Sub Regional RTEP Committee
Western Region
AEP

February 20, 2019

AEP 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

AEP Transmission Zone: Supplemental
Bim, West Virginia

Need Number: AEP-2019-AP001
Process Stage: Needs Meeting
Needs Presented: 2/20/2019
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

Bim 69 kV

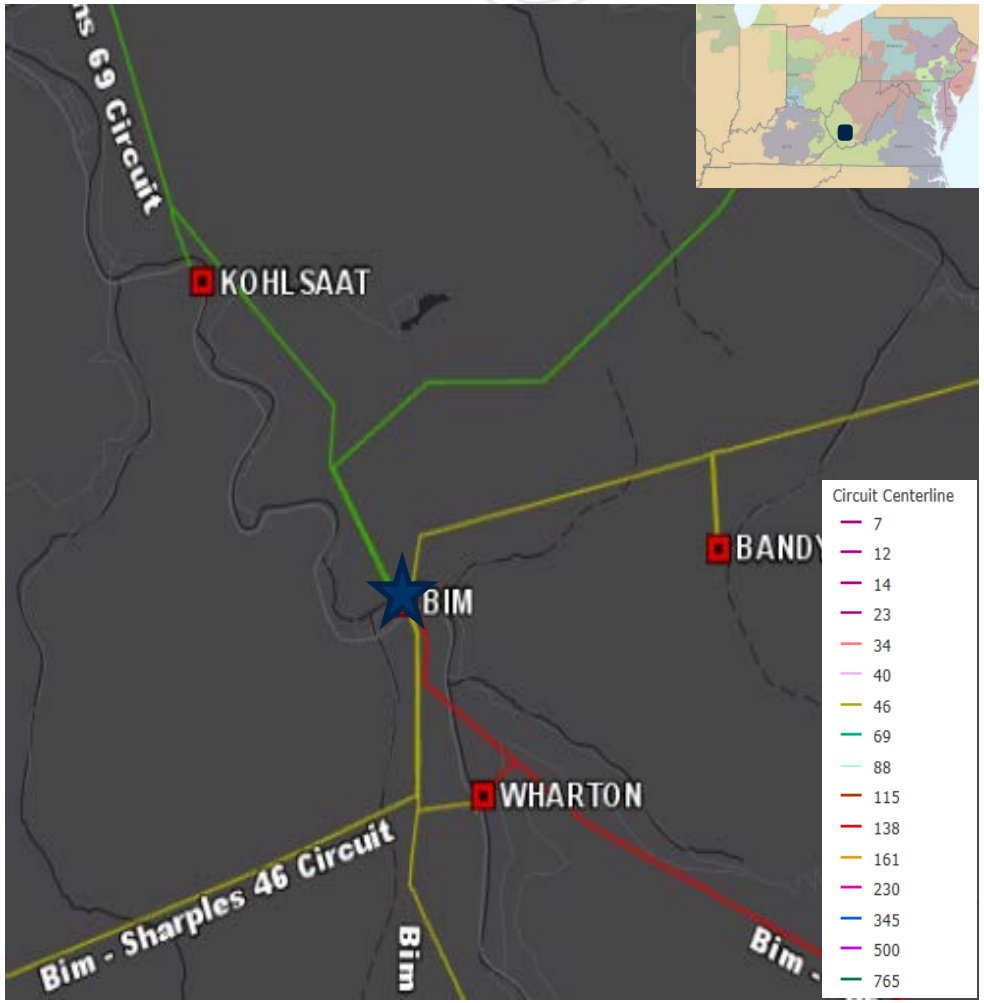
- Breaker "D"
  - 1967 FK oil type breaker without containment
  - Fault operations: 369, recommended 10 operations
- Cap Switchers "AA" and "BB"
  - SC-2030 type
  - No gas monitoring
  - Sister units have experienced numerous gas and interrupter failures

Bim 46 kV

- Breakers "A", "B", "C", and "E"
  - 1967 FK oil type breakers without containment
  - Fault operations: CB A (85), CB B (14), CB C (131), CB E (63), recommended 10 operations

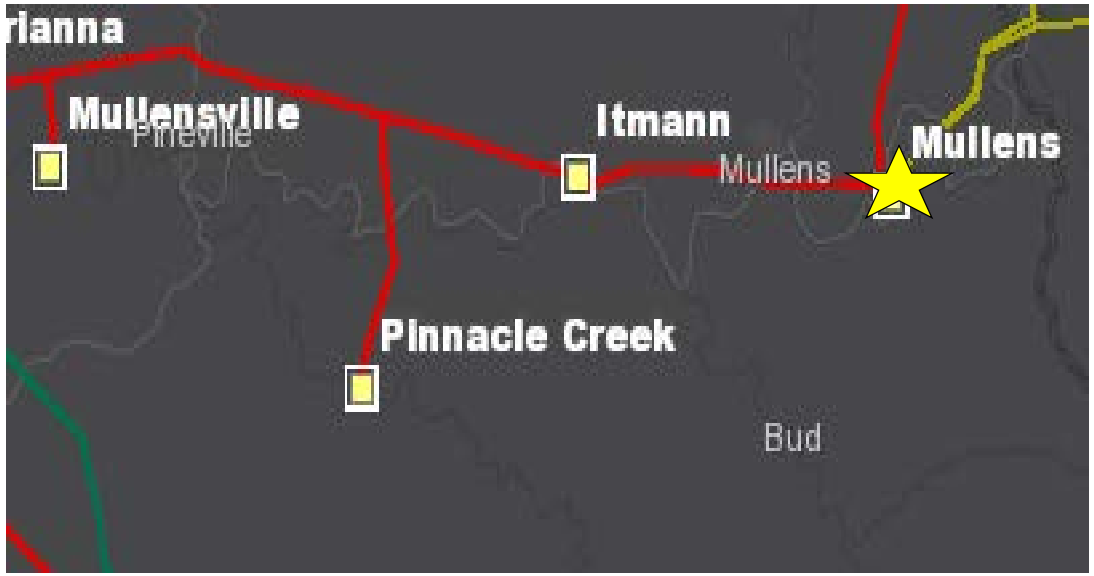
Bim Station

- Existing Gr. SW. MOAB configuration creates faults in the station; known safety hazard in legacy station designs
- Transformer Bank #1 138/69/46
  - Oil leaking at a steady rate
  - Deteriorating wooden crossties, obsolete arresters and bushings, LTC is not in adequate condition
  - Cooling system and controls need replaced
- GND Bank
  - Interfacial tension in all three units has been on the decline or at sustained low levels for around 15 years, indicating the development of sludge which can impede oil circulation/cooling
  - Rising/Sustained high moisture content has resulted in degrading/sustained low levels of dielectric strength
  - Obsolete arresters/bushings, deteriorating wooden crossties
  - Cooling system/controls need replaced



Need Number: AEP-2019-AP002
Process Stage: Needs Meeting 2/20/2019
Needs Presented: 2/20/2019
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumption References: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:
Mullens Station

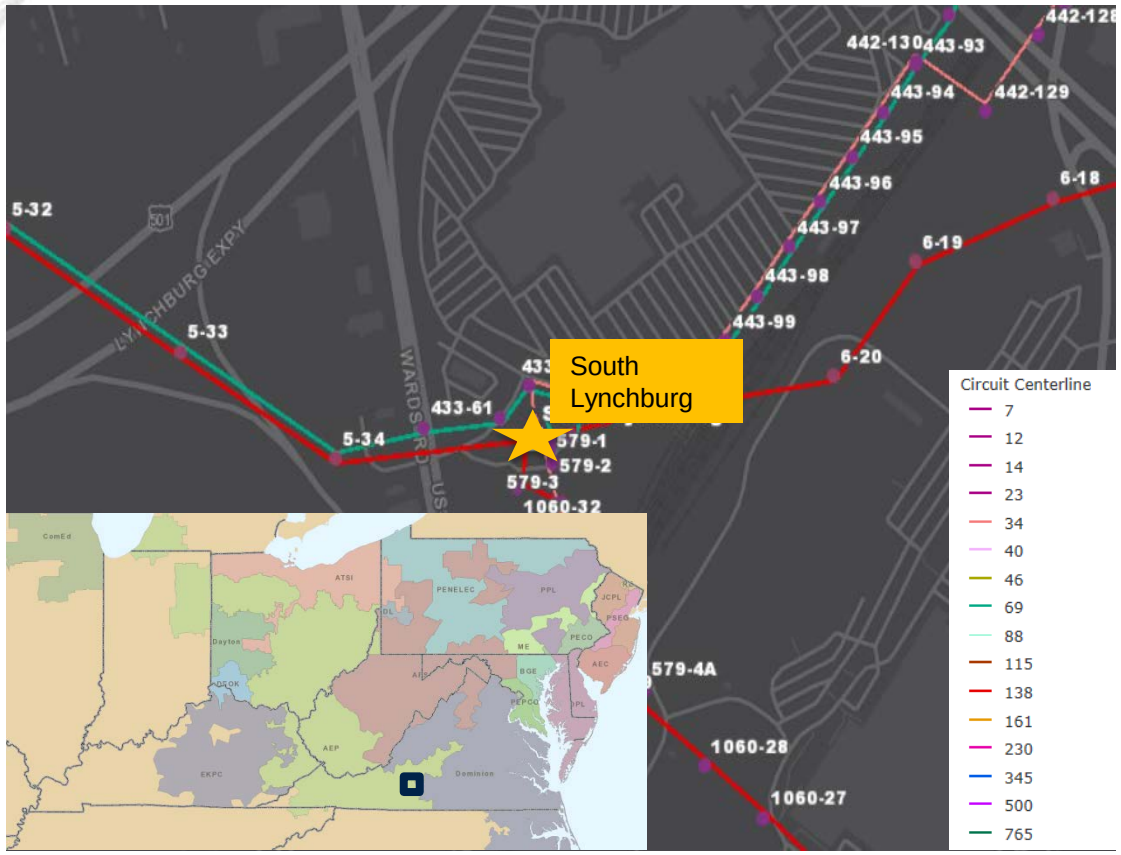
- Transformer Bank #4 138/46 kV
  - Short circuit strength breakdown caused by the amount of high energy electrical through fault events
  - Numerous gases are at the IEEE level 2 condition level with acetylene and ethylene being at the highest condition level 4, which negatively impacts the oil dielectric
  - Major carbonization of the insulating paper as occurred from these numerous through fault events, indicating that this unit is near the end of its useful life
  - There is a bad fan on transformer #4, on the bottom of cooling group 2
- Grounding Bank #3
  - Upward trending of oil moisture content resulting in downward trending to the oil dielectric strength
  - Increasing moisture content is a resultant of water ingress and/or break down of paper insulation of TF windings
  - Short circuit strength breakdown caused by the amount of thermal through fault events
- Existing Gr. SW. MOAB configuration on the 138/46 kV and 138/34.5 kV transformers create faults in the station; known safety hazard in legacy station designs
- 63 of the 74 relays in the station (85% of all station relays) are of the electromechanical type which have significant limitations with regards to fault data collection and retention
- 13.2kV CBs R & S at are oil filled breakers without oil containment



AEP Transmission Zone: Supplemental
Lynchburg, Virginia

Need Number: AEP-2019-AP003
Process Stage: Needs Meeting
Needs Presented: 2/20/2019
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

- The 1959 vintage 138/69/34.5 kV transformer #1 at South Lynchburg Substation has elevated levels of carbon dioxide which began increasing in 2004. Additionally, the interfacial tension is steadily decreasing and the oil power factor is steadily increasing indicating that the oil insulation is beginning to degrade as well. This data proves that the transformers insulation is aged and has degraded.
- The 34.5 kV Grounding Bank was manufactured in 1954 and has high concentrations of combustible gases, specifically CO and CH4, due to various thermal faults and electrical discharges. Short circuit breakdown caused by the amount of through fault events, some greater than 700 degrees Celcius has contributed to the deterioration of the bank.
- 12 kV CBs P, L, K, N, M, and R are oil breakers
- Number of fault operations: P (44), L (42), K (152), N (132), M (34), R (135)
- 34.5 kV CB F has 31 fault operations
- 34.5 kV CB G has 63 fault operations



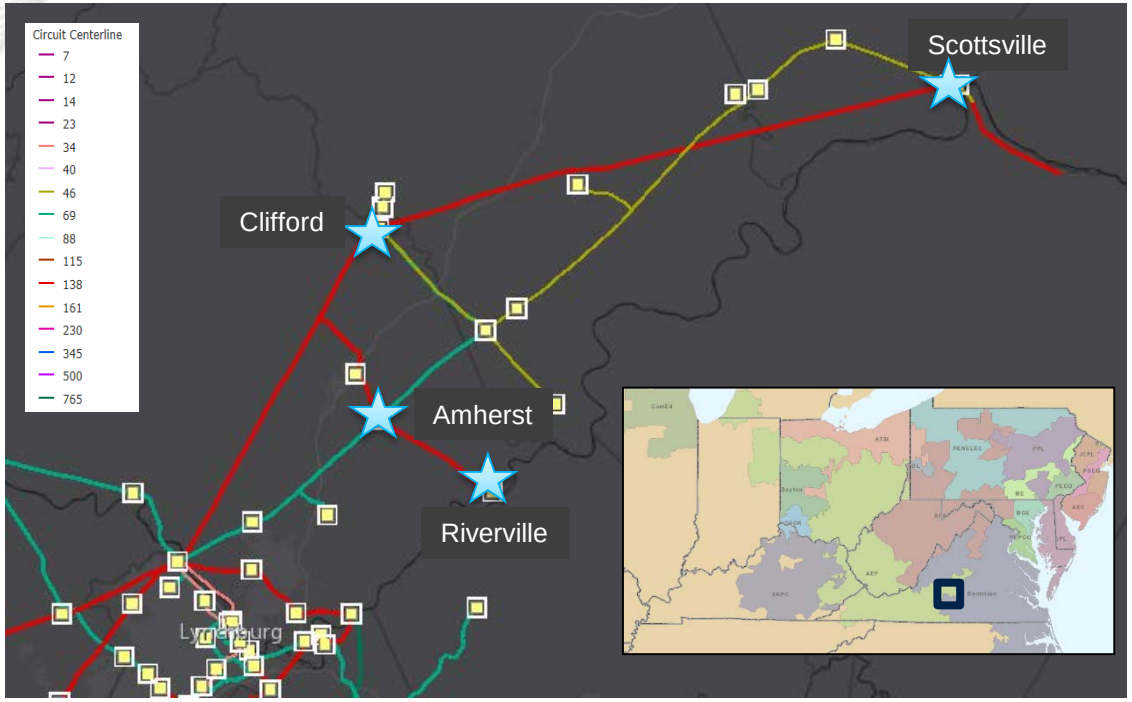
AEP Transmission Zone: Supplemental Clifford-Scottsville, VA Area

Need Number: AEP-2019-AP004
Process Stage: Needs Meeting
Needs Presented: 2/20/2019
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

The Amherst-Clifford 69 kV circuit (13.9 mi.) consists primarily of 1960 wood pole structures with 4/0 ACSR overhead conductor and currently has 26 open conditions including rot top, woodpecker damage, split poles, broken insulators and damaged shield wire. Over the 2015-2018 time frame there were 5 momentary outages which occurred during lightning and wind events due to the lack of shield wire on half of the circuit, exposing it to a higher probability of forced momentary and permanent lightning induced outages.

The Clifford-Scottsville 46 kV circuit (45.5 mi.) consists primarily of 1926 wood pole structures with 4/0 ACSR overhead conductor and currently has 93 open conditions including rot top, rot heart and woodpecker/insect damage. Over the last recorded 3 year period, 6 permanent outages were observed. Also, only 16% of the line has shielding, mainly on the tap sections.

Riverville station serves a large industrial customer (Grief Brothers Corporation) consisting of approximately 45 MW from a radial 138 kV line served from Boxwood S.S. located between Clifford and Reusens. This radial line is approximately 9.2 miles long, leaving a large amount of load exposed to a variety of single contingency events.



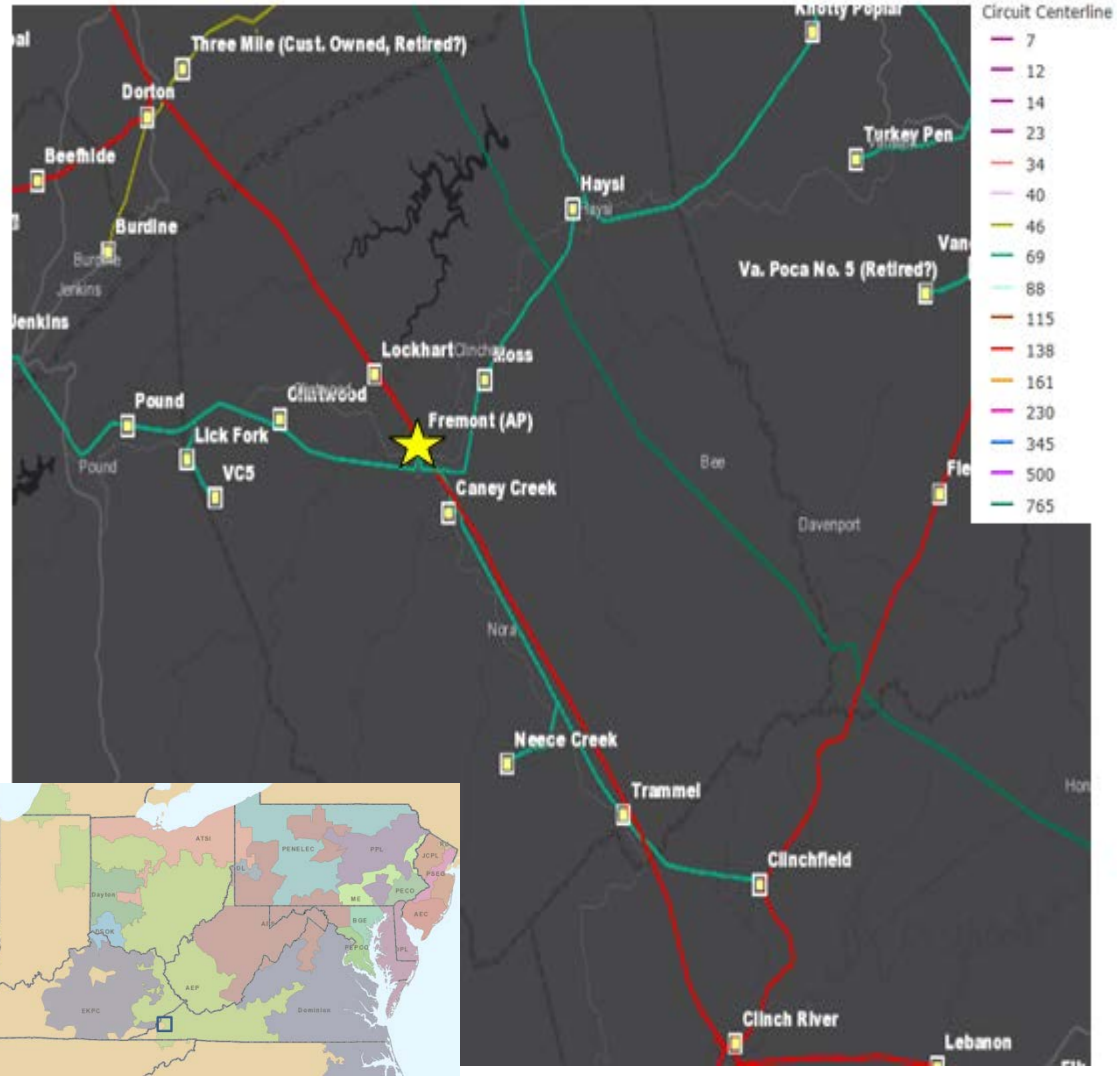
AEP Transmission Zone: Supplemental
Clintwood, VA

Need Number: AEP-2019-AP005
Process Stage: Needs Meeting
Needs Presented: 02/20/19
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

The 138/12 kV Transformer #3 at Fremont station is 1971 vintage and is showing dielectric breakdown (insulation), accessory damage (bushings), and short circuit breakdown (due to through faults).

138/69 kV Transformers #1 and #2 at Fremont station are 1957 vintage and show significant signs of dielectric breakdown (insulation), accessory damage (bushings), and short circuit breakdown (due to through faults).



AEP Transmission Zone: Supplemental Muncie Indiana

Need Number: AEP-2019-IM001
Process Stage: Needs Meeting 02/20/2019
Process Chronology: Needs Meeting 02/20/2019
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

Medford – Blaine Street (~3.3 Miles)

- 1940's vintage wood crossarm construction with cap and pin insulators
- There are currently 40 open conditions on this line. This trend is expected to increase as the structures and conductor age.

Medford – Haymond (section in question is Medford – near 21st Street ~3.3 miles)

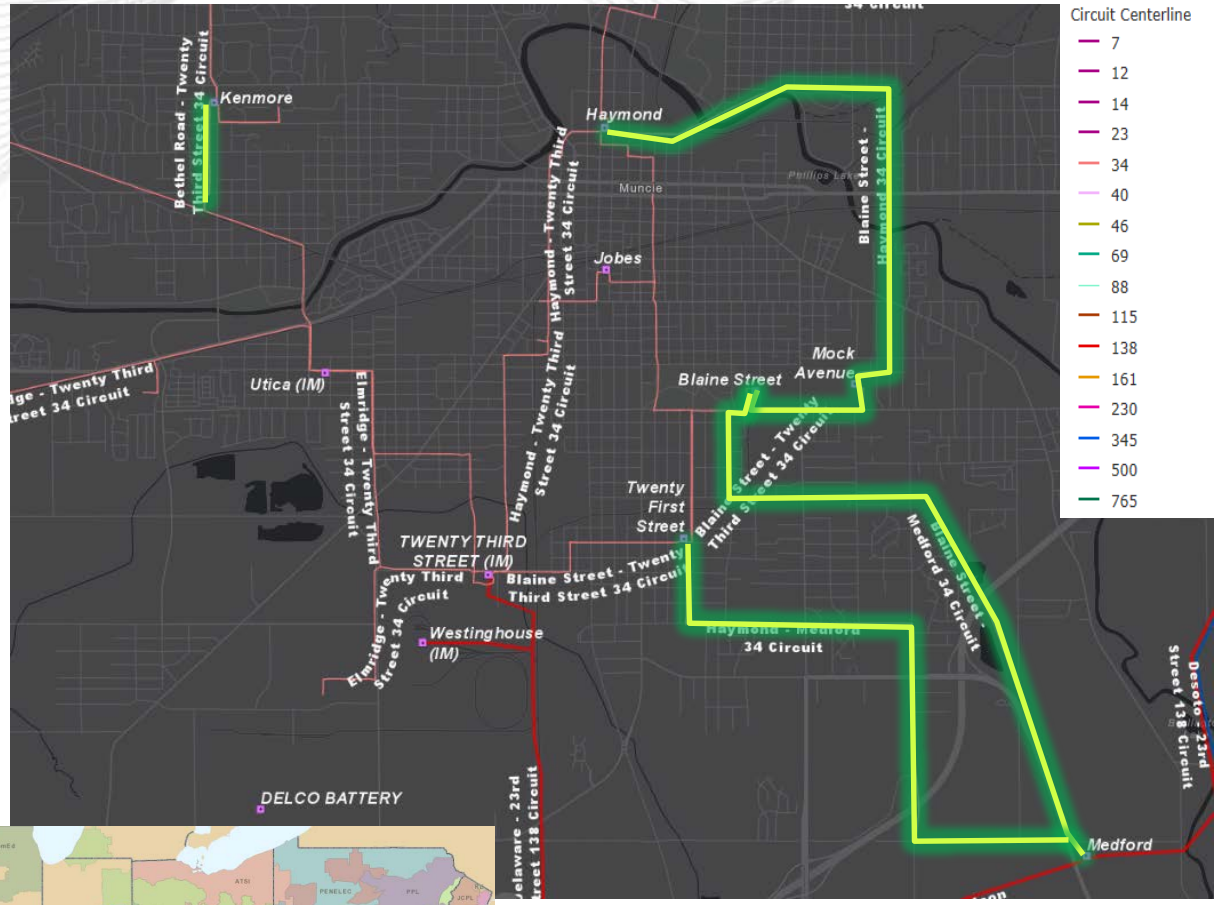
- 1940's vintage wood crossarm construction with cap and pin insulators
- There are currently 29 open conditions on this segment of the line. This trend is expected to increase as the structures and conductor age.

Haymond – Blaine Street (~3.7 miles)

- 1950's vintage wood crossarm construction with cap and pin insulators
- There are currently 7 open conditions on this segment of the line. This trend is expected to increase as the structures and conductor age.

~~Kenmore – 23rd street (Section is .53 miles)~~

- ~~Section has been identified as having multiple physically overloaded structures and must be addressed.~~ Moved to AEP-2019-IM026



AEP Transmission Zone: Supplemental Benton Harbor, MI

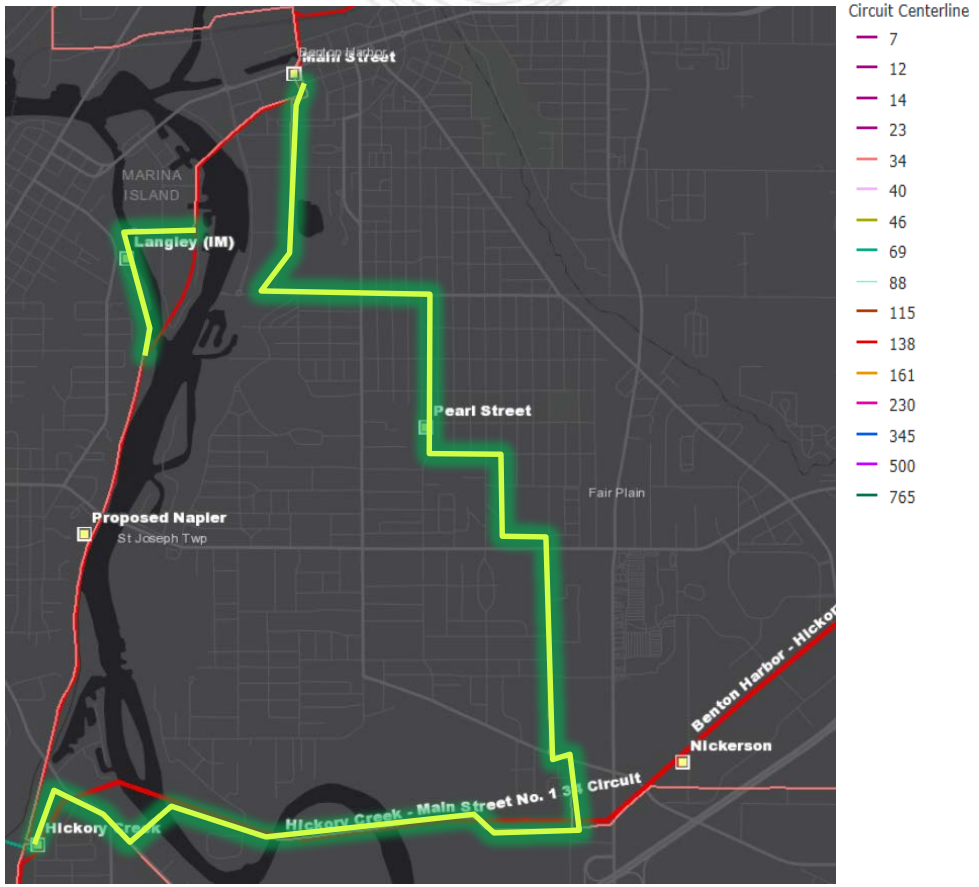
Need Number: AEP-2019-IM002
Process Stage: Needs Meeting 02/20/2019
Process Chronology: Needs Meeting 02/20/2019
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

Hickory Creek – Main Street 1 (~6.7 Miles)

- 1950's vintage wood pole line
- There are currently 31 open conditions, This trend is expected to increase as the structures and conductor age.

Hickory Creek – Main Street 2 (section in question is the Langley Extension ~.7 miles)

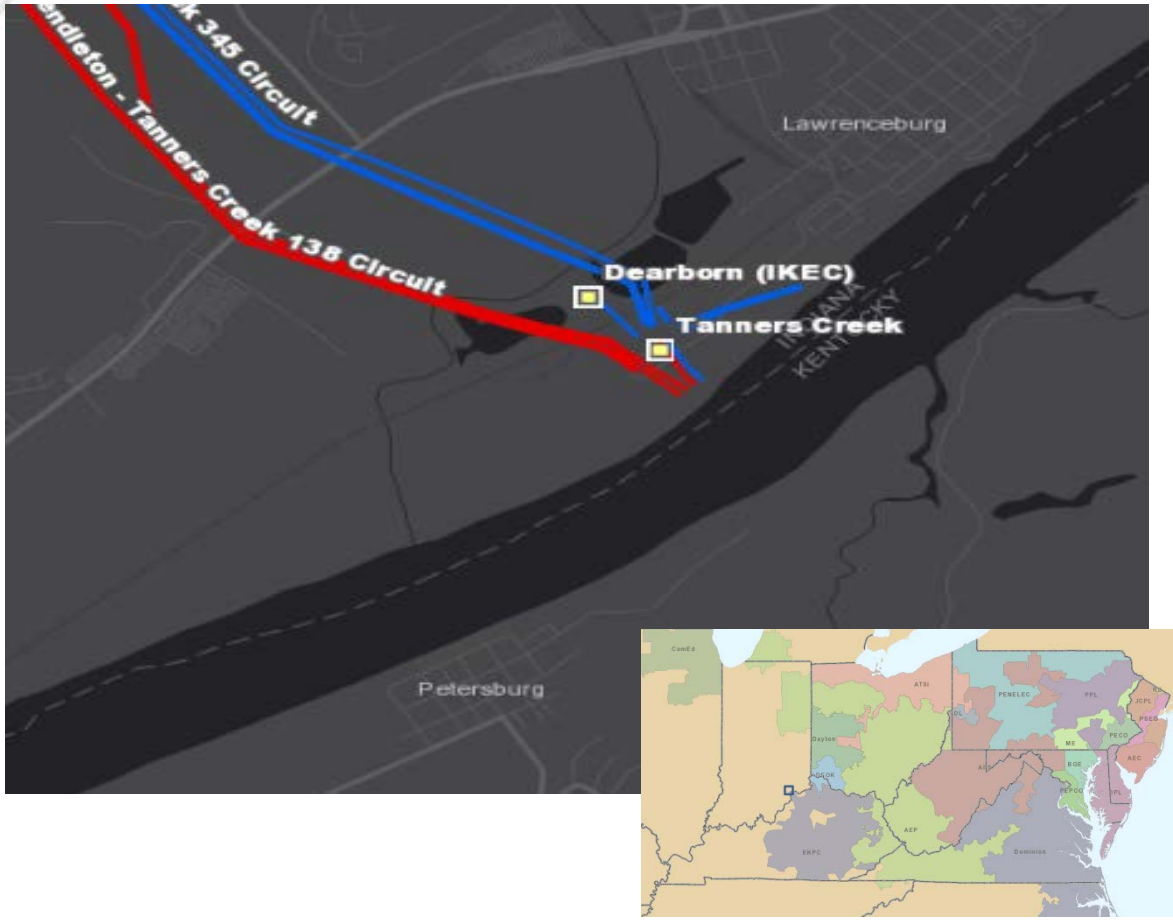
- 1950's vintage wood pole line
- There are currently 11 open conditions on this segment of the line, This trend is expected to increase as the structures and conductor age.



AEP Transmission Zone: Supplemental Tanners Creek, IN

Need Number: AEP-2019-IM003
Process Stage: Needs Meeting
Process Chronology: Needs Meeting
Supplemental Project Driver: Operational Efficiency & Flexibility
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

- Tanners Creek
  - Currently a line fault on the Dearborn circuit causes 5 EHV breakers to open. This is above the AEP max of 4 and must be addressed.
  - According to the DEDSTFMRS PJM document, 200kV+ facilities with 7+ elements are required to be in a complete breaker and a half setup at a minimum. This facility has 9 elements and is currently in an incomplete breaker and a half setup.



AEP Transmission Zone: Supplemental Greentown, IN

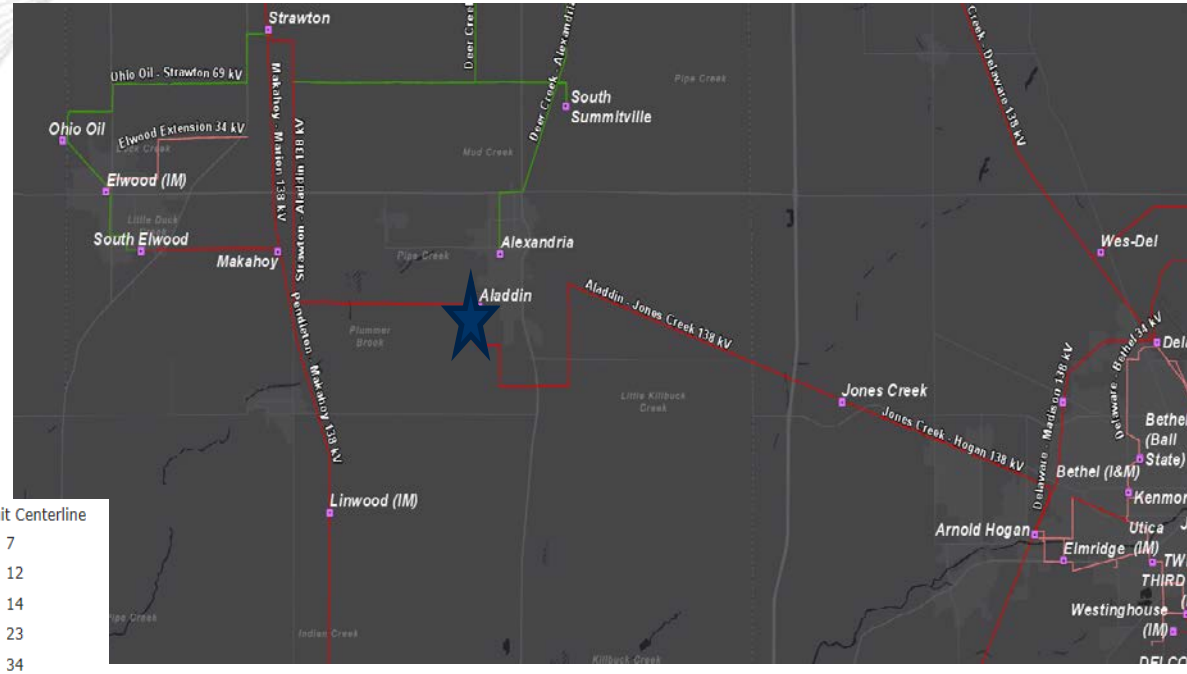
Need Number: AEP-2019-IM004
Process Stage: Needs Meeting 02/20/2019
Process Chronology: Needs Meeting 02/20/2019
Supplemental Project Driver: Operational Efficiency & Flexibility
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

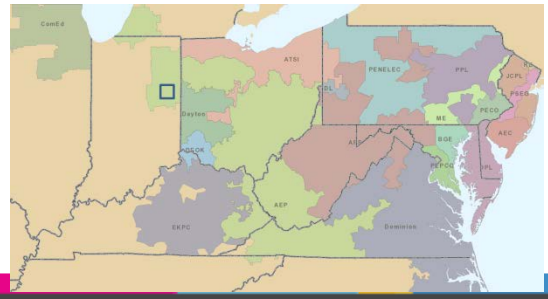
- Greentown
  - According to the DEDSTFMRS PJM document, BES facilities with 7+ elements are recommended to be in a complete breaker and a half setup at a minimum. This facility has 7 elements and is currently in an incomplete breaker and a half setup.

AEP Transmission Zone: Supplemental Alexandria, Indiana

Need Number: AEP-2019-IM005
Process Stage: Needs Meeting 02/20/2019
Process Chronology: Needs Meeting 02/20/2019
Supplemental Project Driver: Operational Flexibility and Efficiency
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:
Associated Needs: AEP-2018-IM010
Strawton – Arnold Hogan 138 kV

- This line currently has 4 MOABS in series (2 at Aladdin and 2 at Jones Creek) which is above AEP's max of 3.





Need Number: AEP-2019-IM006
Process Stage: Needs Meeting 02/20/2019
Process Chronology: Needs Meeting 02/20/2019
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

The load at Hamilton is 9.19 MW and its radially served from Butler station via a 7.74 miles long line. In addition to this there are significant open and closed conditions on the Butler – Hamilton 69kV Line.

Butler – Hamilton 69kV Line
- 1956 vintage wood pole line.
- 33 open conditions with the majority being structure issues.
- CMI – 5,268,522

Dome Tap 69kV Line
- 1978 vintage wood pole line.
- 14 open conditions with the majority being structural issues.

AEP Transmission Zone: Supplemental
South Bend, Indiana Area

Need Number: AEP-2019-IM007
Process Stage: Needs Meeting 02/20/2019
Process Chronology: Needs Meeting 02/20/2019
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

Kankakee – Jackson Rd 34kV Line (~4 miles)

- Wood pole line
- 88 open conditions with the majority being structure issues. This trend is expected to increase as the structures and conductor age.

~~Torrington Tap 34kV Line (~1 mile)~~

- ~~Wood pole line~~
- ~~2 open conditions. This trend is expected to increase as the structures and conductor age.~~ **Moved to AEP-2019-IM037**

AEP Transmission Zone: Supplemental Jay - Lincoln

Need Number: AEP-2019-IM008
Process Stage: Needs Meeting 02/20/2019
Process Chronology: Needs Meeting 02/20/2019
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

~~Hillcrest – Bluffton 69kV line~~ Moved to AEP-2019-IM030
- ~~1964 vintage wood pole line~~
- ~~This line is currently subject to 155 open conditions with the majority being structural issues. This trend is expected to increase as the structures and conductor age.~~

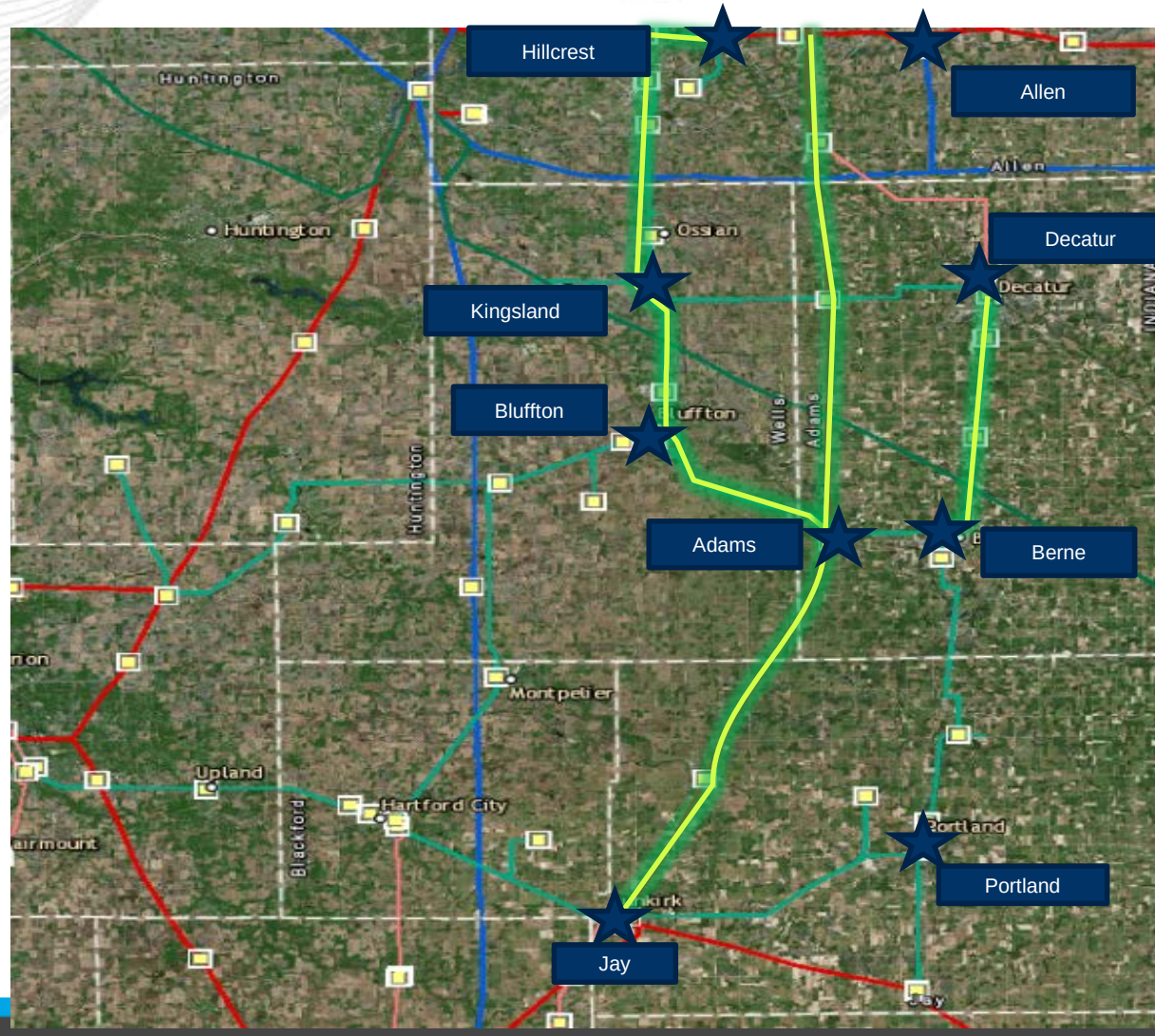
Decatur – Berne 69kV line
- 1966 vintage wood pole line
- This line is currently subject to 95 open conditions with the majority being structural issues. This trend is expected to increase as the structures and conductor age.

Jay – Lincoln 138kV line
- 1953 vintage wood H frame line
- This line is currently subject to 111 open conditions with the majority being structural issues. This trend is expected to increase as the structures and conductor age.

~~Adams – Bluffton 69kV line~~ Moved to AEP-2019-IM030
- ~~1957 vintage wood pole line~~
- ~~This line is currently subject to 32 open conditions with the majority being rotting structural issues. This trend is expected to increase as the structures and conductor age.~~

~~Portland 69kV station~~ Moved to AEP-2019-IM031
- ~~Breakers "A" and "G"~~
  - ~~1962-1969 vintage Oil breakers~~
  - ~~Fault Operations: A(57) G(89) – Recommended(10)~~

~~Kingsland 69kV station~~ Moved to AEP-2019-IM030
- ~~Breakers "A" and "B"~~
  - ~~1969 vintage Oil breaker~~
  - ~~Fault Operations: A(31) B(27) – Recommended(10)~~



Need Number: AEP-2019-IM008
Process Stage: Needs Meeting 02/20/2019
Process Chronology: Needs Meeting 02/20/2019
Supplemental Project Driver: Customer Service
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

Antiville

- Potential economic developments have not materialized due to system load limitations.

~~Trinity Tap (Jay REMC/Wabash Valley Power Authority)~~ Moved to AEP-2019-IM031

- ~~Potential economic developments have not materialized due to system load limitations.~~
- ~~WVPA is targeting this area for load growth.~~

~~WVPA/Heartland Industrial Park 1 (Pleasant station)~~ Moved to AEP-2019-IM030

- ~~WVPA/Heartland has requested a new 138kV delivery point to feed a new industrial park.~~
- ~~2 industrial customers are already building on this site with room for further expansion. This load growth further constrains an already constrained 69kV network~~

~~WVPA/Heartland Industrial Park 2 (Ossian station)~~ Moved to AEP-2019-IM030

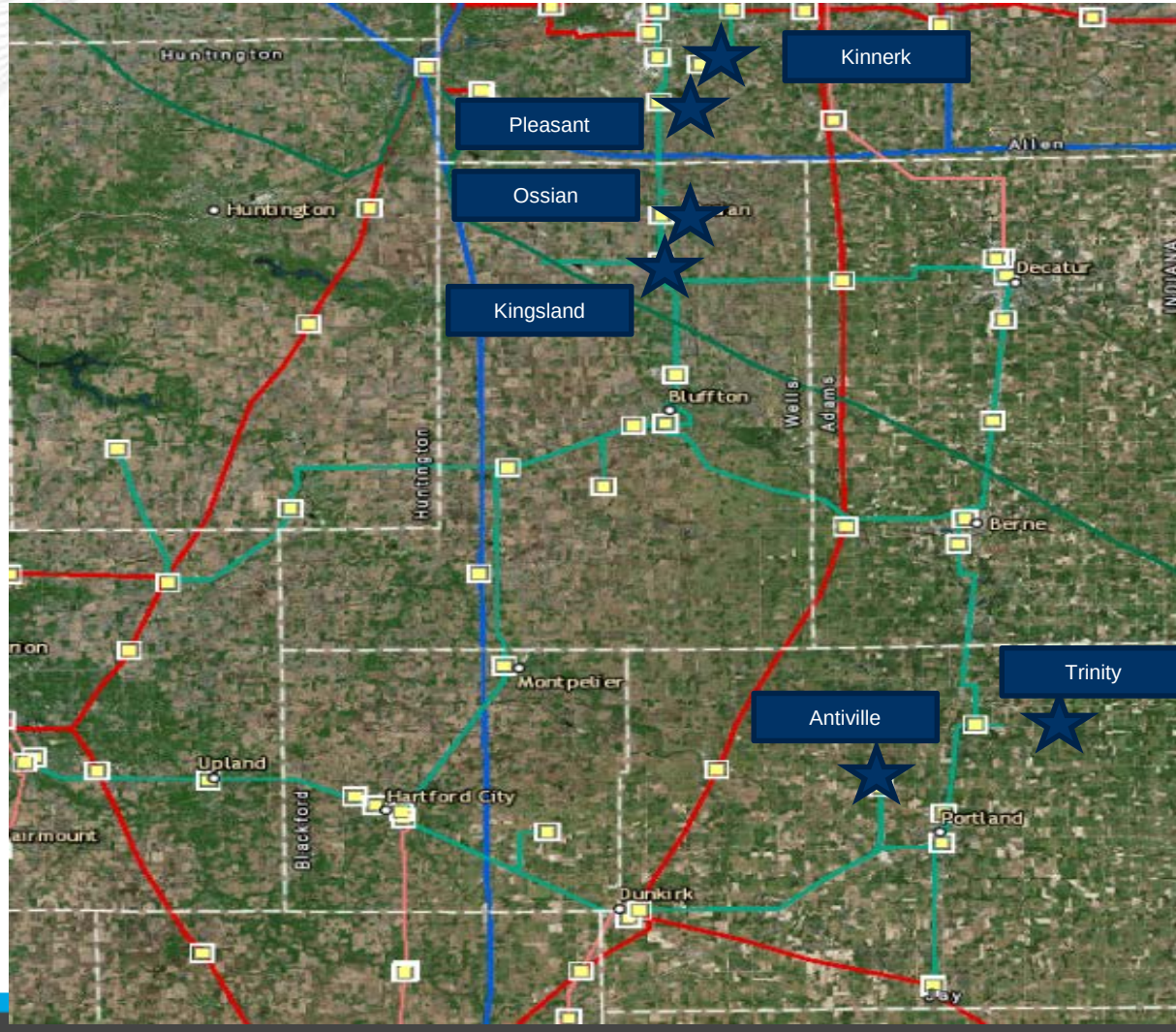
- ~~WVPA/Heartland has target this area for industrial development.~~
- ~~Potential economic developments have not materialized due to system load limitations.~~

~~Kinnerk (WVPA/Heartland station)~~ Moved to AEP-2019-IM030

- ~~Customer has made an offer to upgrade this station to 138kV in order to enable to connect 138kV to the Pleasant and Ossian industrial parks.~~

~~Kingsland (I&M Distribution)~~ Moved to AEP-2019-IM030

- ~~I&M Distribution has indicated a want to move toward 138kV at this facility due to the expected load growth in the industrial park north of this station.~~

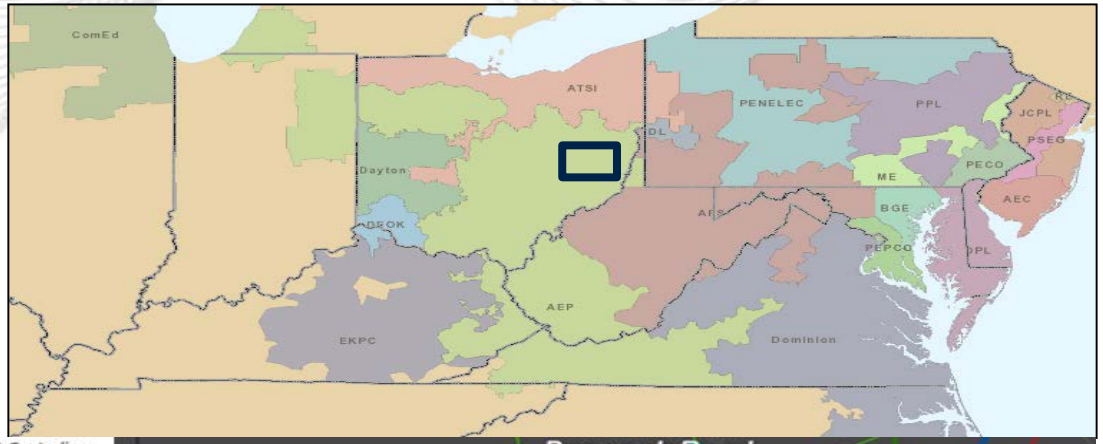


AEP Transmission Zone: Supplemental
Belmont County, Ohio

Need Number: AEP-2019-OH001
Process Stage: Needs Meeting 2/20/2019
Process Chronology: Needs Meeting 2/20/2019
Supplemental Project Driver: Equipment Material/ Condition/Performance/Risk & Operational Flexibility
Specific Assumption References:
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

The Glencoe-Somerton 69kV circuit is 22.5 miles in length and has numerous condition issues. Within the last 5 years, it has experienced 18 momentary outages (3.6 per year) and 7 permanent (sustained) outages (1.4 per year). The average outage duration has been 13.7 hours. AEP and South Central Power Co-op customers served from this circuit suffered nearly 3.5 million minutes of customer interruption (CMI) during the 2015-2018 timeframe. The circuit currently has 148 open conditions (43 structural, 23 on conductor, 5 for shielding/grounding, 24 for hardware, and 53 for forestry/ROW). The majority of the wood poles were installed in 1953 and 1970 (84% of circuit length). The conductor was also primarily installed in 1953 (219 kcmil ACSR) and 1970 (336 kcmil ACSR). The majority of the outage causes have been attributed to T-Line condition issues.

The two 69kV delivery points for South Central Power Co-op's Beallsville and Pipe Creek stations are connected via hard taps (no sectionalizing switches present). This requires an outage to the customer whenever maintenance or emergency repairs must be done on either side of the customer tap.

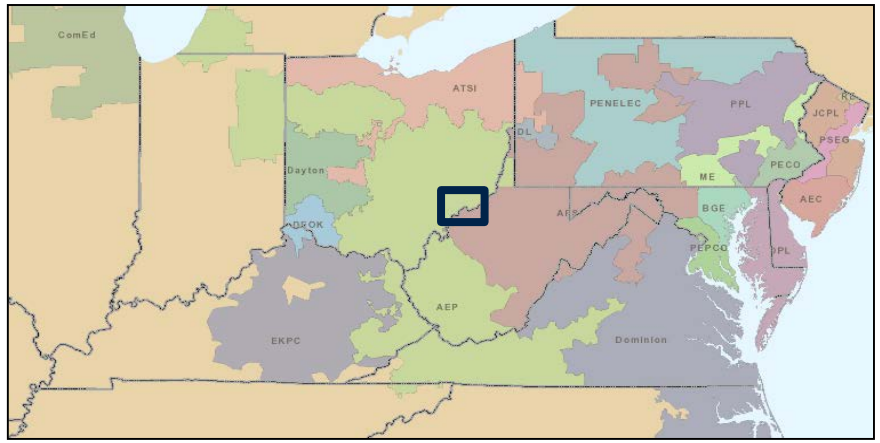


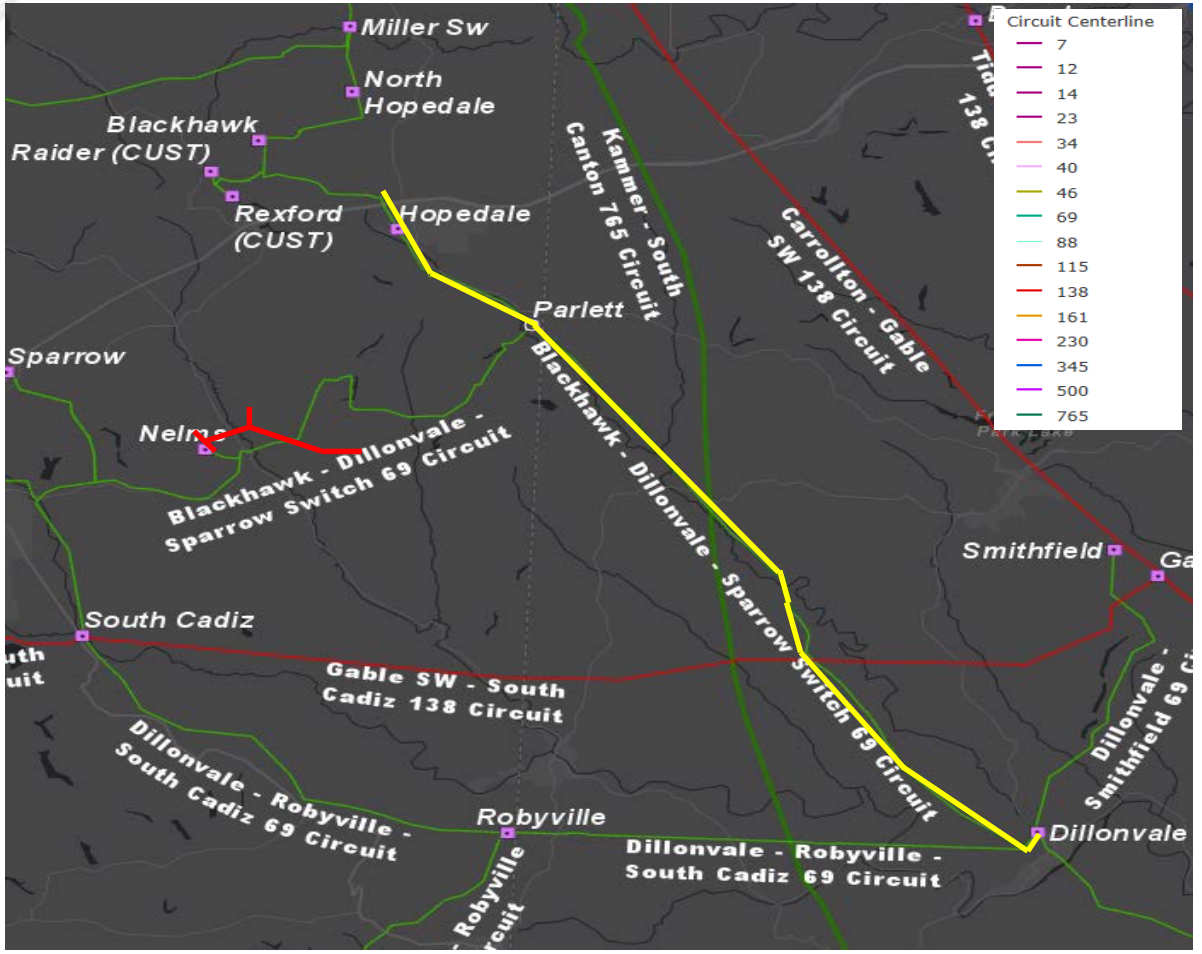
AEP Transmission Zone: Supplemental Dillonvale, OH

Need Number: AEP-2019-OH002
Meeting Date: 02/20/2019
Process Stage: Need
Supplemental Project Driver: Equipment/Material/ Condition/Performance/Risk
Specific Assumption References:
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement

The Blackhawk-Dillonvale-Sparrow 69 kV line was originally constructed in 1918 and approximately 30% of the wood structures are still from 1918. More than half of the structures are of pre-1980 vintage and are affected by heavy rot and woodpecker/insect damage. 70% of the conductor is from 1926 (or prior) and is showing signs of tensile-related failures. There are 180 open A conditions on this line. Sections of the Blackhawk-Parlett line (Blackhawk Extension, Raider Extensions and Rexford Extension) have been recently rebuilt to 138 kV standards. (Shown in Red)





AEP Transmission Zone: Supplemental
Canton, OH

Need Number: AEP-2019-OH003

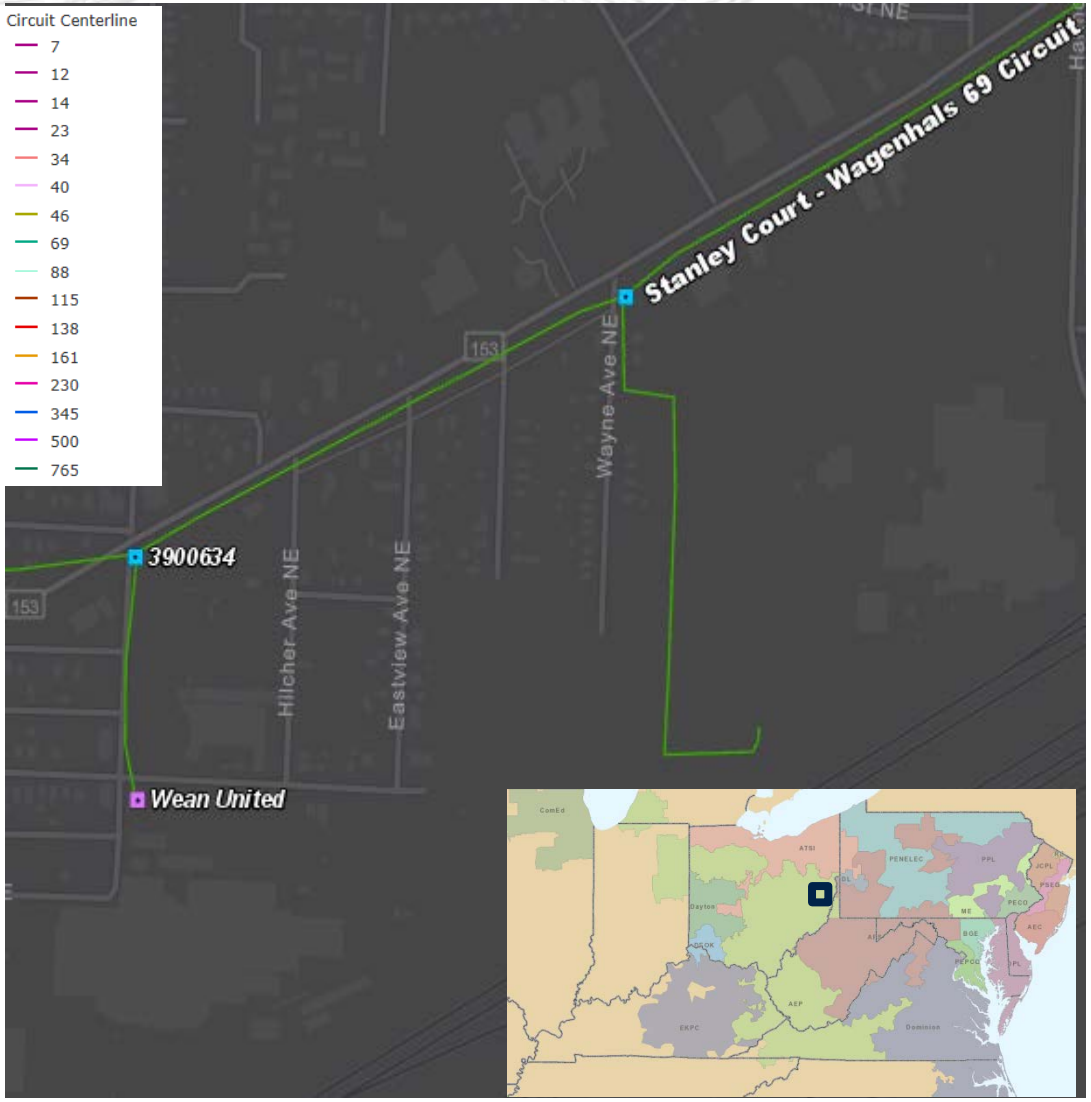
Date: 02/20/2019

Process Stage: Needs Meeting

Supplemental Project Driver: Customer Service

Specific Assumptions Reference:
AEP Guidelines for Transmission Owner Identified

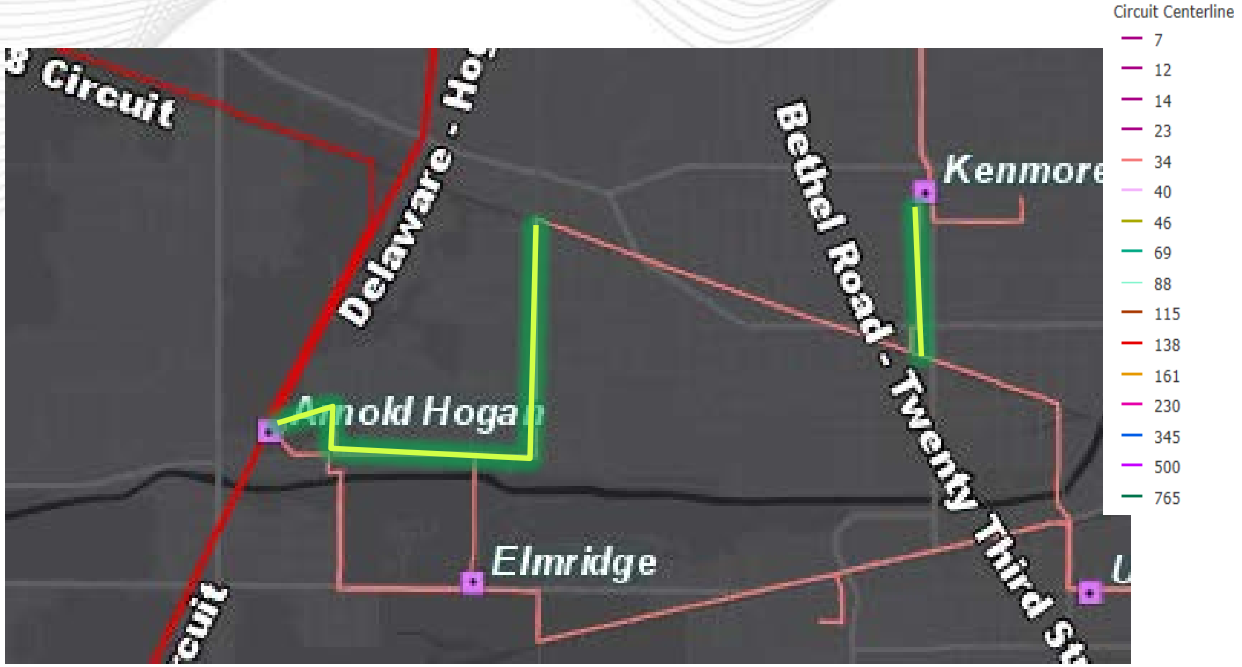
Problem Statement:
A Customer plans to install a 2nd 69/12 kV transformer in their facility to support increased load. This customer had already procured a transformer in advance.



AEP Transmission Zone: Supplemental
Arnold Hogan - Kenmore Indiana

Need Number: AEP-2019-IM026
Process Stage: Needs Meeting 02/20/2019
Process Chronology: Needs Meeting 02/20/2019
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:
Kenmore – 23rd street (Section is .53 miles)

- Section has been identified as having multiple physically overloaded structures and must be addressed.



AEP Transmission Zone: Supplemental Hillcrest - Adams

Need Number: AEP-2019-IM030
Process Stage: Needs Meeting 02/20/2019
Process Chronology: Needs Meeting 02/20/2019
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

Hillcrest – Bluffton 69kV line

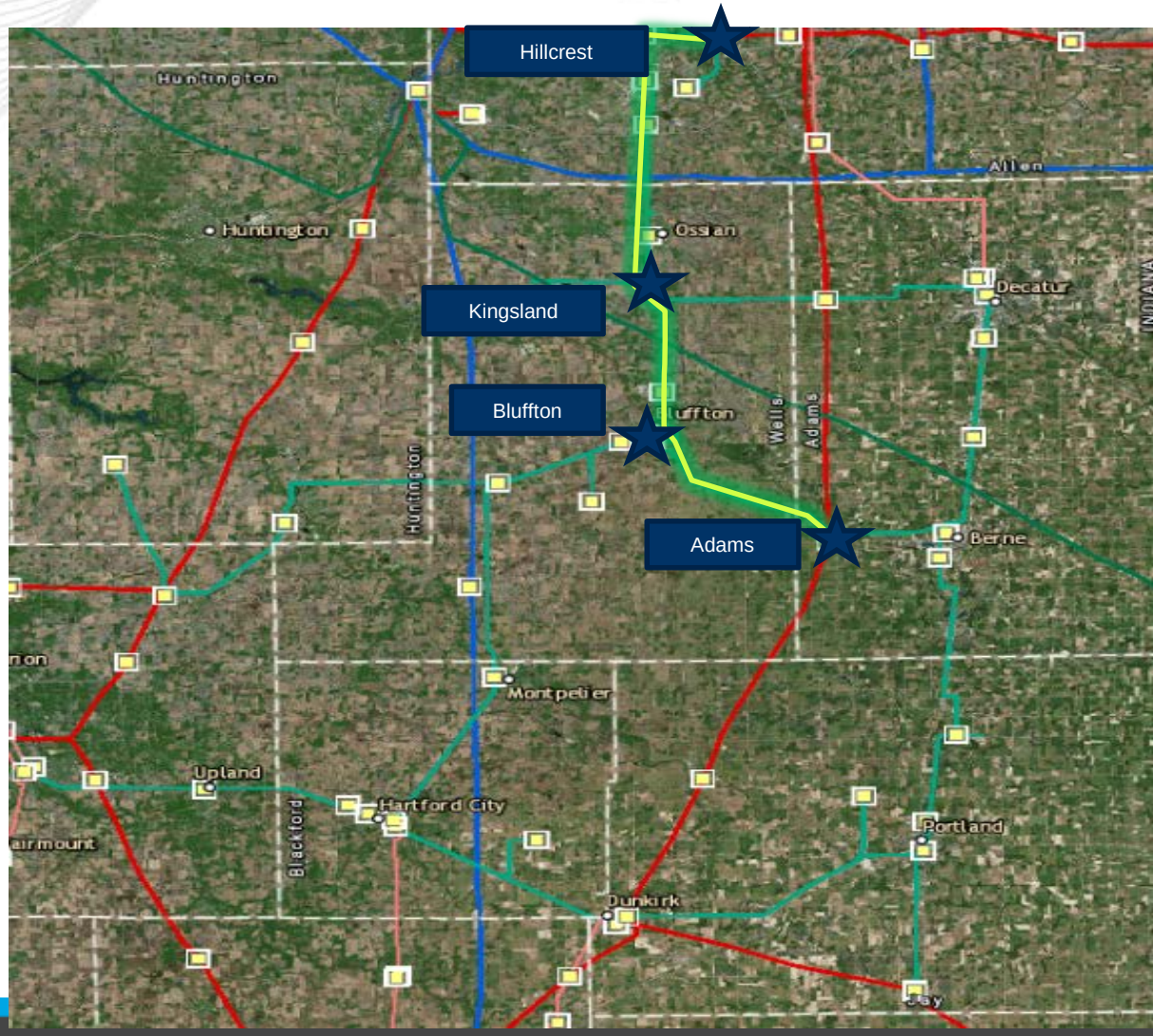
- 1964 vintage wood pole line
- This line is currently subject to 155 open conditions with the majority being structural issues. This trend is expected to increase as the structures and conductor age.

Adams – Bluffton 69kV line

- 1957 vintage wood pole line
- This line is currently subject to 32 open conditions with the majority being rotting structural issues. This trend is expected to increase as the structures and conductor age.

Kingsland 69kV station

- Breakers “A” and “B”
    - 1969 vintage Oil breaker
    - Fault Operations: A(31) B(27) – Recommended(10)



AEP Transmission Zone: Supplemental Hillcrest – Adams

Need Number: AEP-2019-IM030
Process Stage: Needs Meeting 02/20/2019
Process Chronology: Needs Meeting 02/20/2019
Supplemental Project Driver: Customer Service
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

WVPA/Heartland Industrial Park 1 (Pleasant station)

- WVPA/Heartland has requested a new 138kV delivery point to feed a new industrial park.
- 2 industrial customers are already building on this site with room for further expansion. This load growth further constrains an already constrained 69kV network

WVPA/Heartland Industrial Park 2 (Ossian station)

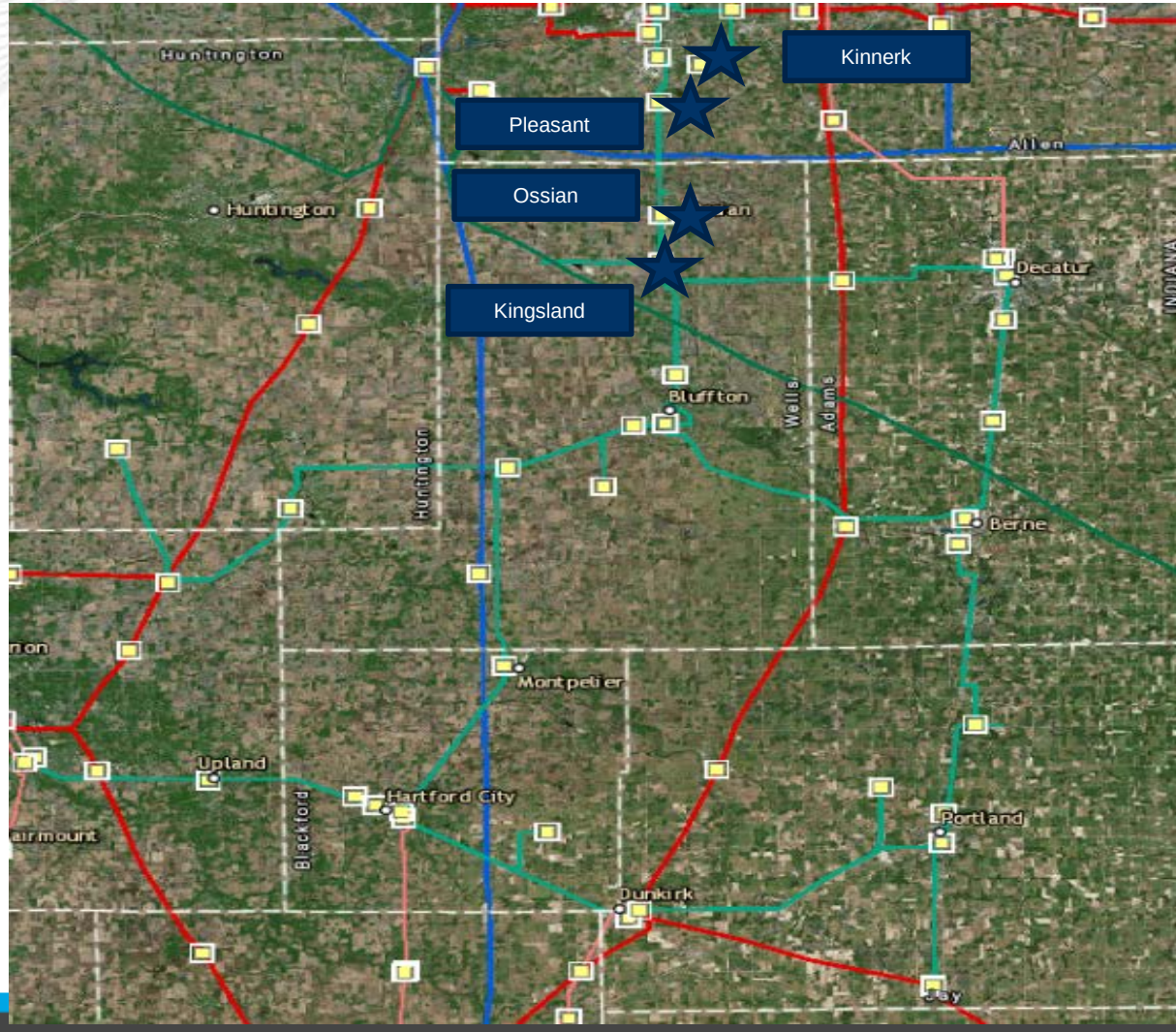
- WVPA/Heartland has target this area for industrial development.
- Potential economic developments have not materialized due to system load limitations.

Kinnerk (WVPA/Heartland station)

- Customer has made an offer to upgrade this station to 138kV in order to enable to connect 138kV to the Pleasant and Ossian industrial parks.

Kingsland (I&M Distribution)

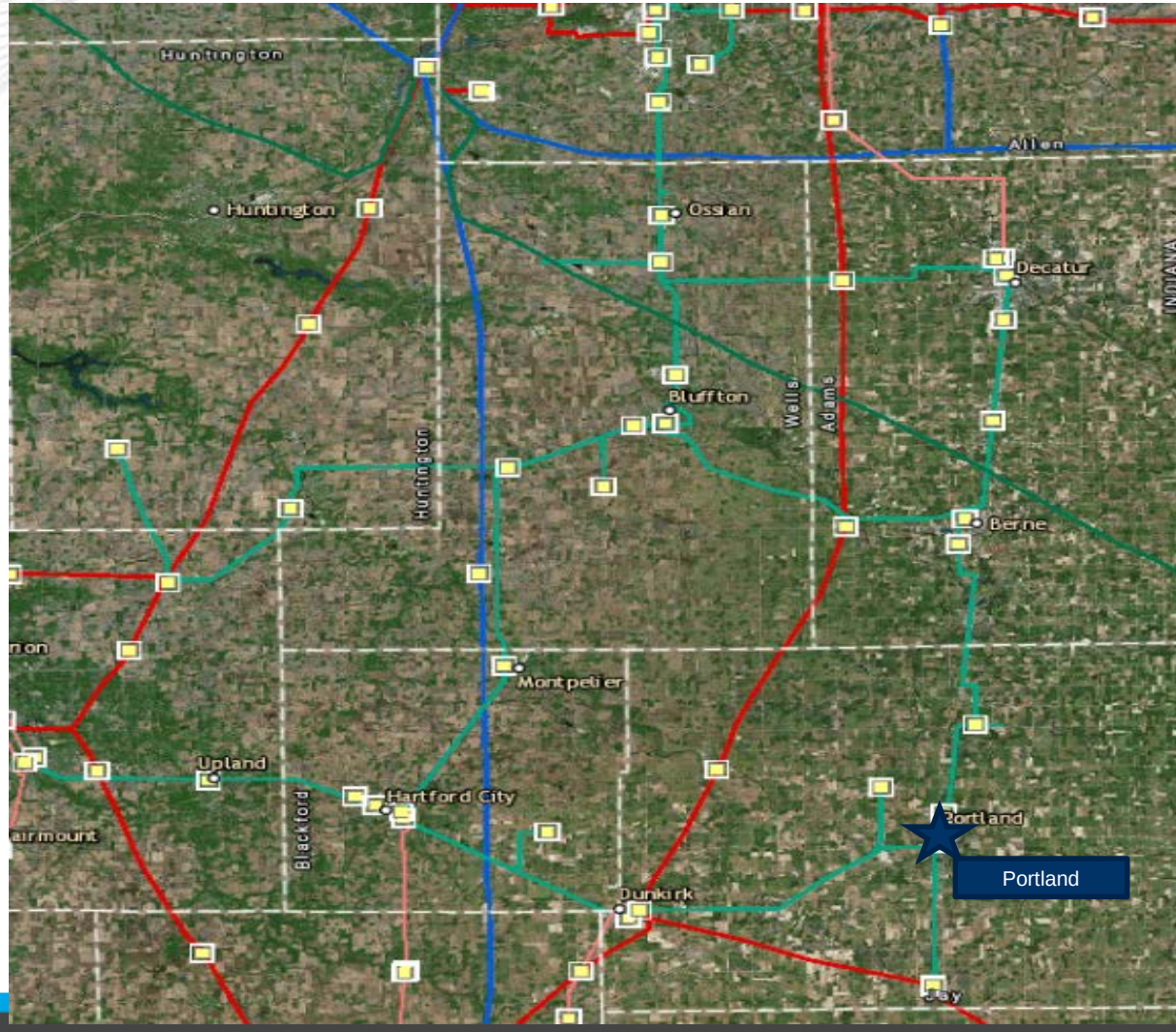
- I&M Distribution has indicated a want to move toward 138kV at this facility due to the expected load growth in the industrial park north of this station.



AEP Transmission Zone: Supplemental Portland Area

Need Number: AEP-2019-IM031
Process Stage: Needs Meeting 02/20/2019
Process Chronology: Needs Meeting 02/20/2019
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:
Portland 69kV station

- Breakers “A” and “G”
  - 1962-1969 vintage Oil breakers
  - Fault Operations: A(57) G(89) – Recommended(10)

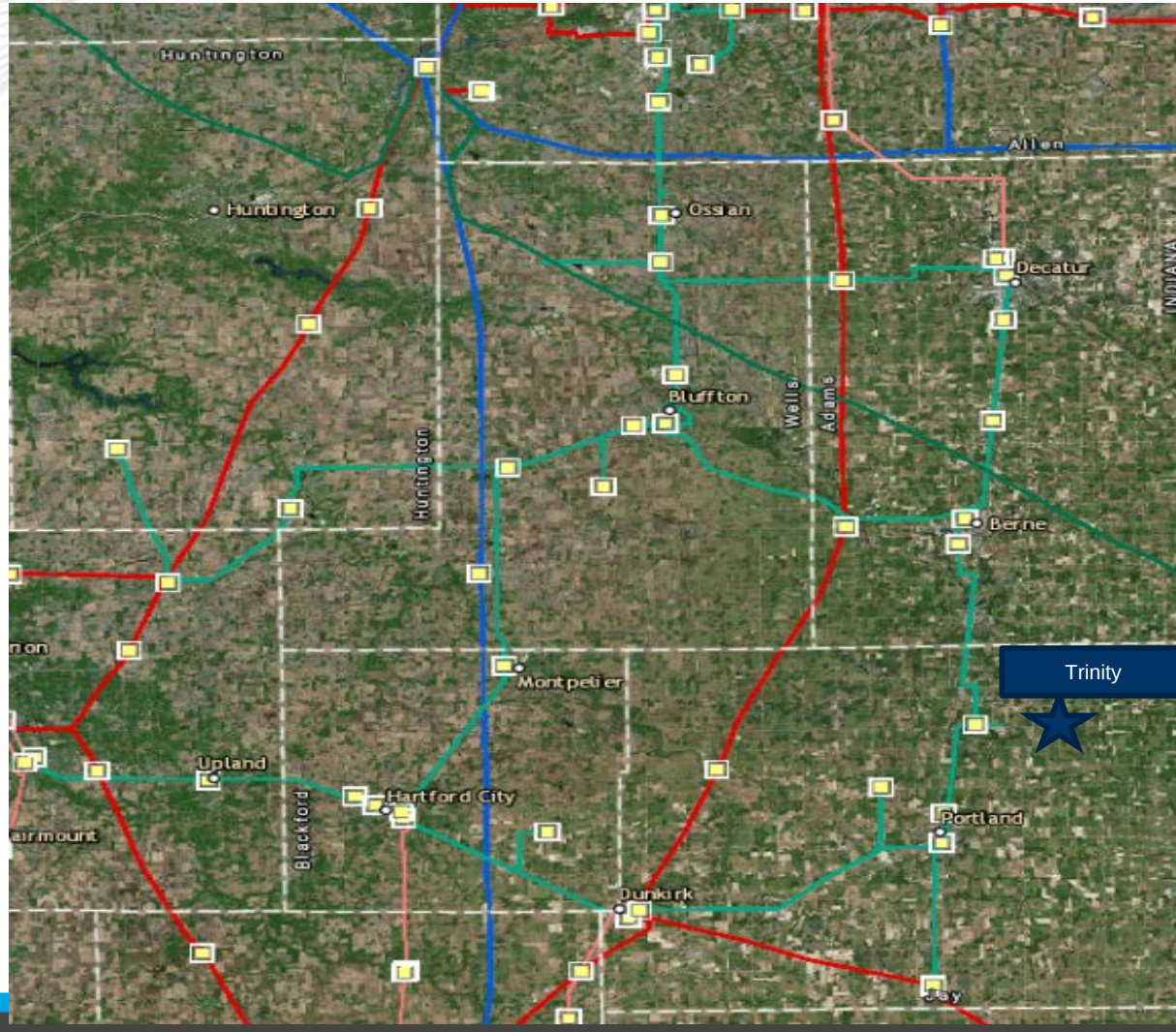


AEP Transmission Zone: Supplemental Portland Area

Need Number: AEP-2019-IM031
Process Stage: Needs Meeting 02/20/2019
Process Chronology: Needs Meeting 02/20/2019
Supplemental Project Driver: Customer Service
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

Trinity Tap (Jay REMC/Wabash Valley Power Authority)

- Potential economic developments have not materialized due to system load limitations.
- WVPA is targeting this area for load growth.



AEP Transmission Zone: Supplemental
South Bend, Indiana Area

Need Number: AEP-2019-IM037
Process Stage: Needs Meeting 02/20/2019
Process Chronology: Needs Meeting 02/20/2019
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:
Torrington Tap 34kV Line (~1 mile)

- Wood pole line
- 2 open conditions. This trend is expected to increase as the structures and conductor age.

AEP 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

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AEP Transmission Zone: Supplemental
Coshocton, Ohio

Need Number: AEP-2018-OH022
Process Stage: Solution Meeting 02/20/19
Needs Presented: 11/29/18
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

- Cyclops 69kV circuit switcher A is currently being used as a line CB. This model has limited spare parts availability and reliability concerns. This circuit switcher has also experienced 41 fault operations.
- Cyclops 69kV CB B is an oil type breaker (vintage 1955) that has exceeded the manufacturers recommended number of fault operations (36 total faults). Oil breakers are difficult to maintain due to oil handling requirements. Oil spill can occur during maintenance and fixes.
- Cyclops station currently has 19 electro-mechanical relays employed.
- Cyclops station is currently built upon a four-pole wooden bay that is progressively deteriorating.

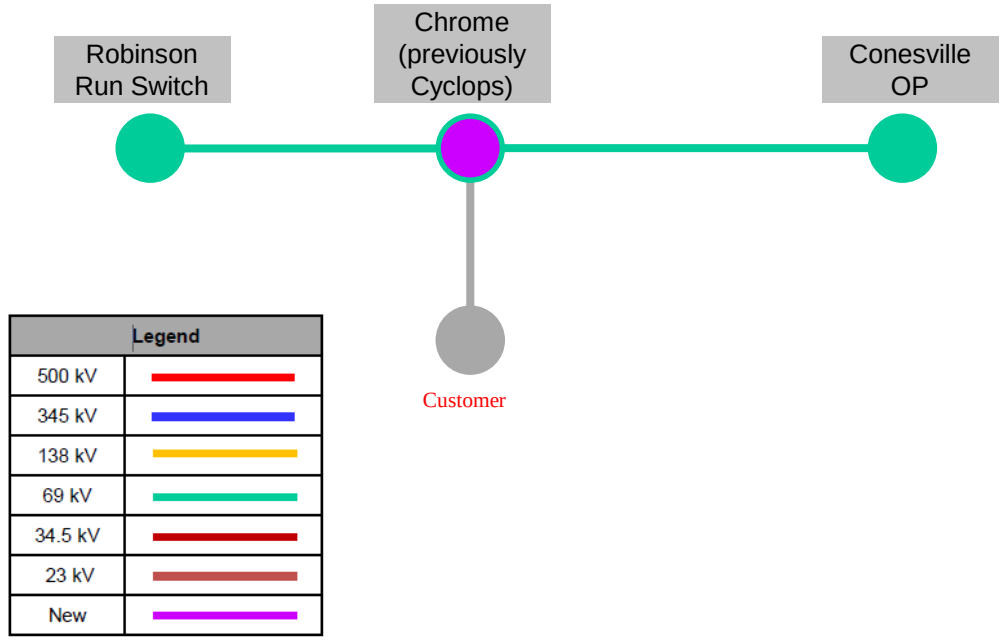
AEP Transmission Zone: Supplemental Coshocton, Ohio

Need Number: AEP-2018-OH022
Process Stage: Solution Meeting
Needs Presented: 2/20/19
Proposed Solution:

- Build a new greenfield station with an in-and-out configuration utilizing two 69 kV 3000 A 40 kA CB's.
- Install a new control house, relaying, and required bus work.
- T-Line work to reconnect the lines to the new Station.
- Removal of the old (Cyclops) Station.

Alternatives:
Rehab the Station equipment in place. This options was not feasible due to the extended outages required for this sensitive customer.

Total Estimated Transmission Cost: $5.3M
Projected IS Date: 6/15/2019
Project Status: Engineering

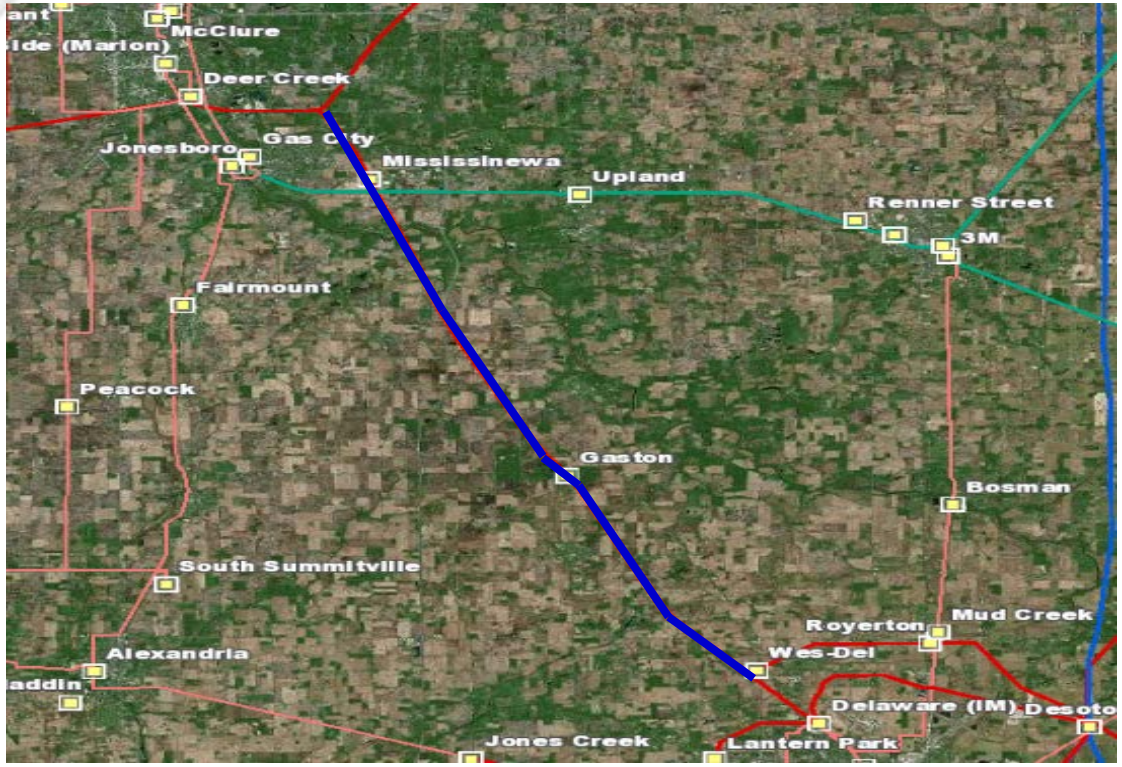


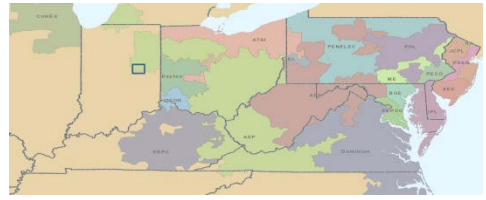
AEP Transmission Zone: Supplemental Marion/Muncie, Indiana Area

Need Number: AEP-2018-IM008
Process Stage: Solution Meeting 02/20/19
Process Chronology: Needs Meeting 10/26/18
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

Deer Creek – Delaware

- 1920's vintage steel lattice line.
- 397.5 ACSR Double Circuit
- 439 open structure and conductor category A and B conditions





Need Number: AEP-2018-IM008
Proposed Solution:

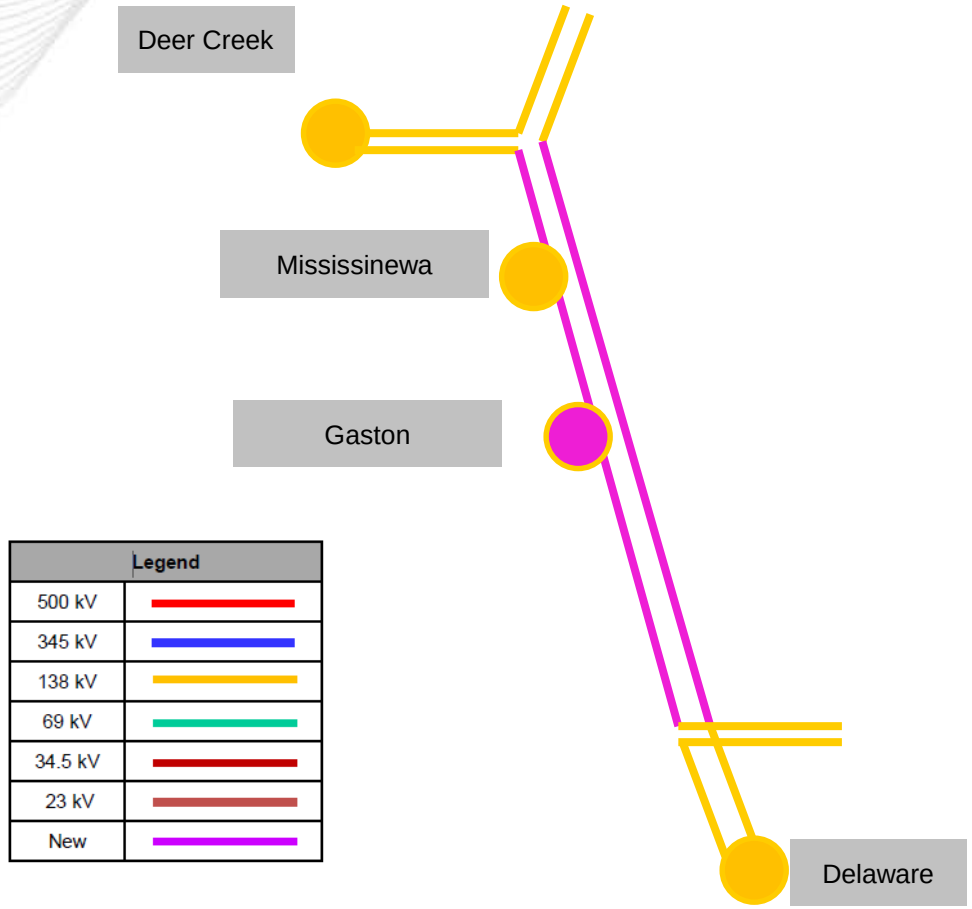
Deer Creek – Delaware:
Rebuild the ~19.8 miles from structure 16 to structure 127 on the Deer Creek – Delaware double circuit 138kV line.

Gaston:
Install a breaker facing Desoto in the bus tie position

Delaware:
Reterminate into the P breaker

Alternatives:
Install a MOAB at Gaston and install a new breaker at either Mississinewa or at Gaston facing Deer Creek. Due to the physical location of Gaston and since there was already a bus tie breaker position open, installing the breaker facing Desoto was deemed the best solution.

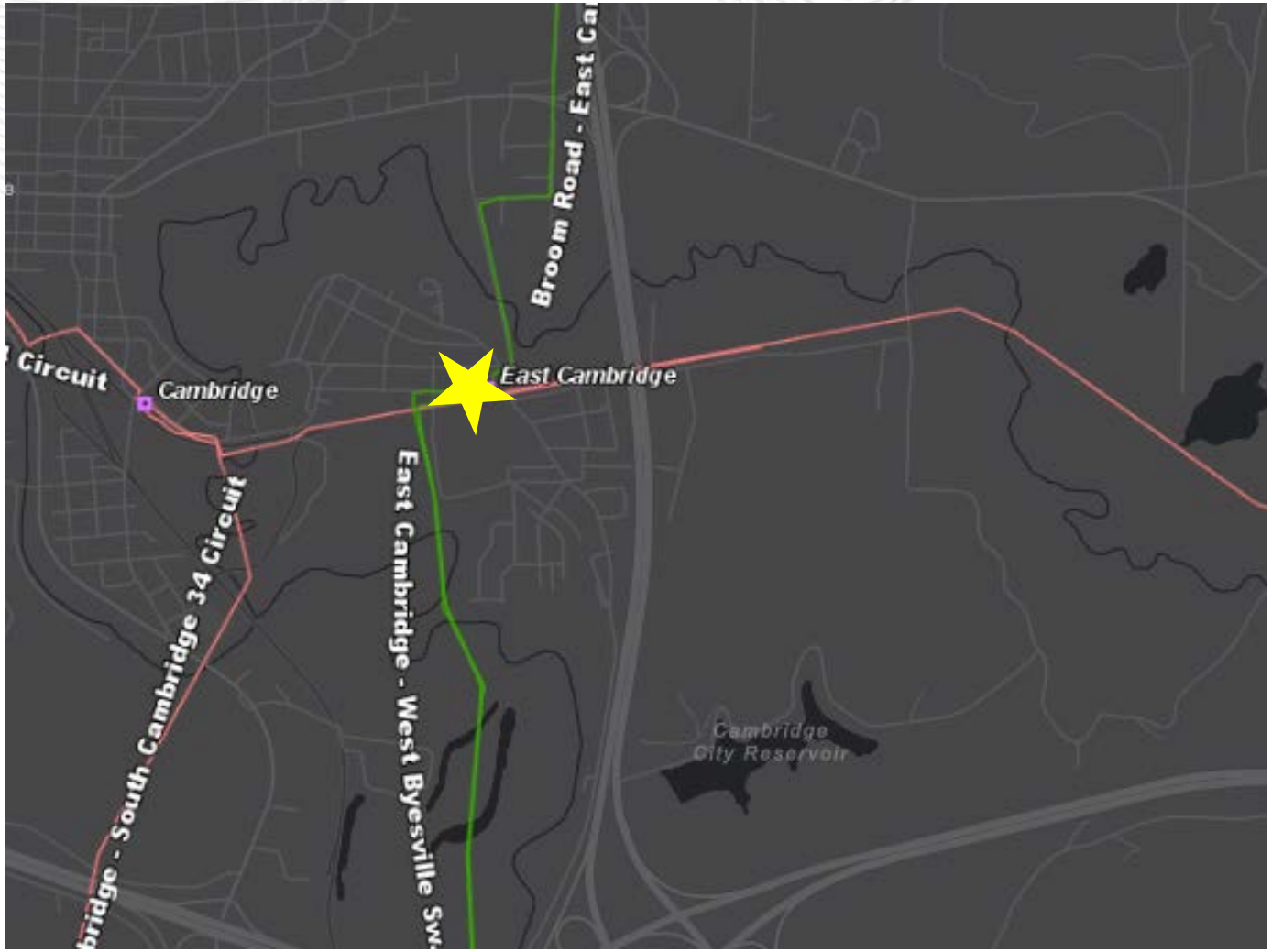
Total Estimated Transmission Cost: $57.15M
Projected IS Date: 10/8/2021
Project Status: Scoping



AEP Transmission Zone: Supplemental Cambridge, Ohio

Need Number: AEP-2018-OH023
Process Stage: Need Meeting 02/20/19
Needs Presented: 11/29/18
Supplemental Project Driver: Customer Request
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

- East Cambridge 34.5kV CB “D”, 69kV CB “A” and 69kV CB “C” are vintage (1970-1975) circuit breakers. Oil breakers are difficult to maintain due to oil handling requirements and risk of oil spills during maintenance and failures. In addition, these CB’s have exceeded the manufacturers recommended fault operations: CB A (8), CB C (28), and CB D (91).
- East Cambridge circuit switcher AA (vintage 1970) is recommended for replacement due to reliability concerns and lack of spare part availability.
- East Cambridge currently has 36 electro-mechanical relays employed.



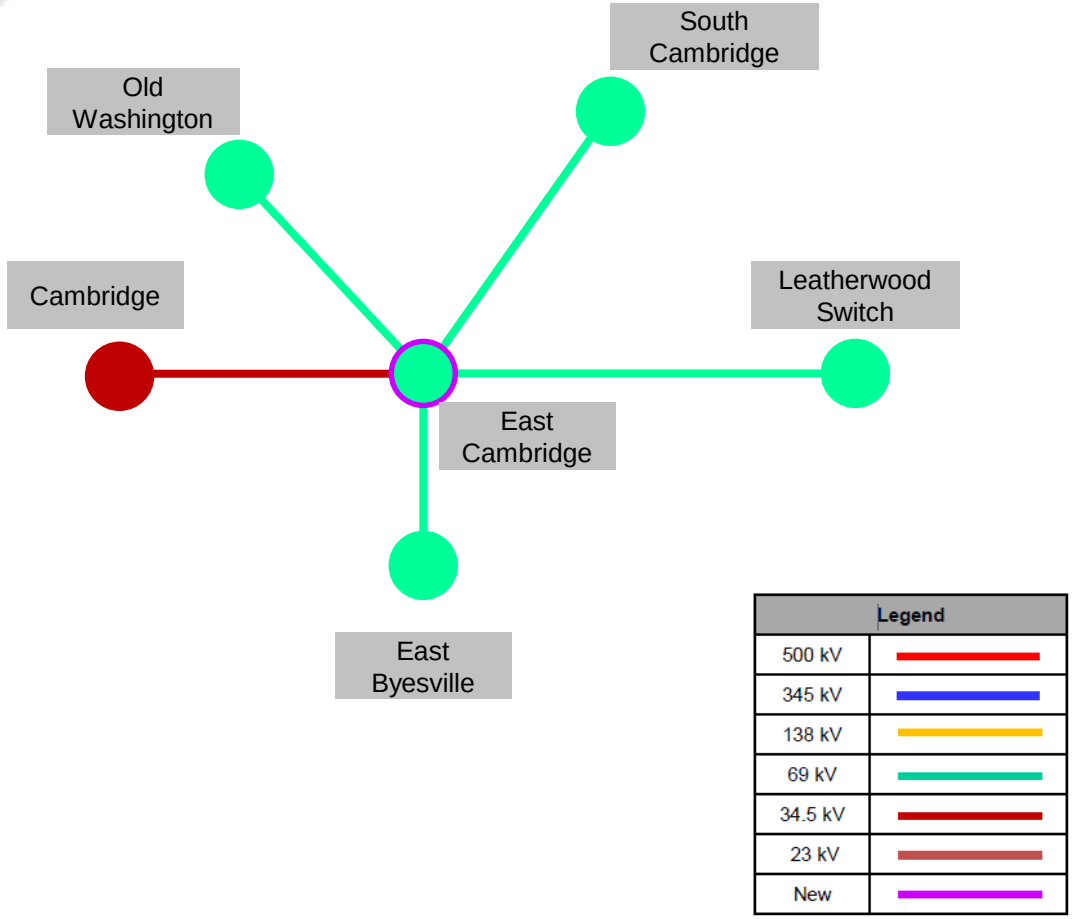
AEP Transmission Zone: Supplemental Cambridge, Ohio

Need Number: AEP-2018-OH023
Process Stage: Solution Meeting
Needs Presented: 2/20/2019

Proposed Solution:
- Rebuild East Cambridge Station into a 69kV, 6-circuit-breaker ring bus with 69 kV 3000 A 40 kA breakers.
- Install a low side 34.5 kV 1200 A 25 kA circuit breaker on transformer #1.
- A new control house, new bus work, and new line relaying will be installed.
- T-Line work needed to reconnect the lines into the new Station.

Alternatives:
Rehab the Station equipment in place. This options was not feasible due to the extended outages required.

Total Estimated Transmission Cost: $13.32M
Projected IS Date: 12/15/2019
Project Status: Engineering



AEP Transmission Zone: Supplemental
Fieldale, VA

Need Number: AEP-2018-AP007
Process Stage: Solution Meeting 02/20/2019
Process Chronology: Needs Meeting 10/26/2018
Supplemental Project Driver: Equipment Condition/Performance/Risk
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

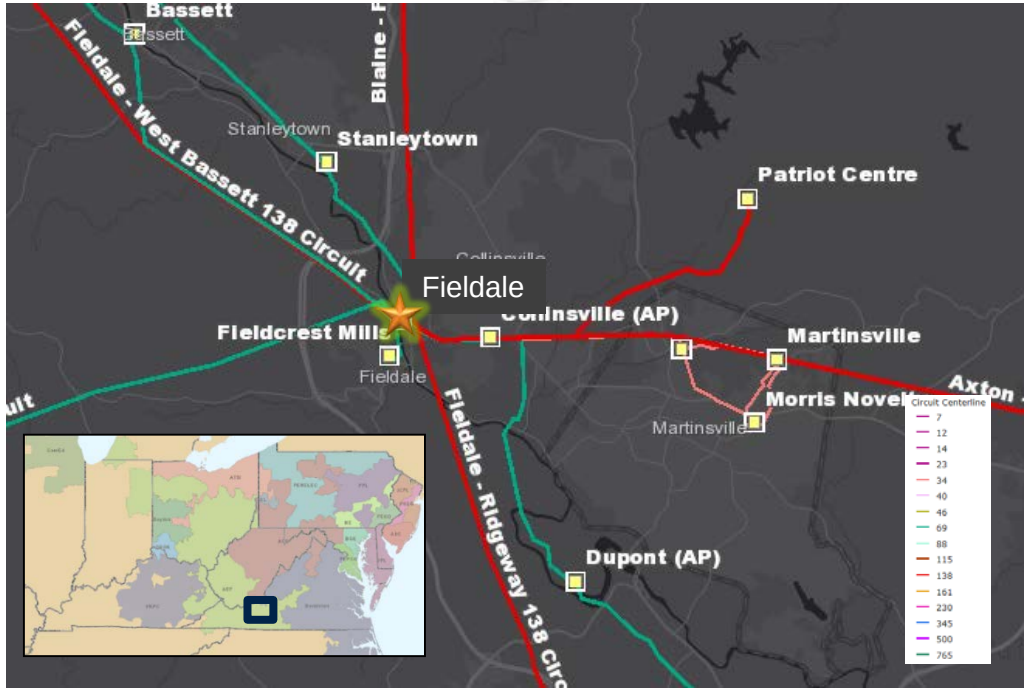
Fieldale Station: Circuit breakers "J" (recently failed), "T" (39 operations), and "F" (15 operations) are FK type oil breakers. The drivers for replacement are bushing damage, no repair part availability and potential of PCB (polychlorinated biphenyl) presence. PCB was used as coolant and lubricant in electrical equipment because of their insulation capabilities. Their manufacturing was stopped in 1977 because of evidence of environment issues and harmful health effects. However, equipment installed prior to 1977 is at risk of having PCB contents.

Breakers "BC" (30 fault operations) and "AC" (31 fault operations) are air blast breakers. AEP is replacing air blast breakers across the system because of safety concerns. These types of breakers tend to fail violently, frequently dispersing porcelain shards from their bushings during failures which is a safety issue for station personnel and public.

Breakers "G" (36 operations), "C" (47 operations), and "D" (27 operations) are also oil breakers but of the type ITE (CB G) and CF-48 (CB C & D). Oil breaker maintenance has become more difficult due to the oil handling required. CF-48 also are notorious for mechanical damage related to the breaker's open and close contacts.

Circuit switchers "DD" and "EE" are Mark V type. Mark V's are an obsolete type that do not coordinate with modern relaying packages. Other drivers for replacement are age and no repair part availability. Transformer 3 (recently failed) is showing a breakdown in winding insulation (dielectric strength). It also shows C2H2 levels above IEEE thresholds. Age and short circuit strength breakdown (due to the amount of through faults suffered) is the main driver for replacement.

Transmission lines out of Fieldale have pilot wire protection. Copper pilot wire is an obsolete technology, and since the telephone companies almost never use it anymore, it is increasingly difficult to find suitable pilot wire cable and hardware.



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Fieldale Synchronous Condenser

- The Fieldale Synchronous Condenser was originally installed in 1974 and is one of only two facilities that provide dynamic voltage regulation and power factor compensation to the AEP 138kV system in Virginia.
- The unit was initially capable of +/-250 MVAR but has since been de-rated to +158/-35 MVAR primarily due to the original Amplidyne excitation control replacement in 1997 with a Basler control. There are no replacement parts or factory support for this Basler unit. If the Basler unit was to fail, the machine would be off-line until a replacement excitation system could be procured and installed.
- The DFR is being replaced due to the maintenance and reliability issues experienced with its model. Protection systems for the condenser utilize electromechanical relaying that is obsolete with no available spares.
- There is no longer vendor support for the existing controls system as well as limited spare parts availability. APCo personnel have devised replacements and workarounds that allow operation of the synchronous condenser. Particular issues include inconsistent mechanical temperature switches, intermittent electrical relays in the control circuitry, and intermittent operation of auxiliary circuit breakers. Other problems occur at the interface between the original mechanical and analog controls and more modern digital controls that have been added to the system, making startup syncing difficult.
- The existing device has multiple problems with the cooling such as water leakages. Corrosion of the steel parts of the cooling system is becoming more of a concern from a machine reliability standpoint. There is no longer vendor support for the cooling system which has made spare parts difficult to procure.
- Environmental concerns include the use of mercury in some switches (26 units with approx. 2 ounces of mercury per unit), the use of asbestos for insulation, and the possibility of bacterial contamination in the cooling system. Due to the open loop cooling system being at a higher risk to develop bacteria, respirators are required when cleaning the cooling pit during maintenance.

Cooling tower interior pan

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DuPont Station: 69 kV circuit breakers 'A' (8 operations), 'B' (38 operations) and 'C' (14 operations) are GE 'FK' oil-filled breakers which have little to no replacement parts and were installed in 1960, 1959 and 1968 respectively. In general, oil breakers have become increasingly difficult to maintain due to the associated oil handling. Oil spills are frequent with failures and routine maintenance, which is an environmental hazard.

Blaine Station: Circuit Switcher 'AA' is a Mark V switcher, which is no longer supported by the manufacturer and parts are not available. Parts are increasingly difficult to locate during maintenance. These are older designed circuit switchers with old controls that no longer coordinate well with modern relaying.

Morris Novelty: 34 kV circuit breaker 'E' and 'F' are GE 'FK' oil-filled breakers which have little to no replacement parts. In general, oil breakers have become increasingly difficult to maintain due to the oil handling associated with them. Oil spills are frequent with failures and routine maintenance which is also an environmental hazard.

Rich Acres: Because of pilot wire retirement on this line, a new circuit switcher on transformer #1 will be needed to coordinate with new line relays on the Fieldale – Ridgeway 69 kV line.

Operational Flexibility and Efficiency:

Based on the measures that are required to be performed when the existing 250 MVAR synchronous condenser is not in service due to maintenance, Transmission Operations Engineering recommends the presence of an active reactive power device at Fieldale Station. The installation of additional static reactive power devices such as shunt capacitor banks would resolve the low voltages that could occur in the isolated scenarios of facility outages, but would likely aggravate the customer issues that exist with such discrete devices. The recommendation would be to install a similarly sized synchronous condenser that would tend to diminish the impacts of transient harmonics and assist in reducing the possible concern of dynamic instability due to the present system configuration where there is no local AEP generation.

Potential Solution:

Fieldale Station ($51.5 M)

- Replace Synchronous Condenser with two units (-50/+100 MVAr). Retire 138 kV Circuit Breakers AC and AB and install new 3000A, 40kA CBs.
- Replace 138 kV Circuit Switcher EE & DD with new 3000 A, 40 kA
- Replace 69 kV CB-F with new 72.5 kV, 3000 A, 40 kA circuit breaker
- Retire 34.5 kV equipment including CB T, 7.2 MVAr Capacitor Bank and Circuit Switcher AA
- Move 69 kV Fieldcrest Mills load to 12 kV service and retire radial 69 kV line to Fieldcrest Mills and Fieldcrest Mills Station

DuPont Station ($1.5 M)

- Retire 3 69 kV breakers (A, B and C) and replace with two line MOABs

Blaine Station ($1.7 M)

- Replace 138 kV S&C Mark V circuit switcher AA

Morris Novelty Station ($1.7 M)

- Reconfigure existing 69kV capacitor bank from a 15.6 MVAr to 10.8 MVAr
- Replace 34.5 kV FK oil CB “F” and “E”

Rich Acres ($0.6 M)

- Add high side circuit switcher to transformer #1

Associated Fiber ($3.0 M)

Total Estimated Transmission Cost: $60 M

Alternate Solution:

- Install a SVC, StatCom or another dynamic Var Compensating device. Synchronous condenser was deemed as a better option due to similar initial cost, the absence of harmonics, less physical space requirements, short term overload capability (2x’s rating for 10 seconds), twice the expected life span, and overall better system dynamic voltage recovery due to the additional system inertia.

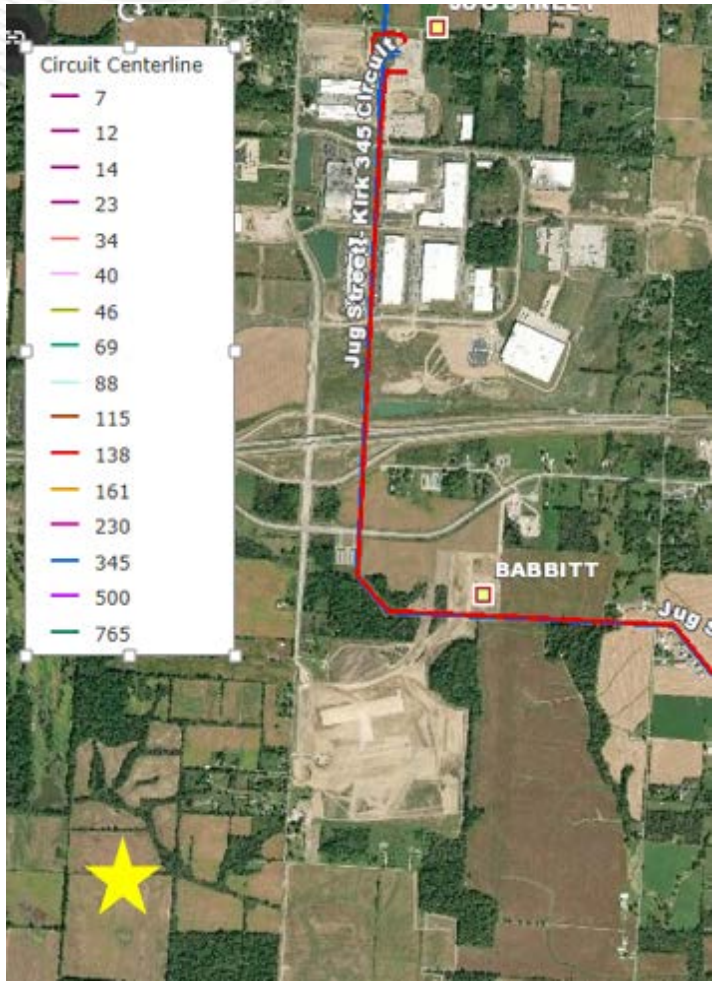
Projected In-service: 12/1/2022

Project Status: Scoping

AEP Transmission Zone: Supplemental
New Albany, Ohio

Need Number: AEP-2018-OH002
Process Stage: Solution Meeting 02/20/19
Needs Presented: 10/28/18
Supplemental Project Driver: Customer Service
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 7)
Problem Statement:
A new customer delivery point has been requested.

- Initial load of 150MW with permanent service available by Q1-2020.
- Ultimate load for this customer is projected to reach 720MW as early as Q4 2026.
- 10 MW of distribution construction power for this customer is required in May 2019. 7 MW of distribution construction power for an existing customer planning to expand is also required in 2019. The existing customer has reserved distribution capacity for up to 10 years of expansion activity. As a result, AEP-Ohio has requested a 138kV delivery Point at Babbitt station to serve a "temporary" skid station for up to 10 years.
- Additional large customers are in discussions to take service in this area.
- Facilities will be designed to accommodate anticipated future load but only facilities required to serve committed load will be constructed.



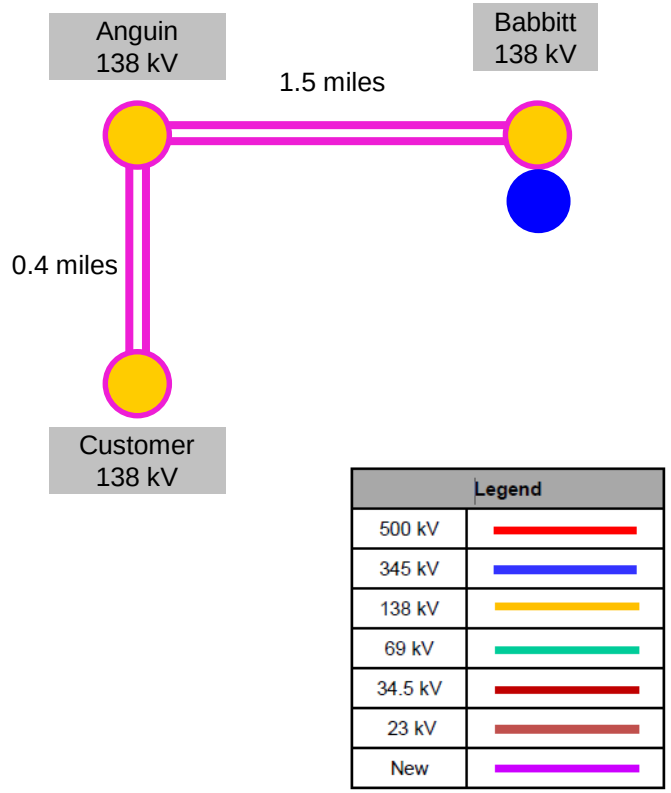
Need Number: AEP-2018-OH002
Process Stage: Solution Meeting
Solution Presented: 02/20/2019
Proposed Solution:

- Construct 2-138 kV circuits (~1.5 miles) from Babbitt Station to a new Anguin Station using 2 bundled 1033 ACSS conductor per circuit.
- Construct 2-138 kV circuits (~.4 miles) from Anguin Station to a new customer station using 795 ACSS conductor.
- Install 4-138 kV 4,000A 63kA breakers at Babbitt to accommodate the new 138 kV double circuit to Anguin Station and 2-138kV 4,000A 63kA bus tie breakers.
- At Babbitt, install a 57.6MVAr capacitor bank with protection.
- At Babbitt, install a 138kV 4,000A 63kA CB to serve AEP-Ohio's requested delivery point.
- Construct Anguin Station in a breaker and a half arrangement utilizing 8-138 kV 4,000A 63kA breakers and 2-57.6MVAr capacitor banks with protection.

Alternatives:

- Build two overhead circuits from Babbitt station, construct one UG circuit from Jug Street station and one UG circuit from Babbitt station Anguin Station to serve initial load.
- Build two overhead circuits from Babbitt station, cut into existing overhead Babbitt-Jug Street 138kV circuit to provide in/out service to Anguin Station.
- These two alternates aren't as cost effective as the chosen solution.

Total Estimated Transmission Cost: $47.59M
Projected IS Date: 2/1/2020
Project Status: Scoping



AEP Transmission Zone: Supplemental Lancaster, Ohio

Need Number: AEP-2018-OH031
Process Stage: Solutions Meeting 02/20/19
Process Chronology: Needs Meeting 12/21/2018
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk
Specific Assumption References:
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:

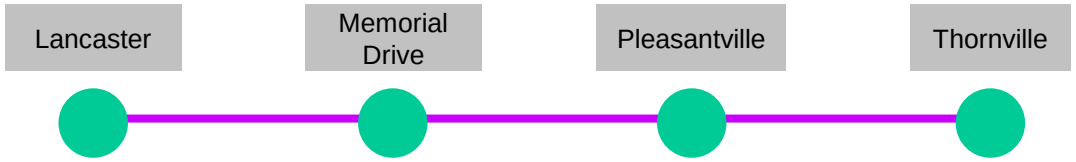
- The existing 18.4 mile 69 kV section between Thornville –Lancaster 69 kV line was constructed in 1915 using wood pole structures with several copper conductors (mostly 1/0 Cu).
- There are currently 228 open A conditions on this line. The Baltimore-East Lancaster 69 kV circuit has experienced over 350,000 customer minutes of interruption over the past three years. The majority of outages were due to conductor failures, shielding failures, structure washouts, and insulators failures.

AEP Transmission Zone: Supplemental
Lancaster, Ohio

Need Number: AEP-2018-OH031
Meeting Date: 02/20/2019
Proposed Solution:
Rebuild 18.4 miles of the Thornville - Lancaster 69kV line. This line will be rebuilt utilizing 795 ACSR (26/7) at 69 kV standards.

Alternatives:
No cost-effective transmission solution was found.

Total Estimated Transmission Cost: $23.66M
Projected IS Date: 11/27/2019
Project Status: In Construction



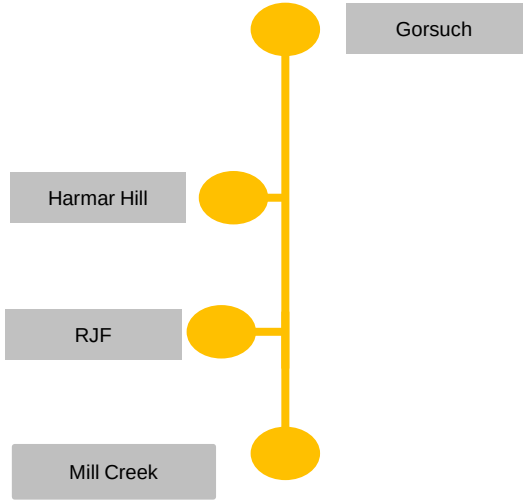
Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

AEP Transmission Zone: Supplemental West-Marietta, Ohio

Need Number: AEP-2018-OH009
Process Stage: Solution Meeting 2/20/2019
Process Chronology: Needs Meeting 10/28/2018
Supplemental Project Driver: Operational Flexibility and Efficiency, Customer Service.
Specific Assumption References:
Equipment Condition, Operational Flexibility
Problem Statement:

RJF is a customer owned substation that is served off a 138kV hard tap. Harmar Hill is served from a tap with a one way switch. Any line work along between Mill Creek and Gorsuch causes considerable outages to both customer loads. There is limited transfer capability at Harmar Hill and no transfer capability for RJF. AEP's internal guidelines justify sectionalizing on this line (FOI: 10.17).

Mill Creek will be replaced by a new substation Devola as part of an unrelated project (S1125).



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

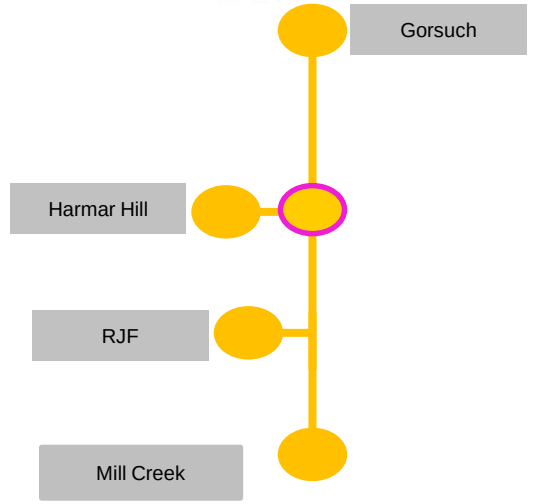
AEP Transmission Zone: Supplemental West-Marietta, Ohio

Need Number: AEP-2018-009
Meeting Date: 02/20/2019
Process Chronology: Needs Meeting 10/26/2018
Supplemental Project Driver: Operational Flexibility and Efficiency, Customer Service.
Specific Assumption References: Equipment Condition, Operational Flexibility

Proposed Solution:
Install a 3-way, SCADA-controlled phase-over-phase switch at Harmar Hill to replace the one-way line switch on the Gorsuch – Mill Creek 138 kV circuit.

Alternatives:
Alternative Description: Expand Harmar Hill Station to an in and out arrangement with circuit breakers.

Total Estimated Transmission Cost: $1.35M
Projected IS Date: 06/01/2020
Project Status: Scoping



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

2/8/2019 – V1 – Original version posted to pjm.com

2/19/2019 – V2 – Remove Slide #21- #24

3/19/2019 – V3 – Slide #18, Change AEP-2019-OH0002 to AEP-2019-OH002

– Slide #25, 26, Change AEP-2018-OH0022 to AEP-2018-OH022

– Slide #29, 30, Change AEP-2018-OH0023 to AEP-2018-OH023

– Slide #35, 36, Change AEP-2018-OH0002 to AEP-2018-OH002

– Slide #37, 38, Change AEP-2018-OH0031 to AEP-2018-OH031

5/16/2019 – V4 – Slide #8, #15, and #16 Changes are as marked

– Slide #19, Remove “PJM Need” from the slide

– Slide #20 - 24, New slides

10/10/2019 – V5 – Slide #14, Changes are as marked

– Slide #25, New slide (AEP-2019-IM037 split from AEP-2019-IM007)