



Reliability Analysis Update

Subregional RTEP Committee
PJM West

May 31, 2017

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



Baseline Reliability and Supplemental Project First Review



DEOK Transmission Zone Supplemental Project

Supplemental Project S0905 Scope Update

Problem Statement: Circuits 3885 (Port Union - Provident – Hall 138 kV) and 3886 (Port Union – Mulhauser 138 kV) are on the same towers through the project area; 3885 is on the northwest side of the towers, 3886 is on the southeast side of the towers. The project site was originally to the southeast of the circuit path so 3886 was to be used to add the new substation between Port Union and Mulhauser. The property eventually purchased is to the northwest of the circuit path so it is more practical to now use 3885. The new plan is to interrupt circuit 3885 between Port Union and Hall.

Original Scope : Build a new 22.4 MVA 138/12 kV substation at East Provident Drive

Original Estimated Cost: \$3.72M

Original Project IS Date: 6/1/2018

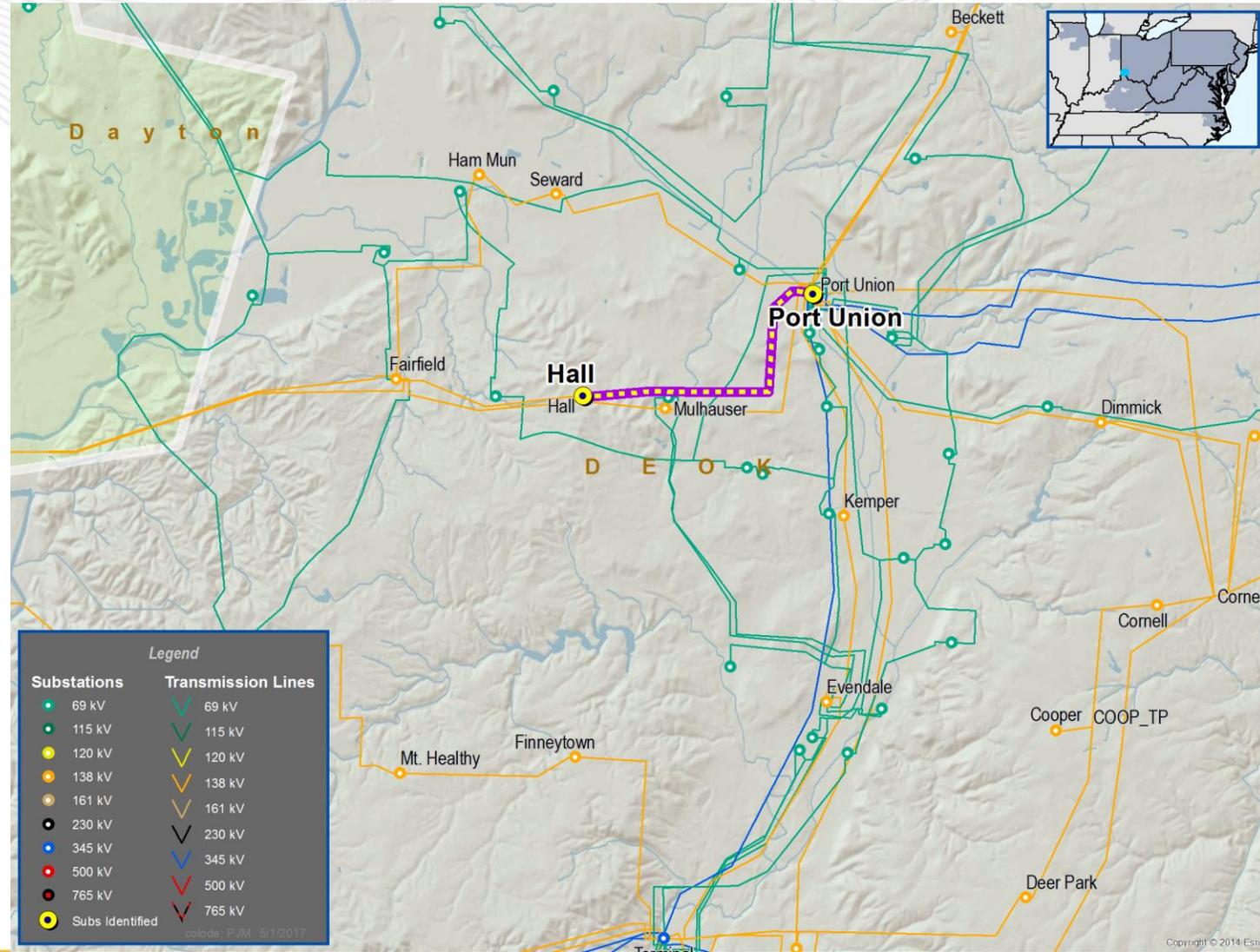
Original Presented Date: 3/5/2015 PJM West SRTEAC

New Scope: Build a new 22.4 MVA 138/12 kV substation at Provident Drive

New Estimated Cost: \$3.72M

New Projected IS Data: 6/1/2018

Status: Engineering





DEOK Transmission Zone Baseline Reliability

Baseline Reliability - N-1-1 Violation Project Replacement

Problem Statement:

Due to the scope change of S0905, The Port Union – Mulhauser 138kV line is overloaded for the loss of the Port Union –Seward 138kV line and the loss of the Port Union- Provident 138kV line.

Due to the scope change of S0905, The driver for B2829 as presented at 1/12/2017 TEAC, the N-1-1overload on the Port Union- East Provident 138kV line, doesn't exist any more

Potential Solutions/Alternatives: No good additional transmission alternatives were identified.

Cancel B2829: Reconductor the feeder from Port Union to East Provident 138 kV line for 300MVA

Estimated Project Cost: \$2.19M

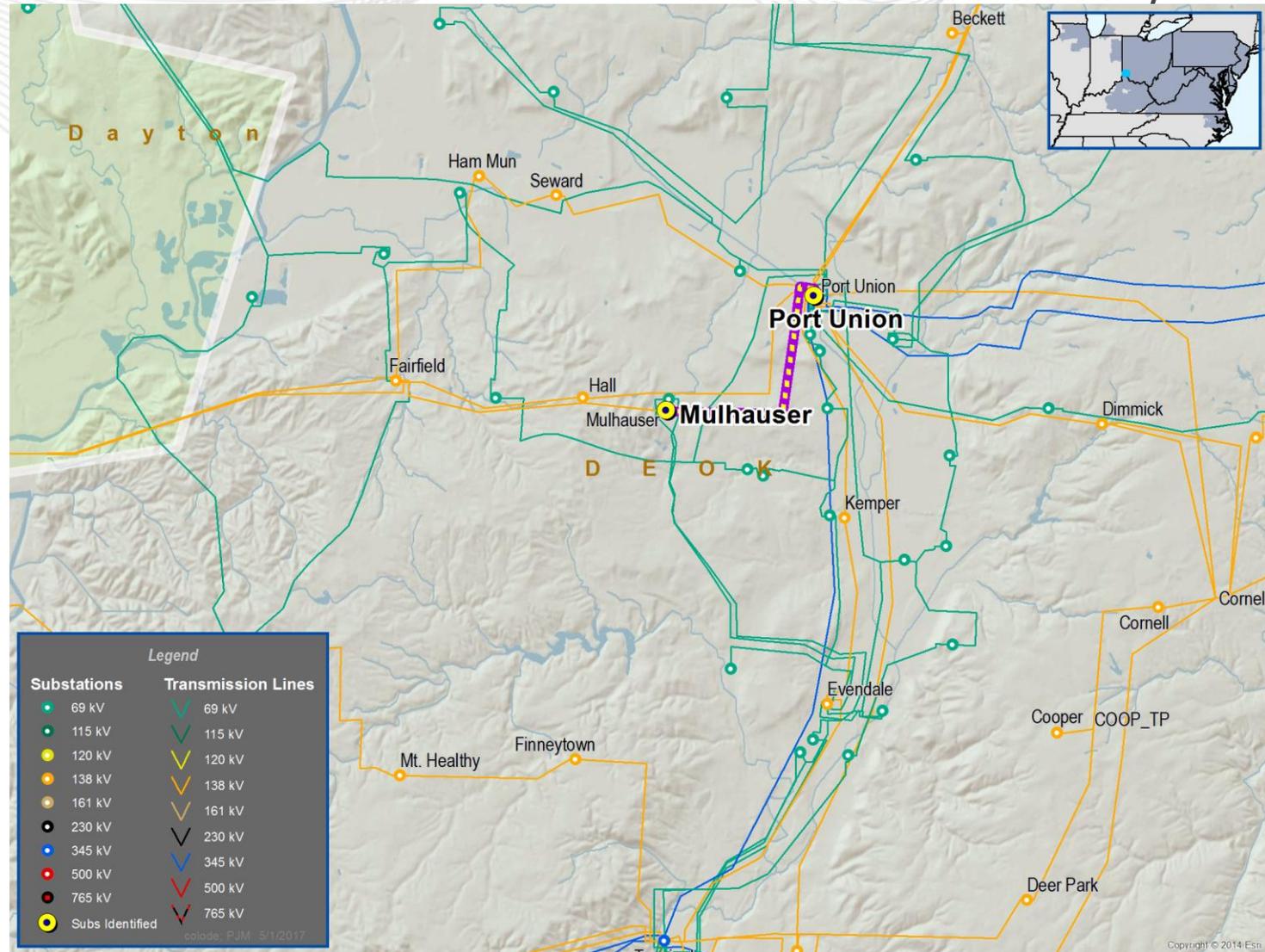
Required IS date: 6/1/2021

Preliminary Solution:

Reconductor the Port Union – Mulhauser 138kV line with 954ASCR bringing the summer ratings to A/B/C=300/300/300 MVA.

Estimated Project Cost: \$4.4M

Required IS date: 6/1/2021





EKPC Transmission Zone Baseline Reliability

Baseline Reliability - Project Replacement (B2785)

Problem Statement:

Potential industrial load continues to grow (2.5MW – 7MW) over the next couple of years at will cause low voltage violations at Asahi, Shopville, and Woodstock substations for the loss of the Norwood-Shopville 69kV line section. The original scope provides only a short term solution to the voltage issues in an area overly reliant on capacitor banks for voltage support. A new scope has been created to better serve voltage in the area, as well as serve as a buffer for the future industrial load growth

This low voltage issues now occurs in the 2018/19W, based on new load forecast data.

Alternatives Considered:

Build new 7 mile 69kv transmission line from Floyd - Woodstock including the addition of two 69 kV breakers and associated equipment at Walnut Grove. Estimated Cost - \$5.05 Million

Cancel Existing Baseline Project:

B2785 (Presented on 12/1/2016 SRTEAC): Install a 13.776 MVAR 69 kV Capacitor Bank at Three Links Jct.

Project Cost Estimate: \$0.35M

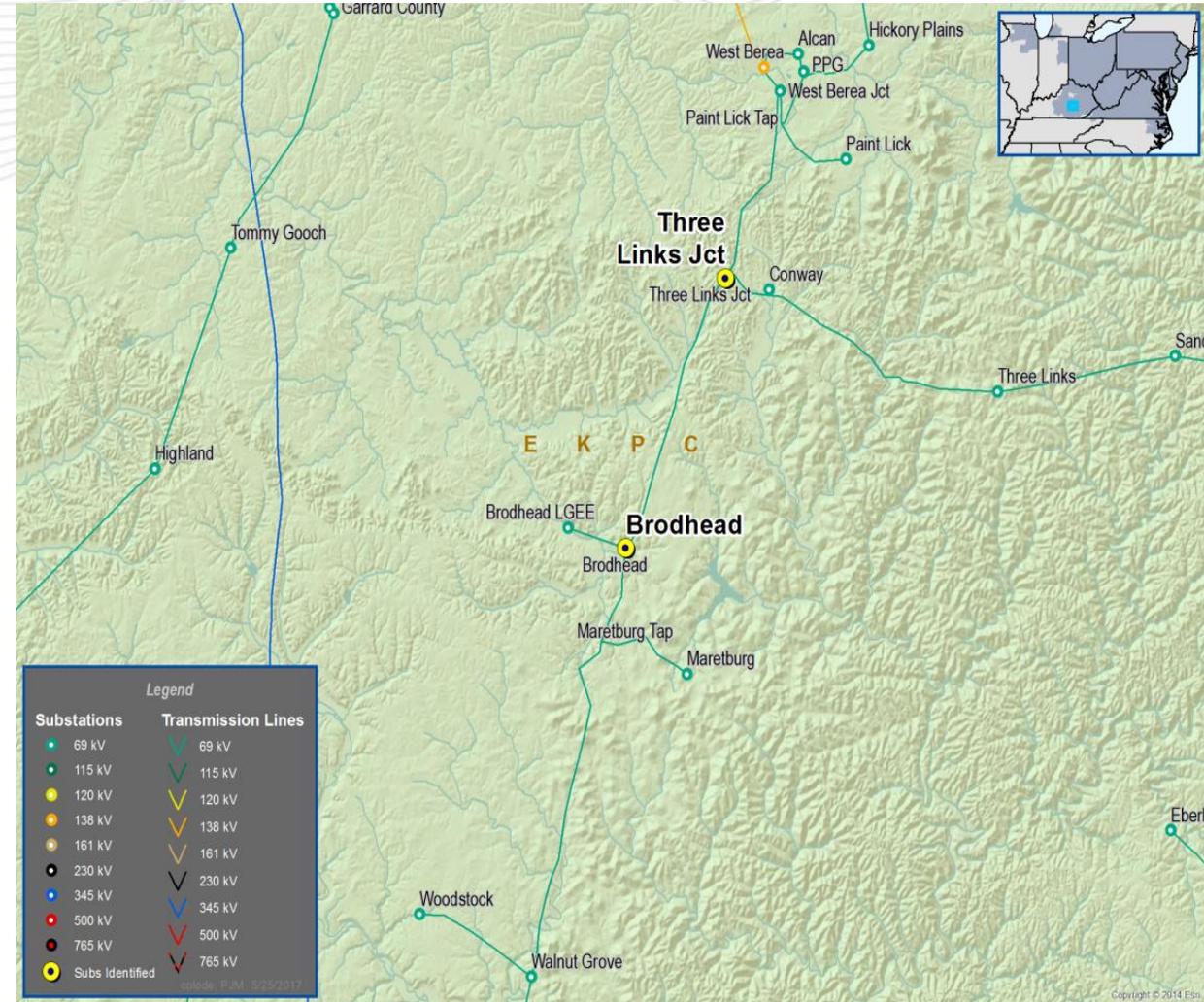
Required IS date: 12/1/2017

Replace existing project with the following preliminary solution:

Rebuild the Brodhead - Three Links Jct. 69 kV line section (8.2 miles) using 556.5 MCM ACTW wire.

Project Cost Estimate: \$4.715M

Required IS date: 12/1/2018



Baseline Reliability - TO Criteria Violation

Problem Statement:

Low voltage at the Coburg 69 kV station during an outage of the Coburg to Sewellton Jct. 69 kV line section.

Potential Solution:

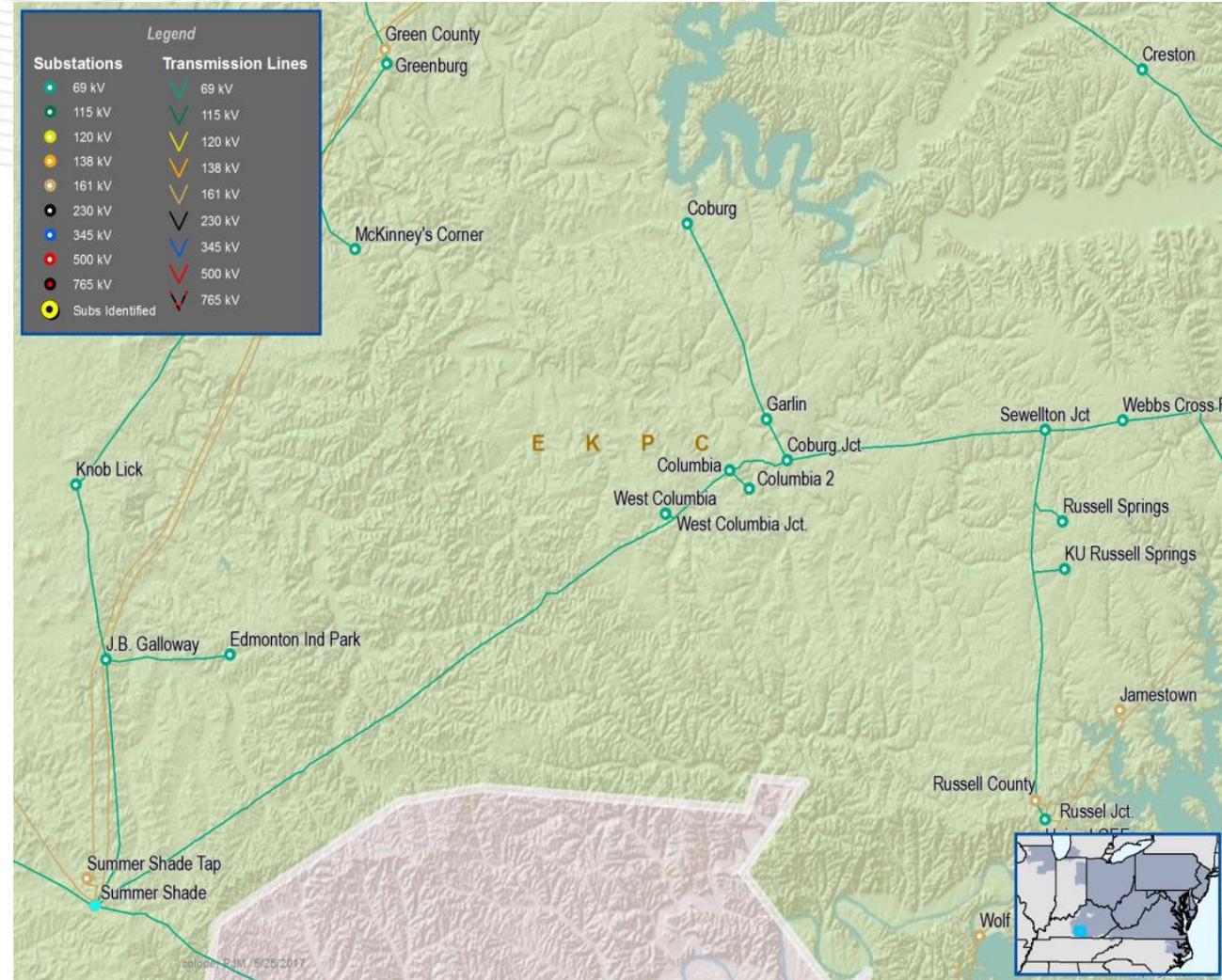
Raise the V-low setting for Summer Shade 69 kV cap bank to 1.01 pu.

Alternatives Considered:

No other alternatives considered.

Estimated Project Cost: \$0

Required IS Date: 12/1/2027





EKPC Transmission Zone Baseline Reliability

Baseline Reliability - TO Criteria Violation

Low voltage at the Mt. Sterling 69 kV station during the loss of the Dale 138-69 kV transformer.

Potential Solution:

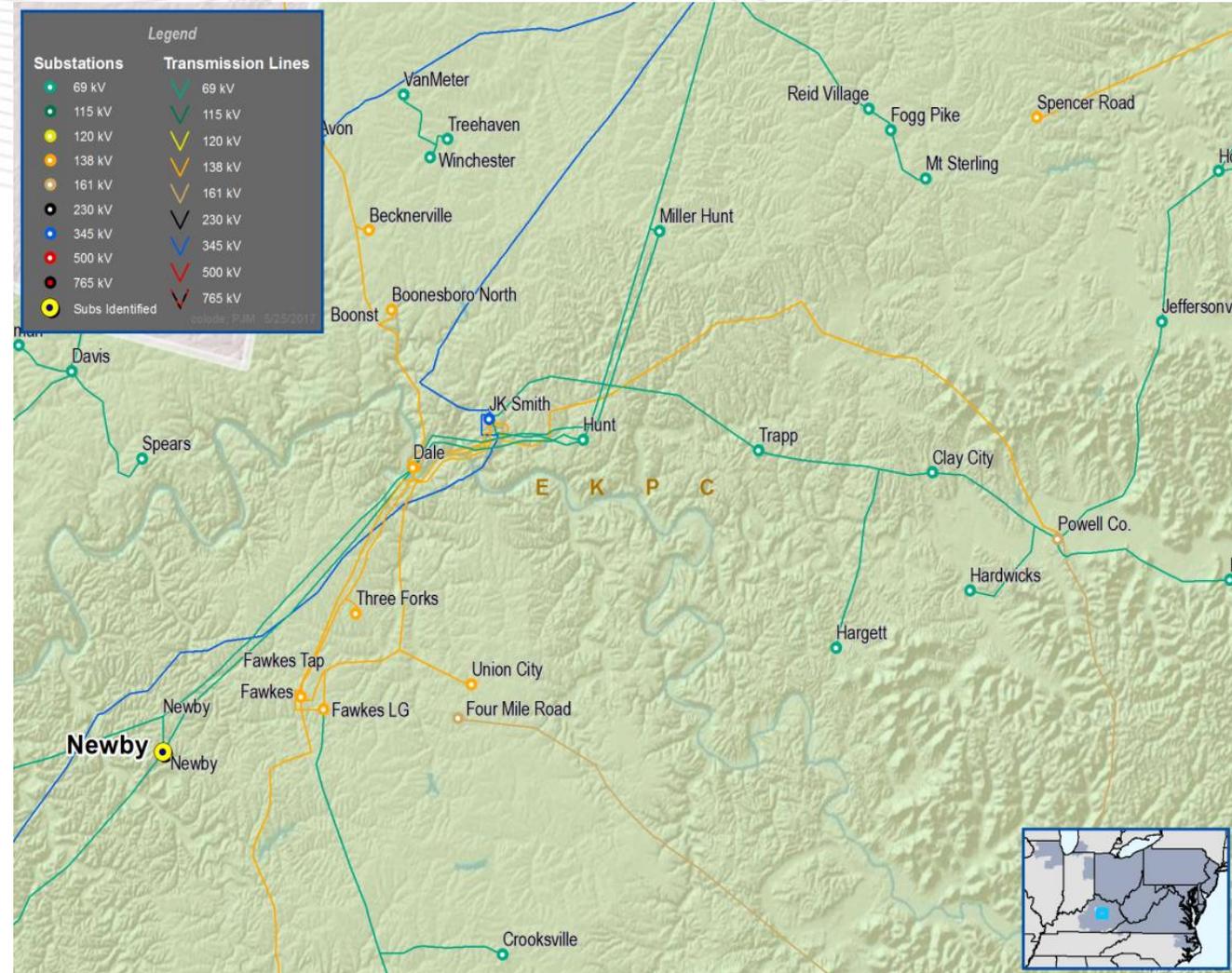
Raise the V-low setting for Newby 69 kV cap bank to 0.955 pu

Alternatives Considered:

No other alternatives considered.

Estimated Project Cost: \$0

Required IS Date: 12/1/2026



Baseline Reliability - TO Criteria Violation

Low voltage at the Upchurch 69 kV station during the loss of the Zula Jct. – Upchurch Tap 69 kV line section.

Potential Solution:

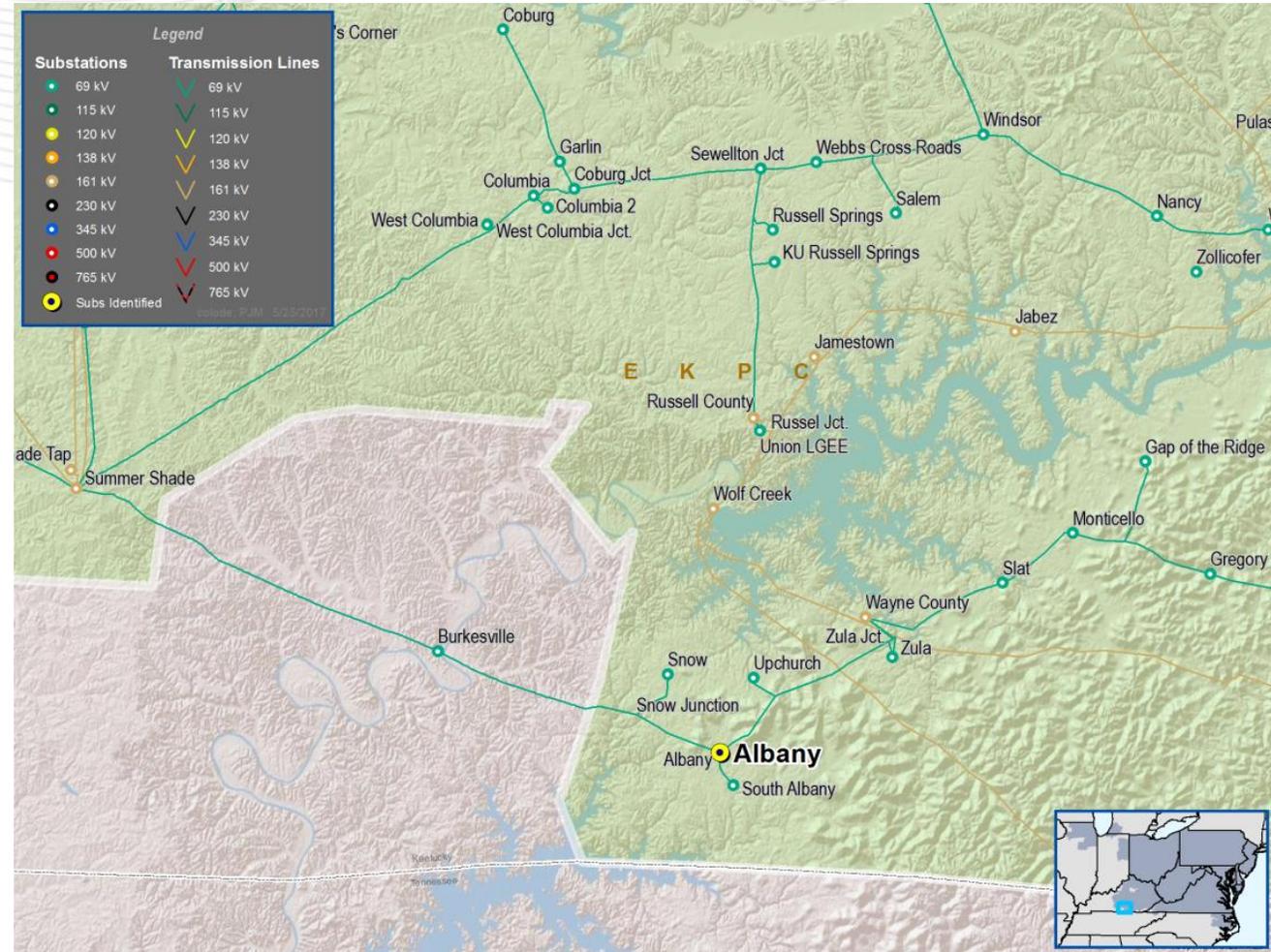
Resize the Albany 69 KV capacitor bank from 8.4 to 13.776 MVAR.

Alternatives Considered:

- Resize the Snow 69 kV cap bank to 10.2 MVAR – Estimated Cost - \$100,000
- Rebuild Snow Tap - Albany 69 kV line section from 4/0 to 556 MCM (4.4 miles) – Estimated Cost - \$2.2 Million
- Rebuild Albany - Upchurch 69 kV line section from 4/0 to 556 MCM (3.79 miles) – Estimated Cost - \$1.9 Million

Estimated Project Cost: \$0.09M

Required IS Date: 6/1/2026



Baseline Reliability - TO Criteria Violation

Overload of the Baker Lane-Holloway Jct 69 kV line section during the loss of the Avon - Fayette 138 kV line.

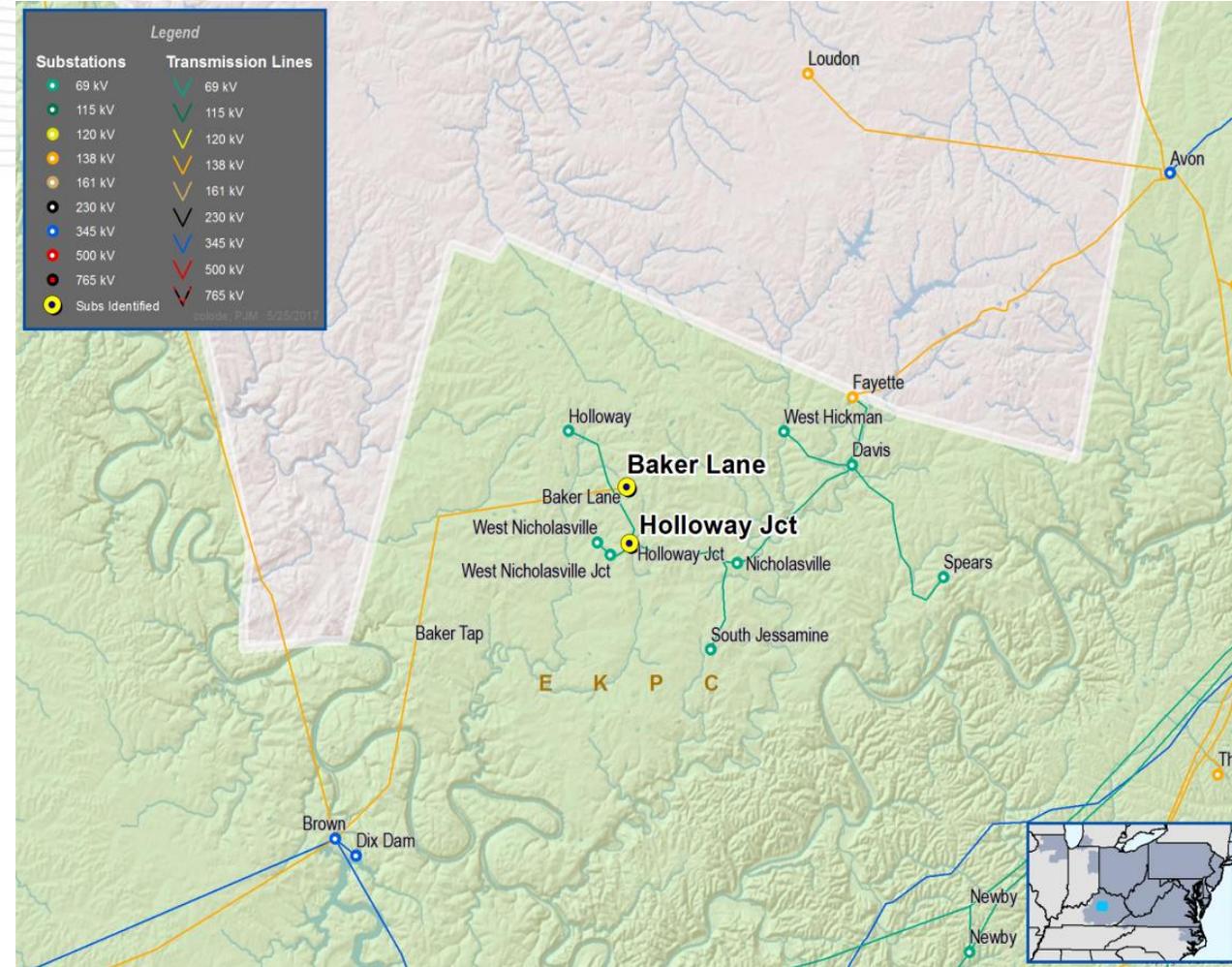
Potential Solution: Increase the Zone 3 distance relay setting at Baker Lane associated with the Baker Lane-Holloway Jct. 69 kV line to at least 142 MVA LTE Winter.

Alternatives Considered:

No other alternatives considered.

Estimated Project Cost: \$0

Required IS Date: 12/1/2018



Baseline Reliability - TO Criteria Violation

Overload of Clay Village - KU Clay Village 69 kV Tap during an outage of the KU Ghent – Owen Co- Scott Co 138 kV line section.

Potential Solution:

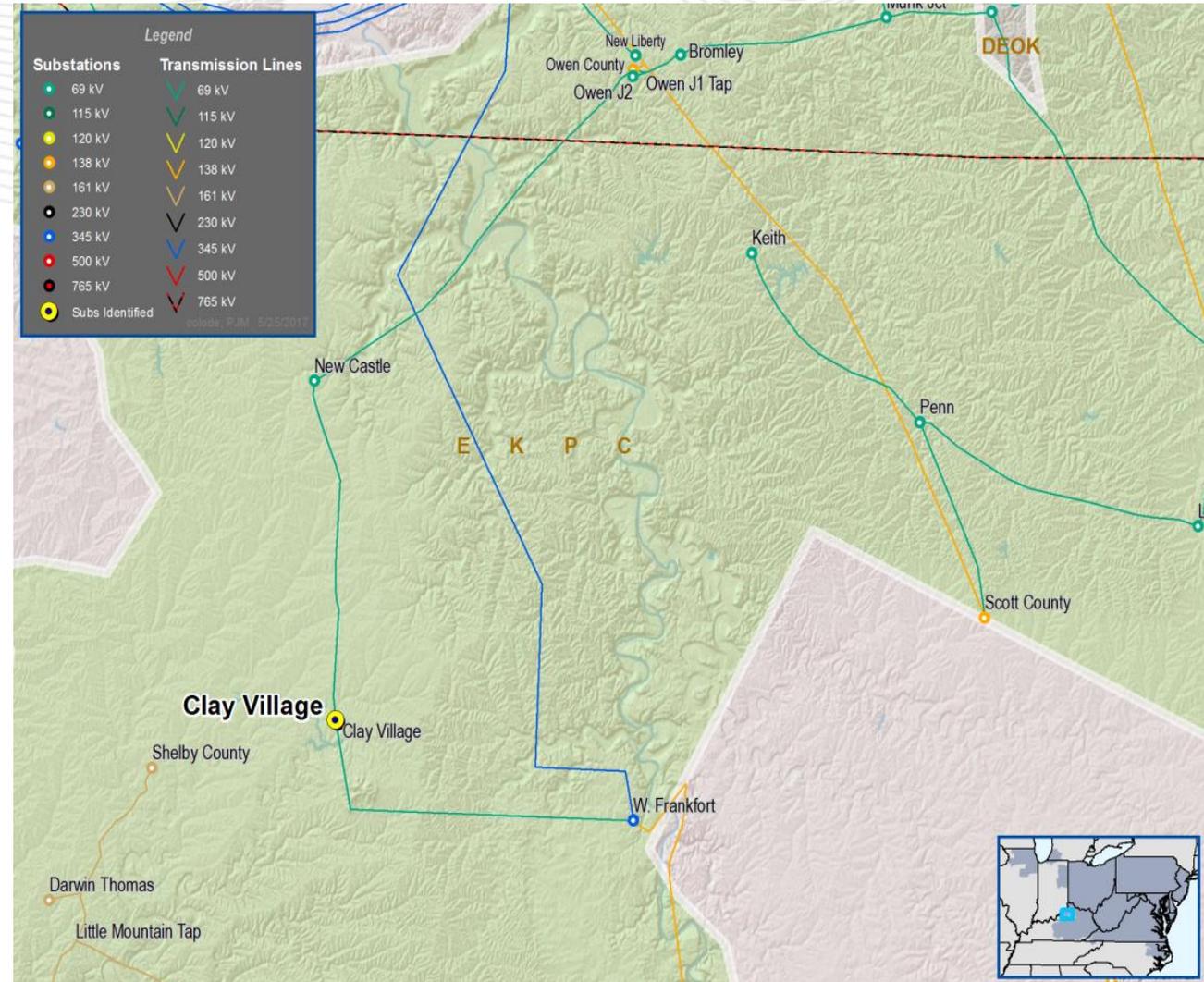
Upgrade the metering CT associated with the Clay Village - KU Clay Village 69 kV Tap line section to 600 A; at least 64 MVA Winter LTE;
Upgrade the distance relay associated with the Clay Village - KU Clay Village 69 kV Tap line section to at least 64 MVA Winter LTE.

Alternatives Considered:

No other alternatives were considered.

Estimated Project Cost: \$0.125M

Required IS Date: 12/1/2024



Baseline Reliability - TO Criteria Violation

Overload of the Dale - JK Smith 138 kV line section.

Potential Solution:

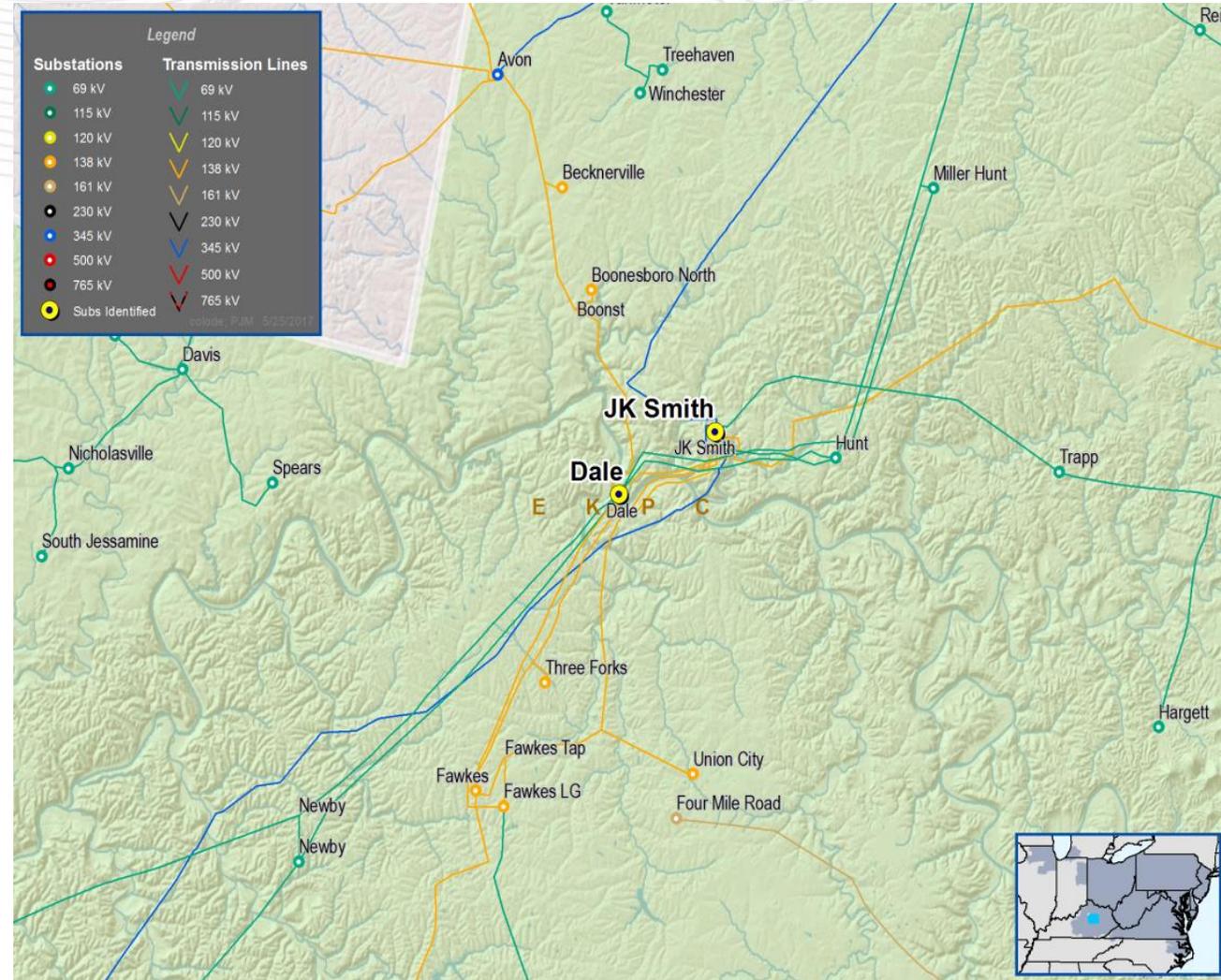
Upgrade the distance relay associated with Dale-JK Smith 138 kV line section to 362 MVA normal rating.

Alternatives Considered:

No other alternatives considered.

Estimated Project Cost: \$0

Required IS Date: 12/1/2027



Baseline Reliability - TO Criteria Violation

Overload of Elizabethtown #2 - Tharp 69 kV Tap line section during the loss of KU Rogersville - Rogersville Junction 69 kV line.

Potential Solution:

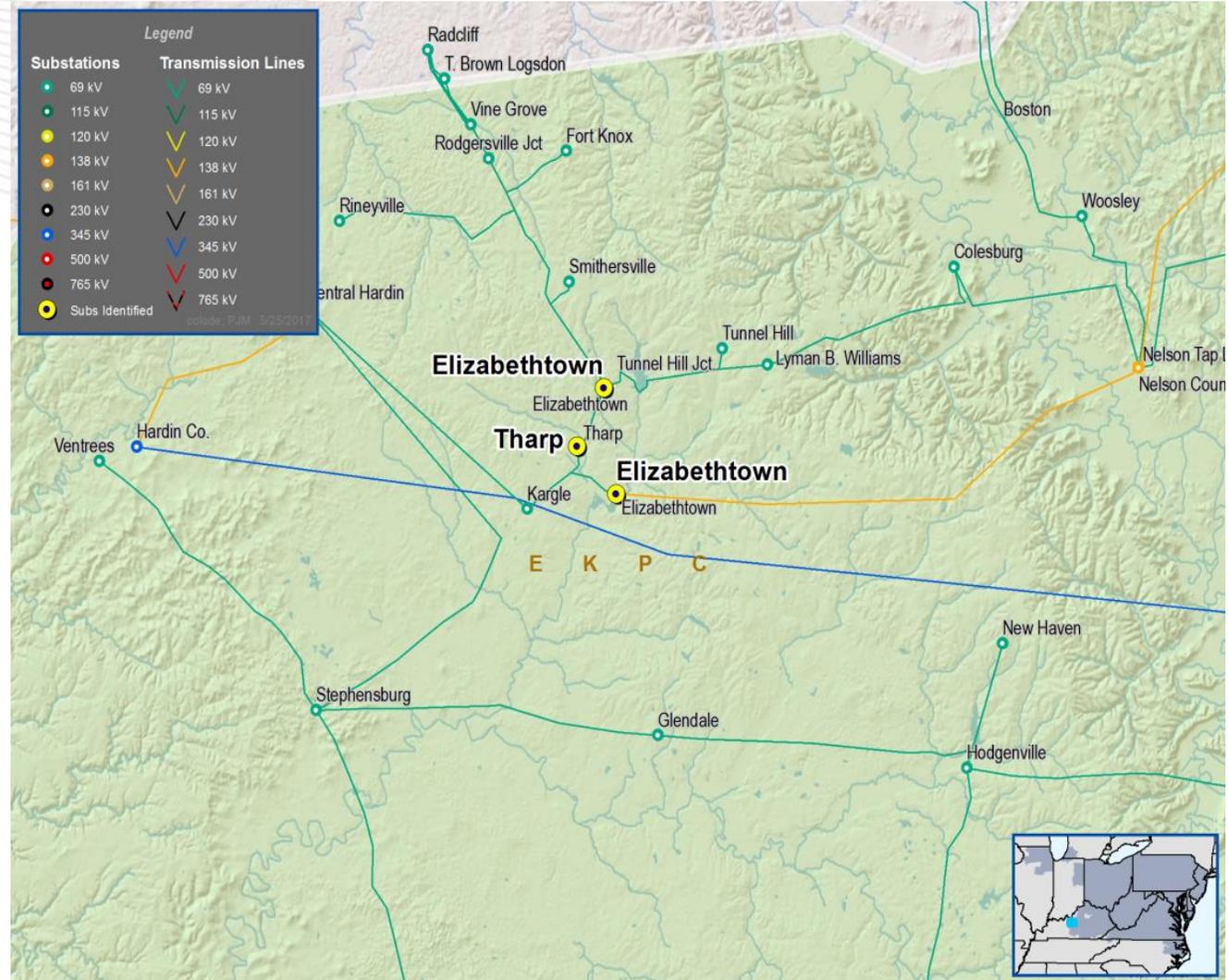
Increase the MOT of the EKPC Elizabethtown - Tharp Tap 69 kV line section (1.7 miles) to 302°F. (LTE at 284°F)

Alternatives Considered:

Rebuild EKPC Elizabethtown #2 - Tharp 69 kV Tap line section.
Estimated Cost of \$900,000.

Estimated Project Cost: \$0.2M

Required IS Date: 12/1/2026



Baseline Reliability - TO Criteria Violation

Overload of the Glendale - Hodgenville 69 kV line section during the loss of KU Elizabethtown - KU Elizabethtown #4 69 kV line section.

Potential Solution:

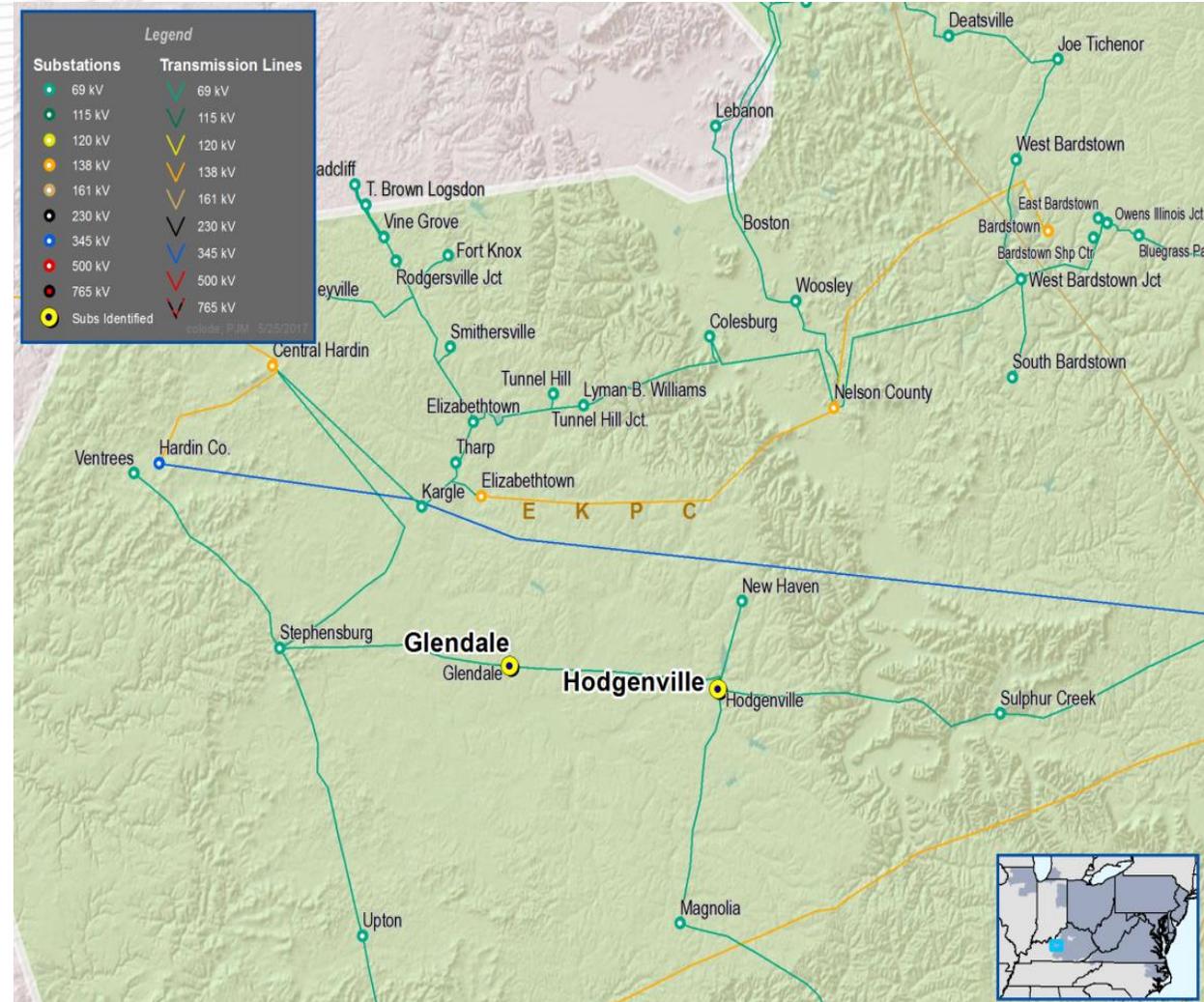
Upgrade the distance relay at the Hodgenville station associated with the Glendale - Hodgenville 69 kV line section to at least 90 MVA Winter LTE.

Alternatives Considered:

No other alternatives considered.

Estimated Project Cost: \$0

Required IS Date: 12/1/2026



Baseline Reliability - TO Criteria Violation

Overload of the Powell County 138-69 kV transformer during the loss of the Powell County – Beattyville 161 kV line section.

Potential Solution:

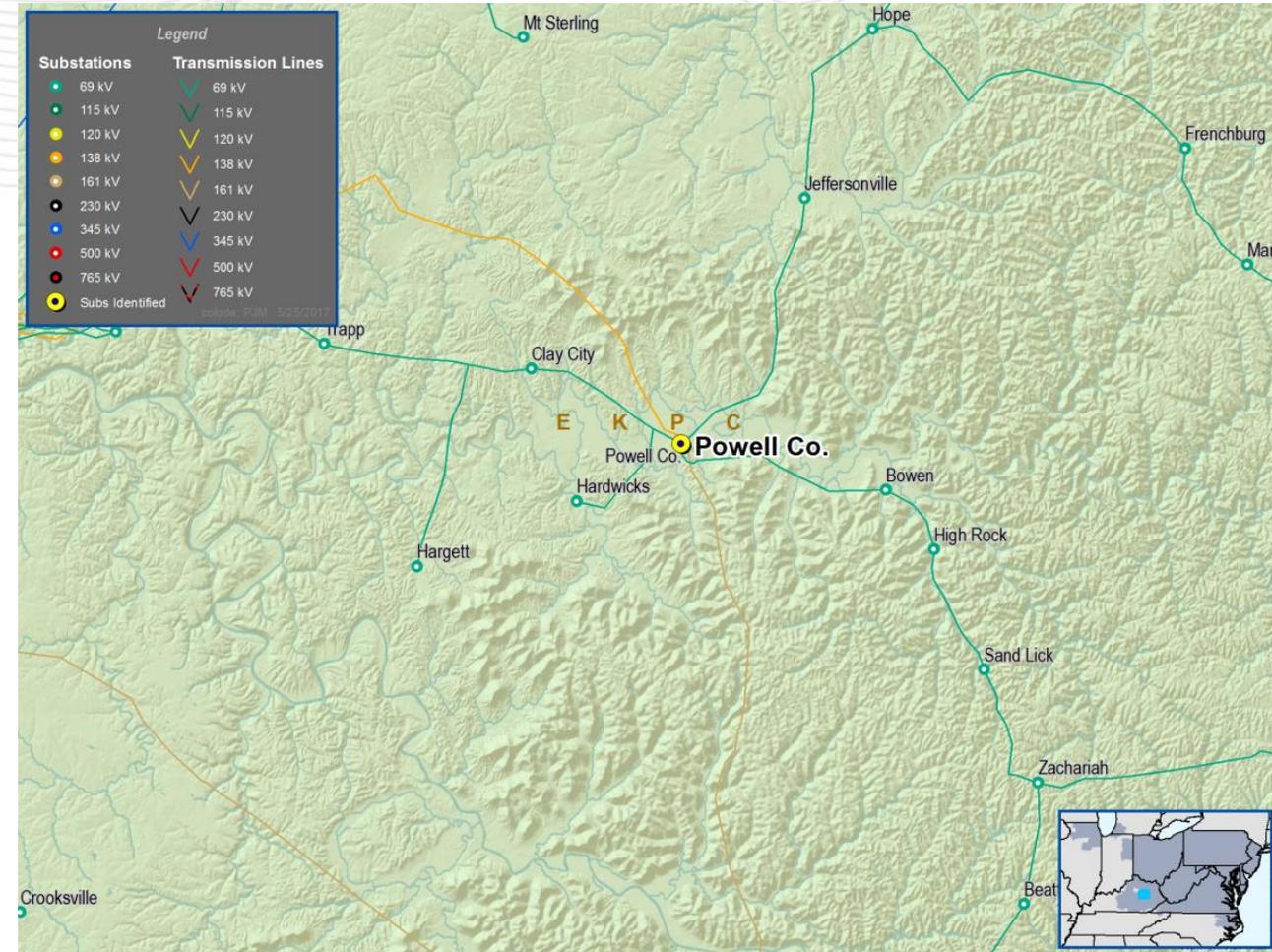
Upgrade the overcurrent relay setting associated with Powell County 138-69 kV transformer to at least 139 MVA Winter LTE.

Alternatives Considered:

No other alternatives considered.

Estimated Project Cost: \$0

Required IS Date: 12/1/2025



Baseline Reliability - TO Criteria Violation

Overload of the KU Russell Springs-Russell Co 69 kV line section during the loss of the Summer Shade - West Columbia 69 kV line.

Potential Solution:

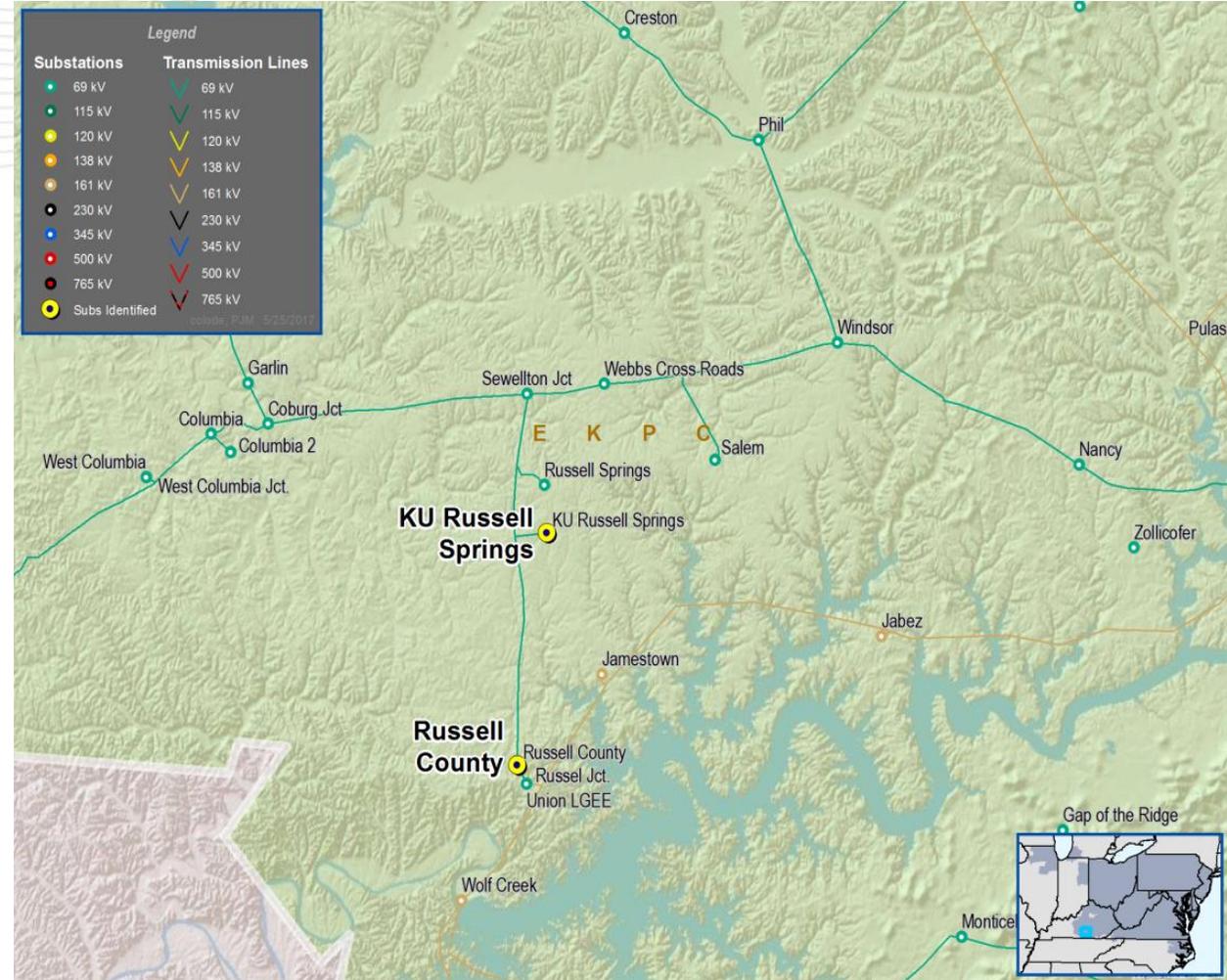
Upgrade the existing S408-605, 600 A KU Russell Springs Tap -Russell County 69 kV disconnect switch to 1200 A.

Alternatives Considered:

No other alternatives were considered.

Estimated Project Cost: \$0.15M

Required IS Date: 12/1/2025



Baseline Reliability - TO Criteria Violation

Overload of the Stephensburg-Glendale 69 kV line section during an outage of the KU Elizabethtown - KU Elizabethtown #4 69 kV line section.

Potential Solution:

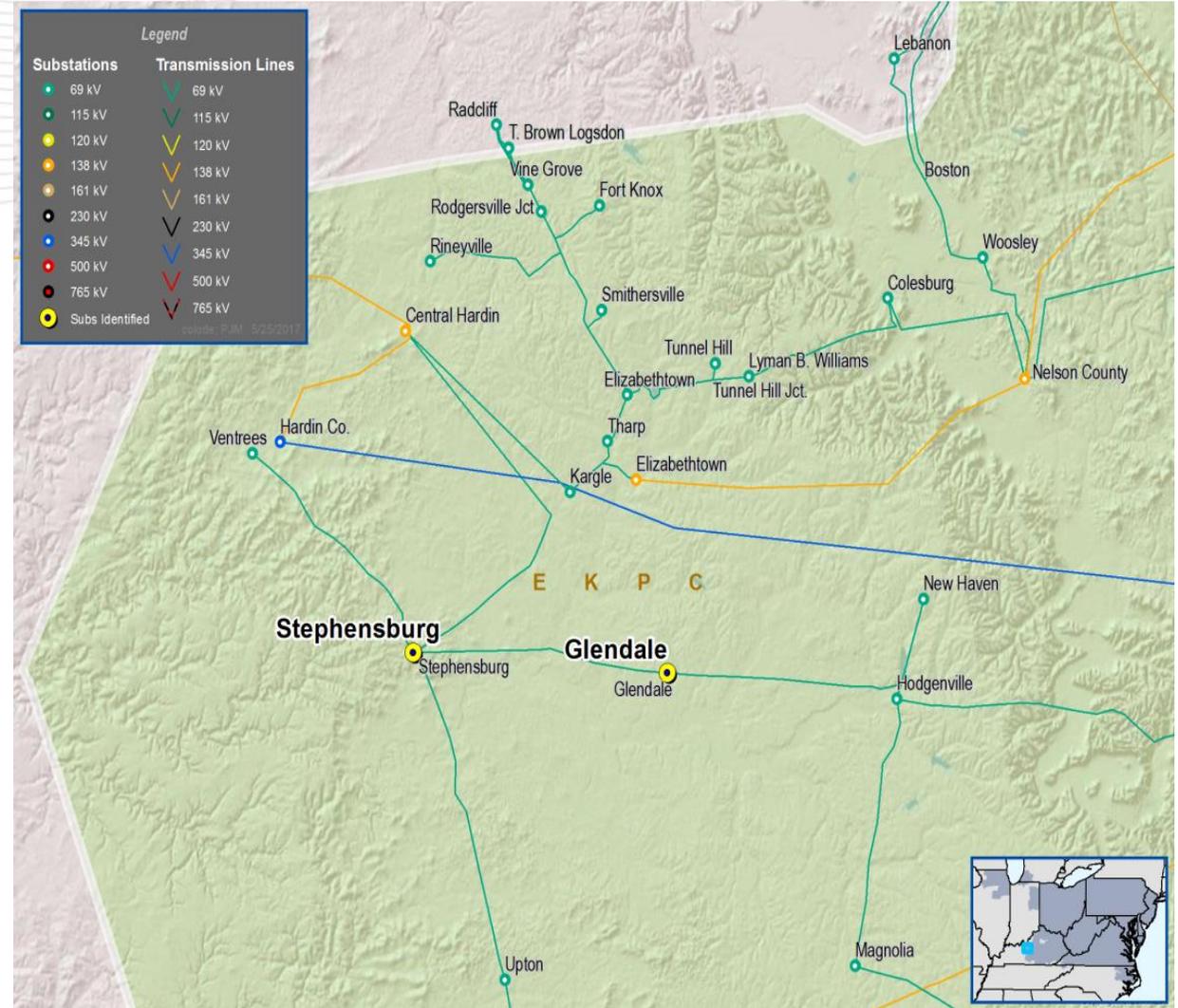
Upgrade distance relay at the Stephensburg station associated with Stephensburg - Glendale 69kV line section to at least winter LTE 100 MVA.

Alternatives Considered:

No other alternatives were considered.

Estimated Project Cost: \$0

Required IS Date: 12/1/2024



Baseline Reliability - TO Criteria Violation

Overload of the Tharp Tap - KU Elizabethtown 69 kV line section during the loss of the Rogersville – Rogersville Jct. 69 kV line section.

Potential Solution:

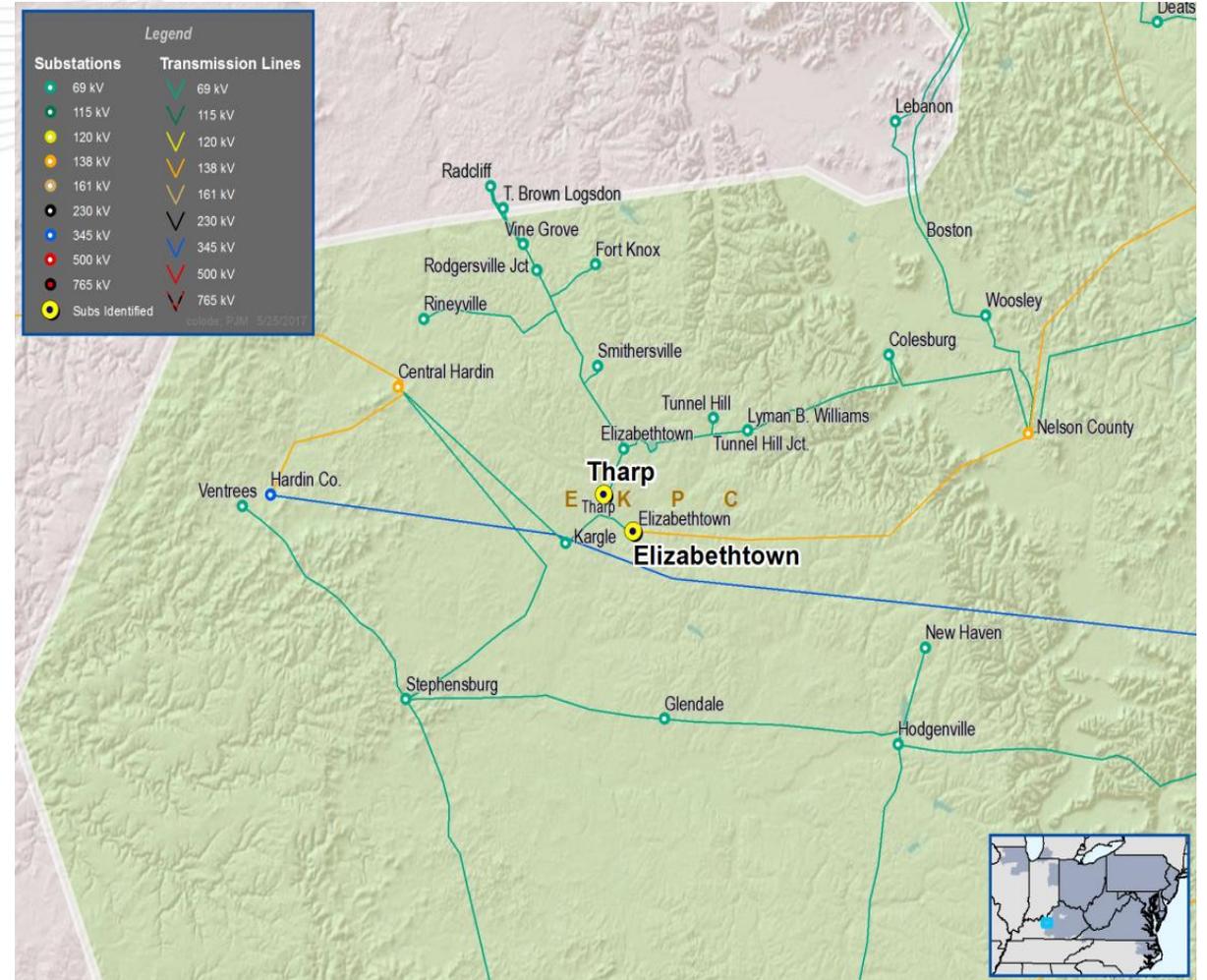
Rebuild Tharp Tap-KU Elizabethtown 69kV line section to 795 MCM (2.11 miles).

Alternatives Considered:

A maximum operating temperature increase was considered, but did not mitigate the overload.

Estimated Project Cost: \$1.22M

Required IS Date: 12/1/2024



Baseline Reliability - TO Criteria Violation

Low voltage at the Mt. Sterling substation for the loss of the Dale 138-69 kV transformer.

Potential Solution:

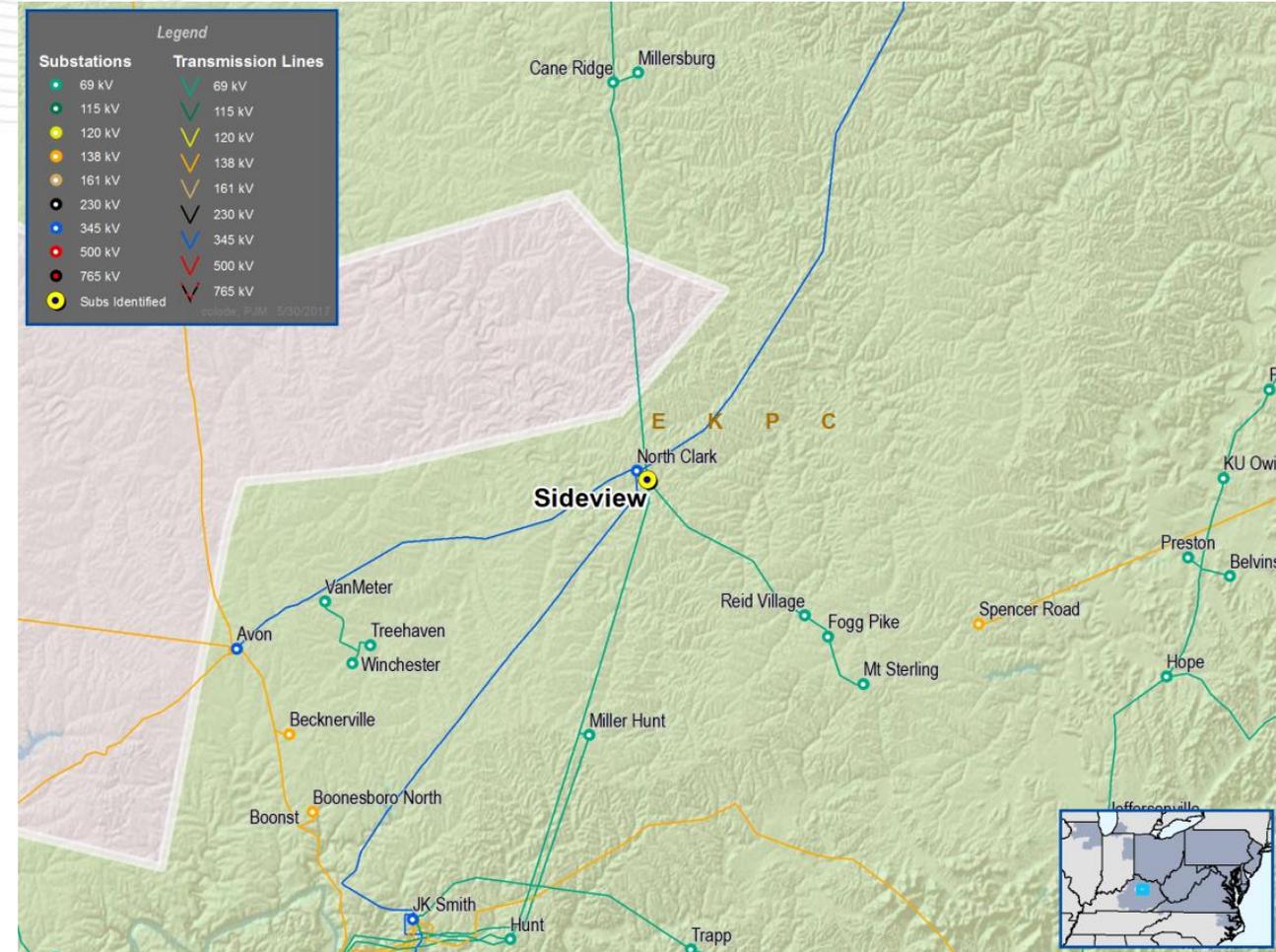
Resize the Sideview 69 kV capacitor bank from 6.12 MVAR to 9.18 MVAR.

Alternatives Considered:

No other alternatives were considered.

Estimated Project Cost: \$0.07M

Required IS Date: 12/1/2023



Baseline Reliability - TO Criteria Violation

Overload of the East Bardstown - KU Bardstown Industrial 69 kV line section during the loss of the Blue Lick 345-161 kV transformer and associated operating guide

Potential Solution:

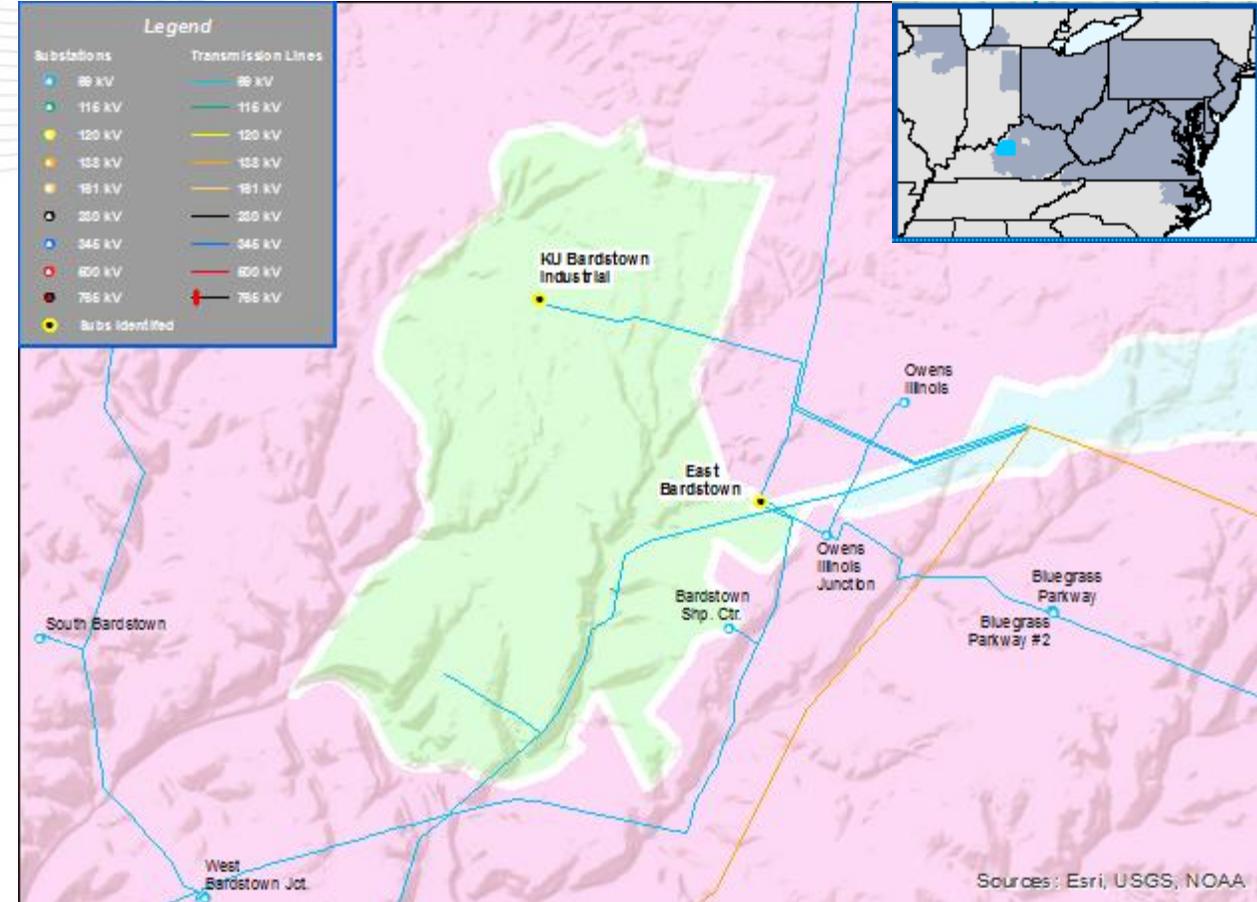
Upgrade the existing metering CTs (Quantity of 2) associated with the East Bardstown - KU Bardstown Industrial Tap 69 kV line section to 1200 A, at least 100 MVA Winter LTE; and upgrade the existing East Bardstown bus and jumpers from 4/0 to 500 MCM Copper

Alternatives Considered:

No other alternatives were considered.

Estimated Project Cost: \$0.25M

Required IS Date: 12/1/2023



Baseline Reliability - TO Criteria Violation

Overload of the West Berea 138-69 kV transformer during the loss of the Crookesville-Fawkes 69kV line.

Potential Solution:

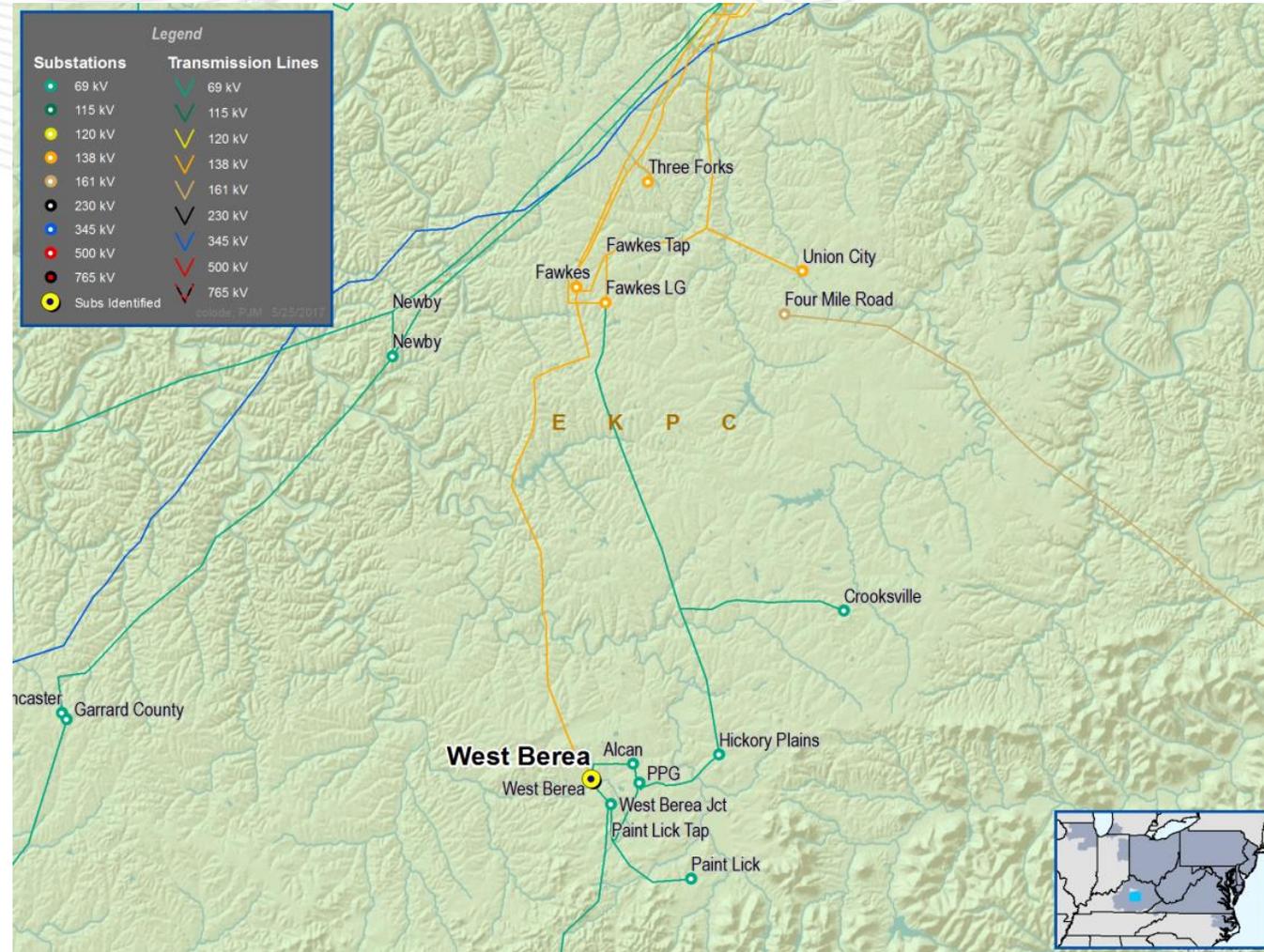
Replace the existing 100 MVA 138-69 kV transformer bank at the West Berea substation with a 150 MVA transformer.

Alternatives Considered:

No other alternatives were considered

Estimated Project Cost: \$1.725M

Required IS Date: 12/1/2026



Baseline Reliability - TO Criteria Violation

Overload of the Three Links Jct-West Berea 69 kV line section during the loss of the KU Brown North-Alcalde-Pineville 345kV line section.

Potential Solution:

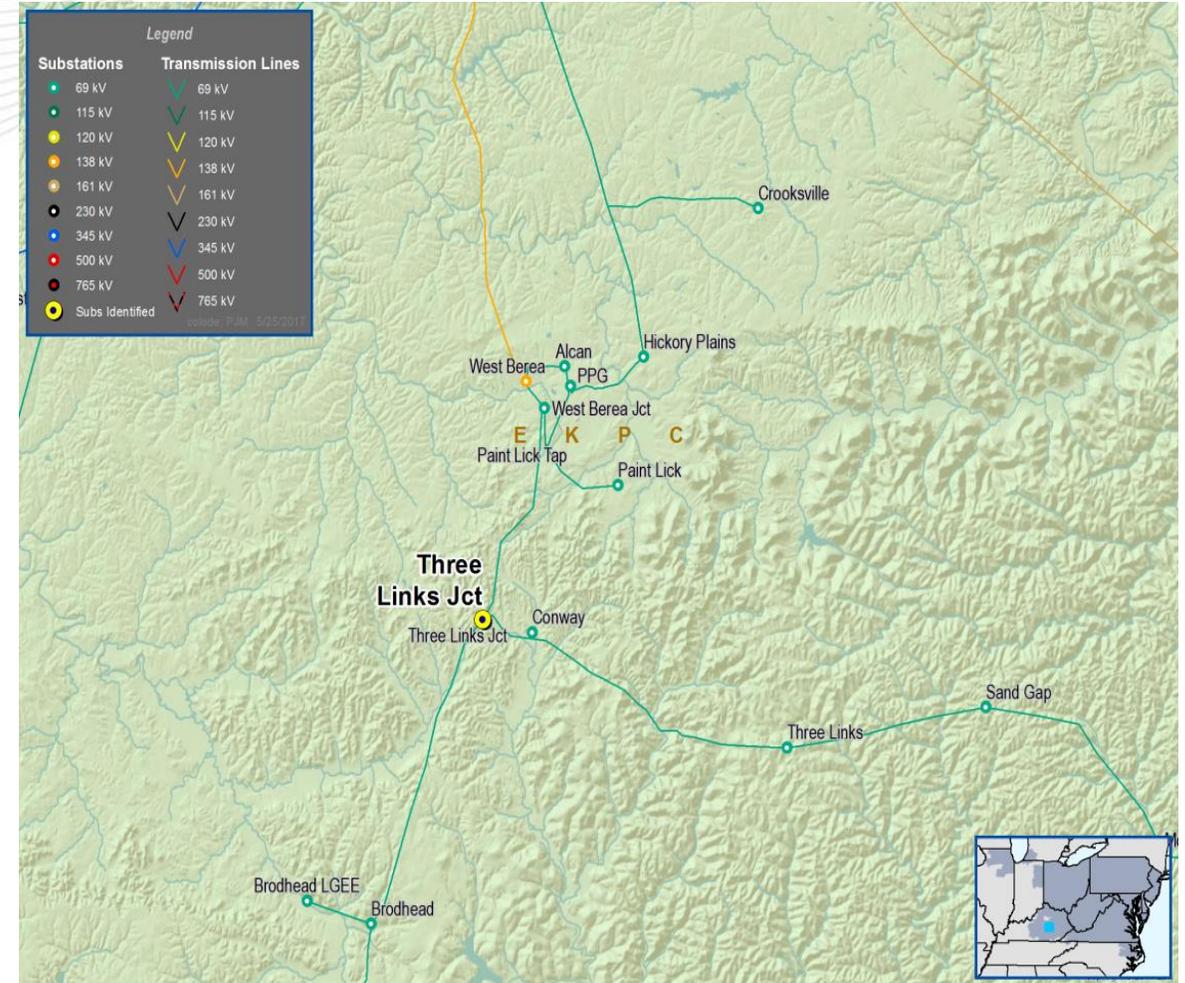
Upgrade the 4/0 bus and jumpers associated with the West Berea Jct. – Three Links Jct 69 kV line to 500 MCM copper or equivalent equipment at the Three Links Jct. substation.

Alternatives Considered:

No other alternatives considered.

Estimated Project Cost: \$0.15M

Required IS Date: 12/1/2026



Baseline Reliability - TO Criteria Violation

Low voltage at the Powell Taylor 69 kV station during the loss of the KU Florida Tile Tap-Lawrenceburg 69kV line section.

Potential Solution:

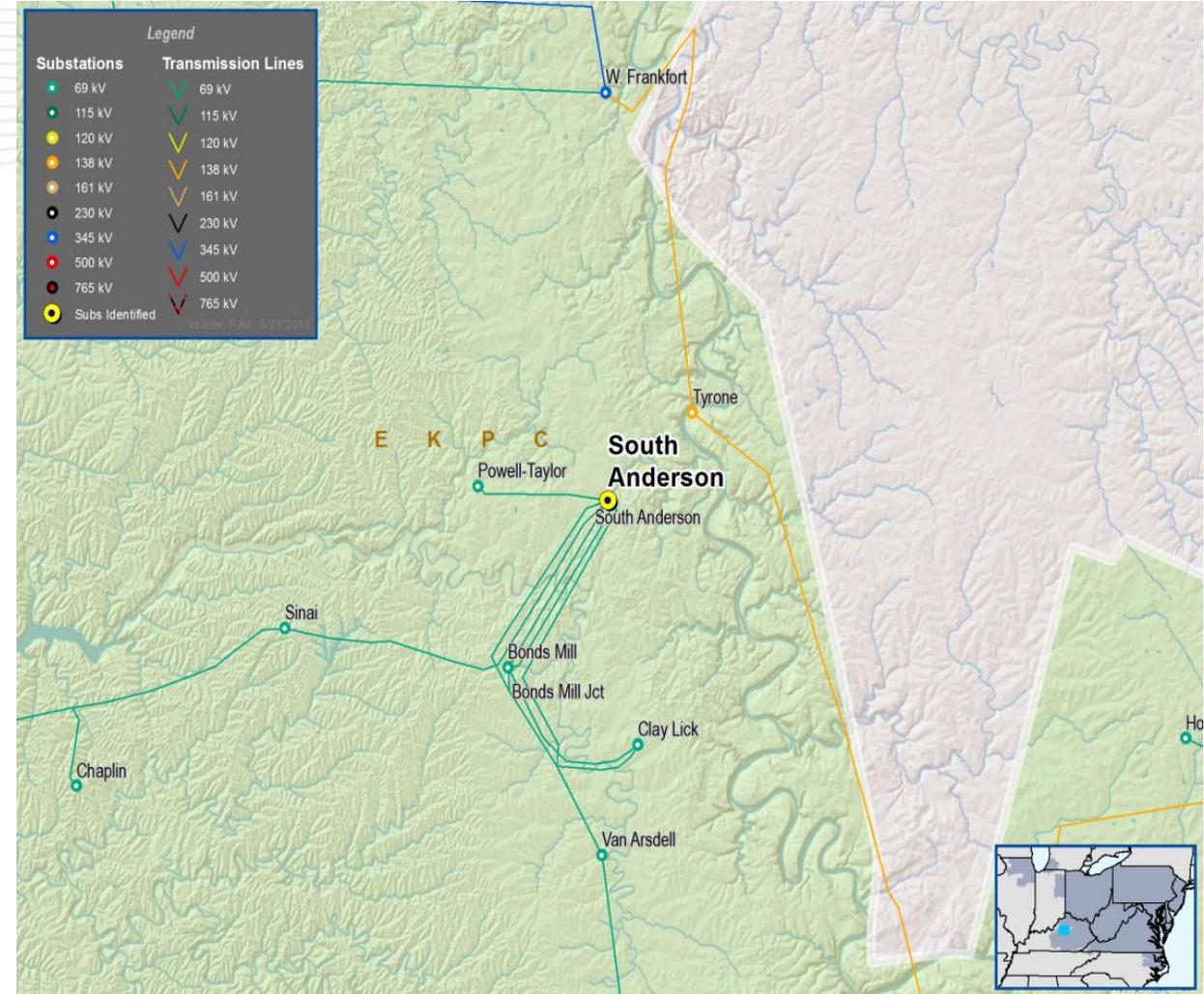
Install a 69 kV, 15.31 MVAR capacitor bank at South Anderson substation.

Alternatives Considered:

Rebuild the South Anderson-Powell Taylor 69kV line section (4.7 miles) and increase the conductor size from 266 ACSR to 556.5 ACT. Estimated cost - \$2.4 Million

Estimated Project Cost: \$0.365M

Required IS Date: 12/1/2026



Baseline Reliability - TO Criteria Violation

Low voltage on the EK Bromley 69 kV bus during the loss of the Owen County Jct 1 – EK Bromley 69 kV line section.

Potential Solution:

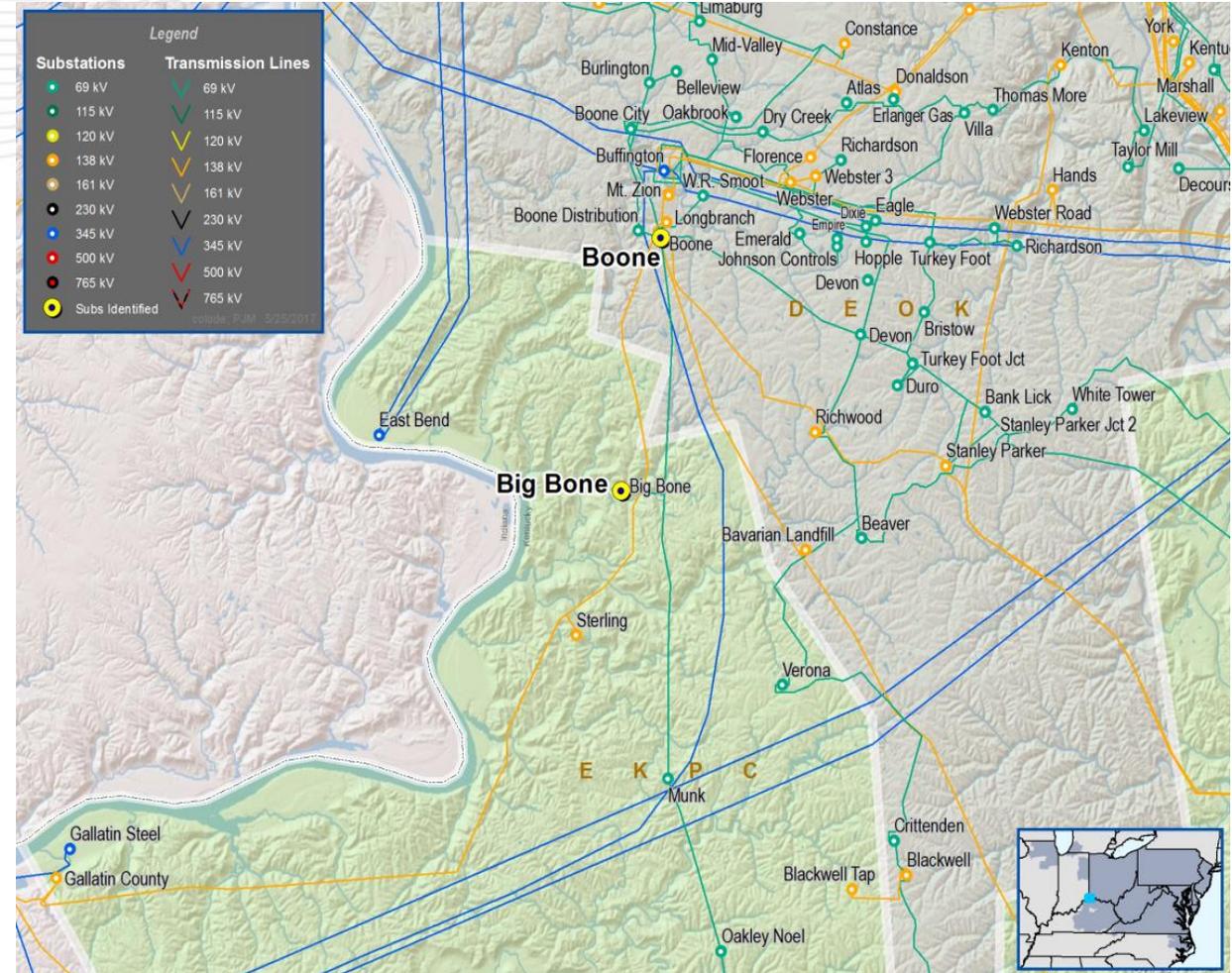
Rebuild Boone - Big Bone Tap 69 kV line section using 556.5 MCM ACTW conductor (6.3 miles).

Alternatives Considered:

No other alternatives were considered.

Estimated Project Cost: \$3.625M

Required IS Date: 12/1/2025



Project Scope Change: S1167 (Previously presented at 7/26/2016 SRRTEP - West)

Original Scope: Rebuild the existing 266.8 MCM ACSR Dale-Hunt 69 kV line section using 556.5 MCM ACSR/TW conductor

Original Estimated Project: \$3.84M

Original Projected IS Date: 12/1/2018

Preliminary New Scope: Construct a new 138-69 kV station at Hunt, including the loop in the existing Dale-JK Smith 138 KV line section. This solution includes the retirement of both of the existing Dale – Hunt 69 kV line sections.

New Estimated Project: \$7.01M

New Projected IS Date: 12/1/2020

Problem Statement:

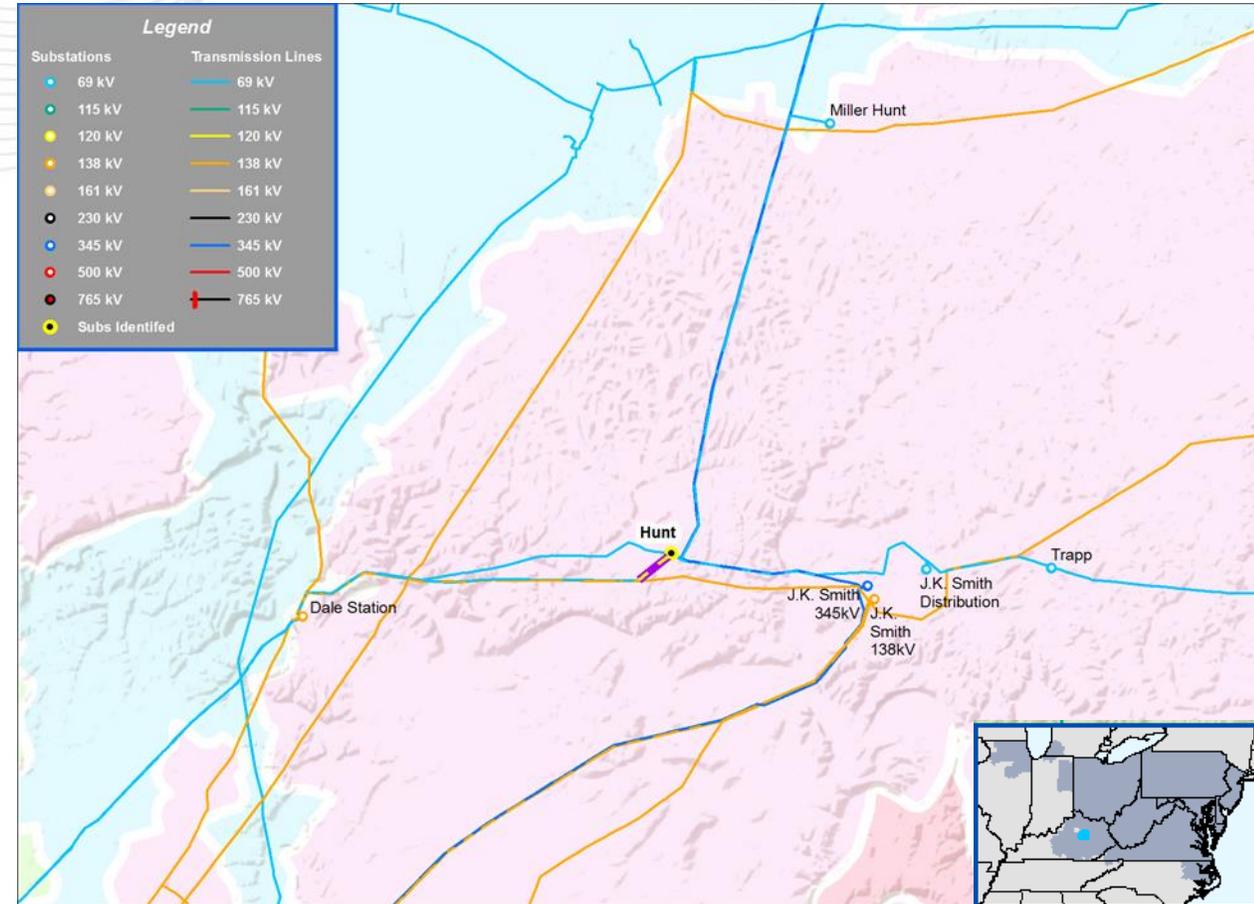
Operational Flexibility and Efficiency -- EKPC's Reliability Team assessed the conductor condition on several older line sections across the system. The Dale - Hunt 69 kV Line section (~6.9 miles) is 63 years old, and the evaluation of this line section resulted in the recommendation to address it because of age and conductor condition. 6.4 miles of this line section is double circuit, and both circuits need to be addressed. When identifying a solution to address the conductor condition, EKPC also looked for alternatives that addressed other system issues in this areas. These other issues considered were: provide operational flexibility (maintenance outages, switching options), minimize transmission losses, reduce risk of simultaneous outages, make it easier to expand the system when needed in the future, and improve the condition of the Hunt distribution substation (built in 1955).

Alternatives Considered:

Rebuild the double circuit line section from Dale - Hunt. Estimated cost of \$7.92 Million. This option does not address all of the concerns listed above. (This alternative is previously presented project - s1167).

Rebuild the Dale - Hunt 69 kV line section as a single line, and build a 69 kV switching station at Hunt. Estimated cost of \$6.9 Million. This option does not address all of the concerns listed.

Status: Scoping



Supplemental Project

Problem Statement (Scope and Need/Drivers):

Customer Service -- New 5 MW load addition to a nearby Industrial Park

Potential Solution:

Construct a new Duncannon Lane 69-13.2 kV 12/16/20 MVA base substation between KU Fawkes-Crooksville. Tap point 7.5 mile from KU Fawkes towards Crooksville and associated 69 KV tap line (1.0 miles).

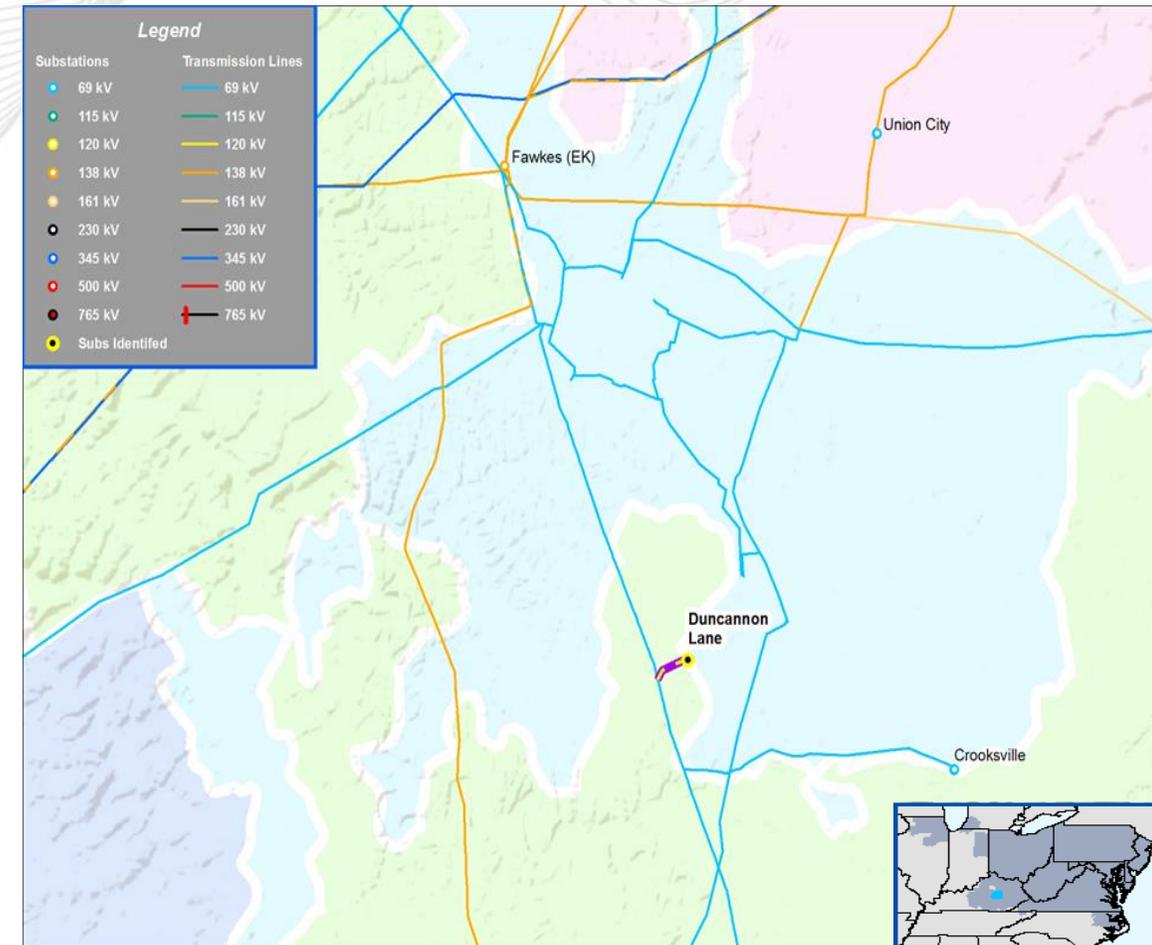
Alternatives Considered:

The EKPC Member System Cooperative could not serve this new load from their existing distribution system. No other alternatives were considered.

Estimated Project Cost: \$2.45M

Projected IS Date (Expected IS Date): 6/1/2018

Status: Engineering



Supplemental Project

Problem Statement (Scope and Need/Drivers):

Equipment Material Condition, Performance and Risk --The Boone County station contains switches with cap and pin insulators, which have been known to become brittle and break. The bus and jumpers will also be replaced during this work because of age and condition related concerns. This station was built in 1956.

Potential Solution:

Replace all of the cap and pin insulators, switches, bus, and jumpers on the 69 kV portion of this station.

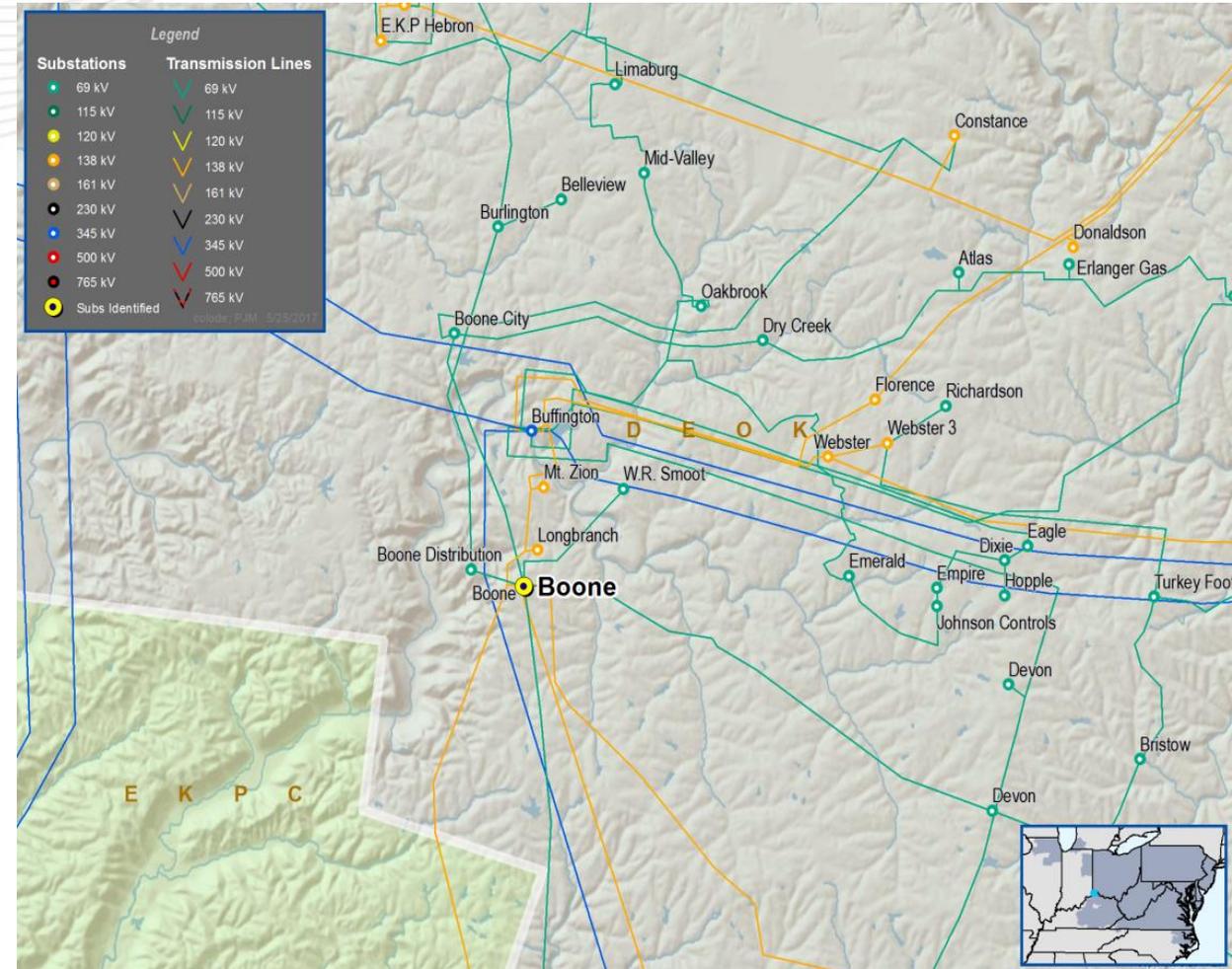
Alternatives Considered:

No other alternatives were considered.

Estimated Project Cost: \$0.548M

Projected IS Date (Expected IS Date): 12/1/2017

Status: Engineering





EKPC Transmission Zone Supplemental Project

Supplemental Project

Problem Statement (Scope and Need/Drivers):

Customer Service -- Overload of the Tommy Gooch 69/25KV transformer, and number of customers served from a single EKPC distribution station criteria.

Potential Solution:

Construct a new Broughtontown 69-26.4 kV, 12/16/20 MVA Distribution Substation and associated 69 KV tap line (7.4 miles). 30 Year NPV \$20.4 Million

Alternatives Considered:

EK Crab Orchard 69-26.4 kV, 12/16/20 MVA New Distribution Substation tapping EKPC's Brodhead-Three Links Jct. line section. 30 Year NPV - \$21.9 Million

EK Crab Orchard 69-26.4 kV, 12/16/20 MVA New Distribution Substation tapping EKPC's Tommy Gooch-Highland line section. 30 Year NPV - \$20.95 Million

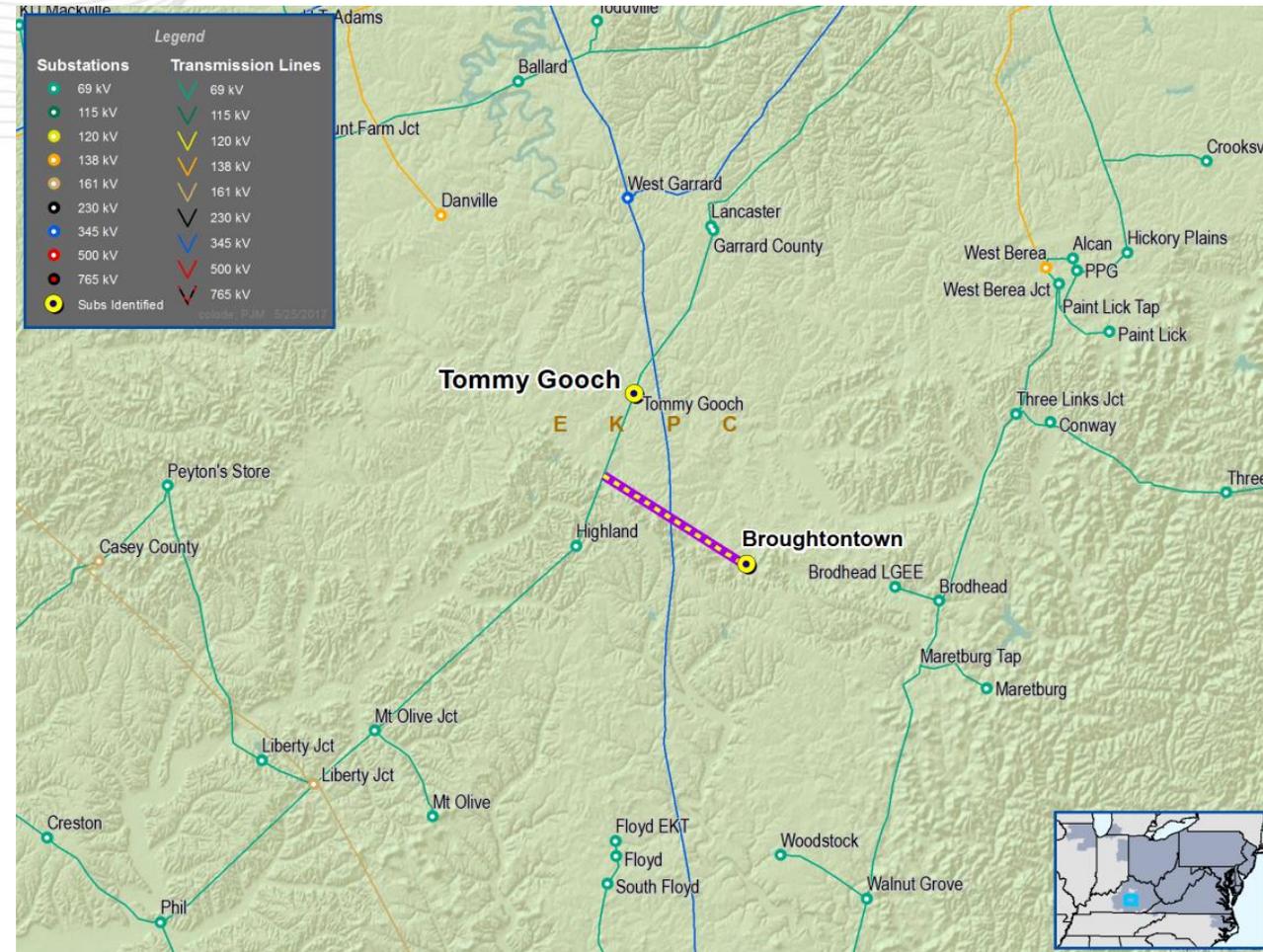
Broughtontown 69-26.4 kV, 12/16/20 MVA New Distribution Substation tapping LGE/KU's Brodhead-Crab Orchard Tap line section. 30 Year NPV \$23.1 Million

Broughtontown 69-26.4 kV, 12/16/20 MVA New Distribution Substation tapping EKPC's Maretburg Tap-Walnut Grove line section. 30 Year NPV \$22.2 Million

Estimated Project Cost: \$8.02M

Required IS Date: 12/1/2021

Status: Scoping



Supplemental Project

Problem Statement (Scope and Need/Drivers):

Customer Service -- Overload of the Holloway 69/12.4 KV distribution transformer, Overload of the West Nicholasville #1 distribution transformer, and Member System distribution reliability concerns.

Potential Solution:

Construct a new Pekin Pike 69-13.2 kV, 12/16/20 MVA Distribution Substation & 6.4 Mile 69 kV Tap Line. 30 Year NPV \$15.6 Million

Alternatives Considered:

New 138-13.2 kV, 12/16/20 MVA Distribution Substation ("Pekin Pike") and 0.12 mile tap to KU Brown - W. Lexington 138 kV Line. 30 Year NPV \$22.5 Million

New 69-13.2 kV, 12/16/20 MVA Distribution Substation ("Pekin Pike") and 3.5 mile tap to KU West Cliff -Higby Mill 69kV Line. 30 Year NPV \$18.9 Million

New 69-13.2 kV, 12/16/20 MVA Distribution Substation ("Pekin Pike") and 1.35 mile tap to KU Wilmore 69kV Tap. 30 Year NPV \$18.5 Million

New 138-13.2 kV, 12/16/20 MVA Distribution Substation ("Mundys Landing") and 0.19 mile tap to KU Brown - Tyrone 138 kV Line. 30 Year NPV \$27.9 Million

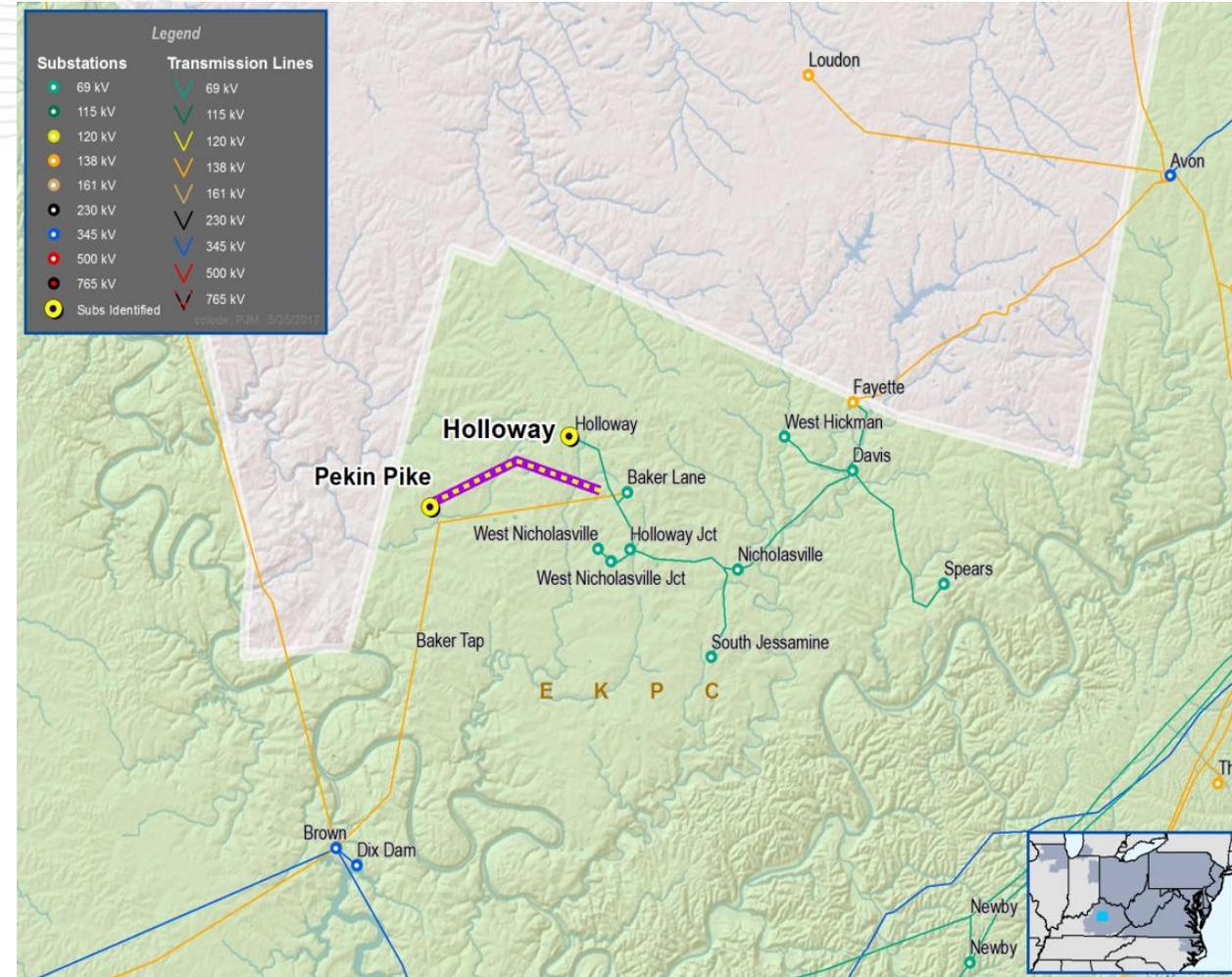
New 69-13.2 kV, 12/16/20 MVA Distribution Substation ("Mundys Landing") and 2.52 mile tap to KU Shakertown - Salvisa 69kV Line. 30 Year NPV \$23.8 Million

New 69-13.2 kV, 12/16/20 MVA Distribution Substation ("Mundys Landing") and 7.4 mile tap to Mercer Co. Ind - Van Arsdell 69kV Line. 30 Year NPV \$24.2 Million

Estimated Project Cost: \$8.21M

Required IS Date: 12/1/2019

Status: Scoping



Supplemental Project

Problem Statement (Scope and Need/Drivers):

Customer Service -- EKPC's Member System Cooperative is expecting a 1.5 MW load addition on the Phil substation in 2019. With this load addition, the Phil 69/25 KV transformer will be overloaded in the winter of 2019/2020.

Potential Solution:

New Contown 69-13.2 kV 12/16/20 MVA substation and associated 69 kV tap line (0.2 Miles).

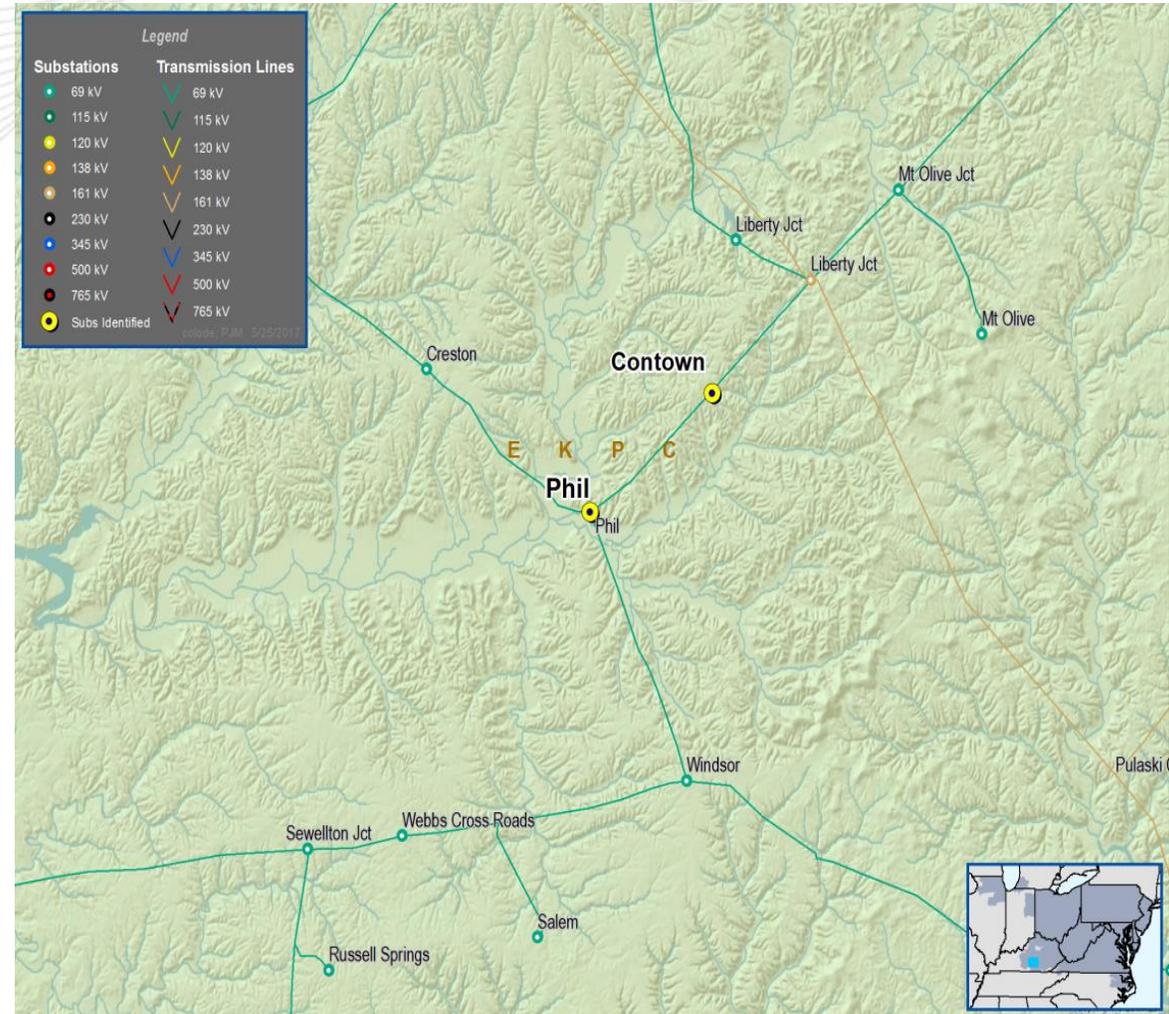
Alternatives Considered:

Upgrade Phil Distribution Substation. Estimated cost (including distribution costs) - \$2.7 Million.

Estimated Project Cost: \$2.3M

Required IS Date: 12/1/2019

Status: Scoping



Supplemental Project

Problem Statement (Scope and Need/Drivers):

Operational Flexibility and Efficiency -- EKPC changed minimum operational requirements to require all transmission lines be capable of an operating temperature of at least 167°F. A program was put in place to upgrade all line sections that did not meet this temperature requirement. This program has been in progress since 2010, and this line will be upgraded to 167°F as part of this program.

Potential Solution:

Increase the MOT of the Oakdale Jct.-Oakdale 69 kV line section (10.5 miles) to 167°F.

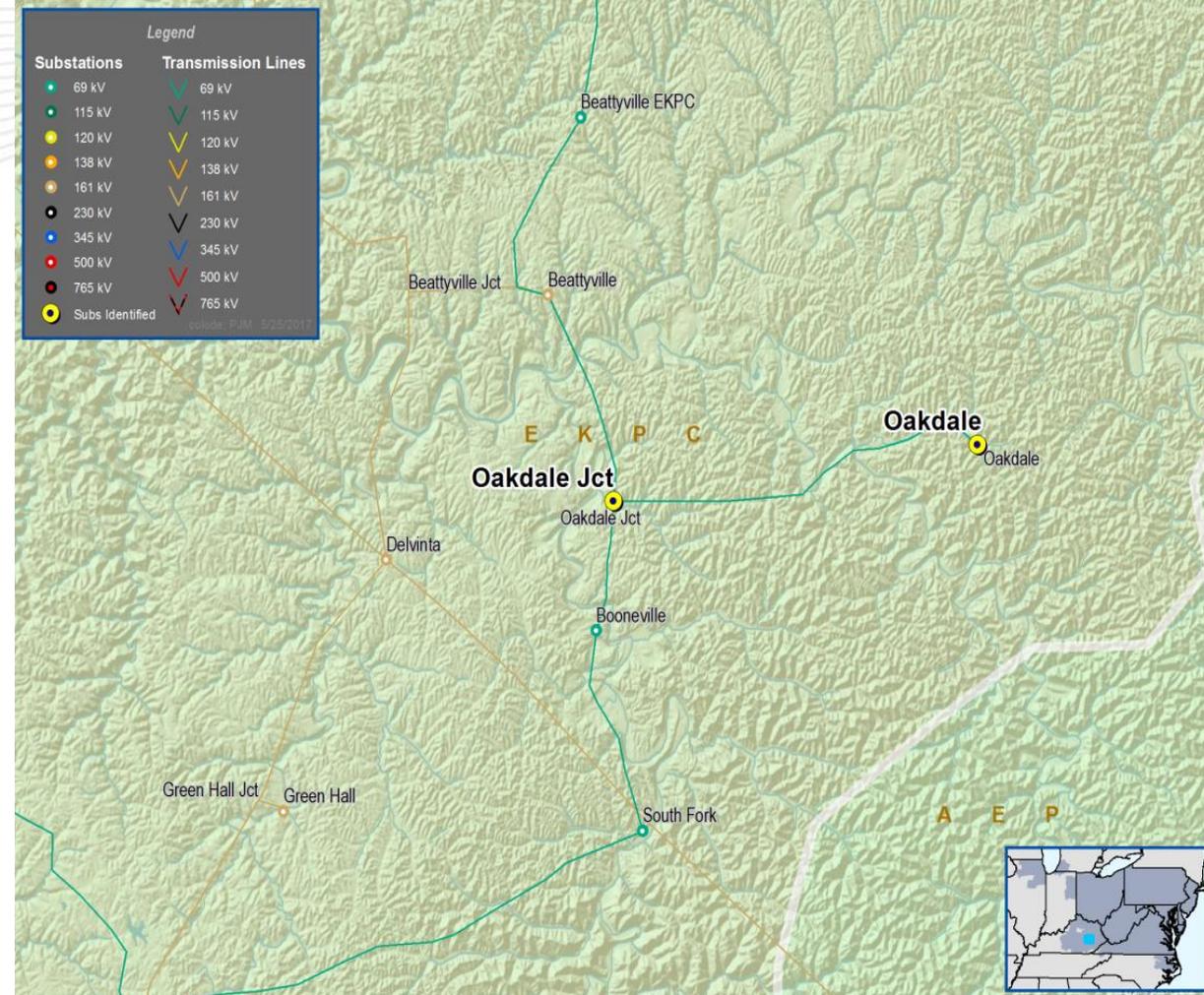
Alternatives Considered:

Rebuild this line section. Estimated cost of \$6.3 Million.

Estimated Project Cost: \$1.0M

Required IS Date: 6/1/2019

Status: Scoping



Short Circuit

Short Circuit Violation

Problem Statement:

The South Canton 138 kV breaker 'K2' is overstressed for a fault at South Canton 138 kV.

Immediate Need:

Due to the immediate need, the timing required for an RTEP proposal window is infeasible. As a result, the local Transmission Owner will be the Designated Entity.

Potential Alternative Solution Considered:

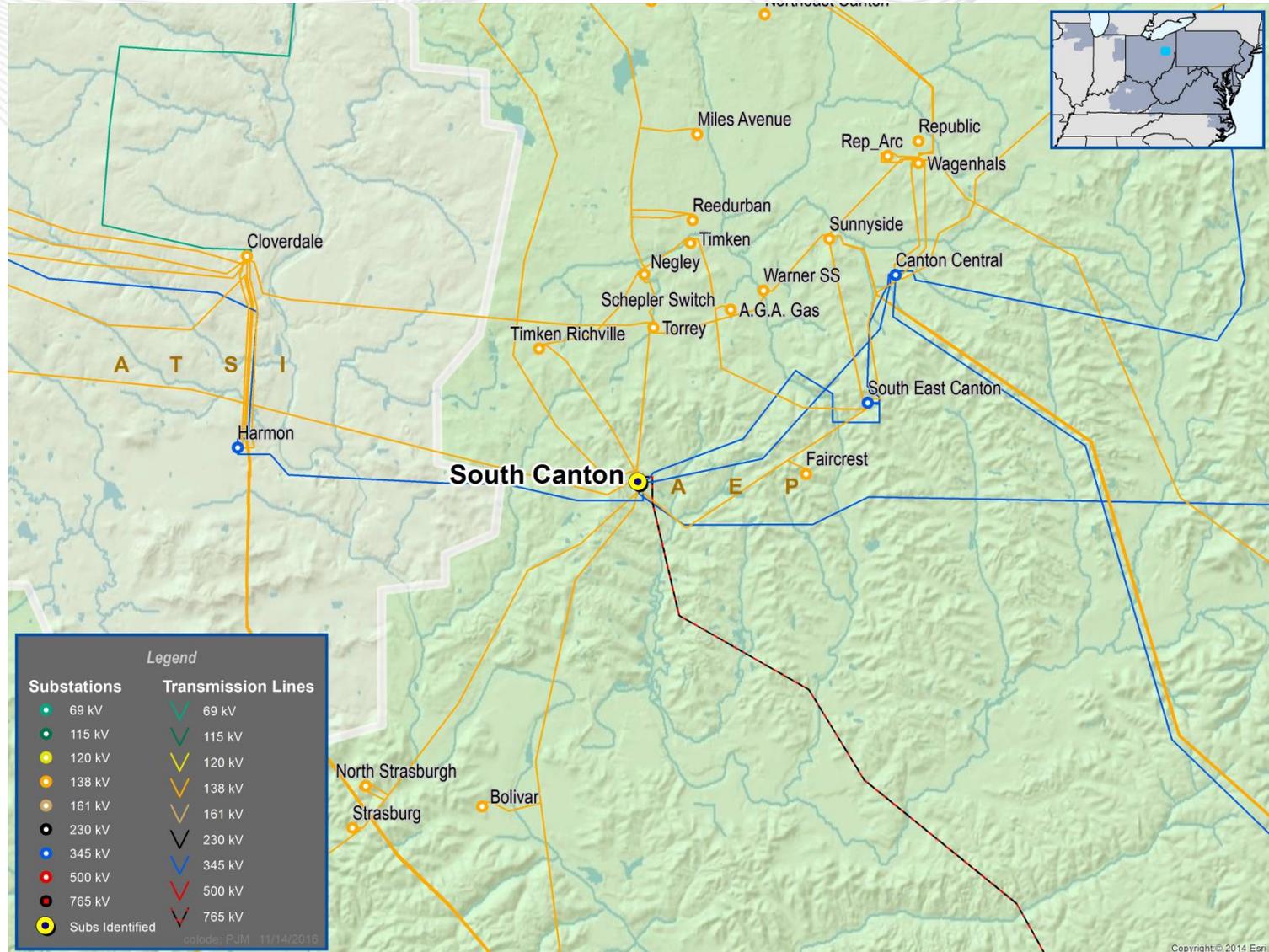
Due to the immediate need of the project no alternatives were considered.

Preliminary Solution:

Replace the South Canton 138 kV breaker 'K2' with an 80 kA breaker .

Estimated Project Cost: \$600 K

Required IS Date: 6/1/2019



Short Circuit Violation

Problem Statement:

The South Canton 138 kV breakers 'M' and 'M2' are overstressed for a fault at South Canton 138 kV.

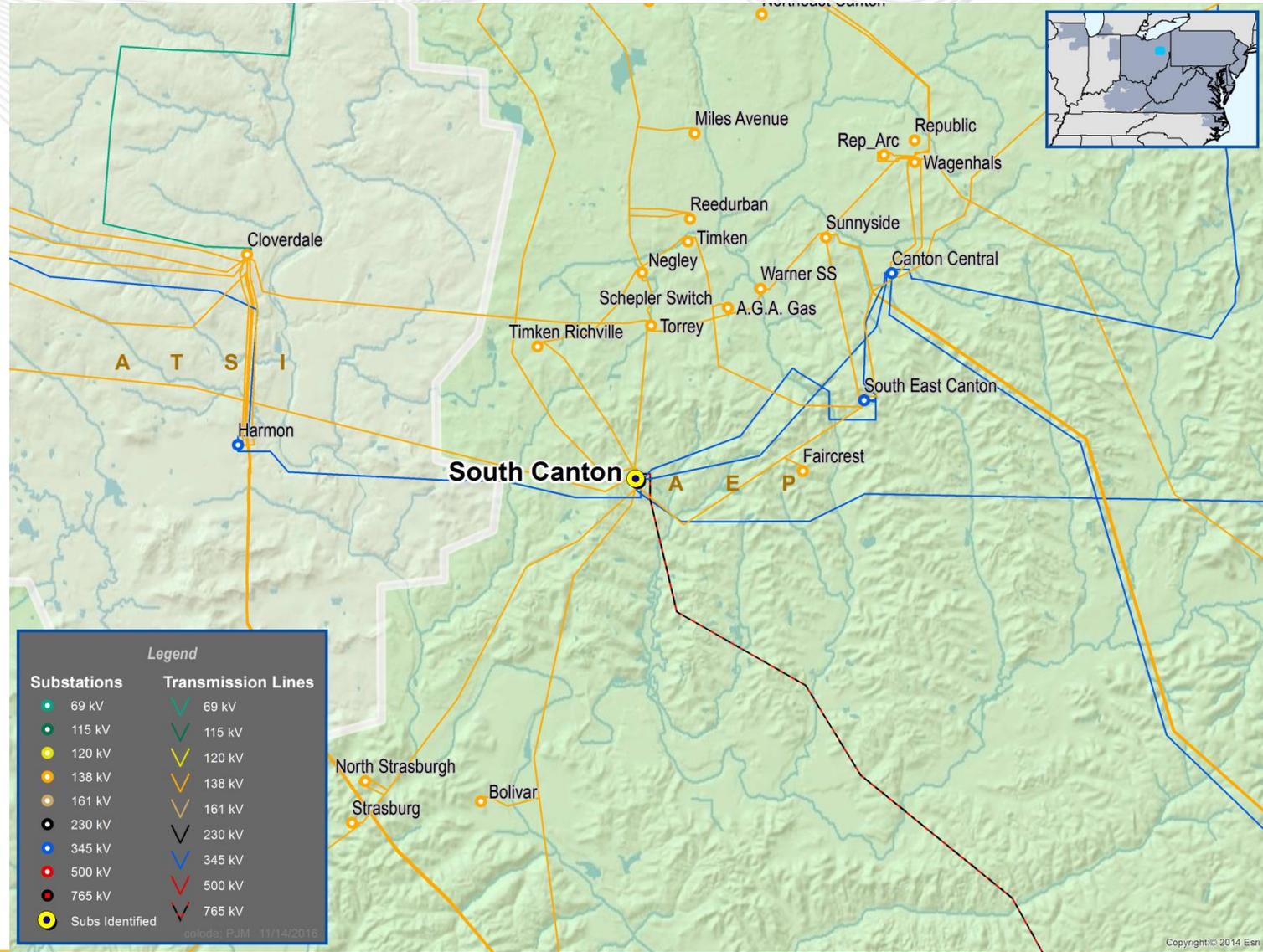
Preliminary Solution:

Replace the South Canton 138 kV breakers 'M' and 'M2' with 80 kA breakers.

Estimated Project Cost: \$600 K per breaker

Required IS Date: 6/1/2022

*Exempt from Proposal Window process per Operating Agreement, Schedule 6,1.5.8 (n).



Short Circuit Violation

Problem Statement:

The Todhunter 138 kV breakers '931', '919', and '913' are overstressed for a fault at Todhunter 138 kV.

Preliminary Solution:

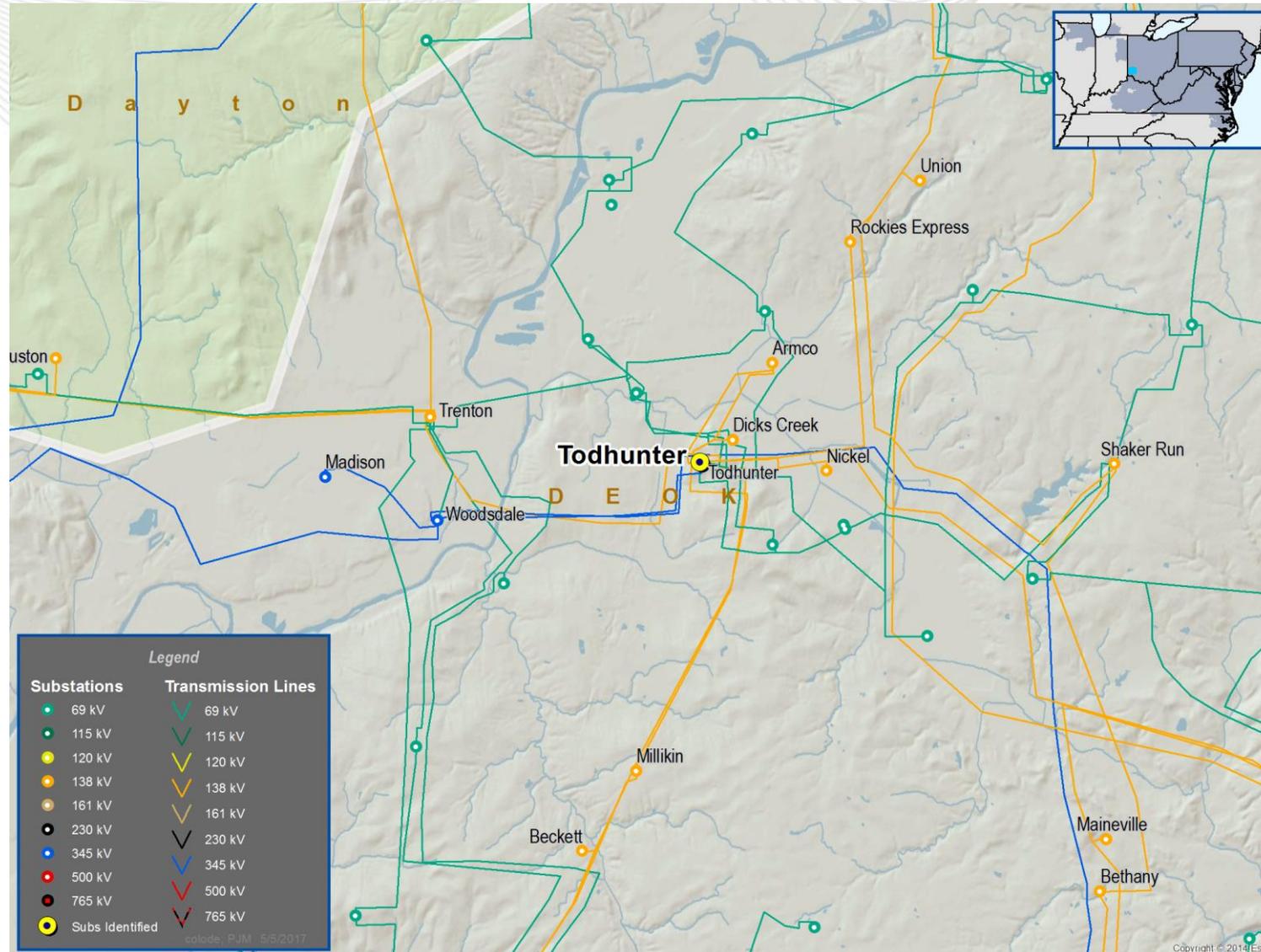
Replace Todhunter 138 kV breakers '931', '919', and '913' with 80 kA breakers (B2894)

Estimated Project Cost: \$1.967 M (total)

Required IS Date: 6/1/2021

Projected IS Date: 6/1/2020

*Exempt from Proposal Window process per Operating Agreement, Schedule 6,1.5.8 (n).



Supplemental Project – S1000 Scope Change

Old Scope:

Replace 138 kV circuit breakers '913', '919', '925', and '931' at Todhunter 138 kV with 80kA interrupting.

New Scope:

Replace Todhunter 138 kV breaker '925' with an 80 kA breaker.

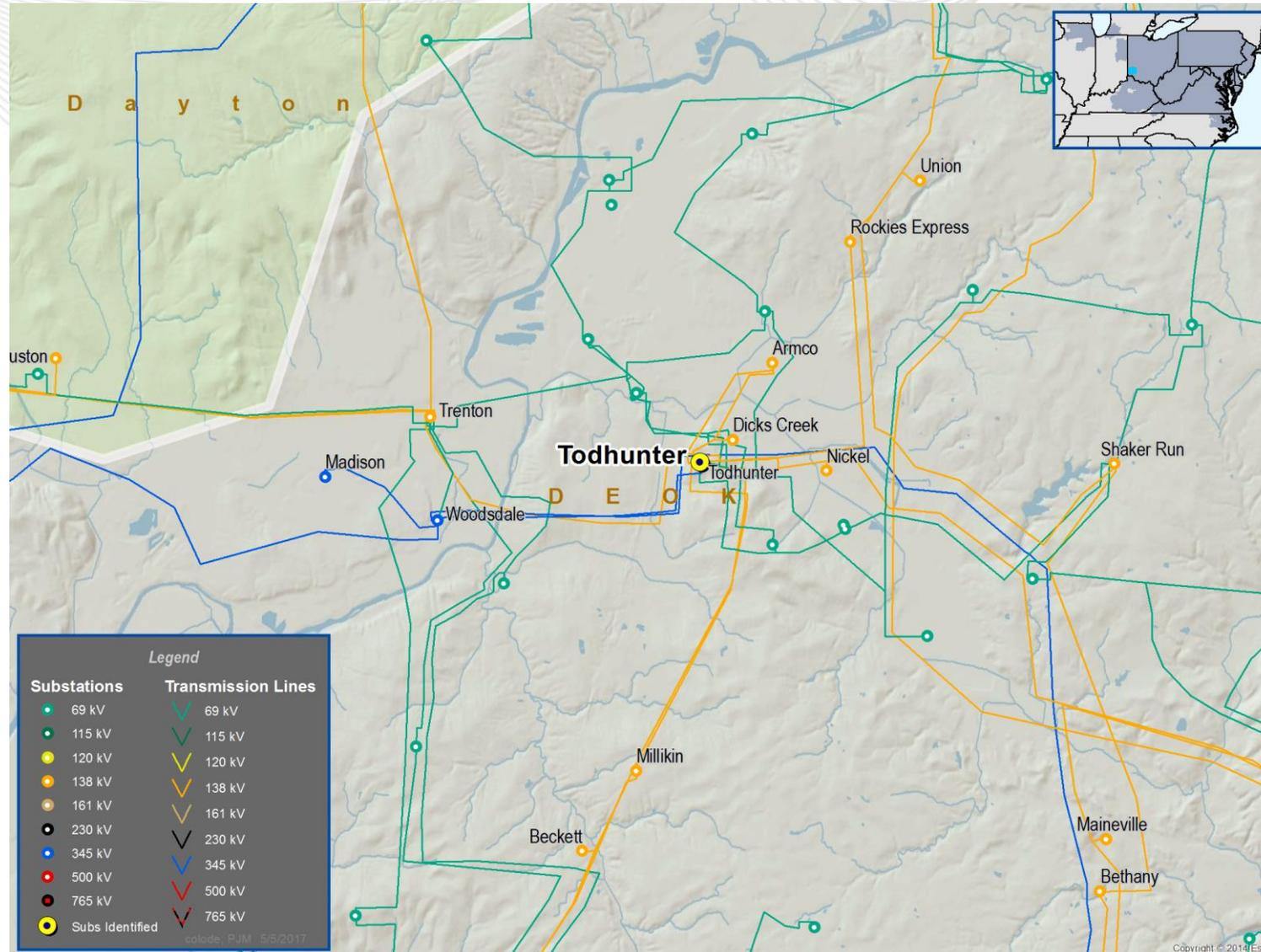
Reason for scope change:

The Todhunter 138 kV breakers '913', '919', and '931' have been previously identified as overdutied in the 2021 short circuit case, and the replacements have been converted into baseline upgrades (see last slide). The 925 breaker replacement remains a supplemental project.

Old Estimated Project Cost: \$2.626 M

New Estimated Project Cost: \$659 K

Projected IS Date: 6/1/2020





DEOK Transmission Area

Short Circuit Violation

Problem Statement:

The Dicks Creek 138kV breaker "963" is overstressed

Immediate Need:

Due to the immediate need, the timing required for an RTEP proposal window is infeasible. As a result, the local Transmission Owner will be the Designated Entity.

Alternatives Considered:

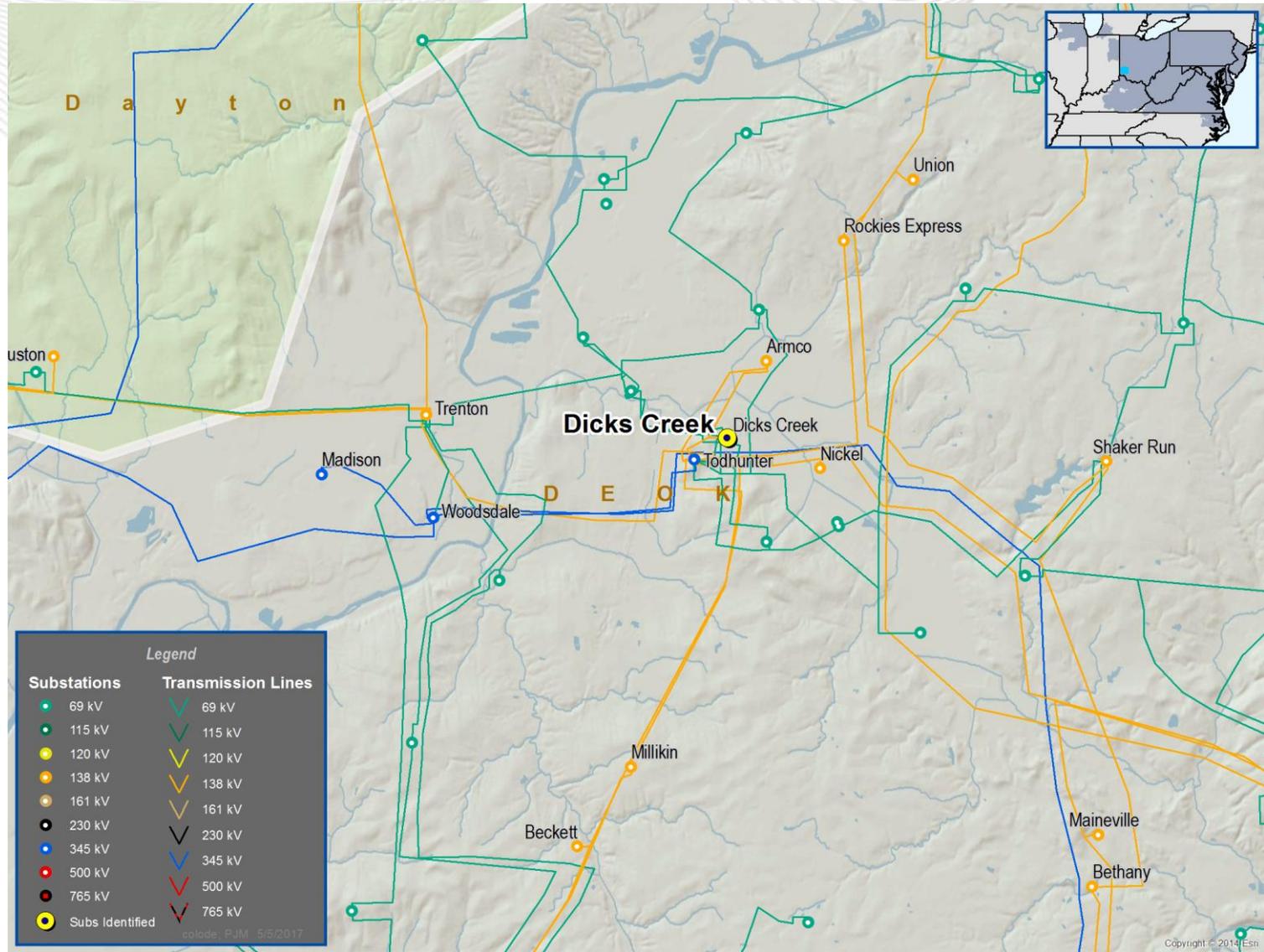
Due to the immediate need of the project no alternatives were considered

Preliminary Solution:

Replace the Dicks Creek 138kV breaker "963" with 63kA breaker

Estimated Project Cost: \$300 K

Required IS Date: June 1, 2019



Previously Presented Baseline and Supplemental Projects Second Review

Additional Scope for Existing Project B2689 Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

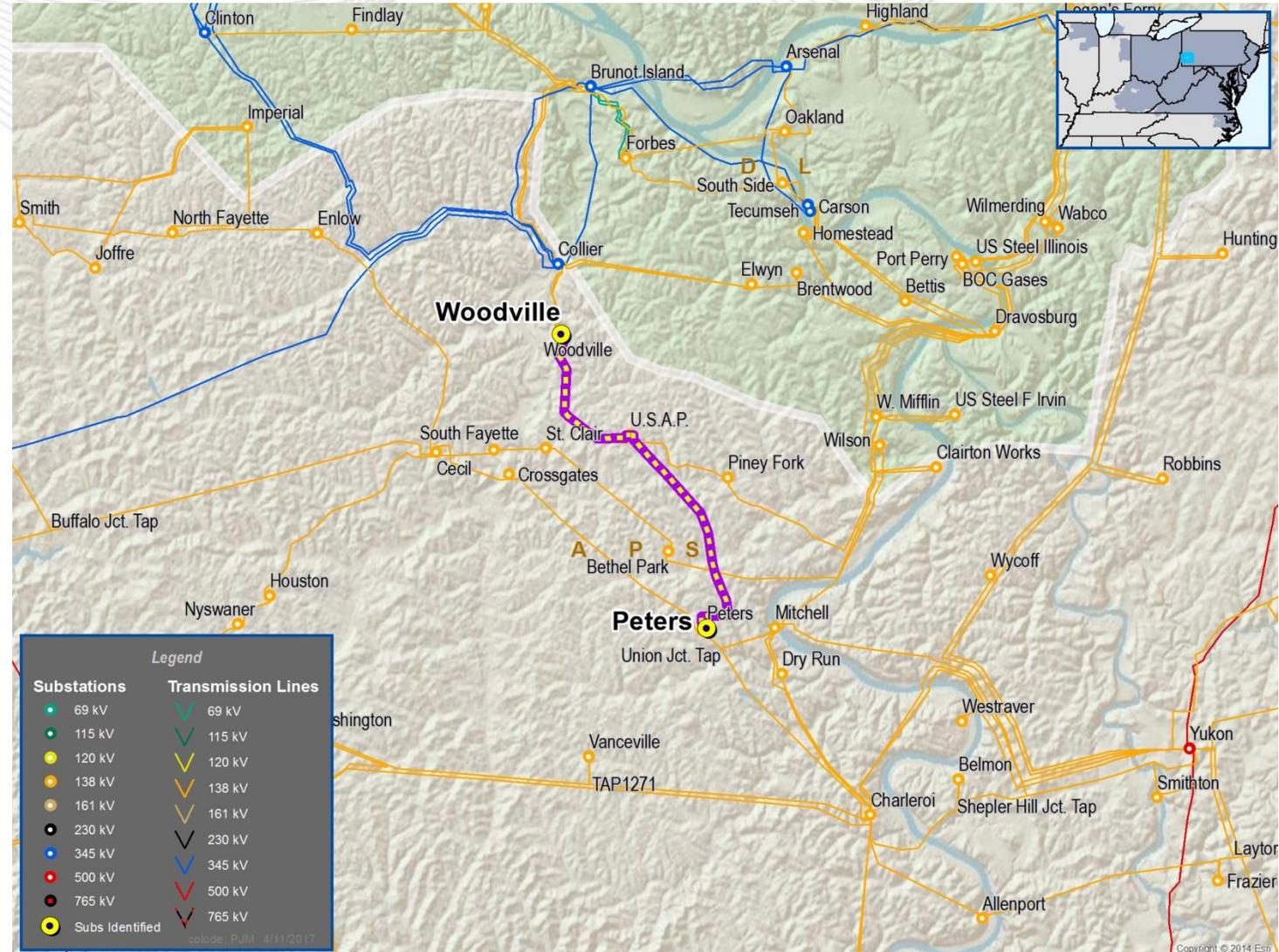
Baseline RTEP project b2689.1 (Reconductor approximately 7 miles of the Woodville - Peters (Z-117) 138 kV circuit), assigned to Duquesne Light, reconductors the Woodville-Peters 138 kV line. The existing conductor will be upgraded from 795 ACSR to 795 ACSS. The termination point is located at structure 27A, which is owned and maintained by West Penn Power (WPP), FE. In order to accommodate baseline RTEP project b2689.1, FirstEnergy/WPP will need to upgrade associated facilities (i.e. insulators, clamps, jumpers, etc.).

Recommended Solution:

B2689.3 - Upgrade terminal equipment owned by FE related to B2689.1

Estimated Project Cost: \$0.05M

Required IS date: 6/1/2018



AEP Transmission Owner Criteria Violation Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The Kaiser Jct – Air Force Jct section (3/0 ACSR, 44 MVA rating) of the Kaiser - Heath 69 kV circuit is overloaded (129%) for the failure of the 138/69 kV transformer at West Hebron and subsequent failure of the 138/69 kV transformer at Newark Center in the 2021 RTEP case. –Newark Ohio, Northeast of Columbus

Recommended Solution:

Reconductor 0.53 miles (14 spans) of the Kaiser Jct-Air Force Jct Sw section of the Kaiser-Heath 69 kV circuit/line with 336 ACSR to match the rest of the circuit (73 MVA rating, 78% loading). (B2787)

Estimated Project Cost: \$1.096M

Required IS Date: 6/1/2021

Status: Scoping



AEP Transmission Owner Criteria Violation Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The Speidel-Barnesville 69kV line section (#1 Copper, 31 MVA rating) is overloaded (117% worst loading) for multiple N-1-1 contingency pairs in the 2021 RTEP case. –Belmont County, Ohio

Recommended Solution: Install a new 3-way 69kV line switch to provide service to AEP's Barnesville distribution station. Remove a portion of the #1 copper T-Line from the 69kV through-path. The Speidel-Summerfield 69 kV line and future bypass route was previously submitted to and reviewed by PJM as s1158. An additional plan of service is being discussed with AEP Ohio.(B2788)

Estimated Project Cost: \$0.35M

Required IS Date: 6/1/2021

Status: Scoping





AEP Transmission Owner Criteria Violation

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The Brues-Glendale Heights 69kV line section (3/0 copper, 46 MVA rating) is overloaded (120% worst loading) for multiple N-1-1 contingency pairs, common towerline, and breaker-failure contingencies in the 2021 RTEP case.

The 5-mile long Brues-Glendale line was built in 1917. 81% of the line is still on the original 1917 wood poles. –Border of Ohio and West Virginia

Recommended Solution: Rebuild the Brues-Glendale Heights 69kV line section (5 miles) with 795 ACSR (128 MVA rating, 43% loading). (B2789)

Estimated Project Cost: \$16.7M

Required IS Date: 6/1/2021

Status: Scoping



AEP Transmission Owner Criteria Violation

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

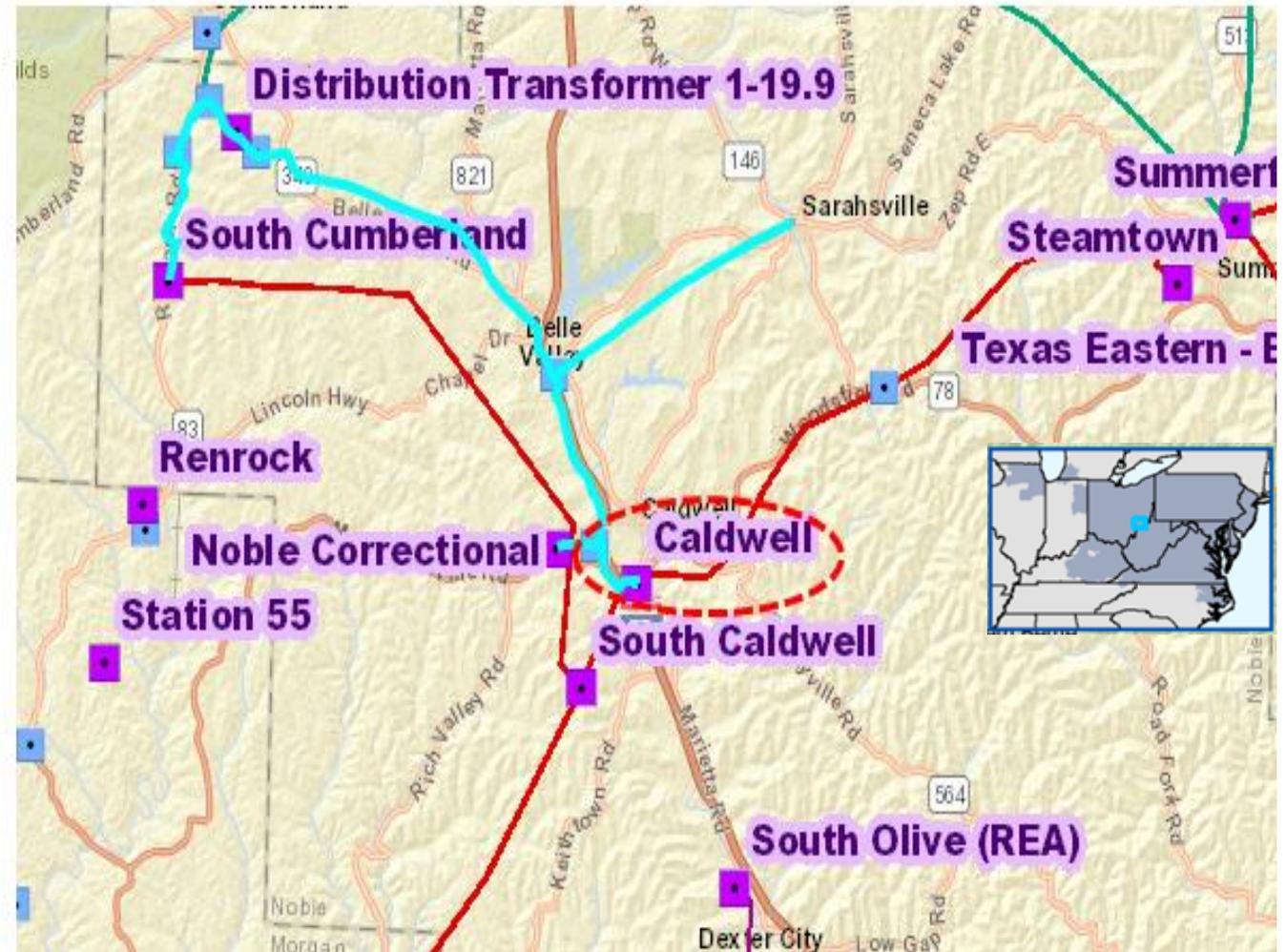
Voltage drop violation (0.915 pu) at Sarahsville 34.5 kV bus for a Caldwell 138/34.5kV transformer fault or bus fault contingencies at Caldwell in the 2021 RTEP case. –Noble County, Ohio

Recommended Solution: Install a 3 MVAR, 34.5kV cap bank at Caldwell substation. (B2790)

Estimated Project Cost: \$0.426M

Required IS Date: 6/1/2021

Status: Scoping



AEP Transmission Owner Criteria Violation and Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The West Rockaway Switch – East Tiffin 69kV line (#1 Copper, 31 MVA, 203%), the Greenlawn – East Tiffin 69kV line (2/0 ACSR, 39 MVA, 161%), the Chatfield – New Washington Switch 69kV line (#1 Copper, 31 MVA, 112%), the Howard – Willard 69kV line (3/0 ACSR, 44 MVA rating, 101%), the Broken Sword – Nevada Switch 69kV line (#1 Copper, 31 MVA rating, 117%), and the Upper Sandusky – Nevada Switch 69kV line (#1 Copper, 31 MVA rating, 124%) are overloaded for a Chatfield 138-69 kV XFMR fault or similar bus fault contingencies near Chatfield and for multiple N-1-1 contingency pairs in the 2021 RTEP case. Voltage drop (9.6%) and voltage magnitude violation (0.916 pu) at West Shelby, Hinesville and other surrounding 69KV buses for multiple contingencies are also seen in the 2021 RTEP case.

The East Tiffin-Howard 69 kV path was originally constructed in 1918 with wood pole structures utilizing #1 Copper conductor. There are 285 open conditions on the 57-mile long line associated with structure, hardware, and shielding. There has also been increased IPP activity in this area, resulting in increased power flows on lines. –Richland County, Ohio

Recommended Solution:

- Rebuild portions of the East Tiffin-Howard 69kV line from East Tiffin to West Rockaway Switch (0.8 miles) using 795 ACSR Drake conductor (129 MVA rating, 50% loading). (B2791.1)
- Rebuild Tiffin-Howard 69kV line from St. Stephen's Switch to Hinesville (14.7 miles) using 795 ACSR Drake conductor (90 MVA rating, non-conductor limited, 38% loading). (B2791.2)
- New 138/69kV transformer with 138kV & 69kV protection at Chatfield station. (B2791.3)
- New 138kV & 69kV protection at existing Chatfield transformer. (B2791.4)

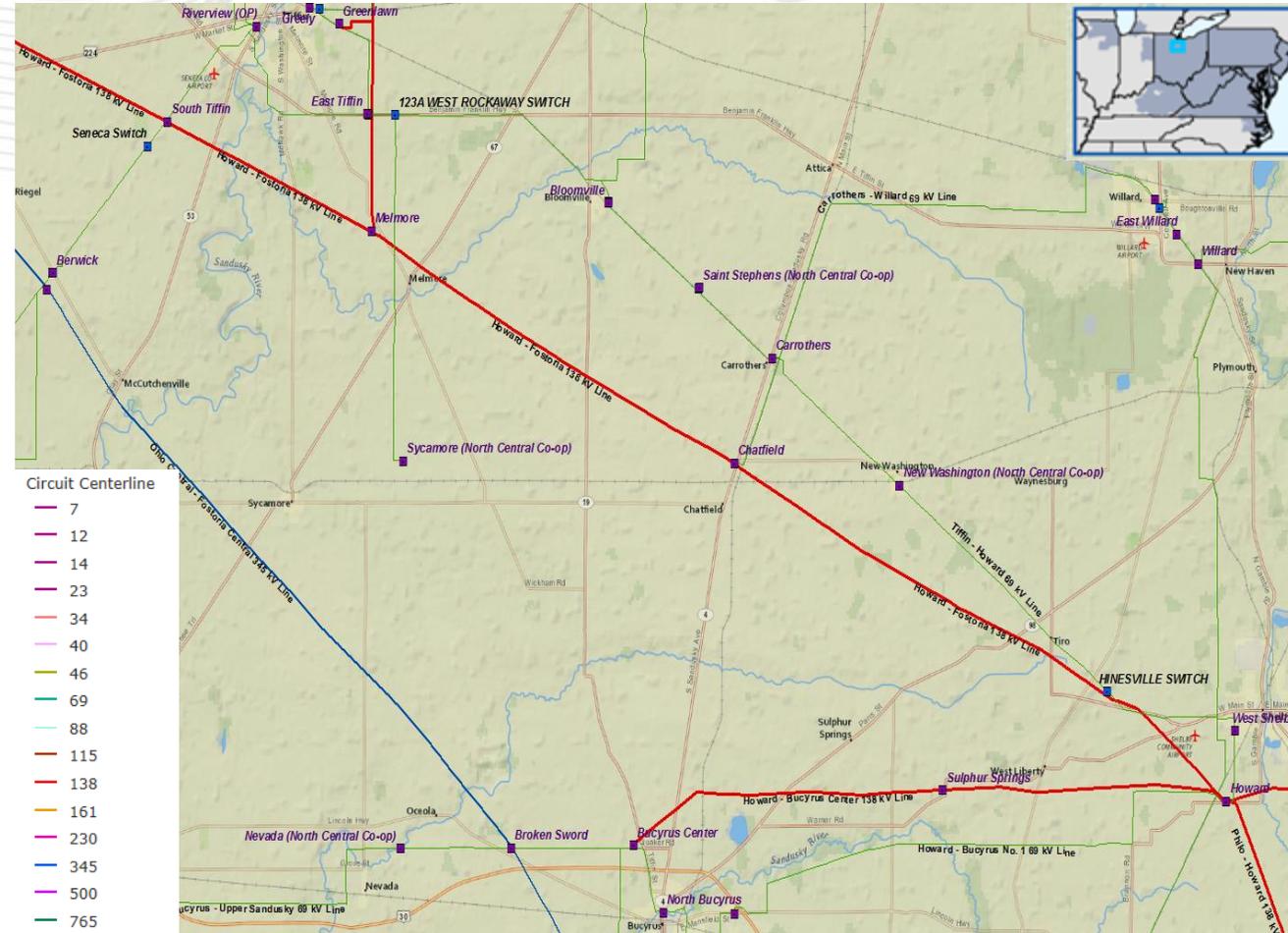
Estimated Baseline Project Cost: \$20.386M

- Rebuild 69kV line from West Rockaway Switch-St. Stephen's Switch 10.6 miles) using 795 ACSR Drake conductor. (S1298.1)
- Rebuild Hinesville-Howard 6.1 miles) using 795 ACSR Drake conductor. (S1298.2)
- New 138kV protection at existing South Tiffin transformer (S1298.3)
- Replace 69kV CB's A & B at Chatfield (S1298.4)

Estimated Supplemental Project Cost: \$21.751M

Required IS Date: 6/1/2021

Status: Scoping



AEP Transmission Owner Criteria Violation Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

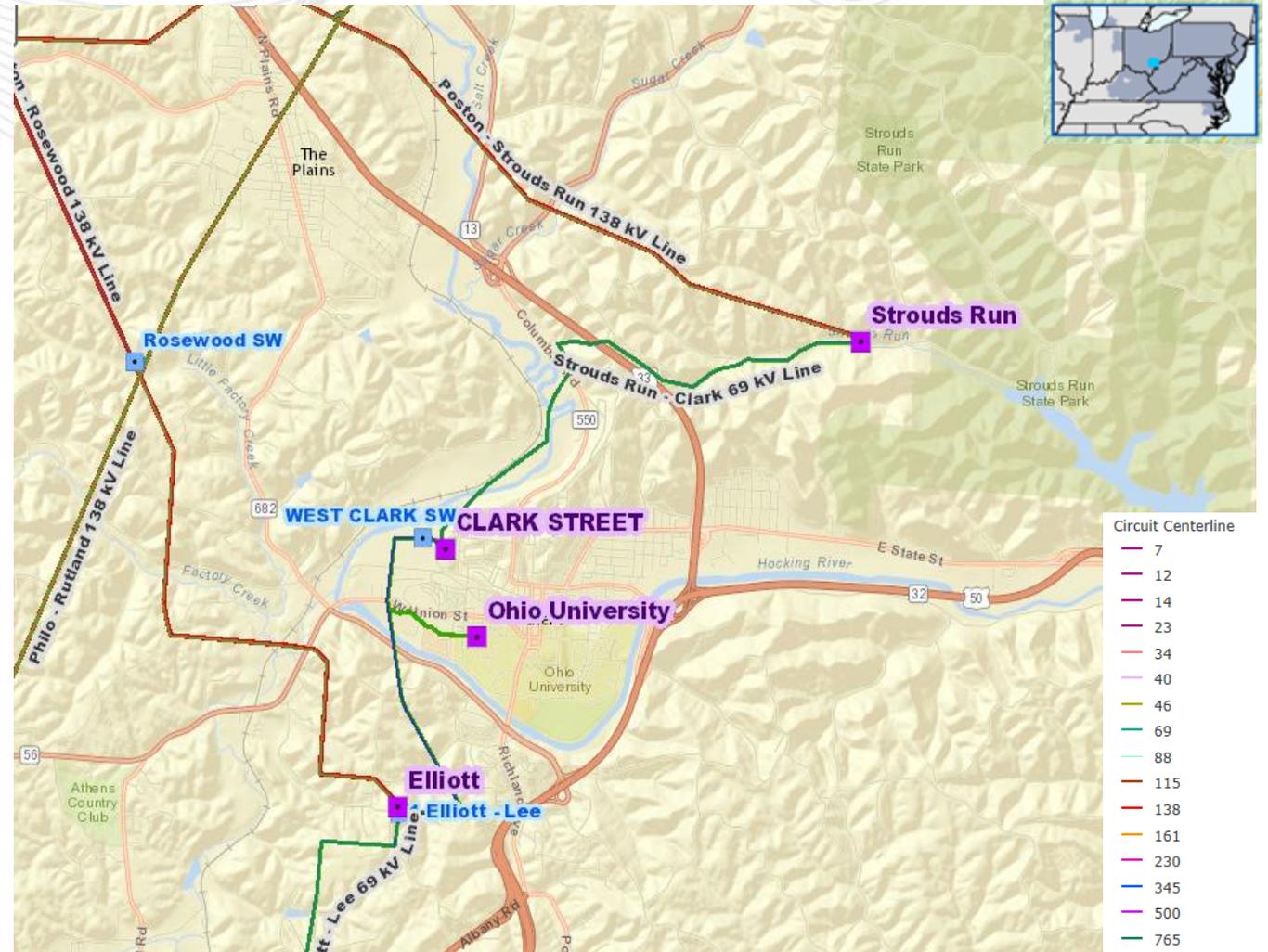
The Elliott 138/69 kV transformer (89 MVA rating) and the Elliott – Ohio University 69 kV line (336 ACSR, 73 MVA rating) are overloaded (108% and 104% respectively) for the loss of the Poston – Strouds Run – Crooksville 138kV Line. The Clark Street – Strouds Run 69 kV line (336 ACSR, 73 MVA rating) is overloaded (107%) for the loss of the Dexter – Elliot – Poston 138kV line in the 2021 RTEP case. –Athens, Ohio

Recommended Solution: Replace the Elliott transformer with a 130 MVA unit. Reconductor 0.42 miles of the Elliott – Ohio University 69 kV line with 556 ACSR to match the rest of the line conductor (102 MVA rating, 73% loading) and rebuild 4 miles of the Clark Street – Strouds Run 69 kV with 556 ACSR conductor (102 MVA rating, 76% loading). (B2792)

Estimated Project Cost: \$5.76M

Required IS Date: 6/1/2021

Status: Scoping





AEP Transmission Zone Baseline Reliability

AEP Transmission Owner Criteria Violation Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

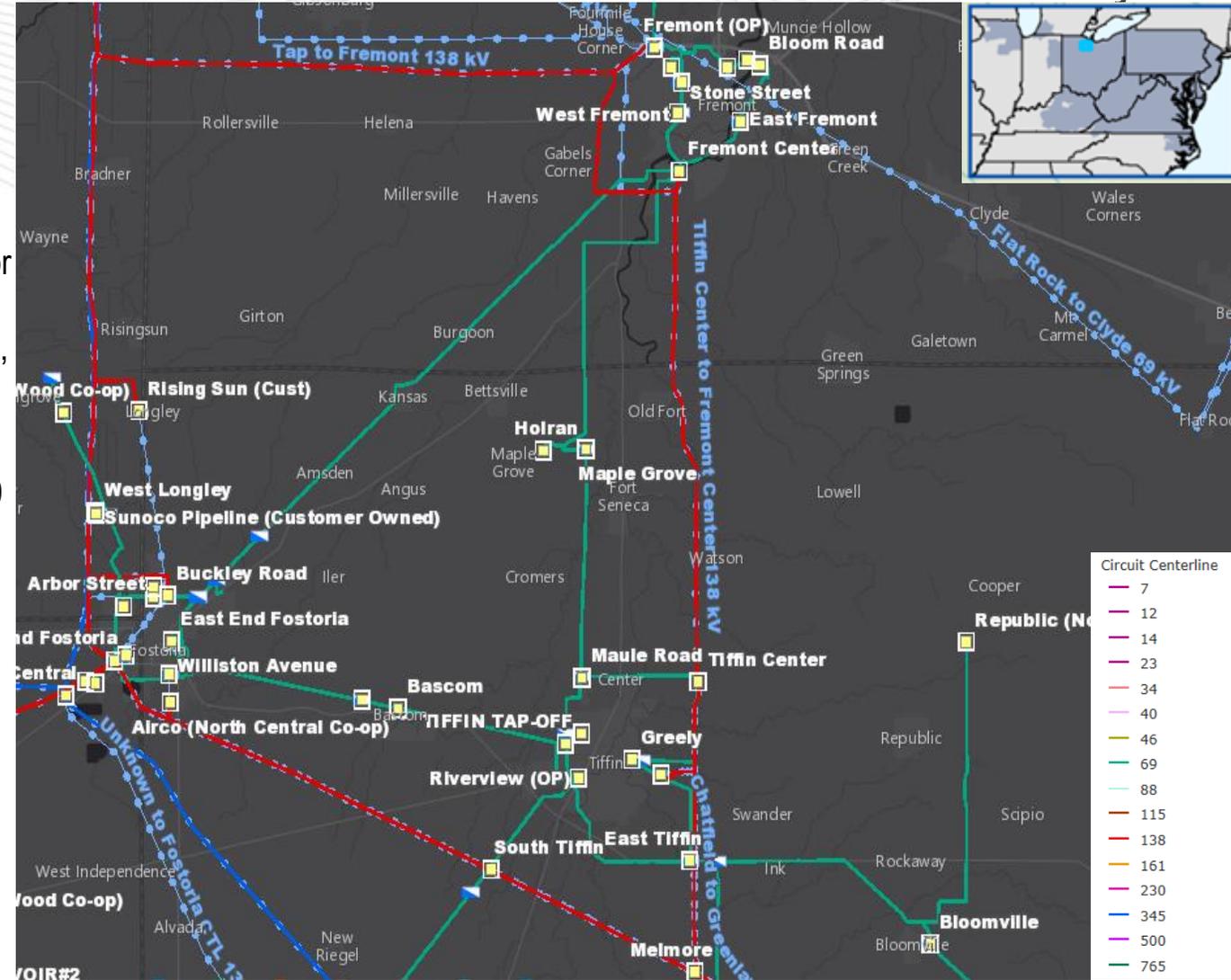
The Fremont Center – Riverview 69 kV circuit is overloaded (118%) for the loss of the Fremont Center 138/69 kV transformer #1 and the Fremont 138/69 kV transformer #1 in the 2021 RTEP case. – Fremont, Ohio.

Recommended Solution: Energize the spare Fremont Center 138/69 kV 130 MVA transformer #3. Reduces overloaded facilities to 46% loading.(B2793)

Estimated Project Cost: \$0.081M

Required IS Date: 6/1/2021

Status: Scoping





AEP Transmission Zone Baseline Reliability

AEP Transmission Owner Criteria Violation Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

Low Voltage (0.883 pu) and voltage drop (17% worst drop) violations at South Upper Sandusky, Harpster, Ridgedale, South Morral, Meeker, and Decliff 69kV buses for the outage of the Upper Sandusky 69kV bus in the 2021 RTEP case.

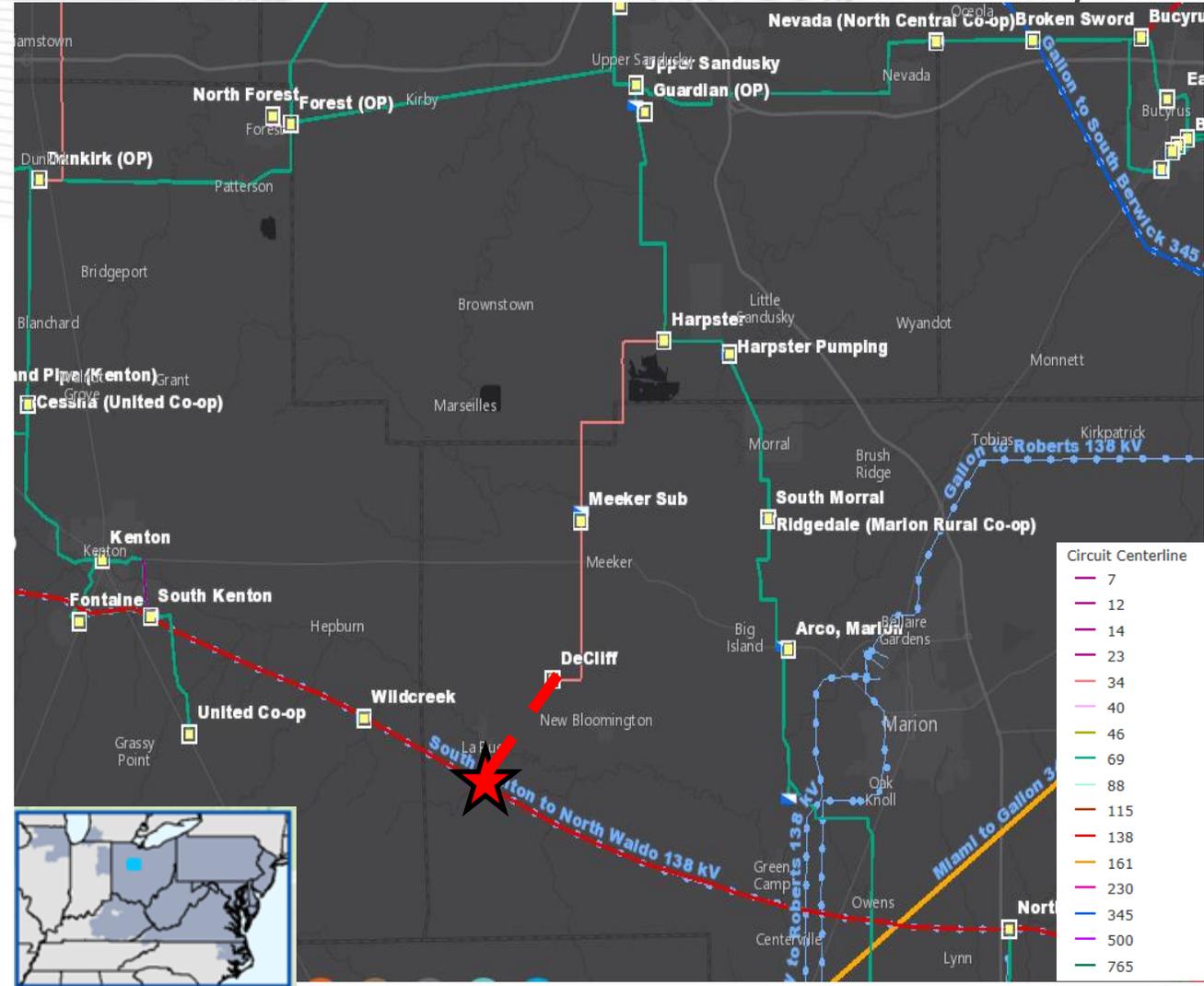
The Harpster area has had over 670,000 customer minutes of interruptions over the past three years, including 360,000 minutes on the Harpster-Decliff line. –Marion, Ohio

Recommended Solution: Construct new 138/69/34kV station and 1-34kV circuit (designed for 69kV) from new station to Decliff station, approximately 4 miles, with 556 ACSR conductor (51 MVA rating). (B2794)

Estimated Project Cost: \$12.65M

Required IS Date: 6/1/2021

Status: Scoping



AEP Transmission Owner Criteria Violation

Previously Presented: 4/21/2017
SRTEAC

Problem Statement:

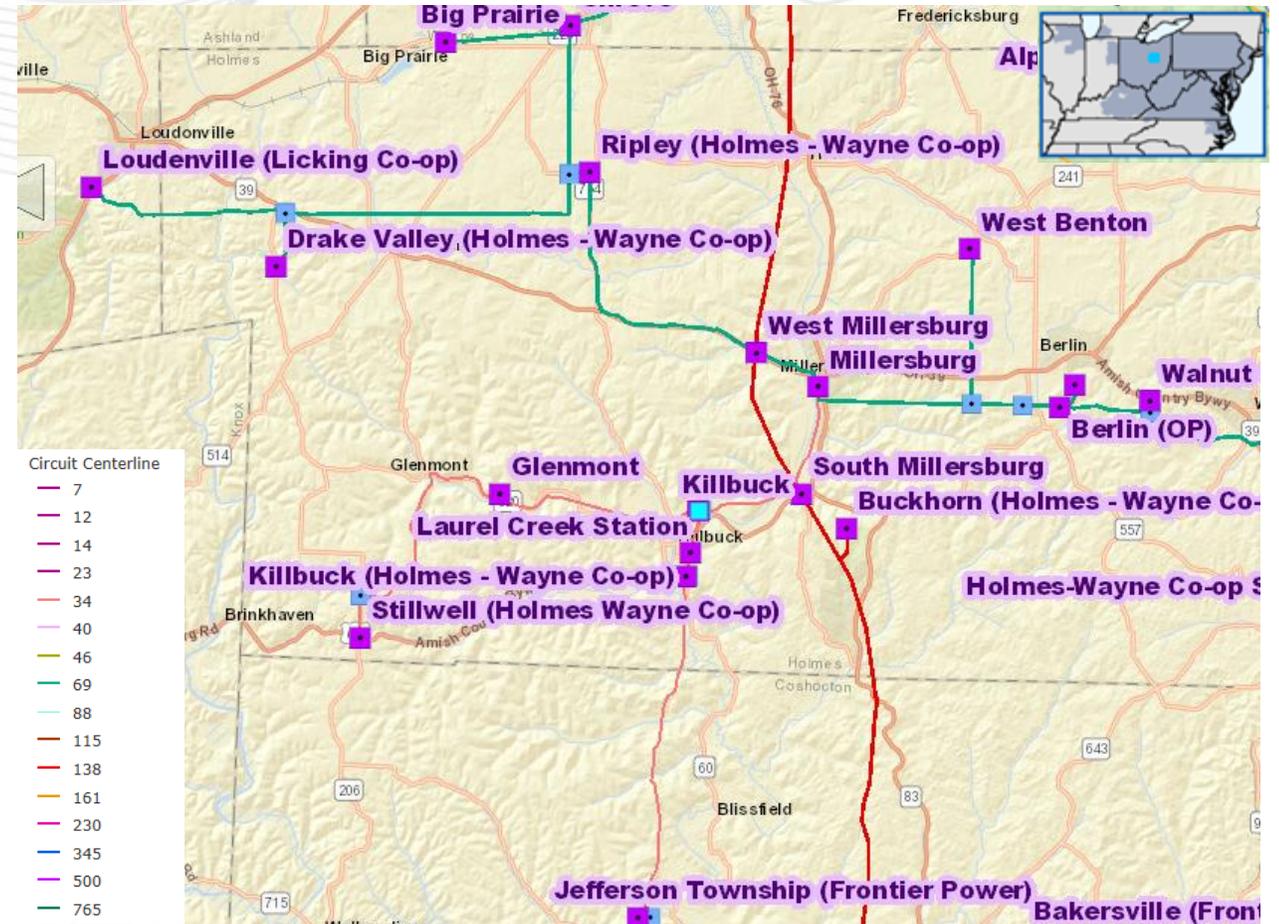
Low Voltage (0.916 pu) and voltage drop (10.7% worst drop) violations at Stillwell, Glenmont, and Killbuck 34.5kV buses for the outage of the South Millersburg 34.5kV bus in the 2021 RTEP case. – Holmes County, Ohio

Recommended Solution: Install a 34.5 kV 4.8 MVAR capacitor bank at Killbuck 34.5kV station. (B2795)

Estimated Project Cost: \$0.482M

Required IS Date: 6/1/2021

Status: Scoping



AEP Transmission Owner Criteria Violation

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

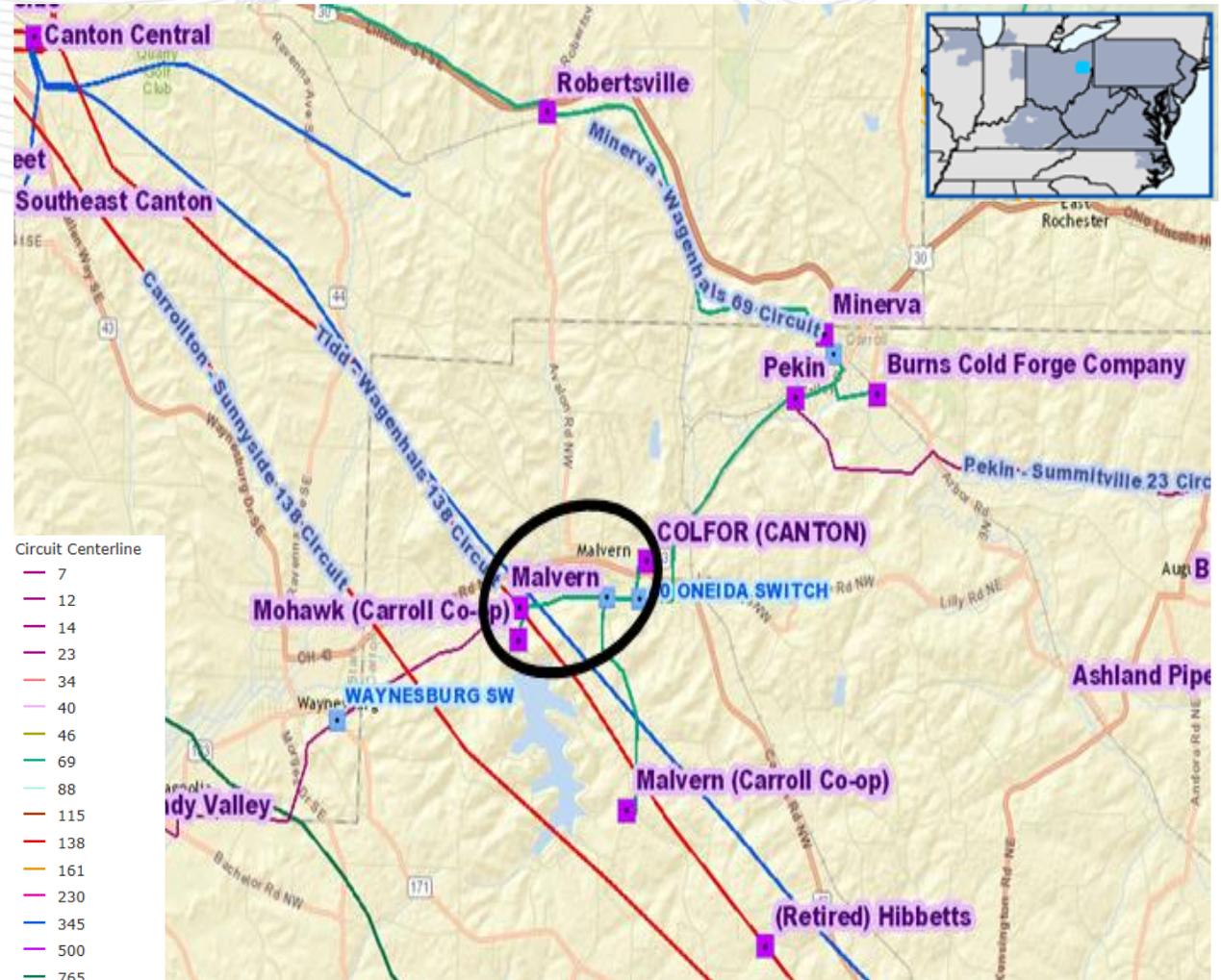
The Malvern - Oneida Switch 69kV line section (4/0 Copper, 54 MVA rating) is overloaded (128% worst loading) for multiple N-1 and N-1-1 contingencies in the 2021 RTEP case. – Carroll County, Ohio

Recommended Solution: Rebuild the Malvern-Oneida Switch 69kV line section with 795 ACSR (1.8 miles, 125 MVA rating, 55% loading). (B2796)

Estimated Project Cost: \$4.1M

Required IS Date: 6/1/2021

Status: Scoping





AEP Transmission Owner Criteria Violation

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

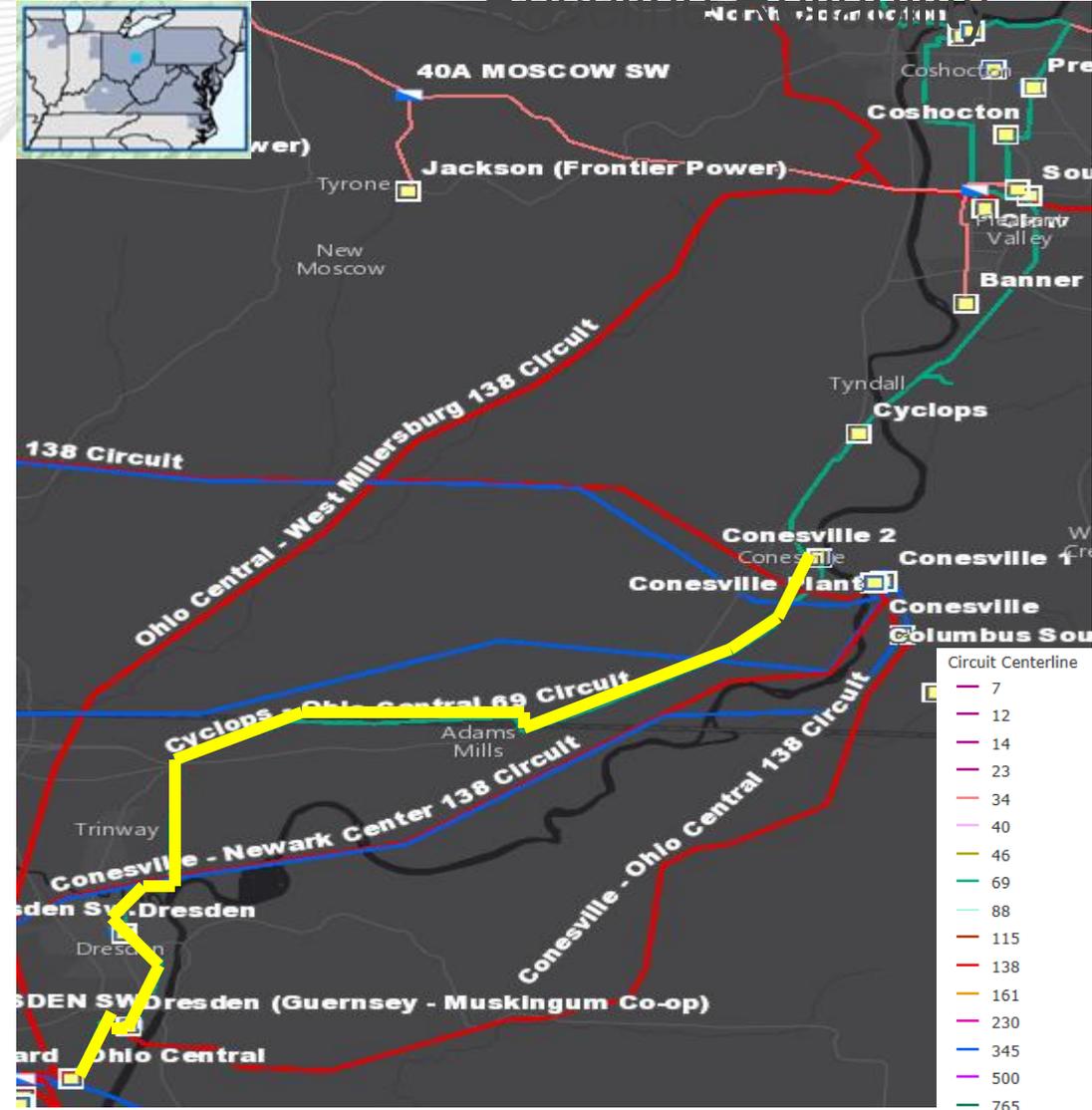
The Ohio Central - Conesville 69kV line section (4/0 Copper and 336 ACSR, 54 MVA rating) and the Ohio Central 138/69 kV transformer (50 MVA rating) are overloaded (135% worst loading) for multiple N-1 and N-1-1 contingencies in the 2021 RTEP case. – Coshocton County, Ohio

Recommended Solution: Rebuild the Ohio Central-Conesville 69kV line section (11.8 miles) with 795 ACSR conductor (128 MVA rating, 57% loading). Replace the 50 MVA Ohio Central 138-69kV XFMR with a 90 MVA unit. (B2797)

Estimated Project Cost: \$20.6M

Required IS Date: 6/1/2021

Status: Scoping





AEP Transmission Owner Criteria Violation

Previously Presented: 4/21/2017
SRTEAC

Problem Statement:

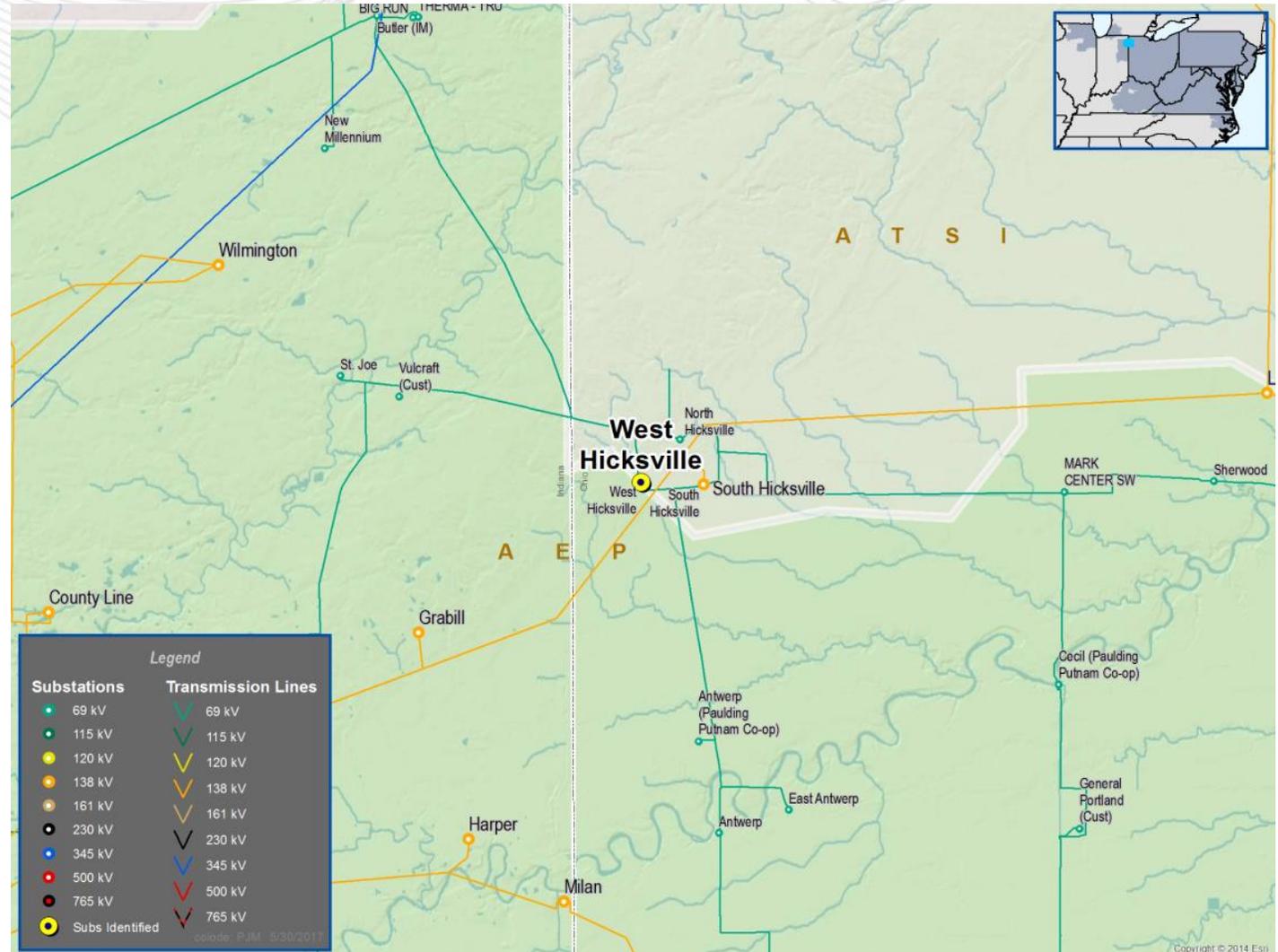
Low voltage violation (0.905 pu) at West Hicksville station for loss of the South Hicksville 69 kV bus in the 2021 RTEP case. –Hicksville, Ohio

Recommended Solution: Install a 14.4 MVar capacitor bank at West Hicksville station. Replace ground switch/MOAB at West Hicksville with a circuit switcher (B2798)

Estimated Project Cost: \$1.3 M

Required IS Date: 6/1/2021

Status: Scoping



AEP Transmission Owner Criteria Violation and Supplemental Project

Problem Statement:

Low voltage violations at 19 different stations (0.70 pu voltage and 33% worst drop) were identified, along with thermal violations on the Hartford – Almena (336 ACSR conductor, 73 MVA rating, 141% worst loading), Riverside – South Haven (4/0 Copper conductor, 54 MVA, 142%), and Valley – Almena (556 AAC conductor, 90 MVA, 111%) 69kV lines. Additionally, Valley 138/69 kV transformer 1 (93 MVA, 117%), Riverside 138/69 kV transformer 5 (71 MVA, 111%), and Hartford 138/69 kV transformer 1 (120 MVA, 102%) overload for multiple N-1-1 type contingencies involving the 138/69 kV sources and lines in the area in the 2021 RTEP case.

The Riverside-South Haven 69 kV line was constructed in the 1960s on wood poles with 4/0 Copper conductor (54 MVA rating). This line has experienced over 6,000,000 customer minutes of interruption over the past three years. There are 57 open A conditions along this 24 mile long line, mostly related to rotten wood poles and cross-arms, burnt insulators, and missing ground lead wire. Transmission Operations cannot sectionalize this line without momentarily dropping all customers currently served from this line. AEP's MOAB installation criteria calculations justify the installation of a MOAB at Vector Switch.

The Almena-Hartford 69 kV line was also constructed in the 1960s with 336 ACSR conductor (73 MVA rating). There are 21 open A conditions on this 16 mile long line and has had 34 momentary and 4 permanent outages over the past three years.

The Almena-Valley 69 kV line was built in 1971 with 556 AAC conductor (99 MVA rating). It has 18 open A conditions along the 11 mile long line.

The existing 69kV bus tie CB A at South Haven station is a 1200 A 20 kA GE, FK-type oil filled breaker that was manufactured in 1966. This breaker has a total 265 fault operations, exceeding the manufacturer limit of 10. The current configuration at South Haven station combines more than 3 elements into one protection zone. The existing bus tie protection scheme exposes all three transformers to line faults and increases the probability of relay misoperations. This has been a concern to the customers in the City of South Haven because this is the only transmission source in the area.

At Hickory Creek station, 138 kV breakers L, A and J are 1200 A 20 kA oil filled breakers and 34.5 kV breakers H, G, C, and F are 1200 A 15 kA oil filled breakers. 138 kV circuit breaker B is a 2000 A 40 kA air insulated breaker. During winter conditions, breaker B is at a higher risk of failure than a typical oil filled breaker due to the lack of a dryer system associated with the air system and the loss of heating source. There have been several instances in the past where this breaker has frozen, putting the system at risk of a breaker failure. Additionally, air breakers tend to fail violently and their porcelain bushings disperse particles into the surrounding area, which is a safety concern. Breaker J has had 47 fault operations. Breaker A has had 57 fault operations. Breaker H has had 28 fault operations. Breaker G has had 22 fault operations. Breaker F has had 85 fault operations. All these exceed the manufacturer recommendation of 10. These breakers all have some combination of the following documented conditions: age, bushing damage, number of fault operations, a lack of available repair parts, and PCB contamination. Additionally, 138/34.5 kV 30 MVA transformers 1 and 3 are showing significant signs of deterioration. Drivers for replacement include dielectric strength breakdown (winding insulation), short circuit strength breakdown (due to the amount of through fault events), and accessory damage (bushings).

At Main Street station, 138 kV 1200 A 20 kA breaker A and 34.5 kV 1200 A 22 kA breakers B, C, D, and E are all oil filled breakers. Breaker A has had 59 fault operations. Breaker B has had 20 fault operations. Breaker C has had 58 fault operations. Breaker D has had 15 fault operations. Breaker E has had 17 fault operations. All exceed the manufacturer recommendation of 10. These breakers all have some combination of the following documented conditions: age, bushing damage, number of fault operations, and PCB contamination. Additionally, 138/34.5 kV 30 MVA transformer 3 is showing significant signs of deterioration. Drivers for replacement include dielectric strength breakdown (winding insulation), short circuit strength breakdown (due to the amount of through fault events), and accessory damage (bushings).

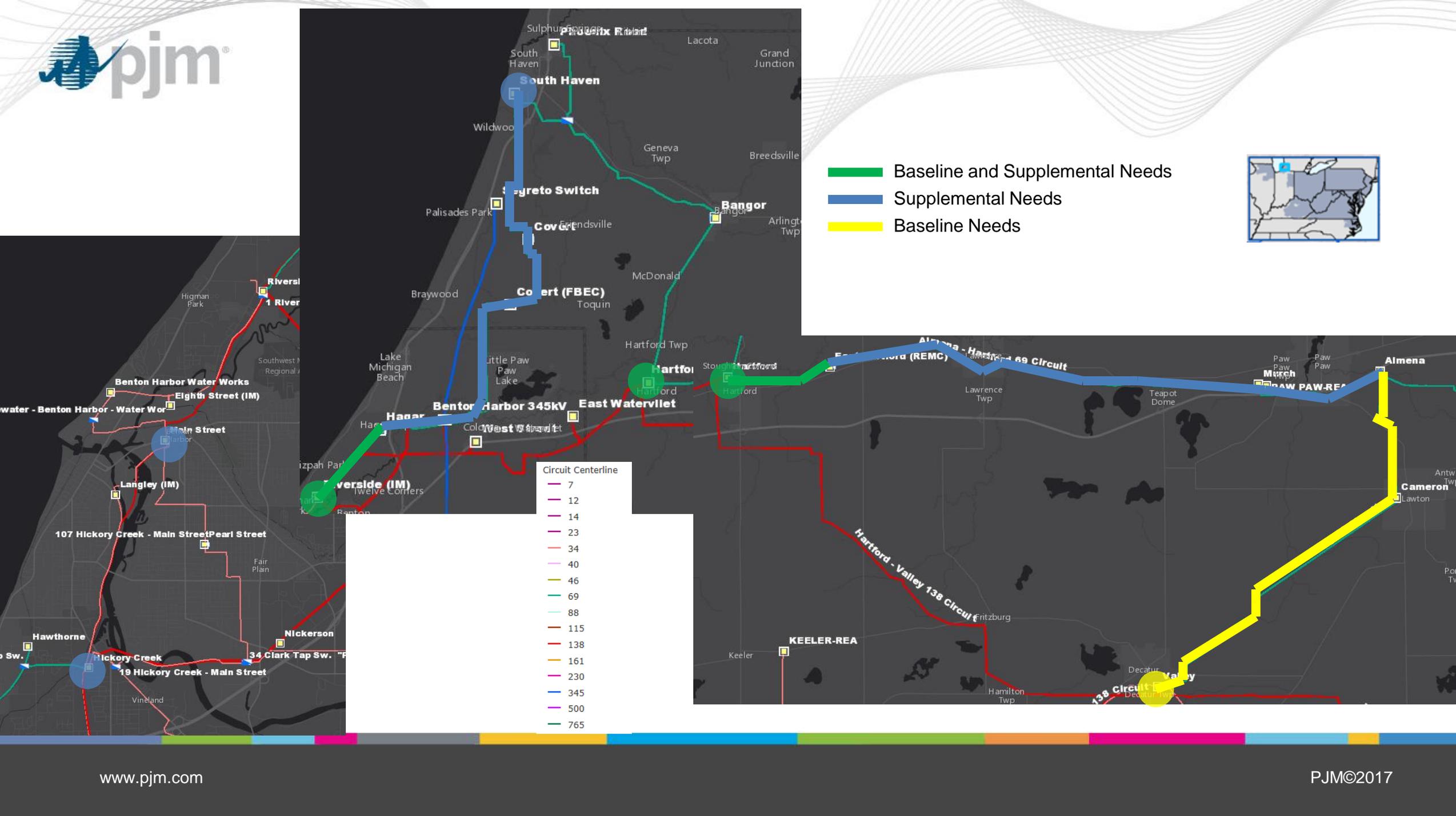
At Riverside station, 69 kV 1200 A 20 kA breaker L and 138 kV 800 A 15 kA breaker R are oil filled breakers manufactured in 1965 and 1947. Breaker L has had 126 fault operations, exceeding the manufacturer recommendation of 10. These breaker have the following documented conditions: age, number of fault operations, a lack of available repair parts, and PCB content. Additionally, 138/69/34.5 kV 50 MVA Transformer #5 is beginning to show signs of deterioration. Drivers for replacement include dielectric strength breakdown (winding insulation), short circuit strength breakdown (due to the amount of through fault events), accessory damage (bushings), and high temperature (winding thermal condition). Transformer #5 also has high levels of dissolved Ethylene and Carbon Dioxide in the oil.

At Hartford station, 69 kV breakers G and H are 1200 A 20 kA oil filled breakers manufactured in 1965 and 1966. Breaker G has had 207 fault operations. Breaker H has had 199 fault operations. Both exceed the manufacturer recommended limit of 10. These breakers have the following documented conditions: age, bushing damage, number of fault operations, and PCB content. Additionally, 138/69/34.5 kV 115 MVA Transformer #1 is showing signs of deterioration. Drivers for replacement include dielectric strength breakdown (winding insulation), short circuit strength breakdown (due to the amount of through fault events), and accessory damage (bushings).

In general, oil breakers have become more difficult to maintain due to the required oil handling. Oil spills occur often during routine maintenance and failures, which can become an environmental concern.

–Kalamazoo, MI

Continued on next slide...



- █ Baseline and Supplemental Needs
- █ Supplemental Needs
- █ Baseline Needs



Circuit Centerline	
7	
12	
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23	
34	
40	
46	
69	
88	
115	
138	
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AEP Transmission Owner Criteria Violation and Supplemental Project

Continued from previous slide...

Preliminary Solution:

- Rebuild 12 miles of Valley – Almena 69kV line as a double circuit 138kV/69kV line using 795 ACSR conductor (360 MVA rating) to introduce a new 138 kV source into the 69 kV load pocket around Almena station. (B2799.1)
- Rebuild 3.2 miles of Almena to Hartford 69kV line using 795 ACSR conductor (90 MVA rating). (B2799.2)
- Rebuild 3.8 miles of Riverside – South Haven 69V line using 795 ACSR conductor (90 MVA rating). (B2799.3)
- At Valley station, add new 138kV line exit with a 3000 A 40 kA breaker for the new 138 kV line to Almena and replace CB D with a 3000 A 40 kA breaker. (B2799.4)
- At Almena station, install a 90MVA 138kV/69kV transformer with low side 3000 A 40 kA breaker and establish a new 138kV line exit towards Valley. (B2799.5)
- At Hartford station, install a second 90MVA 138/69kV transformer with a circuit switcher and 3000 A 40 kA low side breaker. (B2799.6)

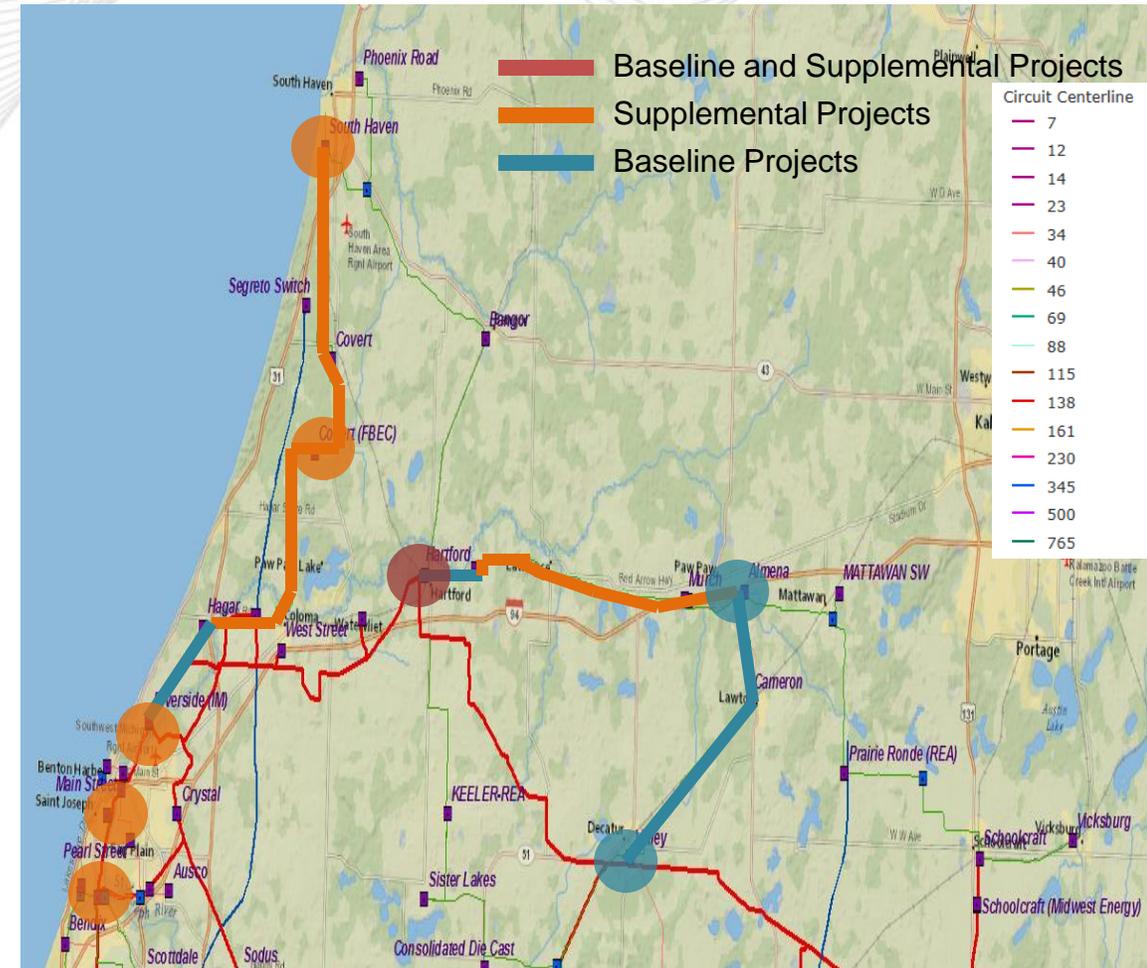
Estimated Baseline Project Cost: \$53.0 M

- Rebuild remaining 13.8 miles of Almena to Hartford 69kV line using 795 ACSR conductor (90 MVA rating). (S1297.1)
- Rebuild remaining 21.2 miles of Riverside – South Haven 69V line using 795 ACSR conductor (90 MVA rating). (S1297.2)
- At Hartford station, replace transformer 138/69kV 1 with a 90 MVA unit and replace 69kV CB H and G with 3000 A 40 kA breakers. (S1297.3)
- At Riverside station, replace Transformer 5 with a new 90MVA 138/69kV transformer, replace 69 kV CB L and 138 kV CB R with 3000 A 40 kA breakers. (S1297.4)
- At Main Street station, rebuild the entire station on existing property at the site and install a 90 MVA transformer with 3000 A 40 kA breakers. (S1297.5)
- At Hickory Creek station, rebuild the 34.5 kV yard, replace the 138kV CBs with 3000 A 40 kA breakers, replace the existing 138/34.5 kV transformers #1 and #3 with a single 138/69/34.5 kV 90 MVA bank and move the distribution feeds from 34.5 kV to 138 kV service. (S1297.6)
- At South Haven station, retire bus tie CB A and install two new 69kV 3000 A 40 kA breakers towards Riverside and Hartford remote end stations. (S1297.7)
- At the Covert FBEC hard tap location, install a new phase-over-phase switch (Vector Switch) with load splitting capability. (S1297.8)

Estimated Supplemental Project Cost: \$143.0 M

Required IS Date: 6/1/2021

Status: Scoping





AEP Transmission Zone Baseline Reliability

AEP Transmission Owner Criteria Violation Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The Cannonsburg – South Neal 69 kV line section (336 ACSR, 75 MVA rating, 100%) overloads for loss of Bellefonte 69 kV bus #2 or loss of Bellefonte – Hoods Creek 69 kV in the 2021 RTEP case.

In addition to the planning criteria violation, this rebuild will address three open category A conditions on the Cannonsburg – South Neal line section. These conditions include damaged equipment and cross arm. – Ashland, KY

Recommended Solution:

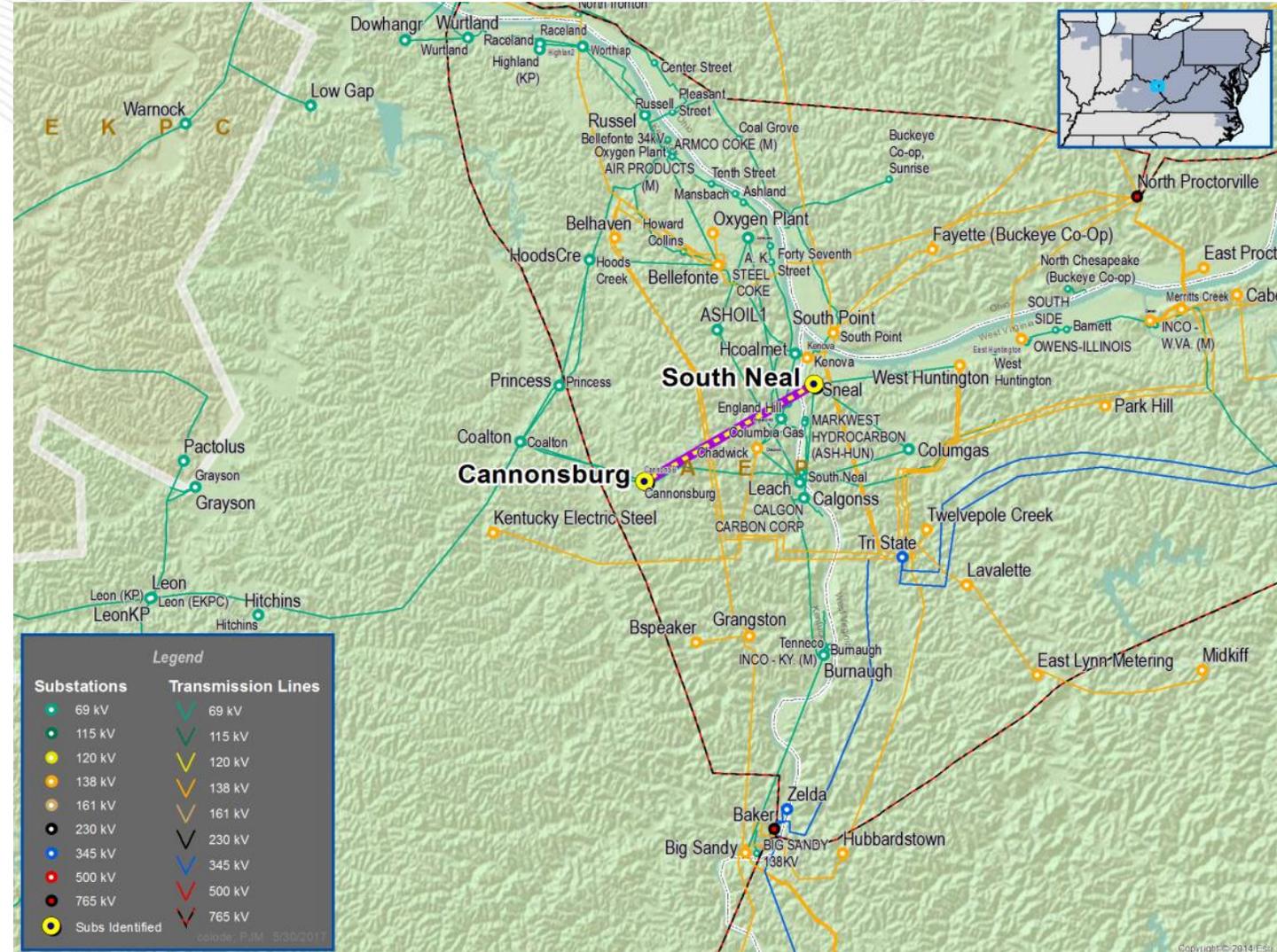
Rebuild approximately 4.77 miles of the Cannonsburg – South Neal 69 kV line section utilizing 795 ACSR conductor (90 MVA rating, 83%). (B2880)

Estimated Project Cost: \$12.5M

Required IS Date: 6/1/2021

Projected IS Date: 12/1/2018

Status: Scoping



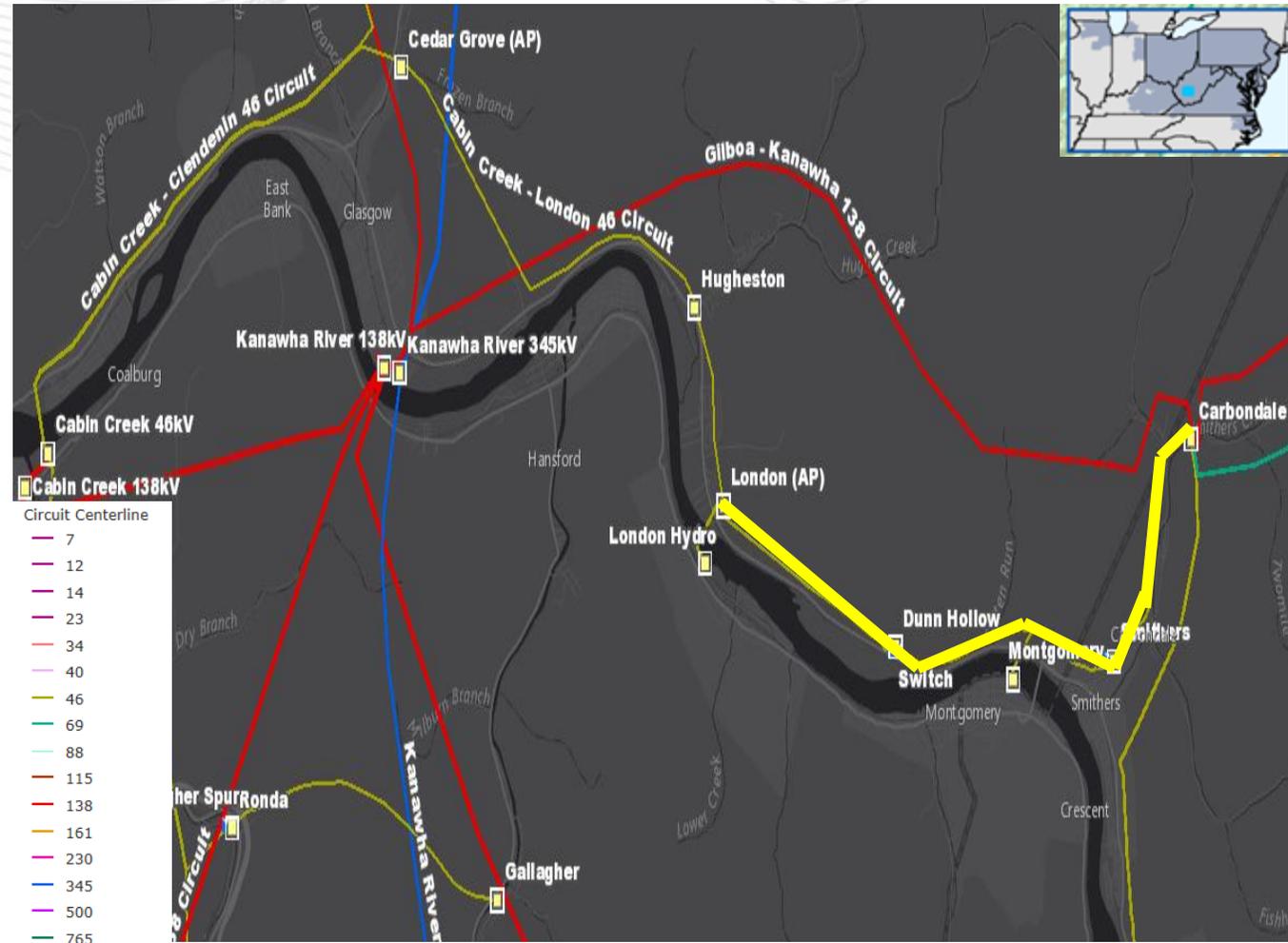
AEP Transmission Owner Criteria Violation and Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The Dunnhollow – London 69 kV line (3/0 Copper, 31 MVA rating, 103%) overloads for loss of Kanawha River 138 kV Bus #1 or multiple breaker failure contingencies at Kanawha River in the 2021 RTEP case.

In addition to the planning criteria violation, the Carbondale – London 46kV line is a poor performing circuit in the APCo region. From 2013-2016, this circuit has experienced 9 permanent outages and 1,721,181 customer minutes of interruption. Approximately 2.4 miles of this circuit utilizes structures from 1915. There are currently 65 category A open conditions along the 5.9 mile long line. These open conditions include damaged/rotted poles and damaged guy wires, shield wire, conductor, insulator and cross arms. -- Charleston, WV

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AEP Transmission Zone Baseline Reliability

AEP Transmission Owner Criteria Violation and Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Continued from previous slide

Recommended Solution:

Rebuild ~1.7 miles of the Dunn Hollow – London 46kV line section utilizing 795 26/7 ACSR conductor (58 MVA rating, non-conductor limited, 55%). (B2881)

Estimated Baseline Project Cost: \$4.5M

Rebuild ~3.5 miles of the Carbondale – Dunn Hollow 46kV line section with 795 ACSR conductor. This section of line is currently comprised of a mix of 2/0, 3/0, and 4/0 Copper conductor. The line portion to Montgomery station is of newer construction with larger conductor. (S1290.1)

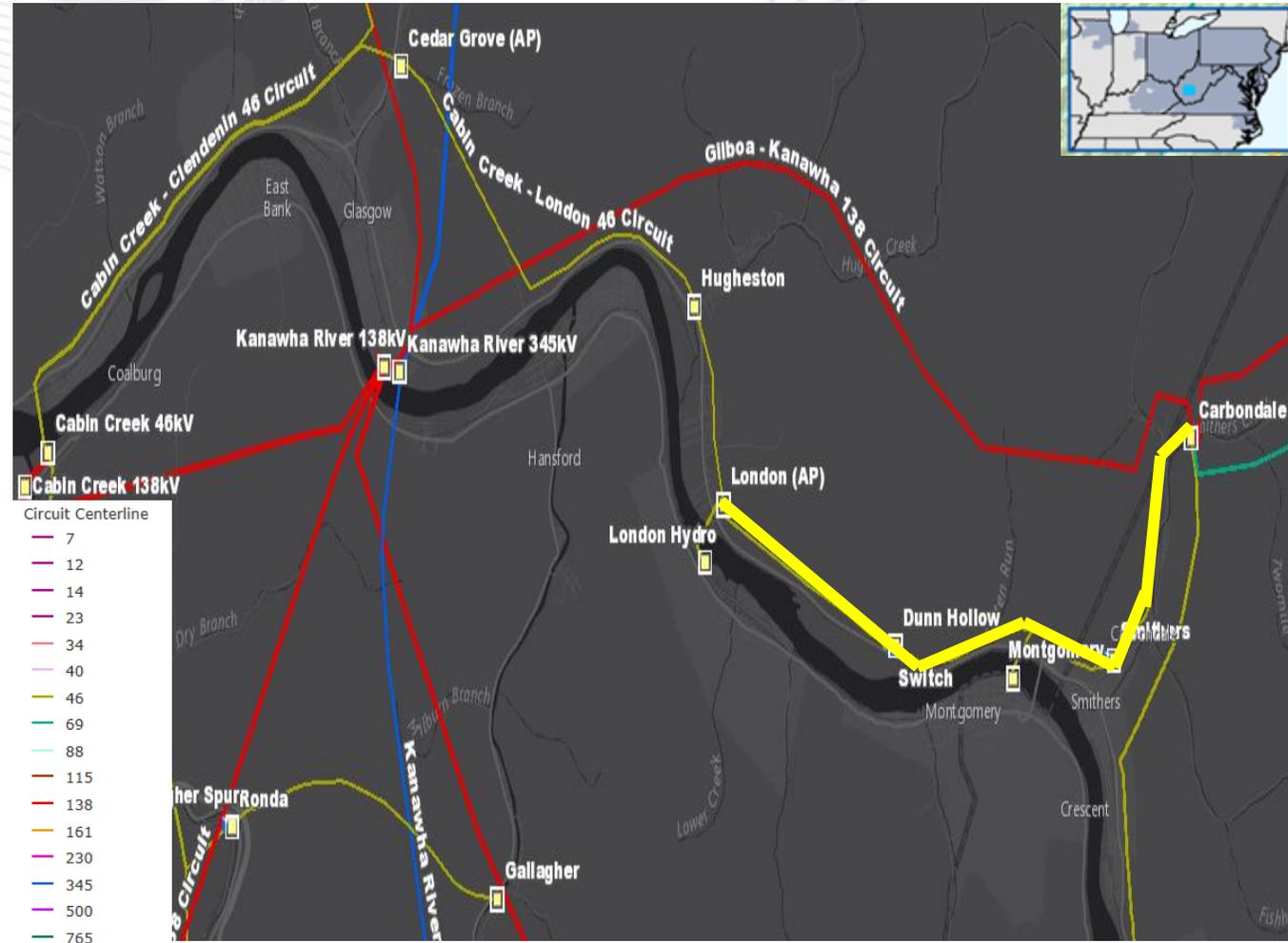
Retire the Smithers Switch structure. Smithers load will be served out of Carbondale station via a new transformer. Replace existing Dunn Hollow Switching Structure with new 3-way phase over phase Structure. (S1290.2)

Estimated Supplemental Project Cost: \$9.4M

Required IS Date: 6/1/2021

Projected IS Date: 12/1/2018

Status: Engineering





AEP Transmission Zone Baseline Reliability

AEP Transmission Owner Criteria Violation and Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The Reusens – Peakland Switch 69 kV line (4/0 Copper, 54 MVA rating, 106%) overloads for loss of the Peaksview 69 kV bus in the 2021 RTEP case.

The Dearington – Reusens 69kV is a poor performing circuit in the APCo region. From 2013 – 2016, the circuit has experienced 12 permanent outages with 1,469,505 customer minutes of interruption. Approximately 75% of the structures of this circuit are 1925 vintage. There are currently 60 category A open conditions along the 5.2 mile long line. These conditions include damaged pole/crossarm/shield wire and conductor. – Lynchburg, VA

Recommended Solution:

Rebuild the Reusens - Peakland Switch 69 kV line (approximately 0.8 miles) utilizing 795 ACSR conductor (86 MVA rating, non-conductor limited, 67%). (B2882.1)

Replace existing Peakland S.S with new 3 way switch phase over phase structure.(B2882.2)

Estimated Baseline Project Cost: \$2.9M

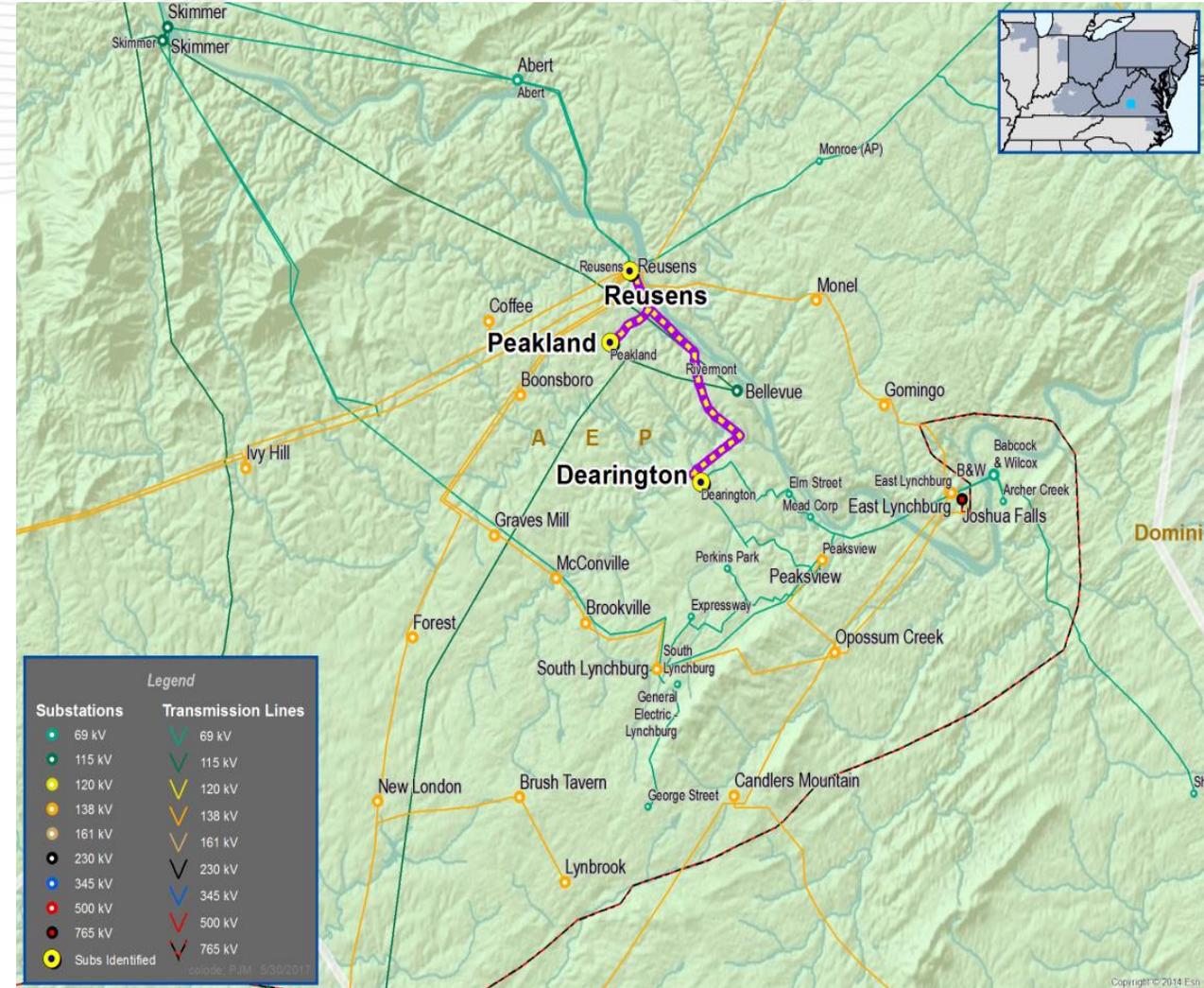
Rebuild Peakland – Dearington 69 kV circuit (approximately 4.4 miles) utilizing 795 26/7 ACSR conductor. A portion of this line shares a common tower with the Dearington – Blackwater 34.5 kV circuit. This line is currently comprised of 4/0 Copper, 1/0 Copper, and 336 ACSR conductor. (S1291)

Estimated Supplemental Project Cost: \$12.7M

Required IS Date: 6/1/2021

Projected IS Date: 12/1/2018

Status: Scoping





AEP Transmission Zone Baseline Reliability

AEP Transmission Owner Criteria Violation and Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The Craneco – Pardee – Three Forks – Skin Fork 46kV line (3/0 Copper, 37 MVA rating, 126%) overloads due to the N-1-1 outage of the Huff Creek 138/69/46 kV and Chauncey 138/46 kV transformers in the 2021 RTEP case.

The Becco – Skin Fork circuit is a poor performer in the APCO region. From 2013-2016, the Becco – Skin Fork circuit has experienced 15 permanent outages, resulting in 8,031,079 customer minutes of interruption. Approximately 11.5 miles of the line utilizes 1955 wood structures. There are 78 open category A conditions along the 18 mile long line. These include damaged poles and crossarms, conductor/shield wires, and guy anchor/knee/vee braces. –Logan, WV

Recommended Solution:

Rebuild the Craneco – Pardee – Three Forks – Skin Fork 46kV line section (approximately 7.2 miles) utilizing 795 26/7 ACSR conductor (108 MVA rating, 43%). (B2883)

Estimated Baseline Project Cost: \$12.2M

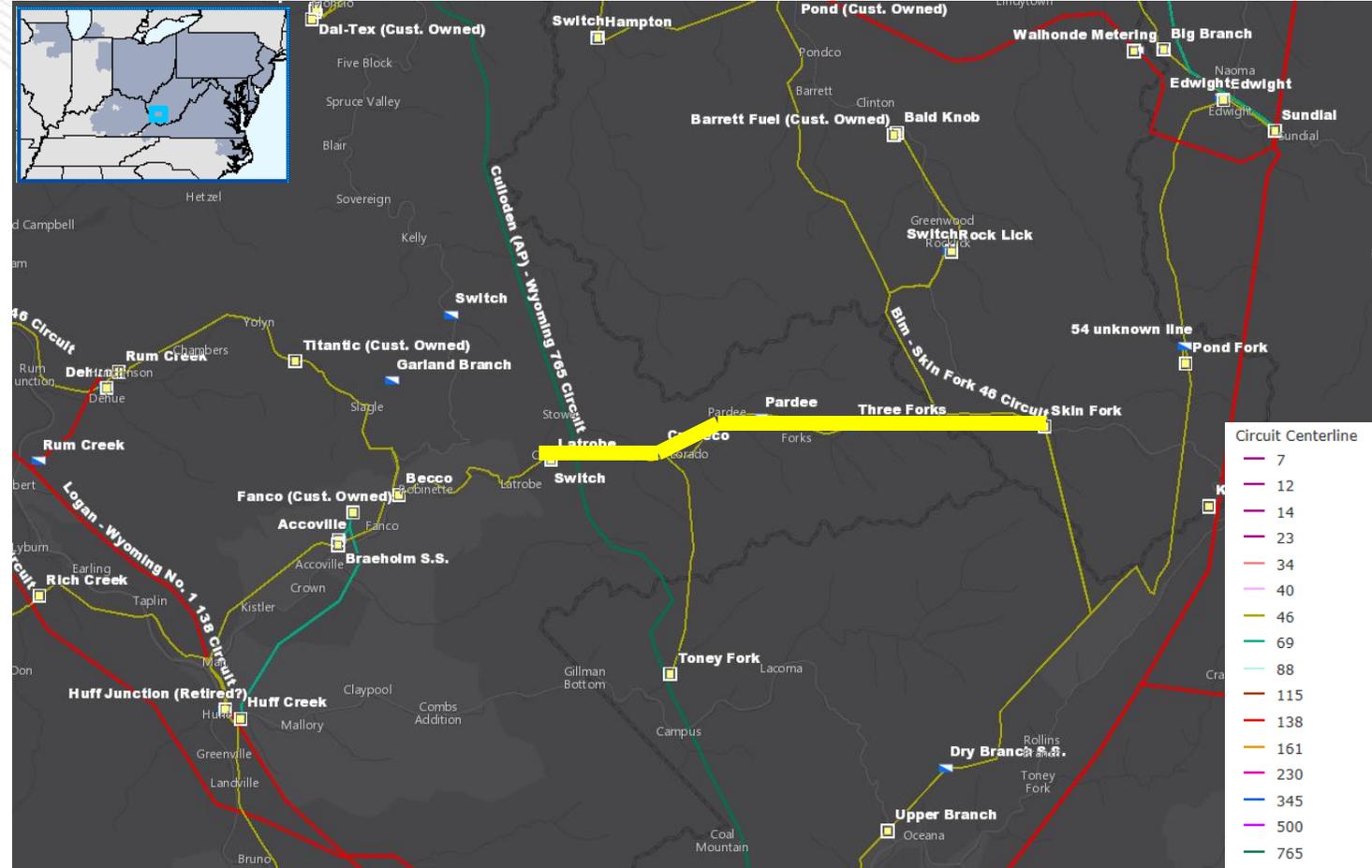
Rebuild Latrobe – Craneco 46kV line section (approximately 2.3 miles) utilizing 795 26/7 ACSR conductor. (S1292)

Estimated Supplemental Project Cost: \$4M

Required IS date: 6/1/2021

Projected IS date: 4/1/2018

Status: Engineering



AEP Transmission Owner Criteria Violation and Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

Numerous thermal and voltage deviation violations on the Kingsport 34.5 kV sub-transmission system for various N-1 and N-1-1 outages were identified in the 2021 RTEP case.—Kingsport, TN

Recommended Solution:

Install a second transformer at Nagel station, comprised of 3 single phase 250MVA 500/138kV transformers. Presently, TVA operates their end of the Boone Dam – Holston 138 kV interconnection as normally open preemptively for the loss of the existing Nagel 500/138 kV XF. By adding a second 500/138 kV transformer at Nagel, TVA will close in the interconnection, providing an additional source to the Kingsport area. (B2884)

Estimated Baseline Project Cost: \$13M

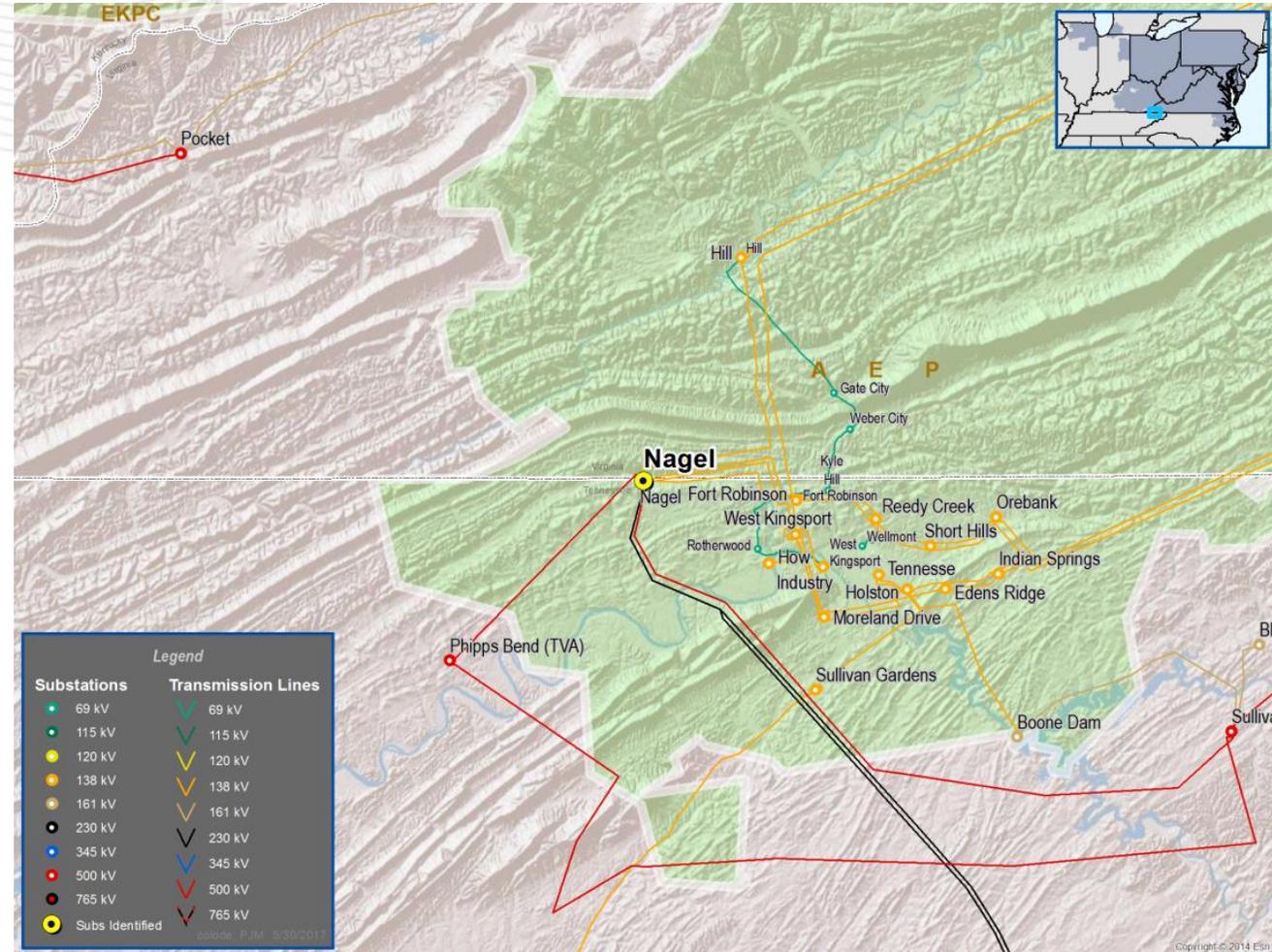
Purchase single phase 250MVA 500/138kV bank to be a shared spare for Nagel Station existing transformer 3 and for the proposed transformer.(S1293)

Estimated Supplemental Project Cost: \$2.8M

Required IS date: 6/1/2021

Projected IS date: 12/1/2019

Status: Scoping





AEP Transmission Zone Baseline Reliability

AEP Transmission Owner Criteria Violation and Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

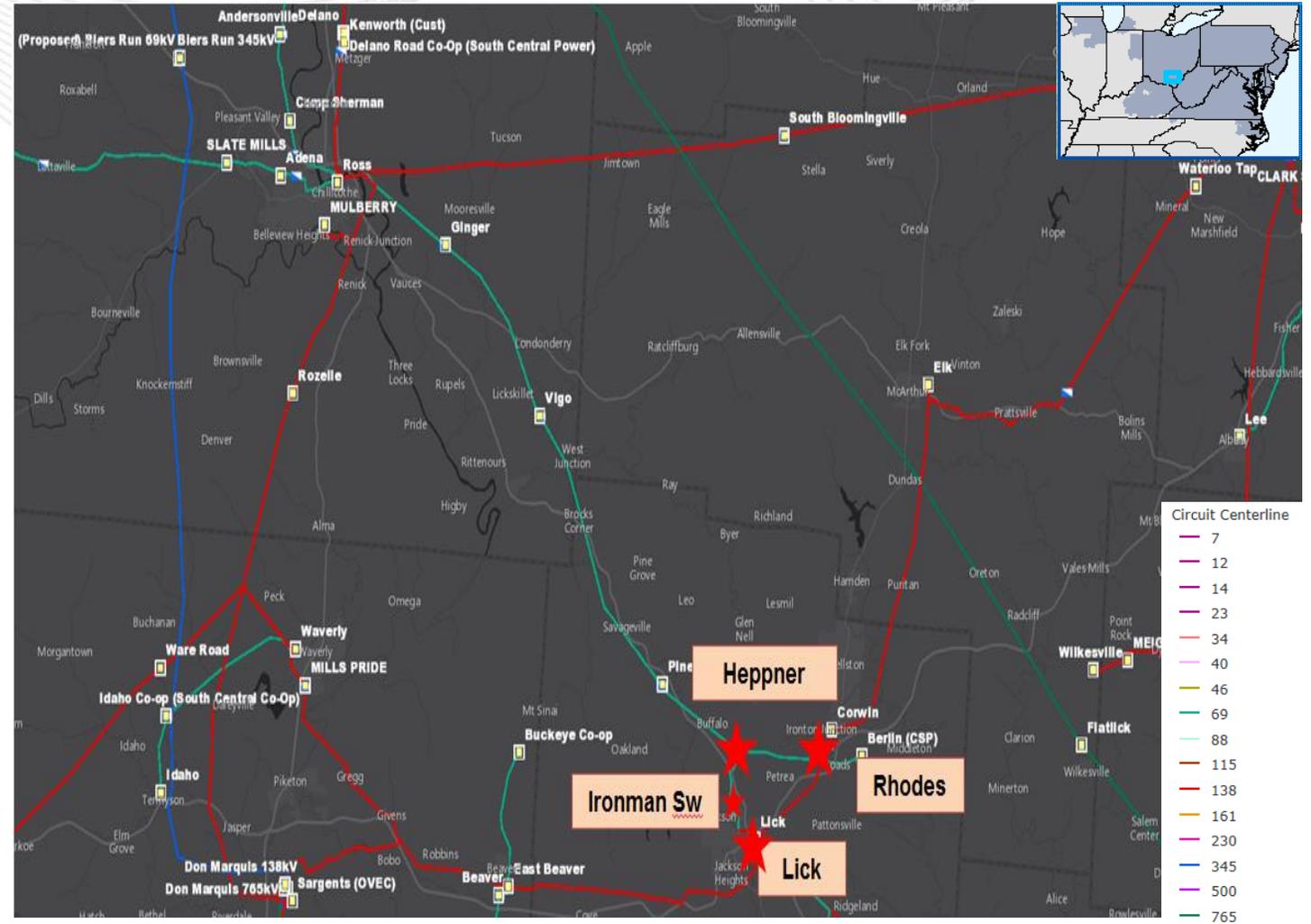
The City of Jackson has requested a new 69kV delivery point (Ironman Switch) capable of carrying their entire load, which will be ~37 MW due to a 4 MW load increase by the City. This new delivery point will be redundant with the existing 138kV delivery point out of Lick Station.

After the customer load is connected and is at the full capacity, there is an N-1 violation that drops the voltage at the customer bus to ~65% and thermally overloads the Lick-Ross 69kV Circuit to 130%. To solve this violation, a new 138/69kV station will be established (Rhodes Station), injecting a 3rd source onto the Lick-Ross 69kV circuit. Following the solution, no N-1 or N-1-1 violations appear.

The new City of Jackson delivery point is directly adjacent to the existing Berlin-Lick-Ross 69kV circuit. Of the 37+ miles of conductor on the circuit, 88% (32.96 miles) is original from the 1926 line construction – mostly 4/0 ACSR Penguin (50 MVA rating). Of the 275 structures, 98% (269) are wood and 43% (119) are older than 1960. There are 241 open conditions on the line, including issues with conductor, structures, and ROW encroachments. The line has been responsible for 1.4M CMI from 2013-2015, including over 12.5k customer interruptions. It is recommended that this circuit be rebuilt to 138kV standards in anticipation of a future 138kV conversion to become an additional 138kV path to support Ross Station as there is only one 138 kV source that currently feeds Ross station from the South.

Issues at every switch structure on this circuit (Coalton Sw, Pine Ridge Sw, Vigo, and Ginger) complicates any planned outages as momentary outages are required at all three stations in order to isolate a circuit section. AEP's MPOI calculation justifies the installation of breakers at Heppner station, which will replace Coalton switch. –City of Jackson, Jackson County, OH

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AEP Transmission Zone Baseline Reliability

AEP Transmission Owner Criteria Violation and Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Continued from previous slide

Recommended Solution:

Install a new Ironman Switch to serve a new delivery point requested by the City of Jackson for a load increase request. (B2885.1)

Install a new 138/69 kV station (Rhodes) to serve as a third source to the area to help relieve overloads caused by the customer load increase. (B2885.2)

Replace Coalton Switch with a new three breaker ring bus (Heppner). (B2885.3)

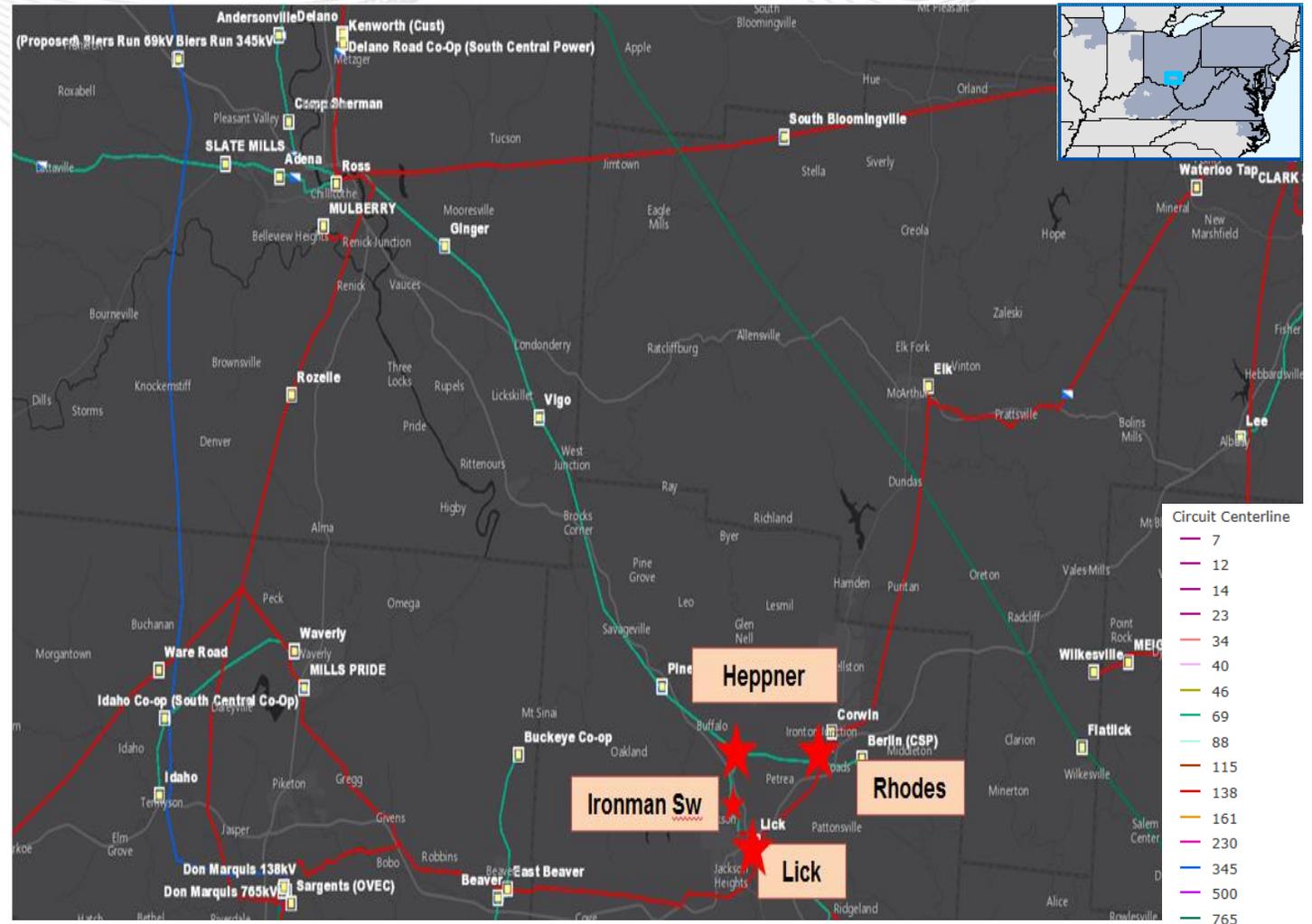
Estimated Baseline Project Cost: \$13M

Rebuild the around 6 miles line from Rhodes to Heppner and from Heppner to Lick with 1033 ACSR (148 MVA rating). Build for future 138 kV conversion (\$1342)

Estimated Supplemental Project Cost: \$7M

Required IS date: 3/1/2018

Status: Engineering



AEP Transmission Owner Criteria Violation and Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

N-1-1 analysis identified an overload of the East End Fostoria-West End Fostoria 69 kV line and low voltage violations on the 69 kV system for loss of the West End Fostoria 138/69 kV transformer and the Buckley Road 138/69 kV transformer in the 2021 RTEP case.

At West End Fostoria, 69 kV circuit breakers S and BB are vintage GE, FK and Allis-Chalmer, FZO model oil filled circuit breakers manufactured in 1965 and 1961. Furthermore, the maintenance has become difficult due to the oil handling required to maintain them. Oil spills are frequent with breaker failures and routine maintenance and can become an environmental hazard.

The West End Fostoria breakers have the following documented conditions: unavailability of spare parts, obsolete interrupting medium, PCB content, and age.

The installation of a high side CB to replace the existing transformer #5 MOAB "XX" will eliminate the need to isolate the entire 138 kV bus for a transformer fault. This will ensure the path to Melmore/Chatfield, Lemoyne(FE) and Fostoria Central will remain intact for loss of the existing transformer. –Fostoria, OH

Recommended Solution:

Install 90 MVA 138/69 kV transformer, new transformer high and low side 3000 A 40 kA CBs, and a 138 kV 40 kA bus tie breaker at West End Fostoria. (B2886)

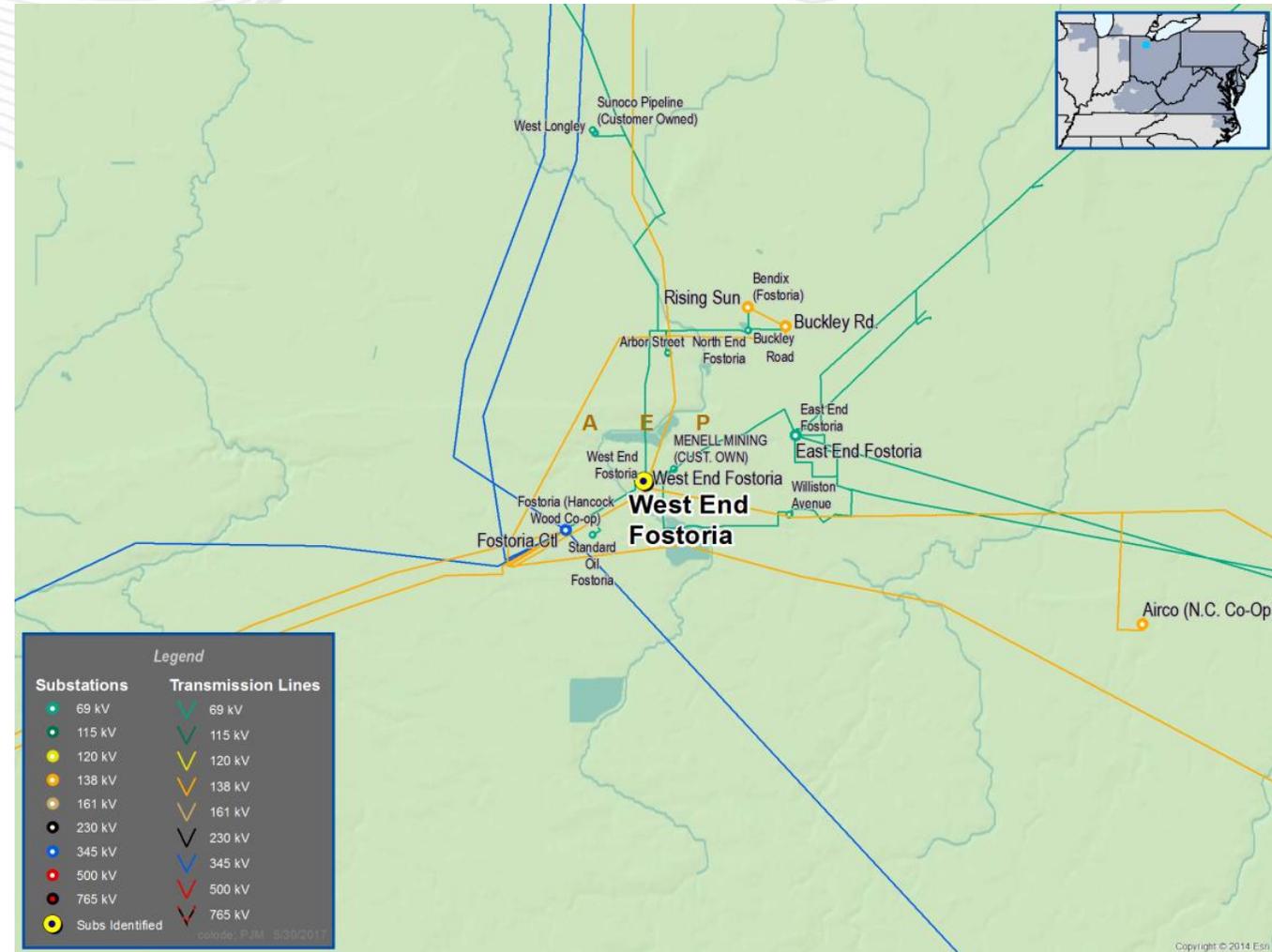
Estimated Cost: \$3.2M

Replace 600 A 40 KA MOAB (XX) with new 40 kA transformer CB. Replace 69 kV CBs BB (21 kA) & S (12 kA) with new 40 KA units at West End Fostoria. (S1294)

Estimated Cost: \$2.7M

Required IS date: 6/1/2021

Status: Engineering





AEP Transmission Zone Baseline Reliability

Common Mode Outage

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

PJM identified the Mifflin-Stelzer 138kV line overloaded for the loss of the Clinton – Morse Road 138kV line with the stuck breaker at Morse. – East side of Columbus, OH

Immediate Need: Due to the immediate need, the timing required for an RTEP proposal window is infeasible. As a result, the local Transmission Owner will be the Designated Entity.

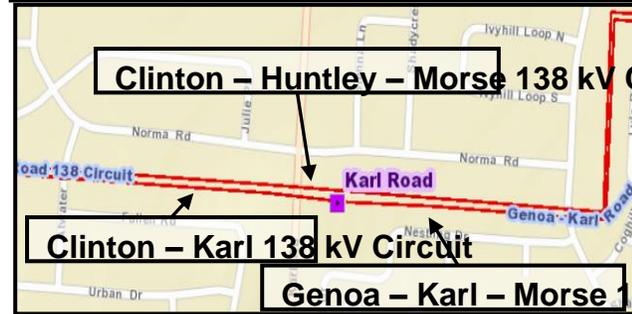
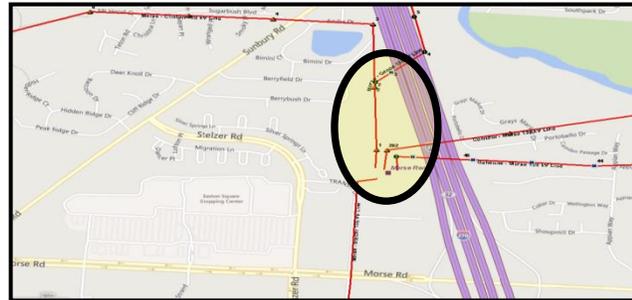
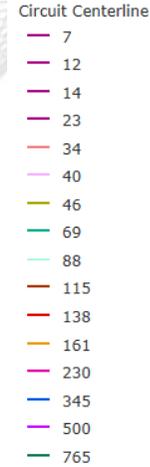
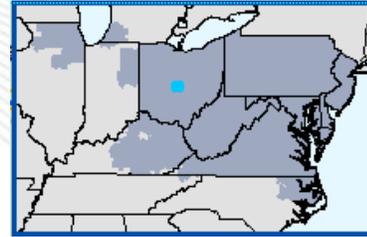
Recommended Solution:

Add 2-138kV CB's and relocate 2-138kV circuit exits to different bays at Morse Road. Eliminate 3 terminal line by terminating Genoa-Morse circuit at Morse Road. (B2887)

Estimated Cost: \$3.0M

Projected IS date: 12/31/2019

Status: Engineering





AEP Transmission Zone Baseline Reliability

Common Mode Outage, Basecase Analysis and TO criteria violation Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

PJM identified the Elliot – Rosewood 138kV line is overloaded for multiple common mode contingencies at Poston 138kV substation

AEP and PJM identified the Elliot – Ohio-U 69kV line and Elliot transformer are overloaded for multiple common mode contingencies at Poston 138kV substation.

PJM identified Low Voltage and Voltage drop violations at Elliot 138kV bus for multiple common mode contingencies at Poston 138kV substation.

The physical equipment at Poston is deteriorated and is mostly over 60 years in age. The bus consists of cap and pin insulators which are a safety concern due to the fact that the mechanical strength of the supports is greatly weakened over time. These cap and pin arrangements have a high tendency to fail during switching and AEP has had multiple instances of cap and pin insulators cracking and breaking while being removed out of service. Additionally, this station has been subject to flooding in the past, making it very difficult to repair or replace existing equipment in place.

All except 1 breaker (138kV & 69kV) at Poston are oil breakers (1200 A 20 kA FK-439's and 600 A 13 kA GO-4Bs types) that were originally installed in the 1940's and 50's. These breaker types are obsolete and do not work well with modern relaying schemes. Oil breakers in general have become difficult to maintain due to the required oil handling. Breaker 552N has had 49 fault operations. Breaker 652S has had 18 fault operations. Breaker 452S has had 178 fault operations. Breaker 252N has had 138 fault operations. Breaker 352N has had 36 fault operations. Breaker 152S has had 82 fault operations. Breaker 152N has had 99 fault operations. Breaker 652 has had 79 fault operations. The manufacturer recommended limit for fault operations for these types of breakers is 10. These breakers have the following documented conditions: age, bushing damage, PCB content, and number of fault operations.

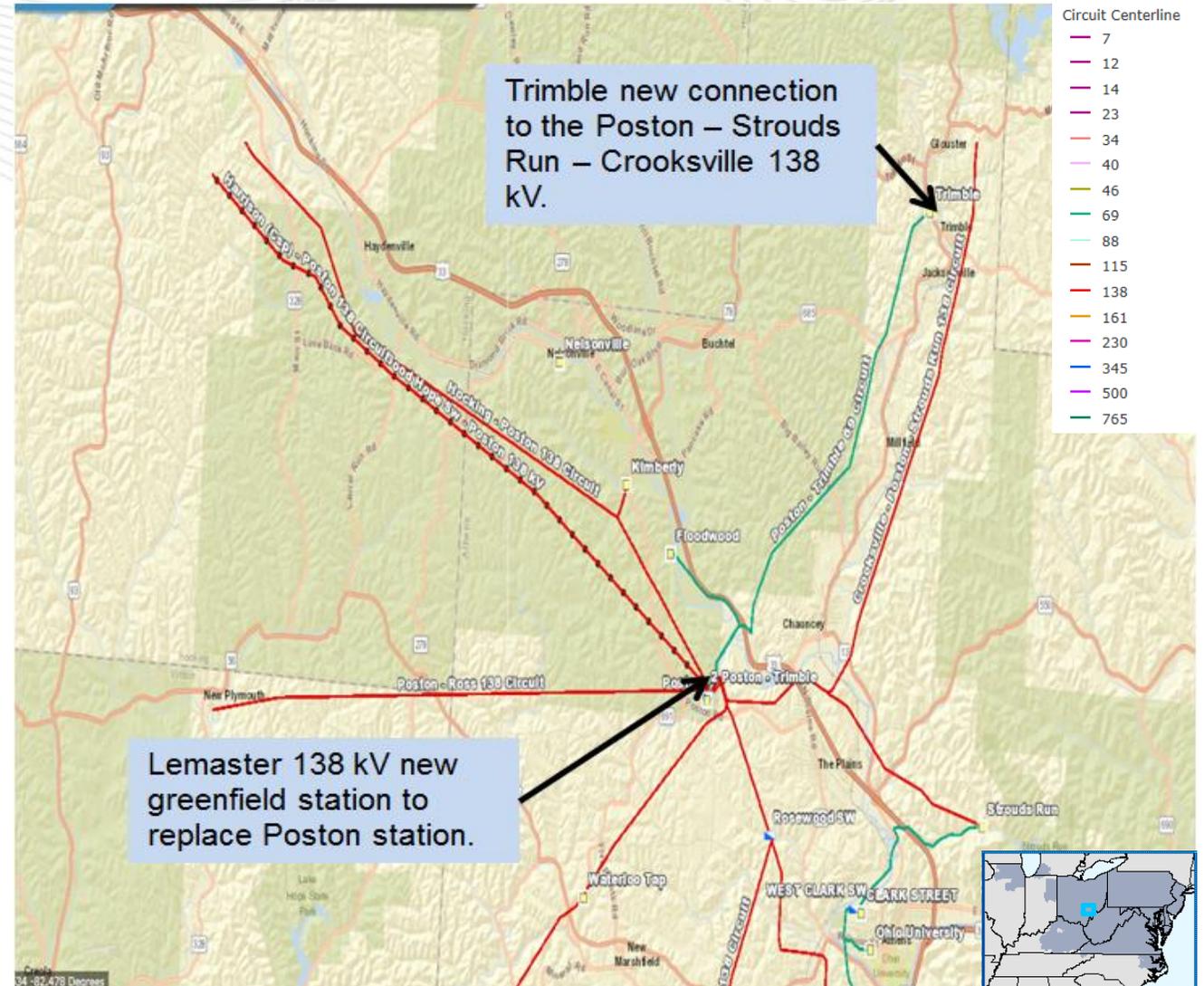
Poston 138/69 kV 47 MVA transformer 2 also needs to be replaced. The drivers for replacement are age, dielectric strength breakdown (winding insulation), short circuit strength breakdown (due to the amount of through fault events), and accessory damage (bushings).

The Poston – Trimble 69 kV line was originally built in 1924 utilizing 336 ACSR conductor (75 MVA rating) and currently has 30 open conditions along the 9.7 mile long line. In coordination with AEP Ohio and transmission operations and transmission field services, a plan to replace the existing 69 kV radial line with a new 138 kV tap to serve customers at Trimble station was developed.

–Athens, OH

Immediate Need: Due to the immediate need, the timing required for an RTEP proposal window is infeasible. As a result, the local Transmission Owner will be the Designated Entity.

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AEP Transmission Zone Baseline Reliability

**Common Mode Outage, Basecase Analysis and TO
criteria violation**

Previously Presented: 4/21/2017 SRTEAC

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Recommended Solution:

Remove and retire the Poston 138kV station (B2888.1)

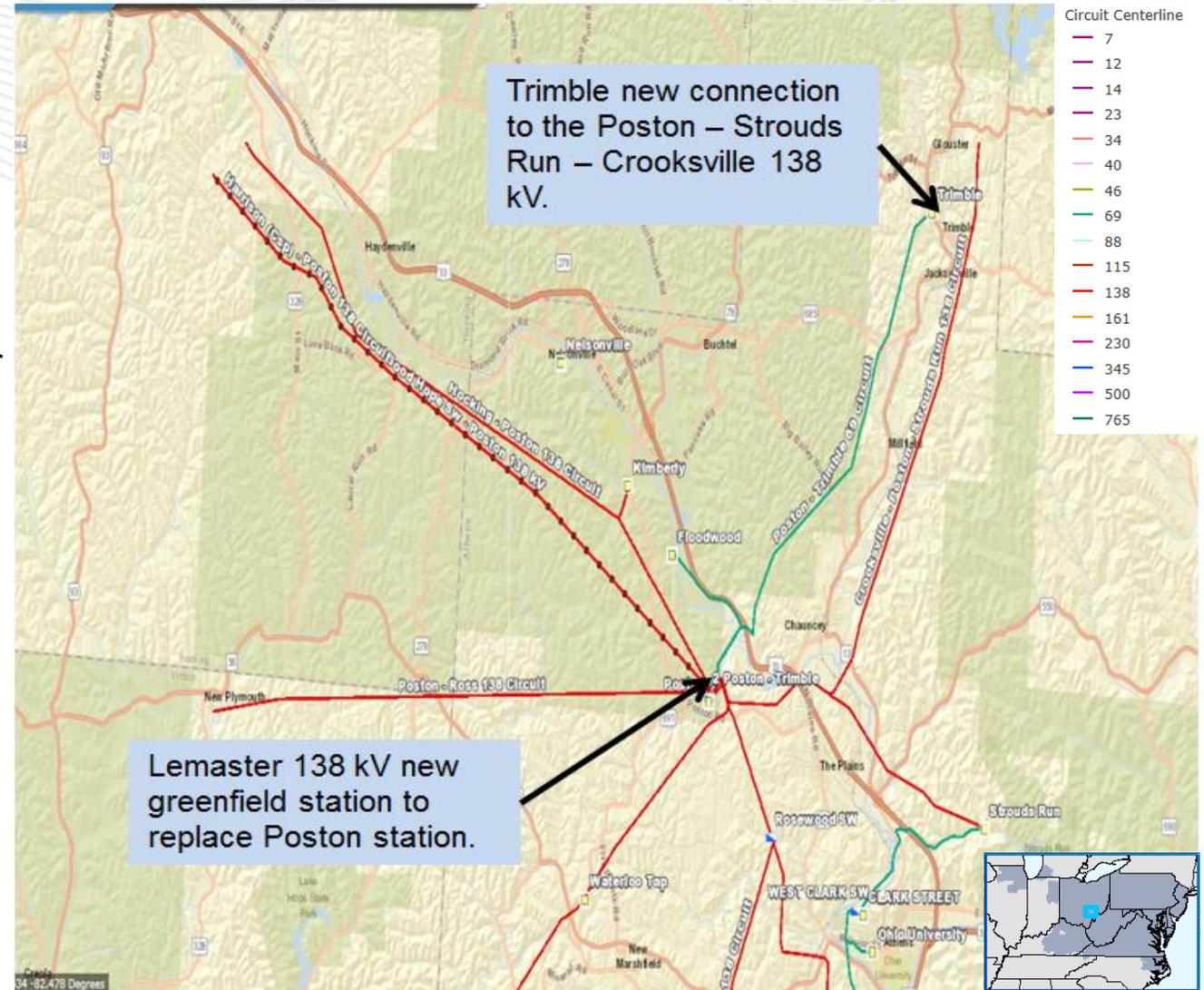
Install a new greenfield station, Lemaster 138kV Station, in the clear as a 138 kV switching station utilizing 3000 A 40 kA breakers. (B2888.2)

Relocate the Trimble 69 kV AEP Ohio radial delivery point to 138 kV, to be served off of the Poston – Strouds Run – Crooksville 138 kV circuit via a new three-way switch. Retire the Poston-Trimble 69kV line. (B2888.3)

Estimated Cost: \$26.97M

Projected IS date: 12/31/2018

Status: Engineering





AEP Transmission Zone Baseline Reliability

AEP Transmission Owner Criteria Violation and Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

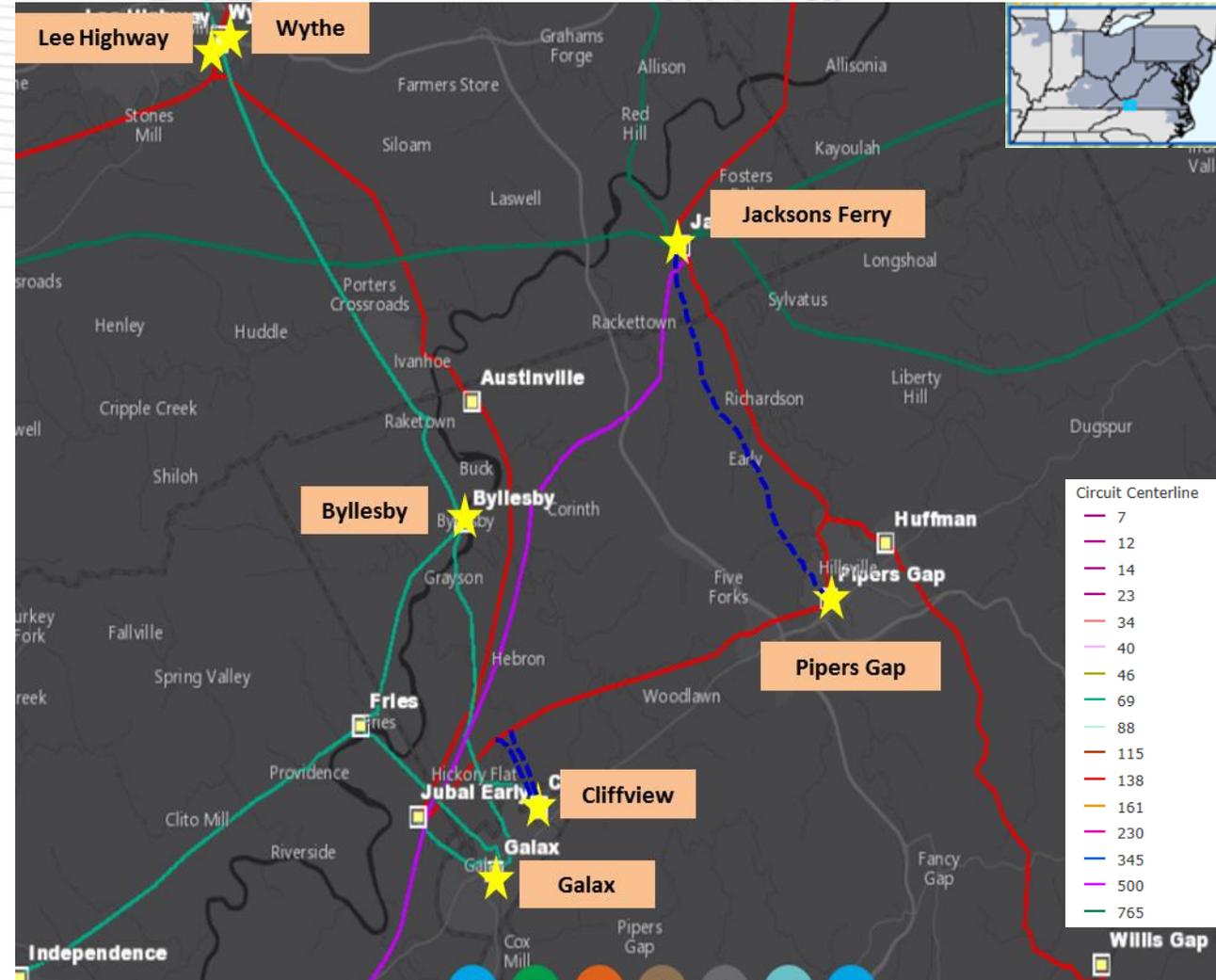
Problem Statement:

The Cliffview – Lee Highway 69 kV line (1/0 Copper, 48 MVA rating, 139%) overloads for loss of the Jubal Early 138/69 kV transformer in the 2021 RTEP case.

The ~13 mile double circuit line section north of Byllesby (Wythe – Cliffview and Wythe – Byllesby) is approximately 93 years old and has small 1/0 CU conductor. ~4 miles of this double circuit line is also in the national forest near Byllesby.

There is approximately 120 MW of load being served directly off the 138kV system in this area. Under N-1-1 conditions on the 138kV system, this entire load would be dropped. There is no opportunity to sectionalize the 138kV system as this would force the 69kV system to support the existing 90 MW of load plus the 120 MW of load on the 138kV, resulting in the entire 69kV system overloading. –Wytheville, VA

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AEP Transmission Zone Baseline Reliability

AEP Transmission Owner Criteria Violation and Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

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Recommended Solution:

Cliffview Station: Establish 138kV bus. Install two 138/69kV XFRs (130 MVA), six 138kV CBs (40kA 3000A) and four 69kV CBs (40kA 3000A) .(B2889.1)

Cliffview Line: Tap the existing Pipers Gap – Jubal Early 138kV line section. Construct double circuit in/out (~2 miles) to newly established 138kV bus, utilizing 795 26/7 ACSR conductor.(B2889.4)

Byllesby – Wythe 69kV: Retire all 13.77 miles (1/0 CU) of this circuit (~4 miles currently in national forest). (B2889.2)

Galax – Wythe 69kV: Retire 13.53 miles (1/0 CU section) of line from Lee Highway down to Byllesby. This section is currently double circuited with Byllesby – Wythe 69kV. Terminate the southern 3/0 ACSR section into the newly opened position at Byllesby 69kV, creating a new Galax – Byllesby 69kV circuit..(B2889.3)

Estimated Baseline Project Cost: \$30M

Pipers Gap: Install five 138kV CBs (40kA 3000A). (S1295.1)

Jacksons Ferry: Install one 138kV CB (S1295.2)

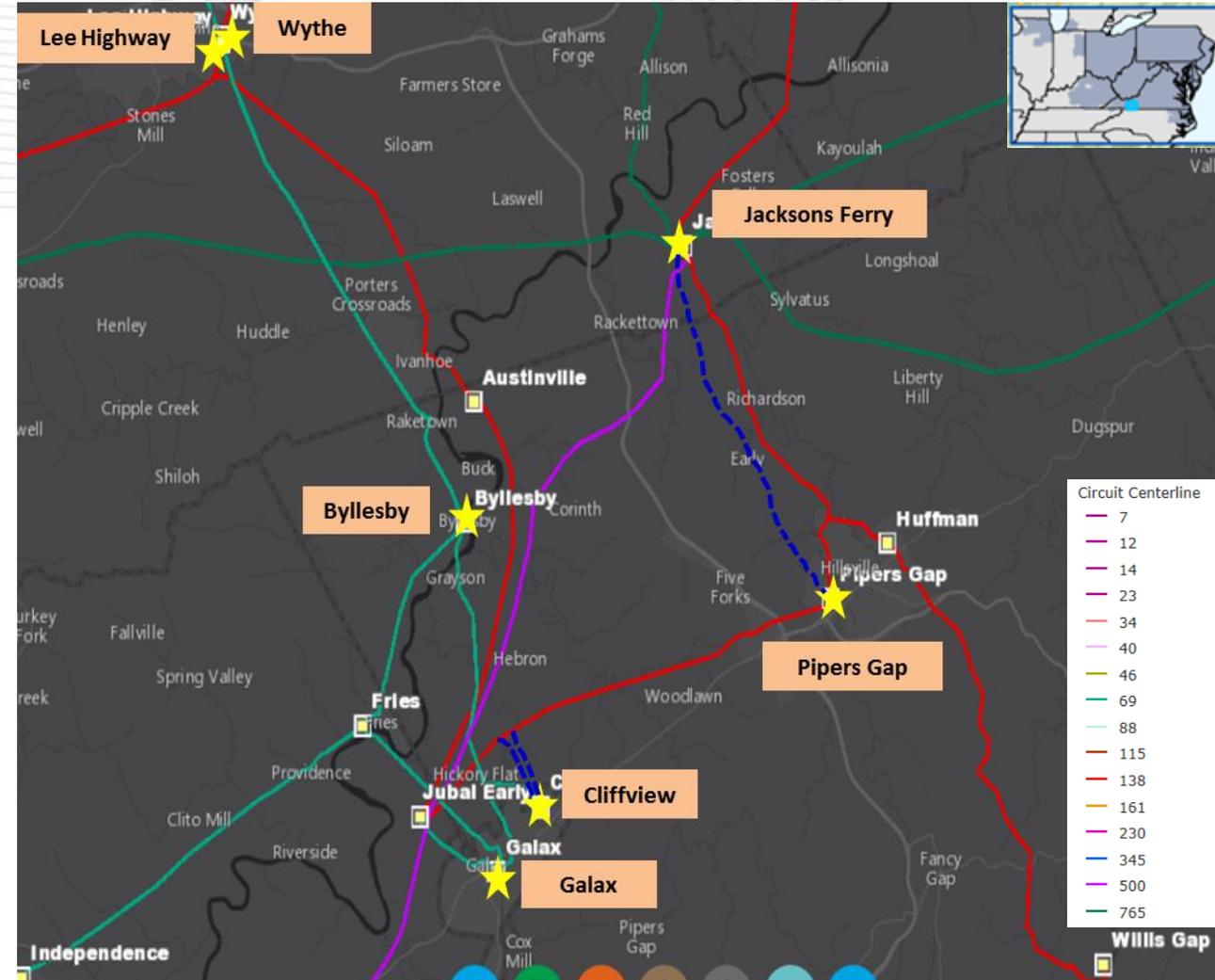
Jacksons Ferry – Pipers Gap 138kV: Construct a new 138kV line (~10 miles) from Jacksons Ferry – Pipers Gap utilizing 1033.5 ACSR conductor. (S1295.3)

Estimated Supplemental Project Cost: \$35M

Required IS Date: 6/1/2021

Projected IS Date: 6/1/2021

Status: Scoping





AEP Transmission Owner Criteria Violation and Baseline Scope Change

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The Fairdale-Cambridge 69 kV line (266 ACSR, 64 MVA rating), the Summerfield-Derwent 69 kV line (336 ACSR, 75 MVA rating), and the Cambridge-West Cambridge 34.5kV line (4/0 Copper, 27 MVA rating) are overloaded for several combinations of N-1-1 contingencies in the Cambridge area in the 2021 RTEP.

The East Cambridge – Smyrna 34.5 kV circuit was built originally in 1954 and is comprised of mostly 1/0 and 4/0 Copper conductor (17 MVA rating). It presently has 135 open A conditions on the 23.5 mile long line associated with conductor and structure concerns and has resulted in over 3.1M customer minutes of interruption between 2013 and 2016

The East Cambridge-Smyrna lines and associated stations can't be adequately maintained without shutting power off to customers. After significant outreach and discussions with all stakeholders, including AEP Distribution and the Guernsey-Muskingum Co-op, a commitment to the 69kV loop was agreed to. –Cambridge, OH

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AEP Transmission Zone Baseline Reliability

AEP Transmission Owner Criteria Violation and Baseline Scope Change Previously Presented: 4/21/2017 SRTEAC

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Recommended Solution:

Rebuild 23.55 miles of the East Cambridge – Smyrna 34.5 kV circuit with 795 ACSR conductor (128 MVA rating) and convert to 69 kV. Estimated cost: \$34M (B2890.1)

East Cambridge: Install a 2000 A 69 kV 40 kA circuit breaker for the East Cambridge – Smyrna 69 kV circuit. Estimated cost: \$0.538M (B2890.2)

Old Washington: Install 69 kV 2000 A two way phase over phase switch. Estimated cost: \$0.512M (B2890.3)

Antrim Switch: Install 69 kV 2000 A two way phase over phase switch. Estimated cost: \$1.2M (B2890.4)

Modify the scope for PJM project b2715 (see below)

Estimated Cost: \$36.25M

Required IS Date: 6/1/2021

Status: Engineering

B2715 original Scope : Build approximately 11.5 miles of 34.5 kV line with 556.5 ACSR 26/7 Dove conductor on wood poles from Flushing station to Smyrna station. Original Estimated cost: \$14.355M, Old Required IS Date: 6/1/2020

B2715 new Scope: Install a 69 kV ring bus at Flushing instead of a 69/34.5 kV transformer, Convert Smyrna to 69 kV and install two 69 kV breakers, Convert Vail to 69 kV and serve AEP Distribution via a 69/34.5 kV transformer, Build the Flushing – Smyrna line to 69 kV instead of 34.5 kV.

New Estimate Cost: \$18.355M

New Required IS Date: 6/1/2020

Total Estimated Project Cost: \$54.605M



AEP Transmission Owner Criteria Violation Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The Midland Switch-East Findlay 34.5 kV line (4/0 ACSR, 25 MVA rating) is overloaded for the N-1-1 loss of the Ebersole 138/34.5 kV transformer and the Findlay Center 138/34.5 kV transformer. –Findlay, OH

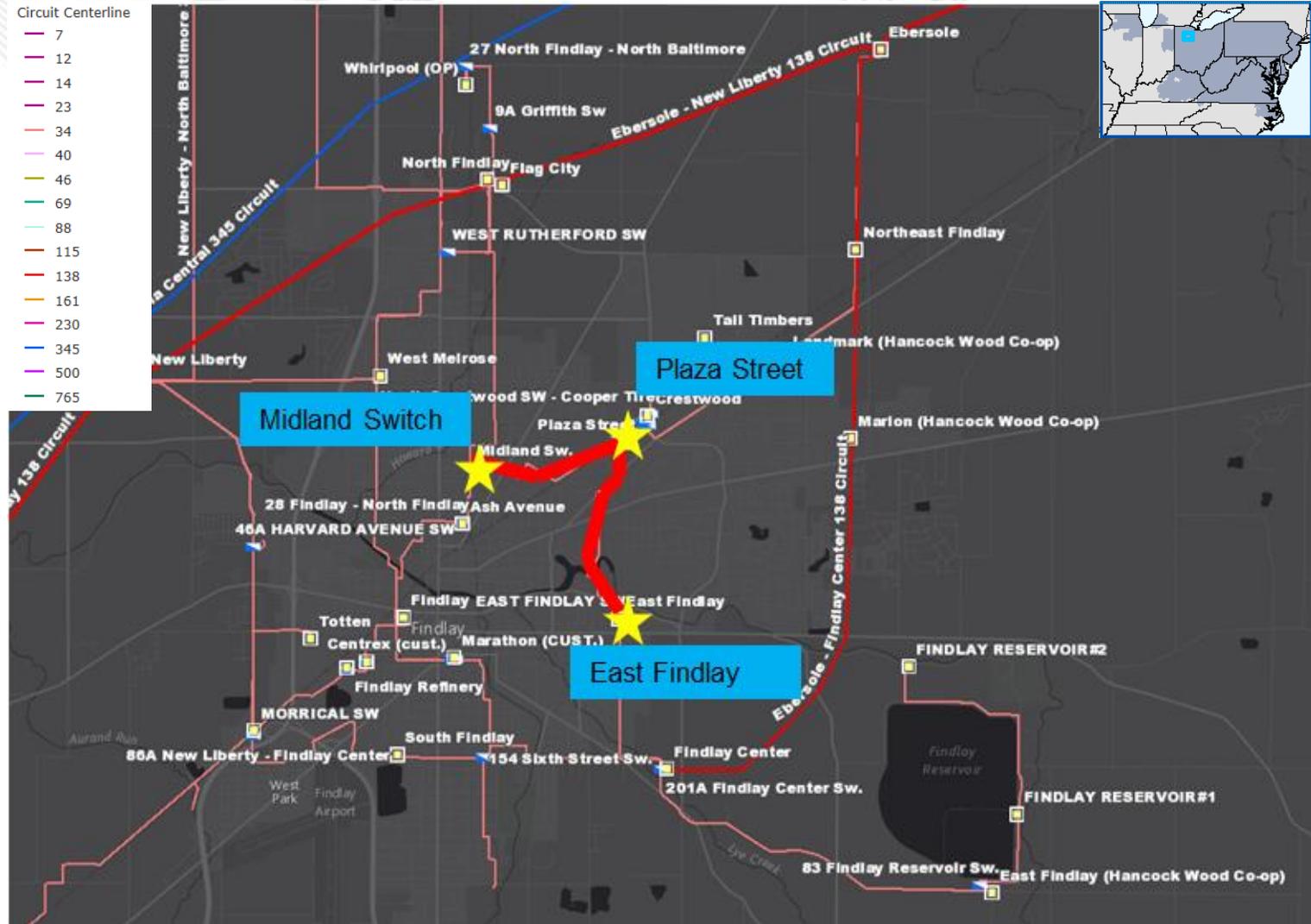
Recommended Solution:

Rebuild the Midland Switch to East Findlay 34.5 kV line (3.31 miles) with 795 ACSR (63 MVA rating) to match other conductor in the area. (B2891)

Estimated Cost: \$4.8M

Required IS Date: 6/1/2021

Status: Scoping





AEP Transmission Zone Baseline Reliability

AEP Transmission Owner Criteria Violation and Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The Leon-Ripley 69kV line (4/0 ACSR, 61 MVA rating, 125%) and 138/69kV transformers #3 at Leon (45 MVA rating, 100%) overload for N-1-1 loss of the Gavin – Meigs 69kV line in conjunction with the Lakin – Racine 69 kV line in the 2021 RTEP case. There are voltage violations (0.90 pu, 12% drop) at the Ripley bus for an N-1 loss of the Leon-Ripley line.

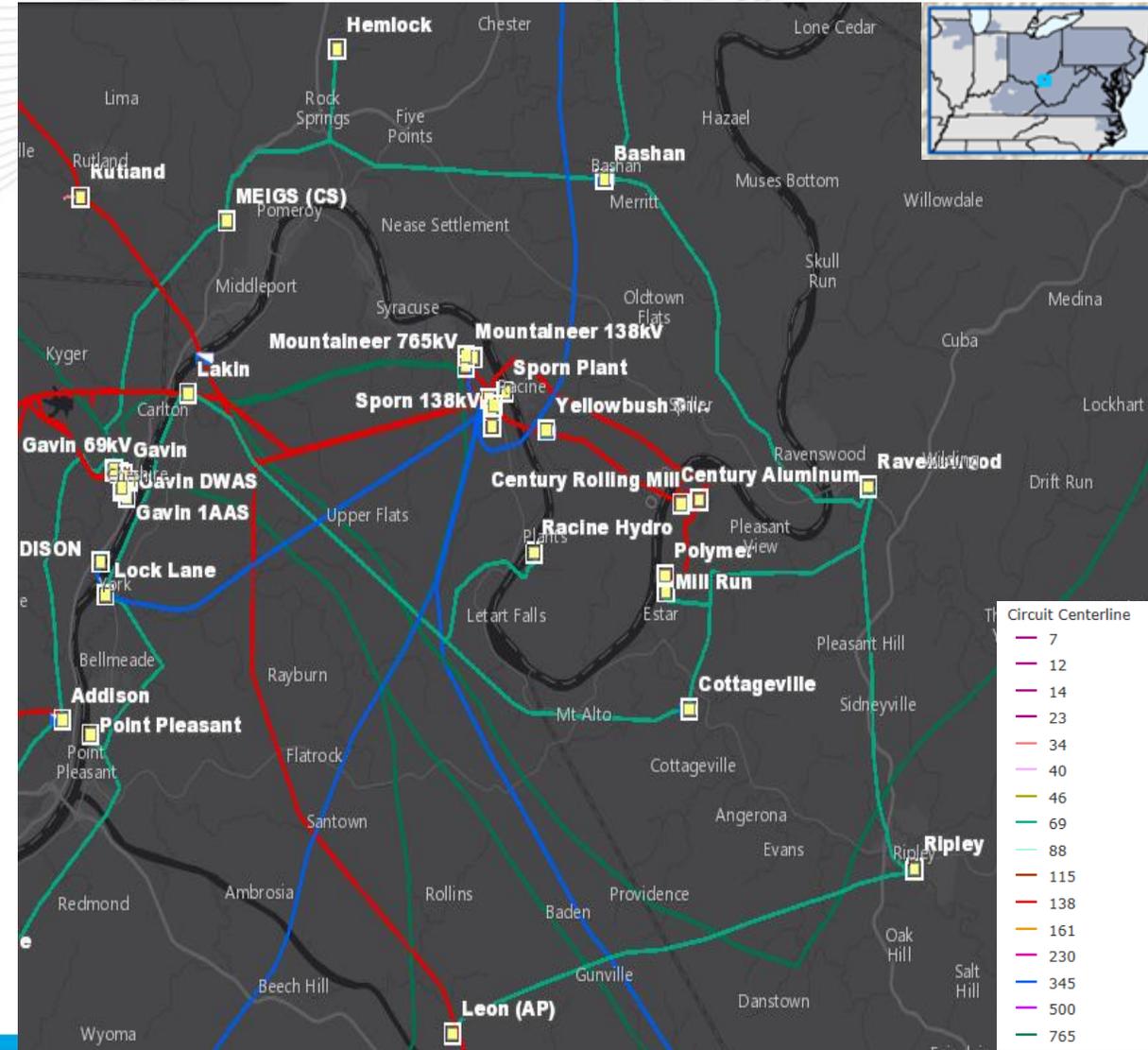
The Leon-Ripley line was constructed in 1957 utilizing 4/0 ACSR conductor on wood H-frame structures and has 209 open A conditions on the 13 mile long line. Most of the structures on this line (77%) are still original from 1957.

Leon 69 kV breaker A is a 1200 A 12 kA FK-type oil breaker manufactured in 1958. Breaker A has had 127 fault operations, exceeding the manufacturer recommended limit of 10. 138/69 kV 25 MVA transformers 1 and 3 at Leon have High concentrations of combustible gases due to Corona Partial Discharges. There is also significant increased trending in oil moisture content which reduces the oil dielectric strength, indicating a breakdown of the paper insulation of the transformer windings. Additionally, there are multiple overlapping zones of protection at Leon (two line exits, two transformers, and bus). The recommended maximum is two overlapping zones.

The Ravenswood 69 kV breakers G and H are 1200 A 20 kA CF-type oil filled breakers manufactured in 1968. Breaker G has had 125 fault operations. Breaker H has had 202 fault operations. Both exceed the manufacturer recommended limit of 10.

In general, oil breakers have become more difficult to maintain due to the required oil handling. Oil spills occur often during routine maintenance and failures, which can become an environmental concern.

– Charleston, WV





AEP Transmission Zone Baseline Reliability

AEP Transmission Owner Criteria Violation and Supplemental Project
Previously Presented: 4/21/2017 SRTEAC

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Recommended Solution:

Install new 138/12kV transformer with high side circuit switcher at Leon and a new 138 kV line exit towards Ripley. Establish 138kV at Ripley station with a new 138/69 kV 130MVA transformer and move the distribution load to 138 kV service. Rebuild the existing 69kV Leon – Ripley branch with 1033 ACSR and operate at 138kV. Rebuild the Ripley 69 kV bus. (B2892)

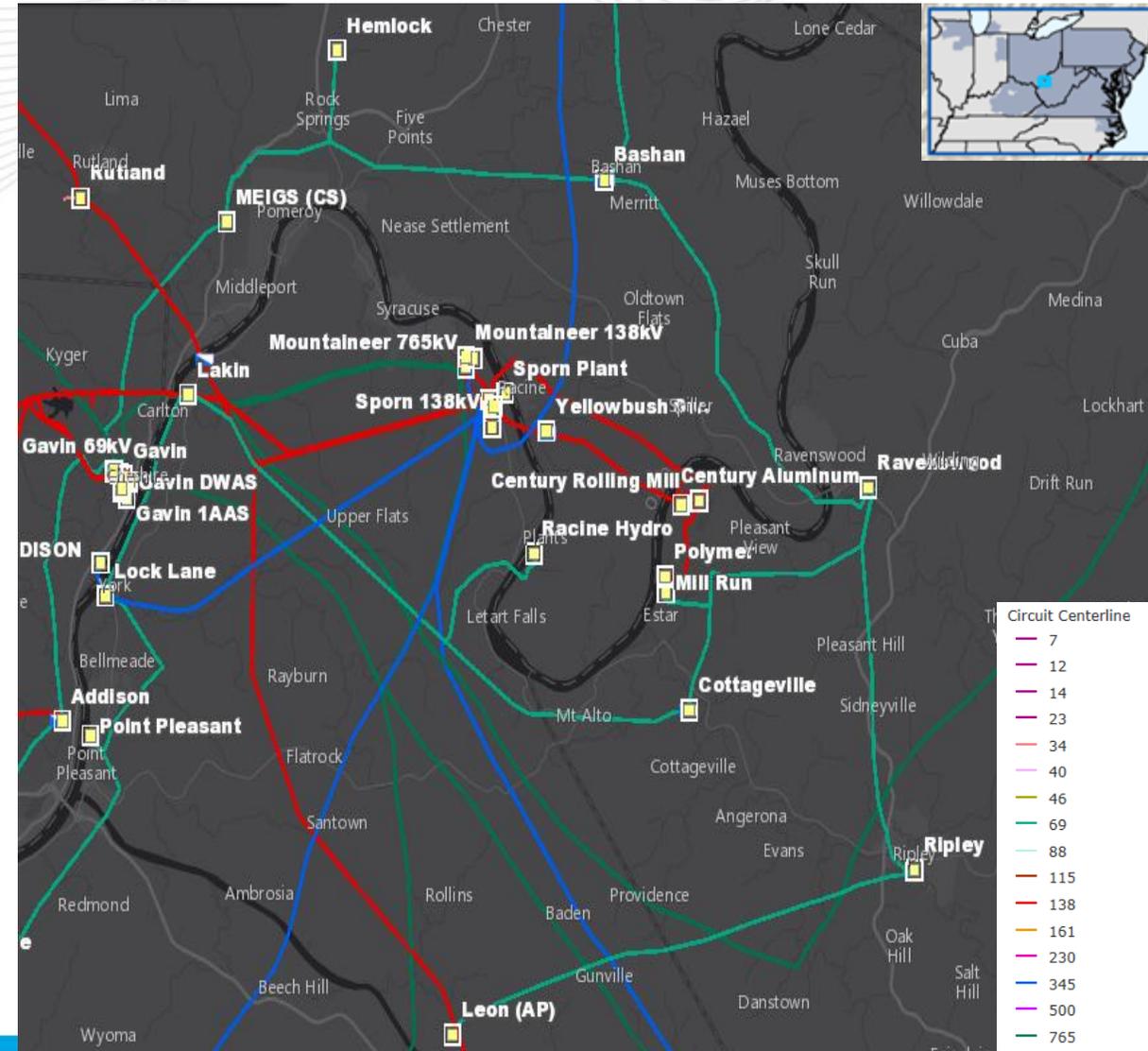
Estimated Baseline Project Cost: \$27.1M

Replace circuit breakers G and H at Ravenswood station with 3000 A 40 kA breakers. Install 3000 A 40 kA circuit breakers on all line exits at Leon station. (S1296)

Estimated Supplemental Project Cost: \$4M

Required IS Date: 6/1/2021

Status: Engineering





AEP Transmission Zone Supplemental Project

Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

Buckeye Power, on behalf of North Central Electric Cooperative Inc. (NCEC), requested a new Adrian 69kV delivery point to serve load. –Upper Sandusky, OH

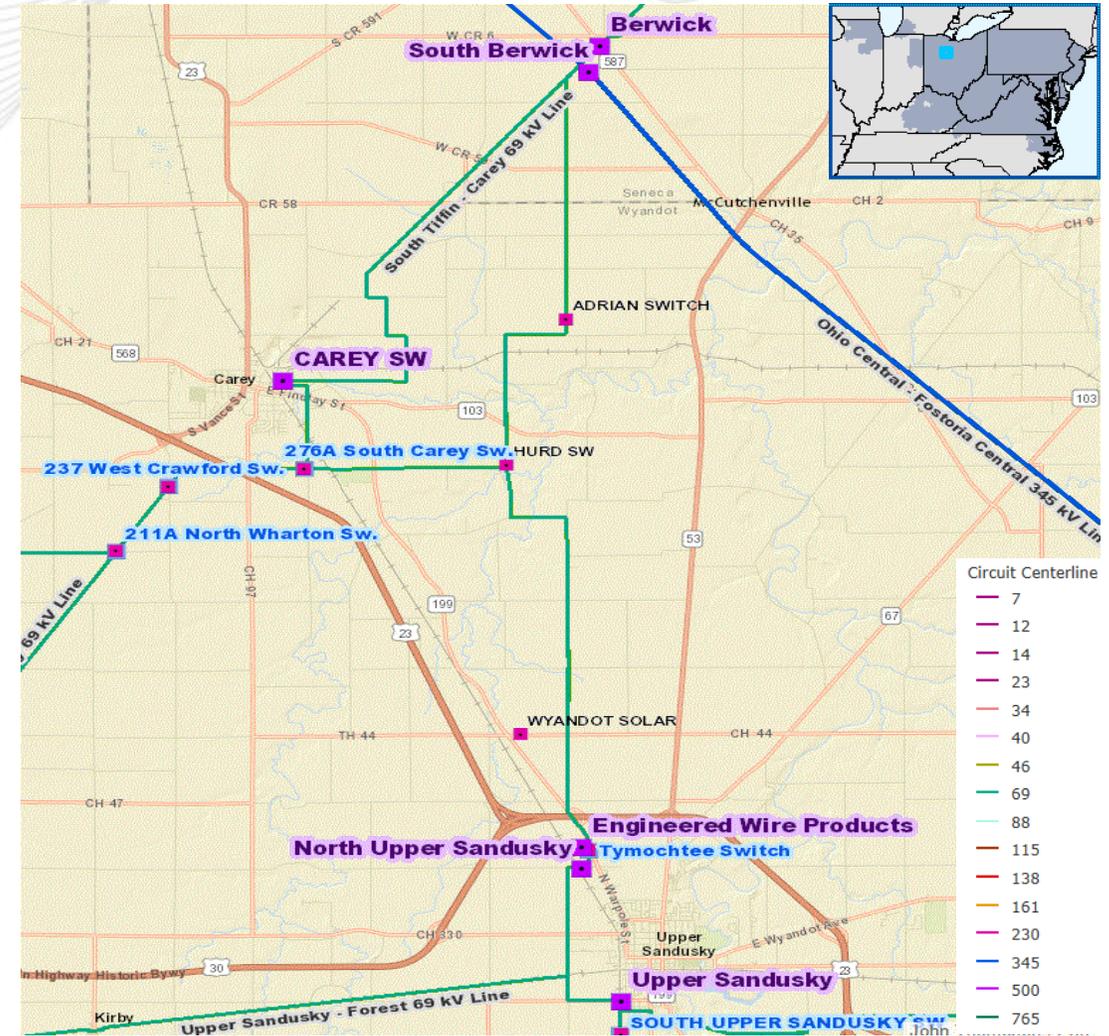
Selected Solution:

Install a New 69kV PH/PH switch to connect NCEC to 69kV and new 3-Element Revenue Metering. (S1299)

Estimated Cost: \$0.75M

Projected IS date: 8/31/2017

Status: Engineering



Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

All breakers included in this project are 3000 A 80kA 2-cycle trip air blast, PK type breakers. AEP is replacing air blast breakers for safety concerns across the AEP system. Air blast breakers in general have become a safety concern due to their catastrophic and violent failures which typically expels sharp pieces of porcelain.

The drivers for these replacements are age, wear, amount of fault operations, and no repair part availability. Circuit breaker C has 102 fault operations, C1 has 23 fault operations, and C2 has 102 fault operations. The recommended value from the manufacturer is 10 fault operations. –Charleston, WV

Selected Solution:

Replace Amos 138kV circuit breaker C, C1, C2, 80kA CBs (2~ trip) with new 3000 A 80kA CBs (3~ trip). (\$1300)

Estimated Cost: \$1.7M

Projected IS date: 11/9/2017

Status: Engineering





Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

Breakers C & D at Chadwick and C at Kenova are 1800 A 27 kA FK-72.5 type and over 40 years old. These are oil breakers that have become more difficult to maintain due to the required oil handling. In general, oil spills occur often during routine maintenance and failures with these types of breakers. Other drivers include PCB content, damage to bushings and number of fault operations exceeding the recommendations of the manufacturer. Chadwick breakers C & D have had 25 and 16 fault operations respectively with breaker C at Kenova recording 32 fault operations. The manufacturer recommended limit for fault operations is 10 for these types of breakers.

Breaker E at Leach and A & B at England Hill are 1200 A 20 kA CF-48 type oil breakers. Maintenance, as stated above, for oil breakers has become more difficult with age. In addition, these breakers also have bushing damage, some have exceeded the amount of fault operations recommended by the manufacturer and they are all experiencing mechanical breakdown associated with contacts and resistors. Lastly, the latest readings indicate moisture content has been trending unfavorably to higher levels. England Hill breaker B has had 22 fault operations. The manufacturer recommended limit for fault operations is 10 for these types of breakers.

There are currently five overlapping zones of protection at Chadwick station: 138kV Bellefonte line, 138kV Kentucky Electric Steel, 138kV bus differential, transformer #1 differential, and the 69kV bus differential. This setup is prone to misoperations. Installing line breakers on the Bellefonte and Kentucky Electric Steel lines will isolate the line protection from the bus protection, thereby shielding the 138kV Chadwick bus from faults on the nearby 138kV lines. In accordance to AEP guidelines, no more than two protection zones can be combined. Since the 69 kV breakers are being addressed as part of this project, AEP is taking the opportunity to also fix the overlapping zone concern. – KY, OH, WV border

Selected Solution:

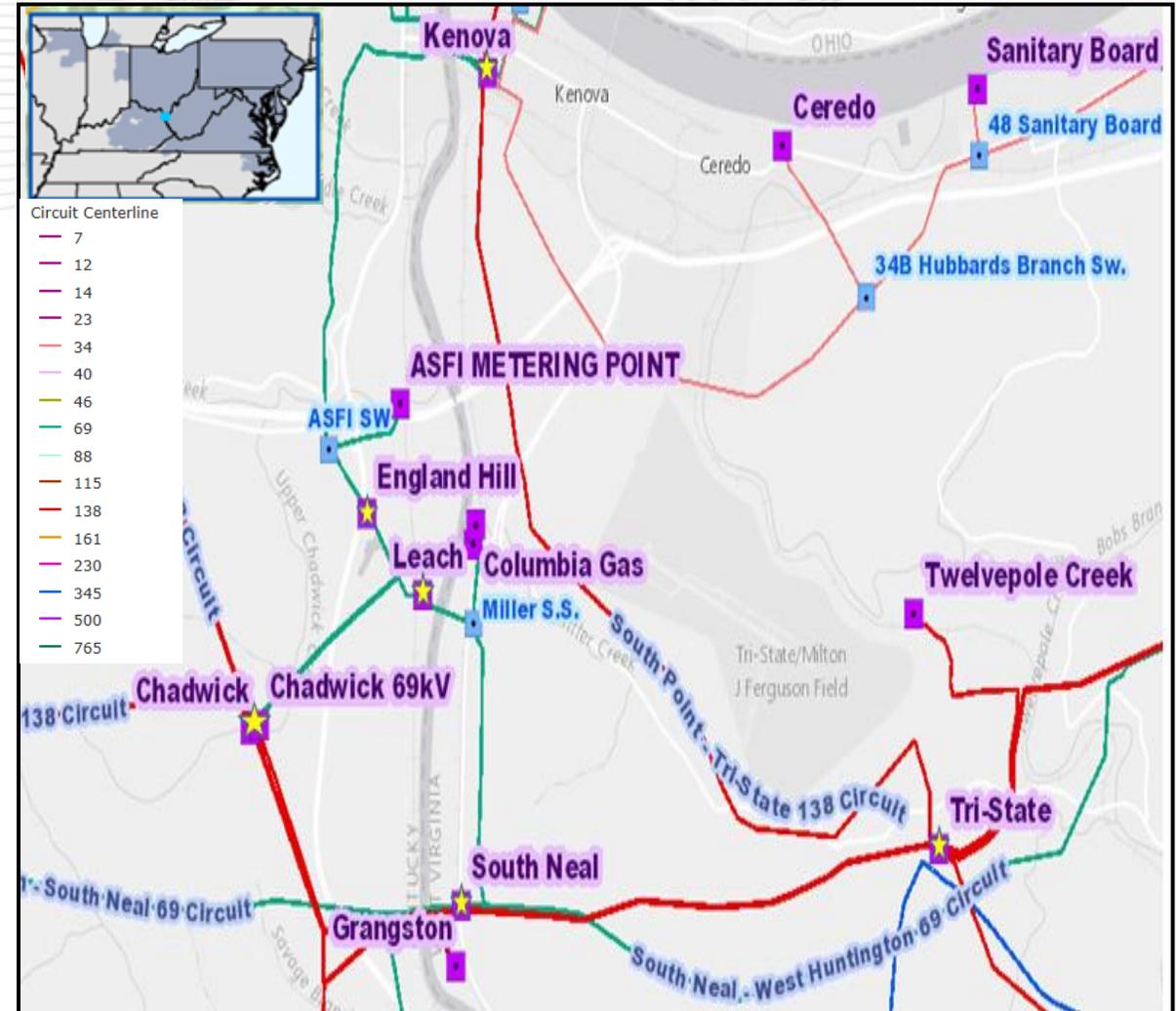
- At Chadwick 138kV station, install two 138 kV circuit breakers in place of the MOAB switches “V” and “Y”. (S1301.1)
- Replace 69kV circuit breakers C and D with 3000 A 40 kA breakers. (S1301.2)
- At Leach station, replace 69 kV breaker E with a 3000 A 40 kA breaker. (S1301.3)
- At England Hill, replace 69 kV circuit breakers A and B with 3000 A 40 kA breakers. (S1301.4)
- At Kenova, replace 69 kV circuit breaker C with a 3000 A 40 kA breaker. (S1301.5)

Estimated Cost: \$10.94M

Projected IS date: 6/7/2017

Status: Under Construction

AEP Transmission Zone Supplemental Project





AEP Transmission Zone Supplemental Project

Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

Battelle (4.5 MVA load served out of Nautilus station) has requested AEP to upgrade its Transmission service with looped service. Nautilus is currently served radially at 69 kV from Blair station. Looped 69 kV service will be provided to Nautilus and Blair from Trabue station by rebuilding portions of the West-Wilson Road 40 kV radial line to 69 kV and reconnecting to the Trabue-Galloway Road 69 kV line. The remaining portions of 40 kV circuit will be retired, along with West station.

The West-Wilson Road 40 kV radial line was originally constructed in 1953 and has 143 open A conditions along the 12 mile long line. The 40 kV line was built with 2/0 ACSR conductor (22 MVA rating). The radial line makes it difficult to secure outages to perform maintenance as any outage directly affects two industrial customers and an Ohio Power Company Distribution station. –West side of Columbus, OH

Selected Solution:

Retire West 40kV Station and North Galloway 40kV Switch. (S1302.1)

Rebuild portions of the West-Wilson Road 40 kV line as 69 kV with 1033 ACSR conductor (125 MVA rating) to match the rest of the 69 kV through path and connect at Nautilus station. (S1302.2)

Reconnect the rebuilt portion of the 40kV line to the Trabue-Galloway Road line to create a 69 kV loop through Nautilus and Blair stations. (S1302.3)

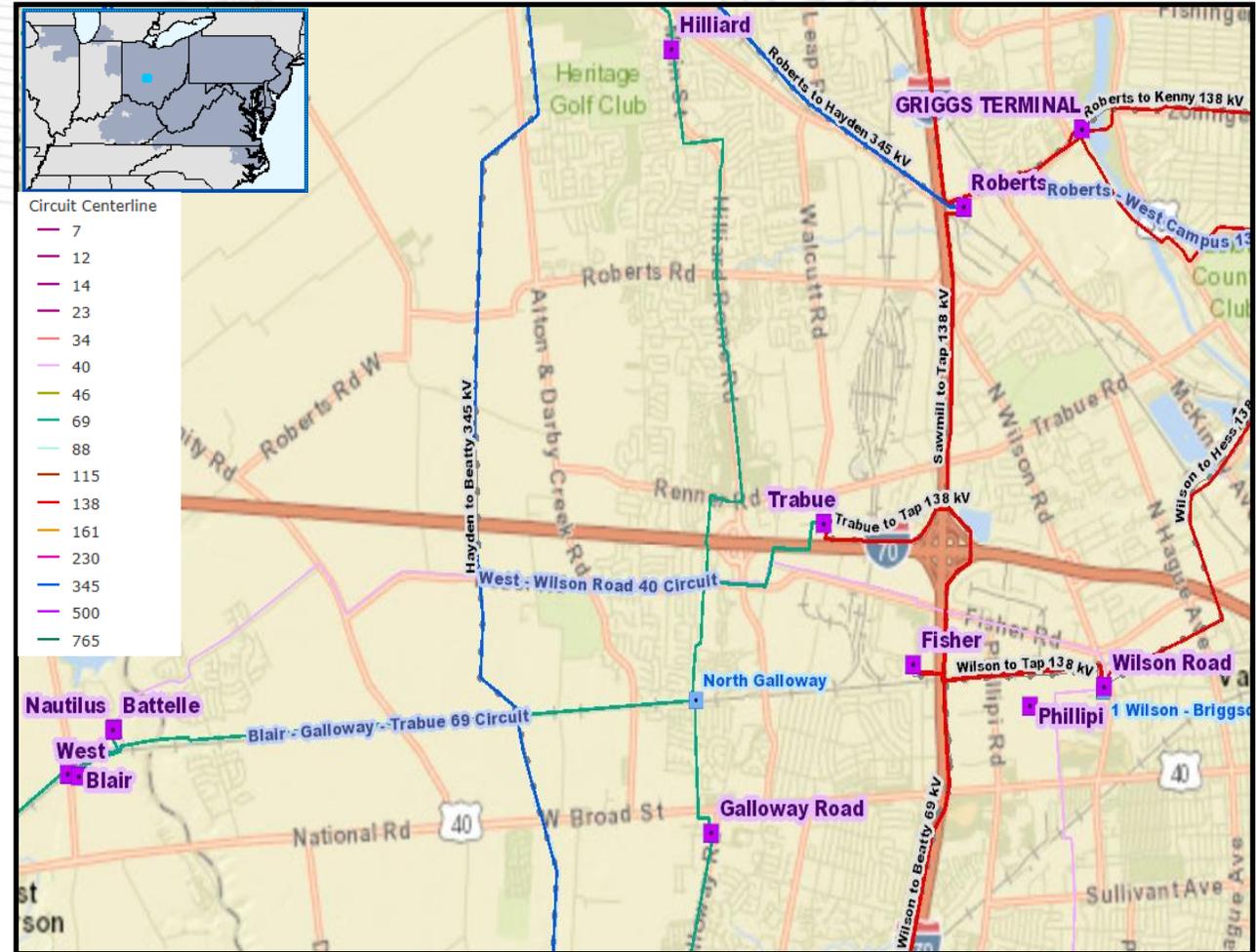
Retire remainder of the West-Wilson Road 40 kV line. (S1302.4)

Retire a portion of the Trabue-Galloway Road 40kV line. (S1302.5)

Estimated Cost: \$22.3M

Projected IS date: 12/1/2017

Status: Construction





AEP Transmission Zone Supplemental Project

Supplemental Project
Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The Calcutta-North Wellsville 69kV line was built in 1939 utilizing wood structures with wooden cross-arms & spar-arms. The existing conductors are a mix of 3/0 Copper and 336 ACSR, with brittle copper shield wire (46 MVA rating). Due to the poor condition of the nearly-80-year-old conductors and poles, it is necessary to do a complete line rebuild rather than just a reconductor. This line has been subjected to 9 outages over the past three years and serves two distribution stations (Glenmoor and Calcutta) with over 7,000 customers. In addition to the general deterioration all along this line, there are 43 open A conditions on this 6.4 mile long line, a mix of damaged splices/conductor and broken/rotted poles.– East Liverpool, OH

Selected Solution:

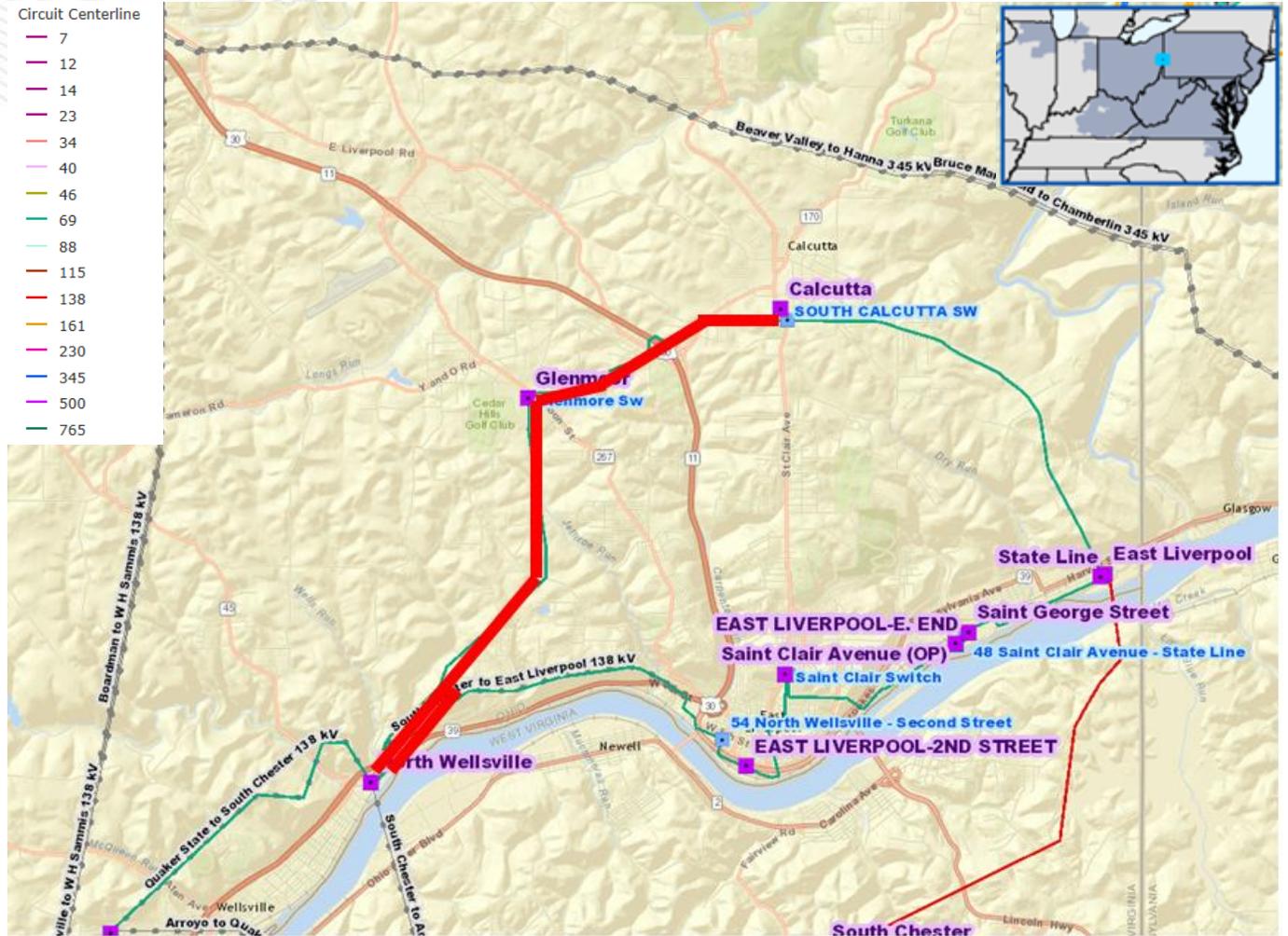
Install New 69kV T-Line exits at North Wellsville 69kV substation and revised relay settings. (S1303.1)

Rebuild Calcutta-North Wellsville 69kV line section (6.4 miles) with the 1234 ACSR/TW conductor (90 MVA rating, non-conductor limited) to match the rest of the circuit, utilizing mostly single-circuit steel poles. Install ADSS fiber under-build. (The first 1.0 mile from North Wellsville will be double-circuit, with the North Wellsville-Second Street 69kV attached). (S1303.2)

Estimated Cost: \$6.25M

Projected IS date: 9/1/2017

Status: Construction





AEP Transmission Zone Supplemental Project

Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The five breakers at Capitol Hill station are all FK-339 32 kA breakers and use oil as the interrupting medium. The drivers for their replacement are age, repair part availability and bushing damage issues. In general oil breakers have become increasingly difficult to maintain due to the oil handling associated with them. Oil spills are frequent with failures and routine maintenance which is also an environmental hazard. Breaker A has experienced 82 fault operations, breaker D 86 fault operations and breaker F 49 fault operations. The manufacturer's recommended amount is 10 fault operations. – Charleston, WV

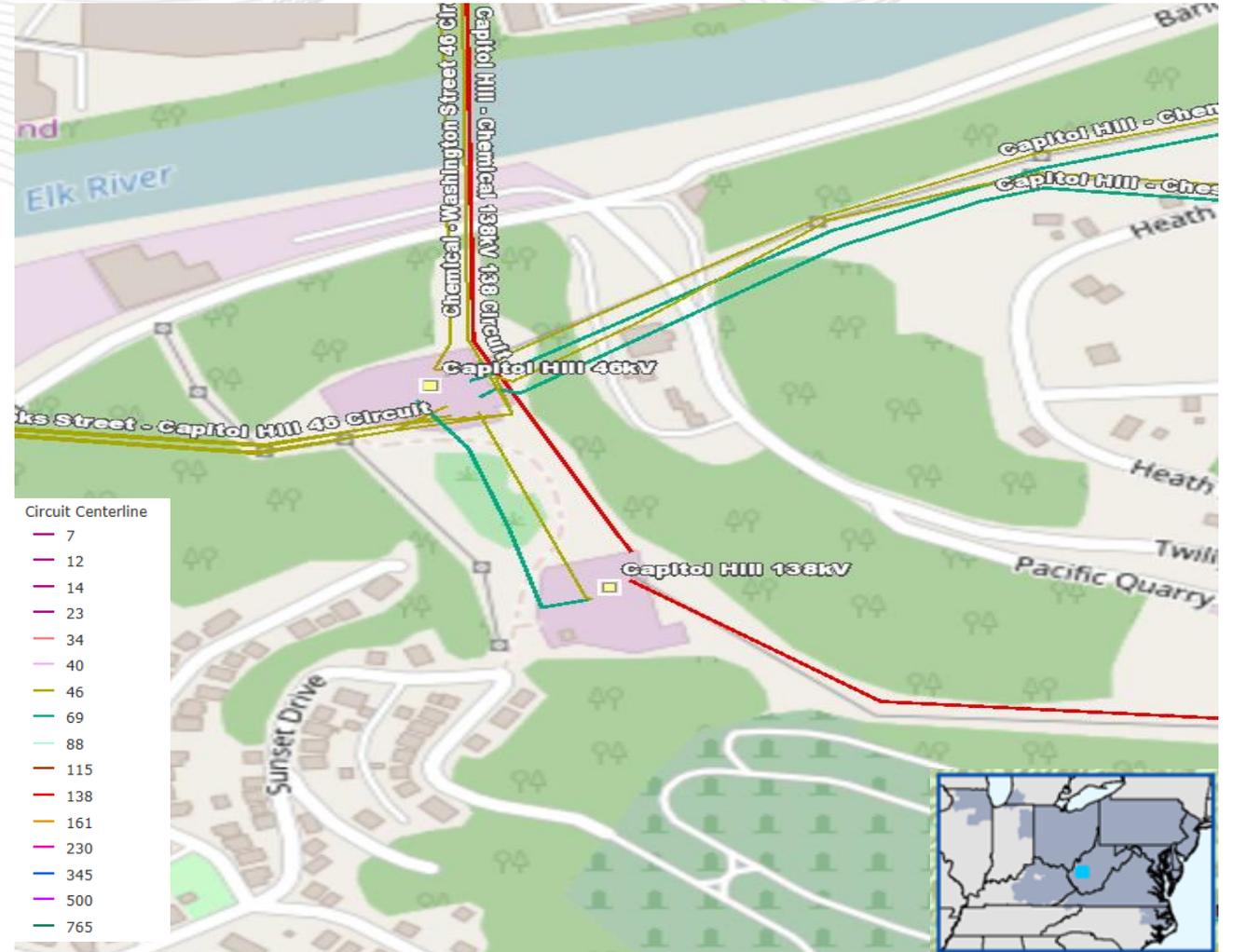
Selected Solution:

Replace Capitol Hill 46kV circuit breakers F, A, S, D, & R with new 40kA breakers. (S1304)

Estimated Cost: \$3.81M

Projected IS date: 12/31/2017

Status: Engineering





AEP Transmission Zone Supplemental Project

Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The Dover Wire 69kV circuit breaker 'A' is an old GE 'FK' oil-filled breaker installed in 1956. It is a 9kA unit. The breaker is leaking oil and has had many recent maintenance issues. It has also operated through 95 fault operations, exceeding the manufacturer recommendation of 10. The breaker has the following documented conditions: age; bushing problems; unavailability of spare parts; lifetime fault operations count; and high moisture readings. Combined, these justify replacing the breaker.

The breaker disconnects use cap & pin insulators which are prone to failure and are a safety issue.

The station currently has no SCADA functionality. As part of the project, an RTU will be installed and 69kV SCADA controls, which will increase Operations' ability to sectionalize and restore loads in the area. –Dover, OH

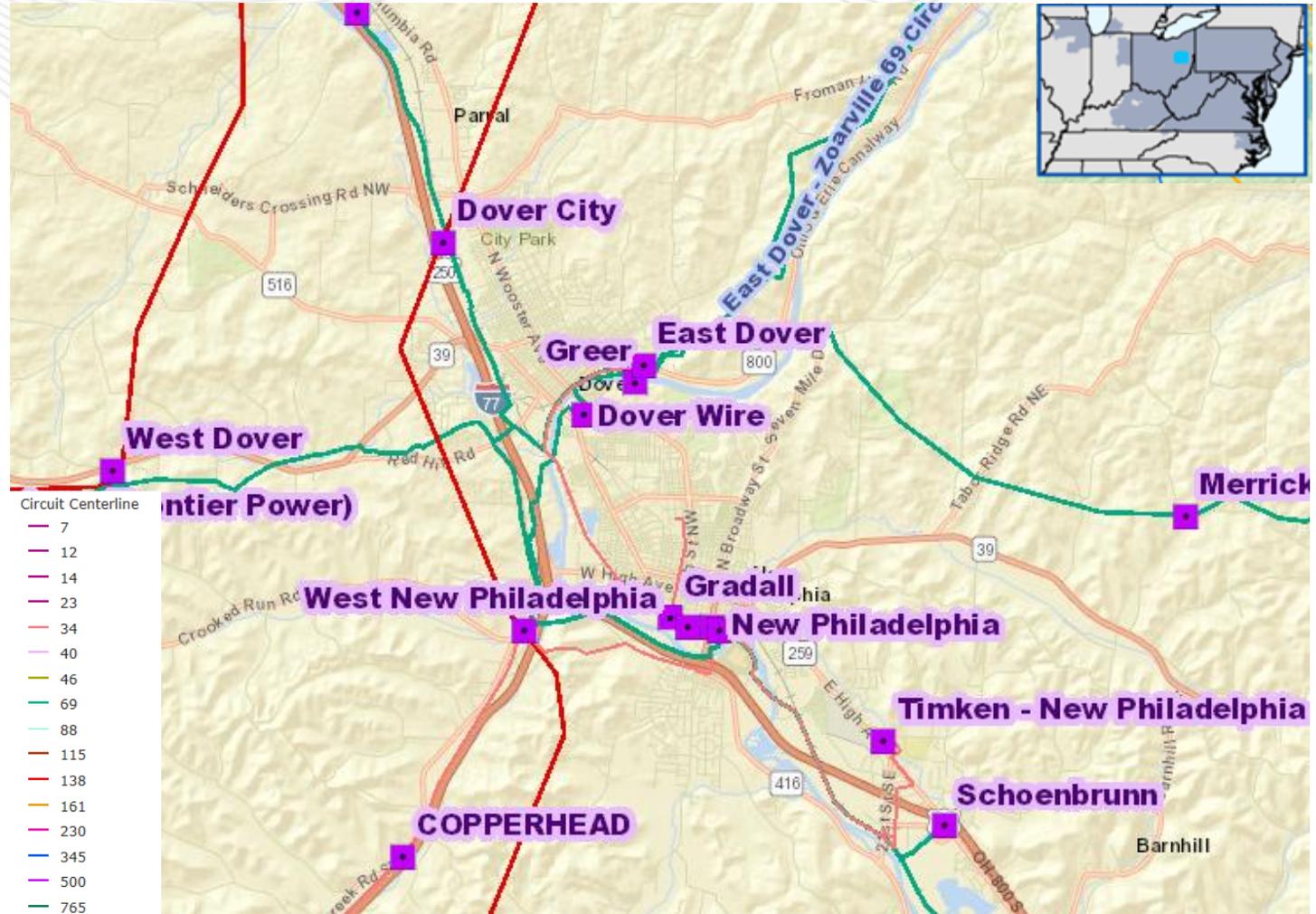
Selected Solution:

Replace Dover Wire 69kV 9 kA breaker 'A' with a new 40 kA unit. (S1305)

Estimated Cost: \$0.63M

Projected IS date: 12/1/2017

Status: Engineering





Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

There are currently four overlapping zones of protection at East Danville Station: 138kV Monument line, 138kV bus differential, 230kV Bus #2 differential and transformer #4 differential. This arrangement results in poor reliability as multiple elements are tripped resulting in potential consequential load loss. Also, this arrangement reduces the life of breakers by tripping them for events in any of the four protection zones. – Danville, VA

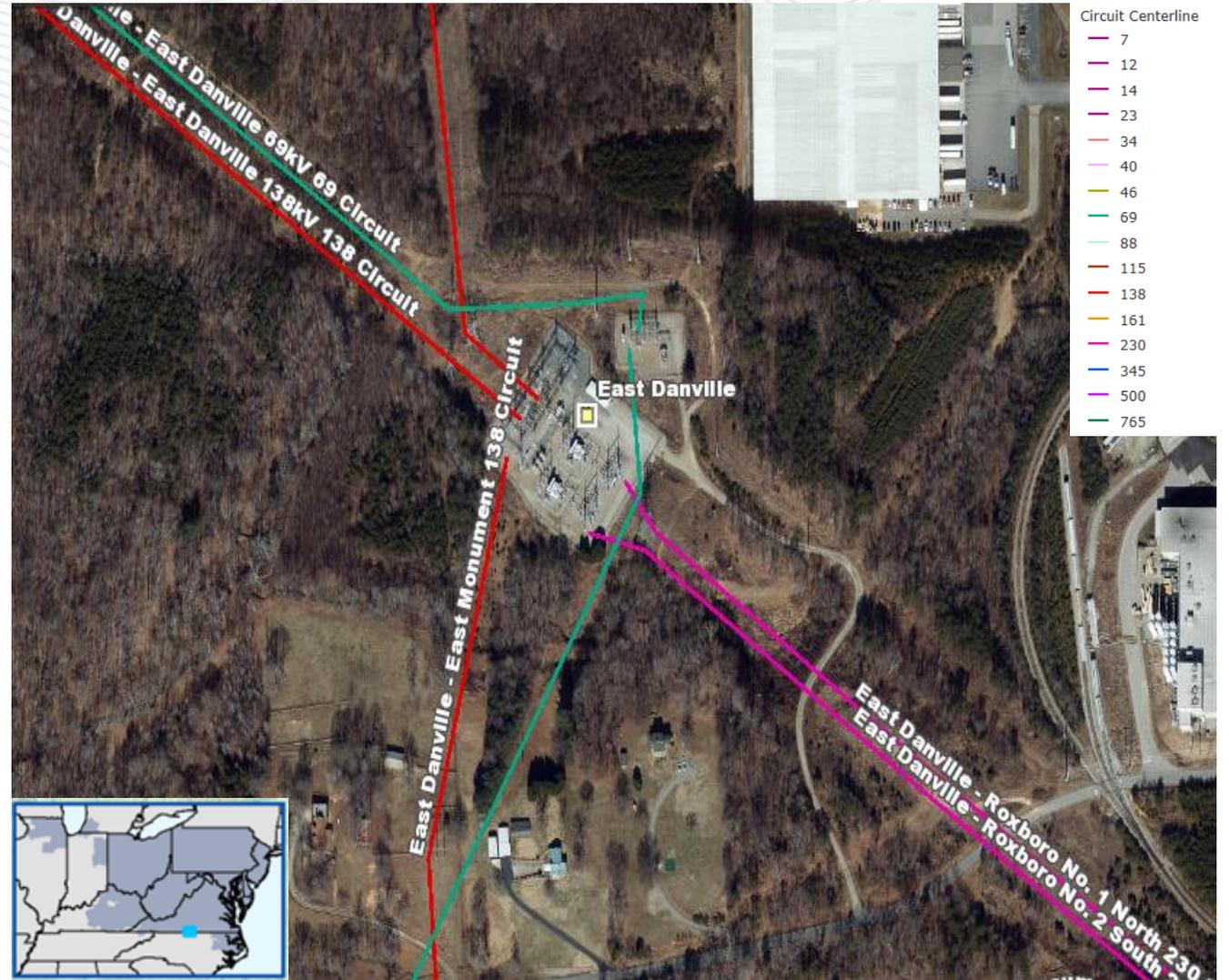
Selected Solution:

East Danville 138kV Station: Replace existing MOAB “V” on East Monument – East Danville 138kV Circuit with a new 3000A 40kA Circuit Breaker. (S1306)

Estimated Cost: \$0.95M

Projected IS date: 10/27/2017

Status: Engineering





AEP Transmission Zone Supplemental Project

Supplemental Project

Previously Presented: 4/21/2017
SRTEAC

Problem Statement:

At East Monument station, 138 kV circuit breakers A and B are 45.5 kA a GEC, PK-2B50 type, Air Blast breakers that were manufactured in 1979. Air blast breakers are being replaced across the AEP system due to their catastrophic and violent failures. Sharp pieces of porcelain from their bushings are typically expelled from the breakers and can be a potential safety hazard to field personnel. Other factors driving the replacement are age and scarce availability of spare parts. Breaker A has experienced 11 fault operations and breaker B has experienced 10 fault operations. This meets or exceeds the manufacturer's recommended 10 fault operations. –Danville, VA

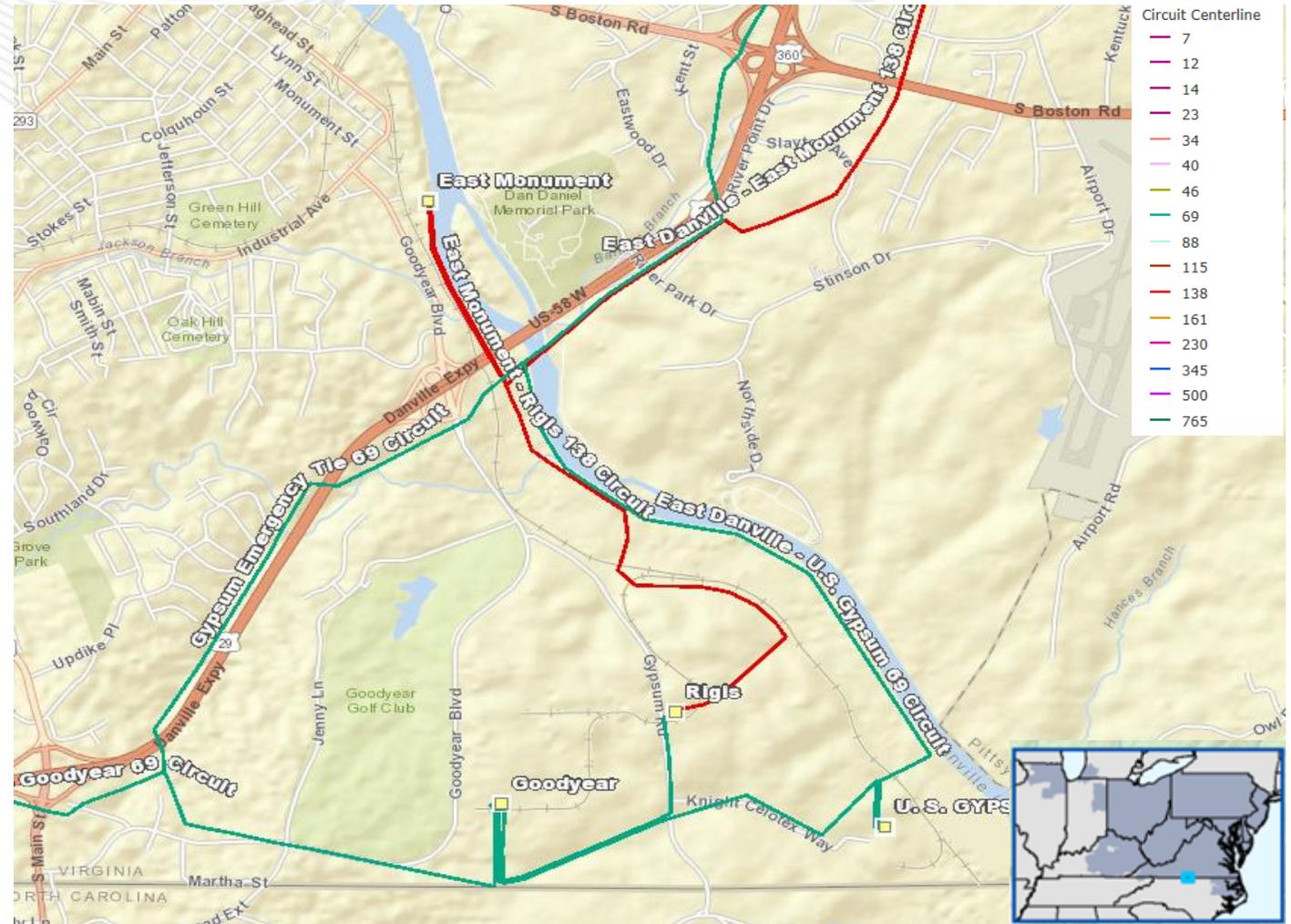
Selected Solution:

Replace 138 kV Circuit Breakers A and B with new 40 kA Breakers at East Monument 138kV station. (S1307)

Estimated Cost: \$3.0M

Projected IS date: 10/27/2017

Status: Engineering





AEP Transmission Zone Supplemental Project

Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The two Georges Run 69kV circuit breakers 'D' and 'E' are 1200 A 16.6 kA GE 'FK' oil breakers made in 1964. The breakers have the following conditions: age; unavailability of spare parts; lifetime fault operations count (40 & 33, compared to a recommended limit of 10); and high moisture readings (35-40 ppm, compared to guidance of 20). Combined, these justify replacing the breakers.

However, due to the multi-level substation yard, it is not feasible to install new breakers and controls. New 69kV motor-operated switches with auto-sectionalizing capability will be installed in place of the breakers; these switches will have SCADA control. Steubenville, OH

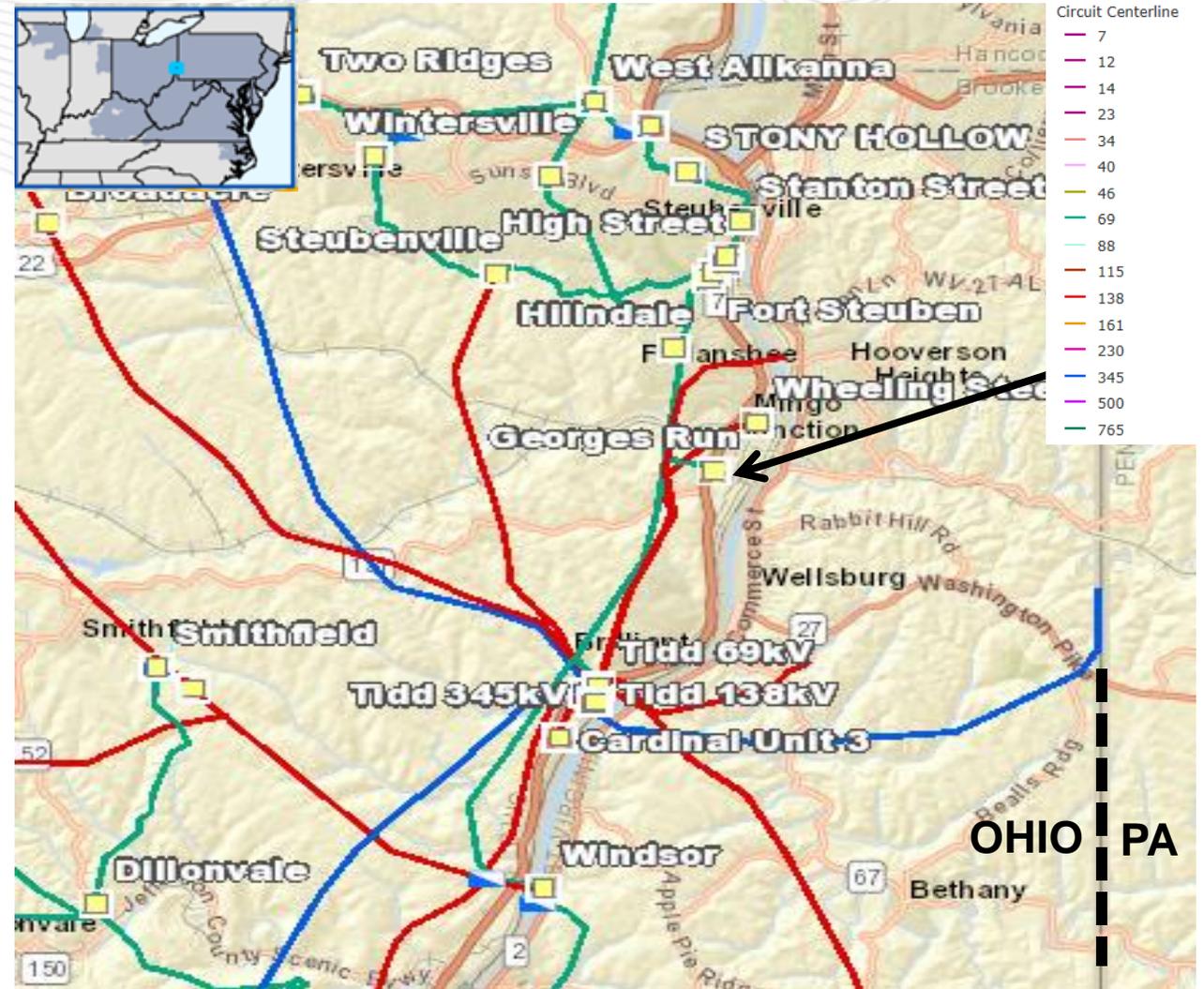
Selected Solution:

Georges Run 69kV: Retire and remove the two 69kV line breakers and replace with two 69kV motor-operated switches (with auto-sectionalizing). (S1308)

Estimated Cost: \$0.43M

Projected IS date: 12/1/2017

Status: Engineering





AEP Transmission Zone Supplemental Project

Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The existing Gravel Pit 34.5/12 kV transformer is 1950's vintage. The Gravel Pit 34.5 kV line was built in the 1950s with 795 AAC conductor (62 MVA rating). Between 2012-2015, 5.4 million customer minutes of interruption (CMI) were recorded at Gravel Pit station due to outages related to the condition of the 4.7 mile radial transmission line. There are 26 open A conditions along the line.

More than 40% of the load at Gravel Pit is not recoverable from / transferable to other sites making rebuilding the existing line impractical. In addition, 34.5 kV system is out of phase with 69 kV and 138 kV networks that results in additional outages when customers have to be transferred to a different source. –South Bend, IN

Selected Solution:

Replace and convert the existing Gravel Pit 34.5/12 kV station with a 138/12 kV station. (S1309.1)

Construct two single circuit 138 kV lines (795 ACSR conductor, 251 MVA rating), approximately 6 miles total and tap the Jackson Road – New Carlisle 138 kV line (Edison – Kankakee 138 kV ckt). (S1309.2)

Retire the 34.5 kV tap line that at present is utilized to serve Gravel Pit station from the Jackson Road – Kankakee 34.5 kV ckt. In addition, retire Gravel Pit station. (S1309.3)

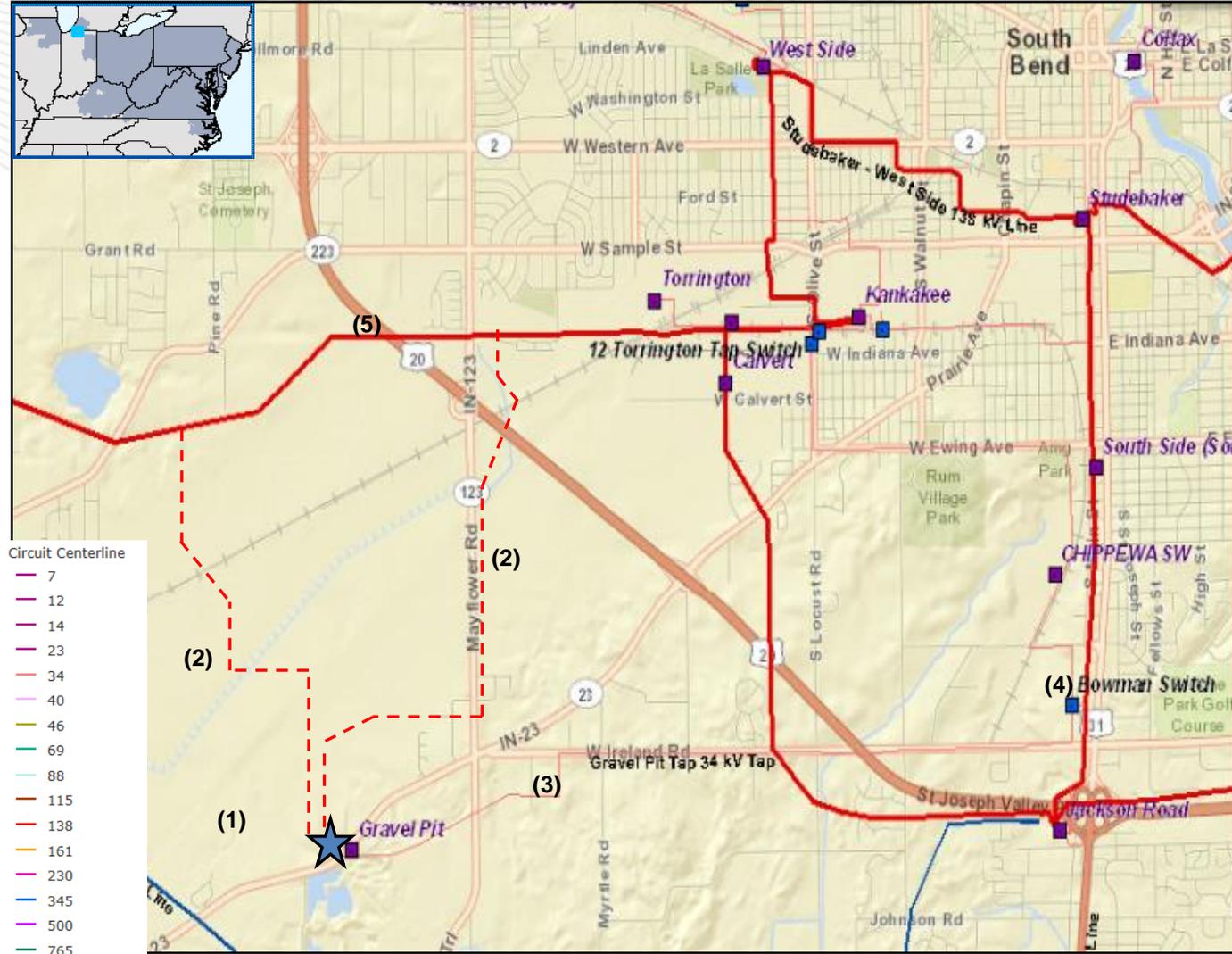
Retire Bowman Creek 34.5 kV switch. (S1309.4)

De-energize sections of the Jackson Road – New Carlisle 138 kV line (Edison – Kankakee 138 kV ckt). (S1309.5)

Estimated Cost: \$17.24M

Projected IS date: 12/1/2018

Status: Engineering



Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

Breakers C and D at Layland station are oil breakers built in 1964. The breakers have the following documented conditions: age, bushing damage, scarce availability of spare parts for break and fix scenarios, and number of fault operations. Breaker C has had 402 fault operations and breaker D has had 309 fault operations. The manufacturer's recommended amount is 10 fault operations. In general oil breakers are more difficult to maintain because of the oil handling. Oil spills happen often with failures and routine maintenance which can become an environmental hazard. The existing steel structures were initially installed in 1969 and in poor shape due to rust and wear. For this reason, the 69kV bus will be rebuilt.

There are currently four overlapping zones of protection at Layland 69kV station: McClung 69kV line, 69kV bus differential and 69/12kV transformer differential. This arrangement results in poor reliability as multiple elements are tripped resulting in potential consequential load loss. 69kV Breaker E is being added to the McClung line in order to reduce the number of overlapping zones. –Fayette County, WV

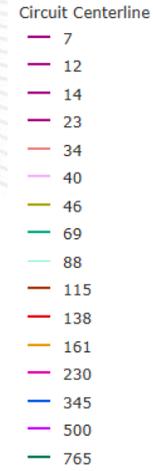
Selected Solution:

Layland 69kV Station: Replace 21 kA circuit breakers C and D with new 40kA CBs. Replace MOAB "X" with a new 40kA CB. Rebuild the 69kV Bus. (S1310)

Estimated Cost: \$2.0M

Projected IS date: 12/29/2017

Status: Engineering



Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

Marathon Pipe Line LLC has requested 4 MW 69 kV service in Heath, OH off of the Heath – Newark 69 kV circuit (structure #6 Heath – Southgate 69 kV line). They have requested a in service date of March 2017.

In addition to the customer needs, this project will rebuild the small section (<1/4 mile) of line between the new phase-over-phase switch and Heath Station. To coordinate outages, the small section between structures #1 and #7 will be included with the customer project. This section contains five structures with open Category A conditions (Structures 1, 2, 3, 5, 6) constructed with 4/0 copper conductors (54 MVA rating). – Newark, OH

Selected Solution:

Install new 69kV 3-Way phase-over-phase switch with one MOAB towards Newark Station. (S1311.1)

Install new 69kV metering outside of the customer station. (S1311.2)

Reroute Heath – Newark 69kV circuit to connect the new 69kV phase-over-phase switch and install a 69kV radial line to the customer metering structure. (S1311.3)

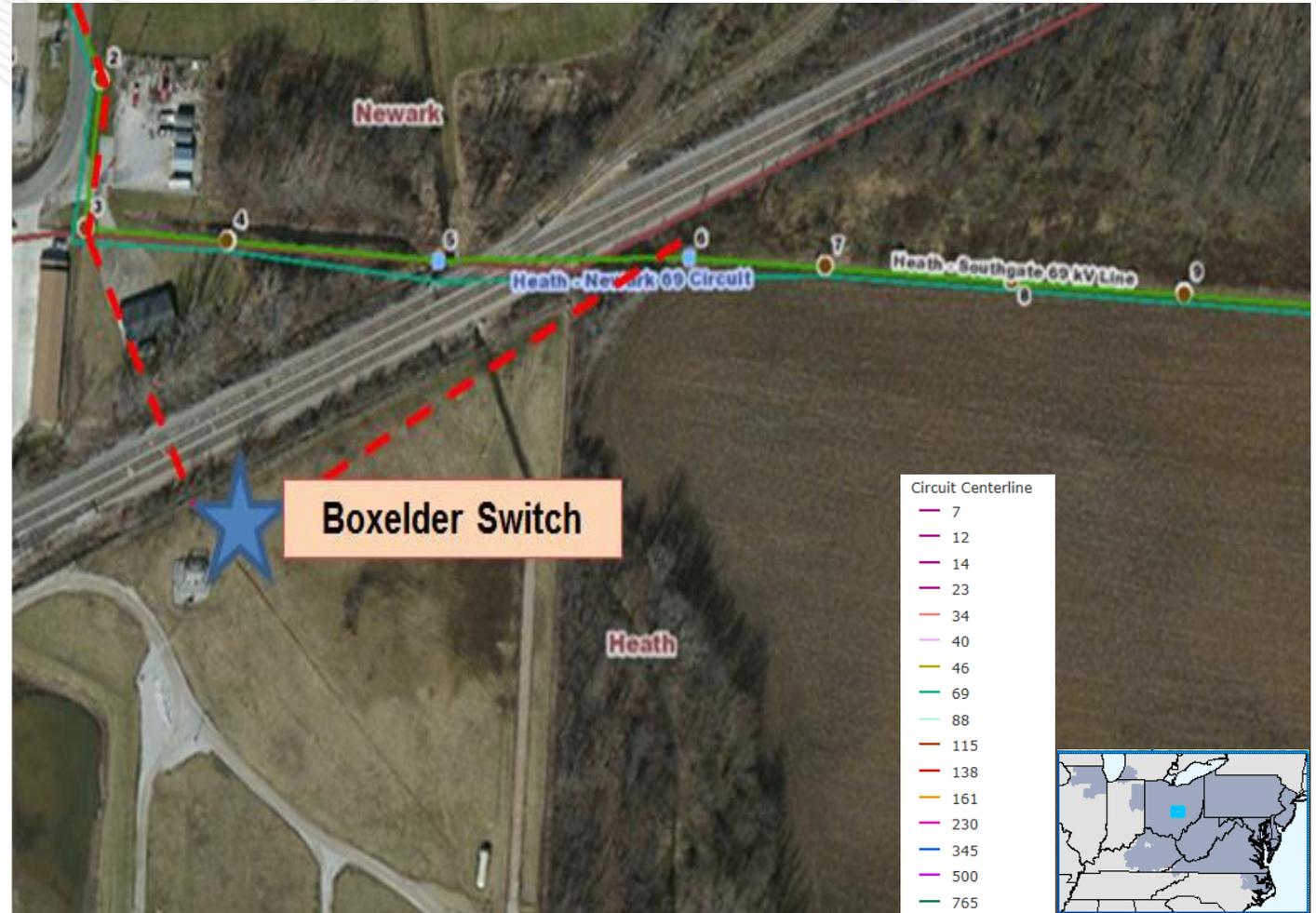
Rebuild section between the new phase-over-phase switch and Heath Station. (S1311.4)

All through-path 69kV will be rebuilt with 556 ACSR Dove conductor (102 MVA rating). (S1311.5)

Estimated Cost: \$1.4M

Projected IS date: 4/25/2017

Status: In Service



Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

Currently, the Miles Avenue 138-12 kV AEP Ohio distribution station is served via a 2-way switch tapping the South Canton-West Canton #2 138 kV line, with a radial feed to Miles Avenue station. The line switch failed and is not currently operable. When work must be done on the 10-mile 138kV circuit, the entire Miles Avenue station must be taken out of service due to the inoperability of the switch. In addition, the property near the switch now has various residential buildings, making switch maintenance or replacement very difficult (located in a backyard, with a pool nearby). For this reason it is necessary to remove the inaccessible switch and instead install 138kV line breakers within the station fence.

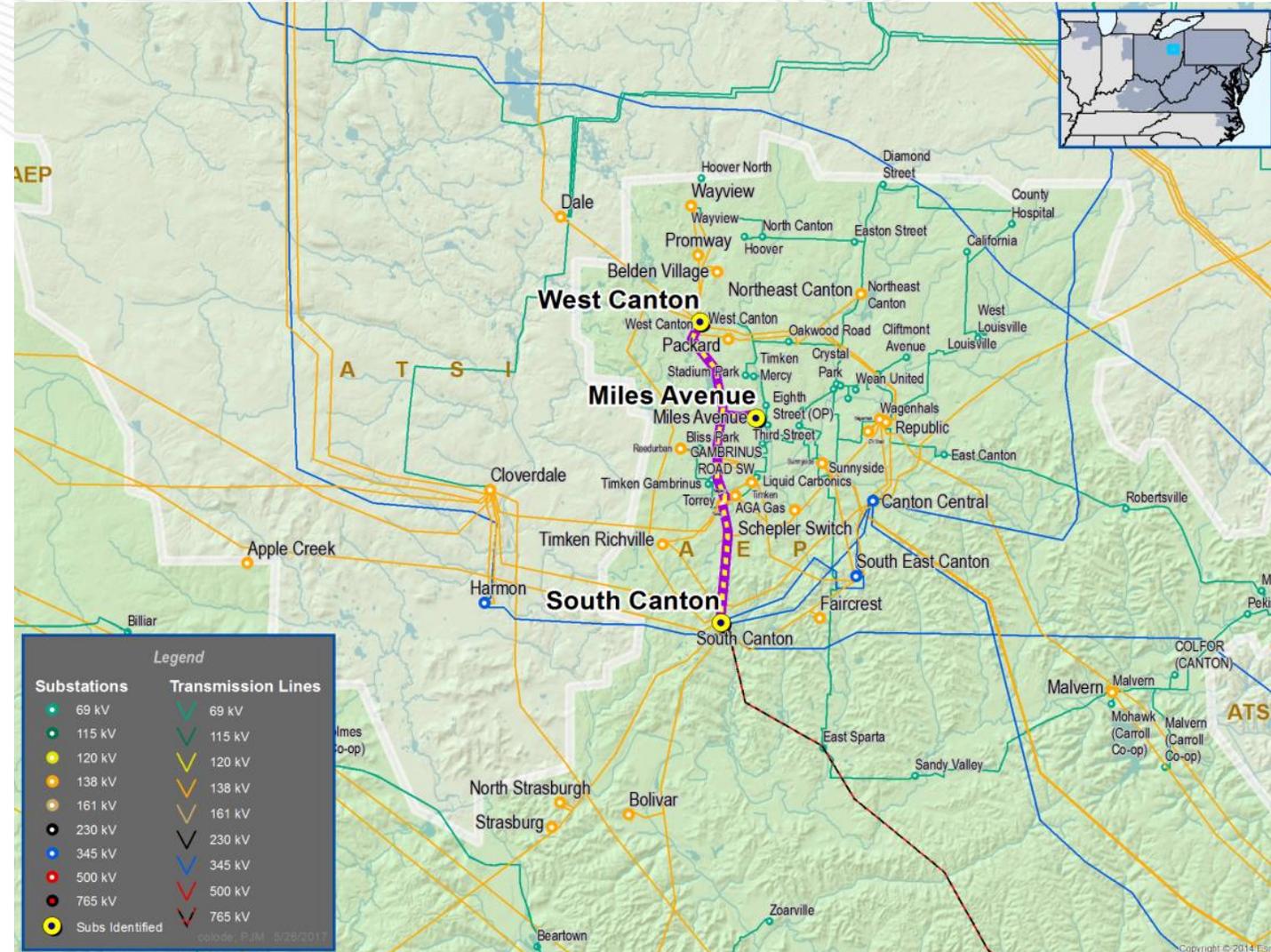
In addition, a ground-switch scheme, which trips the entire 138kV circuit for a transformer fault (interruption to 8,700 customers at Miles Ave, Reedurban, Negley and takes out the 138-69 kV source at Reedurban) results in unnecessary fault operation of remote end breakers thus reducing their operational life span.

For the past six years, the switch serving Miles Avenue station has been inoperable, creating various operational challenges for local crews and Transmission dispatchers. In addition, distribution load must be transferred to other stations during these events, which may not be possible year-round. Also, the radial 138kV T-Line tap is difficult to maintain due to the radial feed. There is also no SCADA capability at Miles Ave currently.

This line meets AEP's MPOI (Momentary/Permanent Outage Index) calculation guideline for breaker installations listed in AEP's Customer Connection Requirements document.

For the 2013-16 period, this 138kV circuit had over 640,000 customer-minutes-interrupted (CMI). -Canton, OH

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Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Continued from previous slide

Selected Solution:

Miles Avenue 138kV Station: Install a 138kV bus, 2- 138kV 3000 A 40 kA line breakers (to West Canton & South Canton), new relay panels, and an RTU with SCADA. Remove the ground switching MOAB scheme that places a fault on the line for transformer faults. (S1312.1)

South Canton & West Canton 138kV Station: update relay settings accordingly (S1312.2)

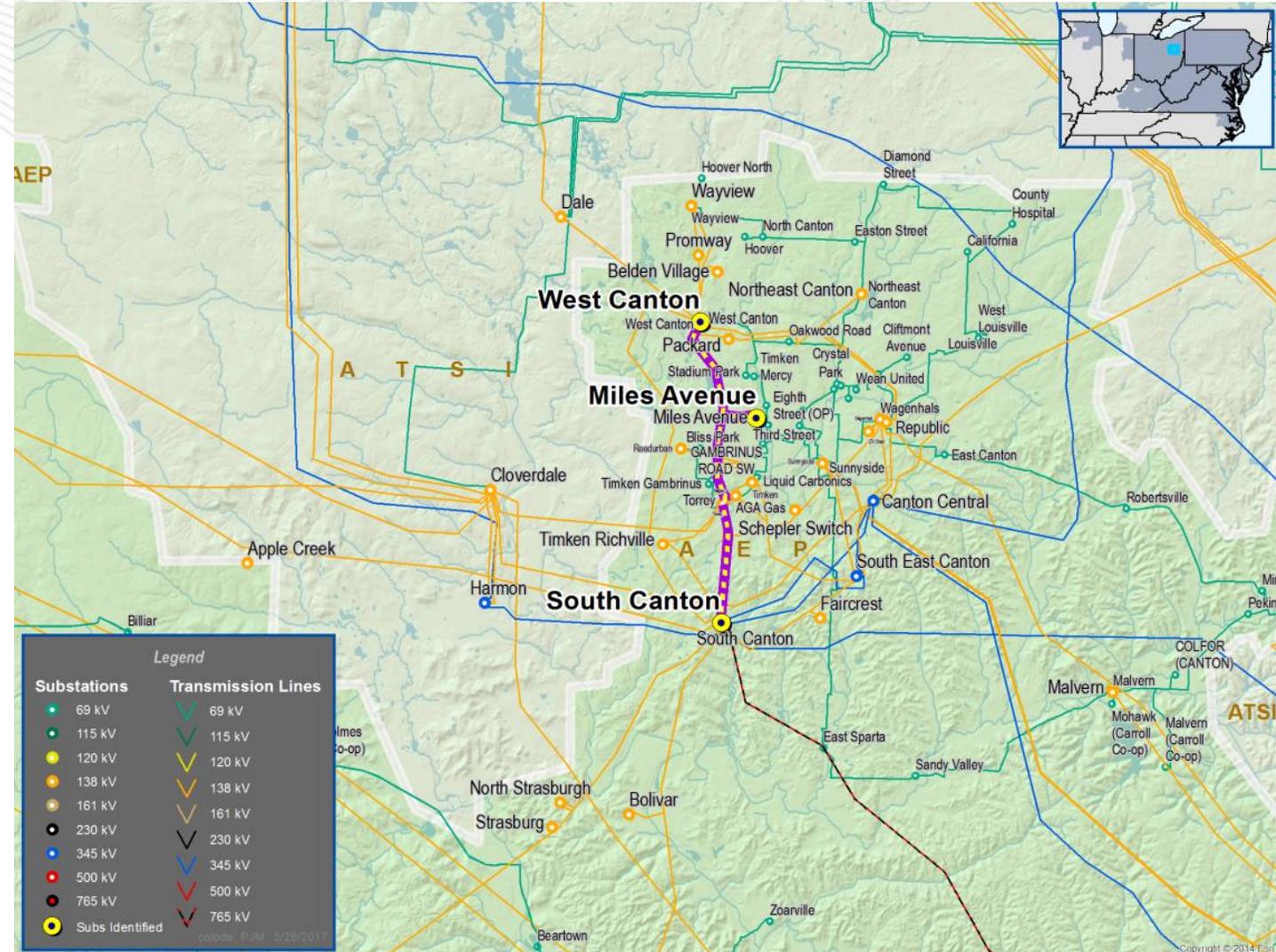
On the South Canton-West Canton #2 138kV line, remove the inoperable 2-way 138kV line switch. (Note that this is part of a double-circuit towerline.) (S1312.3)

Extend a short 138kV double-circuit T-Line loop into Miles Avenue station with 795 ACSR (257 MVA rating, approximately 325 ft.) (S1312.4)

Estimated Cost: \$2.6M

Projected IS date: 11/1/2017

Status: Engineering



Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

Glen Lyn 138kV Breakers K & J are 1600 A 40 kA type FGK-138-10000 and use oil as the interrupting medium. Circuit Breaker J had 334 fault operations which exceeds the manufacturer's recommended amount of 10 fault operations. These are oil breakers that have come more difficult to maintain due to the required oil handling. Environmental risks are also present due to oil spills resulting from failures and maintenance.

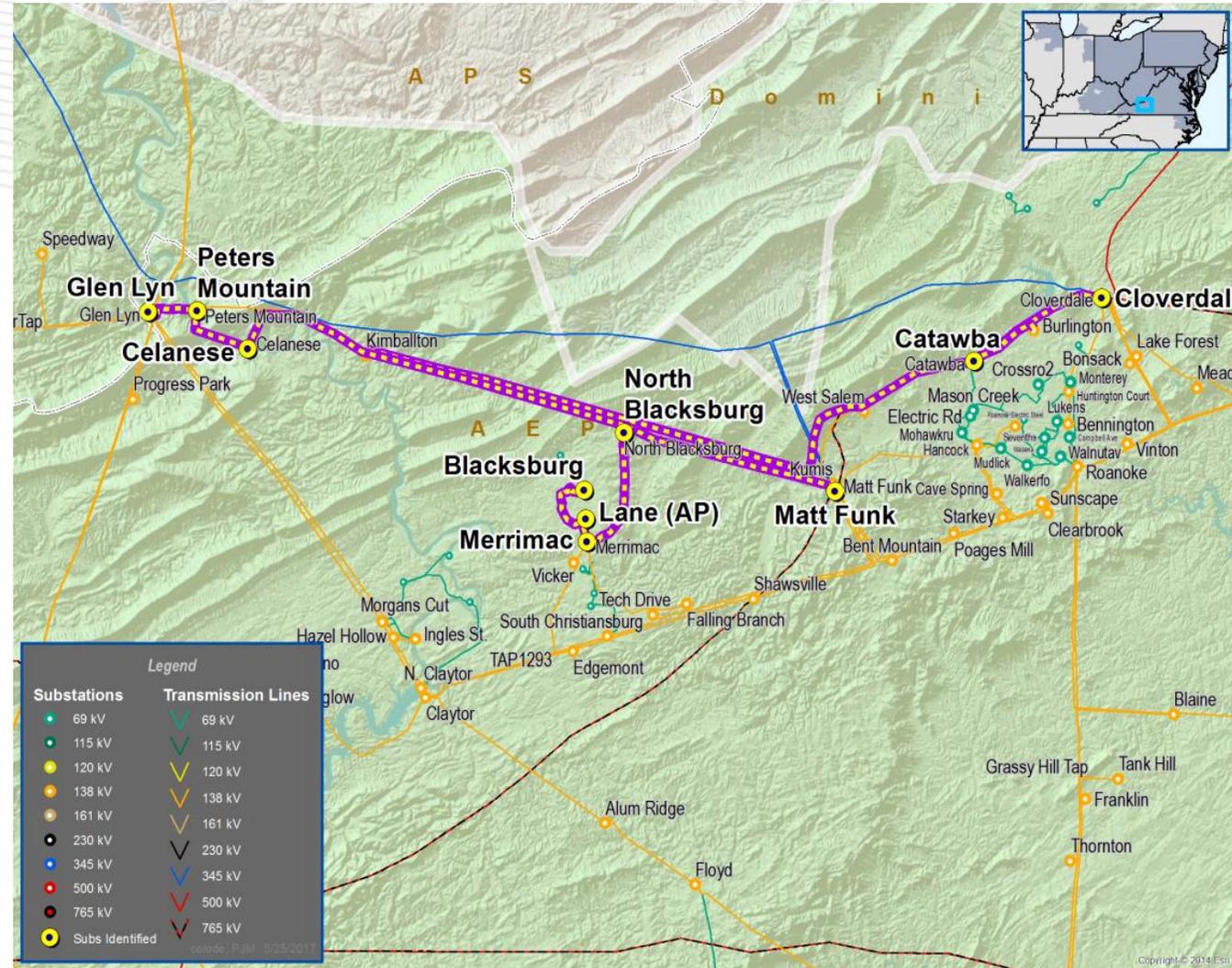
Merrimac 69kV breakers N & M are 1200 A 20 kA CF type oil breakers. The drivers for replacements are amount of fault operations and issues pertaining to bushings. Mechanical issues around the breaker contact's timing and speed have also led to their replacement. These are oil breakers that have come more difficult to maintain due to the required oil handling. Environmental risks are also present due to oil spills resulting from failures and maintenance. Circuit Breaker M has had 52 fault operations, which exceeds to manufacturer's recommended amount of 10 fault operations.

Catawba 69kV Breaker B is a 2000 A 31.5 kA type CGH-50-72.5-31.5 breaker and uses oil as the interrupting medium. Drivers for replacing are amount of fault operations (184 fault operations exceeds manufacturer's recommended amount of 10), no spare part availability, recurrent issues with bushings and increased maintenance. There are only 8 breakers of this type across the AEP system. With break and fix type scenarios spare parts are not readily available.

Cloverdale – Glen Lyn is approximately a 60 mile line with no sectionalizing capabilities. MPOI calculation justifies the need for breakers to be installed at Catawba Station in accordance with AEP's Interconnection Requirements. Matt Funk – Celanese line is approximately 33 miles long with no sectionalizing capabilities. In order to provide sectionalizing along this line 138kV breakers are being installed at North Blacksburg.

Ground switch MOABs complicate the protection scheme and reduce the life of circuit breakers as they introduce a line fault so the breakers can see a transformer fault. These ground switch MOABs are being replaced with circuit switchers on transformers at Catawba (XF1 and XF2) and N. Blacksburg (XF1 and XF2) to improve operational flexibility. Fiber/relaying upgrades are being installed on lines to replace existing pilot wire that has been cut out. –Blacksburg, VA

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AEP Transmission Zone Supplemental Project

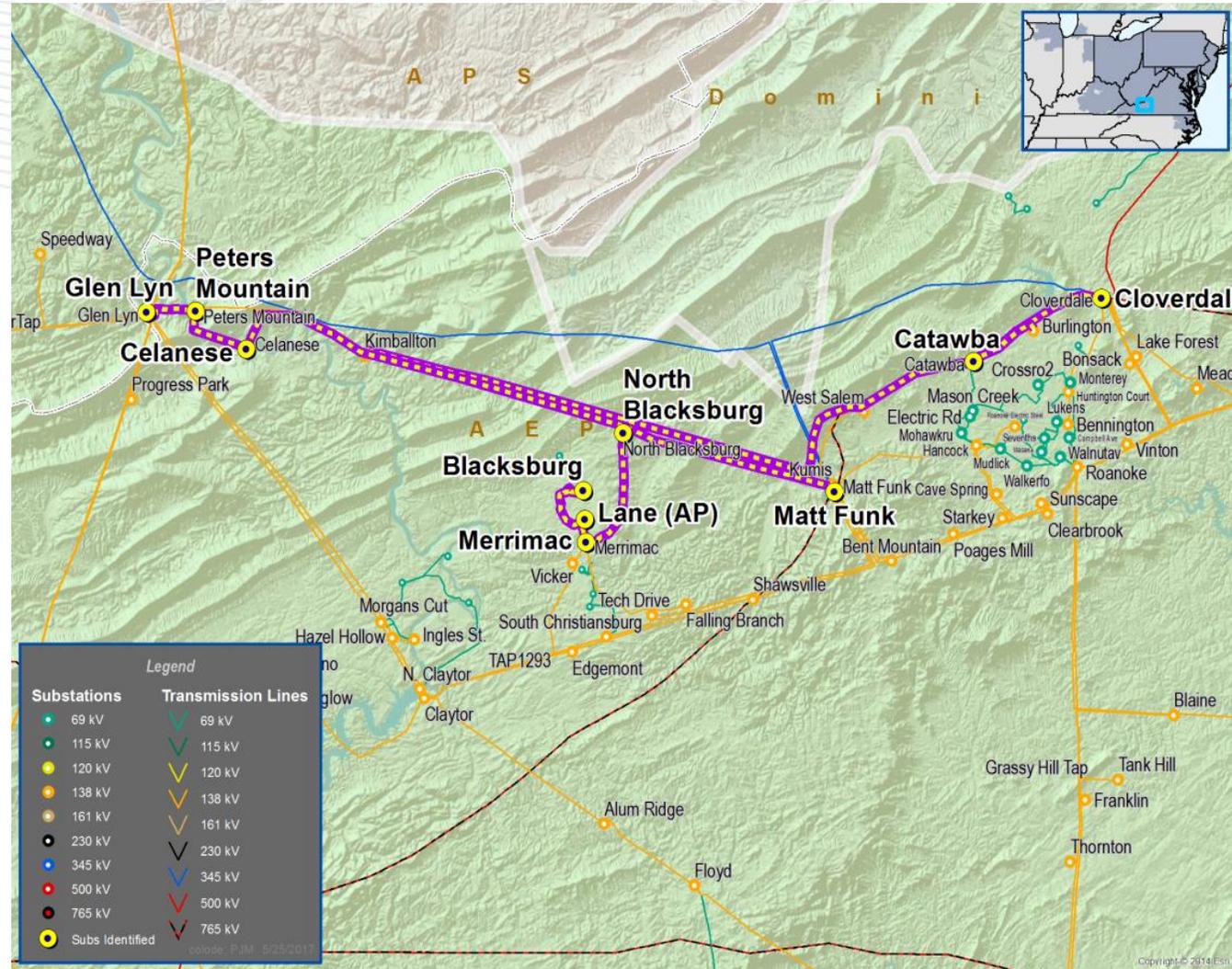
Supplemental Project Previously Presented: 4/21/2017 SRTEAC

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Selected Solution:

- North Blacksburg – Matt Funk 138kV line relaying/fiber (S1313.1)
- North Blacksburg – Celanese 138kV line relaying (S1313.2)
- Glen Lyn – Catawba – Cloverdale 138kV line relaying/fiber (S1313.3)
- Glen Lyn – Peters MT. 138kV relaying/fiber (S1313.4)
- North Blacksburg – Lane 69kV relaying/fiber (S1313.5)
- North Blacksburg – Blacksburg 69kV relaying/fiber (S1313.6)
- Lane – Merrimac 69kV relaying/fiber (S1313.7)
- Merrimac – North Blacksburg 69kV relaying/fiber (S1313.8)
- North Blacksburg Station: Install 3000 A 40 kA 138kV CBs and switchers on the transformers (S1313.9)
- Glen Lyn 138kV Station: Replace two 138kV CBs with 3000 A 40 kA breakers. (S1313.10)
- Merrimac 69kV Station: Replace two 69kV CBs with 3000 A 40 kA breakers. (S1313.11)
- Catawba 138kV Station: Install two 3000 A 40 kA 138kV CBs, two 138kV switchers on the transformers, and three 3000 A 40 kA 69kV CBs. (S1313.12)

Estimated Cost: \$37.5M
Projected IS date: 6/1/2018
Status: Construction





AEP Transmission Zone Supplemental Project

Supplemental Project

Previously Presented: 4/21/2017
SRTEAC

Problem Statement:

Tidd: 138kV breaker D1 is a 1600 A 50 kA 1960's vintage GE 'ATB' air-blast breaker that has shown signs of failure. It has a severe gas leak, which requires gas to be balanced every other day, and gas additions bi-weekly. This breaker has the following documented conditions: age, unavailability of spare parts, high number of fault interruptions (18, whereas the recommended lifetime limit is 10). – Brilliant, OH

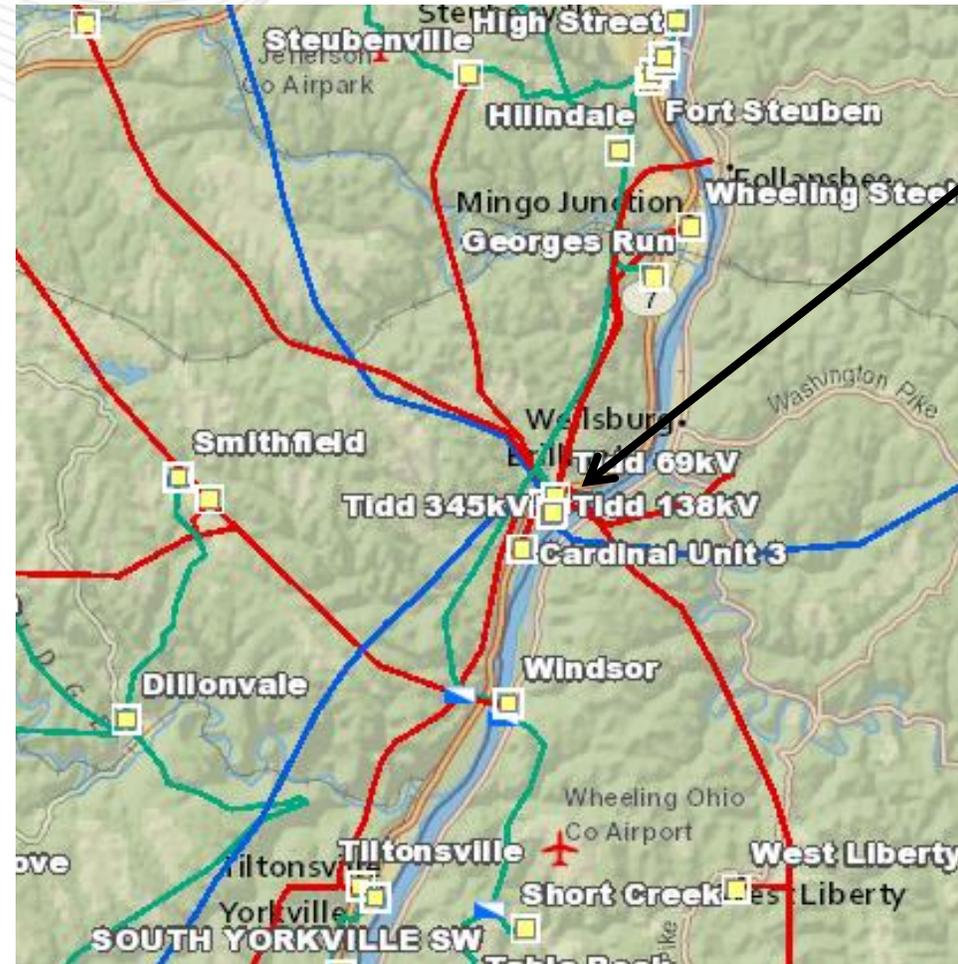
Selected Solution:

Replace Tidd 138kV breaker D1 with a new 3000A/63kA breaker to match the other breakers at the station. (S1314)

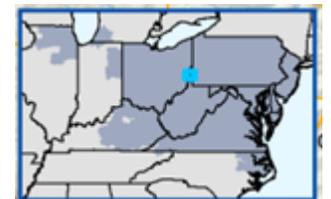
Estimated Cost: \$0.261M

Projected IS date: 4/20/2017

Status: In Service



Tidd Substation (Jefferson County, OH)



Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The existing Robison Park 600 MVA 345/138 kV transformer was manufactured in 1968 and has issues with oil leaks, leading to the need for additional maintenance outages. – Fort Wayne, IN

Selected Solution:

Replace Robison Park 345/138 kV Transformer #5 and associated equipment with a 675 MVA transformer. (S1315)

Estimated Cost: \$4.5M

Projected IS date: 12/31/2017

Status: Engineering





AEP Transmission Zone Supplemental Project

Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The existing 8 mile, 69 kV line section between Phillips Tap and Kendallville was constructed in 1957 using wood pole structures with 4/0 ACSR conductor (50 MVA rating). There are 270 open A conditions on this line, including rotten cross-arms, burnt/broken insulators, and loose/broken conductor hardware. The Albion-Kendallville 69 kV circuit has experienced over a million customer minutes of interruption in the past three years. – Fort Wayne, IN

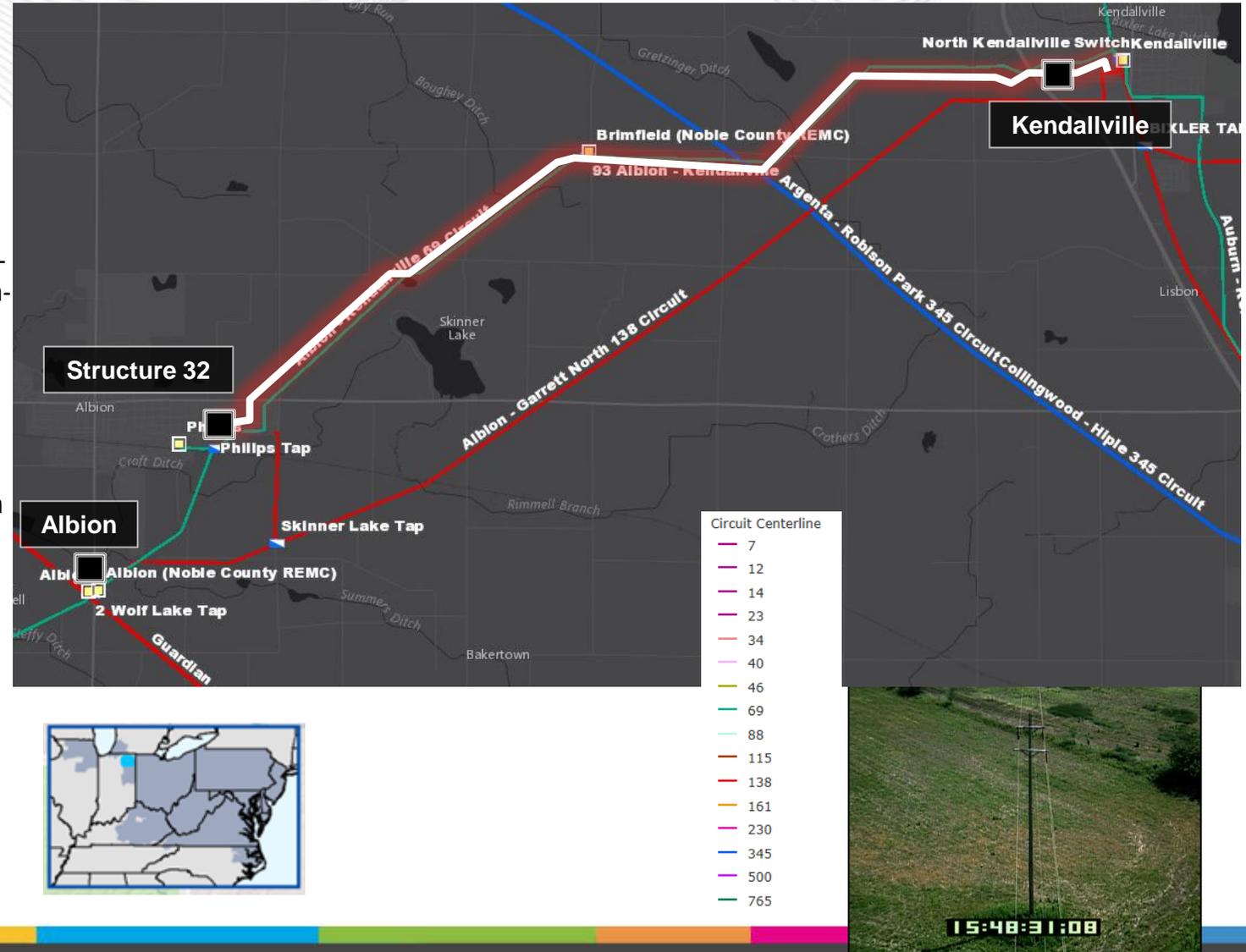
Selected Solution:

Rebuild approximately 8 miles of 69 kV line between Albion and Kendallville stations (starting at structure 32) using 795 ACSR conductor (128 MVA rating) on the existing circuit centerline. (S1316)

Estimated Cost: \$7.625M

Projected IS date: 6/1/2018

Status: Engineering



Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

69 kV breakers A, B, and C at East Lancaster are McGraw-Edison, CF-type oil filled breakers manufactured in 1962, 1964 and 1965. Oil filled breaker maintenance has become more difficult due to the oil handling required to maintain them. Oil spills are frequent with breaker failures and routine maintenance and can become an environmental hazard. Breaker B has had 337 fault operations and breaker C has had 88 fault operations. The manufacturer recommendation is 10 for this type of breaker. Breakers A, B and C have the following documented conditions: PCB content, fault operation exceeding manufacturer life expectancy, availability of spare parts, bushing damage, and age. – Lancaster, OH

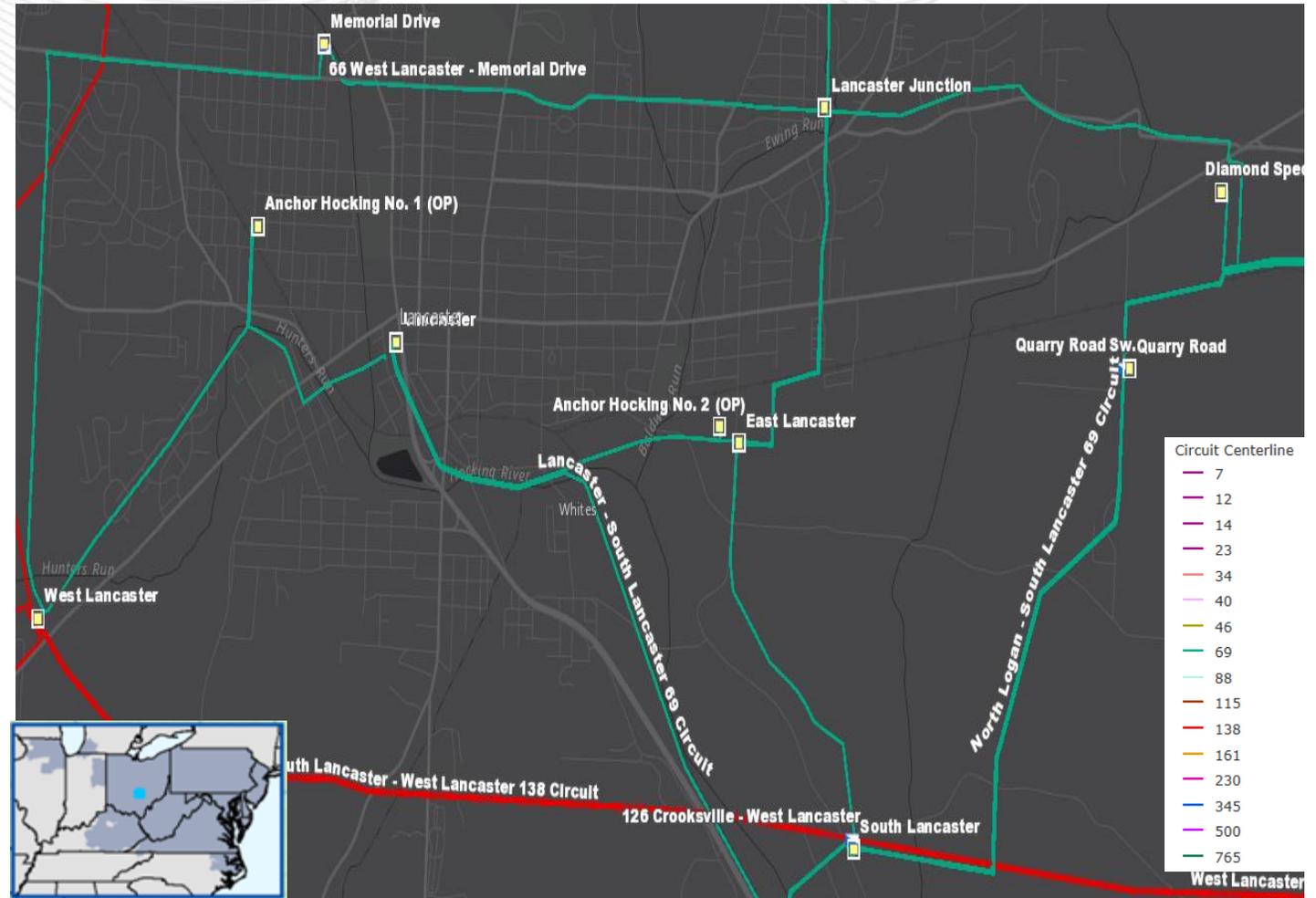
Selected Solution:

Replace East Lancaster 69 kV breakers A (21 kA), B (21 kA), and C (29 kA) with new 40 kA units. (S1317)

Estimated Cost: \$1.236M

Projected IS date: 12/1/2017

Status: Engineering





AEP Transmission Zone Supplemental Project

Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

69 kV breakers B, C, and D at South Lancaster station are all McGraw-Edison, CF-type oil filled breakers manufactured in 1969. Oil filled breaker maintenance has become more difficult due to the oil handling required to maintain them. Oil spills are frequent with breaker failures and routine maintenance and can become an environmental hazard. Breaker B has had 125 fault operations over its lifetime. Breaker C has had 56 fault operations over its lifetime. Breaker D has had 76 fault operations over its lifetime. The manufacturer recommendation is 10 operations for this breaker type. Breakers B, C and D have the following documented conditions: high moisture readings, fault operation exceeding manufacturer life expectancy, bushing maintenance issues, and age. – Lancaster, OH

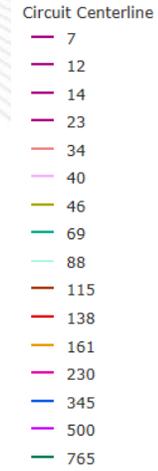
Selected Solution:

Replace the South Lancaster 69 kV 21 kA circuit breakers B, C and D with new 40 kA units. (S1318)

Estimated Cost: \$1.8M

Projected IS date: 6/30/2017

Status: Engineering





AEP Transmission Zone Supplemental Project

Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The transmission lines owned by Century Aluminum serve two other customers. In order to maintain service to these customers, it is necessary to purchase these transmission facilities. –Ravenswood, WV

Selected Solution:

Purchase Transmission lines owned by Century Aluminum, which has shut down. Century Aluminum has retired and planned to scrap the lines. (S1319)

Estimated Cost: \$5.215M

Projected IS date: 3/31/2018

Status: Engineering



Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The City of Fort Wayne has scheduled a tunnel boring project to last 4-5 years, with the peak load scheduled to be in-service for two years and a reduced load in service for an additional 2-3 years. The projected load (4 MVA peak, 2 MVA reduced) and voltage requirements are such that the existing nearby distribution station, Water Pollution, cannot serve the temporary load due to limited transformer capacity; therefore, the city has asked for 12 kV delivery voltage. This results in the need for a dedicated skid station that will be installed and utilized for the entire period of the City's project. –Fort Wayne, IN

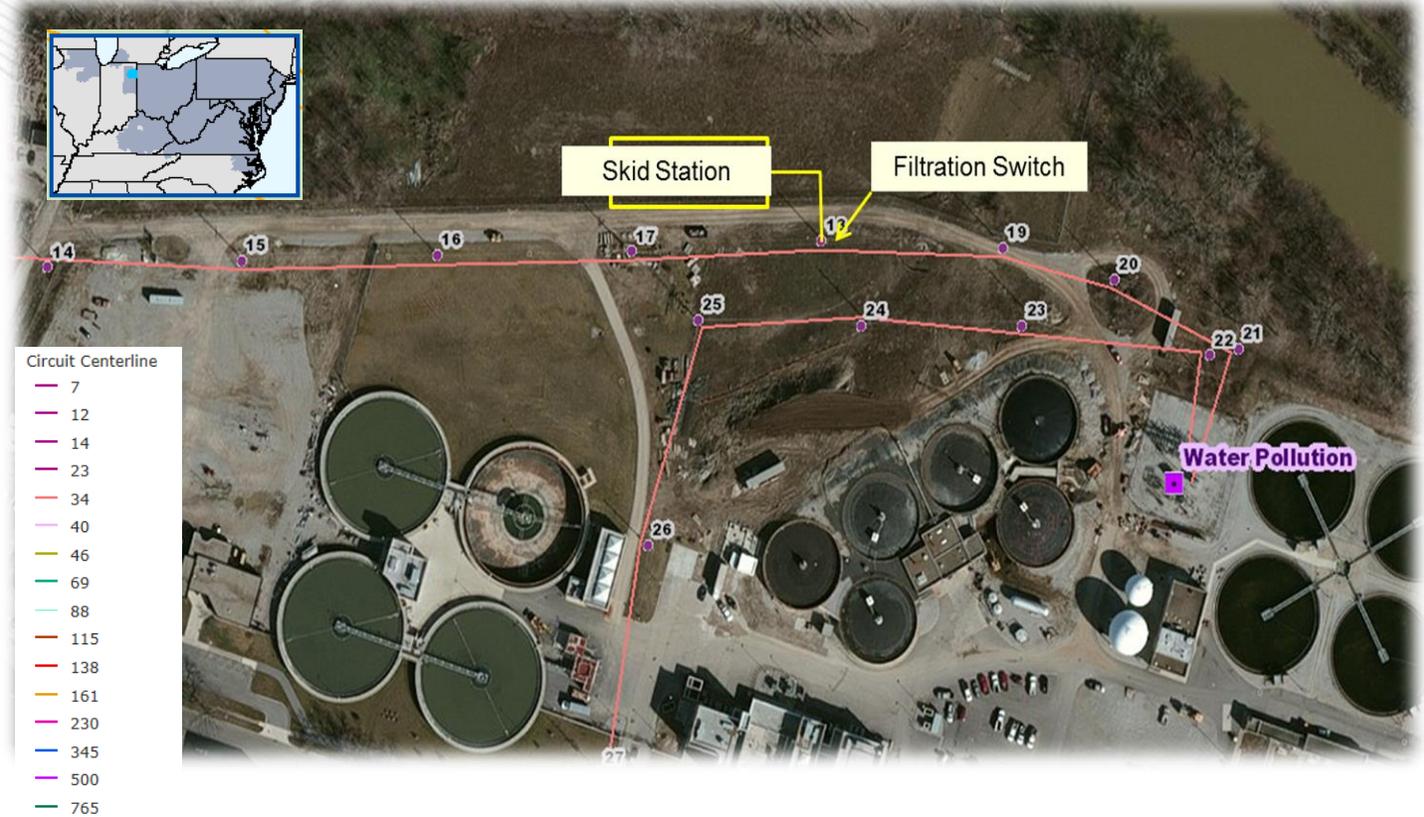
Selected Solution:

Install a temporary 34.5/12 kV skid station to be served by tapping the existing Lakeside-Water Pollution 34.5 kV circuit just west of the existing Water Pollution station. (S1320)

Estimated Cost: \$0.8M

Projected IS date: 7/25/2017

Status: Construction



Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

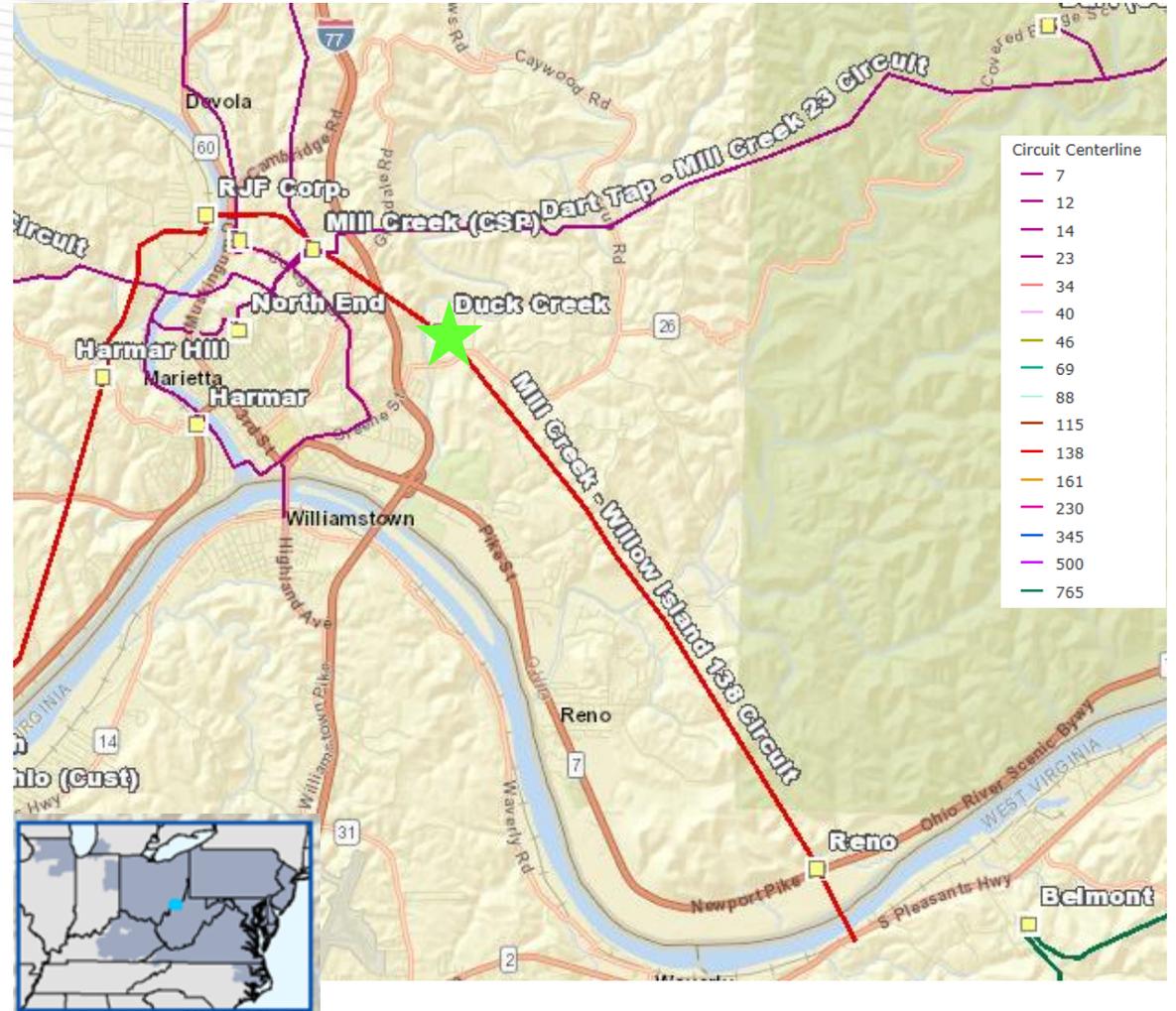
Problem Statement:

Duck Creek currently only has manually-operated line switches with no fault-interrupting or sectionalizing capability. Installing a new breaker will enhance operational flexibility for this remote part of the AEP system, by better isolating the 138kV system after faults, and allowing system dispatchers to remotely sectionalize the system. In addition, the station currently lacks an RTU, which will be installed as part of the project, with SCADA indication & control on the 138kV equipment. Installing additional 138kV line MOAB switches instead of a breaker does not reduce the FOI calculation below the AEP requirement; therefore a breaker is justified in this instance.

The breaker installation will also serve to improve reliability to AEP's Mill Creek distribution station, due to the fact that a fault on Mill Creek-Willow Island 138kV currently takes out two Mill Creek distribution transformers tapped off the line (#1 & #3, for a summer peak of 26 MVA). The Duck Creek breaker will significantly reduce the miles of exposure for a 138kV line fault east of Mill Creek station.

The Duck Creek distribution station east of Marietta, Ohio is currently a tap of the Mill Creek-Willow Island 138kV tie-line with FirstEnergy, which is a 13-mile line from Ohio to West Virginia. Duck Creek is a large load center (22 MVA summer peak), serving over 2,000 AEP Ohio customers. Due to historically poor reliability in the greater-Marietta area, an official MOU was signed by AEP Transmission, AEP Ohio, Washington Electric Co-op and Buckeye Power to create a 138kV transmission area plan and retire the 23kV system over the next decade. As part of the overall plan, the circuit breaker installation at Duck Creek will improve reliability to AEP distribution customers by reducing the impact of transmission line faults. -- Marietta, OH

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Supplemental Project Previously Presented: 4/21/2017 SRTEAC

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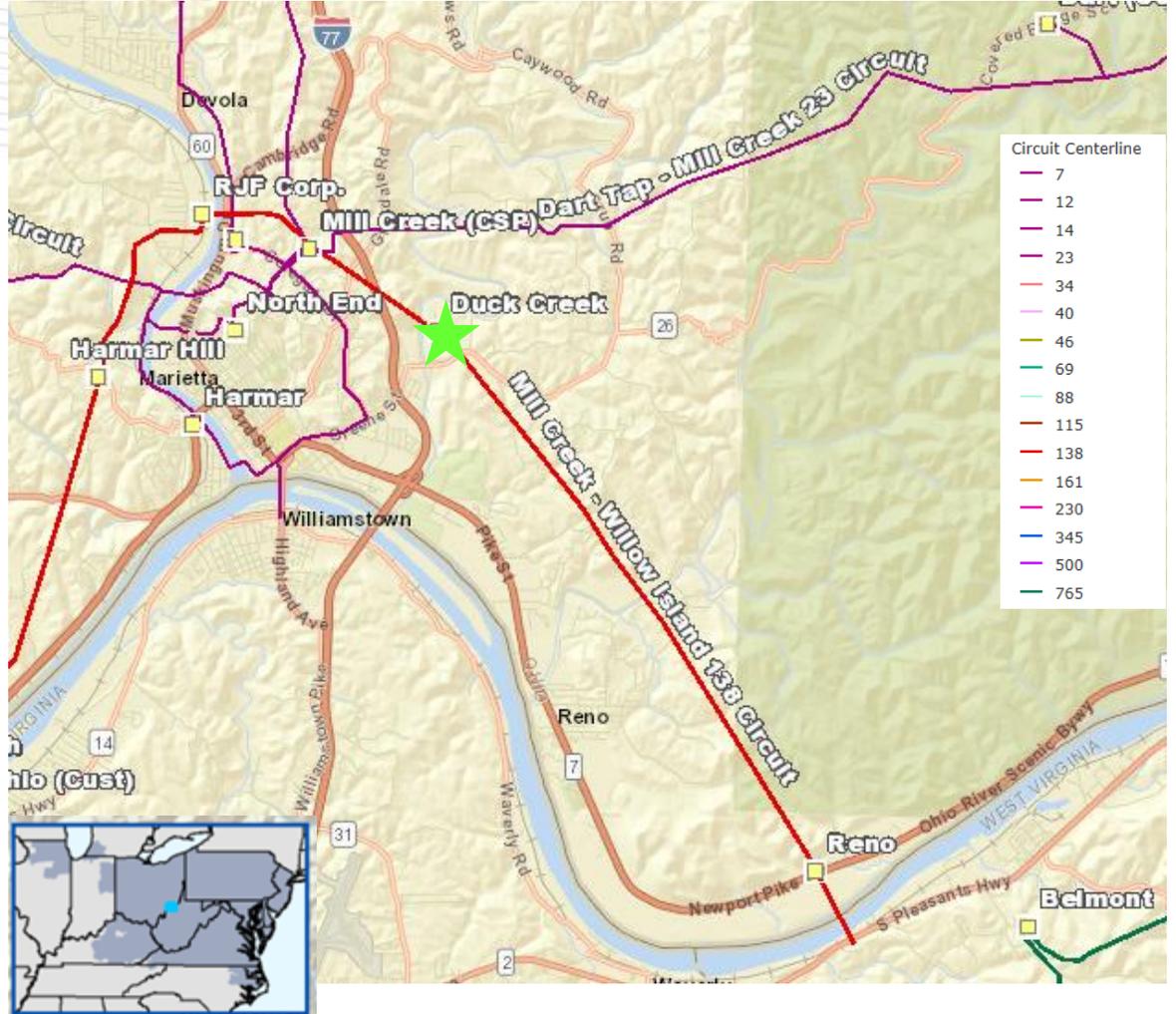
Selected Solution:

Duck Creek: At AEP Ohio's 138-12kV distribution station, install a new 3000 A 40 kA 138kV breaker toward Willow Island. This is currently a tap of the Mill Creek-Willow Island 138kV tie-line with FirstEnergy (soon to be Mill Creek-Belmont). (S1321)

Estimated Cost: \$0.8M

Projected IS date: 12/1/2017

Status: Engineering





AEP Transmission Zone Supplemental Project

Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The Heath – Southgate line section was built in 1916 with wooden structures and 4/0 copper conductors (54 MVA rating). It has 37 open A conditions on this 2.7 mile long line. Between 2013 -2016 the circuit has had 3 permanent outages attributed to defective cross arms and rotten poles. –Newark, OH

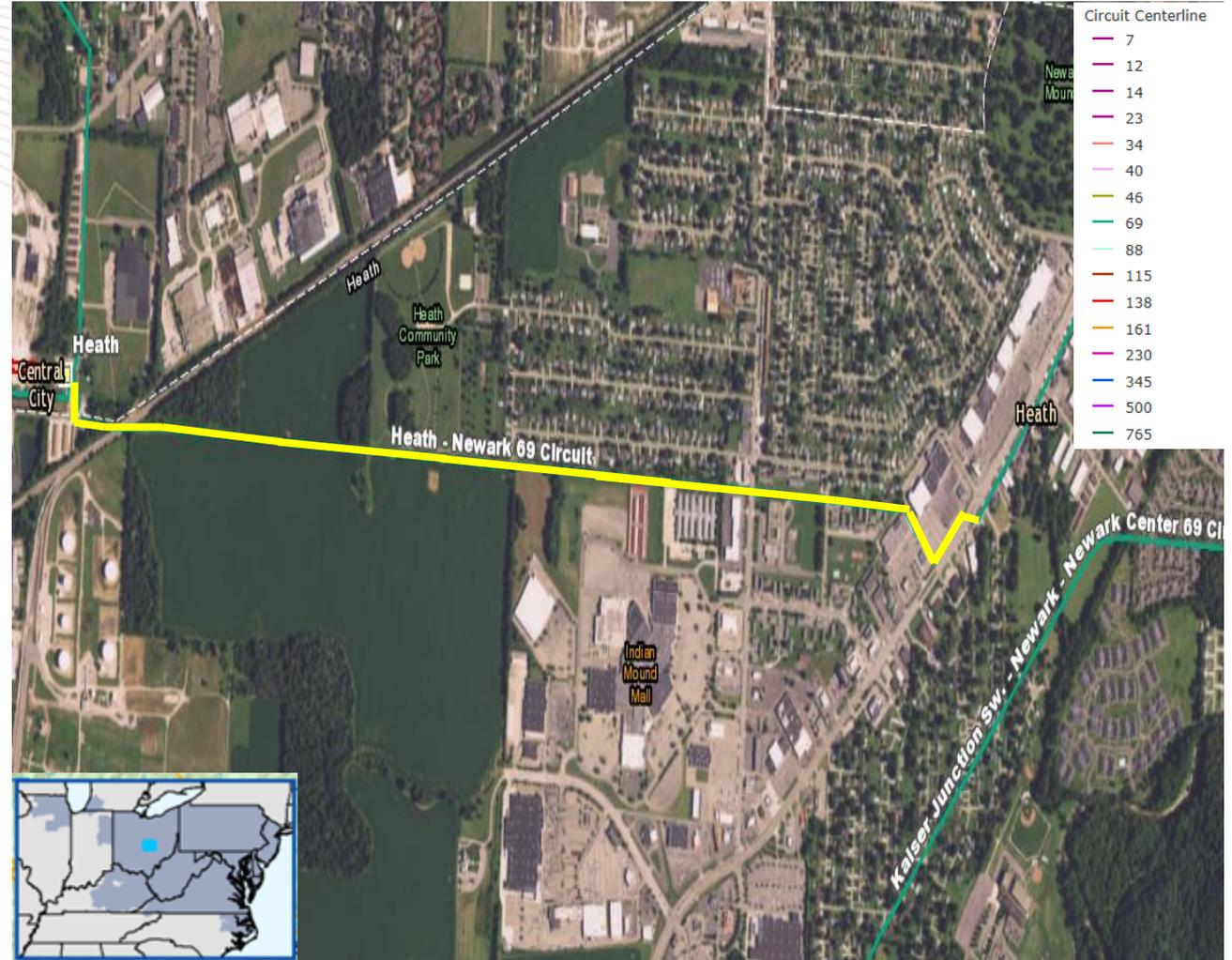
Selected Solution:

Rebuild 2.71 miles of Heath- Southgate 69 kV 4/0 copper conductor with 556 ACSR conductor (102 MVA rating). The customer project associated with the Marathon-Heath proposal has rebuilt the first section of this line. (S1322)

Estimated Cost: \$1.9M

Projected IS date: 12/1/2017

Status: Engineering





Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The Hocking – Poston 138 kV line was built in 1949 utilizing wooded H-Frame structures with 636 ACSR conductor (223 MVA rating) that are showing signs of severe deterioration. The circuit has accumulated a total of 170 thousand customer minutes of interruption over the past three years. In addition, it has 44 open A conditions along the 16 mile line which are due to rot, structure damage, and broken cross arms. –Athens, OH

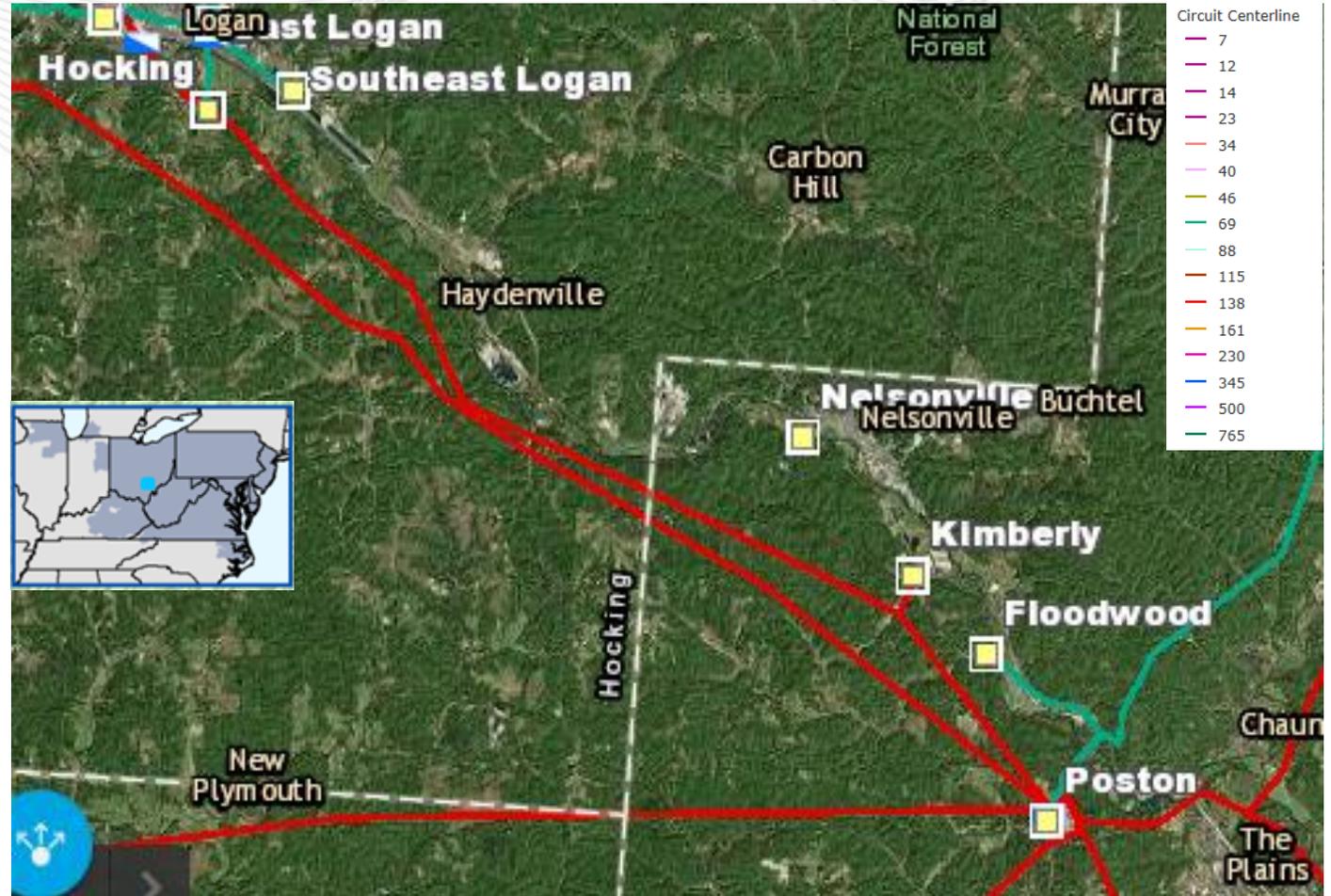
Selected Solution:

Rebuild 16.62 miles of the Hocking-Poston 138 kV line with 1033 ACSR (296 MVA rating) on steel poles. (S1323)

Estimated Cost: \$17.1M

Projected IS date: 12/1/2017

Status: Engineering



Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

Jackson Road – Lapaz/Marshall 34.5 kV ckt has 269 open conditions and is approximately 13 miles long. The majority of the line was built in the 1950s and is wood pole construction with 4/0 Copper and 336 ACSR conductor (27 MVA rating). 5.5 million customer minutes of interruption have been recorded at Lapaz and Quinn stations between 2010-2015.

At present Lapaz and Quinn stations are on a radial feed with partial emergency back up available through Marshall (NIPSCO's) station. The transformer size at Marshall prohibits the desired operational flexibility by limiting the periods when the Lapaz and Quinn loads can be fully served out of Marshall. Under this project, Lapaz and Quinn load is being converted to a looped 69 kV service.

Indiana and Michigan Power Company (IMPCO) has requested that Quinn and Lapaz stations be converted to 69 kV. –South Bend, IN

Selected Solution:

Replace 138/34.5 kV transformer with a 138/69-34.5 kV transformer, replace 34.5 kV circuit breaker F, and add a new 69 kV breaker at Jackson Road station. (S1324.1)

Rebuild and convert ~13 miles of 34.5 kV line between Jackson Road and Marshall (NIPSCO) to 69 kV utilizing 556 ACSR conductor (102 MVA rating). (S1324.2)

Convert Quinn to 69 kV (S1324.3)

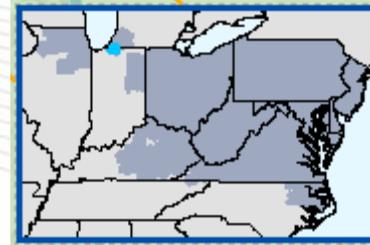
Construct Vintage 69 kV station to replace Lapaz (S1324.4)

Install 69 kV tie line metering at Marshall station (S1324.5)

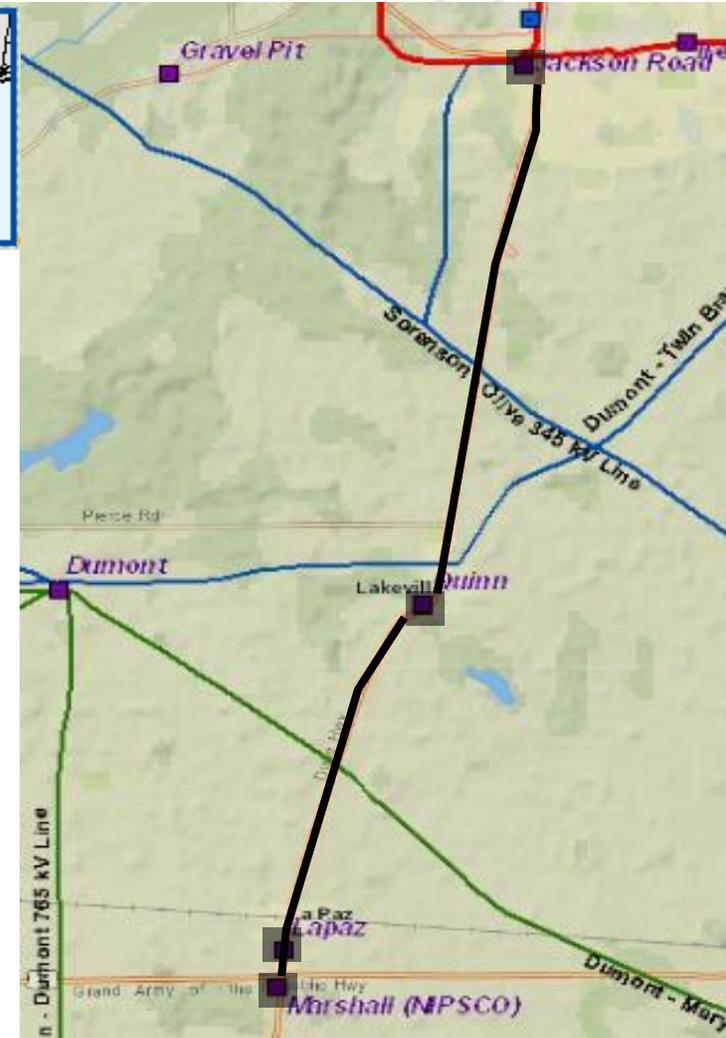
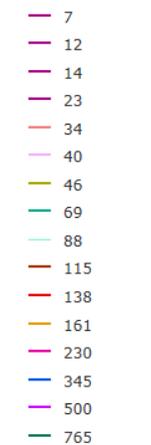
Estimated Cost: \$32M

Projected IS date: 12/1/2018

Status: Engineering



Circuit Centerline





AEP Transmission Zone Supplemental Project

Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

A customer requested 138 kV transmission service adjacent to the existing Jug Street Station property. The projected load for this single customer is 190 MVA. Additionally, there is currently 26 MVA of load served by AEP Ohio and another 3 MVA of load served by a local co-op out of this station. AEP Ohio has space for a total of four 50 MVA transformers to serve future load. The co-op has space for two 20 MVA transformers. A separate PJM project (s1191) will introduce a new 138 kV source at Jug Street to serve this load.

Expanding Jug Street Station into a ring bus design will be beneficial for Operations as the existing 138 kV circuit breakers require an outage of the transmission line when maintenance is necessary. Additionally, the new 190 MVA load will be served via five individual transformers along with the existing load at the station. The ring bus design eliminates the potential of losing all load at the station for a breaker failure scenario.

– New Albany, OH

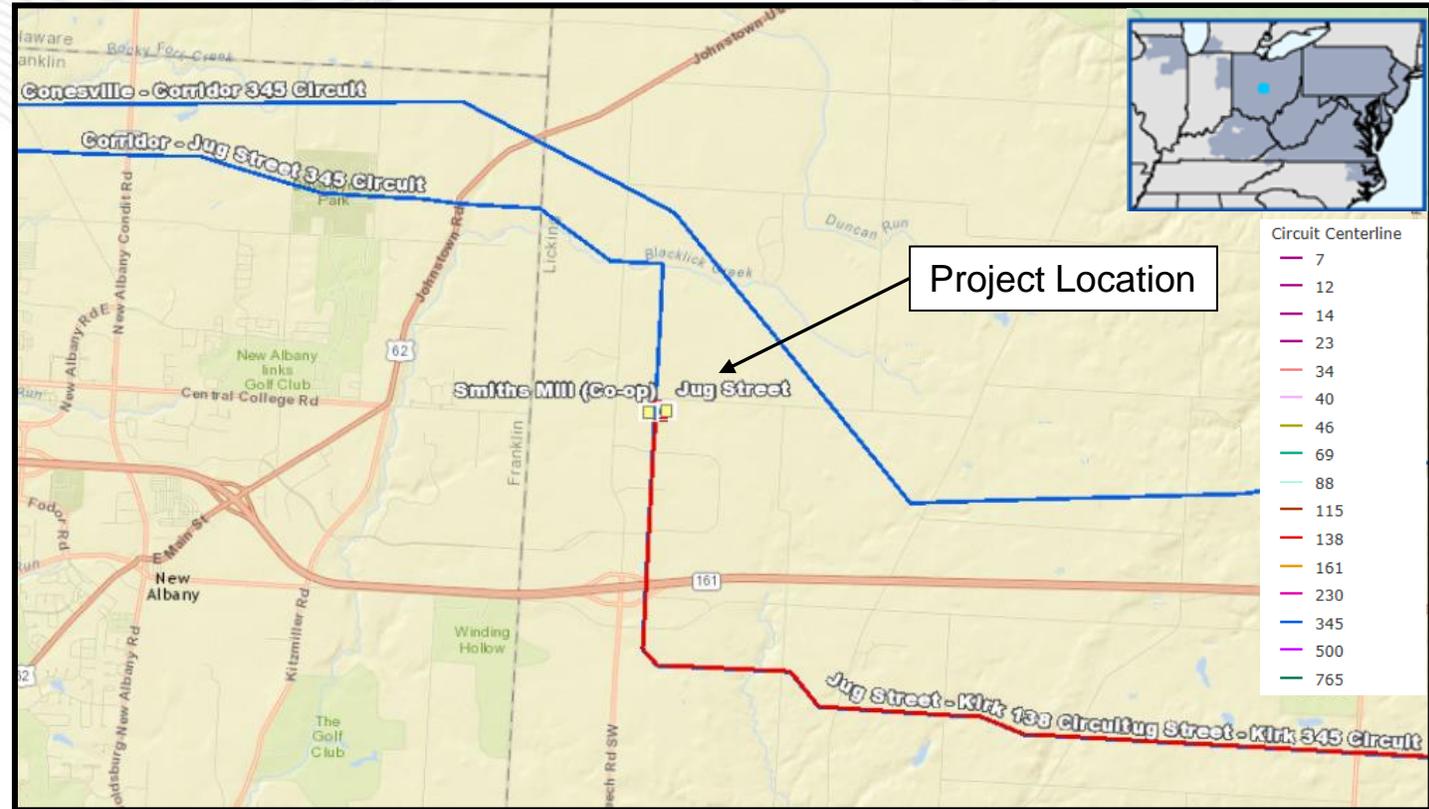
Selected Solution:

Jug Street 138 kV Station will be expanded and modified into a two ring bus configuration to serve up to five additional 50 MVA, 138/34.5 kV customer transformers. (S1325)

Estimated Cost: \$9.1M

Projected IS date: 6/1/2017

Status: In service



Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

At Kankakee station, the 34.5kV Circuit Breakers H, I, F & D are all 1200 A 25 kA oil type (FK) breakers manufactured in 1955. Oil filled breaker maintenance has become more difficult due to the oil handling required to maintain them. Oil spills are frequent with breaker failures and routine maintenance and can become an environmental hazard. Breaker D has had 108 fault operations and breaker I has had 16 fault operations. The manufacturer recommendation is 10 for this type of breaker. The breakers have the following documented conditions: age, wear, PCB content, maintenance issues, and no repair part availability.

138/34.5kV 70 MVA transformer #1 at Kankakee, manufactured in 1955, will be replaced because of breakdown in dielectric strength (insulation system), short circuit strength (winding short circuit strength breakdown due to magnitude of short circuit fault events), oil quality issues, and accessory problems (bushings, pumps, etc.). – South Bend, IN

Selected Solution:

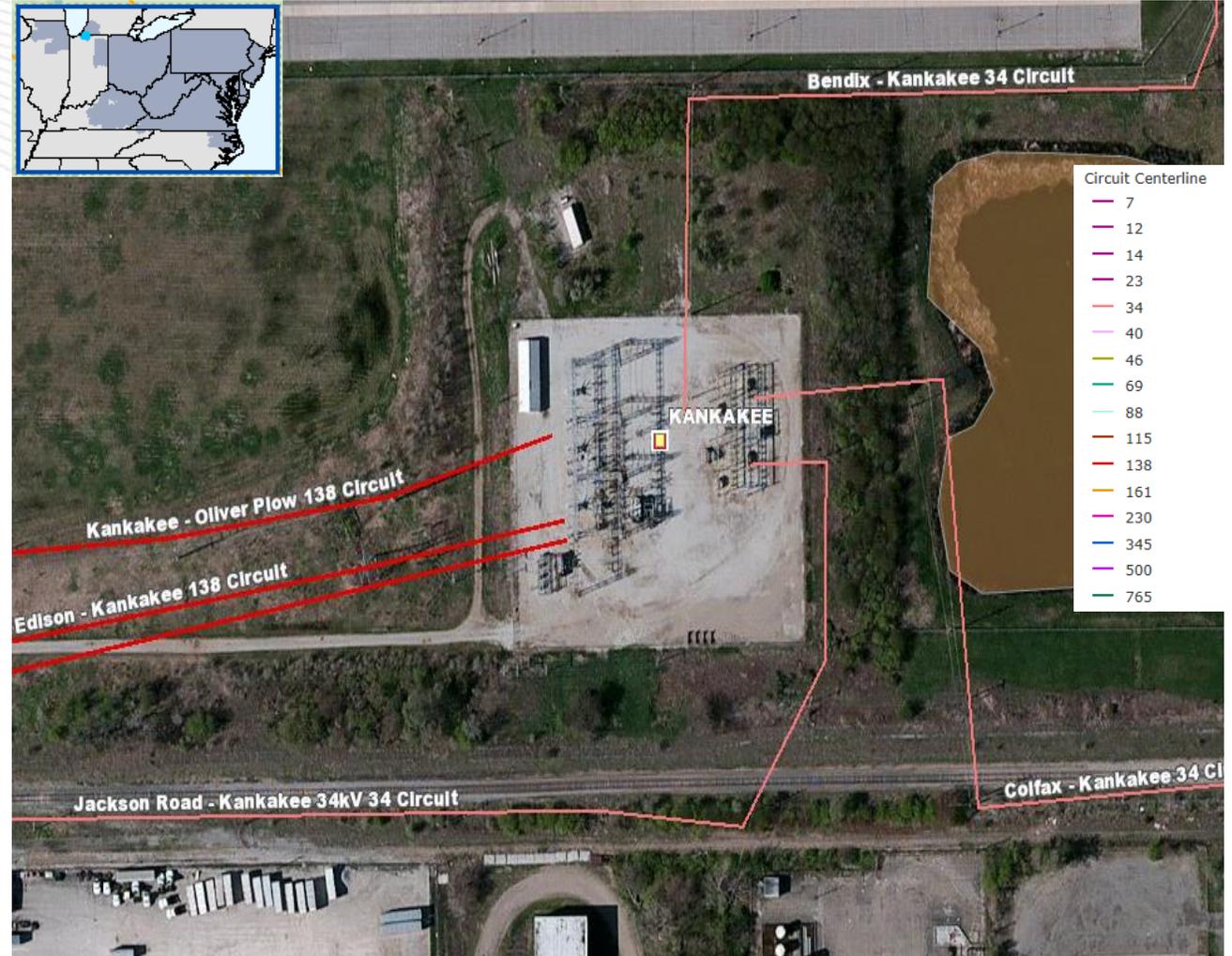
Replace existing Kankakee transformer #1 with a 138/69/34.5 kV 130 MVA transformer. Estimated cost: \$3.0M (S1326.1)

Replace 34.5 kV circuit breakers H, I, D and F with new 1200A 25kA circuit breakers along with associated equipment and protection. Estimated cost: \$2.0M (S1326.2)

Estimated Cost: \$5.0M

Projected IS date: 12/1/2017

Status: Engineering



Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

Virginia Tech Electric Service (VTES) requested an additional 69 kV delivery point via two new transformers from AEP at Lane station. – Blacksburg, VA

Selected Solution:

Relocate the Lane-Merrimac 69 kV line to accommodate the Lane station expansion. Expand Lane Station to establish a second Virginia Tech Electric Service (VTES) 69 kV delivery point. Install one 3000 A 40 kA 69 kV circuit breaker and associated equipment. Motorize an existing 69 kV switch and system protection equipment. Add 2-12 kV metering to the new transformers to be added by VTES. (S1327)

Estimated Cost: \$0.3M

Projected IS date: 4/1/2018

Status: Engineering





Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The current location of Northwest Elkhart is very space constrained and has structures dating back to 1966. Circuit breakers A, B and J were manufactured in 1960 and are oil filled breakers. Oil filled breaker maintenance has become more difficult due to the oil handling required to maintain them. Oil spills are frequent with breaker failures and routine maintenance and can become an environmental hazard. The breakers have the following documented conditions: age, wear, PCB content, maintenance issues, and no repair part availability.

The transformers are in poor condition due to dielectric strength breakdown (insulation) and decreased short circuit strength (through fault events). –Elkhart, IN

Selected Solution:

Rebuild the 34 kV facility currently located at the Northwest Elkhart station, to be renamed to “Mackey” station. Estimated cost: \$3.456M (S1328.1)

Retire the existing Northwest Elkhart station. Estimated cost: \$0 (S1328.2)

Retire the line that was previously serving Miles Lab. Estimated cost: \$0.4M (S1328.3)

Retire the remaining equipment at Miles Lab station that was left after the customer went out of service a couple of years ago. Estimated cost: \$0.2M (S1328.4)

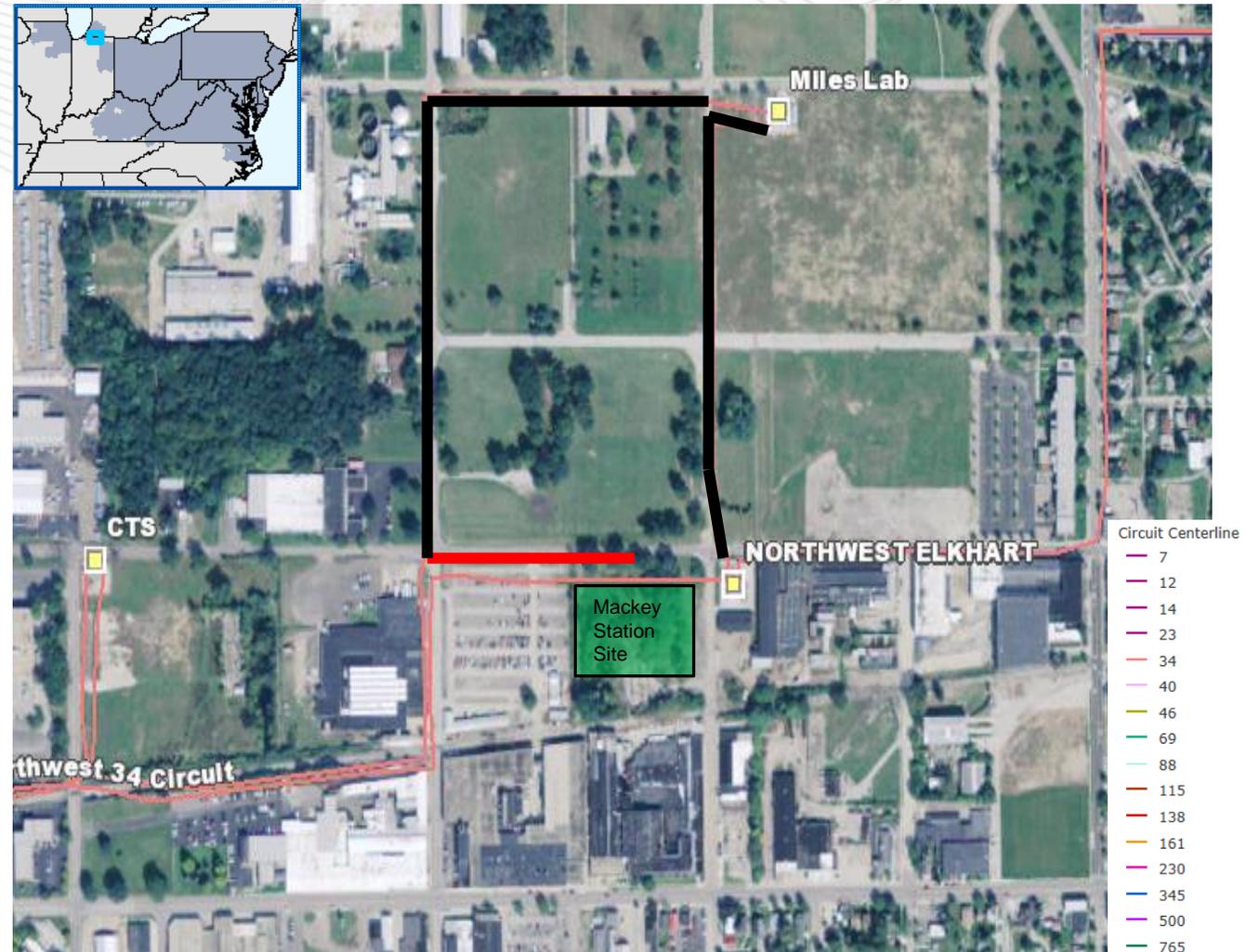
Build a new 0.15 mile 34.5kV line with 795 AAC (62 MVA rating) from Mackey station to re-terminate the Concord 34.5 kV line, bypassing the retired Miles Lab line. Estimated cost: \$0.01M (S1328.5)

Estimated Cost: \$4.066M

Projected IS date: 12/15/2017

Status: Engineering

AEP Transmission Zone Supplemental Project





AEP Transmission Zone Supplemental Project

Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

BREC has requested AEP retire the AEP-owned Waterloo hard tap, which currently serves the BREC-owned Elliot Station, and re-establish service at a new station called New Marshfield, which will be owned by Buckeye, via the new AEP-owned Mineral switch.

When the Elk – Poston 138 kV circuit trips from service, outages occur at Bolin’s Mills and Waterloo stations. This load cannot be transferred to any nearby stations to get picked up in case of an outage. Thus, by placing MOABs at the new Mineral switch, the 138 kV source will keep Bollins Mill and Mineral in service, as well as provide the following benefits:

By having MOABs with supervisory control the circuit could sectionalize and provide TDC a location for the fault, which would reduce time spent troubleshooting and customer outage duration.

MOABs would greatly improve AEP’s ability to perform maintenance because we would not need to rely on BREC to transfer load or take an outage.

Currently, AEP must rely on BREC to isolate Waterloo for any line work. In an emergency condition it can take several hours for BREC personnel to be on-site to perform switching operations. The MOAB will eliminate the need for BREC to isolate their load.

–Athens, OH

Selected Solution:

Install new 138 kV phase over phase switch (“Mineral”) to connect the BREC (“New Marshfield”) delivery point. Estimated cost: \$0.8M (\$1329.1)

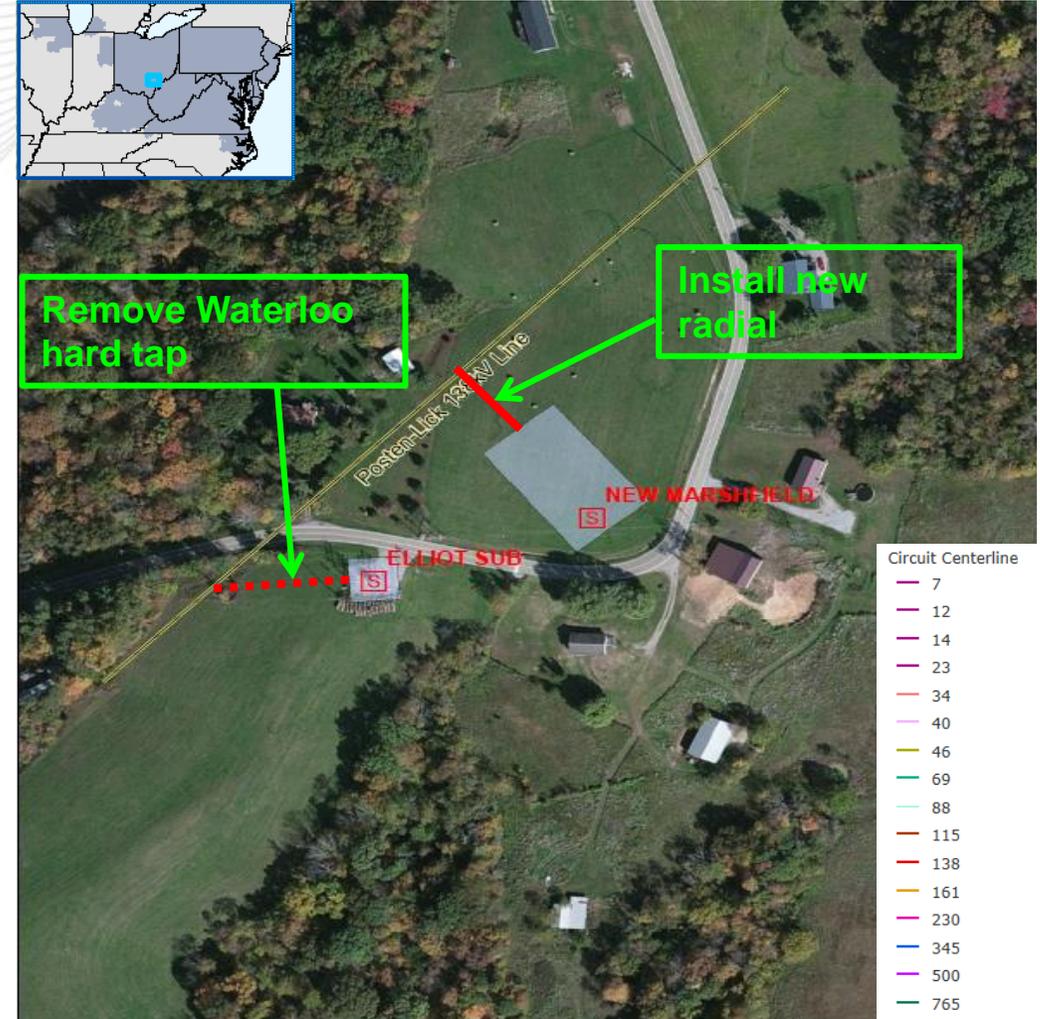
Construct a new 50-foot span between the new Mineral Switch structure and New Marshfield.

Remove Waterloo (Elliot Station) radial hard tap. Estimated cost: \$0.1M (\$1329.2)

Estimated Cost: \$0.9M

Projected IS date: 9/26/2017

Status: Scoping





AEP Transmission Zone Supplemental Project

Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The 138kV circuit breakers L, B and M at New Carlisle 138kV substation are all 3000 A 40 kA air blast type PK model. Air breakers tend to fail violently and their porcelain bushings disperse particles into the surrounding area, which is a safety concern. Breakers B has had 45 fault operations, breaker L has had 30 fault operations, and breaker M has had 12 fault operations. The manufacturer recommendation is 10 for this type of breaker. Factors leading to the replacement of these three breakers are age, repair part availability, and safety concerns. – South Bend, IN

Selected Solution:

Replace existing 138kV CB B, M and L at New Carlisle with 3000A 63kA circuit breakers along with associated equipment and protection to match other breakers at the station. (S1330)

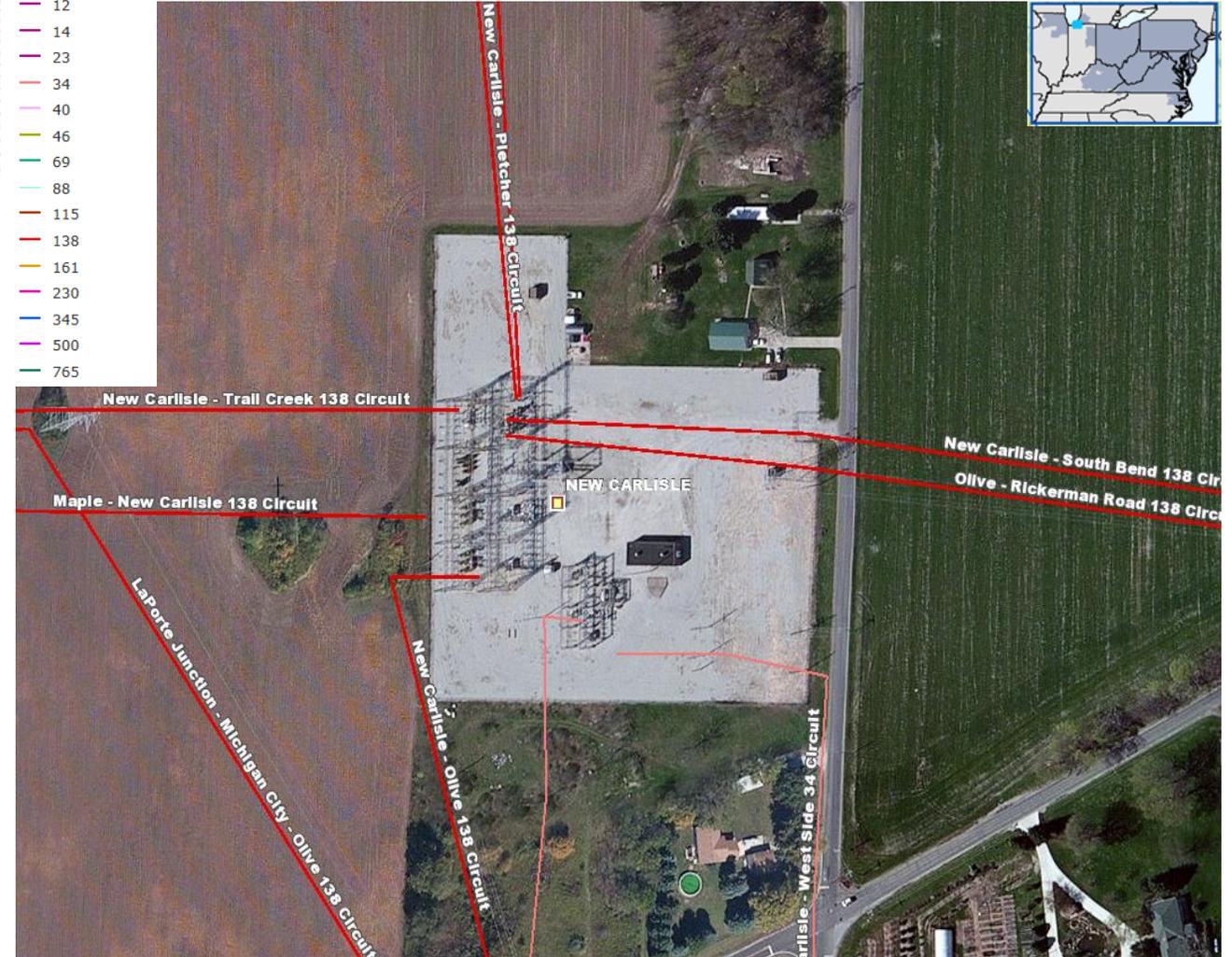
Estimated Cost: \$2.3M

Projected IS date: 12/1/2017

Status: Scoping

Circuit Centerline

- 7
- 12
- 14
- 23
- 34
- 40
- 46
- 69
- 88
- 115
- 138
- 161
- 230
- 345
- 500
- 765





Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

An AEP Ohio customer served out of North Lexington station approached AEP Transmission in 2016 to relocate their delivery point to 69 kV due to the nature of their load, which is very sensitive to any type of power outage. The existing 138 kV delivery point is on a 38 mile long line with no existing sectionalizing capability. Only 2 MW of load is transferable when the 138 kV line is out of service. Currently, there is 24 MVA of load served from North Lexington at peak. Therefore, AEP Transmission recommended a plan to install breakers at North Lexington station to keep the station transformer in service for a line outage. –Mansfield, OH

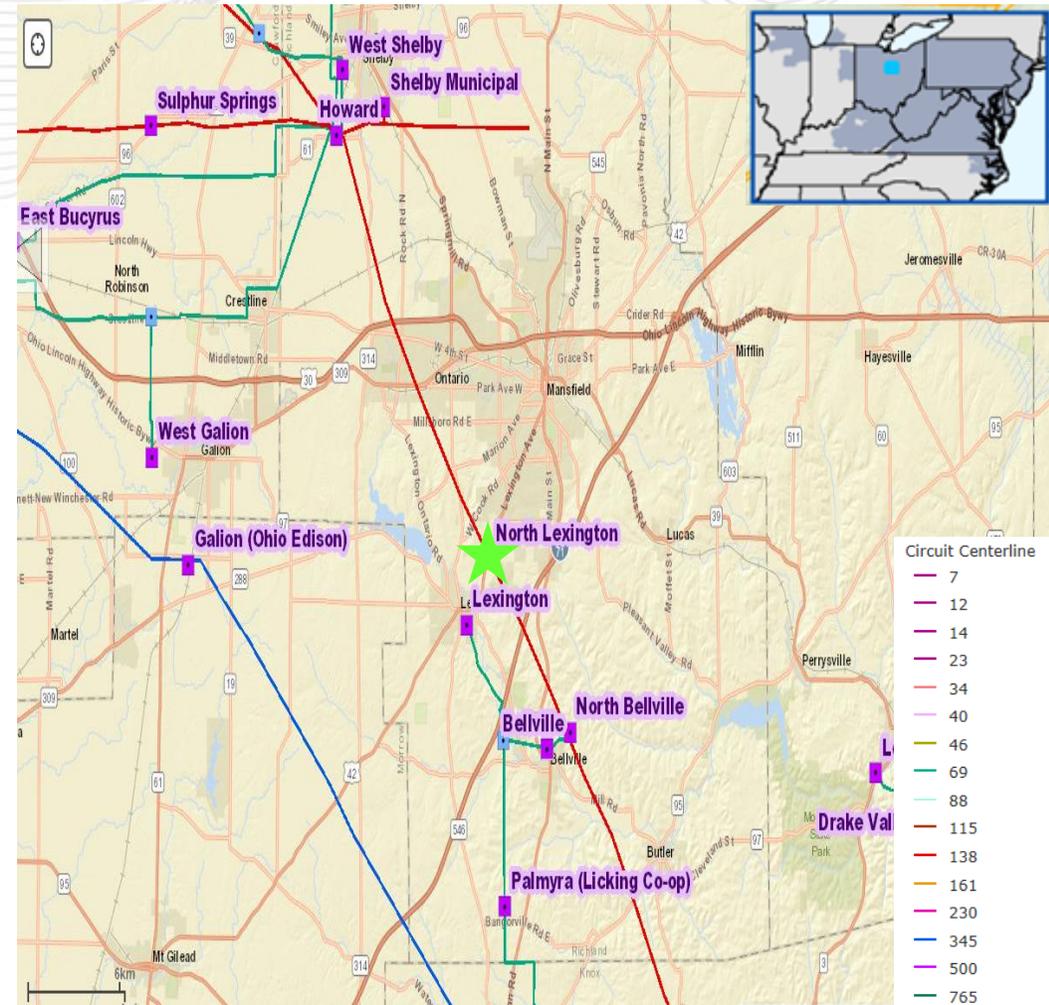
Selected Solution:

Install two 138 kV 3000 A 40 kA circuit breakers at North Lexington 138kV station. (S1331)

Estimated Cost: \$2.214M

Projected IS date: 5/31/2017

Status: In Service



Supplemental Project

Previously Presented in TEAC on 4/13/2017 and 5/4/2017, and 4/21/2017 SRTEAC

Problem Statement:

The LaPorte Junction - New Carlisle 34.5 kV circuit has a vintage from 1930s and is wood pole construction with 4/0 Copper conductor (27 MVA rating). Between 2010-2015, ~2 million customer minutes of interruption (CMI) were recorded at Silver Lakes station.

There are 183 open conditions, 95 of which are A conditions on the ~20 mile long line.

Indiana and Michigan Power Company has requested to convert Silver Lake and Springville to 138 kV operation. – La Porte, IN

Selected Solution:

Construct two 138/12 kV distribution stations, Bootjack and Marquette, to replace Silver Lake 34.5 kV and Springville 69 kV stations. Estimated cost: \$7.97M (S1279.1)

Cut the existing Olive – Bosserman line into New Carlisle station. Estimated cost: \$1.454M (S1279.2)

Rebuild sections of the LaPorte Junction-New Carlisle/New Buffalo 34.5 kV line to 138 kV to establish Bootjack-Olive 138 kV circuit utilizing 795 ACSR conductor (251 MVA rating). Estimated cost: \$9.894M (S1279.3)

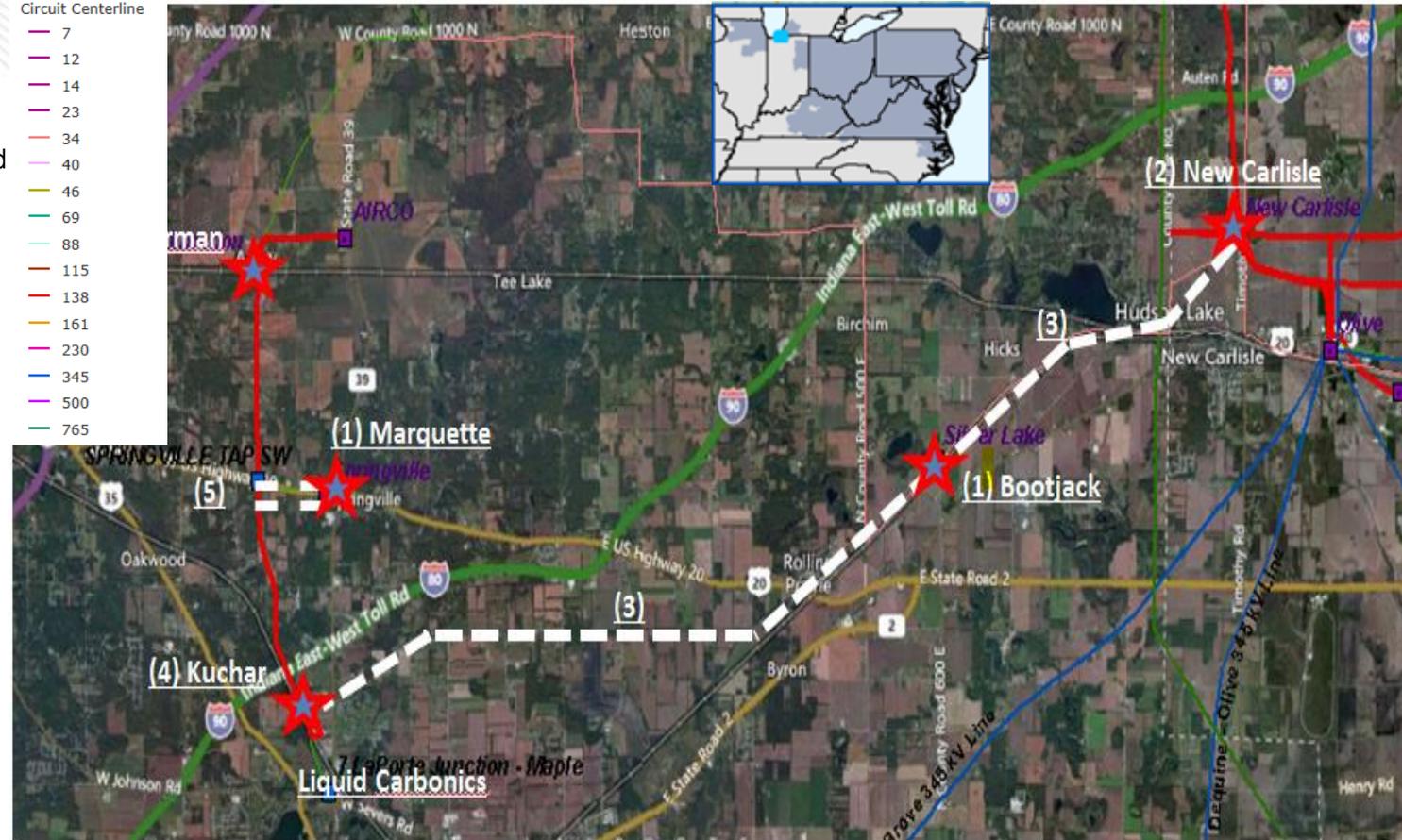
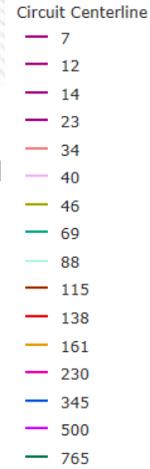
Install a three way phase over phase switch, called Kuchar, near Liquid Carbonics station and construct a new 138 kV line between Bootjack and Kuchar. Estimated cost: \$15.538M (S1279.4)

Construct a 138 kV extension to Marquette station by tapping the Bosserman-Liquid Carbonics 138 kV line utilizing 795 ACSR conductor (251 MVA rating). Estimated cost: \$1.93M (S1279.5)

Estimated Cost: \$36.786M

Projected IS date: 12/1/2019

Status: Scoping



Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

There are five overlapping zones of protection (138 kV lines, 138/12 kV transformer, 138/69/34.5 kV transformer, 34.5 kV bus and lines) at Shawnee Road station. Additionally, installation of the proposed breakers addresses legacy hybrid IED/EM Mux transfer trip protection schemes which are very difficult to maintain and have shown a history of failure on the AEP system. These transfer trip schemes are difficult to maintain or replace in kind due to the fact that multiple line outages are needed.– Wapakoneta, OH

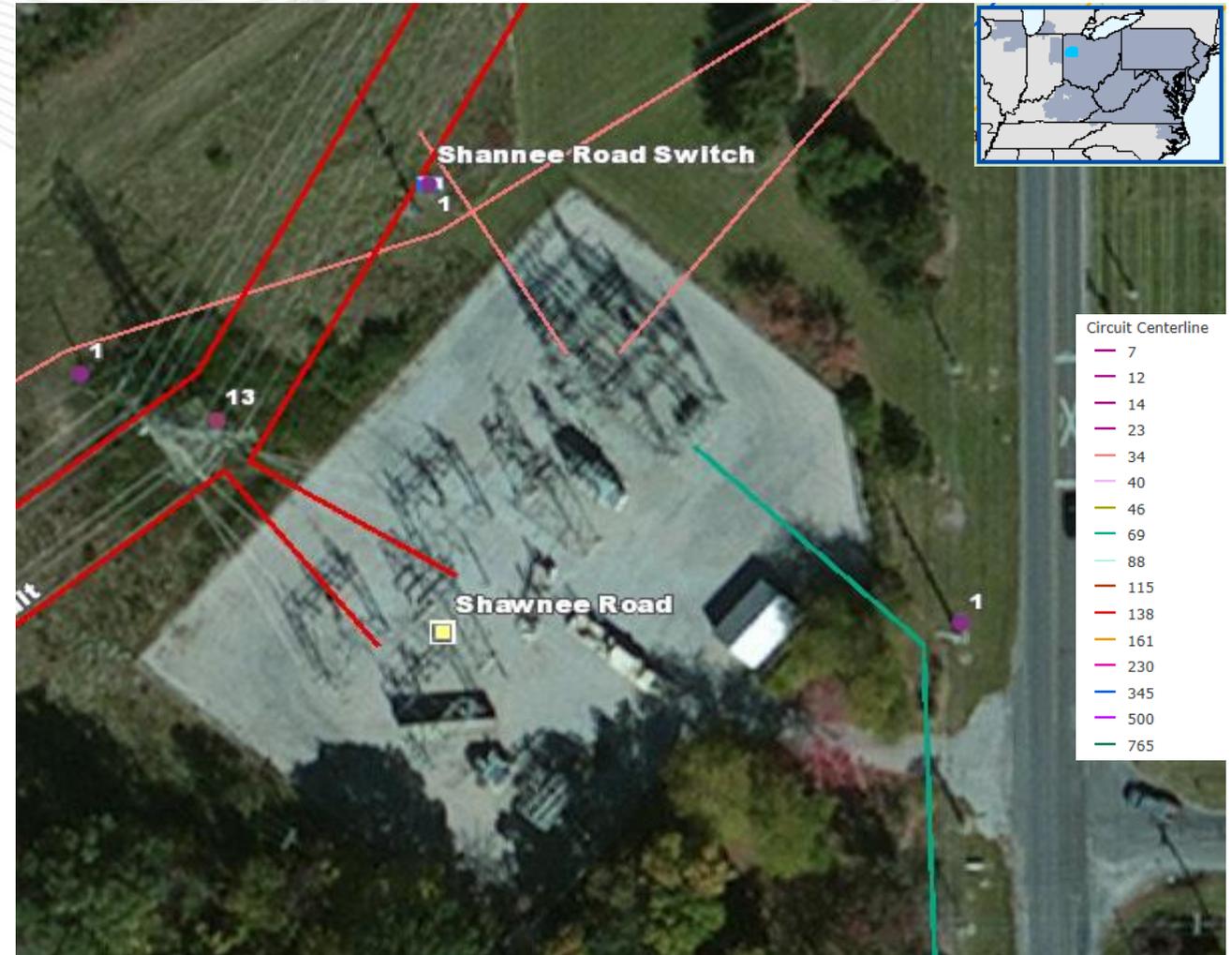
Selected Solution:

At Shawnee Road 138kV station, install 40 kA circuit breakers A, B & C on the branches to Southwest Lima and Junction Switch and on the high side of Transformer #2 and a circuit switcher on Transformer #1. (S1333)

Estimated Cost: \$1.609M

Projected IS date: 11/1/2017

Status: Engineering





AEP Transmission Zone Supplemental Project

Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

Karl Road 138kV CBs 104, 105, 102 & 101 are all 1200 A 20 kA oil breakers with 105 being an FK type and the other three being AHE's. The drivers to replace are age (1963), number of fault operations suffered, bushing damage and lack of repair parts for break and fix scenarios. These are the only 3 AHE type breakers in the eastern AEP footprint.

Clinton 138kV CBs 102, 108, 104, 107, and 105 are 2000 A 40 kA oil filled 145GMA type breakers. There are only 8 remaining GMA's in the entire AEP system, including these five at Clinton. Additional drivers for replacement include age, bushing damage, and lack of available repair parts.

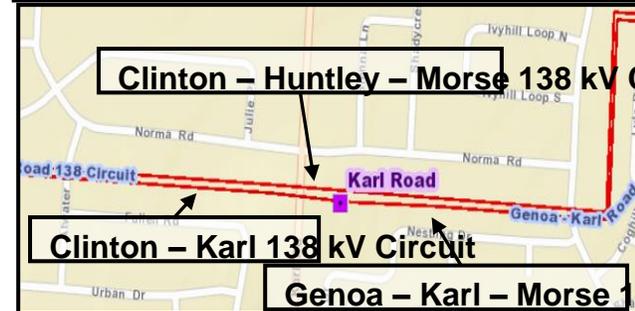
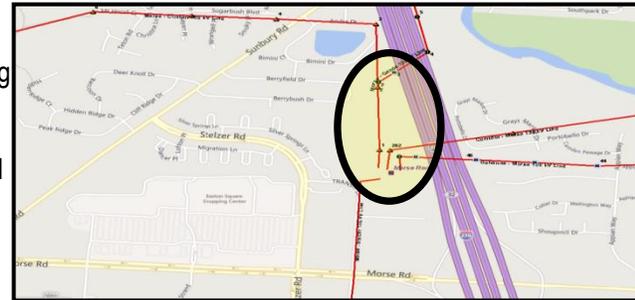
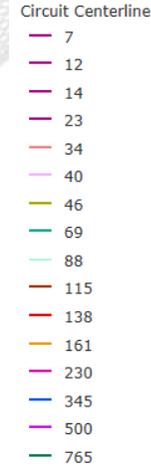
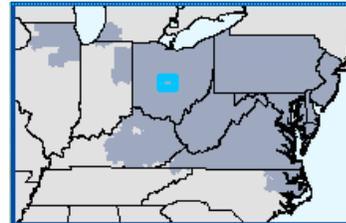
Morse Road 138kV CBs 110, 101, 109, 102, and 108 are 1600 A 42 kA oil filled ALP-60 type breakers. All these breakers have the following documented conditions: age, bushing damage, and lack of repair parts available.

In general, oil breakers have become more difficult to maintain due to the oil handling. Oil spills occur frequent with failures and routine maintenance which can become an environmental concern.

Existing protection at Morse is very difficult to coordinate properly due the complexity of the system, number of lines coming in, old relaying schemes, and three terminal line configurations affecting the station. This project will eliminate a three terminal line just outside of Morse station. A 3 terminal line exposes Karl, Genoa, and Morse stations to unnecessary outage risk as well as relay miscoordination risk.

Karl Station has three 84 MVA 138/13.8 kV Distribution Transformers serving approximately 125 MVA of load. This load is non-transferrable, so is unable to be picked up by alternate sources for outages to the sources serving Karl Road. – East side Columbus, OH

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AEP Transmission Zone Supplemental Project

Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Continued from previous slide

Selected Solution:

Add 3-138kV 3000 A 63 kA CB's at Karl Road to create a ring bus and cut in the other side of the existing double circuit tower line. Estimated cost: \$5.3M (S1334.1)

Replace CB's at Karl Road, Morse Road, and Clinton stations with 3000 A 63 kA circuit breakers. Estimated cost: \$9.2M (S1334.2)

Note: Additional breaker replacements at Morse Road and Clinton stations were previously reviewed as baseline projects b2821 and b2822.

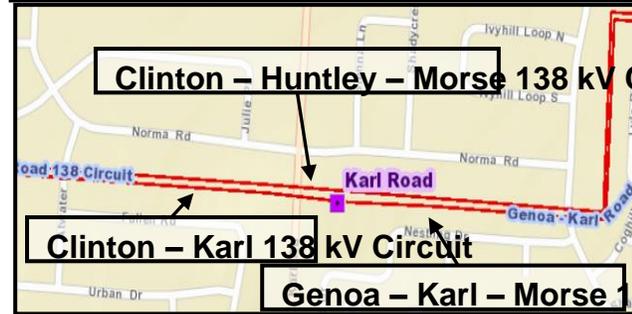
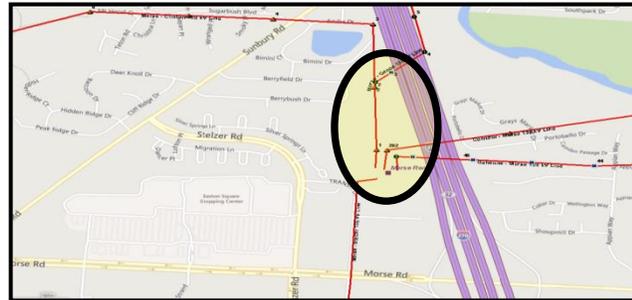
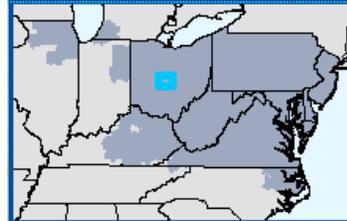
Estimated Cost: \$14.5M

Projected IS date: 12/31/2019

Status: Engineering

Circuit Centerline

- 7
- 12
- 14
- 23
- 34
- 40
- 46
- 69
- 88
- 115
- 138
- 161
- 230
- 345
- 500
- 765



Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

New Carlisle – West Side 34.5 kV circuit has experienced 202,942 customer minutes of interruption between 2013-2015. Construction of this new station will reduce customer outages by breaking the existing New Carlisle-West Side circuit into two segments, New Carlisle-Tulip Road and Tulip Road-West Side.

Scrap Metal Services (customer) is served via a hard tap. Every time scheduled/non-scheduled maintenance is taken on the New Carlisle – West Side 34.5 kV circuit, the customer is forced out of service. Tulip Road station addresses this situation.

Two retail customers are served via the New Carlisle – West Side 34.5 kV circuit through two delivery points (Smilax Switch and the other via a hard tap) that are in close proximity (4 spans) to each other. Construction of Tulip Road station will consolidate the two delivery points and simplify grid connectivity.

A MOAB is recommended between the New Carlisle & Tulip Road and Lydick & Tulip Road sections per the AEP MPOI/FOI calculation. However, this circuit already has two MOABs in series at Lydick. Two additional MOABs at Tulip Road will result in four total MOABs in series, which is not recommended as that introduces relay coordination complications, potentially resulting in misoperations. Therefore, instead of two additional MOABs at Tulip Road, installation of one circuit breaker is recommended. – South Bend, IN

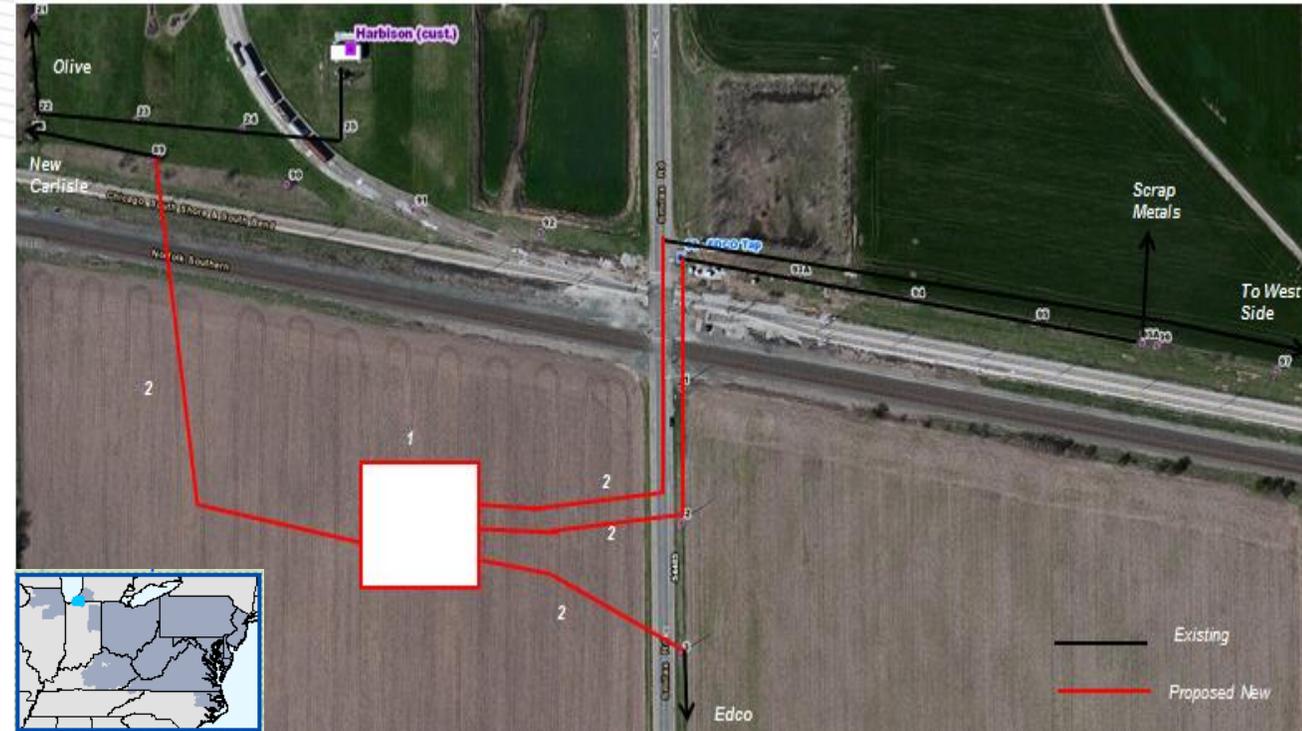
Selected Solution:

- Construct a new 34.5 kV Tulip Road station with one circuit breaker on the West Side line exit. Estimated cost: \$2.98M (S1335.1)
- Terminate New Carlisle, West Side, Scrap Metals, and Edco lines into the new station. Estimated cost: \$3.3M (S1335.2)
- Remote end work at New Carlisle station due to breaker addition at Tulip Road. Estimated cost: \$1.2M (S1335.3)

Estimated Cost: \$7.48M

Projected IS date: 12/1/2017

Status: Engineering



Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The existing 65 mile, 138 kV double circuit line between Twin Branch and Robison Park was constructed in 1926 using lattice towers with 397 ACSR conductor (167 MVA rating). There are 686 open conditions on this line, including burnt/broken insulators, loose/broken conductor strands, damaged conductor hardware and corroded shield wire. –Fort Wayne and South Bend, IN

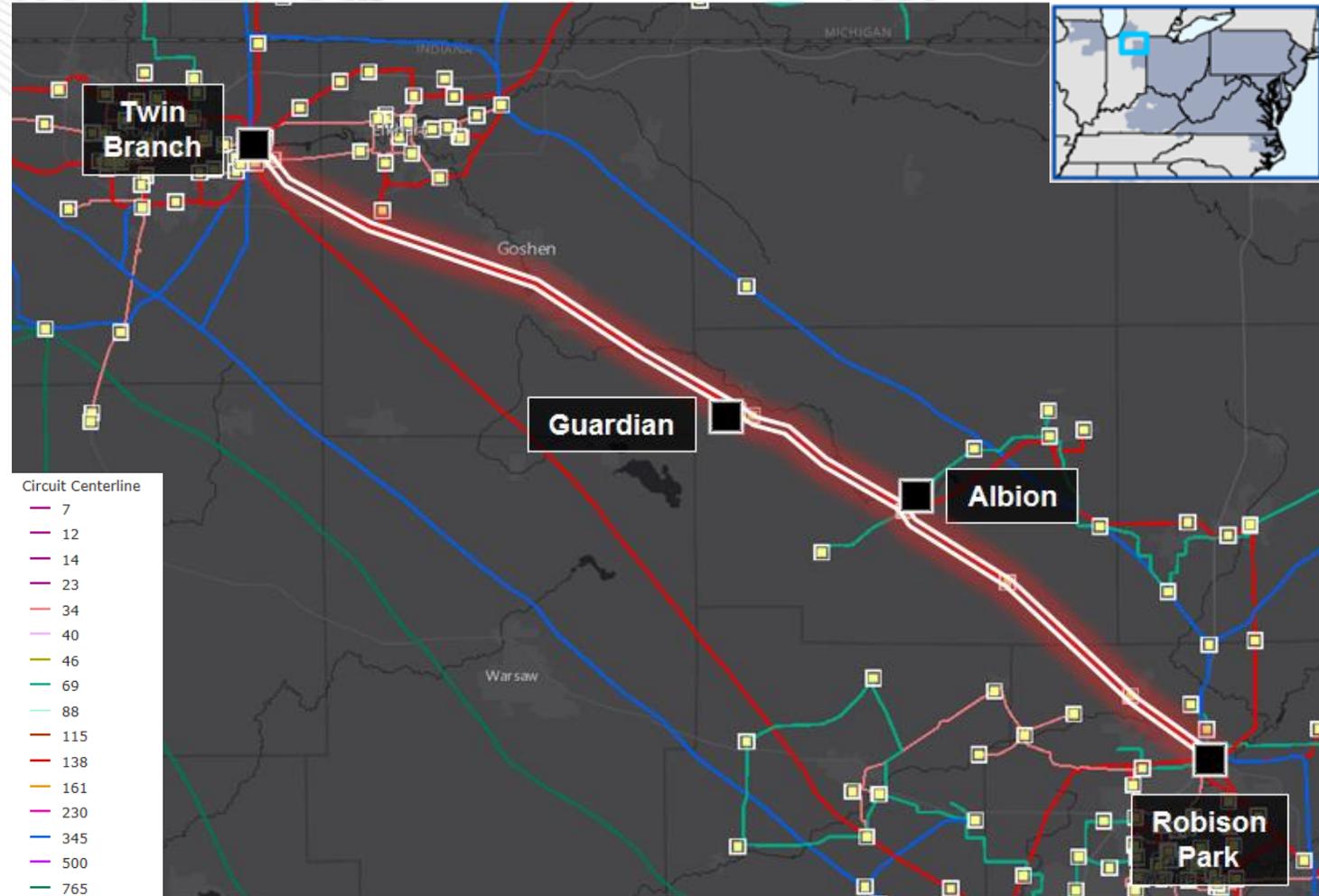
Selected Solution:

Rebuild approximately 65 miles of 138 kV double circuit tower line between Twin Branch and Robison Park stations using 795 ACSR overhead conductor (251 MVA rating). (S1336)

Estimated Cost: \$98.7M

Projected IS date: 6/1/2020

Status: Scoping





Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The 34.5kV circuit breakers A,G,E & F at West Side, three of which are 2000 A 36 kA type FK-38-36000 and the remaining one is a 1200 A 25 kA FK-439-34.5-1500, were manufactured in 1971 and 1953. All use oil as the interrupting medium. Oil filled breaker maintenance has become more difficult due to the oil handling required to maintain them. Oil spills are frequent with breaker failures and routine maintenance and can become an environmental hazard. Breaker A has had 61 fault operations, breaker E has had 68 fault operations and breaker G has had 16 fault operations. The manufacturer recommendation is 10 for this type of breaker. These breakers have the following documented conditions: age, high moisture readings, fault operation exceeding manufacturer life recommendation, and bushing maintenance issues. – West side of South Bend, IN

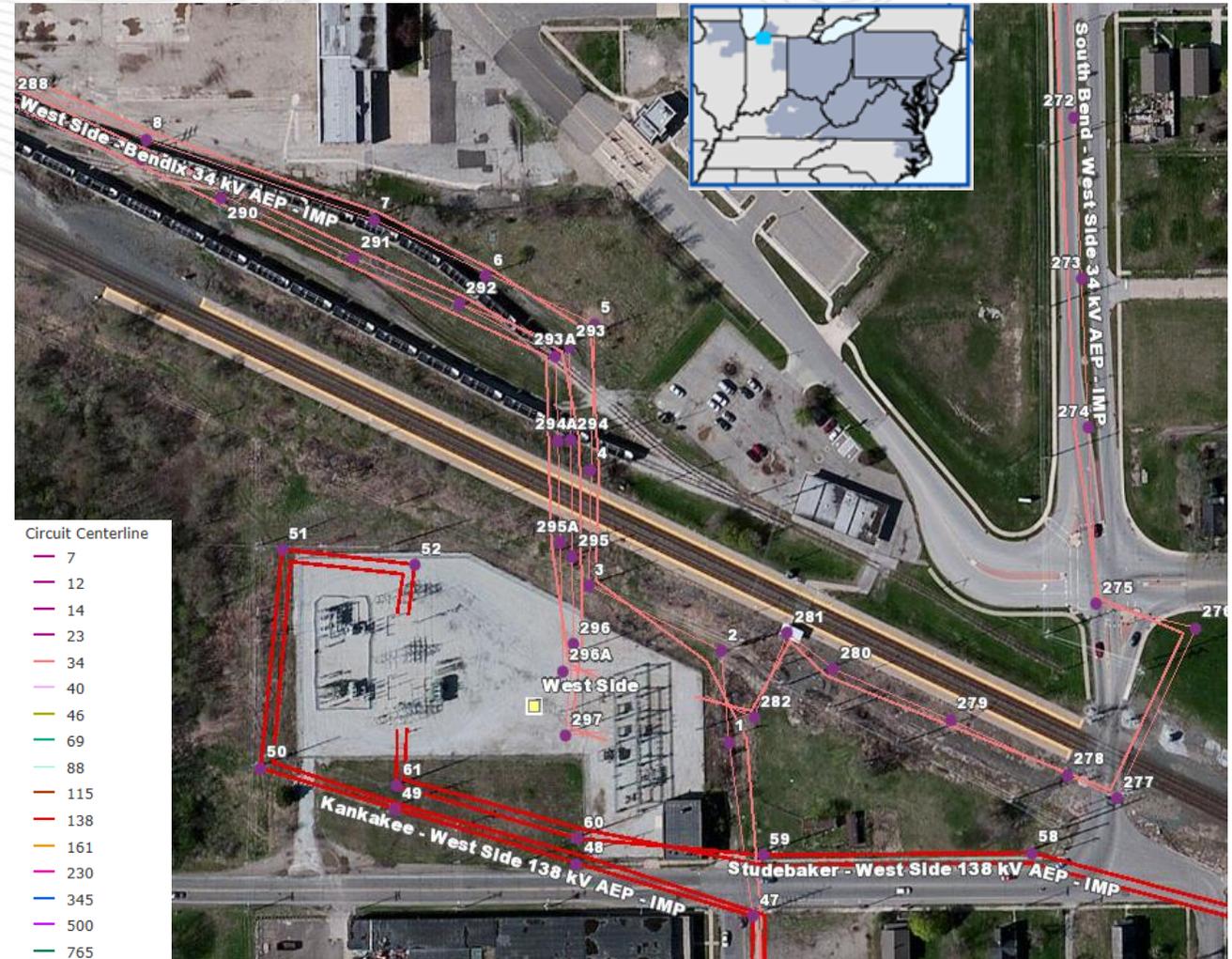
Selected Solution:

Replace West Side existing 34.5kV breakers A, F, E and G with new 3000A 40KA circuit breakers along with associated equipment and protection. (S1337)

Estimated Cost: \$3.088M

Projected IS date: 10/2/2017

Status: Engineering





AEP Transmission Zone Supplemental Project

Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

MK Morse has requested to convert their existing 3.8 MW, 12kV delivery point to 69kV to improve their electrical reliability. A fully executed Letter of Commitment (LOC), Letter of Credit (LC), and Contribution In Aid of Construction (CIAC) has been secured from MK Morse. –Canton, OH

Selected Solution:

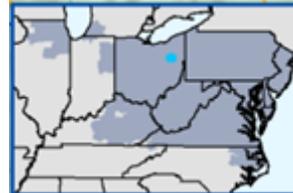
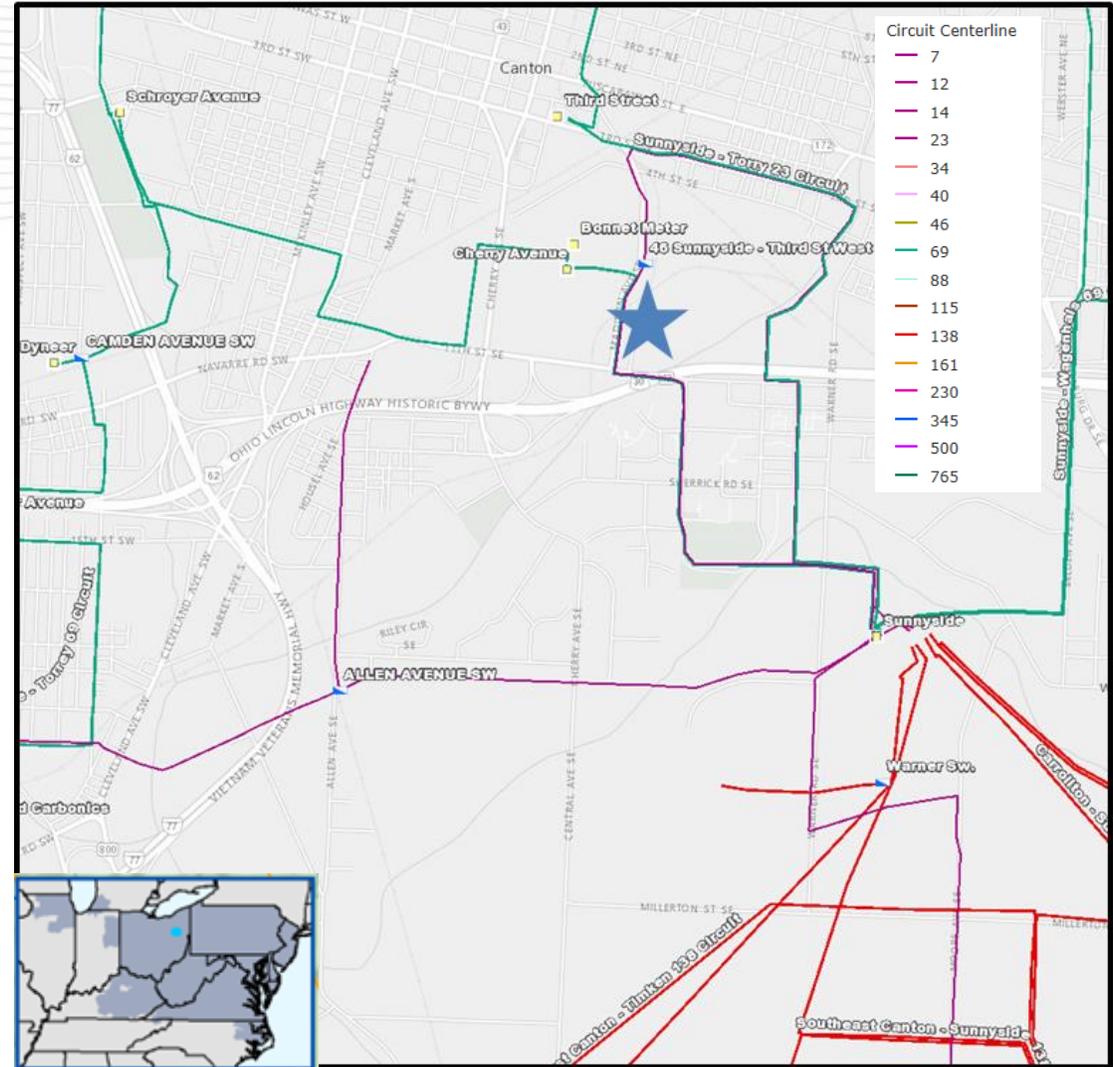
Install new 69kV PH/PH switch to connect MK Morse to Cherry Avenue – Sunnyside 69kV circuit , 2-MOABs on the through-path with full SCADA control, and New 69kV customer metering. Estimated cost: \$0.399M (S1338.1)

Cut existing Cherry Avenue – Sunnyside 69kV circuit to accommodate new 69kV PH/PH switch, Re-route Sunnyside – Torrey 23kV circuit to go underneath 69kV tap to customer station. Supplement existing easements to support new switch location and 23kV re-route. Estimated cost: \$0.162M (S1338.2)

Estimated Cost: \$0.561M

Projected IS date: 10/1/2017

Status: Engineering





ComEd Transmission Zone Supplemental Project

Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement :

Distribution station Veterans currently has one 138/12 kV transformer and is fed from a single 138 kV line.

Projected load growth in the area from new warehouse construction and residential growth along I355.

Existing station is projected to be over its allowable loading in 2018.

A second 138/12 kV transformer will be installed in 2018, requiring a second transmission feed.

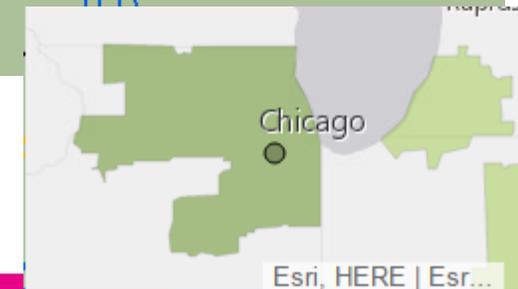
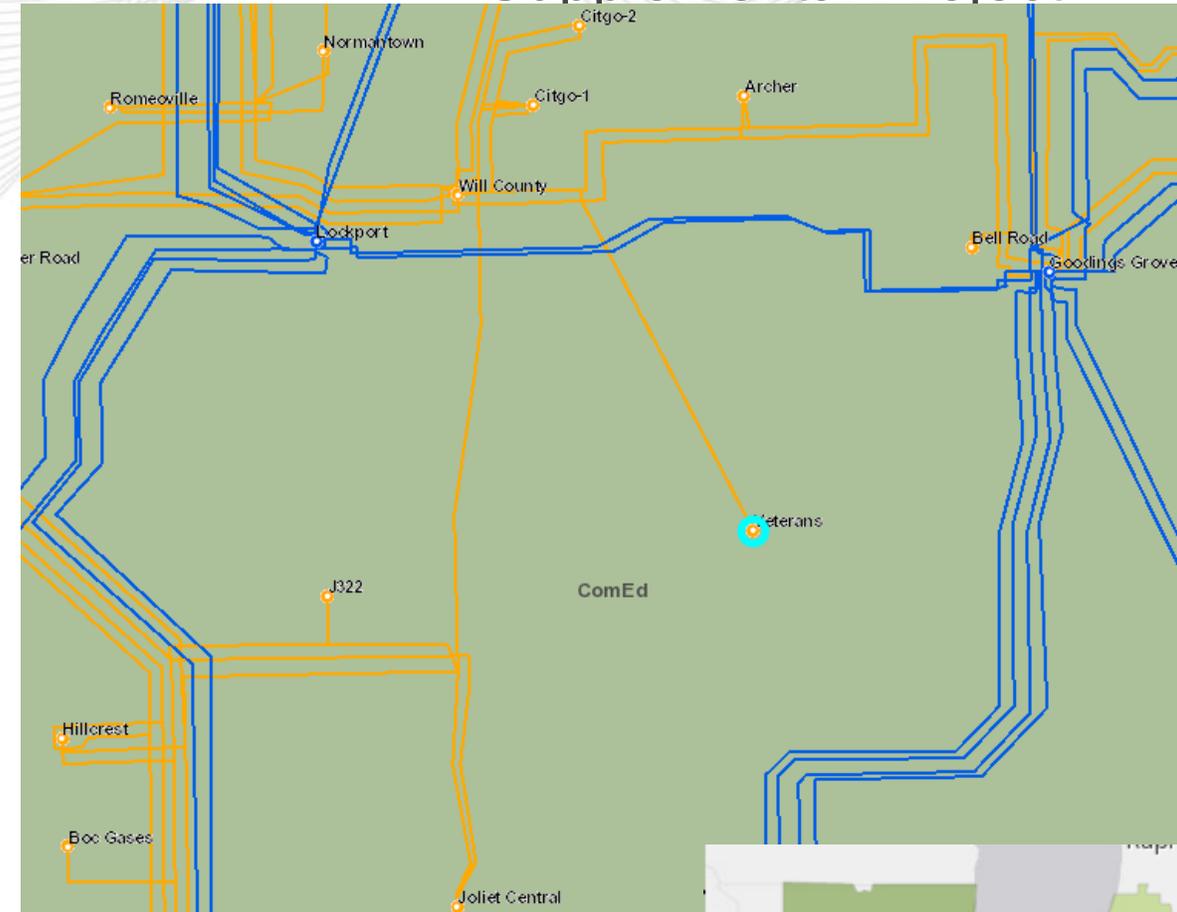
Selected Solution:

Tap existing 138 kV line 1808 (Will County – Goodings Grove) and extend for 4.6 miles on existing towers. (S1281)

Estimated Cost: \$0M (No transmission cost, all costs classified as distribution)

Project IS Date: 6/1/2018

Status: Engineering & Construction





ComEd Transmission Zone Supplemental Project

Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement :

Load is growing rapidly in Elk Grove Village area due to several new data center customers.

108 MW connecting to 34 kV distribution

Tonne station is projected to be overloaded in 2018

Selected Solution:

Expand Itasca 138 kV bus and install new 34 kV terminal at Itasca substation.
(S1282)

Estimated Cost: \$0M (No transmission cost, all costs classified as distribution)

Projected IS Date: 6/1/2018

Status: Engineering & Construction





ComEd Transmission Zone Supplemental Project

Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

138 kV Line 7421 (Kewanee – Toulon) has 18 NERC Alert potential violations.

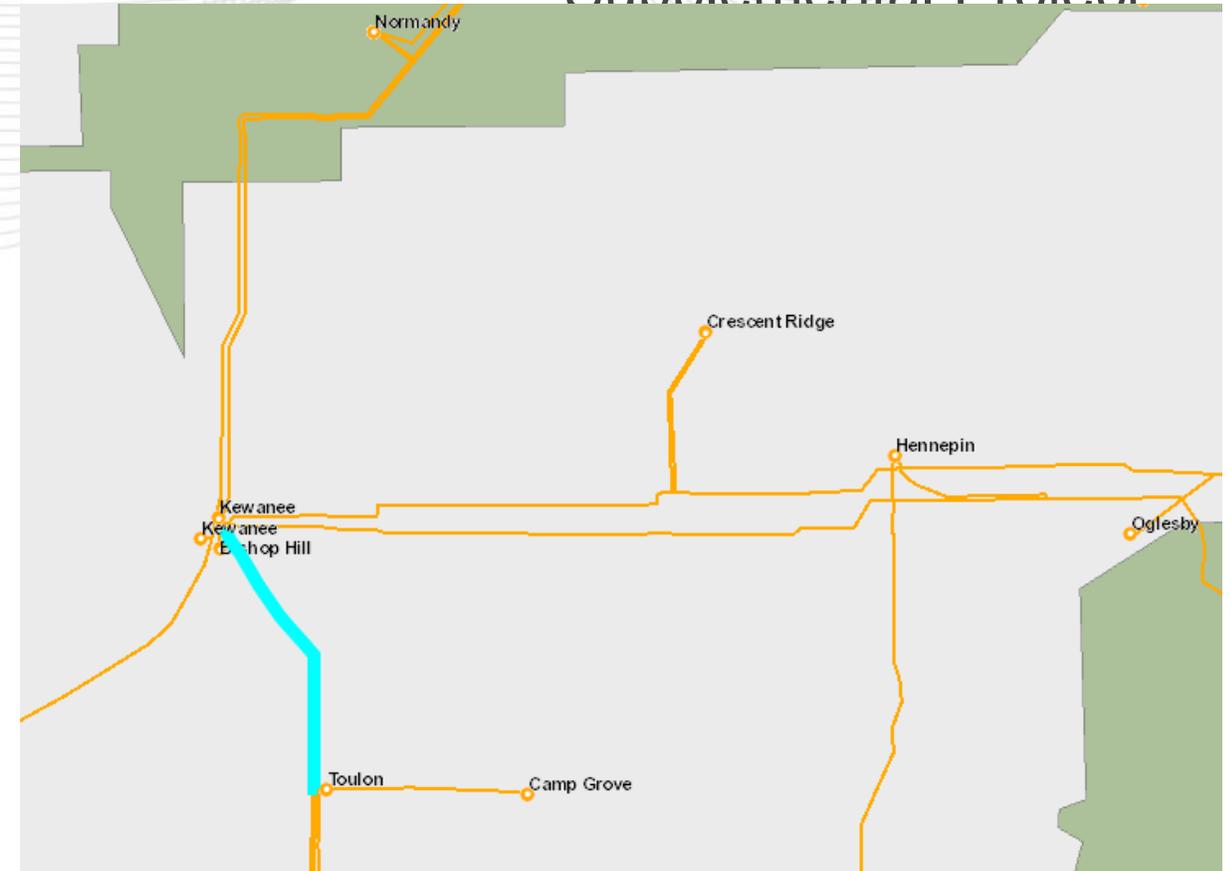
Selected Solution:

Reconductor 0.3 miles of the 138 kV Line 7421 (Kewanee – Toulon), replace 3 structures, install 3 dead-ends, replace insulators (S1283)

Estimated Cost: \$2.8M

Projected IS Date: 12/31/2018

Status: Engineering & Construction



Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Problem Statement :

138 kV Line 13304 (Rock Falls – Normandy) is wood H frame construction dating from 1950 and has been identified for replacement due to deteriorated condition. 11% of the wood poles need repair, and 40% of those need complete replacement. All hardware shows moderate to heavy wear and is nearing end of life. 20% of wood cross-arms have already been replaced and more are expected to need replacement soon. This line has experienced a high rate of emergency repairs.

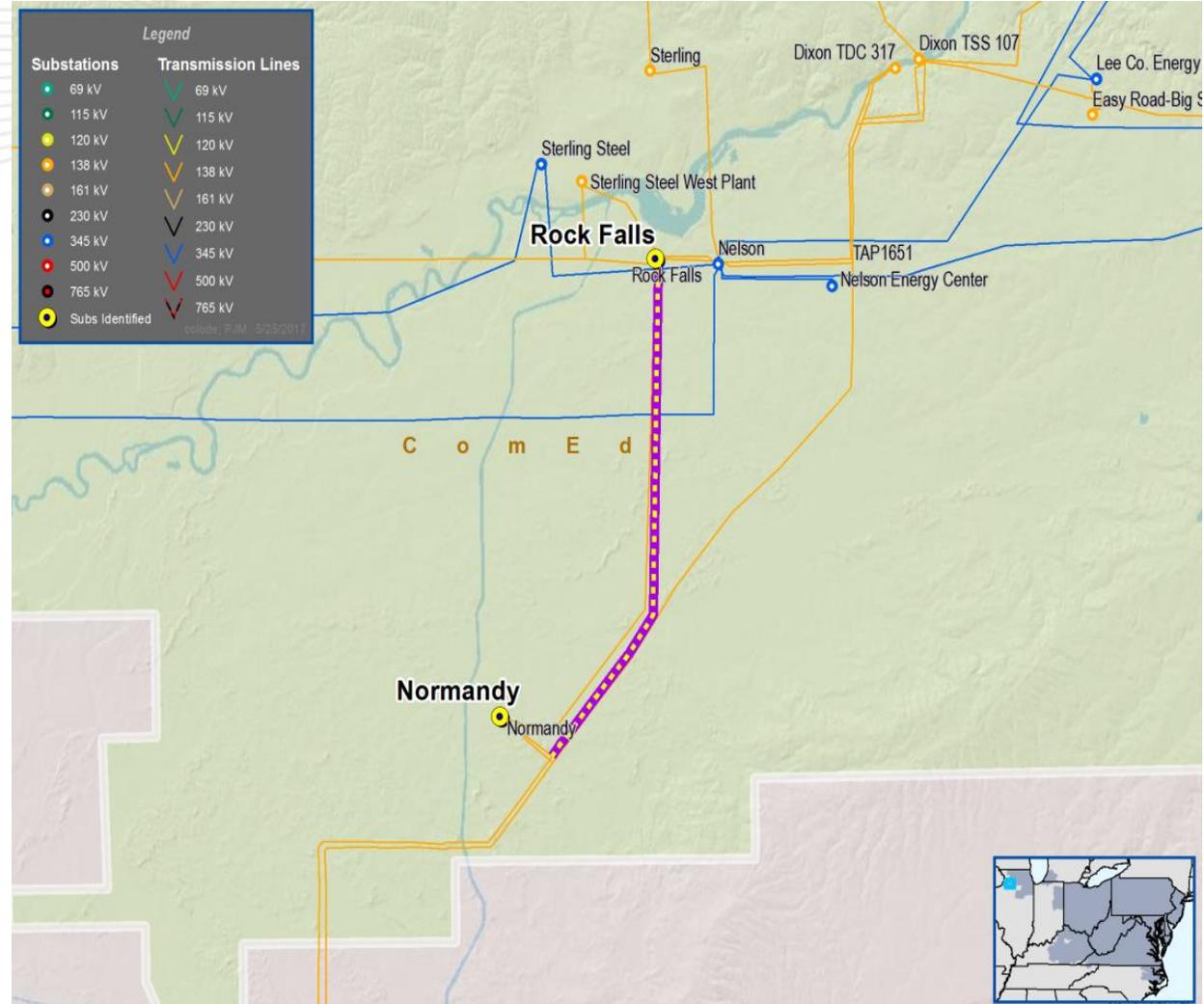
Selected Solution:

Rebuild the 138 kV Line 13304 (Rock Falls – Normandy) 11 miles of wood H frame construction with steel poles. (S1284)

Estimated Cost: \$13.2M

Projected IS date: 12/31/2018

Status: Engineering & Construction



Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The Ford-Sharonville substation is supplied by a 69kV radial feeder that is tapped off of a feeder from Port Union to Evendale. An alternate 69kV radial feeder to Ford-Sharonville is tapped off a feeder from Allen to Wycarver. The Port Union Evendale radial feeder is aged and in deteriorating condition. The Allen Wycarver radial feeder has inadequate capacity.

Driver: Equipment Condition, Operational Flexibility

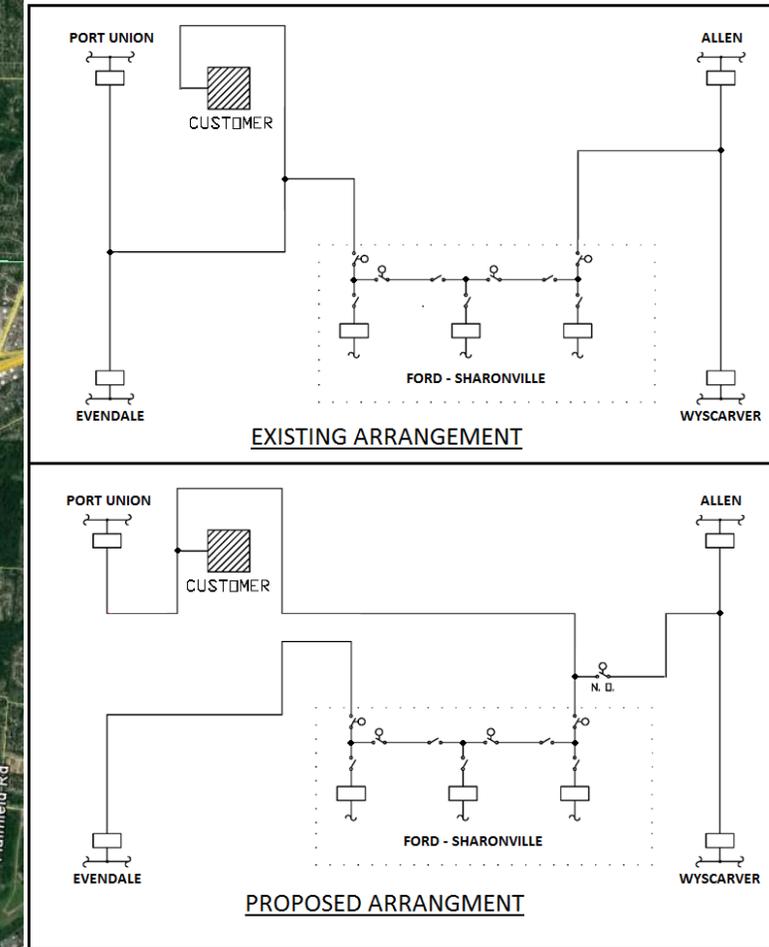
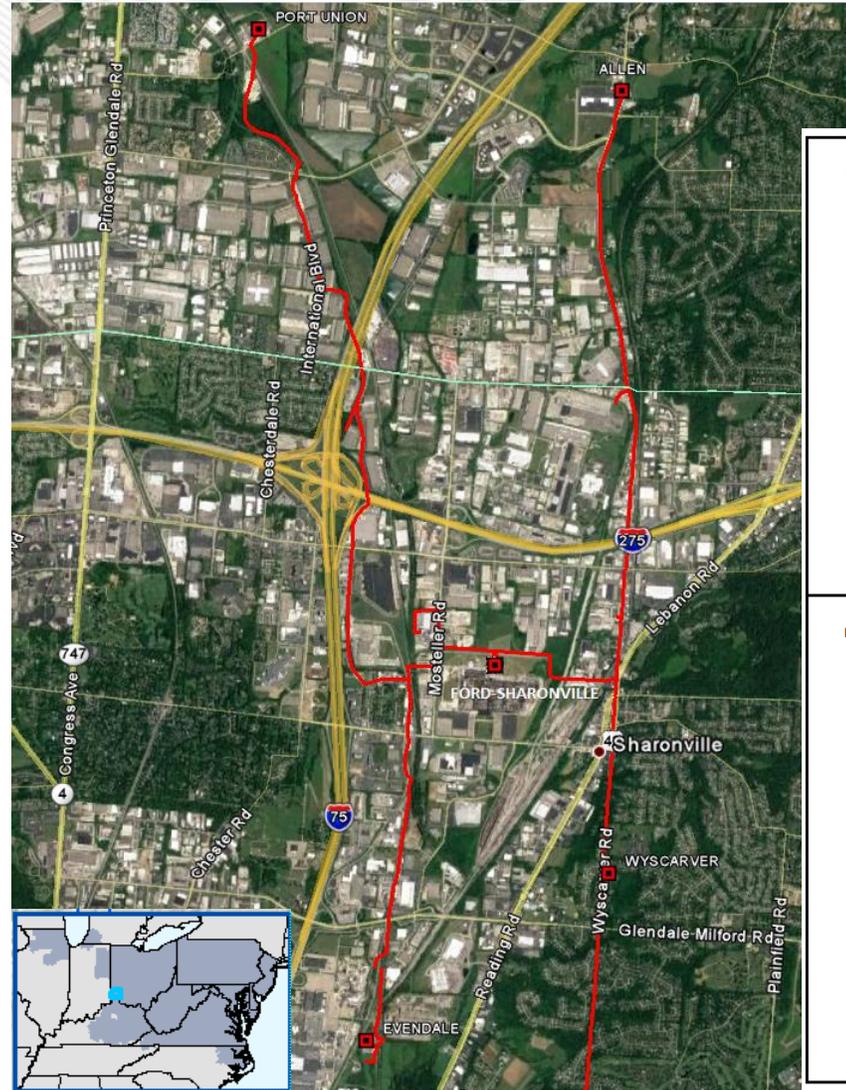
Selected Solution:

Rebuild and reconfigure the Ford-Sharonville 69kV feeder into two separate feeds, a feeder straight from Port Union to Ford-Sharonville and a feeder straight from Evendale to Ford-Sharonville to be used in a primary and secondary feed arrangement. (S1285)

Estimated Cost: \$1.31M

Projected IS Date: 6/30/2018

Status: Engineering





DEOK Transmission Zone Supplemental Project

Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

Miami Fort Unit 6 was retired June 2015. The GSU and connecting infrastructure needs to be removed
Driver: Other, retirement.

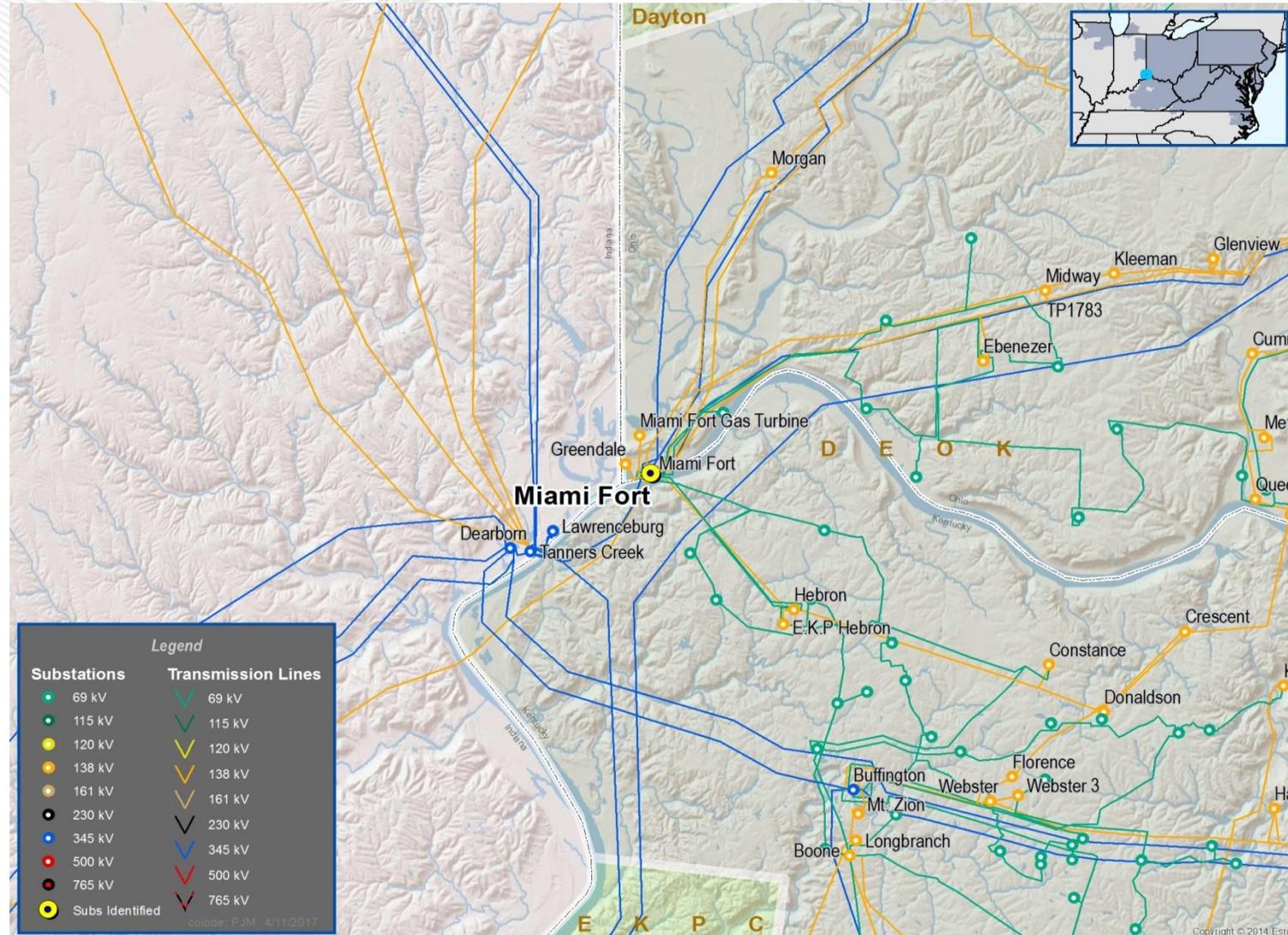
Selected Solution:

Remove Miami Fort Unit 6 GSU, aux transformer, and associated equipment. (S1286)

Estimated Cost: \$0.44M

Projected IS Date: 12/31/2018

Status: Engineering



Supplemental Project

Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

Mitchell 138/69/33kV Transformer #3, the connected 69kV oil filled circuit breaker, and cap and pin insulators are in deteriorating condition and obsolete.

Driver: Equipment Condition, Performance and Risk

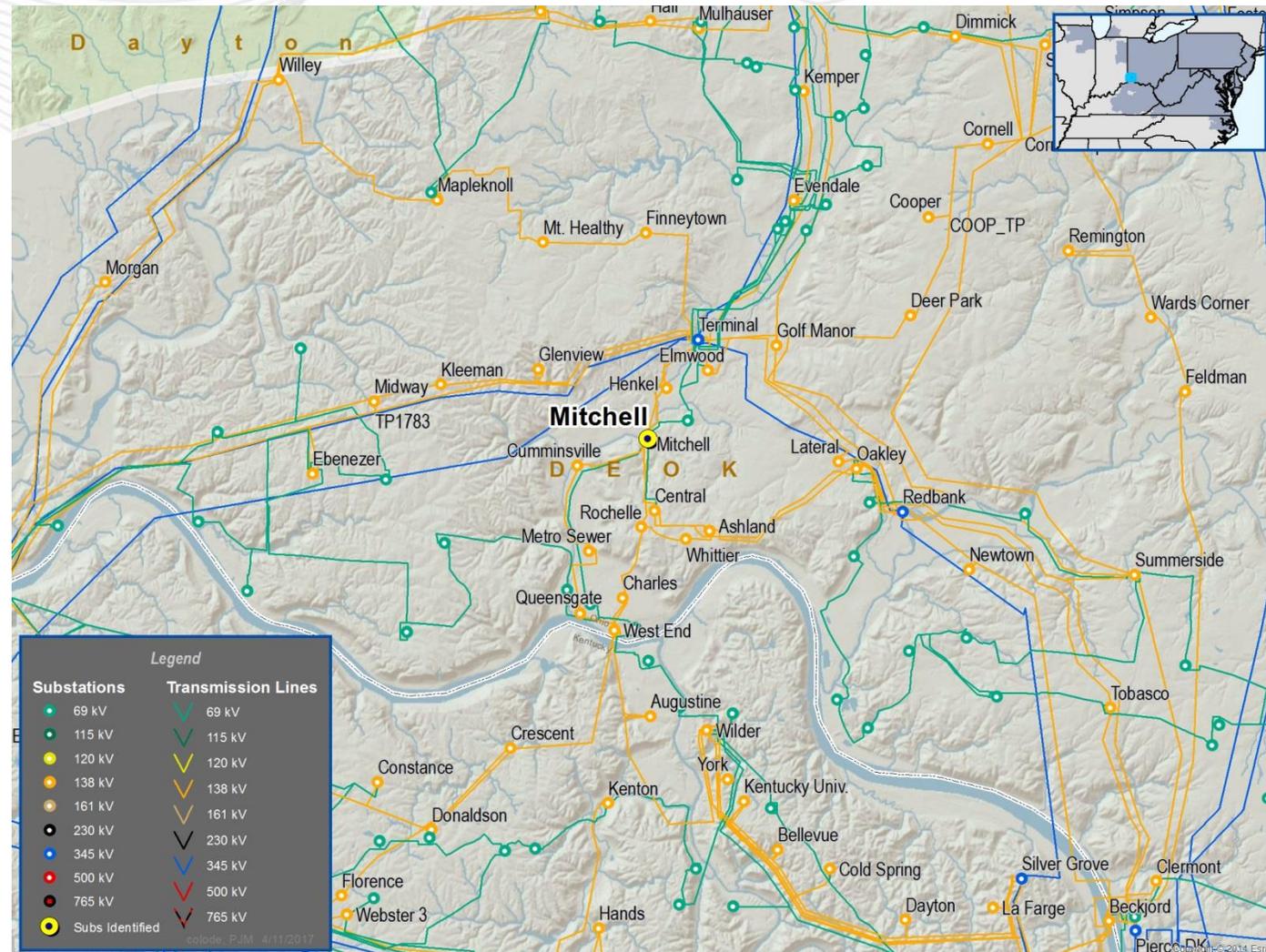
Selected Solution:

Install a 138/69kV transformer and a 138/13kV transformer at Mitchell 138kV substation. Replace related circuit breaker and insulators. (S1287)

Estimated Costs: \$5.52M

Project IS Date: 6/30/2018

Status: Engineering



Supplemental Project Previously Presented: 4/21/2017 SRTEAC

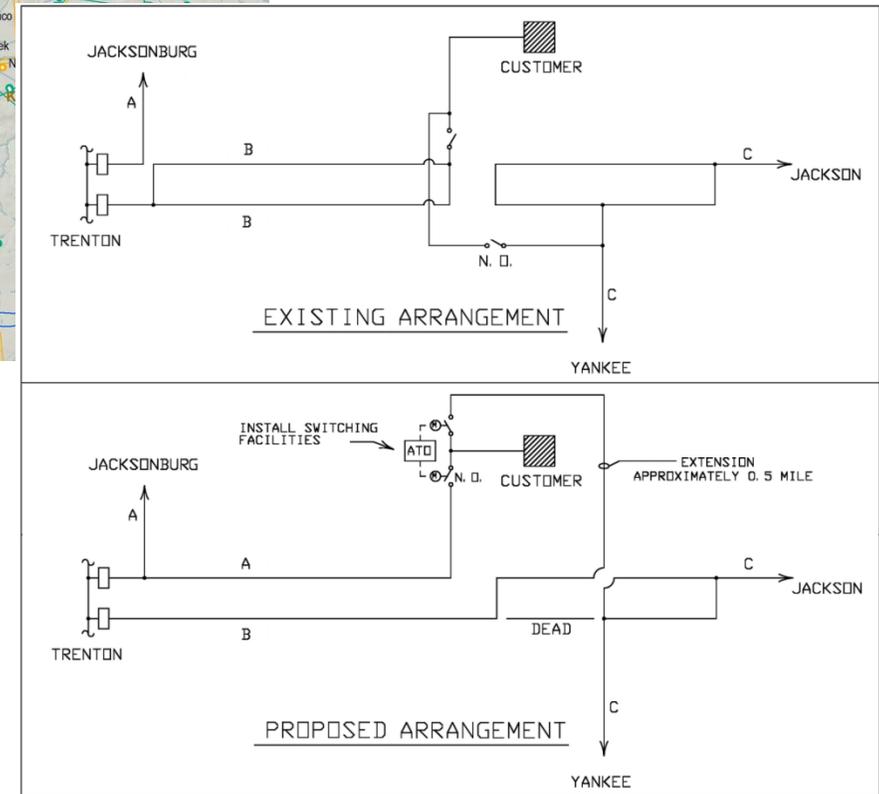
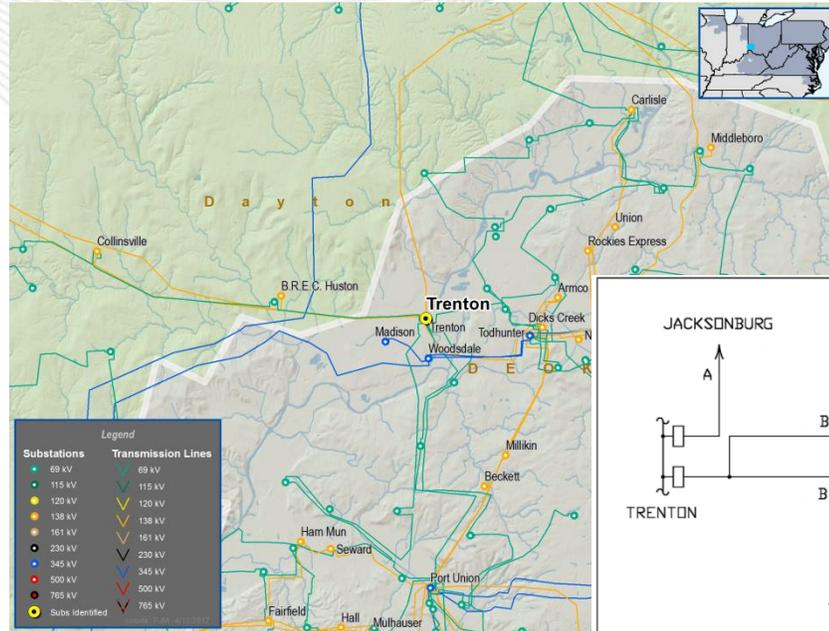
Problem Statement:

Critical customer has only one feed.

Driver: Customer Service

Selected Solution:

The 69kV feeder between Trenton and the customer has two parallel sets of conductors joined at the customer property. The new configuration will separate the conductors at the customer property, extending the first set around the customer's property and connecting them to an auto-throw-over switch. The second set of conductors will connect to the other side of the auto-throw-over switch and then be tapped into another feeder near Trenton to be used as a secondary feed.(S1288)



Estimated Costs: \$2.18M

Projected IS Date: 6/30/2018

Status: Engineering



DEOK Transmission Zone Supplemental Project

Supplemental Project Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

The Wards Corner-Feldman 138kV feeder is highly loaded;
Prevents planned service outages.
Driver: Operational Flexibility

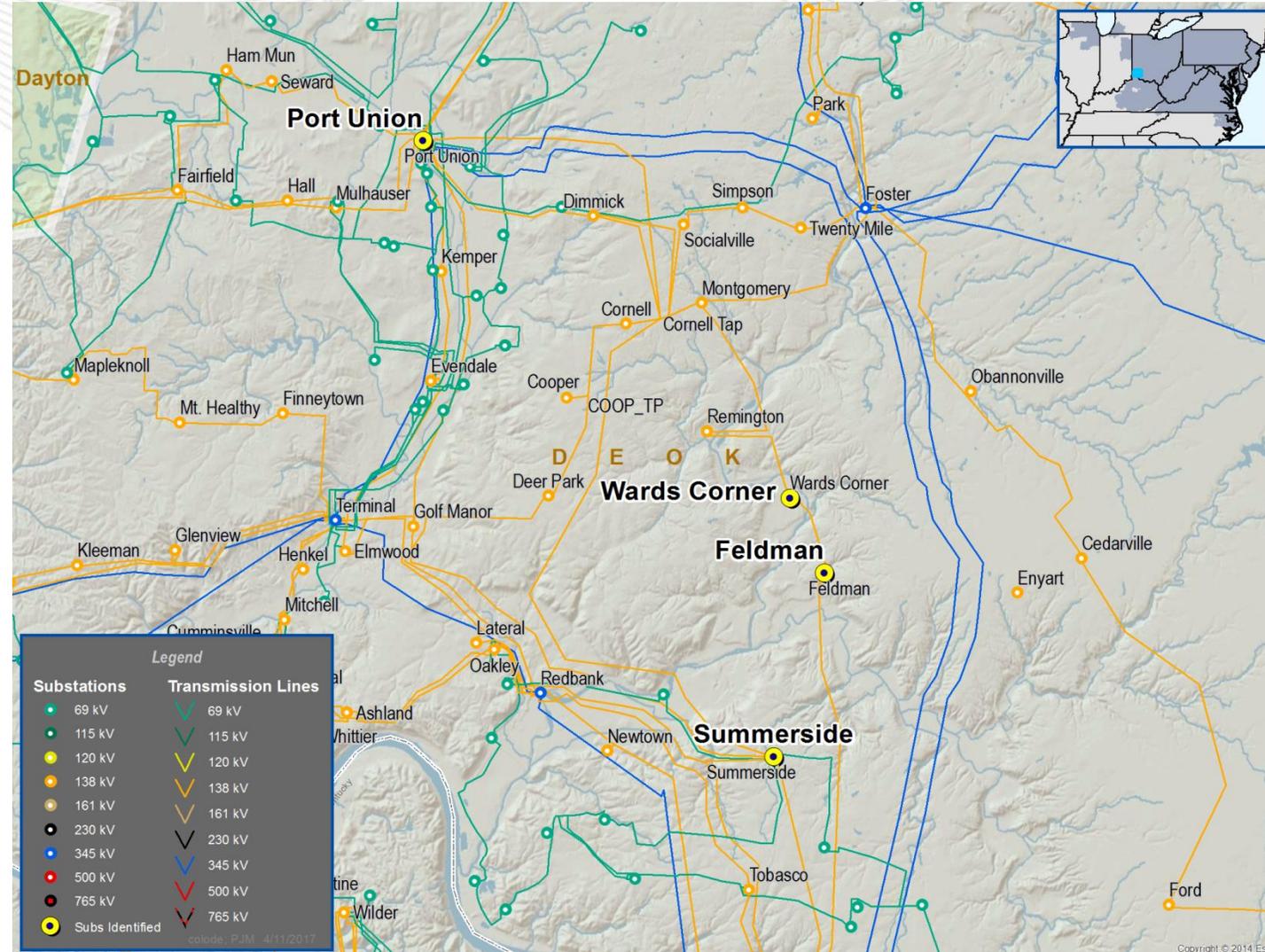
Selected Solution:

Disconnect the Remington-Wards Corner-Feldman 138kV feeder at Wards Corner. Refeed Wards Corner with Port Union-Summerside 138kV feeder. Both on shared tower at Wards Corner. (S1289)

Estimated Cost: \$0.992M

Projected IS Date: 12/31/2019

Status: Engineering





EKPC Transmission Zone Baseline Reliability

EKPC Transmission Owner Criteria Violation Previously Presented: 4/21/2017 SRTEAC

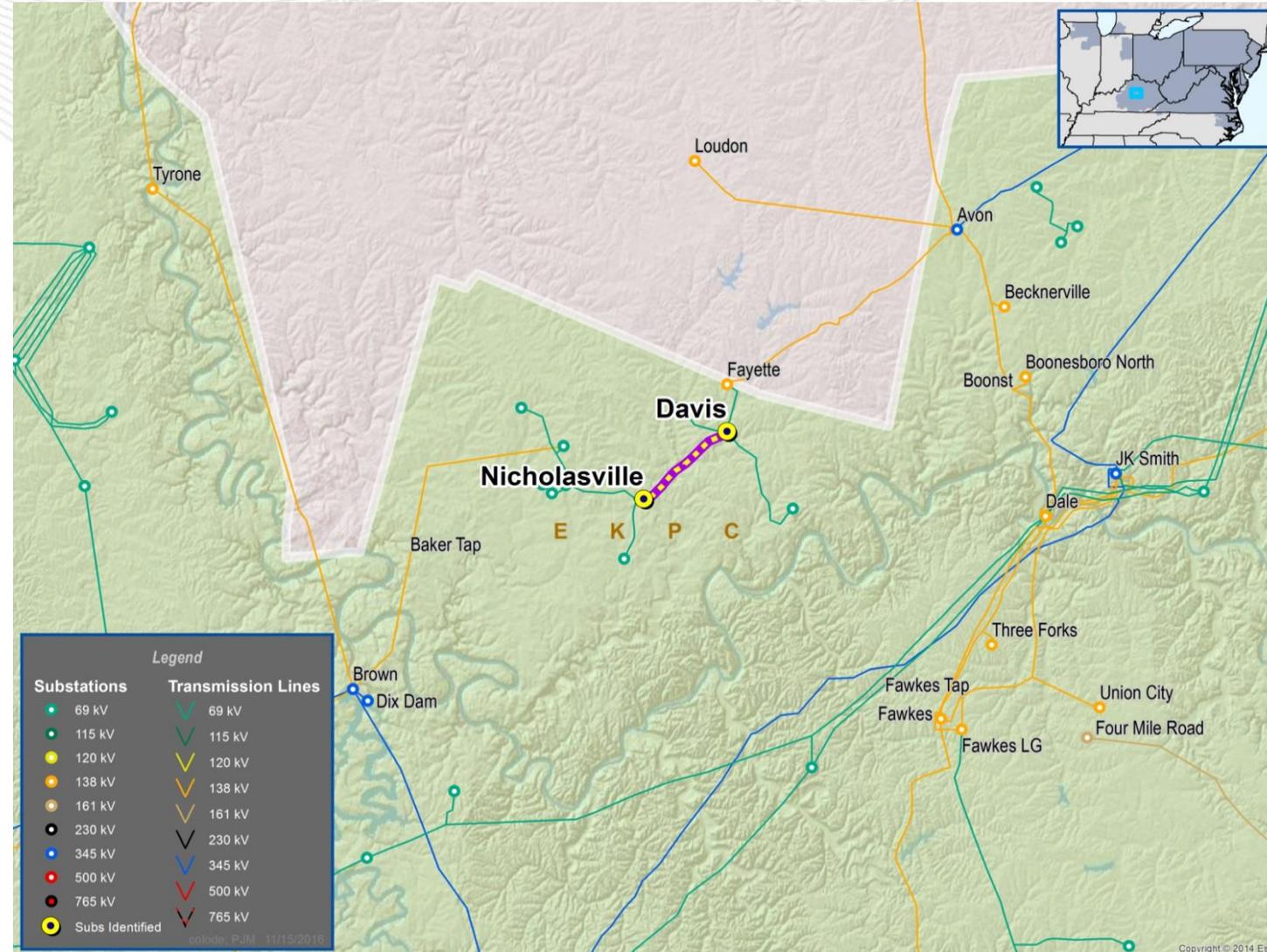
Problem Statement:

The Davis - Nicholasville 69kV line is overloaded for the loss of the Baker Lane-Baker Lane 138kV line and Trimble unit #2 .

Recommended Solution: Increase Maximum Operating Temperature of Davis - Nicholasville 69kv line section 266.8 MCM conductor to 284°F (LTE of 266°F). (B2781)

Estimated Project Cost: \$0.19M

Required IS Date: 6/1/2021





EKPC Transmission Zone Baseline Reliability

EKPC Transmission Owner Criteria Violation Previously Presented: 4/21/2017 SRTEAC

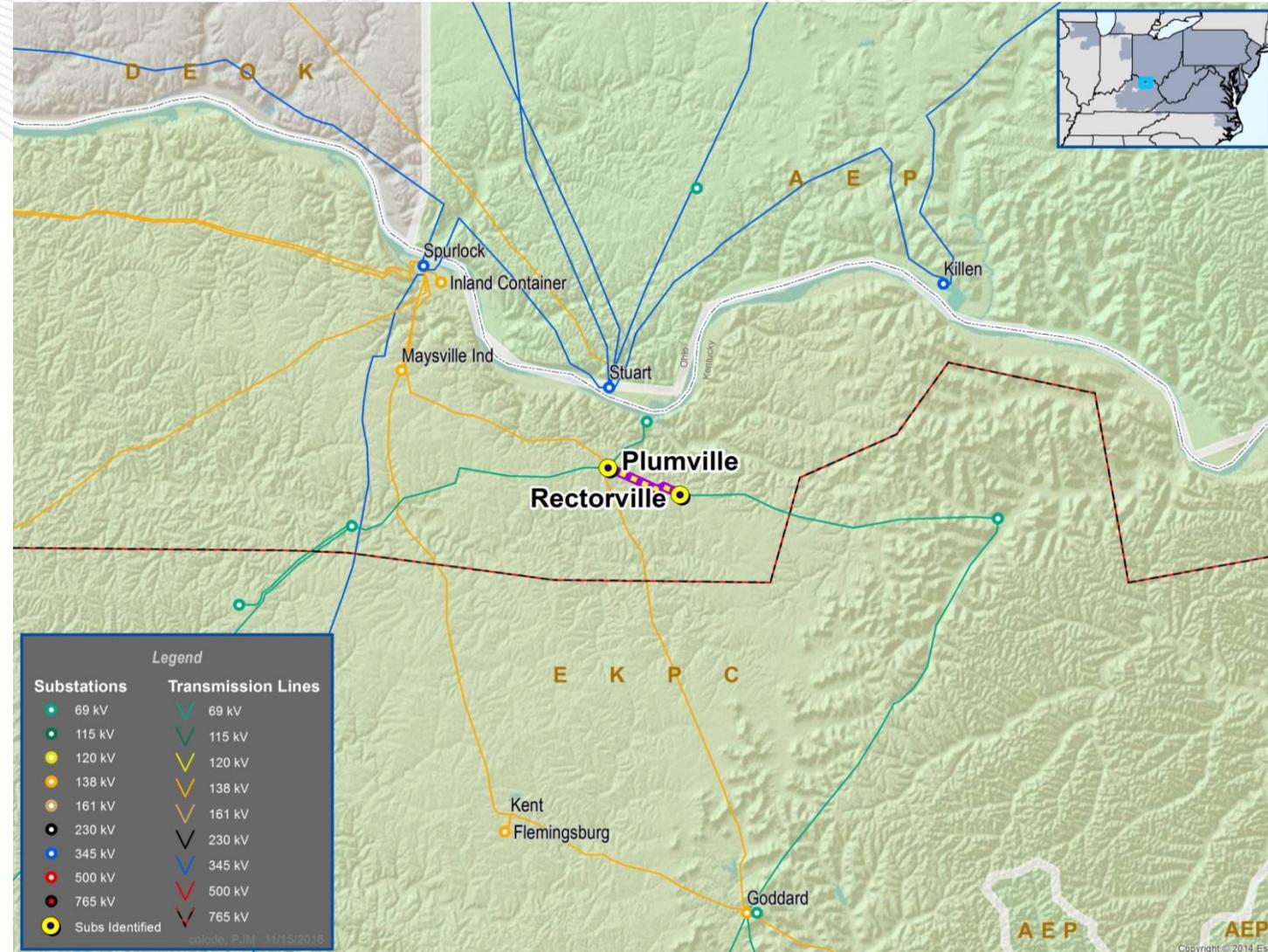
Problem Statement:

The Plumville - Rectorville 69kV line is overloaded for the loss of the Goddard 138/69KV transformer and Cooper units 1&2.

Recommended Solution: Increase the maximum operating temperature of Plumville - Rectorville 69kV line section 266.8 MCM conductor to 212°F (LTE of 185°F). (B2782)

Estimated Project Cost: \$0.14M

Required IS Date: 6/1/2021





EKPC Transmission Zone Baseline Reliability

EKPC Transmission Owner Criteria Violation Previously Presented: 4/21/2017 SRTEAC

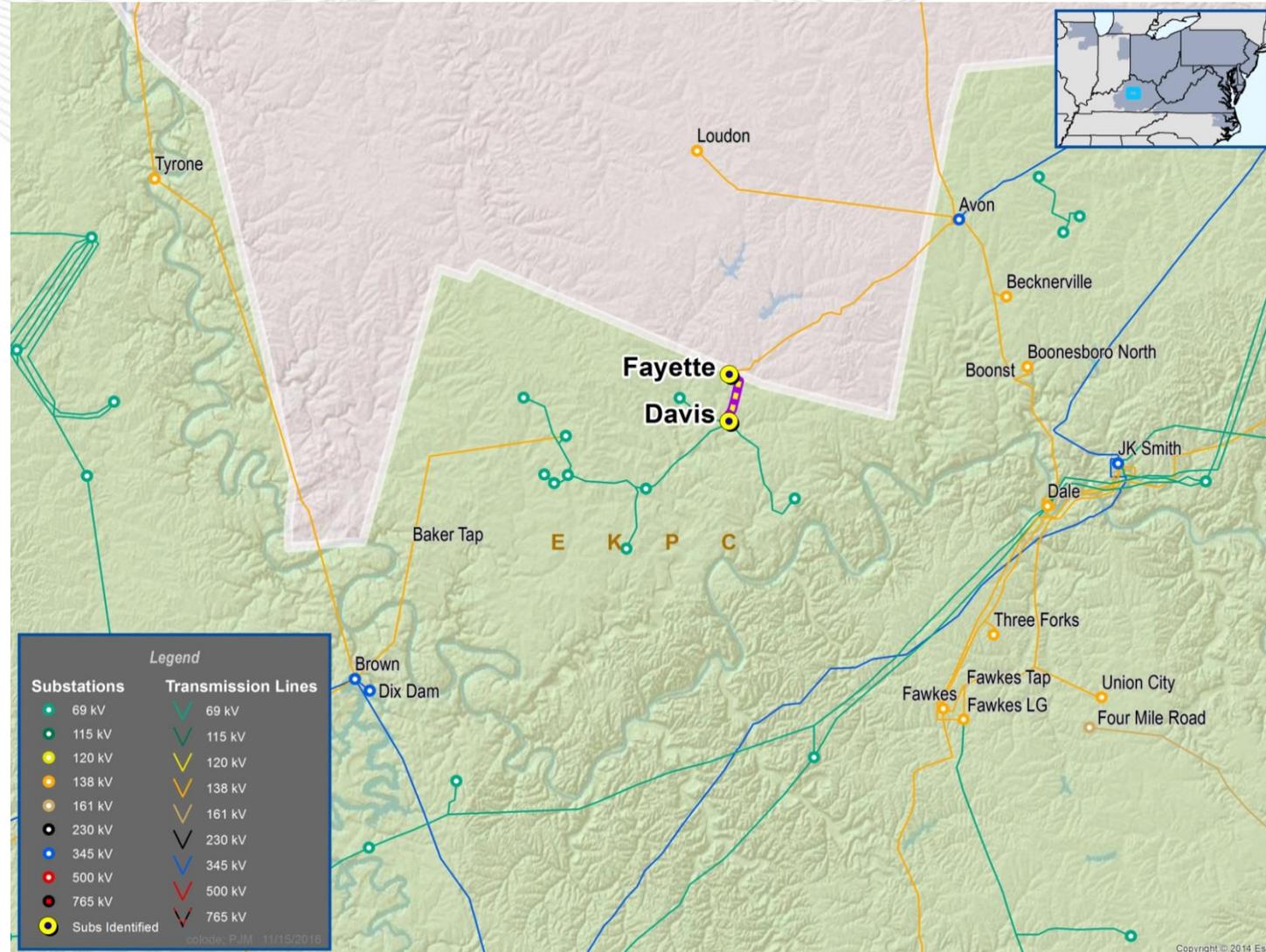
Problem Statement:

The Davis - Fayette 69kV line is overloaded for the loss of the Baker Lane-Baker Lane 138KV line and Brown unit #3.

Recommended Solution: Rebuild the Davis - Fayette 69kv line section to 556.5 MCM (3.15 miles) (B2783)

Estimated Project Cost: \$1.3M

Required IS Date: 12/1/2021



EKPC Transmission Owner Criteria Violation Previously Presented: 4/21/2017 SRTEAC

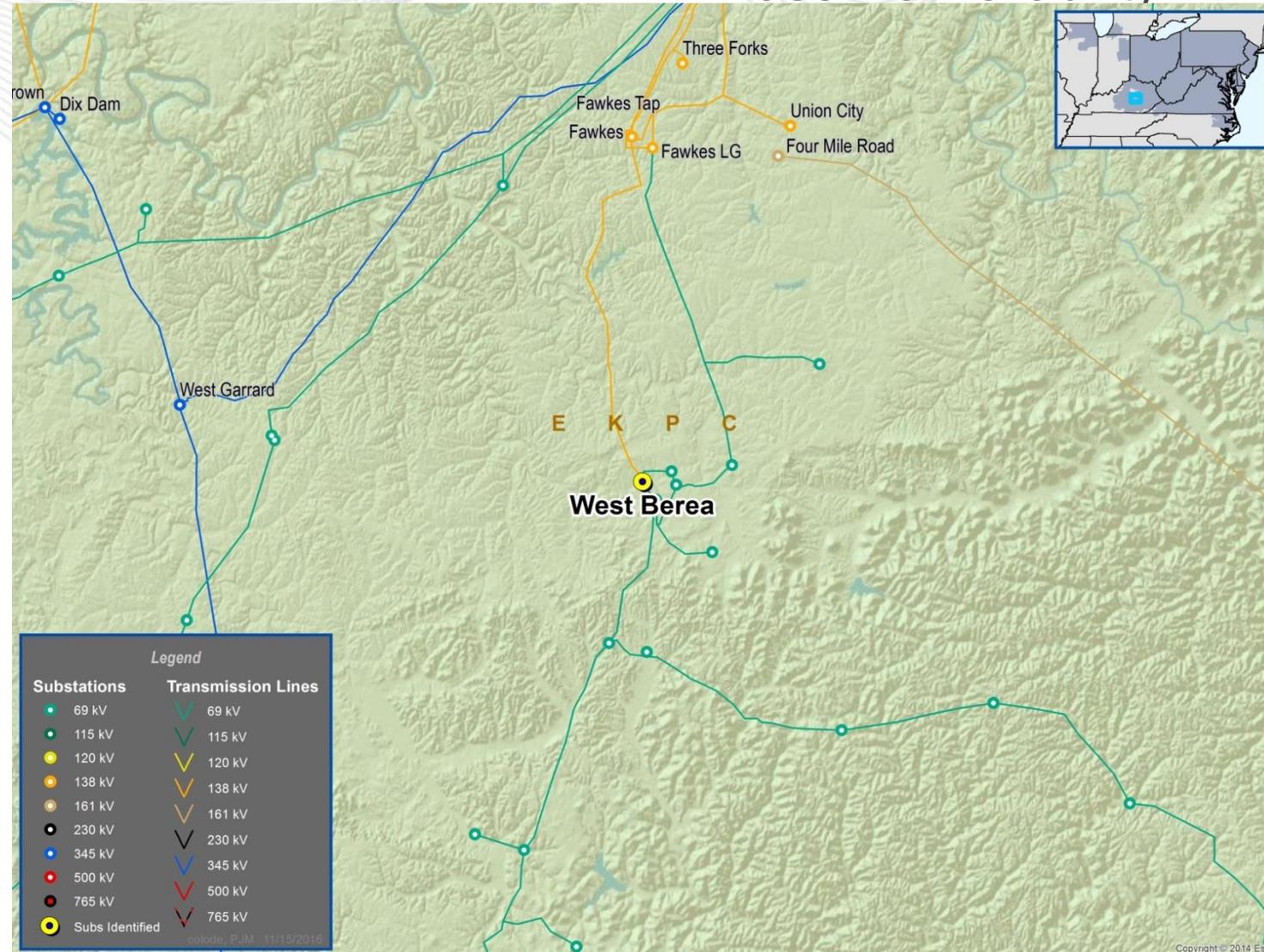
Problem Statement:

The West Berea 138/69kV transformer is overloaded for the loss of the Crooksvil-Fawks 69kV line and Cooper units 1&2.

Recommended Solution: Increase overcurrent relay at West Berea 138/69kV to at least 139 MVA Winter LTE (B2784)

Estimated Project Cost: \$0.0M

Required IS Date: 12/1/2021





EKPC Transmission Zone Baseline Reliability

EKPC Transmission Owner Criteria Violation

Previously Presented: 4/21/2017 SRTEAC

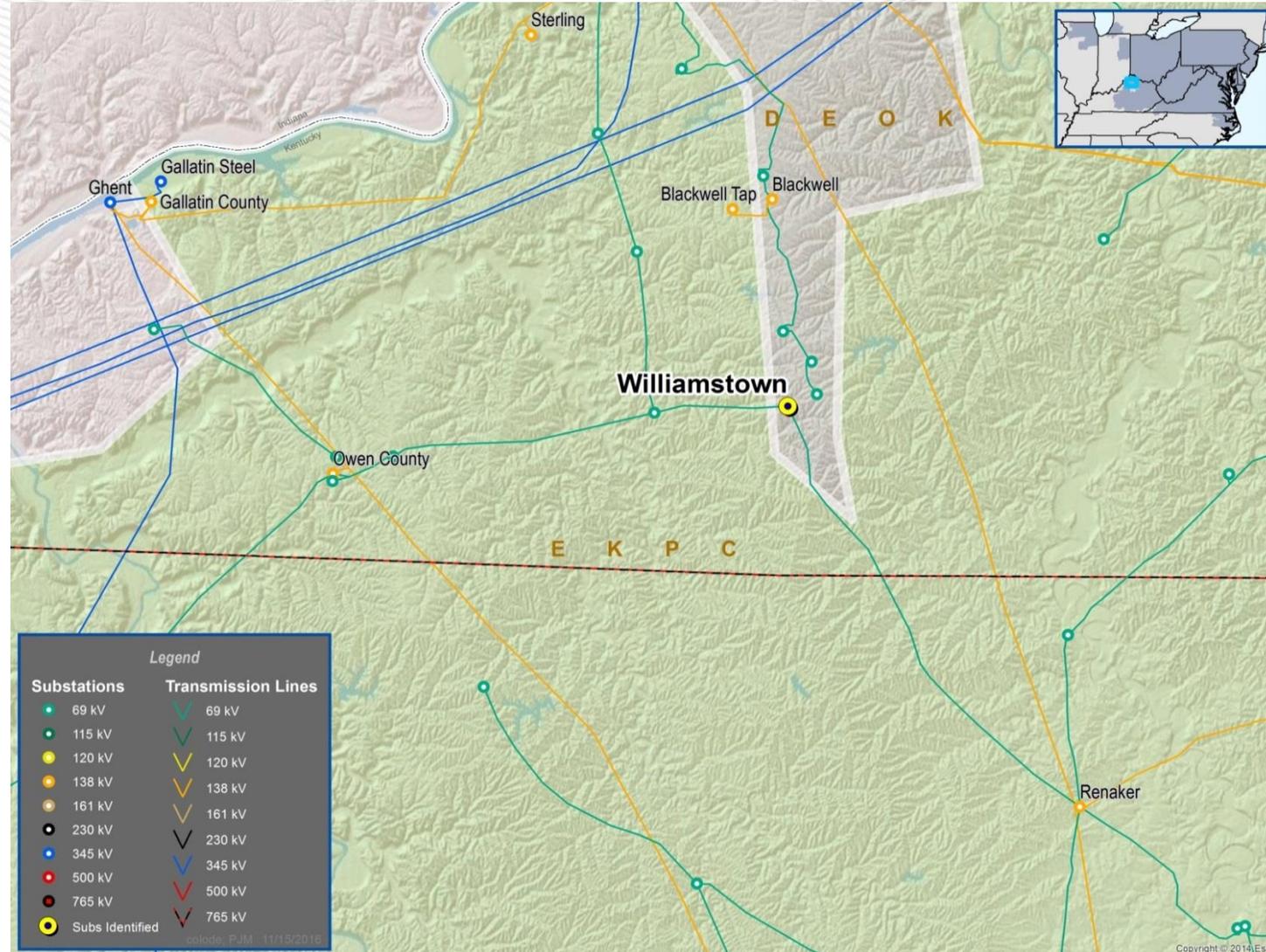
Problem Statement:

Low voltage at Williamstown 69kV bus for the loss of the Munk Jct.- Williamstown 69kV line and JK Smith Unit 9.

Recommended Solution: Increase Williamstown cap bank to 11.225 MVAR (B2786)

Estimated Cost: \$0.02M

Required IS Date: 12/1/2021





EKPC Transmission Zone Baseline Reliability

EKPC Transmission Owner Criteria Violation Previously Presented: 4/21/2017 SRTEAC

Problem Statement:

Low voltage at the Deatsville distribution substation during the loss of the Bullitt County-Deatsville Tap 69 KV line section.

Thermal overload of the South Bardstown – West Bardstown Jct. 69kV line during the loss of the Bullitt County 138/69 KV transformer.

Other Considerations:

EKPC Reliability Team identified concerns related to the age and condition of this conductor during their conductor assessment. The Reliability Team identified this entire line section as one of the top line sections to be addressed based on condition of the conductor and age of the line.

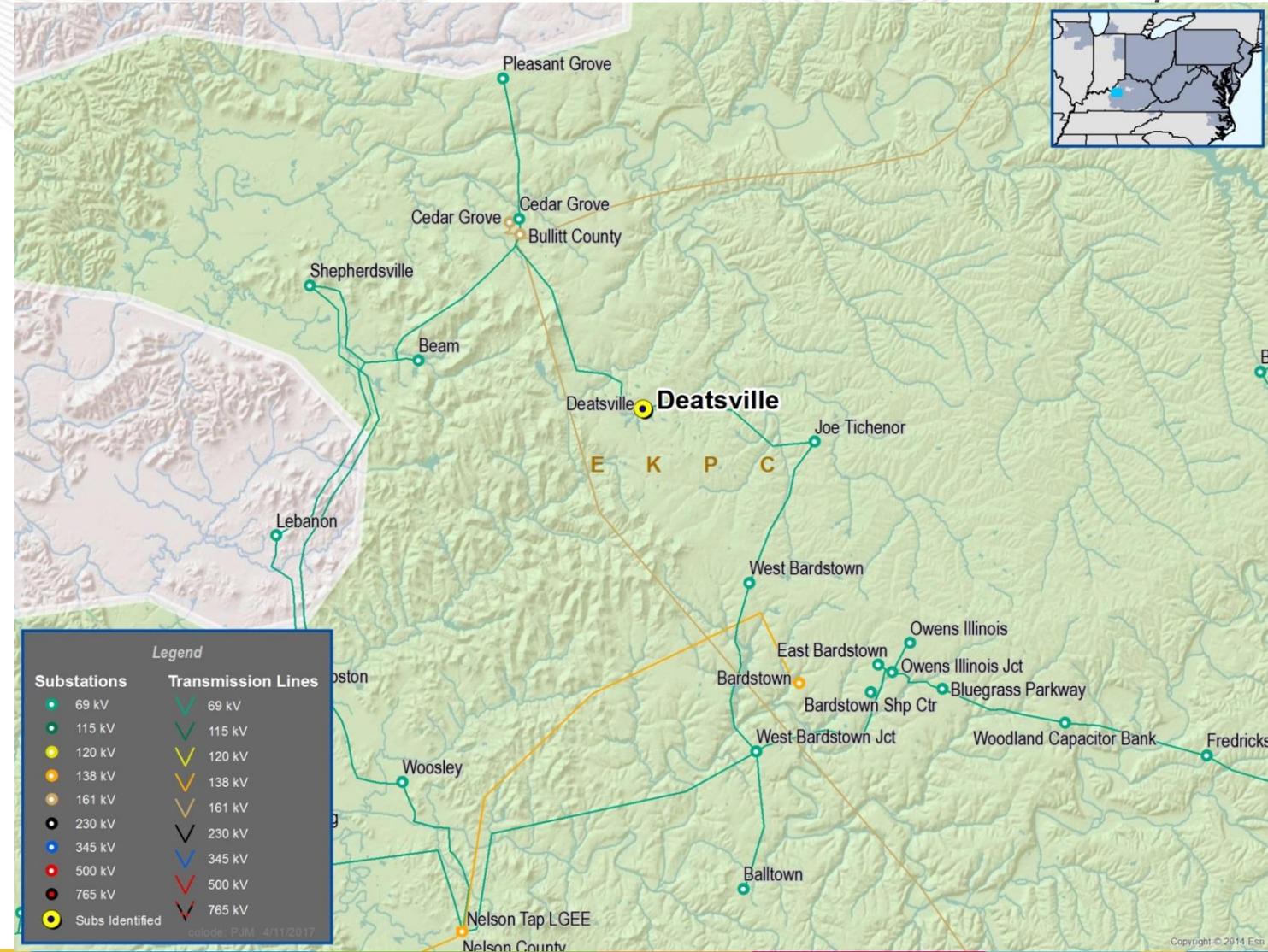
Recommended Solution:

Re-build the existing (1.5 mile), 1/0 MCM ACSR South Bardstown – West Bardstown Jct. 69kV line using 556.5 MCM ACTW conductor. (B2893)

Estimated Cost: \$1.03M

Required IS Date: 6/1/2017

Projected IS Date: 12/1/2017





EKPC Transmission Zone Supplemental Project

Supplemental Project- S0916 Scope change Previously Presented: 4/21/2017 SRTEAC

S0916 Old Scope:

- Retire the Hilda 18.37 MVAR capacitor bank and move to Big Woods
- Project IS Date: 6/1/2017
- Estimated cost: \$0.35M

New Scope:

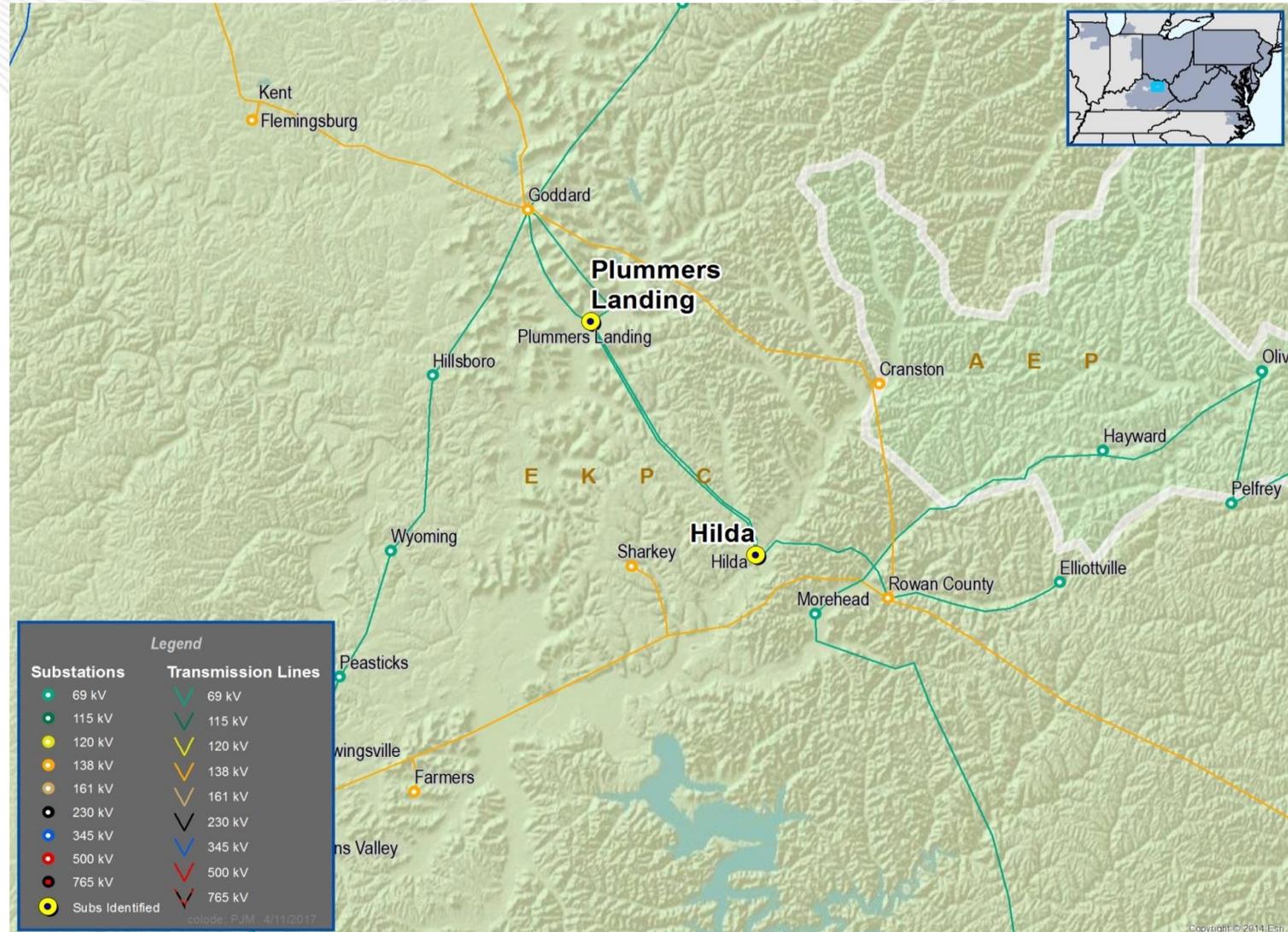
- Retire the Hilda 18.37 MVAR capacitor bank. Move the retired Hilda bank to Plummers Landing distribution substation and resize to 12.245 MVAR.
- Project IS Date: 12/1/2018
- Estimated cost: \$0.35M

Reason for scope change:

- A nearby industrial customer has experienced transient voltage during the operation of the existing Hilda capacitor bank. EKPC had planned to relocate this cap bank to the Big Woods distribution substation, which is 4.75 miles away from the industrial customer, to buffer the transient experienced. However, upon discussions with our Member System distribution cooperative it has been determined that a larger buffer would be preferred. EKPC now plans to relocate the Hilda Capacitor Bank to Plummer's Landing distribution station, which is 4.71 miles (total of 9.46 miles) further from the industrial customer to provide an even greater buffer.

Alternative Considered: Move capacitor to Big Woods (\$0.35M)

Status: Engineering



- Monthly Meetings already scheduled for June, July, August & September 2017
- Thursday, June 8, 2017 TEAC meeting
- Feedback

Questions?

Email: RTEP@pjm.com

Revision History

- 5/25/2017 - Original version posted to PJM.com
- 5/30/2017 - Slide #120 (S1284), added more details for problem statement
 - Slides #6 and #24 , refine the problem statement
 - Add the small diagram to indicate the location of the project in PJM for each slide
- 5/31/2017 - Slide #4 , added project status for the new scope and original SRTEAC date for the original scope
- 6/12/2017 - Original Slides #40-51,#53-70, #73-116: Updated the content on one or multiple items including Problem Statement, Alternatives, Preliminary Solution, Status, and maps
 - Original Slides #52: Expanded to three slides (52, 53&54) with content update
 - Original Slides #52: Expanded to three slides (52, 53&54) with content update
 - Original Slides #59 -60: The project is split into baseline part and supplemental part (61-62)
 - Original Slides #72: Deleted, Combine with baseline slides #44
- 6/27/2017 - Slides #70, 104-107, 110, 113, 114, 117
 - updated wording for clarity. Added cost breakdowns.
- 10/20/2017 - Slides #110, change S1332.* to S1279.*