage Magnitude
- 20 FERC 715 Voltage Drop
- 1 Light Load Generation Deliverability
- 22 Summer Generation Deliverability
- 11 Summer N-1 Thermal
- 2 Summer N-1-1 Thermal
- 20 Winter Generation Deliverability
- 76 Winter N-1 Thermal

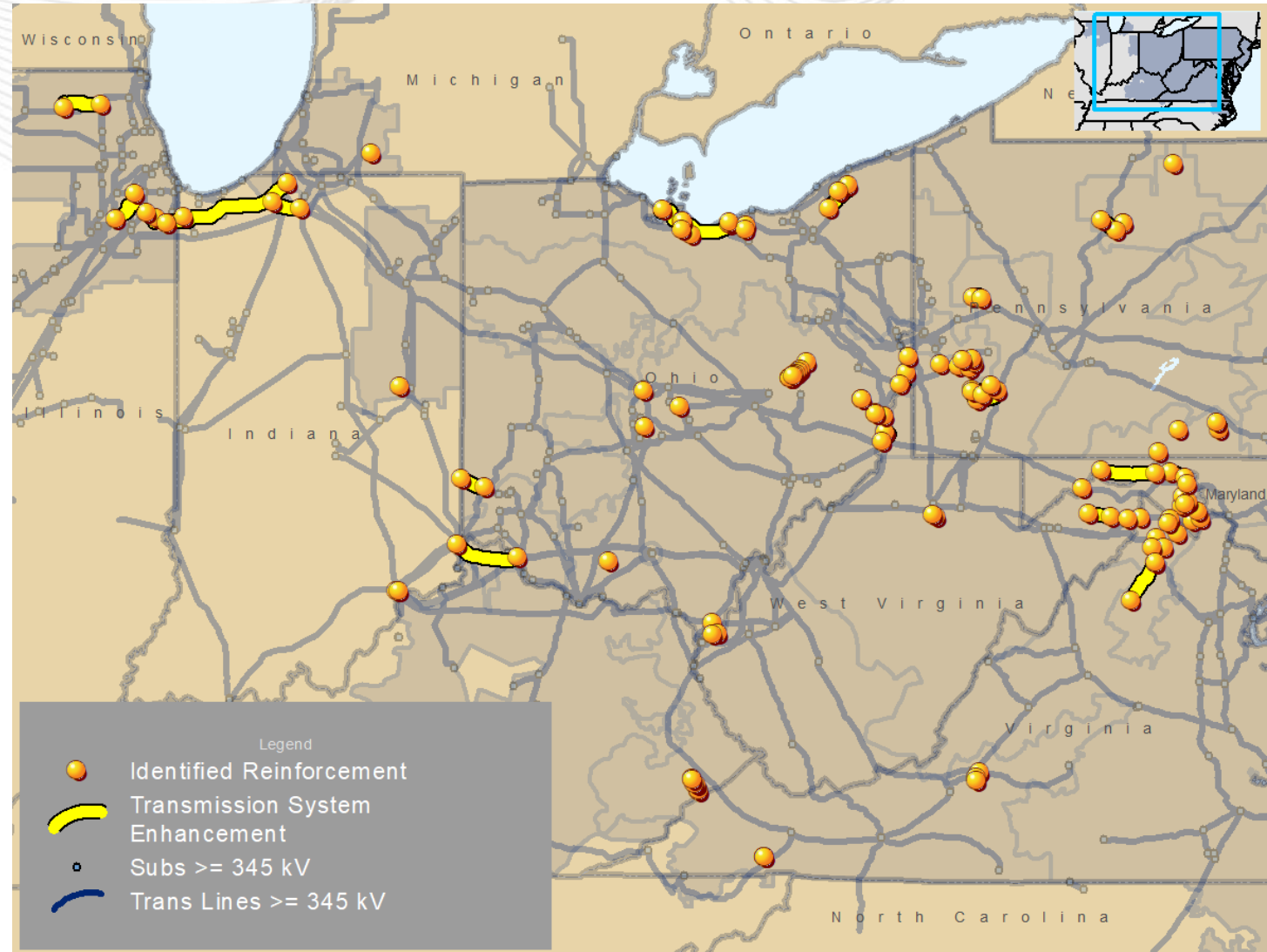


250 Eligible Flowgates

- 2 Light Load Baseline Generation Deliverability
- 2 Light Load N-1 Voltage Magnitude
- 5 Summer Generation Deliverability
- 41 Summer N-1-1 Voltage Drop
- 2 Winter Generation Deliverability
- 198 Winter N-1-1 Voltage Drop

357 Flowgates Excluded from the Window

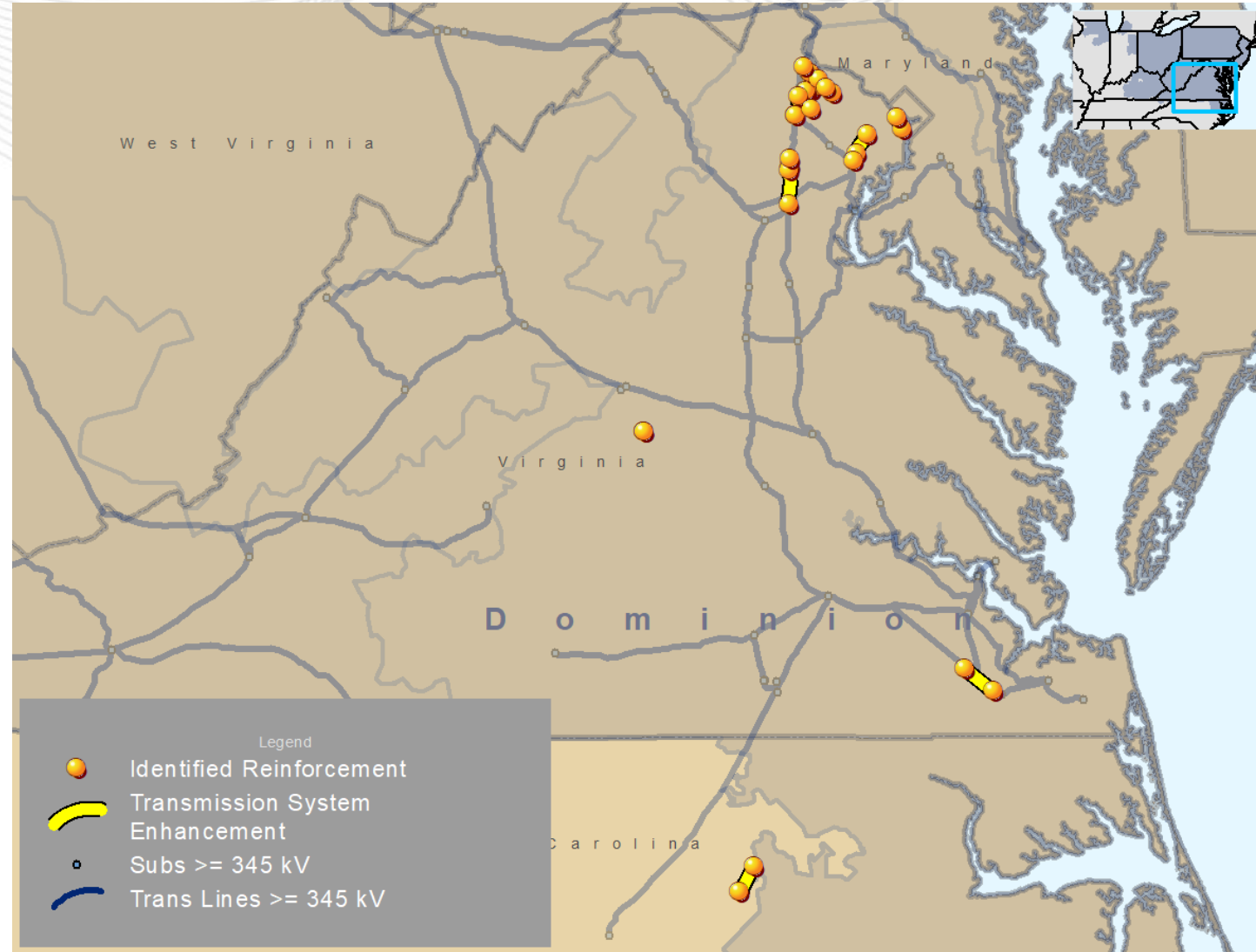
- 11 FERC 715 Thermal
- 39 FERC 715 Voltage Magnitude
- 48 FERC 715 Voltage Drop
- 1 FERC 715 Short Circuit
- 20 Short Circuit
- 34 Summer Generation Deliverability
- 7 Summer N-1 Thermal
- 20 Summer N-1 Voltage Drop
- 16 Summer N-1 Voltage Magnitude
- 9 Summer N-1-1 Thermal
- 18 Winter Generation Deliverability
- 13 Winter N-1 Thermal
- 46 Winter N-1 Voltage Drop
- 40 Winter N-1 Voltage Magnitude
- 35 Winter N-1-1 Voltage Magnitude



65 Flowgates Excluded from the Window

- 1 Light Load Generation Deliverability
- 1 Light Load N-1 Thermal
- 10 Summer Generation Deliverability
- 5 Summer N-1 Thermal
- 4 Summer N-1-1 Load Drop
- 40 Summer N-1-1 Thermal
- 4 Winter N-1-1 Load Drop

* At this time, PJM will not be accepting proposals for resolving reliability violations in the Dominion, northern Virginia Data Center Alley area. The near term needs (2025 and earlier) are currently being addressed via an immediate need due to nature and level of identified reliability violations as well operational constraints in the area. Once the immediate need solution is finalized, the remaining needs will be evaluated and posted in a standalone competitive window.

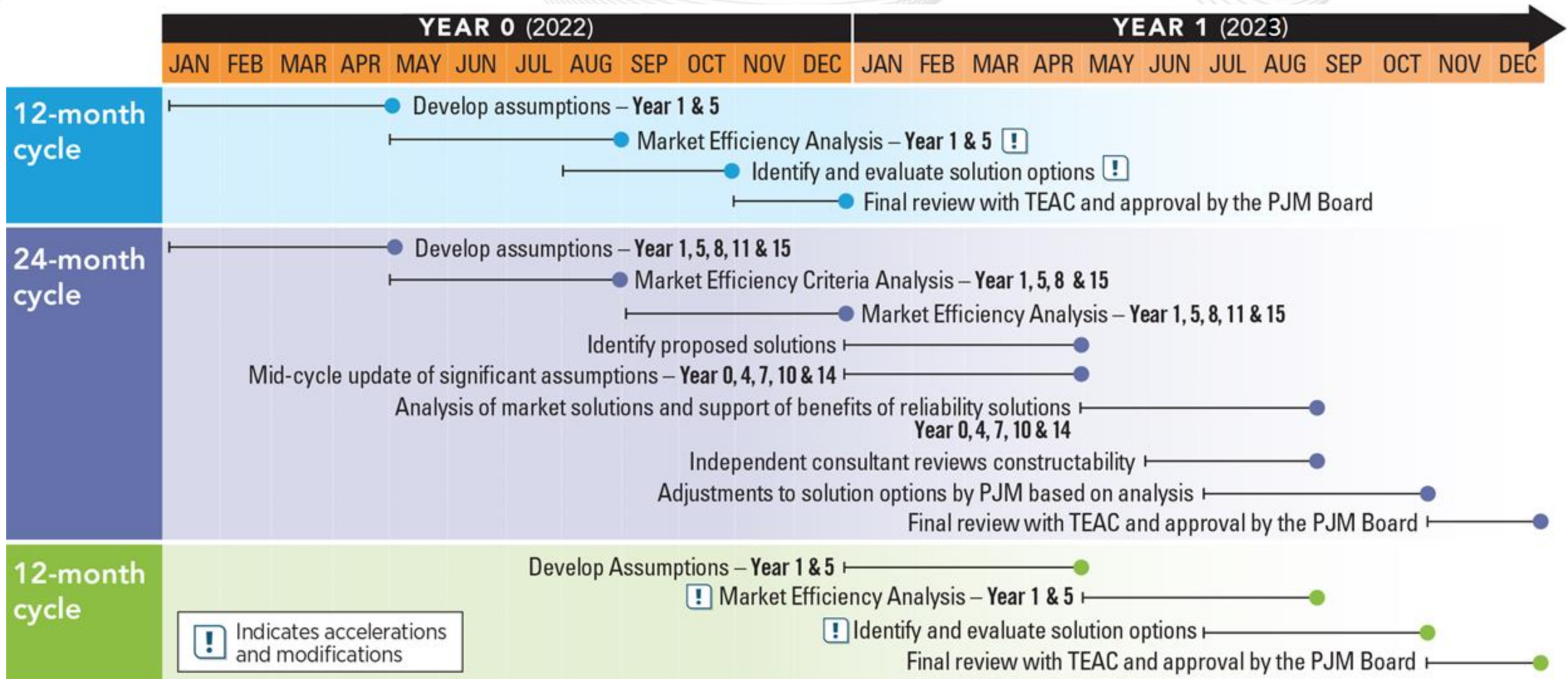




2022 Multi-Driver Proposal Window 1

- PJM will open 2022 Multi-Driver Proposal Window 1 to address reliability and market efficiency needs on the following facilities:
 - Crete-St. John 345 kV
 - Crete-E. Frankfort 345 kV
 - University Park N-Olive 345 kV
 - Stillwell-Dumont 345 kV
- While this will not be reflected in the 2022 RTEP window, due to the area sensitivity, the following queue project changes will be included in the multi-driver window:
 - U3-021/AB2-096 (withdrawn) will be removed
 - AB1-089 (recently signed an ISA) will be included
- PJM will coordinate with MISO when evaluating the proposals.
- The 60 day window will open on June 7, 2022 and close on August 8, 2022.

Market Efficiency Update



- First draft of the 2022/23 Market Efficiency Base Case and the Market Efficiency Assumptions whitepaper to be posted by the end of July.
- Stakeholders feedback expected by August 31st
 - Summer/Winter ratings
 - Contingency definitions
 - Topology updates (if any)
- Next steps:
 - Interregional update: MISO, NY-ISO, etc.
 - PJM border interchanges.

Step	Target Date
Post Draft Base Case	July 2022
Stakeholders Feedback	End of August 2022
Update Interregional Data	August - September 2022
Identify Congestion Drivers	September – November 2022
2022 Reevaluation Analysis	September – November 2022
2022 Acceleration Analysis	September – November 2022
Post Final Base Case and Congestion Drivers	January 2023
Open Long Term Proposal Window	January 2023

Interregional Market Efficiency Update

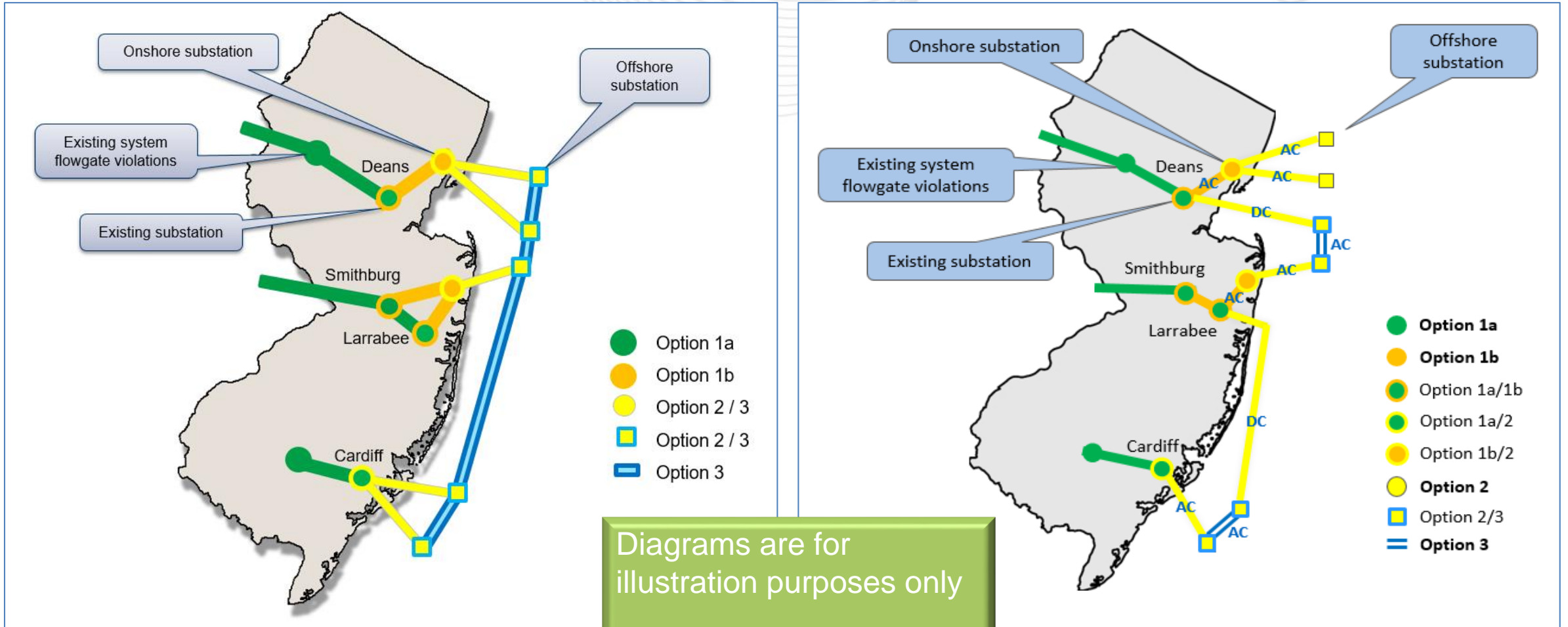
- Limited to historically binding M2M flowgates
- Projects must be in service by 3rd summer peak
- Projects over \$20 million not eligible
- Benefits based on relieving average of past 2 years of historical congestion (Day Ahead + Balancing)
- Four years worth of benefits must completely cover project's installed capital cost
- Discount/inflation rate not necessary as all projects are near term
- Interregional cost allocation based on congestion relief in each RTO
 - Adjusted by M2M payments

Monitored Facility	Flowgate Description	Notes
QuadCities-RockCreek 345 kV	QuadCities-RockCreek 345 kV I/o QuadCities-Sub91 345/161 kV Sub91 XF	Flowgate still under review for outage causes and potential fixes. Potential project candidate to upgrade ComEd terminal equipment (wave trap).
Mohomet - ChampTP 138 kV	Mohomet - ChampTP 138 kV I/o Clinton - Oreana - GooseCrk 345 kV	Congestion appears persistent; evaluating conductor and switch replacement as a potential fix.
Chicago-Praxair 13831	Chicago-Praxair 13831 I/o Wilton CenterDumont 765	Flowgate still under review for outage causes and potential fixes.
Powerton - Towerline 138 kV	Powerton - Towerline 138 kV I/o Fargo - Sandburg 345 kV	Limited by ComEd terminal equipment (wave trap); Low cost upgrade(s) available. Outage causes still under review.

NJ Offshore SAA Window Update

Description of Options

- Option 1a, Onshore Upgrades on Existing Facilities
- Option 1b, Onshore New Transmission Connection Facilities
- Option 2, Offshore New Transmission Connection Facilities
- Option 3, Offshore Network



- 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

Overview of Onshore Option 1b only Proposals

Proposing Entity	Proposals	Description of Project	Injections (MW)	Landing Pt	Cost
ACE_Exelon	797 (transition vault, cables to Cardiff) 734 (add New Freedom, reduce Deans inject) 127 (add NF, eliminate Smithburg inject) 929 (add Orchard, eliminate Smithburg inject)	(797) New transition vault connecting 275 kV offshore cables and onshore 275 kV cables, new 275 kV UG transmission line to new 275-230 kV substation near Cardiff to accommodate the injection of 1200 MW at Cardiff. Various upgrades to existing facilities to accommodate additional 490 or 1148 MW at NF or 1148MW at Orchard. Major construction includes a second Cardiff-Orchard 230, rebuild Cardiff-New freedom 230 and expansion of Cardiff substation (230)	1200 at Cardiff, 490 -1148 at New Freedom and 1148 Orchard	Great Egg Harbor, near Cardiff, ~8 miles from Cardiff	\$758 (734) \$200M (127) \$775M (929) \$233M (797 ACE)
JCPL	453 (1b partial only)	Various upgrade to existing facilities and some new line construction to support injections at a future substation adjacent to Larrabee and injections at existing Smithburg and Atlantic substations. Major upgrades include expansion of Smithburg (500kV) and new UG circuits to Larrabee converter station (converter station is not included in JCPL proposal)	Smith 1342, Larrabee 1200, Atlantic 1200, Smith	*assumes 1b soln near Sea Girt	\$660M
LSP Central Transmission (1b only) Clean Energy Gateway	781, 294	Construction of new POI onshore substation Lighthouse to receive AC cables from OSW platforms. Three additional substations, Crossroads(230/500kV), Gateway (500kV), Wells Landing (230/500kV) to interconnect to Larrabee 230 Station, Deans E. Windsor 500, Hunters Glen -Trenton 230 and Devils Brook Trenton 230. Reactive compensation is provided between Lighthouse and Gateway switching station. Includes OH/UG options. Alternatives support 4200MW or 6000 MW of injection	Alternate POI Lighthouse sub near Sea Girt	Sea Girt National Guard Training Ctr (Larrabee)	\$1.7B (781 Soln A) \$1.6 B (294)
LSP Central Transmission (1b only) Clean Energy Gateway	629, 72, 627	Construction of new POI onshore substation Lighthouse to receive AC cables from OSW platforms. Three new substations, Crossroads, (500kV), Garden View (500) and Old York (500/230) to interconnect to Larrabee 230, Smithburg 500, E Windsor 230, Deans 500, New Freedom-E Windsor (500), Williams-Mansfield 230 and Burlington-Crosswicks 230. Includes OH/UG construction options. Alternatives support 4200or 6000 MW of injection.	Alternate POI Lighthouse sub near Sea Girt	Sea Girt National Guard Training Ctr (Larrabee)	\$1.6 B (629) \$1.8B (72) \$1.4B (627)
Rise Light & Power Outerbridge Renewable Connector	582(Base Offer 1-1200MW) 490 (Base Offer 2-2400MW) 376 (Addl Offer A 400MW) 171 (Addl Offer B 800MW)	One or two 1200 MW HVDC lines from Werner to Half-Acre sub (near Monroe to tap into the Deans-E Windsor line and shore station, option to inject up to 400 or 800 MW direct at Werner from 275kV AC wind generators	Deans 1200+ 1200 (via Deans East Windsor 500kV), 800 at Werner =3200MWs	Werner Site Raritan Bay, South Amboy, industrial waterfront landing point	\$1B (582) \$1B (490) \$68M (376) \$109M (171)

Overview of Onshore/Offshore Option 1b/2 Proposals

Proposing Entity	Proposals	Description of Project	Injections (MW)	Landing Pt	Cost	Offshore Cables	Option 3	OSW Gen Connection
Anbaric - Boardwalk Power	831, 841, 574	1-1400 MW, 400kV DC circuits to Deans	Deans	Keyport (Deans)	\$2B	400kV DC	(400kV DC) NC	66kV
Anbaric - Boardwalk Power	944, 802, 183, 131	1-1400 MW, 400kV DC circuits to Sewaren	Sewaren	Perth Amboy/ alt Buckeye Port Reading	\$1.9-2B	400kV DC	(400kV DC) NC	66kV
Anbaric - Boardwalk Power	921, 285	1-1400 MW, 400kV DC circuits to Larrabee	Larrabee	Bay Head (Larrabee)	\$1.9B	400kV DC	(400kV DC) NC	66kV
Anbaric - Boardwalk Power	145, 882, 568	1-1148 MW, 400kV DC circuits to Deans (OW2), 1-1510 MW, 400kV DC to Deans (AS1)	Deans	Bay Head (Larrabee) Perth Amboy (Sewaren)	\$2.0-2.3B	400kV DC	(400kV DC) NC	66kV
Atlantic Power Transmission (Blackrock)	210 (first 1200 MW), 172 (second 1200MW), 769 (third 1200 MW)	Three lines 320kV DC, 1200MWs each, converter station outside of Deans	Deans 1200+ 1200+1200=3600	Raritan Bay, South Amboy adjacent to former Werner generating station	\$2B (210) single ckt \$1.6B (172) second ckt \$1.5B (769) third ckt	320kV DC	future	66kV
Con Ed Clean Link New Jersey	990	Base case - 2-1200 MW, 320kV HVDC lines, in UG ducts 1 ckt to Larrabee and 1 ckt to Smithburg with ability to substitute one of both circuits to Deans.	Larrabee(1200MW), Smithburg (1200MW) and Deans optional (1200 or 2400MW)	Sea Girt (Larrabee)	\$2.75B Larrabee and Smithburg Alt 1 Ckt \$1.86B Deans Alt \$3.14B Larrabee and Deans Alt \$3.32B Smithburg and Deans Alt \$3.7B 2 Ckts at Deans	320kV DC	fut	66kV
LSP Central Transmission (Option 2 only) Clean Energy Gateway	594	Two (2) 345kV offshore substations and eight (8) 345kV submarine cables that connect to the LSP onshore station.	Alternate POI Lighthouse sub near Sea Girt	Sea Girt National Guard Training Ctr (Larrabee)	594 (\$2B)	345kV AC/alt 275kV AC	none	345kV
MAOD (EDFR,Shell)	431, 551, 321	3 proposals for 2, 3 or 4 1200MW, 320kV DC circuits to Larrabee converter station. Larrabee converter station is included in MAOD proposal. Include 1 platform per circuit.	Smith 1200, Larrabee 1200, Atlantic 1200, Smith +1200	Sea Girt National (Larrabee/ Atlantic/ Smithburg)	\$3B (431) Prop1 \$4.4B (551) Prop2 \$5.7B (321) Prop3 \$2.4M per mile addl sub cable	320kV DC	320 kV HVDC ties (NO)	66kV
Next Era (Options 1b/2-3)	461, 860, 250 (Deans)	2-1500MW, 400kV DC circuits to Deans, alternate for 3 or 4 circuits to achieve 4500 MW or 6000 MW. One offshore platform for each circuit.	Deans 3000, 4500, 6000	Raritan Bay (Deans),	\$3.6 B (461), \$5.2B (860), \$7.1B (250), \$738M (359)	400kV DC	230kV AC ties (NO)	66kV
Next Era (Options 1b/2-3)	27, 298, 15 (Oceanview)	1 or 2-1500MW, 400kV DC circuits to Oceanview or 2-1200MW circuits. One offshore platform for each circuit.	Ocean View 1500, 2400, 3000	Asbury Park (Oceanview)	\$1.5B (27), \$2.7 (298), \$3.0B (15), \$738M (359)	400kV DC	230kV AC ties (NO)	66kV
Next Era (Options 1b/2-3)	604(Cardiff)	1-1500MW, 400kV DC circuit and 1-1200MW, 400kV DC circuit to Cardiff.	Cardiff 2700	Absecon Bay (Cardiff)	\$3.0B (604) \$738M (359)	400kV DC	230kV AC ties (NO)	66kV
PSEGRT Coastal Wind Link	397, 214, 613, 230	1-1200 MW, 320 kV or 1-1400MW, 400 kV DC circuit from offshore platform, to either Sewaren or Larrabee.	Sewaren 1200/1400, Larrabee1200/1400	Sea Girt (Larrabee),Keyport, alt Union Bay (Deans), site under negot (Sewaren)	Sewaren \$2.3B (397)/\$2.4B (214) Larrabee \$2.2B (613)/\$2.3B (230)	320 or 400kV DC	na	275kV
PSEGRT Coastal Wind Link	208, 871	2-1400MW, 400kV DC circuits from offshore platforms, to Sewaren and Larrabee or Sewaren and Deans.	Sewaren 1400, Larrabee 1400 Deans1400	Sea Girt (Larrabee),Keyport, alt Union Bay (Deans), site under negot (Sewaren)	\$4.7B (208) \$4.8B (871)	320 or 400kV DC	275 kV HVAC ties (NC)	275kV
PSEGRT Coastal Wind Link	683	3-1400MW, 400kV DC circuits from offshore platforms, to Sewaren, Larrabee and Deans.	Sewaren 1400, Larrabee 1400 Deans1400	Sea Girt (Larrabee),Keyport, alt Union Bay (Deans), site under negot (Sewaren)	\$7.2B (683)	320 or 400kV DC	275 kV HVAC ties (NC)	275kV

- Option 1a Upgrade proposals (approx. 50 different solutions) include reconductoring projects, line rebuilds, substation upgrades and new line construction.
- Option 1a solutions are primarily located in NJ; some projects are proposed in PA/MD.
- The detailed list of Option 1a solutions is posted with the July 18, 2022 meeting materials.

On July 18, 2022 PJM presented its initial findings as a result of the following analysis performed:

- Reliability Analysis
- Economic Analysis
- Constructability Analysis
- Financial Analysis
- Legal Review of Cost Containment

- PJM has shared all of its analysis completed to date with NJBPU
- NJBPU will complete its independent evaluation of the proposals and make its recommendation to the NJ Board of Commissioners for approval in October
- PJM and NJBPU will consider feedback and update findings where appropriate and provide an update at the August or September TEAC.



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ISAC Update

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Appendix: Previously Reviewed Baseline Upgrade Recommendations for the July 2022 PJM Board Review

Note: Items presented at the June 2022 TEAC and SRRTEP meetings will also be recommended for Board approval.



PSEG Transmission Zone: Baseline

Process Stage: Second Review

Criteria: PSEG FERC Form 715

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP Summer case

Proposal Window Exclusion: None

Problem Statement:

The Lawrence 230/69 kV transformer # 220-4 has been identified for replacement based on equipment performance, condition assessment and system needs.

Violations were posted as part of the 2021 Window 3: FG# PSEG-01

Existing Facility Rating: 297SN/375SE, 344WN/464WE MVA

Proposed Facility Rating: 313SN/384SE, 369WN/454WE MVA

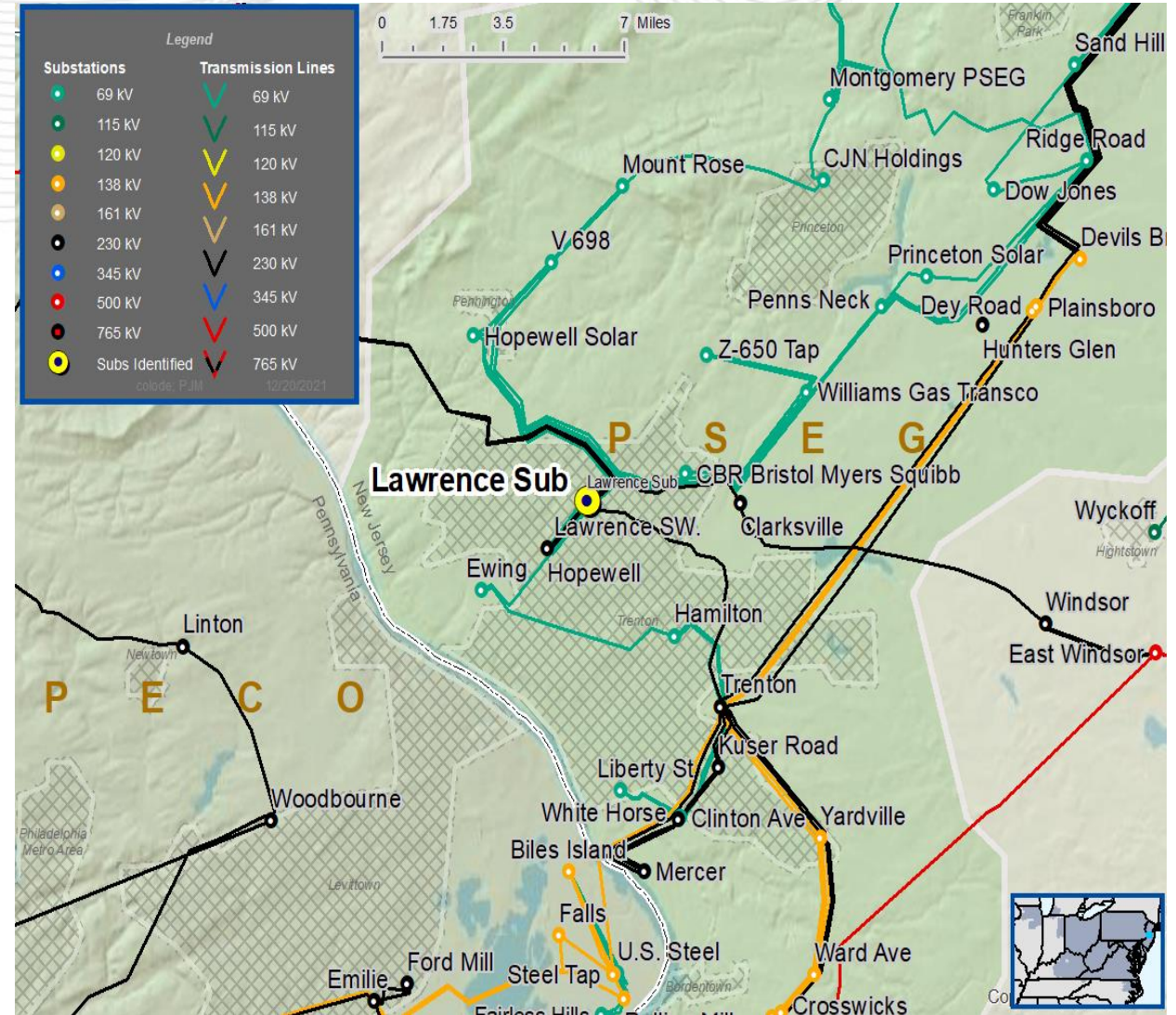
Recommended Solution:

Replace Lawrence Switching Station 230-69kV transformer 220-4 and its associated circuit switchers with a new larger capacity transformer with Load Tap Changer (LTC) and new dead tank circuit breaker. Install a new 230kV gas insulated breaker, associated disconnects, overhead bus, and other necessary equipment to complete the bay within the Lawrence 230kV Switchyard. (b3704)

Estimated Cost: \$13.36 M

Alternatives: N/A

Required In-Service: 6/1/2026



Process Stage: Second Review

Criteria: PSEG FERC Form 715

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP Summer case

Proposal Window Exclusion: None

Problem Statement:

The Athenia 230/138 kV transformer # 220-1 autotransformer has been identified for replacement based on equipment performance, condition assessment and system needs. . The 220-1 Auto-Transformer at Athenia has been heavily gassing for many years. The transformer has been de-gassed multiple times due to high levels of combustible gas in the main tank.

Violations were posted as part of the 2021 Window 3: FG# PSEG-02

Existing Facility Rating: 606SN/807SE, 717WN/954WE MVA

Proposed Facility Rating: 606SN/807SE, 717WN/954WE MVA

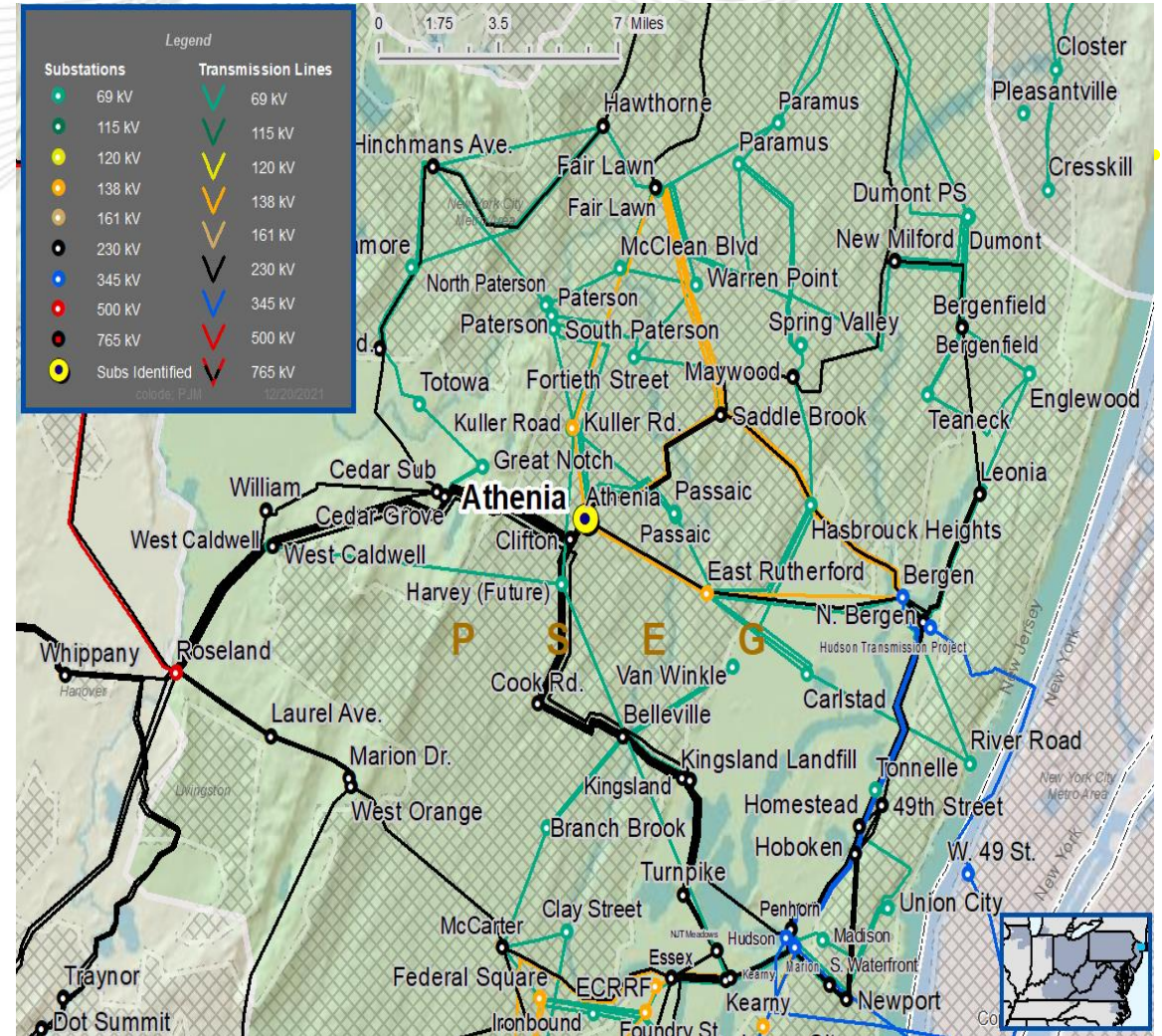
Recommended Solution :

Replace existing 230/138kV Athenia 220-1 transformer. (b3705)

Estimated Cost: \$13.04 M

Alternatives: N/A

Required In-Service: 6/1/2026





PSEG Transmission Zone: Baseline

Process Stage: Second Review

Criteria: PSEG FERC Form 715

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP Summer case

Proposal Window Exclusion: None

Problem Statement:

The Fair Lawn 230/138 kV #220-1 Auto-Transformer has been identified for replacement based on equipment performance, condition assessment and system needs. The transformer has been generating acetylene since 2015 along with other key combustible gasses.

Violations were posted as part of the 2021 Window 3: FG# PSEG-03

Existing Facility Rating: 596SN/808SE, 685WN/874WE MVA

Proposed Facility Rating: 470SN/674SE, 554WN/739WE MVA

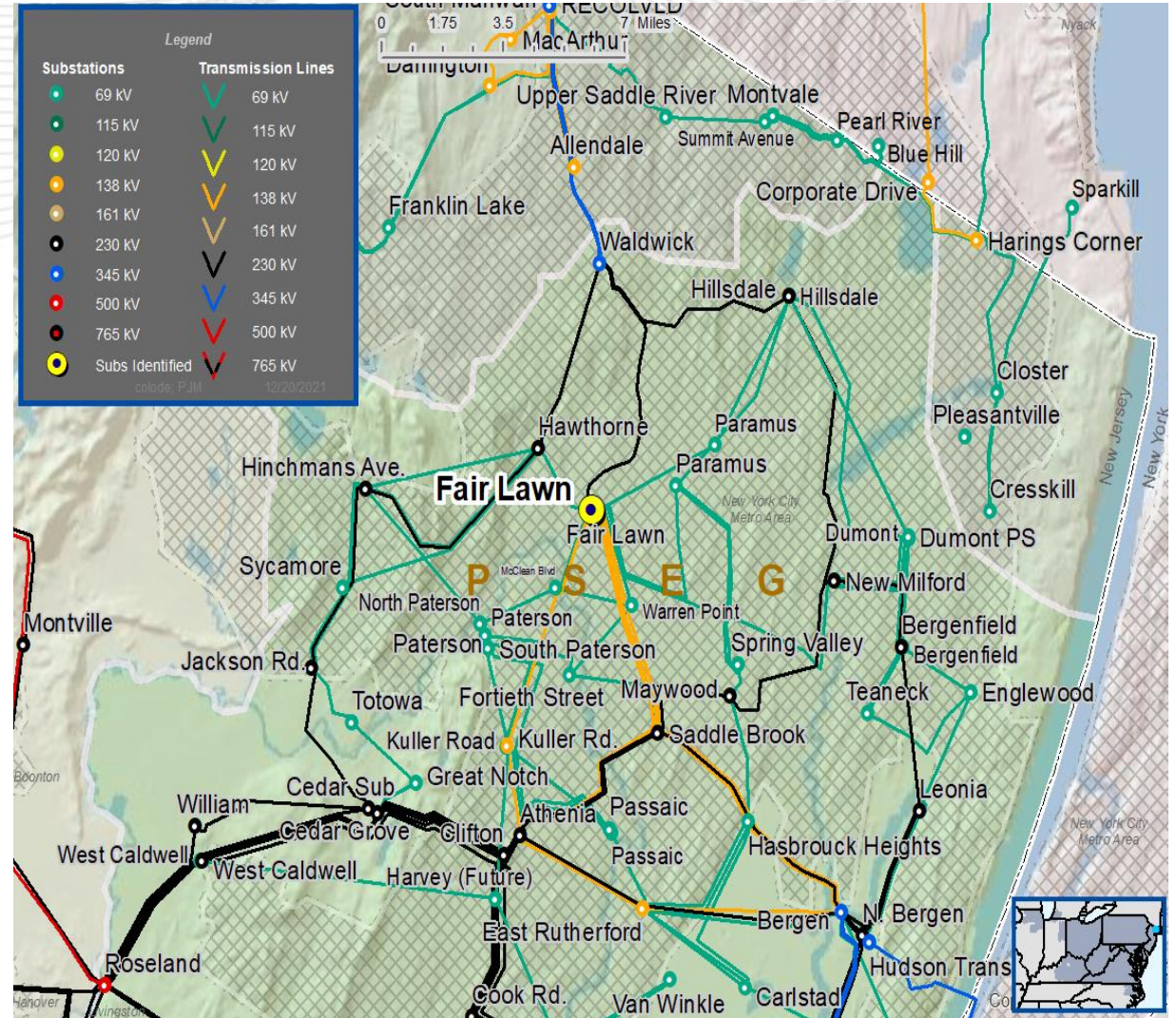
Recommended Solution:

Replace Fair Lawn 230-138kV transformer 220-1 with an existing O&M system spare at Burlington. (b3706)

Estimated Cost: \$4.454 M

Alternatives: N/A

Required In-Service: 6/1/2026



Process Stage: Second Review

Criteria: Light Load Generation Deliverability and N-1

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP Summer case

Proposal Window Exclusion: None

Problem Statement:

The Shawville 230/115/17.2 kV transformer #2A is overloaded for multiple contingencies.

Violations were posted as part of the 2021 Window 1: FG# N1-LLT20, N1-LLT21, GD-LL45, GD-LL46

Existing Facility Rating: 114SN/149SE, 147WN/178WE MVA

Proposed Facility Rating: 422SN/471SE, 530WN/544WE MVA

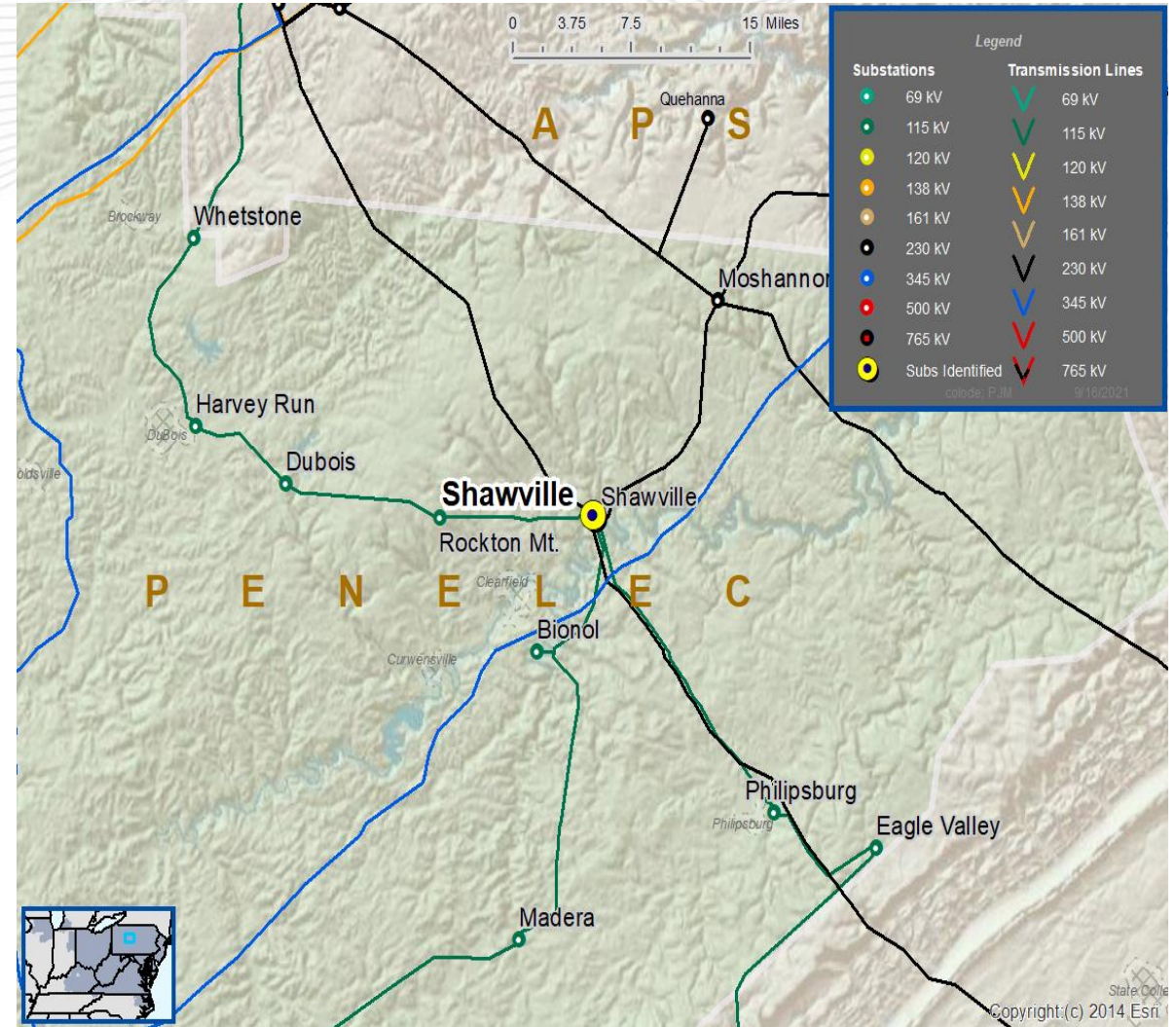
Recommended Solution:

Proposal ID 100 - Install a new 230/115 kV transformer and associated facilities. Replace the Plant's 2B 115-17.2 kV transformer with a larger 230/17.2 kV transformer. (B3708)

Estimated Cost: \$8.775 M

Alternatives: Proposal ID 306 - Replace the Shawville 2A 230/115-17.2 kV Transformer with a larger unit. (\$5.4 M)

Required In-Service: 6/1/2026



Process Stage: Second Review

Criteria: Winter Generation Deliverability

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP Winter retool case

Proposal Window Exclusion: None

Problem Statement:

The Dresden 345/138 kV No. 81 transformer is overloaded for an N-2 outage. Violations were posted as part of the 2021 Window 2: FG# GD-W2-W211, GD-W2-W214

Existing Facility Rating: 403SN/442SE, 420WN480WE MVA

Proposed Facility Rating: No change to transformer rating, 63 kA circuit breaker

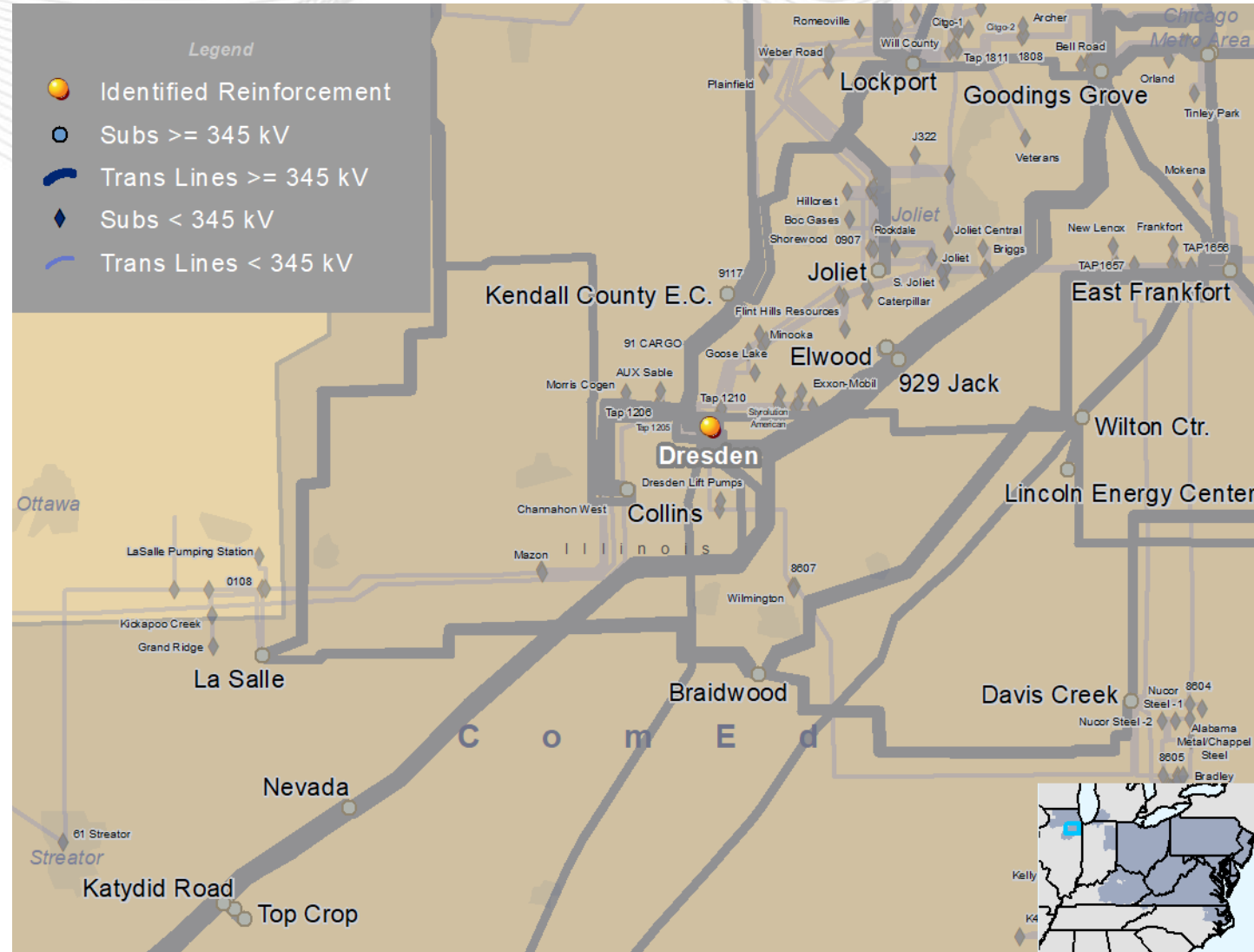
Proposed Solution:

Proposal ID 408 - Install 345 kV bus tie 5-20 circuit breaker in the ring at Dresden station in series with existing bus tie 5-6. (b3711)

Estimated Cost: \$4.26 M

Alternatives: Proposal ID 442 - Interconnect the Katydid Road-Goodings Grove Blue and AB1-122-Mole Creek 345 kV circuits at a new East Spring 345 kV substation. (\$10.4 M)

Required In-Service: 12/1/2026



Process Stage: Second Review

Criteria: Summer N-1-1 Voltage

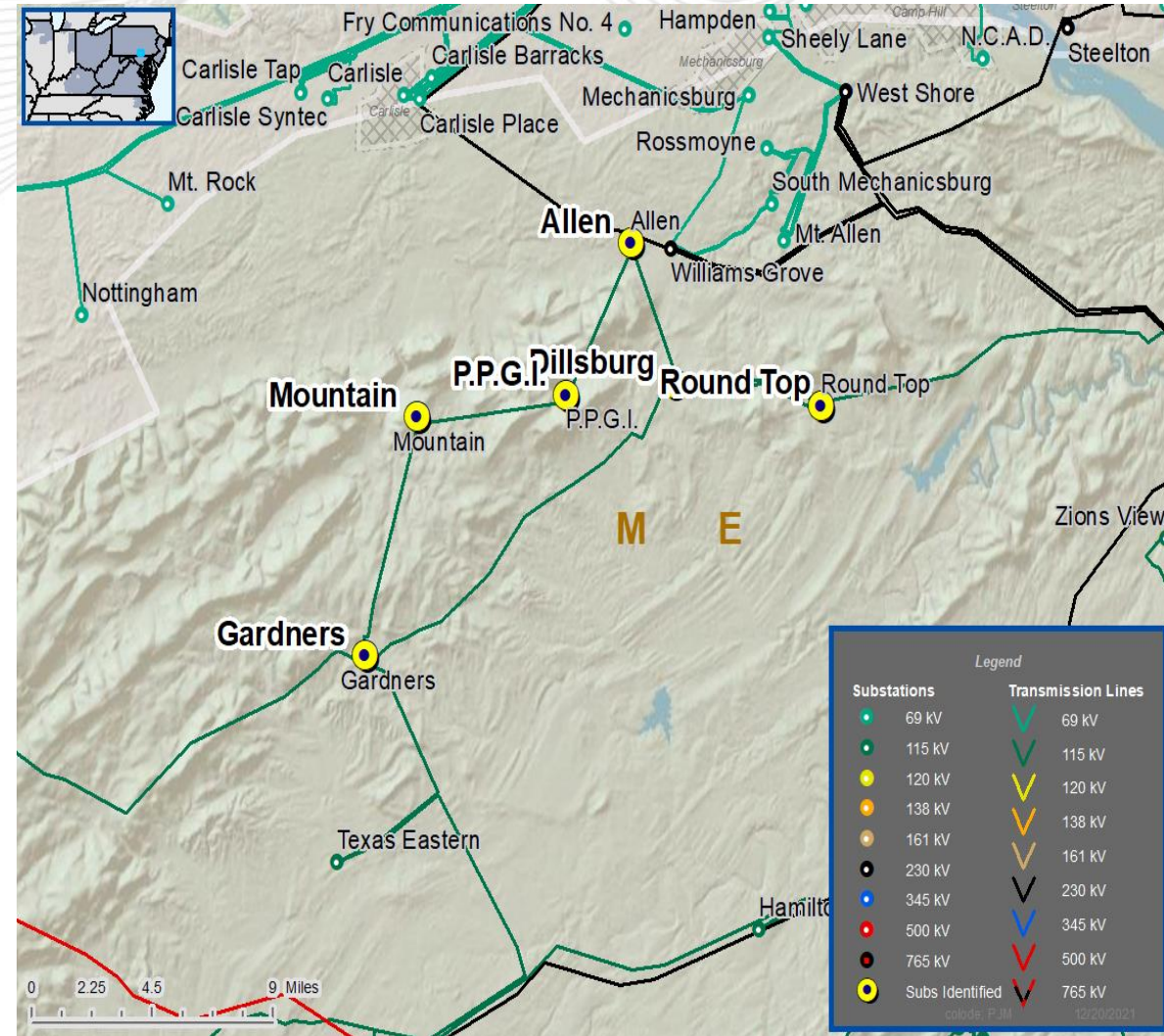
Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP Summer case

Proposal Window Exclusion: None

Problem Statement:

Voltage magnitude and voltage drop violation at several 115 kV stations in the Allen (MetEd) vicinity for N-1-1 contingencies.



	# of Flowgates
Violations were posted as part of the 2021 Window 1	N2-SVM8, N2-SVM9, N2-SVM10, N2-SVM11, N2-SVM12, N2-SVM13, N2-SVM16, N2-SVM17, N2-SVM18, N2-SVM19, N2-SVM26, N2-SVM27, N2-SVD1, N2-SVD2, N2-SVD3, N2-SVD4, N2-SVD5, N2-SVD6, N2-SVD7, N2-SVD8, N2-SVD9, N2-SVD10, N2-SVD11, N2-SVD12, N2-SVD15, N2-SVD16

Continue on next page ...



PJM Proposal ID	Project Description	Proposer Cost Estimate (\$M) Current-Year	Reliability Assessment		Operational Flexibility	Market Efficiency	Detailed Constructability Performed	Comments
			Addressed Identified Flowgates	Did the solution cause harm	Operational Flexibility Impact	Provides ME Benefit		
292	Dogwood Run 115/230kV Transmission Project	\$15.10	Yes	No	Medium	Negligible	Yes	Does not enhance operational flexibility, as the Allen 115 kV configuration remains the same - The Allen substation will be dropped for faults on terminating lines (Tapped Sub)
582	Dogwood Sprint 115/500kV Transmission Project	\$21.58	Yes	No	Medium	N/A	Yes	Does not enhance operational flexibility, as the Allen 115 kV configuration remains the same - The Allen substation will be dropped for faults on terminating lines (Tapped Sub)
561	Williams Grove - Allen 115 kV line upgrade sourced from Williams Grove 69 kV bus (PPL-Allen Switchyard)	\$15.62	Yes	No	Medium	N/A		This project is similar to ID 457, with the exception of the new 115 kV substation will be constructed by PPL. The additional feed to Allen 115 kV is from 69 kV PPL system.
992	Williams Grove - Allen 115 kV line upgrade sourced from Williams Grove 230 kV bus (PPL-Allen Switchyard)	\$18.57	Yes	No	High	N/A		The project is similar to ID 99, with the exception of the new 115 kV substation will be constructed by PPL (additional greenfield)
386	Multi-Driver Project: Allen-Williams Grove Greenfield Line & Reconductor	\$20.25	Yes	No	Low	N/A		This project is similar to ID 113 (lacks operational flexibility), with additional work to solve Market Efficiency need. The ME need is already addressed independently.
113	Allen-Williams Grove Greenfield Line	\$12.03	Yes	No	Low	N/A		The project doesn't enhance operational flexibility due to the proposed configuration (single breaker connection) at Allen 115 kV
789	New Allen 115 kV Source	\$28.54	Yes	Yes	High	N/A		The project causes a new violation.
477	Northern Loop STATCOM	\$32.16	Yes	No	Low	N/A		The project doesn't enhance operational flexibility.
457	Williams Grove - Allen 115 kV line upgrade sourced from Williams Grove 69 kV bus (FE-Allen Switchyard)	\$15.27	Yes	No	Medium	N/A		The additional feed to Allen 115 kV is from 69 kV PPL system
99	Williams Grove - Allen 115 kV line upgrade sourced from Williams Grove 230 kV bus (FE-Allen Switchyard)	\$17.82	Yes	No	High	Negligible	Yes	Provides the most operational flexibility due to the Allen 115 kV proposed configuration



Independent Cost and Constructability review was performed for the following projects.

PJM Proposal ID	Project Description	Proposer Total * Project Cost (\$M)	Proposer Project * Cost Cap (\$M)	Cost Cap Exclusions	Independent Total* Project Cost (\$M)	Independent Cost* Overrun Scenario (\$M)	Quality of Proposal	Proposal Completeness	Environmental & Siting / Permitting Risks	Project Development Risk	Independent Constructability Findings
292	Dogwood Run 115/230kV Transmission Project	\$17.08 ¹	\$19.00	1. Scope of Work change 2. Uncontrollable Force 3. O&M costs 4. Capital upgrades occurring after Project is initially placed in service	\$18.80	\$21.20	Low	No	Medium	Medium	> Line: Uses Greenfield > Substation: Greenfield > Didn't include remote end relay and interconnection metering consideration. > Proposal Deficiency: >>No High side transformer protection (breaker)
582	Dogwood Sprint 115/500kV Transmission Project	\$24.44 ²	\$27.30	1. Scope of Work change 2. Uncontrollable Force 3. O&M costs 4. Capital upgrades occurring after Project is initially placed in service	\$33.52	\$33.40	Low	Yes	Medium	High	> Line: Uses Greenfield > Substation: Greenfield > Didn't include remote end relay and interconnection metering consideration. > Project utilizes First Energy ROW for substation siting. > Least detailed proposal
99	Williams Grove - Allen 115 kV line upgrade sourced from Williams Grove 230 kV bus (FE-Allen Switchyard)	\$19.76 ³	\$12.65	1. Change in law. 2. Change in ISO req'ts 3. Force Majeure 4. Legal Fees & Expenses 5. Charges associated with acceleration of work before commercial ops.	\$21.81	\$23.30	High	Yes	Low	Low	> Line: Uses Greenfield > Substation: Upgrade Construction > Most detailed proposal and accounts for existing substation design/expansion requirements

- Notes:** *All costs in In-Service Year \$
1. Project 292 Capped Component Costs are \$15.07M
 2. Project 582 Capped Component Costs are \$22.60M
 3. Project 99 Capped Component Costs are \$12.65M

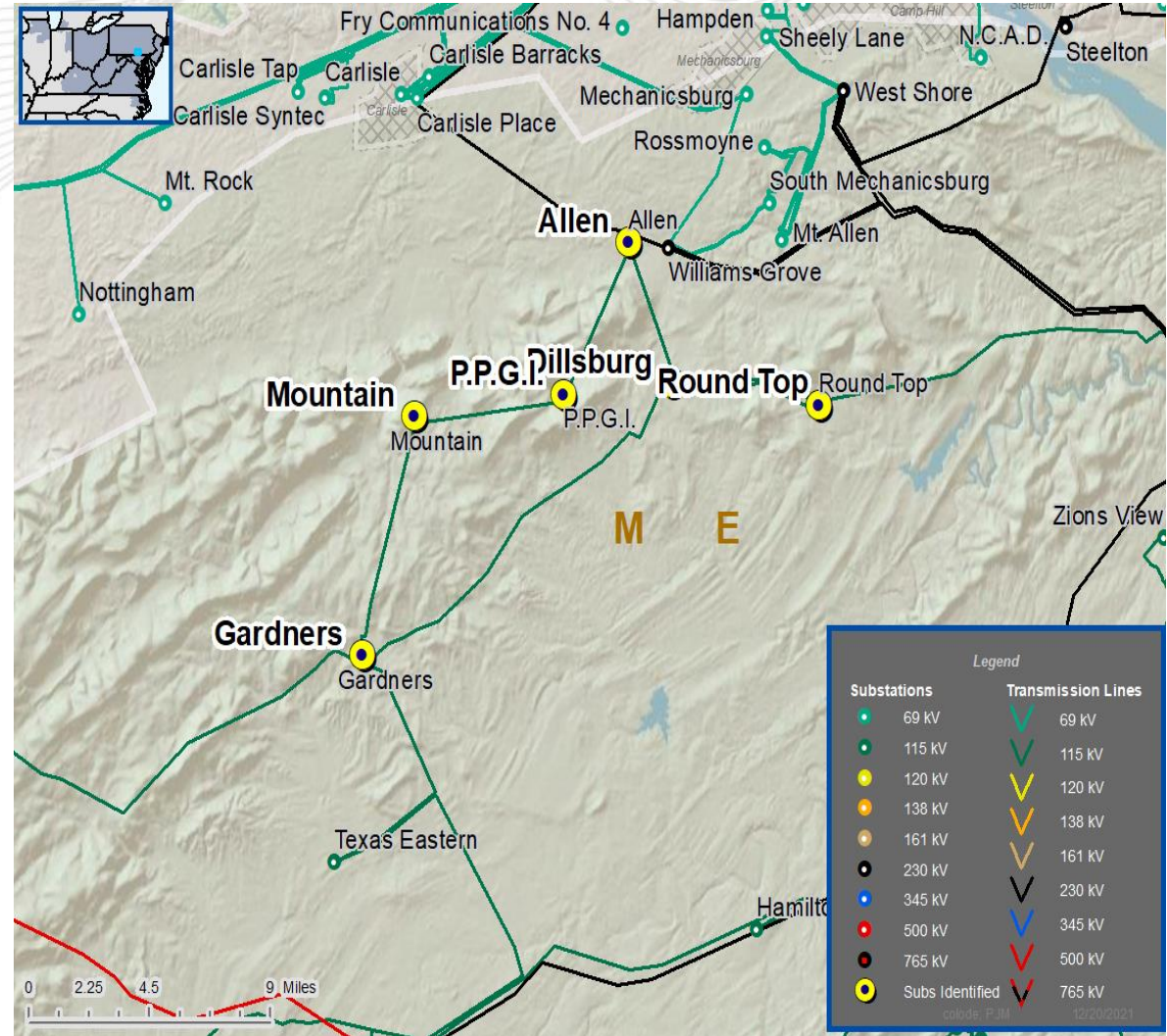
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Recommended Solution:

Proposal ID 99 : At the existing PPL Williams Grove Substation, install a new 300 MVA 230/115 kV transformer. Construct a new ~3.4 mile 115 kV single circuit transmission line from Williams Grove to Allen Substation. Install a new Allen four breaker ring bus Switchyard near the existing METED Allen Substation on adjacent property presently owned by FE. Terminate the Round Top - Allen and the Allen-PPGI 115 kV lines into the new switchyard. (B3715)

Estimated Cost: \$17.82 M

Required In-Service: 6/1/2026



Process Stage: Recommended Solution

Criteria: AEP 715 Criteria

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2023 short circuit RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion and Immediate Need Exclusion

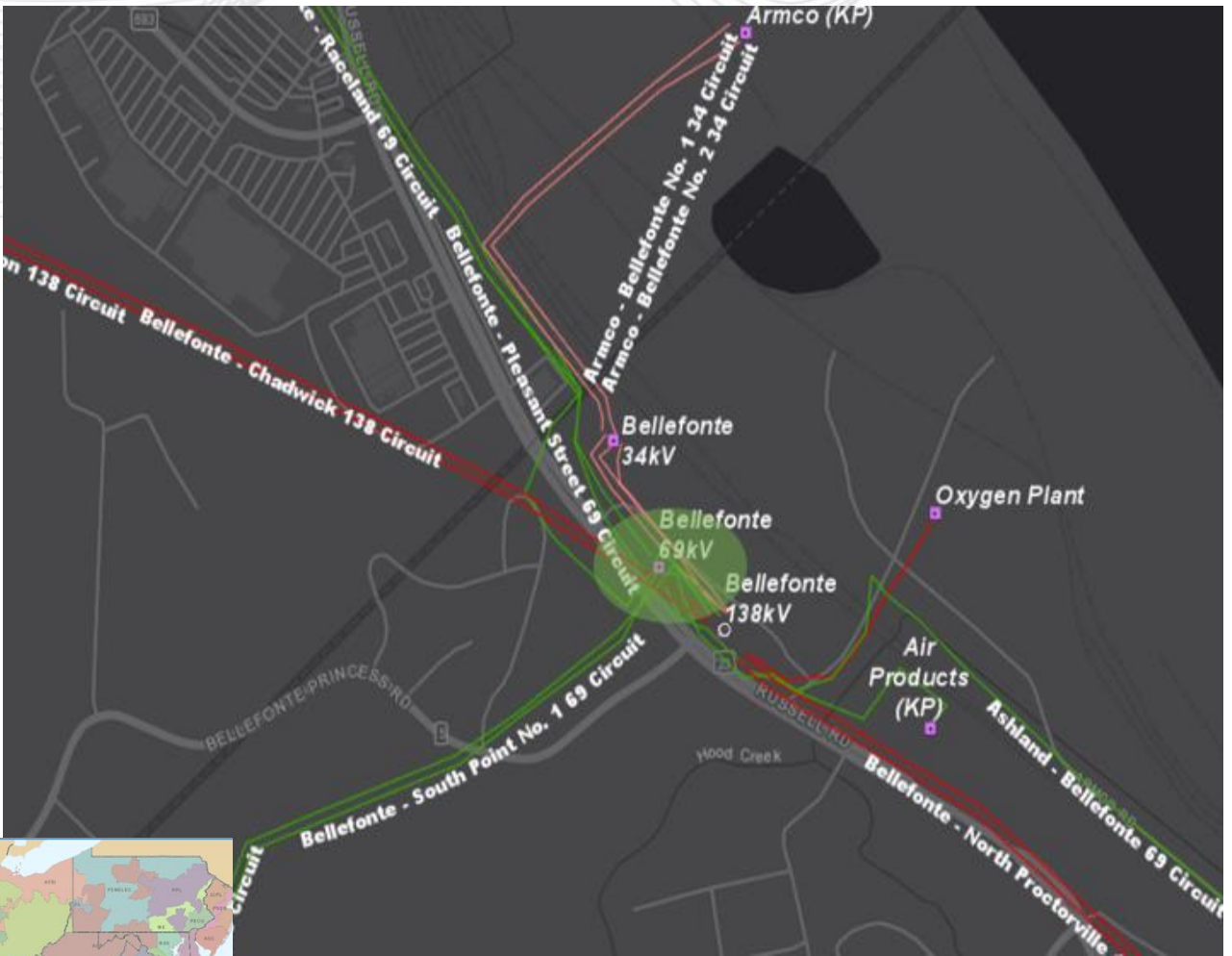
Problem Statement:

FG: AEP-SC1, AEP-SC2, AEP-SC3, AEP-SC4, AEP-SC5, AEP-SC6

In 2023 RTEP short circuit case, Bellefonte 69kV breakers JJ, C, I, AB, Z and G are overdutied.

Existing Facility Rating:

Breaker	KA
BELLEFNT 69kV Breakers: C, G, I, JJ, I, AB, Z	27





AEP Transmission Zone: Baseline Bellefonte 69kV breakers

Recommended Solution:

Replace overdutied 69kV breakers C, G, I, Z, AB and JJ in place. The new 69kV breakers to be rated at 3000 A 40kA breakers. (B3350.1)

Transmission Estimated Cost: \$2.0M

Remote end relaying at Point Pleasant, Coalton and South Point 69KV substations (B3350.2)

Transmission Estimated Cost: \$0M

Distribution Estimated Cost: \$1.52M

Preliminary Facility Rating:

Breaker	KA
BELLEFNT 69kV Breakers: C, G, I, JJ, I, AB, Z	40

Ancillary Benefits: Breakers C, G, I, Z, AB and JJ are Oil Circuit Breakers without oil containment. Oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require. Spare parts for these units are difficult to impossible to procure, and this model type is no longer vendor supported.

Required IS date: 6/1/2023

Projected IS date: 6/1/2023

Previously Presented: 12/17/2021



Process Stage: Recommended Solution

Criteria: AEP 715 Criteria

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2023 short circuit RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion and Immediate Need Exclusion

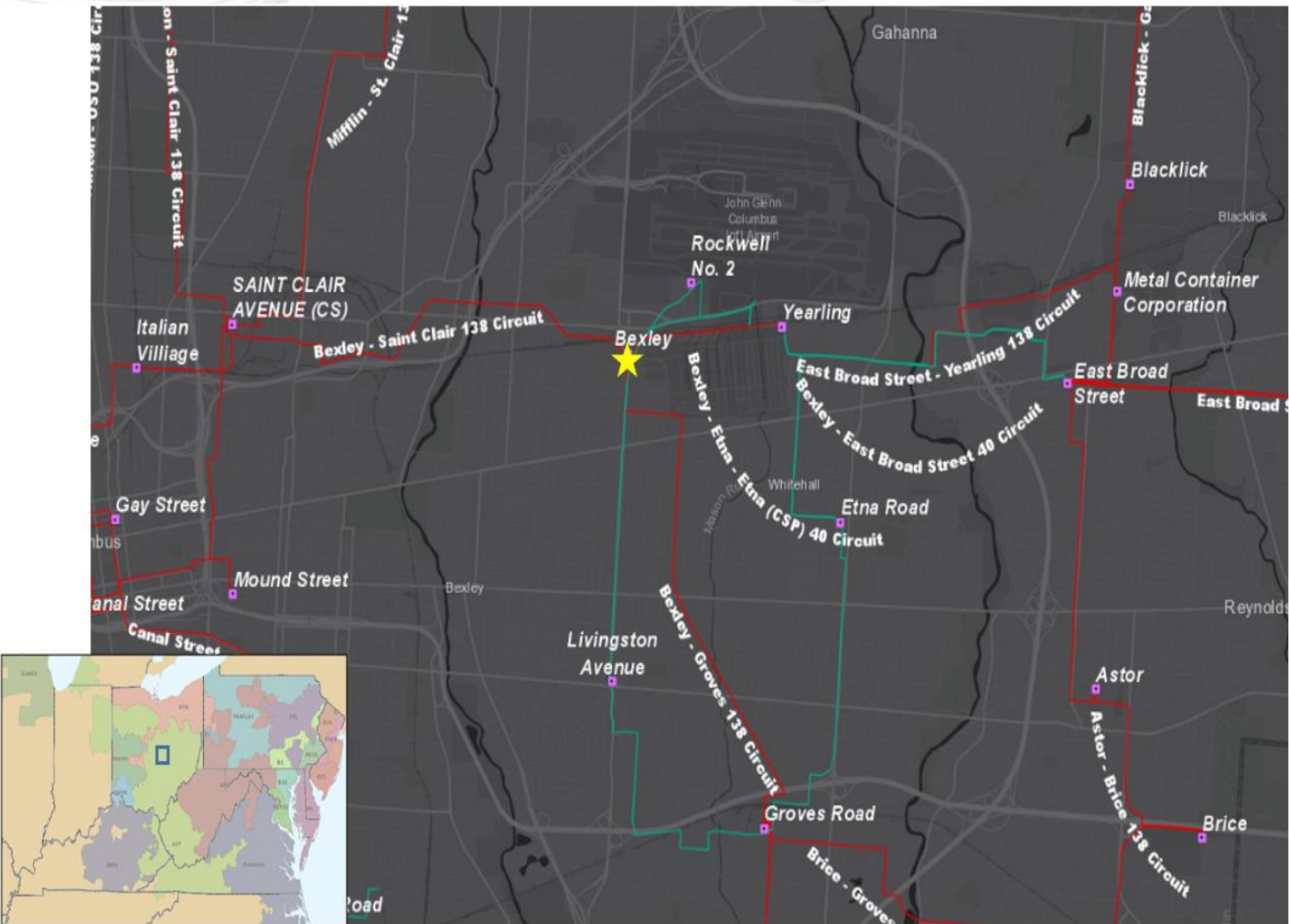
Problem Statement:

FG: AEP-SC7, AEP-SC8

In 2023 RTEP short circuit case, 40 kV circuit breakers '42' and '43' at Bexley station are overdutied.

Existing Facility Rating:

Breaker	KA
Bexley 40kV Breakers: 42, 43	10





AEP Transmission Zone: Baseline Bexley Breaker Replacement

Recommended Solution:

Replace circuit breakers '42' and '43' at Bexley station with 3000A, 40 kA 69 kV breakers (operated at 40 kV), slab, control cables, jumpers. (B3354)

Transmission Estimated Cost: \$1.0M

Preliminary Facility Rating:

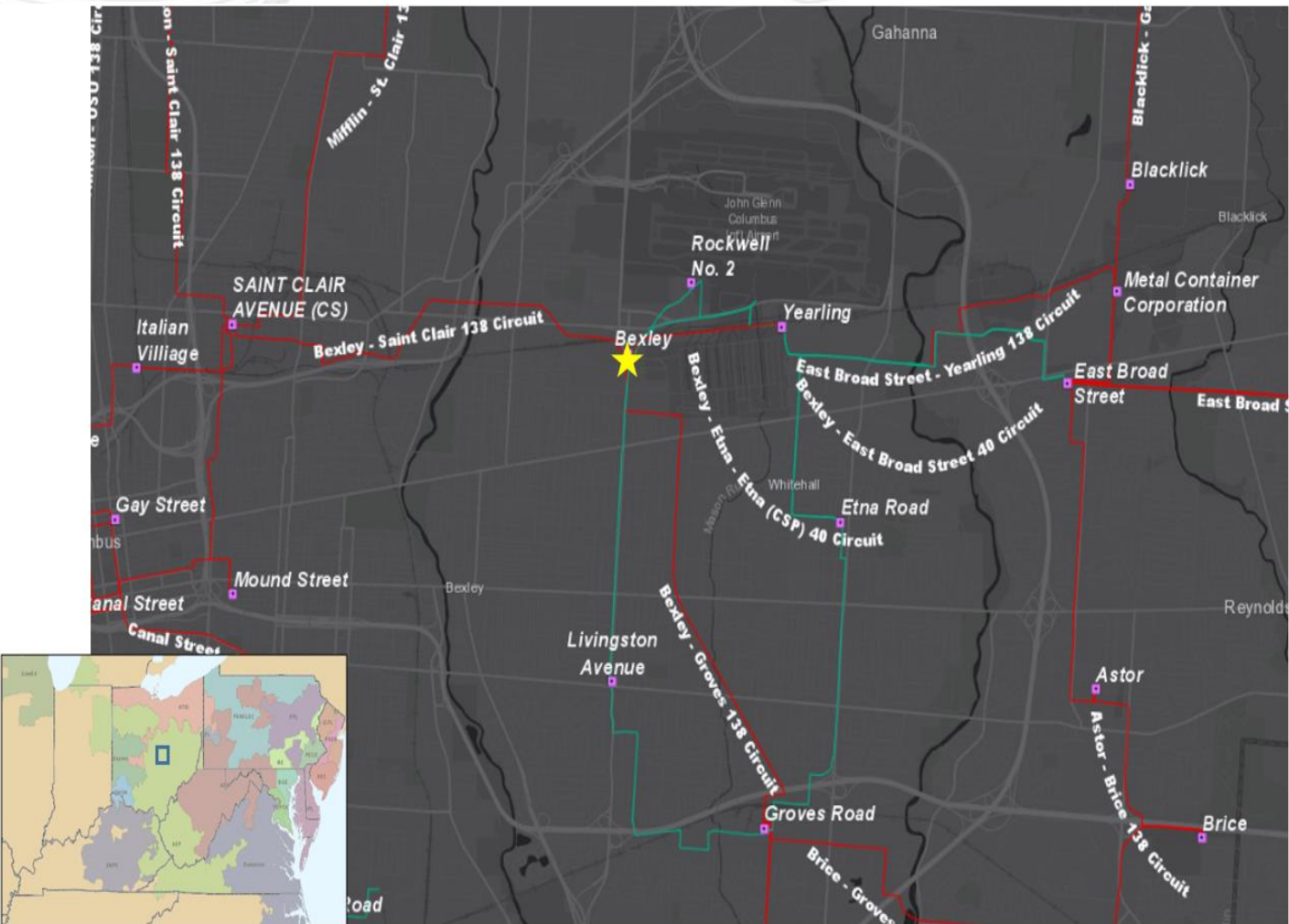
Breaker	KA
Bexley 40kV Breakers: 42, 43	40

Ancillary Benefits: Bexley 40kV breakers 42 and 43 are 1970's vintage Oil type Circuit Breakers without oil containment. Oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require. Spare parts for these units are difficult to impossible to procure, and this model type is no longer vendor supported.

Required IS date: 6/1/2023

Projected IS date: 6/1/2023

Previously Presented: 12/17/2021



Process Stage: Recommended Solution

Criteria: AEP 715 Criteria

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2023 short circuit RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion and Immediate Need Exclusion

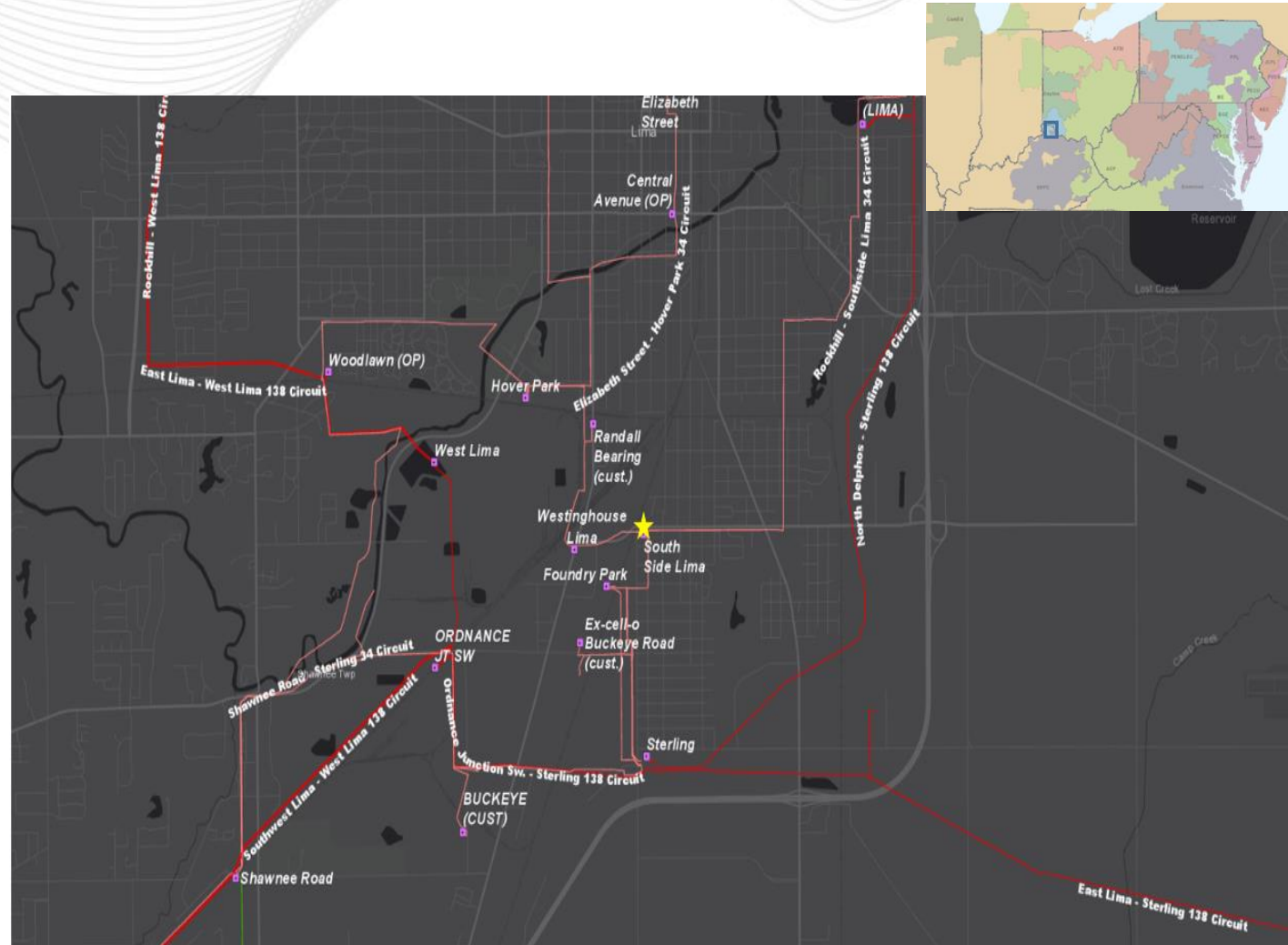
Problem Statement:

FG: AEP-SC13, AEP-SC14

In 2023 RTEP short circuit case, 34.5 kV circuit breakers 'A' and 'B' at South Side Lima station are overdutied.

Existing Facility Rating:

Breaker	KA
South Side Lima 34.5kV Breakers: A, B	14.2





AEP Transmission Zone: Baseline South Side Lima Breaker Replacement

Recommended Solution:

Replace 34.5kV circuit breakers 'A' and 'B' at South Side Lima station with 1200A, 25 kA 34.5 kV breakers , slab, control cables, jumpers. (B3355)

Transmission Estimated Cost: \$0.75M

Preliminary Facility Rating:

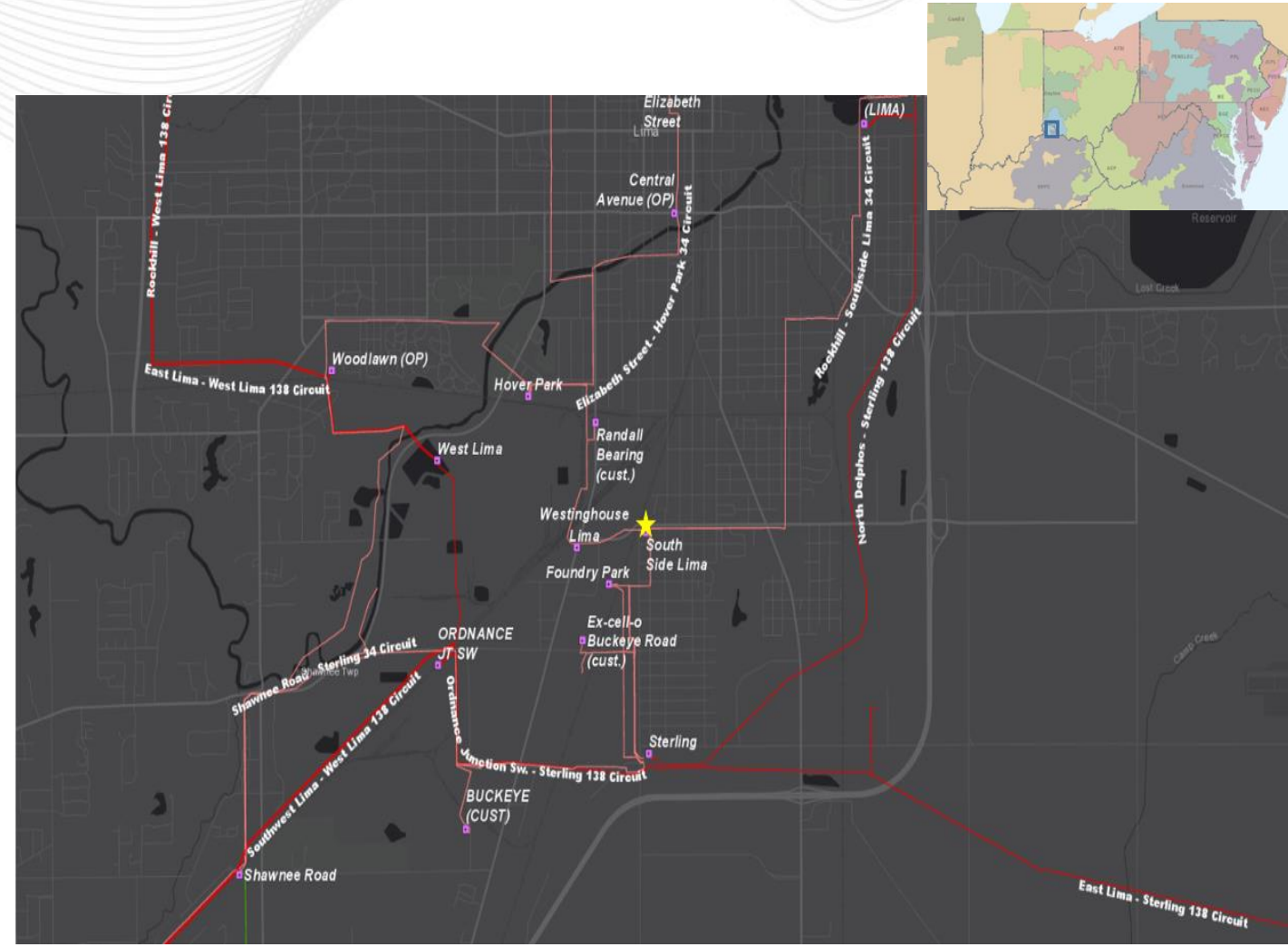
Breaker	KA
South Side Lime 34.5kV Breakers: A, B	25

Ancillary Benefits: South Side Lima 34.5kV breakers A and B are 1950's vintage Oil type Circuit Breakers without oil containment. Oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require. Spare parts for these units are difficult to impossible to procure, and this model type is no longer vendor supported.

Required IS date: 6/1/2023

Projected IS date: 6/1/2023

Previously Presented: 12/17/2021





AEP Transmission Zone: Baseline West End Fostoria Breaker Replacement

Process Stage: Recommended Solution

Criteria: AEP 715 Criteria

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2023 short circuit RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion and Immediate Need Exclusion

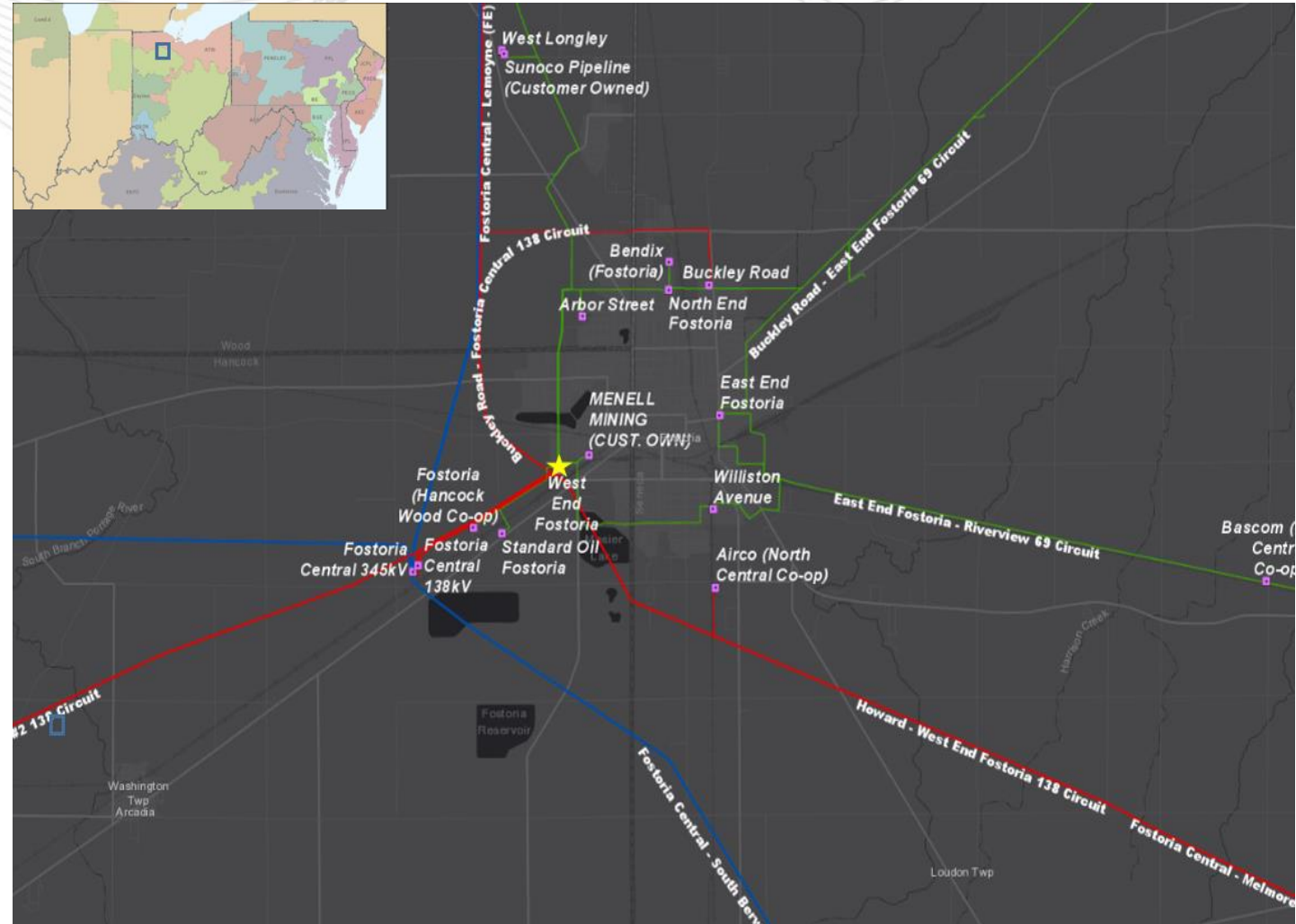
Problem Statement:

FG: AEP-SC15

In 2023 RTEP short circuit case, 69 kV circuit breaker 'H' at West End Fostoria station is overdutied.

Existing Facility Rating:

Breaker	KA
West End Fostoria 69kV Breakers: H	20





AEP Transmission Zone: Baseline West End Fostoria Breaker Replacement

Recommended Solution:

Replace circuit breaker 'H' at West End Fostoria station with 3000A, 40 kA 69 kV breaker , slab, control cables, jumpers. (B3356)

Transmission Estimated Cost: \$0.5M

Preliminary Facility Rating:

Breaker	KA
West End Fostoria 69kV Breakers: H	40

Required IS date: 6/1/2023

Projected IS date: 6/1/2023

Previously Presented: 12/17/2021



Process Stage: Recommended Solution

Criteria: AEP 715 Criteria

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2023 short circuit RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion and Immediate Need Exclusion

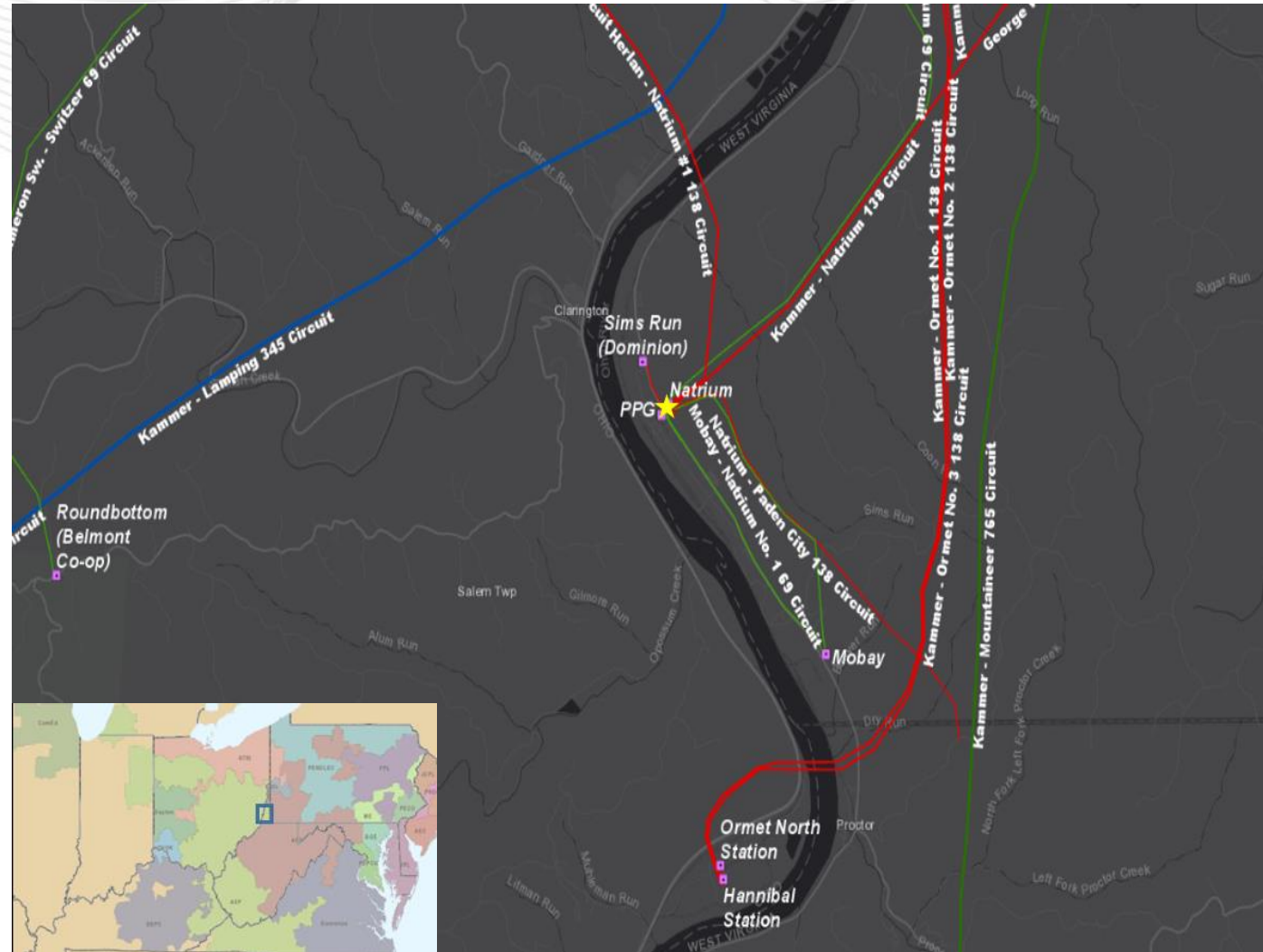
Problem Statement:

FG: AEP-SC10, AEP-SC11, AEP-SC12

In 2023 RTEP short circuit case, 69 kV circuit breakers 'C', 'E', and 'L' at Natrium station are overdutied.

Existing Facility Rating:

Breaker	KA
Natrium 69kV Breakers: C, E, L	21



Recommended Solution:

Replace circuit breakers 'C', 'E', and 'L' at Natrium station with 3000A, 40 kA 69 kV breakers, slab, control cables, jumpers. (B3357)

Transmission Estimated Cost: \$1.5M

Preliminary Facility Rating:

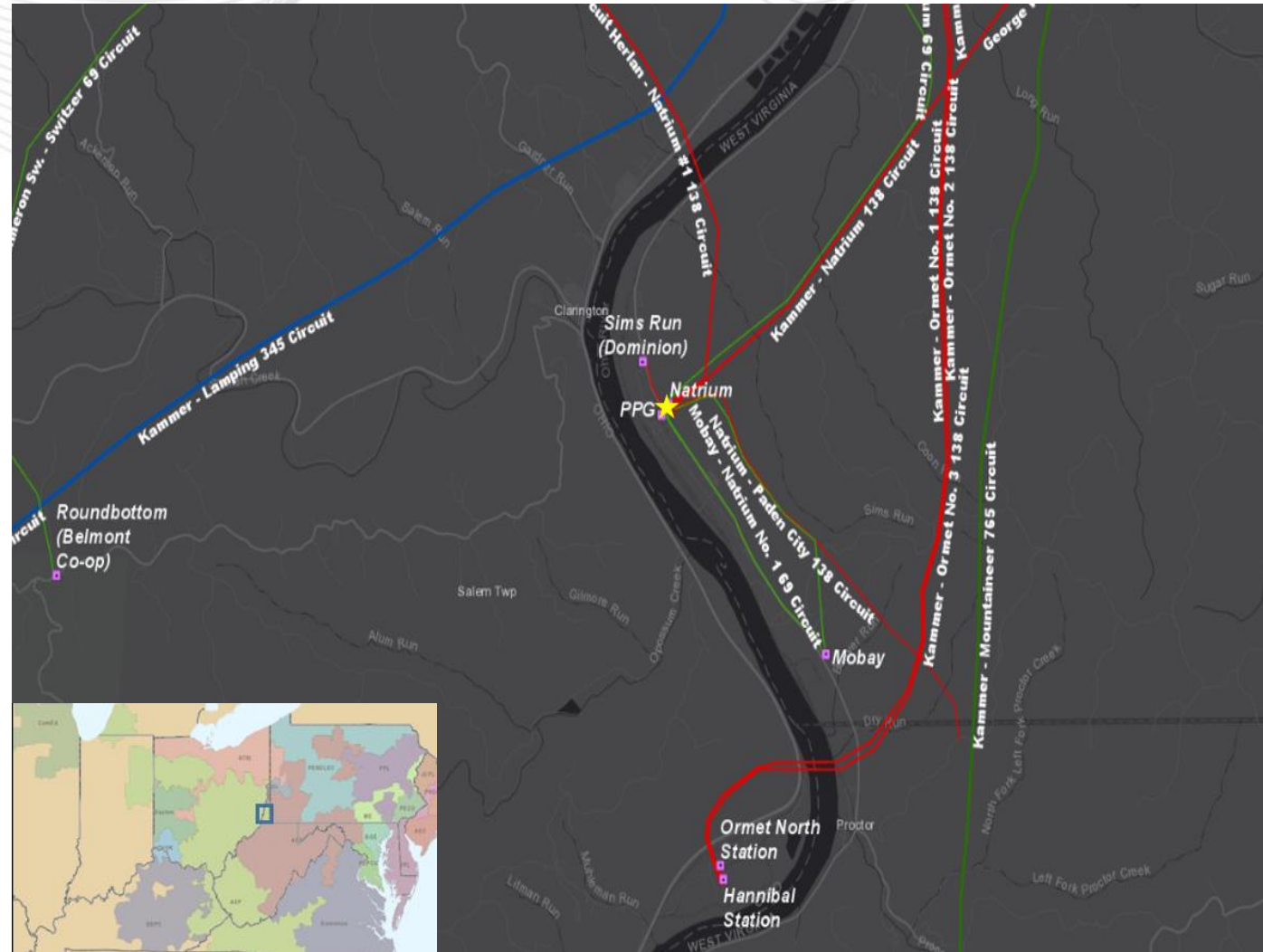
Breaker	KA
Natrium 69kV Breakers: C, E, L	40

Ancillary Benefits: Natrium 69kV breakers C, E and L are Oil Circuit Breakers without oil containment. Oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require. Spare parts for these units are difficult to impossible to procure, and this model type is no longer vendor supported.

Required IS date: 6/1/2023

Projected IS date: 6/1/2022

Previously Presented: 12/17/2021





EKPC Transmission Zone: Baseline Summer Shade-West Columbia 69 kV Rebuild

Process Stage: Recommended Solution

Criteria: EKPC 715 Criteria

Assumption Reference: EKPC Assumptions Presentation Slide 3-10

Model Used for Analysis: EKPC's internal models representing 2024/25 winter peak conditions that were used for EKPC's annual system screening analysis for 2021 planning cycle. Includes Cooper Units 1 and 2 off with replacement generation imported from south of EKPC system.

Proposal Window Exclusion: Below 200 kV Exclusion

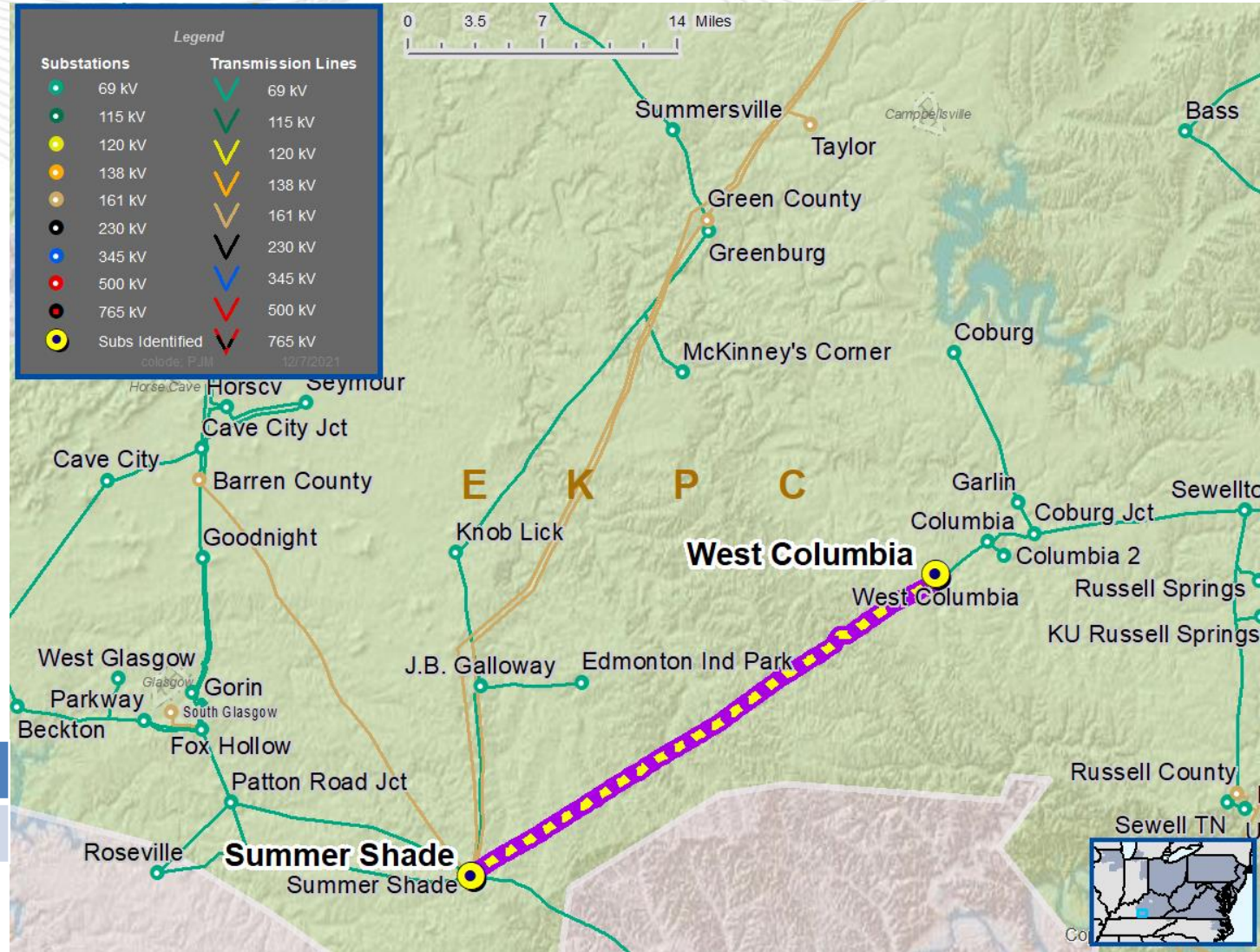
Problem Statement:

FG: EKPC-T1

The Summer Shade-West Columbia 69 kV line section is overloaded for a N-1 outage.

Existing Facility Rating:

Branch	SN/SE/WN/WE (MVA)
2SUMM SHADE-2W COLUMBI T 69 kV	57/63/82/86





EKPC Transmission Zone: Baseline Summer Shade-West Columbia 69 kV Rebuild

Recommended Solution:

Rebuild the Summer Shade-West Columbia 69 kV 0.19 miles of 266 conductor double circuit to 556 conductor. **(b3709)**

Total Estimated Cost: \$0.191 M

Preliminary Facility Rating:

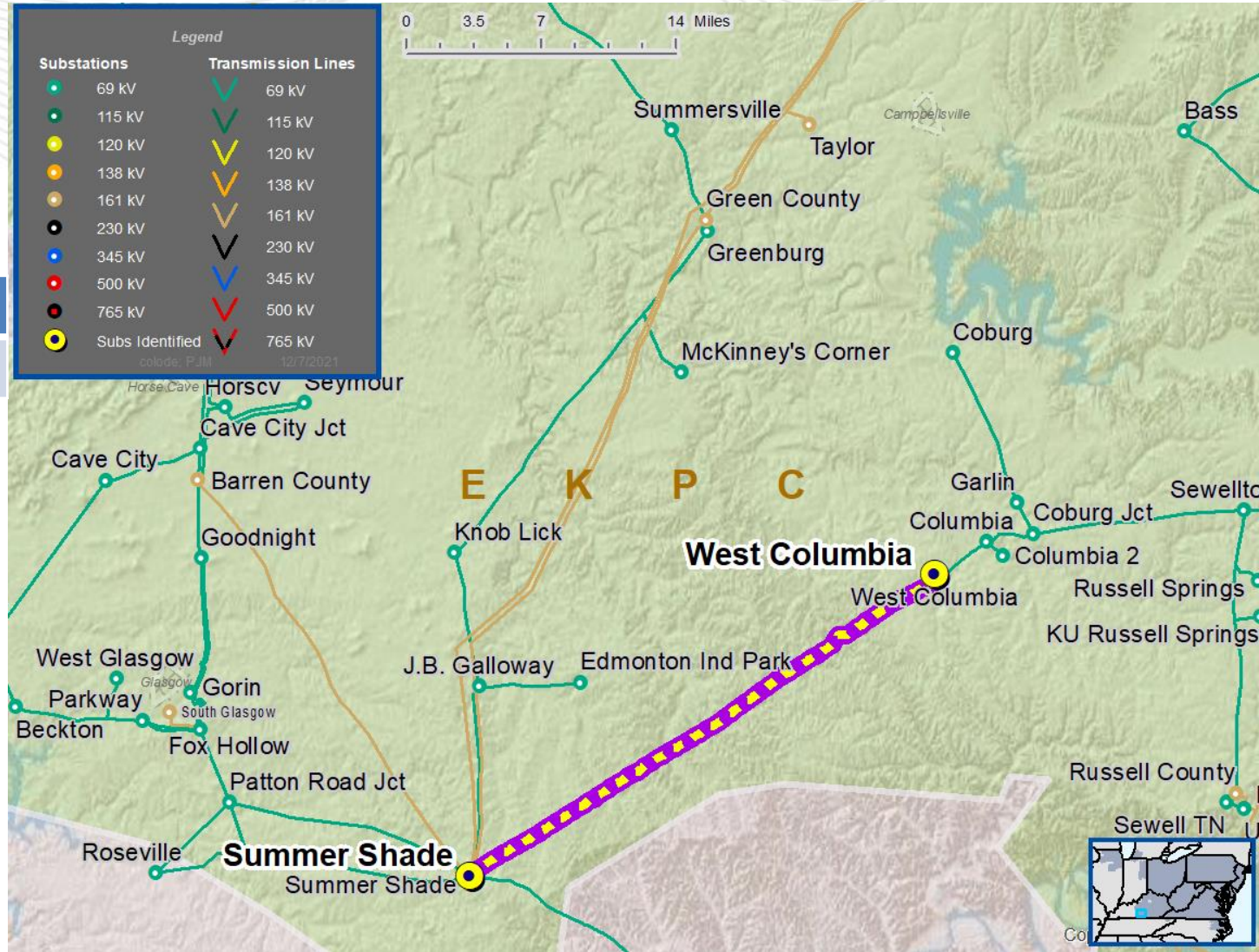
Branch	SN/SE/WN/WE (MVA)
2SUMM SHADE-2W COLUMBI T 69 kV	73/76/86/89

Ancillary Benefits:

Minimizes maintenance costs and increases operational flexibility over a MOT increase.

Required IS date: 12/1/2025

Projected IS date: 12/1/2025





APS Transmission Zone: Baseline Yukon to AA2-161 Tap 138 kV

Process Stage: Recommended Solution

Criteria: Generation Deliverability

Assumption Reference: 2026 RTEP assumption

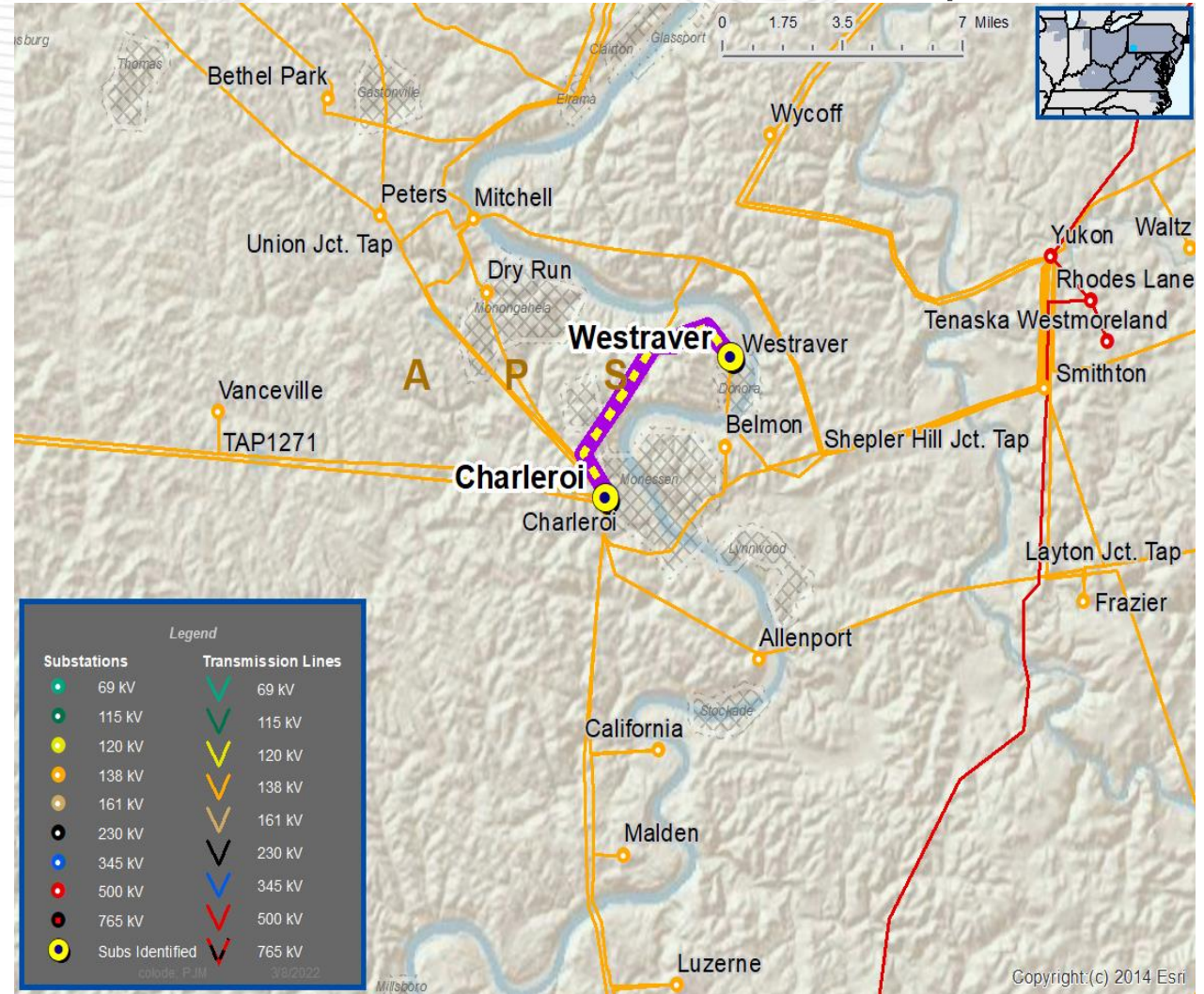
Model Used for Analysis: 2026 Summer RTEP case

Proposal Window Exclusion: Below 200 kV Exclusion

Problem Statement: GD-S24 & GD-S29

In 2026 RTEP Summer case, Yukon to AA2-161 Tap 138 kV lines are overloaded due to single contingencies.

Branch	SN/SE/WN/WE (MVA)
Yukon to Westraver 138 kV	308/376/349/445
Westraver to Charleroi 138 kV	274/342/345/382





APS Transmission Zone: Baseline Yukon to AA2-161 Tap 138 kV

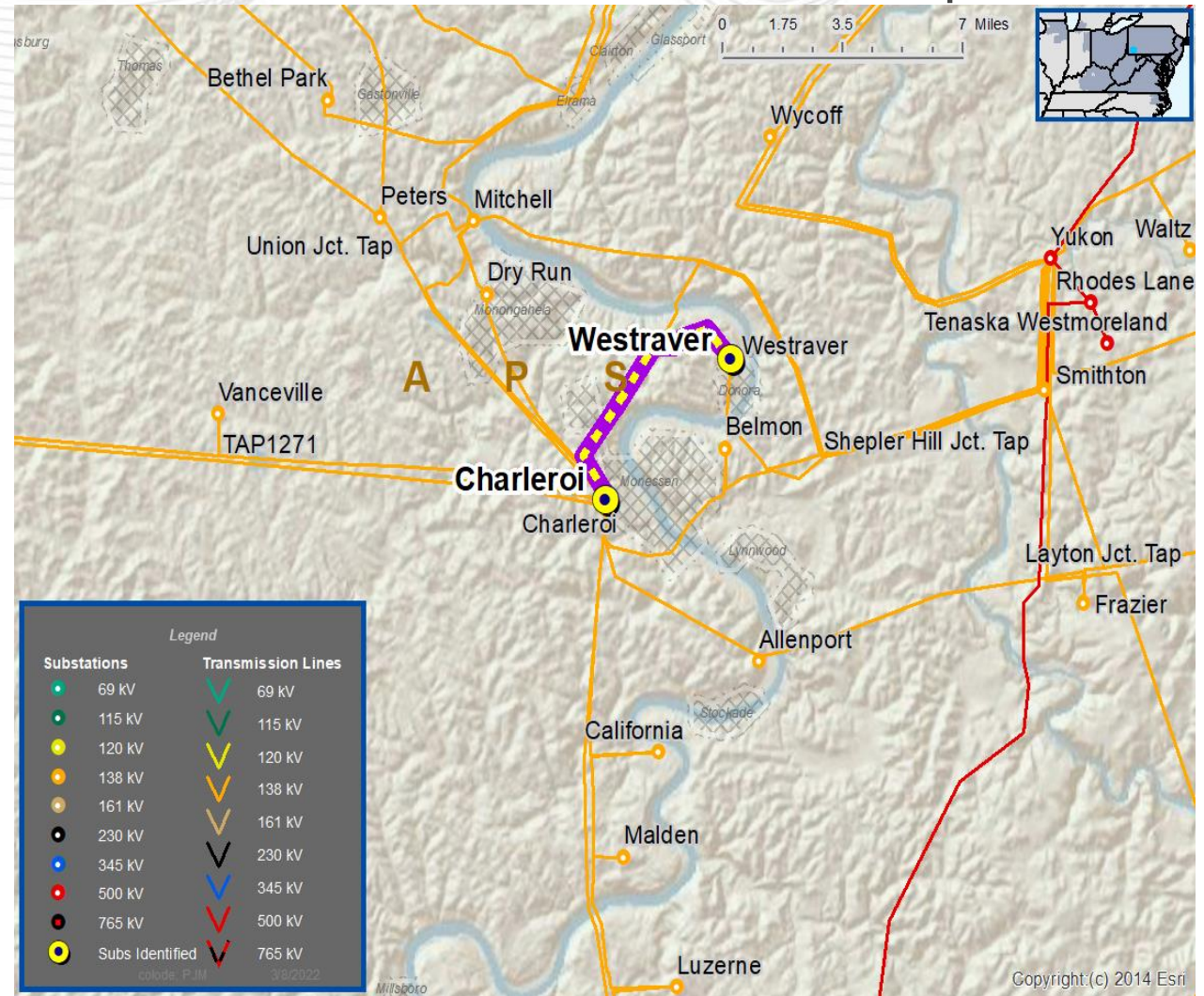
Recommended Solution:

Expand the future AA2-161 138 kV six (6) breaker ring bus into an eleven (11) breaker substation with a breaker-and-a-half layout by constructing five (5) additional breakers and expanding the bus. Loop the Yukon - Charleroi #2 138 kV line into the future AA2-161 substation. Relocate terminals as necessary at AA2-161. Upgrade terminal equipment (wavetrap, substation conductor) and relays at Yukon, Huntingdon, Springdale, Charleroi, and the AA2-161 substation. (b3710)

Transmission Estimated Cost: \$14.37M

Preliminary Facility Rating:

Branch	SN/SE/WN/WE (MVA)
Yukon to Westraver 138 kV	308/376/349/445
Westraver to AA2-161 138 kV	308/376/349/445
AA2-161 to Charleroi 138 kV	297/365/345/441





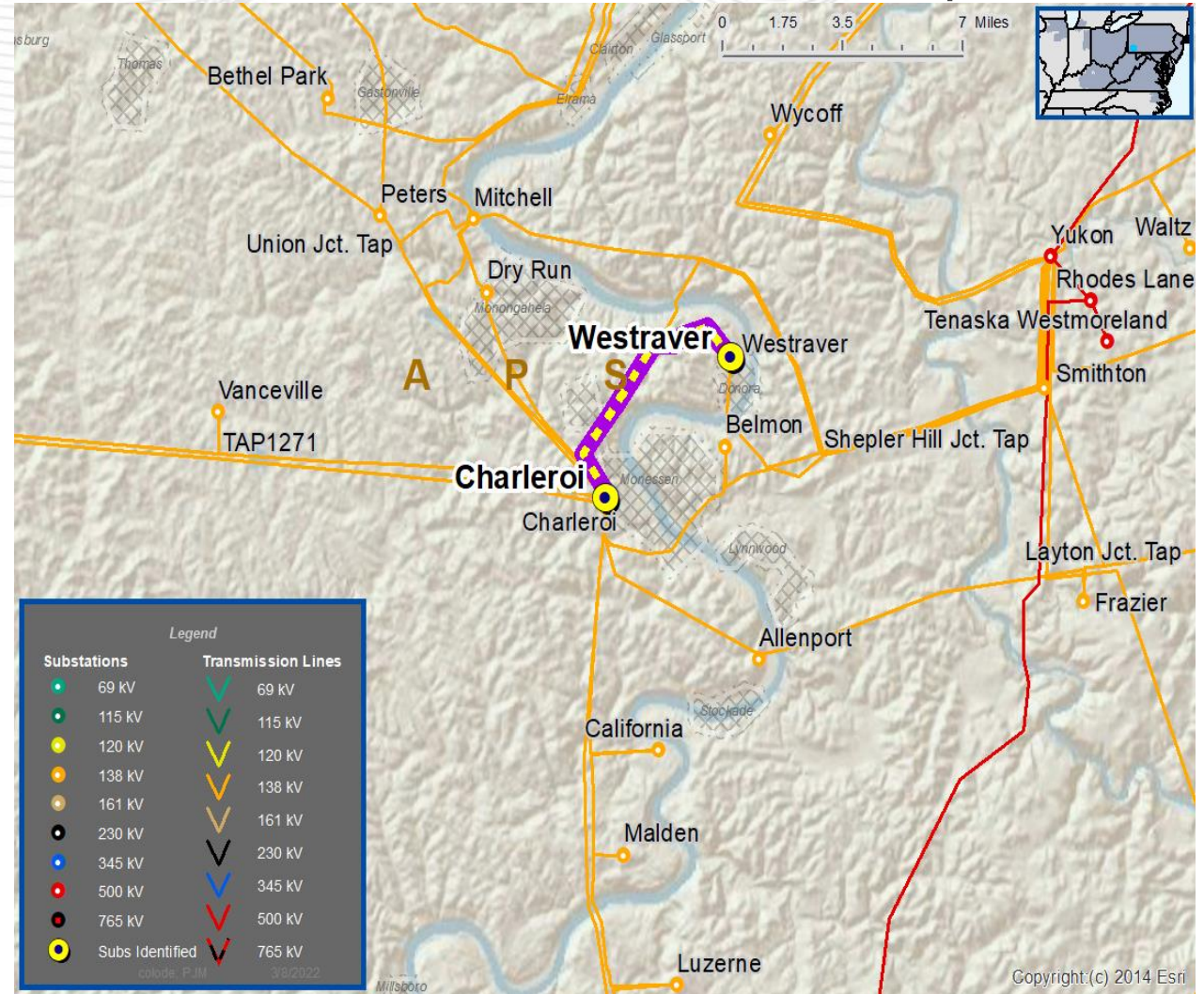
APS Transmission Zone: Baseline Yukon to AA2-161 Tap 138 kV

Alternatives: Reconductor both Yukon - AA2-161 138 kV lines. This alternative would cost \$15.1 million.

Ancillary Benefits: Looping the Yukon - Charleroi #2 138 kV line into the future AA2-161 substation would alleviate the thermal overload violations. This project will also provide an additional network path from Yukon to Springdale, which is currently unavailable for multiple P4, P6, & P7 contingencies.

Required IS date: 6/1/2026

Projected IS date: 6/1/2026





EKPC Transmission Zone: Baseline Liberty Junction Cap Bank

Process Stage: Recommended Solution

Criteria: EKPC 715 Criteria

Assumption Reference: EKPC Assumptions Presentation Slide 3-10

Model Used for Analysis: EKPC's internal models representing 2022/23 winter peak conditions that were used for EKPC's annual system screening analysis for 2021 planning cycle. Includes Cooper Units 1 and 2 off with replacement generation imported from north of EKPC system.

Proposal Window Exclusion: Immediate Need/Below 200 kV Exclusion

Problem Statement:

FG: EKPC-VM1, EKPC-VM3, EKPC-VM4

Low voltage at Broughtontown, Tommy Gooch and Highland 69 kV for a N-1 outage.

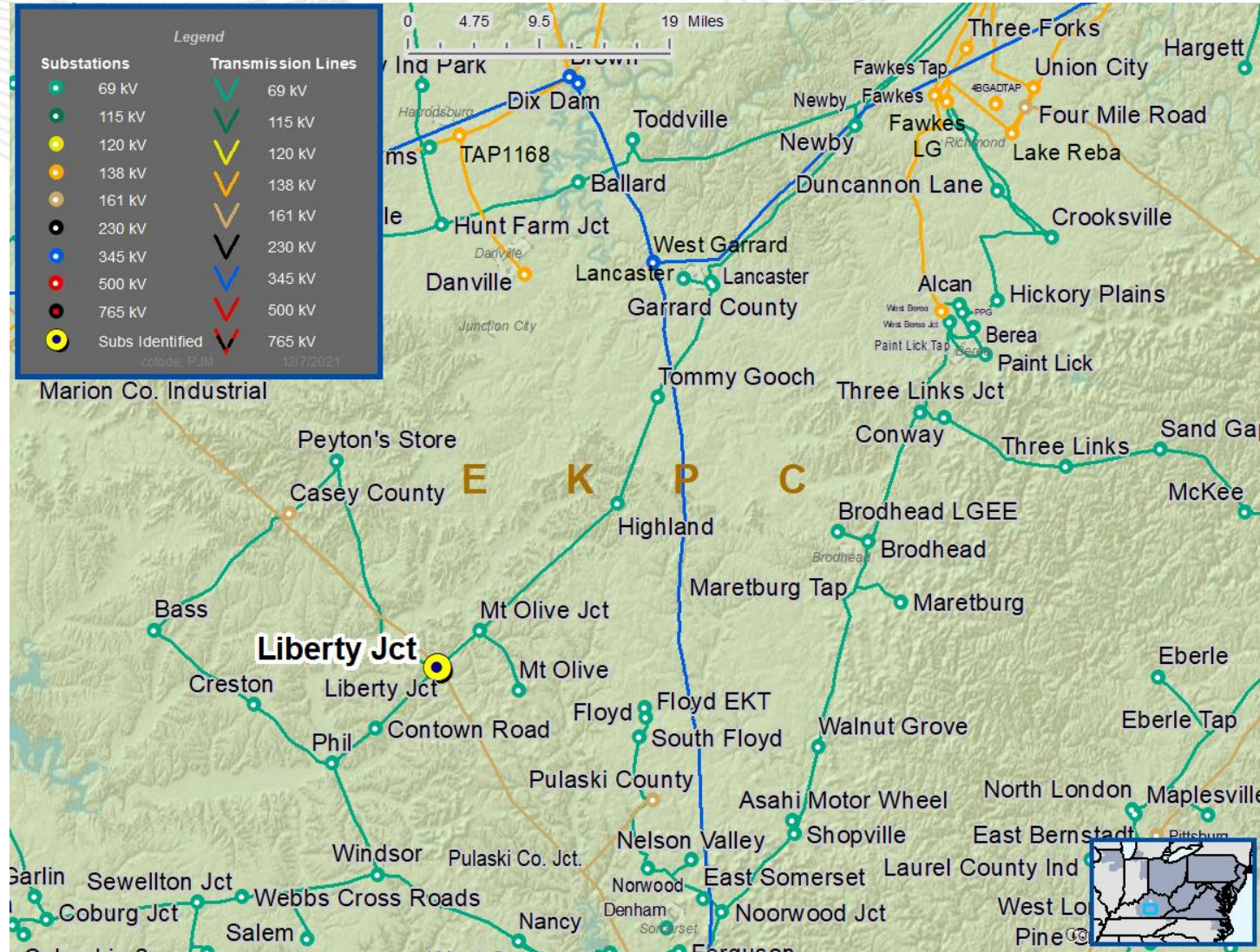
Existing Facility Rating: N/A

Proposed Solution:

Install a 28 MVAR cap bank at Liberty Junction 69 kV. (b3712)

Total Estimated Cost: \$0.542 M

Preliminary Facility Rating: N/A





EKPC Transmission Zone: Baseline Liberty Junction Cap Bank

Alternatives:

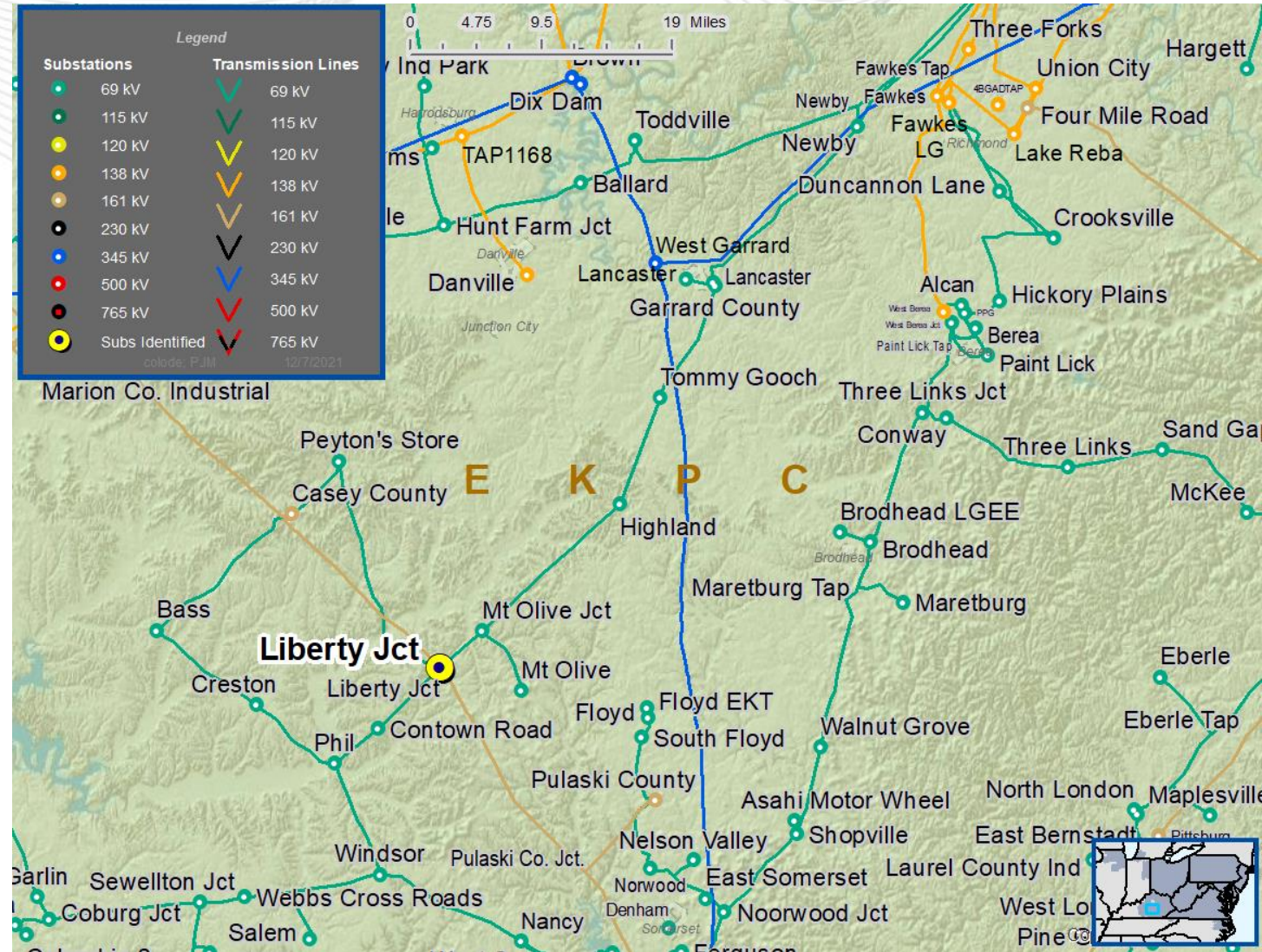
1. Build KU Stanford-Tommy Gooch normally-open connection using 556 ACSR (3.4 miles).
2. Build second line from Garrard Co-Tommy Gooch using 556 ACSR (7.3 miles) with Tommy Gooch served radially.
3. Build Brodhead-Broughtontown normally-open using 556 ACSR (8 miles).
4. Build Three Links Jct-Tommy Gooch normally-closed line using 556 ACSR (16.67 miles).

Ancillary Benefits:

Provides voltage support for the Oakhill area without need for future projects as compared to other alternatives.

Required IS date: 12/1/2022

Projected IS date: 12/1/2022



Process Stage: Second Review

Criteria: Winter Generator Deliverability

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP Winter case

Proposal Window Exclusion: Substation Equipment and Below 200 kV exclusion

Problem Statement: The Preston - Todd 69 kV circuit is overloaded for line fault stuck breaker contingency.

Violations were posted as part of the 2021 Window 1: (FG# GD-W30)

Existing Facility Rating: 82SN/93SE, 96N/105WE MVA

Proposed Facility Rating: 95SN/130SE, 125WN/162WE MVA

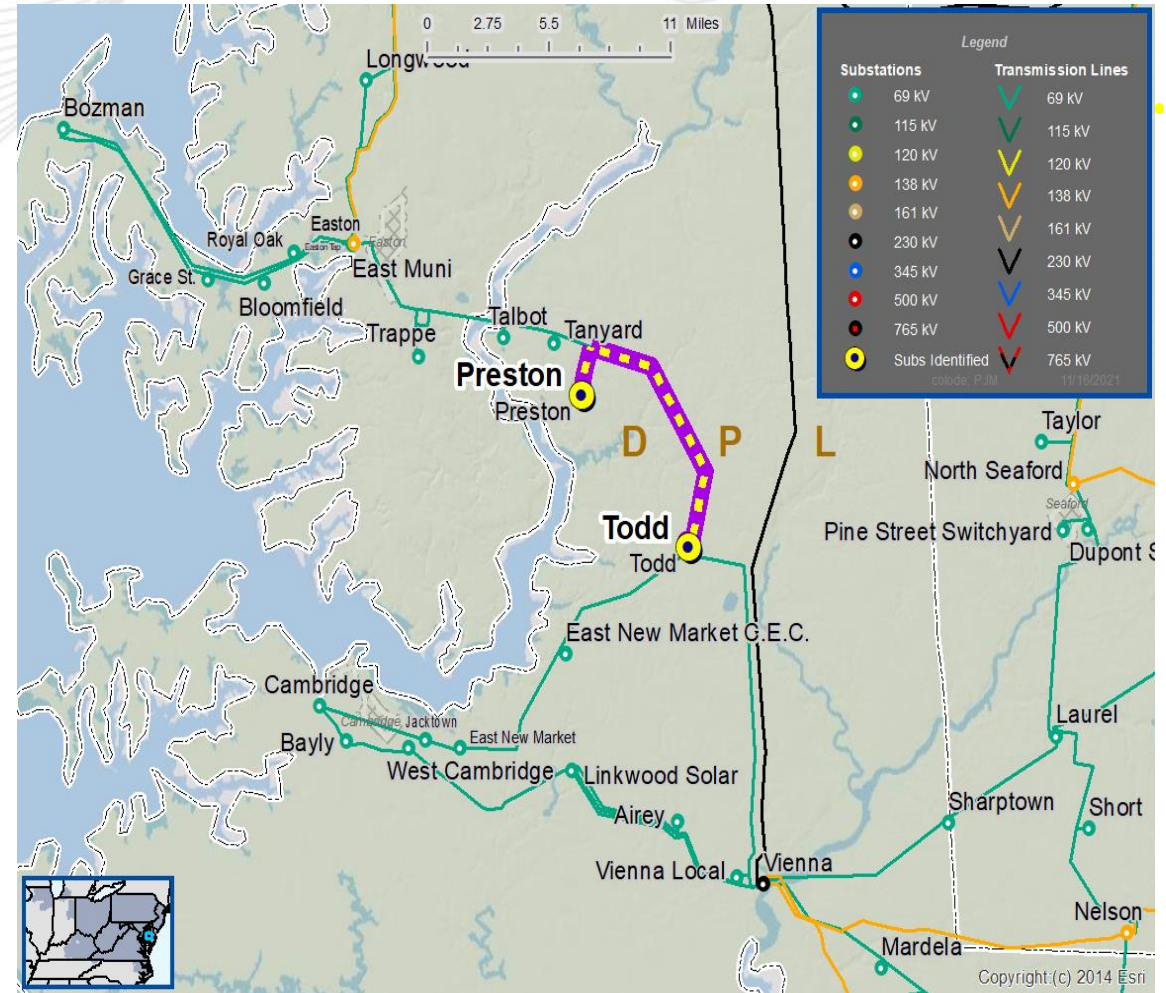
Recommended Solution:

Replace the 4/0 SDCU stranded bus with 954 ACSR and a 600 A disconnect switch with a 1200 A disconnect switch on the 6716 line terminal inside Todd substation (on the Preston – Todd 69 kV circuit). (B3688)

Estimated Cost: \$0.75 M

Alternatives N/A

Required In-Service: 6/1/2026



Process Stage: Second Review

Criteria: PSEG FERC Form 715

Assumption Reference: 2026 RTEP assumption

Model Used for Analysis: 2026 RTEP Summer case

Proposal Window Exclusion: Immediate Need/ Below 200 kV

Problem Statement:

A large customer located in the Princeton Area is increasing peak load to 44MW. Per PSE&G's FERC Form 715 criteria, if load exceeds 20 MW and an N-1-1 event would result in a complete loss of electric supply for more than 24 hours, a third source is required.

Recommended Solution:

Construct a third 69kV supply line from Penns Neck substation to the West Windsor substation. (B3703)

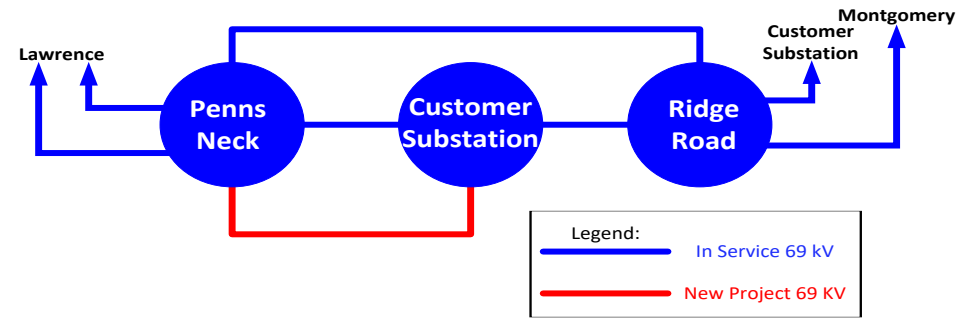
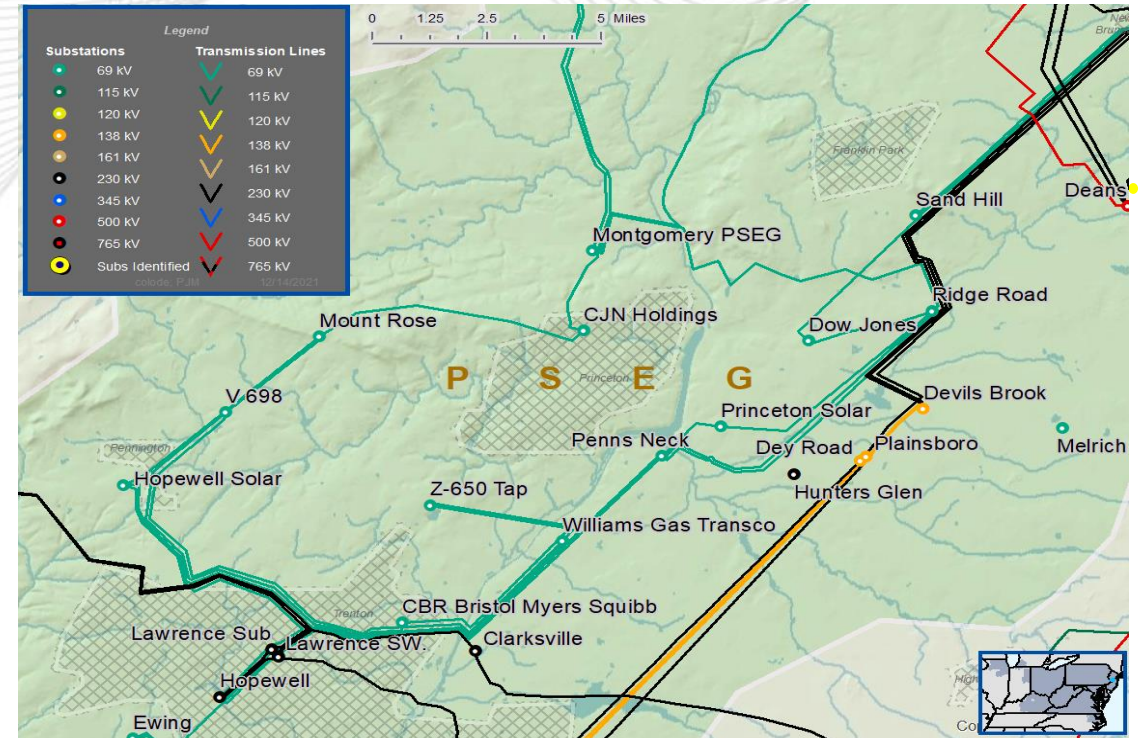
New Rating: 95SN/131SE, 126WN/154WE MVA

Estimated Cost: \$1.05 M

Alternatives:

- A third 69kV supply from Ridge Road would be considerably longer with routing challenges.
- There is no transmission in the area for a potential alternate supply.

Required In-Service: 1/1/2023



B3674, B3675 and B3676 Upgrades Change

The B3674, B3675 and B3676 upgrades were identified as part of the 2021 RTEP Window 1 to resolve a First Energy FERC FORM 715 criteria.

- B3674 - Replace Five Atlantic 34.5 kV breakers (J36, BK1A, BK1B, BK3A and BK3B) with 63kA rated breakers and associated equipment
- B3675 - Replace Six Werner 34.5 kV breakers (E31A_Prelim, E31B_Prelim, V48 future, W101, M39 and U99) with 40 kA rated breakers and associated equipment
- B3676 - Replace One Freneau 34.5 kV breaker (BK6) with 63 kA rated breakers and associated equipment

Based on the latest First Energy analysis, it was determine that the B3674 and B3675 upgrades are driven by the B3130 (the MCRP replacement projects). As a result the baseline upgrade # for the B3674 and B3675 will be replaced by the following.

- B3130.11 - Replace four Atlantic 34.5 kV breakers (BK1A, BK1B, BK3A and BK3B) with 63kA rated breakers and associated equipment
- B3130.12 - Replace Six Werner 34.5 kV breakers (E31A_Prelim, E31B_Prelim, V48 future, W101, M39 and U99) with 40 kA rated breakers and associated equipment.

The B3676 will be canceled, the Freneau 34.5 kV breaker BK6 is no longer overdutied.

The Atlantic J36 breaker replacement will be canceled, the breaker is no longer overdutied.