

Western Sub Regional RTEP: AEP Supplemental Projects

April 21, 2023

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 M-3 Process Huntington, WV

Need Number: AEP-2023-AP009

Process Stage: Need Meeting 4/21/23

Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumption Slide 13)

Problem Statement:

Circuits: Darrah – East Huntington 34.5 kV

Original Install Date (Age): 1939

Length of Line: 3.2 miles

Total Structure Count: 82, 87% is 1939 vintage

Original Line Construction Type: Wood, Lattice Steel

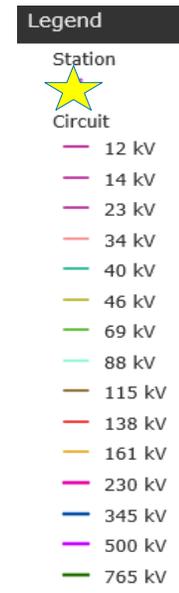
Conductor Type: 636,000 CM ACSR 26/7 (Grosbeak), 1,033,500 CM ACSR 54/7 (Curlew), 4/0 ACSR 6/1 (Penguin)

Line Conditions:

- Currently there are 18 structures with at least one open structural condition, which relates to 22% of the structures on the line. There are currently 26 structure related open conditions affecting crossarms, poles, and a knee/vee brace including split, rot top, rot heart, leaning transverse, burnt, and broken. There are 6 hardware related open conditions affecting insulators including electrical interference, burnt, and broken. There are currently 2 open shielding conditions for missing ground lead wires.

Momentary/Permanent Outages: 0 Momentary, 3 Permanent

- Since 2017, there have been 3 permanent outages on the Darrah – East Huntington 34.5kV Circuit. The permanent outages were due to pole fire, line equipment crossarm failure, and station relays/MOAB control box fire causes. The permanent outages caused 7.6 hours of total circuit outage time.



AEP Transmission Zone M-3 Process Buchanan County, Virginia

Need Number: AEP-2023-AP010

Process Stage: Need Meeting 4/21/2023

Supplemental Project Driver: Equipment Condition/Performance/Risk

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

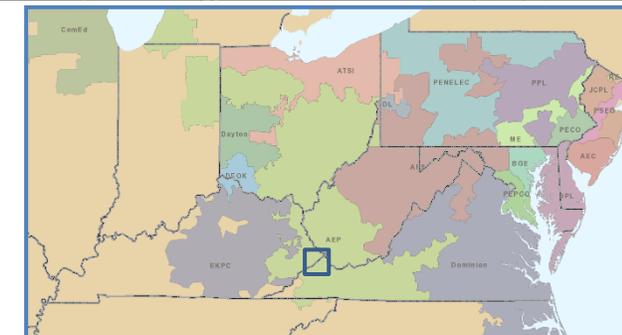
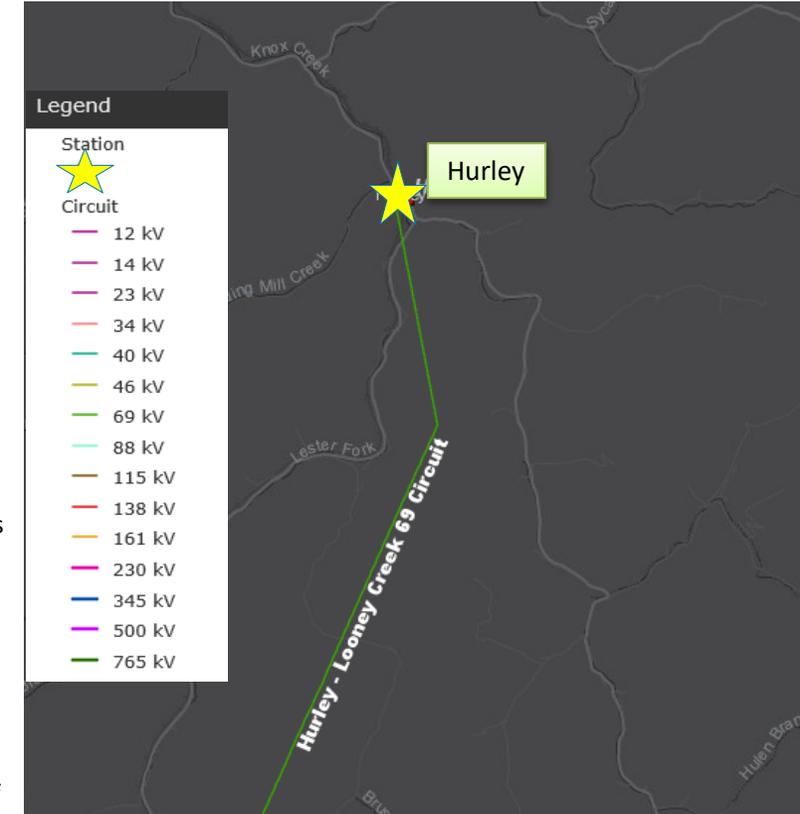
Problem Statement Hurley Station:

69/12kV TR-1

- 1977 Vintage Transformer
- The elevated and rising levels of acetylene indicate high decomposition of the paper insulating materials.
- The transformer has elevated moisture level which can be the result of gasket leaks or breakdown in the oil or paper/pressboard insulation. The decreasing and low level of dielectric strength, indicates an increase in particles within the oil, which in turn decreases the dielectric strength of the oil to withstand fault events. This can ultimately damage the paper insulation. The values of moisture and oil dielectric strength indicate the dielectric strength of the insulation system (oil and paper) is in poor condition.
- The condition of the transformer's wood tie foundation is unknown because it lies under the legacy asphalt oil containment.

Relay

- There are currently 7 electromechanical type relays which have significant limitations with regard to spare part availability and fault data collection and retention. In addition, these relays lack vendor support. 9 of the 11 relays (82% of all station relays) are in need of replacement.
 - Station exists within the 100-year floodplain. This site has flooded multiple times, most recently in 2021.
 - Low side expansion is not feasible due to proximity of the station to the road and high side expansion would be difficult without major earthwork due to the station being against a hillside.
 - One 69kV line outage on the Hurley – Looney Creek 69kV circuit from 2017 to 2022 caused 863,000 CMI for distribution customers at Hurley due to being on a radial 69kV service and Distribution not having any transferable capability. The radial 69kV line is 10.1 miles long and the Distribution load is 12.5 MVA.
 - Limited access off the road for station ingress/egress.
- SRRTEP-Western – AEP Supplemental 4/21/2023



AEP Transmission Zone M-3 Process Pulaski County, Virginia

Need Number: AEP-2023-AP011

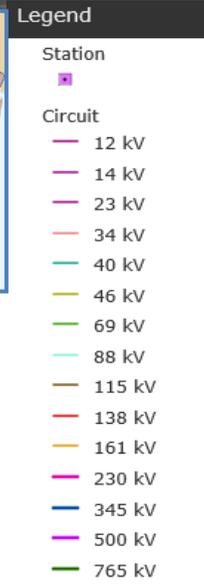
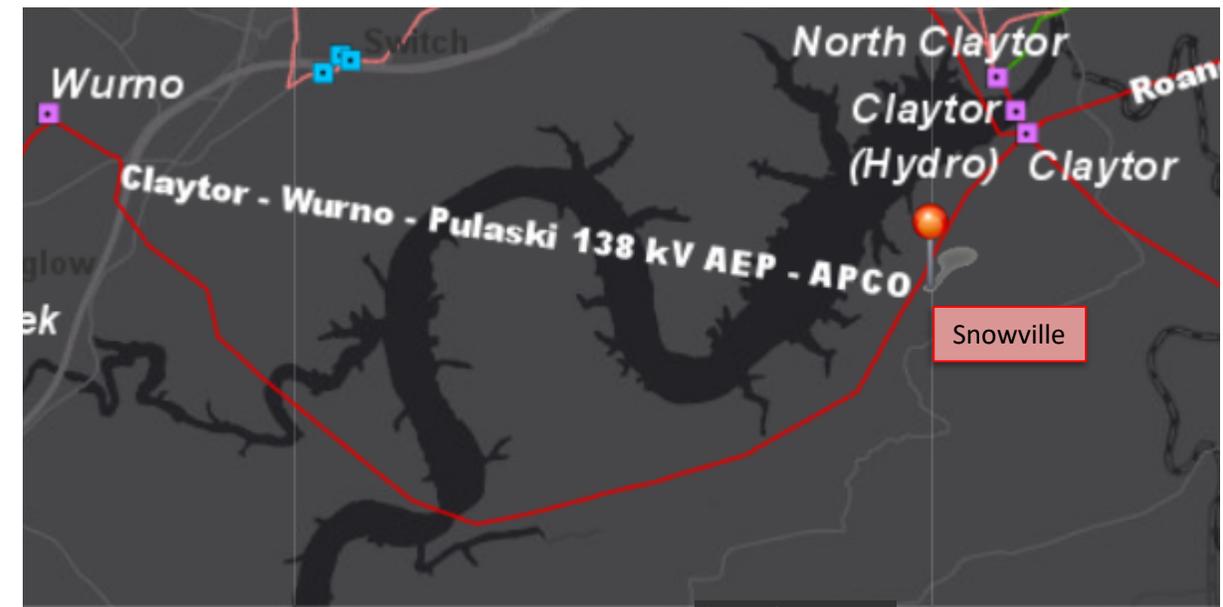
Process Stage: Need Meeting 4/21/2023

Supplemental Project Driver: Customer Service

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 12)

Problem Statement:

- AEP Distribution has requested a new delivery point (Snowville).
- The Distribution customers south of Claytor Lake are fed by one 34.5kV distribution circuit out of Wurno station and the circuit has one lake crossing. This circuit is currently 187-line miles long and has no other 34.5kV distribution circuit ties. Over the past five years, there were 223 distribution outages resulting in 5.9 million CMI.
- The greenfield Snowville station will pick up 6.5 MVA from Wurno station.



Need Number: AEP-2023-AP012

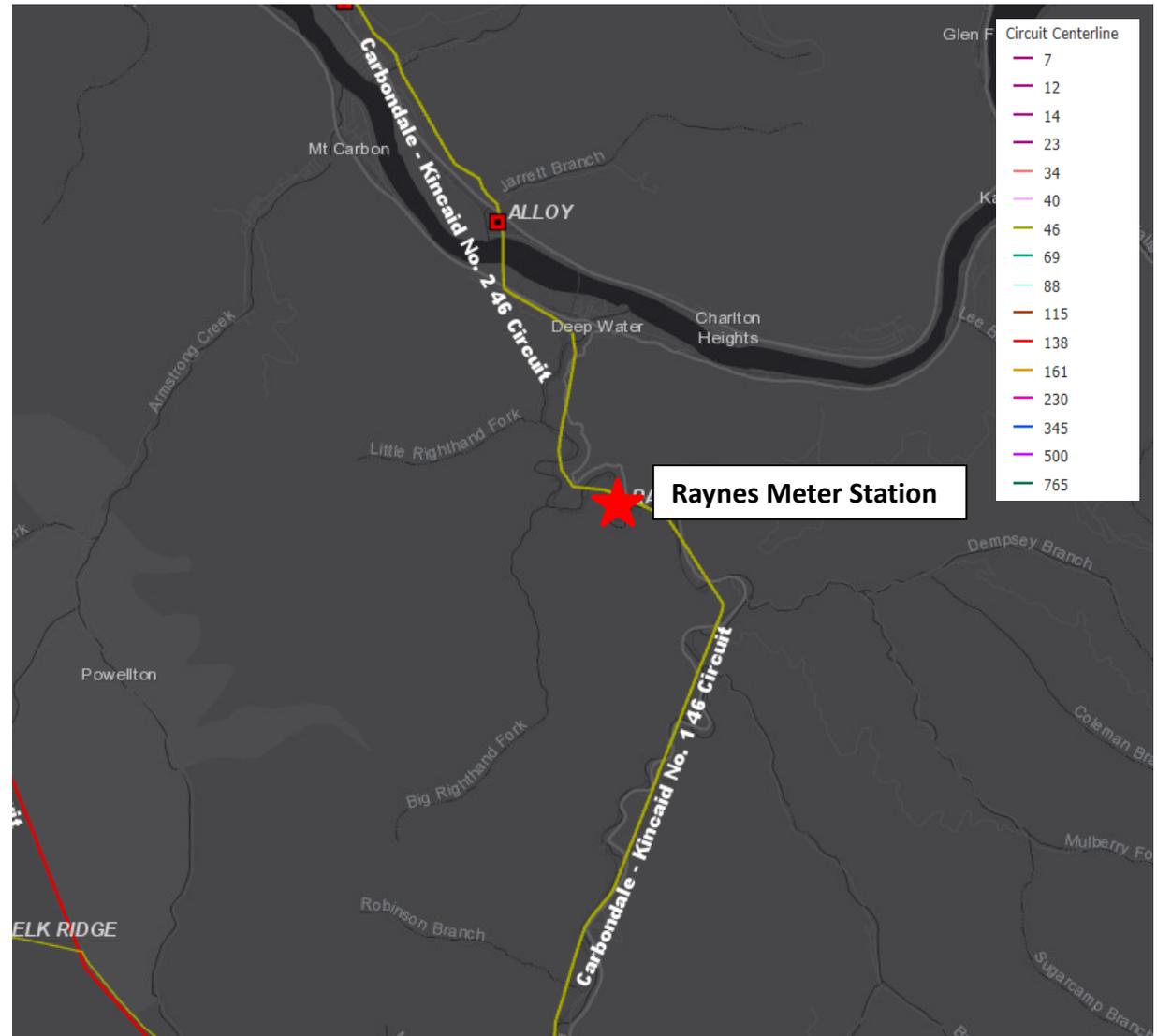
Process Stage: Needs Meeting 4/21/2023

Supplemental Project Driver: Customer Service and Operational Flexibility

Specific Assumption References: AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 14)

Problem Statement:

Resilient Mining has requested service at the existing Raynes Meter Station to serve a new delivery point, approximately 1.5 MW of load. The requested in service date is 10/2023.



Need Number: AEP-2023-AP013

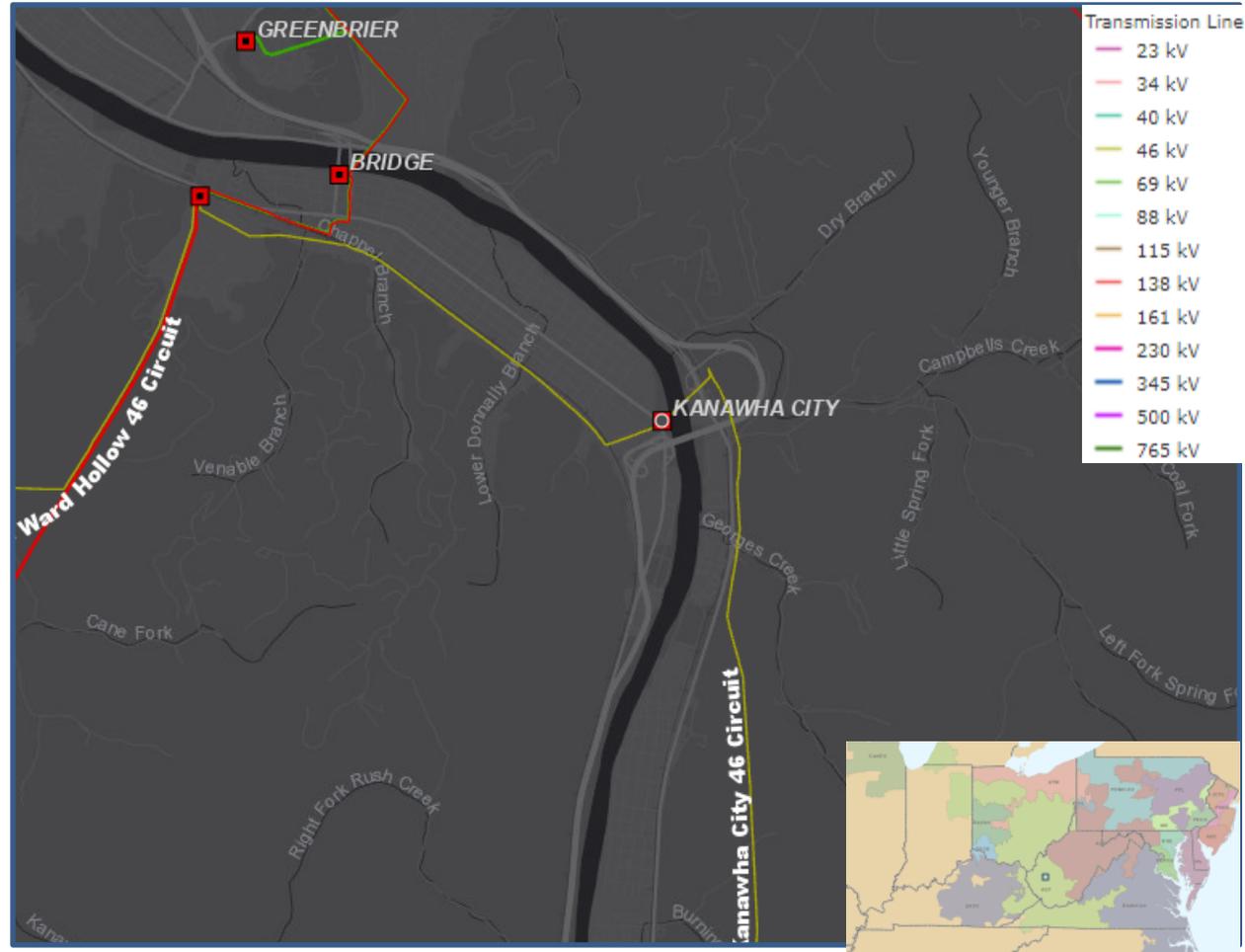
Process Stage: Need Meeting 4/21/2023

Project Driver:
Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:
Kanawha City Station

- 46kV circuit breaker A is 72PM31-20 type, SF6 filled breaker.
 - 1994 vintage
 - Circuit breakers of this type across the AEP system have had reports of moisture ingress into the breaker tank. This moisture ingress leads to increased maintenance and a higher risk of failure. These breakers have documented issues with failures to close due to burned up coils. There have been five catastrophic failures involving this specific model type on the AEP system.
- 46 kV circuit switcher AA is a VBM-69 type, vacuum filled switcher
 - 1997 Vintage
 - This model family has experienced malfunctions including failing to trip due to pole malfunction, worn out stops on the control yoke or solenoid nylon pin binding not allowing it to trip due to corrosion, loose bolts, or broken poles. In addition, these switchers perform poorly in cold weather, leading to more malfunctions.
 - This unit has experienced two malfunctions related to a failure to close.
- 32 of the 38 relays at the station are in need of replacement/upgrades
 - 30 relays are electromechanical type which have significant limitations with regards to fault data collection and retention.
 - 2 MP relays have firmware that is unsupported
- 46 kV capacitor bank AA has failed



Need Number: AEP-2023-AP014

Process Stage: Need Meeting 4/21/2023

Project Driver:

Equipment Material/Condition/Performance/Risk

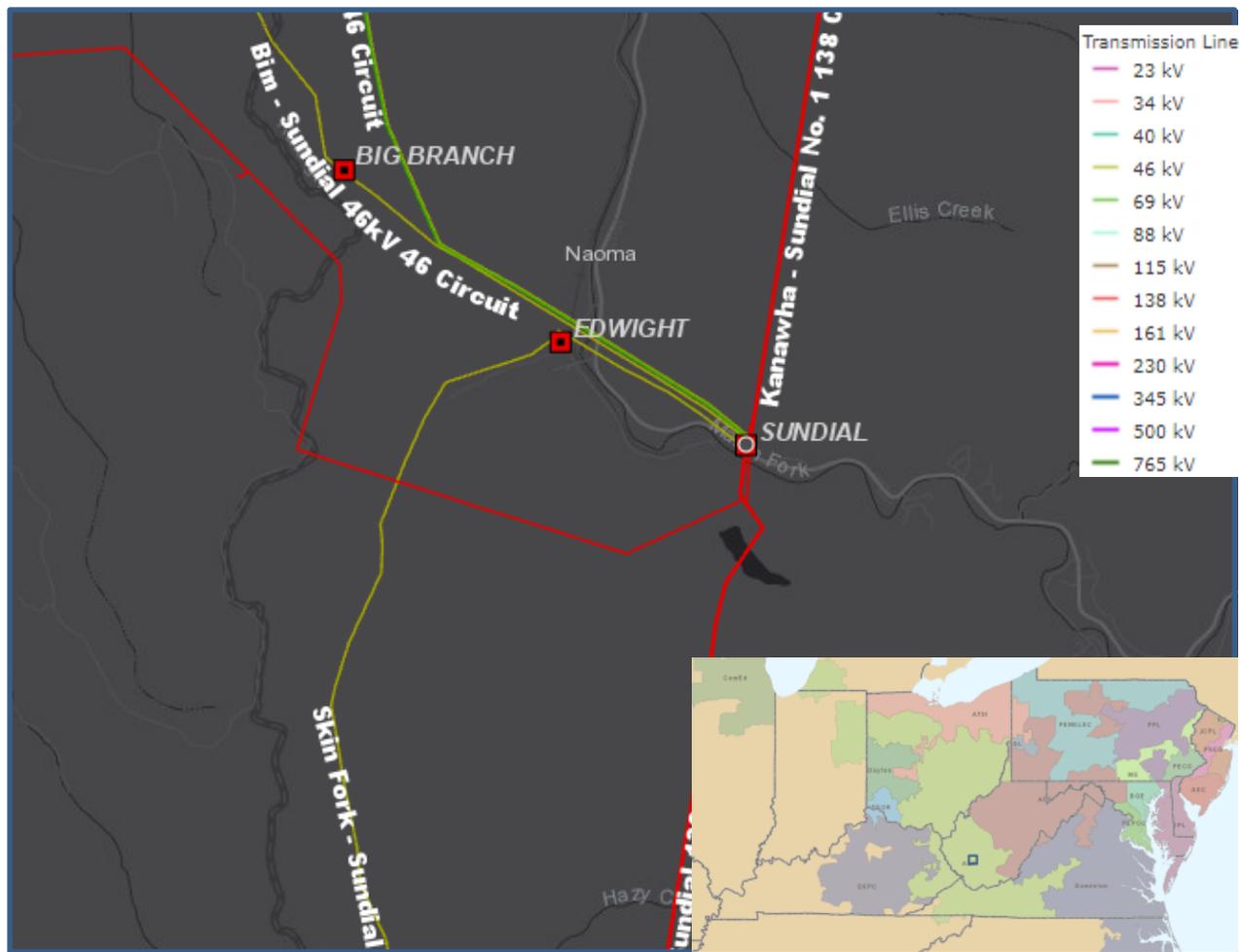
Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

Sundial Station

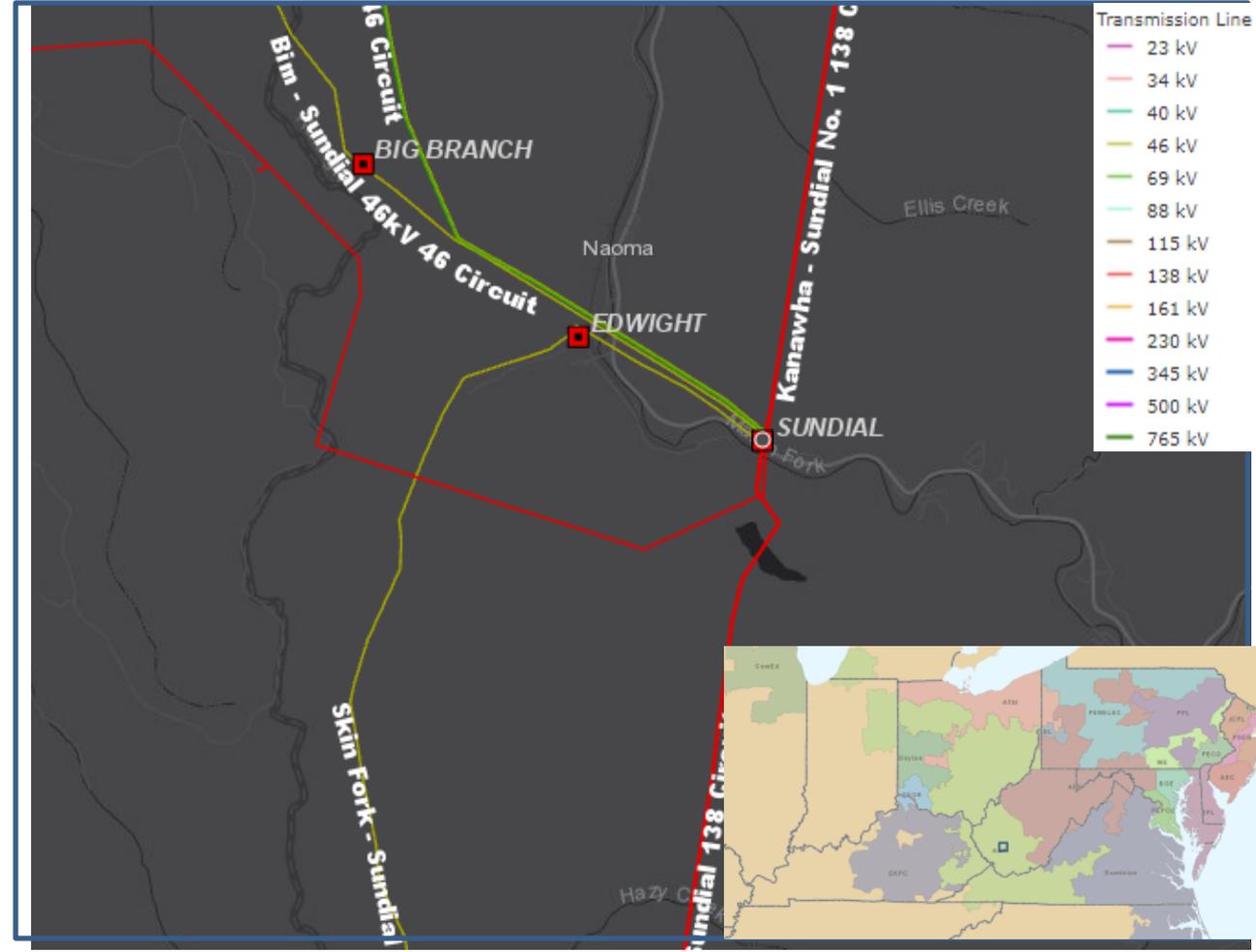
- 46kV circuit breaker A is 72PM31-20 type, SF6 filled breaker.
 - 1996 vintage
 - Circuit breakers of this type across the AEP system have had reports of moisture ingress into the breaker tank. This moisture ingress leads to increased maintenance and a higher risk of failure. These breakers have documented issues with failures to close due to burned up coils. There have been five catastrophic failures involving this specific model type on the AEP system.
- 46 kV circuit breakers B, C, and D are FK-72.5-27000-1 type, oil filled breakers
 - 1972 vintage
 - These breakers are oil filled without oil containment; oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require.
 - Each of these circuit breakers has each exceeded the manufacturer's designed number of full fault operations.
- 46 kV circuit switcher AA is a VBM-69 type, vacuum filled switcher
 - 1978 Vintage
 - This model family has experienced malfunctions including failing to trip due to pole malfunction, worn out stops on the control yoke or solenoid nylon pin binding not allowing it to trip due to corrosion, loose bolts, or broken poles. In addition, these switchers perform poorly in cold weather, leading to more malfunctions.
 - Older VBM types have been very problematic over the years especially on higher voltages where there are two vacuum interrupters in series per phase
- 60 of the 75 relays at the station are in need of replacement/upgrades
 - 51 relays are electromechanical type which have significant limitations with regards to fault data collection and retention.
 - 3 static relays which have significant limitations with regards to spare part availability and fault data collection and retention.
 - 6 MP relays have firmware that utilize obsolete firmware



Problem Statement (continued):

Sundial Station

- Ground Bank #2 has experienced elevated levels of Ethane and Carbon Dioxide. The presence of Ethane and Carbon Dioxide, along with the indication of overheating faults, indicated decomposition of the non-thermally upgraded and increasingly brittle paper insulation that impairs the unit’s ability to withstand future short circuit or through fault events.
- Sundial 138/69/46 kV Transformer #1 lacks high side sectionalizing.
- Currently Sundial Station has two 138 kV buses that are electrically separated. Both of these buses are part of a significant 138 kV path between Kanawha River Station and Baileysville Station. Due to the buses being electrically separate, it limits operational flexibility on the system to utilize both paths to better serve load in the area when necessary during outages.



Need Number: AEP-2023-AP015

Process Stage: Needs Meeting 04/21/2023

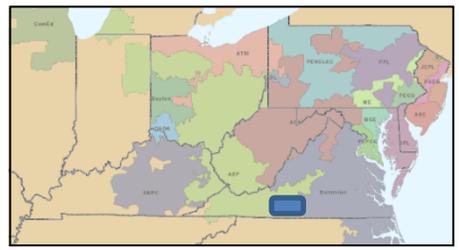
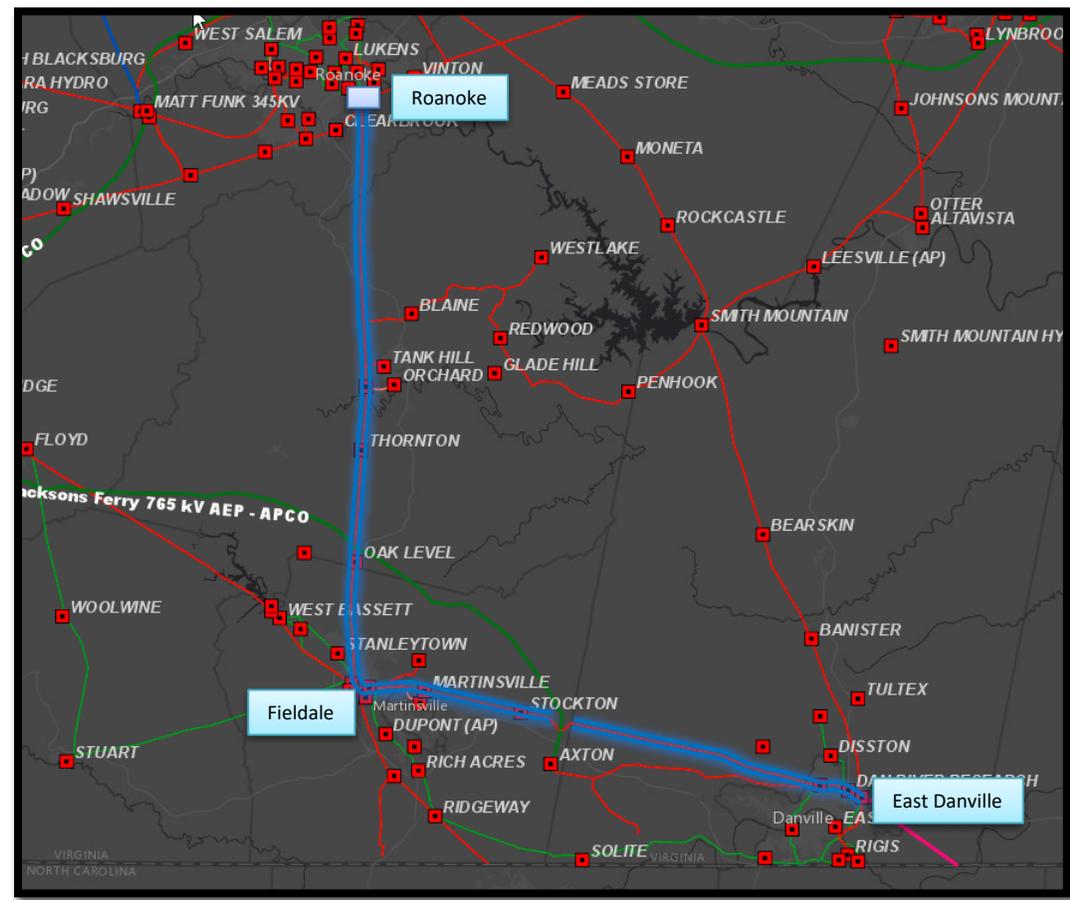
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8); AEP Eastern System Pre-1930s Era Lattice Tower and Transmission Line System

Problem Statement:

- **Roanoke-Carolina 138 kV Double Circuit Line Asset (69.8 mi.)**
 - Installed in 1927, the majority of the 316 total structures are original vintage double circuit steel lattice towers with approximately 80% utilizing original vintage 8-bell porcelain insulators.
 - The conductor is also primarily of original vintage consisting of various sizes, including 795,000 CM ACSR 45/7 (Tern), 336,400 CM ACSR 30/7 (Oriole), 636,000 CM ACSR 26/7 (Grosbeak), 966,200 CM ACSR/TW, and 795,000 CM ACSS 26/7 (Drake/ACSS).
 - About 3%, or about 2 miles, of this line is not shielded.
 - This line is associated with the Fieldale – Roanoke 138 kV, Blaine – Fieldale 138 kV, Axton - Danville No. 1 138 kV, Blaine – Roanoke 138 kV, Axton – Fieldale 138 kV, Axton – Martinsville 138 kV, Danville - East Danville 138 kV , and Fieldale – Martinsville 138 kV Circuits.
 - The representative structure on the Roanoke – Carolina 138 kV Line fails to meet 2017 NESC Grade B loading criteria, fails to meet current AEP structural strength requirements, and fails to meet the current ASCE structural strength requirements.
 - The porcelain insulators on the line do not meet current AEP standards for CIFO and minimum leakage distance requirements.
 - The shield angle on a typical tangent structure is measured at 50° and is inadequate for current AEP shield angle requirements. This could be contributing to the poor lightning performance of some of the associated circuits.

AEP Transmission Zone: Supplemental Roanoke, Fieldale & Danville, VA Area



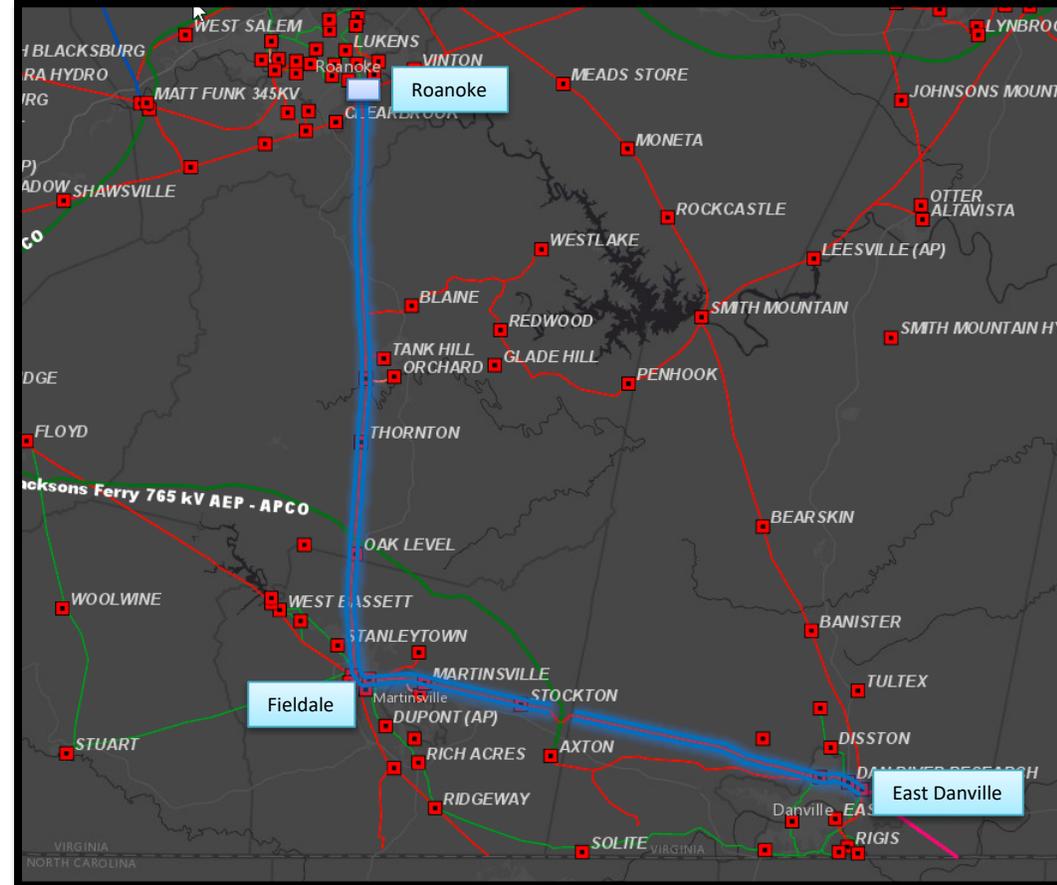
AEP Transmission Zone: Supplemental Roanoke, Fieldale & Danville, VA Area

Problem Statement (continued):

- 11 structures were assessed by a ground crew and 161 structures were assessed by an unmanned aerial vehicle (UAV). About 30% of those structures had reported conditions; however, this statistic doesn't properly capture the prevalence of rust and hardware attachment point ovalization in structures along the line. Of the 11 structures assessed by ground crews, all of them showed signs of moderate to severe rust across the structure and hardware.
- The other most common conditions found are as follows:
 - 39 structures displayed flashing damage on insulator porcelain and glass.
 - 9 of the structures assessed by ground crews had rusty hardware including bolts, connections, and insulator hardware.
 - 9 of the structures suffered from moderate ground line corrosion.
 - At least 5 structures exhibited ovalization of bolt holes at attachment points.
 - 5 structures had arresters that were disconnected.
 - 3 structures showed severe rust on their conductor dampeners.
 - 2 structures showed severe rust on the insulator end fittings and hardware.
 - 2 structures displayed bowing on their cross braces.

Open Conditions

- There are currently 2 open structural conditions for bent lacing. There are currently 109 open hardware conditions related to broken arresters (105), disconnected arresters (2), a burnt arrester (1), and an insulator with electrical interference (1). This significant amount of arrester damage could be contributing to the poor lightning performance of some of the associated circuits.
- There are currently 6 open conductor conditions, related to broken strands.
- There are currently 2 open shielding conditions related to broken shield wire strands. This could be contributing to the poor lightning performance of some of the associated circuits.



AEP Transmission Zone: Supplemental Roanoke, Fieldale & Danville, VA Area

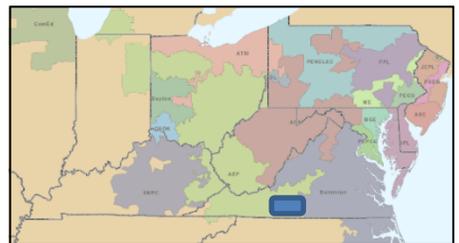
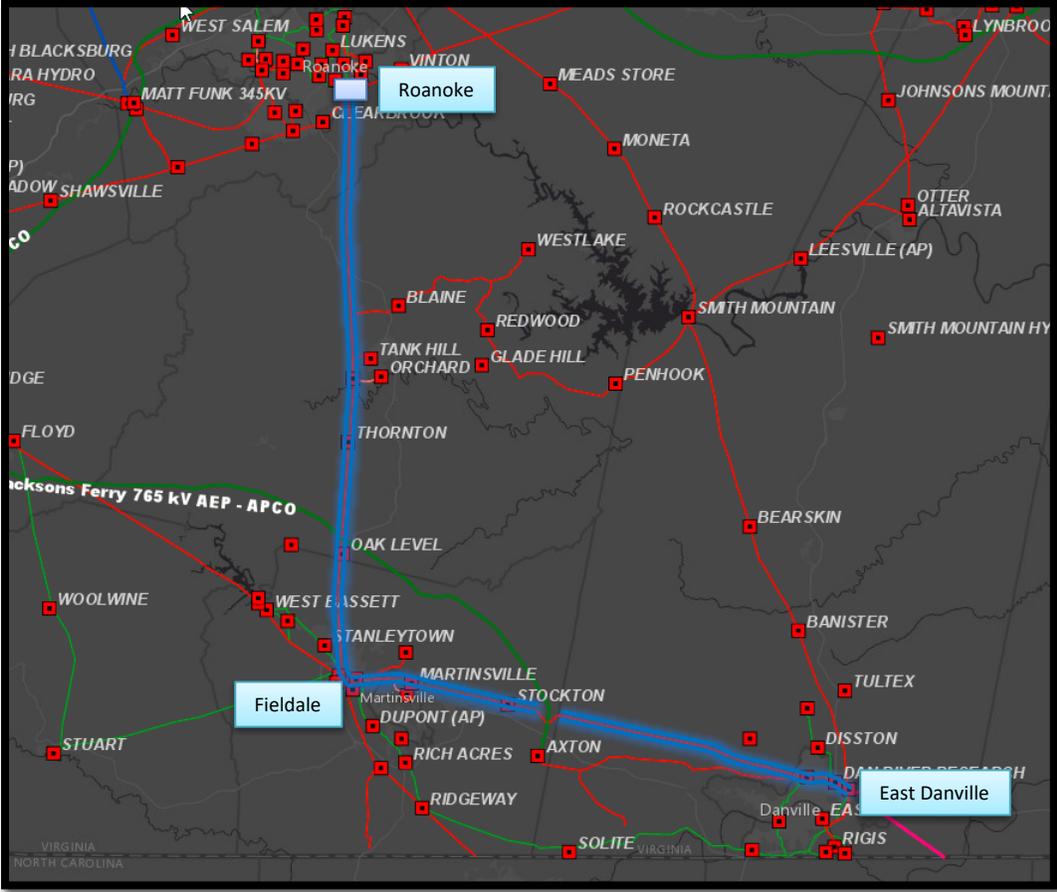
Problem Statement (continued):

- **Axton-Danville No. 1 138 kV Circuit**
 - Since 2018, there have been 9 momentary and 4 permanent outages on the Axton – Danville No. 1 138kV Circuit. The 9 momentary outages were due to lightning (7) and unknown (2) causes. The 4 permanent outages and 1 of the lightning caused momentary outages caused about 148 hours of transmission circuit interruption. The permanent outages were due to vegetation fall-ins from outside the AEP ROW (2), ice/snow (1), and station insulator (1) causes.

- **Blaine-Roanoke 138 kV Circuit**
 - Since 2018, there have been 2 momentary and 2 permanent outages on the Blaine – Roanoke 138kV Circuit. The 2 momentary outages were due to vegetation fall-in from outside the AEP ROW (1) and unknown (1) causes. The 2 permanent outages caused just over 63 hours of transmission circuit interruption. The permanent outages were due to wind (1) and vegetation fall-in from outside the AEP ROW (1) causes.

- **Axton-Fieldale 138 kV Circuit**
 - Since 2018, there have been 2 momentary and 2 permanent outages on the Axton – Fieldale 138kV Circuit. The 2 momentary outages were due to lightning (1) and field error (1) causes. The 2 permanent outages caused just over 12 hours of transmission circuit interruption. The permanent outages were due to other (1) and field error (1) causes. The outage coded as other was the result of several factors occurring at the same time. The Axton – Danville No. 1 138kV Circuit locked out as a result of a failed station insulator during a scheduled outage of the new Axton – Berry Hill 138kV Circuit, ultimately causing an outage on the Axton – Fieldale 138kV Circuit.

- **Axton-Martinsville 138 kV Circuit**
 - Since 2018, there have been 5 momentary outages on the Axton – Martinsville 138kV Circuit. These 5 momentary outages were due to distribution (2), wind (1), field error (1), and unknown (1) causes. The outage coded as unknown was most likely related to a relay mis-operation associated with the circuit latching of the 138kV CB C at Martinsville Substation. The outage notes indicated this has been a recurring issue.



AEP Transmission Zone: Supplemental Roanoke, Fieldale & Danville, VA Area

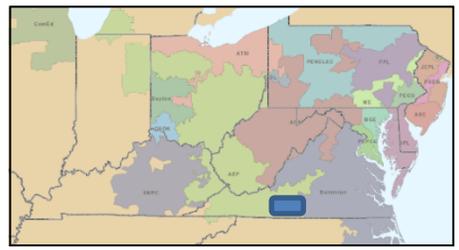
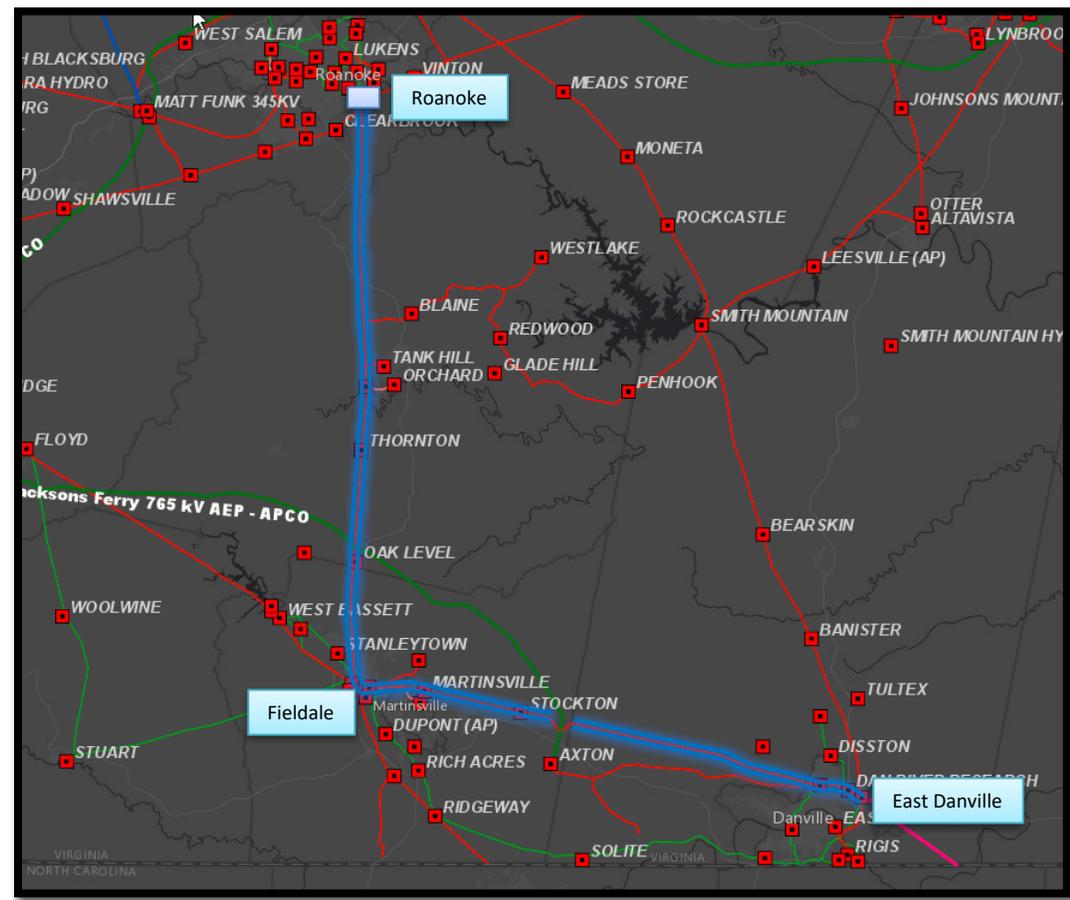
Problem Statement (continued):

- **Danville-East Danville 138 kV Circuit**
 - Since 2018, there have been 3 momentary and 1 permanent outages on the Danville – East Danville 138kV Circuit. The 3 momentary outages were due to line static wire (1), animal contact (1), and field error (1) causes. The 1 permanent outage in addition to the line static wire caused momentary outage resulted in 14 hours of transmission circuit interruption. The permanent outage was due to a failed line jumper/riser.
 - Energy Delivery Operations frequently must open the Axton 138 kV CB N at Danville to prevent overloading the Danville – East Danville 138 kV Circuit. During the summer of 2019, PJM instructed AEP to do this 3 times over a span of 30 days. This circuit is limited by six-wired 336.4/556.5 KCM ASCR and the 1.5" AL tubular bus on the line and within associated substations. Relay thermal limits at both Danville and East Danville, the 1200 A switches at Danville, and the 1590 KCM AL risers at both Danville and East Danville also limit this circuit. With this extensive list of limiting elements and the operational criticality of this corridor, this circuit has been a major concern for Operations. This circuit is protected by legacy electromechanical relays and lacks redundant protection. It is difficult to schedule an outage on this circuit, and outages must be taken in the spring or fall timeframe.

- **Fieldale-Martinsville 138 kV Circuit**
 - Since 2018, there have been 16 momentary outages on the Fieldale – Martinsville 138kV Circuit. These 16 momentary outages were due to lightning (11), unknown (3), and vegetation grow-in (2) causes. One of the outages coded as unknown was likely related to an MA alarm on the 138kV CB J at Martinsville Substation.

- **Fieldale-Roanoke 138 kV Circuit**
 - Since 2018, there have been 2 momentary and 2 permanent outages. The 2 momentary outages were due to lightning (1) and distribution (1) causes. The 2 permanent outages caused 215,000 minutes of interruption for distribution customers served from Tank Hill Substation. Both permanent outages were due to vegetation fall-ins from outside the AEP ROW.

- **Blaine-Fieldale 138 kV Circuit**
 - Since 2018, there have been 8 momentary and 2 permanent outages. The 8 momentary outages were due to lightning (3), distribution (2), wind (1), station breaker (1), and unknown (1) causes. The 2 permanent outages caused 3,300,000 minutes of interruption for distribution customers served from the Franklin and Thornton Substations. Both permanent outages were caused by wind.



AEP Transmission Zone M-3 Process Northeastern Michigan

Need Number: AEP-2023-IM011

Process Stage: Needs Meeting: 4/21/2023

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

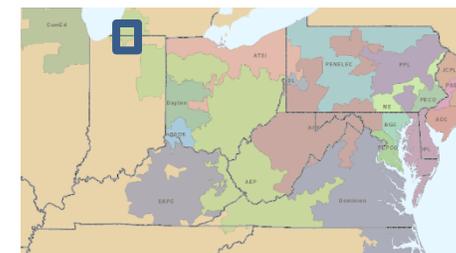
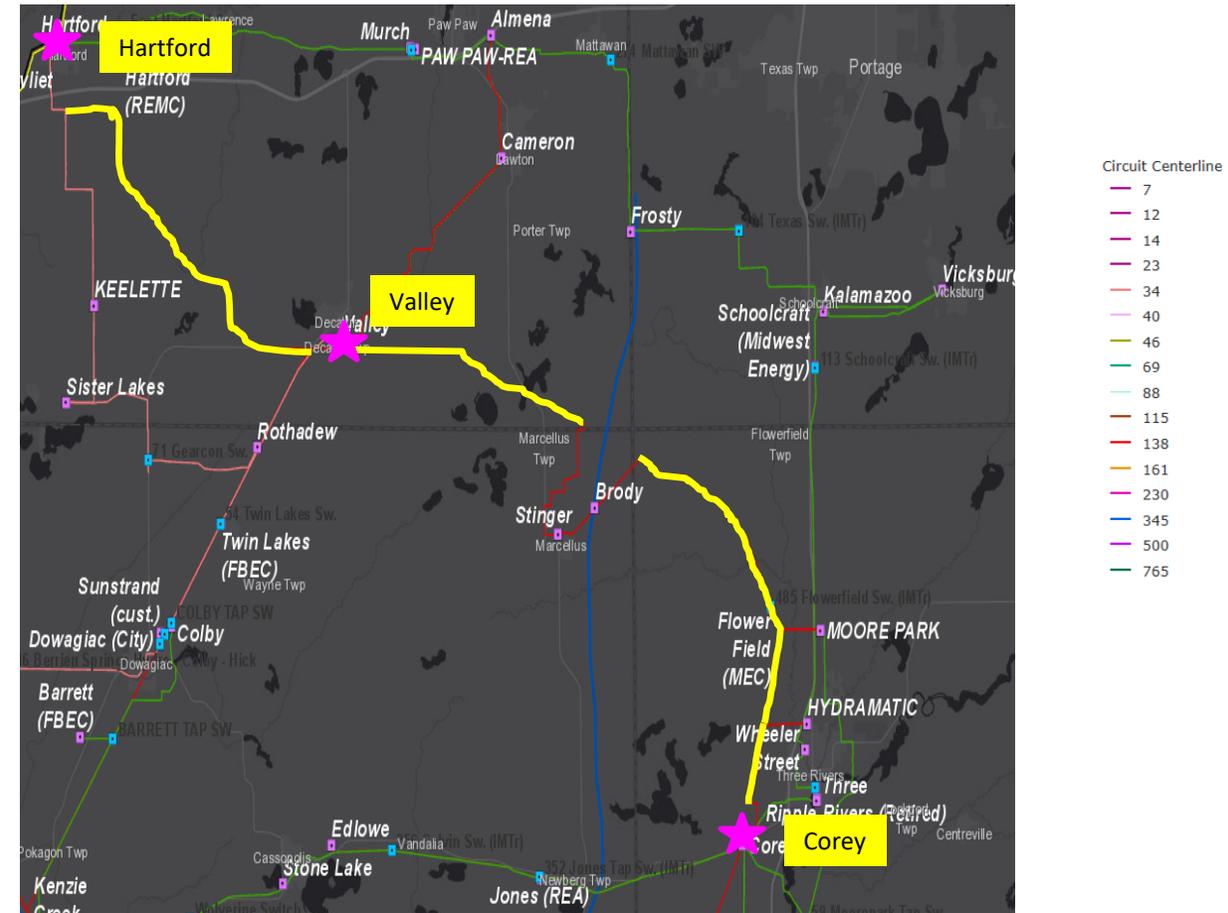
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Model: N/A

Problem Statement:

Hartford – Valley – Corey 138kV Line:

- Hartford – Valley – Corey 138kV line is 36.49 miles long that was originally installed in 1973 and mostly consists of single wood poles
- Since 2018, the Hartford – Valley 138kV circuit has experienced 2 momentary and 3 permanent outages caused by weather and vegetation. The permanent outages resulted in about 213 hours of interruption to the circuit
- Since 2018, the Brody – Moore Park 138kV circuit has experienced 1 momentary outage due to weather
- Since 2018, the Stinger – Valley 138kV circuit has experienced 1 momentary and 1 permanent outage due to weather and a trip check error. The permanent outage resulted in 49 minutes of interruption to the circuit
- Structures fail to meet 2017 NESC Grade B and AEP structural strength requirements
- The insulators on the line do not meet current AEP standards for CIFO and minimum leakage distance requirements.
- The grounding does not meet current AEP standards
- There are 210 structures with that have at least one (1) open condition (44% of line). These conditions specifically affecting the pole include woodpecker damage, rot top, insect damage, split, rot shell, general damage, rot heart, rot pocket, sitting in water, cracked, and leaning traverse conditions
- Out of 60 structures assessed (30 by aerial drone and 30 by ground crew), the following conditions were found:
 - The vast majority of wood poles assessed have some level of decay or top rot, woodpecker holes, insect damage, and/or shell rot
 - There is a significant number of structures with flashed, burnt, or broken insulators due to the application of aluminum grounding



Need Number: AEP-2023-IM012

Process Stage: Needs Meeting: 4/21/2023

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

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Model: N/A

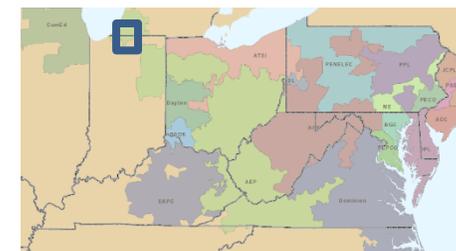
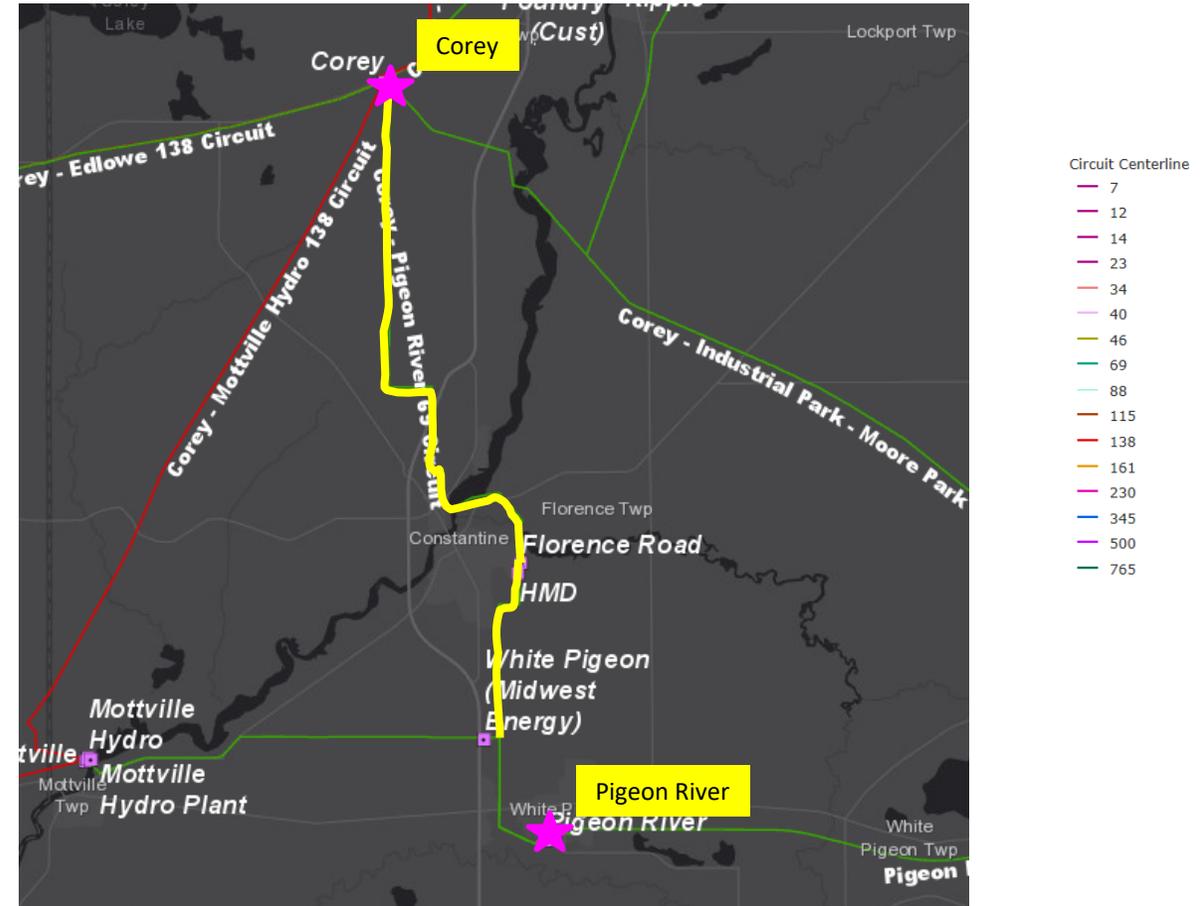
Problem Statement:

Corey – Florence Road 69kV Line:

- Corey – Florence Road 69kV line is 7.1 miles long originally installed in 1979 consisting of wood pole structures with legacy porcelain horizontal line post insulators
- Since 2018, the Corey – Florence Road 69kV line has experienced 10 momentary and 2 permanent outages due to weather, resulting in 48.8 hours of interruption to the circuit from the permanent outages
- The insulators on the line do not meet current AEP standards for CIFO and minimum leakage distance requirements.
- The grounding does not meet current AEP standards
- There are 51 structures that have at least one (1) open condition (32.3% of line). These conditions specifically affecting the pole include woodpecker damage, rot top, rot heart, rot shell, split, and rot pocket conditions
- Out of 37 structures assessed, approximately 35% of the wood poles have some level of decay or top rot, woodpecker holes, and/or shell rot. Roughly 24% of assessed structures had flashed, burnt, or broken insulators.
- Several poles are near the Saint Joseph river in areas prone to flooding

Florence Road – Pigeon River 69kV Line:

- Florence Road – Pigeon River 69kV line is 2.27 miles long originally installed in 1971 consisting of wood pole structures with legacy porcelain horizontal post insulators from structures 1-39
- Since 2017, the Florence Road – Pigeon River 69kV line has experienced 10 momentary and 3 permanent outages due to weather, resulting in 135.45 hours of interruption to the circuit from the permanent outages
- Structures fail to meet 2017 NESC Grade B loading criteria
- The insulators on the line do not meet current AEP standards for CIFO and minimum leakage distance requirements.
- The grounding does not meet current AEP standards. The grounding method utilizes butt wraps on every other pole, which is inadequate for AEP standards
- There are 33 structures that have at least one (1) open condition (59% of line). These conditions specifically affecting the pole include woodpecker, rot top, rot heart, rot shell, burnt, and split conditions
- Out of the 39 structures assessed, approximately 23% have pole cavities or woodpecker damage



Need Number: AEP-2023-OH006

Process Stage: Need Meeting 04/21/2023

Project Driver:

Equipment Material/Condition/Performance/Risk

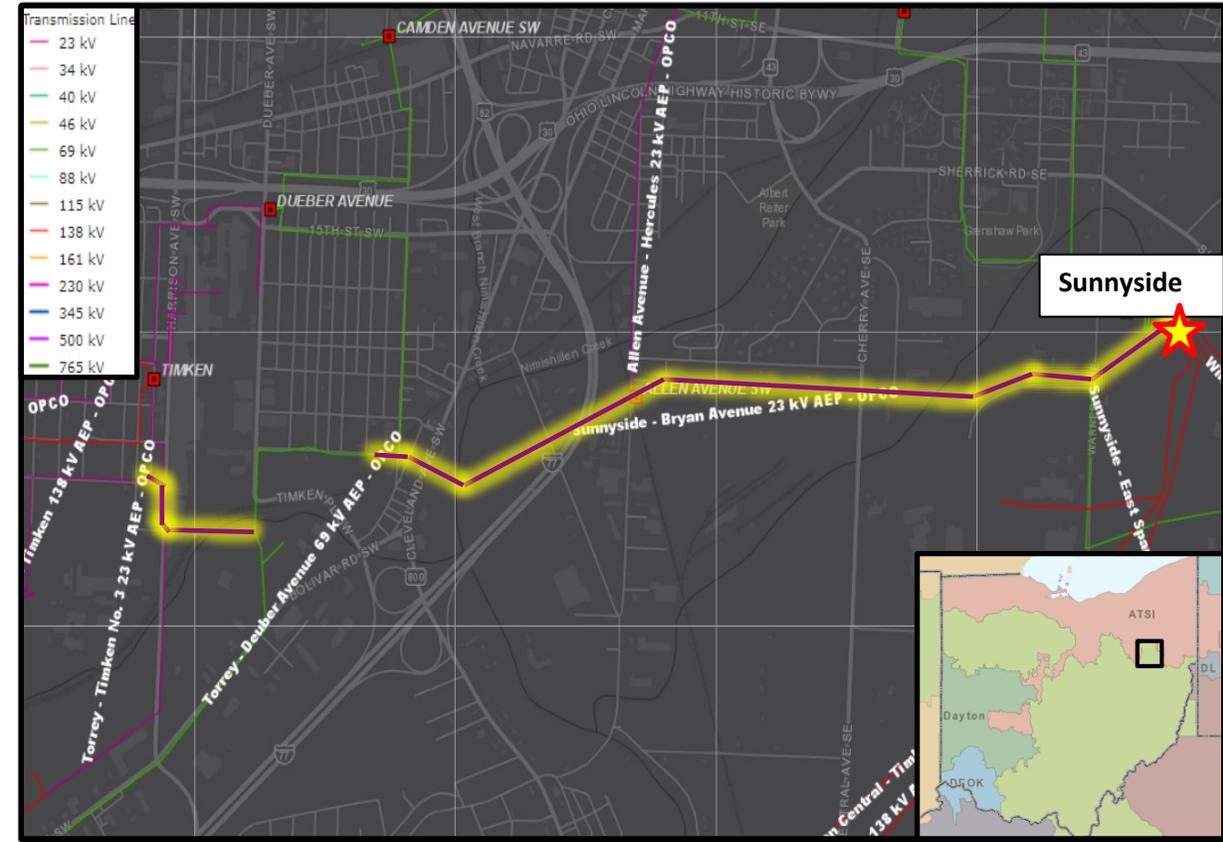
Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

Sunnyside – Bryan Avenue 23kV Transmission Line:

- Length of Line: 2.18 Miles
- Total Structure Count: 75
 - Wooden Monopole: 55
 - 9 from 1941, 2 from 1950s, 25 from 1960s, 7 from 1970s, 5 from 1980's, 6 from 2010's, 5 additional structures are assumed to be from the 1960-80s with limited data
 - Steel Lattice Towers: 10 from 1919
 - Steel Monopole: 8 from 2010
 - Wooden H Frame: 2 from 2006
- Conductor Types:
 - 2.05 Miles of 4/0 Copper
 - 0.27 miles from 1929, 1.78 miles from 1962
 - 0.11 Miles of 336,400 CM ACSR 30/7 (Oriole) from 1962
 - 0.02 Miles of 556,500 CM ACSR 18/1 (Osprey) from 1972
- 5 structures were assessed by a ground crew. 80% of those structures had reported conditions, which includes the following: one structure had rot heart conditions, one structure had moderate deterioration to the distribution arm, one structure had a faded aerial number sign, two structures had moderate deterioration to arms/braces, one structure had surface rust present on the guys/anchors, one structure had rusted and corroded guys, one structure had wooden guy strain insulators that are moderately deteriorated, one structure had 3 reported shield wire splices, three structures had rusty steel clamps, one structure had a weathered pole topper, one structure had a weathered bayonet and two structures had porcelain insulators that are deteriorated.
- The representative structure on the Sunnyside – Bryan 23kV line fails to meet 2017 NESC Grade B loading criteria and fails to meet current AEP structural strength requirements.



Need Number: AEP-2023-OH015

Process Stage: Need Meeting 04/21/2023

Project Driver:
Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

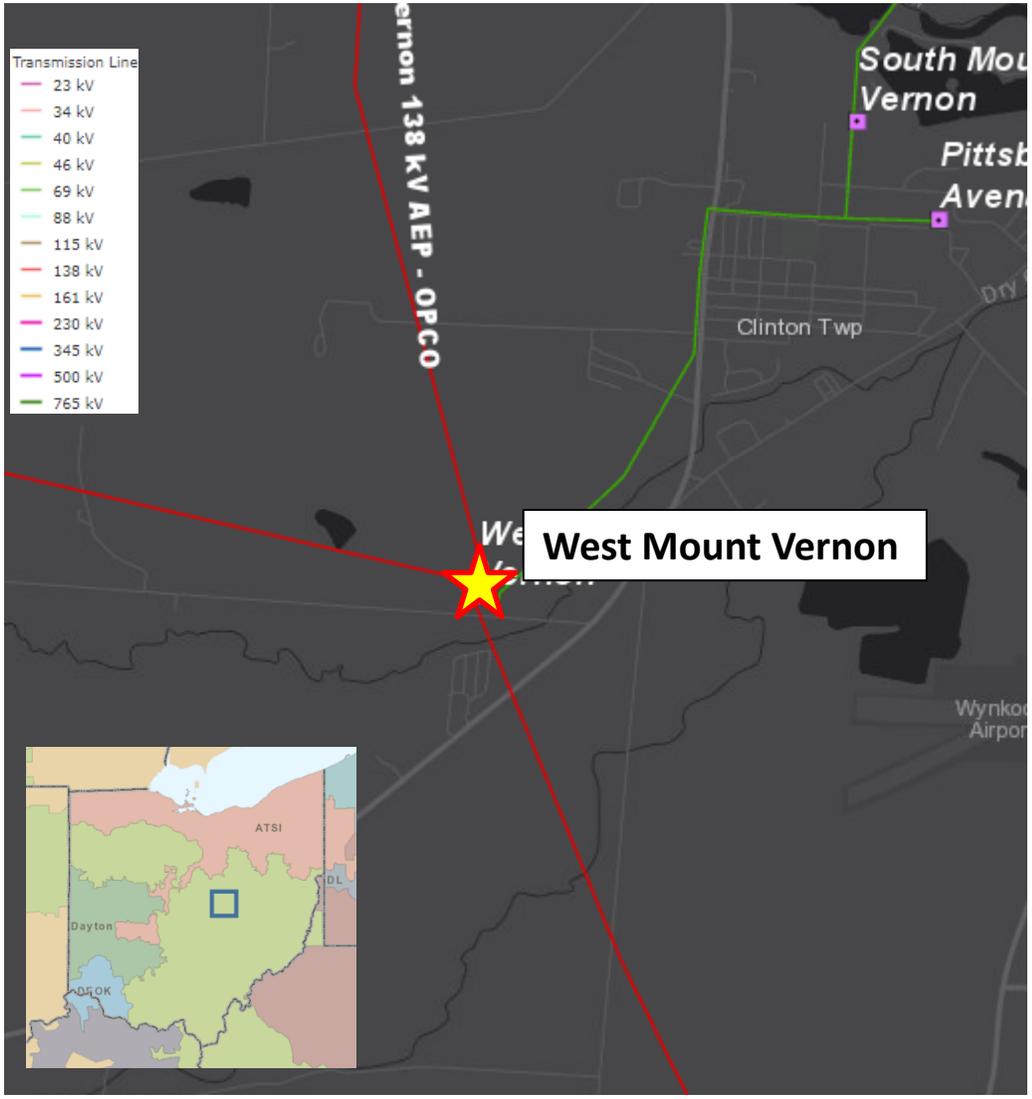
Problem Statement:
West Mount Vernon Circuit Breakers: A, B
Breaker Age:

- 1991: A, B
- Interrupting Medium: (SF6)

Additional Breaker Info:

- From the time period of July 2020- January 2023, there have been 82 recorded malfunctions of this 145-PA model family on the AEP System. The most common issues documented are related to loss of SF6 gas and mis-operations. The expected life of the bushing gaskets and door inspection port seals is 25 years; Both of these units have reached this age. Seals that are no longer adequate can cause SF6 leaks to become more frequent. The manufacturer provides no support for this 145-PA family of circuit breakers, and spare parts are no longer available.

- CB-A has experienced 60 malfunctions and CB-B has experienced 30 malfunctions. These malfunctions include low gas alarms which required additional SF6 gas to be added, malfunctions due to a leak in the valve packing and malfunctions due to low temperature readings in the breaker.



Need Number: AEP-2023-OH036

Process Stage: Need Meeting 04/21/2023

Project Driver: Equipment Material/Condition/Performance/Risk

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

138 kV Circuit Breakers CB- 1, 2, 3, 4:

- Breaker age: CB- 1= 1980, 2&3 =1966, 4=1969
- Interrupting Medium: (Oil)
- Additional Information:
 - These breakers are all oil filled without oil containment; oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require. These breakers are of 1960s and 1980s vintage. The breakers are no longer supported by vendors with spare parts no longer being available.



Need Number: AEP-2023-OH036

Process Stage: Need Meeting 04/21/2023

Problem Statement, continued:

138 kV Circuit Switcher CS-AA:

- Circuit Switcher age: 1995
- Interrupting Medium: SF6
 - The 138 kV circuit switcher CS-AA is an SF6 type switcher. It's 1993 vintage switcher type and has no gas monitor. From May 2000 to December 2022, this model of switcher has experienced 88 malfunctions with in-service units on the AEP system. Failed operational components, including high contact resistance, gas loss, and interrupter failure, represent half of these malfunctions. Two malfunctions catastrophic equipment failures involving failures to trip.

Relays:

- Currently, 133 of the 147 relays (90% of all station relays) are in need of replacement or upgrades. There are 111 of the electromechanical type and 8 of the static type which have significant limitations with regards to fault data collection and retention. These relays lack vendor support and have little to no access to spare parts. In addition, there are 14 microprocessor relays that were installed/commissioned between 2002 and 2010.
- AEP Ohio Distribution has indicated that there is a significant amount of distribution equipment at the station in poor condition that needs addressed.



Need Number: AEP-2023-OH037

Process Stage: Need Meeting 04/21/2023

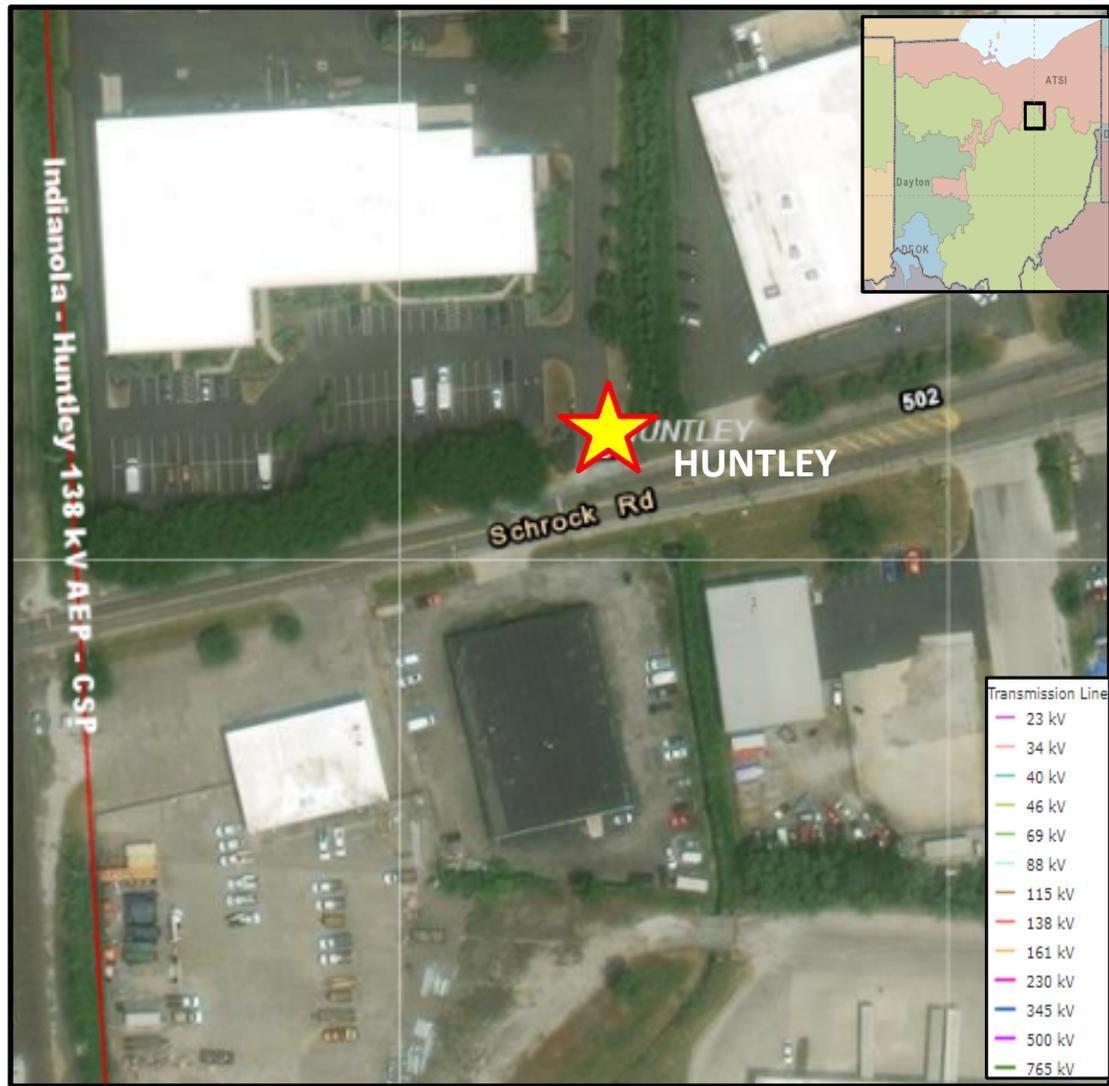
Project Driver: Equipment Material/Condition/Performance/Risk

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

138 kV Circuit Switcher CS - AA:

- Circuit Switcher age: 1995
- Interrupting Medium: SF6
- Additional Information:
 - The 138 kV transmission owned circuit switcher CS-AA is a SF6 type switcher. It's 1993 vintage switcher type and has no gas monitor. From May 2000 to December 2022, this model of switcher has experienced 88 malfunctions with in-service units on the AEP system. Failed operational components, including high contact resistance, gas loss, and interrupter failure, represent half of these malfunctions. Two malfunctions of note were catastrophic equipment failures involving failures to trip.



AEP Transmission Zone M-3 Process Franklin County, OH

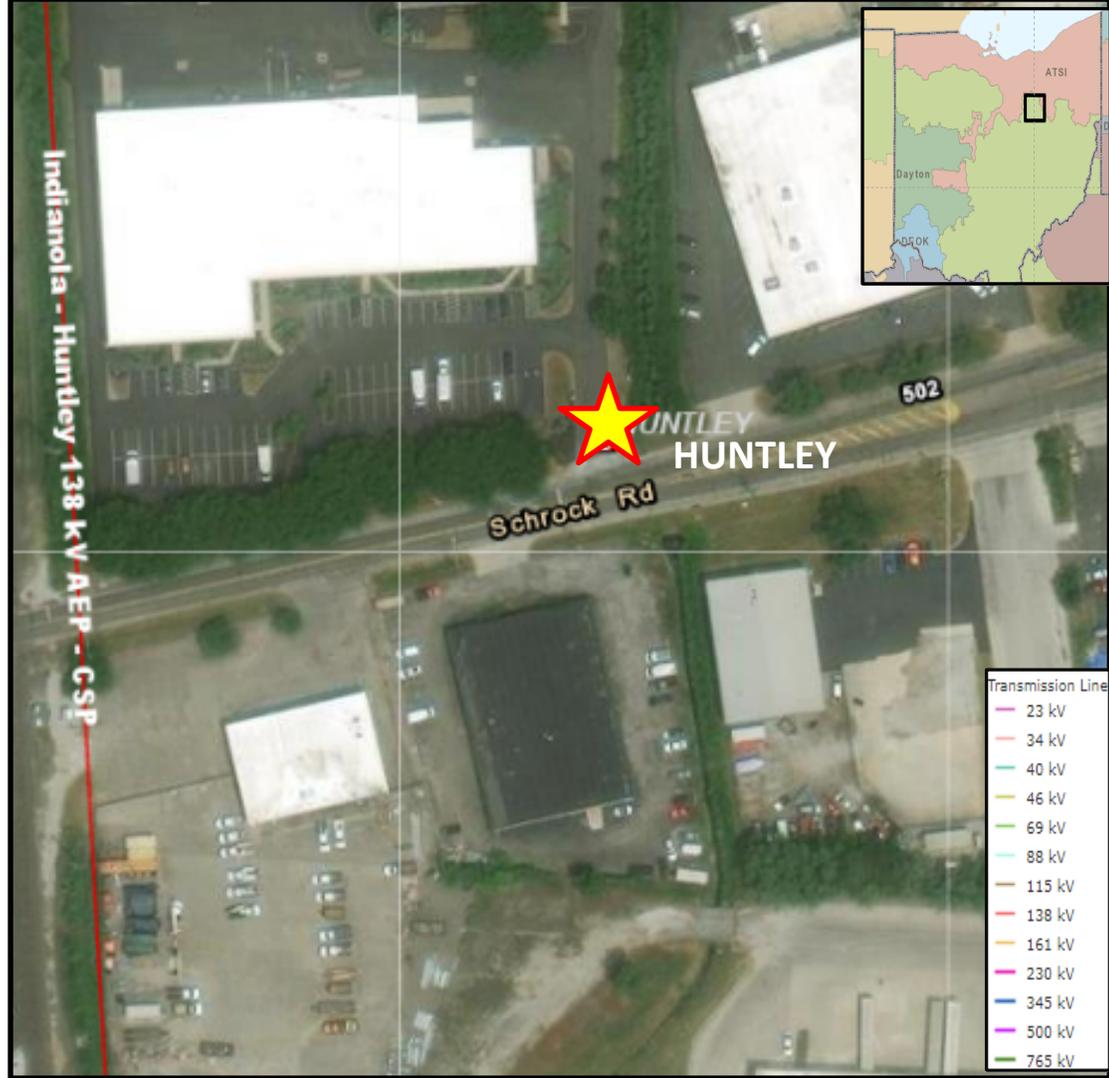
Need Number: AEP-2023-OH037
Process Stage: Need Meeting 04/21/2023
Problem Statement, continued:

69 kV Circuit Breakers CB- 60, 63, 64, 65, 66, 69:

- Breaker age: CB- 63, 64, 65, 66, 69 = 1971, CB- 60 = 1976
- Interrupting Medium: (Oil)
- Additional Information:
 - These breakers are oil filled without oil containment; oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require. These breakers are of 1970s vintage. The manufacturing company does not provide any support for these circuit breakers and spare parts are not available. This kind of breakers have several malfunctions within the AEP system such as; low-pressure readings, hydraulic leaks, pump lockouts, and failure to shut off. These mechanism malfunctions have led to several failures to close and other types of mis-operations across the AEP fleet.

Relays:

- Currently, 146 of the 176 relays (83% of all station relays) are in need of replacement or firmware upgrades. Of the 146 relays, 142 are of the electromechanical and static type which have significant limitations with regards to spare part availability and fault data collection and retention. These types of relays have a history of causing problems with the protection and operation of the substation. This specific type of relay has a high failure/malfunction rate. Fault monitoring and capability checking is not accessible, and information cannot be sent to the RTU through SCADA. This relay does not have DME capability meaning fault data cannot be recorded which hurts the determination of proper operation and fault location. Electromechanical relays do not meet current AEP P&C standards. There are 4 microprocessor relays that were installed/commissioned in 2007.



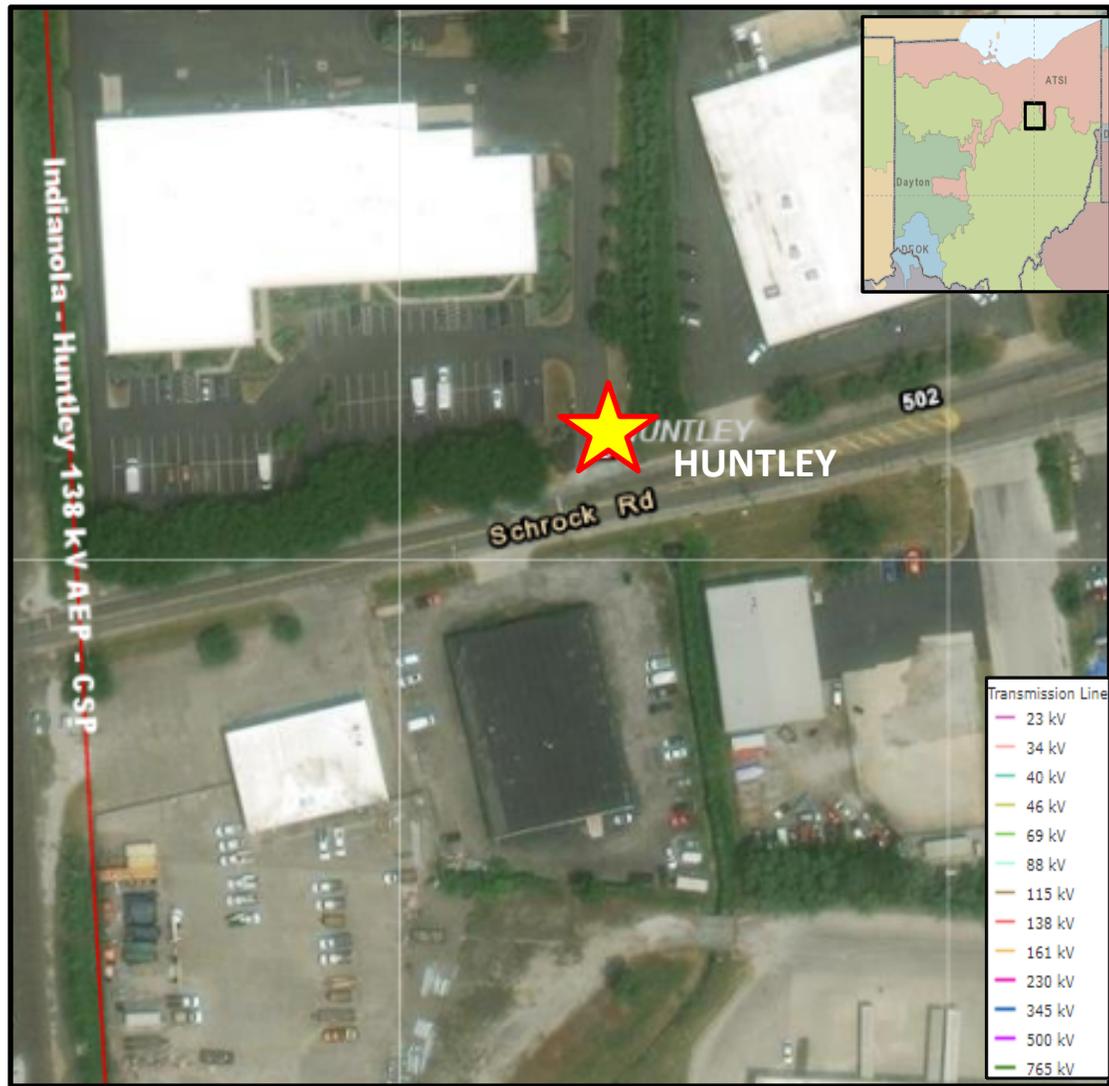
AEP Transmission Zone M-3 Process Franklin County, OH

Need Number: AEP-2023-OH037
Process Stage: Need Meeting 04/21/2023

Problem Statement, continued:

138 kV Cap Bank #5:

- Cap Bank age: 1990
- Additional Information:
 - This cap bank is a poor performing 1990s vintage Mark V style cap bank which has experienced 26 malfunctions over its lifespan with 15 of the malfunctions spanning from June 2015 to January 2023. 6 of the outages since 2015 have been over 1 month in duration with an average of 4 months out of service. Failed operational components include one blown fuse which accounts for the 11 of the total malfunctions.



Need Number: AEP-2023-OH052

Process Stage: Need Meeting 4/21/2023

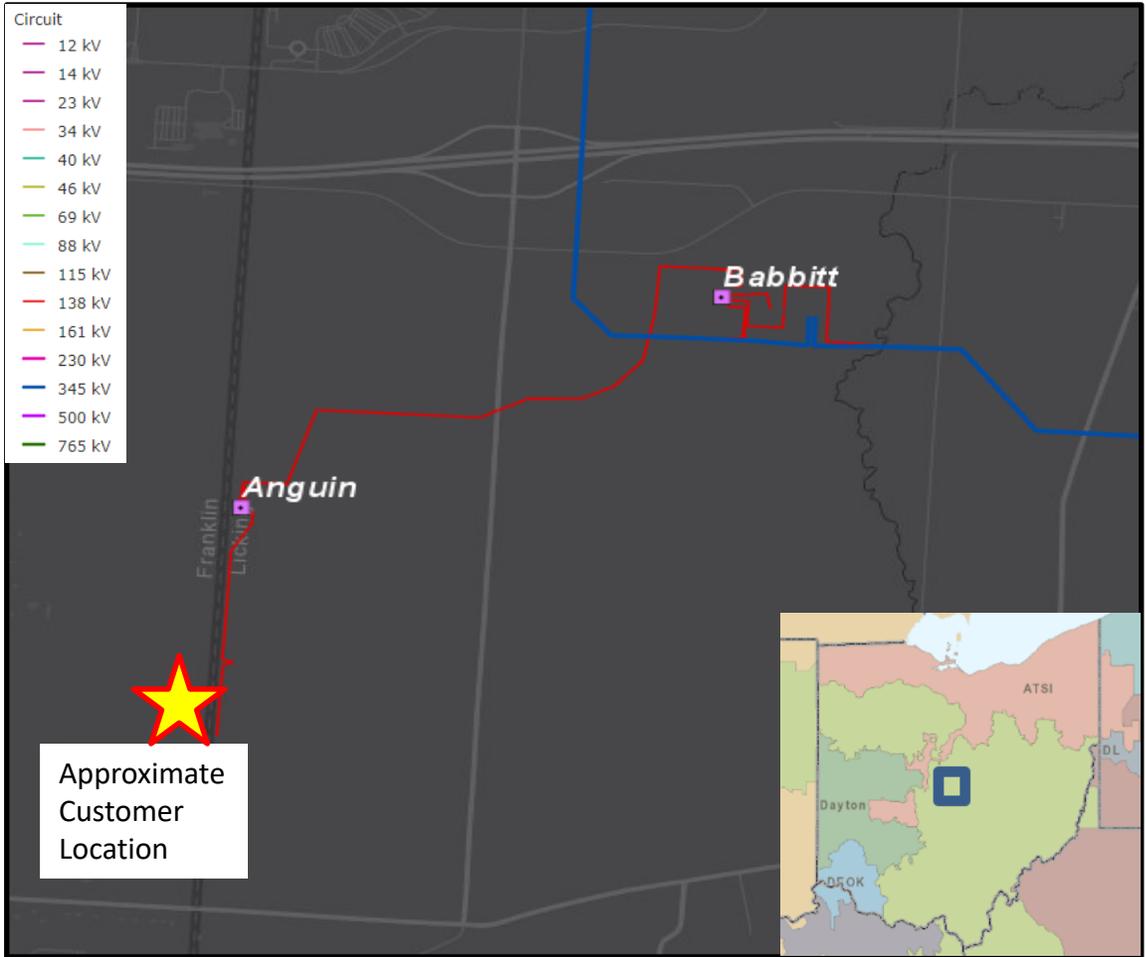
Project Driver: Customer Service

Specific Assumption Reference:

AEP Connection Requirements for the AEP Transmission System
(AEP Assumptions Slide 12)

Problem Statement:

- An existing customer served out of AEP’s Anguin Station in New Albany, OH, has requested an additional service for a new bulk load addition of 100 MW. This will bring the total load for the customers site to 450 MW with an ultimate capacity of up to 720 MW.
- Customer requested in-service date of 3/31/2024.



Need Number: AEP-2023-OH062

Process Stage: Need Meeting 04/21/2023

Project Driver: Customer Service

Service Specific Assumption Reference: AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 12)

Problem Statement:

AEP Ohio has requested to add capacity at Wayview station, due to continuous load growth in the North Canton area near the Akron-Canton Airport. The station has limited transferability to surrounding distribution stations. The anticipated total peak distribution load is 24 MVA. The requested in-service date is 12/31/2025.



Need Number: AEP-2023-OH063

Process Stage: Need Meeting 04/21/2023

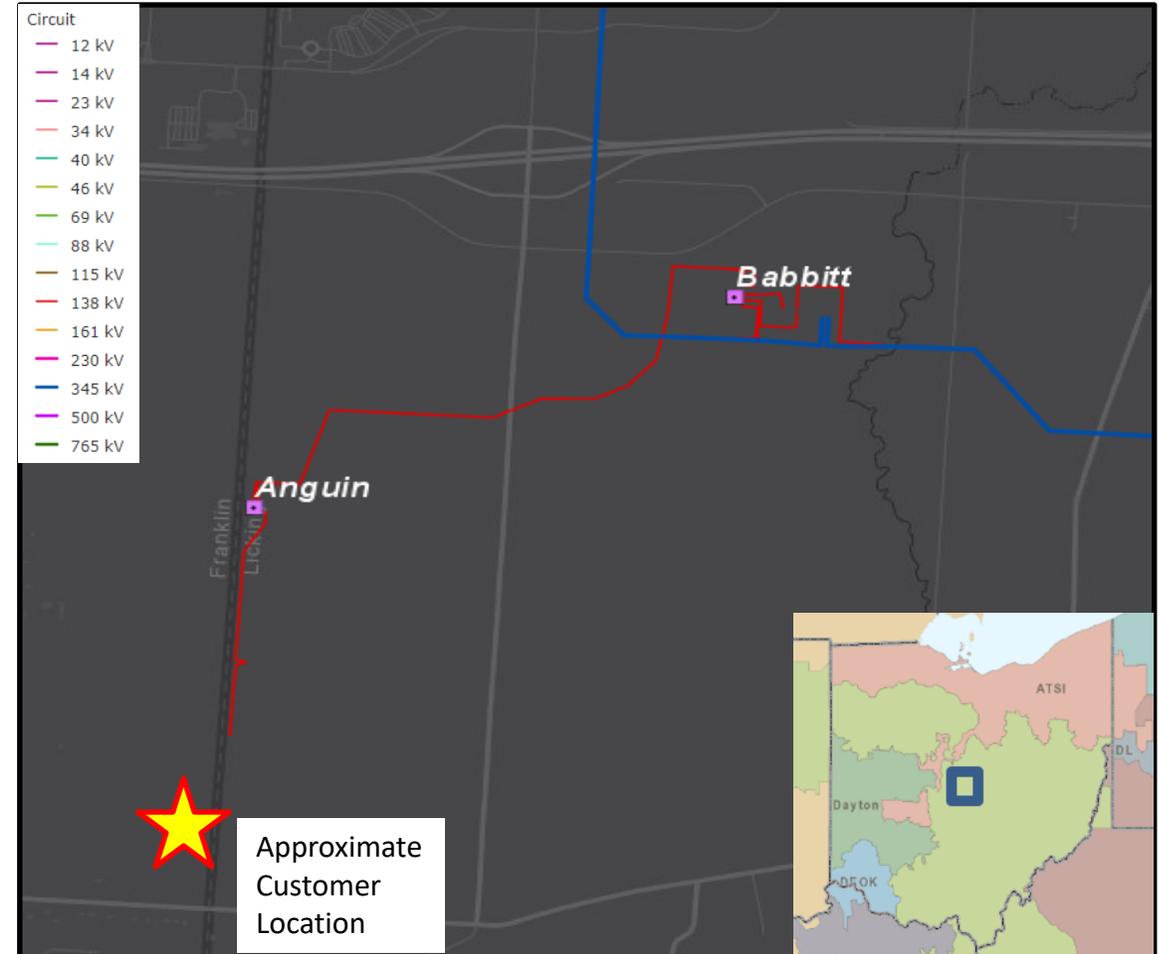
Project Driver: Customer Service

Specific Assumption Reference:

AEP Connection Requirements for the AEP Transmission System
(AEP Assumptions Slide 12)

Problem Statement:

- An existing customer served out of AEP’s Anguin Station in New Albany, OH, has requested an additional service for a new bulk load addition of 100 MW. This will bring the total load for the customer’s site to 550 MW with an ultimate capacity of up to 720 MW.
- Customer requested in-service date of 07/31/2024.



AEP Transmission Zone M-3 Process Scio, Ohio

Need Number: AEP-2023-OH064

Process Stage: Need Meeting 04/21/2023

Project Driver: Customer Service; Equipment Material/Condition/Performance/Risk

Specific Assumption Reference: AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 12); AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

AEP Ohio’s Scio distribution station does not have any SCADA functionality, limiting the ability of T & D operations personnel to properly monitor real-time conditions at the station. It can also lead to lengthier outage times for customers.

In addition, it has an outdated ungrounded 69 kV capacitor bank (9.6 MVAR) that has been prone to malfunction. The capacitor was manufactured in 1989. This cap bank is a manually switched bank with no SCADA control of the switcher.



AEP Transmission Zone M-3 Process Van Wert Co., OH

Need Number: AEP-2023-OH065

Process Stage: Need Meeting 04/21/2023

Project Driver:

Customer Service

Specific Assumption Reference:

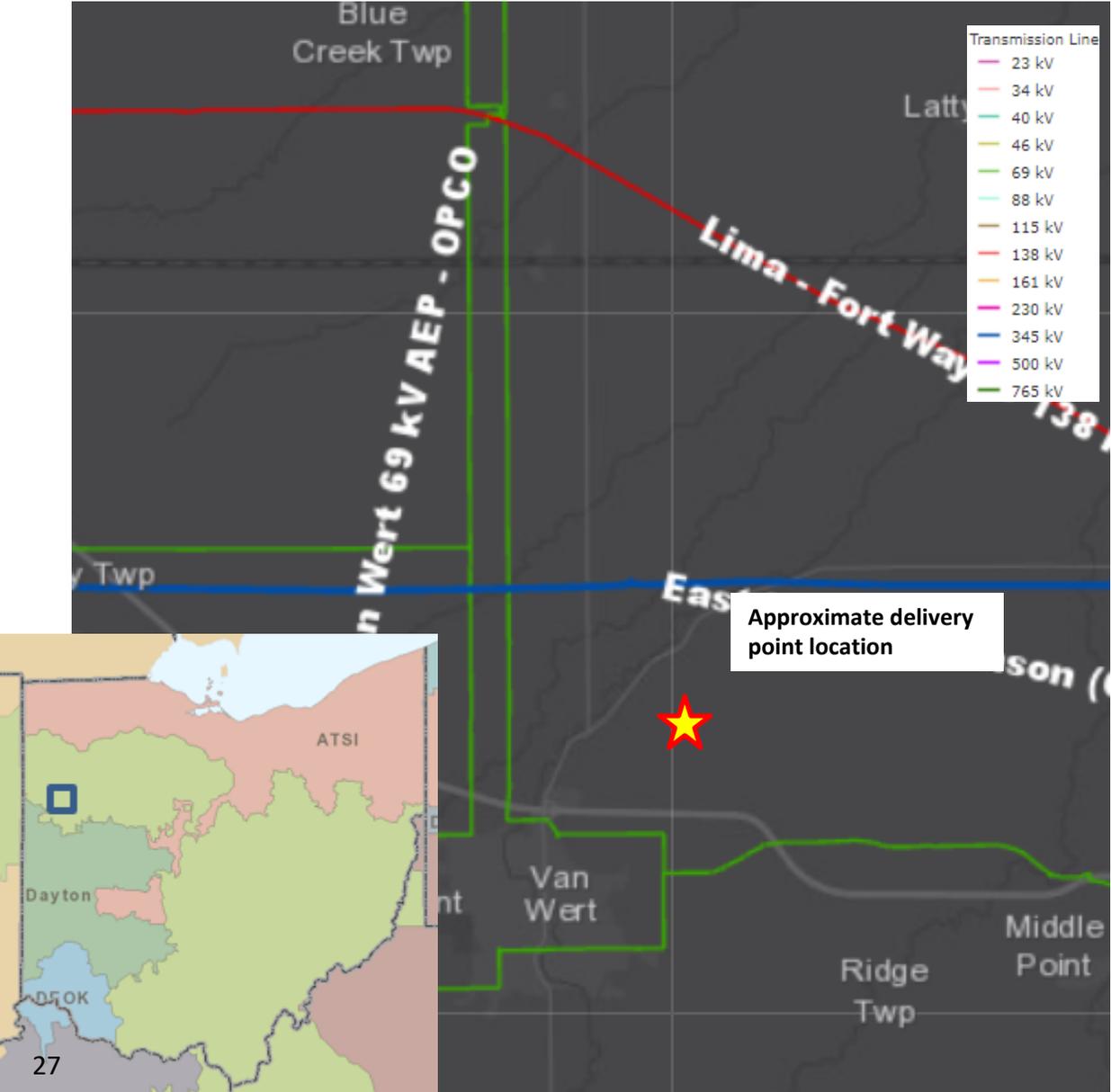
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 12)

Problem Statement:

Van Wert Mega Site:

The Van Wert Mega industrial site is located north of Van Wert in Van Wert County Ohio. The site is approximately one mile east of AEP's Van Wert - Haviland 69kV circuit. The site has been heavily targeted by regional and state economic development efforts and will continue to be. The site is highlighted by JobsOhio and its partner Regional Growth Partnership as its top available property for EV manufacturing. From January 2022 to March 2023 AEP Economic Development has had 32 requests for electric service plans at the site. The prospective customer's electric demand ranged from 5MW to 760MW. Around the industrial site, significant investment has been performed to prepare the site for manufacturing industry development, including installation of a rail spur.

Many of these prospective customers cannot be connected to the existing Van Wert area 69kV network without significant upgrades.



Need Number: AEP-2023-OH066

Process Stage: Needs Meeting 4/21/2023

Project Driver: Customer Service

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions slide 12)

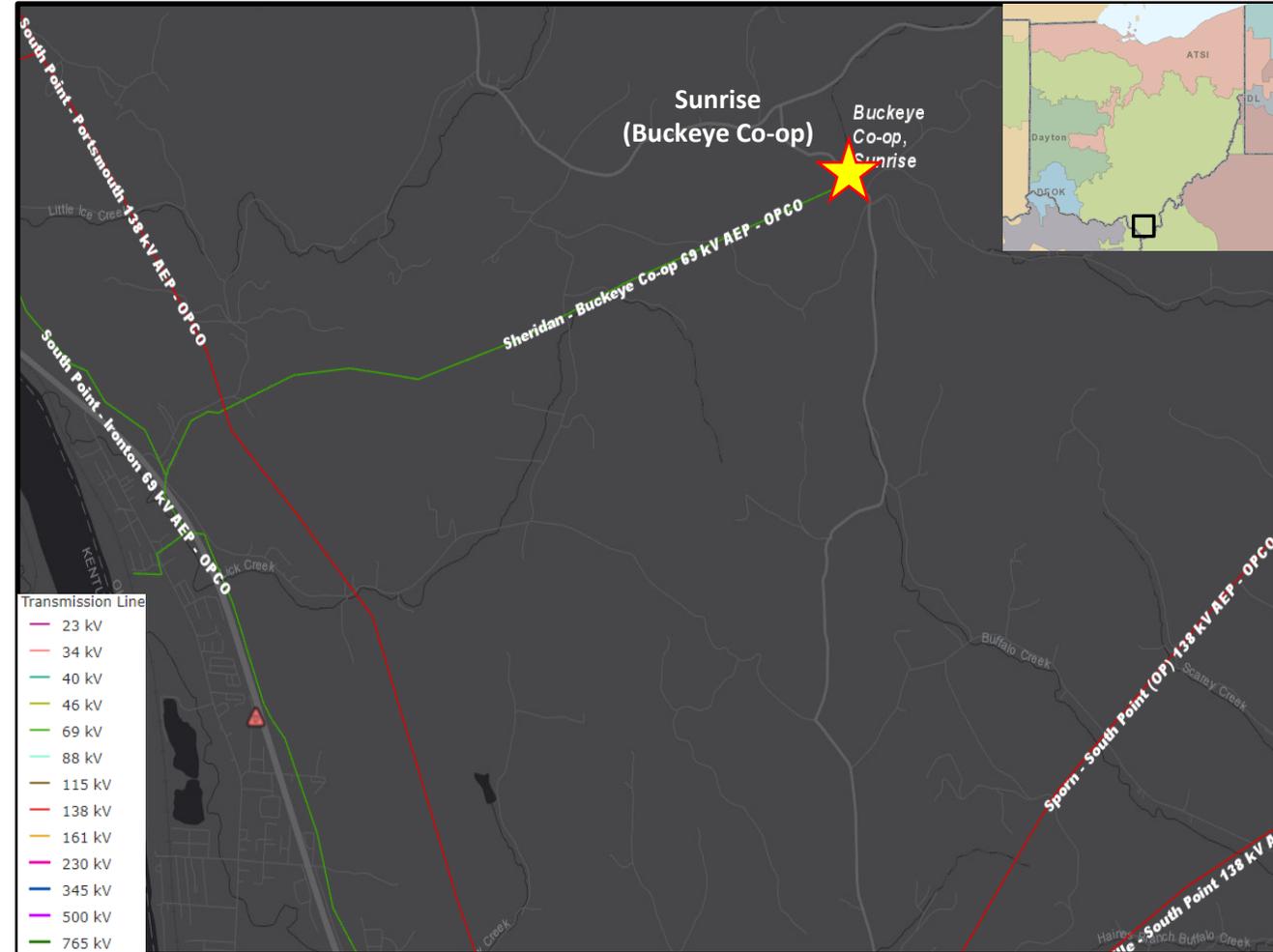
Problem Statement:

Buckeye is requesting 69kV looped service for Sunrise (Buckeye Co-op). This station is currently being fed by a ~3.5 mile 69kV radial line, with partial transfer capability to Fayette and Windsor during favorable loading conditions in the spring or fall.

6.2M CMI at Sunrise (Buckeye Co-op) last year, from three separate outages in February; Causes of outages included: vegetation contact, conductor uplift due to ice accumulation, and static wire failure

Additional Info: Radial service severely restricts the ability to perform routine maintenance and restoration activities. The maintenance of radial transmission lines often requires costly temporary facilities or other labor-intensive measures involving energized work because a maintenance outage to such radial loads is generally not feasible.

The South Point-Ironton 69 kV line feeds the Sunrise radial line. The South Point-Ironton line is a 1950s vintage line. 96 of the 158 structures on the line are 1970s vintage or older, accounting for 60% of structures.



AEP Transmission Zone M-3 Process Monroe County, Ohio

Need Number: AEP-2023-OH067

Process Stage: Need Meeting 04/21/2023

Project Driver: Customer Service

Service Specific Assumption Reference: AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 12)

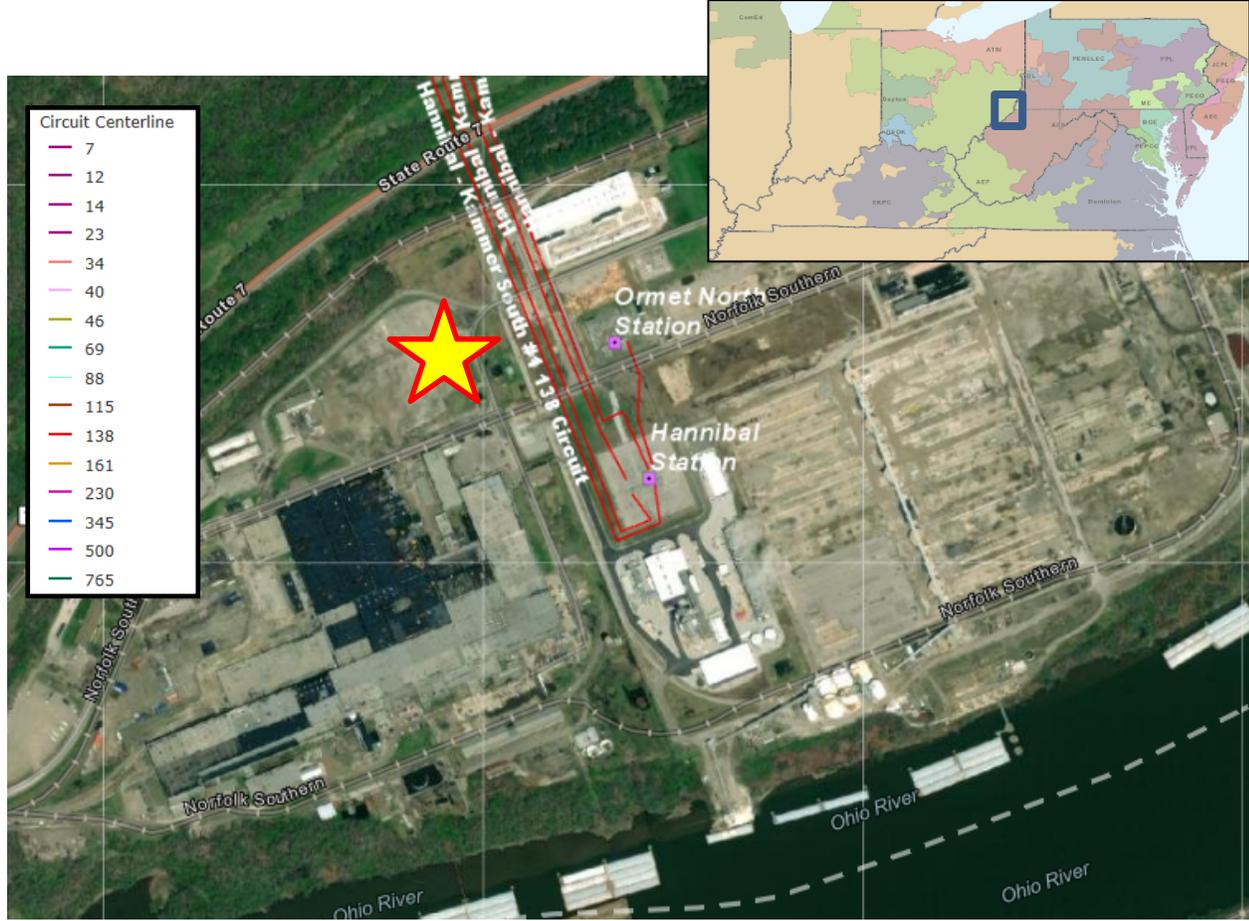
Problem Statement:

AEP Ohio has requested a new distribution station delivery point near Hannibal station in Monroe County, Ohio. Currently, distribution customers are served via the electrical facilities of another retail transmission customer, which presents a number of operational and reliability challenges for all parties.

AEP has also received many economic development inquiries from potential customers at the site of the former Ormet Aluminum plant.

Lastly, there is an island of local Ohio distribution customers served via distribution circuits sourced across the Ohio River in West Virginia, which pose various risks to the customers.

The requested in-service date is 12/31/2024.



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

Need Number: AEP-2022-AP037

Process Stage: Solutions Meeting 4/21/2023

Previously Presented: Needs Meeting 9/16/2022

Supplemental Project Driver: Customer Service

Specific Assumption References: AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 12)

Problem Statement:

APCO Distribution has requested to install new distribution transformer at the existing Coco 138 kV Transmission Station to support load growth in the Meadowbrook, WV Area. The projected load at the new Coco transformer is 6.9 MVA and this is being transferred from Mink Shoals and Greenbriar stations.



Need Number: AEP-2022-AP037

Process Stage: Solutions Meeting 4/21/2023

Proposed Solution:

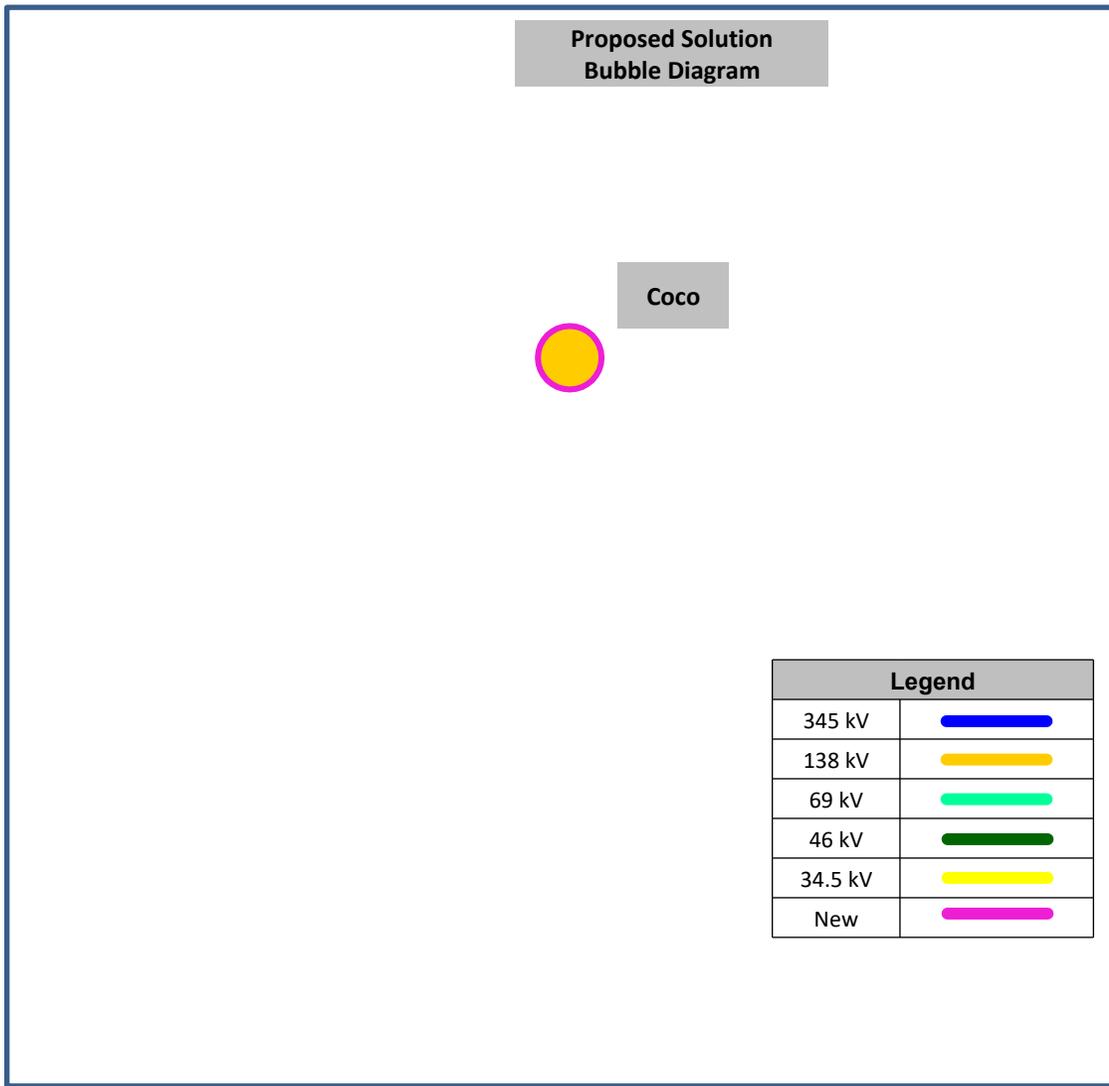
Install one new 138/12 kV XFR and one new 138 kV CB at the existing Coco Station. Estimated Trans Cost: \$0.9M

Total Estimated Transmission Cost: \$0.9M

Projected In-Service: 11/22/2023

Project Status: Scoping

Model: 2027 RTEP



AEP Transmission Zone M-3 Process Benton Harbor Area Improvements

Need Number: AEP-2022-IM004

Process Stage: Solution Meeting 4/21/2023

Previously Presented: Needs Meeting 1/21/2022

Supplemental Project Driver: Equipment Condition/Performance/Risk

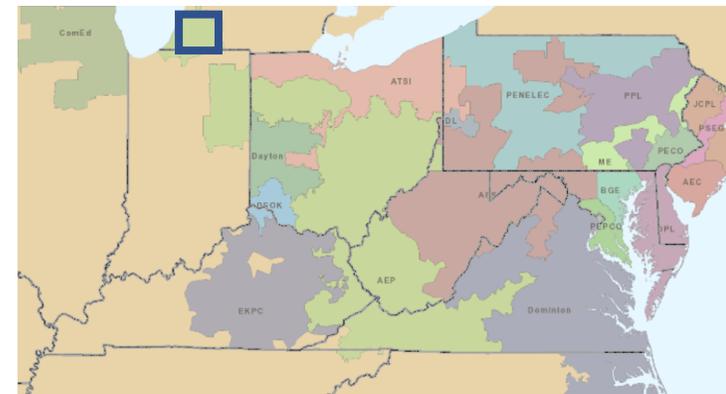
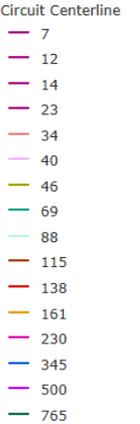
Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Model: N/A

Problem Statement:

Hickory Creek – Main Street 138kV (~3.53 miles):

- 57 total structures (a mixture of wood and steel)
 - 44 were installed in 1968
 - 7 were installed in 1929
 - The remaining more recent
- The line consists of 1968 636 ACSR 26/7 Grosbeak conductor
- Since 2016
 - Main Street – Pletcher 138kV has experienced 2 momentary and 1 permanent outage
 - Main Street – Napier 34.5kV has experienced 1 permanent outage resulting in 739,134 customer minutes of interruption
- Structures fail NESC Grade B and AEP Strength requirements. Grounding methods utilize butt wraps on every other structure, which is inadequate for current AEP standards
- 40 representative structures were assessed by ground and drone
 - 50% have ground line heart and/or shell rot
 - High percentage of wood poles have woodpecker damage and moderate to advanced wood decay from insect and bird damage
- There are 11 structures with at least one documented open condition not included in the ground and aerial assessment.





AEP Transmission Zone M-3 Process Benton Harbor Area Improvements

Need Number: AEP-2022-IM004

Process Stage: Solution Meeting 4/21/2023

Project Summary: Rebuild the Main Street – Derby 138kV/Main Street – Napier – Hickory Creek 34.5kV double circuit line. This is the last section of line still built to 34.5kV standards in the area. The rebuild will allow for conversion to 69kV in the Benton Harbor area. AEP is moving away from the 34.5kV voltage class to improve operational efficiency and eliminate drop and pick switching scenarios.

Proposed Solution:

Main Street – Hickory Creek 138kV Line Asset: Rebuild ~3.47 miles of the Derby – Main Street 138kV circuit up to structure 125. Of that ~3.47 miles, the Main Street – Napier – Hickory Creek 34.5kV circuit is double circuited with Derby – Main Street 138kV circuit for ~2.84 miles, which will also be rebuilt and then energized to 69kV. Both lines will utilize the 795 ACSR 26/7 Drake conductor.

Estimated Cost: \$16.2M

Main Street – Hickory Creek 34.5kV (via Pearl Street): Energize at 69kV.

Estimated Cost: \$0M

Main Street: Energize circuit breakers J, K, and L to 69kV.

Estimated Cost: \$0.91M

Hickory Creek: Retire 34.5kV circuit breaker BG and remaining 34.5kV equipment. Energize circuit breakers AQ, BE, and BH to 69kV. Breaker BH will be used as a bus tie breaker.

Estimated Cost: \$1.18M

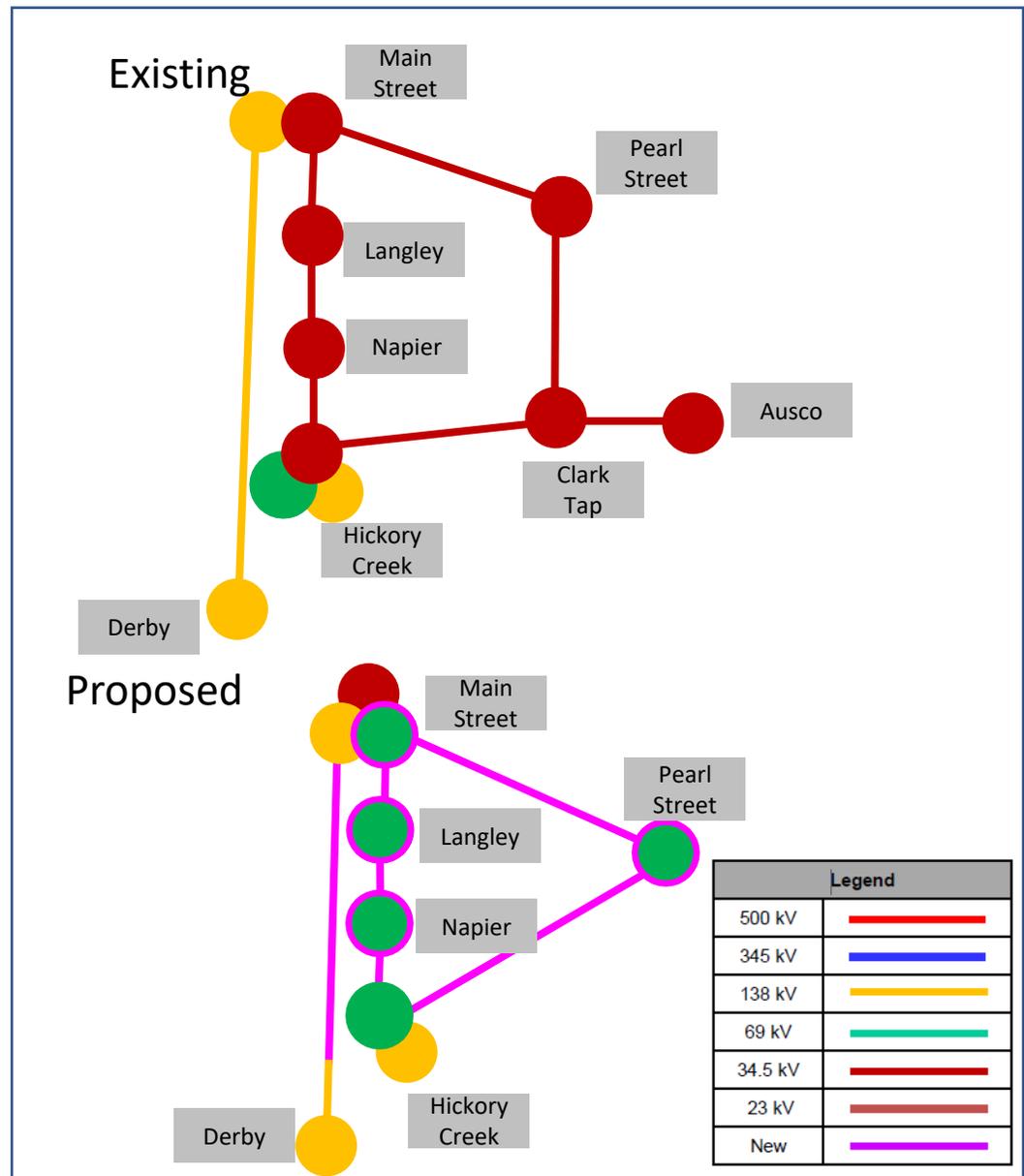
Pearl Street, Langley, and Napier: Energize to 69kV.

Estimated Cost: \$0.41M

Ausco Radial 34.5kV: Retire the 34.5kV Ausco radial

Estimated Cost: \$0.6M

Total Estimated Transmission Cost: \$19.3M



Need Number: AEP-2022-IM004
Process Stage: Solution Meeting 4/21/2023

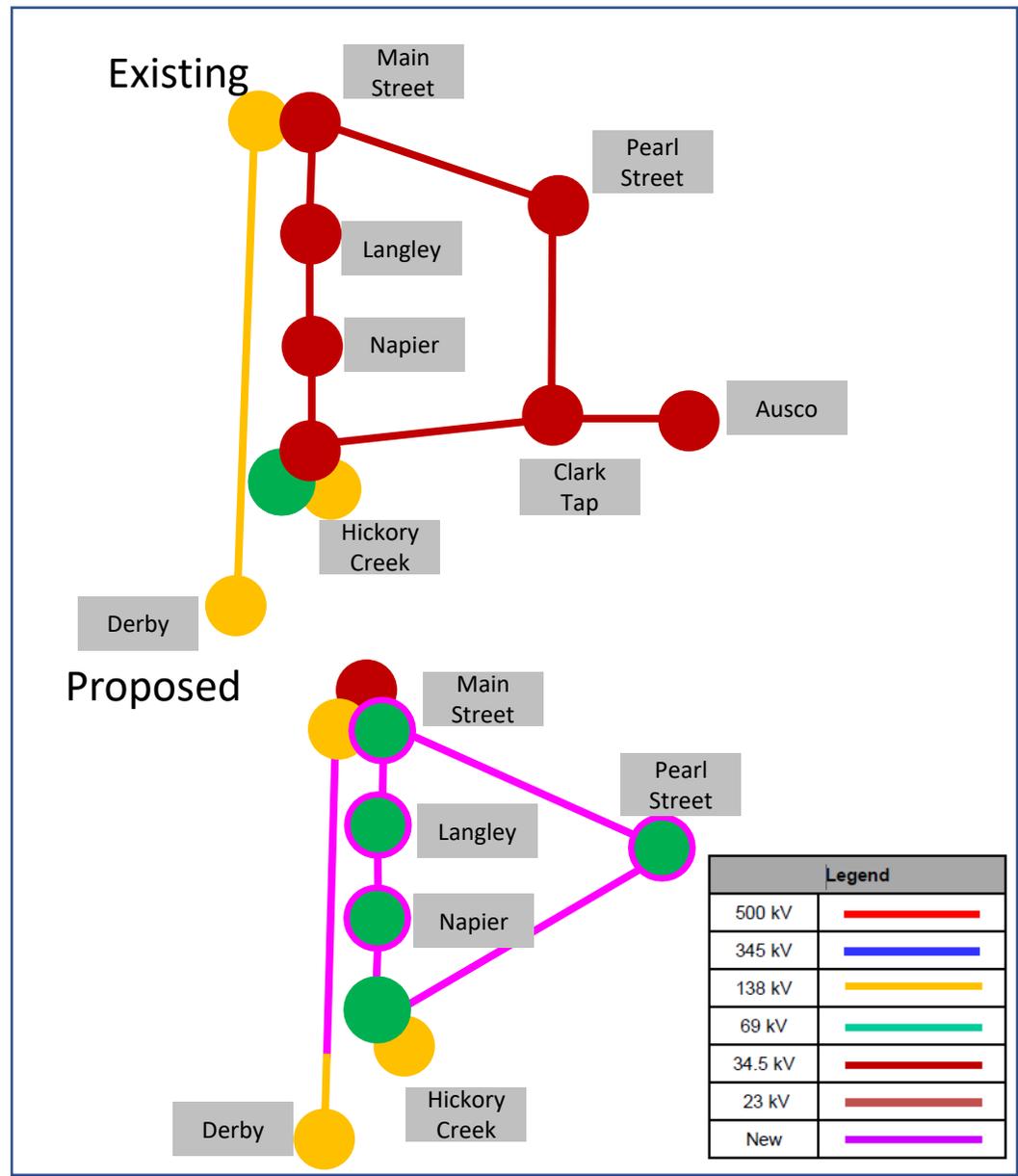
Ancillary Benefits: Moving to 69kV will improve operational flexibility and eliminate the problem of the drop and pick issues that the 34.5kV voltage class experiences.

Alternative Considered:
 Rebuild ~3.47 miles of the Derby – Main Street 138kV circuit up to structure 125. Of that ~3.47 miles, the Main Street – Napier – Hickory Creek 34.5kV circuit is double circuited with Derby – Main Street 138kV circuit for ~2.84 miles, which would also be rebuilt but keep this and the rest of the area operating at 34.5kV. This would not take into account the opportunity to convert majority of the remaining 34.5kV lines to 69kV in the Benton Harbor area, keeping a drop-and-pick scheme in place for outages on the system in order to transfer load. The remaining 34.5 kV lines in the area have already been rebuilt to 69 kV capability.

Estimated Cost: \$16.2M

Projected In-Service: 5/7/2027

Project Status: Scoping



AEP Transmission Zone M-3 Process Magley-Decatur 69kV line rebuild

Need Number: AEP-2022-IM015

Process Stage: Solutions Meeting 4/21/2023

Previously Presented: Needs Meeting 9/16/2022

Project Driver: Equipment Material Condition, Performance and Risk

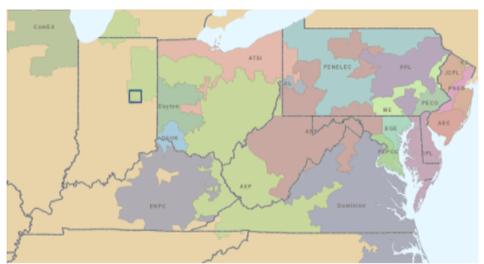
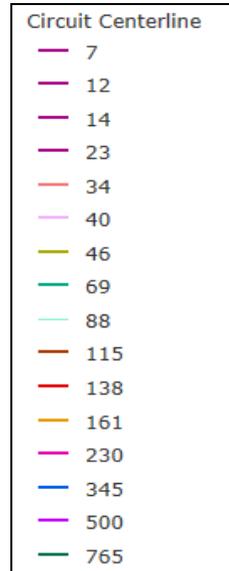
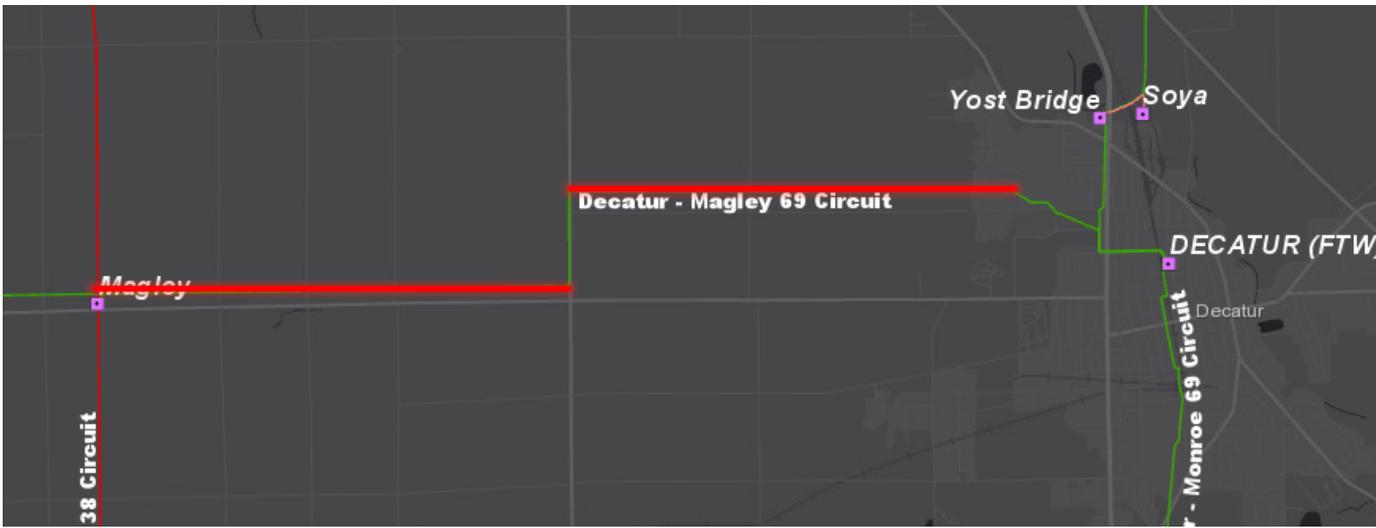
Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions slide 13)

Problem Statement:

Magley – Decatur 69 kV (Vintage 1957/1966)

- Length of line: 5.88 miles
- Total structure count: 24 dating back to 1957, 1 installed in 1965 and 45 installed in 1966.
- Line construction Type:
 - Wood pole and H frame structures
 - 5/16" steel shield wire which has history of failure
- Conductor Type:
 - 6 wired, 4/0 ACSR 6/1 Penguin (1957): 3.16 miles
 - 336,400 CM ACSR 30/7 Oriole (1966): 2.72 miles
- Momentary/Permanent Outages: 7 Momentary and 1 Permanent
- Condition Summary:
 - Number of open conditions: 6 structures have at least one open condition. 43 structures were assessed by drone and 10 assessed by a ground crew and the following were identified
 - H Frame structures had moderate shell damage with some heavy checking.
 - Wood structures on this line are subject to high number of woodpecker and insect damage.
 - Multiple instances of decay, pole split, rot top, crossarm split, pole cavity, brace splitting and flashed/split insulator.
 - Structures fail NESC Grade B, ASCE structural strength requirements, AEP grounding standards, AEP structural strength requirements and the H Frame portions fail AEP shielding angle standards.



AEP Transmission Zone M-3 Process Magley-Decatur 69kV line rebuild

Need Number: AEP-2022-IM015

Process Stage: Solution Meeting 4/21/2023

Proposed Solution:

Rebuild 5.88 miles of the 6.36 mile circuit from Magley-Decatur with 795 ACSR. The rebuild will consist of all 1957 and 1966 vintage poles, towers with failed strength requirements, as well as the 4/0 and 336 ACSR conductor.

Total Estimated Transmission Cost: \$12.48 M

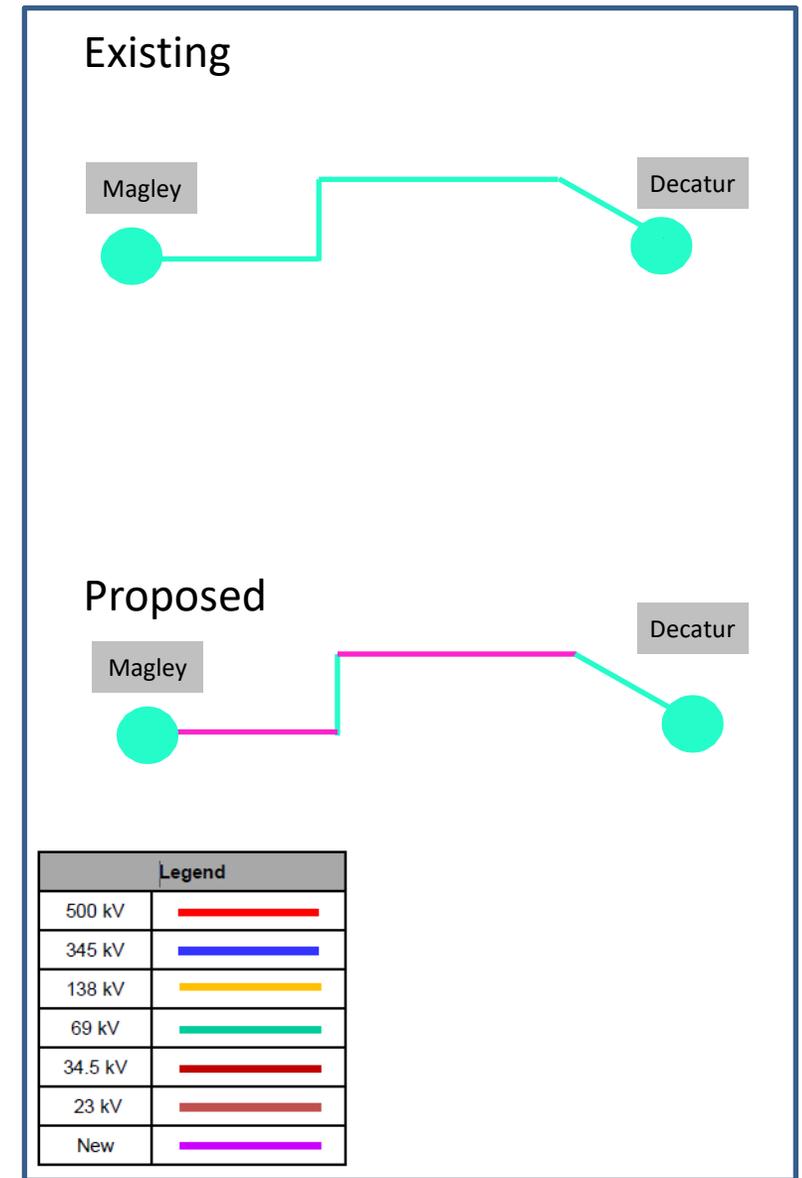
Alternative considered:

Retire Decatur – Magley 69kV line. This would require a new transformer at Lincoln station and a larger cap bank at Berne station. Without the Magley-Decatur 69kV line supporting the area, in N-1-1 conditions load on the 69kV network would be separated by 30+ miles from a 69kV source. This solution does not work if the southern Fort Wayne 69kV region grows by just 6MW. Due to sensitivity to the area and heavy loading of lines in N-1-1 conditions this solution was not chosen.

Total Cost: \$3.11M

Projected In-Service: 08/01/2028

Project Status: Scoping



AEP Transmission Zone M-3 Process Wheeling, West Virginia

Need Number: AEP-2022-OH060

Process Stage: Solution Meeting 04/21/2023

Previously Presented: Need Meeting 07/22/2022

Project Driver: Equipment Material/Condition/Performance/Risk

Specific Assumption Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

69 kV Circuit Breakers A, B, & K:

- Breaker Age: A & B 1965, K 1966
- Interrupting Medium: (Oil)
- Number of Fault Operations: These circuit breakers have exceeded the manufacturer’s designed number (10) of fault operations.
 - A: 34, B: 53, K: 30
- Additional Information:
 - These breakers are oil filled without oil containment; oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require.
 - Circuit Breakers A & B are part of the CF family. 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 family 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. These mechanism malfunctions have led to several failures to close and other types of mis-operations across the AEP fleet.
 - Circuit Breaker K is part of the FK family. The manufacturer provides no support for this fleet of circuit breakers and spare parts are increasingly more difficult to obtain; components are often taken from out of service units with remaining usable parts. A common failure mode documented in AEP malfunction records are compressor failures and valve defects, which cause low pressure and oil leaks. Another failure mode includes trip or reclose failures, caused primarily by spring latching and charging motor component failures. In addition, the vacuum oil and oil breakers have a lot of oil contamination from aging gaskets allowing moisture and other particle ingress.

Relays:

Currently, 23 of the 27 relays (85% of all station relays) need replacement. 21 of these are of the electromechanical type which have significant limitations with regards to spare part availability and fault data collection and retention. In addition, these relays lack vendor support. There are also 2 DPU type units. Out of the 366 relays of this family in the AEP system, 97 of them have had at least one malfunction record documented. This relates to 27% of the DPU fleet. The DPU relays pose a potential safety risk to persons performing breaker operation because the DPUs are mounted directly on the circuit breaker without a delay for opening and closing the breaker.



AEP Transmission Zone M-3 Process Warwood Station Upgrade

Need Number: AEP-2022-OH060
Process Stage: Solution Meeting 04/21/2023
Previously Presented: Need Meeting 07/22/2022

Proposed Solution:

Replace the 3- 69kV oil circuit breakers with new SF6 gas breakers. Replace the electromechanical 69kV line relays and bus differential relays with microprocessor-based relays.

Total Estimated Transmission Cost: \$1.49M

Alternatives Considered:

No viable alternatives due to the many equipment conditions at the station. The station can't be relocated to a greenfield site due to its central location for serving distribution customers north of Wheeling.

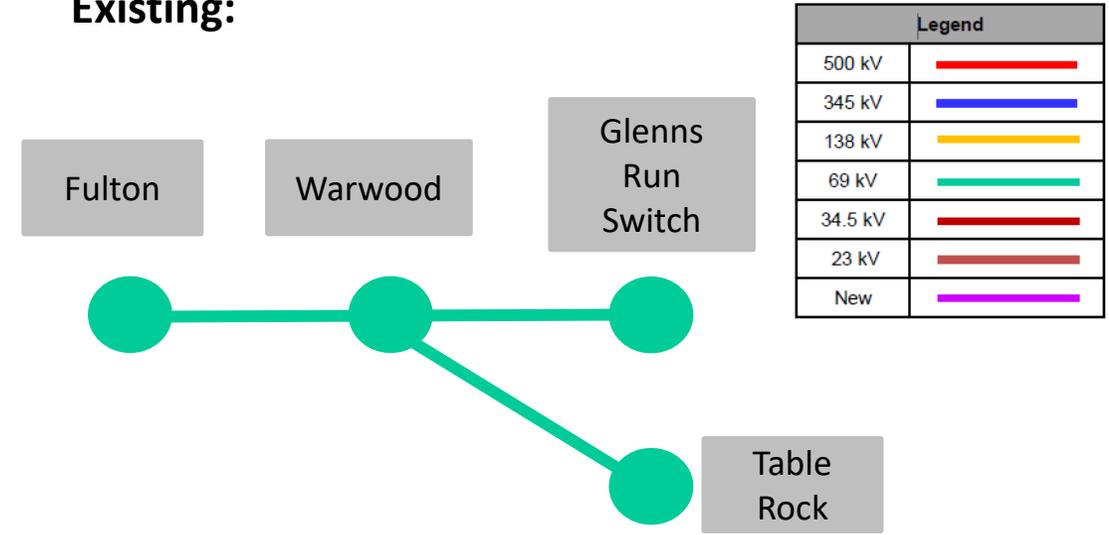
Ancillary Benefits:

This project will greatly expand the SCADA capabilities at Warwood, which serves as a transmission hub on the local 69kV system. This will provide enhanced switching capabilities and situational awareness for AEP System Operations personnel.

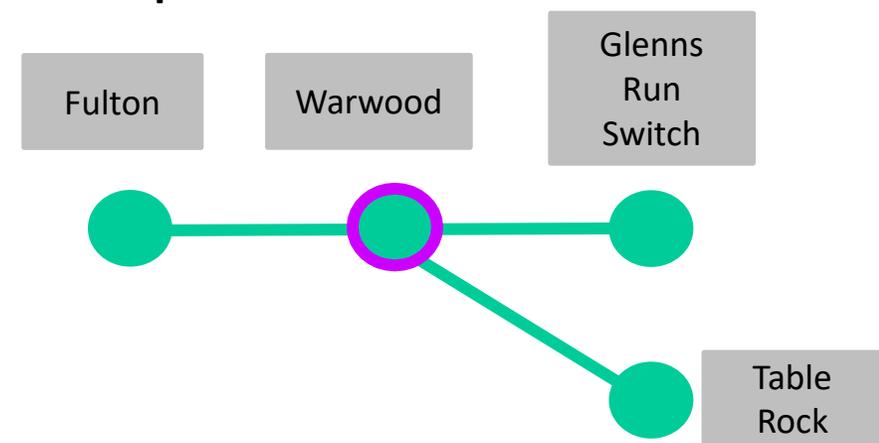
Projected In-Service: 10/1/2024

Project Status: Scoping

Existing:



Proposed:



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

4/11/2022– V1 – Original version posted to pjm.com

4/20/2022– V2 – Slide #32, Added Projected In-Service date, Project Status, and Model information