



Sub Regional RTEP Committee Mid-Atlantic



June 9, 2017



Subregional RTEP (SRRTEP) Meeting Format Update

- Response to stakeholder feedback
- Today's Presentation approach
 - First Review (baseline and supplemental by transmission owner zone)
 - Second Review (baseline and supplemental by transmission owner zone)
- Additional Information
- Meeting Frequency



Baseline Reliability and Supplemental Project First Review





PSEG Transmission Zone Baseline Reliability

N-1-1 PSEG Planning Criteria (FERC Form 715):

Third Source for Springfield Rd. and Stanley Terrace Stations

Problem Statement:

FERC Form 715: Springfield Substation is supplied by two 230kV underground lines.

Springfield supplies more than 10,000 customers with load in excess of 80MVA. An N-1-1 event would result in a complete loss of electric supply to the station for more than 24 hrs.

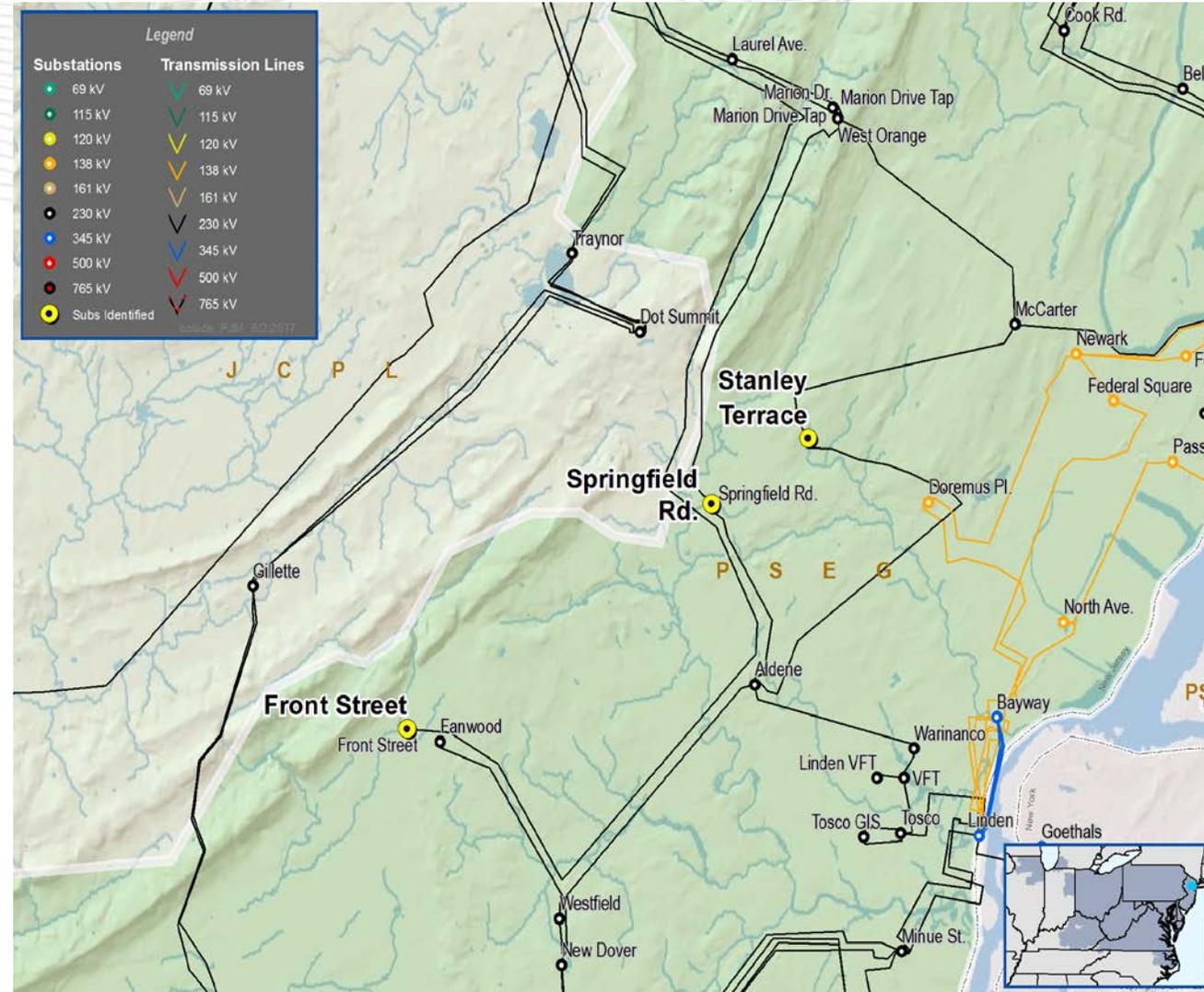
FERC Form 715 : Stanley Terrace is supplied by two 230kV underground lines. Stanley

Terrace will supply more than 5,000 customers with an anticipated load in excess of 37MVA. An N-1-1 event would result in a complete loss of electric supply to the station.

Potential Solutions/Alternatives:

1. Construct a new 230kV cable from Springfield to Stanley Terrace.
Estimated Project Cost: \$300M
2.
 - a) Construct a 230/69kV station at Springfield Substation and construct a 230/69kV station at Stanley Terrace Substation.
 - b) Construct a 69kV network between Front Street, Springfield and Stanley Terrace Substations.
Estimated Project Cost: \$197M
3. Do Nothing Alternative
 - Consequences of No Action - there is a reliability risk created by not acting to address.

Project Status: Conceptual





PSEG Transmission Zone Baseline Reliability

N-1-1 PSEG Planning Criteria (FERC Form 715):

Third Source at Carlstadt and Hasbrouck Heights Stations

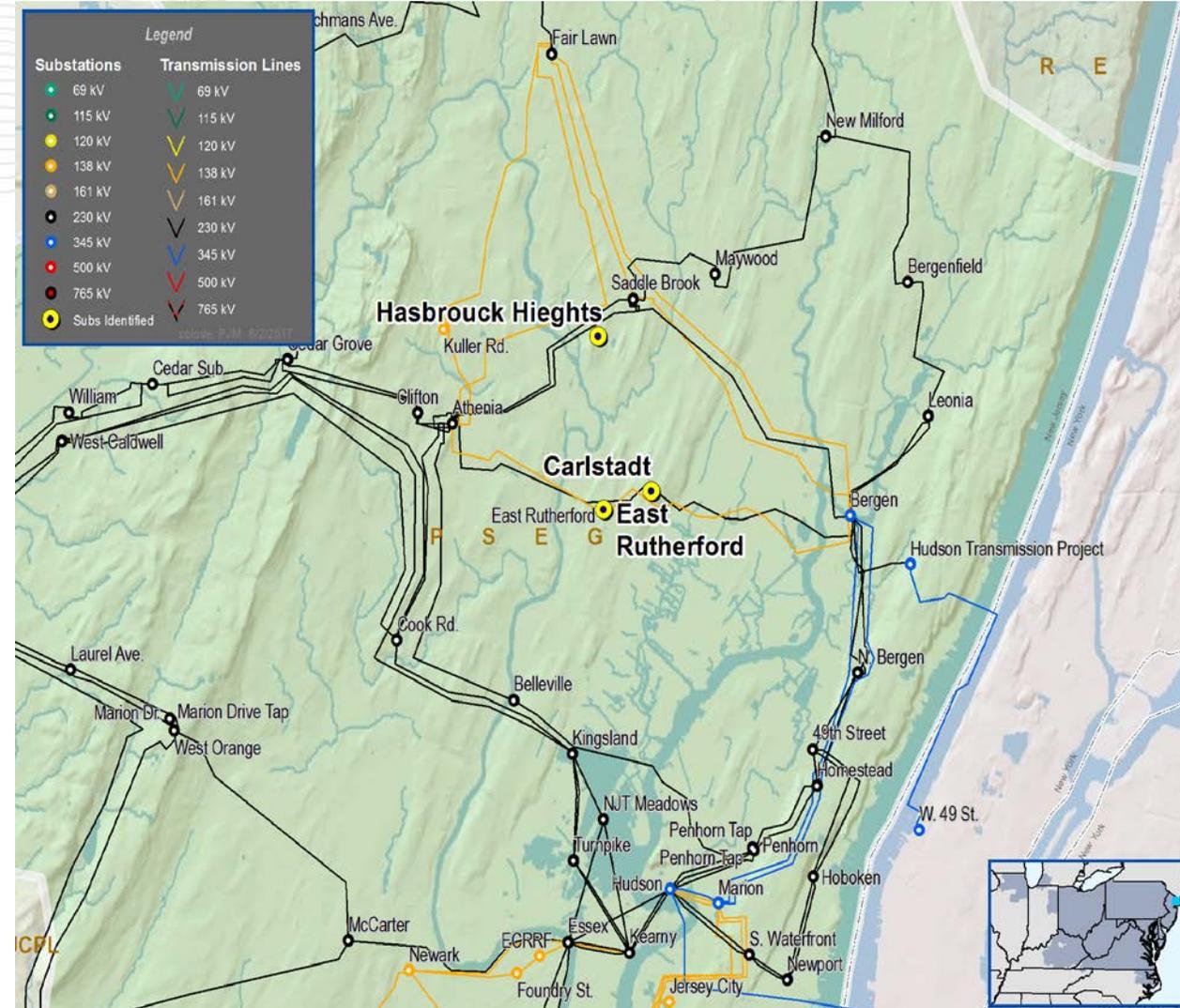
Problem Statement:

FERC Form 715: The Carlstadt 69kV Substation is supplied by two partially underground 69kV circuits. Carlstadt supplies more than 1,400 customers with load in excess of 30 MVA. An N-1-1 event would result in a complete loss of electric supply to the station for more than 24 hrs.

Alternatives:

1. Connect Carlstadt 69kV to Penhorn 69kV Substation.
 - Provides Carlstadt with a third supply circuit
 - Estimated Project Cost: \$30M
2. Build a new 69kV line between Hasbrouck Heights and Carlstadt.
 - Both stations benefit from a third supply circuit.
 - Estimated Project Cost: \$21M
3. Do Nothing Alternative.
 - Consequences of No Action - there is a reliability risk created by not acting to address.

Project Status: Conceptual





PSEG Transmission Zone Baseline Reliability

N-1-1 PSEG Planning Criteria (FERC Form 715):

Third Supply for Runnemedede 69kV

Third Supply for Woodbury 69kV

Additional Transmission Supply for Camden-Gloucester Load Pocket

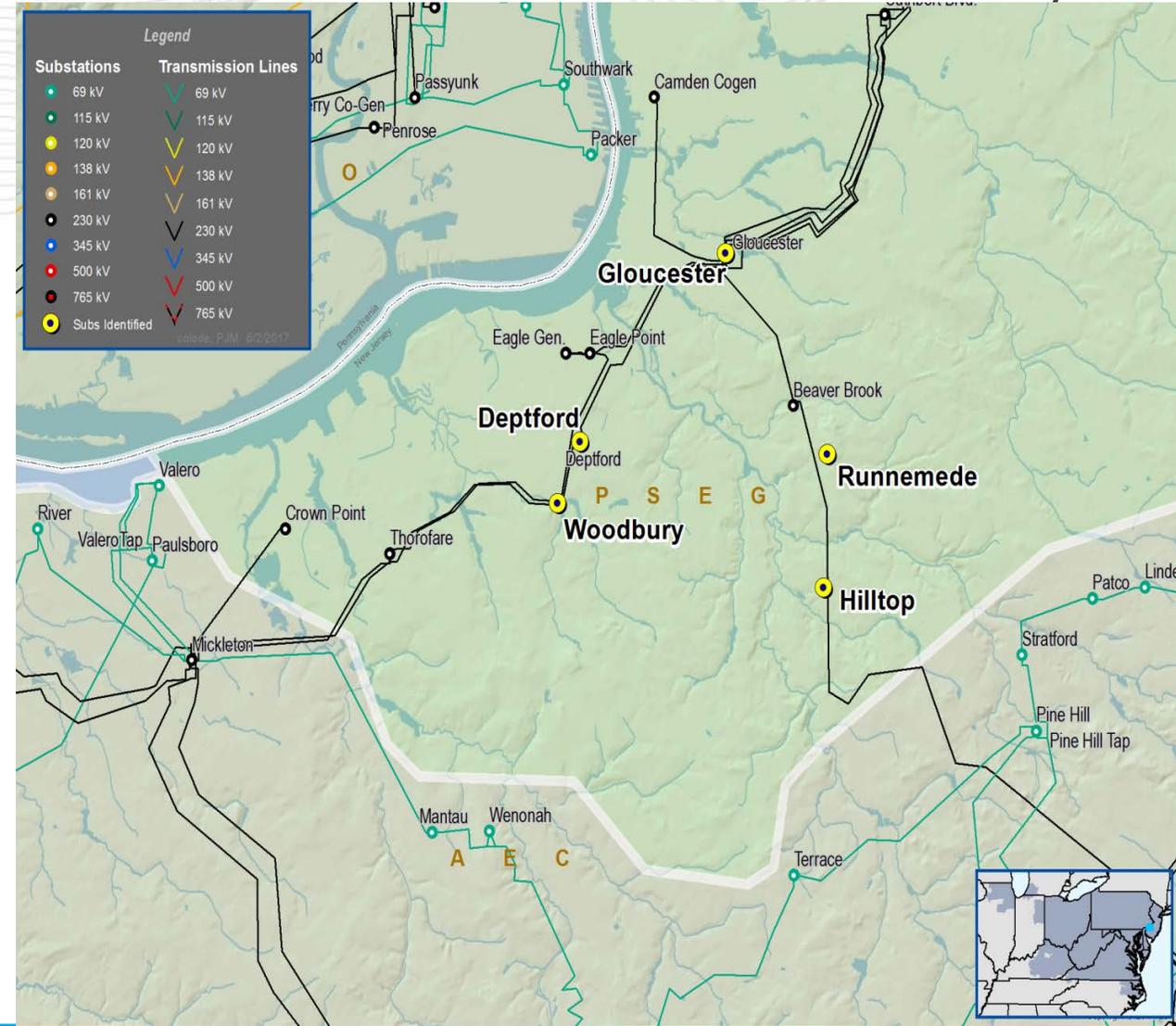
Problem Statement:

FERC Form 715: Runnemedede 69kV Substation is supplied by only two 69kV lines; load exceeds 46MW. One of the lines has portions of the circuit fed by underground cable that would take longer than 24 hours to restore during an outage. In addition, a breaker failure on the Runnemedede 69kV bus would result in the loss of both 69kV supply lines and a complete substation shutdown, interrupting more than 11,000 customers. As a result, there is a need to enhance the station design and provide a 3rd source to Runnemedede 69kV station.

The Woodbury station, after conversion to 69kV, will be supplied by two 69kV lines from Gloucester 69kV station with no other 69kV source in the near vicinity to supply the 3rd source, leaving a need to provide a 3rd supply to satisfy FERC Form 715 requirements.

Network Availability: The cost effective solution for the southern area is to convert stations to 69kV. Long term it will be cost effective to supply all PSE&G stations in Gloucester and Camden County from 69kV because there is less infrastructure required and the system benefits from being planned to and operating at higher voltages.

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PSEG Transmission Zone Baseline Reliability

N-1-1 PSEG Planning Criteria (FERC Form 715):

Third Supply for Runnemedede 69kV

Third Supply for Woodbury 69kV

Additional Transmission Supply for Camden-Gloucester Load Pocket

Alternatives:

1. Purchase a new property, tap an existing 230kV line to supply a new 230/69kV station, and install a new transformer
 - This option will require new 230kV lines and a new 230kV ROW to supply the station.
Estimated Project Cost: \$130M

2. Build a new 230/69kV switching substation at Hilltop, utilizing the existing PSE&G property footprint and the K-2237 230kV line.

Build a new 69kV line between Hilltop and Woodbury 69kV providing the 3rd supply (FERC Form 715).

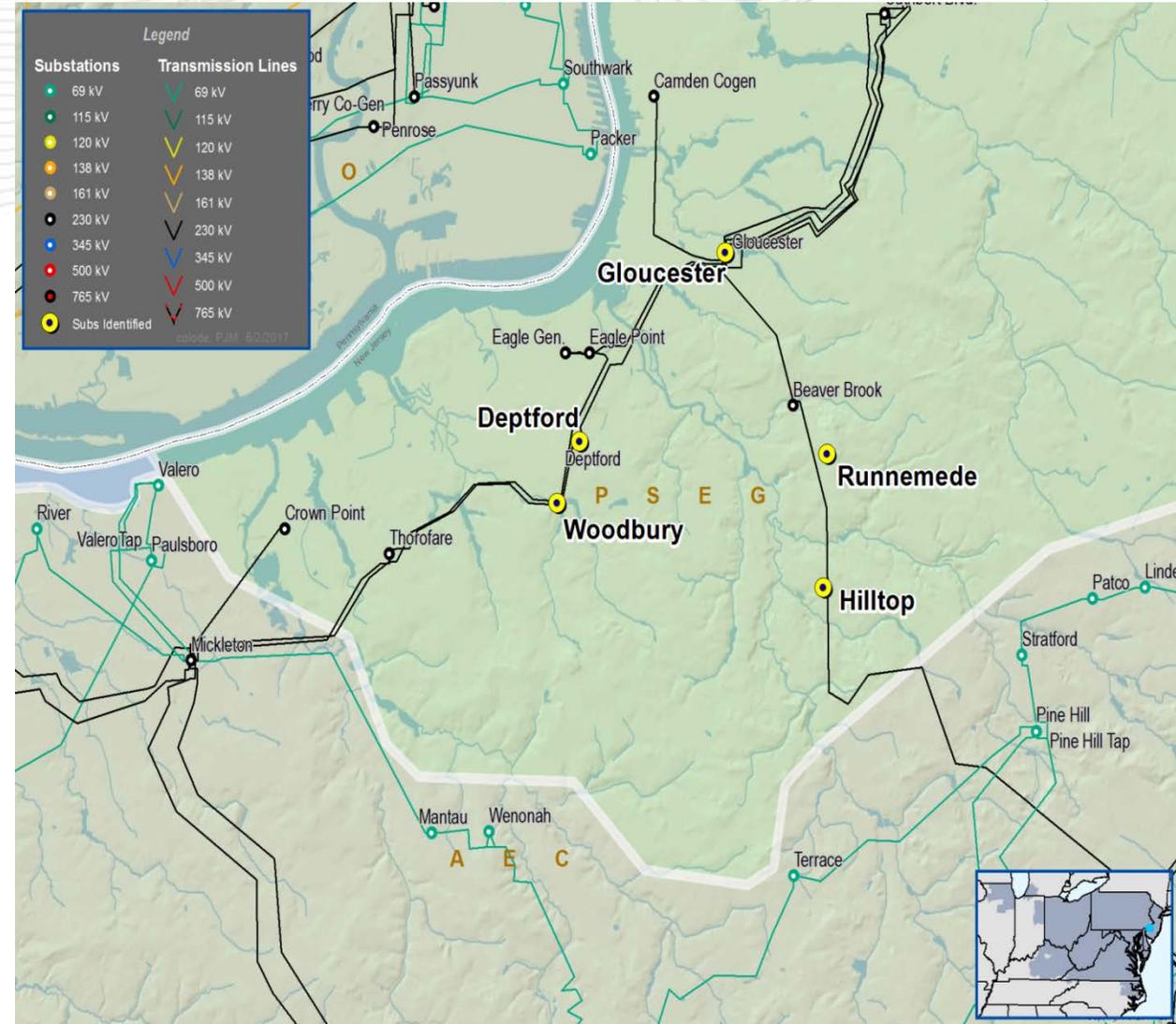
Convert the Runnemedede straight bus to a ring bus (eliminating the bus fault violation) and construct a 69kV line from Hilltop to Runnemedede.

- The Hilltop property is ideally located between Runnemedede and Woodbury
Estimated Project Cost: \$95M

3. Do Nothing Alternative

- Consequences of No Action - there is a reliability risk created by not acting to address.

Project Status: Conceptual





PSEG Transmission Zone Supplemental Project

Paterson Area Asset Condition and Reliability

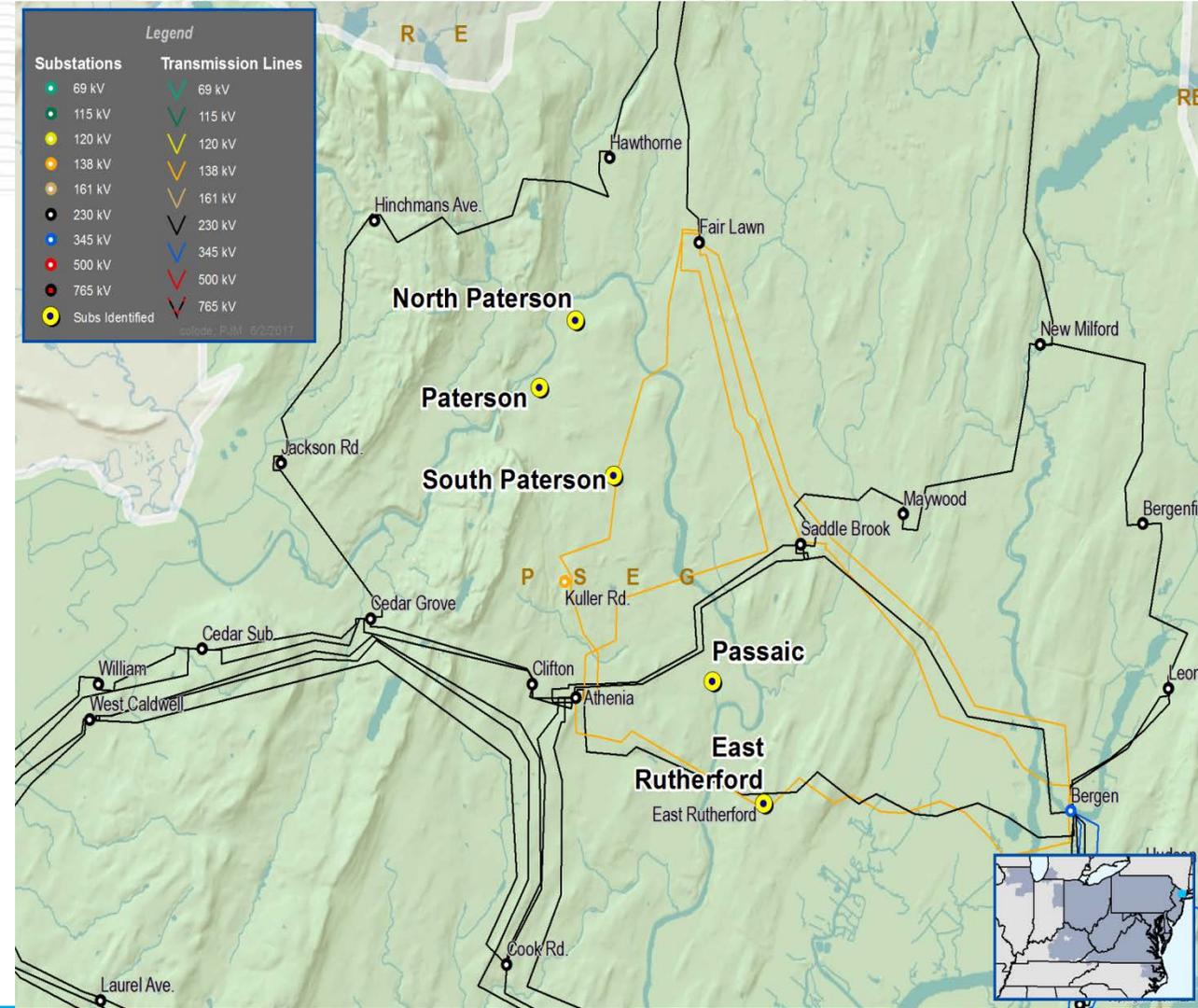
Problem Statement:

Equipment Material Condition, Performance and Risk; Operational Flexibility and Efficiency: Paterson and Passaic 26kV Substations went into service in the 1930s supplying the cities of Paterson and Passaic. The area has experienced an increase in supply outages, with over 70 interruptions on the Paterson and Passaic 26kV circuits in the last five years.

Potential Solutions/Alternatives:

- Upgrade 40 miles of the eight (8) underground 26kV circuits that currently feed Paterson and Passaic Substations and replace 26kV station equipment.
 - Addresses the reliability issues of the 26kV network and circuit performance.
 Estimated Project Cost: \$205M
- Convert Paterson and Passaic to 69kV substations. Expand the 69kV network to include Paterson and Passaic.
 - Increases the capacity, more reliability (network)
 - Reduces exposure (line lengths) and allows for improvement of the remaining 26kV.
 Estimated Project Cost: \$169M
- Do Nothing Alternative
 - Consequences of No Action - there is a reliability risk created by not acting to address

Project Status: Conceptual





PSEG Transmission Zone Supplemental Project

Station Reliability and Area Load Growth near Camden 69kV

Problem Statement:

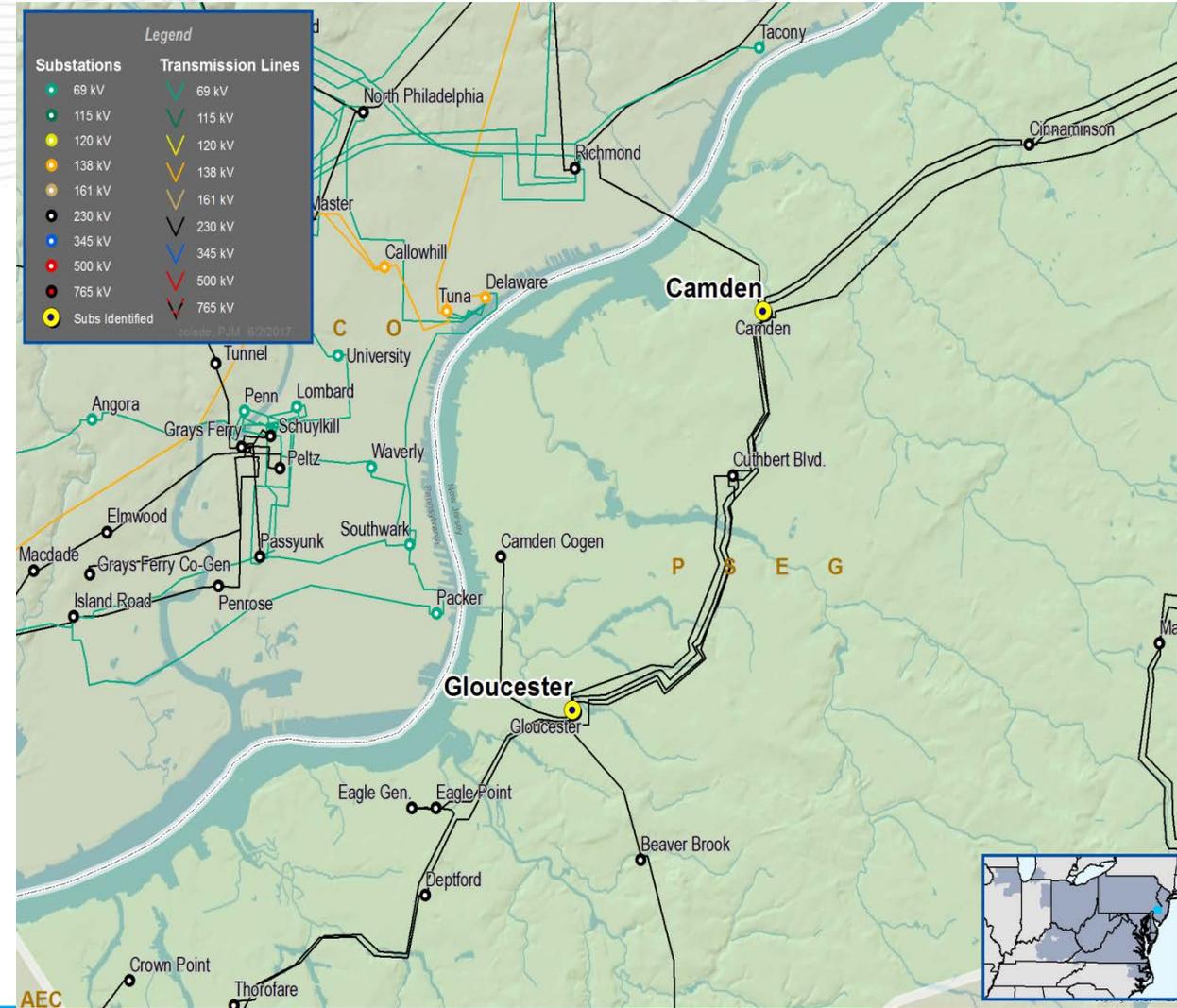
Operational Flexibility and Efficiency, Customer Service: PSE&G must address voltage issues caused by a normally open bus. PSE&G also needs to increase capacity by providing more 69kv supply lines due to load growth in the area.

- Bus faults at Camden 69kV station result in losing two 69kV lines on either side of the Camden 69kV bus breaker and a 230/69kV transformer. As a result, there are multiple voltage issues at neighboring 69kV buses.
- If the breakers are replaced and the normally open bus breaker is closed and a breaker failure occurs, the voltage would drop to near 67% of nominal voltage. In addition, there are severe voltage drop conditions at Locust Street 69kV and Maple Shade 69kV stations.

Potential Solutions/Alternatives:

1. Tap an existing 230kV line to supply a new 230/69kV station at another location to supply load
 - Construct an additional 69kv circuit from new 230/69kV station to supply Camden 69kV load
Estimated Project Cost: \$130
2. Replace the 69kV AIS bus at Camden with a GIS breaker-and-a-half design
 - Increases reliability, sectionalizes faults, and accommodates additional circuits
Estimated Project Cost: \$79M
3. Consideration was given to strategically placing capacitors around the network. Due to the amount of capacitance required to alleviate the voltage drop, placing these capacitors in service prior to a disturbance to alleviate the post-contingency voltage drop would create a severe pre-contingency over-voltage condition. This alternative is not feasible.
4. Do Nothing Alternative
 - Consequences of No Action - there is a reliability risk created by not acting to address.

Project Status: Conceptual





PSEG Transmission Zone Supplemental Project

Station Reliability and Customer Load Growth at Penns Neck 69kV

Problem Statement:

Operational Flexibility and Efficiency, Customer Service : PSE&G must address voltage issues caused by a normally open bus. PSE&G also needs to increase capacity by providing more 69kv supply lines due to load growth in the area.

- During a breaker failure on the Penns Neck 69kV bus, the voltage at Penns Neck 69kV substation will collapse

Potential Solutions/Alternatives:

1. Tap an existing 230kV line to supply a new 230/69kV station at another location to supply load
- Construct an additional 69kv circuit from new 230/69kV station to supply Penns Neck 69kV load

Estimated Project Cost: \$130M

2. Replace the 69kV AIS bus at Penns Neck with an AIS breaker-and-a-half design, install a 69kV line between Penns Neck and Ridge Road, and install additional 18MVAR capacitor banks at Penns Neck

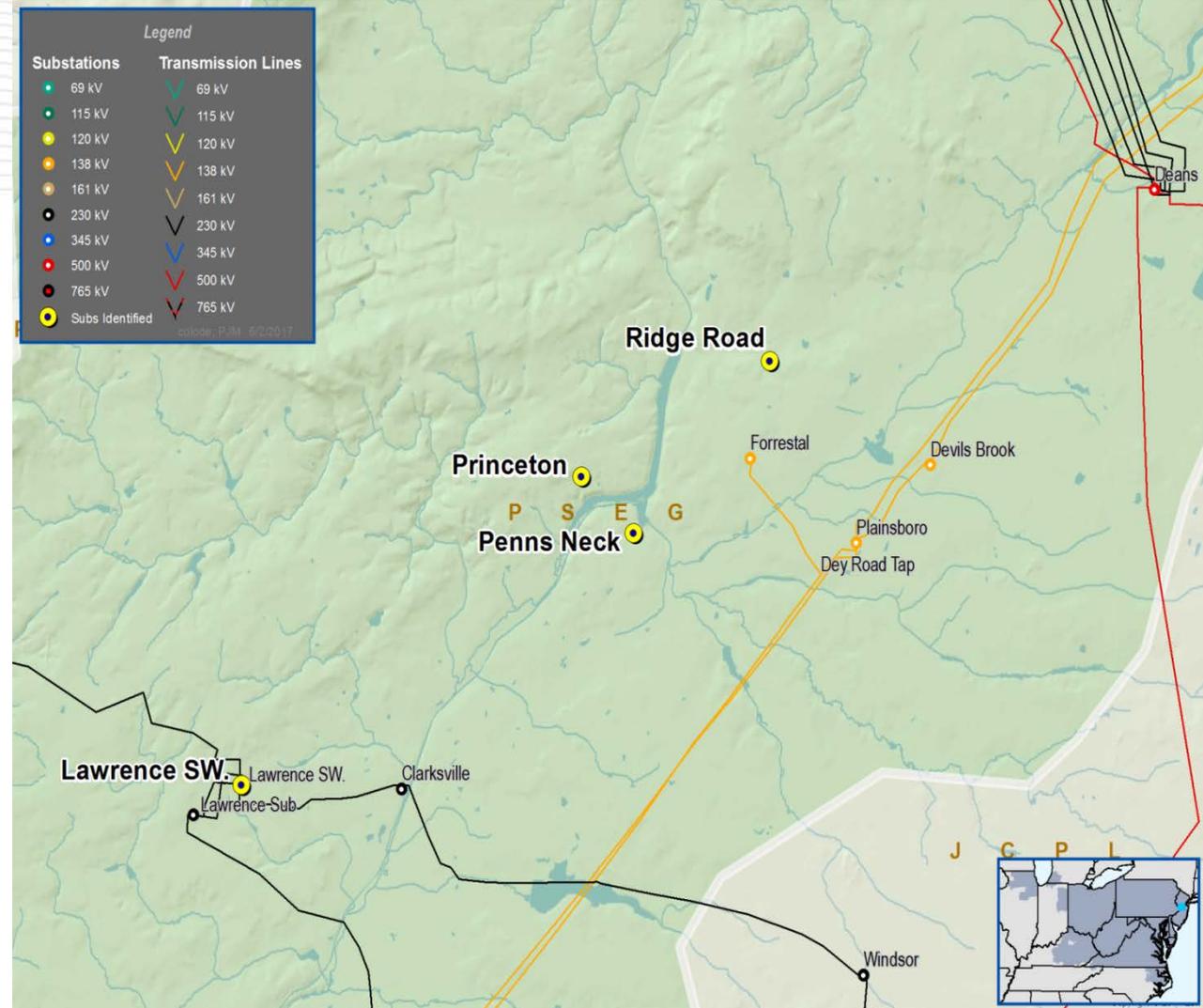
- Increases reliability, sectionalizes faults, and accommodates additional circuits
- Estimated Project Cost: \$84M

3. Consideration was given to strategically placing capacitors around the network. Due to the amount of capacitance required to alleviate the voltage drop, placing these capacitors in service prior to a disturbance to alleviate the post-contingency voltage drop would create a severe pre-contingency over-voltage condition. This alternative is not feasible.

4. Do Nothing Alternative

- Consequences of No Action - there is a reliability risk created by not acting to address.

Project Status : Conceptual



Station Reliability and Area Load Growth near Gloucester 69kV

Problem Statement:

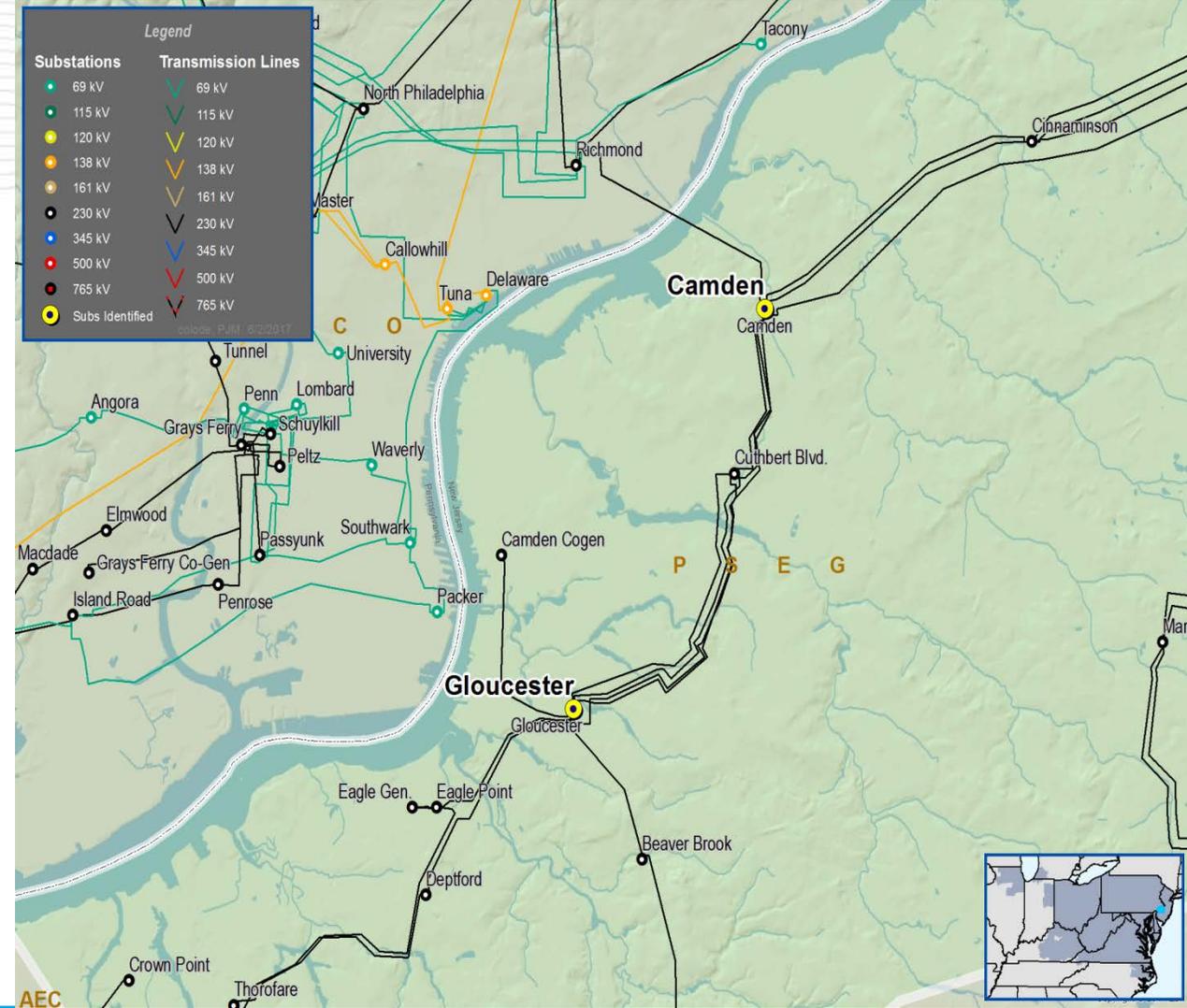
Operational Flexibility and Efficiency, Customer Service: PSE&G must address voltage issues caused by a normally open bus. PSE&G also needs to increase capacity by providing more 69kv supply lines due to load growth in the area.

- Loss of bus section three leaves Runnemede with one source. This creates a large voltage drop not recoverable with capacitors.
- Loss of bus section four causes two large customers to hang off Locust Street Substation with long lines from Camden, causing low voltage at these customers.
- If the breakers are replaced and the normally open bus breaker is closed and a bus fault occurs, voltage collapse would occur for a stuck breaker.

Potential Solutions/Alternatives:

1. Tap an existing 230kV line to supply a new 230/69kV station at another location to supply load
 - Construct an additional 69kv circuit from new 230/69kV station to supply Gloucester 69kV load
Estimated Project Cost: \$130M
2. Replace the 69kV AIS bus at Gloucester with a GIS breaker-and-a-half design
 - Increases reliability and sectionalizes faults, and accommodates additional circuits
Estimated Project Cost: \$74M
3. Consideration was given to strategically placing capacitors around the network. Due to the amount of capacitance required to alleviate the voltage drop, placing these capacitors in service prior to a disturbance to alleviate the post-contingency voltage drop would create a severe pre-contingency over-voltage condition. This alternative is not feasible.
4. Do Nothing Alternative
 - Consequences of No Action - there is a reliability risk created by not acting to address.

Project Status: Conceptual





PSEG Transmission Zone Supplemental Project

Station and Supply Circuit Condition at Woodbury 26kV

Problem Statement:

Equipment Material Condition, Performance and Risk; Operational Flexibility and Efficiency : The overall performance of the 26kV Woodbury Substation and the supply circuits has begun to deteriorate. Additionally, the Gloucester-Camden area has experienced load growth. This network feeds Woodbury Station and six large industrial customers scattered around the lower Gloucester county area. By converting this station, PSE&G can improve service to the industrial customer load base in the area while providing additional capacity to the general area at-large.

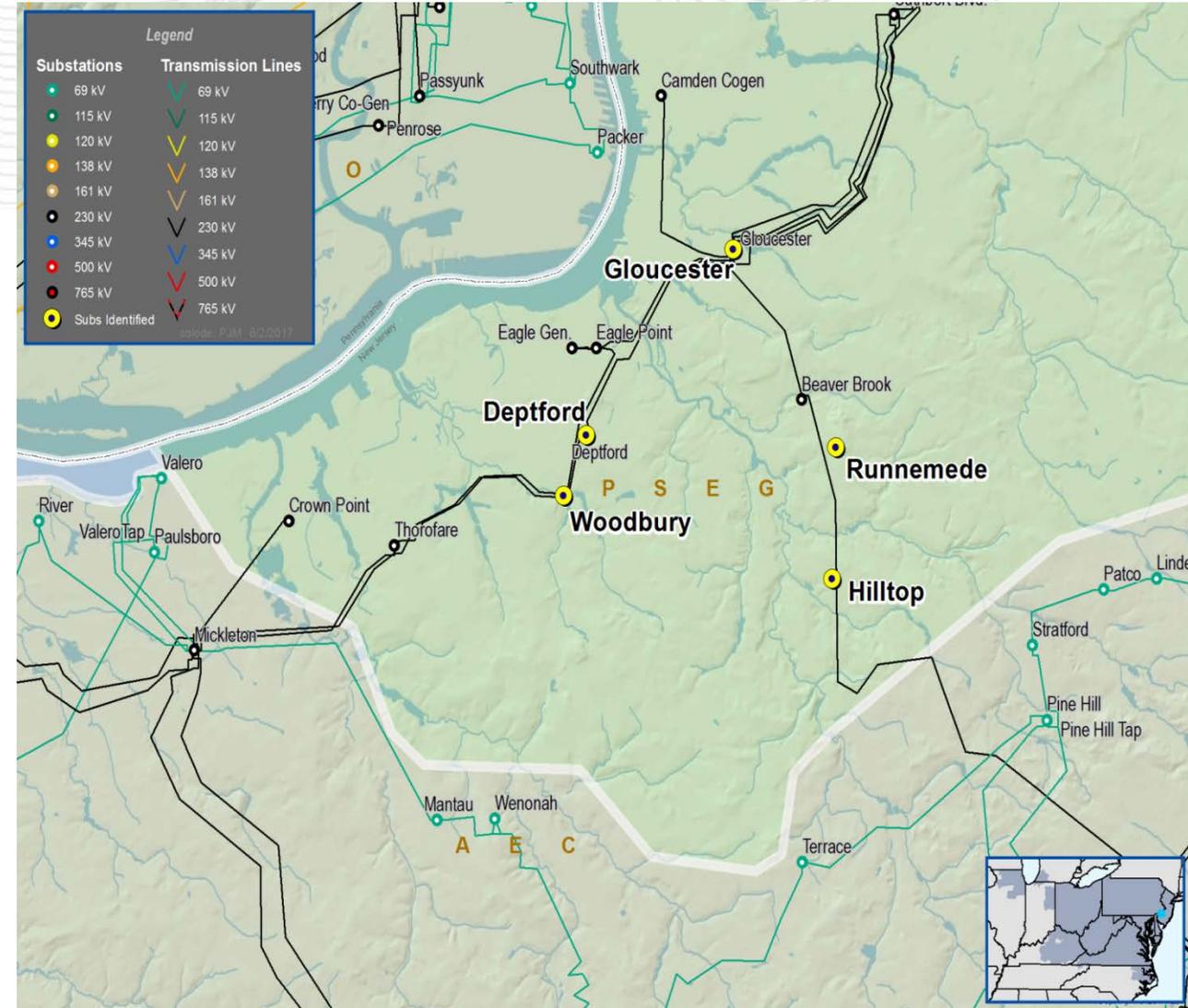
Potential Solutions/Alternatives:

1. Upgrade 30 miles of the four (4) 26kV circuits that currently feed Woodbury Substation and replace 26kV station equipment
 - Addresses the reliability issues of the 26kV network and circuit performance.

Estimated Project Cost: \$120M
2. Convert Woodbury to a 69kV substation. Build two new 69kV lines between Gloucester and Woodbury (15 miles each)
 - Increases the capacity, more reliability (network)
 - This will facilitate a direct and more reliable 26kV supply to the industrial customers from the express network to the station.

Estimated Project Cost: \$99M
3. Do Nothing Alternative
 - Consequences of No Action - there is a reliability risk created by not acting to address.

Project Status: Conceptual





Supplemental Projects presented at April SRRTEP Second Review



AEC Transmission Zone Supplemental Project

Supplemental Upgrade:

Monroe – Pine Hill 69kV – Rebuild Line 0752

Previously presented: 4/25/2017

Problem Statement (Need/Drivers):

- This project is needed to mitigate performance risk associated with the current equipment material and condition. Specifically, based on aerial inspection data, several cracked, deteriorated, and woodpecker damaged poles along with several deteriorated crossarms were identified, which places this line in the top quartile of the ACE age and condition ranking. This line was originally installed in 1965 and the majority of the structures are single wooden poles and crossarms.

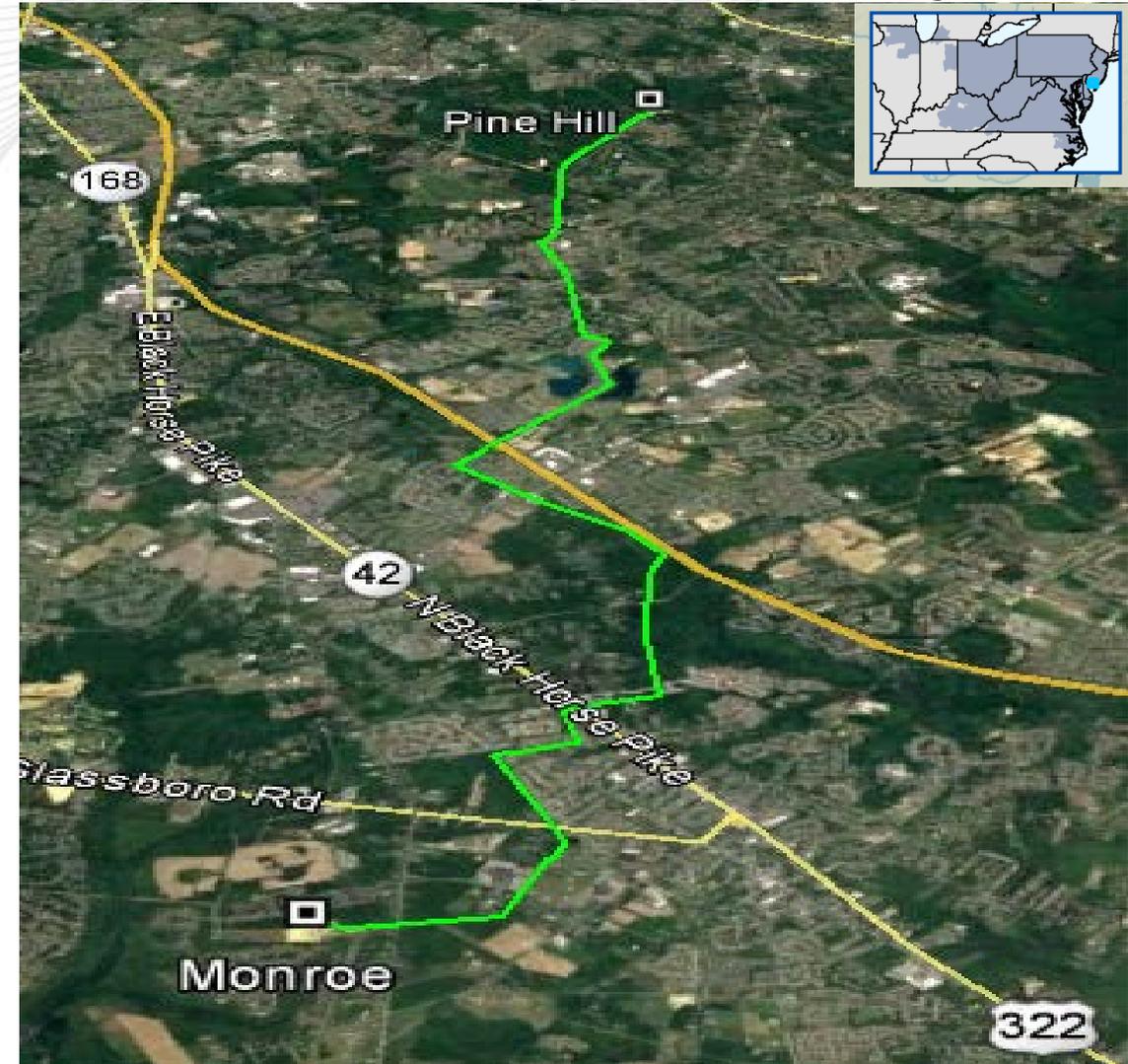
Selected Solution:

- Rebuild line 0752 between Monroe and Pine Hill substations. All structures, conductor, and static wire will be replaced with new weathering steel poles, conductor, and OPGW.

Estimated Project Cost: \$16.04M

Projected IS Date: 5/31/2019

Status: Engineering





Supplemental Upgrade:

Monroe – Tansboro 69kV – Rebuild Line 0754

Previously presented: 4/25/2017

Problem Statement (Need/Drivers):

- This project is needed to mitigate performance risk associated with the current equipment material and condition. Specifically, based on aerial inspection data, several cracked and deteriorated poles along with several deteriorated and cracked crossarms were identified, which places this line in the top quartile of the ACE age and condition ranking. This line was originally installed in 1970 and the majority of the structures are single wooden poles.

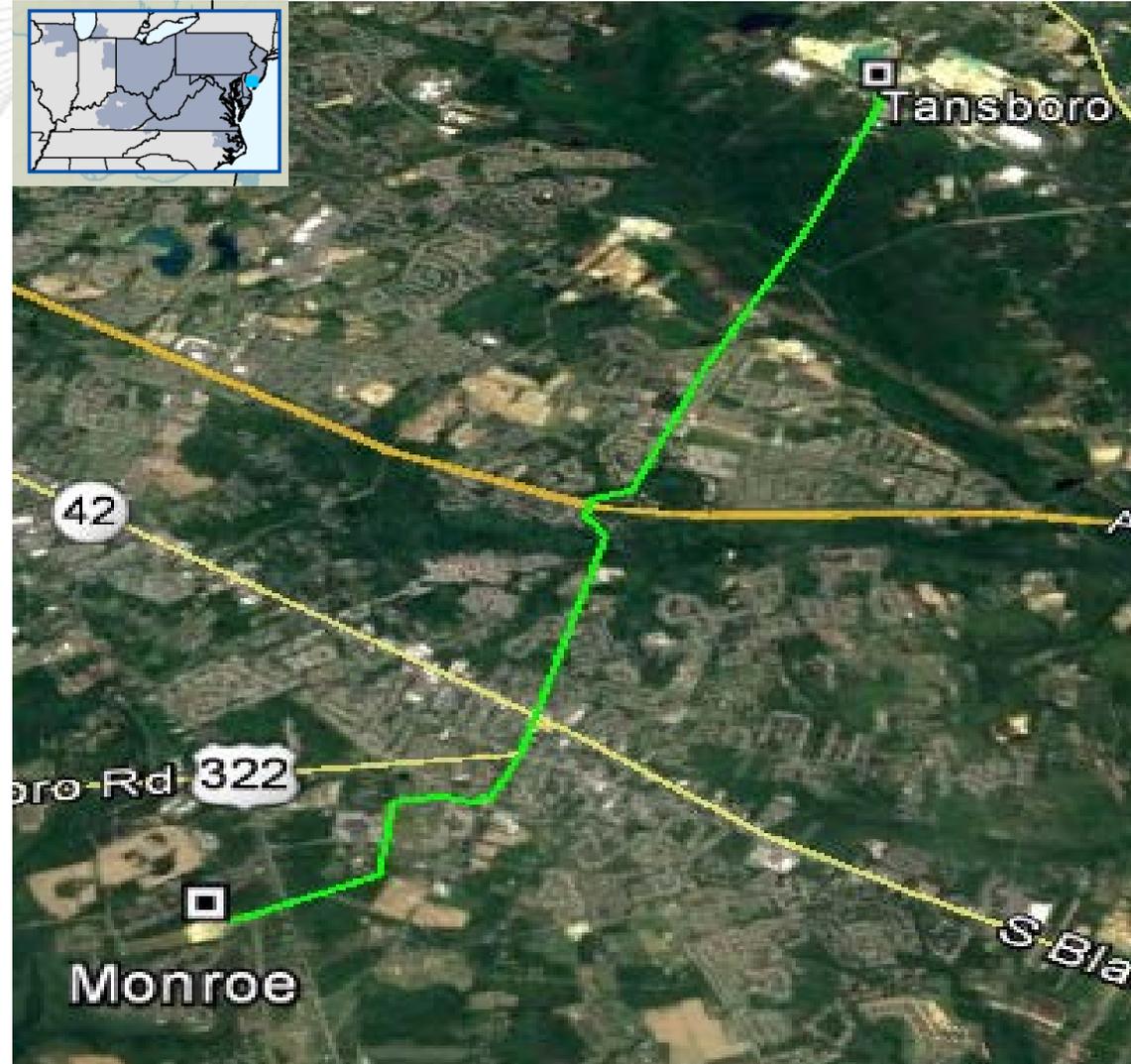
Selected Solution:

- Rebuild line 0754 between Monroe and Tansboro substations. All structures, conductor, and static wire will be replaced with new weathering steel poles, conductor, and OPGW.

Estimated Project Cost: \$13.62M

Projected IS Date: 12/31/2019

Status: Engineering





Supplemental Upgrade:

Monsanto – River 69kV – Rebuild Line 0763

Previously presented: 4/25/2017

Problem Statement (Need/Drivers):

- This project is needed to mitigate performance risk associated with the current equipment material and condition. Specifically, based on aerial inspection data, several cracked and deteriorated poles along with several deteriorated and cracked crossarms were identified, which places this line in the top quartile of the ACE age and condition ranking. This line was originally installed in 1930 and the majority of the structures are single wooden poles. A small portion of the line was rebuilt in 1992.
- The local 34 kV distribution system, served from River substation, is in the process of being retired due to aging infrastructure. This project will enable the bypassing of River substation to create a Monsanto – Mickleton line.

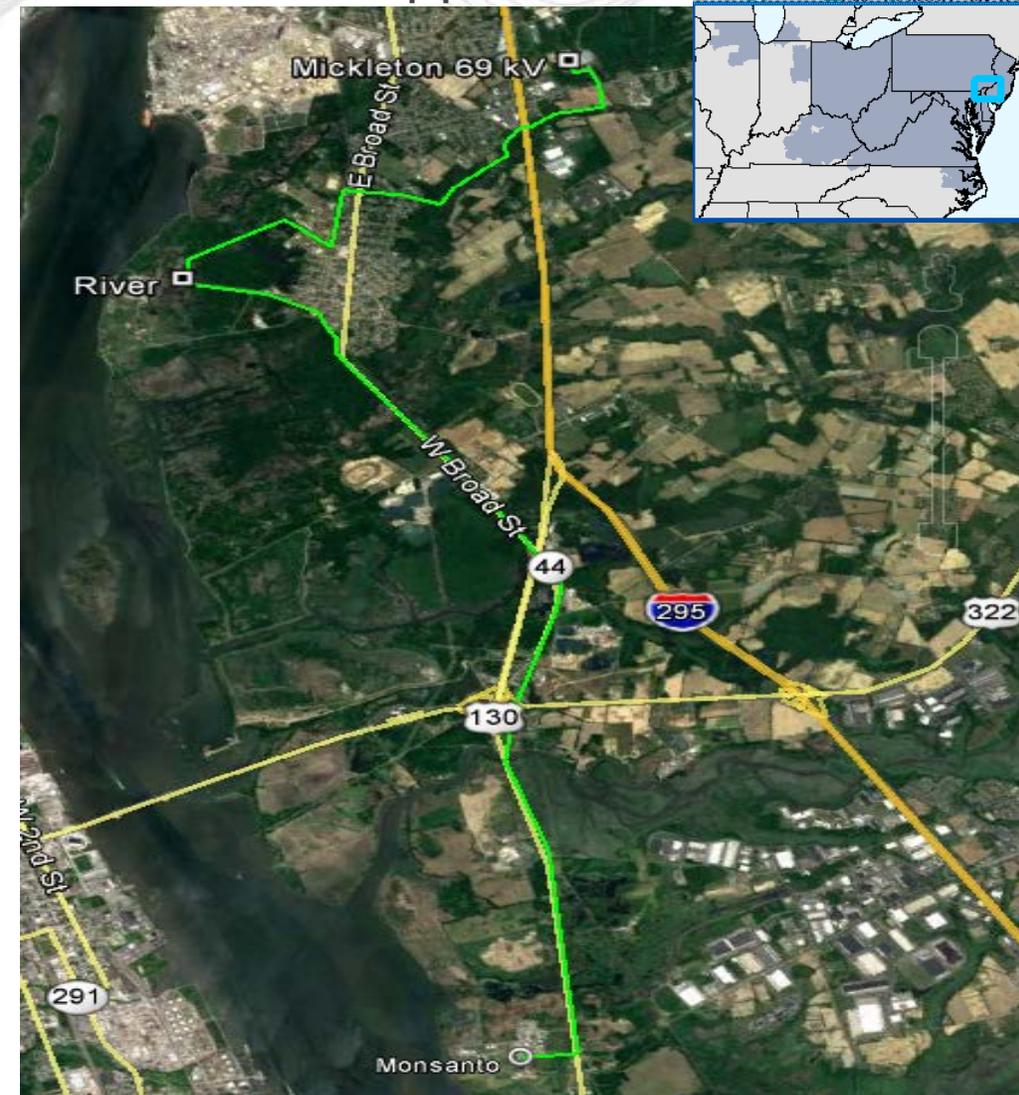
Selected Solution:

- Rebuild line 0763 between Monsanto and River substations. All structures, conductor, and static wire will be replaced with new weathering steel poles, conductor, and OPGW. Tie the Monsanto – River (0763) line to the Mickleton – River (0747) to create a new Monsanto – Mickleton 69 kV line.

Estimated Project Cost: \$14.36M

Projected IS Date: 5/31/2020

Status: Engineering





AEC Transmission Zone Supplemental Project

Supplemental Upgrade:

South Millville – Lincoln 69kV – Rebuild Line 0603

Previously presented: 4/25/2017

Problem Statement (Need/Drivers):

- This project is needed to mitigate performance risk associated with the current equipment material and condition. Specifically, based on aerial inspection data, this line was determined to be severely deteriorated, which places the rebuild in the top quartile in the ACE age and condition ranking. This line was originally installed in 1950 with some poles replaced in 1980. Additionally, this circuit is connected to Vineland Electric's CT unit increasing its importance to the local system.

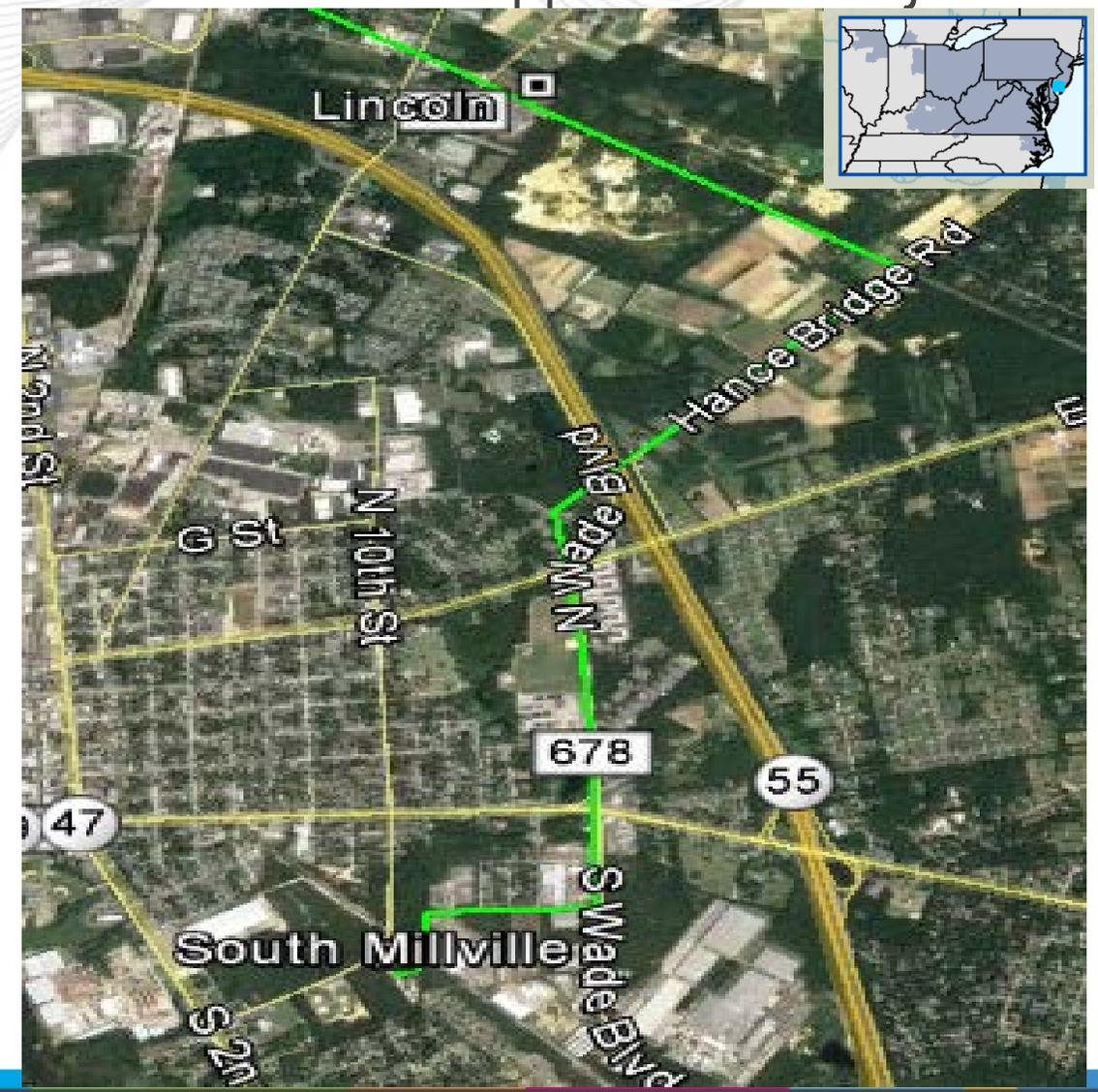
Selected Solution:

- Rebuild line 0603 between South Millville and Lincoln substations. All structures, conductor, and static wire will be replaced with new wood and steel poles, conductor, and OPGW.

Estimated Project Cost: \$4.63M

Projected IS Date: 12/31/2020

Status: Engineering



Supplemental Upgrade:

Lenox – Lewis 69kV – Rebuild Line 0721

Previously presented: 4/25/2017

Problem Statement (Need/Drivers):

- This project is needed to mitigate performance risk associated with the current equipment material and condition. Specifically, based on aerial inspection data, several cracked, deteriorated, and woodpecker damaged poles were identified, which places this line in the top quartile of the ACE age and condition ranking. This line was originally installed in 1939 and the majority of the structures are single wooden poles. Additionally, this circuit feeds a large commercial customer that will benefit from these upgrades.

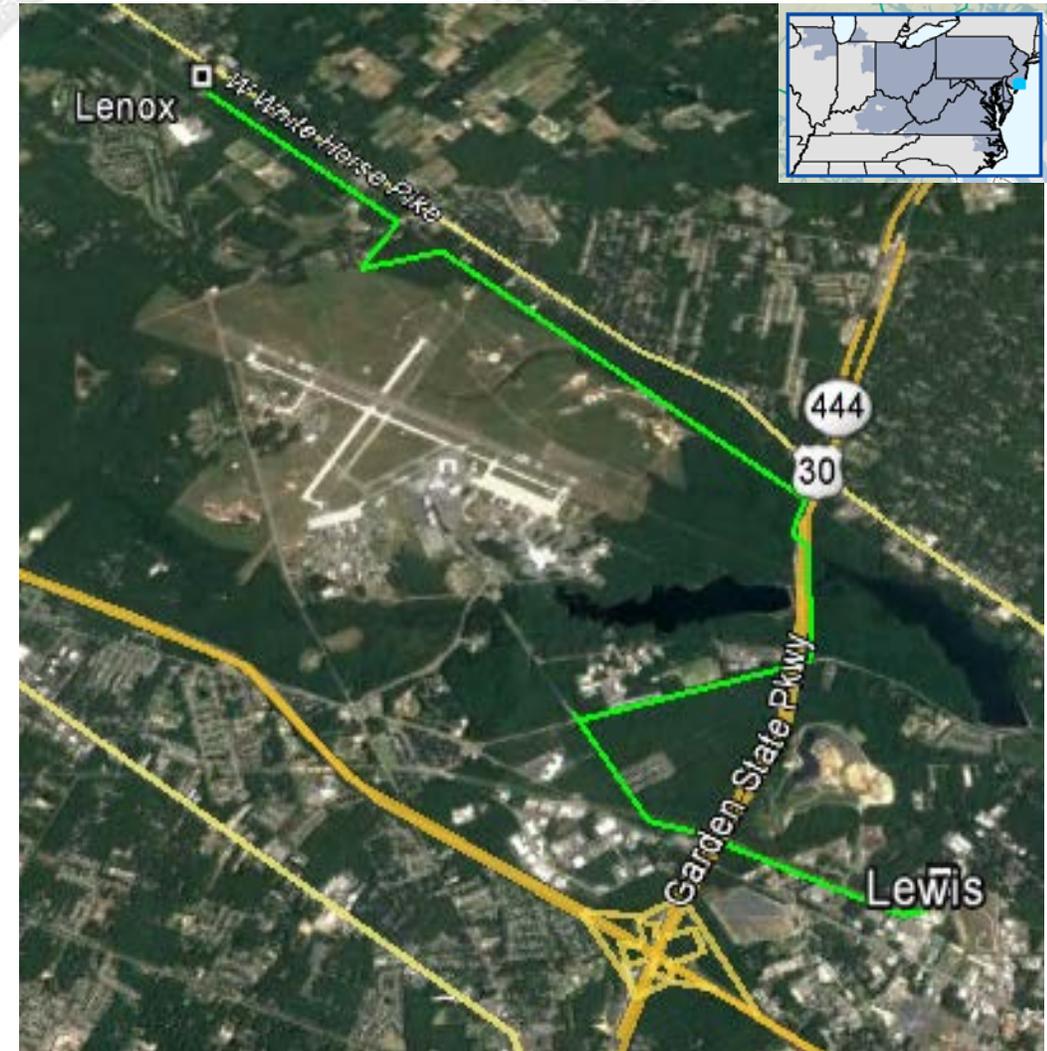
Selected Solution:

- Rebuild line 0721 between Lewis and Lenox substations. All structures, conductor, and static wire will be replaced with new weathering steel poles, conductor, and OPGW.

Estimated Project Cost: \$13.16M

Projected IS Date: 12/31/2020

Status: Engineering





DPL Transmission Zone Supplemental Project

Supplemental Upgrade:

Harbeson – Zoar – Rebuild Line 6734

Previously presented: 4/25/2017

Problem Statement (Need/Drivers):

- This project is needed to mitigate performance risk associated with the current equipment material and condition. Specifically, based on inspection data, deteriorated, cracked, and weathered crossarms and deteriorated poles were identified, which places this line in the top quartile of the DPL age and condition ranking. This is a wood pole single circuit line that was originally installed in 1975. Additionally, there is a Delaware Electric Co-op “Zoar” 69kV substation that is tapped off of this line that would benefit from these upgrades.

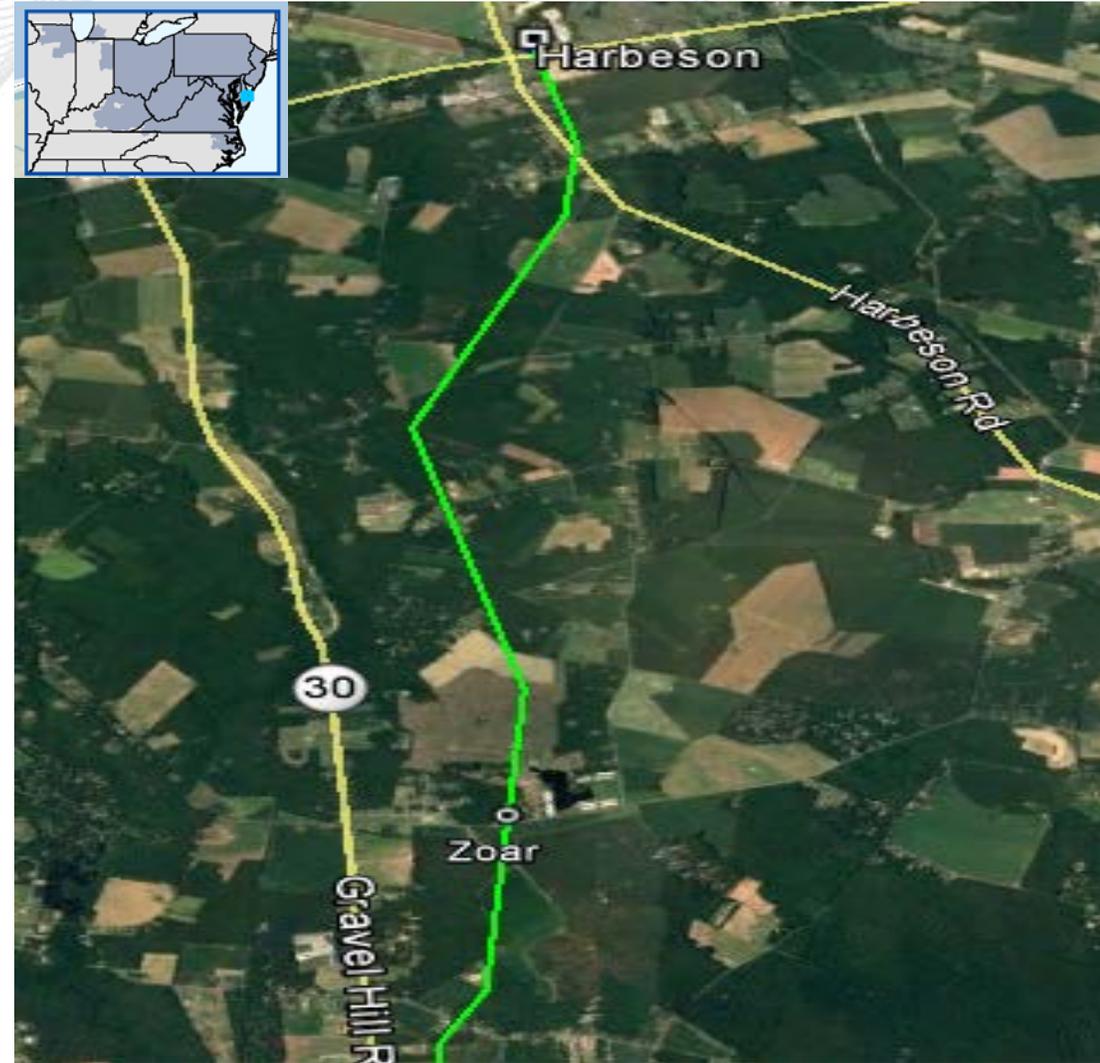
Selected Solution:

- Rebuild Circuit 6734 from Harbeson substation to the Zoar tap. All structures, conductor, and static wire will be replaced with new weathering steel poles, conductor, and OPGW.

Estimated Cost: \$6.50M

Projected ISD: 12/31/2018

Status: Engineering





PenElec Transmission Zone Supplemental Project

Supplemental Upgrade:

Bethlehem 33 - Summit 46kV line: Kokomo Road 46 kV Tap

Previously presented: 4/25/2017

Problem Statement:

Provide 46 kV service to new customer. Anticipated load is 2.8 MW (0.85 pf) in Cresson, PA.

Selected Solution:

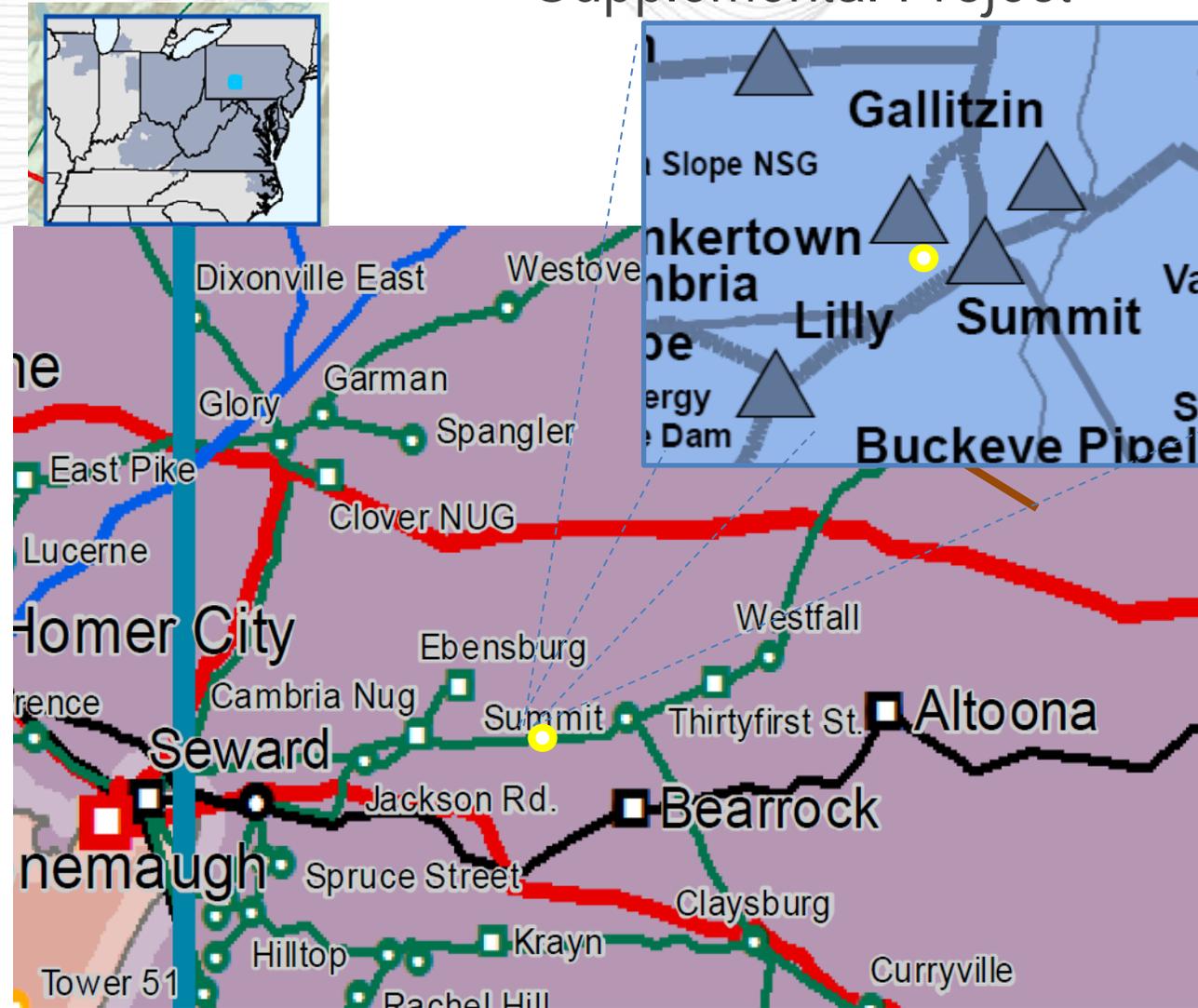
Tap Lilly - Summit section of the Bethlehem 33 – Summit 46 kV line:

- Install (2) 46 kV disconnects with whips
- Install (1) disconnect with a vacuum bottle
- Install (1) revenue meter.
- Install (1) span (length~200 ft) to the interconnection point.
- Install SCADA on the network switches.

Estimated Project Cost: \$0.2 M

Projected IS Date: 8/31/2017

Project Status: Engineering





PenElec Transmission Zone Supplemental Project

Supplemental Upgrade:

Niles Valley – Wellsboro – Marshall 115 kV

Previously presented: 4/25/2017

Problem Statement:

Niles Valley-Wellsboro-Marshall 115 kV line is needed to:

- Improve reliability due to multiple outages over past several years
- Reduce loading on contingency constrained facilities

Recommended Solution :

Phase 1: Niles Valley-Wellsboro 115 kV

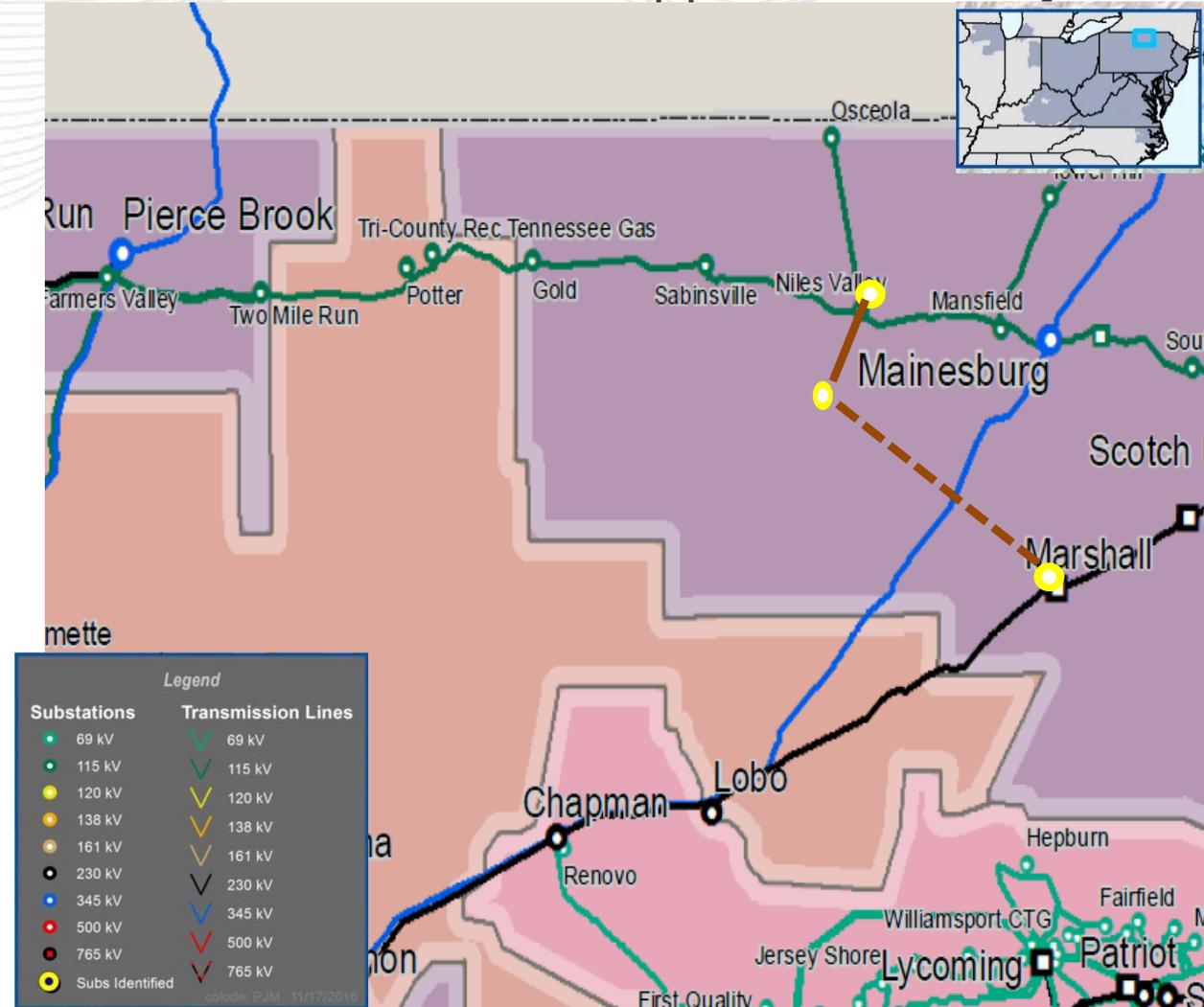
- Construct ~5 miles of 115 kV line using existing right-of-way (where possible)
- Install new 115 kV bus tie breaker at Niles Valley
- Relocate Potter 115 kV line at Niles Valley
- Install two SCADA controlled switches
- Install switch structure for future network line extension

Phase 2: Wellsboro-Marshall 115 kV (Future)

Estimated Project Cost: Phase 1 - \$12.8 M

Projected IS Date: Phase 1 - 6/1/2020

Project Status: Engineering





PenElec Transmission Zone Supplemental Project

Supplemental Upgrade:

Tiffany - Thompson 115 kV line: Pentagon 115 kV Tap

Previously presented: 4/25/2017

Problem Statement:

Provide 115 kV service to new customer. Anticipated load is 13 MVA (0.97 pf) in New Milford, PA.

Recommended Solution :

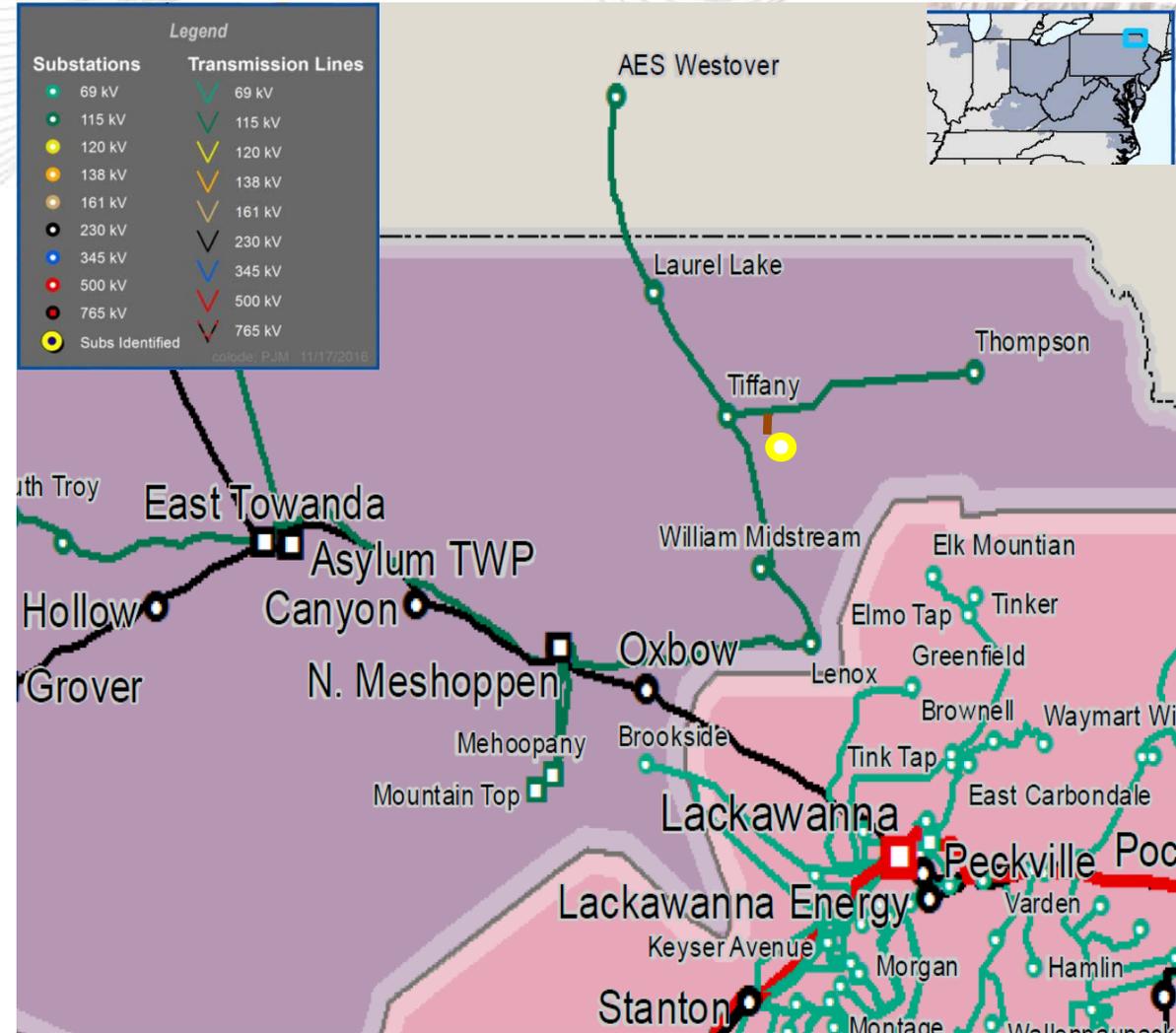
Tap the Tiffany - Thompson 115 kV line.

- Install (2) 115kV disconnects with SCADA.
- Install (1) revenue meter.
- Install (1) span (length~200ft) to the interconnection point.

Estimated Project Cost: \$0.8 M

Projected IS Date: 12/31/2017

Project Status: Engineering





PSEG Transmission Zone Supplemental Project

Supplemental Upgrade:

Reconfigure Kearny 230kV Station Light & Power

Previously presented: 4/25/2017

Problem Statement:

- The Kearny 230kV Switchyard is currently fed from less than reliable 4kV street power from nearby Turnpike and Third Street Substations, leaving Kearny Switching Station subject to interruptions from events in the area, such as pole damage.

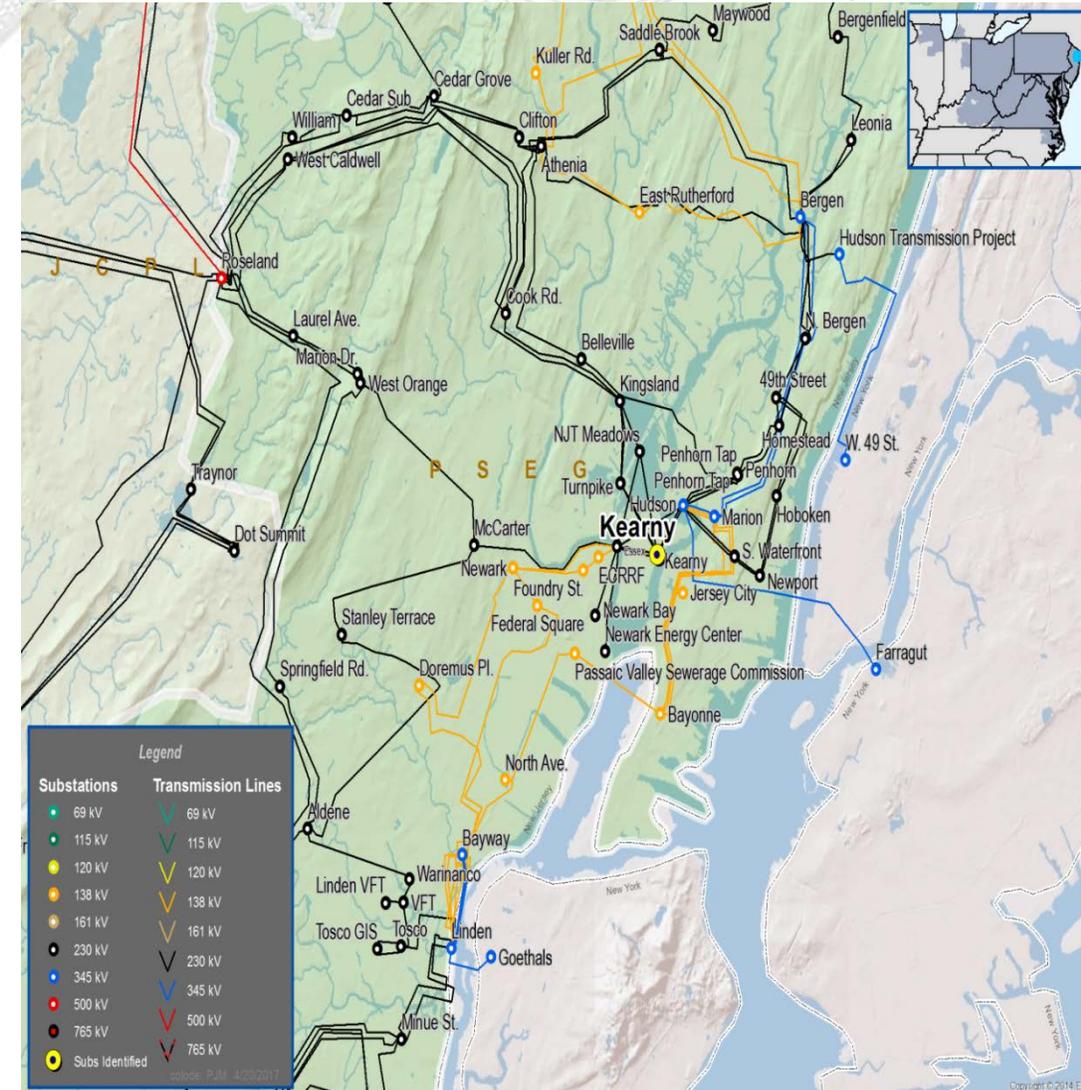
Recommended Solution:

- Providing a more robust and reliable power source to the 230kV Kearny Switching Station, the existing station light & power (SL&P) transformers fed from street power will be replaced with Station Service Voltage Transformers (SSVTs) fed from Kearny 230kV Bus 1 and Bus 2. The SSVTs will provide 208/120V directly to the control house.

Estimated Project Cost: \$6.3 M

Projected IS Date: 11/30/2017

Project Status: Conceptual



Canceled Projects



PSEG Canceled Projects

Upgrade Id	Description	Transmission Owner	Cost Estimate	TEAC Date	Reason for Cancellation
b2218	Convert the three circuits (R-1318, Q-1317, and S-2219) located on the right-of-way between Edison and Metuchen to two 230kV circuits. Relocate the existing Metuchen autotransformer to Edison	PSEG	48.6	3/7/2013	Replaced by MTB project
b2589	Install a 100 MVAR 230 kV shunt reactor at Mercer station	PSEG	7.2	1/7/2015	Replaced by MTB project
b2590	Install two 75 MVAR 230 kV capacitors at Sewaren station	PSEG	8.4	1/7/2015	Replaced by MTB project
s0317	Reconfigure Edison for Breaker and Half. Build for 230 kV, operate at 138 kV with 63 kA breakers	PSEG	60	8/19/2011	No longer required due to the Edison generators retirement and construction of the MTB project
s1014.2	Trenton: Replace 440V and 220V AC Panels and install step up 208/440 kV transformers for the 440V loads	PSEG	0	12/8/2015	Replaced by MTB project
s1014.1	Decommission the Trenton Switch 440V Bus System. Retire 26/0.44 kV SL&P transformers and transfer remaining 208V load to new control house supply (two new 1000 kVA transformers).	PSEG	2.2	12/8/2015	Replaced by MTB project
s1018	Install Edison Control House	PSEG	10	12/8/2015	No longer required due to the Edison generators retirement and construction of the MTB project
s1140	Install OPGW (Optical Ground Wire) on the N-1340 Trenton - Plainsboro - Brunswick 138 kV circuit	PSEG	2	7/26/2016	Replaced by MTB project
s1179	Replace Trenton 138/26/11 kV 132-1, 132-2 and 132-3 transformers	PSEG	36	1/5/2017	Replaced by MTB project
s1178	Replace Bustleton 230/13 kV T-1 and T-2 transformers	PSEG	7.8	1/5/2017	Replaced by MTB project
s1183	Replace Trenton 230/138 kV 220-2 transformer	PSEG	12	1/5/2017	Replaced by MTB project

Questions?

Email: RTEP@pjm.com

- 6/2/2017 – Original version posted to PJM.com