

Sub Regional RTEP Committee: Western AEP Supplemental Projects

March 19, 2020

Needs

Stakeholders must submit any comments within 10 days of this meeting in order to provide time necessary to consider these comments prior to the next phase of the M-3 process

Need Number: AEP-2019-OH005 **Canceled**

Process Stage: Need Meeting 03/25/2019

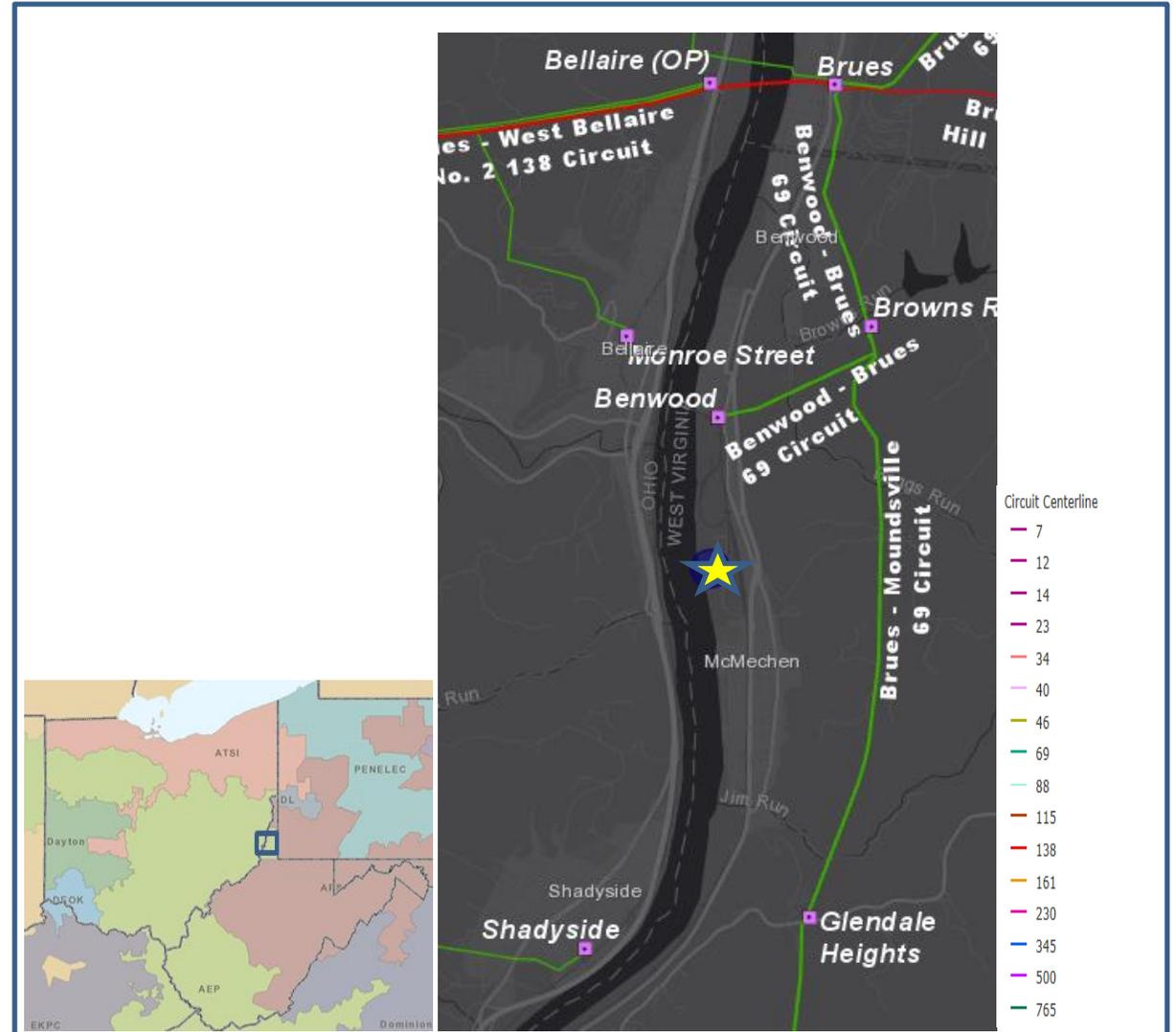
Project Driver: Customer Service

Specific Assumption Reference:

AEP Connection Requirements for the AEP Transmission System

Problem Statement:

- A customer has requested new service south of Benwood, West Virginia. The forecasted peak demand is 8 MVA.
- **This need has been canceled by the customer.**



AEP Transmission Zone M-3 Process Muskingum, Guernsey, Tuscarawas & Stark Counties, Ohio

Need Number: AEP-2020-OH001 (revised)

Process Stage: Need Meeting 3/19/2020

Supplemental Project Driver:

Equipment Material Condition, Performance and Risk; Operational Flexibility & Efficiency

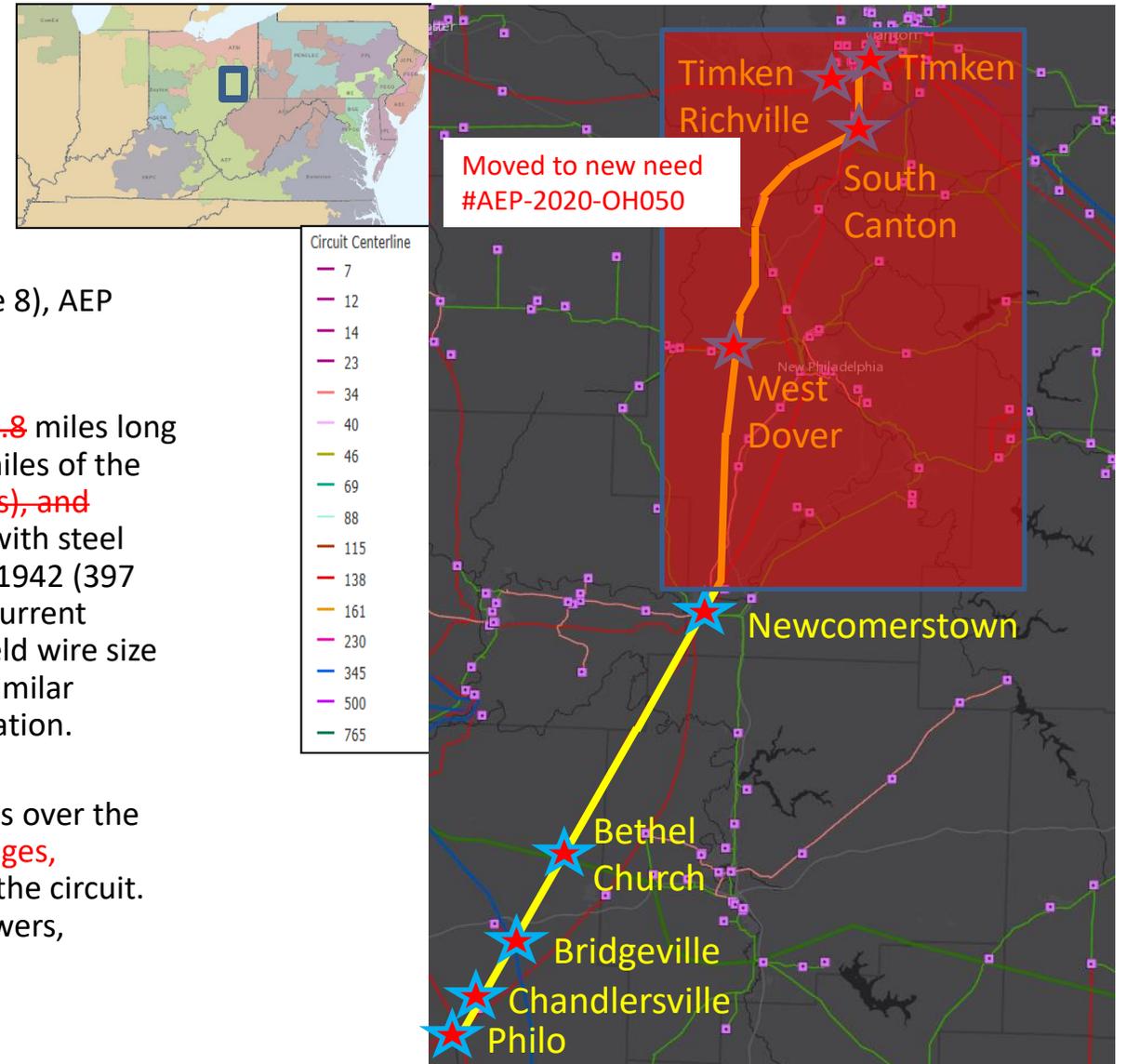
Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8), AEP Presentation on Pre-1930s Lines

Problem Statement:

The Philo-Newcomerstown ~~Torrey~~ 138kV transmission line ~~section asset~~ is ~~32 70.8~~ miles long and consists of portions of the following circuits: Philo-South Canton (~~32 68.2~~ miles of the total circuit length of 75.2 miles), ~~South Canton-Timken Richville (2.0 of 3.5 miles), and Timken Richville-Timken (0.6 of 3.4 miles)~~. The line was originally built in 1942 with steel lattice towers. The conductor is 6-wired single-circuit, with one side installed in 1942 (397 ACSR) and the other side installed in 1954 (477 ACSR). The line does not meet current grounding and shielding requirements, due to the condition of the obsolete shield wire size (159 ACSR), and the line shielding angle being inadequate. This T-line exhibits similar conditions as the examples listed in AEP's 1930's steel lattice tower line presentation.

The Philo-South Canton 138kV circuit has experienced ~~18 15~~ momentary outages over the past 5 years (~~zero sustained outages, resulting in zero CMI~~) and 4 sustained outages, ~~resulting in 437,567 minutes of CMI~~. There are currently 18 open conditions on the circuit. Examples of the conditions include: burnt insulators, worn hardware, rusting towers, damaged shield wire, and severe rusting of the tower steel.



AEP Transmission Zone M-3 Process Muskingum, Guernsey, Tuscarawas & Stark Counties, Ohio

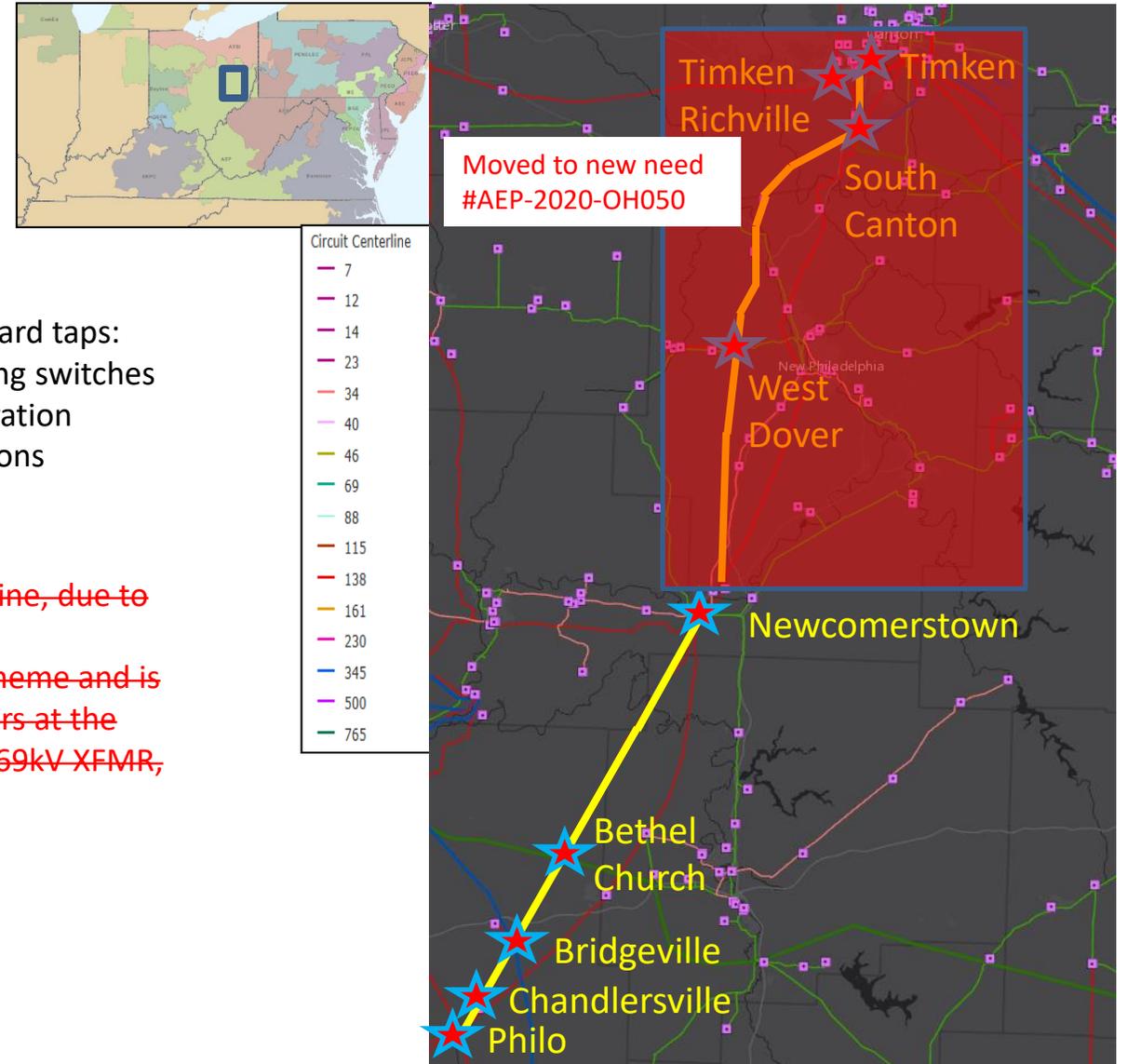
Need Number: AEP-2020-OH001 (revised)

Process Stage: Need Meeting 3/19/2020

The Philo-~~Newcomerstown South Canton~~-138kV circuit contains 3 consecutive hard taps: Chandlersville Co-op, Bridgeville, Bethel Church Co-op. Without line sectionalizing switches at these taps, it makes it very difficult to perform T-Line maintenance and restoration activities. Outages must be scheduled with the customers at each of these stations whenever the 138kV circuit needs taken out of service.

~~In addition, the West Dover 138-69kV station creates a 3-terminal point on the line, due to the lack of 138kV line breakers or a 138kV transformer protection device (just a MOAB/ground-switch system today). This complicates the circuit protection scheme and is a risk for misoperations and over-tripping. In addition, due to the lack of breakers at the station, there are 3 dissimilar zones of protection combined: 138kV circuit, 138-69kV XFMR, 69kV bus.~~

Model: N/A



AEP Transmission Zone M-3 Process Tuscarawas & Stark Counties, Ohio

Need Number: AEP-2020-OH050 (**Revised to exclude Dover – South Canton**) (**Previously revised to exclude West Dover, South Canton – Sunnyside, & South Canton – Torrey**)

Process Stage: Need Meeting 3/19/2020

Supplemental Project Driver:

Equipment Material Condition, Performance and Risk; Operational Flexibility & Efficiency

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8), AEP Presentation on Pre-1930s Lines

Problem Statement:

- The Newcomerstown- ~~Sunnyside South Canton~~ North Intertie eastern 138kV transmission line is ~~42 36.5~~ 22.3 miles long, originally constructed in 1923. The vast majority of the structures are still original, as well as the six-wired 336 ACSR conductor, insulators, and hardware. This line is made up of several circuits connected between Newcomerstown and ~~Sunnyside South Canton~~ North Intertie stations.
- Insulator assemblies are showing corrosion and deterioration, which could lead to additional failures and safety concerns.
- There have been 0.7 million customer-minutes-of-interruption (CMI) over the 2008-2018 time period.
- This line has experienced ~~36 33~~ 21 momentary outages and ~~5-4~~ 2 sustained outages over the past 10 years.



AEP Transmission Zone M-3 Process Tuscarawas & Stark Counties, Ohio

Need Number: AEP-2020-OH050 (Revised to exclude Dover – South Canton) (Previously revised to exclude West Dover, South Canton – Sunnyside, & South Canton – Torrey)

Process Stage: Need Meeting 3/19/2020

Problem Statement, Continued:

- The Newcomerstown – ~~West Dover Torrey~~ western 138kV transmission line is ~~17.1 35.1 38.6~~ miles long and is part of the 75.2-mile-long circuit Philo-South Canton circuit ~~consists of portions of the following circuits: Philo-South Canton (36 miles of the total circuit length of 75.2 miles), South Canton-Timken Richville (2.0 of 3.5 miles), and Timken Richville-Timken (0.6 of 3.4 miles).~~ The line was originally built in 1942 with steel lattice towers. The conductor is 6-wired single-circuit, with one side installed in 1942 (397 ACSR) and the other side installed in 1954 (477 ACSR). The line does not meet current grounding and shielding requirements, due to the condition of the obsolete shield wire size (159 ACSR), and the line shielding angle being inadequate. This T-line exhibits similar conditions as the examples listed in AEP’s 1930’s steel lattice tower line presentation.
- The Philo-South Canton 138kV circuit has experienced 18 momentary outages over the past 5 years and 4 sustained outages, resulting in 437,567 minutes of CMI. There are currently 18 open conditions on the circuit. Examples of the conditions include: burnt insulators, worn hardware, rusting towers, damaged shield wire, and severe rusting of the tower steel.
- ~~In addition, the West Dover 138-69kV station creates a 3-terminal point on the line, due to the lack of 138kV line breakers or a 138kV transformer protection device (just a MOAB/ground switch system today). This complicates the circuit protection scheme and is a risk for misoperations and over-tripping. In addition, due to the lack of breakers at the station, there are 3 dissimilar zones of protection combined: 138kV circuit, 138-69kV XFMR, 69kV bus.~~

Model: N/A



AEP Transmission Zone M-3 Process Stark & Tuscarawas Counties, Ohio

Need Number: AEP-2020-OH053 (split from AEP-2020-OH050)

Process Stage: Need Meeting 3/19/2020

Supplemental Project Driver:

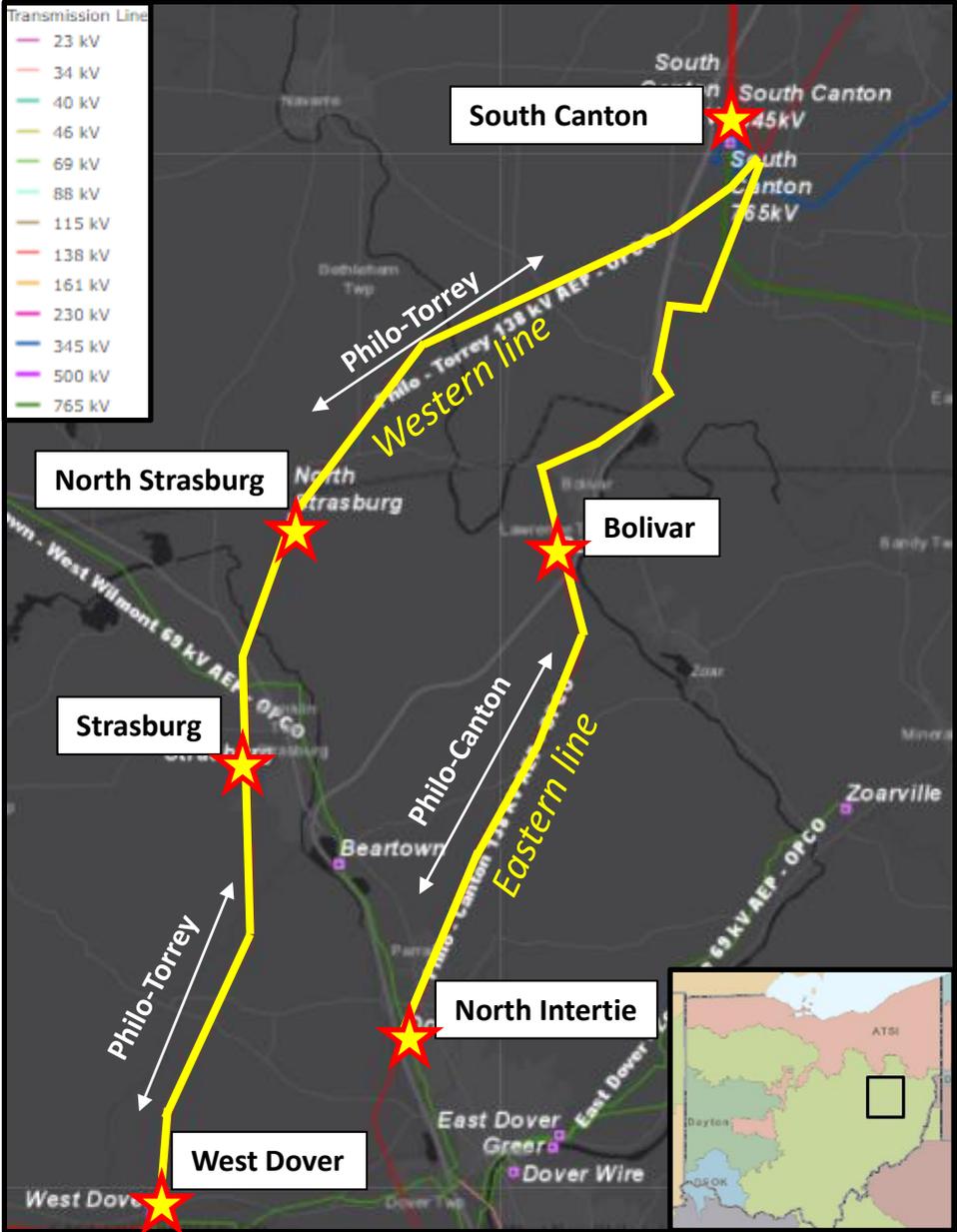
Equipment Material Condition, Performance and Risk; Operational Flexibility & Efficiency

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8),
AEP Presentation on Pre-1930s Lines

Problem Statement:

- The South Canton – North Intertie eastern 138kV transmission line is 14.6 miles long, originally constructed in 1923. The vast majority of the structures are still original, as well as the six-wired 336 ACSR conductor, insulators, and hardware. This line is made up of several circuits connected between South Canton and Sunnyside stations.
- Insulator assemblies are showing corrosion and deterioration, which could lead to additional failures and safety concerns.
- This line has experienced 12 momentary outages and 2 sustained outages over the past 10 years (2008/2018).



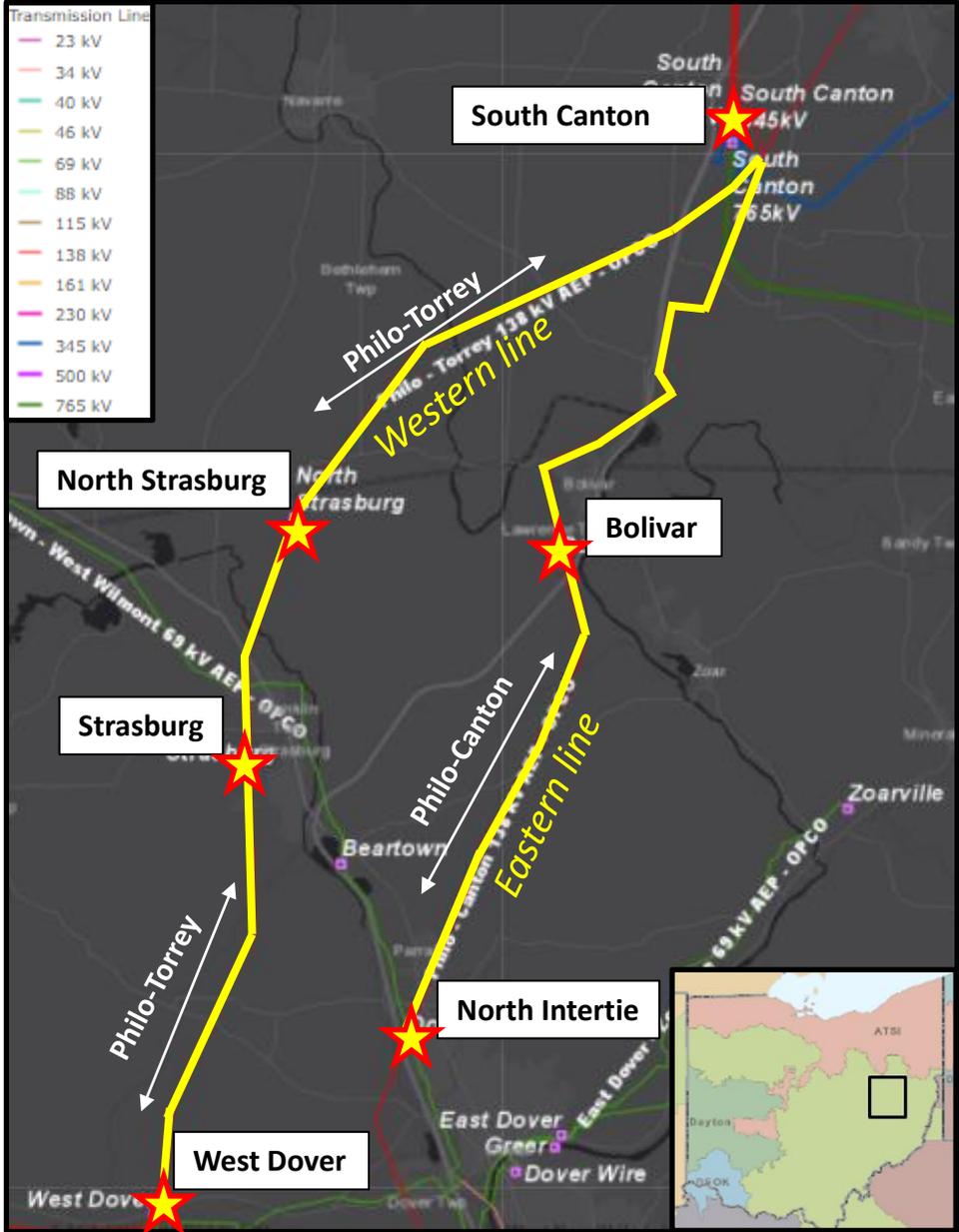
AEP Transmission Zone M-3 Process Stark & Tuscarawas Counties, Ohio

Need Number: AEP-2020-OH053 (split from AEP-2020-OH050)

Process Stage: Need Meeting 3/19/2020

Problem Statement:

- The South Canton-West Dover western 138kV transmission line is 18.0 miles long and is part of the 75.2-mile-long circuit Philo-South Canton. The line was originally built in 1942 with steel lattice towers. The conductor is 6-wired single-circuit, with one side installed in 1942 (397 ACSR) and the other side installed in 1954 (477 ACSR). The line does not meet current grounding and shielding requirements, due to the condition of the obsolete shield wire size (159 ACSR), and the line shielding angle being inadequate. This T-line exhibits similar conditions as the examples listed in AEP’s 1930’s steel lattice tower line presentation.
- The Philo-South Canton 138kV circuit has experienced 18 momentary outages over the past 5 years and 4 sustained outages, resulting in 437,567 minutes of CMI. There are currently 18 open conditions on the circuit. Examples of the conditions include: burnt insulators, worn hardware, rusting towers, damaged shield wire, and severe rusting of the tower steel.



Need Number: AEP-2020-OH051 (split from AEP-2020-OH050)

Process Stage: Needs Meeting 3/19/2020

Supplemental Project Driver:

Equipment Material Condition, Performance and Risk; Operational Flexibility & Efficiency

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

West Dover 138-69kV station creates a 3-terminal point on the line, due to the lack of 138kV line breakers or a 138kV transformer protection device (just a MOAB/ground-switch system today). This complicates the circuit protection scheme and is a risk for misoperations and over-tripping. In addition, due to the lack of breakers at the station, there are 3 dissimilar zones of protection combined: 138kV circuit, 138-69kV XFMR, 69kV bus.



Need Number: AEP-2020-OH052 (split from AEP-2020-OH050)

Process Stage: Needs Meeting 3/19/2020

Supplemental Project Driver:

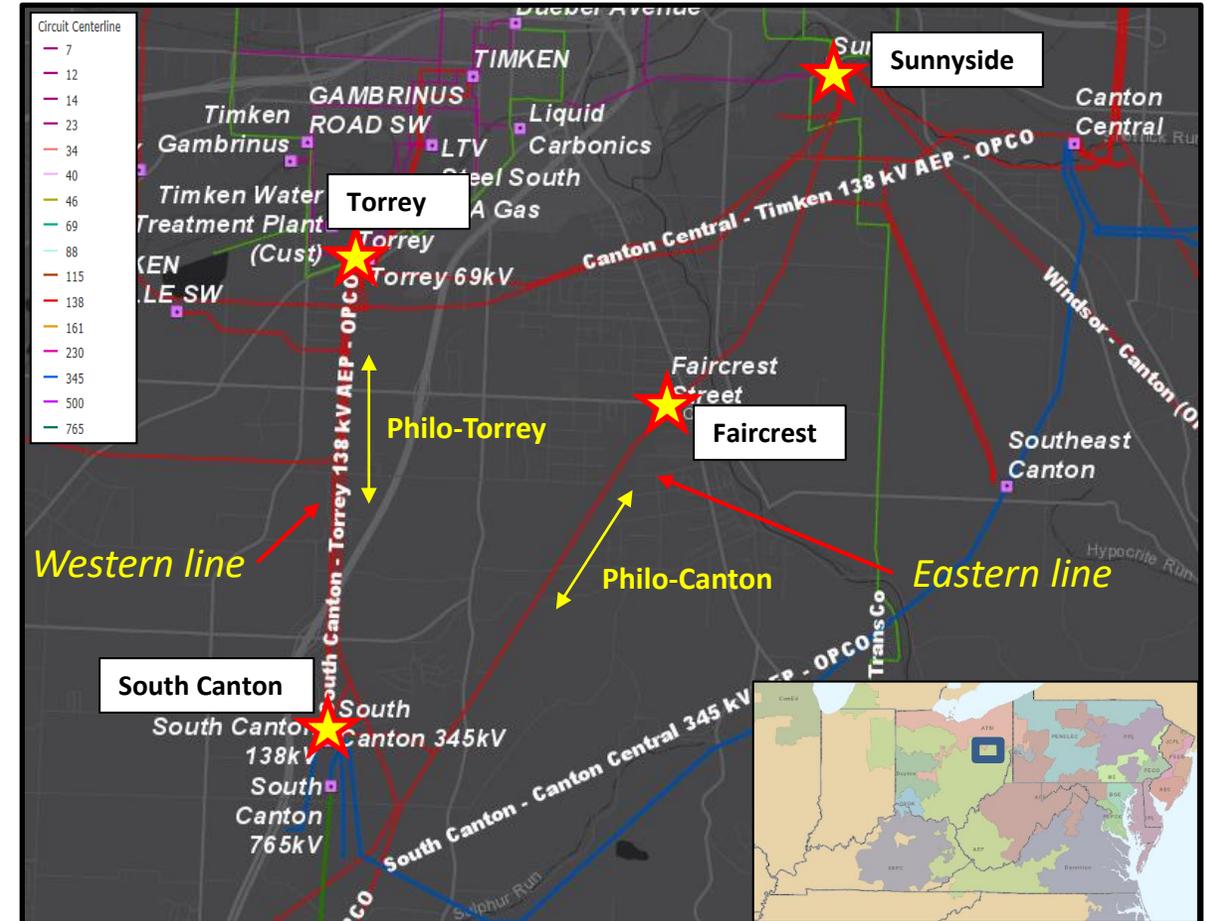
Equipment Material Condition, Performance and Risk; Operational Flexibility & Efficiency

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8), AEP Presentation on Pre-1930s Lines

Problem Statement:

- The South Canton - Sunnyside eastern 138kV transmission line is 5.5 miles long, originally constructed in 1923. The vast majority of the structures are still original, as well as the six-wired 336 ACSR conductor, insulators, and hardware. This line is made up of several circuits connected between South Canton and Sunnyside stations.
- Insulator assemblies are showing corrosion and deterioration, which could lead to additional failures and safety concerns.
- This line has experienced 3 momentary outages and 1 sustained outages over the past 10 years (2008/2018).

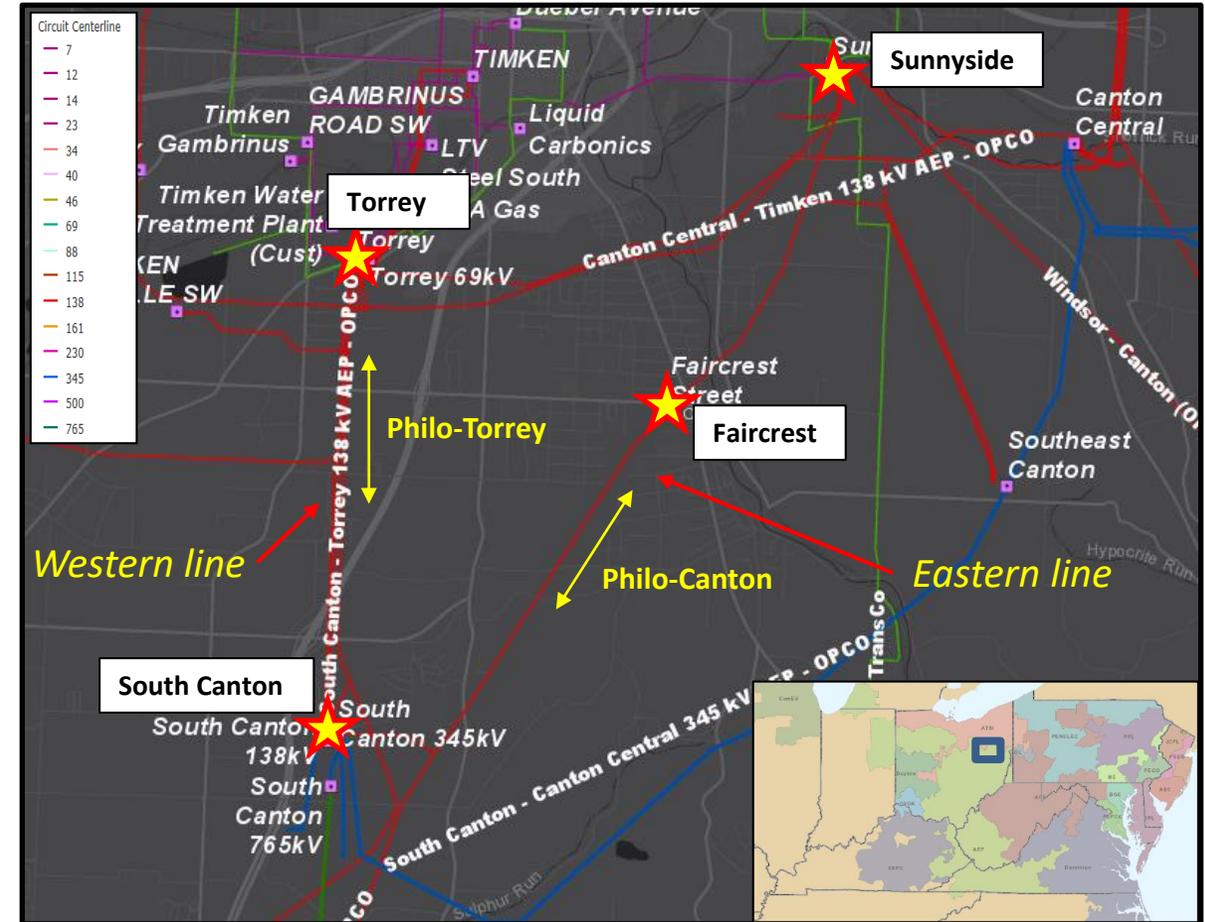


Need Number: AEP-2020-OH052

Process Stage: Needs Meeting 3/19/2020

Problem Statement, continued:

- The South Canton-Torrey western 138kV transmission line is 3.5 miles long and consists of portions of the following circuits: South Canton-Timken Richville (2.0 of 3.5 miles), and Timken Richville-Timken (0.6 of 3.4 miles). The line was originally built in 1942 with steel lattice towers. The conductor is 6-wired single-circuit, with one side installed in 1942 (397 ACSR) and the other side installed in 1954 (477 ACSR). The line does not meet current grounding and shielding requirements, due to the condition of the obsolete shield wire size (159 ACSR), and the line shielding angle being inadequate. This T-line exhibits similar conditions as the examples listed in AEP's 1930's steel lattice tower line presentation.
- The 2- 138kV line switches at Faircrest station (part of S.Canton-SE Canton circuit) are barely functional, difficult to open/close, and date to 1971.
- The protection equipment on the Southeast Canton-Sunnyside 138kV circuit consists of legacy electromechanical relays and pilot wire communications channel. Electromechanical relays lack vendor support, don't have SCADA, and lack fault data collection capabilities. Aging pilot wire is increasingly prone to failure and increased maintenance, leading to risk of having to rely on backup protection methods.



AEP Transmission Zone M-3 Process Whitehall, OH

Need Number: AEP-2020-OH016

Process Stage: Need Meeting 03/19/2020

Supplemental Project Driver: Customer Service

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

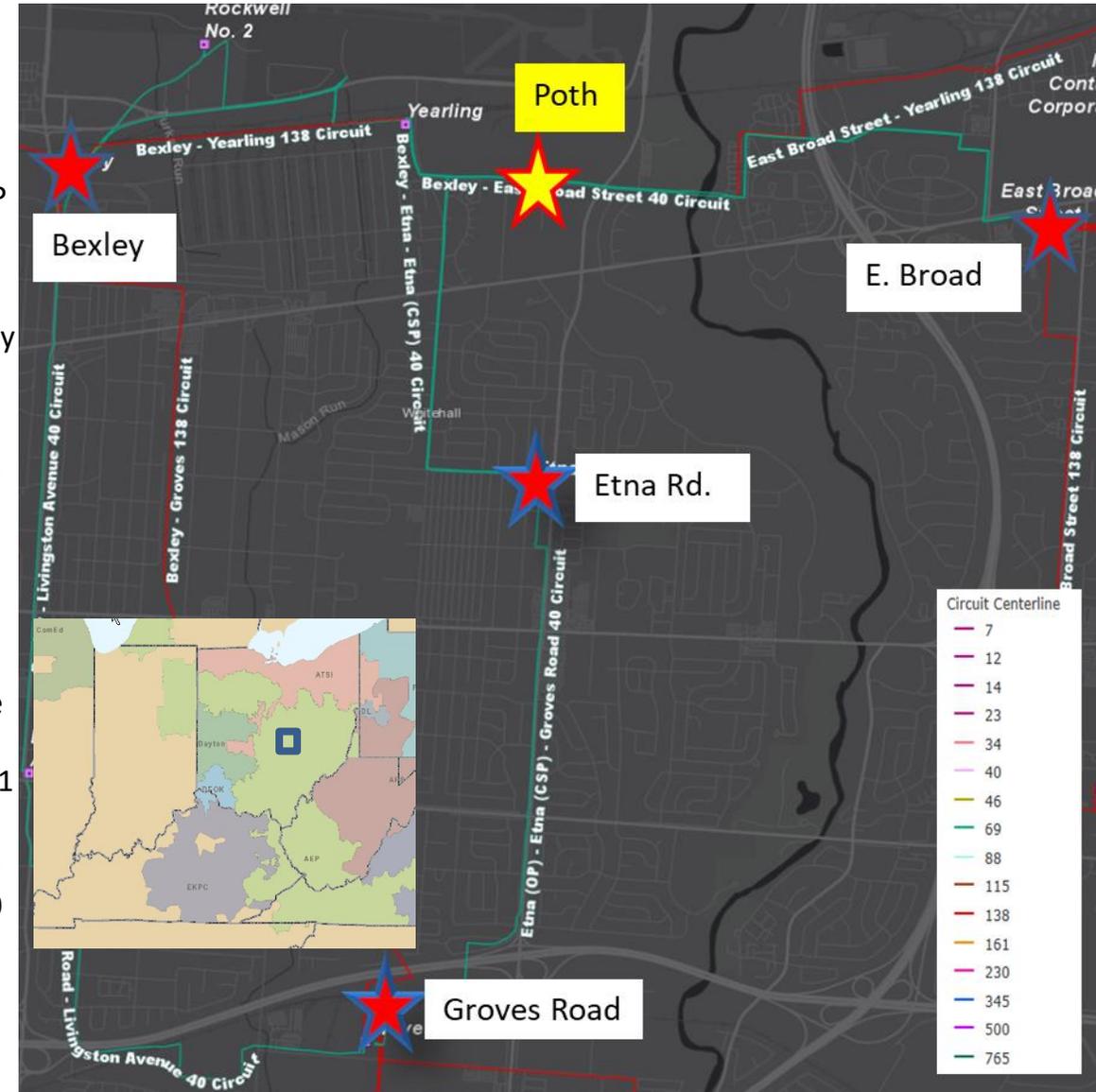
AEP Ohio has requested a new 138kV delivery point (Poth) off the East Broad Street - Bexley 138kV circuit by December 2022.

At Etna Road station, 101/102 of the relays are electro-mechanical that are no longer supported by the manufacturer, lack SCADA ability, and lack fault collection. 46 kV CB's 30, 31, 32, 33, 34, and 36 (vintage 1955) are oil type breakers, with some have a high number of fault operations, and are an obsolete kV. Over the last 5 years we have had 402,323 CMI and three outages.

Etna-Groves Road 40 kV line is a majority 1960's vintage (70%) wood pole line with the remainder being built since 1990. The conductor is the original 636 ACSR from 1965. There are a total of 56 open conditions on this line with 51% (42/82) of the poles having at least one condition. These conditions include rot top poles and cross arms, woodpecker damage, broken/missing ground leads, and damaged guy wires. Over the last 5 years there have been 1 momentary and 3 permanent outages on this line.

Etna Tap 40 kV extension (part of the Etna – Bexley circuit) is a vintage 1957 (57%) with the remainder between 1970 (8%), 1980 (5%), 1990 (5%), and 2010 (22%). There are currently 30 open conditions with 28% (22/80) of poles having at least one condition. These conditions include rot top poles and cross arms, woodpecker damage, broken/missing ground leads, and damaged guy wires. Over the last 5 years there have been 4 momentary and 2 permanent outages.

Model: N/A.



AEP Transmission Zone M-3 Process Meigs County, OH

Need Number: AEP-2020-OH017

Process Stage: Need Meeting 03/19/2020

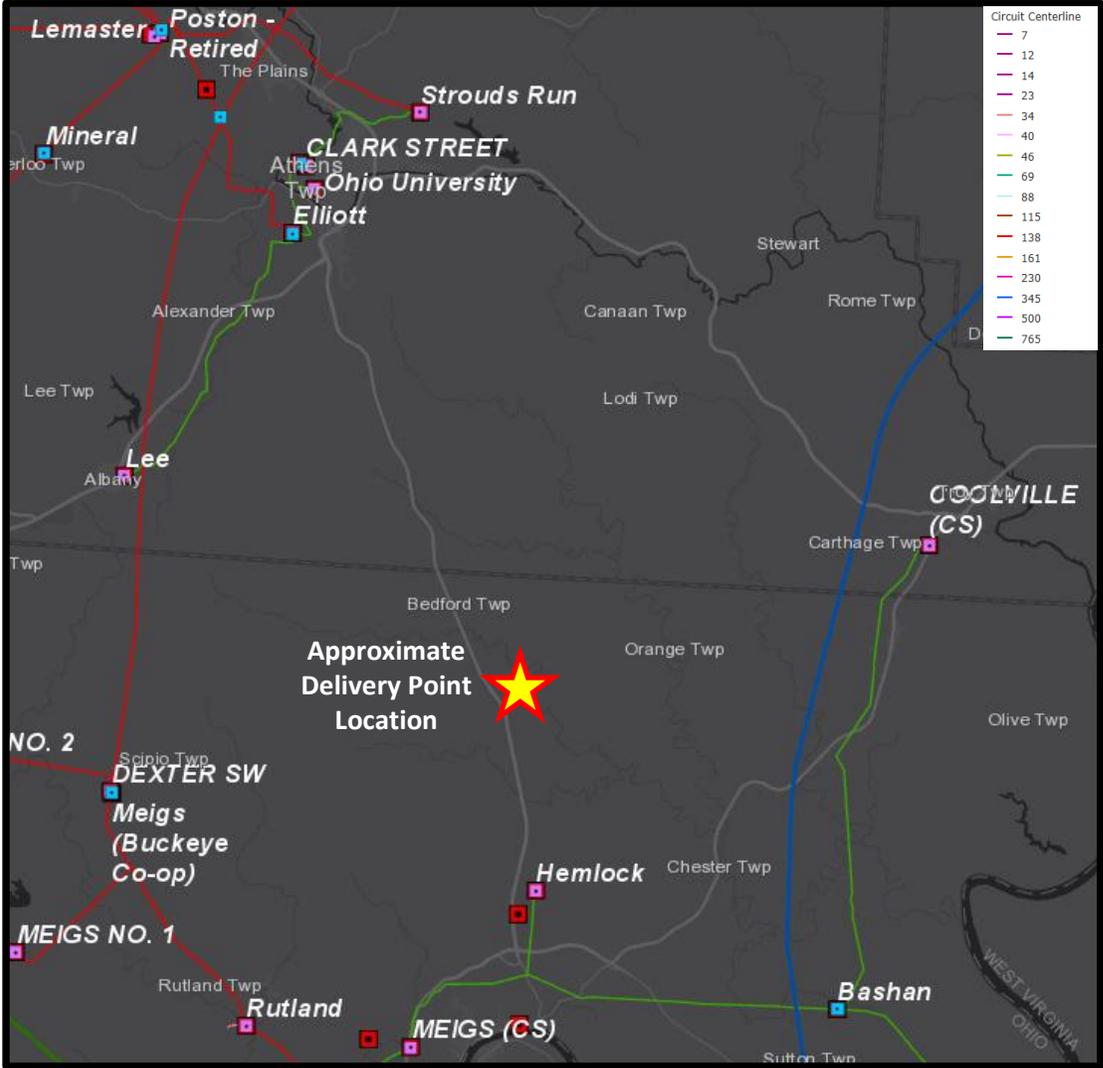
Project Driver:
Customer Service

Specific Assumption Reference:
AEP Connection Requirements for the AEP Transmission System
(AEP Assumptions Slide 7)

Problem Statement:
Customer Service:

- Buckeye Rural Electric Cooperative, Inc. has requested 69kV service to a new delivery point near AEP’s Hemlock station by December 2022. Anticipated load is approximately 2.6 MW of transferred load.

Model: 2024 RTEP



AEP Transmission Zone M-3 Process Putnam/Hancock County

Need Number: AEP-2020-OH020

Process Stage: Need Meeting 3/19/2020

Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

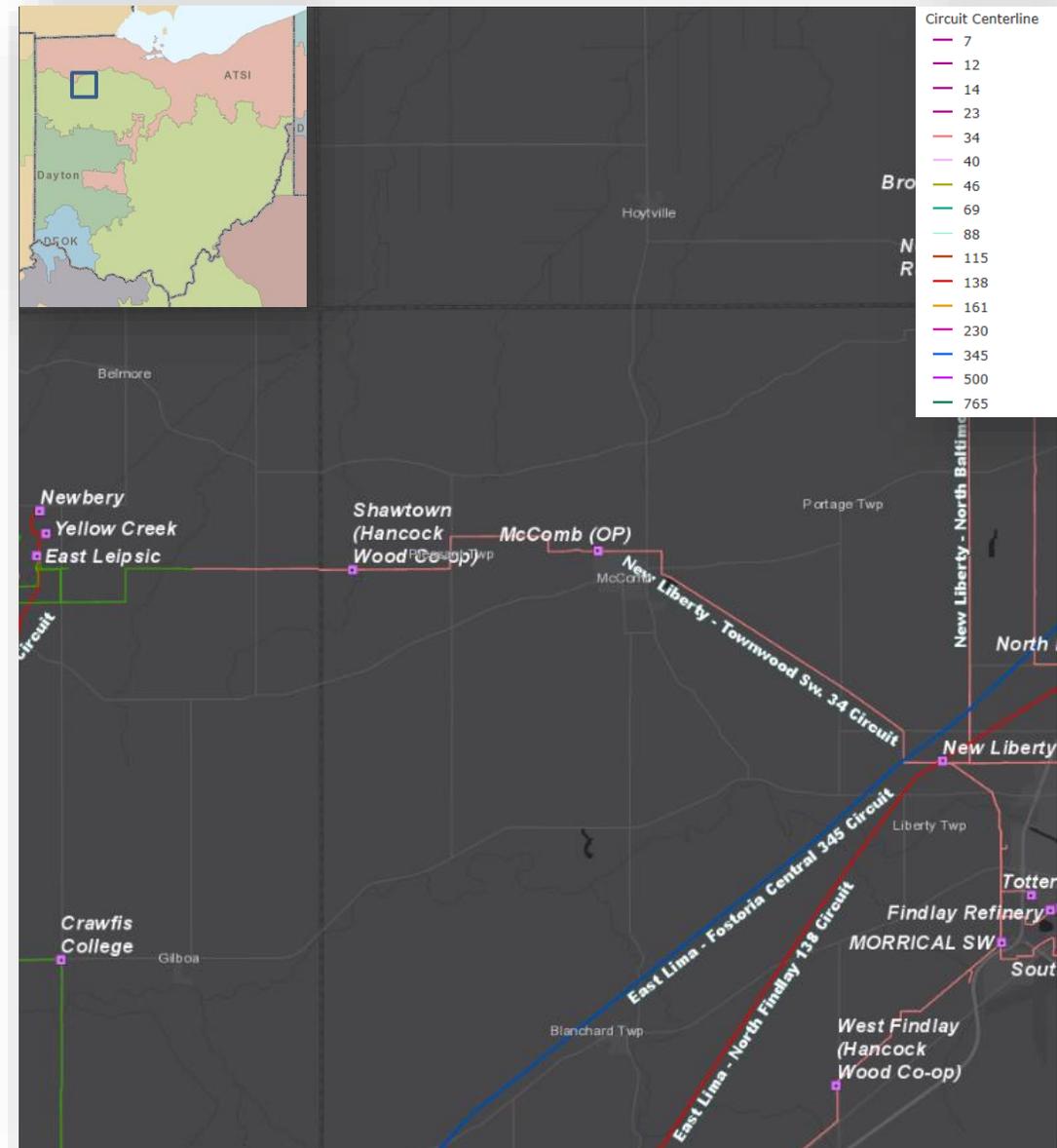
East Leipsic – Townwood Switch 34.5 kV Line:

The East Leipsic – Townwood Switch 34.5 kV line (vintage 1934) is 4.04 miles long and still has the original conductor on 65% of the line with the remainder from 1991 (26%) and 2011 (9%). The conductor is a mixture of 336 ACSR (65%), 4/0 ACSR (26%), and 556 ACSR (9%). The majority of the wood pole structures are a mix of 1960's (33%), 1970's (20%), 1990's (36%), and 2000's (11% - steel) vintage. There are 9 open conditions on the 92 structures that include broken/damaged insulators, damaged hardware, and missing ground leads.

New Liberty – Townwood Switch 34.5 kV Line:

The New Liberty – Townwood Switch 34.5 kV line (vintage 1936) is 13.99 miles long and still has the original conductor on 50% of the line with the remainder from 1939 (49%) and 1956 (1%). The conductor is a mixture of 336 ACSR (50%), 2/0 ACSR (49%) and 4/0 (1%). The majority of the wood pole structures are a mix of 1930's (13%), 1950's (5%), 1960's (14%), 1970's (4%), 1980's (7%), 1990's (27%), 2000's (30%). There are 49 open conditions on this 307 structure circuit that include insect damage, broken ground wire, woodpecker damage, rot heart/top, and loose insulators.

There have been a total of 1 momentary and 2 permanent outages over the last 5 years (57,384 CMI) on these two line sections.



AEP Transmission Zone: Supplemental Salem, VA

Need Number: AEP-2020-AP020

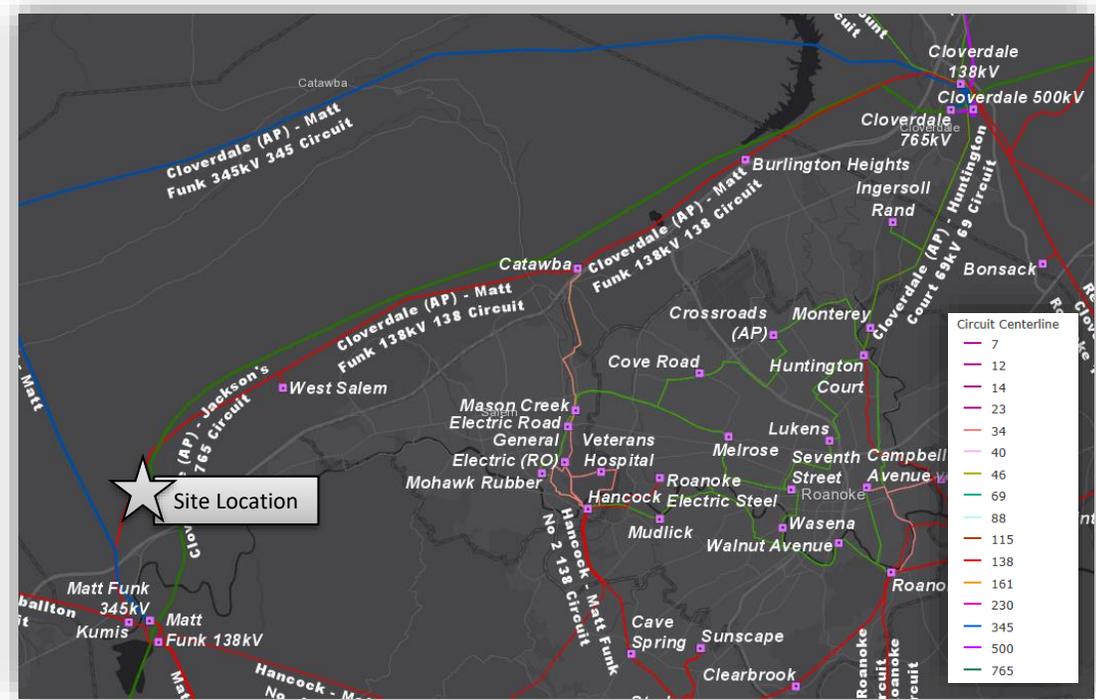
Process Stage: Needs Meeting 03/19/2020

Supplemental Project Driver: Customer Service

Specific Assumptions Reference: AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 7)

Problem Statement:

- AEP Distribution is requesting redundant service for a new critical and sensitive load in the Roanoke region, approximately 0.6 MW total.



AEP Transmission Zone M-3 Process Pike County, Kentucky

Need Number: AEP-2019-AP022 ~~AEP-2020-AP022~~

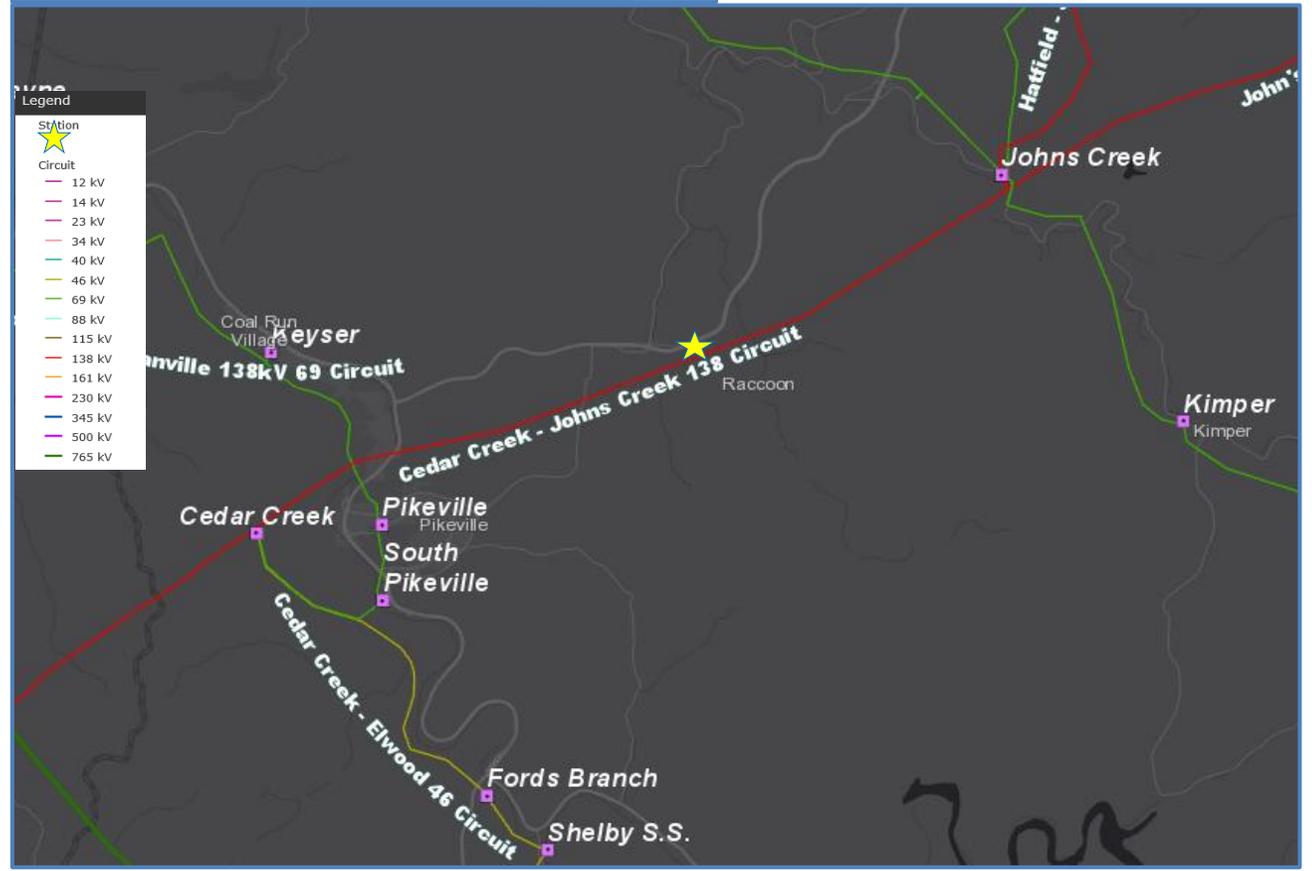
Process Stage: Need Meeting 03/19/2020

Supplemental Project Driver: Customer Service

Specific Assumptions Reference: AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 7)

Problem Statement:

- AEP Kentucky Power Distribution has requested a new distribution service out of the Cedar Creek – John Creek 138kV circuit near Pikeville, Kentucky. The projected Winter peak projected load is 13 MVA.



AEP Transmission Zone M-3 Process Mercer, VA

Need Number: AEP-2020-AP023

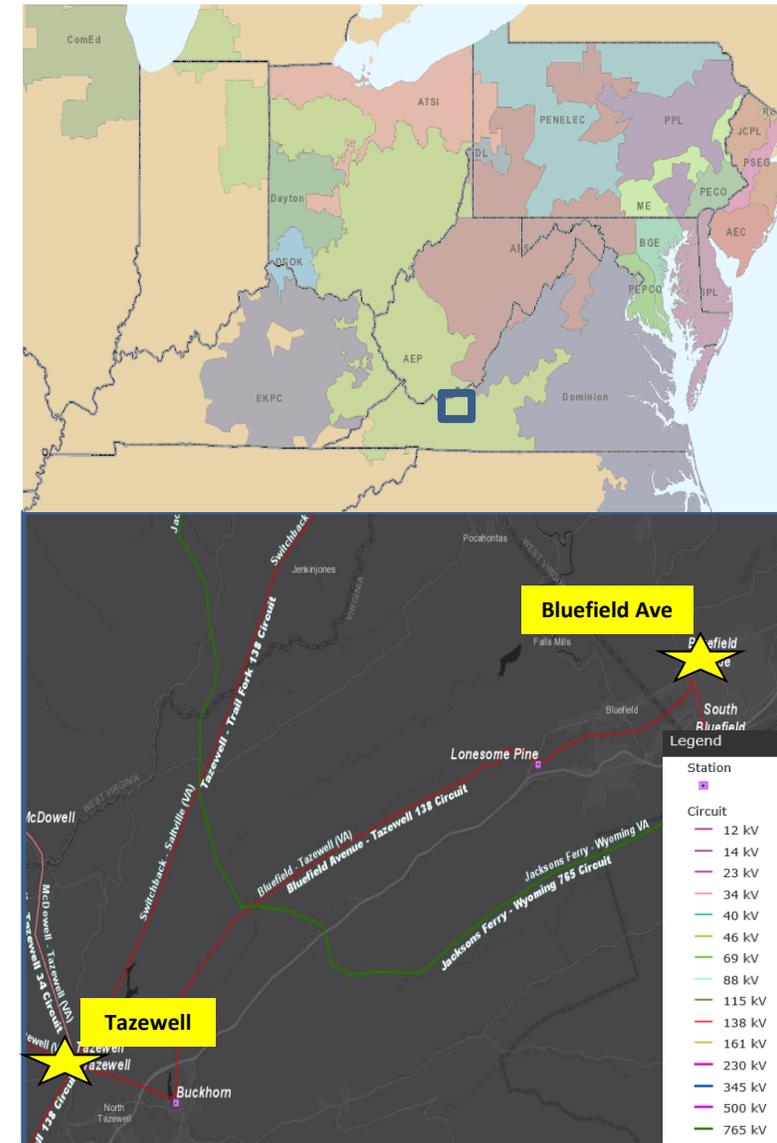
Process Stage: Needs Meeting 03/19/2019

Supplemental Project Driver: Customer Service

Specific Assumption References: AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 7)

Problem Statement:

Distribution has requested a new station to be served from the Bluefield — Tazewell 138 KV line. The projected peak demand is 35 MW.



Need Number: AEP-2020-AP024

Process Stage: Needs Meeting 03/19/2020

Supplemental Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

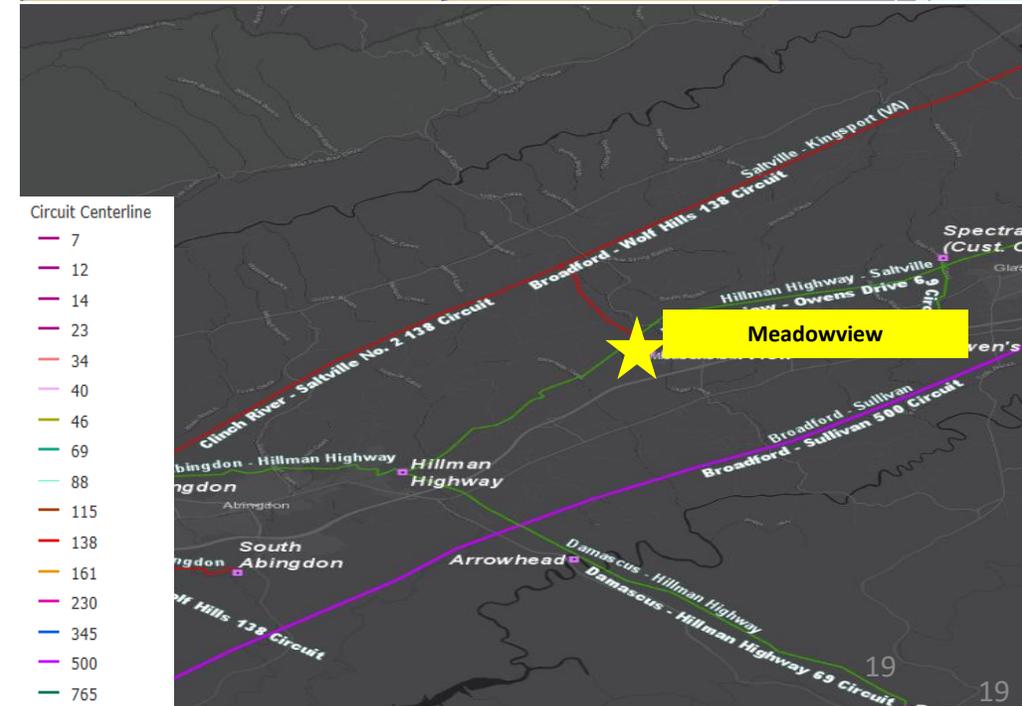
Station

Meadowview Station

Transformer 2 (138/69-34.5 KV):

- Transformer 2 is 39 years old with indications of brittle insulation materials
- There are elevated levels of Carbon Dioxide, which is indicative of high decomposition of the paper insulating materials.
- The decomposition of the paper insulation impairs the unit's ability to withstand short circuit or through fault events.

AEP Transmission Zone: Supplemental Washington, Virginia



Need Number: AEP-2020-AP025

Process Stage: Needs Meeting 03/19/2020

Supplemental Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

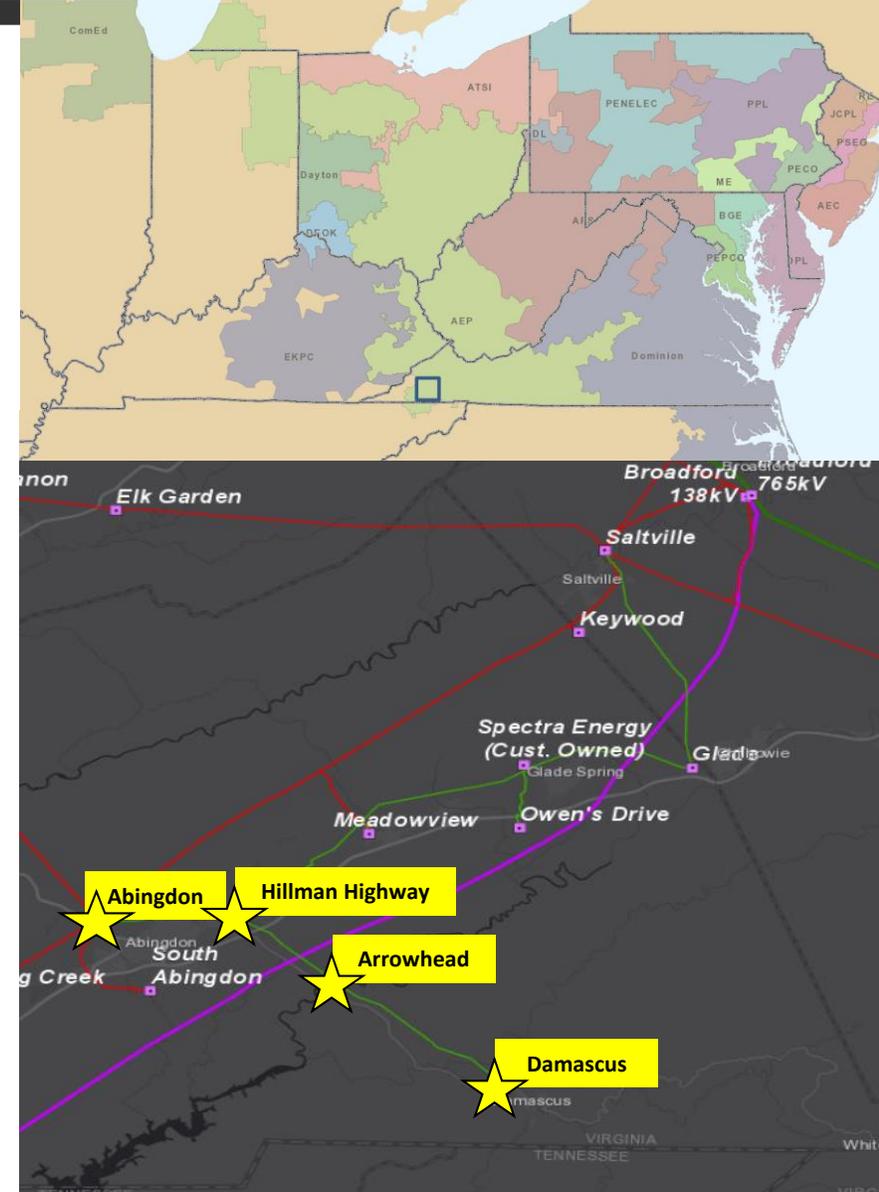
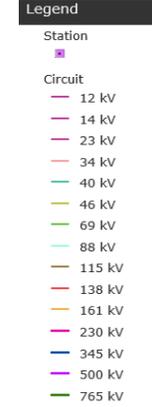
Problem Statement:

Abingdon Area

- There is approximately 25 MVA of nontransferable load on the ~10 mile radial line between Hillman Highway – Damascus stations

- Abingdon — Hillman Highway 69 KV (installed in 1969)
 - Length: ~ 5 Miles
 - Original Construction Type: Wood
 - Conductor Type: 52% 4/0 ACSR 6/1 (Penguin), 20% 556,600 CM ALUM, 14% 336,400 CM ALUM 19
 - Momentary/Permanent Outages: 3/8 (5 years)
 - Total structure count: 71
 - Number of open conditions: 70
 - Open conditions include: structure, broken conductor strands, broken/burnt insulators, shield wire, hardware.
 - Unique structure count with open conditions: 44 (62%)
 - Affected crossarms and poles show signs of rot, woodpecker holes, bowed, twisted conditions, broken and loose bayonets, loose, broken, and rusted guys, and loose insulators.

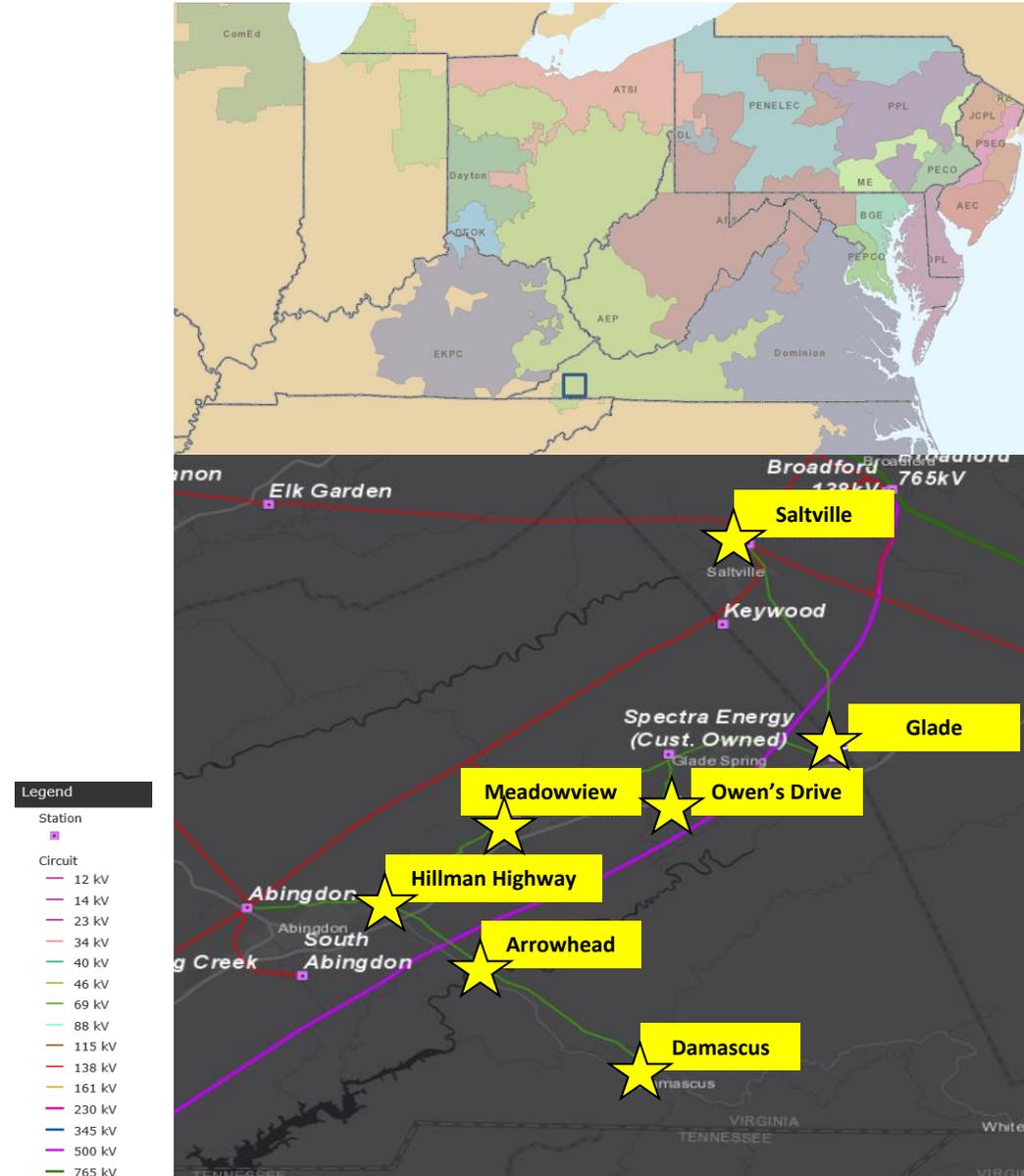
AEP Transmission Zone: Supplemental Washington County, Virginia



Problem Statement (continued)

- Hillman Highway — Saltville 69 KV (installed in 1951)
 - Length: ~ 23 Miles
 - Original Construction Type: Wood
 - Conductor Type: 37% 336,400 CM ACSR 30/7 (Oriole), 32% 219,900 CM ACSR 8/7 (219AC), 29% 336,400 CM ALUM 19
 - Momentary/Permanent Outages: 10/5 (5 years)
 - Total structure count: 243
 - Number of open conditions: 70
 - Unique structure count with open conditions: 42 (17%)
 - Affected cross-arms and poles show signs of rot, woodpecker damage, leaning in-line poles, corrosion, and insect damage.

AEP Transmission Zone: Supplemental Washington County, Virginia



AEP Transmission Zone M-3 Process

Leslie County, Kentucky

Need Number: AEP-2020-AP026

Process Stage: Need Meeting 03/19/2020

Supplemental Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Line Name: Wooton – Pineville 161kV

Line Section: Leslie – Pineville 161kV

Original Install Date (Age): 1942

Length of Line: ~34.24 mi

Total structure count: 189

Original Line Construction Type: Wood

Conductor Type: 500 KCM COPPER

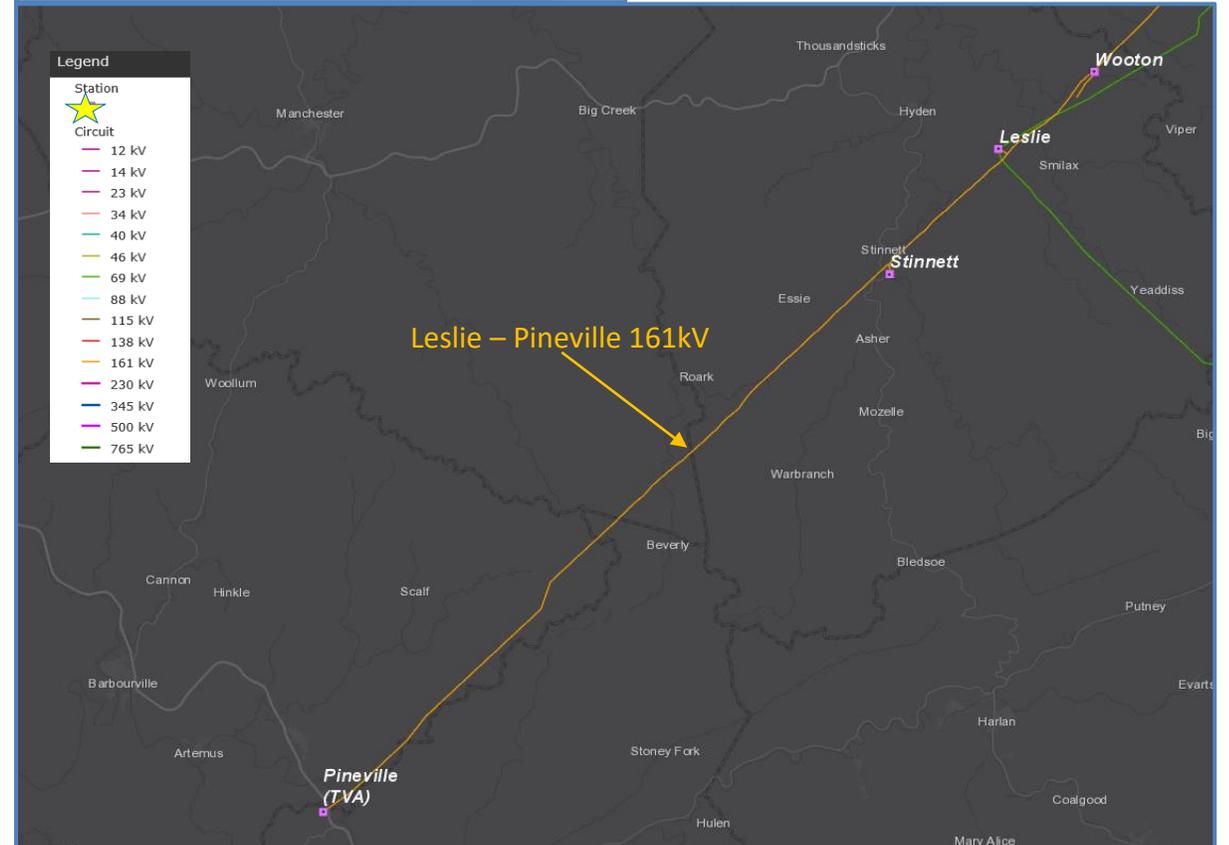
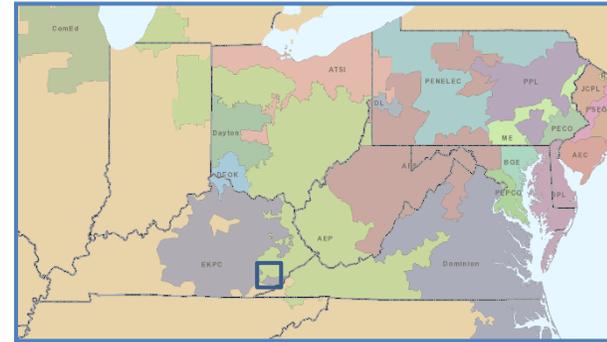
Momentary/Permanent Outages and Duration: 12 Momentary and 5 permanent Outage

CMI (last 5 years only): 26,096 minutes

Line conditions:

Leslie – Pineville line section:

- 130 structures with at least one open condition, 69% of the structures on this circuit.
- 221 structure related open conditions : affecting the crossarm, knee/ vee brace, or pole including rot, split, woodpecker, damaged, loose, and bowed conditions
- 2 open conditions related to the shielding wire, including broken strands
- 3 hardware related open conditions related to insulator, conductor hardware, or shield wire hardware, including broken, missing bolt, and worn

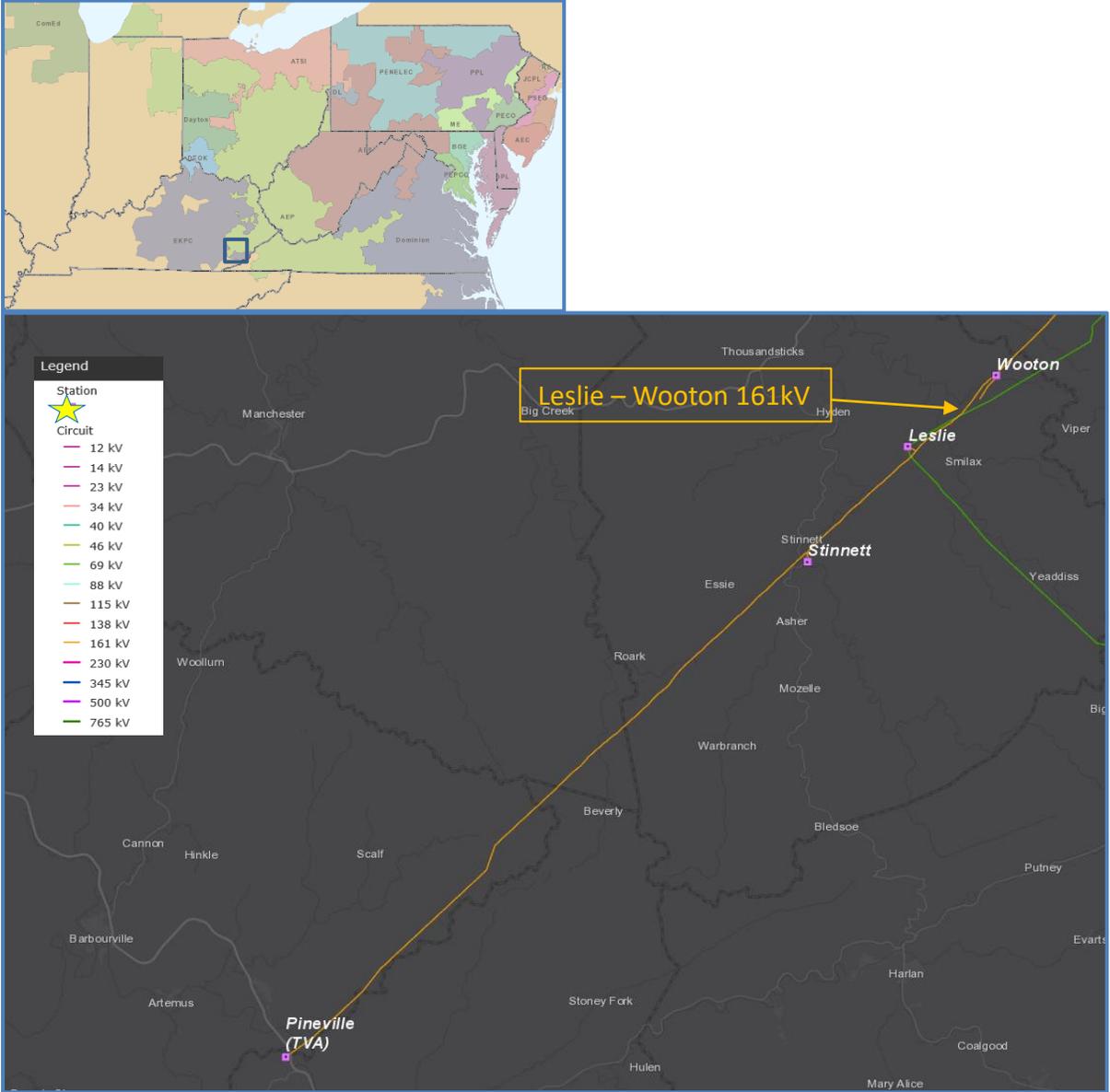


AEP Transmission Zone M-3 Process

Leslie County, Kentucky

Line Section: Wooton – Leslie 161kV
 Original Install Date (Age): 1942
 Length of Line: ~4.68 mi
 Total structure count: 23
 Original Line Construction Type: Wood
 Conductor Type: 500 KCM COPPER
 Momentary/Permanent Outages and Duration: none in last five years
 CMI (last 5 years only): none in last five years

- Line conditions:
- Leslie – Wooton line section:
- 17 structures with at least one open condition, 74% of the structures on this section.
 - 32 structure related open conditions including: crossarm or pole including rot, insect damage and woodpecker damage



Need Number: AEP-2020-IM013

Process Stage: Needs Meeting 03/19/2020

Supplemental Project Driver: Equipment
Condition/Performance/Risk

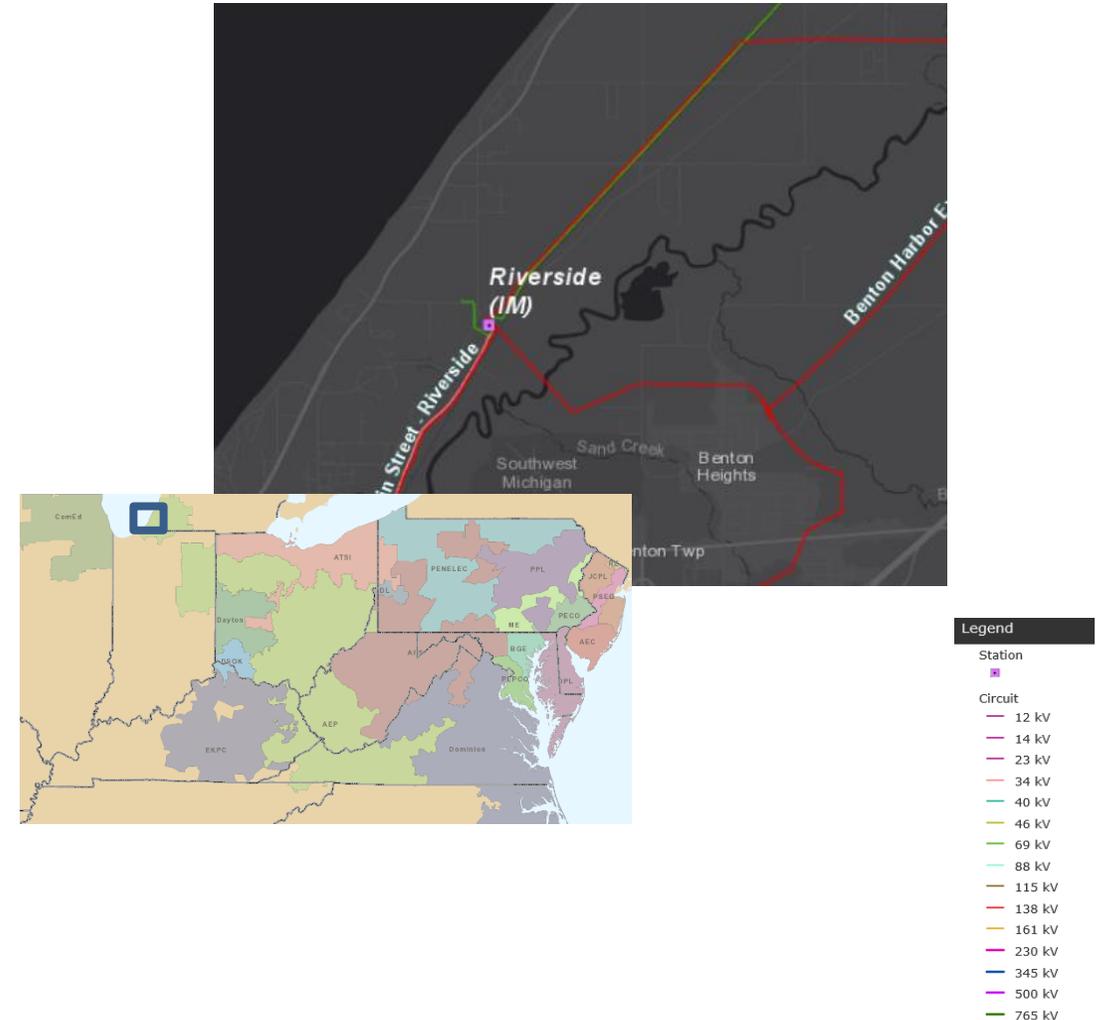
Specific Assumption Reference: AEP Guidelines for Transmission
Owner Identified Needs (AEP Assumptions Slide 8)

Model: 2024 RTEP

Problem Statement:

Riverside Station:

- (2) 138kV Breakers “O” & “A”
 - 1988 vintage SF-6 filled breakers
 - The breaker type has hydraulic leak issues on internal mechanisms which are caused by porous cylinder blocks and chips in the seal groove on the spring connecting rods.
 - Breaker A has operated for a fault 17 times exceeding its manufacturer recommendation of fault operations (10)



Solutions

Stakeholders must submit any comments within 10 days of this meeting in order to provide time necessary to consider these comments prior to the next phase of the M-3 process

AEP Transmission Zone: Supplemental Wytheville, Virginia

Need Number: AEP-2018-AP023

Process Stage: Solution Meeting 3/19/2020

Needs Presented: 01/11/19

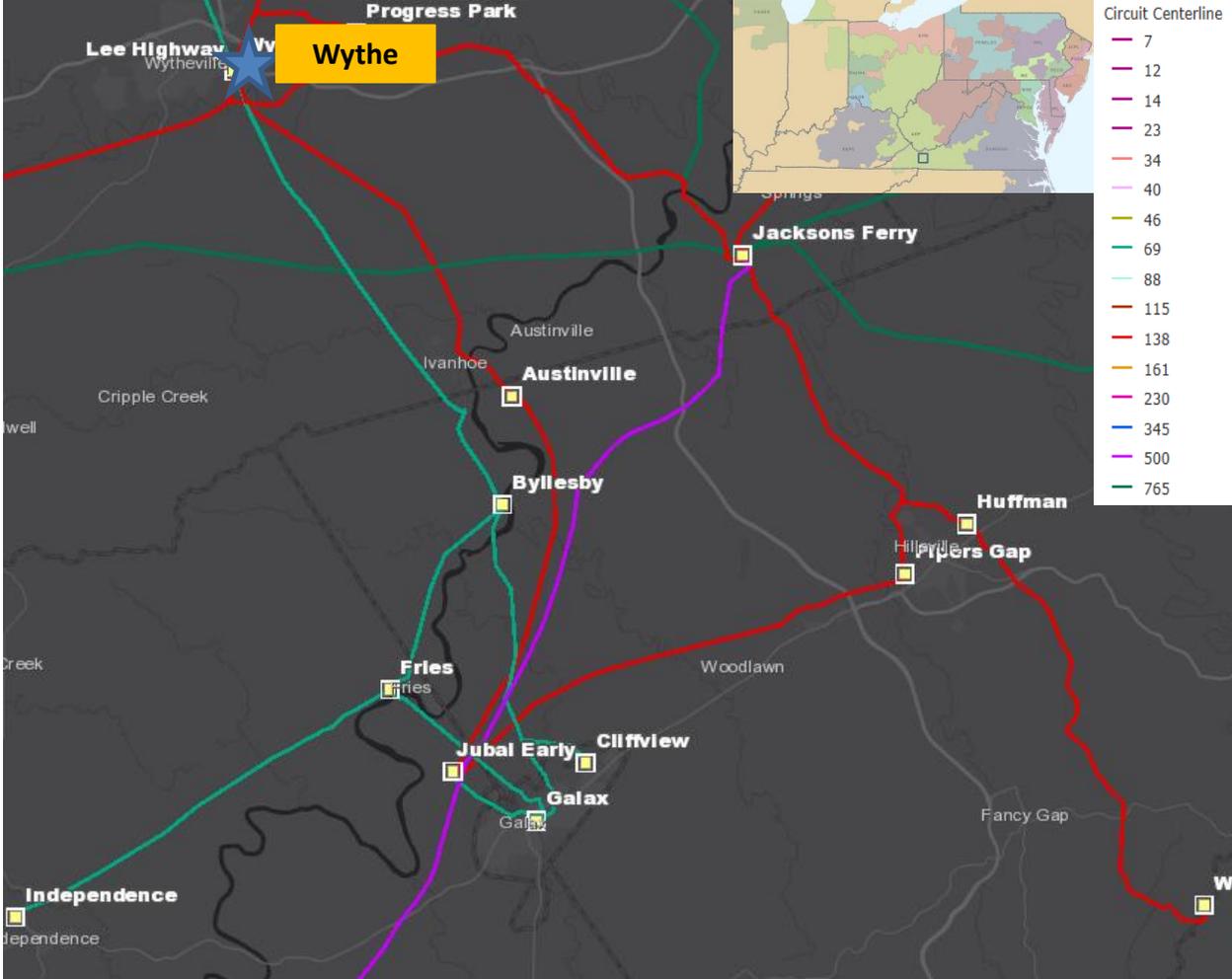
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Wythe 138/69 kV transformer has experienced thermal through fault events, mostly in excess of 700°C, have led to numerous overheating events, steady increases in gasses including high levels of ethylene and ethane, and carbonization of the insulating paper. The oil’s interfacial tension is showing signs of sludge beginning to form due to the carbonization created contaminants. In addition, the moisture content is beginning to climb which has not yet been reflected in a drop in dielectric strength. Wythe circuit breaker F is an FK type oil filled breaker. Oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require. The FK-439-115-3500-3 is no longer vendor supported and is 1 of 2 remaining on the AEP system, making spare parts difficult or impossible to acquire. Wythe circuit breaker M is a CF type oil filled breaker. Oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require. This particular unit has a recorded malfunction related to a broken S.S. line on the maintenance valve and pressure switches.

Continued on next slide



AEP Transmission Zone: Supplemental Ivanhoe & Galax, Virginia

Need Number: AEP-2018-AP023 continued
Process Stage: Solution Meeting 3/19/2020
Needs Presented: 01/11/19

Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Byllesby circuit breakers B and D are oil filled breakers manufactured in 1952 and 1965 respectively. Both breakers have exceeded the designed number of fault operations (10). These breakers are GE FK type oil breakers with no oil containment. The GE FK type breakers are known to have an internal operating mechanism that are prone to high failure rates.

Galax circuit breakers G, F, and H are all GE FK type oil breakers with no oil containment. The GE FK type breakers are known to have an internal operating mechanism that are prone to high failure rates. Circuit Breakers G, F, and H are all approximately 50 years old and have exceeded the designed number of fault operations (10).

Jubal Early 138/69kV Transformer has reoccurring bushing damage, dielectric strength breakdown (insulation breakdown) and short circuit breakdown (due to fault events). Recent test reports show oil interfacial tension to be below the minimum acceptable level for a unit of this voltage class. Reduction in oil interfacial tension is related to oil contamination and presence of oxidation byproducts in the oil.

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AEP Transmission Zone M-3 Process Cliffview Area Project

Need Number: AEP-2018-AP023

Process Stage: Solutions Meeting 3/19/2020

Proposed Solution:

At Galax Station, replace existing 69 kV circuit breakers F, G, and H with new 40 kA 3000 A circuit breakers. **Estimated Cost: \$0 (no transmission cost)**

At Byllesby Station, replace existing 69 kV circuit breakers B and D with new 40 kA 3000 A circuit breakers. **Estimated Cost: \$ 4.7 M**

At Jubal Early Station, replace the existing 138/69/34.5 kV 75 MVA XFR with a new 138/69/34.5 kV 90 MVA XFR. **Estimated Cost: \$1.6 M**

At Wythe Station, replace existing 138/69 kV 75 MVA XFR with a new 138/12 kV 20 MVA XFR, remove 69 kV CBs F and M, remove 69 kV bus and install 12 kV bus. Retire Lee Highway Station and serve load from Wythe. **Estimated Cost: \$ 3.9M**

Total Estimated Transmission Cost: \$10.2 M

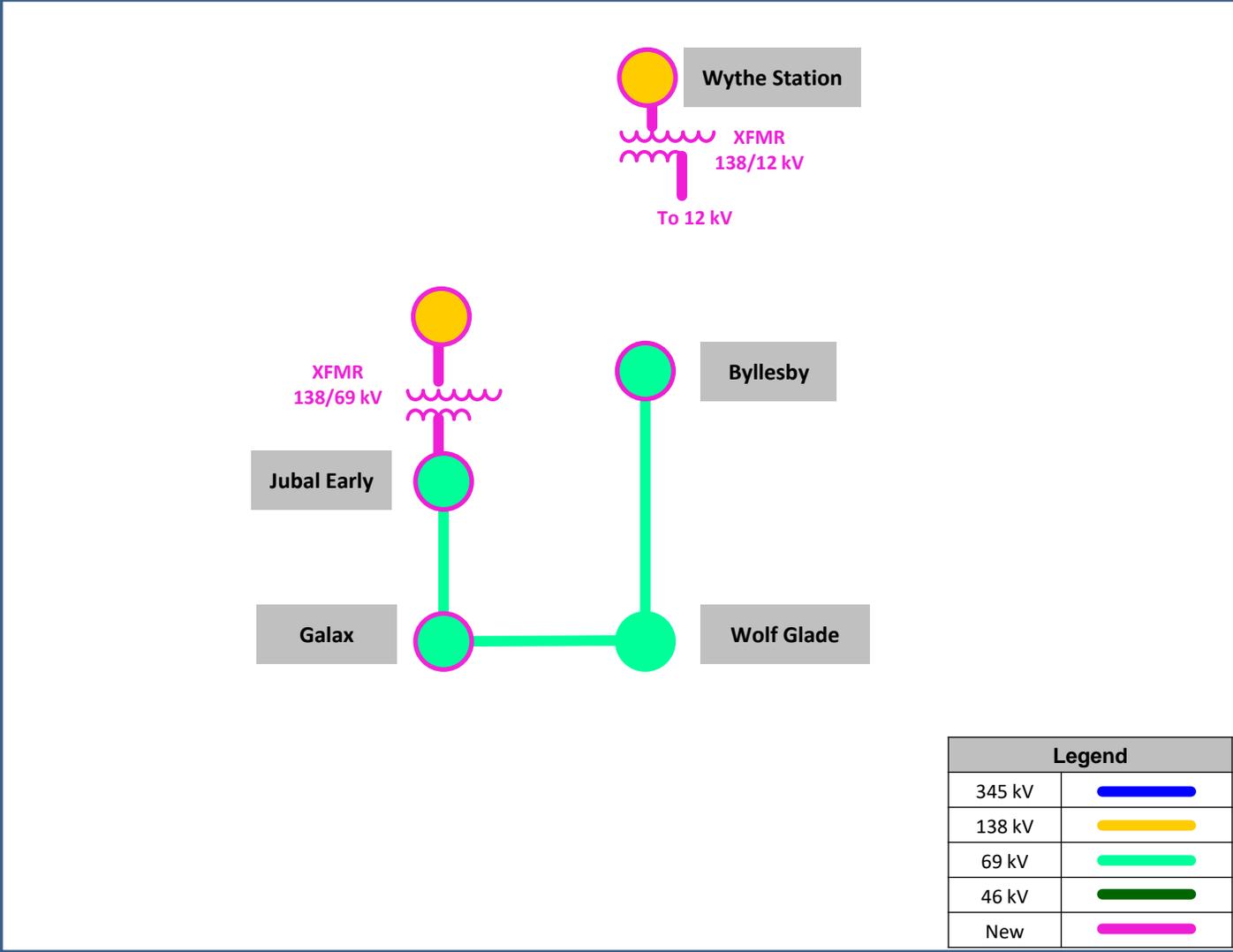
Ancillary Benefits: Wythe Station work allows for the retirement of the Lee Highway Station and consolidates the two stations by serving the 12 kV load from Wythe.

Alternatives Considered:

- Galax, Byllesby and Jubal Early work would remain the same as they all involve replacing existing equipment with similar, newer equipment. At Wythe Station we could replace the existing 138/69 kV 75 MVA XFR and 69 kV CB F then continue to serve the 12 kV load out of Lee Highway. This would not be preferred as it would likely cost more to replace the transmission level equipment and we would not be able to consolidate the two stations.

Projected In-Service: 10/31/2021

Project Status: Engineering



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AEP Transmission Zone M-3 Process Letcher County, Kentucky

Need Number: AEP-2019-AP007

Process Stage: Solutions Meeting 03/19/2020

Previously Presented: Needs Meeting 03/25/19

Supplemental Project Driver: Equipment Material/Condition/Performance/Risk, Operational Flexibility and Efficiency

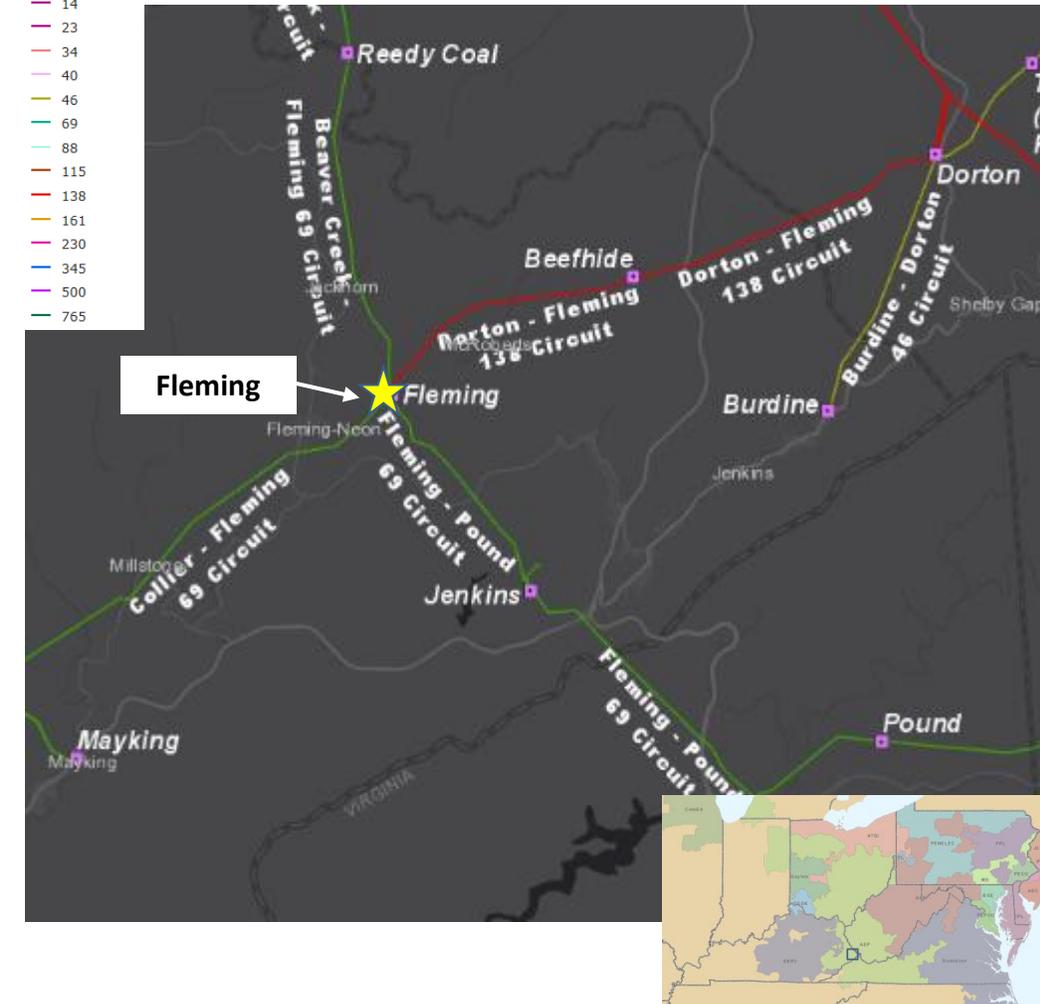
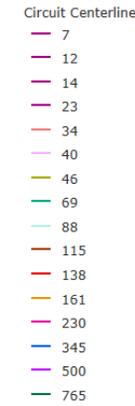
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Fleming Station

- 138/69 kV Transformer #1
 - 1984 vintage transformer.
 - Shows signs of dielectric breakdown (insulation), accessory damage (bushings), and short circuit breakdown (due to through faults).
 - Reports from the field show active oil leaks from the gaskets and slight leaks from the unit's welds.
 - Utilizes a ground switch MOAB scheme as part of the high side transformer protection.
- 69/12 kV Transformer #3
 - 1979 vintage transformer.
 - Shows signs of dielectric breakdown (insulation), accessory damage (bushings), and short circuit breakdown (due to through faults).
- 69 kV Circuit Breakers B, E, and F
 - CF-48 type oil breakers. (1965, 1968, and 1967 vintage)
 - These are oil breakers that are 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.
 - Have experienced 114, 26, and 68 fault operations respectively. The manufacturer's recommendation for this type of breaker is 10.
 - This circuit breaker model family has experienced numerous documented mechanism bearing issues and failures within the AEP population. CBs B & F have had malfunction records indicating a failure to properly latch during operation.

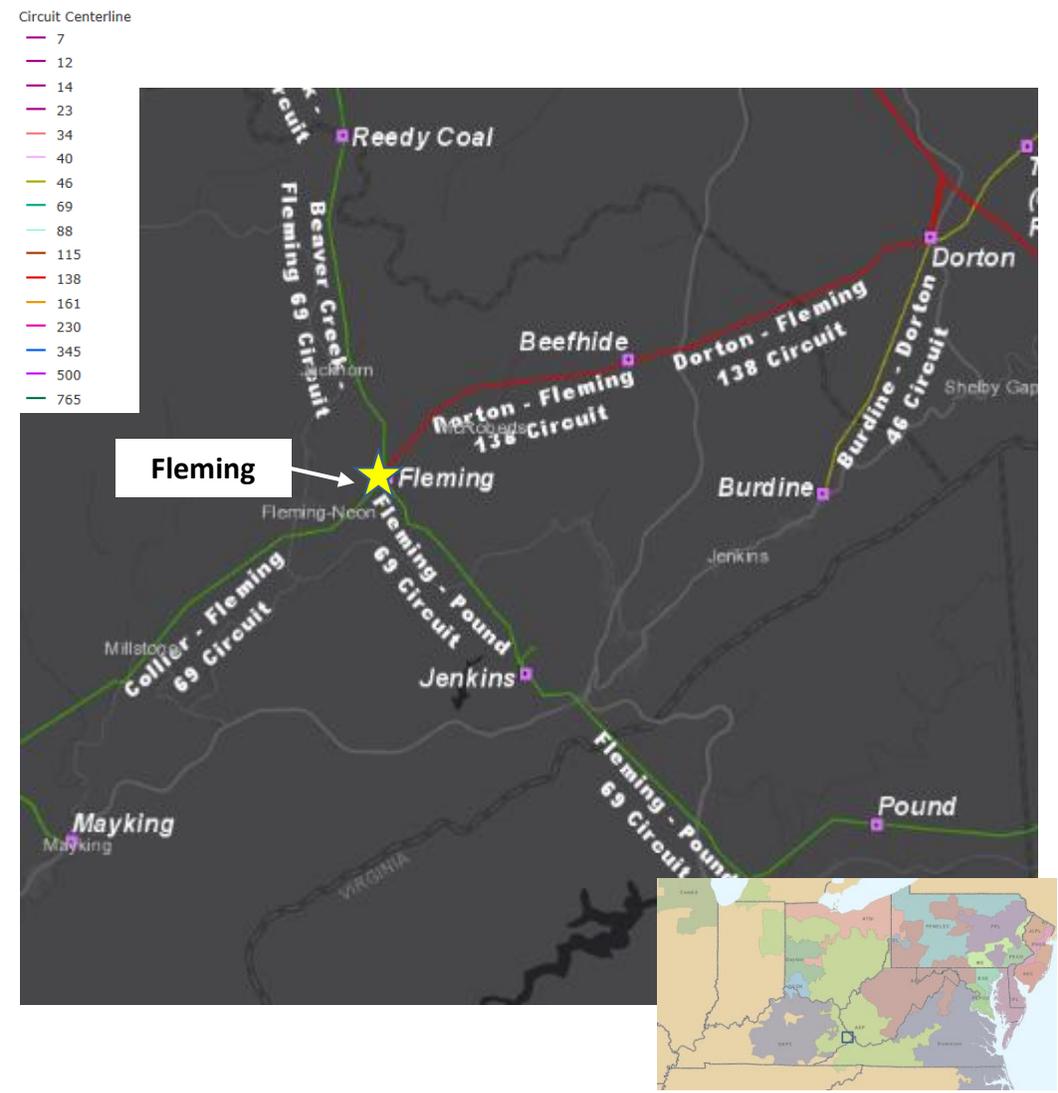
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Fleming Station

- S&C 69 kV Circuit Switcher 'AA'
 - No gas monitor, sister units on the AEP system have a history of gas loss, interrupter failures, and operating mechanism failures.
- 12 kV Circuit Breakers C and D
 - ES type oil breakers. (1979 vintage)
 - 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.
 - Have experienced 36 and 19 fault operations respectively. The manufacturer's recommendation for this type of breaker is 10.
- 69 kV Circuit Breaker A
 - 72EPB-31.5-20 SF6 type breaker with known gas leaks. (1990 vintage)
 - 18 malfunction records for this breaker since 2009 related to low gas alerts.
 - 1 of 12 remaining breakers of this type on the AEP system.

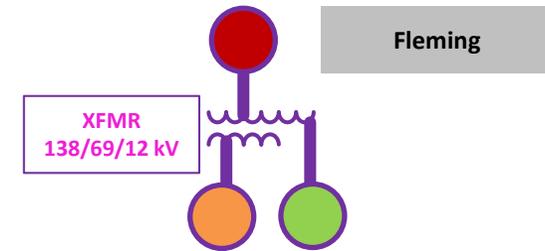


Proposed Solution:

Fleming Substation (Supplemental):

- Rebuild Fleming station in the clear
- Replace 138/69kV Fleming Transformer #1 with 138/69kV 130 MVA transformer with high side 138 kV CB
- Install a 5 breaker 69 kV ring bus on the low side of the transformer, replace 69 kV circuit switcher AA, replace 69/12kV transformer #3 with 69/12kV 30 MVA transformer, Replace 12 kV CB A and D. Retire existing Fleming substation.

Total Estimated Transmission Cost: \$21.1 M



Legend	
345 kV	
138 kV	
69 kV	
12 kV	
New	

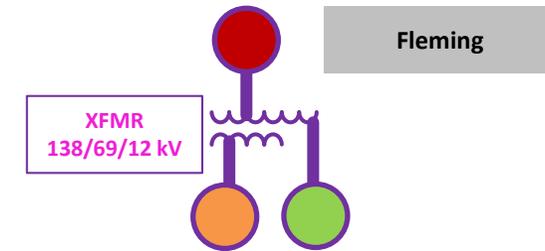
Alternatives considered:

Alternative #1:

- Rebuild the station in the existing footprint. However, the existing single bus configuration is a less reliable configuration.
- A single 69 kV bus-tie breaker will warrant the loss of Fleming station, additionally a bus fault would result in the loss of 2 of the 3 sources to the 69 kV system and loss of Distribution load at Fleming Station. Building a new ring bus configuration will solve this issue and increase reliability.
- However, the outage constraints and constructability of building the ring bus in the existing footprint appeared to be unpractical and this solution was not selected
- Additionally, Fleming station existing footprint causes further sizing concerns as the station expansion is unpractical. The station perimeter is restricted by an access road on the North side and high-sloped terrain on the South side. The high-sloped terrain would prove to be costly to develop into a station yard.
- **Estimated Cost:** \$18 M

Projected ISD: 09/01/2022

Required In-Service: 6/1/2024



Legend	
345 kV	
138 kV	
69 kV	
46 kV	
New	

AEP Transmission Zone M-3 Process Pike County, Kentucky

Need Number: AEP-2019-AP022

Process Stage: Solutions Meeting 03/19/2020

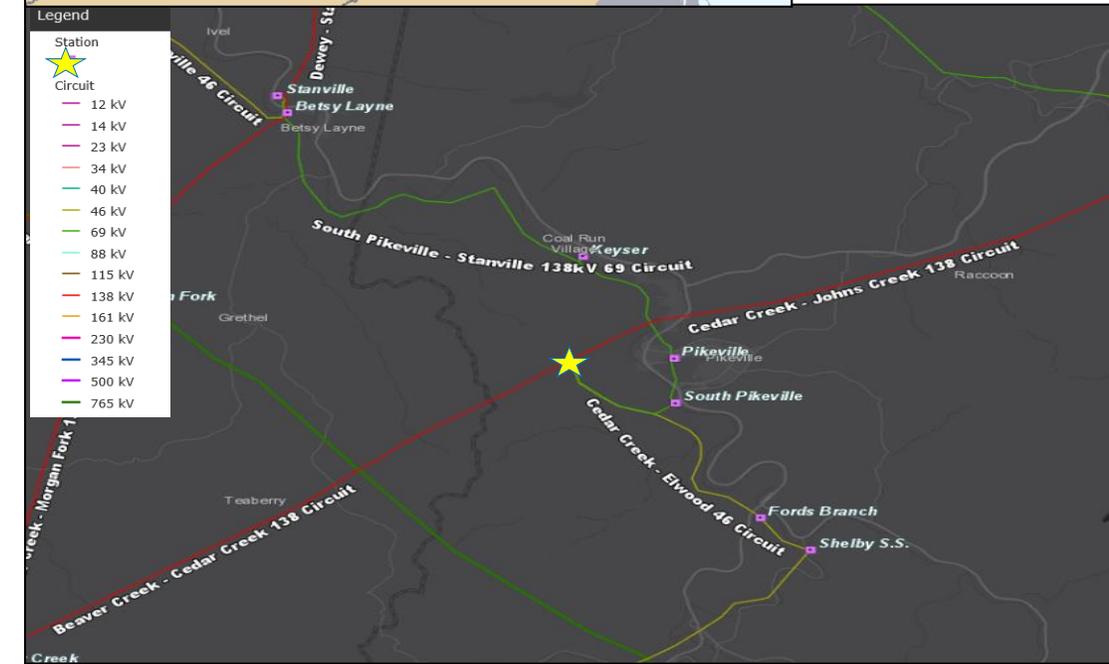
Previously Presented: Need Meeting 5/20/2019

Supplemental Project Driver: Customer Service

Specific Assumptions Reference: AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 7)

Problem Statement:

- AEP Kentucky Power Distribution has requested a new distribution service out of the existing Cedar Creek Station located in Pikeville, Kentucky. Winter projected load is 12.5 MVA.



AEP Transmission Zone M-3 Process Pike County, Kentucky

Need Number: AEP-2019-AP022

Process Stage: Solutions Meeting 03/19/20

Proposed Solution:

Install 138/12 kV 25 MVA transformer on the Cedar Creek 138kV Bus #1 to serve the new load.

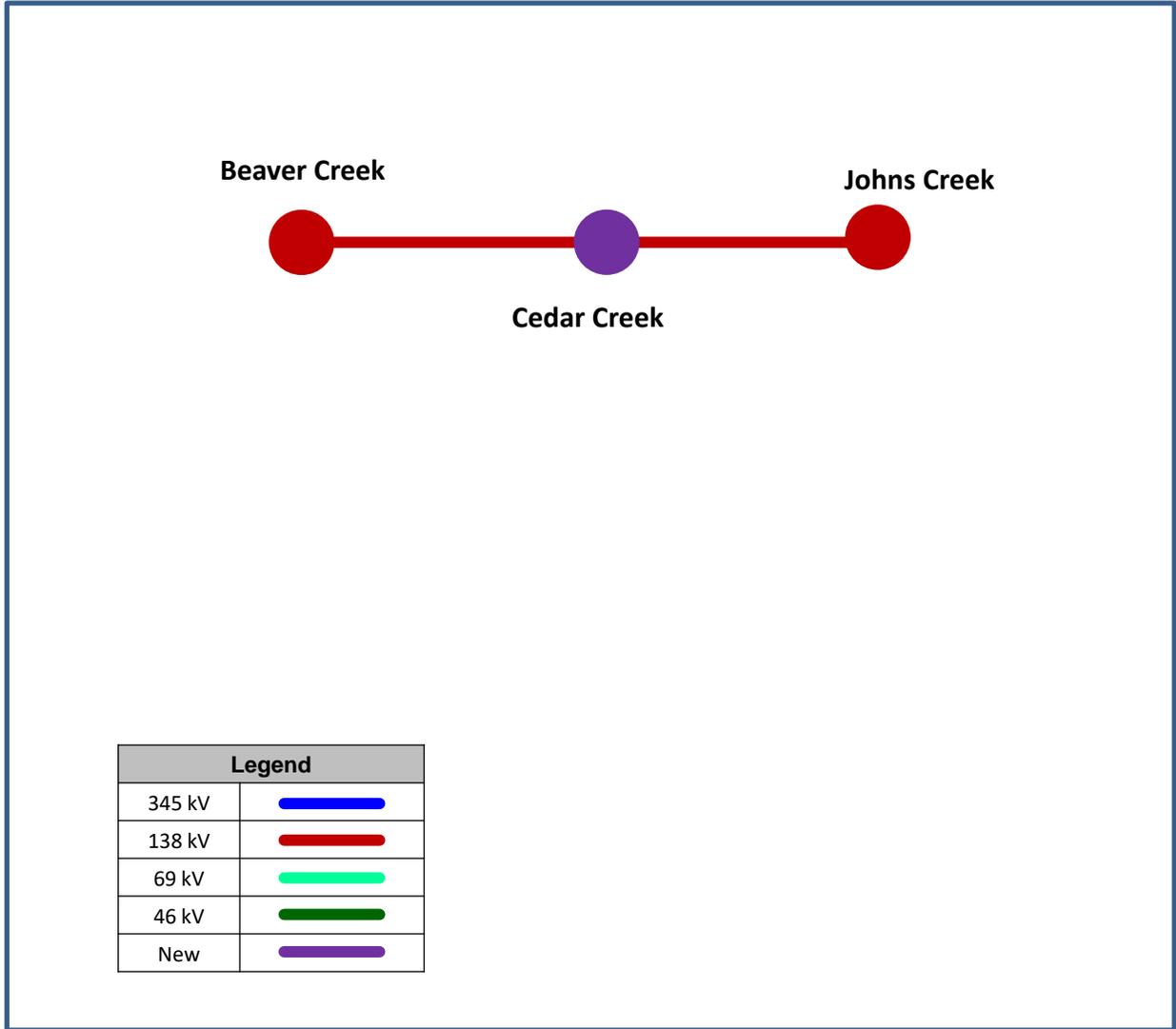
Total Estimated Transmission Cost: \$3.5 M

Alternatives Considered:

No other transmission alternatives were found considering the location and timing of the customer request.

Projected In-Service: 3/29/2020

Project Status: Under Construction



AEP Transmission Zone M-3 Process Moundsville Customer Service

Need Number: AEP-2019-OH006 (S2097.1-.4) **Canceled**

Process Stage: Submission of Supplemental Project for inclusion in the Local Plan 12/5/2019

Previously Presented:
Needs Meeting 03/28/19
Solutions Meeting 10/25/19

Supplemental Project Driver: Customer Service

Specific Assumption References:
AEP Guidelines for Transmission Owner Identified Needs
(AEP Assumptions Slide 7)

Problem Statement:

- A customer has requested new service four miles east of Moundsville, West Virginia. The forecasted peak demand is 20 MVA.
- **This need has been canceled by the customer. All project costs incurred by AEP up to this point will be reimbursed by the customer, per contracts signed with the customer.**

Model:
2024 PJM RTEP



AEP Transmission Zone M-3 Process Moundsville Customer Service

Need Number: AEP-2019-OH006 (S2097.1-.4) **Canceled**

Process Stage: Submission of Supplemental Project for inclusion in the Local Plan 12/5/2019

Proposed Solution:

- **This project has been canceled by the customer.**
- 0.1-mile radial tap to the customer station. Utilize 477 ACSR conductor, single-circuit, for the radial portion. **(S2097.1) Estimated Cost: \$0.6 M**
- Modify the 138kV Wayman-Gosney transmission line on both sides of Wetzel Switch to accommodate the new 3-way switch. **(S2097.2) Estimated Cost: \$0.4 M**
- Construct a new 138kV 3-way MOAB switch called Wetzel Switch. The switch shall have SCADA functionality. The switch toward Gosney Hill will have auto-sectionalizing protection. **(S2097.3) Estimated Cost: \$0.7 M**
- Install 138kV revenue metering outside of the customer station. **(S2097.4)**

Estimated Cost: \$0.4 M

Ancillary Benefits: The new SCADA data points will improve operational capability in the area, by increasing situational awareness.

Total Estimated Transmission Cost: \$2.1M

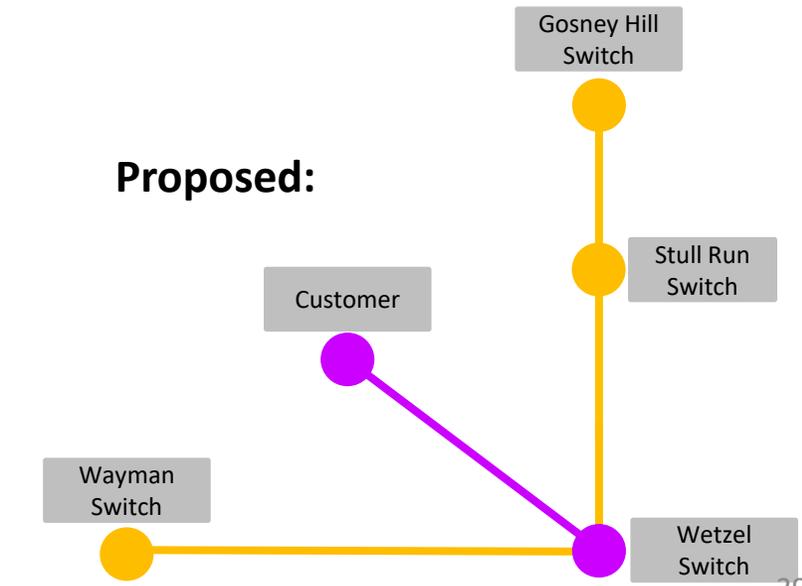
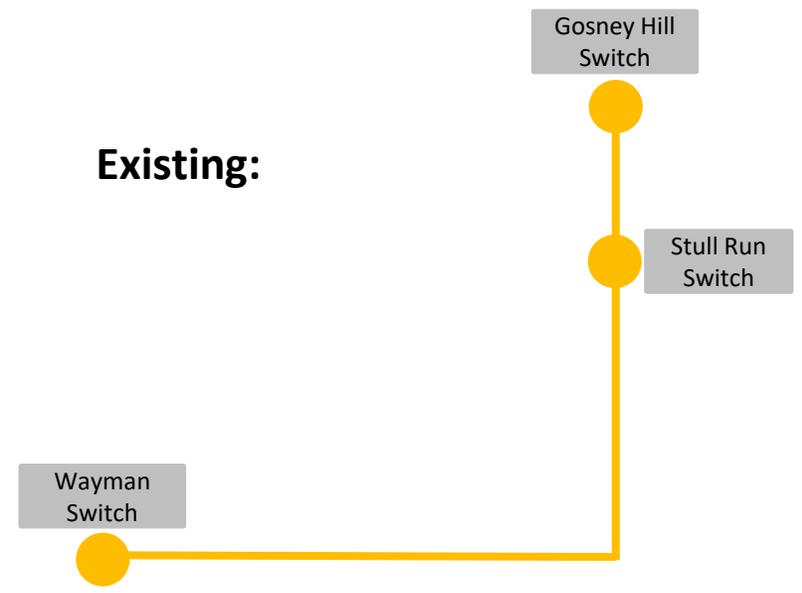
Projected In-Service: 6/19/2020

Supplemental Project ID: S2097.1-.4

Project Status: Scoping

Model: 2024 RTEP

Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	



AEP Transmission Zone M-3 Process Putnam County, Ohio

Need Number: AEP-2018-OH017

Process Stage: Solution Meeting 3/19/2020

Previously Presented: Needs Meeting 10/26/2018

Supplemental Project Driver:

Equipment Material/Condition/Performance/Risk and Customer Service

Specific Assumption Reference:

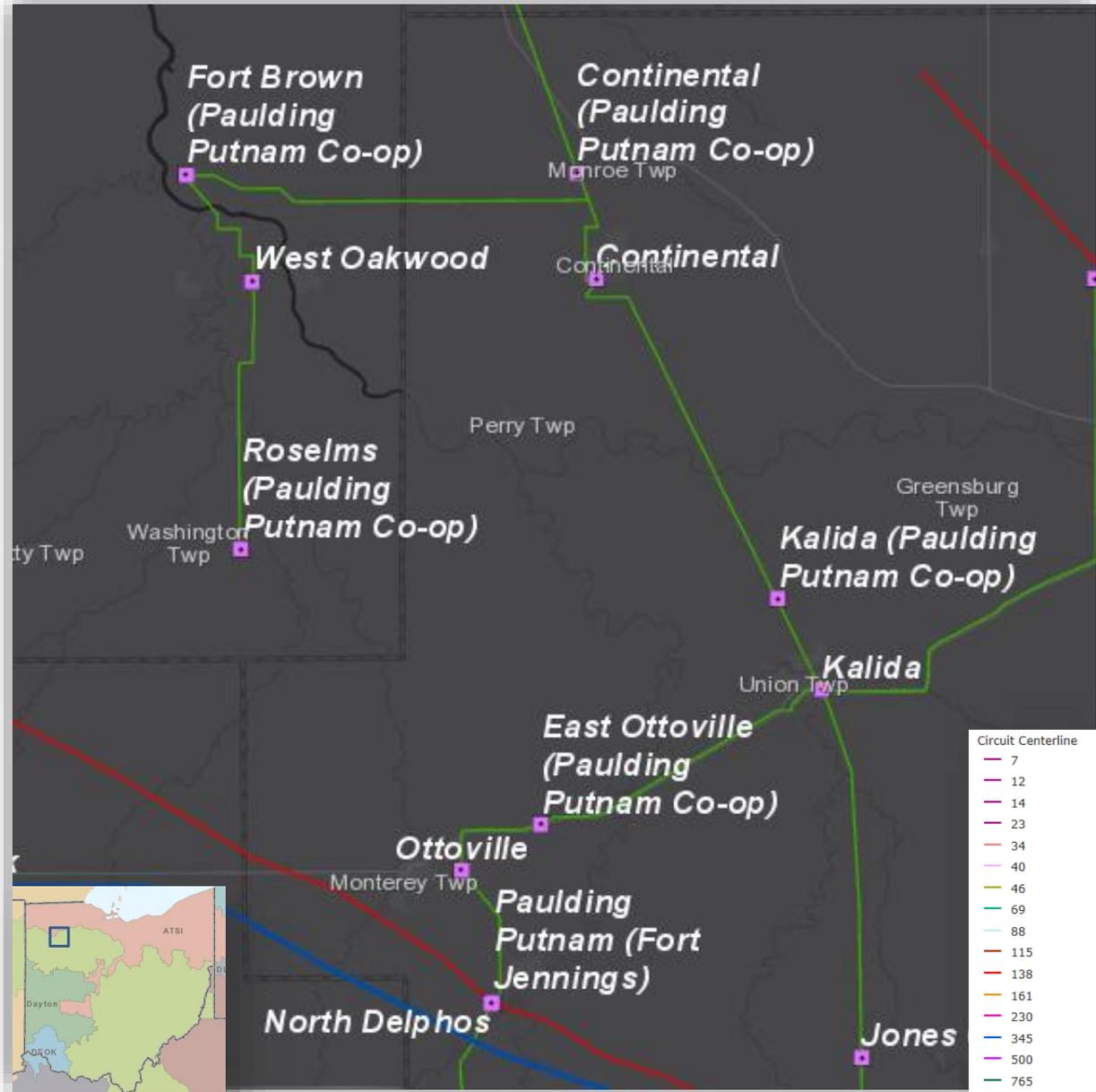
AEP Guidelines for Transmission Owner Identified Needs and AEP Connection Requirements for the AEP Transmission System

Problem Statement:

Continental – Roselms 69 kV is a 18 mi radial circuit serving ~10.6 MVA load. The customers served from this radial line have experienced 2.1 million customer minutes of interruptions over last 5 years. These radial loads are not automatically transferable. Any maintenance on this line results in outages to multiple stations.

Majority of the line has 4/0 ACSR conductor with a 2 mi section with 795 ACSR. This circuit has 89 open conditions. Most of the 258 structures on this circuit are 1960s and 1970s wood pole vintage with rotting issues.

Model: N/A



AEP Transmission Zone M-3 Process Putnam County, Ohio

Need Number: AEP-2019-OH059

Process Stage: Solution Meeting 3/19/2020

Previously Presented: Needs Meeting 11/22/2019

Supplemental Project Driver:

Equipment Material/Condition/Performance/Risk:

Specific Assumption Reference:

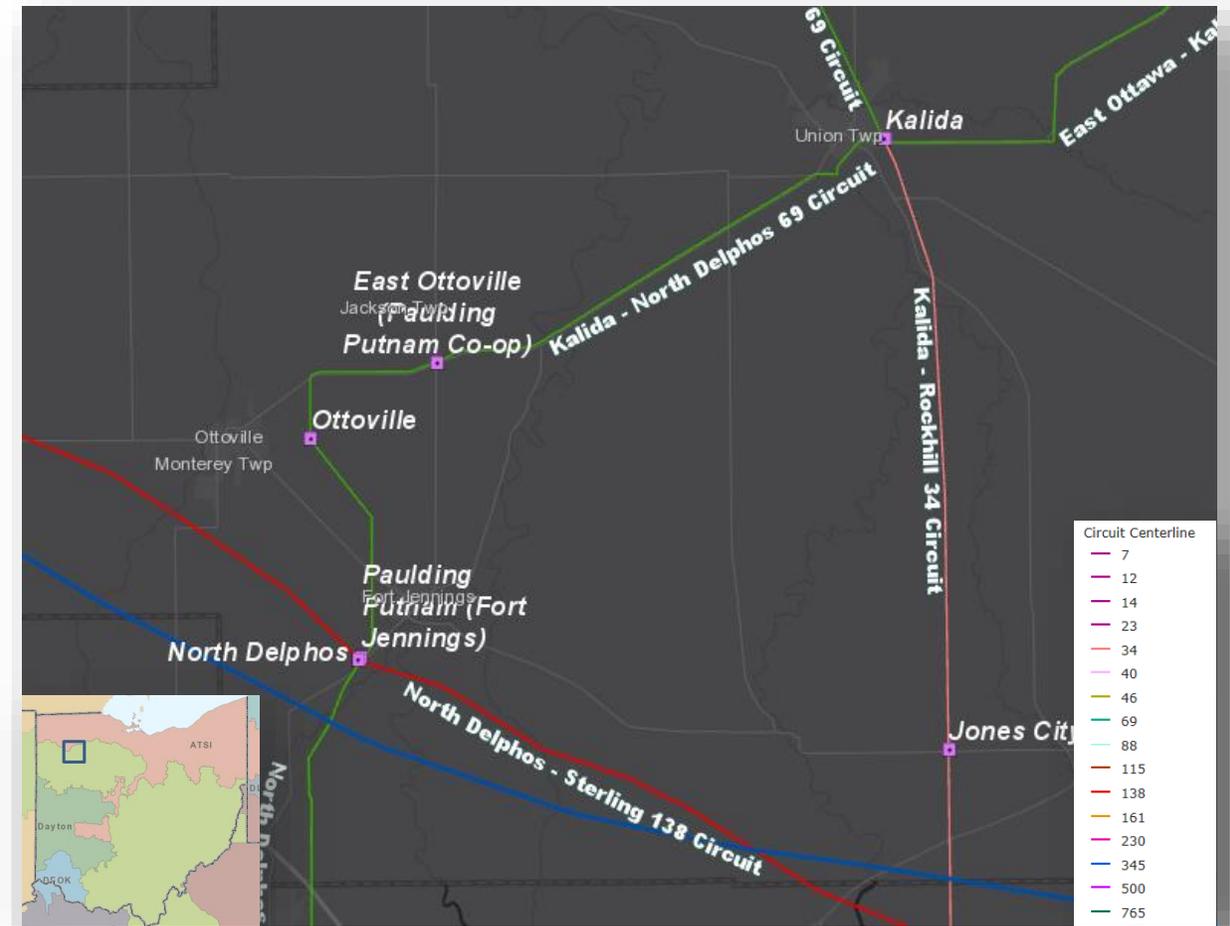
AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

Kalida – North Delphos (Original 1914)

- Length: 11.26
- Original Construction Type: Wood
- Original Conductor Type: 4/0 Copper 7
- Momentary/Permanent Outages: 9 Momentary, 3 Permanent (5 year)
- CMI: 206,131 (5 year)
- Total structure count: 268
- Number of open conditions: 58
 - Open conditions include: rot heart, insect damage, broken/missing ground leads, burnt insulators
- Unique structure count with open conditions: 50

Model: N/A



AEP Transmission Zone M-3 Process

Putnam County, Ohio

Need Number: AEP-2018-OH017 & AEP-2019-OH059

Process Stage: Solution Meeting 3/19/2020

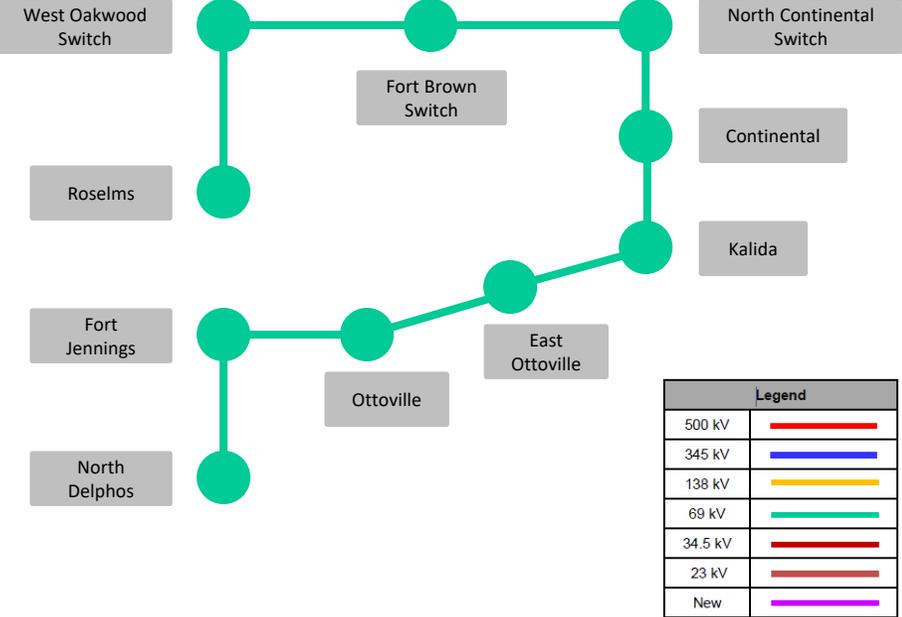
Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs

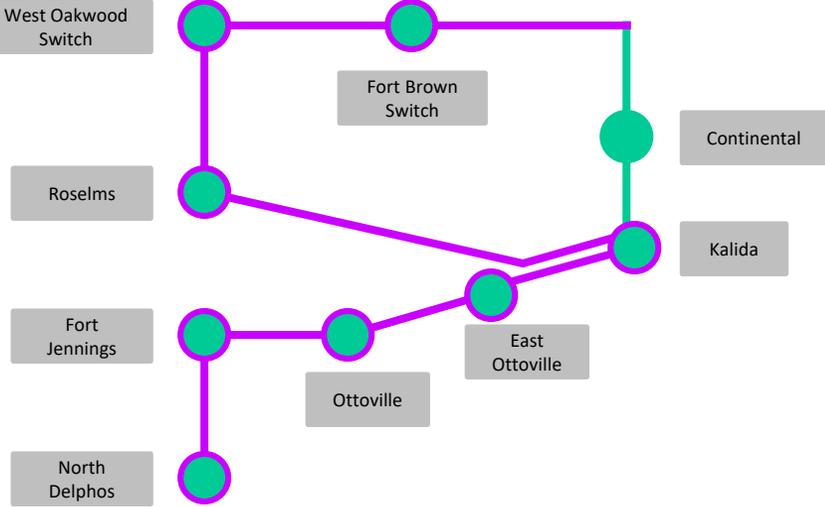
Proposed Solution:

- Rebuild 16 miles of 69 kV single circuit line from North Continental Switch (existing switch to be retired) to Roselms Switch (located next to the existing Roselms- PP Co-op Station). **Estimated Cost: \$38.4M**
- Build 9.4 miles of single circuit 69 kV line from Roselms to near East Ottoville 69 kV Switch. **Estimated Cost: \$13.7M**
- Rebuild 7.5 miles of double circuit 69kV line between East Ottoville Switch and Kalida Station (combining with the new Roselms to Kalida 69 kV circuit). **Estimated Cost: \$23.6M**
- Rebuild 5.1 miles of single circuit 69 kV line from East Ottoville to North Delphos. **Estimated Cost: \$9.4M**
- At North Continental, remove normally open bypass switch. **Estimated Cost: \$0.1M**
- At Fort Brown Switch, install a three way 69kV, 1200 A phase-over-phase switch, with sectionalizing capability. **Estimated Cost: \$0.7M**

Existing Configuration:



Proposed Configuration:



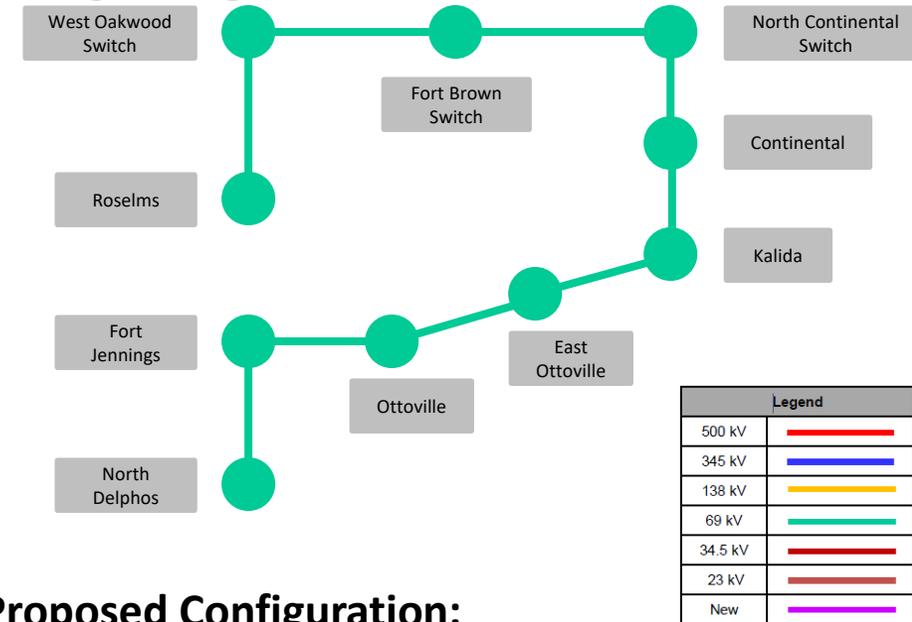
AEP Transmission Zone M-3 Process Putnam County, Ohio

Proposed Solution (cont.):

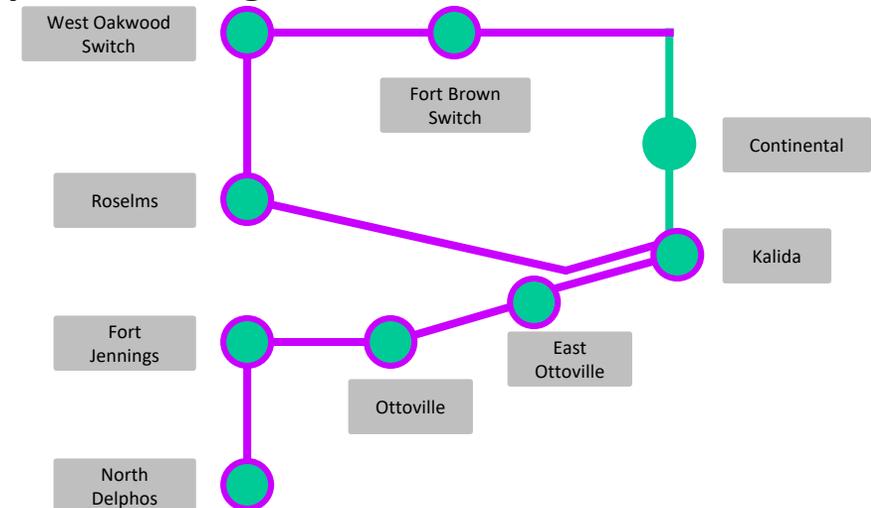
- At West Oakwood Switch, install a three way 69kV, 1200 A phase-over-phase switch, with sectionalizing capability. **Estimated Cost: \$0.6M**
- At Roselms Switch, install a new three way 69kV, 1200 A phase-over-phase switch, with sectionalizing capability. **Estimated Cost: \$0.6M**
- At Kalida station, move CB J from low side of Transformer 2 to terminate the new line from Roselms Switch. Move the CS XT2 from high side of T2 to the high side of T1. Remove existing T2 transformer. **Estimated Cost: \$1.0M**
- Remote end work at North Delphos station. **Estimated Cost: \$0.8M**
- At East Ottoville, install a three way 69kV, 1200 A phase-over-phase switch, with sectionalizing capability. **Estimated Cost: \$0.7M**
- At Ottoville station, install 2- three way 69 kV, 1200 A, phase over phase Switches, with sectionalizing capability. **Estimated Cost: \$1.9M**
- At Fort Jennings, replace hard tap with a three way 69kV, 1200 A phase-over-phase switch, with sectionalizing capability. **Estimated Cost: \$0.6M**

Total Estimated Transmission Cost: \$92.1M

Existing Configuration:



Proposed Configuration:



AEP Transmission Zone M-3 Process Putnam County, Ohio

Alternatives Considered: This alternative was not chosen because of higher costs than the proposed solution.

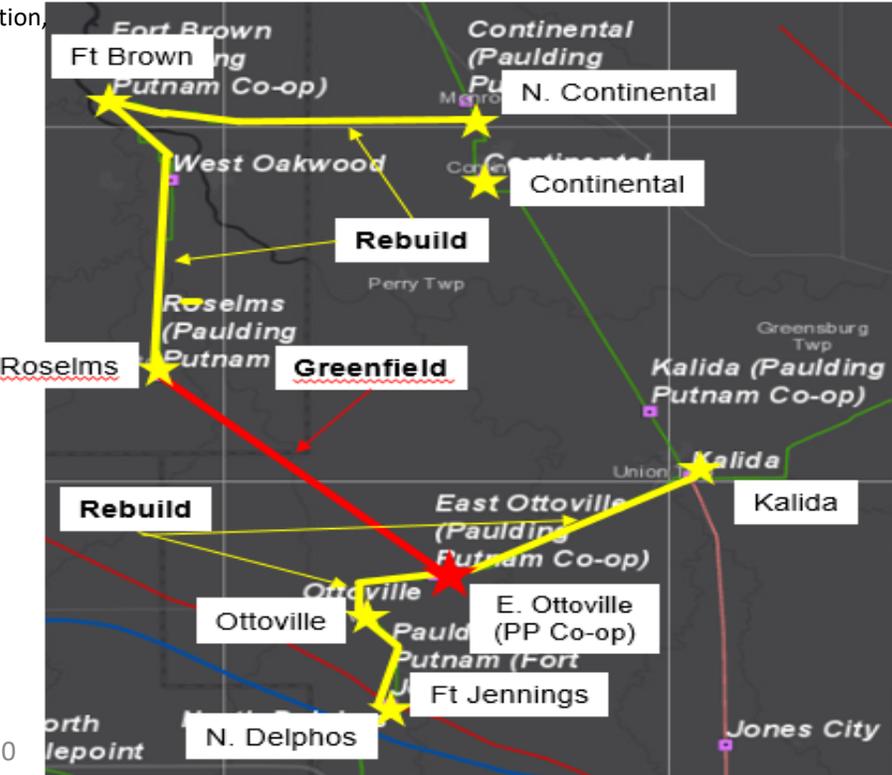
Alternate #1:

- Rebuild the 69 kV line from North Continental Switch to Roselms .
- Build a new 69 kV line from Roselms to East Ottoville.
- Rebuild the 69 kV line from East Ottoville to Kalida.
- Install a 4-breaker ring 69 kV station at E. Ottoville
- Rebuild the 69 kV line from East Ottoville to North Delphos.
- Replace switches as indicated in the chosen solution, with the exception of East Ottoville 69 kV.
- **Estimated Cost:** \$94 M

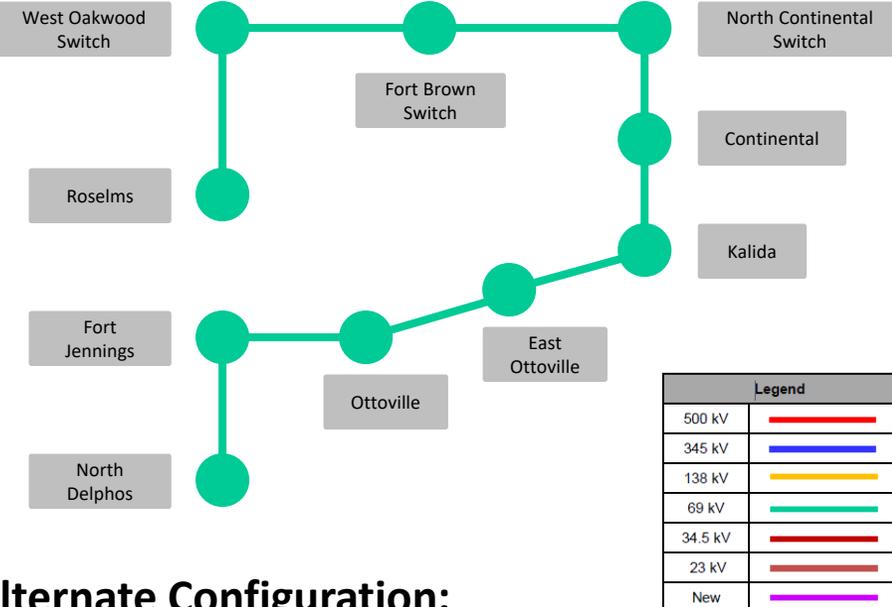
Projected In-Service: 8/15/2022

Project Status: Engineering

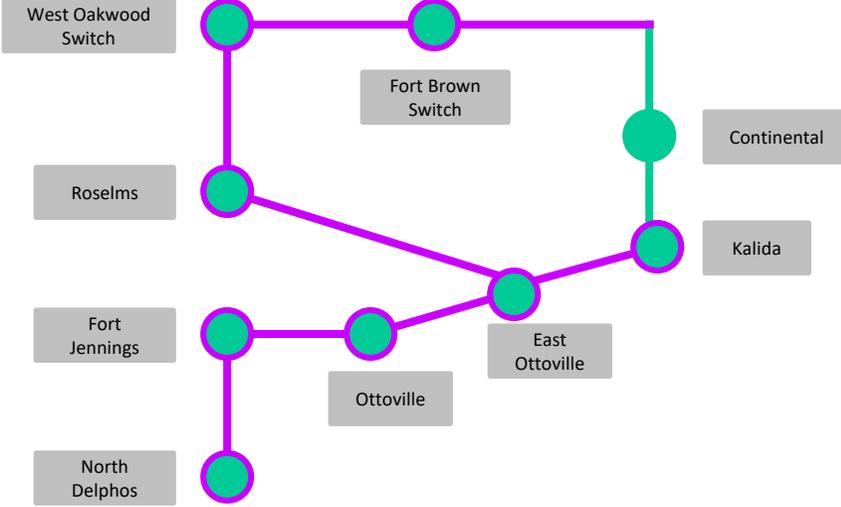
Model: 2024 Summer RTEP



Existing Configuration:



Alternate Configuration:



AEP Transmission Zone M-3 Process Monroe County, Ohio

Need Number: AEP-2019-OH037

Process Stage: Solutions Meeting 3/19/2020

Previously Presented: Needs Meeting 06/17/2019

Supplemental Project Driver:

Customer Service and Operational Flexibility

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slides 7 and 8)

Problem Statement:

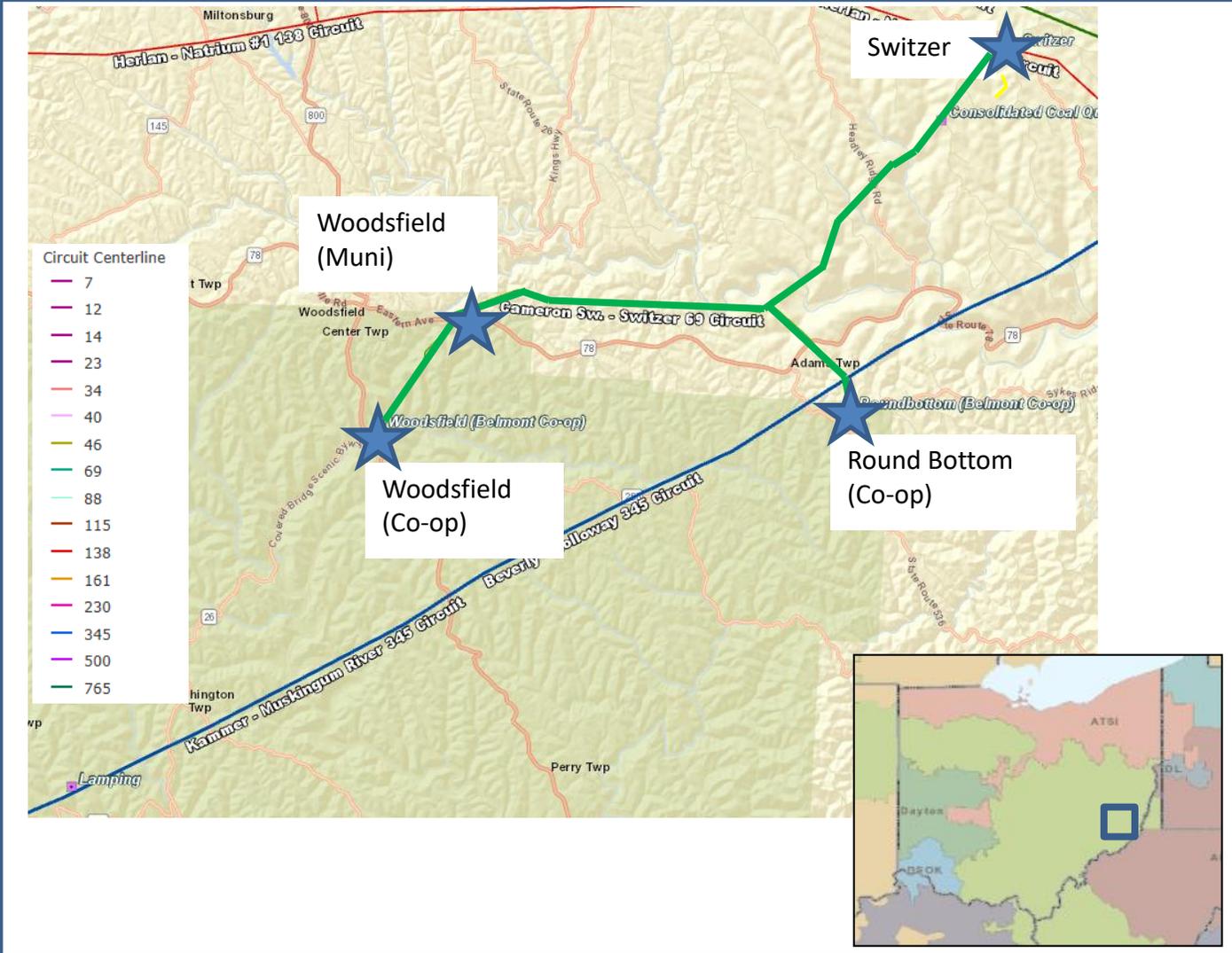
The Cameron-Switzer 69kV circuit is 16.2 miles long and serves 3 wholesale customer stations (over 3,800 customers), with a combined peak load of 11 MW. The circuit is radially fed from AEP's Switzer Station, making it difficult to perform proactive maintenance or restoration activities after an outage. The circuit is located in a remote part of AEP's service territory and traverses very hilly and wooded terrain.

The 69kV transmission line is of wood pole construction and was built in 1970. There are currently 121 open conditions on the circuit, with the majority being structure deficiencies (e.g., burnt insulators, insect damage, & cracked cross-braces).

In addition, the City of Woodsfield is served via a 69kV hard tap, with no line sectionalizing switches present.

South Central Power Co-op has reported 1.1 million customer-outage minutes (CMI) over a three year period (2015-2017).

Model: PJM 2019 RTEP Series



AEP Transmission Zone M-3 Process Lamping - Woodsfield

Need Number: AEP-2019-OH037

Process Stage: Solutions Meeting 3/19/2020

Proposed Solution:

At Lamping station, install a 138kV breaker string with 2 breakers, a 90 MVA 138-69kV transformer, and 1- 69kV breaker. **Estimated Cost: \$4.8M**

Construct a 10-mile 69kV transmission line between Lamping and the Woodsfield area. **Estimated Cost: \$19.9M**

At the existing Woodsfield Co-op station, install a 3-way 69kV switch with SCADA functionality (Cranes Nest Switch). **Estimated Cost: \$0.6M**

At the existing hard tap to Woodsfield Municipal, install a 3-way 69kV switch with SCADA functionality (Standingstone Switch). **Estimated Cost: \$0.6M**

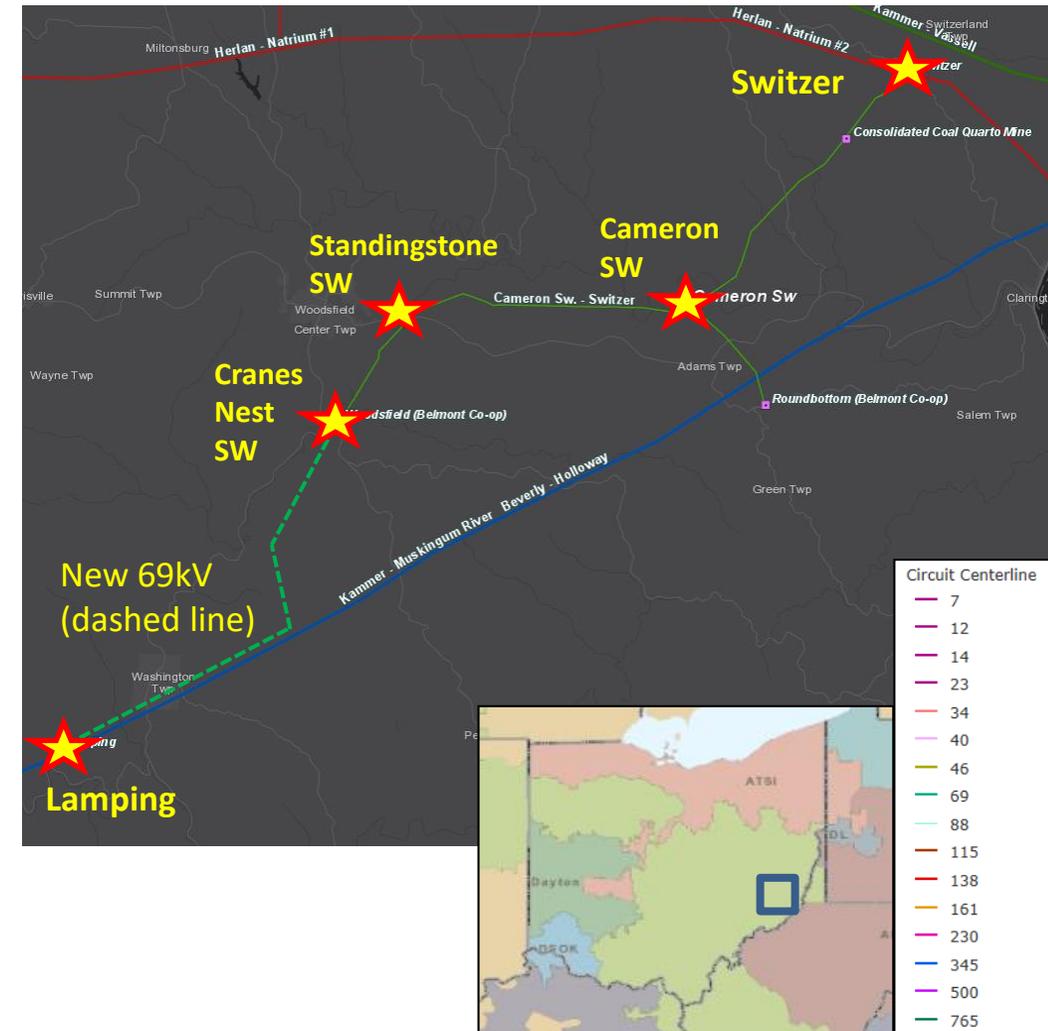
Remove the existing Cameron 2-way switch and install a new 3-way 69kV switch with SCADA functionality. **Estimated Cost: \$0.6M**

At Switzer station, install 2- 138kV line breakers (toward Herlan & Natrium). **Estimated Cost: \$1.1M**

At the 138kV remote-end of Natrium, replace the line protection relays to coordinate with the upgrade at Switzer. **Estimated Cost: \$0.6M**

Modify the existing Switzer-Woodsfield 69kV transmission line on each side of the switches due to the switch installation. **Estimated Cost: \$1.9M**

Total Estimated Transmission Cost: \$30.1M

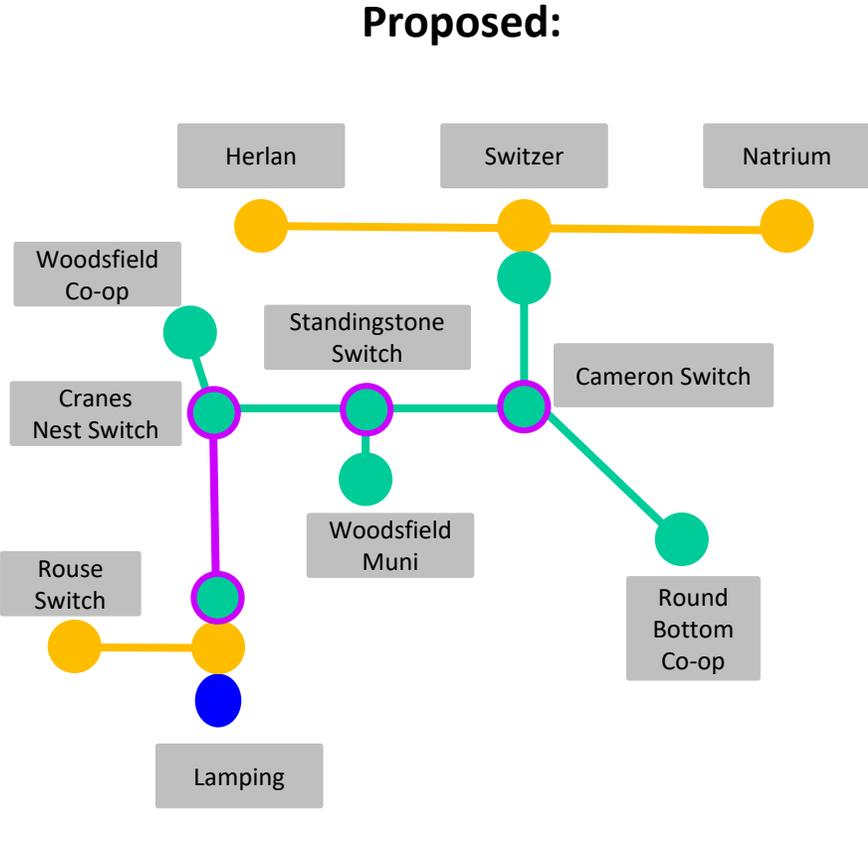
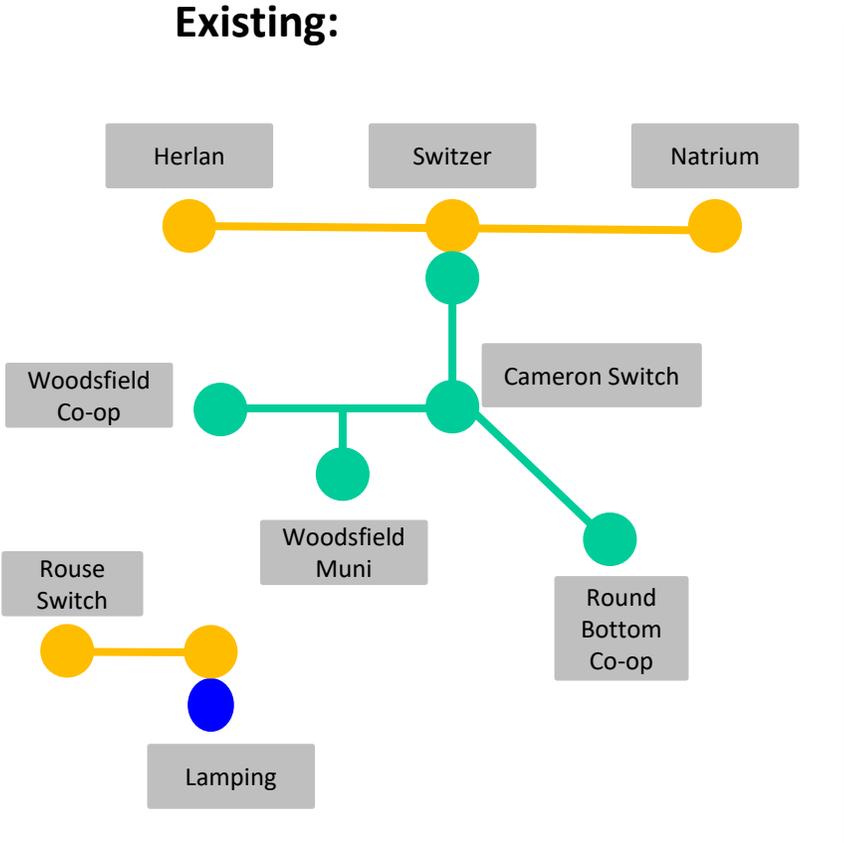


AEP Transmission Zone M-3 Process Lamping - Woodsfield

Ancillary Benefits: Improved reliability for the 3 wholesale customer stations served from the 69kV circuit; increased ability for AEP to maintain the existing 69kV transmission line and Switzer station equipment (without dropping customers).

Projected In-Service: 5/1/2023
Project Status: Scoping
Model: PJM 2019 RTEP Series Models

Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	



AEP Transmission Zone M-3 Process Lamping - Woodsfield

Alternatives Considered:

1. Construct a new 138-69kV station near the Somerton 138kV hard tap off of the Herlan-Natrium 138kV double-circuit line ("Malaga" station). Construct a 4-breaker 138kV ring bus and 138-69kV transformer; 3- 138kV circuit exits to Herlan, Natrium, and Somerton. Build 9 miles of new 69kV line from Malaga south to the Woodsfield area. From Woodsfield east to Switzer, do the same scope of work as the preferred solution, including the new switches and Switzer breakers.

Total Estimated Cost = \$45 million (higher cost primarily due to the grading & site work needed to establish the Malaga station, which is in a very hilly area and adjacent to a state wildlife area)

Cons: This would require the construction of a completely new 138-69kV station and associated land purchase. In addition, it would be cutting into the Herlan-Natrium 138kV double-circuit lattice tower line, which would be costly to segment and connect the new station either north or south of the towerline. In addition, this Malaga station would be sourced from the same 138kV pathway as the Switzer 138kV station, which would put area 69kV customers at risk of outages for severe events along the 138kV pathway. The preferred 138-69kV source at Lamping offers better power source diversity.



AEP Transmission Zone M-3 Process Columbus, OH

Need Number: AEP-2019-OH038

Process Stage: Solution Meeting 3/19/2020

Previously Presented: Need Meeting 6/17/2019

Supplemental Project Driver:

Equipment Material/Condition/Performance/Risk, Operational Flexibility and Efficiency

Specific Assumption Reference:

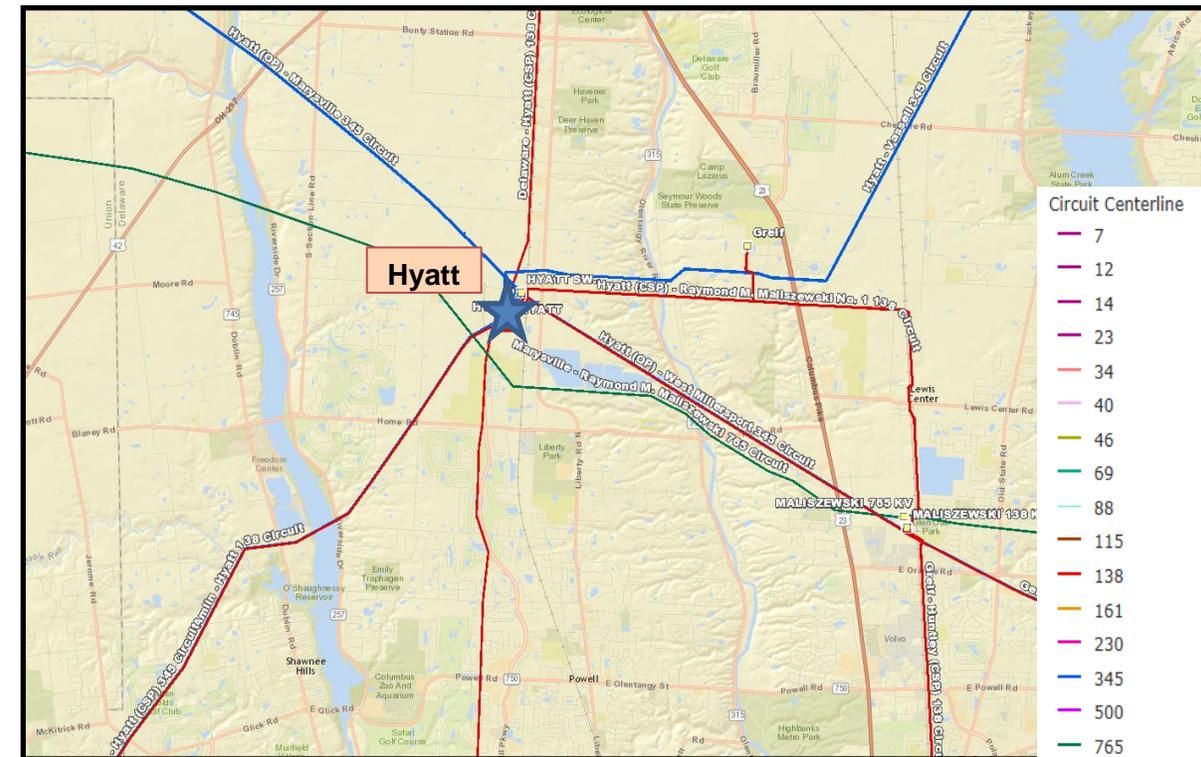
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

138kV circuit breaker 105S at Hyatt station is showing signs of deterioration. This is an oil breaker installed in 1980. 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. This is the last remaining oil breaker at Hyatt.

Transformer 1A has failed at Hyatt station and needs to be replaced. Transformer 1B is the same age (1973) and type, and Transmission Field Services has expressed similar concerns with 1B as they did with 1A (pre-failure), including dielectric breakdown (insulation), accessory damage (bushings), and short circuit breakdown (due to through faults).

The existing configuration of Hyatt station includes both 345/138kV transformers in the same protection zone. The 345kV side of this zone is only energized from one bus such that a single bus outage would outage both transformers.



AEP Transmission Zone M-3 Process Columbus, OH

Need Number: AEP-2019-OH038

Process Stage: Solutions Meeting 3/19/2020

Proposed Solution:

At Hyatt station, replace 2-345/138kV 300MVA transformers 1A & 1B with 450 MVA units. Install 3-345kV 5,000A / 63kA circuit breakers to separate the transformer protection zones. Replace 138kV breaker 105S with a 3,000A / 63kA breaker. Install new 138kV 3,000A breakers to terminate the second transformer.

Total Estimated Transmission Cost: \$25M

Alternatives Considered:

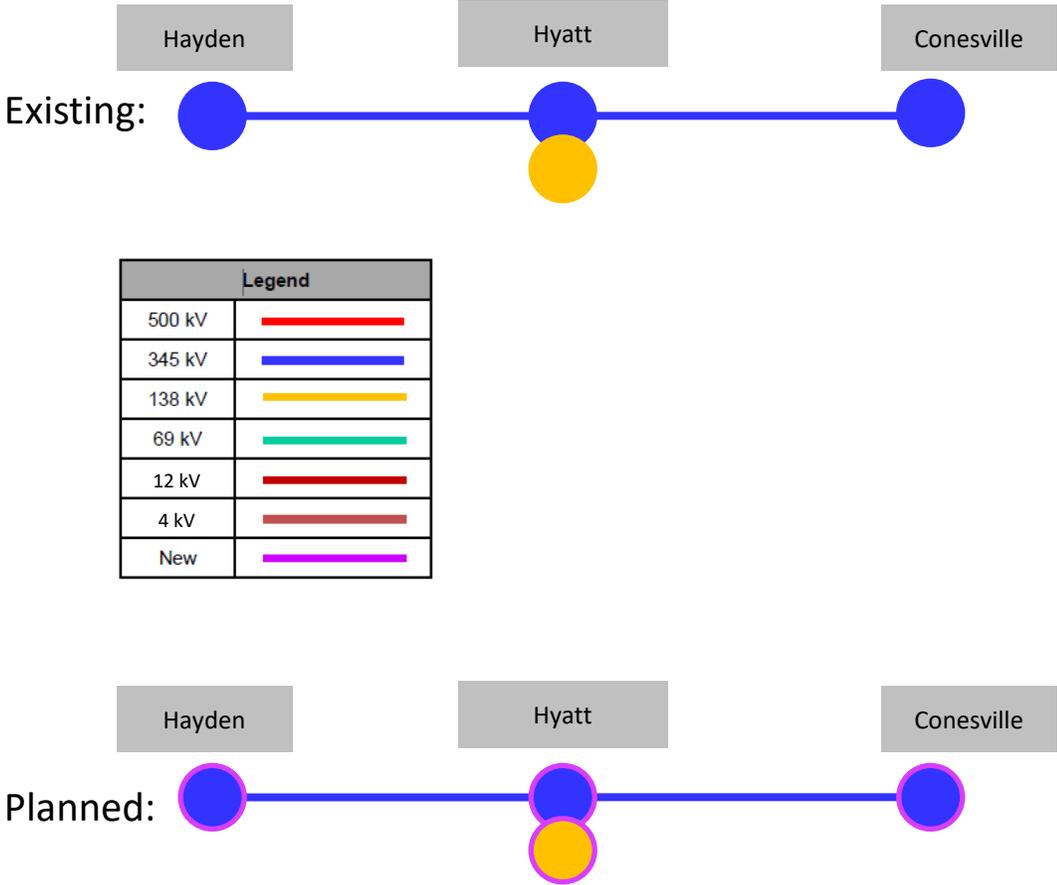
- 1. No viable cost effective alternatives were identified for this scope of work at Hyatt station

Alternative Cost: N/A

Projected In-Service: 11/27/2019

Project Status: In Service (Failure Replacement)

Model: 2024 Summer



AEP Transmission Zone M-3 Process Bladensburg

Need Number: AEP-2019-OH050

Process Stage: Solutions Meeting 03/19/2020

Previously Presented:

Needs Meeting 08/29/2019

Supplemental Project Driver:

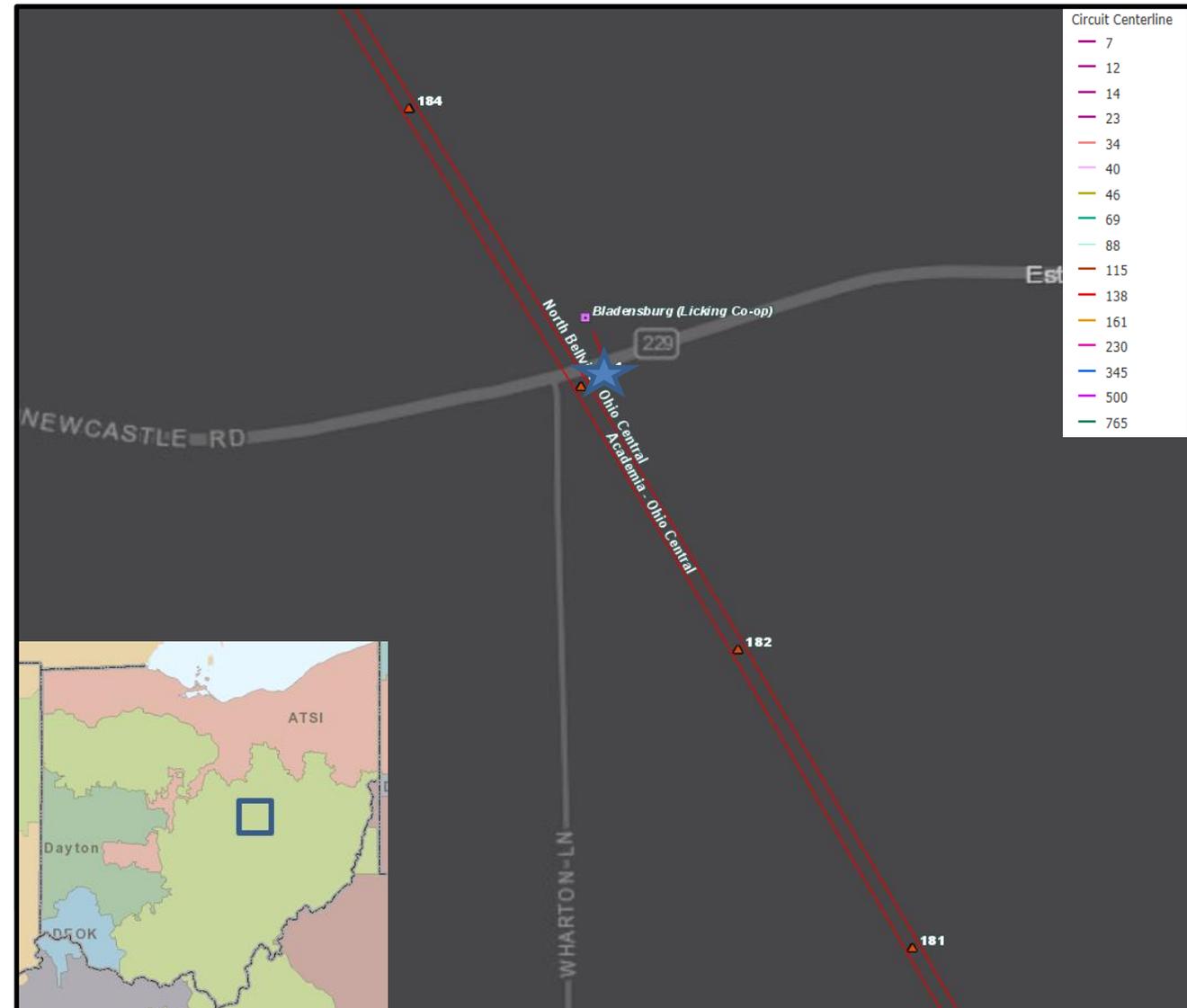
Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

- The Bladensburg Licking Rural Electrification Co-op (LRE) 138 kV delivery point, connected to the 45 mile North Bellville – Ohio Central 138 kV circuit, has a load of 3.9 MW peak demand serving 1449 customers. The Bladensburg load is 100% transferrable but under high loading conditions transferring loads can take several hours. For heavy loading periods LRE has experienced areas of low voltage while transferring loads.
- The Bladensburg delivery point has experienced approximately 553,000 minutes of CMI over the last 5 years.
- This delivery point is connected to the North Belleville – Ohio Central 138 kV circuit via a hard tap which limits operational flexibility and the effectiveness of protection schemes. In addition, it is difficult to coordinate maintenance efforts because the line cannot be removed from service without either a customer outage or temporary jumper configuration.



AEP Transmission Zone M-3 Process Bladensburg

Need Number: AEP-2019-OH050

Process Stage: Solutions Meeting 03/19/2020

Proposed Solution:

- Install a new 3-way 1200A switch with Auto-Sectionalizing, MOABs, and SCADA to serve the existing Bladensburg Delivery Point (Wakatomika). Additional structure work on the existing line will be required to accommodate the new switching structure.

Total Estimated Transmission Cost: \$1.90M

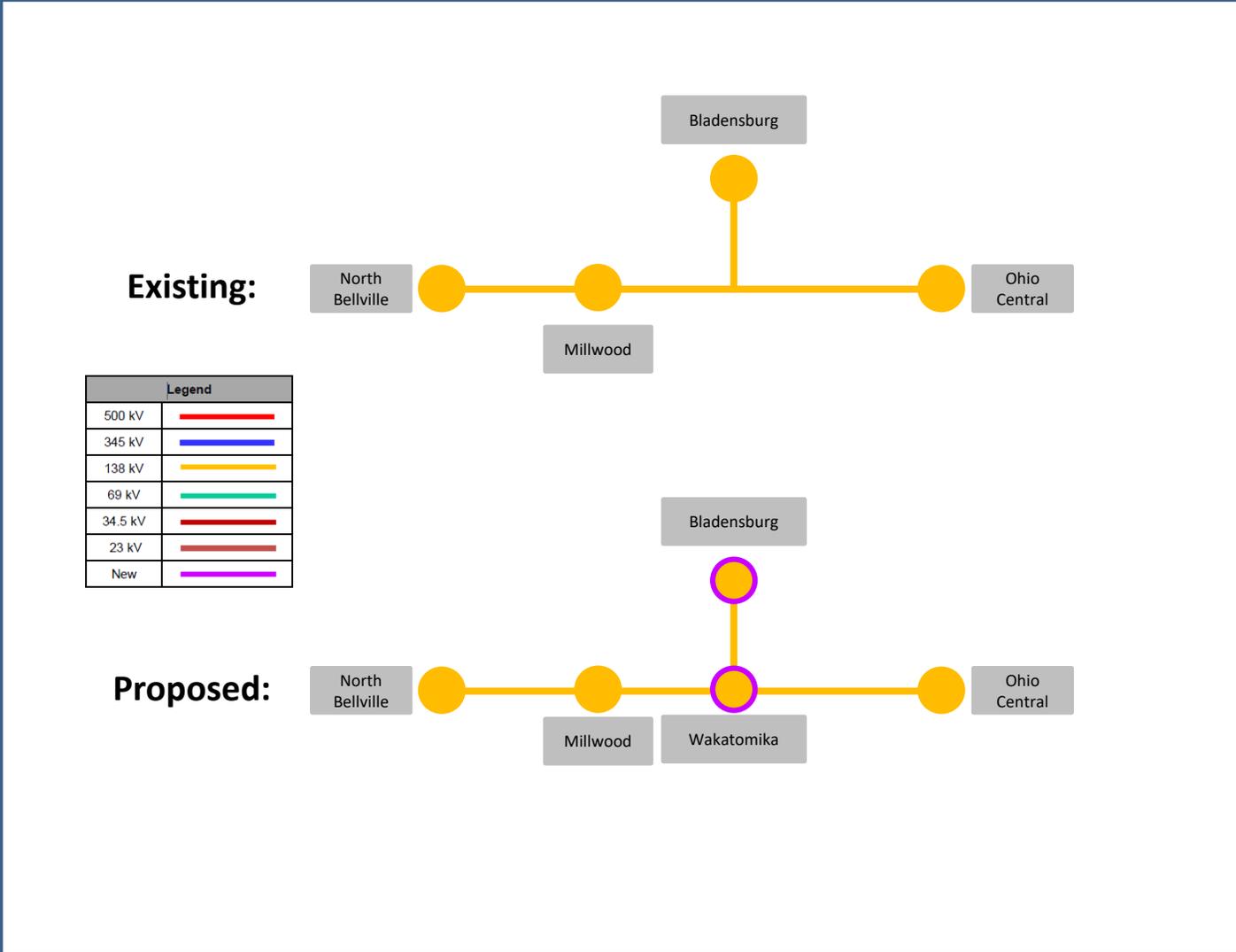
Ancillary Benefits: Removes a hard tap from the 138kV system and provides a more reliable service to customers.

Alternatives Considered:

- No viable cost-effective transmission alternative was identified due to the location of the existing customer.

Projected In-Service: 4/15/2021

Project Status: Engineering



AEP Transmission Zone M-3 Process Senecaville Loop 69kV

Need Number: AEP-2019-OH040

Process Stage: Solutions Meeting 03/19/2020

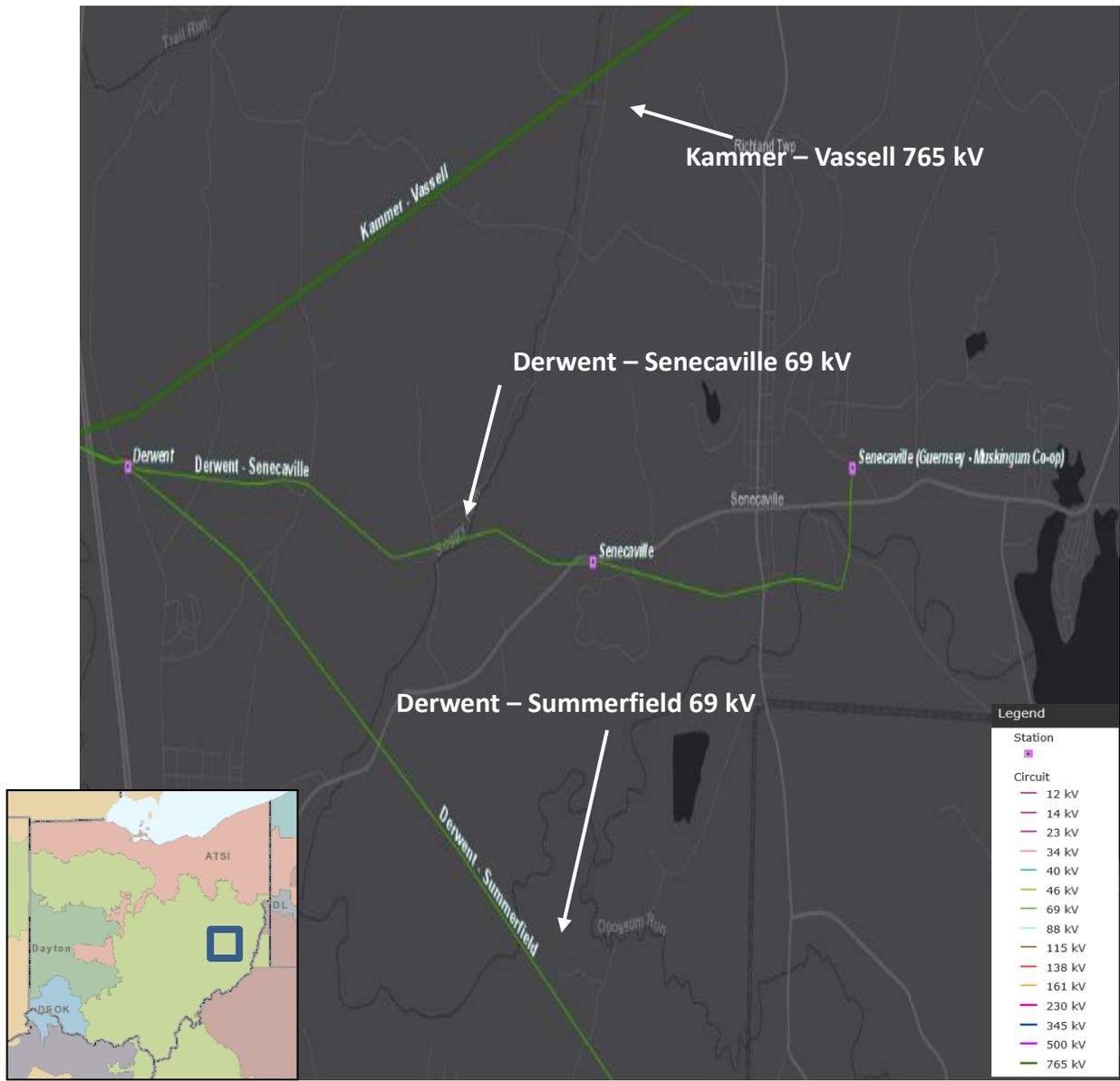
Previously Presented: Needs Meeting 06/17/2019

Supplemental Project Driver:
Operational Flexibility and Customer Service

Specific Assumption Reference:
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions slides 7 and 8);

Problem Statement:
Derwent – Senecaville 69 kV circuit

- The Derwent – Senecaville 69 kV circuit is ~4.3 miles long and serves a AEP Ohio and Guernsey-Muskingum Electric Cooperative station radially out of Derwent station.
- Guernsey-Muskingum Electric Cooperative and AEP Ohio customers are currently served off the radial line.
- Maintenance on the line is difficult to coordinate as it requires outages to multiple stations.
- Guernsey-Muskingum Electric Cooperative has reported approximately 210,000 customer-outage minutes (CMI) over a three year period (2015-2017).



AEP Transmission Zone M-3 Process Senecaville/Summerfield, Ohio

Need Number: AEP-2019-OH047

Process Stage: Solutions Meeting 3/19/2020

Previously Presented: Needs Meeting 7/24/2019

Supplemental Project Driver:

Equipment Material/Condition/Performance/Risk

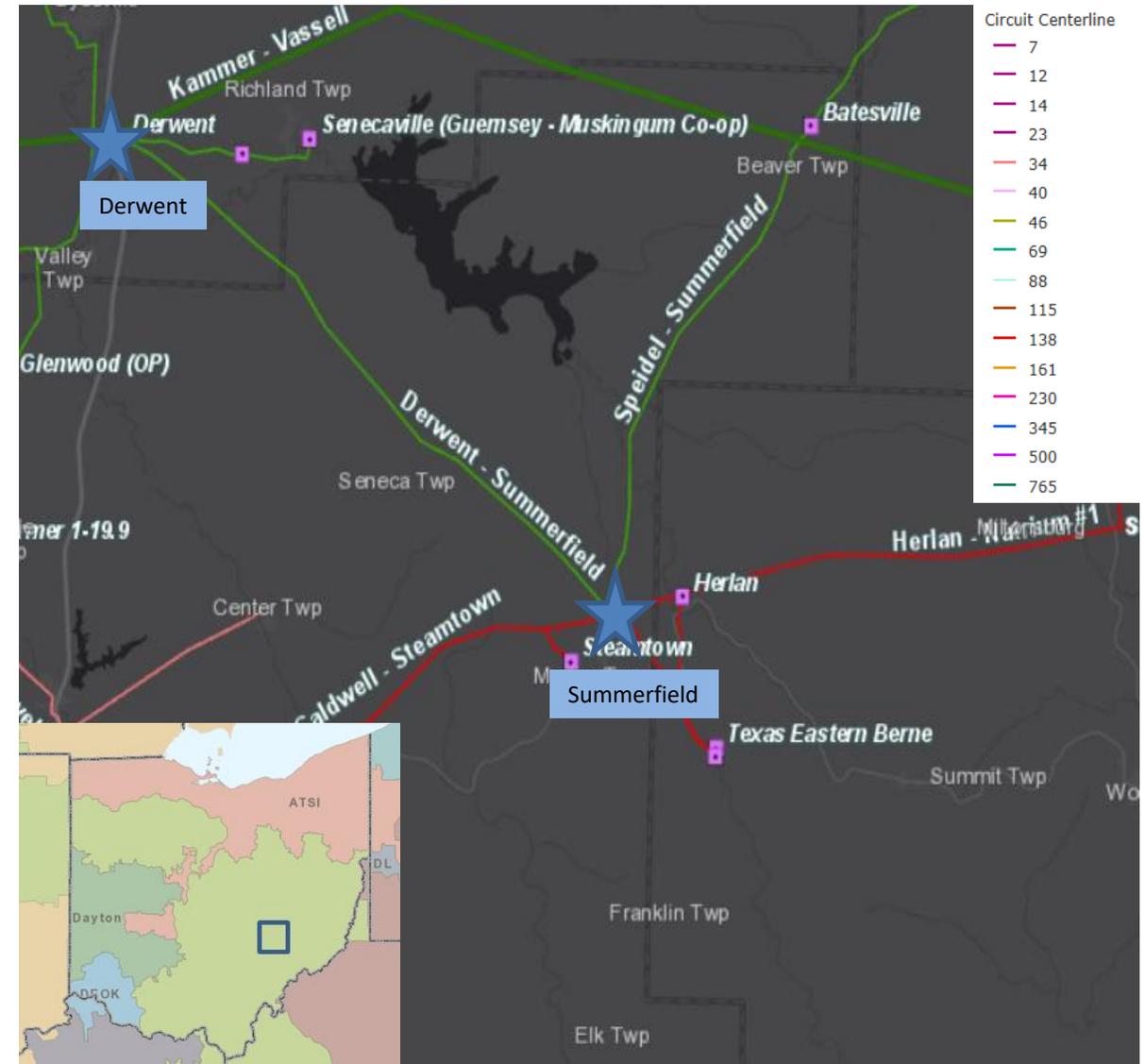
Specific Assumption References:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

Derwent – Summerfield 69kV

- Majority of 3.3 miles circuit utilizes wood structures installed in 1962.
- Circuit utilizes 336.4 kCM ACSR 30/7 Oriole conductor installed in 1962.
- Five momentary and permanent outages over last three years.
- 20 Open Structure/Conductor conditions
 - Insect damage, woodpecker holes, along with rotted and cracked structures.



AEP Transmission Zone M-3 Process Senecaville Loop 69kV

Need Number: AEP-2019-OH040 & AEP-2019-OH047

Process Stage: Solutions Meeting 03/19/2020

Proposed Solution:

- Remove ~3.3 miles of the Derwent – Summerfield 69 kV line. **Estimated Cost: \$2.0M**
- Build a new 69 kV line (~2.42 miles) from Lashley to the existing Summerfield line to loop the customers served from the existing radial. **Estimated Cost: \$6.1M**
- Install a new 69kV 1200A 3-way POP switch (Lashley) with auto-sectionalizing MOABs to serve the Senecaville GM co-op. **Estimated Cost: \$1.1M**
- Install 1 - 69kV 2000A wave trap at Senecaville (AEP) Station for relaying coordination. **Estimated Cost: \$0.1M**
- Install 1 - 69kV 2000A wave trap at the GM Senecaville Station for relaying coordination. **Estimated Cost: \$0.1M**
- At Derwent station, remove the Summerfield line exit and associated equipment. **Estimated Cost: \$0.4M**

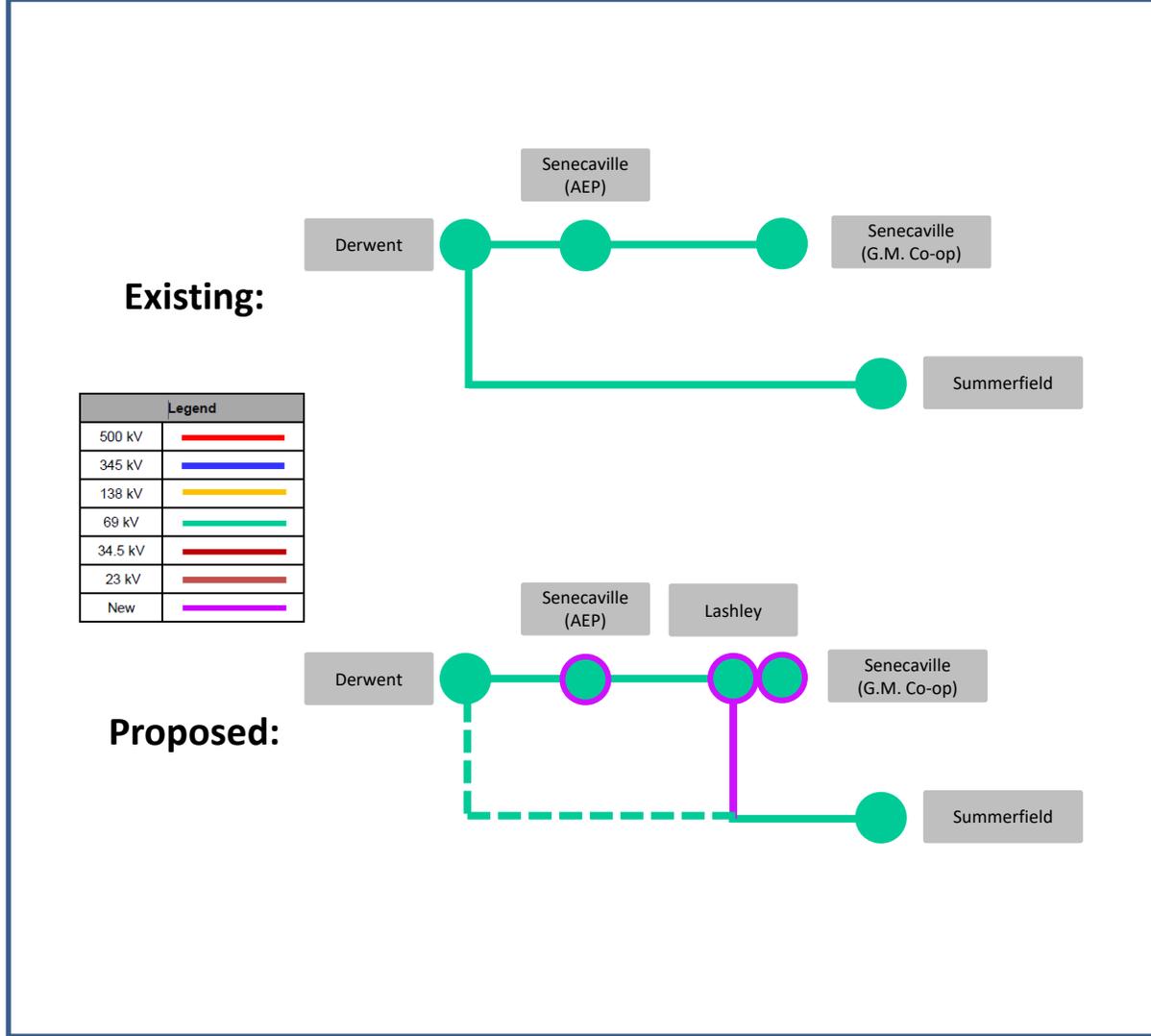
Total Estimated Transmission Cost: \$9.8M

Alternatives Considered:

- Build a new line to loop Senecaville back to Derwent. Cost: \$11M
 - This cost does not address the Derwent – Summerfield need.

Projected In-Service: 11/01/2024

Project Status: Engineering



AEP Transmission Zone M-3 Process Service to Ilesboro (65-91) 138kV

Need Number: AEP-2019-OH044

Process Stage: Solutions Meeting 03/19/2020

Previously Presented:

Need Meeting 7/24/2019

Supplemental Project Driver:

Customer Service

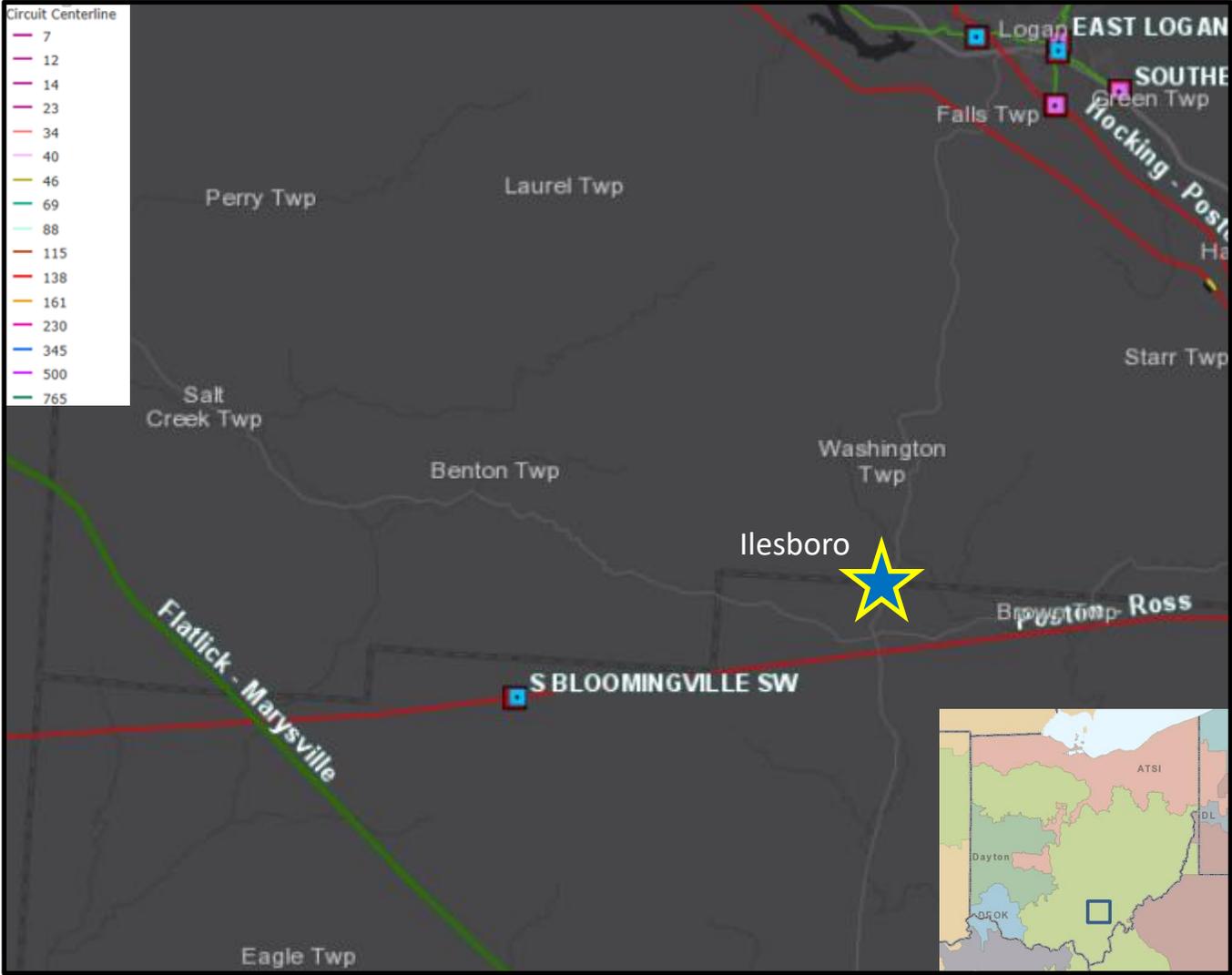
Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions slide 7)

Problem Statement:

- South Central Power is requesting a new 138kV delivery point on the Lemaster – Ross 138 kV circuit by September 2020. Anticipated load is about 4 MW.

Model: 2023 Summer RTEP



AEP Transmission Zone M-3 Process Service to Ilesboro (65-91) 138kV

Need Number: AEP-2019-OH044

Process Stage: Solutions Meeting 03/19/2020

Proposed Solution:

- Build a new single circuit 138 kV line (~1.5 mi) to connect the new Ilesboro delivery point to the Lemaster - Ross 138kV circuit using 336.4 ACSR. **Estimated Cost: \$4.3M**
- Install a new 3-way phase over phase 138 kV 2000 A switch (Fiddlestix) with MOABs on the Lemaster – Ross 138kV circuit. Update remote end work at Lemaster. **Estimated Cost: \$0.9M**

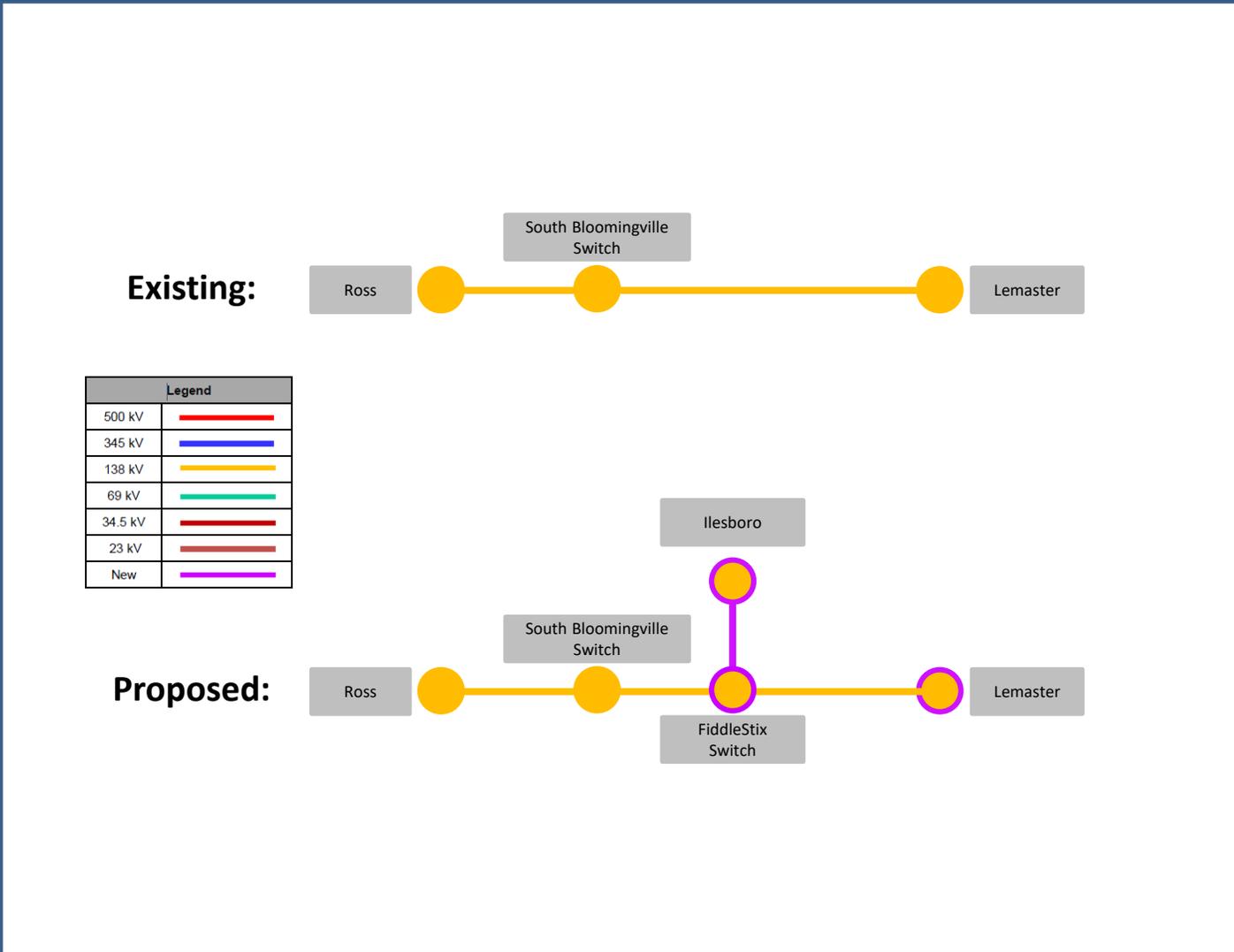
Total Estimated Transmission Cost: \$5.2M

Alternatives Considered:

- No viable cost-effective transmission alternative was identified due to the location and timing of the customer request.

Projected In-Service: 12/01/2022

Project Status: Engineering



AEP Transmission Zone M-3 Process Crooksville / Harrison, Ohio

Need Number: AEP-2020-OH004

Process Stage: Solutions Meeting 03/19/2020

Previously Presented:

Need Meeting 02/21/2020

Supplemental Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption References:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8),
AEP Presentation on Pre-1930s Lines

Problem Statement:

Crooksville – Philo 138kV

- Length: 13 Miles
- Original Construction Type: Aluminum/Steel Lattice
- Original Conductor Type: 397.5 ACSR Lark / 636 ACSR Grosbeak (vintage 1926)
- Momentary/Permanent Outages: 1 total outages
 - CMI: 320,767
 - Number of open conditions: 5
 - Total structure count: 65
 - Open conditions include: Burnt insulators, damaged shield wire
- Please reference assumptions materials on pre-1930s era lattice lines

Model: N/A



AEP Transmission Zone M-3 Process Crooksville-Philo 138 kV Circuit Rebuild

Need Number: AEP-2020-OH004

Process Stage: Solutions Meeting 03/19/2020

Proposed Solution:

- Rebuild ~12 miles of the Crooksville – Philo 138kV circuit. **Estimated Cost: \$29.8M**
- Replace Cannelville Switch with a new phase-over-phase switch. Relocate the existing Cannelville – Guernsey-Muskingum Co-op 138kV line to new Cannelville Switch. The switch needs to be relocated to maintain service to the customer while the line is being rebuilt. **Estimated Cost: \$1.1M**

Total Cost: \$30.9M

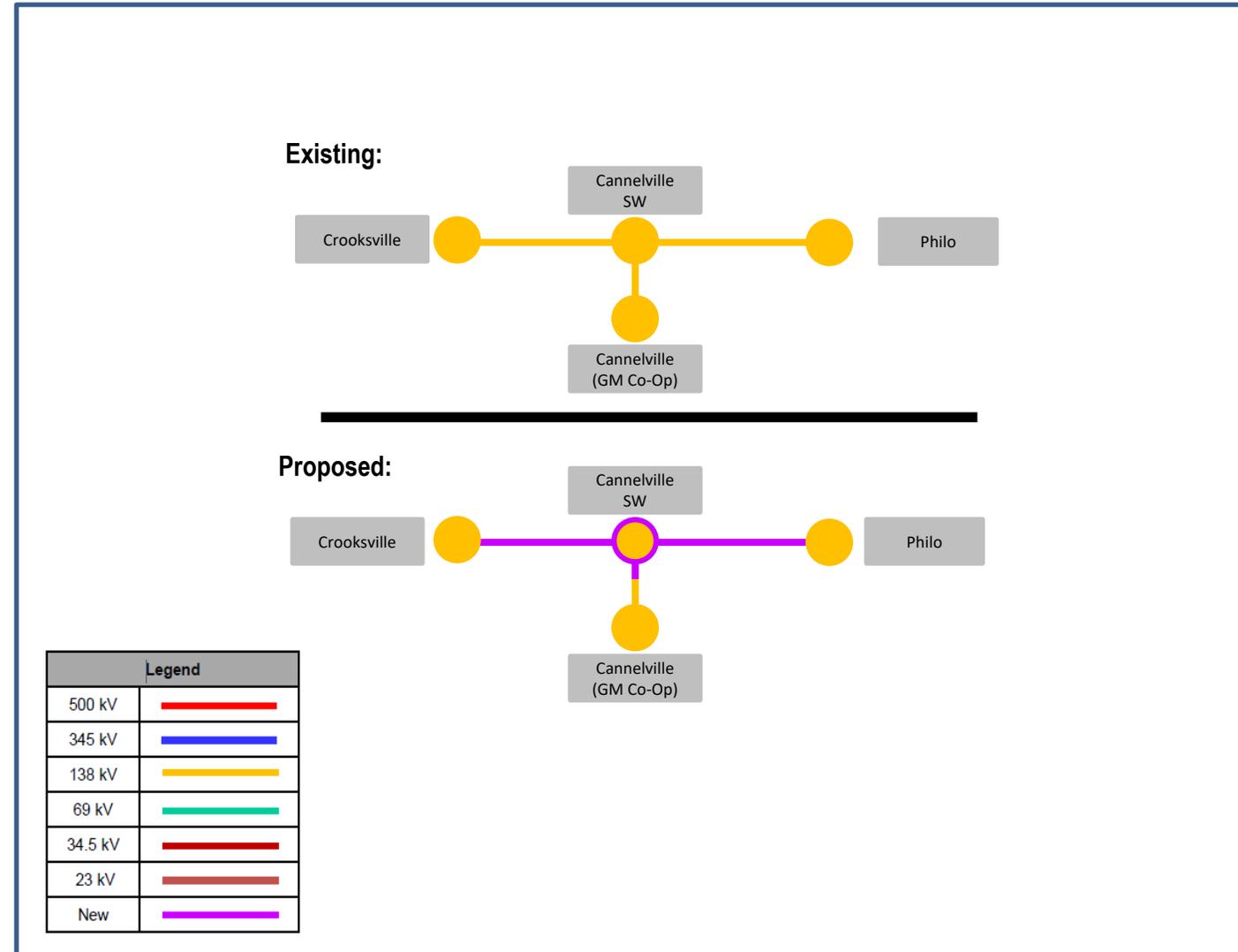
Ancillary Benefits: Improved customer reliability

Alternatives Considered:

No viable cost-effective transmission alternative was identified.

Projected In-Service: 09/30/2022

Project Status: Engineering



AEP Transmission Zone M-3 Process Athens Area Improvements

Need Number: AEP-2018-OH027

Process Stage: Solutions Meeting 03/19/2020

Previously Presented:

Needs Meeting 11/29/2018

Project Driver:

Equipment Material/Condition/Performance/Risk, Operational Flexibility and Efficiency

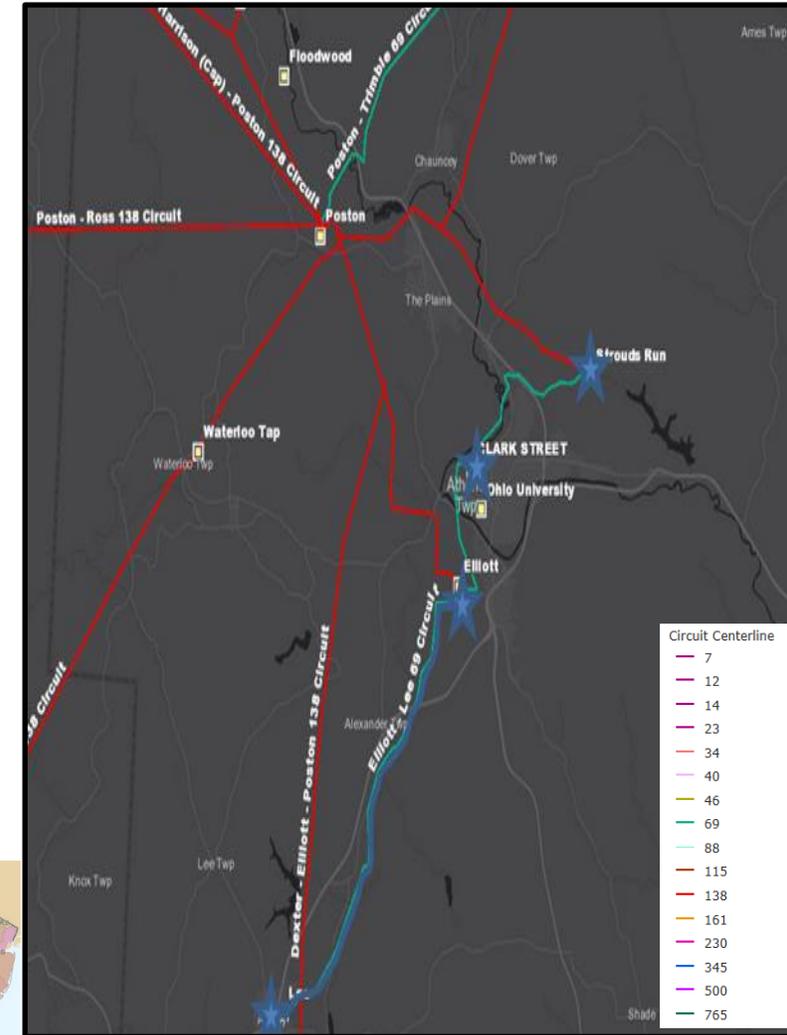
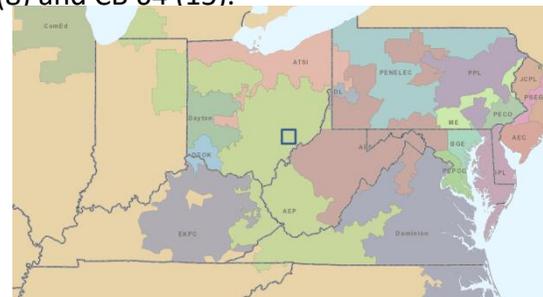
Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (slide 8)

Problem Statement:

Equipment Material / Condition / Performance / Risk:

- Elliott 138 kV circuit breaker 102 (vintage 1956) is an oil type breaker recommended for replacement due to bushing damage, reliability, and lack of spare part availability.
- Elliot 69kV circuit breakers 61, 66, and 67 (vintage 1972) have experienced the following numbers of fault operations: CB-102 (38), CB-67 (10), CB-66 (40), and CB-61 (1). These breakers are oil type breakers recommended for replacement due to reliability and lack of spare part availability.
- Strouds Run 69kV circuit breakers 63 and 66 (vintage 1969-1973) are oil breakers recommended to replace due to reliability and lack of spare part availability. Maintenance has become more difficult due to the oil handling required to maintain them. They have experienced the following fault operations: CB 63 (24), CB 66 (0).
- Strouds Run 138kV Circuit switchers “CS-TR1” and “CS-TR2” are Mark type switchers. Mark switchers are being recommended for replacement system wide due to their inability to coordinate with modern relaying packages. Circuit switchers have experienced the following fault operations: CS-TR1 (17), CS-TR2 (18).
- Strouds Run 138/69 kV 33.6MVA transformer #1 (vintage 1972) is also showing significant signs of deterioration. Drivers for replacement include dielectric strength breakdown, short circuit strength breakdown, and bushing damage.
- Clark Street 69 kV circuit breakers 61 and 64 (vintage 1968) are oil filled breakers that have been recommended for replacement due to oil handling requirements, no longer has vendor support, lacks sufficient spare part availability, and has a history of malfunctions. The breakers have had the following fault operations: CB 61 (8) and CB 64 (15).



AEP Transmission Zone M-3 Process Athens Area Improvements

Need Number: AEP-2018-OH027

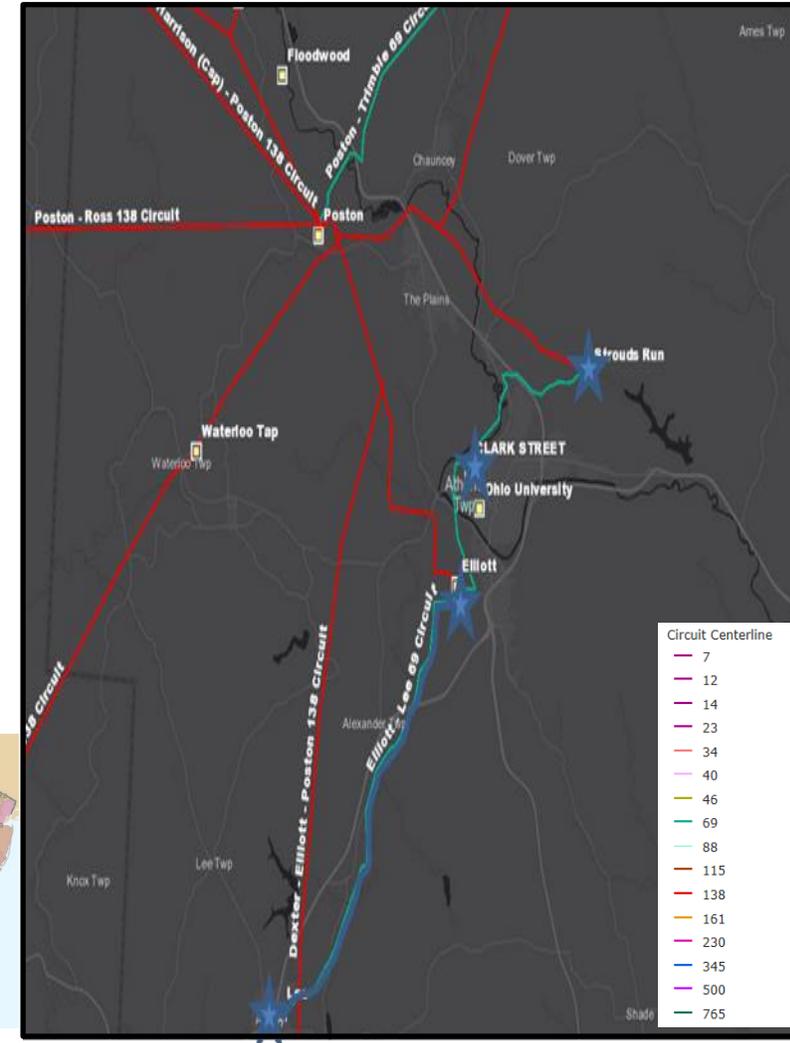
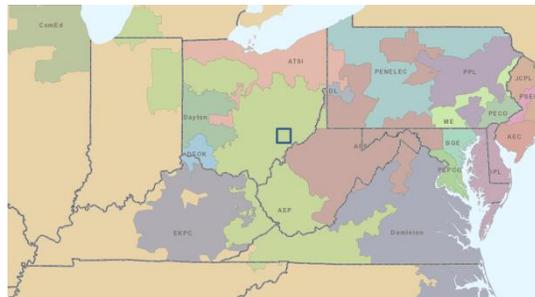
Problem Statement Continued:

Equipment Material / Condition / Performance / Risk:

- The Elliot – Lee 69kV 8 mile, 69 kV line (vintage 1974) was constructed using wood pole structures with 336.4 KCM ACSR 18/1 conductor (73 MVA rating).
- There are 106 open A conditions on this line, including rotten structures, burnt/broken insulators, and loose/broken/sagging conductor sections, improperly installed shield wires and woodpecker damaged structures.
- These stations still have the following amount of electromechanical relays employed: Elliot (29), Strouds Run (78), Clark Street (25). EM relays have limited vendor support, lack SCADA functionality, and don't offer fault data collection.

Operational Flexibility and Efficiency:

- The Crooksville – Poston – Strouds Run 138kV circuit is a three-terminal line, which limits sectionalizing and can cause mis-operations and over tripping.
- The Dexter – Elliott – Poston 138kV circuit is a three-terminal line, which limits sectionalizing and can cause mis-operations and over tripping



AEP Transmission Zone M-3 Process Athens Area Improvements

Need Number: AEP-2020-OH011

Process Stage: Solutions Meeting 03/19/2020

Previously Presented:

Need Meeting 02/21/2020

Supplemental Project Driver:

Equipment Material/Condition/Performance/Risk

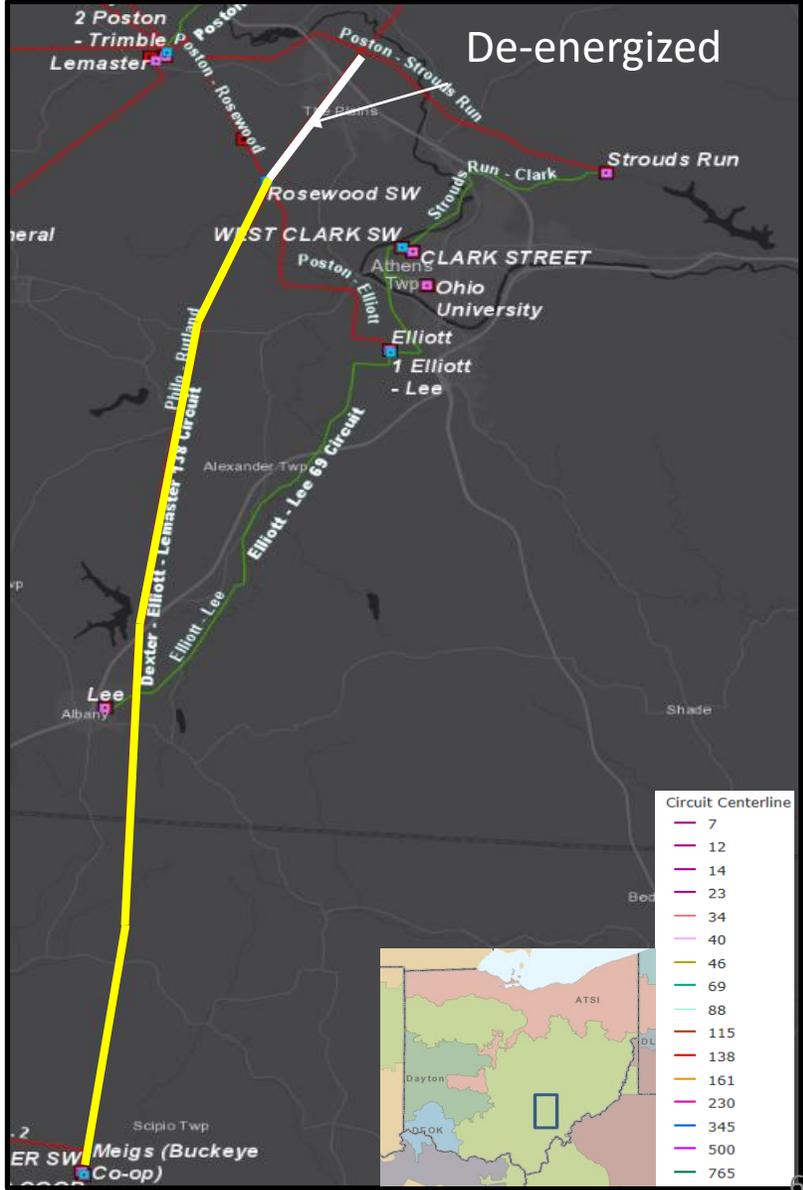
Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8), AEP Presentation on Pre-1930s Lines

Problem Statement:

Dexter – Rosewood 138kV (1927 Steel Lattice Line)

- Length: 8.8 Miles
- Original Construction Type: Aluminum/Steel Lattice
- Original Conductor Type: 397.5 CM ACSR 30/7 (1926 vintage)
- Momentary/Permanent Outages: 3 total outages over last 5 years
 - Total structure count: 38
- Please reference needs materials on pre-1930s era lattice lines
- There is an additional 2.5 miles of the 1920’s Philo - Rutland lattice line which is de-energized and runs through the middle of The Plains community north of Athens



AEP Transmission Zone M-3 Process Athens Area Improvements

Need Number: AEP-2020-OH014

Process Stage: Solutions Meeting 03/19/2020

Previously Presented:

Need Meeting 02/21/2020

Supplemental Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions slide 8)

Problem Statement:

Poston – Shrouds Run 138kV (1965)

- Length 7.52 Miles
- Original Construction Type: Wood H-Frame
- Original Conductor Type: 636 ACSR Conductor (vintage 1966)
- Momentary/Permanent Outages: 3 total outages last 5 years
 - Number of open conditions: 62
 - Total structure count: 46
 - Open conditions include: rot top, woodpecker holes, bowed structures, and burnt poles
 - Unique structure count with open conditions: 31



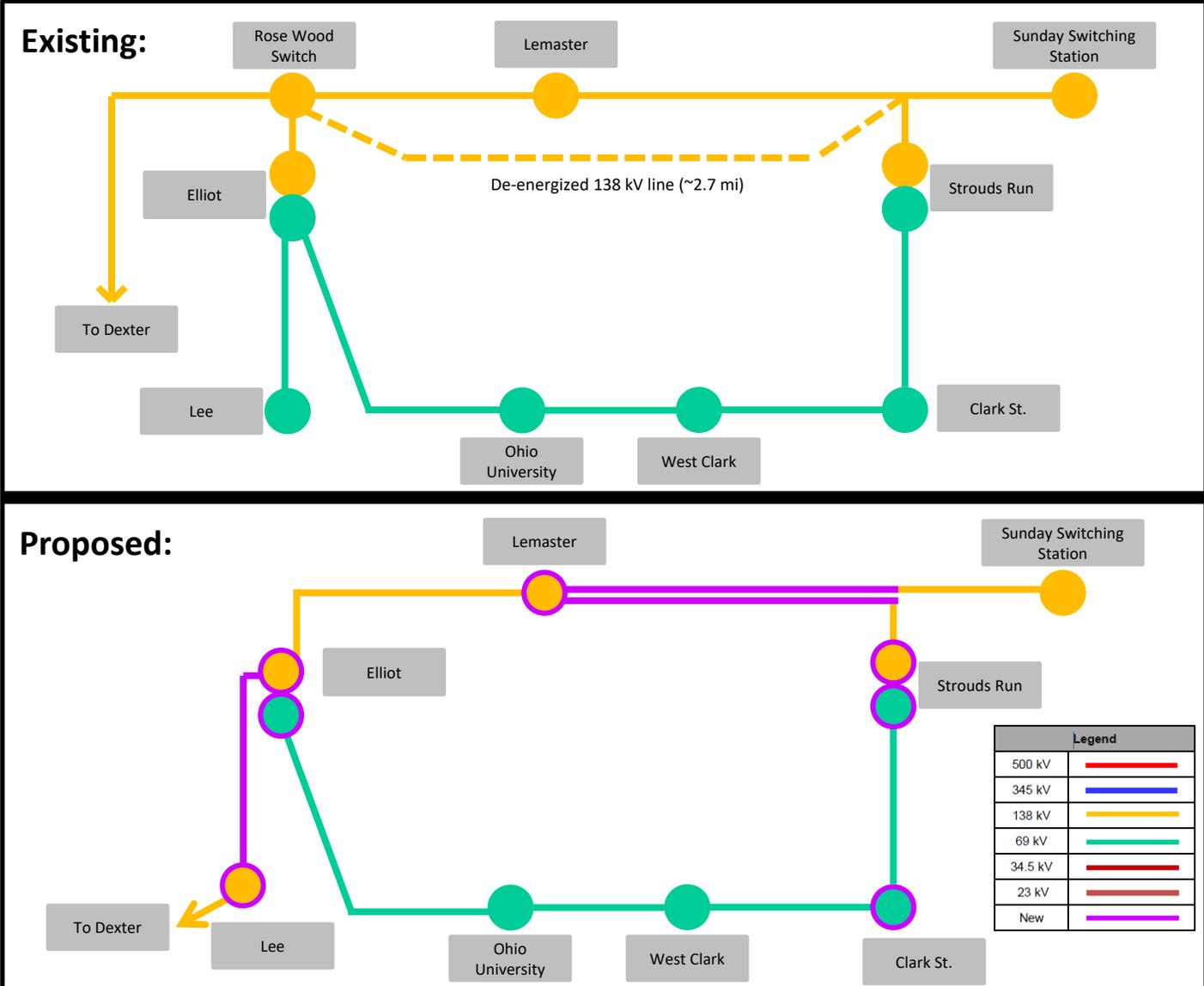
AEP Transmission Zone M-3 Process Athens Area Improvements

Need Numbers: AEP-2018-OH027, AEP-2020-OH011, & AEP-2020-OH014

Process Stage: Solutions Meeting 03/19/2020

Proposed Solution:

- Rebuild the existing ~8 mile Elliott – Lee 69kV line to 138 kV and retire the existing 69 kV line. **Estimated Cost: \$20.7M**
- Retire approximately 11.5 miles of the Philo – Rutland 138kV line asset from Lee station north, including the de-energized portion of the line that runs through the Plains community. **Estimated Cost: \$3.5M**
- Convert Lee to 138 kV service and install two line MOABs connected to the 138 kV line between Dexter and Elliot. **Estimated Cost: \$3.0M**
- At Clark Street, replace 69 kV circuit breakers “61” & “64” (3000A 40kA). **Estimated Cost: \$2.9M**
- At Elliot, install a new 138/69 kV transformer (130 MVA) in addition to high and low side protection (3000 A 40 kA) which will replace transformer #1 at Strouds Run that will be retired. Replace existing 138 kV circuit breaker “102” and 69 kV circuit breakers “61” and “66” (3000A, 40 kA). Install 138 kV circuit breaker (3000A, 40 kA) on the new 138 kV line towards Dexter (via Lee) along with a 138 kV bus-tie breaker (3000, 40 kA). Retire 69 kV circuit breaker “67” due to the conversion of Lee station to 138 kV. **Estimated Cost: \$6.7M**
- Rebuild ~3.68 miles of single circuit line from the Poston - Strouds Run line as double circuit 138kV transmission line to eliminate the hard tap on the line. **Estimated Cost: \$16.0M**



AEP Transmission Zone M-3 Process Athens Area Improvements

Proposed Solution Continued:

- At Strouds Run, install a 138kV line breaker (3000A 40kA) towards Lemaster. Replace transf #2 high side circuit switcher with a circuit breaker (3000A, 40 kA). Replace the 69kV circuit breaker “66” (3000A, 40kA). Retire 138/69/13 kV 33.6 MVA transf #1, 69 kV circuit breaker “63”, and circuit switcher # 1. **Estimated Cost: \$1.6M**
- At Lemaster station, install a 138kV breaker (3000A 40kA) to accommodate the new circuit. **Estimated Cost: \$1.0M**
- Remove Rosewood switch. **Estimated Cost: \$0.1M**

Total Estimated Transmission Cost: \$55.5M

Alternatives Considered:

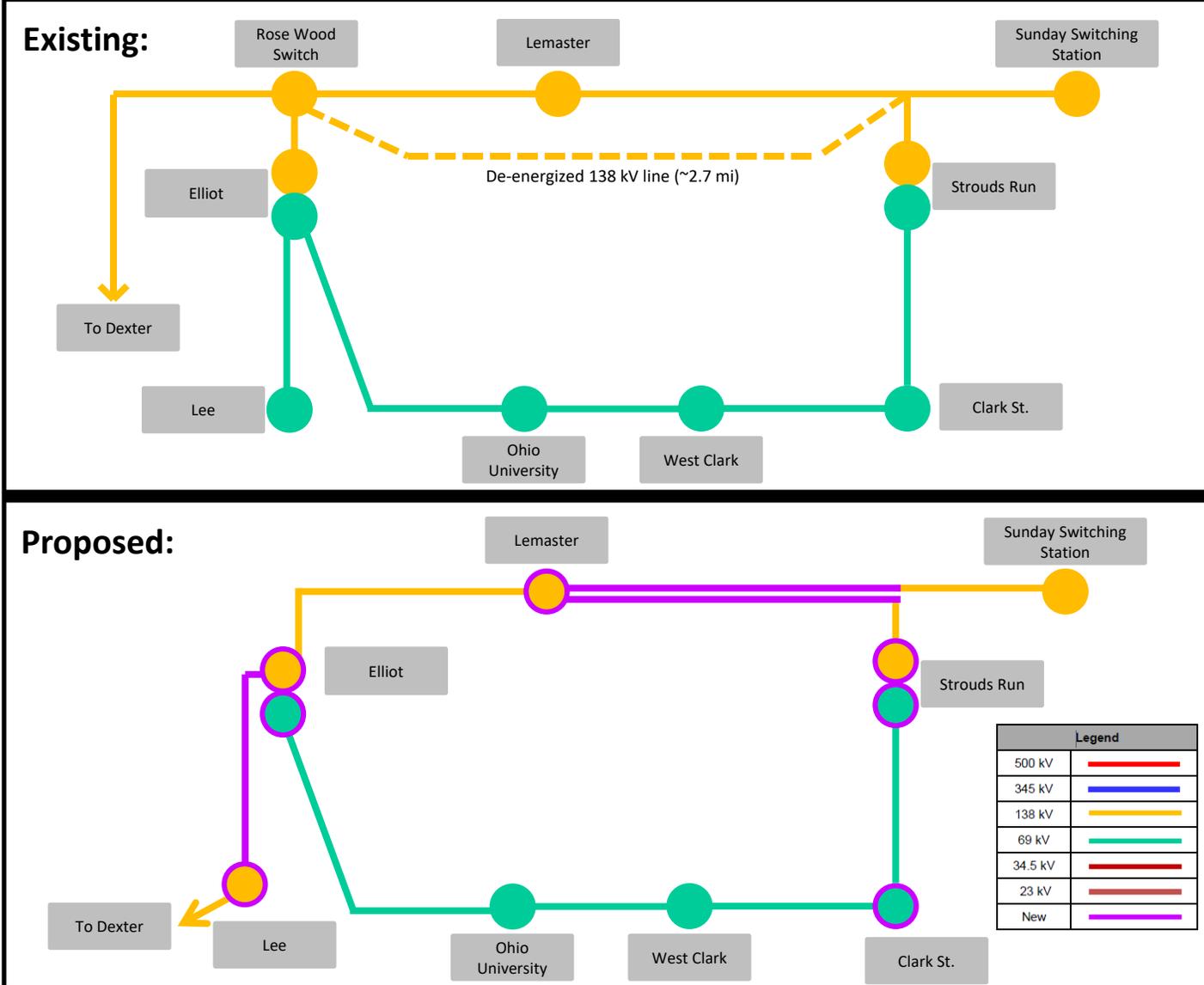
Replacing the existing 138/69 kV transformer at Strouds Run was evaluated. The decision was made to move the transformation to Elliot since the station would have two 138 kV lines into the station versus only one at Strouds. Both options were considered to be equal from a cost perspective.

At Elliot, reconfiguring the 138 kV portion of the station into a ring configuration was considered given the number of elements and new breakers being installed, but not chosen due to space and outage constraints that would have required an expansion of the station. There are significant elevation changes just outside the existing station footprint that would have made this alternative cost prohibitive.

Projected In-Service: 10/01/2024

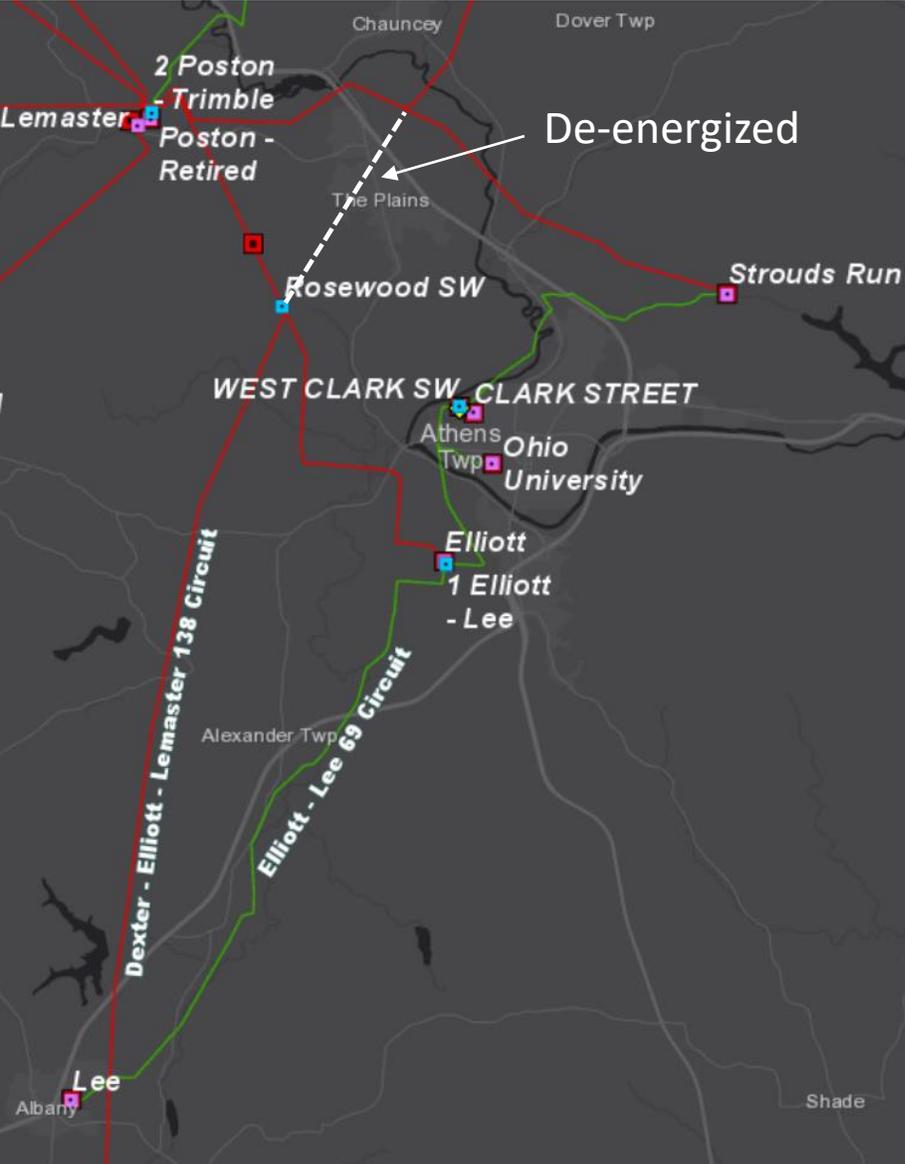
Project Status: Scoping

Model: N/A

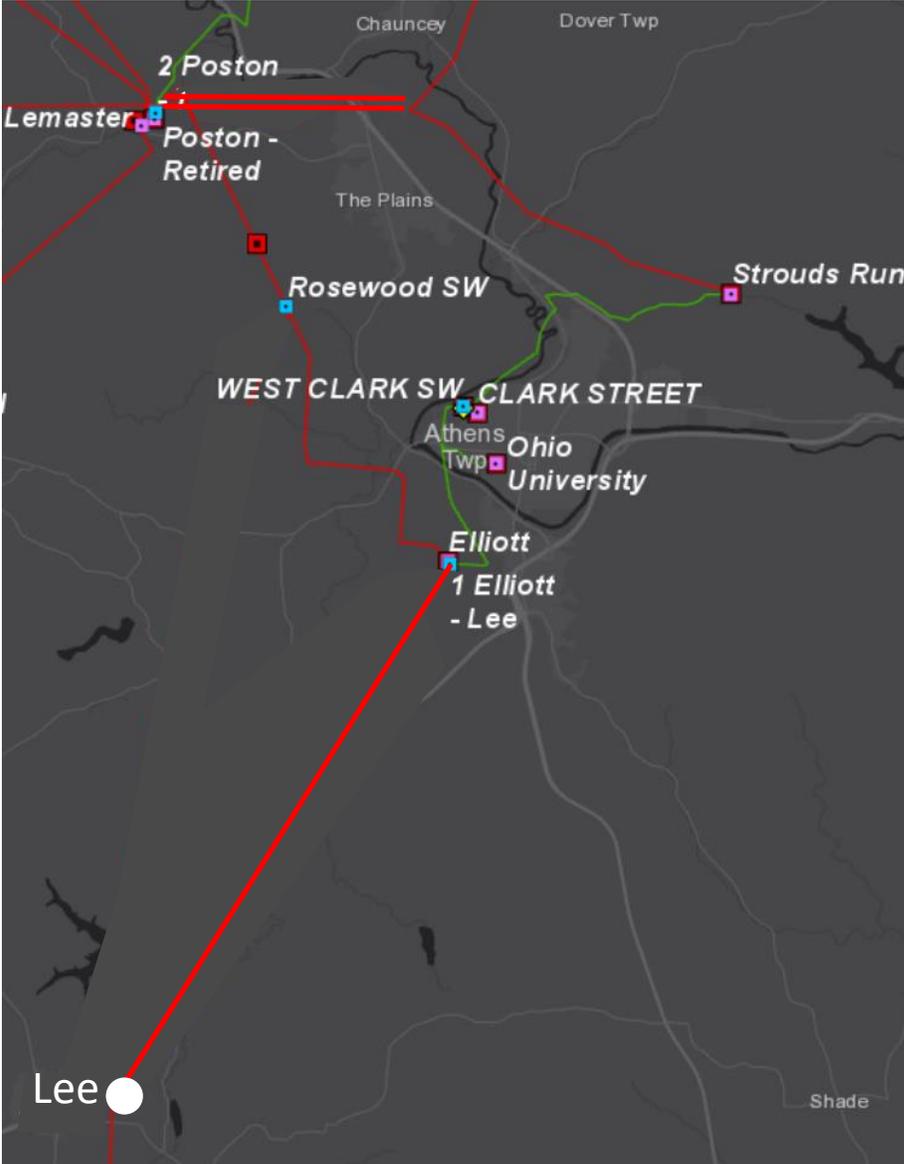


AEP Transmission Zone M-3 Process Athens Area Improvements

Existing:



Proposed:



AEP Transmission Zone M-3 Process Hernshaw Area Project

Need Number: AEP-2019-AP015

Process Stage: Solutions Meeting 3/19/2020

Previously Presented:

Need Meeting 8/29/2019

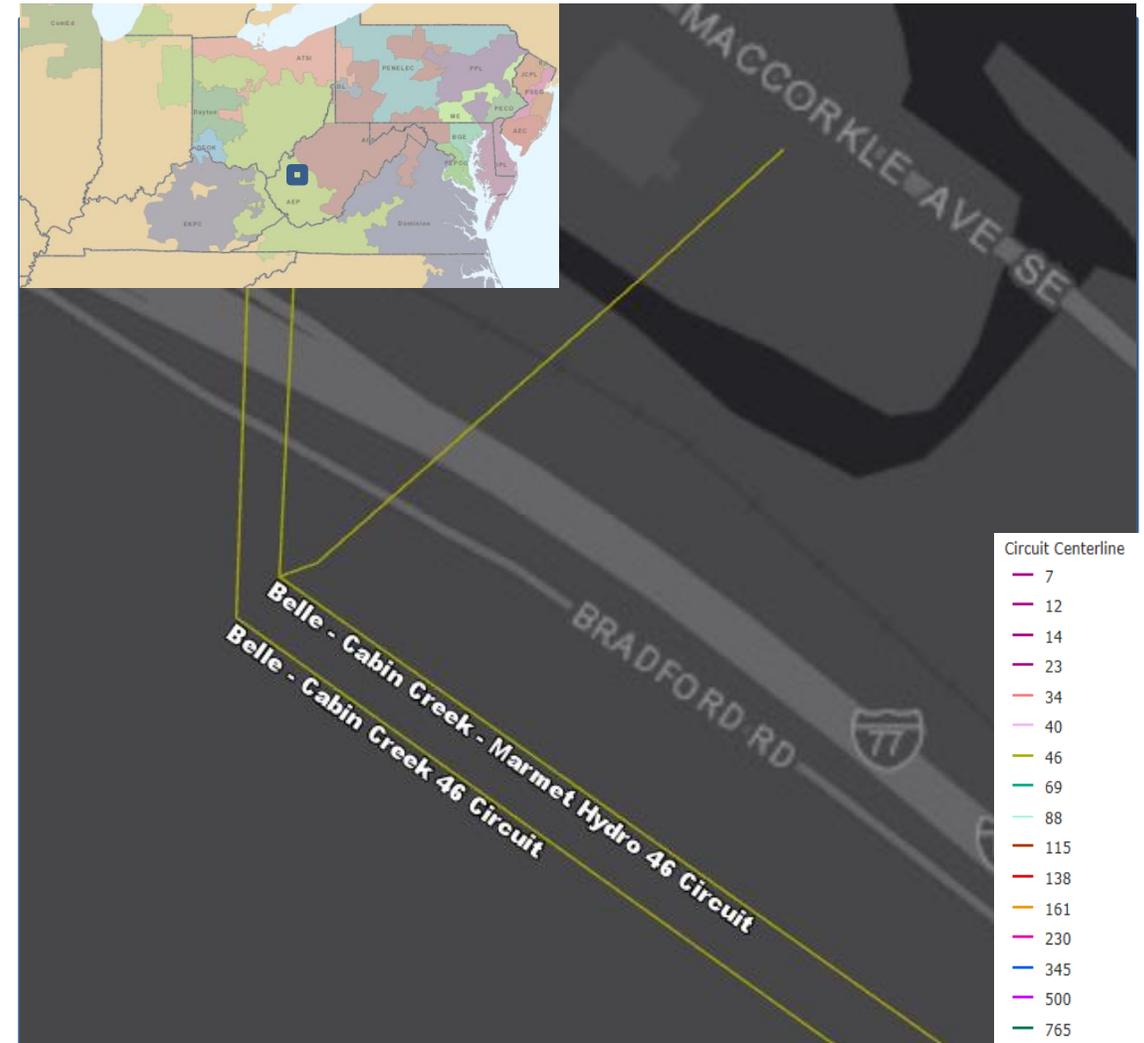
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

- A customer station is currently served off a hard tap on the Belle – Cabin Creek – Marmet Hydro 46 kV circuit.
 - Hard taps are difficult to maintain due to required outages or temporary jumper configurations in lieu of a switch.
 - Hard taps can also result in extended outages to customers due to the inability to sectionalize faulted facilities.

Model: N/A



AEP Transmission Zone M-3 Process Hernshaw Area Project

Need Number: AEP-2019-AP027

Process Stage: Solutions Meeting 3/19/2020

Previously Presented:

Need Meeting 8/29/2019

Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

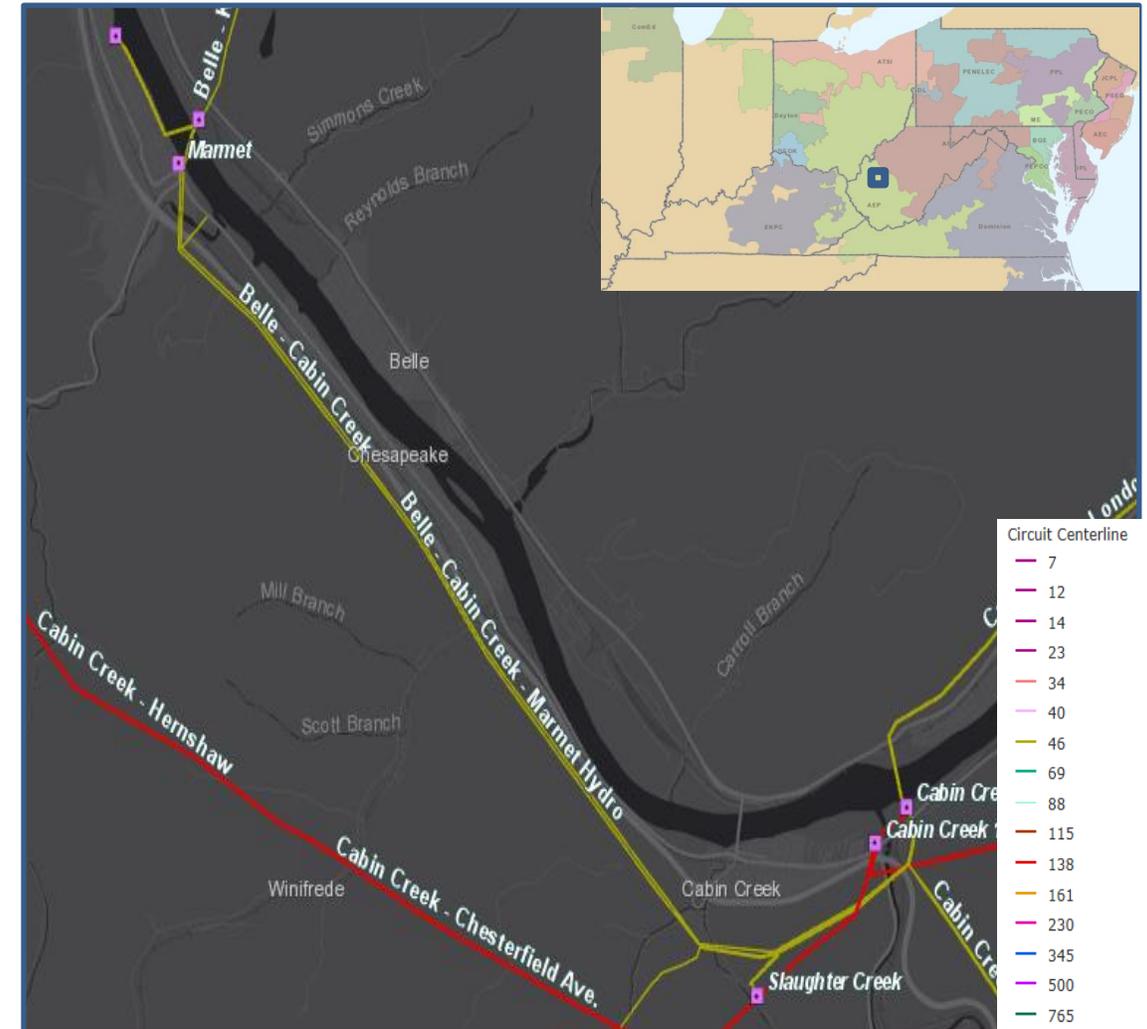
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Belle – Cabin Creek – Marmet Hydro 46 kV Circuit (7.58 miles)

- Majority of the circuit is constructed with 1930s lattice structures.
- Between 2015-2018 the circuit experienced 4 momentary and 3 permanent outage resulting in approximately 24k customer minutes of interruption
- There are currently 13 open conditions associated with the structures and hardware and include heavy rust, broken insulators and damaged shield wire hardware.
- The line does not comply with current NESC Standards.
- Most structures are situated on an extreme side hill, which also sits above the WV Turnpike which presents a significant danger/risk should the structures fail.
- This line parallels the Belle – Cabin Creek – Marmet line, need AEP-2019-AP028.

Model: N/A



AEP Transmission Zone M-3 Process Hernshaw Area Project

Need Number: AEP-2019-AP028

Process Stage: Solutions Meeting 3/19/2020

Previously Presented:

Need Meeting 8/29/2019

Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

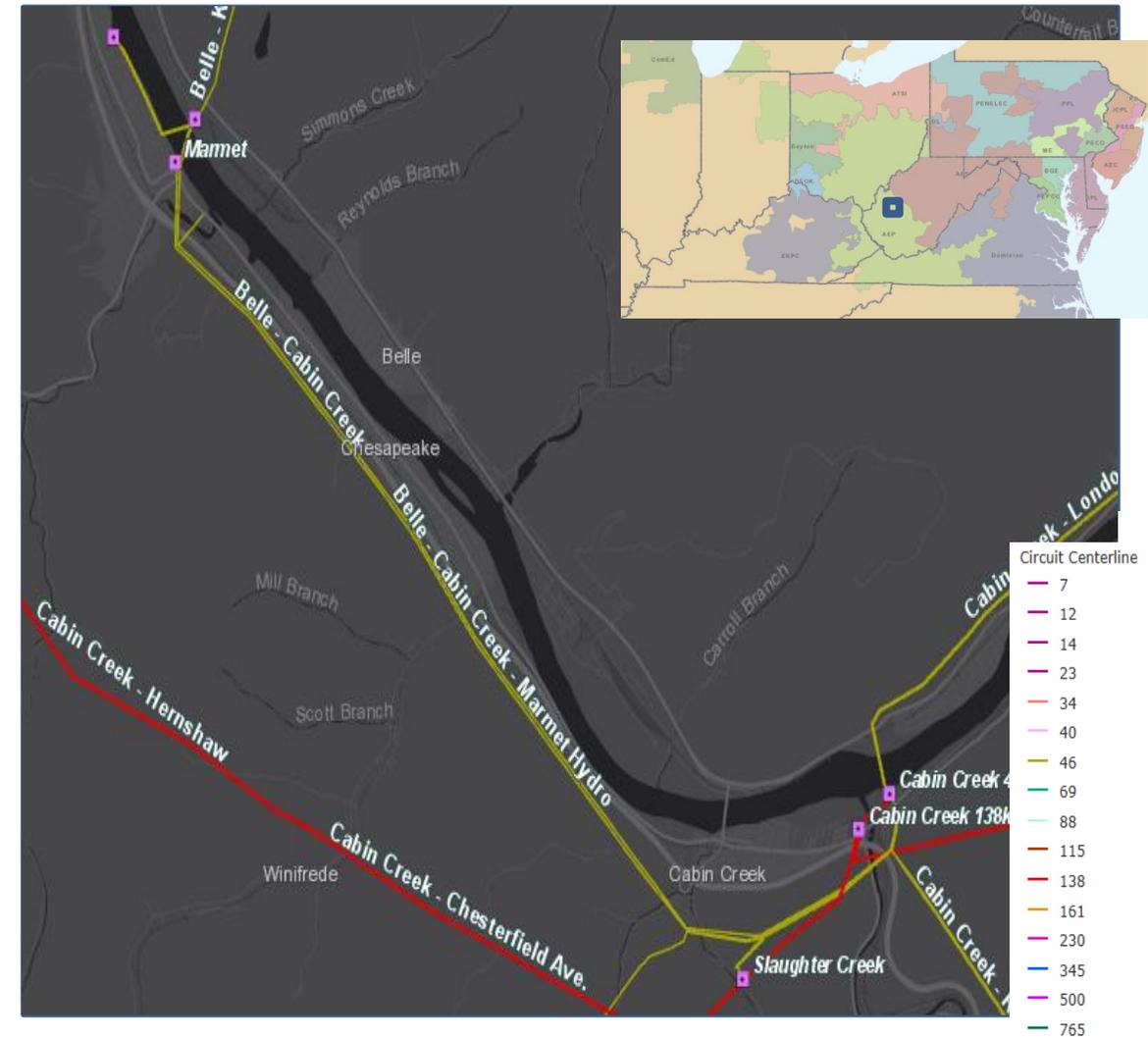
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

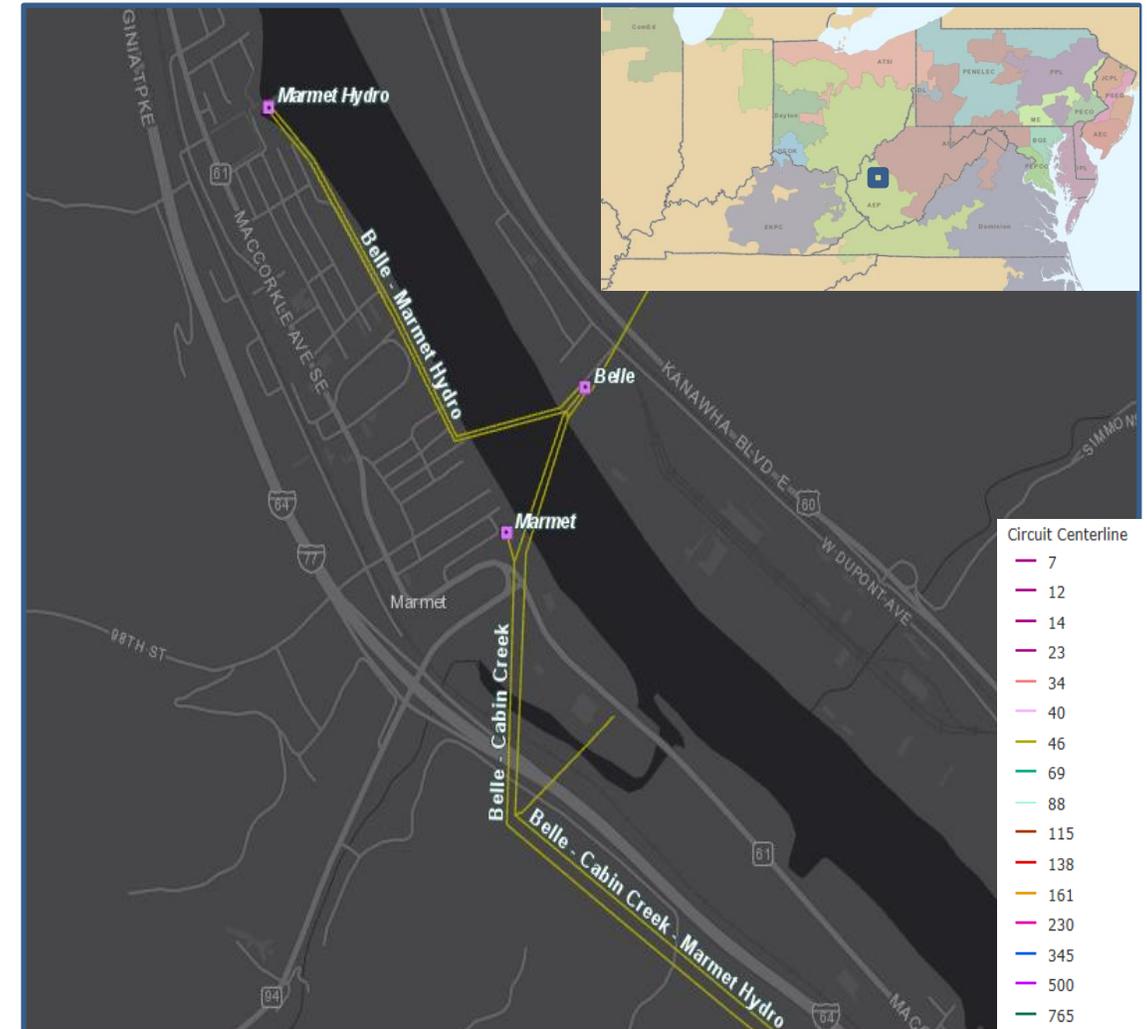
Belle – Cabin Creek 46 kV Circuit (7.14 miles)

- Majority of the circuit is constructed with 1930s lattice structures.
- Between 2015-2018 the circuit experienced 6 momentary and 2 permanent outage resulting in approximately 242k customer minutes of interruption
- There are currently 13 open conditions associated with the structures and hardware and include heavy rust, broken insulators and corroded shield wire.
- The line does not comply with current NESC Standards
- Most structures are situated on an extreme side hill, which also sits above the WV Turnpike which presents a significant danger/risk should the structures fail.
- This line parallels the Belle – Cabin Creek – Marmet line, need AEP-2019-AP027.

Model: N/A



AEP Transmission Zone M-3 Process Hernshaw Area Project



Need Number: AEP-2019-AP029

Process Stage: Solutions Meeting 3/19/2020

Previously Presented:

Need Meeting 8/29/2019

Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

- Marmet Hydro is currently served off a hard tap on the Belle – Marmet Hydro – Cabin Creek 46 kV circuit
 - Hard taps are difficult to maintain due to required outages or temporary jumper configurations in lieu of a switch.
 - Hard taps result in extended outages to customers due to the inability to sectionalize faulted facilities.

Model: N/A

AEP Transmission Zone M-3 Process Hernshaw Area Project

Need Number: AEP-2019-AP015, AEP-2019-AP027, AEP-2019-AP028, AEP-2019-AP029

Process Stage: Solutions Meeting 3/19/2020

Proposed Solution:

Retire the existing 7.5-mile long Belle-Cabin Creek #1 and #2 circuits from Belle to Cabin Creek.

Estimated Cost: \$10.0M

Construct new double circuit 46kV line (designed to 138 kV) from Belle to Hernshaw (~4 miles).

Estimated Cost: \$13.5M

At Hernshaw Station, install 4 new 3000 A 40 kA 46 kV CBs (138 kV design) in a ring configuration. Install two new 138/46 kV 90 MVA transformers at Hernshaw with two 3000 A 40 kA 138 kV CBs on the high side of each new XFR. **Estimated Cost: \$13.5M**

Remote end work and retire circuit breakers AA and AB at Cabin Creek station. **Estimated Cost: \$0.8M**

Install Chesapeake 46 kV S.S. to eliminate existing hard tap currently serving Praxair. Install a new line extension to Praxair (0.2 miles). **Estimated Cost: \$1.8M**

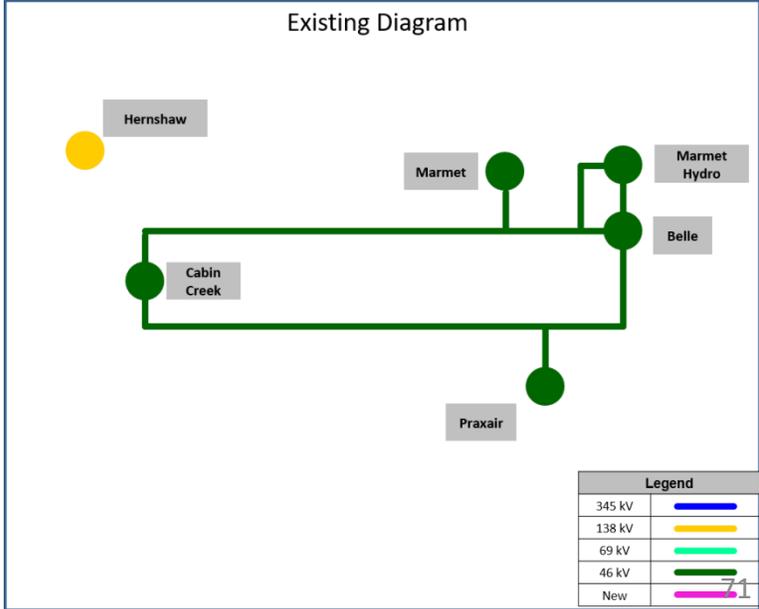
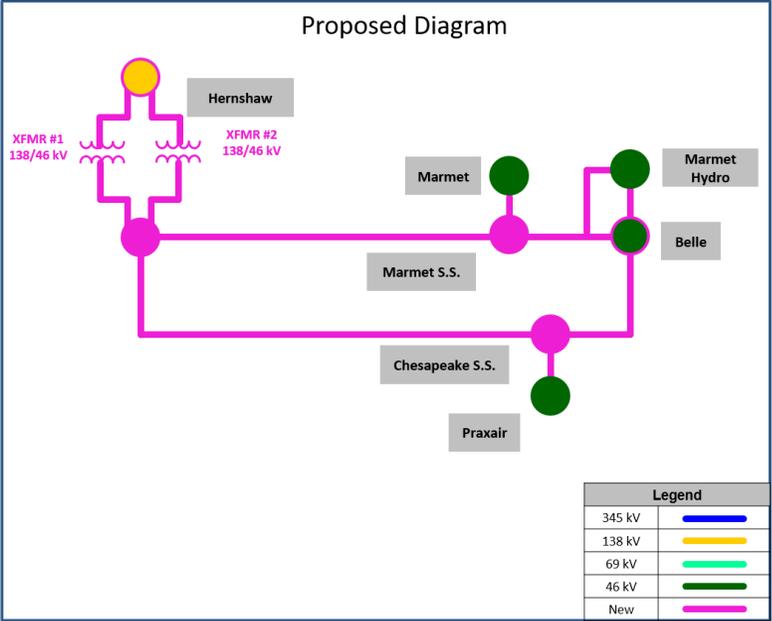
Replace the existing switches at Marmet Station to accommodate the new line construction. **Estimated Cost: \$0.3M**

Marmet Hydro Hard Tap will be relocated to be positioned between 46 kV circuit breaker G at Belle and the new switches at Marmet Station. Remote end work required at Marmet Hydro Station. **Estimated Cost: \$0.6M**

Belle Station work to replace CCVTs with new 46 kV PTs and upgrade line surge arresters. **Estimated Cost: \$1.3M**

Total Estimated Transmission Cost: \$41.8M

Ancillary Benefits: The extreme terrain on which the line sits presents numerous maintenance and access issues. This project moves the line away from the WV Turnpike and eliminates the access and maintenance concerns with the current location.



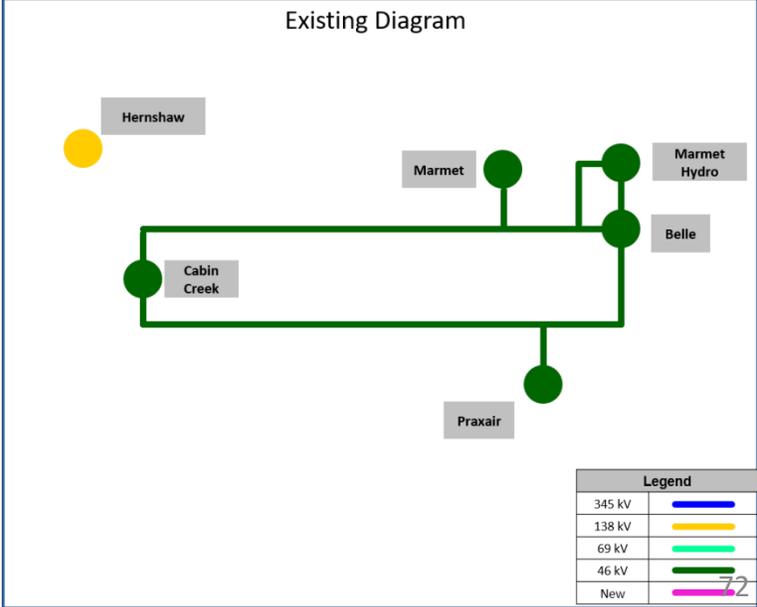
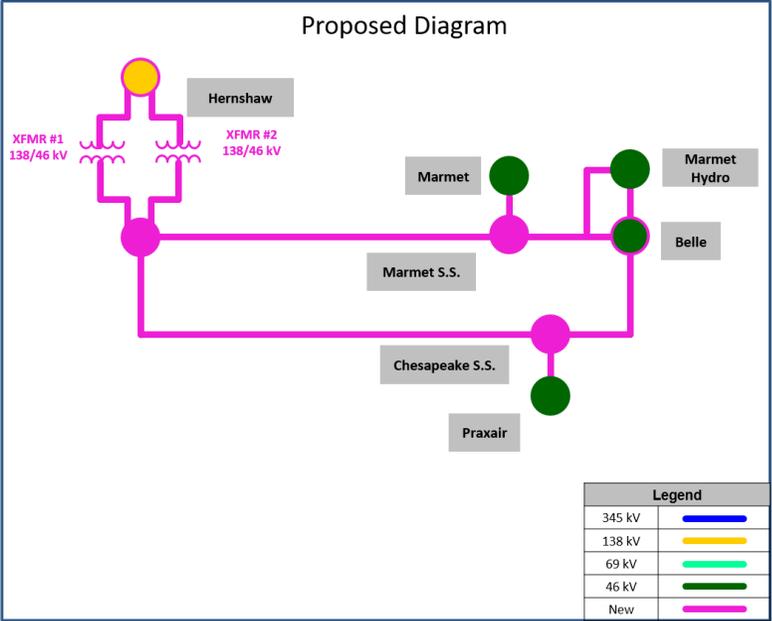
AEP Transmission Zone M-3 Process Hernshaw Area Project

Alternatives Considered:

1. Retire existing Belle – Cabin Creek #1 and #2 circuits. Construct the Belle – Cabin Creek #1 and #2 circuits as a new double circuit 46 kV line in new ROW further up the mountain side, away from I-77. Install Chesapeake 46 kV S.S. to eliminate existing hard tap currently serving Praxair. Install a new line extension to Praxair (0.2 miles). Relocate Marmet Hydro Hard Tap to be positioned between 46 kV circuit breaker G at Belle and the new switches at Marmet Station. Replace the existing switches at Marmet Station to accommodate the new line construction. This option is not preferred as there is still a significant slide risk. Estimated Cost: \$50.0M
2. Construct a new 138/46 kV station along the Cabin Creek – Chesterfield 138 kV line. Install two 138/46 kV transformers, 2 new 46 kV (138 kV design) circuit breakers and two new 138 kV circuit breakers. Install a new double circuit 46 kV line (138 kV design), approximately 3 miles, from the new station to Belle. This option was not feasible due to the difficulty in finding a suitable property for a new station.

Projected In-Service: 4/1/2023

Project Status: Scoping



Need Number: AEP-2019-AP018

Process Stage: Solutions Meeting 3/19/2020

Process Chronology: Need Meeting 05/20/2019

Supplemental Project Driver: Equipment Material/ Condition/Performance/Risk, Operational Flexibility and Efficiency

Specific Assumption References: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Specific Assumption References:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Speedway 138 kV Tap

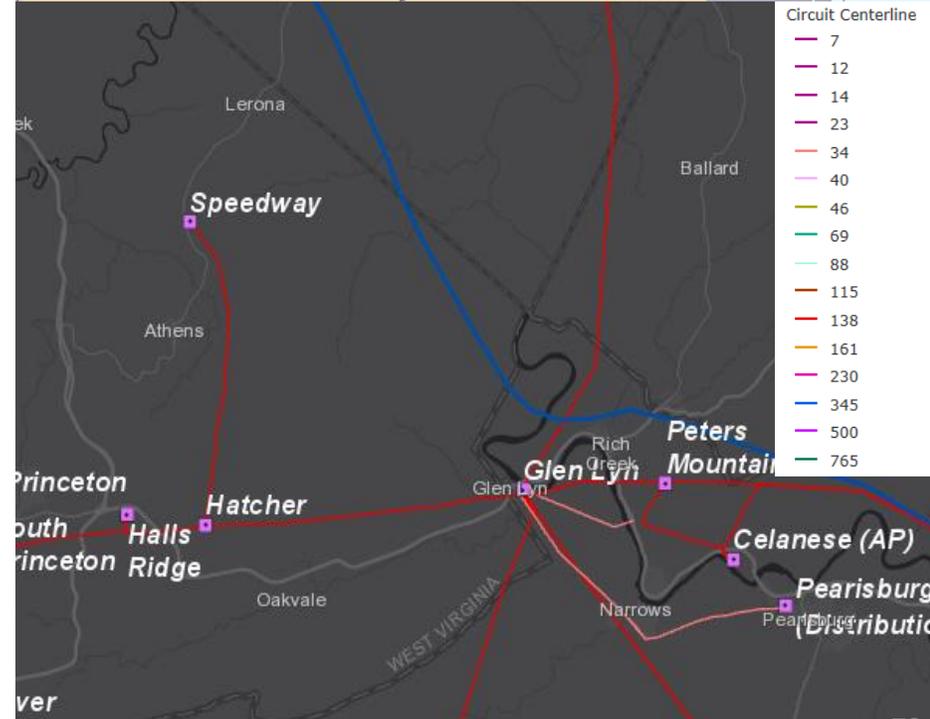
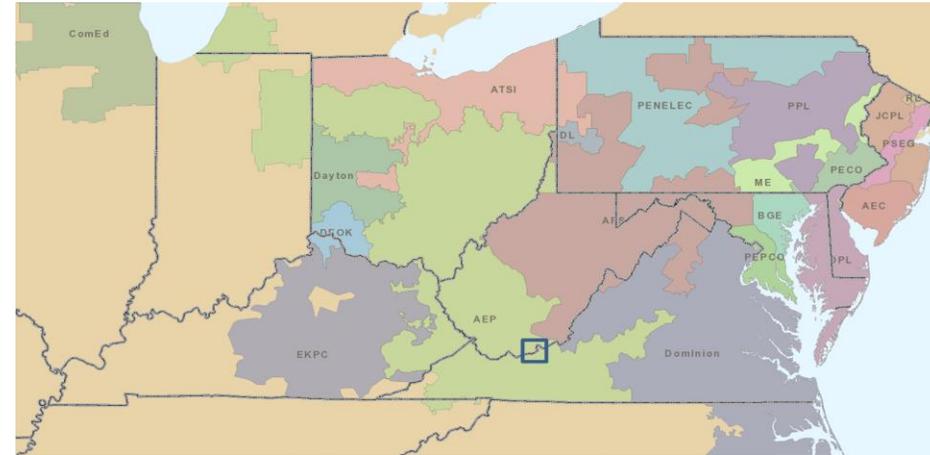
- There are 34 open conditions associated with the 1960s wood structures that comprise the 7.3 mile Speedway Tap that serves Speedway station. These conditions include damage due to woodpecker holes, damaged poles, and corroded cross-arms.

Glen Lyn – Hatcher 138 kV Line Section

- The Glen Lyn – Hatcher 138 kV line section utilizes double circuit lattice structures and conductor installed during the 1920s. The structures, conductor, hardware, and insulators on the line are displaying issues associated with their age.

Speedway Station

- Speedway station is currently radially served off the ~7.3 mile Speedway 138 kV Tap.
- Speedway station has 20 MW of nontransferable load (25 MW peak).



AEP Transmission Zone M-3 Process Mercer County, West Virginia

Need Number: AEP-2019-AP018
Process Stage: Solutions Meeting 3/19/2020

Proposed Solution:

Phase 1:

Construct approximately 10 miles of new 138kV line between Glen Lyn and Speedway. New ROW will be required for the new Glen Lyn – Speedway 138kV line. Retire the existing section of line from Glen Lyn to Hatcher Switch (~ 8 miles), including Hatcher Switch. **Estimated Cost: \$32.0M**

Retire Hatcher Switch. Install MOABs at Speedway on new line to Glen Lyn and existing line towards South Princeton. Install a circuit switcher on the Speedway transformer. **Estimated Cost: \$1.5M**

Phase 2:

Rebuild ~7.3 miles of the Glen Lyn – South Princeton 138 KV circuit between Speedway station and the previous Hatcher Switch. **Estimated Cost: \$21.9M**

Total Estimated Transmission Cost: \$55.4M

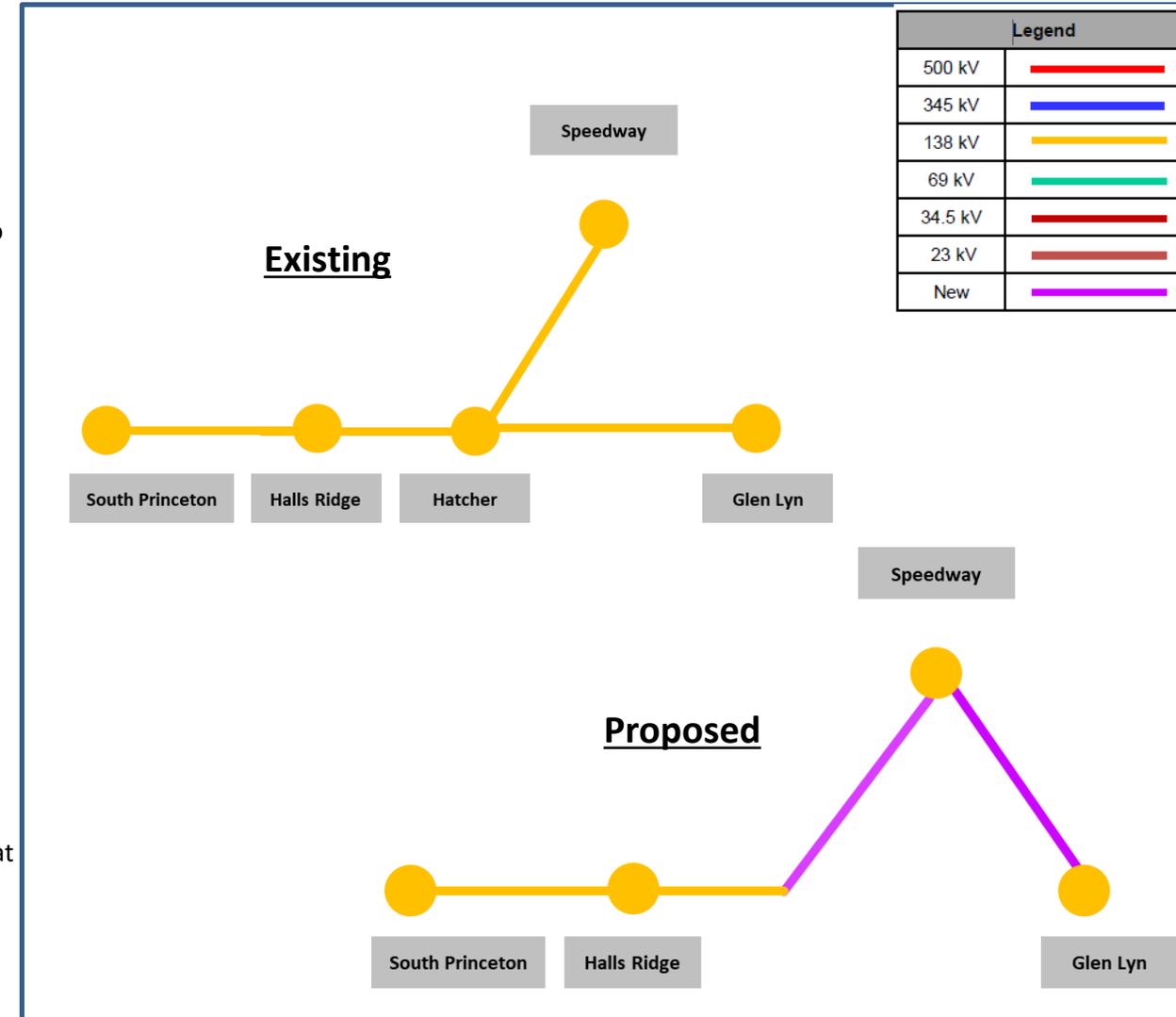
Alternative:

Rebuild ~8 miles of the Glen Lyn – South Princeton 138 KV circuit from Hatcher to Glen Lyn. Build ~7.3 miles double circuit to create In/Out loop to Speedway tapped off the Glen Lyn – Hatcher 138 KV line section. Retire Hatcher Switch. Install MOABs at Speedway on new line to Glen Lyn and existing line towards South Princeton. One MOAB will be set up for automatic sectionalizing, with the other having supervisory control capabilities. Remote end work will be required. This option is not ideal, given that that double circuit line would need to be built in the clear since we would be unable to sustain a long outage on the radial line. **Estimated Cost: \$55.0M**

Projected IS Date: Phase 1: 5/1/2023

Projected IS Date: Phase 2: 12/1/2026

Project Status: Scoping



Appendix

High Level M-3 Meeting Schedule

Assumptions	Activity	Timing
	Posting of TO Assumptions Meeting information	20 days before Assumptions Meeting
	Stakeholder comments	10 days after Assumptions Meeting
Needs	Activity	Timing
	TOs and Stakeholders Post Needs Meeting slides	10 days before Needs Meeting
	Stakeholder comments	10 days after Needs Meeting
Solutions	Activity	Timing
	TOs and Stakeholders Post Solutions Meeting slides	10 days before Solutions Meeting
	Stakeholder comments	10 days after Solutions Meeting
Submission of Supplemental Projects & Local Plan	Activity	Timing
	Do No Harm (DNH) analysis for selected solution	Prior to posting selected solution
	Post selected solution(s)	Following completion of DNH analysis
	Stakeholder comments	10 days prior to Local Plan Submission for integration into RTEP
	Local Plan submitted to PJM for integration into RTEP	Following review and consideration of comments received after posting of selected solutions

Revision History

3/9/2020 – V1 – Original version posted to pjm.com

3/12/2020 – V2 – Slide #35-37, updated bubble diagrams

3/19/2020 – V3 – Slide #23-24, removed AEP-2020-AP005

3/31/2020 – V4 – Slide #66-67, Changed AEP-2019-AP021 to AEP-2019-AP018

- Slide #19, #20 and #22, Changed AEP-2018-AP016 to AEP-2018-AP023

- Remove Slide #21

2/1/2021 – V5 – Slide #4-7, Update/Split AEP-2020-OH001 and added AEP-2020-OH050

10/4/2021 – V6 – Slide #6-7, Update/Split AEP-2020-OH050

- Slide #8-10, Added AEP-2020-OH051 and AEP-2020-OH052

9/1/2022 – V7 – Slide #6-9, Further split AEP-2020-OH050 into AEP-2020-OH050 and AEP-2020-OH053