2018 Supplemental Projects

West - 2

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AEP Transmission Zone: Supplemental
East End Fostoria-Riverview

Previously presented on 1/8/2018 SRRTEP

Problem Statement:
Equipment Material/Condition/Performance/Risk:
The existing 12.8 mile, 69 kV line section between East End Fostoria and Riverview was originally constructed in 1912 using wood pole & lattice structures with #1 Copper and 3/0 Copper conductor (31 MVA rating). There are 81 open conditions on this line. The line has also experienced 50,680 Customer Minutes of Interruption (CMI). As part of the line rebuild, the switching structures for Bascom will also be replaced.

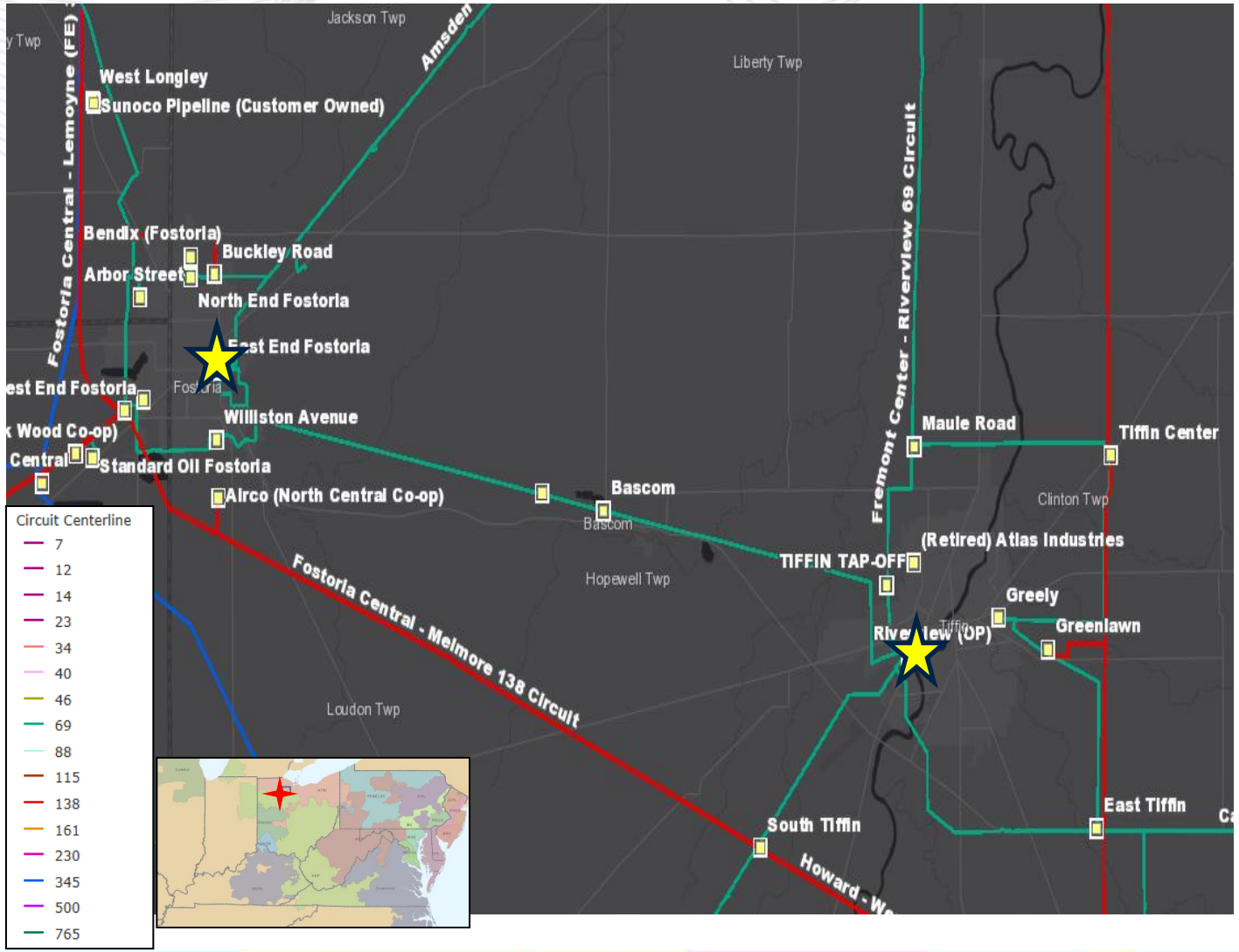
Selected Solution:
Rebuild 11.3 miles of line between East End Fostoria – Riverview 69kV with 795 ACSR (129 MVA rating) and steel poles. (**S1486.1**)
Estimated Cost: $12.4M

Install new Bascom 69 kV 1200 amp line switches. (**S1486.2**)
Estimated Cost: $0.8M

Total Estimated Transmission Cost: $13.2M

Projected In-service: 11/01/2018

Project Status: Under Construction



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AEP Transmission Zone: Supplemental Harrison-Poston Line Rebuild

Previously presented on 1/8/2018 SRRTEP

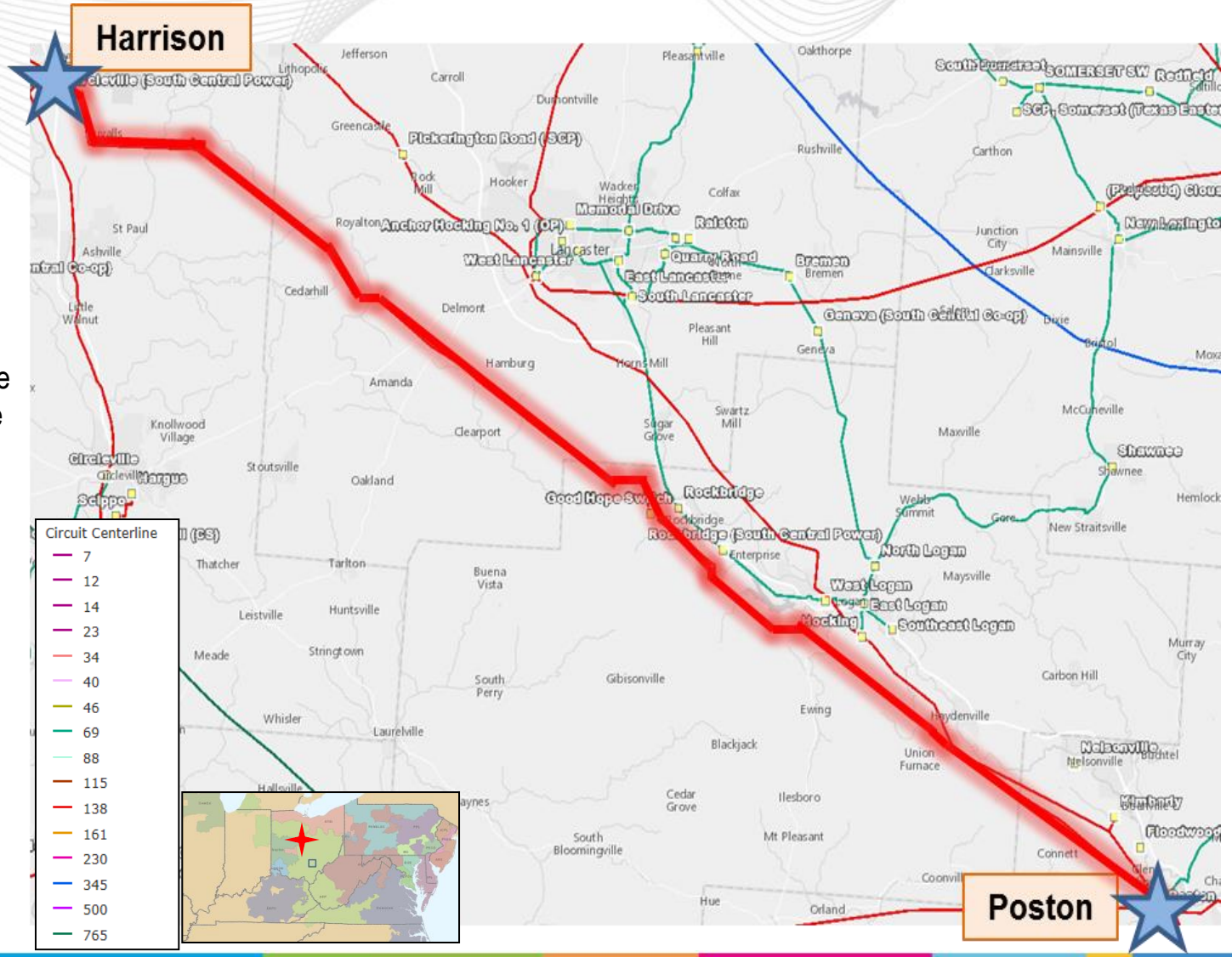
Problem Statement:
Equipment Material/Condition/Performance/Risk:
The Poston - Harrison 138 kV Line is 54.4 miles long and was built in 1953 utilizing wood pole H-Frame structures and 636 ACSR conductor (223 MVA rating). The existing 138 kV line is in need of major repair. The poles and crossarms are deteriorated so severely that they have become a hazard to effective maintenance practices. There are 269 open conditions spread along the entire distance of this line.

Selected Solution:
Rebuild 54.4 miles of line between Harrison and Poston 138kV stations with 1033 ACSR (296 MVA rating) and steel poles. (**S1487**)

Estimated Transmission Cost: $61.9M

Projected In-service: 12/31/2019

Project Status: Under Construction



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AEP Transmission Zone: Supplemental Dennison-Newcomerstown Rebuild

Previously presented on 1/8/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The Newcomerstown-Dennison 69kV transmission line was originally built between 1925-1929 with wood poles and 3/0 copper conductor (46 MVA rating). While the line has been rehabbed over the decades, the line is now in very poor condition, with heavy deterioration on poles & cross-arms and various encroachments. It has 71 open conditions including but not limited to encroachments, burned poles, broken/damaged poles & arms, broken guy wires, damaged insulators, pole rot, and woodpecker damage. Between 2013-2016, the customers served from the transmission line have been subject to 9 million minutes of customer-interruption.

Operational Flexibility and Efficiency

Lock 17 station and Frontier Co-op are served off a 1.6-mile radial tap, which prevents T-Line maintenance and adversely impacts reliability due to having one source of power. The tap will be rebuilt as a double-circuit loop into Lock 17, with switches placed inside the station, which will permit T-Line repairs and improve operational flexibility.

Lock 17 has a 69kV MOAB/ground-switch combination unit for the transformer protection scheme, which requires remote-breaker-clearing on the entire Newcomerstown-Newport 69kV circuit, taking customers out of service. This protection system will be replaced with a 69kV circuit switcher and relaying. In addition, SCADA functionality will be added to Lock 17 via an RTU installation.

The Belden Switch 69kV MOAB switch will be retired. MOAB switches will be installed in the upgraded Lock 17 station. The MOAB installation score exceeds AEP's Forced Outage Index (FOI) guidelines for installing motor-operated switches (22 compared to the threshold of 6).

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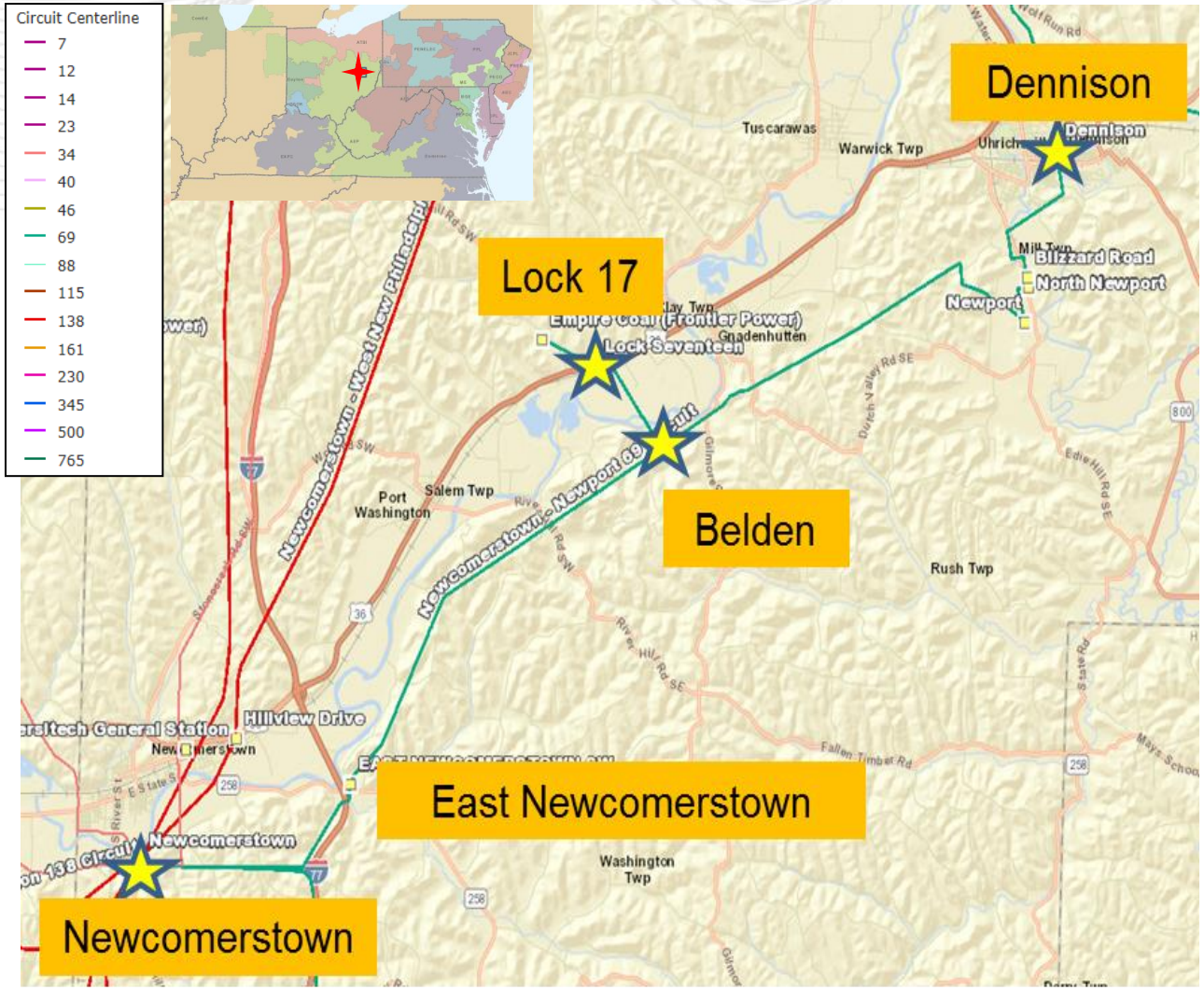

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AEP Transmission Zone: Supplemental Dennison-Newcomerstown Rebuild

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Selected Solution:

Rebuild the 20-mile 69kV transmission line between Newcomerstown and Dennison stations with 1033 ACSR (148 MVA rating). (**S1488.1**) Estimated Cost : $28.5M

Rebuild the 1.6-mile radial tap to Lock 17 station as a double-circuit 69kV loop with 1033 ACSR (148 MVA rating). (**S1488.2**) Estimated Cost : $3.4M

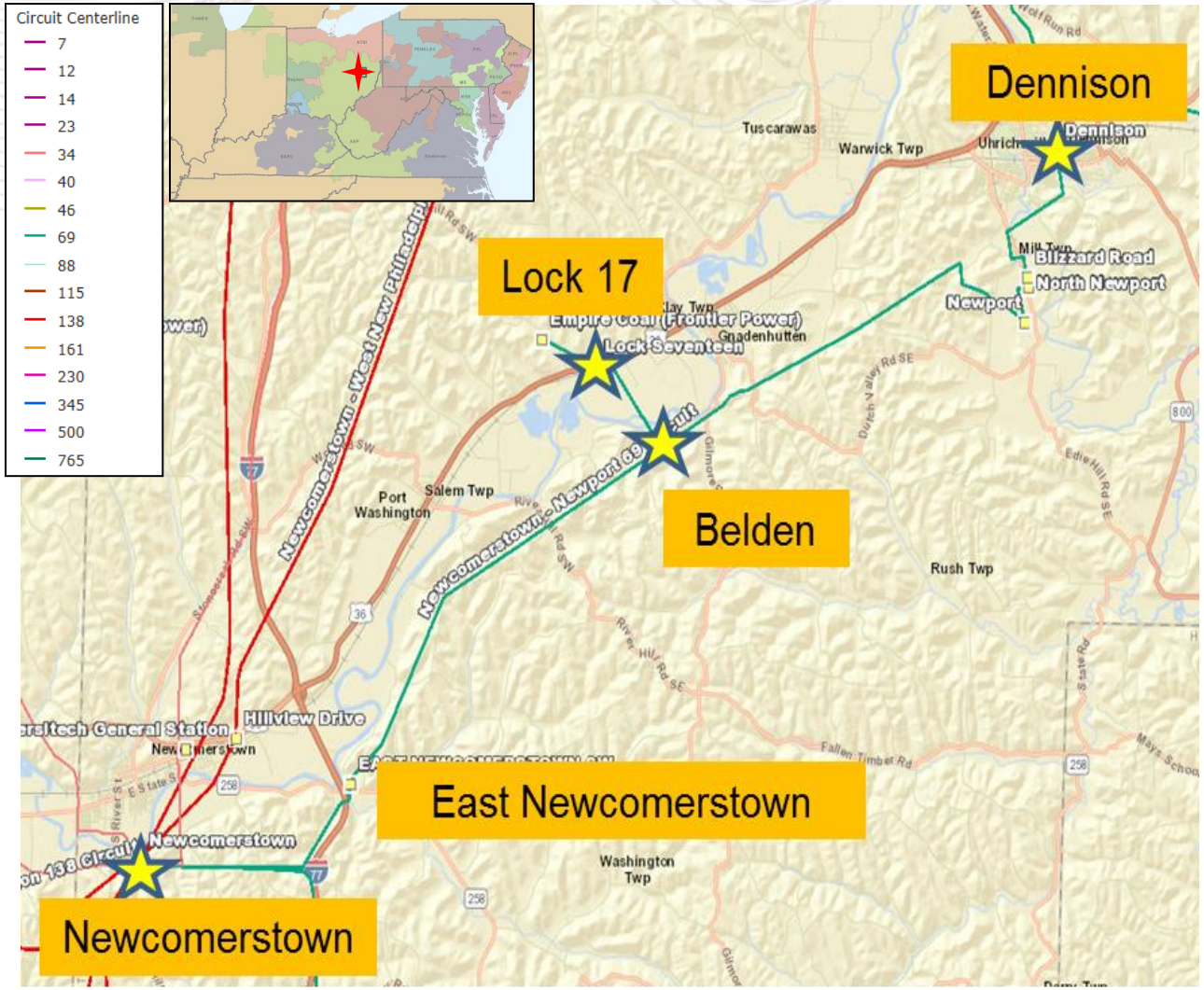
At Lock 17 69kV station, add a 69kV station bay structure and 2- 69kV MOAB switches. Relocate the 69kV cap bank and expand to 10.8 MVAR. Replace the transformer protection with a circuit switcher (**S1488.3**). Estimated Cost : $1.3M

Replace East Newcomerstown 69kV Switch with a new 2-way switch. Retire Belden 69kV switch. (**S1488.4**) Estimated Cost : $0.2M

Total Estimated Transmission Cost: $33.4M

Projected In-service: 12/01/2019

Project Status: Under Construction



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AEP Transmission Zone: Supplemental Southwest Lima Breaker Replacement

Previously presented on 1/30/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

At Southwest Lima station, circuit breakers J, J1, J2 and K are all 138 kV 40 kA air blast, PK-type breakers manufactured in 1969. Air blast breakers tends to fail violently and when they do bushings usually explode which expel shards of ceramic and could potentially harm anyone at the station. In addition, PKs are no longer supported by vendors and cannot be integrated to modern relaying packages. Breaker K2 is an SF6 type 145-PA. Even though PAs are SF6, they have started giving the field problems due to significant seal issues in their design that result in low SF6 gas pressure. Field crews have tried repairing these breakers but after seal issues pop up it is very difficult to return the breaker to 100% operation. SF6 has been added in the past, with little to no improvement on the condition on this breaker type. Fault operation counts for CB J2, J, and K2 are 20, 25, and 39 respectively.

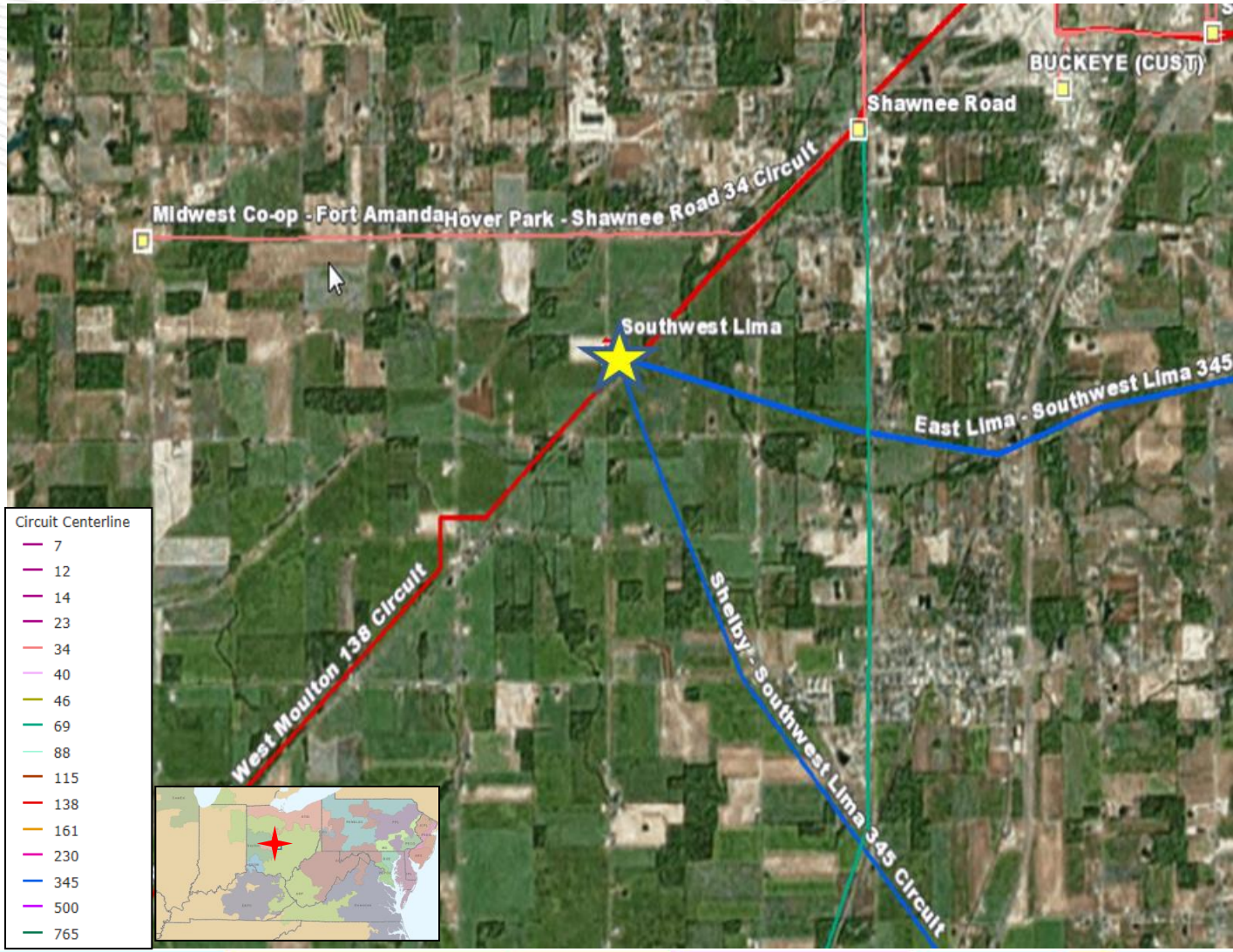
Selected Solution:

Replace existing 138 kV breakers J, J1, J2, K, and K2 at Southwest Lima with new 138 kV 3000 A 63 KA breakers. (**S1489**)

Estimated Transmission Cost: $1.8M

Projected In-service: 06/01/2019

Project Status: Engineering



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AEP Transmission Zone: Supplemental
North Portland Station

Previously presented on 1/30/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The Portland area is non-recoverable in case of a failure. Load growth is slow but steady and transformer maintenance is restricted to only a few weeks per year. A transformer failure recovery has to be by a mobile transformer. To mitigate this, there needs to be a second distribution feeder at North Portland.

There currently are four Motor Operated Air Break Switches (MOABs) in series on the Portland – Berne circuit. Having more than three MOABs in series on a circuit introduces increased chance of mis-operation and requires complex protection schemes. It is AEP current standard to not allow more than 3-MOABs in series. To mitigate this, a line breaker is required at a new station.

Transformer #1 at North Portland 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), and accessory damage (bushings).

Operational Flexibility and Efficiency:

The Berne – Portland line has experienced 39 momentary forced outages over the past 10 years and has a CMI of 1,040,639 over the last 3 years. 69% of this CMI value was triggered by the multiple unprotected stations on this line. Installing a breaker will effectively separate the City of Portland from the REMC owned Trinity Tap as well as 14.3 miles of exposure and will significantly improve the area system performance and overall reliability.

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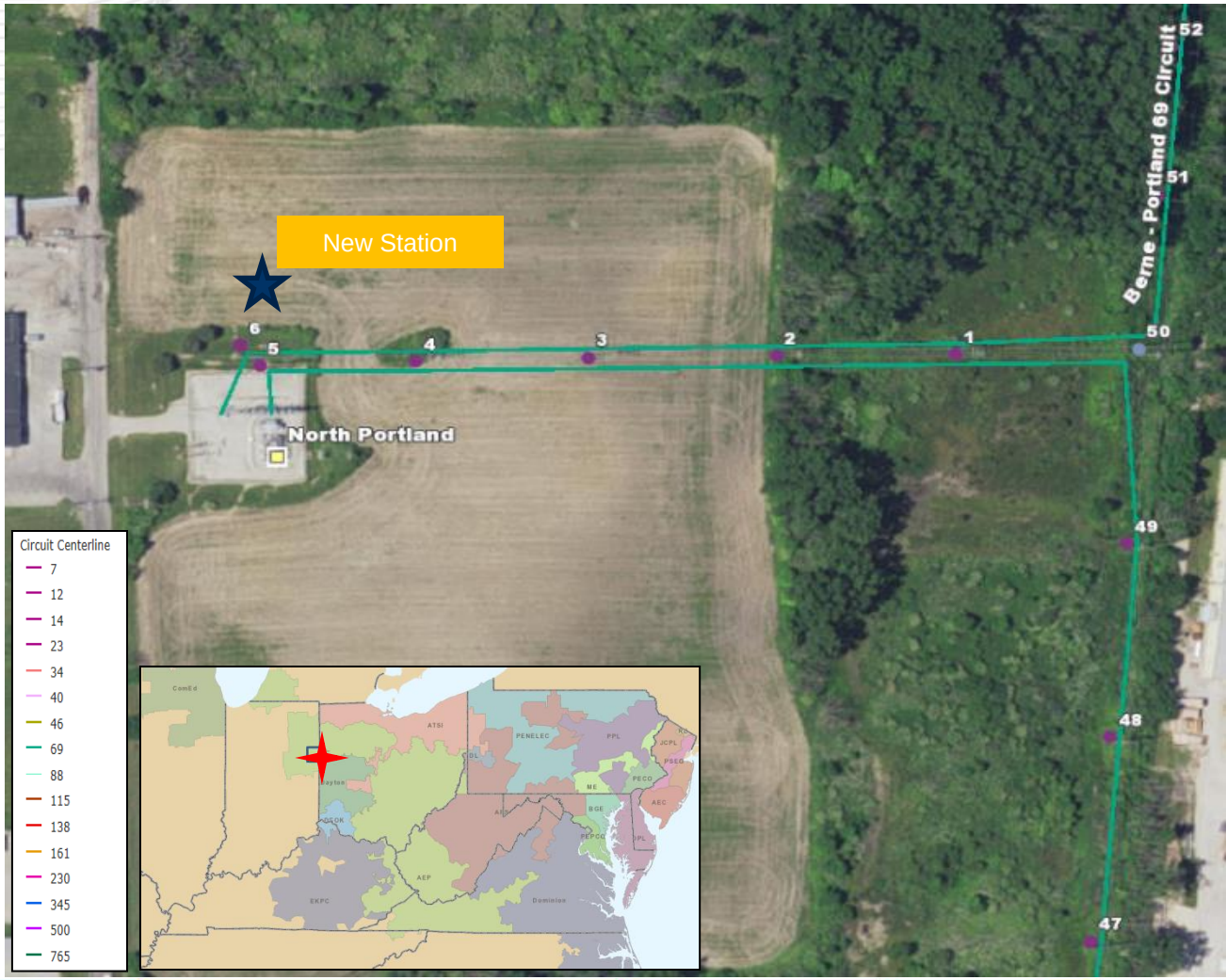

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AEP Transmission Zone: Supplemental
North Portland Station

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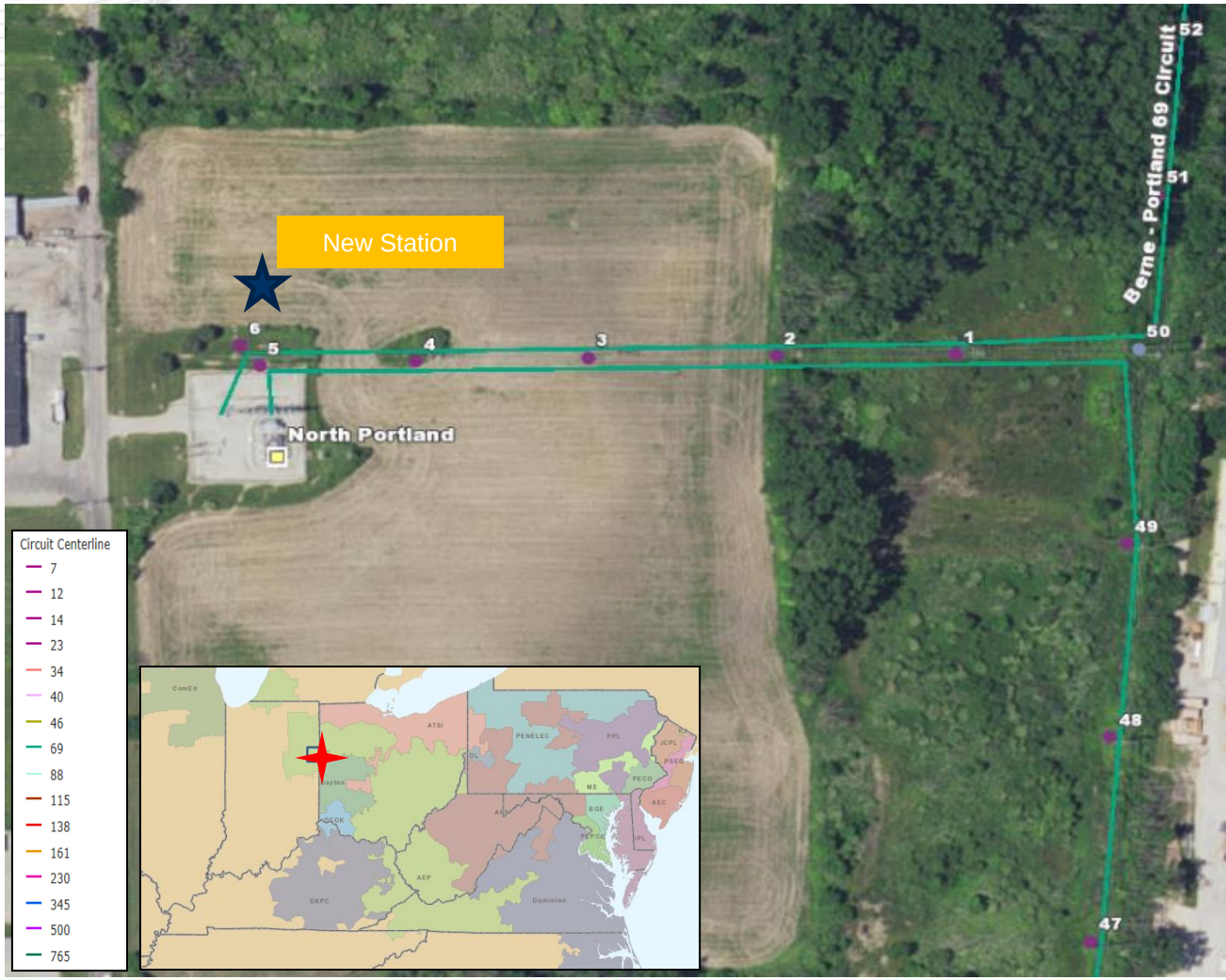
Selected Solution:
Retire North Portland Station. Install 2 69kV buses separated by a 2000A switch. At the 69kV bus 1, install a 69kV 3000A 40kA circuit breaker 'D'. Install two 20MVA 69/12kV transformers with high side 2000A circuit switcher and low side 12kV 2000A circuit breakers. Install 2 15kV main and transfer buses separated by a 2000A circuit breaker. Install 6 1200A circuit breakers on the 6 12kV station exits. (**S1436.1**)

Rebuild the Portland Extension portion of the Berne – Portland 69kV circuit to the new station utilizing 556.5 ACSR (102 MVA rating). (**S1436.2**)

Estimated Transmission Cost $3.5M

Projected In-service: 12/03/2018

Project Status: Engineering



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AEP Transmission Zone: Supplemental
North Wellsville 69 kV Station Upgrades

Previously presented on 1/30/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

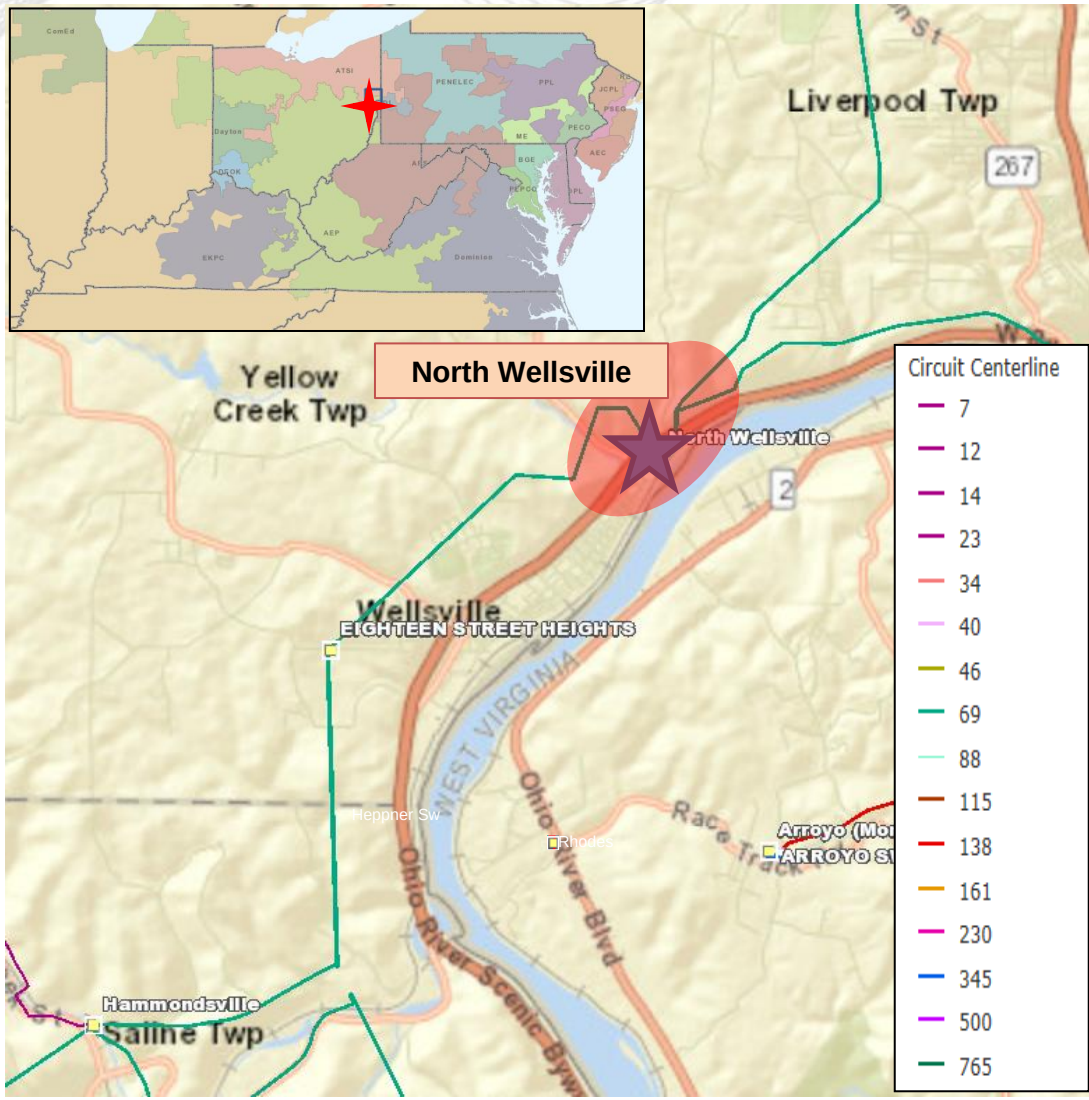
North Wellsville 69kV breakers L & M are GE 'FK' 600 A 8kA oil-filled breakers made in 1951. They have operated for 74 and 43 faults respectively, above the manufacturer recommendation of 10. These breakers have had problems with oil leaks in recent years. The breaker foundations have deteriorated significantly. Finding spare repair parts for these breakers is very challenging. There are 6- 69kV 600-amp switches in need of replacement. The 69kV circuits utilize electromechanical relays which are recommended for an upgrade. Pilot wire relaying is used on the circuit to Hammondsville, which has been unreliable. The 69kV bus CCVT's are also in poor condition.

Of the 40 protective relays in the control house, 36 are electromechanical and 2 are solid-state units which are recommended for replacement due to poor performance, high maintenance costs, and lack of fault event recording capabilities. Due to the extent of protection upgrades needed, a prefabricated drop-in-control-module (DICM) will be utilized, as the station can't be completely taken out of service during construction.

Operational Flexibility and Efficiency:

The 69-12kV distribution transformer lacks a high-side protective device, so the entire 69kV bus is tripped for a distribution transformer fault or 12kV bus fault (opens 3- 69kV circuits plus a 69kV cap bank). There are three overlapping zones of protection (69kV bus, 69-12kV transformer, 12kV bus). This arrangement reduces the life of the transmission breakers by tripping for faults in any zone. Installing a 69kV circuit switcher for the transformer will address these problems.

The existing AEP fiber-optic telecom network in the area will be extended into North Wellsville and 69kV remote terminals, to improve the capability of EMS, SCADA, and system protection equipment.



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AEP Transmission Zone: Supplemental
North Wellsville 69 kV Station Upgrades

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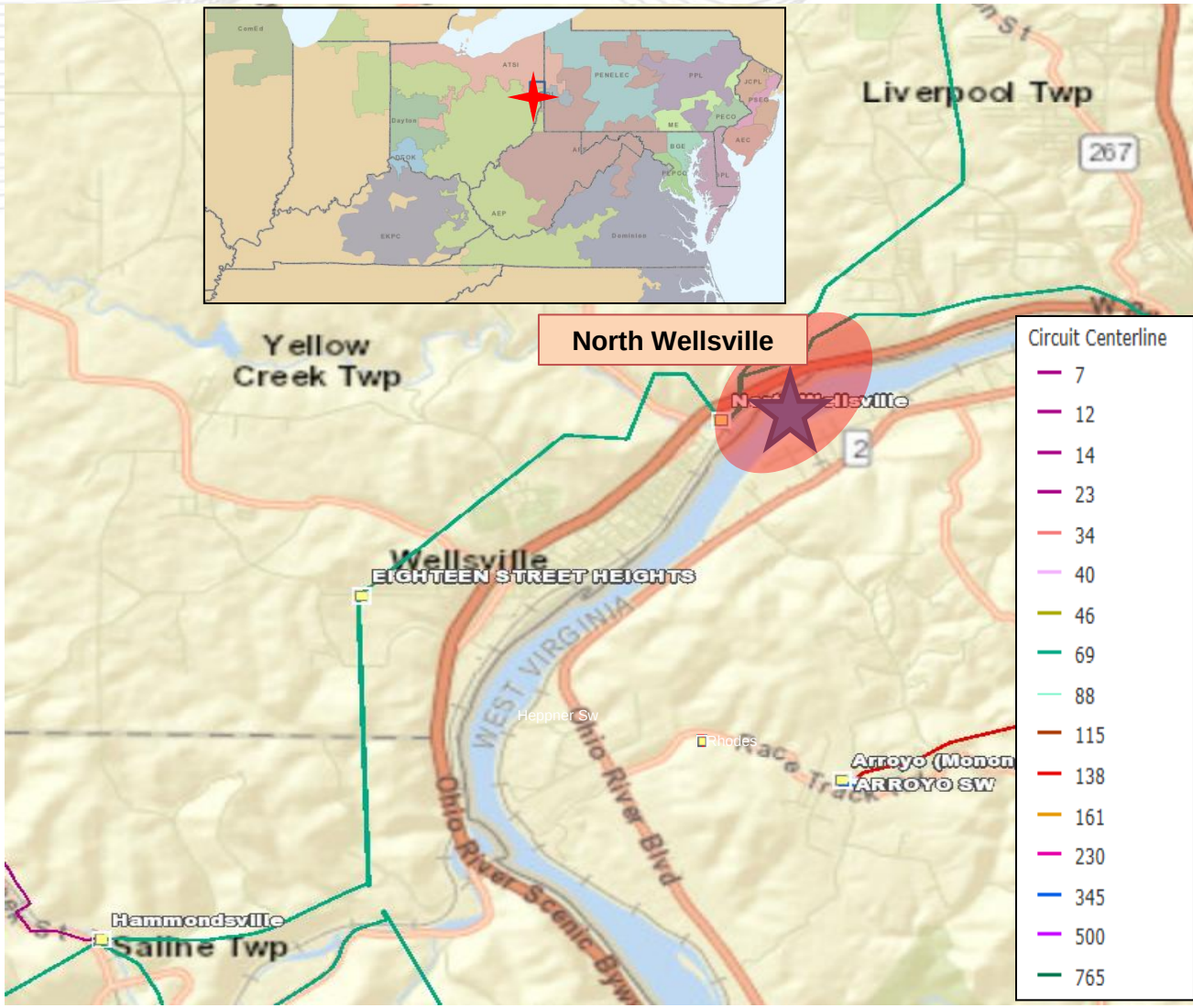
Selected Solution:
At North Wellsville station, replace 69kV oil breakers L & M with new 3000A 40 kA breakers; replace all 69kV disconnect switches; add 69kV transformer protection with circuit switcher & relaying; install distribution DICM to house new 69 & 12kV protection/communications; replace 12kV bus voltage regulator; replace both 12kV feeder breakers and protection/controls. (**S1437**)

Estimated Transmission Cost $1.3M

Projected In-service: 12/1/2019

Project Status: Scoping



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AEP Transmission Zone: Supplemental Pendleton Breaker and Relay Replacement

Previously presented on 1/8/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk/Operational Flexibility:

The 34.5 kV oil breakers E, F, G, H, and K at Pendleton station are 2000 A 36 kA FK and CF type breakers manufactured between 1952 and 1971. Oil breakers, in general, 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. Other drivers include age, bushing damage, number of fault operations, and a lack of available repair parts. Breaker G has experienced 30 fault operations. Breaker E has experienced 42 fault operations. Breaker F has experienced 36 fault operations. The manufacturer recommendation for fault interruptions is 10.

138kV breakers M and N at Pendleton station are 1200A 17.5kA models from 1951 and have had 18 and 13 fault operations respectively, which is higher than the manufacturer recommendation of 10. 138kV Breaker P being replaced is a 800A 17.5A model manufactured in 1946.

Operational Flexibility and Efficiency:

Currently a fault from transformer 2 requires 3 138kV breakers to operate in order to clear. Adding a circuit switcher is recommended to prolong the life of the new 138kV breakers.

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AEP Transmission Zone: Supplemental
Pendleton Breaker and Relay Replacement

Continued from previous slide…

Potential Solution

At Pendleton station, replace 34kV CBs “H”, “F”, “E”, “G”, and “K” with 2000A 38kV 25kA breakers. Replace 138kV CB’s “M”, “P”, and “N” with 3000A 40kA breakers. Install a 3000A 40kA circuit switcher on the high side of transformer #2. (**S1490**)

Estimated Transmission Cost $6.1M

Projected In-service: 3/31/2018

Project Status: Construction

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AEP Transmission Zone: Supplemental
Tiffin Center Breaker Replacements

Previously presented on 1/30/2018 SRRTEP

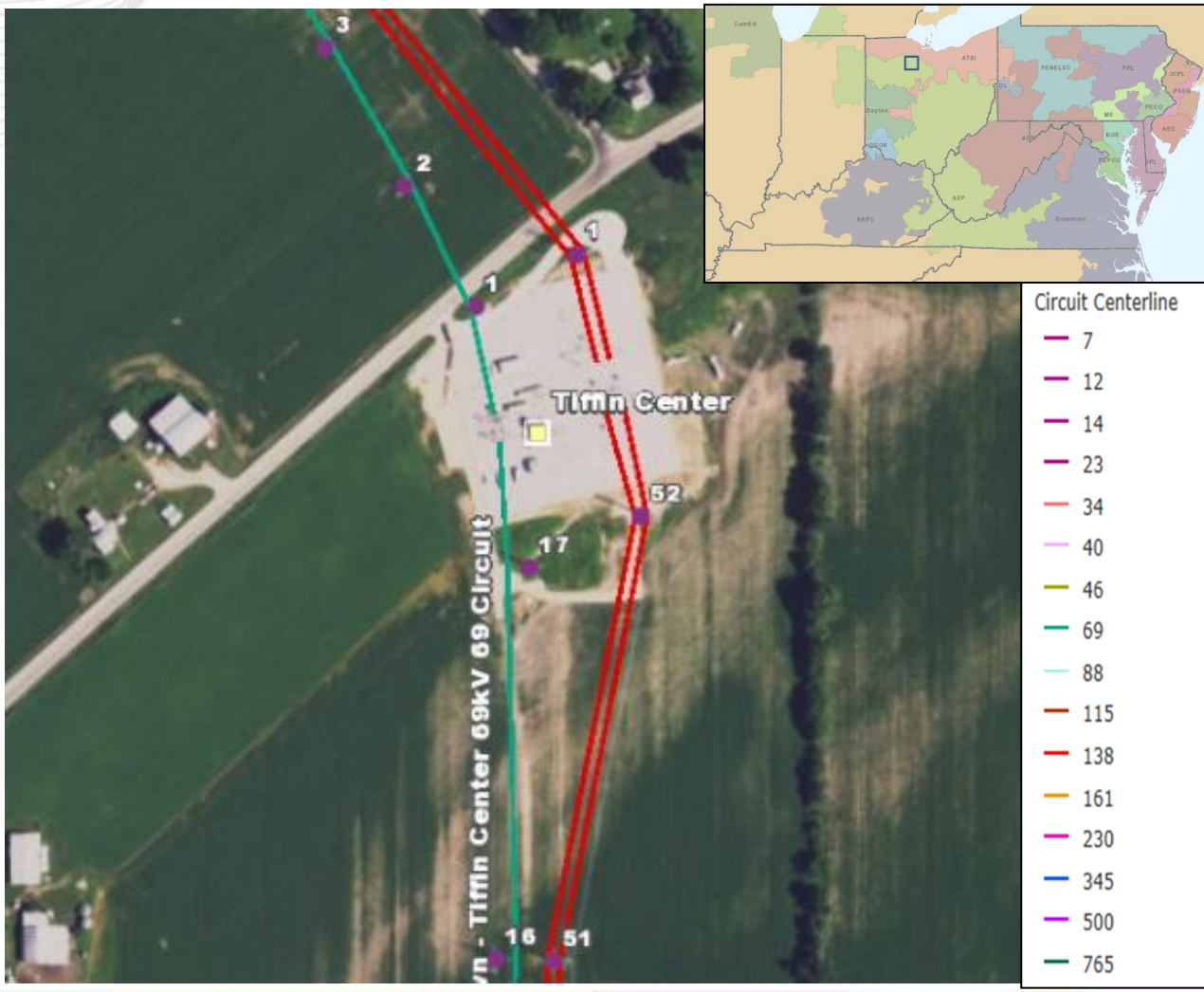
Problem Statement:
Equipment Material/Condition/Performance/Risk:
Breakers 'A' and 'B' at Tiffin Center station are 1200A 21 kA oil medium breakers manufactured in 1965 with fault counts of 149 and 73 respectively. Oil breaker maintenance has become more difficult due to the oil handling required to maintain them. Oil spills are frequent with breaker failures and routine maintenance and can become an environmental hazard. The drivers for replacement of these breakers are age, number of fault operations, a lack of available repair parts, and PCB content.

Selected Solution:
At Tiffin Center 69KV station, replace 69kV breaker 'A' and 'B' with 3000A 40kA breakers and associated equipment. (**S1491**)

Estimated Transmission Cost: $1.24M

Projected In-service: 03/16/2018

Project Status: Engineering



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AEP Transmission Zone: Supplemental Wharncliffe CB Replacement

Previously presented on 1/30/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Wharncliffe 46 kV circuit breakers “A”, “B”, & ”C” have all significantly exceeded (A = 228 operations , B = 175 operations , C = 60 operations) the manufacturer’s designed number of fault operations of 10. In addition, all three breakers are ME Type EPB 1200 A 20 kA breakers and are on the obsolete breakers list. This type of breaker has very few parts for repairs and AEP has been working towards eliminating these breakers from the system

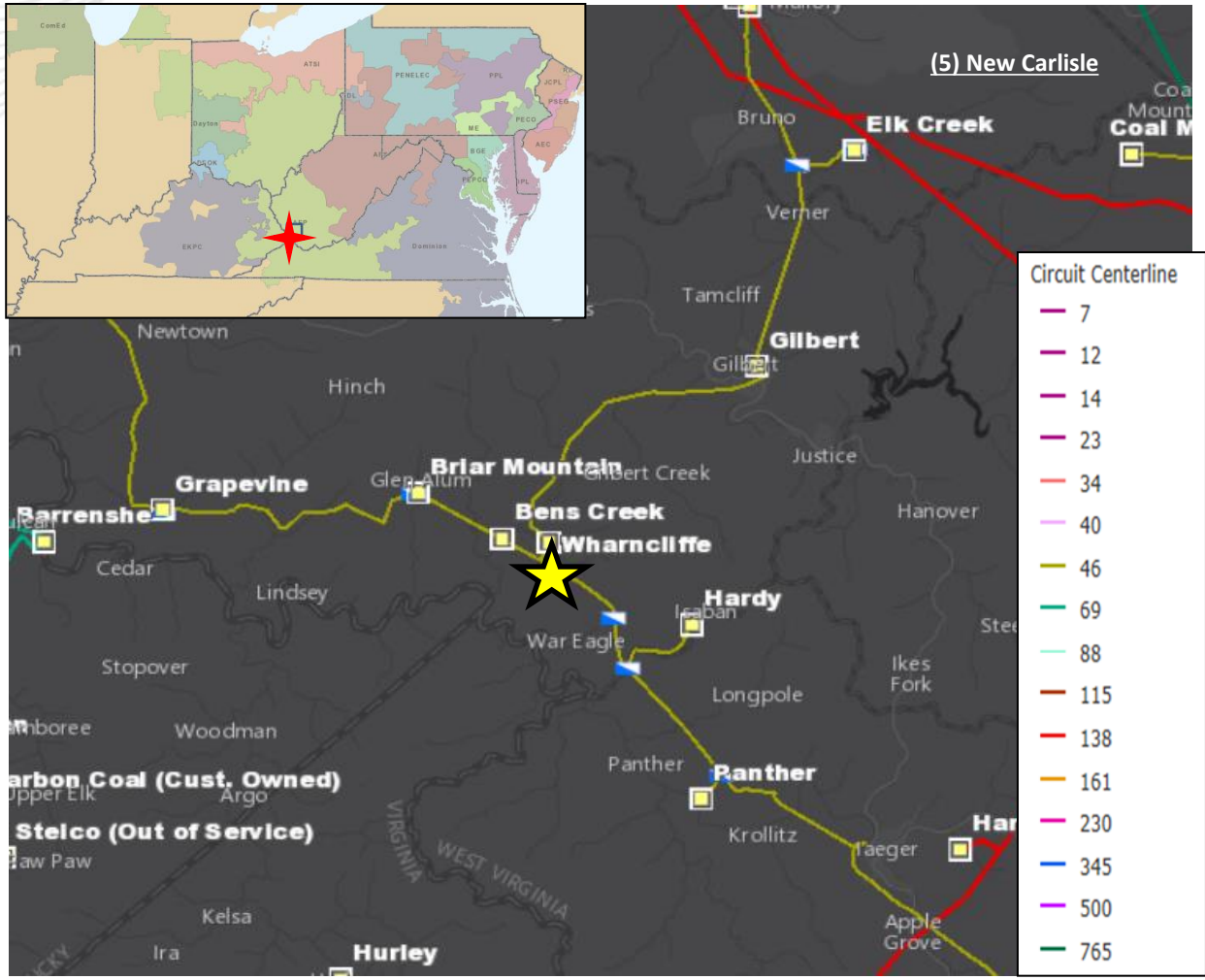
Selected Solution:

Replace existing Wharncliffe 46KV circuit breakers A, B, and C with 3000 A 40 kA circuit breakers. (**S1492**)

Estimated Transmission Cost $ 3.41M

Projected In-service: 06/01/2018

Project Status: Scoping



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AEP Transmission Zone: Supplemental Madison 69 kV Loop

Previously presented on 1/30/2018 SRRTEP

Problem Statement:

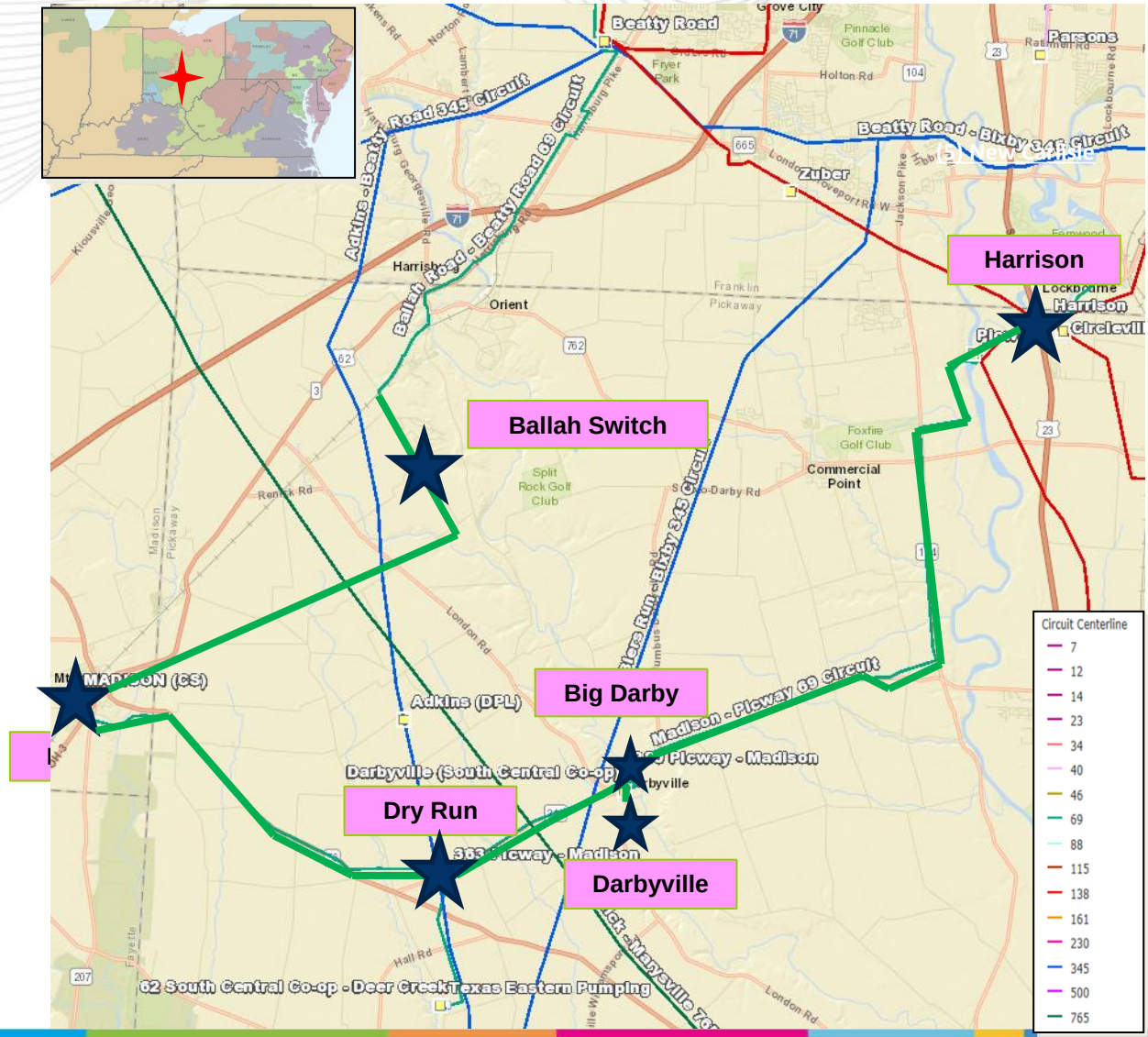
Equipment Material/Condition/Performance/Risk:

The Harrison-Madison 69kV circuit (made up of Picway-Madison, vintage 1944 & Picway Harrison, vintage 1969) is in very poor condition and in need of rebuild. 15.29 miles of the 24.2 mile line is 73 years old and 16.4 miles of it is comprised of copper conductor (25 MVA rating). There are 248 known conditions as of the last inspection. Due to the radial nature of the line, it cannot be rebuilt without first completing and closing the loop at Madison station in order to avoid extensive customer outages.

The transmission line operations crew receives multiple call outs on this line, and it's construction makes it difficult to repair. There are also co-op customers and a pipeline customer served off this line that are affected when the line is outaged.

Four circuit breakers at Harrison station are showing signs of deterioration. These breakers were installed in the late 1960's and early 1970's and use oil as the interrupting medium. Oil 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 drivers for replacement of these breakers are age, bushing damage, no repair part availability, amount of fault operations and PCB content. Fault operation counts at Harrison include 13 on 69kV CB 61, 58 on 69kV CB 62, and 23 on 69kV CB 63, which exceed the manufacturer's recommended limit of 10.

Harrison 138/69kV transformer 1 is also showing signs deterioration. Drivers for transformer replacement include age, dielectric strength breakdown (winding insulation), short circuit strength breakdown (due to the amount of through fault events) and accessory damage (bushings).



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AEP Transmission Zone: Supplemental Madison 69 kV Loop

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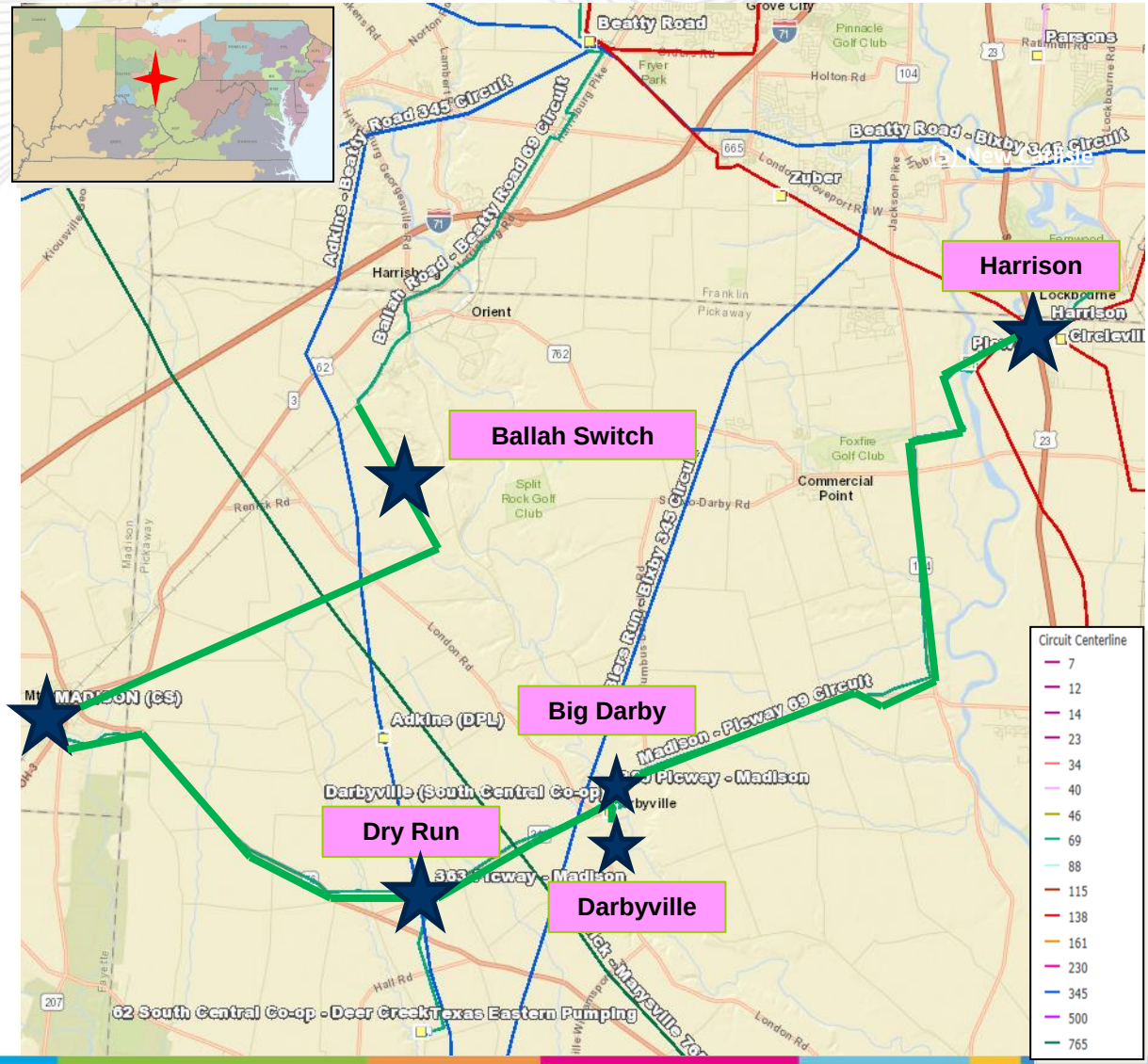
Operational Flexibility and Efficiency:
A normally opened configuration at Str. 280 (near the Darbyville tap location) allows for limited temporary recovery of loads at Deer Creek, Darbyville, Clark Lakes, Texas Eastern Co., and Madison stations for outages involving Str. 280 to Harrison branch. This configuration depends on utilizing normally radial customer owned 69kV transmission line. However, there are not recovery options if the outages involve Str. 280 to Madison branch. Existing small conductors also limit the load recovery options in this configuration.
Customer Service:
SCP has approached AEP to help address numerous outages affecting customers in this area.

Selected Solution:
Build a new Beatty-Madison 69 kV line utilizing 795 ACSR (129MVA rating) in new ROW. Acquire existing 636 ACSR & 336 ACSR (73 MVA rating) in existing ROW. (**S1493.1**) Estimated Transmission Cost: $16.2M
Rebuild single circuit 69kV line from Harrison to Madison with 795 ACSR (129 MVA rating), mostly in existing ROW. (**S1493.2)** Estimated Transmission Cost: $23.4M
Rebuild tap to Darbyville as double circuit 795 ACSR (129 MVA rating). (**S1493.3**)
Estimated Transmission Cost: $0.9M
At Harrison station, replace the 138/69kV transformer with a 90 MVA. Install 3-69kV CB's with 2,000A 40kA breakers. Install 1-138kV CB with a 3,000A 63kA breaker. Install a 14.4 MVAr 69kV capacitor. (**S1493.4**)
Estimated Transmission Cost: $5.8M
At Madison station, install 2 new 69kV 2,000A 40kA CB's and 1 600A 40kA ckt switcher. (**S1493.5**)
Estimated Transmission Cost: $3.0M
At Big Darby Switch, Dry Run Switch, and Ballah Switch, upgrade with 2000A switches at new locations. Retire old switches (**S1493.6**) Estimated Transmission Cost: $1.3M

Total Estimated Transmission Cost: $50.6M

Projected In-service: 12/1/2019

Project Status: Engineering



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AEP Transmission Zone: Supplemental Meadowbrook Station

Previously presented on 1/30/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Breakers C and D are currently not in use and are accruing yearly O&M costs. Due to the cost, retirement is recommended.

Operational Flexibility and Efficiency

Currently there are three overlapping zones of protection at Meadowbrook station: the 34.5kV bus, the 138/34.5kV transformer and the Pendleton – Madison line. It is AEP's current standard to not allow for an overlap of more than two protection zones. The configuration at Meadowbrook does not meet AEP's current standards as three protection zones share the same relays thus increasing the probability of mis-operations. Also, a transformer protection zone overlapping with a bus and line protection zones does not allow for bus one-shot and high-speed reclosing schemes, respectively. This adds restoration delays and significantly reduces reliability. Also, this arrangement reduces the life of breakers by tripping them for events in any of the three protection zones.

Selected Solution:

Retire out of service breakers "C" and "D" at Meadowbrook station and install a high side 138kV 3000A 40kA breaker for transformer protection. (**S1494**)

Estimated Transmission Cost: $2.5M

Projected In-service: 11/1/2018

Project Status: Scoping

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AEP Transmission Zone: Supplemental
Deer Creek-Sorenson Rebuild

Previously presented on 1/30/2018 SRRTEP

Problem Statement:

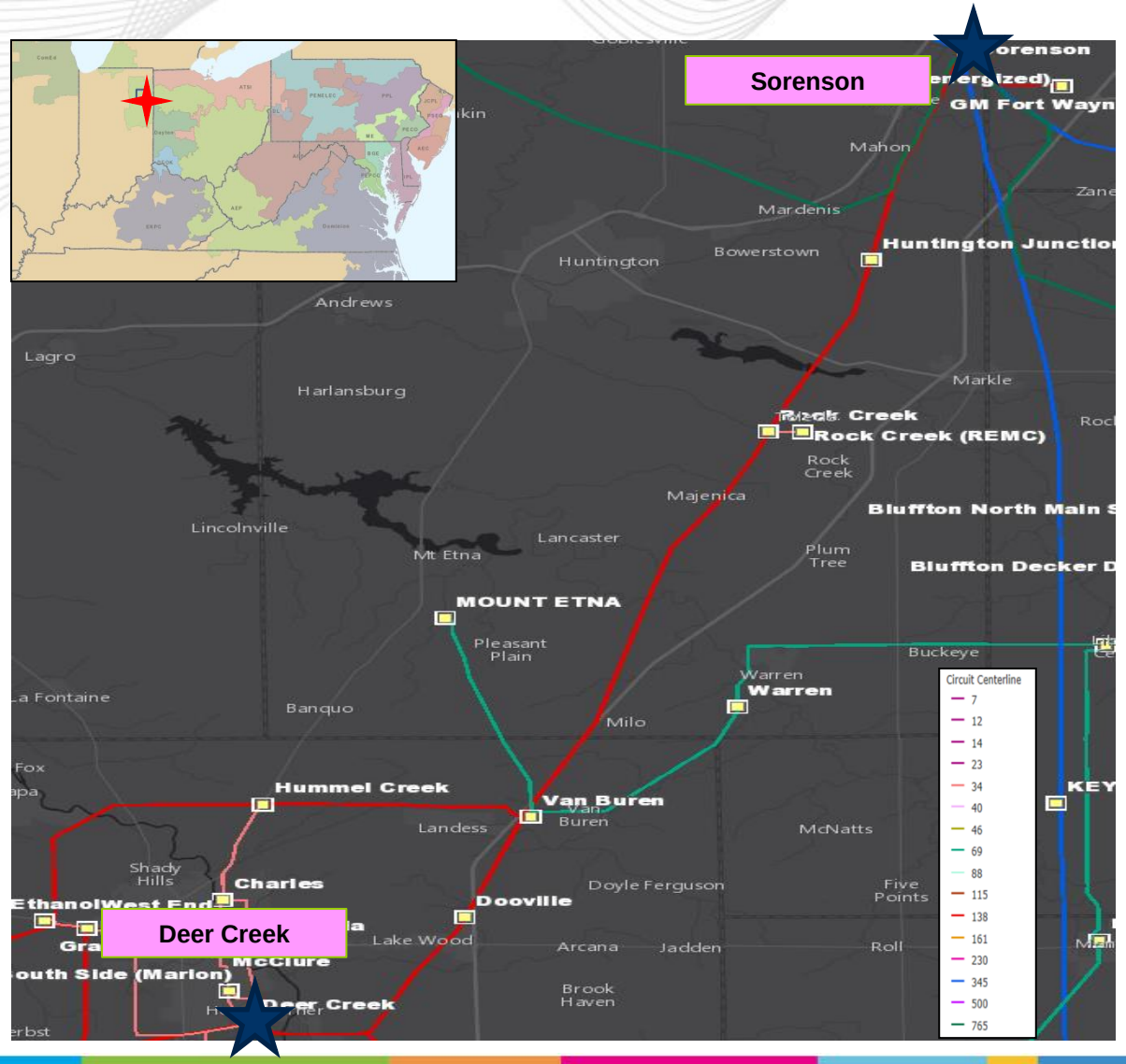
Equipment Material/Condition/Performance/Risk:

The Deer Creek – Sorenson double circuit line has 236 open conditions and is comprised of conductor and towers from 1928 with mostly 397 ACSR conductor (167 MVA rating) along the 36 mile length. It is currently subject to corroded towers; broken clamps; broken dampers; burnt insulators; vine hazards and broken shield wire.

Design standards from the 1920s do not meet modern standards for strength, resilience, and horizontal and vertical clearances for safety. Underlying land rights secured prior to the line's original construction do not contain modern protective language which would provide the ability to properly manage non-conforming land uses. The ability to control building encroachments and intrusive vegetation were often not included in the language of the original easements. This transmission line has exceeded its original life expectancy. Age and normal deterioration of the line, now over ninety (90) years old, warrants its complete replacement.

Operational Flexibility and Efficiency

Due to the relative length of the line, wind exposure, and perpendicularity of this line to the prevailing winds, the Deer Creek – Sorenson circuit has had a history of "galloping" which has led to 30 momentary interruptions across the Deer Creek – Hummel Creek – Sorenson circuit and 43 momentary interruptions on the Delaware – Sorenson circuit in the last 10 years alone. Rebuilding this line with structures and configurations more suited for high wind environments is required.



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AEP Transmission Zone: Supplemental
Deer Creek-Sorenson Rebuild

Continued from previous slide…

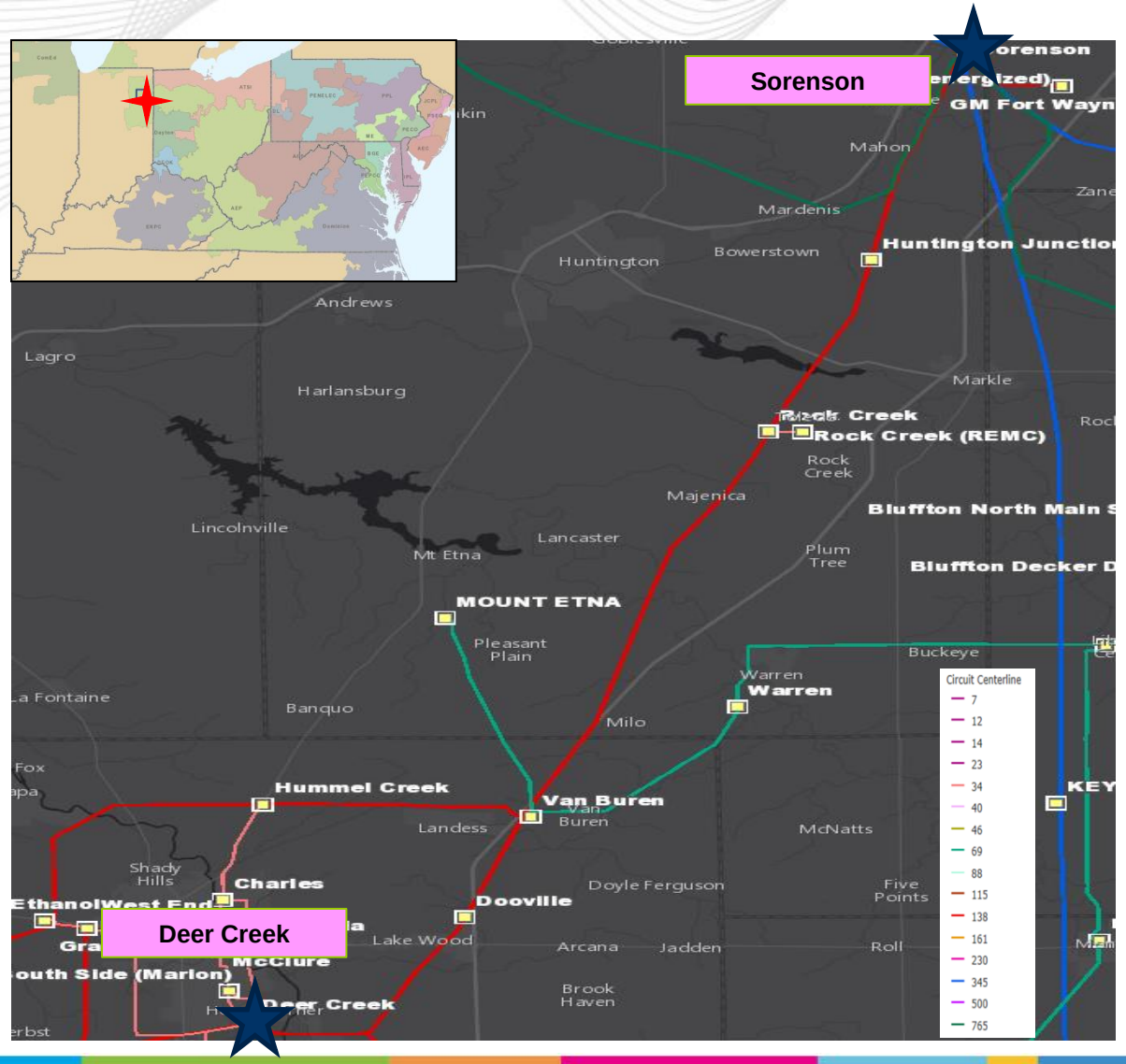
Selected Solution:
Rebuild ~32 miles of the Delaware – Sorenson & Sorenson – Deer Creek 138kV double circuit line using 795ACSR (257 MVA rating). (**S1495.1**)
Estimated Transmission Cost: $82.6M

Rebuild ~3 miles of the Deer Creek 138kV double circuit extension using 795 ACSR (257 MVA rating). (**S1495.2**)
Estimated Transmission Cost: $1.7M

Total Estimated Transmission Cost: $84.3M

Projected In-service: 12/2/2019

Project Status: Engineering



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AEP Transmission Zone: Supplemental Anthony-Lakeside Rebuild

Previously presented on 1/30/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Original construction of the Anthony-Lakeside 34.5 kV line is estimated to be from the 1950's, is approximately 2 miles long, and consists of 72 wood pole structures and 336 AAC conductor (36 MVA rating). Currently, this line has 21 open conditions, most of which include rotten wood poles and burnt/broken conductor. Recommendations to address the physical condition of this line have been received from Transmission Field Services.

In addition to the replacement of the transmission line, the associated remote end station circuit breakers "A" and "B" at Water Pollution and "H" at Anthony are 1950's and 1970's vintage, which are recommended for replacement due to their age and physical condition.

The Anthony-Lakeside 34.5 kV line serves the City of Fort Wayne's water treatment plant as well as temporary service for their tunnel boring project to improve the City's waste water system. The line rebuild and breaker replacements will address the age and condition issues of these facilities and aim to improve the reliability of service to the City of Fort Wayne and local network.

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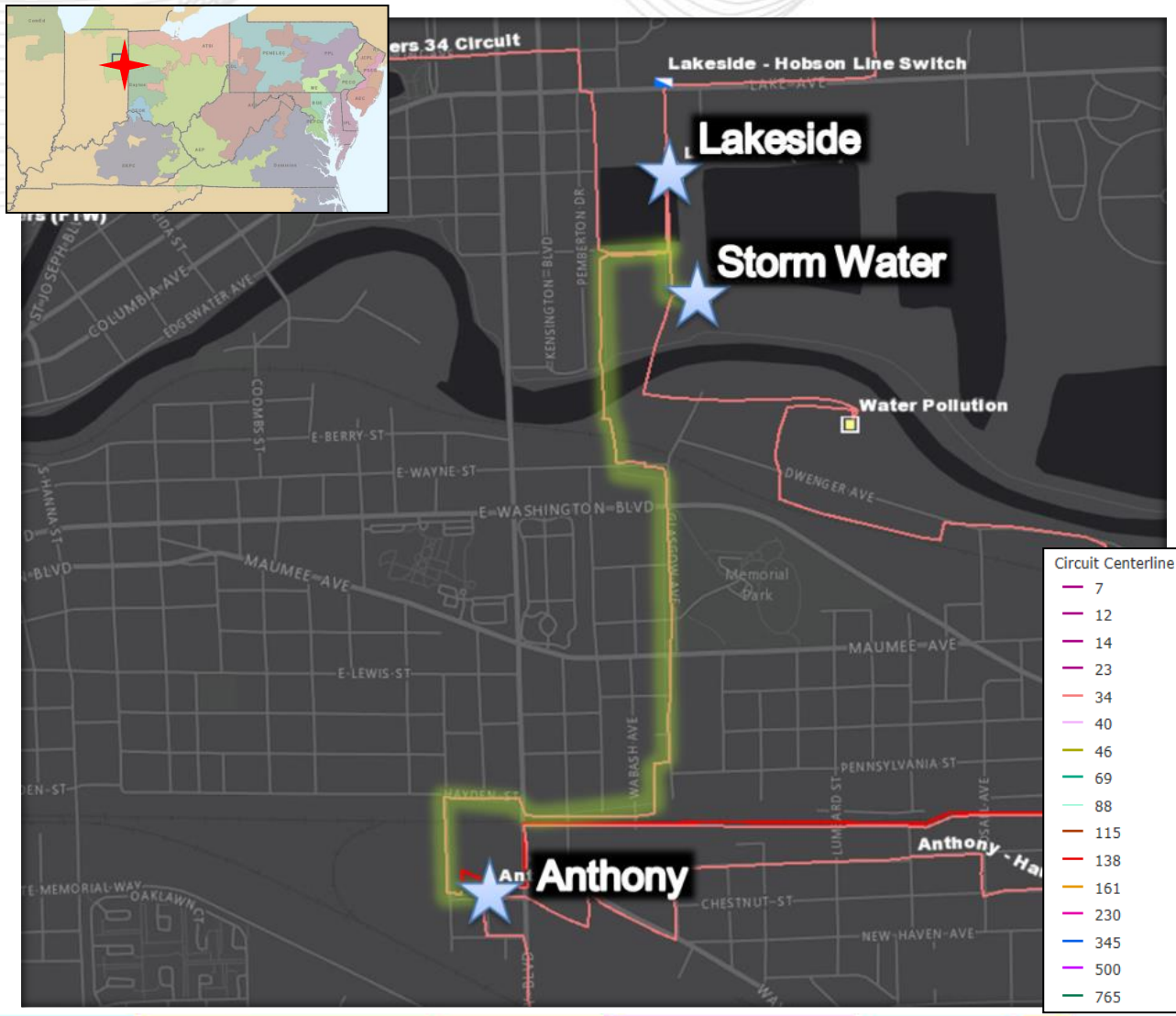

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AEP Transmission Zone: Supplemental
Anthony-Lakeside Rebuild

Continued from previous slide…

Selected Solution:
Rebuild approximately 2 miles of single circuit line with 795 ACSR from Anthony Station to structure 66 (just south of Lakeside station) and continue to Storm Water Station. This conductor type was selected to match the remaining overhead conductor capability of the circuit. The remaining portion of line (north of structure 66) will be retired along with Lakeside station. The rebuilt 34.5 kV circuit from Anthony-Storm Water 34.5 kV will be limited by 600 A switches at Storm Water creating an overall rating of 41/45 MVA (SN/SE) and 53/57 MVA (WN/WE). (**S1496.1**) Estimated Cost: $7.0M

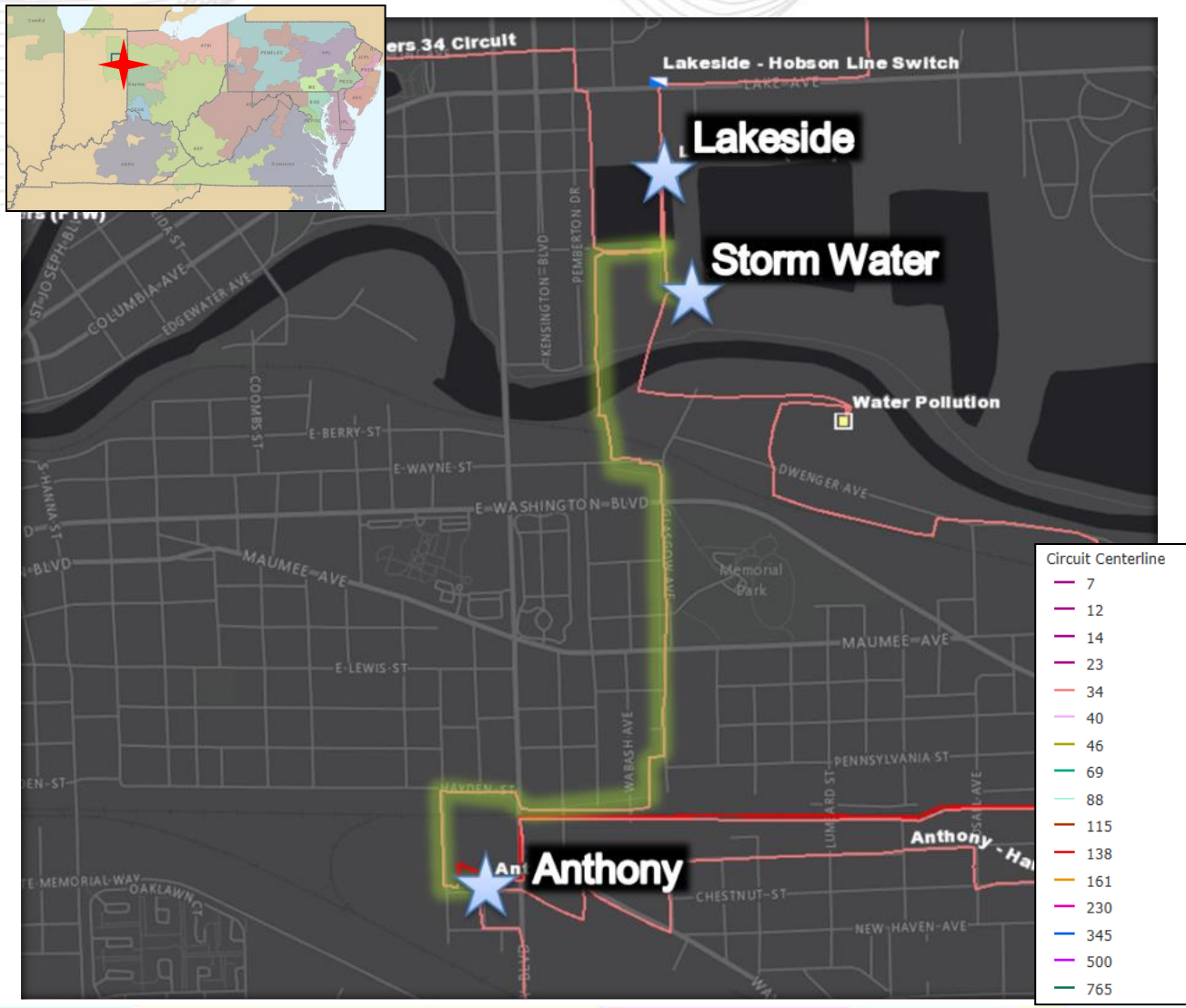
At Water Pollution Station, replace 34.5 kV circuit breakers “A” and “B” with 1200 A, 25 kA ABB breakers. (**S1496.2**) Estimated Cost: $0.8M

At Anthony Station, replace 34.5 kV circuit breaker “H” with a 1200 A, 25 kA ABB breaker. (**S1496.3**) Estimated Cost: $0.9M

Total Estimated Transmission Cost: $8.7M

Projected In-service: 05/30/2020

Project Status: Scoping



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AEP Transmission Zone: Supplemental
Baileysville-Bolt Rebuild

Previously presented on 1/30/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The Baileysville – Bolt 46 kV circuit has experienced 4.5 million customer minutes of interruption from 2013 to 2016. Approximately 16 miles of the 19 mile long circuit utilizes wood pole structures from the 1940s with 3/0 and 4/0 ACSR conductor (29 MVA rating). In addition, this line has a shield wire along only 13% of the structures and lightening strikes are a frequent occurrence. There are currently 39 category A open conditions along the circuit. These open conditions include damaged/rotted poles and cross arms. Our circuit breaker guideline justifies installing a breaker at McGraws Station towards Baileysvile Station with a Momentary/Permanent Outage Index (MPOI) calculation of 273, above the 200 threshold.

Selected Solution:

Rebuild ~16.6 miles of the Baileysville-Bolt line with 795 ACSR conductor to 138 kV standards (energized at 46 kV, 86 MVA rating). Existing ROW will be used when possible but supplemental ROW may be needed in order to build to 138kV standards. ADSS will be installed on the new line. (**S1497.1**)

Estimated Cost: $25.8M

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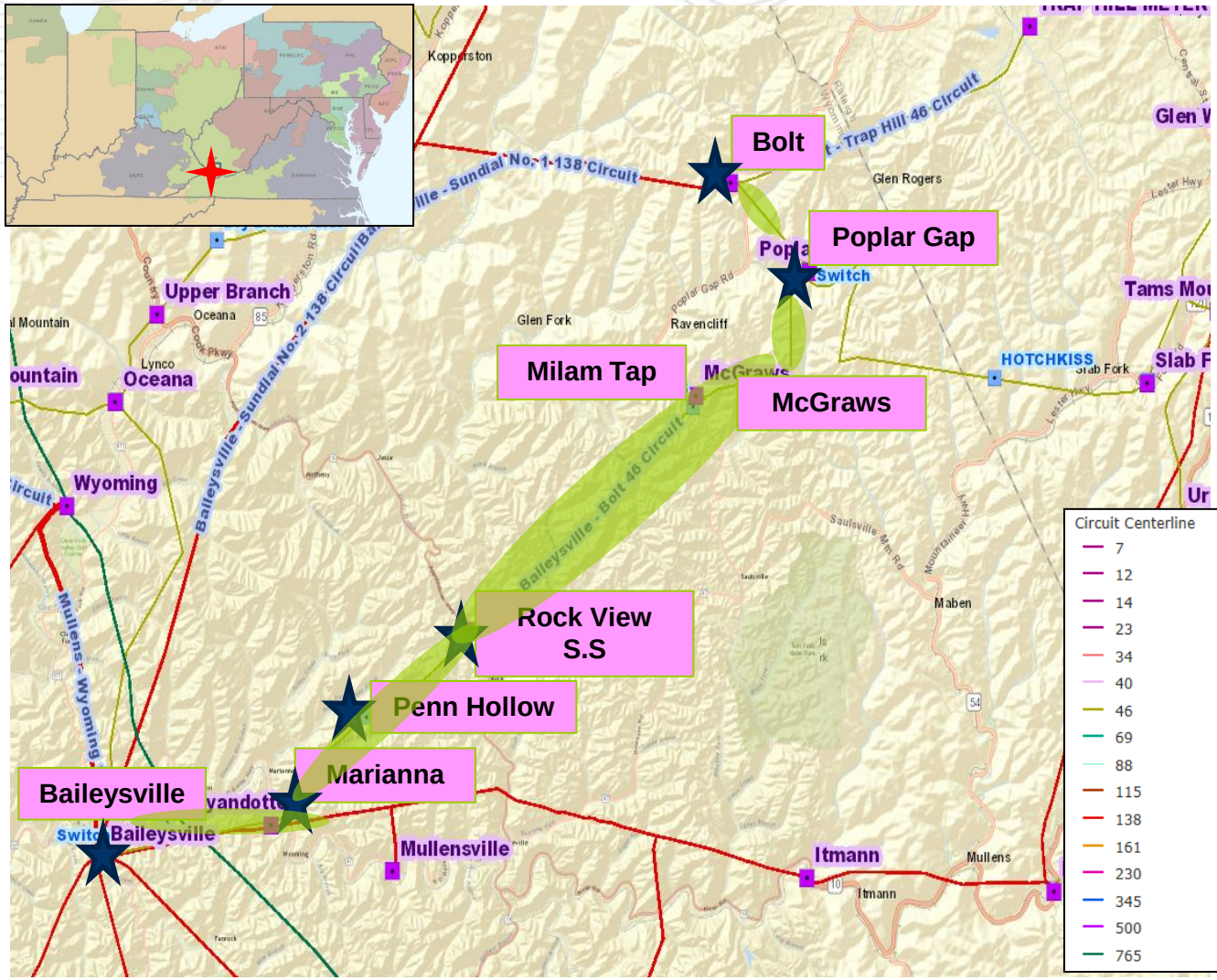

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AEP Transmission Zone: Supplemental
Baileysville-Bolt Rebuild

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At Baileysville Station, replace 46kV bus/risers and switches on circuit breaker E. (**S1497.2**) Estimated Cost: $0.6M

At Marianna Station, replace the existing switches with a 1200A phase-over-phase switch and replace the bus/risers. (**S1497.3**) Estimated Cost: $0.0M

At Rock View Station, replace the existing switches with a 1200A phase-over-phase switch. (**S1497.4**) Estimated Cost: $0.4M

At Poplar Gap Station, replace the existing switches with a 1200A phase-over-phase switch. (**S1497.5**) Estimated Cost: $0.6M

Retire Milam Tap Station. (**S1497.6**) Estimated Cost: $0.0M

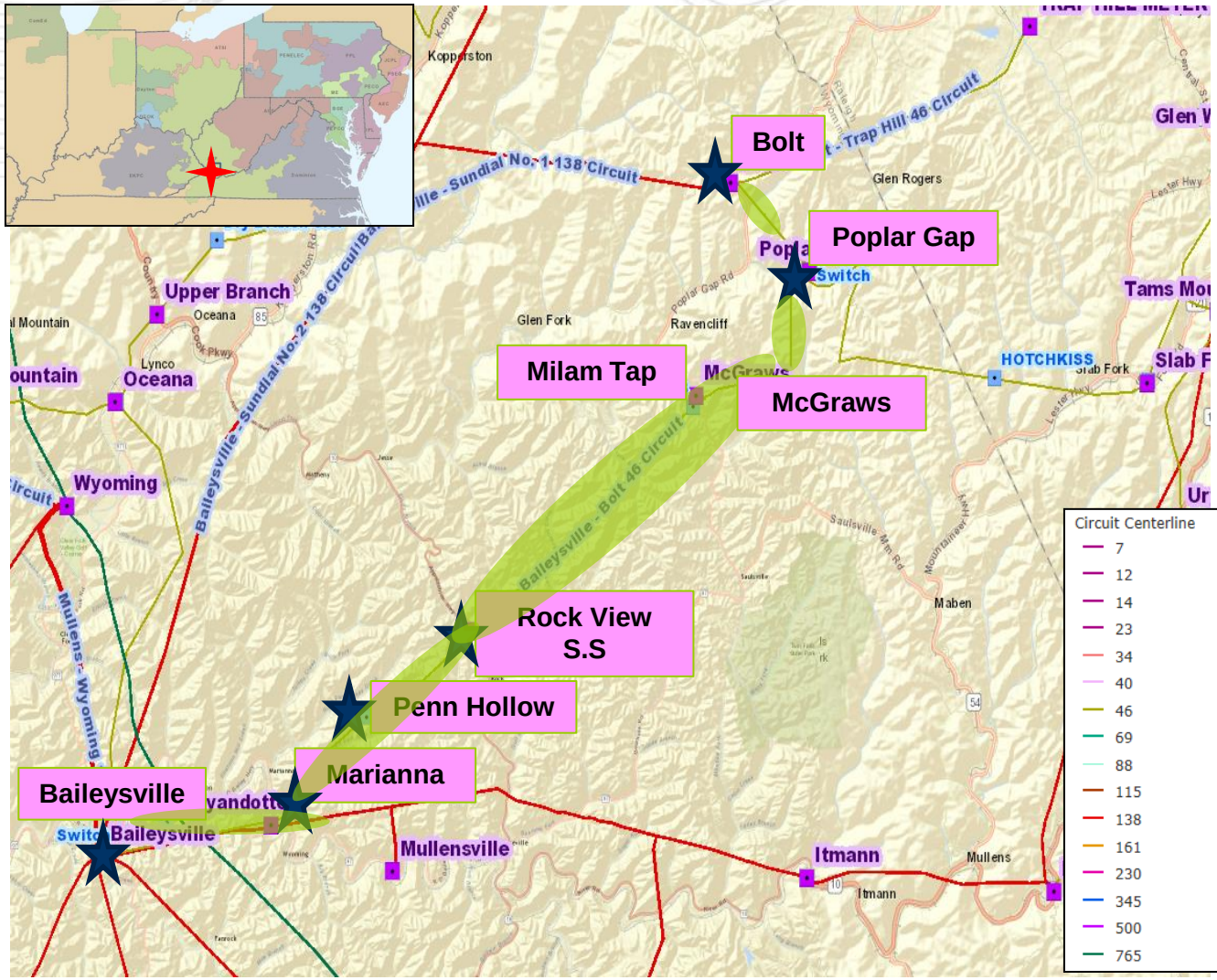
Retire Penn Hollow Tap Station. (**S1497.7**) Estimated Cost: $0.0M

Install a 3000A circuit breaker at McGraws Station towards Baileysville. (**S1497.8**) Estimated Cost: $1.2M

Total Estimated Transmission Cost: $28.6M

Projected In-service: 12/01/2019

Project Status: Scoping



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AEP Transmission Zone: Supplemental Delaware-Madison Rebuild

Previously presented on 1/30/2018 SRRTEP

Problem Statement:
Equipment Material/Condition/Performance/Risk:
The Delaware – Madison 138kV line is a 1928 vintage circuit that has a total of 100 open conditions across its ~19 miles including burnt insulators, broken shield wire, loose conductor hardware, broken guy wires, and broken ground lead wires. It was constructed with 397 ACSR conductor (167 MVA rating).
In addition, the line riser at Delaware will be replaced so that it doesn't limit the new ~19 mile long line.

Operational Flexibility and Efficiency
Daleville station is configured in a non-standard configuration. Because of this, any work on the transformer requires that the line be taken out of service. Reconfiguring this station's switches will eliminate unnecessary maintenance outages.

Selected Solution:
Rebuild the ~19 miles of the Delaware – Madison double circuit 138kV line utilizing double circuit 556.5 ACSR 26/7 (SN:204 SE:284 WN: 258 WE: 319). (**S1498.1**)
Estimated Cost: $54.3M

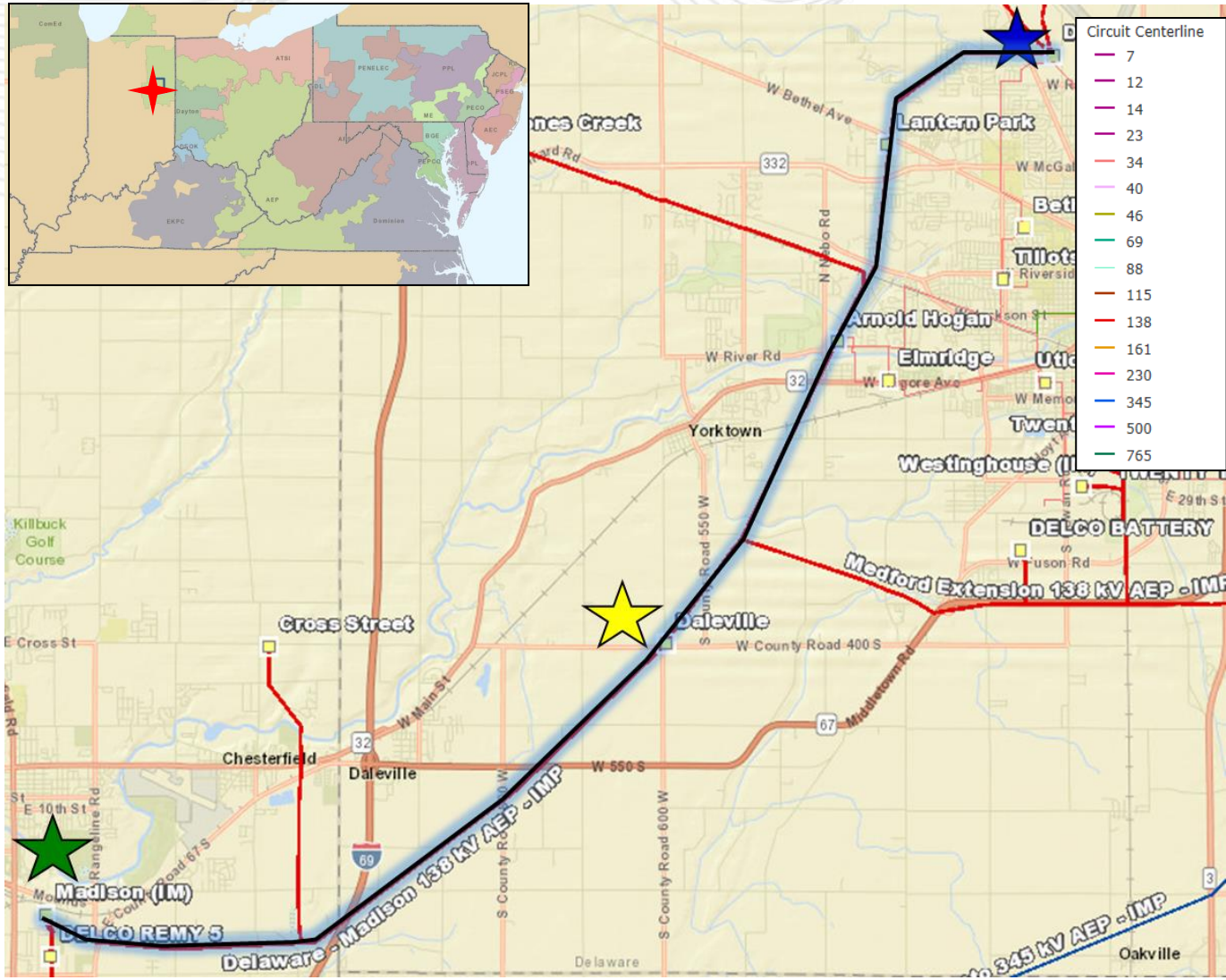
Replace risers at Delaware station with 1200A AAC jumpers. (**S1498.2**)
Estimated Cost: $0.3M

Replace the switches at Daleville station with 2000A 100kA switches (**S1498.3**)
Estimated Cost: $0.1M

Total Estimated Transmission Cost: $54.7M

Projected In-service: 12/31/2021

Project Status: Scoping



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AEP Transmission Zone: Supplemental
Dennison-West New Philadelphia Upgrades

Previously presented on 1/30/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Breaker L at West New Philadelphia station is a McGraw-Edison oil breaker manufactured in 1962. In general, oil breakers have become increasingly difficult to maintain due to the oil handling associated with them. Oil spills occur frequently with failures and while performing routine maintenance, which, is an environmental hazard. Additionally, breaker L has experienced 104 fault operations.

Operational Flexibility and Efficiency

Dennison – West New Philadelphia 69kV has been responsible for 3.9 million minutes of CMI over the prior 3 years. 60% of the outage-duration was due to Station Equipment problems.

Malfunctioning MOAB flip-flop switching scheme at New Philadelphia has been inoperable since 2012. Lack of SCADA at Schoenbrunn & New Philly limits system operator's ability. RTU's will be installed at both stations, to provide real-time power flow data (voltage, currents, MW/MVAR) to system operators.

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AEP Transmission Zone: Supplemental
Dennison-West New Philadelphia Upgrades

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Two 69kV hard taps will be eliminated as part of the project (just outside West New Philly station, and near New Philly). Hard taps are problematic when doing maintenance on the circuit or stations involved.
The New Philly 69kV breakers prevent a 69kV T-Line outage from taking out the 69kV cap bank there; this cap bank is valuable for supporting system voltages. The Momentary Permanent Outage Index (MPOI) calculations support installing breakers at New Philadelphia (230, above the 200 threshold).

There are large AEP Ohio distribution load centers served from New Philly station (24 MVA peak, 4800 customers) and Schoenbrunn (23 MVA, 3500 customers). Today, a line fault would outage 8300 customers or 47 MVA of load at summer peak. Additional breakers at Schoenbrunn are recommended to help keep these customers in service for line faults. The MOAB/ground switch at Schoenbrunn will be replaced. MOAB/ground switch combinations induce a fault on the system, tripping remote breakers for a transformer fault, reducing the life and increasing relay coordination complexity for the transformer protection.

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AEP Transmission Zone: Supplemental Dennison-West New Philadelphia Upgrades

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Selected Solution:
Remove the 69kV hard taps outside of West New Philly & New Philly stations. 6-wire the between West New Philly-New Philly stations (2.4 miles). Modify the Schoenbrunn double-circuit loop due to station expansion. (**S1499.1**) Estimated Cost: $1.7M

At West New Philly 69kV station, upgrade relaying toward Dennison; replace 69kV circuit breaker 'L' (to Beartown); install a breaker on the low-side of the 138-69kV transformer. (**S1499.2**) Estimated Cost: $2.6M

At New Philly 69-34kV station, replace inoperable 69kV MOAB flip-flop switching scheme with breakers and relays. Upgrade RTU & expand SCADA functionality. Install a distribution bus-tie breaker. (**S1499.3**) Estimated Cost: $1.2M

At Schoenbrunn 69-12kV station, replace 69kV MOAB/ground-switch transformer protection with circuit switcher protection scheme. Add RTU & SCADA. Install 69kV bay with 2- circuit breakers. (**S1499.4**) Estimated Cost: $1.7M

At Dennison 69kV station, upgrade relaying toward West New Philly. (**S1499.5**) Estimated Cost: $0.3M

Extend ADSS fiber into Schoenbrunn and New Philly stations for SCADA/protection needs. (**S1499.6**) Estimated Cost: $0.1M

Total Estimated Transmission Cost: $7.6M

Projected In-service: 06/01/2019

Project Status: Scoping

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AEP Transmission Zone: Supplemental Bethel Upgrades

Previously presented on 1/30/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Circuit Breaker #103, #104, #106, & #107 at Bethel Road station are late 1960's vintage oil filled breakers without oil containment. All of these oil filled breakers have exceeded their life expectancy for full fault operations.

The Distribution transformers #1 & #2 are both large units with load transferability both at the distribution bus and at the distribution circuit level. XF#1 is nearly 40 years old with no automated high side protection and XF#2 only utilizes a MOAB for high side protection. In the existing configuration, failure of either unit will interrupt part of the transmission 138kV through path and failure of both XF's will fragment the 138kV ring bus.

Operational Flexibility and Efficiency

Addition of the distribution high side circuit switchers will allow automatic isolation for transformer faults as well as remote isolation for better control by operations.

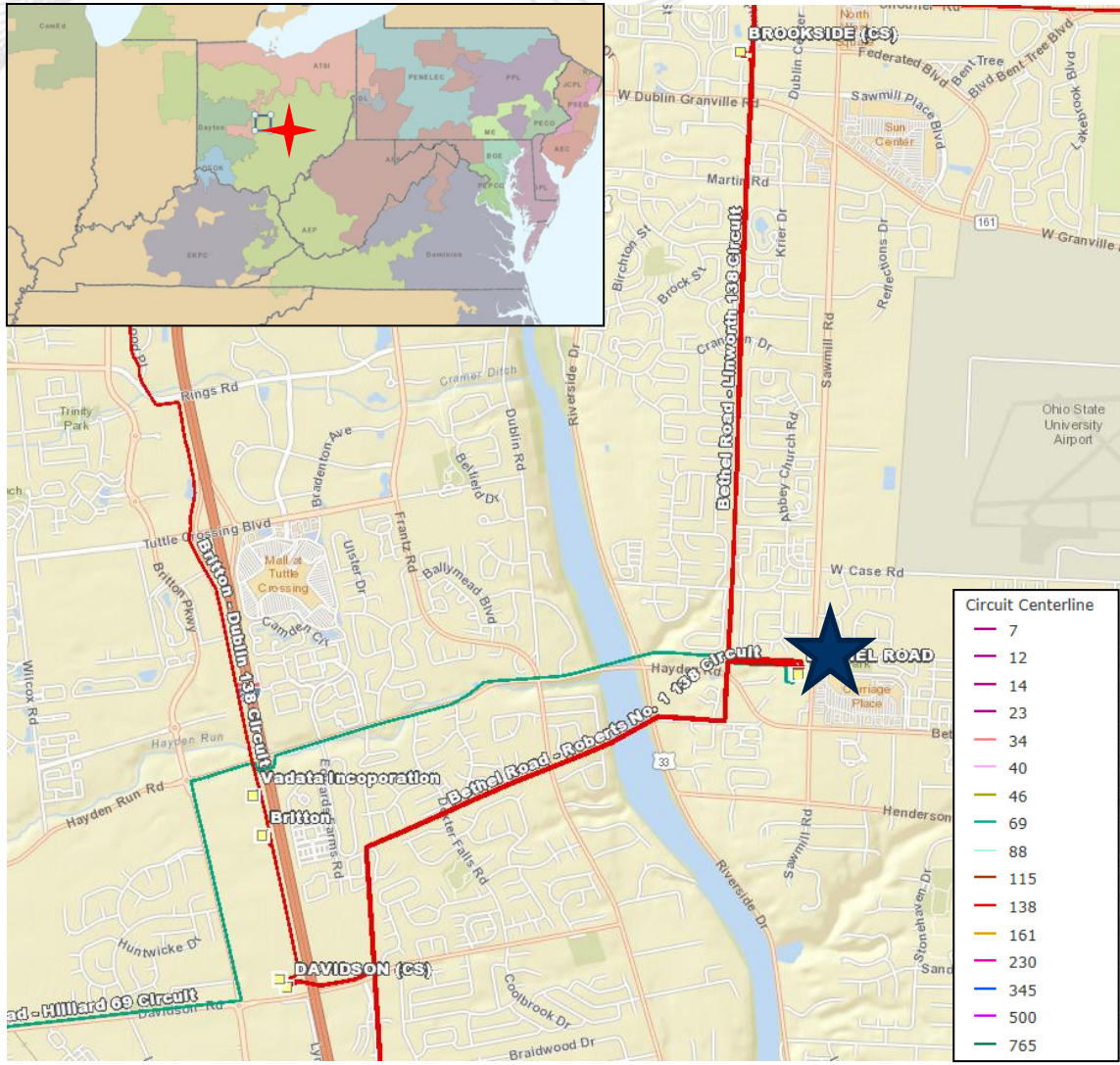
Selected Solution:

Bethel Road station: Replace 4-138kV 1600A 40kA CB's and associated disconnect switches with equipment rated for 3000A 40kA. Replace various 138kV switches and miscellaneous hardware for rehab needs. Install new DICM with multiple relay packages and remote relaying. Install 450 ft of plastibeton trench, 300ft of conduit, 500 ft of 4/0 copper grounding. Install 3-3ph sets of CCVT's. Install 2-138kV distribution transformer ckt switchers (**S1500**)

Total Estimated Transmission Cost: $3.5M

Projected In-service: 12/01/2018

Project Status: Engineering



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AEP Transmission Zone: Supplemental
Boone – Ward Hollow Rebuild

Previously presented on 1/30/2018 SRRTEP

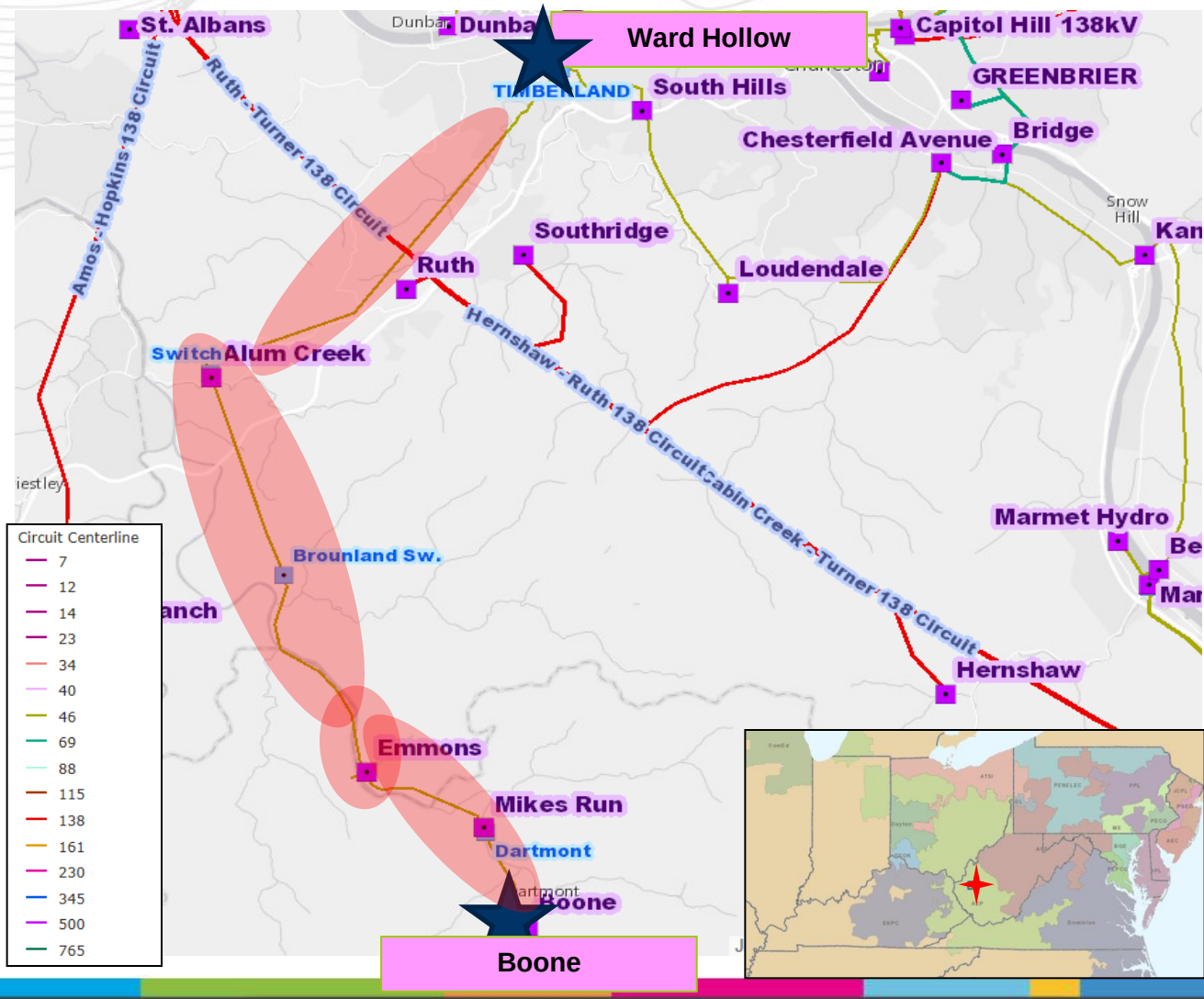
Problem Statement:
Equipment Material/Condition/Performance/Risk:
From 2013 – 2016, the Boone – Ward Hollow 46 kV circuit has experienced 8 Permanent and 5 Momentary outages resulting in 393,000 customer minutes of interruption. Over 90% of the structures that make up the approximately 17.5 mile circuit were installed in 1920 with 2/0 Copper conductor (27 MVA rating) and only 21% of the circuit is shielded for lightning protection. These service interruptions are due to a lack of shielding. Additionally, there are 35 current open A conditions consisting of pole, conductor and hardware damage.

Selected Solution:
Rebuild ~17.5 miles of the Boone – Ward Hollow circuit utilizing 795 26/7 ACSR (86 MVA rating) at 69 kV standards (operated at 46 kV). Switching structures at Mikes Run, Emmons, and Alum Creek will be replaced with a standard 3-way Phase Over Phase Switch. Retire Timberland Switching Station. (**S1501**)

Total Estimated Transmission Cost: $32.7M

Projected In-service: 12/01/2020

Project Status: Engineering



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AEP Transmission Zone: Supplemental Byllesby Breaker Replacement

Previously presented on 1/30/2018 SRRTEP

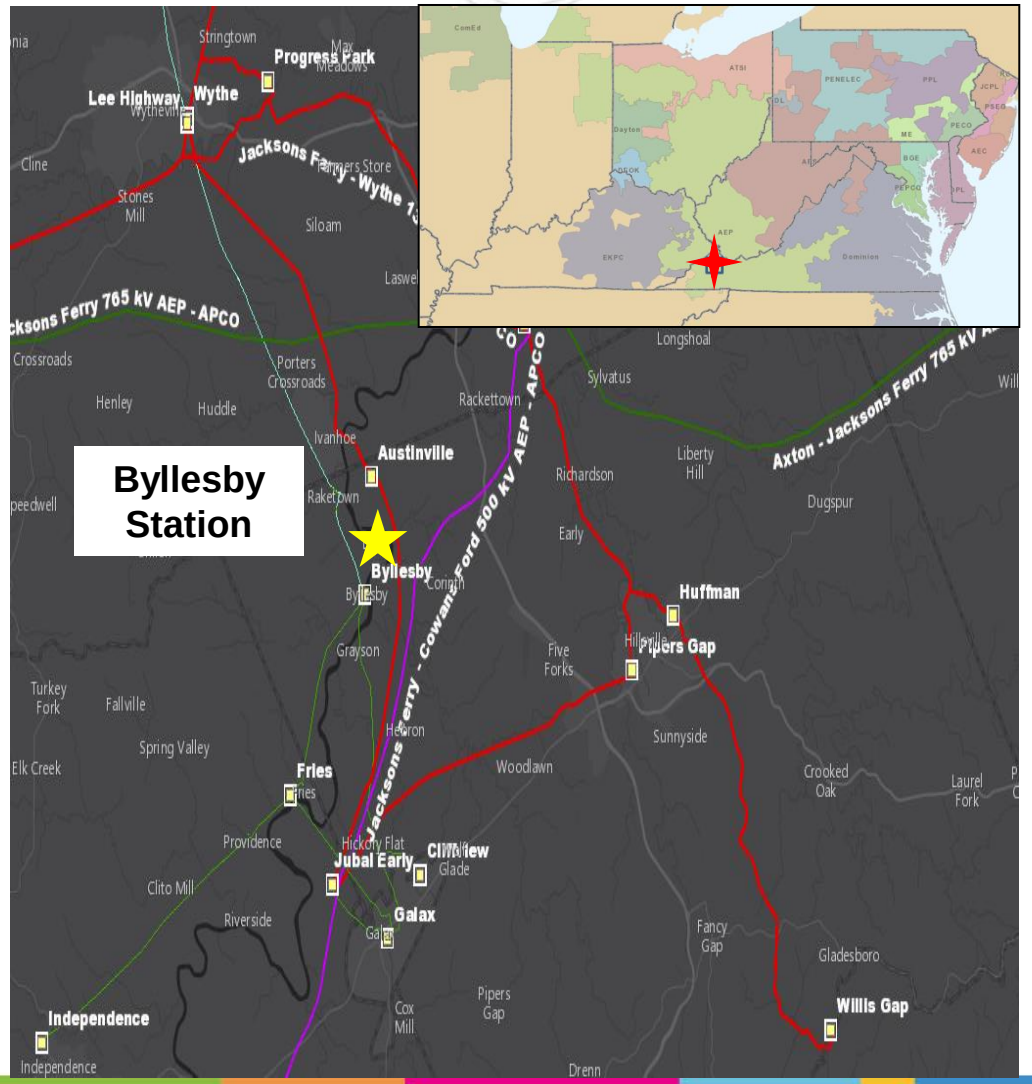
Problem Statement:
Equipment Material/Condition/Performance/Risk:
Breakers “B” & “D” at Byllesby are FK type breakers and are over 50 years old. These are oil breakers that have become more difficult to maintain due to oil handling requirements. In general, oil spills occur often during routine maintenance and failures with these types of breakers. Other drivers include potential PCB content, damage to bushings, and exceeding the manufacturer recommended number of fault operations (10). Byllesby breakers “B” & “D” have experienced 39 and 50 fault operations, respectively.

Selected Solution:
Replace existing Byllesby 69 kV 1200A 17.5kA circuit breaker “B” with 3000 A 40 kA breaker.
Replace existing 69 kV Byllesby 1200A 21 kA circuit breaker “D” with 3000 A 40 kA breaker.
(**S1502**)

Total Estimated Transmission Cost: $0.4M

Projected In-service: 9/01/2018

Project Status: Scoping



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AEP Transmission Zone: Supplemental Clinchfield Breaker Replacement

Previously presented on 1/30/2018 SRRTEP

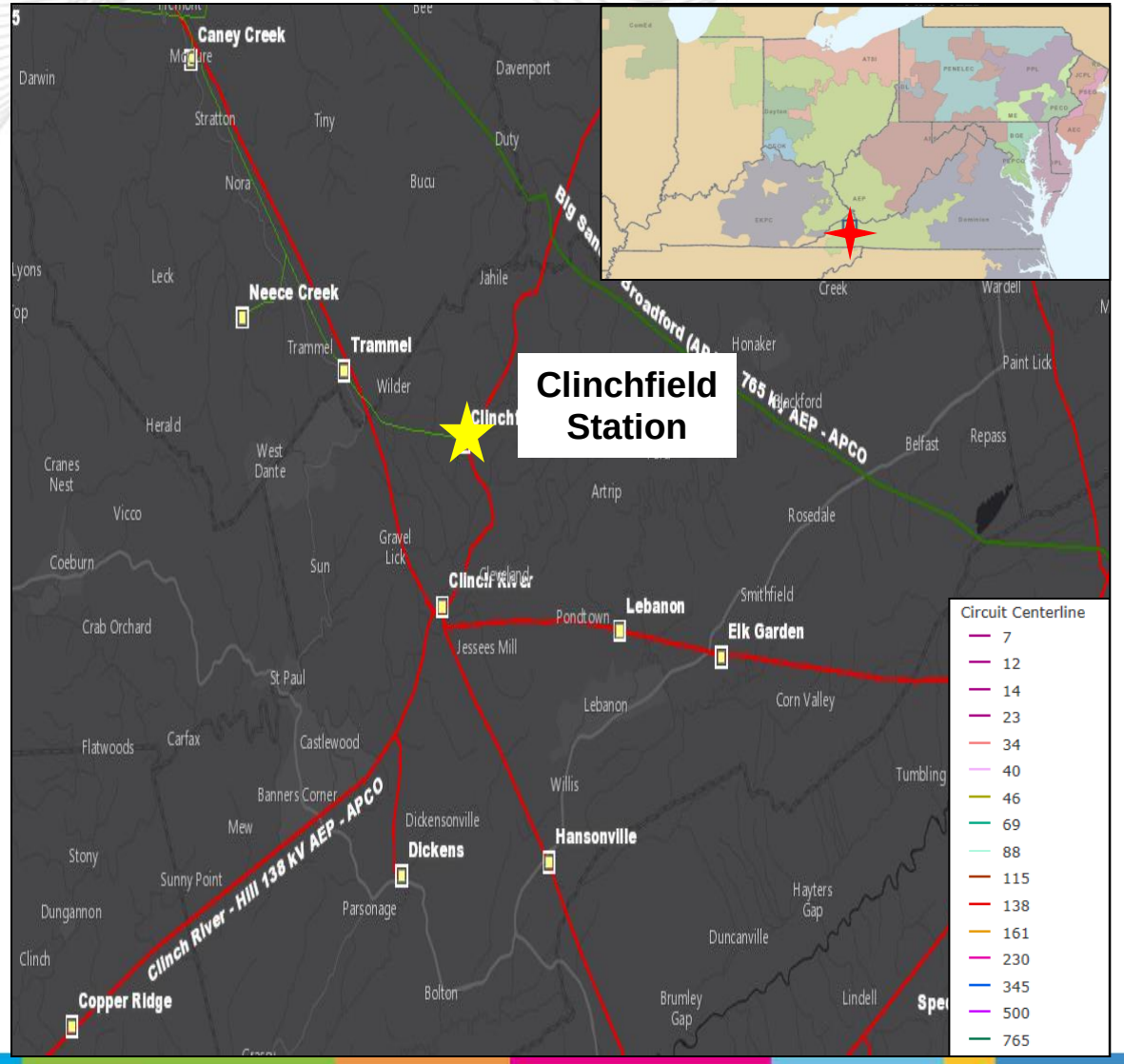
Problem Statement:
Equipment Material/Condition/Performance/Risk:
Breakers “A” & “B” at Clinchfield are FK type oil breakers and are 1958 vintage. These oil breakers are difficult to maintain due to oil handling requirements. In general, oil spills occur often during routine maintenance and failures with these types of breakers. Other drivers include potential PCB content, damage to bushings, and exceeding the manufacturer’s recommended number of fault operations (10). Clinchfield breakers “A” & “B” have experienced 101 and 58 fault operations, respectively. The MOAB/ground switch at Clinchfield will be replaced. MOAB/ground switch combinations induce a fault on the system, tripping remote breakers for a transformer fault, reducing the life and increasing relay coordination complexity for the transformer protection.

Selected Solution:
Replace the existing ground switch MOAB on the high side of the Clinchfield 138/69 kV transformer #1 with a circuit switcher. Replace the existing 69 kV 1200 A 12.5 kA circuit breakers “A” and “B” with 3000 A 40 kA breakers. (**S1503**)

Total Estimated Transmission Cost: $0.4M

Projected In-service: 9/01/2018

Project Status: Scoping



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Previously presented on 1/30/2018 SRRTEP

Problem Statement:

Operational Flexibility and Efficiency

This project will eliminate an existing hard tap and serve the customer with a 69kV phase over phase switch, which is more efficient, convenient, and safer for our field service employees. In addition, the new circuit that the customer will be served off of has 30% less outages per 100 miles for both permanent and momentary outages, as well as having 13% reduced permanent outage duration.

One switch on the through-path of the line (towards Bremen) will be have fully rated attachments (loop-splitting/line–dropping/load-dropping), auto-sectionalizing and SCADA indication/control.

The Forced Outage Index (FOI) calculation supports the installation of MOABs at this location (11.9 score, above the threshold of 6).

Customer Service:

The existing circuit that the customer is on will be undergoing structure replacements that would require the customer to take numerous outages that they are unable to manage. By changing circuits, they can take a more manageable outage that is shorter in duration due to our ability to build the new switch in the clear.

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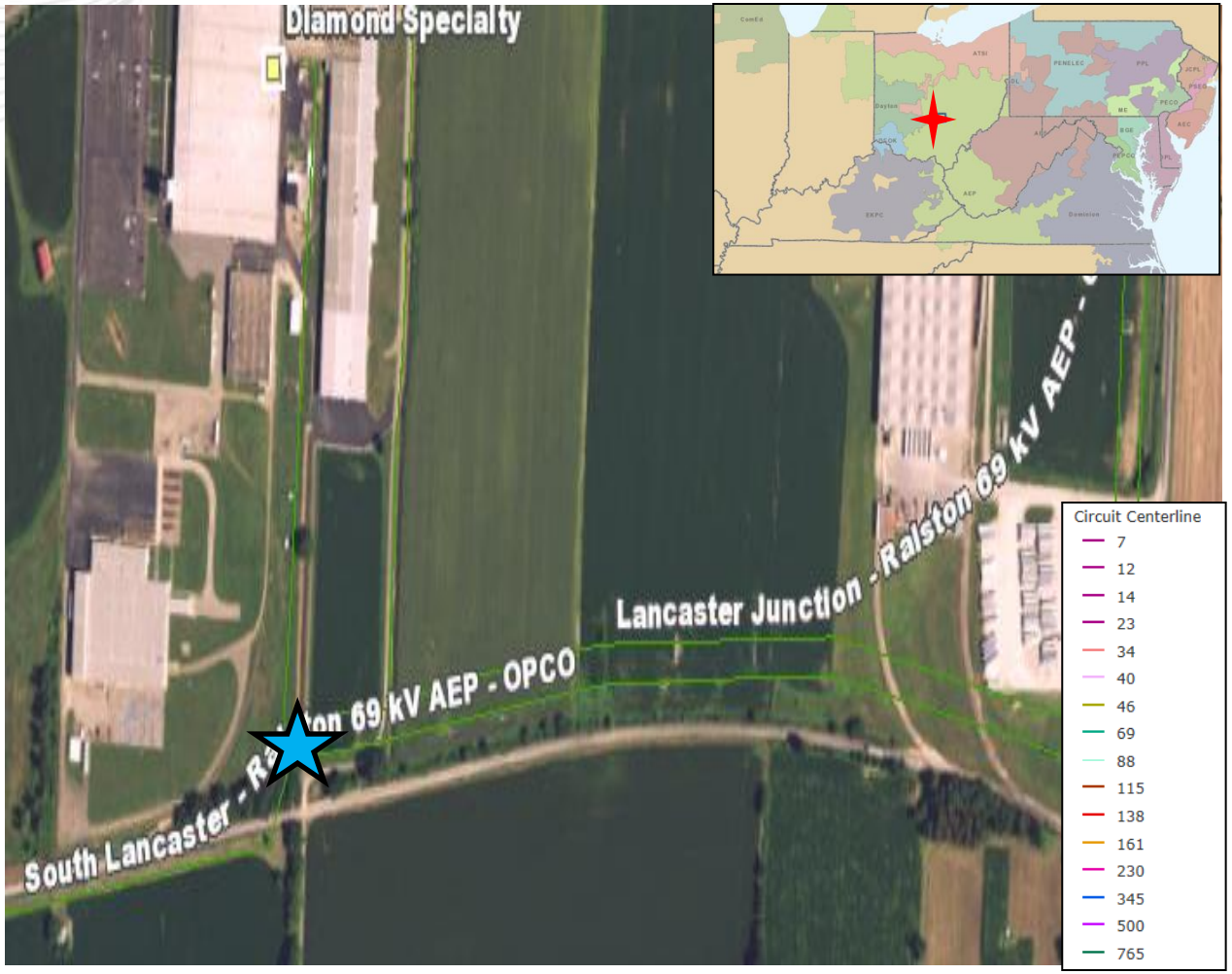

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AEP Transmission Zone: Supplemental Heft Switch Installation

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Selected Solution:
Install new 69kV 2-way switch with MOAB on the E. Lancaster – Ralston – W. Lancaster 69kV circuit. Retire existing structures that are no longer required. (**S1504**)

Total Estimated Transmission Cost: $1.6M

Projected In-service: 06/01/2018

Project Status: Engineering

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AEP Transmission Zone: Supplemental Huff Creek Breaker Replacement

Previously presented on 1/30/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Breakers “A” & “B” at Huff Creek are FK type breakers and are over 50 years old. These are oil breakers that have become more difficult to maintain due to oil handling requirements. In general, oil spills occur often during routine maintenance and failures with these types of breakers. Other drivers include potential PCB content, damage to bushings, and exceeding the manufacturer’s recommended number of fault operations (10). Huff Creek breakers “A” & “B” have experienced 166 and 219 fault operations, respectively.

Operational Flexibility and Efficiency

The MOAB/ground switch will be replaced. MOAB/ground switch combinations induce a fault on the system, tripping remote breakers for a transformer fault, reducing the life of the transformer and increasing relay coordination complexity for the transformer protection.

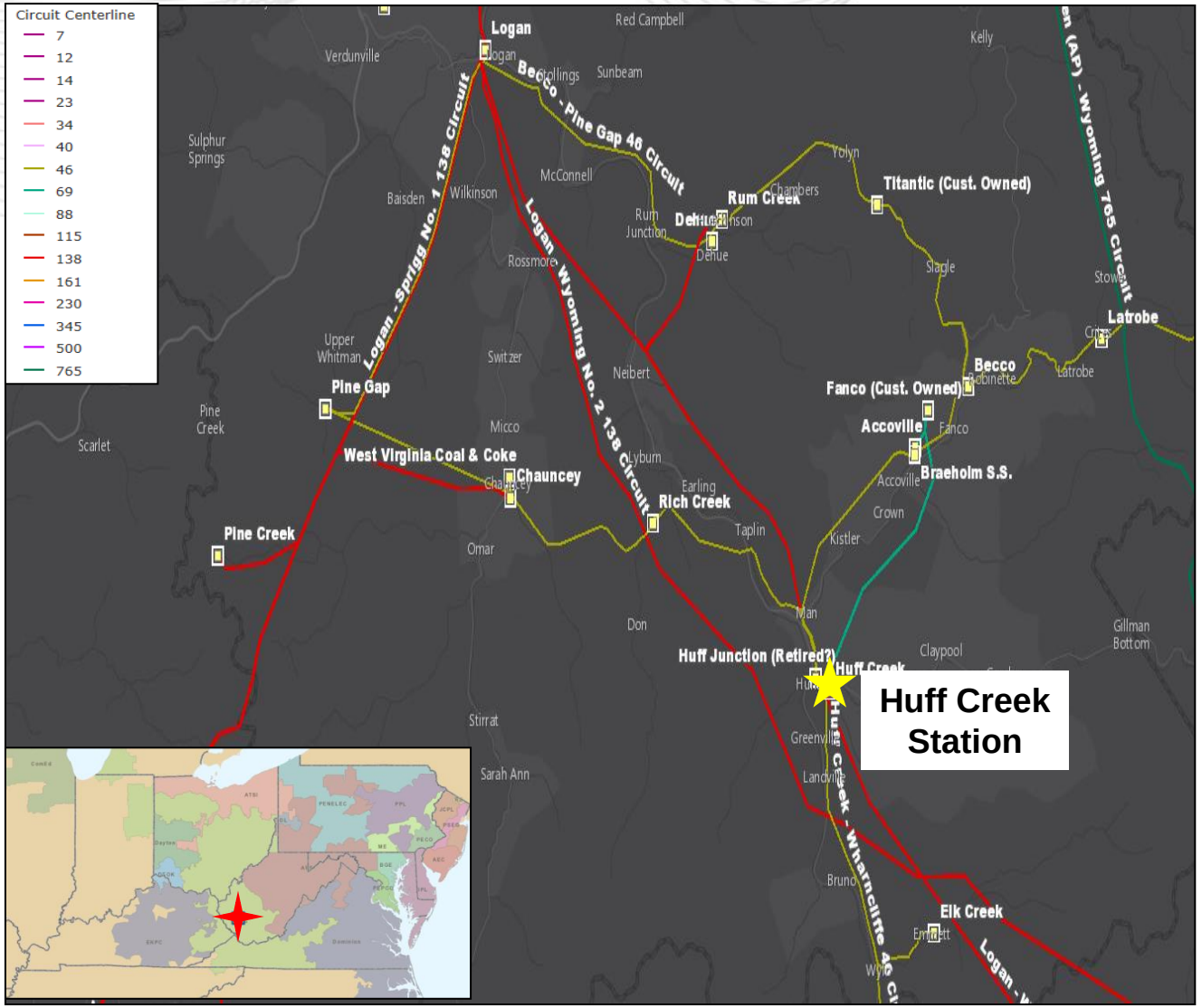
Selected Solution:

Replace existing Huff Creek 46 kV 1200A 21 kA circuit breakers “A” and “B” with 69 kV 3000 A 40 kA breakers. Replace the 138 kV Ground Switch MOAB with a new 3000 A 40 kA circuit switcher. (**S1505**)

Total Estimated Transmission Cost: $0.8M

Projected In-service: 09/01/2018

Project Status: Scoping



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AEP Transmission Zone: Supplemental
Kammer 69 kV Station Rebuild

Previously presented on 1/30/2018 SRRTEP

Problem Statement:
This project is an extension of the PJM Baseline project B2605, Kammer-Moundsville 69kV, which resolves thermal overloads and has a need-date of 6/1/2019.

Equipment Material/Condition/Performance/Risk:
The 5 Kammer 69kV breakers are McGraw-Edison oil-filled units manufactured between 1968-1975 and all lack oil containment systems. The breakers have experienced lifetime fault operations in the range of 12 to 94 operations, above the manufacturer's recommendation of 10 fault operations. The breaker foundations and support structures are deteriorating. The 138-69kV transformer lacks an oil containment system; several surge arrestors are missing from the 69kV circuit exits. The 138kV steel take-off structure is in very poor condition due to rust/corrosion.

The 41 relays in the existing control building consist of 39 electromechanical relays, 1 legacy GE microprocessor relay, 1 static relay, and a legacy RTU unit. Electromechanical relays have significant limitations with regard to fault data collection and retention. The GE microprocessor relay model (DLP) is one of the worst-performing types on the AEP system, due to many sister unit failures, and static relays are very labor-intensive to keep operating. There is not sufficient space in the existing control building to replace these relays and RTU; therefore, a drop-in control module will be installed. The carrier equipment on the George Washington 69kV circuit needs replaced due to not being compliant with AEP Protection standards.

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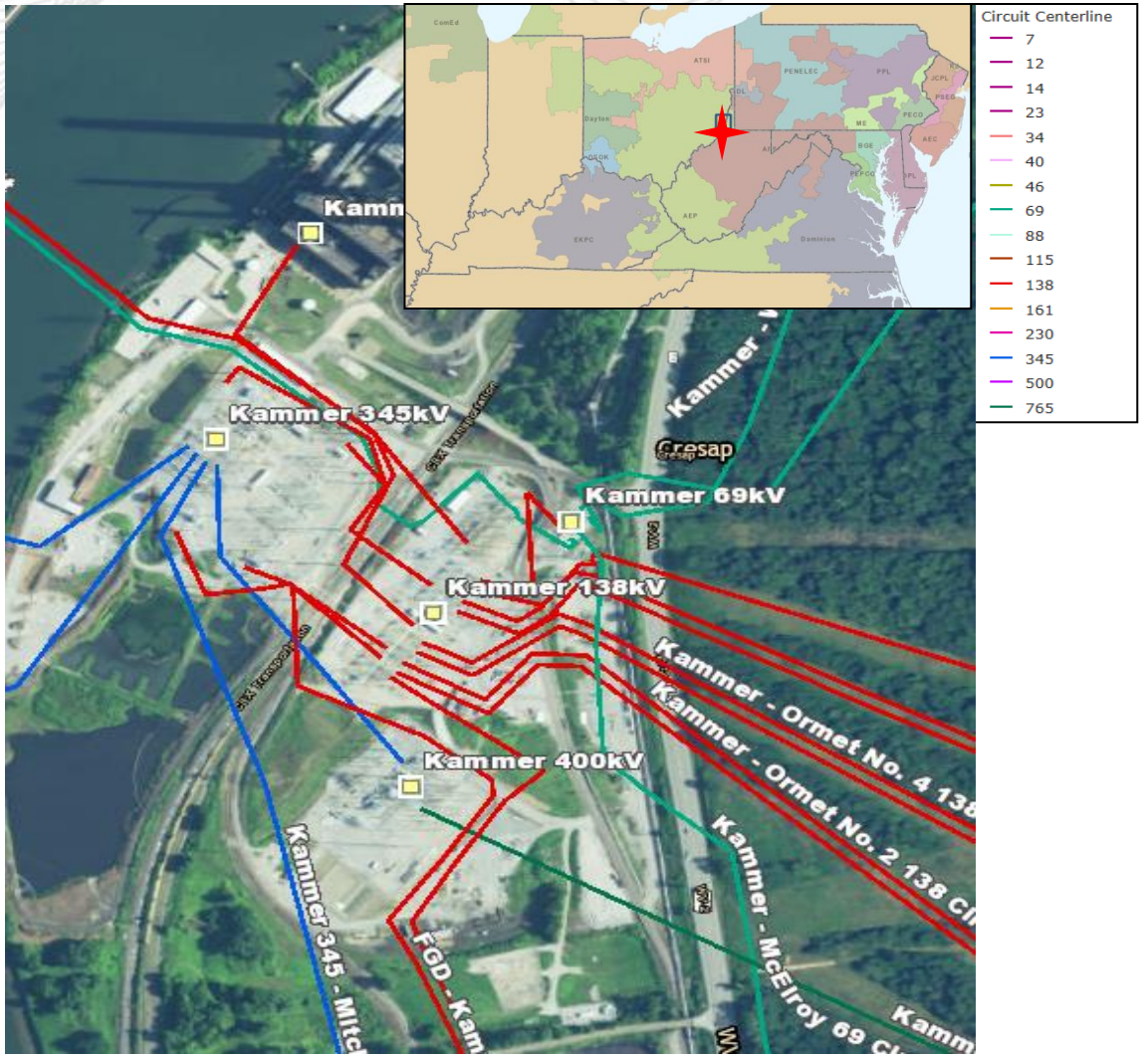

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AEP Transmission Zone: Supplemental
Kammer 69 kV Station Rebuild

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Operational Flexibility and Efficiency

Currently, a breaker-failure condition of 69kV bus-tie breaker GG would trip 69kV breakers KK, JJ, II, HH, as well as 138kV breakers B & B2, for a total of 6 breakers required to isolated the fault, requiring an overly complex protection scheme. In addition, the bus protection zone for 69kV bus 1 overlaps with the 138-69kV transformer protection zone, creating a large differential zone of protection. Also, the 69kV station lacks full SCADA control and real-time metering capabilities, reducing the effectiveness of Transmission Operations when monitoring the local area. As part of the station rebuild, full SCADA and EMS capabilities will be added to the station.

Due to the criticality of the Kammer 138-69kV transformer to the area, it could not be taken out of service for 3 months and relocated during construction, so a new transformer will be installed as part of the project. There are also no mobile 138-69KV transformers of high enough capacity to meet the local sub-transmission loading requirements. The existing Kammer transformer will be returned to stock as a spare for other projects.

Customer Service:

The Kammer 69kV station provides critical start-up power to the nearby Mitchell power plant, so the entire 69kV station cannot be taken out of service for a lengthy duration. In addition, taking the Kammer 69kV station out of service would make the following customer stations radially served during construction (6-9 months): AEP Distribution stations- 2, Industrial stations- 4. Plus, the Kammer-Powhattan 69kV loop (circuits #1 & #2) is only sourced from Kammer 69kV, with no alternate feed on the system, so it is impossible to take Kammer 69kV entirely out, due to the customers served on this local loop (1 AEP Distribution & 1 Industrial load).

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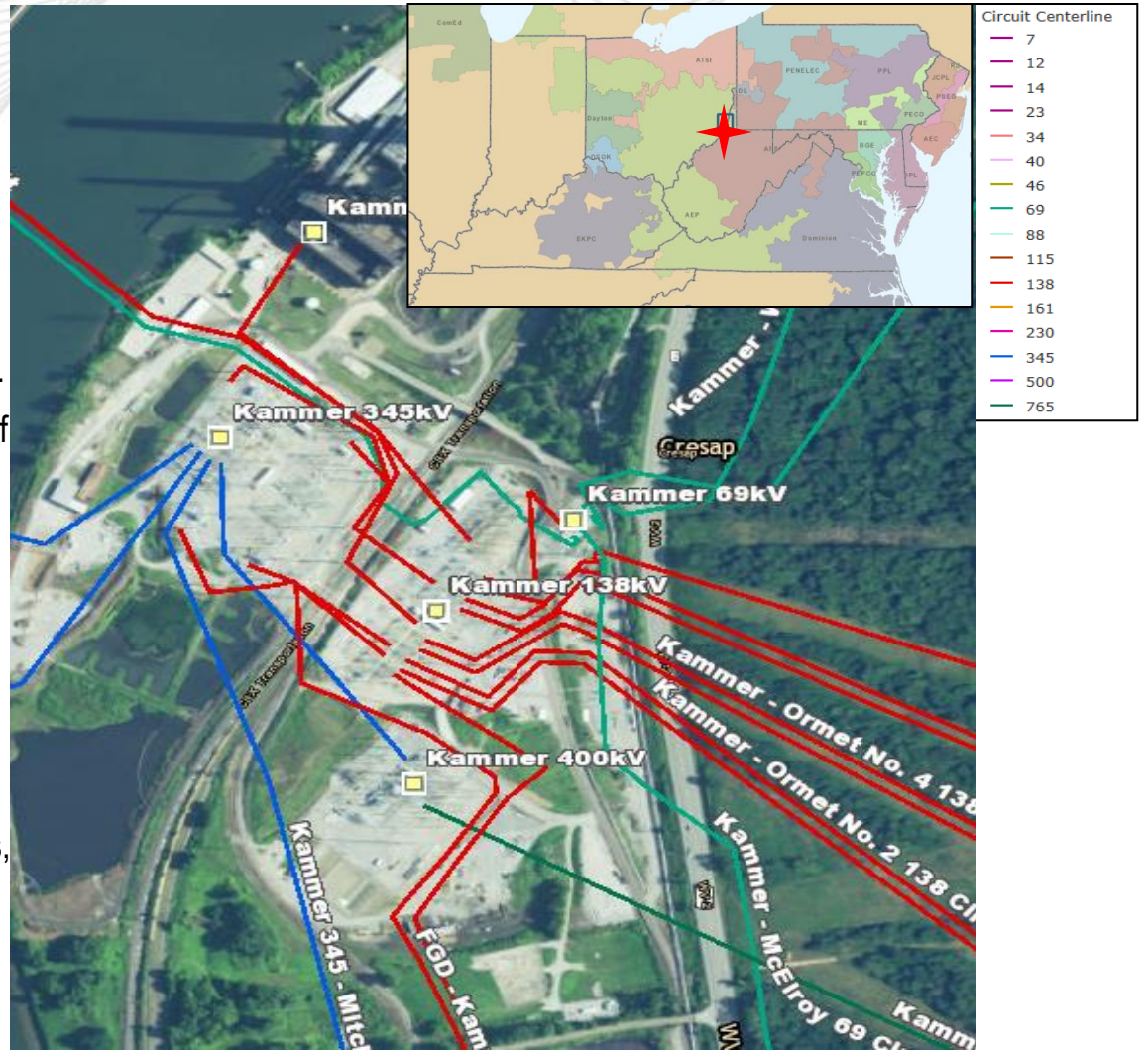

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AEP Transmission Zone: Supplemental
Kammer 69 kV Station Rebuild

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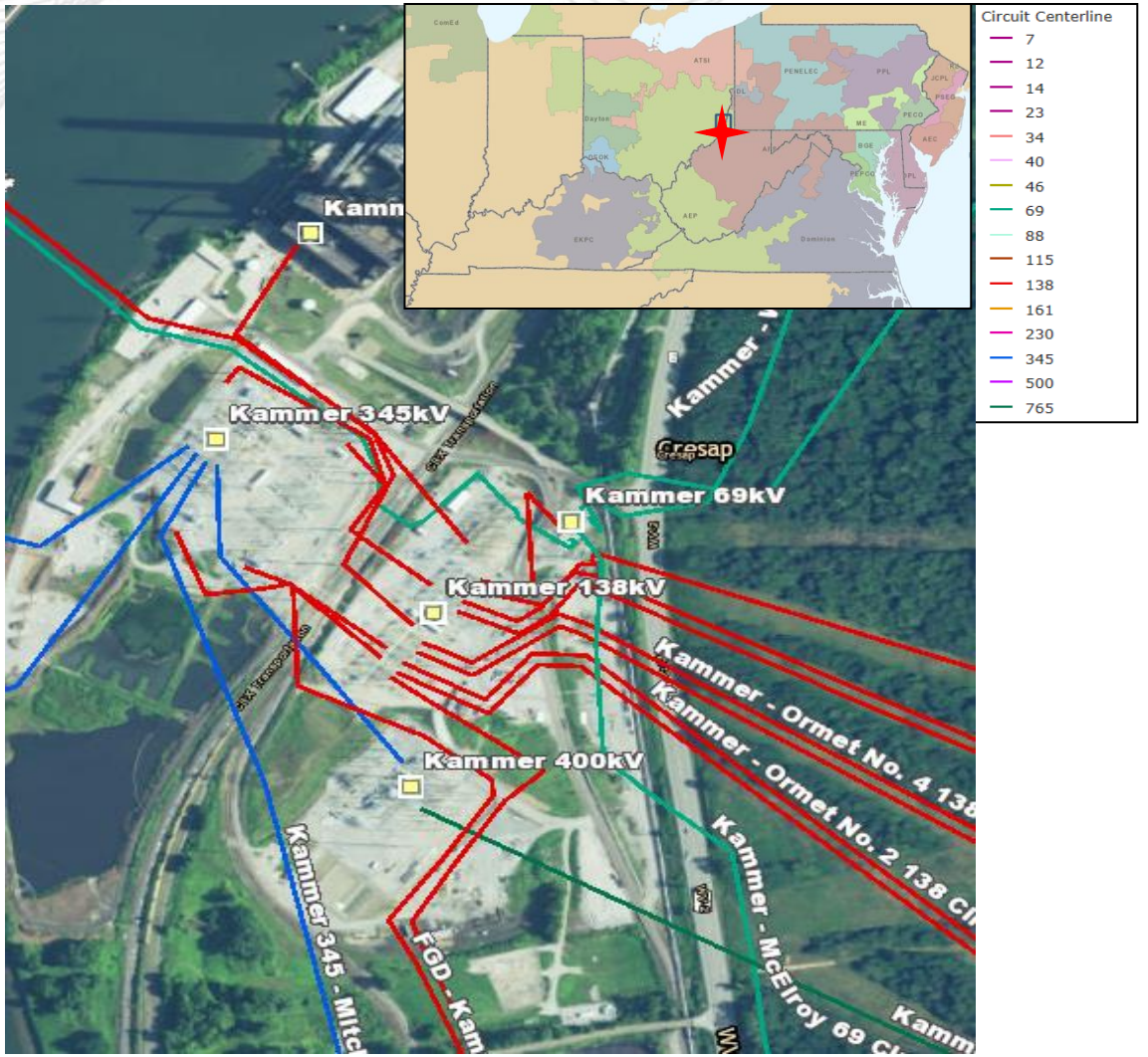
Selected Solution:
Kammer Station: Construct a new 69kV breaker-and-a-half station with 8 breakers (3000 A, 40kA); 4- 69kV circuit exits and 1- 138-69kV transformer position; install a 28.8 MVAR, 69kV cap bank; install a new 138-69kV transformer (130 MVA) to facilitate construction in-the-clear. (**S1506.1**)
Estimated Cost: $7.7M

Remove existing 69kV station entirely (5 breakers, bus-work, etc.). (**S1506.2**)
Estimated Cost: $0.2M

Total Estimated Transmission Cost: $7.9M

Projected In-service: 06/01/2019

Project Status: Engineering



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AEP Transmission Zone: Supplemental South Bend Breaker Replacements

Previously presented on 1/30/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

At South Bend station, 34.5 kV Circuit Breakers K, J, M, P and R and 69kV Circuit Breaker A are GE 'FK' oil-filled breaker manufactured in 1968 and 1953. The 34.5 kV breakers are 2000A 42 kA models. The 69 kV breaker is an 1800 A 27 kA model. These Circuit Breakers are oil filled Breakers without oil containment. Breaker A (114), J (75), P (19), and R (109) are above the manufacturer recommend threshold for full fault operations. 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 numerous issues related to age, high moisture readings, fault operation exceeding manufacturer life expectancy and bushing maintenance issues. The 34.5kV Circuit Breaker N is a SF6 breaker which is not build to 69kV standards and the 34.5kV South Bend Station has future plans of being converted to 69kV, so circuit breaker N was replaced with a 69kV breaker.

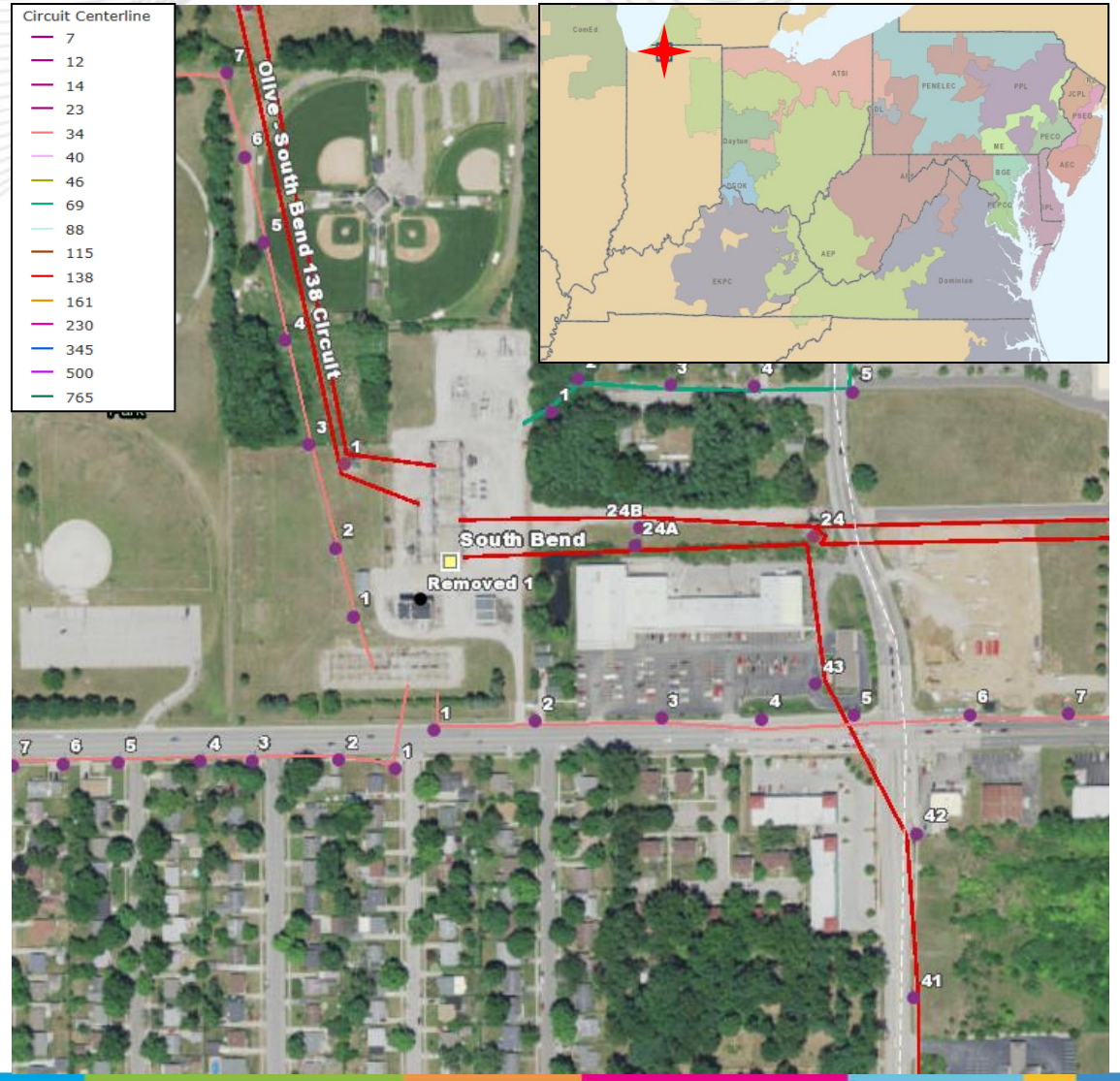
Selected Solution:

Replace South Bend 69kV circuit breaker A and 34.5kV circuit breakers K, J, M, N, P and R with 3000A 40kA breakers. (**S1507**)

Estimated Transmission Cost: $4.6M

Projected In-service: 3/31/2018

Project Status: Under Construction



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AEP Transmission Zone: Supplemental
Stubey Road – Sturgis Rebuild

Previously presented on 1/8/2018 SRRTEP

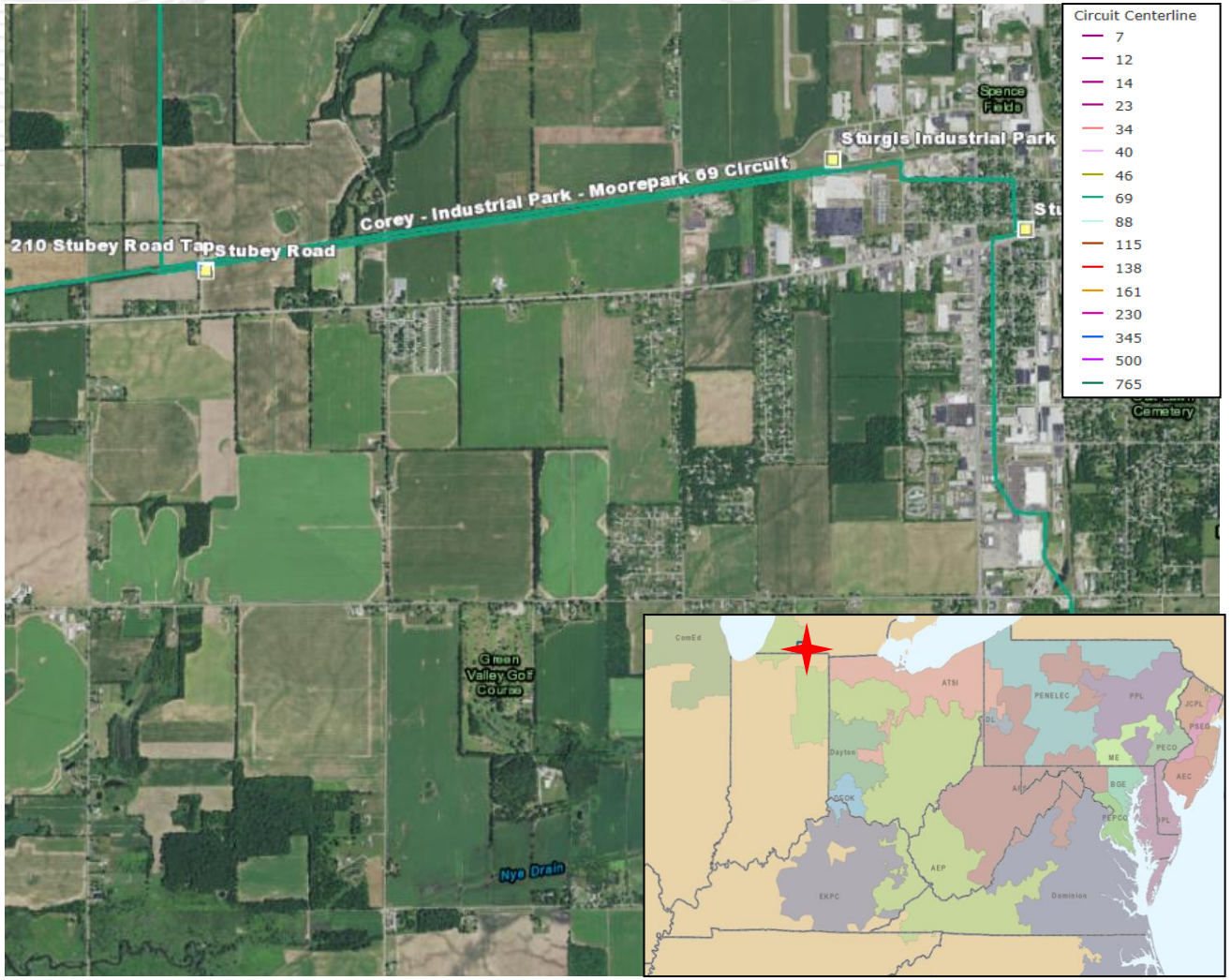
Problem Statement:
Equipment Material/Condition/Performance/Risk:
The 3 mile long Stubey Road – Sturgis line portion currently is subject to 18 open conditions and is wood pole construction from 1953 with 4/0 ACSR and 556 ACSR conductor (50 MVA rating). This line is currently subject to stolen, broken and missing ground lead wire; corroded shield wire; and burnt or broken insulators.

Selected Solution:
Rebuild the ~3 miles of the Stubey Road – Sturgis 69kV circuit utilizing 795 ACSR (76 MVA rating) (**S1522**)

Estimated Transmission Cost: $5.3 M

Projected In-service: 03/30/2018

Project Status: Construction



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AEP Transmission Zone: Supplemental
Anchor Hocking - Price Rebuild

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

From 2013-2016, this circuit has had 3 permanent outages mainly due to T-Line related issues and accumulated 215,119 CMI. Due to the historical performance of this line, replacement of the 6.5 mile section is recommended.

This line has a vintage of 1951, is wood pole construction with 4/0 ACSR conductor (50 MVA rating), and has 20 open conditions. The original poles, crossarms and support braces are undersized in terms of both height and strength with respect to current standards, and may not be able to sustain higher wind speeds. In addition, many of the poles are constructed using crossarms with suspension insulator assemblies which have proven to be susceptible to failures across AEP footprint and are not part of AEP's current standards. The life expectancy of these crossarms is far less than the poles and requires constant replacement. The line currently uses 3#8 Copperweld shield wire which is also obsolete and very difficult to repair and splice due to lack of availability. Finally, the line is currently only grounded at every other pole, which increases safety risk to personnel and general public.

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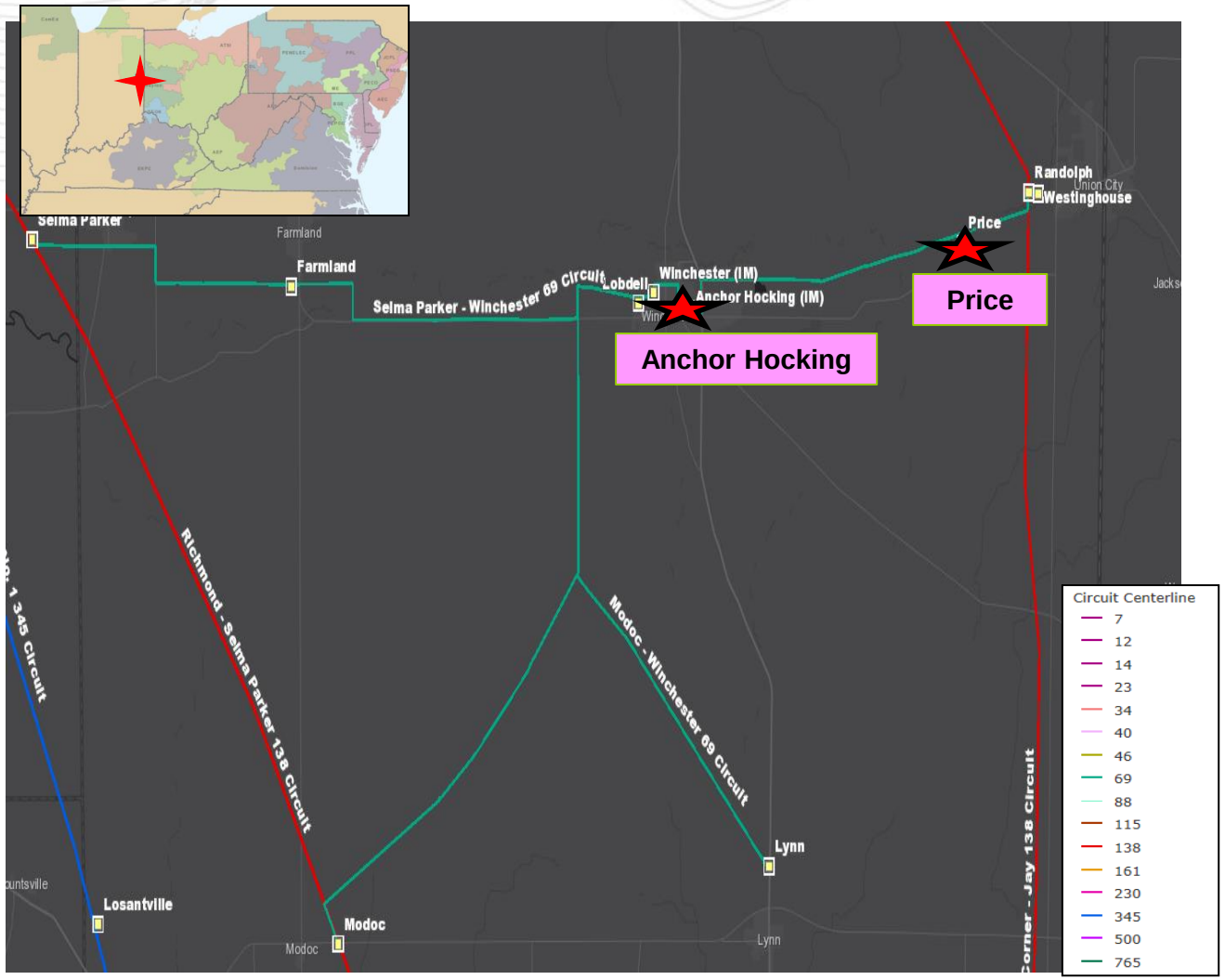

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AEP Transmission Zone: Supplemental
Anchor Hocking - Price Rebuild

Continued from previous slide…

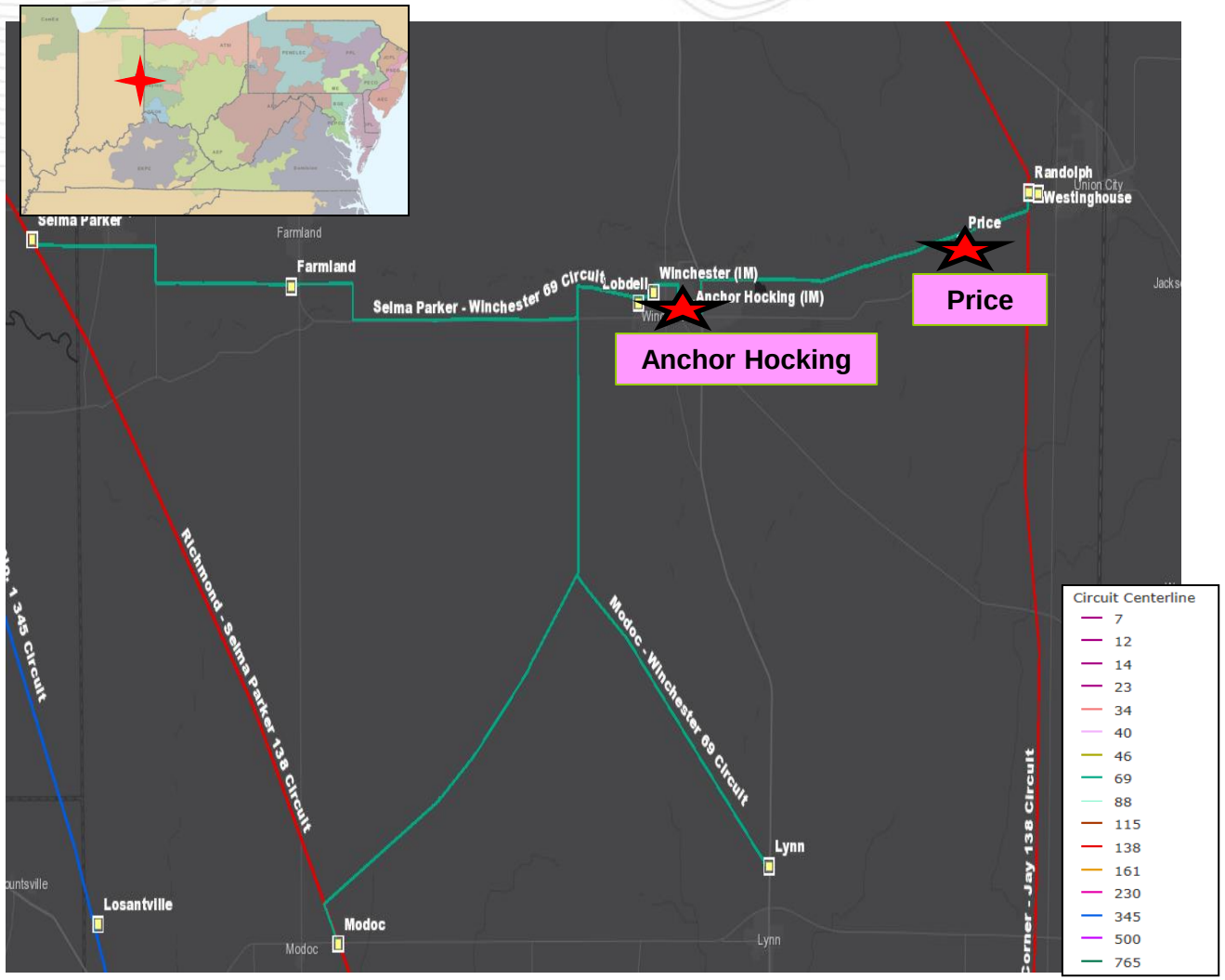
Selected Solution:

Rebuild from Structure 1 near Anchor Hocking Station to structure 139A near Price station (~6.5 miles) using 556.5 ACSR 26/7 (SN:102 SE:141 WN:129 WE:159) (**S1508**)

Total Estimated Transmission Cost: $10.6M

Projected In-service: 12/01/2019

Project Status: Scoping



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AEP Transmission Zone: Supplemental
Carbondale - Tower 117 Rebuild

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

From 2013 – 2016 the Carbondale – Tower 117 69 kV (vintage 1938) circuit has experienced 23 permanent and 8 momentary outages resulting in over 3.4M customer minutes of interruption. 5.6 miles of this line has no shielding, which leaves it susceptible to outages due to lightening. AEP's Transmission Line Engineering group has determined shielding cannot be added to the existing structures In addition, the 9.8 miles we are rebuilding (out of a total of 21.1 miles) have 23 current open A conditions on 79 structures of single circuit wood pole construction. These conditions consist of rotted/broken poles, rotted/broken crossarms, damaged shield wires, burnt poles, and woodpecker/insect damage. The conductor on the sections being rebuilt varies in size from 3/0 ACSR, 4/0 ACSR, and 556 ACSR (44 MVA rating). The original conductor over the course of its 79 year life has endured multiple contacts and severe weather conditions.

The existing 600 A phase over phase (P.O.P.) switch will be replaced with a 1200 A P.O.P. due to the line rebuild at Gauley Mountain.

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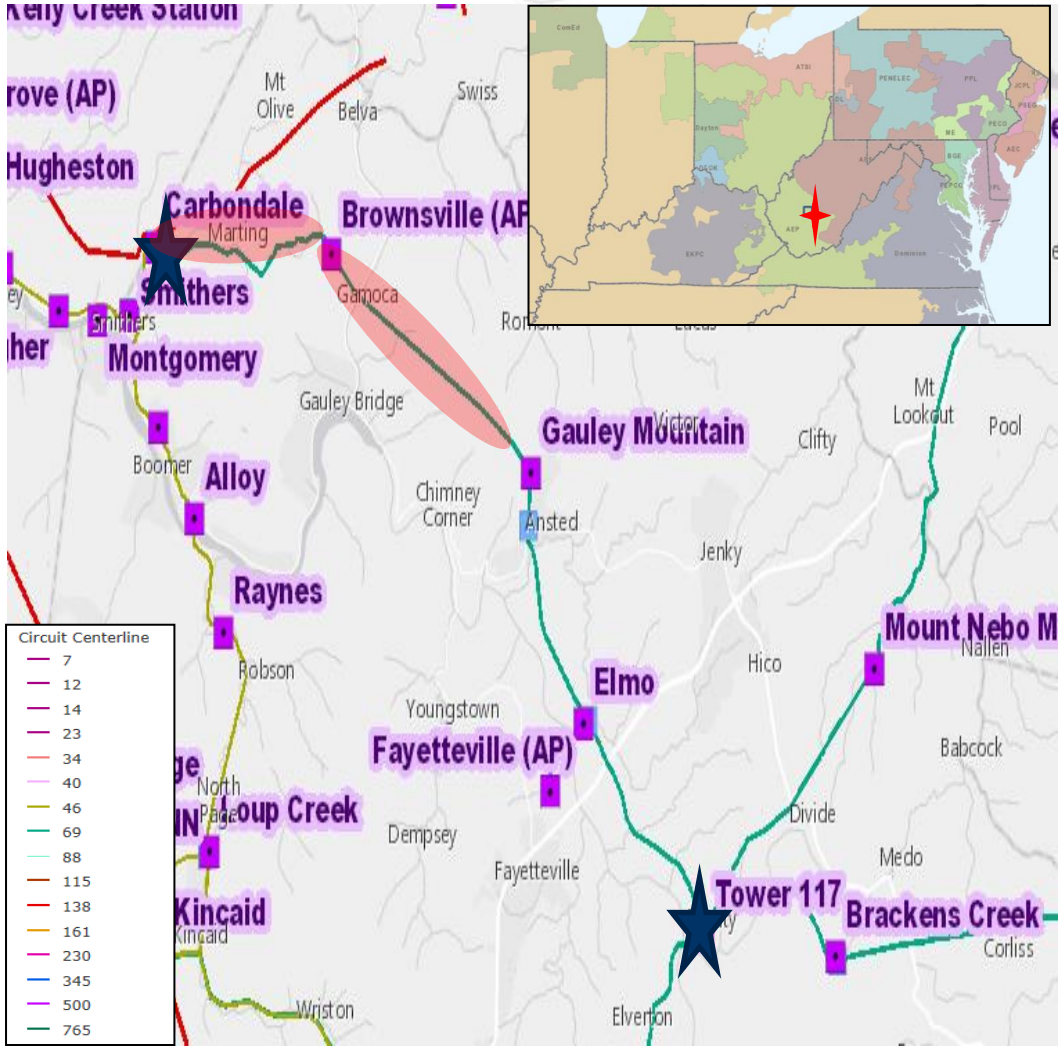

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AEP Transmission Zone: Supplemental
Carbondale - Tower 117 Rebuild

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Selected Solution:

Rebuild ~4 miles of the Carbondale – Brownsville 69 kV line utilizing 795 ACSR conductor (125 MVA rating) at 69 kV standards with steel equivalent H frame structures. Rebuild ~5.6 miles of the Brownsville – Gauley Mountain 69 kV line utilizing 795 ACSR conductor at 69 kV standards with steel equivalent H frame structures. Rebuild 0.1 miles of the Elmo – Tower 117 69 kV line over route 19 with 795 ACSR conductor at 69 kV standards. (**S1509.1**)

Estimated Cost: $25.5M

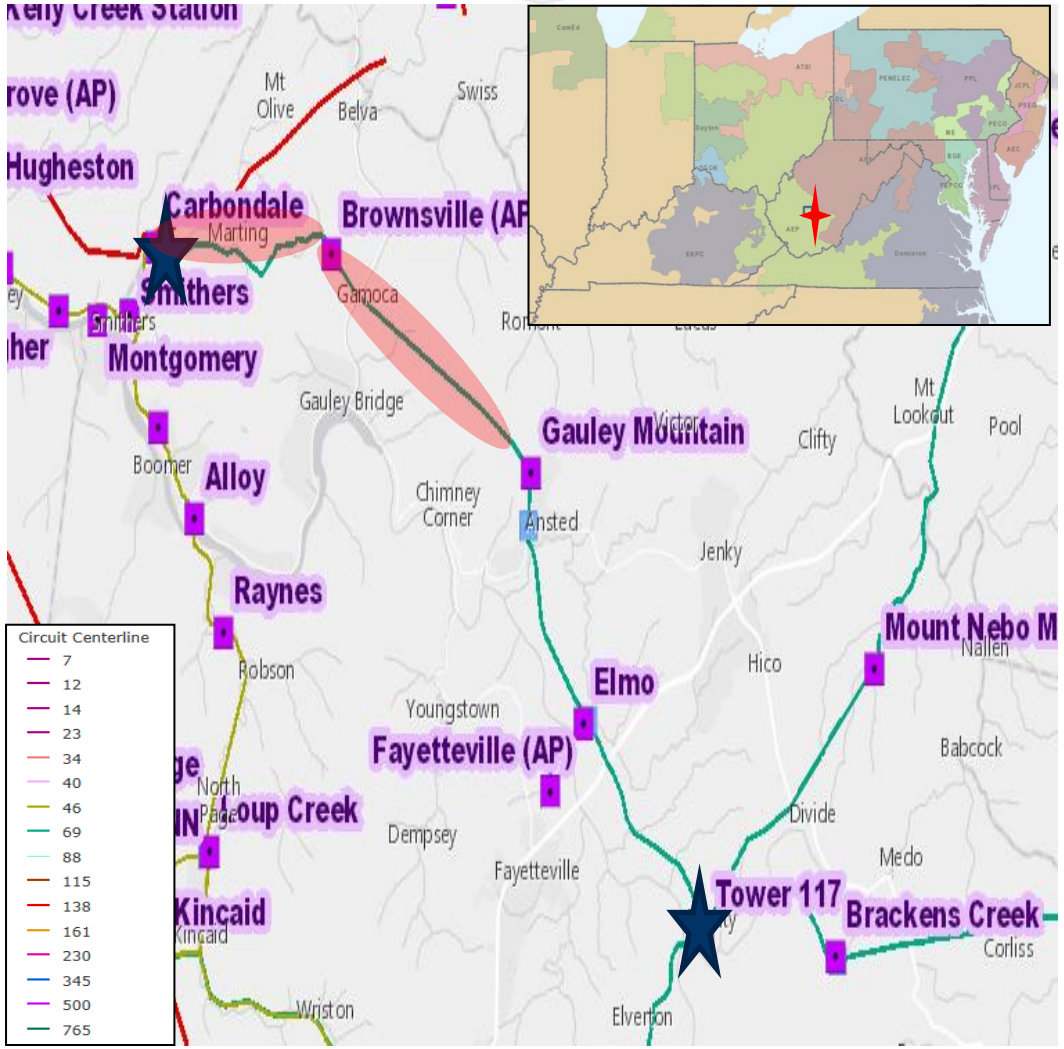
Replace Gauley Mountain switches with a new 3 way motorized Phase Over Phase structure. (**S1509.2**)

Estimated Cost: $0.5M

Total Estimated Transmission Cost: $26.0 M

Projected In-service: 12/01/2019

Project Status: Engineering



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AEP Transmission Zone: Supplemental
Kirk Rehab and Upgrades

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Several circuit breakers at Kirk station are showing signs of deterioration. These breakers are all (with the exception of CB 106N) oil breakers installed in 1975. Oil 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. CB 106N is an SF-6 breaker manufactured in 1986. To maximize cost effectiveness, CB 106N will be replaced at the same time. The drivers for replacement of these breakers are bushing damage, no repair part availability, number of fault operations, system impact scoring, and trouble report scoring. The following CB's will be replaced: 102S, 102C, 106S, 106C, & 106N. CB 102N will be retired.

Transformers 1 and 4 are also showing signs of deterioration. Drivers for Transformer 1 replacement include accessory damage (bushings), dielectric strength breakdown (winding insulation), and short circuit strength breakdown (due to the amount of through fault events). Drivers for Transformer 4 replacement include those same drivers associated with Transformer 1 with the addition of high temperature scoring (winding thermal condition).

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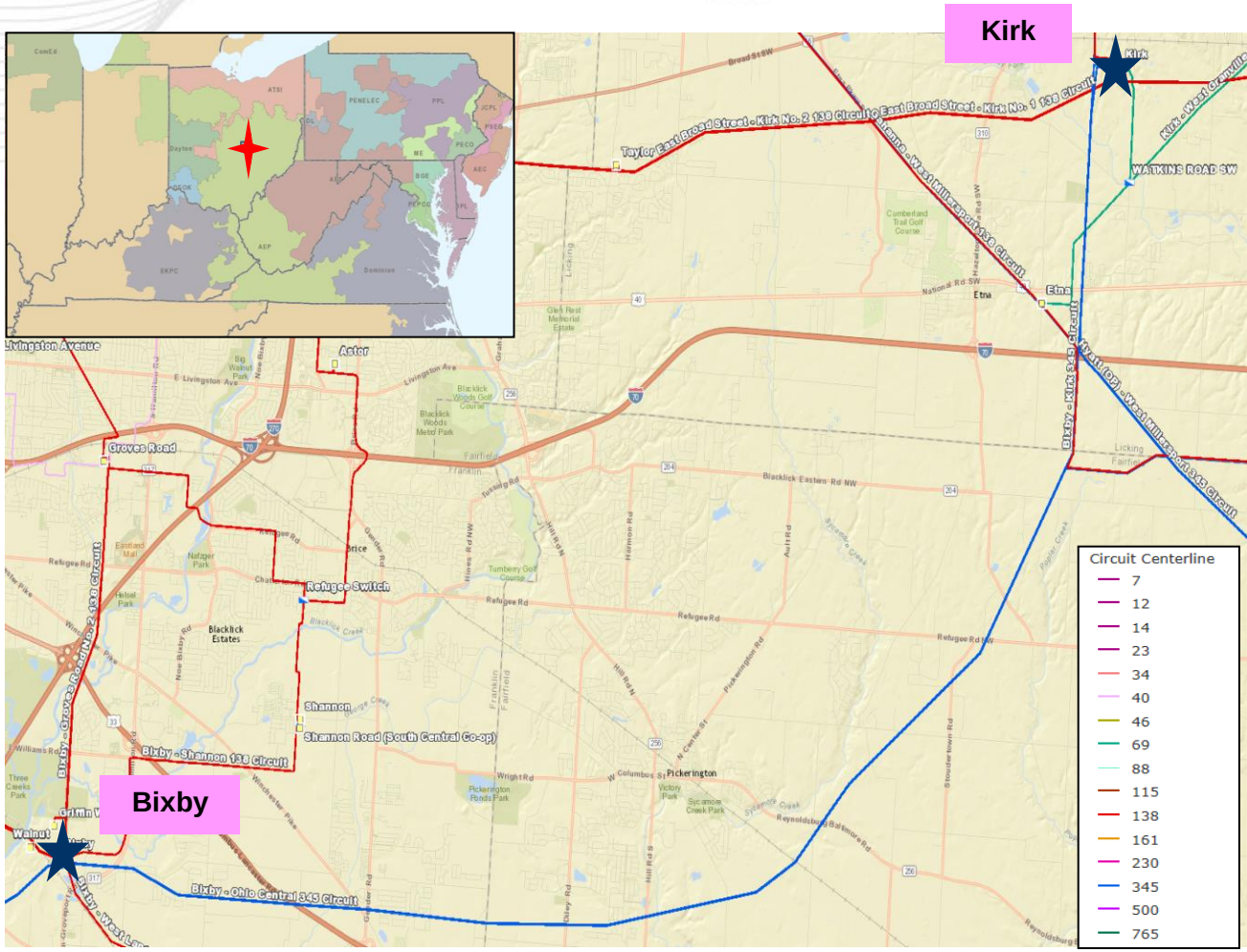

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AEP Transmission Zone: Supplemental
Kirk Rehab and Upgrades

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Operational Flexibility and Efficiency:

Transformer #4's high side lead and the 345kV bus #1 are combined into the same protection zone such that a XF#4 fault intermittently outages all three of the 345kV lines until MOAB X4 opens (this is undesirable for EHV).

In order to protect a XF#4 fault condition involving a breaker failure scenario on any of the three 345kV breakers, a high speed ground switch on the 345kV (Z4) is required. Intentionally putting faults on the 345kV system is not desirable and non-standard.

The 345kV XF#4 high side lead differential relays limit the WE rating of all three 345kV lines. This is not desirable for a relay thermal to limit EHV lines and the condition cannot be improved without replacing the relays.

A fault in XF#1 or XF#2 or the 138kV high side lead, will outage both XF#1 and XF#2 since their protection zones are combined. By separating them, a fault in XF#1 will no longer affect XF#2 and vice versa. The current scheme requires a ground switch in order to clear low side XF#1 faults with the combined transformer configuration. There is currently only one relay system providing protection for the 138kV lead between CB-106N/106C and the XF high sides (non-standard). At 138kV our current standard calls for redundant systems. It is also difficult to do maintenance on this single relay system without taking outages on XF#1 and XF#2 which is also undesirable.

A breaker failure on CB-102C, CB-102N, CB-E, CB-D, or CB-C will outage all of Kirk's 345kV. This is not desirable as Kirk is a critical station in the East Columbus area.

East Broad St. circuit #2 and West Hebron circuit are radially fed from the 103S and 105C CB's respectively. Reliability and circuit breaker flexibility for these circuits and the 138kV yard as a whole will be improved by adding CB's and completing the through path strings.

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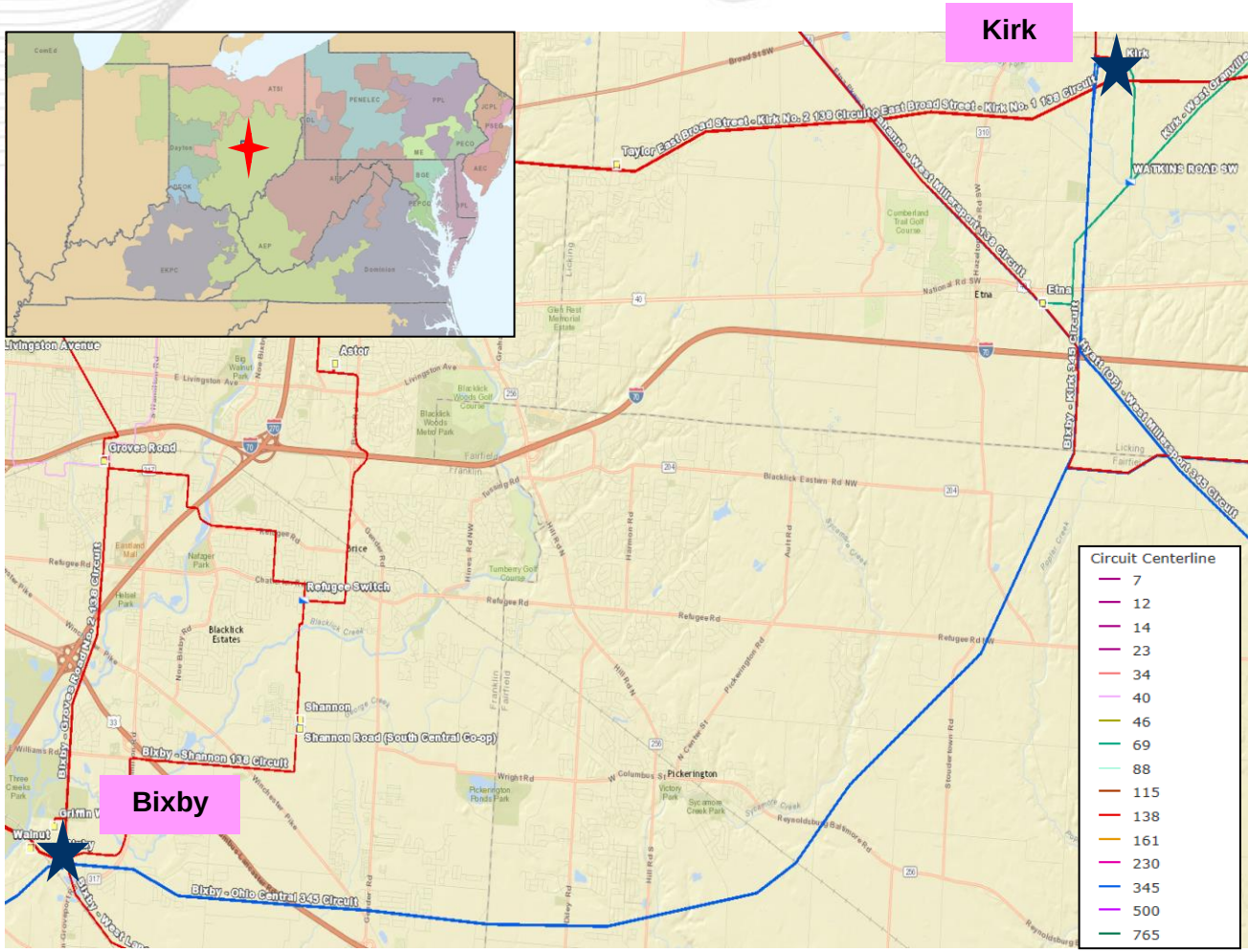

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AEP Transmission Zone: Supplemental
Kirk Rehab and Upgrades

Continued from previous slide…

Kirk-Bixby 345kV line is limited by various line risers at Kirk and Bixby as well as thermal relay limits at Kirk. Relaying and line risers at Kirk will be replaced with the replacement of transformer #4 and the new 345kV CB's. Line risers at Bixby also need to be replaced under the same line outage to maximize the benefit of the outage. The next limiting factor for the circuit is a line switch at Bixby. Replacing this switch now further increases the SN line capability by approx. 49 MVA and allows for a potentially larger rating increase without an additional outage if a future sag study is done on the line.

Transmission operations requested upgrading the Kirk 345kV yard to breaker and a half, completing the 138kV strings, and separating T1 & T2 for the reason of improved operational and maintenance flexibility.

Customer Service:

AEP-Ohio has agreed with separating the Distribution transformer lead and the 138/69kV transformer lead as well as the replacement of T#1 and CB's 50 & 51. They have also asked for disconnect switches for a future Distribution transformer.

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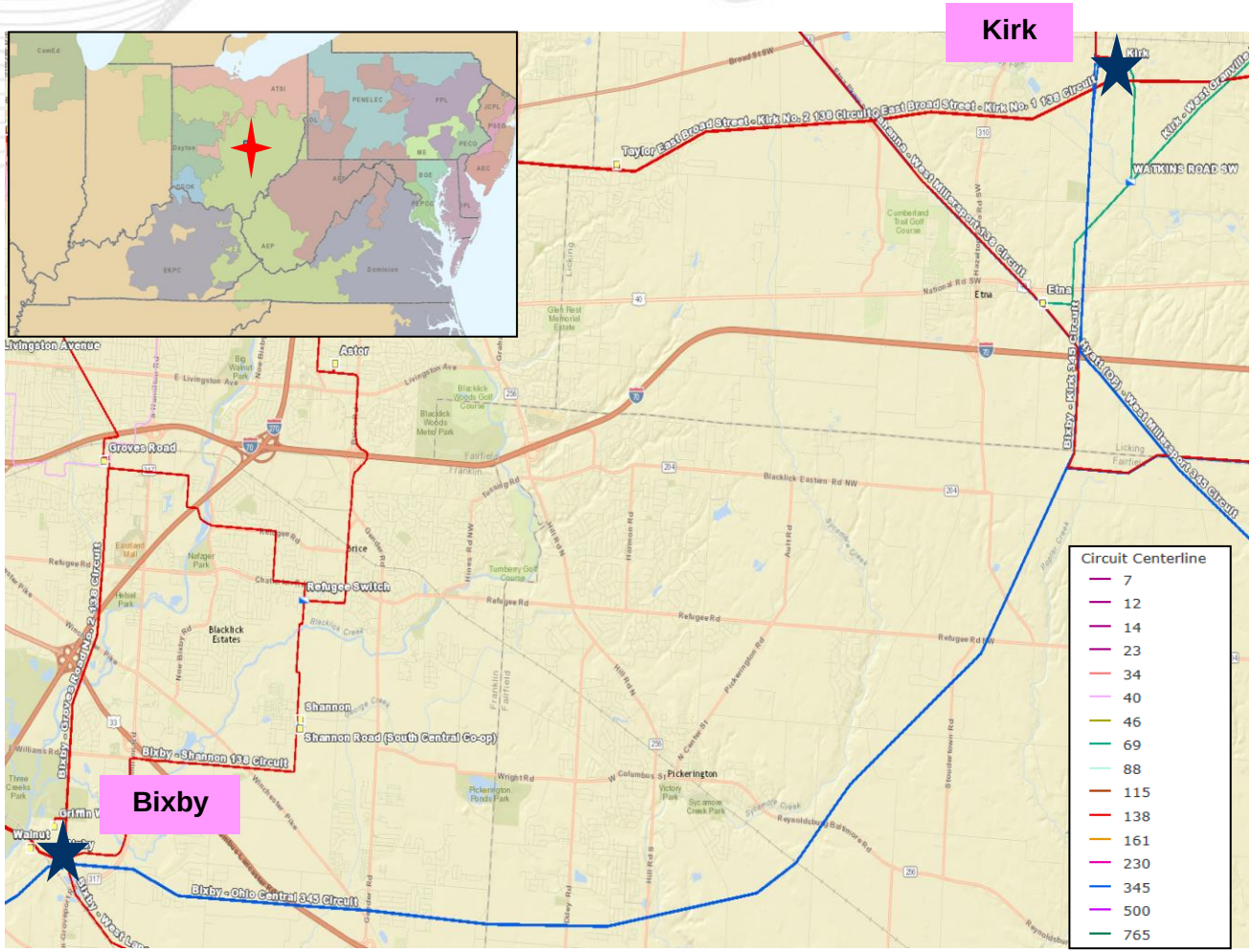

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AEP Transmission Zone: Supplemental
Kirk Rehab and Upgrades

Continued from previous slide…

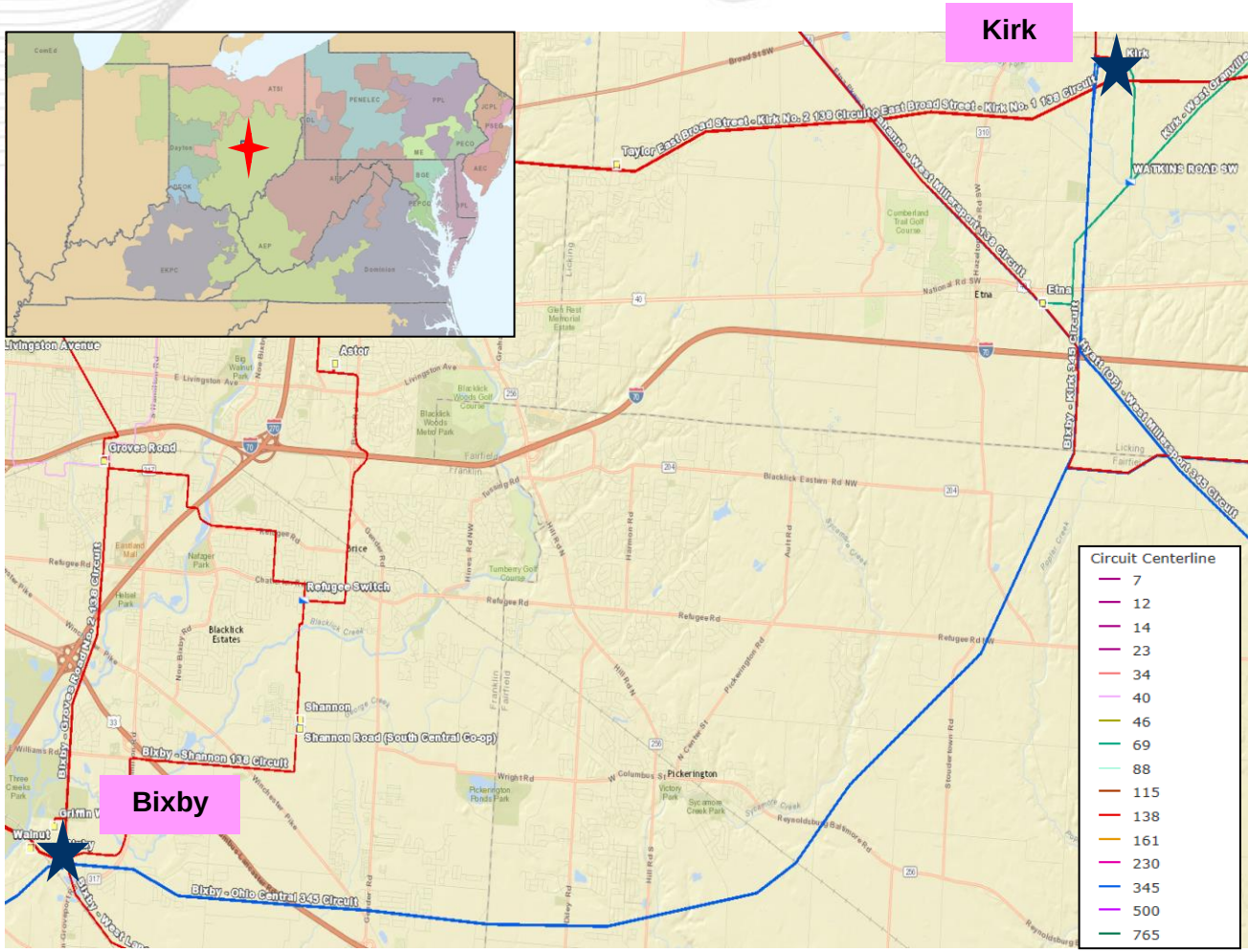
Selected Solution:

At Kirk, Install 4-345kV 3,000A CB's & end bus and complete the 345kV breaker and a half configuration. Replace 345/138kV XF with 675 MVA unit. Connect in different 345kV bay and on new 138kV string before removing old unit. Upgrade 2-138kV 4,000A CB's & retire 1 CB on 102 string. Install 2-138kV 4,000A CB's on new 104 string. Install 3 new 3,000A 138kV CB's and complete 103 & 105 strings. Upgrade 3-138kV CB's with 3,000A on 106 string. Separate 138/69 & 138/34kV XF connections and install 1-138kV ckt switcher on distribution bank.
Replace 138/34kV XF and 2-34kV CB's. (**S1510.1**) Estimated Cost: $19.7M
At Bixby, replace Kirk 345kV line risers and line switch and upgrade relaying (**S1510.2**) Estimated Cost: $1.9M
Upgrade relaying at Jug Street (**S1510.3**) Estimated Cost: $0.4M
Upgrade relaying at West Millersport (**S1510.4**) Estimated Cost: $0.8M
Upgrade relaying at West Hebron (**S1510.5**) Estimated Cost: $0.2M

Total Estimated Transmission Cost: $23.0M

Projected In-service: 12/01/2019

Project Status: Engineering



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AEP Transmission Zone: Supplemental
LuK USA and Madisonburg Loop

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Customer Service:

LuK USA, LLC has requested a new 69kV delivery point (Clutch Switch) to serve a peak demand of 11 MVA, as their load growth has outgrown the local distribution in the area. LuK USA, LLC in Wooster, OH performs sales, design, development and manufacturing of clutch systems and torque converters for the automotive industry. A fully executed Letter of Commitment (LOC) has been established with the customer.

Equipment Material/Condition/Performance/Risk:

North Wooster has two long radial circuits (7.5 miles & 5 miles) serving three Holmes-Wayne Co-Op delivery points, two AEP Ohio substations, and LuK USA. These radials were constructed in the 1940s with a mix of 556 ACSR, 4/0 AL, #2 CU, and 1/0 ACSR (37 MVA rating) and have roughly 100 open category A conditions combined. The total peak summer load connected to these radials will be approximately 35 MW. These radials serve the largest shopping area for the Wooster community, four different medical offices, Green Local Schools and the Wayne County Vocational school. Any extended outage on these radials not only negatively impacts a large number of customers in numerous industries, it is harmful in the eyes of the customer and Holmes-Wayne/AEP Ohio's public image suffers because of it.

Operational Flexibility and Efficiency:

On the 20 miles of 69kV in North Wooster, only two automatic sectionalizing devices exist to support the four AEP Ohio substations and three Holmes-Wayne Co-Op delivery points. Most outages on the 69kV network would thus require manual operation of switching devices, which leads to longer outage times for sensitive customers (shopping centers, medical facilities, and local schools).

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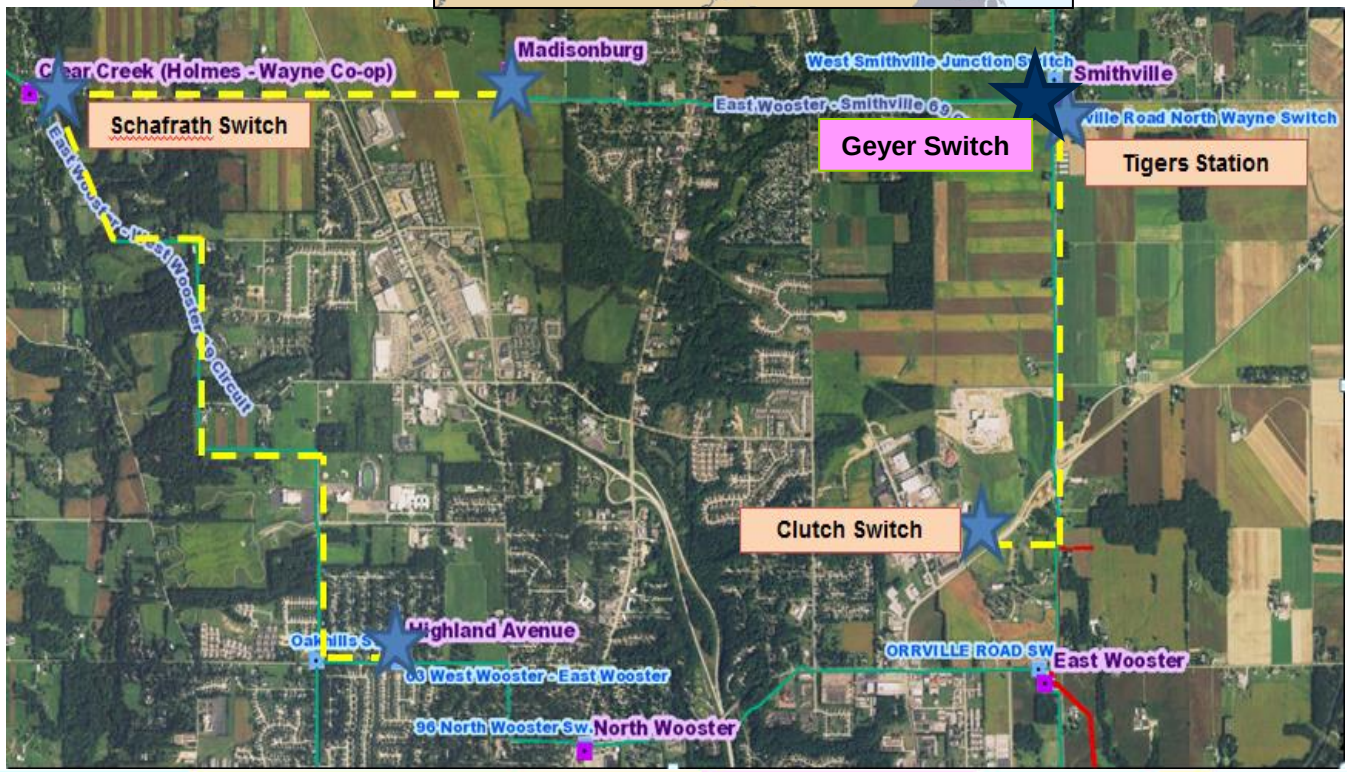

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AEP Transmission Zone: Supplemental
LuK USA and Madisonburg Loop

Continued from previous slide…

Selected Solution:

Construct double-circuit line extension to Clutch Switch (0.5 miles) (**S1511.1**) Estimated Cost: $1.6M

Construct a single circuit line to close the loop between Schafrath Sw and Madisonburg (2 miles) (**S1511.2**) Estimated Cost: $3.1M

Rebuild Clutch Switch to Tigers as single circuit (1.5 miles) (**S1511.3**) Estimated Cost: $3.7M

Rebuild from Schafrath Sw to Oakhills Switch (3.0 miles single circuit) and from Oakhills to Highland (0.4 miles double circuit) (**S1511.4**) Estimated Cost: $8.5M

Establish a new station to serve customer (Clutch) (**S1511.5**) Estimated Cost: $3.4M

Establish a new station at Schafrath Switch to eliminate hard tap and loop lines (**S1511.6**) Estimated Cost: $1.0M

Expand Madisonburg station to establish new line exit to Schafrath (**S1511.7**) Estimated Cost: $1.4M

Construct new station at Tigers to eliminate hard tap and replace Smithville station (**S1511.8**) Estimated Cost: $4.6M

Install new phase-over-phase switch at Geyer Switch (**S1511.9**) Estimated Cost: $0.8M

Retire Oakhills Switch and establish a new box bay at Highland Avenue for the double circuit line (**S1511.10**) Estimated Cost: $5.2M

Retire Orrville Road Switch (**S1511.11**) Estimated Cost: $0.1M

Upgrade relaying at West Wooster (**S1511.12**) Estimated Cost: $0.8M

Upgrade relaying at East Wooster (**S1511.13**) Estimated Cost: $0.8M

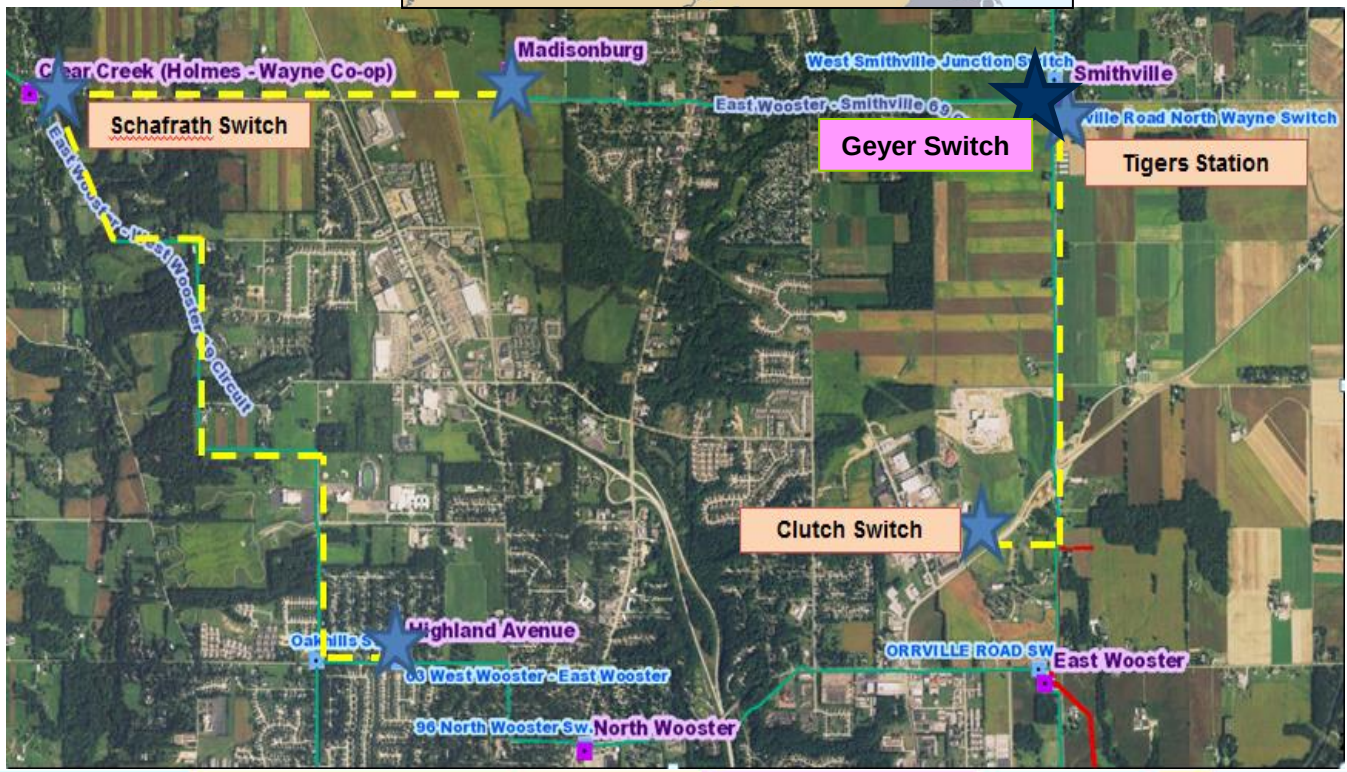
Retire Smithville station (**S1511.14**) Estimated Cost: $0.4M

**Note: AEP already owns 99% of Right of Way (ROW) in sections where loops will be closed. All new line construction will be 69kV with 556 ACSR conductor (126 MVA rating)*

Total Estimated Transmission Cost: $35.4M

Projected In-service: 12/31/2018

Project Status: Engineering



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AEP Transmission Zone: Supplemental Mid-Vol Station

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Customer Service:

Mid-Vol Coal request to serve 8 MW of load on the Jim Branch – Switchback 138 kV line. Obligation to serve customer request.

Selected Solution:

Tap the existing Jim Branch – Switchback 138 kV line. (**S1512.1**)

Estimated Customer Cost: $0.52M

Estimated Transmission Cost: $0.0M

Establish the new Thorpe Switching Station and install a new 2000 A 138 kV phase-over-phase switch and install necessary 138 kV metering equipment. (**S1512.2**)

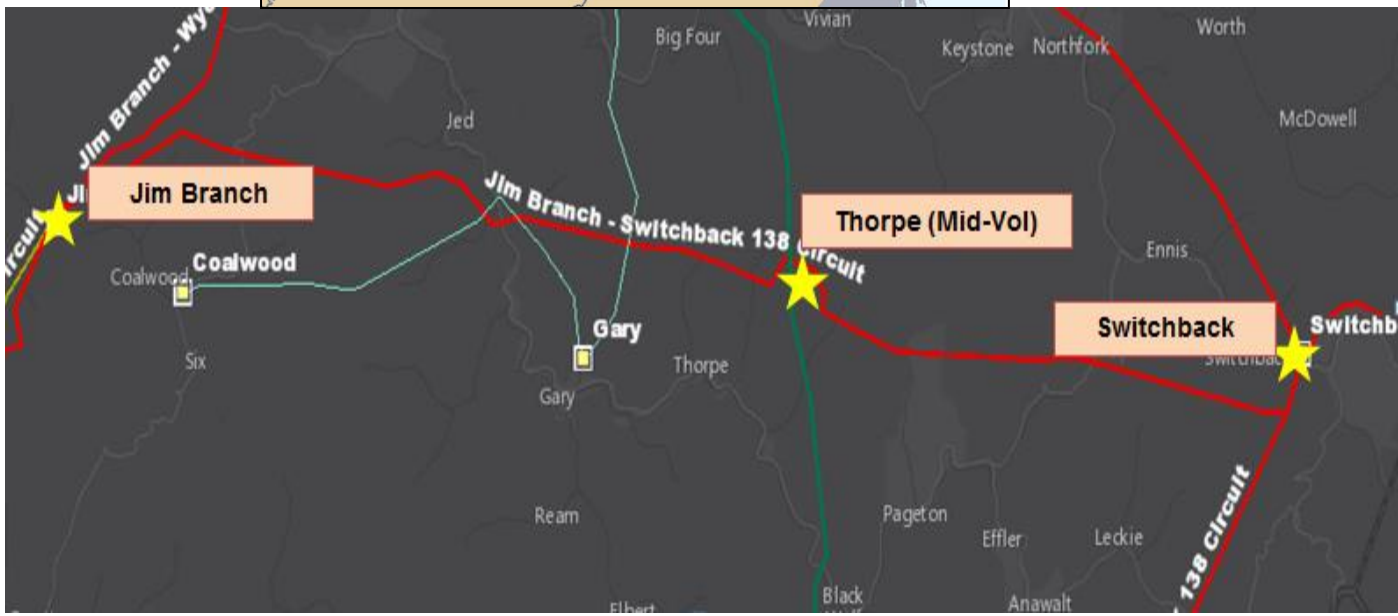
Estimated Customer Cost: $0.95M

Estimated Transmission Cost: $0.0M

Total Estimated Transmission Cost: $0 M

Projected In-service: 4/16/2018

Project Status: Scoping



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AEP Transmission Zone: Supplemental
Morgan Rd Switching Station

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Operational Flexibility and Efficiency:

Newcomerstown – North Coshocton 34.5 kV circuit is approximately 27.61 miles long. Many of the structures were replaced in 1989. This circuit currently has 218,976 customer minute interruptions. The Newcomerstown – North Coshocton 34.5 kV circuit serves approximately 14.67 MW. The customer minute interruptions can be reduced by either rebuilding the line or improving sectionalizing. Installing circuit breakers is more cost effective than rebuilding to reduce the CMI.

Selected Solution:

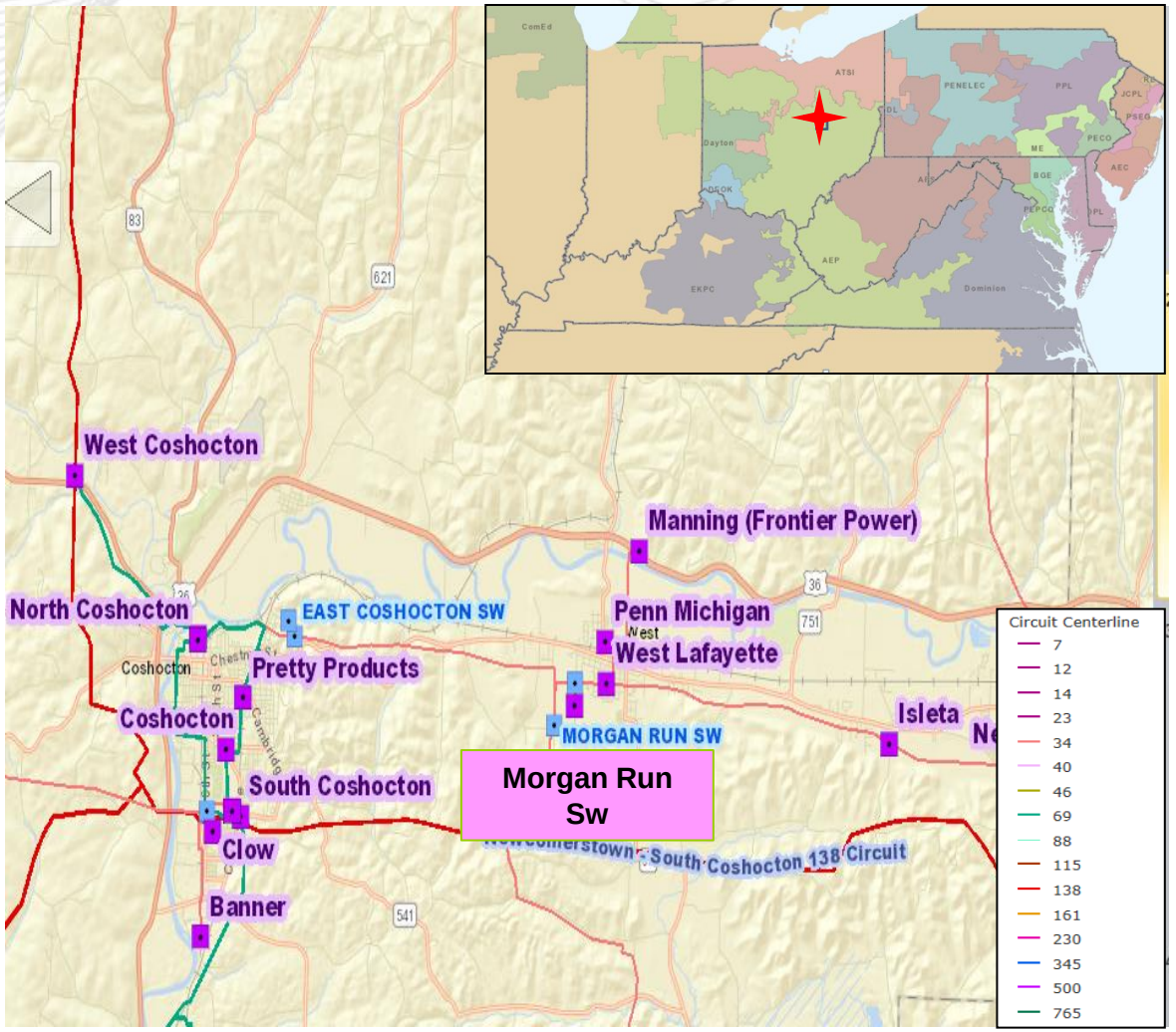
Establish Morgan Run Switch and install three 69 kV (to be operated at 34.5 kV) circuit breakers 2000 A 40 kA in a ring bus layout as a breaker and a half standard. (**S1513.1**)
Estimated Cost: $4.7M

Relocate Morgan Run – Alleghany 34.5 kV line to accommodate the new circuit breakers. (**S1513.2**) Estimated Cost: $1.1M

Total Estimated Transmission Cost: $5.8 M

Projected In-service: 12/15/2020

Project Status: Scoping



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AEP Transmission Zone: Supplemental
Mt Sterling – Zanesville 69 kV Circuit

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Mount Sterling – South Fultonham 69kV line is a 7.22-mile radial line serving ~8 MW of peak demand. This line was built in 1959 and has 47 open A-type conditions. The line has contributed to 2.4 million customer minutes of interruptions (CMI) between 2013 and 2016.

The Zanesville 69 kV circuit breakers "J", "K" and "L" are FK oil type circuit breakers. Oil 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. They have fault operations of 43, 45 and 47 respectively, higher than the manufacturer recommended number of 10 fault operations.

Selected Solution:

Build a new 5.7-mile 69 kV line from Mount Sterling to Zanesville station with 556.5 ACSR (102 MVA rating) to close the radial loop. (**S1514.1**) Estimated Cost: $8.1M

Zanesville – Linden Avenue 69 kV structure removal. (**S1514.2)** Estimated Cost: $0.8M

Mount Sterling – Zanesville 69 kV fiber cable. (**S1514.3**) Estimated Cost: $0.3M

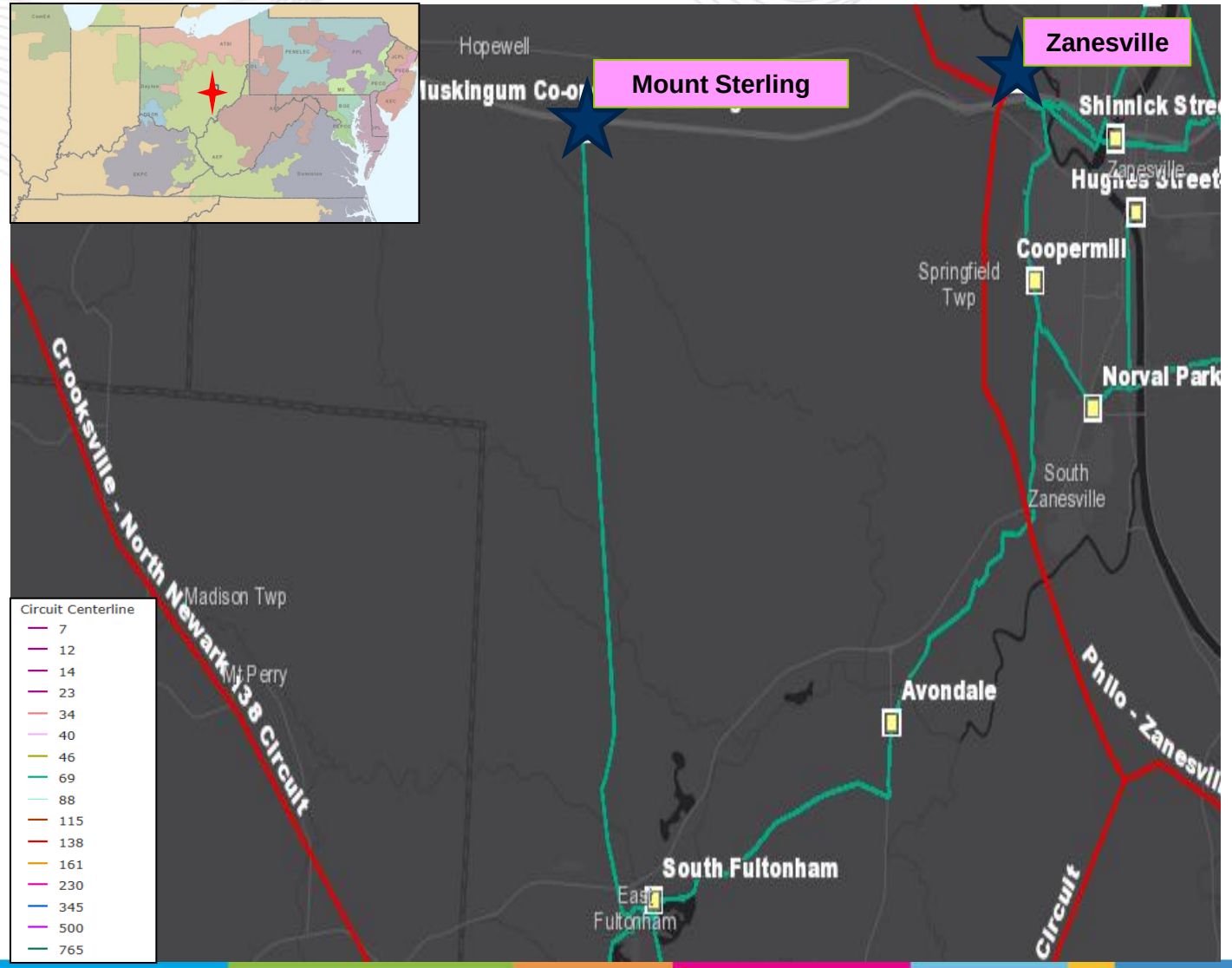
At Zanesville station, install a 69 kV 40 kA 2000A circuit breaker. Replace 69 kV breakers J, K, and L. Install a 138 kV high side circuit breaker and a 69 kV low side circuit breaker for the 138/69 kV transformer. (**S1514.4**) Estimated Cost: $4.3M

At Mount Sterling station, install two 69 kV 40 kA 2000A circuit breakers in a box bay configuration. (**S1514.5**) Estimated Cost: $3.0M

Total Estimated Transmission Cost: $16.5M

Projected In-service: 12/15/2019

Project Status: Engineering



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AEP Transmission Zone: Supplemental
Napier (Lakeland Hospital) Station

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Customer Service:

Lakeland Memorial Hospital has requested AEP Transmission provide a new dual feed point of service to their current location. The hospital is currently served from the Distribution system but construction is underway to expand their facilities to add 4 MW of additional loading to their current location. The customer has expressed sensitivity to any potential reliability issues and will install two transformers for the dual feeds.

Selected Solution:

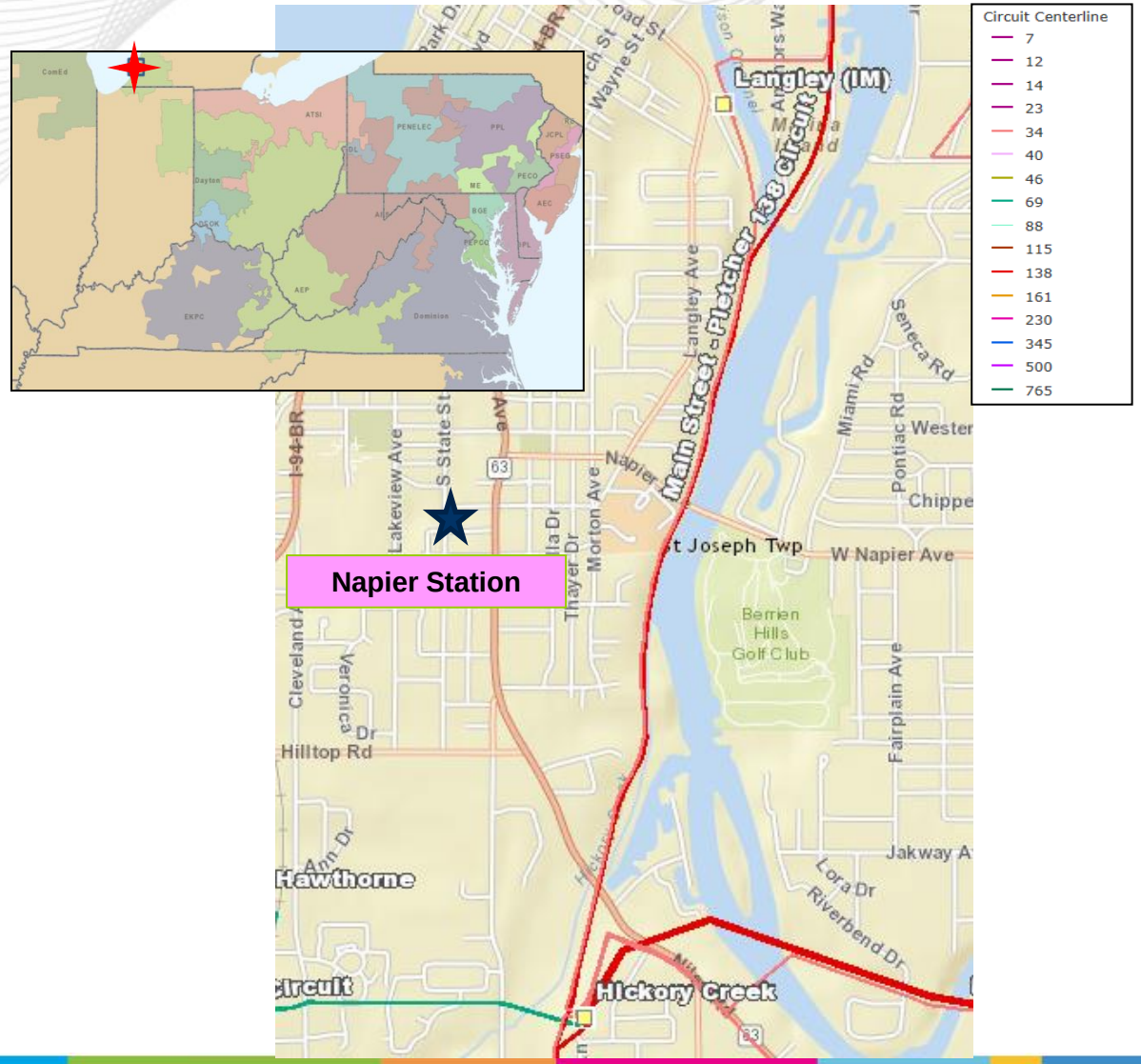
Create an in & out from the existing Hickory Creek – Main Street No. 2 34.5 kV circuit (**S1515.1**) Estimated Cost: $1.7M

Construct a new Napier station with a single circuit breaker between two customer feeds. The two feeds will serve two customer owned transformers. (**S1515.2**) Estimated Cost: $2.9M

Total Estimated Transmission Cost: $4.6 M

Projected In-service: 06/30/2019

Project Status: Scoping



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AEP Transmission Zone: Supplemental
North Bristol CB Replacement

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

North Bristol 138 kV circuit breakers A and B (vintage 1975) are type Air Blast breakers. Air blast breakers are being replaced across the AEP system due to reliability concerns, intensive maintenance, and their tendency to catastrophically fail. During failures, sharps pieces of porcelain from their bushings are typically expelled, which can be a potential safety hazard to field personnel. In addition, the ability to get spare parts for these breakers is becoming increasingly difficult. Circuit breaker B has exceeded (40 operations) the manufacturers recommended number of fault interruption (10 operations).

Selected Solution:

North Bristol 138 kV: Replace existing 3000 A 50 kA 138 kV circuit breakers 'A' and 'B' with new 3000 A 40 kA 138 kV circuit breakers. (**S1516**)

Total Estimated Transmission Cost: $2.5 M

Projected In-service: 11/1/2019

Project Status: Engineering

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AEP Transmission Zone: Supplemental
Parlett Switching Station

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Operational Flexibility and Efficiency

The Blackhawk-Dillonvale-Sparrow 69kV circuit is a 24-mile 3-terminal line. This circuit has experienced frequent mis-operations, power quality events, and customer outages over the last several years, due to a non-standard 3-terminal protection configuration. These events resulted in severe effects on industrial customers' operations, especially for those in the Utica shale midstream gas processing industry.

The Markwest-Hopedale plant in Harrison County, Ohio has experienced significant impacts due to momentary outages and voltage dips caused in part by protection mis-operations on AEP's local area 69kV system. Their plant is served from the Blackhawk 69kV substation, which was placed in-service in 2013, and serves as a critical hub for the area midstream processing operations. These momentary interruptions force the customer into 12-24 hour restart cycles resulting in significant monetary and production losses. AEP met with the customer to address the customer's concerns and, as a result, has developed a plan to improve area reliability including a project to upgrade Parlett Switch. Parlett is currently part of a 3-terminal 69kV circuit ("Blackhawk-Dillonvale-Sparrow 69kV"), which is especially difficult to protect, due to having 3 sources of power.

Customer Service:

Marathon/Markwest has started a relatively new production plant at Blackhawk station with a sensitive load that is very critical to many of regional gas-pipeline processes. Recent momentary outages with extensive recovery times have resulted in considerable losses .

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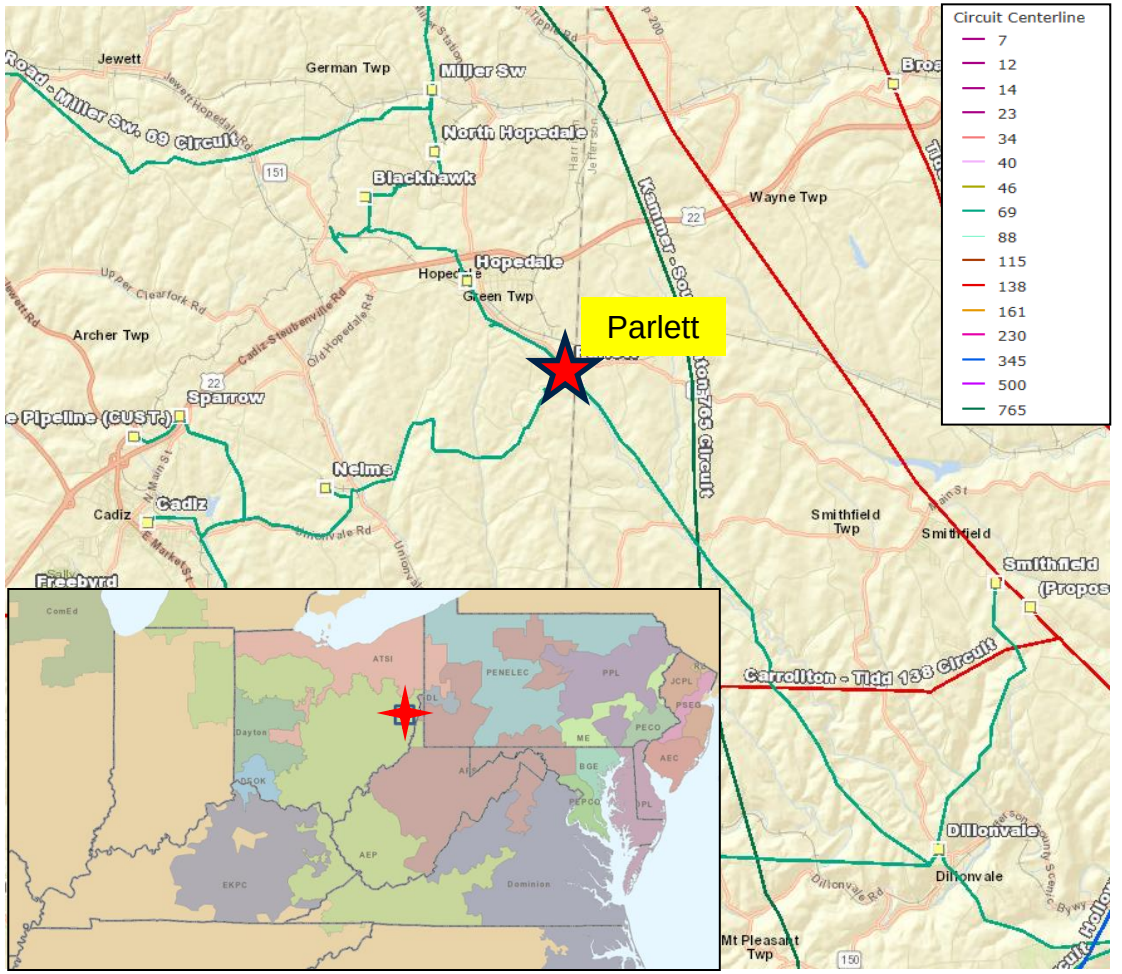

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AEP Transmission Zone: Supplemental
Parlett Switching Station

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Selected Solution:

Construct 138kV-rated 4-breaker ring bus, with a 14.4 MVAR cap bank; station to be operated at 69kV until area is converted to 138kV. (**S1517.1**) Estimated Cost: $12.3M

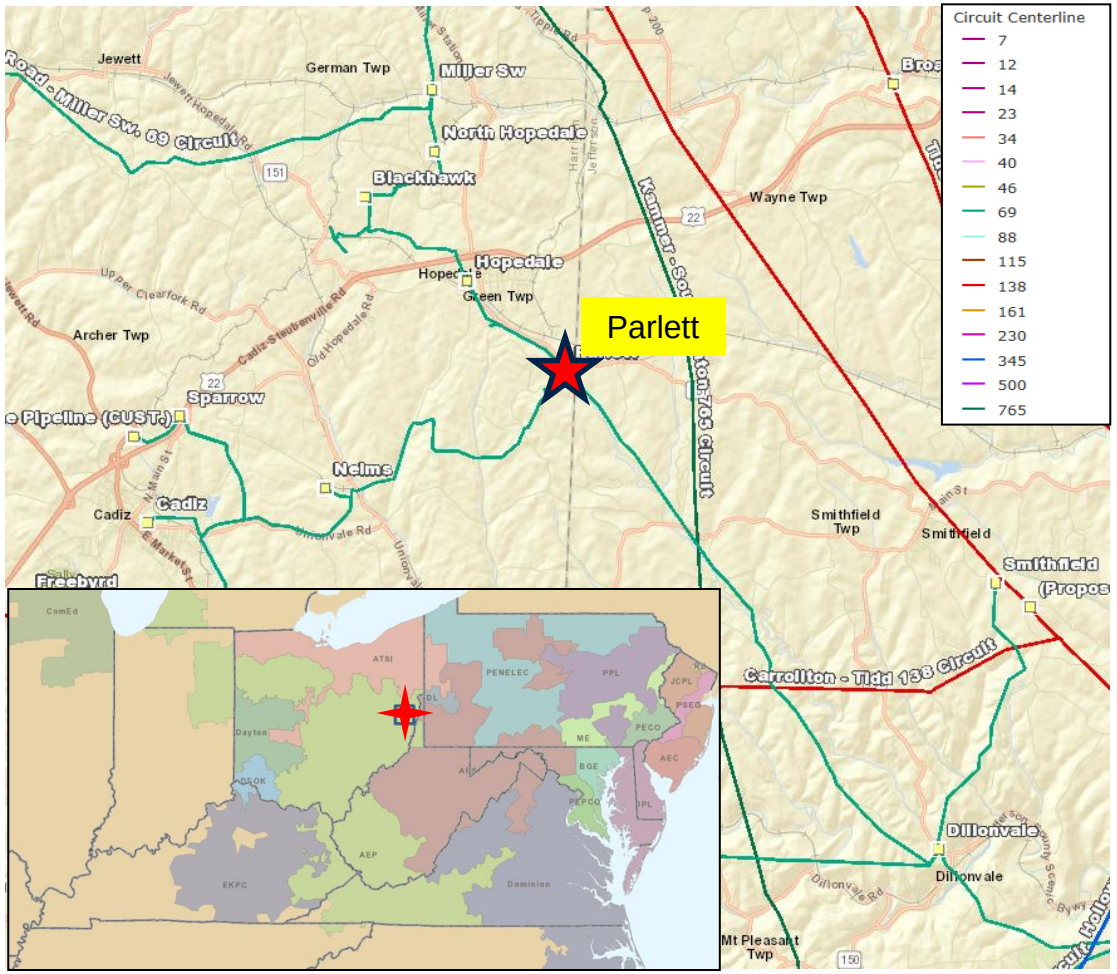
Reroute the 3- 69kV lines to enter Parlett station. (**S1517.2**) Estimated Cost: $1.6M

Retire Parlett 69kV switch (**S1517.3**) Estimated Cost: $0.1M

Total Estimated Transmission Cost: $14.0 M

Projected In-service: 12/01/2018

Project Status: Engineering



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AEP Transmission Zone: Supplemental
Riggs Station

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Other:

Obligation to serve new customer request. Summer projected load 14 MVA, Winter Projected load 23 MVA.

Selected Solution:

Tap the Holston – Sullivan Gardens 138kV circuit. (**S1518.1**)

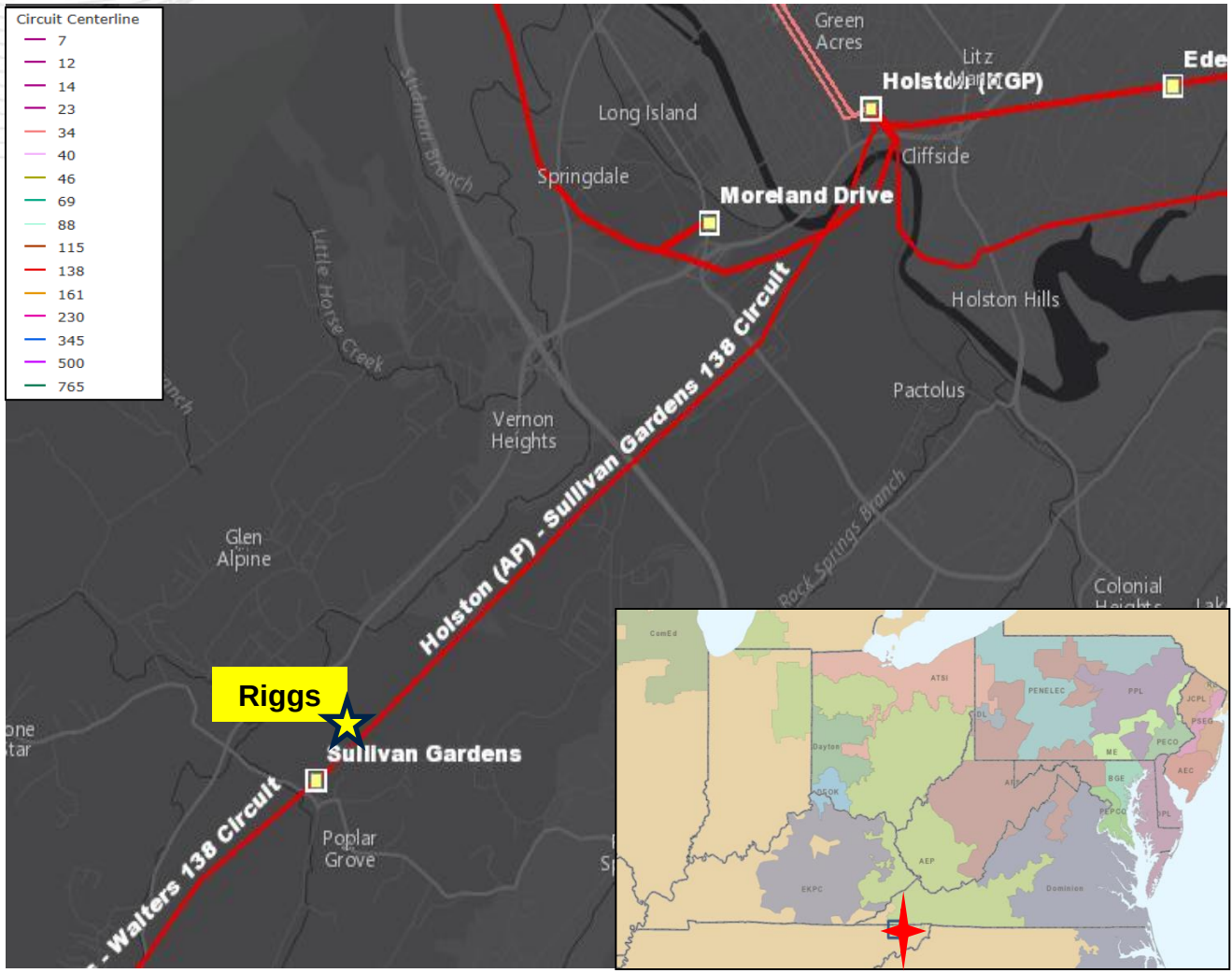
Estimated Cost: $0.4M

Construct a 138/34.5kV distribution station (Riggs). Install a new 138/34.5 kV 30 MVA, two 3000 A 100kA 138 kV MOABs and a 3000 A 40 kA 138 kV circuit switcher. (**S1518.2**) Estimated Cost: $0.0M

Total Estimated Transmission Cost: $0.4M

Projected In-service: 12/31/2018

Project Status: Engineering



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AEP Transmission Zone: Supplemental
Roberts Rehab & Upgrades

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Transformer 2 (560 MVA unit) at Roberts station is 43 years old with dielectric strength breakdown (winding insulation), short circuit strength breakdown (due to the amount of through fault events), and accessory damage (bushings). The ratings on Transformer 1 are currently limited by equipment in the 138 kV yard. Replacing this equipment will allow both transformers to operate at their full capabilities.

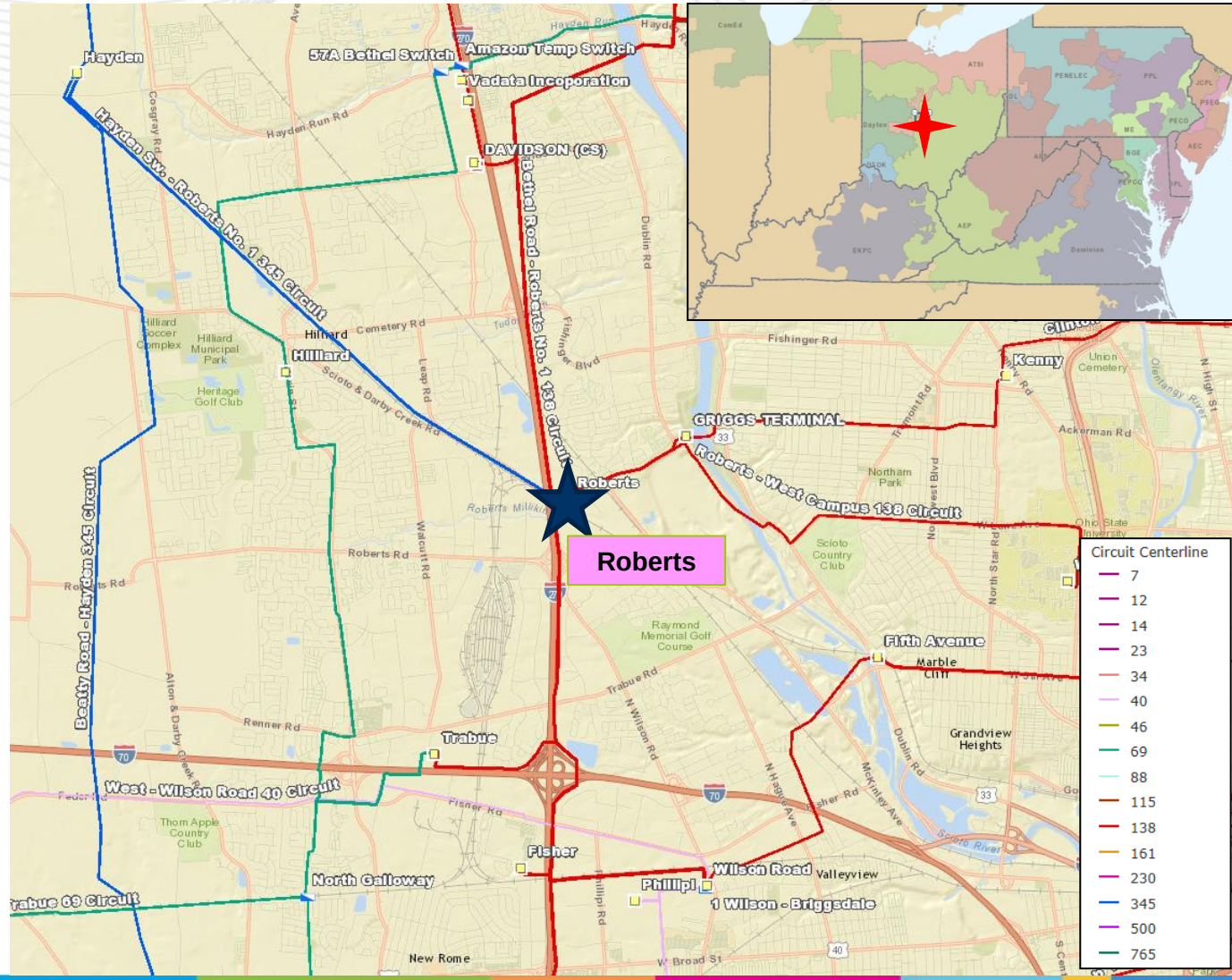
Selected Solution:

Replace XF#2 with a 675 MVA 345/138kV unit and upgrade all XF#2 risers and XF#2 138kV lead to 4,000A ratings. Add 138kV 4,000A XF#2 switch. Upgrade XF#1 risers to 4,000A ratings. (**S1519**)

Estimated Transmission Cost: $8.4M

Projected In-service: 12/01/2019

Project Status: Engineering



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AEP Transmission Zone: Supplemental Rockwell Mining

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Customer Service:

Rockwell Mining request to serve a new 6 MW load on the Bim – Skin Fork 46 kV line.

Selected Solution:

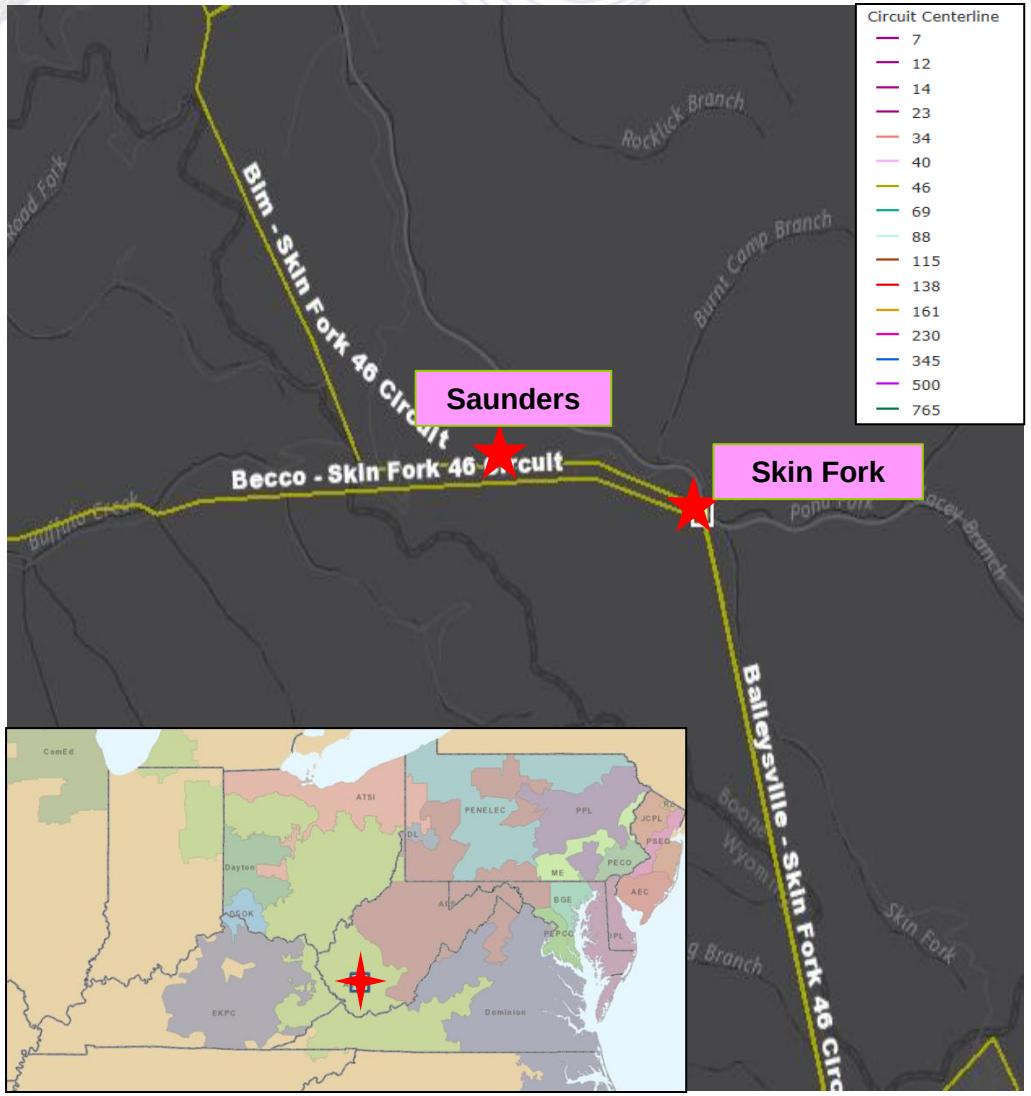
Tap existing Bim – Skin Fork 46 kV line and re-enforce structures for the new delivery point and switch installation. (**S1520.1**) Estimated Cost: $0.3M

Install a 1200 A 3-way phase-over-phase switch on Bim – Skin Fork 46 kV circuit at newly established Saunders Switching Station. (**S1520.2**) Estimated Cost: $0.0M

Total Estimated Transmission Cost: $0.3M

Projected In-service: 10/01/2018

Project Status: Scoping



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AEP Transmission Zone: Supplemental
Somerset 69 kV Switching Station

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Operational Flexibility and Efficiency

The New Lexington – South Fultonham 69 kV circuit serves 6.74 MW of load. In three years the New Lexington – South Fultonham 69 kV circuit has experienced customer minute interruptions of 1,732,378. Much of this line was rebuilt in 2013. CMI can be reduced by either rebuilding the line or improving sectionalizing. Installing circuit breakers is more cost effective.

Selected Solution:

Relocate three lines to the new Somerset Switching Station. (**S1521.1**)

Estimated Cost: $2.7M

Install four 69 kV circuit breakers in a ring bus configuration at Somerset Switch. (**S1521.2**) Estimated Cost: $5.7M

Total Estimated Transmission Cost: $8.4 M

Projected In-service: 12/15/2020

Project Status: Engineering

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AEP Transmission Zone: Supplemental Vicksburg – Schoolcraft Improvements

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Vicksburg – Schoolcraft 69kV is a 5 mile 1970's vintage radial line that currently has 22 structures with open conditions affecting 36% of the total number of structures. With our current system configuration this line cannot be addressed as it will result in significant outages to Vicksburg station, which cannot be recovered from a backup facility.

Schoolcraft station equipment is mostly 1970s vintage. The 1967 vintage 69kV circuit breaker A at Schoolcraft Substation is an oil filled FK-breaker without oil containment. It has also operated through 175 fault operations, exceeding the manufacturer's recommendation of 10. 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.

Schoolcraft substation currently deploys 17 relays, implemented to ensure the adequate protection and operation of the substation. Currently, 9 of the relays are of the electromechanical type which have significant limitations with regards to fault data collection and retention.

Operational Flexibility and Efficiency:

The Moore Park – Schoolcraft 69kV line has averaged 5 million customer minutes of interruption per year over the last three years. For the past 10 years this line has experienced a total of 23 momentary outages, and 7 permanent outages.

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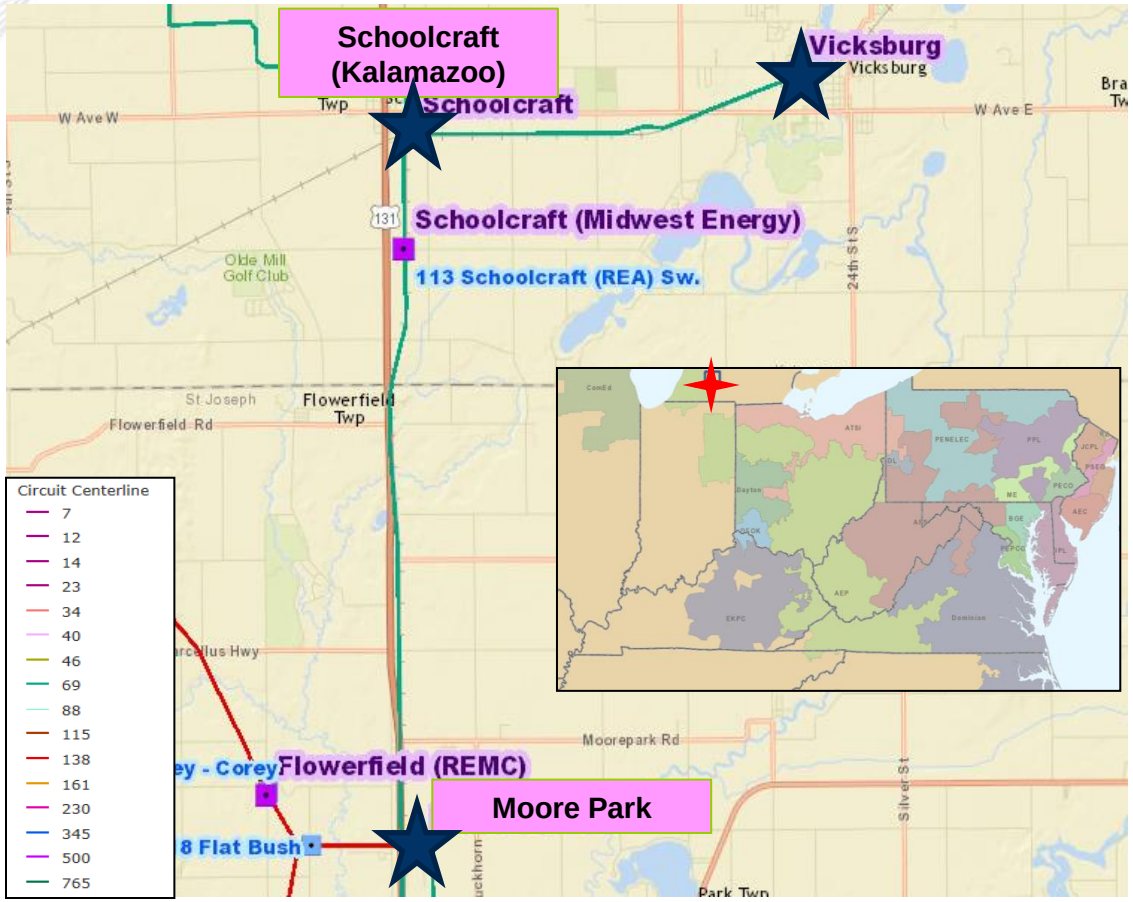

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AEP Transmission Zone: Supplemental Vicksburg – Schoolcraft Improvements

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Vicksburg 69kV station, with a projected load of 14MW, is currently being served radially. Also, the current configuration at Schoolcraft station combines 3 elements into one protection zone. This protection scheme exposes the only transformer at Schoolcraft and both transformers at Vicksburg to line faults and increases the probability of relay mis-operations. This has been a historical issue to the customers in the Schoolcraft area because there is zero distribution recoverability or load transferability between Schoolcraft and Vicksburg station.

Customer Service:

In addition to the transmission facilities, I&M Distribution has identified switchgear replacements at Schoolcraft. Historically, 12 kV switchgear distribution facilities like the one at Schoolcraft are very problematic due to the many complications associated to maintenance and repairs. The cost of the switchgear is not a part of the scope as it is a distribution asset.

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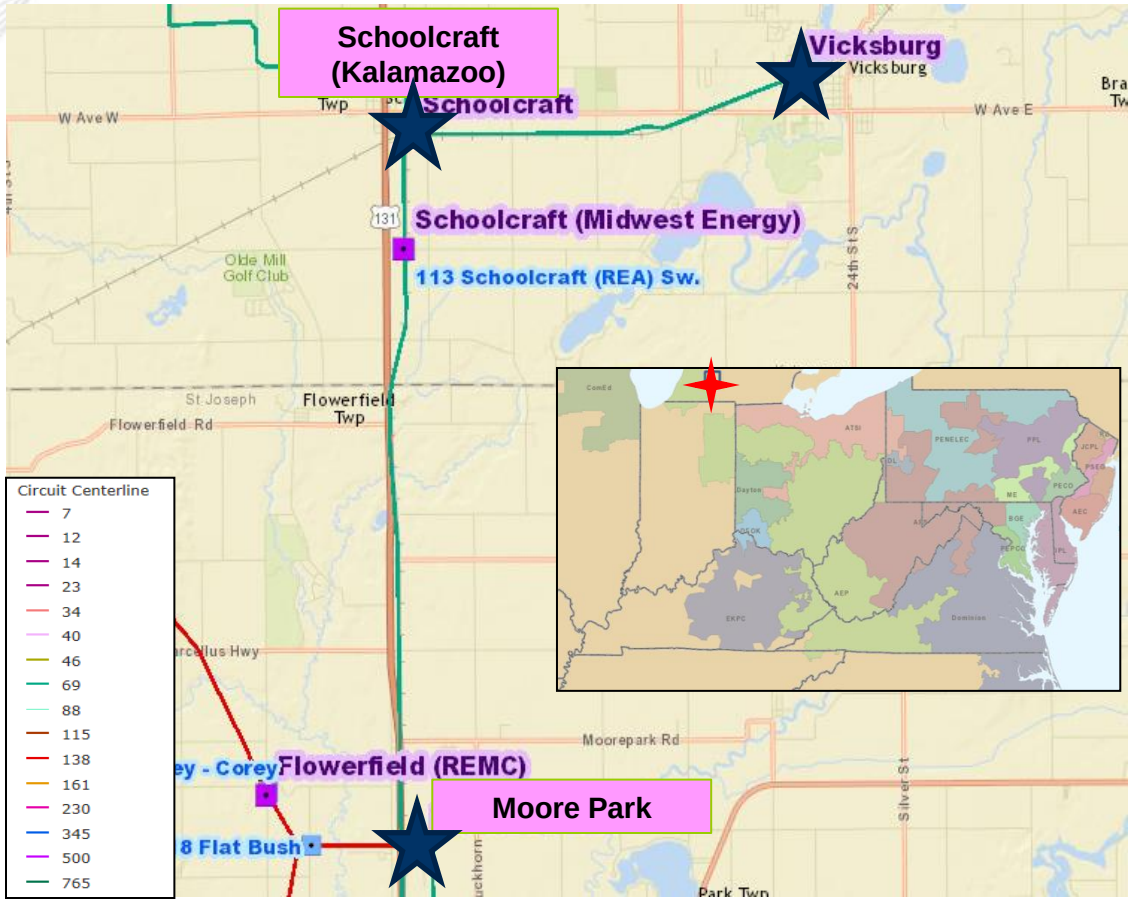

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AEP Transmission Zone: Supplemental Vicksburg – Schoolcraft Improvements

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Selected Solution:

Rebuild Schoolcraft 69kV station as Kalamazoo 69kV station in the clear. Kalamazoo station will have a breaker and half configuration with (6) 69kV CBs , (2) 69/12kV transformers, 12kV bus with associated feeders, and a 14.4MVAR cap bank. One transformer will be transferred from the existing Schoolcraft station and the second will be new. (**S1523.1**) Estimated Cost: $5.2M

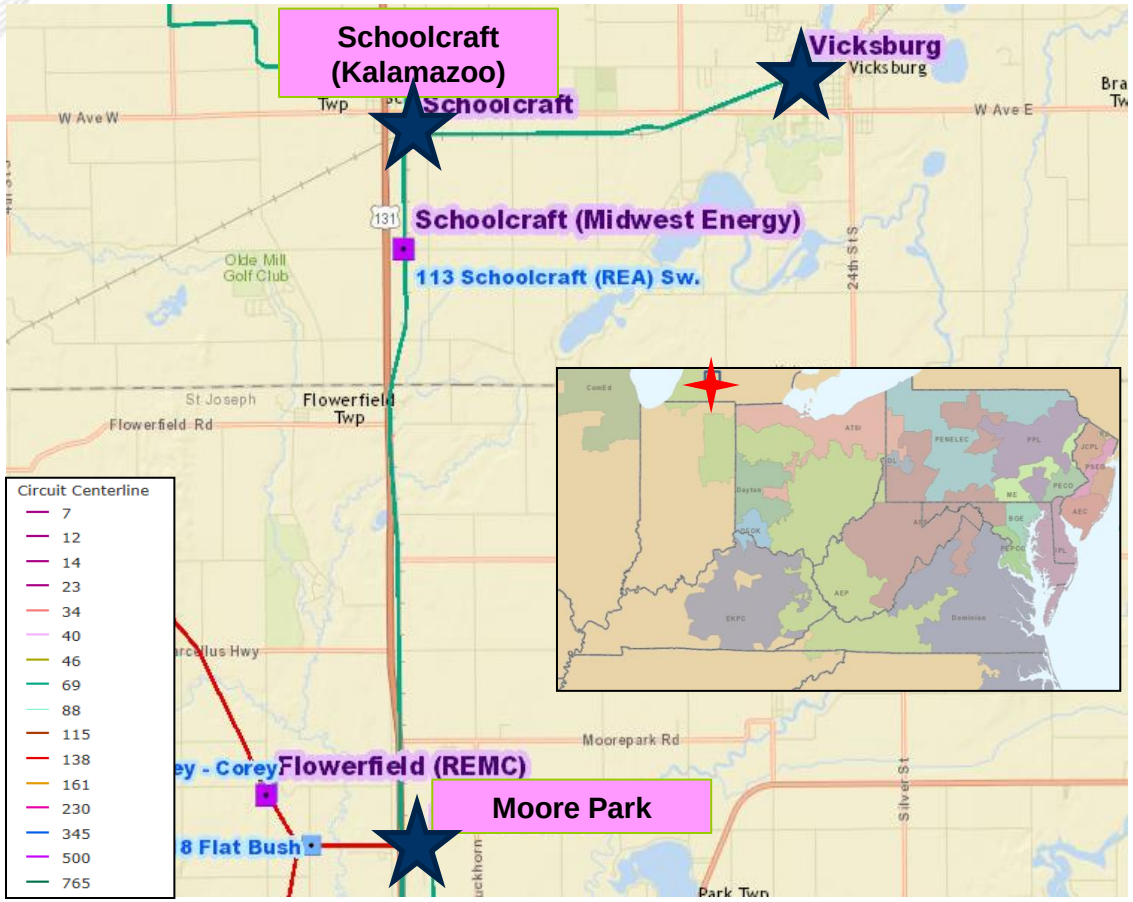
Install (2) 69kV CBs and install DICM at Vicksburg to accommodate the new, second line. (**S1523.2**) Estimated Cost: $1.5M

Construct a new 5 mile 69kV line between Kalamazoo and Vicksburg stations with 336.4 ACSR conductor (73 MVA rating). Install Fiber between Kalamazoo and Vicksburg Station. Extend Moore Park-Schoolcraft line into Kalamazoo. (**S1523.3**) Estimated Cost: $12.5M

Total Estimated Transmission Cost: $19.2 M

Projected In-service: 12/01/2018

Project Status: Scoping



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AEP Transmission Zone: Supplemental
Thelma Station

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Thelma Station 69 kV circuit breaker 'D' (vintage 1965) and 46 kV circuit breaker 'B' (vintage 1961) are both showing signs of deterioration. Circuit breaker 'B' is an oil type FZO Allis-Chalmers type that has historically presented AEP with catastrophic failures which have resulted in AEP targeting them for replacement. Circuit breaker 'D' is a GE FK oil type that was installed without oil containment and are prone to failure. This risk of contamination upon a failures has driven AEP to target them for replacement. In addition, the manufacturers recommended number of fault operations is 10. Breaker 'B' has experienced 260 operations and breaker 'D' has experienced 45 operations.

Circuit switcher BB is a MARK V unit. Mark III's, IV's and V's do no longer work with modern relaying packages and are recommended to be replaced.

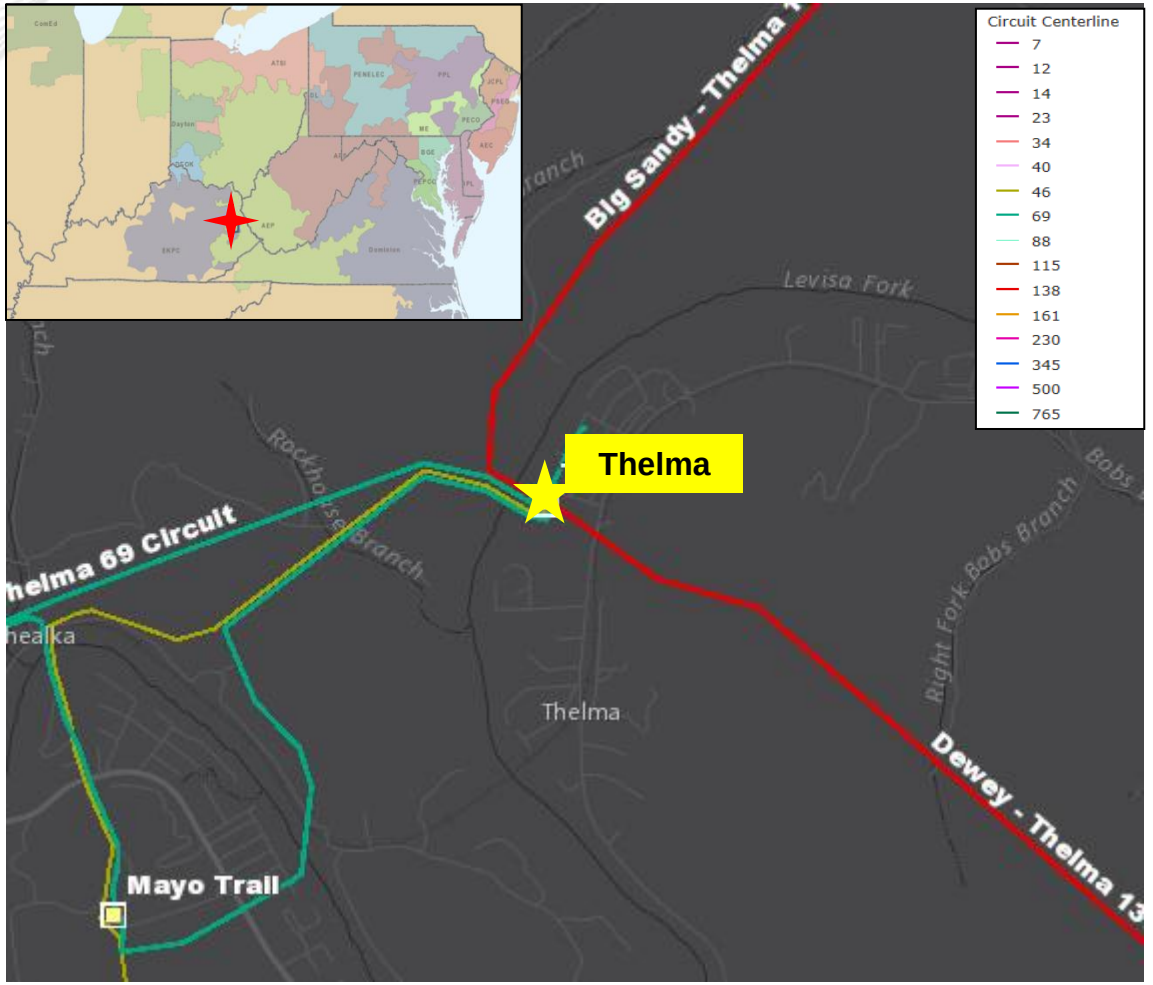
Selected Solution:

Replace existing 1200 A 12.5 kA 46 kV circuit breaker 'B' with a new 3000 A 40 kA 46 kV circuit breaker. Replace existing 1200 A 21 kA 69 kV circuit breaker 'D' with a new 3000 A 40 kA 69 kV circuit breaker. Replace existing 1200 A 30 kA 138 kV cap switcher 'BB' with a new 650 A 31.5 kA 138 kV cap switcher. (**S1524**)

Estimated Transmission Cost: $1.7 M

Projected In-service: 06/07/2018

Project Status: Engineering



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AEP Transmission Zone: Supplemental
Van Buren – Liberty Center Rebuild

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The Liberty Center – Van Buren line currently is subject to 44 open conditions including broken and damaged conductor; broken ground wire; and broken and damaged shield wire. The circuit was built in 1959 and 1968 using wooden poles. From 2013-2016 there have been five permanent outages with the majority cause being T-Line.

The existing line was constructed predominantly using shorter poles with wood crossarms and vertical post insulators. This type of construction is not a current AEP standard. Many of the crossarms are smaller cross-section, typical of those used for less resilient distribution construction. End splitting and bowing are common reasons for crossarms failing to pass periodic visual inspection, carrying an elevated risk of failure and line outages. In addition, crossarm construction results in a poor shielding angle, leading to a higher frequency of lightning strikes and momentary interruptions during lightning activity. Design standards from 1950s do not meet modern standards for strength, resilience, and horizontal and vertical clearances for safety for these poles.

Original conductors between Van Buren and Warren, and between Bluffton and Liberty Center were re-conductored with 4/0 ACSR conductors (50 MVA rating) in 1963. A 5/16" EHS steel shield wire was added in 1963. To avoid changing poles, most poles were retrofitted with a crossarm-type "bay-o-net" attached to the pole tops to support the shield wire addition. Bay-o-nets are prone to inspection rejection and occasional failure and are no longer an acceptable method of supporting a shield wire attachment.

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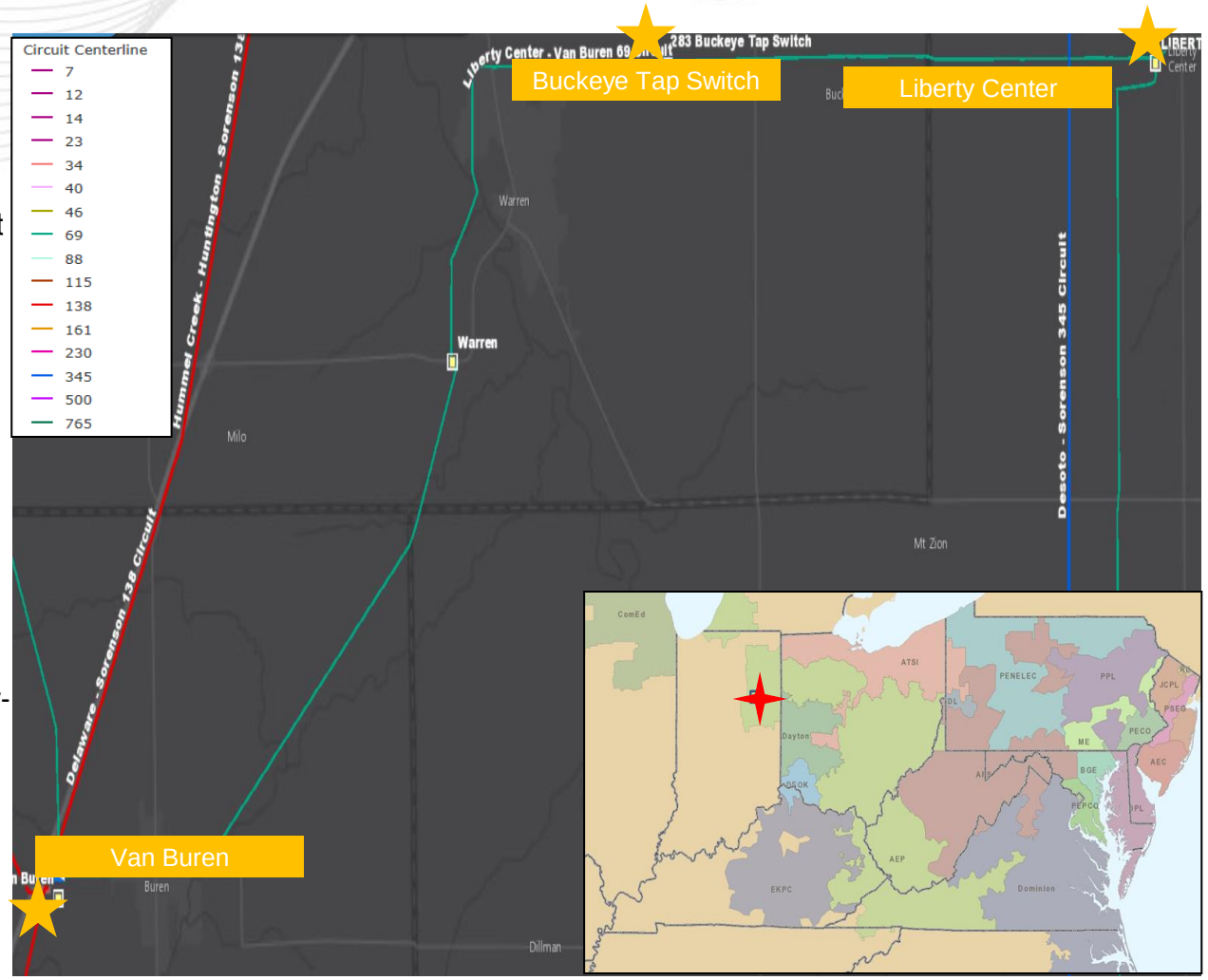

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AEP Transmission Zone: Supplemental
Van Buren – Liberty Center Rebuild

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Existing grounding is only every other structure, at best, which is not the current AEP standard and may contribute to a higher frequency of momentary interruptions during lightning activity.

Legacy underlying land rights, where they exist, are typically inadequate by present day AEP Transmission standards. Some sections of the lines were originally constructed within public road rights-of-way with no easement rights acquired on the adjacent private properties. The lack of easement rights provides no ability to properly manage non-conforming land uses. Where easement rights do exist, the ability to control building encroachments and intrusive vegetation were often not included in the language of the original easements.

These wood pole transmission lines have exceeded their original life expectancy. Age and normal deterioration of the lines warrant their complete replacement.

As the Buckeye Switch Tap is part of the line, the switching structure will have to be replaced.

<u>Operational Flexibility and Efficiency</u>

The Liberty Center – Bluffton, Liberty Center – Montpelier, Montpelier – Hartford City and the Hartford City – Bosman all are either built using 795 ACSR or are being built using 795 ACSR. If anything less than 795 ACSR is installed on this line, it will effectively limit the network

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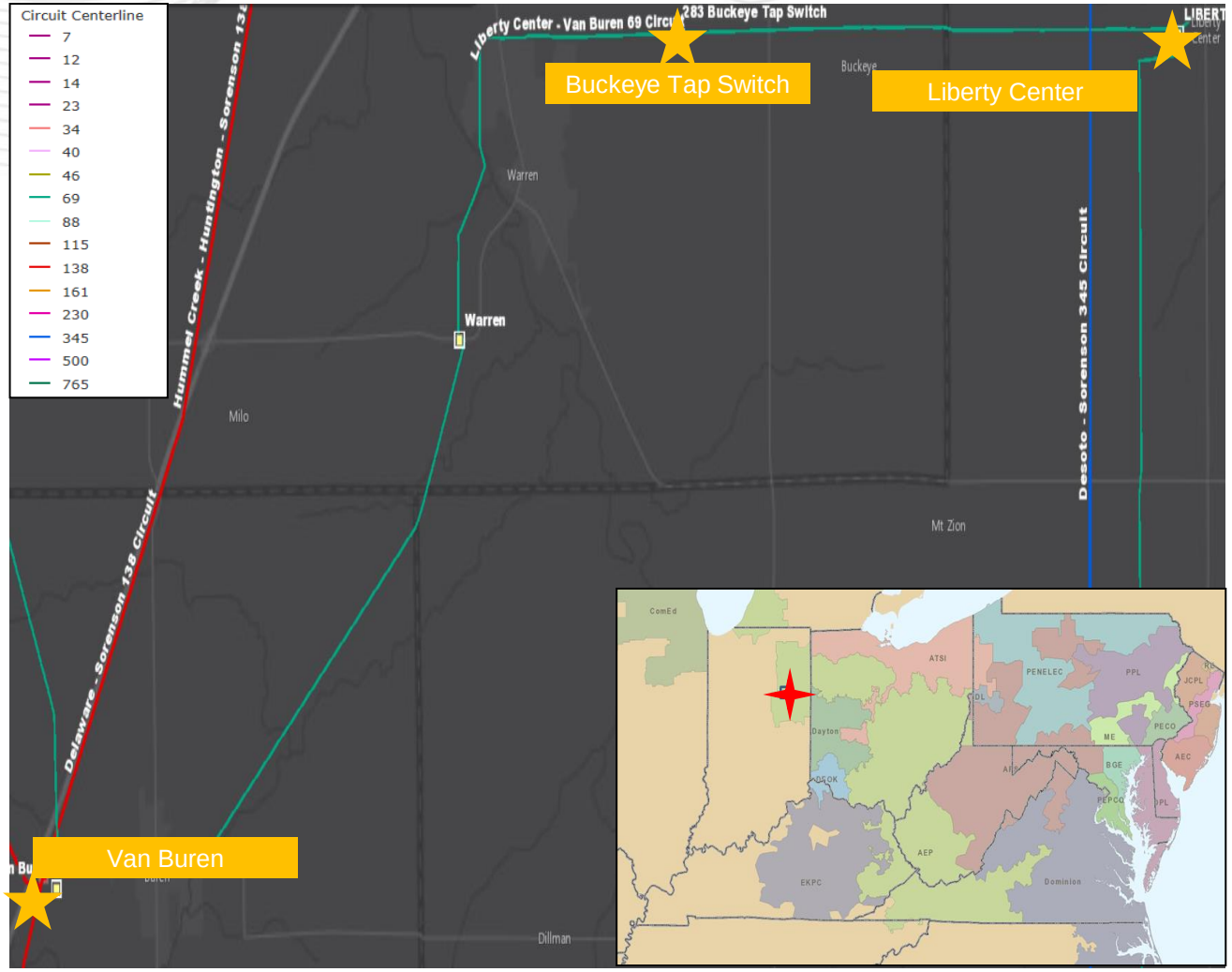

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AEP Transmission Zone: Supplemental
Van Buren – Liberty Center Rebuild

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Selected Solution:

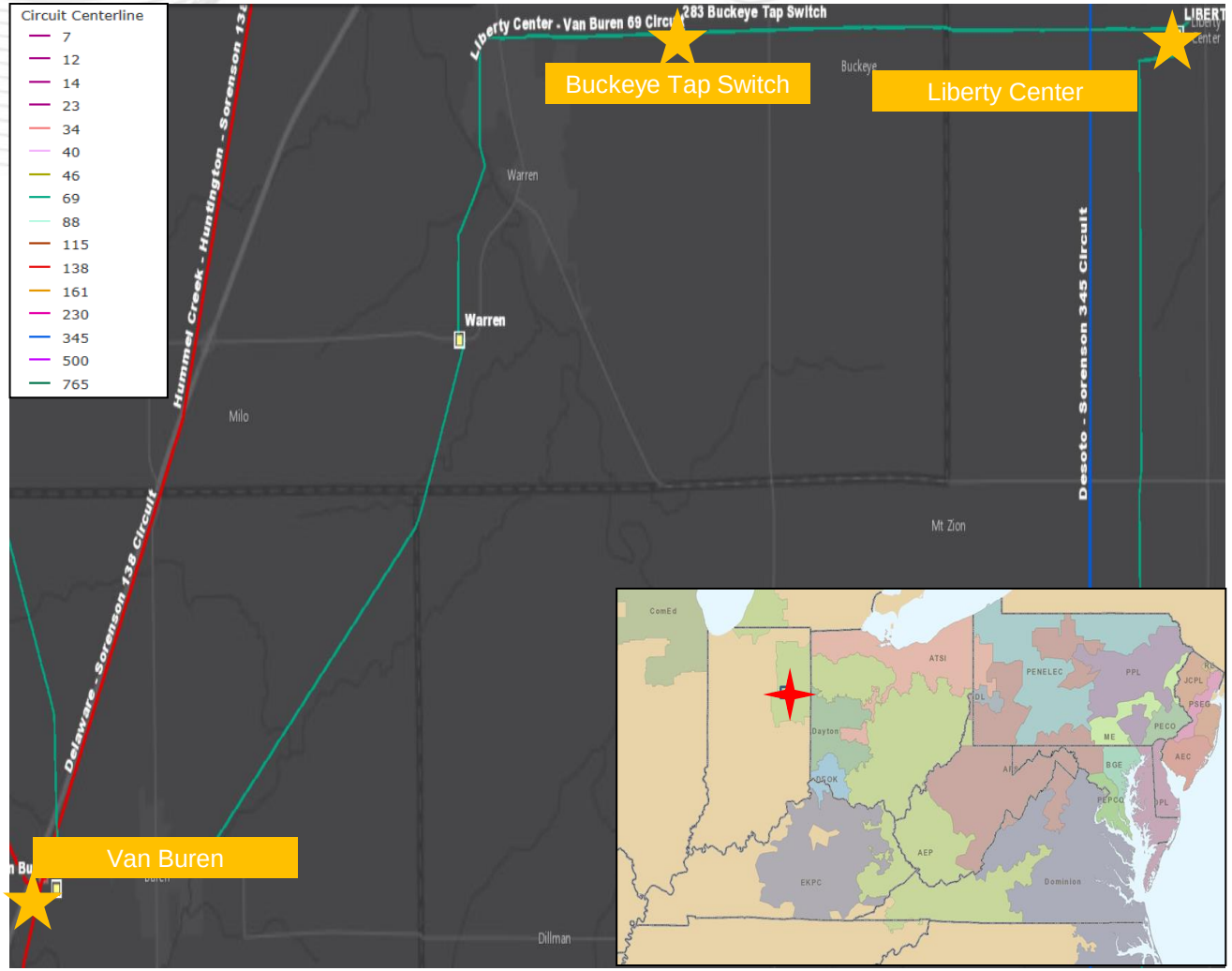
Rebuild 16.3 miles of the Van Buren – Liberty Center line utilizing 795 ACSR (129 MVA rating) (**S1525.1**) Estimated Cost: $22.1M

Install a new 3-way phase-over-phase 1200A steel switching structure at the Buckeye Tap Switch. (**S1525.2**) Estimated Cost: $0.3M

Total Estimated Transmission Cost: $22.4 M

Projected In-service: 06/05/2019

Project Status: Engineering



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AEP Transmission Zone: Supplemental
Ambler Ridge Station

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Operational Flexibility and Efficiency:

Currently AEP serves three critical customers from Thorofare Creek Switching Station. Due to physical limitations, AEP is unable to install circuit breakers at the Thorofare Creek Station. Therefore, by installing two 138 kV line breakers at Ambler Ridge Station, these critical customers will have line fault exposure reduced by 14 miles.

Customer Service:

Obligation to serve distribution customer request at a new station. Ambler Ridge station will serve approximately 6 MVA of load, transferred from Clendenin station.

Selected Solution

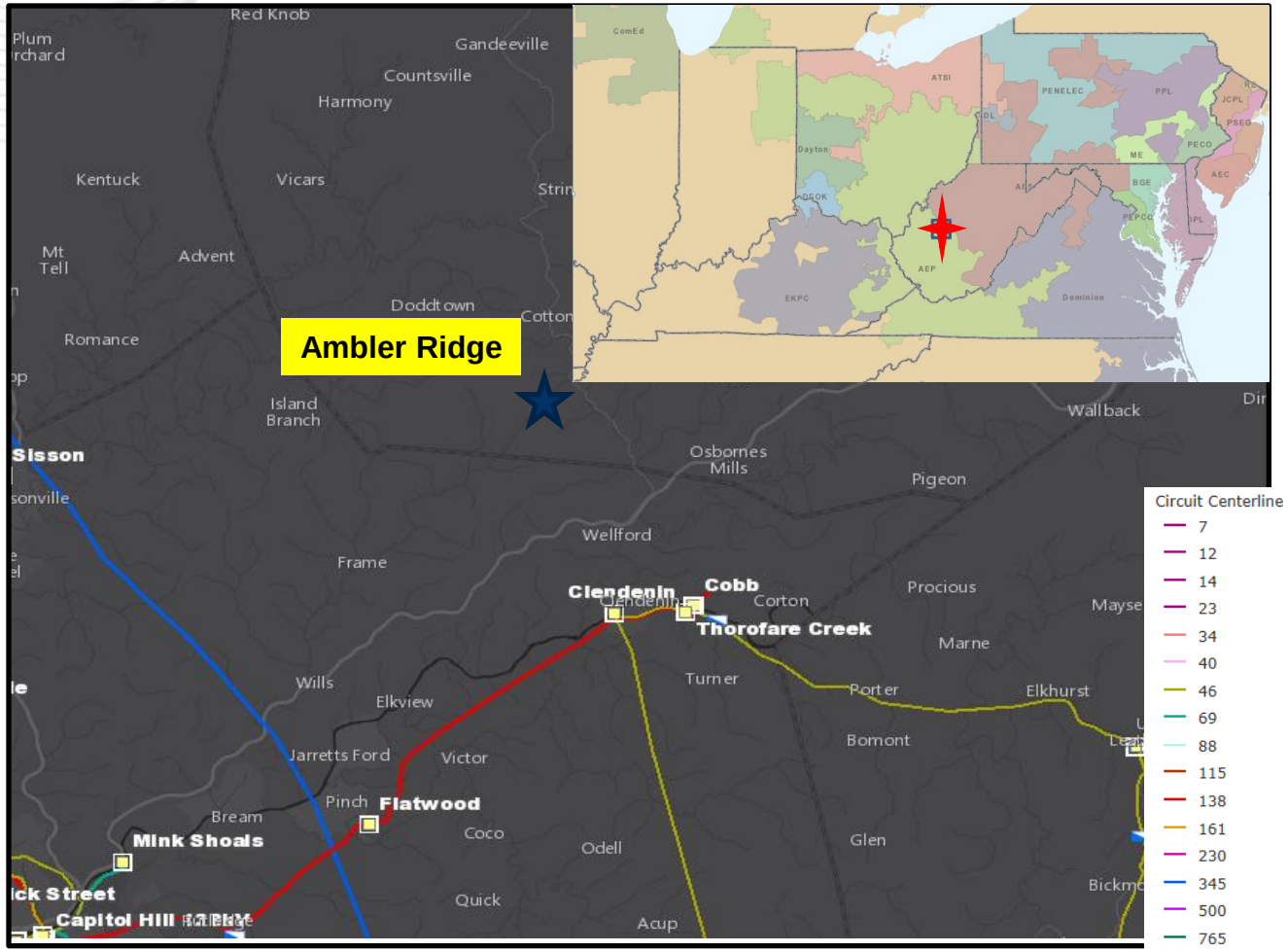
Construct a 138/34.5kV distribution station (Ambler Ridge). Install a new 138/34.5 kV 30 MVA transformer, two 3000 A 138 kV MOAB's and a 3000 A 40 kA 138 kV circuit switcher. (**S1526.1**)

Route the Thorofare – Chloe 138 kV in and out to Ambler Ridge Station. (**S1526.2**)

Estimated Transmission Cost: $1.5M (total cost is $6.0M)

Projected In-service: 6/1/2019

Project Status: Scoping



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AEP Transmission Zone: Supplemental West Huntington Station Rehab

Previously presented on 2/14/2018 SRRTEP

Problem Statement:
138 kV circuit breaker 'D' at West Huntington has been identified by PJM as exceeding its rated interrupting capabilities due to supplemental project S1377.1 -.11, which was presented on 11/2/2018 and 12/18/2017 SRRTEP

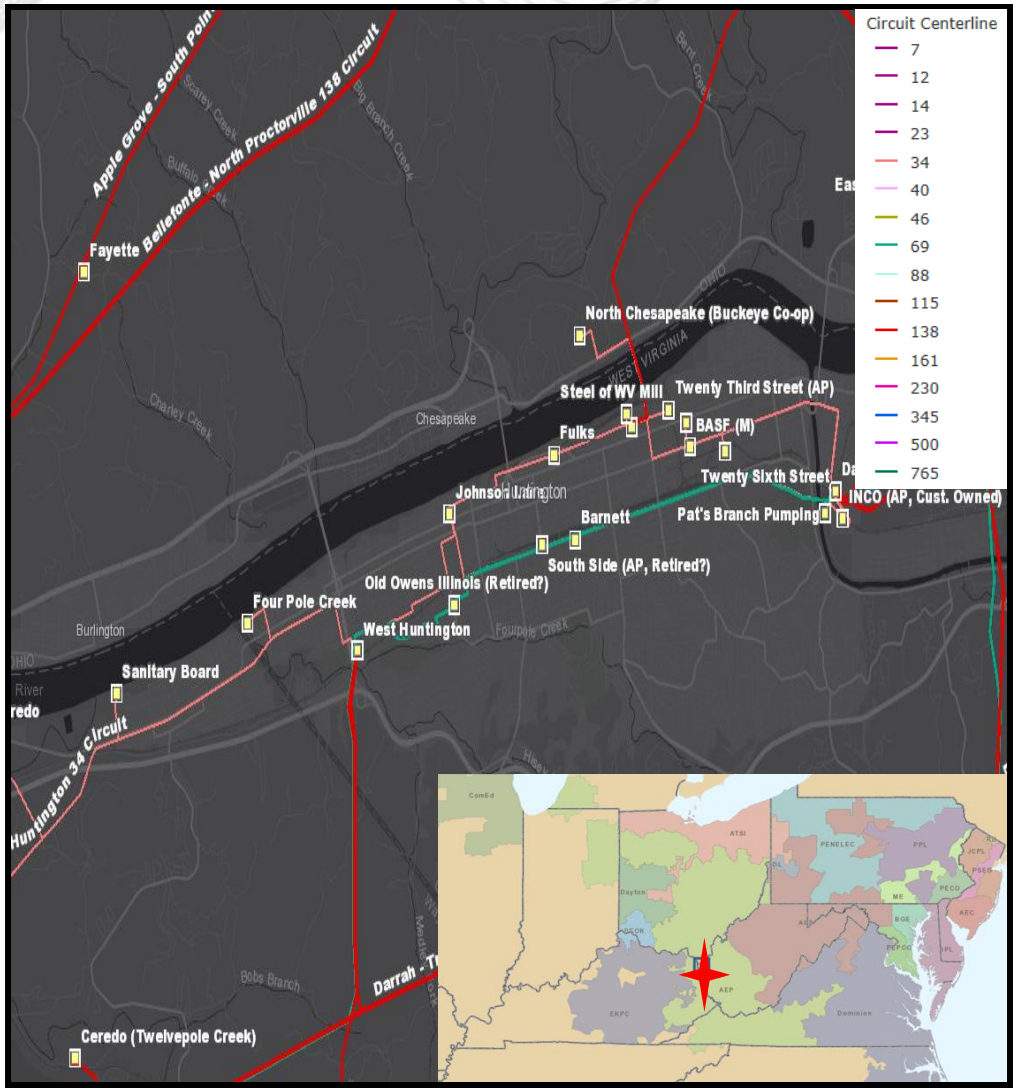
Equipment Material/Condition/Performance/Risk:
138 kV circuit breakers "D" at West Huntington is FK type breaker that is over 67 years old. It is oil breakers that have become more difficult to maintain due to the required oil handling. There is an increased potential for oil spills during routine maintenance 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. West Huntington breakers "D" & "E" have experienced 89 and 18 fault operations. The manufacturer's recommendation for this type of breaker is 10.

Selected Solution:
Replace the existing 1200A 20 kA 138 kV circuit breaker 'D' with a new 3000A 40 kV 138 kV circuit breaker at West Huntington station. (**S1377.12**)

Estimated Cost: $0.6M

Projected In-service: 5/1/2018

Project Status: Under Construction



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AEP Transmission Zone: Supplemental
West Huntington Station Rehab

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

138 kV circuit breaker "E" at West Huntington is FK type breakers that are both over 67 years old. It is oil breaker that has become more difficult to maintain due to the required oil handling. There is an increased potential for oil spills 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. West Huntington breaker "E" have experienced 89 and 18 fault operations. The manufacturer's recommendation for this type of breaker is 10.

69 kV circuit breaker "C" and 34.5 kV circuit breaker "J" at West Huntington are FK type oil breakers that are over 46 years and share the same concerns listed for the 138 kV breakers above. Circuit Breakers "C" & "J" have experienced 23 and 40 fault operations. The manufacturer's recommendation for this type of breaker is 10.

Capacitor switcher "AA" at West Huntington is a VBM type switcher. Joslyn Varmaster VBM-34's have a double stack interrupter design requiring simultaneous operation for rated current interruption; any delay between the two stacks would cause the full electrical stress of the operation to be placed on one stack. This could lead to capswitcher and/or cap bank failure. Like Mark V switchers, new control integration is difficult.

Operational Flexibility and Efficiency

138 kV circuit breakers will be added to the high side of the transformers at West Huntington to separate dissimilar zones of protection.

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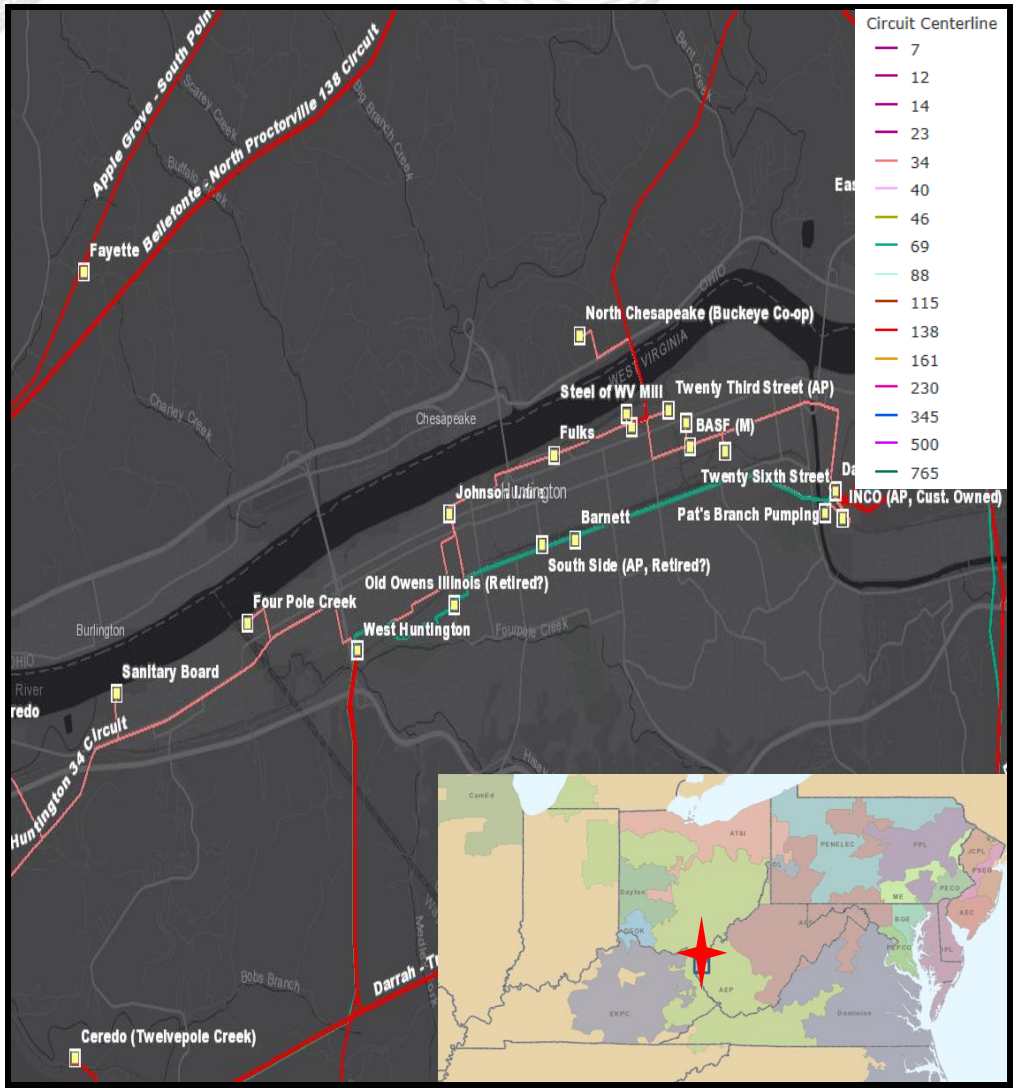

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AEP Transmission Zone: Supplemental
West Huntington Station Rehab

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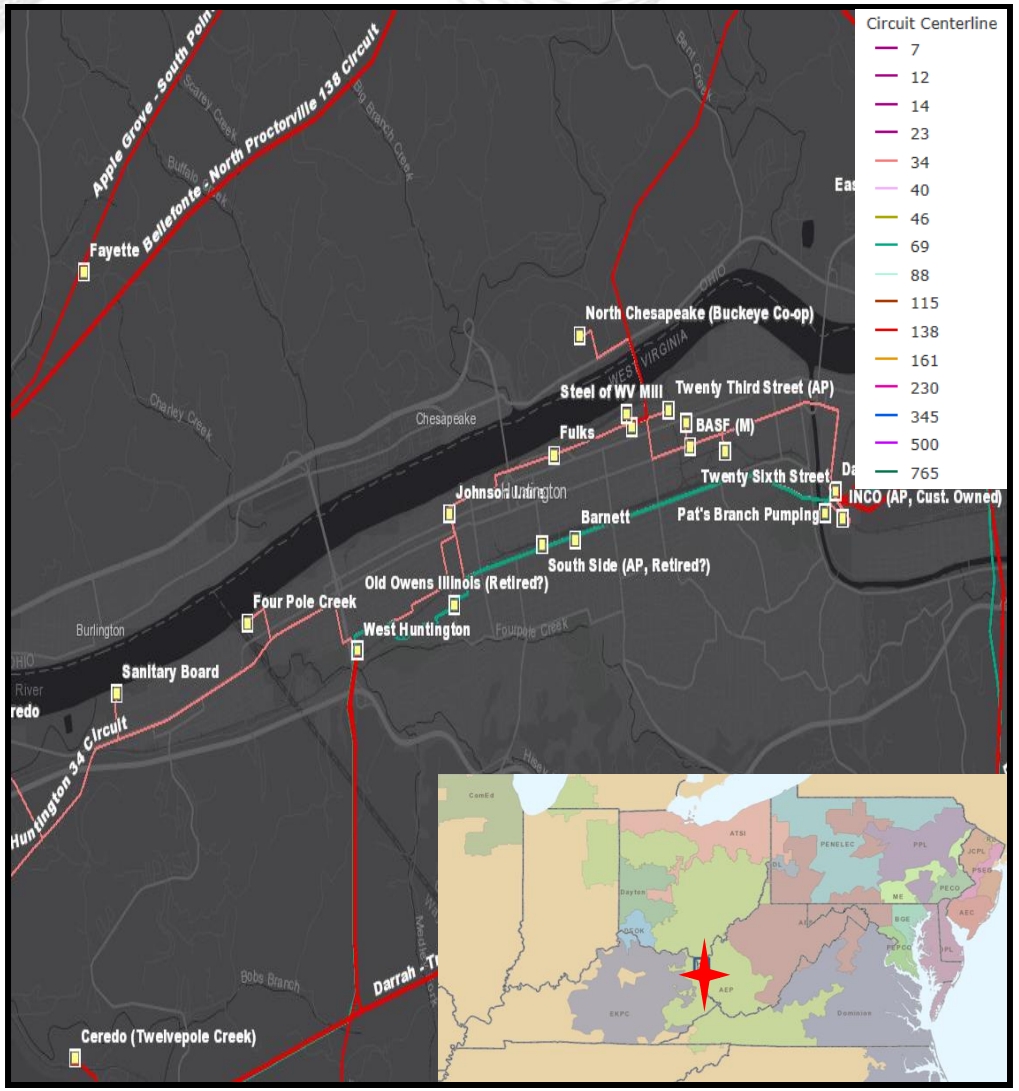
Selected Solution:

Replace the existing 1200A 20 kA 138 kV circuit breaker 'E' with a new 3000A 40 kV 138 kV circuit breaker. Install three 138 kV 3000 A 40 kA circuit breakers on the high side of the three transformers at West Huntington. Replace the existing 1800A 27 kA 69 kV circuit breaker 'C' with a new 3000 A 40 kA 69 kV circuit breaker. Replace the existing 1800A 27 kA 34.5 kV circuit breaker 'J' with a new 3000A 40 kA 34.5 kV circuit breaker. Replace the existing capacitor switcher 'AA' with a new circuit switcher. (**S1527**)

Estimated Cost: $3.9M

Projected In-service: 5/1/2018

Project Status: Under Construction



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AEP Transmission Zone: Supplemental
Mount Vernon-Howard 69 kV Line Rebuild

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The Lexington – North Bellville – North Liberty Switch section of the Mount Vernon – Howard 69 kV line has conductor sizes of #1 Copper (31 MVA rating, originally built in 1917) and 1/0 ACSR (34 MVA rating, built in 1959). The line has 75 open conditions that pose risk of failure. Since 2013, the line has experienced over 2.9 M customer minutes of interruptions.

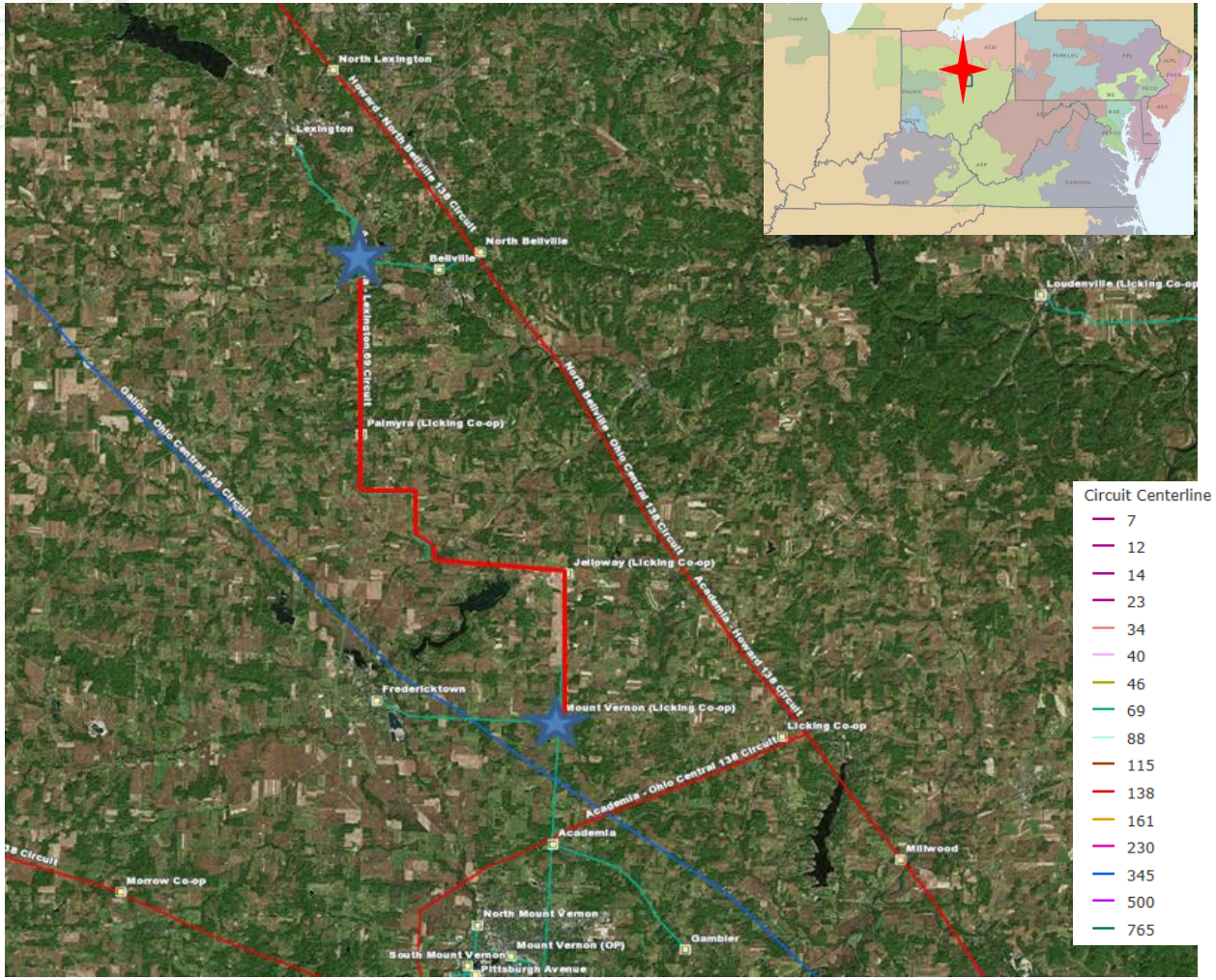
Selected Solution:

Rebuild the North Liberty Sw – West Bellville Sw section (12 miles) of the Mount Vernon – Howard 69 kV line with the conductor size 959.6 ACSR/TW (141 MVA rating). (**S1557**)

Estimated Cost: $8.5M

Projected In-service: 6/1/2018

Project Status: Under Construction



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Previously presented on 2/14/2018 SRRTEP

Baseline & Supplemental Project

Problem Statement:

Planning Criteria Violations (TO criteria violation):

For N-1 loss of the Reedurban 138-69kV transformer (or the South Canton-West Canton #2 138kV circuit), the following summer peak overloads are observed: Torrey-S. Gambrinus Switch 69kV (117% SE); S. Gambrinus Switch-Gambrinus Road 69kV (106% SE). The circuit sections are overloaded due to 4/0 Copper conductor (rated at 54 MVA SE).

Equipment Material/Condition/Performance/Risk:

The existing 2.7 mile, 69 kV line section between Torrey and Bliss Park was originally constructed in 1922 using wood pole structures with 4/0 Copper conductor (54 MVA rating). The majority of the existing structures date to 1963 or earlier (55 years old), with the conductor dating to 1922. In addition, there is a 400 foot underground cable section that is in poor condition.

This 69kV line section has experienced 1.25 million minutes of customer interruption (CMI) in the past three years.

There are 17 open Category A conditions on this line section and 3 Category B items of concern. These issues include: rotted poles, damaged splices, and stolen ground-wire leads.

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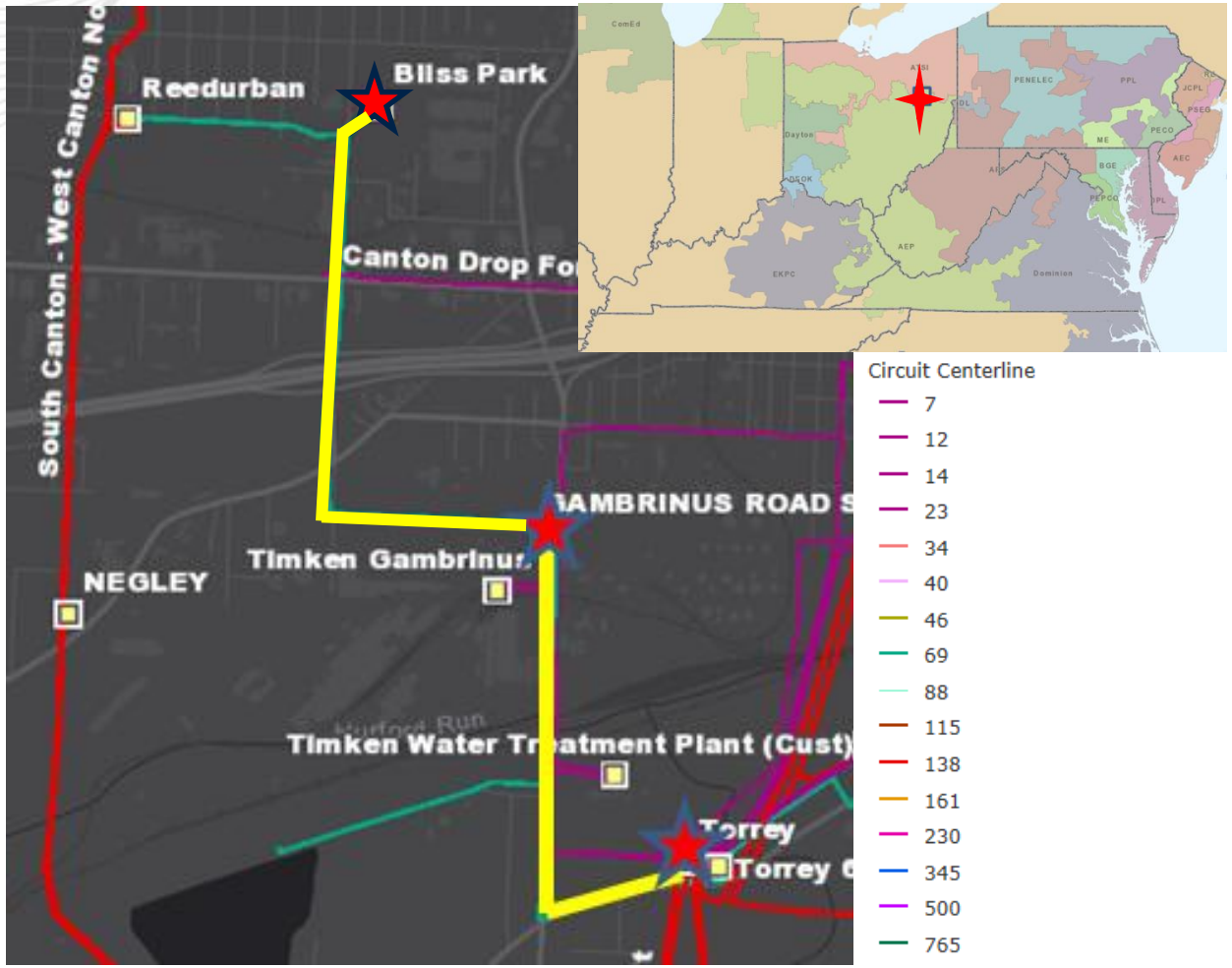

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AEP Transmission Zone: Baseline and Supplemental
Torrey-Bliss Park 69kV Line Rebuild

Continued from previous slide…

Operational Flexibility and Efficiency:

This 69kV line section provides service to a large oil refinery, which has sensitive electrical equipment. Proactively replacing this aging asset will ensure a high level of reliability for years to come. In addition, the existing capacity constraints hinder future customer expansion plans.

The circuit has experienced numerous local PCLLRW warnings in 2016-17, due to the real-time loads being above the N-1 capability of the circuit.

In addition, the Bliss Park-Gambrinus 69kV section loads to 51 MVA (94% of its 54 MVA SE rating), for an N-1 contingency of the Torrey 138-69KV transformer fault or a Torrey 69kV bus fault. The 3 MVA of margin on this line may be used up quickly due to the large industrial customers on the circuit (oil refinery and scrap metal yard).

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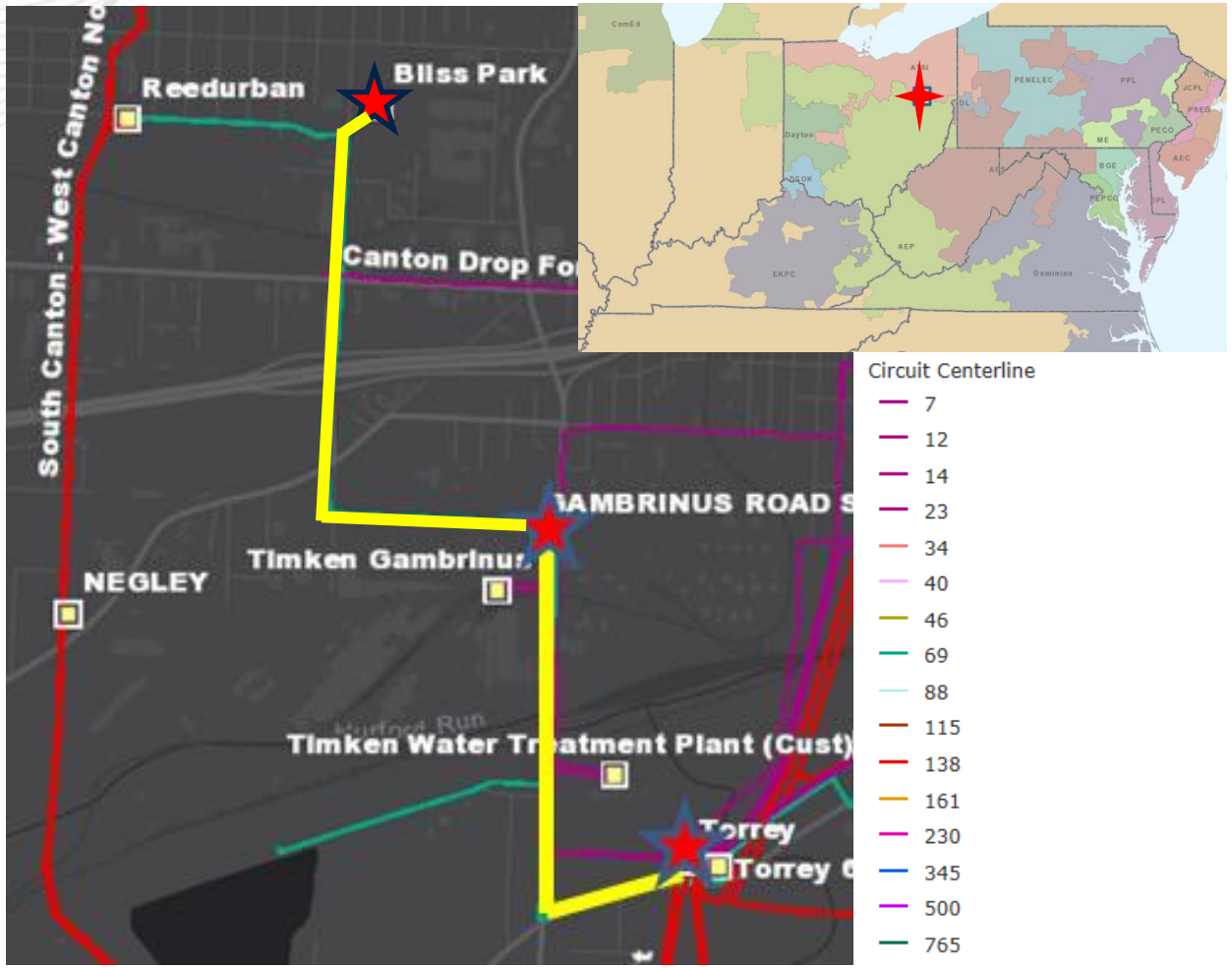

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AEP Transmission Zone: Baseline and Supplemental
Torrey-Bliss Park 69kV Line Rebuild

Continued from previous slide…

Selected Solution:

Baseline:

Rebuild the Torrey – South Gambrinus Switch – Gambrinus Road 69kV line section (1.3 miles) with 1033 ACSR 'Curlew' conductor and steel poles. (**B2993**)

Estimated Baseline Cost: $2.8M

Required In-service: 6/01/2018

Projected In-service: 12/01/2018

Supplemental:

Rebuild the Gambrinus Road – Bliss Park 69kV line section (1.4 miles) with 1033 ACSR 'Curlew' conductor and steel poles. (**S1558**)

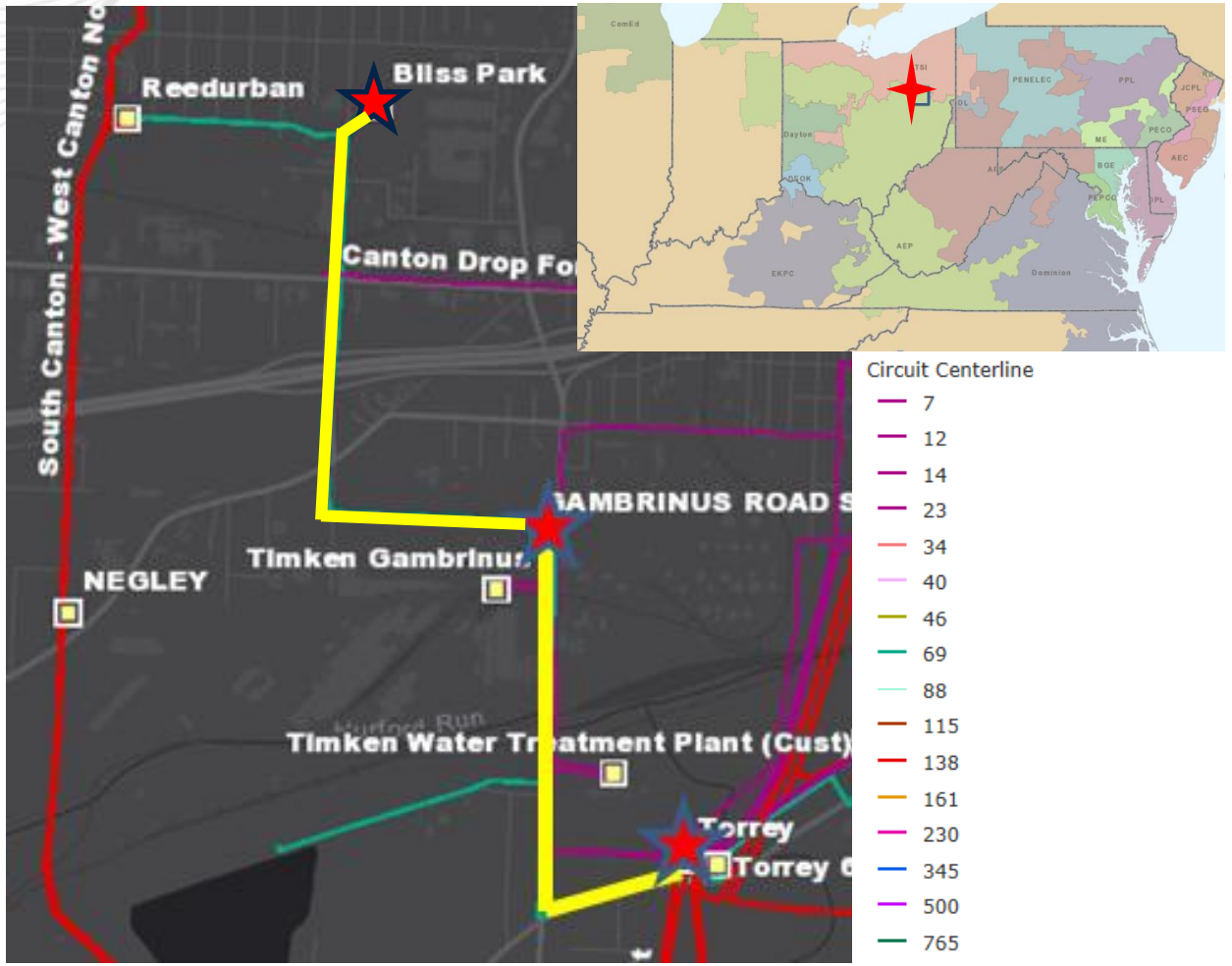
Estimated Supplemental Cost: $3.0M

Total Estimated Cost: $5.8M

[This conductor size was chosen due to the location of the major oil refinery that has discussed potential major load increases with AEP in recent years; in addition, this conductor is one of the most common in the Canton area, resulting in procurement/warehousing/spare-part cost savings.]

Projected In-service: 12/01/2018

Project Status: Engineering



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AEP Transmission Zone: Supplemental Buckskin-Highland 69 kV Rebuild

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The Buckskin – Highland line was installed in 1926 with 4/0 ACSR conductor (50 MVA rating), with the majority of the line (96%) still from that vintage. There were 651 open conditions found during the most recent inspection of the Buckskin-Highland line, which was completed in 2015. Outages on this circuit are attributed to broken pole tops, floating phases, broken poles, and weather.

Petersburg Switch has been identified as a safety concern due to the terrain around the switch handles and the height at which the handles are installed. It has been recognized that when a switch person is switching, there is a tripping hazard due to the steep elevation change at the base of the pole where the GOAB handles are located: the switch handle is at head level at the high end of the terrain and is above the head when completely open. Switches on wood poles also have issues with the blades seating properly during switching, requiring additional outage and switching time from Transmission Dispatch. The existing wood pole switch will be replaced with a steel pole switch across the road from the existing location to allow for better footing, proper seating of the switch blades reducing outage and switching time, and safer operation of the switch. The FOI outage metric is 19.2, sufficient for the justification of MOAB switch installation.

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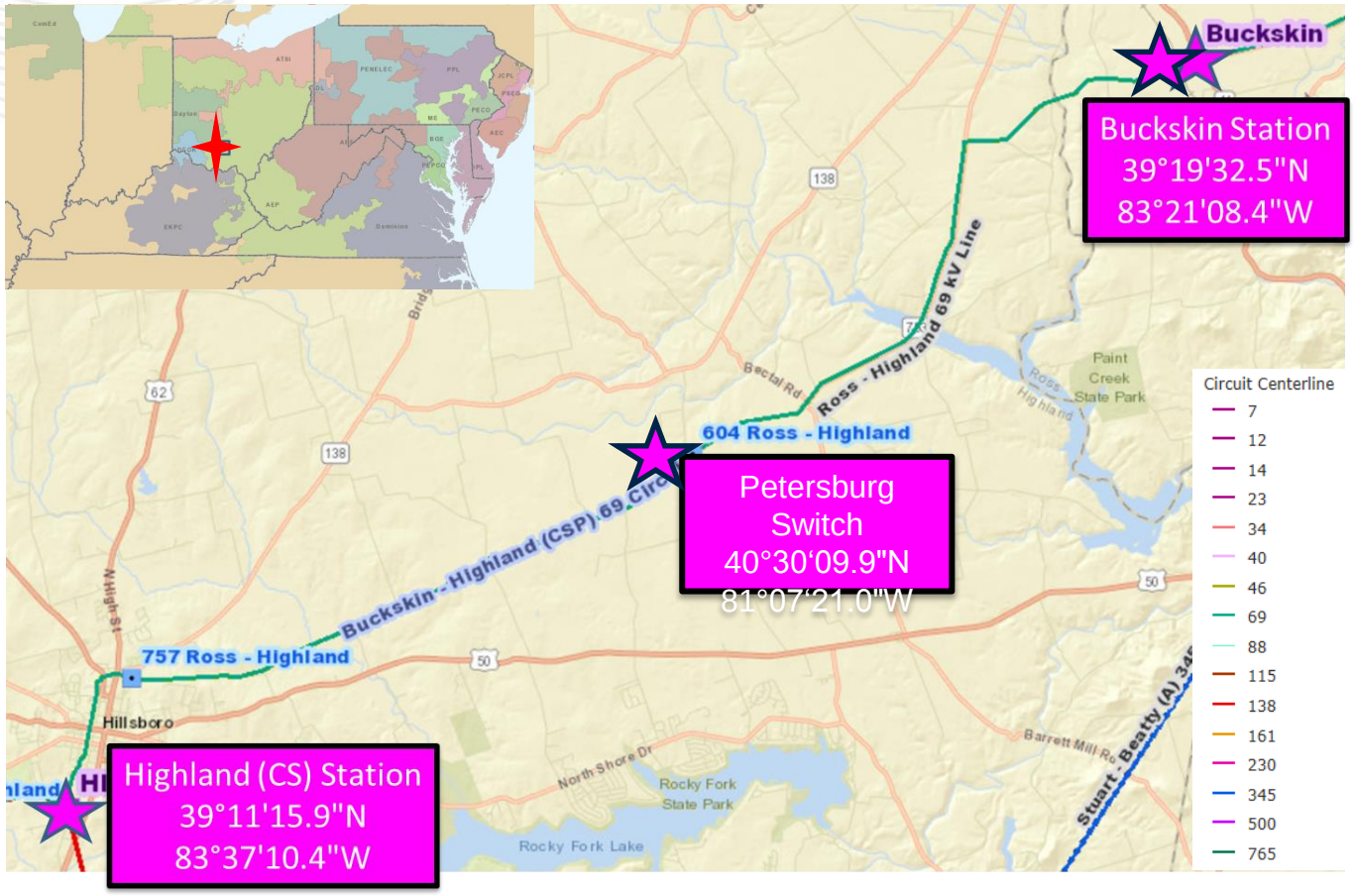

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AEP Transmission Zone: Supplemental
Buckskin-Highland 69 kV Rebuild

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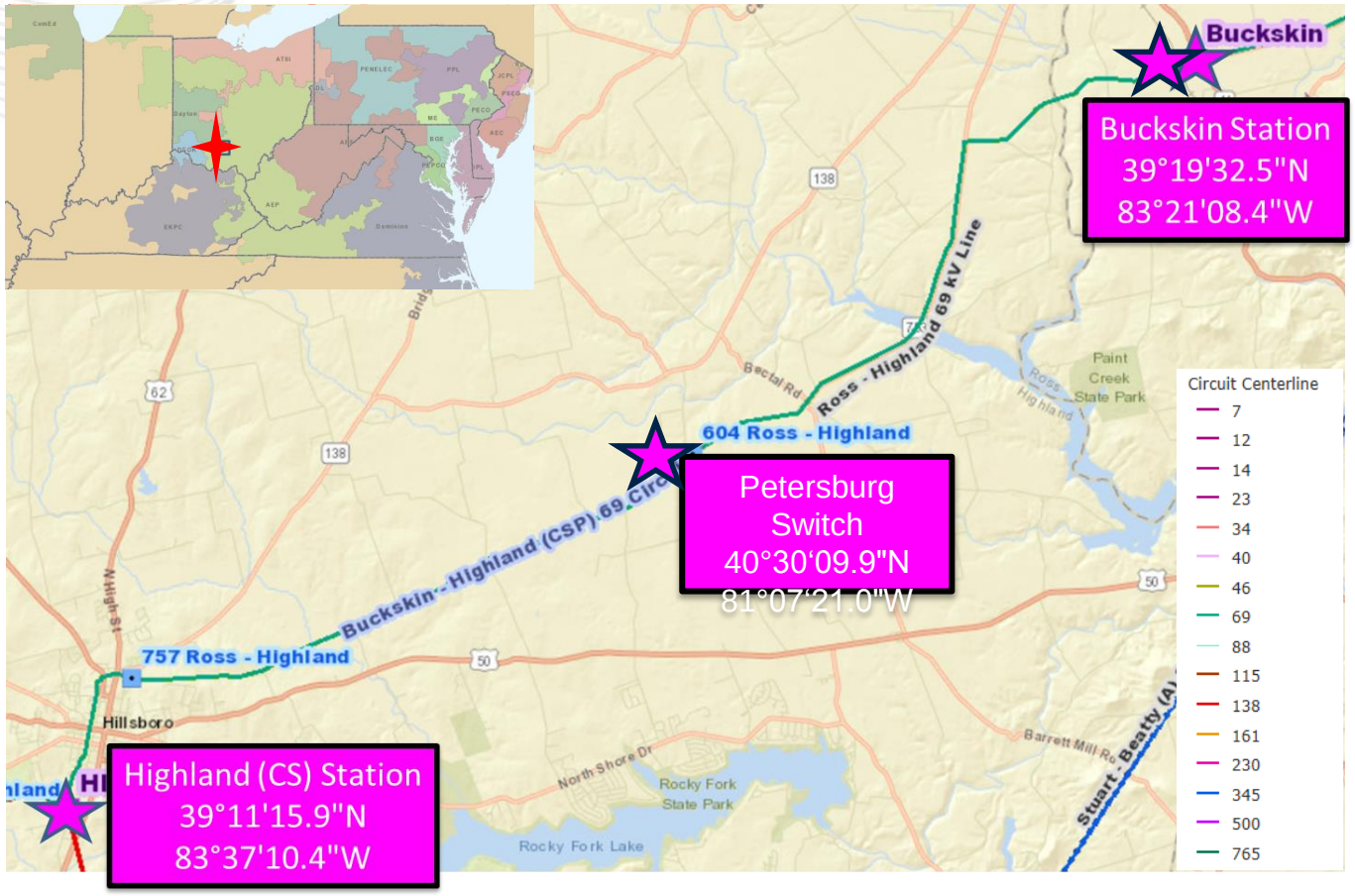
Selected Solution:
Rebuild ~18.7 miles of the Ross – Highland 69kV Line using 795 ACSR conductor (128 MVA rating) and 69kV Self Supporting steel with partial reroute around Hillsboro. (**S1559.1**)
Estimated Cost: $20.7M

Replace Petersburg Switch (**S1559.2**)
Estimated Cost: $0.3M

Total Estimated Transmission Cost: $21.0M

Projected In-service: 12/01/2019

Project Status: Engineering



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AEP Transmission Zone: Supplemental
Cabin Creek – Clendenin Rebuild

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

From 2014-2016, the Cabin Creek – Clendenin 46 kV circuit (~ 26 miles) has experienced 8 permanent and 14 momentary outages resulting in approximately 750,000 customer minutes interrupted. The 17 mile Kelly Creek – Clendenin 46 kV line section that is to be rebuilt currently has 49 category A conditions along 114 structures of single circuit wood pole construction. These conditions include damaged/rotted poles and damaged guy wires, cross arms and contribute to the amount of momentary and permanent outages seen on the circuit. The majority of this circuit utilizes 1960s and 1970s wood structures as well as some 1910s lattice structures with a mix of 3/0 ACSR, 4/0 Copper and 3/0 Copper conductor (29 MVA rating).

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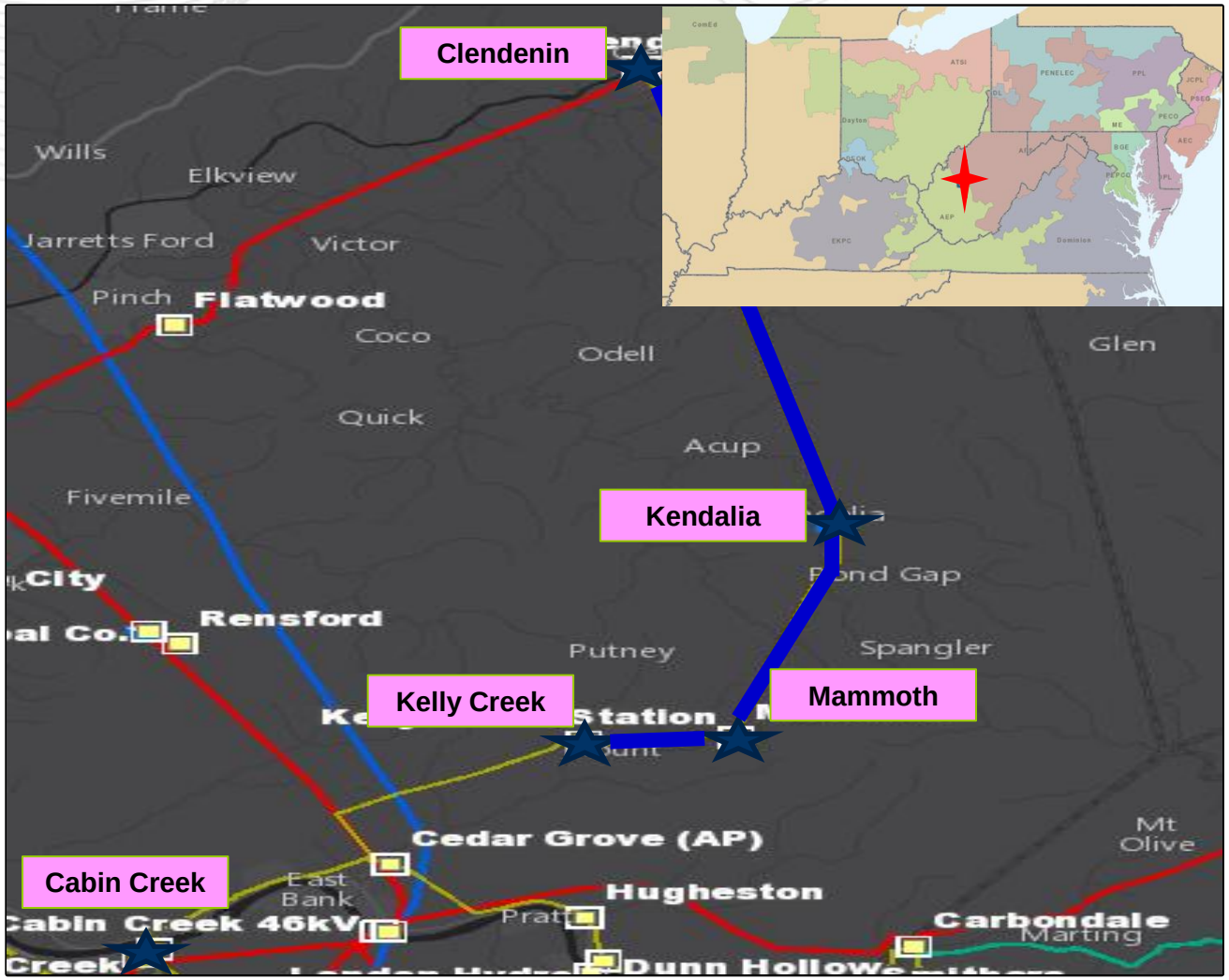

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AEP Transmission Zone: Supplemental
Cabin Creek – Clendenin Rebuild

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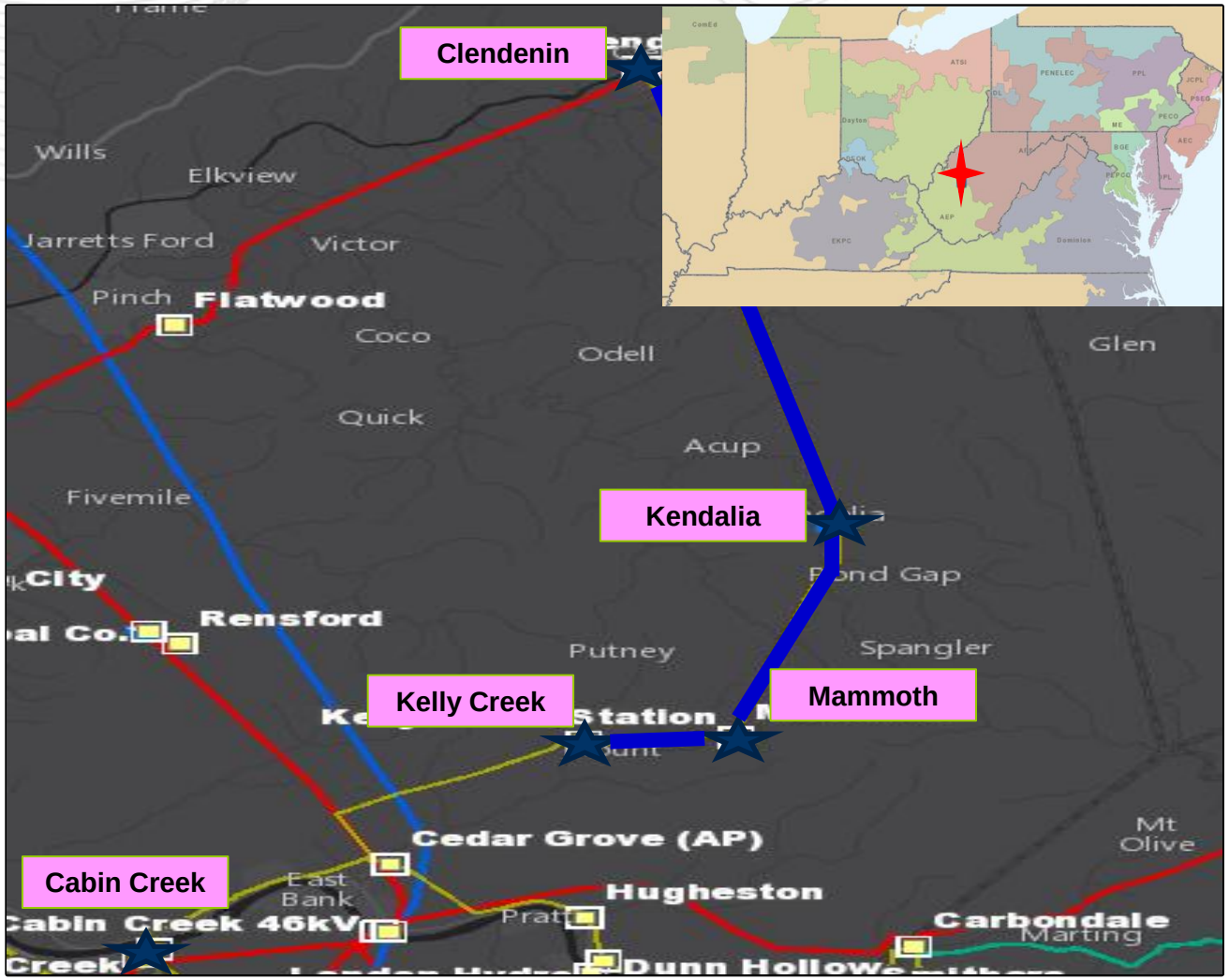
Selected Solution:
Rebuild approximately 17.5 miles of the Clendenin –Kelly Creek 46kV line to 69kV standards (energized at 46kV) utilizing 556 ACSR (68 MVA rating).
Retire Kendalia switch. (**S1560.1**)
Estimated Cost: $29.3M
At Kelly Creek retire the switching structure and replace it with a 1200 A 3 way Phase Over Phase (POP) motorized switching structure. (**S1560.2**)
Estimated Cost: $0.7M
At Mammoth station install a 1200 A 3 way POP motorized switching structure. (**S1560.3**)
Estimated Cost: $0.7M

Total Estimated Transmission Cost: $30.7M

Projected In-service: 12/04/2020

Project Status: Engineering



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AEP Transmission Zone: Supplemental Dorton Station Rehab

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Dorton's 138/46 kV Transformer #1 is 1956 vintage and is showing dielectric breakdown (insulation), accessory damage (bushings/windings) and short circuit breakdown (due to amount of through faults).

Operational Flexibility:

There are two overlapping zones of protection on the 46 kV bus – the transformer, bus, and line exits.

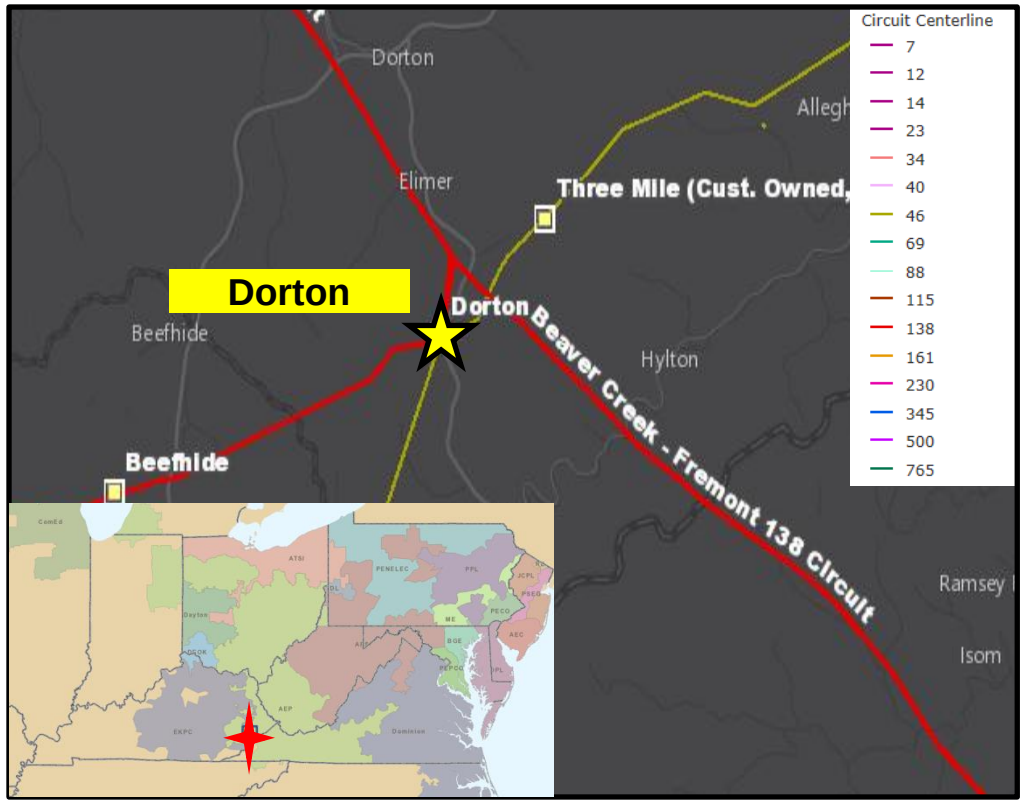
Selected Solution:

Replace the existing 138/46 kV 45 MVA transformer bank with a new 138/69/46 kV 90 MVA transformer bank at Dorton Station. A lowside 69 kV circuit breaker (operated at 46 kV) will be added to the transformer. (**S1562**)

Total Estimated Transmission Cost: $2.5 M

Projected In-service: 08/01/2019

Project Status: Scoping



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Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The East Lima – Haviland 138kV line was originally constructed in 1925 with lattice towers and 397 ACSR conductor (167 MVA rating). The double circuit sectios of the line being rebuilt is approximately 30 miles long on the path from Haviland – North Delphos – Rockhill. There are 99 total open conditions along the line. There are numerous issues with the conductor and conductor hardware on this line. Armor grip suspension assemblies were installed during routine maintenance periods in an attempt to restore the strength of the conductor. However, crews have found many cases of broken conductor strands under these armor grip assemblies. In addition, the conductors' steel core has been found to be deteriorated in sections due to corrosion, which is a cause for concern as the mechanical strength of the wire can be compromised. Many insulators have lost their outer glaze, allowing contaminant buildup, compromised electrical integrity and growing risk of electrical failure. As this line was originally built in 1925, its design standards do not meet modern standards for strength, resilience, galloping and horizontal and vertical clearances for safety. Also, the easement conditions present sections with undefined width and have several encroachments.

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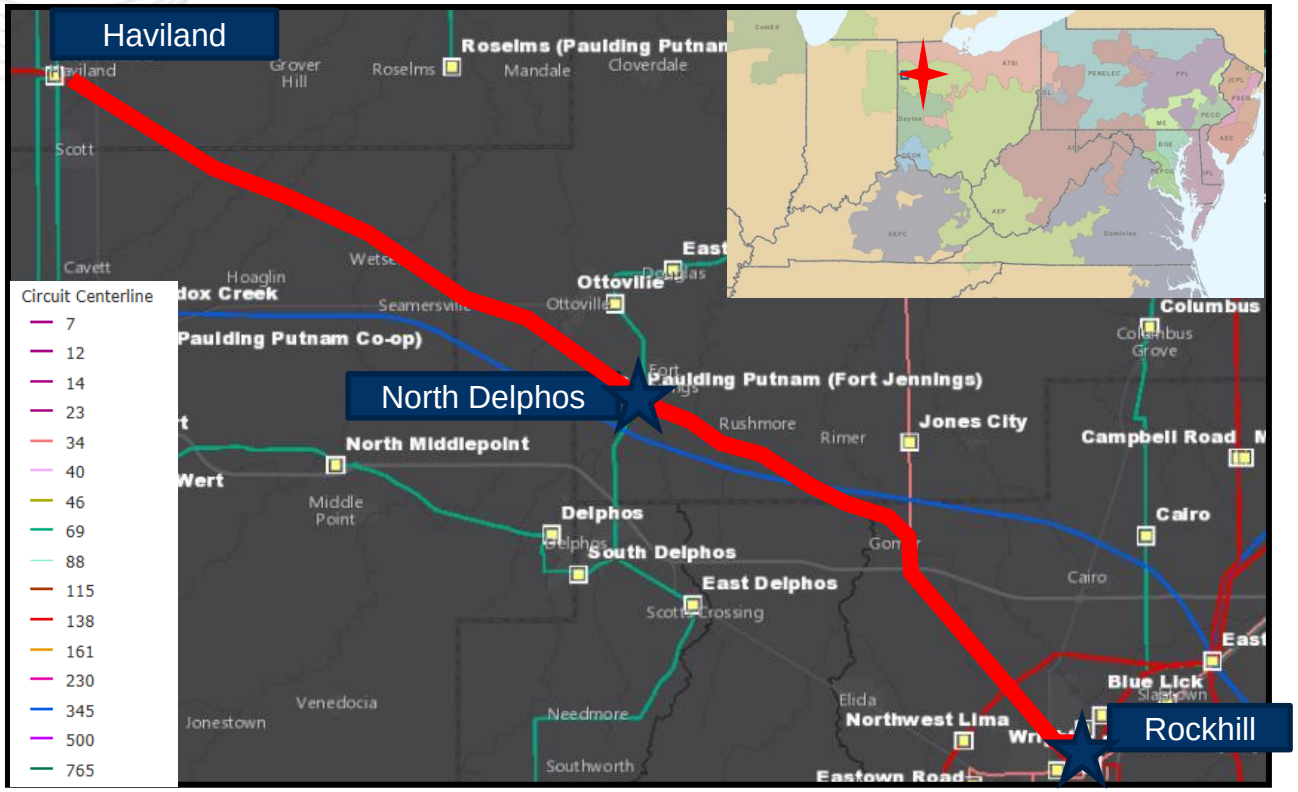

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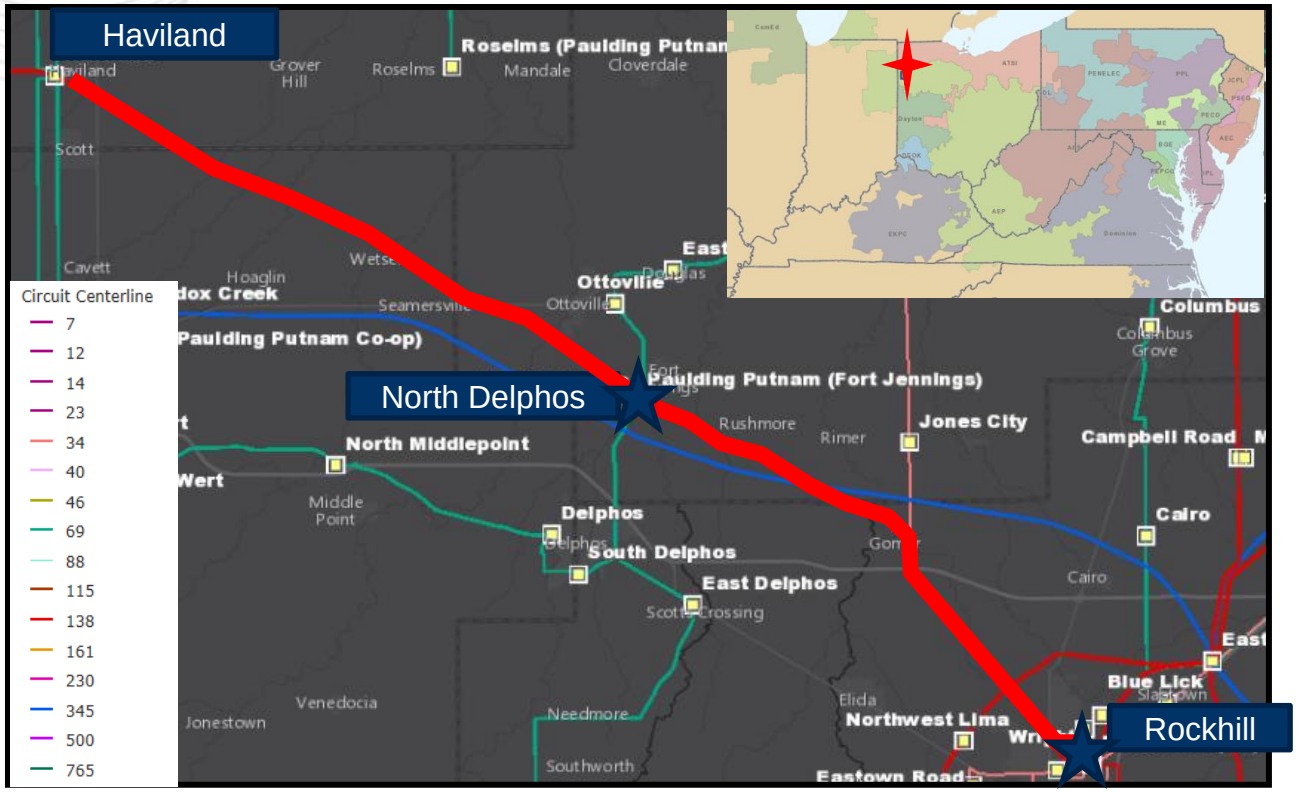
Selected Solution:
Haviland – North Delphos 138kV: Rebuild 15.6 miles of double circuit 138kV line utilizing 1033 ACSR conductor (296 MVA rating) (**S1563.1**)
Estimated Cost: $24.3M
North Delphos – Rockhill 138kV: Rebuild 15.4 miles of double circuit 138kV line utilizing 1033 ACSR 1033 ACSR conductor (296 MVA rating) (**S1563.2**)
Estimated Cost: $24.5M

Total Estimated Cost: $48.8M

Projected In-service: 12/18/2020

Project Status: Engineering



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AEP Transmission Zone: Supplemental
Harpster – Waldo 69 kV Rehab

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The Harpster – North Waldo 69 kV circuit was built between 1946 - 1969 and is almost entirely wood poles with 132 A and 214 B open conditions distributed along the entire circuit. Almost the entire line is cross arm construction with vertical post insulators (not a current AEP standard).These cross arms and braces typically fail to pass inspection. Maintenance has become increasingly difficult due to the in availability of material for repair as the existing line is primarily 1/0 copper (35 MVA rating). The existing wood pole structures have bay-o-nets supporting the shield wire, with poor grounding at every other structure (currently not to AEP standard) contributing to poor momentary outage performance. Much of the line has distribution underbuilt whose mechanical loads consume pole strength. Some of these underbuilt is owned by Ohio Edison (a First Energy subsidiary). Furthermore, the present easement rights for this vintage line is inadequate by present day AEP Transmission standards.

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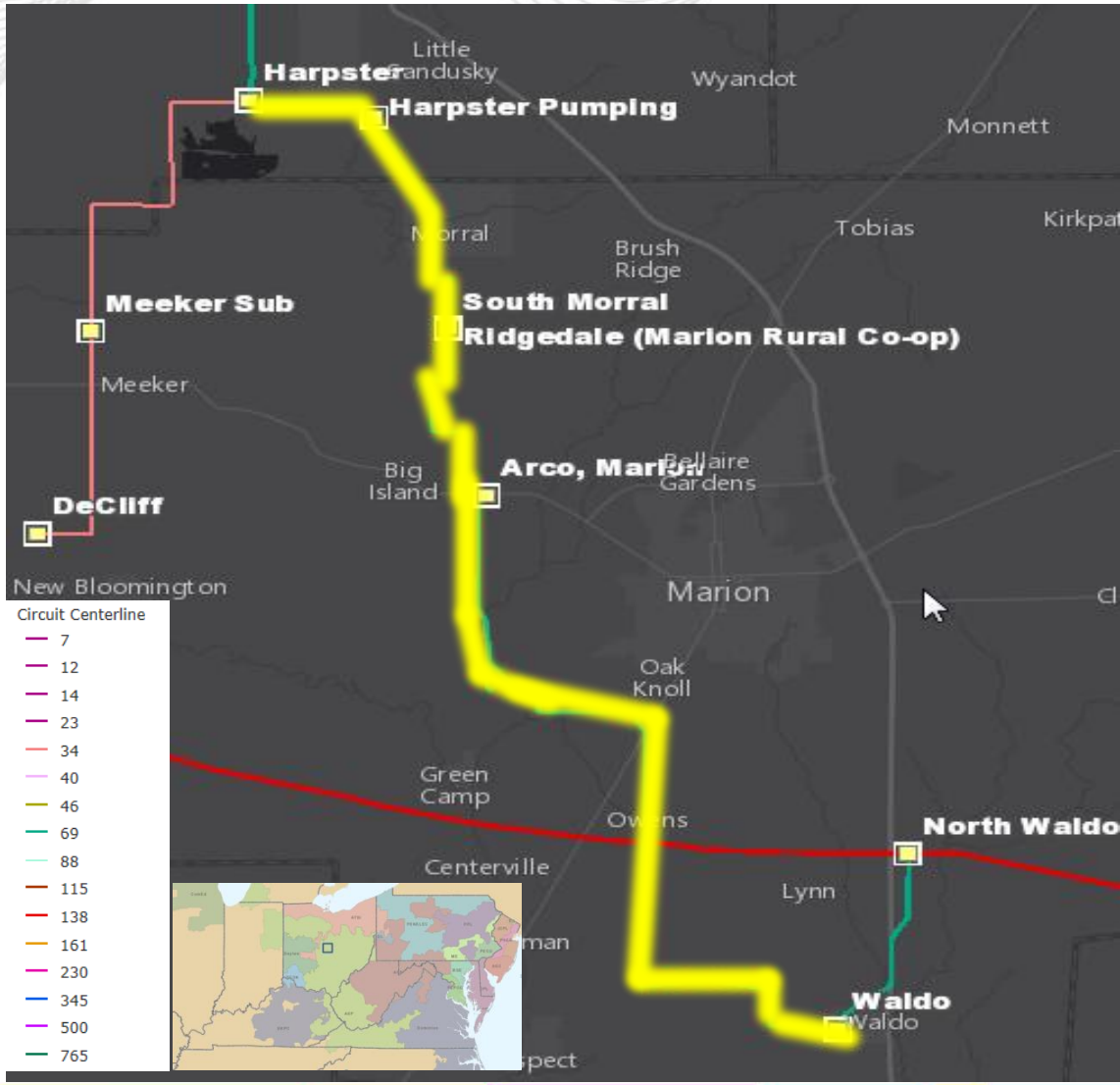

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AEP Transmission Zone: Supplemental
Harpster – Waldo 69 kV Rehab

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Selected Solution:
Rebuild ~27.7 miles from Harpster 69 kV Station to Waldo 69 kV Station utilizing 795 ACSR conductor (SN 129 MVA rating) (**S1564.1**)
Estimated Trans Cost: $30.0M

Replace existing 600 A two way switch at Harpster Pump station with 1200 A three way switch. (**S1564.2**)
Estimated Transmission Cost: $0.91M

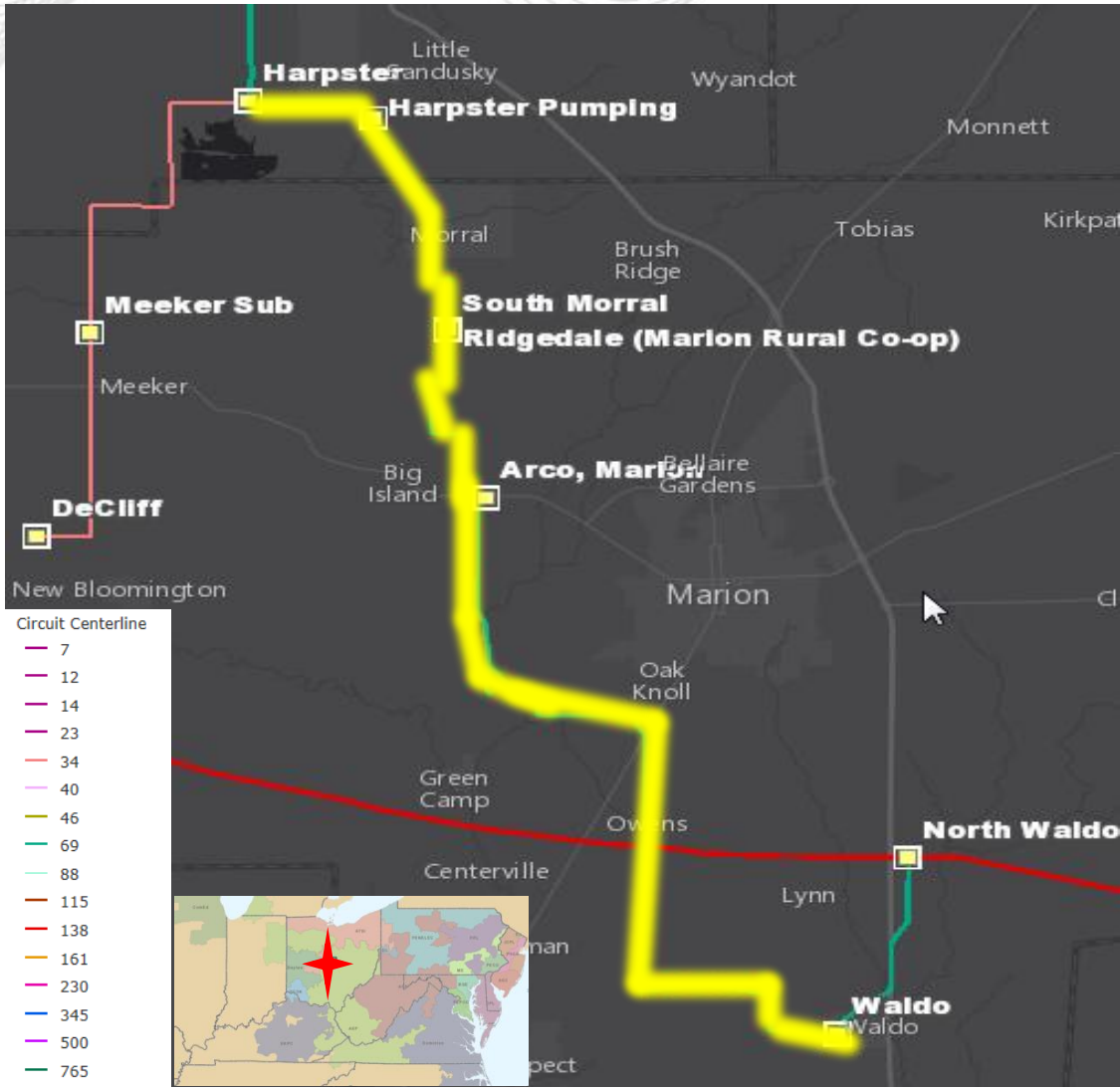
Install a one way 1200 A phase over phase switch (Goodnow Road SW) just north of Ridgedale (Marion Rural Co-op) (**S1564.3**)
Estimated Transmission Cost: $0.17M

Remove station West Marion SW. (**S1564.4**)
Estimated Transmission Cost: $0.08M

Total Estimated Transmission Cost: $31.2 M

Projected In-service: 06/04/2021

Project Status: Engineering



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AEP Transmission Zone: Supplemental
Johns Creek Station Rehab

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Transformer Bank #1 (1980 vintage) has bad high side internal CTs which are not field replaceable. Given the faulty internal CT and the current maintenance issues, the bank is being replaced. Drivers for replacement include short circuit strength breakdown, bushing damage and dielectric strength breakdown (winding insulation). In order to move the 34.5 kV distribution load off the tertiary winding of the existing 138/69/34.5 kV transformer, a new 138/34.5 transformer is being installed along with the new 138/69/34.5 kV transformer.

Circuit Breaker 'A' is an oil breaker that is leaking oil. In addition the breaker has surpassed the manufacturer's recommended fault operations of 10 (135 fault operations).

Capacitor switcher 'AA' does not have pre-insertion inductor and has caused customer protection equipment in the area to trip off line due to voltage surges.

Capacitor switcher 'BB' is a Mark V model which no longer supports modern relaying packages. Mark V's have been historically prone to mechanism failures and are being replaced system wide where possible.

The MOAB/ground switch will be replaced. MOAB/ground switch combinations induce a fault on the system, tripping remote breakers for a transformer fault, reducing the life and increasing relay coordination complexity for the transformer protection.

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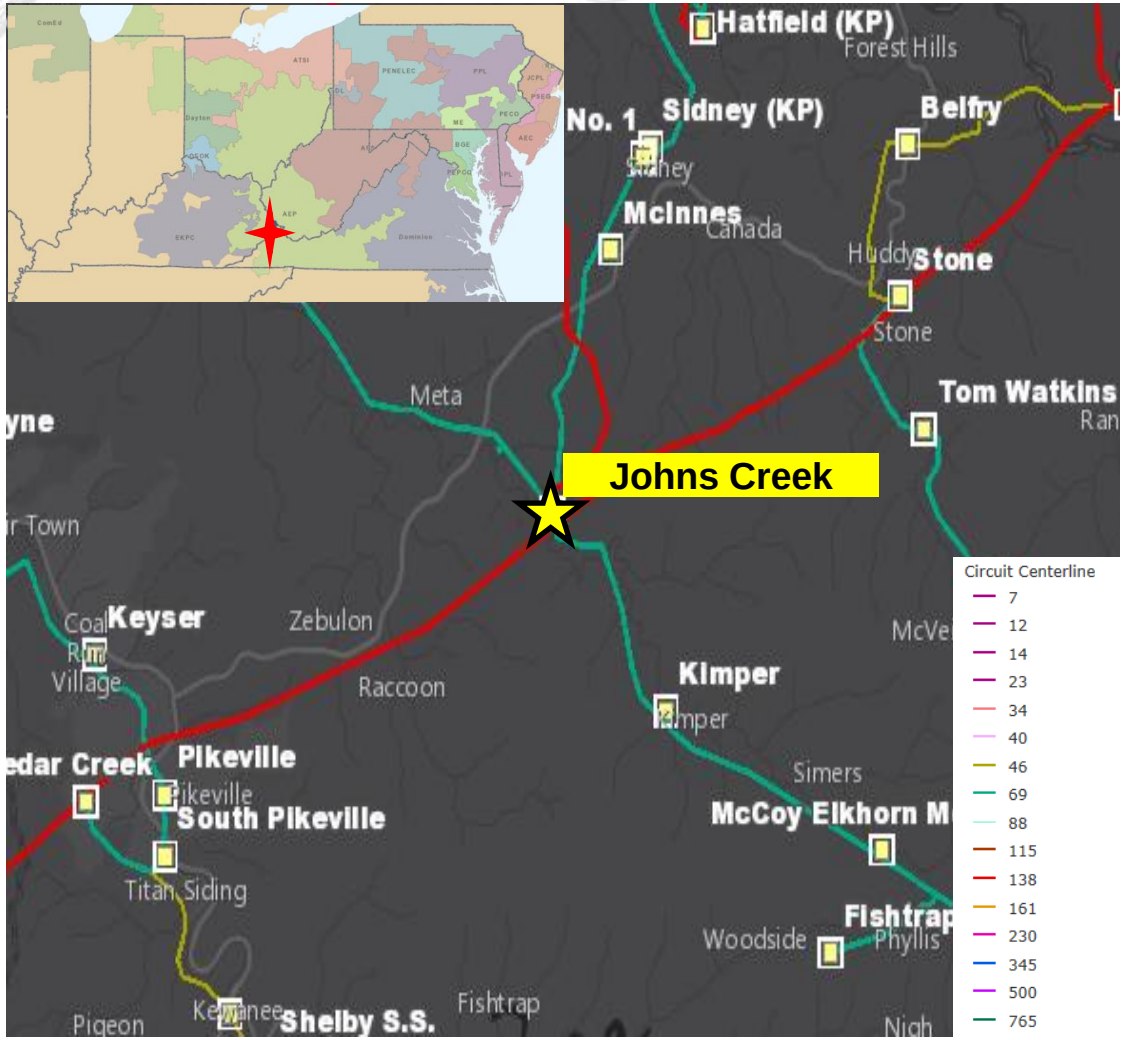

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AEP Transmission Zone: Supplemental
Johns Creek Station Rehab

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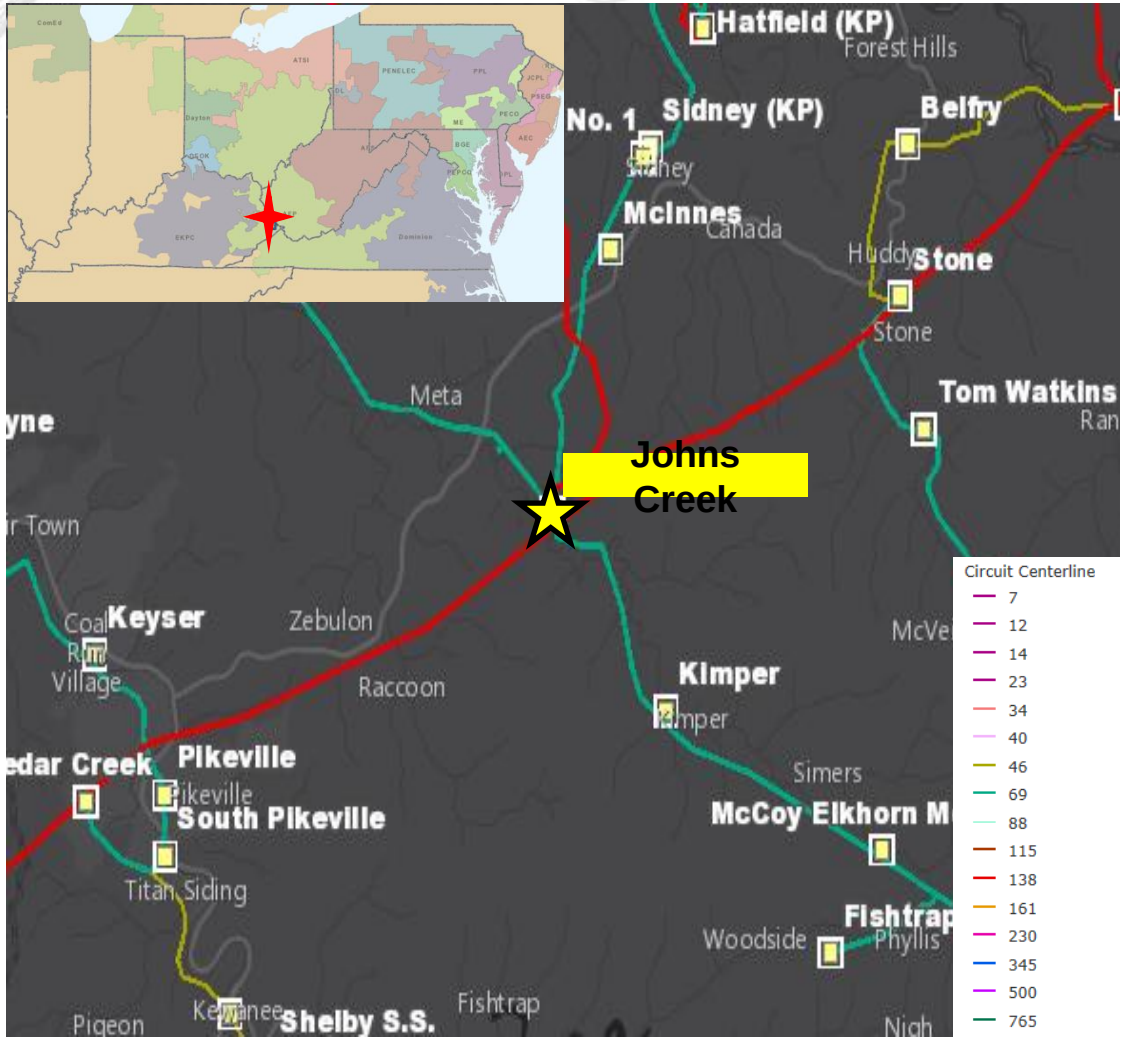
Selected Solution:
At Johns Creek Station, replace existing 69 kV circuit breaker 'A' with a new 3000 A 40 kA circuit breaker. Replace the existing 138/69/34.5 kV 90 MVA transformer #1 with a new 90 MVA 138/69/34.5 kV transformer. Install a new 20 MVA 138/34.5 kV transformer to remove the distribution load from the tertiary of transformer #1. Install a new 2000 A 40 kA high side circuit switcher on the 138/34.5 kV Transformer. Replace existing capacitor switcher 'AA' with a new 3000 A 40 kA switcher and existing capacitor switcher 'BB' with new 3000 A 40 kA switcher. (**S1565**)

Total Estimated Transmission Cost: $7.4 M

Projected In-service: 07/01/2019

Project Status: Scoping



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AEP Transmission Zone: Supplemental
Layland – McClung Line Rebuild

Previously presented on 2/14/2018 SRRTEP

Problem Statement:
Equipment Material/Condition/Performance/Risk:
From 2013-2016 the Layland – McClung 69 kV line (~20 miles) has experienced 13 momentary and 14 permanent forced outages resulting in over 3.6M customer minutes of interruption. The line consists of 169 structures of single circuit 69 kV wood pole construction built in the 1930s. There are currently 45 structures with category A open conditions along the line. These conditions include damaged/rotted poles and cross arms. This line does not currently have shielding and is not designed to physically support a shield wire. The conductor for this line is 3/0 ACSR 6/1 Pigeon (16.5 miles) and 4/0 ACSR 6/1 Penguin (3.5 miles).

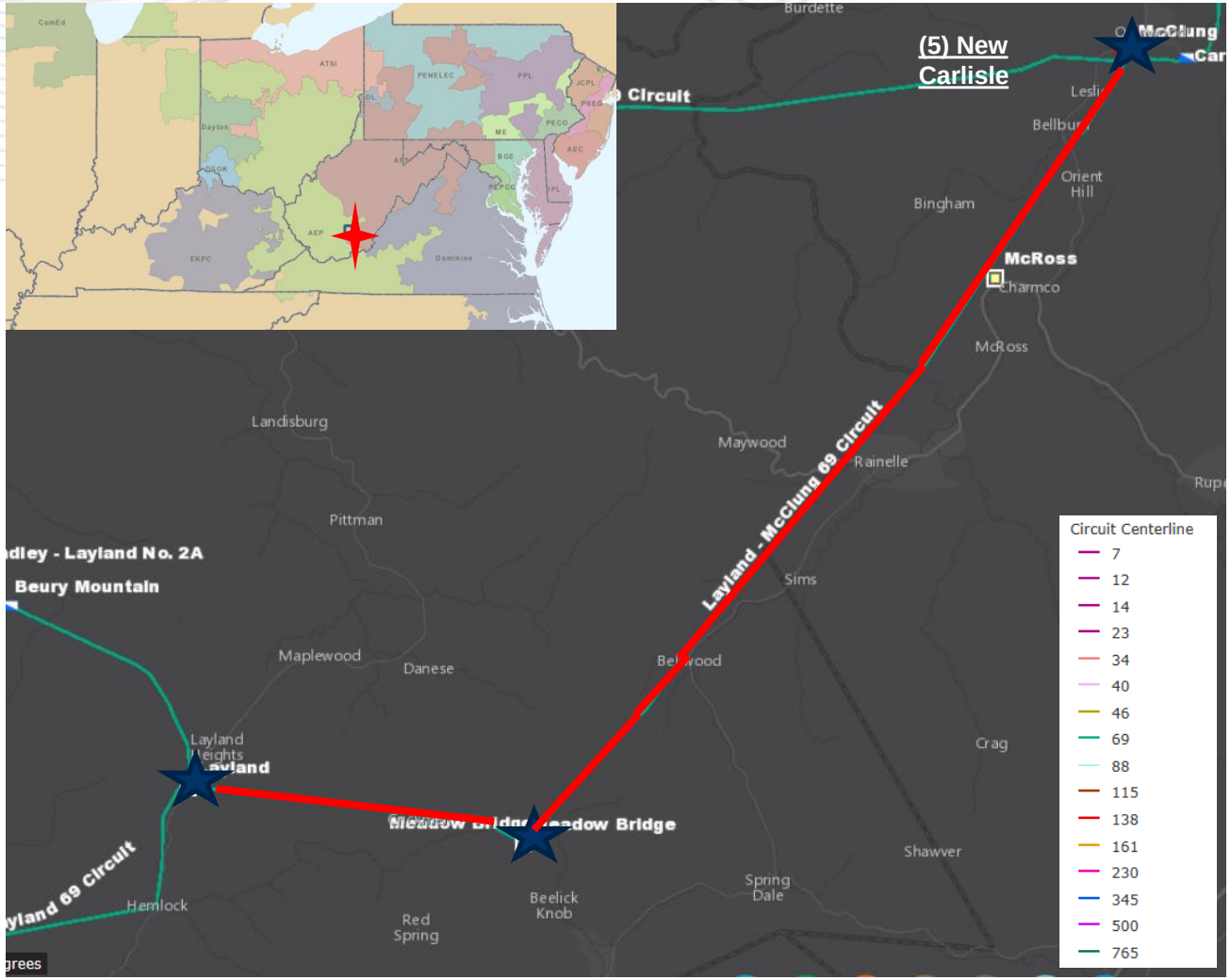
Selected Solution:
At Meadow Bridge station, replace the 600 A 2 way Phase over Phase Switch with 1200 A 2 way Phase over Phase Switch (motorized). (**S1566.1**)
Estimated Cost: $0.6M

Rebuild approximately 20 miles of the Layland – McClung 69 kV line with 556.5 ACSR conductor. (**S1566.2**)
Estimated Cost: $34.4M

Total Estimated Transmission Cost: $35 M

Projected In-service: 12/04/2020

Project Status: Scoping



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AEP Transmission Zone: Supplemental Newcomerstown Line Conversion and Transformer

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Newcomerstown 138/69/12 kV transformer #1 was installed in 1966. The transformer is showing signs of deterioration due to dielectric strength breakdown (winding insulation), accessory damage (bushings) and short circuit strength breakdown (due to the high number of through fault events).

Customer Service:

The Newcomerstown 138/69/12kV transformer overloaded for several contingencies when considering a large shale load increase in this area. The transformer is a 50 MVA unit with distribution load served off the tertiary winding. The transformer loaded to 101% of Summer Emergency (SE) for a breaker-failure contingency at West New Philadelphia and to 116% of SE for the single contingencies of Kammer – South Canton 765 kV and West New Philadelphia – Newcomerstown 138 kV circuit.

The Newcomerstown – Sugarcreek Terminal 34.5 kV line is already built to 69 kV standards. As part of this project, we are converting the line to operate at 69 kV in collaboration with customers presently served off the line. After the Newcomerstown – Sugarcreek Terminal circuit is converted to 69 kV, Sugarcreek Terminal – Belden 34.5 kV will be the only 34.5 kV connected to the Sugarcreek Terminal. There is not much 34.5 kV in the area or sources thus the N-1-1 outage of the Newcomerstown 69/34.5 kV transformer in conjunction with Sugarcreek Terminal 69/34.5 kV transformer would take out the Newcomerstown – Sugarcreek Terminal 34.5 kV and all its customers.

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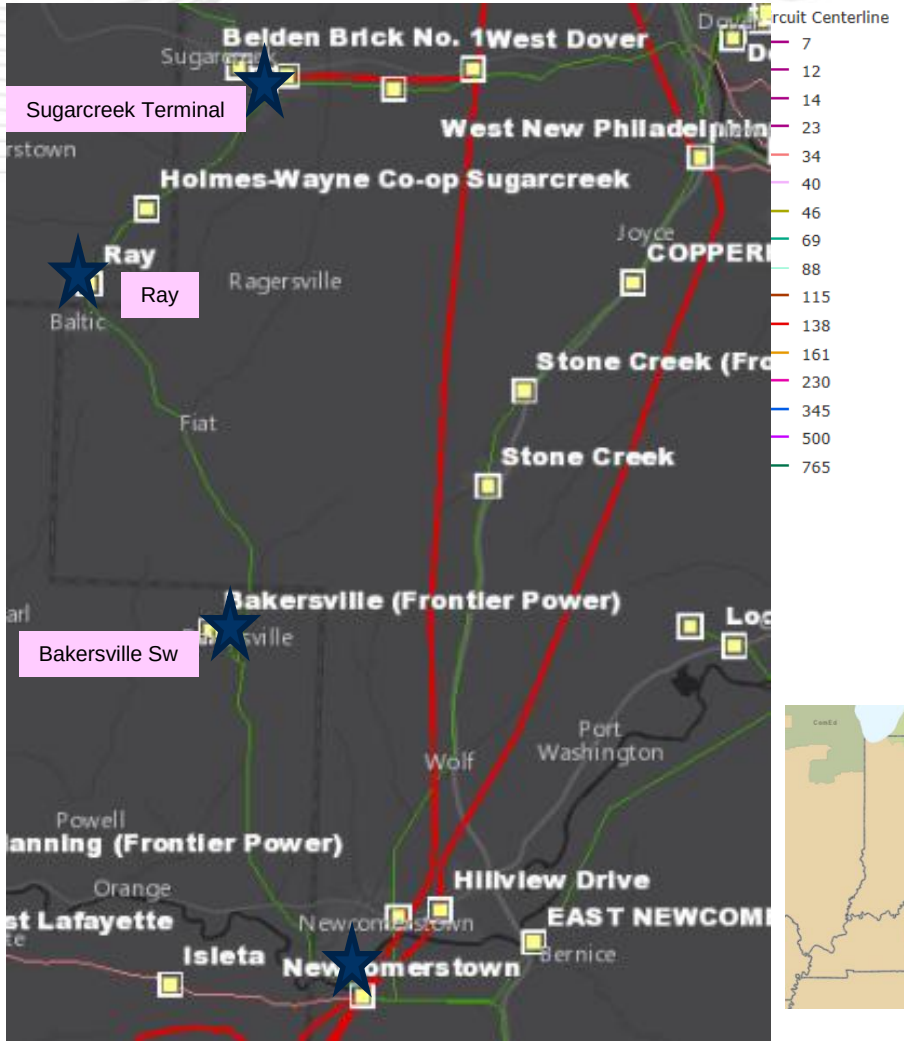

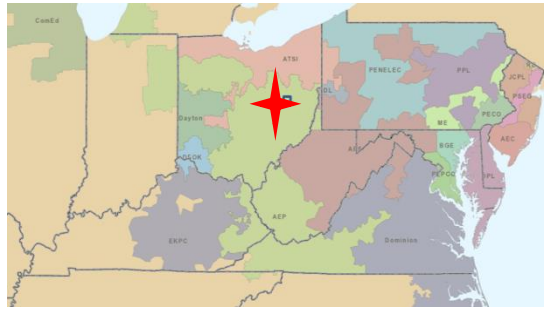

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AEP Transmission Zone: Supplemental Newcomerstown Line Conversion and Transformer

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Selected Solution:

Relocate the Newcomerstown-Ray line to the 69 kV bay at Newcomerstown station. (**S1567.1**)
Estimated Cost: $0.1M

At Newcomerstown station, install a new 69kV 3000 A 40 kA circuit breaker for the Sugarcreek Terminal line exit. Remove the 34.5 kV Circuit Breaker "I". Replace the 50 MVA transformer with a 90 MVA transformer and install a high side and low side circuit breaker. (**S1567.2**)
Estimated Cost: $10.7M

At Ray station, install a 69 kV 3000 A 40 kA bus tie circuit breaker and transformer circuit switchers. Install a 69/34.5 kV transformer to serve the existing customers. (**S1567.3**)
Estimated Cost: $0.7M

At Bakersville switch, remove existing and install new PTs due to the 34.5kV to 69kV conversion. (**S1567.4**)
Estimated Cost: $0.3M

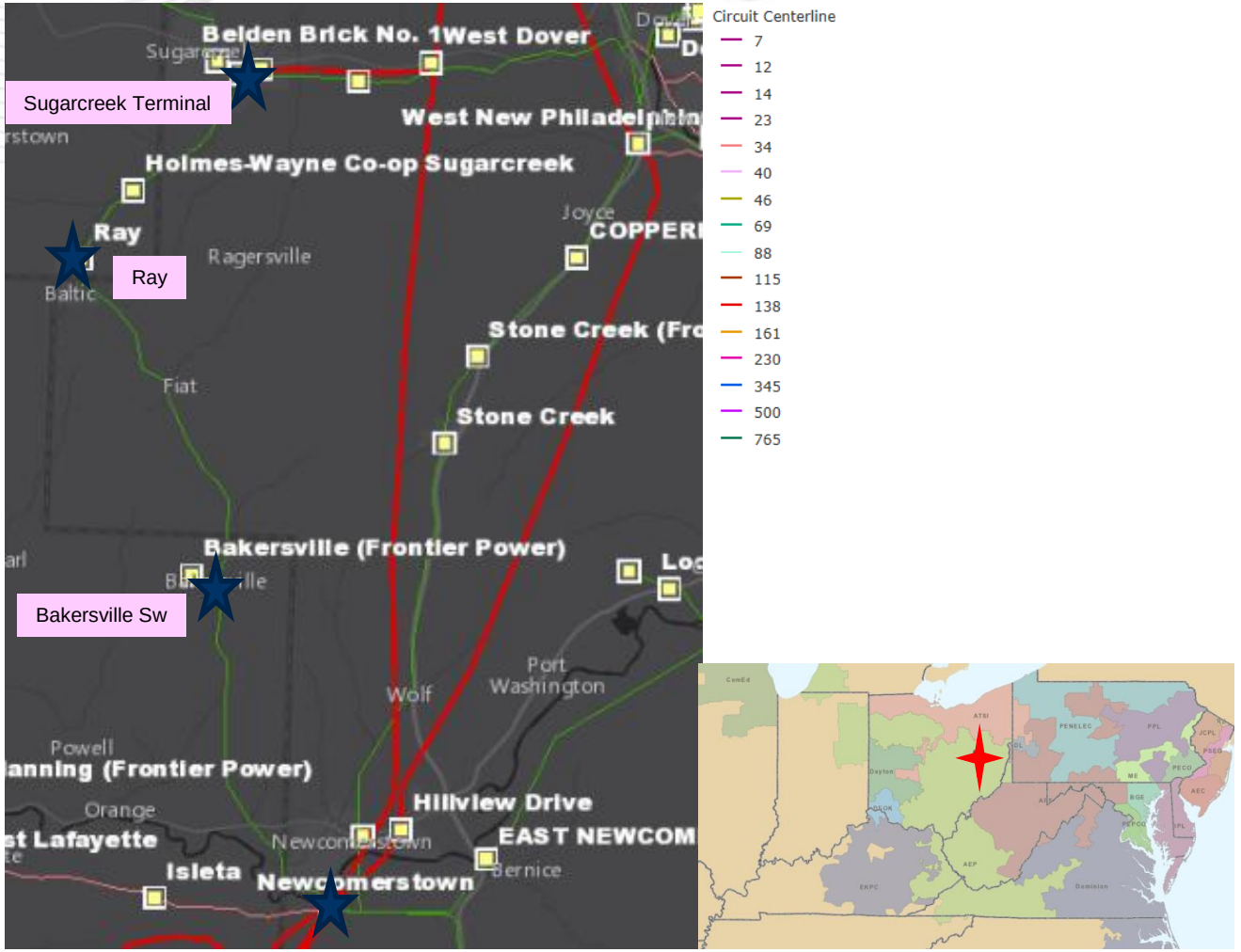
At Sugarcreek Terminal station, install a 69kV 3000 A 40 kA circuit breaker "F" for the Newcomerstown line exit. Remove 34.5 kV breaker "L." (**S1567.5**)
Estimated Cost: $0.7M

Relocate Ray-Sugarcreek 69 kV line to 69 kV bay at Sugarcreek Terminal. (**S1567.6**)
Estimated Cost $0.1M

Total Estimated Transmission Cost: $12.6M

Projected In-service: 12/16/2018

Project Status: Engineering



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AEP Transmission Zone: Supplemental
South Hicksville to Mark Center 69 kV Line

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The Mark Center-South Hicksville line was originally constructed in 1957 with 336 ACSR conductor (73 MVA rating). There are 119 open conditions on this 8.8 mile long circuit. The existing line is almost entirely crossarm construction with suspension insulator assemblies, which is not the current AEP standard; the existing crossarms and braces are typical for distribution construction, not transmission construction. End splitting and failure is an elevated risk. Many arms fail periodic inspection; quantity failing inspection is abnormally high. Undersized braces are prone to end fittings becoming separated and arms rotating. Some existing wood pole structures have bay-o-nets supporting the shield wire. At least once in the last year the line experienced a cascading failure of multiple poles in a row. Existing grounding is only every other structure. The line is double-circuit construction for several spans near South Hicksville Station. Structure failures in the double-circuit section jeopardize system stability in the Hicksville, OH area, elevating the risk of an area-wide outage. Some of the line has distribution underbuild, which mechanically consumes pole strength. Legacy underlying easement rights for a line of this vintage are typically inadequate by present day AEP Transmission standards.

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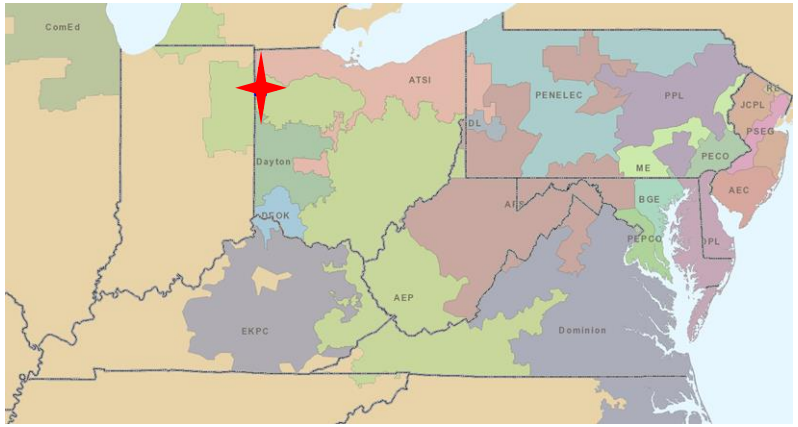
Existing Mark Center – South Hicksville 69 kV Line is highlighted in green;
Proposed rebuild is highlighted in red.



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AEP Transmission Zone: Supplemental
South Hicksville to Mark Center 69 kV Line

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Selected Solution:

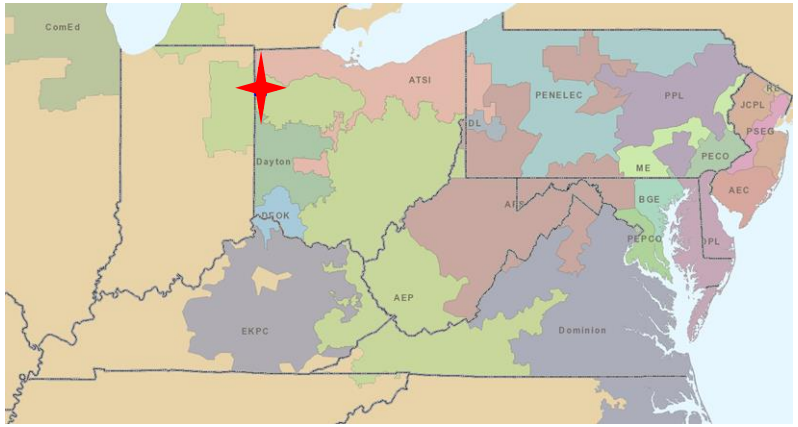
Rebuild existing South Hicksville – Mark Center Switch 69 kV line (~7.89 miles) with 795 ACSR (128 MVA rating), including a partial reroute to parallel the existing 138 kV line in the area. (**S1568**)

Estimated Cost: $8.2 M

Projected In-service: 5/31/2019

Project Status: Engineering

Existing Mark Center – South Hicksville 69 kV Line is highlighted in green;
Proposed rebuild is highlighted in red.



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AEP Transmission Zone: Supplemental Sunbright Station Rehab

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

34.5 kV circuit breakers “A” & “B” at Sunbright and “F” & “G” at Hill Stations are all FK type breakers (vintage 1950’s). 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. Sunbright breakers “A” & “B” have experienced 25 and 26 fault operations respectively, which exceeds the manufactures recommended number of operations (10). Hill breakers “F” & “G” have experienced 74 and 35 fault operations respectively, which exceeds the manufactures recommended number of operations (10).

The 34.5/12 kV transformer at Sunbright is 61 years old and has experienced short circuit strength breakdown caused by a large amount of high temperature through fault events. This has led to minor gassing of the unit, and carbonization of the insulating paper. In addition, there is an upward trending of oil moisture content which will begin resulting in downward trending to the oil dielectric strength. Increasing moisture content is a resultant of water ingress through worn gaskets, leaks from the tank, or a breakdown of paper insulation of transformer windings.

Customer Service:

Obligation to serve distribution customer. The load on the Sunbright #1 transformer is projected to reach 124 % of its 8.5 MVA capability by winter 2017/18. The increase in loading is due to a 2 MVA addition to the Duffield Industrial Park in 2017. The Sunbright – Hill double circuit is already built to 69 kV standards.

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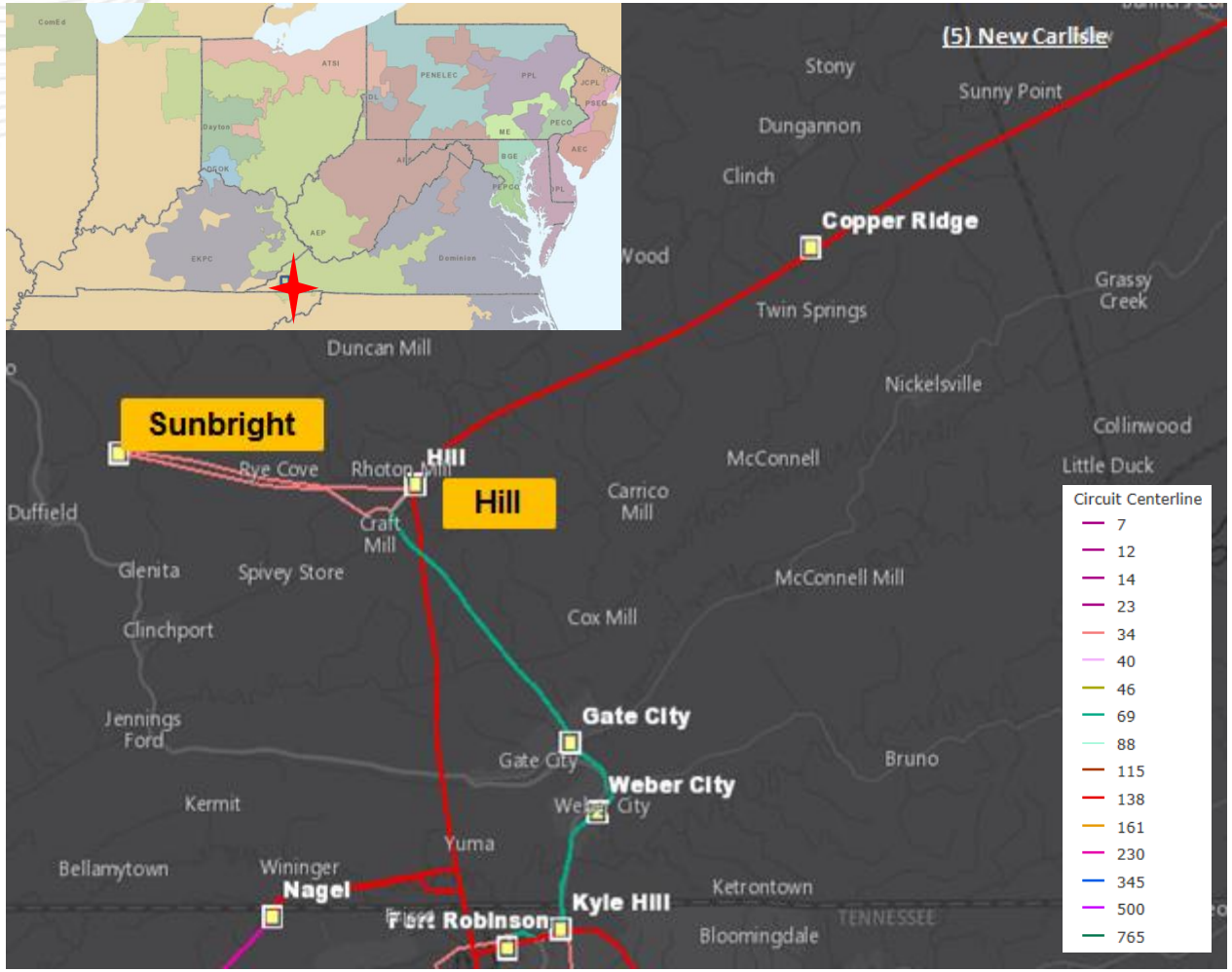

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AEP Transmission Zone: Supplemental Sunbright Station Rehab

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Selected Solution:
Convert Hill – Sunbright 34.5 kV circuits #1 and #2 to 69 kV. These lines were built to 69 kV standards. (**S1569.1**)
Estimated Cost: $0.0M

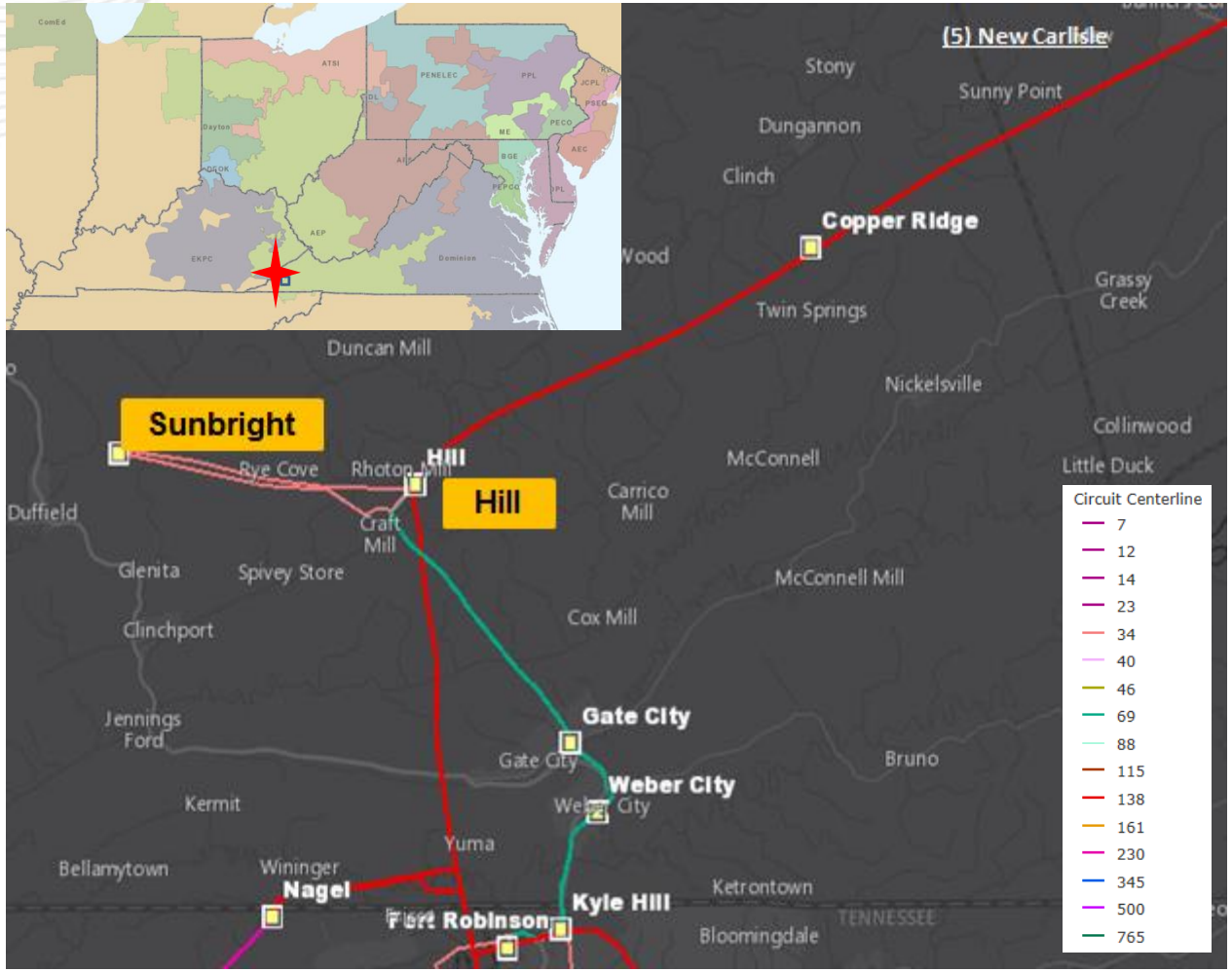
At Hill station, replace 34.5 kV circuit breakers “F” and “G” with new 3000 A 40 kA 69 kV circuit breakers to accommodate the conversion of the Hill – Sunbright circuit to 69 kV. A 69 kV circuit breaker will also be installed on the low side of the transformer 69 kV winding. (**S1569.2**)
Estimated Cost: $1.4M

At Sunbright station, replace the existing 34/12 kV 5 MVA transformer with a new 69/12 kV 25 MVA transformer. Replace existing 34 kV 1200 A 17 kA circuit breakers with new 3000 A 40 kA 69 kV circuit breakers. (**S1569.3**)
Estimated Cost: $0.0M

Total Estimated Cost: $1.4 M

Projected In-service: 5/1/2018

Project Status: Engineering



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AEP Transmission Zone: Supplemental
Martinsville Station

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Martinsville 138 kV CB “C”, 69 kV CB “A” & “B” are oil type breakers without oil containment. These are oil breakers 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 and damage to bushings. CBs “A” & “B” are also legacy GE, oil-filled FK type breakers which have little to no access to replacement parts. CB “A” has experienced 27 fault operations, CB “B” has experiences 64 fault operations, and CB “C” has experienced 38 fault operations. The 138/34.5 kV transformer #1 has seen short circuit strength breakdown caused by excessive through fault events, some in excess of 700°C, which, has lead to an increased gassing of the unit. This transformer type (ME Co. auto banks) have frequent failures due to loose windings caused by thru faults. This transformer is needing a major overhaul to repair or replace safety and maintenance items (fans, pumps, paint, gasket, leaks). The 138/34.5 kV transformer #2B has an upward trending of oil moisture content resulting in decreasing oil dielectric strength. Increasing moisture content is a result of water ingress and/or break down of paper insulation of TF windings. The moisture content has since decreased without improvement to the dielectric strength. Short circuit strength breakdown caused by the amount of thermal through fault events, mostly in excess of 700°C, has lead to major gassing of the unit and carbonization of the insulating paper. The 138/34.5 kV transformer #2A is showing short circuit strength breakdown and high temperature health contributions due to the amount of thermal through fault events, with a majority in excess of 700°C . There are elevated levels of ethylene, methane, carbon monoxide, and carbon dioxide caused by these numerous through fault events. The CO/CO2 ratio has mostly been sustained at or above the warning level, and at times nearing the alert level. Carbonization of the insulating paper has begun which indicative of a transformer near the end of it useful life. 34.5 kV Martinsville – Morris Novelty #1 & #2 lines have pilot wire line relaying. Copper pilot wire is a relatively obsolete technology, and since the telephone companies almost never use it anymore, it is increasingly difficult to find suitable pilot wire cable and hardware. Consequently, we are avoiding like-kind replacement of pilot wire because the technology is increasingly difficult to maintain.

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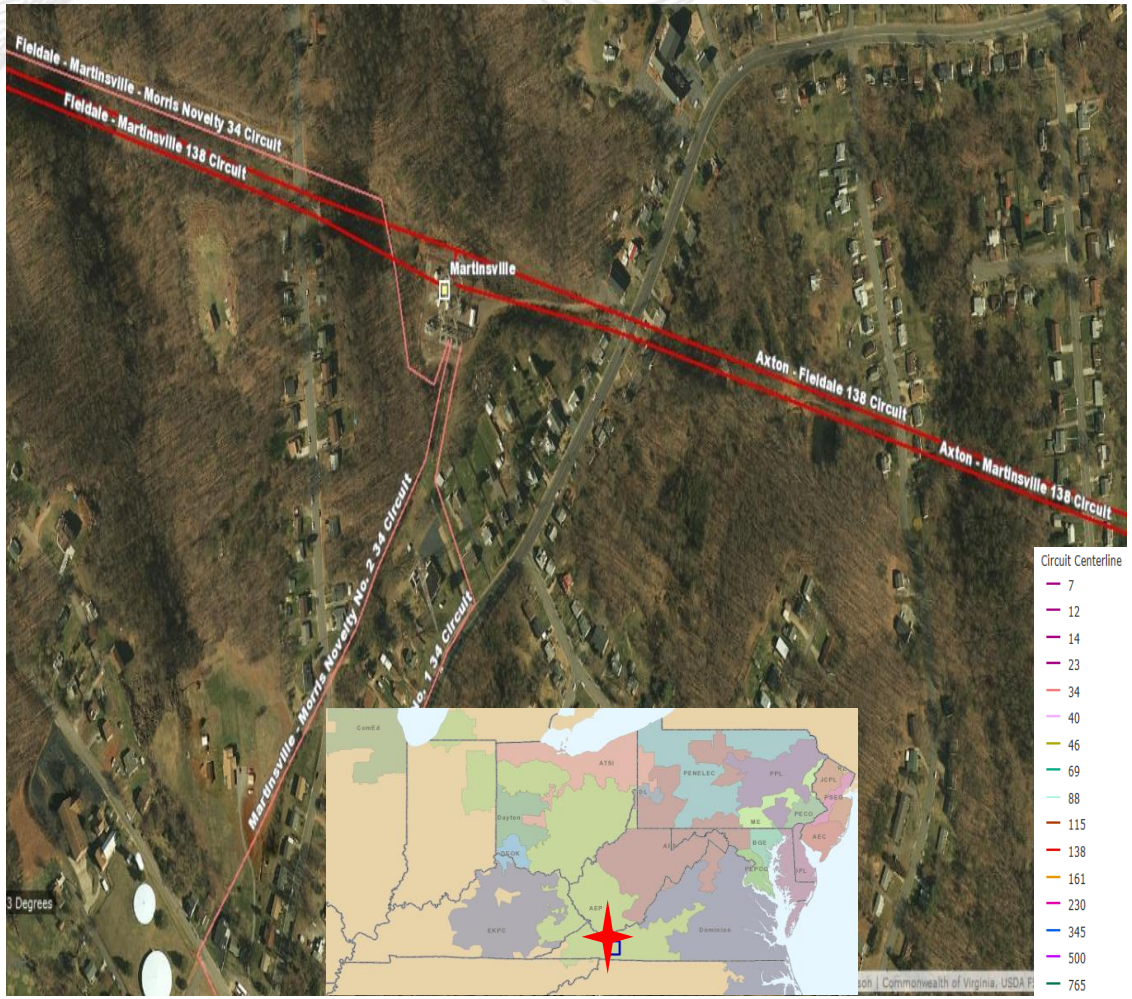

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AEP Transmission Zone: Supplemental Martinsville Station

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Operational Flexibility and Efficiency:

The addition of Martinsville 138 kV line breaker (towards Fieldale) is going to break up three dissimilar zones of protection (line, bus and transformer) at Martinsville Station.

Infrastructure Resilience:

The existing control house at Martinsville Station has no room for additional relay panels. A new DCIM will be installed to accommodate new relay panels.

Customer Service:

The Martinsville substation is used as a back up to the Patriot Center Substation. The Patriot Center substation serves the largest industrial park in Henry county with over 25 business and the Patrick Henry Community College. With the current configuration both sources are going to experience outages with line or station faults. The breaker will isolate the sources during faults, allowing us to provide Patriot Centre with an increased reliability. Martinsville substation also serves all of the Southern Finishing accounts with is a large industrial customer with over 2.4 mw of load. This is a very power quality sensitive customer.

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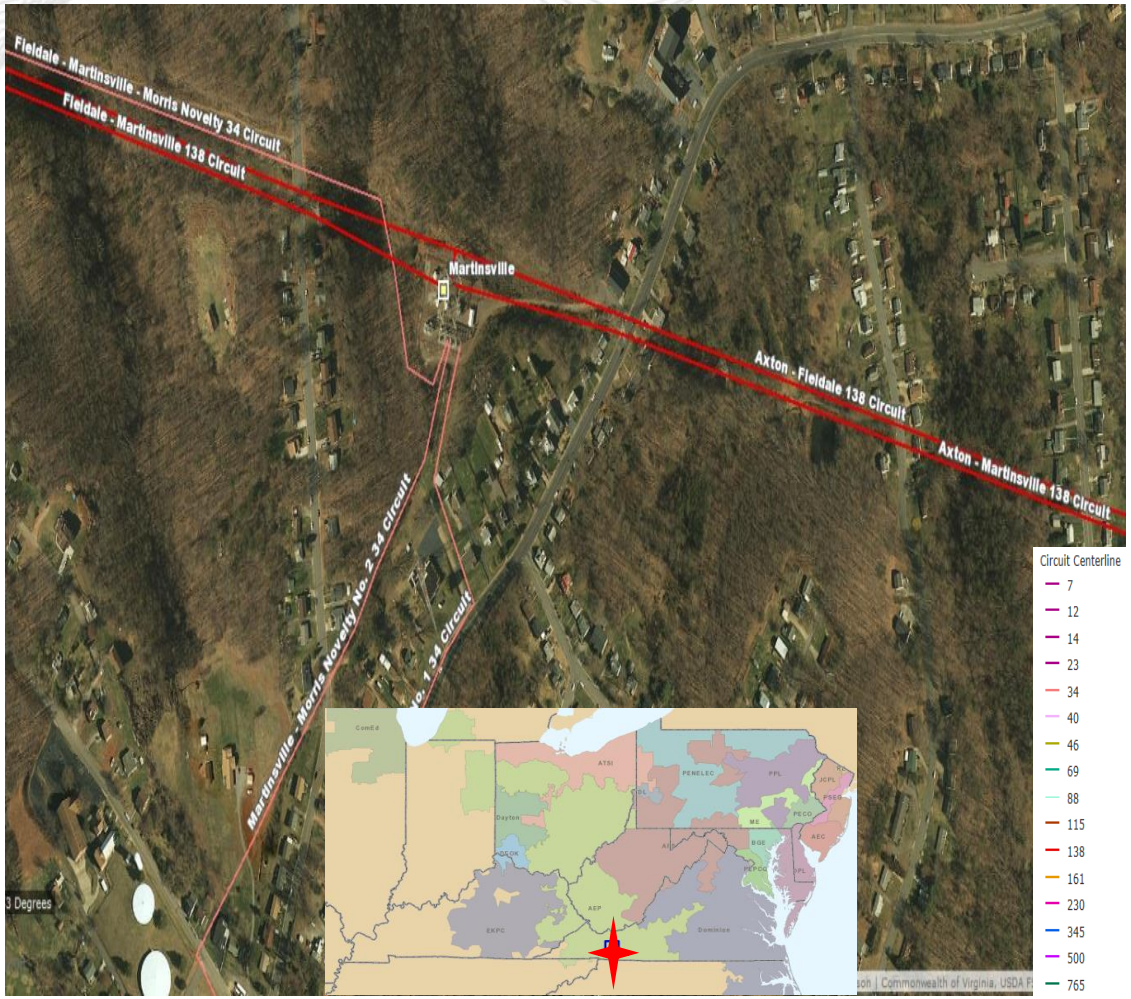

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AEP Transmission Zone: Supplemental
Martinsville Station

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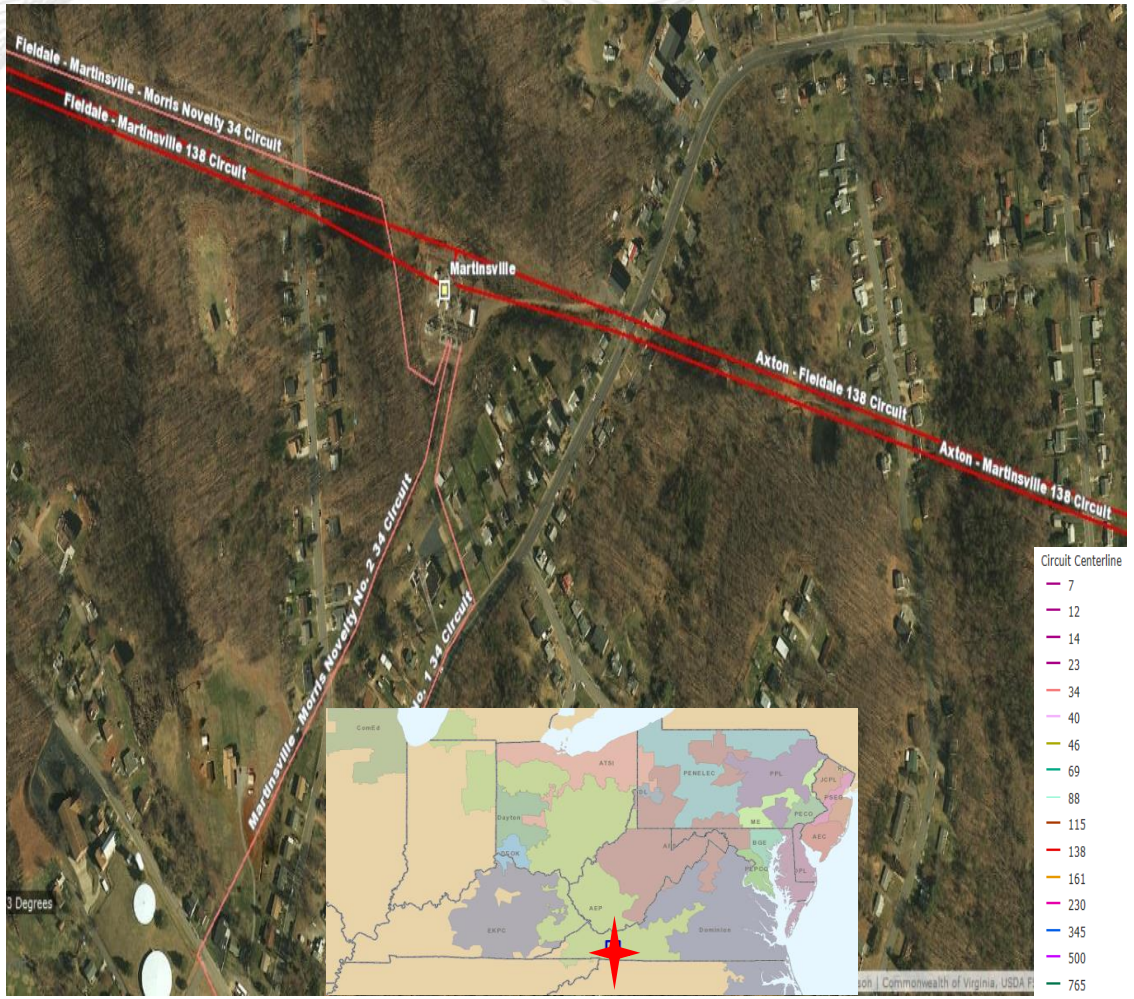
Selected Solution:

Replace the existing 138 kV/40 kA/3000A CB "C" at Martinsville Station and install new 138 kV/40 kA/3000A circuit breaker towards Fieldale. Relaying associated with the lines will be upgraded and new station equipment will be installed to support new relaying. Install a new Drop In Control Module (DICM). Replace 138/34 kV 30 MVA parallel transformers #2A and #2B with new 138/69/34 kV 90 MVA transformer. Install 138 kV/650 A/31.5 kA circuit switcher on both transformer #2 & #3. Retire 138/34 kV 128 MVA transformer #1. Retire 34 kV oil circuit breakers "A" and "B". Replace pilot wire relays on Martinsville – Morris Novelty #1 & #2. (**S1570**)

Estimated Cost: $2.8M

Projected In-service: 6/1/2018

Project Status: Engineering



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Previously presented on 2/14/2018 SRRTEP

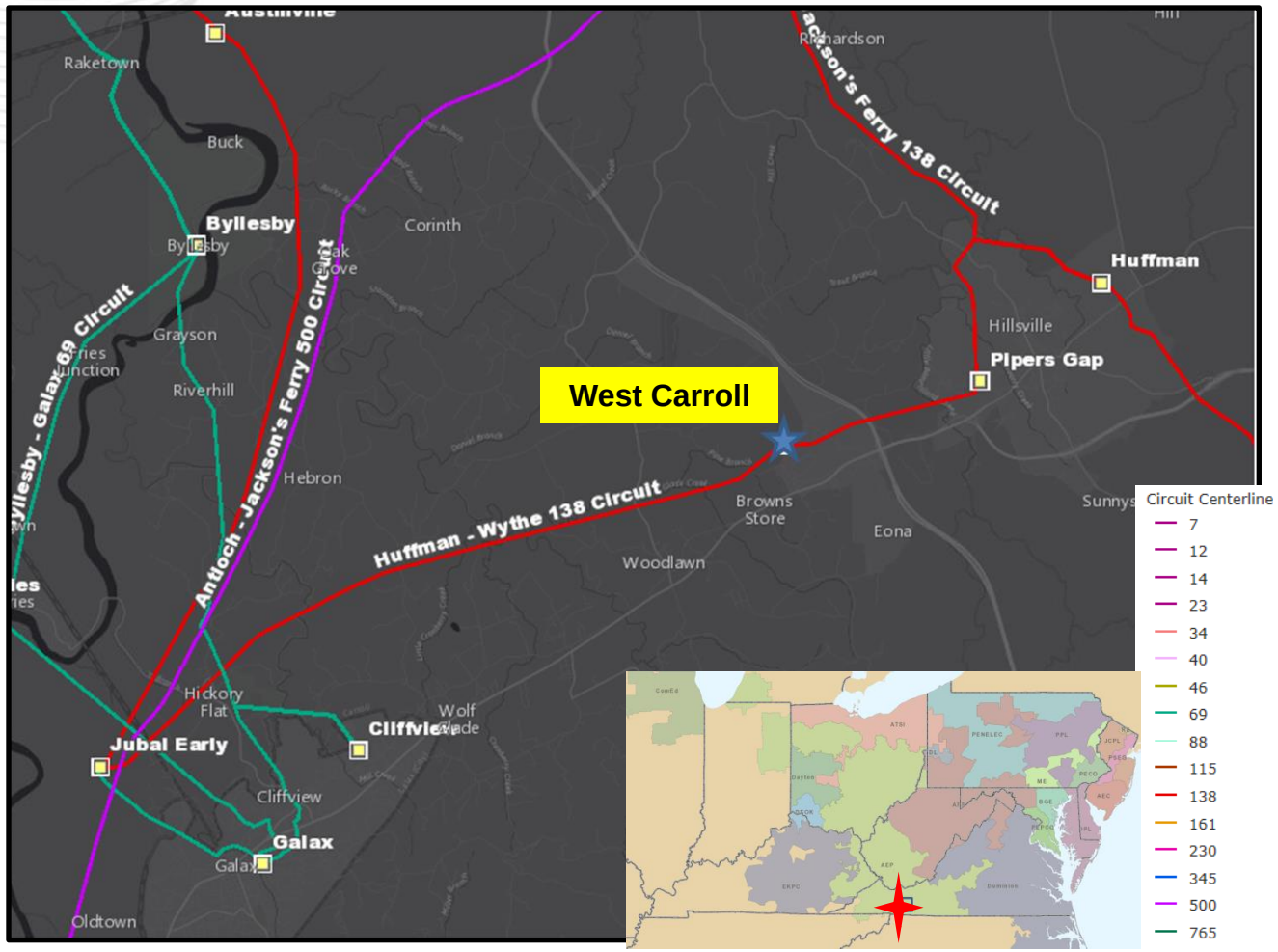
Problem Statement:
Customer Service:
Obligation to serve distribution customer request at a new station. West Carroll station will serve approximately 17 MVA of load.

Selected Solution:
Construct a new 138/34.5kV distribution station (West Carroll). Install a new 138/34.5 kV 30 MVA, two 3000 A 138 kV MOABs, and a 3000 A 40 kA 138 kV circuit switcher. (**S1571.1**)
Estimated Cost: $0.0M
Tap the Huffman – Wythe 138kV circuit into West Carroll station. (**S1571.2**)
Estimated Cost: $0.6M

Total Estimated Transmission Cost: $0.6M

Projected In-service: 12/1/2019

Project Status: Scoping



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AEP Transmission Zone: Supplemental Stone Station

Previously presented on 2/14/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The 138/69/46 kV 50 MVA transformer at Stone station has failed beyond repair and requires replacement.

Circuit breaker “A” and “B” at Stone (vintage 1966) are 1200A, 21 kA CF-48 type breakers. These are oil breakers that have become more difficult to maintain due to the required oil handling. There is an increased potential for oil spills during routine maintenance and failures with these types of breakers. In addition, these breakers also have bushing damage, and they are experiencing mechanical breakdown associated with its contacts and resistors. Both breakers have exceeded the amount of fault operations recommended by the manufacturer of 10. Breaker “A” and “B” have experienced 84 and 101 fault operations respectively.

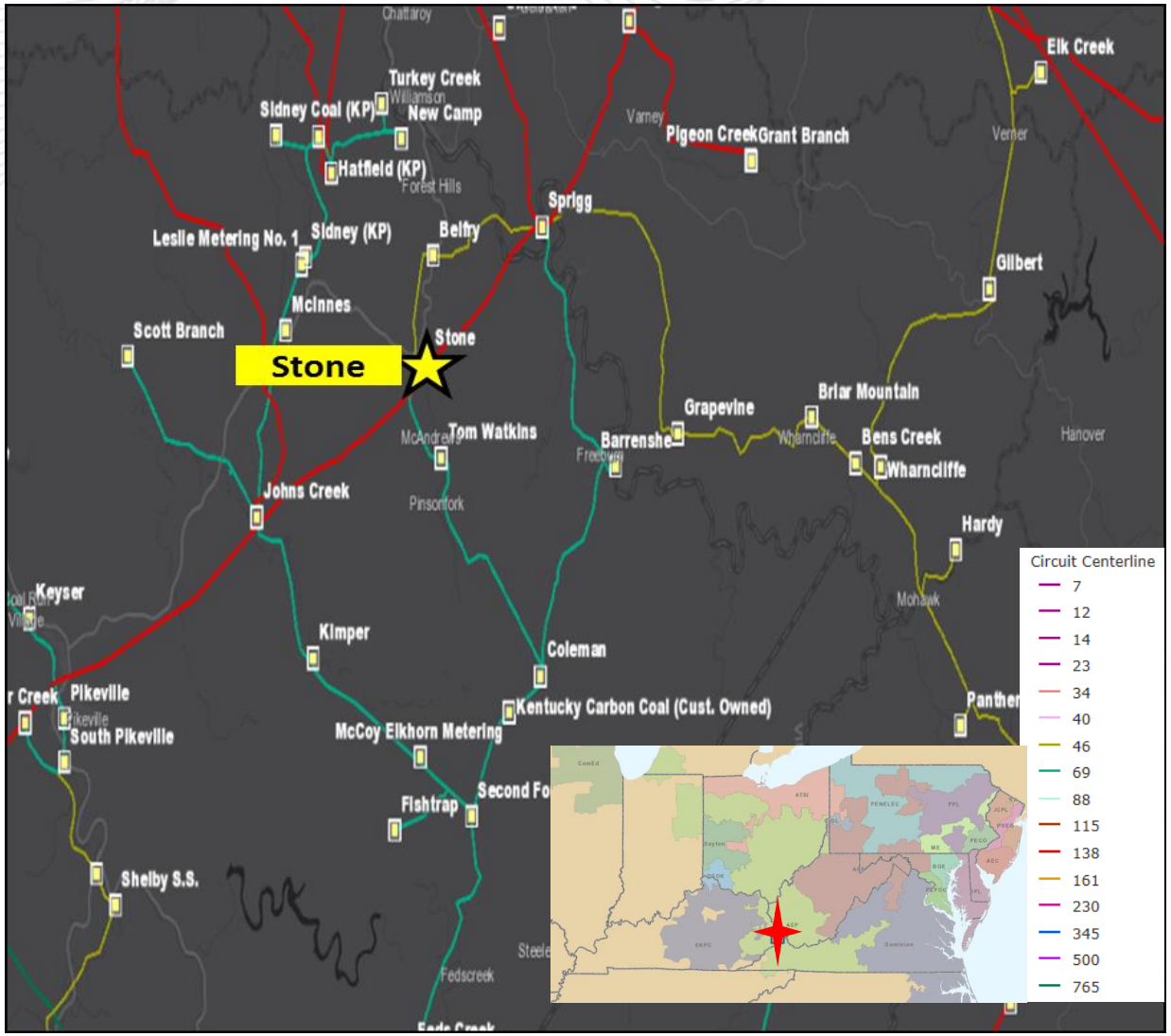
Selected Solution:

Replace the failed 138/69/46 kV 50 MVA transformer bank at Stone station with a new 138/69/46 kV 90 MVA transformer bank. Replace circuit breaker “A” with a new 69 kV 3000 A 40 kA circuit breaker. Replace circuit breaker “B” with a new 69 kV 3000 A 40 kA circuit breaker. (**S1572**)

Total Estimated Transmission Cost: $3.3M

Projected In-service: 12/1/2018

Project Status: Engineering



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Previously Presented: 3/9/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Boone 46 kV CB's "A", "B", and "C" (vintage 1972) are 1200A 20 kA oil filled circuit breakers without oil containment. Oil breakers have become more difficult to maintain due to the required oil handling. There is an increased potential for oil spills during routine maintenance and failures with these types of breakers. These circuit breakers have operated for 135, 177, and 58 faults respectively. The manufacturers recommended number of fault operations is 10.

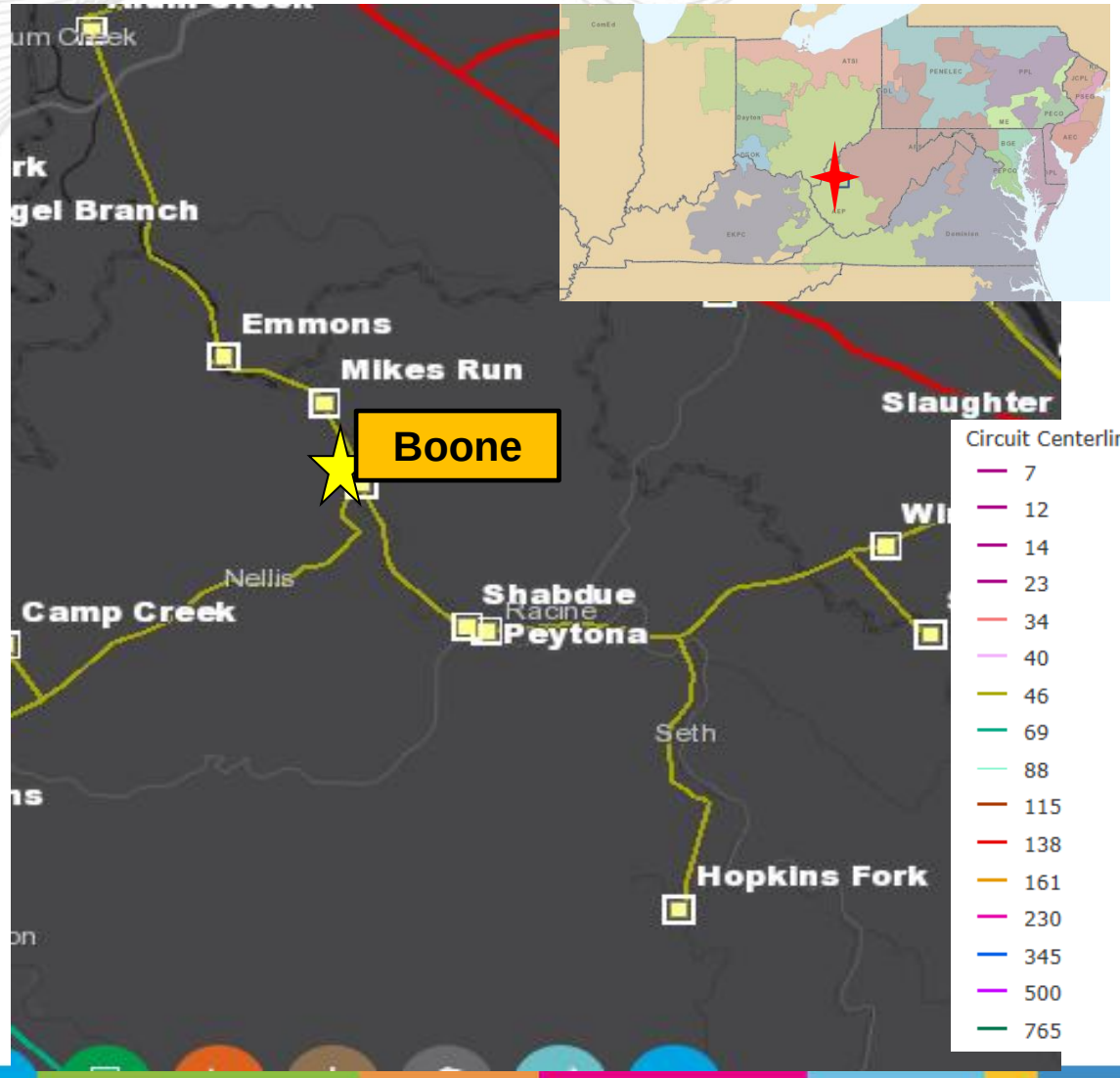
Selected Solution

Replace three existing 1200 A 20 kA 46 kV circuit breakers "A", "B", and "C" at Boone with new 3000 A 40 kA 46 kV circuit breakers. (**S1545**)

Estimated Cost: $1.5M

Projected In-service: 11/1/2019

Project Status: Engineering



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Previously Presented: 3/9/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Several 69 kV circuit breakers at Heath station are showing signs of deterioration. These breakers are all 1200 A 20 kA oil breakers manufactured in 1962 and 1973. Oil 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 69 kV circuit breakers “A”, “B”, “C” and “D” have fault operations of 16, 28, 58 and 70 respectively.

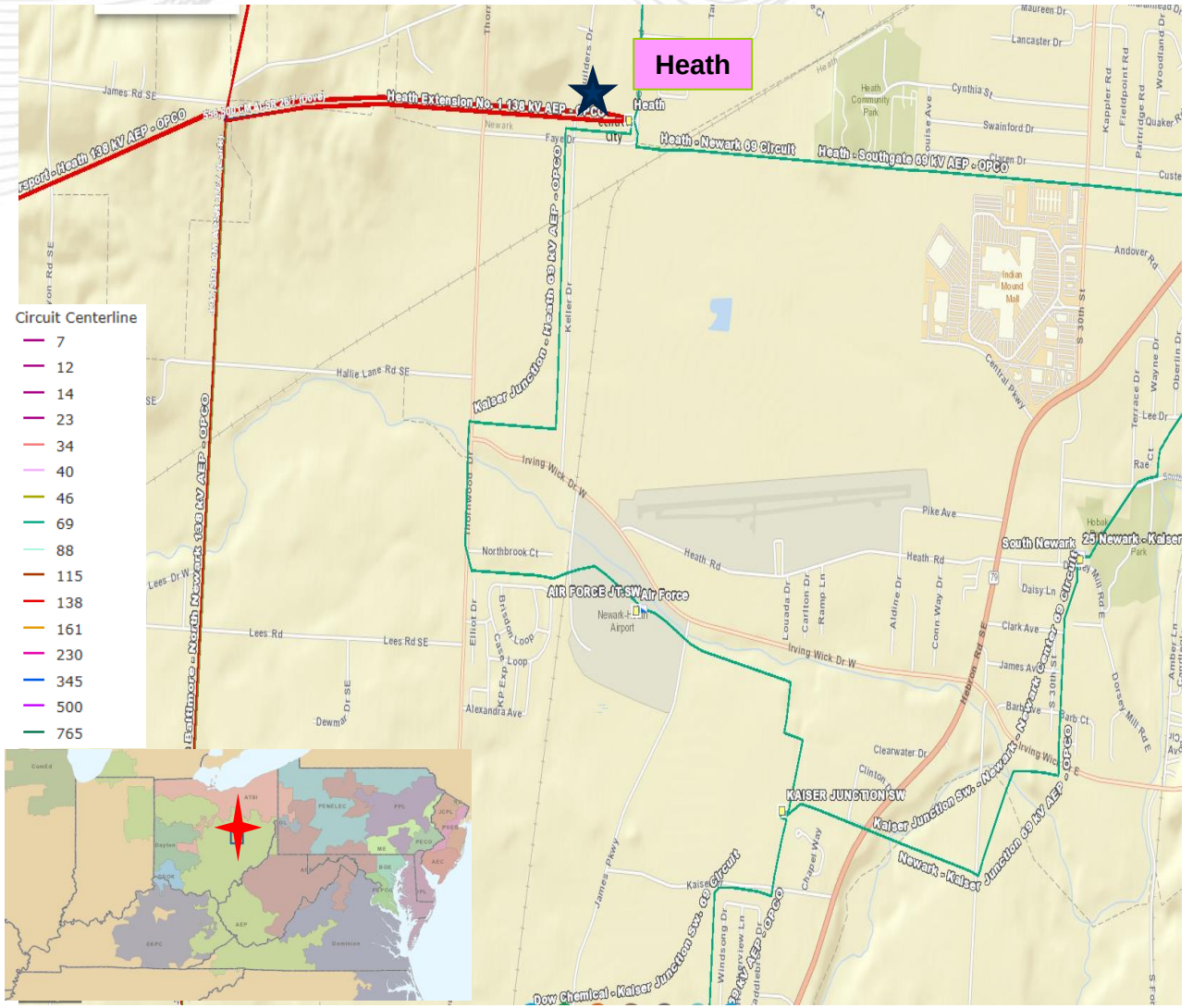
Selected Solution

Replace 69 kV circuit breakers “A”, “B”, “C” and “D” at Heath station with 2000 A 40 kA circuit breakers. Expand the DICM. Remove the 138/34.5 kV 25 MVA transformer #5. (**S1546**)

Estimated Cost: $3.9M

Projected In-service: 06/01/2021

Project Status: Engineering



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Previously Presented: 3/92018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The 161/69 kV transformer at Leslie is 36 years old and shows an upward trending of oil moisture content resulting in downward trending to the oil dielectric strength. Increasing moisture content is a result of water ingress and break down of paper insulation of TF windings. Short circuit strength breakdown caused by through fault events has lead to gassing of the unit, and carbonization of the insulating paper. All of this indicates that the transformer is in need of replacement. A spare transformer (non-switchable) for the station is also being purchased as this is the sole 161/69 kV transformer on AEP's eastern footprint.

161 kV circuit breaker "K" at Leslie station is a HVB242 type breaker. HVB's have a history of slow reclosing due to documented issues associated with their air receivers and control valves. Currently there are only nine breakers of this type in service on the AEP system. Parts for the breaker are hard to come by and are no longer available through the manufacturer. The breaker in question has external rust issues which resulted in a failure to reclose properly in the past. The breaker has experienced 141 fault operations exceeding the manufacturer recommendation number of 10.

Selected Solution

Replace existing 90 MVA Leslie 161/69 kV transformer with a new 130 MVA 161/69 kV transformer. A second 161/69 kV transformer will be purchased as a non--switchable spare on site. Replace Leslie 161 kV 3000 A 50 kA circuit breaker "K" with a new 3000 A 40 kA 161 kV circuit breaker. (**S1547**)

Estimated Cost: $6.3M

Projected In-service: 08/01/2020

Project Status: Engineering

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Previously Presented: 3/9/2018 SRRTEP

Problem Statement:

Customer Service:

The University of Notre Dame (UND) has requested a service upgrade to accommodate an increase in load and upgrades to its current station. UND currently has (2) 138/4 kV transformers and it will be upgrading its station and adding (2) additional 138/12 kV transformers. To accommodate the customer upgrades and reduce the customer exposure to 138 kV line faults, AEP proposes the installation of a bus tie breaker and in-and-out service.

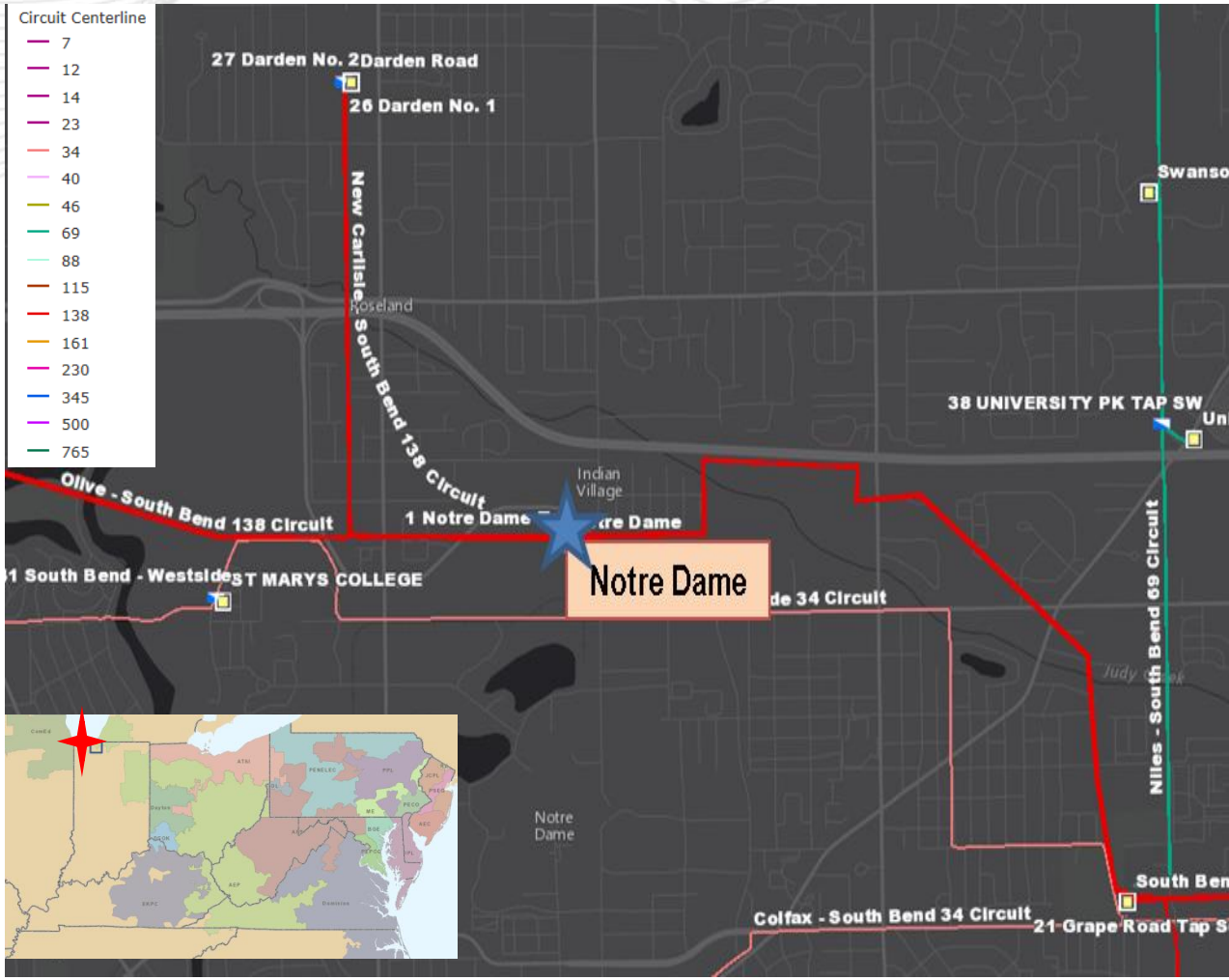
Selected Solution

Remove Notre Dame's 3 way switch and build the Notre Dame 138kV station into an in and out configuration with a bus tie 138kV 3000A 40kA breaker. (**S1548**)

Estimated Cost: $3.1M

Projected In-service: 10/01/2018

Project Status: Scoping



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Previously Presented: 3/9/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Transformer #1 138/69/34.5kV 50 MVA at East Elkhart Station manufactured in 1968 and transformer #1 138/69/34.5kV 50 MVA at Osolo Station manufactured in 1961 will be replaced because of breakdown in dielectric strength (winding insulation), 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.). Transformer Grounding banks manufactured in 1956 and 1961 will be replaced at both East Elkhart and Osolo Station.

34.5 kV 1200A 1500MVA Circuit Breaker N at East Elkhart Station, manufactured in 1965, has experienced 33 fault operations. 34.5 kV 1200A 1500 MVA Circuit Breakers A and B at Osolo Station, manufactured in 1950, have experienced 45 and 38 fault operations respectively. These Circuit Breakers are oil filled Breakers and 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 numerous issues related to age, bushing damage, maintenance issues and no repair part availability. They also have numerous fault operations. The 138 kV Circuit Breakers and Circuit Switcher on the high side of the 138/69/34.5 kV transformer #1 will be installed at Osolo Station to get rid of the three terminal line and provide improved reliability to the 40 MVA Distribution load.

Operational Flexibility and Efficiency

Operational bus tie switches cause the protection scheme to be split which leads to mis-operations. Because of this, AEP will be addressing these whenever entering a station. In this case, a breaker is required to take the place of the bus tie switch to ensure the load's recoverability for a bus outage.

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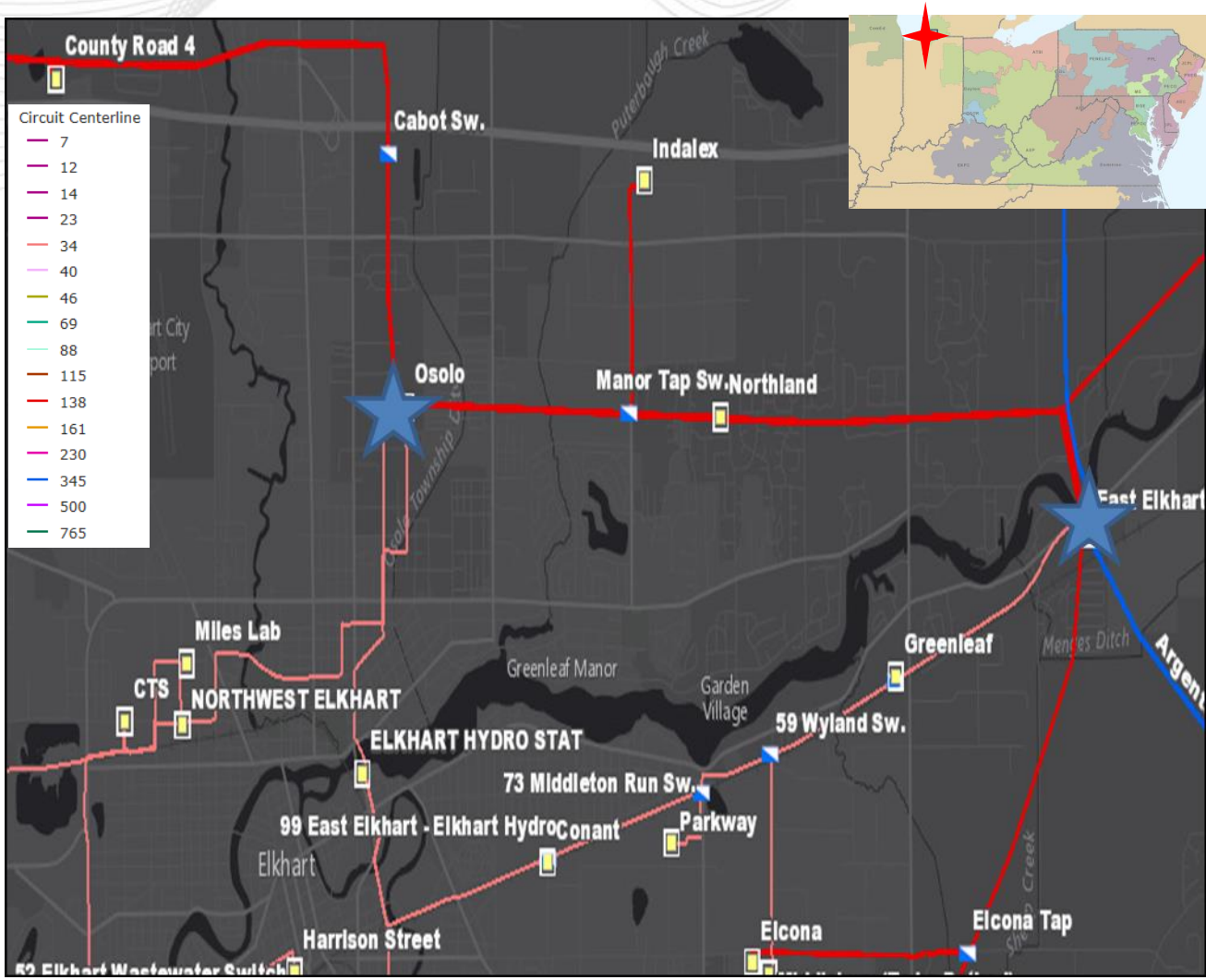

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AEP Transmission Zone: Supplemental
Osolo Area

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Selected Solution

At Osolo station, replace 34.5kV breakers “A” and ”B” with Alstom 1200A 69kV 40kA breakers. Replace transformer 1 with a 138/69/34.5 75 MVA unit and install a high side circuit switcher. Install two line breakers and a bus tie breaker in between the two loads utilizing 3000A 138kV 40kA breakers. (**S1549.1**)

Estimated Cost: $7.6M

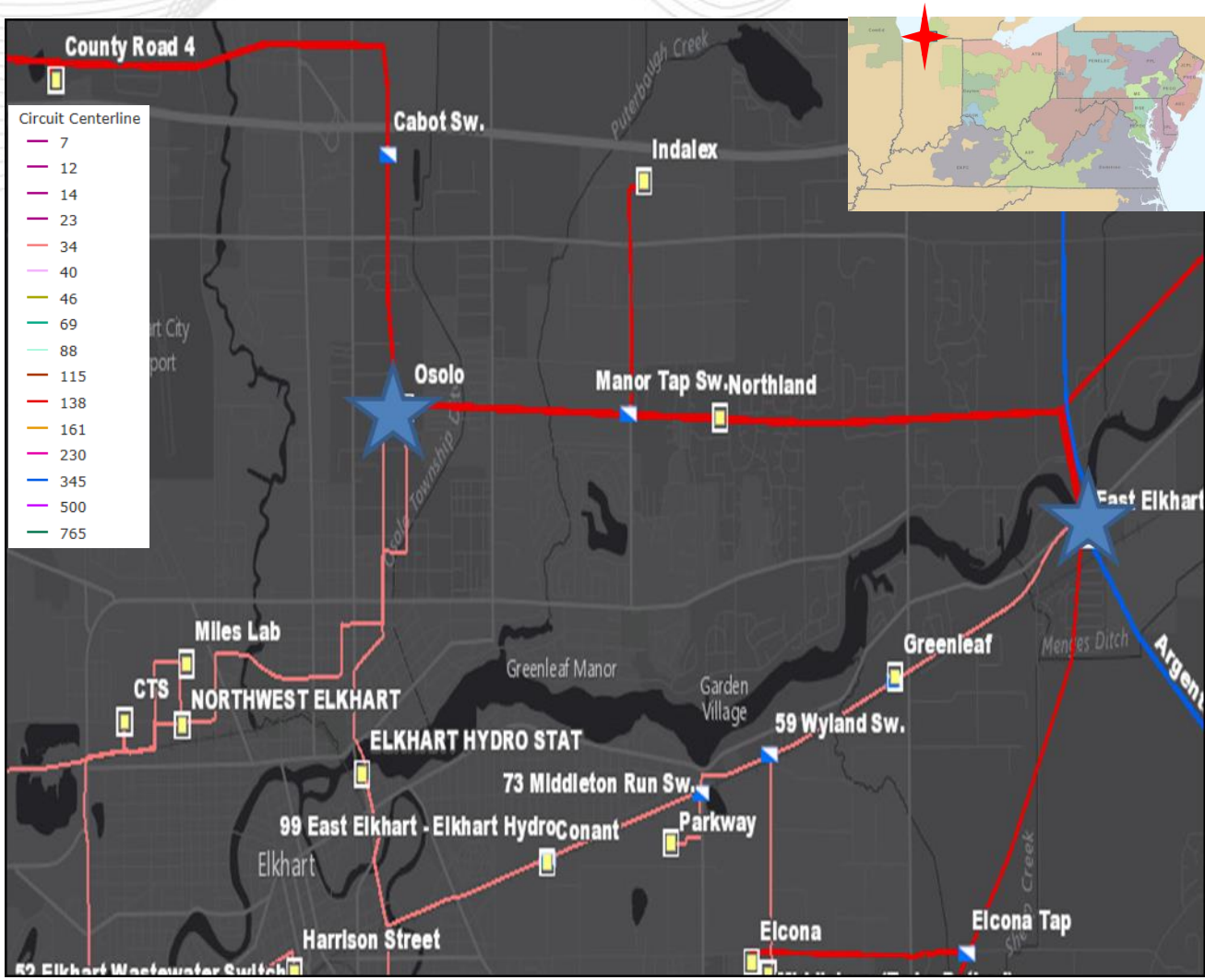
At East Elkhart station, replace transformer 2 with a 138/69/34.5kV 75MVA transformer Replace breaker “N” with a 3000A 40kA 69kV breaker. (**S1549.2**)

Estimated Cost: $4.5M

Total Estimated Transmission Cost: $12.1M

Projected In-service: 04/10/2020

Project Status: Scoping



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AEP Transmission Zone: Supplemental
Tulip Road-West Side Rebuild

Previously Presented: 3/9/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

On the Tulip Road-West Side 34.5 kV line is estimated to be around 1934 vintage, constructed with 4/0 copper and 336 aluminum conductor (27 MVA rating). It is constructed from wood poles which are currently subject to 160 conditions including but not limited to, broken conductor hardware; broken, top rotted, split and twisted crossarms; broken and missing ground lead wires; damaged insulator; and damaged, leaning, rotted and split poles;

Operational Flexibility and Efficiency

Grandview is currently hard tapped on the Tulip Road – West Side line. This means that any time AEP wants to maintain this line, the Grandview interconnection would have to be disconnected. While this project does not eliminate the tap, it sets the line up so that it can be replaced with a switching structure in a future project while simultaneously reducing the length of the line exposed to the hard tap.

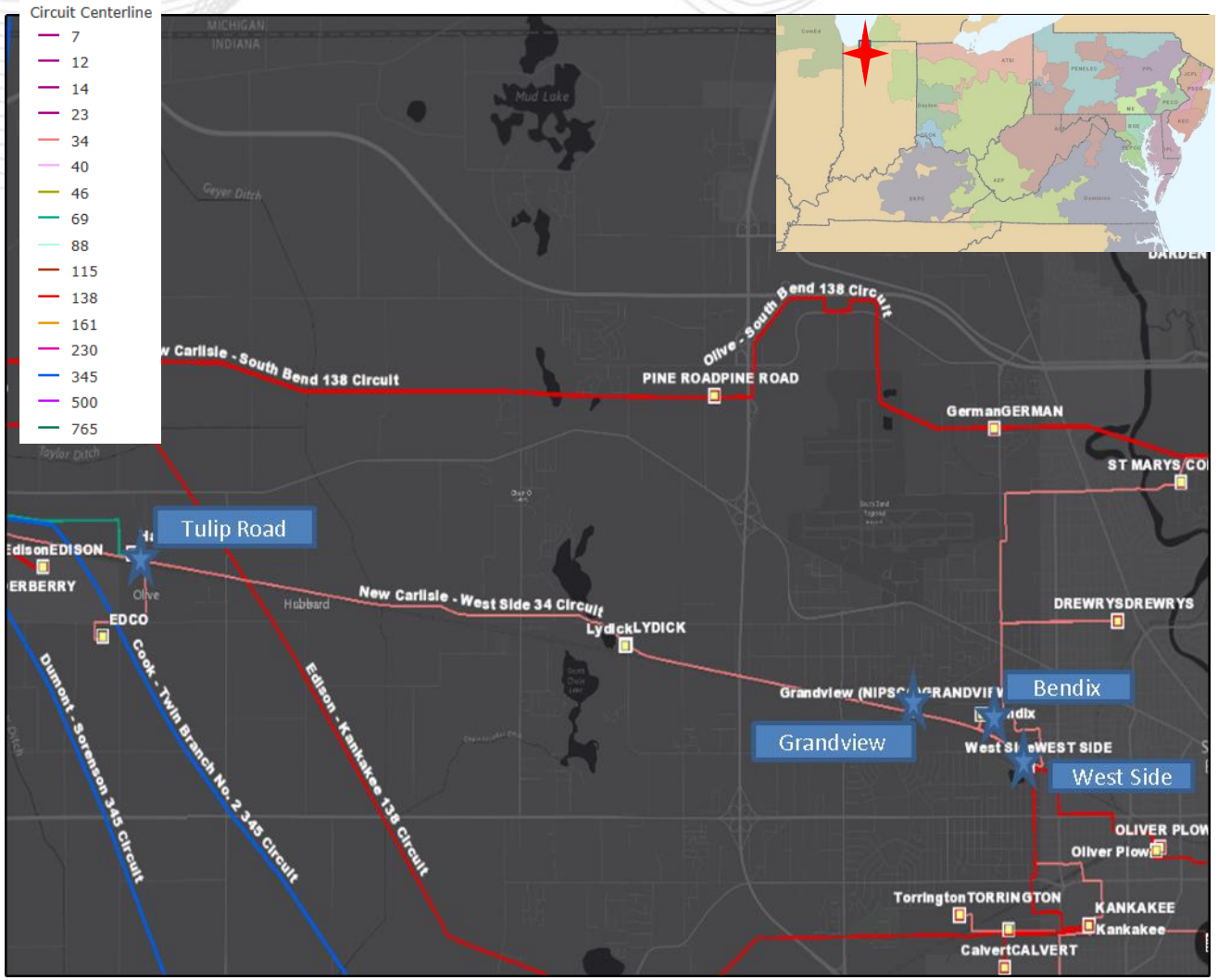
Selected Solution

Rebuild from Tulip Road to Grandview station utilizing 7.4 miles of single circuit 765 ACSR (64 MVA rating) built to 69kV but energized at 34.5kV. From Grandview – West Side, build 1.2 miles of double circuit 795 ACSR built to 69kV but operated at 34.5kV. Remove the emergency switch toward Bendix station. Remove the Grandview hard tap and feed the station radially from West Side. (**S1550**)

Estimated Cost: $17.2M

Projected In-service: 11/30/2018

Project Status: Engineering



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AEP Transmission Zone: Supplemental Conesville-Cyclops

Previously Presented: 3/9/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

This project is an extension of the adjacent Ohio Central-Conesville 69kV transmission line rebuild (11.8 miles) and Ohio Central 138-69KV transformer upgrade, which resolve thermal overloads (PJM Baseline #B2797). This project will rebuild the remaining 1.8 miles of the 69kV circuit between Conesville-Cyclops. After the associated Baseline line rebuild, this 1.8 mile section is loaded to 96% SE for the worst contingency (70 MVA loading/73 MVA rating, leaving only 3 MVA of margin for future area load growth). Cyclops station serves a stainless steel plant.

Customers served from this circuit (2- AEP distribution stations and 1- rural co-op station) experienced 2.02 million minutes of interruption (CMI) over the 2014-16 time period, or equivalently 8 hours of outage-duration per customer.

This 1.8 mile line section was built in 1948 on wood poles that are in poor condition with 336 ACSR conductor (73 MVA rating). The T-line currently has five reported conditions. Proactively upgrading this 1.8-mile line section at the same time as the adjacent Baseline rebuild results in construction and outage-scheduling synergies.

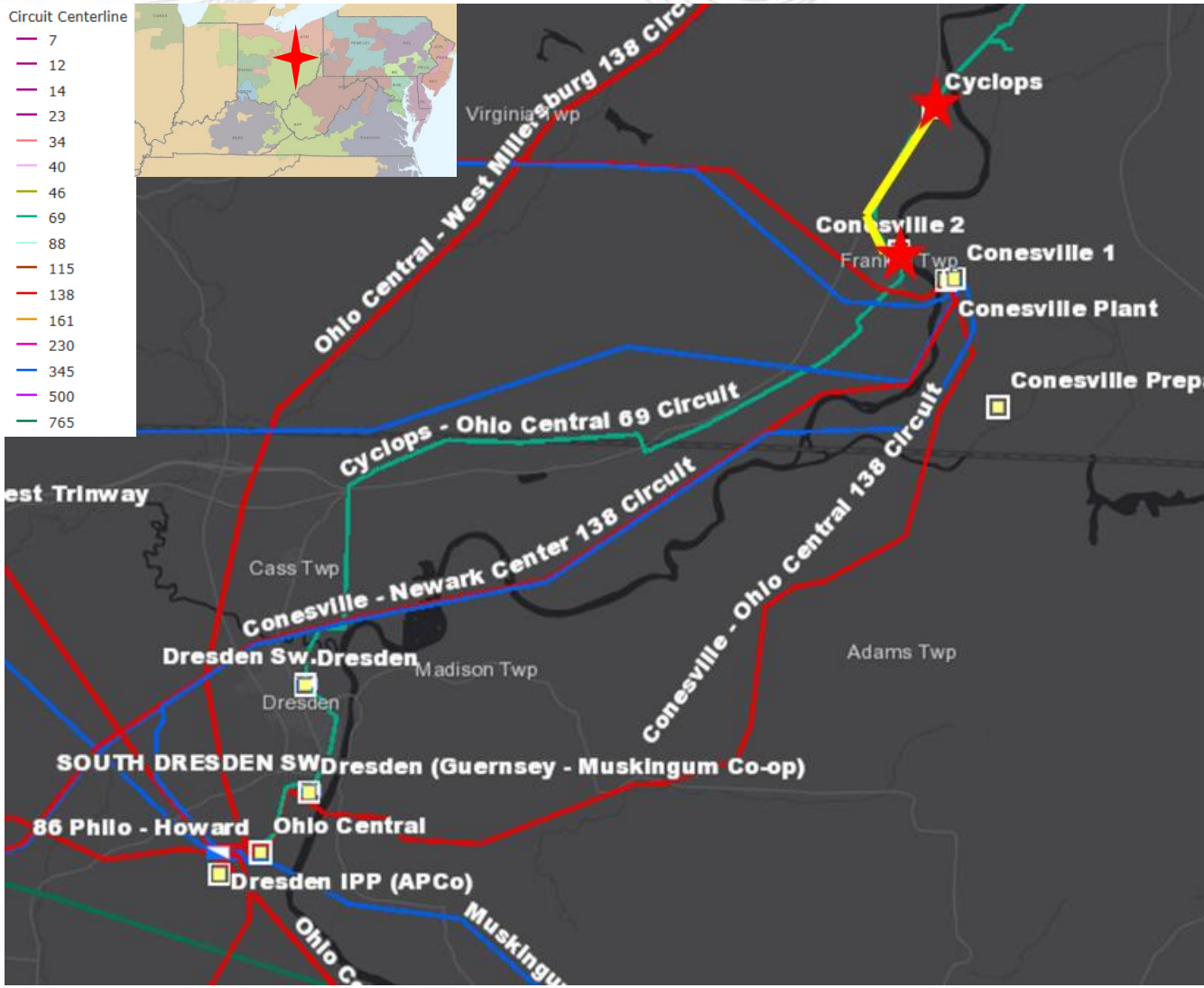
Selected Solution:

Rebuild 69kV transmission line from Conesville station to Cyclops station (1.8 miles) with 795 ACSR conductor (125 MVA rating). Update & modify right-of-way to accommodate the rebuild. Remove the old T-Line. (**S1551**)

Estimated Cost: $2.2M

Projected In-service: 12/01/2019

Project Status: Engineering



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Previously Presented: 2/17/2018 SRRTEP

Problem Statement:

Customer Service:

AEP Ohio has requested a new 138kV delivery point capable of serving 5-50MVA transformers. One transformer is to be installed now and a second will be install within 5 years as the load in the area increases.

AEP Ohio is also currently working with a large power prospect which would take two additional 138kV delivery points from Mink if this site is selected. There have been more than 10 large load requests that would connect directly to the new Mink Station, ranging from 50 MW to 1000 MW over the last several years. Many of the requests would like service in less than a year.

Equipment Material/Condition/Performance/Risk:

The 138 kV CBs 5 & 6 at East Broad Street Substation are oil filled, 2000A 40kA GE FK-Type breakers, manufactured in 1979 and are without oil containment. FK-Type oil filled breakers historically have poor performing operating mechanisms. The existing switches are mounted on cap and pin insulators. The steel is in poor condition and foundations are crumbling.

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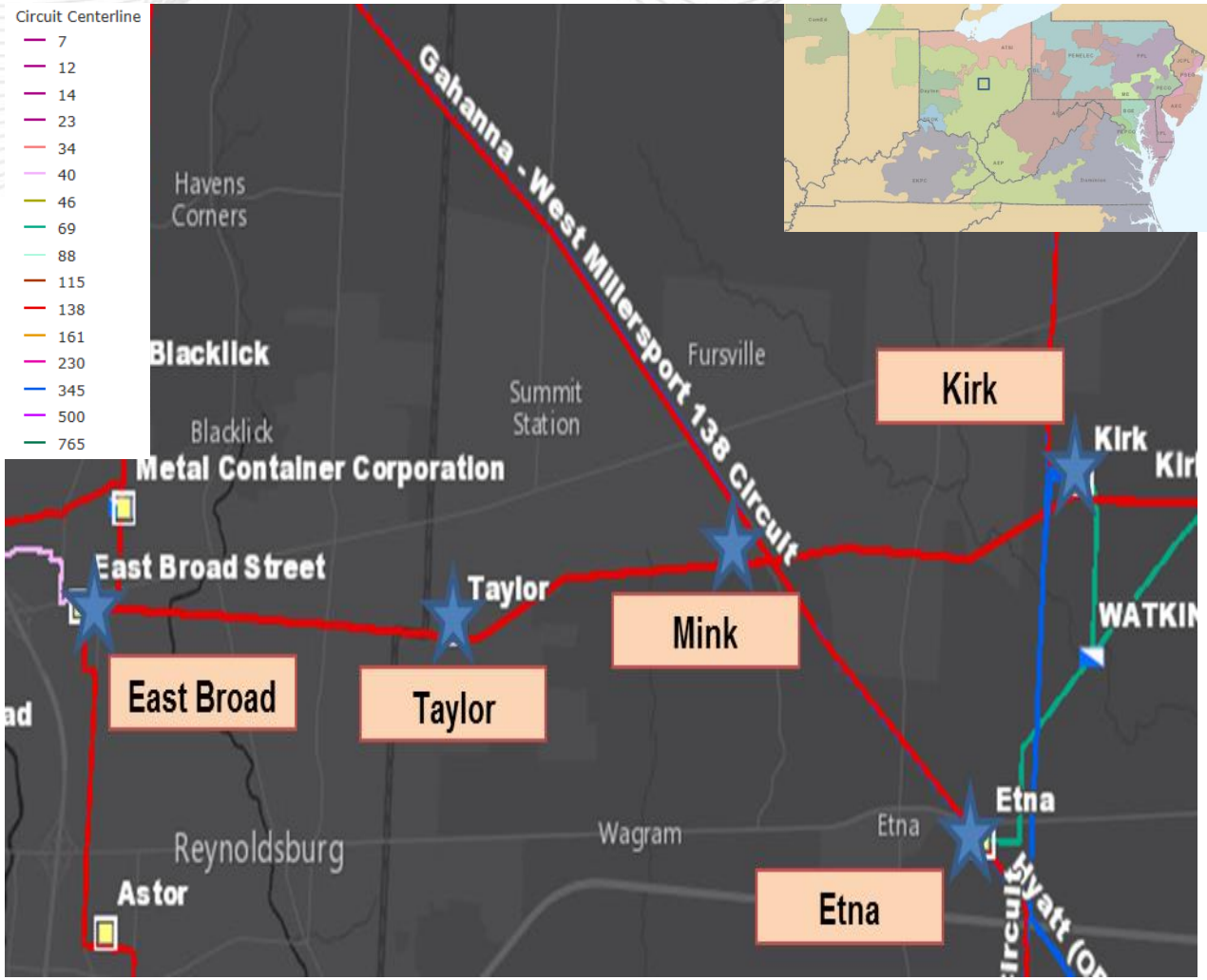

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AEP Transmission Zone: Supplemental Mink Station

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Potential Solution

Install 2 transmission line poles to cut the 138kV East Broad – Kirk #1 line into the Mink Station. Install 2-138kV line exits from the station to the new poles. Match conductors of existing line, which are 1272 ACSR (338 MVA rating). (**S1561.1**)

Estimated Cost: $0.6M

Mink Station: Install breaker and a half station with 6-138kV 3000A 63kA circuit breakers on five strings with two distribution transformers. (**S1561.2**)

Estimated Cost: $5.1M

East Broad Station: Replace circuit breakers 5 and 6 and line relaying with 2-138kV 3000A 63kA circuit breakers. (**S1561.3**)

Estimated Cost: $1.5M

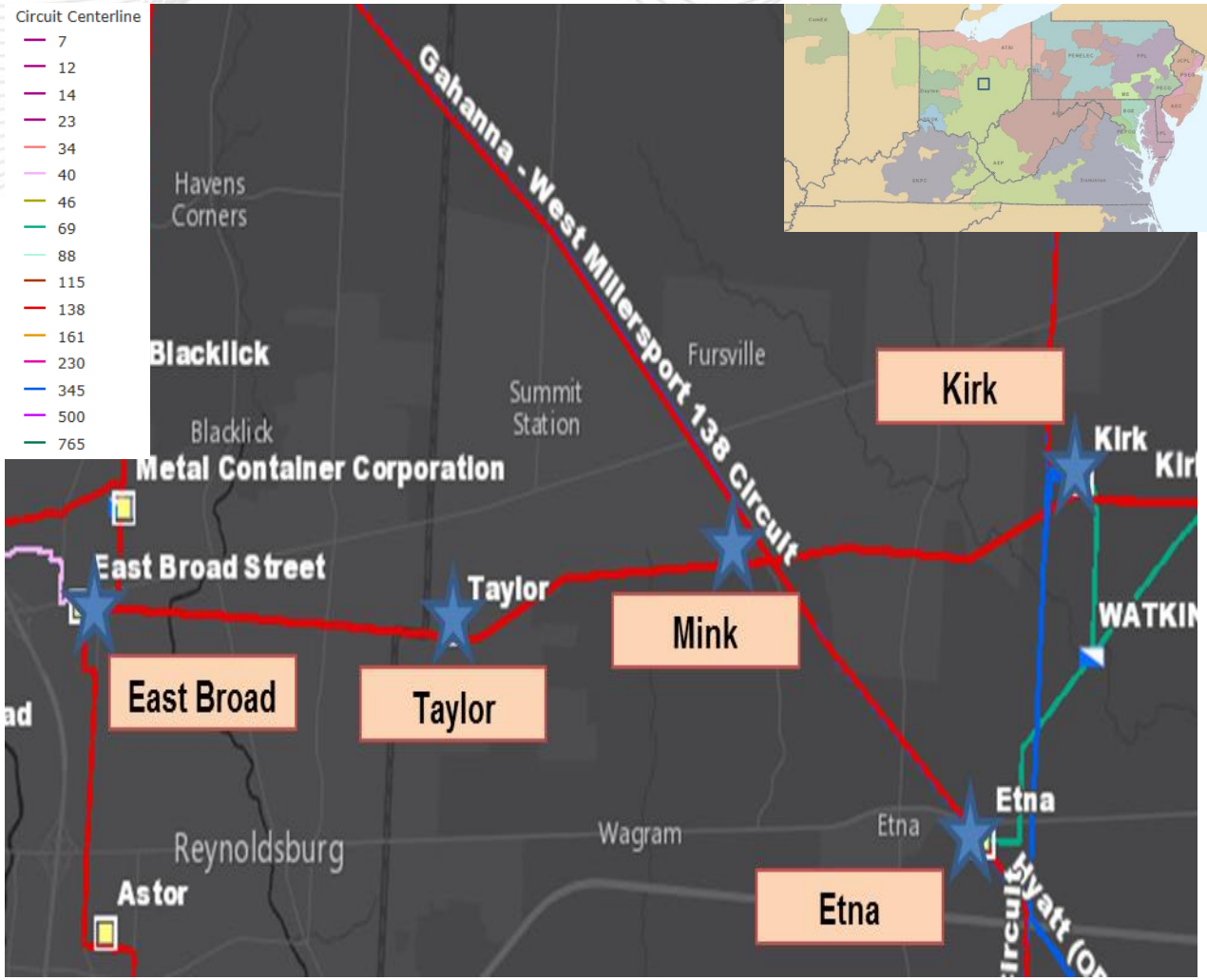
Taylor Station: Remote end relaying. (**S1561.4**)

Estimated Cost: $0.3M

Total Estimated Transmission Cost: $7.5M

Projected In-service: 6/29/2018

Project Status: Under Construction



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Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The Auburn 69 kV circuit breaker 'A' is a 600 A, GE 'FK' oil-filled breaker installed in 1956 and circuit breaker 'D' is a 1200 A, GE 'FK' oil-filled breaker installed in 1957. 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.

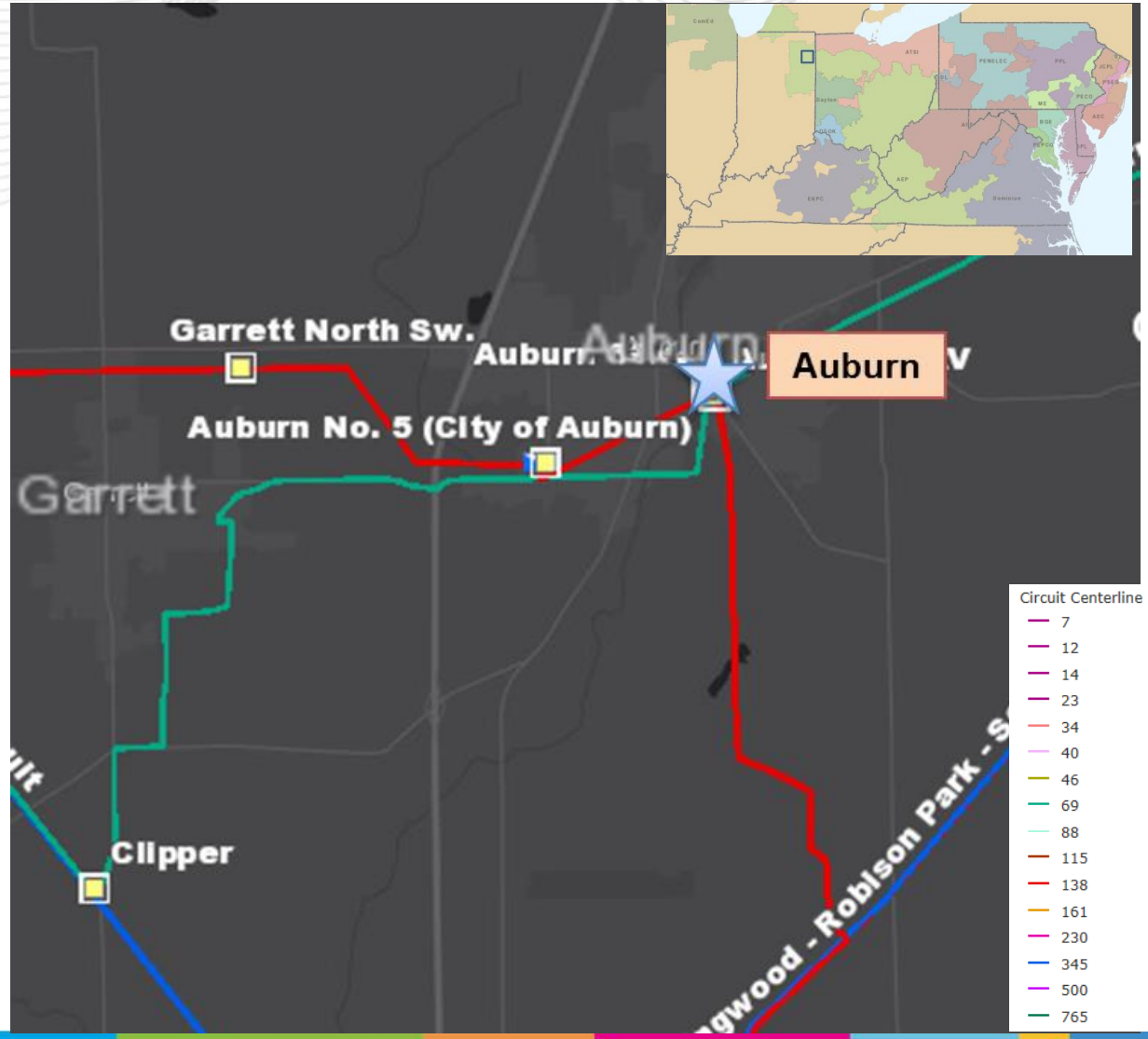
Selected Solution:

At Auburn station, replace 69 kV breakers "A" and "D" with 40 kA, 3000 A, 69 kV circuit breakers. (**S1589**)

Estimated Transmission Cost: $1.6M

Projected In-service: 6/1/2019

Project Status: Scoping



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Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The Butler 69 kV circuit breaker 'A' is a 1200 A, GE 'FK' oil-filled breaker installed in 1957. In general, oil breakers have become increasingly difficult to maintain due to the oil handling associated with them. It has also operated through 68 fault operations, exceeding the manufacturer recommendation of 10. Oil spills are frequent with failures and routine maintenance which is also an environmental hazard. Capacitor Switchers "AA" and "BB" are Mark types which no longer work with modern relaying packages causing protection and coordination issues.

Operational Flexibility and Efficiency

Replace Butler station MOABs "X" and "Y" with 69 kV CBs to improve the reliability of the Auburn-Hamilton 69 kV circuit. Currently, Hamilton Station is fed radially out of Butler Station (along with two hard tapped customers) on a ~7.5 mile radial line which is susceptible to dropping load for faults on the Auburn-Butler 69 kV circuit momentarily due to existing MOAB line protection. In addition, customers served from Butler station will also benefit from the MOAB upgrades to circuit breakers at Butler Station, eliminating exposure to line faults.

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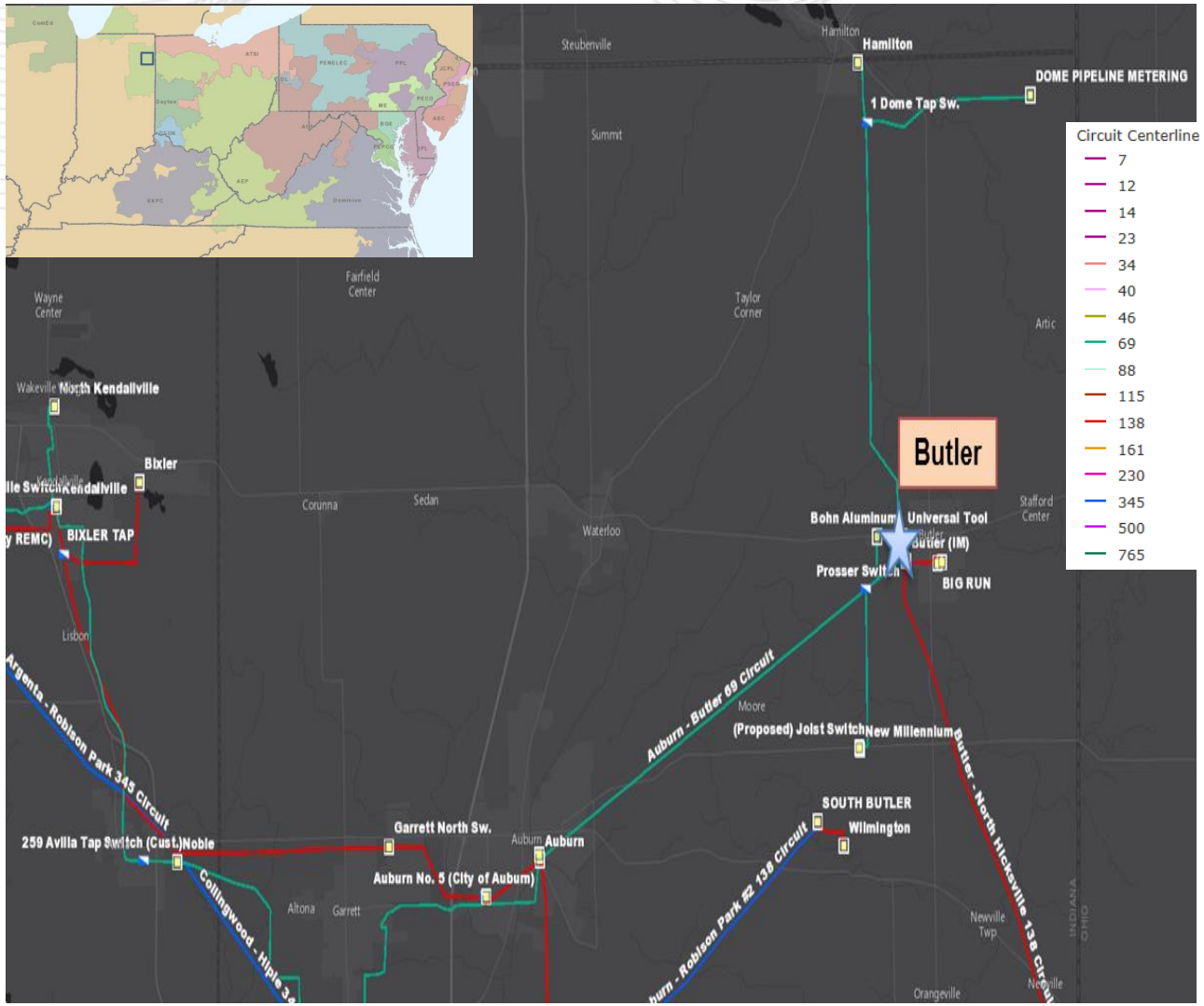

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AEP Transmission Zone: Supplemental Butler Station

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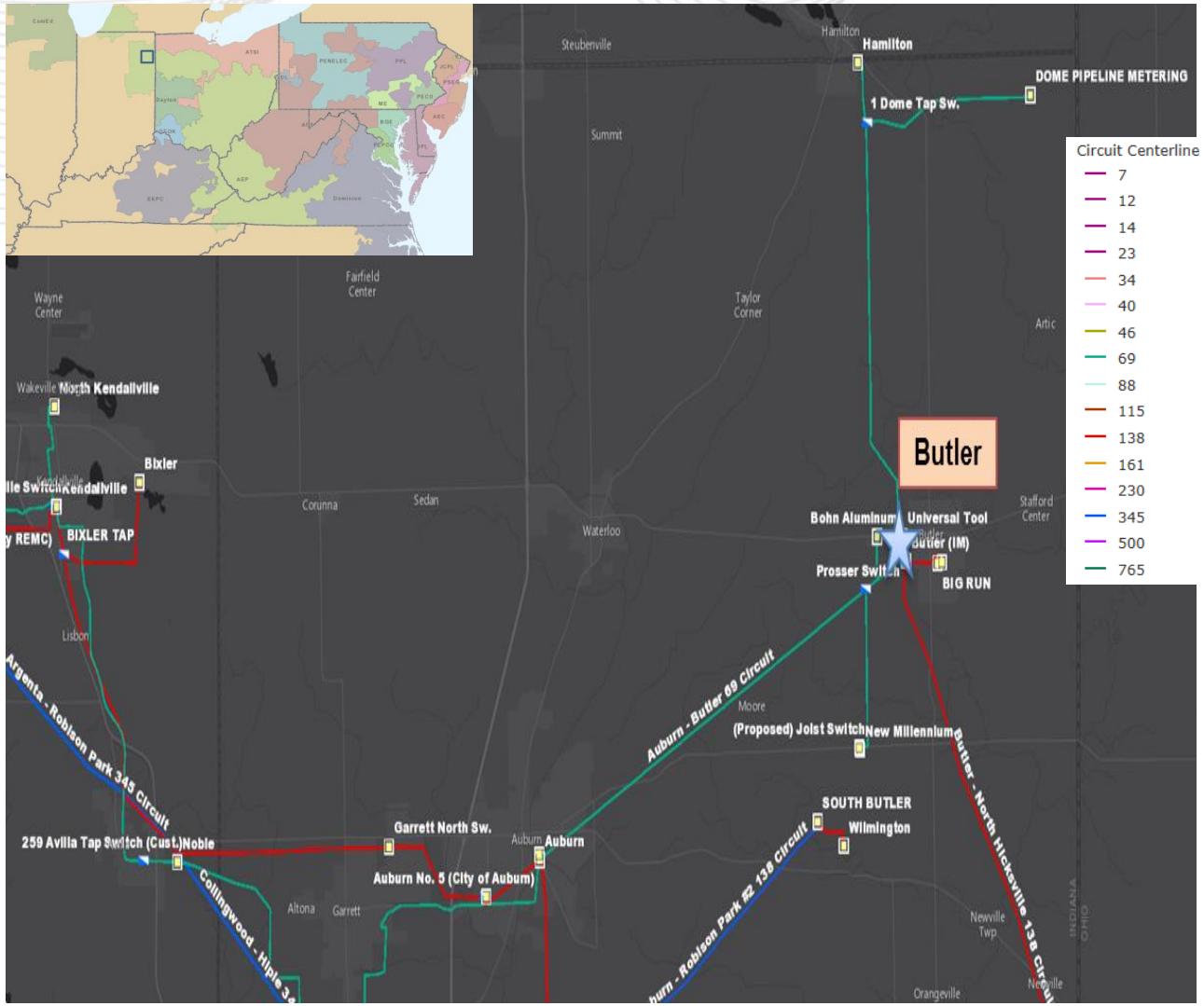
Selected Solution

At Butler station, replace 69 kV breaker “A”, replace 69 kV MOABs “X” and “Y” with 69 kV breakers, replace 69 kV cap switchers “AA” and “BB” (S&C Mark V) with 3000 A, 40 kA circuit breakers. (**S1590**)

Estimated Transmission Cost: $2.5M

Projected In-service: 6/1/2019

Project Status: Scoping



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Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The existing 34.5 kV circuit breakers “A”, “D”, “E”, “H”, and “I” at East Huntington are all 1800 A 27 kA FK oil type breakers that are all 46 years old. These are oil breakers that have become more difficult to maintain due to the required oil handling. There is an increased potential for oil spills during routine maintenance and failures with these types of breakers. Other drivers include damage to bushings and an excessive number of fault operations exceeding the recommendations of the manufacturer. East Huntington breakers “A”, “D”, “E”, “H”, and “I” have experienced 10, 13, 14, 16, and 10 fault operations respectively. The manufacturer’s recommendation for this type of breaker is 10.

Operational Flexibility and Efficiency

Circuit switchers will be added to the high side of transformers #1 and #4 at East Huntington station to separate dissimilar zones of protection.

A 138 kV bus-tie circuit breaker will be added at East Huntington to better sectionalize the four transformers currently off the single 138 kV bus.

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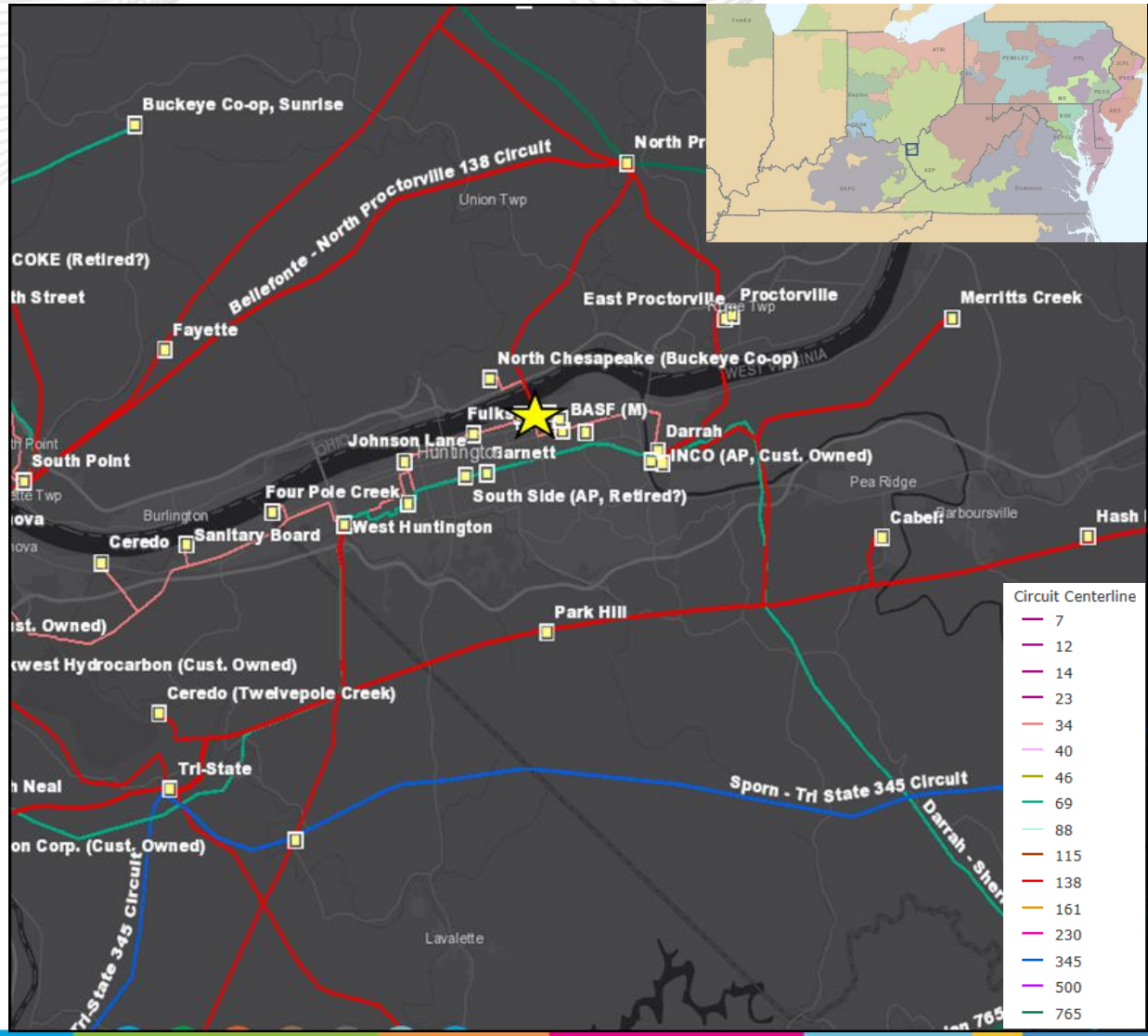

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AEP Transmission Zone: Supplemental
East Huntington Station

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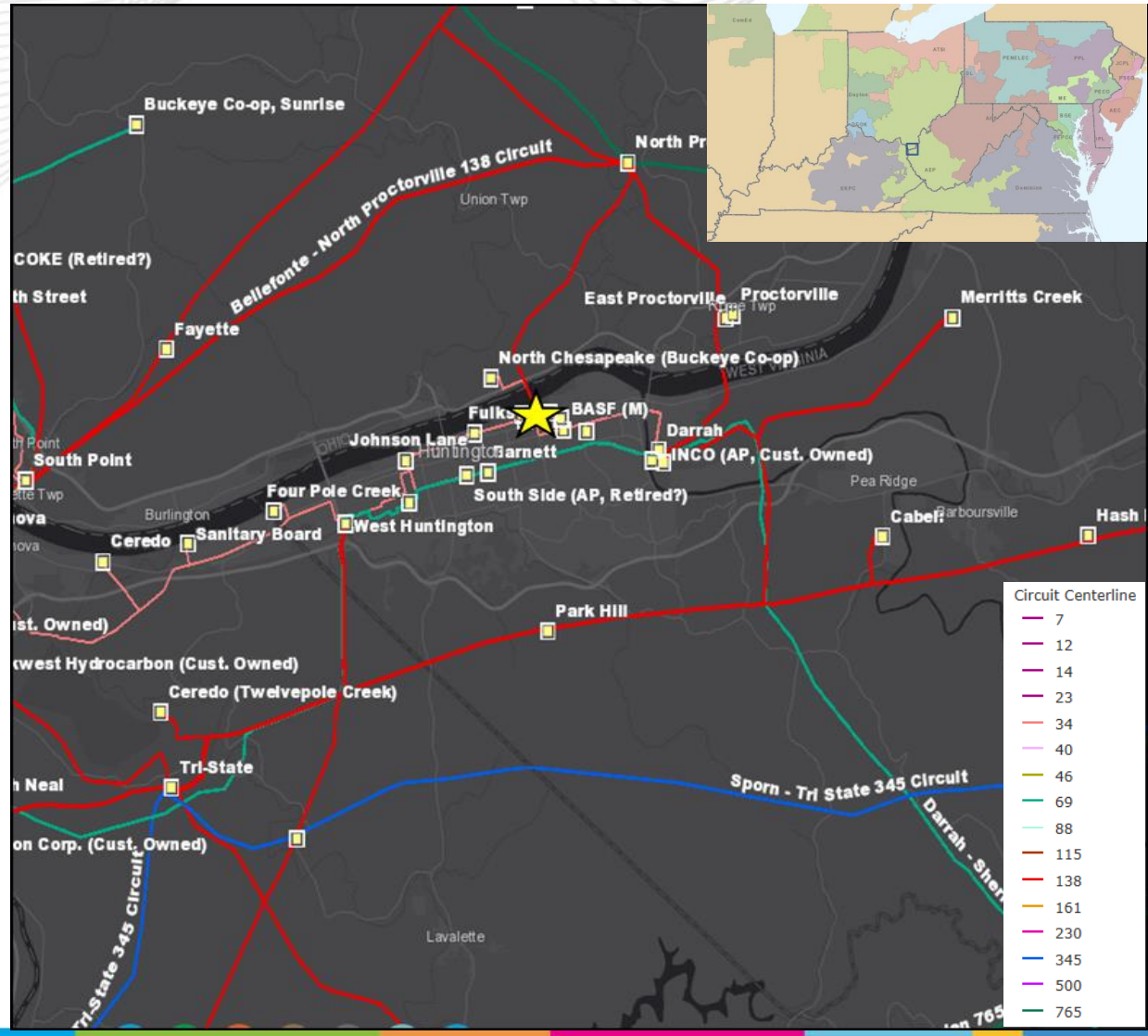
Selected Solution

At East Huntington station, replace 34.5 kV circuit breakers “A”, “D”, “E”, “H”, and “I” with new 3000 A 40 kA 34.5 kV circuit breakers. Add 3000 A 40 kA 138 kV circuit switchers to the high side of East Huntington transformers #1 and #4 to replace the existing Ground Switch MOAB’s. Install a new 3000A 40 kA 138 kV circuit breaker to split the existing single 138 kV bus. Add a fuse to the high side of the 34/12 kV transformer #2. (**S1591**)

Estimated Cost: $4.5M

Projected In-service: 6/1/2020

Project Status: Scoping



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Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Customer Service:

This is an AEP Distribution driven project. The Elkhart UG Network is presently served via 2-34.5 kV Feeders and 2- 4 kV feeders from Elkhart Hydro Station. The present arrangement and configuration is not in compliance with the AEP Distribution Network Planning Criteria regarding UG primary feeder separation and UG secondary replacement. Harrison Station and it's two 69/13.8 KV transformers is necessary to allow the redesign and reconfiguration of the UG Elkhart Network system by 12/2018. Specifically Harrison Station will provide 4-13.8 kV feeders which will allow the separation of the UG Primary and compliance with the AEP Distribution Network Planning Criteria. The reasoning behind this is as follows: The UG Elkhart system is being designed for mixed contingency operation, shall have the feeders arranged with no more than two feeders of the same network in common duct, manholes or vaults, and shall have the feeders connected so that loss of no single duct bank, manhole or vault causes an outage to any network customer, including the single-contingency portions all per AEP Distribution Network Planning Criteria and Distribution Network Systems Center of Excellence.

The current Harrison St station is fed from a radial 34.5kV sub transmission line which would need to be looped and rebuilt to provide a high level of reliability for the network. The decision was made to rebuild at 69kV to modernize the transmission into the Elkhart area and prepare for further revitalization plans by the city. The transmission work will also convert Lusher station to 69kV operation upgrade facilities at Dunlap and Concord stations. Elkhart Hydro will have all network facilities retired and distribution equipment replaced that is at the end of its engineered life.

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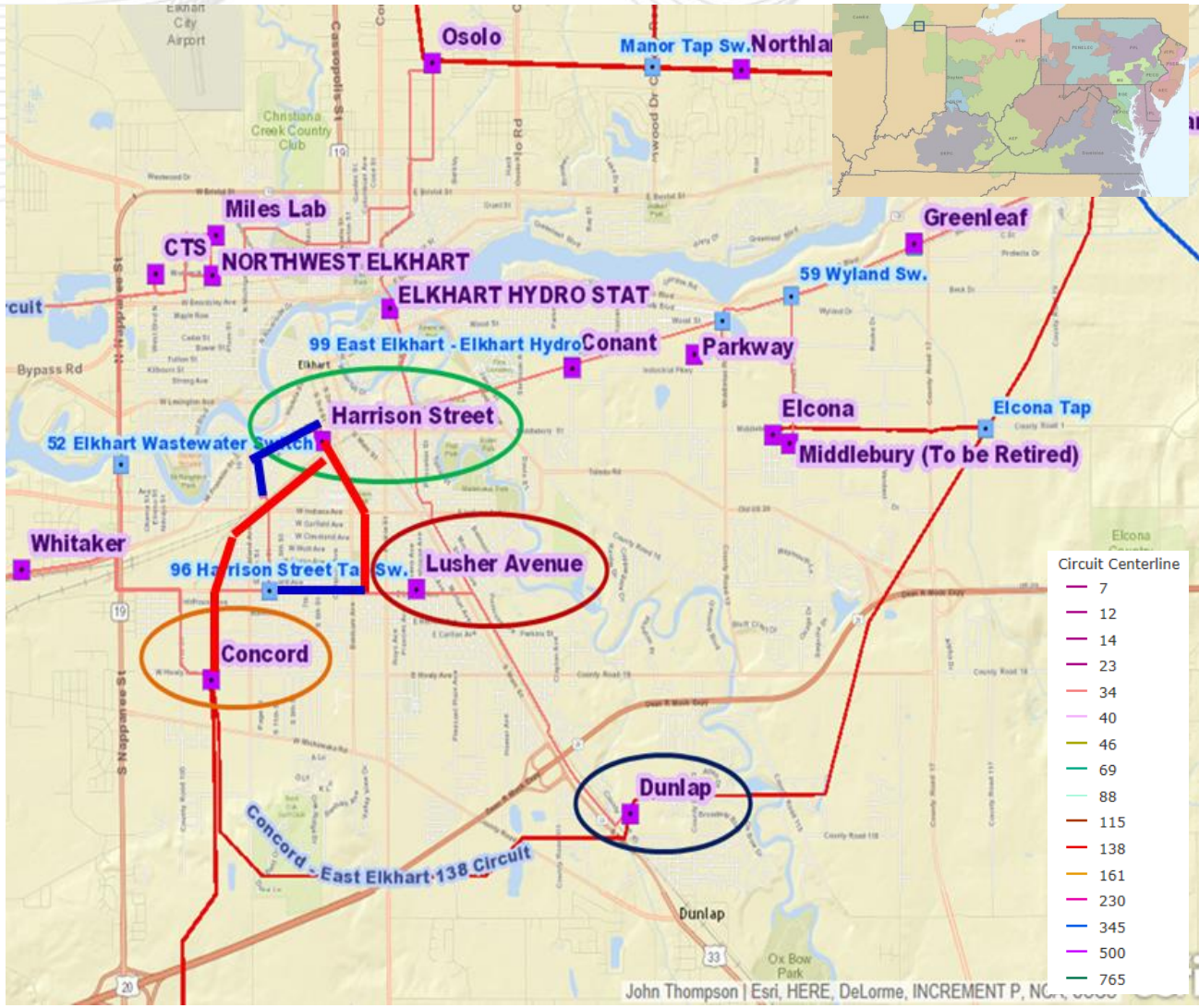

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AEP Transmission Zone: Supplemental Elkhart Network

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Equipment Material/Condition/Performance/Risk:

Elkhart Hydro is a station that presently supplies the Elkhart underground distribution network via two 1950's vintage 34.5/4 kV transformers. The 34.5/4 kV GSU transformer 1 at Elkhart Hydro Substation has high values of ethylene and carbon oxides that began increasing in 2004. The CO/CO2 ratio has been fluctuating between the warning and alarm limit since 2005 indicating that this unit has degraded paper insulation. Additionally, the interfacial tension and power factor are trending in a direction that shows degradation of the transformer oil. This unit has aged insulating materials. The 34.5/4kV transformer 2 at Elkhart Hydro Substation has low values of combustible gasses. The 34.5/12kV transformer 3 at Elkhart Hydro Substation has high values of hydrogen and carbon oxides that have been steadily rising since 1993. The hydrogen and carbon monoxide fluctuate in a similar manner and the unit has experienced partial discharge events. Additionally, the interfacial tension indicates that the oil is in poor quality and the moisture content is high. The transformer insulating system is degraded. Elkhart Hydro station 4 kV equipment is indoor, obsolete, characterized by very compact clearances, and has a vintage estimated in the 1920's. The 1975 vintage 34.5/12kV transformer 2 at Lusher Avenue Substation has an extremely high value for Ethane. This unit has experienced overheating faults which has deteriorated the paper insulation. The 1970 vintage 138/12kV transformer 1 and 1976 vintage transformer 2 at Dunlap Substation has high carbon dioxide values and the bushing dielectric data. The unit has low values of combustible gases.

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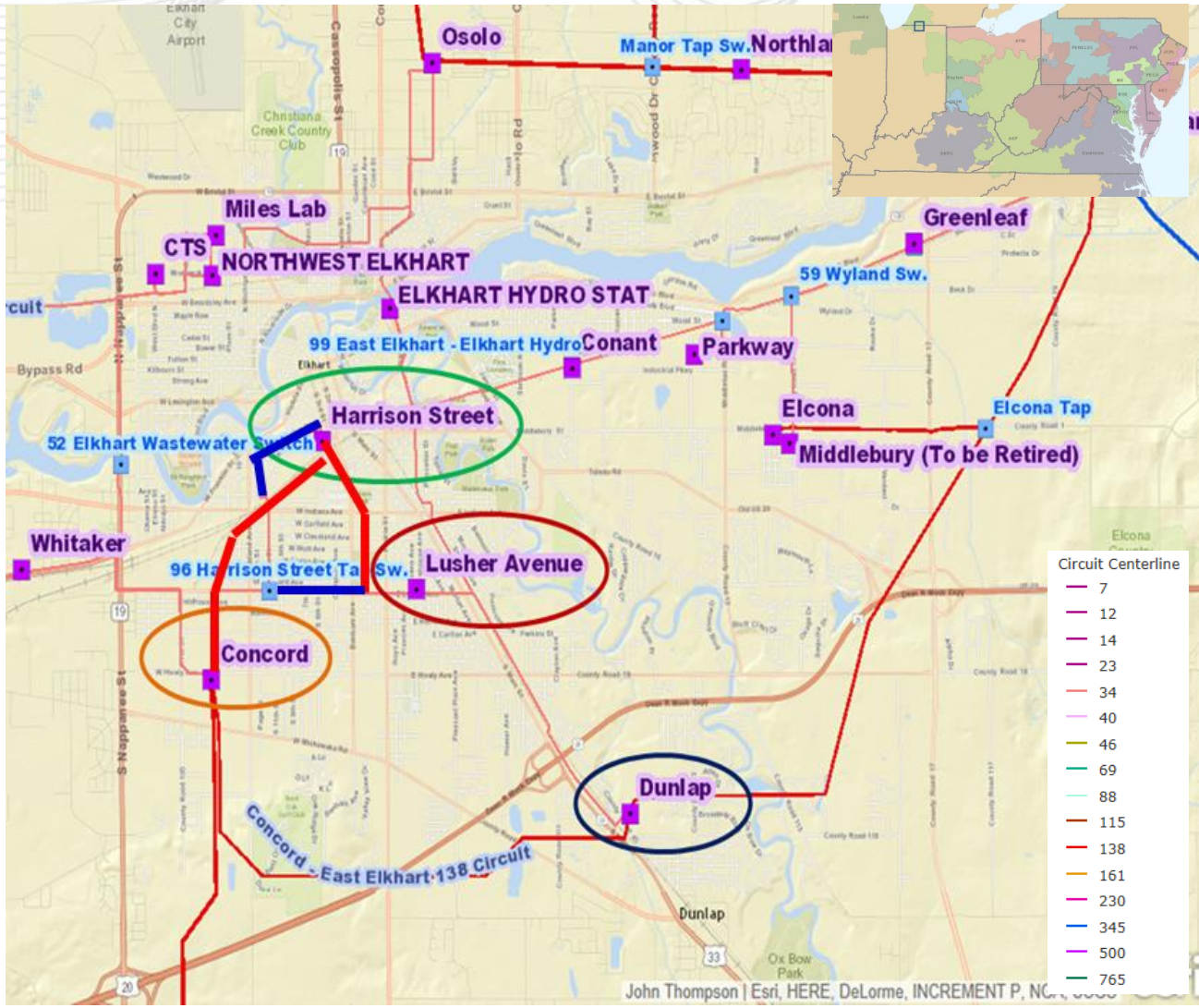

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AEP Transmission Zone: Supplemental Elkhart Network

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The 1950's and 1960's vintage 34.5kV circuit breakers A, D, E, F, G, and H, at Elkhart Hydro Substation have operated through 38, 26, 30,18 & 4 fault operations. The 1987 vintage 34.5kV Cap Switcher J has operated through 44 fault operations. The 1952 vintage 34.5kV circuit breakers A and B at Lusher Avenue Substation have operated through 8 & 14 fault operations. The 1972 vintage 34.5kV circuit breakers H and J at Dunlap Substation have operated through 28 & 45 fault operations. These Circuit Breakers are oil filled FK-breakers without oil containment. These breakers have the following documented conditions: age; bushing problems; unavailability of spare parts; lifetime fault operations count; and high moisture readings. 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 can be an environmental hazard. All these circuit breakers are above the manufacturer recommended limit for full fault operations except the 34.5kV circuit breaker H at Elkhart Hydro and A & J at Lusher Avenue.

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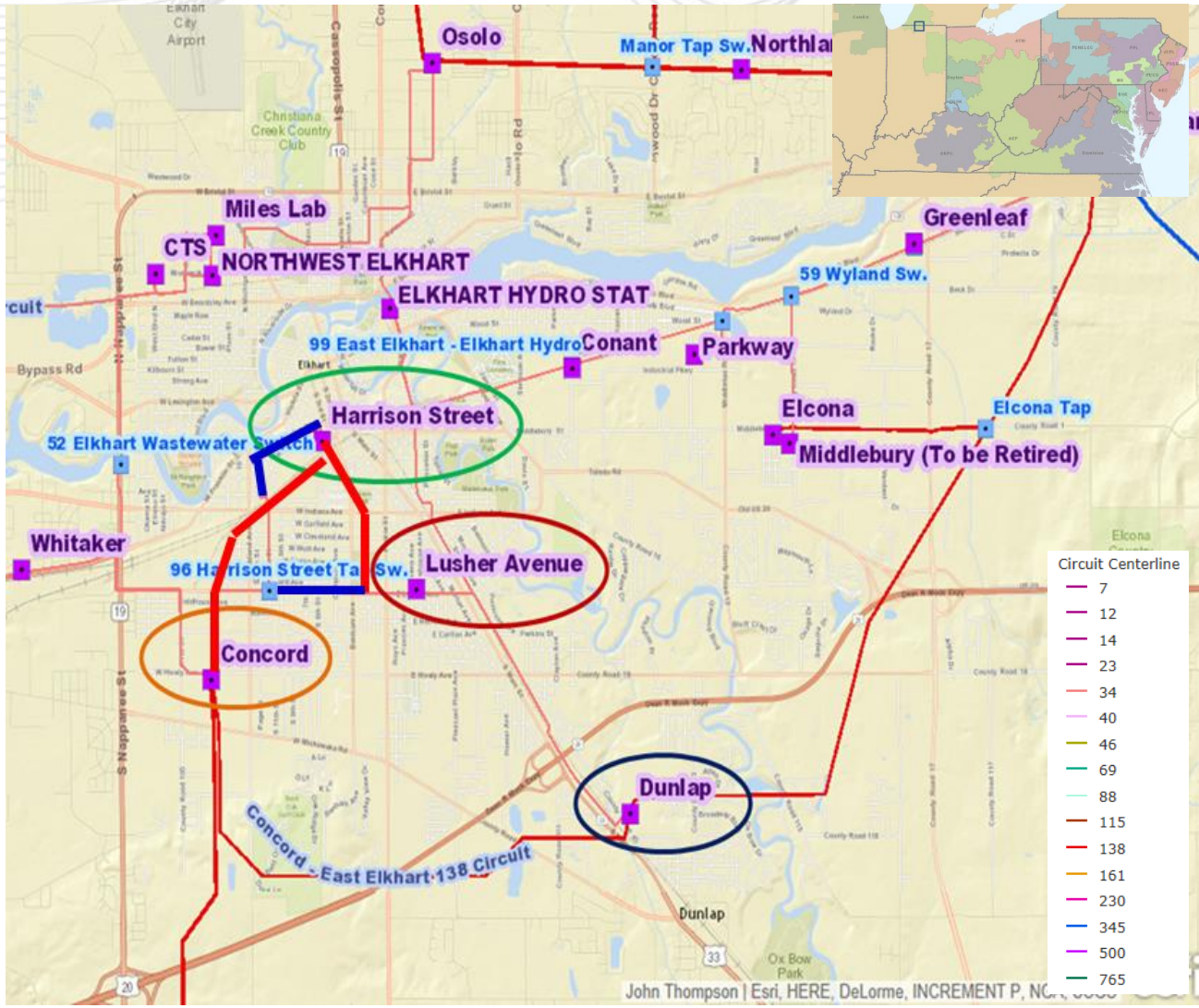

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Selected Solution

Rebuild Harrison Street station as a 69kV ring bus station using 3000A 40kA breakers. (**S1592.1**) **Estimated Cost: $4.2M**

Rebuild Lusher Avenue as a 69kV station using a DT1 FK F1 3000A 40kA model bus tie breaker with 2 MOABS on the line exits. (**S1592.2**) **Estimated Cost: $1.8M**

Install a 69kV 3000A 40kA breaker at Concord station toward Harrison Street. Install a 69kV (34.5kV operated) 3000A 40kA breaker at Concord station toward AE COMP. (**S1592.3**) **Estimated Cost: $2.3M**

At Dunlap Station replace transformer 2 with a 138/69-34.5kV 90MVA transformer. The transformer will have a high side 3000A 40kA circuit switcher. Install two 138kV line breakers using 3000A 40kA breakers. Replace circuit breaker 'H' and 'J' with 69kV 3000A 40kA models. (**S1592.4**) **Estimated Cost: $11.6M**

Rebuild Elkhart Hydro to 69kV standards but operate it at 34.5kV. Replace circuit breaker 'F' and 'A' with 3000A 40kA breakers. Install a 3000A 40 kA 69kV line breaker. (**S1592.5**) **Estimated Cost: $8.7M**

Remove Harrison Street Tap Switch. (**S1592.6**) **Estimated Cost: $0.1M**

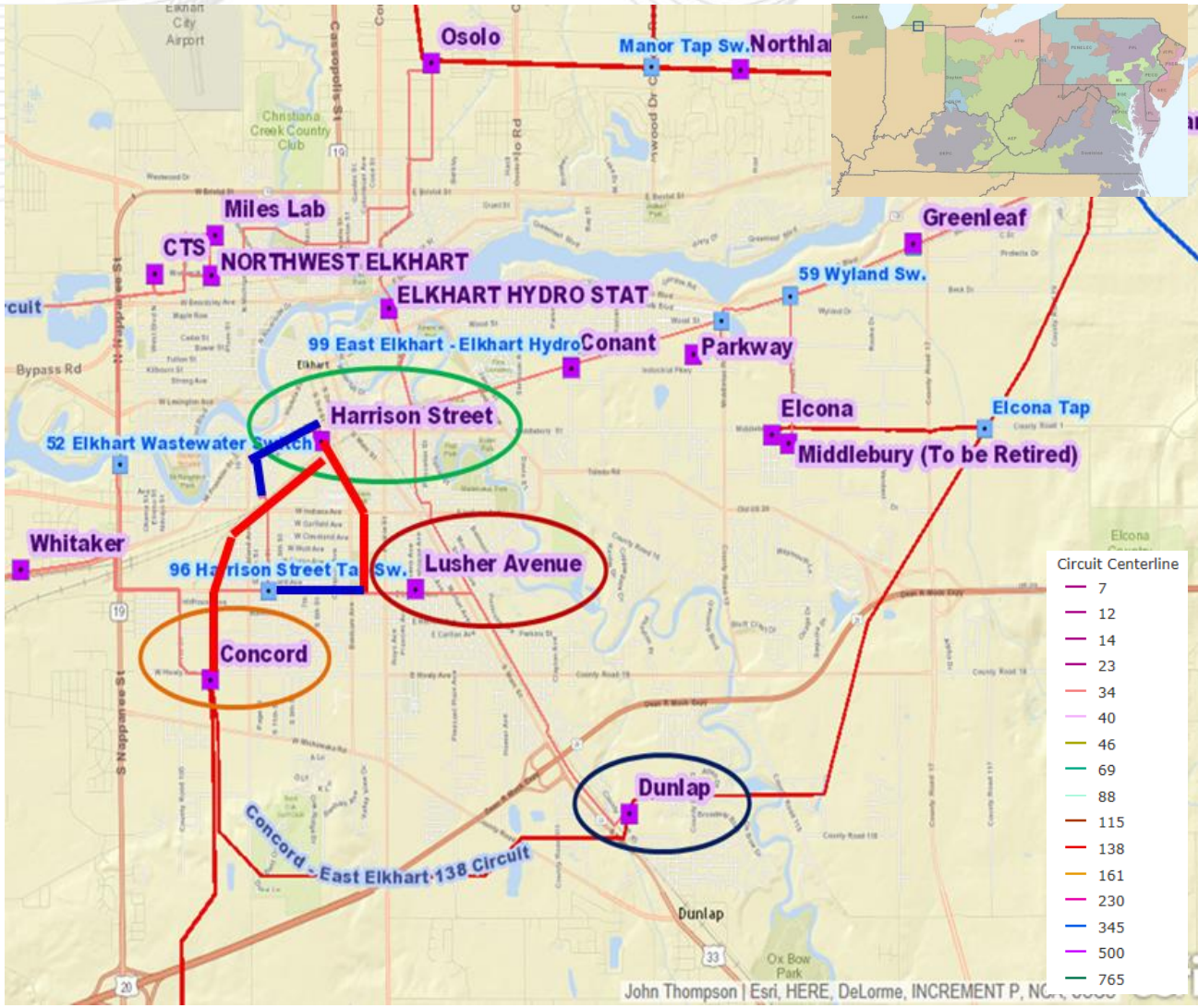
Build ~1.5 miles of line from the existing Concord – Wolf de-energized 138kV line to Harrison Street at 69kV utilizing 795 ACSR (64 MVA rating). After this, retire the line portion from AE Comp – Harrison Street. (**S1592.7**) **Estimated Cost: $4.4M**

Build ~1.5 miles from the Dunlap – Concord line to Harrison Street station. Rebuild .5 miles of the existing Dunlap – Lusher line to 69kV standards and retire the portion between Harrison Street Tap and the new line. All new line will utilize 795 ACSR (64 MVA rating). (**S1592.8**) **Estimated Cost: $5.8M**

Total Estimated Transmission Cost: $38.9M

Projected In-service: 4/1/2019

Project Status: Scoping



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Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Derby Station: The 69kV CBs F, G, and H and the 34.5kV CB K at Derby Substation are oil filled GE-FK breakers. Failure of these units generally results in fire and oil spillage within the substation. The units are severely rusted and the foundation is deteriorated. These breakers have significantly exceeded the designed number of full fault operations (10) with 40, 40, 49, and 53 fault operations, respectively.

The 138/69/34 transformer was commissioned in 1961 and is also in poor condition. This bank has experienced high energy faults and has ever increasing oil contamination.

Berrien Springs Station: The two transformers are approaching 70 years of service and are all in poor condition. Also, the 34.5 kV CB's are approaching 50 years of service and have experienced numerous faults and are all in poor condition. The 34.5 kV switch yard sits on an elevated concrete platform directly above the fish ladder and lacks oil containment or proper equipment grounding (safety concern). The deteriorated condition of this platform is of significant concern. Also, all drainage around the station goes directly to the river and with this station being located below the dam on the St. Joseph River, uncontained oil spills have direct access to Lake Michigan. There's no ability to expand the 34.5/12 kV system which is an already an atypical arrangement (one of only 3 in I&M) to which distribution has previously requested replacement. The control house lacks space and the equipment is outdated and unable to communicate with our current IED relays.

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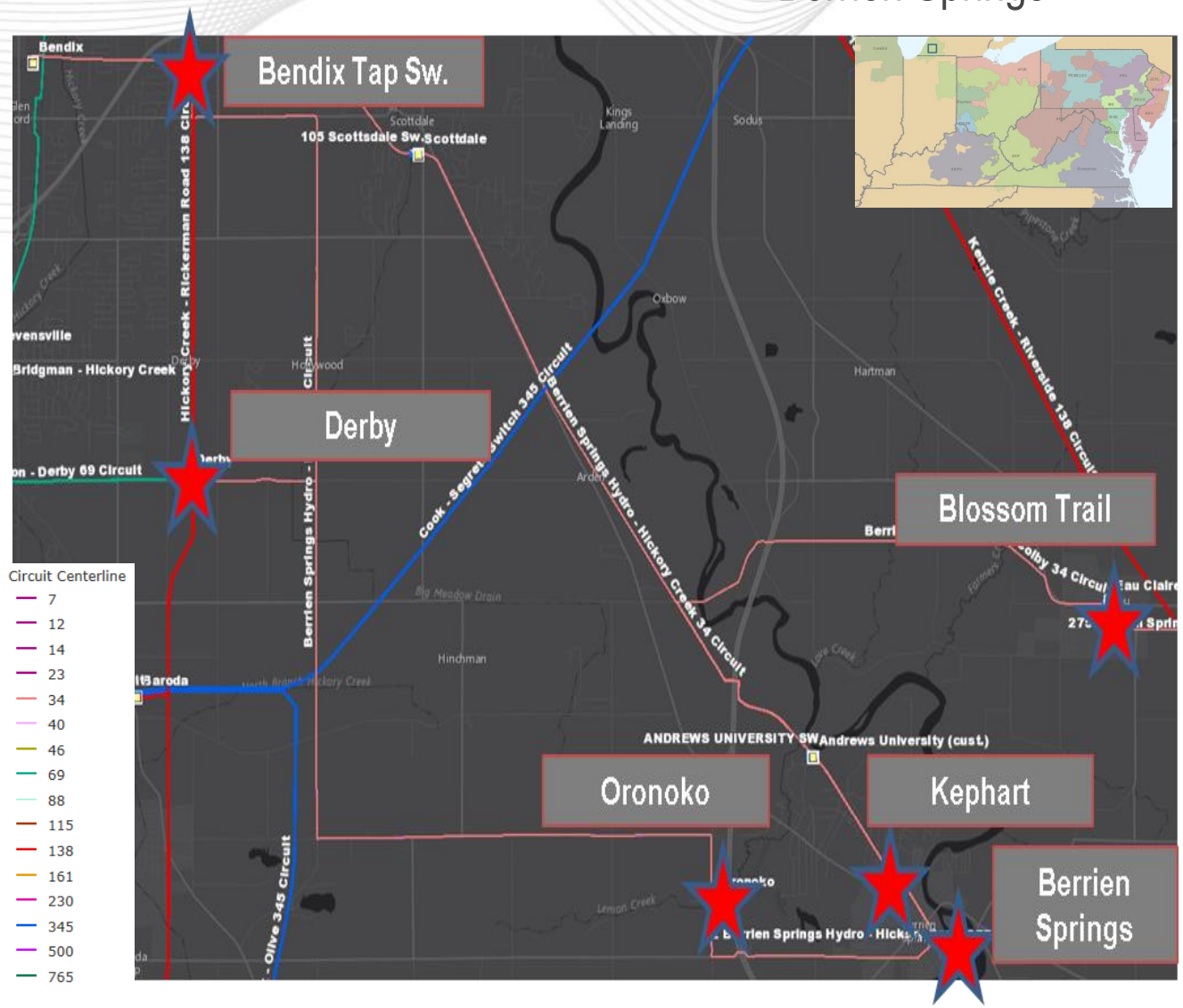

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AEP Transmission Zone: Supplemental
Berrien Springs

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Oronoko Station: I&M Distribution has ongoing failures with the 34.5 kV underground terminations at Oronoko and Derby Stations. These cables are at the end of their expected life.

Line Assets: From 2014 to 2017 the Berrien Springs Hydro – Derby line was subject to 1,575,738 Customer Minutes of Interruption (CMI). The underground components of the Berrien Springs Hydro – Derby circuit were built in the 1970's. The cable manufacturing technology and insulating compounds produced during this time period results in contaminant levels far exceeding today's standard; this notion is accepted in the utility industry. Formation of cable tress inside the insulation layer leads to ever increasing risk of electrical breakdown and failure. The high end of life expectancy for cables of this vintage is generally predicted to be at 35-40 years of age. Additionally, the component that is part of the Derby Tap Line Asset is a non-standard size of the XLPE (cross-linked polyethylene) cable. In November of 2015, there was a failure on the phase 2 cable entrance at Oronoko which led to a 50 day outage. In April of 2016, there was a failure on the Phase 1 cable on the Derby Tap which resulted in a 79 day outage. The Berrien Springs Hydro – Derby circuit was built with wood structures and mostly 4/0 ACSR conductor. The total open conditions, 226, date from 2009 – 2017. Some of the structure conditions reported were broken and split cross arms, disconnected x-braces and rot. Currently, 119 of the 462 structures have at least one open condition.

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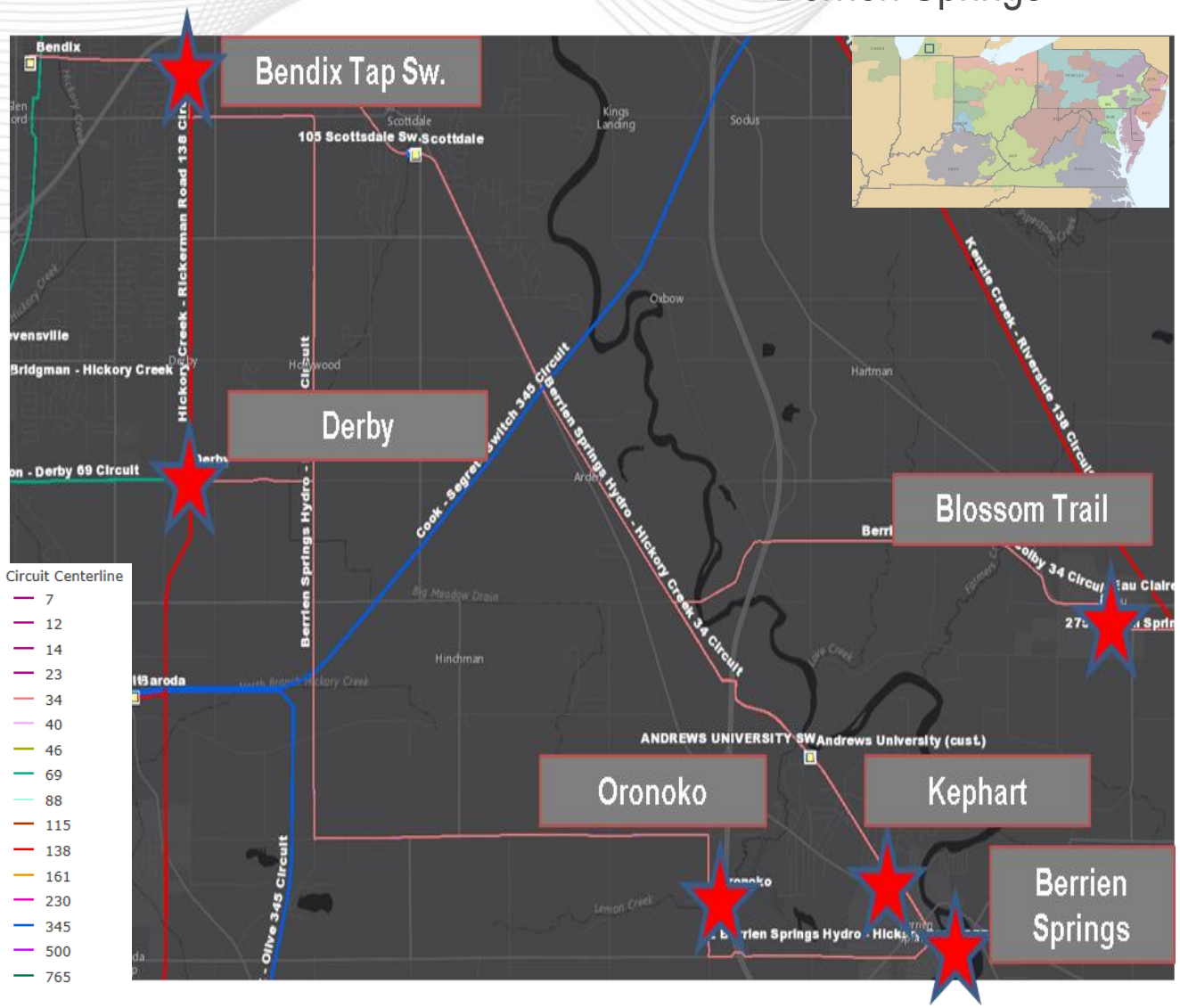

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AEP Transmission Zone: Supplemental
Berrien Springs

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Operational Flexibility and Efficiency

Historically the loss of the Hickory Creek and Derby sources have resulted in low voltages and voltage instability. DDC has reported that the voltage switching transients during 34.5 kV operations are approaching 8 volts (on a 124 volt base) when a lose of Hickory Creek 34.5 kV is experienced. The remoteness of AEP's Berrien Springs Hydro generation from stronger 138 or 69 kV systems has long been an issue. The introduction of a new 138 kV source near Eau Claire, MI would provide the opportunity to strengthen the grid and restore stability to the area with 138/69/34.5 kV transformation. This project will also prepare our 34.5kV network for future 69kV conversions and will eliminate drop and pickup issues when transferring distribution loads.

The Berrien Springs Hydro – Derby line is a combination of underground and overhead cables. When underground and overhead are mixed, the circuit must be operated in manual reclose to protect the underground cable section from additional damage to the underground cable caused by reclosing into a fault. If for some reason a circuit is operated with automatic reclosing like an all overhead circuit, there is great risk to causing additional (catastrophic) damage to the cable if the fault is still present.

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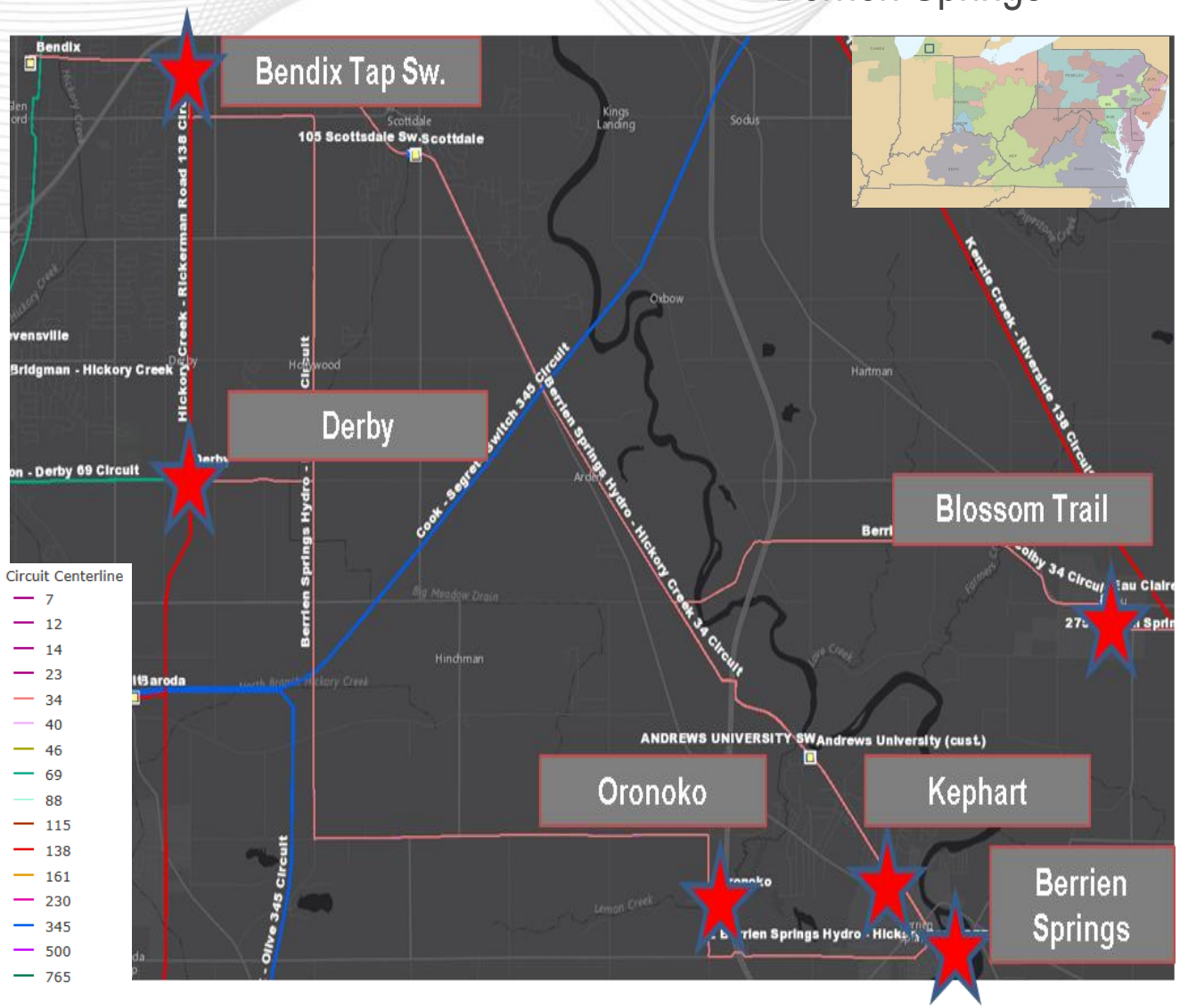

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AEP Transmission Zone: Supplemental
Berrien Springs

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Selected Solution

Derby - Bendix: Relocate line exits and eliminate the need for underground 69/34kV lines at Derby. Replace Bendix Tap Sw. Pole. (**S1593.1**) **Estimated Cost: $2.5M**

Berrien Springs Hydro - Oronoko - Hickory Creek 34.5kV: Eliminate UG 69kV section at Oronoko. Rebuild ~1.3mi of 34.5 kV as 69kV double circuit. Build line extension to the proposed site for Kephart station. (**S1593.2**) **Estimated Cost: $0.9M**

Rebuild Derby station in the clear. Proposed station will have (2) 138kV CBs, (4) 69kV CBs, (1) 34.5 CB, (1) dual voltage 138-69/34.5kV transformer with a circuit switcher on the primary. (**S1593.3**) **Estimated Cost: $4.0M**

Construct a new Kephart station with (2) 69kV CBs, (1) 34.5kV CB, (1) 69/12kV transformer, (1) 69/34.5kV transformer, and (3) 12kV CB's. Construct a 69kV yard that can accommodate 34.5kV and 69kV operation. (**S1593.4**) **Estimated Cost: $1.9M**

At Berrien Springs, retire existing 34.5kV yard, concrete platform and associated transmission equipment. Install (2) 69kV CBs and replace 69kV CB "H" on the primary side of T1. (**S1593.5**) **Estimated Cost: $2.5M**

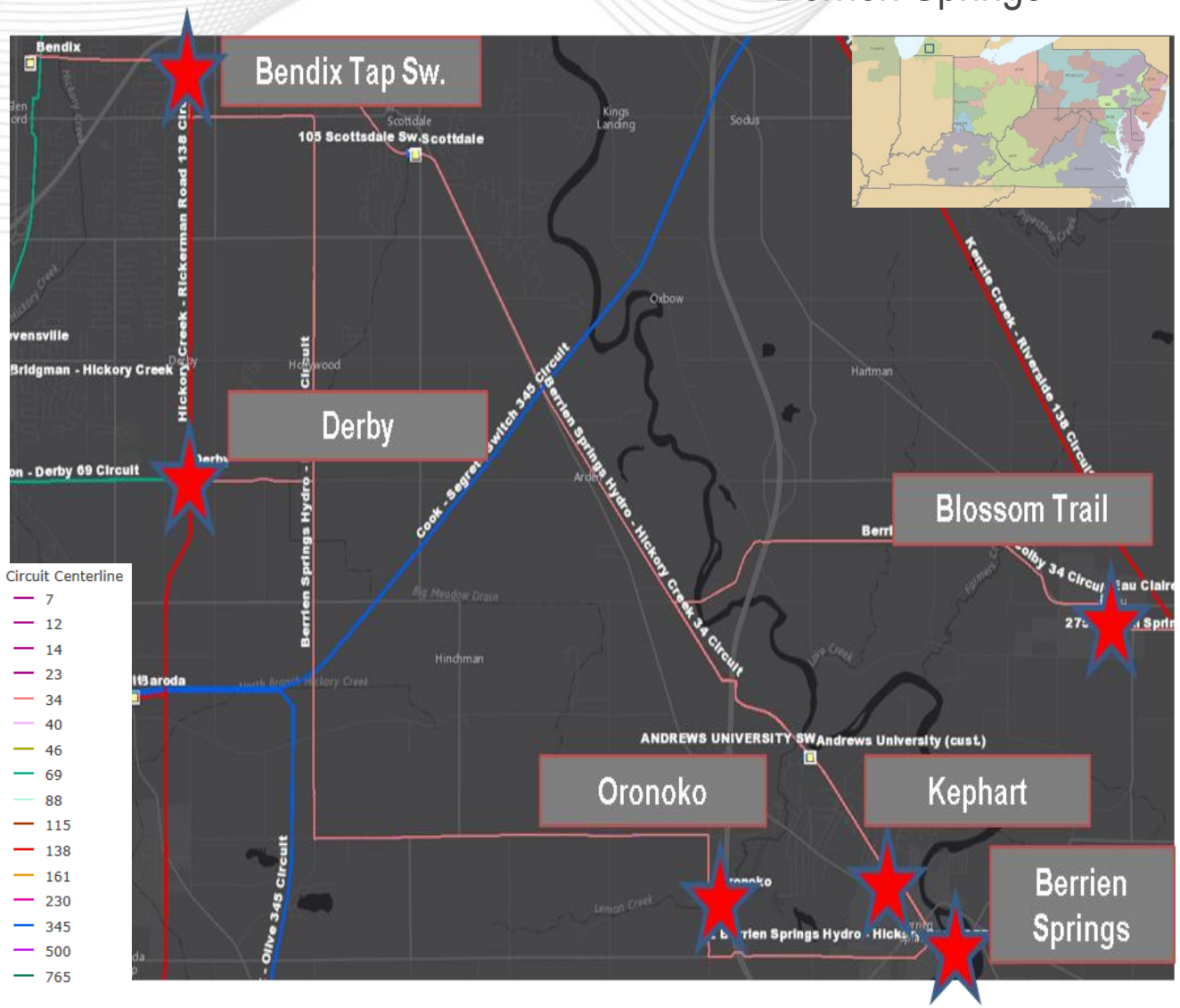
At Blossom Trail, install (1) dual voltage 138-69/34.5kV transformer, (4) 138kV CBs, (1) 138kV CS, (1) 69kV CB , (1) 34.5 CB, and (1) 34.5 ground bank. (**S1593.6**) **Estimated Cost: $6.0M**

Replace Bendix tap switch with 1200A 69kV phase over phase switch. (**S1593.7**) **Estimated Cost: $0.6M**

Total Estimated Transmission Cost: $18.4M

Projected In-service: 6/1/2020

Project Status: Scoping



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AEP Transmission Zone: Supplemental
Brice Station

Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Customer Service:

AEP-Ohio has requested a new 138kV delivery point capable of serving 3-50 MVA transformers to address their concerns as listed below.

- Two Distribution circuits from Astor are nearing 90% capabilities. Load transfer options are exhausted.
- One Distribution circuit from Shannon is forecasted to exceed 90% capability in 2018 and 100% capability in 2019 with confirmed additions of block loads. Only temporary load transfers can be utilized as the forecasted loads for all feeders in the area would be exhausted.
- Reynoldsburg 34.5kV/13.2kV Station (served from Distribution line) is radially fed and has no method for recovery in the event of a full station outage. This area has a history of reliability problems and complaints.
- AEP Ohio has been approached numerous times about relocating Reynoldsburg Station by the City of Reynoldsburg for economic development purposes.
- Reynoldsburg and Pataskala areas along I-70 are active residential and commercial load growth centers. No appreciable capacity left on existing facilities.
- With load transfers from Shannon Station to this station, would have ability to utilize the freed up capacity on the Shannon circuits to pick up load from of the areas served by the northern circuits out of Bixby that are starting to have capacity issues.
- With the addition of the Brice Station, we would have sufficient facilities in a very marketable location to push economic development opportunities.

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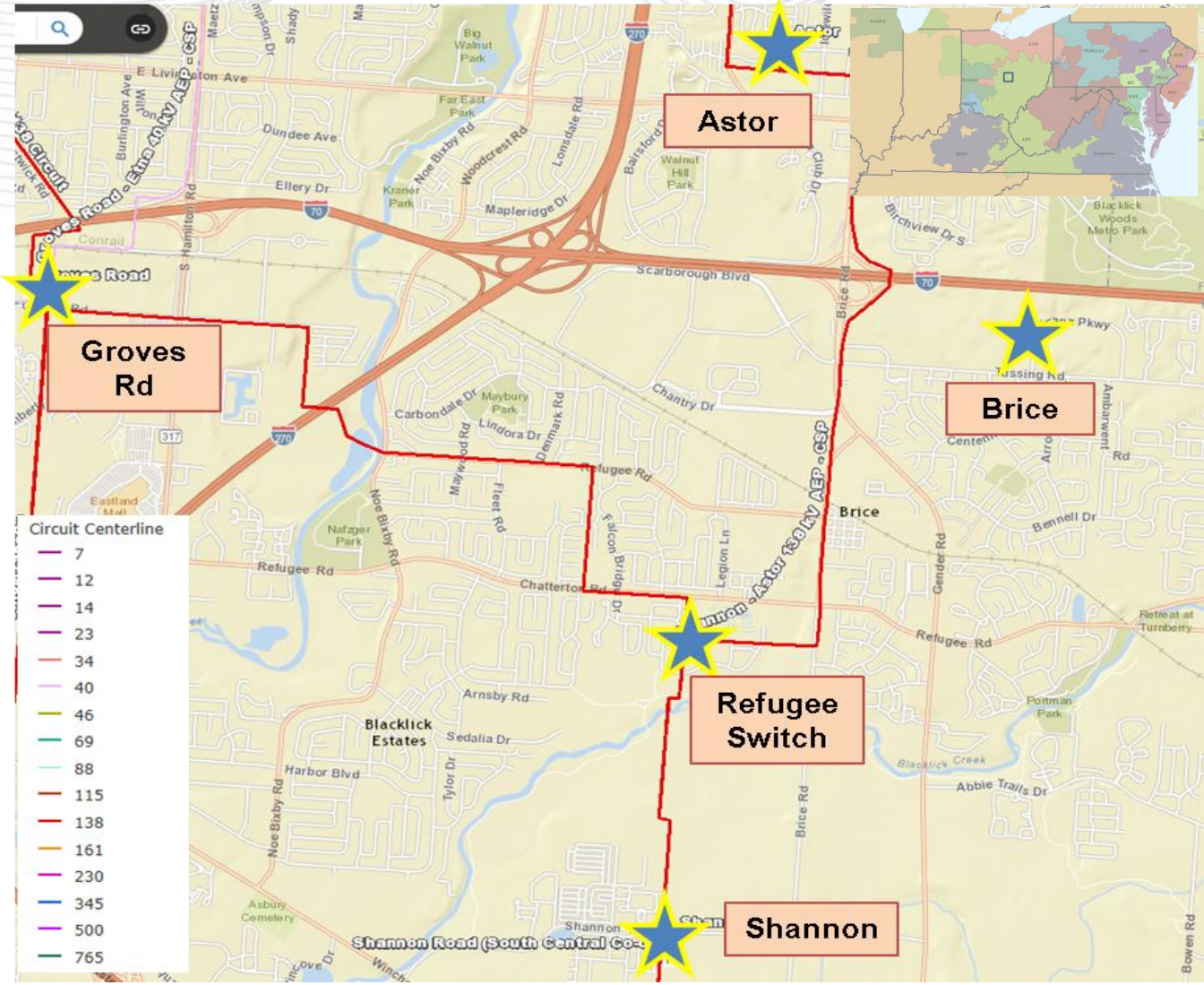

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AEP Transmission Zone: Supplemental
Brice Station

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Operational Flexibility and Efficiency

Columbus is a large urban load center. AEP-Ohio routinely utilizes larger than average Distribution transformers in this area due to load density needs, distribution line routing difficulties, and other reasons. Use of such large Distribution transformers as well as unique combinations of transformer windings operated in parallel tends to put large amounts of customer load at risk. For this reason, circuit breakers will be installed at Brice.

Specifically, in the area of the new Brice station installation, the new station will cut into an existing 3 terminal line. A longer term solution will be required to address the 3 terminal line issue but, in the meantime, it is necessary to avoid increasing load and line exposure to this outdated configuration.

Selected Solution

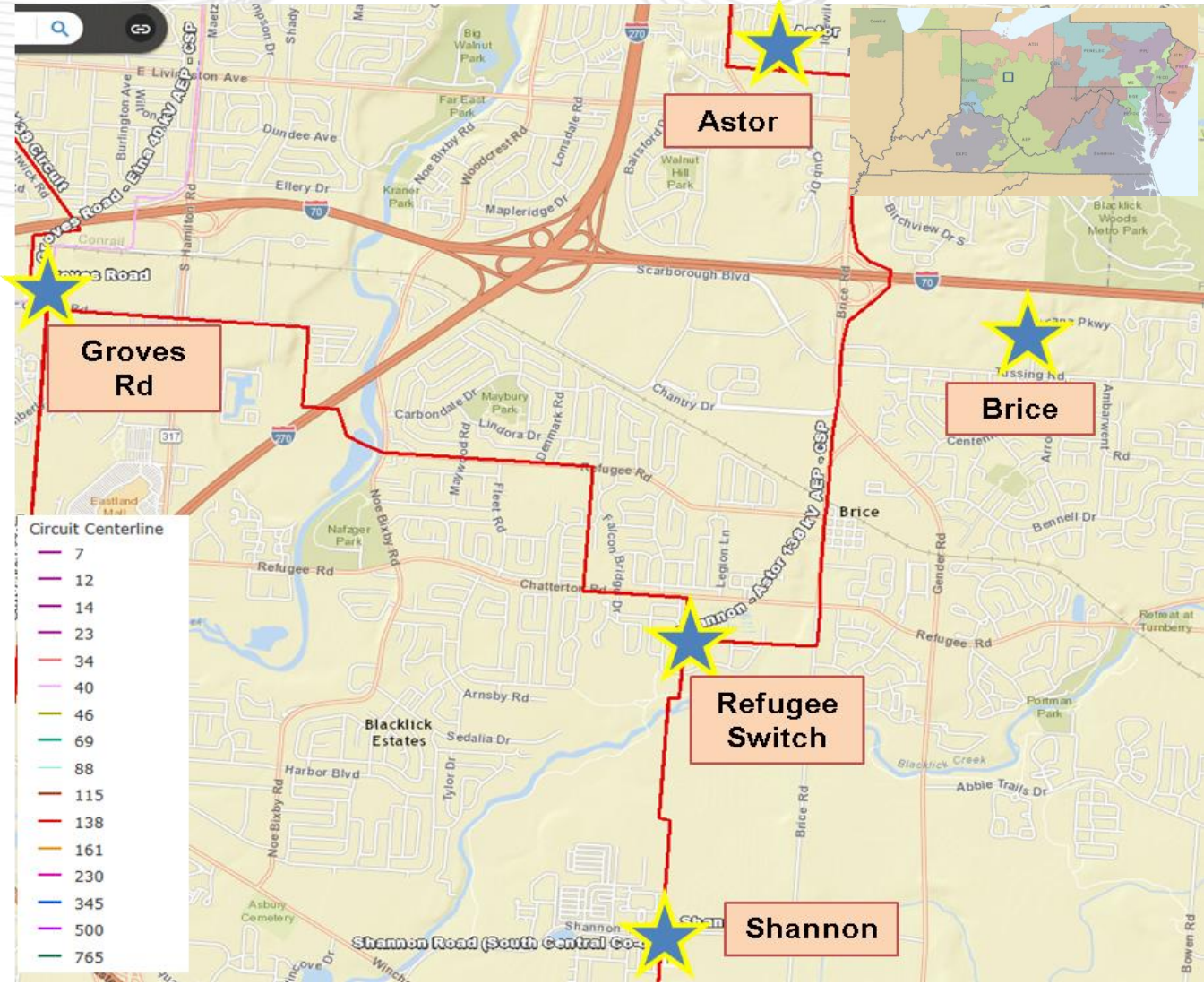
Cut into existing Astor-Groves-Shannon 138kV circuit with 0.69 miles of new double circuit 795 ACSR (257 MVA rating). (**S1594.1**) **Estimated Cost: $0.8M**

Construct a new Brice station as a ring bus laid out for breaker and a half. Install 3-138kV 3000A 40kA CB's. (**S1594.2**) **Estimated Cost: $1.5M**

Total Estimated Transmission Cost: $2.3M ($4.0M for Distribution Cost)

Projected In-service: 10/21/2019

Project Status: Scoping



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AEP Transmission Zone: Supplemental Darrah Station

Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The existing 34.5 kV circuit breakers “C”, “D”, “F”, “G”, “I”, “J”, and “N” at Darrah are all FK oil type breakers that are all between 45-70 years old. These are oil breakers that have become more difficult to maintain due to the required oil handling. There is an increased potential for oil spills during routine maintenance and failures with these types of breakers. Other drivers include damage to bushings and an excessive number of fault operations exceeding the manufacturers recommendations. Darrah breakers “C”, “D”, “F”, “G”, “I”, “J”, and “N” have experienced 12, 10, 85, 22, 1, 18, and 90 fault operations respectively. The manufacturer’s recommendation for this type of breaker is 10.

138 kV circuit breaker “T” at Darrah is a FGK oil type breaker that is close to 60 years old. These oil breakers share similar concerns to the FK types listed above. Darrah breaker “T” has experienced 23 fault operations, exceeding the manufacturer’s recommendation of 10.

Darrah’s 138/34.5 kV Transformer #1 (vintage 1949) and is showing dielectric breakdown (insulation), accessory damage (bushings/windings) and short circuit breakdown (due to amount of through faults).

Operational Flexibility and Efficiency

Circuit switchers will be added to the high side of transformers #1, #2, #3, and #4 at Darrah Station to separate dissimilar zones of protection. Installation of a circuit switcher was evaluated for transformer #5 at Darrah. It was determined a switcher could not be added without a complete relocation of the transformer and its low side bus work or a significant reconfiguration of the 138 kV bus at Darrah.

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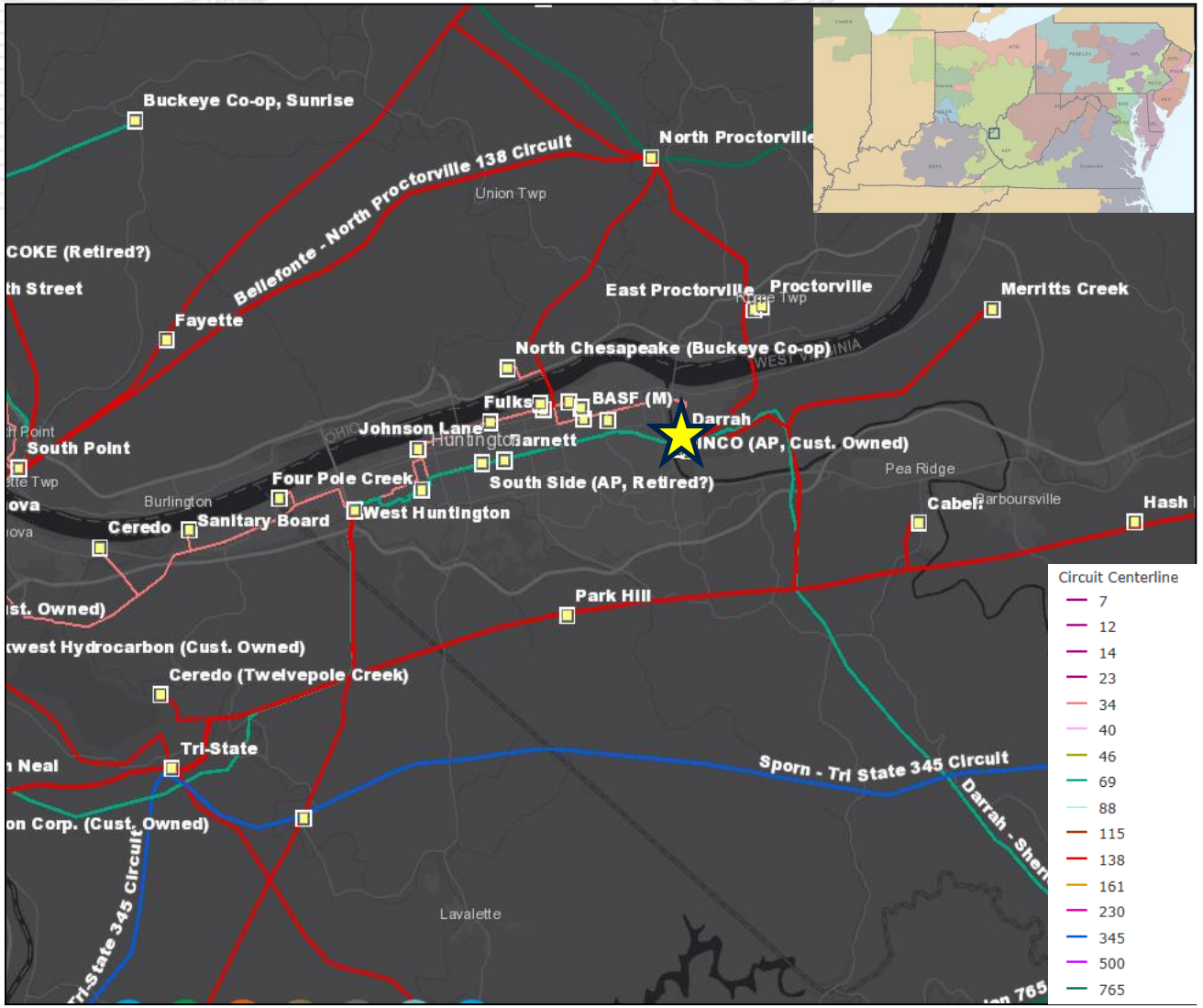

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AEP Transmission Zone: Supplemental Darrah Station

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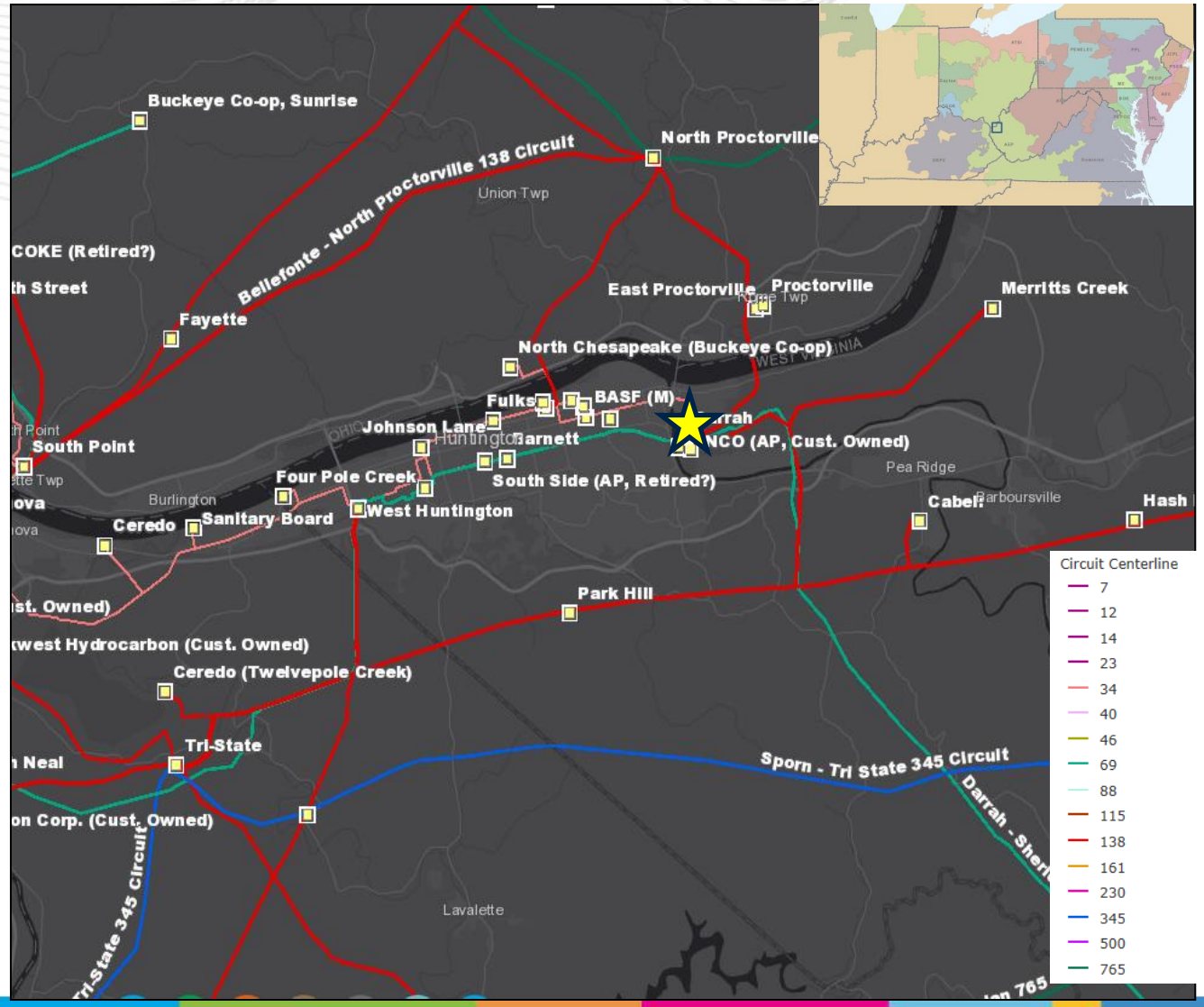
Selected Solution

At Darrah station, replace the existing 1600 A 42 kA 138 kV circuit breaker "T" with a new 3000 A 40 kA 138 kV circuit breaker. Replace the existing 1200 A 17 kA 34.5 kV circuit breakers "C", "D", "F", and "I" with new 3000 A 40 kA 34.5 kV. Replace the existing 1800 A 27 kA 34.5 kV circuit breakers "J", "G", and "N" with new 3000 A 40 kA 34.5 kV circuit breakers. 138 kV circuit switchers will be added to the high side of Darrah transformers #1, #2, #3, and #4. The existing 45 MVA 138/34.5 kV transformer #1 will be replaced by 138/69/34.5 kV transformer with a 50 MVA tertiary. (**S1595**)

Estimated Transmission Cost: $11.5M

Projected In-service: 6/1/2020

Project Status: Engineering



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Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

South Lynchburg station 69 kV circuit breakers 'D' & 'C' and Dearington station 69 kV circuit breakers 'L', 'K' & 'M' are oil type breakers without oil containment containment manufactured between 1959 and 1969. In general, oil breakers have become increasingly difficult to maintain due to the oil handling requirements. Oil spills are frequent with failures and routine maintenance. Other drivers include damage to bushings. South Lynchburg CB 'D' is also legacy oil-filled FK type breakers which have little to no replacement parts. 69KV circuit breaker 'C' is a EPB Gas Circuit Breaker with gas leaks, bushing failures, and CT gasket problems.

The 69 kV network lines in the area is currently protected with pilot wire technology. Copper pilot wire is a relatively obsolete technology, which makes it increasingly difficult to find suitable pilot wire cable and hardware parts. Consequently, we are avoiding like-kind replacement of pilot wire because the technology will be increasingly difficult to maintain.

At Dearington station the station battery voltage its being changed from 48 vdc to 125 vdc (AEP standard). Reusing Cap Switcher 'AA' would have required modifying the controls and motor to work with 125 vdc, which, is a very difficult and costly task. The CS can be a safety hazard as the gas sensor cannot be monitor remotely. One has to be standing in front of the CS to determine if adequate pressure is available to operate. This becomes a safety hazard if the gas is depleted and it is called on to operate.

Customer Service:

Dearington station serves critical loads in the Lynchburg, VA area. These customers include the Lynchburg General Hospital, Lynchburg College, EC Glass High School, and two nursing homes. Adding a bus tie breaker at Dearington station will limit the exposure to customers in the area.

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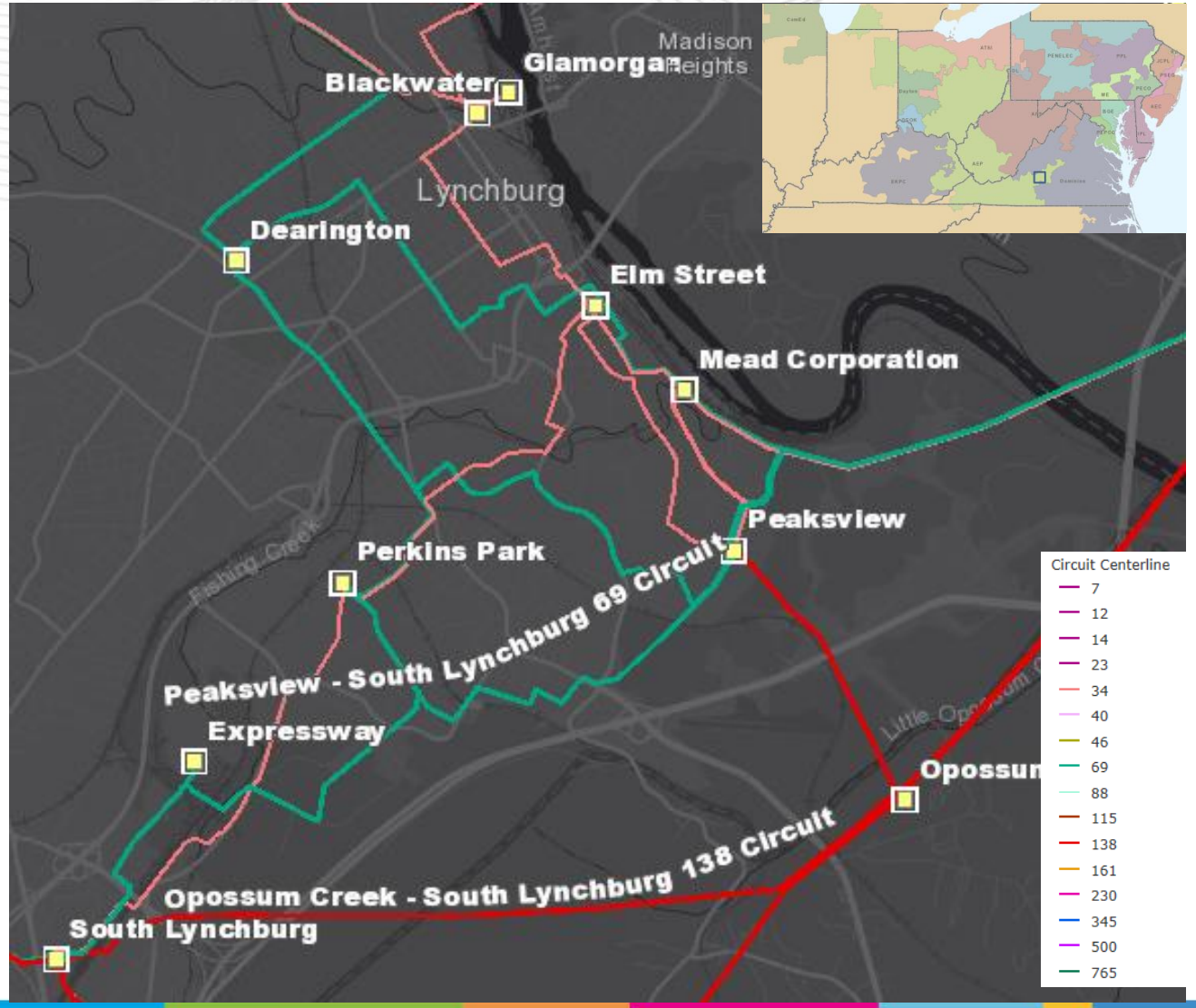

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AEP Transmission Zone: Supplemental Dearington Area

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Selected Solution

At South Lynchburg station, replace the existing 69 kV/1200 A/21 kA CB "C" and the 69 kV/1200 A/11.3 kA CB "D" with 3000 A/40 kA circuit breakers. Install new control relays for breakers. Retire pilot wire from the Peaksview and Skimmer 69 kV line relays and install new line relays. (**S1596.1**) **Estimated Cost: $1.3M**

At Peaksview station, retire pilot wire from the Dearington #1 & #2 and South Lynchburg 69 kV lines and install new line relays. Install a 20' building expansion to accommodate new relays and RTU. (**S1596.2**) **Estimated Cost: $1.9M**

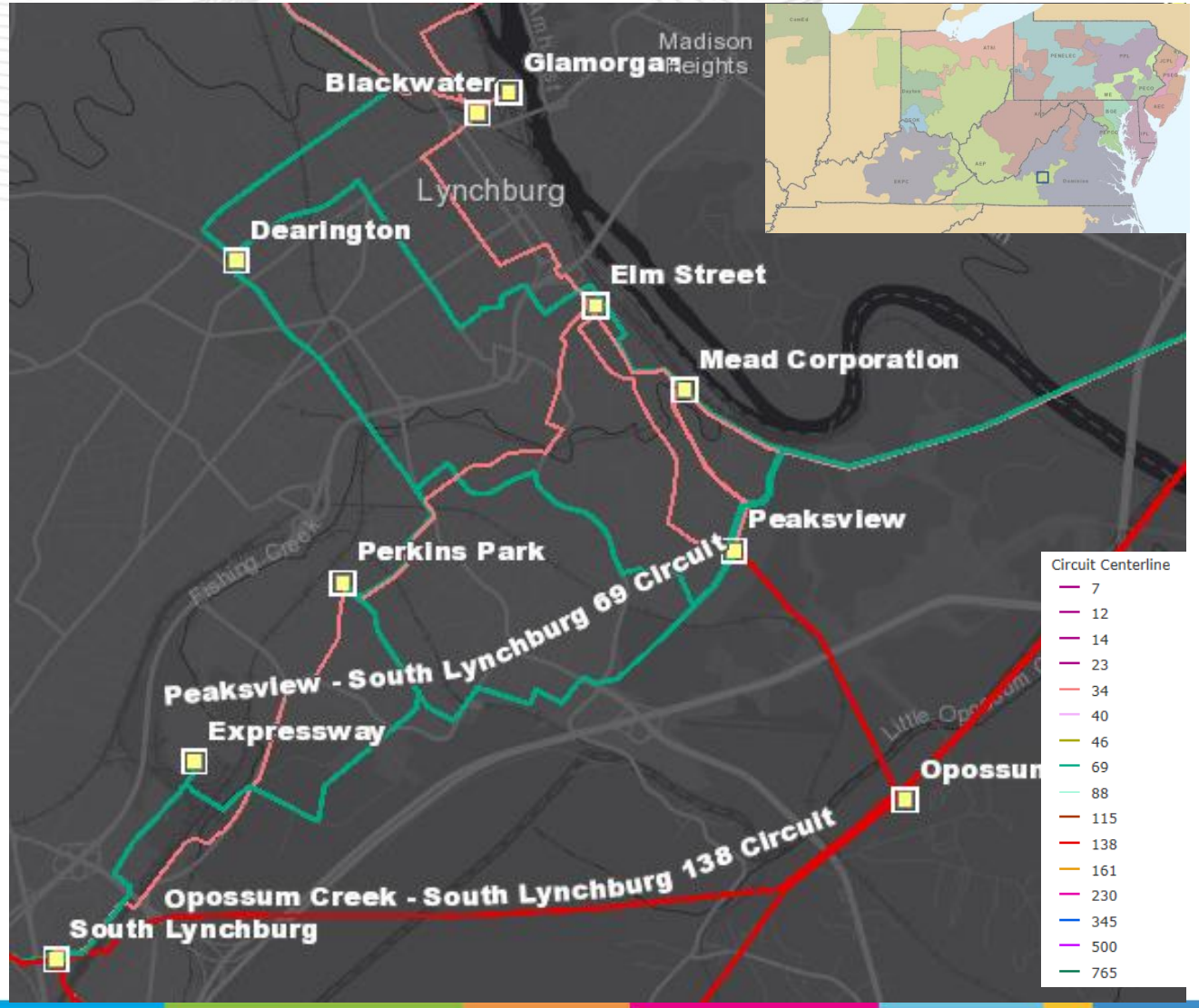
At Dearington station, replace the existing 69 kV/1200 A/21 kA CB 's "L", "M", and "K" with 3000 A/40 kA circuit breakers. Install a new 69 kV/3000 A/40 kA bus tie breaker. Retire pilot wire from the Peaksview #1 & #2 and Reusens lines and install new line relays. Replace existing 69 kV/400 A/40 kA circuit switcher "AA" with a new 420 A/18 kA circuit switcher. Install new DICM to accommodate all new relays and RTU. (**S1596.3**)**Estimated Cost: $0M**

At Perkins Park station, retire pilot wire from the Dearington and Peaksview lines and install new line relays. Install high side circuit switcher on distribution transformer. Install new RTU. (**S1596.4**) **Estimated Cost: $0M**

Total Estimated Transmission Cost: $3.2M

Projected In-service: 8/31/2019

Project Status: Engineering



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Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk**:**

The East Logan 69 kV circuit breakers “M” and “N” are showing signs of deterioration. These breakers are 1969 vintage oil breakers. Oil 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 can become an environmental hazard. The drivers for replacement of these breakers are age, bushing damage, number of fault operations, and a lack of available repair parts. Circuit breaker “M” and “N” have fault operations of 185 and 69 respectively. Circuit switcher AA is a Mark type switcher 1970 vintage. Mark switchers are being recommended for replacement due to their inability to coordinate with modern relaying packages. 54 of the 57 relays at East Logan are either electromechanical or static type. 33 of these are Transmission. The new line relays needed CCVT’s to be installed . Cable and trenching was needed to connect these to the DICM which is in a different location because of space constraints. A backup station service was needed for the 69 kV as there was none at the station currently.

Customer Service:

The rehab upgrades are being done to align with AEP Ohio work. They will be replacing their 69/12 kV transformer, installing a new feeder, constructing a new 12 kV bus, upgrading 12 kV circuit breakers, installing a 69 kV circuit switcher, installing feeder regulators, installing a DICM and replacing outdated equipment.

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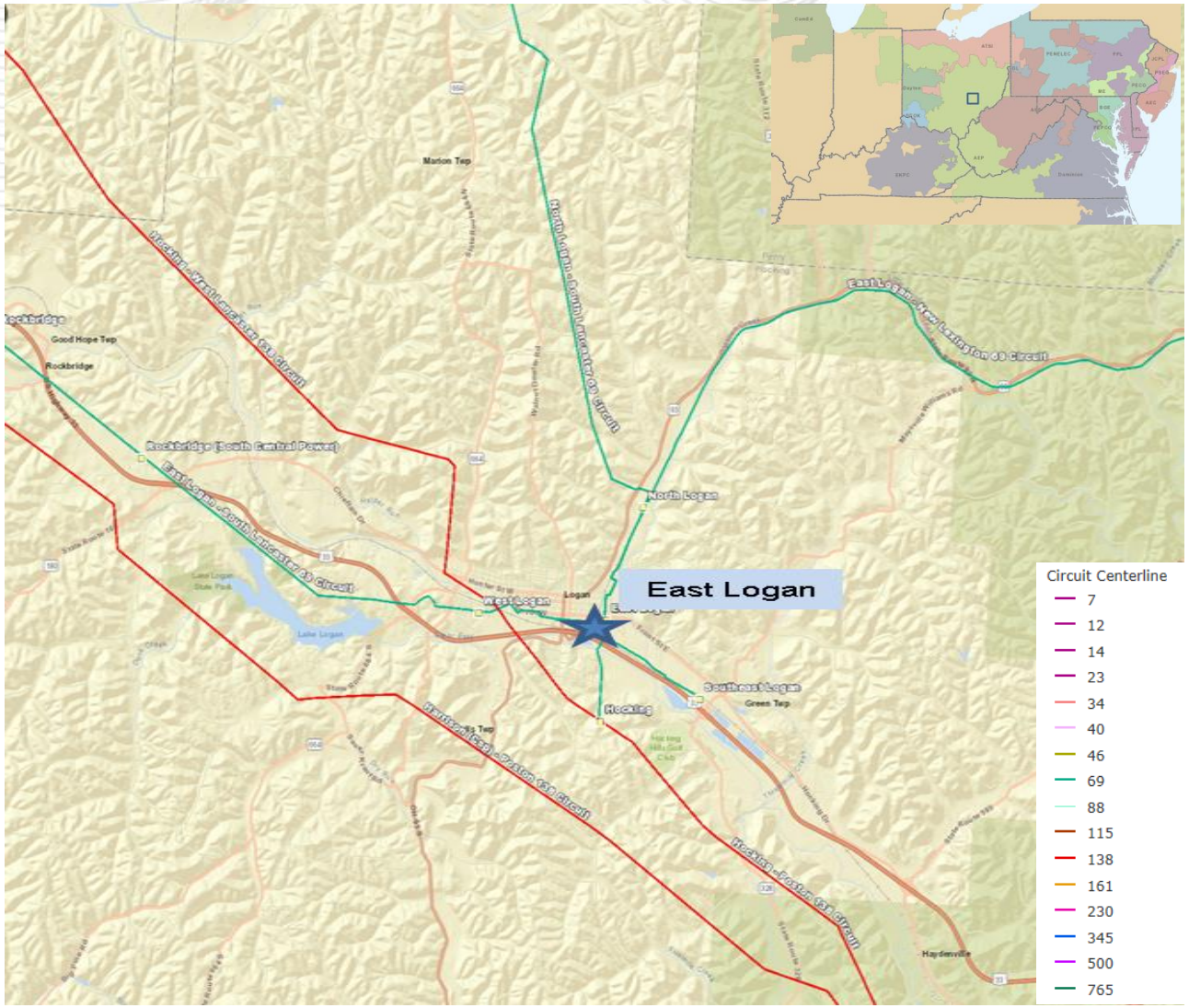

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AEP Transmission Zone: Supplemental
East Logan

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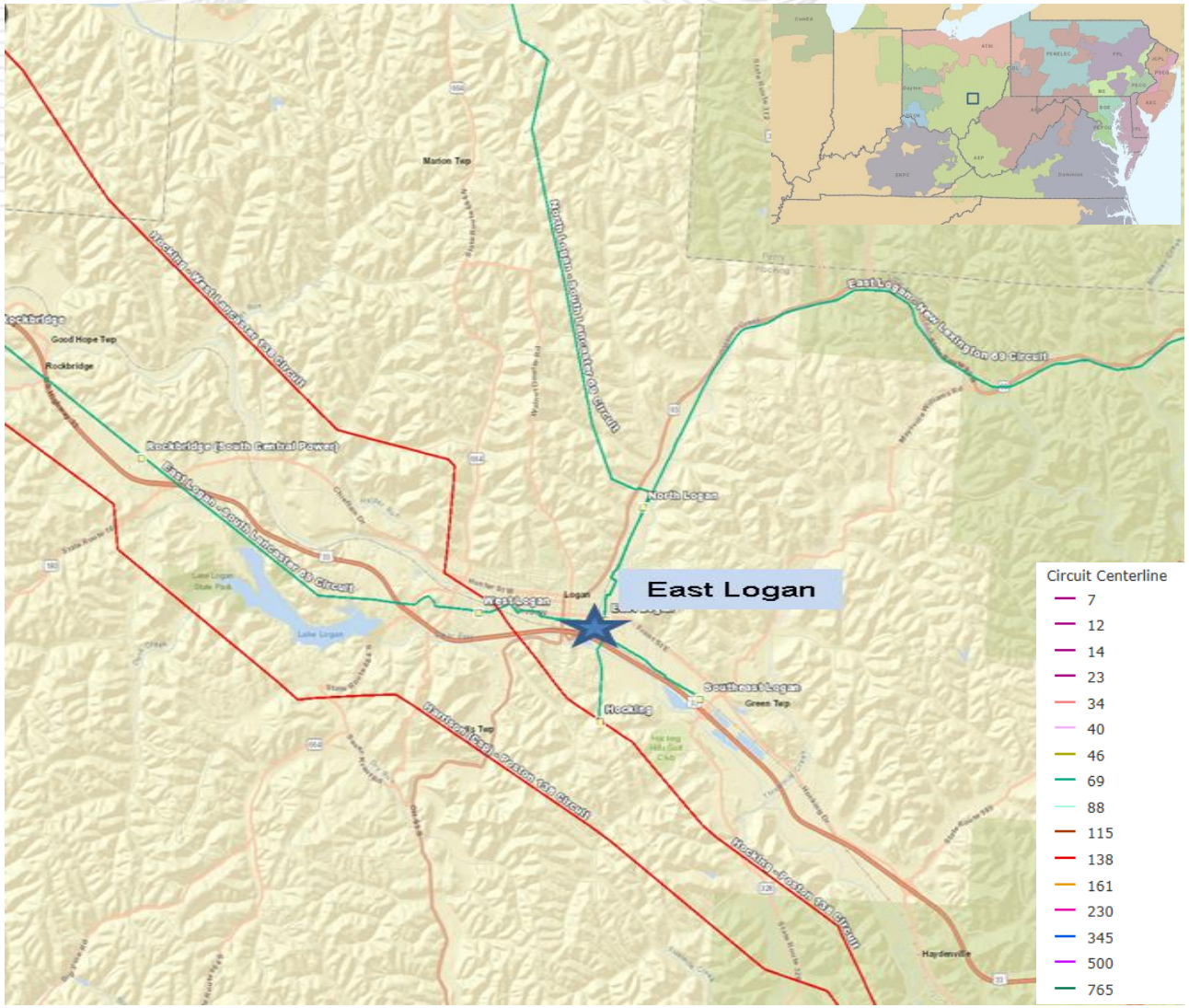
Selected Solution:

At East Logan station, replace 69 kV circuit breakers “M” and “N”. Replace the 69 kV capacitor bank. Install 15 69 kV CCVT’s. Replace 33 electromechanical relays. Install cable and trenching to connect CCVTs to the DICM. Install station backup service. (**S1597**)

Estimated Transmission Cost: $4.0M

Projected In-service: 5/1/2019

Project Status: Engineering



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Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Hancock station 138 kV circuit breakers 'A', 'B' & 'C', 69 kV circuit breakers 'CA', 'M' and 'N', 34 kV circuit breakers 'J', 'I', 'P', 'R' & 'S' are oil type breakers without oil containment. In general, oil breakers have become increasingly difficult to maintain due to the oil handling requirements. Oil spills are frequent with failures and routine maintenance which is also an environmental hazard. Other drivers include damage to bushings. CBs 'A', 'B', 'C', 'CA', 'N', 'J', 'I' & 'P' are also legacy oil-filled FK type breakers which have little to no replacement parts. 69KV circuit breaker 'Q' is a EPB Gas Circuit Breaker with gas leaks, bushing failures and CT gasket problems.

Hancock 138/69/34.5 kV Transformer #2, 1951 vintage, is currently in a poor physical and operational condition. All three single phase transformers are showing short circuit strength breakdown caused through fault events, gassing of the unit, and a significant number of overheating events. There is an upward trending of oil moisture content resulting in downward trending to the oil dielectric strength. Increasing moisture content is a resultant of water ingress through aged gaskets, tank or pump leaks, or a breakdown of paper insulation of the transformer windings. In the Phase 1 tank, the most current reading for ethylene is at IEEE Condition 3 and has been steadily rising over the bank's lifetime. In the Phase 2 and 3 tanks, the most current reading for carbon dioxide is at IEEE Condition 3 and 2, respectively, and has recently been on the rise.

Circuit Switcher BB is an Mark V which is no longer supported by the manufacturer and parts are not available. We have to scavenge for parts during maintenance. These are older designed circuit switchers with old controls that no longer coordinate well with modern relaying.

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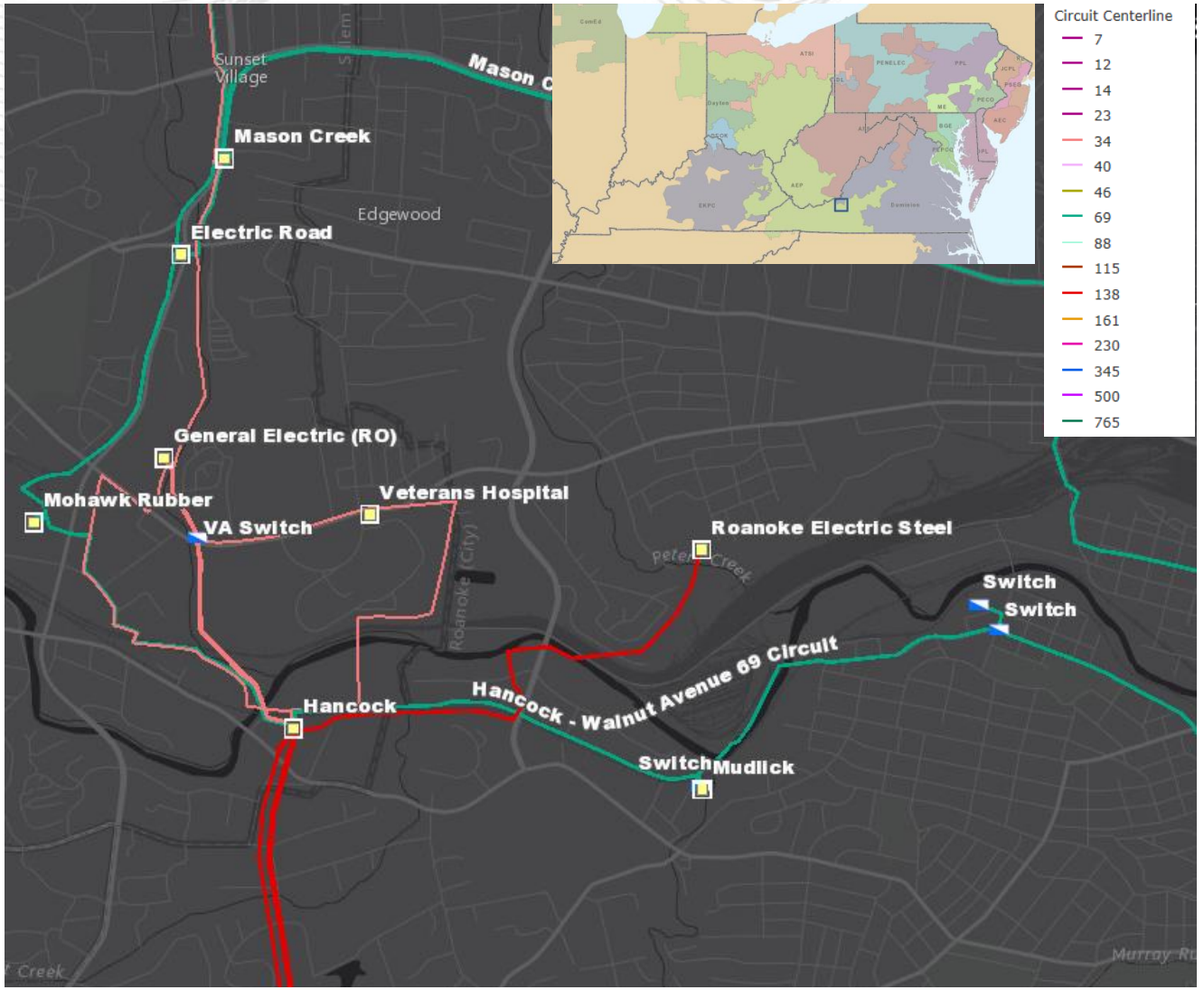

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AEP Transmission Zone: Supplemental Hancock

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69 kV Mason Creek and Walnut Ave. lines have pilot wire line relaying. Copper pilot wire is a relatively obsolete technology, and since the telephone companies almost never use it anymore, it is increasingly difficult to find suitable pilot wire cable and hardware. Consequently, we are avoiding like-kind replacement of pilot wire because the technology will be increasingly difficult to maintain.

Operational Flexibility and Efficiency

The breaker and half configuration will break the three dissimilar zones of protection (138 kV bus #2, transformer #1 and transformer #2), increase reliability, and allow for shorter maintenance outages. With the current configuration we are susceptible to a station outage with a breaker failure of 138 kV bus tie breaker "F".

Customer Service:

Hancock is a critical station for customers in the area. It feeds Roanoke Electric Steel, VA Hospital, General Electric and City of Salem.

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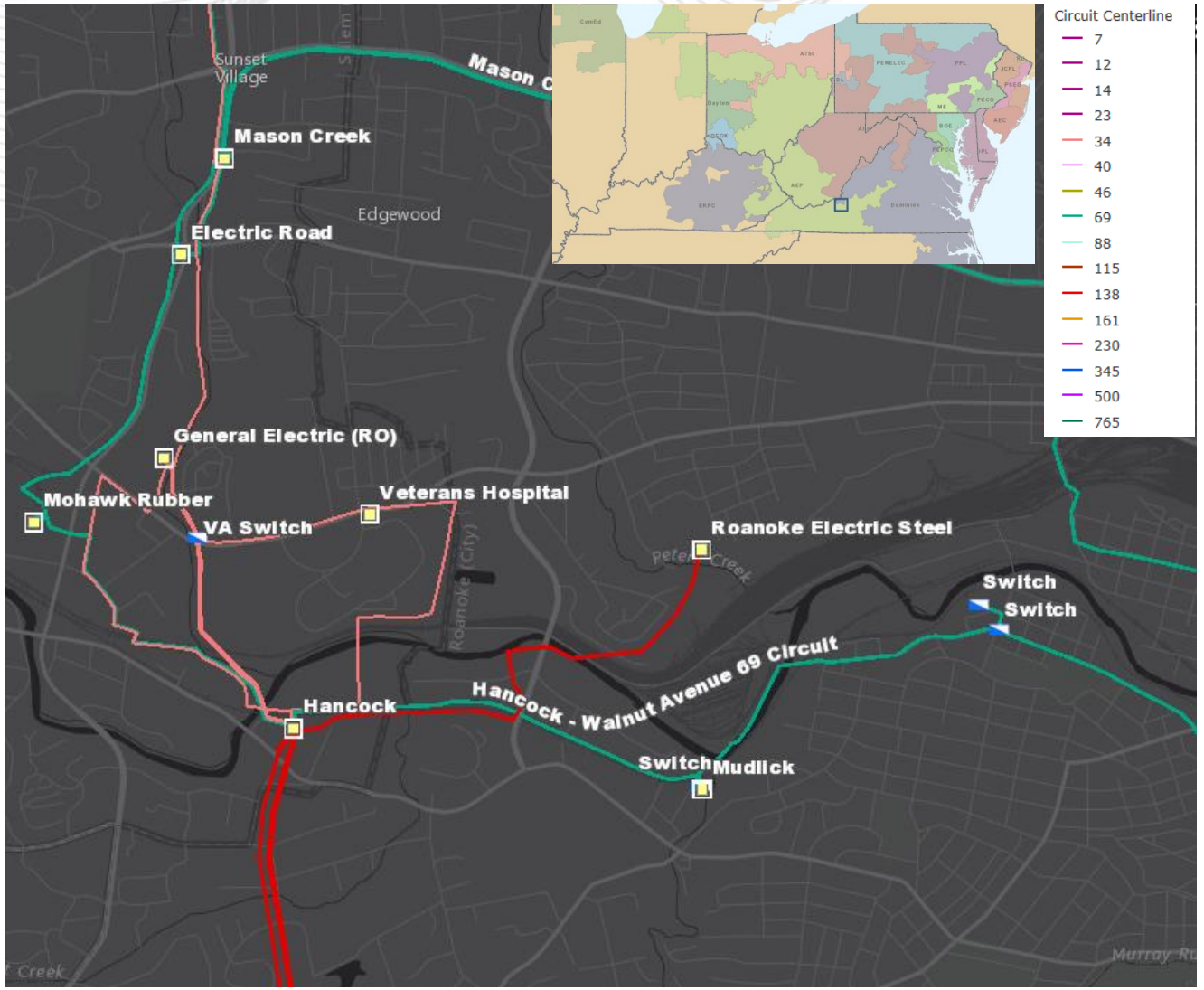

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AEP Transmission Zone: Supplemental
Hancock

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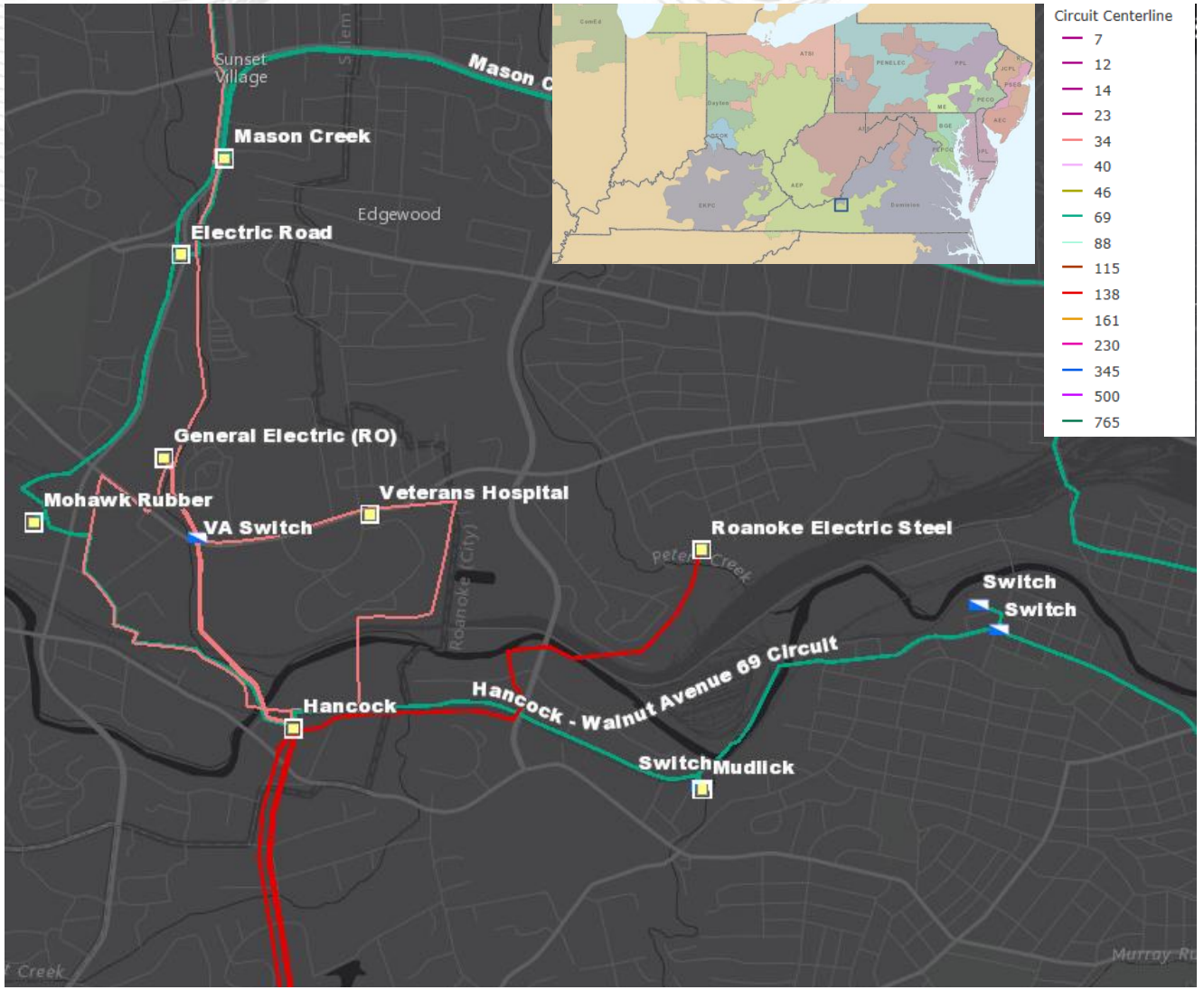
Selected Solution:

At Hancock station, build a new 138 kV breaker and half configuration with 3 strings. Install 9 new 3000 A/40 kA circuit breakers. Replace the existing 69 kV/27 kA/1800 A CB “N” and “CA”, 1200 A/21 kA CB “M” and 2000 A/31.5 kA CB “Q” with 3000 A/40 kA circuit breakers. Replace the existing 34.5 kV/560 A/12 kA CB “R” and “S”, 1200 A/16.8 kA CB “I” with 1200 A/25 kA circuit breakers. Install new DICM. Replace 138/34 45 MVA Transformer #2 with new 138/69/34.5kV 130MVA. Add new 138/34.5 kV 30 MVA Transformer #3 with high side Circuit Switcher (3000 A, 40 kA). Replace the existing 138 kV 1200 A/61 kA Circuit Switcher “BB” with new 650A, 31.5 kA CS. Replace 138kV Bus #1, 34.5kV Bus #1 and 34.5kVBus #2 CCVT’s. Replace 34.5 kV Circuit Breakers “P” and “J” with new 34.5 kV, 3000 A, 40 kA CB’s. Replace 34.5 kV Capacitor Bank Circuit Switcher “AA” with new 40 kA CS. Install Bus Regulators on 34.5kV Bus #3. Replace remote end line relaying. (**S1598**)

Estimated Transmission Cost: $30.0M

Projected In-service: 12/18/2021

Project Status: Scoping



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Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The 36 miles of transmission line sections from Hillsboro to Hutchings Tap were constructed in 1943 using wood pole structures with 477 ACSR conductor (185 MVA rating). There are 1,098 open conditions on this line, including rotten cross-arms, burnt/broken insulators, and loose/broken conductor hardware.

Operational Flexibility and Efficiency

In the event there is a failure of the line between Hillsboro and Hutchings, the driving time can be approximately 1-2 hours from the Chillicothe Service Center to Middleboro Switch. A MOAB will allow for automatic sectionalizing.

Selected Solution

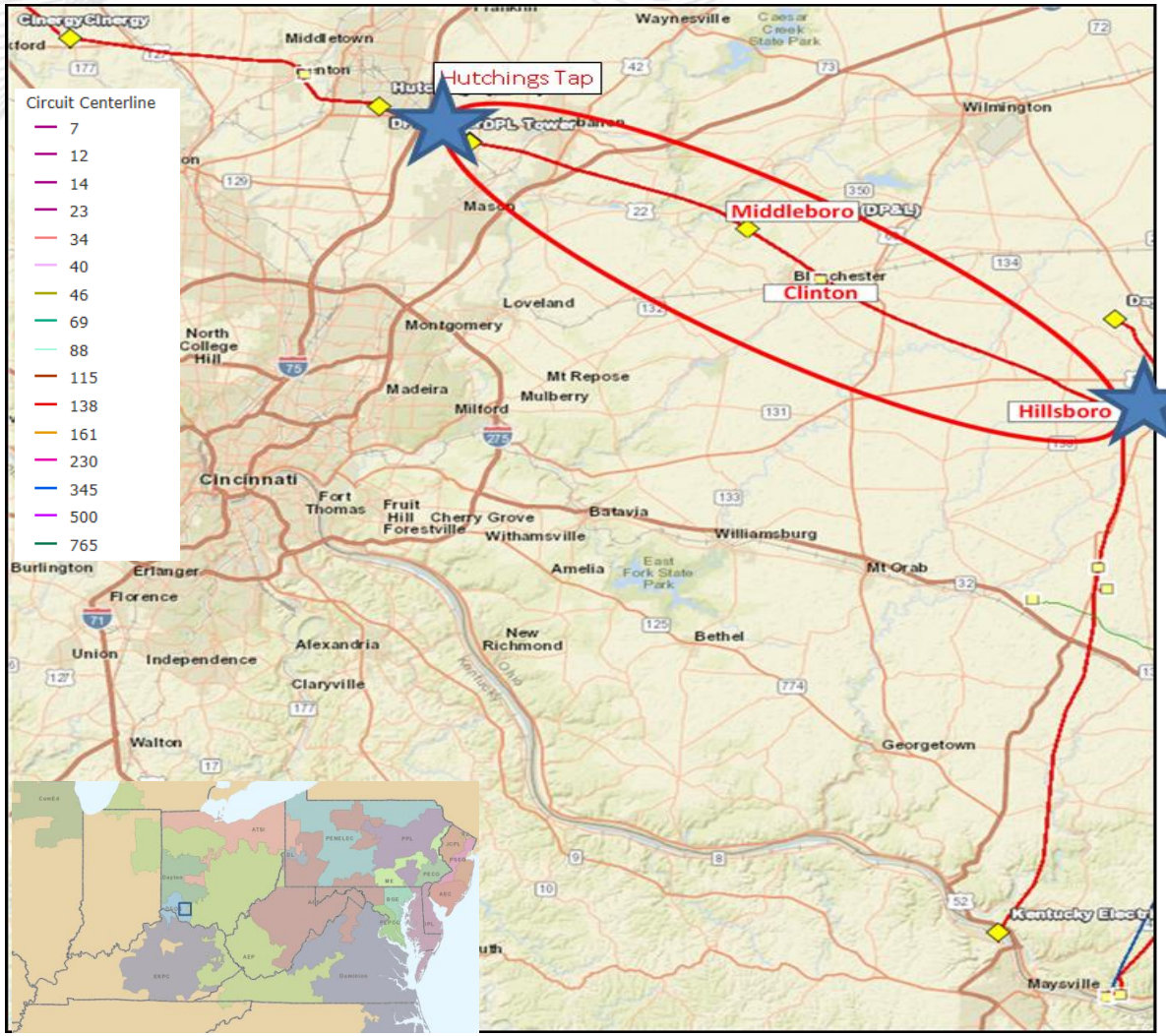
Rebuild two 138kV transmission lines between Hillsboro and Hutchings Tap as double circuit construction. Construct the 19-mile AEP segment from Middleboro to Hutchings Tap as a single circuit line using 954 ACSR conductor. (**S1599.1**) **Estimated Cost: $113.1M**

The 1200 A switch at Middleboro will be upgraded to 2000 A. The new switch will have SCADA control, auto sectionalizing and loop opening/line dropping capability. (**S1599.2**) **Estimated Cost: $1.5M**

Total Estimated Transmission Cost: $114.6M

Projected In-service: 12/01/2021

Project Status: Scoping



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Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Customer Service:

ICG Beckley request to serve projected 1.5 MW of load on the Bradley – Tams Mtn. 46 kV line. Obligation to serve customer.

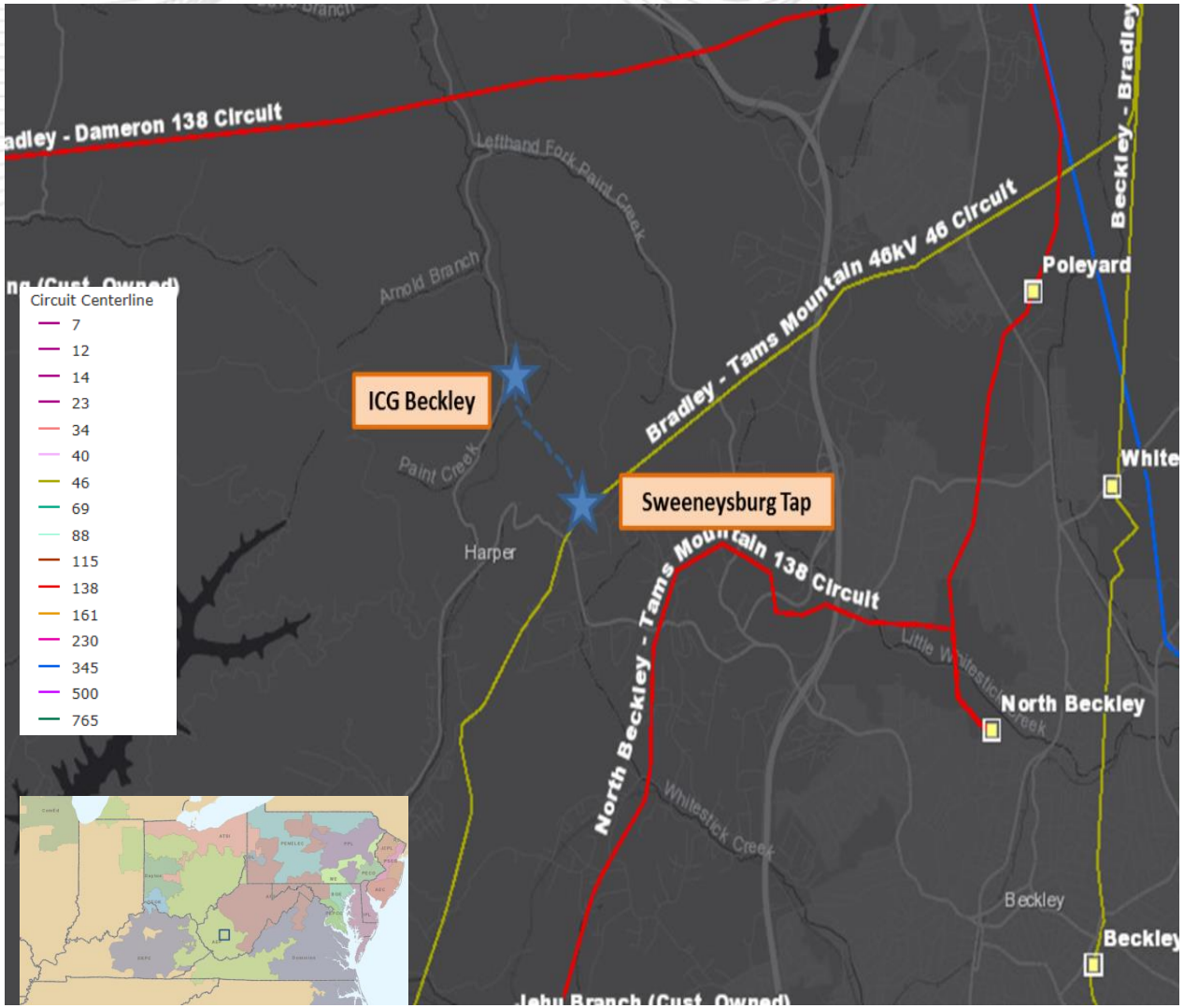
Selected Solution:

Tap the Bradley-Tams Mountain 46 kV line and install a 69 kV, 1200A 3-way switch. Install low side metering. (**S1600**)

Estimated Transmission Cost: $0.5M

Projected In-service: 06/01/2019

Project Status: Scoping



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AEP Transmission Zone: Supplemental
Johnsons Lane

Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The existing 34.5 kV circuit breakers “E”, “F”, and “W” at Johnsons Lane are all FK oil type breakers. Breaker “E” was manufactured in 1955 with breakers “F” and “W” manufactured in 1971. These are oil breakers that have become more difficult to maintain due to the required oil handling. There is an increased potential for oil spills during routine maintenance and failures with these types of breakers. Other drivers include damage to bushings.

Operational Flexibility and Efficiency

Appalachian Power Distribution is currently working on a project to convert the 4 kV distribution out of Johnsons Lane to 34.5 kV. Once complete, the existing 34.5/4 kV transformer at the station will no longer be required and will be retired. After the 34.5/4 kV transformer is retired the 34.5 kV bus tie circuit breaker will be retired and a new 34.5 circuit breaker will be installed on the high side of transformer #1 to separate dissimilar zones of protection.

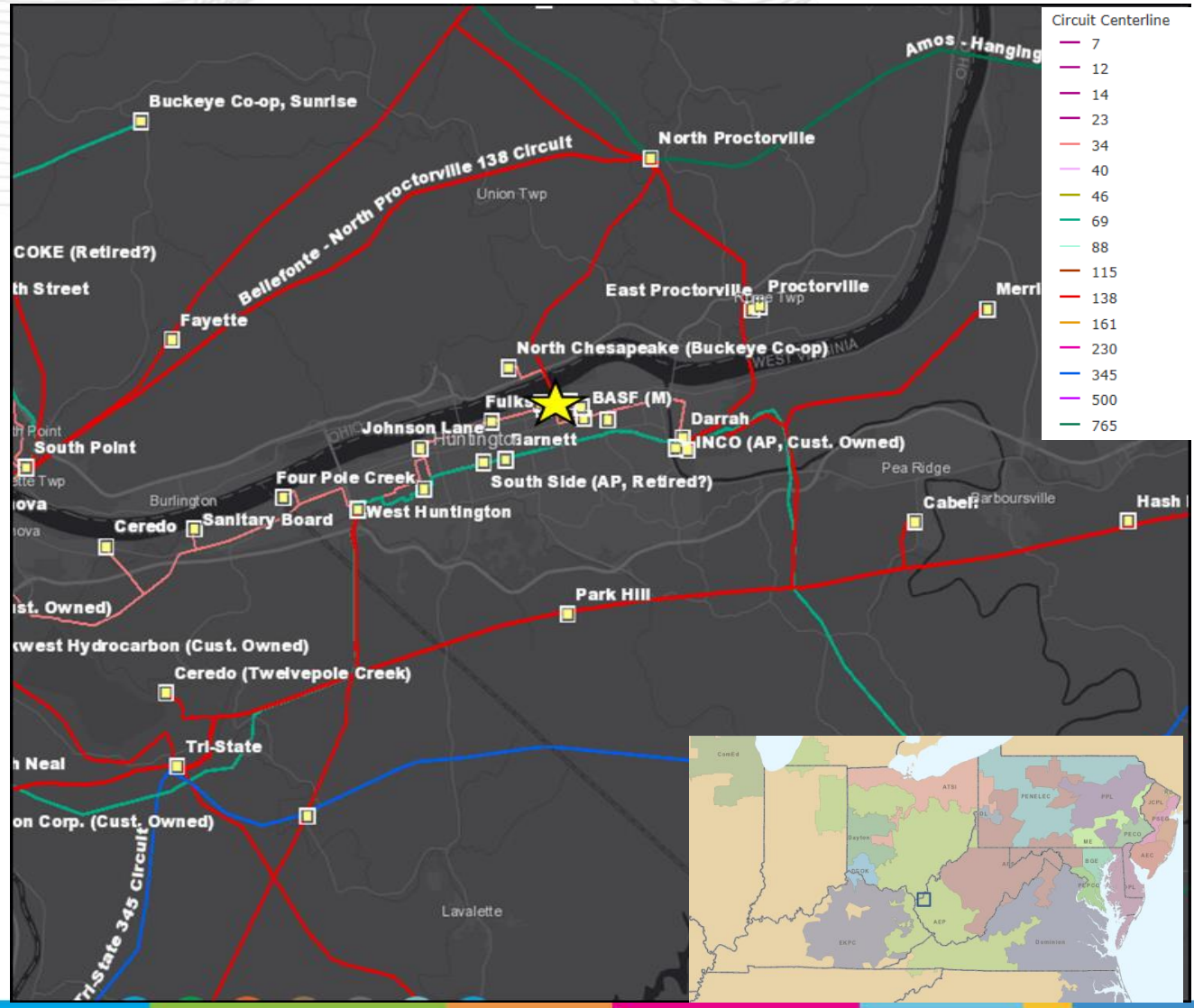
Selected Solution:

Retire the existing 1200 A 17 kA 34.5 kV bus tie circuit breaker “E” at Johnsons Lane. Install a new 3000 A 40 kA 34.5 kV circuit breaker on the high side of transformer #1. Replace the existing 1800 A 27 kA 34.5 kV circuit breakers “F” and “W” at Johnsons Lane with new 3000 A 40 kA 34.5 kV circuit breakers. (**S1601**)

Estimated Transmission Cost: $0M

Projected In-service: 12/1/2020

Project Status: Scoping



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Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Customer Service

Distribution customers served by the South Berne – Geneva circuit experience frequent outages. Contributing to the number of interruptions is significant amount of distribution line exposure between the load center and South Berne Station. One large customer, Red Gold, has experienced 447 minutes of interruption in the last 3 years. Due to the current distribution circuit configuration, there are limited recovery options for this circuit. A station outage at South Berne Station results in 7 MVA of unrecoverable load until repairs are made or a mobile substation can be set. Also due to current circuit configuration, load transfers for routine maintenance are limited. Customers served off Berne-Portland 69 kV circuit experience frequent outages due to lack of sectionalizing along the line. In addition to this, the Berne – Portland line currently has 1,000,000+ CMI. In order to reduce the complexity of the protection scheme and to reduce fault exposure, AEP recommends installing a new "Limberlost" station off the Berne-Portland 69 kV circuit. Installing two MOABs at Limberlost would put four MOABs in series on this line. AEP's current practices and standards do not recommend more than three MOABs in series, so adding circuit breaker facing Portland station and a MOAB facing Berne station is recommended in order to resolve reliability issues and decrease the number of MOABs in series. This project is resulting from a request from I&M distribution.

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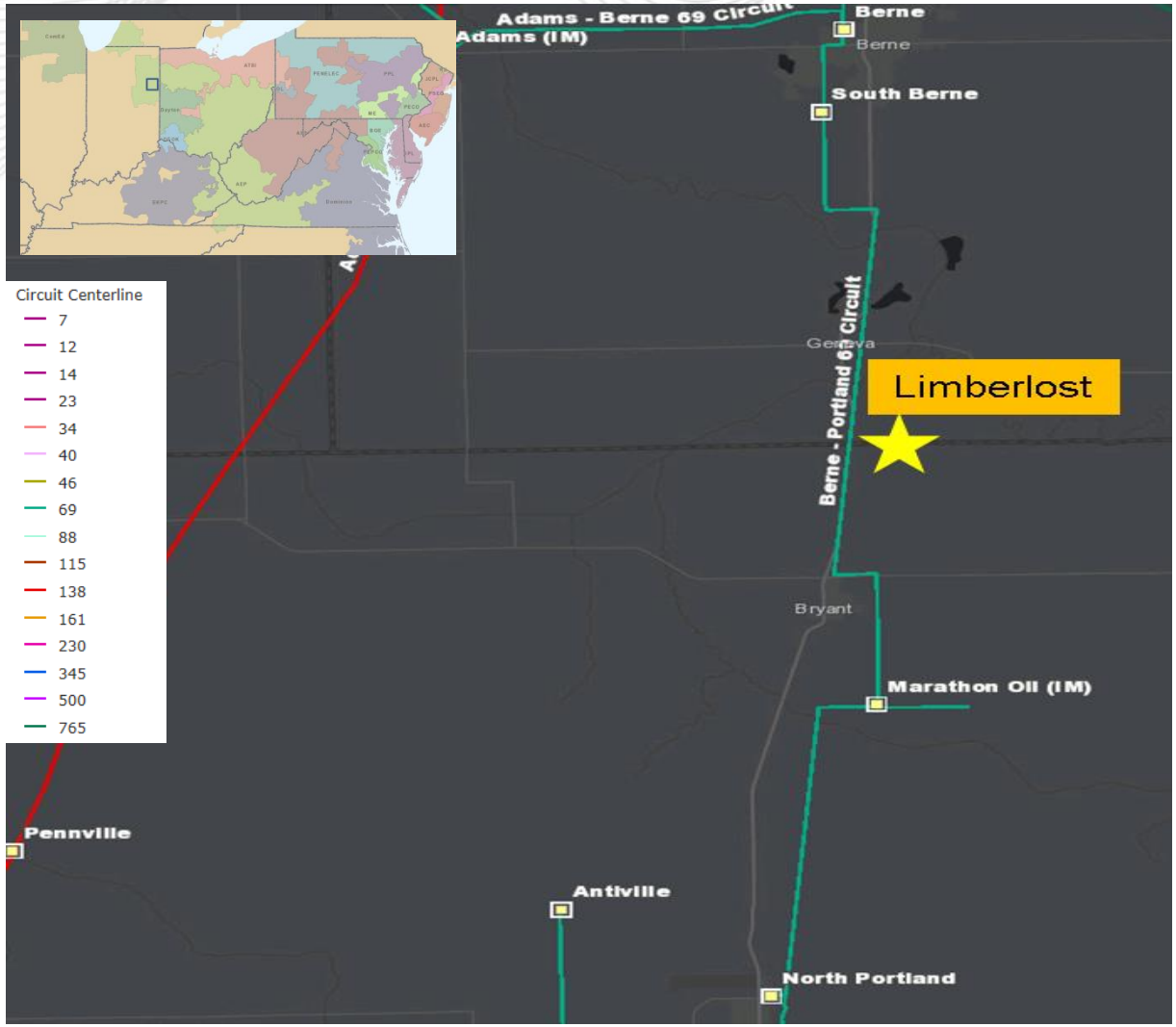

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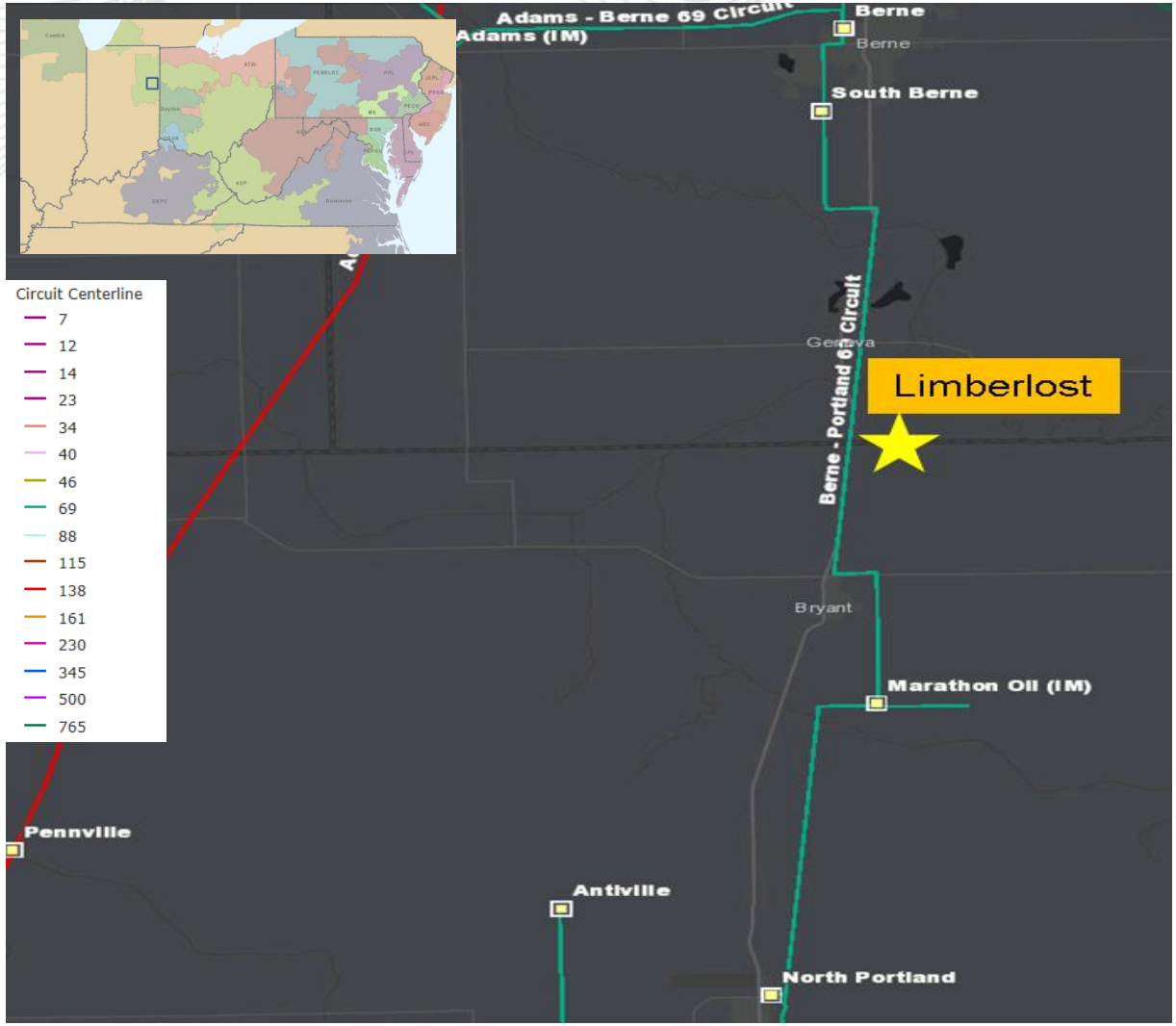
Selected Solution

Cut the Berne-Portland 69 kV line into a new substation called Limberlost. Establish new Limberlost station by installing a 69 kV breaker and MOAB along with a 69/12 kV transformer and two 12 kV feeders. (**S1602**)

Estimated Cost: $4.0M

Projected In-service: 12/1/2018

Project Status: Scoping



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Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The transformer at Madison is a vintage from 1964. The CO/CO2 ratio is above the warning threshold and the interfacial tension is trending downward. This data shows that the units insulation is degrading and should be addressed. Additionally, the unit has experienced serious leaking issues since 2015. Due to the mentioned notices, AEP recommends the replacement of transformer 1. The 1964 vintage 34.5kV circuit breaker's B, C, E, and H at Madison Substation are oil filled FK-breakers without oil containment. Additionally, all of the breakers, are in deteriorating condition and breakers B and C have fault operations beyond the manufacturers recommended limit. AEP recommends the replacement of all circuit breakers mentioned due to the stated conditions. Breakers B and C have 17 and 11 fault operations respectively. Currently the foundations of the 34.5kV yard are severely deteriorated and need to be addressed.

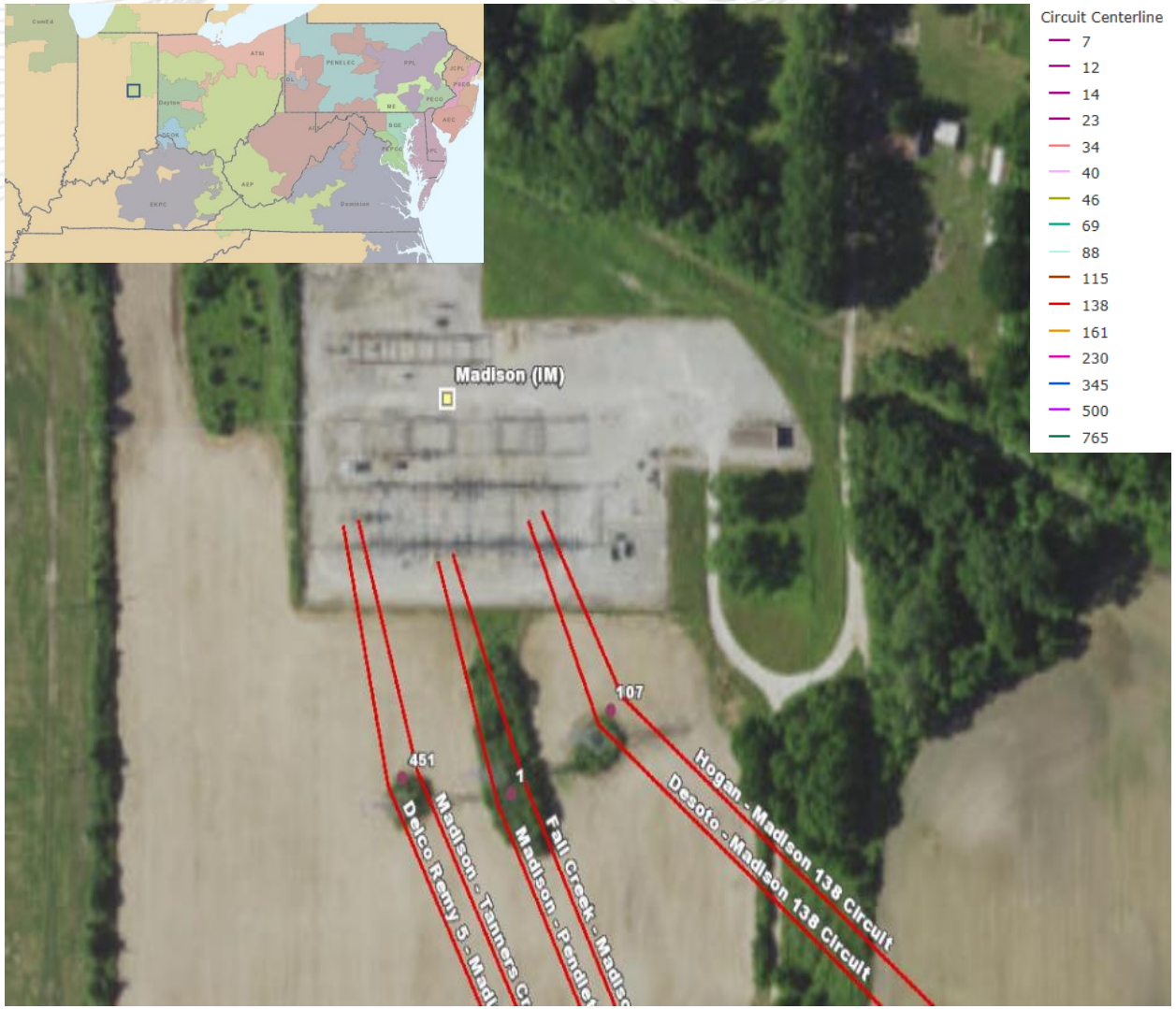
Selected Solution:

At Madison substation, replace Breaker 'B', 'H' and 'C' with new 34.5kV 25kA 1200A models. Remove Breaker 'E'. Replace the 138/34.5kV transformer with a new 138/34.5kV 75MVA model with a high side switcher. Remove bus 1 and reroute all lines to the rebuilt bus 2. (**S1603**)

Estimated Cost: $5.7M

Projected In-service: 12/30/2019

Project Status: Scoping



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Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

This project is an extension of the adjacent Malvern-Oneida 69kV rebuild, which resolves thermal overloads (PJM Baseline #B2796). This Supplemental project will rebuild the remaining 3.5 miles of the circuit to Pekin, as well as replace the aging Pekin circuit breaker. After the associated Baseline line rebuild (B2796), this 3.5 mile section is loaded to 94% SE for the worst N-1-1 contingency pair (51 MVA loading/54 MVA rating, leaving only 3 MVA of margin for future area load growth). This area has had large block load additions from industrial customers, 3 MVA is not enough margin for long-term planning.

The T-Line was built in the early 1960's on wood poles that are in poor condition; it utilizes 4/0 copper conductor (54 MVA rating) and 11/32" copperweld shield wire, both of which are no longer stocked in storerooms, making it difficult to perform field repairs & public relocations, potentially leading to higher O&M costs and outage restoration times. Note that the actual copper conductor dates to 1922 and has become brittle (assuming it was re-used through the decades). The T-Line section has the following open condition count: A2- 10 (broken braces, ground-leads, insulators; burned insulators); A3- 1 (broken ground-lead); B- 1 (leaning pole); Forestry concerns- 7; for a total count of 19 concerns. A stretch of 21 structures are built in the style of having 3 crossarms with conductor & insulators only on one side, where the unequal weighting and style of the knee braces has lead to numerous maintenance calls in recent years.

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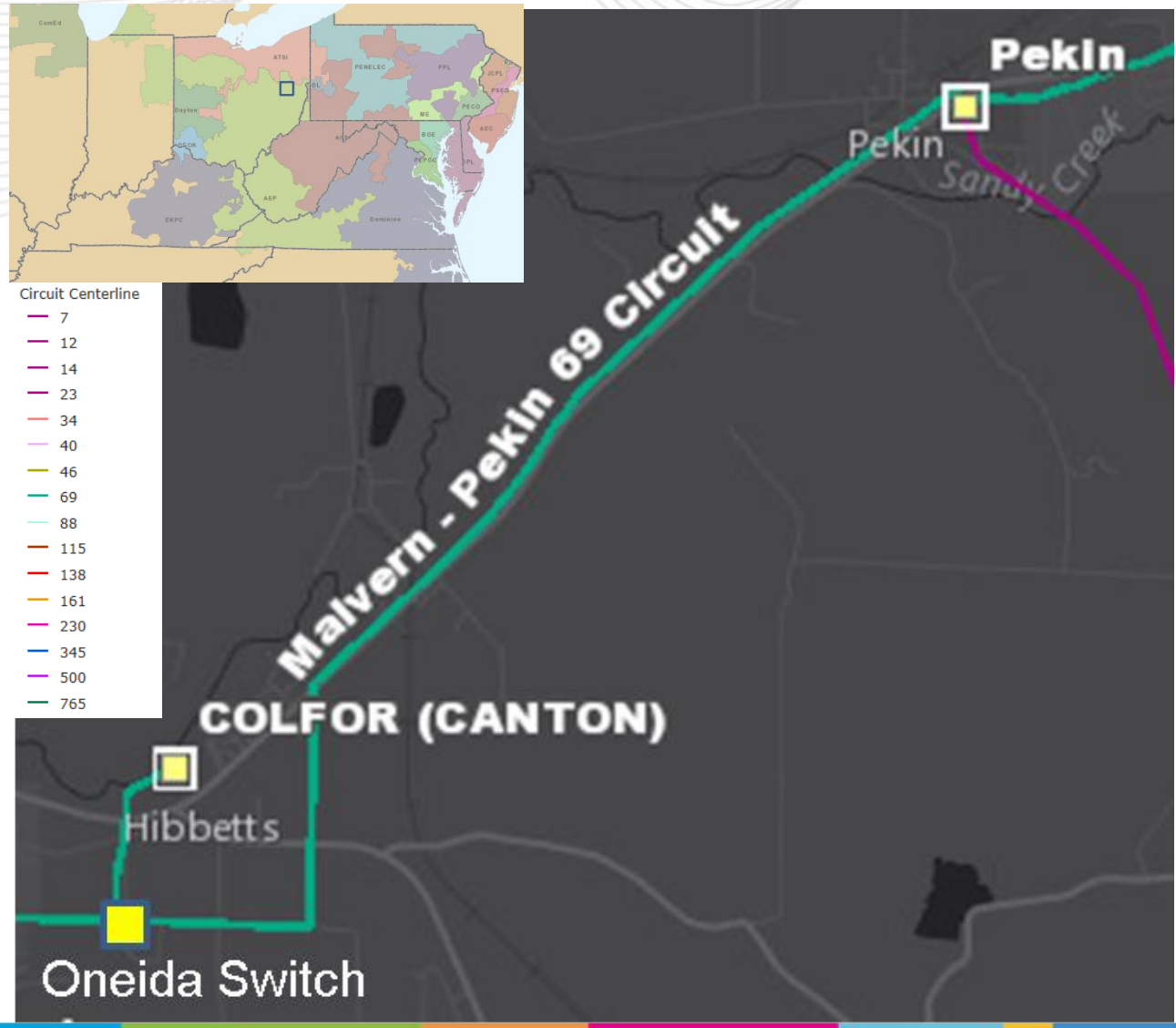

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In the 2013-2017 timeframe, the Malvern-Pekin 69KV circuit has experienced 9 momentary outages and 7 sustained outages, with an average outage duration of 7.1 hours. The circuit currently serves 3- Buckeye Power co-op stations and one large industrial company. The outages have been due to vegetation fall-in, storms, animal contact, and broken cross-arms.

Circuit breaker 'A', at Pekin, is an 'FK' oil breaker that is 52 years old; it is recommended for replacement due to age, lack of spare parts, and number of fault operations: 111 fault operations in its lifetime, versus a manufacturer recommendation of 10.

The associated controls and relays will need upgraded to coordinate with AEP's fiber-based protection scheme.

Selected Solution

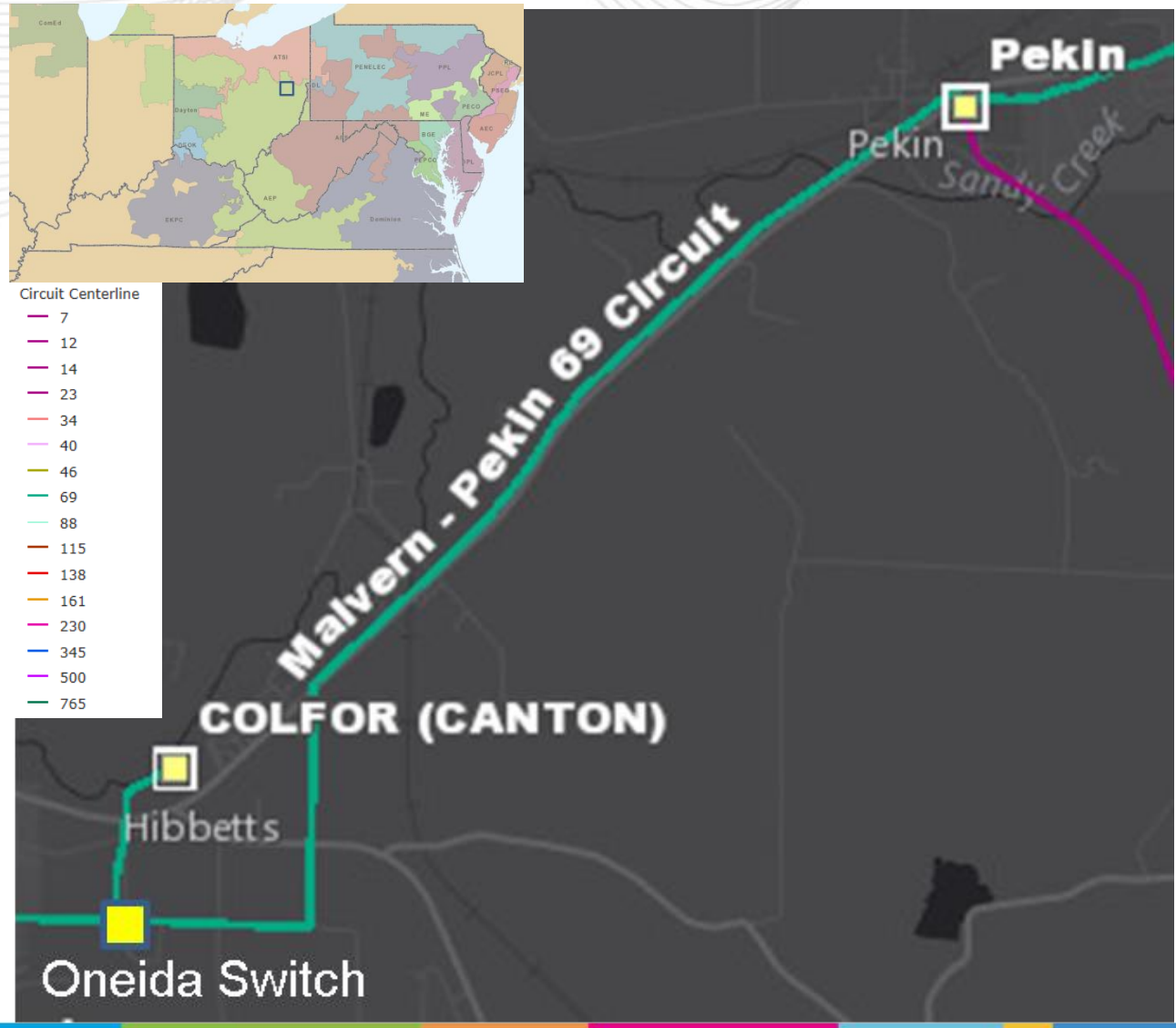
Rebuild 69kV transmission line from Oneida Switch to Pekin (3.5 miles) with 795 ACSR (125 MVA rating). Update & modify right-of-way to accommodate the rebuild. Remove the old T-Line. (**S1604.1**) **Estimated Cost: $5.4M**

At Pekin station, replace 69kV oil breaker 'A' with an SF6 gas breaker (40kA unit). Upgrade relays for circuit protection to June Road. Replace 69kV disconnect switch (line side of breaker A). Upgrade breaker risers to exceed ampacity of new T-Line. (**S1604.2**) **Estimated Cost: $0.5M**

Total Estimated Transmission Cost: $5.9M

Projected In-service: 12/1/2019

Project Status: Engineering



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AEP Transmission Zone: Supplemental
Provident Switch

Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Customer Service:

This project will directly improve system reliability for AMP wholesale customer (St. Clairsville), by eliminating hard tap configuration. Also improves area reliability for AEP Ohio distribution customers (served via the following stations on the 3-terminal line: Highland Terrace, St. Clairsville, Pleasant Grove, Bannock Road, Flushing) and South Central Co-op customers (at Shepherdstown), all of which could otherwise be affected by the Glencoe-Bannock-Robyville 69kV 3-terminal line misoperations.

Operational Flexibility and Efficiency:

The new station eliminates a 28-mile 3-terminal line which is inherently unreliable (Glencoe-Bannock-Robyville 69kV). It aligns the area's 69kV circuit protection (Glencoe-Robyville + Flushing-Smyrna 69kV), which will all be fiber-based, as a result of other projects in the works. Also, today there are 4- MOAB auto-sectionalizing switches in series on this circuit, which is no longer permitted protection-wise, due to the likelihood of miscoordination. Installing breakers will split the circuit, to have 2 MOAB's on each branch.

In addition, 400 feet from the existing Provident Switch pole, St. Clairsville Municipal's Hess station is connected via a 'hard tap' (lacks proper line sectionalizing switches). This causes St Clairsville to take an outage whenever T-Line maintenance work must be done nearby, and also has a negative impact on transmission system sectionalizing and outage restoration.

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AEP Transmission Zone: Supplemental
Provident Switch

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In the past 5 years, the Glencoe-Robyville 69kV 2-terminal circuit has experienced 20 momentary outages and 7 sustained outage events (with an average duration for customers of 19.1 hours). A significant number of the outages have been due to protection misoperation and station equipment issues, which will only worsen once the circuit becomes a 3-terminal circuit in 2021 (by connecting the radial circuits via the Flushing-Smyrna project). Installing this new ring bus station will greatly improve operational flexibility and reduce the frequency and duration of transmission outage events.

The protective relays and controls at Bannock station cannot be adequately upgraded to match the remote-ends at Provident and Flushing (which will utilize fiber-based microprocessor relays). There is no control house, and the site is not suitable for a new control house. 69kV MOAB switches are reasonable in this case to provide adequate reliability for the distribution station. Today the basic overcurrent protection is adequate on the radial line to Flushing, but once Flushing is networked to Smyrna, the protection is not adequate (not capable of 2-way protection).

Selected Solution:

Re-route Glencoe-Robyville-Flushing 69kV circuit to connect to new Provident Switch station. (**S1605.1**) **Estimated Cost: $0.5M**

Construct a new 4-breaker 69kV ring bus station called Provident; provide service to St Clairsville Muni's Hess station. Update relay settings at remote-ends. Retire 69kV breaker at Bannock station. Install 2- 69kV MOAB switches with auto-sectionalizing. Install new revenue metering at Hess station. Coordinate protection with Provident Station. (**S1605.2**) **Estimated Cost: $3.1M**

Total Estimated Transmission Cost: $3.6M

Projected In-service: 12/1/2021

Project Status: Scoping

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Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Customer Service:

AEP-Ohio's transformer loads at Briggsdale are at 93% capacity with no physical space for expansion. A relatively large load increase is anticipated in the area in the near term. Area distribution circuits are loaded so that adequate relief with adequate backup redundancy is not available. As a result, AEP-Ohio has requested a new 138kV delivery point, named Reaver, that is expandable to serve up to 4-50 MVA transformers worth of distribution load.

Operational Flexibility and Efficiency:

The only two delivery points currently served from the Wilson-McComb 40kV system are Briggsdale and Phillipi. Briggsdale is the AEP-Ohio distribution station and Phillipi is a customer owned station that has been designed for easy conversion to 138kV in the future. Working with AEP-Ohio and the customer at Phillipi, an area plan has been developed to convert these loads to 138kV and retire all of the local 40kV system. The next step in this plan is to transfer the Briggsdale load to a new 138kV sourced distribution station named Reaver. This will allow one of the two 40kV circuits to be de-energized. The elimination of Briggsdale station is necessary to properly plan for the rehab needs at Wilson station, the remaining 40kV to 138kV conversion of Phillipi station, and an increase in available distribution capacity at McComb due to freeing up the currently reserved transmission capacity on the existing transformers.

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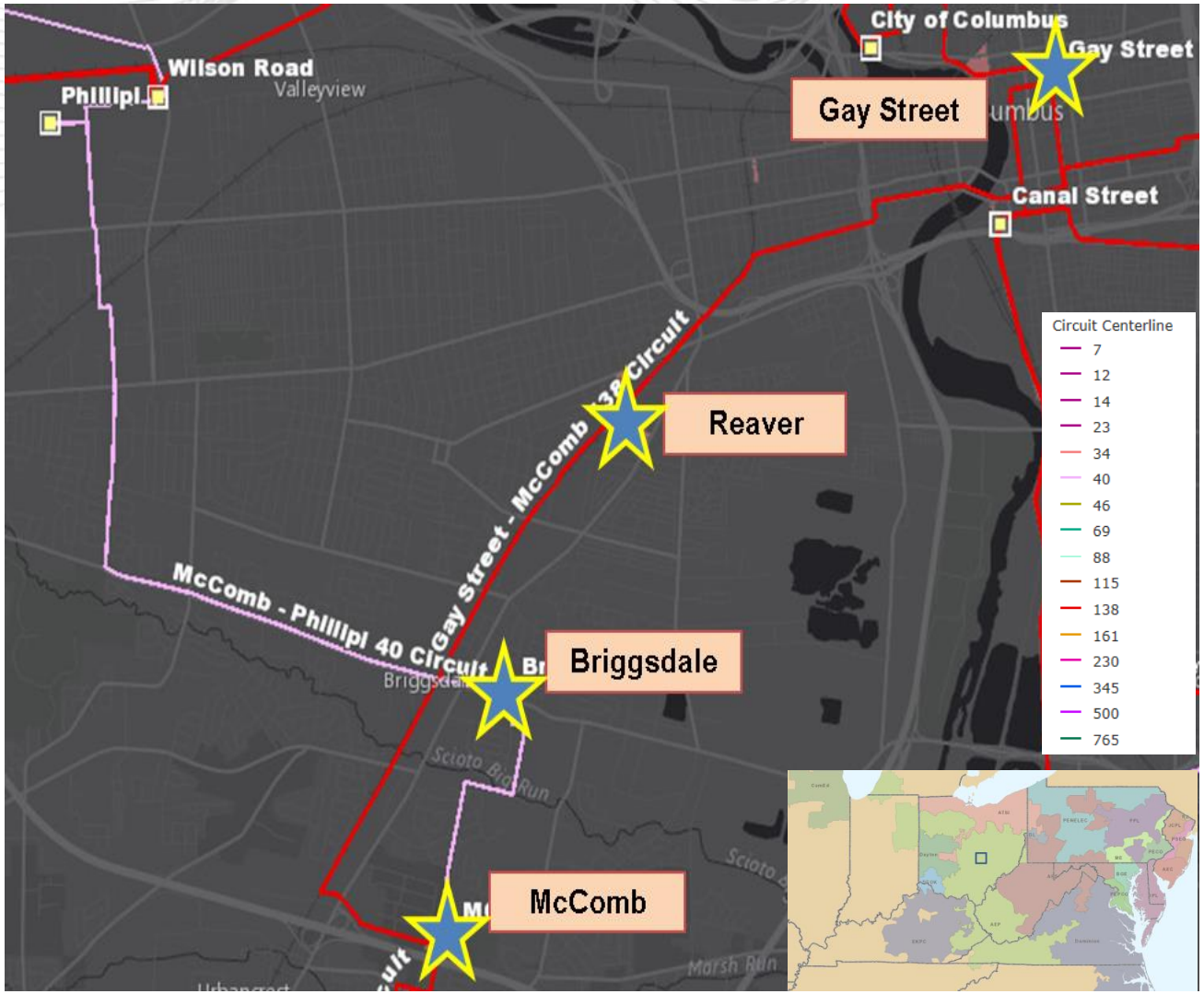

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AEP Transmission Zone: Supplemental Reaver

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Equipment Material/Condition/Performance/Risk:

The majority of equipment at Wilson station is in need of rehab driven replacement. The 40kV system between Wilson and McComb is antiquated, obsolete, and in poor condition. Significant portions of this system are in the process of being converted to 69kV with the final solution to completely eliminate the 40kV system.

138kV CB's 101E & 101C are both oil type and approx. 50 years old, and both have exceeded the recommended number fault operations.

Selected Solution

Construct a new 138/13kV station (Reaver) with 2-3,000A 40kA 138 kV CB's. (**S1606.1**) **Estimated Cost: $2.4M**

Retire and remove Briggsdale station. (**S1606.2**) **Estimated Cost: $0.2M**

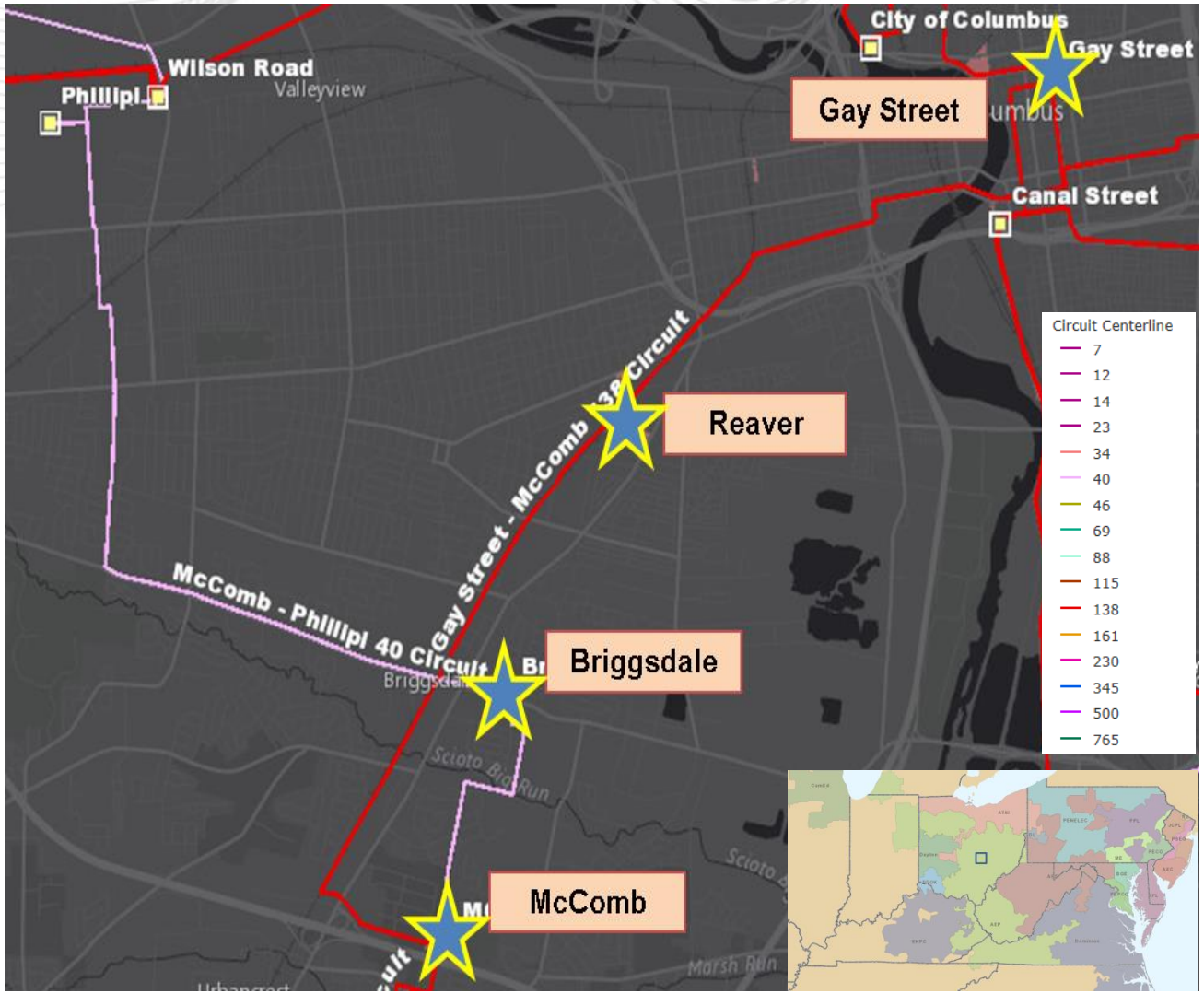
At McComb station, replace 2-138kV 1600A 40kA CB's 101C & 101E and disconnect switches with 3,000A 40kA CB's. (**S1606.3**) **Estimated Cost: $1.3M**

Cut Reaver station into existing Gay Street-McComb 138kV circuit with very short construction of 636 ACSR 26/7 Grosbeak conductor (223 MVA rating). (**S1606.4**) **Estimated Cost: $0.7M**

Total Estimated Transmission Cost: $4.6M

Projected In-service: 12/1/2019

Project Status: Engineering



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Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Reusens Station: The 138 kV CB "AB" is a PK air blast breaker, which currently require hearing protection be used for personnel within the substation. PK air blast breakers have a tendency to fail catastrophically, which, cause sharp pieces of porcelain from their bushings are typically expelled causing potential safety hazard to field personnel. In addition, the ability to get spare parts for these breakers is becoming increasingly difficult. The Manufacturers recommended number of fault operations is 10. CB "AB" has experienced 118 operations. 69 kV circuit breaker "AA", "BB" & "CC" are 1962 vintage oil type breakers without oil containment. 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. CB "AA" has experienced 60 operations, "BB" has experienced 103 operations, and "CC" has experienced 51 operations.

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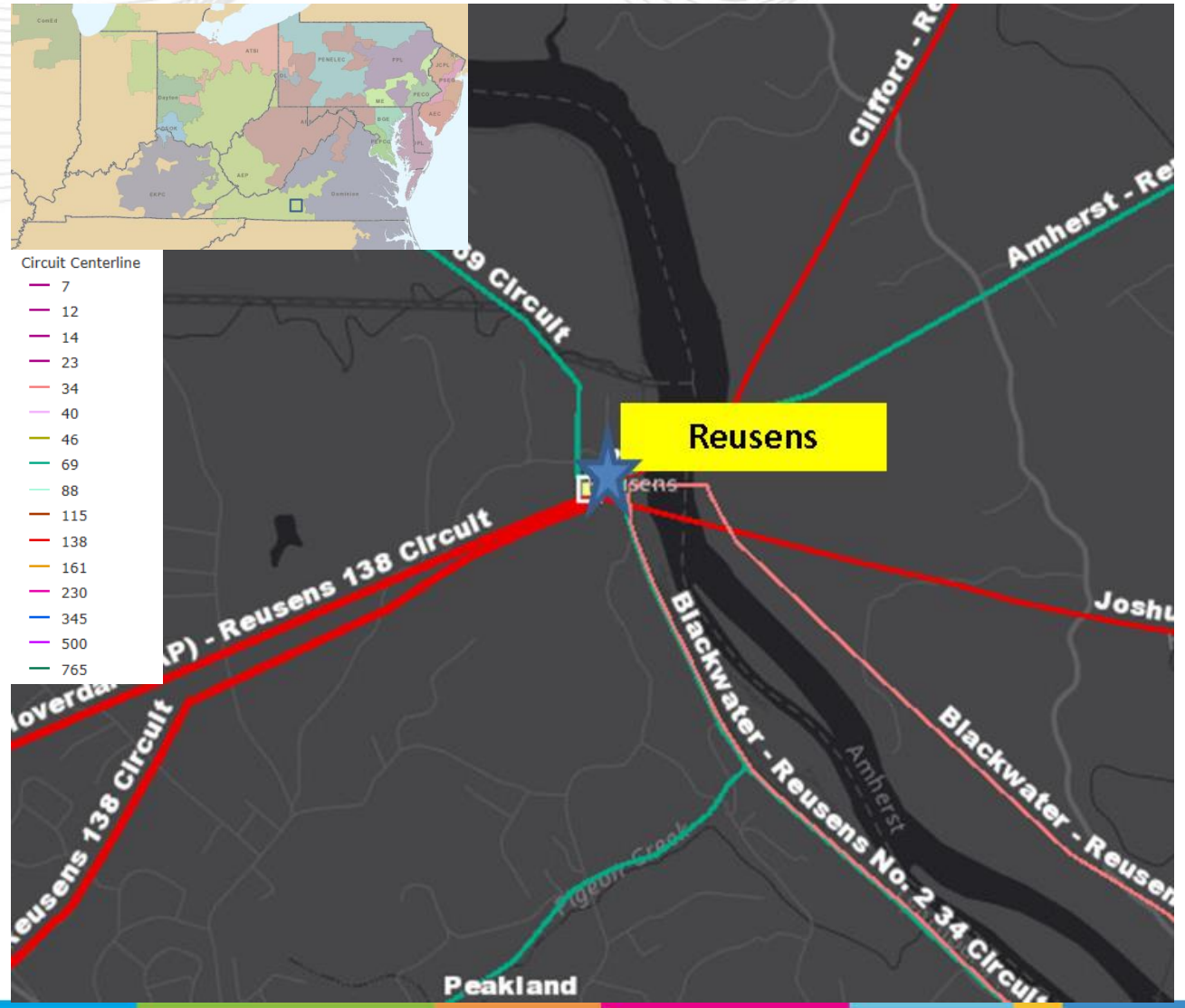

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AEP Transmission Zone: Supplemental Reusens

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138 kV 3000 A 50 kA CB "D" is a vintage 1980 GA gas mechanical two pressure air blast breaker no longer supported by the manufacturer. These breakers require extensive maintenance to keep them from leaking air. Due to their excessive leaks, we had a program some years back to maintain/rebuild all GA breakers. The rebuild required 400 man-hours per breaker to rebuild. From AEP's experience, we determined that it was more cost effective to replace these breakers which will eventually leak again. CB "D" has experienced 52 operations. The existing Transformer #1, vintage 1951, has seen major through fault events which has contributed to extremely elevated levels of combustible gases and carbonization of insulating paper. The existing Transformer # 2, vintage 1954, has also seen numerous major through fault events causing significant gassing of the unit and upward trending moisture content in the oil. The high side circuit switchers is being installed on Transformer #1, #2, and # 3 will break up dissimilar zones of protection, which causes over tripping and miss-operations. In addition, this current lack of sectionalizing makes it difficult to perform routine maintenance work. Circuit switcher "DD" is an VMB type, which, is no longer supported by the manufacturer and parts are difficult to obtain. This CS is a poor cold weather performer due to the use of fiberglass parts in the interrupter which expand and contract with the weather causing miss operations. Due to their age and design we are seeing increased contact resistance on most units. Circuit Switcher "AC " is a Mark III which the manufacturer no longer makes parts for. We have to scavenge for parts to do routine maintenance. These are older designed circuit switchers with old controls that no longer coordinate well with modern relaying.

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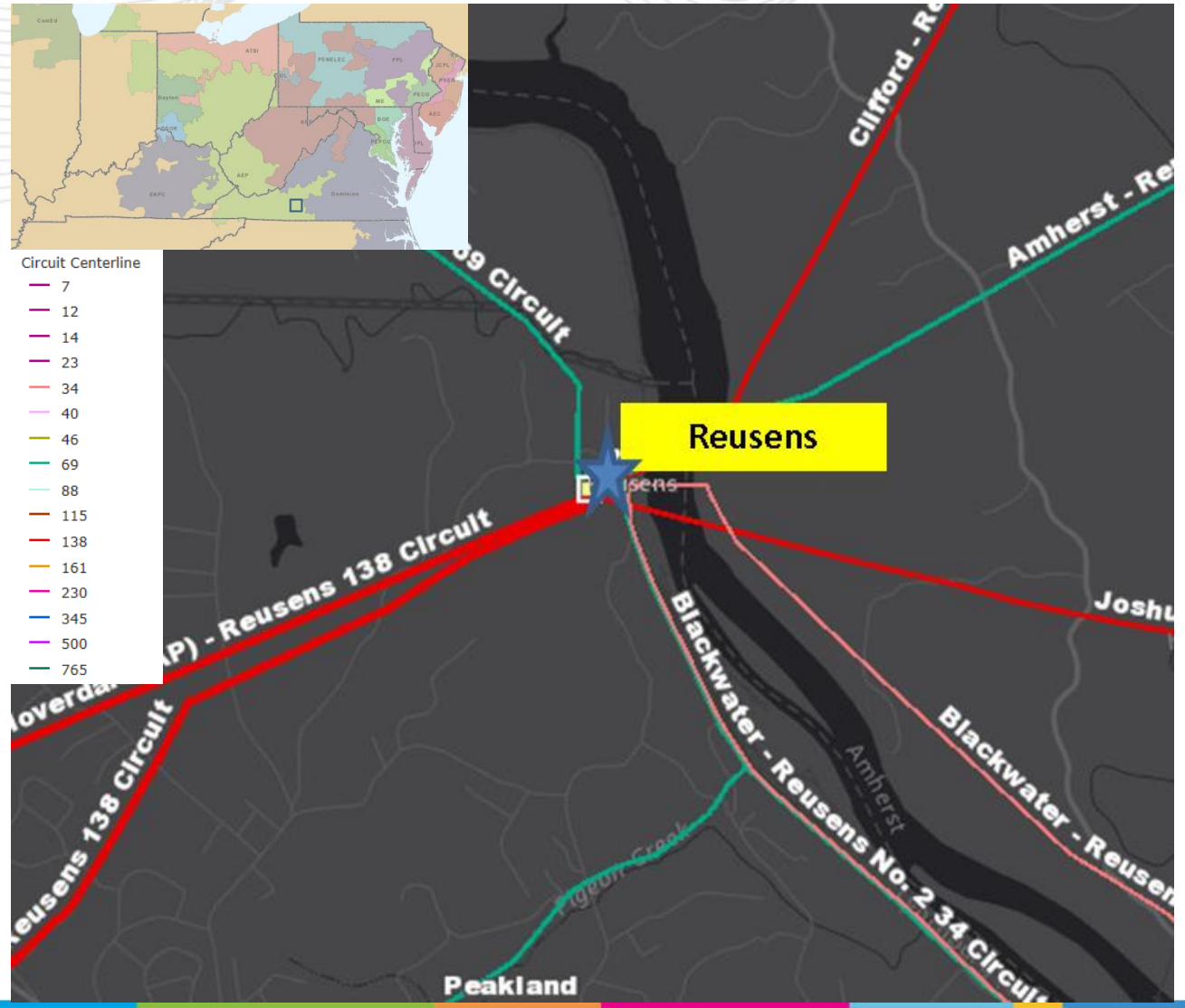

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AEP Transmission Zone: Supplemental Reusens

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Moseley Station: The addition of CB "B" & Transformer # 1's high side circuit switcher are being installed to break up dissimilar zones of protection on the 138 kV system, which causes misoperations and over tripping. The 138 kV CB "A" is 1959 vintage oil filled breaker without oil containment and has experienced 176 operations. The 69 kV CB "E", which feeds the Town of Bedford, is a 1967 vintage oil filled breaker without oil containment and has experienced 101 operations. 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.

Clifford Station: The 138 kV CB "F" and Transformer #1's high side CB "XT1" are being added to break up dissimilar zones of protection on the 138kV, which could cause misoperations and over tripping.

<u>Operational Flexibility and Efficiency:</u>

Ground switch MOAB's are being replaced to prevent intentional induce a faults on the system, tripping remote breakers for a transformer fault, reducing the life of the transformer and increasing relay coordination complexity for the transformer protection.

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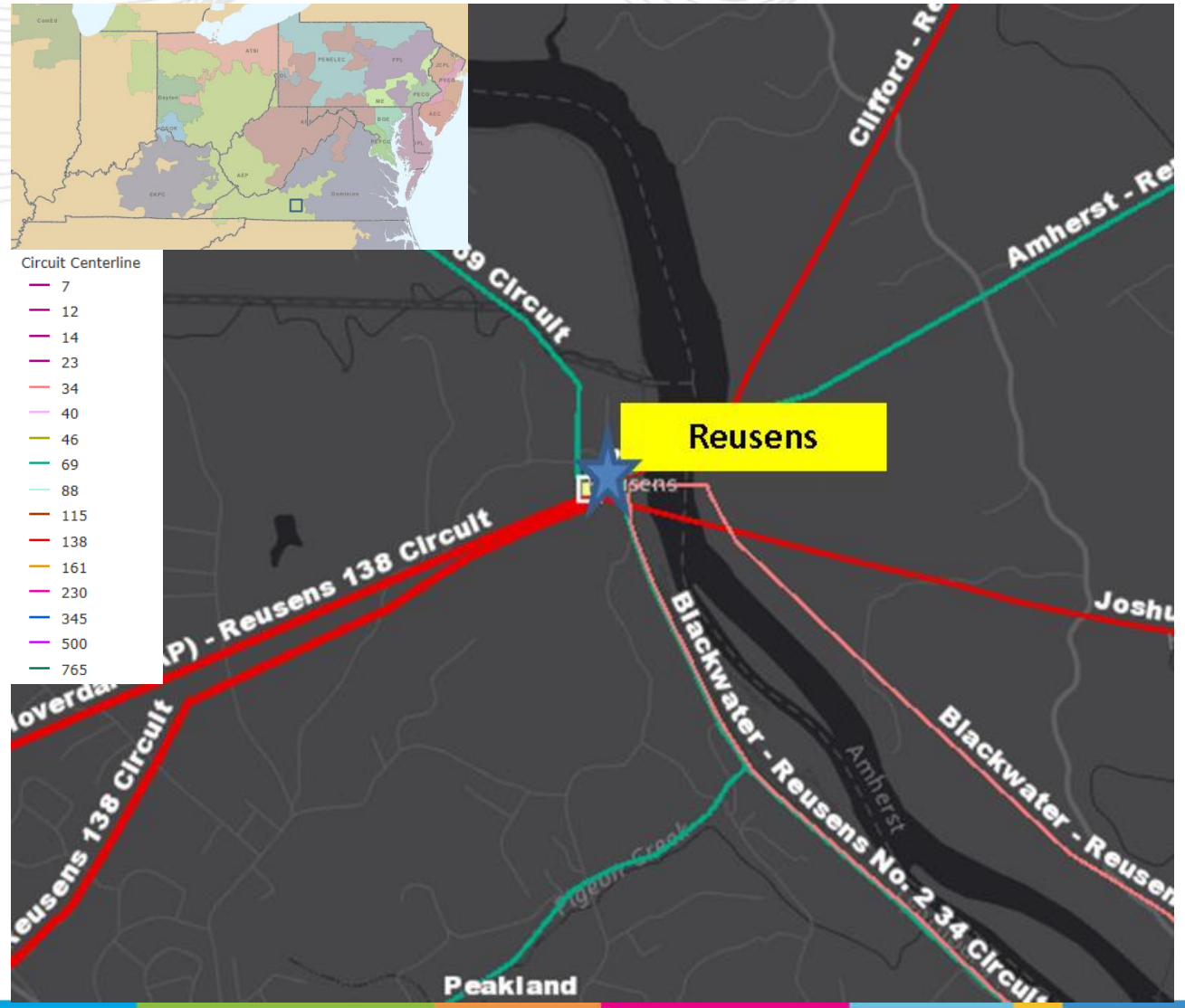

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Selected Solution

At Reusens station, replace existing 3000 A 40 kA 138 kV CB's "AB" & "D" with new 3000 A 40 kA CB. Replace existing 138/34.5 kV 130 MVA XF's #1 & XF #2 with new 138/34.5 kV 130 MVA XF's. Add new 3000 A 40 kA 138 kV circuit switchers "XT1"," XT2", "XT4" on the high side of their respective transformers. Replace existing 1200 A 61 kA 138 kV cap switcher "AC" with new 650 A 31.5 kA cap switcher. Replace existing 300 A 12.5 kA 69 kV cap switcher "DD" with new 420 A 15 kA cap switcher. Install a new 3000 A 40 kA 69 kV CB "XB4L" to the low side of XF #4. Replace existing 1200 A 69 kV CBs "AA", "BB", & "CC" with new 3000 A 40 kA CB's. Replace the 138/69 kV 60 MVA XF #4 with a new 138/70.5/13 kV 130 MVA transformer. (**S1607.1**) Estimated Cost: **$12.6M**

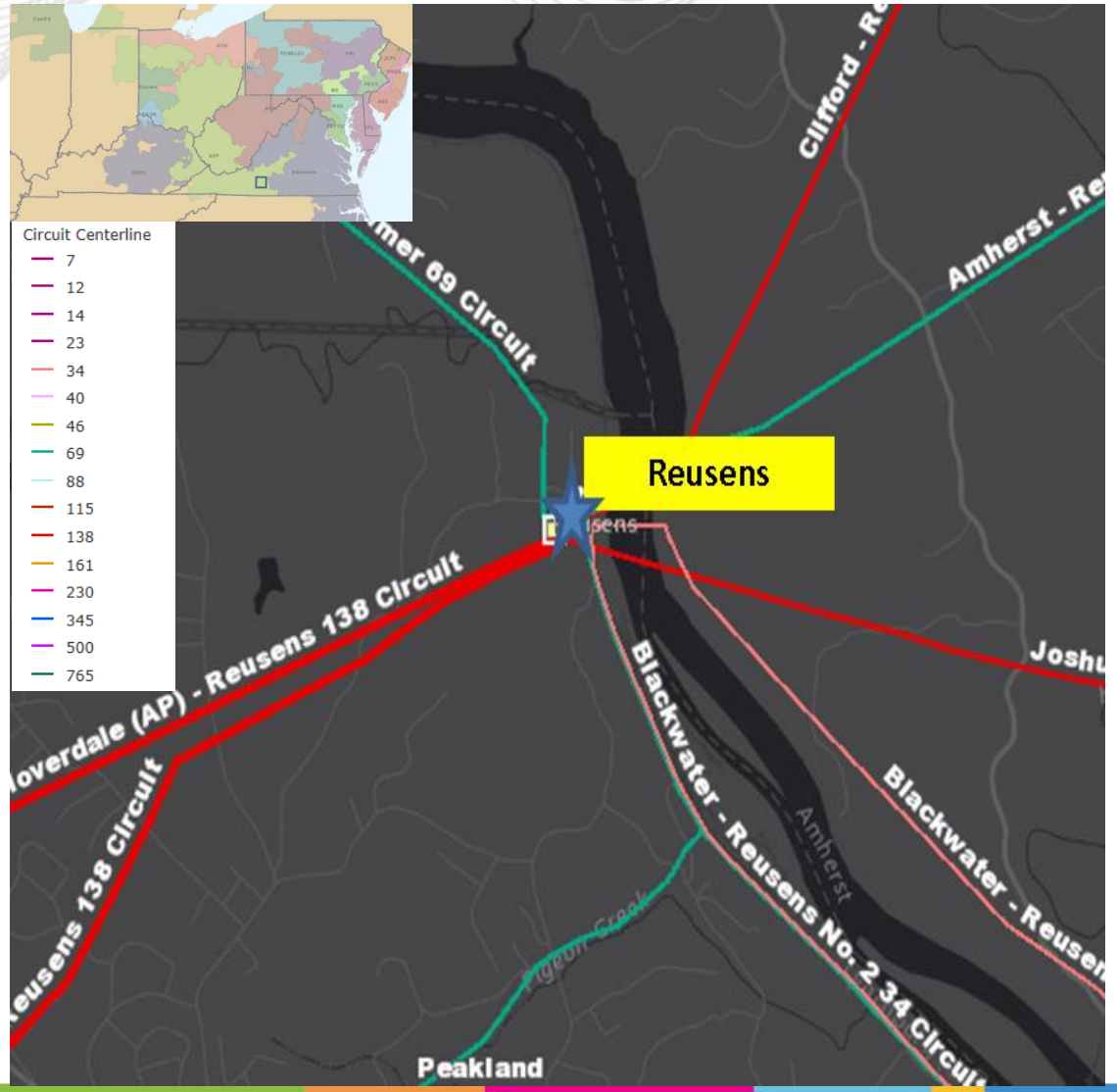
At Mosely station, replace existing 800 A 17.5 kA 138 kV CB "A" with new 3000 A 40 kA CB. Add a new 3000 A 138 kV 40 kA line CB "B" on the Roanoke exit. Replace existing 1200 A 69 kV CB "E" with new 3000 A 40 kA CB. Replace the existing 1200 A 61 kA grounding switch MOAB "Z1" with new 3000 A 40 kA circuit switcher "XT1". (**S1607.2**) Estimated Cost: **$4.7M**

At Clifford station, Replace existing MOAB "Y" with new 3000 A 40 kA 138 kV CB "F" on the Boxwood line exit. replace grounding switch MOAB "Z1" with new 3000 A 40 kA circuit switcher "XT1". 138/46 kV Transformer #3 ground switch MOAB will be retired on a separate baseline project. (**S1607.3**) Estimated Cost: **$3.4M**

Total Estimated Transmission Cost: $20.7M

Projected In-service: 12/31/2022

Project Status: Engineering



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AEP Transmission Zone: Supplemental Haviland-West Van Wert

Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

There are 332 open conditions on the Haviland – S. Van Wert circuit, the majority of which are on the Haviland – W. Van Wert line section.

The subject 69 kV line in Van Wert County, Ohio was originally constructed in 1955. The vast majority of the original-vintage poles are 55 ft. class 4 wood poles. These original vintage poles are far undersized in terms of both height and strength when compared to today's AEP Transmission standards.

Since January 1, 2002 there have been at least eight (8) instances of cascading pole failures during adverse weather, each resulting in a long-duration sustained transmission line outage which interrupted the transmission source to two (2) AEP Ohio distribution stations (South Convoy and Ohio City) and one (1) Paulding-Putnam Electric Cooperative substation (Convoy). These two AEP Ohio distribution stations supply approximately 1350 retail customers. In addition to the cascading pole failure events there have been other sustained outages due to broken insulators, broken crossarms, and broken shield wires.

The majority of the original-vintage tangent wood poles are insulated with 66 kV rated brown porcelain horizontal post insulators. This type of insulator is no longer standard on the AEP system. AEP's experience has shown that this size and type of insulator is subject to base and end fitting separation from the porcelain body when subjected to climatic thermal cycling. They are also prone to electrical backflash.

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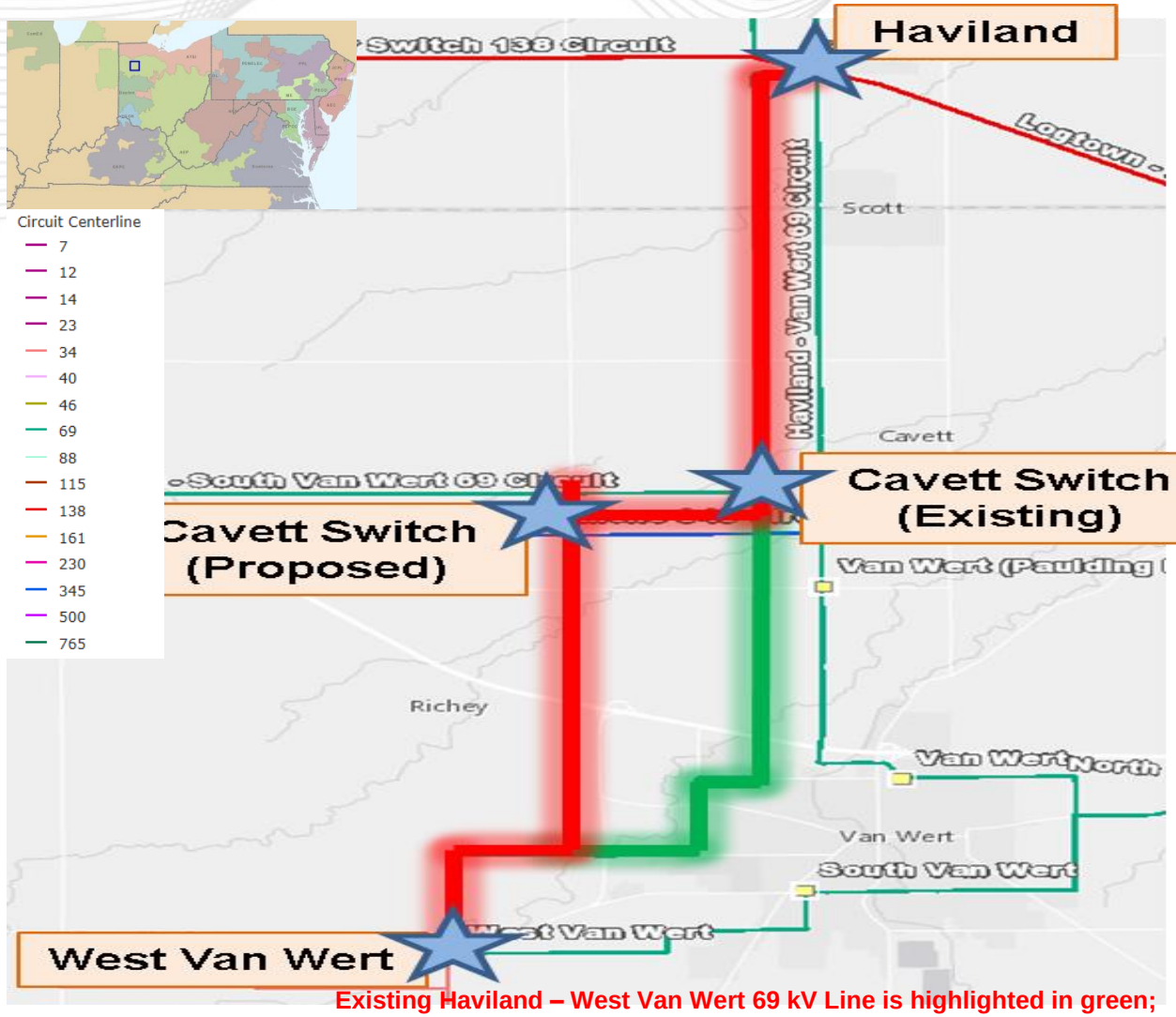

Existing Haviland – West Van Wert 69 kV Line is highlighted in green; Proposed rebuild is highlighted in red.

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AEP Transmission Zone: Supplemental
Haviland-West Van Wert

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Some original vintage poles utilize wood crossarm construction with either vertical post insulators or suspension insulator strings. The life expectancy of wood crossarms is far less than that of wood poles, meaning the required timing of the replacement of the major structural components is not synchronized. This results in the inspection failure rate of crossarms being higher than the inspection failure rate of poles. The cost to access poles in an environmentally responsible way to replace defective crossarms can result in the decision being made to prematurely replace older poles too, prior to the poles actually being judged as defective. Construction types that do not utilize crossarms resolve this issue.

Crossarms and support braces of this vintage are typically undersized, more closely resembling distribution crossarm assemblies. End splitting and suspension insulator string fallout is an elevated risk.

A portion of the line utilizes 4/0 copper phase conductors (50 MVA rating). This size and type of conductor is obsolete on the AEP system, meaning it can be difficult to splice and repair due to lack of available stock materials.

The majority of the shield wire on the line is either 5/16" EHS steel or No. 1 copper 3-strand. Both of these shield wire sizes and types are obsolete on the AEP system, meaning they can be difficult to splice and repair due to lack of available stock materials.

Many of the original-vintage wood poles utilize non-standard crossarm-type bay-o-nets extending from the pole top to support the shield wire. Bay-o-nets decay at the same rate as wood crossarms, meaning bay-o-net replacement is typically required prior to the pole itself needing to be replaced. Bay-o-net top rot and splitting also poses the risk of dropping the shield wire into the top or center phase conductor, and resulting sustained outage to the circuit.

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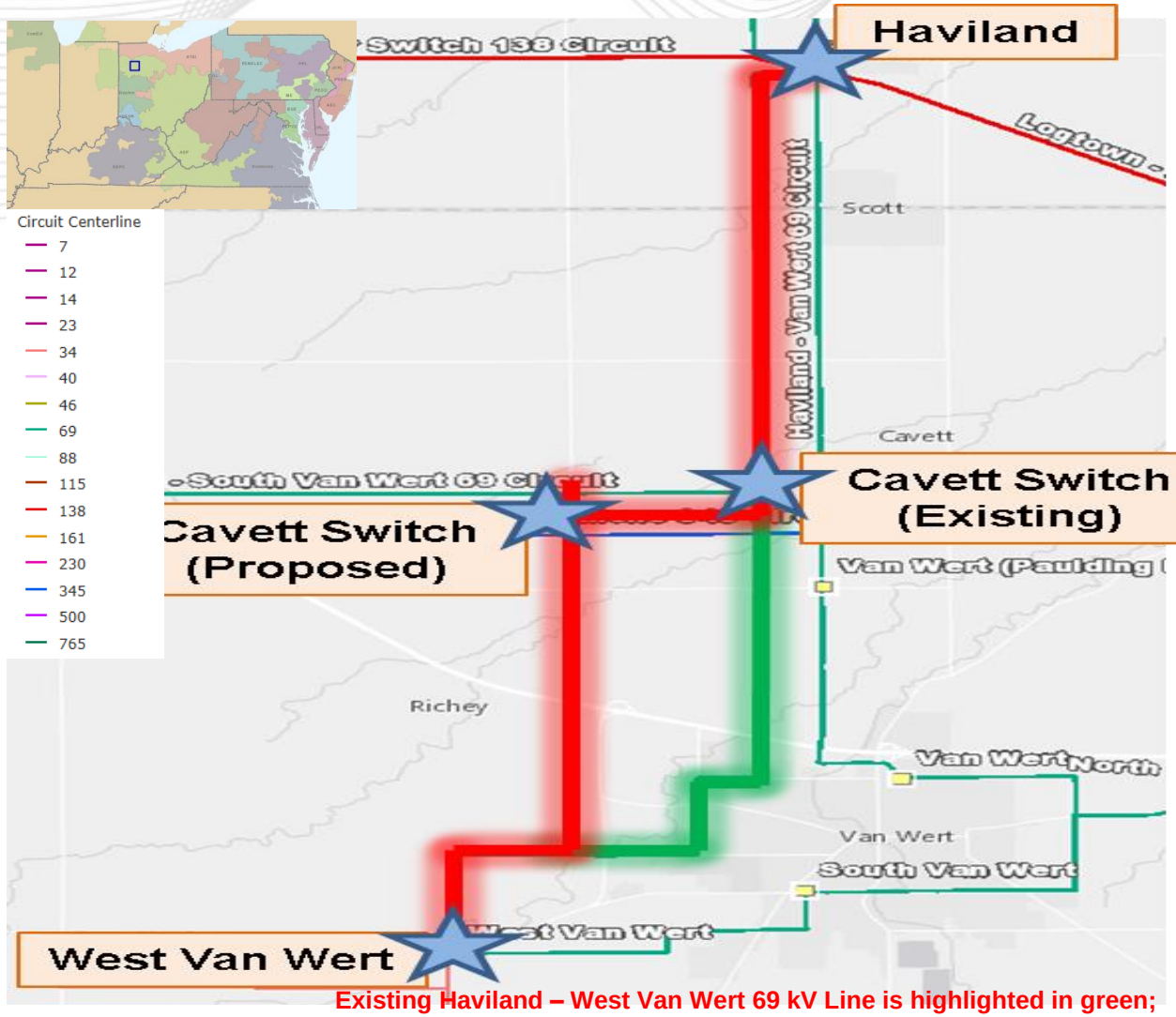

Existing Haviland – West Van Wert 69 kV Line is highlighted in green; Proposed rebuild is highlighted in red.

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AEP Transmission Zone: Supplemental
Haviland-West Van Wert

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Existing grounding is only every other structure. This is not the current AEP standard. Grounding electrodes are typically a butt-wrap, which can be high impedance and less effective than driven rods.

Some of the line has distribution underbuilt. Distribution underbuilt mechanical loads consume pole strength, adding to the risk of future cascading pole failure events.

Legacy underlying land rights for a line of this vintage are typically inadequate by present day AEP standards, offering less-than-desired protective rights for encroachment control and vegetation management.

Operational Flexibility and Efficiency

The FOI calculation justifies a MOAB at Cavett Switch facing toward West Van Wert.

Selected Solution

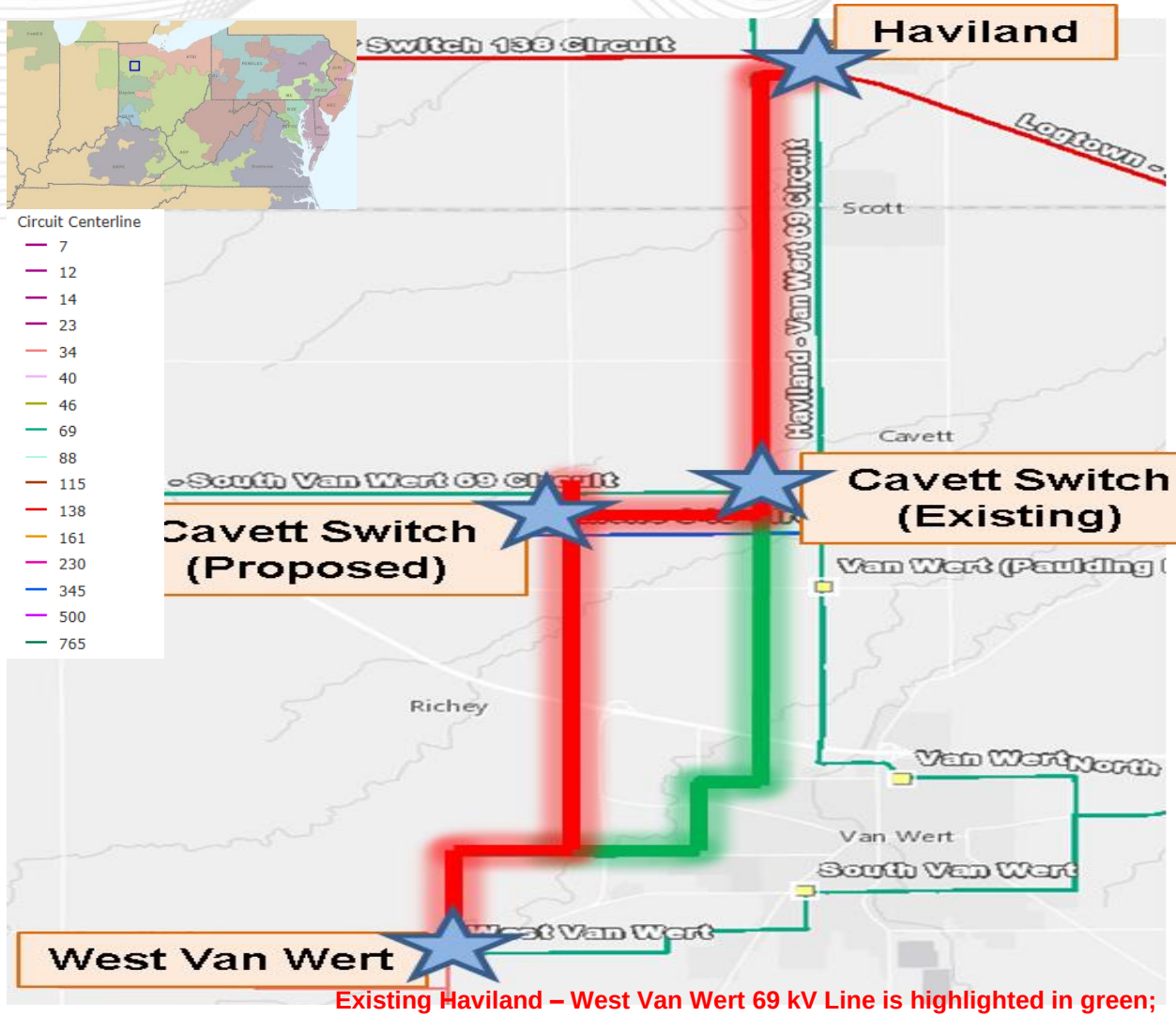
Retire existing Cavett 2-way line switch. Replace with 3-way line switch on new route with MOAB facing West Van Wert. (**S1608.1**) **Estimated Cost: $0.3M**

Rebuild existing Haviland–West Van Wert 69 kV line asset (~14.6 miles) with 795 ACSR conductor (68 MVA rating, non-conductor limited), including partial line reroute. Remove old 211.6 ACSR, 4/0 Copper, and 336.4 ACSR conductor. (**S1608.2**) **Estimated Cost: $15.7M**

Total Estimated Transmission Cost: $16.0M

Projected In-service: 12/31/2020

Project Status: Engineering



Existing Haviland – West Van Wert 69 kV Line is highlighted in green; Proposed rebuild is highlighted in red.

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Previously Presented: 3/27/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The existing 11.9 mile, 69 kV radial line section between Seaman and Sardinia was constructed in 1938 using wood pole structures with 336 ACSR conductor (60 MVA rating). There are 363 open A conditions on the entire 20.3-mile line from Adams to Seaman including the radial to Sardinia. The 11.9-mile section has approximately 60% of those (217). The conditions include rotten cross-arms, burnt/broken insulators, and loose/broken conductor hardware.

Operational Flexibility and Efficiency

AEP Ohio Stations Sardinia and Wildcat have transfer capability between them. Installing 138 kV circuit breakers will help keep customers in service.

Selected Solution:

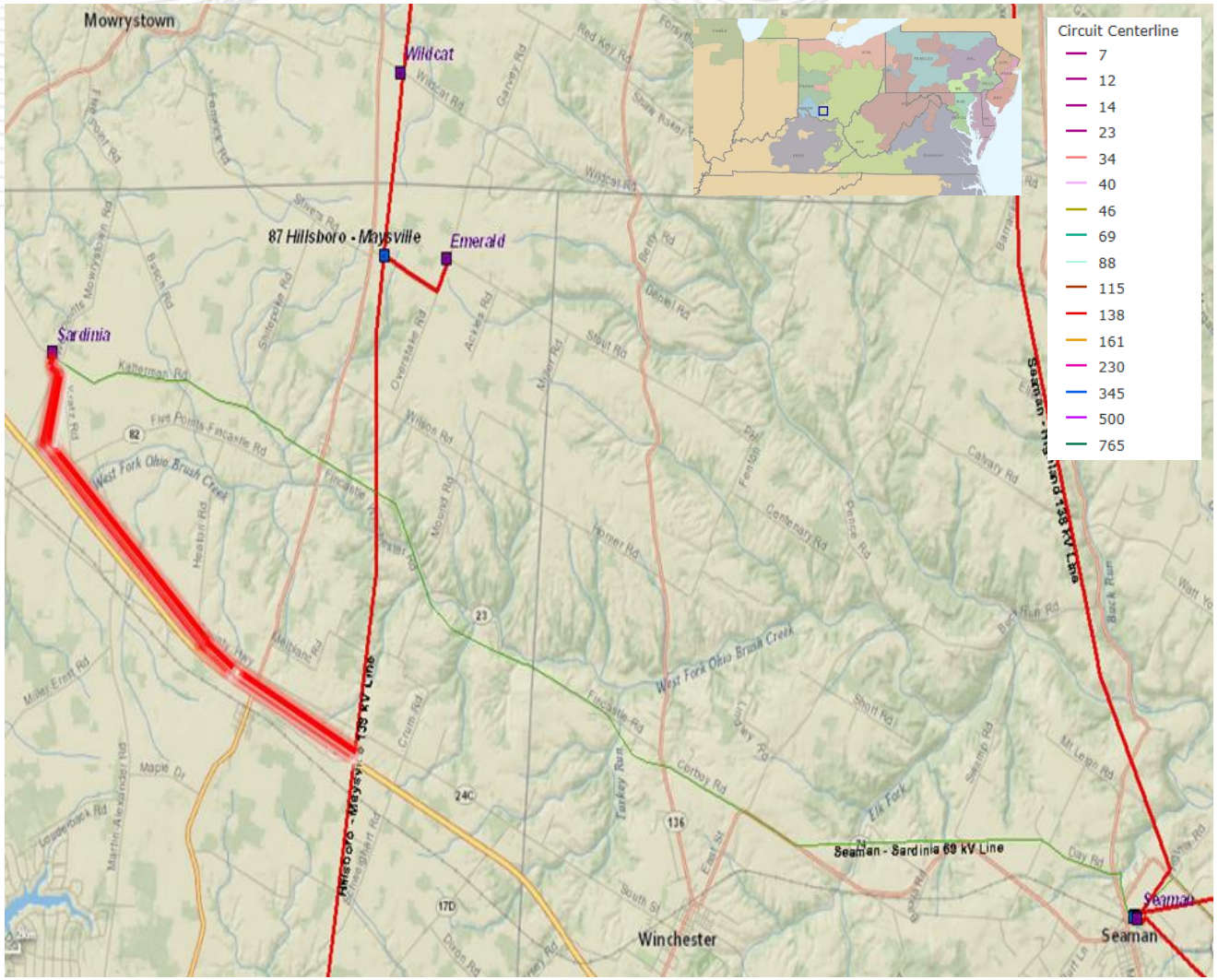
Build a 4.5-mile 138kV double circuit line from Sardinia Station to tap point on the Kenton – Wildcat 138kV circuit, capable of 200 MVA. Once complete, remove the 11.9-mile 69kV Seaman-Sardinia transmission line and associated 69kV equipment at the Seaman and Sardinia substations. (**S1609.1**) **Estimated Cost: $14.0M**

Install 138 kV bus and two 138 kV circuit breakers at Sardinia station. (**S1609.2**) **Estimated Cost: $3.0M**

Total Estimated Transmission Cost: $17.0M

Projected In-service: 12/1/2021

Project Status: Scoping



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Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The Adams-Rarden line was constructed in 1962 using 4/0 ACSR (50 MVA). There are 193 category A Conditions (116 structures); a portion of those are on a radial tap (16 structures), serving Davon substation. Over the previous 3 years there were 547,876 customer minutes of interruption.

Operational Flexibility and Efficiency

The line cannot be taken out of service while it is being rebuilt. The FOI justifies the addition of MOABs.

Selected Solution

Rebuild the 69kV Adams-Rarden line. The new line will be rebuilt adjacent to the existing one leaving the old line in service until the work is completed in the existing ROW as feasible. Supplemental ROW easements will be obtained where necessary. The new 69kV line will be built with 795 ACSR (125 MVA). (**S1612.1**)

Estimated Cost: $18.7M

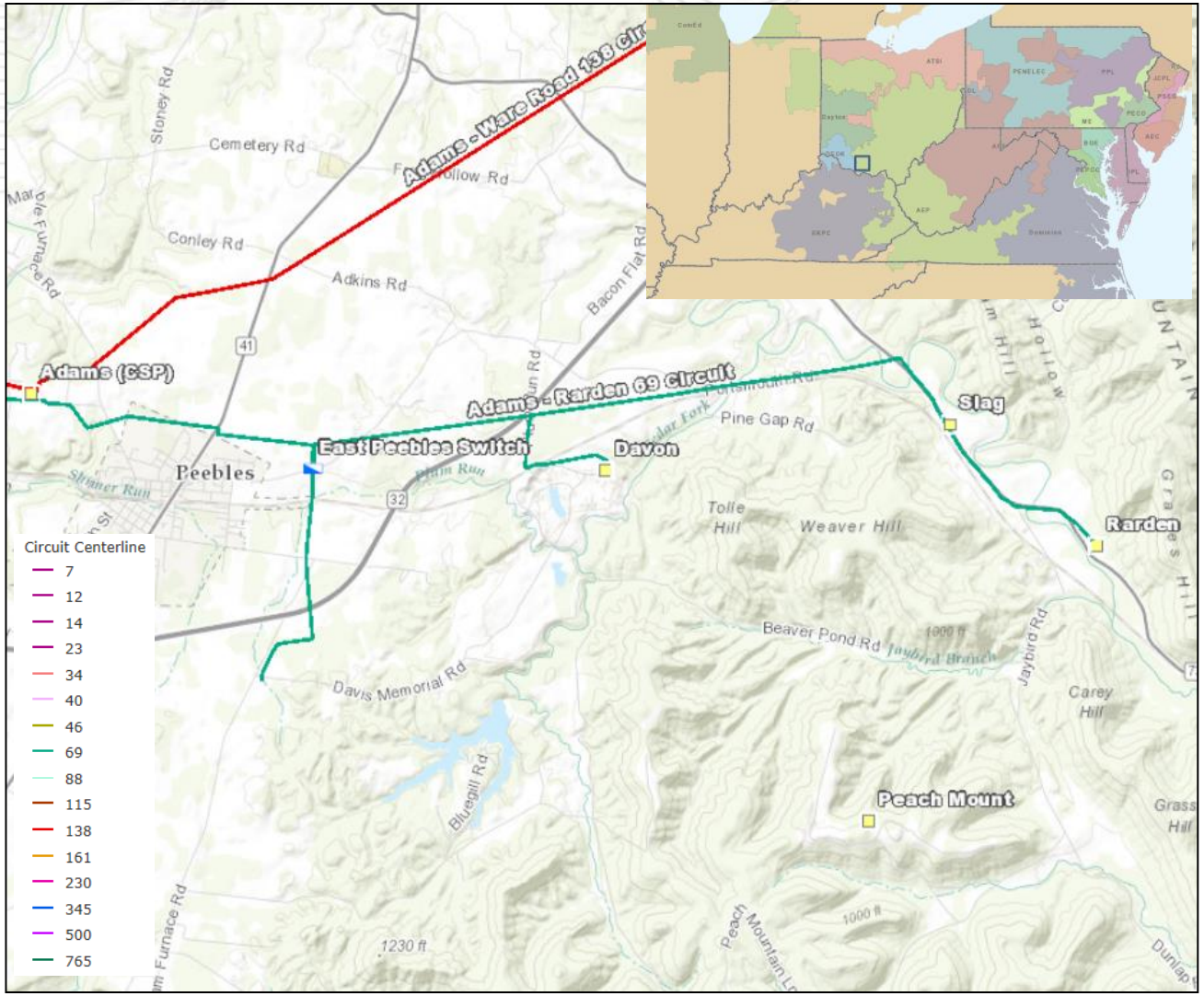
The switch at the Peebles Tap will be replaced with a 3- way SCADA-controlled MOAB switch. A new 3-way SCADA-controlled MOAB switch will be installed at the Davon Tap. (**S1612.2**)

Estimated Cost: $1.6M

Total Estimated Transmission Cost: $20.3M

Projected In-service: 6/1/2020

Project Status: Engineering



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Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The Auburn-Kendallville 69 kV line asset was constructed in 1954 using wood pole structures and 4/0 ACSR and 4/0 Cu overhead conductor types (50 MVA rating). Approximately 38% of the Auburn-Kendallville structures have open condition issues contributing to a 3 year CMI of 104,041 minutes of interruption affecting approximately 600 customers. Circuit breakers "A" (1952), "B" (1958) and "M" (1971) at Kendallville Station and the remote end breaker "A" (1952) at Albion Station are FK-type 1200A oil breakers that were identified for replacement. In general, these "FK" type 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.

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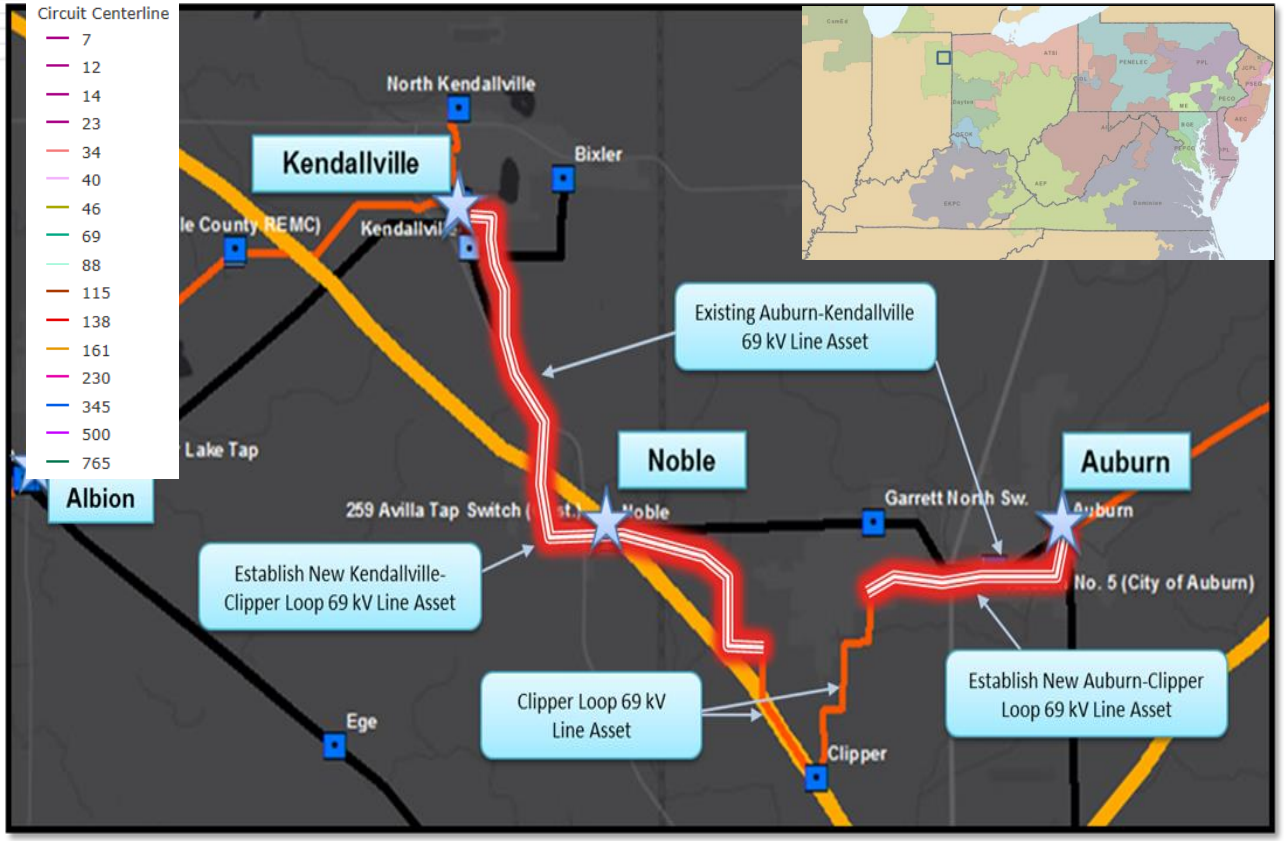

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AEP Transmission Zone: Supplemental
Auburn – Kendallville 69 kV Line Rebuild

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Selected Solution

Rebuild the existing Auburn-Kendallville 69 kV line asset using 556 ACSR 26/7 "Dove" overhead conductor (~15 miles, 102 MVA rating) (**S1613.1**) **Estimated Cost: $14.9M**

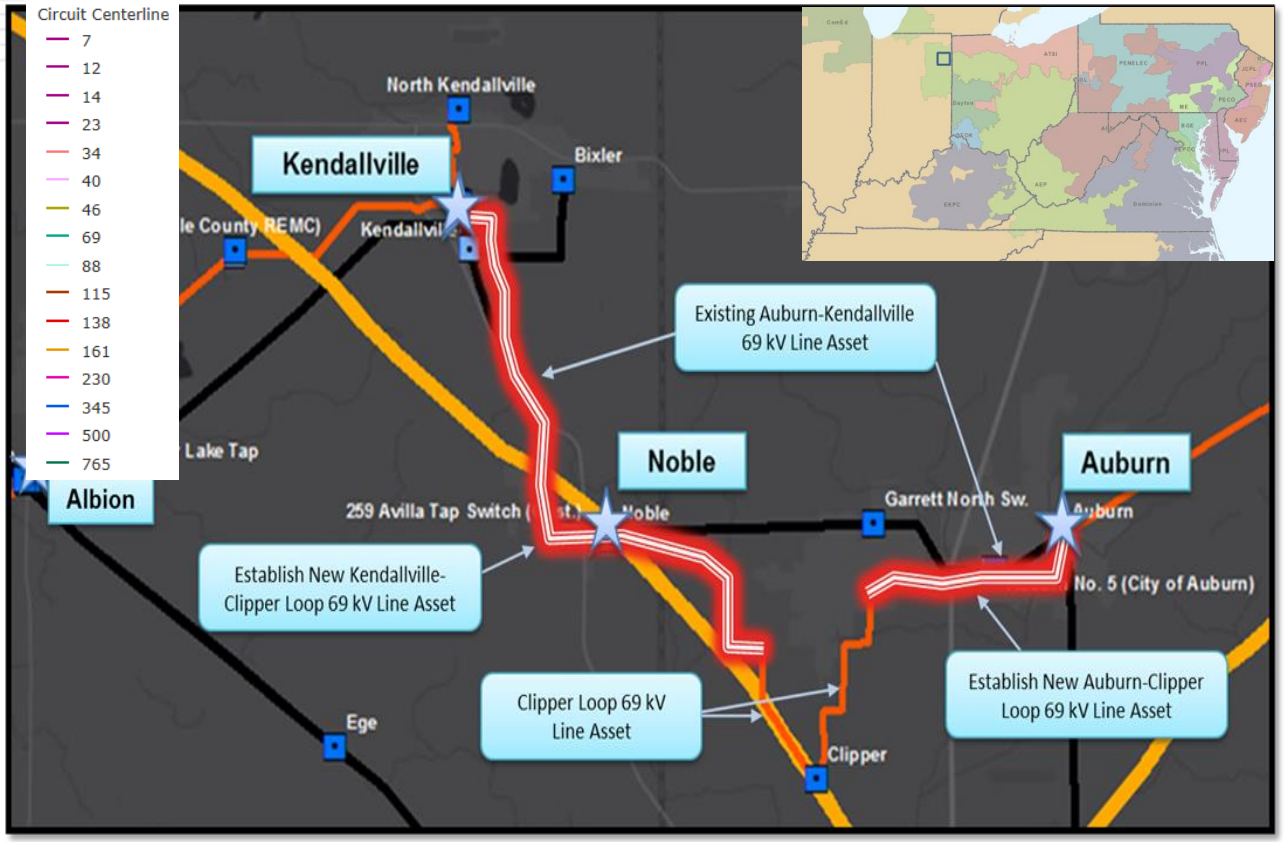
At Kendallville Station, replace 69 kV circuit breakers A, B and M and associated equipment with 69 kV, 40 kA, 3000 A circuit breakers. (**S1613.2**) **Estimated Cost: $1.7M**

At Albion Station, replace 69 kV circuit breaker A and associated equipment with 69 kV, 40 kA, 3000 A circuit breaker. (**S1613.3**) **Estimated Cost: $0.3M**

Total Estimated Transmission Cost: $16.9M

Projected In-service: 06/30/2019

Project Status: Scoping



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Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Breakers 'A' and 'C' at Buckley Road station are vintage 1975, 1800 A, 27 kA oil medium models with fault counts of 7 and 82 respectively. Oil 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 drivers for replacement of these breakers are age, number of fault operations, a lack of available repair parts and potential PCB content.

Breaker 'D' will be added at Buckley Road to improve high side transformer protection by eliminating the existing ground switch and MOAB scheme. This will improve reliability by more effectively isolating faults on either side of the breaker so that the 69kV lines are not affected by a 138kV line fault and vice versa or faults in the transformer.

The Allendale – Fremont Center 69kV line is predominately 1917 era construction and is made up of the Amsden – Fremont Center 69kV and Buckley Road – East End Fostoria 69kV Circuits. The significant age of the structures, conductor, and shield wire has prompted the need for a line rebuild. There are 11 category A conditions and 29 category B conditions along on this line.

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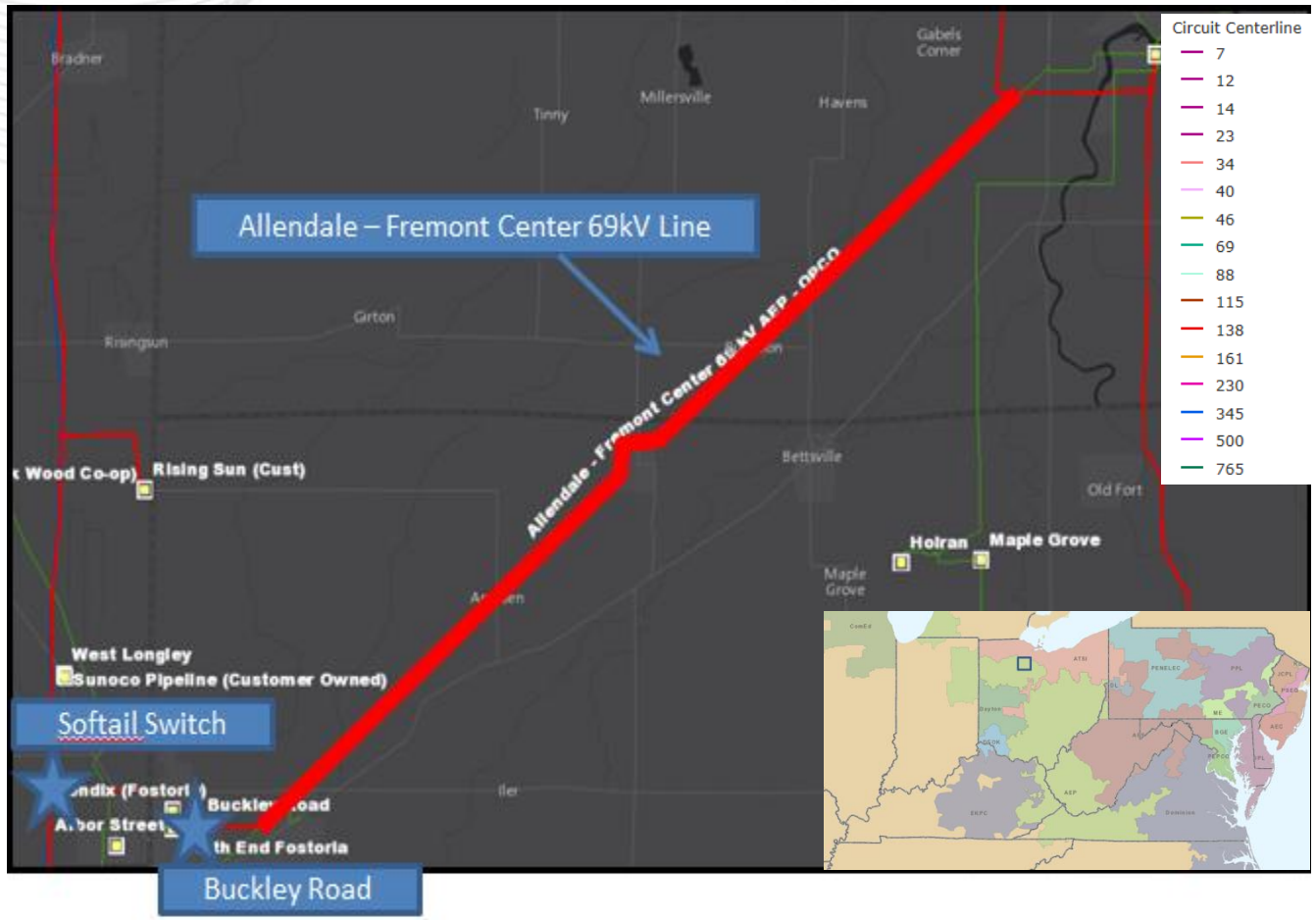

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AEP Transmission Zone: Supplemental
Buckley Road Area Improvements

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Operational Flexibility and Efficiency

Rebuilding the Allendale – Fremont Center 69kV line to 138kV standards will provide operational flexibility and efficiency benefits when a conversion to 138kV operation is conducted in the future. The conversion to 138kV will create a direct path between Buckley Road and Fremont Center stations; the 69kV path is currently kept normally open at Amsden Switch due to the low-rated conductor section that exists on the Allendale – Fremont Center 69kV line. Future conversion will also allow Buckley Road to have 138kV looped service; currently the station is radially fed from Fostoria Central station.

Customer Service:

Softail Switch is being installed as requested by Buckeye Power on behalf of NCEC, to improve reliability and operational flexibility for their Rising Sun delivery point. The new three-way GOAB switch replaces the existing hard tap allowing Rising Sun to be switched back into service during an outage at Buckley Road station. The Buckley Road – Fostoria Central 138kV circuit information has been provided in the appendix for reference.

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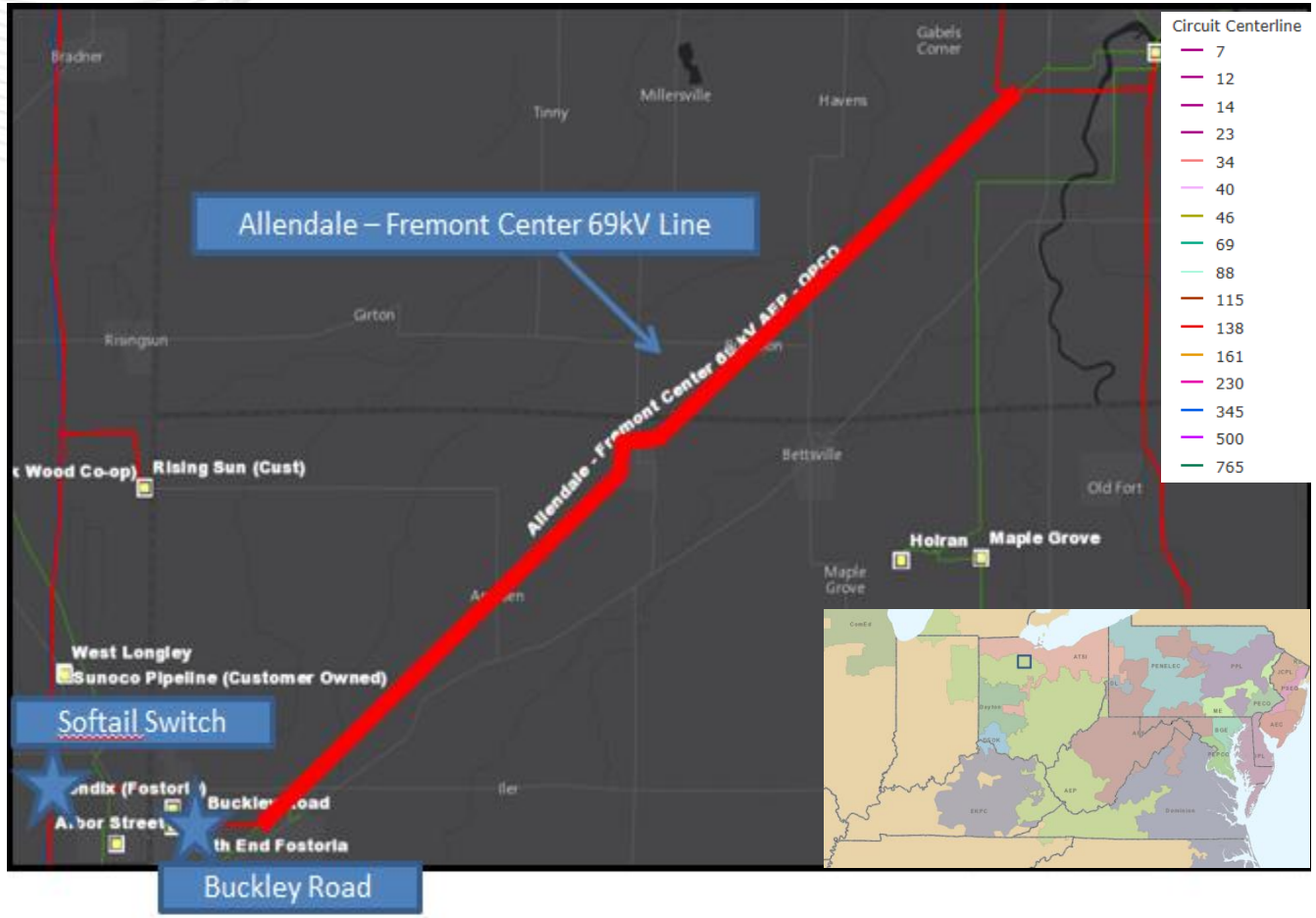

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Selected Solution

At Buckley Road Station, replace 69kV breaker 'A' and 'C' with 3000A 40kA breakers and associated equipment. Add 3000A 40kA 138kV circuit breaker 'D' for high side protection of transformer #1. This will replace the existing ground switching protection currently at the station. (**S1614.1**)

Estimated Cost: $2.6M

At Softail Switch, replace the hard tap for the Rising Sun delivery point, on the Buckley Road – Fostoria Central 138kV Line, with a 2000A three-way phase-over-phase switch. (**S1614.2**)

Estimated Cost: $1.06M

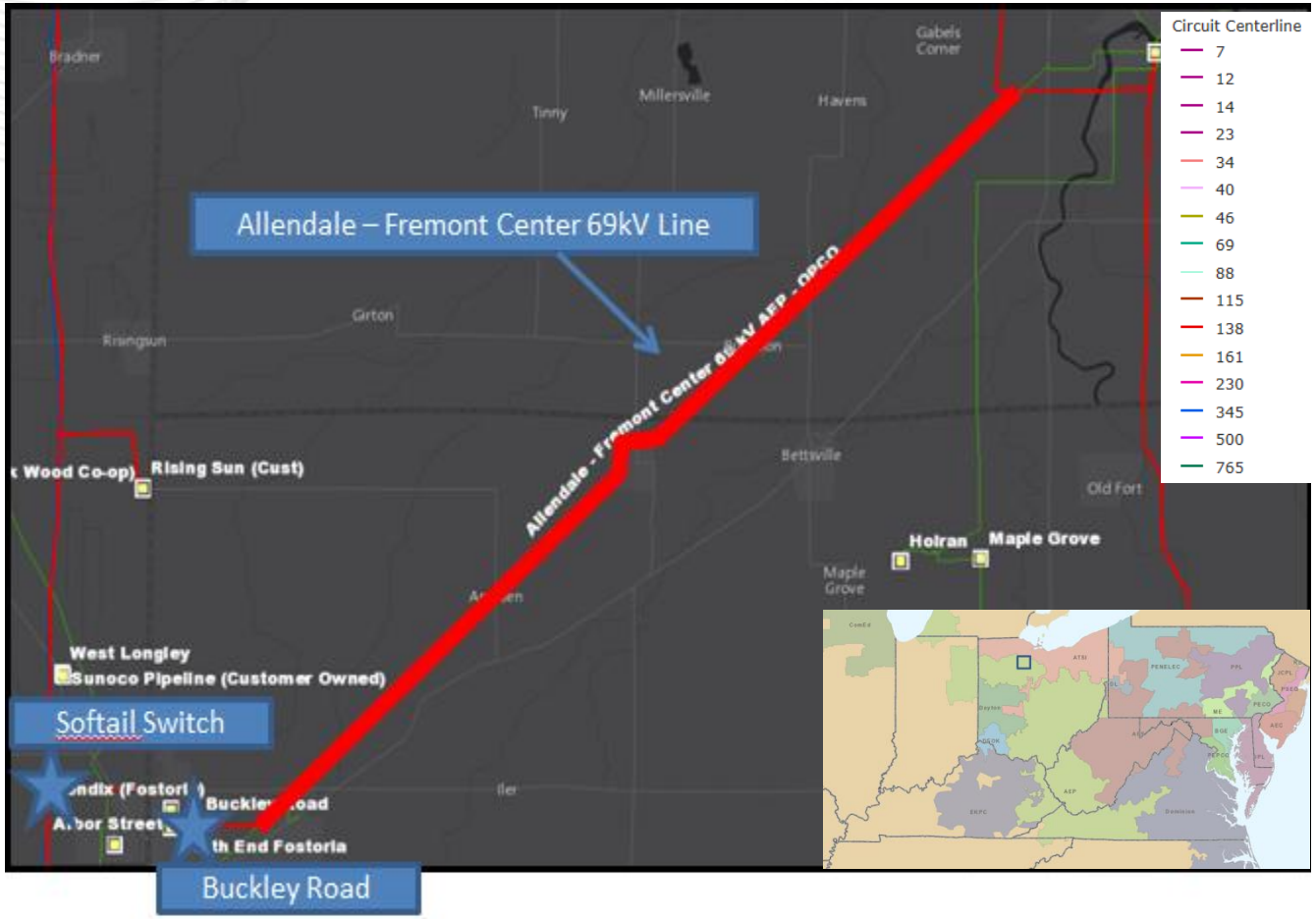
Rebuild approximately 15.2 miles of the Allendale – Fremont Center 69kV Line with 138kV line construction operated at 69kV. The new line will be double circuit 138kV construction for 0.6 miles at the Allendale end so that the customer served at Weaver Switch can remain served at 69kV even after a future 138kV conversion of the rebuilt line. The remaining 14.6 miles of line rebuild will be single circuit 138kV construction. (**S1614.3**)

Estimated Cost: $22.2M

Total Estimated Transmission Cost: $25.9M

Projected In-service: 12/31/2020

Project Status: Engineering



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Previously Presented: 4/17/2018 SRRTEP

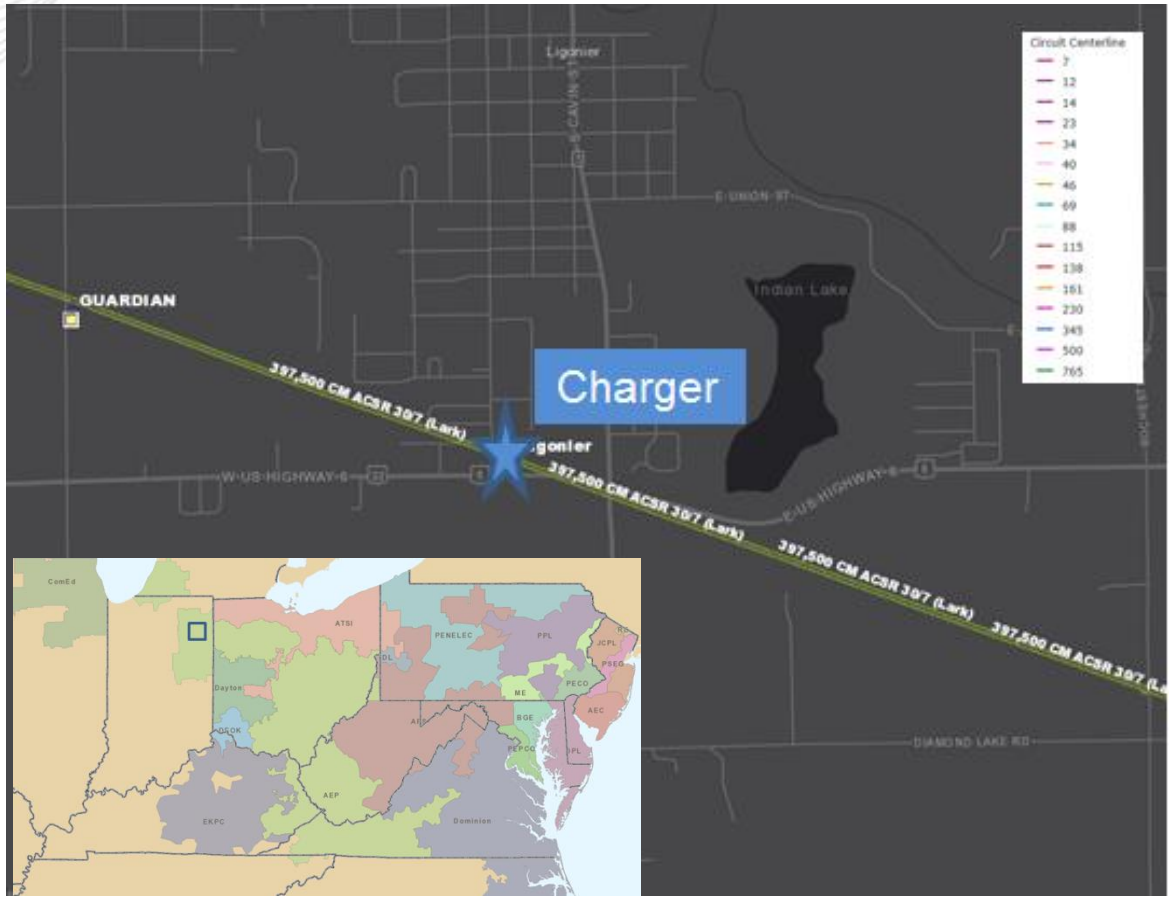
Problem Statement:

Operational Flexibility and Efficiency

The current 138 kV transmission line configuration entering Ligonier Station consists of two “hard taps” which are non-standard and contribute to customer interruptions. The existing line-tie looprupter is unable to split the loop flow when needing to split the circuit tie after it has been closed for planned work or customer load recovery reasons. To safely open the looprupter switch the customers must be interrupted by drop-and-pick switching. Reconstructing the station to a standard configuration will modernize the station, reduce customer interruptions, enhance operational flexibility, and eliminate a legacy transmission system configuration deficiency.

Customer Service:

The associated line rebuild of the Robison Park-Twin Branch 138 kV line (s1336), which serves the existing Ligonier station, will require a re-route to eliminate several encroachments caused by construction of business underneath the line. By adjusting the ROW route slightly, this avoided the need to purchase several local businesses directly underneath the line, which was appreciated by the local community and Mayor. The re-route of this line to the south of the existing station site provided an opportunity to establish a new station with sufficient property size to accommodate the layout of the 3 breaker ring bus, improving the reliability and performance of the customers served from this station.



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AEP Transmission Zone: Supplemental Charger 138kV Switching Station

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Selected Solution

Construct a new 138 kV tie line from the new Charger 138 kV Switching Station to the existing Ligonier Station using 795 ACSR conductor. (**S1615.1**)

Estimated Cost: $0.6M

Construct new 3-breaker ring bus 138 kV switching station across the road from the existing I&M 138/12 kV Ligonier Station, allowing a 138 kV transmission line reroute through an area with multiple underlying commercial building encroachments. Equipment consists of 138 kV, 40 kA, 3000 A circuit breakers and 3000 A disconnect switches. (**S1615.2**)

Estimated Cost: $6.5M

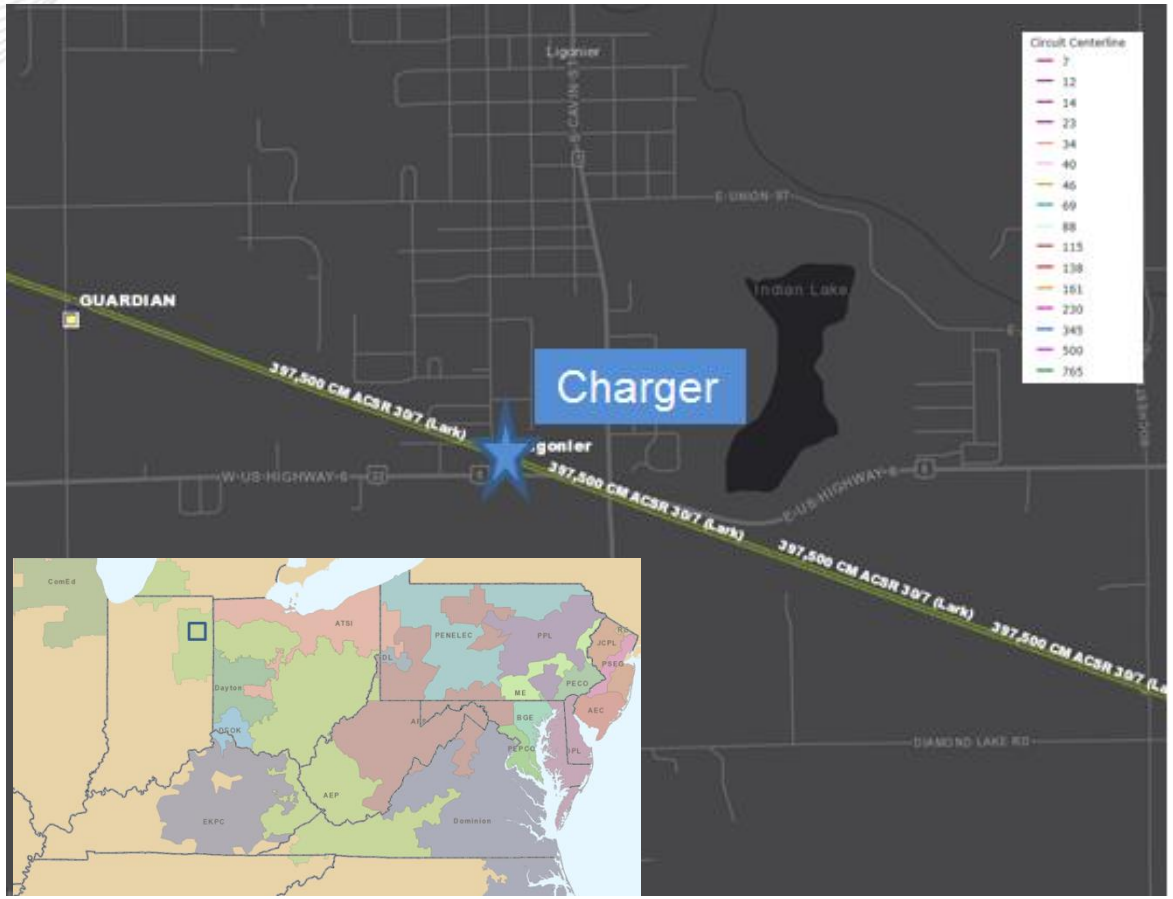
Expand existing Ligonier Station. (**S1615.3**)

Estimated Cost: $0.1M

Total Estimated Transmission Cost: $7.2M

Projected In-service: 12/31/2018

Project Status: Scoping



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AEP Transmission Zone: Supplemental
Ottawa - Columbus Grove 69kV Line Rebuild

Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk**:**

The Ottawa-Columbus Grove 69kV line is mostly wood pole construction with the oldest structures dated at 66 years old (vintage 1951) and the vast majority of the line at or above 50 years old with 3/0 ACSR 6/1 Pigeon conductor (44 MVA) . Also, the East Lima-East Ottawa 69kV circuit has CMI of more than 251,509. There are a variety of conditions including rotting poles, splitting and rotting cross arms, burnt insulators, and insect damage. Newer steel poles on this line were replacements required due to a derecho in recent years where the older wood poles were broken. The newer steel poles are not targeted for replacement except as is necessary to complete the targeted work. North Columbus Grove Switch has experienced alignment problems on a wood pole and needs to be replaced.

East Ottawa station currently utilizes 3 transmission oil CB's, requiring rehab driven replacement based on age and condition. The 69 kV CB's L, N, and K have experienced 16, 55, and 42 fault interruptions respectively and were manufactured in 1966. Additionally, the 69kV cap switcher is a Mark V model and has had a number of operations that has led to issues with the interrupters. Mark V cap switchers have a track record of mechanical problems and have been recommended for replacement due to these issues in addition to the fact that they don't integrate well into modern relaying packages. Spare parts for Mark V cap switchers are also becoming more difficult to find.

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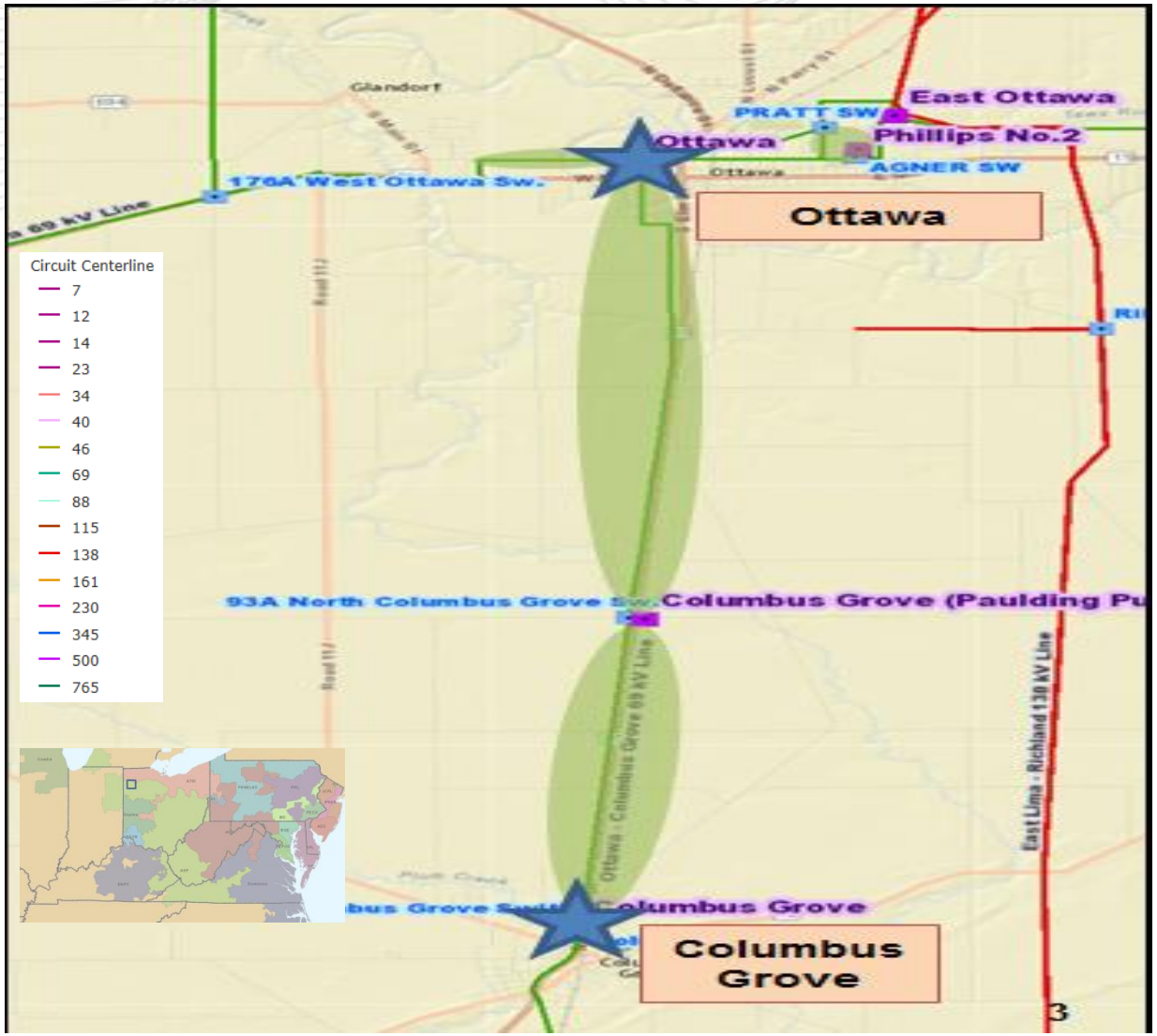

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AEP Transmission Zone: Supplemental
Ottawa - Columbus Grove 69kV Line Rebuild

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Operational Flexibility and Efficiency

69/12kV Ottawa station is currently radially served from two short radial hard taps into station MOABs, one of which is operated N.O. The line between Kalida and the new Glandorf site includes 13 miles of exposure (including a 5.3 mile radial to Miller City) through a wind prone area of primarily farm land. The line between East Ottawa and the new Glandorf site includes 2.3 miles of exposure that crosses the flood prone Blanchard river and includes a few short stretches of forested area and several residential properties with nearby trees. Adding CB's on each side of Glandorf station will provide automated protection from potential failures on the Kalida-East Ottawa and will provide remote operational flexibility to recover from complications in the area such as flooding conditions.

With the reconfiguration of Agner switch, a N.O. switch and a line in the bus zone of protection will be eliminated. This switch and connected load will be relocated to the East Lima-East Ottawa 69kV circuit. The location of this load makes further sectionalizing of the line desirable. Given the need to replace the switches at North Columbus Grove Switch and the relative exposure involved, North Columbus Grove Switch was selected as the best location for motorizing a switch.

East Ottawa Station has experienced 2,965,627 of CMI. Extended outages were experienced during the 2012 derecho when several structures had to be replaced to restore service to all customers. East Ottawa Station is surrounded on three sides by the Blanchard River which has severely flooded the station at least twice in the past, rendering the station unusable until flood waters receded.

Customer Service:

A new station at a different location is needed to avoid the flooding problem in the future. AEP-Ohio has elected to retire Ottawa station and replace it with Glandorf station, largely to address this flooding issue. The majority of equipment in the station is in need of replacement, and the Distribution company has requested to move the station due to flooding at the site.

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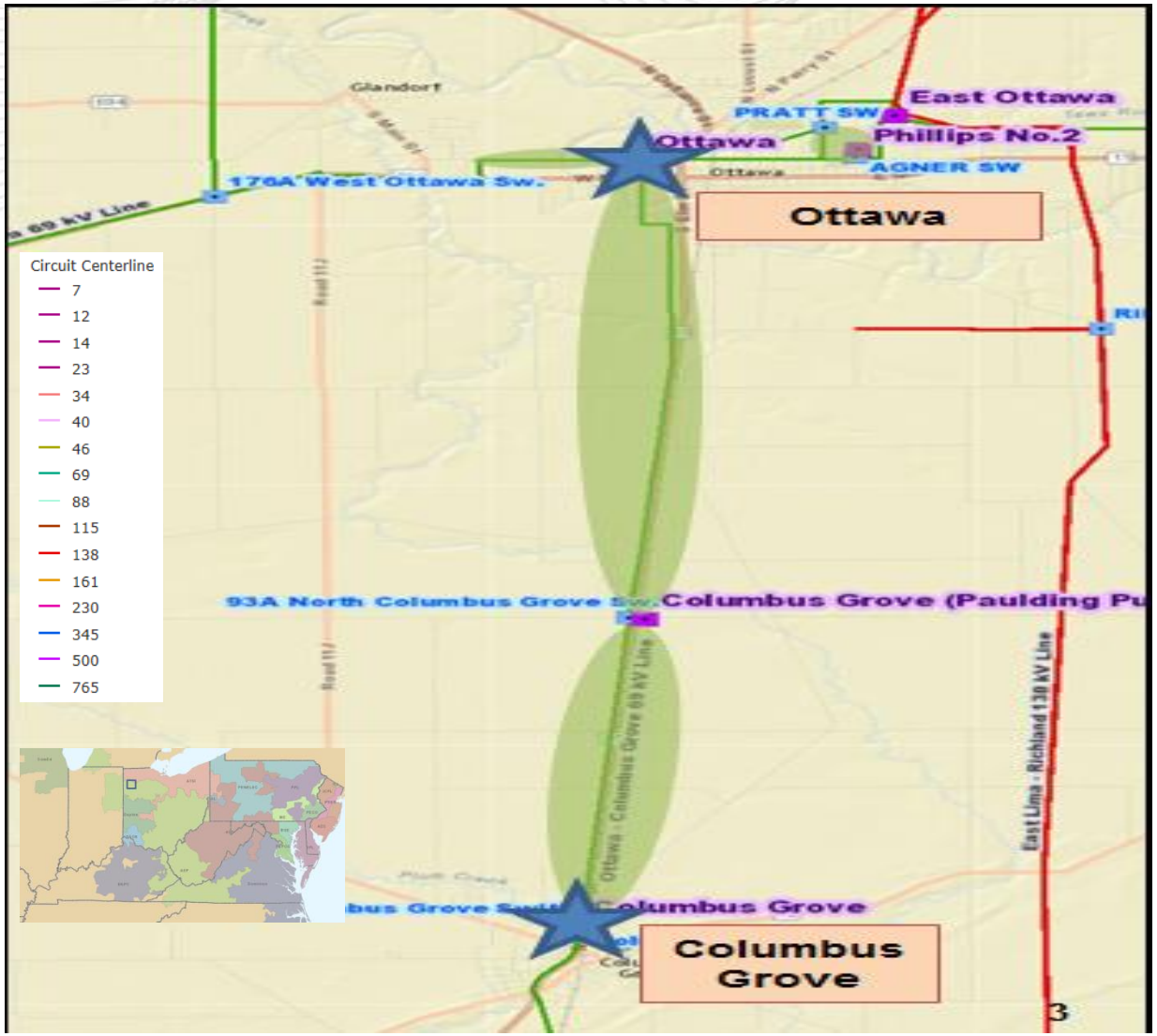

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AEP Transmission Zone: Supplemental
Ottawa - Columbus Grove 69kV Line Rebuild

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Selected Solution

Rebuild 6.91 miles on Ottawa - Columbus Grove 69kV line with 795 ACSR (128 MVA rating) in existing ROW. Remove taps to Ottawa station. Build 69kV line extensions to serve Glandorf station using 795 ACSR. Retire Pratt Extension 69kV Line. Reconfigure 69kV connections at Agner Switch. Remove line sections and de-energized conductor that will no longer be needed. (**S1616.1**)

Estimated Cost: $13.0M

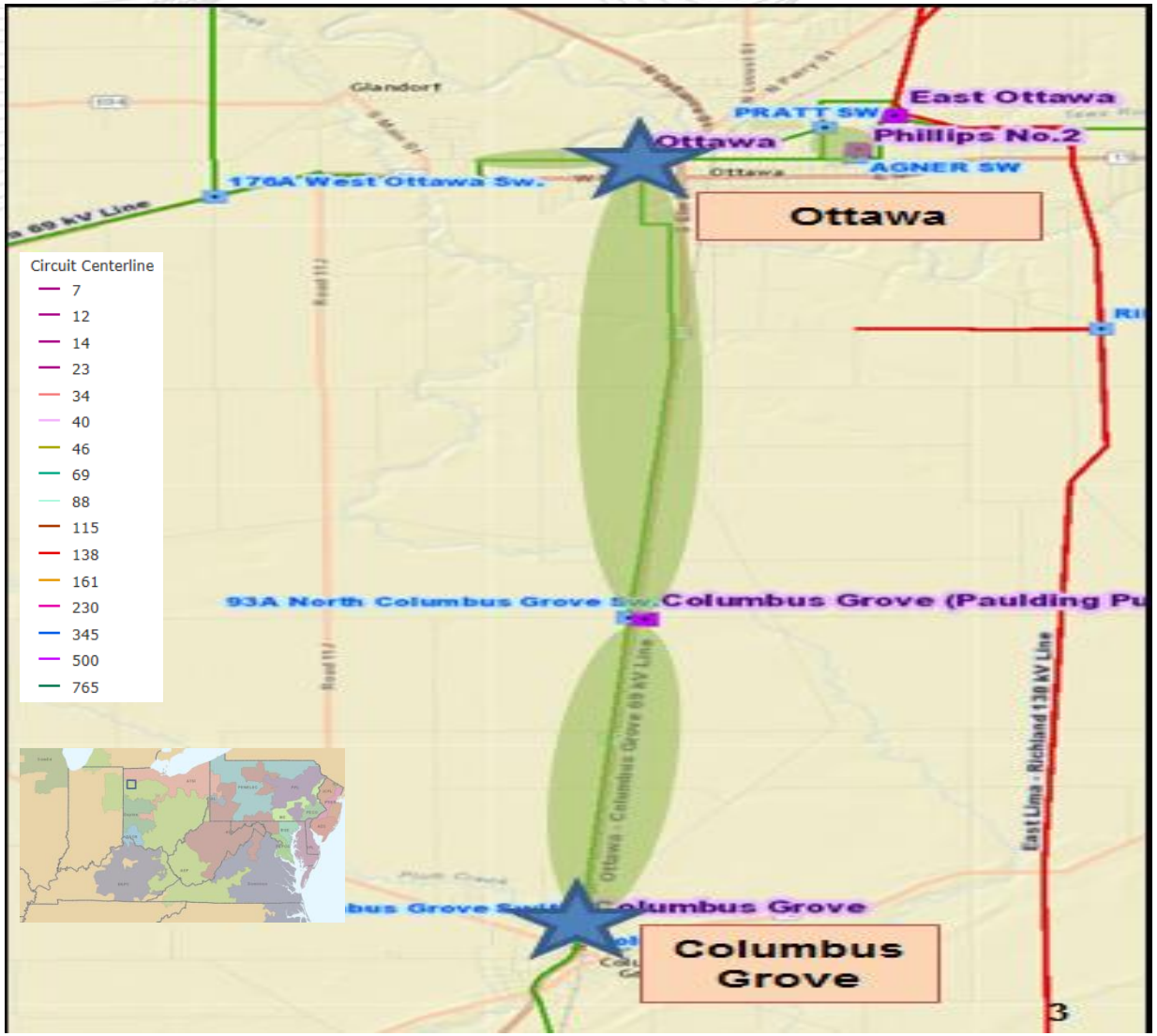
Replace 69/12kV Ottawa station with 69/12kV Glandorf station at a new station site. Upgrade existing 3 way switch at North Columbus Grove to 3 way switch with 1 MOAB. Replace 3-69kV CB's and 1-69kV cap switcher at East Ottawa. (**S1616.2**)

Estimated Cost: $6.1M

Total Estimated Transmission Cost: $19.1M

Projected In-service: 12/01/2019

Project Status: Scoping



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AEP Transmission Zone: Supplemental Delphos Area 69 kV Line Rebuilds

Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

There are 284 open conditions on the North Delphos – Van Wert circuit, which was originally constructed in 1926 with 2/0 Copper conductor (40 MVA rating). There are 727 open conditions on the North Delphos – West Moulton section, constructed in 1927 with 2/0 Copper. Existing lines between Delphos and Van Wert and between East Delphos and North Spencerville are almost entirely cross arm construction with vertical post insulators, which is not a current AEP standard. Along the East Delphos-Kossuth circuit, many vertical post insulators have burn marks, showing signs of in-service failures. Many insulators on both lines are tie-top type, and some existing wood pole structures have bay-o-nets supporting the shield wire, which are prone to failure. Existing line between North Spencerville and Kossuth is mostly burnt-colored horizontal post insulators with many leaning poles and bay-o-nets. The ability to repair breakdowns of the obsolete conductor size and type on both lines is becoming increasingly difficult due to limited availability of materials. Existing shield wire conductor types are obsolete for use as shield wires on the AEP system, and some are even unavailable as a like-kind breakdown replacement. Both lines have distribution underbuild, which mechanically consumes pole strength. Legacy underlying easement rights for a line of this vintage are inadequate by present day AEP Transmission standards.

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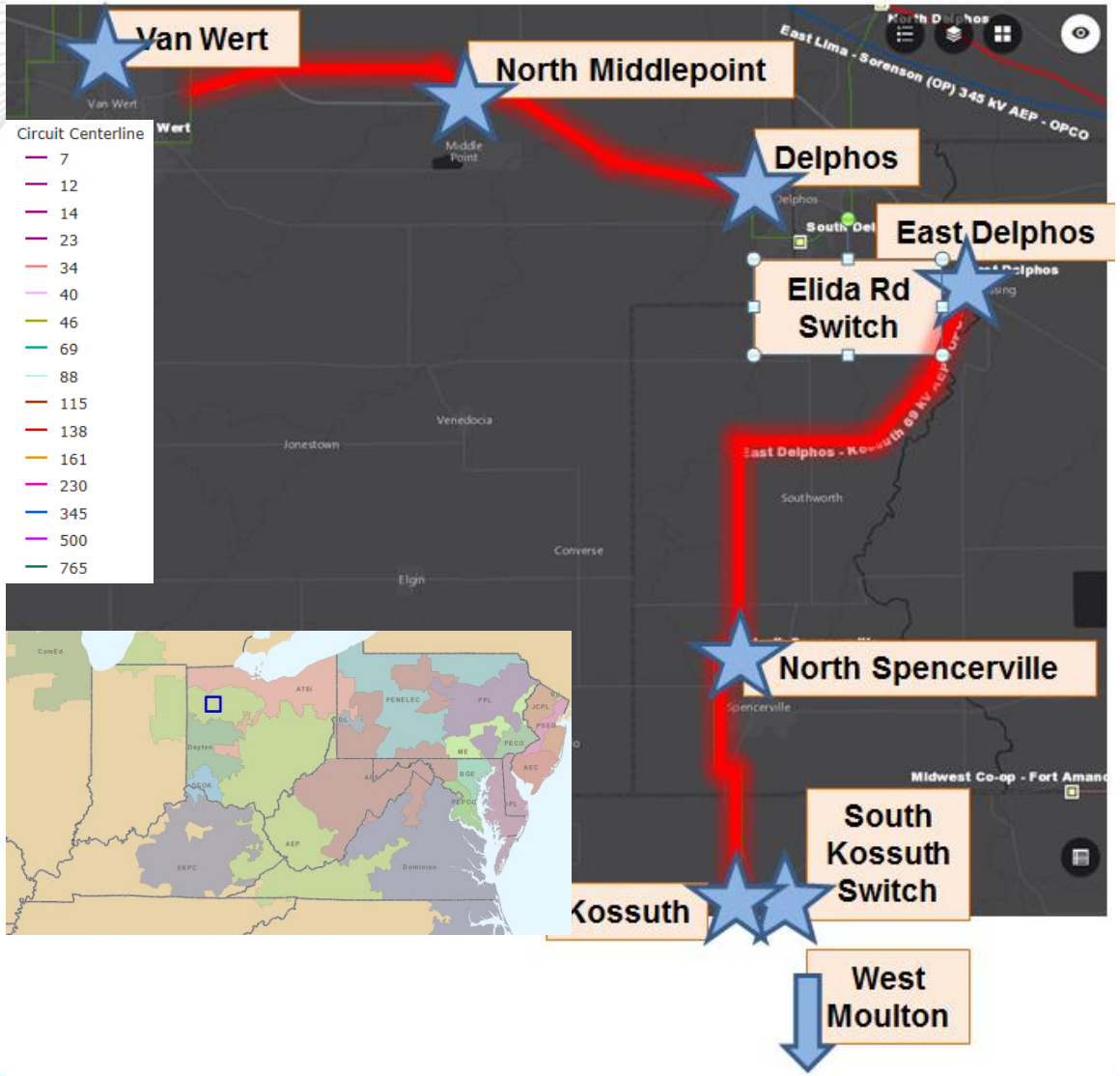

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AEP Transmission Zone: Supplemental Delphos Area 69 kV Line Rebuilds

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Operational Flexibility and Efficiency

North Spencerville station will be rebuilt to include new bus work and two new Transmission CBs. The new CBs at North Spencerville will break up the North Delphos-West Moulton circuit. This will greatly improve the circuit's reliability because the stations will no longer be exposed to 29 miles of line, and this will eliminate the ground switch MOAB scheme at North Spencerville. There are currently 2466 customers on this line with approximately 18.6 MVA of load. There have been 25 total sustained or momentary outages on this line from 2013 to present. By placing breakers at North Spencerville, customers will no longer be interrupted by line faults. Current CMI for this circuit is 161,901.

At North Middlepoint station, there will be one new MOAB looking toward station Vanwert and another motor mech operated switch looking toward Delphos. This will improve the circuit reliability thus improving the SAIFI numbers because the minutes of interruption will be decreased. Also there will be new circuit switcher at the high side of the transformer which will allow any temporary fault on the bus to restore and will not allow faults on the distribution to effect the transmission.

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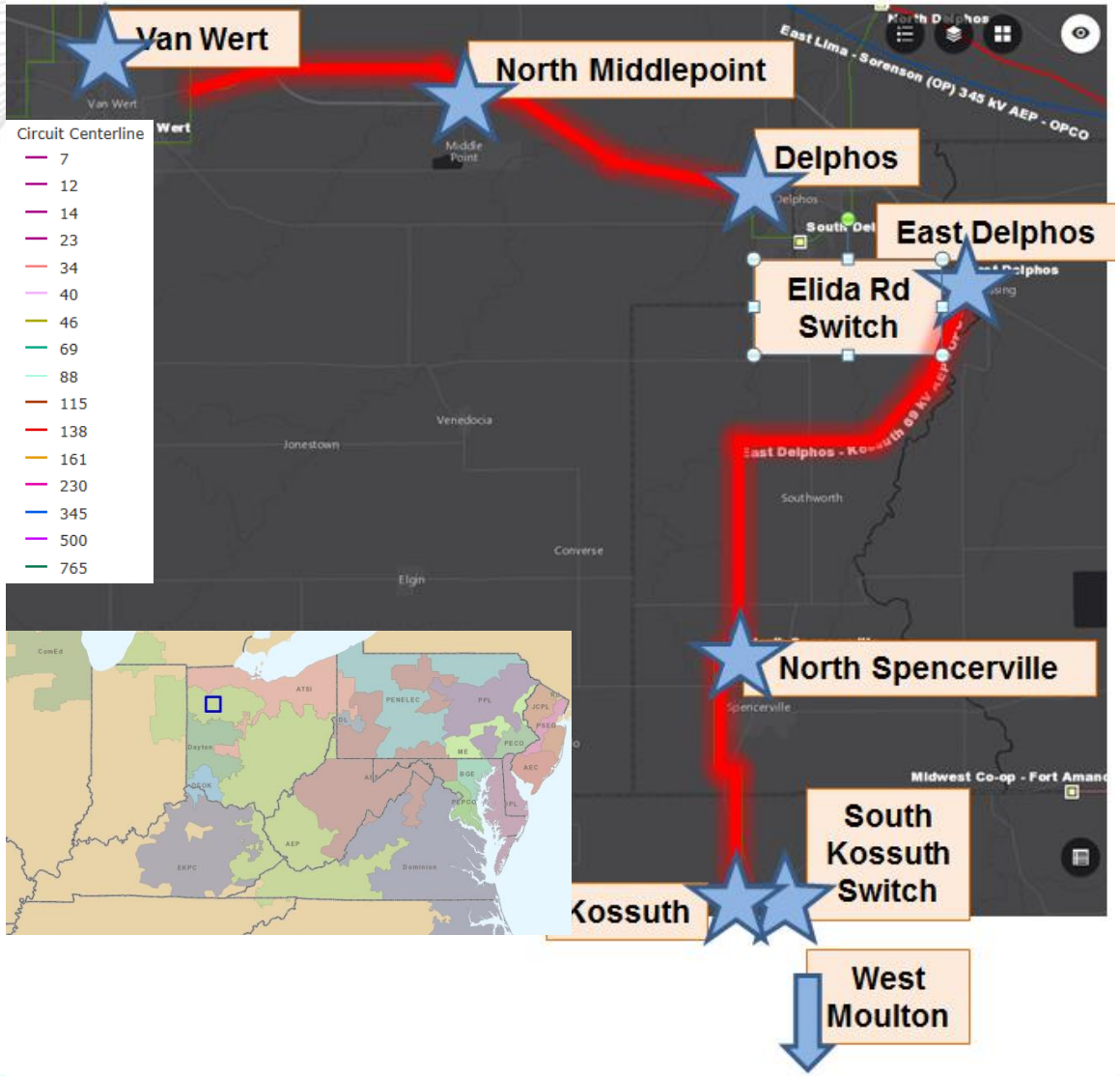

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AEP Transmission Zone: Supplemental Delphos Area 69 kV Line Rebuilds

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Selected Solution

Rebuild North Spencerville station. Install two 69 kV CBs. (**S1617.1**)

Estimated Cost: $1.2M

At North Middlepoint station, construct new high side switching facilities. Install one MOAB, Switch and Circuit Switcher. (**S1617.2**)

Estimated Cost: $0.3M

At South Kossuth station, install a new 1-way switch toward North Spencerville, retire the existing 1-way switch and build a section of line in the clear on the north side of the highway. (**S1617.3**)

Estimated Cost: $0.2M

Rebuild existing Delphos – Van Wert 69 kV line (~11.4 miles) with 795 ACSR (128 MVA rating), including partial line reroute. (**S1617.4**)

Estimated Cost: $12.3M

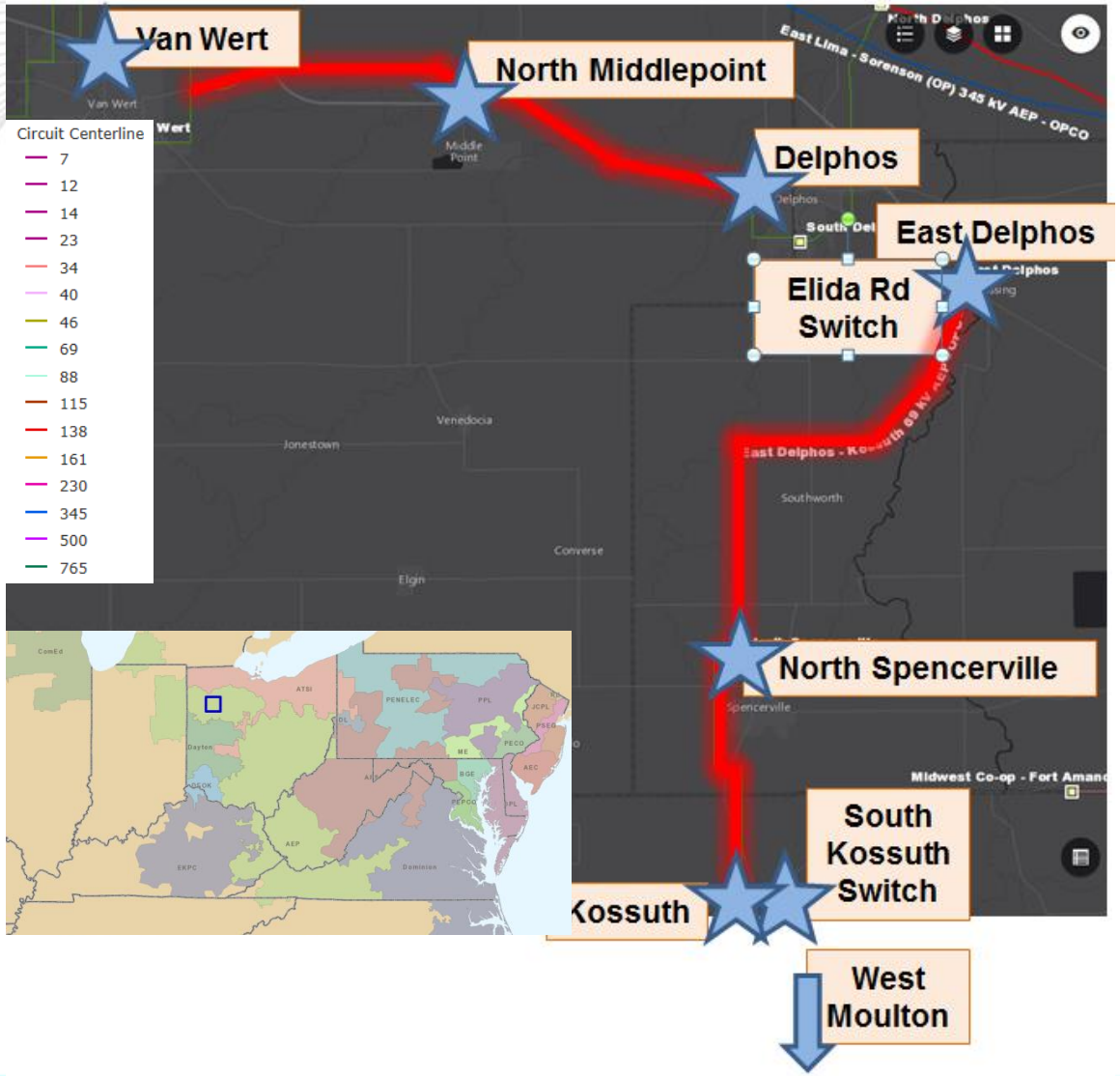
Rebuild existing East Delphos – Kossuth 69 kV line (~15.5 miles) with 795 ACSR, including partial reroute. (**S1617.5**)

Estimated Cost: $16.1M

Total Estimated Transmission Cost: $30.1M

Projected In-service: 12/31/2020

Project Status: Engineering



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AEP Transmission Zone: Supplemental
Gavin Plant 69kV Bus Upgrade

Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The 69kV CB's BJ, BK, and BH at Gavin are all oil breakers without oil containment. Oil 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. These breakers are also models that are worthy of replacement due to their reliability, and lack of spare part availability. Meigs CB-BJ is 1 of 33 remaining CG-48-72.5-20-1200 circuit breakers remaining on AEP's system, and CB-BK/CB-BH are 2 of 45 remaining FK-72.5-27000-10 circuit breakers remaining on the system. Breaker BJ and BH both have exceeded their manufacturers recommended fault operations (28 and 18 respectively).

Customer Service:

Gavin is the largest coal power plant in Ohio, with 2.64 GW Nameplate capacity. The two units' sources of operating power for start up and coal handling are the 138-69 kV Gavin Transformers. The loss of either of the 138-69kV transformers will prevent continuous operation of one of the 1.3GW units.

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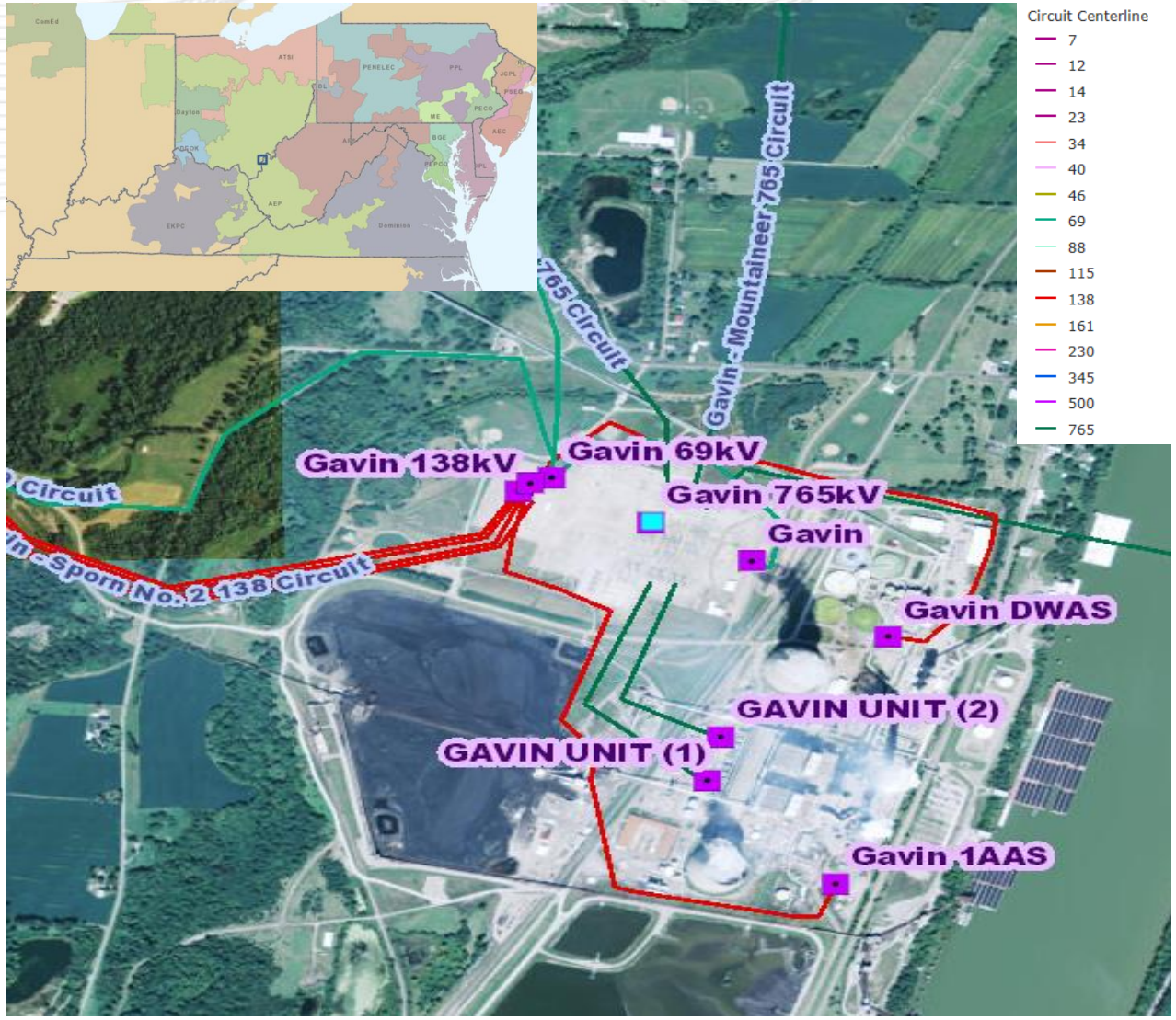

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AEP Transmission Zone: Supplemental Gavin Plant 69kV Bus Upgrade

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Selected Solution

Rebuild the existing 69kV yard as a 6-CB ring bus station, using 2000A, 40kA breakers. The Plant's existing auxiliary power source, the 138-69 kV transformer #2, will terminate into the ring along with the local service 138-69kV transformer #1. Add 1 new CB (138 kV) at the high side of the transformer #1. The station's auxiliary power will then be supplied from the ring. Associated PCE upgrades (**S1618.1**)

Estimated Cost: $9.2M

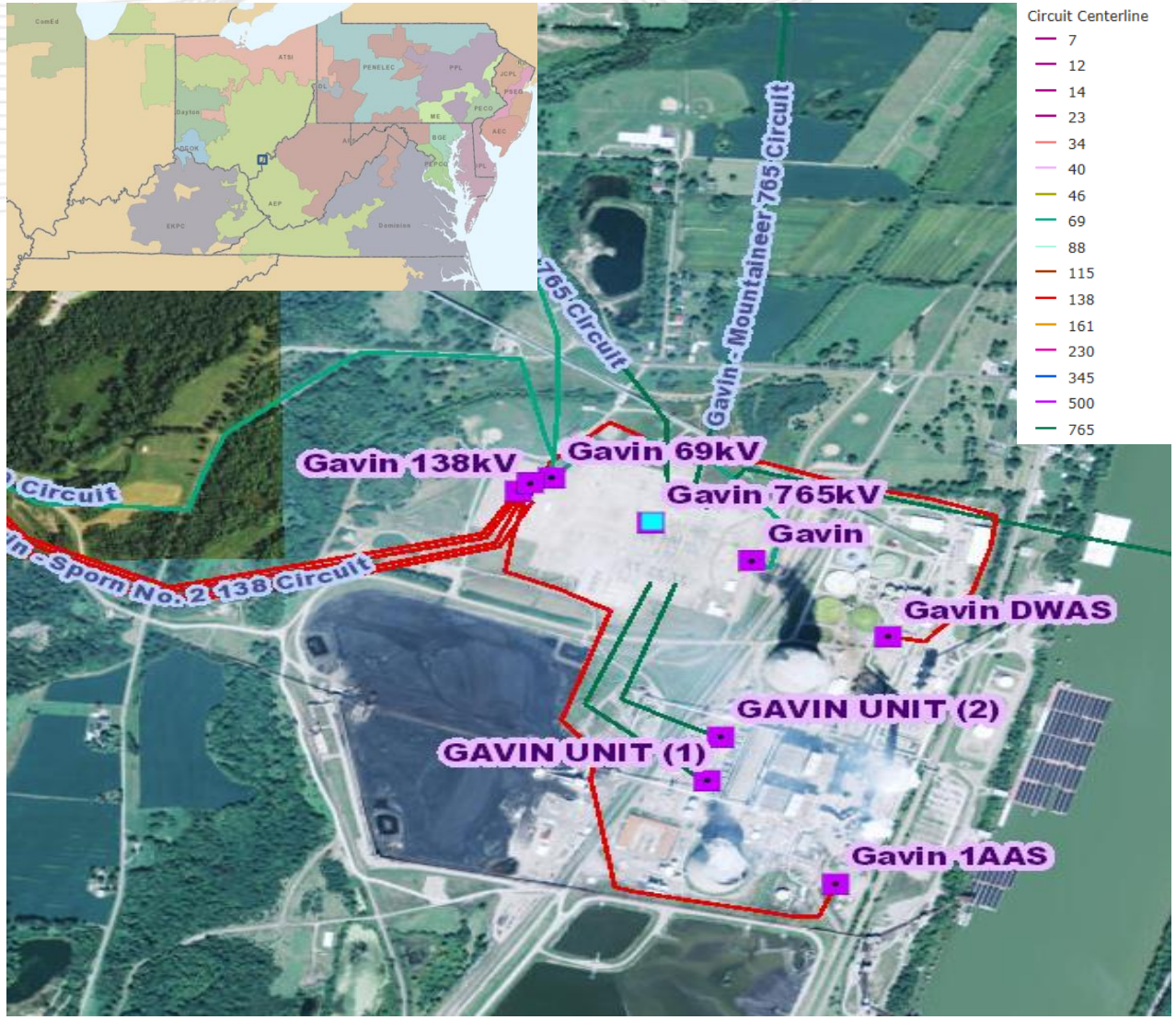
Modify existing line exits out of Gavin station. (**S1618.2**)

Estimated Cost: $0.3M

Total Estimated Transmission Cost: $9.5M

Projected In-service: 06/01/2019

Project Status: Scoping



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AEP Transmission Zone: Supplemental North Canton 69/12kV Station Upgrades

Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The North Canton 69-12kV distribution transformer failed. 69kV breakers E & G are oil-filled breakers made in 1963 (CF-48 model). The 69kV CB's E and G at North Canton are oil breakers without oil containment. Oil 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. These breakers are also models that that are worthy of replacement due to their past reliability, and lack of spare part availability. These breakers have exceeded the designed number of full fault operations (10) with 12 and 26 fault operations respectively.

The distribution XFMR was made in 1968 and failed in 2017 (since that time load has been transferred to adjacent distribution stations where possible, or by using a mobile sub during peak periods).

The 69kV circuit protection uses electromechanical relays and pilot wire, which is more prone to misoperations and has issues in finding repair parts. The 69kV protection will be upgraded to microprocessor relays and fiber-optic communications. The 69kV bus protection currently utilizes an older IAC electromechanical scheme, which needs upgraded to modern bus-differential protection. The RTU is also of an obsolete vintage and needs to be replaced.

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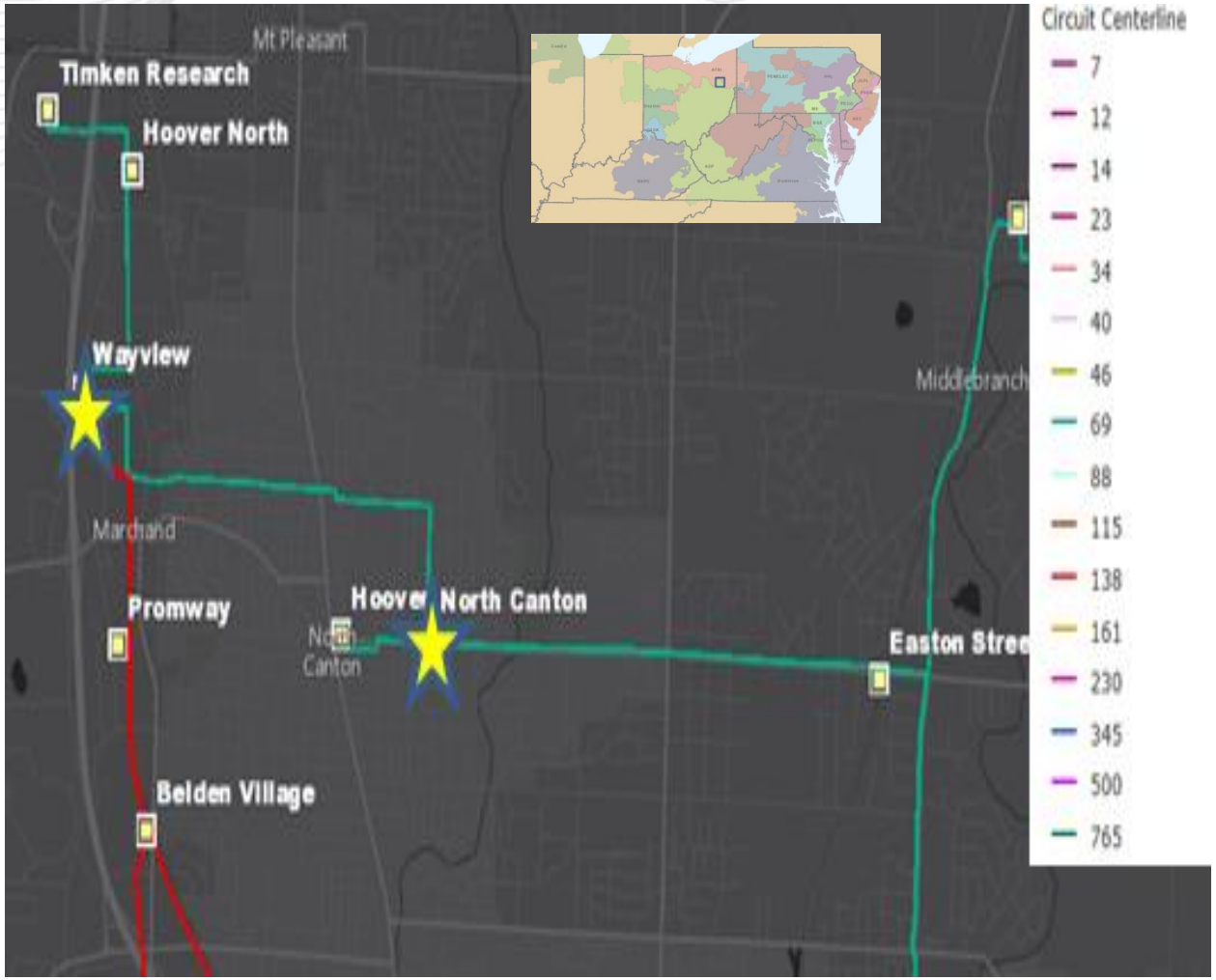

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AEP Transmission Zone: Supplemental
North Canton 69/12kV Station Upgrades

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Operational Flexibility and Efficiency

Currently the North Canton-Hoover 69kV circuit is tapped directly to the North Canton 69kV bus, without a fault-interrupting device. As a result, a fault on the 69kV T-Line, or at the high-side of the Hoover customer's station would take out the entire North Canton station, including the substantial amount of distribution load (21 MVA peak, 5200 customers). In addition, the failed distribution transformer at North Canton only had a high-side MOAB switch, which required tripping the entire 69kV bus to remove XFMR faults, plus outaged the Hoover customer. A 69kV circuit switcher will be installed to protect the XFMR and properly isolate faults.

Currently, there are 3 separate zones of protection lumped together: Hoover 69kV circuit, N. Canton 69-12kV XFMR, N. Canton 69KV bus. Adding the 3rd 69kV breaker, plus the XFMR circuit switcher will greatly improve reliability for customers in the area.

To facilitate the 69kV & 12kV improvements at the small urban station, the 69kV cap bank needs to be removed. This system change was studied in conjunction with AEP Operations, and no adverse effects were found.

The pilot wire communications scheme between North Canton and Wayview 69kV will be replaced with a modern fiber-optic communications channel, increasing the resiliency of the sub-transmission grid.

Customer Service:

By installing the 3rd 69kV breaker and 69kV circuit switcher, reliability will be improved for the Hoover 69kV customer and North Canton AEP Ohio distribution customers. Today, a fault for either customer will interrupt the other. This risk will be eliminated due to this project.

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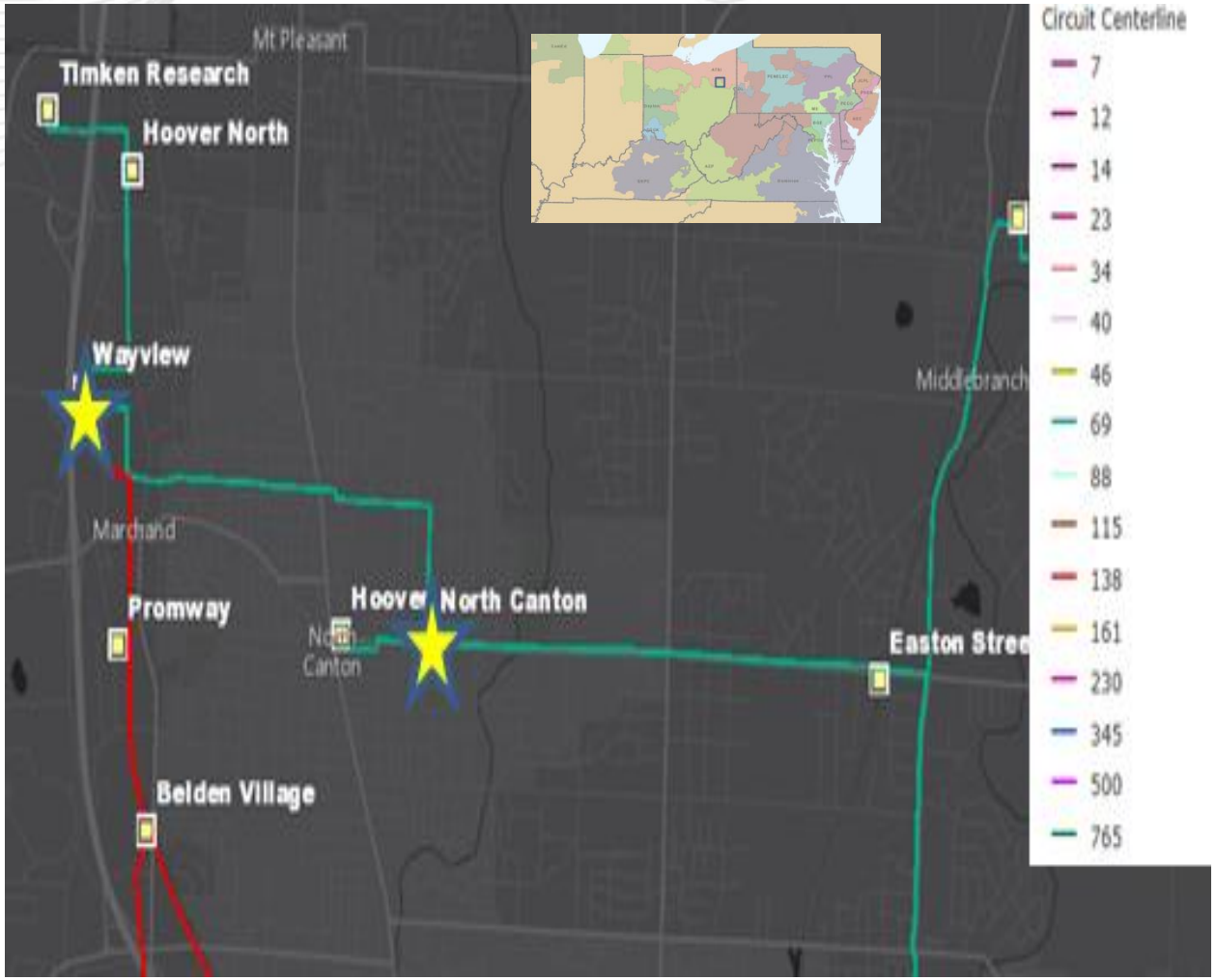

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AEP Transmission Zone: Supplemental North Canton 69/12kV Station Upgrades

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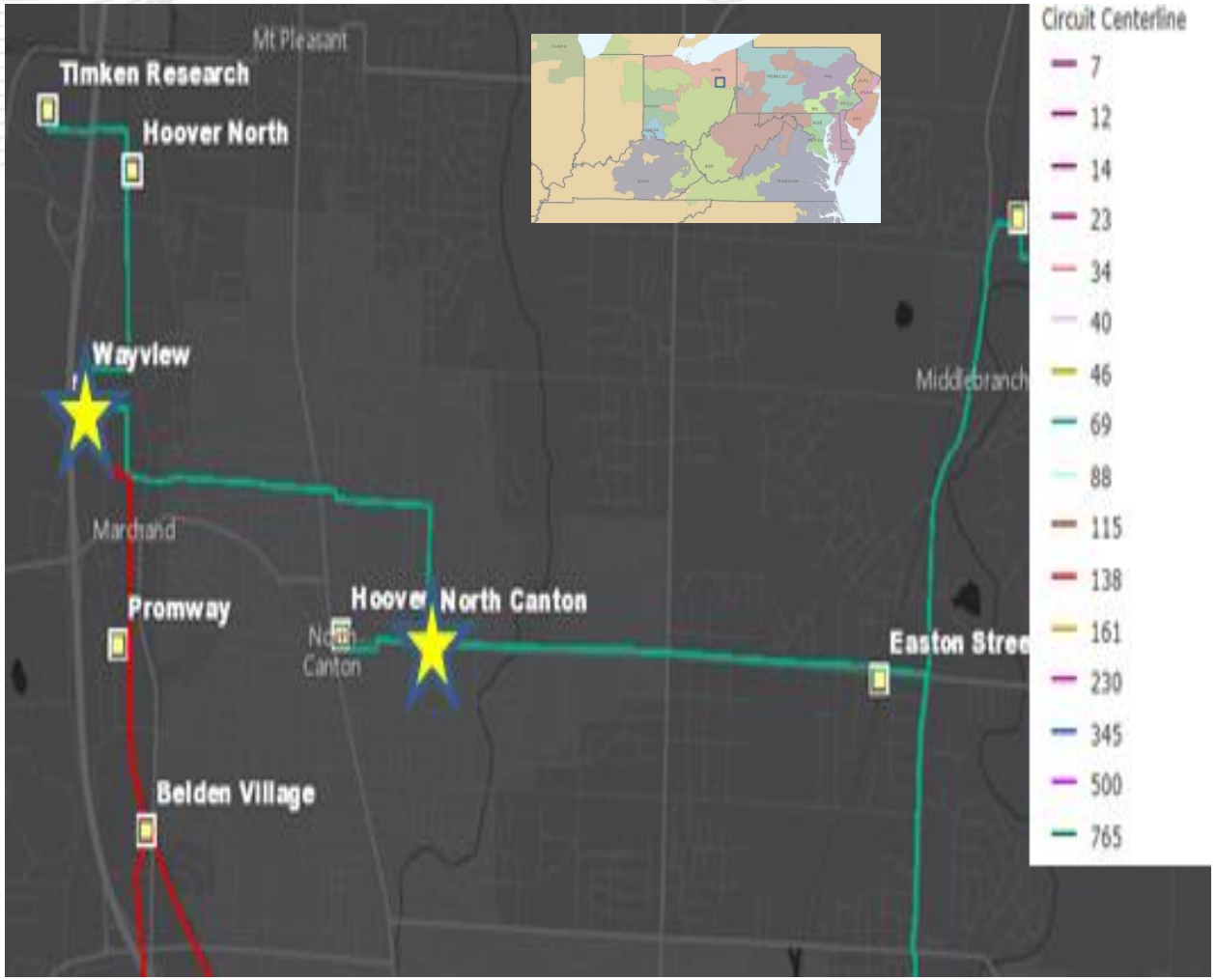
Selected Solution

At North Canton station, rebuild 69kV bay, install 3- 69kV gas breakers, remove 69kV cap bank. Replace failed 69-12kV distribution transformer and other associated distribution work. Upgrade the Wayview 69kV remote-end circuit protection to coordinate with North Canton. (**S1619**)

Total Estimated Transmission Cost : $3.2M

Projected In-service: 12/01/2018

Project Status: Engineering



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AEP Transmission Zone: Supplemental
Northeast Canton Upgrades

Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The four 69kV breakers at NE Canton station are oil-filled units between 43-57 years old with between 16 and 38 fault operations on them. The transformer is a 3-winding model (138-69-12kV), with distribution load served off of the tertiary. The XFMR is 55 years old and is in poor condition. NE Canton has wood station support structures on the 138kV & 69kV, which are deteriorating. The control house consists of 70 electromechanical relays, 4 static relays, and zero modern microprocessor relays. Electromechanical and static relays are more prone to failure and a challenge to find replacement parts.

West Canton 138kV breaker C is 31 years old and a rare model, making repairs & maintenance difficult.

Oakwood 69kV breaker is oil-filled (55 years old) and in poor condition, and relays are electromechanical.

Diamond Street 69kV breaker is oil-filled (55 years old) and in poor condition and relays are obsolete. A leased-line pilot wire communications scheme is used for area system protection, which is obsolete and prone to service interruptions in the coming years.

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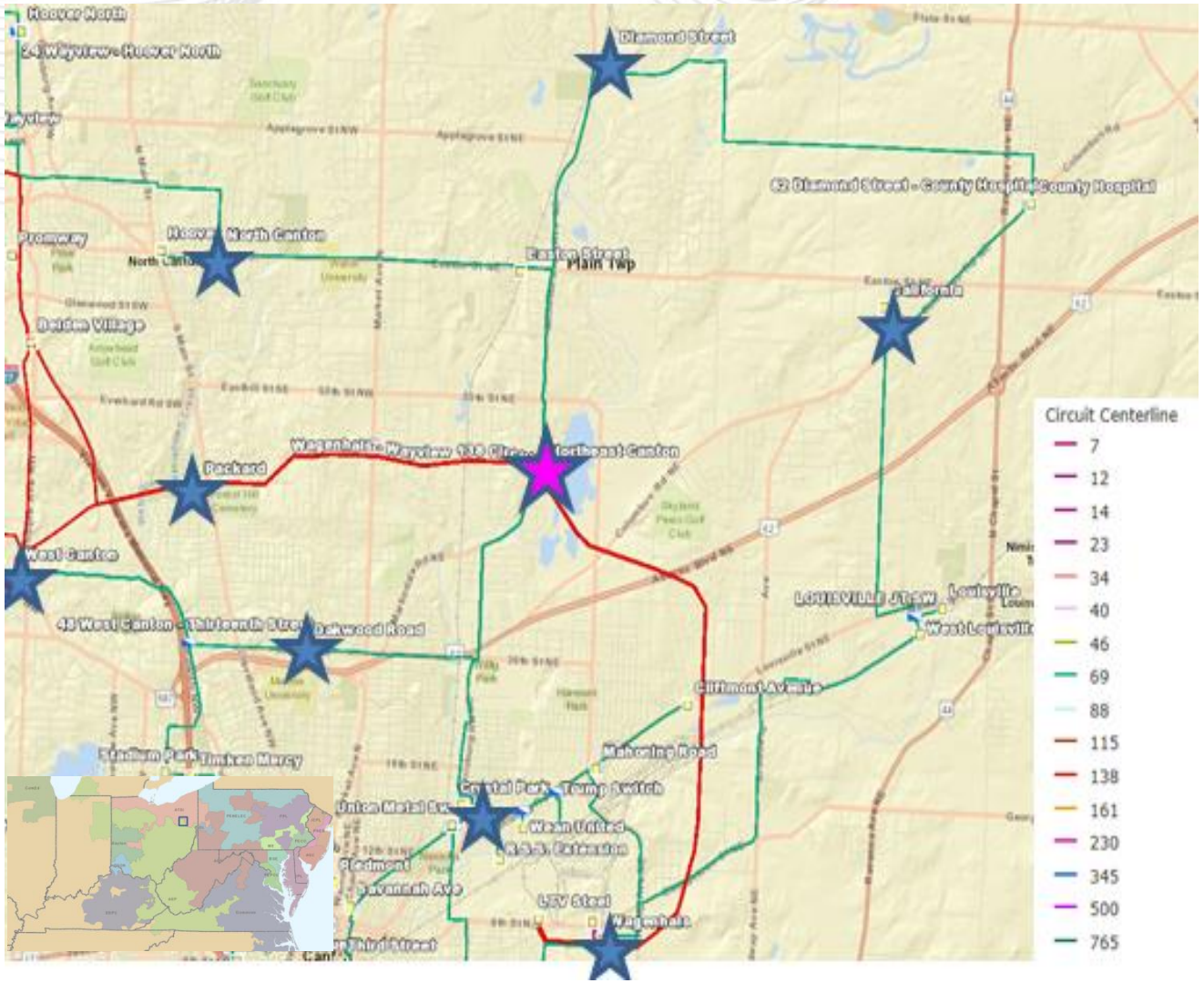

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AEP Transmission Zone: Supplemental Northeast Canton Upgrades

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Operational Flexibility and Efficiency

The Wagenhals-NE Canton-West Canton 138kV circuit is a 3-terminal line, due to the 138-69kV source at NE Canton; this is a protection challenge and places customer load at risk. The NE Canton XMFR doesn't have a high-side breaker (only motor-operated switch and remote-end tripping scheme); this places the XFMR at a higher risk of fault damage, and unnecessarily outages customers at NE Canton & Packard stations. The NE Canton XFMR has distribution load served off of the 12kV tertiary winding, with no isolation device, which is a reliability risk to the transmission system. The 138kV line switches at Packard will be converted to motor-operated switch with auto-sectionalizing, due to the large load center served there, and meeting AEP's MPOI calculation threshold. The 69kV breaker and MOAB switch installations adhere to AEP's MPOI/FOI guidelines.

Operational Flexibility:

The Telecom fiber network will be connected by the hub at NE Canton station; this will upgrade the communications network utilized by EMS/SCADA and protective relaying. The outdated pilot wire system will be retired. In addition, today NE Canton has very little SCADA functionality, which is inadequate for such a critical station.

Customer Service:

This project will improve service reliability for many AEP Ohio distribution customers in the area, as well as the transmission customer served from Diamond Street station.

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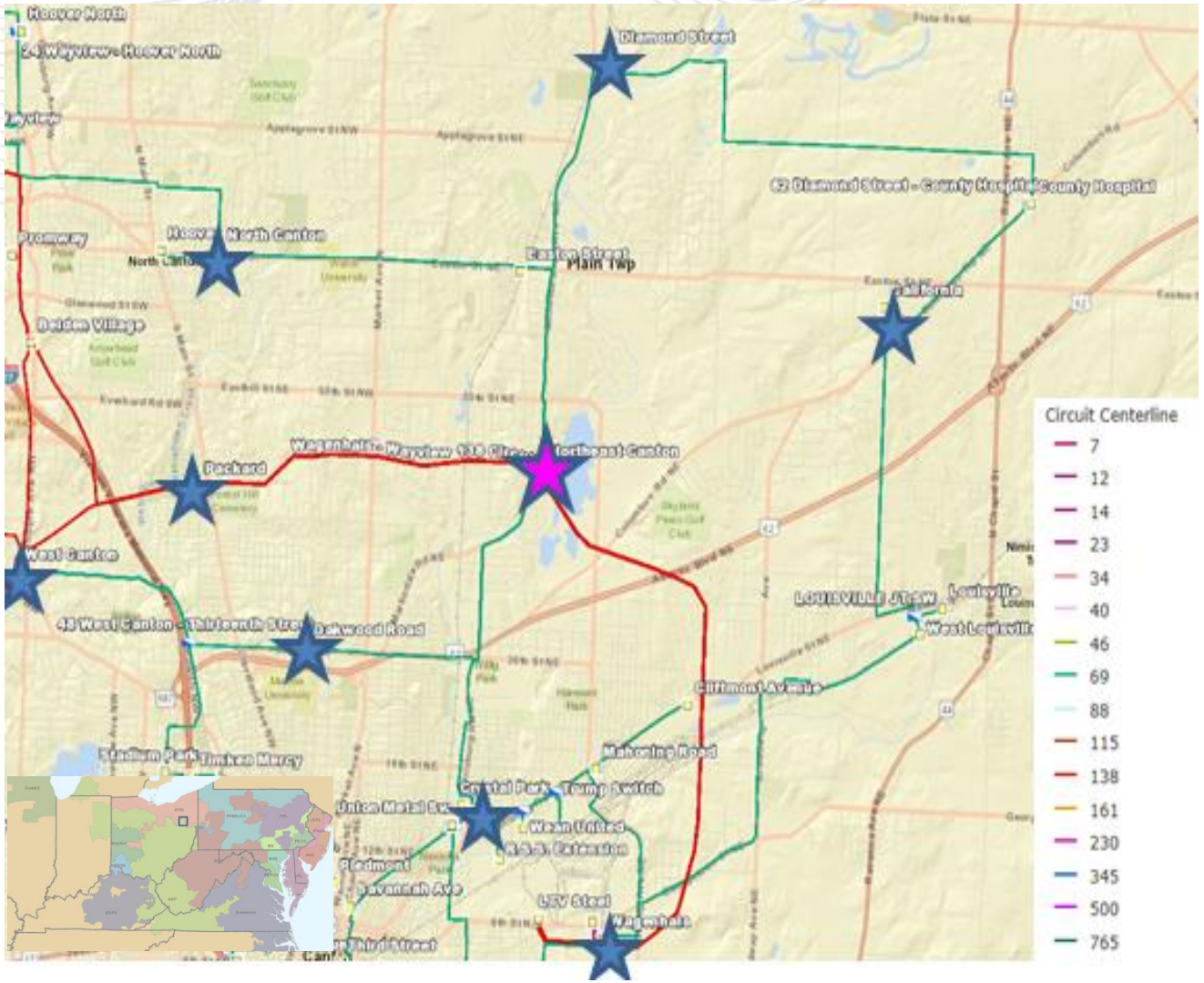

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Selected Solution:

Rebuild the NE Canton 138/69/12kV station on the existing property. Install a 138kV 4-breaker ring bus, 138-12kV distribution transformer, 138-69kV, 90 MVA transformer, 69kV 6-breaker ring bus, 69kV cap bank (14 MVAR). (**S1620.1**)

Estimated Transmission Cost: $9.4M

At West Canton 138kV station, replace 138kV breaker, disconnects & relays.

Estimated Transmission Cost: $0.7M (**S1620.2**)

At Wagenhals 138kV station, change relay settings to coordinate with NE Canton. **Estimated Transmission Cost:** $0M (**S1620.3**)

At Packard 138kV station, convert manual line switches (2) to auto-sectionalizing MOAB's. **Estimated Transmission Cost:** $0.2M (**S1620.4**)

At Stanley Court 69, upgrade relays to coordinate with NE Canton (fiber-based).

Estimated Transmission Cost: $0.2M (**S1620.5**)

At Oakwood Rd 69KV station, replace 69kV breaker & relays.

Estimated Transmission Cost: $0.4M (**S1620.6**)

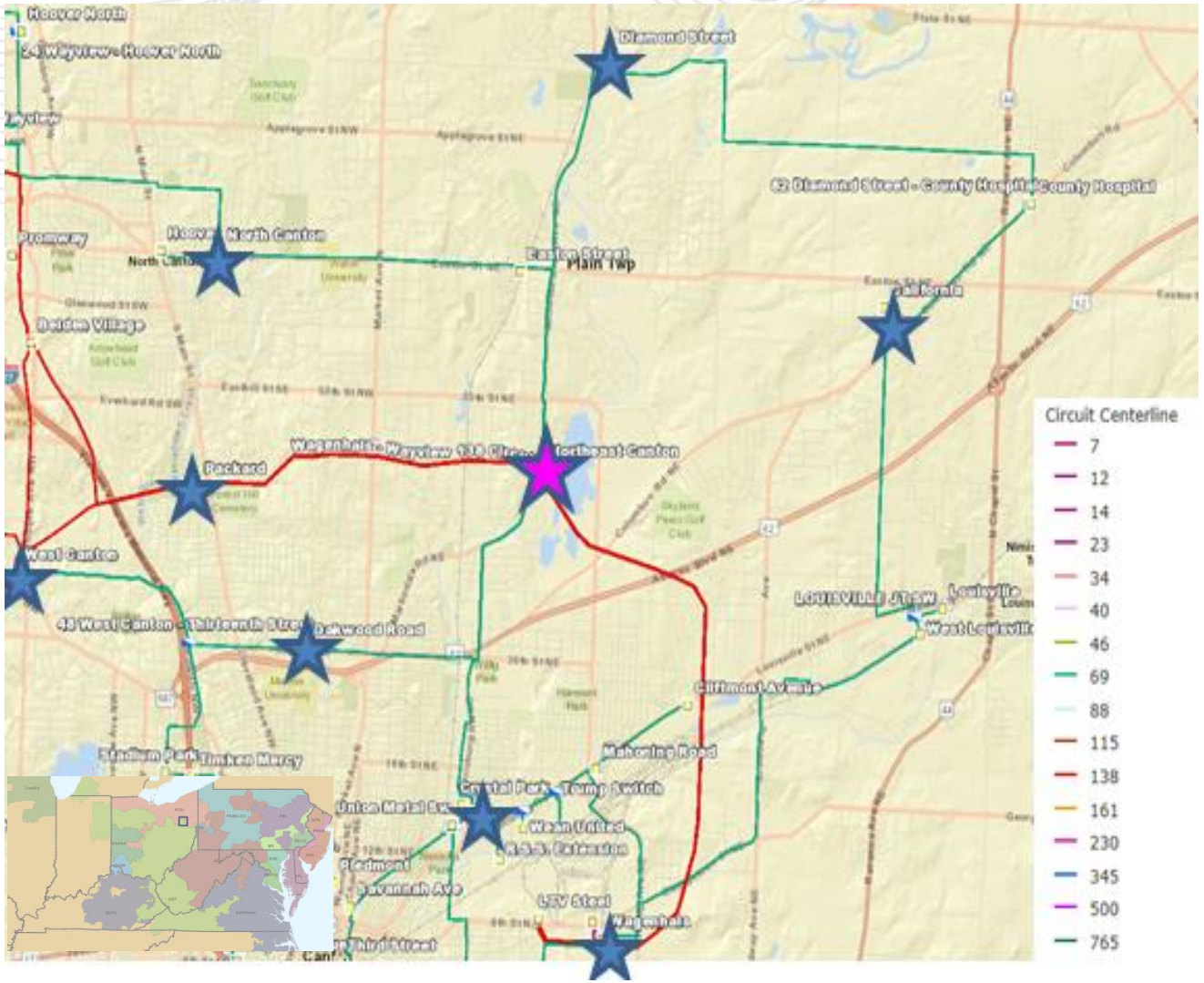
At Diamond St 69KV station, remove 69kV breakers (2) and replace with sectionalizing MOAB's (This change is due to lack of space and poor condition of existing control house, which doesn't permit 2 new gas breakers and modern relays to be installed). **Estimated Transmission Cost:** $0.3M (**S1620.7**)

At California 69kV station, relocate the breakers from Diamond St (2) and install new relays. **Estimated Transmission Cost:** $0.7M (**S1620.8**)

Total Estimated Transmission Cost: $11.9M

Projected In-service: 12/01/2020

Project Status: Scoping



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AEP Transmission Zone: Supplemental
Waverly-Adams-Seaman 138 kV Line Rebuild

Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The 32.8 mile Waverly-Adams-Seaman 138 kV line was built in 1954 with 336 ACSR conductor (150 MVA rating). On the 244 structures on this line, there are 153 open conditions. There have been over 1 Million customer minutes of interruption in a 3-year period. The conditions include: rotten cross-arms, burnt/broken insulators, and loose/broken conductor hardware. The average duration of sustained outage is 2.8 hours.

The majority of the Adams-Seaman 69kV line was built in 1939 with 336 ACSR (75 MVA rating). The line extends 11.9 miles radially from Seaman to serve Sardinia. On the line's 440 structures, there are 401 open conditions. Of the 401 conditions between Adams and Sardinia, approximately 88 conditions are in the Adams-Seaman section (97 structures). There have been 8 momentary and 5 sustained outages on this circuit over the last 3 years. The 69kV line is needed to serve Adams Coop's 69-12kV Lawshe load, and to provide a back up source for Seaman and Adams.

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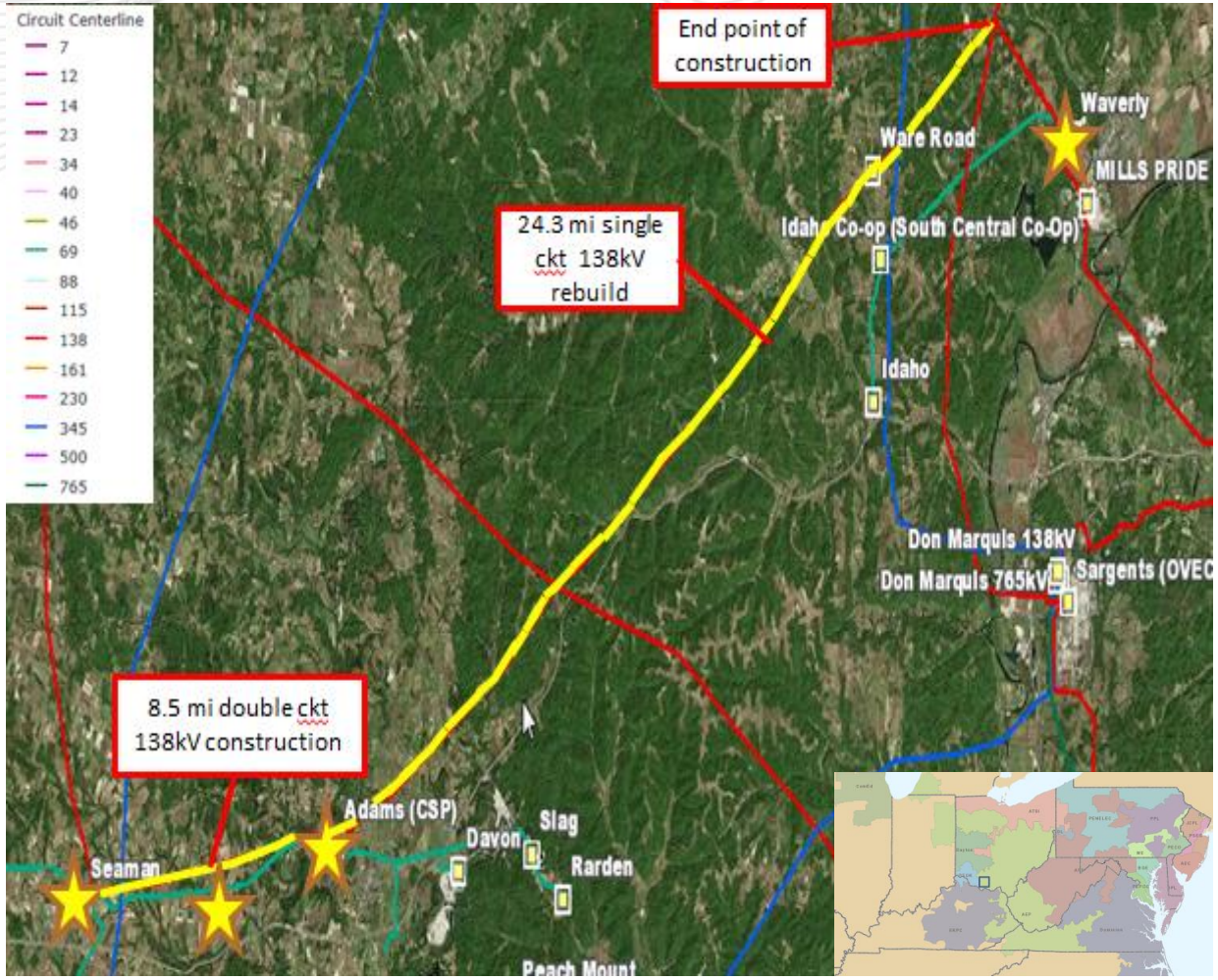

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AEP Transmission Zone: Supplemental
Waverly-Adams-Seaman 138 kV Line Rebuild

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Selected Solution

Rebuild the 138kV line from Waverly to Adams utilizing 1033.5 ACSR (296 MVA). The rebuild will begin at structure 22 west of Waverly where the line changes to the Waverly-Ross line and continue 24.3 miles to Adams Substation. The remaining 3.1-mile section from structure 22 to Waverly is newer double ckt construction and was not identified for renewal at this time. Remove old line after rebuild complete. (**S1621.1**)

Estimated Cost: $42.0M

Rebuild two independent lines, less than 1/2 mile apart between Seaman and Adams, one 138kV and one 69kV, as a double circuit for approximately 8.5 miles using 1033.5 ACSR. Remove old lines after rebuild complete. There will also need to be a short single ckt tap for Lawshe 69kV. (**S1621.2**)

Estimated Cost: $23.0M

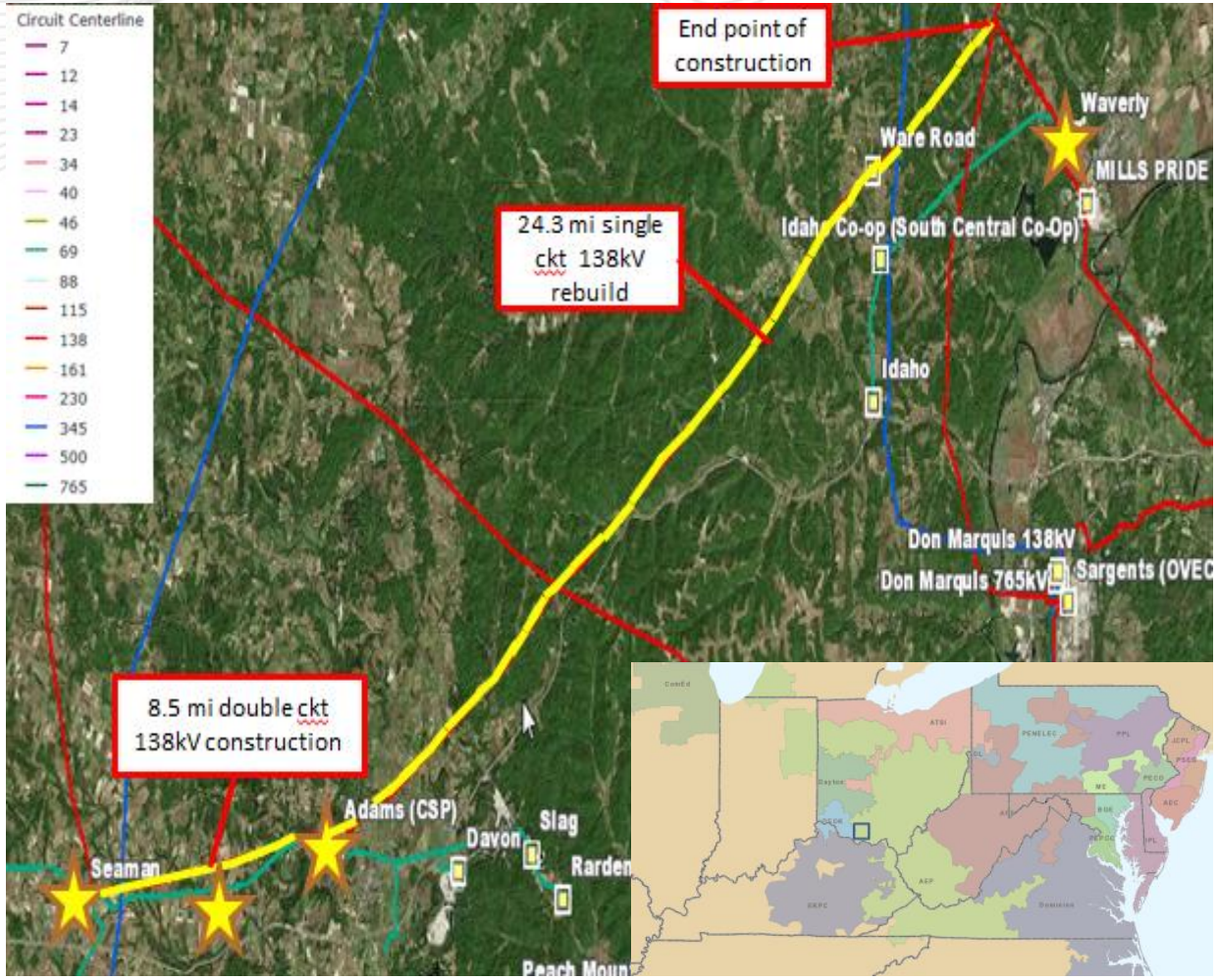
A three-way POP switch structure will be constructed outside Lawshe 69kV substation. (**S1621.3**)

Estimated Cost: $1.0M

Total Estimated Transmission Cost: $66.0M

Projected In-service: 06/01/2021

Project Status: Engineering



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AEP Transmission Zone: Supplemental
Twin Branch – Benton Harbor 138kV Line Rebuild

Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The Twin Branch-Benton Harbor 138kV line asset is split up in two assets (IN & MI) and consists of different circuit sections: Benton Harbor-Riverside, Riverside-Kenzie Creek, Hickory Creek-Kenzie Creek, Kenzie Creek-Sauk Trail and Sauk Trail-Twin Branch. The original Twin Branch-Benton Harbor line assets were placed in service in 1929. The line assets combined have a total of 489 structures of which 65% are still from 1929. In addition, roughly 77% of the 397 ACSR conductor is still from 1929. The line assets' obsolete design included installation of armor grip suspension assemblies that were installed to extend the life of the conductors originally. Over the life of the line, through maintenance and remediation work, crews have found broken conductor strands under the armor grip suspensions due to long term exposure to Aeolian vibration. Crews have also found spots where the steel core of the conductor has been significantly corroded at the low point of sag. There are numerous issues with insulators along the line as evidenced by the 97 reported conditions associated with insulators and insulator suspensions. Many of these insulators have lost their outer glaze, allowing contaminant buildup, compromised electrical integrity and growing risk of electrical failure. Also, original easement language does not include ability to control building encroachments.

The Hickory Creek-Kenzie Creek has experienced 3 sustained outages over the last three years, resulting in 775,945 Customer Minutes of Interruption.

The Benton Harbor extension is 1969 vintage and is currently subject to 64 open conditions across its 34 structures including broken conductor strands; burnt insulator; and burnt, chipped and contaminated insulator suspension.

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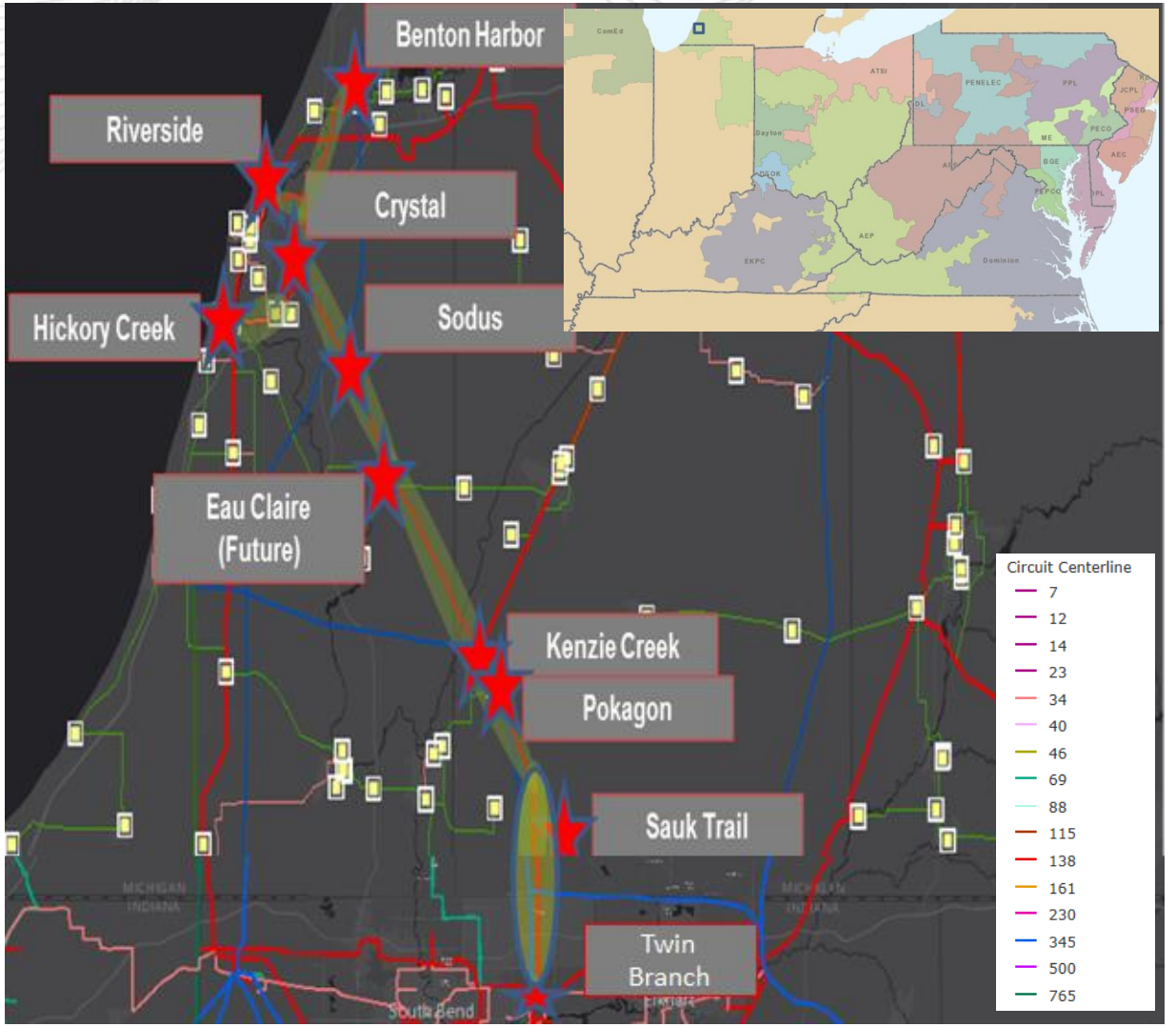

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AEP Transmission Zone: Supplemental
Twin Branch – Benton Harbor 138kV Line Rebuild

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The Hickory Creek extension is 1951 vintage and is currently subject to 10 open conditions across its 27 structures including burnt insulator; and chipped and broken insulator suspension. In addition to this, the Hickory Creek extension currently has 3 river crossings and has a location where the line is in danger of being washed away by the St Joseph River.

The Twin Branch – Benton Harbor is 1929 vintage and is currently subject to 106 open A conditions across its 218 structures including broken conductor; burnt insulator; broken insulator suspension and loose shield wire hardware.

<u>Operational Flexibility and Efficiency:</u>

The Twin Branch-Benton Harbor double circuit 138 kV line is one of three critical 138 kV sources into Michigan. The existing conductor is currently the most limiting element in this corridor and moving to a higher capacity conductor will match the capability of other area facilities and provide the necessary system strength and prepare the grid for future load or generation changes.

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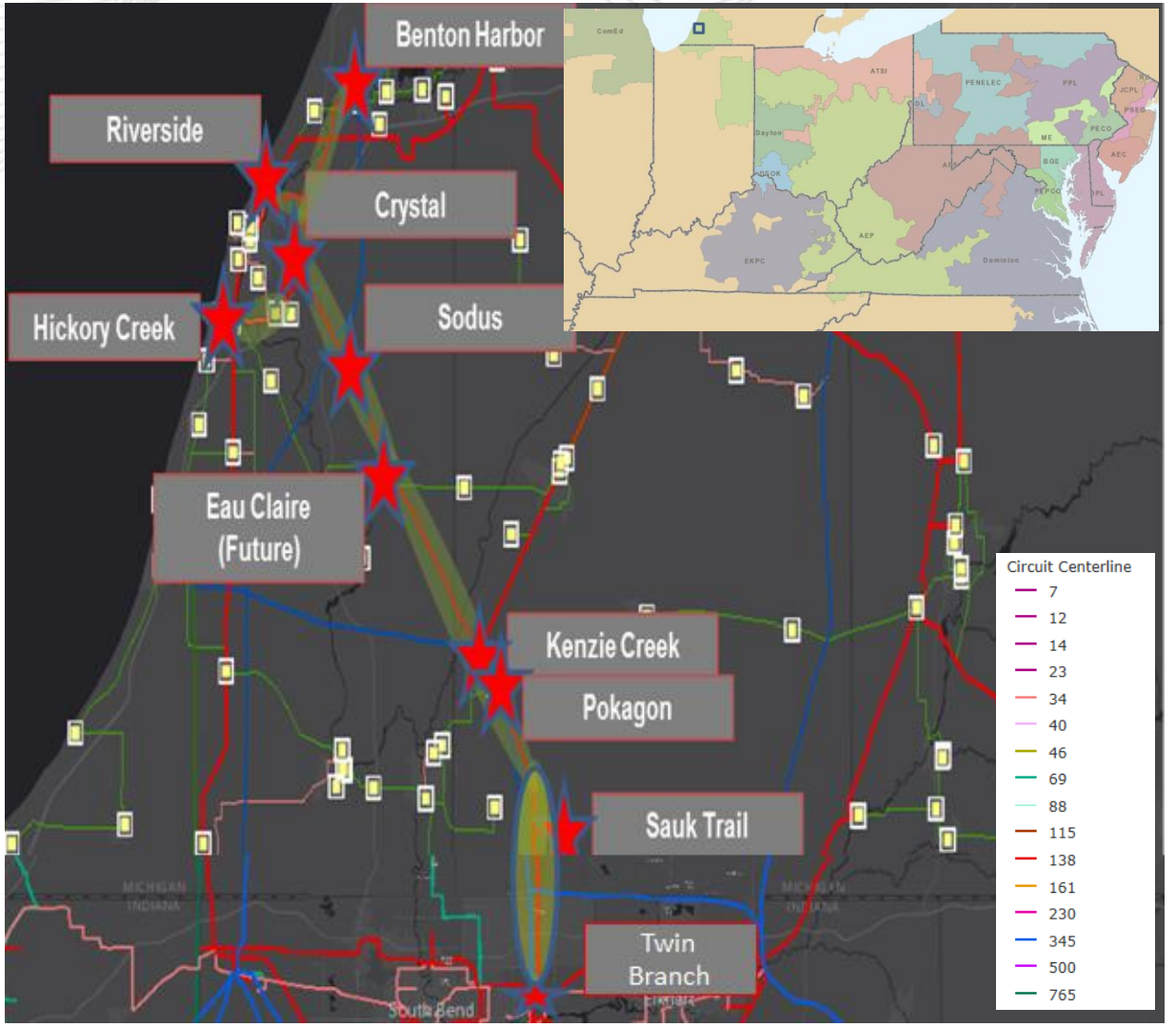

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AEP Transmission Zone: Supplemental
Twin Branch – Benton Harbor 138kV Line Rebuild

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Selected Solution

Rebuild the roughly 43 miles from the Twin Branch to Riverside station with double circuit 138kV 1033.5 ACSR (296 MVA rating). (**S1622.1**)

Estimated Cost: $94.3M

Rebuild the 6 mile double circuit Benton Harbor 138kV extension with double circuit 138kV 1033.5 ACSR. (**S1622.2**)

Estimated Cost: $16.9M

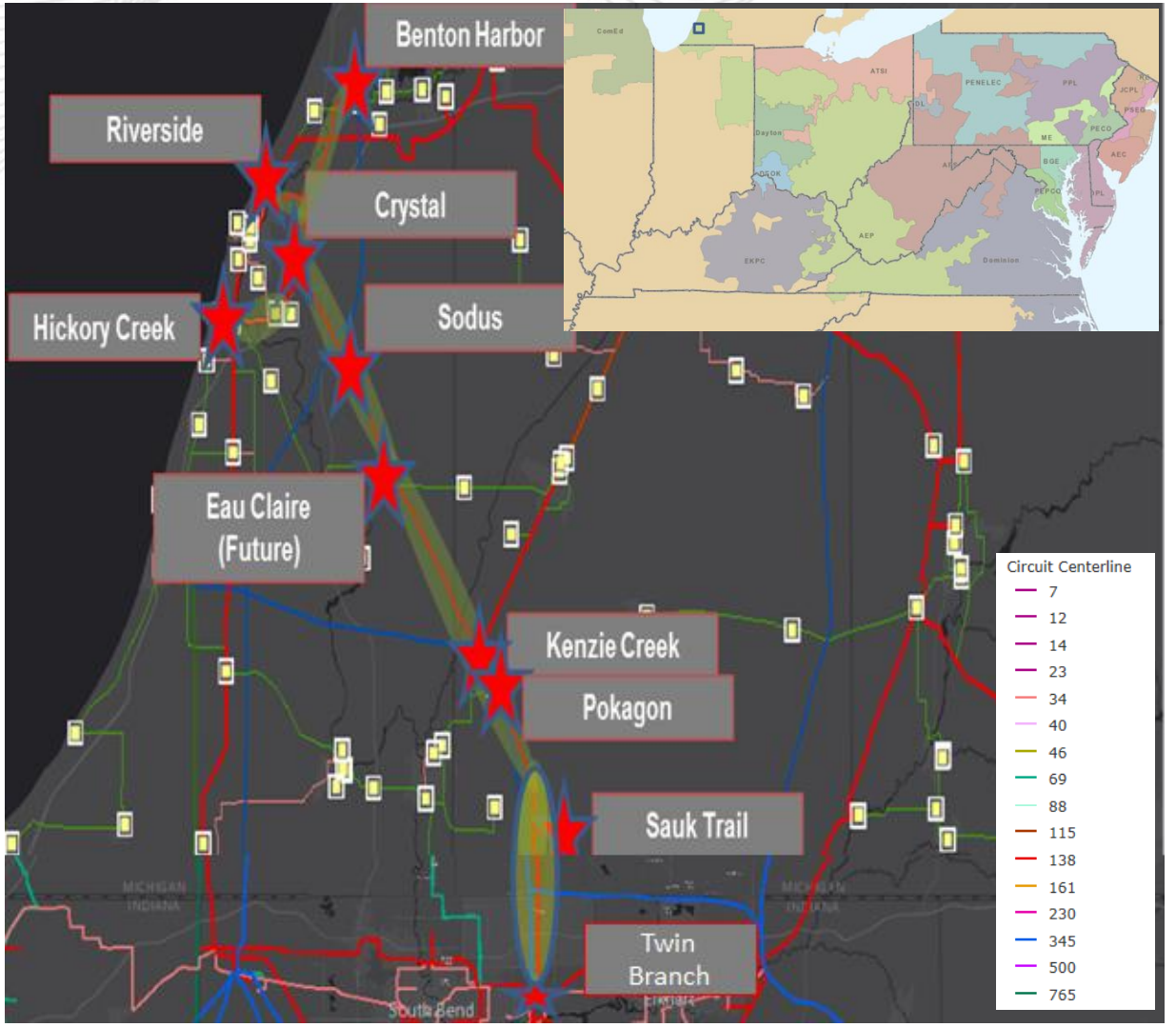
Rebuild the 5 mile double circuit Hickory Creek 138kV Extension with double circuit 138kV 1033.5 ACSR. (**S1622.3**)

Estimated Cost: $16.5M

Total Estimated Transmission Cost: $127.7M

Projected In-service: 12/01/2021

Project Status: Scoping



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AEP Transmission Zone: Supplemental
West Bellaire-Moundsville 69kV Circuit Rebuild

Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The 20-mile 69kV Moundsville-West Bellaire circuit has a 3-year CMI total of 6.76 million minutes of customer interruption. Very lengthy outages have resulted from degraded T-Line structures, inoperable sectionalizing equipment, and rugged terrain. 91% of the outage duration and 75% of the outage frequency was due to T-Line equipment problems.

The line has 141 open conditions. Examples include broken poles, hazard trees, woodpecker damage, pole rot, and broken insulators.

The majority of circuit (9 miles) was built in 1943 with 3/0 & 4/0 copper conductor and copperweld ground wire (runs north-south, 46 MVA rating)). The Glencoe-Bellaire 69kV line (4.4 miles) was built in 1913, but reconductored in 1970 with 556 ACSR conductor (runs east-west between West Bellaire and Bellaire, 100 MVA rating). The Shadyside and Monroe Street 69kV radial T-Line taps were built in 1944 & 1960, with 4/0 or 2/0 ACSR conductor (40 MVA rating) and are in very poor condition.

Operational Flexibility and Efficiency

West Monroe Street Switch (MOAB) and West Shadyside Switch are inoperable (since 2010), so are now hard taps. Monroe Street and Shadyside distribution stations are served off long radial taps through rugged terrain; their distribution load is non-recoverable (cannot be picked up by other stations). Per AEP's MPOI/FOI calculations, the data exceeds the guideline for installing MOAB switches. However, due to the number of taps and existing MOAB at Bellaire station, more than 3 MOAB's cannot be installed in series (due to protection/timing complications); therefore two breakers will be installed at Monroe Street to sectionalize this 20-mile circuit.

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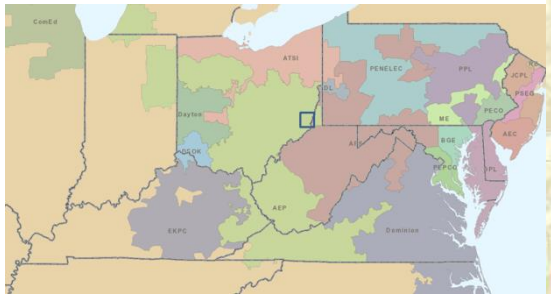

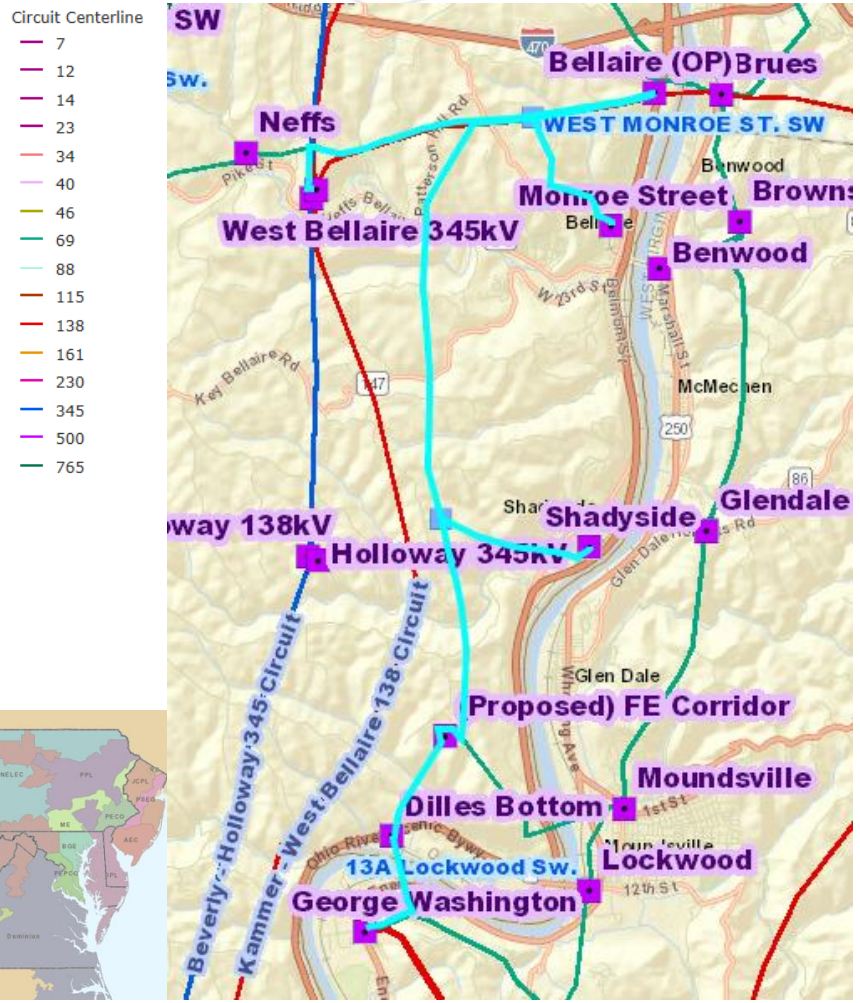

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AEP Transmission Zone: Supplemental
West Bellaire-Moundsville 69kV Circuit Rebuild

Continued from previous slide…

The 69kV MOAB/ground-switch transformer protection scheme at Monroe Street will be replaced with a circuit switcher & relays. Note that at the Shadyside distribution station there is not sufficient space to install a 69kV circuit switcher, and the transformer is too large to permit fusing.

Customer Service:

The circuit has suffered from poor reliability historically, which will be improved through the T-Line rebuild and station upgrades. The circuit currently serves 6,100 AEP Ohio distribution customers, and 24 MW of peak load.

Selected Solution

Rebuild the West Bellaire-Moundsville 69kV circuit; utilize 795 ACSR conductor (128 MVA rating). *Note that the section from West Bellaire east to structure #31 will not be rebuilt, due to adequate condition (2.4 miles). The extension into Monroe Street will be rebuilt as a double-circuit loop. The extension into Shadyside will be mostly rebuilt as a double-circuit loop (except for final 0.5 mile, due to route constraints). (**S1623.1**)

Estimated Cost: $39.7M

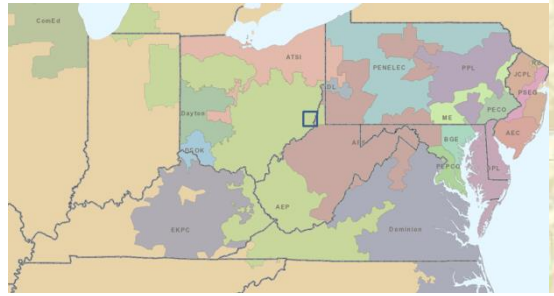
Convert Monroe Street to in-and-out with 2- 69kV breakers; replace 12kV breakers & regulators; install 69kV circuit switcher. Remove inoperable line switches at West Monroe Street and West Shadyside. Install new 3-way MOAB switch with sectionalizing and SCADA at Shadyside. (**S1623.2**)

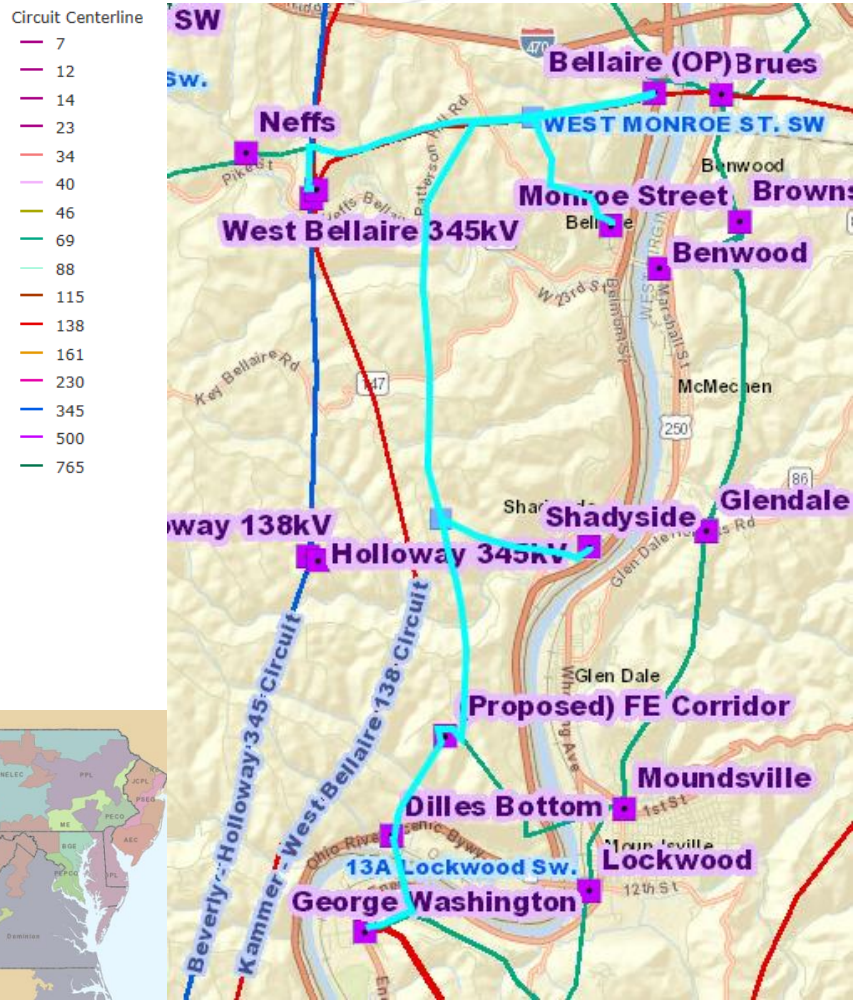
Estimated Cost: $2.6M

Total Estimated Transmission Cost: $42.3M

Projected In-service: 12/01/2022

Project Status: Scoping





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AEP Transmission Zone: Supplemental Whitaker 69/34.5/12kV Station Rebuild

Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The 34.5/12kV Transformer #2 at Whitaker Station, manufactured in 1973, is showing signs of deterioration. The unit has extremely high values of combustible gasses and carbon dioxide. The unit has experienced overheating temperature faults. Also, the interfacial tension is extremely low proving that the oil is in poor condition. The LTC DGA values are high for Ethylene and the LTC compartment shows visible leaks. Drivers for replacement of the transformer include 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.).

The 12kV Circuit Breakers A and B manufactured in 1968 are oil filled breakers without oil containments. 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 221 fault operations and breaker B has had 84 fault operations. The manufacturer recommendation is 10 for this type of breaker. The Breakers have numerous issues related to age, wear, PCB content, maintenance issues and no repair part availability.

Adding the Bus Tie Circuit breaker will keep the distribution customer energized when we lose one of the two lines serving this station.

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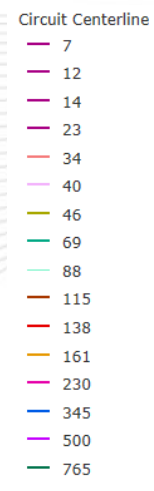

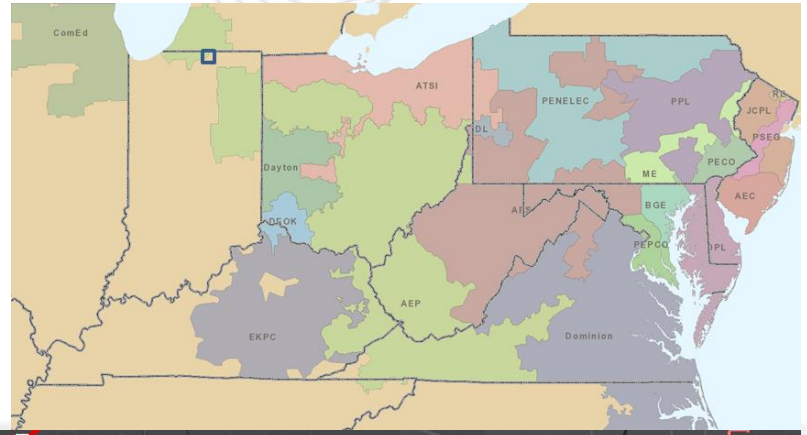

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AEP Transmission Zone: Supplemental Whitaker 69/34.5/12kV Station Rebuild

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Selected Solution

At Whitaker Station, install one 69kV, 40 kA, 3000A Bus Tie Circuit Breaker along with associated distribution work to rebuild the station. (**S1624.1**)

Estimated Cost: $1.2M

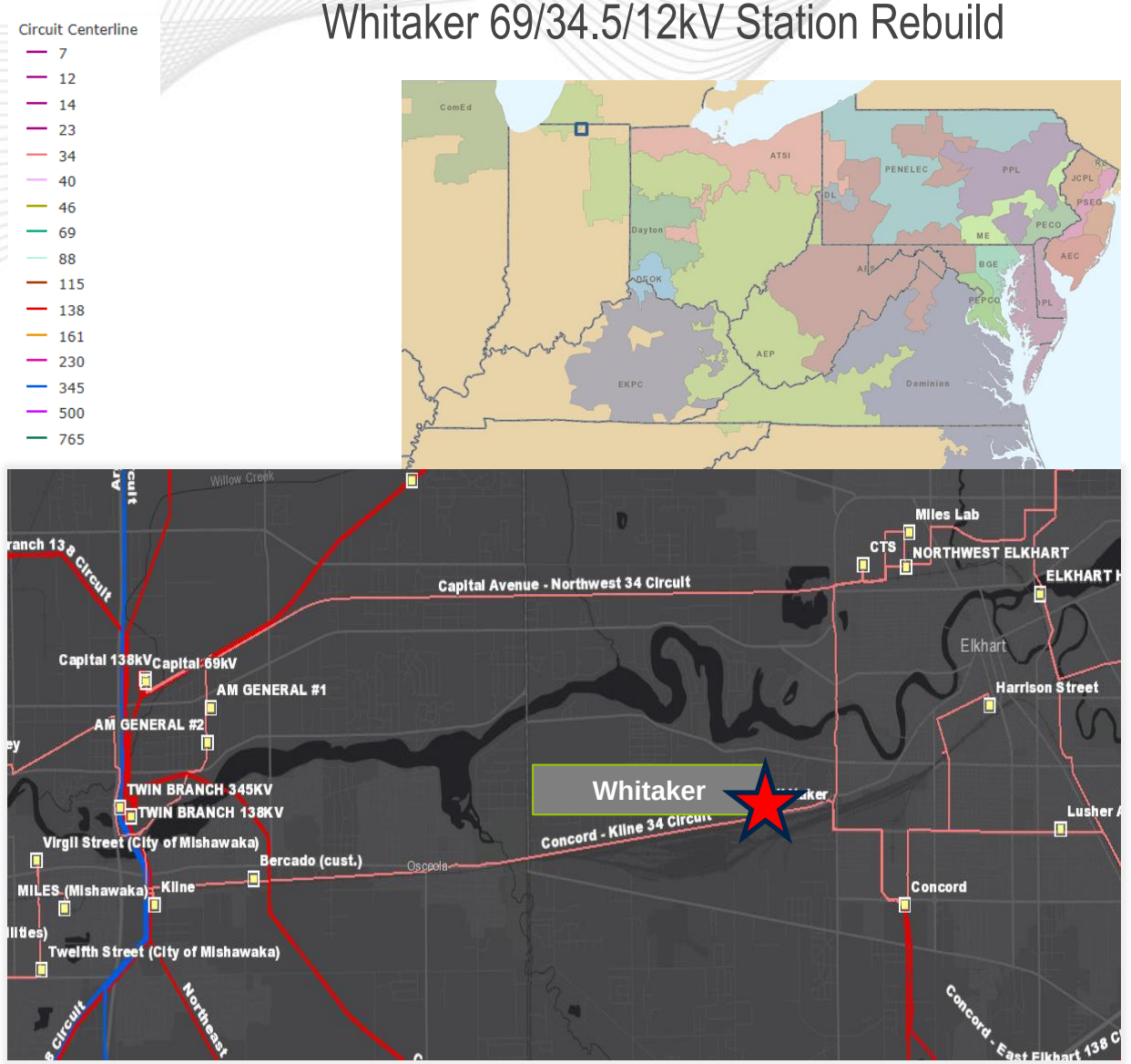
Rebuild Whitaker - Kline 34.5kV for Distribution under-build. (**S1624.2**)

Estimated Cost: $0.5M

Total Estimated Transmission Cost: $1.6M

Projected In-service: 12/01/2018

Project Status: Scoping



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AEP Transmission Zone: Supplemental South Point Bus Reconductor

Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Operational Flexibility and Efficiency

The South Point-Millbrook Park Line was loaded to 96% of the 107 MVA rating as recently as Sept 22, 2017. Low ratings on the 138kV South Point-Millbrook Park and South Point-Apple Grove lines will cause delays in outage scheduling for construction and maintenance to avoid overloads.

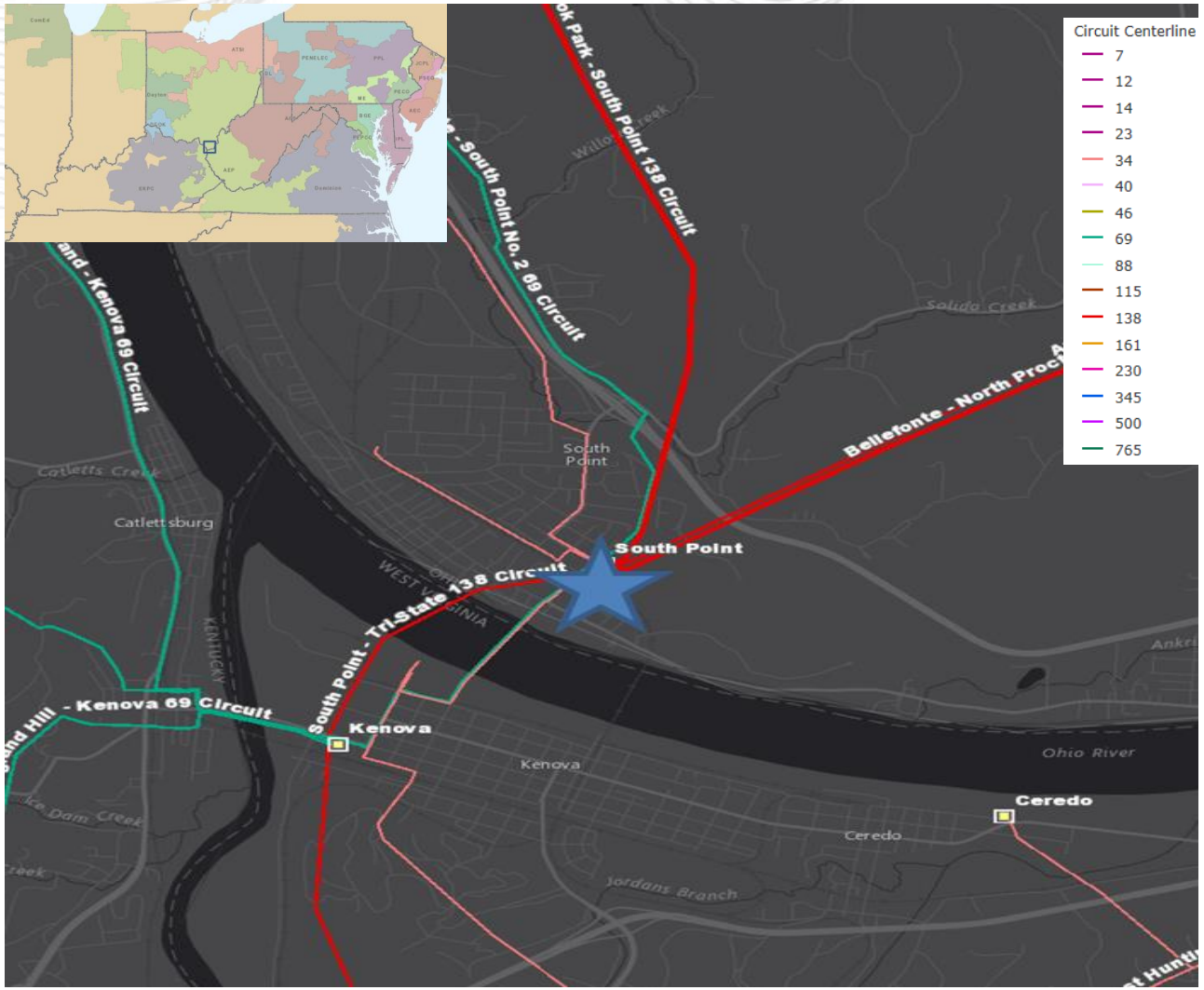
Selected Solution:

Replace 4/0 Copper risers that are the limiting elements on the South Point 138kV transmission lines to Millbrook Park and Apple Grove. Upgrade two section of 300 Cu on the bus ends to match the bus thermal rating. Upgrade the electromechanical relays for the bus diff and capacitor. (**S1660**)

Estimated Cost: $0.5M

In-service Date: 5/1/2018

Project Status: In Service



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Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Customer Service:

The NFL Hall of Fame (HOF) in Canton, Ohio has a major expansion in the works for 2017 through 2020. The Pro Football Hall of Fame Village will be an $800 million mixed-use development, including the museum, expanded stadium, hotels, apartments, and other features. There will be a large amount of new load forecasted, which is above the capacity of the existing Stadium Park 69-12kV distribution transformer. In addition, the HOF needs additional land, which is occupied by AEP's distribution station. AEP will be relocating the station further to the west.

Equipment Material/Condition/Performance/Risk:

West Canton 69kV breaker 'S' is a CF oil breaker made in 1970 (47 years old). It is recommended for replacement, due to age, lack of spare parts, and breaker-failure system impact to other facilities. Since the year 2000, the breaker has experienced 25 fault operations (lifetime count of 45), above the recommended limit of 10. The breaker lacks modern gas & moisture-monitoring capabilities. In general, oil breakers have become increasingly difficult to maintain due to the oil handling and environmental hazards associated with them. The breaker itself is rusting, along with heavy rust on the supporting structure and foundations.

During the time that the 69kV circuit protection is being upgraded, it makes sense to also replace this breaker, so as to reduce engineering/construction costs and utilize outage-windows, by doing it all in one project.

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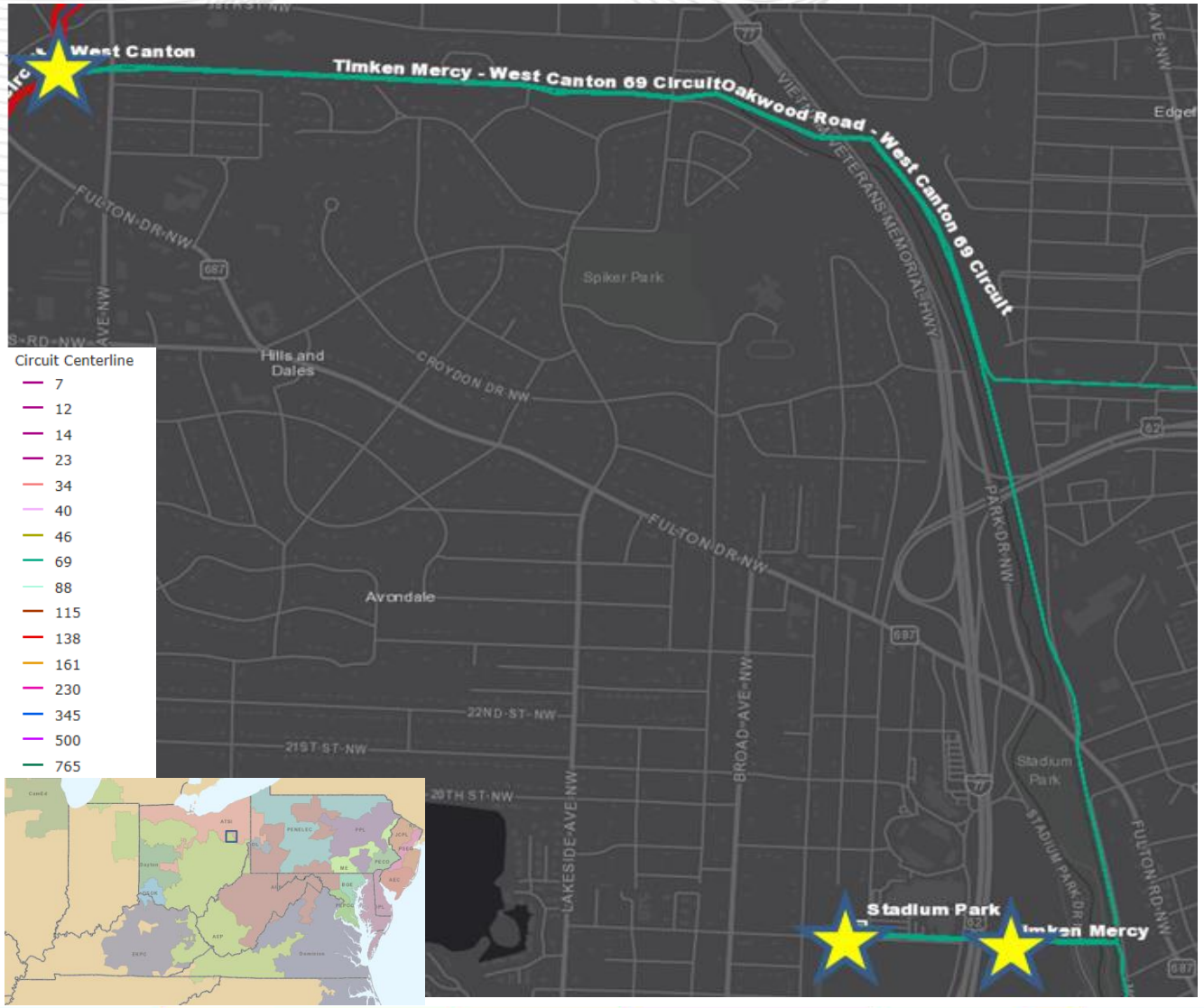

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Operational Flexibility and Efficiency

Two new 20 MVA 69-12kV Distribution (AEP Ohio) transformers will be installed at the greenfield station. Due to the existing and future load growth, 2- 69KV circuit breakers will be installed. The addition of the Stadium Park 69kV circuit breakers will prevent a distribution fault at Stadium Park from causing an outage to the hospital served from Timken Mercy Hospital station.

The 69kV capacitor bank will be retired due to space constraints. This retirement was studied in conjunction with AEP Operations, and no concerns were found.

Selected Solution:

Relocate Distribution (AEP Ohio) station next to the HOF to the west, to facilitate the needed station upgrades to address capacity overloads. Install 2- 69kV circuit breakers and relaying. Retire the 69kV cap bank. (**S1661.1**) **Estimated Cost: $2.1M**

At the 69kV remote-end of West Canton, upgrade protection to coordinate with Stadium Park; replace 69kV oil breaker 'S'. (**S1661.2**) **Estimated Cost: $0.8M**

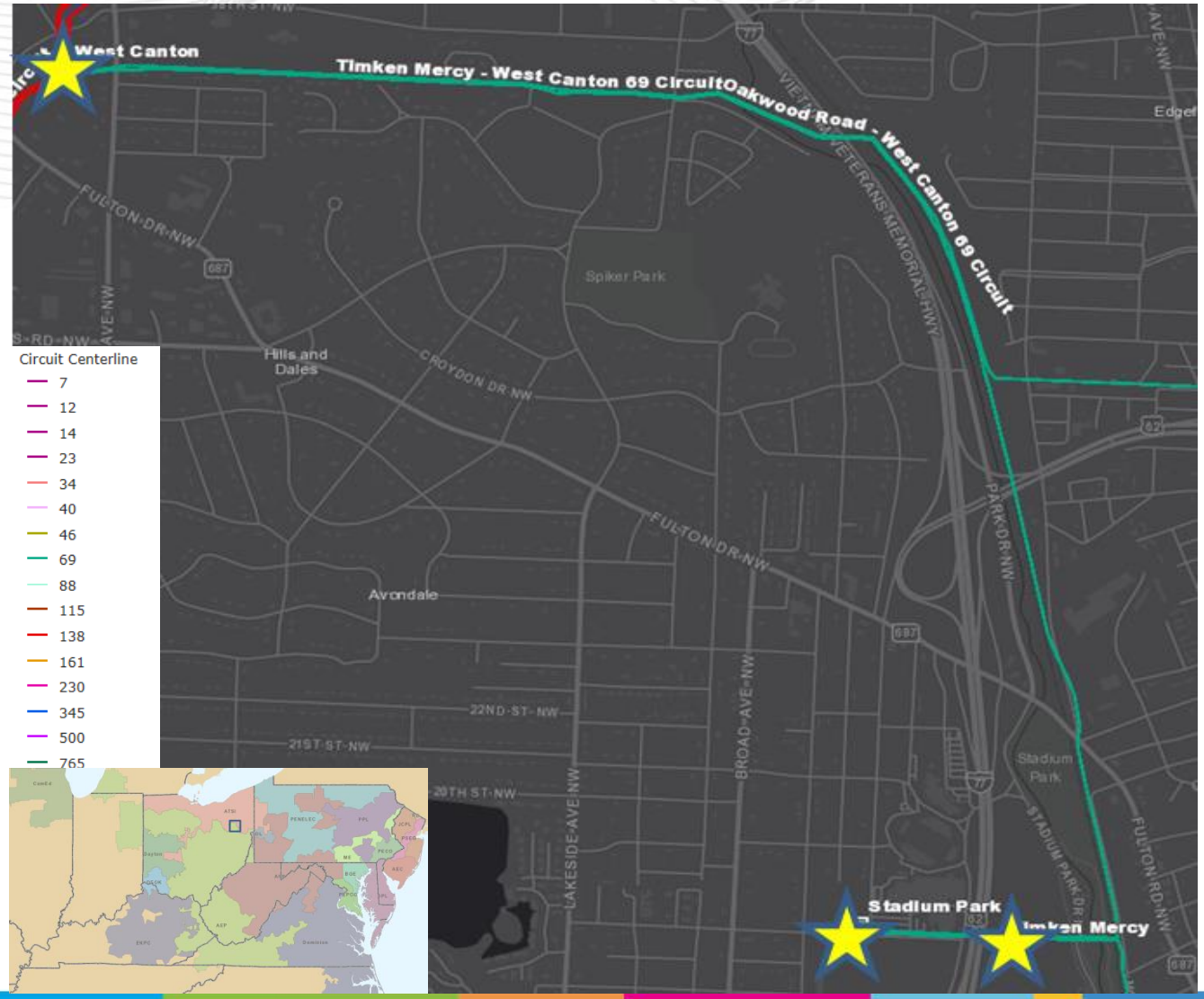
At the 69kV remote-end of Timken Mercy, upgrade protection to coordinate with Stadium Park; install CCVT's. (**S1661.3**) **Estimated Cost: $0.8M**

Extend West Canton-Stadium Park-Timken Mercy 69kV double-circuit loop to new Stadium Park station location, approximately 300 ft. to the west. (**S1661.4**) **Estimated Cost: $0.3M**

Total Estimated Transmission Cost: $4.0M

Projected In-service: 12/31/2018

Project Status: Engineering



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AEP Transmission Zone: Supplemental
Tidd Station

Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The 5- remaining 1600A 50 kA 138kV 'ATB' air-blast breakers at Tidd were manufactured in 1966. These units are overall in poor condition and a safety hazard to field personnel, due to the violent manner in which they tend to fail. 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 (52 years), scarce availability of spare parts, and system impact upon failure. The breakers lack real-time condition monitoring, but instead require a de-energized test for evaluation

The existing control house is in poor condition and has experienced flooding in the basement, placing protection and telecom equipment at risk numerous times. There are various safety concerns in the deteriorating building, including lighting and heating/cooling issues. The DC system in the building has failed due to degraded cables.

The majority of the relays being replaced are electromechanical or solid-state units, which are aging and prone to failure; these also lack modern fault-location and event-recording functionality. The 138kV bus PT's are rusting and leaking oil, along with deteriorated foundations. The 138kV bus-work utilizes cap-and-pin insulators, which are prone to failure.

The 138kV switches are in a hard-to-access location, due to the station being retrofitted from double-bus double-breaker to breaker-and-a-half over the years. Any work on the 12- incoming T-Line entrances or Transformer leads requires a full bus outage due to necessary safety clearances over the bus extensions. The placement of the current switches is very complex (in a stacked arrangement on the bus), which can lead to switching errors by field personnel or safety issues.

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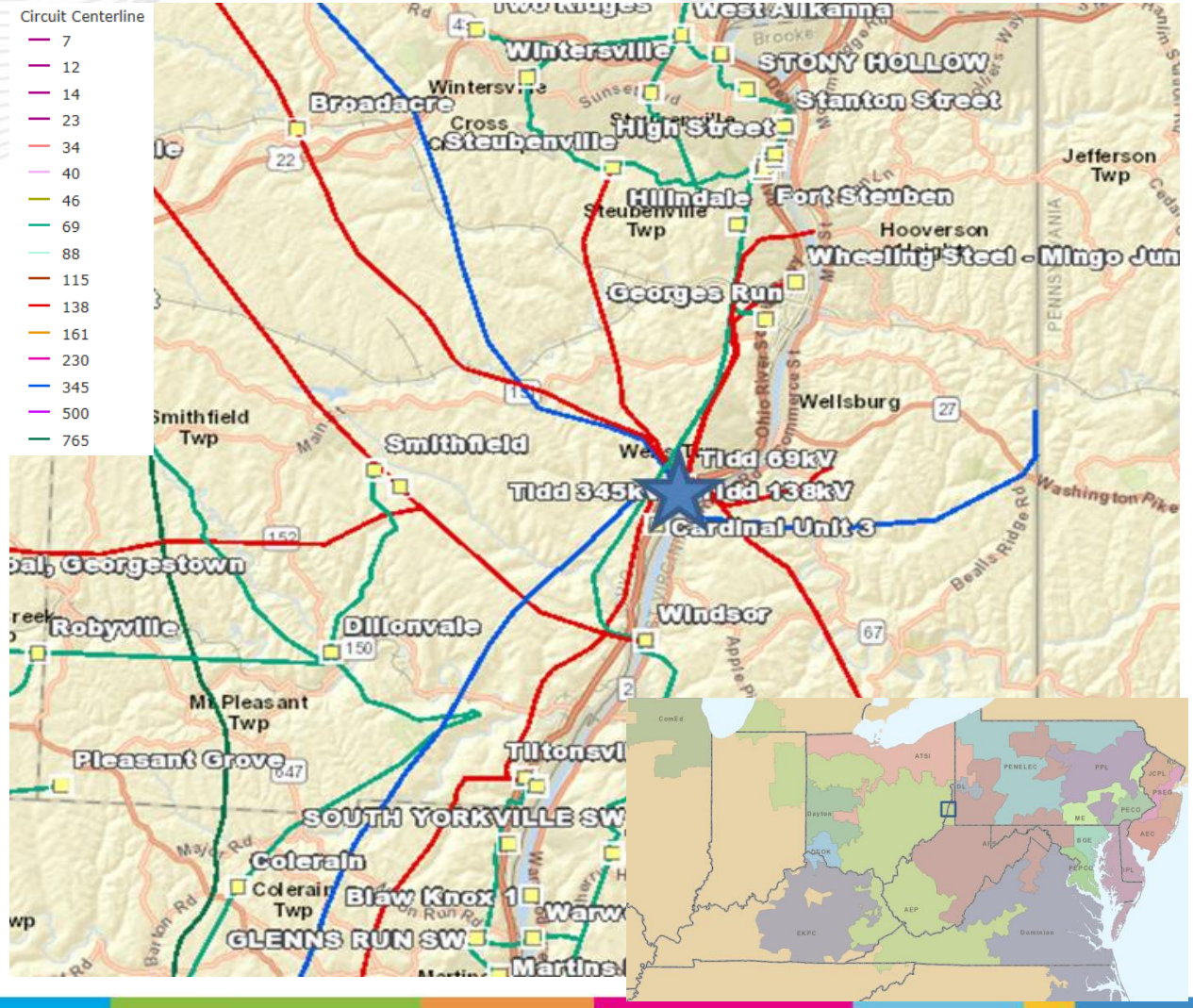

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AEP Transmission Zone: Supplemental Tidd Station

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Operational Flexibility and Efficiency

Currently, the two 138kV straight buses at Tidd have significantly more than the recommended amount of connected breakers. A fault on Bus 1 requires the tripping of 9 breakers and the loss of a source of station service power. A fault on Bus 2 requires the tripping of 9 breakers, the loss of an 86 MVAR cap bank, and the loss of a source of station service power. Furthermore, when either bus must be taken out of service for maintenance or project commissioning, it takes significantly longer than necessary to isolate the bus. AEP's general recommendation is to limit the amount of breakers tripped for a bus fault to 6 or less. To remedy the situation, two 138kV bus-tie breakers will be installed, to split the two buses into four.

The area around Tidd has a significant amount of industrial load, such as power plant scrubbers, steel-making, and shale gas processing loads. The addition of a 2nd 138kV capacitor bank will provide operational flexibility, by providing needed voltage support capability, especially for times when any of the Cardinal power plant generators may be offline or if there are performance problems with the single existing 138kV cap bank.

In addition, SCADA indication/control & metering capability will be added to parts of the 138kV station where it is currently lacking (e.g., 6- circuit breakers).

Customer Service:

Tidd provides two direct 138kV feeds to a steel-making customer, which will benefit from the Tidd station reliability improvements. This customer has significant expansion plans in the future.

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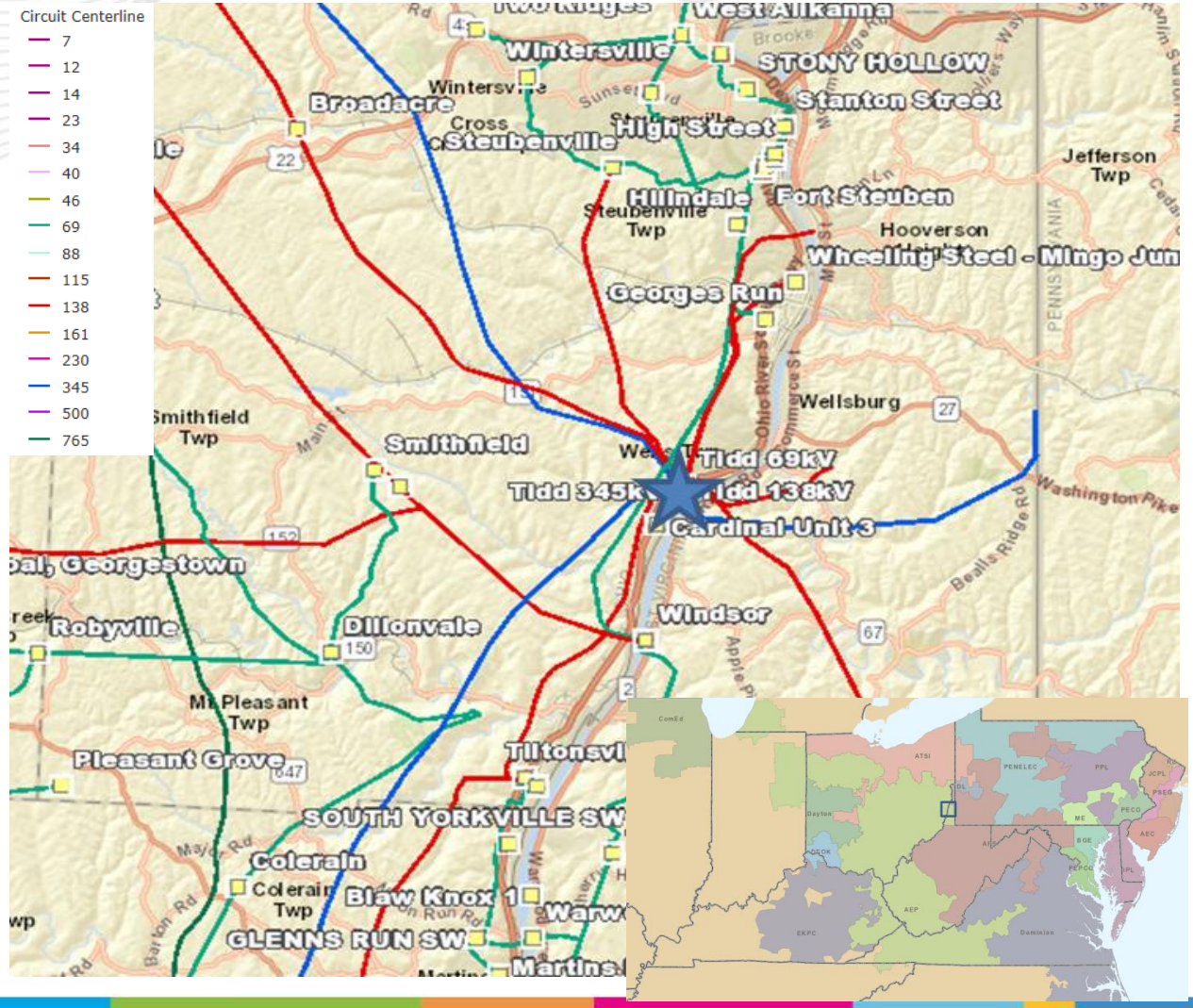

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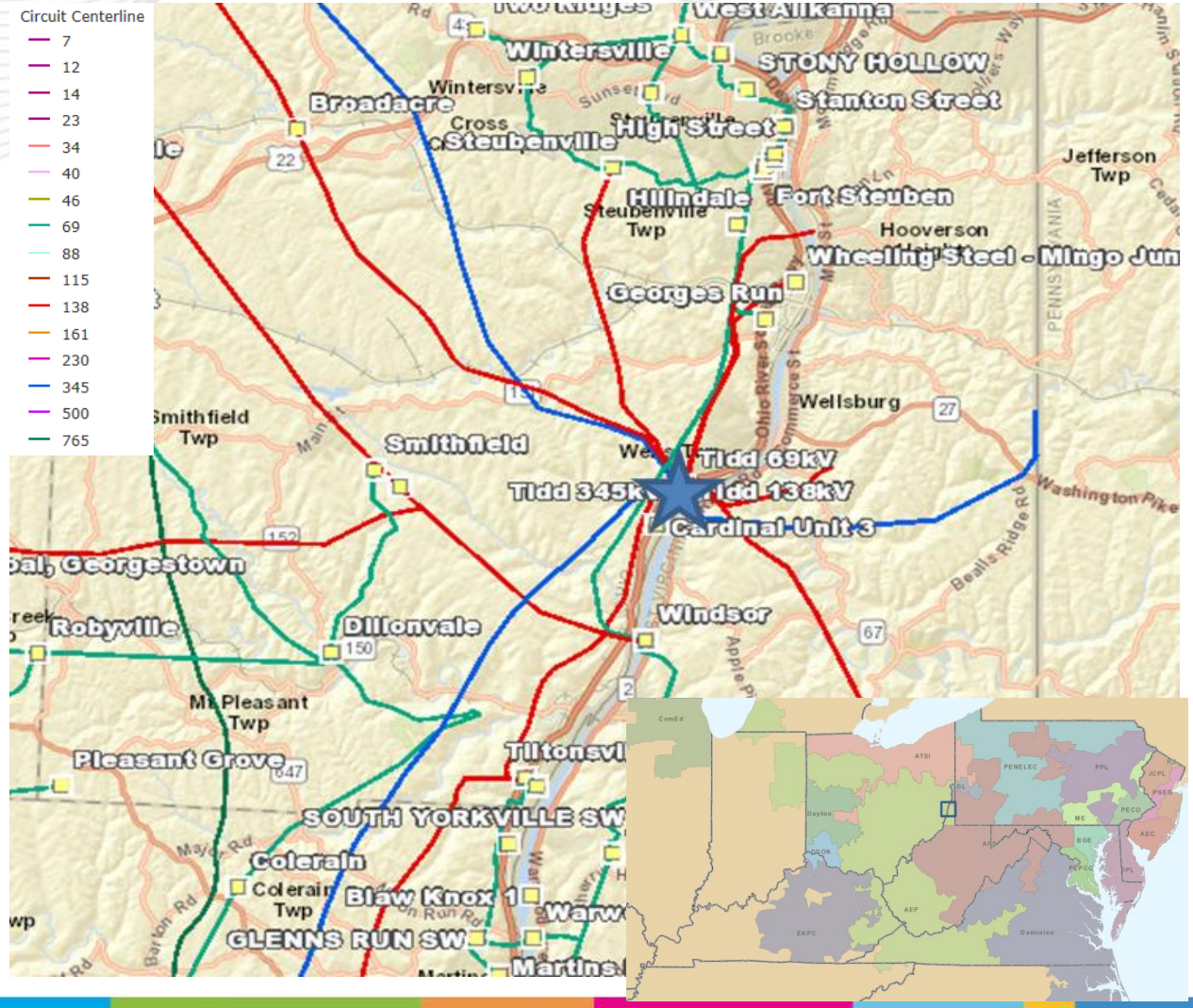
Selected Solution:

At the Tidd 138kV station, replace the 5 remaining 'ATB' air-blast circuit breakers with new 4000A 63kA units. Install 2- 138kV bus-tie breakers. Install new protection & communications equipment in a new DICM (drop-in control module) and demolish the old control house. Install a 58 MVAR cap bank. To address safety hazards, replace and relocate a number of manual disconnect switches throughout the station. (**S1662**)

Estimated Cost: $9.1M

Projected In-service: 12/01/2020

Project Status: Engineering



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Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Customer Service:

PUCO obligation to serve a new 138kV service to a 56 MVA PRO-TEC facility, with a typical steady state load of 40MVA.

Operational Flexibility and Efficiency

FOI calculations (21.47) have determined that at a minimum MOABs should be installed. With Pro-Tec's existing service from Yellow Creek containing breakers, to maintain consistent practice and reliable service, due to the critical and sensitive nature of Pro-Tec's steel production processes, and requests from operations for breakers, breakers will be installed.

Selected Solution:

New ~0.75 mile double-circuit 138kV line extension to a new substation to serve a new PRO-TEC facility by cutting the existing East Leipsic-Yellow Creek 138kV circuit (Yellow Creek Extension). Match existing conductors on new line extension, which are 1033 ACSR Curlew. (**S1663.1**) **Estimated Cost: $0.9M**

New 2-breaker, 3000A, 40kA, 138kV in and out station (Newbery), with two line exits (East Leipsic & Yellow Creek) and one tap to a PRO-TEC transformer. (**S1663.2**)

Estimated Cost: $6.0M

Total Estimated Transmission Cost: $6.9M

Projected In-service: 12/31/2018

Project Status: Engineering

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Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Customer Service:

Buckeye Pipe Line, LP has requested a new 34.5kV service for a new customer owned station to be installed adjacent to the existing Cygnet Buckeye Pipe Line station. Their peak diversified demand will be 2.5MW with a requested in service date of 3/1/18, although we have worked with the customer on a more realistic ISD of Q2 2018.

The new load and station is needed to move new refined petroleum east to Pennsylvania. The existing Cygnet Buckeye Pipe Line station will become fully owned and operated by Sunoco Pipeline LP. No significant changes are expected with the existing Cygnet Buckeye Pipe Line station.

Operational Flexibility and Efficiency

FOI calculations (8.96) justify a MOAB on this circuit. With the circuit being radial, it is recommended to install a MOAB towards the remaining portion of the radial. This will enable AEP to remotely isolate any problems further down the radial, retaining service to Buckeye Pipe Line as well as all other customers served from the radial line.

Selected Solution:

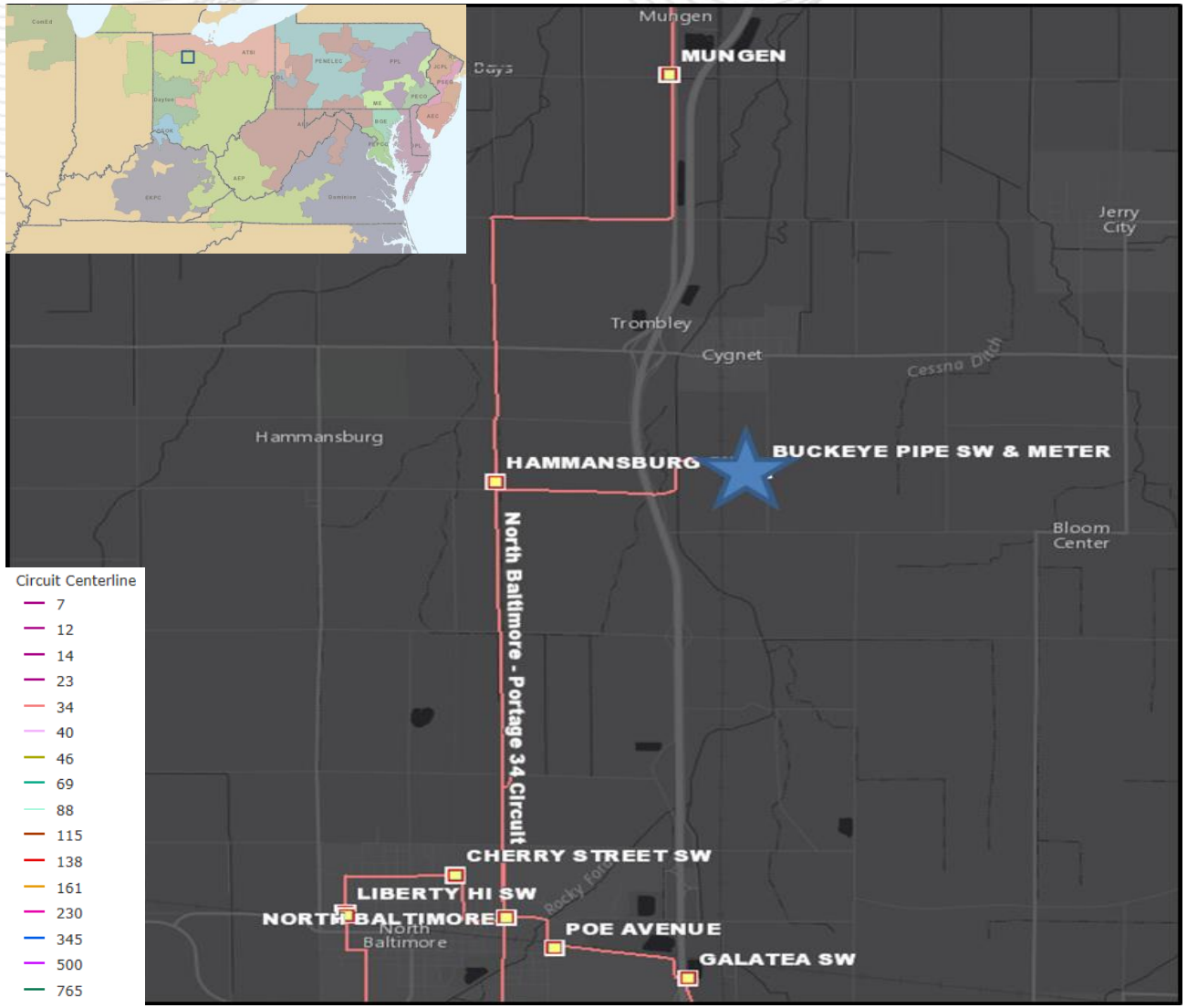
New 69kV (energized at 34.5kV) POD Box Bay (Hoiles Switch), with one MOAB towards the former customer station, Cygnet. Relaying upgrades at North Baltimore 34.5kV station. (**S1664.1**) **Estimated Cost:** $0.9M

Cut existing line into new 34.5kV station, matching existing conductors of 4/0 ACSR (25 MVA rating). (**S1664.2**) **Estimated Cost:** $1.5M

Total Estimated Transmission Cost: $2.4M

Projected In-service: 10/31/2018

Project Status: Engineering



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Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

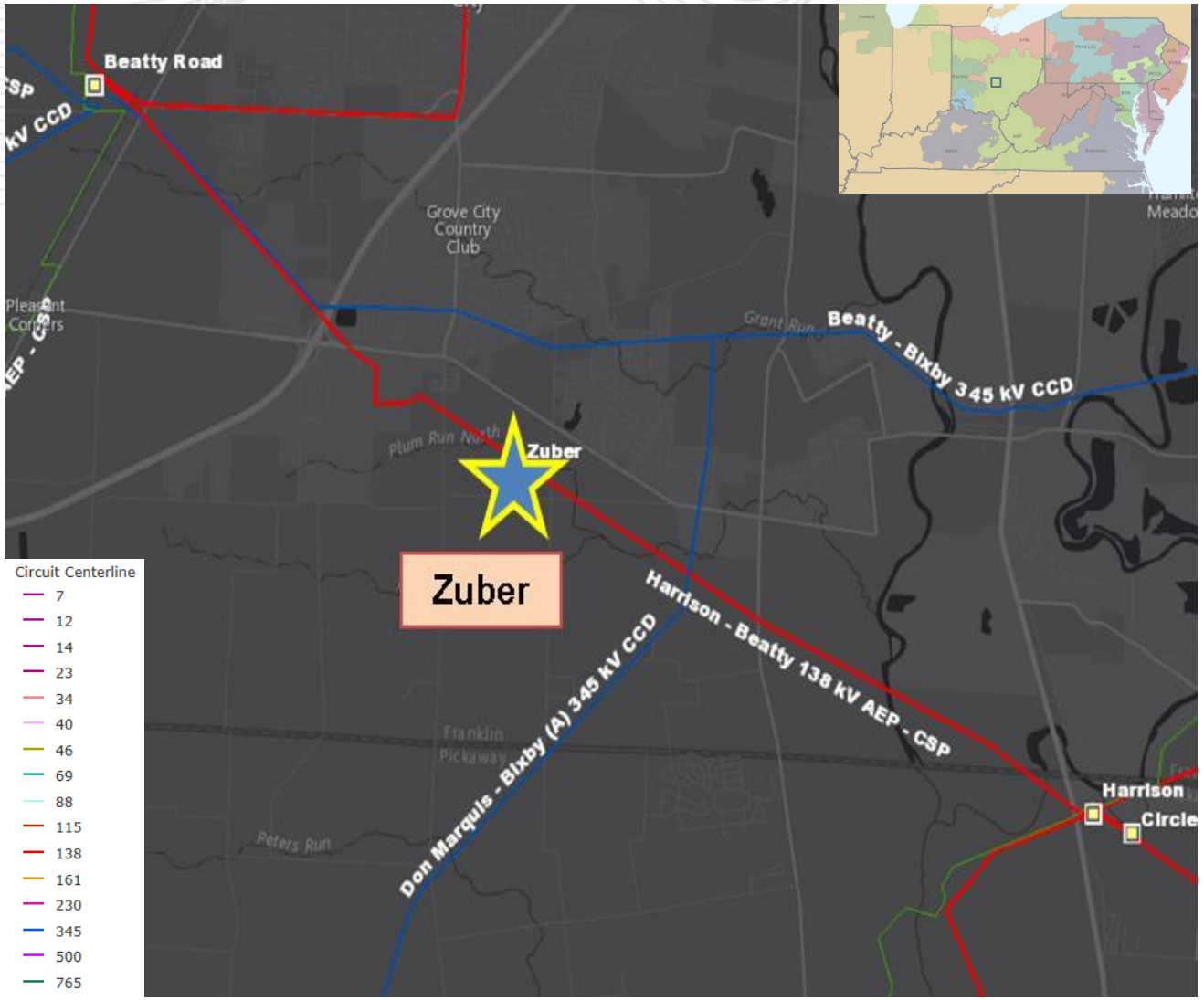
Customer Service:

AEP-Ohio requested service for a 2nd 138/13kV 50 MVA transformer with 2 additional distribution circuits to address expected overloads on existing distribution as early as 2018. Ultimate station design will include up to 4-138/13kV 50 MVA transformers.

Operational Flexibility and Efficiency

The Zuber distribution station is designed to eventually serve 4-50 MVA transformers. AEP-Ohio now plans to install the 2nd of these transformers. Due to the load density of the Columbus area, Distribution utilizes 50MVA transformers. Transmission is recommending installation of 138kV circuit breakers due to the large size of these banks and the amount of load served.

AEP Transmission is anticipating serving a large customer in the area which would drive the need for a second circuit between Beatty and Harrison. It is desirable to both maximize reliability of the station in it's proposed configuration and to minimize future outages for the future circuit to be cut into Zuber.



Selected Solution:

Expand Zuber 138kV station bus to a ring design with 3,000A 40kA CB's. (**S1665.1**) **Estimated Cost: $3.9M**

Reterminate Harrison-Beatty 138kV line on new bus work. (**S1665.2**) **Estimated Cost: $0.7M**

Total Estimated Transmission Cost: $4.6M

Projected In-service: 12/1/2019

Project Status: Engineering

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AEP Transmission Zone: Supplemental
Central South Bend Improvements

Previously Presented: 4/17/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

AEP has identified multiple rehab needs at Colfax, Drewry's and Saint Mary's stations. Colfax station is a cubicle switch gear type construction, is obsolete, and spare parts are unavailable. Mobile transformer can't be installed on site due to physical space limitations and complete station outage can only be taken during off-peak months (Sep-May). The 34.5 kV CB C and D at Colfax Station are GE FK oil-filled breakers manufactured in 1950s, have operated through 12 and 20 fault operations, exceeding the manufacturer recommendation of 10. These breakers are oil breakers. Oil 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 drivers for replacement of these breakers are age, number of fault operations, and a lack of repair parts. The 34.5/12 kV Transformer at Colfax was manufactured in 1974 and is also showing significant signs of deterioration. It has a load tap changer (LTC) and therefore distribution voltage regulation is difficult. Drivers for replacement of the transformer include dielectric strength breakdown (winding insulation), short circuit strength breakdown (due to the amount of through fault events), and accessory damage (bushings).

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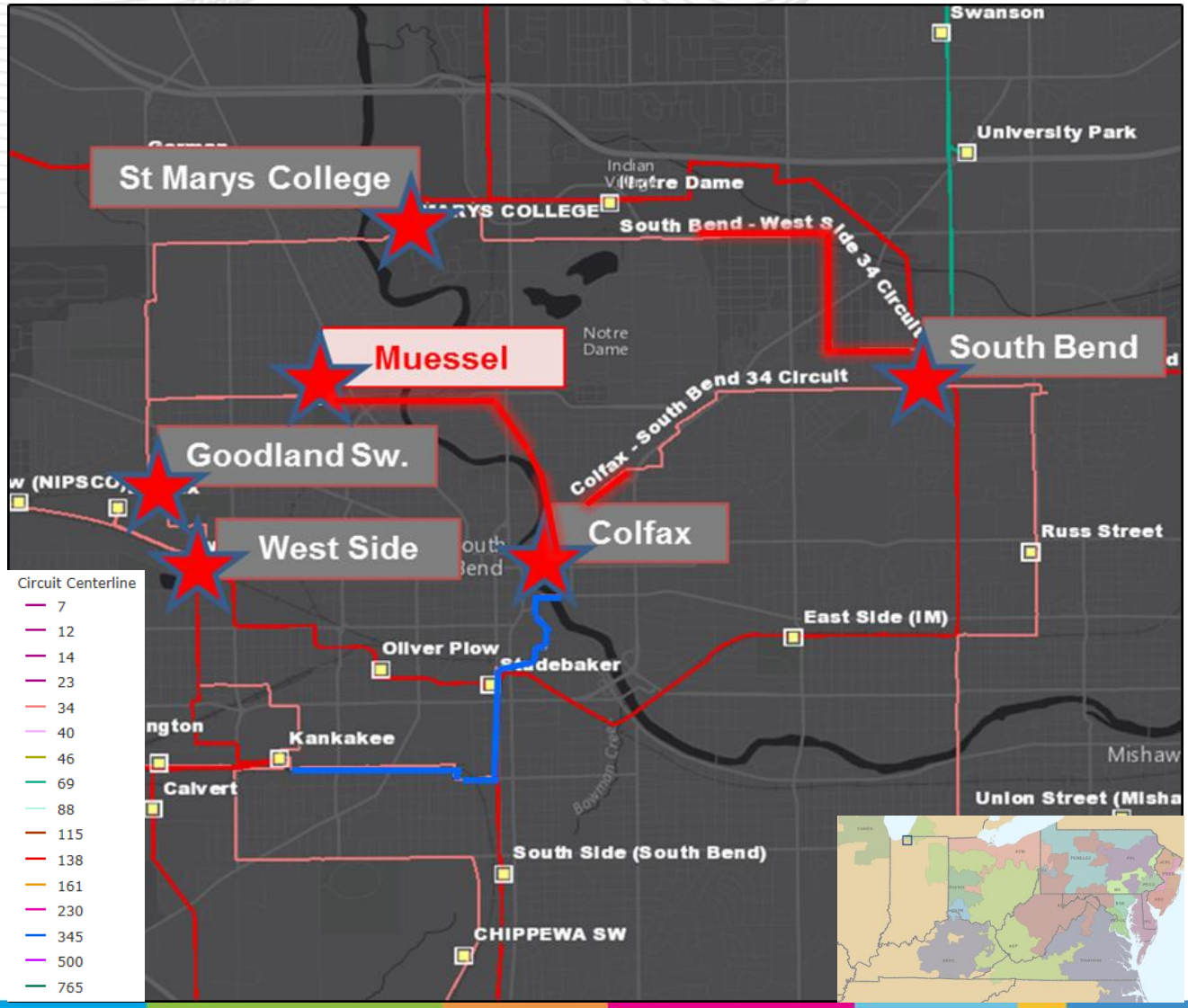

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AEP Transmission Zone: Supplemental Central South Bend Improvements

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Drewry's Station is very congested and is located adjacent to Muessel Grove public park. On site mobile transformer can't be installed due to physical space limitations. Station transformers do not meet present day electrical clearance standards. Transformer high side ground switches can't be replaced with circuit switchers and low side breakers can't be installed due to physical space limitations. There is no control house present and 14 out of 20 relays are electromechanical and are obsolete. Station drive path is not available and poses additional maintenance and safety challenges. Station foundations and steel on 12 kV structures are beginning to show signs of deterioration. 12 kV circuit breaker A,B,C & D at Drewry's are 2000 vintage but have severely exceeded the life expectancy of full fault operations. The 34.5/12kV Transformer#2 was manufactured in 1963 and the steady increase in ethylene, methane, and carbon dioxide over the years show that there has been heating of the Transformer #2 at Drewry's which has deteriorated its insulation. Additionally, the LTC is not operating properly.

The 34.5/4kV Transformer at Saint Mary's Station was manufactured in 1952 and is also showing significant signs of deterioration. Drivers for replacement of the transformer include dielectric strength breakdown (winding insulation), short circuit strength breakdown (due to the amount of through fault events), and accessory damage (bushings).

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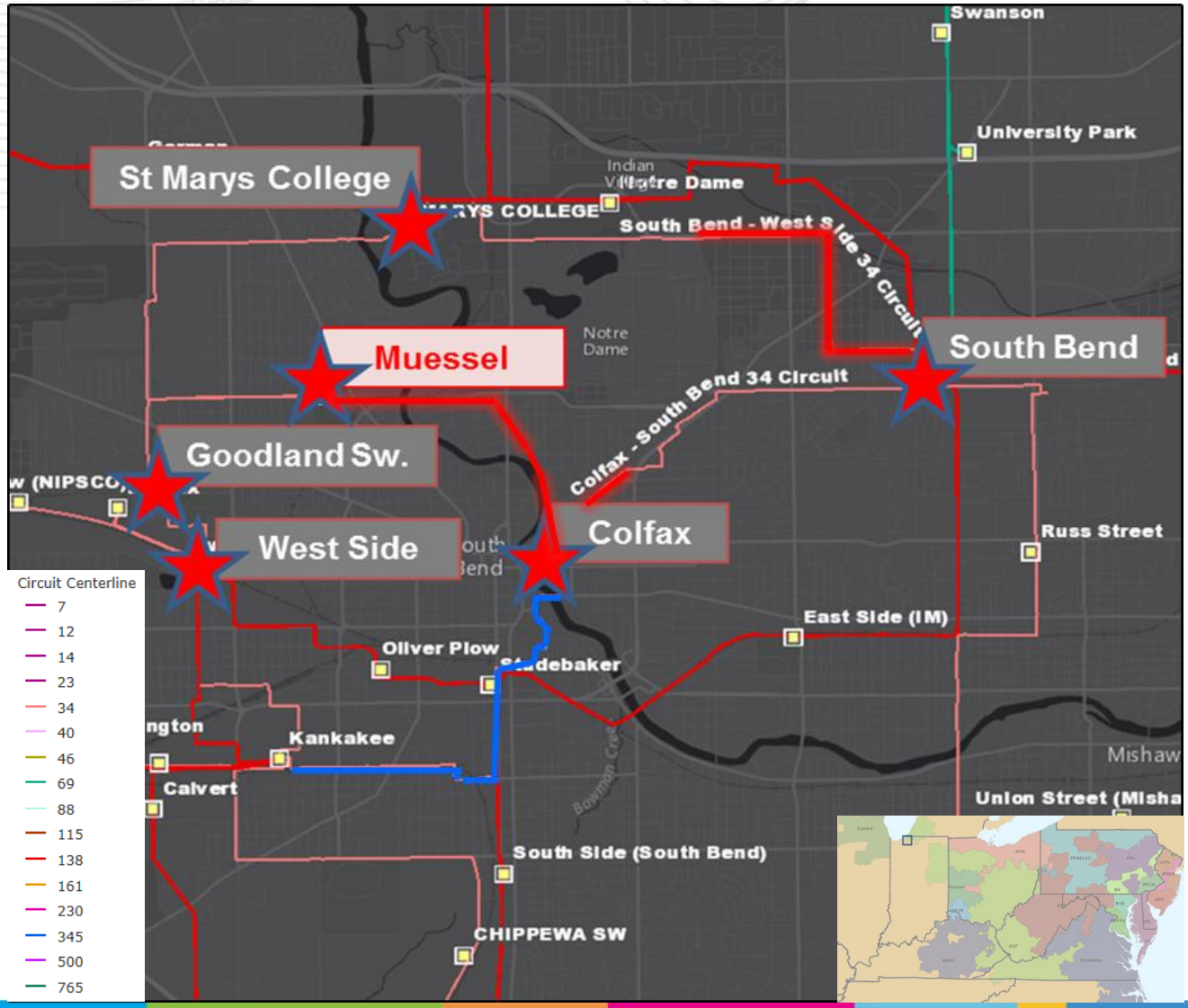

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AEP Transmission Zone: Supplemental Central South Bend Improvements

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On the Colfax-Kankakee 34.5 kV circuit, the overhead portion is ~1.5 miles while the underground section is ~1.3 miles. The overhead portion utilizes wood poles cross arm construction which is not a current AEP transmission standard. The overhead portion of this circuit is suspension insulator type construction with smaller cross-section distribution-type cross arms and braces. Historical experience with these types of wood cross arms is a higher frequency of required proactive replacement and occasional failure resulting in forced outages. The underground portion of the line occupies a manhole and conduit system that was not designed for transmission use. The underground portion occupies 33 manholes. Over half of the manholes contain transmission cable splices. An underground transmission cable system of this length should require no more than 4-7 manholes in order to minimize the number of cable splices required. Due to the number of manholes, the required number of cable splices is very excessive. Industry experience is that cable system components such as splices are a far more common failure cause than the transmission cables themselves. Almost all of the manholes are physically undersized for transmission cable system occupation, making splicing very difficult to accomplish. Many conduits are clay tile ducts installed in the 1930s. Since 2009 there have been at least seven documented failures, primarily on cable system components (splices and terminations). Cable testing performed in September 2013 and the cables passed the testing however, nine days later a cable failure occurred, causing the circuit to trip from service.

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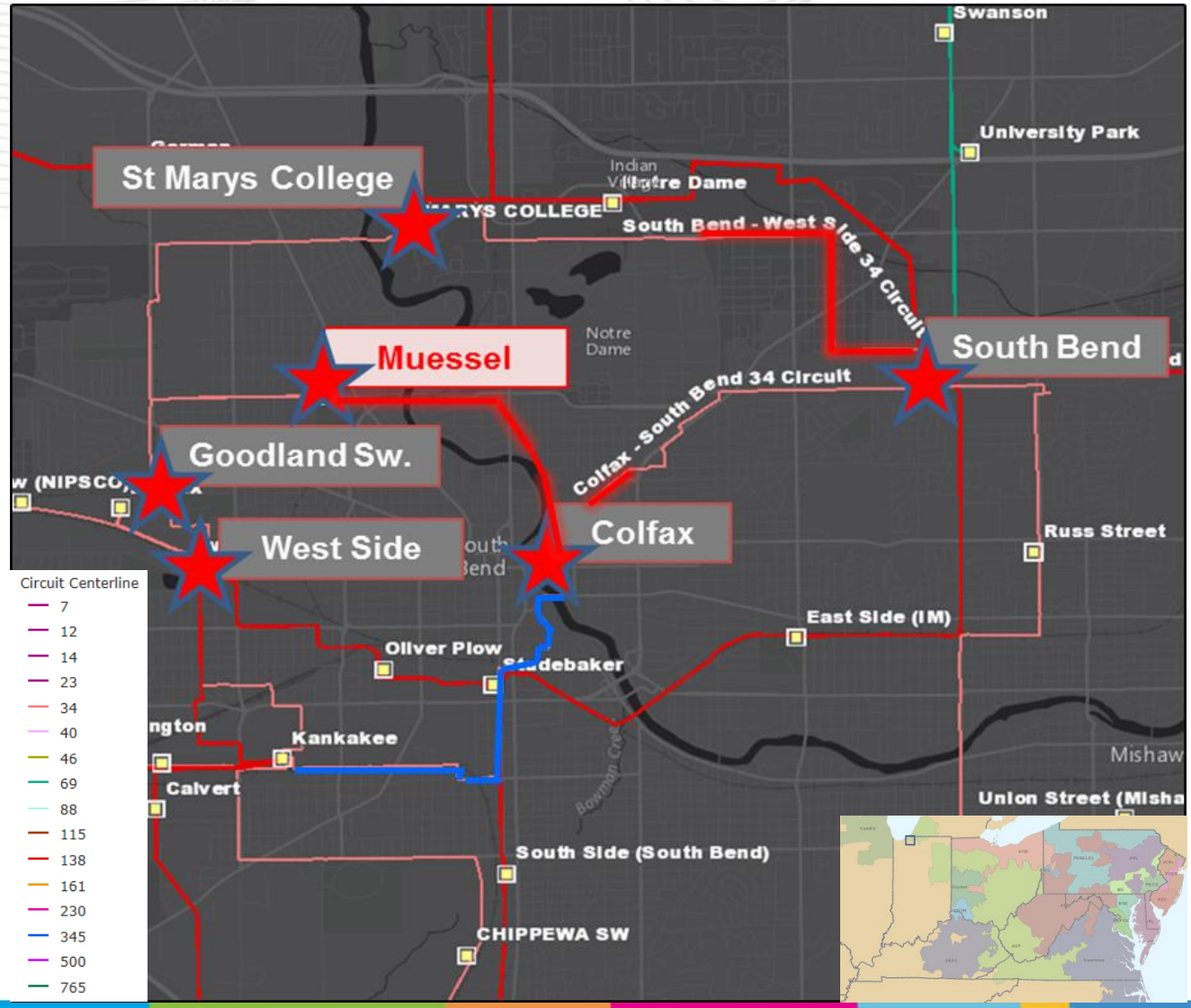

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AEP Transmission Zone: Supplemental
Central South Bend Improvements

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Operational Flexibility and Efficiency:

Colfax station backs up a portion of distribution load from the South Bend station. South Bend is a 138 kV station while Colfax is 34.5 kV which results in a load drop and pick issue. On average there are between 3 to 5 drop and pick cycles per year that are experienced by Colfax and Drewry's customers. Drewry's station is served by a double circuit transmission line which traverses through residential areas and a gravel pit. An outage involving the double circuit lines results in a complete station outage and the station peak load is not recoverable from an alternate source. Colfax station serves central South Bend load and is presently served from two 34.5 kV sources, South Bend and Kankakee. Kankakee source has an underground line section which is near its useful life and has been forced out multiple times in the recent past. The new Colfax – Drewery 34.5kV Line will be an additional source to Drewry's and Colfax Station. The transformer high side protection at Drewry's and Saint Mary's station is via high side ground switch scheme which is not a standard practice in modern installations. South Bend-West Side 34.5 kV circuit is ~11 miles and serves three stations (Goodland, Drewry's, and St Mary's College). There are two series MOBs each at Drewry's and St Mary's College. Having 4 MOAB in series is an undesirable configuration as it introduces coordination challenges related to P&C.

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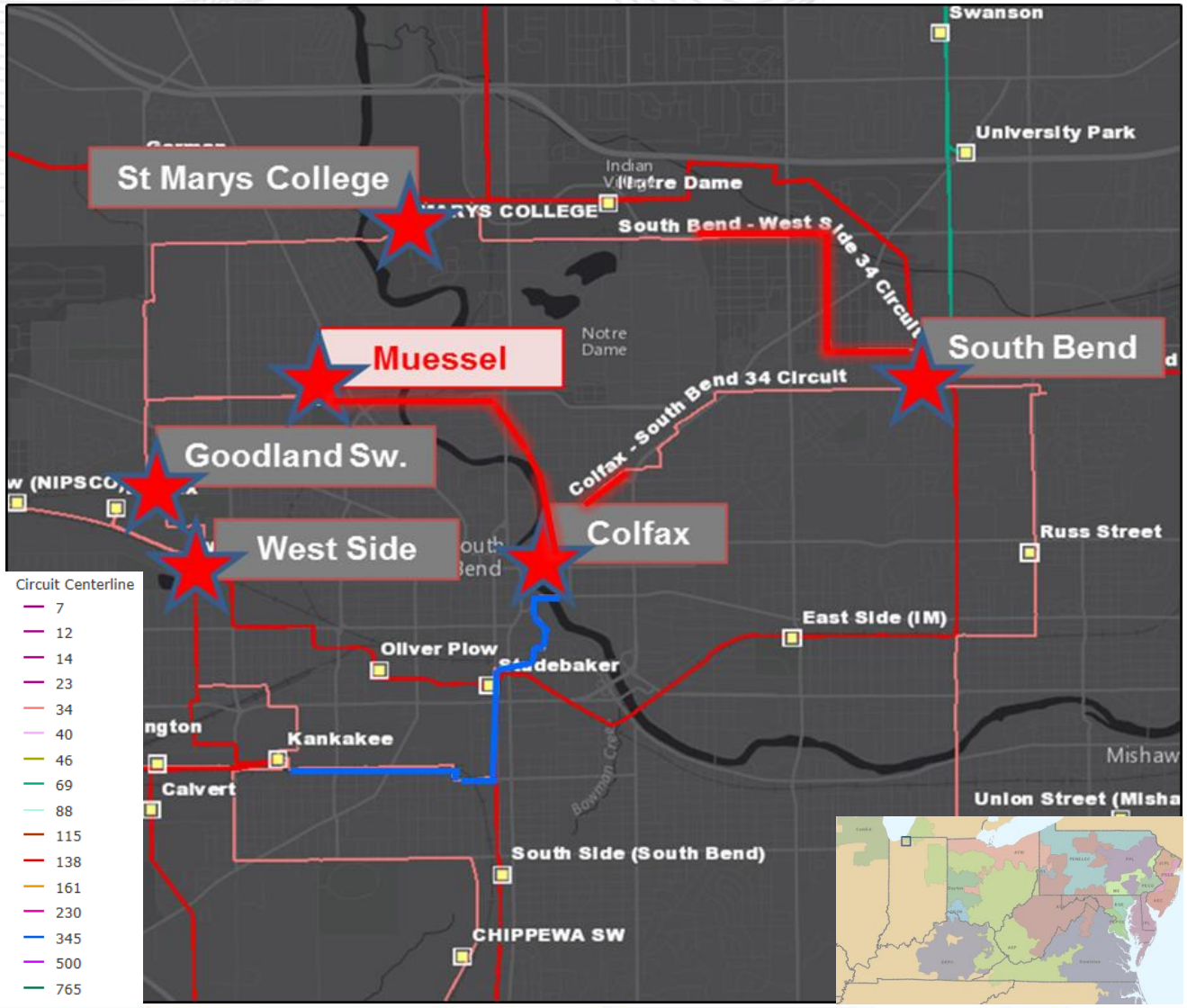

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AEP Transmission Zone: Supplemental
Central South Bend Improvements

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Selected Solution:

Construction of approximately 2.5 mile 69 kV underground line between Colfax and Muessel using 1750KCMIL Copper XLPE Conductor. (**S1666.1**) **Estimated Cost: $20.1M**

Install Drewry's Extension 34.5kV. (**S1666.2**) **Estimated Cost: $0.7M**

Retire Kankakee – Colfax (UG) 34kV Line. (**S1666.3**) **Estimated Cost: $0.6M**

Rebuild .33 miles of the South Bend - Colfax UG line using 1750KCMIL Copper XLPE Conductor. (**S1666.4**) **Estimated Cost: $4.1M**

Rebuild 1.9 miles of the South Bend – West Side Line using 795 ACSR (64 MVA rating). (**S1666.5**) **Estimated Cost: $3.7M**

Bendix – Kankakee 34.5kV Line Work. (**S1666.6**) **Estimated Cost: $0.2M**

South Bend station work to set up 69kV energization. (**S1666.7**) **Estimated Cost: $0.6M**

West Side station work to set up 69kV energization. (**S1666.8**) **Estimated Cost: $0.5M**

Completely rebuild Colfax station. Install a 69kV CB towards Muessel Station. Replace 34kV CB D with a 69kV CB towards South Bend Station. Install a 69kV SWR, 69/12kV TR#1 and (4) 12kV CB's. All 69kV CB's are 40kA breakers. (**S1666.9**) **Estimated Cost: $1.8M**

Completely rebuild Drewrys station as Muessel station in the clear. Install (3) 69kV line CB's, (1) Bus Tie CB, (2) 69kV SWR's, (2) 69/12kV TR's and (7) 12kV CB's.All 69kV CB's are 40kA breakers. (**S1666.10**) **Estimated Cost: $5.0M**

At St. Mary's College, install 69kV circuit switcher. Replace 69/12kV TR and (2) 69kV switches. (**S1666.11**) **Estimated Cost: $0.4M**

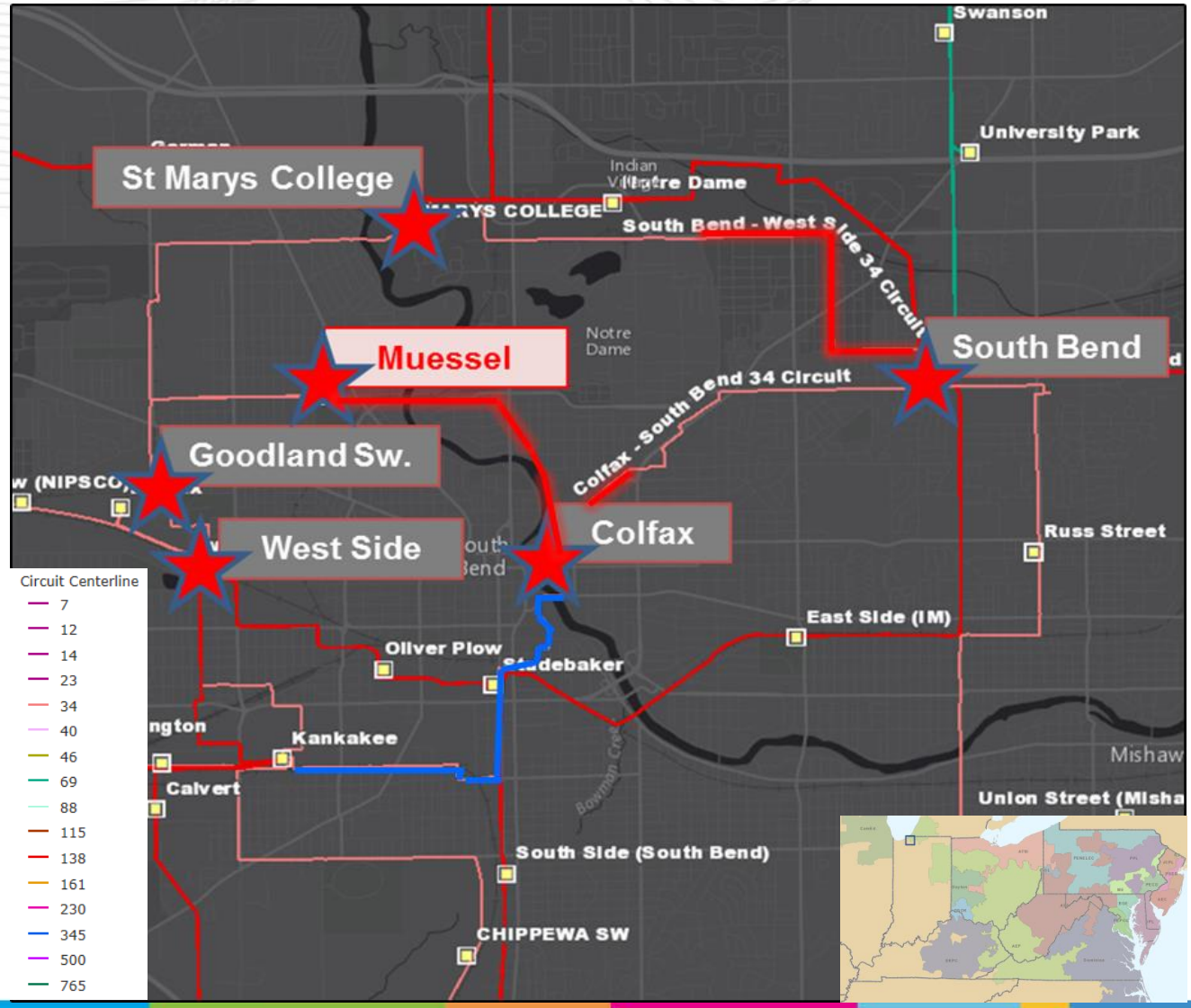
Relocate Goodland Sw to West Side – Bendix 34kV Line. (**S1666.12**) **Estimated Cost: $1.0M**

Kankakee: Remove 34.5kV breaker I. (**S1666.13**) **Estimated Cost: $0.1M**

Total Estimated Transmission Cost: $38.8M

Projected In-service: 5/10/2020

Project Status: Scoping



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AEP Transmission Zone: Supplemental
Tams Mountain Station Rebuild

Previously Presented: 6/26/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Tams Mountain 46 kV circuit breakers A, B, C, D and E are all oil-filled breakers installed in 1965. In general, oil breakers are difficult to maintain. Oil spills are frequent with failures and routine maintenance which is also an environmental risk. All five 46 kV breakers have exceeded the manufacturer's expected number of 10 fault operations; A: 237 fault ops, B: 248 fault ops, C: 113 fault ops, D: 84 fault ops, E: 63 fault ops.

Tams Mountain 138/69/46 kV XFR #1 (vintage 1965) is showing rising ethane, ethylene, and methane levels. All three gas concentrations are trending upwards. Despite decreasing moisture content, the dielectric strength has continued to decline. The short circuit strength has been deteriorated by the amount of thermal through faults.

Sophia 46 kV circuit breaker C is an oil-filled breaker manufactured in 1965. In general oil breakers are difficult to maintain. Oil spills are frequent with failures and routine maintenance which is also an environmental risk. Breaker C has experienced 41 fault operations which exceeds the manufacturer's expectation of 10 fault operations.

Operational Flexibility and Efficiency

The Tams Mountain – Mullens 138 kV and Tams Mountain – Pemberton 138 kV lines currently connect and create a three terminal line at Tams Mountain 138 kV bus #2. Two new 138 kV breakers will be installed and the station will be re-configured into a ring bus to eliminate the three terminal line at the station. The Ground-Switch MOAB on the high side of the 138/69/46 kV transformer at Tams Mountain is obsolete and creates an overlap in the zones of protection.

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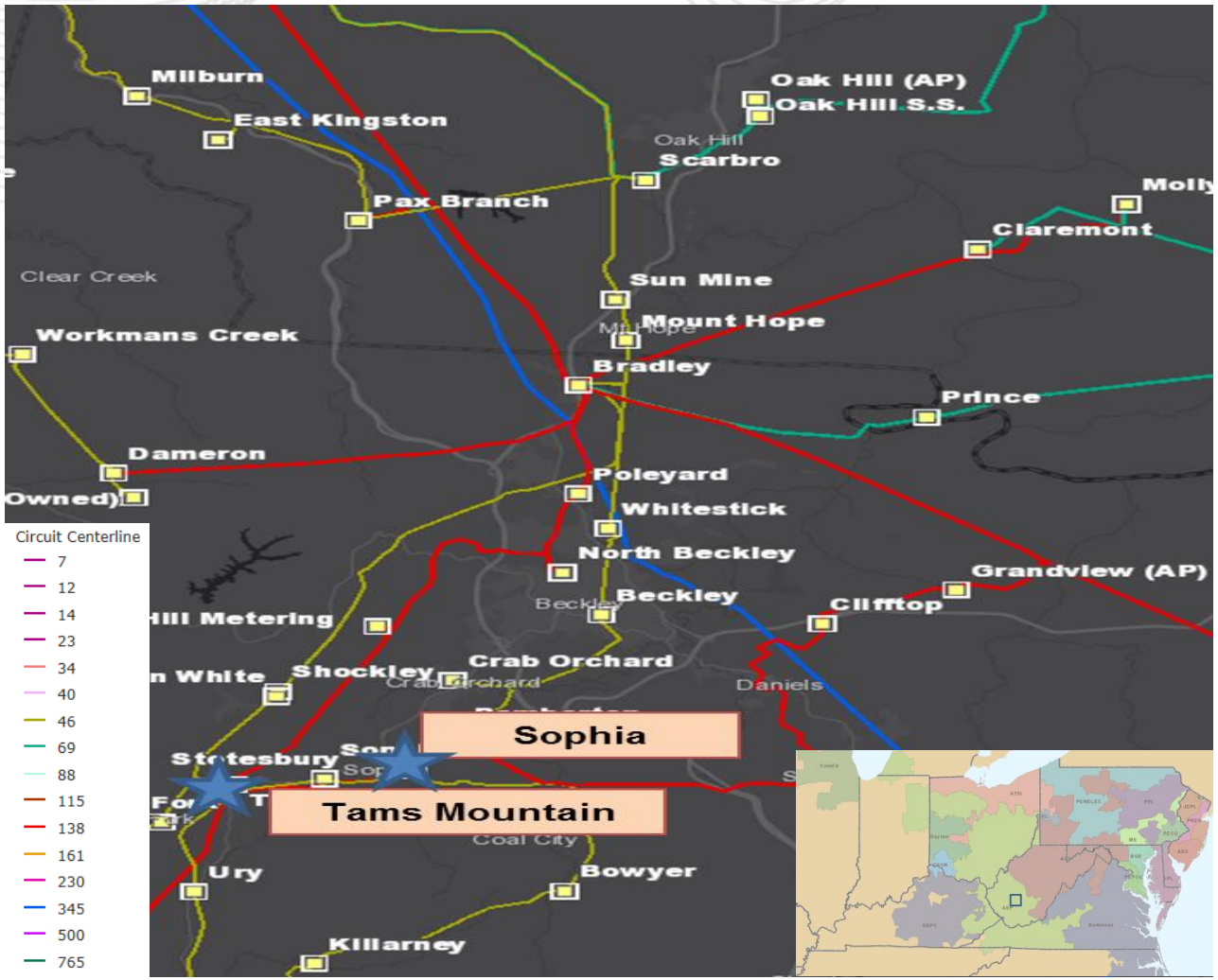

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AEP Transmission Zone: Supplemental
Tams Mountain Station Rebuild

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Selected Solution:

At Tams Mtn. Station, replace all 46 kV CB's (A, B, C, D, E) with 3000 A 40 kA CB's designed to 138 kV standards in ring bus operated at 46 kV. Replace the 138 kV GR. SW. MOAB with a new circuit switcher. Retire 138 kV bus tie breaker 'F' and establish one 138 kV bus. Install two new 3000 A 40 kA 138 kV CB's on Pierpont 138 kV line and Pemberton 138 kV lines. Replace existing 138/69/46 kV 40 MVA XFR with a new 138/69/46 130 MVA XFR. Reconfigure transmission lines entering the station to accommodate new ring configuration. (**S1667.1**) **Estimated Trans. Cost: $19.7M**

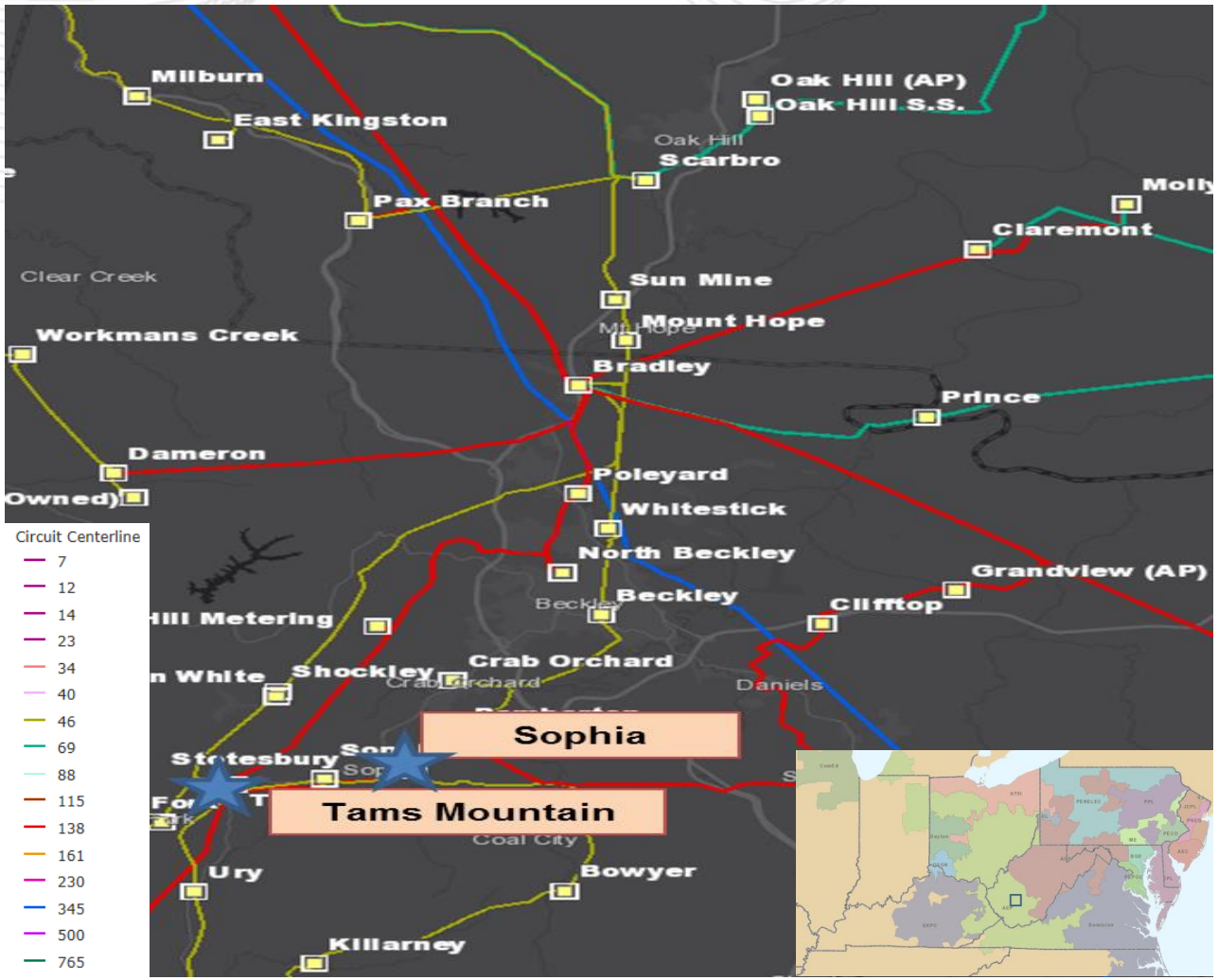
Sophia 46 kV Station remote end work to upgrade line relays, replace existing 1200 A 21 kA circuit breaker "C" with a new 3000 A 40 kA 69 kV CB. (**S1667.2**)
Estimated Trans. Cost: $0.9M

Pemberton 138 kV Station remote end relay work. (**S1667.3**) **Estimated Trans. Cost: $0.6M**

Total Estimated Transmission Cost: $21.2M

Projected In-service: 6/1/2021

Project Status: Scoping



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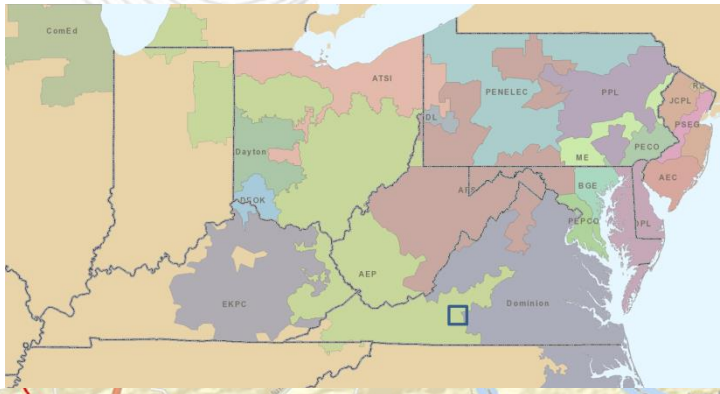

Previously Presented: 6/26/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Joshua Falls: The Gas Insulated Station (GIS) at Joshua Falls, installed in 1979 , will only operate if the hydraulic pressure is at a minimum of 5000 psi. The hydraulic gears that are used to open and close the circuit breakers were leaking hydraulic oil at a high rate, and therefore we were not able to keep the pressure to 5000 psi. The hydraulic reservoirs needed to have hydraulic fluid added weekly to maintain adequate fluid levels in the system. Many of the hydraulic seals have deteriorated, causing additional oil leakage. Because the oil leakage was so severe, the circuit breakers often didn't have enough pressure to close when required. When this situation occurred, field personnel are dispatched to the station to re-pressurize the system. Because of the nature of the GIS issues, AEP installed a temporary station in 2014 until the new 138 kV yard could be rebuilt in the clear.

765/138 kV transformer #1 phase 1 (vintage 1980) is showing short circuit strength breakdown caused through fault events, gassing of the unit (high readings for ethane and methane), and a significant number of overheating events. There is an upward trending of oil moisture content resulting in downward trending to the oil dielectric strength. Increasing moisture content is a resultant of water ingress through aged gaskets, tank or pump leaks, or a breakdown of paper insulation of the transformer windings.

765/138 kV transformer #1 phase 3 (vintage 1992) is showing short circuit strength breakdown caused by thermal through fault events that this unit has experienced. These events have led to gassing of the unit and carbonization of the insulating paper, showing high readings of carbon dioxide and carbon monoxide. Phase 3 has shown signs of accelerated winding aging from the recent hot spot indicated on the low side winding well above the alert level. Similar transformer units have seen failures in the windings.

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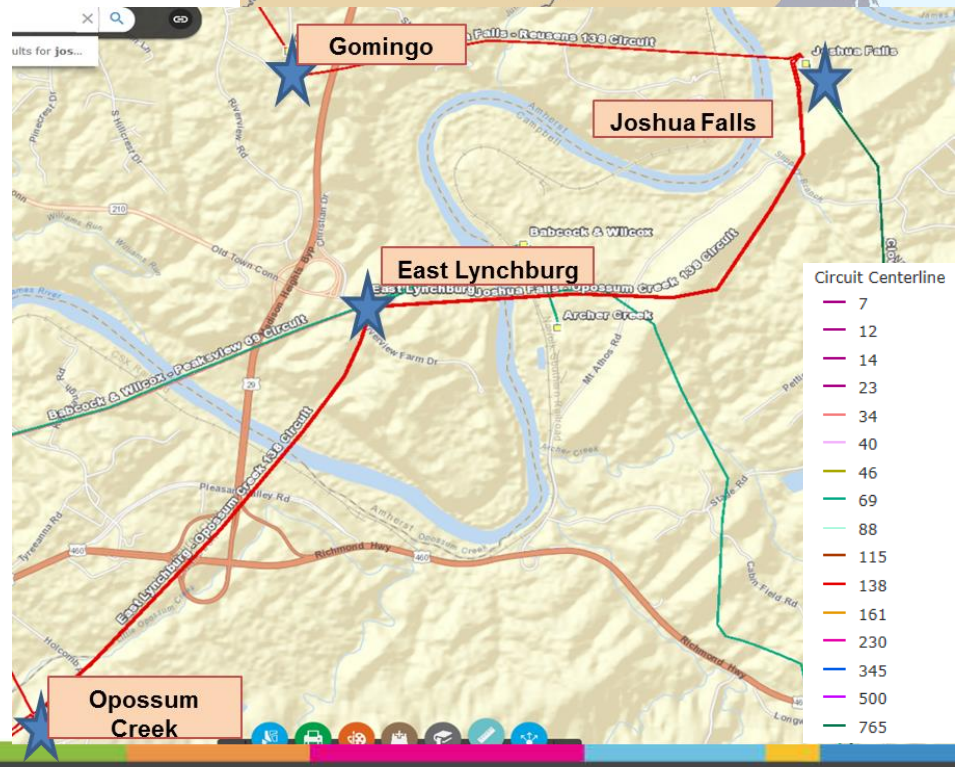

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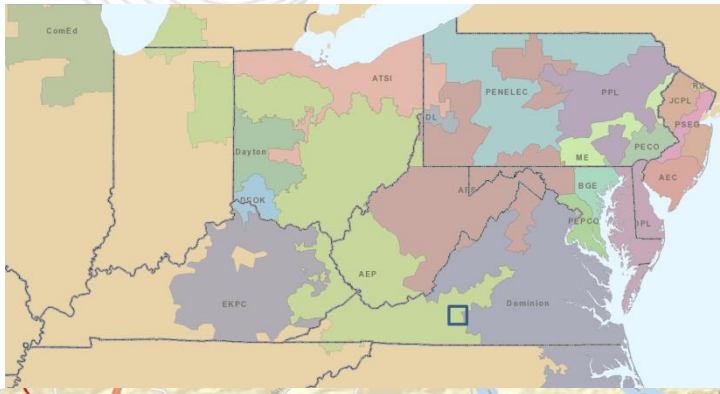
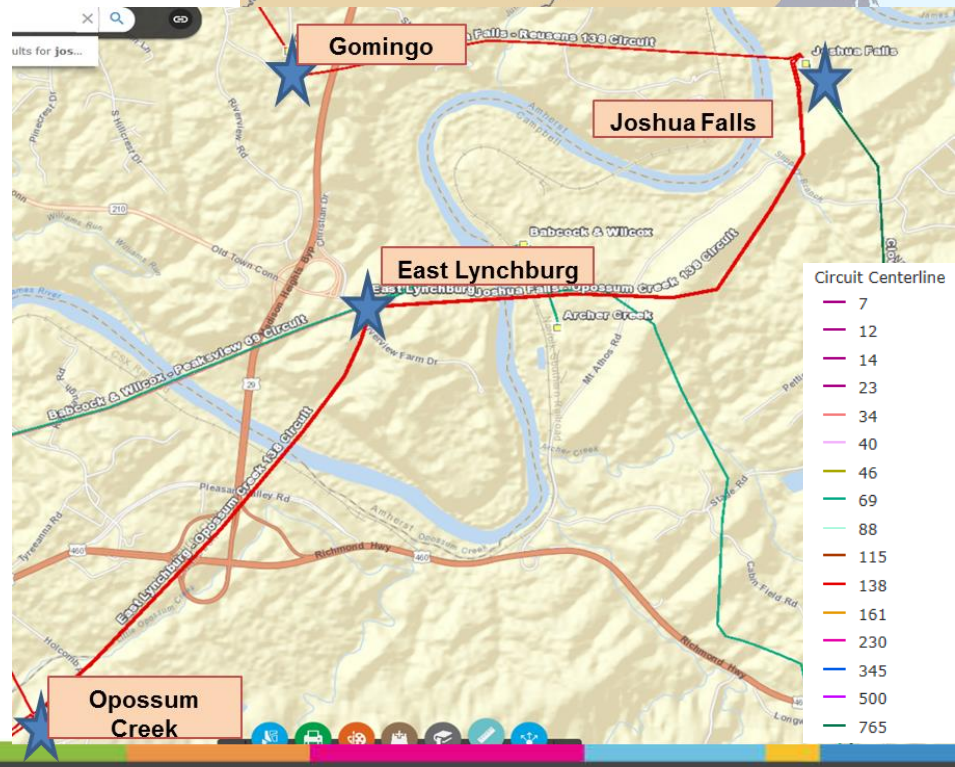
AEP Transmission Zone: Supplemental
Joshua Falls





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East Lynchburg: The 138 kV circuit breaker "K" (vintage 1974) at East Lynchburg is an air blast PK type breaker, which have become a safety concern due to their catastrophic and violent failures. During failures sharp pieces of porcelain are expelled, which can be a hazard to field personnel. In addition, CB "K" has experienced 70 fault operations exceeding manufacturers recommended fault operations of 10. The East Lynchburg 34.5 kV circuit breaker "A" (vintage 1956) is an oil type breaker without oil containment. These oil breakers have become more difficult to maintain due to the required oil handling. In general, oil spills occur more frequently during routine maintenance and failures with these types of breakers. Other drivers include damage to bushings. CB "A" has experienced 33 operations, exceed the manufacturers recommended number of 10. Circuit Switcher "AA" is a MARK V unit, which have presented AEP with a large amount of failures and misoperations.

<u>Operational Flexibility and Efficiency</u>

There are currently three dissimilar zones of protection at East Lynchburg station: 138 kV Opossum Cr. line, 138/69/34.5 kV XF #1, and the 69 kV Babcock & Wilcox line. This configuration can lead to misoperations and over tripping.

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AEP Transmission Zone: Supplemental Joshua Falls

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Selected Solution:

At Joshua Falls, retire the existing 138 kV yard at Joshua Falls Station and build a new one in the clear. The new 138 kV yard includes two 138 kV busses and 4-3000 A/63 kA circuit breakers in a breaker and a half layout. In addition, primary and backup single phase station service transformers will be added on bus 1 & 2 respectively. New CCVT's will be installed on the 138 kV lines and busses. A new 16'x 48' DICM will also be needed for this new station. In the Joshua Falls 765 kV yard a bus will be established to allow the spare 765/138 kV bank to be switchable. Electromechanical relaying packages on the transformers and line exit will be upgraded. A DICM will be required in this 765kV yard. Replace 765/138 kV 250 MVA phase 1 & 3 with new 250 MVA transformers. (**S1668.1**)
Estimated Cost: $34.6M

Construct 0.25 miles of 1590 ACSR (operated at 138kV) connecting the Joshua Falls 765 kV station to the new 138 kV yard. (**S1668.2**) **Estimated Cost: $0.5M**

Install 0.25 miles of 1590 ACSR connecting the Gomingo – Joshua Falls line to the new 138 kV yard. (**S1668.3**)
Estimated Cost: $0.8M

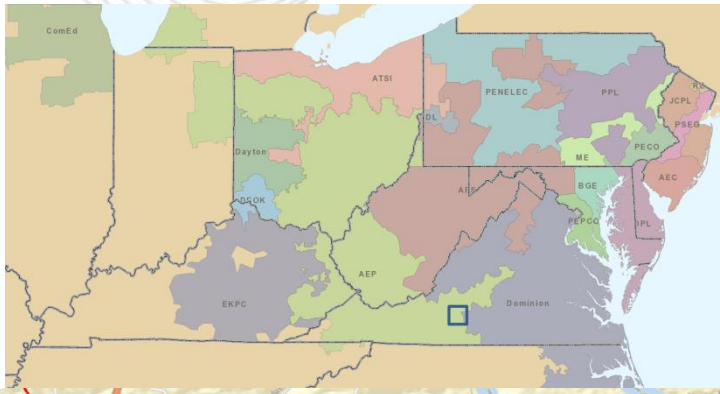
Install 0.4 miles of double circuited 1590 ACSR connecting the Opossum Creek and Easy Lynchburg lines to the new 138 kV yard. (**S1668.4**) **Estimated Cost: $1.1M**

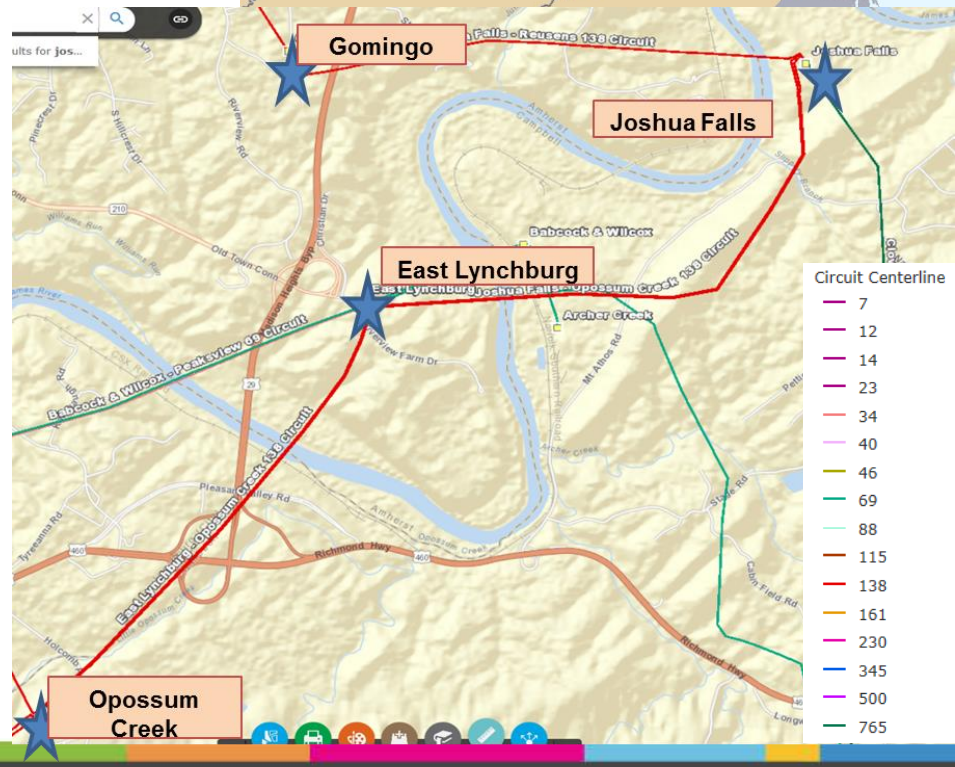
At East Lynchburg, install a new 3000 A/40 kA 138 kV circuit breaker "L" towards Opossum Creek. Replace the existing circuit breaker 3000 A/50 kA "K" with a 3000 A/40 kA 138 kV circuit breaker. Install a new 3000 A/40 kA circuit breaker "F" on the 69 kV station exit. Replace the existing 1200 A/17 kA 34.5 kV circuit breaker "A" with a 1200 A/25 kA breaker. Install a new station service transformer on the 138 kV bus and replace the existing 34.5 kV station service transformer (used for a backup). Retire capswitcher "AA" and 57.6 MVAR capacitor bank. (**S1668.5**) **Estimated Cost: $3.7M**

Total Estimated Transmission Cost: $40.7M

Projected In-service: 7/31/2020

Project Status: Engineering





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AEP Transmission Zone: Supplemental Service to Braidy Aluminum

Previously Presented: 7/27/2018 SRRTEP

Problem Statement:

Customer Service:

Braidy Industries has requested electric service with a peak demand of 60 MW for their Aluminum Mill operation at the EastPark Industrial Center in Boyd County, KY.

Kentucky Power Distribution has requested a new delivery point (Ramey station) to provide load relief to nearby distribution circuits and stations along with a reduction of distribution line exposure.

Kentucky Power Distribution has requested a new delivery point at the proposed Moore Hollow station to serve industrial customers at the EastPark Industrial Center and to reduce exposure on customers served out of the existing Princess station.

Operational Flexibility and Efficiency

The 69/34.5 kV transformer at Princess station utilizes a ground switch MOAB scheme as part of the high side transformer protection.

The 69/12 kV transformer at Hoods Creek station utilizes a ground switch MOAB scheme as part of the high side transformer protection.

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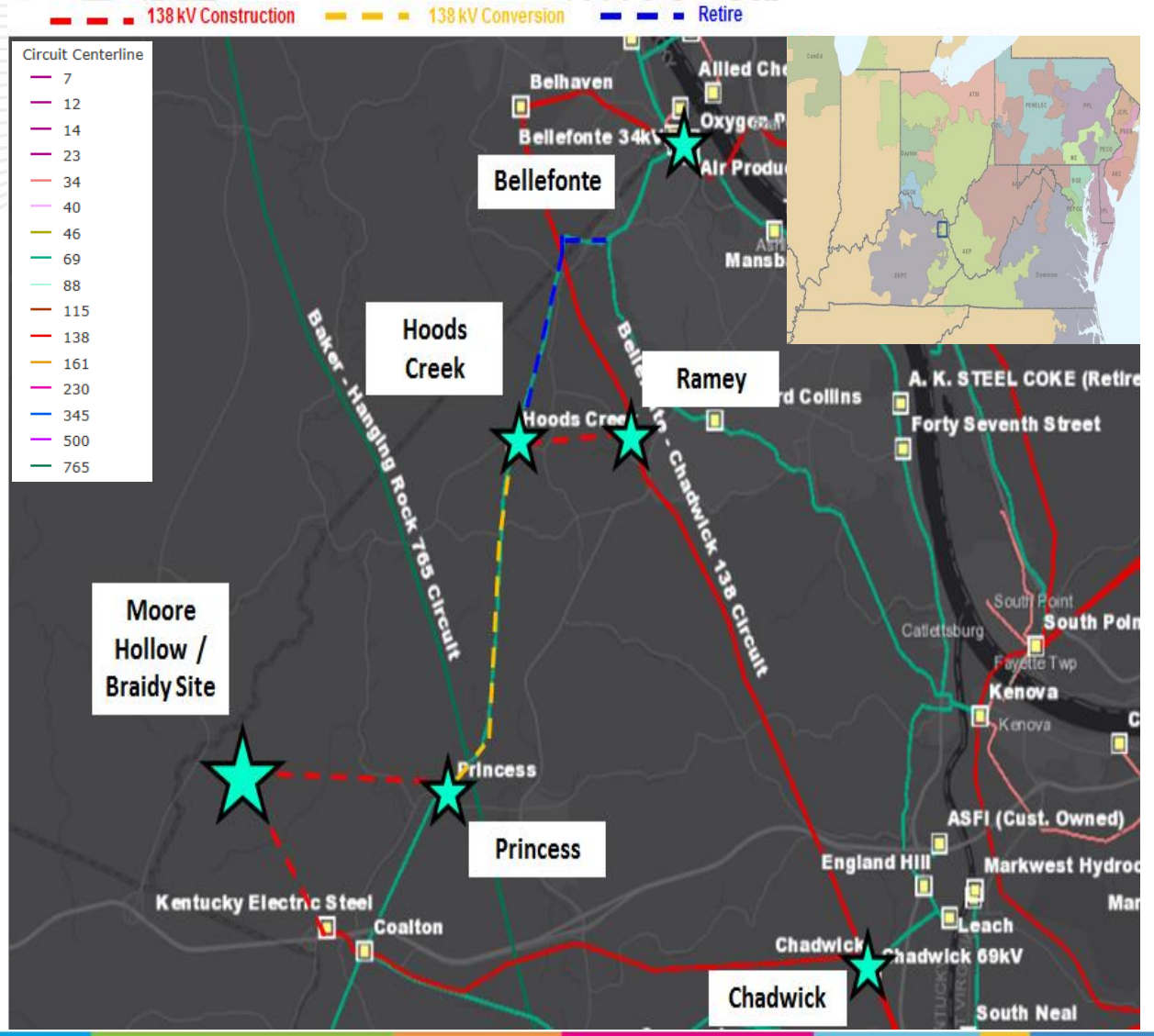

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AEP Transmission Zone: Supplemental Service to Braidy Aluminum

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Equipment Material/Condition/Performance/Risk:

The 69/12 kV Transformer #1 at Hoods Creek station is 1969 vintage and is showing dielectric breakdown (insulation), accessory damage (bushings/windings) and short circuit breakdown (due to through faults). Hoods Creek station is comprised of a four pole wood crib design. The wood poles that make up the station show condition issues associated with rot and wood pecker holes. The existing transformer at Hoods Creek is currently sitting on a wood tie foundation.

The 69/34.5 kV Transformer #1 at Princess station is 1962 vintage and is showing dielectric breakdown (insulation), accessory damage (bushings/windings) and short circuit breakdown (due to through faults). The existing transformer at Princess station is currently sitting on a wood tie foundation.

The 69 kV circuit breaker 'Z' at Bellefonte is an FK oil type breaker that was manufactured in 1971. These are oil breakers that have become more difficult to maintain due to the required oil handling. There is an increased potential for oil spills during routine maintenance and failures with these types of breakers. Other drivers include damage to bushings and an excessive number of fault operations exceeding the manufacturers recommendations. Bellefonte breaker 'Z' has experienced 17 fault operations respectively. The manufacturer's recommendation for this type of breaker is 10.

The 34.5 kV circuit breakers 'A' and 'B' at Princess station are VWVE oil type breakers manufactured in 1992. VWVE breakers carry similar concerns to those of the FK breaker listed above. Princess circuit breakers 'A' and 'B' have experienced 66 and 36 fault operations respectively. The manufacturer's recommendation for this type of breaker is 20. S&C circuit switcher 'AA' at Princess station is an S&C 2030 type with no gas monitor, sister units on the AEP system have a history of gas loss, interrupter failures, and operating mechanism failures.

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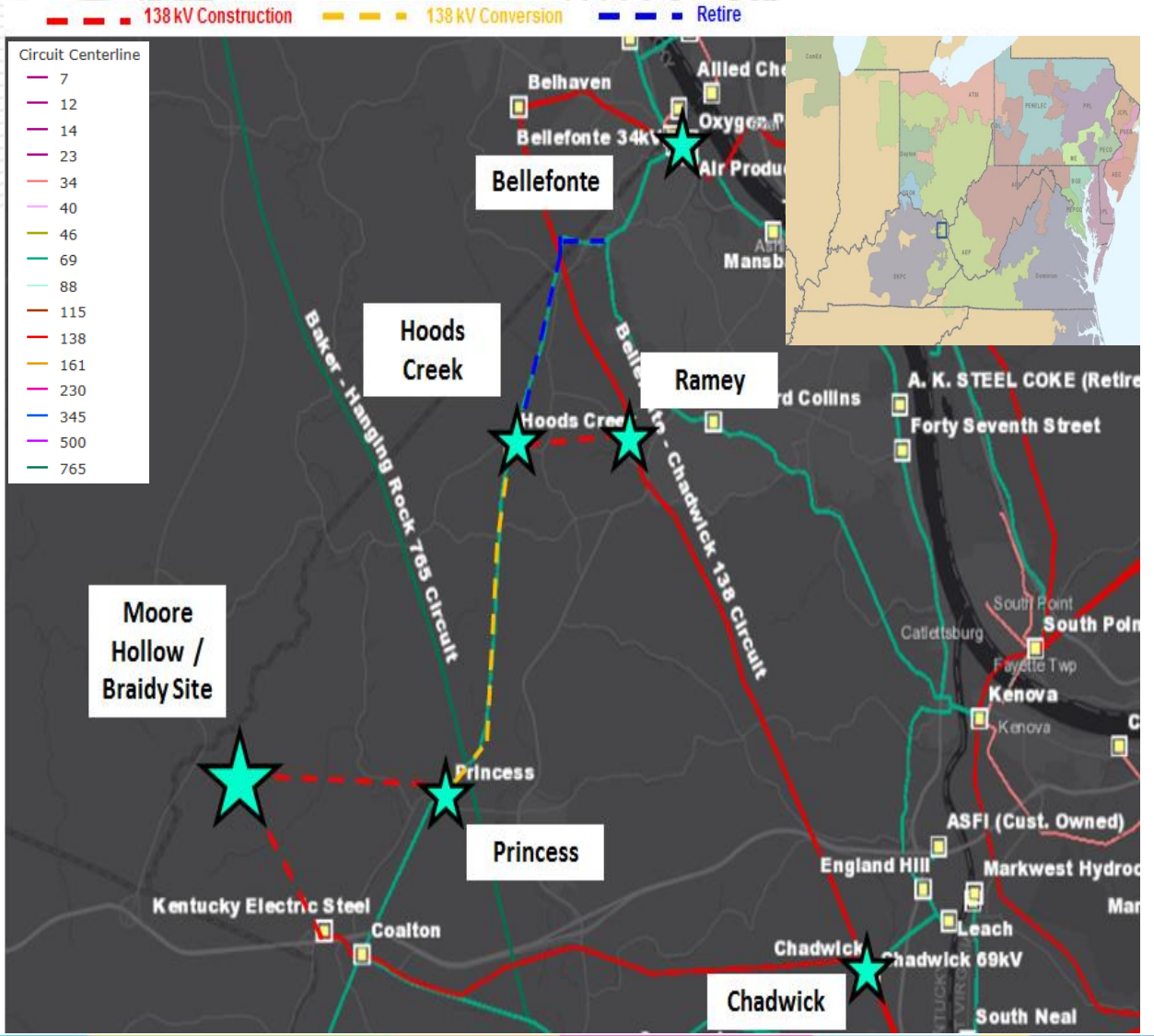

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AEP Transmission Zone: Supplemental Service to Braidy Aluminum

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Selected Solution

Construct a new greenfield station named Moore Hollow. Six 138 kV CBs (3000 A 40 kA) will be installed as well as a 138/34.5 kV transformer (30 MVA) and a 57.6 MVAR capacitor at the station. (**S1687.1**) **Estimated Cost: $ 13.6M**

Construct a 2.7 mile 138 kV line extension between Moore Hollow and Kentucky Electric Steel. At this time the existing KES metering structure will be retired due to the announced closure of the KES plant. (**S1687.2**) **Estimated Cost: $ 8.4M**

At Chadwick Station, remote end relaying work will be required. (**S1687.3**) **Estimated Cost: $0.4M**

Construct a new greenfield station, named Ramey, tapping the Bellefonte – Grangston 138 kV circuit. Four 138 kV CBs (3000 A 40 kA) will be installed as well as a 138/12kV XF (25 MVA). AEP already owns the land at the proposed Ramey station site. (**S1687.4**) **Estimated Cost: $ 0M**

Construct a new 2.8 mile 138 kV extension from Ramey to the existing Bellefonte – Coalton line. (**S1687.5**) **Estimated Cost: $10.5M**

Convert the existing Bellefonte to Coalton 69 kV line between Bellefonte and Princess to 138 kV (line is built to 138 kV standards). (**S1687.6**) **Estimated Cost: $3.8M**

Retire CB 'Z' at Bellefonte station. (**S1687.7**) **Estimated Cost: $0.1M**

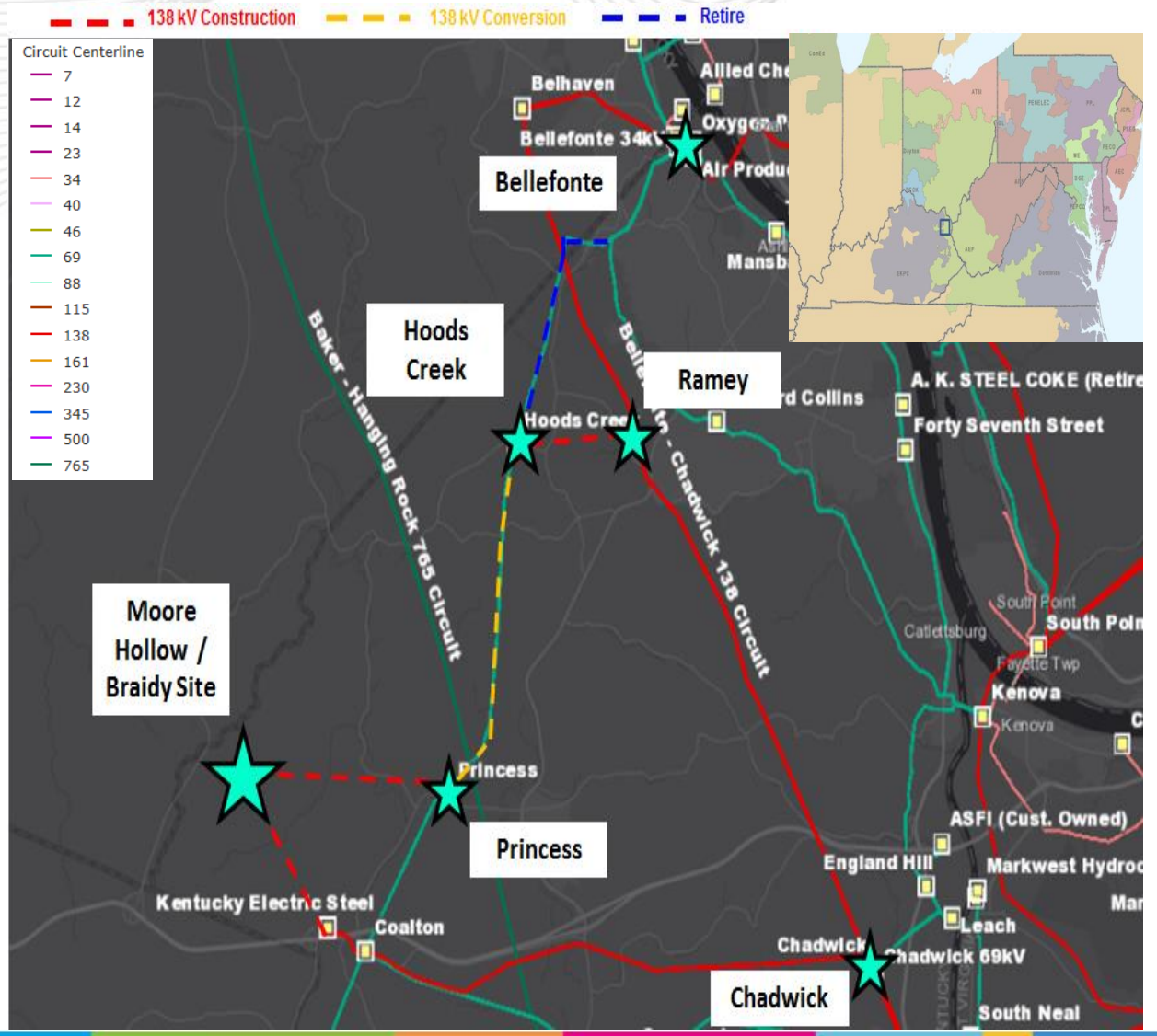
Convert Hoods Creek station to 138 kV by rebuilding the station in the adjacent lot with a 138/12 kV XF. (**S1687.8**) **Estimated Cost: $ 0M**

Convert Princess station to 138 kV by installing five 138 kV CBs (3000 A 40 kA), a 138/69 kV XF (to Coalton), and a 138/34.5 kV XF. (**S1687.9**) **Estimated Cost: $5.7M**

Construct 3.4 mile 138 kV line between Princess and Moore Hollow stations. (**S1687.10**) **Estimated Cost: $11.5M**

Total Estimated Transmission Cost: $54M - $63.4M
Projected In-service: 12/1/2021

Project Status: Scoping



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AEP Transmission Zone: Supplemental Hammondsville 69kV Station Upgrades

Previously Presented: 7/27/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The Hammondsville 69-12kV station is in need of major upgrade, due to the poor condition of the equipment. The station serves as a local hub of the sub-transmission network, with 4- circuit connections. Performing these needed upgrades at the same time as the B2606 baseline project is beneficial from an engineering/construction standpoint.

69kV circuit breakers A, B, & C are oil breakers without oil containment. Oil breaker maintenance has become more difficult in recent years due to the handling requirements and the potential for environmental risks. These 3 breakers are GE 'FK' style, which have been prioritized as needing upgraded, due to subpar reliability and lack of spare parts. The breakers were made between 1969-1975 and have experienced fault operations of 34, 70 and 81, far above the recommended limit of 10.

The station has 46 protective relays, and 41 are in immediate need of replacement (40 electromechanical and 1 static). The relays are more prone to misoperation and lack fault data collection and retention capability. In addition, the current system protection to North Wellsville uses a pilot wire communications scheme (dependent on phone company), which has been in an abnormal state for several years, placing customer load at risk. The protection to South Toronto uses a dated custom high-speed relaying scheme, which is prone to misoperations.

Customer Service:

Hammondsville serves one 69-12kV AEP distribution transformer. The fusing will be replaced with a high-side circuit switcher & relaying, permitting trip and reclose functionality for momentary faults. This will reduce the duration of outages for local customers.

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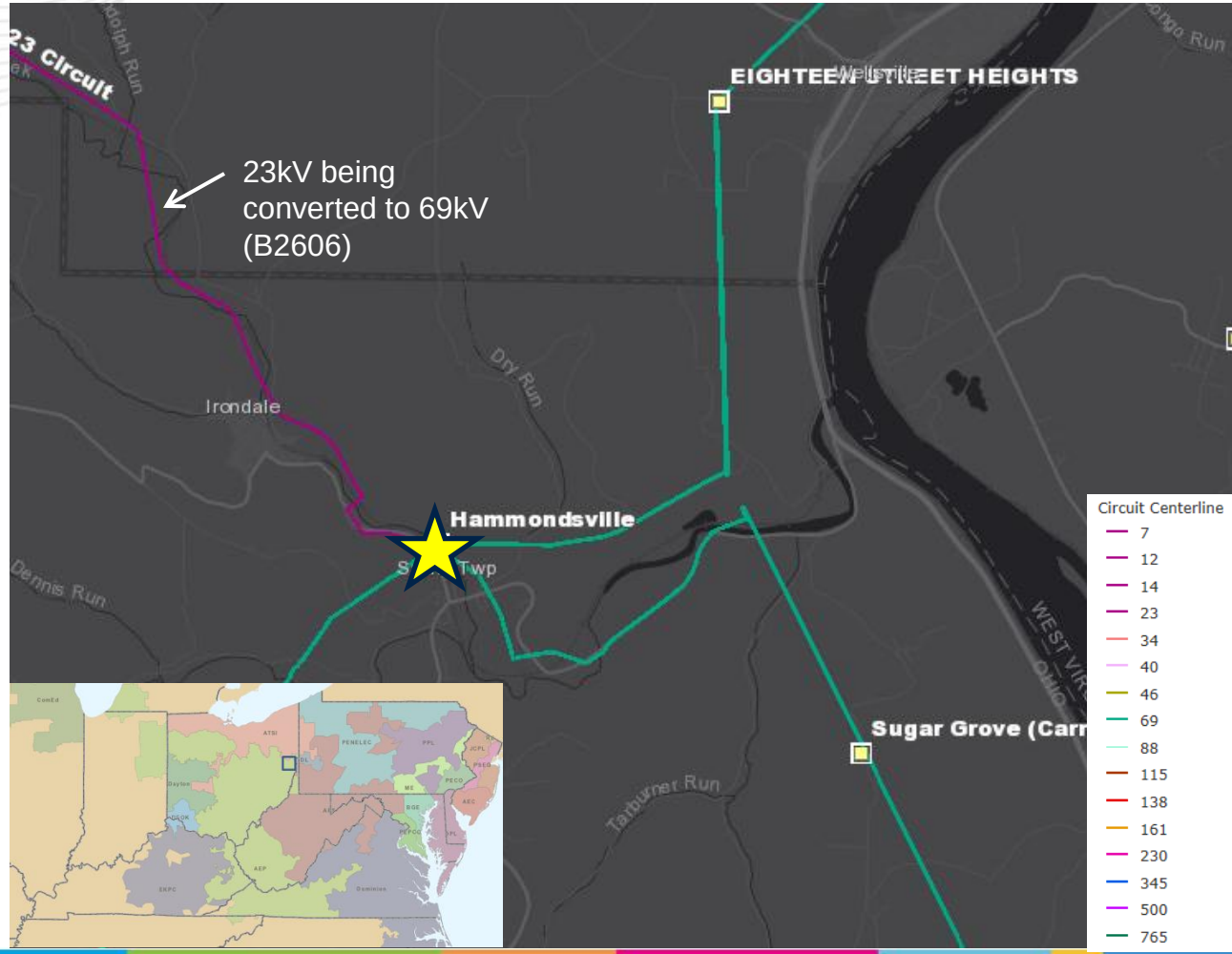

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AEP Transmission Zone: Supplemental Hammondsville 69kV Station Upgrades

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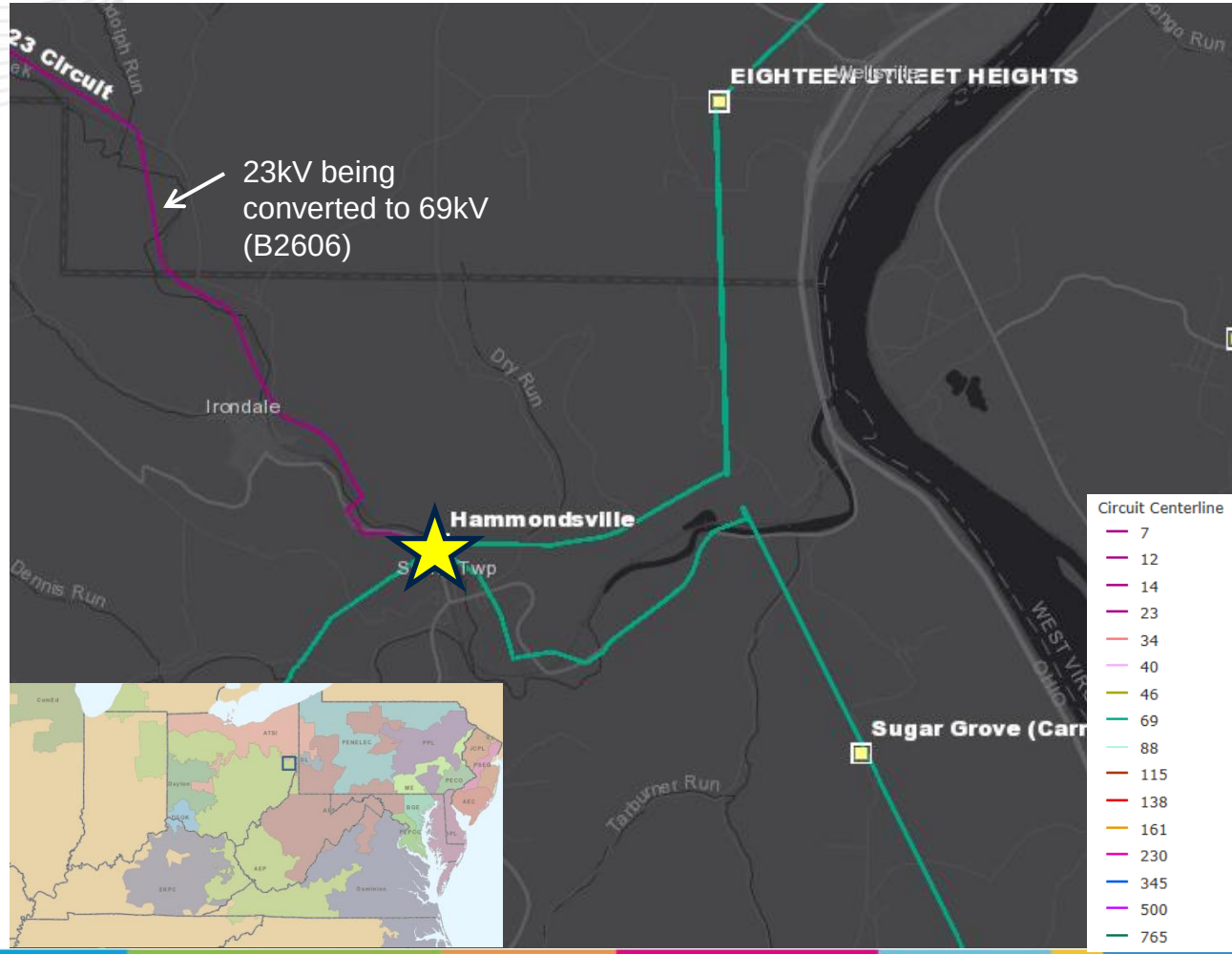
Selected Solution:

At Hammondsville 69kV station: replace 69kV oil circuit breakers A, B, & C with gas breakers, replace disconnect switches & CCVT's; upgrade line relays; upgrade bus differential protection; install a new DICM (old control building to be removed); add SCADA. Replace transformer fuses with a circuit switcher. (**S1688**)

Estimated Transmission Cost: $3.9 M

Projected In-service: 12/1/2019

Project Status: Scoping



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AEP Transmission Zone: Supplemental
Divelbiss 69 kV switching station and Academia station upgrades

Previously Presented: 7/27/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Academia station 69 kV circuit breakers “A” and “D” are showing signs of deterioration. Circuit breaker “A” has had 115 fault operations and circuit breaker “D” has had 259 fault operations (manufacturer recommended limit is 10). These breakers are oil breakers. Oil breaker maintenance has become more difficult due to the oil handling required to maintain them. Academia station transformer #1 138/69/12 kV 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).

Operational Flexibility and Efficiency:

A scope change is being done to S0770 as Divelbiss (previously know as East Fredericktown Switch). This station will be built into a 69 kV four circuit breaker ring bus versus a 69 kV two circuit breaker box bay configuration as originally proposed. There have been approximately 2 million customer minutes of interruptions. There is approximately 28 MW of load. It is optimal for sectionalizing because this prevents taking out customers or stations unnecessarily. This is also optimal for protection because each line will have its own protection zone. With a single breaker towards a radial circuit, bypasses or outages would be needed to the customers when maintenance is required. With a ring maintenance outages do not require customer outages. This project will replace S0770, which will be cancelled.

S0770 : Replace 69 kV GOAB switch and BOAB switch "W" at East Fredericktown Switch with 69 kV circuit breakers

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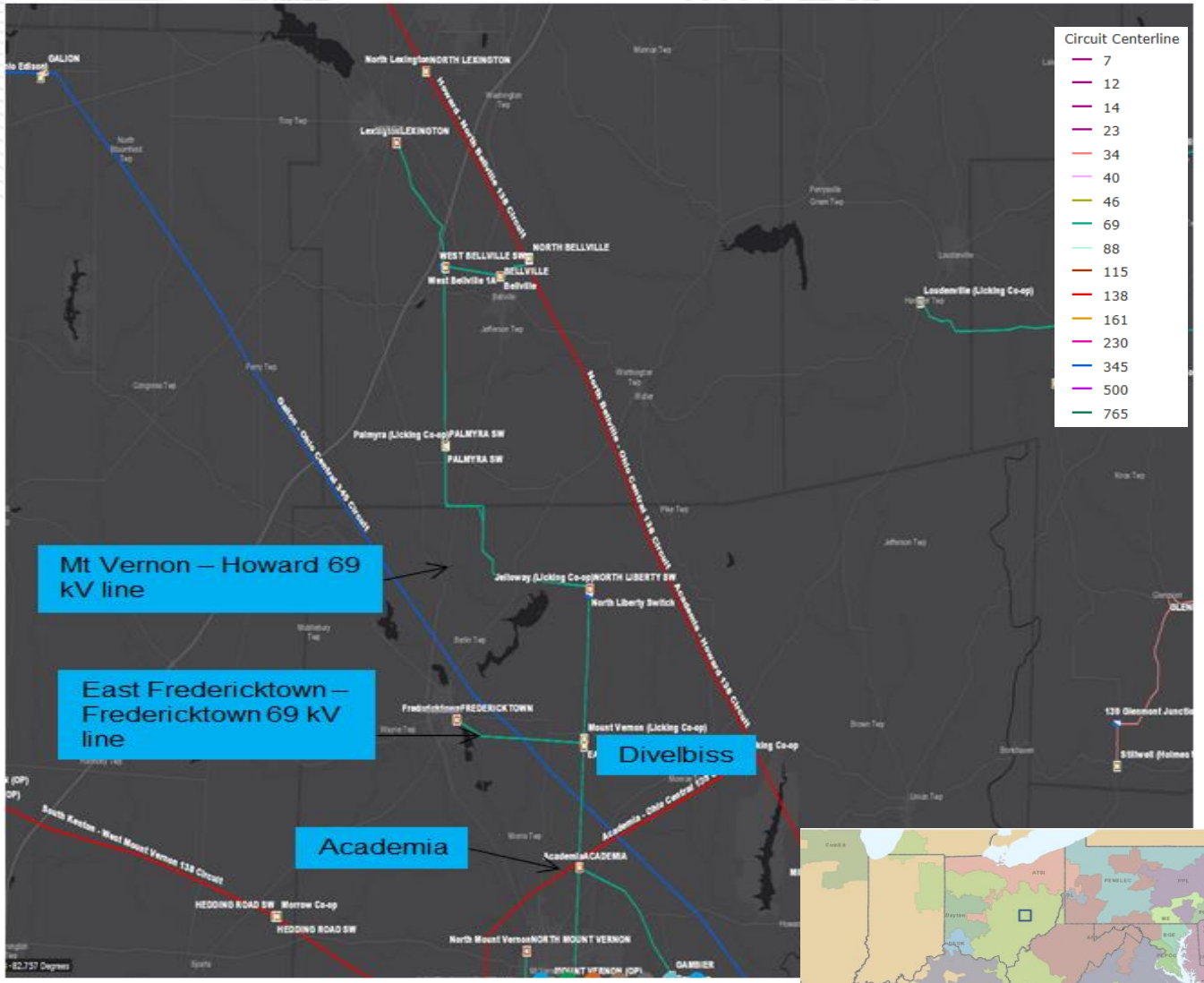

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AEP Transmission Zone: Supplemental
Divelbiss 69 kV switching station and Academia station upgrades

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Selected Solution

At Divelbiss station install four 69 kV 2000 A 40 kA circuit breakers in a ring bus configuration. Also install fiber cable extension at the station. (**S1689.1**) **Estimated Cost: $7.5M**

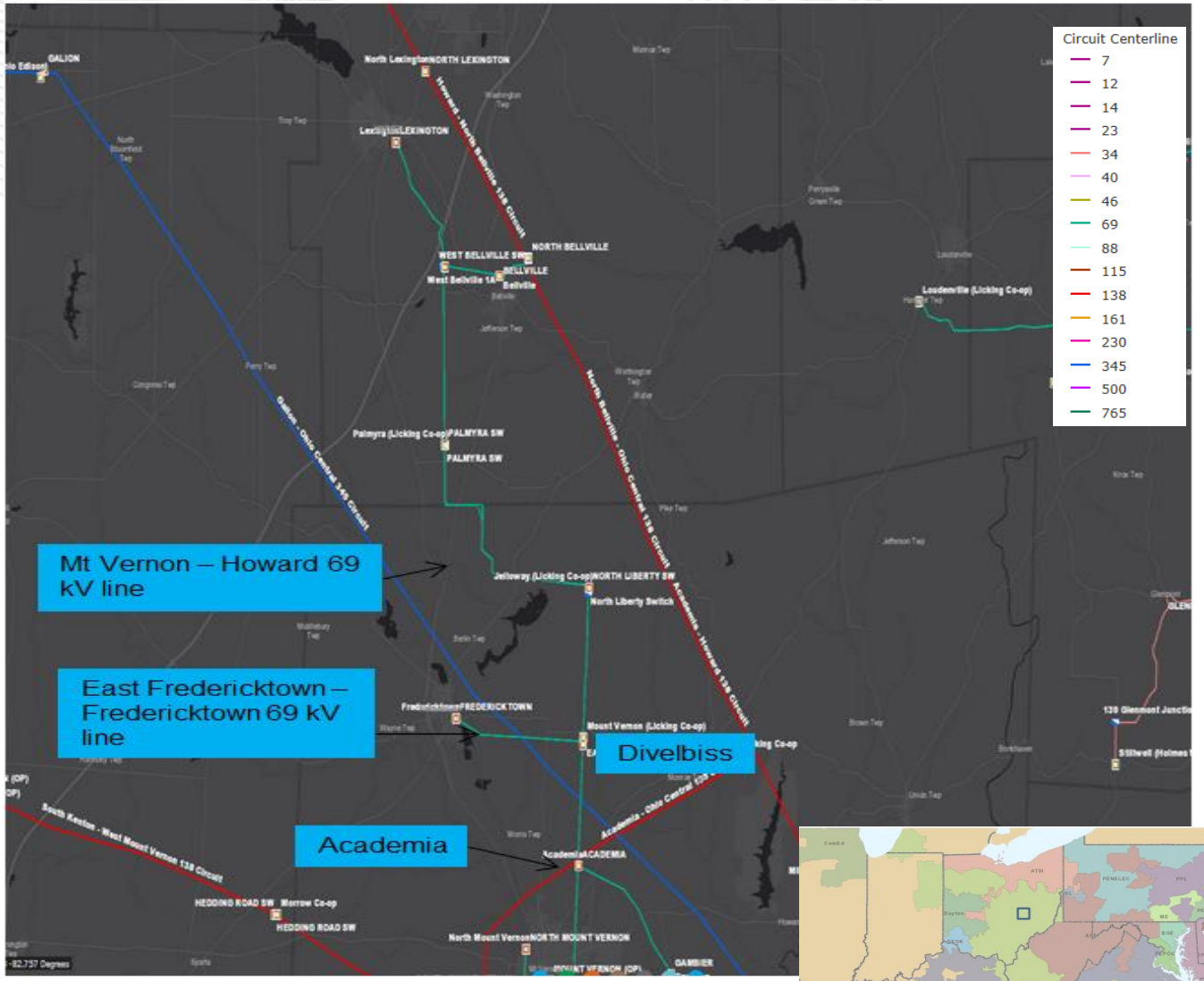
At Academia station, replace the138/69/12 kV 115 MVA transformer with a 138/69 kV 130 MVA transformer. Replace the 69 kV circuit breaker “A" and circuit breaker “D" each with 3000 A 40 kA circuit breakers. (**S1689.2**) **Estimated Cost: $4.5M**

Relocate the Mt Vernon – Howard 69 kV line and the East Fredericktown – Fredericktown 69 kV line to the new Divelbiss switch station. Additionally, install two deadend structures at the East Fredericktown – Licking CO-OP – Mount Vernon 69 kV line to accommodate the new Divelbiss switch station (**S1689.3**) **Estimated Cost: $1.3M**

Total Estimated Transmission Cost: $13.3M

Projected In-service: 12/31/2019

Project Status: Engineering



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AEP Transmission Zone: Supplemental Gable

Previously Presented: 7/27/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The Dillonvale-Smithfield 69kV circuit was originally built in the 1930's and consists of #1 copper and 4/0 ACSR conductor. Retiring this asset and transferring load to Gable will improve reliability for customers. Installing a transformer at the existing Gable station will permit the aging Smithfield station and radial 69kV circuit from Dillonvale to be retired. The Gable source will be more reliable, due to having 3- 138kV sources.

Customer Service:

AEP Ohio has a forecasted transformer overload at Smithfield in 2019 (7 MVA nameplate; capability of 8.2 MVA summer & 9.4 MVA winter; forecasted peak of 8.7 MVA summer & 11 MVA winter). This is due to large block load additions from area shale gas customers.

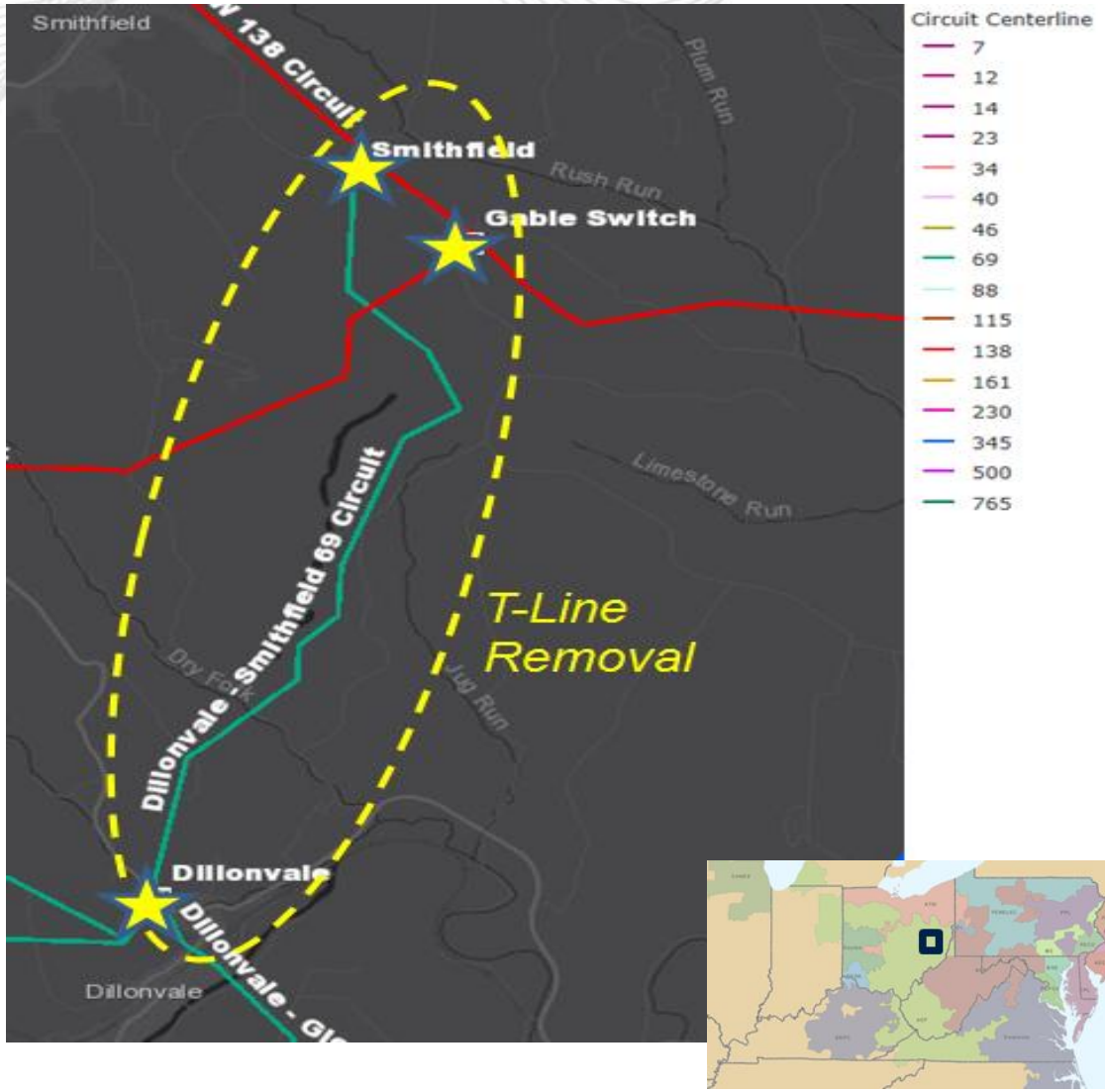
Selected Solution

Retire the 4.5-mile radial 69kV circuit between Dillonvale and Smithfield and Smithfield station. (**S1690**)

Estimated Transmission Cost: $3.1M

Projected In-service: 06/01/2019

Project Status: Scoping



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Previously Presented: 7/27/2018 SRRTEP

Problem Statement:

Customer Service:

AEP Ohio has indicated their existing 50MVA transformer at Jug Street is projected to overload in the very near future and, as a result, has requested connection for a second 50 MVA transformer at Jug Street.

Selected Solution:

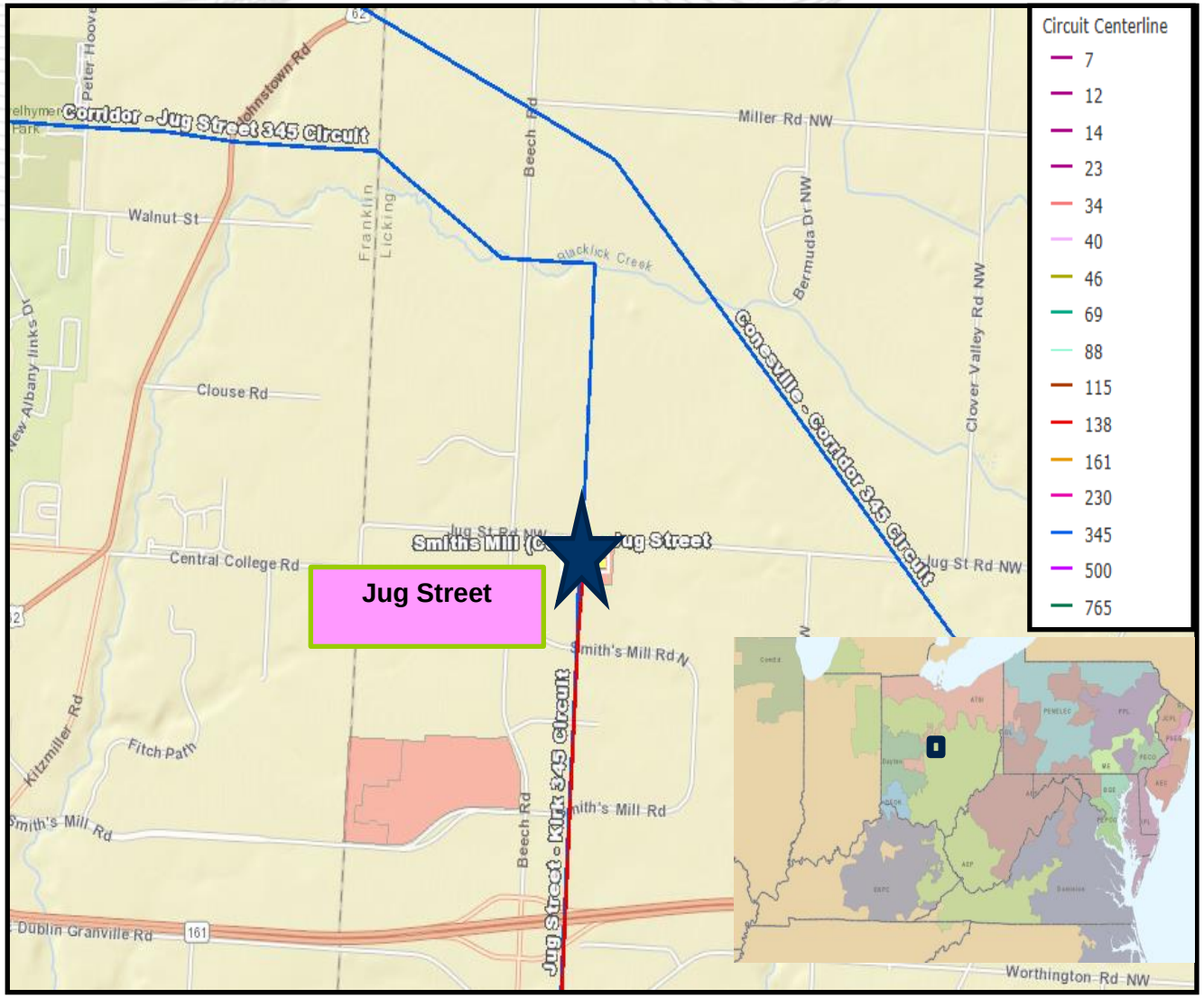
At Jug Street, install a new 3,000A 138kV 63kA CB to accommodate the new transformer. (**S1691**)

Estimated Cost: $0.5M

Total Estimated Transmission Cost: $0.5M

Projected In-service: 06/01/2019

Project Status: Scoping



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AEP Transmission Zone: Supplemental Friendship Loop

Previously Presented: 7/27/2018 SRRTEP

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The 17-mile long 69 kV Central Portsmouth-North Portsmouth line was built between 1959 and 1966 using wood-pole structures with a combination of 176.9 ACSR and 336 ACSR conductor, with a 41 MVA summer thermal rating. The 176.9 ACSR is an uncommon conductor used in the past and spare parts are an issue. There are 192 open A conditions distributed among the 139 poles on this line. The conditions include: rotten cross-arms, burnt/broken insulators, and loose/broken conductor hardware. The Central Portsmouth-North Portsmouth 69 kV circuit has an MPOI of 350 with 2,141,467 customer-minutes of interruption over the last three years.

At North Portsmouth the 138-69 kV transformer T1 (installed 1958) is recommended for replacement with factors such as moisture content, oil quality, and age. The 138 kV oil-filled breakers C (installed 1948), D (installed 1975) and 69 kV CB A (installed 1954) are at over 80% of their fault interrupting capability for 3-phase faults, and have experienced 27, 7 and 53 operations respectively, with C and A exceeding the manufacturer recommended limit of 10 fault operations. Other factors driving the replacement are age and scarce availability of spare parts.

The central Portsmouth breakers G and H are both 1975 oil-filled breakers with 29 and 25 operations respectively, exceeding the manufacturer recommendation of 10 fault operations. The breakers both exceed AEP's threshold for replacement with conditions including: age; bushing problems; unavailability of spare parts; lifetime fault operations count; and high moisture readings. 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.

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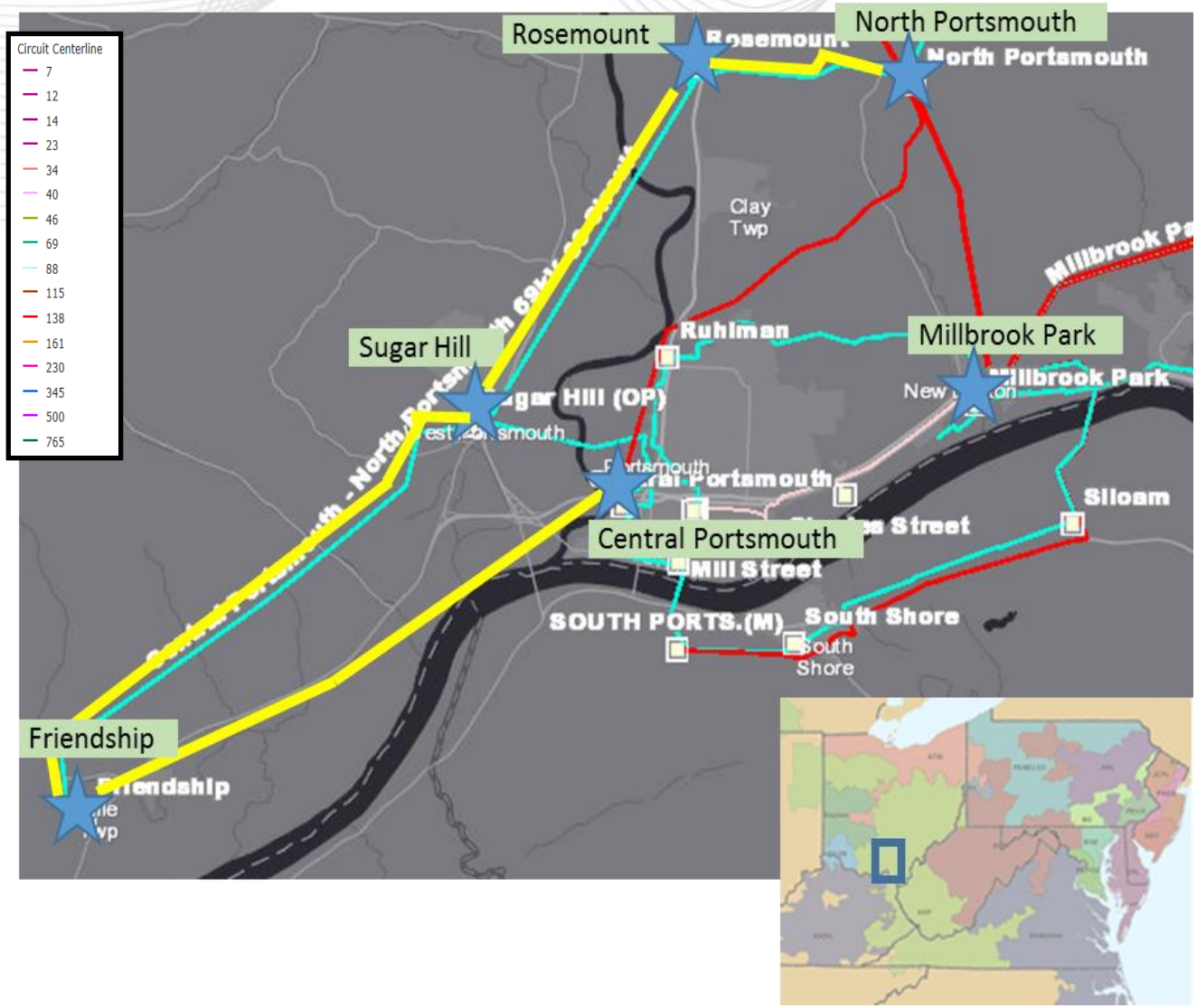

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AEP Transmission Zone: Supplemental Friendship Loop

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Selected Solution:

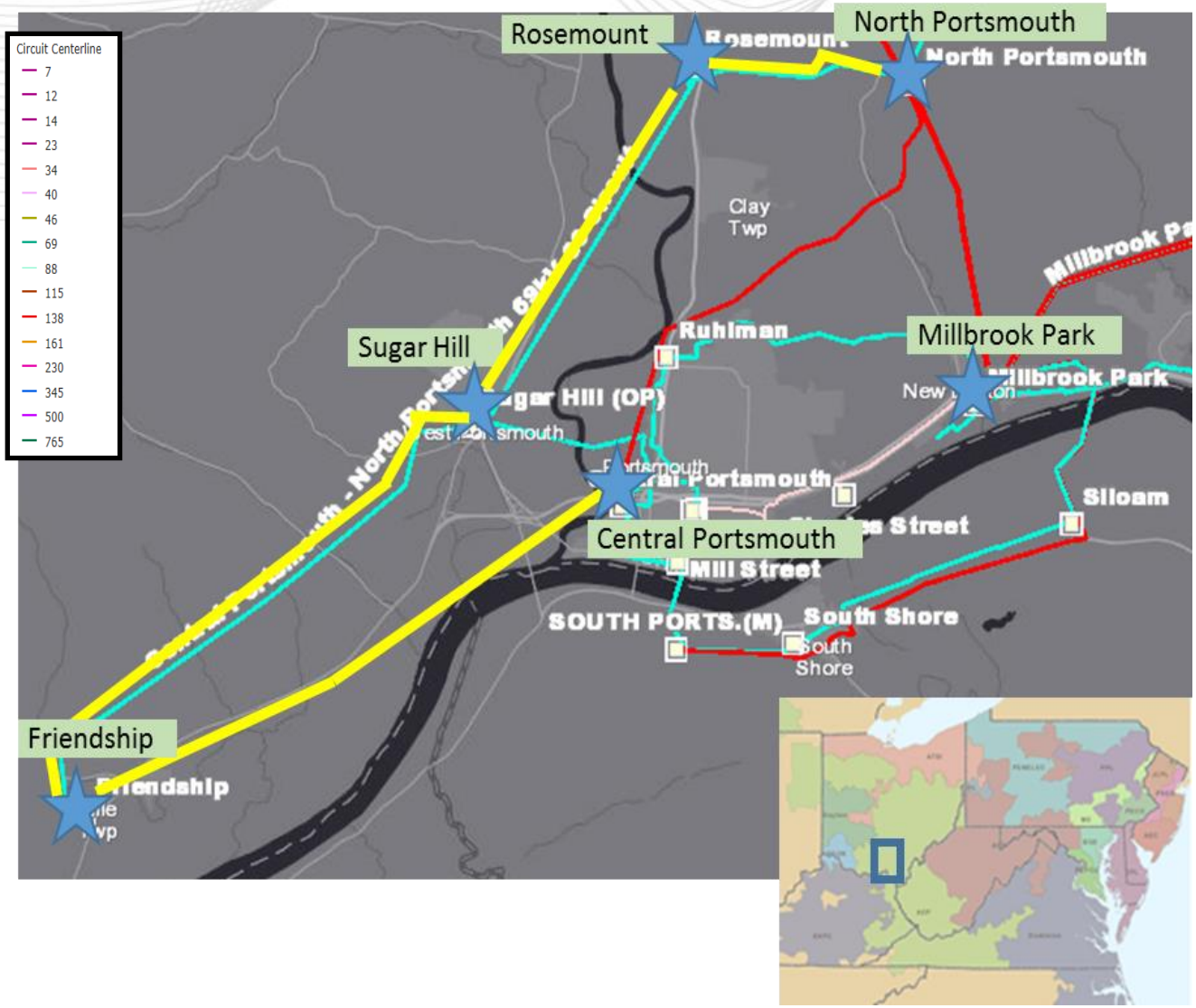
Build a new 8.5 mile 69kV line from Friendship Station to Central Portsmouth Station, using 556 ACSR (102MVA) and remove the old Central Portsmouth-Sugar Hill Line. Rebuild the remaining 13.9 miles of the Friendship Loop from North Portsmouth to Rosemount, from Rosemount to Sugar Hill and from Sugar Hill to Friendship using 556 ACSR (102 MVA) and ADSS. (**S1692.1**)
Estimated Cost: $41.8M

At Friendship station, install a 69kV line CB & line MOAB. At Sugar Hill station, upgrade bus though-path and replace switches to accommodate the line reconfigurations. At North Portsmouth, replace 138-69kV transformer with a 90 MVA unit with a 138kV circuit switcher, replace 138kV CB C and 69kV CB A. Remove bus tie 138kV CB D and install a new 138kV CB to isolate Millbrook Park line. Install a new 69kV CB on low side of the transformer. At Millbrook Park, replace relay & install a CCVT on North Portsmouth Line. At Central Portsmouth, replace 138kV CBs G & H. At Rosemount, install two line MOAB switches inside substation and replace the ground switch MOAB with a 69kV circuit switcher. (**S1692.2**) **Estimated Cost: $12.6M**

Total Estimated Transmission Cost: $54.4M

Projected In-service: 04/01/2023

Project Status: Scoping



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Previously Presented: 7/27/2018 SRRTEP

Problem Statement:

Customer Service:

AEP Ohio Distribution requested a new delivery point to serve their Ridgely station by 6/2020. The initial load is approximately 27 MVA with future growth anticipated. The initial 27 MVA load is being transferred from four adjacent Stations, but future new load is expected.

Selected Solution:

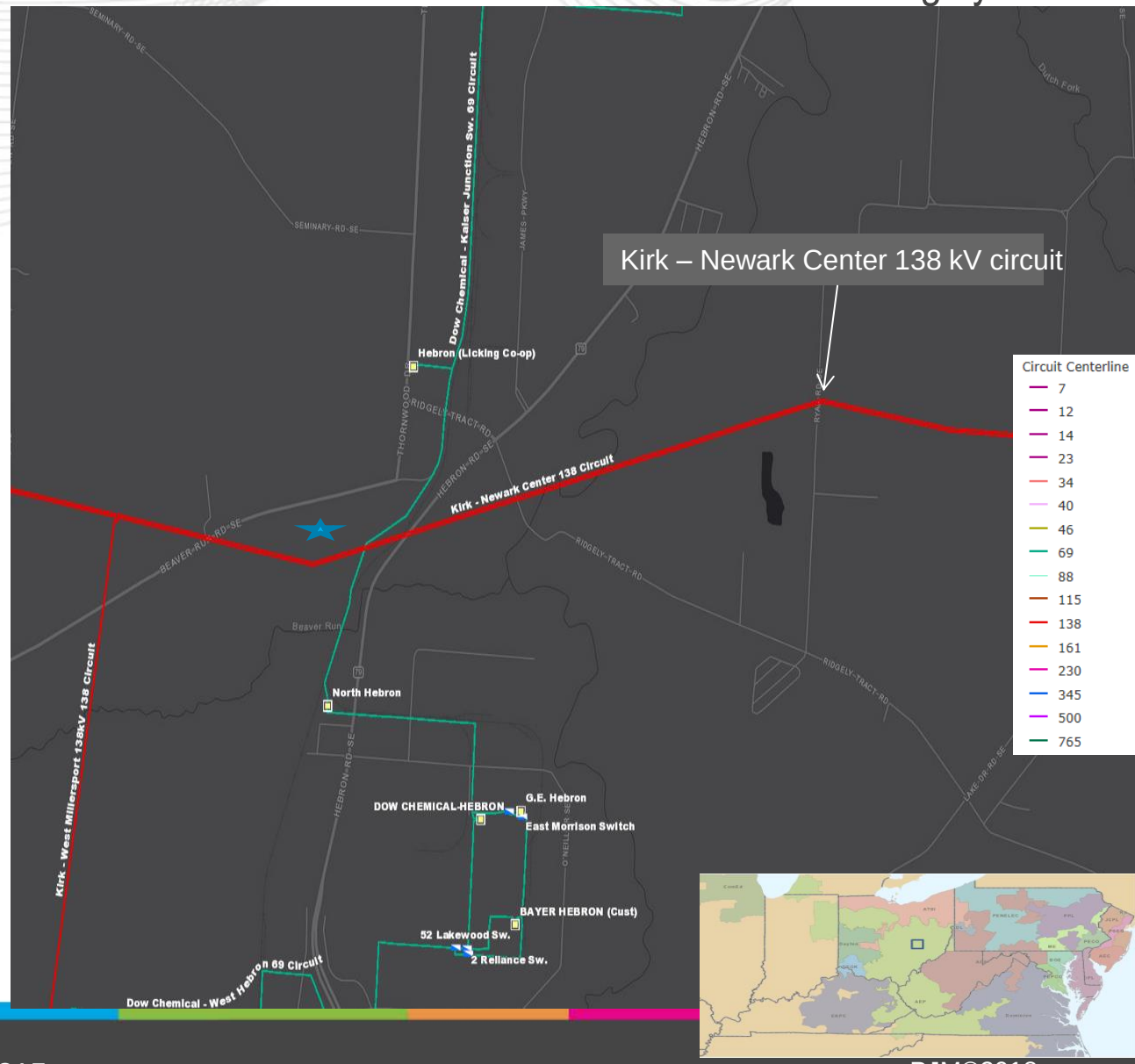
Install a new 0.1 miles 138 kV loop from Ridgely station to the Kirk – Newark Center 138 kV circuit (Conesville – Kirk 138 kV line) with the conductor size 1590 ACSR 54/19. (**S1693.1**) **Estimated Cost: $0.7M**

At Ridgely station install a new 138 kV bus with two 2000 A line Moab switches. The station will have space to expand in the future if needed. Fiber will also be installed at Ridgely station. (**S1693.2**) **Estimated Cost: $1.6M**

Total Estimated Transmission Cost: $2.3M

Projected In-service: 06/30/2020

Project Status: Engineering



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AEP Transmission Zone: Supplemental Project

Previously Presented: 8/31/2018 SRRTEP

Supplemental Project

Problem Statement:

Operational Flexibility and Efficiency:

- Jumpers & risers for the 138 kV breakers HA and HB are the low rated conductors at Muskingum 138 kV station. This could cause the potential overload later if this is retained. Operation has requested to retain CBs so that they can be used as bus tie CBs when its needed. Four disconnect switches for the breakers are 2500 A now.

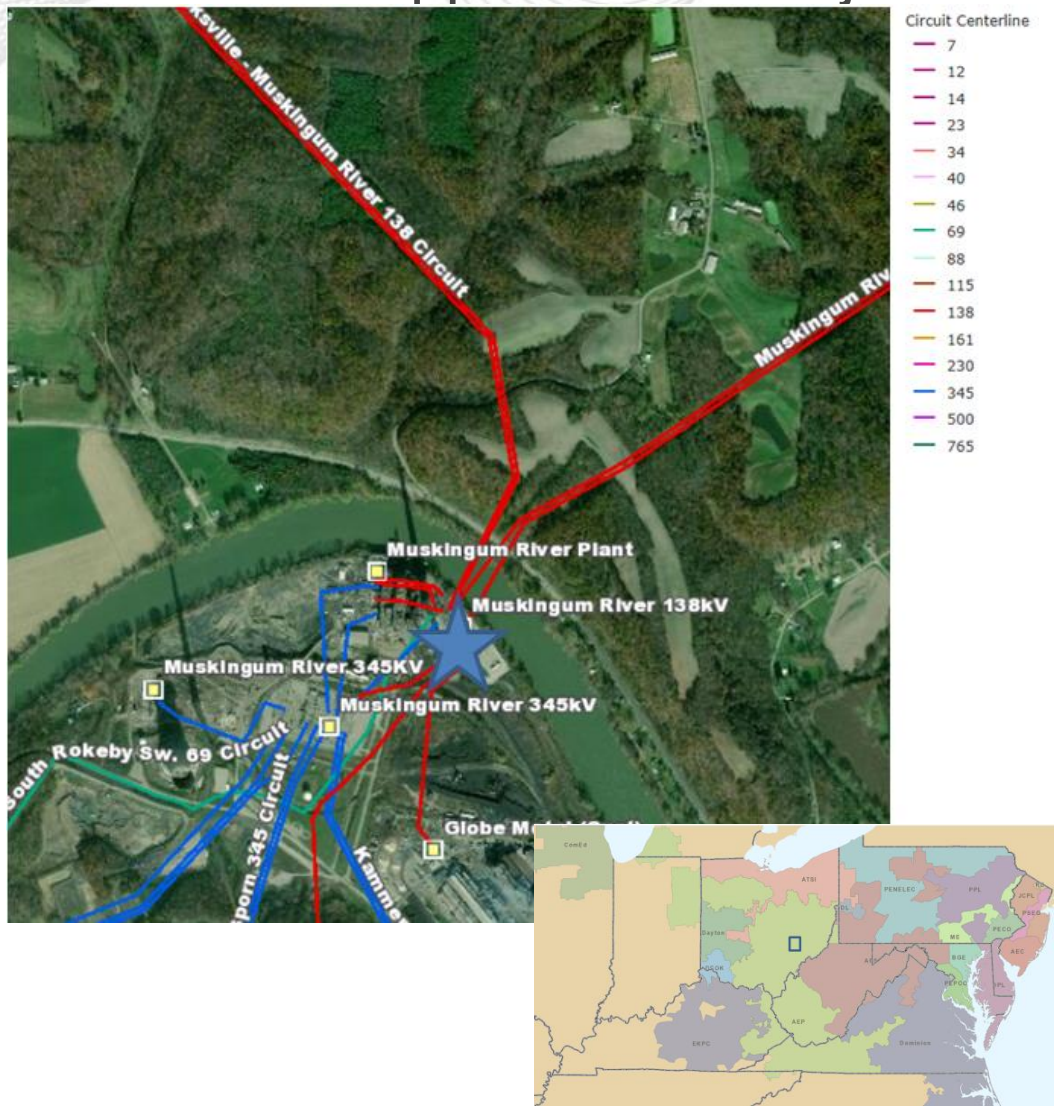
Selected Solution:

Upgrading jumpers/risers and 4 disconnect switches (3000 A) for 138 kV breakers HA and HB at Muskingum 138 kV station. (**S1748**)

Estimated Supplemental Cost: $0.3 M

Projected IS date: 6/1/2023

Status: Scoping



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Supplemental Project
Previously presented: 12/14/2017

Problem Statement:
Equipment Material/Condition/Performance/Risk:

345 kV circuit breakers “Q”, “Q1”, and “Q2” are in poor condition due to corrosion issues and need replacement (vintage 1988). All three breakers are SF6, FX-22A type breakers which is an obsolete 345 kV model. AEP only has 8 of this type of breaker across the entire system and spare parts are difficult to come by. Additionally, the three subject breakers have significantly exceeded the designed number of 10 fault operations. Breaker Q has experienced 87 fault operations, Q1 has experienced 29 fault operations and Q2 has experienced 113 fault operations. All three breakers have also shown issues with their arcing contacts. Due to contact wear, not replacing the breakers can lead to catastrophic failure.

Kanawha River 345/138 “B” Bank will be replaced due to multiple issues and a high risk of failure (vintage 1973) . Failure of this transformer could cause damage to other equipment at the station an oil leakage in the yard. Transformer B has experienced short circuit breakdown caused by the large amount of significant through fault events in excess of 700°C, increased and upward trending of gassing, major periods of overheating, and high concentration of combustible gases (acetylene, ethylene, ethane, and methane). Moreover, studies identified in the AEP Transmission Operations Seasonal Performance Appraisal for the 2017 Winter season show that the failure of 345/138 kV Transformer B would create an overload scenario on 345/138 kV Transformer A for the loss of the Kanawha River-Matt Funk 345 kV circuit. The reliability of each transformer is critical if the other transformer is removed from service.

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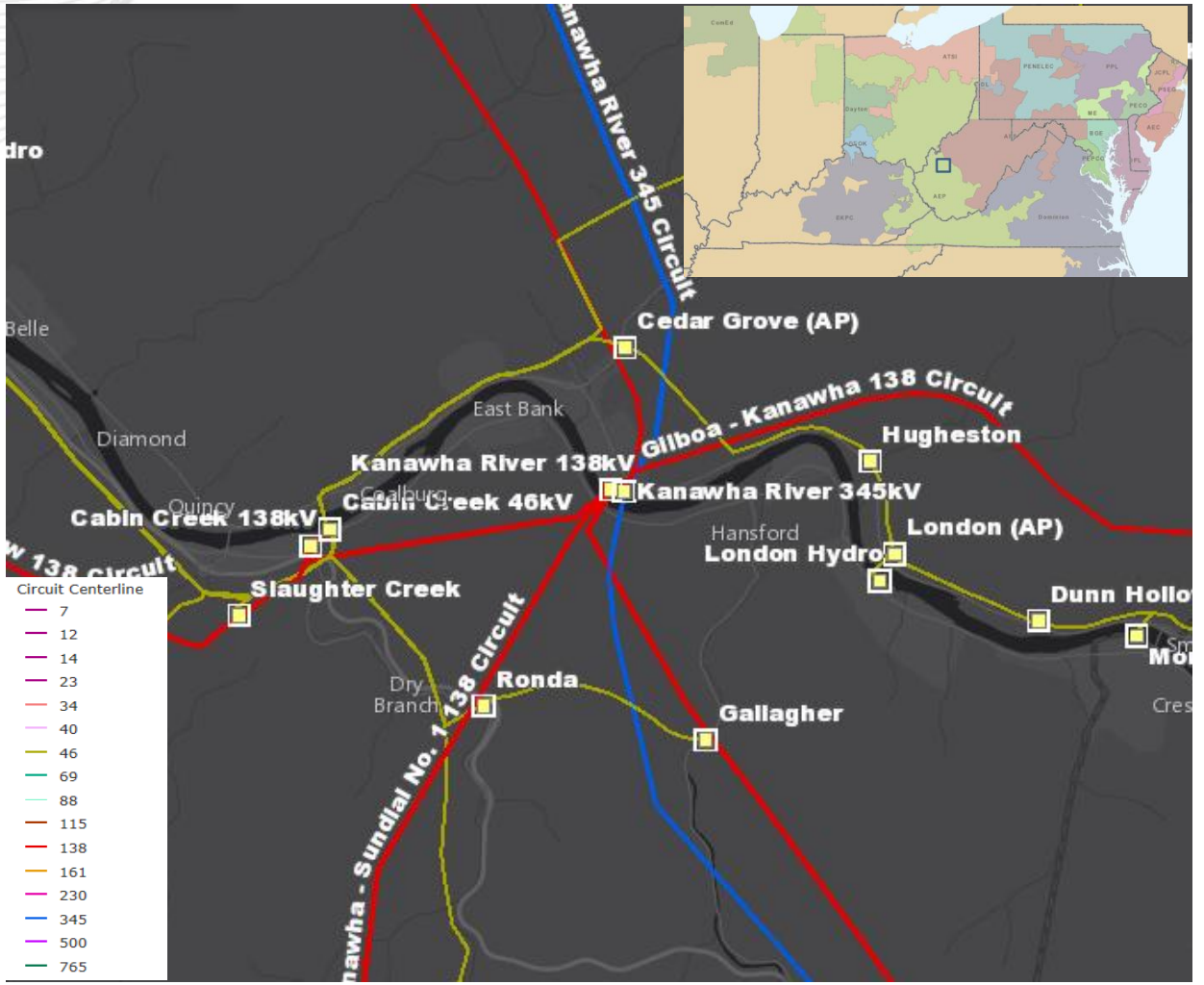

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AEP Transmission Zone: Supplemental Kanawha Station Rehab

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The Kanawha River 345 kV Series Capacitor was installed on the APCo transmission system in 1991 to improve loadability of the Kanawha-Matt Funk 345 kV 108 mile line by reducing its apparent impedance. The existing series capacitor consists of three impedance compensation (i.e. reduction) segments. Segment 1 (10%), Segment 2 (20%), and Segment 3 (30%). Segments 1 and 2 are located on one platform while the segment 3 on a separate platform. The fiber optic cable used in Segment 1 is in complete failure. The power supply for Segment 2 has failed. The control cards for both Segment 1 and Segment 2 have been used to keep Segment 3 available. Segments 1 and 2 cannot be repaired due to lack of parts and Segment 3 may not operate when called upon due to inadequate protection and control equipment. The fiber optic cable in Segment 3 is also on the verge of failure based on recent testing. Due to its age, spare parts are unavailable because they are no longer produced by the manufacturer. The lifecycle of a capacitor in a substation environment is 30 years, and these capacitors are approaching their end of life. In addition, upgrading the protection and control equipment is not an option due to the fact that modern relaying packages are not compatible with the aged series capacitor.

Operational Flexibility and Efficiency

The 345 kV series capacitor is used to help maintain the reliability on the transmission grid and allows flexibility during maintenance and construction outages. Reliability is maintained by adhering to voltage and thermal limits to withstand additional system disturbances. Specifically, the 345 kV Series Capacitor Bank is needed to alleviate Interconnection Reliability Operating Limit (IROL) constraints.

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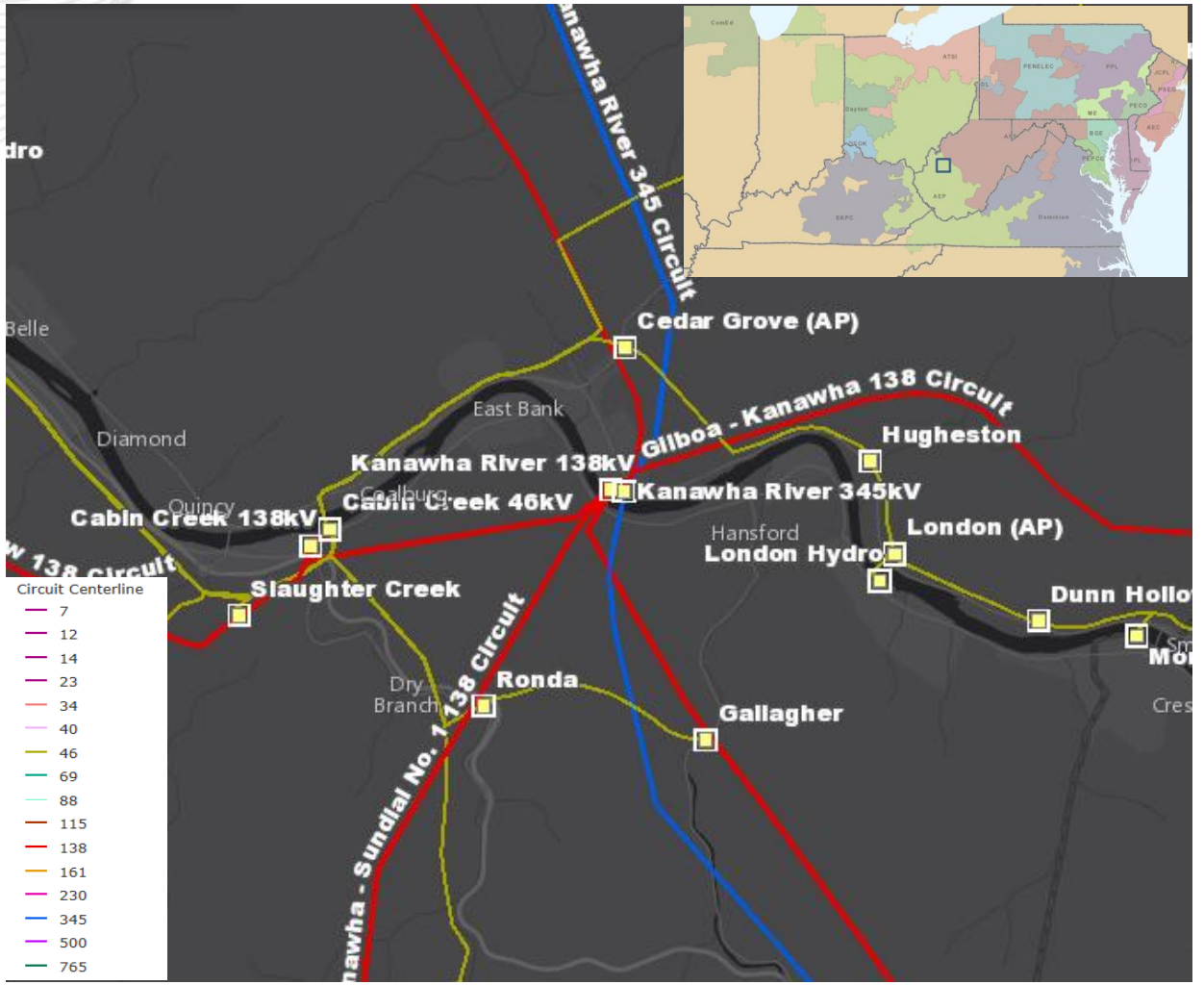

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AEP Transmission Zone: Supplemental
Kanawha Station Rehab

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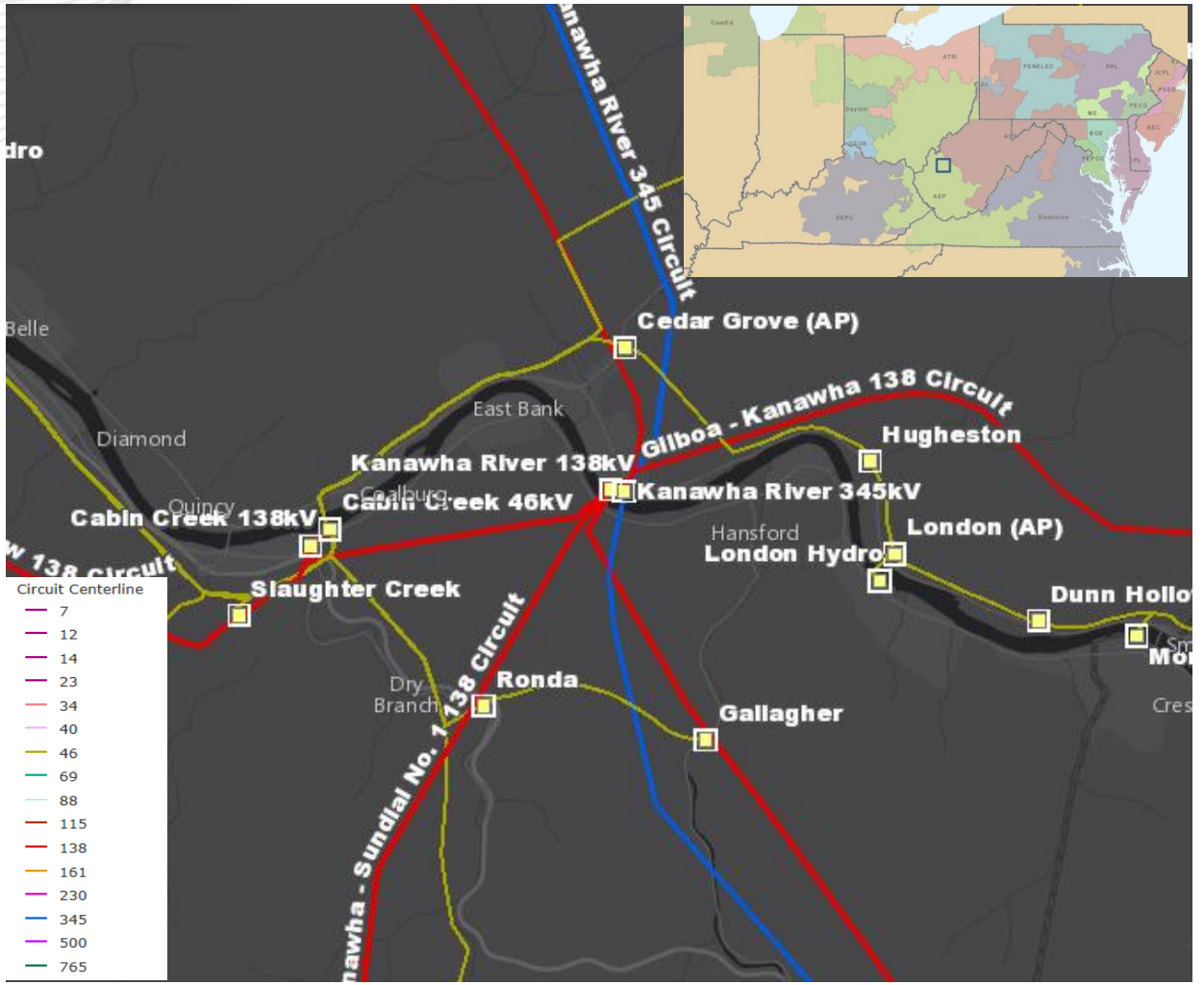
The 345 kV Series Capacitor Bank is used during heavy power flow winter conditions and/or during a significant outage to alleviate voltage and thermal constraints. Since 2014, the series capacitor was used five times to help alleviate operational concerns. The 345 kV Series Capacitor Bank can provide voltage support to the 138 kV system during heavy transfers to the Dominion interface under multiple outage conditions.

Selected Solution:
Replace three existing 3000 A 50 kA 345 kV circuit breakers Q, Q1 and Q2 with new 5000 A 63 kA circuit breakers. Replace the three sections of the existing Kanawha River Series Capacitor with a single 24 ohm 3000 A series capacitor. Replace existing 400 MVA 345/138/13.8 kV XF with a new 450 MVA 345/138/13.8 kV XF. (S1461)

Total Estimated Transmission Cost: $30.0 M

Projected In-service: 12/12/2019

Project Status: Scoping



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Supplemental Project
Previously presented: 12/14/2017

Problem Statement:
Equipment Material/Condition/Performance/Risk/Operational Flexibility:

138kV breakers B, B1, B2, C, and C1 are all air blast breakers type PK-2B40 and 2B50. Air blast breakers are being replaced across the AEP system due to reliability concerns, intensive maintenance, and tendency to fail, catastrophically. During failures, sharp pieces of porcelain from bushings are expelled, which are a potential safety hazard to field personnel. In addition, manufacturers do not develop spare for these types of breakers. The Manufacturers' recommended number of fault operations is 10. Breaker B has experienced 47 fault operations, breaker B1 has experienced 127 fault operations, breaker B2 has experienced 102 fault operations, breaker C has experienced 63 fault operations, and breaker C1 has experienced 100 fault operations .

Drivers for 765/138 kV 600 MVA transformer # 1 (vintage 1969) include bushing damage and wear, dielectric strength breakdown (insulation breakdown), and short circuit strength breakdown due to through fault events. Additionally, transformer # 1 has high levels of Acetylene. Gas formations within a transformer are caused by electrical disturbances and/or thermal decomposition as a result of multiple thermal and/or electrical faults suffered through the life of the transformer.

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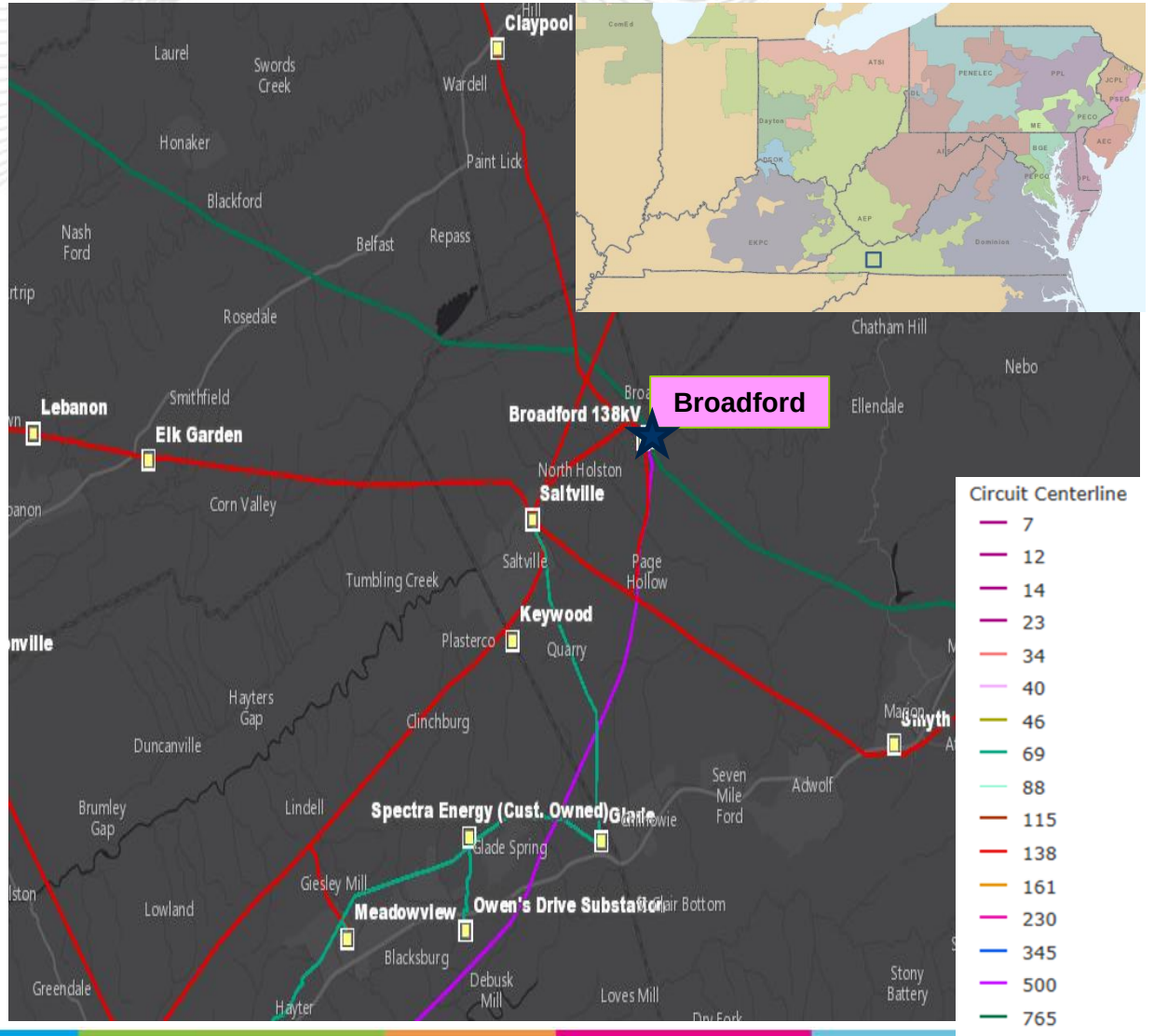

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AEP Transmission Zone: Supplemental Broadford Station

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Drivers for 765/500 kV 1500 MVA transformer # 4 (vintage 1969) include short circuit strength breakdown (due to through fault events), dielectric strength breakdown (insulation), and bushing wear. Additionally transformer # 4 also has high Ethane and Carbon Dioxide levels dissolved in the oil.

Operational Flexibility and Efficiency:

Due to the lengthy outages and space constraints within the existing 765 kV yard, both 765 kV transformer replacements will need to be done in the clear. To accommodate the new transformers position, circuit breakers N, N1, and P will be installed. Taking transformers #1 and #4 off the bus will allow us to separate dissimilar zones of protection, which can lead to relay misoperations. In addition, due to space constraints and construction requirements, the new transformers cannot be physically placed back in their original locations.

Currently at the 138 kV yard, both the Broadford – Wolf Hills and Broadford – Atkins circuits are terminated directly on the bus. This creates dissimilar zones of protection (line and bus) that can cause misoperations. Broadford – Wolf Hills is approximately 30 miles long and Broadford – Atkins is approximately 20 miles long; terminating both of these lines into a new breaker string will help reduce the exposure on each circuit. Installing circuit breakers D, D1, and D2 will mitigate this relay protection issue along with subjecting equipment to undue fault conditions. The station will be reconfigured and the work will be done in the clear to lessen the impact of the outages that need to be taken. In doing so, the reactor and circuit breaker C2 will be replaced as part of the station reconfiguration.

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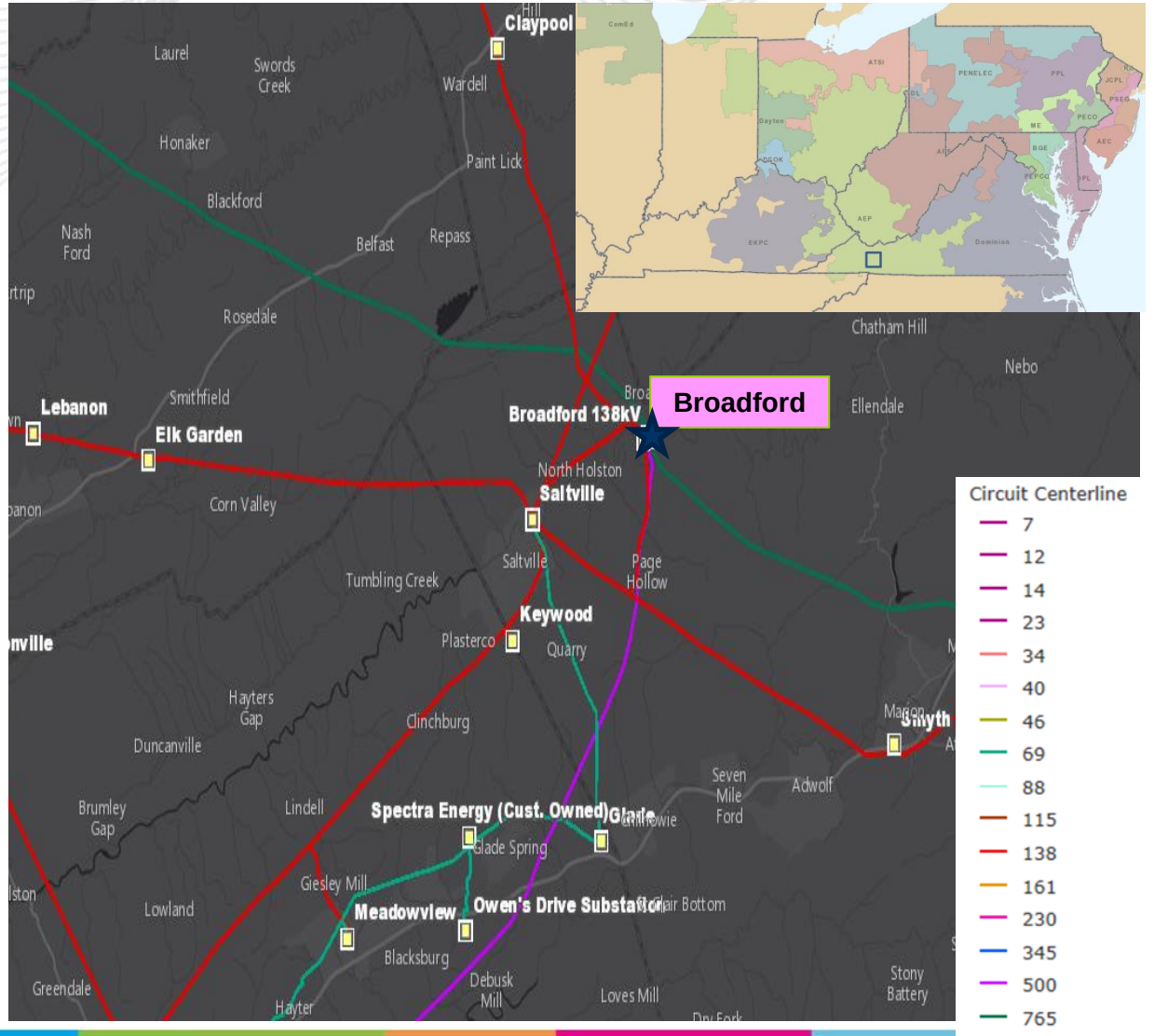

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AEP Transmission Zone: Supplemental Broadford Station

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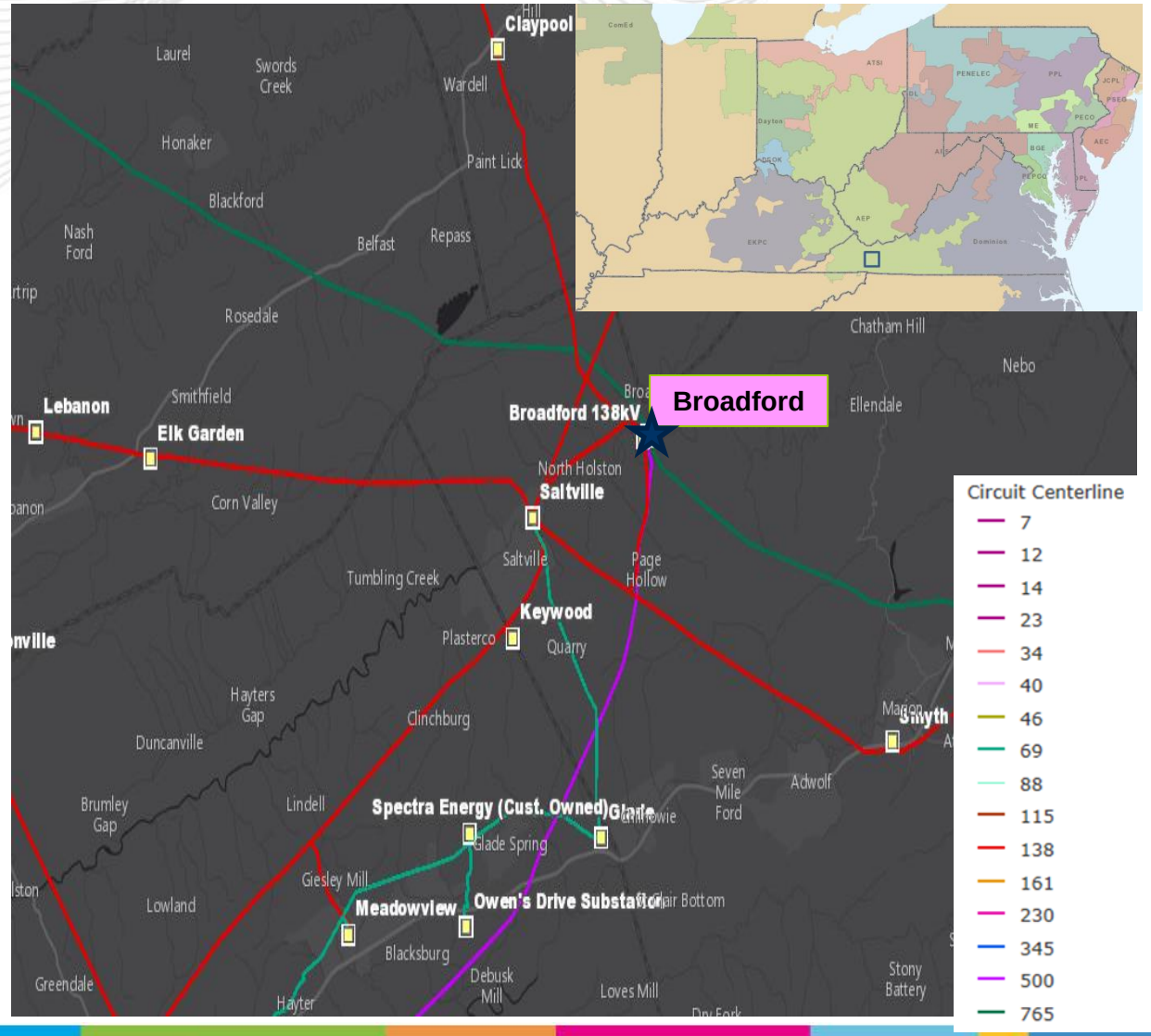
Selected Solution:
Broadford 765 kV Yard: Replace existing 765/138 kV 600 MVA XF #1 with a new 765/138 kV 750 MVA XF (standard size). Replace 765/500 kV 1500 MVA XF #4 with a new 765/500 kV 1500 MVA XF. Install one new 765 kV 4000 A 50 kA circuit breaker to complete the existing "P" string. Install two new 765 kV 4000 A 50 kA circuit breakers in a newly constructed "N" string. (S1462.1) **Estimated Cost: $74M**

Broadford 138 kV Yard: Replace six existing 138 kV 3000 A 42 kA circuit breakers B, B1, B2, C, C1 and C2 with six new 138 kV 3000 A 63 kA circuit breakers. Install three new 138 kV 3000 A 63 kA circuit breakers in newly constructed D string. Replace existing 138 kV 3000 A 40 kA circuit breaker R with a new 138 kV 3000 A 40 kA breaker "CC". Replace existing 138 kV Reactor with a new 138 kV Reactor. (S1462.2) **Estimated Cost: $28M**

Total Estimated Transmission Cost: $102M

Projected In-service: 12/01/2020

Project Status: Engineering



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Supplemental Project
Previously presented: 12/14/2017

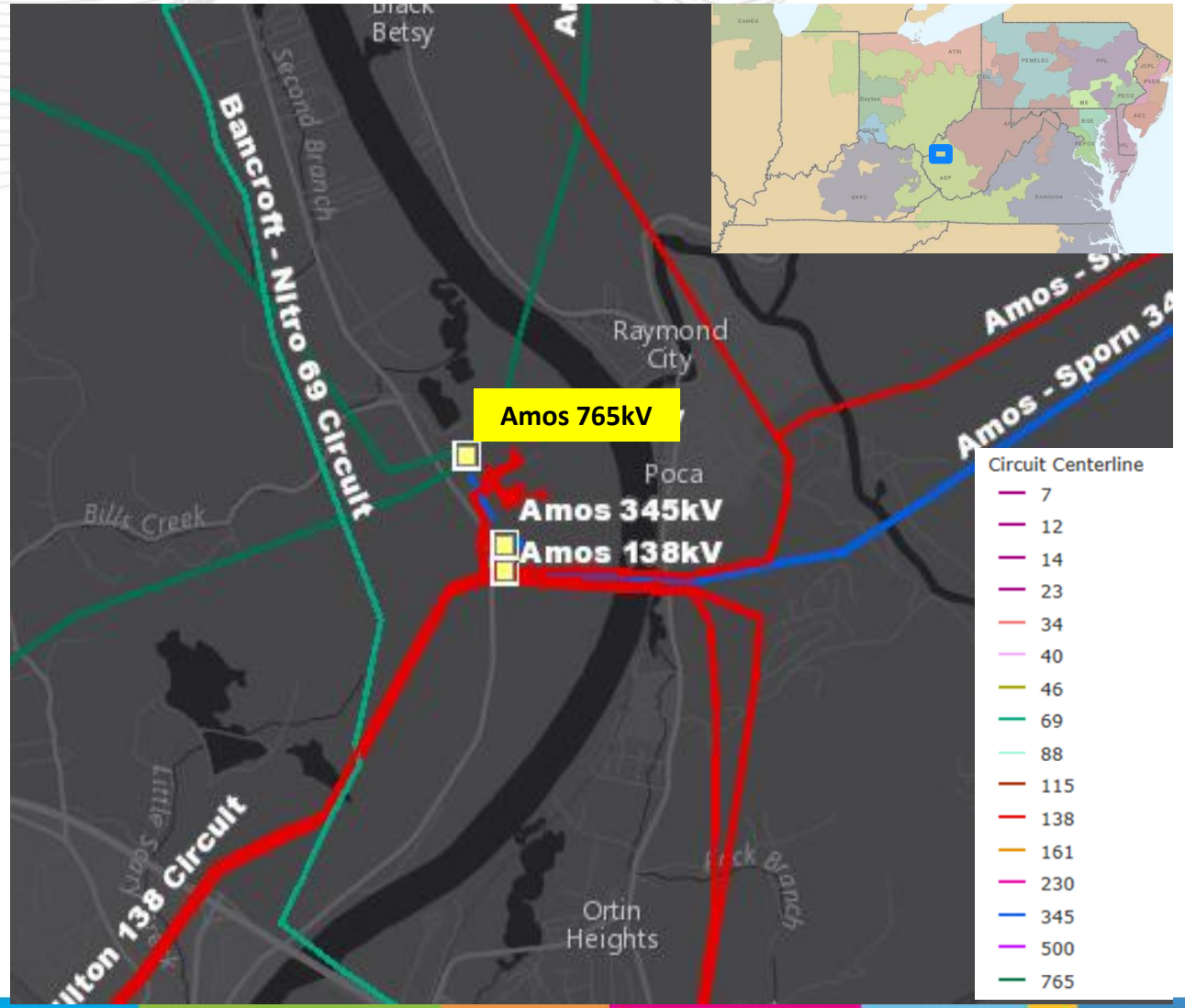
Problem Statement:
Equipment Material/Condition/Performance/Risk/Operational Flexibility:

At Amos station, 765 kV circuit breakers 'U', 'U1' and 'U2' are 29 kA DELLE, PK-10D type air blast breakers that were manufactured in 1972. Air blast breakers are being replaced across the AEP system due to their history of catastrophic and violent failures. During failures, sharp pieces of porcelain from their bushings can be expelled from the breakers, resulting in potential safety hazards to field personnel. In addition, the ability to get spare parts is becoming increasingly difficult. Breaker 'U' has experienced 34 fault operations, breaker 'U1' has experienced 22 fault operations, and breaker 'U2' has experienced 26 fault operations. All of which are over the manufacturer's recommended number of fault operations (10). These breakers are being replaced with higher kA ratings in order to meet AEP's standard design for 765kV.

Selected Solution:
Replace existing 3000 A 29 kA 765 kV circuit breakers 'U', 'U1', and 'U2' with new 4000 A 50 kA 765 kV circuit breakers. (S1463)
Estimated Transmission Cost: $12.5M

Projected In-service: 12/13/2018

Project Status: Engineering



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AEP Transmission Zone: Supplemental
Twin Branch Station Upgrades

Previously Presented: 1/11/2018

Problem Statement:
Equipment Material/Condition/Performance/Risk:
CB's J2, K2, and L1 at Twin Branch are all PK-type air blast breakers installed in the late 60's or early 70's. These four breakers are showing significant signs of deterioration. Drivers include age, number of fault operations, and a lack of available repair parts.
Breakers J2 and L1 are PK 3000A 41kA models. Breaker K2 is a PK 3000A 50kA model.

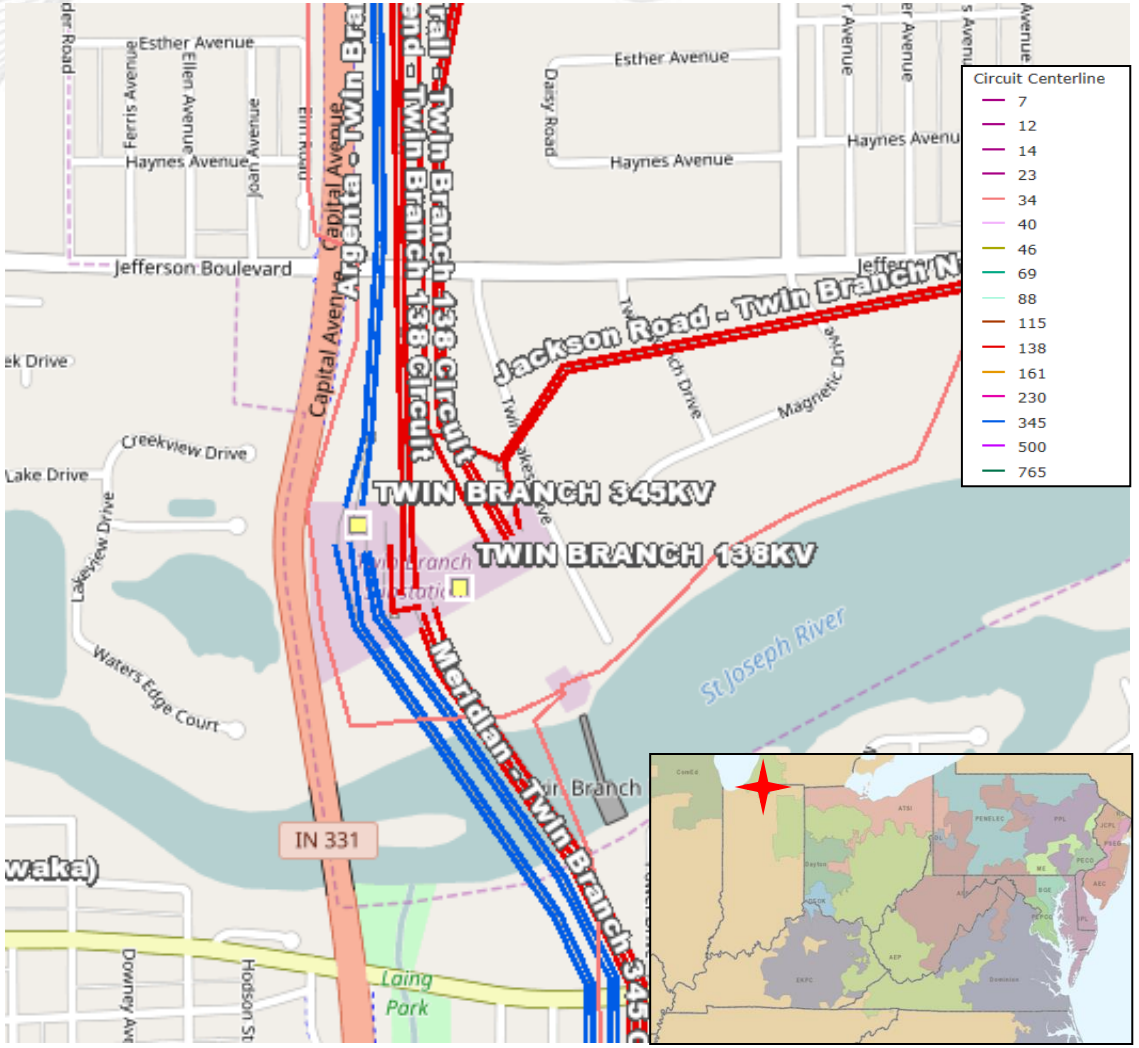
Selected Solution:
Remove and replace 345kV circuit breakers L1, K2 and J2 with 5000A 63kA models. (S1464)

Estimated Transmission Cost: $6.4 M

Alternatives:
No viable cost effective alternates were identified

Projected In-service: 6/1/2020

Project Status: Engineering



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AEP Transmission Zone: Supplemental Jefferson Breakers

Supplemental Project
Previously Reviewed at 2/8/2018 TEAC

Problem Statement:

Equipment Material/Condition/Performance/Risk:
Jefferson 765KV Breakers A and A2 are 1983 PK style Air Blast breakers which have a history of failing violently and are an AEP documented safety concern. Due to the age, fault operations and safety issues with these breakers replacement is required. Old breakers are PK-8D ACB 3000A 41kA models with 44 and 30 fault operations respectively.

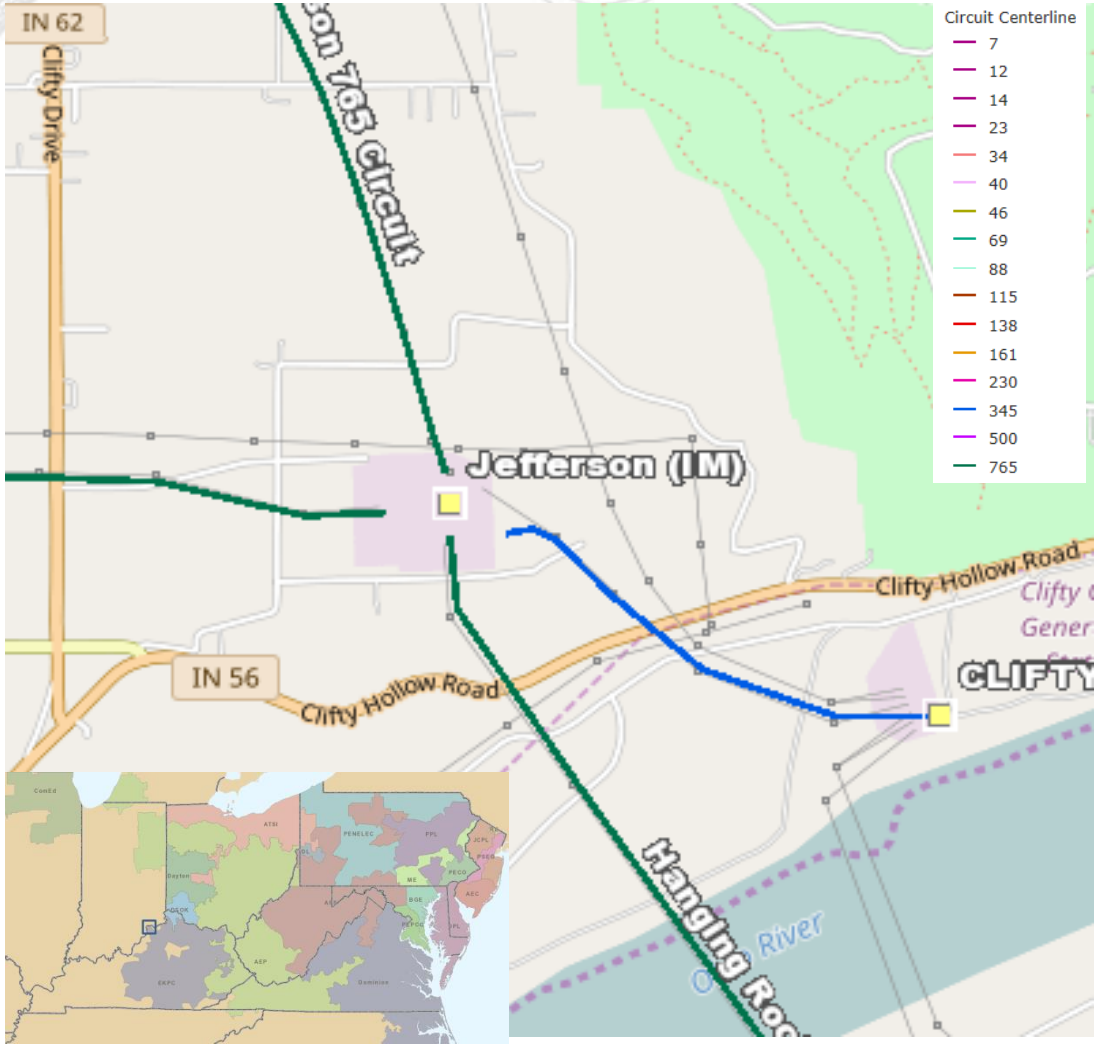
Selected Solution:
Remove and Replace Jefferson 765KV CB A and A2 with 4000A 50kA breakers. (S1528)

Estimated Cost: $5.7M

Alternatives:
No viable cost-effective alternatives could be identified.

Projected In-service: 5/1/2018

Project Status: Under Construction



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Supplemental Project
Previously Reviewed at 3/8/2018 TEAC

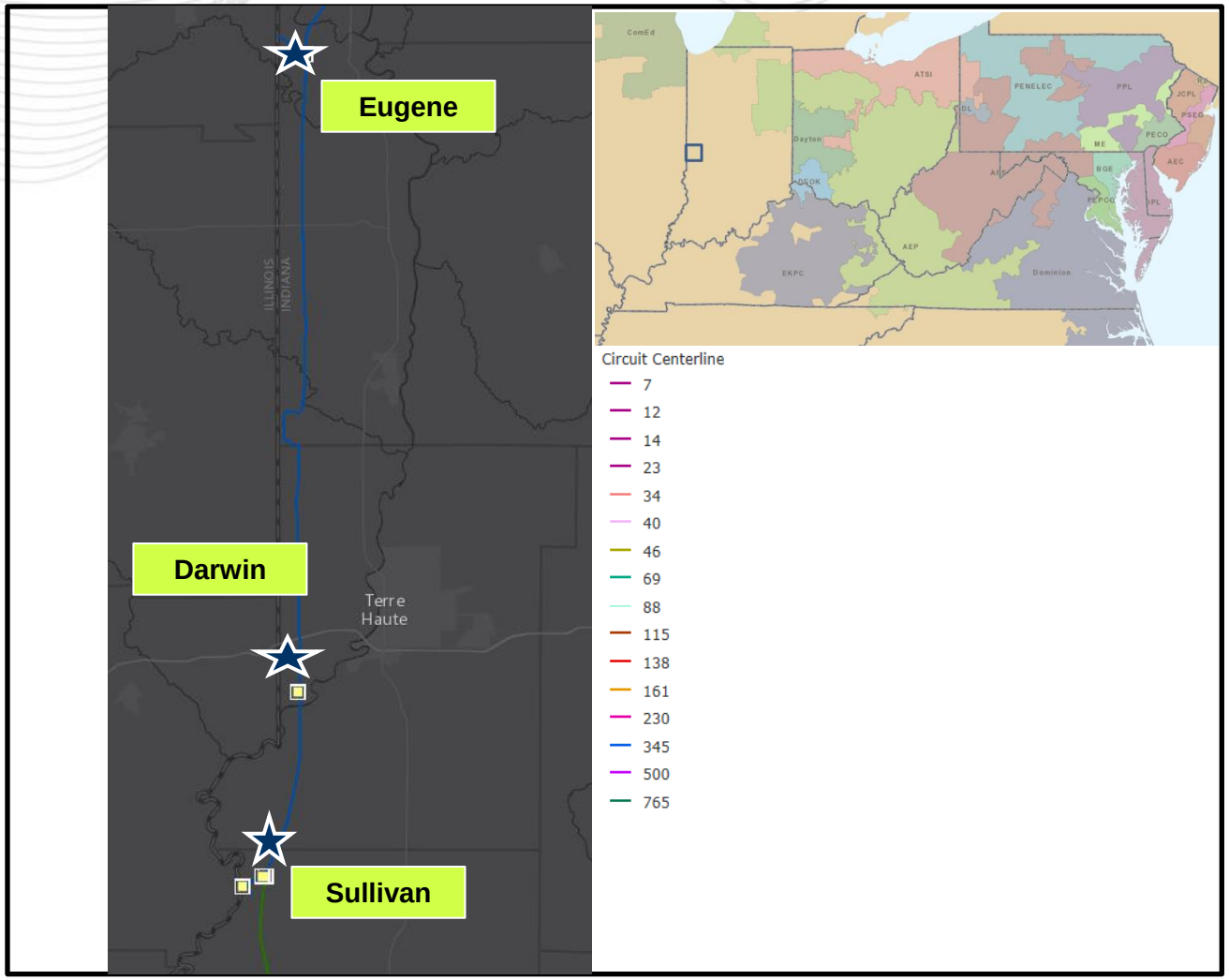
Problem Statement:
Equipment Material/Condition/Performance/Risk:
Darwin station (NIPSCO) was built to connect Sugar Creek IPP (Mirant station) into the PJM market. Sugar Creek IPP no longer has the rights or intention to sell power into PJM. In December 2016, the electrical connection between Mirant and Darwin stations was removed. This reduces Darwin into a mere switching station between Sullivan and Eugene. There are no grid needs to have Darwin station present between Sullivan and Eugene. Therefore, bypass and retirement of AEP owned assets at Darwin station is proposed. AEP owned assets at Darwin include 345 kV relays and metering. This project will assist to reduce AEP O&M costs and responsibilities.

Selected Solution:
Station Description
Disconnect Darwin 345kV station from the Eugene – Sullivan 345kV line and retire all AEP owned equipment at Darwin. (**S1579**)

Total Estimated Trans Cost: $0.9M

Projected In-service: 05/01/2018

Project Status: Engineering



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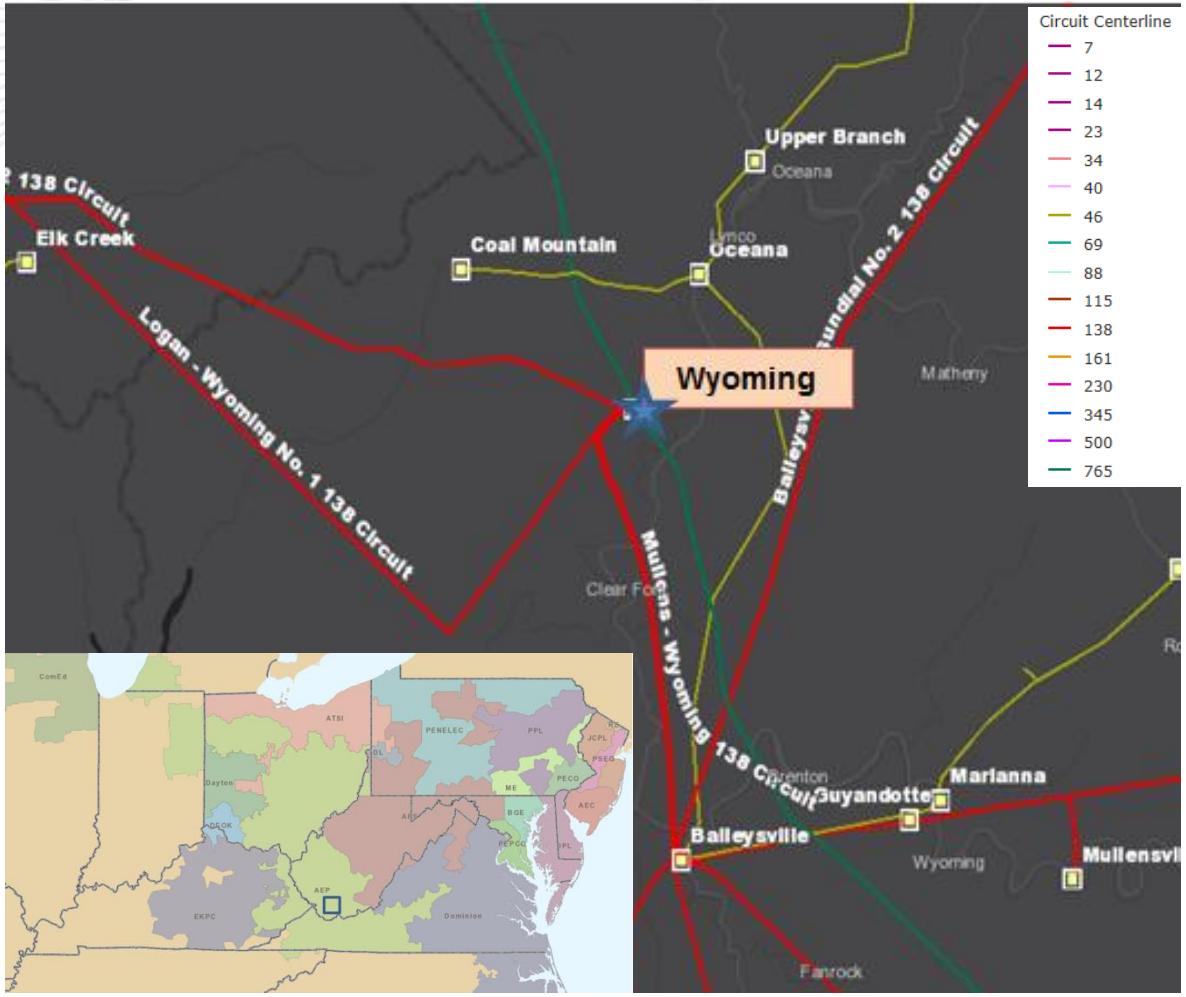
Supplemental Project
Previously Reviewed at 3/8/2018 TEAC

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Transformer #2/Phase 3 unit and three sister units at Wyoming Station (Transf #1/Phase 1, Transf #2/Phase 1, and Transf #2/Phase 2) are all showing similar signs of accelerated aging from through fault events resulting in gassing, overheating, carbonization of insulating paper, decreased interfacial oil tension, and/or elevated bushing power factor levels. Bushing replacements on legacy units are difficult because matching the connecting point with a spare is complicated and would require an outage to take the measurements of the existing bushings. Also, spares of the same era are not readily available and newer bushings do not follow the same design standards of the legacy units. Transformer #1/Phases 2 & 3 also have accelerated aging from through fault events resulting in gassing, overheating, and/or carbonization of insulating paper. There have been cooling control issues reported to and repaired by field personnel as a stop-gap measure to enable continued operation until these units can be replaced. Due to the deteriorated conditions, AEP Equipment Standards indicates that these units can no longer be loaded to their full nameplate capability. By replacing these transformers with new units, loading capability will be able to meet daily system operation. When a similar unit failed at Joshua Falls Substation in APCo – Virginia, Transformer #1/Phase 1 was removed and taken to serve as the replacement transformer. Since that time, the only spare for 1 BANK and 2 BANK has been in service for this removed phase.

The 765 kV shunt reactor on the Wyoming – Culloden line is showing dielectric strength breakdown and elevated operating temperatures.



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AEP Transmission Zone: Supplemental Wyoming 765 XFR Replacement

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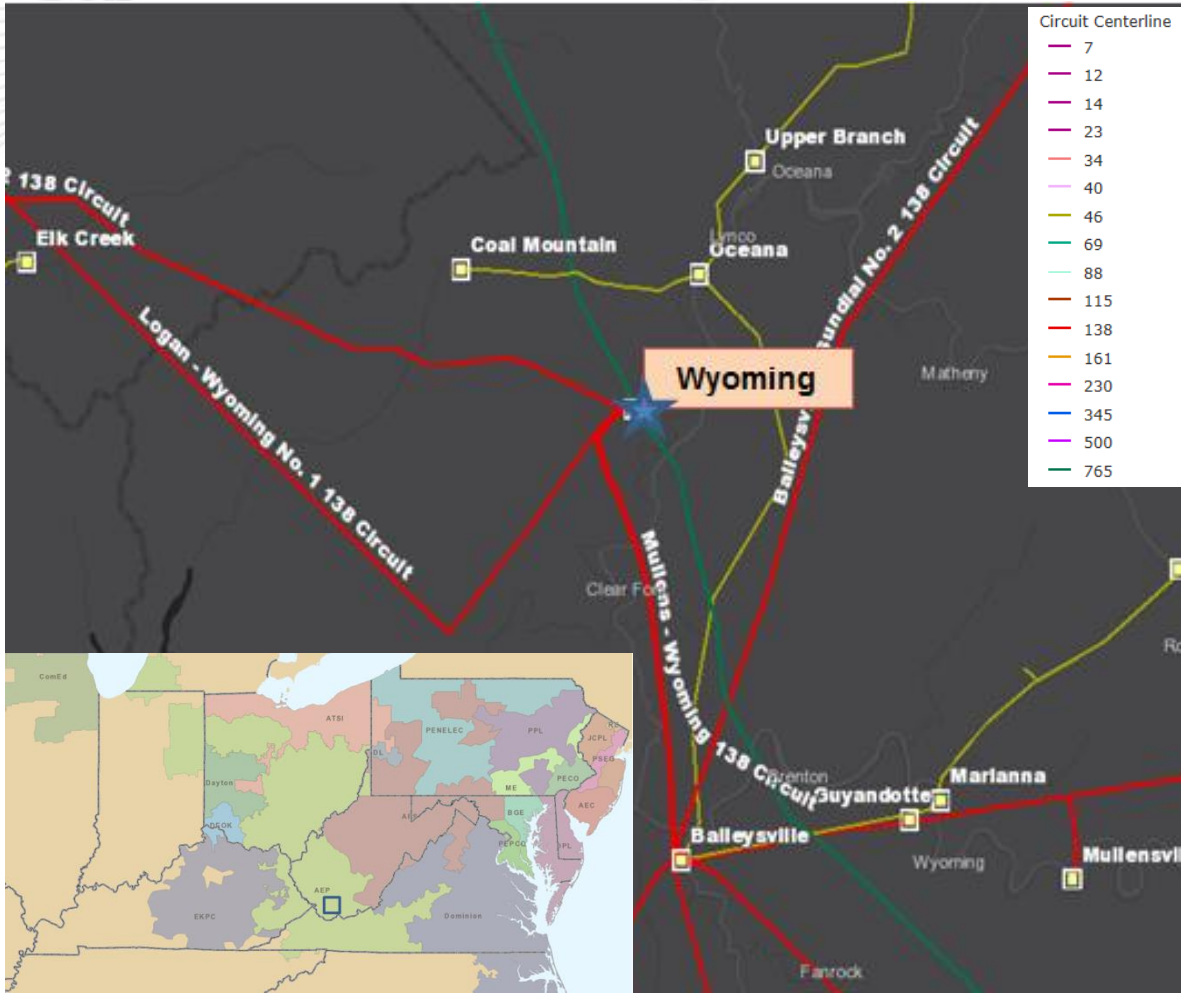
Selected Solution:
Wyoming 765 kV Yard: Replace existing 765/138 kV 750 MVA XF #1 with a new 765/138 kV 750 MVA XF. Replace existing 765/138 kV 750 MVA XF #2 with a new 765/138 kV 750 MVA XF. Install a new switchable spare 250 MVA XF. Replace existing 300 MVAR reactor bank on the Wyoming – Culloden 765 kV line and 40 kA switcher with a new 300 MVAR reactor bank and 50 kA switcher. Make the spare reactor switchable. (**S1580**)

Estimated Cost: $53M

Projected In-service: 12/31/2020

Project Status: Engineering



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Supplemental Project
Previously Reviewed at 3/8/2018 TEAC

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Cloverdale 765/345 kV Transformer #10, 1968 vintage, is currently in a poor physical and operational condition. Transformer #10 phase 1 is showing short circuit strength breakdown caused by the amount of thermal through fault events, mostly in the 300°C to 700°C range, this has lead to an increased gassing of the unit. Transformer #10 phase 2 is showing short circuit strength breakdown caused by the amount of thermal through fault events, mostly under 300°C but some in excess of 700°C, has lead to minor gassing of the unit. In addition, the high side, low side, and tertiary Y2 bushing power factor ratings have been trending in excess of 0.5 which indicates a possible issue with the bushing. Transformer #10 phase 3 has an upward trending of oil moisture content resulting in downward trending to the oil dielectric strength. Increasing moisture content is a resultant of water ingress and/or break down of paper insulation of TF windings. Numerous thermal through faults of under 300°C has lead to an major and upward trending gassing of the unit, and significant carbonization of the insulating paper. This unit has experienced significant degradation of its internal materials. Transformer #10 spare has an upward trending of oil moisture content resulting in relatively stagnant trending to the oil dielectric strength. Increasing moisture content is a resultant of water ingress and/or break down of paper insulation of TF windings. More recently, the moisture content has decreased, yet the dielectric strength has responded with a more severe drop in value. Short circuit strength breakdown caused by the amount of thermal through fault events has lead to consistent gassing of the unit, and significant overheating events in excess of 250°C. The CO/CO2 ratio has consistently been above the warning level.

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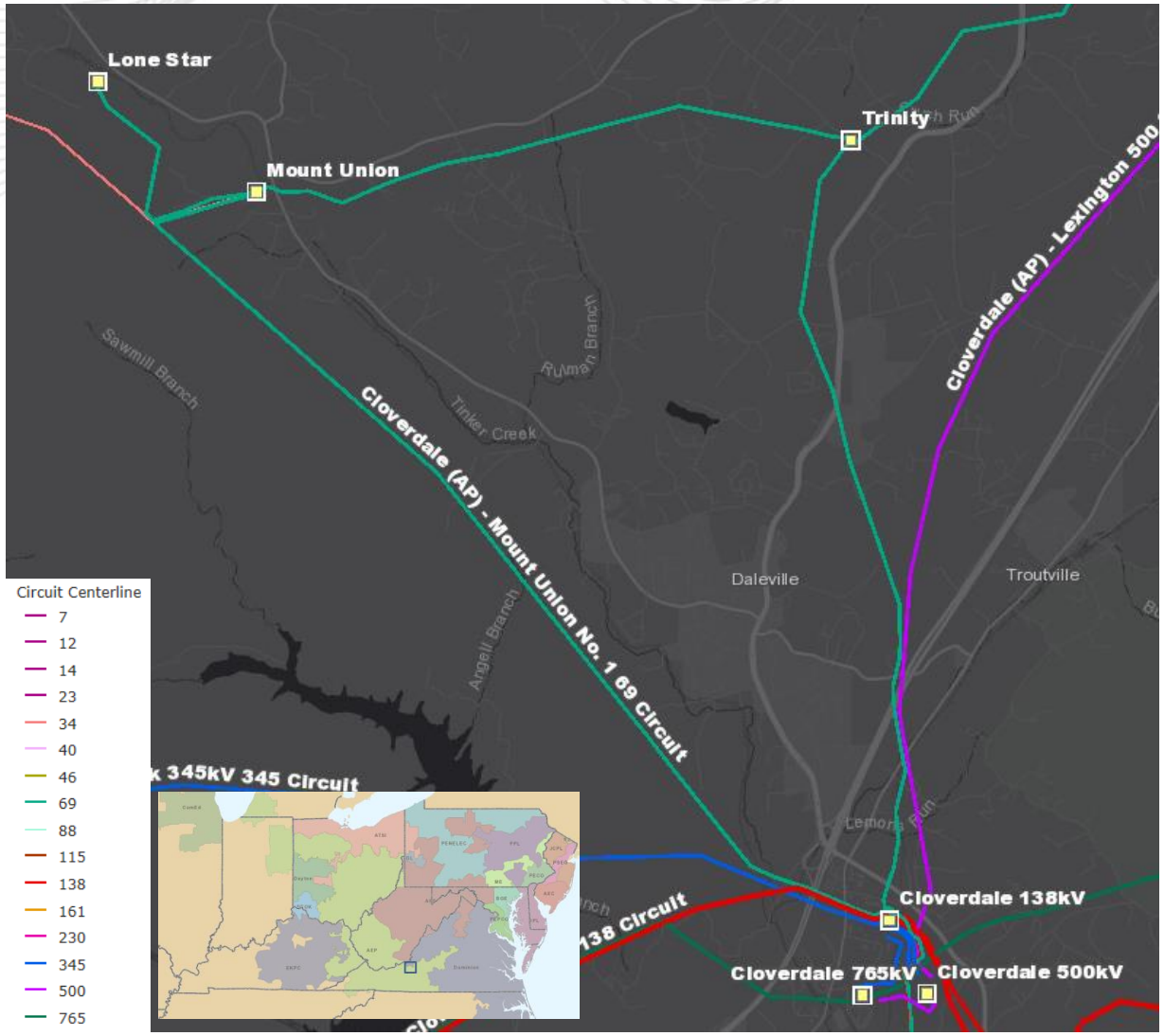

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AEP Transmission Zone: Supplemental Cloverdale Area Improvements

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The 765kV CB's "AA1" &"AA2" are air blast breakers, which have a tendency to fail catastrophically. During failures, sharps pieces of porcelain from their bushings are typically expelled, which, can be a potential safety hazard to field personnel. In addition, the ability to get spare parts for these breakers is becoming increasingly difficult. The Manufacturers recommended number of fault operations is 10. CB "AA1" has experienced 34 operations and CB "AA2" has experienced 21 operations.

138/69/34 kV transformer #4 (will be retired) at Cloverdale is a 1959 vintage which has seen short circuit strength breakdown caused by the amount of thermal through fault events, mostly in the 300°C to 700°C range, minor gassing of the unit, numerous overheating events, and carbonization of the insulating paper. 138/69/34 kV transformer #1 (will be replaced) is showing short circuit strength breakdown caused by the amount of thermal through fault events, mostly in the 300°C to 700°C range, has lead to an increased gassing of the unit. In addition, the tertiary Y2 bushing power factor rating has been trending well in excess of 0.5 which indicates possible issues with the bushing. The 69 kV CB"F" is an oil type breaker without oil containment. These are oil breakers that have come 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. CB "F" has experienced 29 operations.

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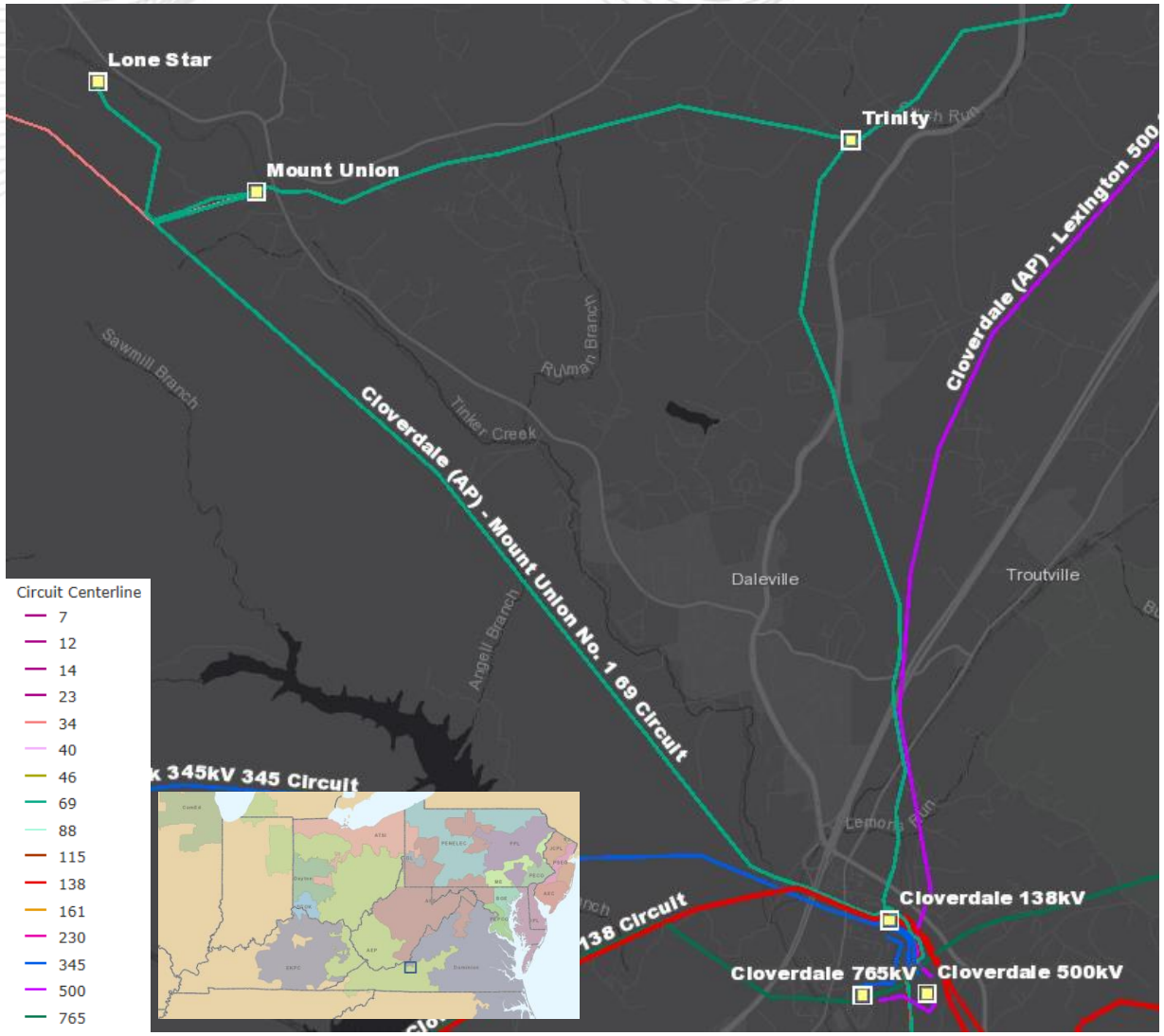

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AEP Transmission Zone: Supplemental
Cloverdale Area Improvements

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Operational Flexibility and Efficiency

Two new 765 kV circuit breakers "DD" & "DD2" will be installed to bring the 765/345kV transformer #10 into a breaker and a half position. This configuration allows for separation of two dissimilar zones of projection on the 765 kV system (transformer and bus), which can lead to mis-operations/over tripping. Two new 138kV kV, 3000 A/63 kA circuit breakers "G" & "G2" will be installed to bring the 138/69 kV transformer # 1 into a breaker and a half position. This configuration allows for separation of two dissimilar zones of projection on the 138 kV system (transformer and bus). Install 138 kV, 3000 A/63 kA circuit breaker "E" on the Reusens line. This will provide operations with another source on the Reusens line when maintenance/outages occur on existing breaker E2.

The Cloverdale – Mt. Union line (7.41 miles) is built to 138kV standards which allow us to replace the transformer at Mt. Union and energize the line to 138kV. Energizing the line to 138 kV standards allows up to fully utilize the line to full capacity as intended.

The 34.5kV tertiary feeds to Huntington Court from 138/69/34 kV transformer #1 and #4 have been de-energized because the load at Blue Ridge is being served at distribution level from Lake Forest Station. Because of this the 34.5 kV system at Cloverdale will be retired.

Customer Service:

Mt. Union serves CBEC (wholesale customer) and Roanoke Cement Co. (retail customer). Both customers will see improvement in voltage regulation with new 138kV source. Increase in transformer MVA is due to expected increase load in the area with a new industrial park being served from the 69 kV network.

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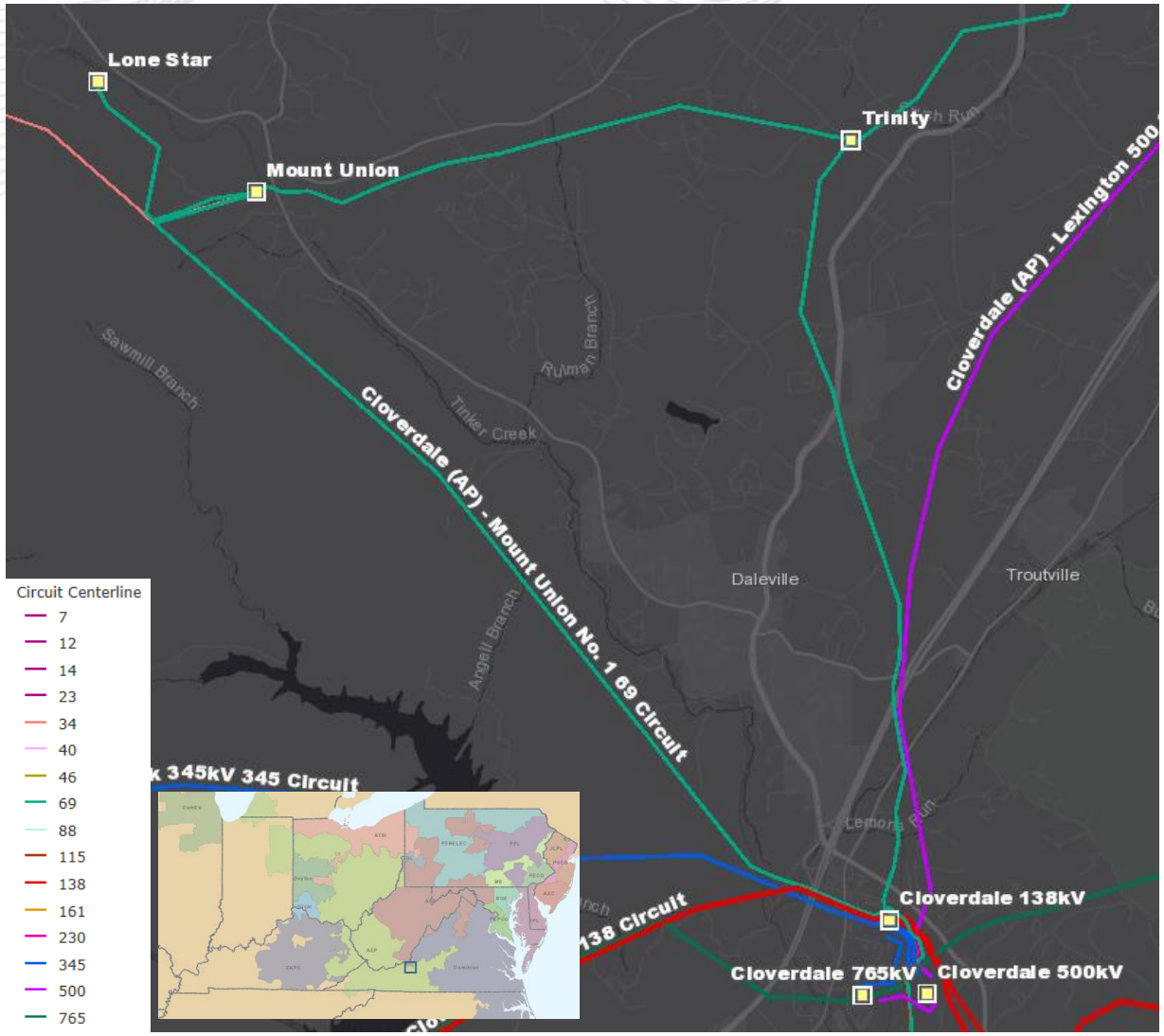

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AEP Transmission Zone: Supplemental Cloverdale Area Improvements

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Selected Solution:

At Cloverdale station, replace all four single phase 500 MVA 765/345 kV TR #10 units with new AEP standard 750 MVA/phase units (switchable spare). TR #10 will be moved from the 765 kV bus #1 position into a new string between CB's "DD" & CB "DD2" (4000 A, 63 kA). (**S1581.1**)

Replace 90 MVA 138/69/34 kV TR #1 with a 130 MVA unit relocated from bus #2 position into a new string between CB's "G"& "G2" (3000 A 63 kA). (**S1581.2**)

Retire 138/69/34kV TR #4 (New 138/69 kV TR will be installed at Mt Union Station). Retire 34 kV CB "H", the Huntington Court 34.5 kV line, and associated 34 kV bus equipment. (**S1581.3**)

Add 138 kV CB's "D" & "D2" (3000 A, 63 kA) in order to bring the newly energized 138 kV Mt Union #1 line (already built to 138 kV standards) into a new string position. (**S1581.4**)

Replace 1800 A 27 kA 69 kV CB "F" with new CB (3000 A, 40 kA). (**S1581.5**)

Replace the Cloverdale – Huntington Court 138 kV line relays; Replace the Cloverdale – Roanoke 138 kV line relay; Replace Cloverdale – Mount Union #2 69 kV line relays. (**S1581.6**)

Replace 138kV Station Service Transformer. (**S1581.7**)

Replace 3000 A 41 kA 765 kV CB "AA2" with new 4000 A, 63 kA breaker. Retire 765 kV CB's "AA1" & CB "CC1". (**S1581.8**)

Estimated Cost: $49.9M

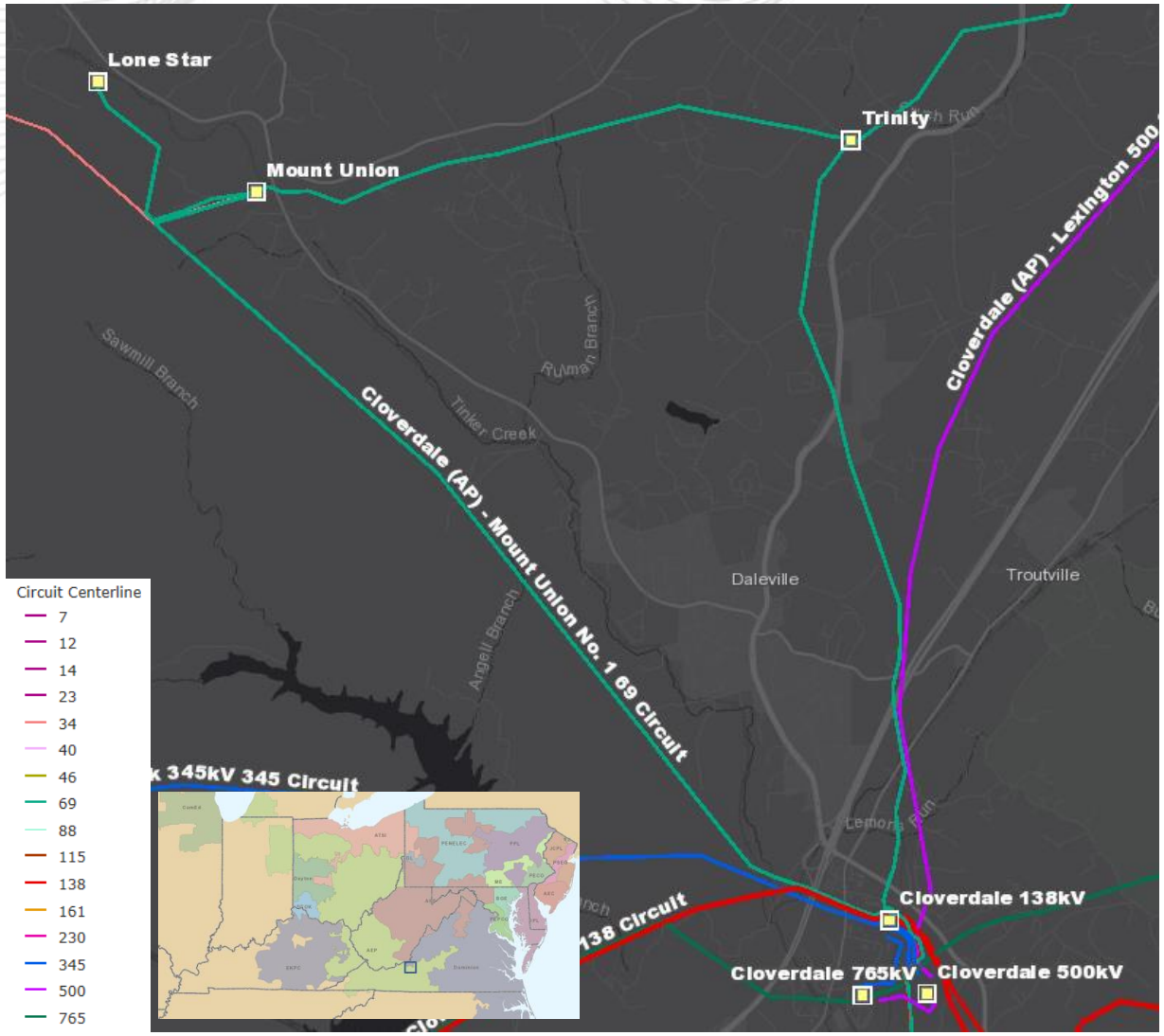
Install new 138/69 kV 130 MVA transformer at Mount Union station and retire 138/69/34kV 75 MVA transformer #4 at Cloverdale Station. The Cloverdale – Mount Union #1 69 kV line is built to 138 kV standards and will be energized to 138 kV after the transformer installation. Replace Cloverdale – Mount Union #2 69 kV line relays. (**S1581.9**)

Estimated Cost: $4.8M

Total Estimated Cost: $54.7 M

Projected In-service: 12/18/2020

Project Status: Engineering



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Supplemental Project
Previously Reviewed at 3/8/2018 TEAC

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The 138kV Circuit Breakers B, B1, B2, C, C2, C1 at Jackson Road Station are 3000A 50kA PK type air blast breakers manufactured in 1972, that has fault operations exceeding the manufacturer recommendation of 10 (26, 31, 18, 54, and 29 respectively). Air breakers tend to fail violently and their porcelain bushings usually blow up, dispersing particles in the surrounding area which is a safety concern. Drivers for replacement include age, number of fault operations, and a lack of available repair parts.

Transformer #3 345/138 kV at Jackson Road manufactured in 1972 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), accessory damage (bushings), and high temperature (winding thermal condition). It also has high levels of Ethylene, Ethane, and Carbon Dioxide dissolved in the gas.

Operational Flexibility and Efficiency

When more than 4 breakers are required to operate to clear a line fault significantly increases the chances of a misoperation and increases the complexity of the protection circuits. Currently a line fault on the 138kV Twin Branch 2 line or a line fault on either of the 345kV lines requires 6 breakers to operate to clear the fault. In addition to this, the 345kV bus relay zone is combined with the two line relay zones and a transformer relay zone. Having three dissimilar relay zones joined together is an unacceptable arrangement, reducing the reliability of the protection equipment and increasing the chance of misoperations. The 345kV EHV lines are currently sectionalized with MOABS. Due to the higher required operation speed that goes along with EHV systems, MOABS can cause misoperations and result in failed sectionalizing.

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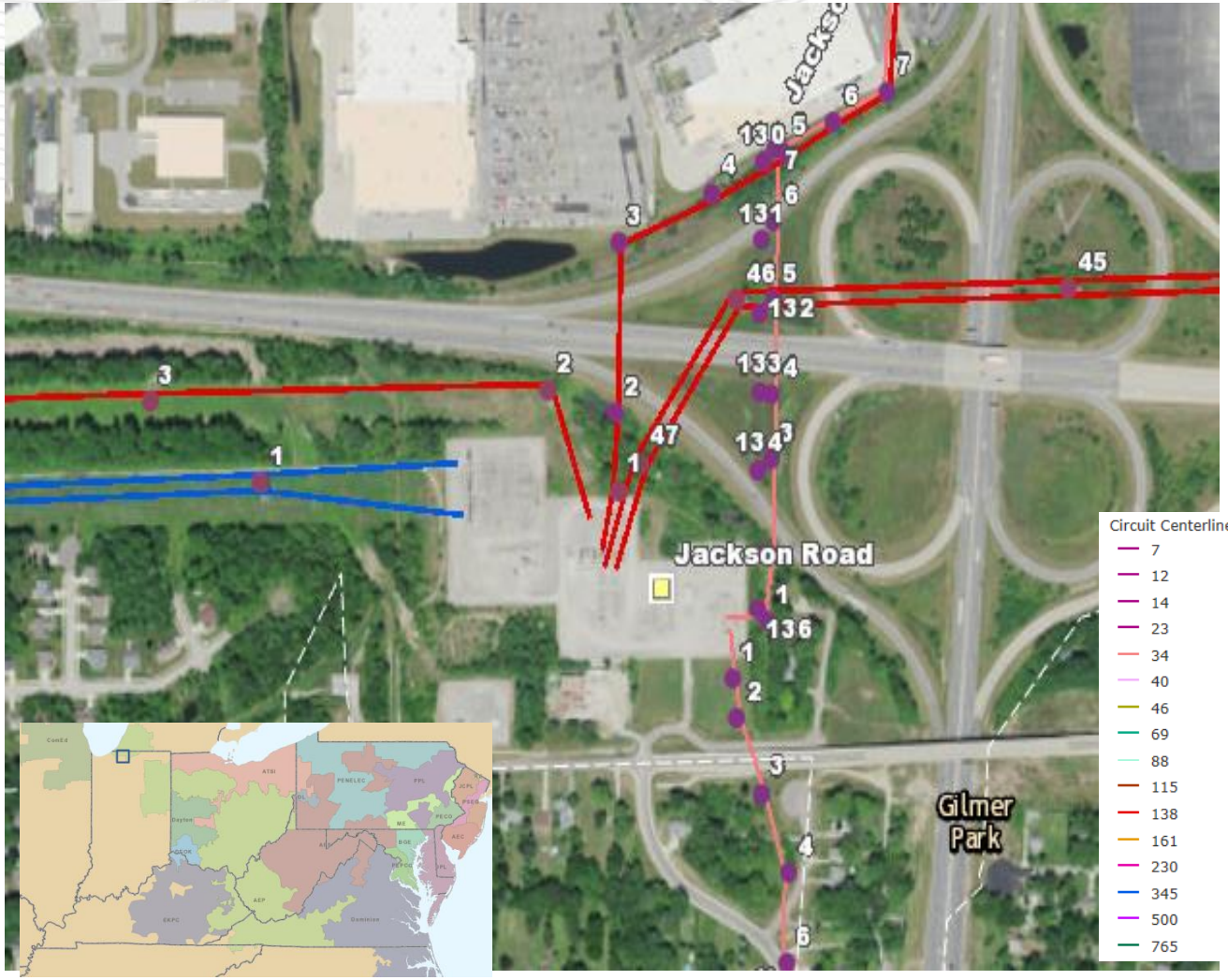

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AEP Transmission Zone: Supplemental
Jackson Road Improvements

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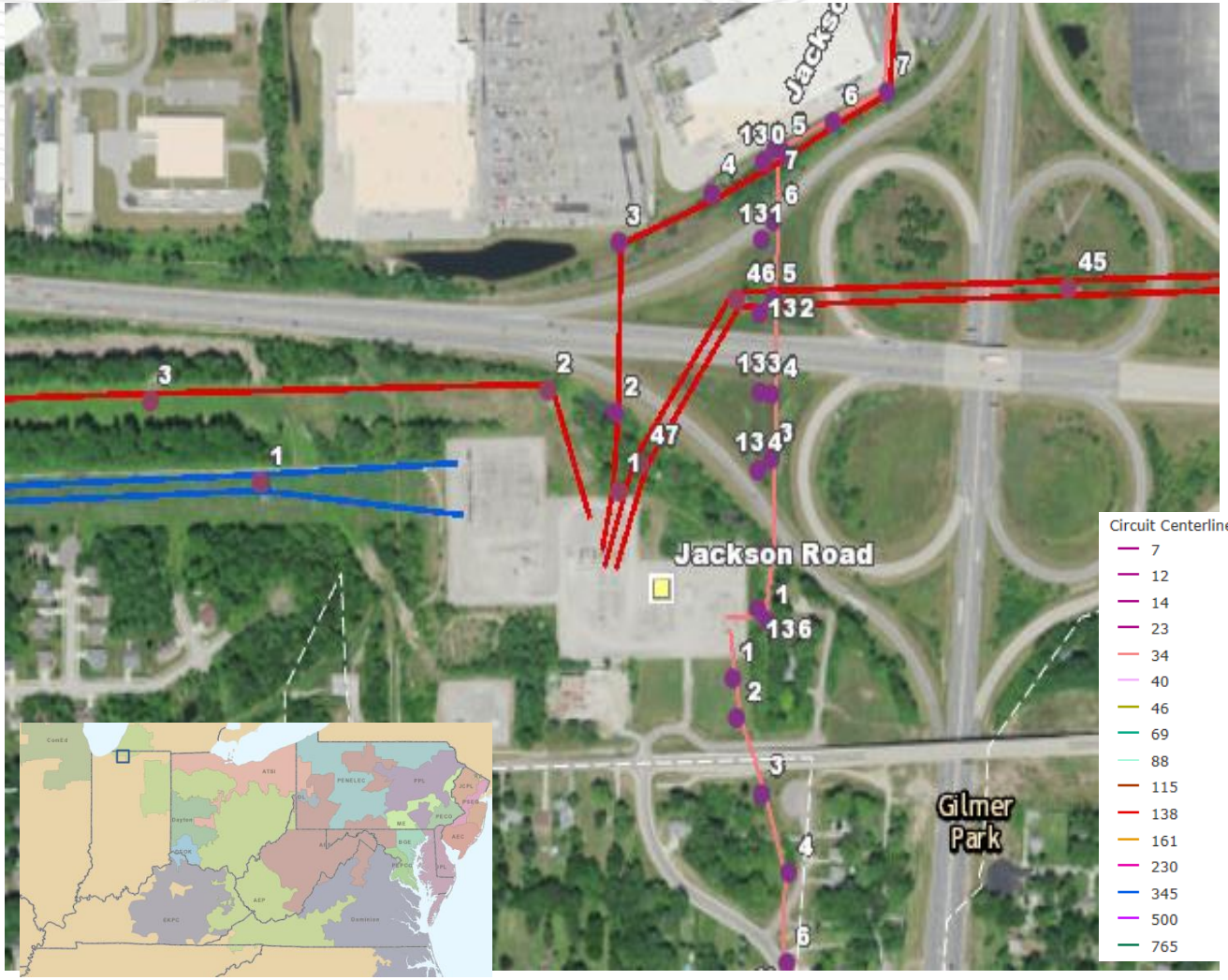
Selected Solution

At Jackson Road station, replace 138kV CB B, B1, B2, C, C1, C2 PK type air blast breakers with new 3000A 63kA circuit breakers. Install five new 3000A 63 kA 138kV breakers J1, J2, M, M1, M2. Install three new 345kV CB A, A1, A2 with 5000A 63kA model. Replace 345/138/34.5kV TR#3 with a 675 MVA unit. (**S1582**)

Estimated Cost: $25.4M

Projected In-service: 12/31/2018

Project Status: Under Construction



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Supplemental Project
Previously Reviewed at 3/8/2018 TEAC

Problem Statement:

Equipment Material/Condition/Performance/Risk:
Breakers "Q", "Q2", and "P2" at Baker are Air Blast type breakers. Air blast breakers are being replaced across the AEP system due to reliability concerns, intensive maintenance, and their tendency to catastrophically fail. During failures, sharps pieces of porcelain from their bushings are typically expelled, which, can be a potential safety hazard to field personnel. In addition, the ability to get spare parts for these breakers is becoming increasingly difficult. Circuit breakers "Q", "Q2", and "P2" have experienced 50, 40, and 114 fault operations compared to the manufacturer recommendation of 10.

The 345/138 kV transformer #200 (1974 vintage) is also being replaced due to dielectric breakdown (insulation), accessory damage (bushings/windings) and short circuit breakdown (due to amount of through faults).

Operational Flexibility and Efficiency
The additional 345 kV breaker is being installed to complete the "J" string and break up dissimilar zones of protection (bus and transformer), which could cause misoperations and over tripping.

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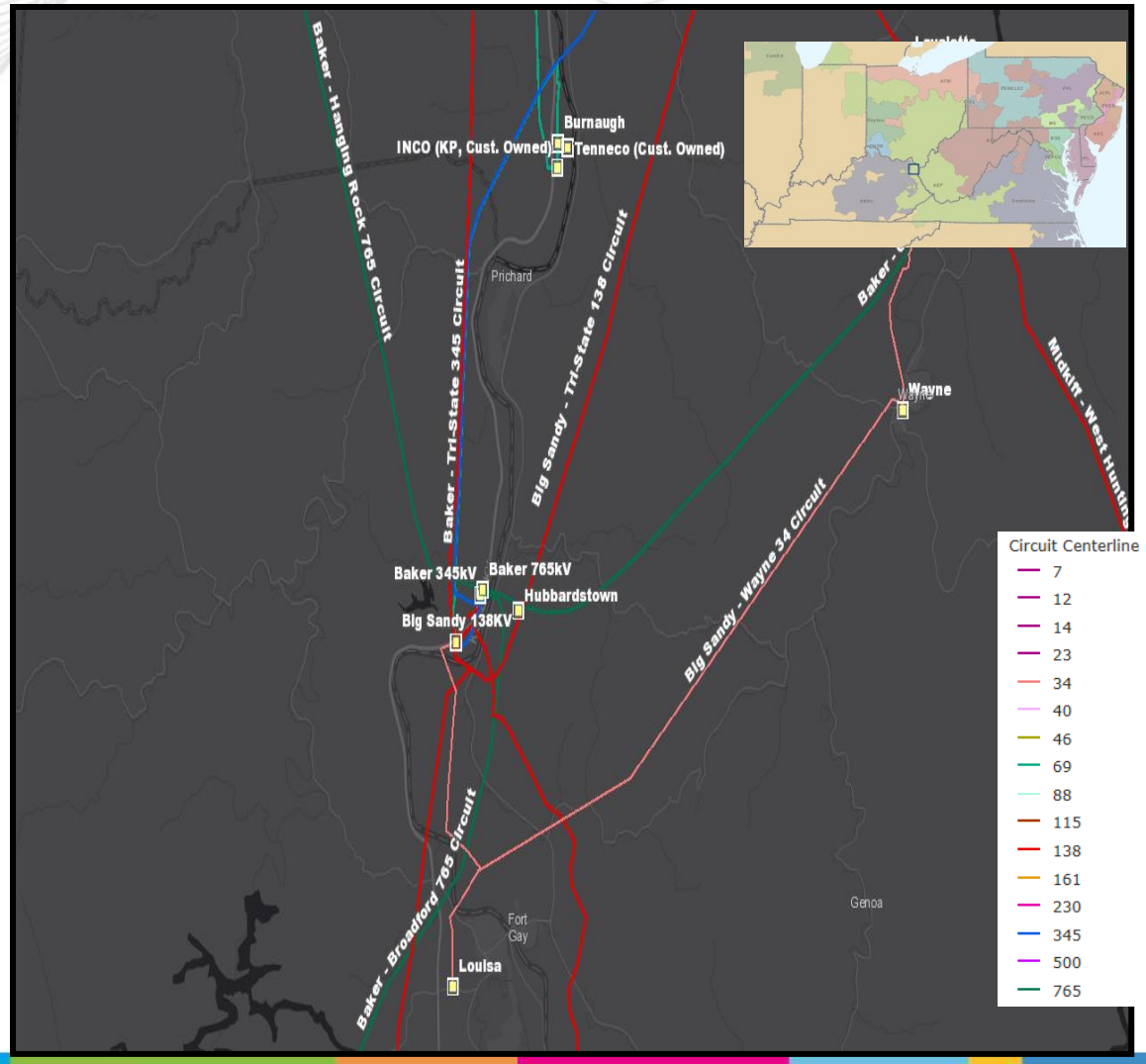

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AEP Transmission Zone: Supplemental
Baker Station

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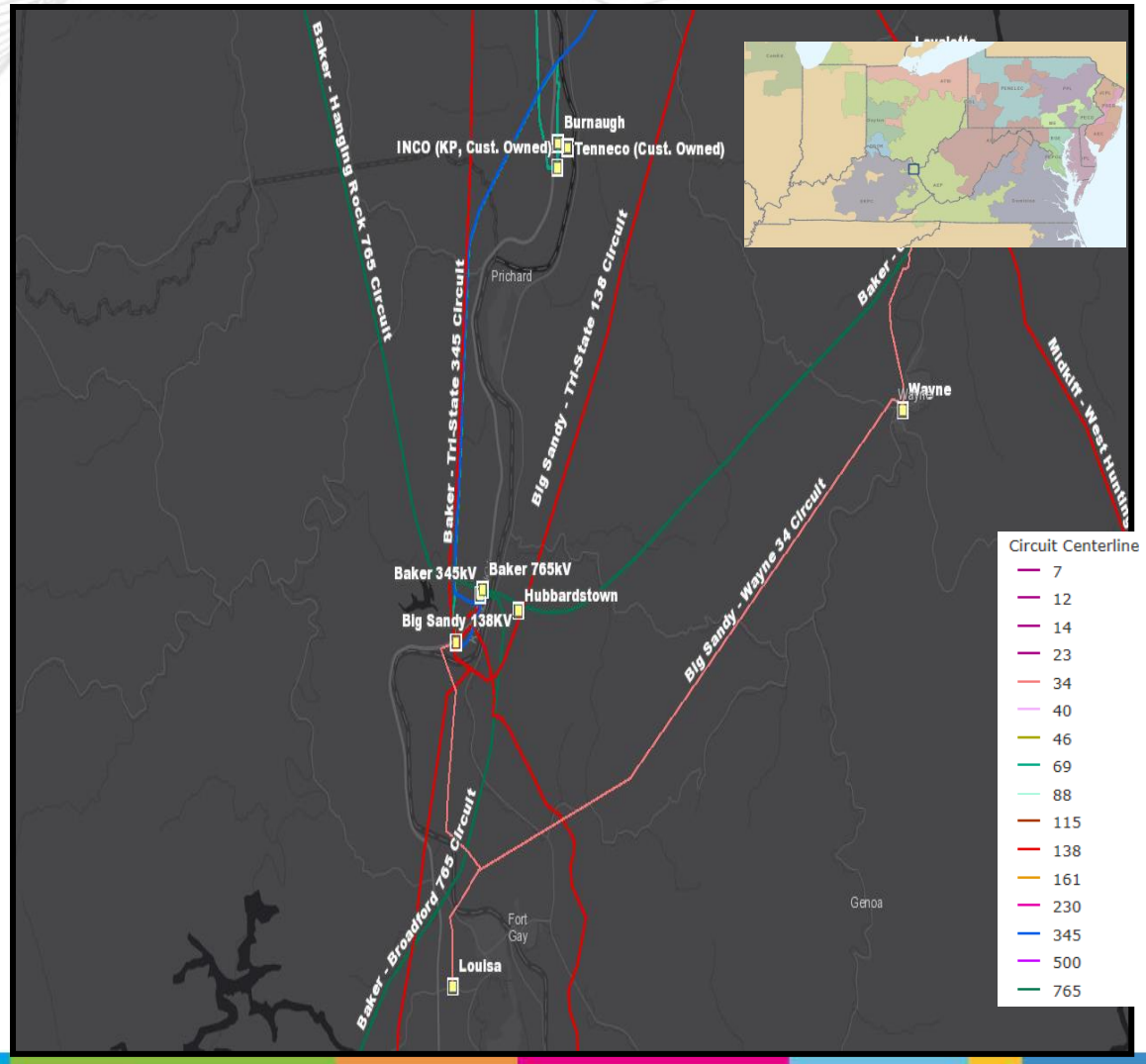
Selected Solution

At Baker Station, replace the existing 765 kV 3000 A 50 kA circuit breakers “Q”, “Q2”, and “P2” with new 765 kV 4000 A 63 kA breakers. Install a new 345 kV 3000 A 63 kA breaker to complete the “J” string. Replace the existing 600 MVA transformer #200 with a new 345/138 kV 675 MVA unit that will be relocated from the 345 kV bus #2 position to the newly created position between the existing breakers “J” and the newly installed breaker “J1”. (**S1583**)

Estimated Cost: $26.9M

Projected In-service: 12/1/2018

Project Status: Engineering



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AEP Transmission Zone: Supplemental Dumont Breaker Addition

Supplemental Project
Previously Reviewed at 3/8/2018 TEAC

Problem Statement:

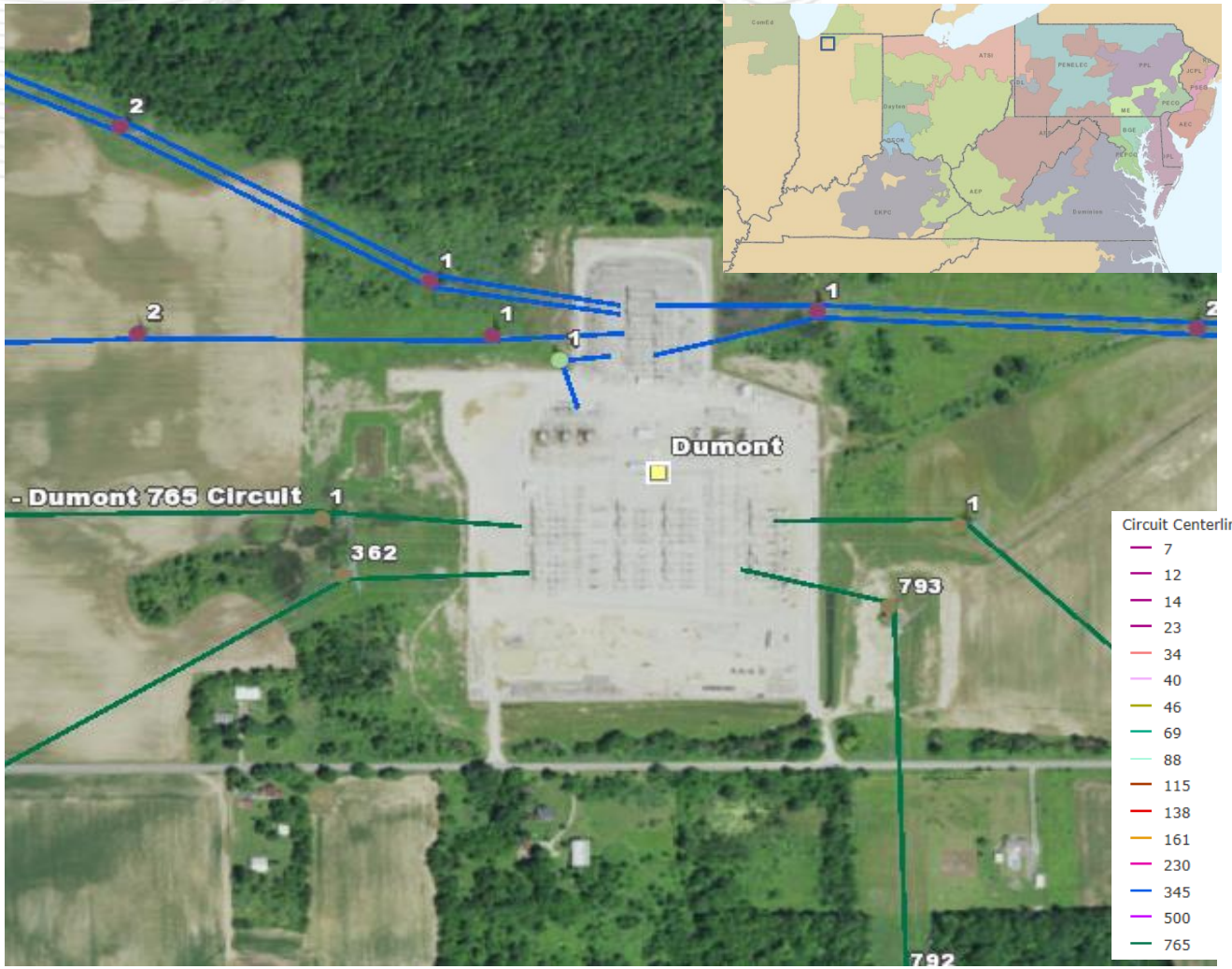
Equipment Material/Condition/Performance/Risk:
Due to the critical nature of EHV buses to AEP's system, having a 345kV line hard tapped on a bus is not acceptable. In addition to this, due to the high speed protections schemes associated with EHV systems and the challenges associated with keeping all three phases of the EHV MOAB's aligned, AEP standard is to use breakers for sectionalization in EHV voltage classes. For these reasons, two breakers will be installed at Dumont station.

Selected Solution
Install 2-345kV Type HVB 5000A 63kA breakers G and G1 at Dumont Station. (**S1584**)
Estimated Cost: $2.5M

Alternatives:
No viable cost-effective alternatives could be identified.

Projected In-service: 12/31/2020

Project Status: Engineering



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AEP Transmission Zone: Supplemental Delaware-Desoto Line

Supplemental Project
Previously Reviewed at 4/5/2018 TEAC

Problem Statement:

Equipment Material/Condition/Performance/Risk:

The College Corner – Delaware 138kV circuit is a 1941 vintage line that has been responsible for 10 sustained outages in the last 10 years. The circuit has 12 open category A conditions and has a ~1 mile long underground section that has caused 2,000+ hours of outages. Due to past performance and conditions, this section of line will have to be addressed.

The Delaware – Deer Creek ~2 mile section being rebuilt is a 1927 vintage construction with 397 ACSR conductor (167 MVA rating) that has 46 open conditions across 11 structures. Rebuilding this portion is required if we retire the underground portion.

Operational Flexibility and Efficiency

The Tanners Creek 345kV line is hard tapped onto the Desoto 345kV bus 1. This means that any time this 48 mile line needs maintenance, AEP has to take a critical EHV bus outage. This is unacceptable from an operational standpoint and sectionalizing it with a breaker is required. Both transformers are tapped to the 345kV bus with MOAB's. Due to the high speed protections schemes associated with EHV systems and the challenges associated with keeping all three phases of the EHV MOAB's aligned, AEP standard is to install high side breaker protection on each transformer.

Desoto 138kV station is exposed to 12.55 miles of Desoto - Jay and 25.24 miles of Desoto – Madison 138kV lines. These lines were constructed in 1964 and 1928 respectively and have contributed to 12 momentary outages and 2 permanent outages in the last 10 years. Since Desoto station is a critical EHV source for the area, it is required to install a new breaker string to reduce the fault exposure seen by Desoto.

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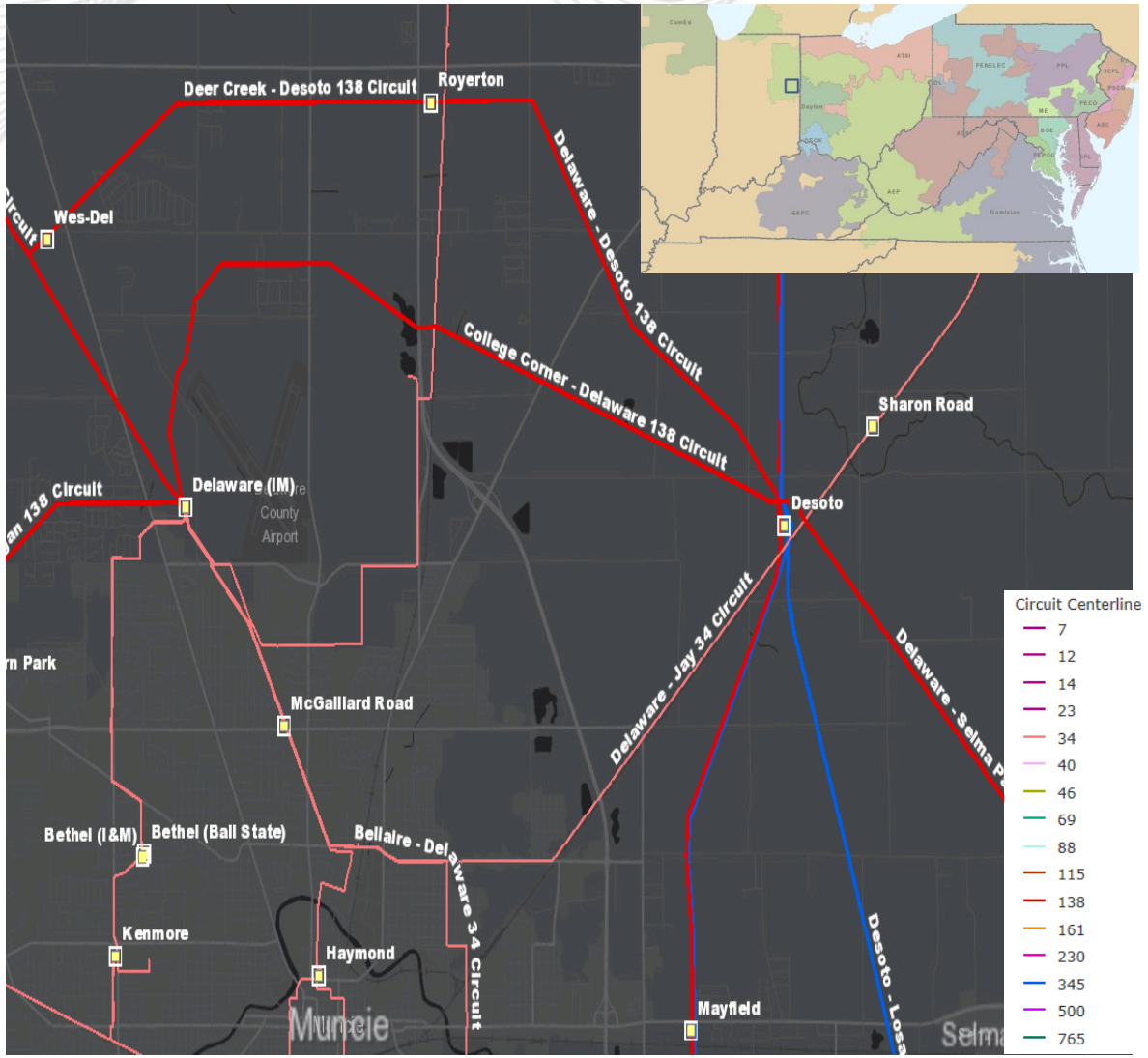

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AEP Transmission Zone: Supplemental Delaware-Desoto Line

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Selected Solution

At Desoto station, install 4 345kV 5000A 63kA breakers in the 345kV yard with breaker B1 & B2 protecting the Tanners Creek #1 line, breaker D2 protecting transformer 1's high side and breaker D1 protecting transformer 2's high side. Install 5 138kV 3000A 63kA breakers; 3 to construct the new G string, 1 to finish the M string and 1 to protect the low side of transformer 2. (**S1610.1**)

Estimated Cost: $9.9M

At Delaware station, retire exits toward College Corner and Selma Parker. Upgrade risers and busses on Deer Creek and Desoto exits. (**S1610.2**)

Estimated Cost: $0.3M

Retire 7 miles of the Delaware-College Corner/Selma Parker double circuit 138 kV line and re-terminate it into Desoto station. (**S1610.3**)

Estimated Cost: $4.7M

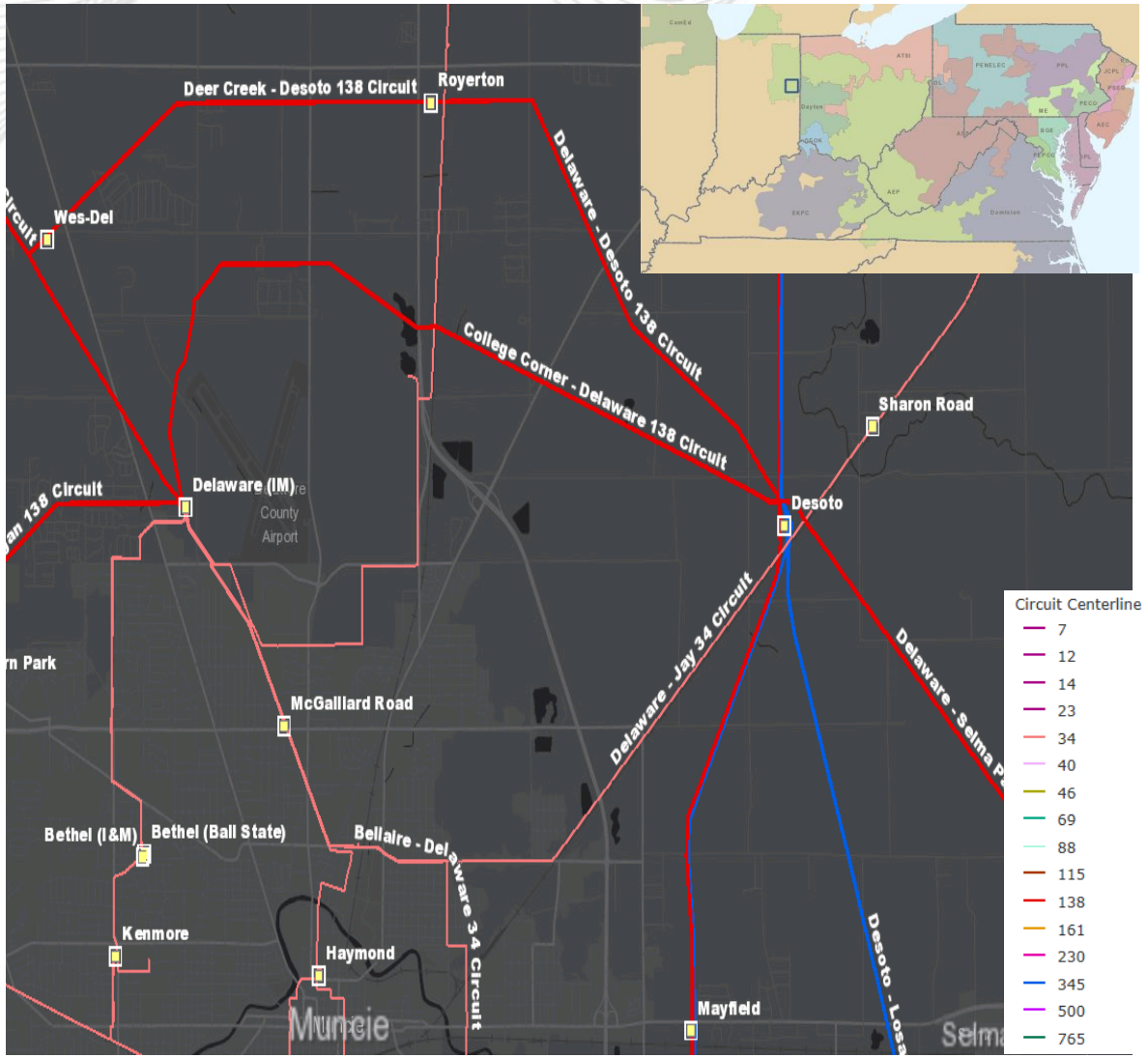
Rebuild roughly 2 miles of the Delaware-Deer Creek/Desoto line using 795 ACSR (257 MVA rating) (**S1610.4**)

Estimated Cost: $6.2M

Total Estimated Transmission Cost: $21.1M

Projected In-service: 04/29/2019

Project Status: Scoping



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Supplemental Project
Previously Reviewed at 4/5/2018 TEAC

Problem Statement:

Equipment Material/Condition/Performance/Risk:

Approximately 75% of the 21.62 mile long South Bend – New Carlisle 138kV Line conductor is 1930's vintage built with 397 ACSR (167 MVA rating) and there are 128 open conditions along the entire line asset.

The Twin Branch – South Bend 138kV Line has 93% of the 4.86 miles constructed in 1925 with 397 ACSR (167 MVA rating) and there are 20 open conditions along the line asset. Multiple locations have ROW encroachment issues, several broken shield wires and conductor strands, woodpecker holes and broken aerial markers. This line also crosses a river and US route 31.

The 1966 vintage 69kV circuit breakers F at Olive Substation has operated through 8 fault operations. This oil 69KV CB is an FK model and has no oil containment. Without oil containment, environmental concerns are present. Recent inspections have also found this breaker to have issues with close operations. The velocity calculated has either been too fast or too slow. Probable causes may be a faulty damper or high pressure in the pneumatic storage tank.

Transformer #3 20 MVA 138/69kV at Olive Station was manufactured in 1950 and is showing high CO2 and Ethane measurements. It currently has failed pumps and fans, so it cannot reliably be loaded up to the name plate. The flow gauges on the pumps have also failed. It currently has oil leaks along the outlet valves. Finally the control cable for this transformer has a green substance that has been tested in other sites and is a sign of PCB contamination.

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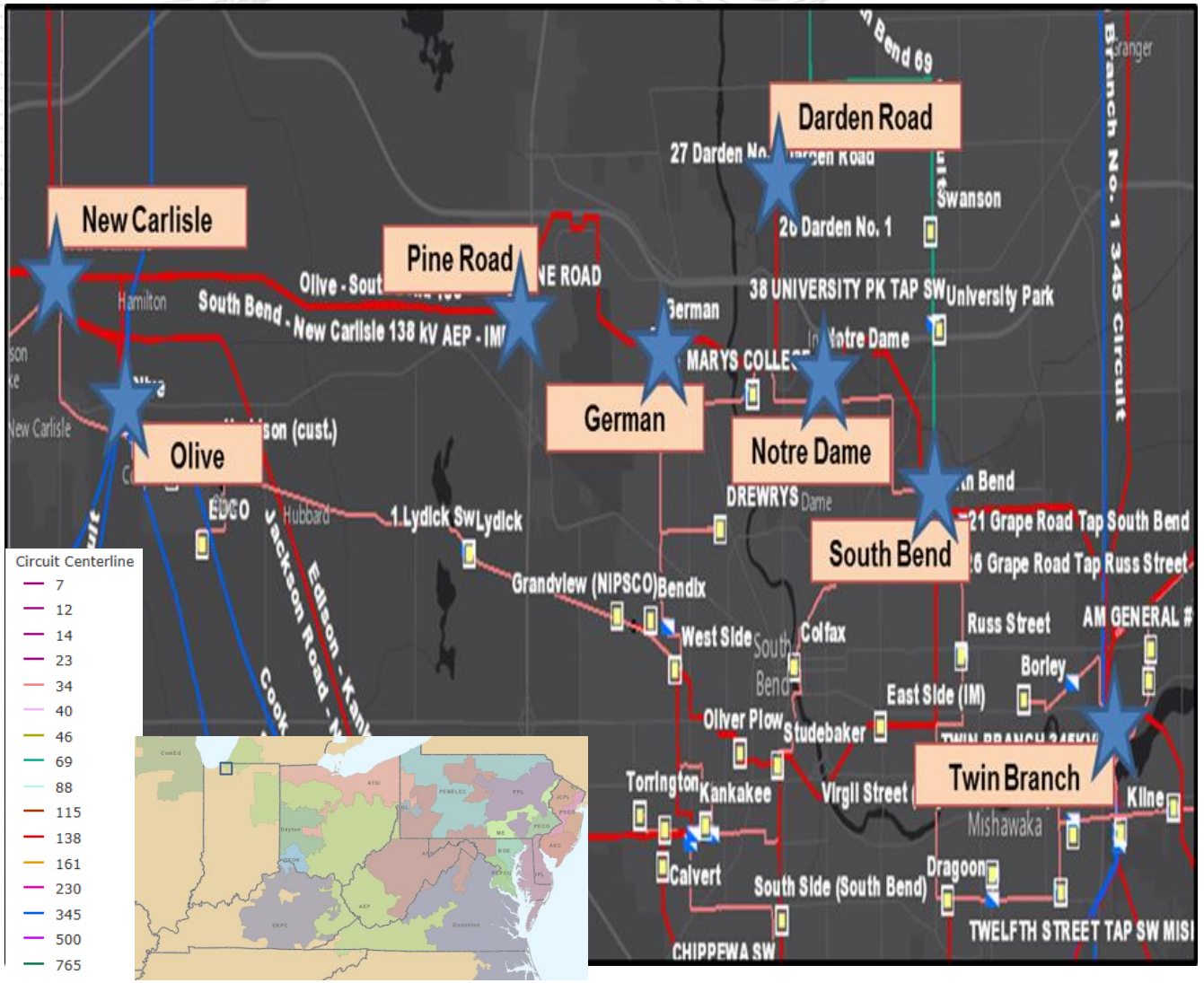

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AEP Transmission Zone: Supplemental South Bend Line Rebuild

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Operational Flexibility and Efficiency

The 345/138 kV transformer at Olive is tapped directly off the bus and includes overlapping zones of protection. The 138/69 kV transformer at Olive is tapped directly off the 138 kV bus and includes overlapping zones of protection. These overlapping zones can lead to misoperations and relay coordination challenges.

There are currently four MOABs in series on this line, which is against current AEP standards. Breakers will be installed at German station to eliminate this potential source of misoperations.

Selected Solution

At South Bend Station, upgrade risers towards Olive and Twin Branch. (**S1611.2**) **Estimated Cost: $0.7M**

At Twin Branch Station, upgrade risers towards South Bend. (**S1611.3**) **Estimated Cost: $0.5M**

At Olive Station, install one 345kV CB, one 138kV CB, replace 69kV CB F and replace 138/69/34kV TR#3 with 60 MVA 138/69kV TR#3. (**S1611.4**) **Estimated Cost: $5.2M**

Rebuild existing double circuit South Bend - New Carlisle 138 kV line asset with 795 ACSR (257 MVA rating), approximately 18.74 miles. (**S1611.5**) **Estimated Cost: $45.0M**

Rebuild existing six wired Twin Branch – South Bend 138 kV line asset with single circuit line with 795 ACSR (257 MVA rating), approximately 4.8 miles. (**S1611.6**) **Estimated Cost: $9.9M**

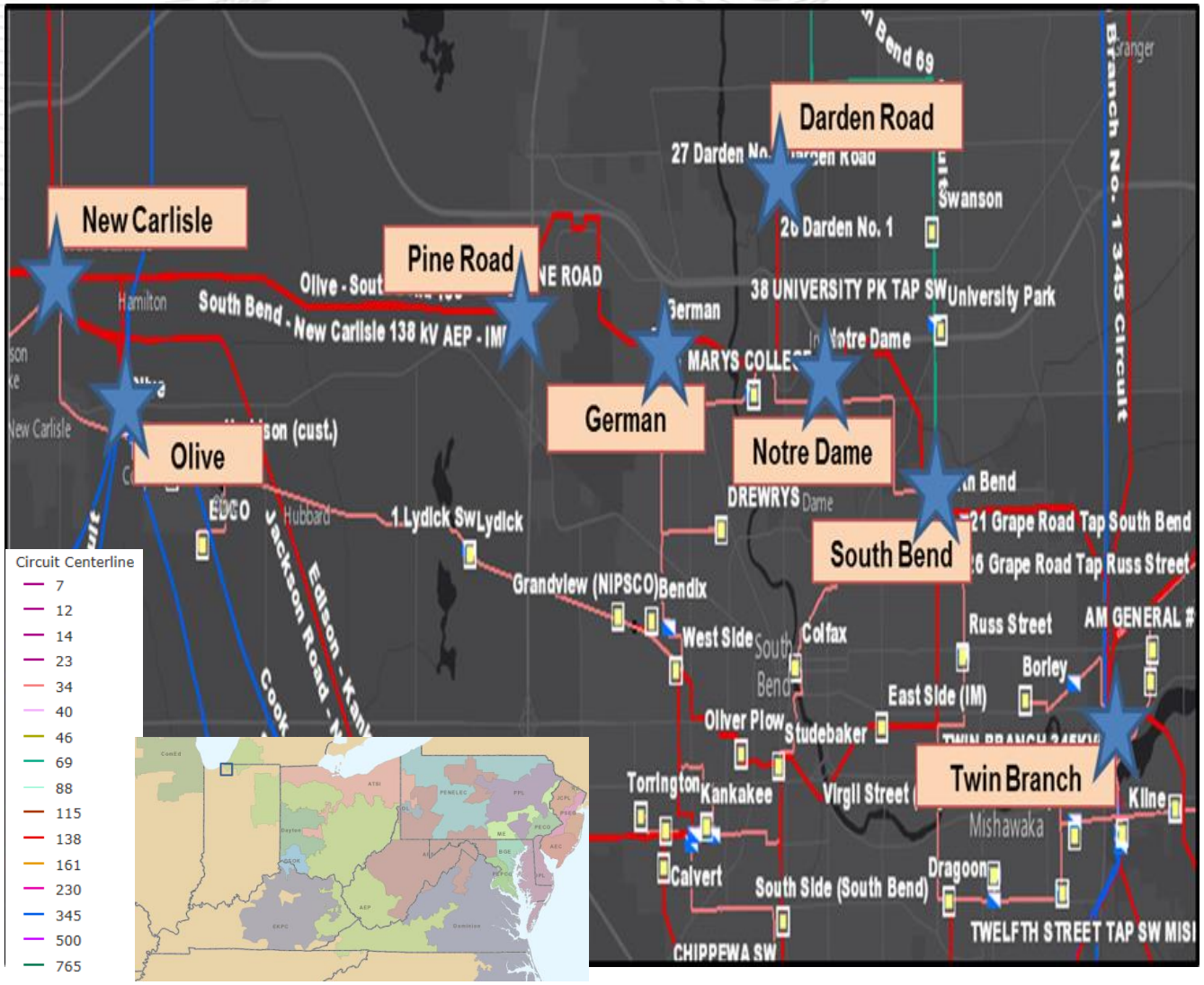
Rebuild existing double circuit Olive Entrance B 138kV Line asset with 795 ACSR (257 MVA rating), approximately 1 mile. (**S1611.7**) **Estimated Cost: $2.9M**

Split the East Side - South Bend line off of the South Bend – Twin Branch shared pole. (**S1611.8**) **Estimated Cost: $0.2M**

Total Estimated Transmission Cost: $64.4M

Projected In-service: 06/30/2020

Project Status: Engineering



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AEP Transmission Zone: Supplemental
Jacksons Ferry 765 kV PK Breakers

Supplemental Project
Previously Reviewed 8/9/2018

Problem Statement:

Equipment Material/Condition/Performance/Risk:
At Jacksons Ferry station, 765 kV circuit breakers “A”, “A1”, “A2”, “B1” & “B2” are PK Air blast breakers, which currently require hearing protection be used for personnel within the substation. Air blast breakers are being replaced across the AEP system due to reliability concerns, intensive maintenance, and their tendency to catastrophically fail. During failures, sharps pieces of porcelain from their bushings are typically expelled, which, can be a potential safety hazard to field personnel. In addition, the ability to get spare parts for these breakers is becoming increasingly difficult. CB “A” has experienced 8 operations, “A1” has experienced 11 operations, “A2” has experienced 17 operations, “B1” has experienced 17 operations and “B2” has experienced 30 operations

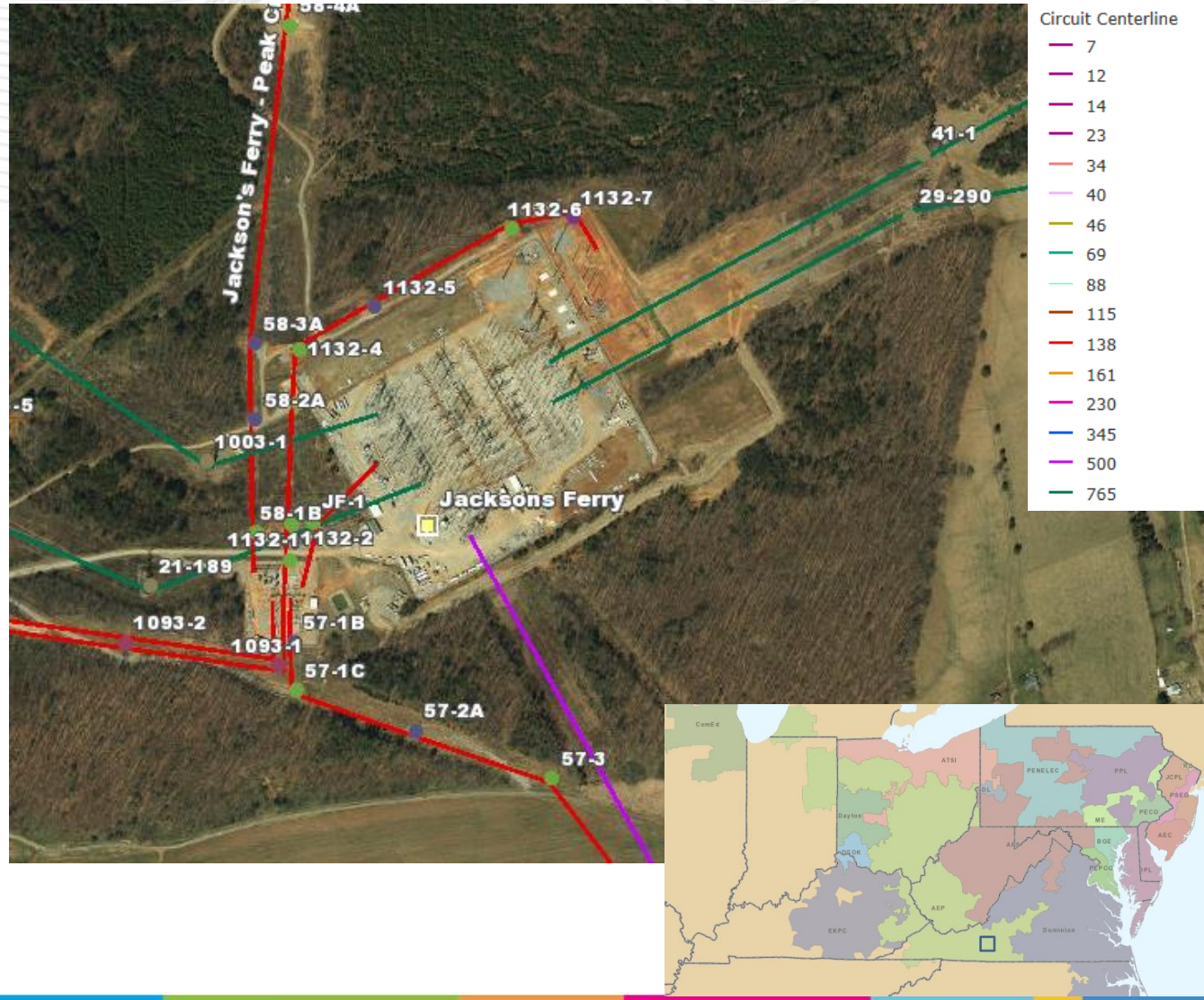
Selected Solution:

Replace existing 3000 A 50 kA 765 kV PK CB’s “A”, “A1”, “A2”, “B1” & “B2” with new 4000 A 63 kA CB. (**S1684**)

Total Estimated Transmission Cost: $25.4M

Projected In-service: 11/2019

Project Status: Engineering



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DL

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DL Transmission Zone: Supplemental WABCO Project

Previously Presented: 8/31/2018 SRRTEP

Problem Statement:
On April 25, a landslide near Wilmerding substation caused multiple transmission structures on the radial Wilmerding-WABCO (Z-98) 138 kV transmission line to shift and caused the conductors to fault. The land which the current Wilmerding-WABCO transmission line remains unstable and, as such, the Wilmerding-WABCO radial line cannot be returned to service without redesign and modifications to the impacted transmission structures. As a result, a new solution is needed to address the changing customer need and site vulnerability.

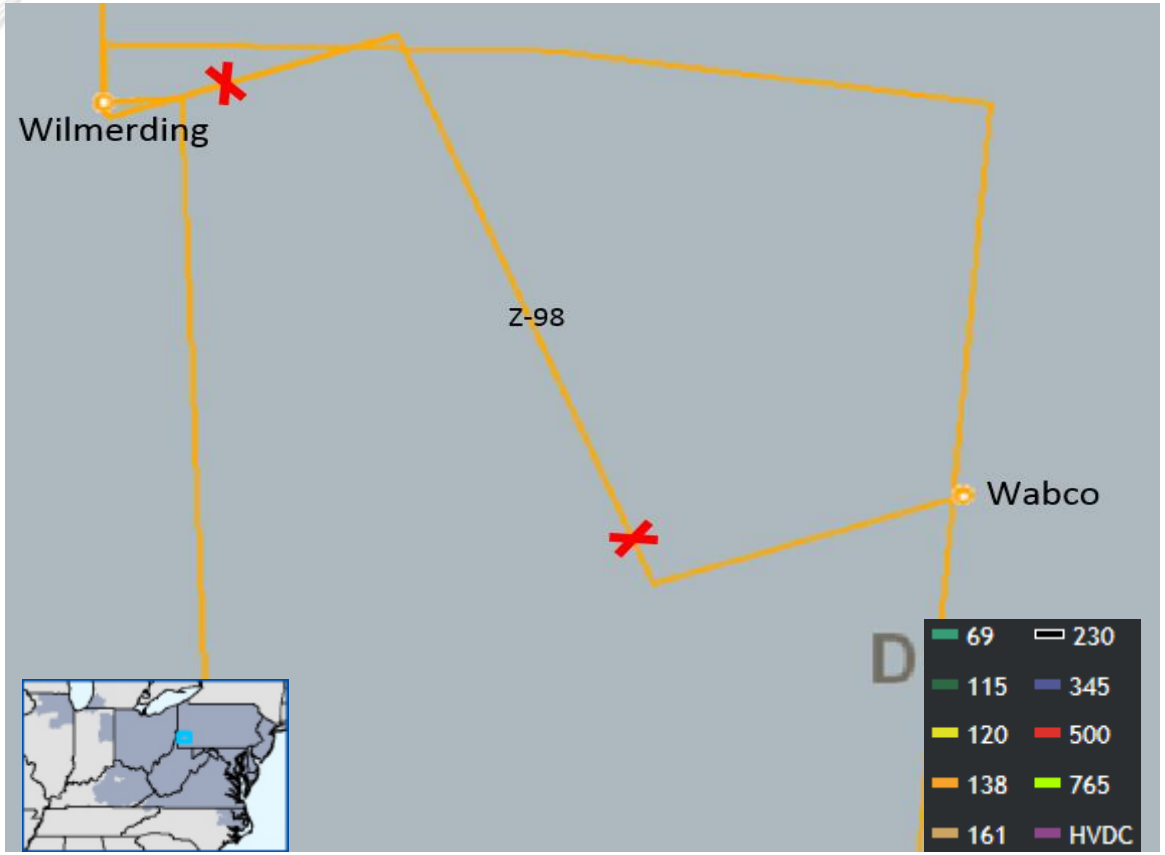
Drivers:
Equipment Material Condition, Performance and Risk; Infrastructure Resilience; Customer Service

Selected Solution:
Remove the 2000 A Wilmerding-WABCO (Z-98) 138 kV line breaker at the Wilmerding substation, the 1600 A Wilmerding-Dravosburg (Z-76) 138 kV line breaker at the Wilmerding substation, and ~0.5 miles of the radial from service to retire the Wilmerding-WABCO (Z-98) 138 kV line. (**S1737**)

Estimated Project Cost: $300 K

Projected IS Date (Expected IS Date): 3/31/2019

Status: Construction



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DL Transmission Zone: Supplemental Potter – NOVA Chemical 138 kV line

Previously Presented: 8/31/2018 SRRTEP

Problem Statement:
Currently NOVA Chemical is being served by the Valley-Hopewell 69 kV transmission line tap to the Kobuta substation, which provides one of two electrical connections to NOVA Chemical. The Valley-Hopewell 69 kV tap is at the end of its useful life. The other service to the customer is from the Potter-AES 138 kV transmission line. The customer has requested to retain two redundant electrical sources to maintain reliability because of their critical business processes.

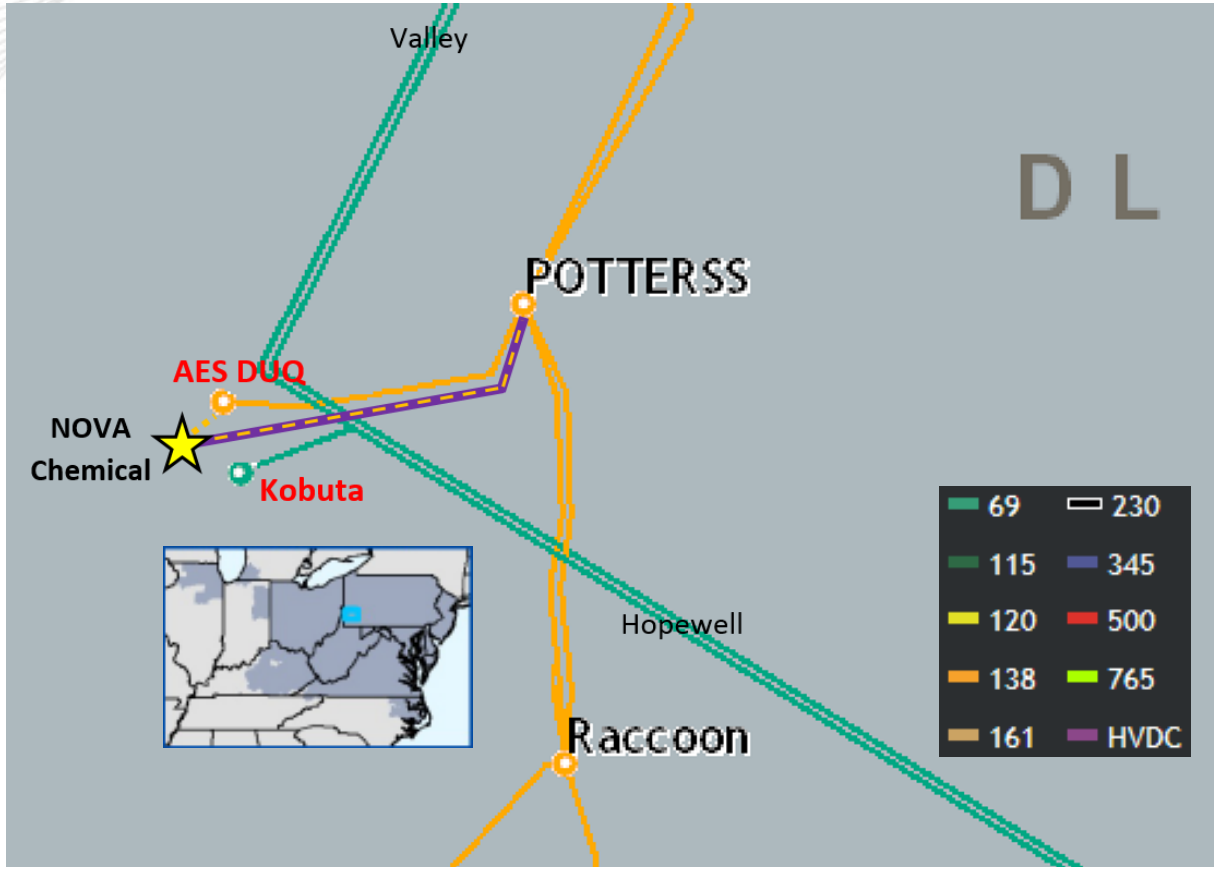
Drivers:
Customer Service, Equipment Material Condition

Selected Solution:
Eliminate the existing Kobuta substation and the 69 kV tap and replace it with a new 138 kV transmission line from the Potter substation to the newly constructed NOVA Chemical substation, which is being built by the customer. **(S1738.1)**
Install a #6-#7 3000 A 63kA 138 kV bus tie breaker and associated protection and control equipment at Potter substation. Install the new Potter-NOVA Chemical (Z-180) 138 kV line using 853.7 ACAR 24/13. (**S1738.2**)
Install two 138 kV disconnect switches, protection, communications, and metering equipment at the newly constructed NOVA Chemical customer substation. (**S1738.3**)
Eliminate the 69 kV Kobuta tap and associated customer substation from the Valley-Hopewell 69 kV line. Remove all associated equipment from the AES substation to establish Potter-NOVA Chemical (Z-80). (**S1738.4**)

Estimated Project Cost: $4 M

Projected IS Date (Expected IS Date): 7/31/2019

Status: Engineering



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DL Transmission Zone: Supplemental Panther Hollow Cut in

Previously Presented: 3/27/2018 SRRTEP

Problem Statement (Scope):
The Oakland 138-23kV substation has exceeded its capacity to reliably serve the increased and projected distribution load growth in the area. The Oakland substation has a peak distribution load of 204MVA.

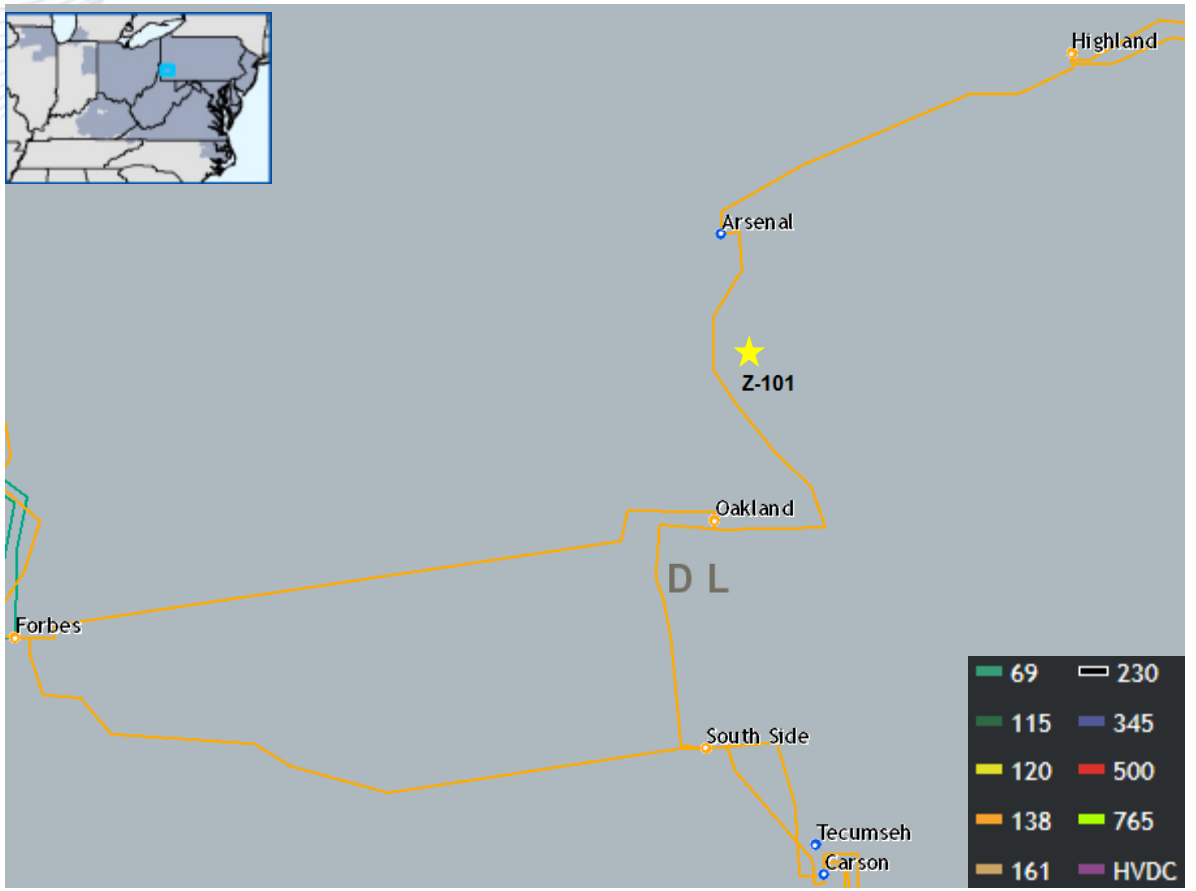
Drivers: Customer Service, Operational Flexibility and Efficiency

Selected Solution:
Establish a new 138-23kV substation (Panther Hollow) utilizing the existing Arsenal-Oakland (Z-101) 138kV circuit as a looped transmission source. (**S1588**)

Estimated Transmission Cost: $16.8M

Projected In-Service Date (Expected IS Date): 5/31/2020

Status: Conceptual



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DL Transmission Zone: Supplemental Wilmerding Breaker Replacement

Previously presented on 2/14/2018 SRRTEP

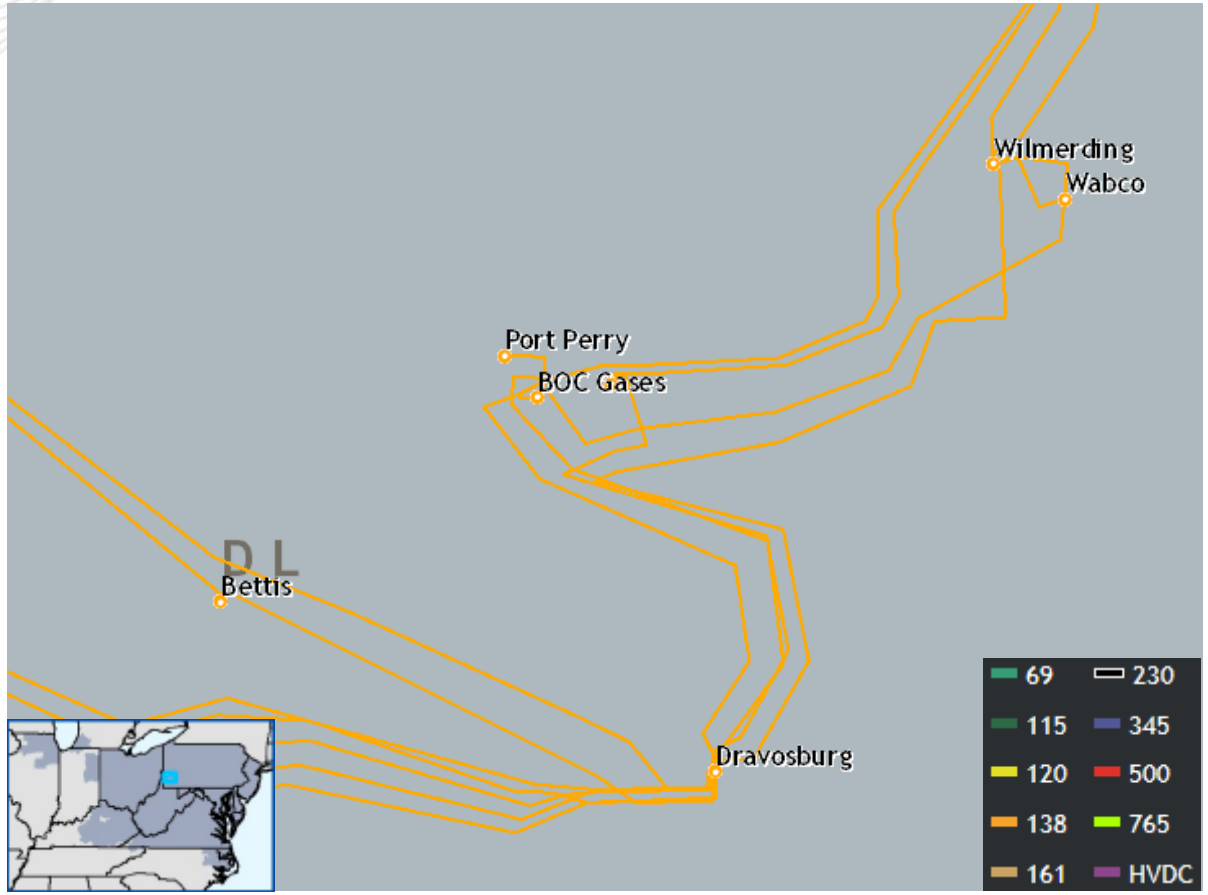
Problem Statement
The Wilmerding #86 and #88 138kV breakers were installed in 1968. The #88 breaker feeds a transmission customer and has the potential to remove this customer from service if not replaced. The lifespan of these breakers have been optimized and each are now at the end of their useful lives based on material condition and performance.
Drivers: Equipment Material Condition, Performance and Risk

Selected Solution:
Replace Wilmerding SS - #86 138kV Breaker (Present rating: 37.1kA, Future rating: 50kA). (**S1573.1**)
Replace Wilmerding SS - #88 138kV Breaker(Present rating: 37.9kA, Future rating: 50kA). (**S1573.2**)

Estimated Project Cost: $0.38M each

Projected IS Date (Expected IS Date): 9/30/2018

Status: Engineering



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Dayton

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Dayton Transmission Zone: Supplemental Rebuild 69 kV Line (6631) from Cisco Substation to Botkins Substation

Previously Presented: 8/31/2018 SRRTEP

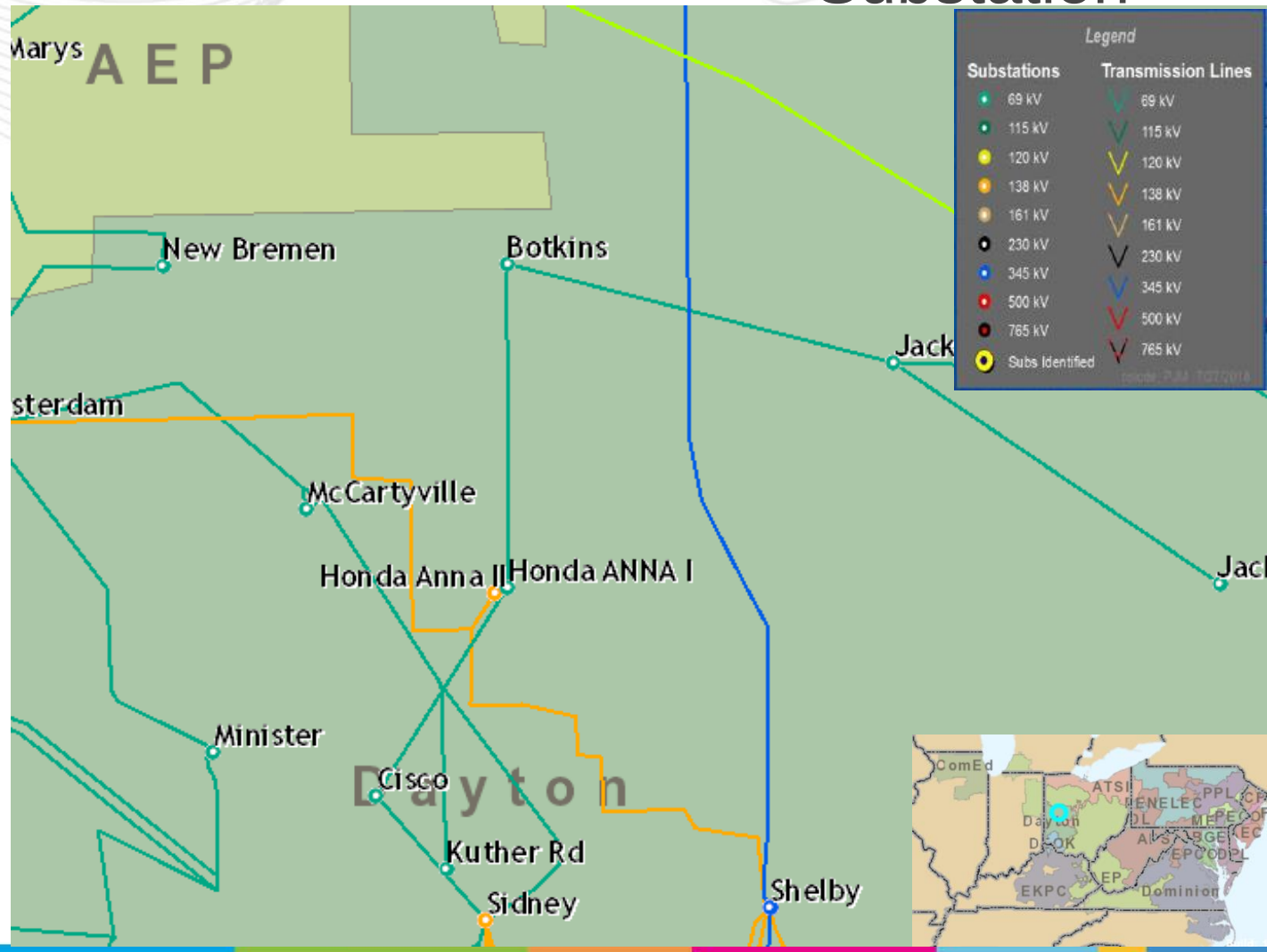
Problem Statement:
A reliability issue has been identified on the 69 kV line from Cisco Substation to Botkins Substation. The line was constructed in the 1950s with wood poles and crossarms. The line has several sleeves and many have failed in recent years, impacting customers in the area.

Selected Solution:
Rebuild the 69 kV line (6631) from Cisco Substation to Botkins Substation. (**S1746**)
Old conductor: 477 ACSR (18x1); New conductor: 1351 AAC
Cisco-Anna 69 kV Old Rating: SN/SE (80/98), Anna-Botkins 69 kV Old Rating SN/SE (80/98); Cisco-Anna 69 kV New Rating: SN/SE (151/187), Anna-Botkins 69 kV Old Rating SN/SE (151/165)

Estimated Transmission Cost: $7.425 M

Required In-Service: 12/31/2019

Status: Engineering



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Dayton Transmission Zone: Supplemental Replace 13827 Switch

Previously Presented: 8/31/2018 SRRTEP

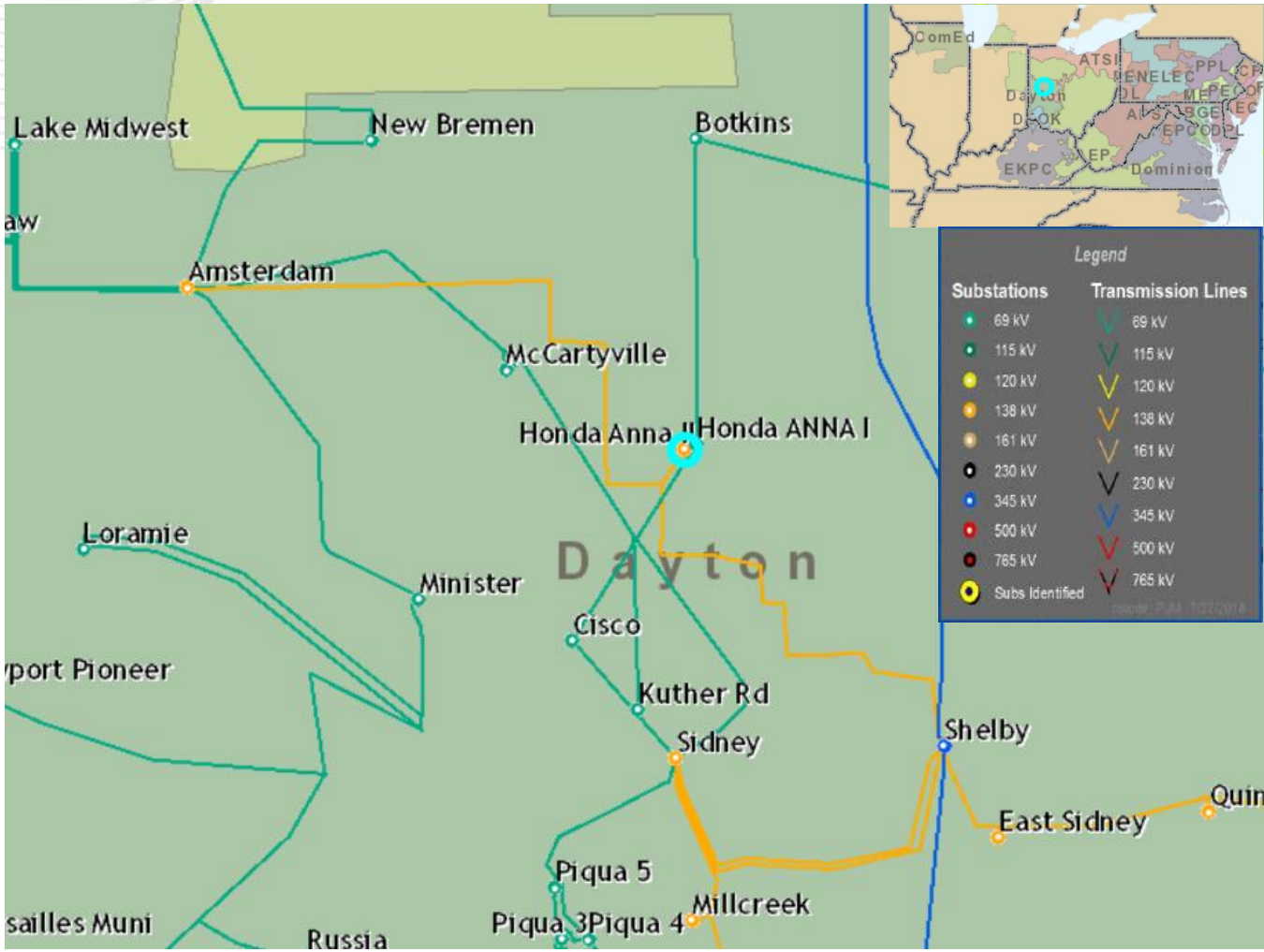
Problem Statement:
This project proposes to replace the existing switch on 13827 with an automatic 138 kV sectionalizing switch on the 13827 line (Amsterdam – Honda Anna 138 kV line). This sectionalizing switch is needed to serve a large industrial customer and is a critical path to maintain reliability in the area. This will give DP&L System Operations the ability to sectionalize the transmission system remotely.

Selected Solution:
Install a 138 kV automatic sectionalizing switch at Honda Anna 138 kV tap on the Amsterdam – Shelby 138 kV line with remote operation capability. (**S1747**)

Estimated Cost: $376 K

Required In-Service: 12/31/2019

Status: Engineering



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