

Sub Regional RTEP Committee: Western AEP Supplemental Projects

February 21, 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-2020-AP006

Process Stage: Needs Meeting 02/21/2020

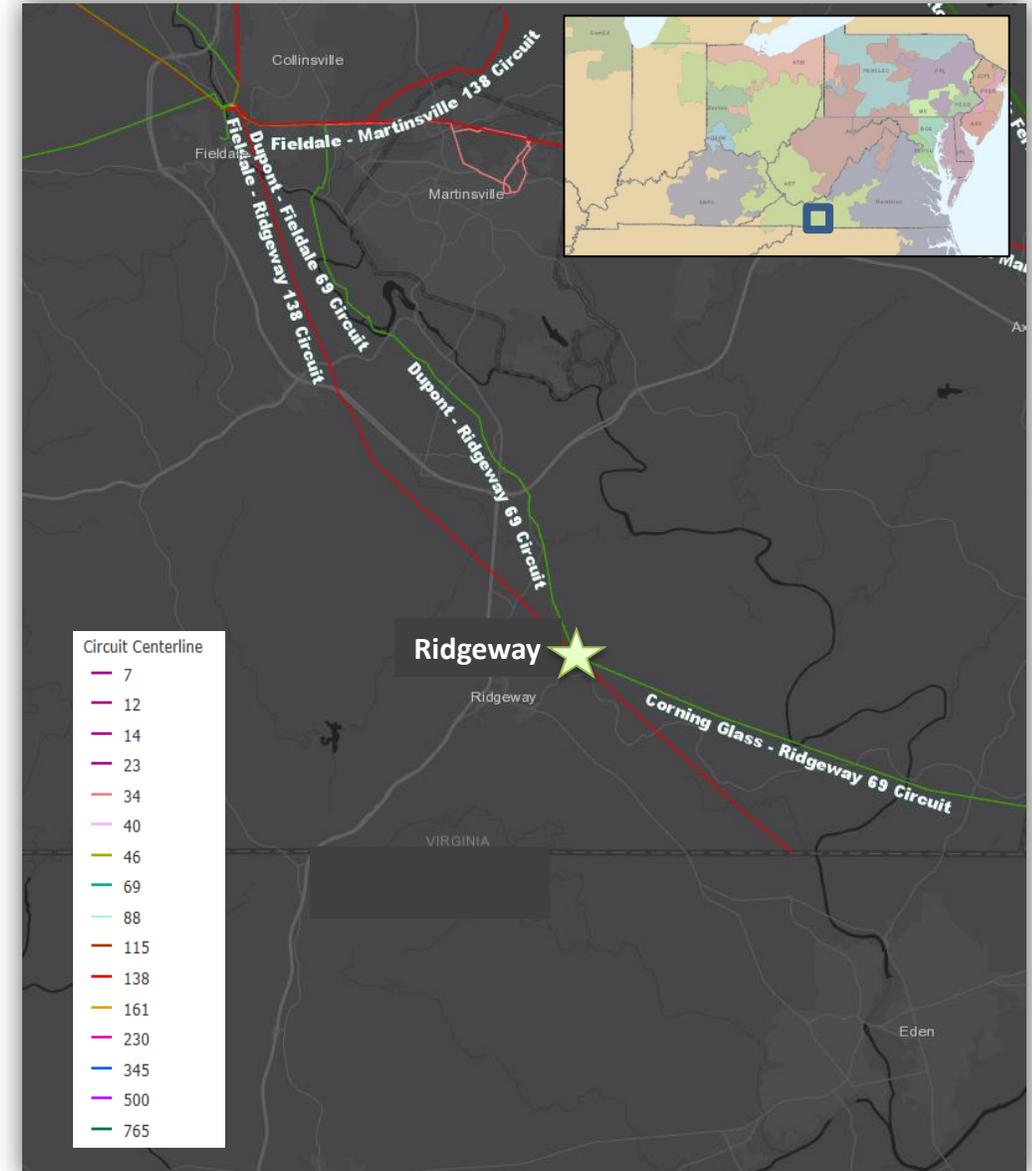
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

Ridgeway Station

- **138/69 kV Transformer 2A**
 - Manufactured in 1960
 - Elevated levels of ethylene, CO₂, and CO due to insulating paper breakdown.
 - The existing foundations for the transformer are wood tie foundations. Wood tie foundations cannot be patched or fixed like their concrete counterparts.
- **138 kV Series Reactors #1, #2 and spare**
 - Manufactured in 1944
 - All of the Reactor 2 units are showing reduced interfacial tension levels in the oil, indicating the beginnings of sludge generation. There are leaks on Reactor 2 Phase 2. The dielectric strength of the oil in the spare unit has continued to decline.
 - Reactor 1 Phase 2 has declining dielectric strength and rising moisture content. The reactor bushings are subject to leakage. The foundations are built with wood ties with signs of rot.
 - The spare unit has low interfacial tension on the oil, indicating contaminants and sludge in the oil itself. If needed, this unit would have impaired circulation and cooling capability.
 - None of the reactors have oil containment.

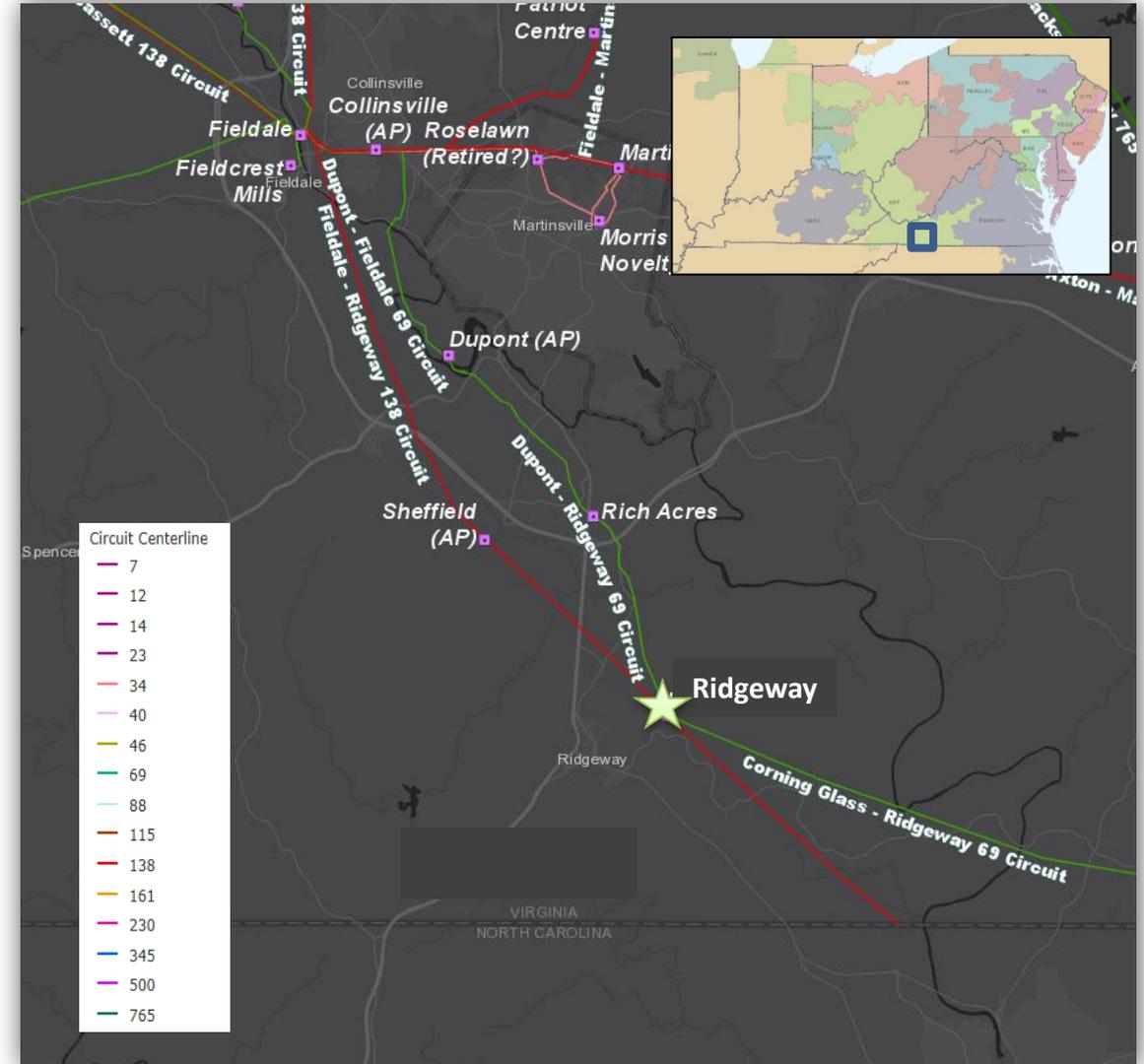


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• **Ridgeway Station**

- **138/34.5 kV Transformer 1**
 - Manufactured in 1972
 - Increased acetylene levels due to through faults and increased moisture levels due to gasket leaks and insulating paper breakdown.
- **138 kV circuit switchers U and V**
 - CS-U manufactured in 1979, CS-V manufactured in 1974
 - MARK V-138 model types lack a gas monitor and have a history of malfunction. Both of these circuit switcher models have presented AEP with a large amount of failures and mis-operations.
- **Relaying**
 - Currently, 41 of the 61 relays (67% of all station relays) are electromechanical type which have significant limitations with regards to spare part availability and fault data collection and retention in addition to a lack of vendor support.

Model: N/A



AEP Transmission Zone M-3 Process Wyoming County, WV

Need Number: AEP-2020-AP007

Process Stage: Need Meeting 2/21/2020

Supplemental Project Driver:

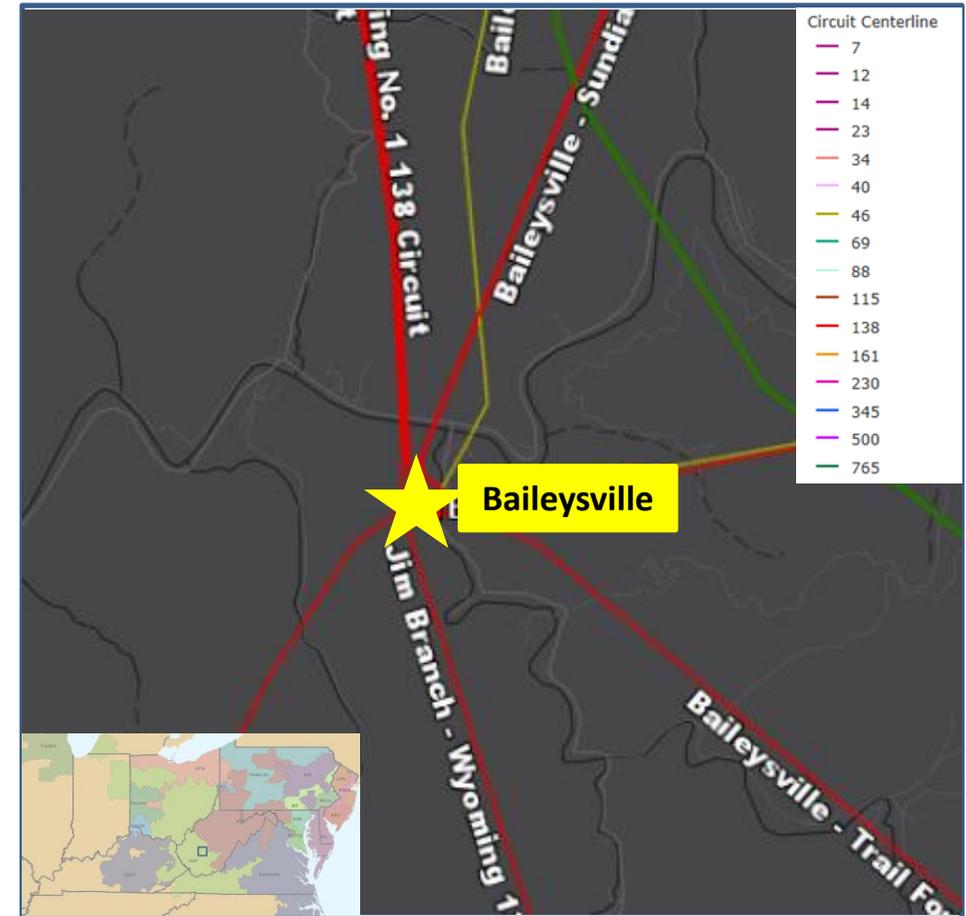
Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

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

Problem Statement:

- Baileysville Station
 - 138 kV circuit breakers G, H, I, K, L and N are SF6 filled type breakers, the only 6 of this specific type on AEP's system
 - Vintage 1980s
 - Limited manufacturer support
 - Obsolete parts that are not available for replacmeent.
 - 46 kV CS AA is an SF6 filled 2030-69 type circuit switcher
 - Vintage 1990s
 - S&C 2030 circuit switcher has no gas monitor and sister units have a history of malfuncitons
 - 138 kV CS CC is an SF6 filled MARK V-138 type circuit switcher.
 - Vintage 1990s
 - This type of switcher have presented AEP with a large amount of failures and mis-operations.
 - Mark V family has no gas monitor
 - Currently 79% of the relays at Baileysville Station are in need of replacement
 - 28 electromechanical and 8 static type relays
 - These type of relays have limitations with regard to fault data collection and retention.
 - Capacitor Bank BB, vintage 1976, has blown fuses and defective cans.
 - The station has seen significant flooding; as recently as 2009 the entire station flooded. In 2001, the control house was flooded with 1.5 feet of water.
 - The station has insufficient room for safe ingress/egress and for accessing equipment around the station.



Need Number: AEP-2020-AP008

Process Stage: Needs Meeting 02/21/2020

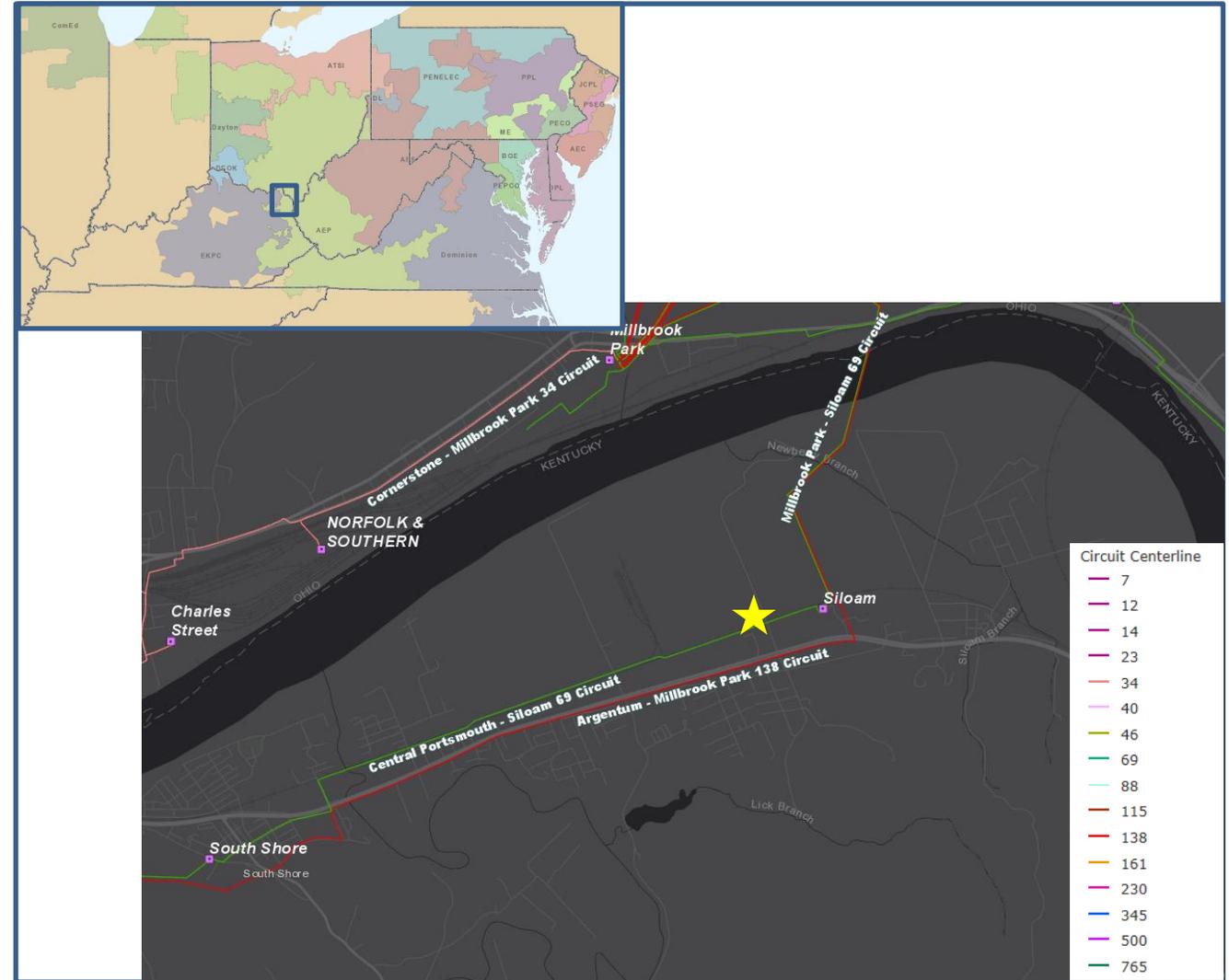
Supplemental Project Driver: Customer Service

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

Problem Statement:

- Kentucky Power has requested a new 69kV Transmission delivery point in Siloam area with a projected load of 9 MW.

Model: 2024 RTEP



Need Number: AEP-2020-AP009

Process Stage: Needs Meeting 02/21/2020

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

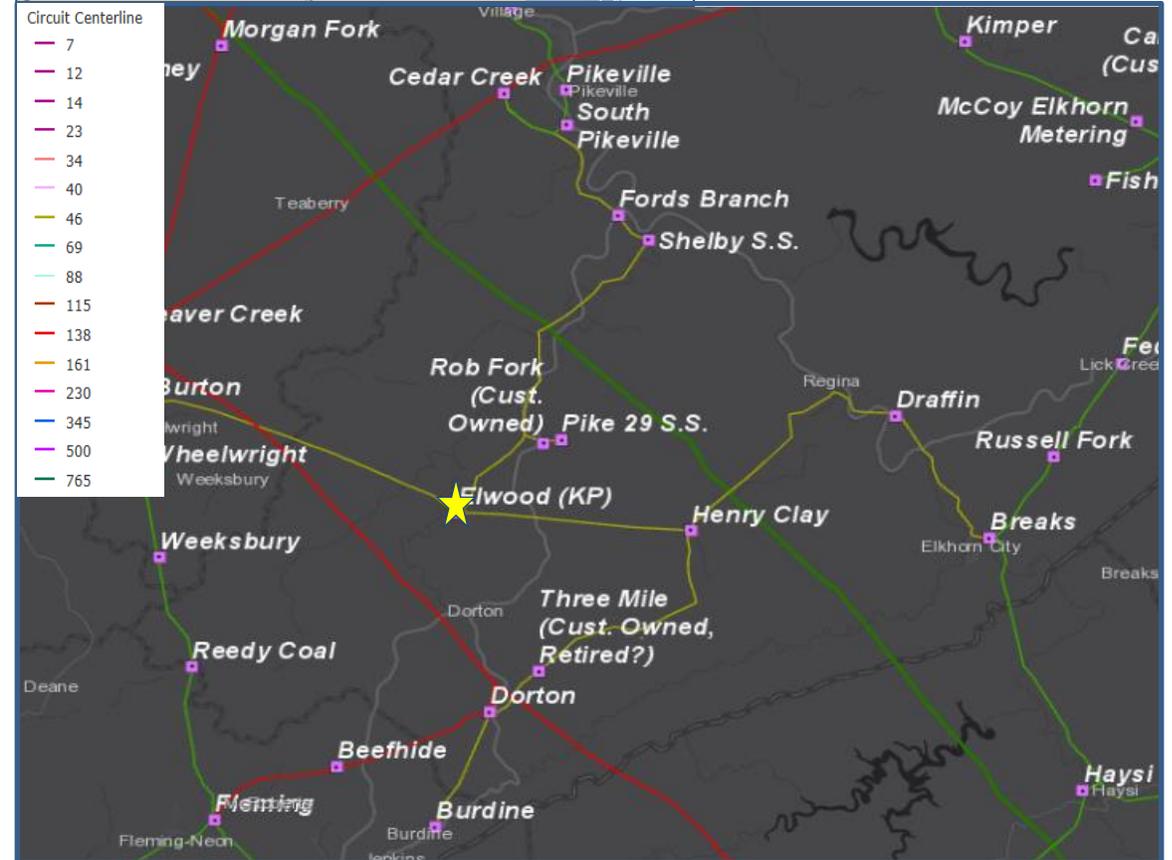
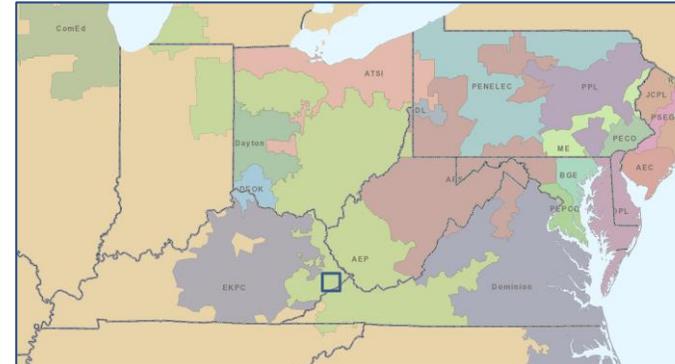
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Elwood 46kV Station:

46 kV Circuit Breakers A,B, and C

- 1960's vintage FZO-69-1500P type oil circuit breakers.
- Fault Ops: CB A (33), CB B (83), and CB C (105). Recommended : 10
- Other drivers: damage to bushings, spare part availability, historical reliability, and lack of vendor support of the breakers.
- There are 8 remaining FZO-69-1500P circuit breakers on the AEP system, including the 3 at this station.
- 86% of the relays (36/42) at the station are electromechanical, which have significant limitations with regards to fault data collection and retention and have no spare part availability due to a lack vendor support.



AEP Transmission Zone M-3 Process

Pike County, Kentucky

Need Number: AEP-2020-AP011

Process Stage: Needs Meeting 02/21/2020

Supplemental Project Driver:

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

Specific Assumption References:

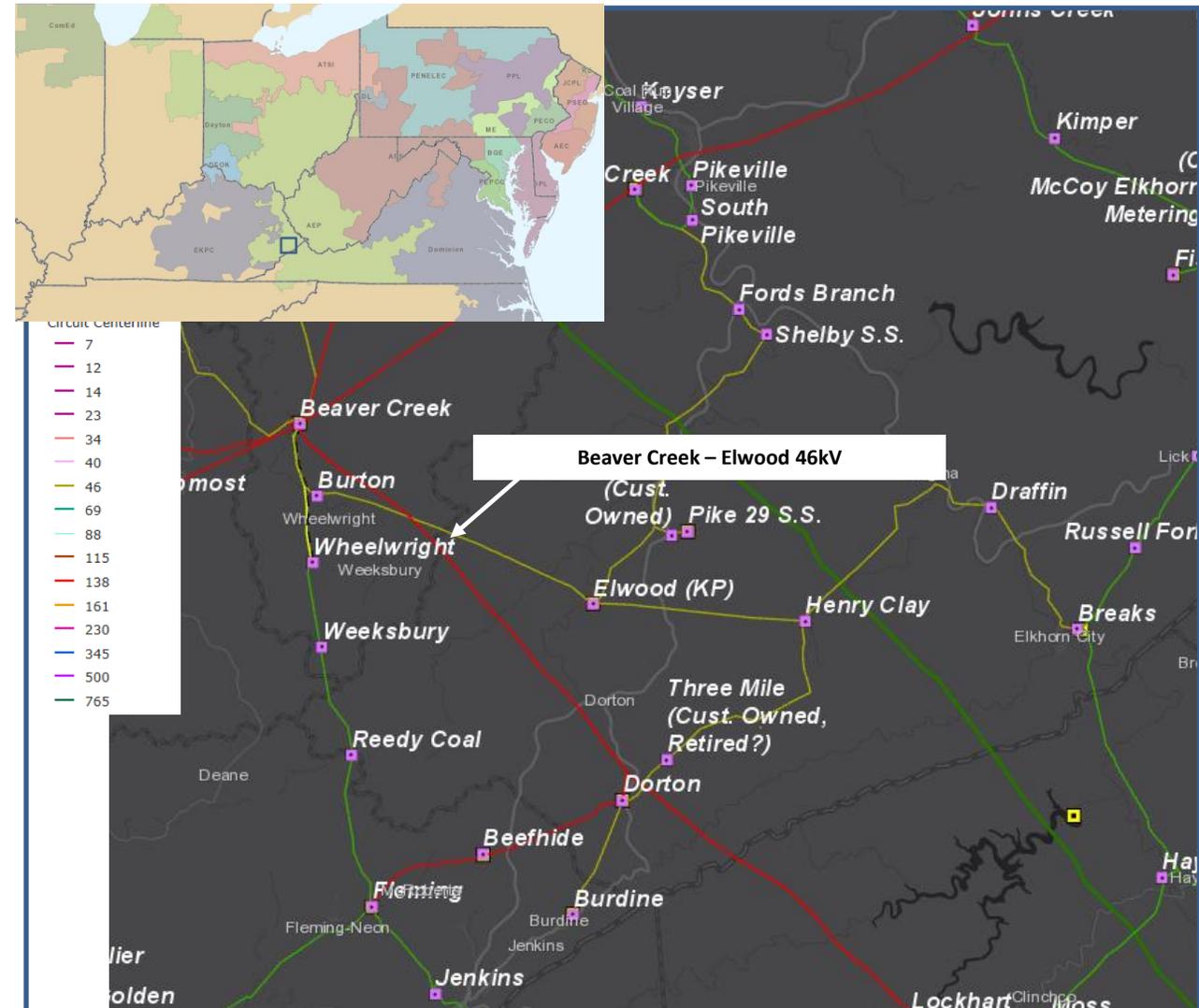
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Model: N/A

Problem Statement:

Beaver Creek – Elwood 46kV:

- Original Install Date: 1930s vintage
- Length of Line: ~10.48 mi
- Total structure count: 60
- Original Line Construction Type: Wood
- Conductor Type: 336 ACSR
- Momentary/Permanent Outages and Duration: 18 Momentary and 1 permanent Outage
- CMI (last 5 years only): 269,070 minutes
- Number of open conditions: 34 open conditions on 20 unique structures.
- Open conditions include crossarms and poles with rot top, woodpecker damage and leaning-in-line conditions.



AEP Transmission Zone M-3 Process Pike County, Kentucky

Need Number: AEP-2020-AP012

Process Stage: Needs Meeting 02/21/2020

Supplemental Project Driver:

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

Specific Assumption References:

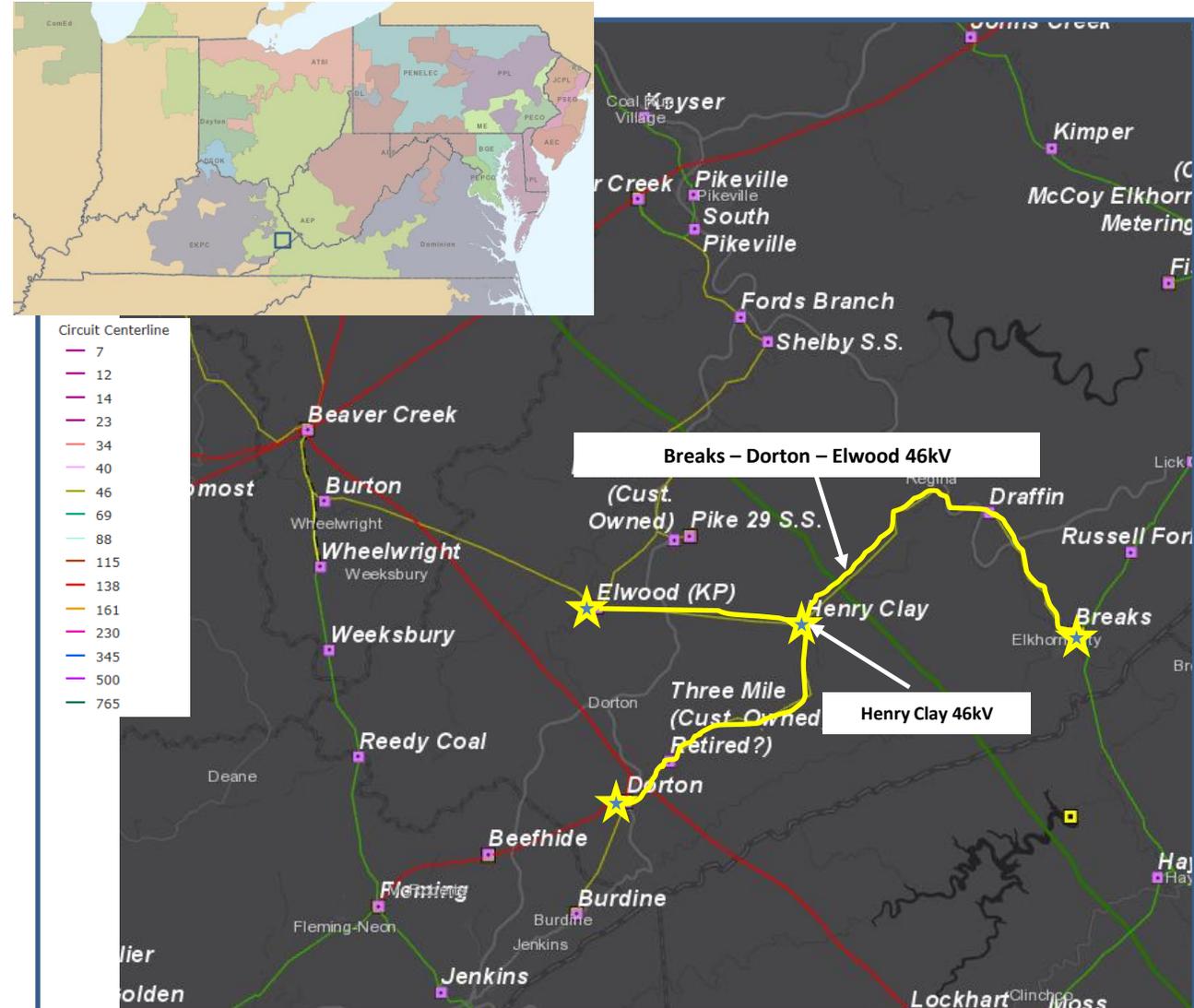
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Model: N/A

Problem Statement:

Breaks– Dorton - Elwood 46kV:

- Original Install Date: 1960s
- Length of Line: ~26 mi
- Total structure count: 135
- Original Line Construction Type: Wood
- Conductor Type: 336 ACSR
- Momentary/Permanent Outages and Duration: 38 momentary and 4 permanent
- CMI (last 5 years only): 99,556
- Number of open conditions by type / defects / inspection failures: 191 open conditions on 74 unique structures
- Open conditions include: Crossarms or braces with rot, woodpecker damage, and bowed conditions.
- There is a three terminal line at Henry Clay substation



Need Number: AEP-2020-AP013

Process Stage: Needs Meeting 02/21/2020

Supplemental Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference:

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

Problem Statement:

Fort Robinson Station

Circuit Breaker E (69 KV):

- Circuit breaker E is 52 years old, CG/CF, oil filled type breaker without oil containment; oil filled breakers have much more maintenance required due to oil handling and spills can result in significant mitigation cost.
- It has experienced 113 fault operations — exceeding manufacturer’s recommended number of 10.

Circuit Breaker D (34.5 KV) Concerns:

- Circuit breaker D is 36 years old, CG, oil filled without oil containment; oil filled breakers have much more maintenance required due to oil handling and spills can result in significant mitigation cost.
- It has experienced 33 fault operations — exceeding manufacturer’s recommended number of 10.
- CB D is 1 of only 27 remaining of the CG-48-72.5-31.5-1200 models on the AEP system. The manufacturer provides no support for the CF/CG/CGH/CH family of circuit breakers and spare parts are increasingly more difficult to obtain. This model has experienced major malfunctions associated with their OA-3 hydraulic mechanism, which includes low-pressure readings, hydraulic leaks, pump lockouts, and failure to shut off.

Transformer 1 (138/69-34.5 KV) :

- The current low side GOAB switch on the tertiary side of 1 Bank is incapable of load breaking.
- MOAB/Ground SW configuration on the high side of the transformer.
- Grounding bank is 48 years old with elevated levels of acetylene. This concentration of acetylene indicates excessive internal component decomposition due to arcing within the tank.

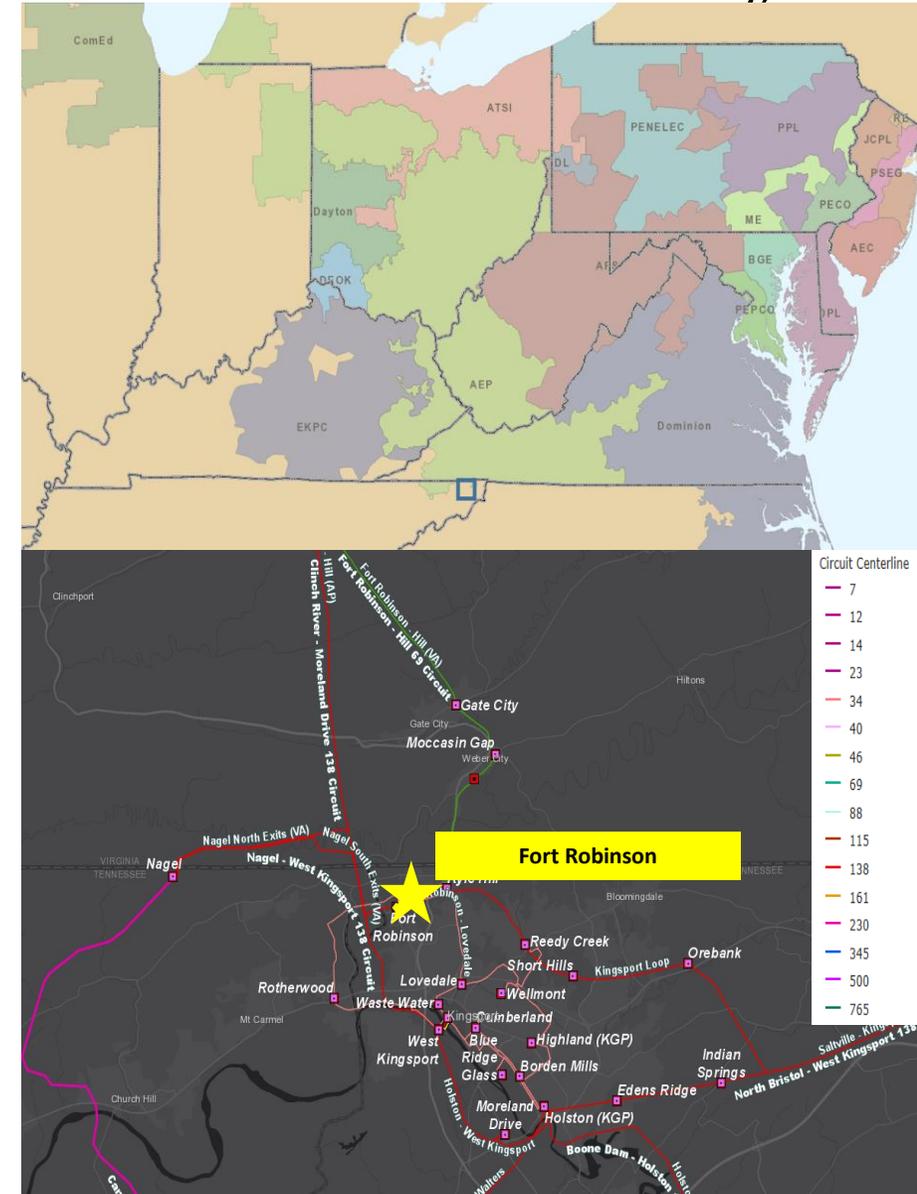
Relay Concerns:

- There are 33 electromechanical type relays (82% of all relays at the station) which have significant limitations with regards to fault data collection and retention.
- There are 4 microprocessor based relays with unsupported firmware and lack of vendor support.

Operations Concerns:

- Fort Robinson Station is served off of the Nagel – Wolf Hills 138 kV circuit which is 39.11 miles long without CB sectionalizing.

AEP Transmission Zone: Supplemental Sullivan County, TN



Need Number: AEP-2020-AP014

Process Stage: Needs Meeting 02/21/2020

Supplemental Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference:

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

Problem Statement:

Hill Station

Circuit Breaker H (69 KV):

- Circuit breaker H is 52 years old, CF model type, oil filled type breaker filled without oil containment; oil filled breakers have much more maintenance required due to oil handling and oil spills can result in significant mitigation cost. Spare parts for these units are difficult to impossible to procure.
- 91 fault operations — exceeding manufacturer’s recommended number of 10.

Circuit Switcher AA (69 KV):

- Circuit switcher AA is 25 years old, 2030-69, SF6 type breaker. This type of circuit switcher has no gas monitor and sister units have a history of malfunctions, including gas loss, interrupter failures, and operating mechanism failures.

Transformer 1 (138/69-34.5 KV) Concerns:

- Transformer bank 1 is 63 years old with elevated levels of carbon dioxide and moisture and a decrease in dielectric strength.
- The current MOAB/Ground SW configuration on the high side of the transformer

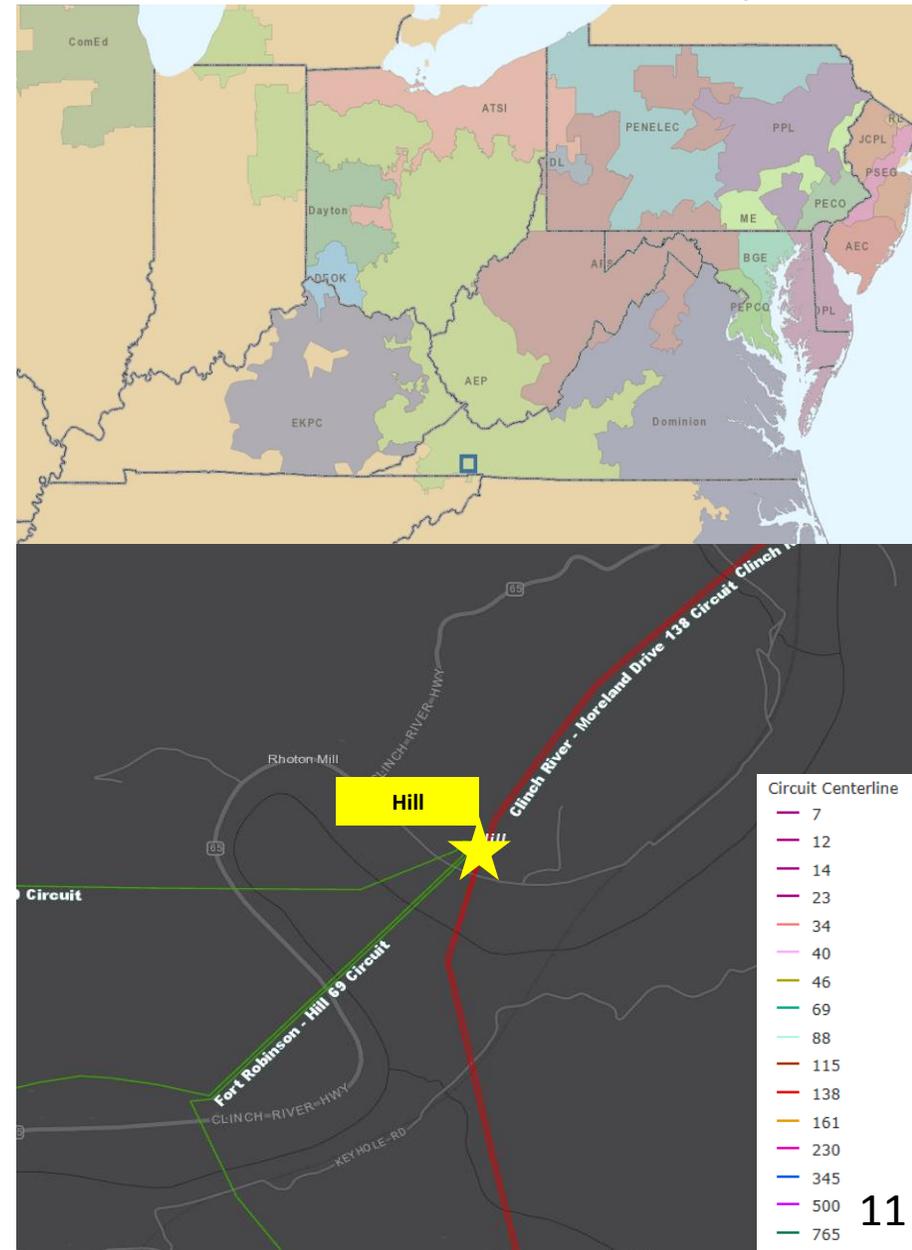
Relays

- 20 relays (53%) are of the electromechanical type which have limitations with regards to fault data collection and retention.
- These relays lack vendor support and have no access to spare parts.

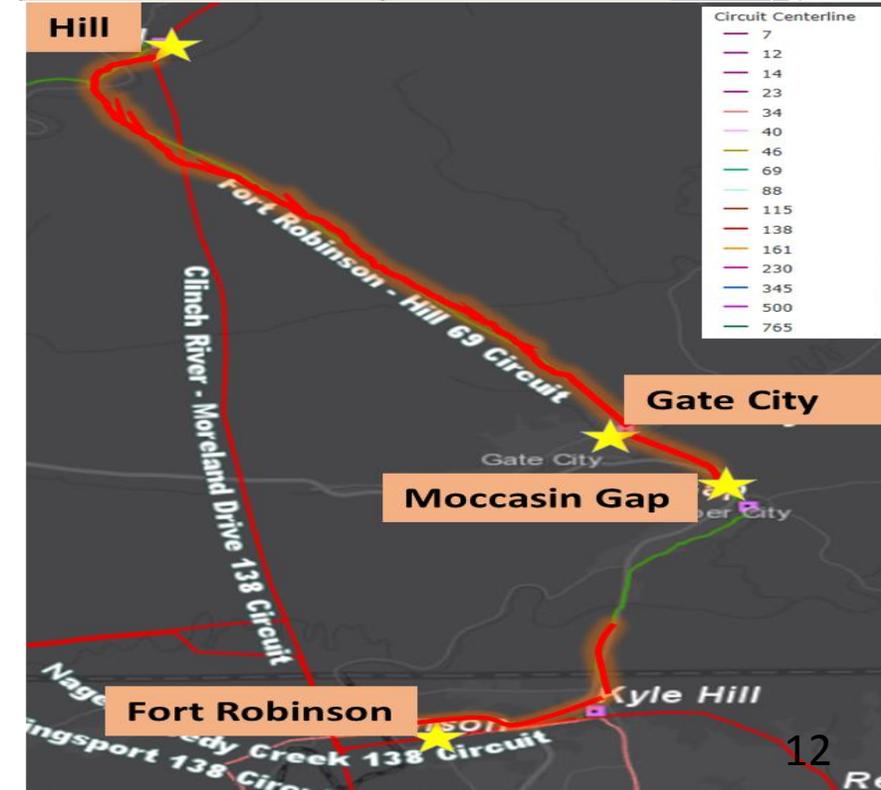
Operations Concerns:

- Hill Station is served off of the Clinch River – Nagle 138 kV circuit which is 41.61 miles long without CB sectionalizing.

AEP Transmission Zone: Supplemental Scott County, VA



AEP Transmission Zone: Supplemental Sullivan County, Tennessee/ Scott County, Virginia



Need Number: AEP-2020-AP015

Process Stage: Needs Meeting 02/21/2020

Supplemental Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference:

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

Problem Statement:

Fort Robinson —Hill 69 KV (installed in 1970)

- Length: 12.7 Miles
- Original Construction Type: Wood (86% original)
- Original Conductor Type (91% original): 219.9 ACSR, 1/0 CU, 336 ACSR, 4/0 ACSR, and 556 ACSR
- Momentary/Permanent Outages: 7 momentary, 8 permanent (5 years)
- CMI: 5,721,762
- Total structure count: 127
- Number of open conditions: 120
 - Open conditions include: broken conductor strands, broken/burnt insulators, split Bayonet, cracked X-Brace.
- Unique structure count with open conditions: 95 (44%)
- Additional Info:
 - There have been 5 weather related momentary outages, with 4 of those being attributed to lightning as well as 1 permanent outage. These lightning caused outages are indicative of insufficient shielding and/or insufficient grounding

Note: ~1.5 mile 1/0 Cu conductor section of the ~ 5 miles Fort Robinson – Moccasin Gap 69 KV line section was addressed under b3101

AEP Transmission Zone M-3 Process Mason County, WV

Need Number: AEP-2020-AP016

Process Stage: Need Meeting 2/21/2020

Supplemental Project Driver: Equipment Condition/Performance/Risk

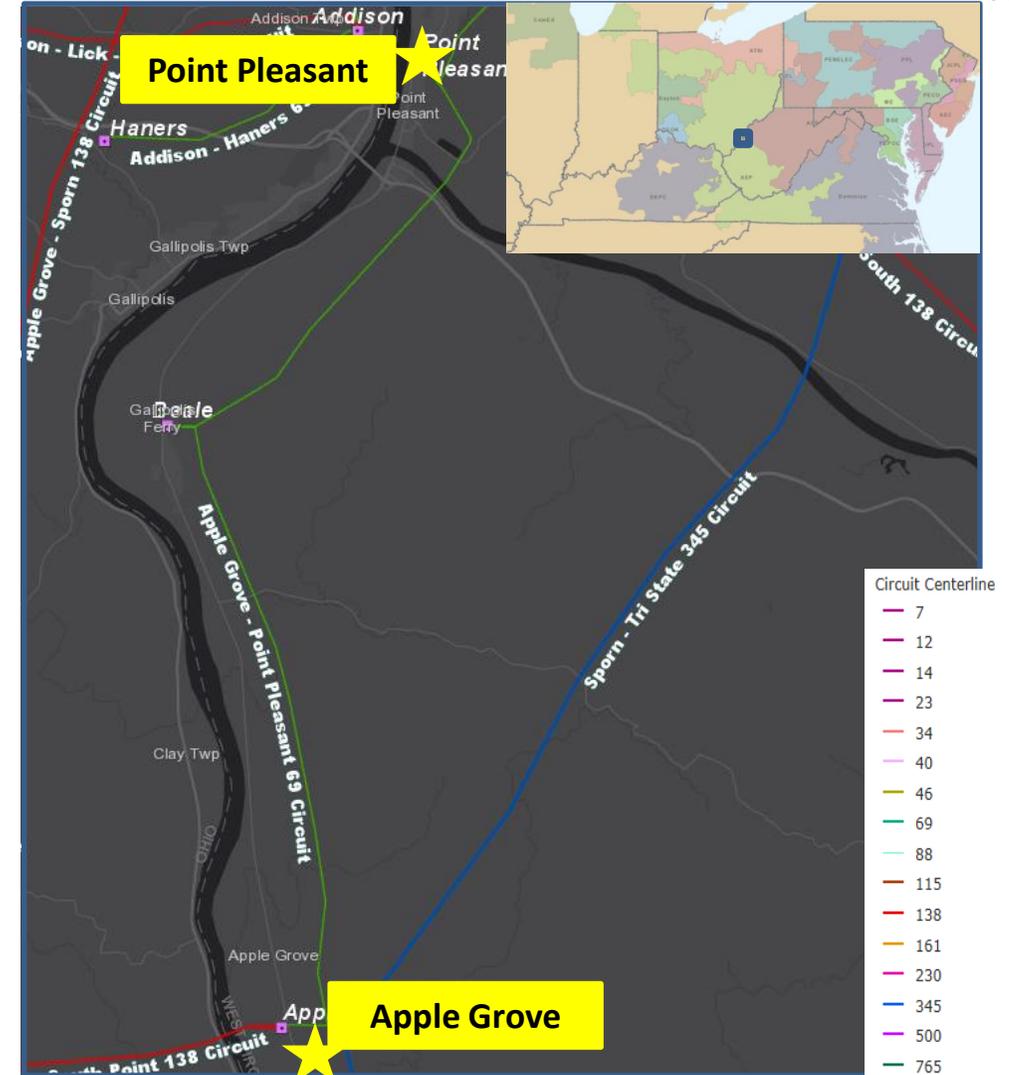
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Apple Grove – Point Pleasant 69 kV (17 miles)

- The line consists of mainly 1960s wood pole structures. The circuit utilizes steel lattice towers with grillage foundations on the Big Sandy River Crossing.
 - The circuit was originally installed in 1960, primarily with 4/0 ACSR conductor and 5-bell porcelain insulators.
 - Structures on the line failed to meet 2017 NESC Grade B loading criteria, failed to meet current AEP structural strength requirements, and failed to meet current ASCE structural strength requirements
 - The insulators do not meet current AEP standards for CIFO and minimum leakage distance requirements.
 - There are currently 79 structures (61% of the line) with at least one open condition
 - A total of 171 open conditions on the line, related to damaged/worn shield wires, rotted crossarms and poles, woodpecker damage, broken or burnt insulators.
- Since 2014 there have been 6 momentary and 6 permanent outages on the circuit
- CMI: 1.5 million

Model: N/A



AEP Transmission Zone M-3 Process Mason County, WV

Need Number: AEP-2020-AP017

Process Stage: Need Meeting 2/21/2020

Supplemental Project Driver: Equipment Condition/Performance/Risk

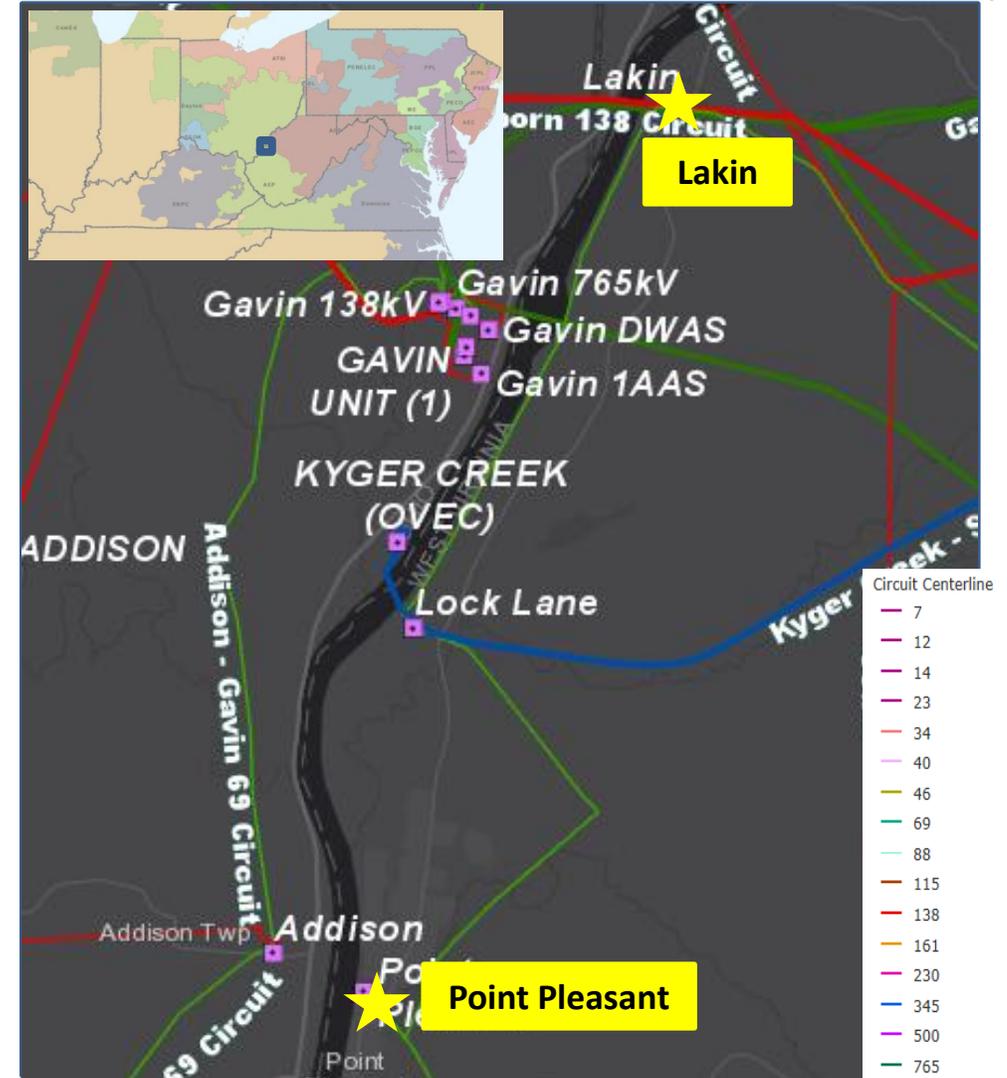
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Lakin – Point Pleasant 69 kV (11 miles)

- The line entirely consists of 1960s wood pole structures with 4-bell porcelain insulators
 - Line was originally installed in 1966, with a combination of 556 ACSR and 3/0 ACSR conductor
 - Structures on the line failed to meet 2017 NESC Grade B loading criteria, failed to meet current AEP structural strength requirements, and failed to meet current ASCE structural strength requirements
 - The insulators do not meet current AEP standards for CIFO and minimum leakage distance requirements.
 - There are currently 95 structures (86% of the line) with at least one open condition
 - A total of 222 open conditions on the line, related to damaged/worn shield wires, rotted crossarms and poles, woodpecker damage, broken or missing ground wire leads, broken or loose guys.
- Since 2014 there have been 17 momentary and 7 permanent outages on the circuit
- CMI: 3.1M

Model: N/A



AEP Transmission Zone M-3 Process Mason County, WV

Need Number: AEP-2020-AP018

Process Stage: Need Meeting 2/21/2020

Supplemental Project Driver: Equipment Condition/Performance/Risk

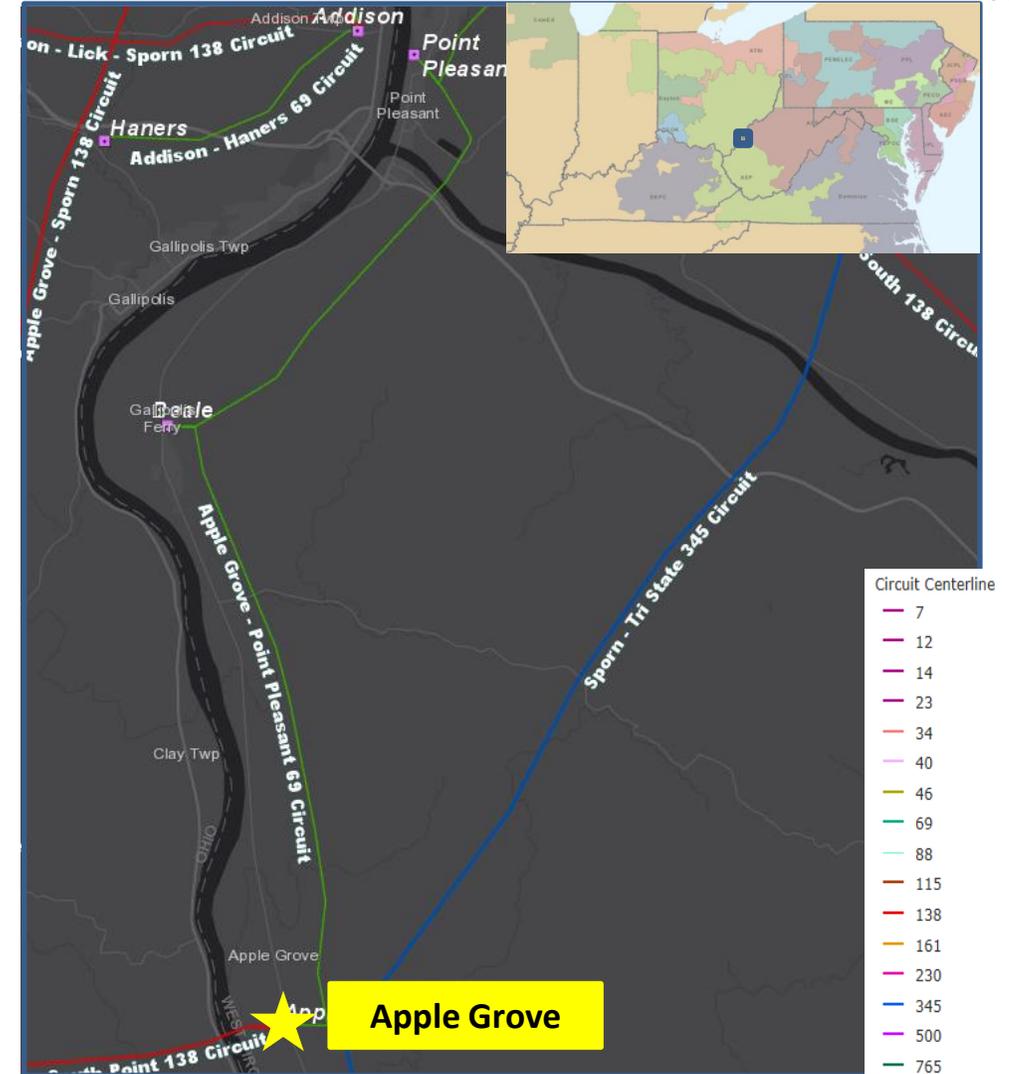
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Apple Grove Station

- 69 kV circuit breaker L is an FK type oil filled breaker, without oil containment.
 - 1960s vintage
 - Oil filled breakers need more maintenance due to the oil handling required and oil spills can result in significant cost associated with environmental mitigations
 - The manufacturer does not provide support for this type of breaker and spare parts are increasingly more difficult to obtain.
- 138/69 kV transformer bank #1 was manufactured in 1965
 - Elevated moisture levels
 - Elevated Carbon Monoxide and Carbon Dioxide levels
 - Indicates abnormal paper insulation deterioration
 - In 2004 one fan was destroyed by a failed fan blade
 - Oil containment inspection indicates deficiencies in the existing containment
 - The bank is connected directly to the 138 kV bus with a high side MOAB switch.
 - This can cause a fault in the station to signal the remote end breakers to open which is a known safety hazard in legacy station designs.
- 54 of the 66 relays (82% of all station relays) have needs associated with them
 - 51 are electromechanical type and 3 are static type which have significant limitations with regards to spare part availability and fault data collection/retention
- Overlapping zones of protection in existing station configuration
 - Apple Grove – Point Pleasant 69 kV line terminates directly into the 69 kV bus

Model: N/A



AEP Transmission Zone M-3 Process Mason County, WV

Need Number: AEP-2020-AP019

Process Stage: Need Meeting 2/21/2020

Supplemental Project Driver: Equipment Condition/Performance/Risk

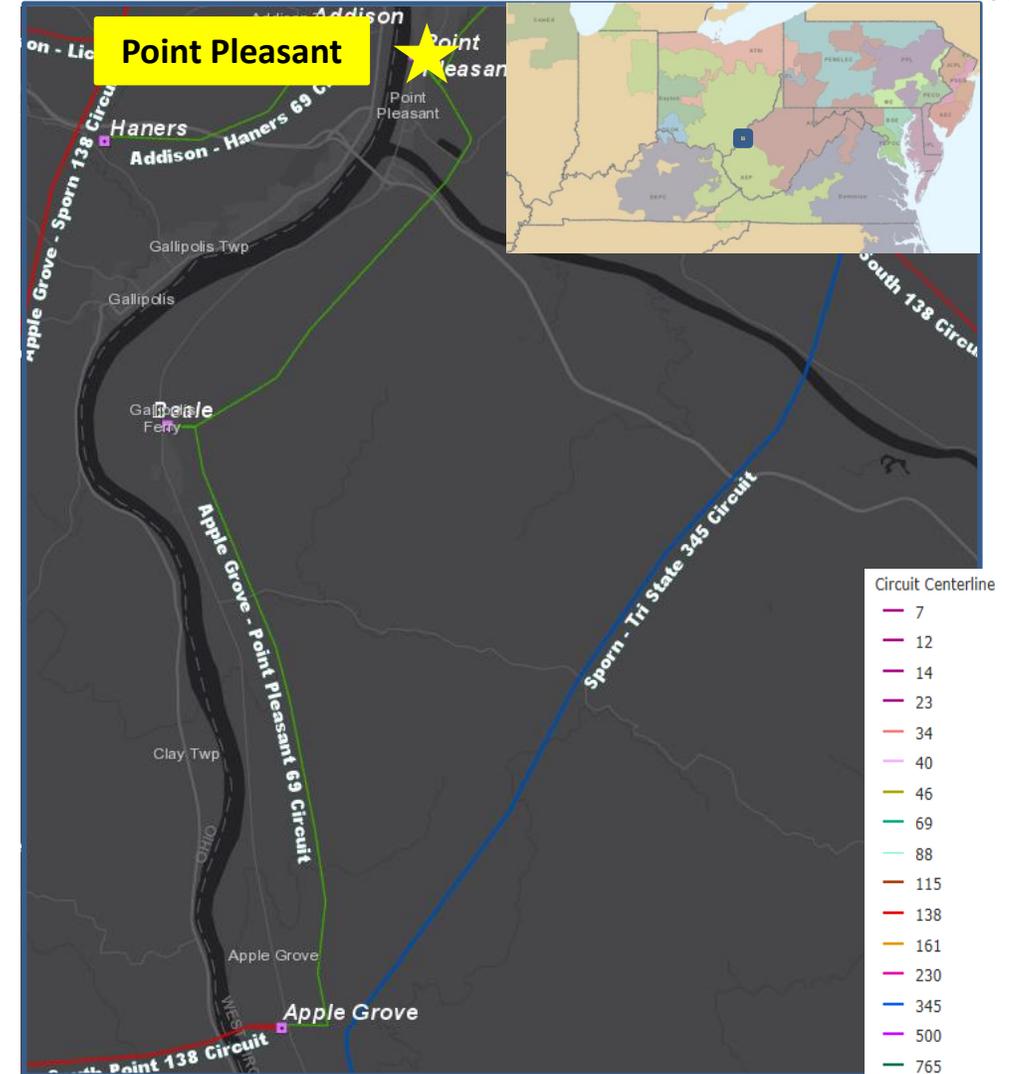
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Point Pleasant Station

- 69 kV circuit breakers G and H are an CF type oil filled breaker, without oil containment.
 - 1968 vintage
 - Oil filled breakers need more maintenance due to the oil handling required
 - The manufacturer does not provide support for this type of breaker and spare parts not available.
 - Oil spills can result in significant mitigation costs.
- 69 kV circuit switcher AA is a 2030-69 type SF6 switcher.
 - 1991 vintage
 - S&C 2030 circuit switcher has no gas monitor and sister units have experienced numerous malfunctions
- 39 out of the 40 relays (98% of all station relays) are in need of replacement
 - 34 relays are electromechanical type and 5 static type which have significant limitations with regards to fault data collection and retention.

Model: N/A



AEP Transmission Zone M-3 Process Berrien Springs-Colby

Need Number: AEP-2020-IM001

Process Stage: Needs Meeting 02/21/2020

Supplemental Project Driver: Equipment
Condition/Performance/Risk

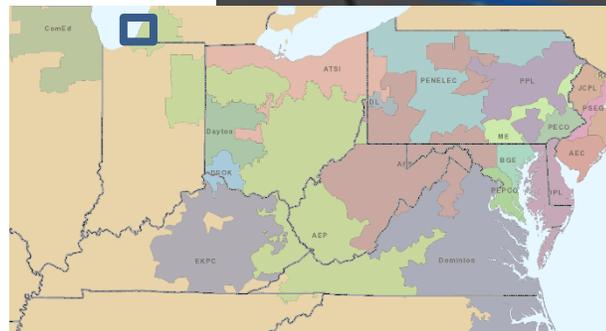
Specific Assumption Reference: AEP Guidelines for Transmission
Owner Identified Needs (AEP Assumptions Slide 8)

Model: N/A

Problem Statement:

Berrien Springs-Colby 69kV line

- 15.72 miles of wood pole structures with horizontal insulators rebuilt in 1995
- 148 structures with at least one open condition, 31% of the structures on the line
 - Open conditions include insect or woodpecker damage, broken or stolen ground wire conditions, and broken or burnt insulators
- Outages: 2 permanent since 2015
- CMI: 297,132



AEP Transmission Zone M-3 Process Main Street-Riverside

Need Number: AEP-2020-IM002

Process Stage: Needs Meeting 02/21/2020

Supplemental Project Driver: Equipment Condition/Performance/Risk

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

Model: 2024 RTEP

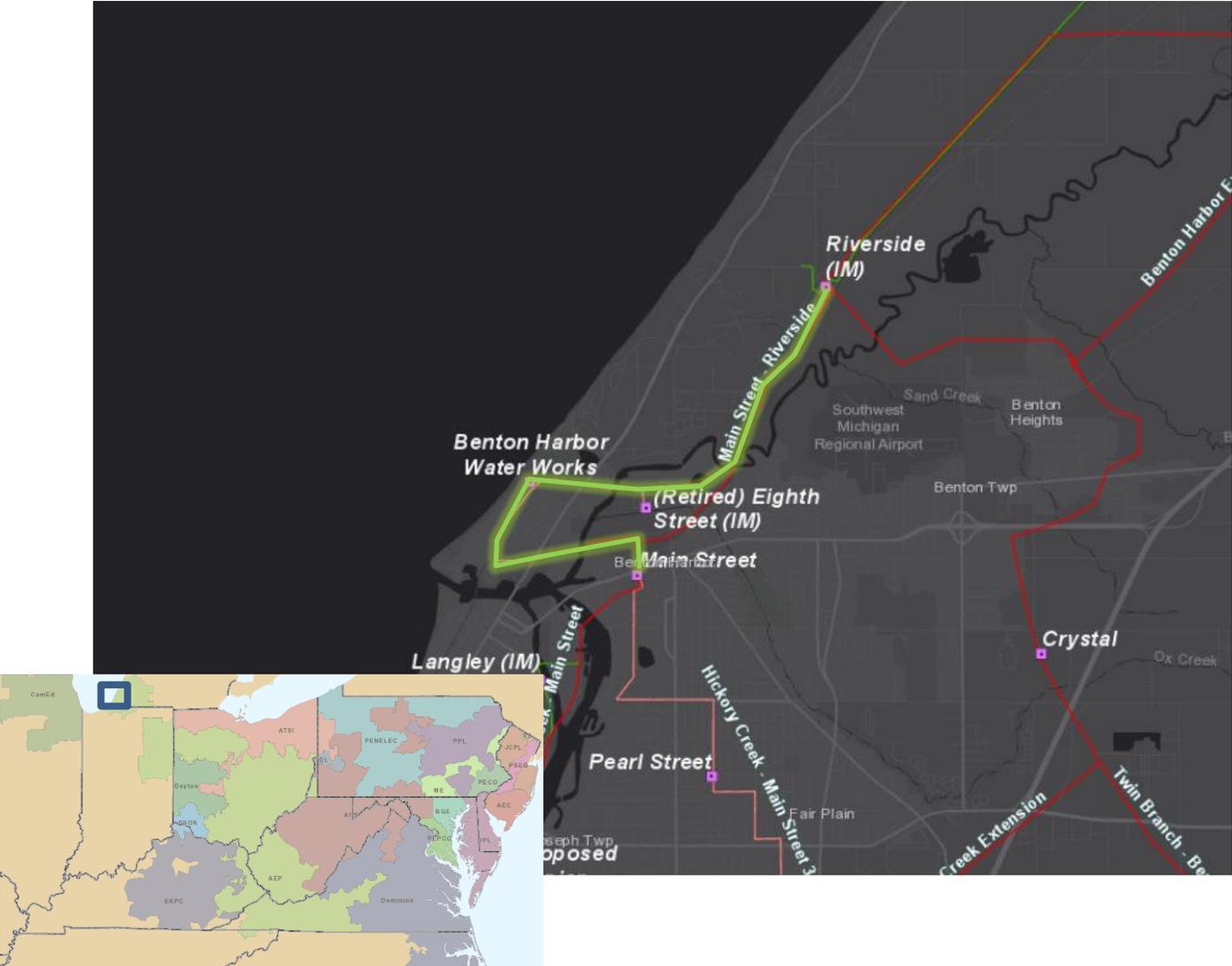
Problem Statement:

Main Street-Riverside 34.5kV line:

- 4.1 miles of the 4.6 mile 34.5kV line from Main St. –Riverside 34.5kV:
 - 1930's double circuit steel lattice towers and 1950's wood pole line with cross arm construction
 - 15 structures with at least one open condition (21% of the line)
 - Open conditions include pole leaning, rot, woodpecker or insect damage

Riverside Station:

- There are (2) 34.5kV oil filled breakers of FK-type 1960's vintage
 - Circuit breaker G has exceeded it's manufacturer designed number of fault operations
 - The common failure mode documented by AEP are compressor failures and valve defects which cause low pressure and oil leaks
 - The manufacturer no longer provides support for this fleet of circuit breakers. Spare parts are not available.



AEP Transmission Zone M-3 Process Buchanan Hydro

Need Number: AEP-2020-IM003

Process Stage: Needs Meeting 02/21/2020

Supplemental Project Driver: Equipment Condition/Performance/Risk

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

Model: N/A

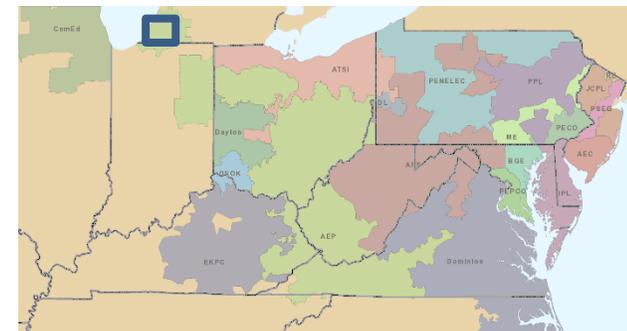
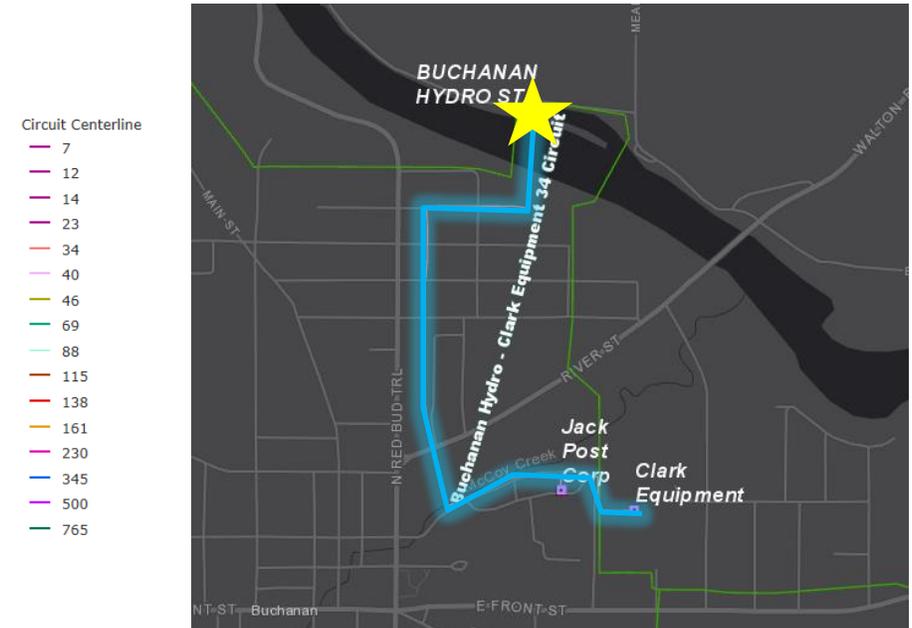
Problem Statement:

Buchanan Hydro Station:

- Buchanan Hydro station has flooded twice in the last 5 years causing the 12kV load to be dropped from the station.
- (2) FK-type Oil filled breakers, AEP has common failure modes for these types of breakers with compressor failures, valve defects, reclose failures and charging motor failures.
 - Both breakers installed in 2003
 - Breaker A has exceeded the designed number of fault operations
- (2) CF-Type oil filled breakers. This model family has experienced major malfunctions associated with their hydraulic mechanisms which have led to several failures to close and other types of mis-operations.
 - Both breakers have exceed the designed number of fault operations
- Transformer #1 was installed in 1964. The transformer has elevated levels of carbon dioxide and ethylene, there is indication of overheating faults occurring in the main tank which have further degraded the insulating paper materials. There is also indication of capacitive layer deterioration.
- Transformer #2 was installed in 1965. The age of the unit's insulation materials can lead to susceptibility of short circuit faults which may cause failure in the main tank. The transformer has elevated levels of carbon dioxide and ethylene, there is indication of overheating faults occurring in the main tank which have further degraded the insulating paper materials

Buchanan Hydro –Clark Equipment Tap 34.5kV:

- 1.36 miles of 1954 and 1984 wood pole cross arm line
- 10 unique structures (26%) with at least one open condition
- Open conditions include pole or cross arm with rot conditions



AEP Transmission Zone: Supplemental Winchester, Indiana and surrounding area

Need Number: AEP-2020-IM004

Meeting Date: Needs Meeting 02/21/20

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

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

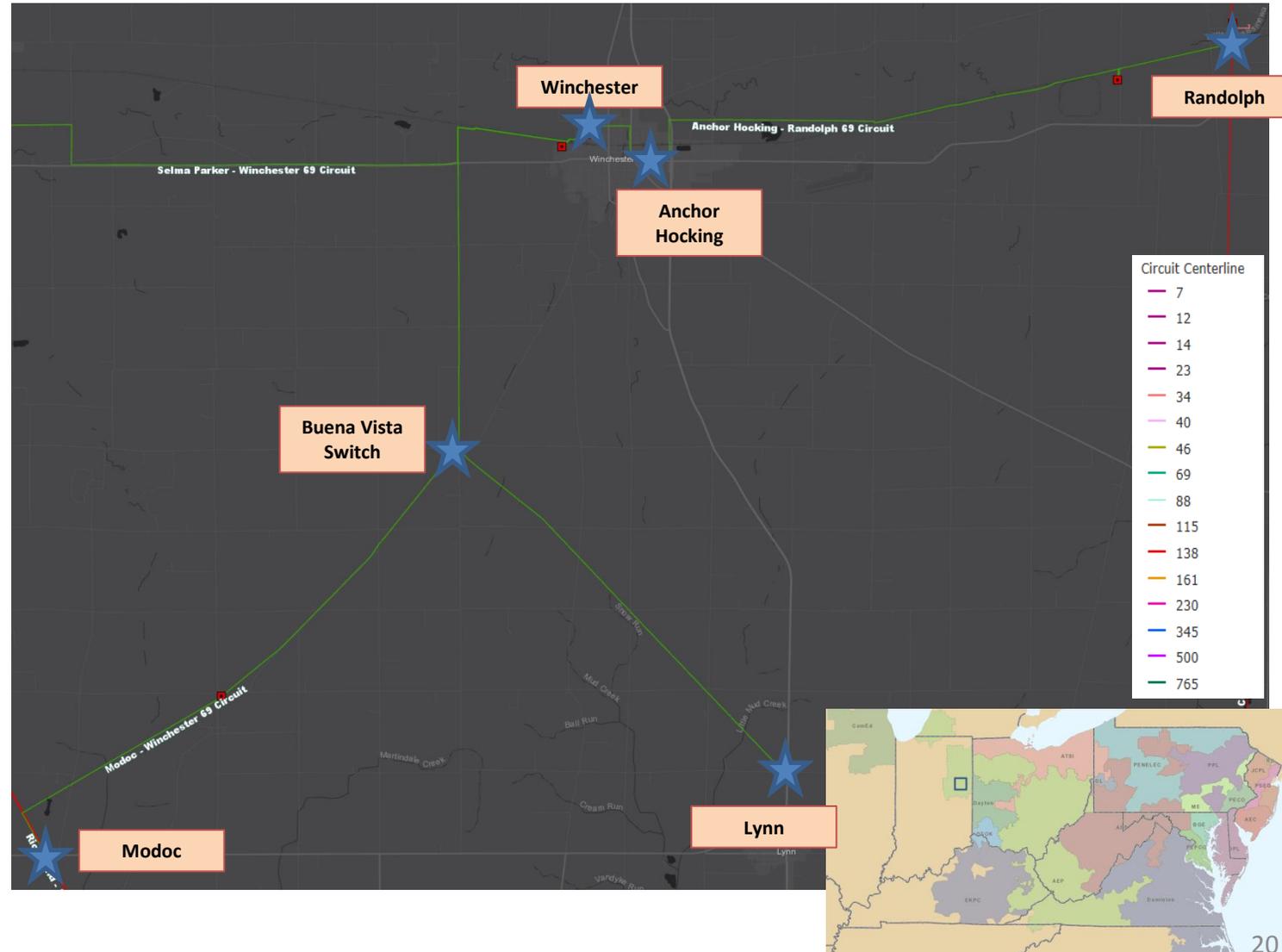
Problem Statement:

Anchor Hocking – Winchester 69kV Line (~1.25 Miles)

- 1968 vintage wood pole, crossarm construction
- There are currently 12 open conditions on this line (11 structures with at least one open condition or 25% of the line).
- Open conditions include: Damaged pole, worn shield wires, stolen ground lead wires, and damaged jumpers.

Anchor Hocking 69kV station

- Breaker B 69kV
 - 1972 vintage oil filled, CF-type breaker. This type is oil filled without oil containment. Oil filled breakers have much more maintenance required due to oil handling that their modern, vacuum counterparts do not require. Finding spare parts for these units not possible as these models are no longer vendor supported



AEP Transmission Zone: Supplemental Winchester, Indiana and surrounding area

Need Number: AEP-2020-IM004

Meeting Date: Needs Meeting 02/21/20

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

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

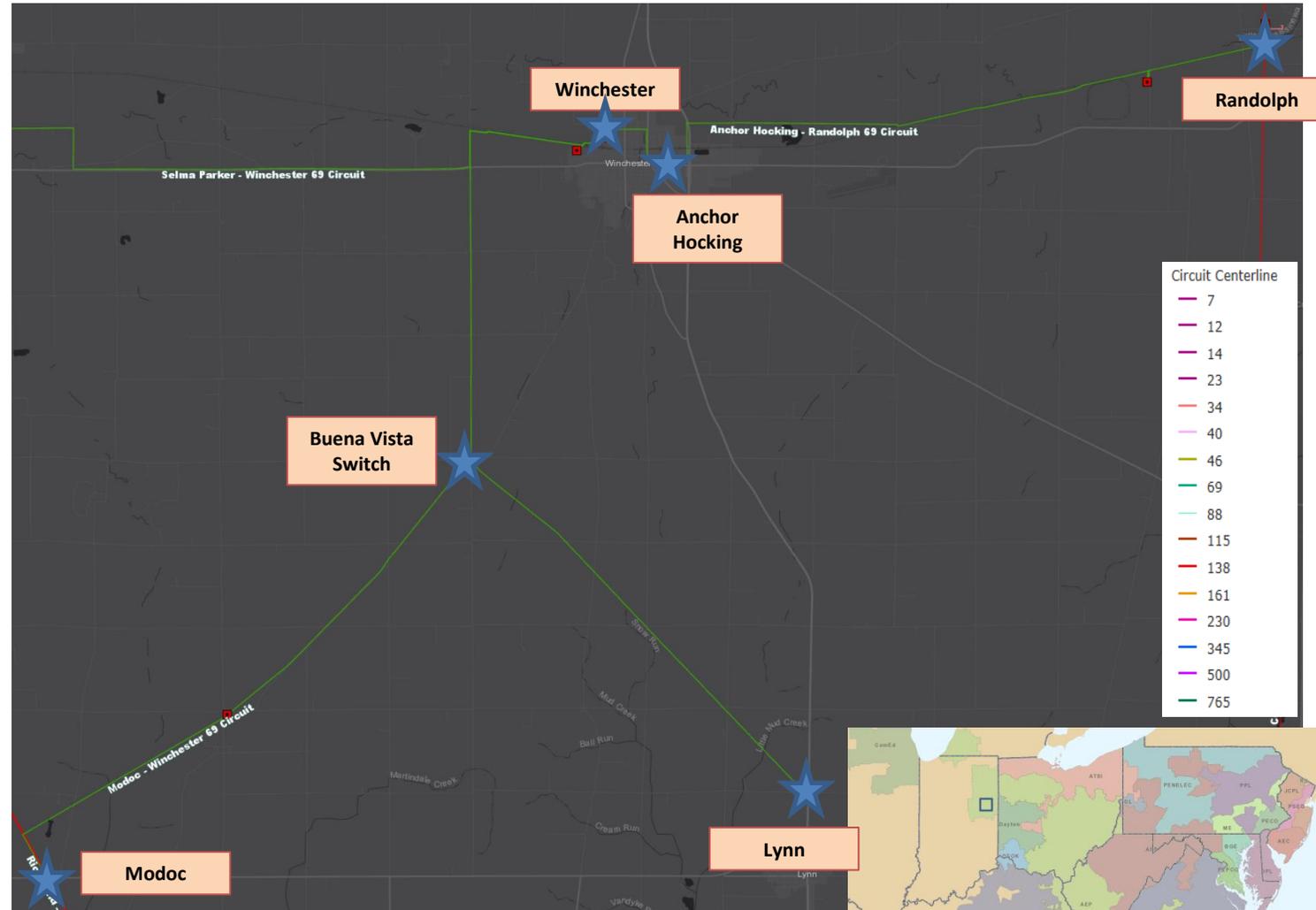
Problem Statement:

Winchester 69kV station

- Breakers A and B 69kV
 - 1971 vintage oil filled, CF-type breaker. This type is oil filled without oil containment. Oil filled breakers have much more maintenance required due to oil handling that modern, vacuum counterparts do not require. Finding spare parts for these units not possible as these models are no longer vendor supported. Also, oil spills can result in significant cost to mitigate

Modoc 138/69/12kV station

- 138/69kV Transformer #1
 - 1965 vintage
 - Elevated moisture levels
 - Decrease in interfacial tension of the oil, reducing its insulating capabilities
 - Unit is showing signs of leaking



AEP Transmission Zone: Supplemental Winchester, Indiana and surrounding area

Need Number: AEP-2020-IM004

Meeting Date: Needs Meeting 02/21/20

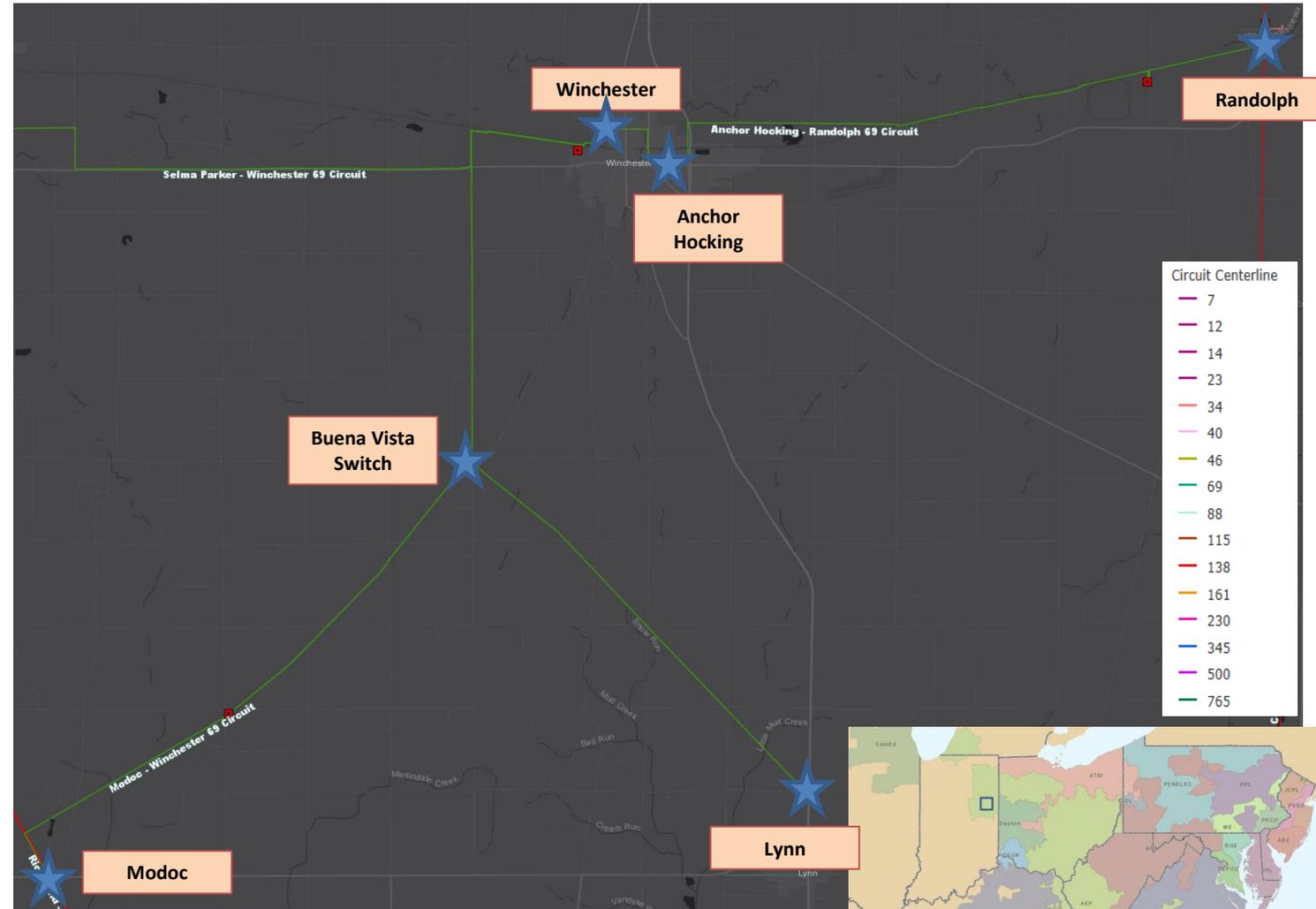
Supplemental Project Driver: Equipment
Material/Condition/Performance/Risk

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

Problem Statement:

Randolph 138/69kV station

- 138/69/12 kV Transformer #1
 - 1970 vintage
 - Elevated carbon dioxide levels
 - Increased levels of decomposition of the paper insulating materials, leading to increased risk of failure
- Switcher V 138kV
 - Mark V S&C Electric type switcher
 - Failed operational components including high contact resistance, gas loss, and interrupter failure represent half of these malfunctions.
 - This model has no gas monitor and a history of malfunction
- Cap Switcher AA
 - 2030-69 S&C Electric type switcher.
 - This model has no gas monitor and a history of malfunction.
 - This particular switcher has exceeded the recommended number of switched operations with 5497 (5000 recommended)



AEP Transmission Zone: Supplemental Winchester, Indiana and surrounding area

Need Number: AEP-2020-IM004

Meeting Date: Needs Meeting 02/21/20

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

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

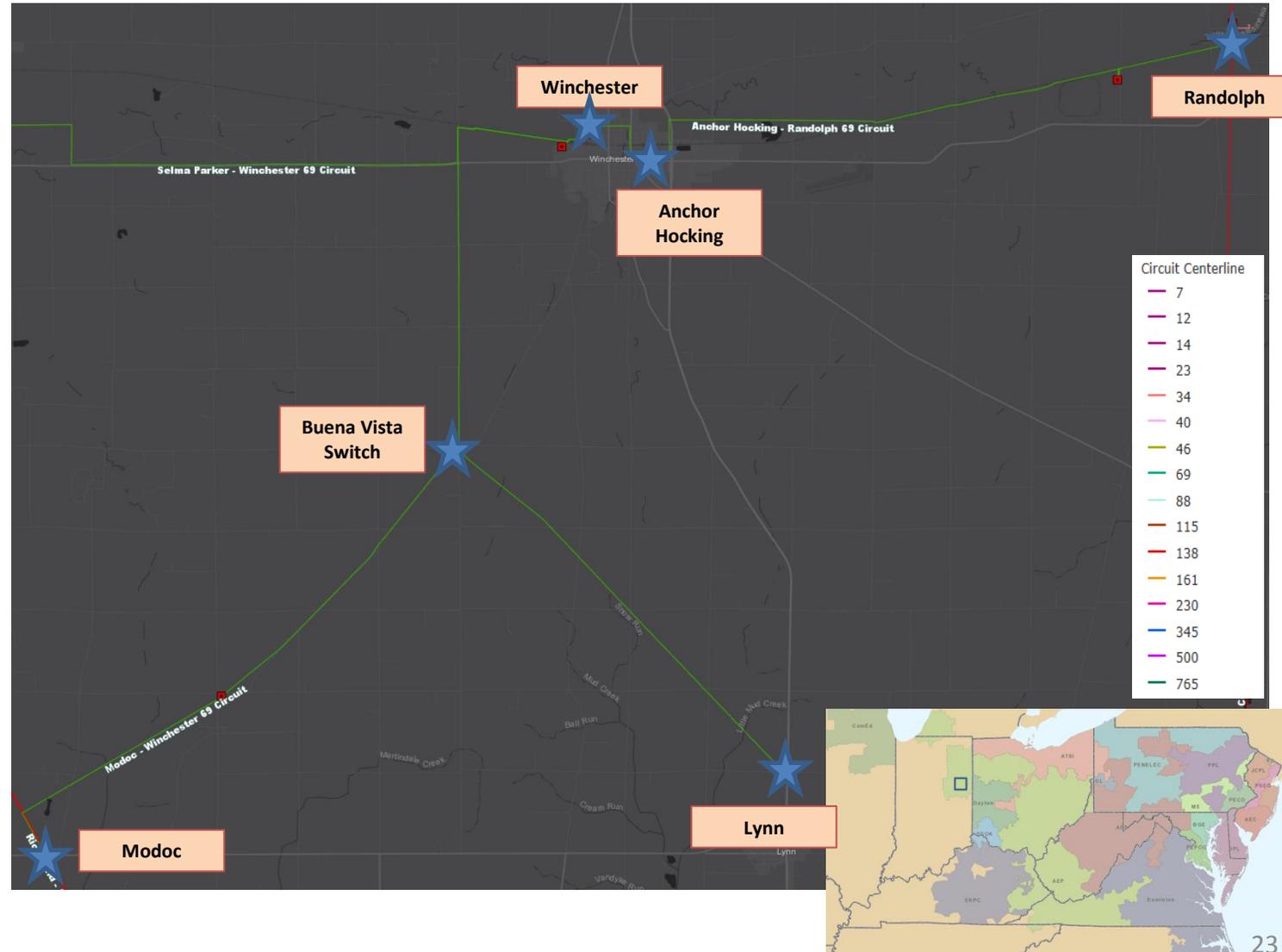
Problem Statement:

Modoc – Winchester 69kV Line (~13.4 Miles)

- 1967 vintage wood pole, horizontal insulator line
- There are currently 69 open conditions on this line (63 structures with at least one open condition or 26% of the line).
- Open conditions include: Damaged poles, damaged braces, broken guy wires, and damaged insulators.

Buena Vista – Lynn 69kV Line (~5.7 Miles)

- 1967 vintage wood pole, horizontal insulator line
- There are currently 31 open conditions on this line (28 structures with at least one open condition or 38% of the line).
- Open conditions include: Damaged poles, damaged shield wires, broken ground lead wires, and damaged insulators.



AEP Transmission Zone: Supplemental Winchester, Indiana and surrounding area

Need Number: AEP-2020-IM004

Meeting Date: Needs Meeting 02/21/20

Supplemental Project Driver: Operational Flexibility

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

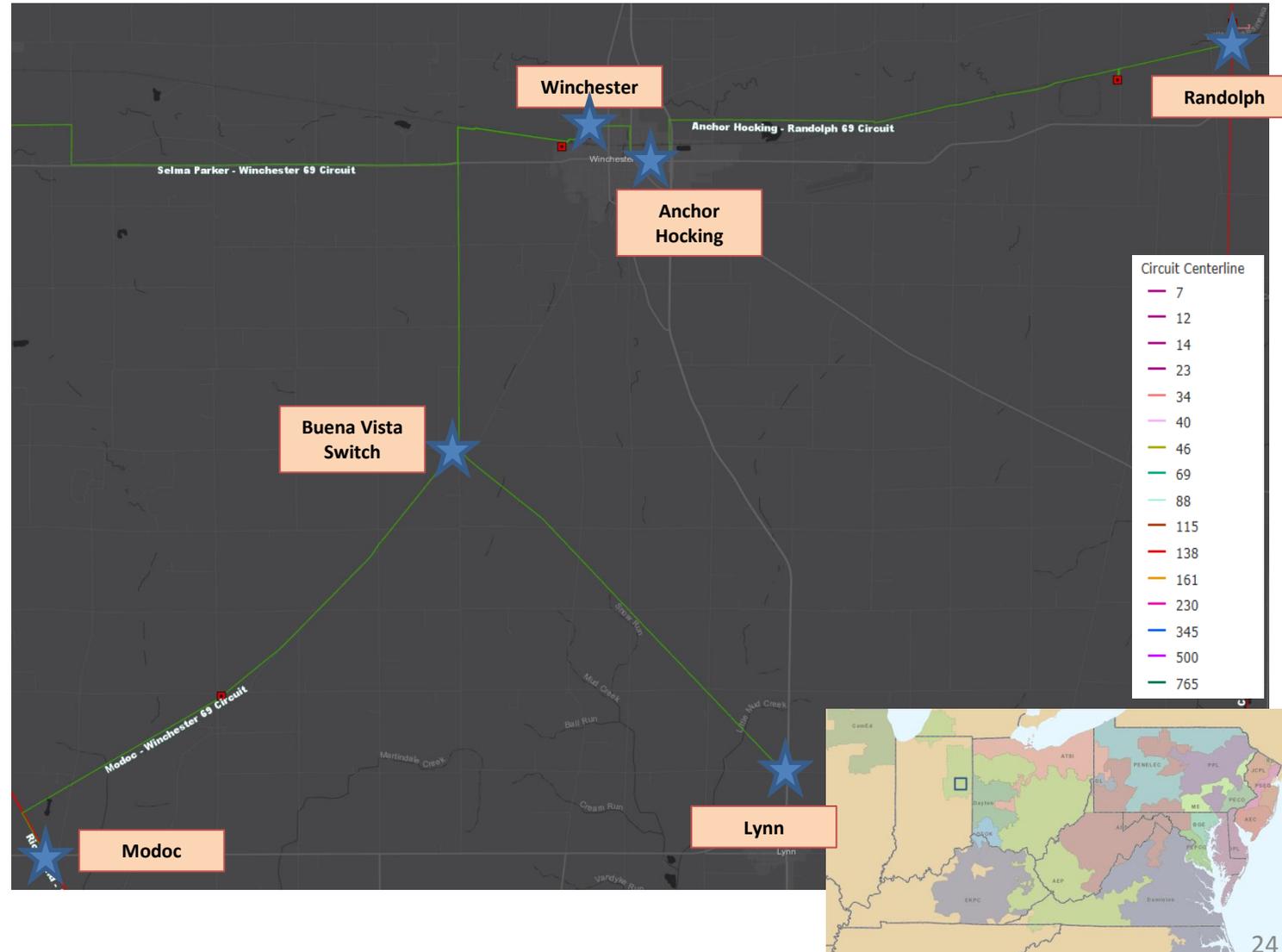
Problem Statement:

Lynn 69/12kV station

- Radial circuit serving 7MW peak load to REMC and the distribution network for the city of Lynn.

Modoc 138/69/12kV station

- Modoc is a 3 terminal line off of the Desoto – College Corner 138kV circuit with high speed ground switch protection on the transformer



Need Number: AEP-2020-IM005

Meeting Date: Needs Meeting 02/21/2020

Supplemental Project Driver: Equipment

Material/Condition/Performance/Risk/Operational

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

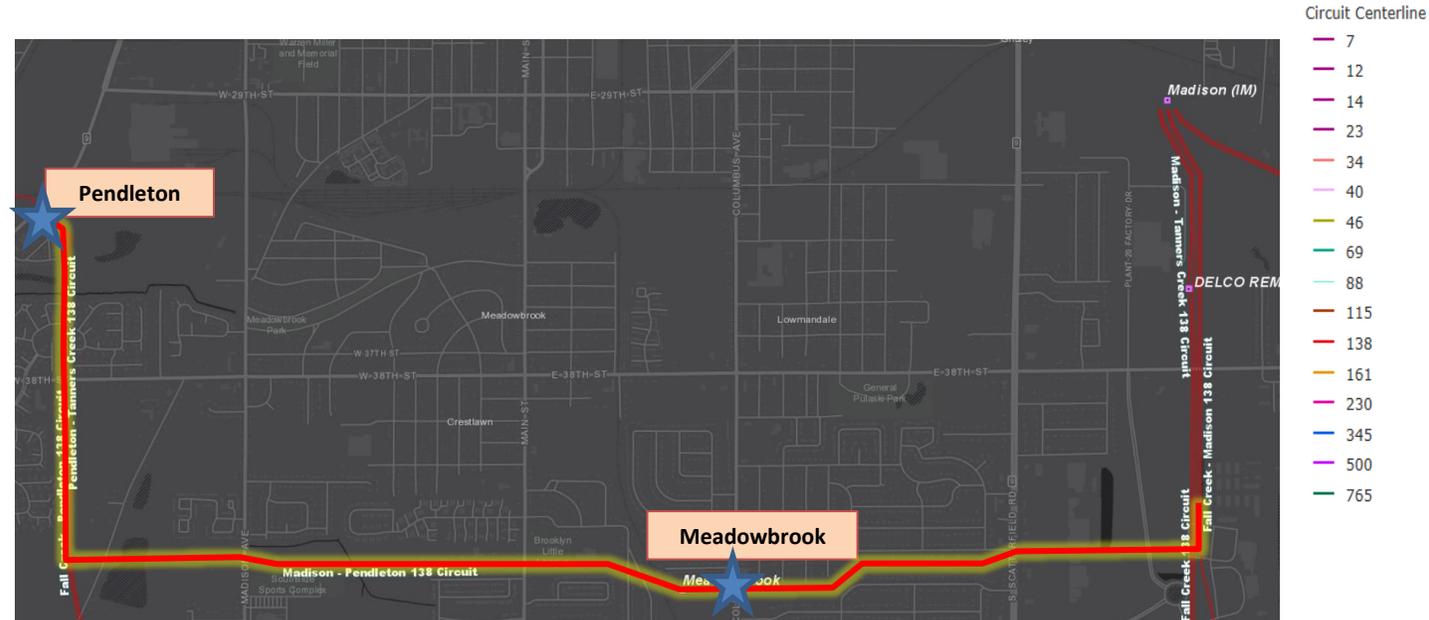
Problem Statement:

Madison – Pendleton 138kV Line (~4.2 Miles)

- 1967 vintage wood pole, H-Frame construction
- There are currently 16 open conditions on this line (9 structures with at least one open condition or 24% of the line).
- Open conditions include: Rotting or bowed crossarms or poles, broken shield wires, and stolen ground lead wires.

Meadowbrook 138/34.5kV station

- Three-terminal line and overlapping zones of protection on the bus, line, and transformer.



AEP Transmission Zone: Supplemental Ft Wayne, IN

Need Number: AEP-2020-IM006

Process Stage: Needs Meeting 2/21/2020

Supplemental Project Driver: Equipment Condition/Performance/Risk

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

Problem Statement:

McKinley 138/69/34.5kV

- Breakers G 34kV
 - 1956 vintage Oil breakers
 - Fault Operations: G(10) – Recommended(10)
- Oil filled breakers have much more maintenance required due to oil handling that modern, vacuum counterparts do not require. Finding spare parts for these units is difficult or impossible, and these models are no longer vendor supported. Oil spills can result in significant costs associated with mitigation.

McKinley – Spy Run 34.5kV line asset (~5 miles)

- 1960 vintage wood crossarm construction
- There are currently 42 open conditions on this line across 37 unique structures (27% of the line) including, but not limited to, split crossarms, rot top, rot heart and broken grounds.
- Structures are in the river flood plains and in the flood control berm.



AEP Transmission Zone M-3 Process Moore Park, IN Area

Need Number: AEP-2020-IM007

Process Stage: Needs Meeting 02/21/2020

Supplemental Project Driver: Equipment Condition/Performance/Risk

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

Model: N/A

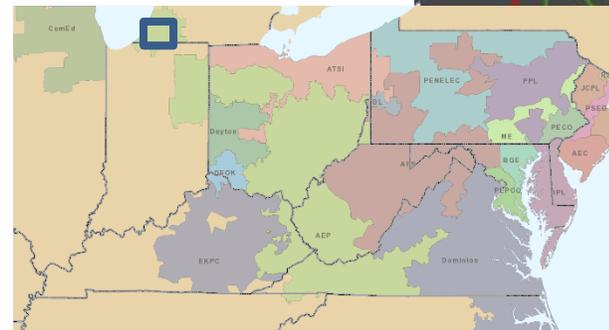
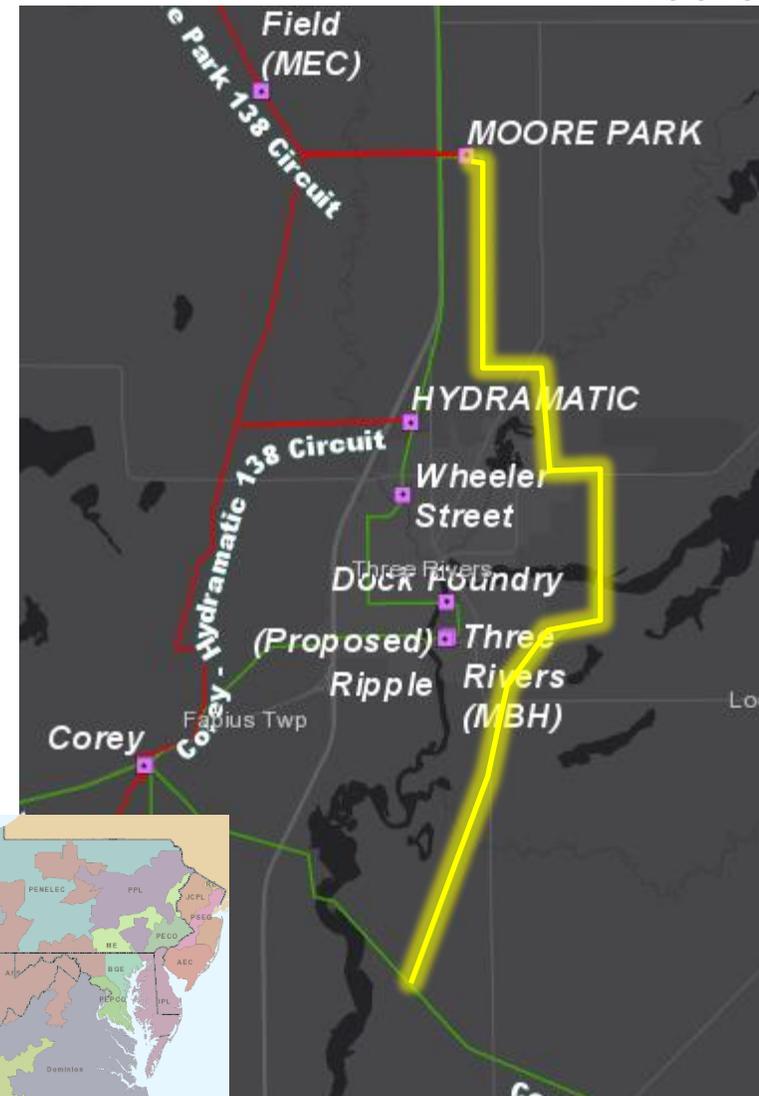
Problem Statement:

Moorepark 69kV Tap line:

- 9.02 miles of 1967 wood pole structure with horizontal insulators
- 94 structures with at least one open condition (52% of the line)
 - Open conditions include pole damage such as cracked, insect damage, rot heart and woodpecker holes, shielding/grounding conditions related to broken, missing or stolen ground wires, and broken or burnt insulators
- Since 2014 8 momentary and 1 permanent outages
 - 7 due to weather (lightning/thunderstorm) demonstrating poor shielding
- This line is a three terminal line which is hard to coordinate from a relaying perspective and is prone to misoperations

Moorepark (138/69kV) Station:

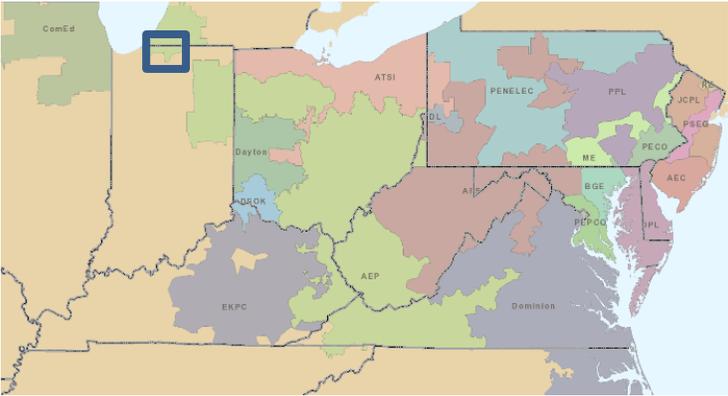
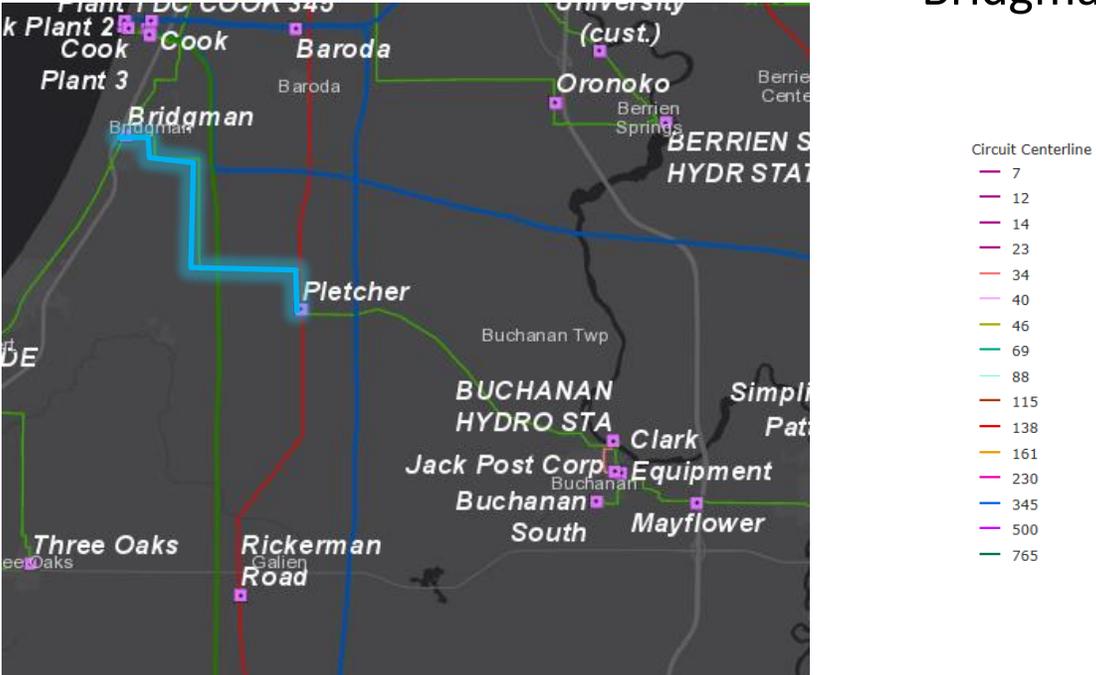
- 69kV circuit breaker (1) installed in 2006 with 41 documented malfunction records due to low SF6. This breaker has exceeded the designed number of fault operations.
- (1) 2030-69 Cap Switcher with no gas monitor. The AEP system has experienced numerous malfunctions of this type of cap switcher due to gas loss, interrupter failures, operating mechanism failures and trip or reclose failures.



AEP Transmission Zone M-3 Process Bridgman-Pletcher

Need Number: AEP-2020-IM009
Process Stage: Needs Meeting 02/21/2020
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Model: N/A
Problem Statement:

- Bridgman-Pletcher 69kV line:
- 7.7 miles of 1964 wood pole line
 - 57 unique structures (46%) with at least one open conditions relating to structure and conductor issues
 - Open conditions include rotted poles, burnt or broken insulators, split or damaged poles or broken conductor strands, woodpecker damage and guy/ground wire damage



AEP Transmission Zone M-3 Process Harrison County, Ohio

Need Number: AEP-2019-OH029 **Canceled**

Process Stage: Needs Meeting 06/17/2019

Supplemental Project Driver:

Customer Service

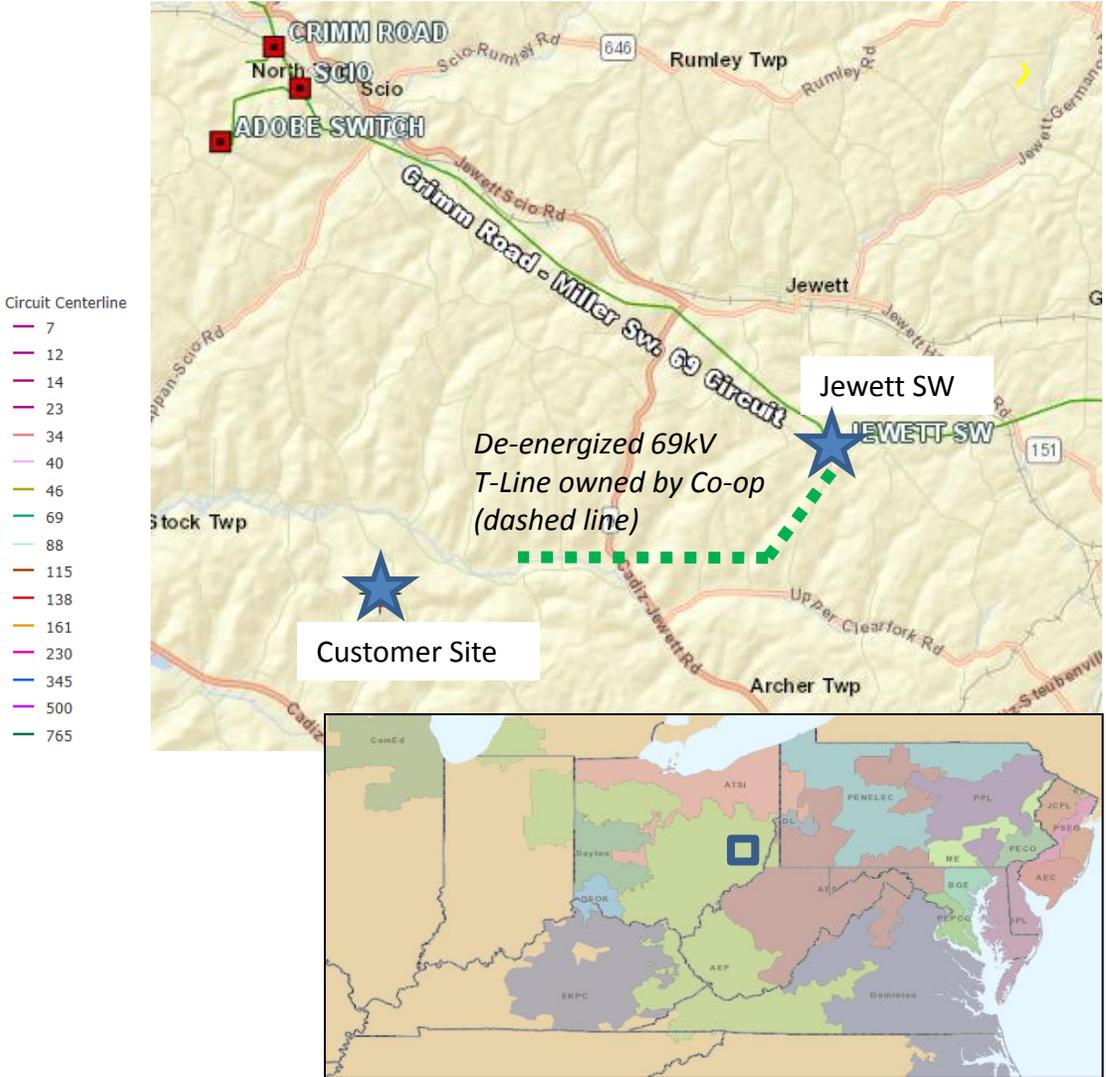
Specific Assumption References:

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

Model: 2023 RTEP

Problem Statement:

- Buckeye Power, on behalf of South Central Power Co-op, has requested transmission service in Stock Township of Harrison County, Ohio.
- The forecasted peak demand is 16 MVA, with an in-service date of 9/1/2020.
- **This need has been cancelled by the customer.**



Need Number: AEP-2020-OH004

Process Stage: Need Meeting 02/21/2020

Supplemental Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption References:

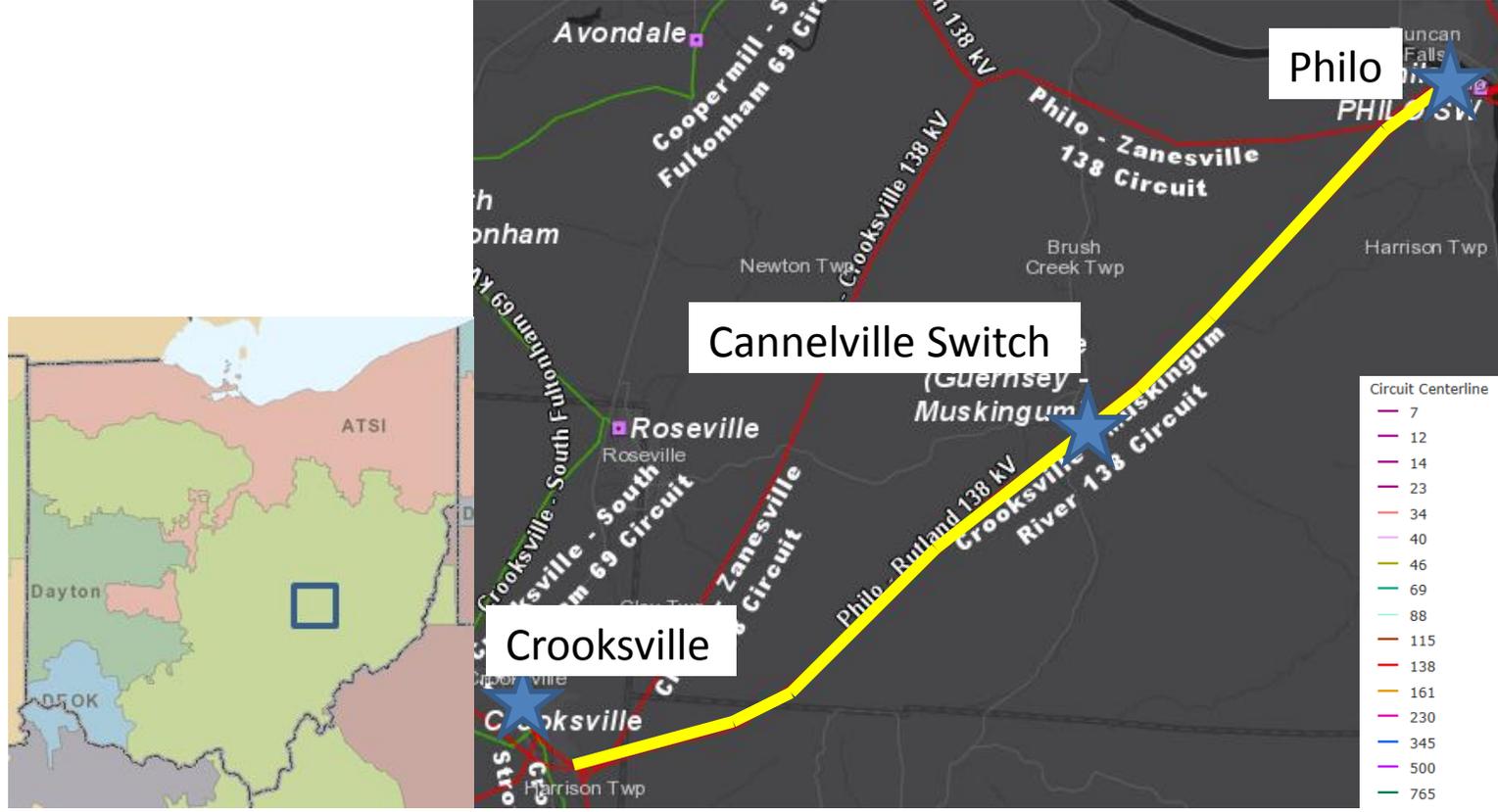
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8), AEP Presentation on Pre-1930s Lines

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 Winesburg, Ohio

Need Number: AEP-2020-OH005

Process Stage: Needs Meeting 2/21/2020

Supplemental Project Driver: Customer Service

Specific Assumption Reference:

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

Problem Statement:

- Holmes-Wayne Electric Cooperative has requested service for a new delivery point near Winesburg, Ohio.
- The anticipated new load is 8 MW.

Model: PJM 2024 RTEP Base Case



AEP Transmission Zone M-3 Process Stockport, Ohio

Need Number: AEP-2020-OH006

Process Stage: Need Meeting 02/21/2020

Supplemental Project Driver:

Customer Service

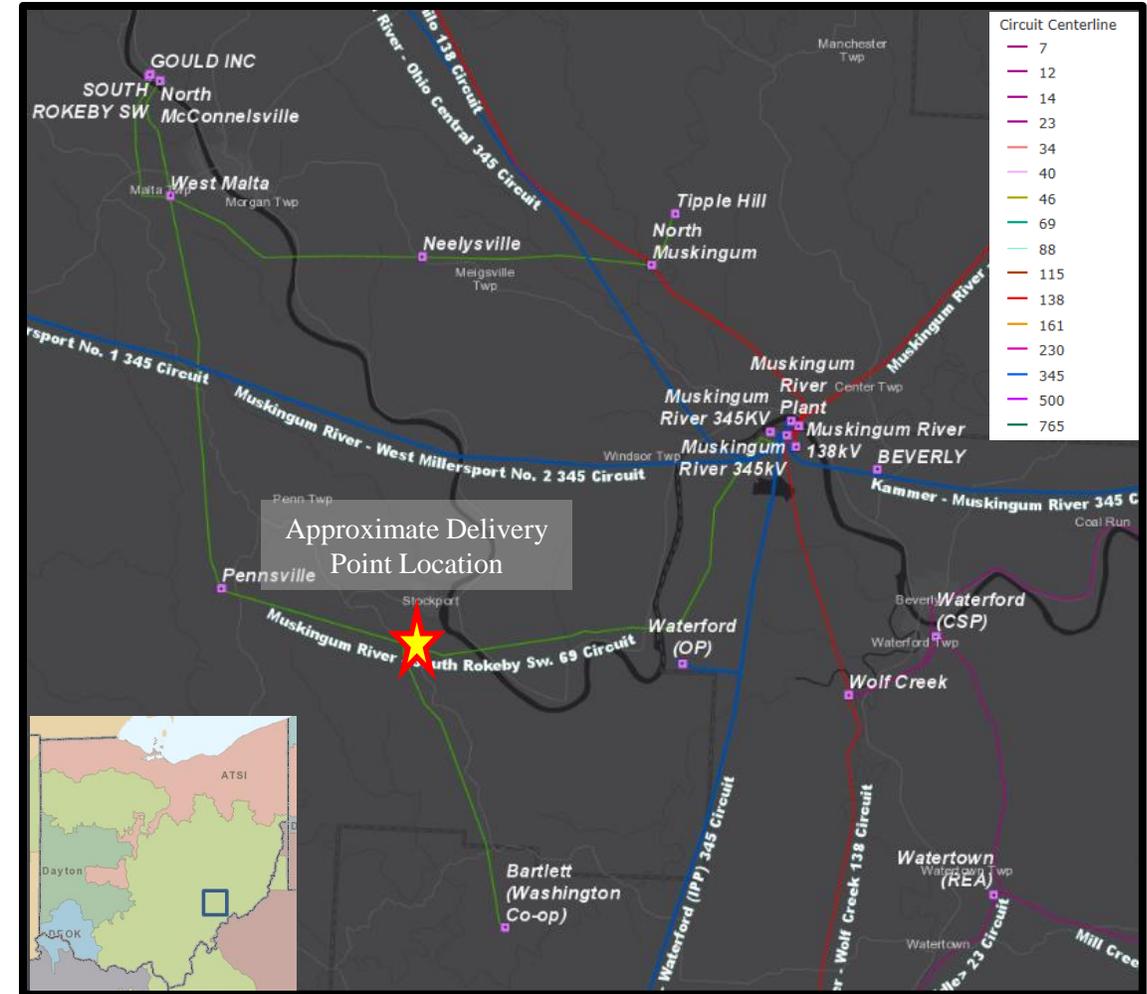
Specific Assumption Reference:

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

Problem Statement:

- AEP Ohio is requesting a new 69kV delivery point on the Muskingum River – South Rokeby SW 69kV Circuit. Anticipated load is about 5 MVA.

Model: 2024 RTEP



AEP Transmission Zone M-3 Process Adena, Ohio

Need Number: AEP-2020-OH007

Process Stage: Needs Meeting 2/21/2020

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:

Equipment Material Condition, Performance and Risk:

- The Robyville 69-12kV substation is in poor condition. The 69kV breaker ‘C’ is an oil-filled unit from 1965, has experienced 143 fault operations (manufacturer recommends 10), and has mechanical problems on the breaker’s open/close mechanism.
- The station consists of deteriorating wooden 69kV & 12kV station structures. Foundations for the 2- transformers and voltage regulator are of wooden rail road tie construction. The station fence and retaining wall are in very poor condition. The two distribution transformers date to 1941 & 1947; both are showing signs of thermal degradation (due to past electrical faults), high carbon-monoxide levels (due to excessive heating), contaminated oil, and hot spots.
- The small control house dates to the 1940’s. Of the 16 relays, 12 are original electromechanical models, which lack modern fault recording, no SCADA functionality, and have limited spare part availability.



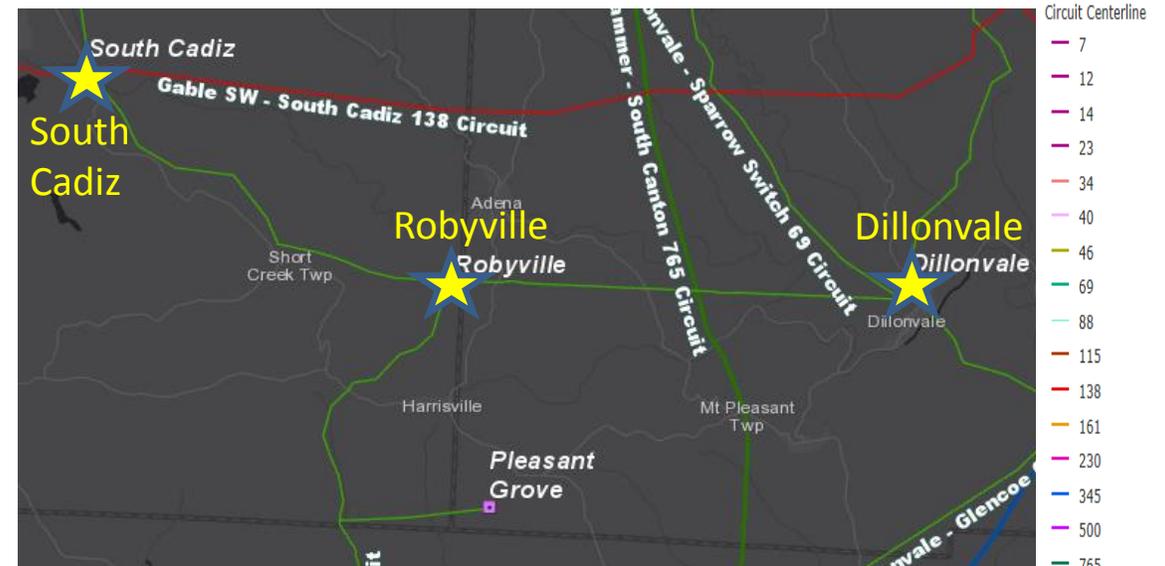
AEP Transmission Zone M-3 Process Adena, Ohio

Need Number: AEP-2020-OH007

Process Stage: Needs Meeting 2/21/2020

Operational Flexibility & Efficiency:

- Robyville Station contains dissimilar zones (2-lines, bus, and transformer) of protection that cause misoperations and over tripping.
- The distribution transformers at Robyville are in parallel (1.5 MVA each) and lack a high-side protective device. A fault on either transformer or the low-side 12kV bus will take out both 69-12kV transformers an outage 1,000+ customers served from this station.
- In the past 5 years, the Dillonvale-Robyville-South Cadiz 69kV circuit has experienced 10 momentary outages and 2 sustained outages. Distribution customers served from Robyville have experienced a CMI (customer-minutes-of-interruption) total of 610,598.
- South Cadiz 69 kV breaker D is an oil-filled unit from 1965, with 34 fault operations; it exhibits signs of mechanical degradation.
- Dillonvale 69 kV breaker B is an oil-filled unit from 1952, with 35 fault operations.



AEP Transmission Zone: Supplemental Hicksville, OH

Need Number: AEP-2020-OH008

Process Stage: Needs Meeting 2/21/2020

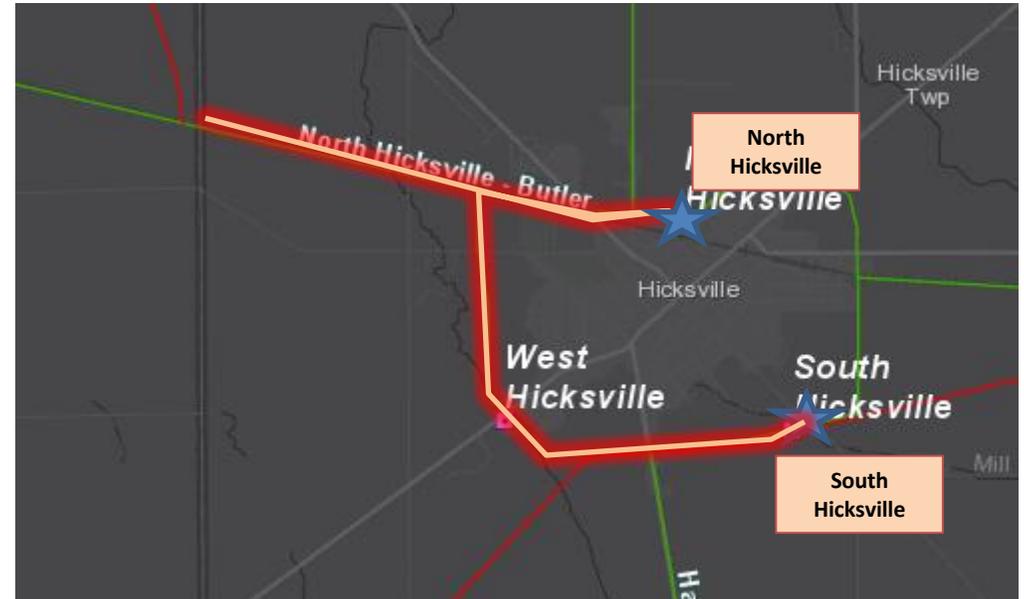
Supplemental Project Driver: Equipment Condition/Performance/Risk

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

Problem Statement:

Rob Park – South Hicksville (OH) 34kV (~4.6 Miles)

- 1956 & 1962 vintage wood pole construction with 32 open conditions on 17 unique structures, approximately 17% of the line. These conditions include but not limited to damaged poles, broken insulators, broken shield wire, rot top and broken Knee/Vee braces
- The circuits on this line have had the following outages across the last 5 years.
Rob Park – South Hicksville: 9 momentary and 6 permanent
CMI: 526,269
North Hicksville – Butler: 5 Momentary and 2 Permanent.
CMI: 120 over the last 5 years.
- Related to previously shared need AEP-2019-IM014.



Need Number: AEP-2020-OH009

Process Stage: Need Meeting 02/21/2020

Supplemental Project Driver:

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

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

Equipment Material/Condition/Performance/Risk:

- This line consists of 15 wood pole structures and has predominantly the original #2 ACSR/AW Sparrow conductors installed in 1943. 9 out of the 15 structures on this line were installed more than 60 years ago. 5 year CMI on this circuit is approximately 95,000. The existing construction is obsolete crossarm construction with 35 kV vertical stud post insulators.

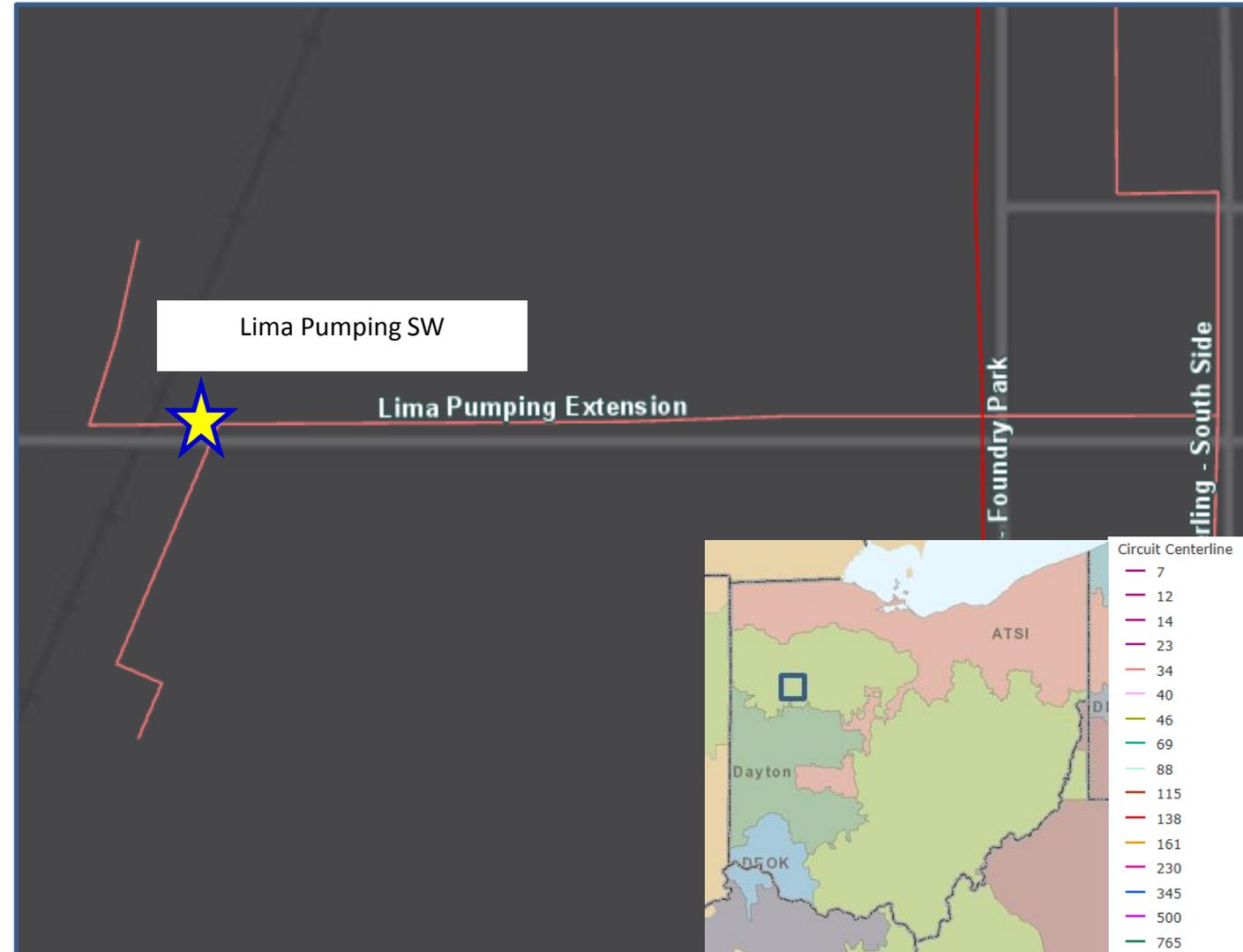
Operational Flexibility and Efficiency

- The line has experienced four (4) conductor failures since August 1, 2018. The first 8 spans of the line have 35 total splices. During these failures the 34 kV conductors end up falling into and faulting the AEP Ohio 3-phase distribution underbuild, interrupting several hundred additional distribution customers.

Customer Service:

- Both customers on this radial line experienced multiple outages due to geese contact on AEP's 34.5 kV transmission line. Additionally these two customers are connected via a hard tap at the end of the radial 34.5 kV line forcing both of them to be out when one of them requests an outage.

Model: N/A



Need Number: AEP-2020-OH010

Process Stage: Need Meeting 02/21/2020

Supplemental Project Driver: Customer Service

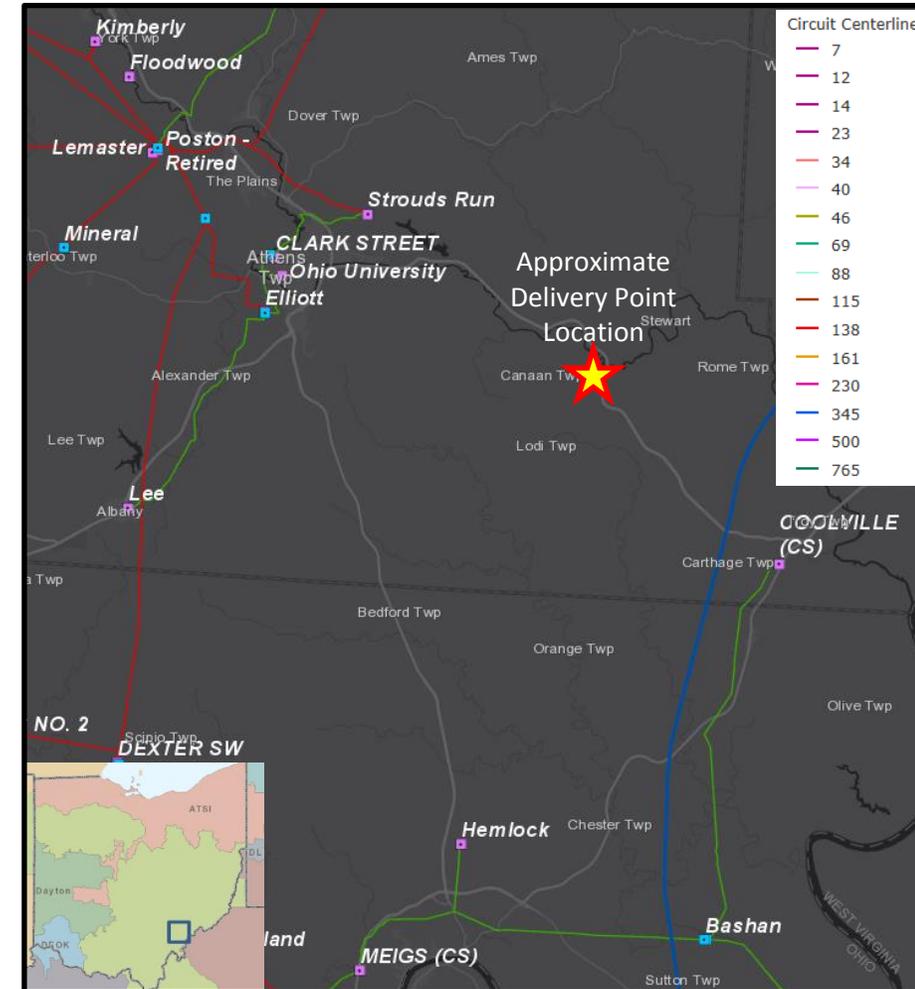
Specific Assumption Reference:

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

Problem Statement:

- AEP Ohio has requested a new delivery point between Coolville and Elliott Stations. Anticipated peak load is approximately 7.5 MVA that will be transferred from nearby stations in the area.

Model: 2024 RTEP



AEP Transmission Zone M-3 Process Athens Ohio

Need Number: AEP-2020-OH011

Process Stage: Need Meeting 02/21/2020

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

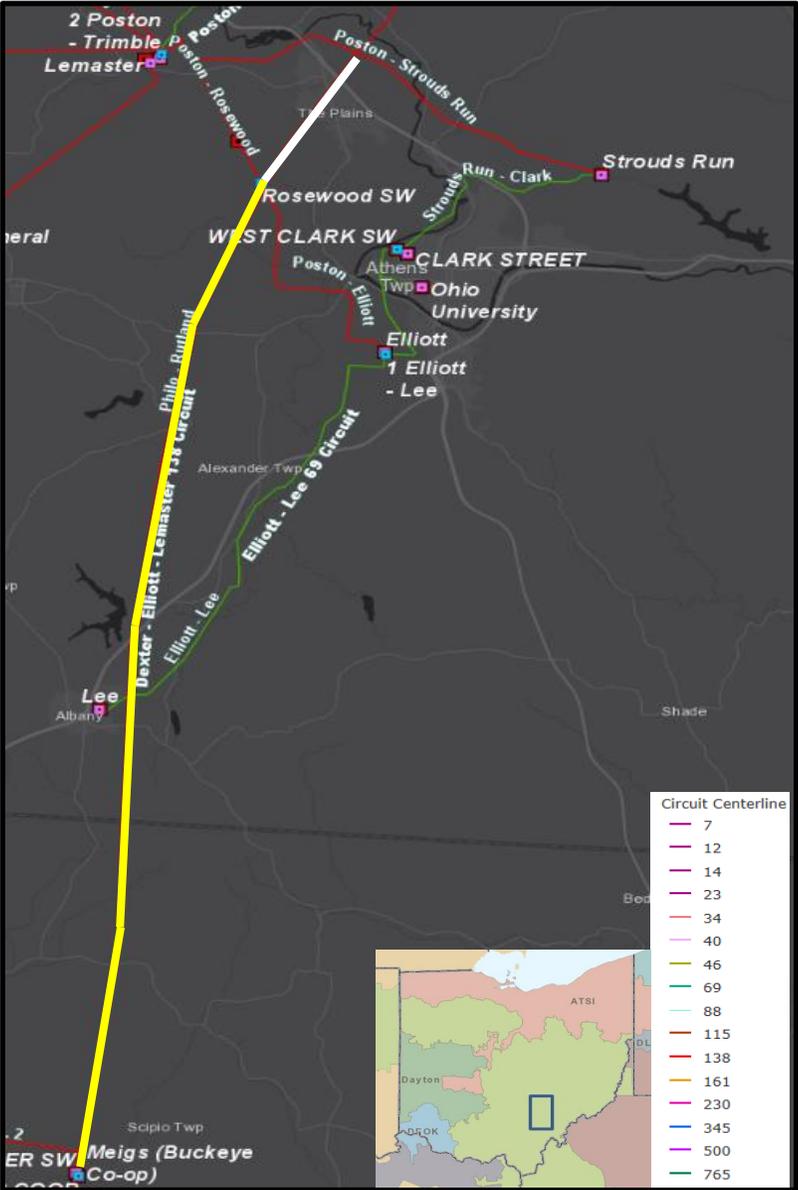
Specific Assumption Reference:
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8), AEP Presentation on Pre-1930s Lines

Problem Statement:
Dexter – Rosewood 138kV (1927 Steel Lattice Line)

- Length: ~~16.8~~ 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: ~~68~~ 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

Model: N/A

The remaining 8 miles out of Dexter will be captured under Need Number: **AEP-2020-OH022**



AEP Transmission Zone M-3 Process Jackson County, Ohio

Need Number: AEP-2020-OH012

Process Stage: Needs Meeting 02/21/2020

Process Chronology: Needs Meeting 02/21/2020

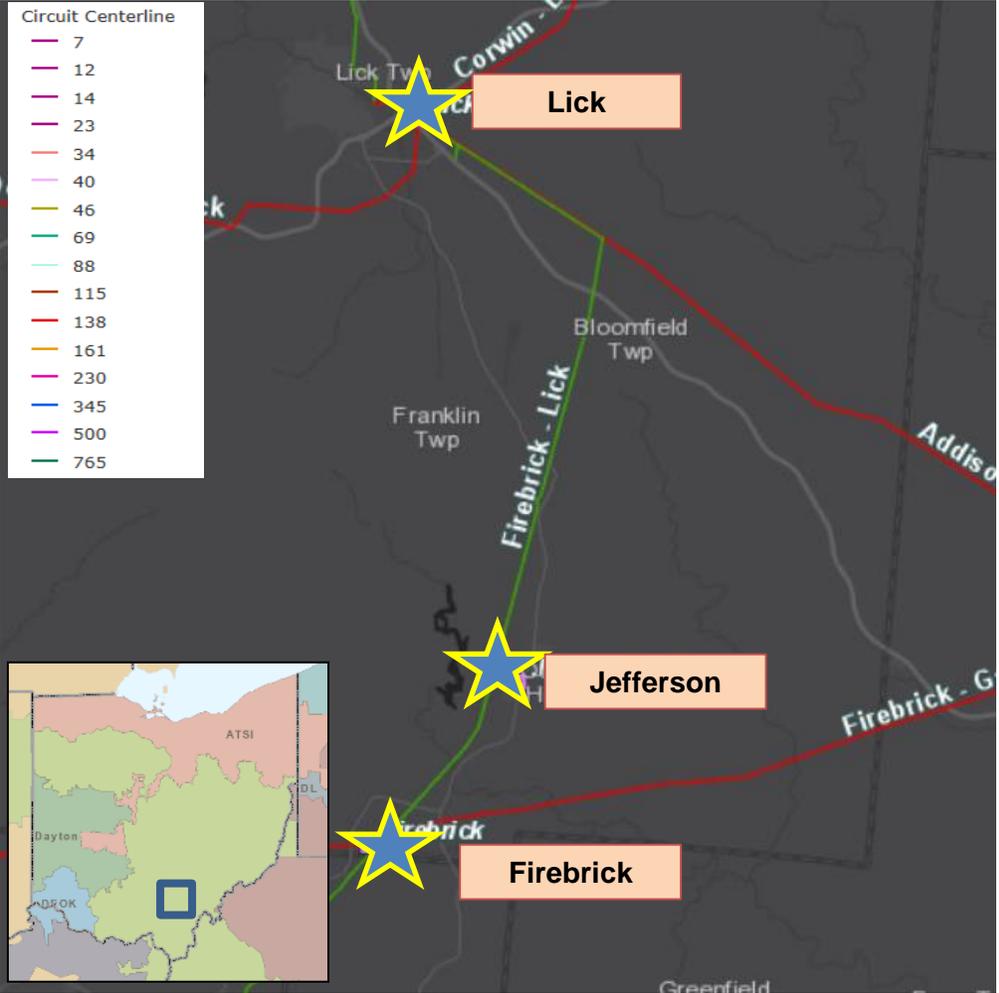
Supplemental Project Driver: Equipment Material/Condition/
Performance/Risk

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

Problem Statement:

Jefferson-Lick 69 kV line

- Original Construction Date: 1927
- Length: 12.5 miles
- Original Construction Type: Wood (1927, 1953, and 1980s)
- Conductor Type: 8.5 miles of 4/0 ACSR conductor (1927 and 1967) with 4.0 miles of 336 ACSR conductor (1980s)
- Outages: 4 Permanent and 17 Momentary (5 years)
- 3.96 million customer minutes of interruption (CMI) associated with the Firebrick – Lick 69 kV circuit over the last 5 years.
- Conditions: 27 of 93 structures have at least one open condition including rot top pole, crossarm damage, and insulator issues.



AEP Transmission Zone M-3 Process Columbus, OH

Need Number: AEP-2020-OH013

Process Stage: Needs Meeting 02/21/2020

Supplemental Project Driver: Equipment Condition/Performance/Risk

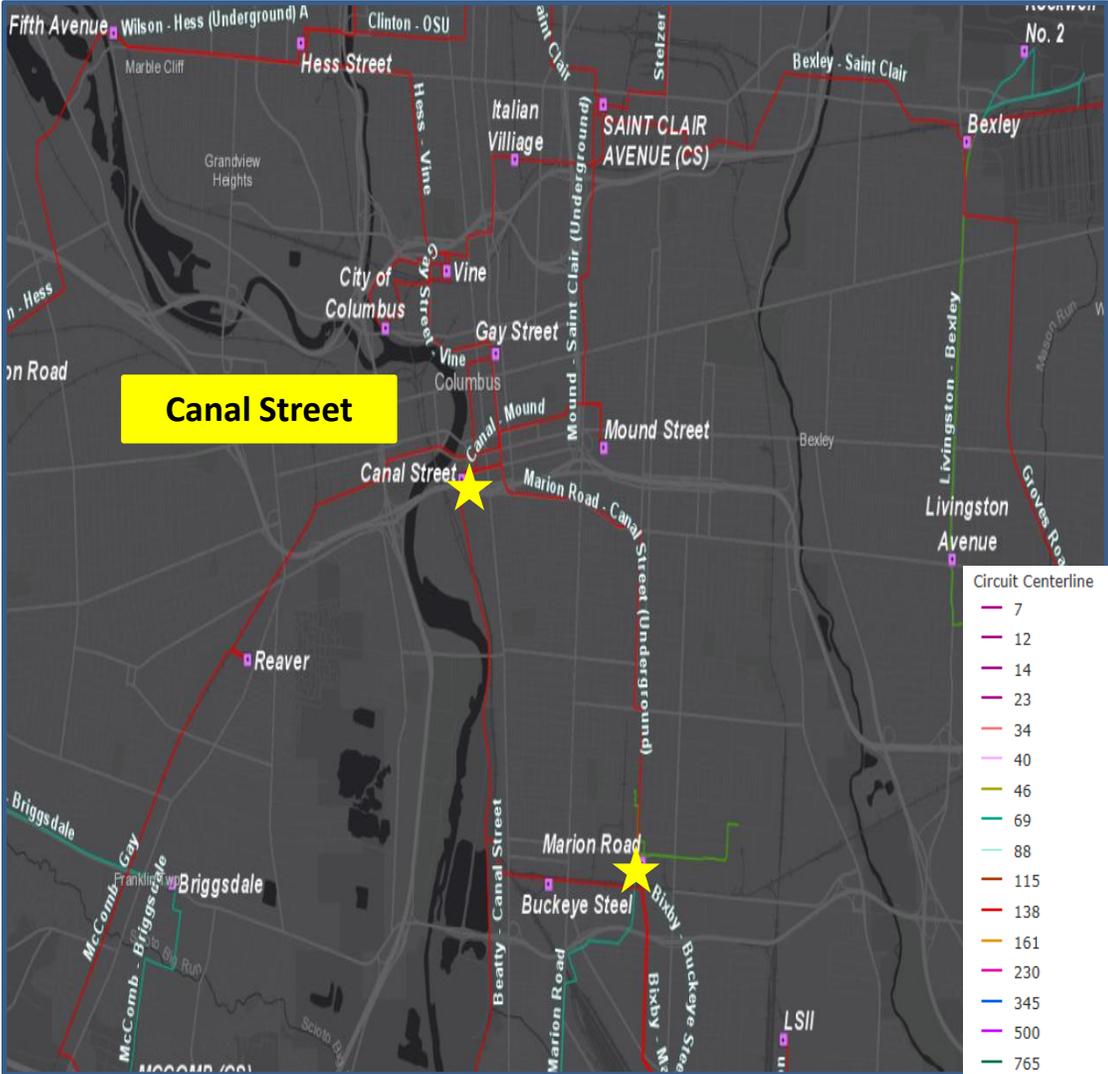
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8), Customer Service

Problem Statement:

Canal Street – Marion Road 138 kV Underground Circuit

- Ohio Department of Transportation (ODOT) has requested that approximately 1500 feet of the existing Canal – Marion 138 kV underground circuit be relocated as part of a planned Interstate improvement project.
- The existing Canal – Marion 138 kV underground circuit is approximately 3.8 miles long and was originally installed in the 1950’s.
- The circuit utilizes an underground oil-filled pipe type cable design. Oil-filled pipe type underground cables come with several challenges/risks in densely populated urban areas. Lead times for replacement/repairs from the remaining single vendor can be 6 months to a year. Even minor issues with the cable could result in costly outages over an extended period of time due to this single remaining vendor.

Model: N/A



AEP Transmission Zone M-3 Process Athens Ohio

Need Number: AEP-2020-OH014

Process Stage: 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

Model: N/A



AEP Transmission Zone M-3 Process Athens Area Improvements

Need Number: AEP-2020-OH022

(Remainder of need transferred from AEP-2020-OH011)

Process Stage: Need Meeting 02/21/2020

Supplemental Project Driver:

Equipment Material/Condition/Performance/Risk

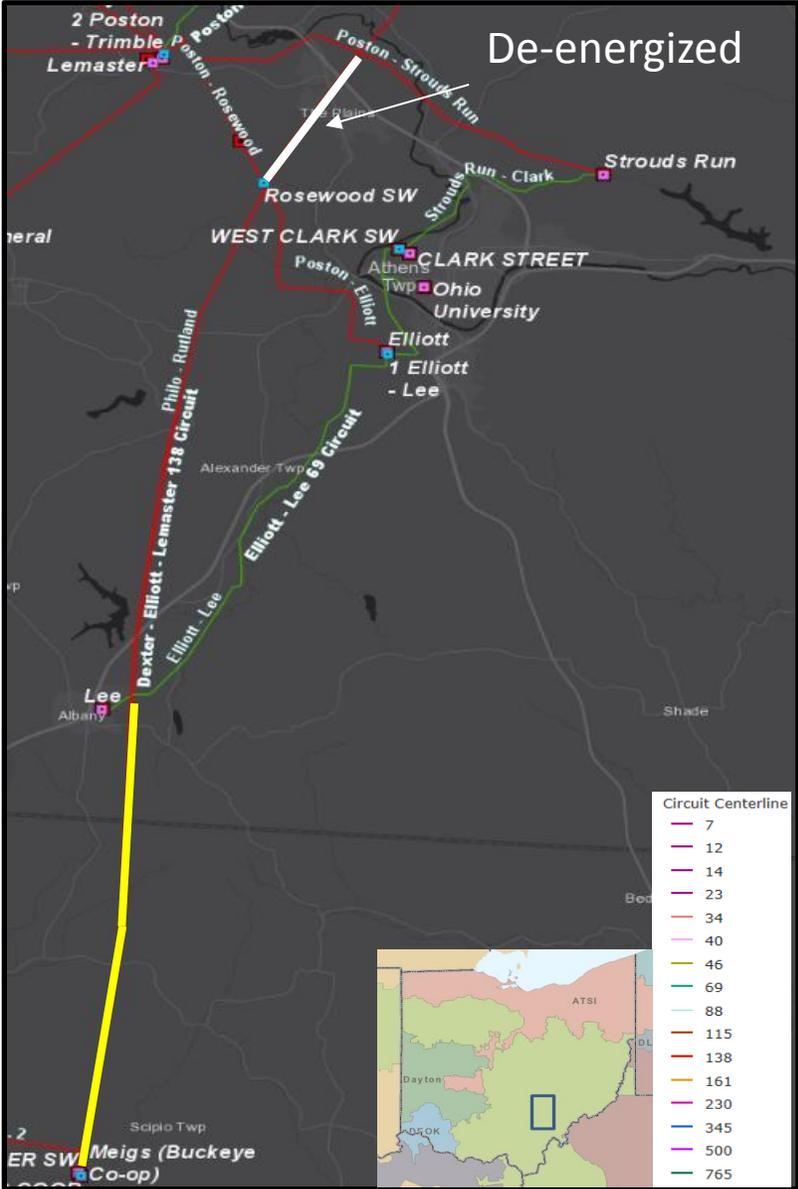
Specific Assumption Reference:

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 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: 30
- 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



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 Findlay, Ohio

Need Number: AEP-2018-OH007

Process Stage: Solutions Meeting 02/21/2020

Previously Presented: Needs Meeting 10/26/2018

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

Specific Assumption References:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

The 138/34kV transformers and 34kV circuit breakers at New Liberty, North Baltimore, and North Findlay Stations have significant asset renewal needs. Between these three stations seventeen (17) 34.5kV circuit breakers/ circuit switchers have been identified as needing replacement, fifteen (15) of which are oil filled (vintage 1950's) and have seen a high number of fault operations. Short circuit capability is also a concern for many of these 34.5 kV breakers at New Liberty and North Findlay stations.

North Findlay Station:

- 34.5kV CBs F, G, H, J, K, L
- 34.5kV circuit switcher BB
- Transformers #1 and 2

New Liberty Station:

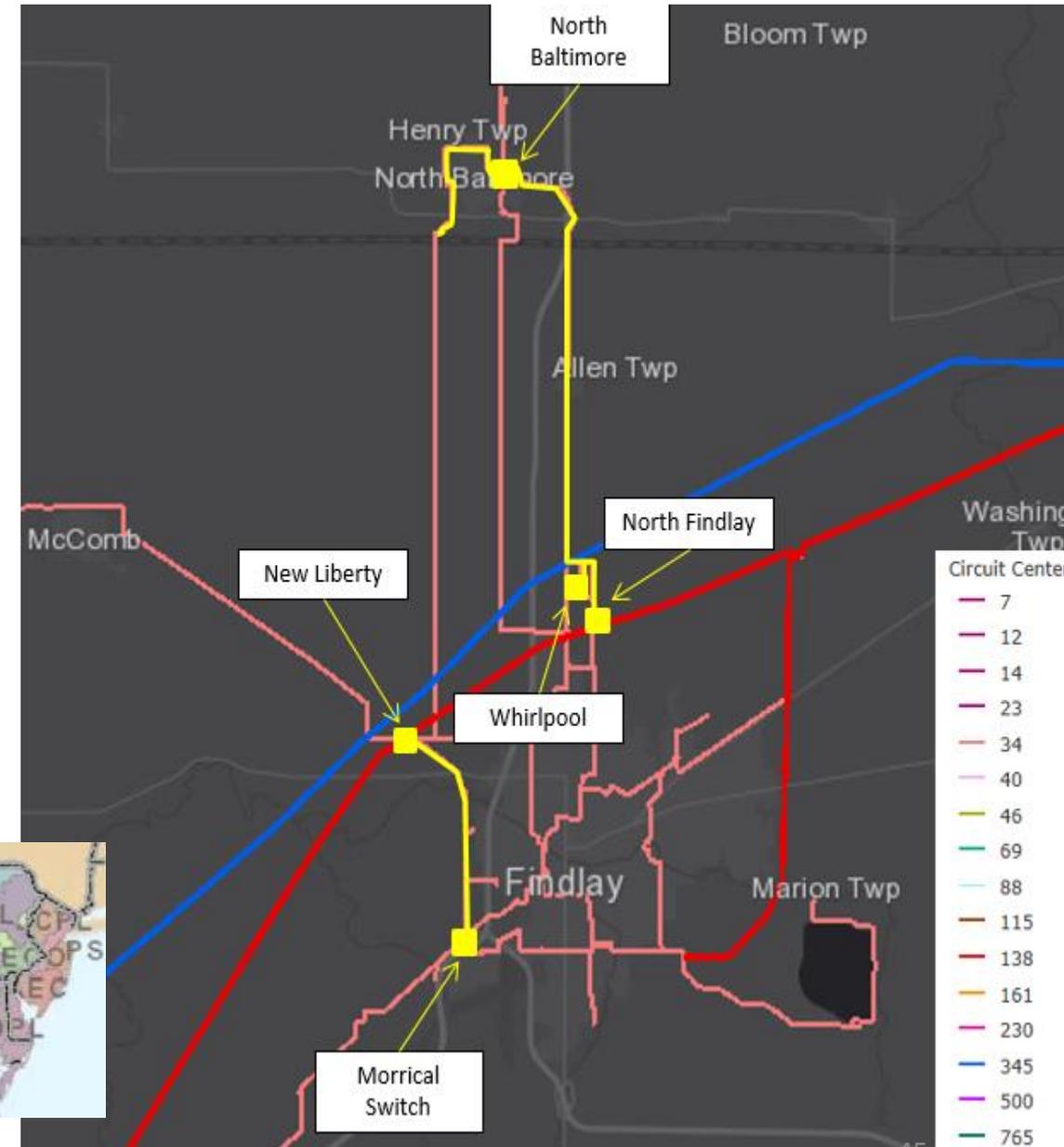
- 34.5kV CBs C, E, G, H, I, J
- Transformers #1 and 2

North Baltimore Station:

- 34.5kV CBs A, B, C, E

Morrical Switch

- 34.5kV CB A



Problem Statement (Continued):

Morrical Switch

- Evaluation of the station has shown the wooden bay structures, the 34.5kV circuit breaker and all existing relaying (electromechanical) at the station are in need of replacement.

The following line sections have identified asset renewal concerns and many have seen loading greater than 90% under contingency conditions.

New Liberty – North Baltimore 34.5kV: The 10 mile circuit is a combination of 4/0 ACSR and 336 ACSR (circa 1940) with wood structures (Predominately pre-1980's). The line section has 30 open A conditions.

North Findlay – North Baltimore 34.5kV #1: The 8 mile circuit identified is predominately 4/0 ACSR (circa 1961) with small portions of 2/0 Copper, 336 ACSR, 556 ACSR, and 795 ACSR. This line has predominantly wood structures (ranging from 1920's – 2000's) with 14 open A conditions.

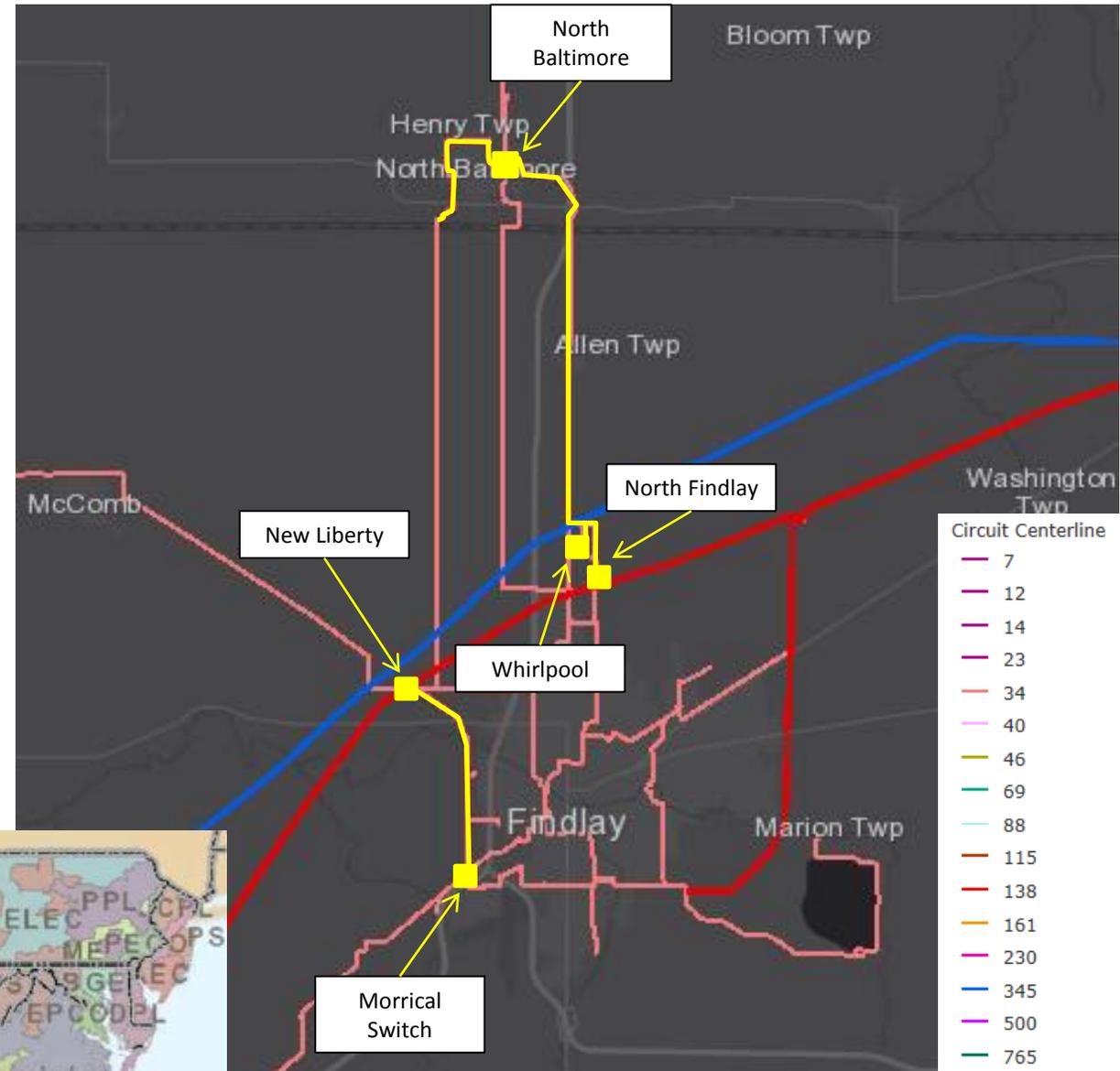
New Liberty – Findlay Center 34.5kV: This 3.3 mile line has a combination of 4/0 Copper, 336 ACSR, and 556 ACSR (circa 1934-1964) with wood structures and 10 open A conditions.

Whirlpool Extension 34.5kV: This 0.15 miles of rebuild identified is 336 ACSR (circa 1967) with wood structures (circa 1967).

Operational Flexibility and Efficiency

There is an existing 34.5kV three terminal line at Morrival Switch and hard taps at in the area that increase outages to customers in the area (Totten and Centrex).

Model: 2022 Summer RTEP



AEP Transmission Zone M-3 Process Findlay – North Baltimore

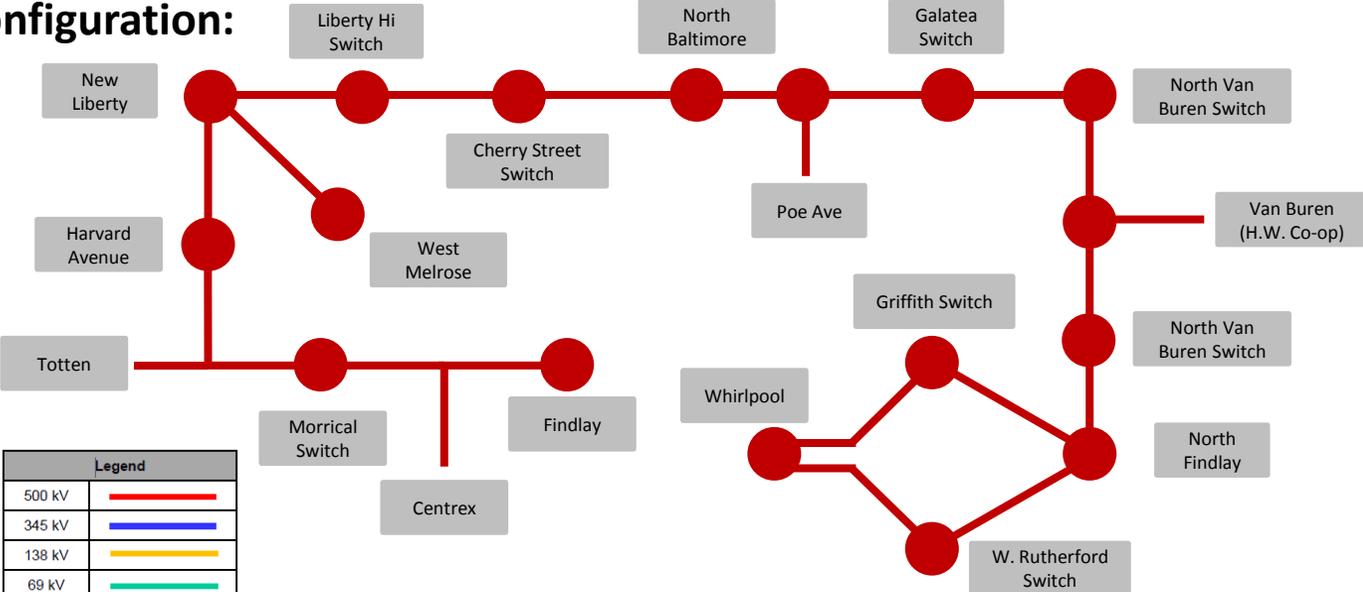
Need Number: AEP-2018-OH007

Process Stage: Solutions Meeting 02/21/2020

Proposed Solution:

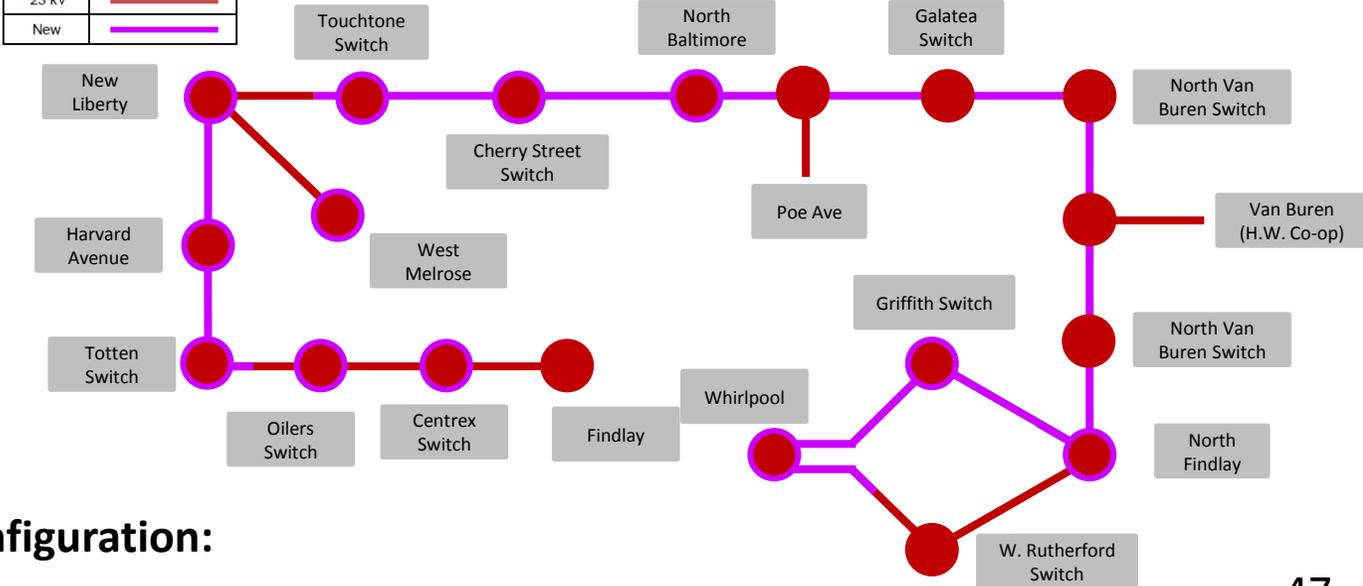
- Rebuild approximately 3.0 miles of New Liberty – North Baltimore 34kV line. **Estimated Cost: \$9.3M**
- Rebuild 8.0 miles of North Findlay – North Baltimore #1 34kV line (advanced construction date due to imminent failure). **Estimated Cost: \$25.3M**
- Rebuild 0.15 miles of Whirlpool Extension. **Estimated Cost: \$0.8M**
- Build 1.0 mile of Oilers Switch Extension. **Estimated Cost: \$2.2M**
- Rebuild 2.9 miles of New Liberty – Findlay Center 34kV line. **Estimated Cost: \$10.4M**
- At North Findlay station, replace 34.5kV CBs F, G, H, J, K, L with 34.5kV 2000A 40kA breakers. Replace 34.5kV circuit switcher BB (40kA). Replace T1 and T2 with 90MVA 138/69/34kV transformers. **Estimated Cost: \$12.1M**
- At New Liberty station, remove existing T1 and T2. Replace with one 90 MVA 138/69/34kV Transformer. Install High Side Circuit switcher for new Transformer. Expand station to build new 34.5 kV ring bus with (6) 2000A 40kA breakers. **Estimated Cost: \$11.4M**
- At Oilers switch station, build new ring bus in the clear with (4) 2000A 40kA breakers to replace Morrival switch. **Estimated Cost: \$5.3M**
- At North Baltimore station, rebuild station with (4) 2000A 40kA breakers. **Estimated Cost: \$4.9M**
- Install three way 1200A switch called “Touchstone” to replace Liberty Hi switch. **Estimated Cost: \$0.7M**

Existing Configuration:



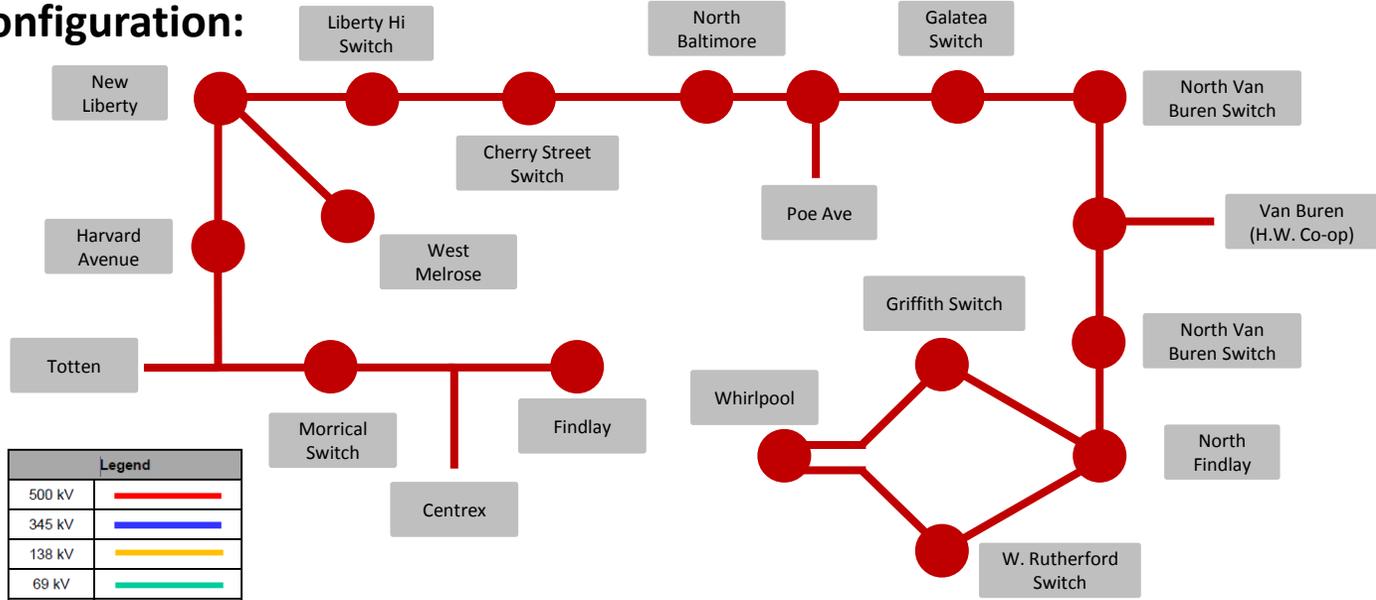
Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

Future Configuration:



AEP Transmission Zone M-3 Process Findlay – North Baltimore

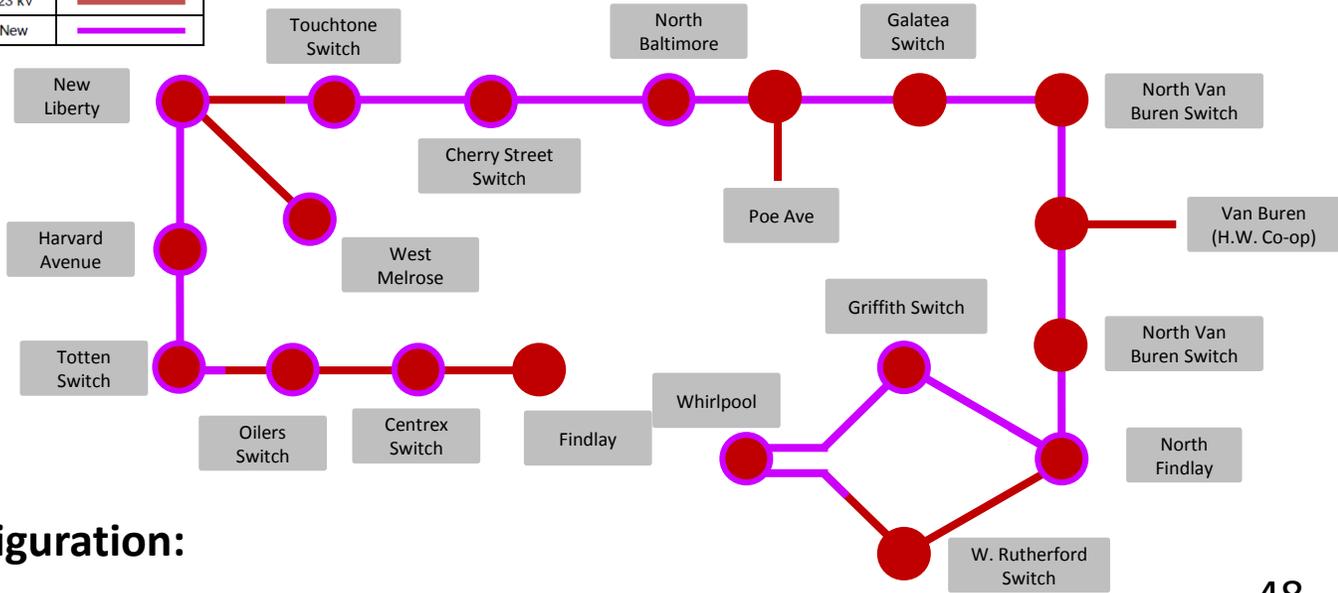
Existing Configuration:



- Replace Cherry Street switch with a two way 1200A switch. **Estimated Cost: \$0.6M**
- Replace West Melrose switch with 1200A switches. **Estimated Cost: \$0.2M**
- Replace Harvard Avenue switch with a three way 1200A switch. **Estimated Cost: \$0.6M**
- Install three way 1200A switch called “Totten” to eliminate the hard tap to the customer. **Estimated Cost: \$0.6M**
- Install two way 1200A switch called “Centrex” to eliminate the hard tap to the customer. **Estimated Cost: \$0.5M**
- Replace Griffith switch with a two way 1200A switch. **Estimated Cost: \$0.6M**
- Replace Whirlpool MOABs with 1200A capability. **Estimated Cost: \$0.4M**

Total Project Cost: \$85.9M

Future Configuration:



AEP Transmission Zone M-3 Process Findlay – North Baltimore

Alternatives Considered:

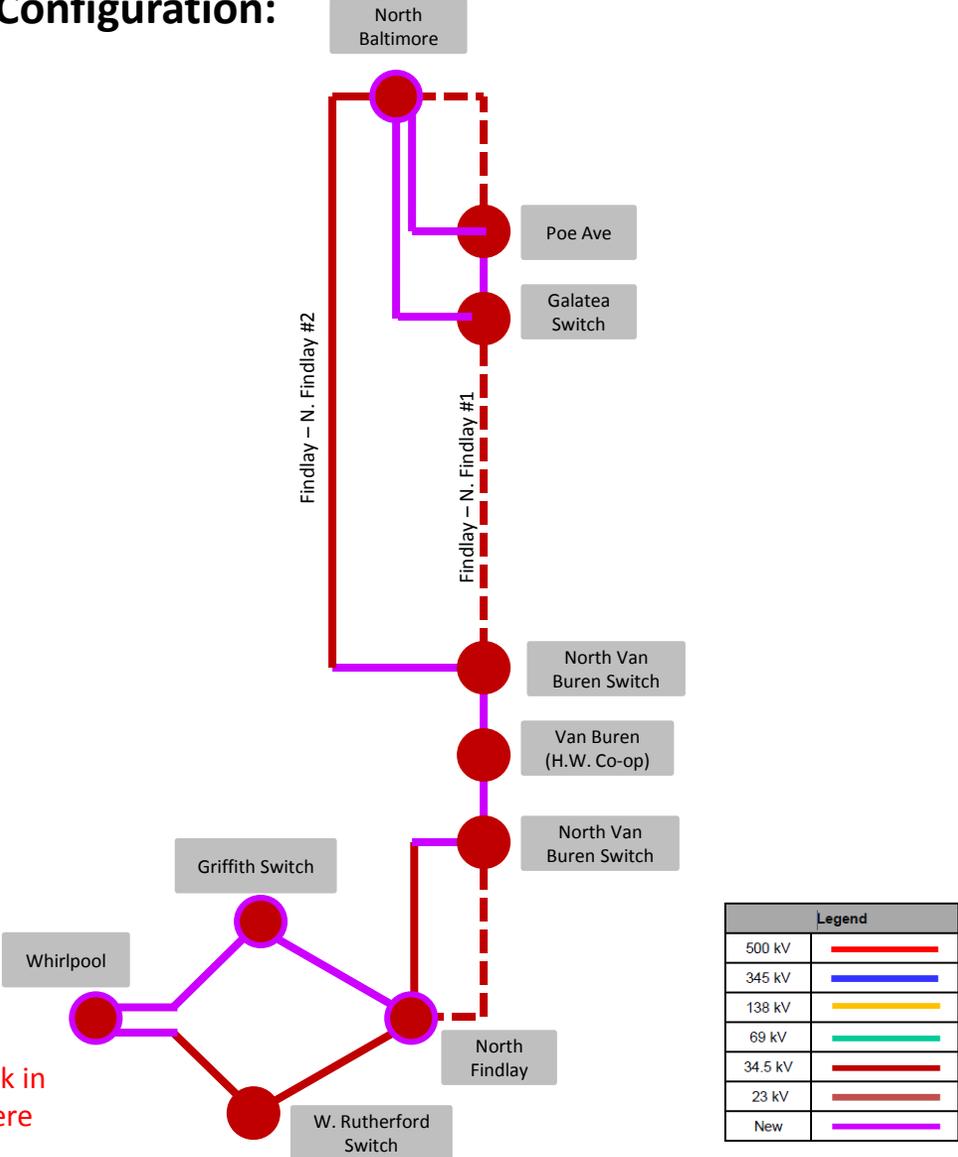
1. Alternate #1 (\$98.3M)

- Rebuild the approximately 1.5 miles of the North Baltimore – North Findlay #1 34.5 kV circuit that is currently double circuit out of North Findlay with the North Findlay #1 – North Findlay #2 34.5 kV circuit as single circuit to continue looped service to customers served out of Griffin, Whirlpool, and West Rutherford switches. This would involve retiring the rest of the 34.5 kV circuit that goes north towards North Baltimore via Van Buren . In order to provide service to the co-op served from the existing North Baltimore – North Findlay #1 circuit that would be retired, a new greenfield 1.1 mile double circuit 34.5 kV line would need to be constructed to loop the customers into the existing North Baltimore – North Findlay #2 circuit (a new crossing of I-75 would be required). An additional 1.6 miles of double circuit 34.5 kV line would be required to be constructed to serve the existing customer at Poe Avenue and service at Galatea switch (a new crossing of I-75 would be required). Under the current proposed solution only certain portions of the ~10 mile New Liberty – North Baltimore 34.5 kV circuit is being rebuilt to allow for flexibility in the future associated with potential developments to the north to address need AEP-2019-OH052 (North Baltimore – Portage 34.5 kV radial). This alternative would eliminate that flexibility and require the entire ~10 mile New Liberty – North Baltimore 34.5 kV circuit to be rebuilt to maintain the existing three sources to the northern Findlay network. The proposed station work would stay mostly unchanged under this alternative. The Whirlpool, Oilers, and New Liberty – Findlay Center line work would also remain unchanged. This alternative was not chosen due to it not being as cost effective as the proposed solution, along with the additional unknowns/impacts associated with the portions of greenfield line construction required.

Projected In-Service: 8/2022

Project Status: Engineering

Alternative Configuration:



****Costs include all the other work in the chosen option not shown here**

AEP Transmission Zone M-3 Process

Pickaway, Ohio

Need Number: AEP-2019-OH012

Process Stage: Solutions Meeting 02/21/2020

Previously Presented: Needs Meeting 03/25/2019

Supplemental Project Driver:

Customer Service

Specific Assumption References:

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

Problem Statement:

- South Central Power is rebuilding Lockbourne 138kV Station due to asset renewal conditions. Lockbourne is currently radially served via AEP's Harrison Station, this line is partially owned by AEP and South Central Power with the point of ownership change being Circleville. The current loading on this radial line is 65MW with plans for increased load. Total CMI 2.7M over 3 year period. (2015-2018).
- Radial service restricts the ability to perform routine maintenance and can cause extended outages to customers. The maintenance of radial transmission lines often requires cost-prohibitive temporary facilities or other labor-intensive measures.



AEP Transmission Zone M-3 Process Cameron Customer Service

Need Number: AEP-2018-OH032

Process Stage: Solutions Meeting 02/21/2020

Previously Presented: Needs Meeting 1/11/2019

Supplemental Project Driver:

Customer Service

Specific Assumption Reference:

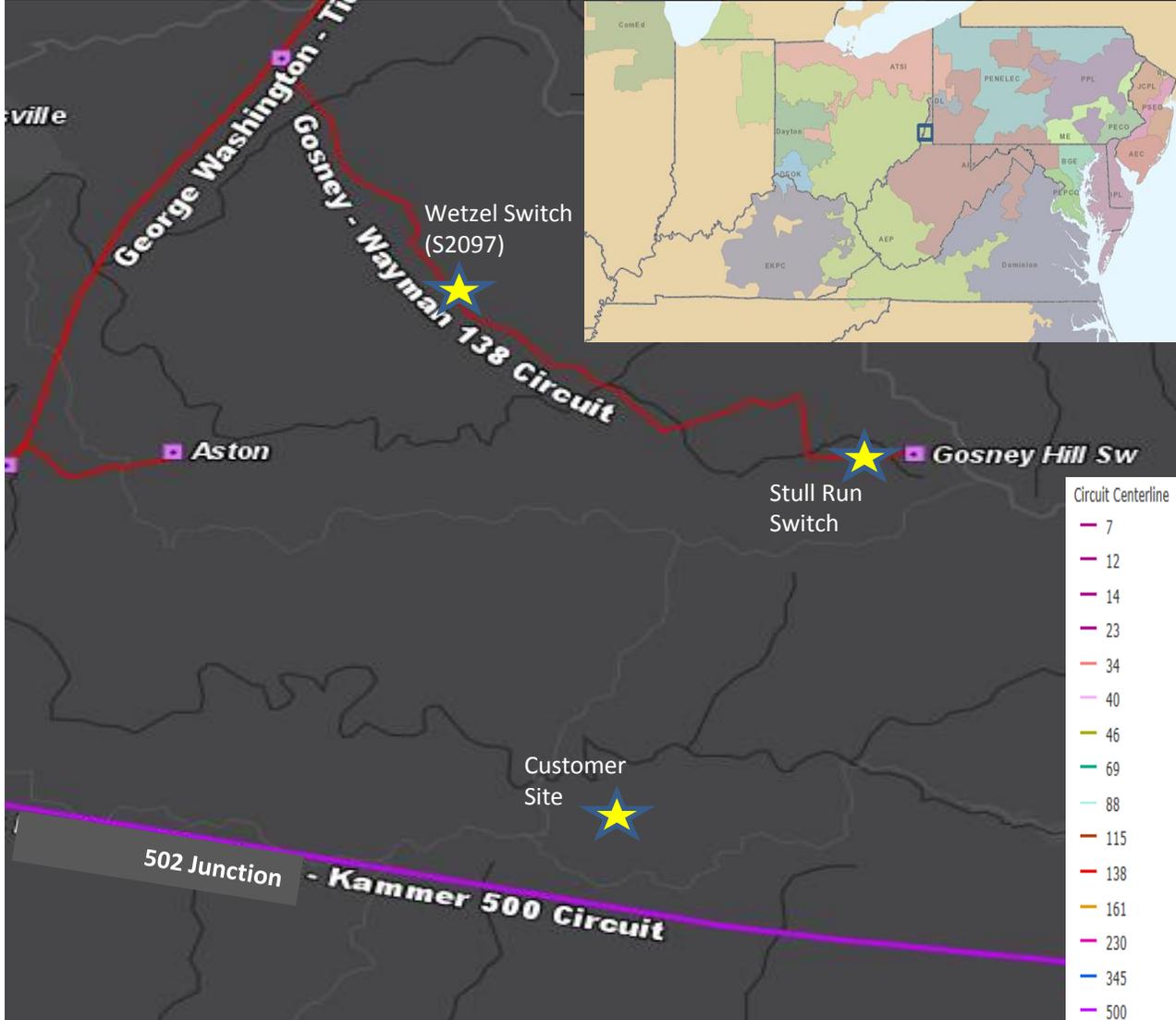
AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 7)

Problem Statement:

A customer has requested new service west of Cameron, West Virginia. The forecasted peak demand is 30 MW initially, with long-term prospects of 90 MW.

With the addition of this customer load, plus the new customer load on S2097 (AEP-2019-OH006), the Wayman-Gosney-Nauvoo Ridge 138kV radial line has an MVA-mile demand of 1142, far exceeding AEP’s guideline of 75 MVA-miles.

Model: Summer RTEP 2024



AEP Transmission Zone M-3 Process Cameron Customer Service

Need Number: AEP-2018-OH032

Process Stage: Solutions Meeting 02/21/2020

Proposed Solution:

Construct a new 500-138kV station (Panhandle), connecting to the Kammer-502 Junction 500kV circuit (~10.3 miles from Kammer, 31.7 miles from 502 Junction). Install a 3-breaker 500kV ring bus; 450 MVA 500-138kV transformer; 3-breaker 138kV ring bus. **Estimated Cost: \$25.0 M**

Construct a new 138kV switching station (Nauvoo Ridge) with 8- 138kV breakers in a breaker-and-a-half design. The station will have 1 circuit to Gosney Hill, 2 circuits to the customer’s facility, 2 circuits to Panhandle, and a 23 MVAR 138kV cap bank. **Estimated Cost: \$16.4 M**

At Gosney Hill, install a new 138kV breaker toward Nauvoo Ridge. Update station protection. **Estimated Cost: \$1.0 M**

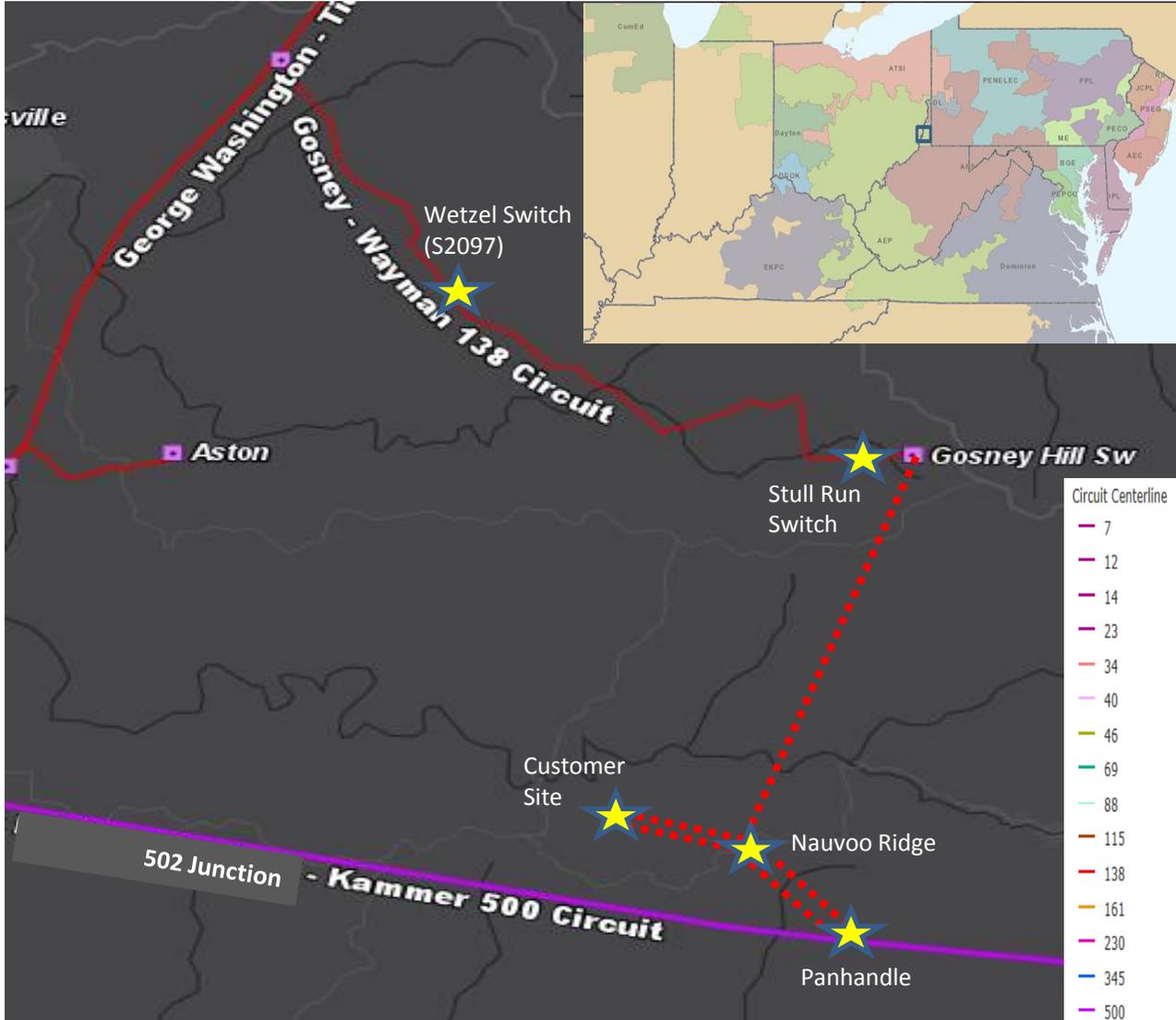
Construct a new 4.7-mile 138kV line south of Gosney Hill station to Nauvoo Ridge. Utilize 1033 ACSR conductor. Acquire new right-of-way. **Estimated Cost: \$14.7 M**

Construct a new 1.3 mile double-circuit 138kV line from Nauvoo Ridge to the customer’s substation. Acquire new right-of-way. **Estimated Cost: \$4.8 M**

Construct a new 1.5 mile double-circuit 138kV line from Panhandle to Nauvoo Ridge. Utilize 1033 ACSR conductor for each circuit. Acquire new right-of-way. **Estimated Cost: \$5.0 M**

Extend the Kammer-502 Junction 500kV transmission line 0.1-mile into Panhandle station (0.2 mile total). **Estimated Cost: \$1.5 M**

Total Estimated Transmission Cost: \$68.4 M



AEP Transmission Zone M-3 Process Cameron Customer Service

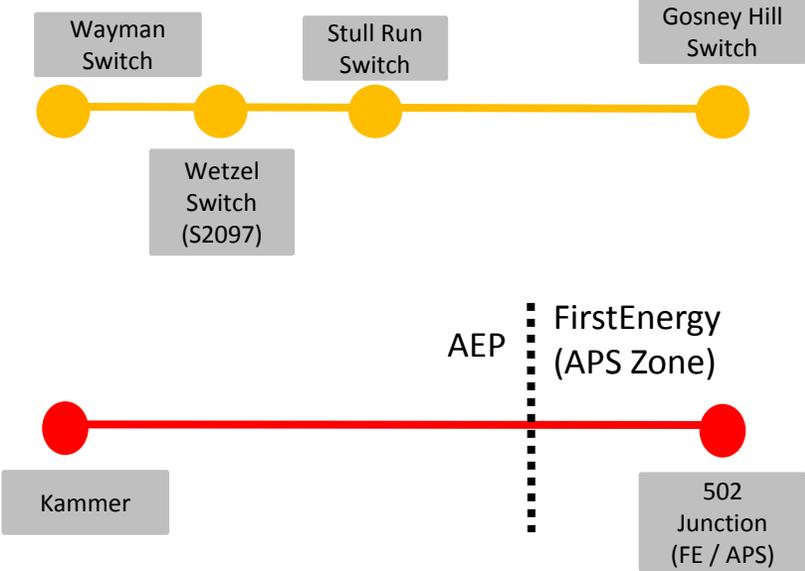
Need Number: AEP-2018-OH032

Process Stage: Solutions Meeting 02/21/2020

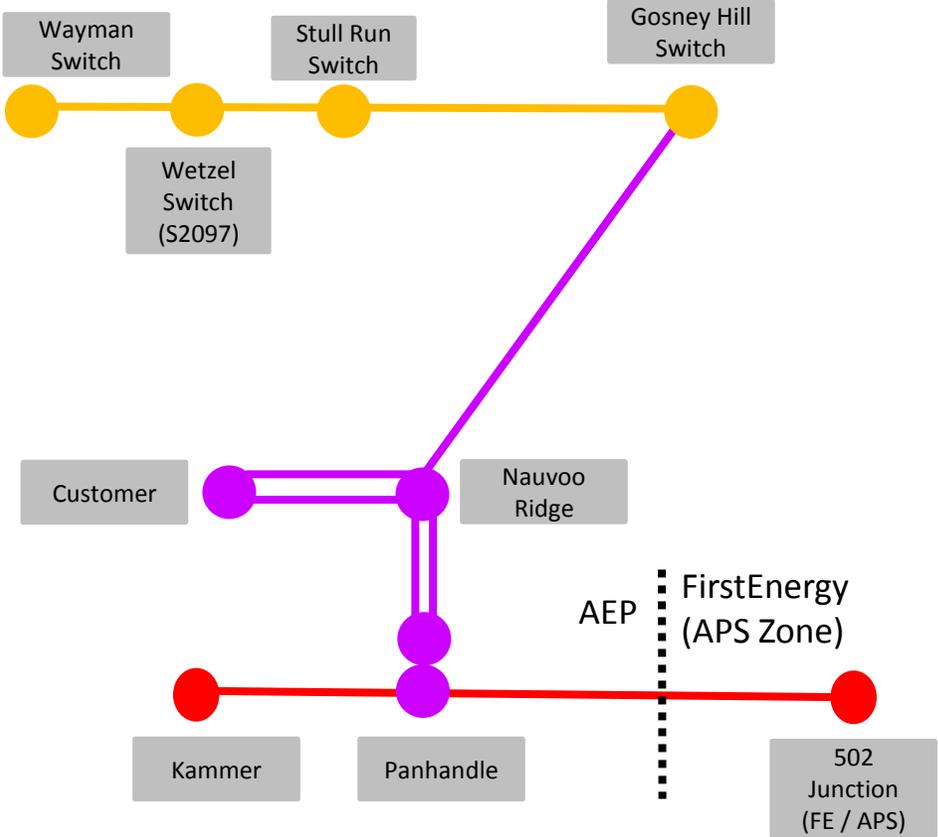
Proposed Solution:

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

Existing:



Proposed:



AEP Transmission Zone M-3 Process Cameron Customer Service

Need Number: AEP-2018-OH032

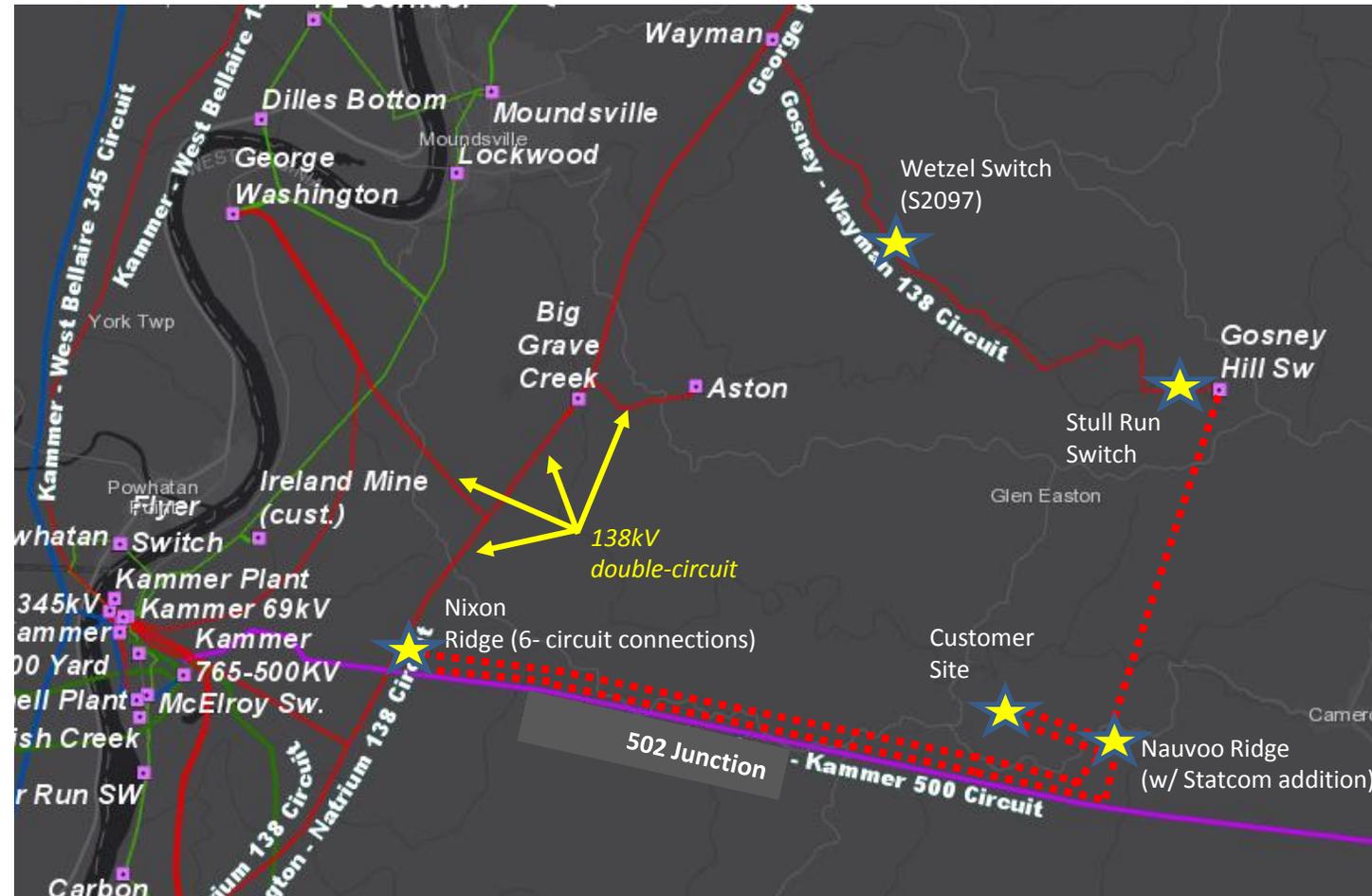
Process Stage: Solutions Meeting 02/21/2020

Alternatives Considered:

Construct a new 9-breaker switching station (Nixon Ridge, breaker-and-a-half) at the crossing of the Kammer-502 Junction 500kV line & 138kV double-circuit corridor (3 miles east of Kammer), looping in the Aston-Kammer 138kV & George Washington-Natrium 138kV circuits, plus 2 new circuits to Nauvo Ridge. Remote-end 138kV protection & RTU updates at Aston, Kammer, George Washington & Natrium stations. Build a 9-mile 138kV double-circuit line from Nixon Ridge east to Nauvo Ridge. *Keep the remaining scope between Gosney-Nauvo-New Customer 138kV.* This solution resulted in several violations, as it strains the local 138kV system, as the only EHV sources in the region are at Kammer & West Bellaire. Overloads on Kammer-Nixon Ridge 138kV, near-overload on Kammer-Natrium 138kV (would overload with a pending customer project). In addition, N-1-1 voltage violations of 0.90-0.92 pu in the area; to rectify this, more cap banks could be placed, but due to 6 in the region already, switching conflicts (hunting) would likely arise. To mitigate these violations, this alternate would require a reconductor or rebuild 18 miles of 138kV lines and install a 138kV +/- 75 MVAR Statcom system in the area, for dynamic voltage support. **Total Cost of \$120 Million**

Projected In-Service: 7/21/2020 (for initial 138kV service to the customer). 3/1/2022 (for the 2nd phase to construct Panhandle station and complete the 138kV loop).

Project Status: Engineering (for initial customer service project); Scoping (for 2nd phase)



AEP Transmission Zone M-3 Process Adams County, Ohio

Need Number: AEP-2019-OH014

Process Stage: Solutions Meeting 02/21/2020

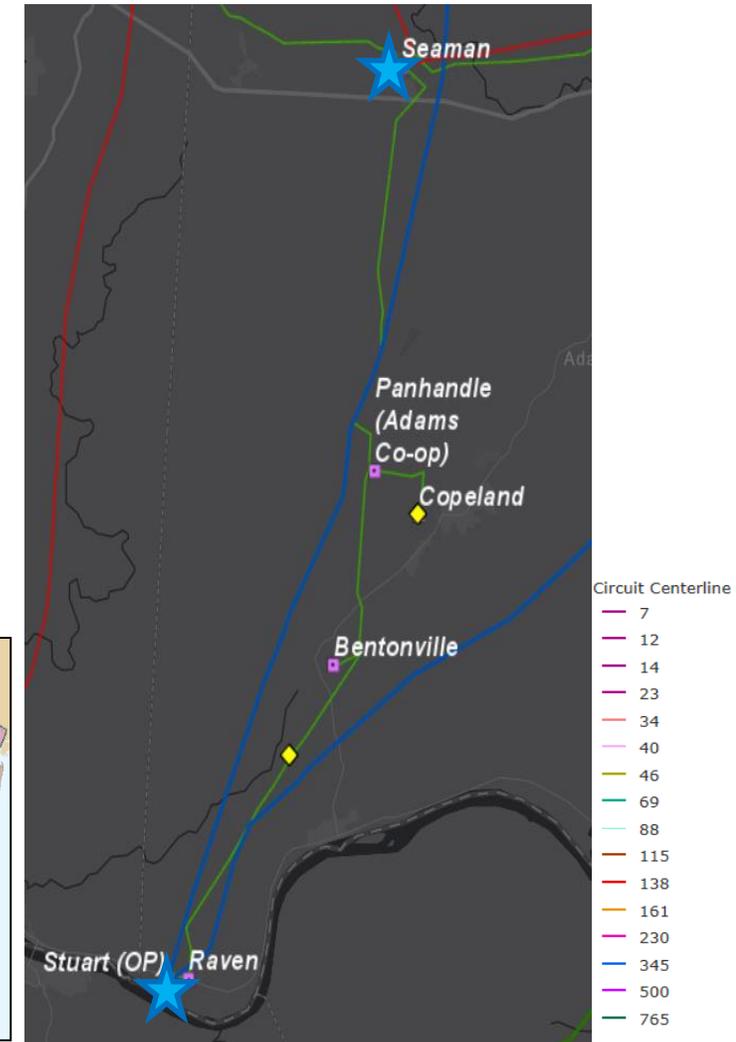
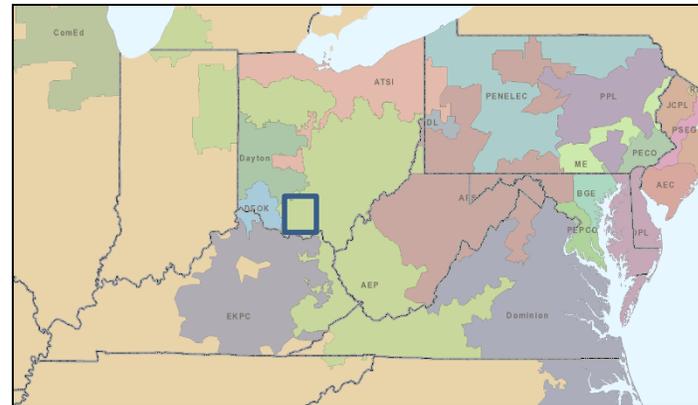
Process Chronology: Needs Meeting 04/23/2019

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

Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

- The existing 28.5 mile, 69 kV line section between Stuart (DP&L/Duke) and Seaman(AEP) was constructed in 1974 using wood pole structures with 636 ACSR conductor. There are 260 open conditions distributed across the 170 structures on this line.
- The Stuart-Seaman 69 kV circuit has experienced over 2.2 million customer minutes of interruption in the past three years: 753,716 for AEP and 1,517,618 for Adams Coop.



AEP Transmission Zone: Supplemental Adams, Ohio

Need Number: AEP-2019-OH014
Process Stage: Solutions Meeting 02/21/2020
Proposed Solution:

Rebuild 22.0 miles of the existing 28.5 mile Stuart-Seaman 69kV circuit with 795 ACSR. Retire approximately 3 miles of the line between West Union and structure 86. 32 of the line’s 170 structure were replaced since 2012 and will not be replaced as part of the rebuild
Estimated Cost: \$48.5M

Construct approximately 2.5 miles of new line from structure 86 on the Stuart – Seaman 69 kV line to Copeland station utilizing 795 ACSR. **Estimated Cost: \$5.0M**

Rebuild the 2.0 mile West Union – Copeland 69 kV line utilizing 795 ACSR. The line is part of the Stuart – Seaman 69 kV circuit and is currently radial fed from West Union switch. **Estimated Cost: \$4.0M**

Establish a four breaker 69 kV ring (3000A, 40kA) at the existing Copeland station to serve the Adams Co-op and AEP Ohio customers currently served from a hard tap at the end of the radial. **Estimated Cost: \$5.0M**

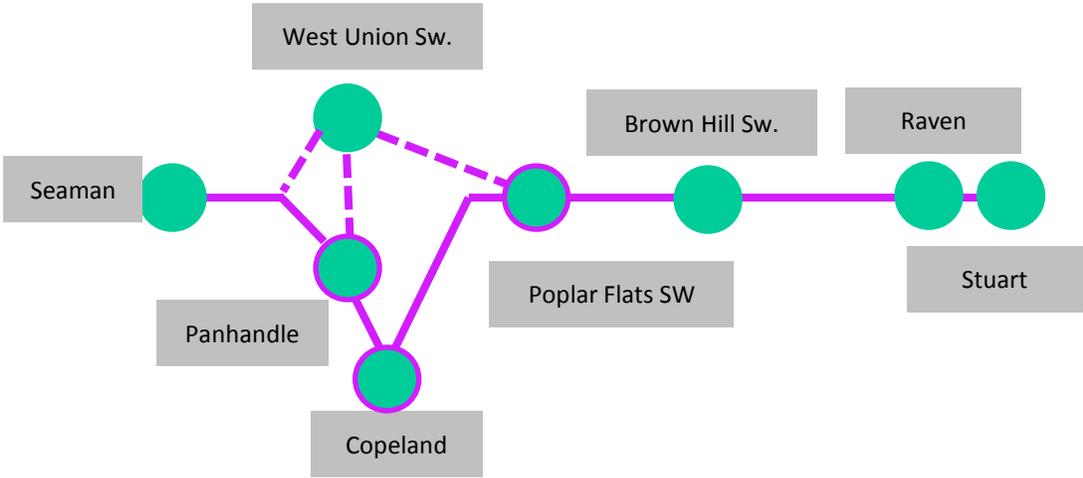
Retire existing West Union Switch
Estimated Cost: \$0.1M

Install new 2000A 3-way phase over phase switch at Panhandle
Estimated Cost: \$0.7M

Replace the existing Poplar Flats switch with a new 2000A 3-way phase over phase switch.
Estimated Cost: \$0.7M

Remote end upgrade and equipment relocation work will be required at Seaman station to accommodate the new line at the station.
Estimated Cost: \$1.0M

Total Estimated Transmission Cost: \$65.0M



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

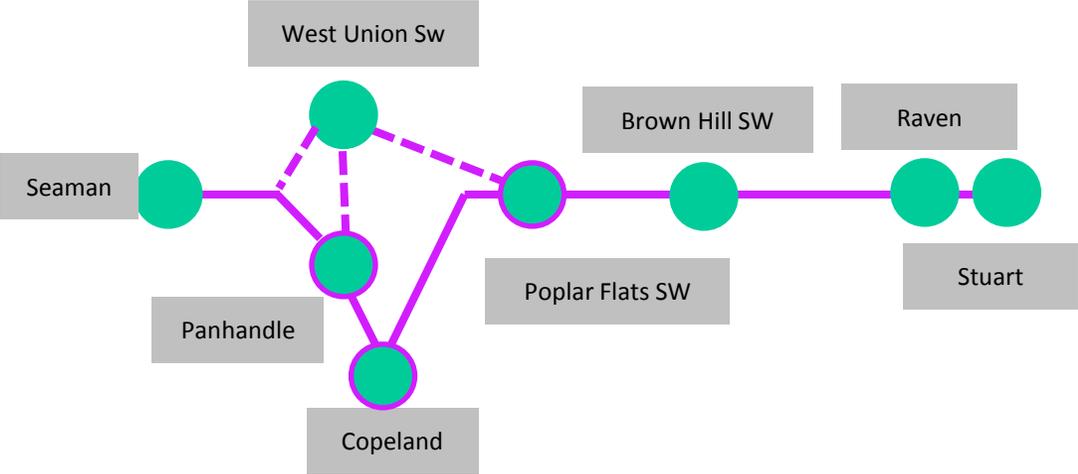
AEP Transmission Zone: Supplemental Adams, Ohio

Need Number: AEP-2019-OH014
Process Stage: Solutions Meeting 02/21/2020
Proposed Solution:

Alternatives:

Alternate #1
 Rebuild the existing 28.5 mile Stuart – Seaman 69 kV circuit leaving the existing configuration. The Panhandle and Poplar Flats switches would still require replacement. Station work would still be required at Seaman station. The existing West Union switch would require replacement rather than being retired. This alternative was not chosen as it would leave the existing radial and hard tapped configuration between West Union switch and Copeland station for a similar if not higher cost overall. In addition, rebuilding the line between West Union and Copeland would be difficult from a constructability perspective due to the radial nature of the line. **\$65.9M**

Projected IS Date: 12/01/2024
Project Status: Scoping



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

AEP Transmission Zone M-3 Process Hillsboro – Millbrook Park 138 kV Line Rebuild

Need Number: AEP-2019-OH024

Process Stage: Solutions Meeting 02/21/2020

Previously Presented: Needs Meeting 05/20/2019

Supplemental Project Driver:

Equipment Condition/Performance/Risk

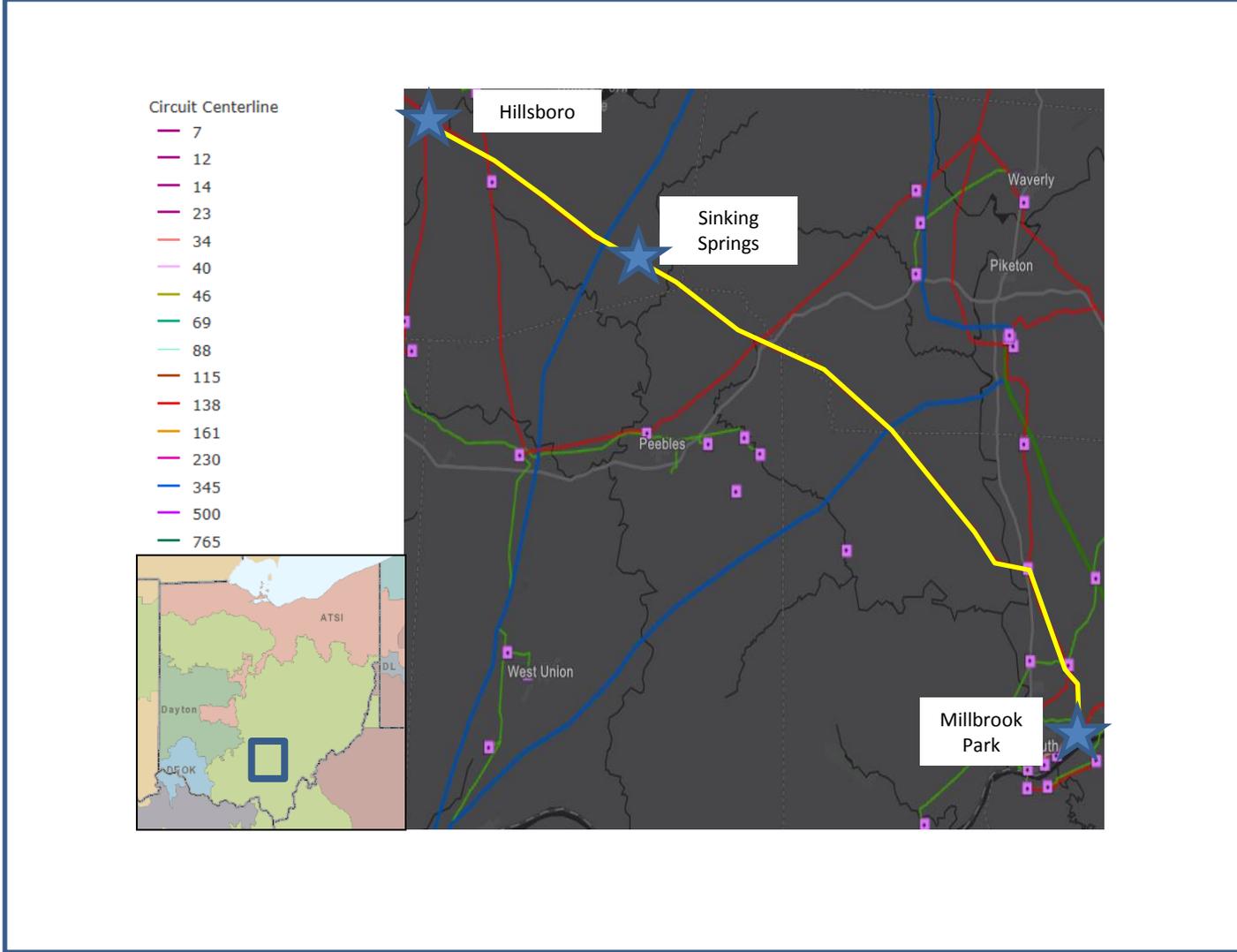
Specific Assumption Reference:

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

Problem Statement:

- The 1943 Hillsboro – Millbrook Park 138 kV circuit (~52 miles) is wood pole construction and has 1,342 open conditions.
- The majority (93%) of the original conductor (vintage 1944 & 1948) is 477 MCM (26/7) ACSR and is still in-service.
- Half of the wood pole structures from the 1940’s are still in-service; the remaining are a mixture from 1960’s – 1980’s.
- There are additional concerns with the shielding, grounding, and hardware along this 52 mile long line.
- Sinking Springs is in a remote part of AEP’s service territory making manual switching difficult.
- Originally installed in 1942-1943 timeframe. 98% of the line is on wood structures.
- Age Profile: 53% from 1940’s; 4.4% from 1960’s; 13% from 1970’s; 27% from 1980’s; 2.6% from 2000’s

Model: N/A



AEP Transmission Zone M-3 Process Hillsboro – Millbrook Park 138 kV Line Rebuild

Need Number: AEP-2019-OH024

Process Stage: Solutions Meeting 02/21/2020

Proposed Solution:

Portsmouth – Trenton #1 & #2 138kV Cost: \$126.1M

Rebuild 43.4 miles single circuit line between Hillsboro – South Lucasville with 1033 ACSR. **Estimated Cost: \$92.5M**

Rebuild 8.5 miles double circuit between Millbrook Park – South Lucasville with 1033 ACSR. **Estimated Cost: \$33.6M**

Install a new 3-way 2000A 138kV, phase over phase switch at Sinking Springs. **Estimated Cost: \$0.7M**

Total Estimated Transmission Cost: \$126.8M

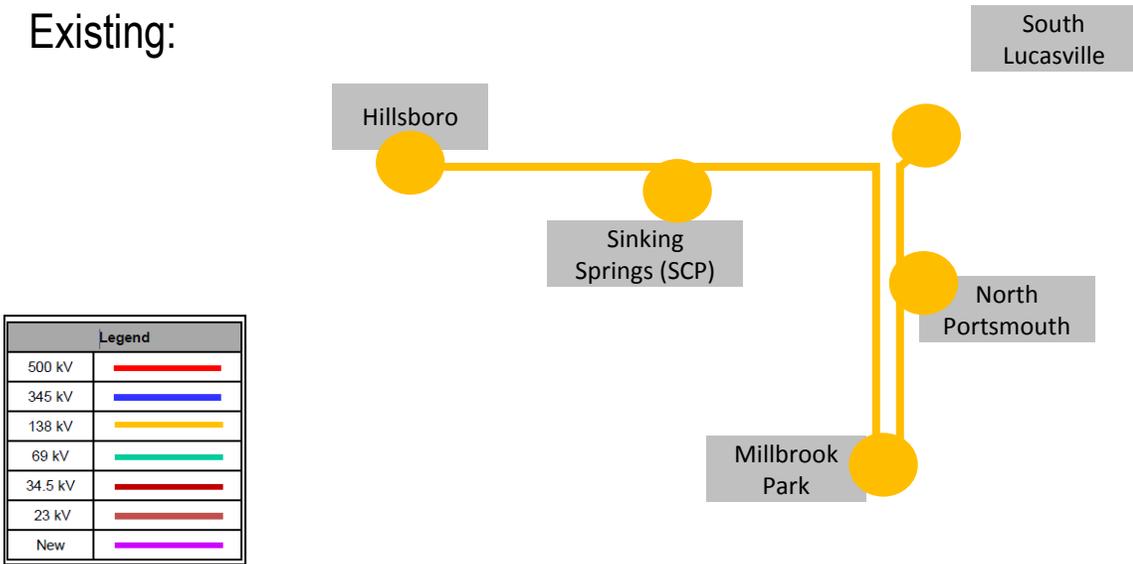
Alternatives Considered:

No viable cost-effective transmission alternative was identified.

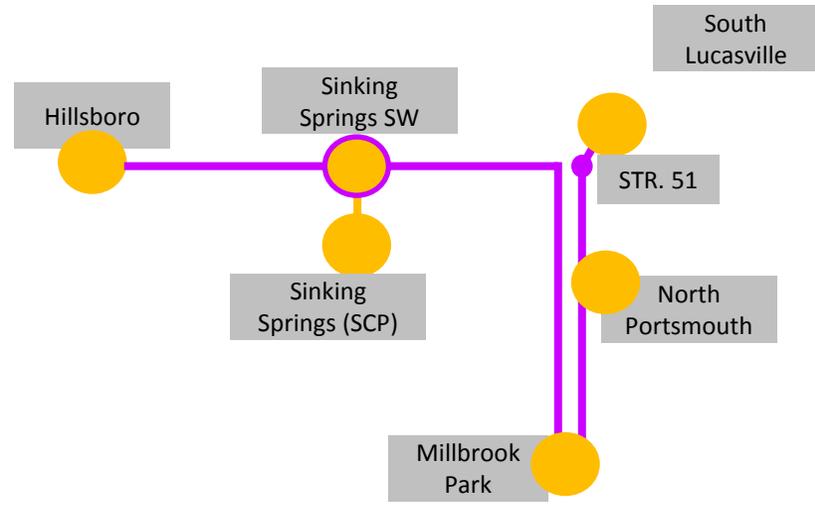
Projected In-Service: 09/30/2022

Project Status: Scoping

Existing:



Proposed:



AEP Transmission Zone M-3 Process Sunnyside-Torrey 138kV Rebuild

Need Number: AEP-2019-OH027

Process Stage: Solutions Meeting 2/21/2020

Previously Presented: Needs Meeting 5/20/2019

Supplemental Project Driver:

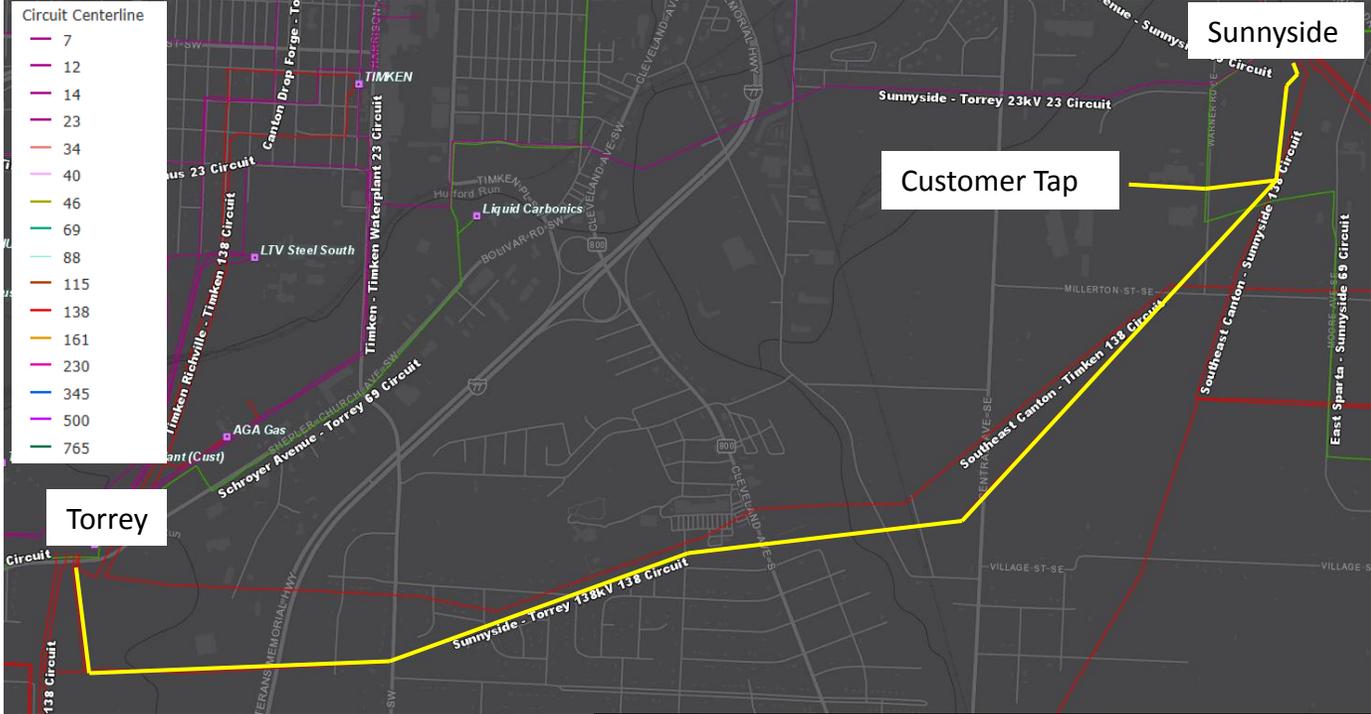
Equipment/Material/Condition/Performance/Risk

Specific Assumption Reference:

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

Problem Statement:

- The majority (94%) of the Sunnyside-Torrey 138 kV line (4.3 miles) is comprised of steel lattice towers built in 1918, with the remaining 6%, dating back to 1954.
- The conductor is original vintage (1918), consisting of 6-wired 200 MCM copper & 250 MCM copper.
- Note that the 0.3-mile customer tap was built in 2007 and is in adequate condition.



AEP Transmission Zone M-3 Process Sunnyside-Torrey 138kV Rebuild

Need Number: AEP-2019-OH027

Process Stage: Solutions Meeting 2/21/2020

Proposed Solution:

Rebuild the 4-mile Sunnyside-Torrey 138kV circuit.
Supplement the existing right-of-way as needed, to resolve encroachments and other constraints.

Cost estimate: \$12.7 Million

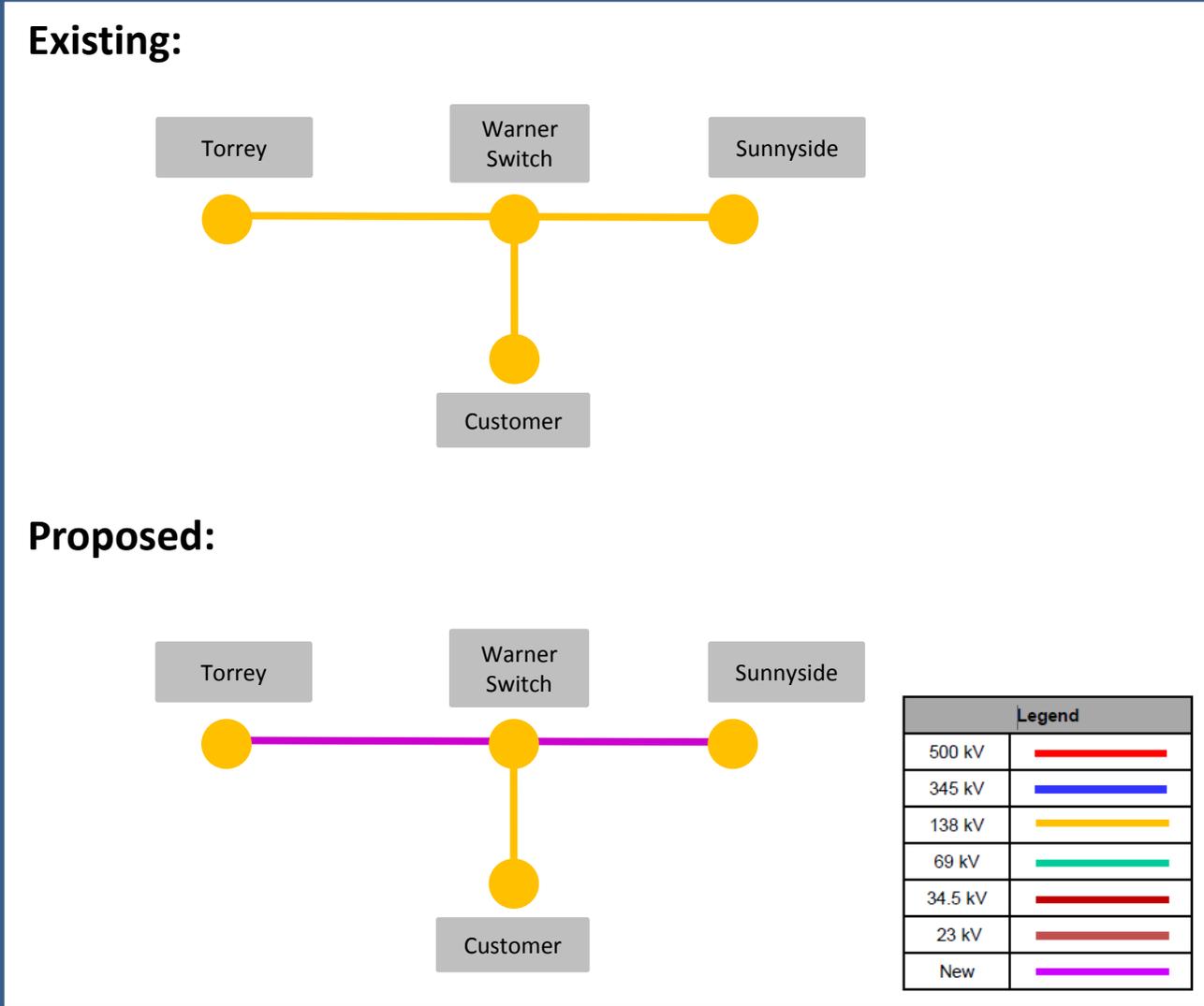
Ancillary Benefits: Improved reliability for the industrial customer served from the circuit.

Alternatives Considered:

No viable cost-effective alternative was identified.

Projected In-Service: 8/1/2022

Project Status: Scoping



AEP Transmission Zone M-3 Process Newark, Ohio

Need Number: AEP-2019-OH043

Process Stage: Solutions Meeting 2/21/2020

Previously Presented: Need Meeting 7/24/2019

Supplemental Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption References:

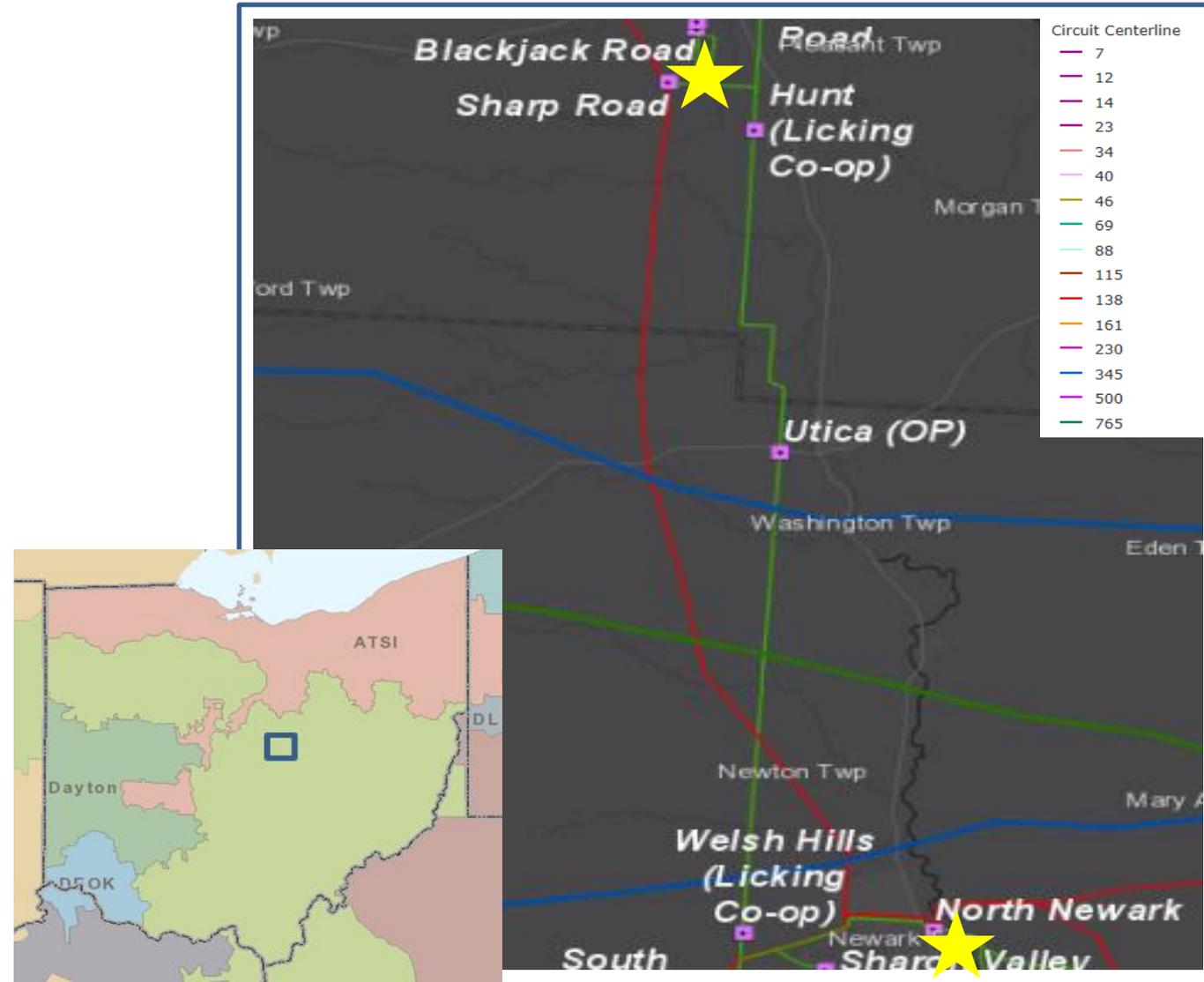
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

North Newark – Sharp Road 138kV (vintage 1951)

- Length: 19.38 Miles
- Original Construction Type: Wood Pole
- Original Conductor Type: 477 KCM Hawk
- Number of open conditions: 68
 - Open conditions include: Burnt insulators, insect damage, pole rot, woodpecker damage

Model: N/A



AEP Transmission Zone M-3 Process Newark, Ohio

Need Number: AEP-2019-OH043

Process Stage: Solutions Meeting 2/21/2020

Proposed Solution:

- Rebuild the existing 138kV line with 19.4 miles of new 1033 ACSR.

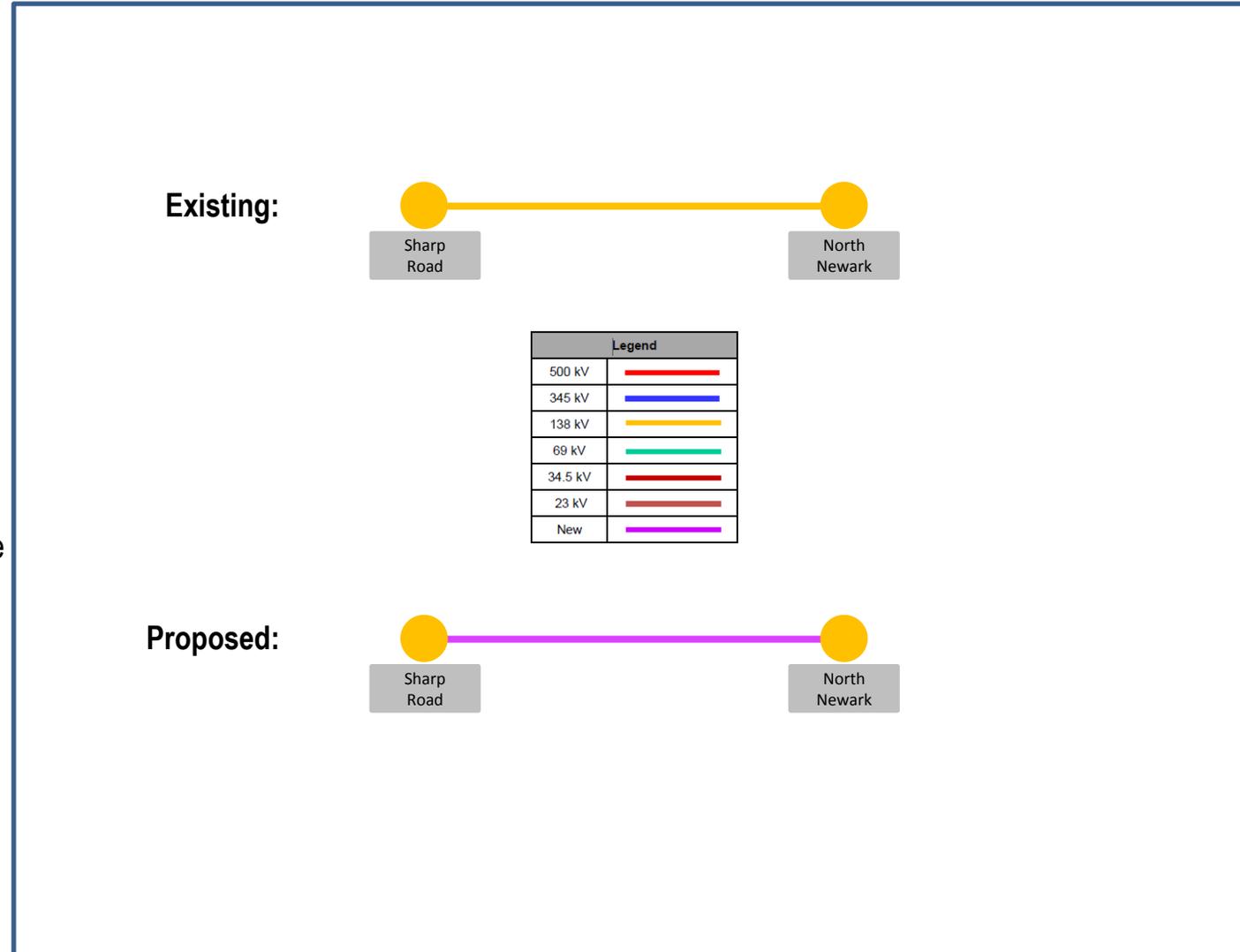
Estimated Cost: \$42.2M

Alternatives Considered:

No viable cost-effective transmission alternative has been identified as this line helps support the New Albany area and has seen increased loading due to 1,600 MW of data center demand over the past 5 years with more expected in the coming years.

Projected In-Service: 7/1/2023

Project Status: Scoping



AEP Transmission Zone M-3 Process Culbertson 138kV Greenfield Station

Need Number: AEP-2019-OH051

Process Stage: Solutions Meeting 02/21/2020

Previously Presented:

Need Meeting 9/25/2019

Supplemental Project Driver:

Customer Service

Specific Assumption Reference:

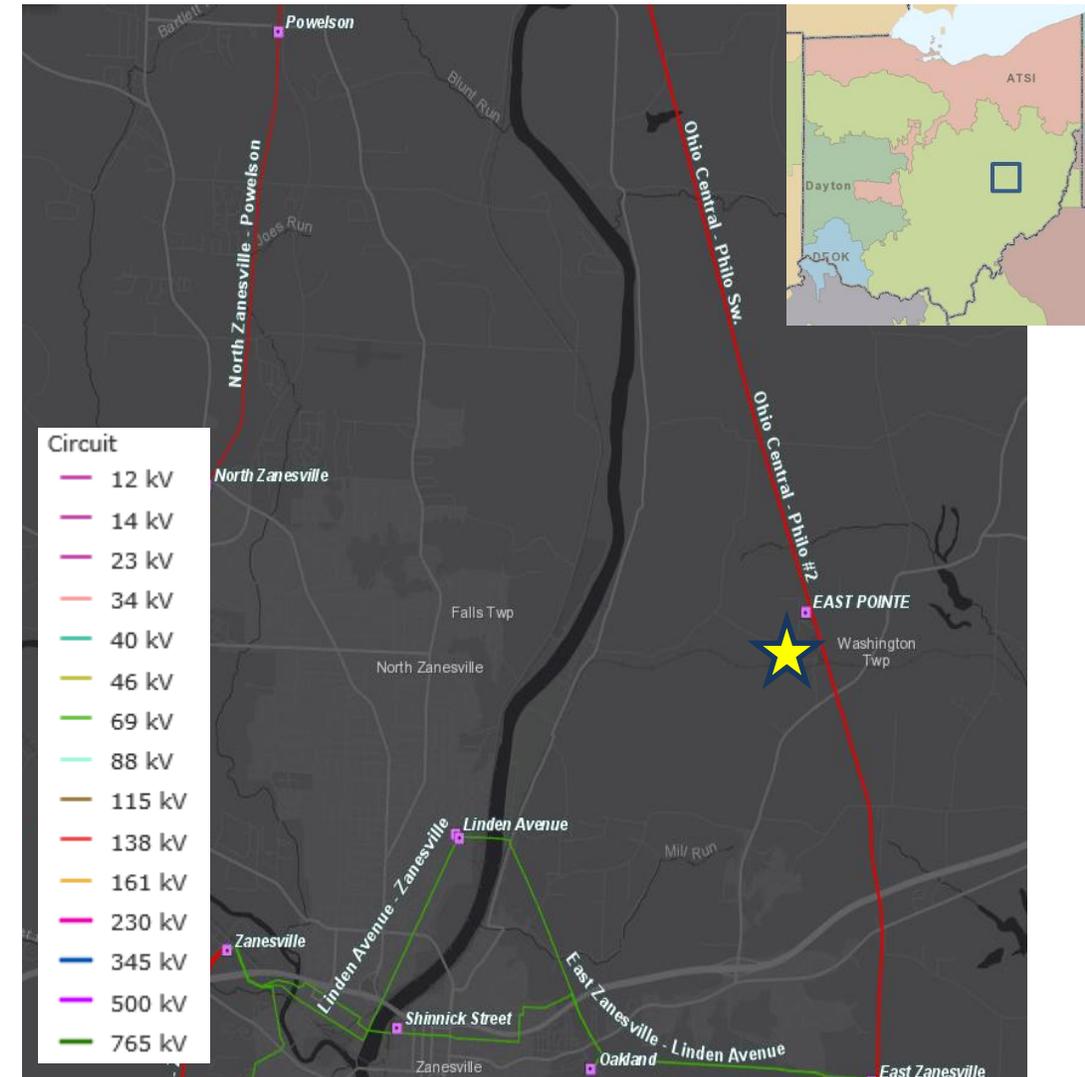
AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 7)

Problem Statement:

Customer Service:

- Peak load: 30MW
- A customer has requested new service on the Ohio Central – Philo #1 138 kV circuit.

Model: 2024 RTEP



AEP Transmission Zone M-3 Process Culbertson 138kV Greenfield Station

Need Number: AEP-2019-OH051

Process Stage: Solutions Meeting 02/21/2020

Proposed Solution:

- Install approximately 0.5 Miles of 138kV double circuit line to tie the greenfield Culbertson station to the Ohio Central – Philo #1 138kV circuit. **Estimated Cost: \$1.9M**
- Culbertson 138kV: Install 4 greenfield 138kV 2000A 40kA CBs in a ring bus configuration to serve the new customer station. **Estimated Cost: \$8.0M**

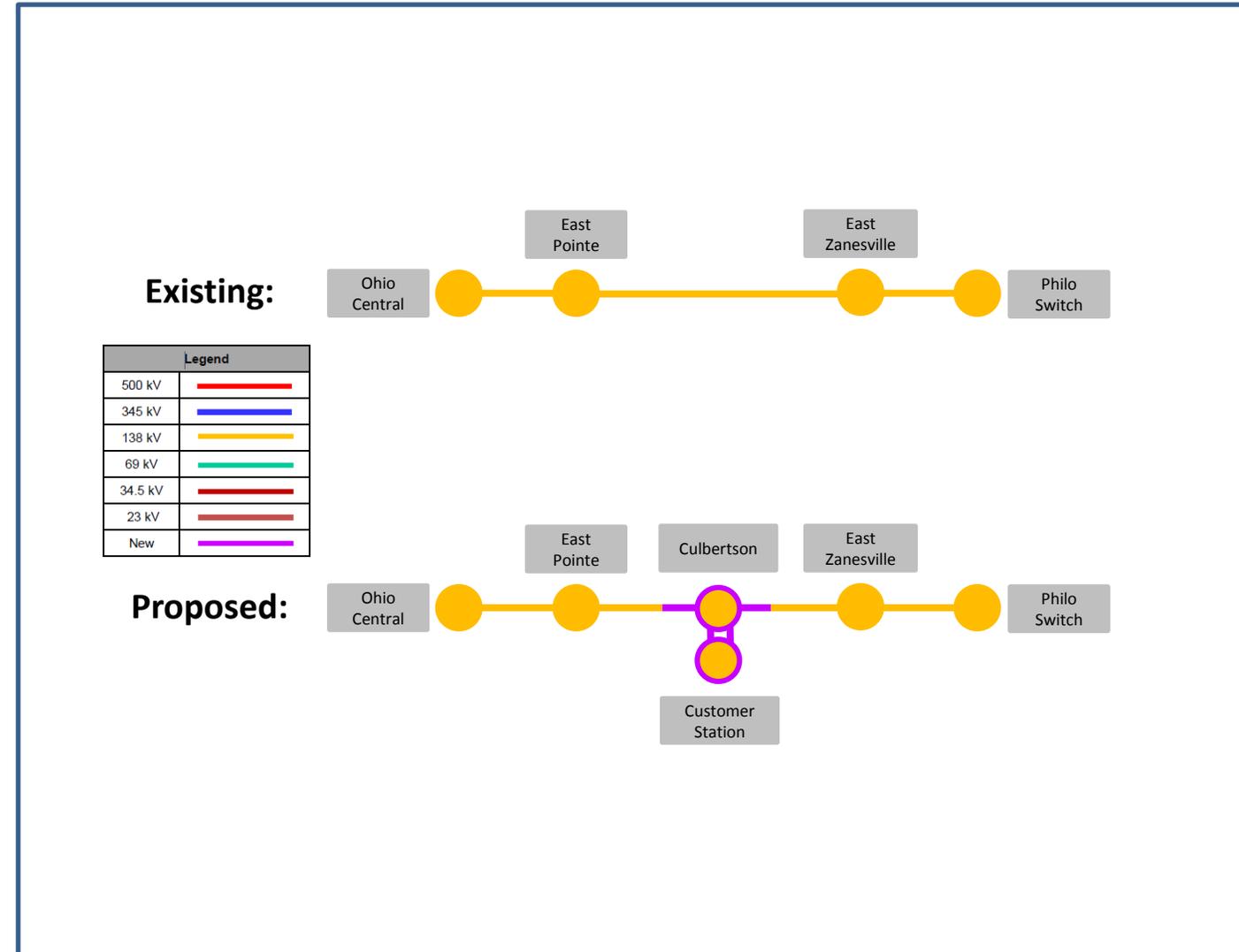
Total Estimated Transmission Cost: \$9.9M

Alternatives Considered:

- No viable cost-effective transmission alternative was identified.

Projected In-Service: 09/01/2020

Project Status: Engineering



Need Number: AEP-2019-AP017

Process Stage: Solutions Meeting 02/21/2020

Previously presented: Need Meeting 06/17/2019

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:

Beaver Creek – McKinney #1 46 kV Circuit

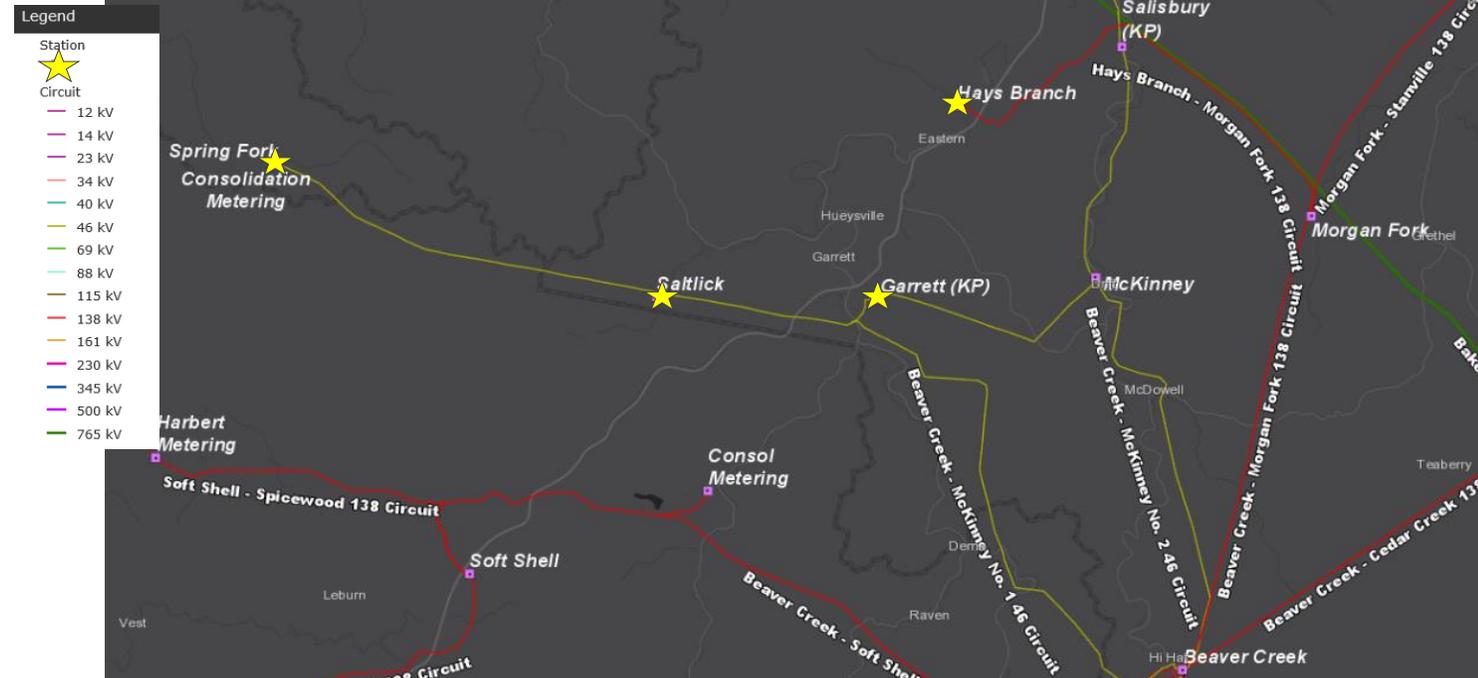
- From 2016-2018, the approximately 24.6 mile Beaver Creek – McKinney #1 46 kV circuit has experienced 22 outages.
- The circuit is comprised of 152 structures, the majority of which are wood structures dating back to 1929 (22/152, 14%) and 1949 (61/152, 40%).
- There are 142 open conditions along the 24.6 mile long line. These include damaged poles and cross-arms, conductor/shield wires, and guy anchor/knee/vee braces.

Hays Branch Station

- Hays Branch serves a ~30 MW gas compressing operation that is currently radially fed from a ~8.25 mile line out of Morgan Fork station.

Saltlick Station

- Saltlick serves an EKPC co-op that is currently radially fed off the Beaver Creek – McKinney 46 kV circuit.



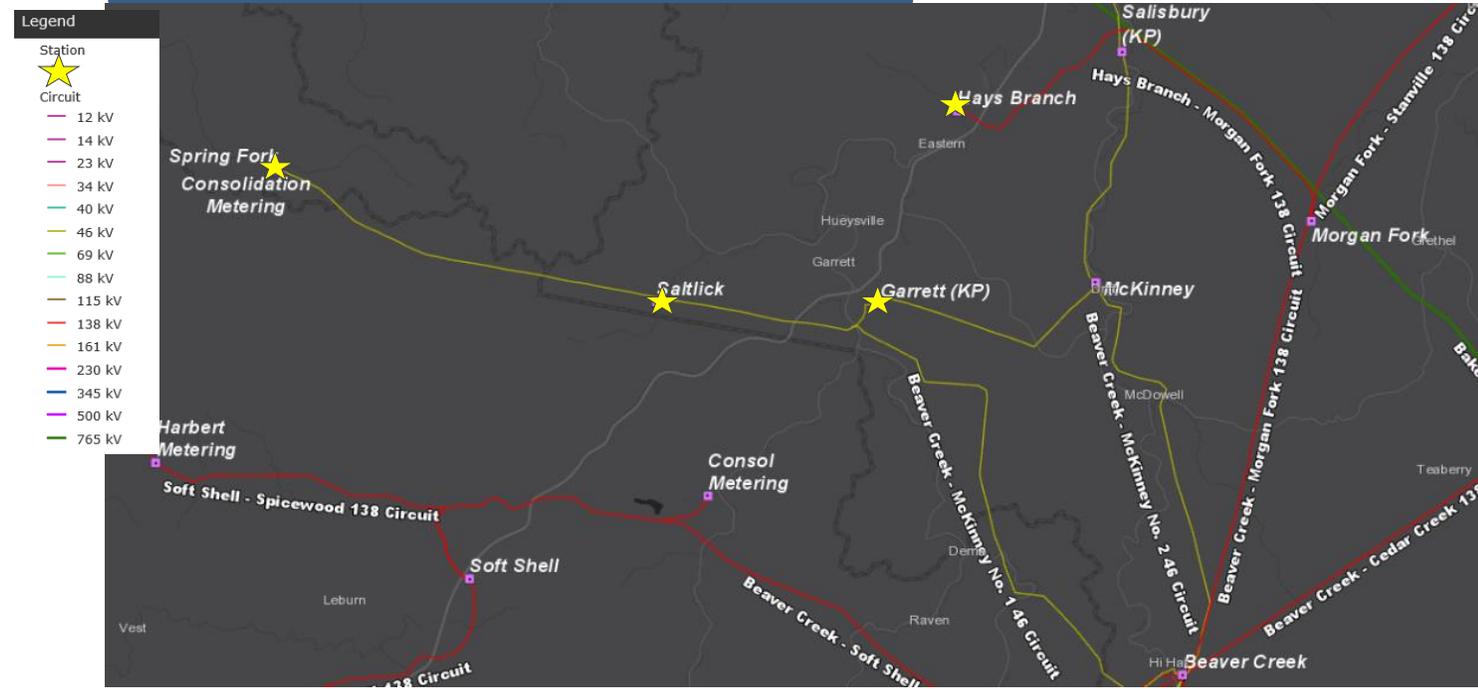
Continued from previous slide...

Spring Fork

- Spring Fork station serves KPCo distribution customers and is currently radially fed off the Beaver Creek – McKinney 46 kV circuit.

Consolidation Metering

- Consolidation Metering station serves a mining operation and is currently radially fed off the Beaver Creek – McKinney 46 kV circuit.



Proposed Solution:

Construct ~9.3 miles of single circuit 138kV from Soft Shell to Garrett picking up Salt Lick Co-op via Snag Fork along the way.

Estimated Cost: \$35.3M

Construct ~3.5 miles of single circuit 138kV from the Eastern station to Garrett station. A short extension will be required from the new station to the existing Hays Branch metering point. Construct short extension to existing Morgan Fork – Hays Branch 138 kV circuit from Eastern station

Estimated Cost: \$11.5M

Double circuit cut into existing Hays Branch - Morgan Fork line to tie into new Hays Branch S.S PoP switch. Installation of a new heavy double circuit dead-end tap structure on the existing Hays Branch - Morgan Fork 138kV Line (Due to unequal loading on the transmission line).

Estimated Cost: \$1.3M

Construct ~0.25 mi of double circuit 138kV line Hays Branch S.S – Eastern. Installation of 3 double circuit suspension structures one of which is a custom pole structure.

Estimated Cost: \$1.6M

New PoP switch structure at Hays Branch to accommodate new line from Eastern station

Estimated Cost: \$0.5M

Expand the Garrett station, Install a 138kV three breaker ring bus (If space becomes a constraint, we should look at installing a straight bus arrangement with two 138 kV breakers and a circuit switcher on the high side of the transformer), 138/12kV 30 MVA transformer

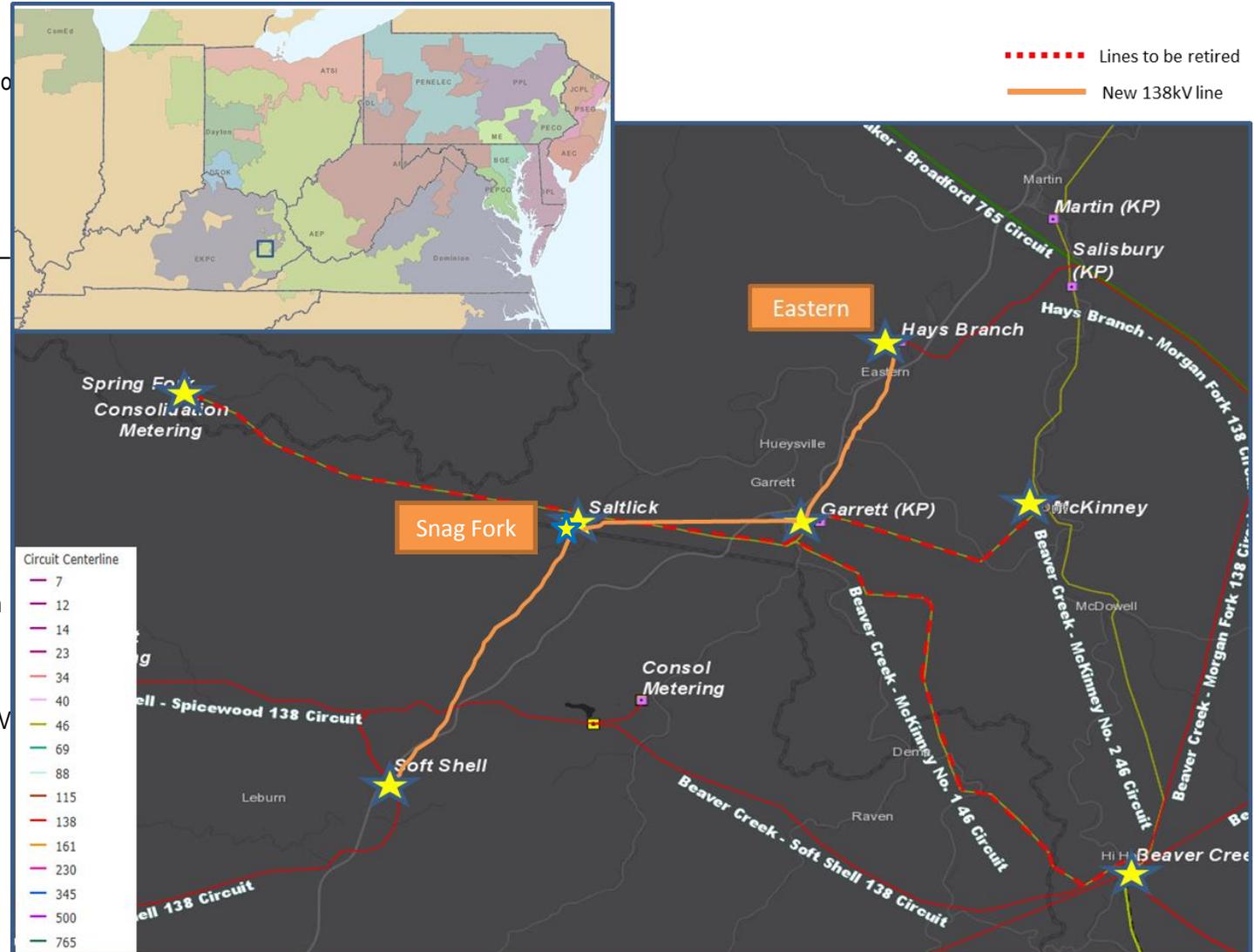
Estimated Cost: \$5.8M

Establish a new 138 kV substation Eastern south of the existing Hays Branch station. Install two 138kV breakers (3000A 40kA) at the new Eastern station on exits toward Morgan Fork and Garrett station.

Estimated Cost: \$6 M

Establish Snag Fork S.S. Install a 3 way phase over phase motorized (automated) switching structure near Saltlick to serve the EKPC co-op.

Estimated Cost: \$1.1 M



AEP Transmission Zone: Baseline Garrett Area Improvements

Proposed Solution (Cont.):

Move the existing 69kV rated CB G to the Beaver Creek – McKinney #2 circuit exit at McKinney substation.

Estimated Cost: \$0.9 M

Install a 138kV breaker (3000A 40kA) with an exit towards Garrett station (via Snag Fork) at Softshell substation.

Estimated Cost: \$0.8 M

Retire the ~25 miles of the 46kV Beaver Creek – McKinney #1 46 KV circuit. Retire Spring Fork Tap.

Estimated Cost: \$17.3 M

Total Estimated Transmission Cost: \$81.9 M

Ancillary Benefits: Removal of obsolete ~25 mi of 46kV network.

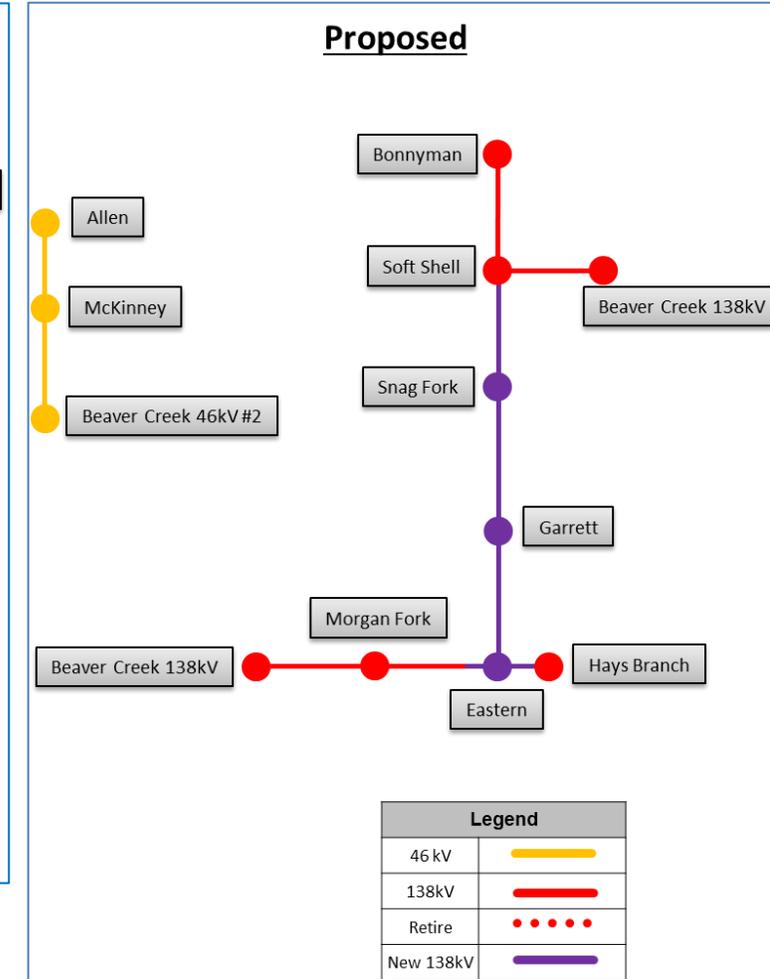
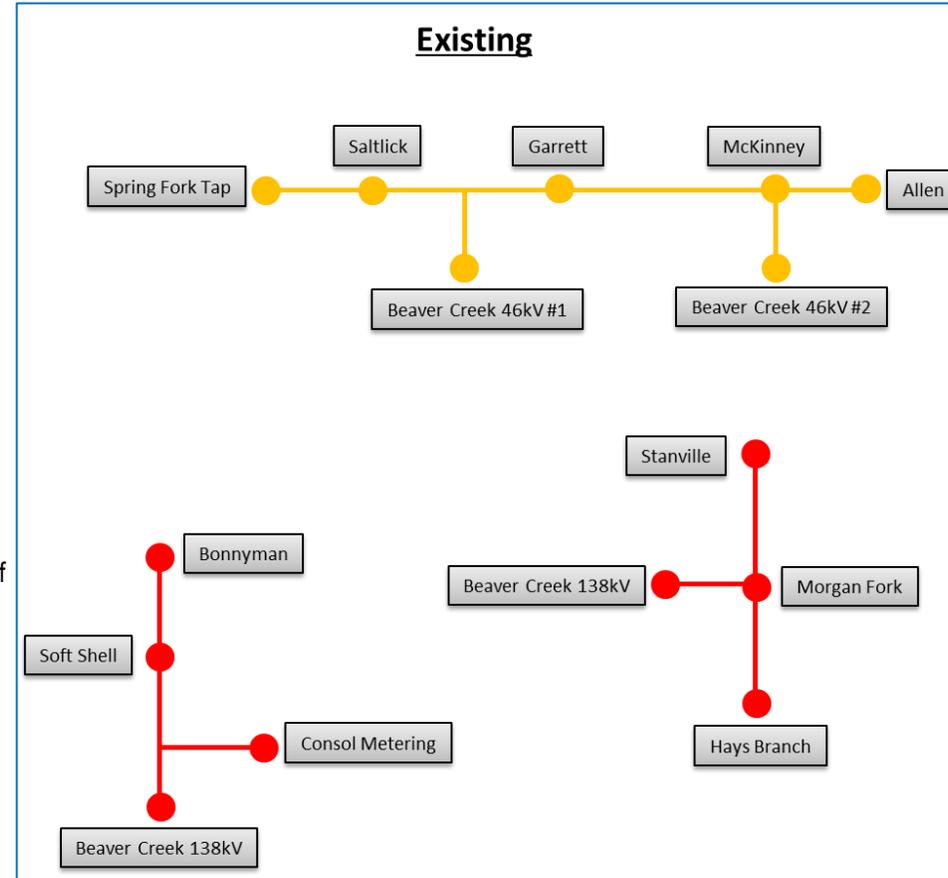
Alternative Solution:

Rebuild Beaver Creek – McKinney 46 kV #1 (approximately 25.0 miles) circuit keeping the system configuration as is. Construct new ~6.5 miles of 138kV line from Stanville station. Convert the ~3.5 mi 138kV existing single circuit to double circuit 138kV line from Hays Branch to newly constructed 138kV from Stanville making one feed for Hays Branch from Morgan Fork and other from Stanville.

Estimated Cost: \$105 M

Projected In Service Date: 10/31/2023

Project Status: Scoping



AEP Transmission Zone M-3 Process Wyoming/McDowel Counties, WV

Need Number: AEP-2019-AP024

Process Stage: Solutions Meeting: 02/21/2020

Previously Presented: Needs Meeting 7/24/2019

Supplemental Project Driver:

Equipment Condition/Performance/Risk

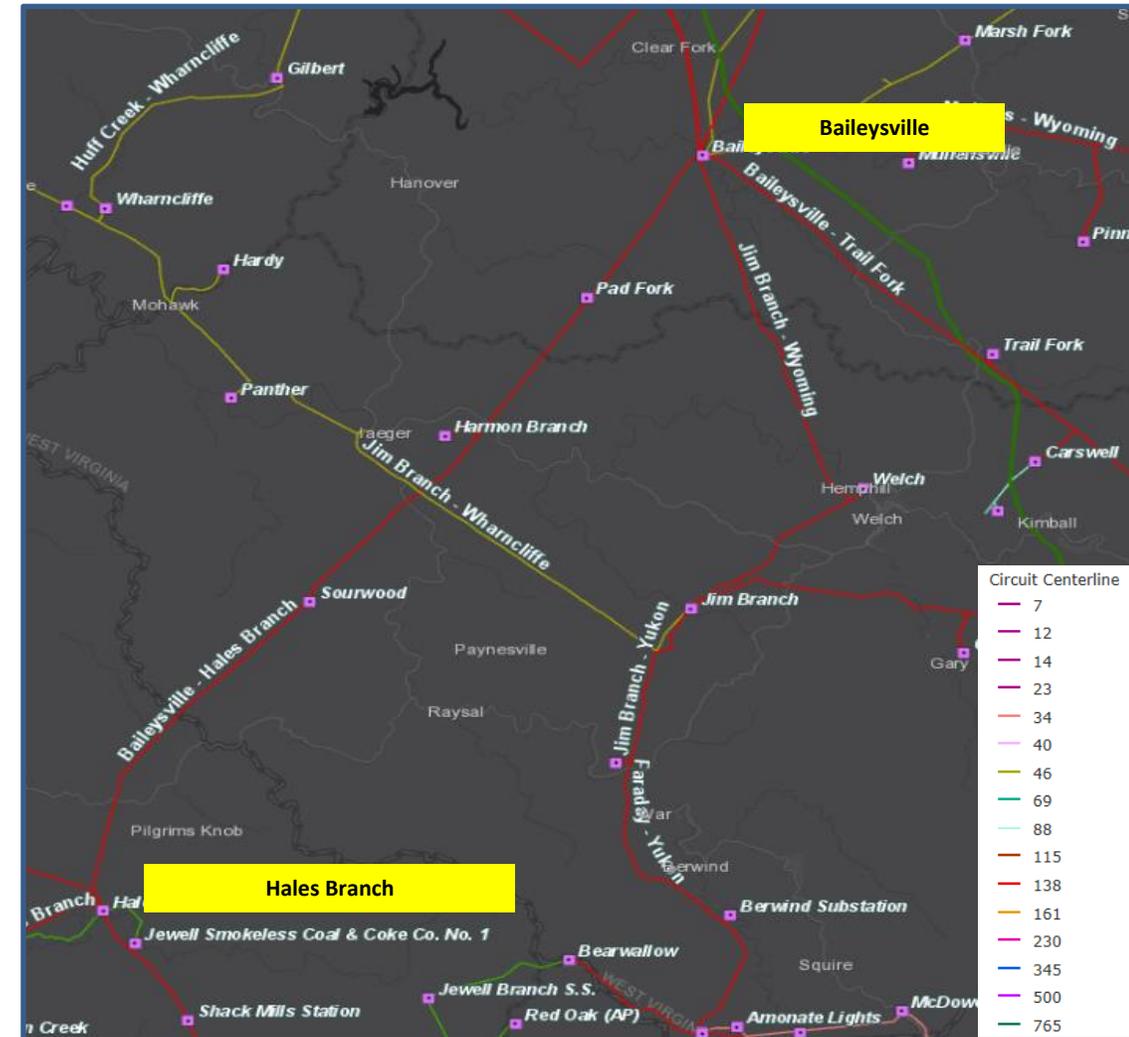
Specific Assumption Reference:

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

Problem Statement:

Baileysville – Hales Branch 138 kV (~27.8 miles)

- Majority of the circuit is constructed with 1970s wood structures.
- Between 2015-2018 the circuit experienced 24 momentary outages.
 - All momentary outages are attributed to lightening, insufficient shielding and aging towers as the structures, conductor, hardware, and insulators on the line are displaying issues associated with their age
- The circuit currently has 54 open conditions
 - Open conditions include: Rotten Tops, Woodpecker damage, Split Poles, Corroded Crossarms, Rotten Shells, Broken Ground Lead Wires, and Buildings Encroachment in Right Of Way
- Structures loading does not meet current NESC standards.



Need Number: AEP-2019-AP024

Process Stage: Solutions Meeting: 02/21/2020

Proposed Solution:

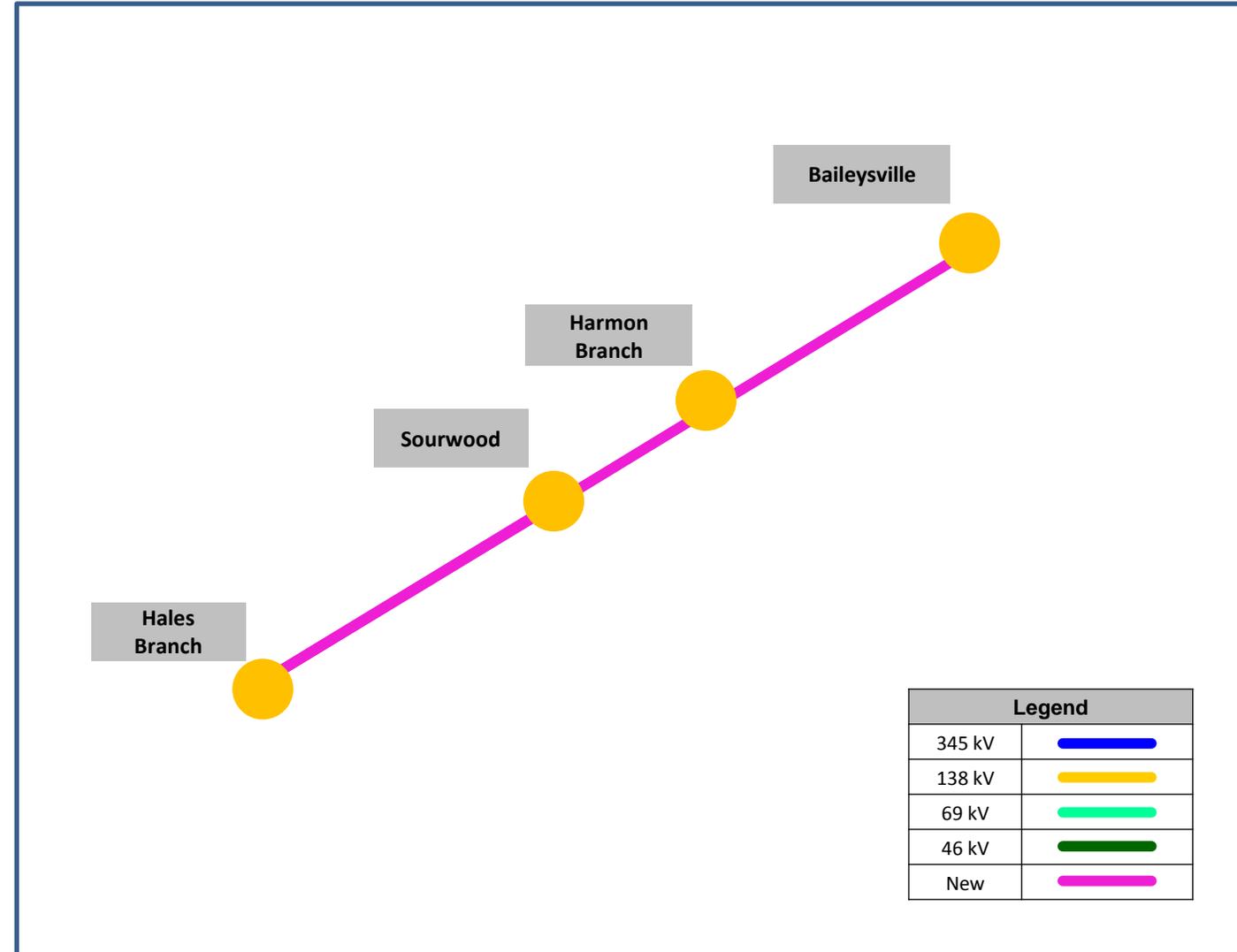
Rebuild ~27.8 miles of the existing Baileysville – Hales Branch 138kV circuit. **Estimated Cost: \$98.5M**

Alternatives Considered:

Retire ~27.8 miles of Baileysville – Harmon Branch 138 KV. Build new ~ 5.2 mile 138 KV double circuit with in/out from Baileysville to Pad fork station. Construct a new ~ 8.6 mile 138 KV line from Jim Branch to Harmon Branch, a new ~ 7.7 138 KV line from Harmon Branch to Sourwood, and ~ 9.2 mile 138 KV from Sourwood to Yukon substation. Add 138 KV circuit breaker at Jim Branch for Jim Branch – Harmon Branch 138KV, 138 KV circuit breaker at Yukon substation for Sourwood – Yukon 138KV. Requires more new ROW and increases cost. **Estimated Cost: ~\$126 M**

Project Status: Scoping

Projected In-Service: 8/01/2026



AEP Transmission Zone M-3 Process Henry County, VA

Need Number: AEP-2019-AP043

Process Stage: Solutions Meeting 02/21/2020

Previously Presented: Needs Meeting 11/22/2019

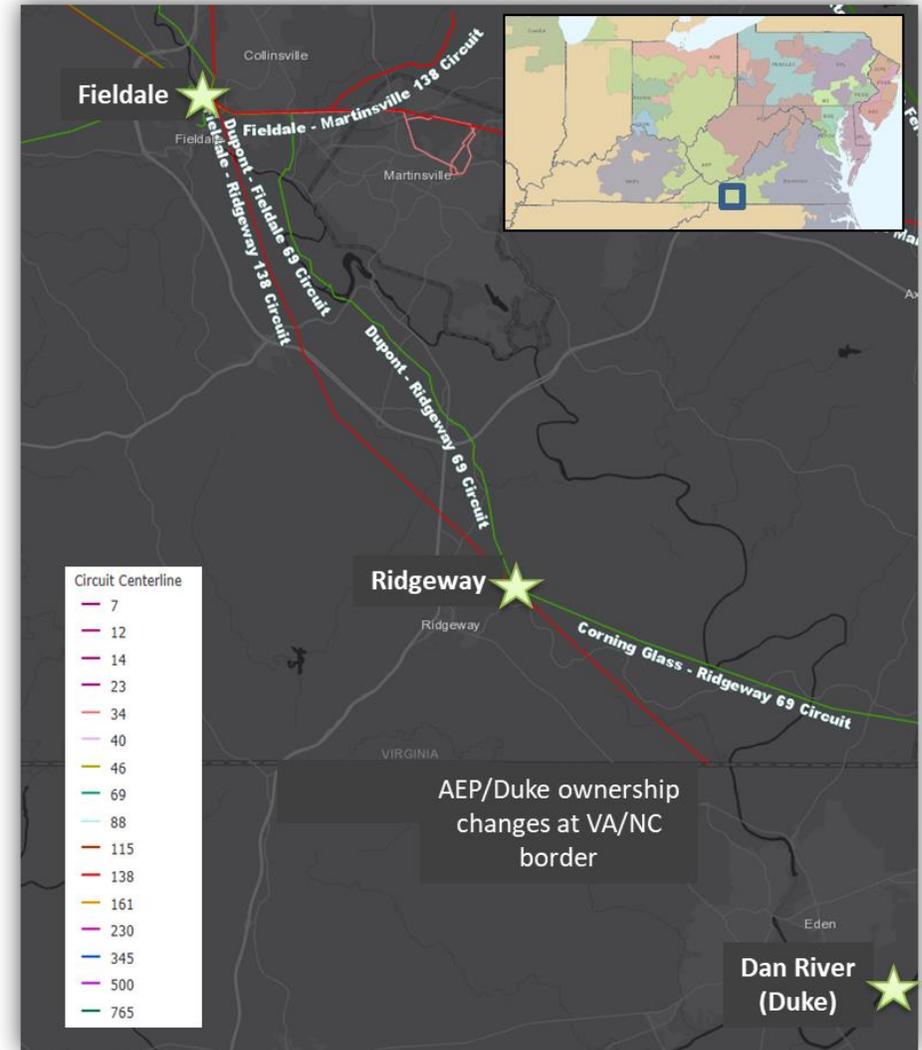
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

- **Fieldale-Ridgeway 138 kV Circuit (10.3 mi.)**
 - 1949 wood H-Frame construction
 - 58 Type A open conditions on 35 unique structures (51% of all structures on circuit)
 - From 2015-2018, a total of 4 permanent outages resulting in 241,094 customer minutes of interruption
- **Ridgeway-Dan River 138 kV Circuit (4.5 mi.)**
 - 1949 wood H-Frame construction
 - 40 Type A open conditions on 23 unique structures (68% of all structures on circuit (owned by AEP))
 - From 2015-2018, a total of 3 permanent outages occurred

Model: N/A



AEP Transmission Zone M-3 Process Henry County, VA

Need Number(s): AEP-2019-AP043

Process Stage: Solutions Meeting 02/21/2020

Proposed Solution:

- Rebuild approximately 15 miles of the AEP-owned portion of the 138 kV line between Fieldale and Dan River stations (AEP/Duke ownership changes at the VA/NC border).

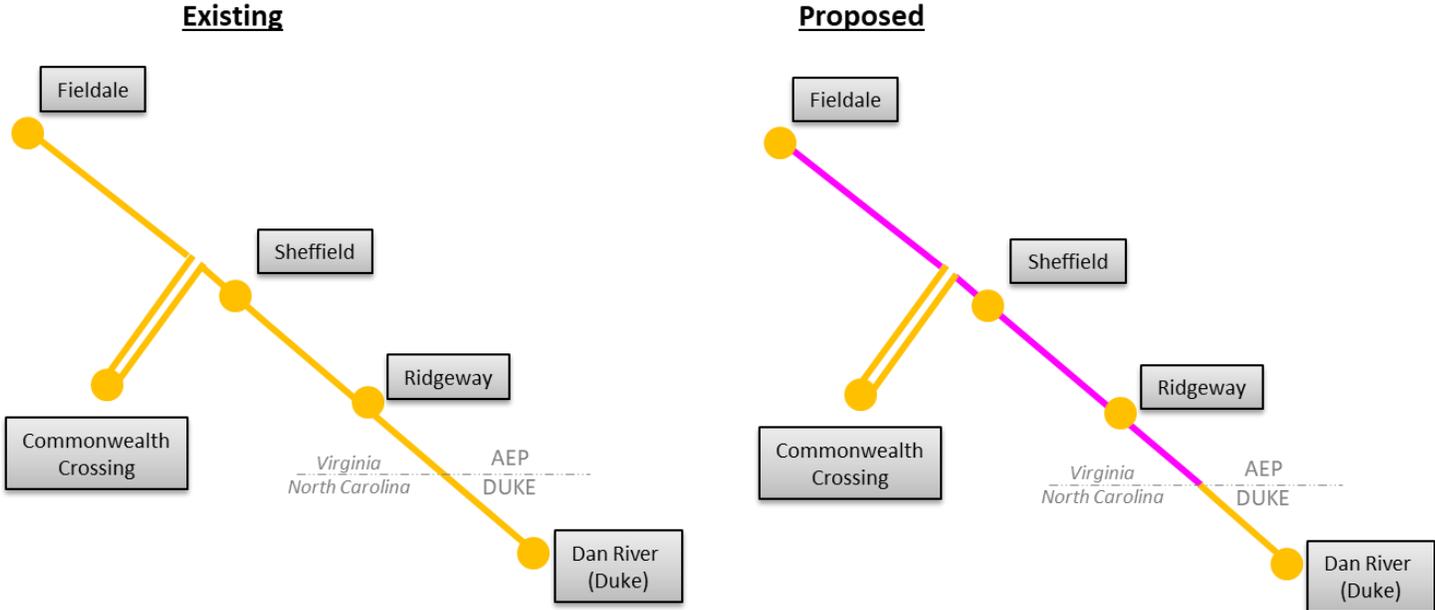
Estimated Cost (\$32.2 M)

Alternatives Considered:

No viable cost effective solution was identified.

Projected In-Service: 10/31/2022

Project Status: Scoping



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

AEP Transmission Zone M-3 Process Henry County, VA

Need Number: AEP-2019-AP045

Process Stage: Solutions Meeting 02/21/2020

Previously Presented: Needs Meeting 11/22/2019

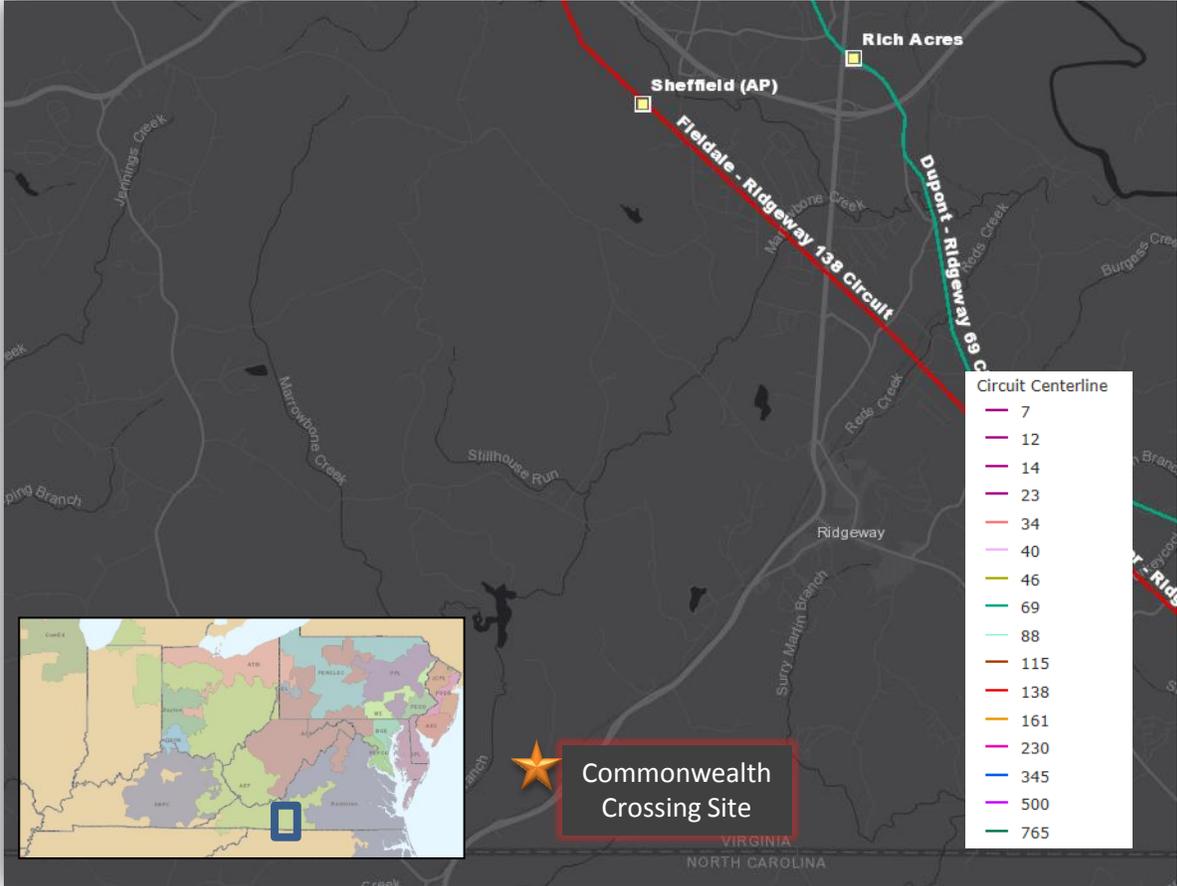
Supplemental Project Driver: Customer Service

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

Problem Statement:

- Henry County VA (Customer) has requested that AEP construct a new 138 kV loop fed transmission line and a new 138-34.5kV (30 MVA) substation in its Commonwealth Crossing Business Centre (CCBC) to initially serve Press Glass (5 MVA). The CCBC is located roughly 5 miles from the Sheffield-Ridgeway 138kV line in Ridgeway VA.

Model: 2024 RTEP



AEP Transmission Zone M-3 Process Henry County, VA

Need Number(s): AEP-2019-AP045

Process Stage: Solutions Meeting 02/21/2020

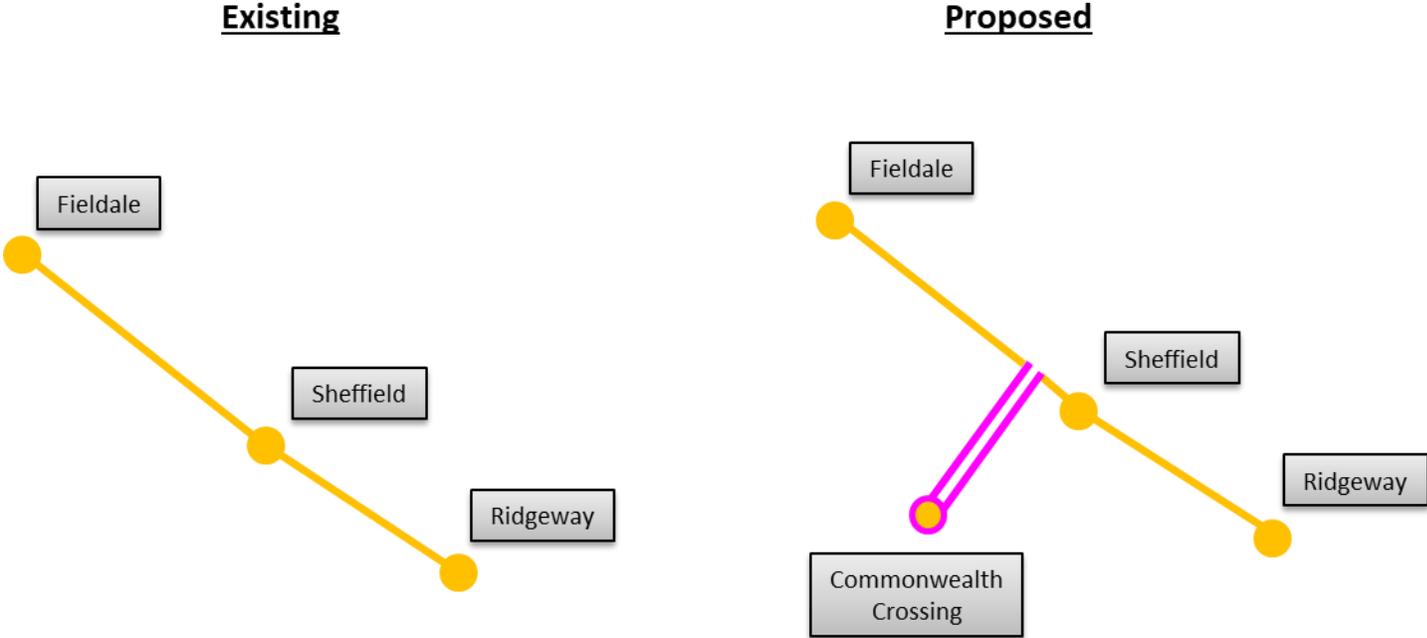
Proposed Solution:

- Construct ~5.75 miles of new double circuit 138 kV line from the Fieldale-Ridgeway 138 kV circuit to a new Commonwealth Crossing station. **Estimated Cost: \$14.8M**
- Establish a new 138/34.5 kV Commonwealth Crossing Station with 2-138 kV, 3000 A, 40 kA circuit breakers, high-side 3000 A, 40 kA circuit switcher, 138/34.5 kV, 30 MVA transformer, and 3-34.5 kV distribution feeders. **Estimated Cost: \$0**
- Install 5.75 miles of 48 ct. fiber between Commonwealth Crossing station and Ridgeway station to support SCADA and relaying. **Estimated Cost: \$0.4M**

Total Estimated Transmission Cost: \$15.2M

Ancillary Benefits:

The new station will provide a reliable source to the Commonwealth Crossing Business Centre (CCBC) which will be ready to accommodate new customers as needed.



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

AEP Transmission Zone M-3 Process Henry County, VA

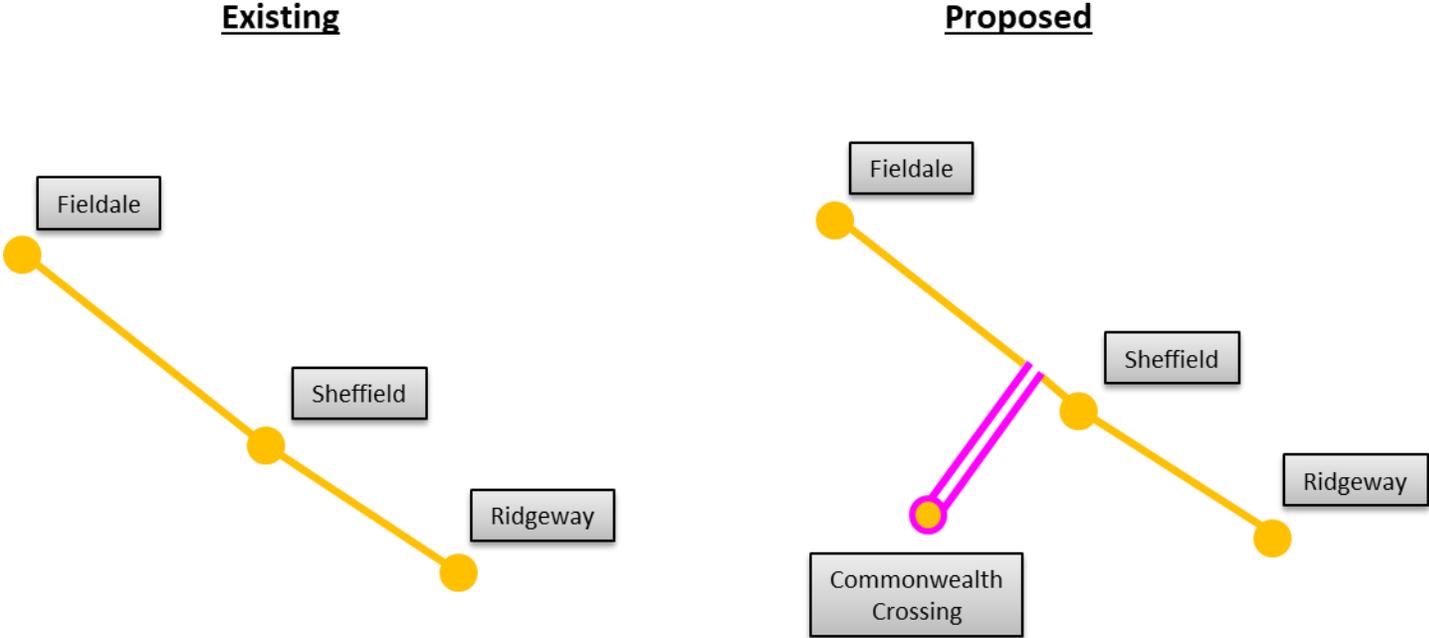
Alternatives Considered:

Establish a new 138 kV, 3 breaker ring station along the Fieldale-Ridgeway 138 kV circuit and extend a 5.75 mile, single circuit 138 kV line to a new Commonwealth Crossing station.

This alternative would adequately serve the load from a capacity perspective, however the reliability of a single circuit line is less due to the higher probability of experiencing a fault on the 5.75 mile radial line. In addition, it is AEP’s guideline to provide loop service to 75 MVA-miles or more. If the existing customer or another customer requests service here it would only require ~13 MVA total to reach this threshold. **Estimated Cost: \$18M**

Projected In-Service: 3/1/2020

Project Status: Construction



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

AEP Transmission Zone M-3 Process Lynchburg, VA

Need Number: AEP-2019-AP050

Process Stage: Solutions Meeting 02/21/2020

Previously Presented: Needs Meeting 11/22/2019

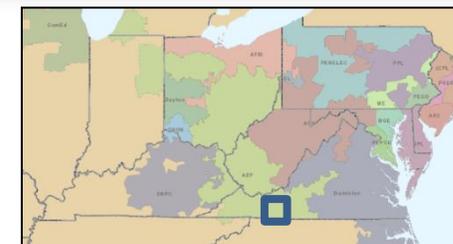
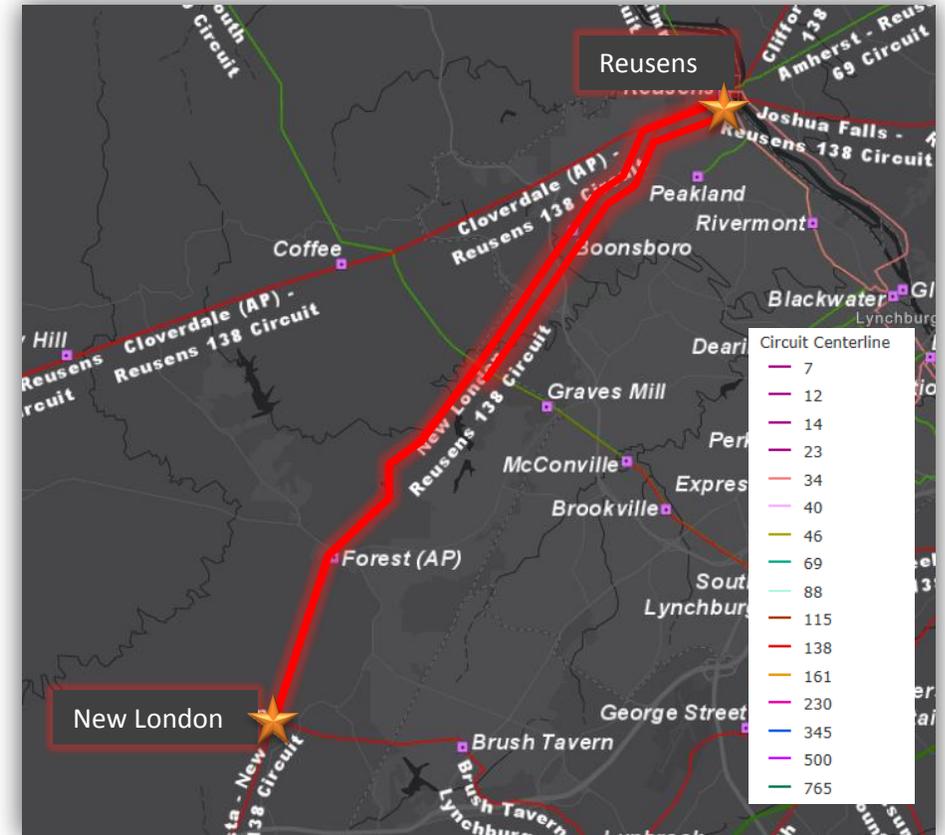
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

- **Reusens-Altavista 138 kV Line Asset (11.6 mi.)**
 - A total of 16 open conditions on 13 unique structures (comprising 18% of the line asset)
 - New London-Reusens 138 kV Circuit: From 2015-2018, a total of 2 permanent and 2 momentary outages occurred
 - McConville-Reusens 138 kV Circuit: From 2015-2018, a total of 2 permanent and 2 momentary outages occurred
 - **138 kV Double Circuit Section (5.5 mi.)**
 - Section exists between Reusens Station and structure 5-10
 - 1949 steel lattice structures
 - The lattice towers used on this line are approximately 70 years old, which exceeds the projected life span for that structure type. Structure loading does not comply with the NESC 250B and 250D standards for the line.
 - The shield wire and most of the conductor is 70 years old as well, which exceeds the expected life span of the conductor. The current shielding does not comply with the current standards, specifying a maximum of 30 degrees. The current shielding angle is approximately 50 degrees.
 - **138 kV Single Circuit Section (6.1 mi.)**
 - Section exists between structure 5-10 and New London Station
 - 1949 wood H-Frame construction
 - The wood structures used on this line are approximately 70 years old, which exceeds the projected life span for that structure type. Structure loading does not comply with the NESC 250B and 250D standards for the line.
 - The shield wire and most of the conductor is 70 years old as well, which exceeds the expected life span of the conductor.
 - The current shielding does not comply with the current standards, specifying a maximum of 30 degrees. The current shielding angle is approximately 50 degrees.

Model: N/A



AEP Transmission Zone M-3 Process Lynchburg, VA

Need Number(s): AEP-2019-AP050

Process Stage: Solutions Meeting 02/21/2020

Proposed Solution:

- Rebuild 11.6 mile section of the Reusens-Altavista 138 kV line asset from Reusens to New London. Approximately 5.5 miles consists of double circuit 138 kV construction and approximately 6 miles consists of single circuit 138 kV construction between Reusens and New London **Estimated Cost: \$36.2M**
- Install a 57.6 MVAR cap bank at Brush Tavern 138kV due to low voltage concerns from operations during construction outages in the area. **Estimated Cost: \$0.0M**

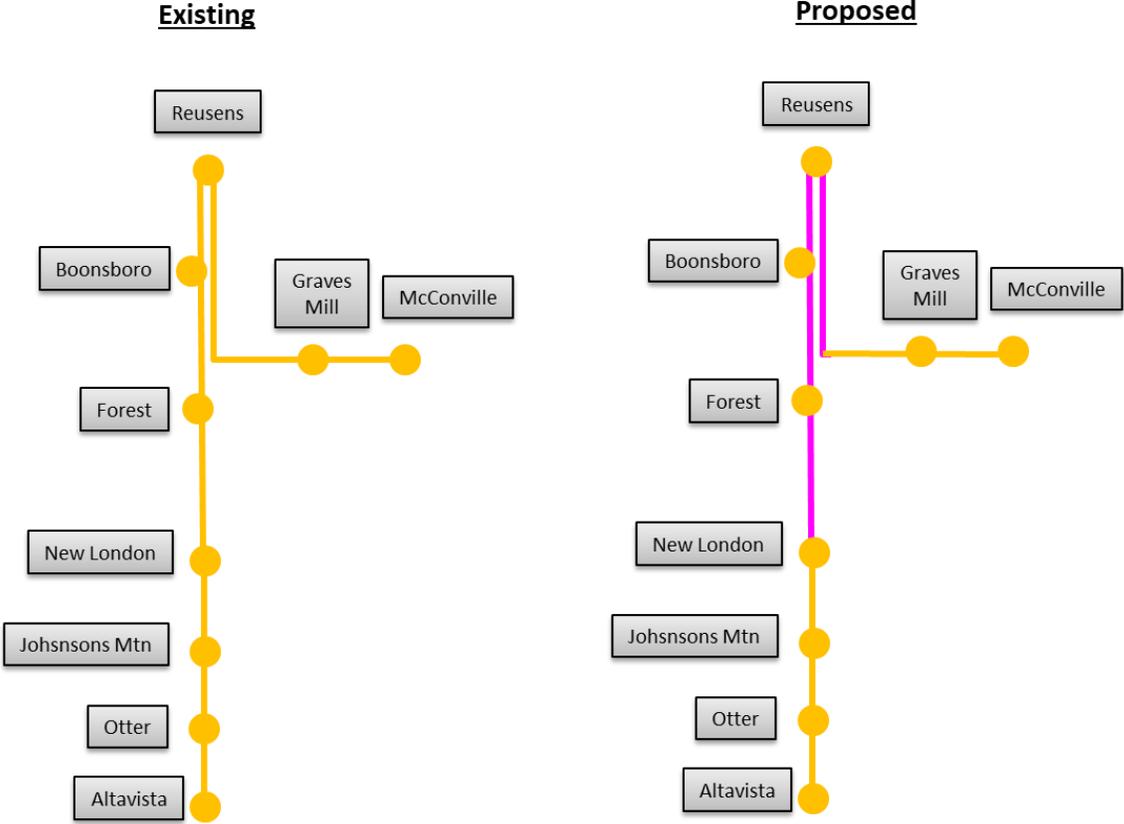
Total Estimated Transmission Cost: \$36.2M

Alternatives Considered:

No cost effective alternative was identified.

Projected In-Service: 10/31/2022

Project Status: Scoping



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

AEP Transmission Zone: Supplemental Illinois Road Station Improvements

Need Number: AEP-2019-IM012

Process Stage: Solution Meeting 02/21/2020

Previously Submitted: Needs Meeting 04/23/2019

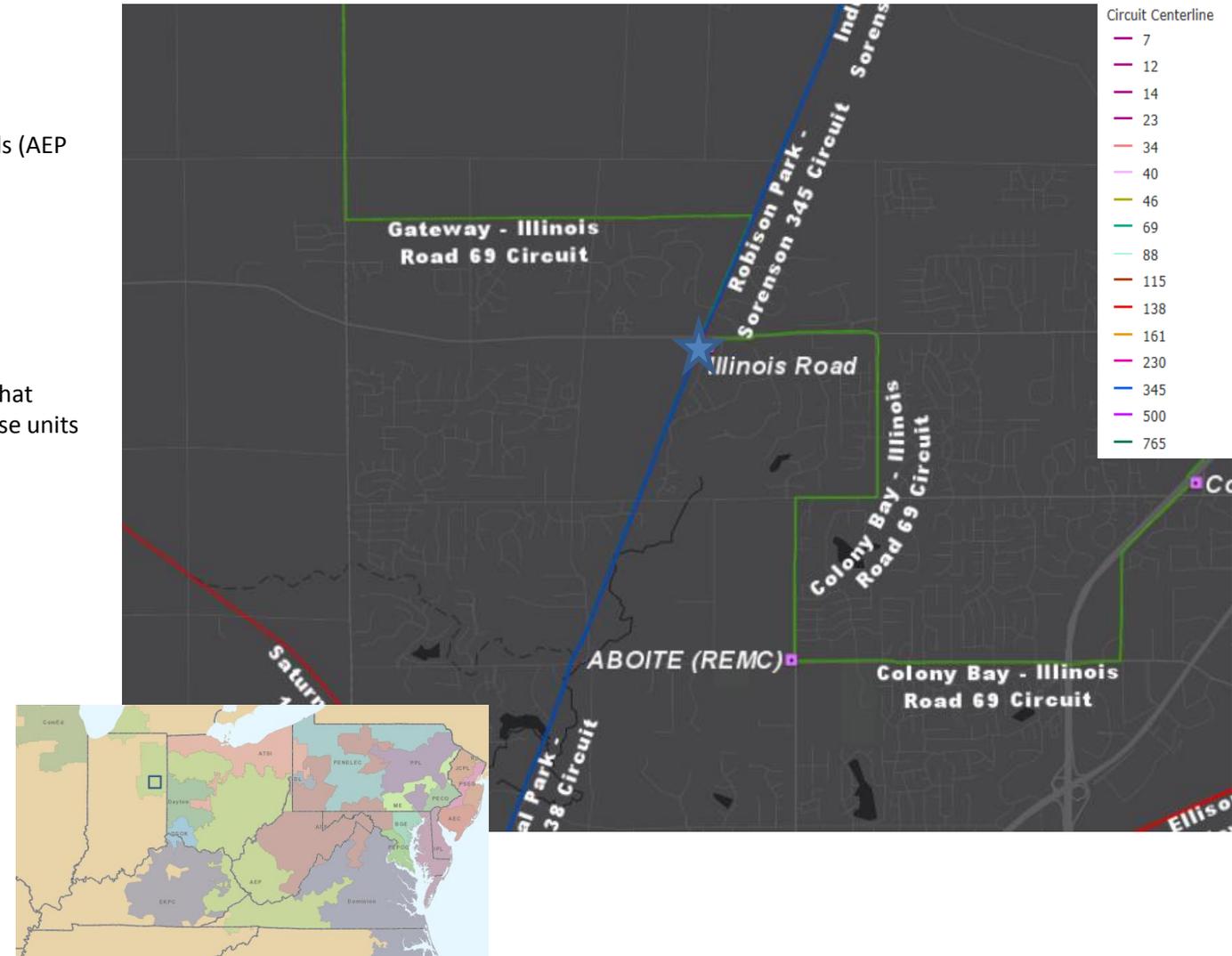
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

Illinois Road 138kV station

- Breakers A & B 69kV
 - 1969 and 1970 vintage Oil breakers
 - Fault Operations: A(23) & B(67) – Recommended(10)
 - Oil filled breakers have much more maintenance required due to oil handling that their modern, vacuum counterparts do not require. Finding spare parts for these units is difficult or impossible, and these models are no longer vendor supported



AEP Transmission Zone: Supplemental Illinois Road Station Improvements

Need Numbers: AEP-2019-IM012

Process Stage: Solutions Meeting 02/21/2020

Proposed Solution:

Illinois Road 138/69kV station:

Replace 69kV CB's A and B and add a low side 69kV CB. Add 2 138kV CB's on the line exits.

Estimated Cost: \$5.9M

Alternatives Considered:

Alternative 1:

Rebuild the high and low side as ring busses. The station still has significant equipment that's in good condition including the transformer, transformer high side protection and busing. For this reason, it was decided to just replace the aging equipment and add the required protection.

Estimated Cost: \$7M.

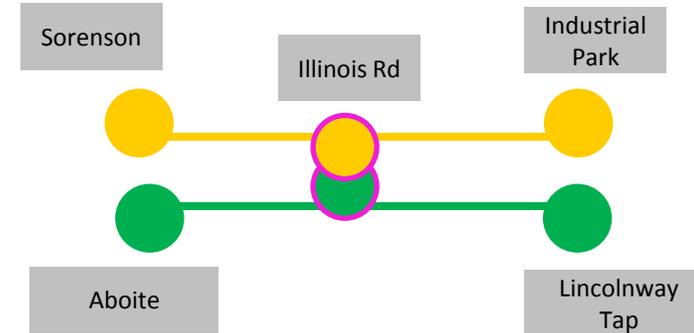
Ancillary benefits:

Since the outage on the 138/69kV XFR was required, AEP decided to take the time to install the low side 69kV CB and high side 138kV CB's in order to bring the station up to the current protection standard.

Total Estimated Transmission Cost: \$5.9M

Projected In-Service: 11/10/2021

Project Status: Scoping



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

AEP Transmission Zone M-3 Process Adams & Pennville Station Rehab

Need Number: AEP-2019-IM019

Process Stage: Solution Meeting 02/21/2020

Previously Presented: Needs Meeting 06/17/2019

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

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

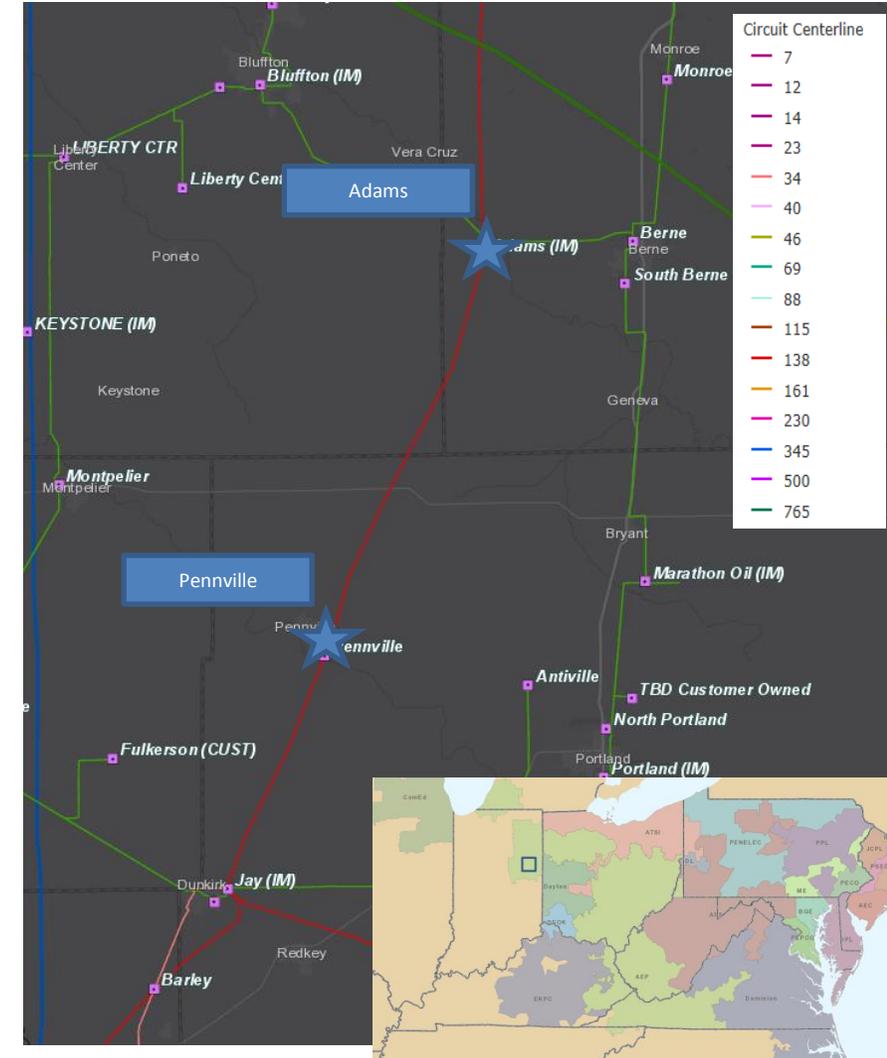
Problem Statement:

Adams 138/69kV station

- The 138/69kV XFR currently is protected by a high side ground switching MOAB.
- Currently there are 3 dissimilar zones of protection at this station with a 138kV line, 138kV bus and a 138/69kV transformer

Pennville 138kV station

- This station's through path is composed of wood support structures and cap and pin bus insulators, both have been identified as safety concerns.
- The Cap and Pin support insulators have a documented history of failing due to degradation in the glue that holds them together. It is currently AEP policy to remove these support style insulators as we have opportunity.
- The support structures for the station's through path reside mostly outside of the station footprint. These bus support structures straddle the station fence which leaves most of the main bus, switches, insulators and support structures outside the station's footprint where there is no ground grid. This has been identified as a safety hazard and will be addressed.



Need Number: AEP-2019-IM027

Process Stage: Solution Meeting 02/21/2020

Previously Presented: Needs Meeting 08/29/2019

Supplemental Project Driver: Equipment Condition/Performance/Risk

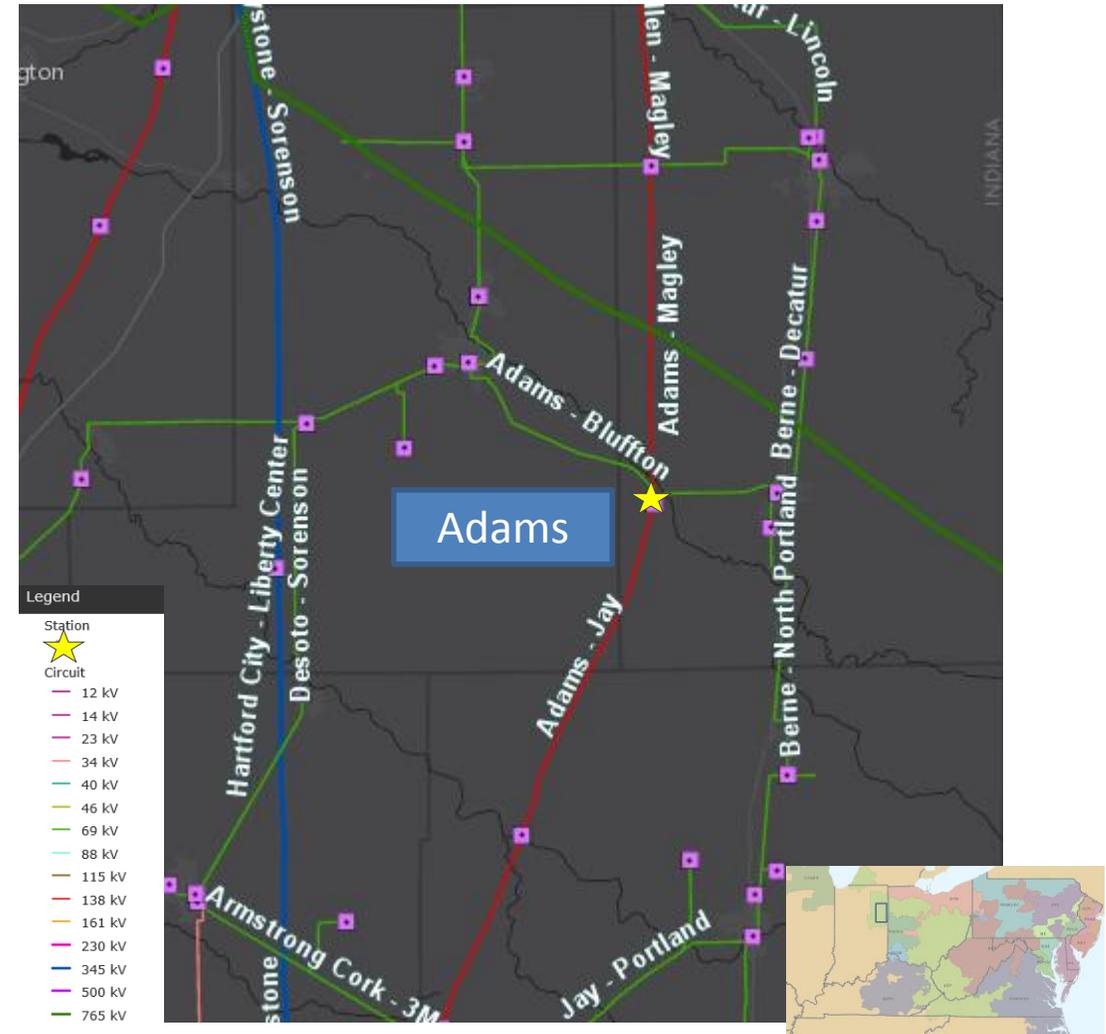
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Adams 69kV Station:

69kV Circuit Breaker D

- Vintage 1966 Oil filled McGraw Edison CF type breaker
- Last oil breaker at Adams station
- Oil filled breakers have much more maintenance required due to oil handling that their modern, vacuum counterparts do not require
- Spare parts are not available and these models are no longer vendor supported
- Fault operations (10) – Manufacturers recommended maximum (10)



AEP Transmission Zone: Supplemental Adams & Pennville Station Rehab

Need Number: AEP-2019-IM027 & AEP-2019-IM019

Process Stage: Solutions Meeting 02/21/2020

Potential Solution

Rebuild the high side of Adams 138/69kV station as a 3 breaker ring bus, re-using the existing breaker “C,” and replace 69kV Breaker “D”

Estimated Cost: \$6.3M

Rebuild the through-path of Pennville 138kV station with 2 MOABS

Estimated Cost: \$1.7M

Total Estimated Transmission Cost: \$8M

Alternates Considered

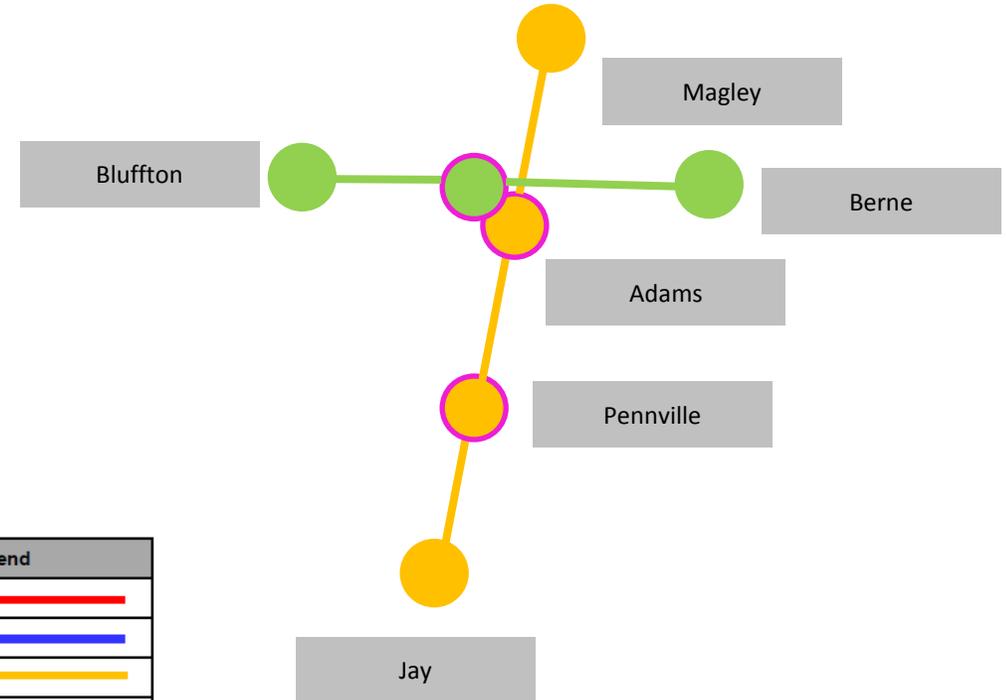
Rebuild the Pennville station through-path as is.

Due to the unrecoverable nature of the load at Pennville it is recommended that two Moabs be installed in lieu of the GOAB and circuit switcher.

*This project will be worked in conjunction with outages for project S2021.3

Projected IS Date: 1/2/2026

Project Status: Scoping



Need Number: AEP-2019-IM034

Process Stage: Solutions Meeting 02/21/2020

Supplemental Project Driver: Equipment Condition/Performance/Risk

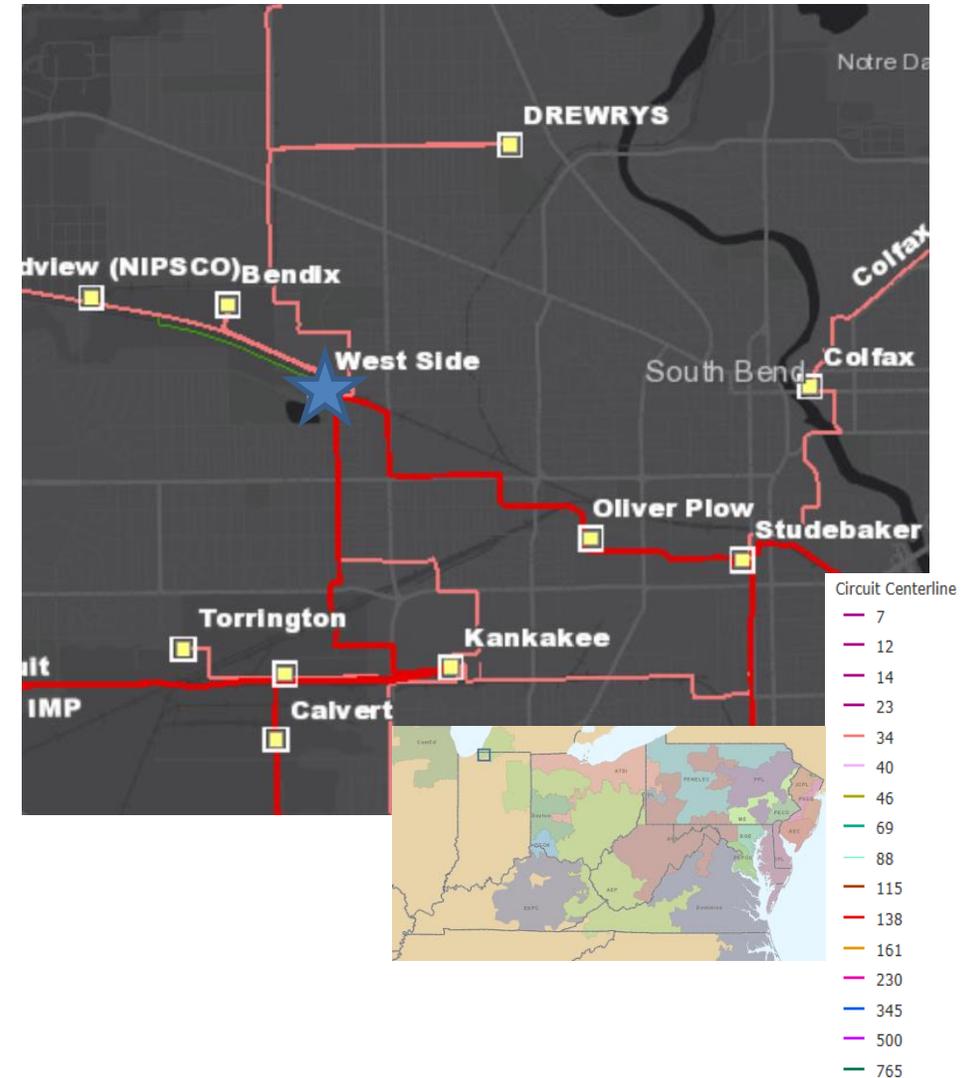
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

West Side 138kV Station

- Three terminal line
 - Three-terminal lines are very challenging to protect/coordinate and mis-operation or switching error become much more significant.

- Bus Tie Switch between the distribution transformers
 - Bus Tie Switch when operated without de-energizing the whole bus jeopardizes the Bus Differential Protection.
 - With no Bus Differential Protection the correct interrupting device wouldn't operate during fault scenarios, this can be dangerous for people working in the station.



Need Number: AEP-2019-IM034

Process Stage: Solutions Meeting 02/21/2020

Proposed Solution

Westside Station

Install 2 138kV line breakers at West Side station to break up the three-terminal line.
Install 1 138kV bus tie breaker. Install one 69kV low-side breaker at Westside Station. **Estimated Cost: \$3.5M**

Ancillary Benefits:

While at the station, AEP will take advantage of the outage and also install a 69kV low side Transformer Circuit Breaker. This way the bus can remain in-service when the transformer goes out as the 69kV has more than one exit and the bus is a single bus single breaker.

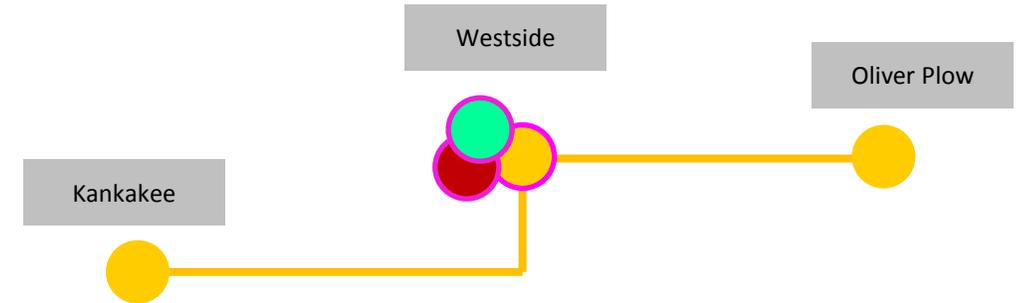
Alternatives Considered:

Only adding one line breaker to mitigate the three terminal line.

- Using two line breakers helps mitigate three zones of protection for a line fault. Adding a line breaker to the Oliver Plow –West Side 138kV line helps mitigate the loss of the transmission transformer, the line, and the 138kV bus for a fault.
- Adding a line breaker to the West Side – Kankakee 138kV line protects the distribution load from being dropped for a line fault. During peak conditions this load is not transferable between the two distribution banks so the load will not be recoverable for an outage on the line.

Total Estimated Transmission Cost: \$3.5M

Project In-Service date: 01/15/2021



Legend	
345kV	
138kV	
69kV	
34.5kV	
New	
Retired	

AEP Transmission Zone: Supplemental Ameriplex Station Solution

Need Number: AEP-2019-IM039

Process Stage: Solutions Meeting 02/21/2020

Previously Presented: Needs Meeting 10/25/2019

Supplemental Project Driver: Customer Service

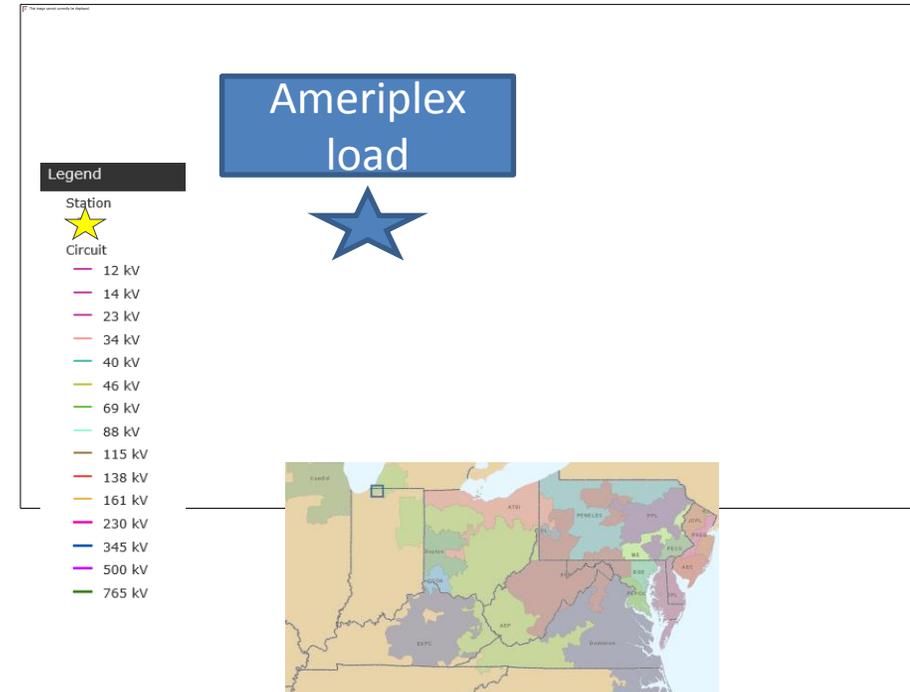
Specific Assumptions Reference: AEP Interconnection Guidelines (AEP Assumptions Slide 7)

Problem Statement:

South Bend-Olive 138kV line-

- New 1.5MVA block load addition to the Ameriplex complex and new delivery point request from I&M distribution.
- Expected loading of 14MVA at Ameriplex distribution station. Future plans to double initial distribution configuration to allow for up to 25MVA load.

Model: 2024 RTEP



Need Number: AEP-2019-IM039

Process Stage: Solutions Meeting 02/21/2020

Proposed Solution

Cut into the existing South Bend-New Carlisle 138kV line and install tap structures for the Ameriplex extension.

Estimated Cost: \$0.7M

Install 1.75 miles of double circuit 138kV, 795 ACSR, off of the New Carlisle-South Bend 138kV line between New Carlisle and Pine road to serve new Ameriplex station.

Estimated Cost: \$6.8M

Install new greenfield station Ameriplex on new greenfield Ameriplex 138kV tap off of the New Carlisle-South Bend 138kV line. The transmission through path consists of one 138kV breaker, one MOAB and one 138kV bus.

Estimated Cost: \$2.1M

Total Estimated Transmission Cost: \$9.6M

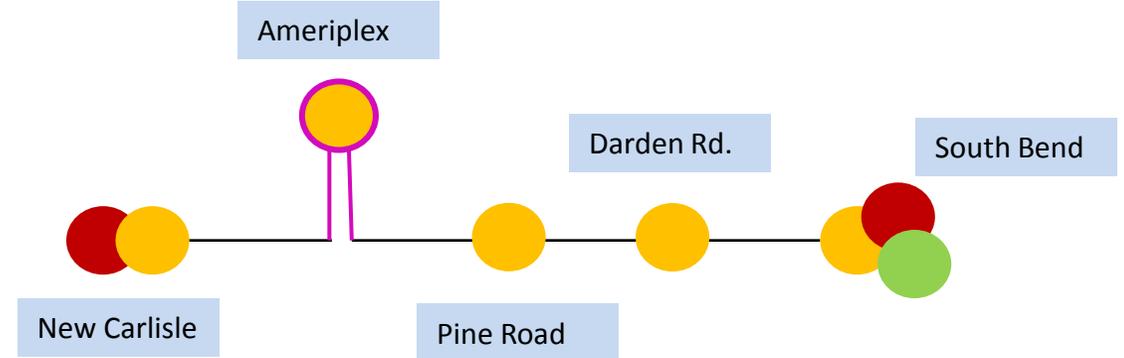
Alternatives Considered:

There were 2 greenfield locations closer to the 138kV line for the new station however these locations were not chosen due to the airport restrictions in the area.

Projected In-Service: 06/01/2021

Project Status: Scoping

AEP Transmission Zone: M-3 Process
Ameriplex Station Solution



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

AEP Transmission Zone M-3 Process Dragoon Station Solution

Need Number: AEP-2019-IM040

Process Stage: Solutions Meeting 02/21/2020

Previously Presented: Needs Meeting 10/25/2019

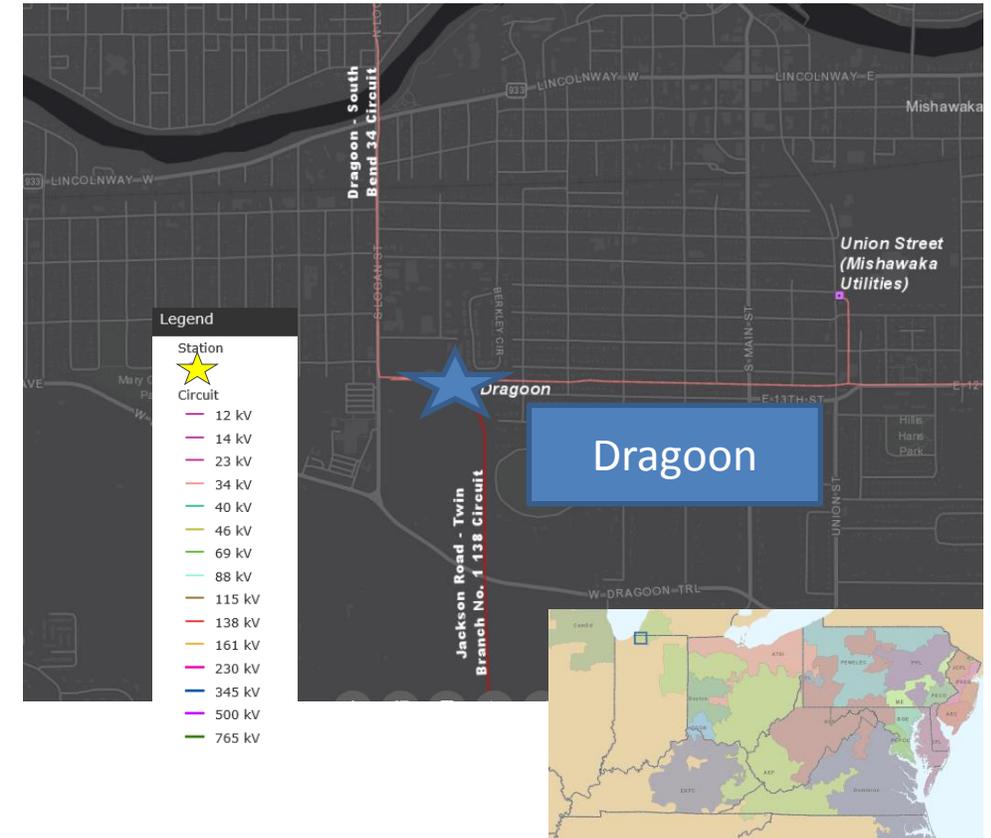
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

Dragoon Station:

- The 34.5 kV Circuit Breakers A, C and D at Dragoon Station are GE 'FK' oil-filled breaker manufactured in 1968
- 17, 51 and 9 fault operations (manufacturer recommendation of 10)
- Oil filled Breakers without oil containment
- The breakers have the following documented conditions:
 - Bushing problems
 - Unavailability of spare parts
 - Fault operations count
 - High moisture readings
- Oil spills are frequent with failures and routine maintenance which is also an environmental hazard



Need Number: AEP-2019-IM040

Process Stage: Solution Meeting 02/21/2020

Proposed Solution:

At Draught Station, replace 3-69kV breakers A, C & D.

Estimated Cost: \$2M

Alternatives:

There are no viable alternatives.

Proposed IS Date: 11/01/2020



Draught

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

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

2/10/2020 – V1 – Original version posted to pjm.com

2/21/2020 – V2 – Slide #69, Add project status

– Slide #78, add KV level for the capacitor

3/6/2020 – V3 – Slide #39, Changes reflected in the slides

– Add Slide #43, Need AEP-2020-OH022