



Transmission Expansion Advisory Committee

October 28, 2010

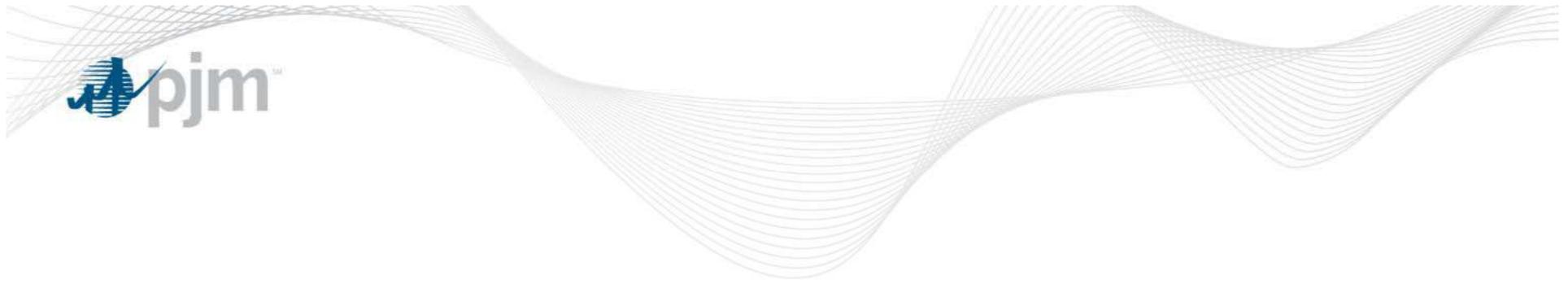


Issues Tracking



Open Issues: None

New Issues:



Aging Infrastructure



Mt Storm – Doubs Rebuild

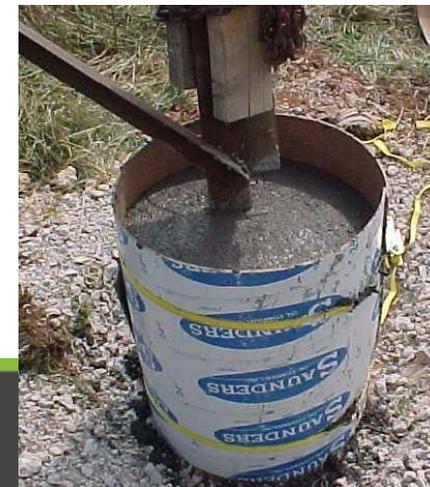
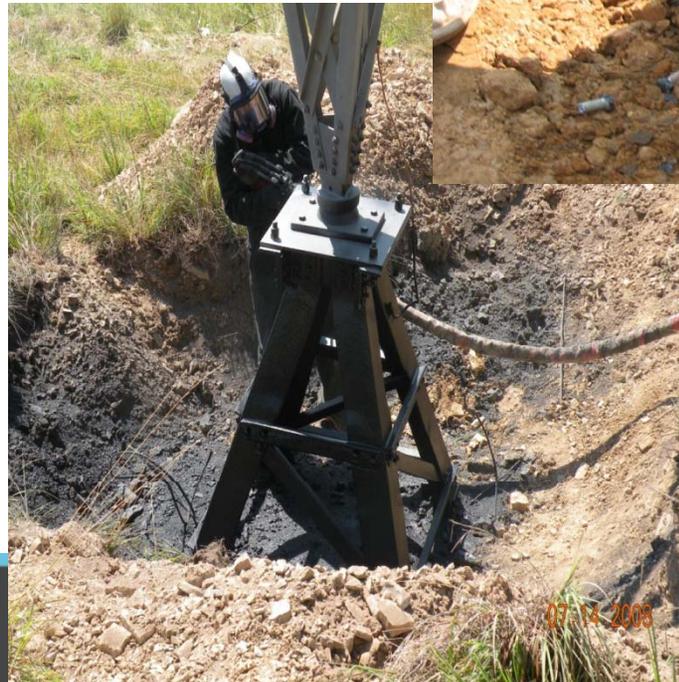
- 99.26 mile line built in 1966
- Major west to east transmission line in Mid-Atlantic
- Heavily loaded; driver for major system reinforcements since the 2006 RTEP
- Approaching end of life
- Despite aggressive efforts since mid-1970's to identify, confirm and repair effects of excessive corrosion, line must be rebuilt now to address risk of physical failure of these critical facilities

- Very difficult to take out of service due to critical nature of line and loading levels
- Could not rebuild in time to address need for Trail in 2011 (Trail)
- Potential window of opportunity to rebuild would be after Trail
- Typical outage availability at least 90 days twice a year (spring and fall)
- Provides time for other outages that impact EHV

- Over 450 Corten lattice structures
- Corrosion problems have led to continuous deterioration of the steel members
- Excessive corrosion weakens the towers and will lead to failure
- Climbing inspection of all towers completed with replacement of deteriorated members as required
- No leg members have been replaced to date



- Grillage foundations used for guyed towers suffer from the same corrosion problem
- Require extensive repair and remedial action
- Concrete foundations on self supporting structures have deteriorated as well
- Concrete foundations have been reconditioned



- Porcelain “V” strings and deadend strings
- Over 71,000 units
- No corona rings
- Experiencing excessive insulator cap erosion and puncture
- Higher voltage stress on remaining insulators
- Over 200 conductor tension splices at end of life based on industry experience



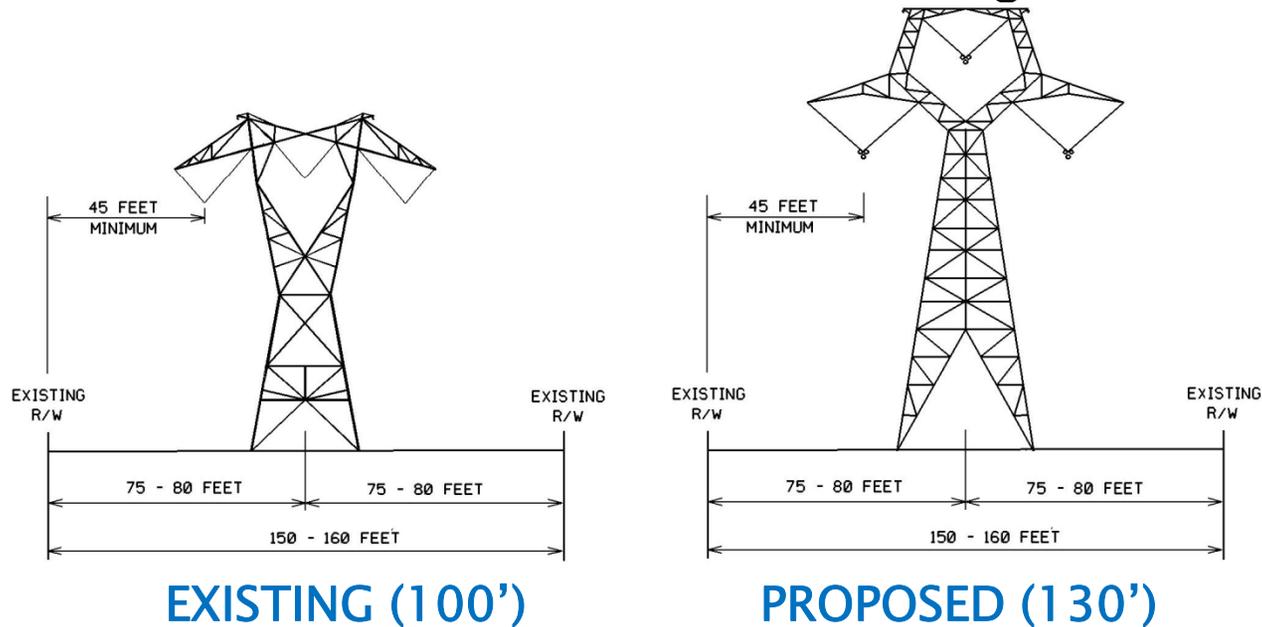
551/343

Middle phase north string corroded bells, bottom two and 4th up string

Further Actions to Date

- Following confirmation of loss of steel thickness from 1984 and 1998 measurements, replacement of individual tower members ongoing since 1999; climbing inspections revealed even more significant fatigue cracking
- Fatigue failure requiring replacement of arm hanger members has been an ongoing effort since the 1990's
- Grips on all guyed V towers replaced by 2004, based on manufacturer recommendation that grips had reached end of useful life
- 2006 up-rate increased rated capacity by 15% to 2598 MVA by earth grading to increase ground clearances; tower modifications precluded by weakened condition of steel due to corrosion

- Typical existing structure ~100 feet
- Existing ROW 150-160 ft
- Rating: 2598 MVA
- Typical new structures ~ 130 feet
- Proposed ROW 150-160 ft
- Rating: 4325 MVA



- Mt Storm – Doubs is one of the most heavily loaded lines with one of the lowest ratings
- Identified as a limiting facility in every RTEP since 2006
- Based on the 2010 RTEP the 2025 loading will exceed 95% regardless of the alternative selected
- Line is nearing the end of life and at risk of major failure – domino effect

- Add Mt Storm – Doubs rebuild to the RTEP as a baseline upgrade in the Operational Performance category
- Estimated cost: \$320 - \$370 Million (Includes APS and Dominion Cost)

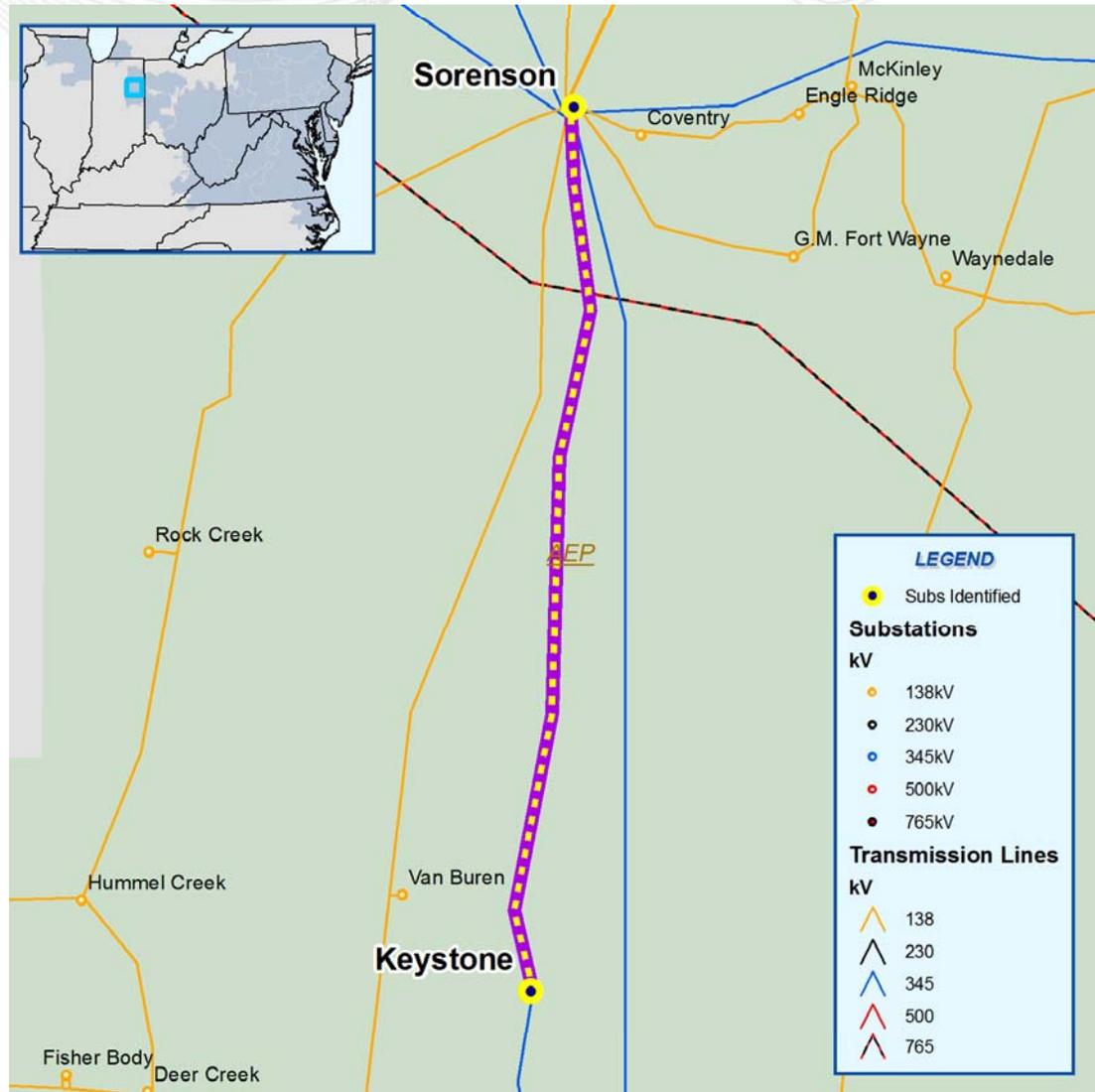
- Window of opportunity to get line outages after Trail is placed in service in the Spring of 2011
- Transmission owners should use best efforts to complete the work by 2015
 - If sufficient outages can not be obtained to complete the work by 2015, the full scope will be finished following PATH being placed in-service.
 - After completion of PATH, outages should be more available
 - Based on worst case estimate, the project could take as long as nine years; therefore it is imperative the parties start as soon as possible



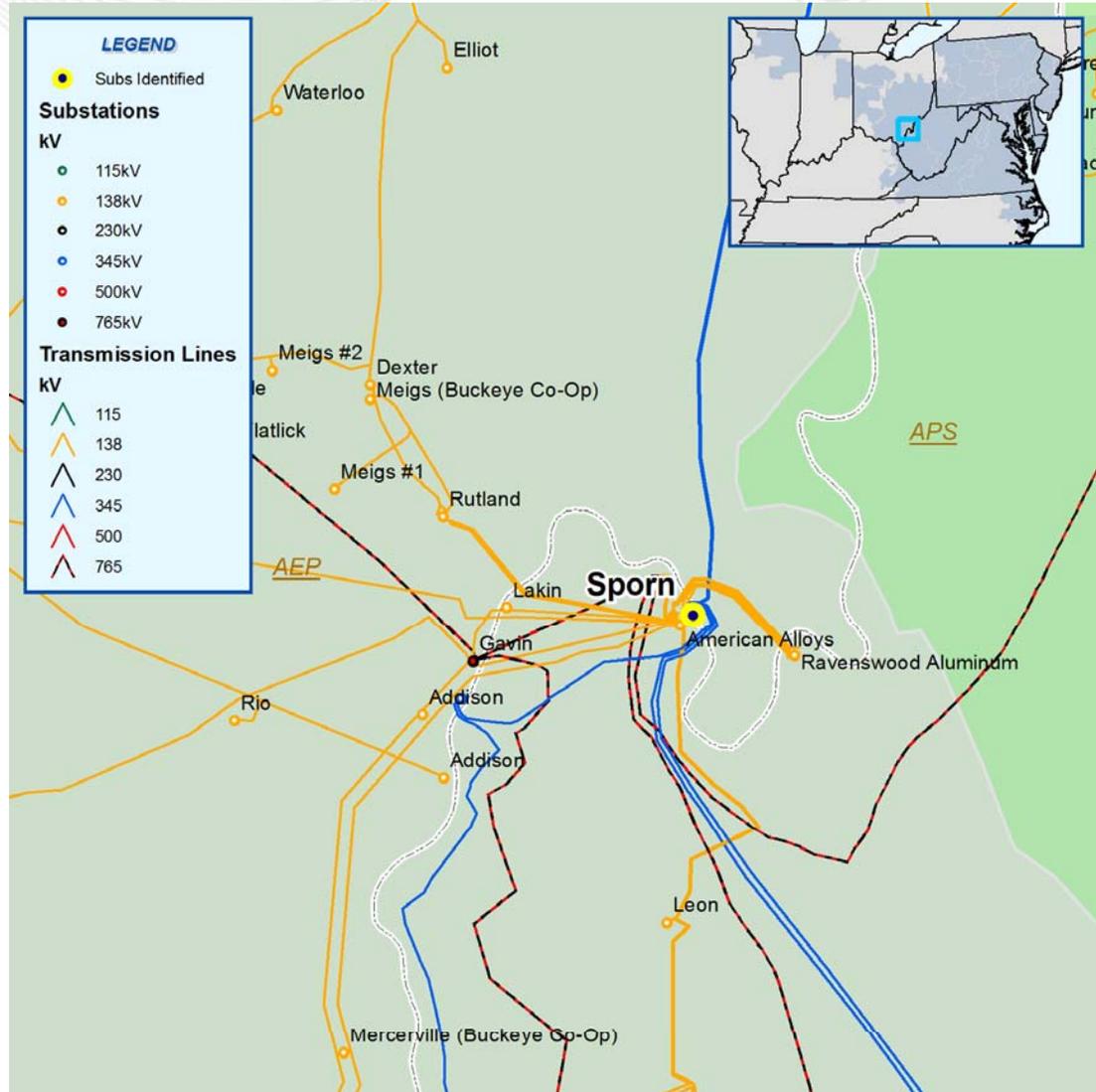
Baseline Reliability Update

- 2014 Retool Analysis is in-progress
- Potential for voltage violations
- SVC locations evaluated as part of MAAC and EMAAC alternative analysis
- SVC Optimization

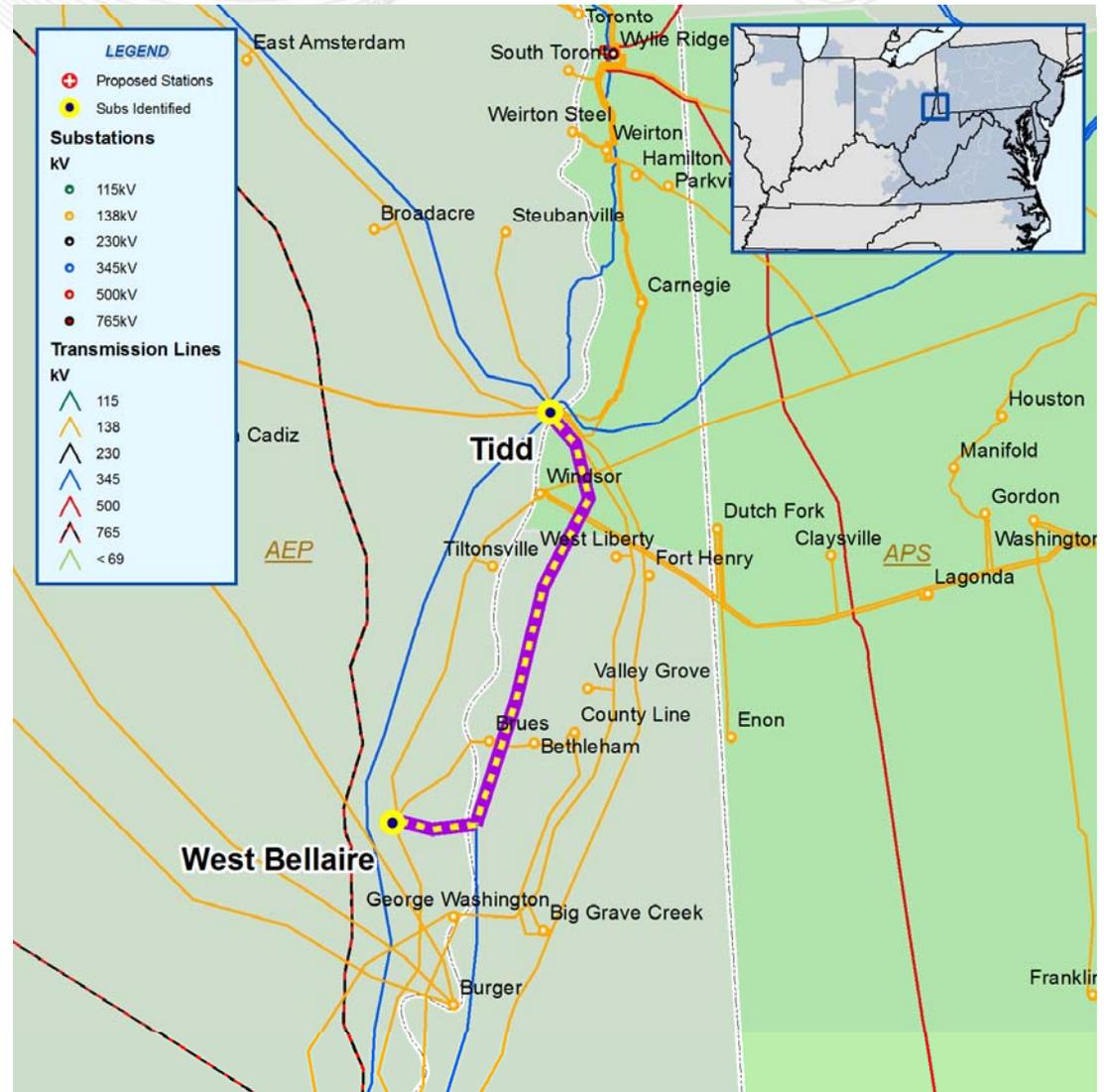
- N-1-1 Thermal Violation
- The Keystone – Sorenson 345KV line is overload for Loss of the Greentown - Jefferson 765 kV line and Desoto – Sorenson 345 kV line
- Recommended Solution: A sag study will be required to increase the emergency rating for this line. Depending on the outcome of this study, more action may be required in order to increase the rating. (B1420)
- Estimated Project Cost: \$0.1012 M
- Expected IS Date: 12/31/2011



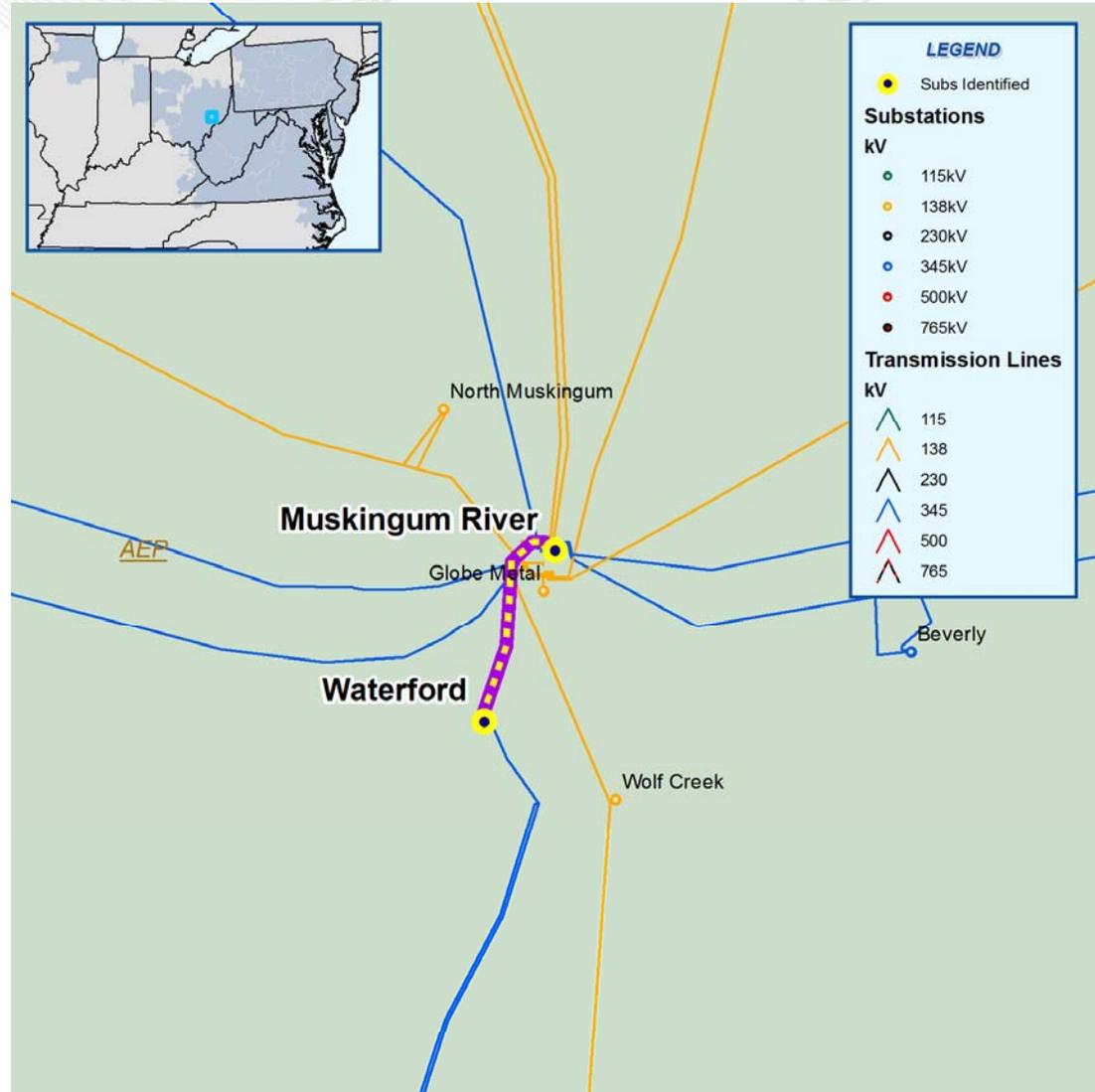
- Generator Deliverability Violation
- The N42 Tap - Sporn 345 KV line is overload for the loss of the Muskingum River – Waterford 345kV line
- Recommended Solution: Replace the 2870 MCM ACSR riser at the Sporn station (B1435)
- Estimated Project Cost: \$0.3 M
- Expected IS Date: 6/1/2015



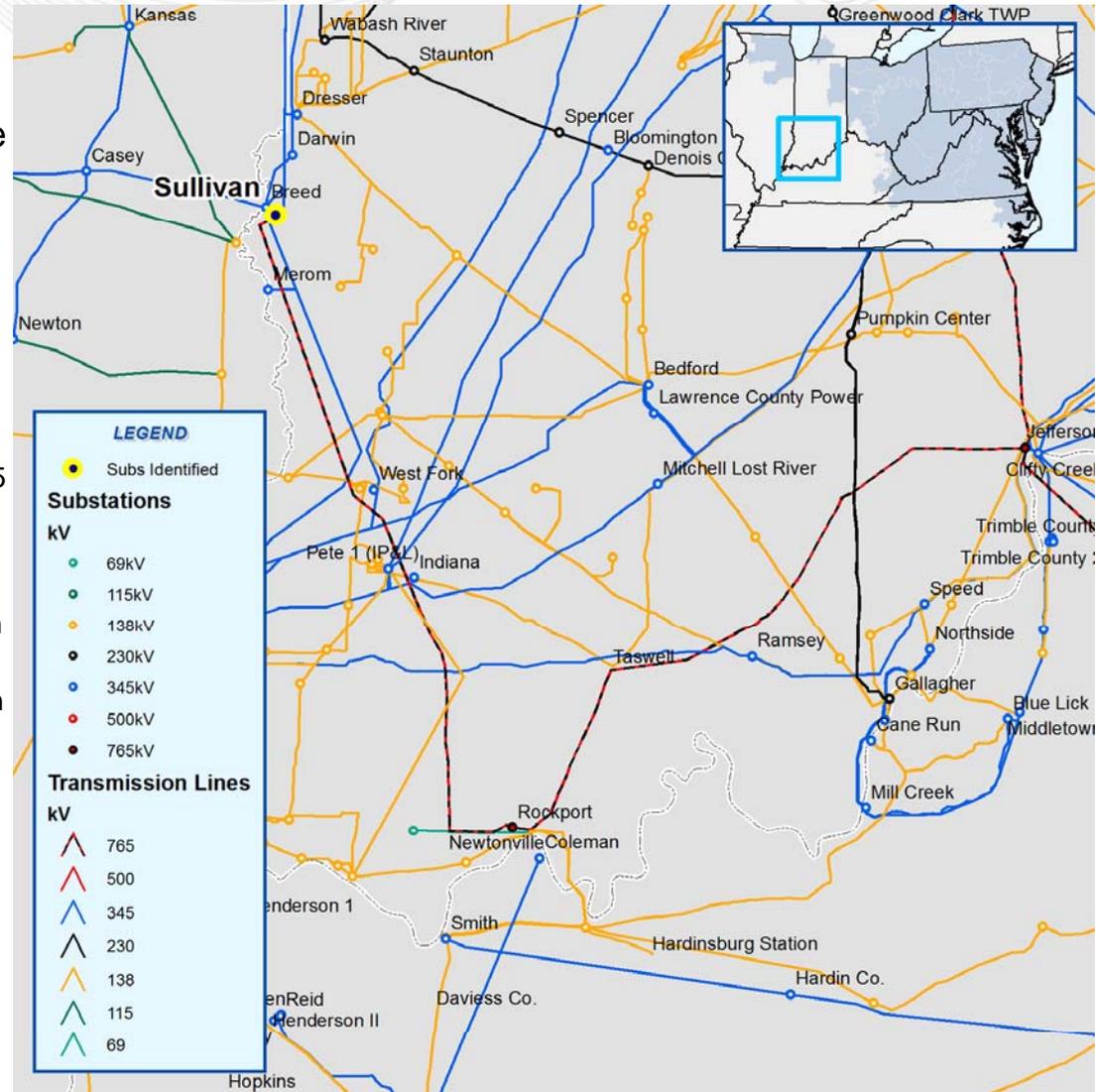
- Common Mode Outage Violation
- The West Bellaire – Tidd 345KV line is overloaded for a Kammer – South Canton 765kV line fault with a stuck breaker at Kammer
- Recommended Solution: The Tidd - West Bellaire 345 kV circuit has been de-rated to its normal rating and would need an electrical clearance study to determine if the emergency rating can be utilized (B1456)
- Estimated Project Cost: \$0.078 M
- Expected IS Date: 12/31/2012



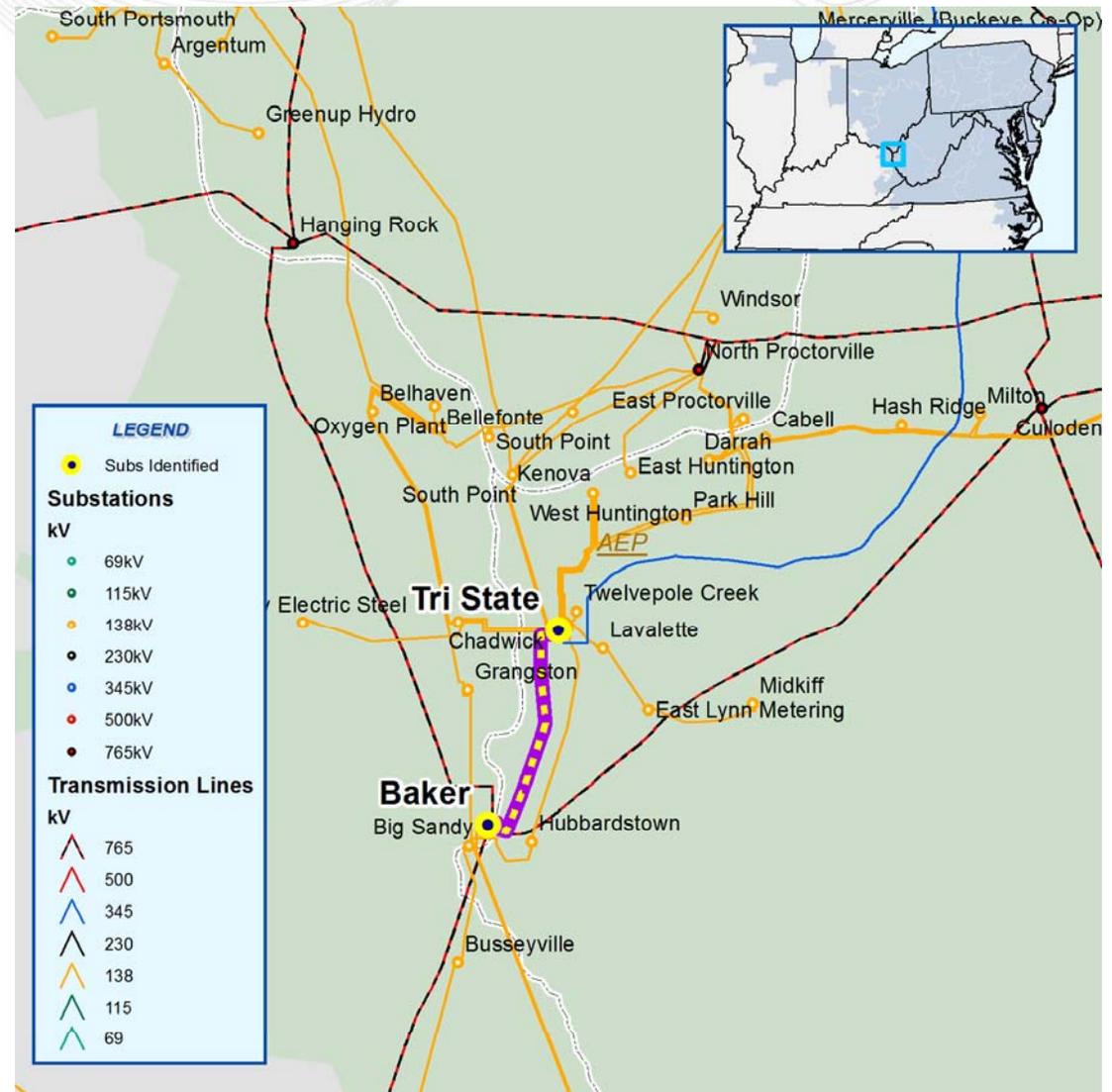
- Generator Deliverability Violation
- The Waterford – Muskingum River 345KV line is overloaded for system normal condition and for the loss of Kammer - Belmont – Mountaineer 765kV line
- Recommended Solution: Reconductor Waterford – Muskingum 345 kV (5 miles) with 1590 kCM ACSR/SSAC 54/19 six wired and upgrade Muskingum risers (B1460)
- Potential Cost: \$14 M
- Expected IS Date: 6/1/2015



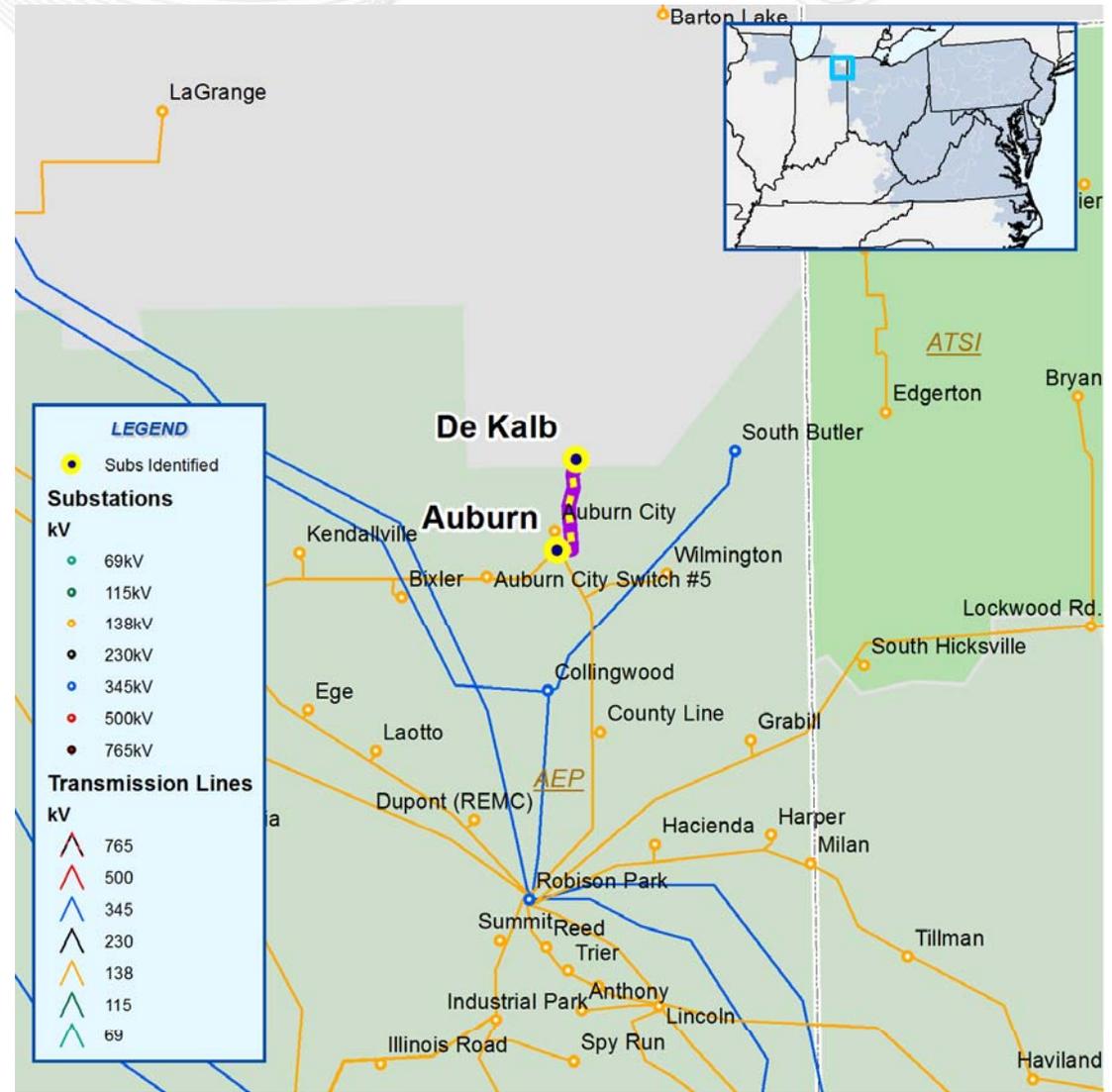
- N-1-1 Thermal Violation
- The Sullivan 765/345kV transformer #1 or #2 is overload for the loss of the other transformer coupled with the loss of Rockport – Jefferson 765kV line
- Recommended Solution:
 - Add a 3rd 2250 MVA 765/345 kV transformer at Sullivan station (B1465.1)
 - Replace the 100 MVAR 765 kV shunt reactor bank on Rockport – Jefferson 765 kV line with a 300 MVAR bank at Rockport Station (B1465.2)
 - Transpose the Rockport – Sullivan 765 kV line and also the Rockport – Jefferson 765 kV line (B1465.3)
 - Make switching improvements at Sullivan and Jefferson 765 kV stations (B1465.4)
- Estimated Project Cost: \$100 M
- Expected IS Date: 6/1/2015



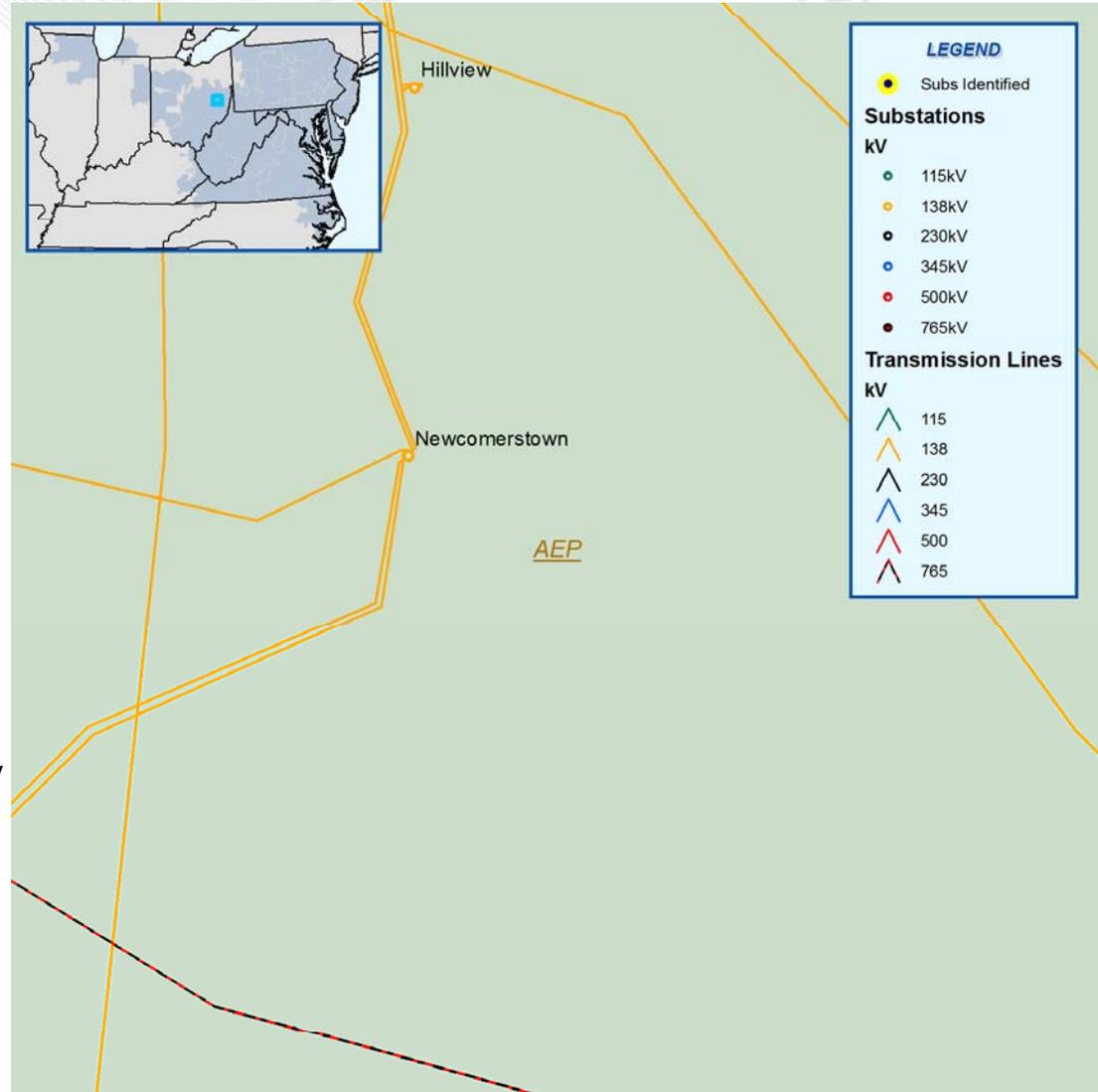
- N-1-1 Thermal Violation
- The Tristate 345/138 kV #1, Tristate 345/138 kV #2, Baker – Tristate 345 kV, Baker 345/138 kV And Other Lines are overloaded for various combination for single contingencies.
- Recommended Solution: Add an additional 765/345 kV transformer at Baker Station. (B1495)
- Estimated Project Cost: \$ 46 M
- Expected IS Date: 6/1/2015



- N-1-1 Thermal Violation
- The Auburn - Dekalb Substation 138 kV line is overloaded for various N-1-1 combinations near Albion, Skinner, Bixler Tap, Auburn, and Kendallville
- Recommended Solution:
 - Establish a new 138/69 kV Butler Center station
 - Build a new 14 mile 138 kV line from Auburn station to Woods Road station VIA Butler Center station
 - Replace the existing 40 MVA 138/69 kV transformer at Auburn station with a 90 MVA 138/69 kV transformer
 - Improve the switching arrangement at Kendallville station
 - (B1490)
- Estimated Project Cost: \$25 M
- Expected IS Date: 6/1/2015



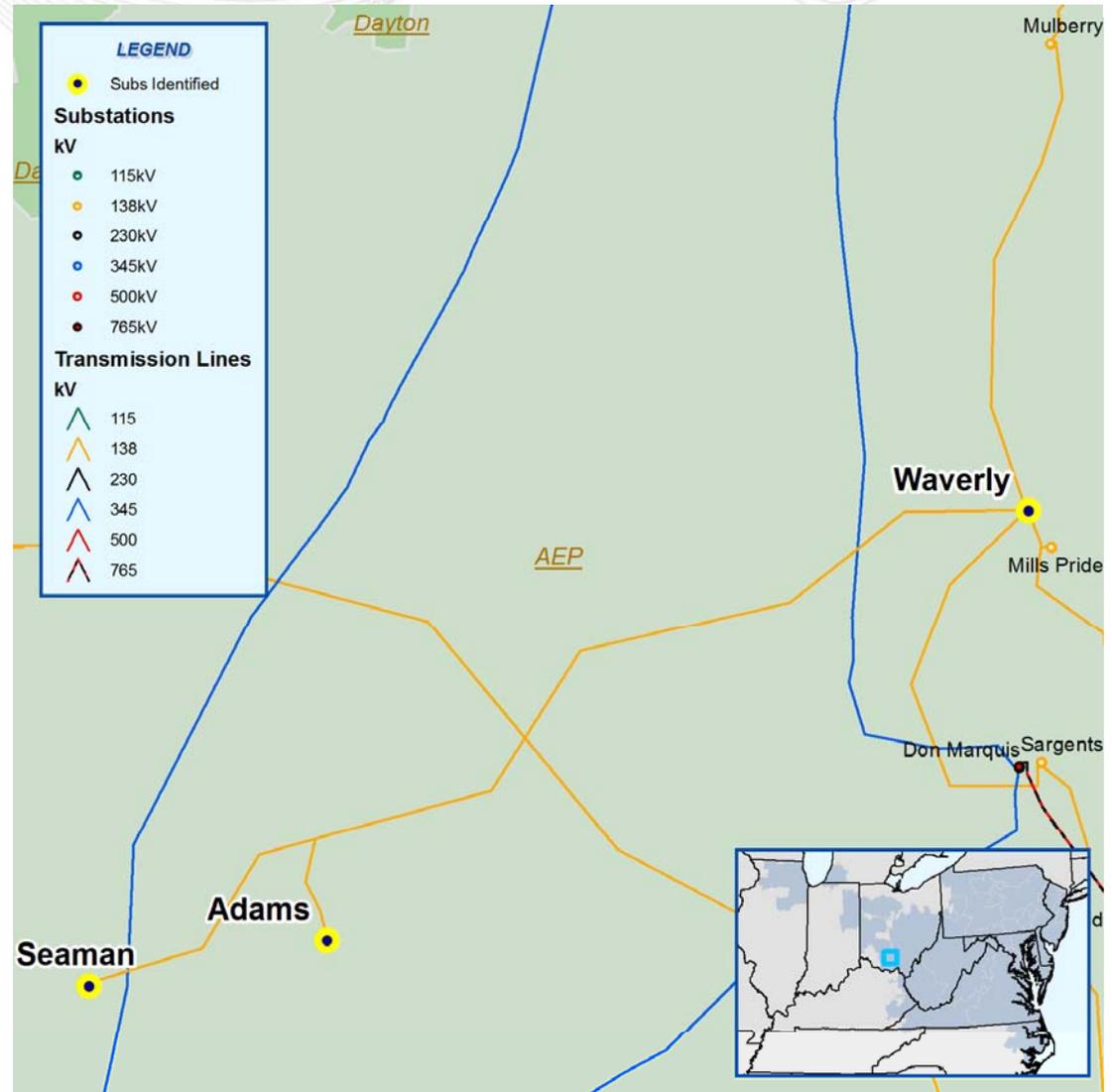
- AEP Criteria Violation
- In the Cambridge, Ohio area, peak summer 2006 voltages on the 138 kV, 69 kV & 34.5 kV systems were down to 92%, 94%, & 86%, respectively; Critical single contingencies could result in loading 69 kV & 34.5 kV equipment as high as 138%, & 144%, respectively, and drop system voltages as low as 75%.
- Recommended Solution:
 - Conversion of the Newcomerstown – Cambridge 34.5 kV system to 69 kV operation
 - Expansion of the Derwent 69 kV Station (including reconfiguration of the 69 kV system)
 - Rebuild 11.8 miles of 69 kV line, and convert additional 34.5 kV stations to 69 kV operation
 - These improvements are necessary to improve normal & contingency system voltages, as well as equipment loadings, to acceptable levels for the 135 MW area load. (B1469)
- Estimated Project Cost: \$23 M
- Expected IS Date: 12/1/2012



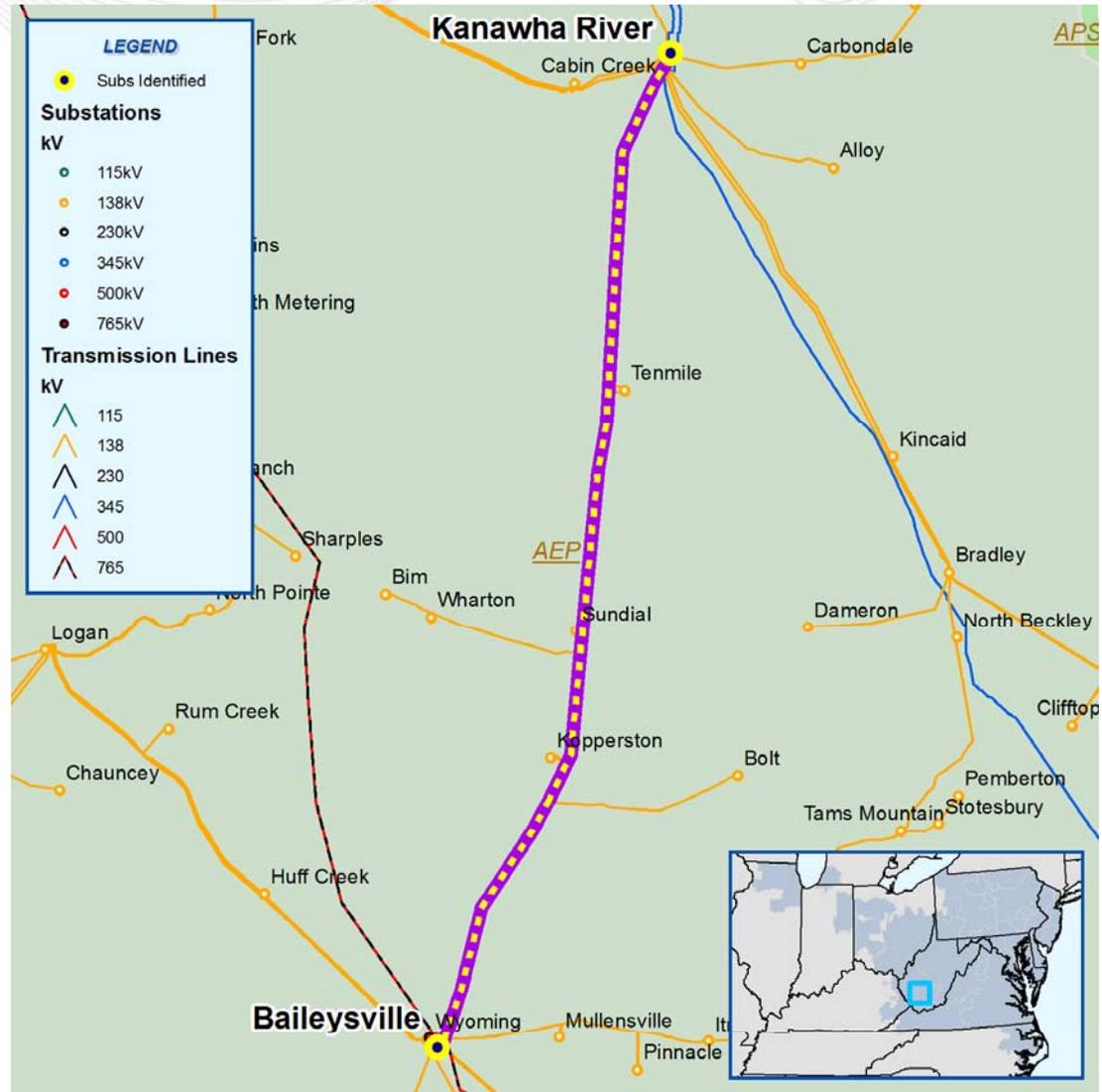
- N-1-1 Thermal Violation
- The North Delphos – East Side Lima - Sterling 138 kV line is overloaded for the loss of the Convoy - Robison Park 345 kV line and Robison Park 345/138 kV transformer and the loss of the East Lima - Haviland 138 kV line
- Recommended Solution:
 - Rebuild the entire 5.96 mile Lima – Sterling 138 kV line between Sterling and Rockhill stations
 - The new conductor will be 795 ACSR (Note that this is a revision to RTEP project B0570)
- Estimated Project Cost: \$16.1 M
- Expected IS Date: 6/1/2012



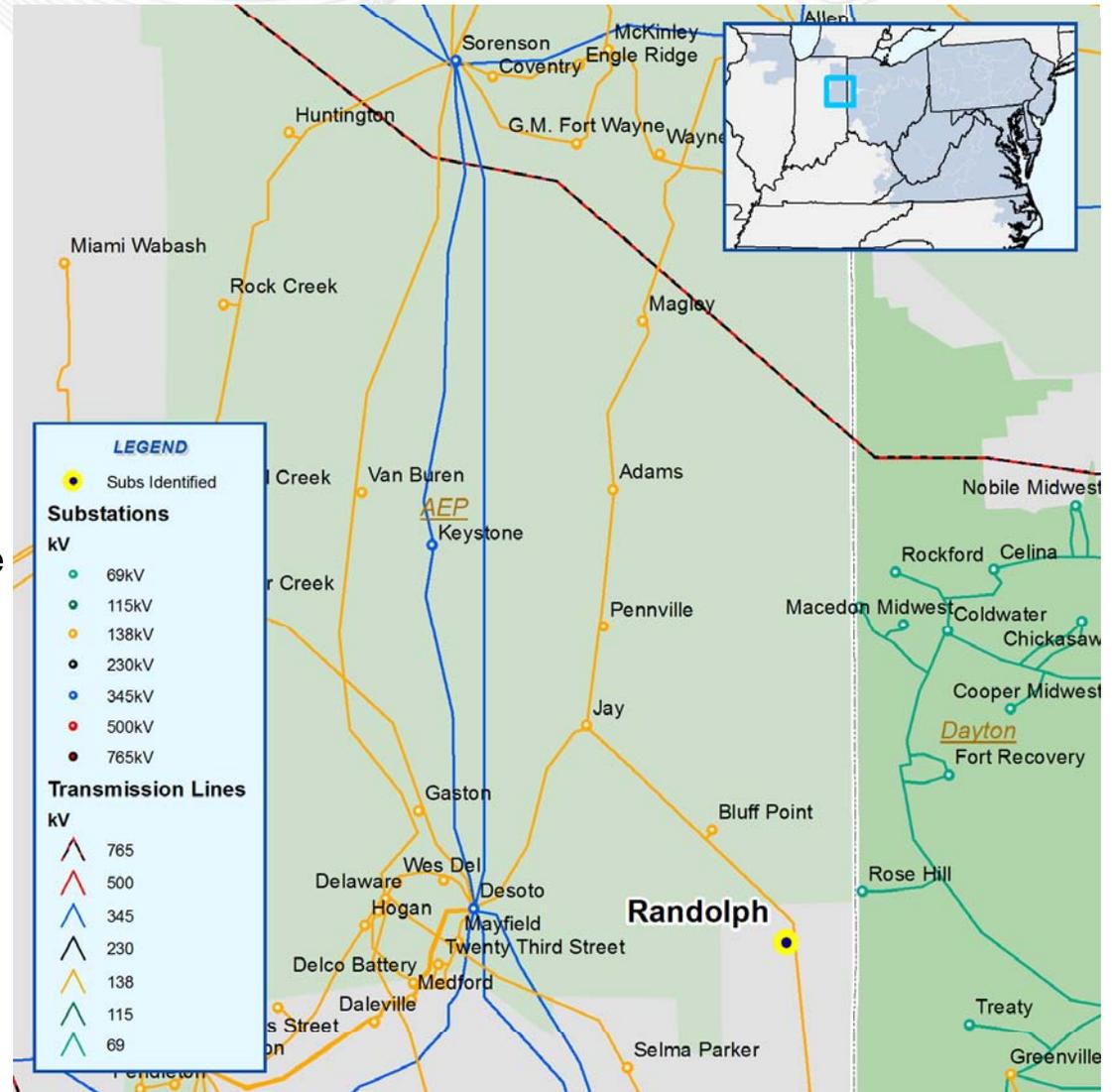
- AEP Criteria Violation
- Low voltage Drop at the Seaman 69 kV bus for the loss of both 138/69 kV transformers at Seaman and Adams in addition to the Adams – Waverly 138 kV branch
- Recommended Solution:
 - Create an in and out loop at Adams Station by removing the hard tap that currently exists
 - Upgrade the Adams transformer to 90 MVA
 - At Seaman Station install a new 138 kV bus and two new 138 kV circuit breakers
 - Convert South Central Co-op's New Market 69 kV Station to 138 kV
 - The Seaman – Highland circuit is already built to 138 kV, but is currently operating at 69 kV, which would now increase to 138 kV
 - At Highland Station, install a new 138 kV bus, three new 138 kV circuit breakers and a new 138/69 kV 90 MVA transformer
 - Using one of the bays at Highland, build a 138 kV circuit from Hillsboro – Highland 138 kV, which is approximately 3 miles. (B1466)
- Estimated Project Cost: \$13.5 M
- Expected IS Date: 6/1/2015



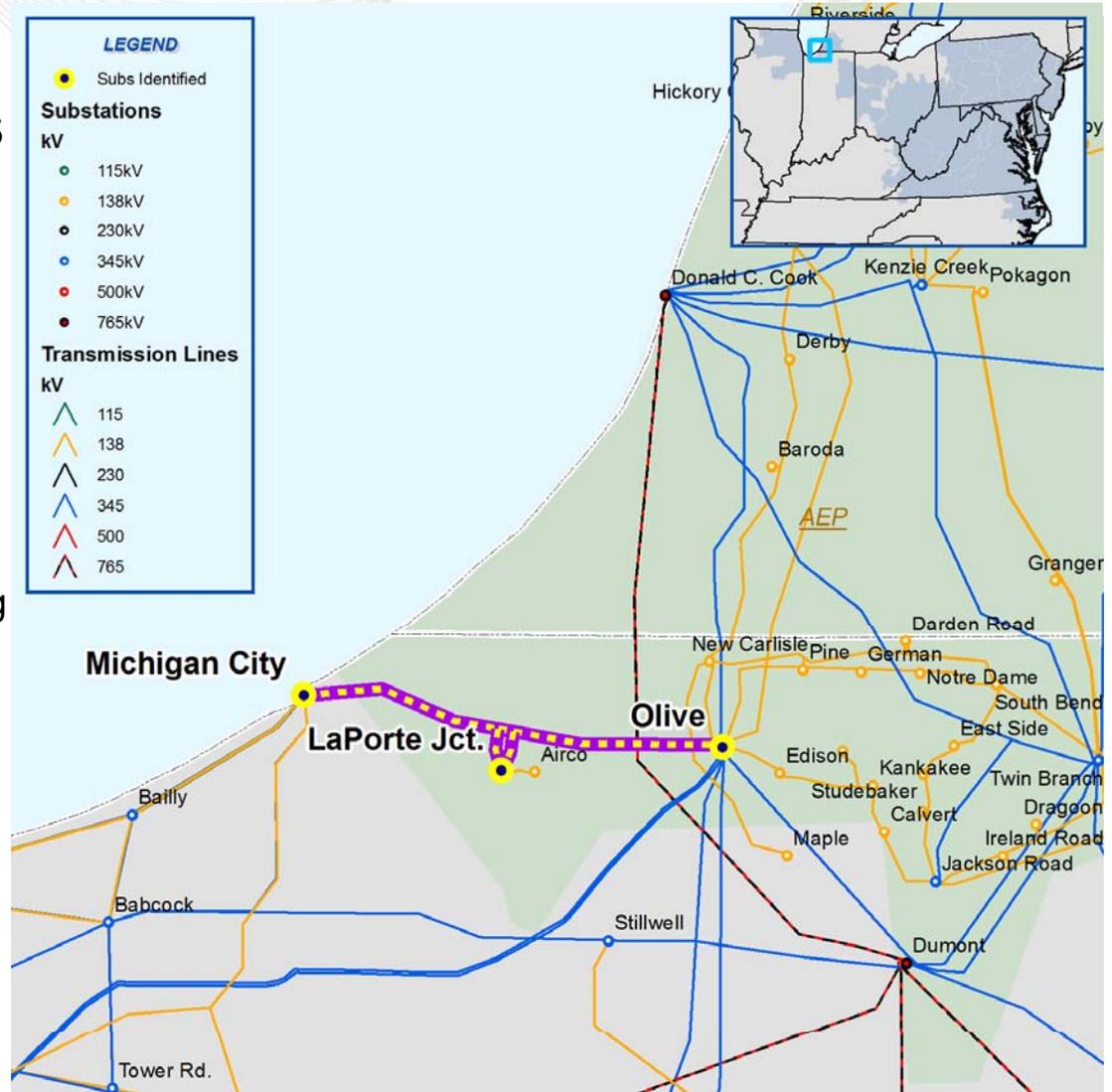
- AEP Criteria Violation
- Thermal overloads to multiple 46 kV lines and low voltage issues in the area of Skin Fork for various single contingencies
- Recommended Solution:
 - Build a new 138 kV double circuit off the Kanawha – Baileysville #2 138 kV circuit to Skin Fork Station
 - Install a new 138/46 kV transformer at Skin Fork
 - Replace 5 Moab's on the Kanawha – Baileysville line with breakers at the Sundial 138 kV station (B1470)
- Estimated Project Cost: \$8.5 M
- Expected IS Date: 6/1/2015



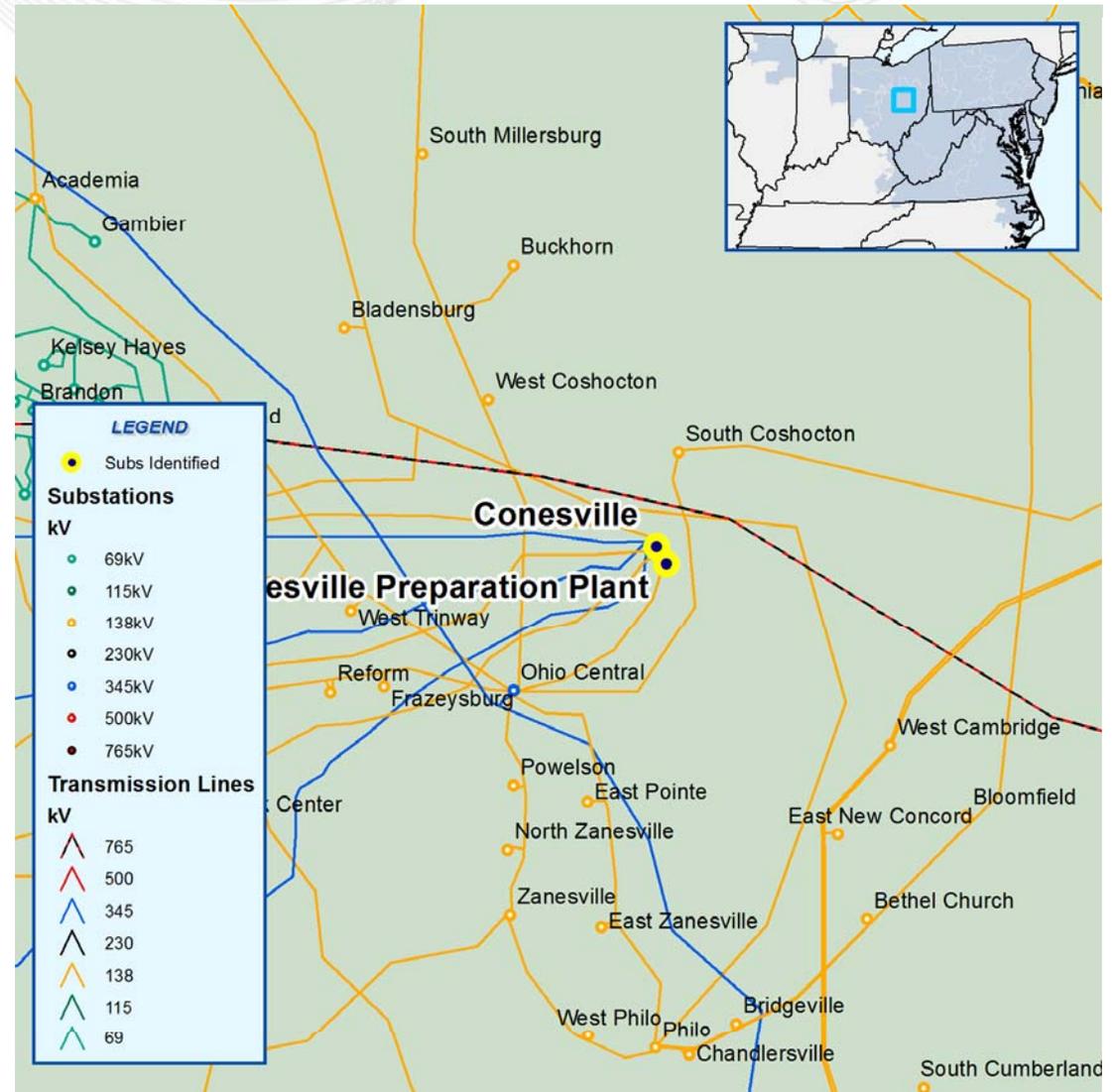
- AEP Criteria Violation
- Low voltage violations on the Winchester, Price, and Anchor Hocking 69 kV buses for a fault on the Jay – College Corner circuit that opens the 138/69 kV transformer at Randolph station
- Recommended Solution:
 - Expand Selma Parker Station and install a 138/69/34.5 kV transformer
 - Rebuild and convert 34.5 kV line to Winchester to 69 kV, including Farmland Station
 - Retire the 34.5 kV line from Haymond to Selma Wire (B1468)
- Estimated Project Cost: \$8 M
- Expected IS Date: 6/1/2015



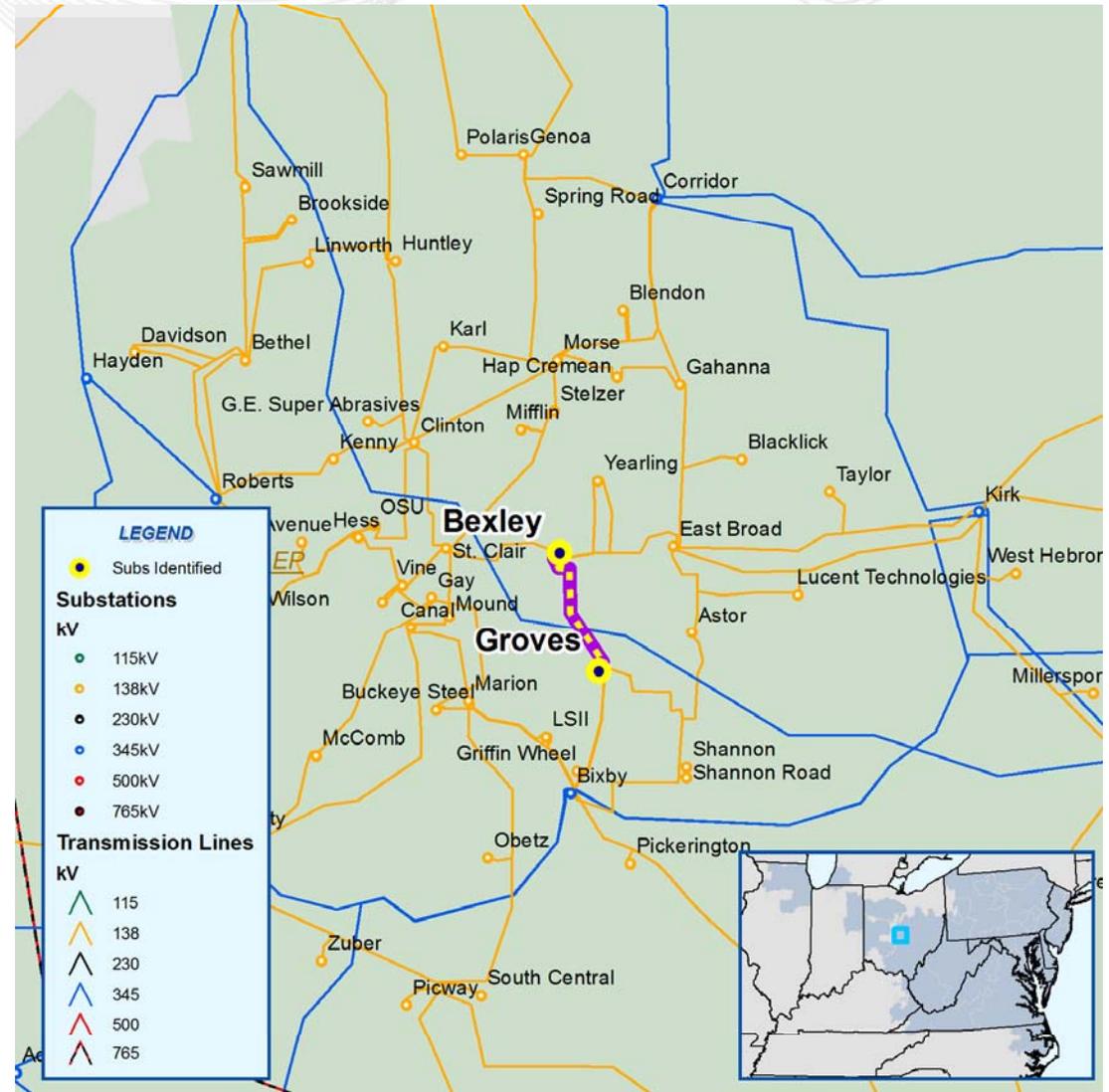
- AEP Criteria Violation
- Depressed voltages and thermal overloads on the AEP 69 kV and 34.5 kV networks in the LaPorte, IN and New Buffalo, MI areas for the loss of the Olive – LaPorte – Michigan City 138 kV line
- Recommended Solution:
 - Install a 14.4 MVAR Capacitor Bank at New Buffalo station
 - Reconfigure the 138 kV bus at LaPorte Junction station to eliminate a contingency resulting in loss of two 138 kV sources serving the LaPorte area (B1467)
- Estimated Project Cost: \$3 M
- Expected IS Date: 6/1/2015



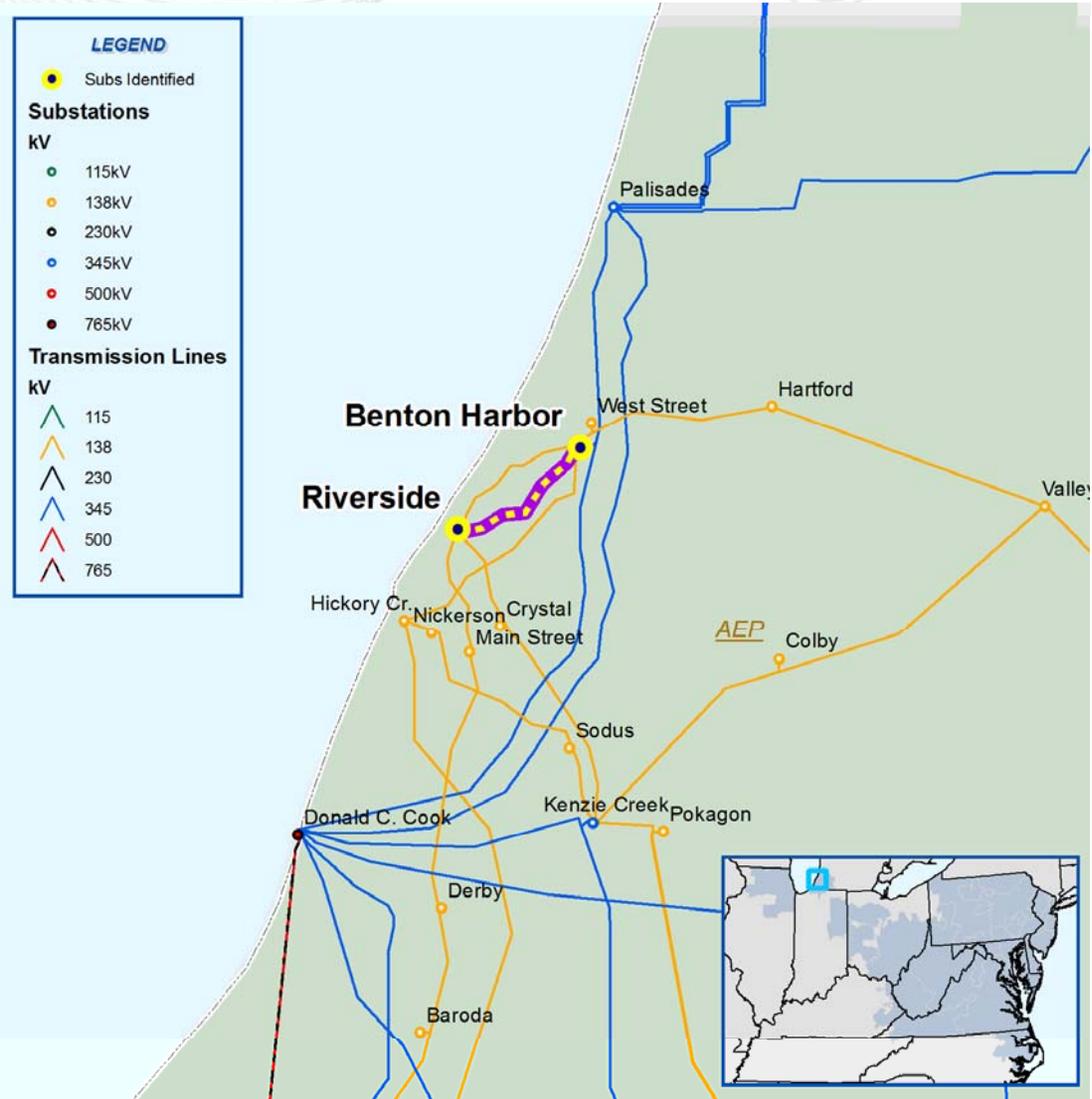
- N-1-1 Thermal Violation
- The Prep Plant Tap - Conesville East 138 kV line is overloaded for various combinations of single contingencies
- Recommended Solution: Reconductor the Conesville East – Conesville Prep Plant Tap 138 kV section of the Conesville – Ohio Central to fix Reliability N-1-1 thermal overloads (B1502)
- Estimated Project Cost: \$2 M
- Expected IS Date: 6/1/2015



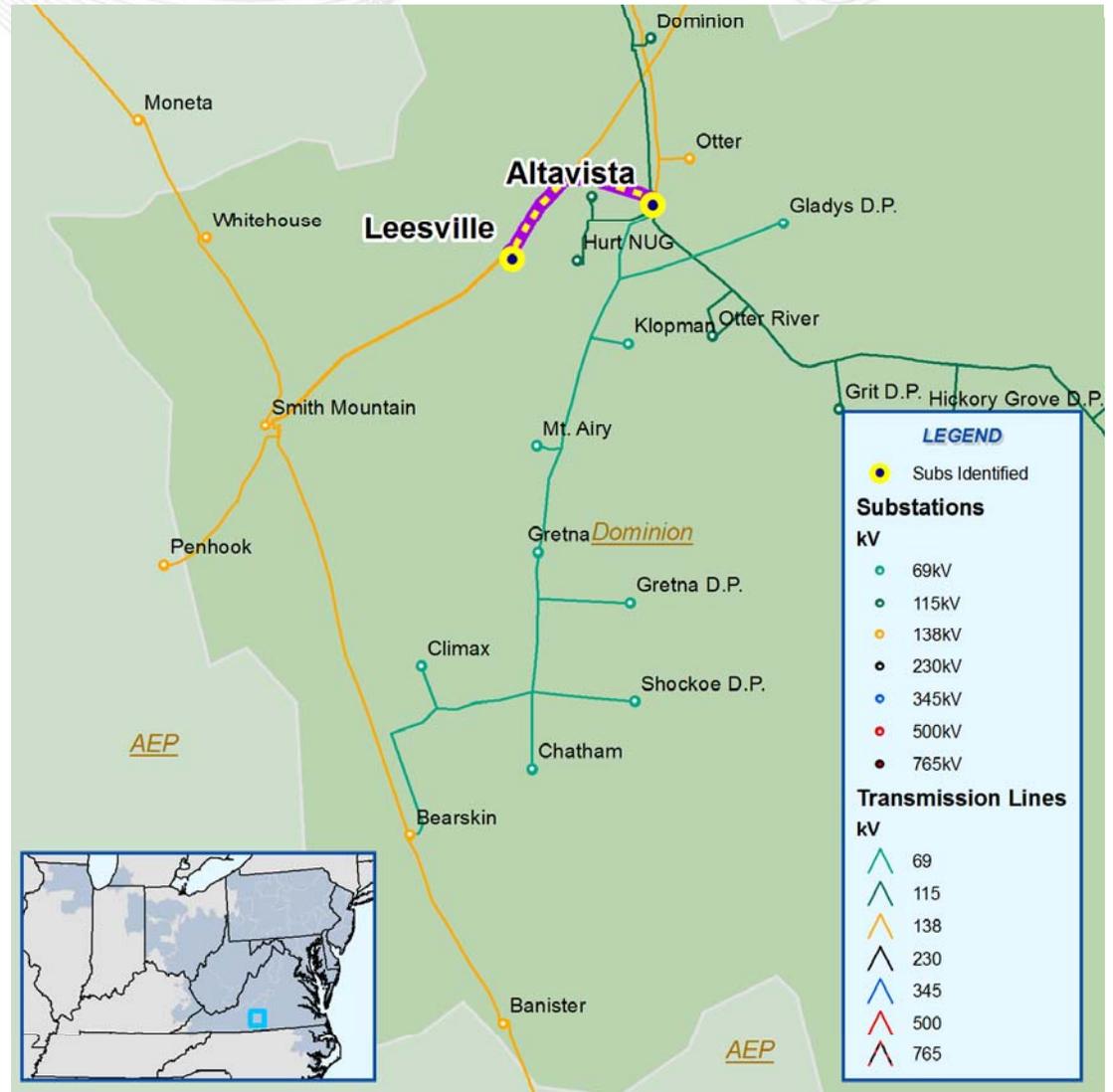
- N-1-1 Thermal Violation
- The Bexley – Groves 138 kV line is overloaded for the loss of Kirk – Taylor 138 kV line and the loading cannot be adjusted below normal rating through re-dispatch
- Recommended Solution: Reconductor the Bexley – Groves 138 kV circuit (B1463)
- Estimated Project Cost: \$2.9 M
- Expected IS Date: 6/1/2015



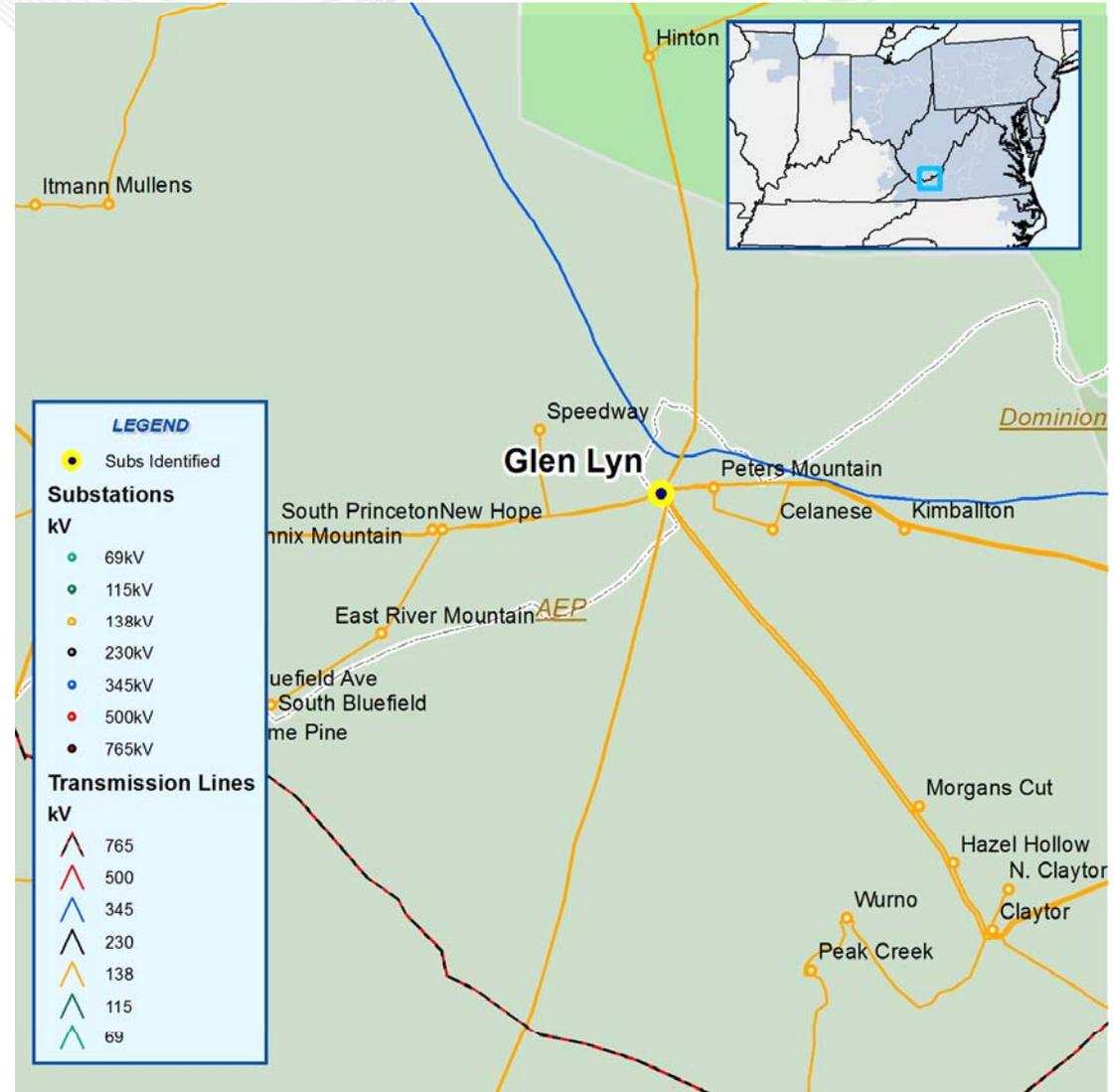
- N-1-1 Thermal Violation
- The Riverside – Benton Harbor 138 kV #1 line is overloaded for the loss of the Riverside – Benton Harbor – West Street – Hartford 138 kV line combined with the loss of Kenzie Creek 345/138 kV transformer overloads
- Recommended Solution: Install a new 138 kV circuit breaker at Benton Harbor station and move the load from Watervliet 34.5 kV station to West street 138 kV station (B1430)
- Estimated Project Cost: \$1.5 M
- Expected IS Date: 6/1/2015



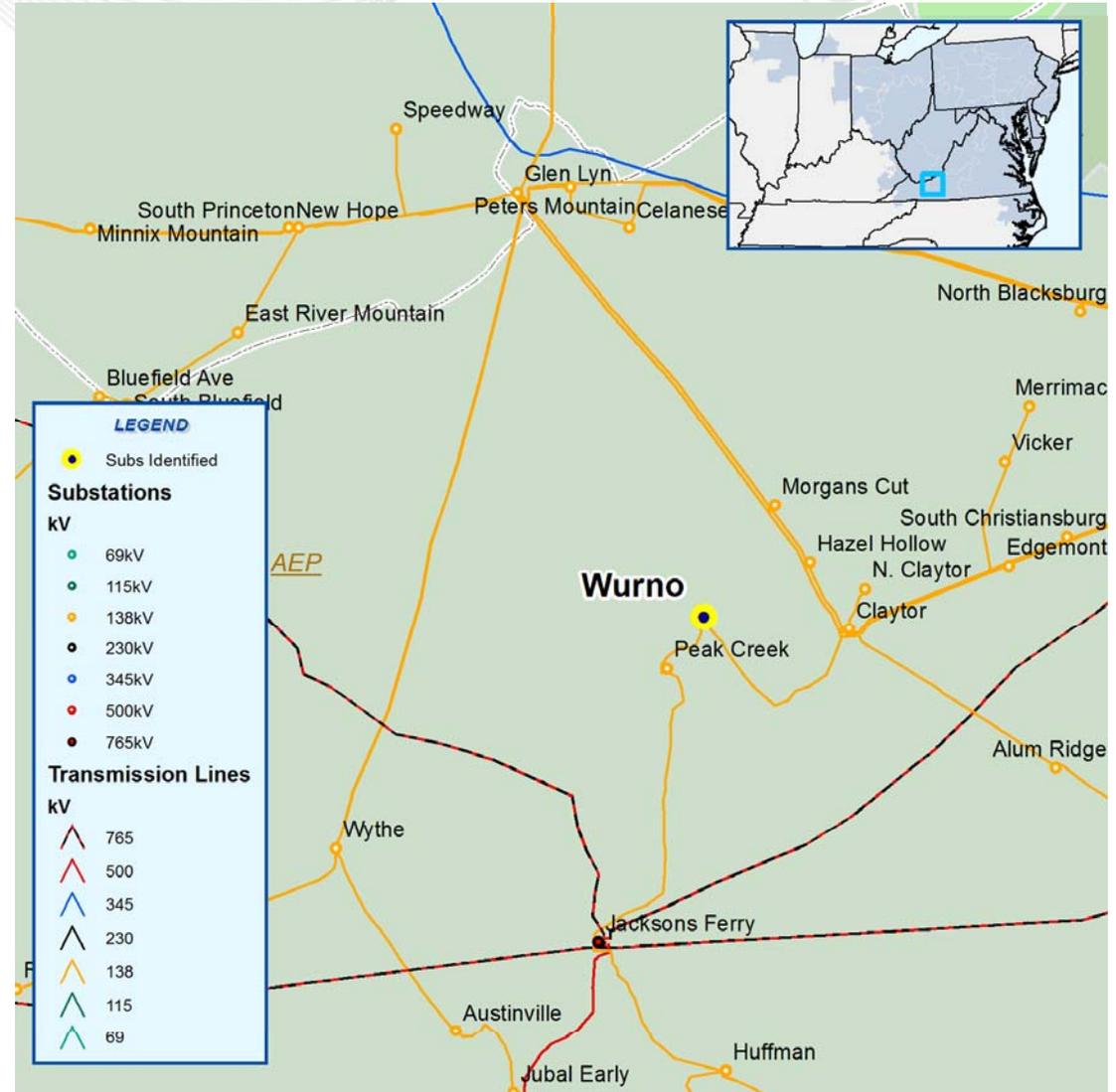
- N-1-1 Thermal Violation
- The Leesville - Altavista 138 kV line is overloaded for various combinations of single contingencies
- Recommended Solution: Replace 138 kV bus and risers at Leesville Station (B1497)
- Estimated Project Cost: \$0.6 M
- Expected IS Date: 6/1/2015



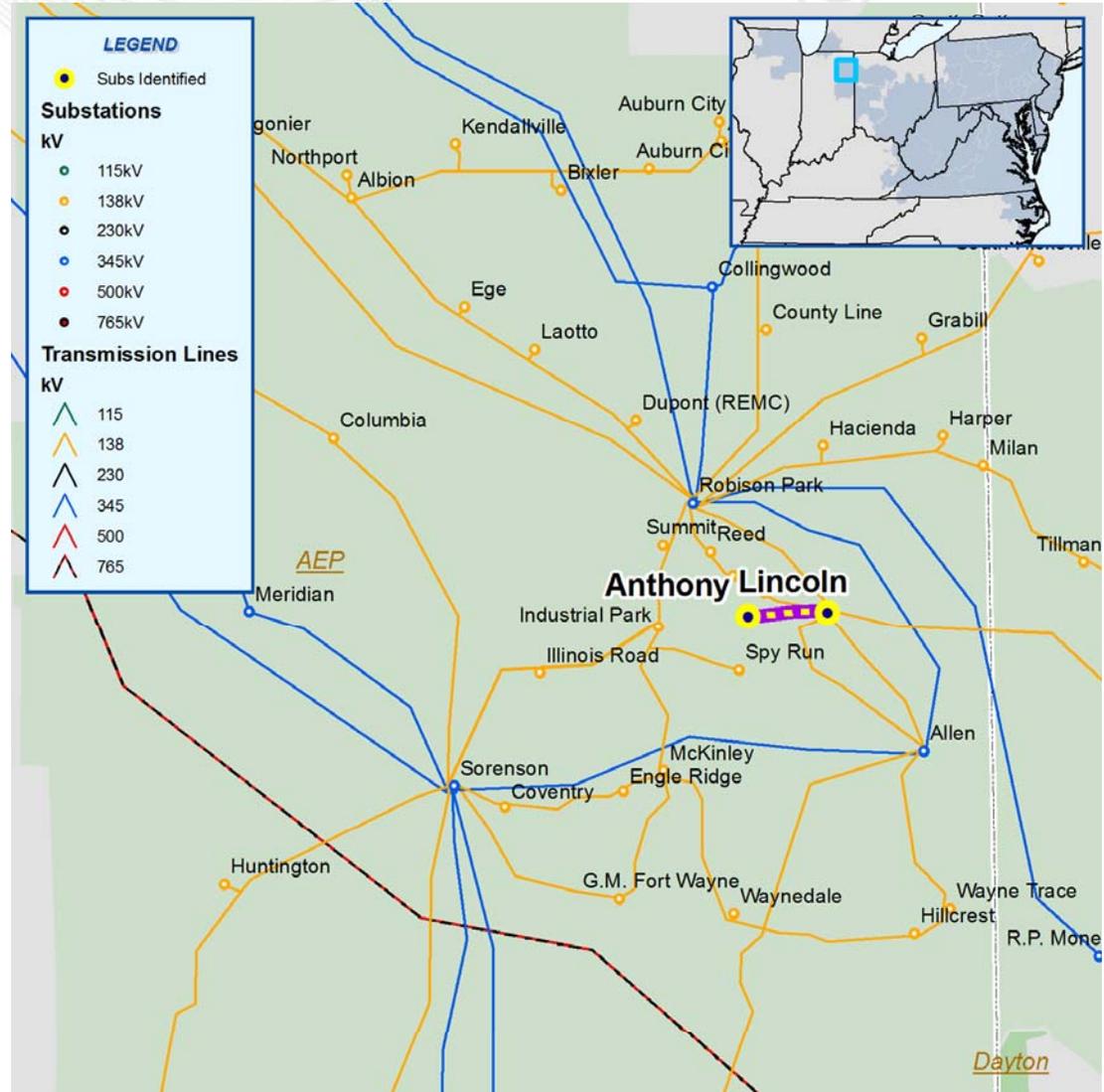
- N-1-1 Thermal Violation
- The Glen Lyn - U2-051 Tap 138 kV line is overloaded for various combinations of single contingencies
- Recommended Solution: Reconductor 0.64 miles of the Glen Lyn – Wythe 138kV line with 3-1590 ACSR (B1492)
- Estimated Project Cost: \$0.7 M
- Expected IS Date: 6/1/2015



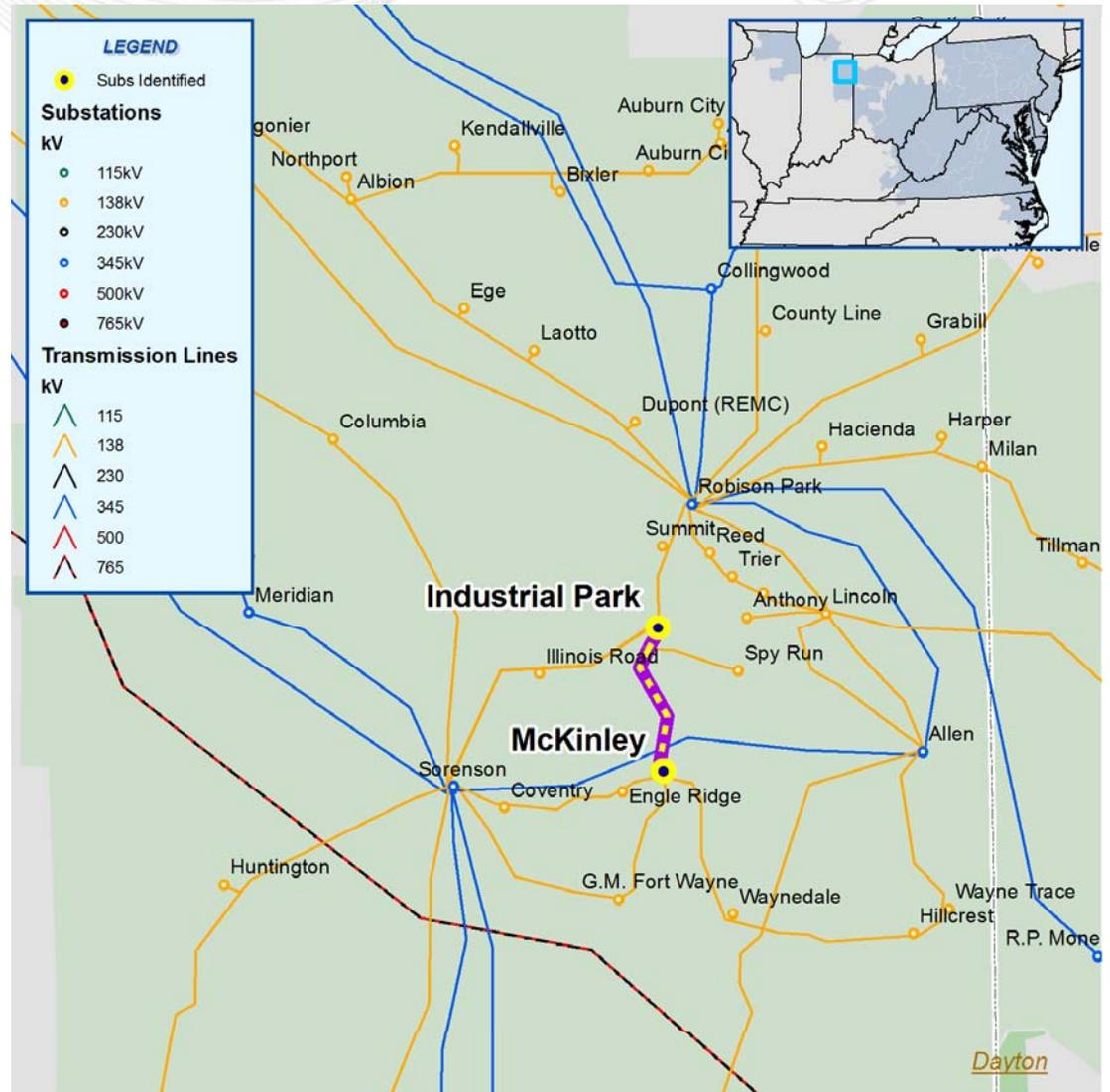
- N-1-1 Thermal Violation
- The West Glow - Wurno 138 kV line is overloaded for various combinations of single contingencies
- Recommended Solution: Replace 138 kV risers at Wurno Station (B1498)
- Estimated Project Cost: \$0.15 M
- Expected IS Date: 6/1/2015



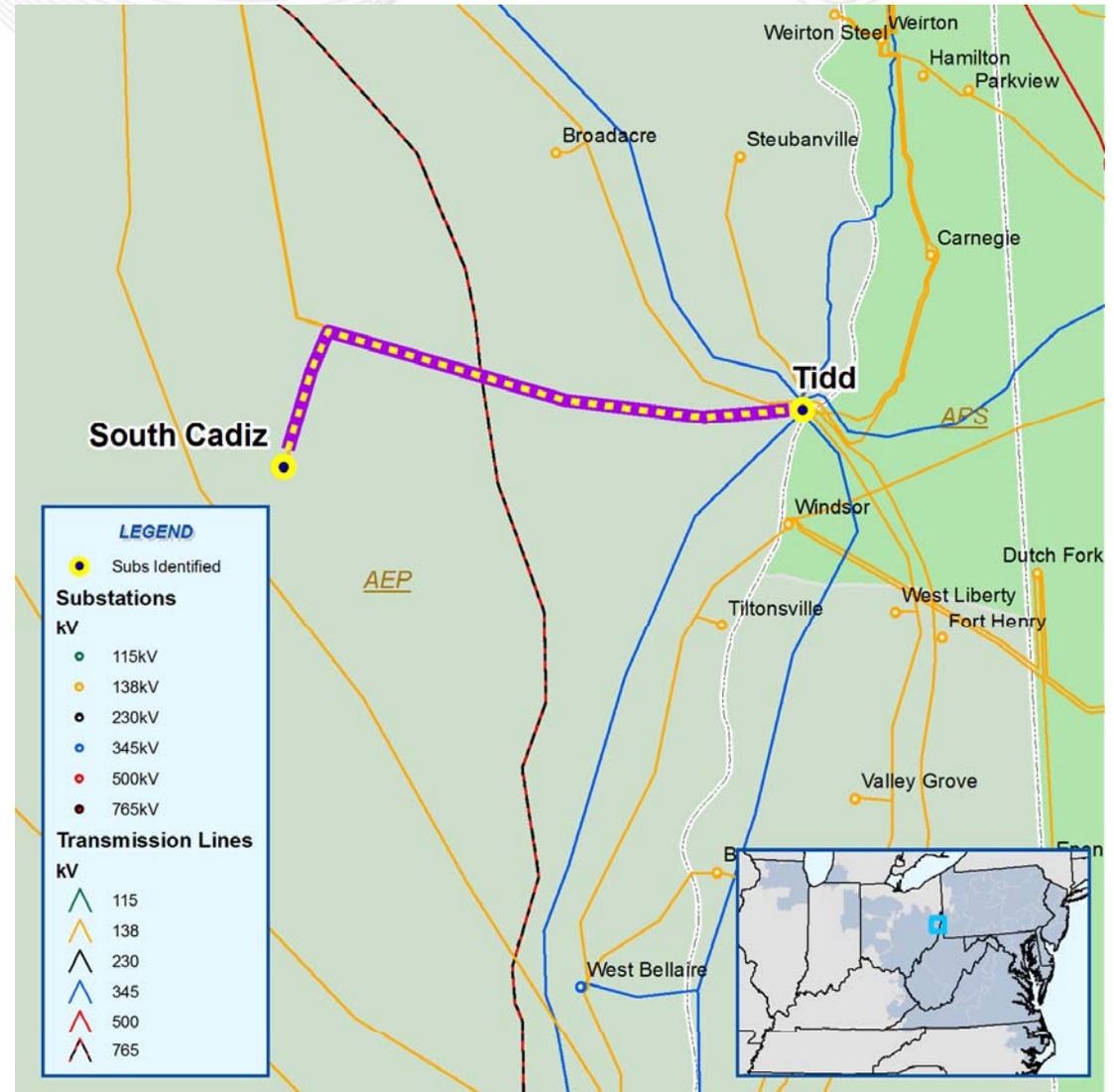
- N-1-1 Thermal Violation
- The Anthony – Lincoln 138 kV line is overload for the loss of the Illinois Road - Industrial Park – Summit - Wallen - Robison Park 138 kV line and the loss of Robison Park 345/138 kV transformer
- Recommended Solution: By replacing the breaker at Lincoln the Summer Emergency rating will improve to 251 MVA (B1440)
- Estimated Project Cost: \$0.55 M
- Expected IS Date: 6/1/2015



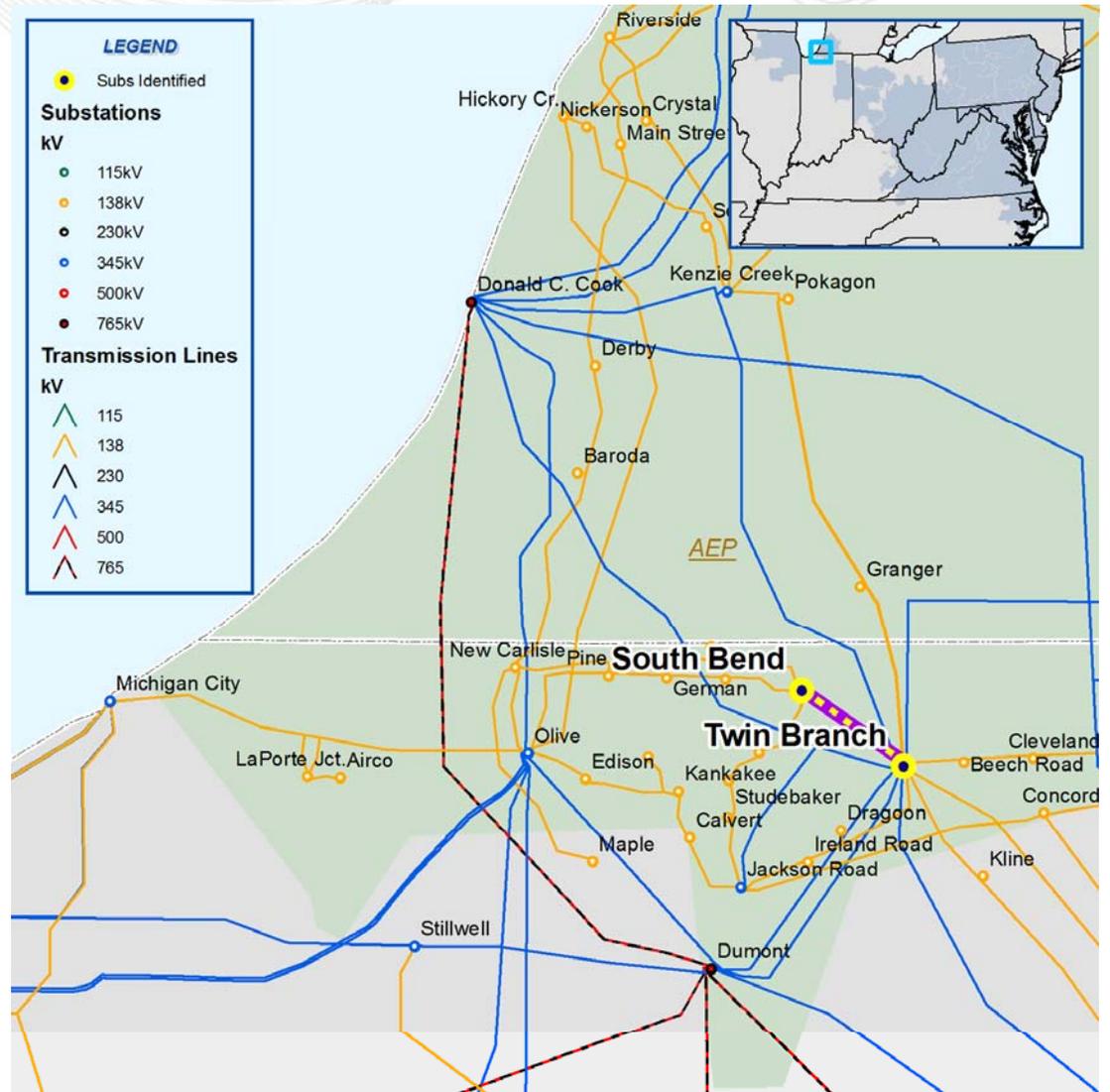
- N-1-1 Thermal Violation
- The Industrial Park – McKinley 138 kV line is overloaded for the loss of Robison Park 345/138 kV transformer and the loss of the Sorenson - Illinois Road - Industrial Park 138 kV line
- Recommended Solution: Replacement of risers at McKinley and Industrial Park stations and performance of a sag study for the 4.53 miles of 795 ACSR section is expected to improve the Summer Emergency rating to 302 MVA (B1438)
- Estimated Project Cost: \$0.15 M
- Expected IS Date: 6/1/2015



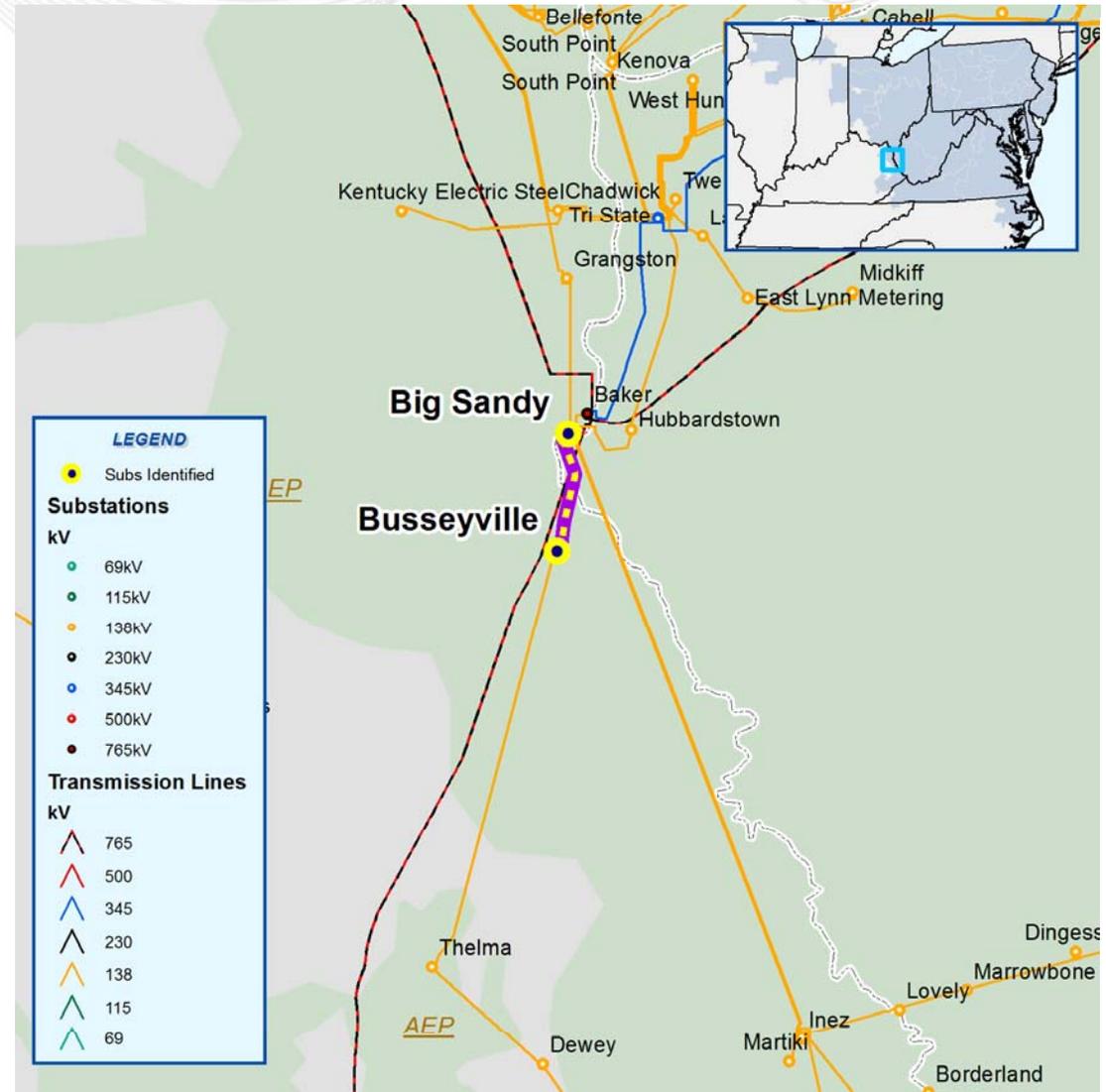
- N-1-1 Thermal Violation
- The South Cadiz Tap - Tidd 138 kV line is overloaded for the loss of the Tidd - Broadacre - East Amsterdam - Malvern – Wagenhals 138 kV line and the loss of the Kammer - South Canton 765 kV line
- Recommended Solution: Replace relays at both South Cadiz 138 kV and Tidd 138 kV (B1462)
- Estimated Project Cost: \$0.5 M
- Expected IS Date: 6/1/2015



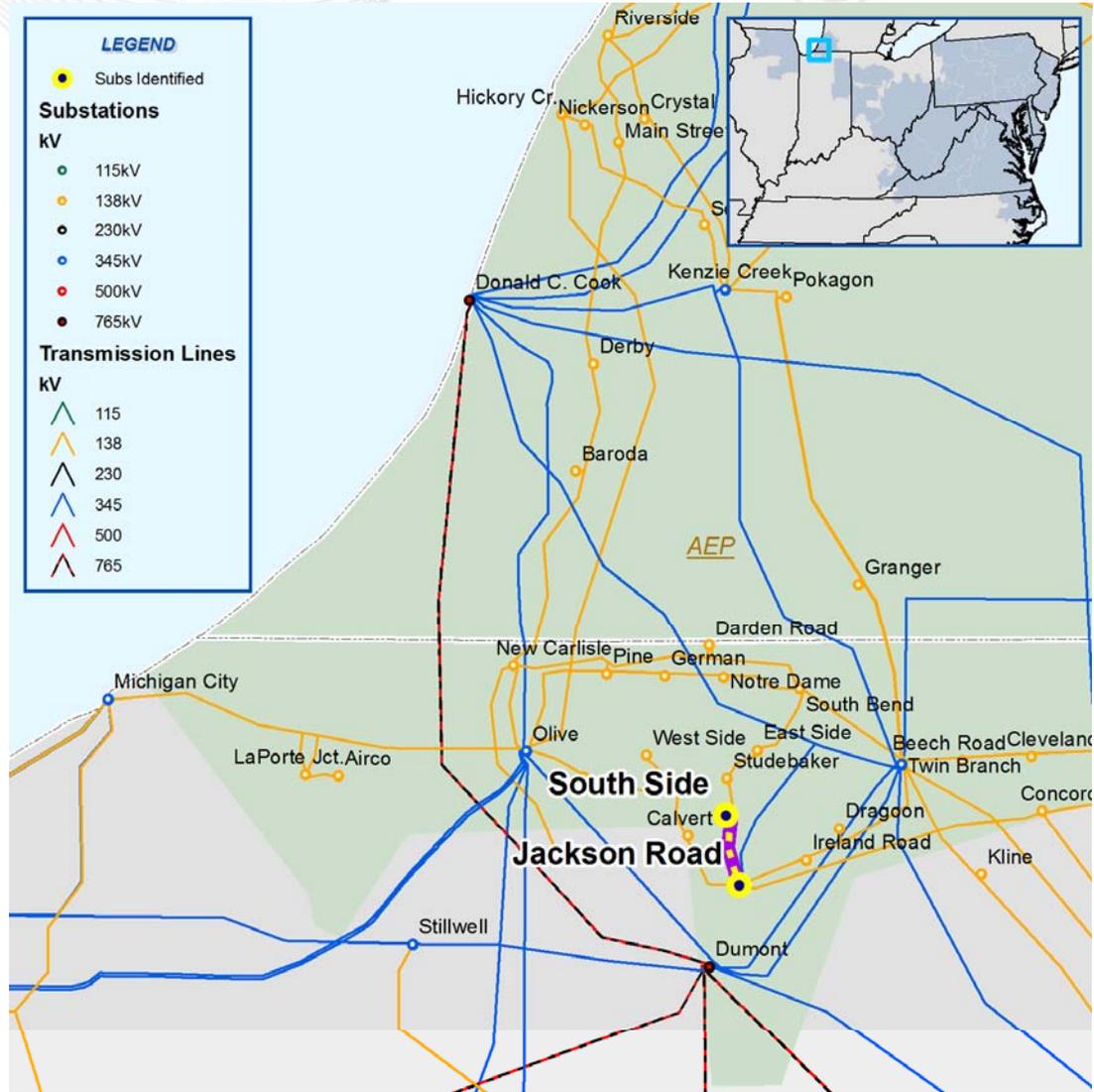
- N-1-1 Thermal Violation
- The South Bend – Twin Branch 138 kV line is overloaded for the loss of Olive 345/138 kV transformer and the Laporte – Olive 138 kV line and the loss of Jacksons Road 345/138 kV transformer or the loss of Jacksons Road 345/138 kV transformer and the loss of Olive 345/138 kV transformer and the loss of Olive 345/138 kV transformer and the Laporte – Olive 138 kV line
- Recommended Solution: Replacement of 954 ACSR conductor with 1033 ACSR and performance of a sag study for the 4.54 miles of 2-636 ACSR section is expected to improve the Summer Emergency rating to 393 MVA (B1442)
- Estimated Project Cost: \$0.5 M
- Estimated IS Date: 12/31/2011



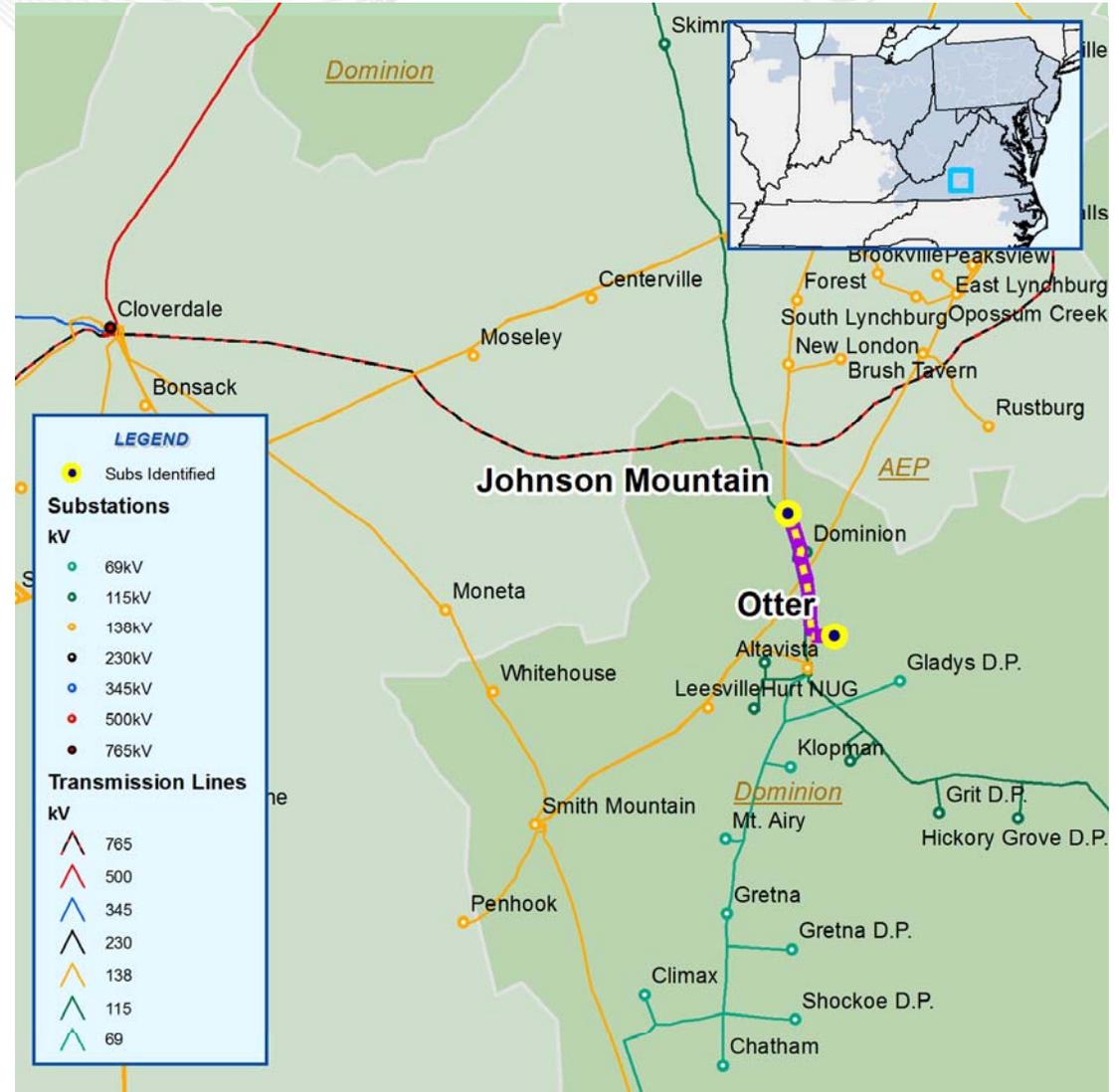
- N-1-1 Thermal Violation
- The Big Sandy - Busseyville 138 kV line is overloaded for various combinations of single contingencies
- Recommended Solution: Replace bus and risers at Thelma and Busseyville stations and perform a sag study for the Big Sandy – Busseyville 138 kV line (B1491)
- Estimated Project Cost: \$0.65 M
- Expected IS Date: 12/31/2013



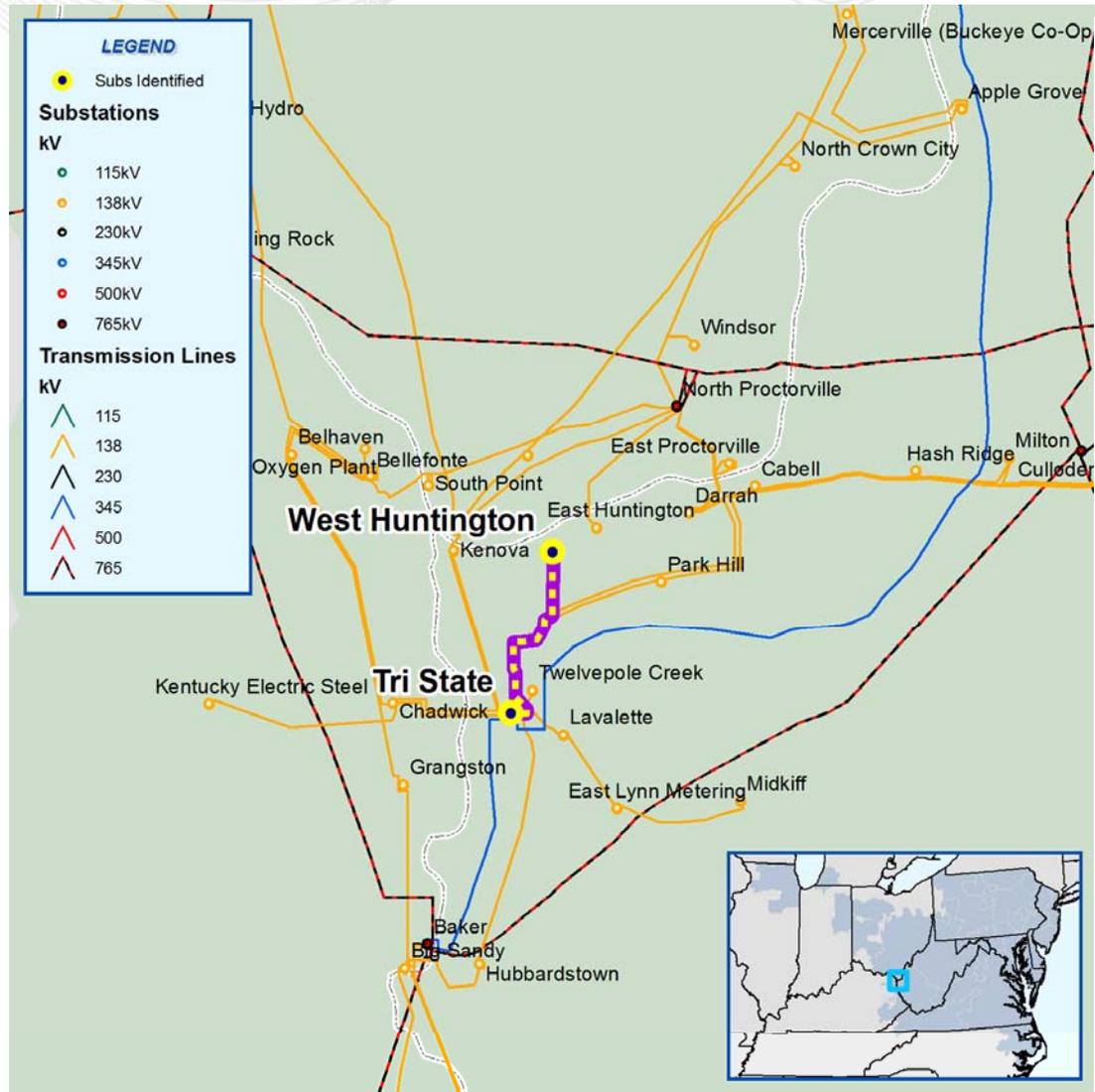
- N-1-1 Thermal Violation
- The South Side – Jackson Road 138 kV line is overloaded for various N-1-1 contingency combinations at Olive, Laporte, South Bend, and Twin Branch
- Recommended Solution: Replacement of risers at South Side and performance of a sag study for the 1.91 miles of 795 ACSR section is expected to improve the Summer Emergency rating to 335 MVA (B1441)
- Estimated Project Cost: \$0.3 M
- Expected IS Date: 12/31/2011



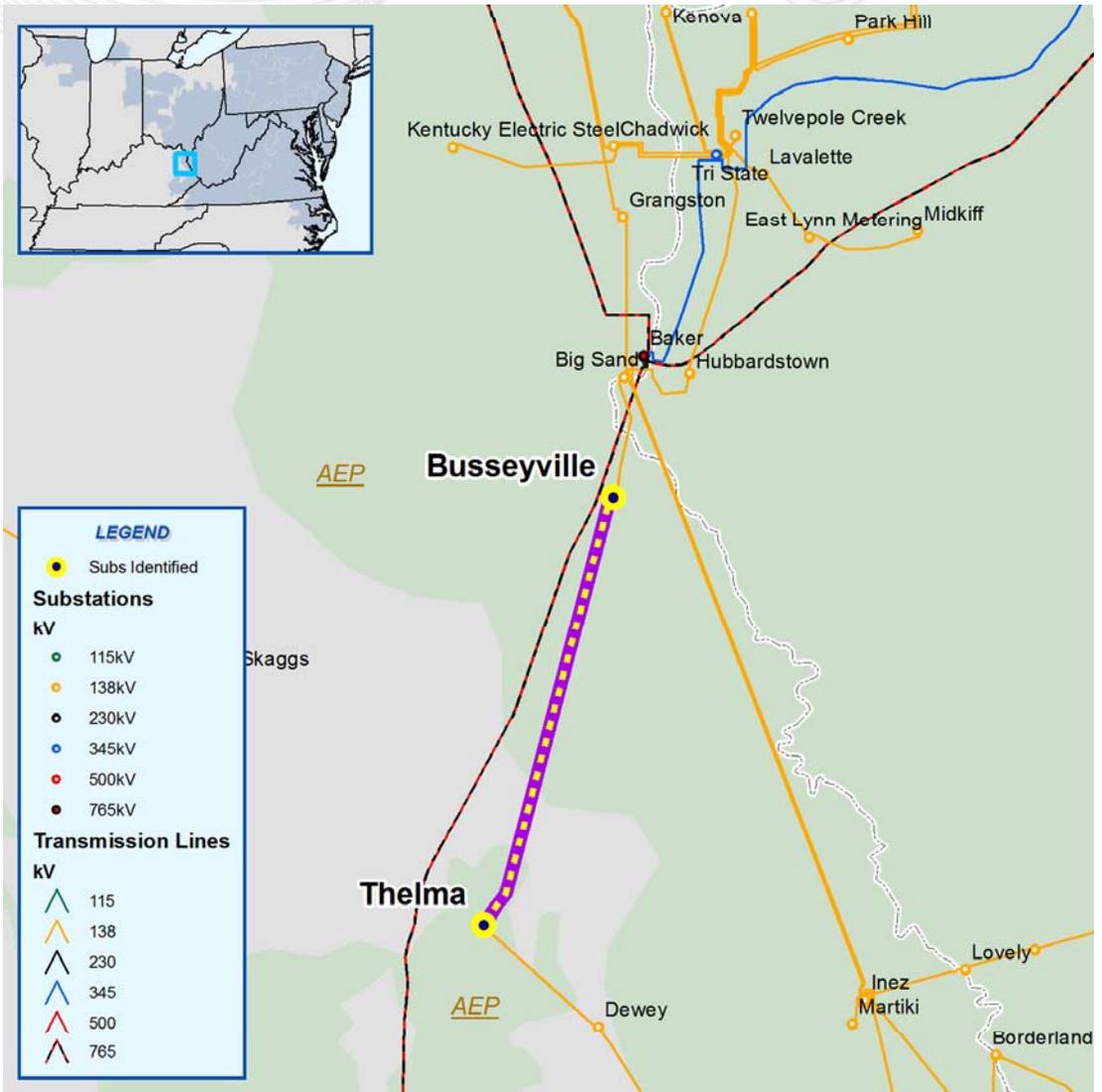
- N-1-1 Thermal Violation
- The Johnson Mountain - Otter 138 kV line is overloaded for various combinations of single contingencies
- Recommended Solution: Replace 138 kV bus and risers at Johnson Mountain Station (B1496)
- Estimated Project Cost: \$0.6 M
- Expected IS Date: 6/1/2015



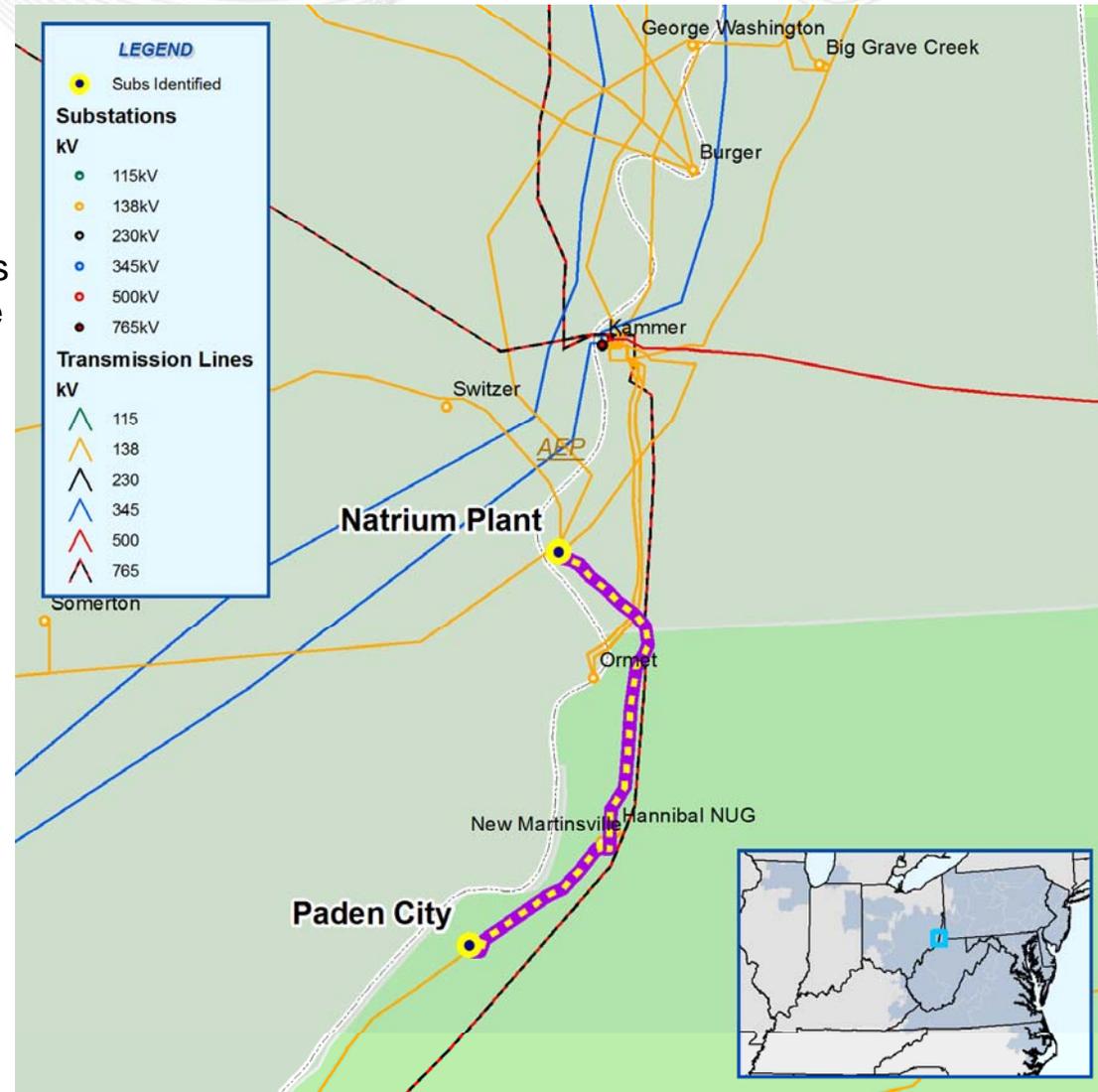
- Baseline Thermal Violation
- The West Huntington – Tri State 138 kV line is overloaded for the Baker – Hanging Rock 765 kV line fault with the stuck breaker at Baker
- Recommended Solution: Replace risers in the West Huntington Station to increase the line ratings which would eliminate the overloads for the contingencies listed (B1433)
- Estimated Project Cost: \$0.1 M
- Expected IS Date: 6/1/2015



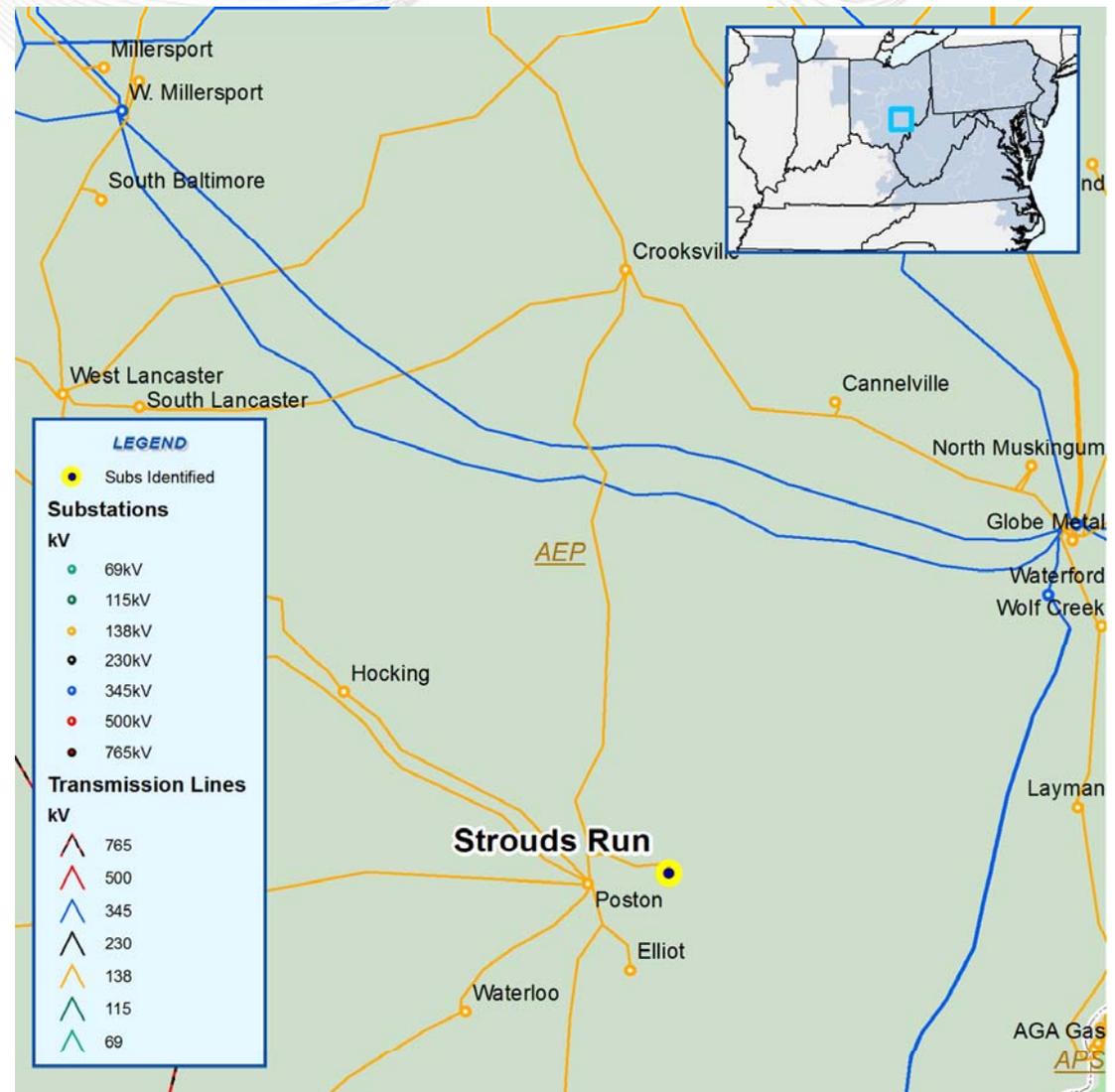
- Baseline Thermal Violation
- The Busseyville – Thelma 138 kV line is overloaded for the fault of the Baker – BroadFord 765 kV line with stuck breaker at Baker
- Recommended Solution: Station work at Thelma and Busseyville Stations will be performed to replace bus and risers (B1443)
- Estimated Project Cost: \$0.2 M
- Expected IS Date: 6/1/2015



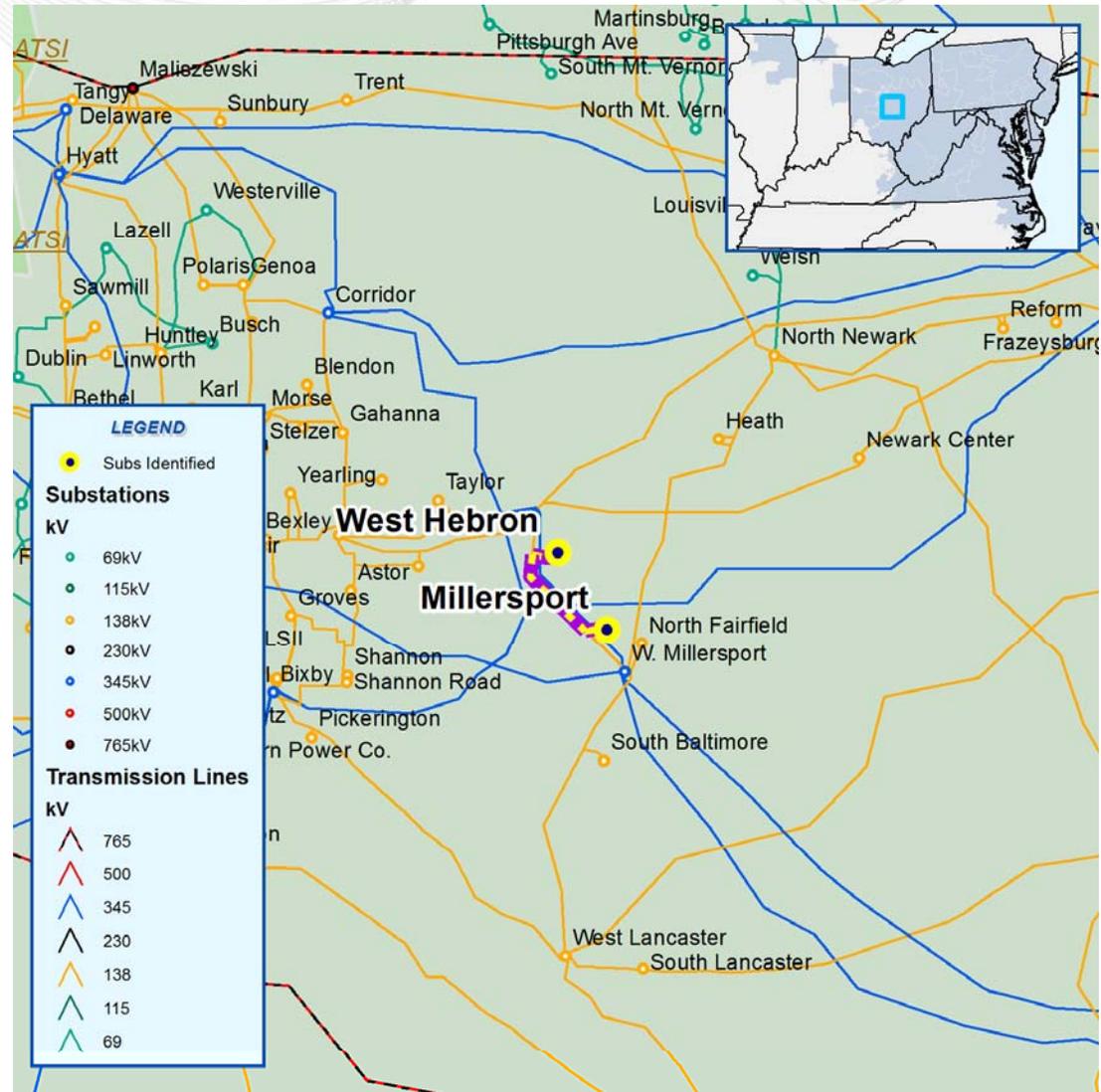
- N-1-1 Thermal Violation
- Natrium – PadenCity (AP) 138 kV (AKA the Natrium – North Martin138 kV) line is overloaded for the loss of the Kammer – Belmont – Mountaineer 765 kV line and the loss of the Belmont – Harrison 500 kV line
- Recommended Solution: Replace meter, metering CTs and associated equipment at the Paden City feeder (B1461)
- Estimated Project Cost: \$0.4 M
- Expected IS Date: 6/1/2015



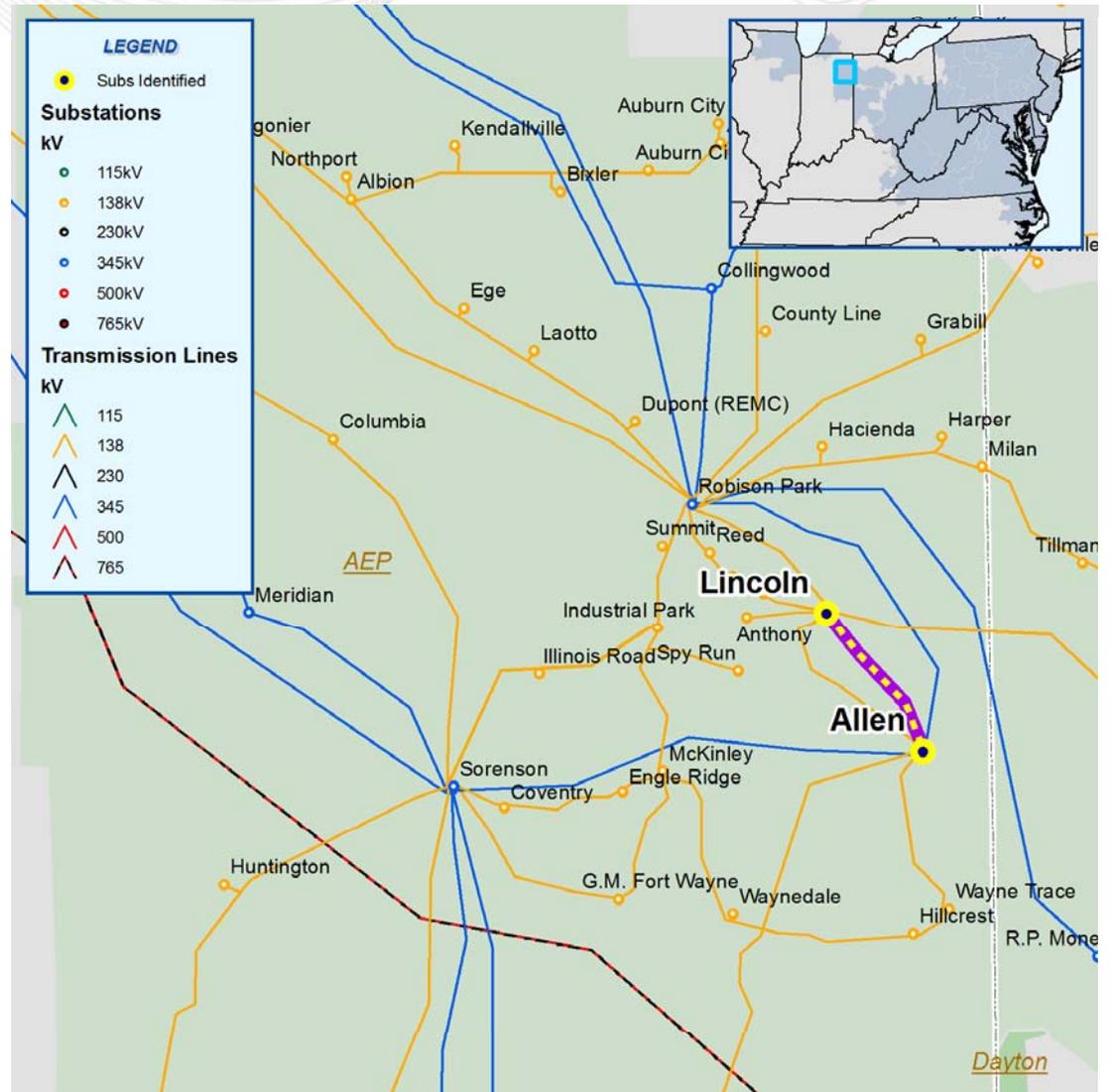
- Generation Deliverability Violation
- The Strouds - Strouds Run 138 kV line is overloaded for the loss of the Dexter - Elliot Tap 138 kV line, Elliot Tap - Elliot 138 kV line, and Elliot Tap - Poston 138 kV line
- Recommended Solution: Upgrade Strouds Run – Strouds Tap 138 kV relay and riser (B1478)
- Estimated Project Cost: \$0.055 M
- Expected IS Date: 6/1/2015



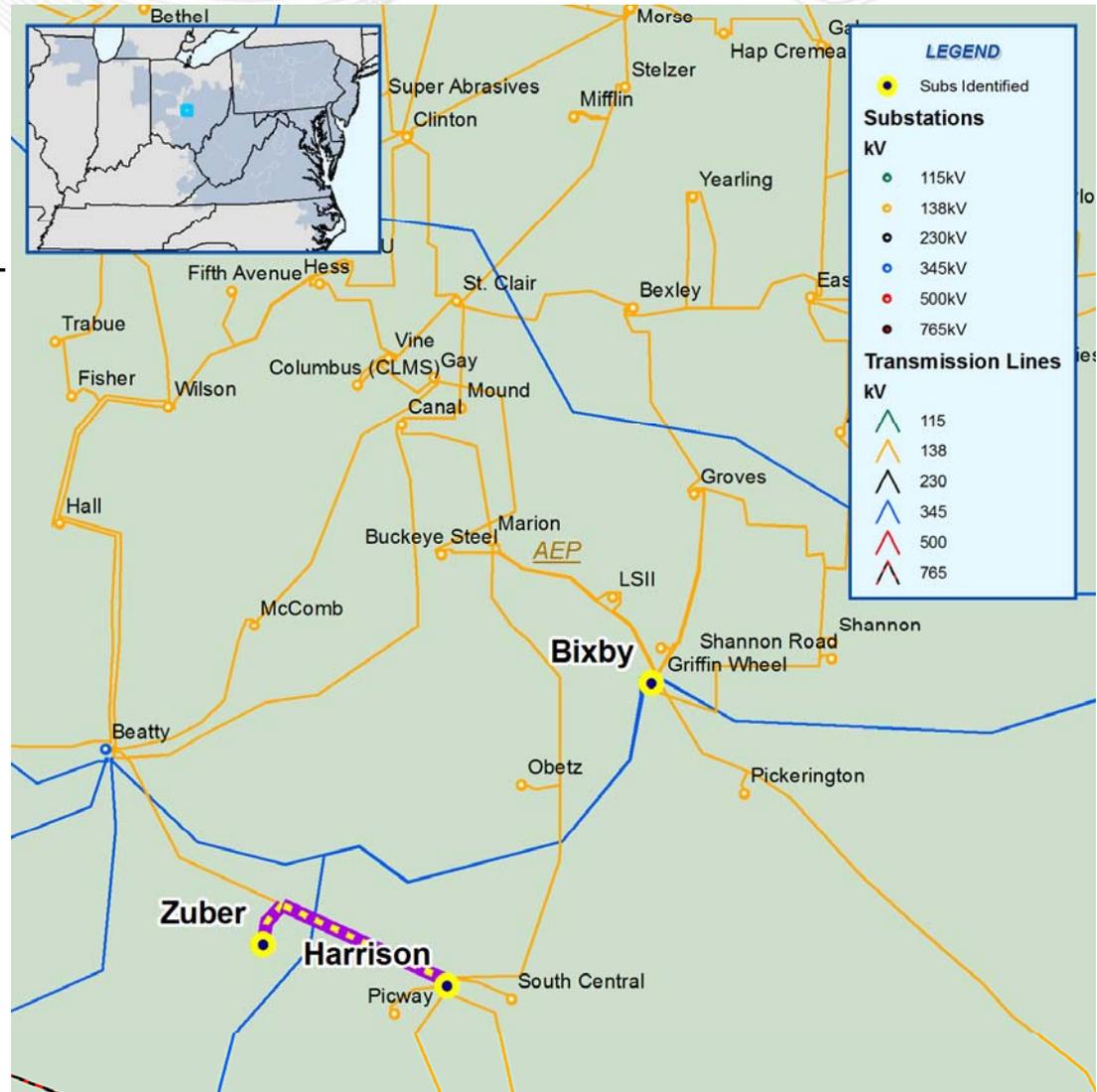
- N-1-1 Thermal Violation
- The Millersport - West Hebron 138 kV line is overloaded for the loss of the Hyatt - West Millersport 345 kV line and the loss of Kirk-West Millersport 345 kV line
- Recommended Solution: West Hebron station upgrades (B1479)
- Estimated Project Cost: \$0.05 M
- Expected IS Date: 6/1/2015



- N-1-1 Thermal Violation
- The Lincoln – Allen 138 kV line is overloaded for the loss of the Allen – Lincoln 138 kV line and the loss of Robison Park 345/138 kV transformer
- Recommended Solution: By replacing the risers at Lincoln both the Summer Normal and Summer Emergency ratings will improve to 268 MVA (B1439)
- Estimated Project Cost: \$0.05 M
- Expected IS Date: 6/1/2015



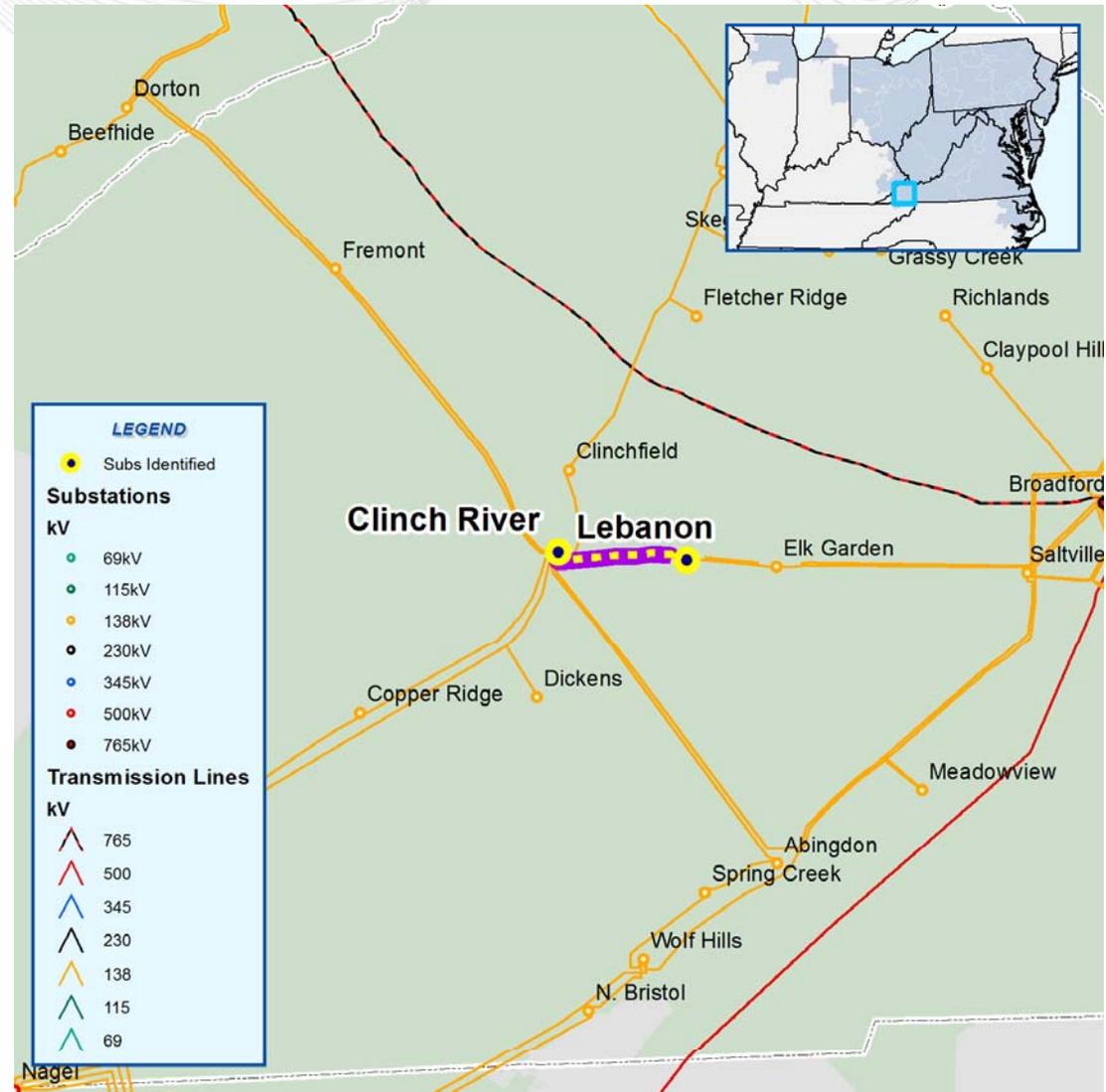
- N-1-1 Thermal Violation
- The Circleville - Zuber – Harrison 138 kV line is overloaded for the loss of the Beatty – Adkins 345 kV line and the loss of the Bixby - North fork 345 kV line or for the loss of the Harrison - Obetz - Marion 138 kV line and the loss of Bixby - North fork 345 kV line
- Recommended Solution: The Circleville – Harrison 138 kV circuit could benefit from the installation of three new 345 kV breakers at Bixby to separate the Marquis 345 kV line and transformer # 2. In addition, operating the 138 kV circuit from Circleville to Harrison and the branch from Harrison – Zuber 138 kV up to its conductor emergency ratings (B1458)
- Estimated Project Cost: \$0.078 M
- Expected IS Date: 6/1/2015



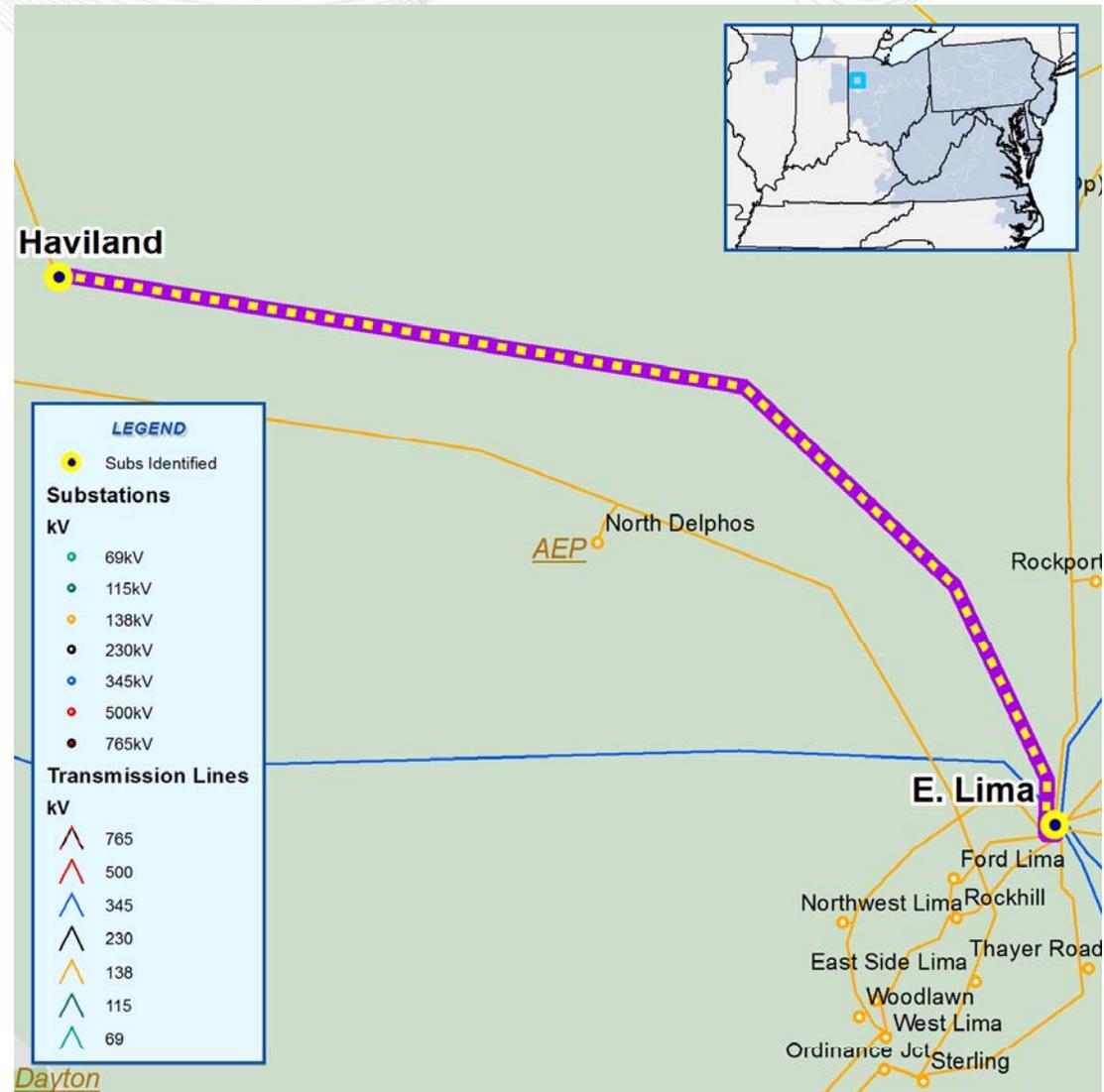
- Common Mode Contingency Violation
- The Corner – Washington MP 138 kV circuit is overloaded for the tower outage of the Belmont – Trissler 138 kV line and the Belmont - Edgelawn 138 kV line
- Recommended Solution: Corner 138 kV upgrades (B1464)
- Estimated Project Cost: \$0.15 M
- Expected IS Date: 6/1/2015



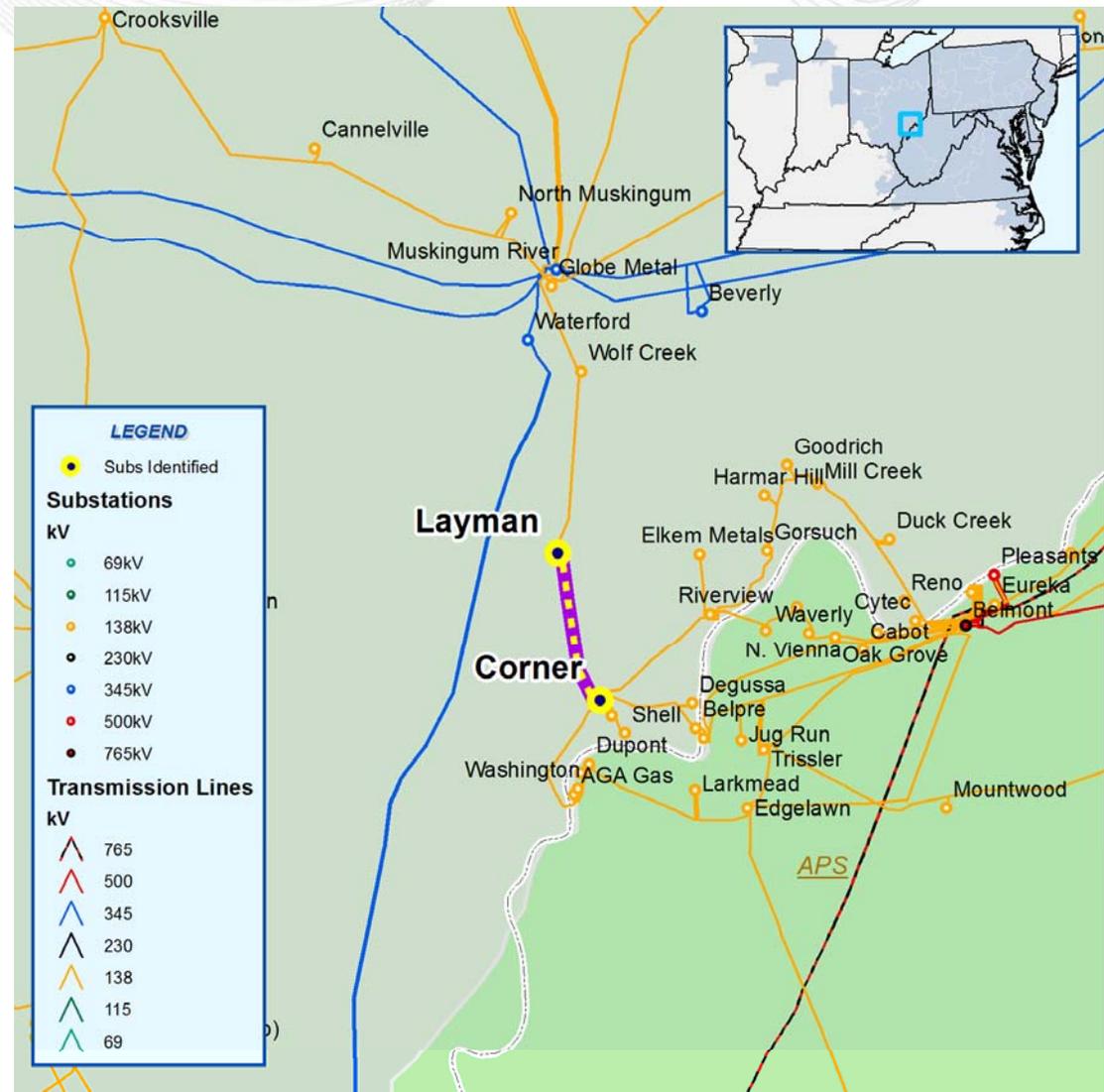
- Common Mode Contingency Violation
- The Clinch River - Lebanon 138 kV line is overloaded for various common mode contingencies
- Recommended Solution: Sag Study 1 mile of the Clinch River – Saltville 138kV line and replace the risers and bus at Clinch River, Lebanon, and Elk Garden Stations (B1483)
- Estimated Project Cost: \$0.22 M
- Expected IS Date: 12/31/2013



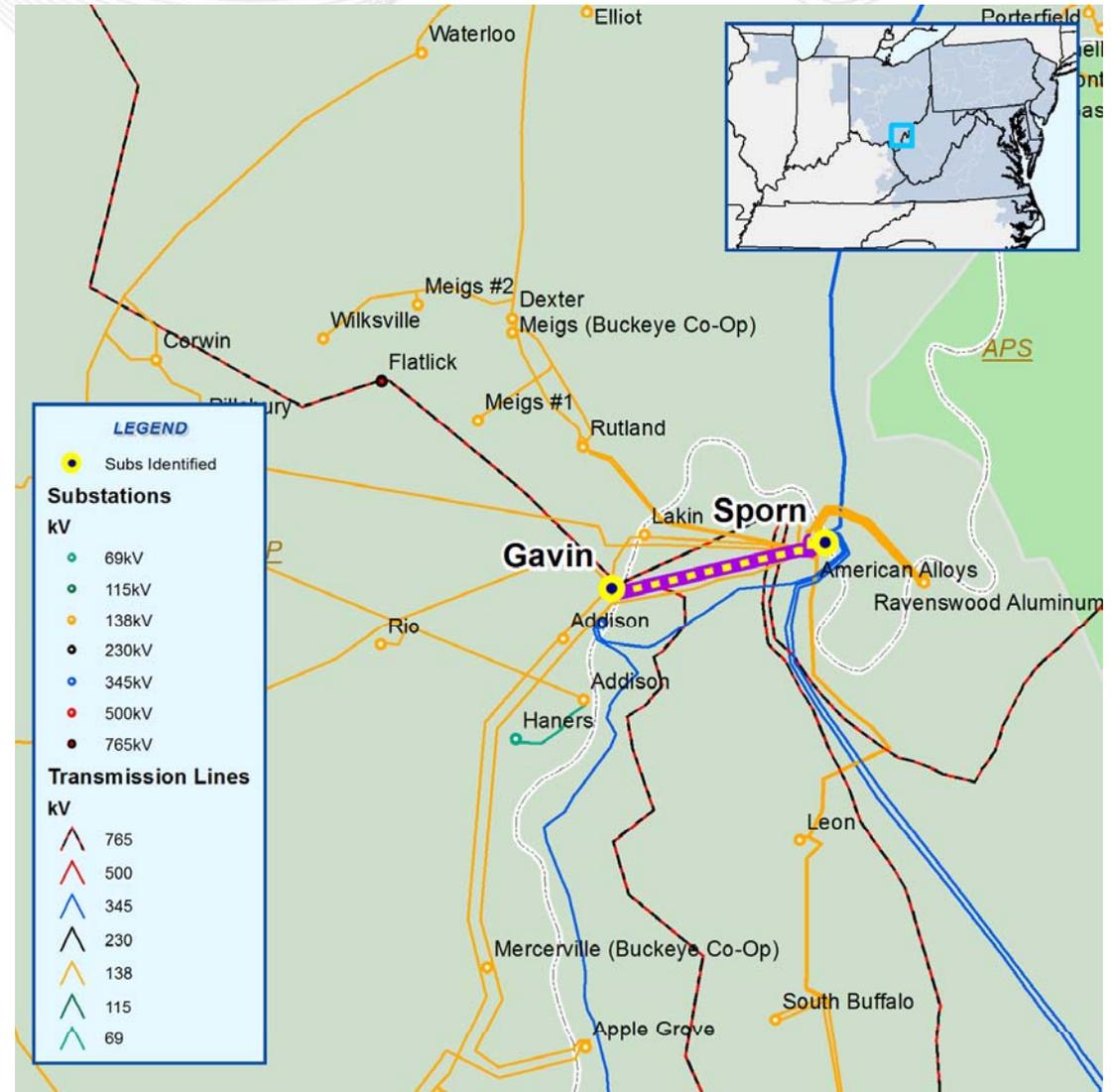
- N-1-1 Thermal Violation
- The East Lima - Haviland 138 kV line is overloaded for the loss of the East Side - North Delphos 138 kV line and the loss of Convoy - Robison Park 345 kV or the Robison Park 345/138 kV transformer
- Recommended Solution: Perform a sag study on the East Lima - Haviland 138 kV line to increase the emergency rating (B1472)
- Estimated Project Cost: \$0.14 M
- Expected IS Date: 12/31/2012



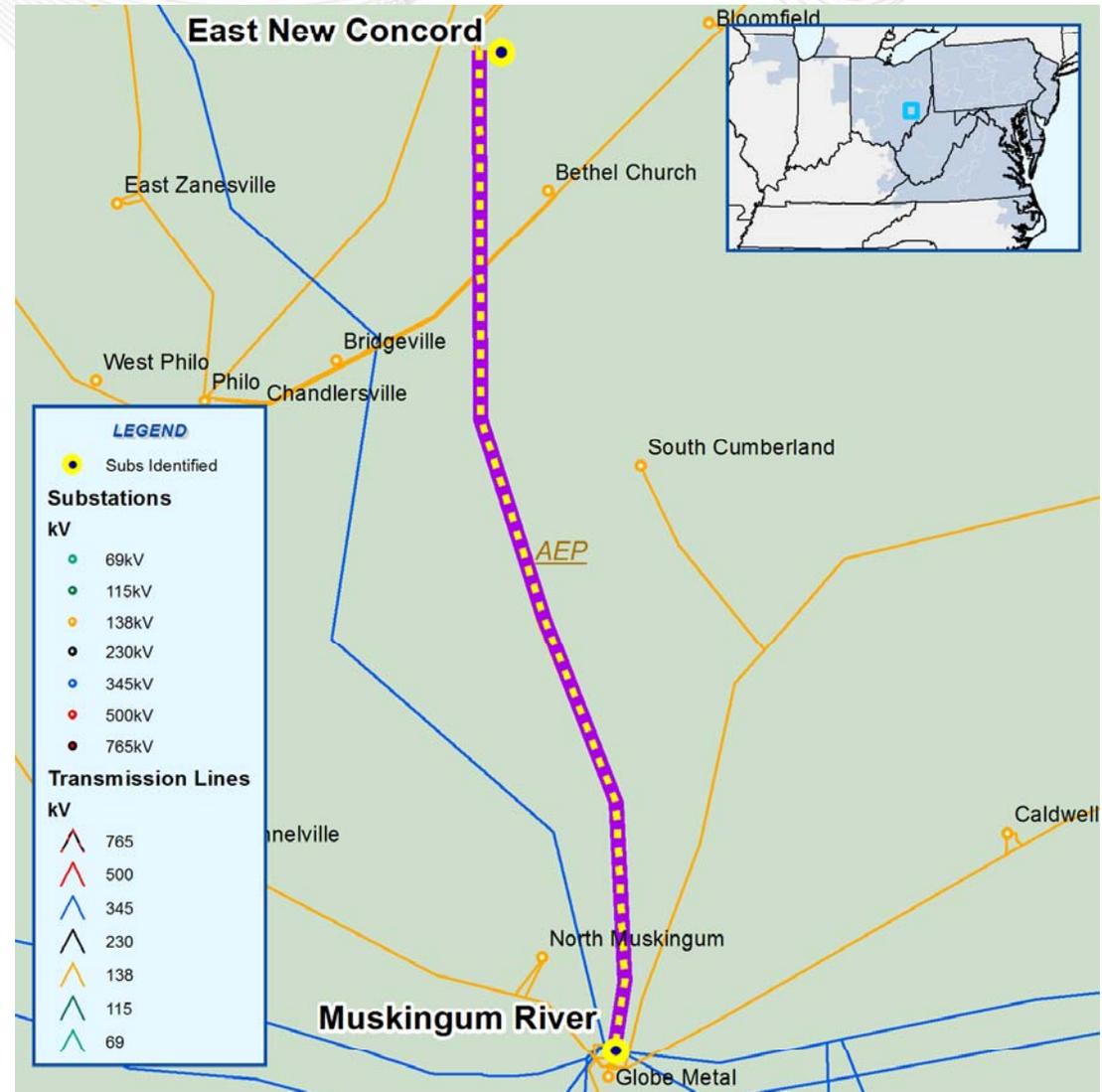
- N-1-1 Thermal Violation
- The Corner - Layman 138 kV line is overloaded for the loss of the Mountaineer – Belmont - Kammer 765 kV line and Belmont 765/500 kV transformer and the loss of the Belmont – Harrison 500 kV line
- Recommended Solution: Perform upgrades and a sag study on the Corner – Layman 138 kV section of the Corner – Muskingum River 138 kV circuit (B1480)
- Estimated Project Cost: \$0.2 M
- Expected IS Date: 12/31/2013



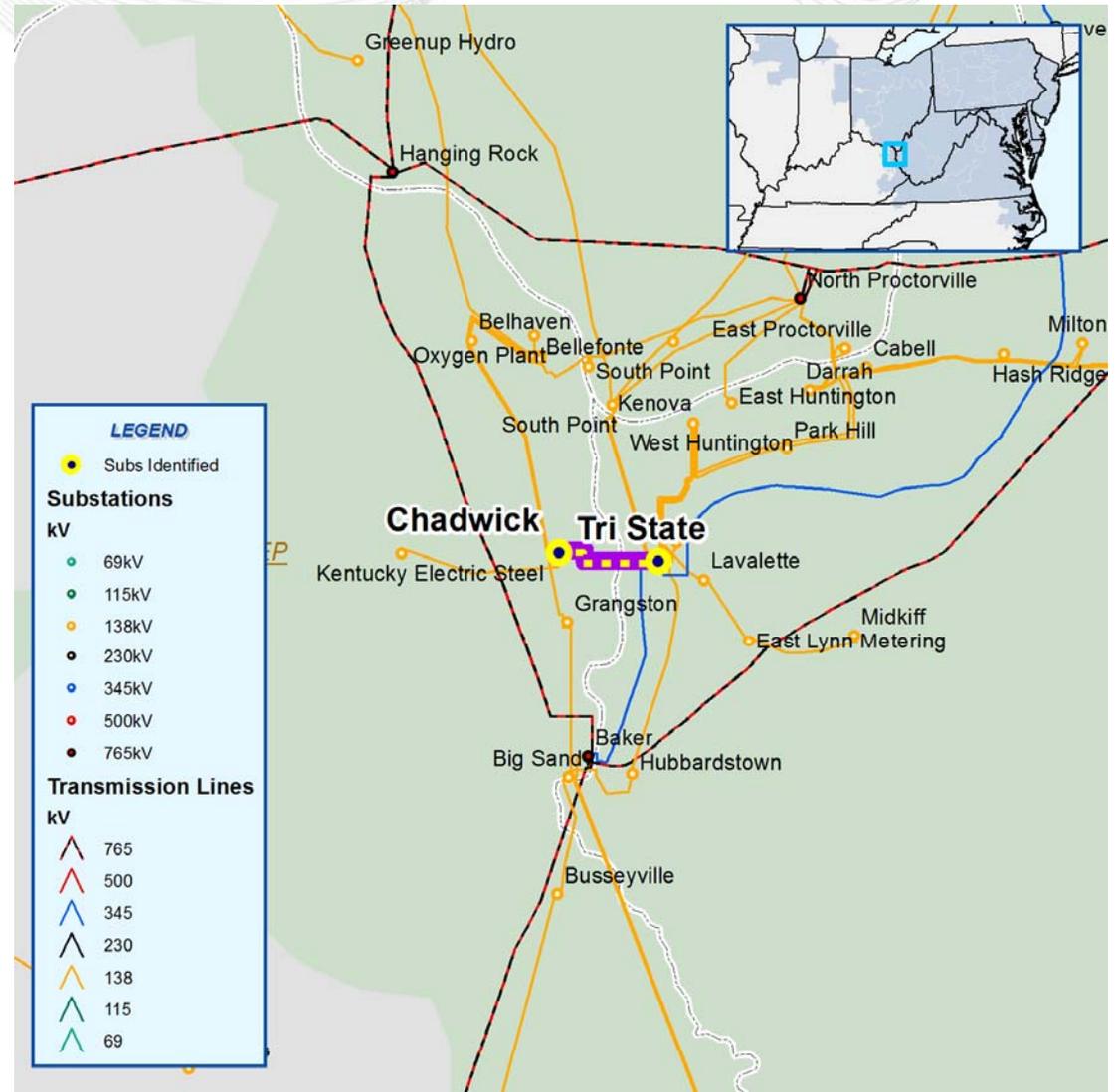
- N-1-1 Thermal Violation
- The Sporn A - Gavin 138 kV line is overloaded for various combinations of single contingencies
- Recommended Solution: These lines have been de-rated to their summer normal conductor rating. A sag study will be performed to determine if the emergency rating can be improved (B1499)
- Estimated Project Cost: \$0.16 M
- Expected IS Date: 12/31/2013



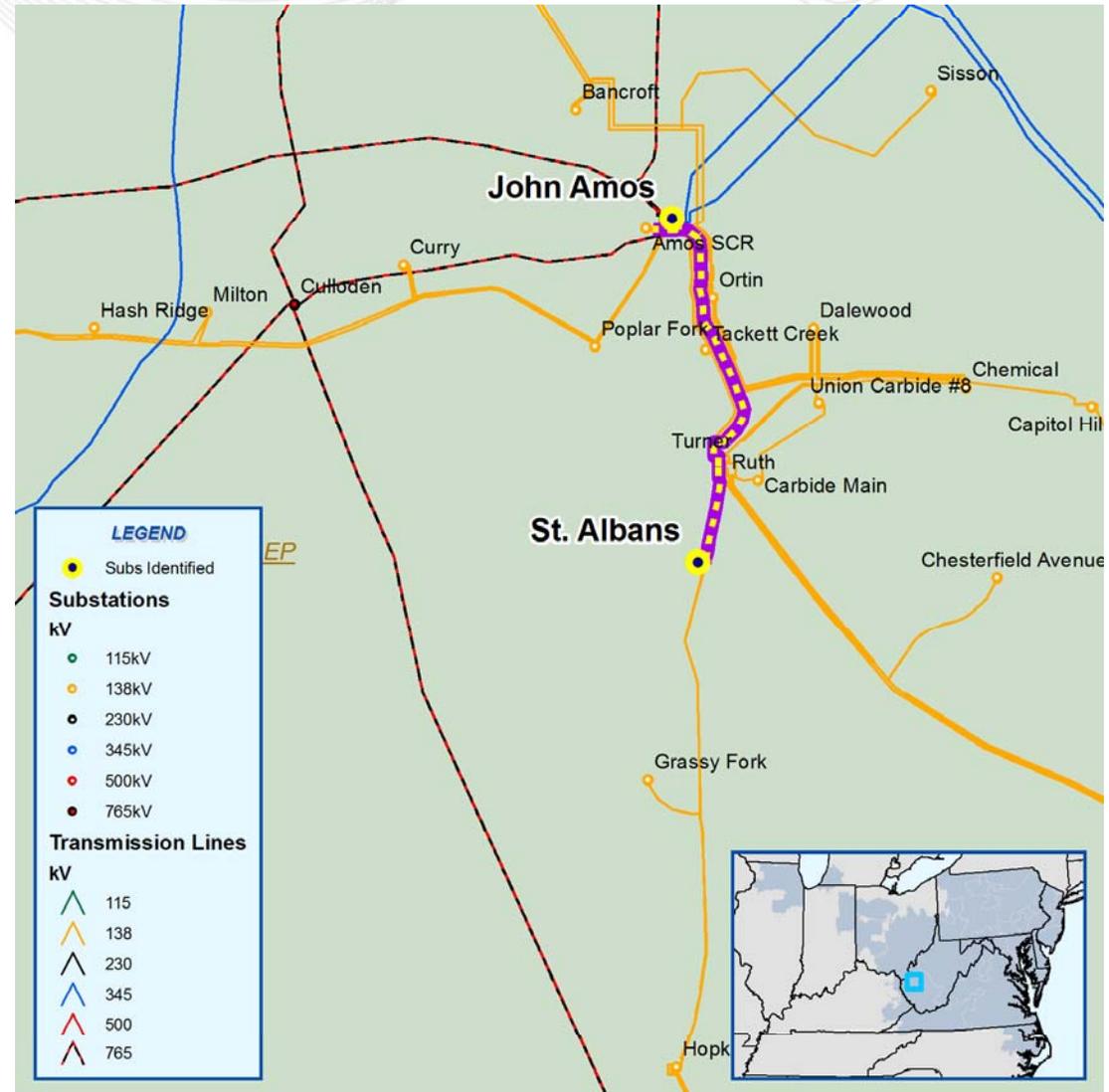
- N-1-1 Thermal Violation
- The East New Concord-Muskingum River 138 kV line is overloaded for the loss of the South Canton 765/345 kV transformer and the loss of Ohio Central-Muskingum River 345 kV
- Recommended Solution: Perform a sag study on the East New Concord – Muskingum River section of the Muskingum River – West Cambridge 138 kV circuit (B1473)
- Estimated Project Cost: \$0.15 M
- Expected IS Date: 12/31/2012



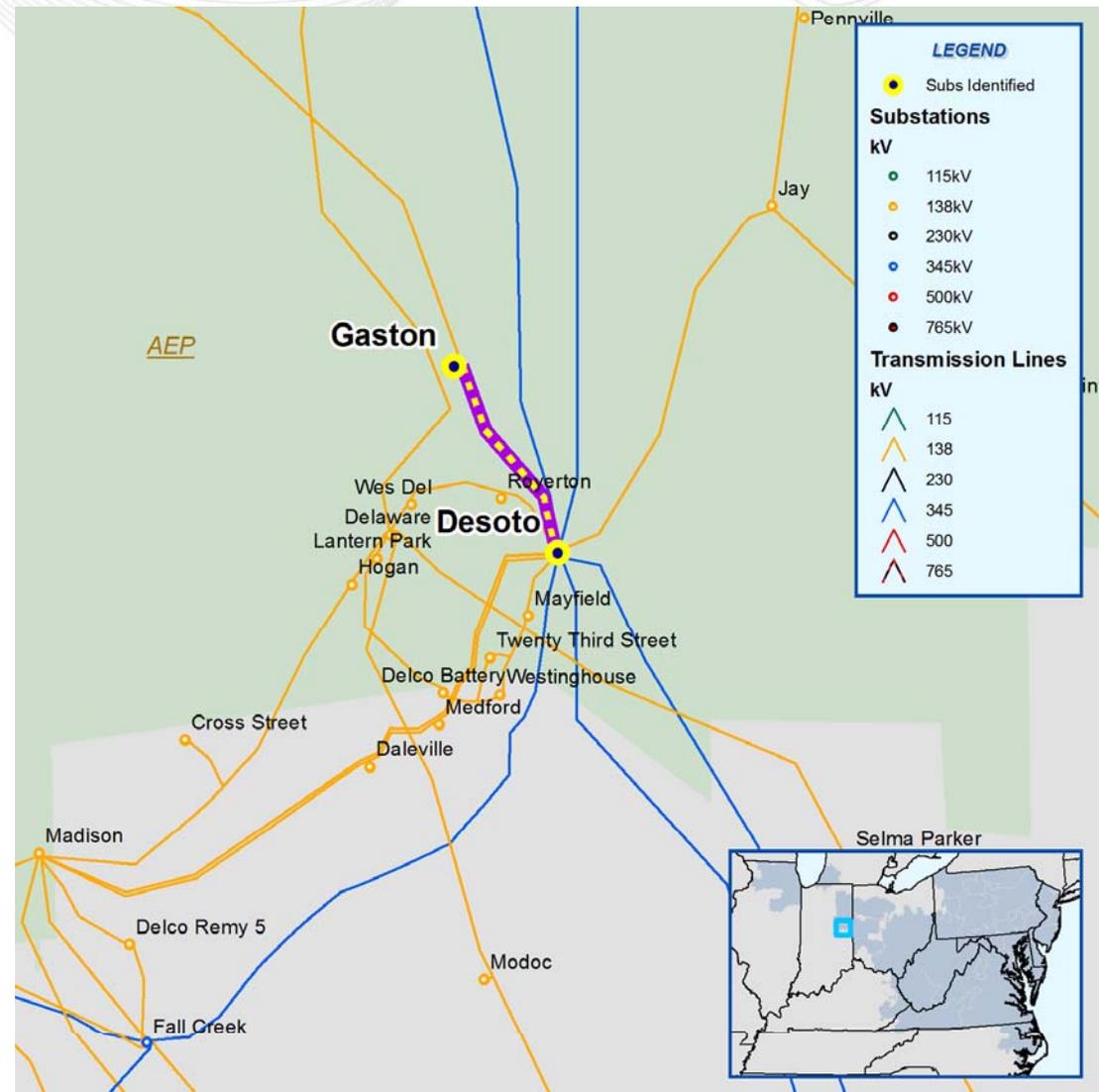
- N-1-1 Thermal Violation
- The Tristate - Chadwick #1 and #2 138 kV lines are overloaded for various combinations of single contingencies
- Recommended Solution: A sag study must be performed for the 5.40 mile Tristate – Chadwick 138 kV line to determine if a higher emergency rating can be used (B1489)
- Estimated Project Cost: \$0.3 M
- Expected IS Date: 12/31/2013



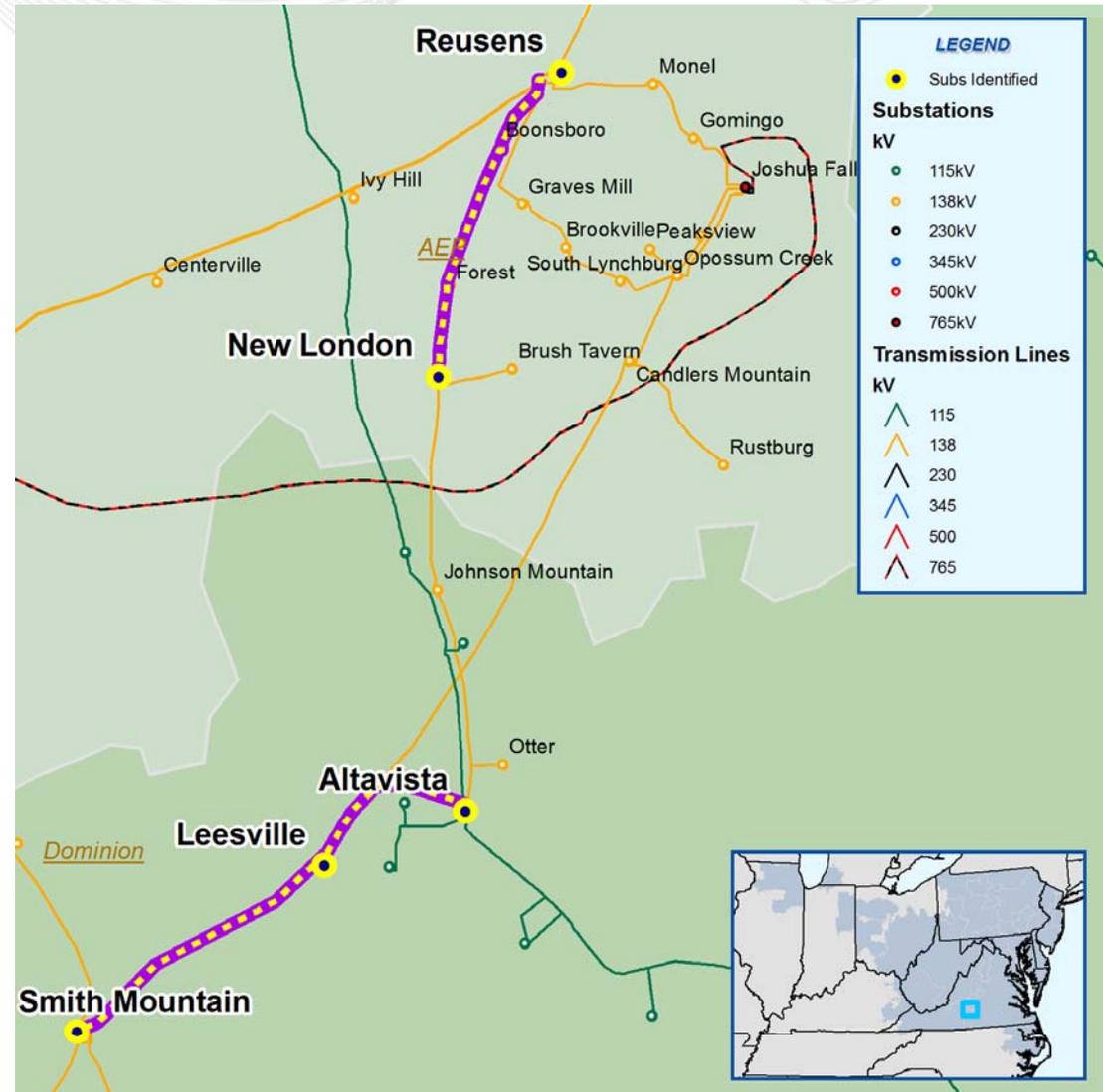
- N-1-1 Thermal Violation
- The John Amos – St. Albans 138 kV line is overloaded for the loss of the Baker – Broadford 765 kV line and the loss of Culloden - Wyoming 765 kV line
- Recommended Solution: Sag studies may allow for operation of these circuits up to their conductor emergency ratings which would eliminate the overloads for the contingencies listed (B1422)
- Estimated Project Cost: \$0.3 M
- Expected IS Date: 12/31/2011



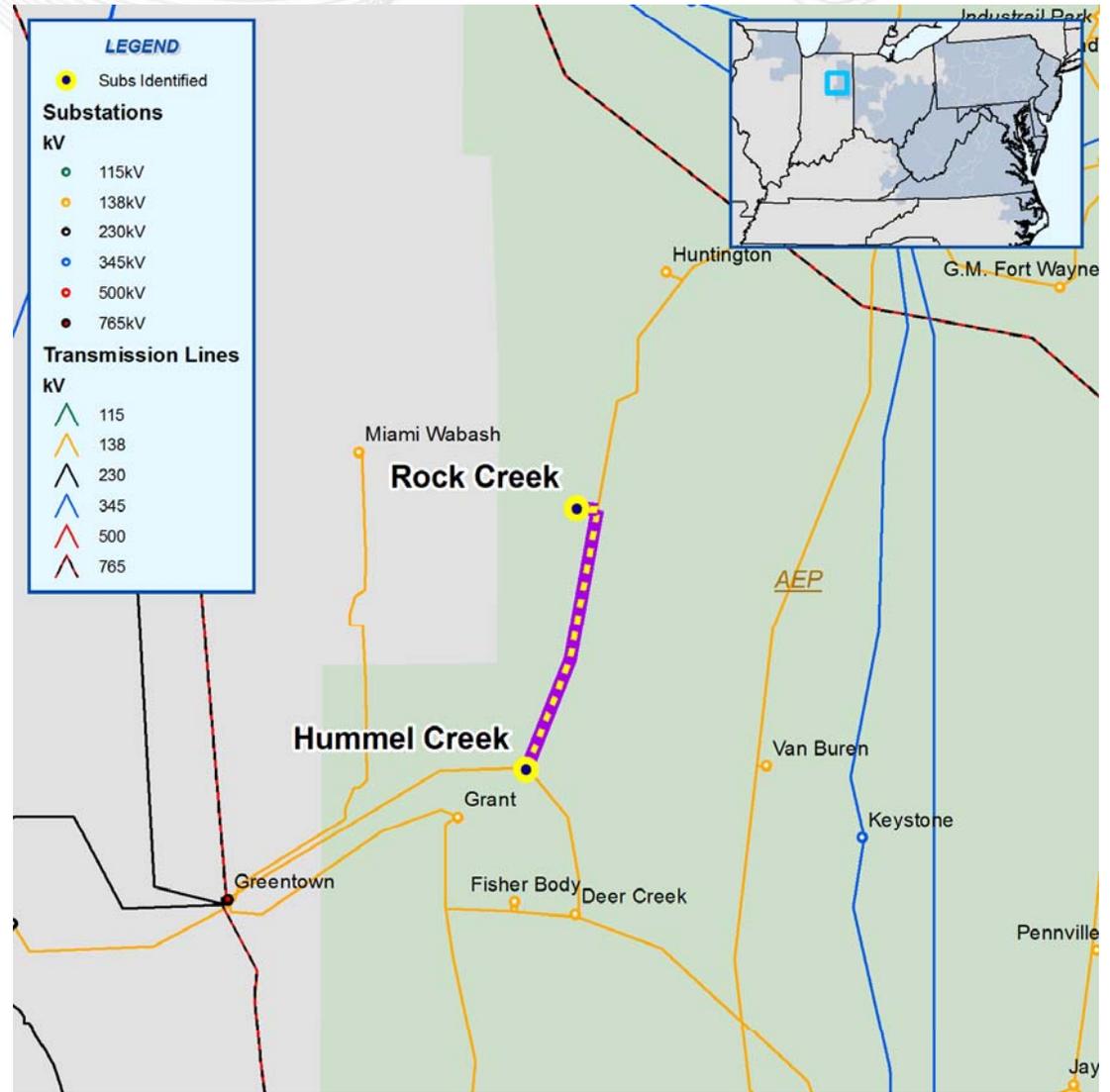
- N-1-1 Thermal Violation
- The Gaston - Desoto 138 kV line is overloaded for the loss of the Linwood – Rosehill - Pendleton 138 kV line and the loss of the Greentown - Jefferson 765 kV line
- Recommended Solution: Perform a sag study on the Desoto – Deer Creek 138 kV line to increase the emergency rating (B1416)
- Estimated Project Cost: \$0.1216 M
- Expected IS Date: 12/31/2011



- N-1-1 Thermal Violation
- The Smith Mountain – Leesville – Altavista - Otter 138 kV line and Boones - Forest - New London – JohnMT – Otter 138 kV line are overloaded for various N-1-1 contingency combinations
- Recommended Solution: Sag studies may allow for operation of these circuits up to their conductor emergency ratings which would eliminate the overloads for the contingencies listed (B1427)
- Estimated Project Cost: \$0.184 M
- Expected IS Date: 12/31/2011



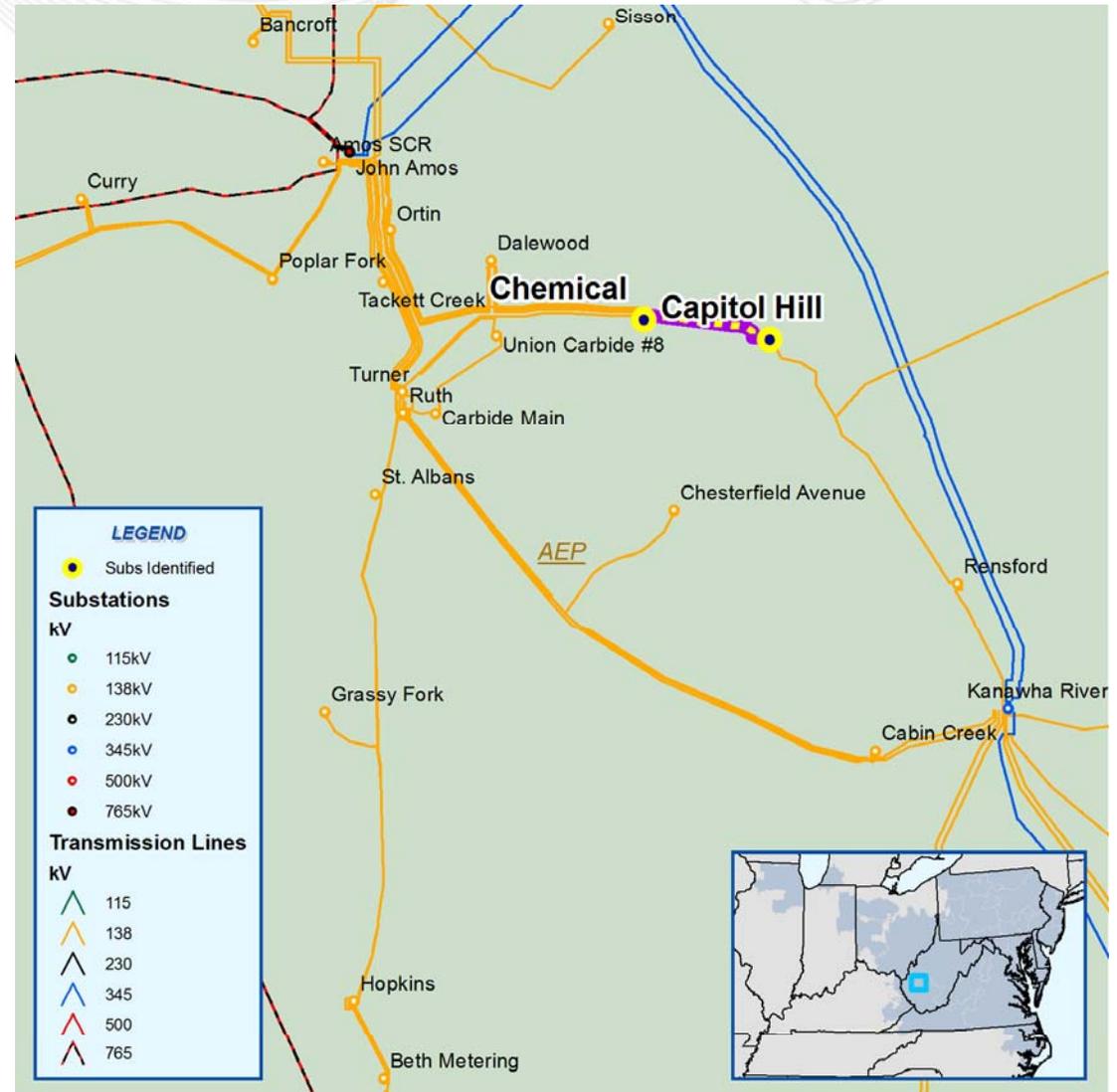
- N-1-1 Thermal Violation
- The Rock Creek – Hummel Creek 138 kV line is overloaded for the loss of the Greentown 138kV – Mier - Wabash 138 kV line, and the loss of Dumont - Greentown 765 kV line
- Recommended Solution: a sag study will be required to increase the emergency MOT for the line, station work at Huntington Junction station to replace bus and risers, and station work at Sorenson to replace the relays for the Hummel Creek – Huntington – Sorenson line. Depending on the outcome of the sag study, more action may be required in order to increase the rating. Because the section of line between Hummel Creek and Rock Creek and between Huntington Junction and Sorenson is only a section of the circuit that runs from Hummel Creek to Sorenson, the entire circuit will have the sag study performed upon it – approximately 33.5 miles (B1437)
- Estimated Project Cost: \$0.3 M
- Expected IS Date: 12/31/2011



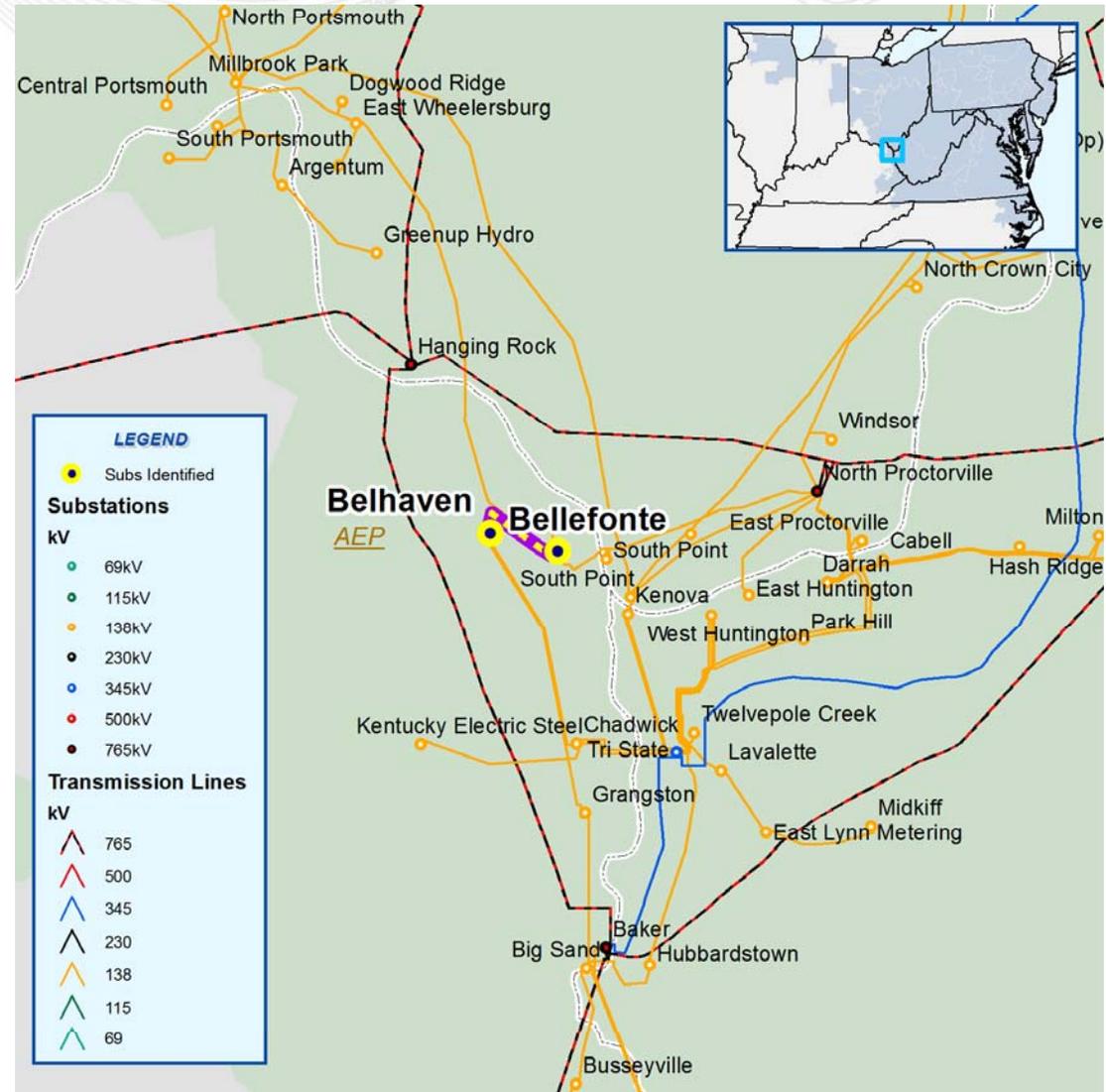
- N-1-1 Thermal Violation and Baseline Thermal Violation
- The Smith Mountain – Candler's Mountain 138 kV line is overloaded for the loss of the Jacksons Ferry – Cloverdale - Joshua Falls 765 kV line and Cloverdale 765/345 kV transformer; and the loss of the Leesville - Smith Mountain 138 kV line and Leesville Unit 1
- There is also a baseline thermal violation for the Joshua Falls – Cloverdale 765KV line fault with a stuck breaker at Cloverdale
- Recommended Solution: Sag studies may allow for operation of these circuits up to their conductor emergency ratings which would eliminate the overloads for the contingencies listed (B1428)
- Estimated Project Cost: \$0.132 M
- Expected IS Date: 12/31/2011



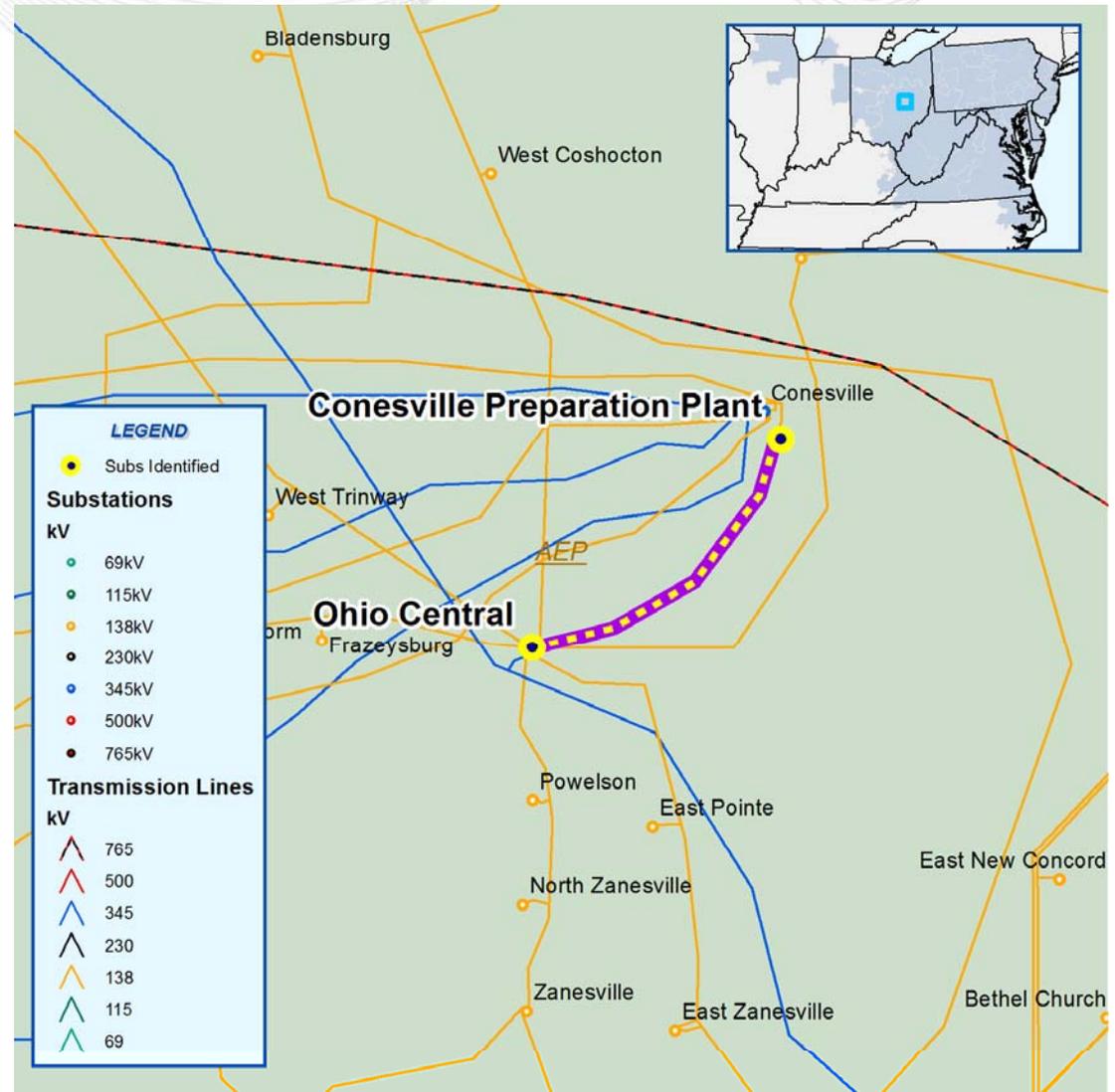
- Baseline Thermal Violation
- The Chemical – Capitol Hill 138 kV line is overloaded for the tower outage of the Amos – Kanawh 345 kV line and the Kanawh – Sporn 345 kV line
- Recommended Solution: A sag study will be performed on the Chemical - Capitol Hill 138 kV line to determine if the emergency rating can be utilized. If sag studies reveal no problems, the conductor emergency rating would eliminate potential overloads in the area. (B1423)
- Estimated Project Cost: \$0.1 M
- Expected IS Date: 12/31/2011



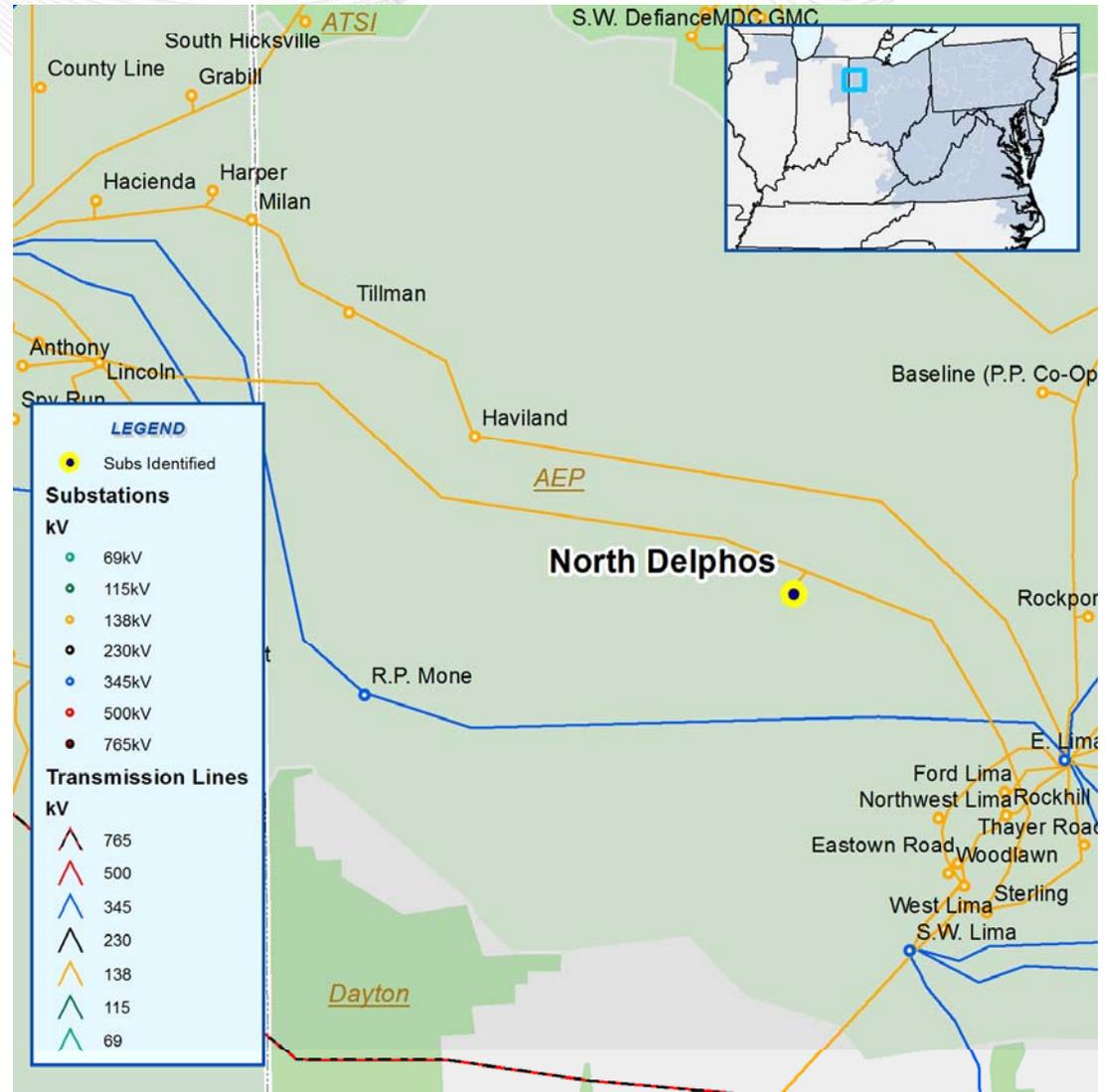
- Generator Deliverability Violation
- The Solida - Bellefonte 138 kV line is overloaded for various combinations of single contingencies
- Recommended Solution: Perform a sag study for the North Proctorville – Solida - Bellefonte 138 kV line to increase its emergency rating (B1494)
- Estimated Project Cost: \$0.09 M
- Expected IS Date: 12/31/2013



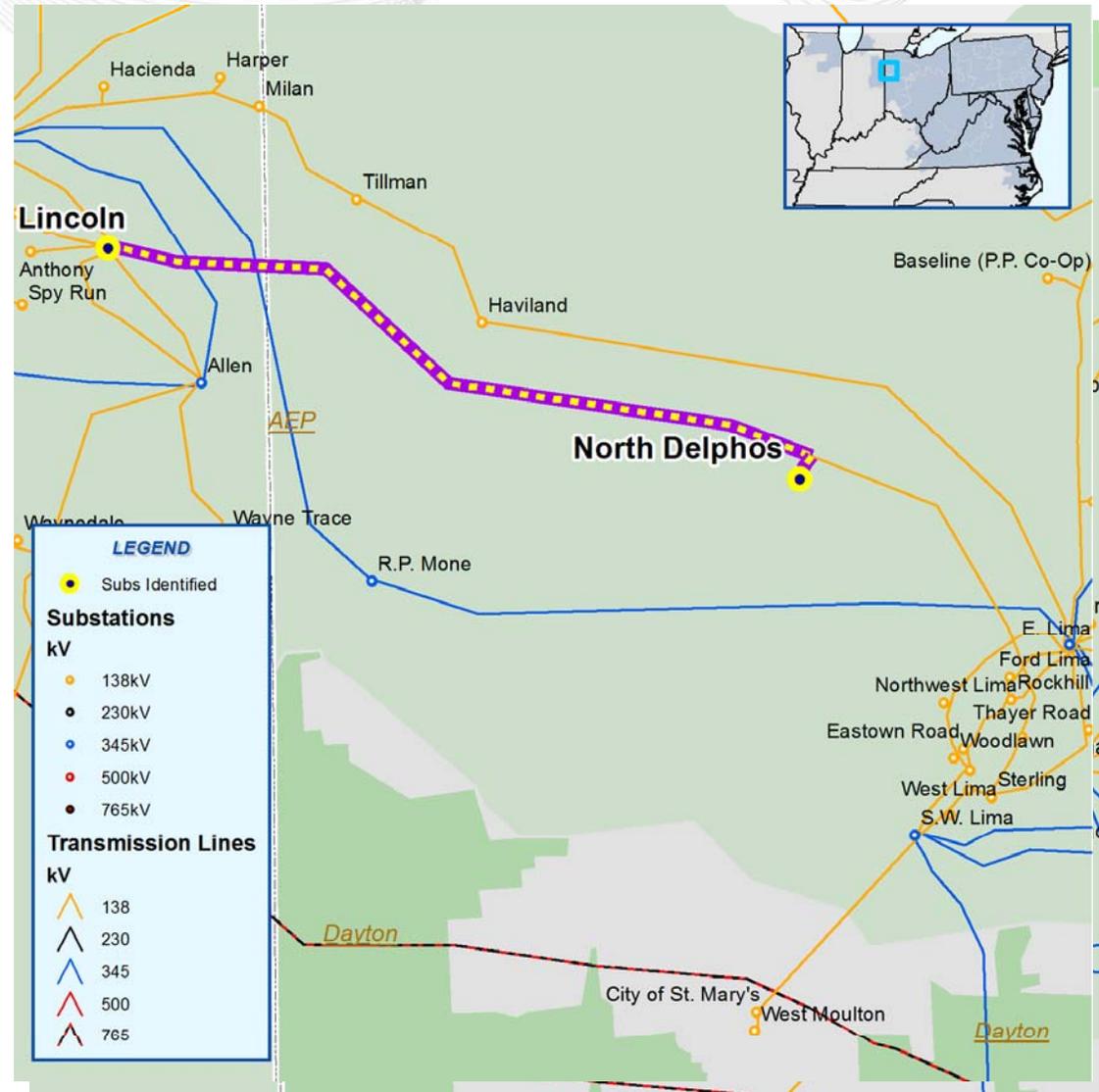
- N-1-1 Thermal Violation
- The Ohio Central - Prep Plant Tap 138 kV line is overloaded for various N-1-1 combinations
- Recommended Solution: Perform a sag study on the Ohio Central – Prep Plant tap 138 kV circuit (B1474)
- Estimated Project Cost: \$0.044 M
- Expected IS Date: 12/31/2012



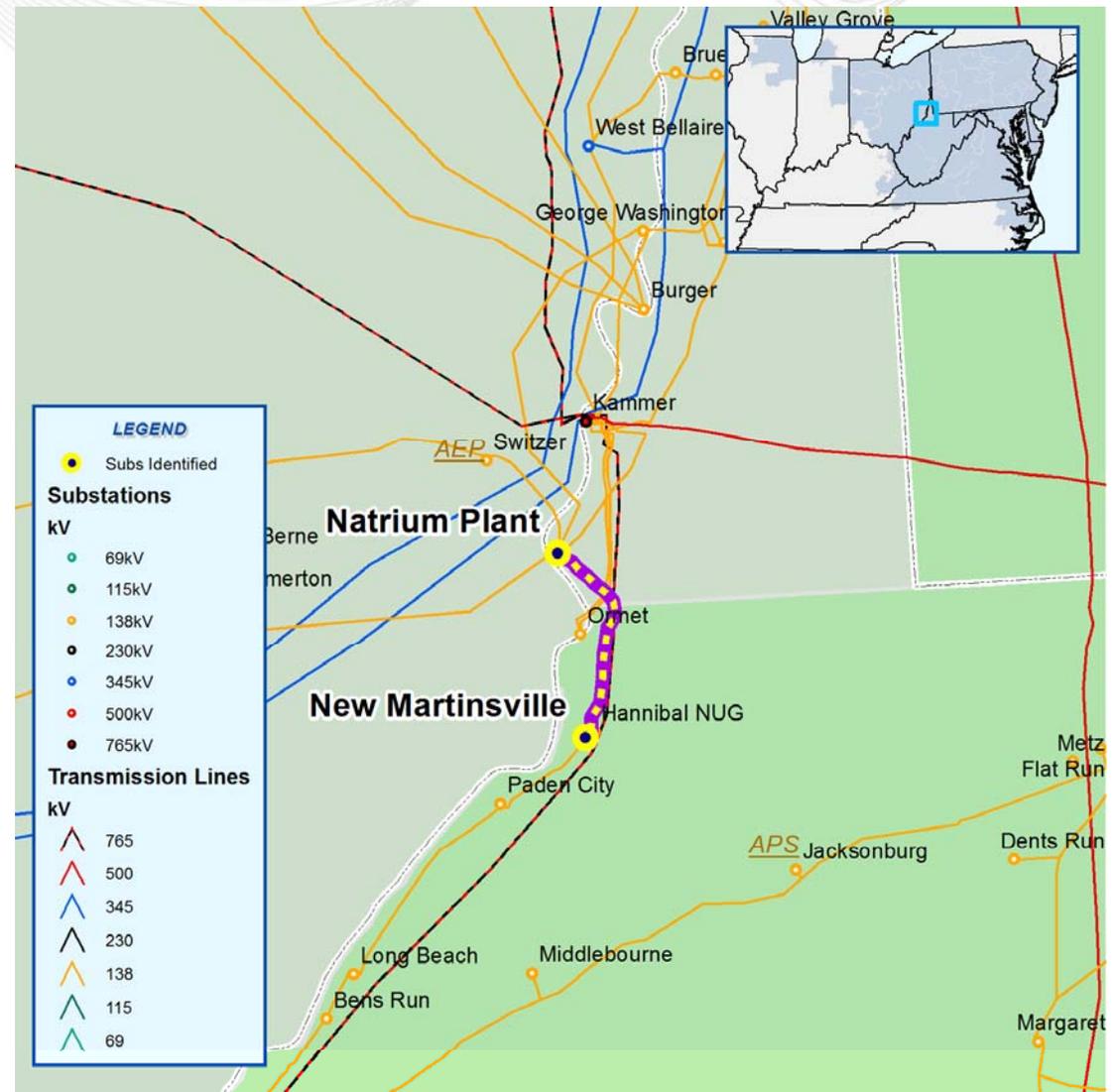
- Common Mode Contingency Violation
- The S-073a - North Delphos 138 kV line is overloaded for the loss of the Tillman – Dawkinss – Milan 138 kV line, Lincoln-T-131 Tap 138 kV line, Tillman-R-049 138 kV line, Tillman 345/138 kV transformer, and Hoffman-Tillman-St R14 345 kV line (B1475)
- Recommended Solution: Perform a sag study on the S73 – North Delphos 138 kV line to increase the emergency rating
- Estimated Project Cost: \$0.075 M
- Expected IS Date: 12/31/2012



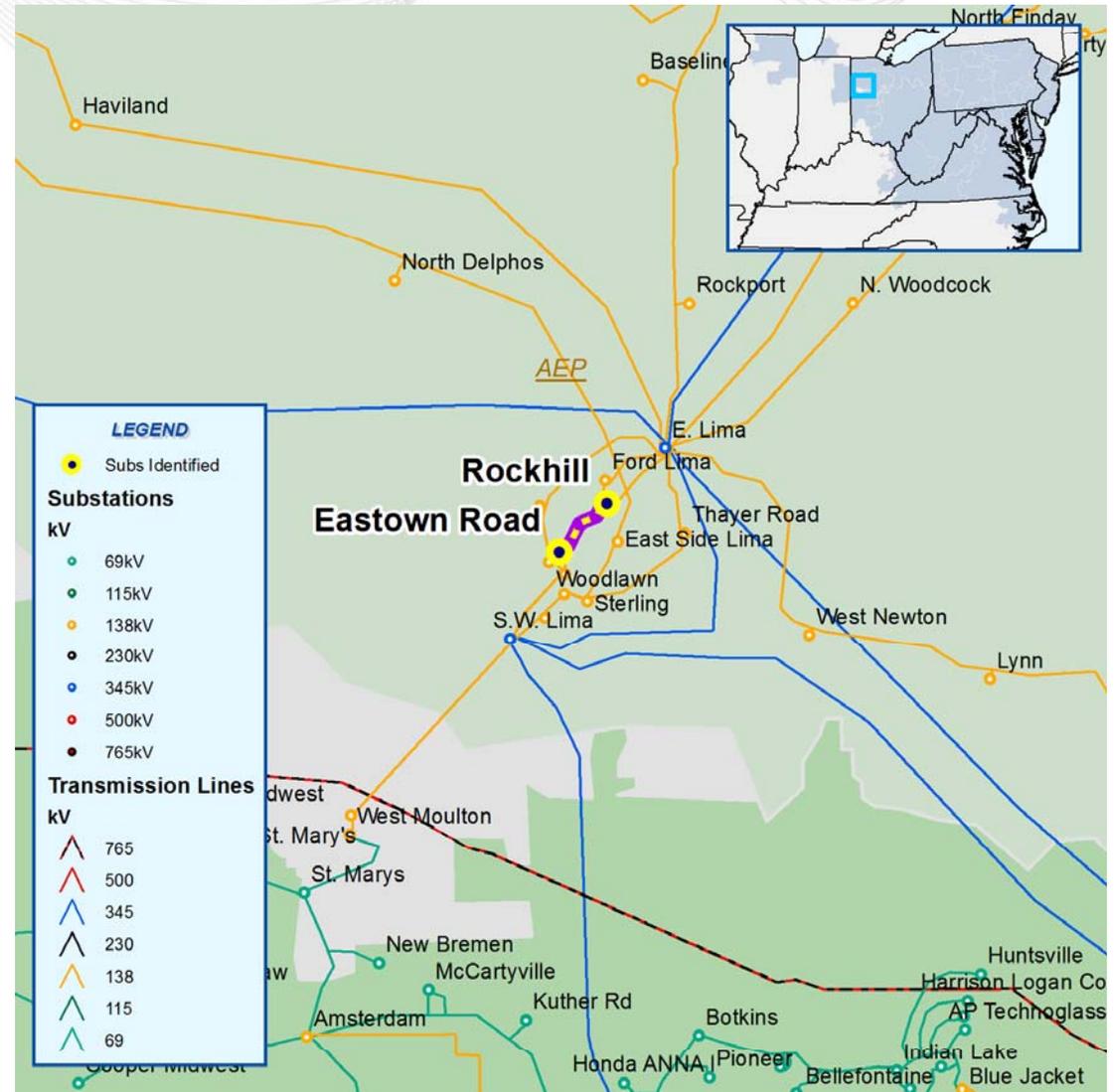
- Common Mode Contingency Violation
- The S73 - T131 Tap 138 kV line is overloaded for various common mode contingencies
- Recommended Solution: Perform a sag study on the S73 – T131 138 kV line to increase the emergency rating (B1476)
- Estimated Project Cost: \$0.03 M
- Expected IS Date: 12/31/2012



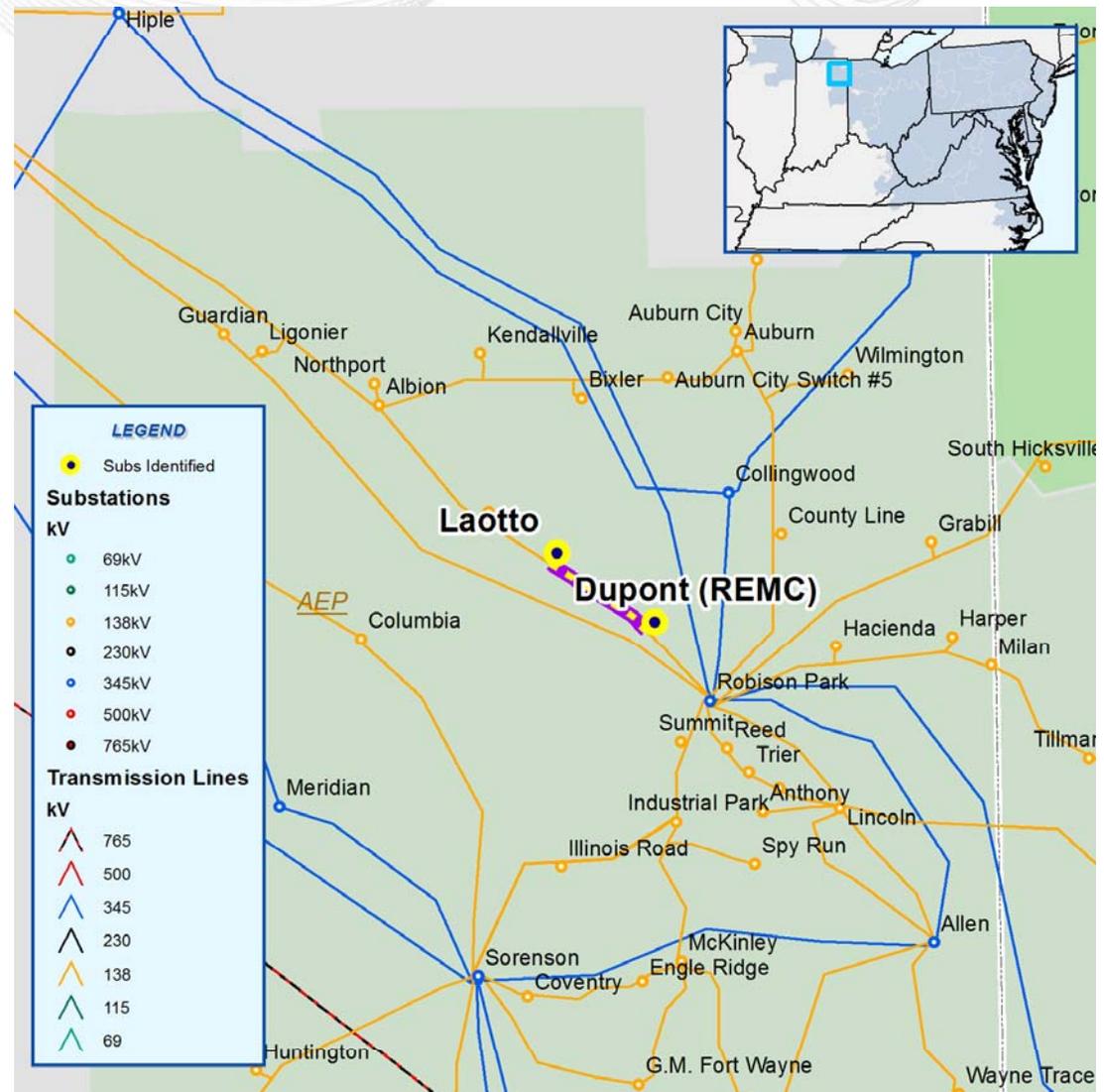
- N-1-1 Thermal Violation
- The New Martinsville 138kv- Natrium 138 kV line is overloaded for the loss of the Montaineer – Belmont - Kammer 765 kV line, and Belmont 765/500 kV transformer; and the loss of Belmont –Harrison 500 kV line
- Recommended Solution: The Natrium – North Martin 138 kV circuit would need an electrical clearance study among other equipment upgrades (B1477)
- Estimated Project Cost: \$0.0995 M
- Expected IS Date: 12/31/2013



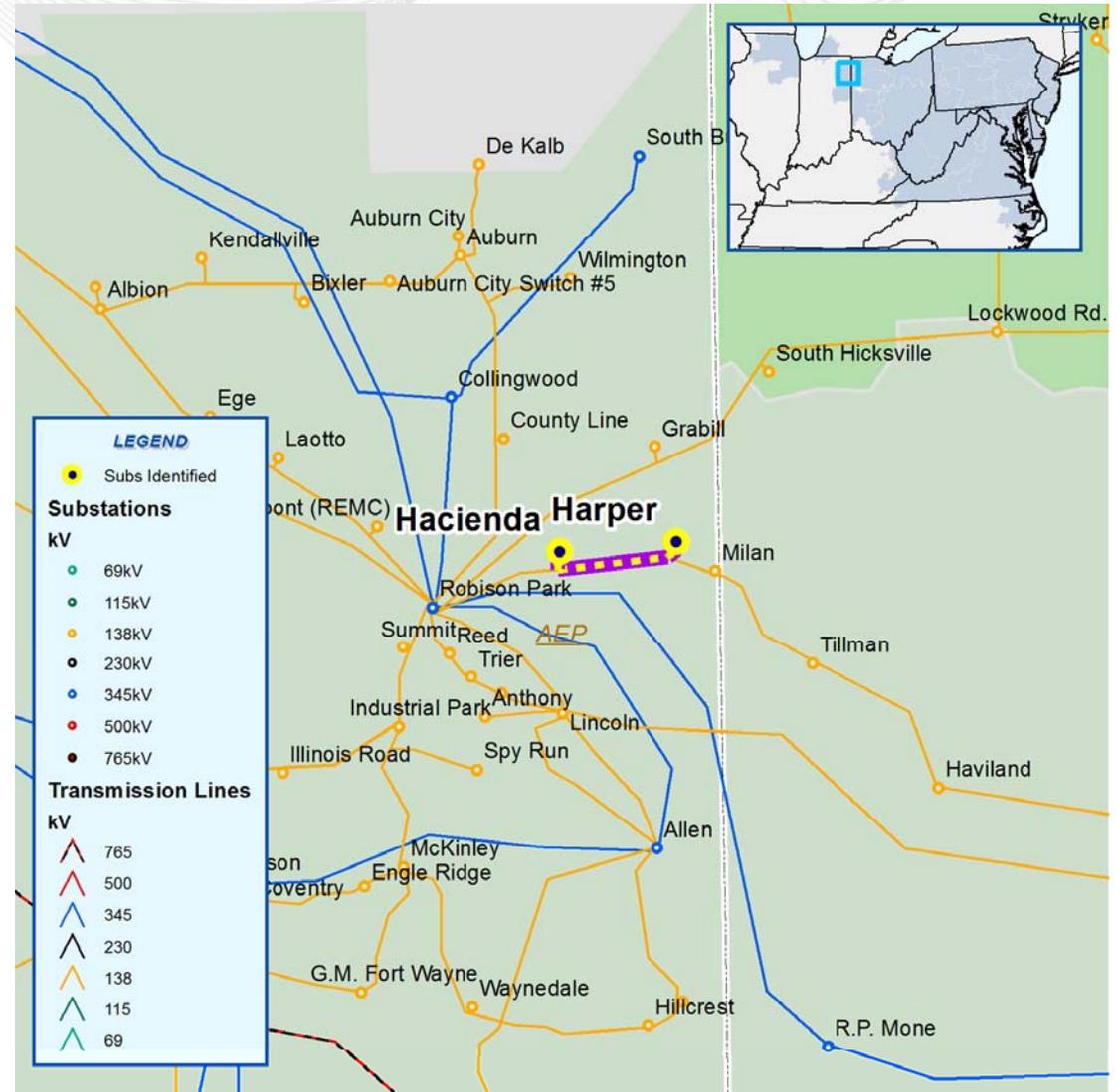
- N-1-1 Thermal Violation
- The Easttown Road - Rockhill 138 kV line is overloaded for the loss of the East Lima - Northwest Lima 138 kV line and the loss of Southwest Lima - West Lima 138 kV line
- Recommended Solution: Perform a sag study on the West Lima – Easttown Road – Rockhill 138 kV line and replace the 138 kV risers at Rockhill station to increase the emergency rating (B1481)
- Estimated Project Cost: \$0.065 M
- Expected IS Date: 12/31/2013



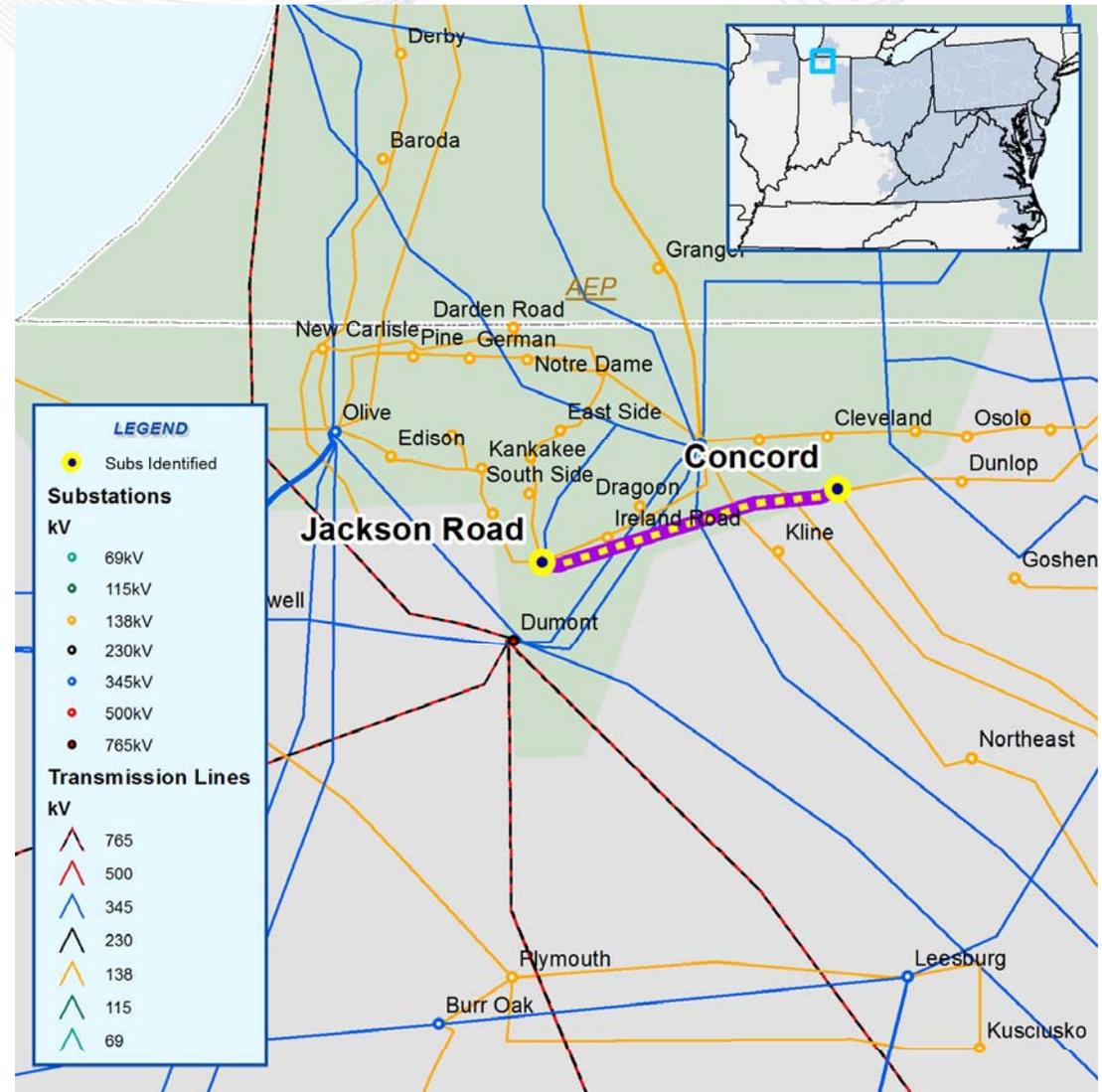
- N-1-1 Thermal Violation
- The Dupont – Huntertown - laotto 138 kV line is overloaded for the loss of the Air Products – Wilmington - Auburn 138 kV line, Wilmington – Countyline - Robison Park 138 kV line, and Countyline - Countyline Load 138 kV line and the loss of Concord - Countryside 138 kV line
- Recommended Solution: Perform a sag study for the Albion – Robison Park 138 kV line to increase its emergency rating (B1482)
- Estimated Project Cost: \$0.0888 M
- Expected IS Date: 12/31/2013



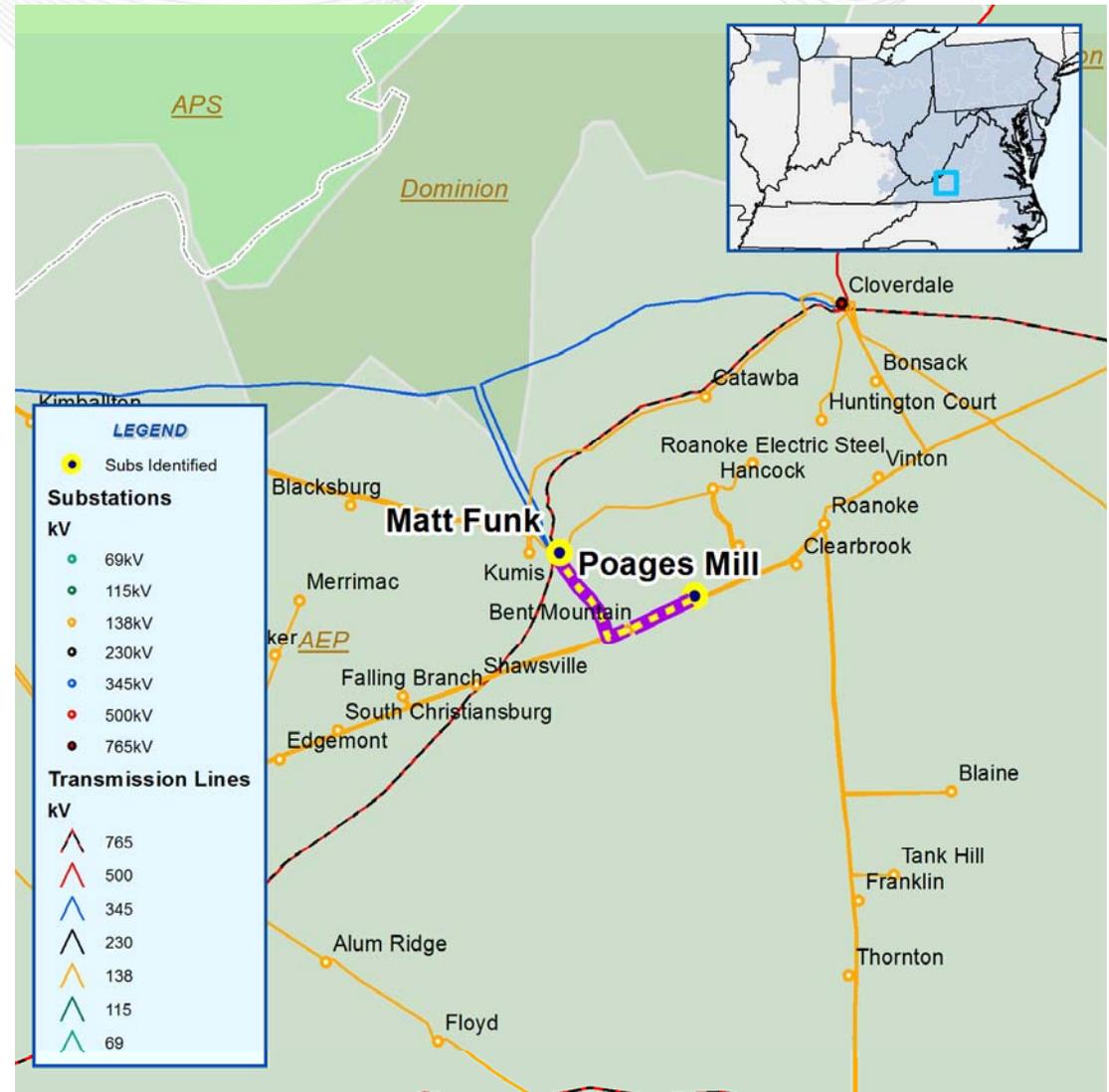
- Common Mode Contingency Violation
- The Harper - Hacienda 138 kV line is overloaded for various common mode contingencies
- Recommended Solution: Perform a sag study on the Hacienda – Harper 138 kV line to increase the emergency rating (B1484)
- Estimated Project Cost: \$0.0596 M
- Expected IS Date: 12/31/2013



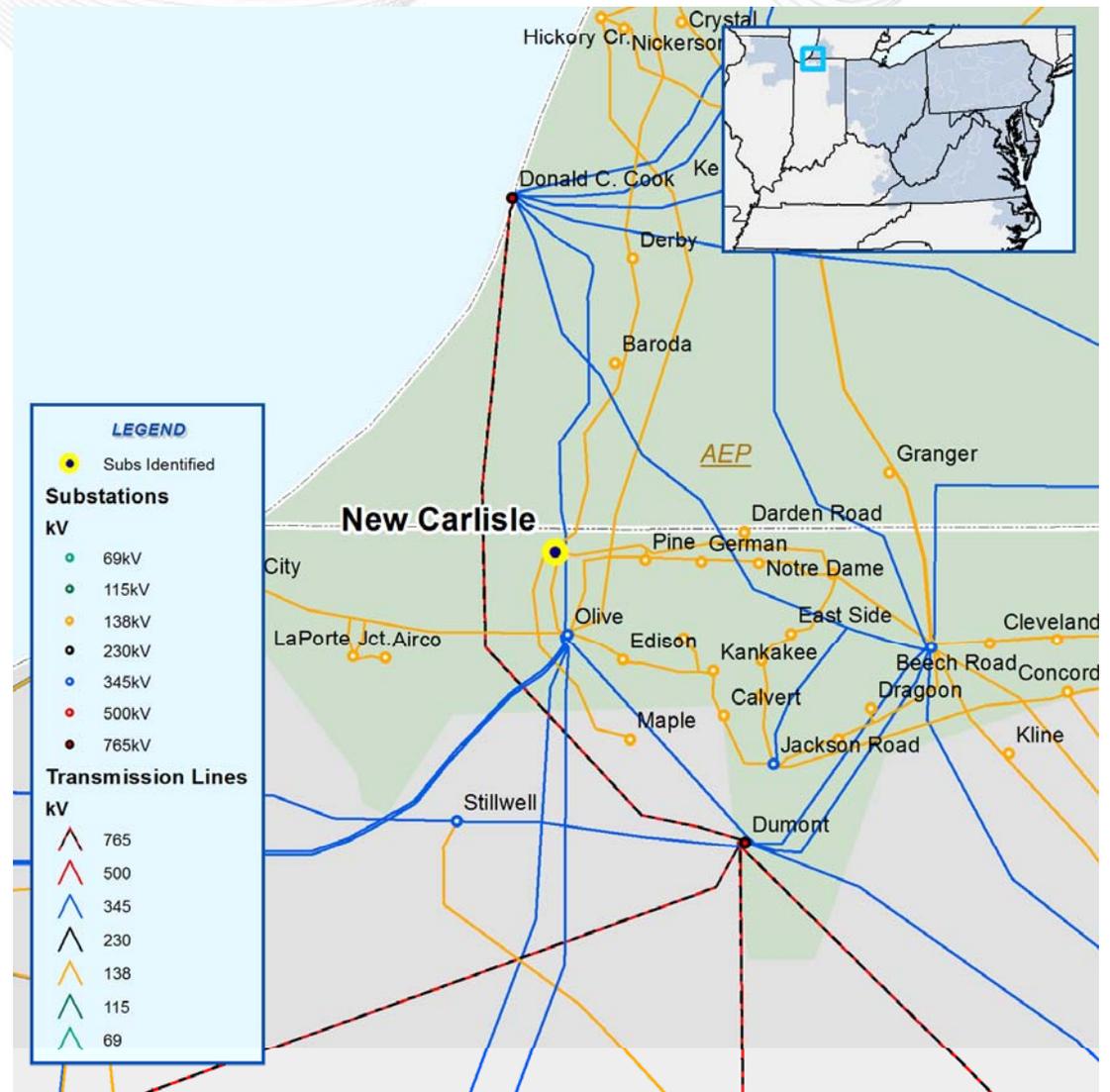
- Common Mode Contingency Violation
- The Jackson Road-Concord 138 kV line is overloaded for various common mode contingencies
- Recommended Solution: Perform a sag study on the Jackson Road – Concord 138 kV line to increase the emergency rating (B1485)
- Estimated Project Cost: \$0.087 M
- Expected IS Date: 12/31/2013



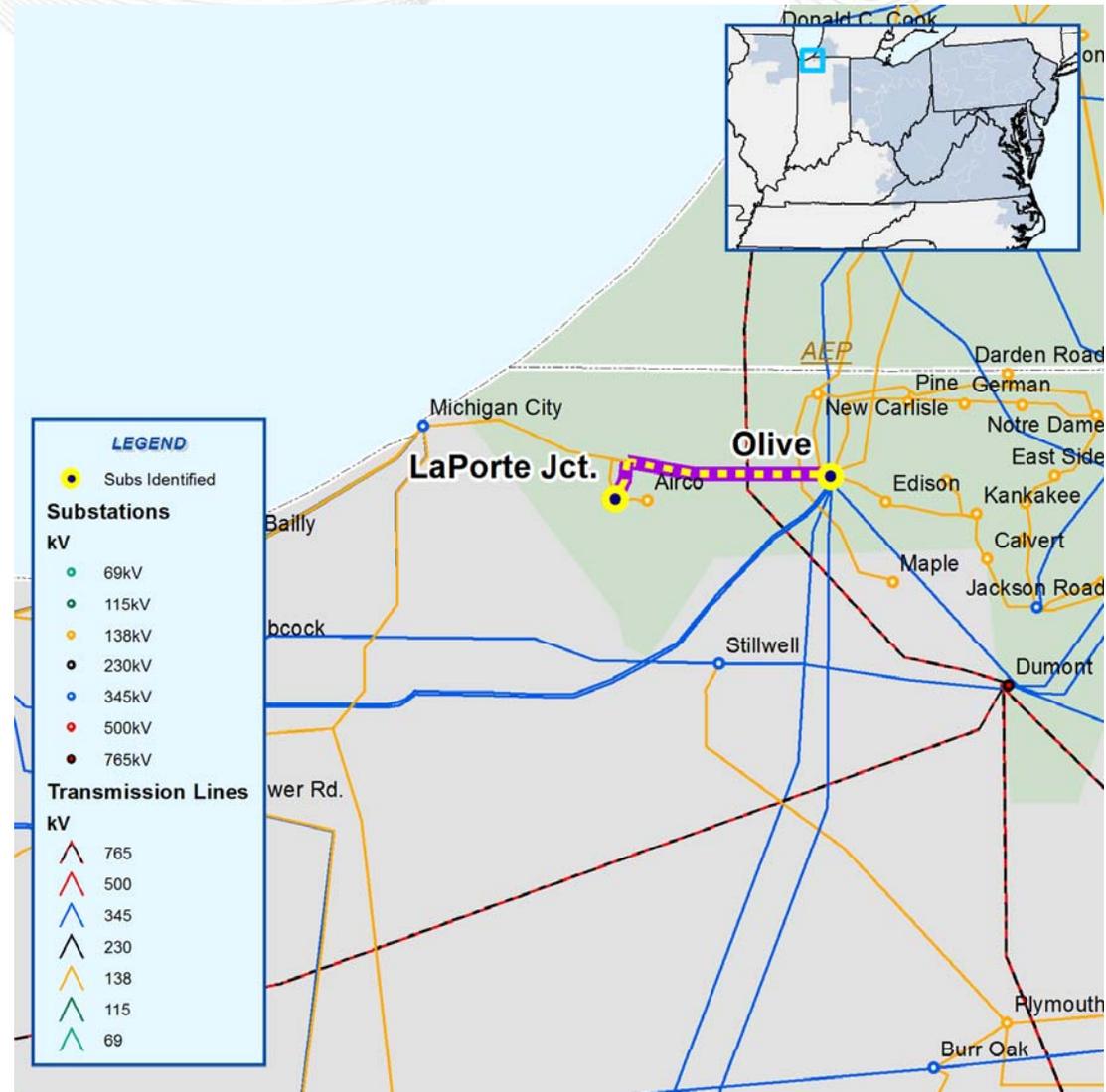
- N-1-1 Thermal Violation
- The Matt Funk - Poages Mill 138 kV line is overloaded for various combinations of single contingencies
- Recommended Solution: The Matt Funk - Poages Mill – Starkey 138 kV line requires a sag study to determine if a higher emergency rating can be utilized (B1486)
- Estimated Project Cost: \$0.032 M
- Expected IS Date: 12/31/2013



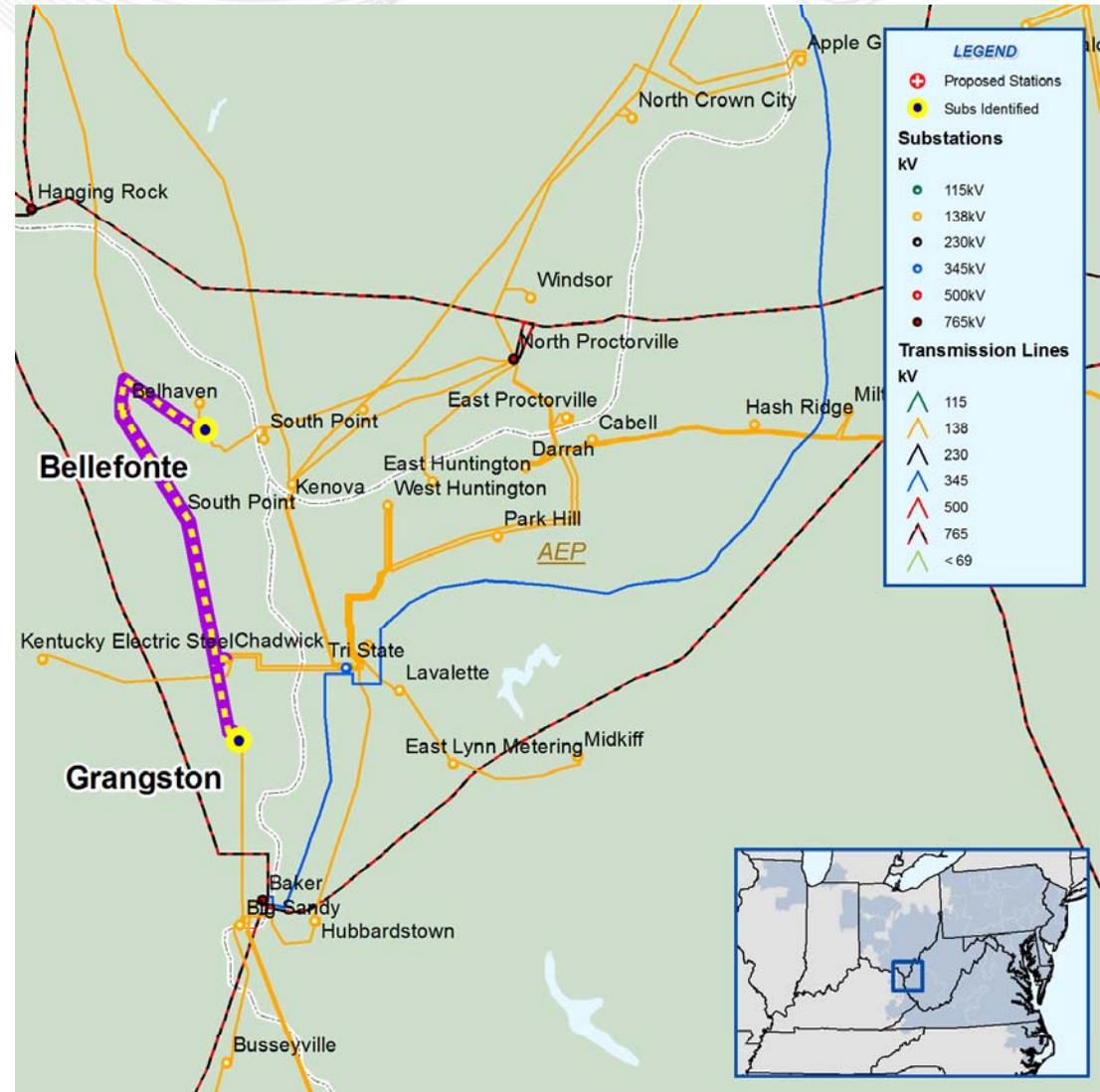
- N-1-1 Thermal Violation
- The New Carlisle - Trail Creek Substation 138 kV line is overloaded for various combinations of single contingencies
- Recommended Solution: Perform a sag study on the New Carlisle – Trail Creek 138 kV line to increase the emergency rating (B1487)
- Estimated Project Cost: \$0.01 M
- Expected IS Date: 12/31/2013



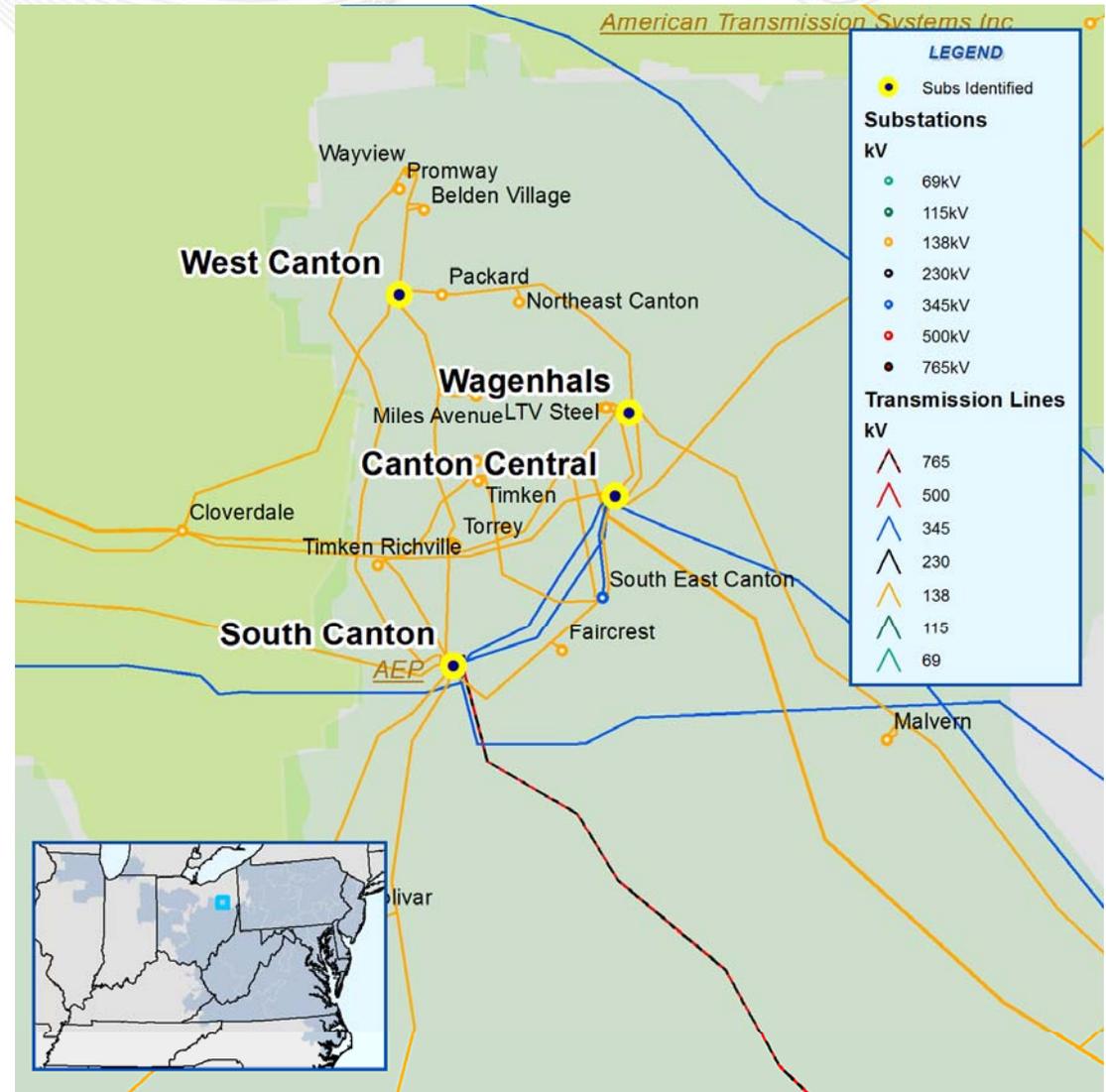
- N-1-1 Thermal Violation
- The Laporte - Olive 138 kV line is overloaded for various combinations of single contingencies
- Recommended Solution: Perform a sag study on the Olive – LaPorte Junction 138 kV line to increase the emergency rating (B1488)
- Estimated Project Cost: \$0.01 M
- Expected IS Date: 12/31/2013



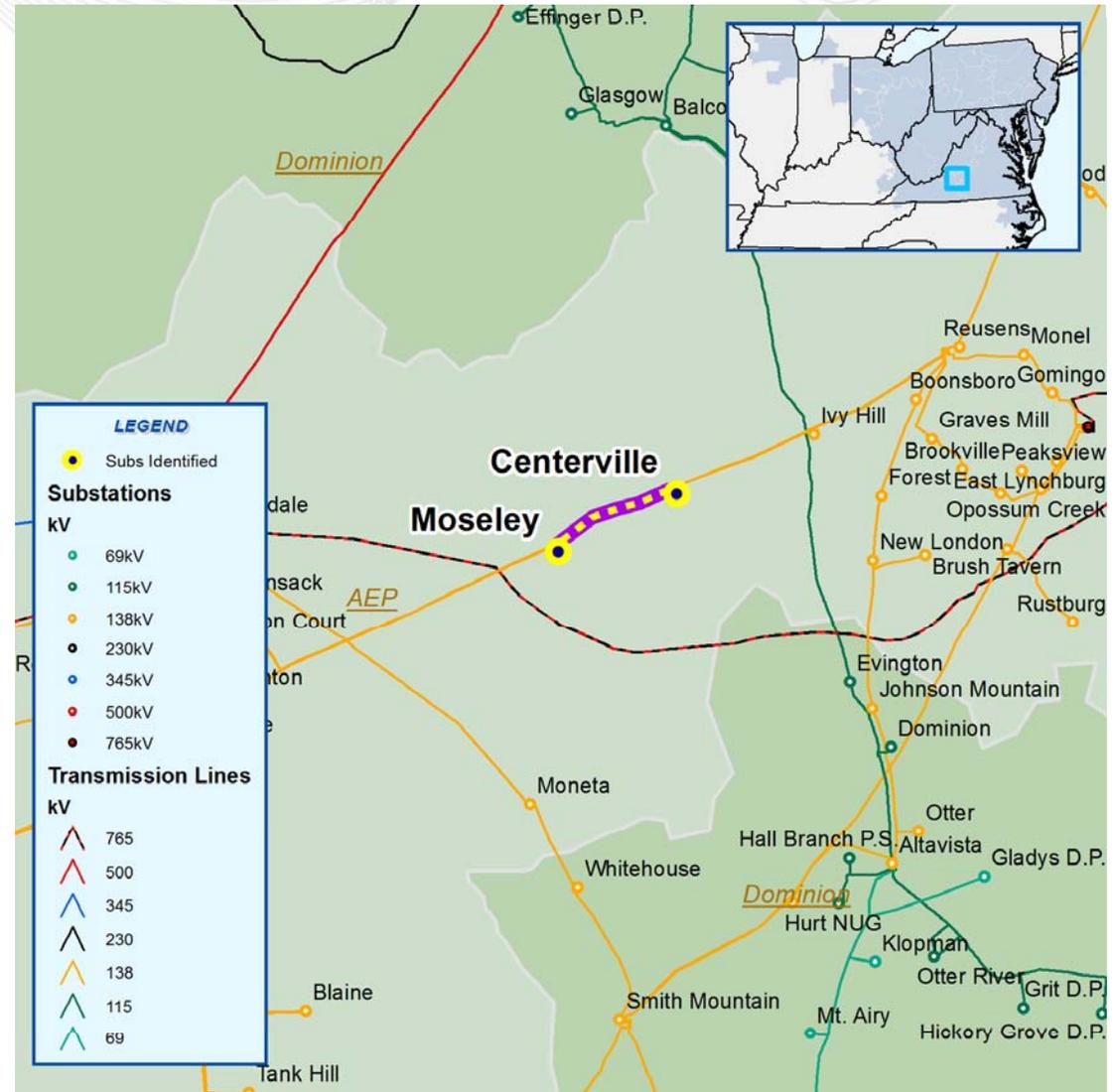
- Generation Deliverability Violation
- The Grangston - Bellefonte 138 kV line is overloaded for the loss of Baker 765/345 kV transformer
- Recommended Solution: Perform a sag study for the Bellefonte – Grangston 138 kV line to increase its emergency rating (B1493)
- Estimated Project Cost: \$0.07 M
- Expected IS Date: 12/31/2013



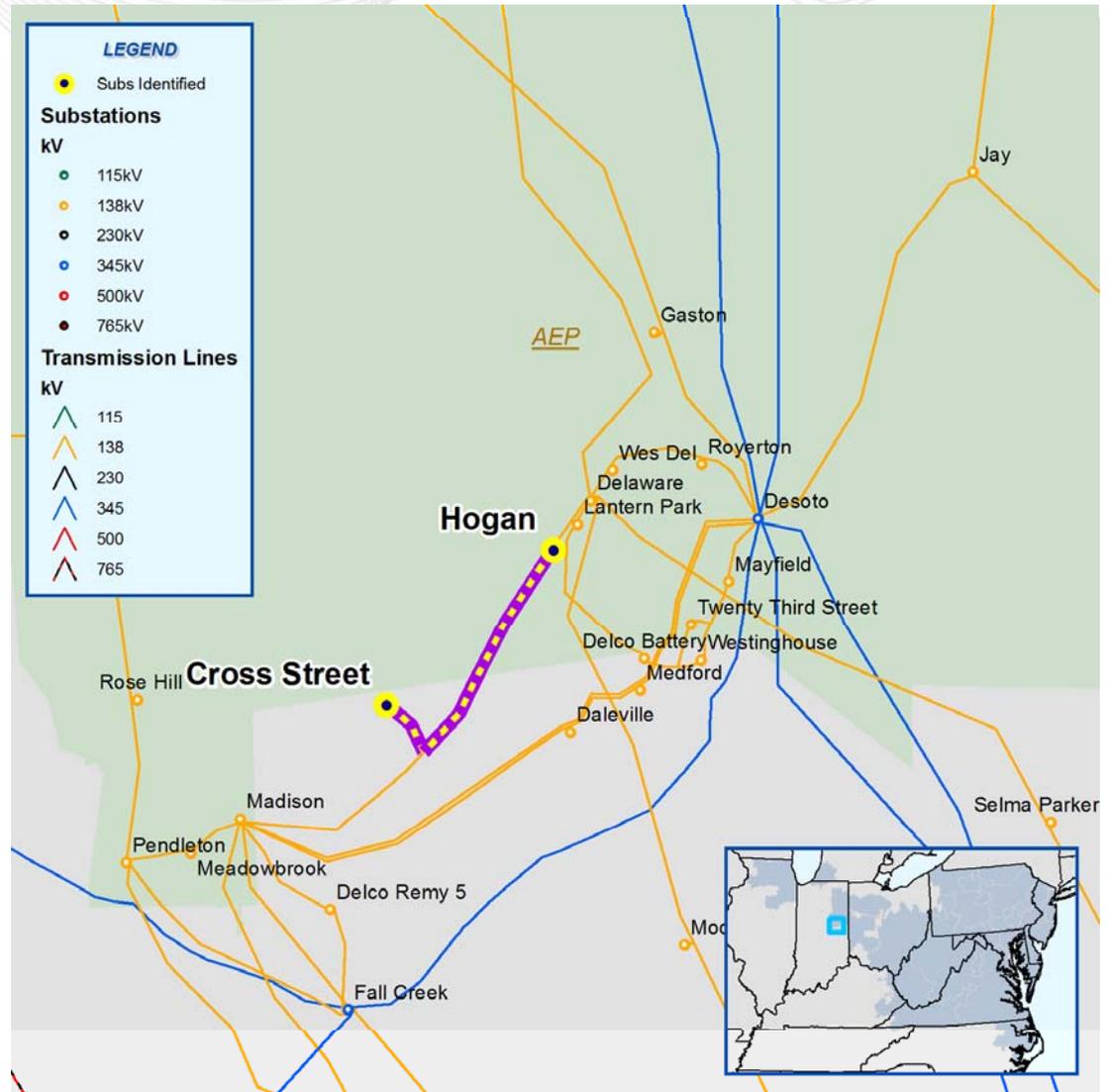
- N-1-1 Thermal Violation
- The Northeast Canton - Wagenhals 138 kV line is overloaded for the loss of the South Canton - West Canton 138 kV line and the loss of the South Canton – Negley - Reedurban 138 kV line and Negley - Negley Load 138 kV line
- Recommended Solution: The North East Canton - Wagenhals 138kV circuit would need an electrical clearance study to determine if the emergency rating can be utilized in order to fix Reliability N-2 Thermal overloads (B1500)
- Estimated Project Cost: \$0.02 M
- Expected IS Date: 12/31/2013



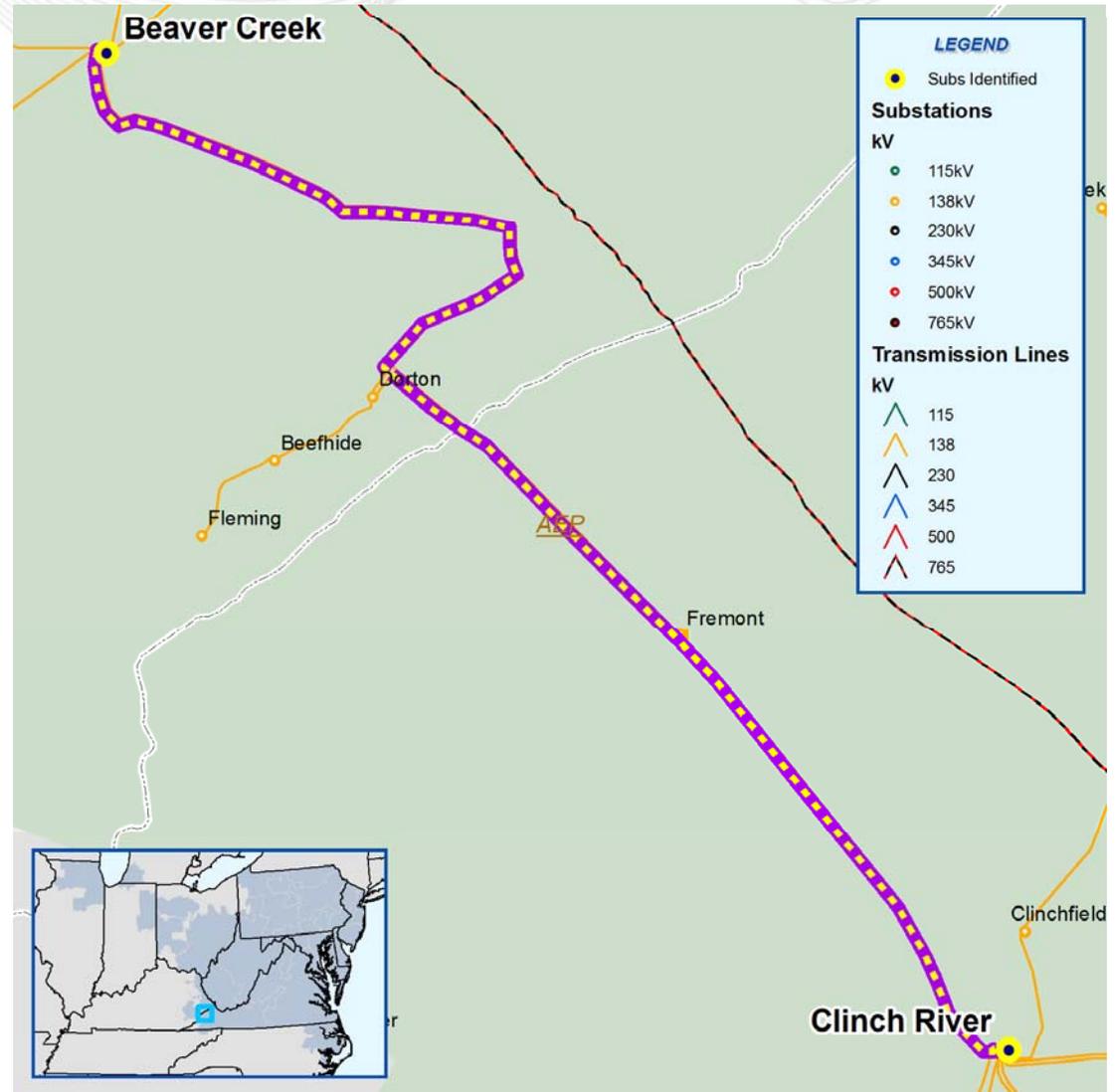
- N-1-1 Thermal Violation
- The Centerville - Moseley 138 kV line is overloaded for various combinations of single contingencies
- Recommended Solution: The Moseley - Reusens 138 kV circuit requires a sag study to determine if the emergency rating can be utilized to address thermal a thermal loading issue for a category C3 contingency (B1501)
- Estimated Project Cost: \$0.088 M
- Expected IS Date: 12/31/2013



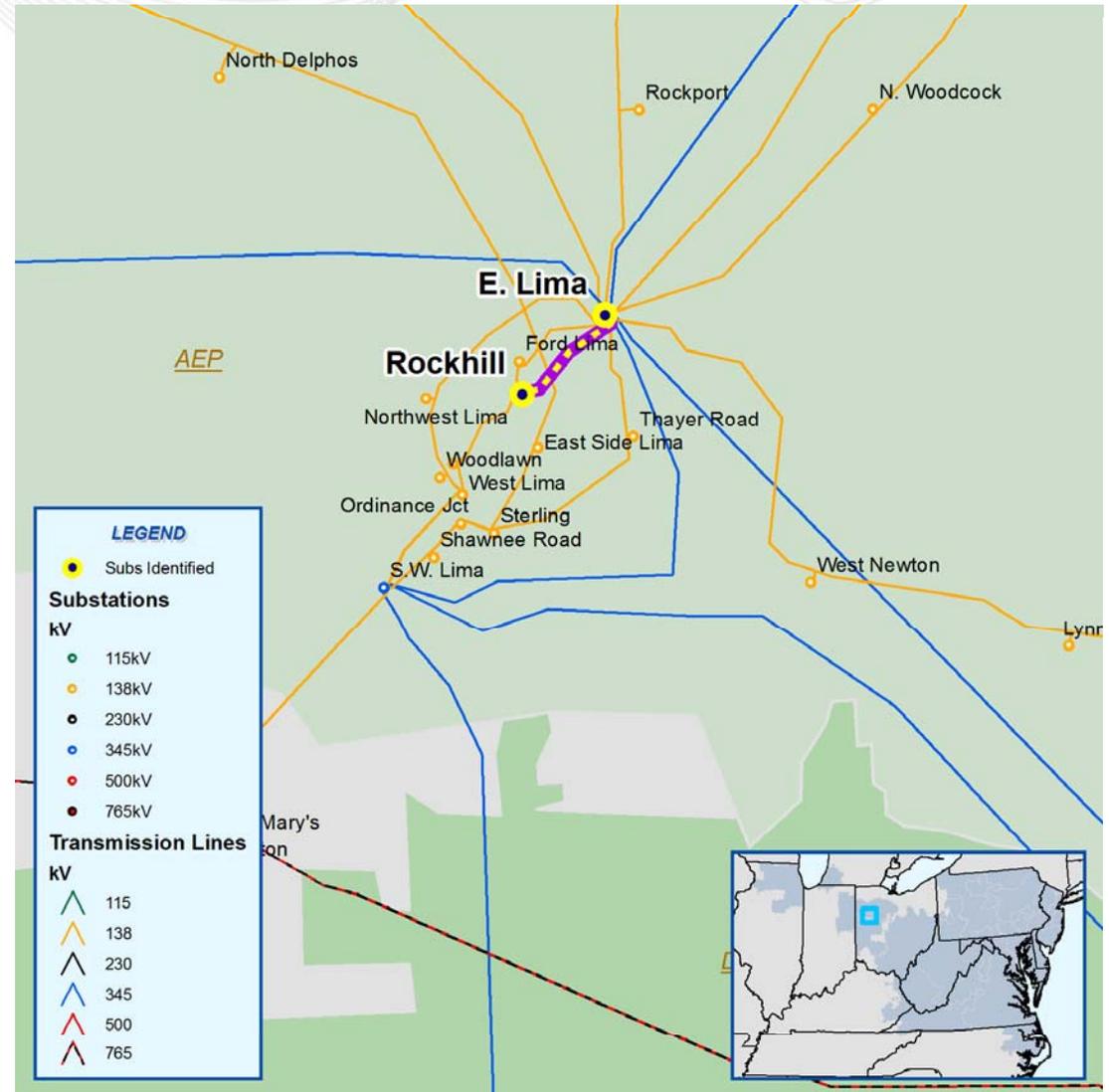
- N-1-1 Thermal Violation
- The Cross Street – Hogan 138 kV line is overloaded for the loss of the Madison - Daleville - Medford – Desoto 138 kV line, and the loss of Desoto 345/138 kV transformer
- Recommended Solution: Perform a sag study on the Delaware - Madison 138 kV line to increase the emergency rating (B1417)
- Estimated Project Cost: \$0.0744 M
- Expected IS Date: 12/31/2011



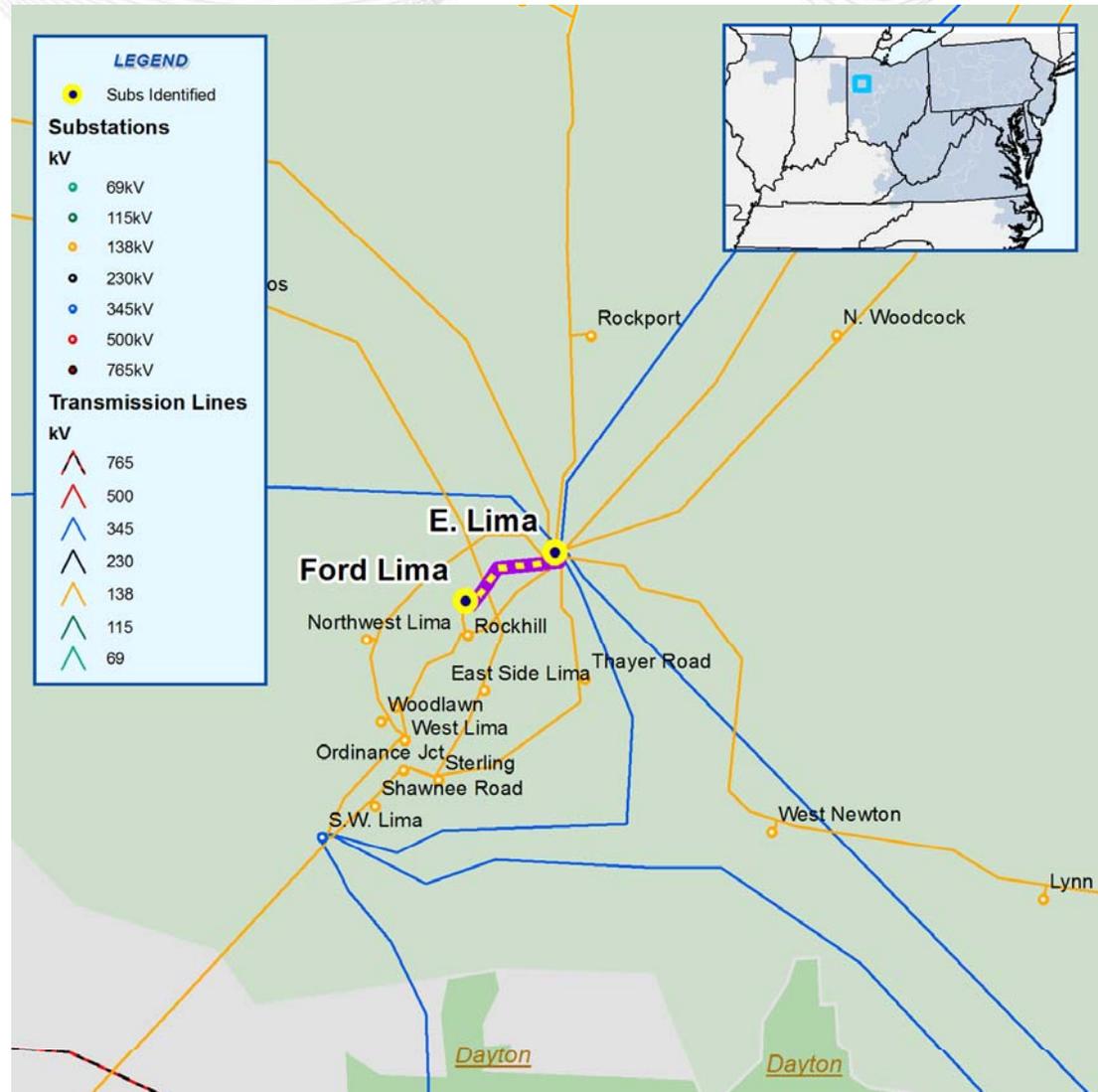
- N-1-1 Thermal Violation
- The Fremont – Clinch River 138 kV line is overloaded for the loss of the Big Sandy – Busseyville 138 kV line and the loss of the Clinch River - Dorton 138 kV line
- Recommended Solution: Sag studies may allow for operation of these circuits up to their conductor emergency ratings which would eliminate the overloads for the contingencies listed (B1429)
- Estimated Project Cost: \$0.172 M
- Expected IS Date: 12/31/2011



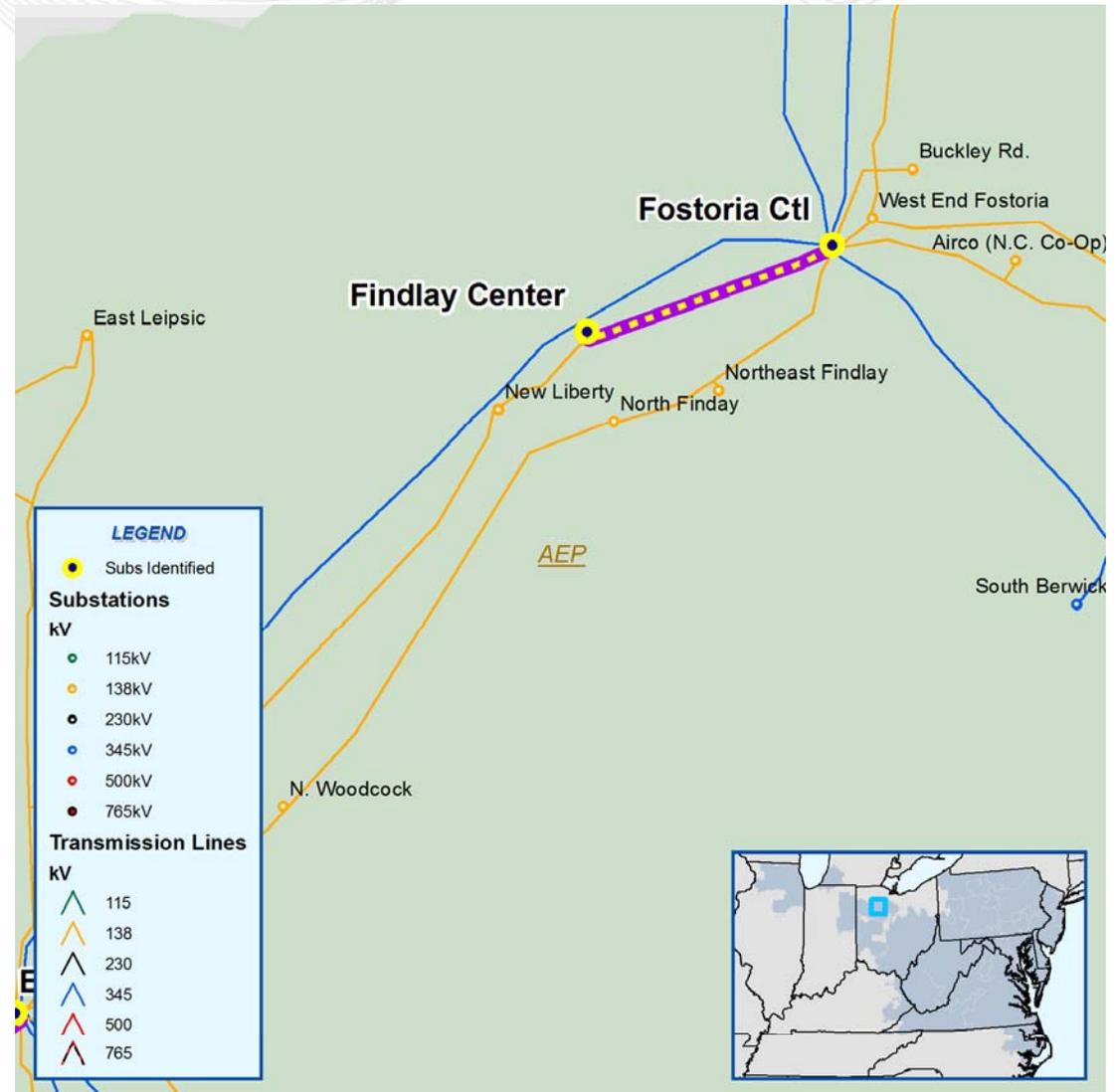
- N-1-1 Thermal Violation
- The Rockhill – East Lima 138 kV line is overloaded for the loss of the Southwest Lima - West Lima 138 kV line and the loss of the East Lima - Ford Lima 138 kV line or for the loss of the Concord - Jackson Road 138 kV line (for rate A)
- Recommended Solution: a sag study will be required to increase the emergency rating. Depending on the outcome of this study, more action may be required in order to increase the rating. (B1418)
- Estimated Project Cost: \$0.0176 M
- Expected IS Date: 12/31/2011



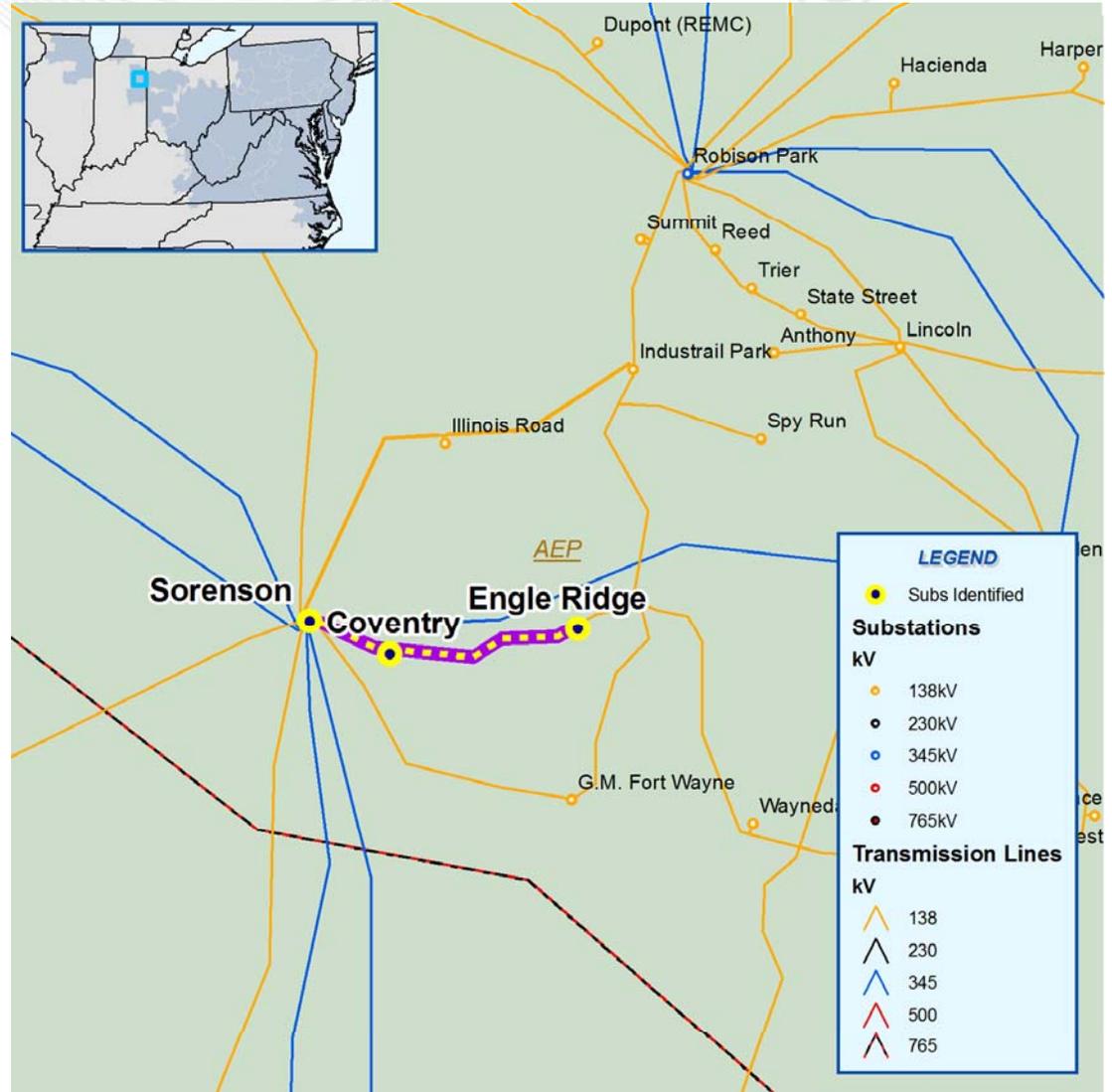
- N-1-1 Thermal Violation
- The East Lima - Ford Lima 138 kV line is overloaded for various combinations of single contingencies
- Recommended Solution: Perform a sag study on the East Lima – Ford Lima – Rockhill 138 kV line to increase the emergency rating (B1471)
- Estimated Project Cost: \$0.018 M
- Expected IS Date: 12/31/2012



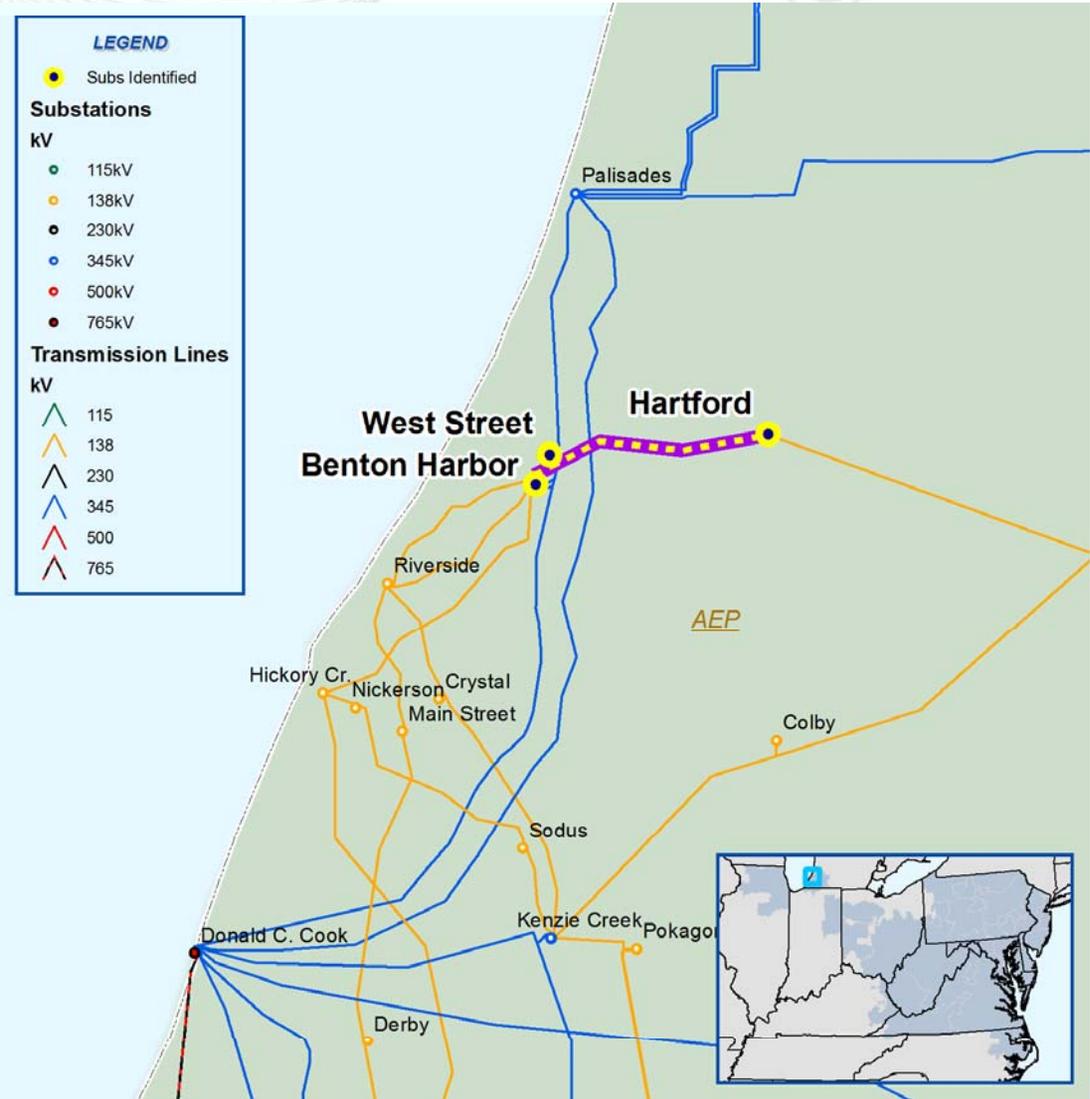
- N-1-1 Thermal Violation
- The Findlay Center – Fostoria Ctl 138 kV line is overloaded for the loss of the East Lima - New Liberty 138 kV line and the loss of Fostoria Central - Northeast Findlay Tap - North Findlay 138 kV line
- Recommended Solution: a sag study will be required to increase the emergency rating for this line. The section of line between Fostoria Central and Findlay Tap is only a section of the circuit that runs from Findlay Center to Fostoria Central to New Liberty, the entire circuit will have the sag study performed upon it – approximately 20.1 miles. (B1419)
- Estimated Project Cost: \$0.0804 M
- Expected IS Date: 12/31/2011



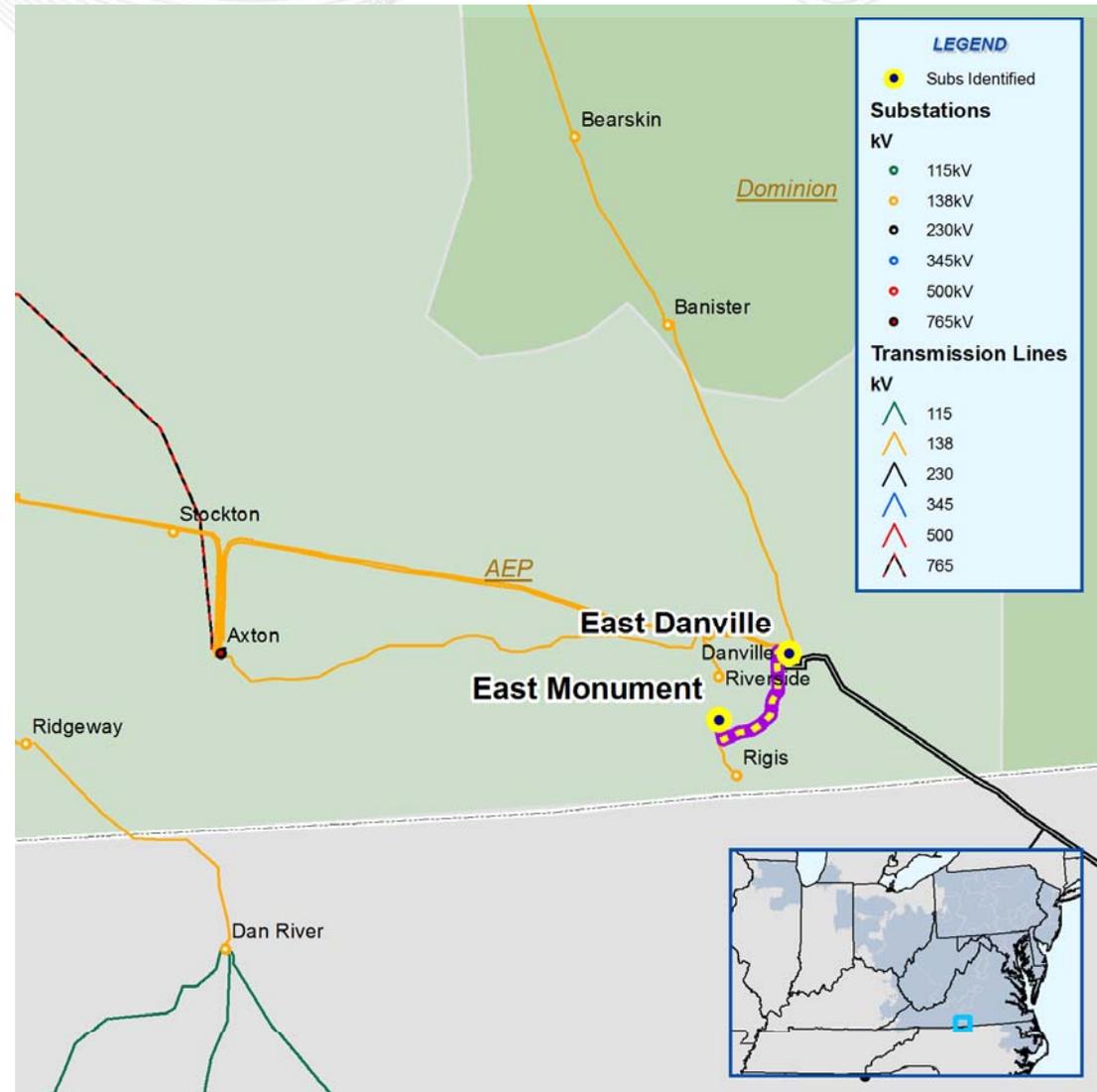
- N-1-1 Thermal Violation
- The Coventry – Engle Ridge – Sorenson 138 kV line is overloaded for the loss of the Sorenson - Illinois Road - Industrial Park 138 kV line and the loss of the Allen - Sorenson 345 kV line and Allen 345/138 kV transformer
- Potential Solution: Perform a sag study on the Sorenson - McKinley 138 kV line to increase the emergency rating (B1421)
- Estimated Project Cost: \$0.0472 M
- Expected IS Date: 12/31/2011



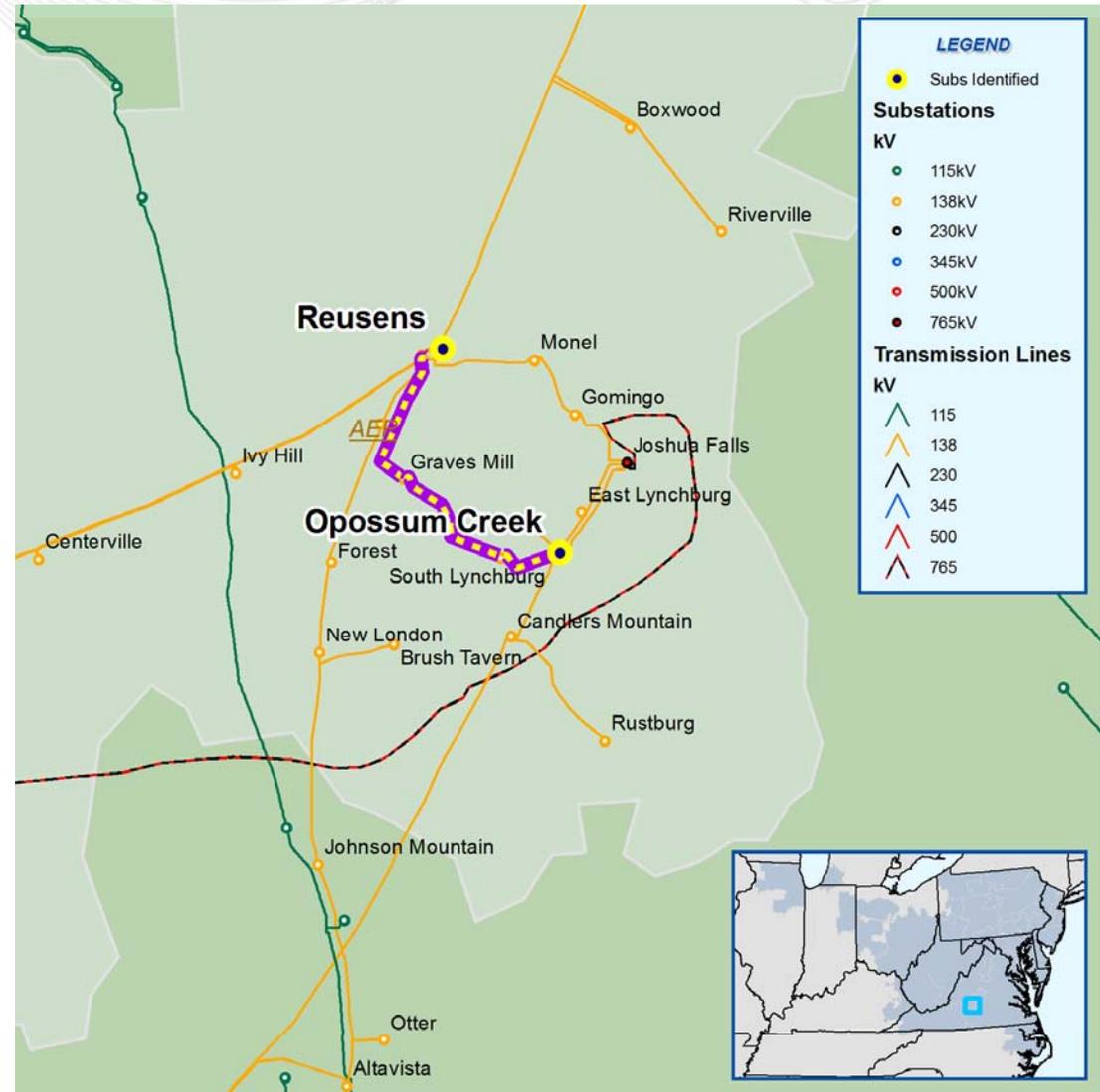
- N-1-1 Thermal Violation
- The Benton Harbor - West Street - Hartford 138 kV line is overloaded for the loss of the Corey - Mottville Tap - East Elkhart 138 kV line and the loss of Colby - Kenzie Creek 138 kV line
- Recommended Solution: Perform a sag study for the Benton Harbor – West Street – Hartford 138 kV line to improve the emergency rating (B1424)
- Estimated Project Cost: \$0.05 M
- Expected IS Date: 12/31/2011



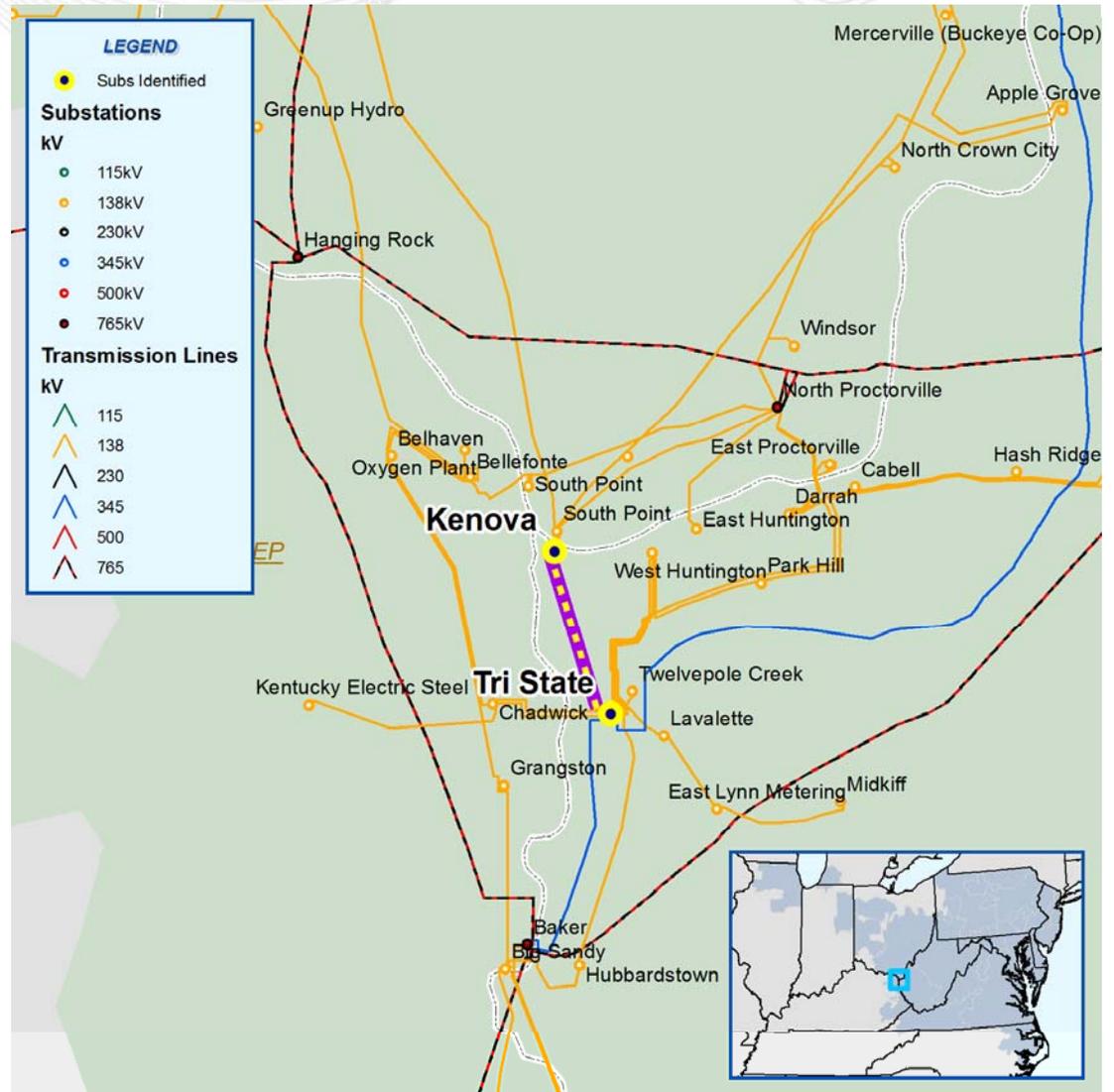
- N-1-1 thermal violation
- The East Monument – East Danville 138 kV line is overloaded for the loss of the Danville - East Danville 138 kV line and East Danville 230/138 kV transformer and the loss of the Axton - Jacksons Ferry 765 kV line and Axton 765/138 kV transformer
- Recommended Solution: Sag studies may allow for operation of these circuits up to the conductor's maximum operating temperature which would eliminate the overloads for the contingencies listed (B1425)
- Estimated Project Cost: \$0.016 M
- Expected IS Date: 12/31/2011



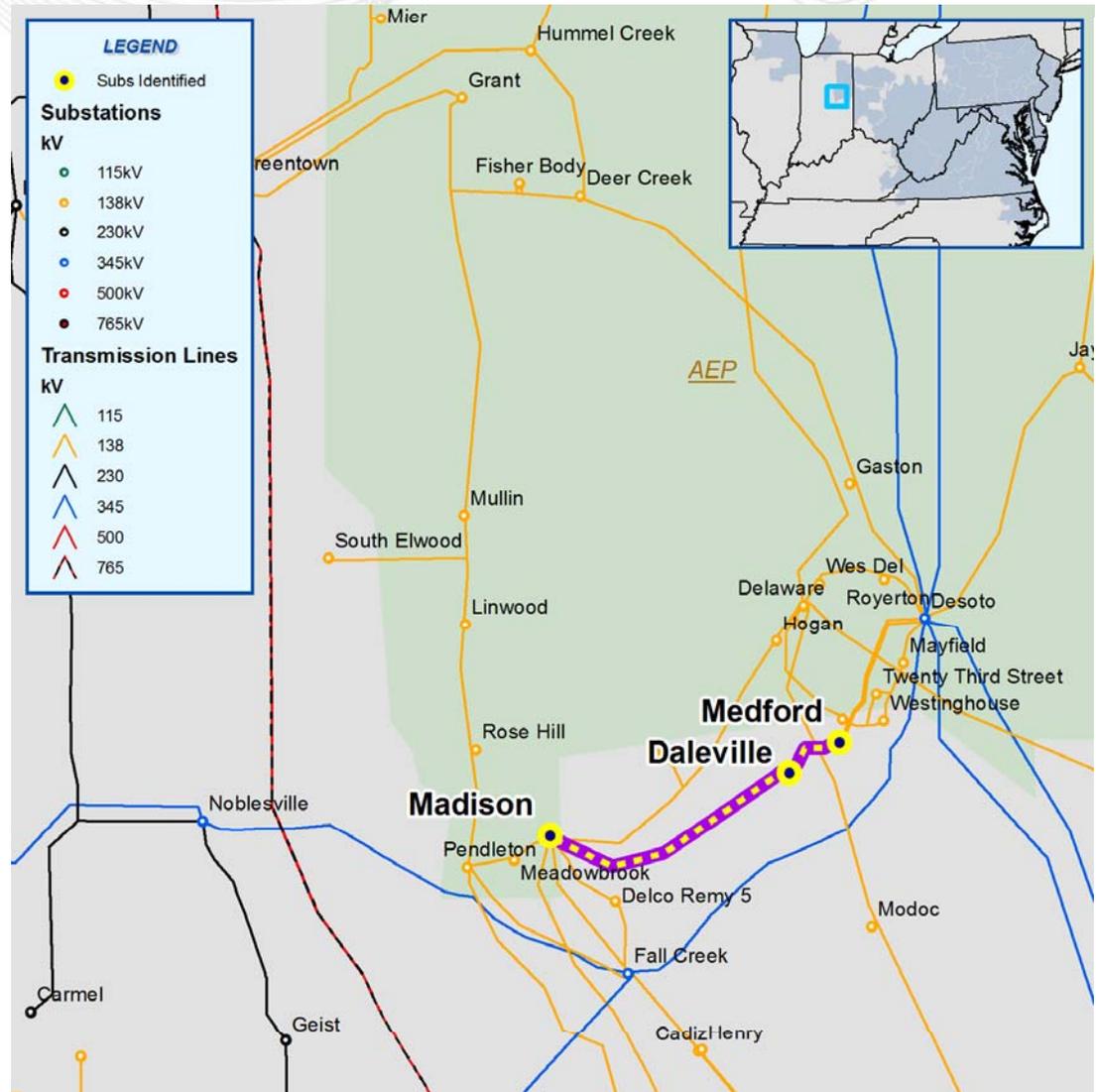
- N-1-1 Thermal Violation
- The Reusens – Graves 138 kV line is overloaded for the loss of the Joshua Falls - East Lynchburg 138 kV line and the loss of the Joshua Falls - Opossum Creek 138 kV line
- Recommended Solution: Sag studies may allow for operation of these circuits up to the conductor's maximum operating temperature which would eliminate the overloads for the contingencies listed (B1426)
- Estimated Project Cost: \$0.020 M
- Expected IS Date: 12/31/2011



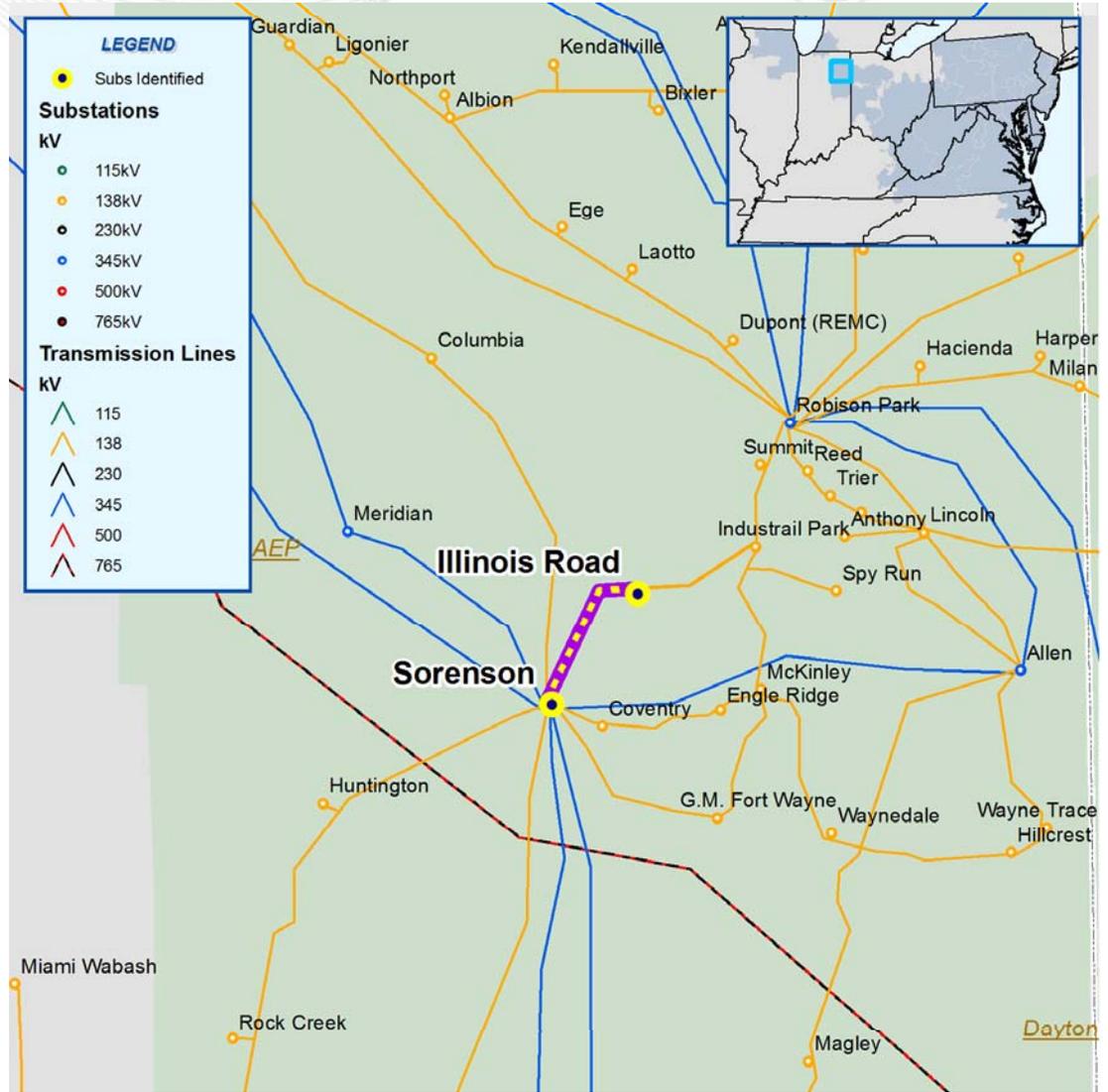
- N-1-1 thermal violation
- The Kenova – Tri State 138 kV line is overloaded for the loss of the Davis Besse Unit 1 and the loss of Baker 765/345 kV transformer
- Recommended Solution: Sag studies may allow for operation of these circuits up to their conductor emergency ratings which would eliminate the overloads for the contingencies listed (B1432)
- Estimated Project Cost: \$0.048 M
- Expected IS Date: 12/31/2011



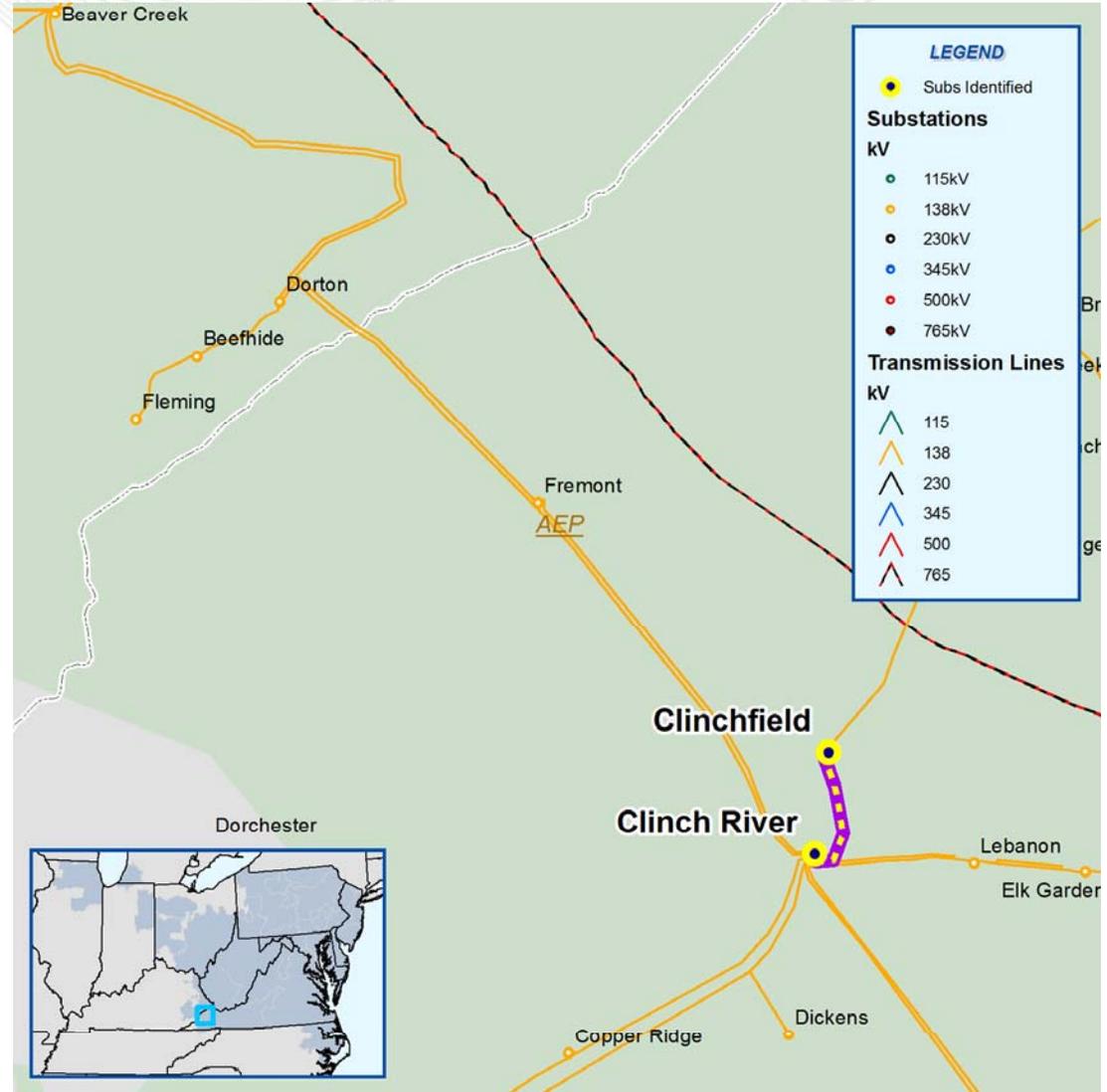
- N-1-1 Thermal Violation
- The Madison – Daleville – Medford 138 kV line is overloaded for the loss of the Hogan - Cross Street - Madison 138 kV line and the loss of Desoto 345/138 kV transformer
- Recommended Solution: Perform a sag study on the line from Desoto to Madison. Depending on the outcome, additional measures may be taken to increase the rating; Replace bus and risers at Daleville station; Replace bus and risers at Madison station (B1434)
- Estimated Project Cost: \$0.5 M
- Expected IS Date: 12/31/2011



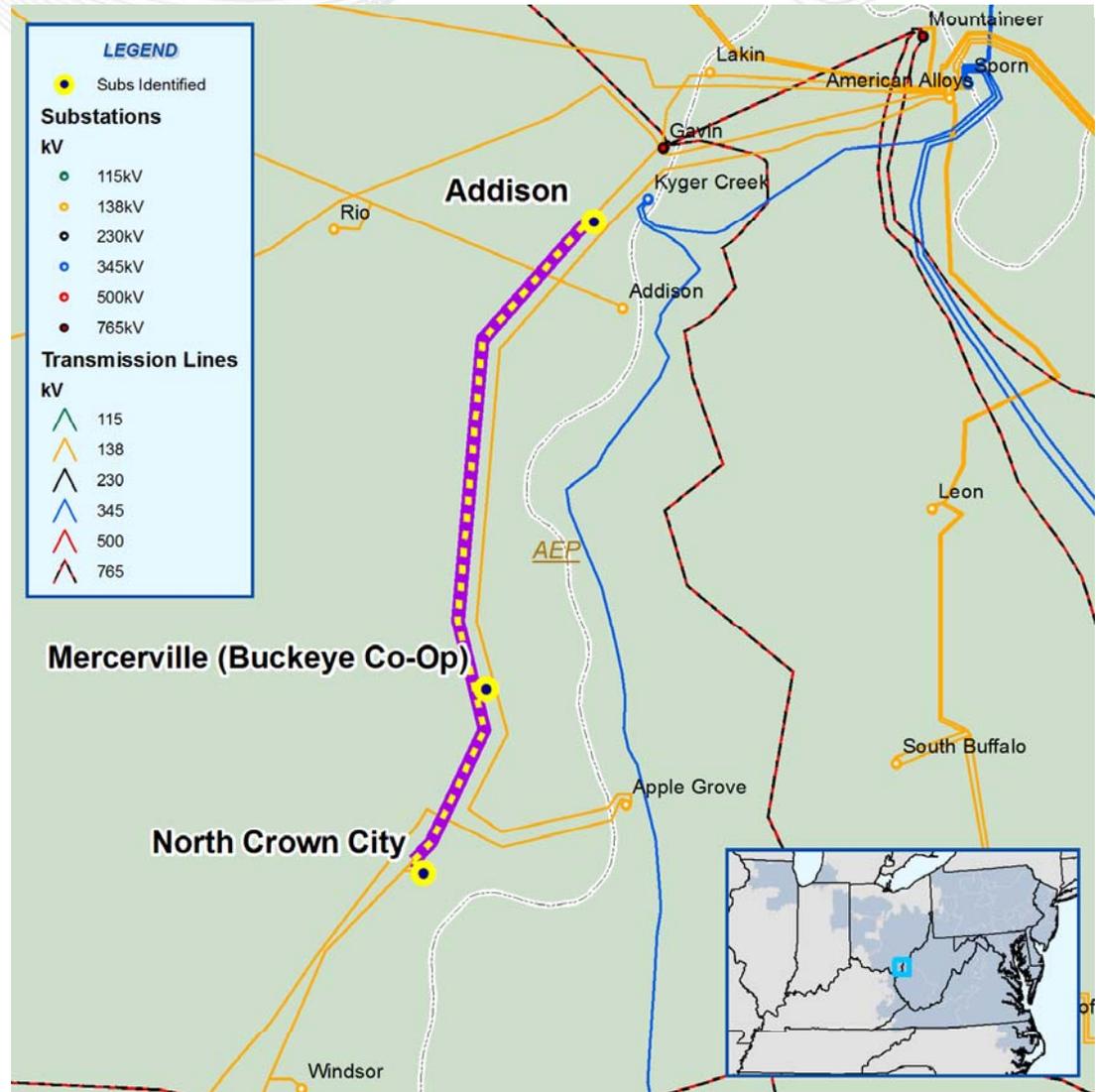
- N-1-1 Thermal Violation
- The Sorenson – Illinois Road 138 kV line is overloaded for the loss of the Sorenson - Coventry Tap - Engle Ridge - McKinley 138 kV line and the loss of the Allen – Sorenson 345 kV line and Allen 345/138 kV transformer
- Recommended Solution: a sag study will be required to increase the emergency MOT for this line and station work at Illinois Road to replace bus and risers. Depending on the outcome of the sag study, more action may be required in order to increase the rating. Because the section of line between Illinois Road and Sorenson is only a section of the circuit that runs from Industrial Park to Sorenson, the entire circuit will have the sag study performed upon it – approximately 19.4 miles (B1436)
- Estimated Project Cost: \$0.2 M
- Expected IS Date: 12/31/2011



- N-1-1 Thermal Violation
- The Clinch River – Clinchfield 138 kV line is overloaded for the loss of the Clinch River – Dorton 138 kV line and the Clinch River – Fremont 138 kV line
- Recommended Solution: Perform electrical clearance studies (a.k.a. sag studies) to determine if the emergency rating can be utilized (B1444)
- Estimated Project Cost: \$0.096 M
- Expected IS Date: 12/31/2012



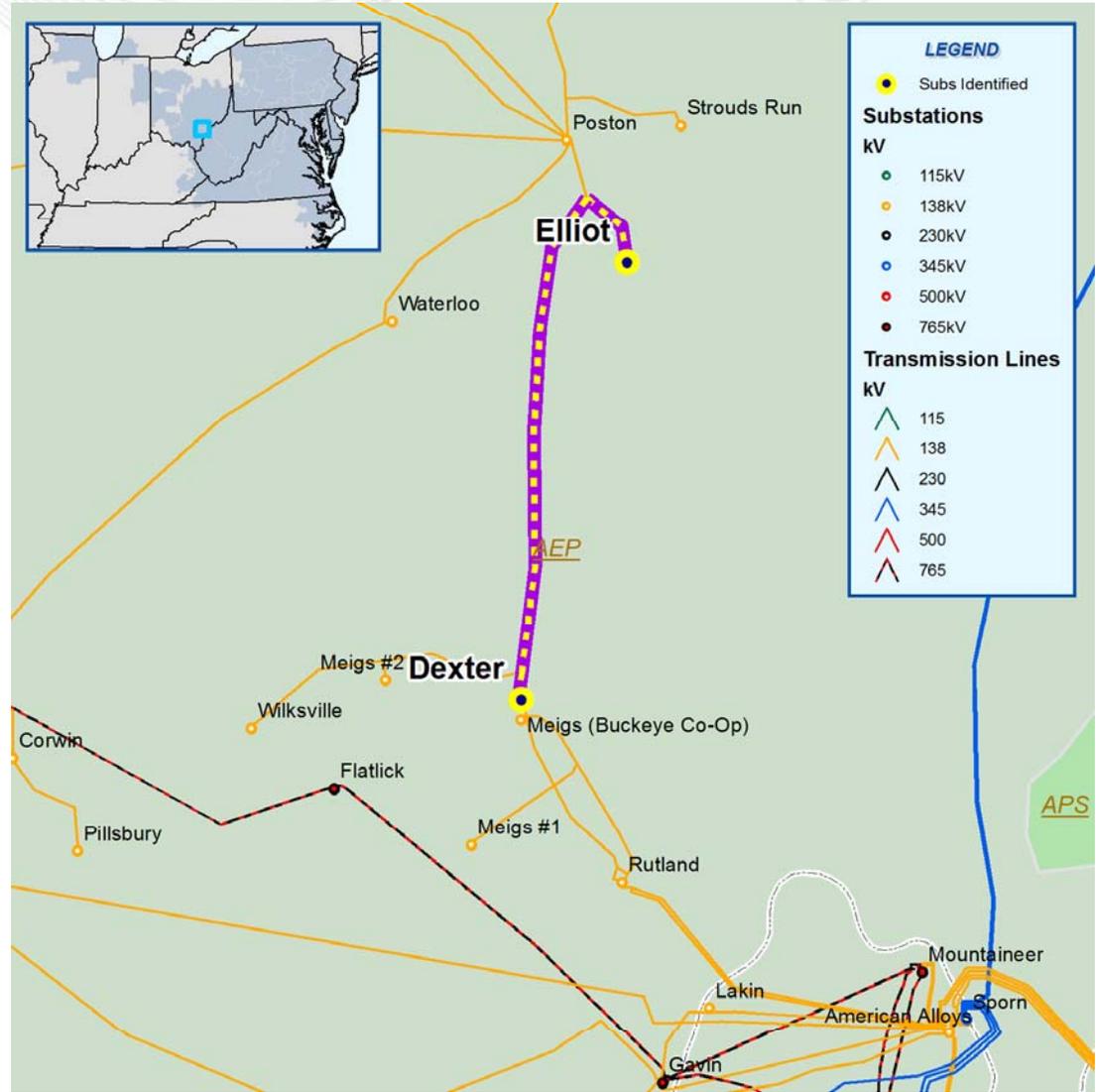
- N-1-1 Thermal Violation
- The North Crown City – Mercerville – Addison 138 kV line is overloaded for the loss of the Marysville 765/345 kV transformer and the Tangy - Marysville 345 kV line and the loss of Sporn 345/138 kV transformer, Sporn A - Sporn A 138 kV line, Sporn A - Sporn A 138 kV line
- Recommended Solution: Perform a sag study on the Addison (Buckeye CO-OP) – Thivener and North Crown City – Thivener 138 kV sag study and switch (B1445)
- Estimated Project Cost: \$0.08 M
- Expected IS Date: 12/31/2012



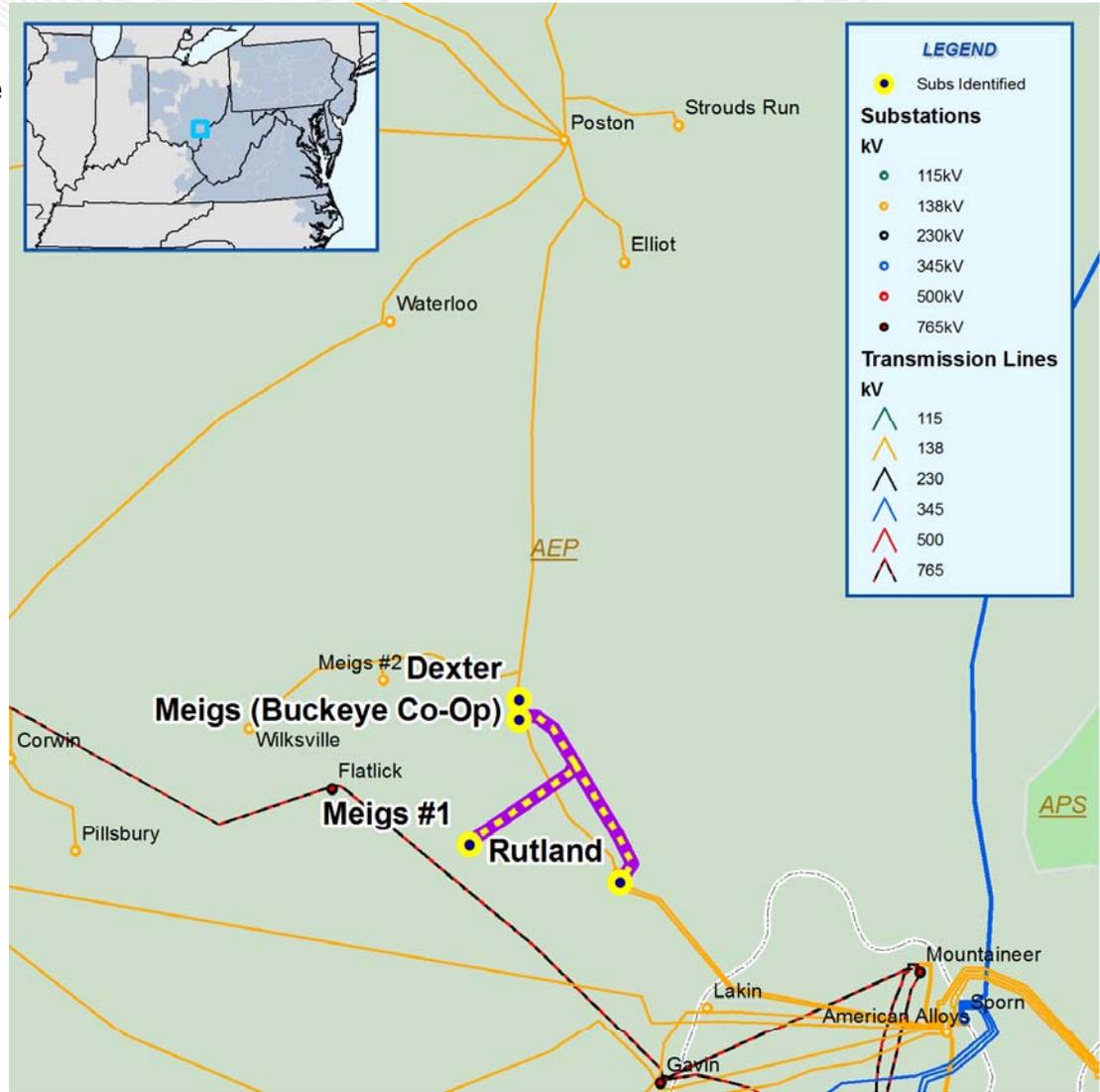


AEP Transmission Zone

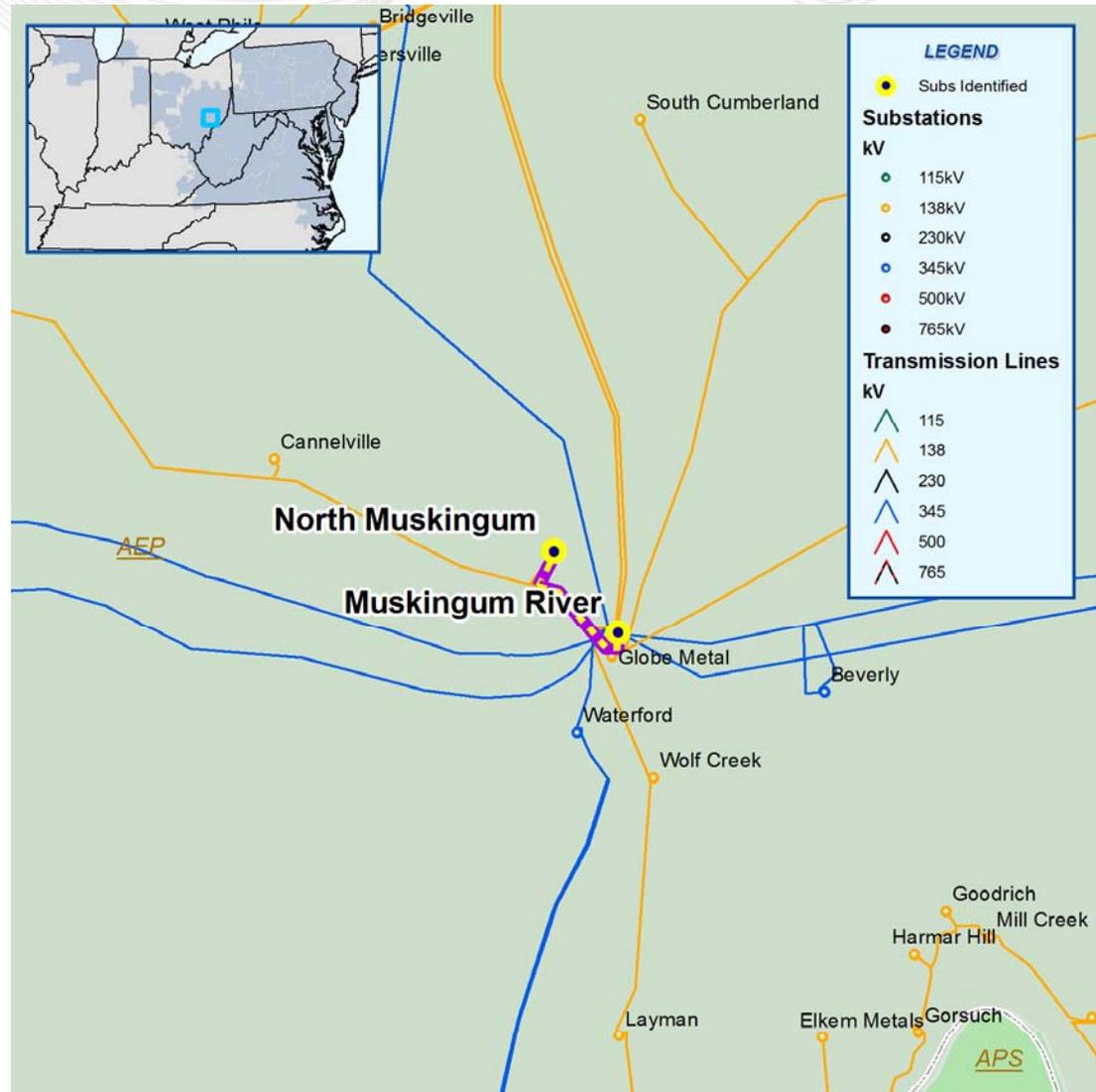
- Generator Deliverability Violation
- The Dexter – Elliot tap 138 kV line is overloaded for the Muskingum – Waterford 345 kV line fault with the stuck breaker at Muskingum
- Recommended Solution: Dexter – Elliot tap 138 kV sag check (B1447)
- Estimated Project Cost: \$0.0672 M
- Expected IS Date: 12/31/2012



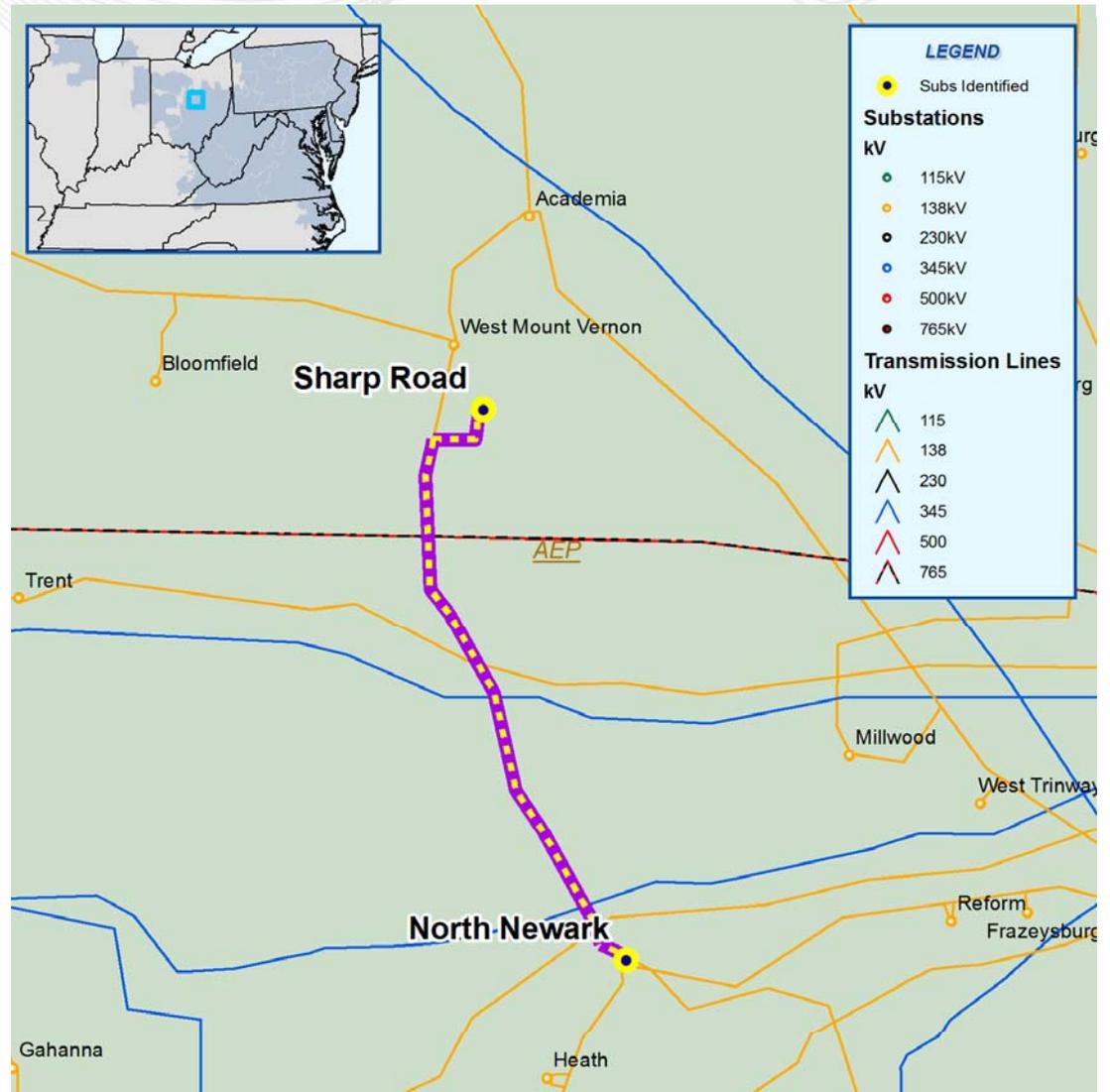
- Baseline Thermal Violation
- The Meigs Tap – Rutland 138 kV line is overloaded for the Muskingum – Waterford 345 kV line fault with the stuck breaker at Muskingum
- Recommended Solution: Meigs tap – Rutland 138 kV sag check (B1449)
- Estimated Project Cost: \$0.01964 M
- Expected IS Date: 12/31/2012



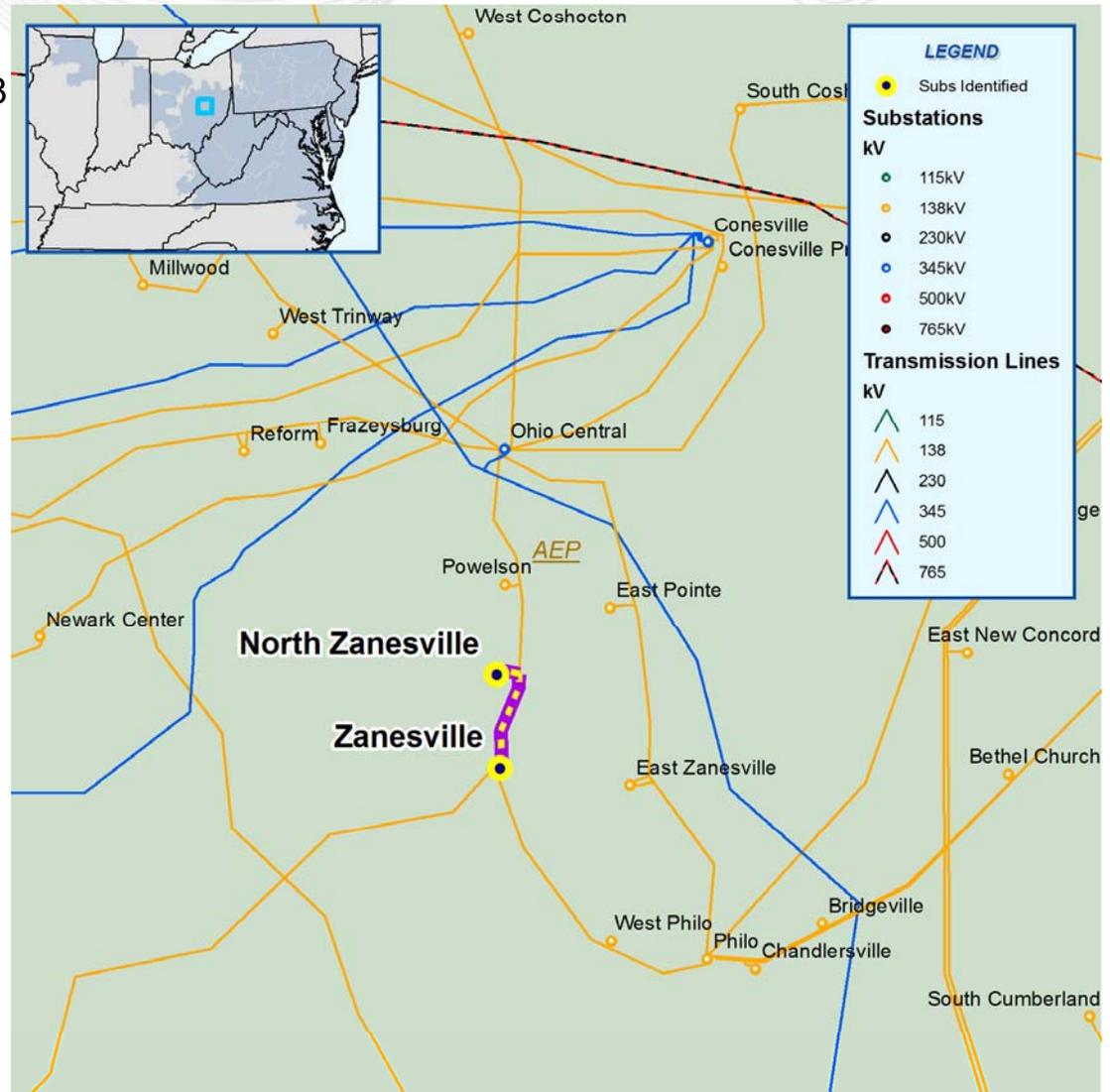
- N-1-1 Thermal Violation
- The North Muskingum – Muskingum River 138 kV line is overloaded for the loss of Kammer - Maliszewski - Marysville 765 kV line and Maliszewski 765/138 kV transformer and the loss of Ohio Central - Muskingum River 345 kV line
- Recommended Solution: Muskingum – North Muskingum 138 kV sag check (B1450)
- Estimated Project Cost: \$0.0148 M
- Expected IS Date: 12/31/2012



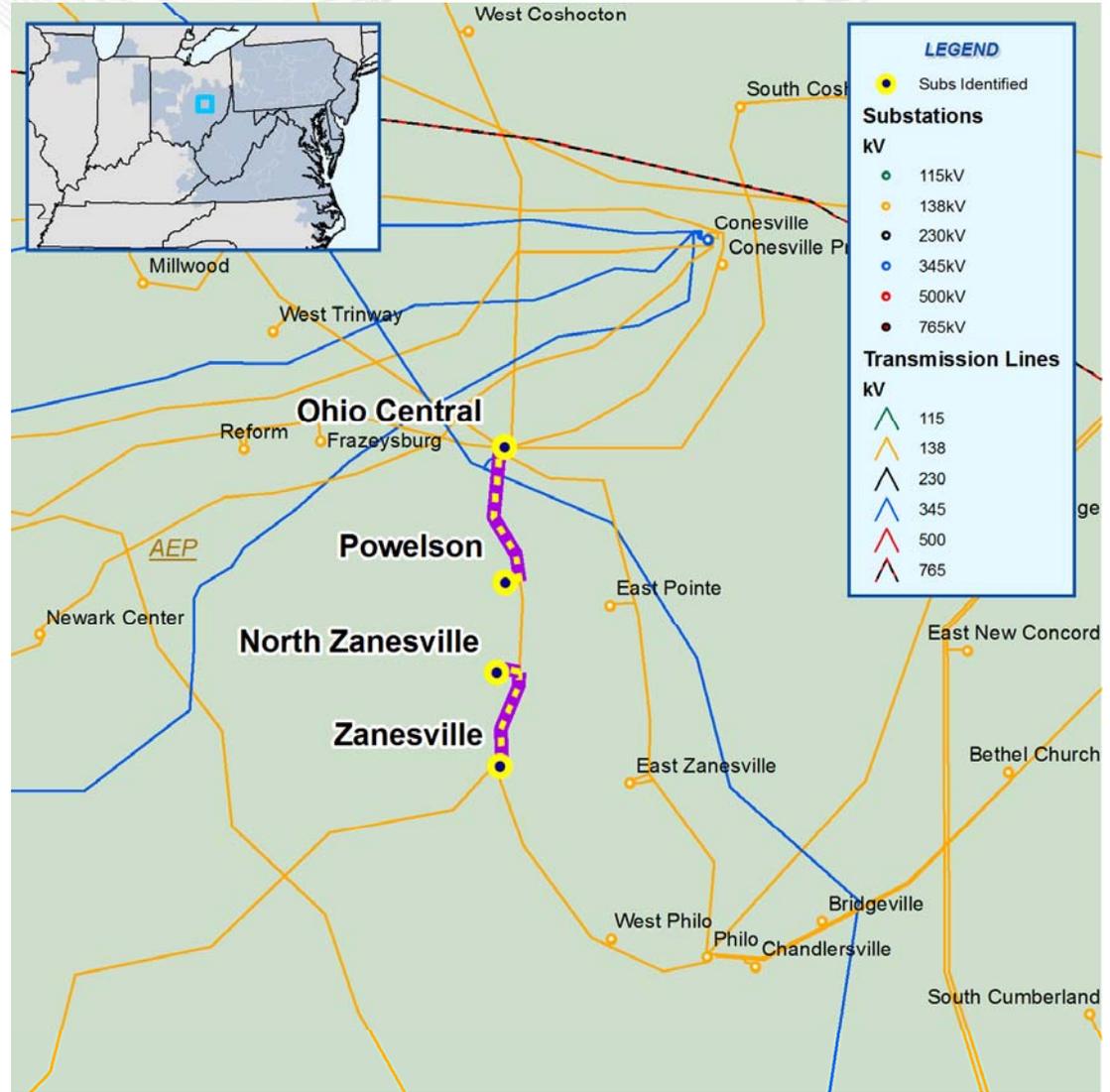
- N-1-1 Thermal Violation
- The Sharp Road – North Newark 138 kV line is overloaded for the loss of the East Lima - West Newton – Lynn - South Kenton 138 kV line and the loss of Academia - West Trinway - Ohio Central 138 kV line
- Recommended Solution: North Newark – Sharp Road 138 kV sag check (B1451)
- Estimated Project Cost: \$0.0776 M
- Expected IS Date: 12/31/2012



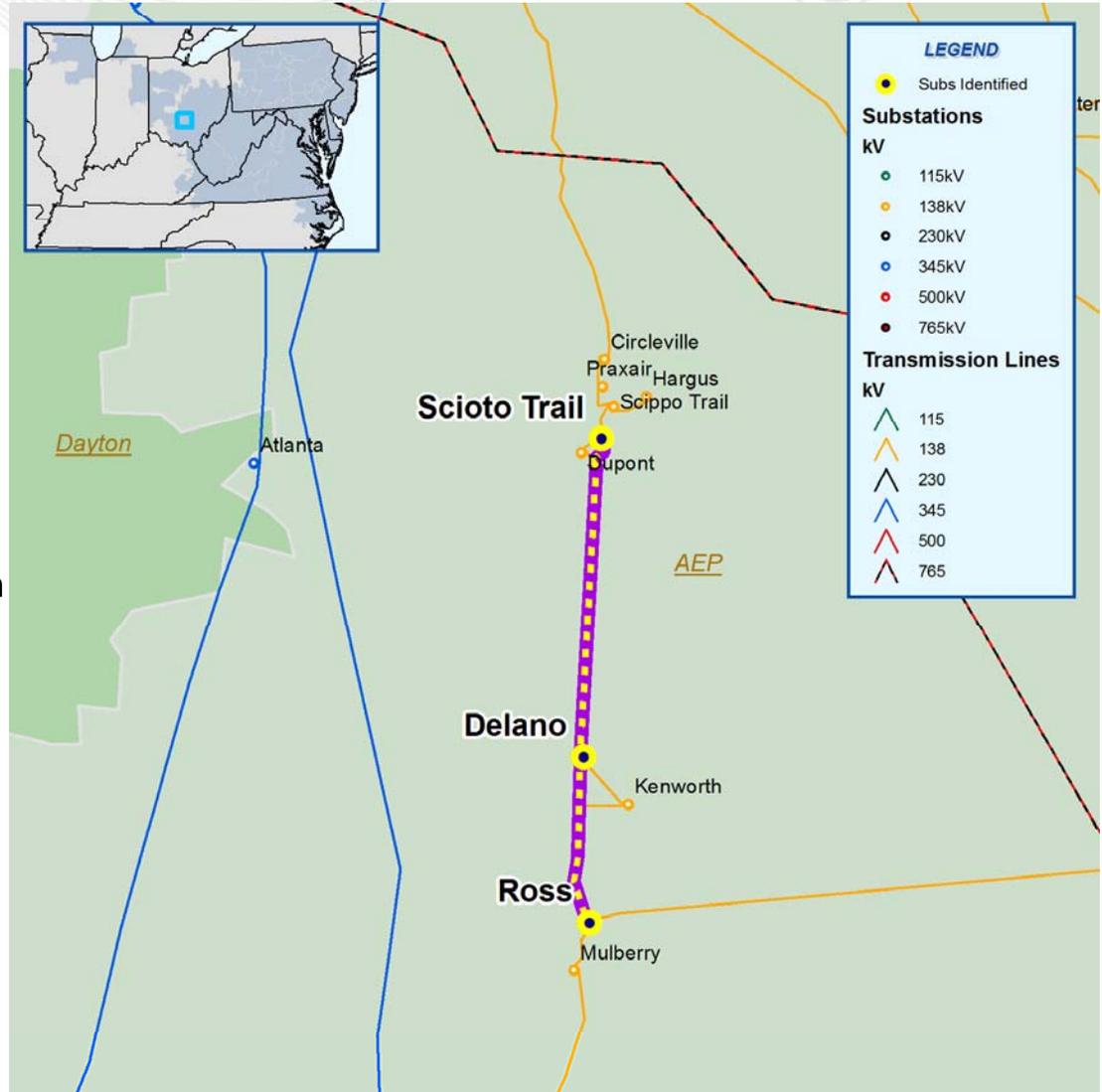
- Baseline Thermal Violation
- The North Zanesville – Zanesville 138 kV line is overloaded for the bus fault at Ohio Central with the loss of the East Point – Ohio Central 138 kV line and Ohio Center – S. Cochocton 138kV line
- Recommended Solution: North Zanesville – Zanesville 138 kV sag check (B1452)
- Estimated Project Cost: \$0.0188M
- Expected IS Date: 12/31/2012



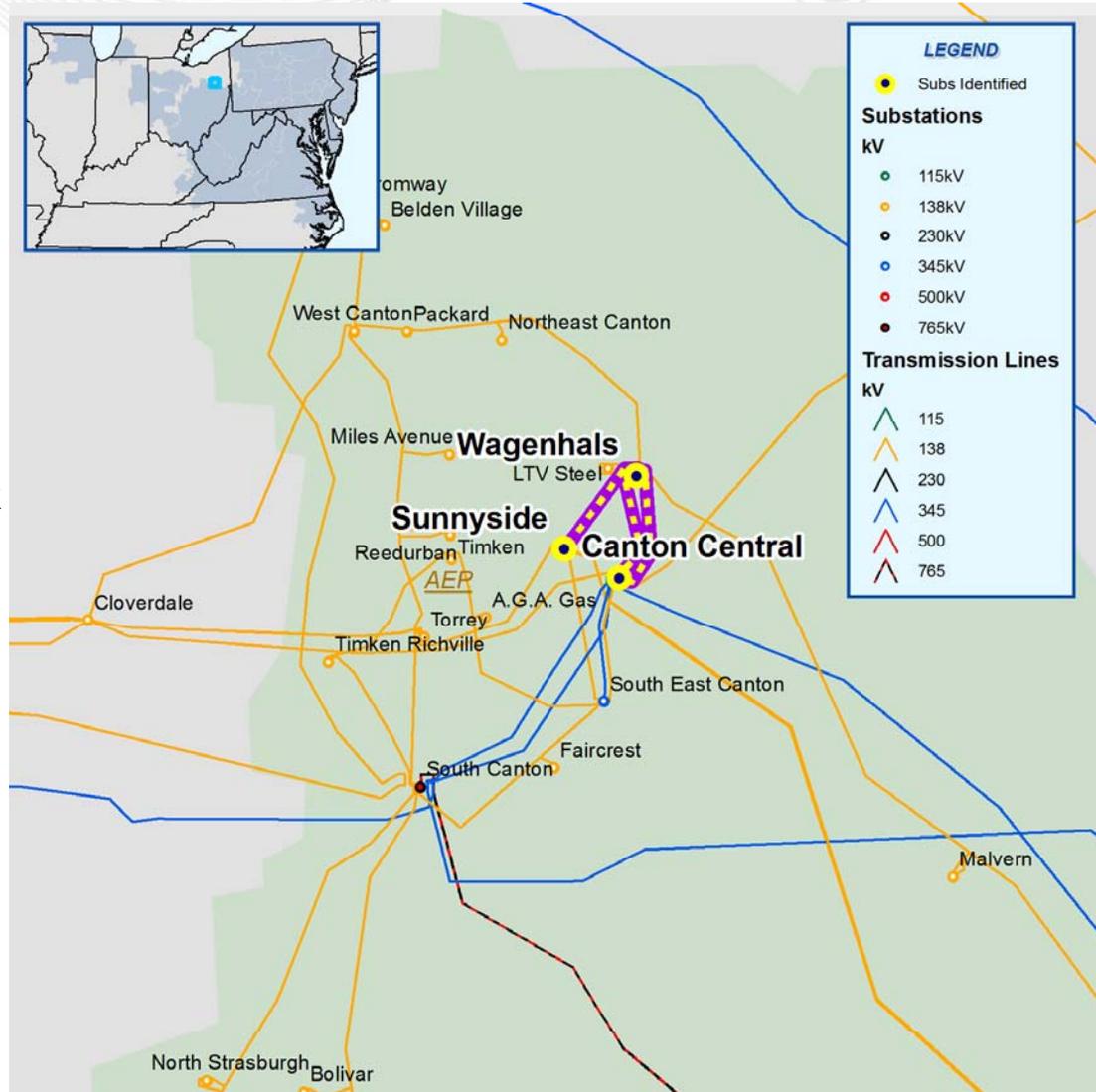
- N-1-1 Thermal Violation
- The North Zanesville – Powelson and Ohio Central – Powelson 138 kV line is overloaded for the loss of South Canton 345/138 kV transformer and the loss of the Ohio Central - East Point - East Zanesville – Philo 138 kV line
- Recommended Solution: North Zanesville – Powelson and Ohio Central – Powelson 138 kV sag check (B1453)
- Estimated Project Cost: \$0.1304 M
- Expected IS Date: 12/31/2012



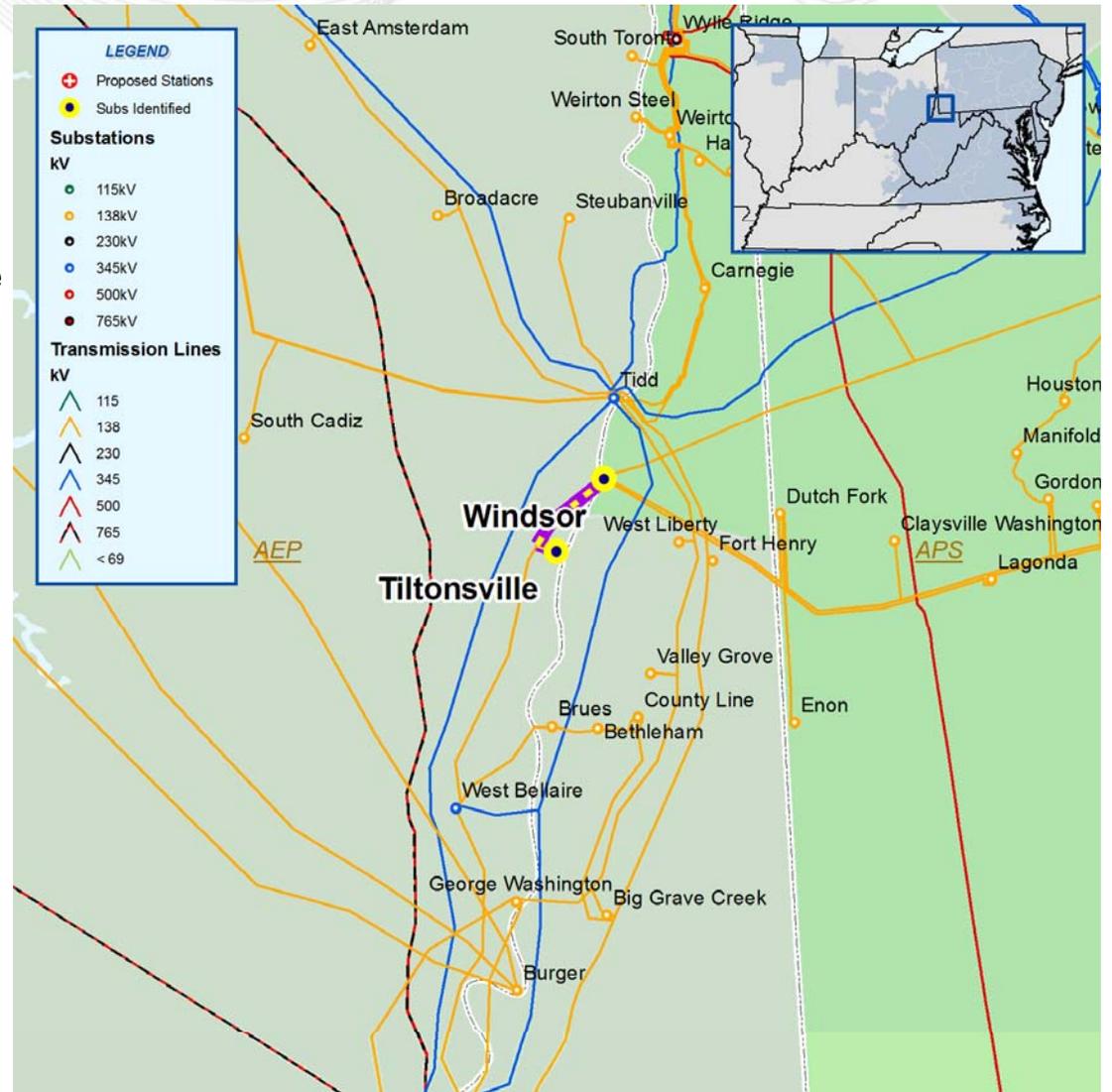
- Basecase Thermal Violation and N-1-1 Thermal Violation
- The Ross – Delano – Scioto Trail 138 kV line is overloaded for the North Fork – Bixby 345 kV line fault with stuck breaker at North Fork and various combination of single contingencies
- Recommended Solution: These circuits have been de-rated to their normal ratings and could benefit from an electrical clearance study to determine if the emergency rating can be utilized (B1454)
- Estimated Project Cost: \$0.064 M
- Expected IS Date: 12/31/2012



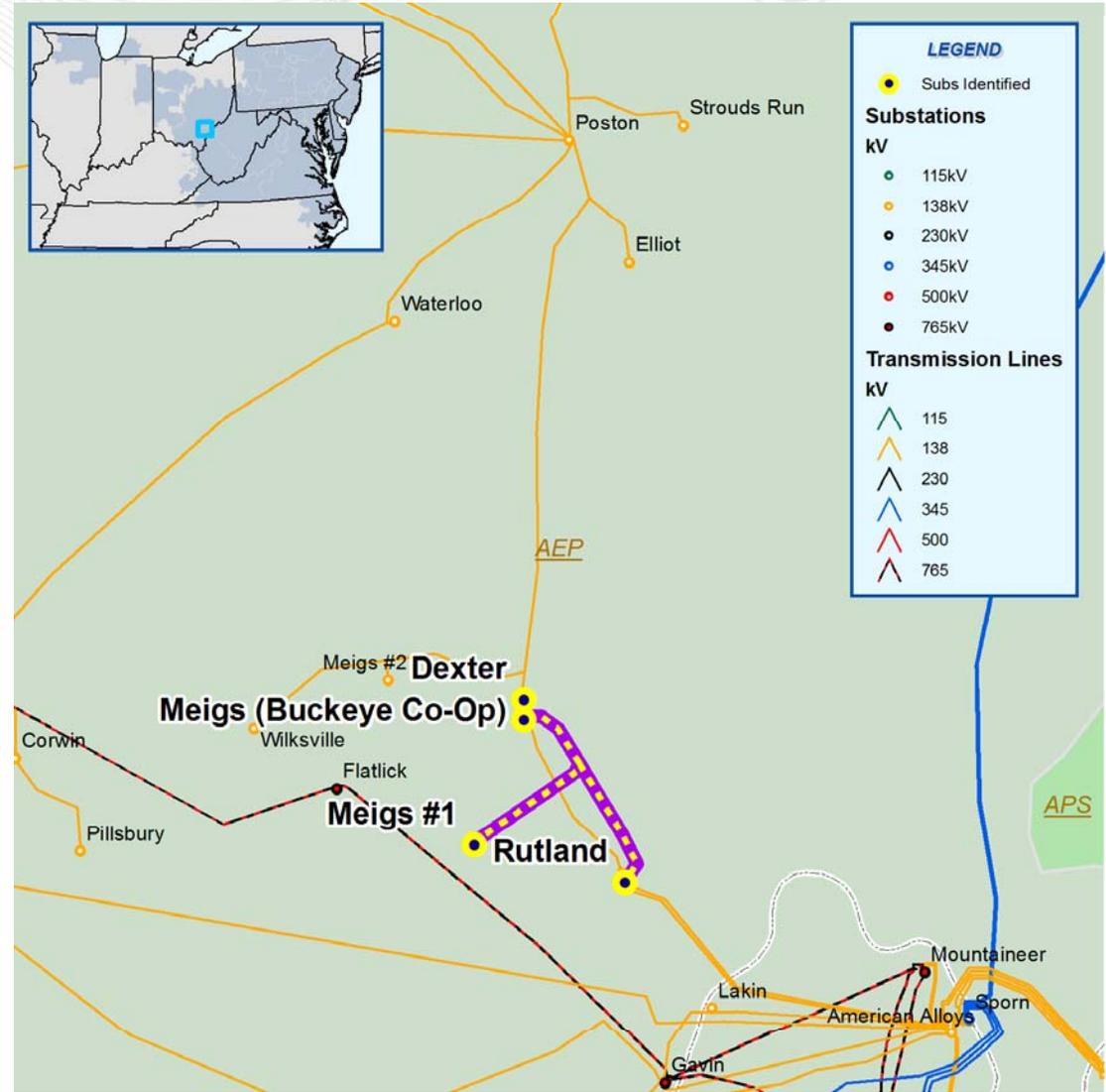
- N-1-1 Thermal Violation
- The Sunny – Canton Central – Wagenhals 138 kV line is overloaded for the loss of the Sunnyside – Wagenhals 138 kV line and the loss of the Canton Central – Wagenhals 138 kV line or the loss of the Canton Central – Wagenhals 138 kV line and the loss of the Canton Central – Wagenhals 138 kV line
- Recommended Solution: A sag check will determine if all circuits can be operated at its summer emergency rating of 396 MVA (B1455)
- Estimated Project Cost: \$0.032 M
- Expected IS Date: 12/31/2012



- Common Mode Contingency Violation
- The Windsor – Tiltonsville 138 kV line is overloaded for the tower outage of the Wylie Ridge – Tidd 345 kV line and the Tidd – Collier 345kV line
- Recommended Solution: The Tiltonsville - Windsor 138 kV circuit has been de-rated to its normal rating and would need an electrical clearance study to determine if the emergency rating can be utilized (B1457)
- Estimated Project Cost: \$0.02 M
- Expected IS Date: 12/31/2012



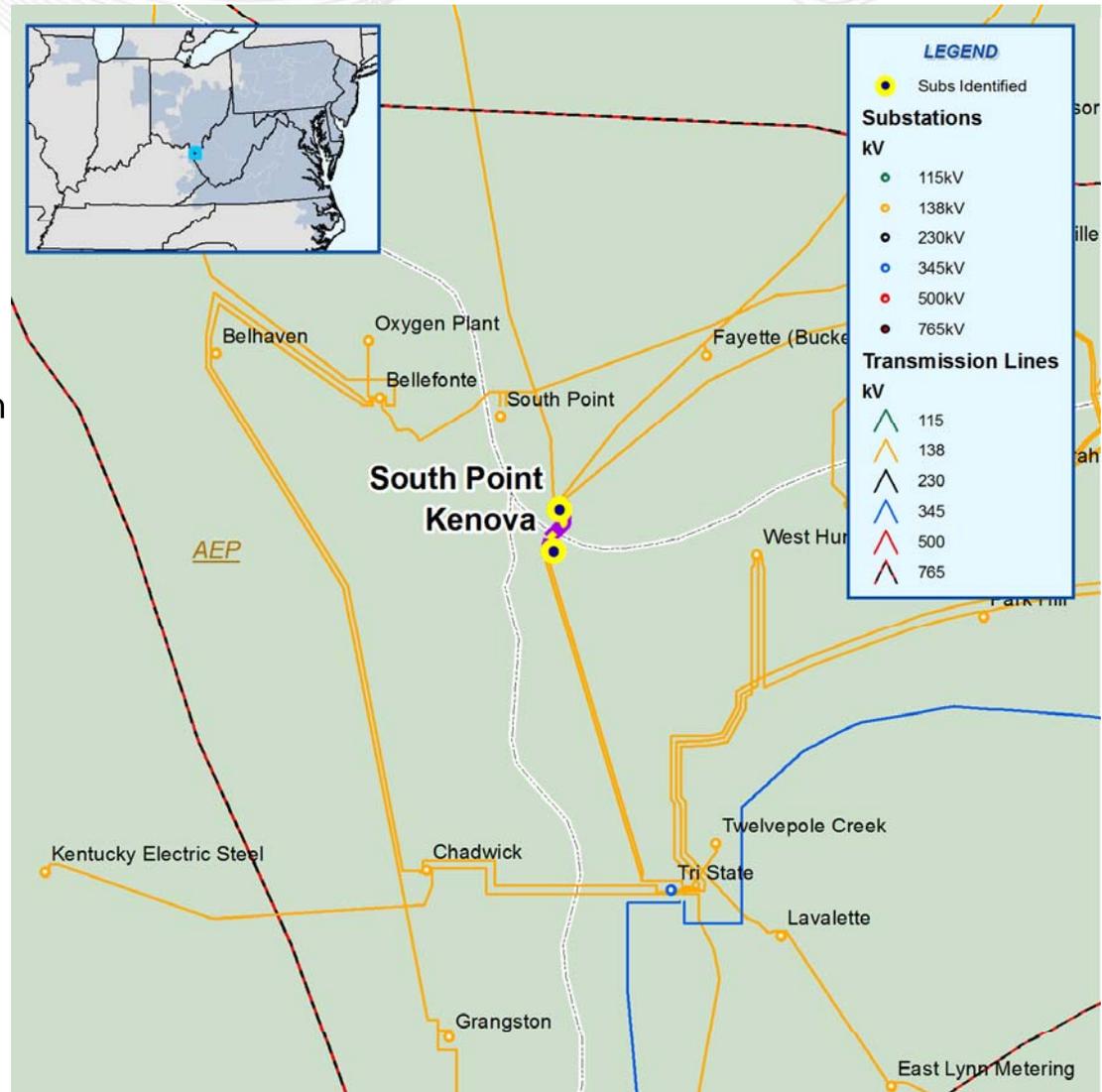
- Generator Deliverability Violation
- The Dexter – Meigs 138 kV line is overloaded for the Muskingum – Waterford 345 kV line fault with the stuck breaker at Muskingum
- Recommended Solution: Dexter – Meigs 138 kV Electrical Clearance Study (B1448)
- Estimated Project Cost: \$0.00824 M
- Expected IS Date: 12/31/2012



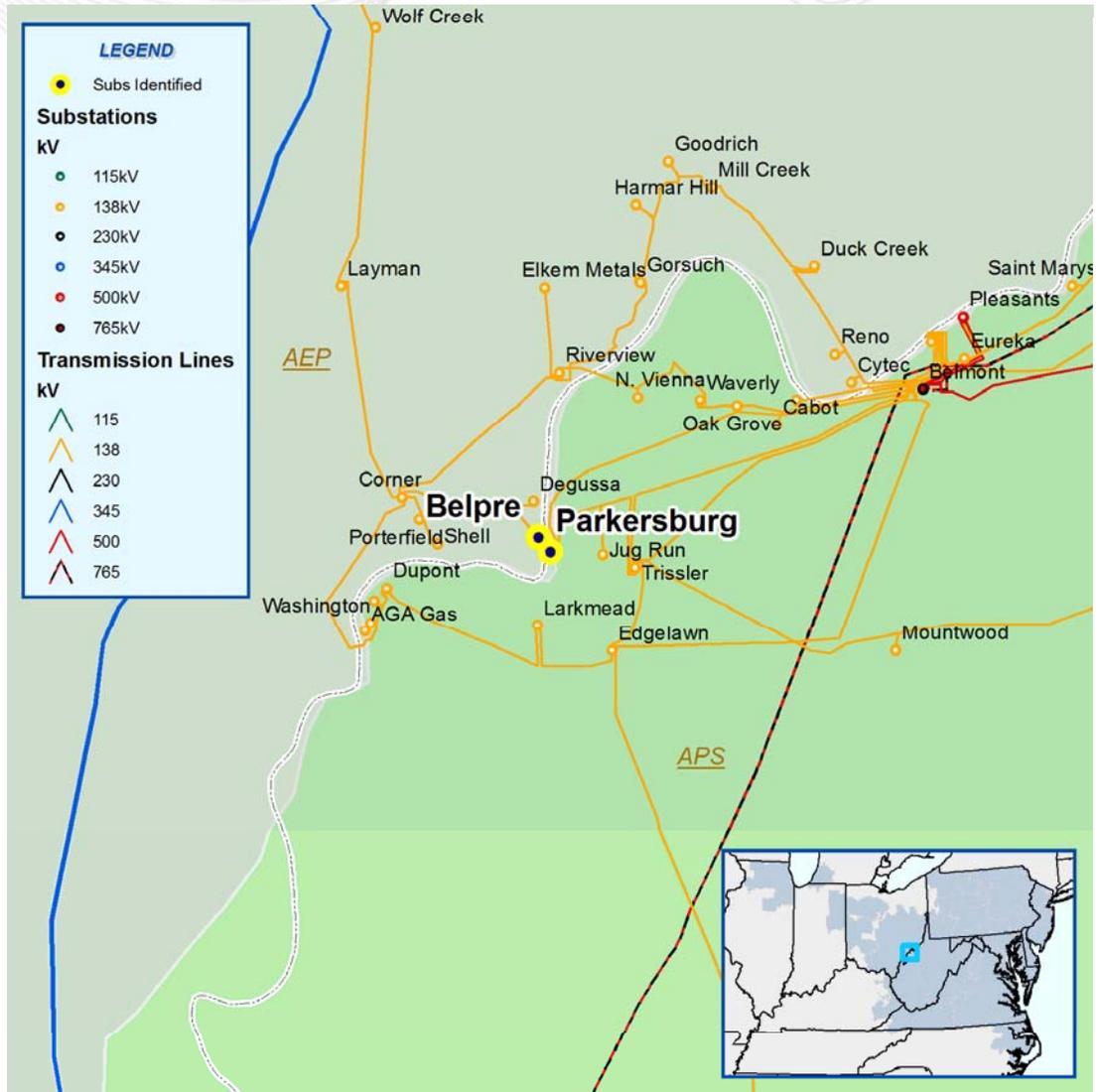


AEP Transmission Zone

- Baseline Thermal Violation
- The Kenova – South Point 138kV line is overloaded for the loss of Baker 765/345 kV transformer
- Recommended Solution: Several circuits have been de-rated to their normal conductor ratings and could benefit from electrical clearance studies (a.k.a. sag studies) to determine if the emergency rating can be utilized (B1459)
- Estimated Project Cost: \$0.00536 M
- Expected IS Date: 12/31/2012

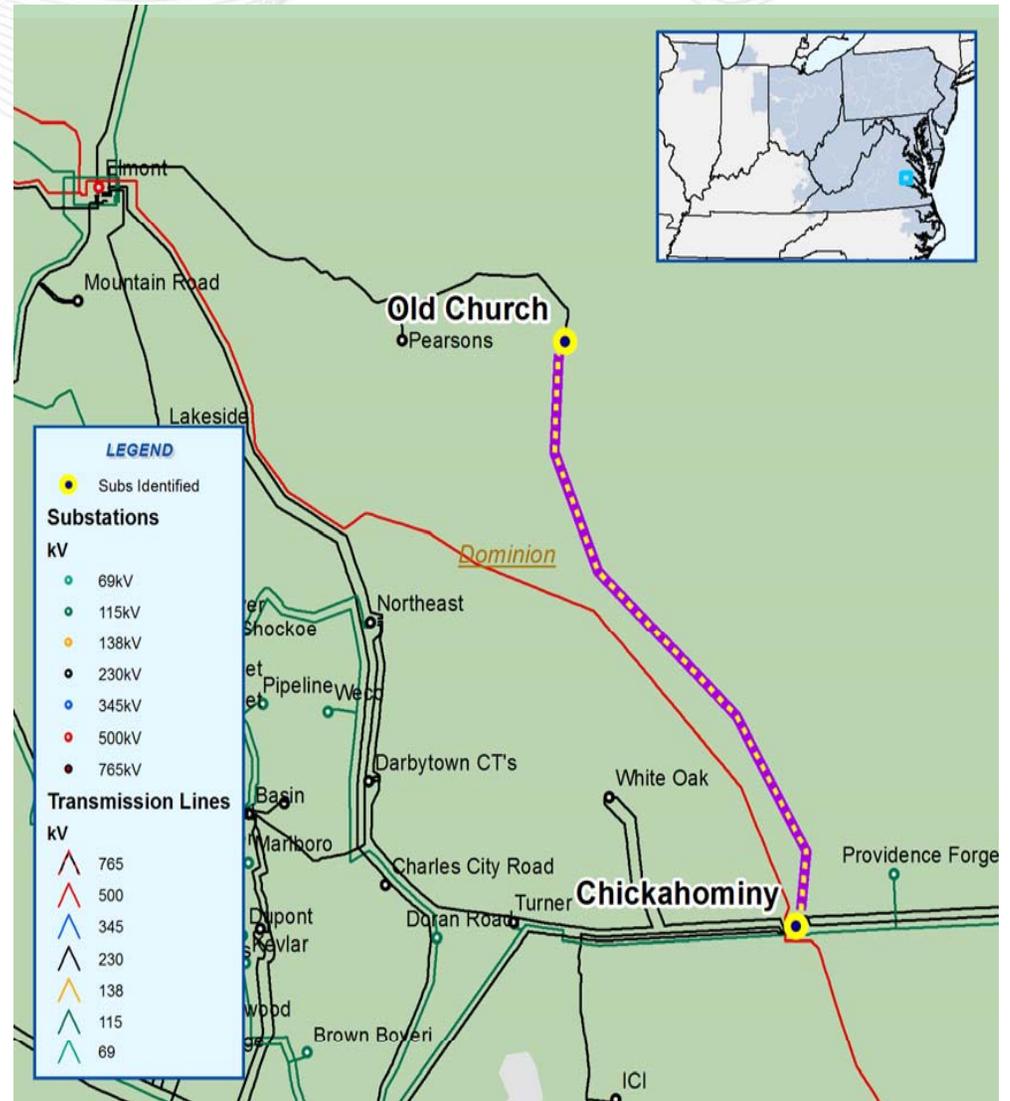


- N-1-1 Thermal Violation
- The Belpre – Parkersburg 138 kV line is overloaded for the loss of the Oak Grove Substation – Waverly 138 kV line and the loss of Willow Island – Cytec 138 kV line
- Recommended Solution: Perform a sag study on the Parkersburg (Allegheny Power) – Belpre (AEP) 138 kV sag study (B1446)
- Estimated Project Cost: \$0.007 M
- Expected IS Date: 12/31/2012



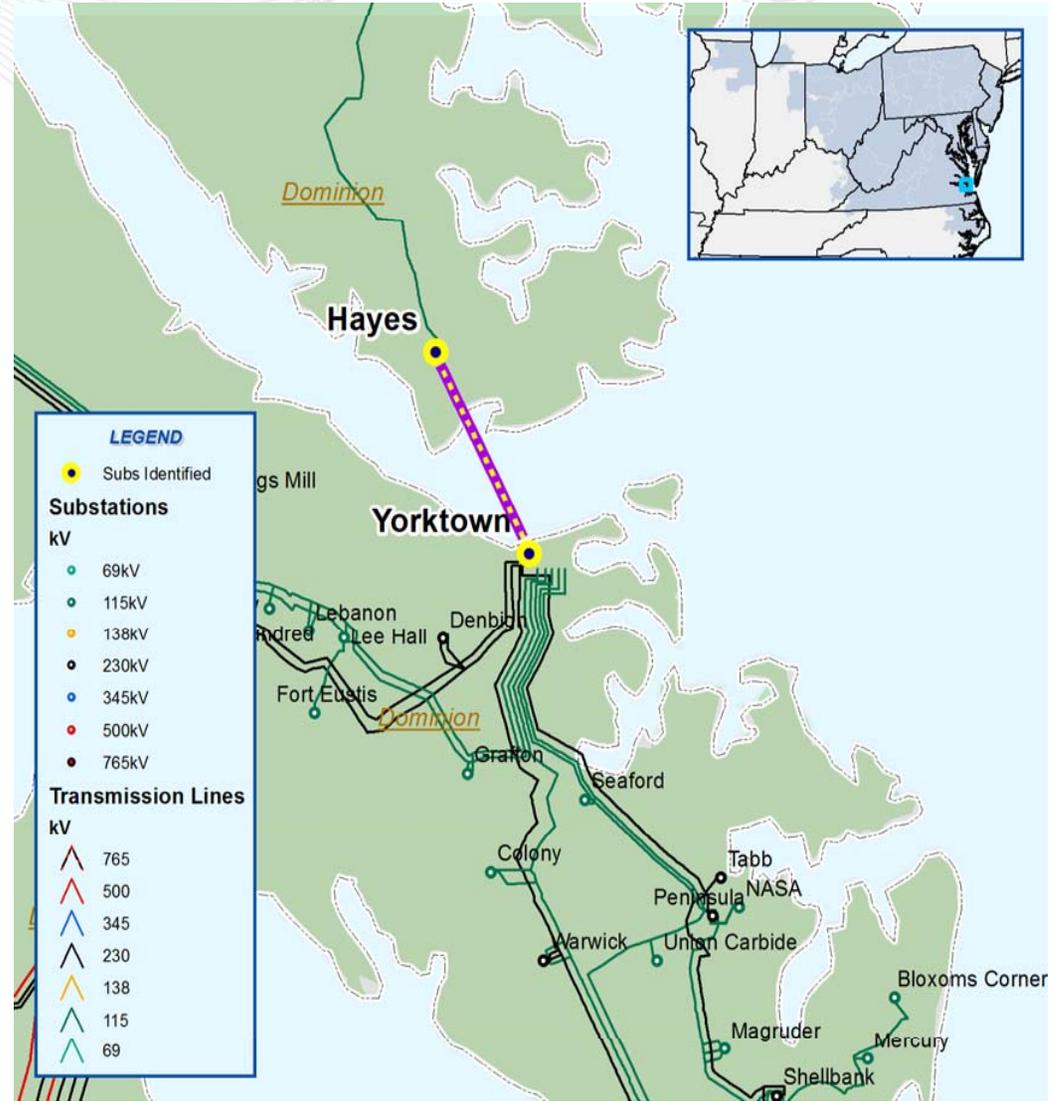
Dominion Criteria Violation

- Problem: Line loading at Pearsons and Old Church Subs. exceeds 100 MVA.
- Solution: Extend the line from Old Church to Chickahominy 230 kV (b0767)
- Previous Estimated Project Cost: \$17.0 M
- New Estimated Project Cost: \$39.0 M
- Previous Projected IS Date: November 2009
- New Projected IS Date: March 18, 2011



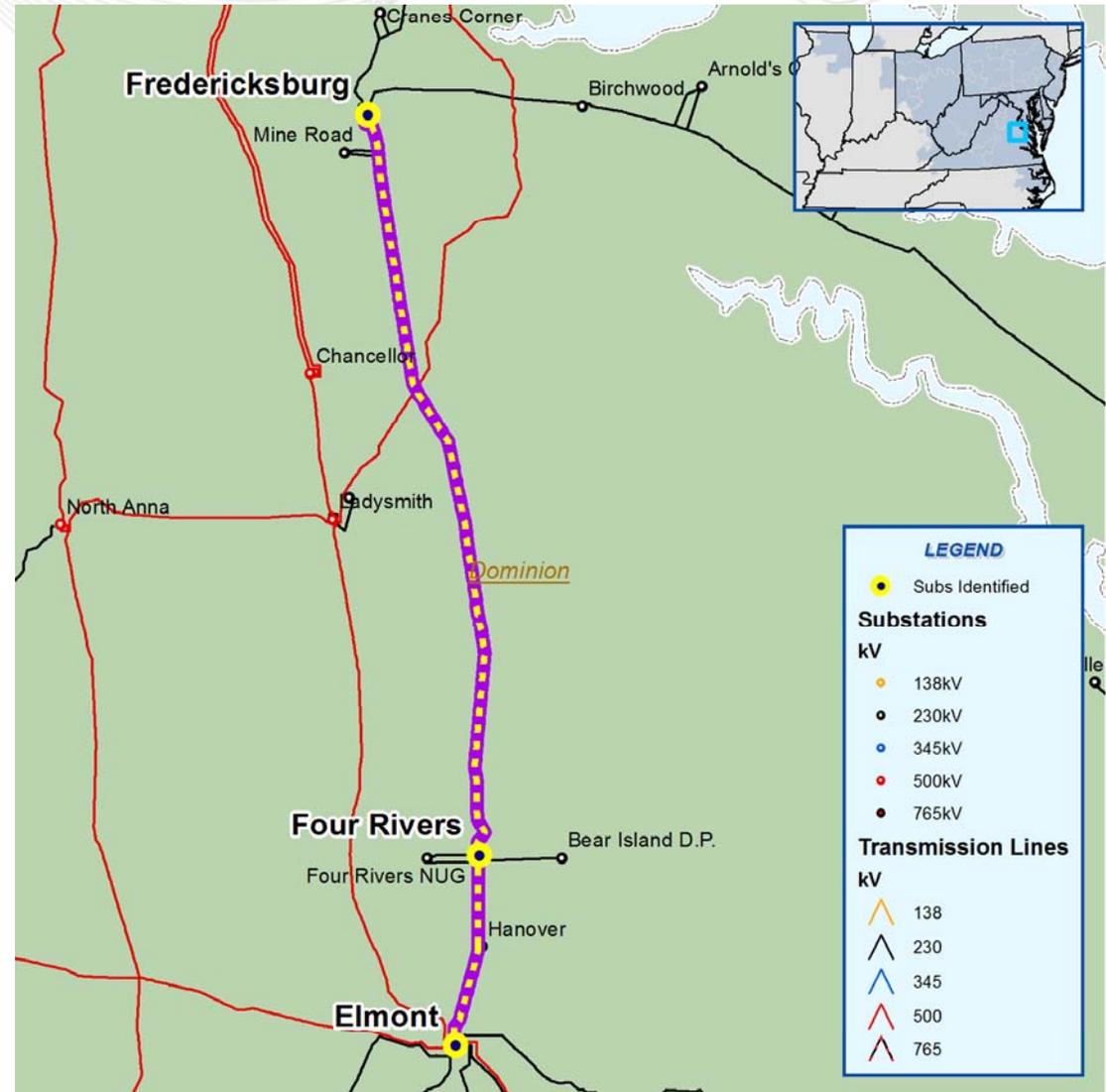
NERC Category B Violation

- Previously approved RTEP upgrade
- Problem: Loss of Lanexa to Harmony results in low voltage on underlying 115 kV
- Proposed Solution: Build a new 230 kV line from Yorktown to Hayes (b0779)
- Previous Estimated Project Cost: \$25.0 M
- New Estimated Project Cost: \$74.0 M
- Projected IS Date: May 2012



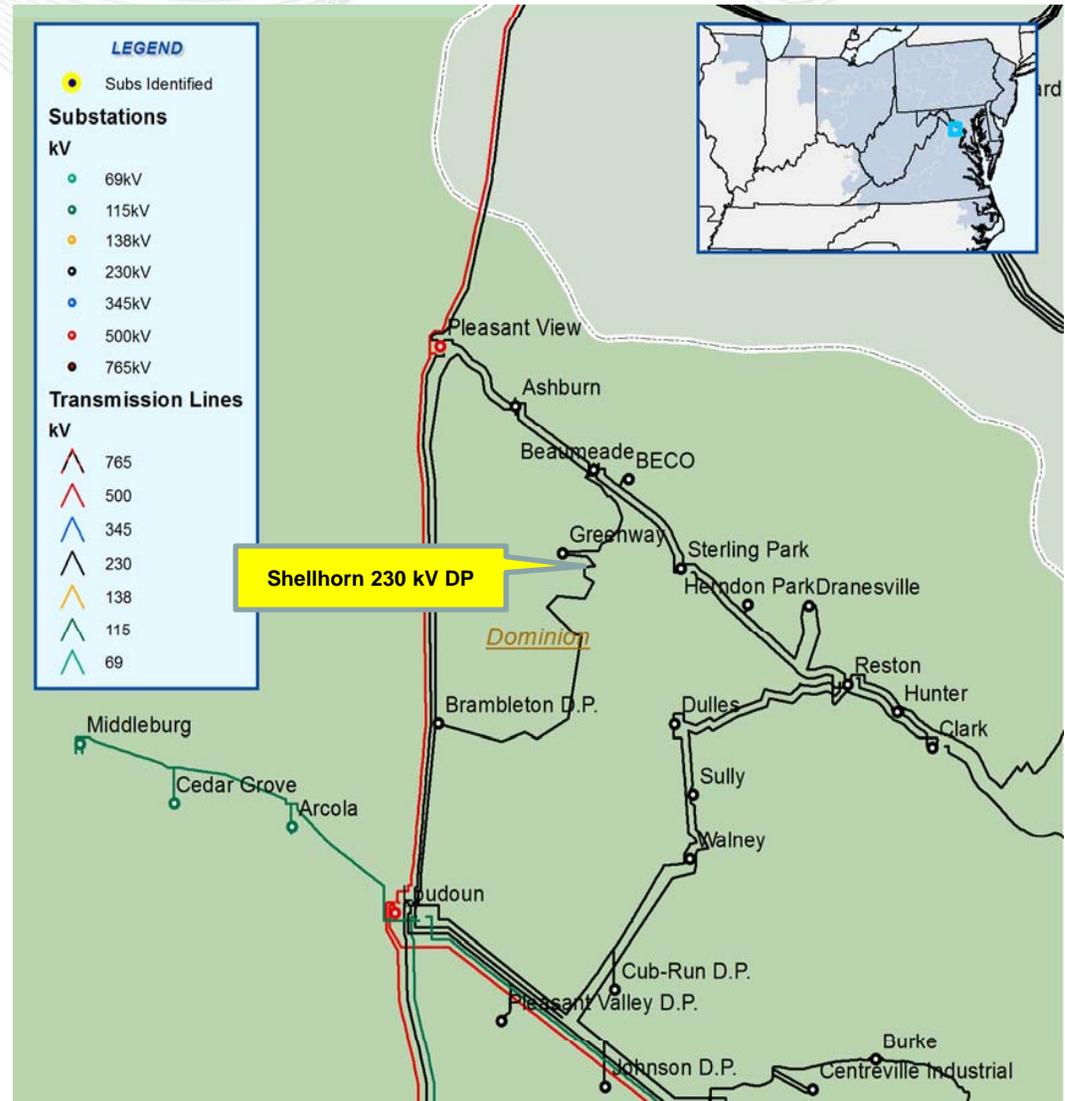
NERC Category C Violation

- Previously approved RTEP upgrade
- The outage of line #73 Four Rivers to Elmont with Four Rivers 115 kV generation off causes low voltages at line #45 Four Rivers to Fredericksburg 115 kV
- Also Line #47 Four Rivers to Fredericksburg overloads for the outage line #29 Fredericksburg to Possum Pt and Fredericksburg 230/115 kV
- Recommended Solution: Install 2nd Fredericksburg 230/115 kV Autotransformer (b0758)
- Estimated Project Cost: \$5.5 M
- Previous Projected IS Date: 5/1/2013
- New Projected IS Date: 5/1/2012



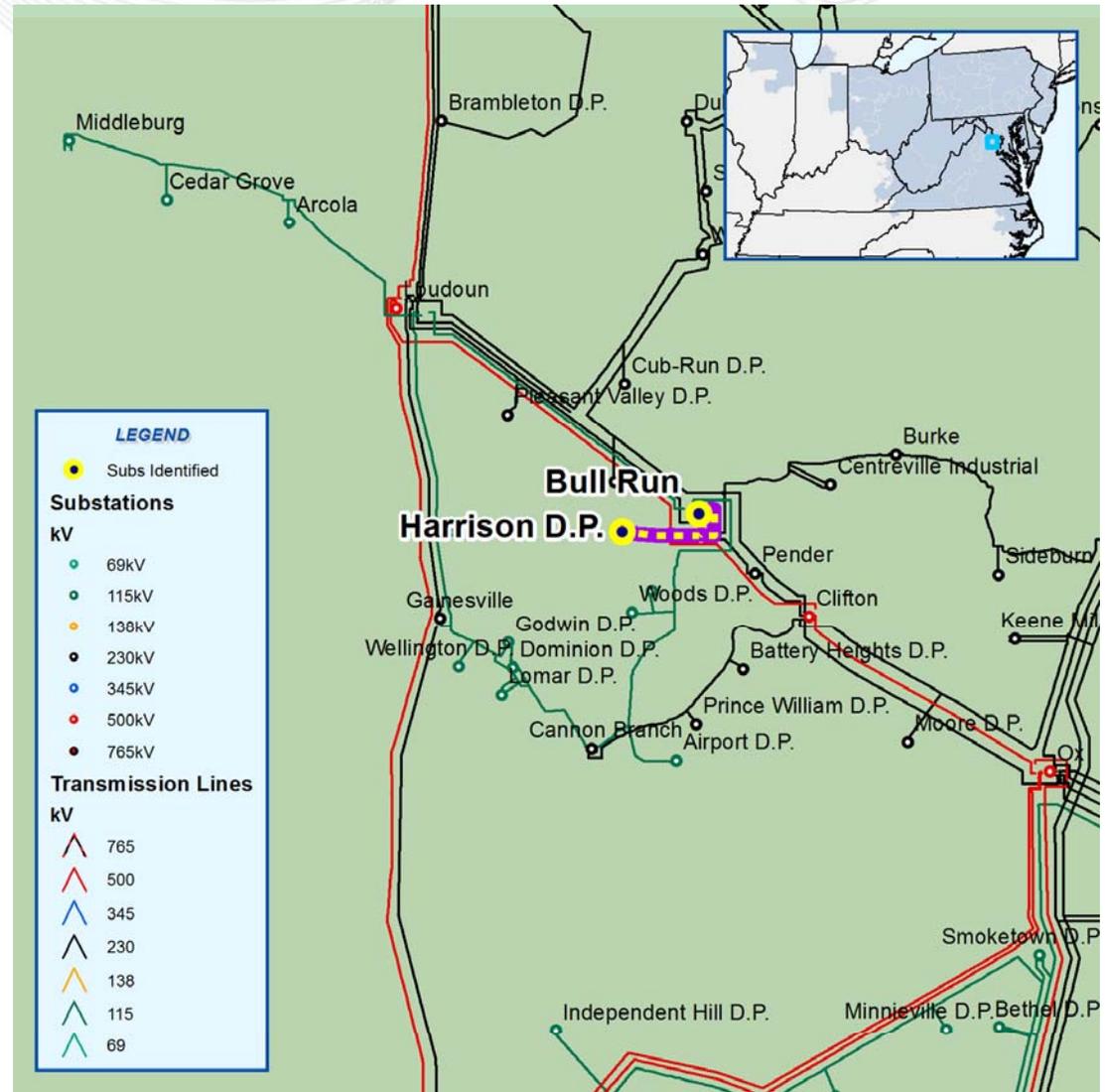
Dominion Criteria Violation

- Dominion Distribution has requested a new 230 kV delivery by 2013 to serve the expansion of an existing datacenter customer. Initial requested capacity is 70 MW in 2013, growing to 100 MW by 2015
- No existing 230 kV lines are located in the area. If a 230 kV line is extended from NIVO to Waxpool then loading on that radial line will exceed 100 MW and networking will be required. If a 230 kV source is extended from Shellhorn then radial line loading will exceed 100 MW and contingencies will drop more than 300 MW violating DVP and PJM criteria
- Proposed solution
 - Network NIVO and Waxpool Substations with Shellhorn Substation
 - Construct a 230 kV underground line approximately 1.6 miles from existing NIVO Substation to Waxpool Substation
 - Install a four-breaker, 230 kV ring-bus at Waxpool Substation
 - Network Waxpool Substation by constructing a 230 kV overhead line approximately 2.1 miles from Waxpool Substation to Shellhorn Substation and install two additional 230 kV breakers at Shellhorn
- Estimated Project Cost: \$30 M
- Projected IS Date: May 2013



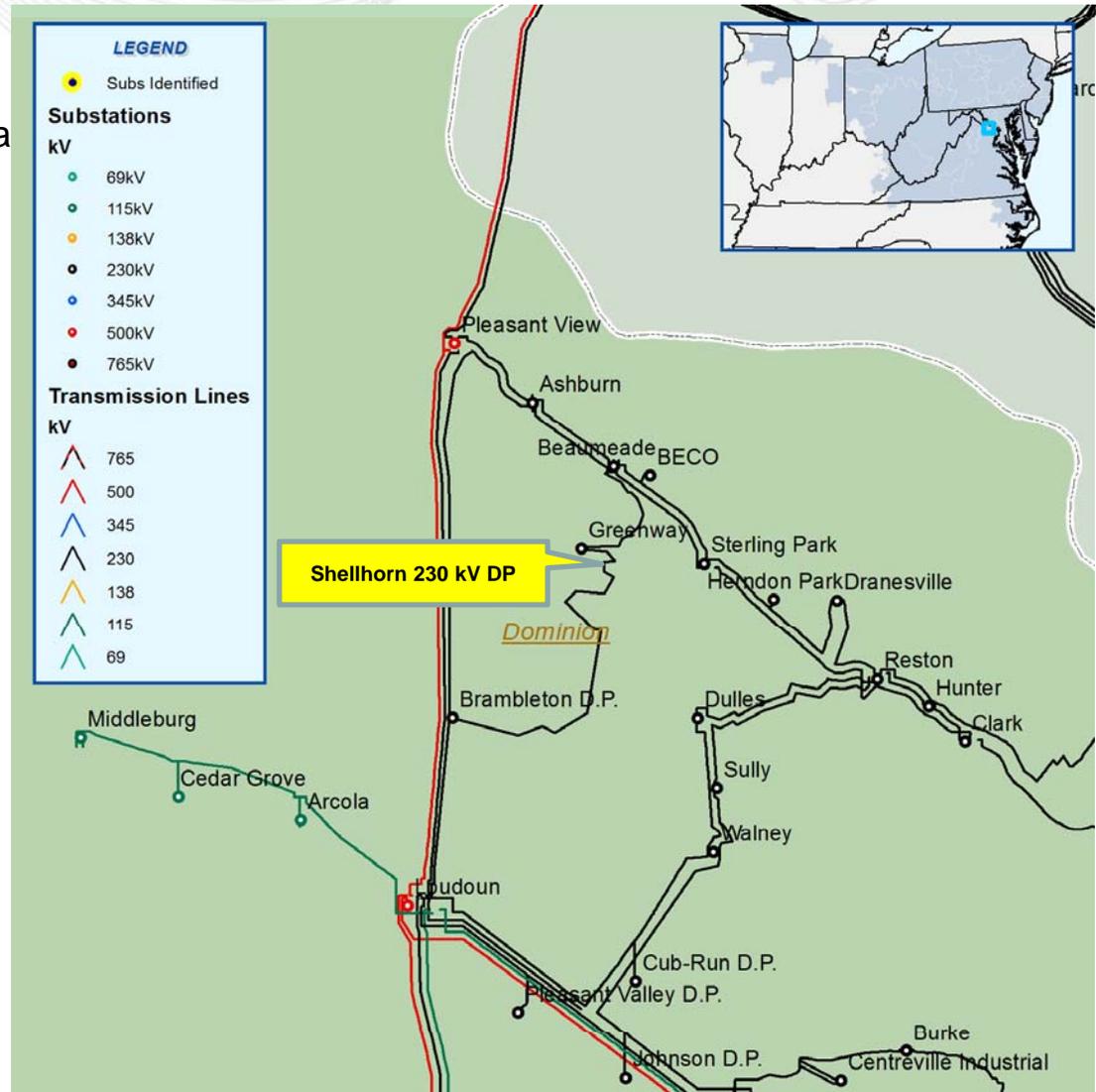
NERC Category B Violation

- Problem: The N-1 contingency loss of NOVEC's 115 kV transmission circuit #923 will result in an overload of Dominion's Line #134 (Bull Run-Harrison DP) while trying to restore load. Additionally, normal loading on Line #134 (radial) is above 100 MW
- Proposed Solution:
 - Re-build Lines #134 and #163 for higher capacity, approximately 0.5 miles from Bull Run Substation to Harrison DP
 - Install a tie-switch between the lines at Harrison DP
- Estimated Project Cost \$3.0 M
- Projected IS Date: May 2013



Dominion Criteria Violation

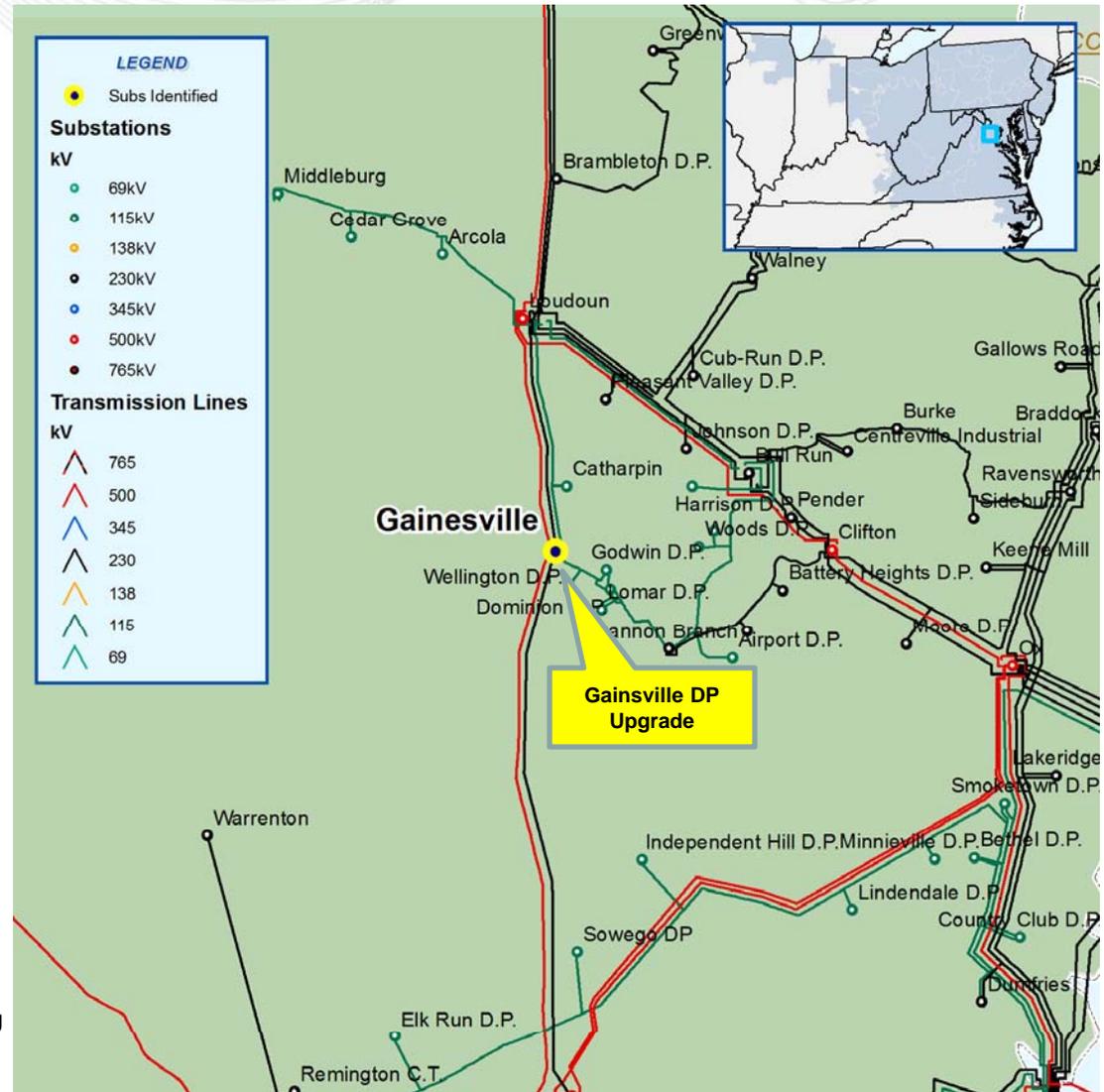
- Dominion Distribution has requested a new 230 kV delivery by 2013 to serve forecasted system conditions associated with the MetroRail extension into Loudoun County and also increased loading due to continued datacenter development. Initial load is 30 MW in 2013 growing to 60 MW by 2015.
- The initial installation will include looping Line 2095 approximately 200 feet in-and-out of the station and installing two 230 kV breakers to avoid having 300 MVA exposed to a single contingency event, Line stuck breaker failure L2095 (227T2095). The loss of 300 MVA would exceed Dominion and PJM criteria
- Estimated Project Cost \$3.0 M
- Projected IS Date: May 2013



NERC Category A Violation

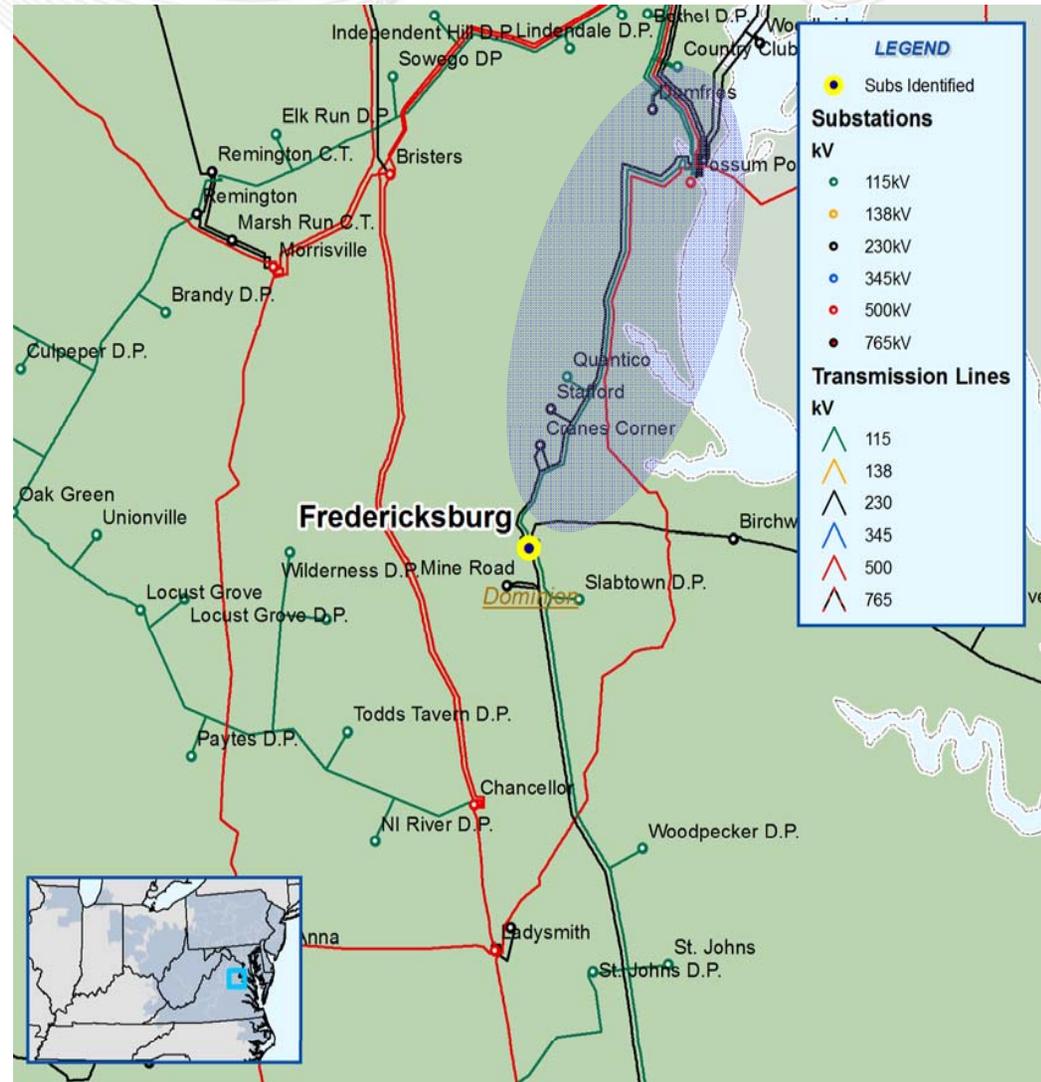
- Problem: Block load additions at NOVEC's Gainesville DP is increasing load by 120-140 MW over the next several years. By summer 2012, the transformer feeding their DP will be above its emergency rating (269.1 MVA) under normal conditions.
- Proposed Solution:
 - At Gainesville Substation, create two 115 kV straight-buses with a normally open tie-breaker
 - Upgrade Line 124 (radial from Loudoun) to a minimum continuous rating of 500 MVA and network it into the 115 kV bus feeding NOVEC's DP at Gainesville
 - Install two additional 230 kV breakers in the ring at Gainesville (may require substation expansion) to accommodate conversion of NOVEC's Gainesville to Wheeler line
 - Convert NOVEC's Gainesville-Wheeler line from 115 kV to 230 kV (will require replacement of three transformers total at Atlantic and Wheeler Substations)
- Estimated Project Cost \$20.0 M*
- Projected IS Date: May 2013

* Note: After conversion to 230kV there will be several radial 230kV lines approaching 100 MW; DVP is evaluating options that will be presented at a later TEAC



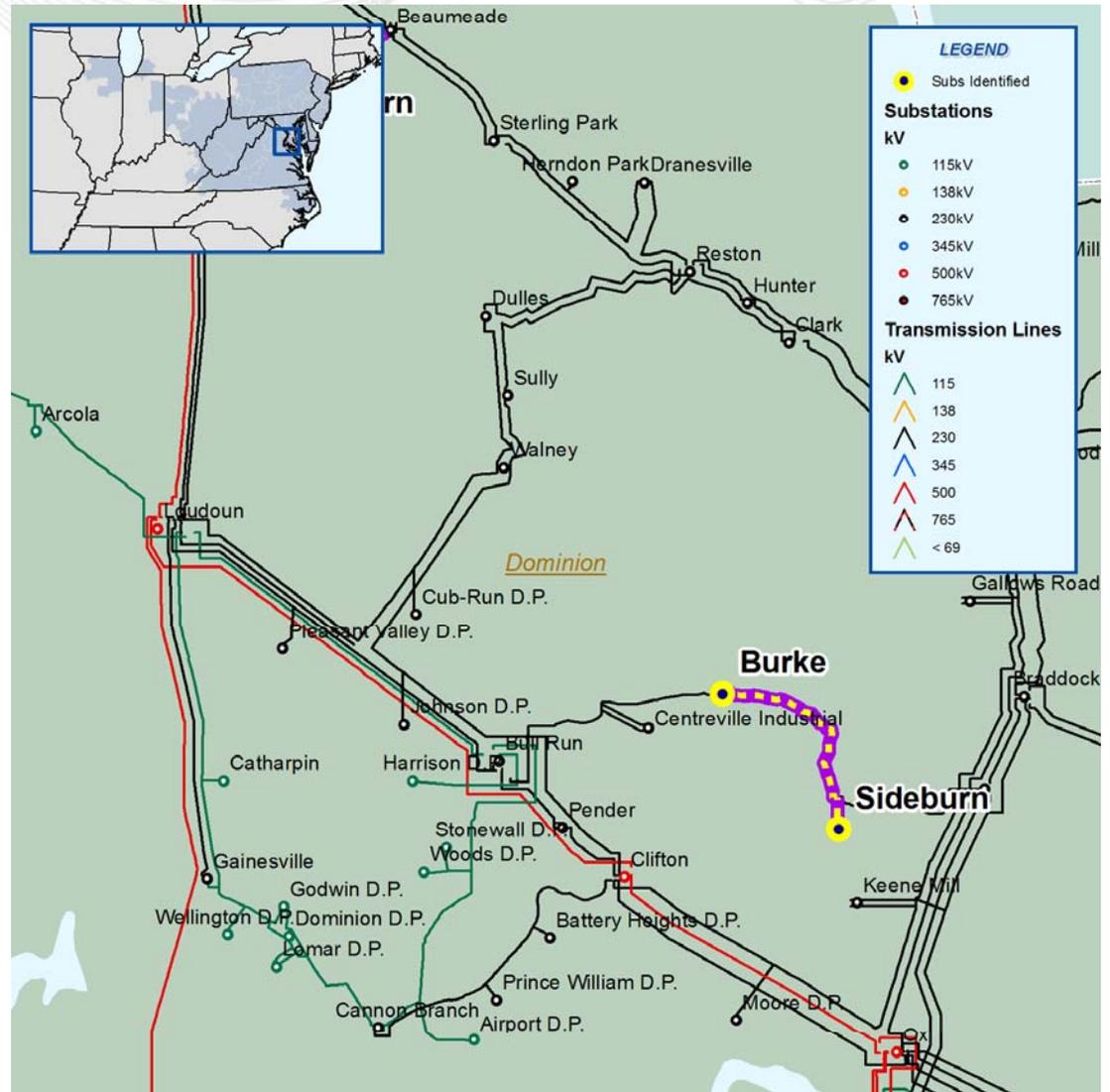
NERC Category C Violation

- Previously approved RTEP upgrade
- Problem: The failure of the Fredericksburg 230kV breaker #2090T2104 results in load loss greater than 300MW – Dominion & PJM Criteria violation
- Proposed Solution: Install a 230kV, 3000 amp breaker at Cranes Corner Substation to sectionalize the 2104 line into two lines. Project(b1311)
- Previous Estimated Project Cost: \$0.75 M
- New Estimated Project Cost: \$1.1M
- Projected IS Date: 05/01/2014



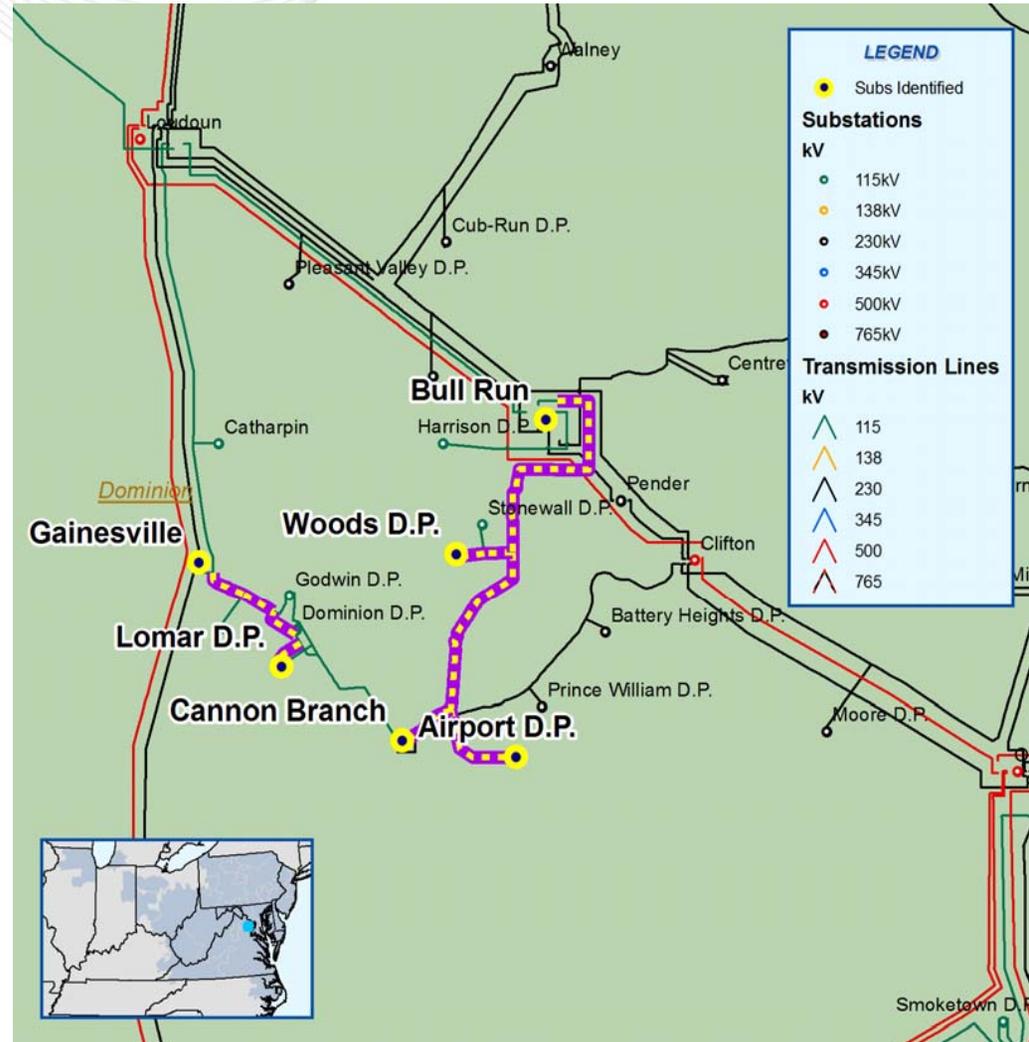
NERC Category C Violation

- Previously approved RTEP upgrade
- Problem: The Burke to Sideburn underground circuit overloads for the N-1-1 loss of Bull Run - Loudoun 230 kV and Clifton - Pender 230 kV
- Proposed Solution: Install 2nd Burke to Sideburn 230 kV underground cable (b1089)
- Previous Estimated cost: \$4.0 M
- New Estimated cost: \$9.0 M
- Projected IS date: 6/1/2014



NERC Category B & C Violation

- Previously approved RTEP upgrade
- Problem: For the N-1 loss of radial 230kV Line #2011 (Clifton-Cannon Branch), Line #172 (Gainesville-Lomar DP) and Line #163 (Bull Run-Airport DP) will load to 102% and 105%, respectively, while trying to restore the load. Additionally, the Gainesville 230/115 kV transformer will load to 96%.
- For a 2nd N-1 event (loss of the Gainesville 230/115 kV TX), Line #163 would exceed its emergency rating between Bull Run and Woods DP (approx 4 miles) and between Woods DP and Cannon Branch (approx 2.7 miles).
- Proposed Solution: Build Cannon Branch to Nokesville 230 kV Line (b1332)
- Estimated Project Cost: \$40 M
- Previous Projected IS Date: 5/31/2018
- New Projected IS Date: 5/31/2015

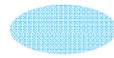




Dominion Transmission Zone



Region with thermal issues



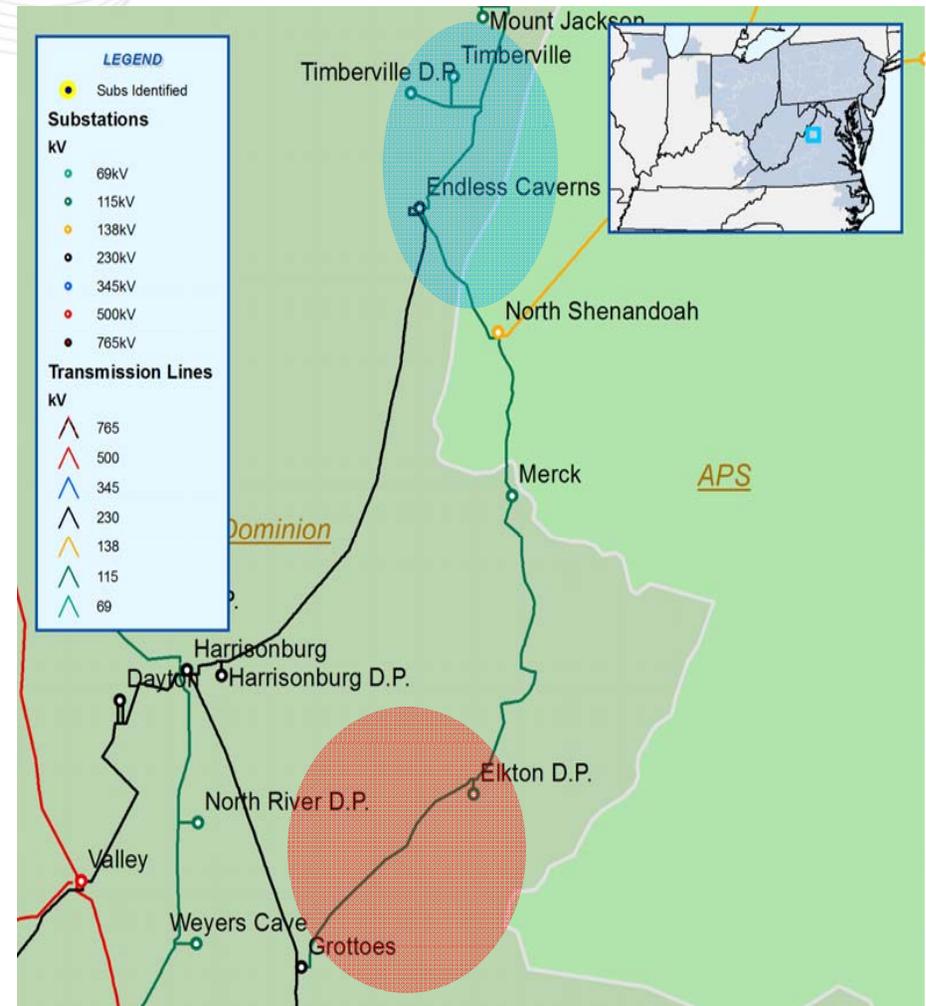
Region with voltage issues

A. NERC Category B. The N-1 loss of the 230kV line section HEC2 DP to Harrisonburg results in a thermal overload of the 115kV Line # 119 (Grottoes to Merck), and the 230-115kV TX at Grottoes

B. NERC Category B. The N-1 loss of one of 230-115kV transformers at Endless Caverns results in thermal overload of the remaining 230-115kV transformer at Endless Caverns.

C. NERC Category C3. The N-1-1 loss of the 230kV line section HEC2 DP to Harrisonburg and the 138kV Line Section (Strasburg to Meadow Brook) results in extreme low voltage in the area.

D. NERC Category C3. The N-1-1 loss of the 230kV line section HEC2 DP to Harrisonburg and the loss of the Grottoes 230-115kV TX results in extreme low voltage in the area.



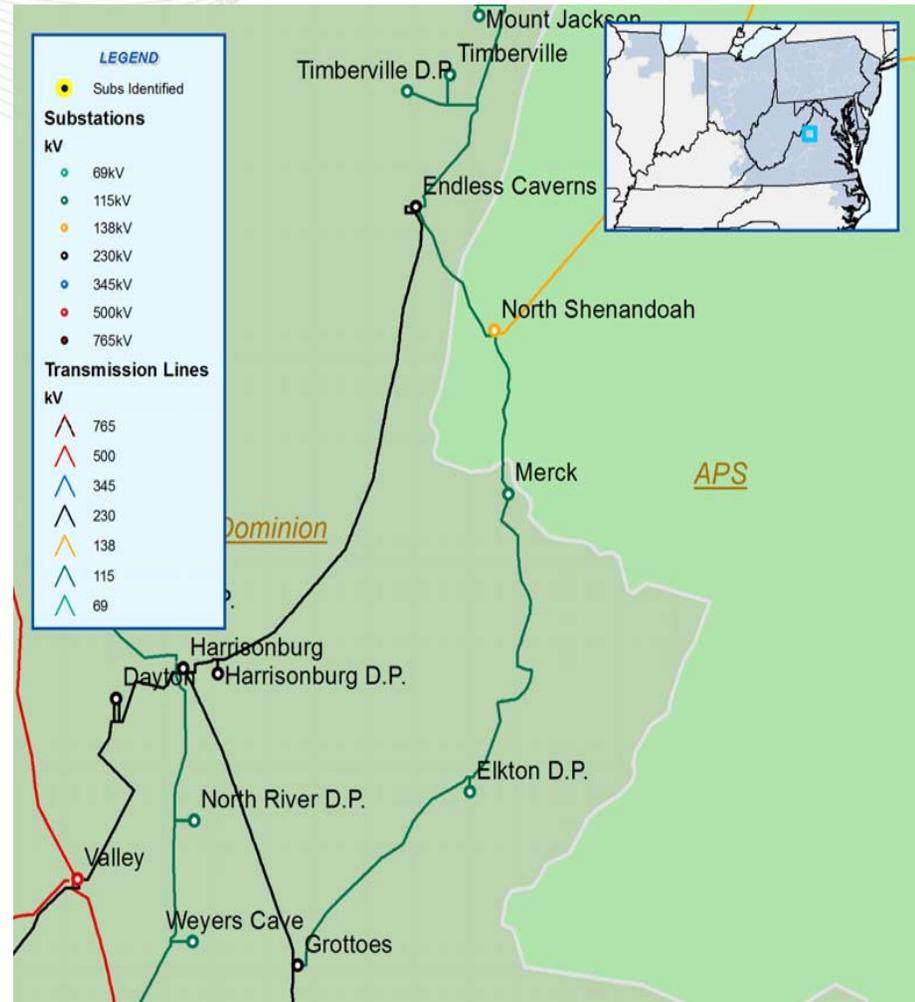


Dominion Transmission Zone

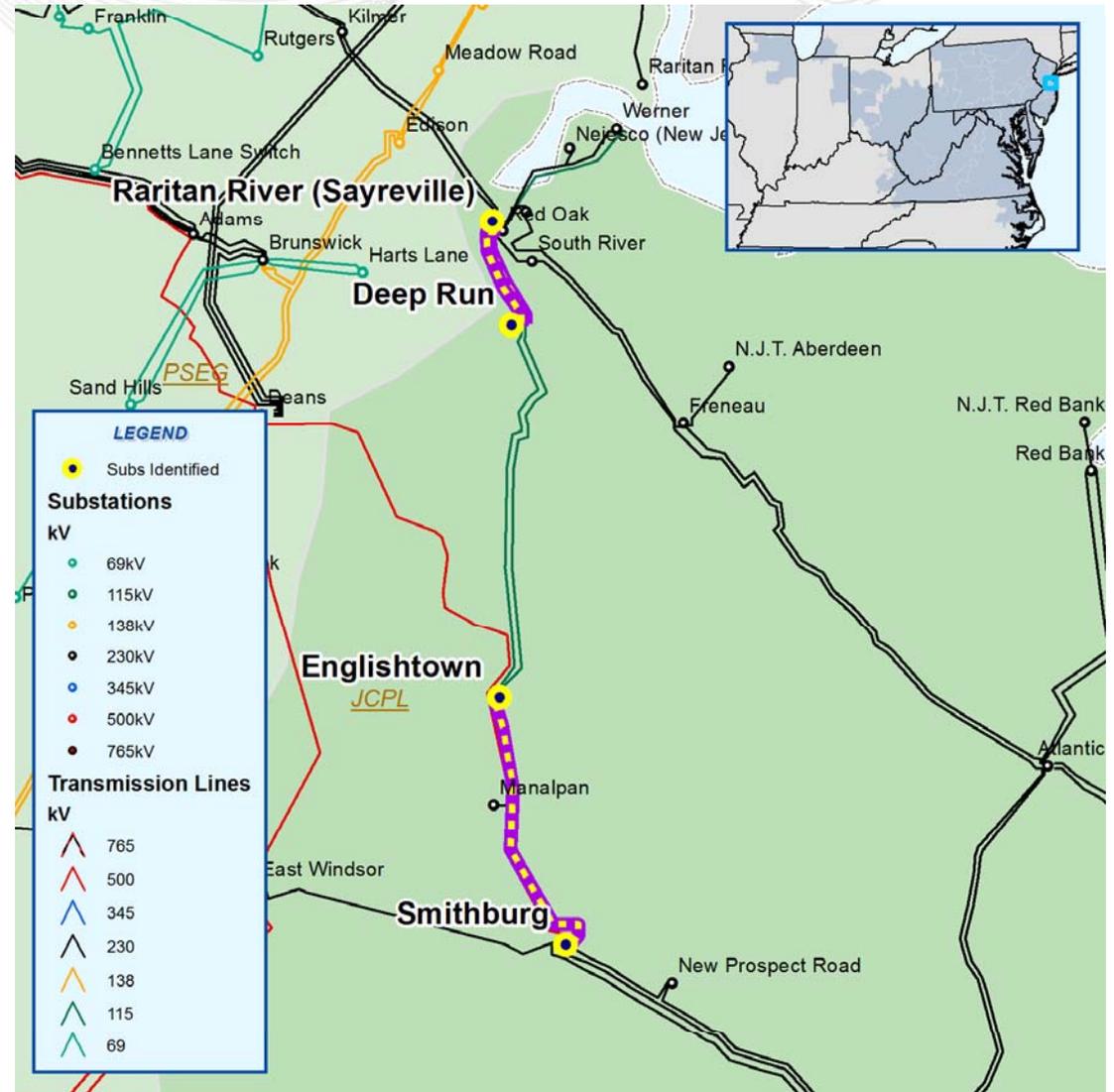
Solutions Considered:	*Estimated Cost	ROW	Does solution solve Deficiencies?			
			A	B	C	D
Build a new 25 mile 230kV line Warrenton to Sperryville (APS) and install a 224MVA 230-138kV transformer at Sperryville.	\$67 M	25 mi of new ROW	No	No	No	No
Build a new 13 mile 230kV line Harrisonburg to Merck and install a 224MVA 230-115kV transformer at Merck. Improve LSE's power factor in area.	\$37 M	13 mi of new ROW	Yes	Yes	No	No
Install a 2 nd 230-115kV TX at Grottoes. Build a 2 nd 115kV transmission line from Grottoes to Merck. Improve LSE's power factor in area, and install a shunt capacitor bank.	\$30.5 M	13 mi of additional ROW	Yes	No	No	No
Build a 2 nd 230kV Line Harrisonburg to Endless Caverns. Install a 3 rd 230-115kV Tx at Endless Caverns. Upgrade 115kV shunt capacitor banks at Merck and Edinburg.	\$70.0 M	20 mi. May be able to utilize existing ROW	Yes	Yes	Yes	Yes

***Note:** Estimated costs do not include cost of right-of-way (ROW) or land purchases.

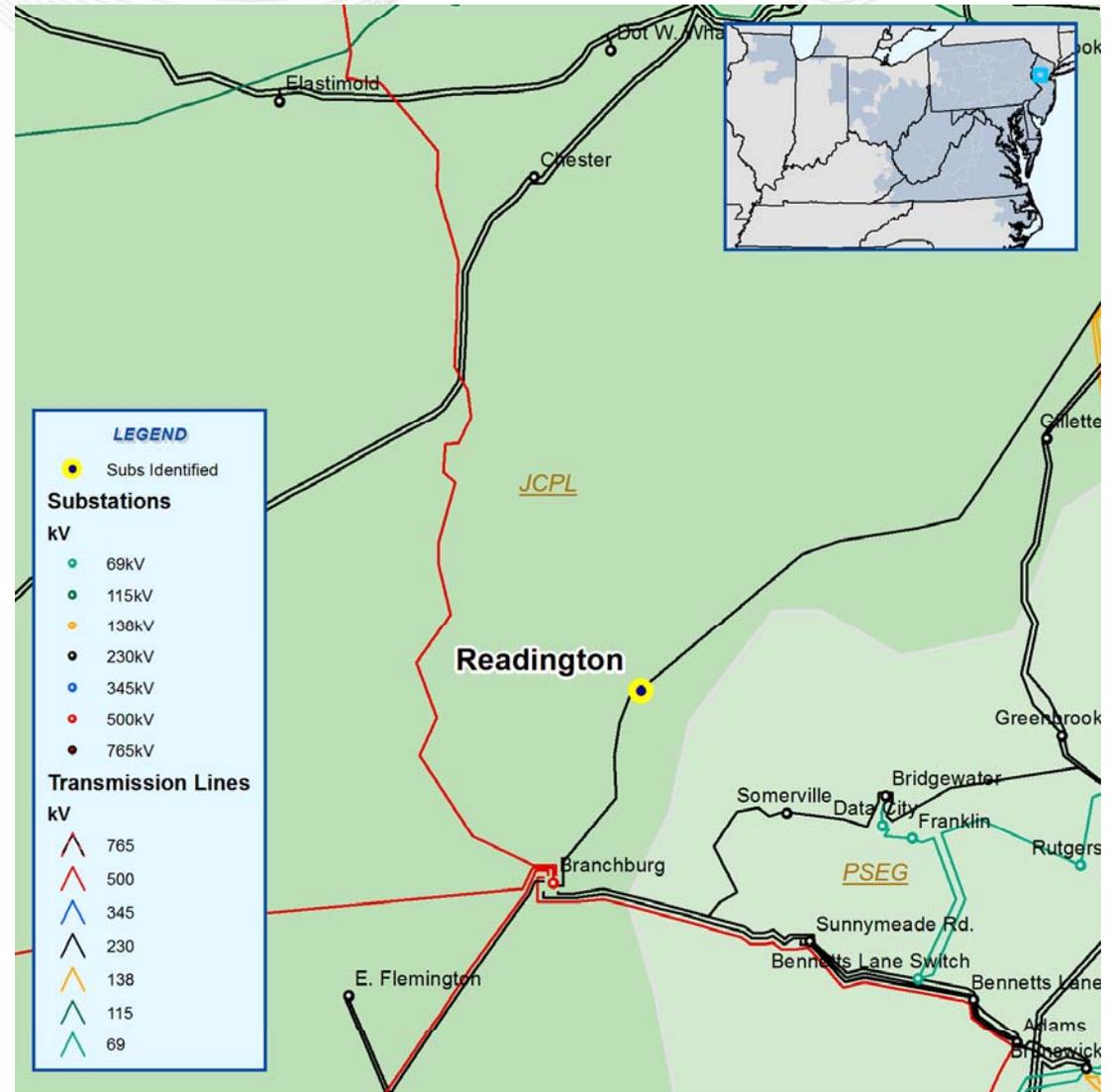
- Continued from previous slide
- Proposed Solution:
 - Build a 2nd 230kV Line Harrisonburg to Endless Caverns
 - Install a 3rd 230-115kV Tx at Endless Caverns
 - Upgrade 115kV shunt capacitor banks at Merck and Edinburg.
- Estimated Project Cost: \$70 M
- Projected IS date: 6/1/2015



- FE planning criteria violation:
- Potential loss of load exceeding 300 MW for the loss of the Smithburg – Englishtown 230 kV and Raritan River – Deep Run 115 kV B2 and C3 circuits
- Proposed Solution:
Replace wave traps at Raritan River and Deep Run 115 kV substations with higher rated equipment for both B2 and C3 circuits (B1374)
- Estimated Project Cost:
\$0.1772 M
- Expected IS Date:
6/1/2013



- FE planning criteria violation:
 - Overload on the Gillette – Stirling Tap (I737) 34.5 kV line section and voltage drop at Chambers Brook for the loss of Readington end of the 34.5 kV (I737) line
 - Overload of the Readington – Somerset (I737) 34.5 kV line section and voltage drop at Stirling for the loss of Gillette end of the 34.5 kV (I737) line
- Proposed Solution:
Install a Martinsville 4-breaker 34.5 ring bus (B1345).
- Estimated Project Cost:
\$2.818 M
- Expected IS Date:
6/1/2012

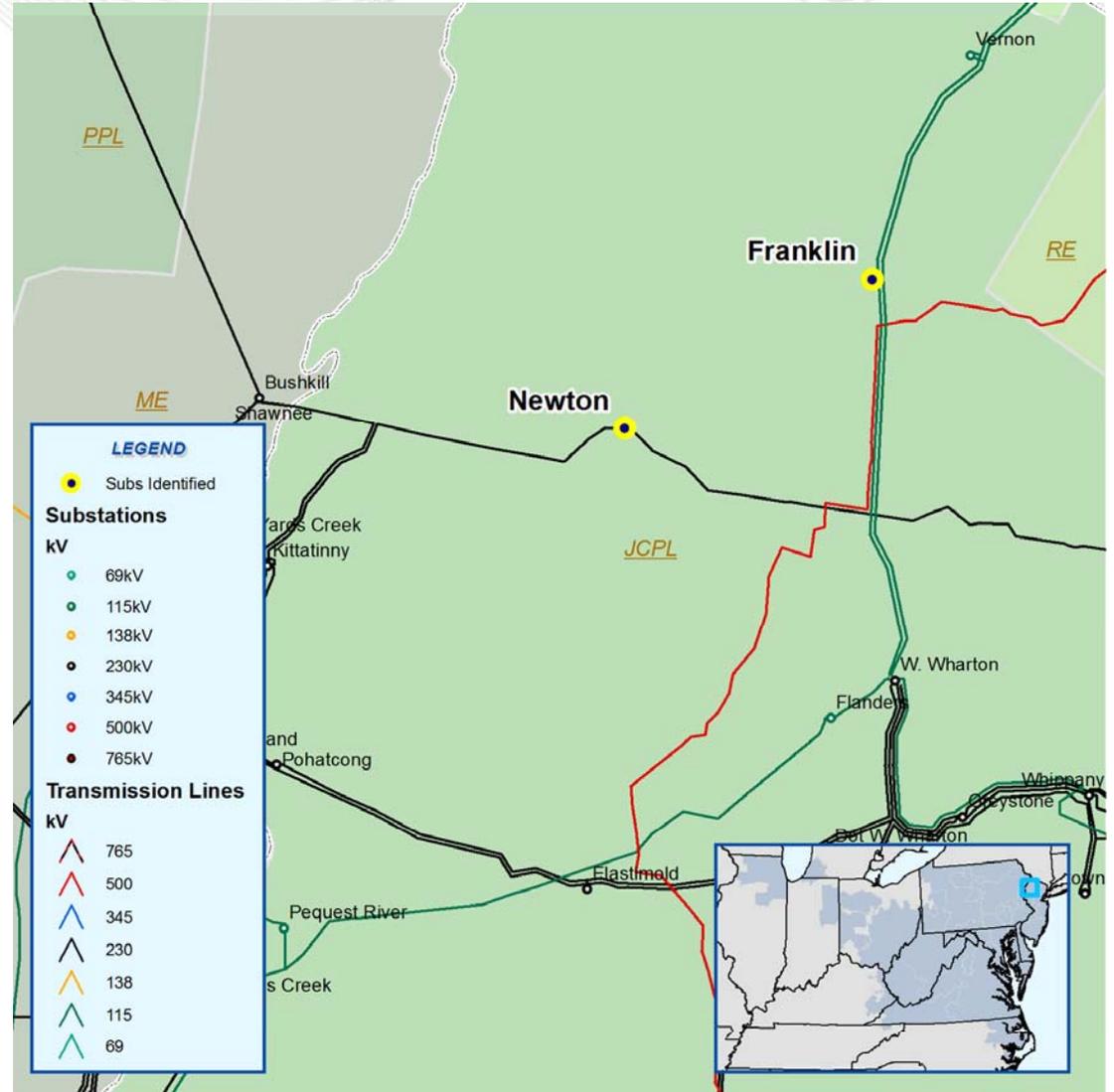


- FE planning criteria violation:
 - Overload on Hamburg – REA (Q745) 34.5 kV and low voltage in the area for the loss of Newton – North Newton 34.5 kV (F708) line
 - Overload on Newton – Branchville (F708) 34.5 kV line and low voltage in the area for the loss of Franklin to Hamburg 34.5 kV(Q745) line
- Proposed Solution:

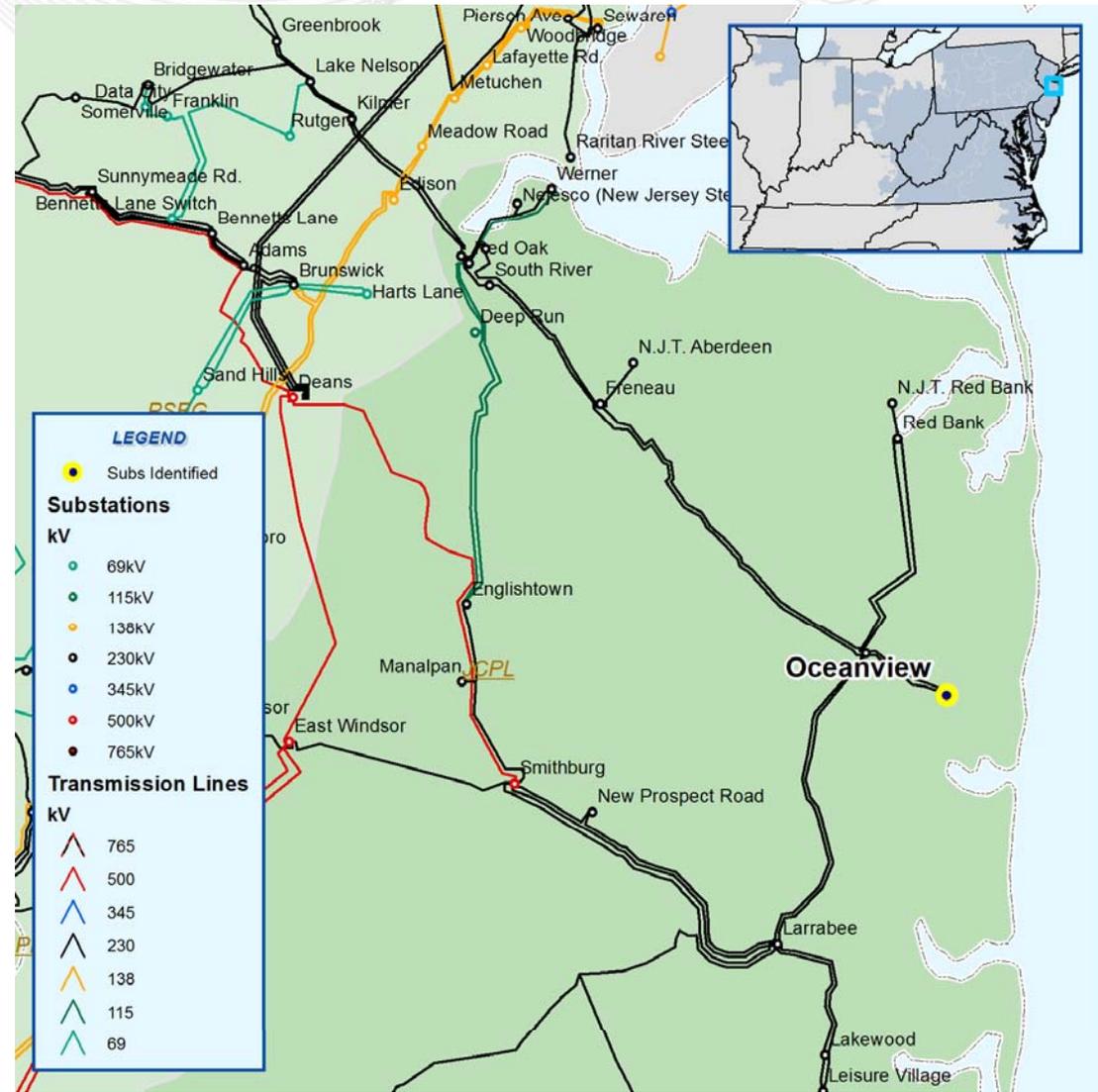
Reconductor 4.7 miles of the Franklin – Hamburg (R746) 34.5 kV line with 556 ACSR and build 2.7 miles 556 ACSR line extension to Sussex REA (B1346)
- Estimated Project Cost:

\$3.979 M
- Expected IS Date:

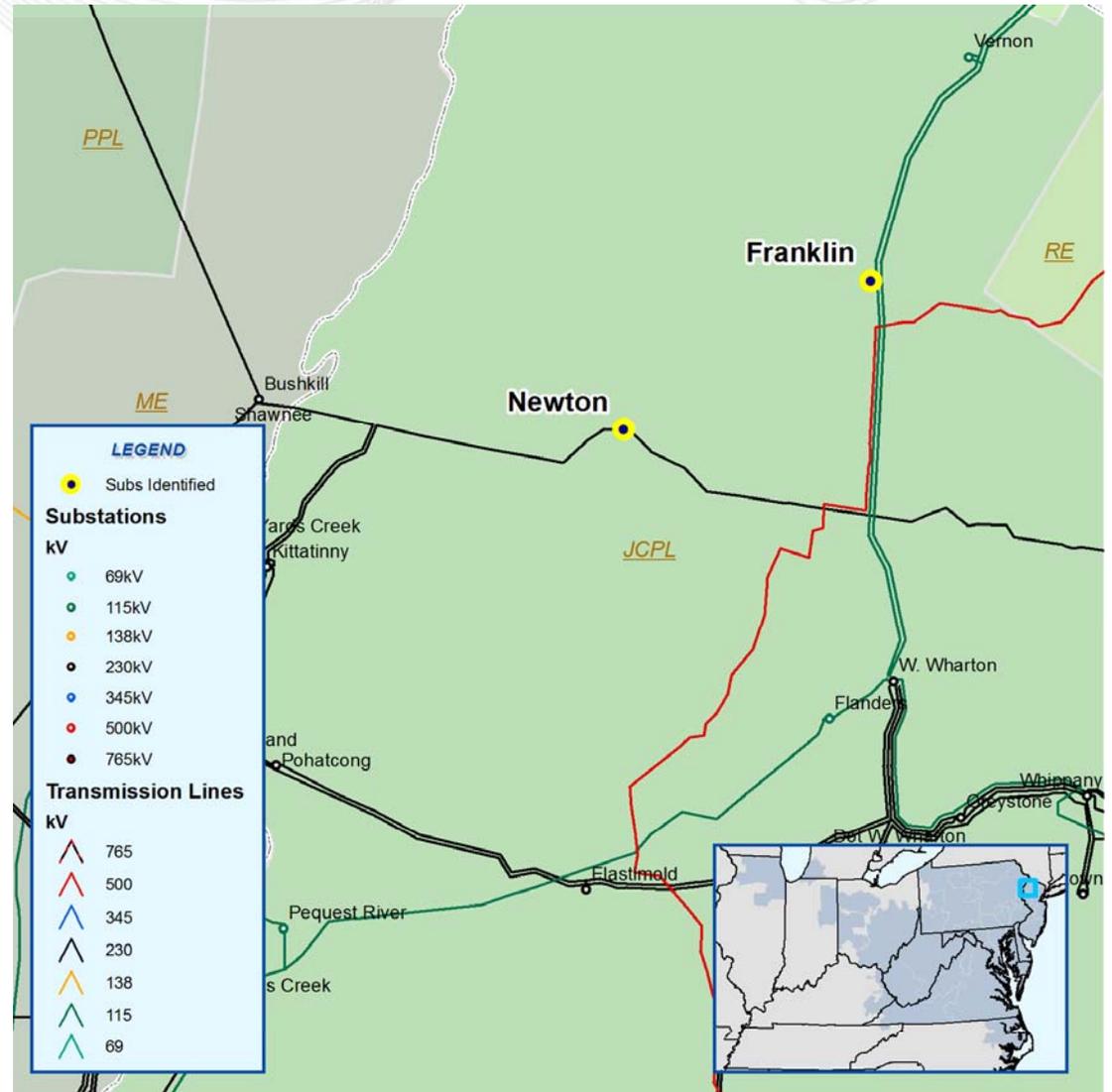
6/1/2012



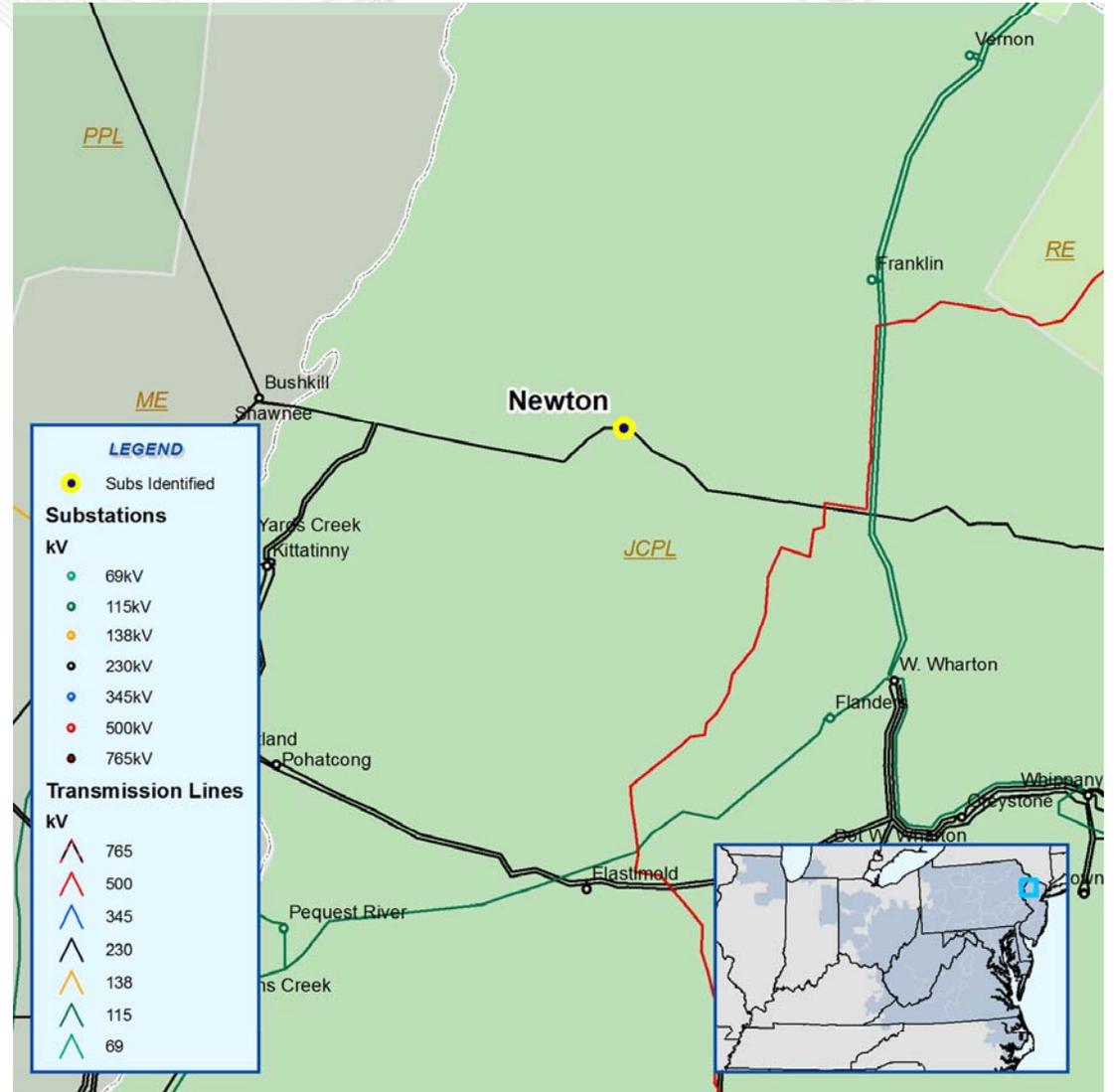
- FE planning criteria violation:
- Overload on the Whitesville – Asbury Tap 34.5 kV (U47) line for the loss of the Oceanview – Neptune Tap 34.5 kV (D130) line
- Proposed Solution:
Replace 500 CU substation conductor with 795 ACSR on the Whitesville - Asbury Tap 34.5 kV (U47) line (B1347)
- Estimated Project Cost:
\$0.015 M
- Expected IS Date:
6/1/2011



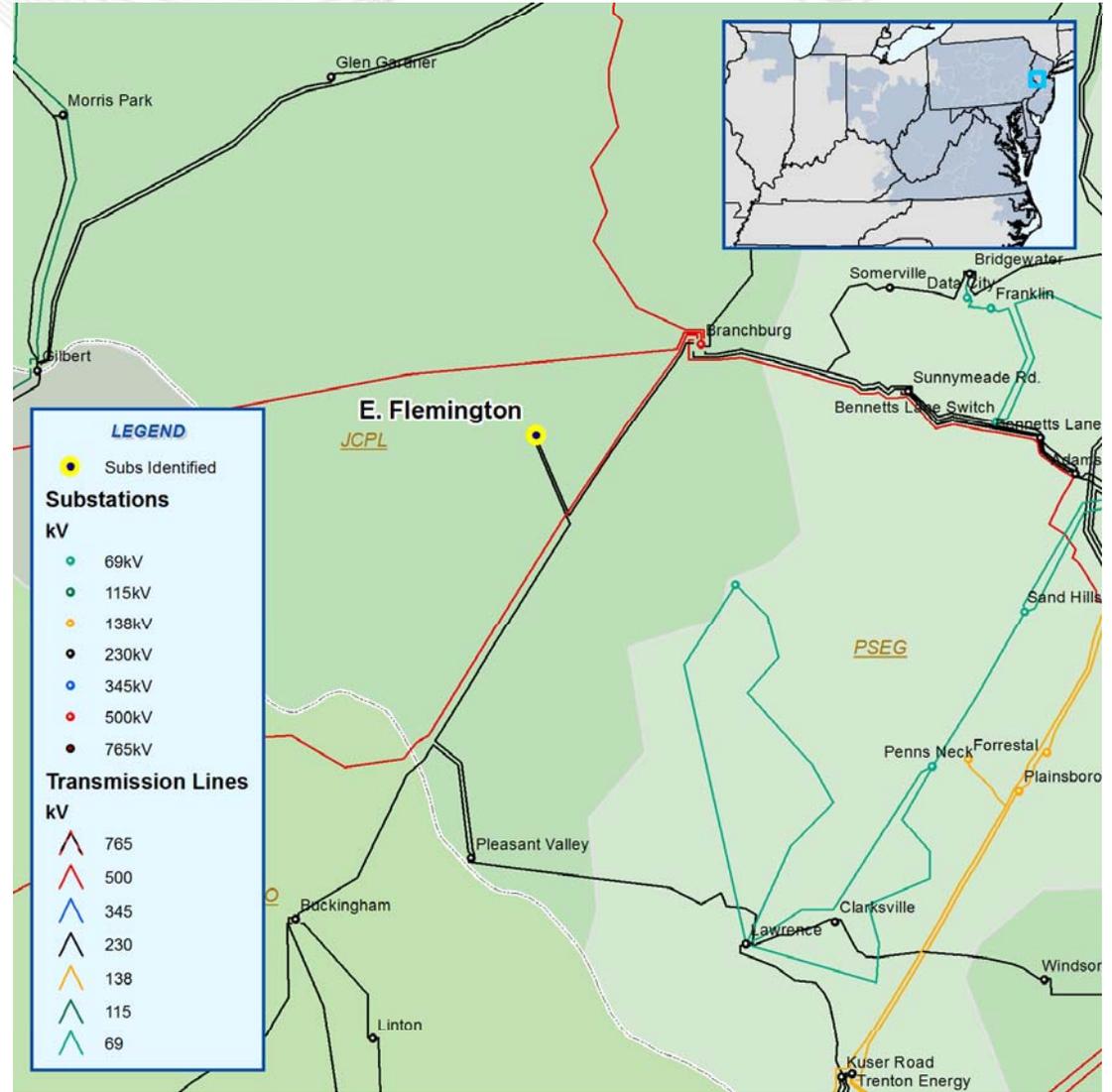
- FE planning criteria violation:
- The Newton – North Newton 34.5 kV (F708) line is overloaded pre-contingency and for the loss of the Franklin – Hamburg 34.5 kV line
- Proposed Solution:
Upgrade the Newton – North Newton 34.5 kV (F708) line by adding a second underground 1250 CU egress cable (B1348)
- Estimated Project Cost:
\$0.092 M
- Expected IS Date:
6/1/2011



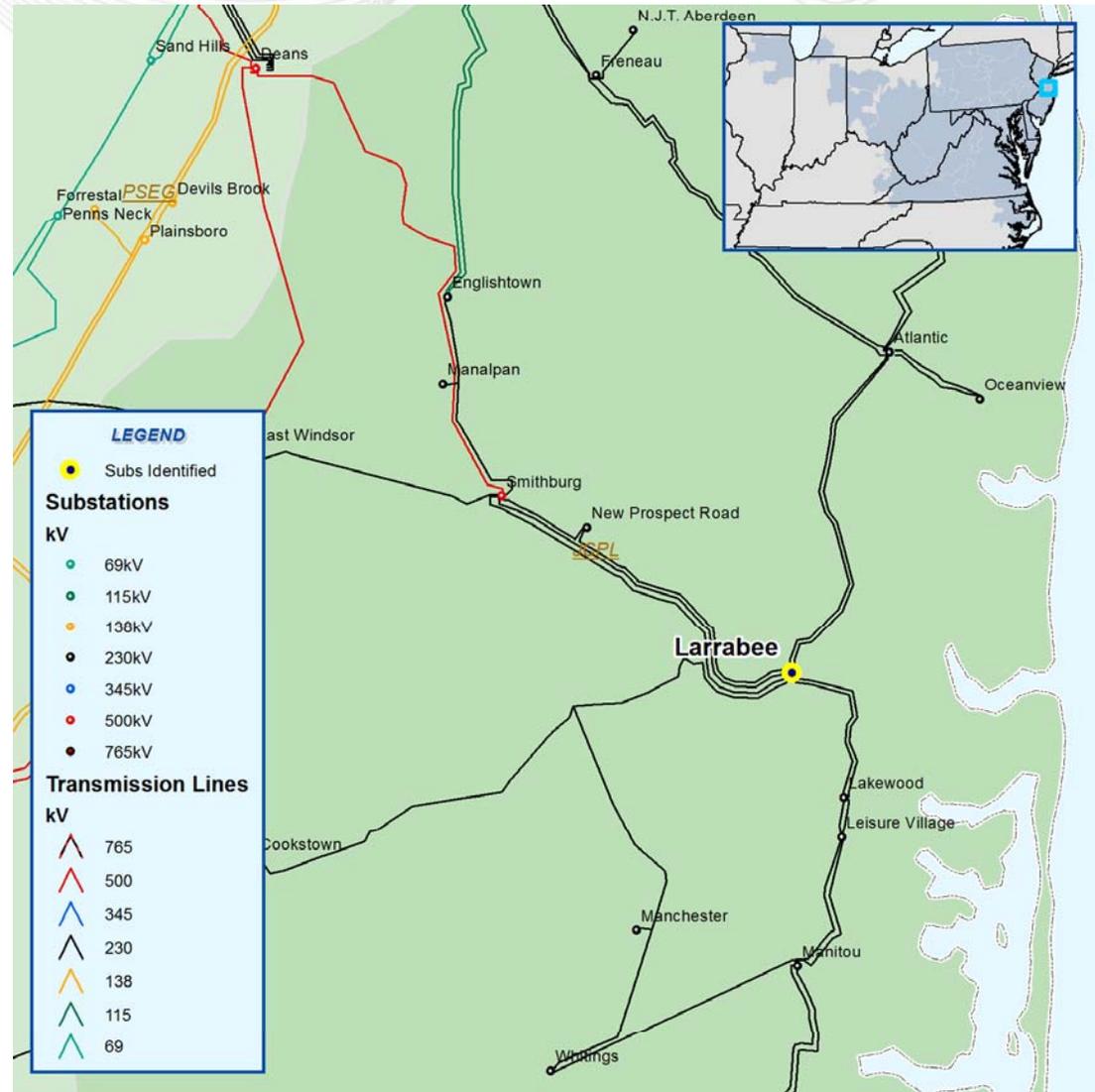
- FE planning criteria violation:
- Overload on the Newton – Woodruffs Gap 34.5 kV (A703) for the loss of the Montville – Newton 230 kV (N2214) line
- Proposed Solution:
Reconductor 5.2 miles of the Newton – Woodruffs Gap 34.5 kV (A703) line with 556 ACSR (B1349)
- Estimated Project Cost:
\$0.932 M
- Expected IS Date:
6/1/2012



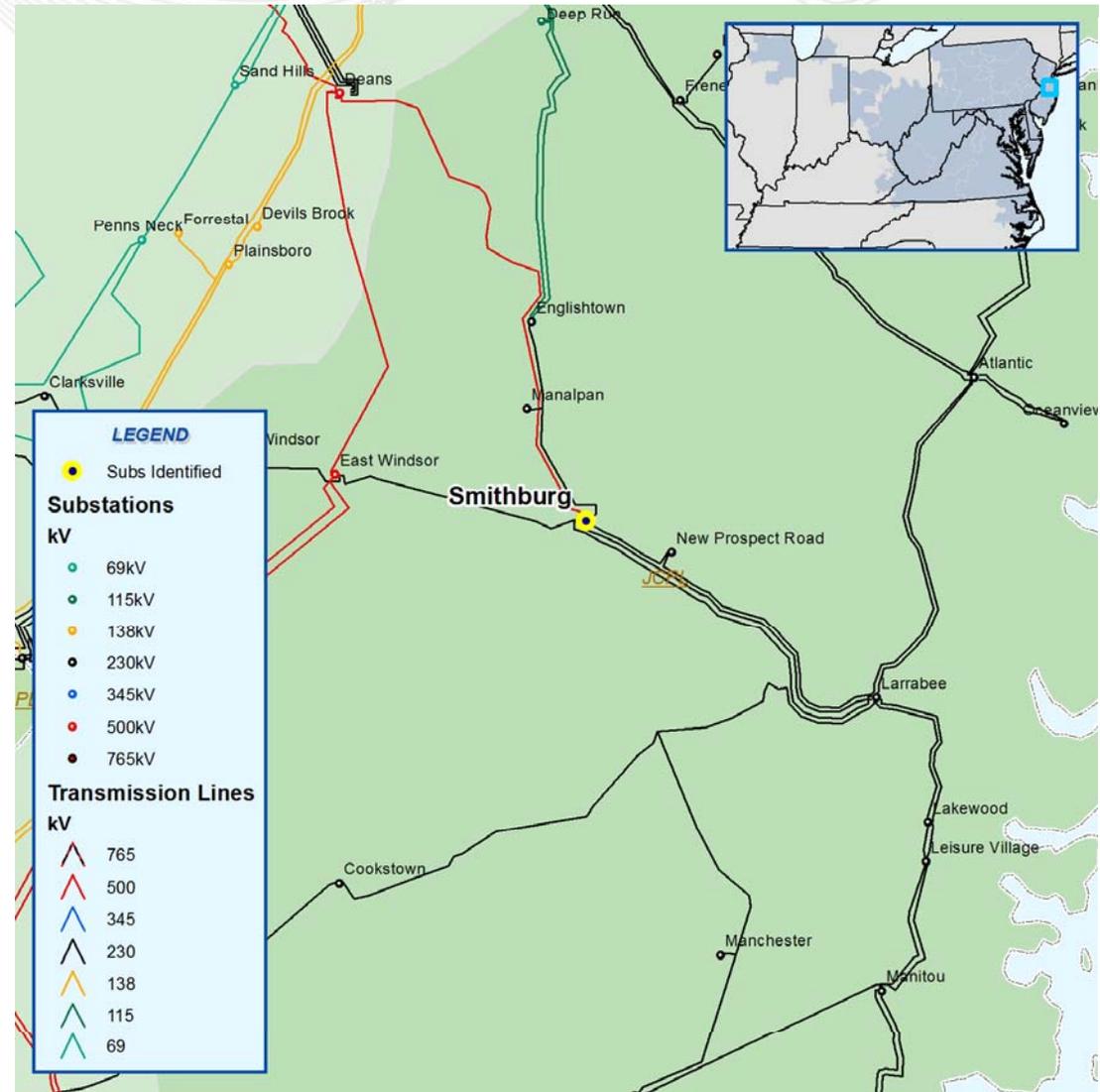
- FE planning criteria violation:
- The East Flemington – Flemington 34.5 kV (V724) line is overloaded pre-contingency and for the single contingency loss of the East Flemington - Pleasant Valley 230 kV (Q2243) line and East Flemington 230/34.5 kV #3 transformer
- Proposed Solution:
Upgrade the East Flemington – Flemington 34.5 kV (V724) line by adding second underground 1000 AL egress cable and replacing 4/0 CU substation conductor with 500 CU (B1350)
- Estimated Project Cost:
\$0.126 M
- Expected IS Date:
6/1/2011



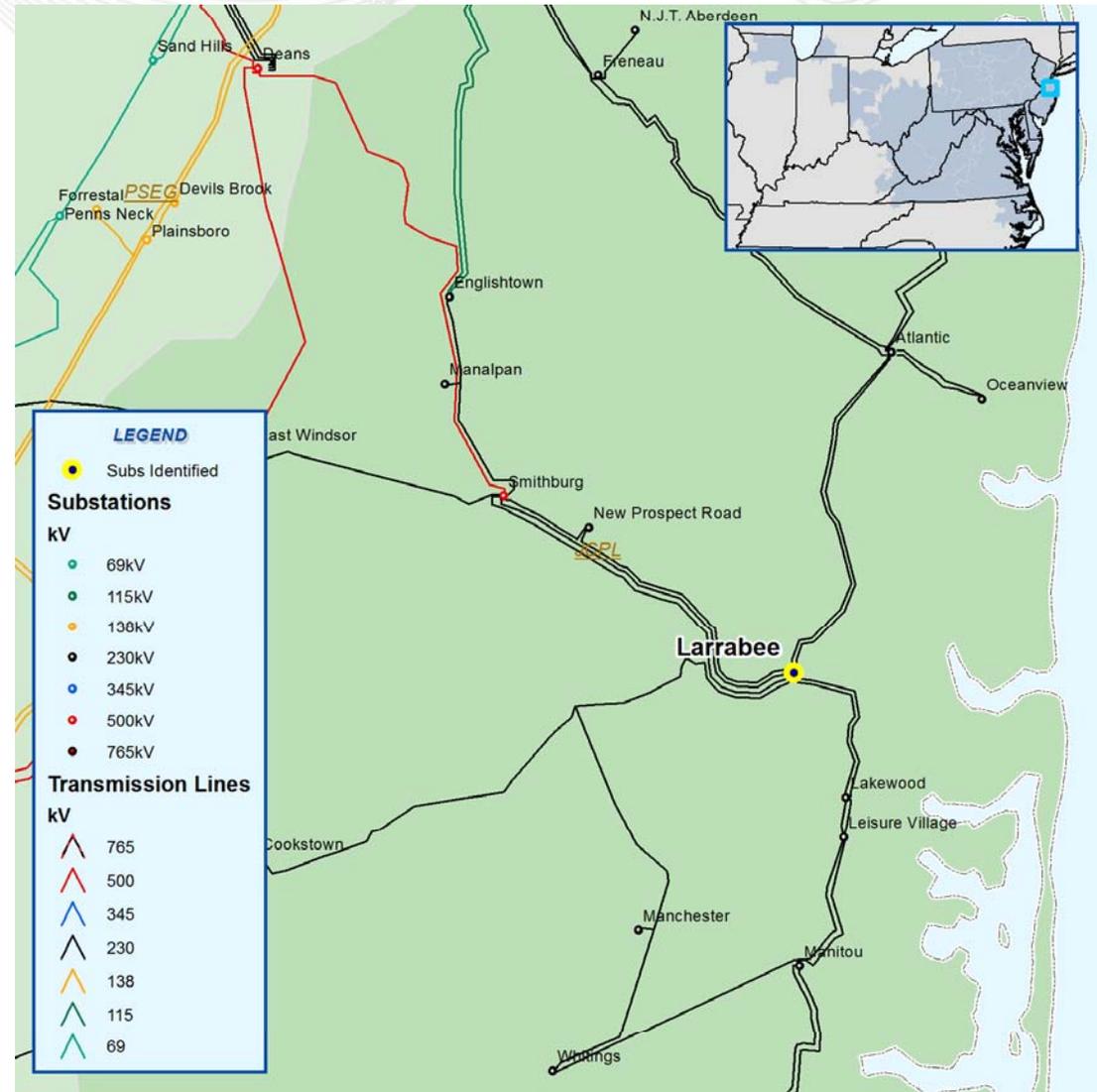
- FE planning criteria violation:
- Overload on the Larrabee 230/34.5 kV #4 transformer for the loss of the Lakewood – Larrabee 230 kV (Z2026) line and Larrabee 230/34.5 kV #3 transformer
- Proposed Solution:
Add a 34.5 kV breaker on the Larrabee A and D bus tie (B1351)
- Estimated Project Cost:
\$0.249 M
- Expected IS Date:
6/1/2013



- FE planning criteria violation:
- The Smithburg – Centerstate Tap 34.5 kV (X752) line is overloaded pre-contingency and for the loss of the Farmingdale – Howell 34.5 kV (N66) line
- Proposed Solution:
Upgrade the Smithburg – Centerstate Tap 34.5 kV (X752) line by adding second 200 ft underground 1250 CU egress cable (B1352)
- Estimated Project Cost:
\$0.093 M
- Expected IS Date:
6/1/2011



- FE planning criteria violation:
- Normal overload on Larrabee – Laurelton 34.5 kV (Q43) egress cable
- Proposed Solution:
Upgrade the Larrabee – Laurelton 34.5 kV (Q43) line by adding second 700 ft underground 1250 CU egress cable (B1353)
- Estimated Project Cost:
\$0.092 M
- Expected IS Date:
6/1/2011

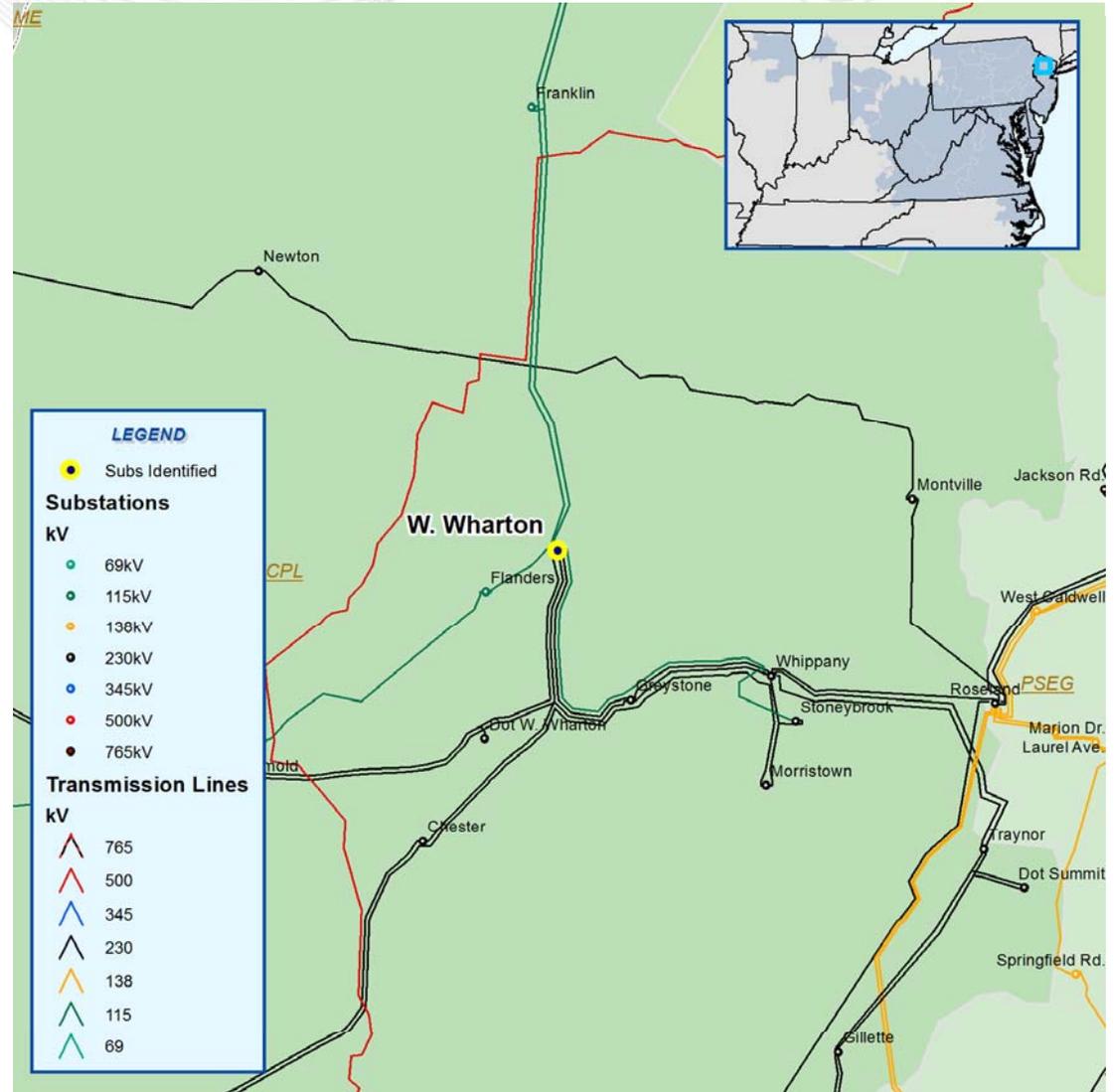


- FE planning criteria violation:
 - Overload on West Wharton – Rockaway Town Square Tap 34.5 kV (D706) line
 - Low voltage at Dickerson for the loss of the Greystone end of the (D706) 34.5 kV line
- Proposed Solution:

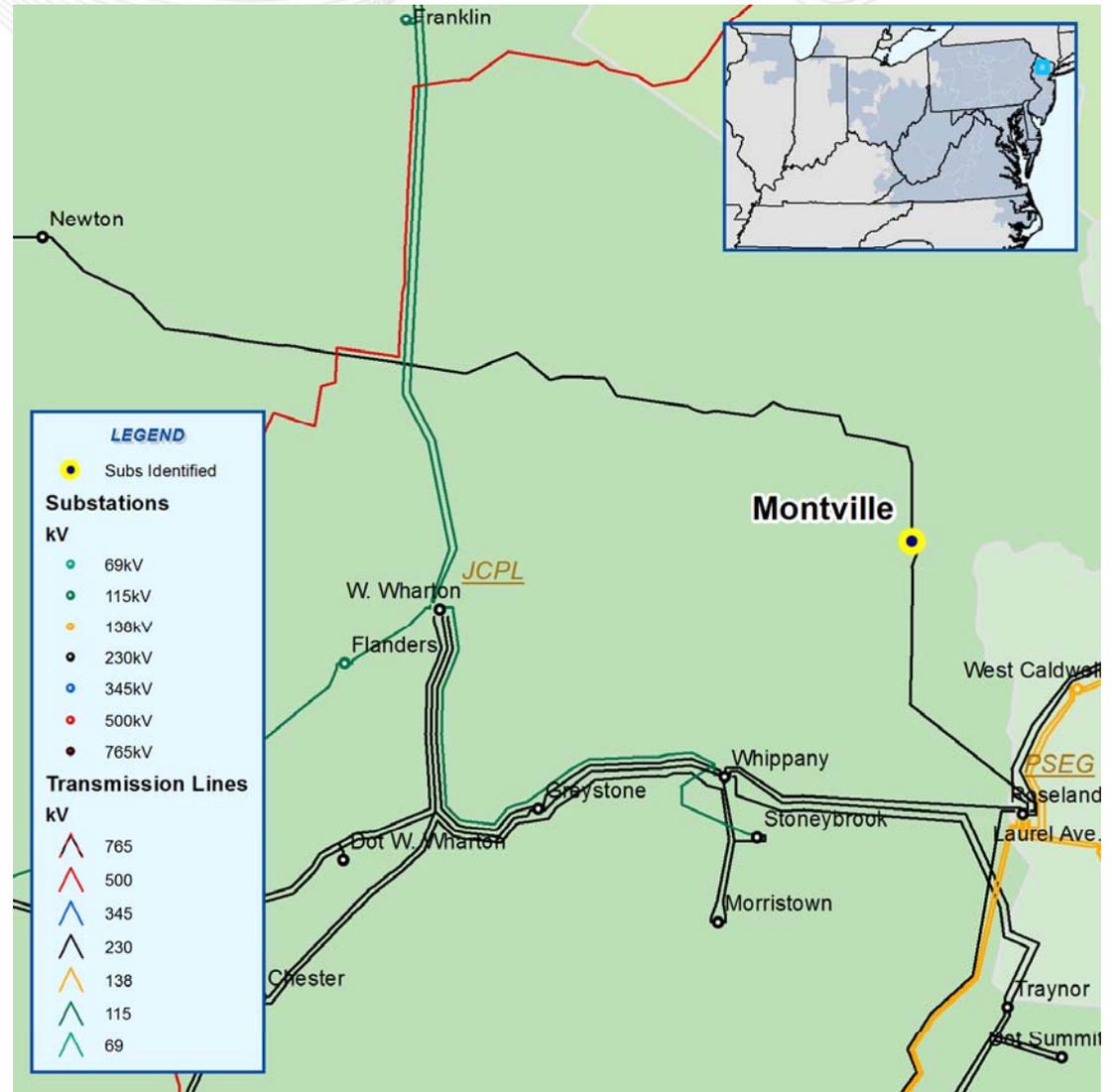
Add four 34.5 kV breakers and re-configure the A/B bus at Rockaway (B1354)
- Estimated Project Cost:

\$1.456 M
- Expected IS Date:

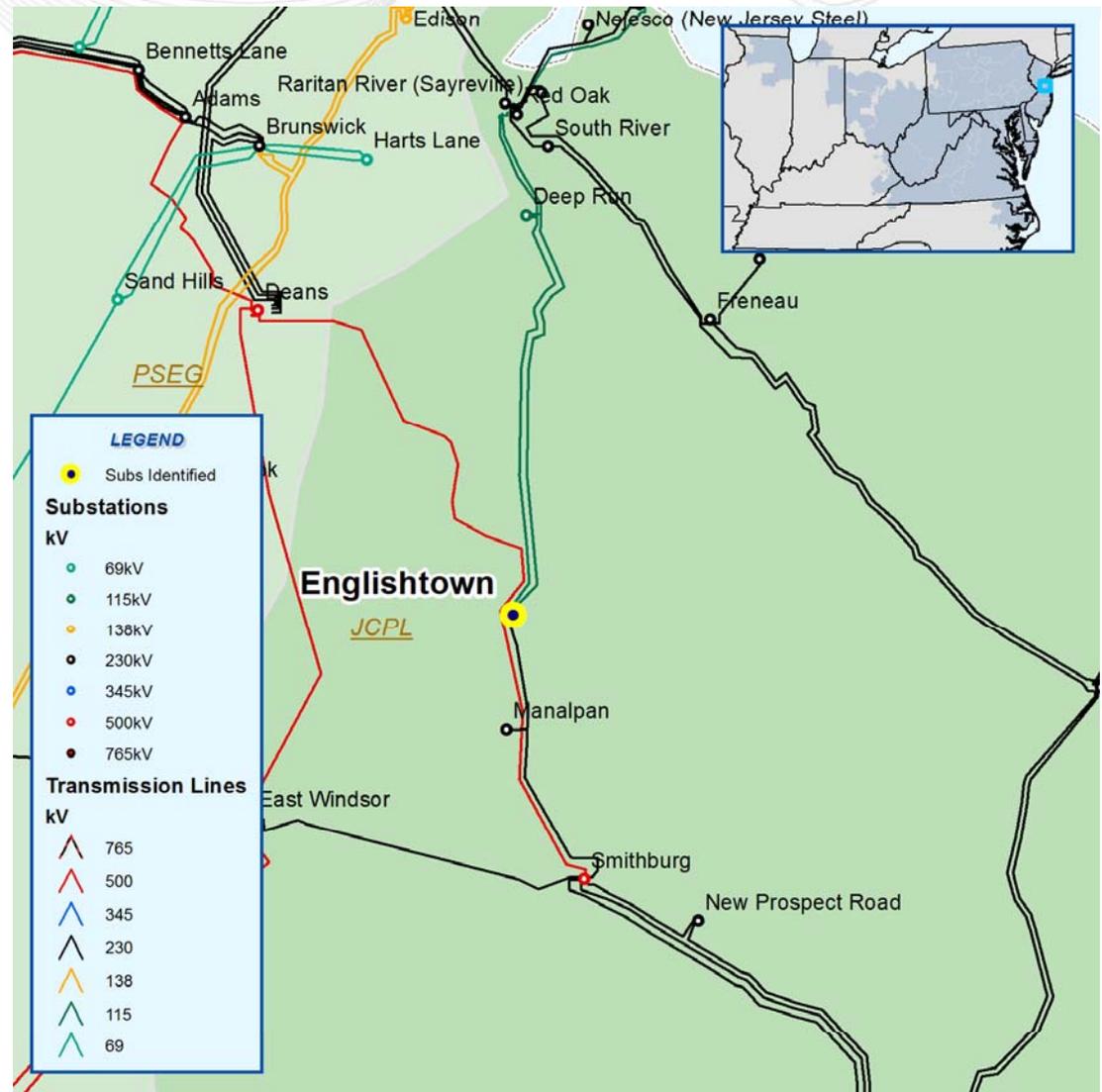
6/1/2012



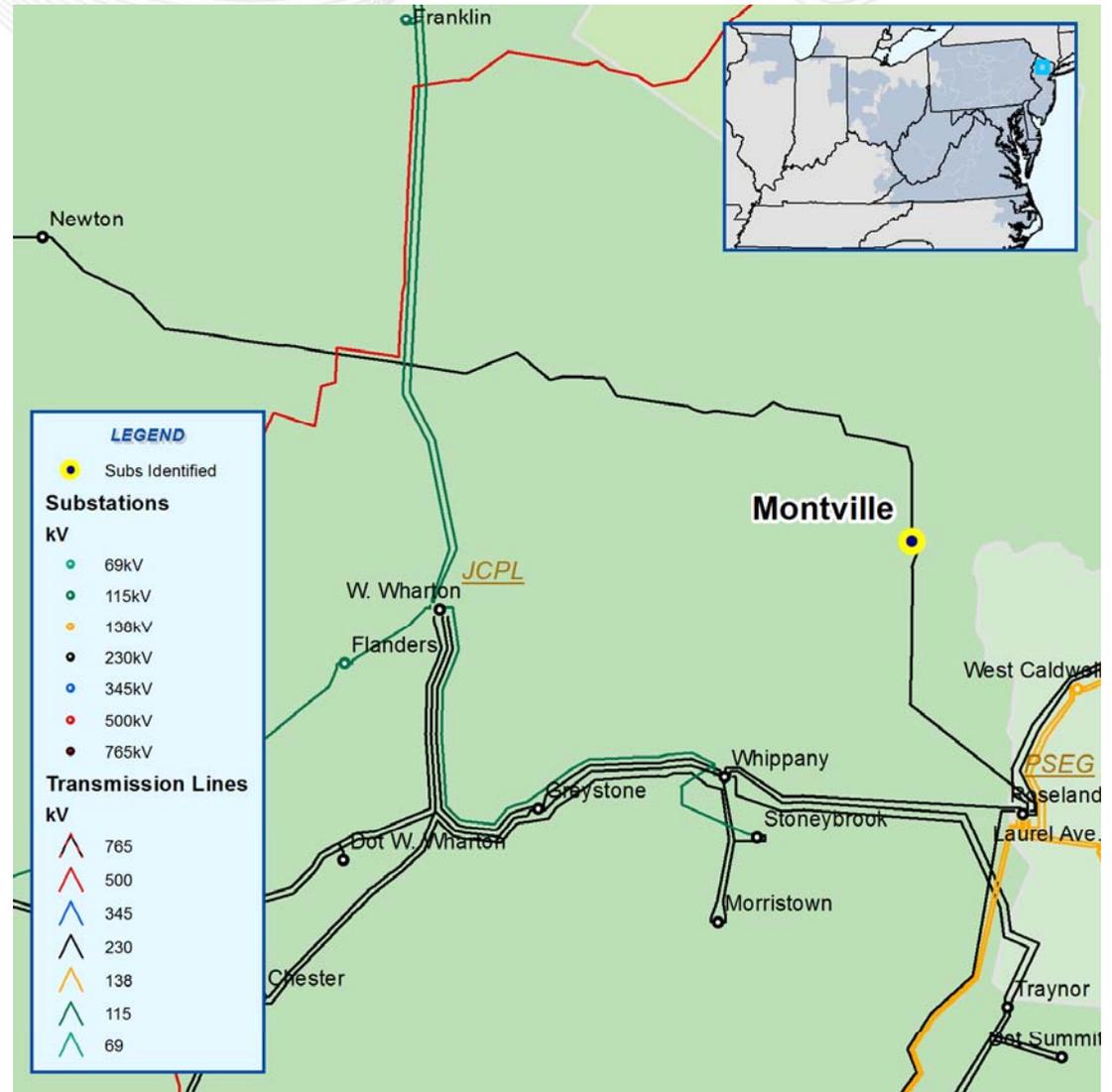
- FE planning criteria violation:
- Overload on the Montville – Butler 34.5 kV (H8) line section for the loss of the Riverdale – Butler 34.5 kV (I9) line
- Proposed Solution:
Build a new second 3.3 mile 34.5 kV 556 ACSR line from Riverdale to Butler (B1355)
- Estimated Project Cost:
\$2.286 M
- Expected IS Date:
6/1/2012



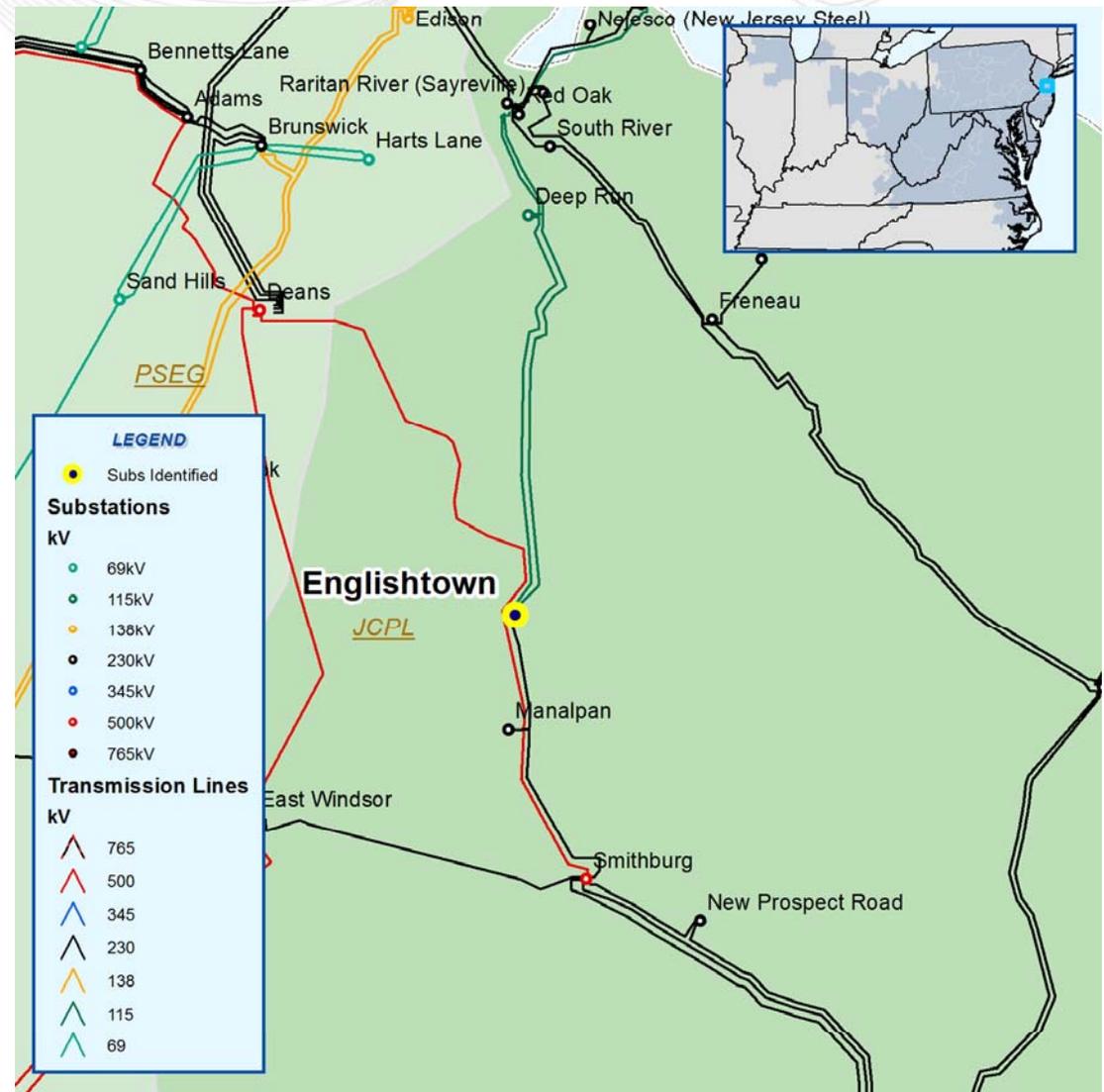
- FE planning criteria violation:
- Overload on Farmingdale – Howell 34.5 kV (N66) line section for the loss of the Englishtown end of the L12 line or the Freneau end of the F32 line or Smithburg 230/34.5 kV bank #2
- Overload on the Englishtown – Freehold Tap 34.5 kV (L12) line section for the loss of Farmingdale end of N66 line
- Overload on Farmingdale – Larrabee 34.5 kV (W49) line section for the loss of the Atlantic – Larrabee 230 kV (R1032) line
- Proposed Solution:
Build 10.2 miles of new 34.5 kV line from Larrabee – Howell (B1357)
- Estimated Project Cost:
\$9.483 M
- Expected IS Date:
6/1/2013



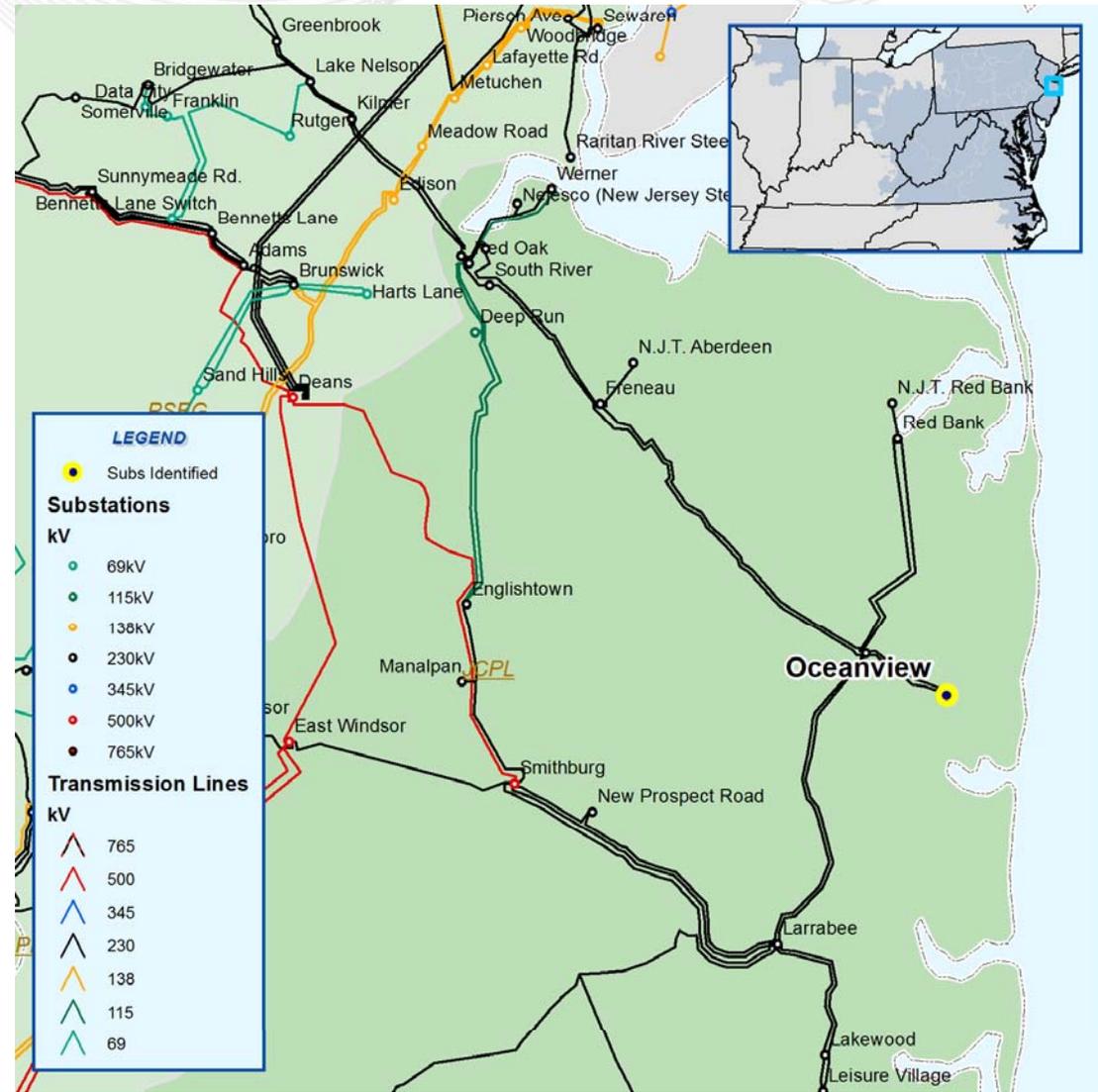
- FE planning criteria violation:
- Overload on the Montville – Parsippany 34.5 kV (D4) line for the loss of the Whippany – Halsey 34.5 kV (D4) line
- Proposed Solution:
Install a Troy Hills 34.5 kV bypass switch and reconfigure the Montville – Whippany 34.5 kV (D4) line (B1359)
- Estimated Project Cost:
\$0.032 M
- Expected IS Date:
6/1/2011



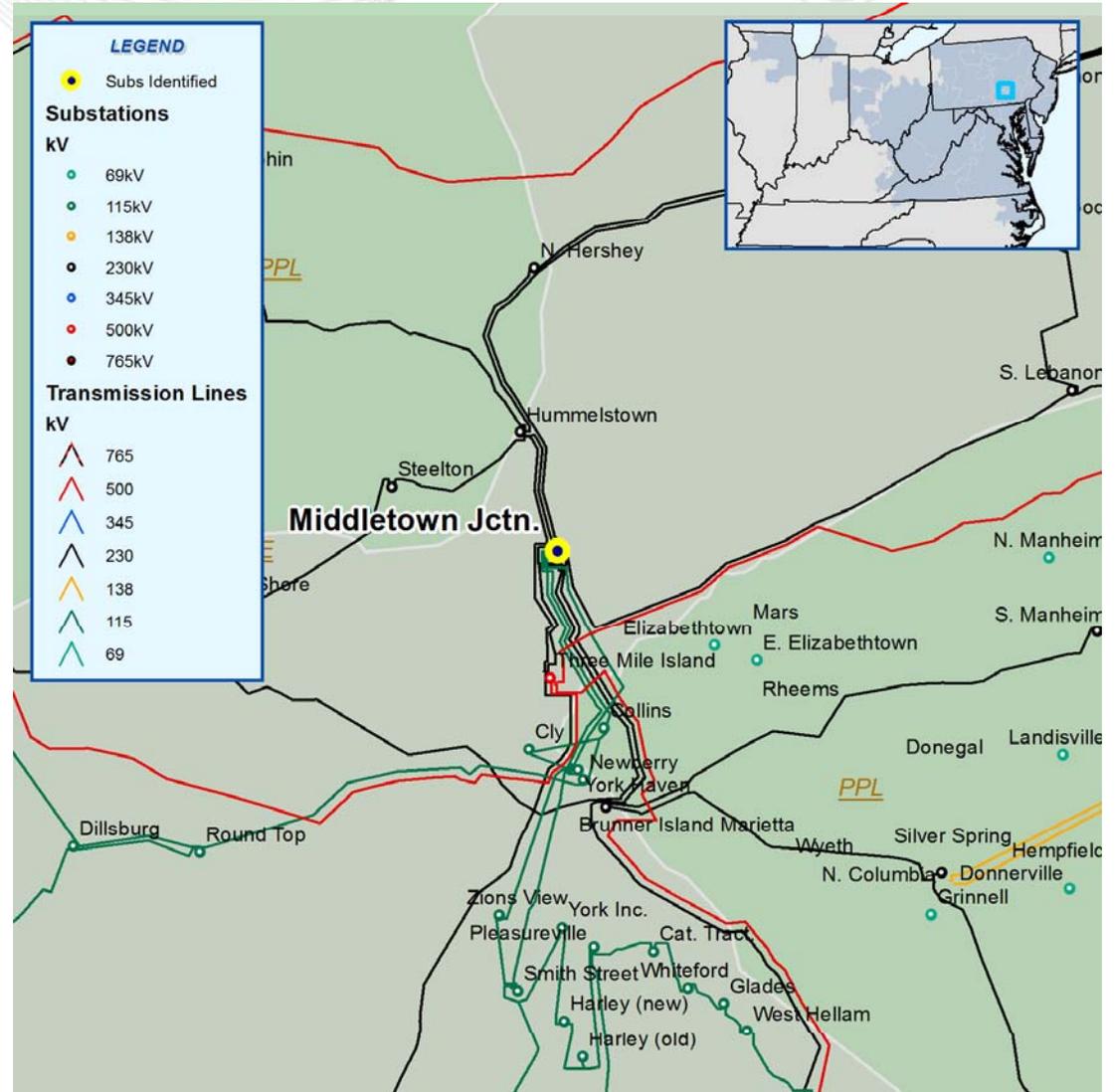
- FE planning criteria violation:
- Overload on the Englishtown – Freehold Tap 34.5 kV (L12) line for the loss of the Smithburg – Centerstate Tap 34.5 kV (X752) line section
- Proposed Solution:
Reconductor 0.7 miles of the Englishtown – Freehold Tap 34.5 kV (L12) line with 556 ACSR (B1360)
- Estimated Project Cost:
\$0.422M
- Expected IS Date:
6/1/2012



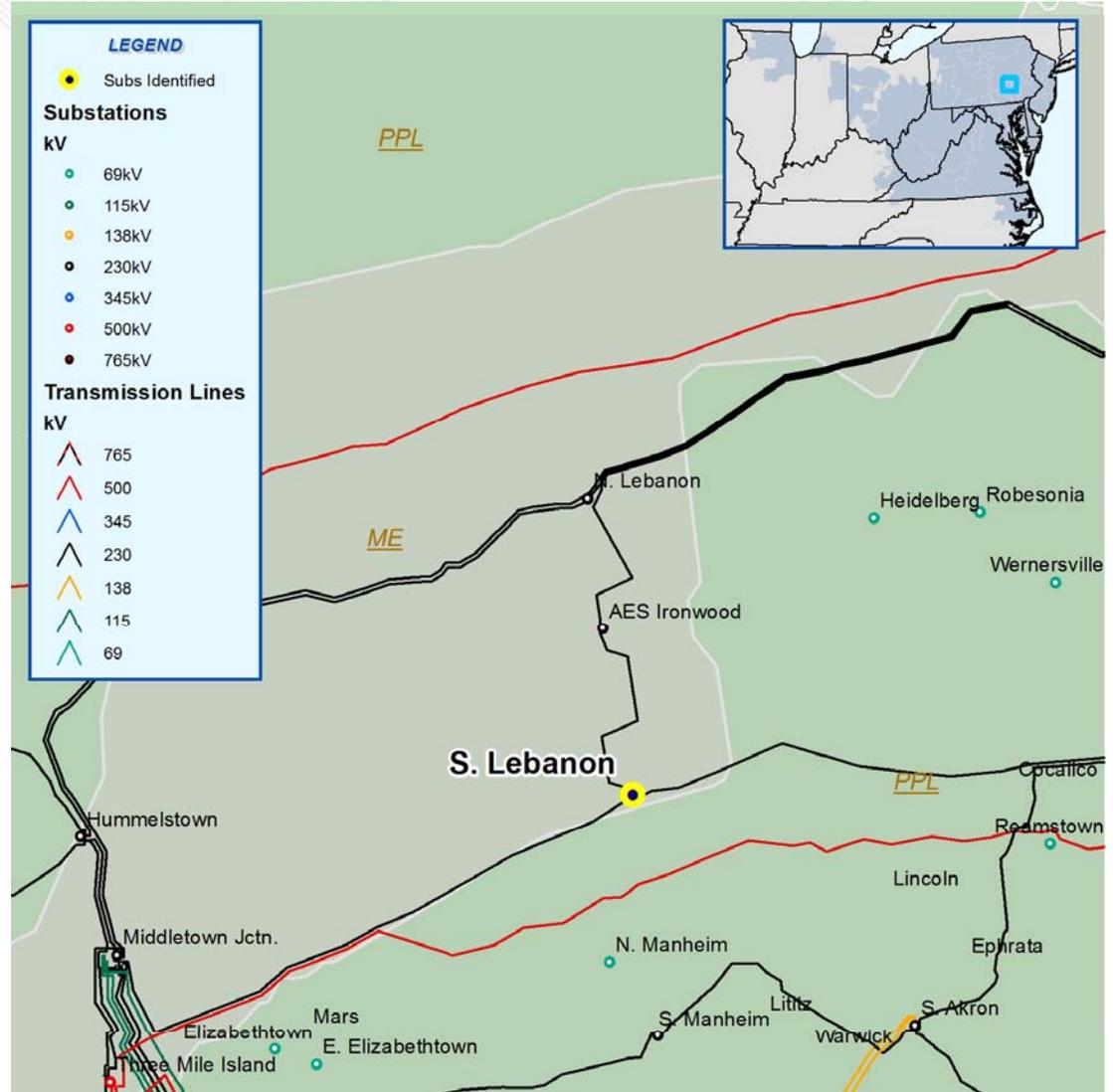
- FE planning criteria violation:
- Overload on the Oceanview – Neptune Tap 34.5 kV (D130) line for the loss of the Asbury Tap – Whitesville 34.5 kV (U47) line
- Proposed Solution:
Reconductor the Oceanview – Neptune Tap 34.5 kV (D130) line with 795 ACSR (B1361)
- Estimated Project Cost:
\$0.436 M
- Expected IS Date:
6/1/2012



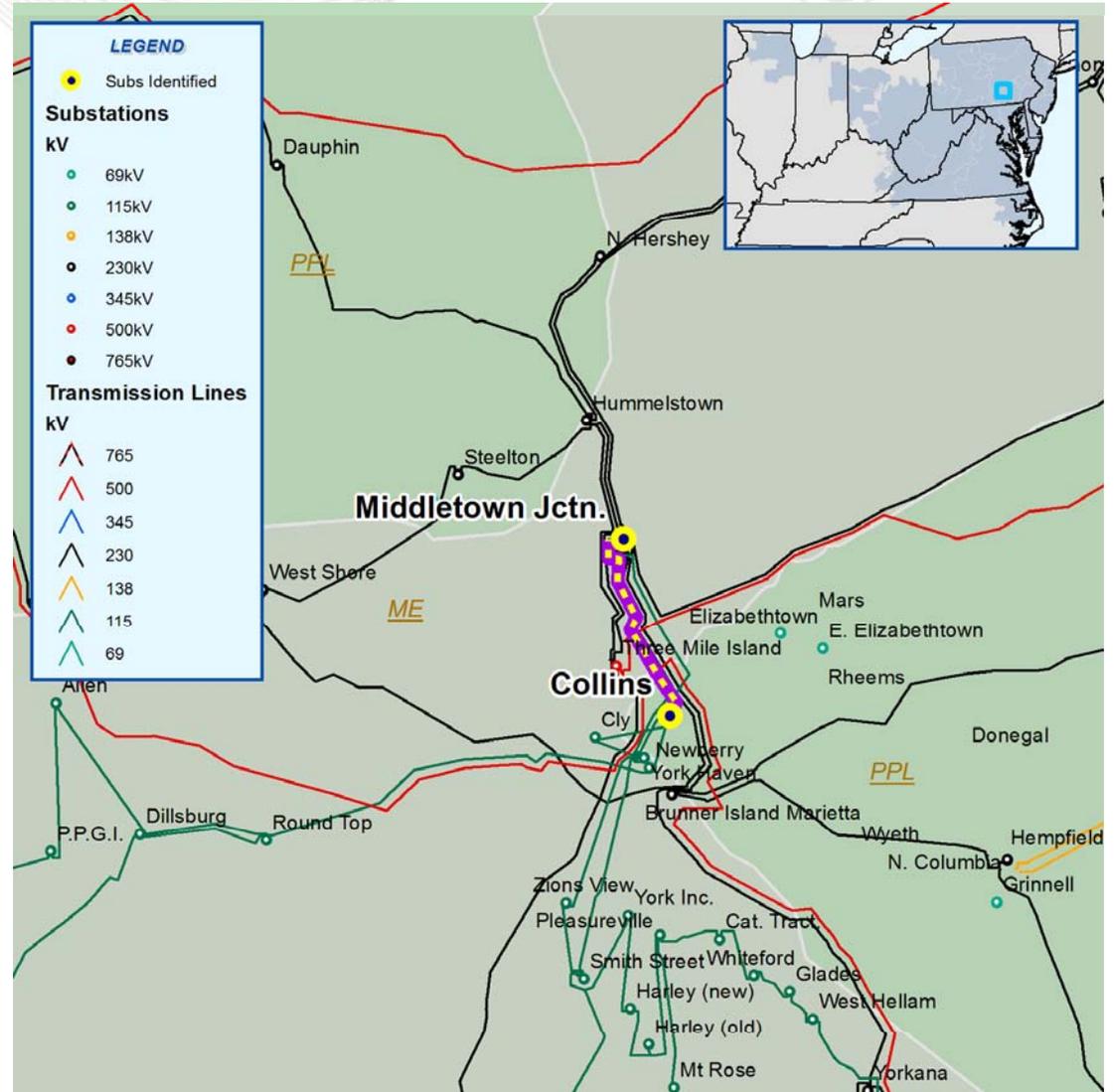
- FE planning criteria violation:
- Low voltage in Olmstead area for the loss of the Middletown Junction 230/69 kV transformer #3
- Proposed Solution:
Install 23.8 MVAR capacitor at Wood Street 69 kV (B1362)
- Estimated Project Cost:
\$0.518 M
- Expected IS Date:
6/1/2011



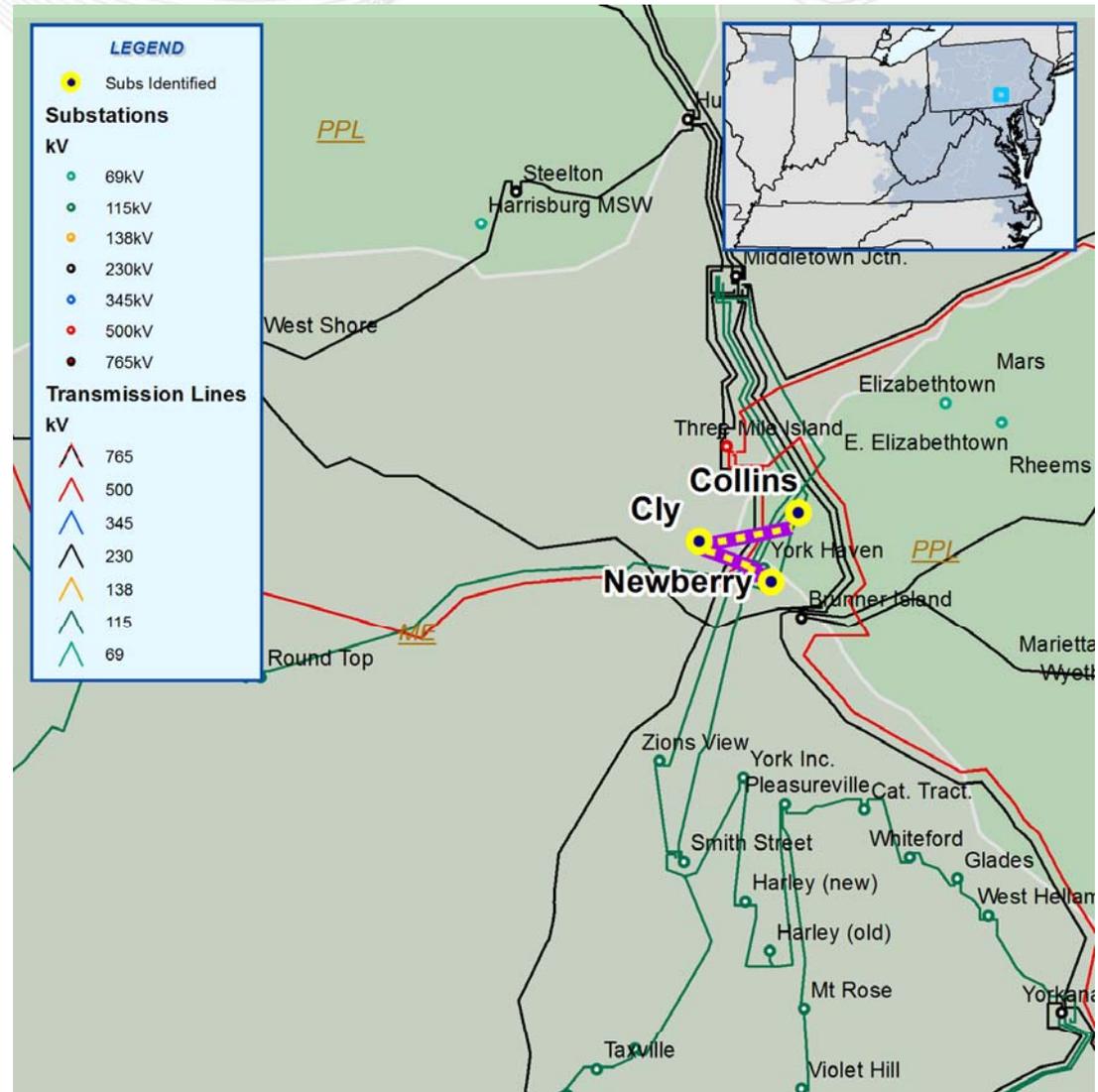
- FE planning criteria violation:
- Overload on South Lebanon 230/69 kV transformer #1 for the loss of South Lebanon 230/69 kV transformer #2
- Proposed Solution:
Upgrade South Lebanon 230/69 kV transformer #1 by replacing 69 kV substation conductor with 1590 ACSR (B1364)
- Estimated Project Cost:
\$0.034 M
- Expected IS Date:
6/1/2011



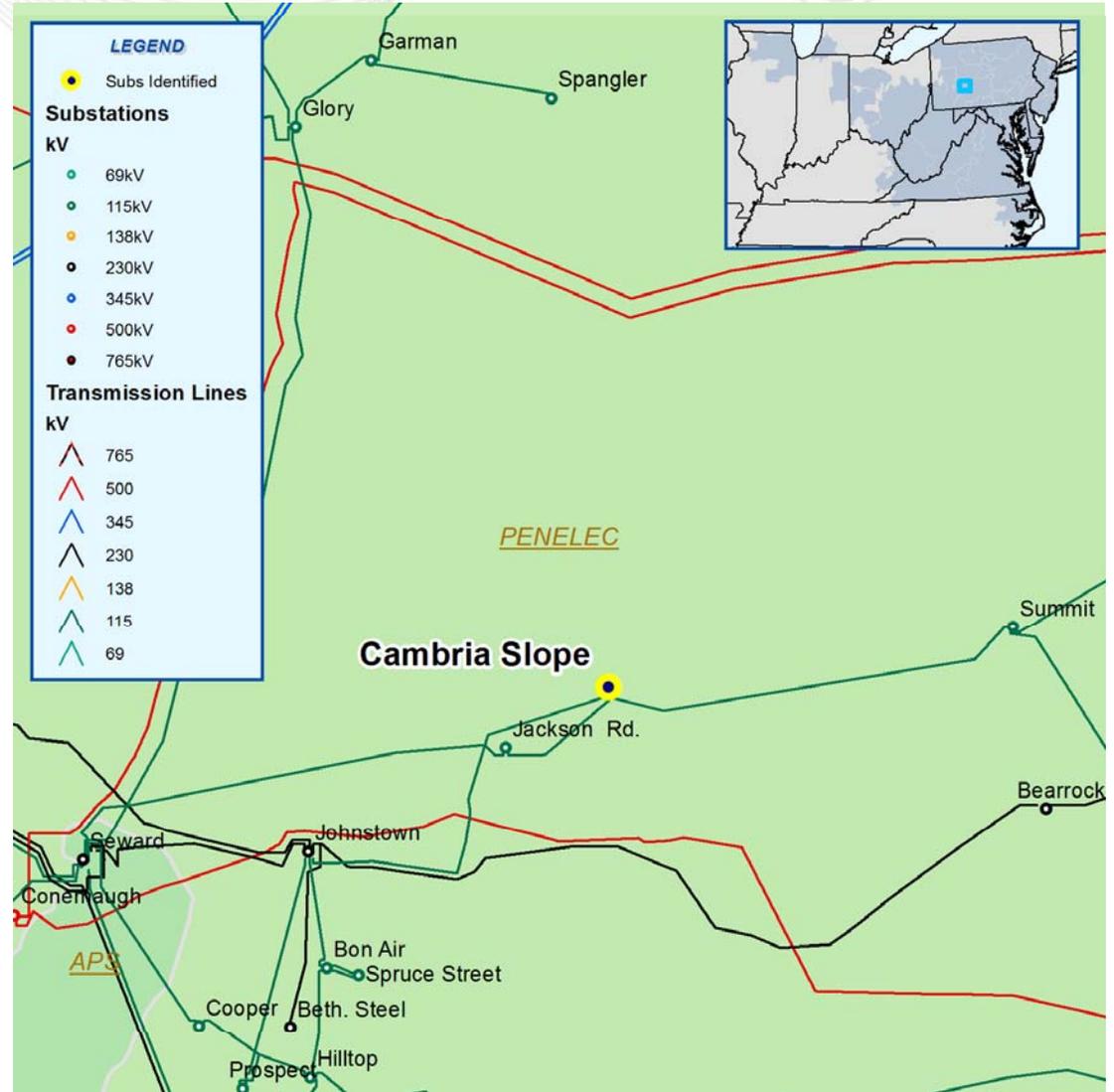
- FE planning criteria violation:
- Overload on the Middletown Junction – Collins 115 kV line for the loss of the Huntertown – Texas Eastern 115 kV line or for an N-1-1 outage of Roxbury – Carlisle and Huntertown – Texas Eastern 115 lines
- Proposed Solution:
Reconductor 0.32 miles of the Middletown Junction - Collins 115 kV (975) line with 336 ACSR (B1365)
- Estimated Project Cost:
\$0.344 M
- Expected IS Date:
6/1/2011



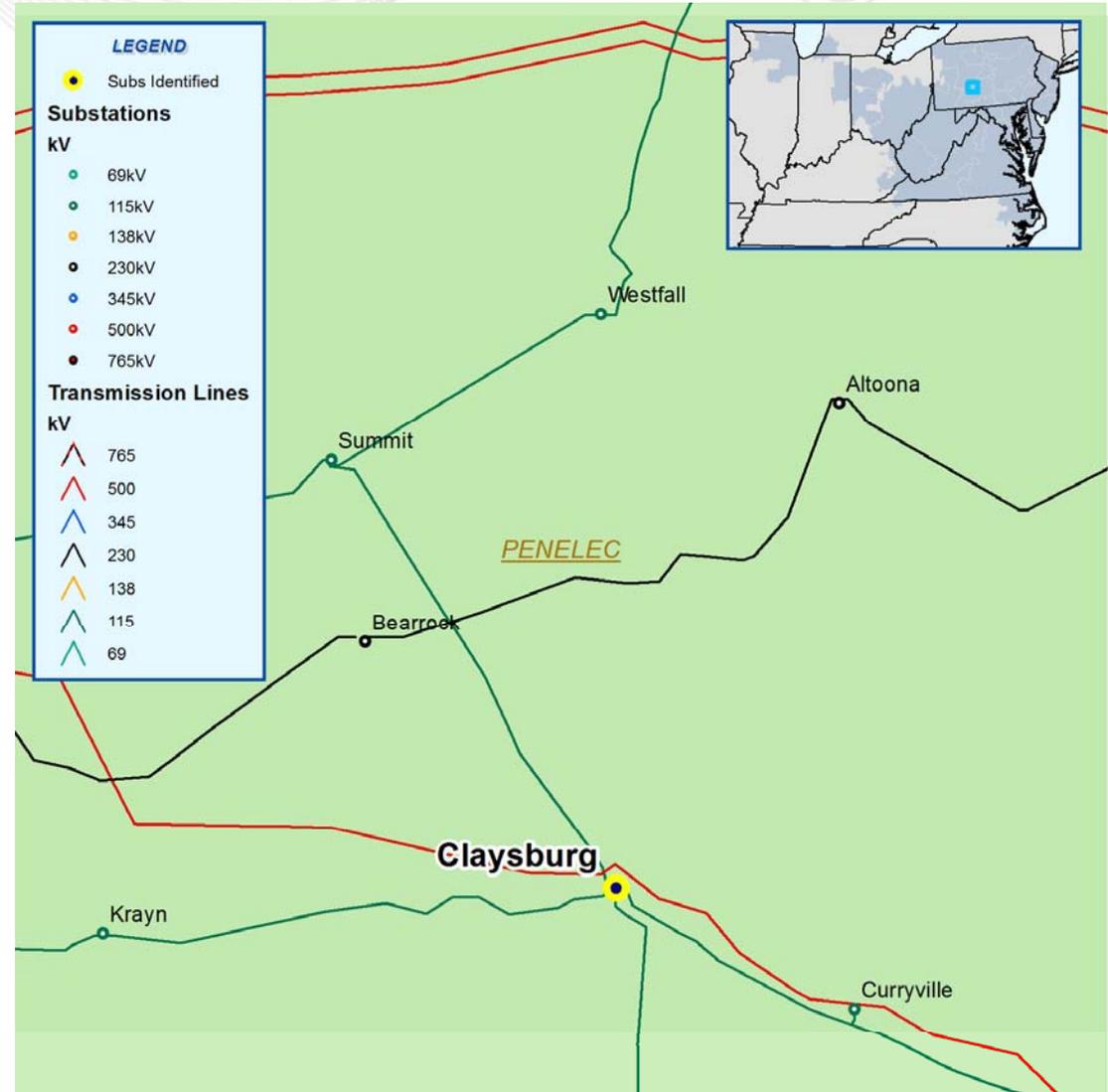
- FE planning criteria violation:
- Overload on Collins – Cly – Newberry 115 kV line for the loss of the Hunterstown – Texas Eastern 115 kV line or for N-1-1 outage of Roxbury – Carlisle and Hunterstown – Texas Eastern 115 kV lines
- Proposed Solution:
Reconductor 5 miles of the Collins – Cly - Newberry 115 kV (975) line with 795 ACSR (B1366)
- Estimated Project Cost:
\$2.387 M
- Expected IS Date:
6/1/2012



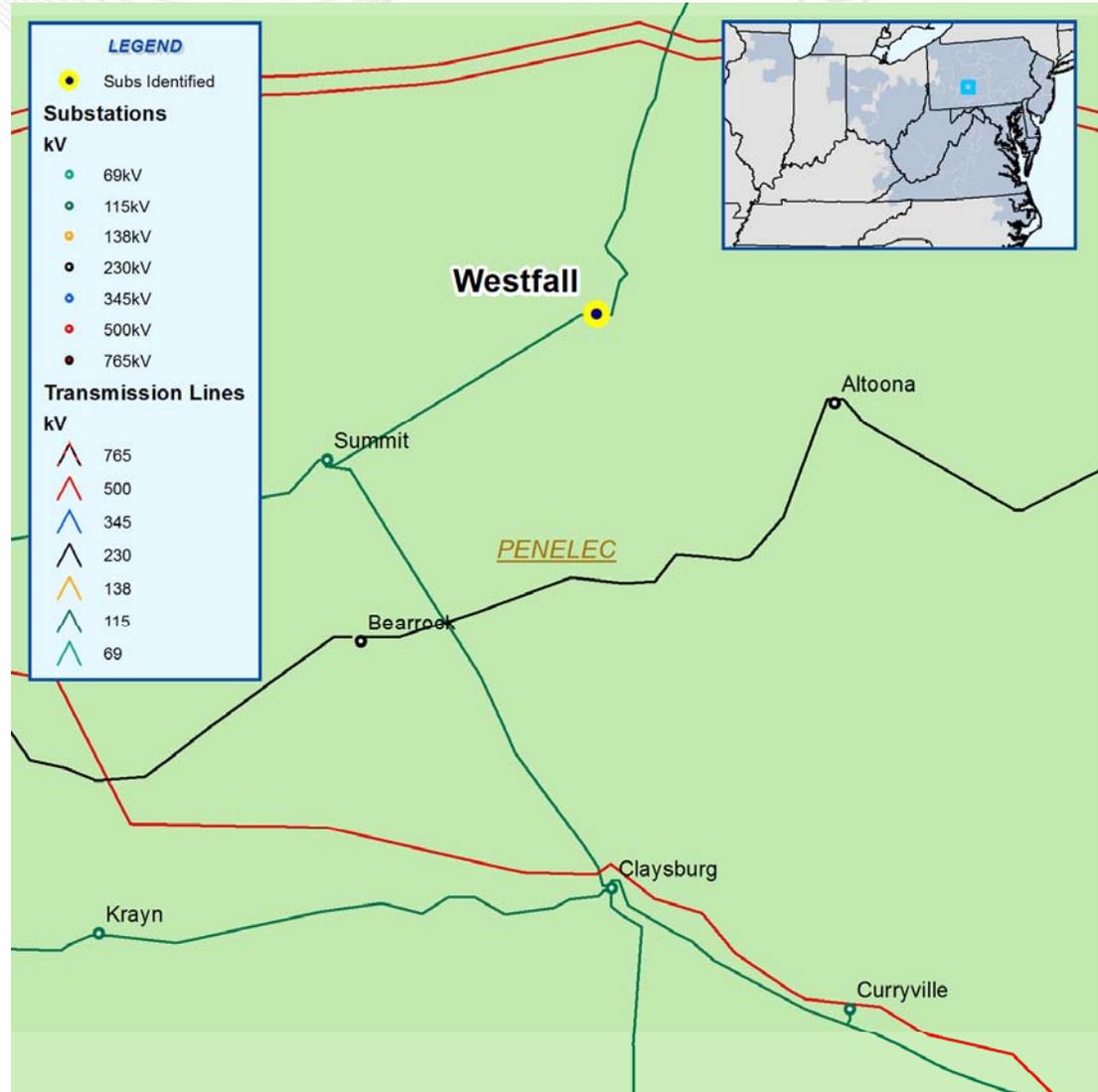
- FE planning criteria violation:
- Overload on Cambria Slope 115/46 kV transformer for the loss of the Cambria Slope – Summit 115 kV line
- Proposed Solution:
Replace the Cambria Slope 115/46 kV 50 MVA transformer with 75 MVA (B1367)
- Estimated Project Cost:
\$1.26 M
- Expected IS Date:
6/1/2011



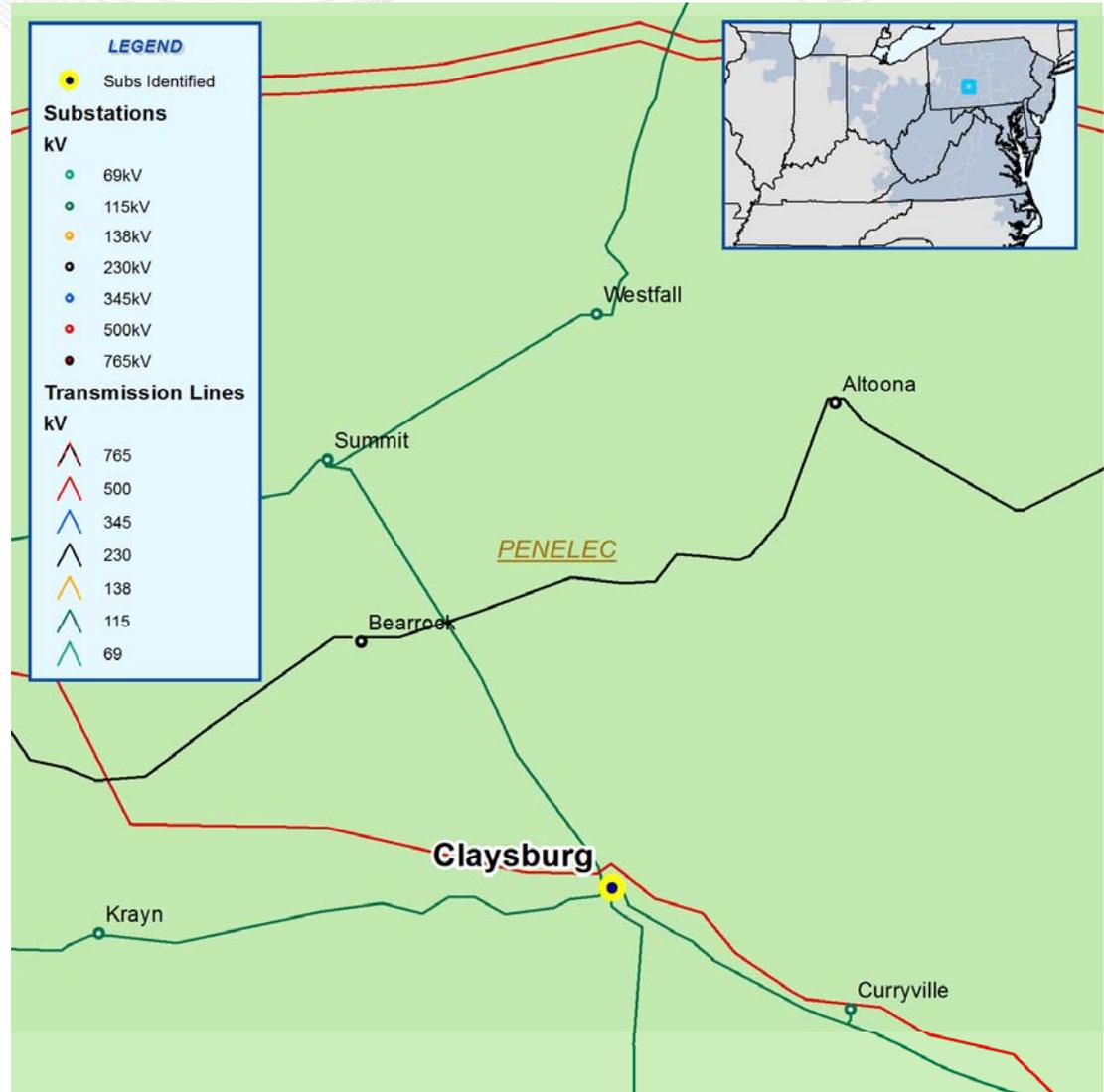
- FE planning criteria violation:
- Overload on the Claysburg 115/46 kV transformer for the loss of the Altoona – Bear Rock 230 kV line
- Proposed Solution:
Replace the Claysburg 115/46 kV 30 MVA transformer with 75 MVA (B1368)
- Estimated Project Cost:
\$1.492 M
- Expected IS Date:
6/1/2011



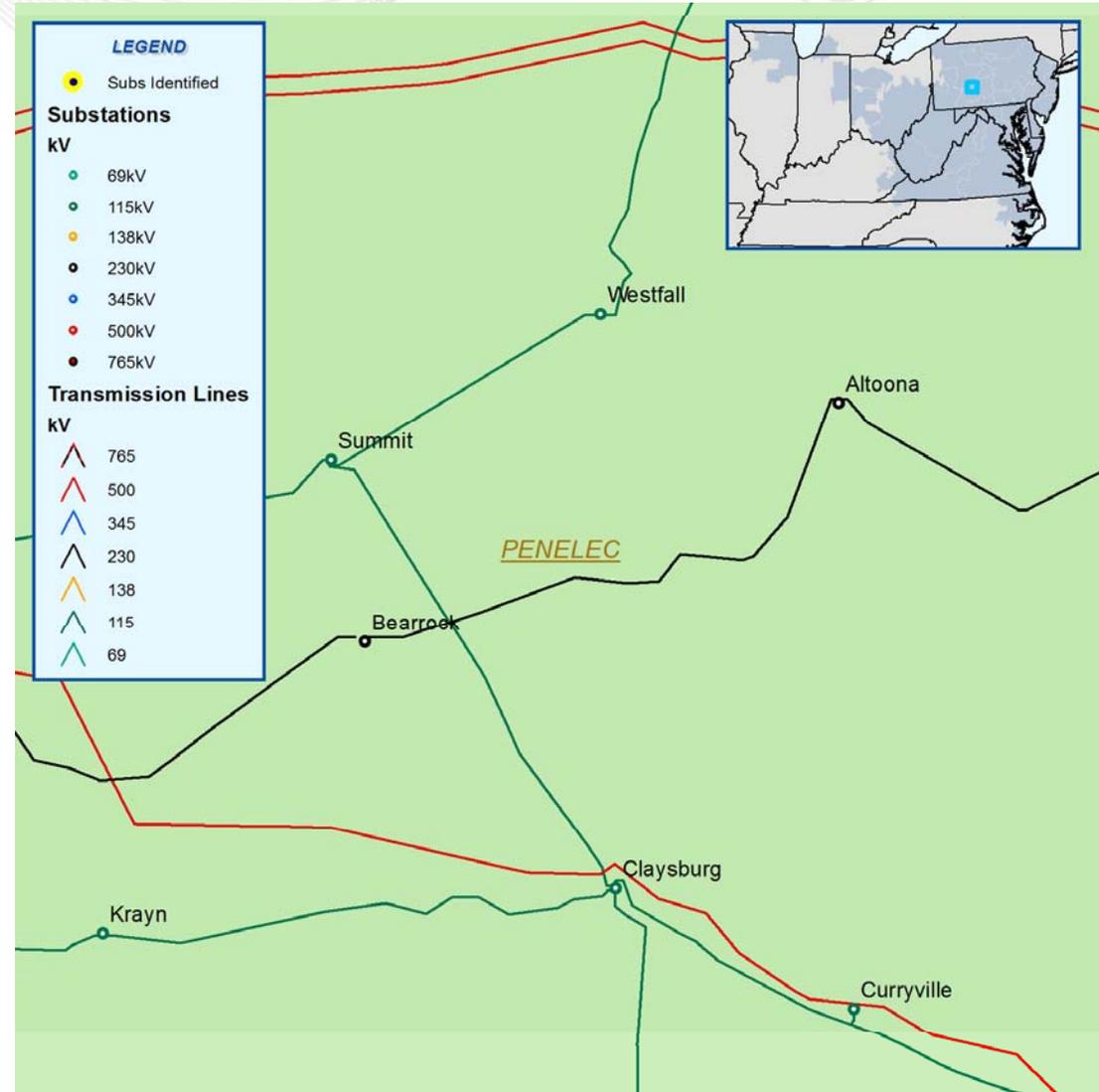
- FE planning criteria violation:
- Overload on the Westfall 115/46 kV transformer for the loss of the Altoona – Bear Rock 230 kV line
- Proposed Solution:
Replace the substation conductor at Westfall with 795 ACSR on the Westfall S21 Tap 46 kV line (B1369) and Install a 3rd 115/46 kV transformer at Westfall (B1370)
- Estimated Project Cost:
\$0.034 M (conductor)
\$3.832 M (transformer)
- Expected IS Date:
6/1/2011



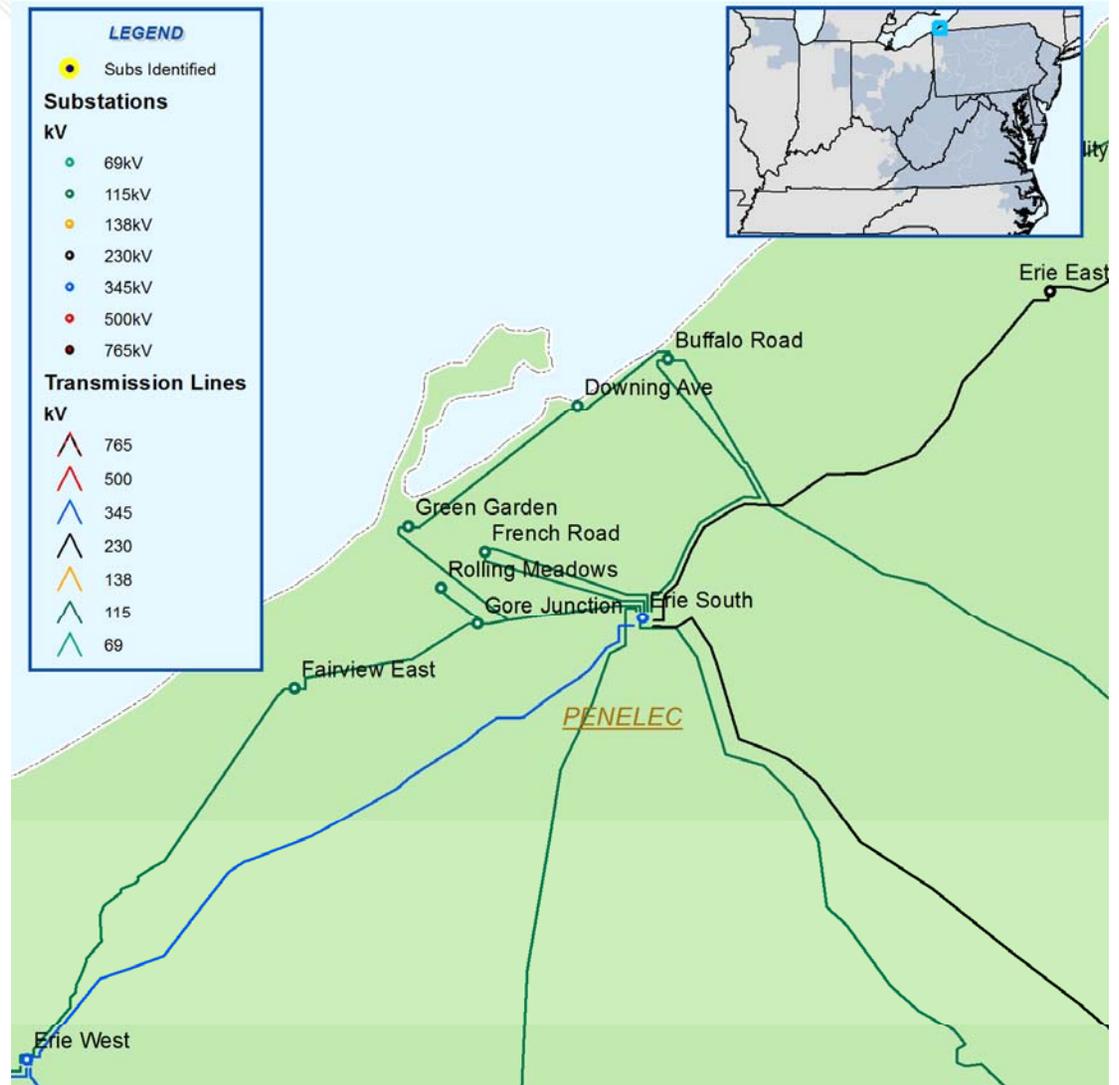
- FE planning criteria violation:
- Overload on the Claysburg - HCR 46 kV line segment for the loss of the Altoona – Bear Rock 230 kV line
- Proposed Solution:
Reconductor 2.6 miles of the Claysburg - HCR 46 kV line with 636 ACSR (B1371)
- Estimated Project Cost:
\$0.633 M
- Expected IS Date:
6/1/2011



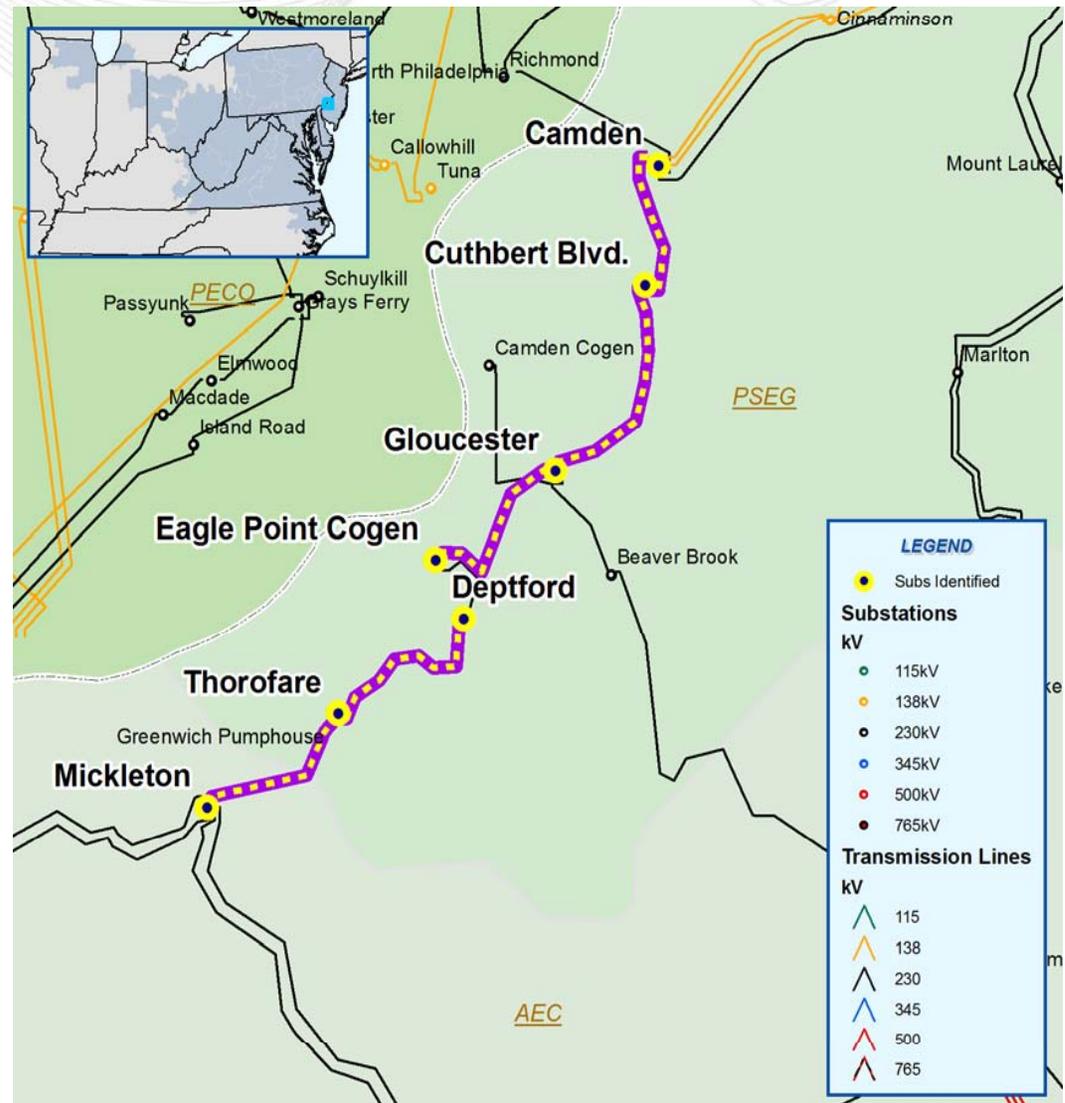
- FE planning criteria violation:
- Overload on Hollidaysburg – HCR 46 kV for the loss of the Altoona – Bear Rock 230 kV line
- Proposed Solution:
Replace substation conductor with 795 ACSR on the Hollidaysburg – HCR 46 kV (B1372)
- Estimated Project Cost:
\$0.044 M
- Expected IS Date:
6/1/2011



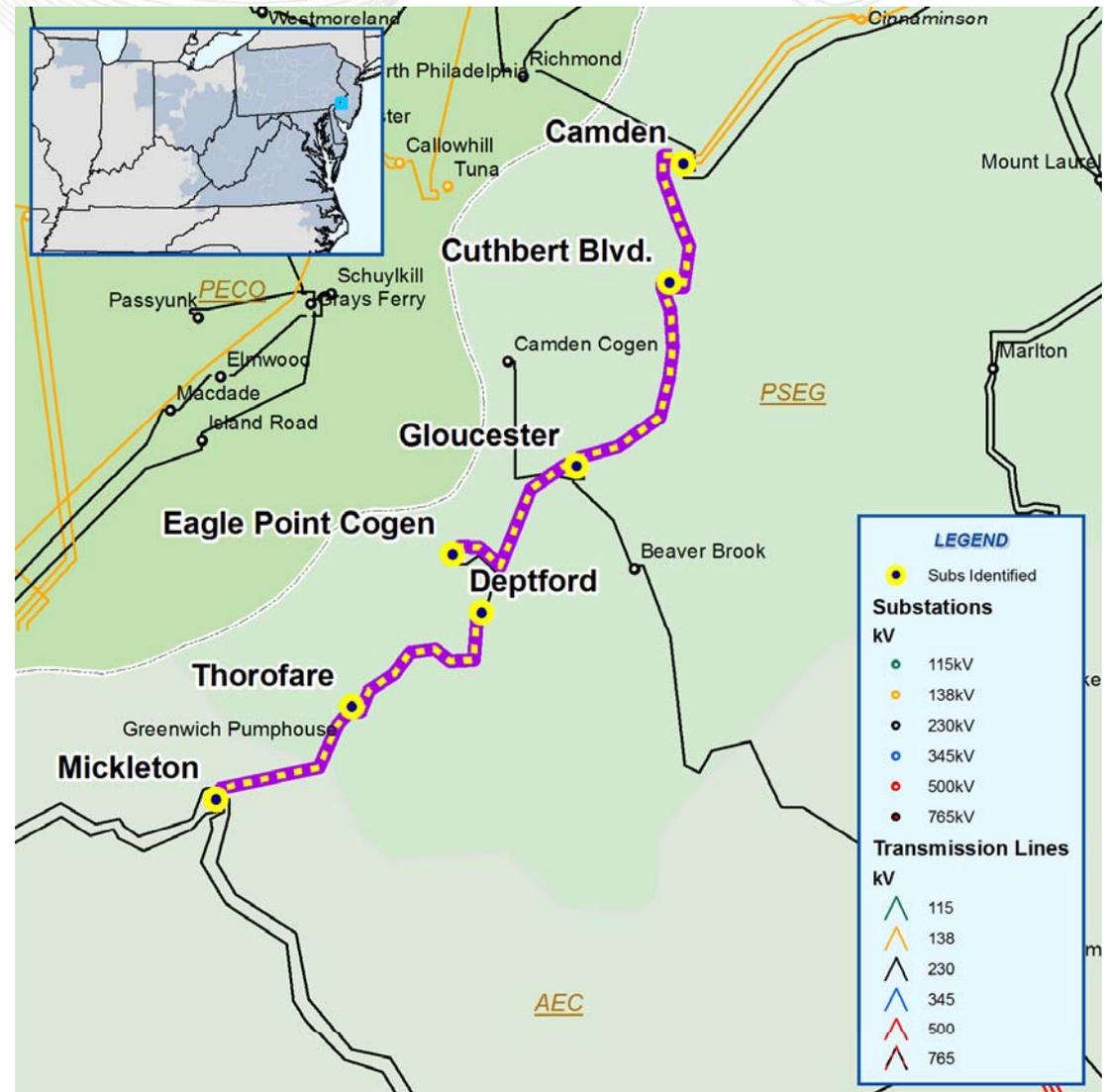
- Common Mode Voltage Violation:
- Low voltages in the Erie area for the 345 kV stuck breaker CB8 at Erie West substation
- Proposed Solution:
Re-configure the Erie West 345 kV substation, add a new circuit breaker and relocate the Ashtabula line exit (B1373).
- Estimated Project Cost:
\$0.955 M
- Expected IS Date:
6/1/2012



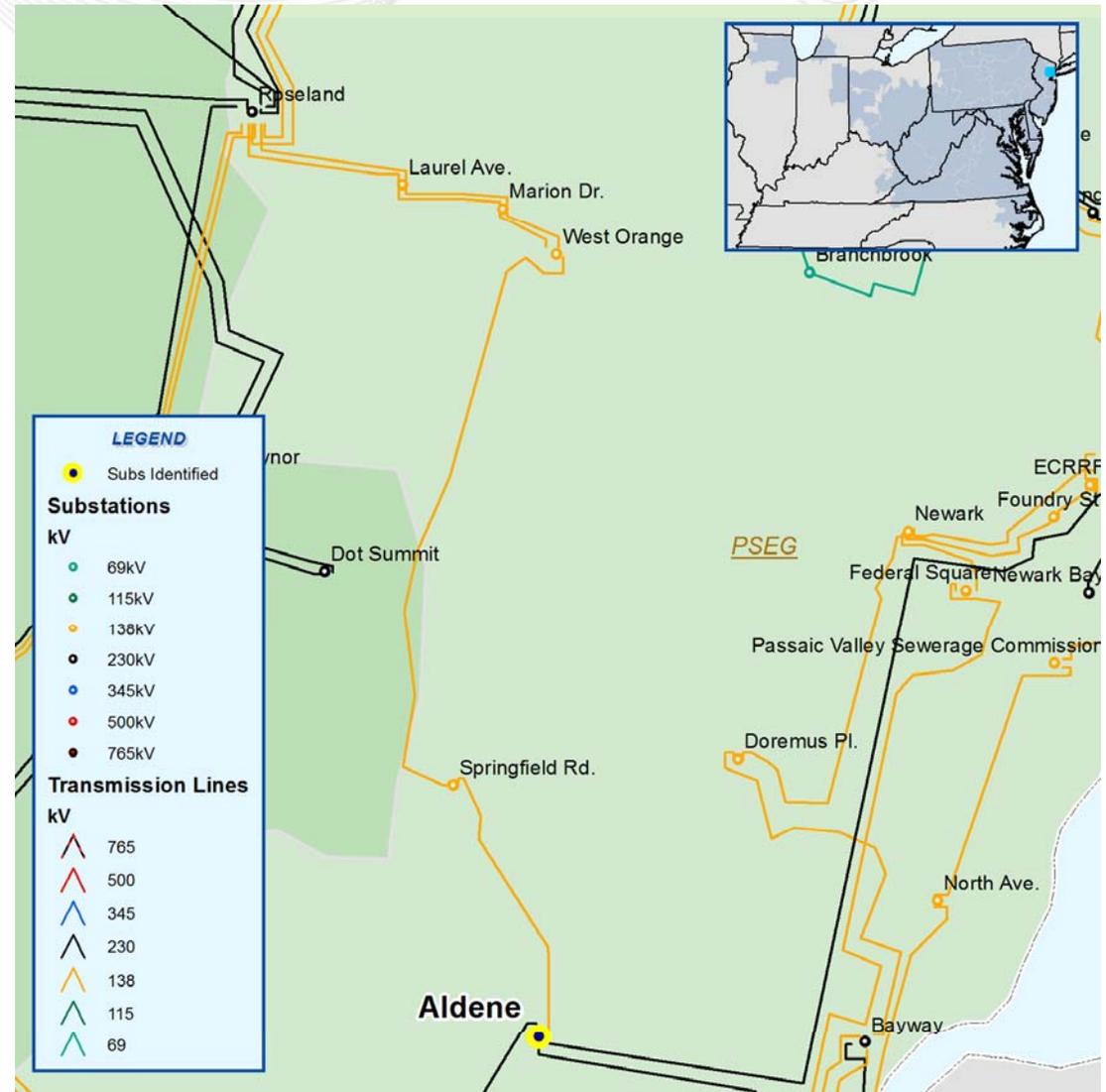
- Generation Deliverability, Load Deliverability, N-1-1 and Baseline Violations:
- The following 230 kV circuits in PSE&G area are overloaded for several contingencies.
 - Gloucester – Cuthbert 230 kV
 - Cuthbert – Camden 230 kV
 - Eagle Point – Gloucester 230 kV
 - Thorofare – Deptford 230 kV
 - Mickleton – Thorofare 230 kV
- Continued on next slide



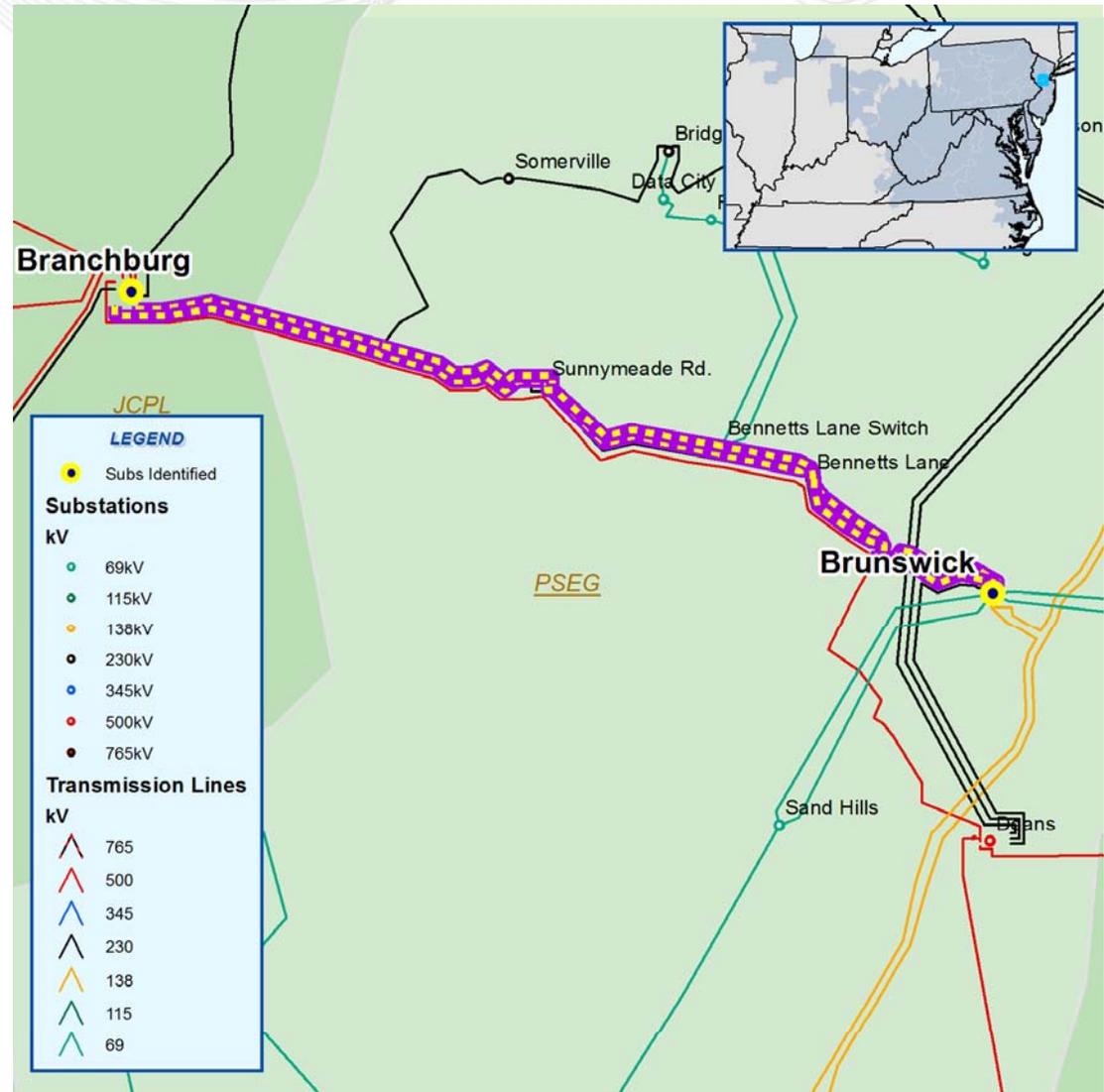
- Continued from previous slide
- Recommended solution:
 - Build two new parallel underground circuits from Gloucester to Camden (via Cuthbert Blvd)
 - Install shunt reactor at Gloucester to offset cable charging
 - Reconfigure the Cuthbert station to breaker and a half scheme
 - Build a second 230 kV parallel overhead circuit from Mickleton – Gloucester and reconductor the existing Mickleton – Gloucester 230 kV circuit
 - Reconductor the Camden – Richmond 230 kV circuit and upgrade terminal equipment at Camden and Richmond substations
 - Reconductor Richmond – Waneeta 230 kV and replace terminal equipment at Richmond and Waneeta substations
 - (B1398)
- Estimated Project Cost: \$249 M
- Expected IS Date: 6/1/2015



- N-1-1 Thermal violation:
- The Aldene 230/138 kV transformer is overloaded for the loss of the Roseland – West Orange 230 kV “S” and “T” circuits
- Recommended Solution:
Convert the 138 kV path from Aldene –Springfield Road - West Orange to 230 kV (B1399)
- Estimated Project Cost:
\$75 M
- Expected IS Date:
6/1/2014



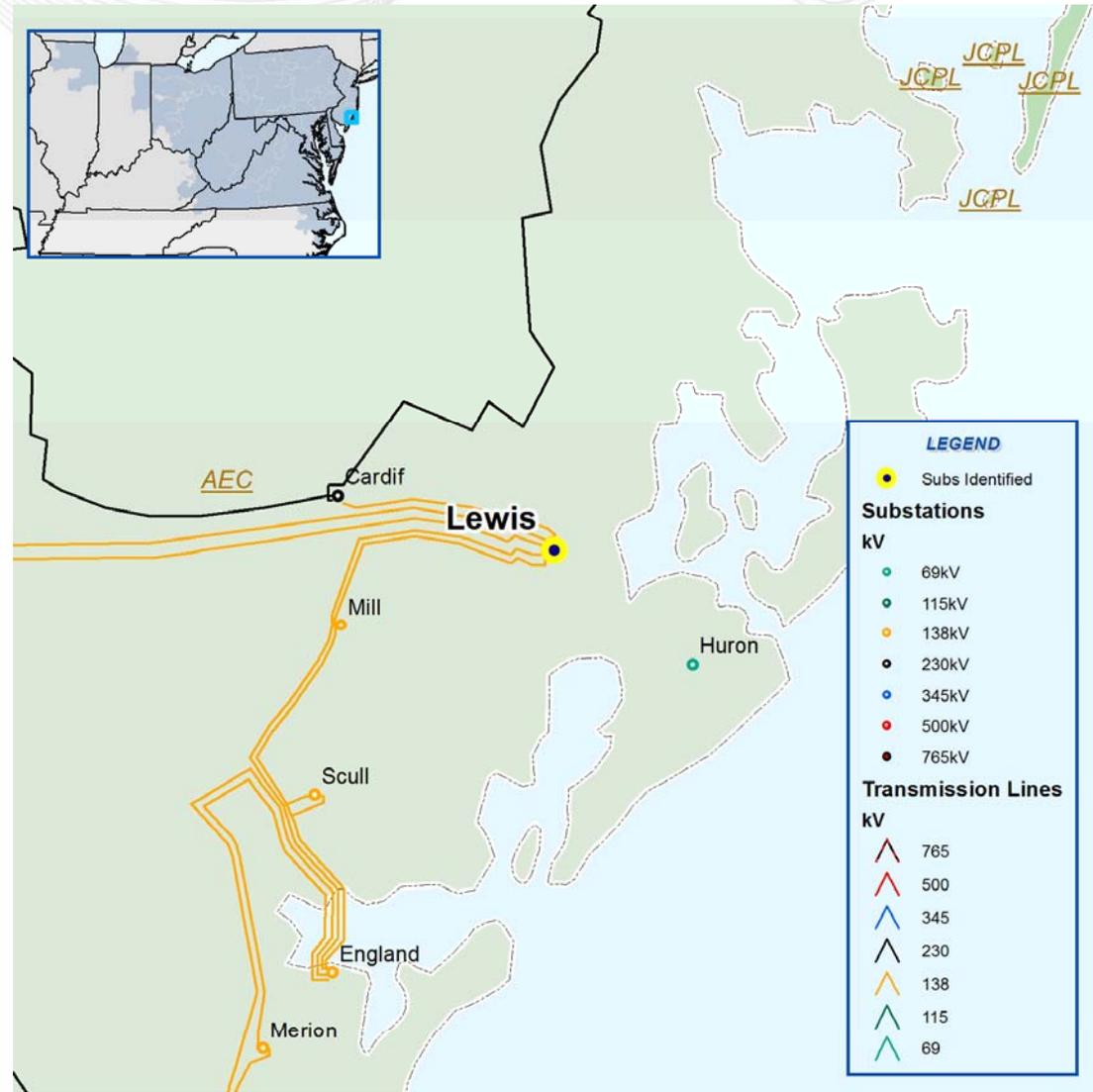
- PSEG Reliability criteria:
- Load loss exceeds 300 MW for the 230 kV tower line outage of the “F-2232” and “X-2224” circuits from Branchburg – Brunswick.
- Recommended Solution: Install 230 kV circuit breakers at Bennetts Lane “F” and “X” buses (B1400).
- Estimated Project Cost: \$3.0 M
- Expected IS Date: 6/1/2012



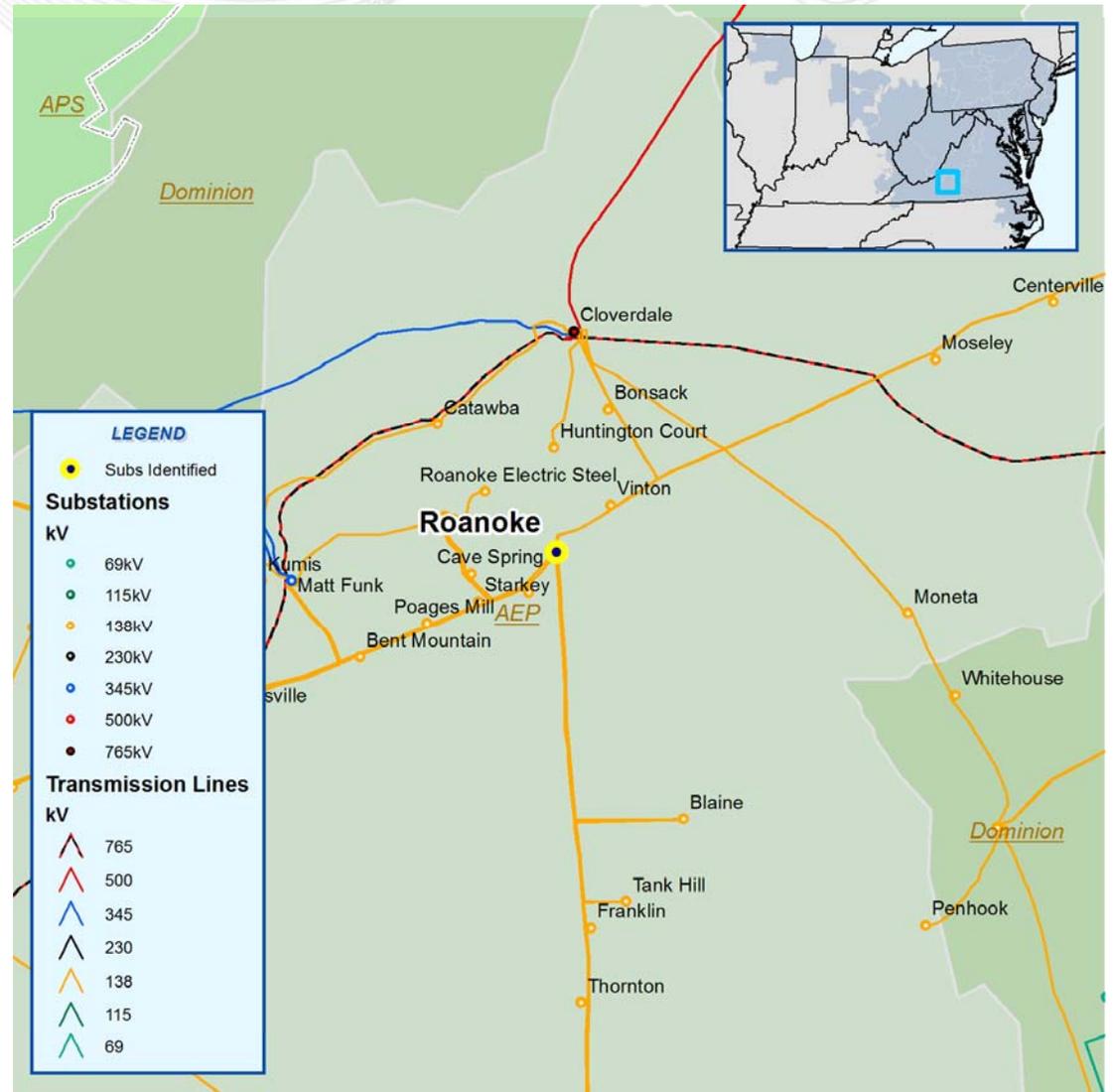


Short Circuit Baseline Upgrades

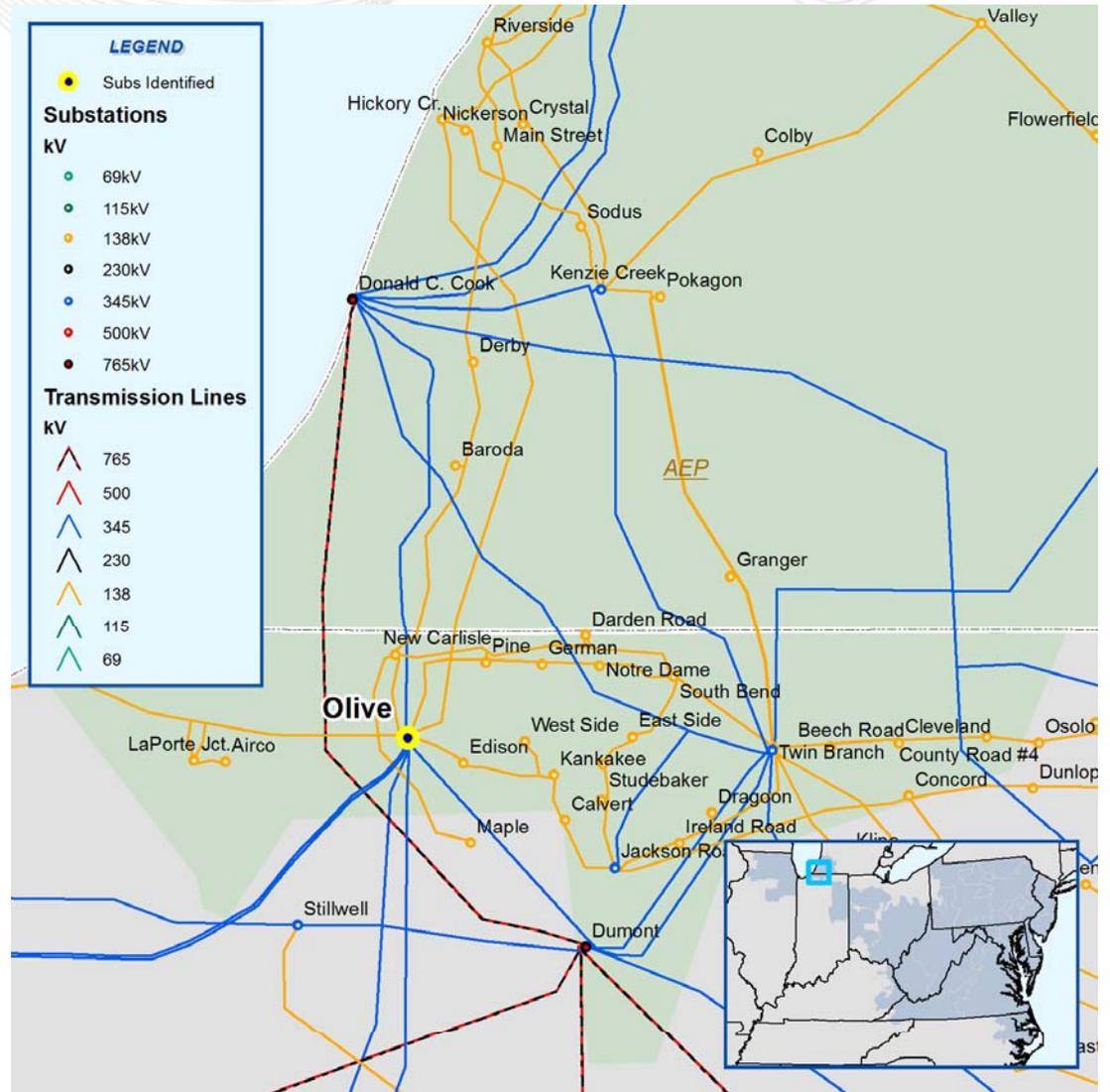
- The Lewis 138 kV breaker 'L' is overstressed
- Proposed Solution:
- Replace the Lewis 138 kV breaker 'L' (b1396)
- Estimated Project Cost: \$400 K per breaker
- Expected IS Date: 6/1/2015



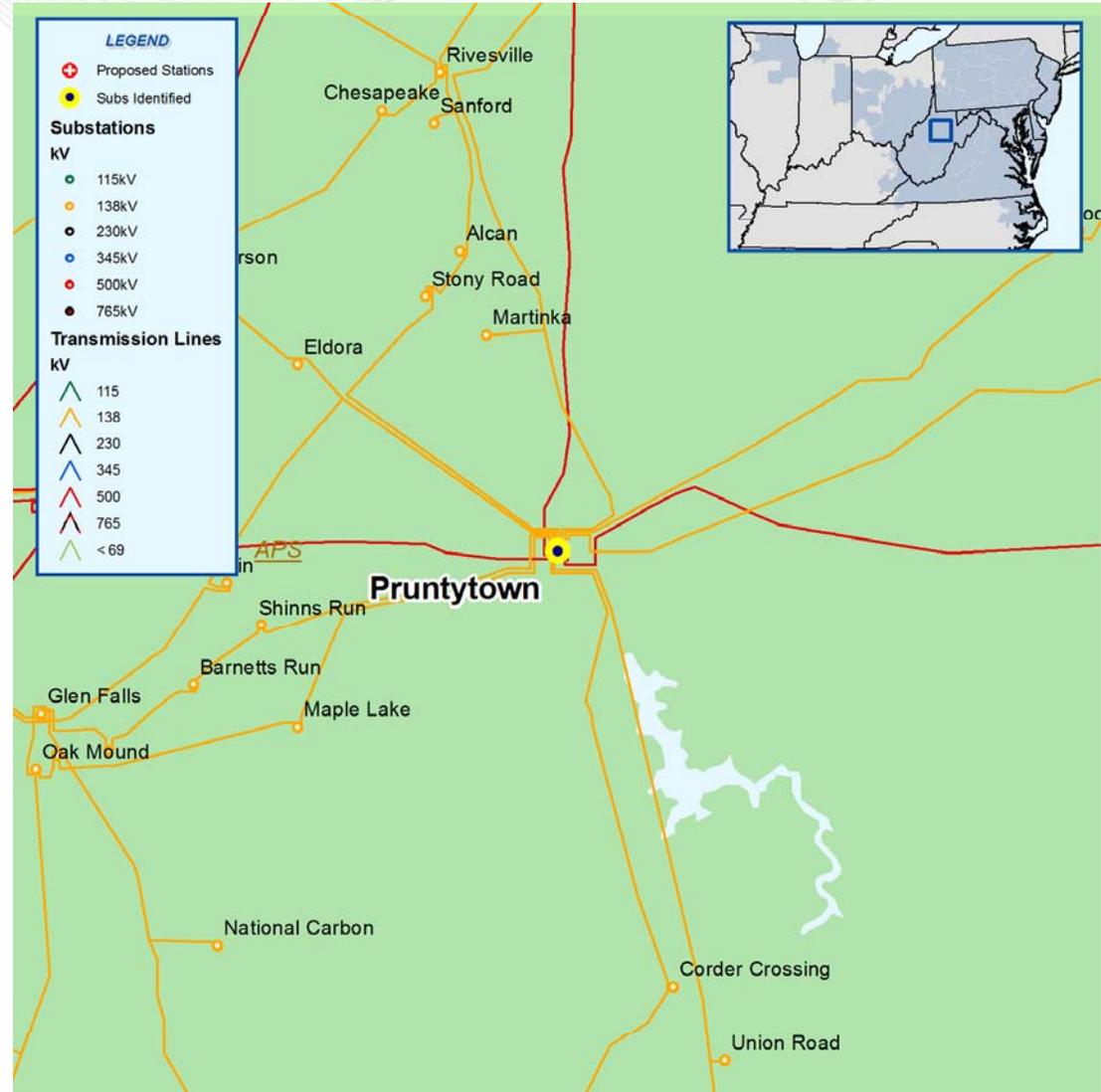
- The following 6 circuit breakers are overstressed
- Roanoke 138 kV breakers 'T', 'E', 'F', 'G', 'B', 'A'
- Proposed Solution:
 - Replace the Roanoke 138 kV breaker 'T' (b1375)
 - Replace the Roanoke 138 kV breaker 'E' (b1376)
 - Replace the Roanoke 138 kV breaker 'F' (b1377)
 - Replace the Roanoke 138 kV breaker 'G' (b1378)
 - Replace the Roanoke 138 kV breaker 'B' (b1379)
 - Replace the Roanoke 138 kV breaker 'A' (b1380)
- Estimated Project Cost: \$800 K per breaker
- Expected IS Date: 6/1/2011



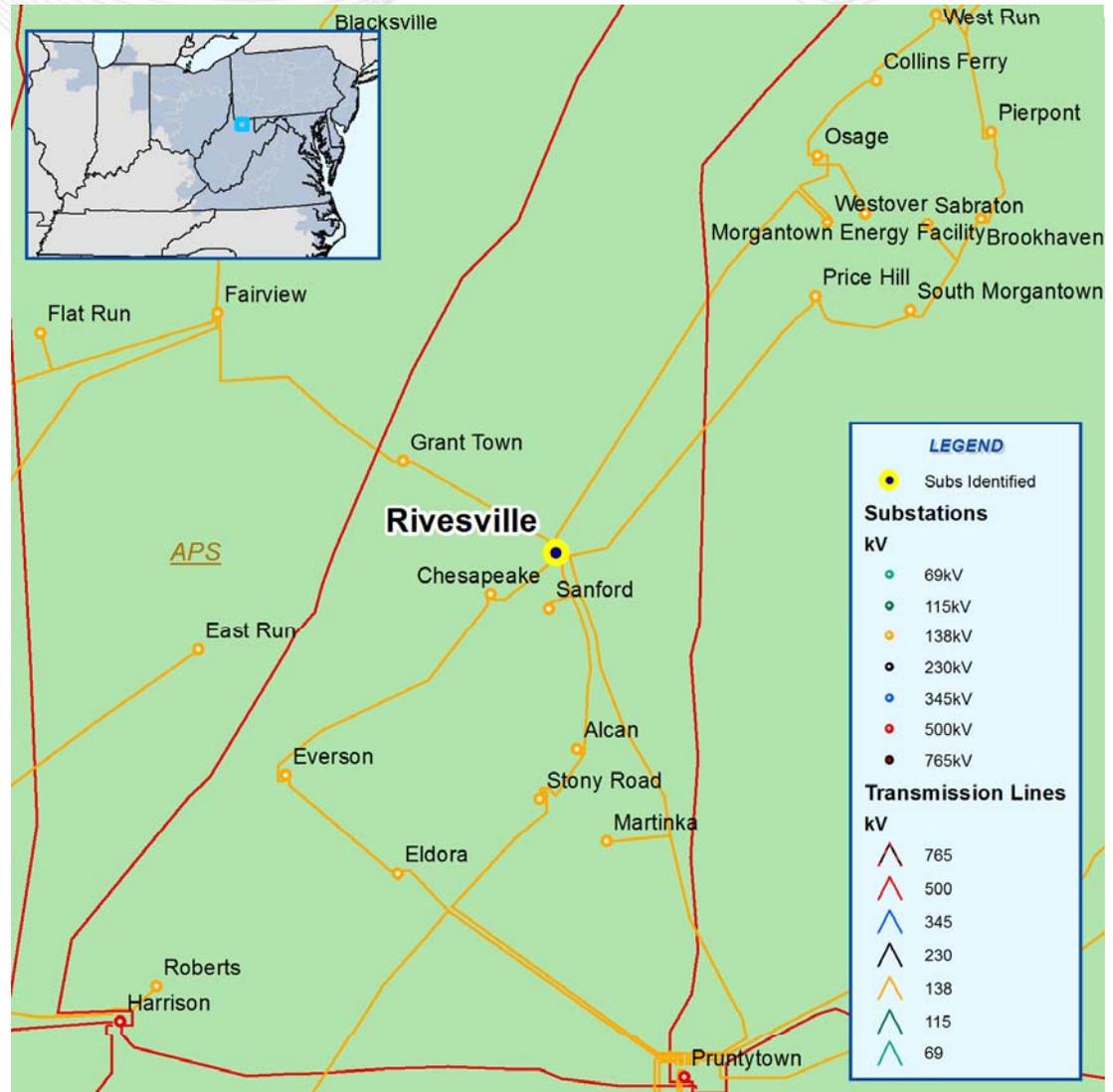
- The following 2 circuit breakers are overstressed
 - Olive 345 kV breaker 'E'
 - Olive 138 kV breaker 'R2'
- Proposed Solution:
 - Replace the Olive 345 kV breaker 'E' (b1381)
 - Replace the Olive 138 kV breaker 'R2' (b1382)
- Estimated Project Cost: \$1.0 M per breaker
- Expected IS Date: 6/1/2011



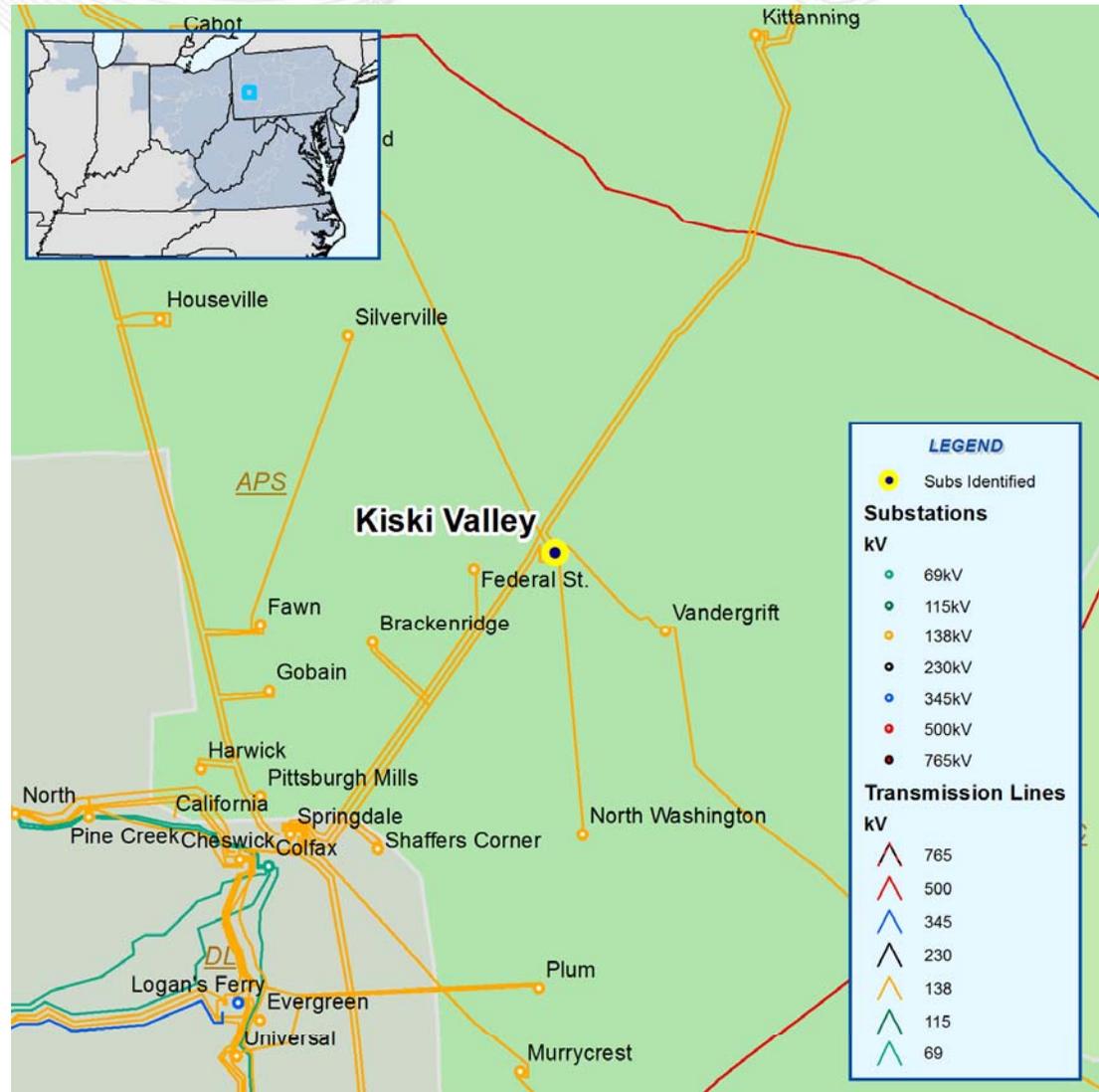
- The Pruntytown 138 kV breaker 'P-16' is overstressed
- Proposed Solution:
- Change the reclosing on the Pruntytown 138 kV breaker 'P-16' to 1 shot at 15 seconds (b1401)
- Estimated Project Cost: \$2 K
- Expected IS Date: 6/1/2011



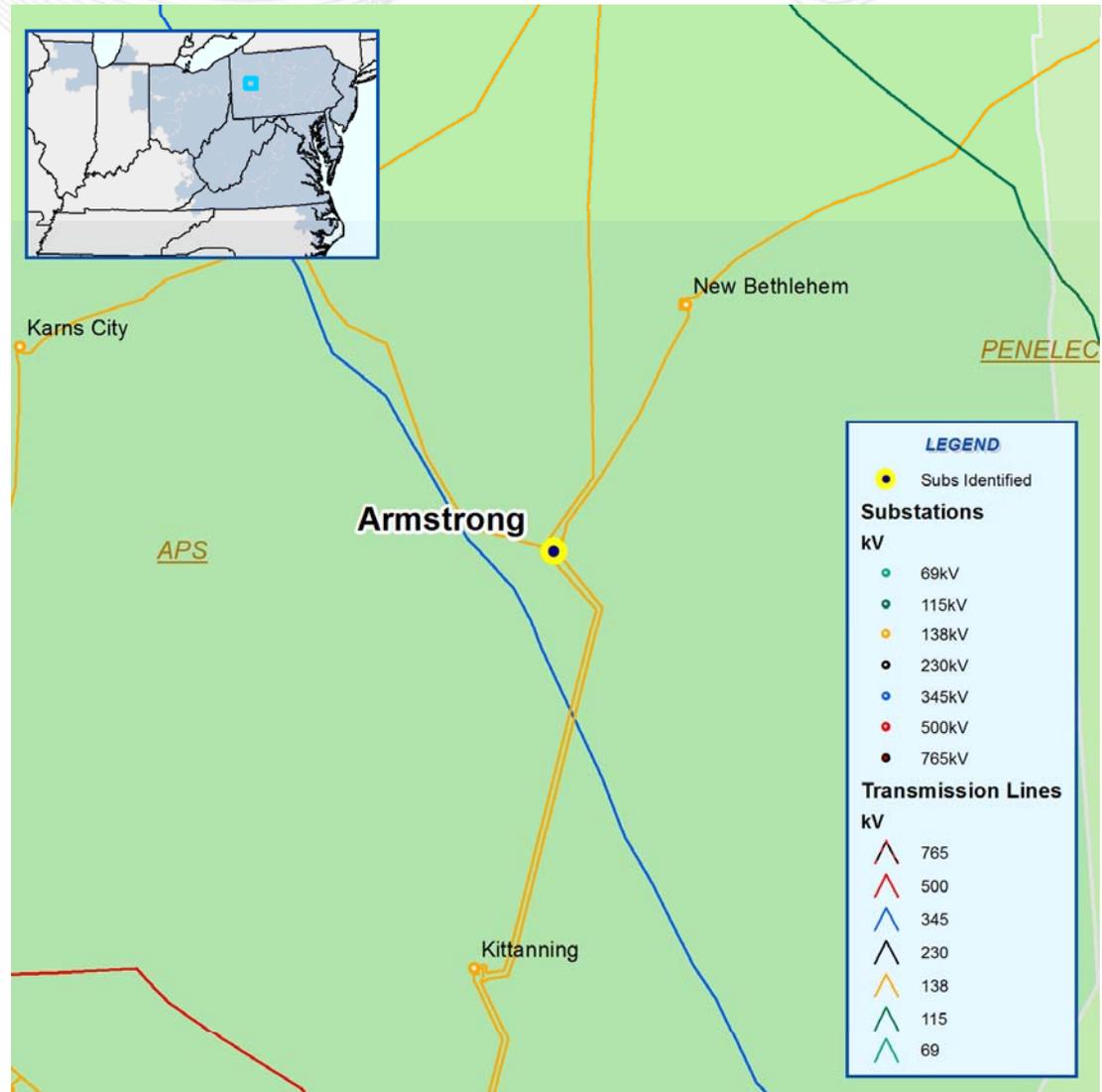
- The Rivesville 138 kV breaker 'Pruntytown #34' is overstressed
- Proposed Solution:
- Change the reclosing on the Rivesville 138 kV breaker 'Pruntytown #34' to 1 shot at 15 seconds (b1402)
- Estimated Project Cost: \$2 K
- Expected IS Date: 6/1/2011



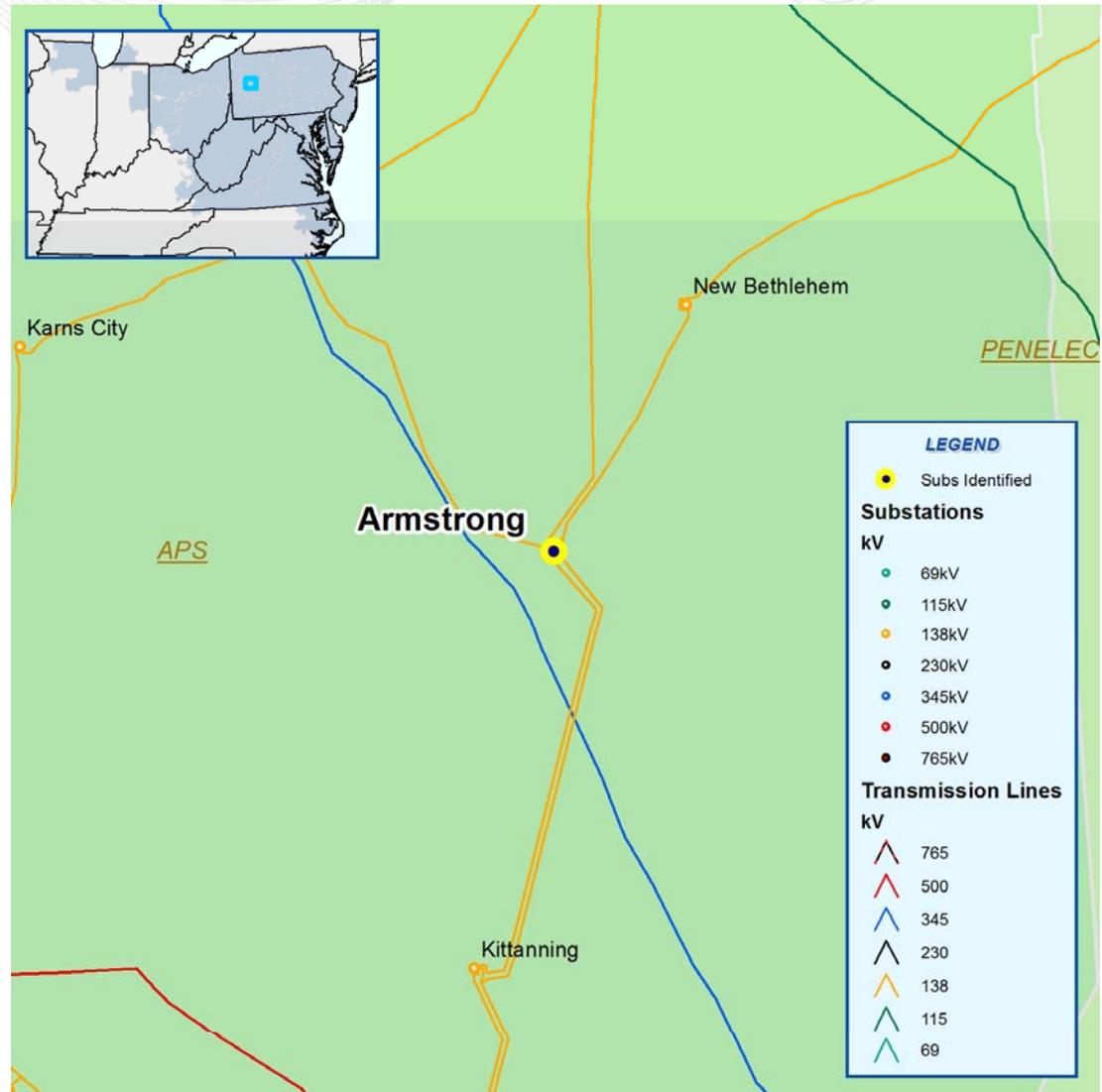
- The Kiski Valley 138 kV breaker 'Vandergrift' is overstressed
- Proposed Solution:
- Replace the Kiski Valley 138 kV breaker 'Vandergrift' with a 40 kA breaker (b1404)
- Estimated Project Cost: \$250 K
- Expected IS Date: 6/1/2015



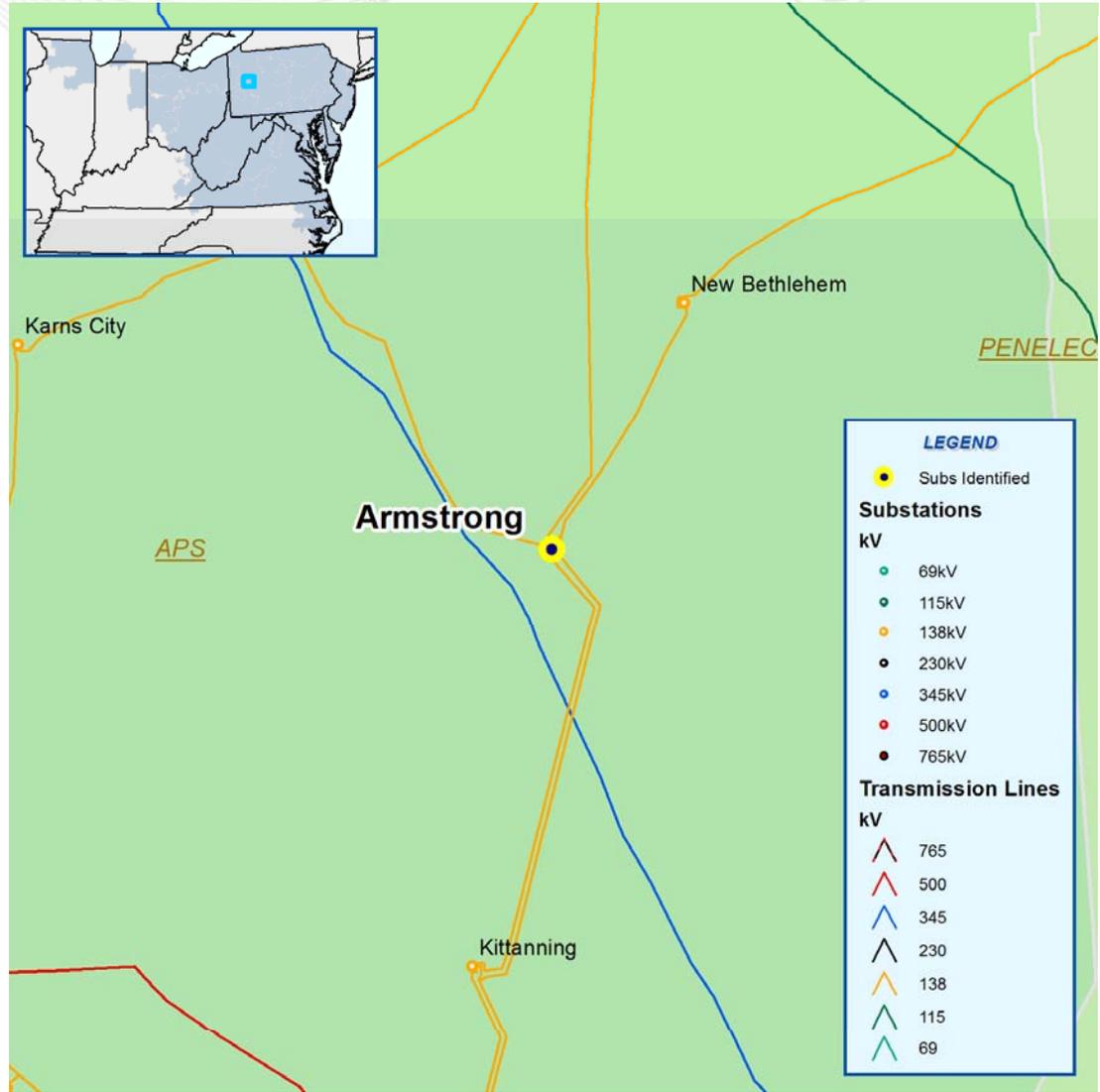
- The Armstrong 138 kV breaker 'GARETTRJCT' is overstressed
- Proposed Solution:
- Change the reclosing on the Armstrong 138 kV breaker 'GARETTRJCT' to 1 shot at 15 seconds (b1405)
- Estimated Project Cost: \$2 K
- Expected IS Date: 6/1/2015



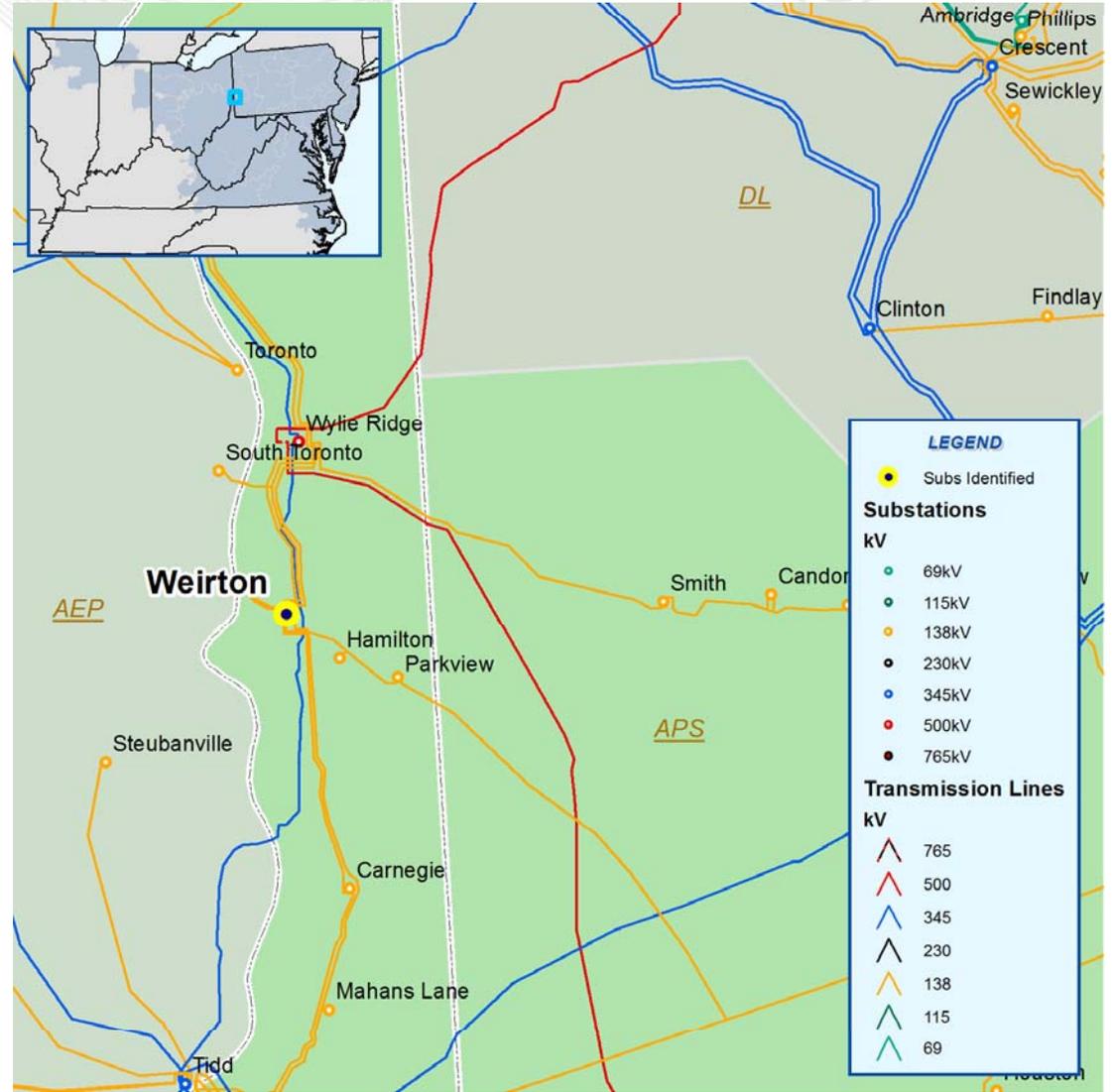
- The Armstrong 138 kV breaker 'KITTANNING' is overstressed
- Proposed Solution:
- Change the reclosing on the Armstrong 138 kV breaker 'KITTANNING' to 1 shot at 15 seconds (b1406)
- Estimated Project Cost: \$2 K
- Expected IS Date: 6/1/2015



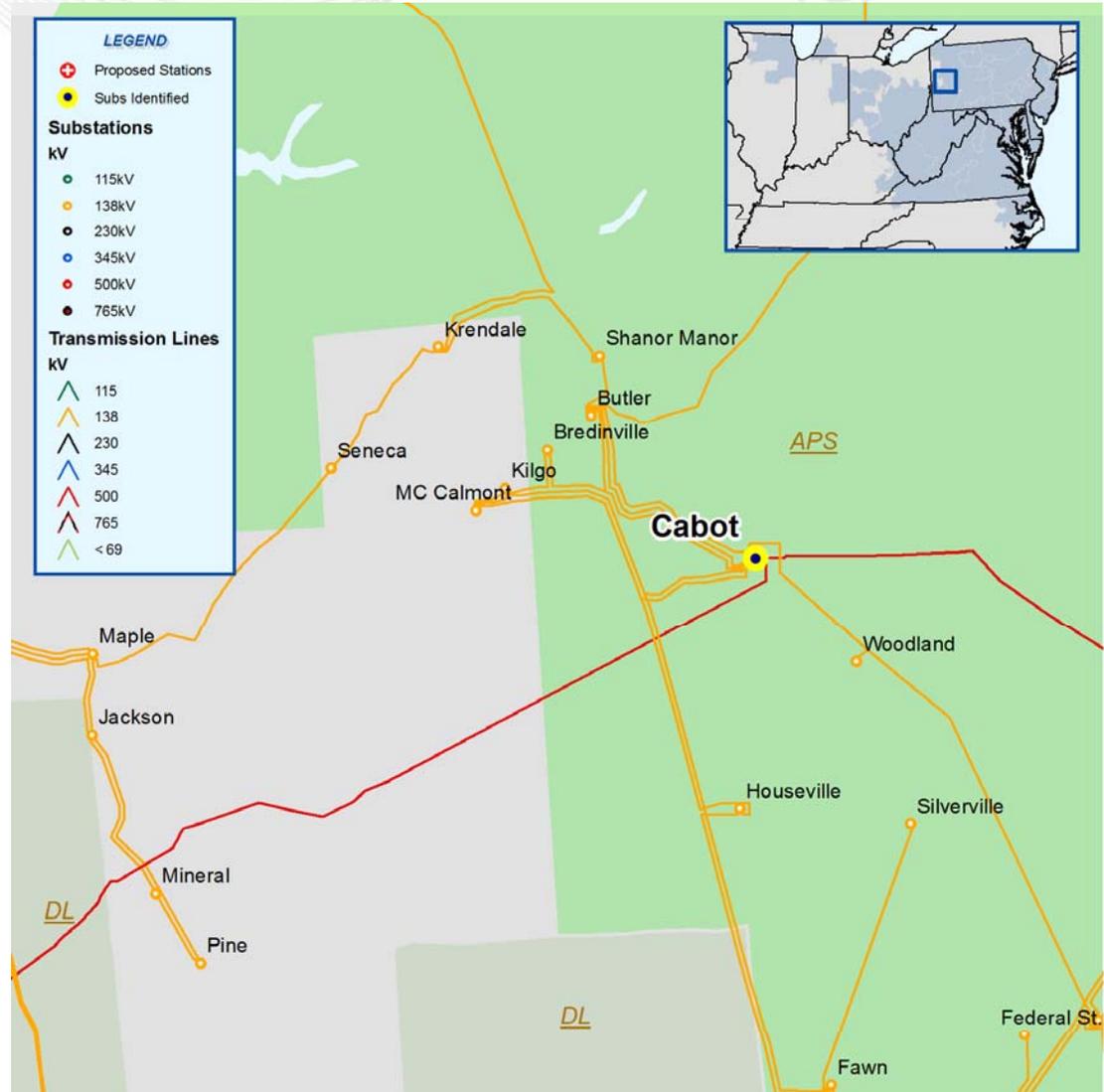
- The Armstrong 138 kV breaker 'BURMA' is overstressed
- Proposed Solution:
- Change the reclosing on the Armstrong 138 kV breaker 'BURMA' to 1 shot at 15 seconds (b1407)
- Estimated Project Cost: \$2 K
- Expected IS Date: 6/1/2015



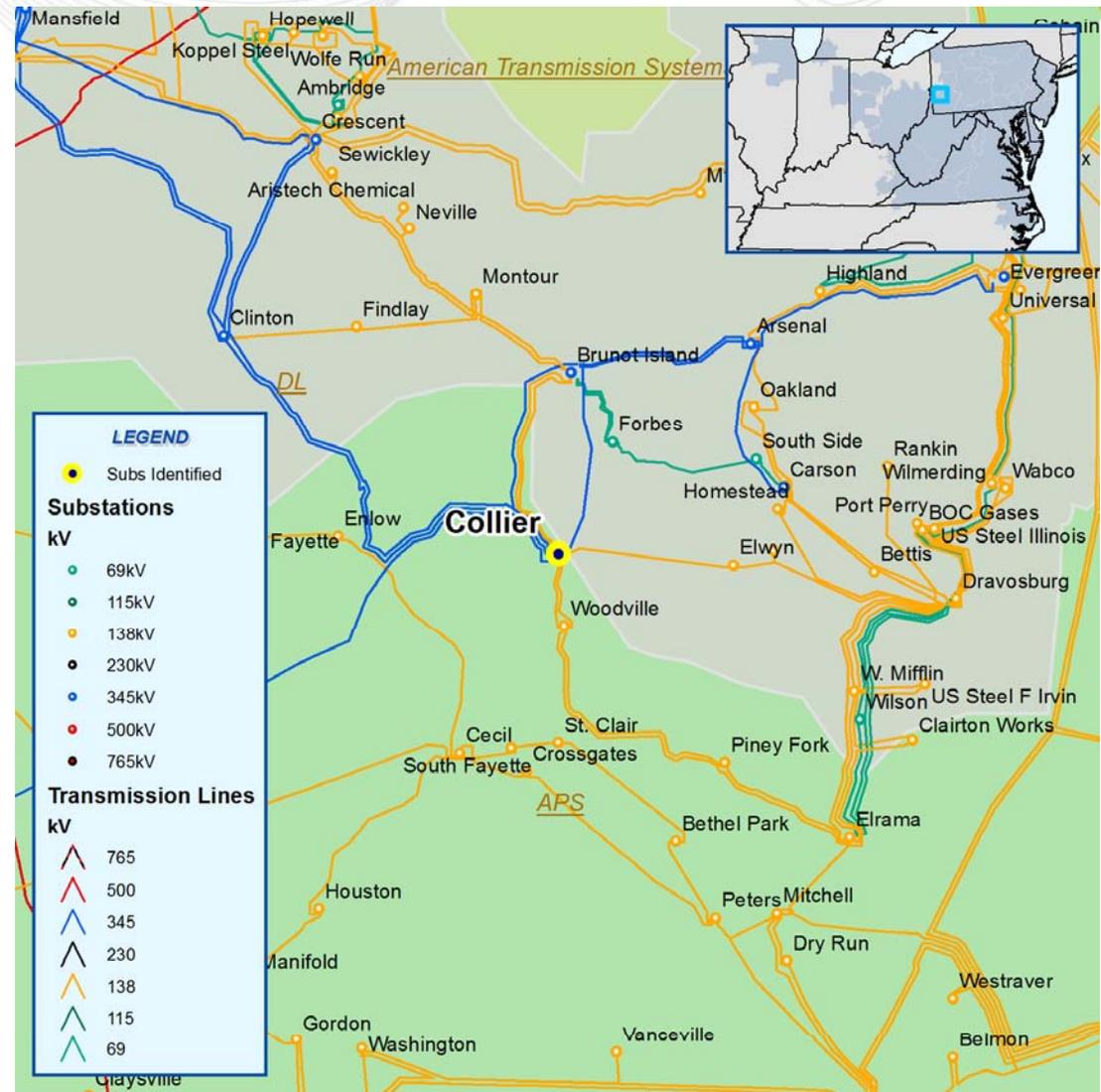
- The Weirton 138 kV breaker 'Tidd 224' is overstressed
- Proposed Solution:
- Replace the Weirton 138 kV breaker 'Tidd 224' with a 40 kA breaker (b1408)
- Estimated Project Cost: \$250 K
- Expected IS Date: 6/1/2015



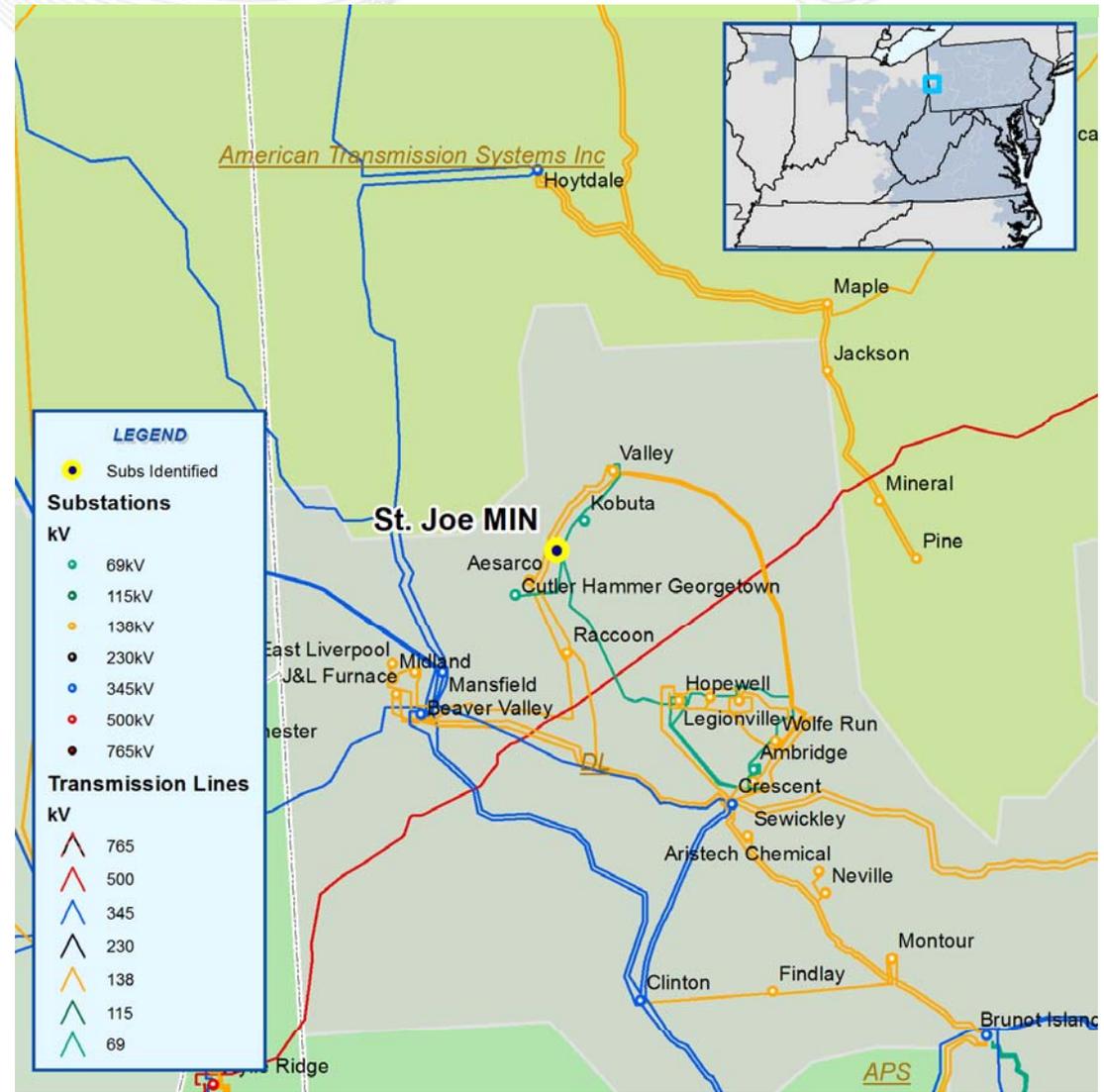
- The Cabot 138 kV breaker 'C9 Kiski Valley' is overstressed
- Proposed Solution:
- Replace the Cabot 138 kV breaker 'C9 Kiski Valley' with a 63 kA breaker (b1409)
- Estimated Project Cost: \$300 K
- Expected IS Date: 6/1/2015



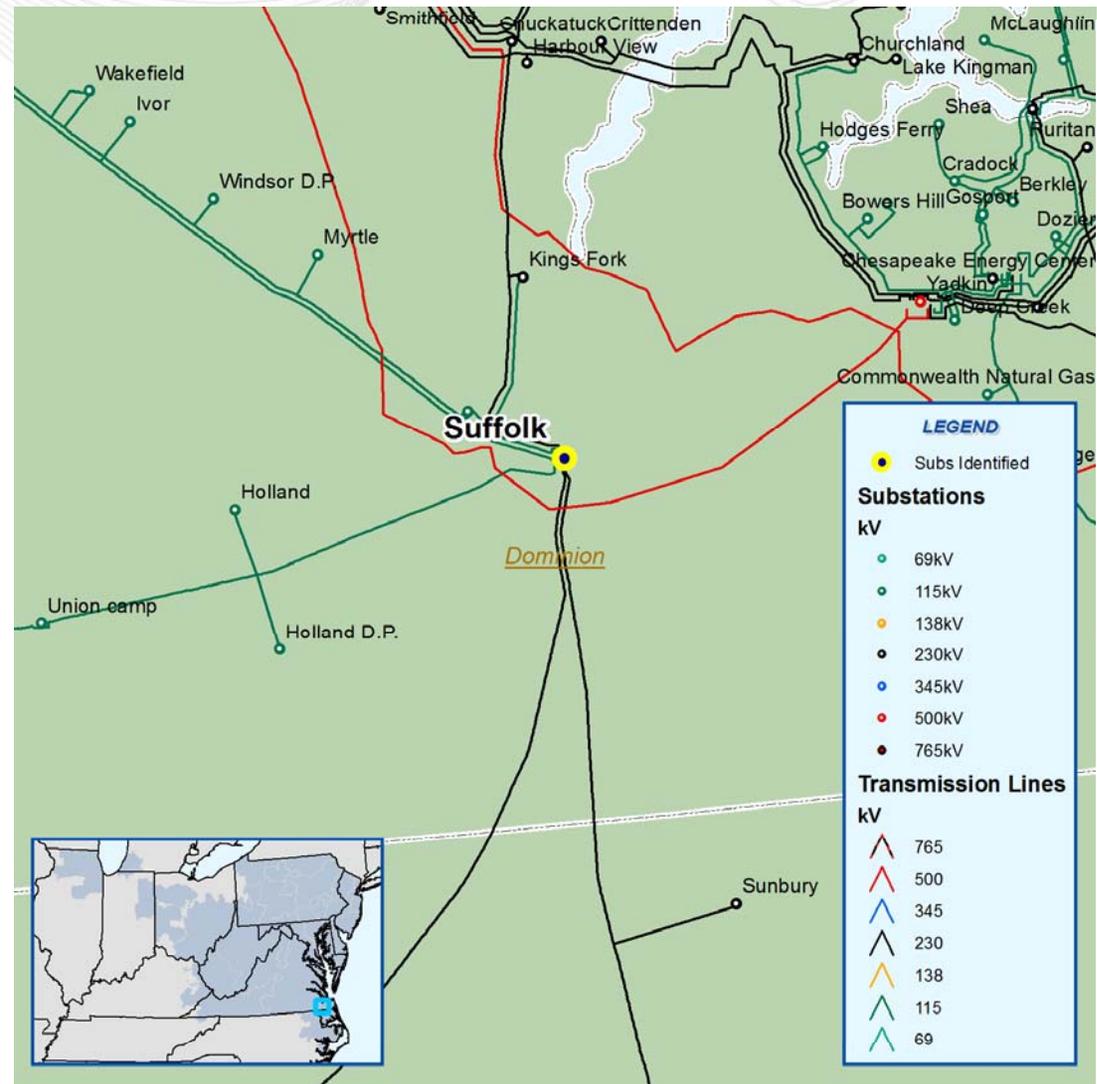
- The Collier 138 kV breaker '2-3 Bus Tie' is overstressed
- Proposed Solution:
- Replace the Collier 138 kV breaker '2-3 Bus Tie' (b1343)
- Estimated Project Cost: \$360 K
- Expected IS Date: 6/1/2015



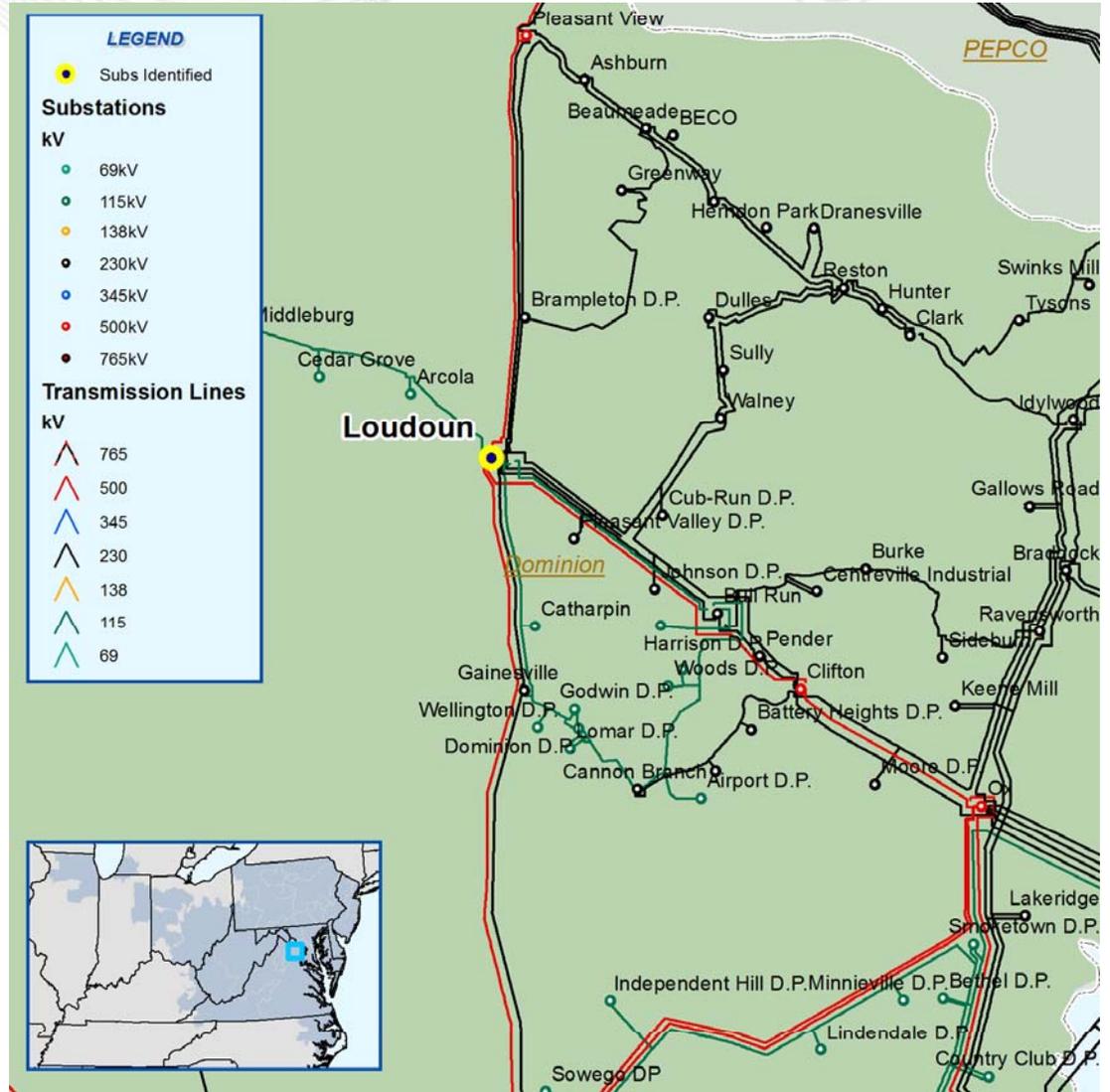
- The St Joe Resources 138 kV breaker 'Z-81 Valley' is overstressed
- Proposed Solution:
- Replace the St Joe Resources 138 kV breaker 'Z-81 Valley' (b1344)
- Estimated Project Cost: \$360 K
- Expected IS Date: 6/1/2015



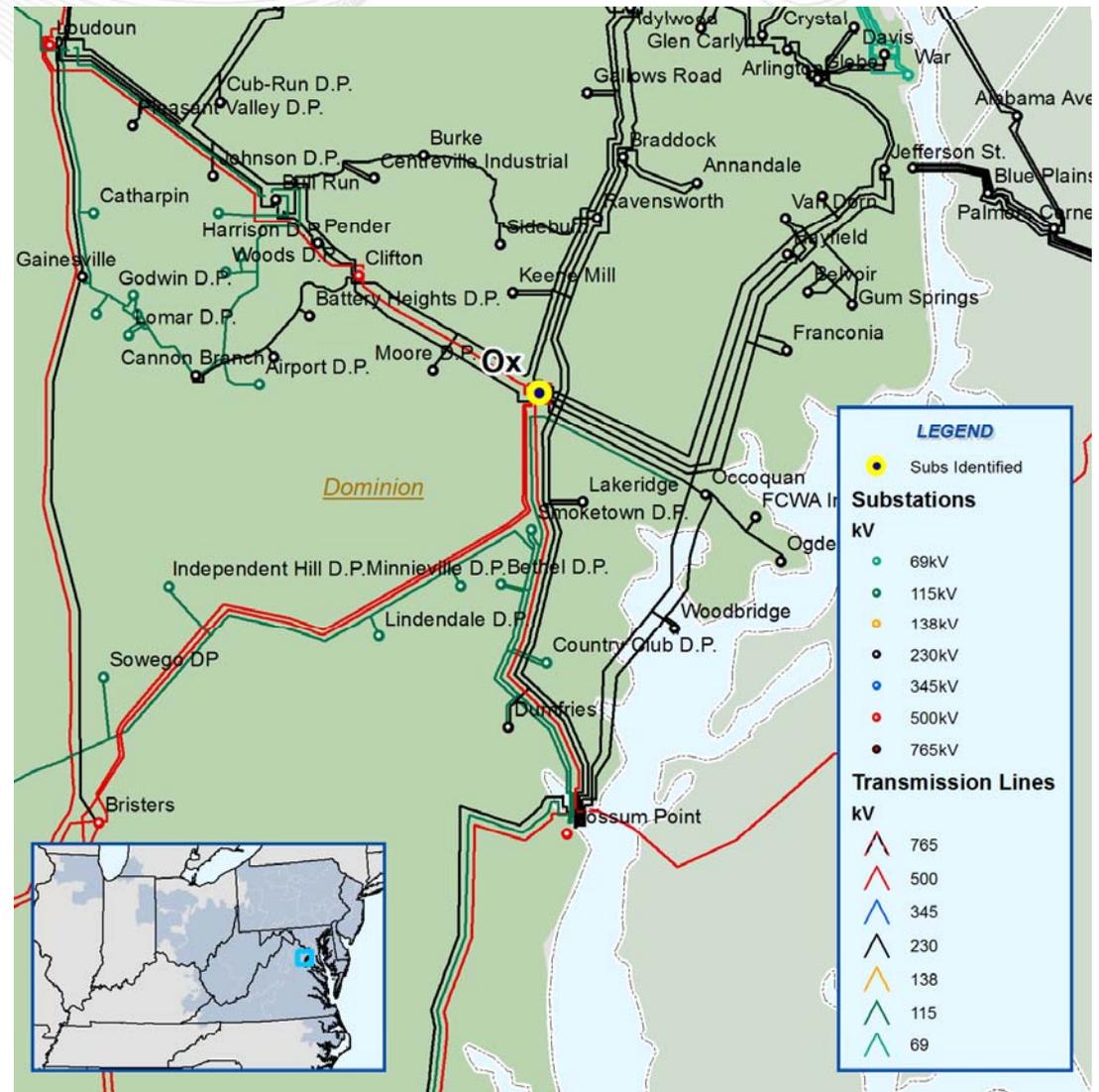
- Suffolk 115 kV breaker 'T122' is overstressed
- Driver: Add a third 230/115 kV transformer at Suffolk (b1058)
- Proposed Solution: Replace the Suffolk 115 kV breaker 'T122' with a breaker rated 40 kA (b1058.1)
- Estimated Project Cost: \$170 K
- Expected IS Date: 6/1/2014



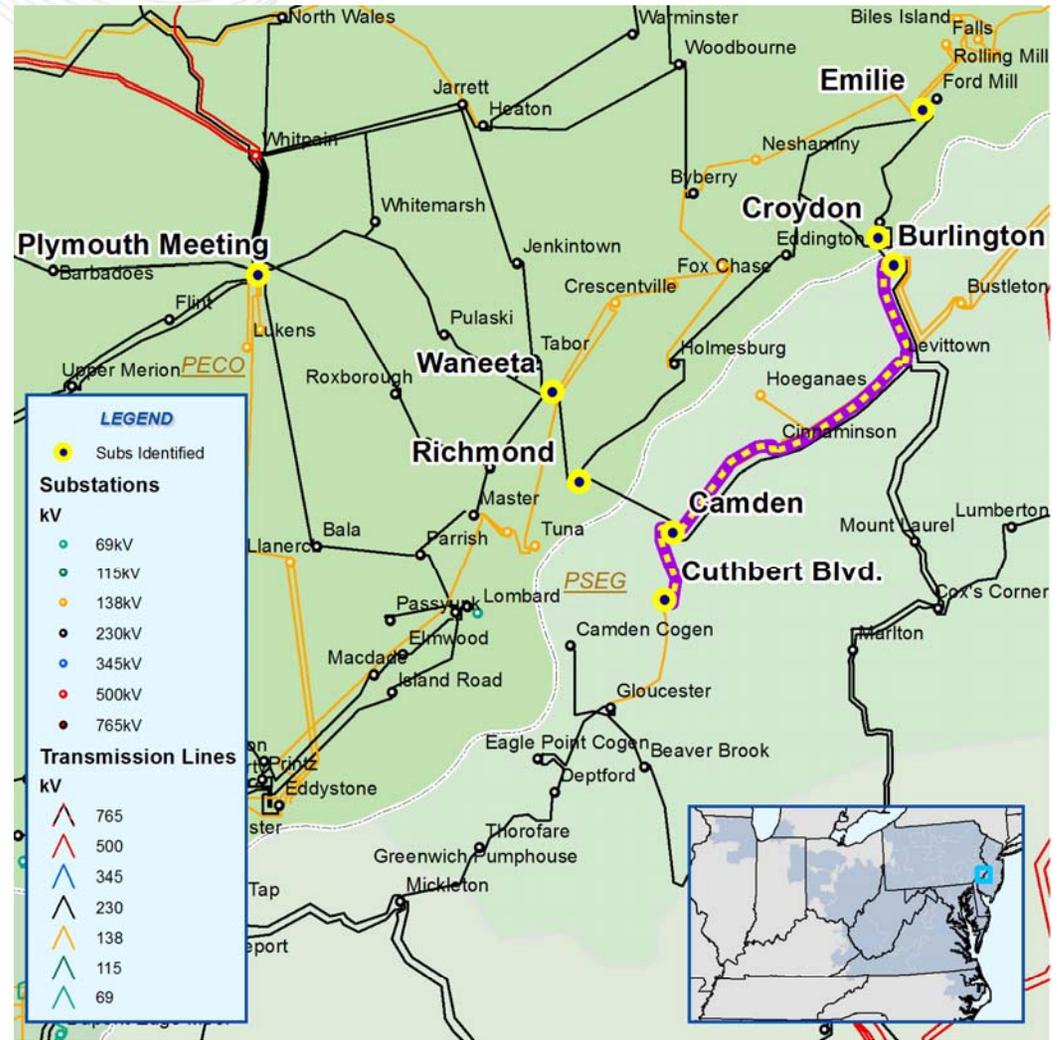
- The following breakers are overstressed:
 - Loudoun 230 kV breaker '200852'
 - Loudoun 230 kV breaker '2008T2094'
 - Loudoun 230 kV breaker '204552'
 - Loudoun 230 kV breaker '209452'
 - Loudoun 230 kV breaker 'WT2045'
- Driver: New Brambleton 500/230 kV substation (b1188)
- Proposed Solution: Replace the following breakers with 63 kA breakers
 - Loudoun 230 kV breaker '200852' (b1188.1)
 - Loudoun 230 kV breaker '2008T2094' (b1188.2)
 - Loudoun 230 kV breaker '204552' (b1188.3)
 - Loudoun 230 kV breaker '209452' (b1188.4)
 - Loudoun 230 kV breaker 'WT2045' (b1188.5)
- Estimated Project Cost: \$215 K per breaker
- Expected IS Date: 6/1/2014



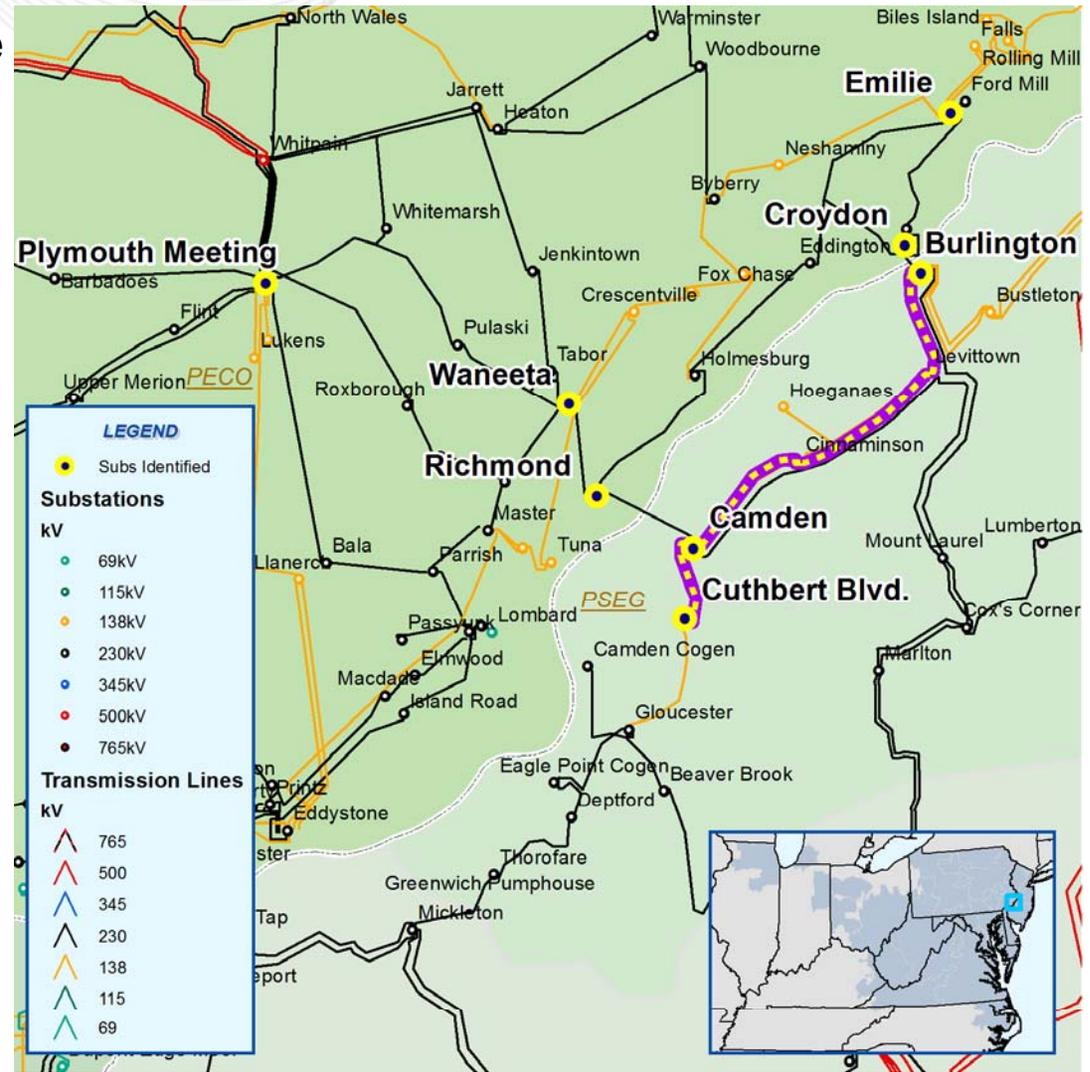
- The following breakers have been previously identified as overstressed due to the V1-031 queue project:
 - Ox 230 kV breaker '22042' (n1748)
 - Ox 230 kV breaker '220T2063' (n1749)
 - Ox 230 kV breaker '24842' (n1750)
 - Ox 230 kV breaker '248T2013' (n1751)
 - Possum Point 230 kV breaker 'H9T237' (n1728)
- The expected in-service date for V1-031 is 2016
- These same 5 breakers have been identified as being overstressed for 2015 baseline conditions
- Proposed Solution: Advance the V1-031 network upgrades from 2016 to 2015
 - Advance n1728 (b1333)
 - Advance n1748 (b1334)
 - Advance n1749 (b1335)
 - Advance n1750 (b1336)
 - Advance n1751 (b1337)
- Estimated Advancement Cost: \$25 K per breaker
- Expected IS Date: 6/1/2015



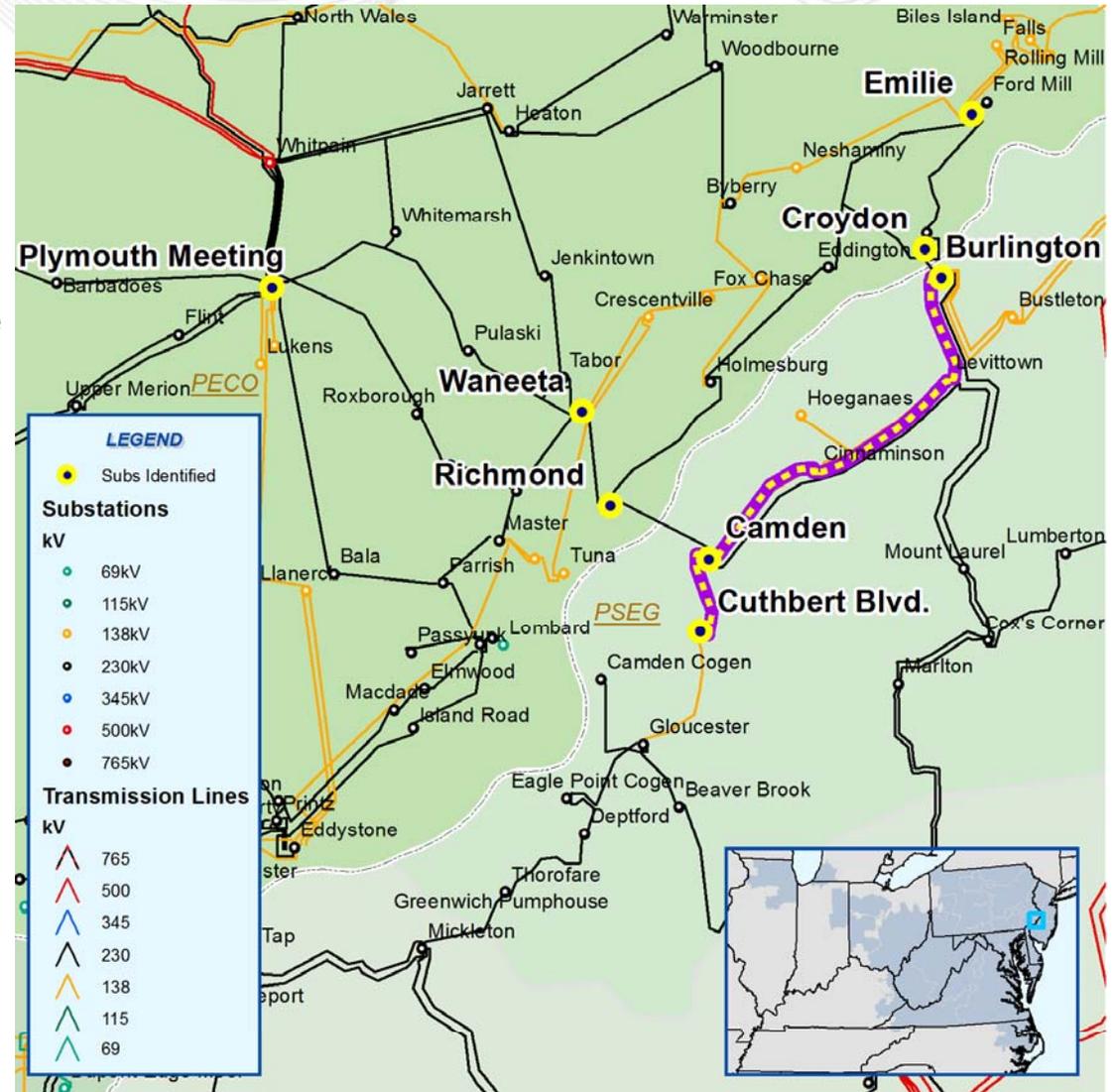
- The following circuit breakers are overstressed due to baseline project b1156 (convert the Burlington – Camden - Cuthbert Blvd 138 kV line and substations to 230 kV)
 - Richmond 230 kV breaker ‘525’
 - Richmond 230 kV breaker ‘415’
 - Richmond 230 kV breaker ‘475’
 - Richmond 230 kV breaker ‘575’
 - Richmond 230 kV breaker ‘185’
 - Richmond 230 kV breaker ‘285’
 - Waneeta 230 kV breaker ‘85’
 - Waneeta 230 kV breaker ‘425’
 - Emilie 230 kV breaker ‘815’
 - Plymouth Meeting 230 kV breaker ‘265’
 - Croydon 230 kV breaker ‘115’
- Continued on next slide



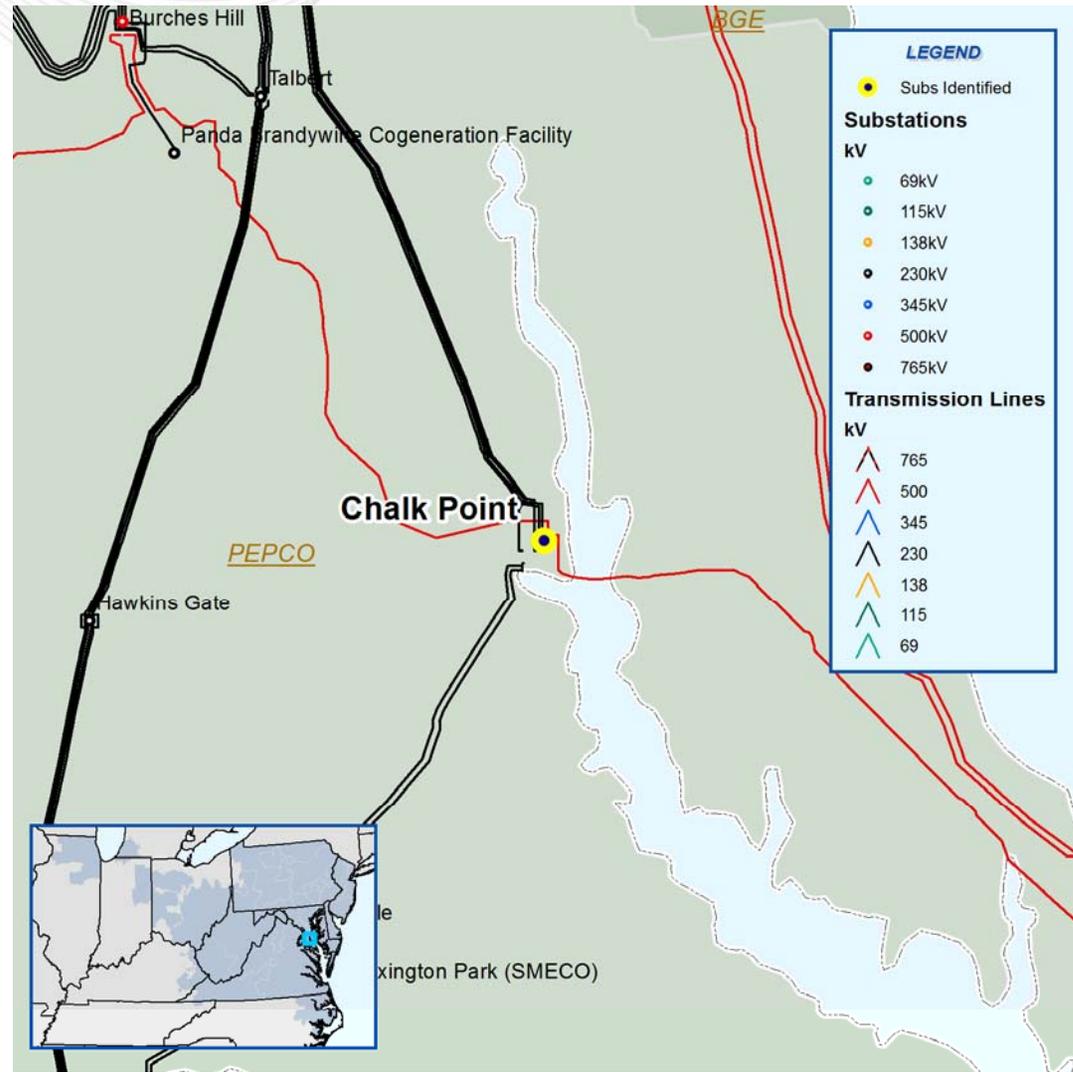
- Continued from previous slide
- Proposed Solution: Upgrade the following overstressed circuit breakers
 - Richmond 230 kV breaker '525' (b1156.1)
 - Richmond 230 kV breaker '415' (b1156.2)
 - Richmond 230 kV breaker '475' (b1156.3)
 - Richmond 230 kV breaker '575' (b1156.4)
 - Richmond 230 kV breaker '185' (b1156.5)
 - Richmond 230 kV breaker '285' (b1156.6)
 - Waneeta 230 kV breaker '85' (b1156.7)
- Estimated Project Cost: \$100 K per breaker
- Expected IS Date: 6/1/2014



- The following circuit breakers are overstressed
 - Waneeta 230 kV breaker ‘425’
 - Emilie 230 kV breaker ‘815’
 - Plymouth Meeting 230 kV breaker ‘265’
- Proposed Solution: Replace the following overstressed circuit breakers
 - Waneeta 230 kV breaker ‘425’ (b1156.8)
 - Emilie 230 kV breaker ‘815’ (b1156.9)
 - Plymouth Meeting 230 kV breaker ‘265’ (b1156.10)
 - Croydon 230 kV breaker ‘115’ (b1156.11)
- Estimated Project Cost: \$500 K per breaker
- Expected IS Date: 6/1/2014



- 23 circuit breakers are overstressed on the Chalk Point 230 kV bus
- PEPCO owns 19 of the 23 circuit breakers
- Proposed Solution: Replace the 19 (PEPCO owned) Chalk Point 230 kV breakers that are overstressed with breakers rated 80 kA (b0845-b0863)
- Estimated Project Cost: \$2.0 M per breaker
- Expected IS Date: 12/31/2014





PSEG Transmission Zone

- The following circuit breakers are overstressed:

- Salem 500 kV breaker '11X'
- Salem 500 kV breaker '12X'
- Salem 500 kV breaker '20X'
- Salem 500 kV breaker '21X'
- Salem 500 kV breaker '31X'
- Salem 500 kV breaker '32X'

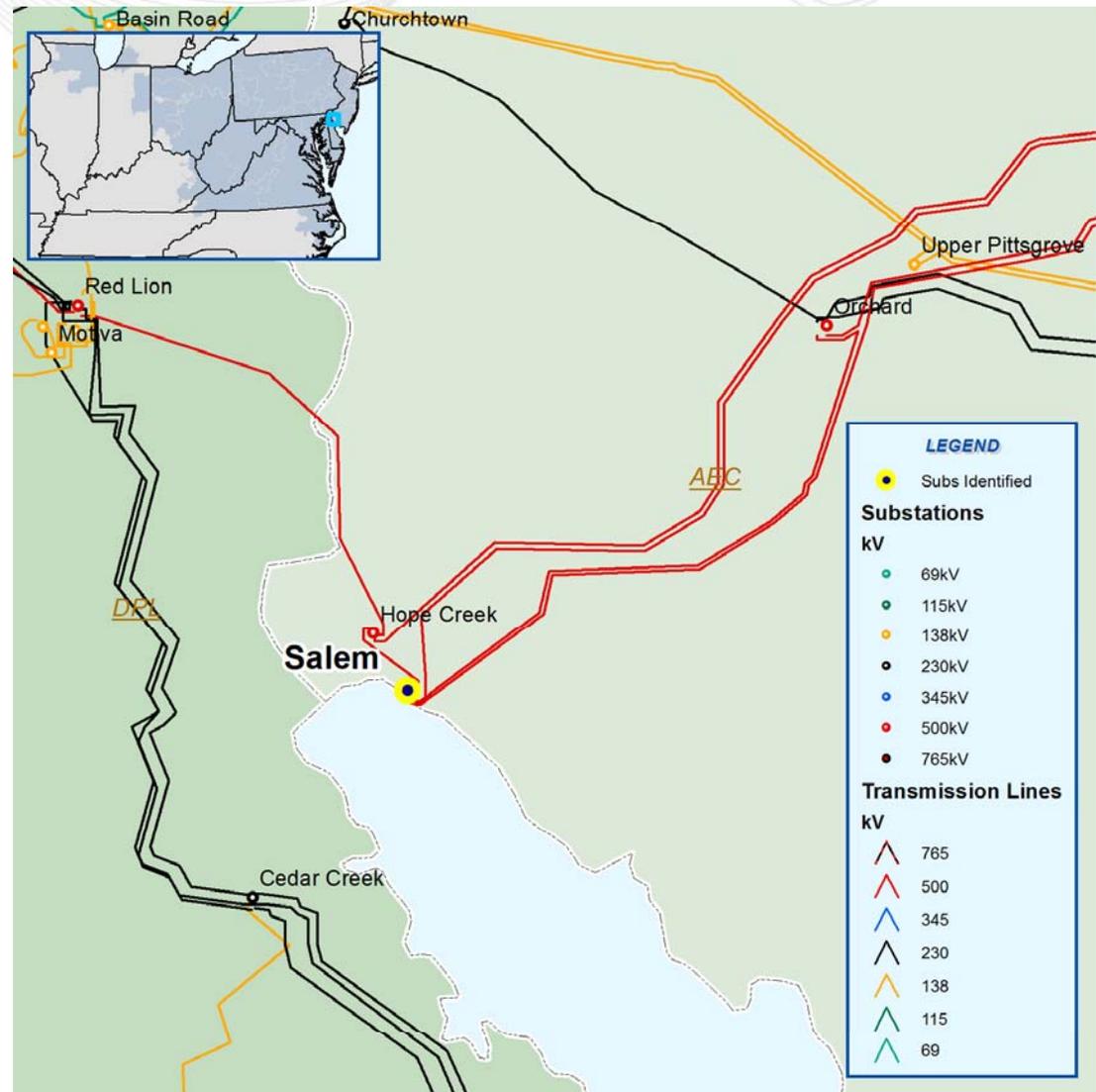
- Proposed Solution:

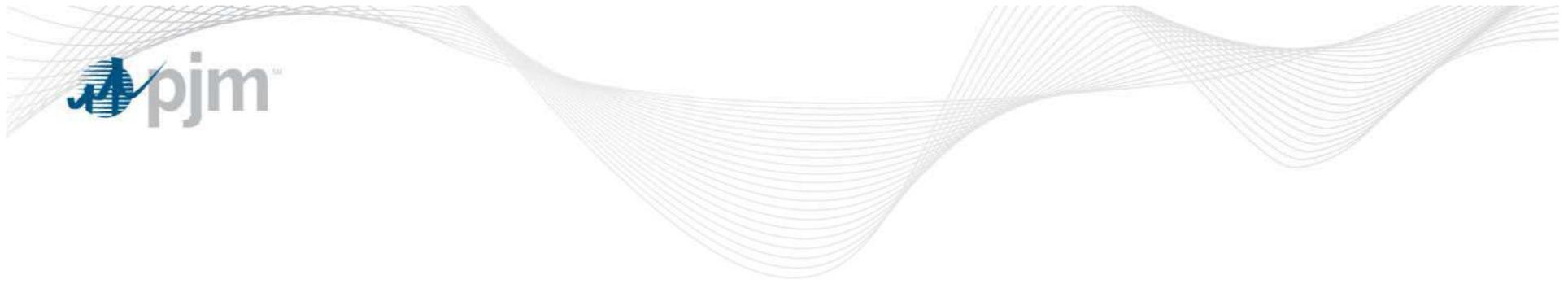
- Replace the Salem 500 kV breaker '11X' (b1410)
- Replace the Salem 500 kV breaker '12X' (b1411)
- Replace the Salem 500 kV breaker '20X' (b1412)
- Replace the Salem 500 kV breaker '21X' (b1413)
- Replace the Salem 500 kV breaker '31X' (b1414)
- Replace the Salem 500 kV breaker '32X' (b1415)

- Estimated Project Cost:

\$1.5 M per breaker

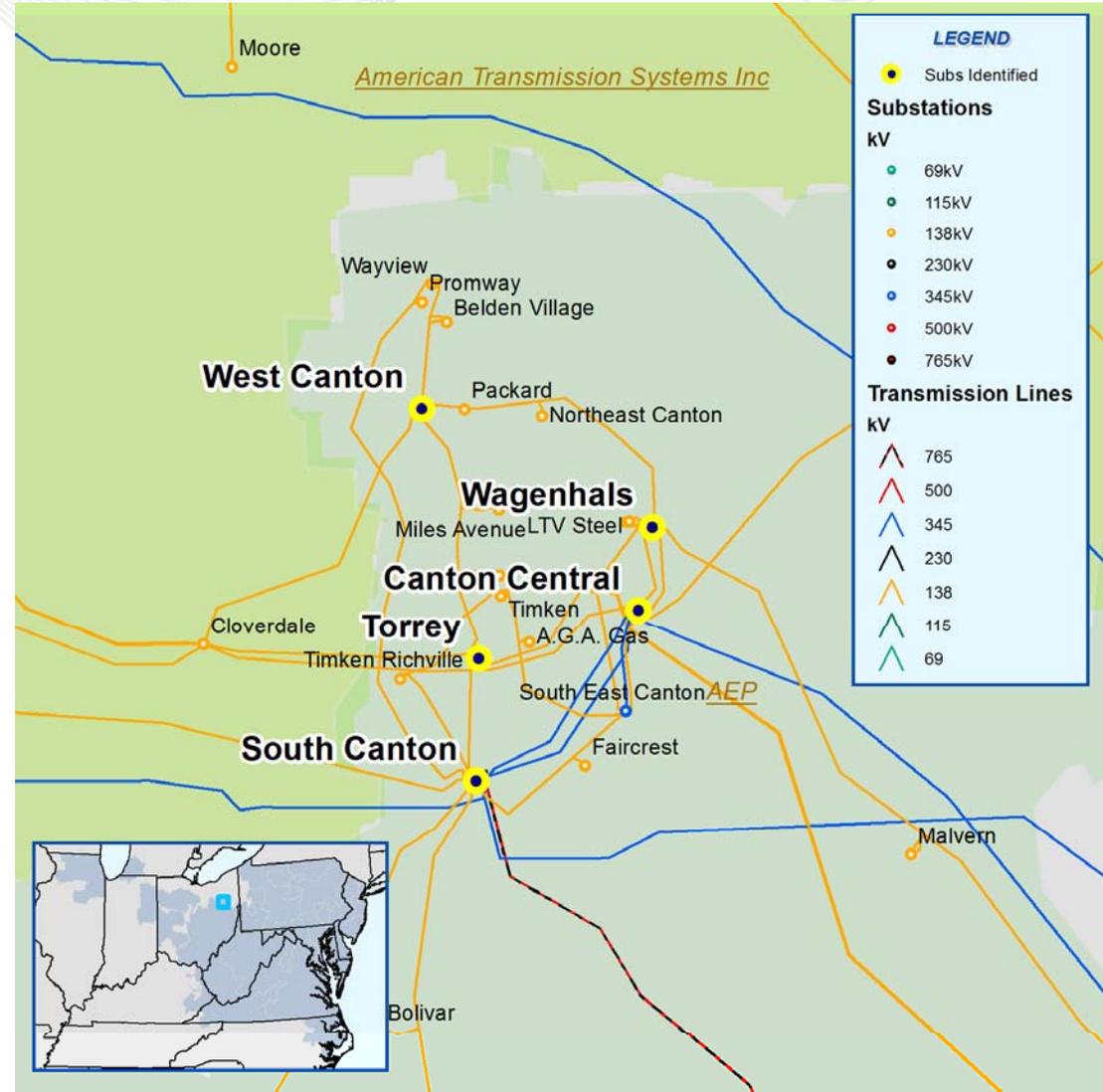
- Expected IS Date: 6/1/2011





Upgrades Previously Presented at the 10/6/2010 TEAC

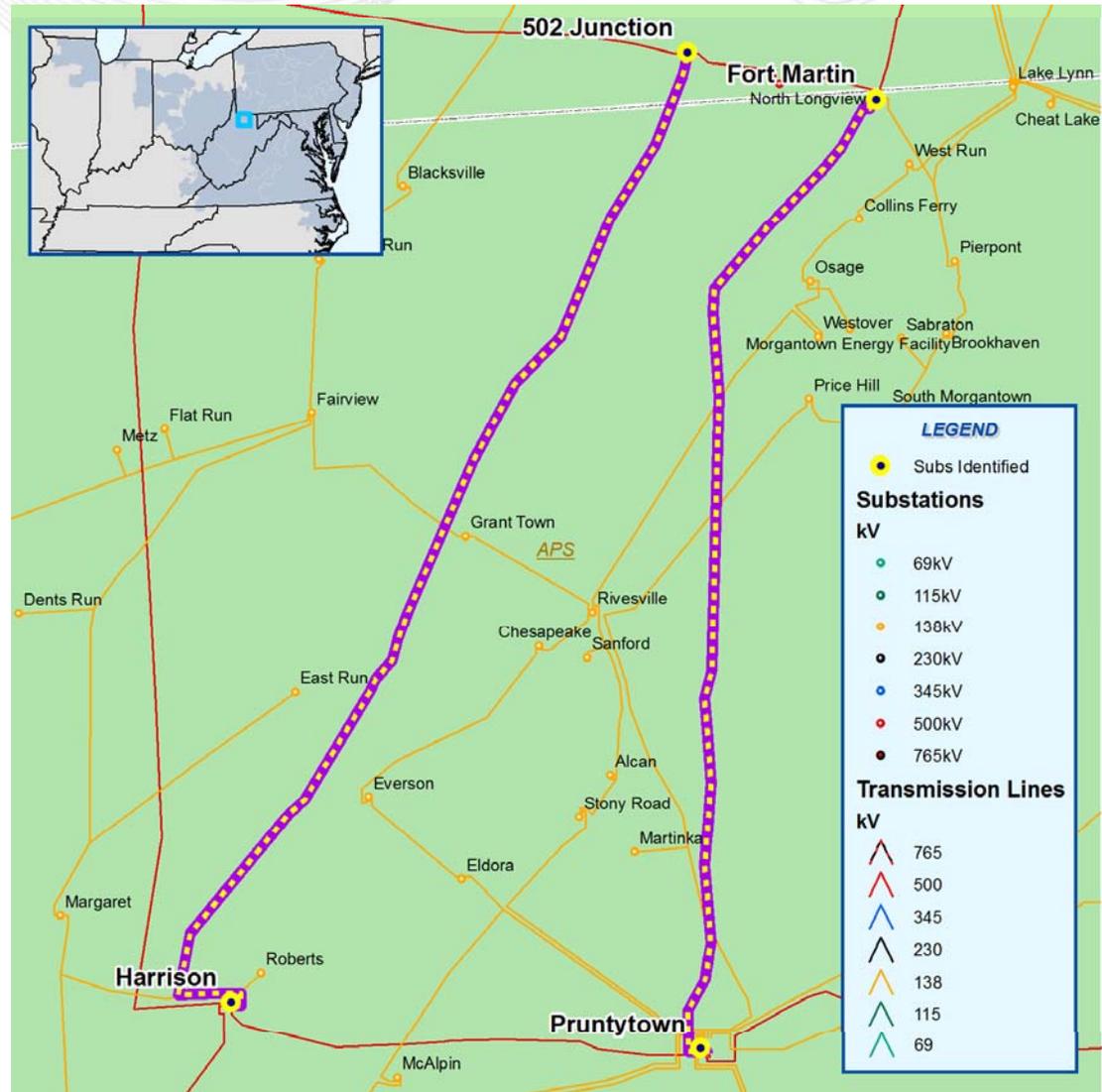
- N-1-1 thermal violation for various contingencies
- Proposed Solutions:
 - These projects are additional detail for existing b1034.1 through b1034.4 to add a S. Canton to W. Canton 138kV line
 - Disconnect/eliminate the West Canton 138kV terminal at Torrey Station (b1034.5)
 - Replace all 138kV circuit breakers at South Canton Station and operate the station in a breaker and a half configuration (b1034.6)
 - Replace all obsolete 138kV circuit breakers at the Torrey and Wagenhals stations (b1034.7)
 - Install additional 138kV circuit breakers at the West Canton, South Canton, Canton Central, and Wagenhals stations to accommodate the new circuits (b1034.8)
- Estimated Project Cost: \$28 M (includes previously presented b1034.* projects)
- Expected IS Date: 6/1/2014





APS Transmission Zone

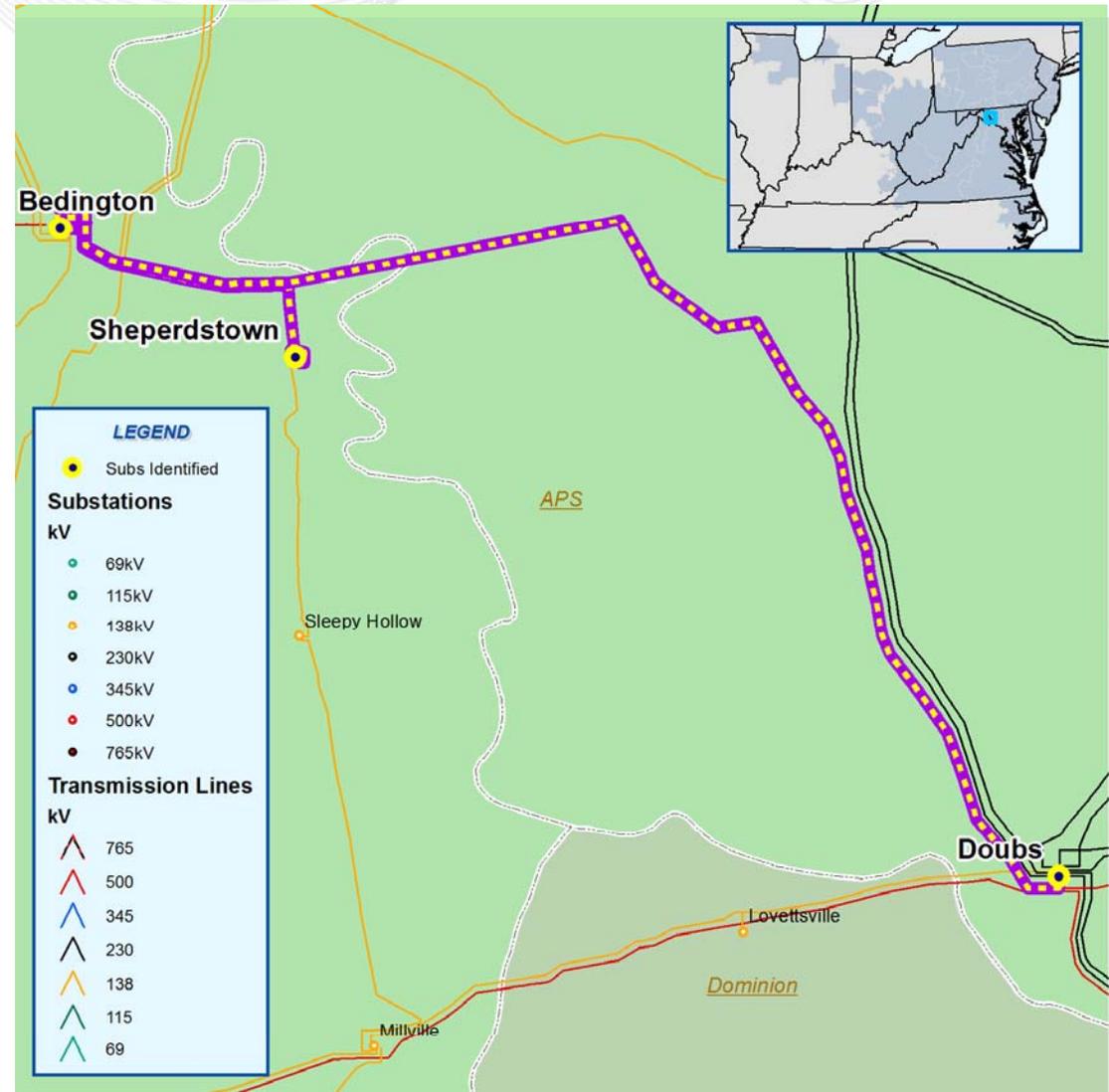
- N-1-1 Thermal Violation
- The 502 Junction 500/138kV transformer is overloaded for the loss of Harrison – Pruntytown 500kV + Fort Martin – Pruntytown 500kV
- Proposed Solution: Install 2nd 500/138kV transformer at 502 Junction (b1383)
- Estimated Project Cost: \$15 M
- Expected IS Date: 6/1/2015





APS Transmission Zone

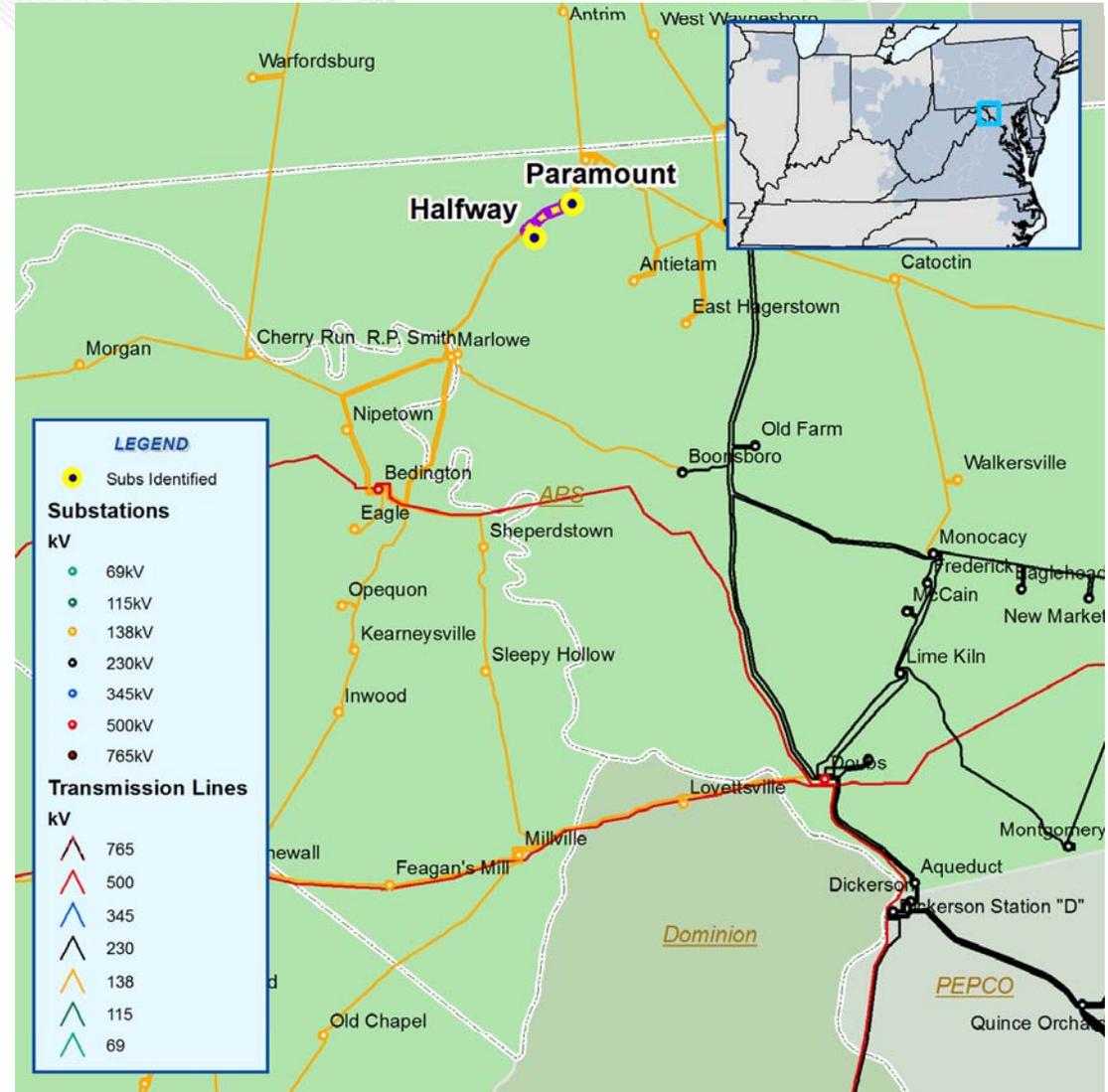
- N-1-1 Thermal Violation
- Overload of Bedington – Shepherdstown 138kV for the loss of Bedington – Doubs 500kV + various other second contingencies
- Proposed Solution: Reconductor approximately 2.17 miles of Bedington – Shepherdstown 138kV with 954 ACSR (b1384)
- Estimated Project Cost: \$1.75 M
- Expected IS Date: 6/1/2015



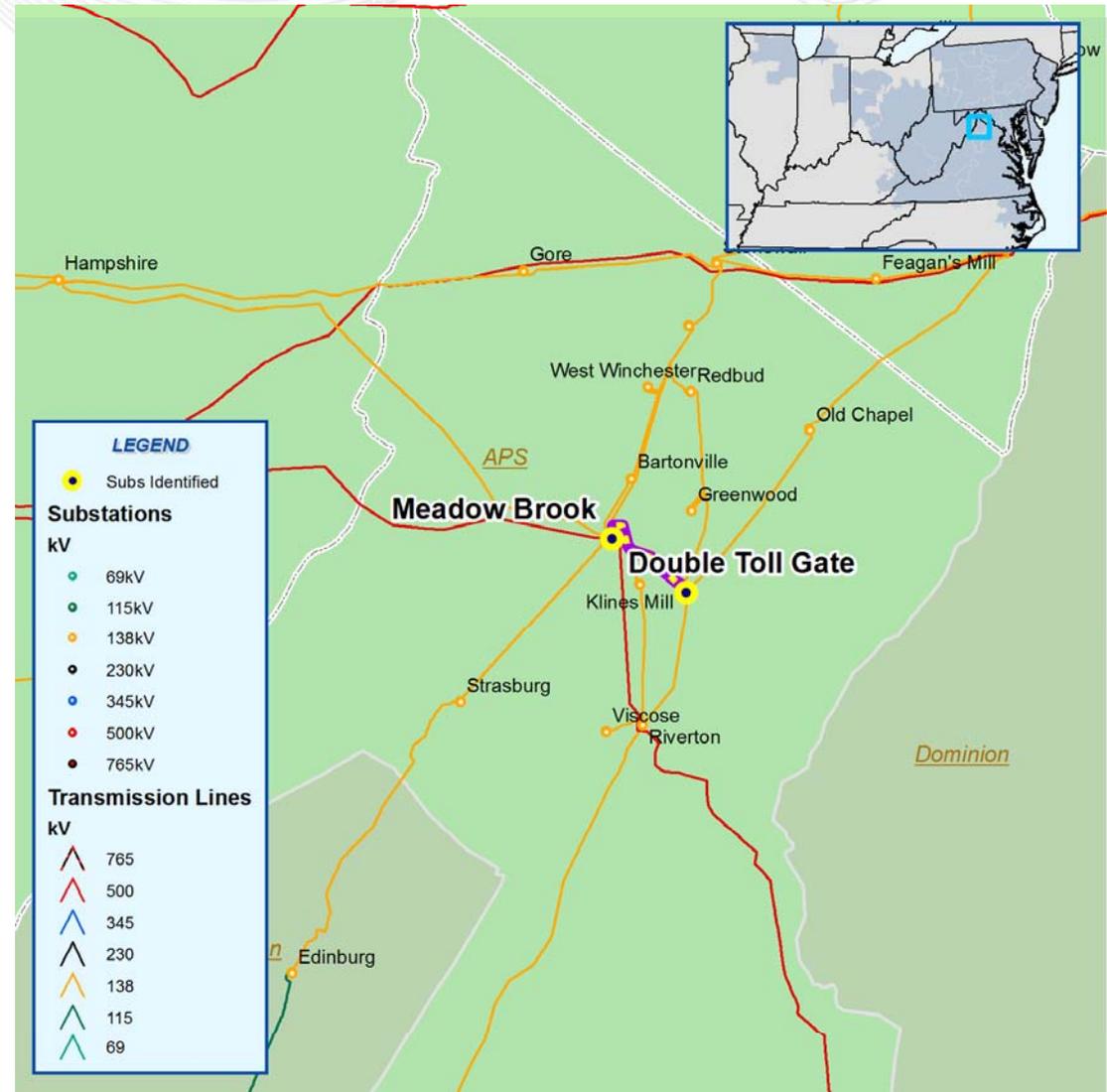


APS Transmission Zone

- N-1-1 Thermal Violation
- Overload of Halfway – Paramount 138kV for the loss of Bedington – Doubs 500kV + Bedington – Nipetown 138kV
- Proposed Solution: Reconductor Halfway – Paramount 138kV with 1033 ACCR (b1385)
- Estimated Project Cost: \$4.75 M
- Expected IS Date: 6/1/2015



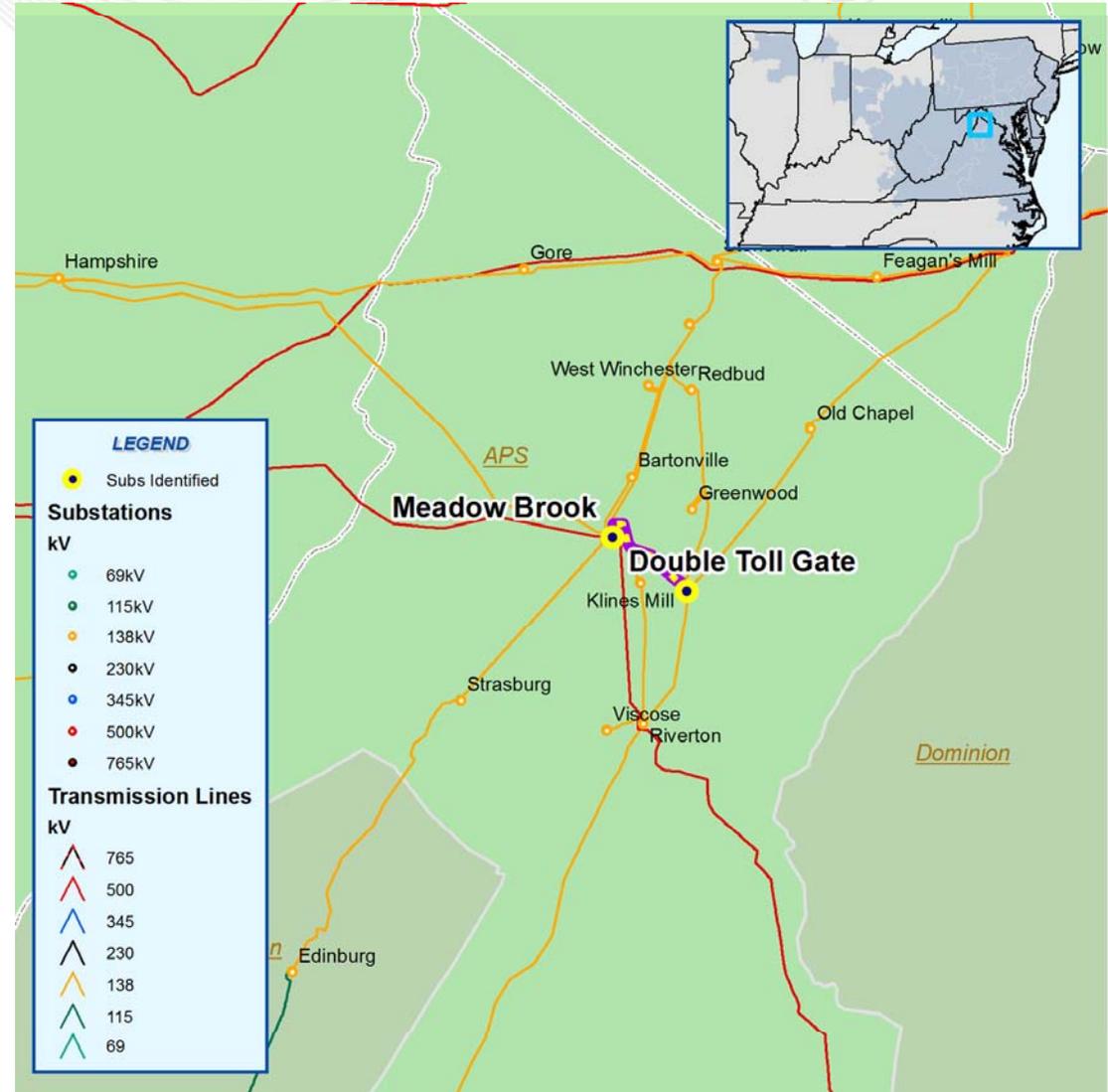
- N-1-1 Thermal Violation
- Overload of Double Tollgate – Meadow Brook 138kV #2 for the loss of Double Tollgate – Meadow Brook 138kV #1 + various other second contingencies
- Proposed Solution: Reconductor Double Tollgate – Meadow Brook 138kV #2 with 1033 ACCR (b1386)
- Estimated Project Cost: \$9 M
- Expected IS Date: 6/1/2015





APS Transmission Zone

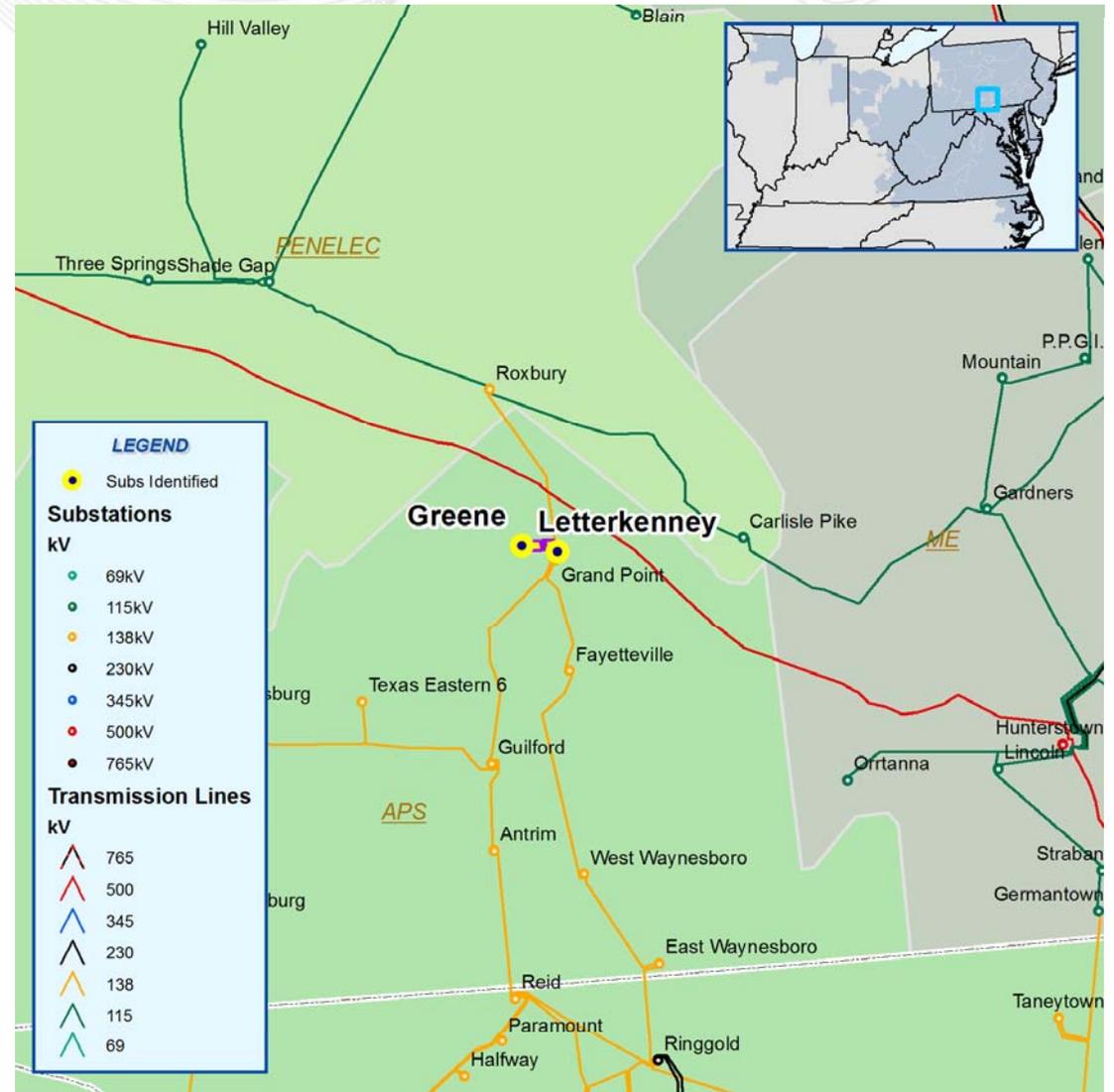
- N-1-1 Thermal Violation
- Overload of Double Tollgate – Meadow Brook 138kV #1 for the loss of Double Tollgate – Meadow Brook 138kV #2 + various other second contingencies
- Proposed Solution: Reconductor Double Tollgate – Meadow Brook 138kV #1 with 1033 ACCR (b1387)
- Estimated Project Cost: \$9 M
- Expected IS Date: 6/1/2015





APS Transmission Zone

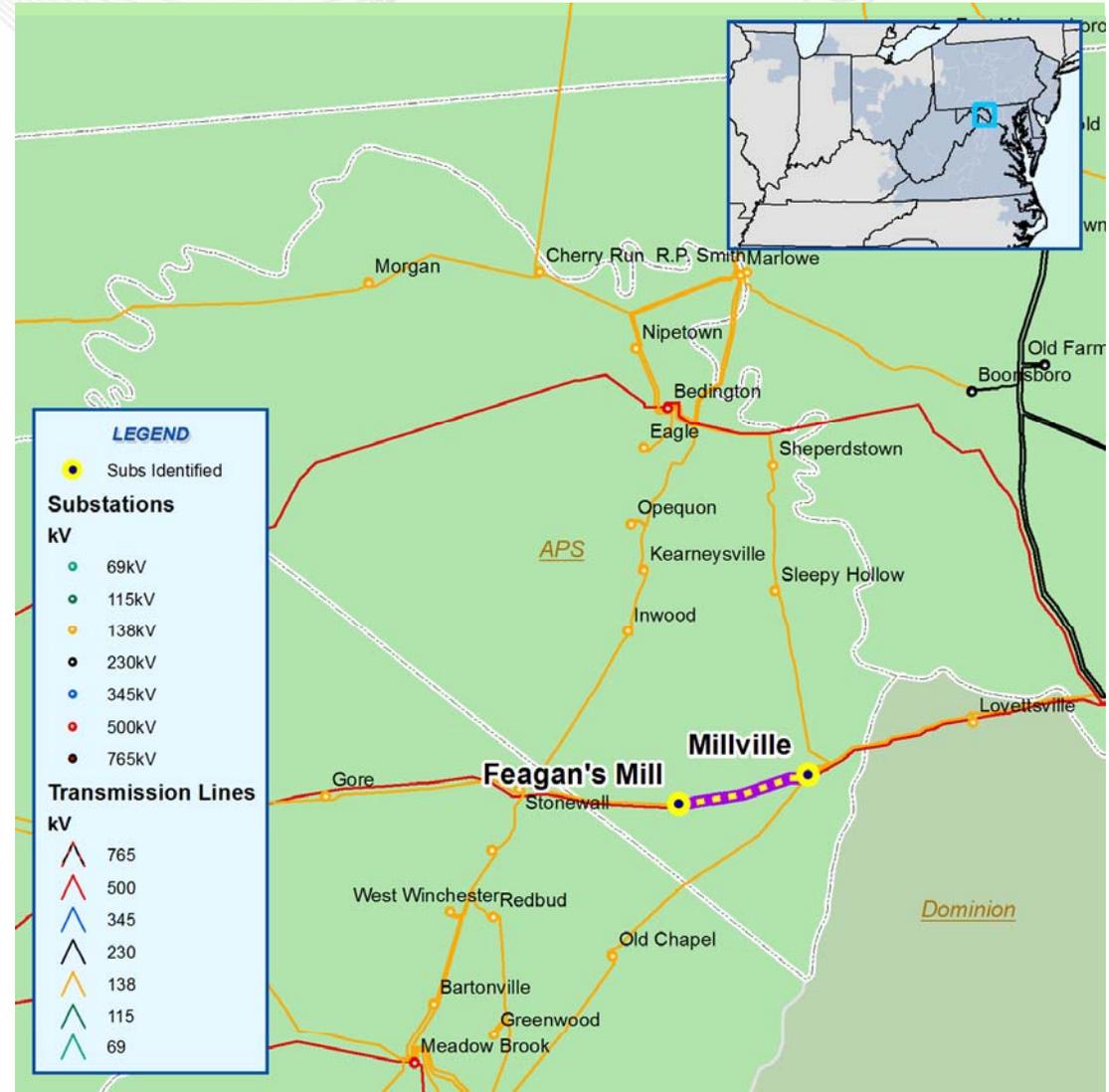
- N-1-1 Thermal Violation
- Overload of Greene - Letterkenny 138kV for the loss of Guilford – South Chambersburg 138kV + East Waynesboro – Ringgold 138kV
- Proposed Solution: Reconductor Greene - Letterkenny 138kV 795 ACSS (Revise baseline project b0680)
- Estimated Project Cost: \$1.7 M
- Expected IS Date: 6/1/2013





APS Transmission Zone

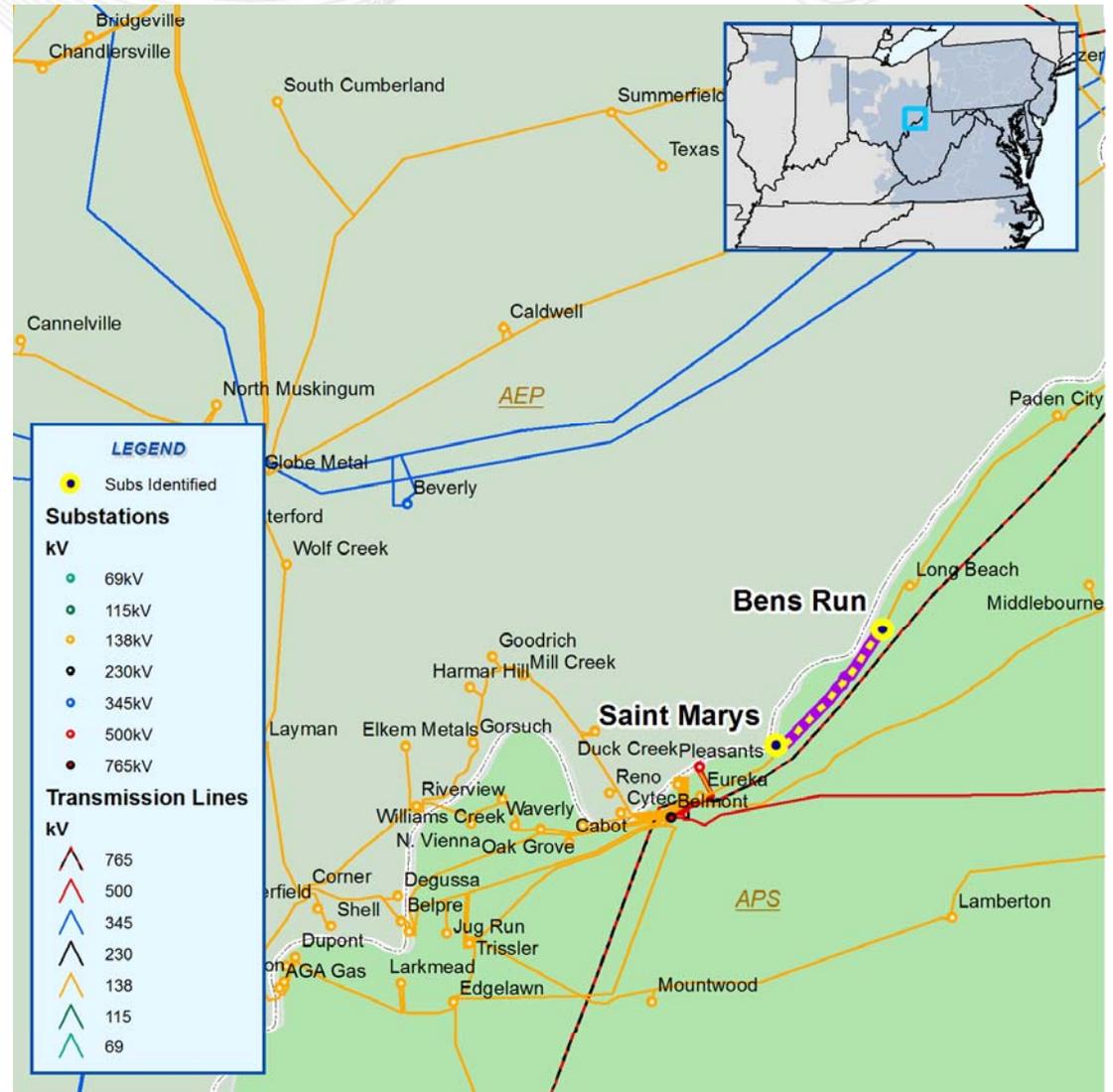
- N-1-1 Thermal Violation
- Overload of Feagans Mill - Millville 138kV for the loss of Bedington - Opequon 138kV + Bartonville – Meadowbrook 138kV
- Proposed Solution: Reconductor Feagans Mill - Millville 138kV with 954 ACSR (b1388)
- Estimated Project Cost: \$3.5 M
- Expected IS Date: 6/1/2015



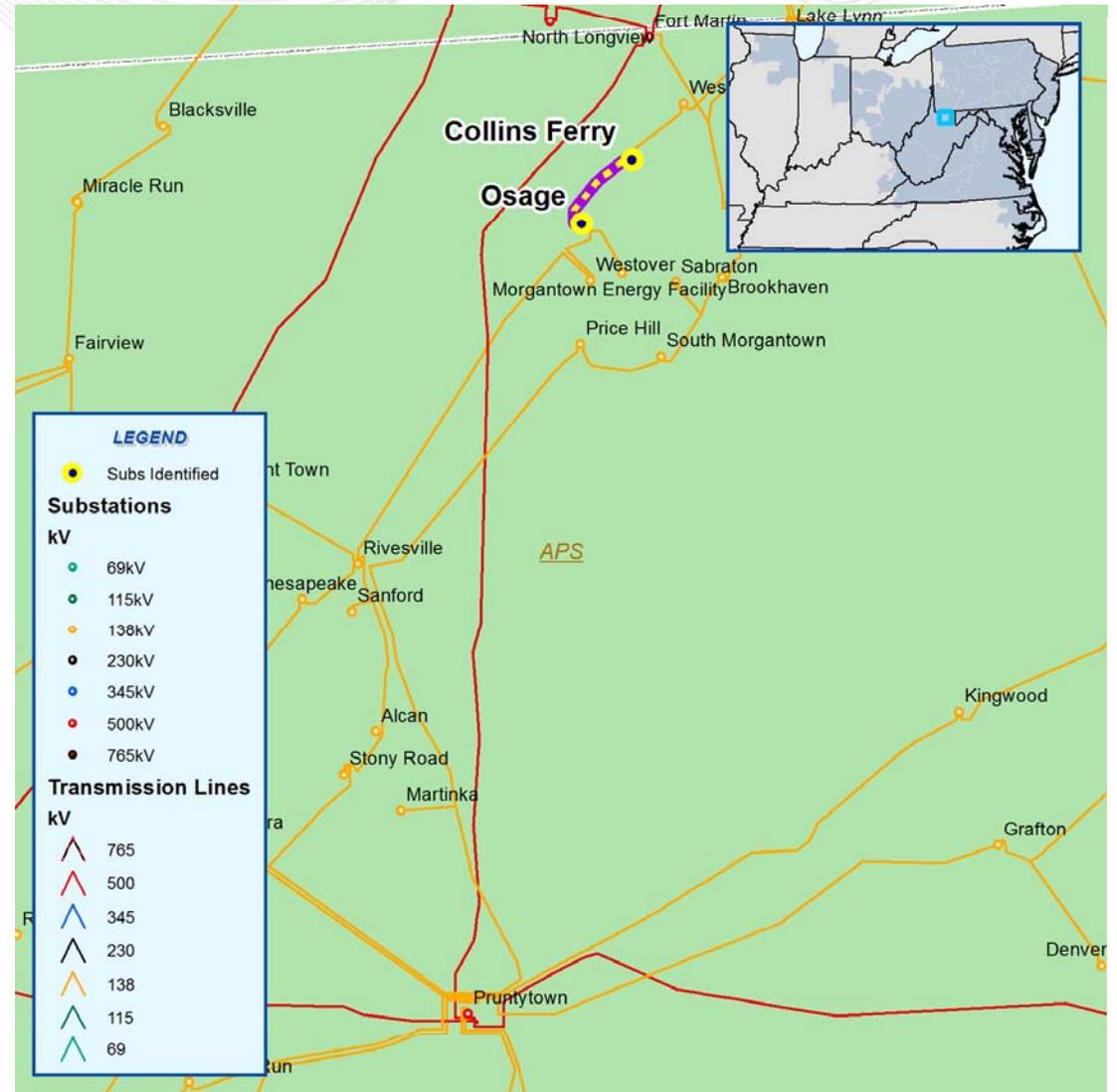


APS Transmission Zone

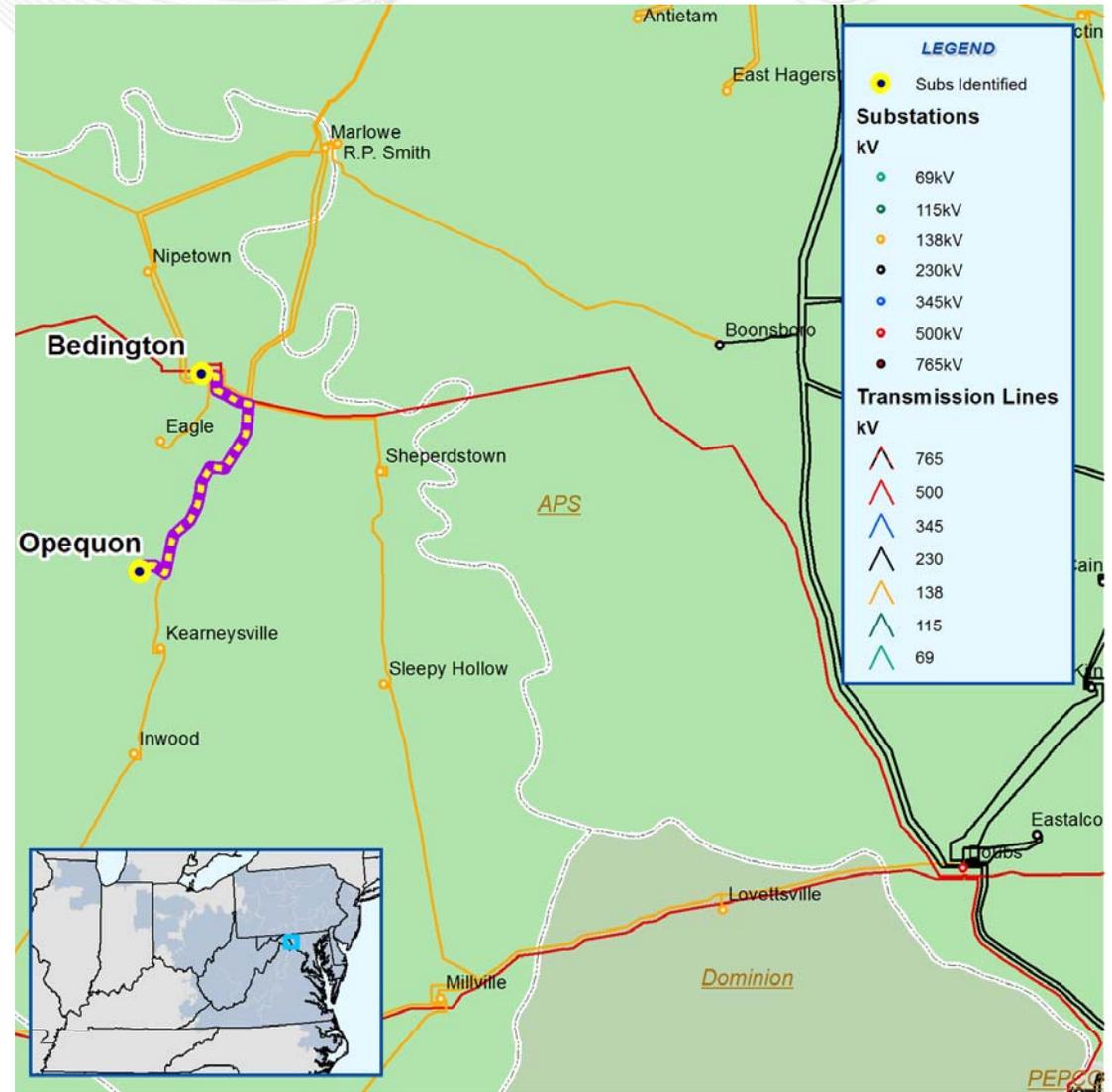
- N-1-1 Thermal Violation
- Overload of Bens Run – St. Mary’s 138kV for the loss of various contingency combinations around Belmont
- Proposed Solution: Reconductor Bens Run – St. Mary’s 138kV with 954 ACSR (b1389)
- Estimated Project Cost: \$5.8 M
- Expected IS Date: 6/1/2015



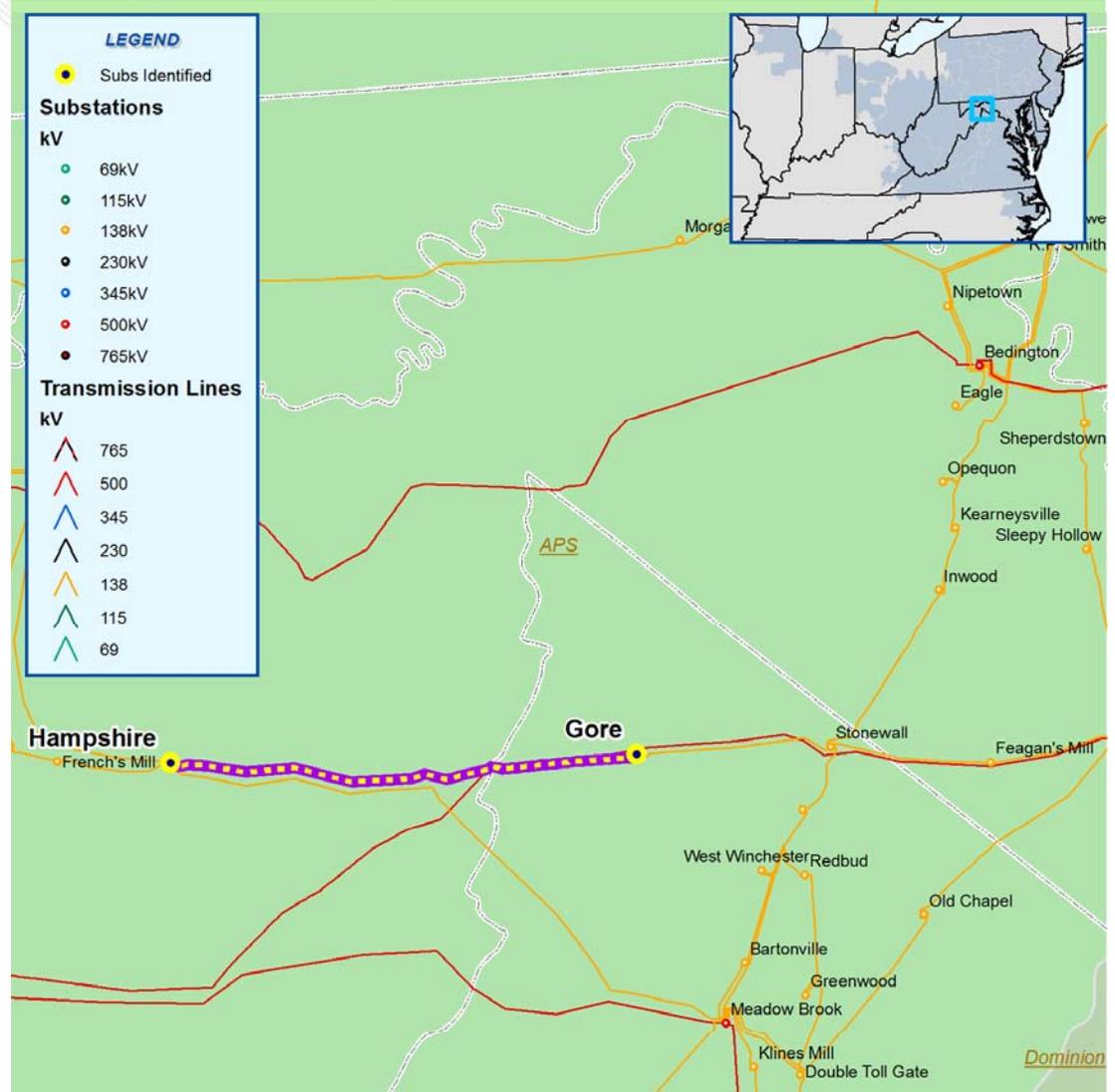
- N-1-1 Thermal Violation
- Overload of Osage – Collins Ferry 138kV for the loss of Hatfield – Black Oak 500kV + one of the following circuits:
 - Price Hill – Pruntytown 138kV
 - Martinka – Pruntytown 138kV
 - Martinka – Price Hill 138kV
- Proposed Solution: Reconductor Osage – Collins Ferry 138kV with 954 ACSR (Revise baseline project b1028)
- Estimated Project Cost: \$2.3 M
- Expected IS Date: 6/1/2013



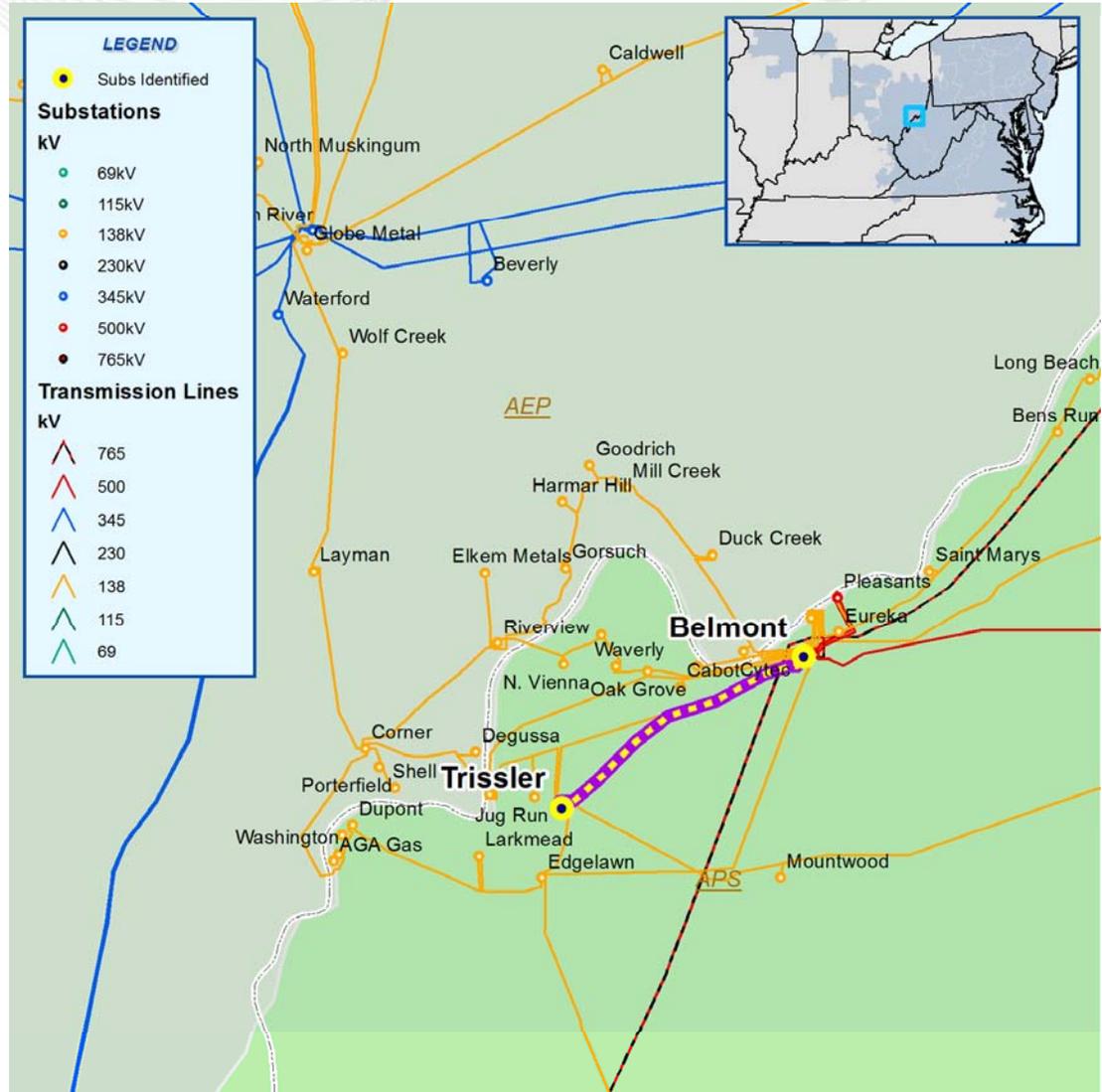
- N-1-1 Thermal Violation
- Overload of Bedington – Opequon 138kV for the loss of Bedington – Doubts 500kV + Bedington – Shepherdstown 138kV
- Proposed Solution: Replace Bus Tie Breaker at Opequon (b1390)
- Estimated Project Cost: \$0.25 M
- Expected IS Date: 6/1/2015



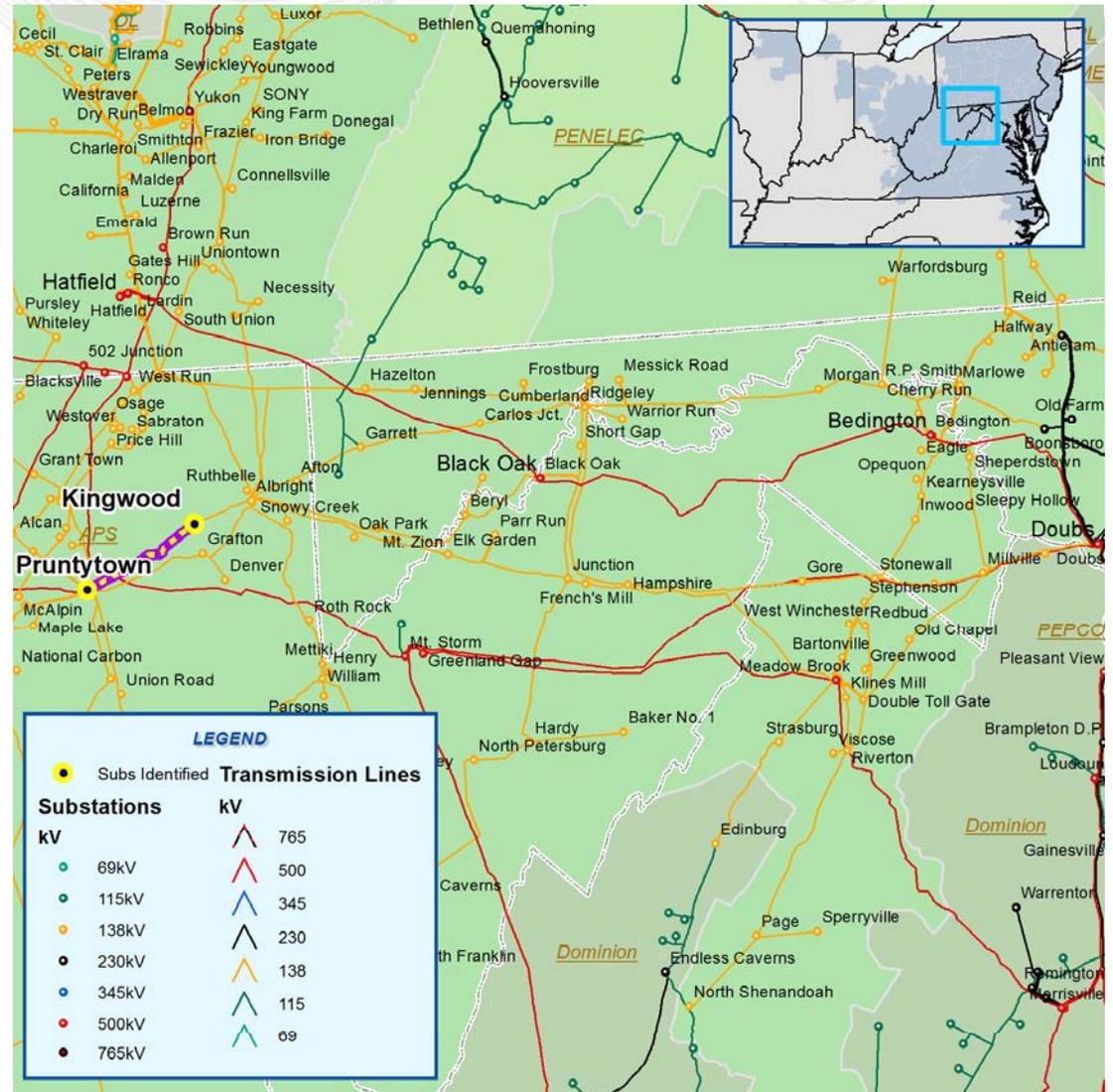
- N-1-1 Thermal Violation
- Overload of Gore – Hampshire 138kV for the loss of Bedington – Opequon 138kV + Bartonville – Meadow Brook 138kV
- Proposed Solution: Replace Line Trap at Gore (b1391)
- Estimated Project Cost: \$0.25 M
- Expected IS Date: 6/1/2015



- N-1-1 Thermal Violation
- Overload of Belmont – Trissler 138kV #1 for the loss of Belmont – Trissler 138kV #2 and one of the following circuits:
 - Belmont – Edgelawn 138kV
 - Oak Grove – Johns Manville 138kV
- Proposed Solution: Replace structures on the Belmont – Trissler 138kV line (b1392)
- Estimated Project Cost: \$0.5 M
- Expected IS Date: 6/1/2015



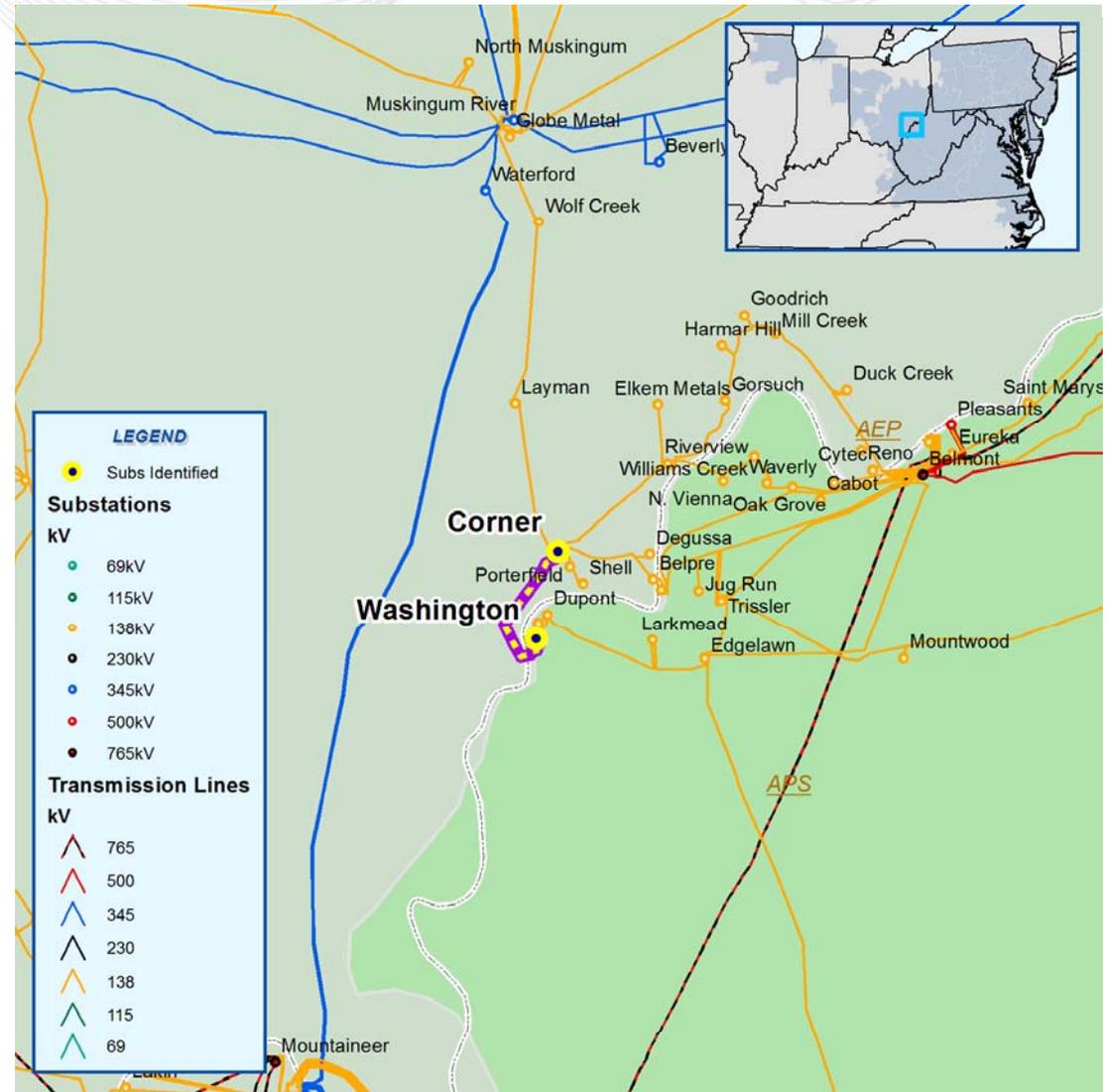
- N-1-1 Thermal Violation
- Overload of Kingwood – Pruntytown 138kV for the loss of Bedington – Doubs 500kV + Hatfield – Black Oak 500kV
- Proposed Solution: Replace structures on the Kingwood - Pruntytown 138kV line (b1393)
- Estimated Project Cost: \$1 M
- Expected IS Date: 6/1/2015



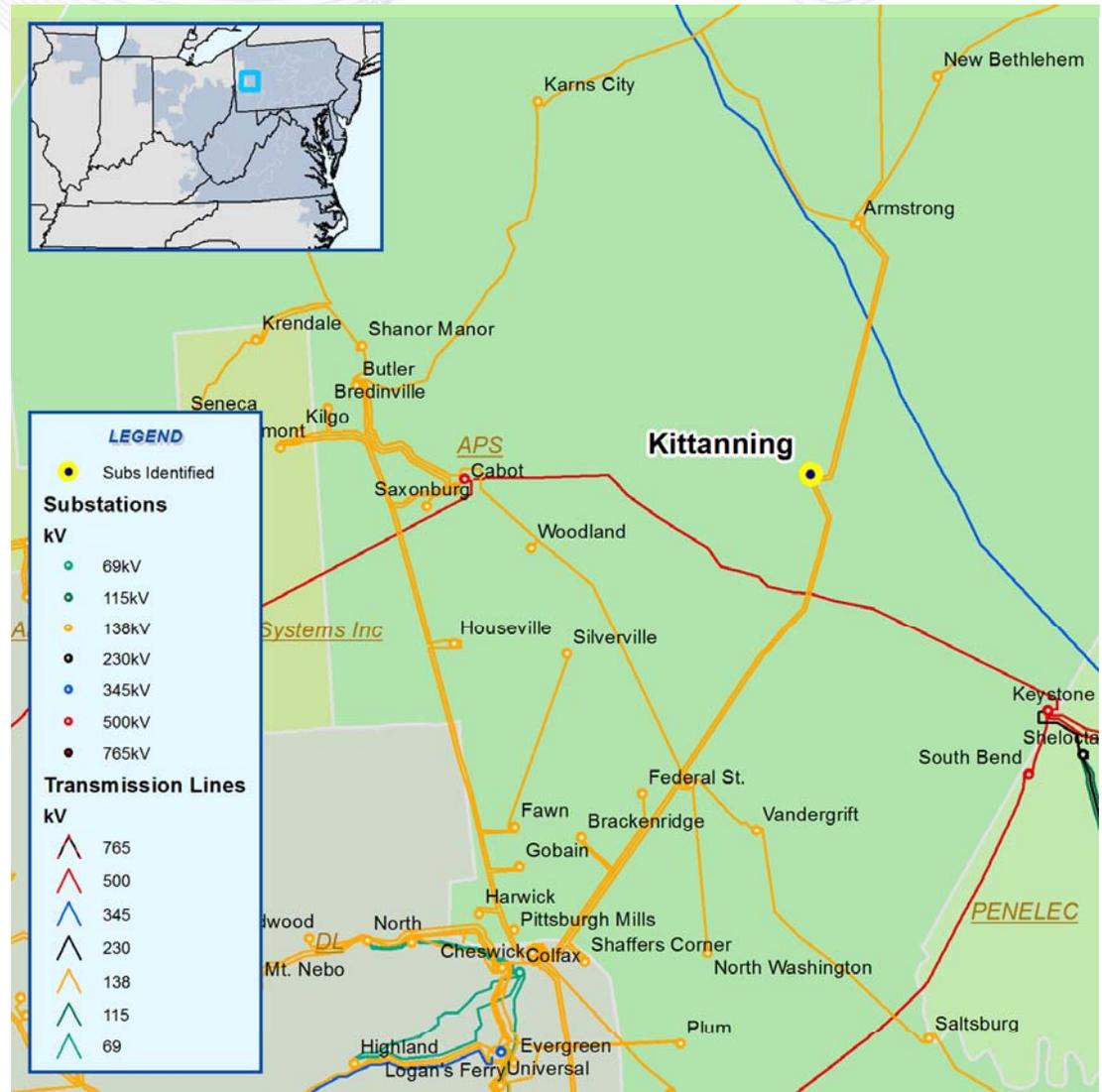


APS Transmission Zone

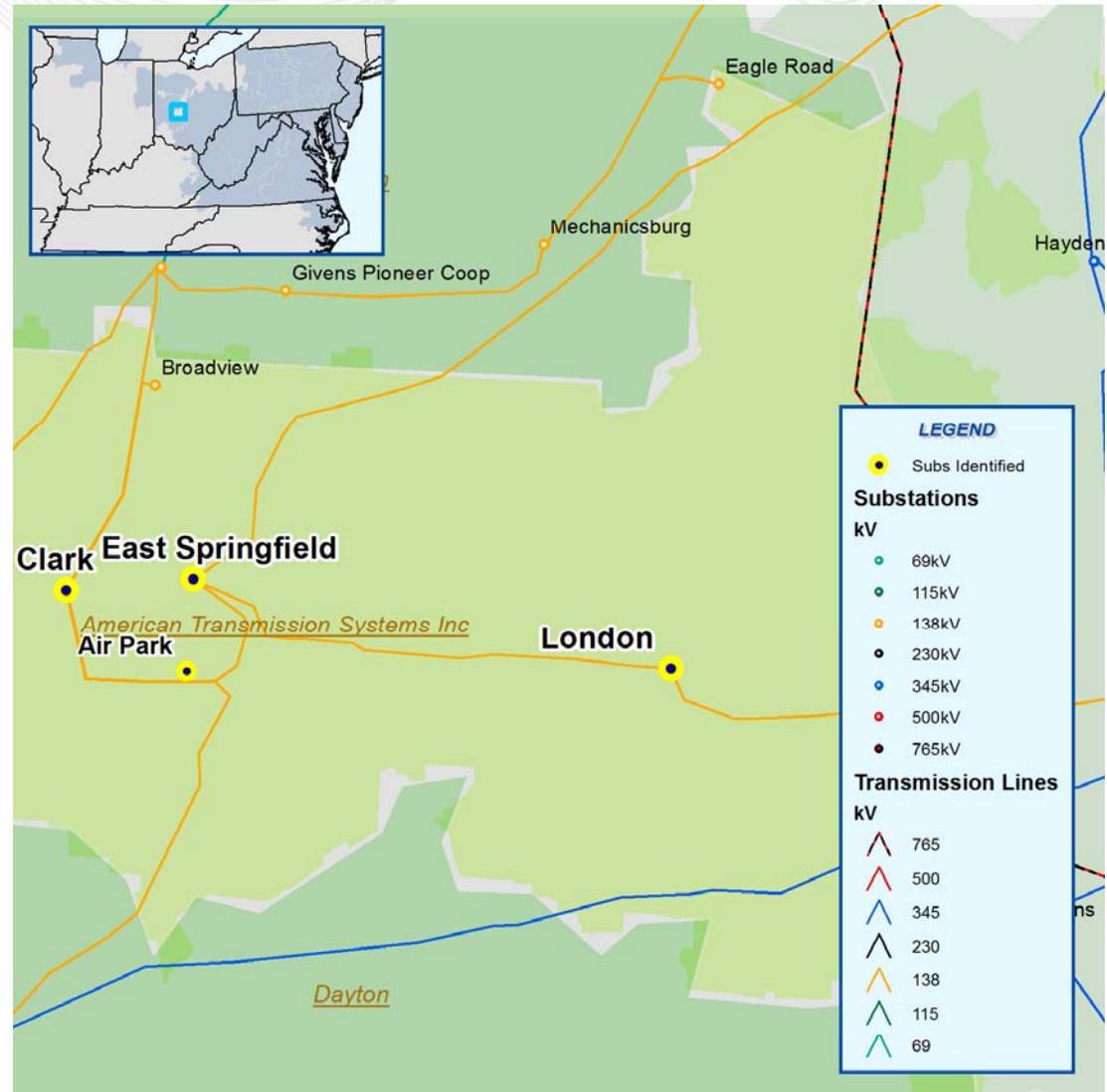
- N-1-1 Thermal Violation
- Overload of Washington (MP) – Corner 138kV for the loss of Edgelawn – Trissler 138kV + Belmont – Edgelawn 138kV
- Proposed Solution: Upgrade Relay Circuitry at Washington (b1394)
- Estimated Project Cost: \$0.05 M
- Expected IS Date: 6/1/2015



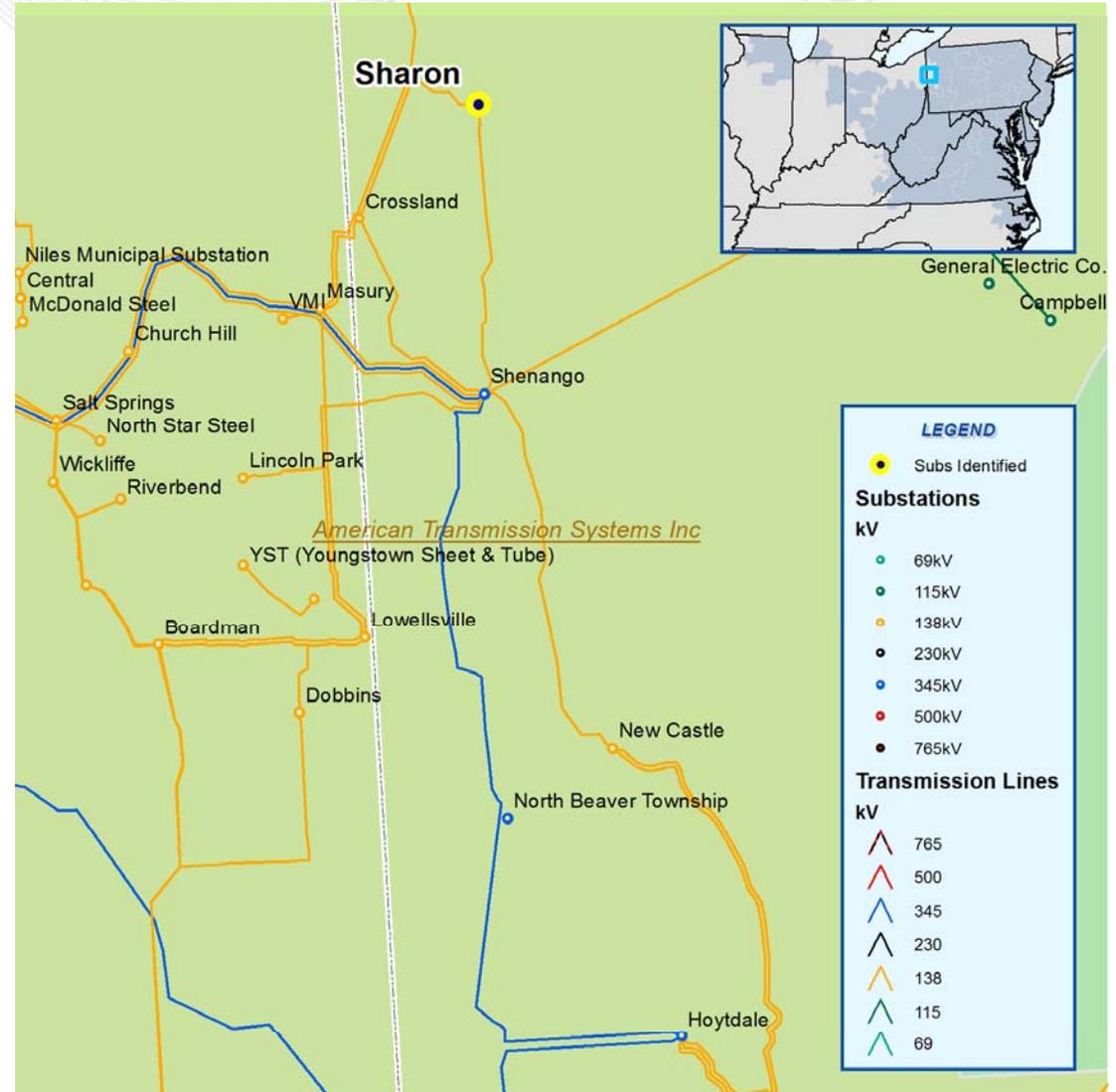
- N-1-1 Thermal Violation
- Overload of Kittanning – Garretts Run Jct 138kV for the loss of Allegheny Ludlum 4 Junction-Springdale 138kV + Allegheny Ludlum 2-Allegheny Ludlum 2 Junction 138kV
- Proposed Solution: Upgrade Terminal Equipment at Kittanning (b1395)
- Estimated Project Cost: \$0.05 M
- Expected IS Date: 6/1/2015



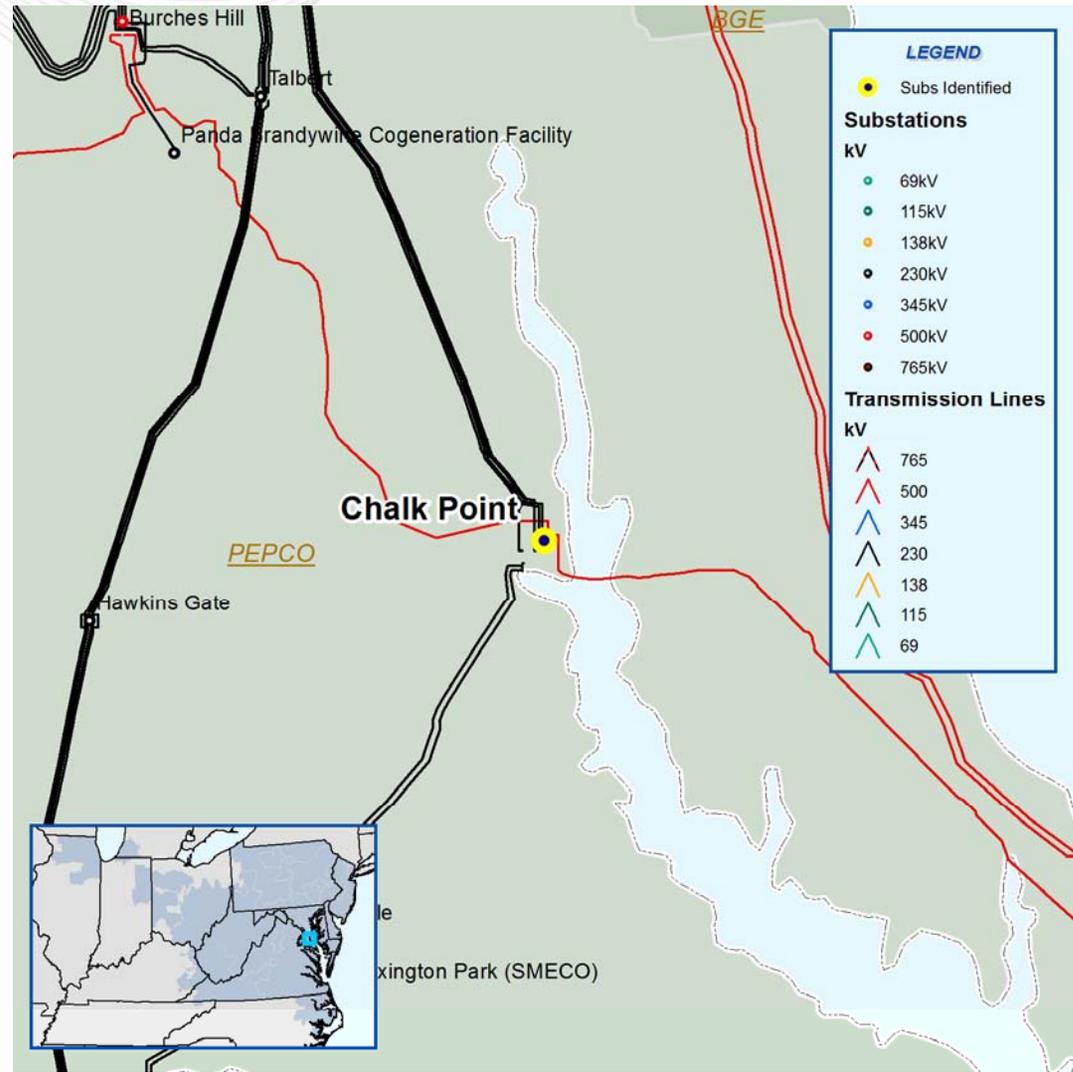
- N-1-1 Voltage violation
- Low Voltage magnitude and Voltage drop at Airpark, Clark, East Spring, and London 138kV buses for various contingency combinations
- Proposed Solution: Install a 25 MVAR cap bank at Airpark 138kV substation (b1341)
- Estimated Project Cost: \$1.5 M
- Expected IS Date: 6/1/2015



- N-1-1 Voltage violation
- Low voltage magnitude at Maysville, Sharon, Sharpville, Winner 138kV buses for the loss of the Hoytdale – Shenango 345kV line and the Highland - Shenango 345kV line
- Proposed Solution: Install a 50 MVAR cap bank at Sharon 138kV substation (b1342)
- Estimated Project Cost: \$1.32 M
- Expected IS Date: 6/1/2015



- 23 circuit breakers are overstressed on the Chalk Point 230 kV bus
- PEPCO owns 19 of the 23 circuit breakers
- Proposed Solution: Replace the 19 (PEPCO owned) Chalk Point 230 kV breakers that are overstressed with breakers rated 80 kA (b0845-b0863)
- Following up on the remaining 4 breakers with the owner
- Estimated Project Cost: \$2.0 M per breaker
- Expected IS Date: 12/31/2014





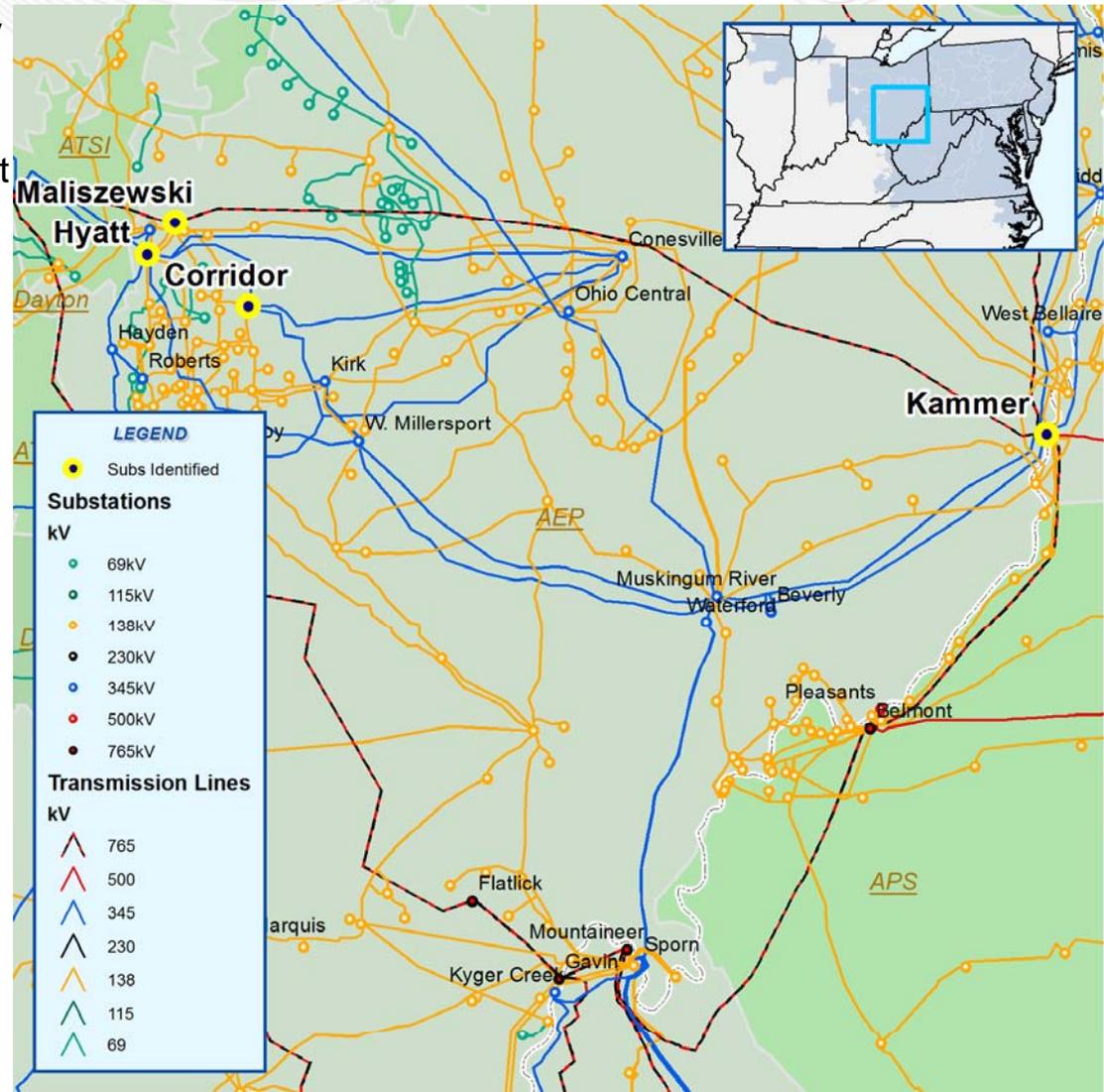
Baseline Reliability Summary

- Baseline upgrade solutions in this presentation (with the exception of ATSI) will be Proposed to the PJM Board in late November 2010 for approval and inclusion in the RTEP
- ATSI mitigation plans will continue to be reviewed with the TEAC and will be presented to the PJM Board for approval following the planned June 1, 2011 ATSI integration
- Supplemental upgrades are not approved by the PJM Board

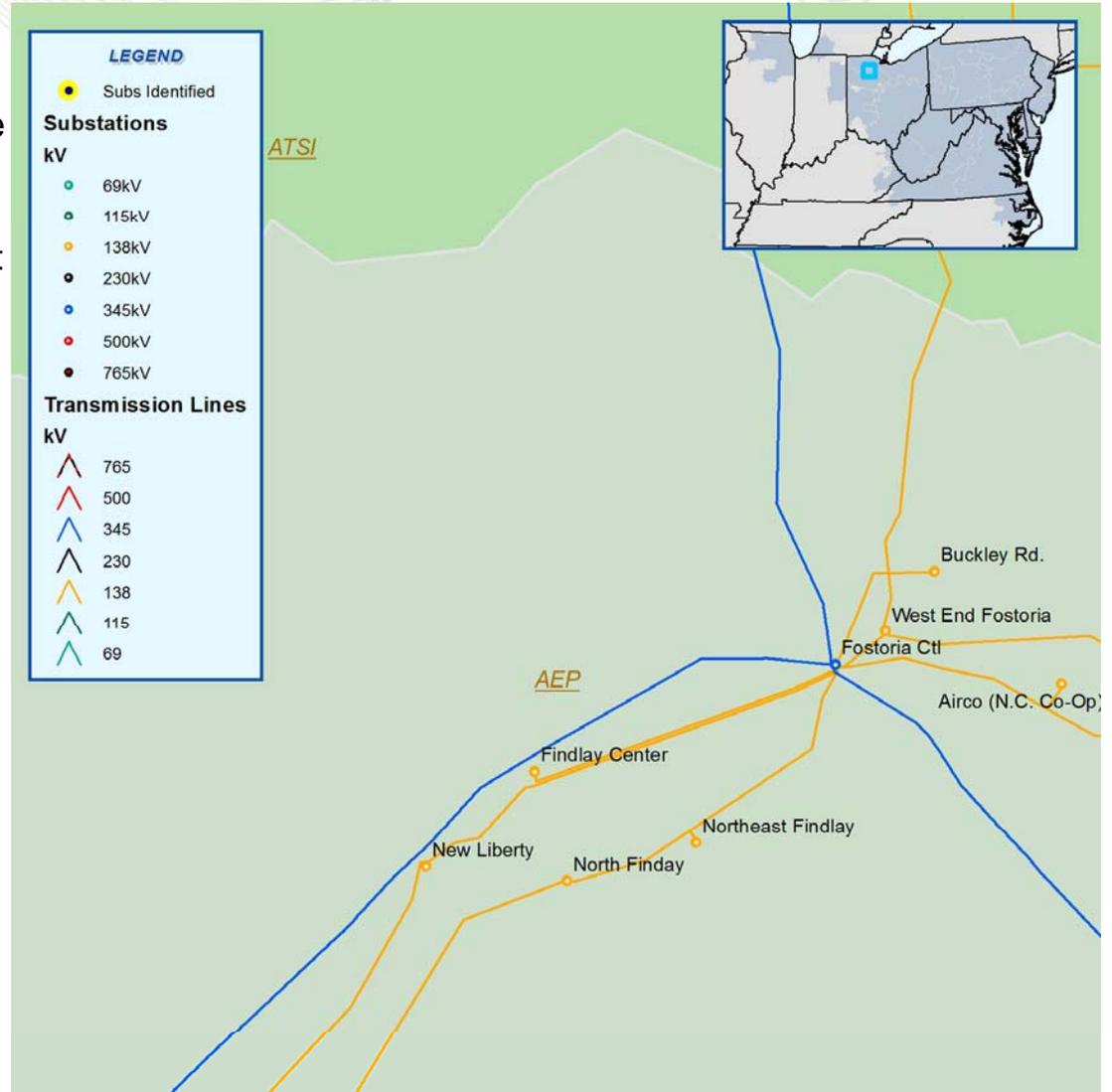


Supplemental Upgrades

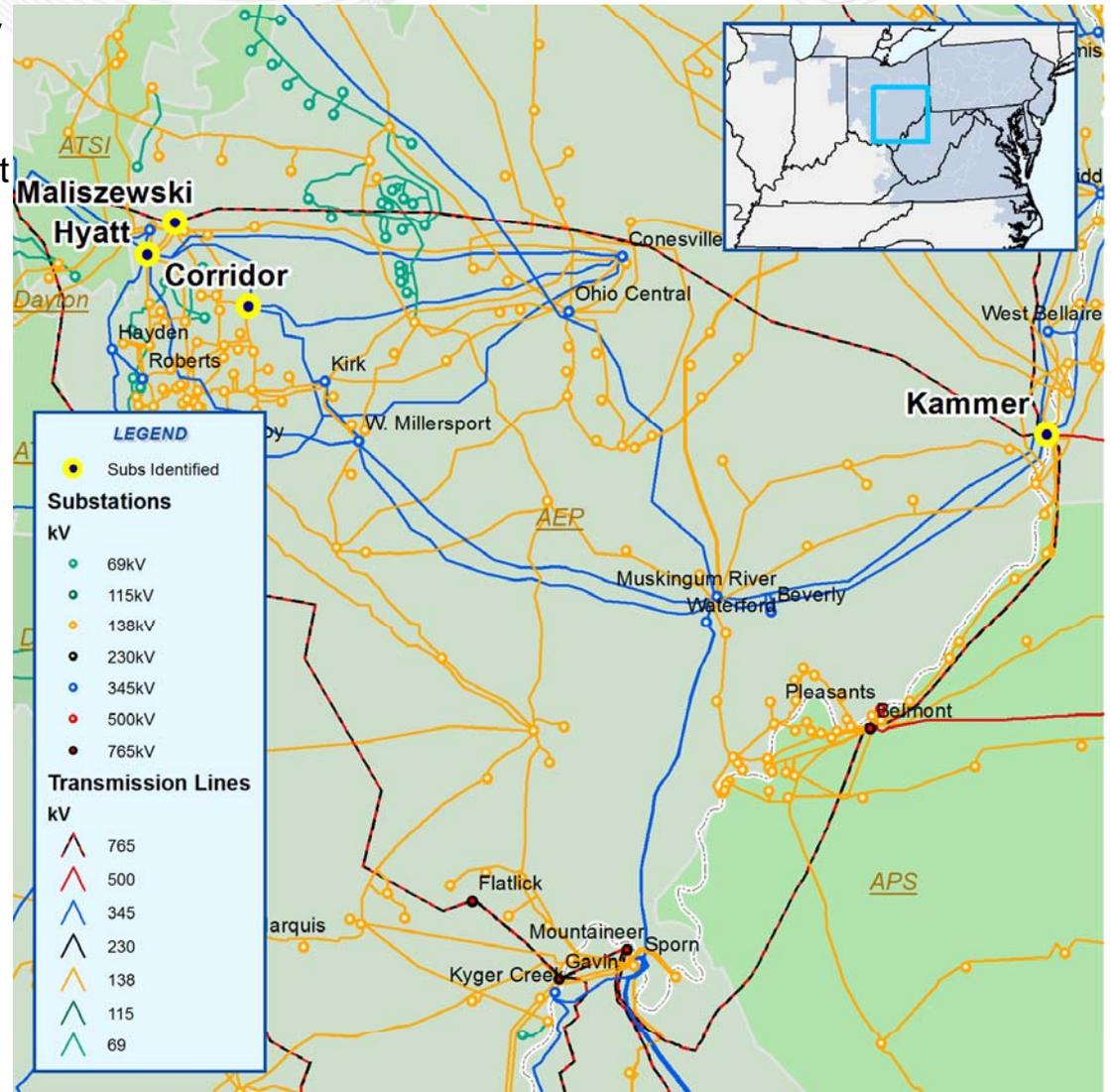
- Build a new “Vassell” 765/345/138 kV Station to the North of Columbus, OH at the intersection of the Kammer – Maliszewski 765 kV line and the Hyatt – Corridor 345 kV line
- This station will provide another EHV source to the area to mainly address potential voltage issues that have been demonstrated for specific outage and transfer scenarios. (S0251)
- Estimated Project Cost: \$185 M
- Expected IS Date: 5/1/2014



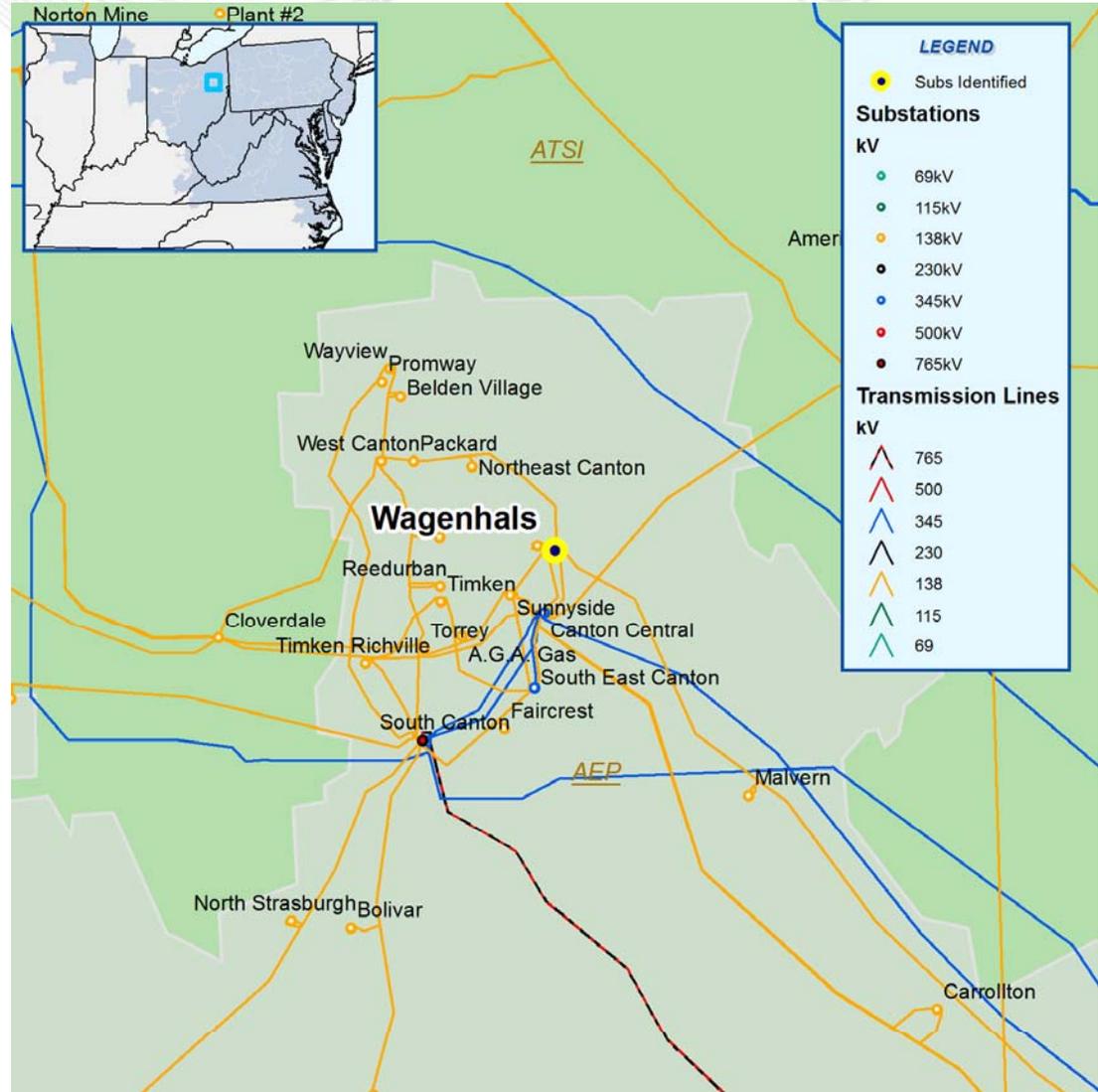
- A load customer requested American Electric Power (AEP) to conduct an Expedited System Study to determine the feasibility and facilities required to provide a Liberty Hi 34.5 kV delivery point. The new 34.5 kV delivery point near North Baltimore, Ohio taps the New Liberty – North Baltimore circuit.
- The load to be served is approximately 8 MVA (S0250)
- Estimated Project Cost: \$0.286 M
- Expected IS Date: 6/18/2010



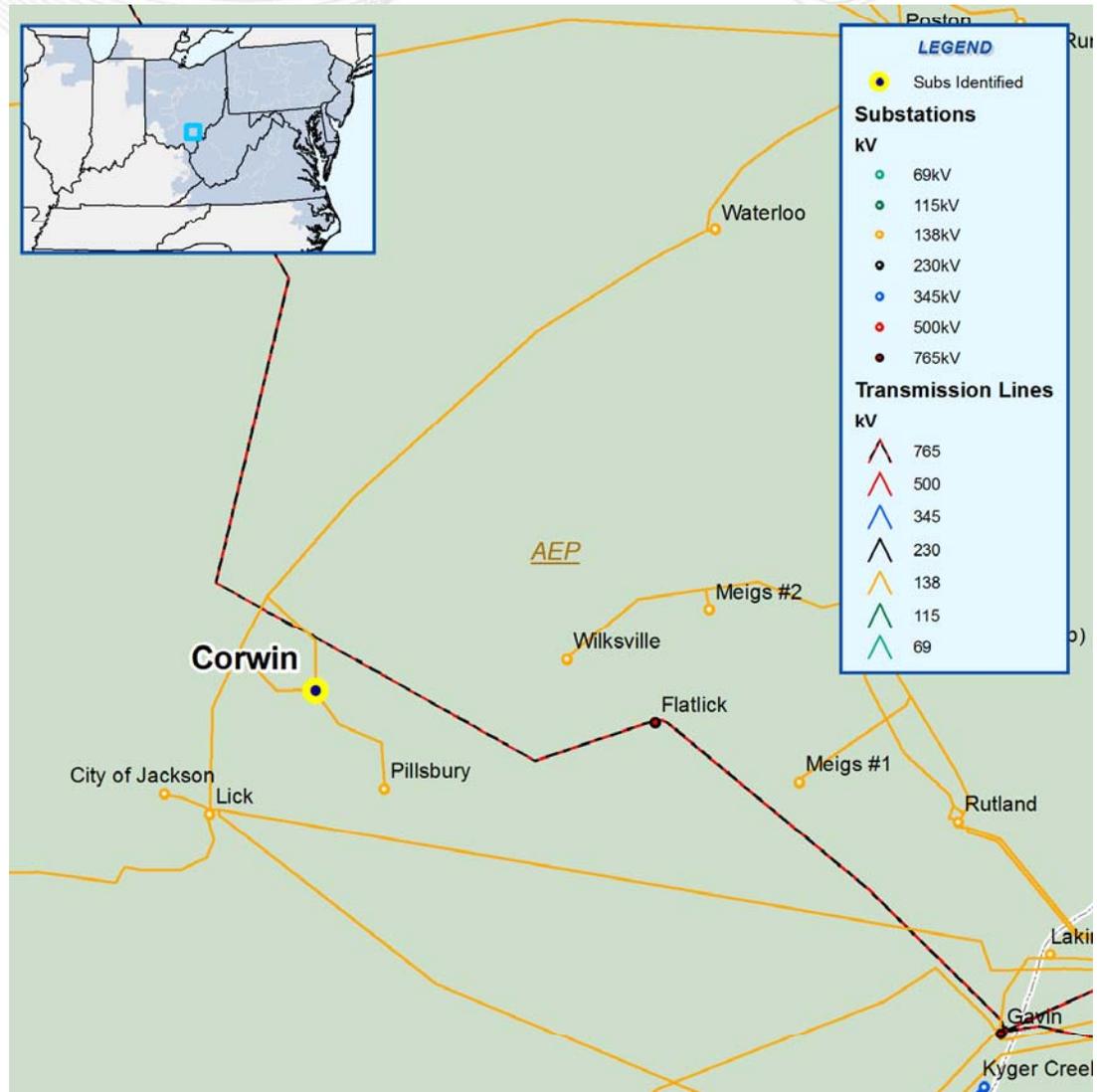
- Build a new “Vassell” 765/345/138 kV Station to the North of Columbus, OH at the intersection of the Kammer – Maliszewski 765 kV line and the Hyatt – Corridor 345 kV line
- This station will provide another EHV source to the area to mainly address potential voltage issues that have been demonstrated for specific outage and transfer scenarios. (S0251)
- Estimated Project Cost: \$185 M
- Expected IS Date: 5/1/2014



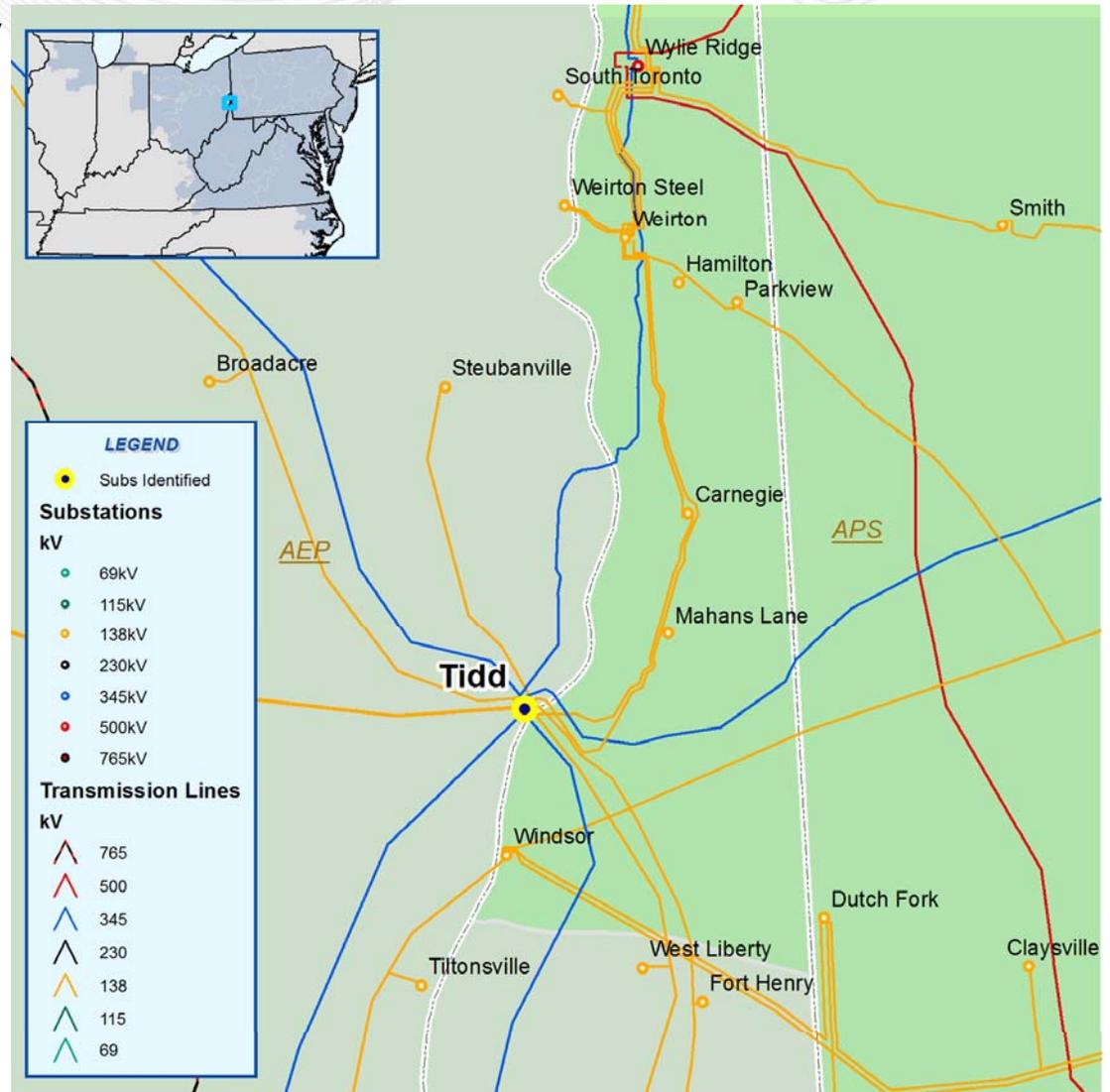
- A load customer has requested 69 kV service to a facility in the Minerva, Ohio vicinity
- The service can be provided by tapping the Wagenhals-Pekin 69 kV circuit. (S0253)
- Estimated Project Cost: \$0.464 M
- Projected IS Date: 3/1/2010



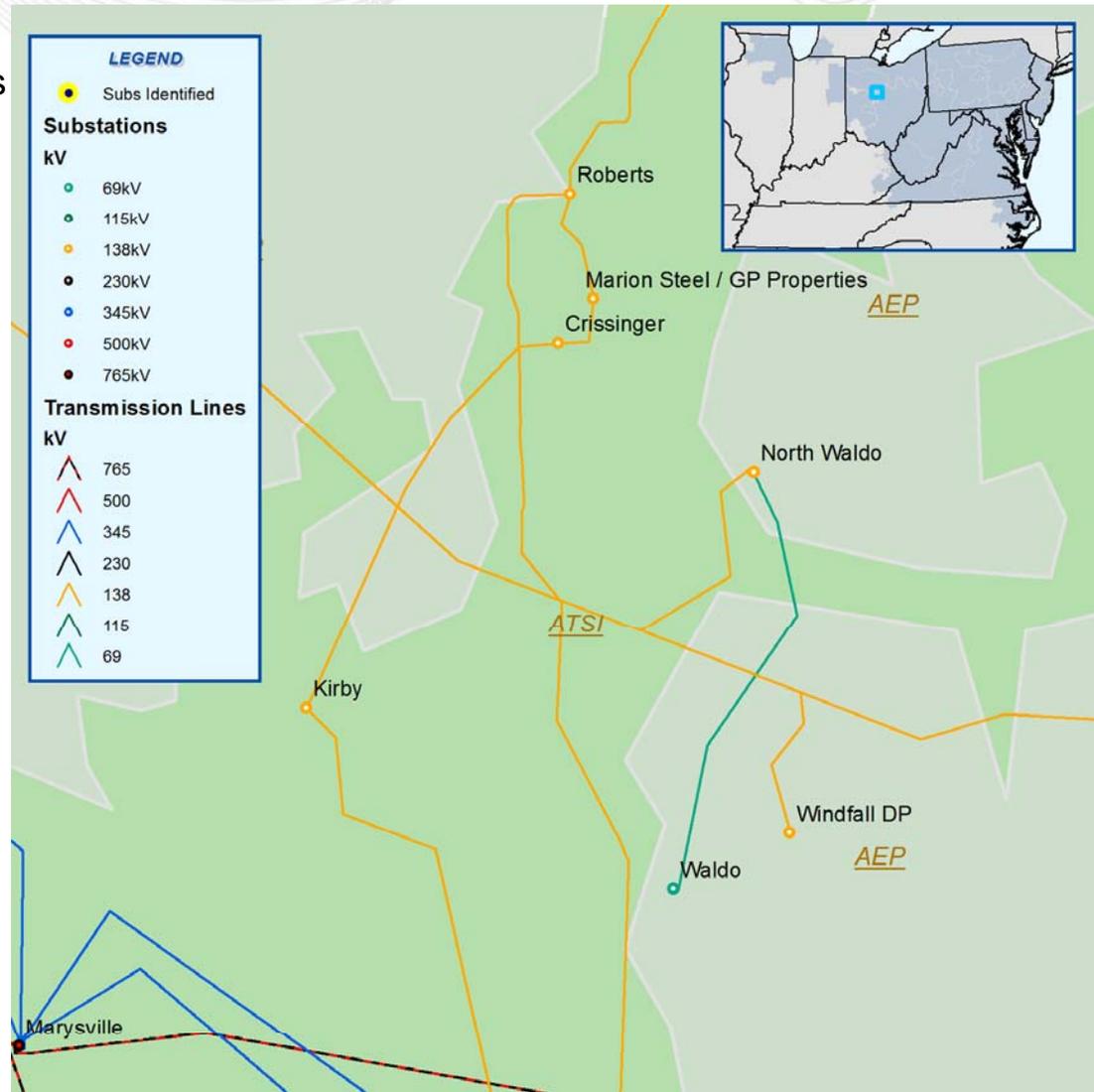
- General Mills would like to increase the electrical service reliability of the current 138 kV feed from AEP's Corwin station to the General Mills processing facility (S0254)
- Estimated Project Cost: \$0.437 M
- Projected IS Date: 10/1/2010



- A load customer has requested 69 kV service to a new facility in the vicinity of Warwood, West Virginia.
- The service can be provided by tapping the Tidd - Fulton 69 kV circuit and building 2.5 miles of 69 kV line from tap point to their facility. (S0255)
- Estimated Project Cost: \$1.773 M
- Projected IS Date: 7/1/2010

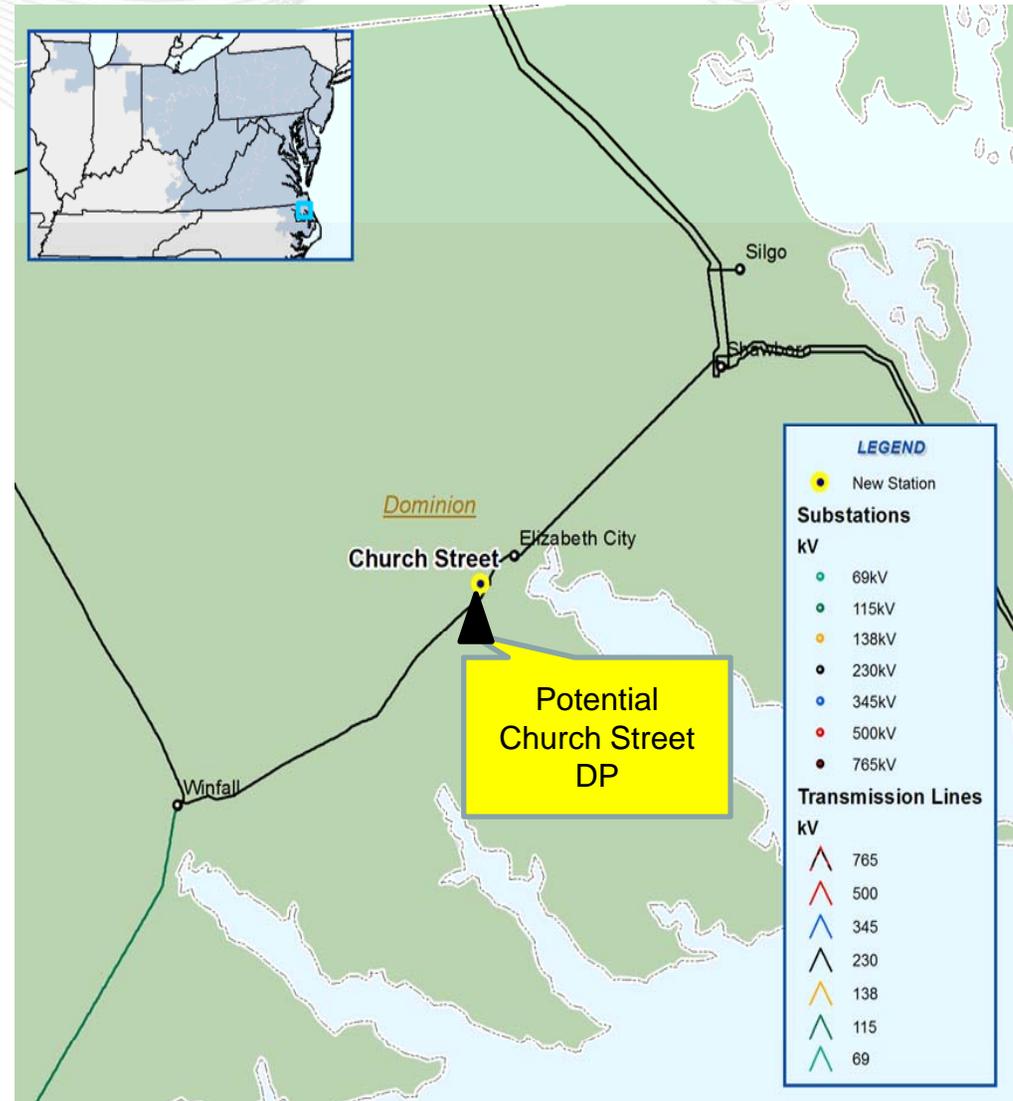


- Mid-Ohio Energy Cooperative's Uncapher station, near Marion, OH, is currently served by Ohio Edison at 34.5 kV. Mid-Ohio plans to upgrade Uncapher to 69 kV and is requesting service from the Harpster Pumping - Waldo 69 kV line. This project will build approximately 0.5 mile double circuit line, install a 3-way GOAB switch, and install low-side metering in Mid-Ohio's Uncapher station. (S0256)
- Estimated Project Cost: \$0.633 M
- Projected IS Date: 3/1/2011



New Delivery Point

- North Carolina Eastern Municipal Power Agency (NCEMPA) has requested a new 230 kV delivery point on behalf of the Town of Elizabeth City to provide increased capacity for future growth. This will require a tap from Line #2020 (Elizabeth City – Winfall) and installation of two 230 kV line switches. Estimated load 30 MW
- Estimated Project Cost: \$0.5 M
- Projected IS Date: Sept 2011



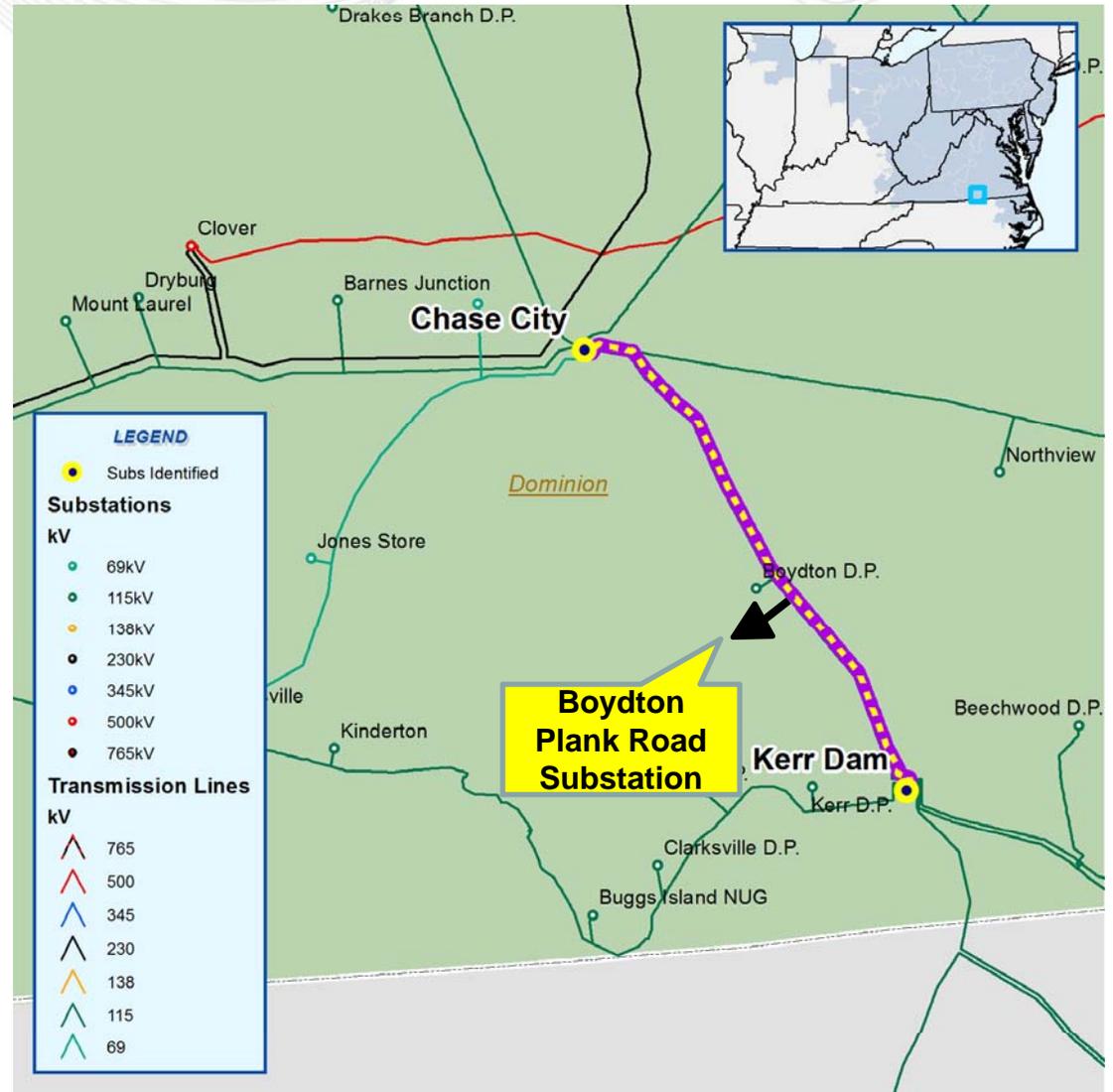
New Delivery Point

Microsoft is building their east coast data center in Boydton Plank Road Industrial Park in Mecklenburg County, VA, estimated load is 50 +MW.

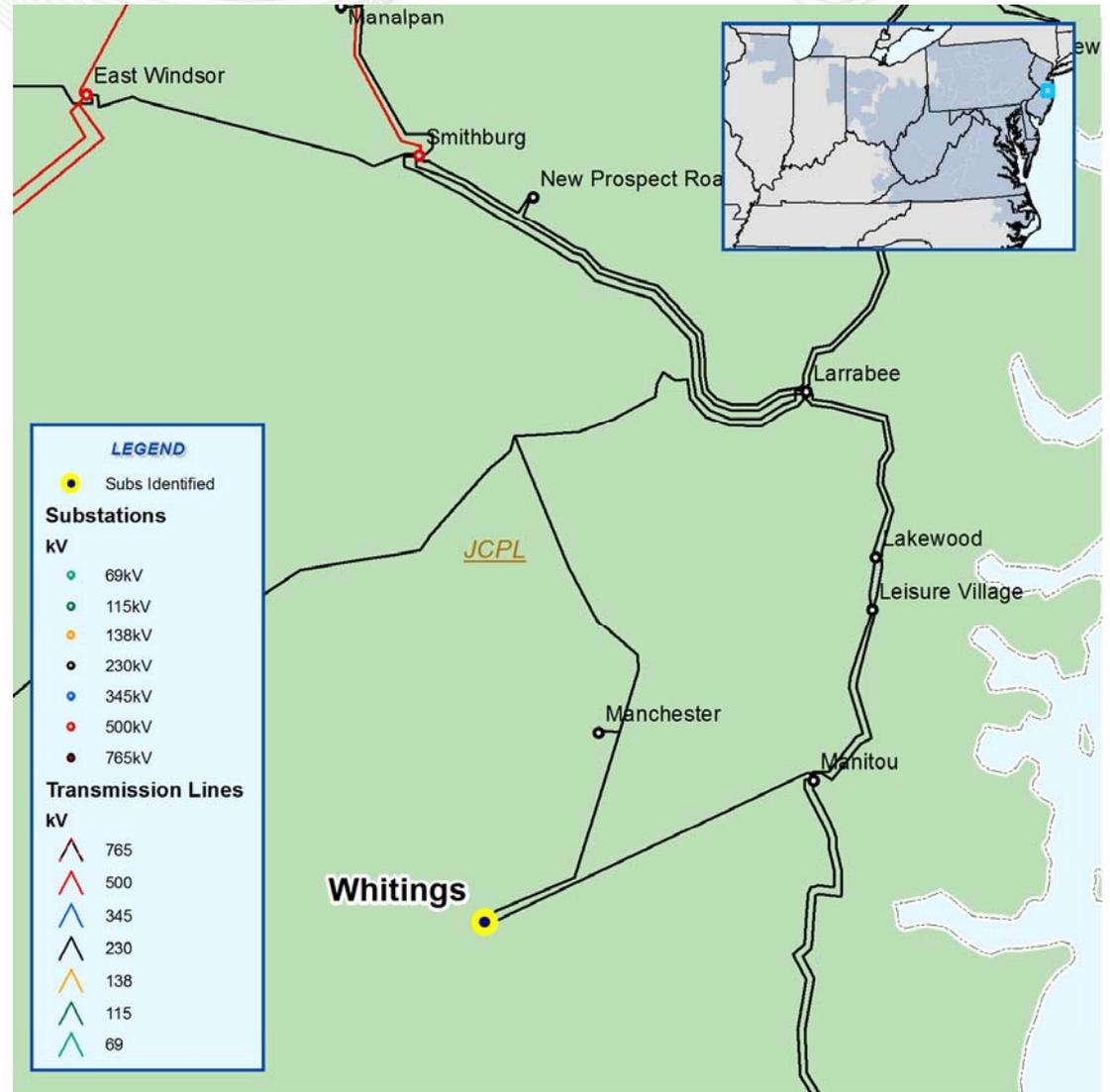
Phase 1: Split 115kV Line 38 (Chase City – Kerr Dam) and build double circuit tap 1.5 miles (new ROW) to BPRI Park. Build substation in BPRI Park with 115kV four breaker ring bus (April 2011)

Estimated Project Cost: \$15.6 M

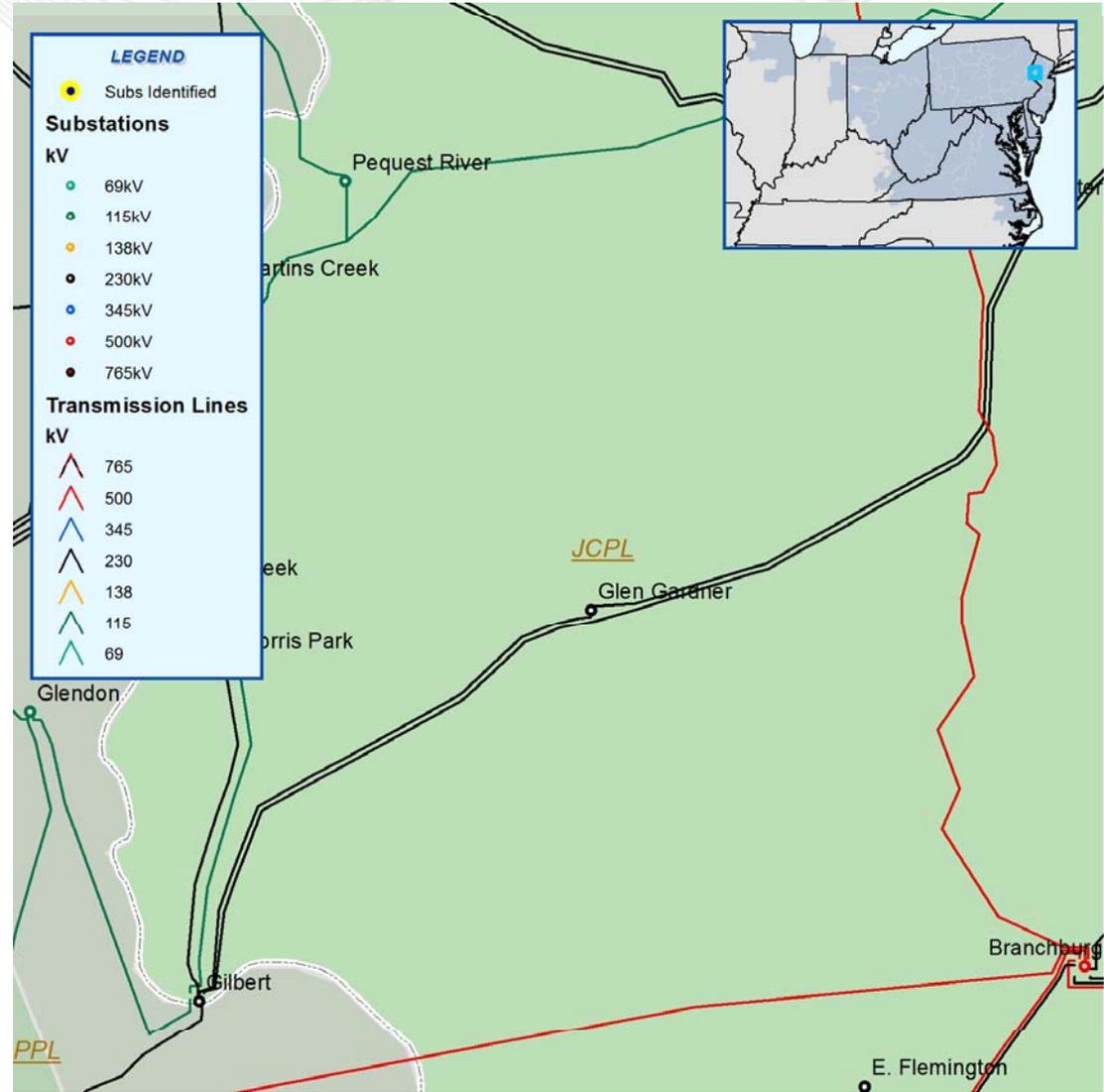
Projected IS Date: April 2011



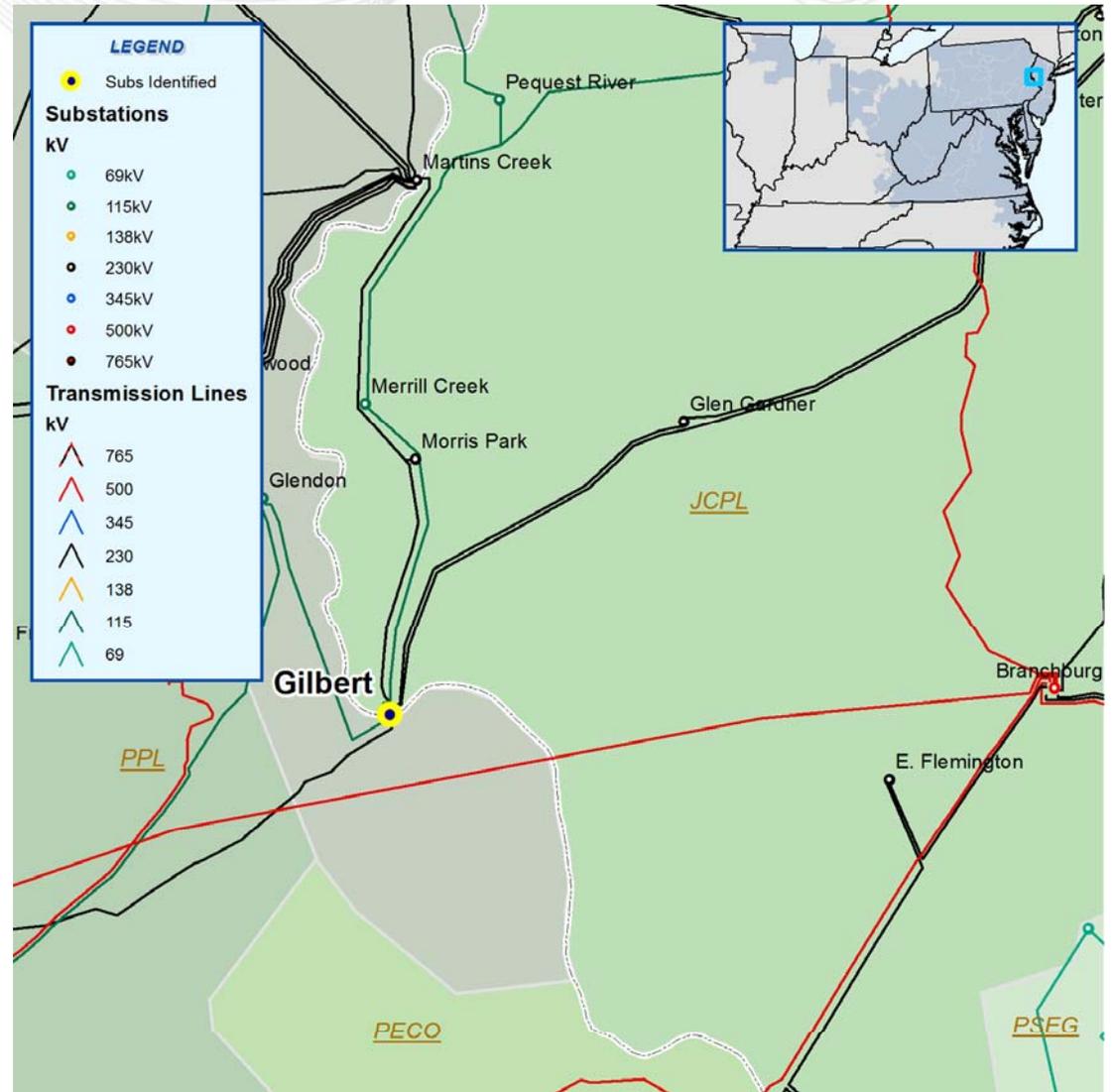
- FE planning criteria violation (non-Tariff facility):
- Low voltage at Upton 34.5 kV station for the loss of Whiting – Upton 34.5 kV (K11) line.
- Proposed Solution:
New Lisbon three breaker 34.5 kV straight bus upgrade (S0246)
- Estimated Project Cost:
\$1.158 M
- Expected IS Date:
6/1/2012



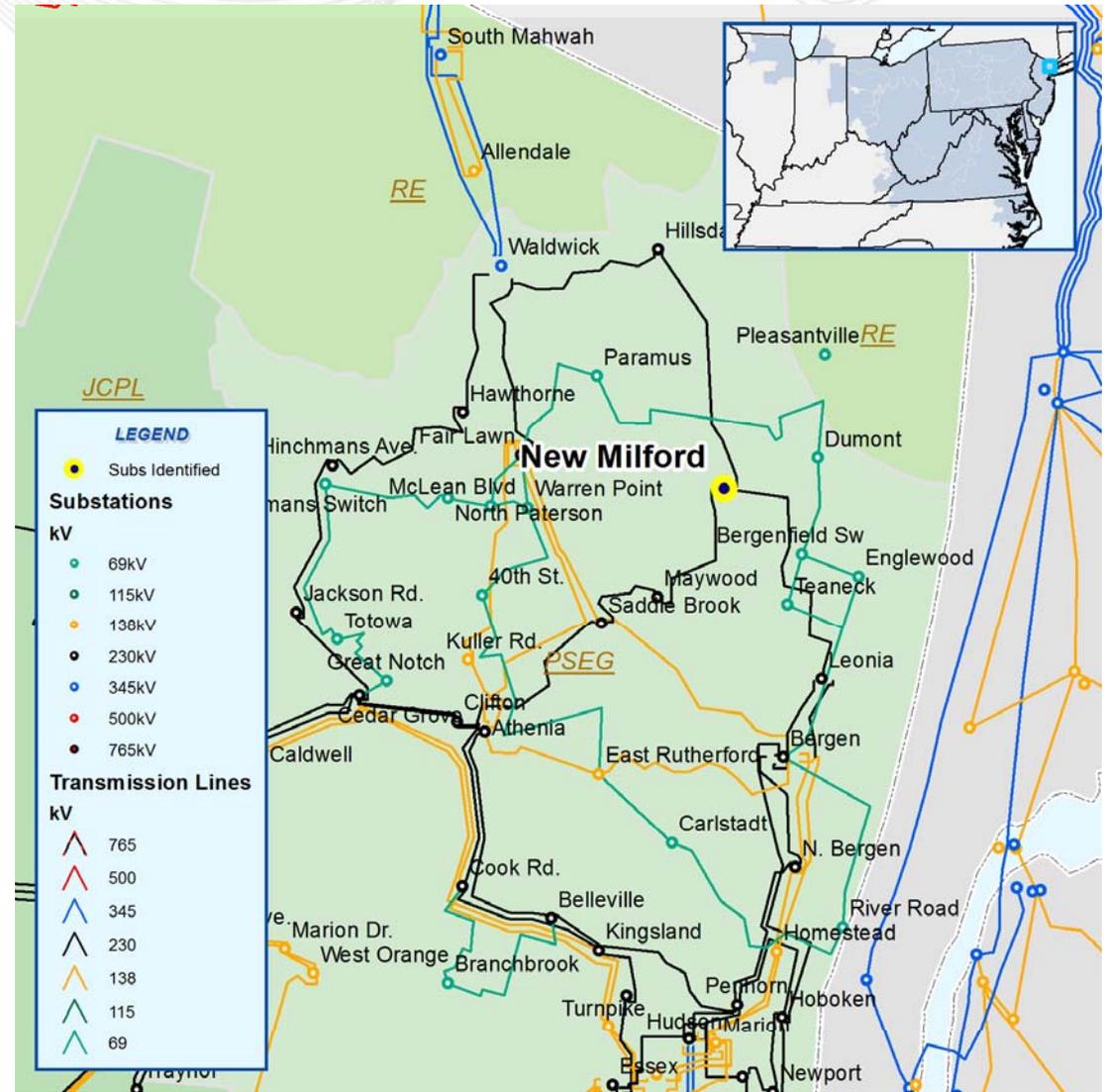
- FE planning criteria violation (non-Tariff facility):
- Low voltage at the Merck bus for the loss of the Lebanon – Merck 34.5 kV (W751) line
- Proposed Solution: Relocate the Merck 6.6 MVAR capacitor (S0247)
- Estimated Project Cost: \$0.051 M
- Expected IS Date: 6/1/2011



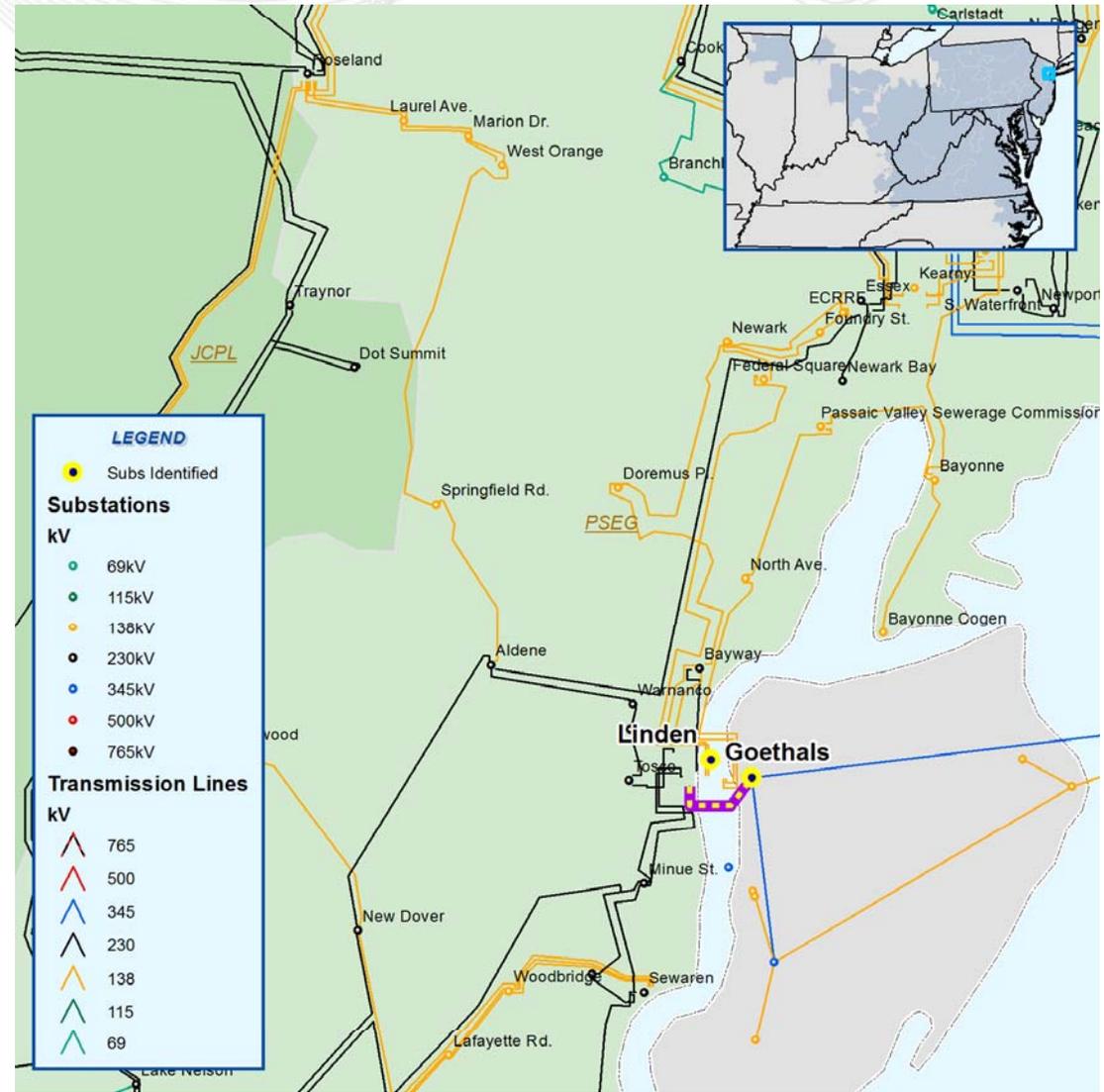
- FE planning criteria violation (non-Tariff facility):
- Overload on the Gilbert – Bridgeton 34.5 kV (J712) line for the loss of Branchburg – East Flemington 230 kV line and East Flemington 230/34.5 kV transformer # 4
- Proposed Solution:
Upgrade the bus conductor at Bridgeton 34.5 kV substation with 795 ACSR on the Gilbert – Bridgeton 34.5 kV (J712) line (S0249)
- Estimated Project Cost:
\$0.031 M
- Expected IS Date:
6/1/2011



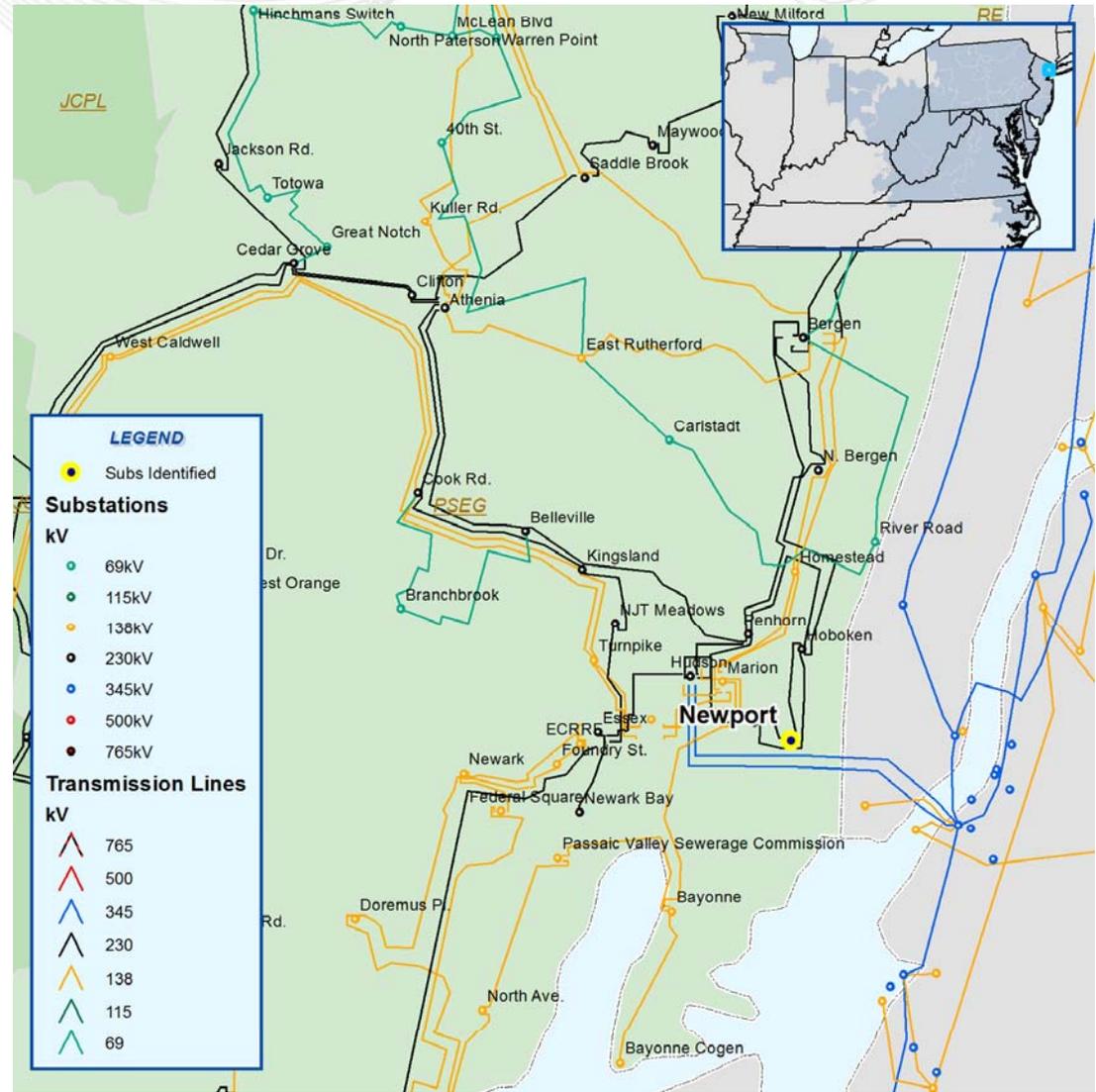
- PSEG Operational:
- The New Milford 230 kV substation was flooded recently and as a result the substation was closed down.
- Proposed Solution: Raise the New Milford yard and control house (S0249).
- Estimated Project Cost: \$70M
- Expected IS Date: 6/1/2015



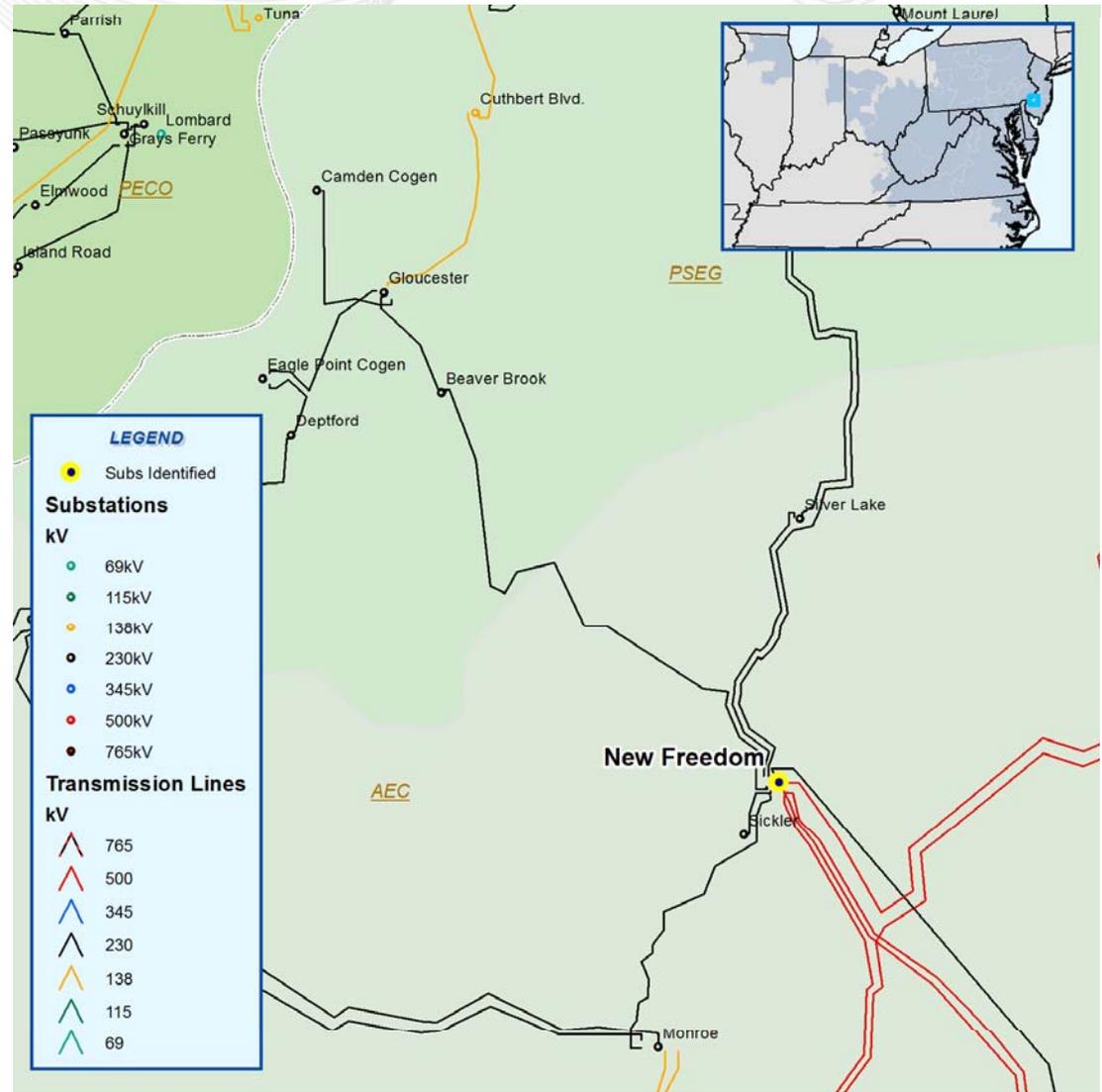
- PSEG Operational:
- The existing Linden 230 kV substation is a breaker and half configuration, however the Linden – Gaethals 230 kV circuit is connected to a bay with no breaker on one side. The circuit also doesn't have line disconnect switch and therefore, the bus has to be removed in order to take the line out of service.
- Proposed Solution: Relocate the Linden – Goethals 230 kV circuit to the existing vacant bay at Linden (S243).
- Estimated Project Cost: \$1.5M
- Expected IS Date: 6/1/2013



- PSEG Operational:
- Bus faults at Newport 230 kV removes multiple circuits resulting in circuit switch mis-operation and mis-alignment of disconnect switches.
- Proposed Solution: Reconfigure the Newport substation to breaker and half scheme (S0244).
- Estimated Project Cost: \$20M
- Expected IS Date: 6/1/2011



- PSEG Operational & Maintenance:
- The two 230 kV PARs at New Freedom are rarely utilized and therefore provide limited benefit. In addition movement of the taps on those PARs causes gassing.
- Proposed Solution: Remove the two New Freedom PARs (S0245).
- Estimated Project Cost: \$2.0M
- Expected IS Date: 6/1/2012





Email RTEP@pjm.com with any comments



Next Steps



Review Issues Tracking