



Sub Regional RTEP Committee Western Region AEP

October 26, 2018



Need Number: AEP-2018-IM002
Process Stage: Needs Meeting 10/26/18
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:

The Pokagon Station

- CBs J, E, and H are oil filled breakers without oil containment
- Fault operations: CB E(28), CB H(61) - Recommended (10)

Lake Street Station

- CBs A and H are oil filled breakers without oil containment
- CB H is a GE FK type which are known to fail violently
- Fault operations: CB A(24), CB H(13) – Recommended (10)
- Transformer 1 – 1969 vintage
 - CO2 IEEE level 3
 - Moisture level high and rising
 - Wood tie supports

Niles Station

- CBs A, B, M, and N are oil filled breakers without oil containment
- CB M and CB N are GE FK type which are known to fail violently
- Fault operations: CB A(30), CB B(42), CB N(21) – Recommended (10)
- Transformer 2 – 1969 vintage
 - CO2 IEEE level 3
 - Moisture level high and rising
 - Wood tie supports



Need Number: AEP-2018-IM002

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Supplemental Project Driver: Equipment Condition/Performance/Risk

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

Problem Statement:

Lake Street – Niles 69kV circuit

- 1960's wood cross arm construction
- Poor shielding condition
- Lakehead Pumping Tap has open conditions on 30% of structures
- Total open conditions – 54

Lake Street – Niles 34.5kV circuit

- 1965 wood pole construction
- Total open conditions – 51
- 40% of structures with open conditions
- 97% of line original wood poles
- Wooden cross arm with cap and pin insulator construction
- No shield wire



Need Number: AEP-2018-IM004

Process Stage: Needs Meeting 10/26/18

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:

Bosman-Delaware 34.5kV

- 1950's wood crossarm construction
- 3/0 copper conductor.
- It's subject to 45 category A conditions
- It's subject to 39 category B conditions

Bosman Station

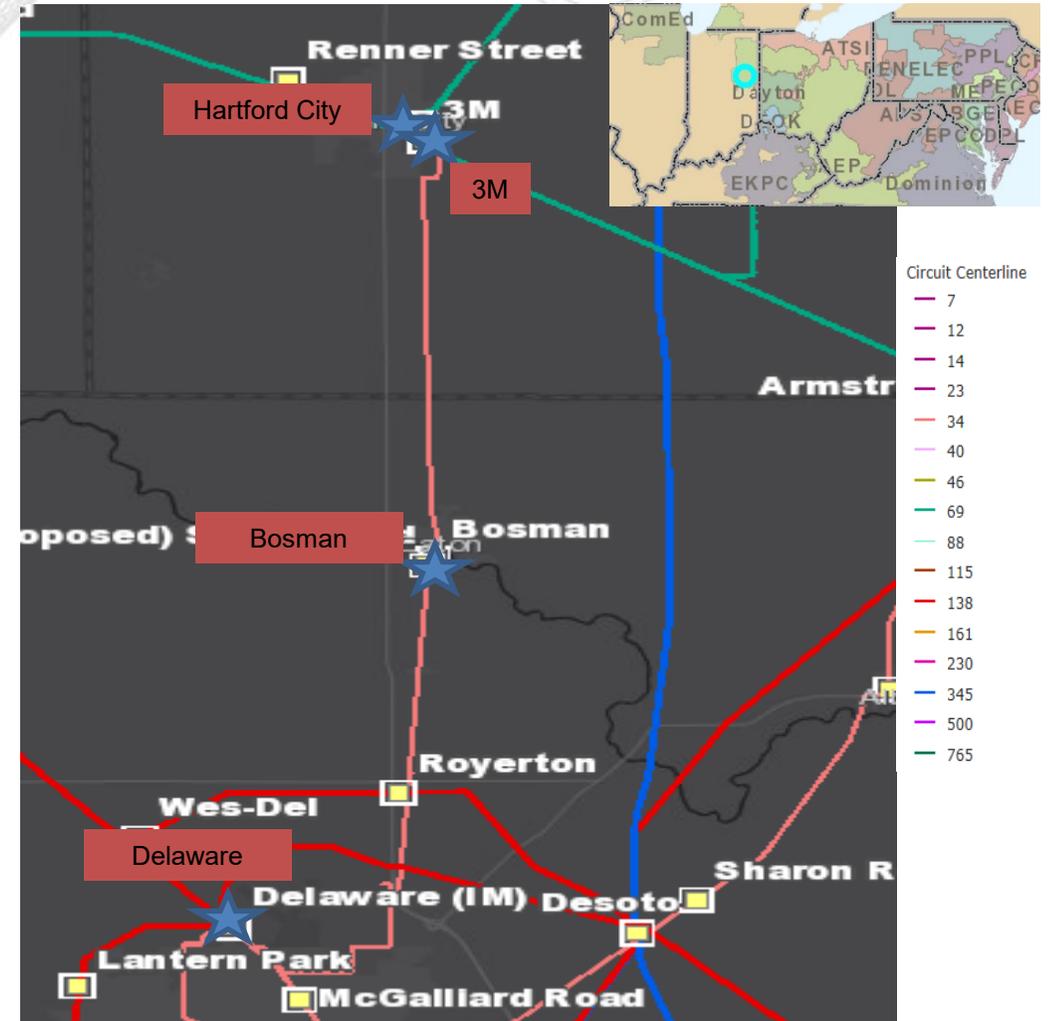
- Station currently resides in the regulatory floodway which presents safety and reliability risks.
- Transformer 1-1956 vintage
 - High levels of carbon dioxide dissolved in the oil.
 - Several fault events between 300-700 degrees Celsius which has caused short circuit strength breakdown
- Breakers "N" and "M"
 - 1970 FK oil type breakers with no oil containment.
 - Fault Operations: CB N(38) CB M(76) – Recommended (10)

Hartford City Station

- Transformer 1-1963 vintage
 - Elevated levels of Ethylene and Ethane dissolved in the oil.
 - Subject to multiple fault events exceeding 700 degrees Celsius which led to short circuit strength breakdown

3M Station

- Breaker A
 - 1967 FK oil filled breakers without oil containment.
 - Fault Operations: CB A(23) – Recommended (10)



Need Number: AEP-2018-IM005

Process Stage: Needs Meeting 10/26/18

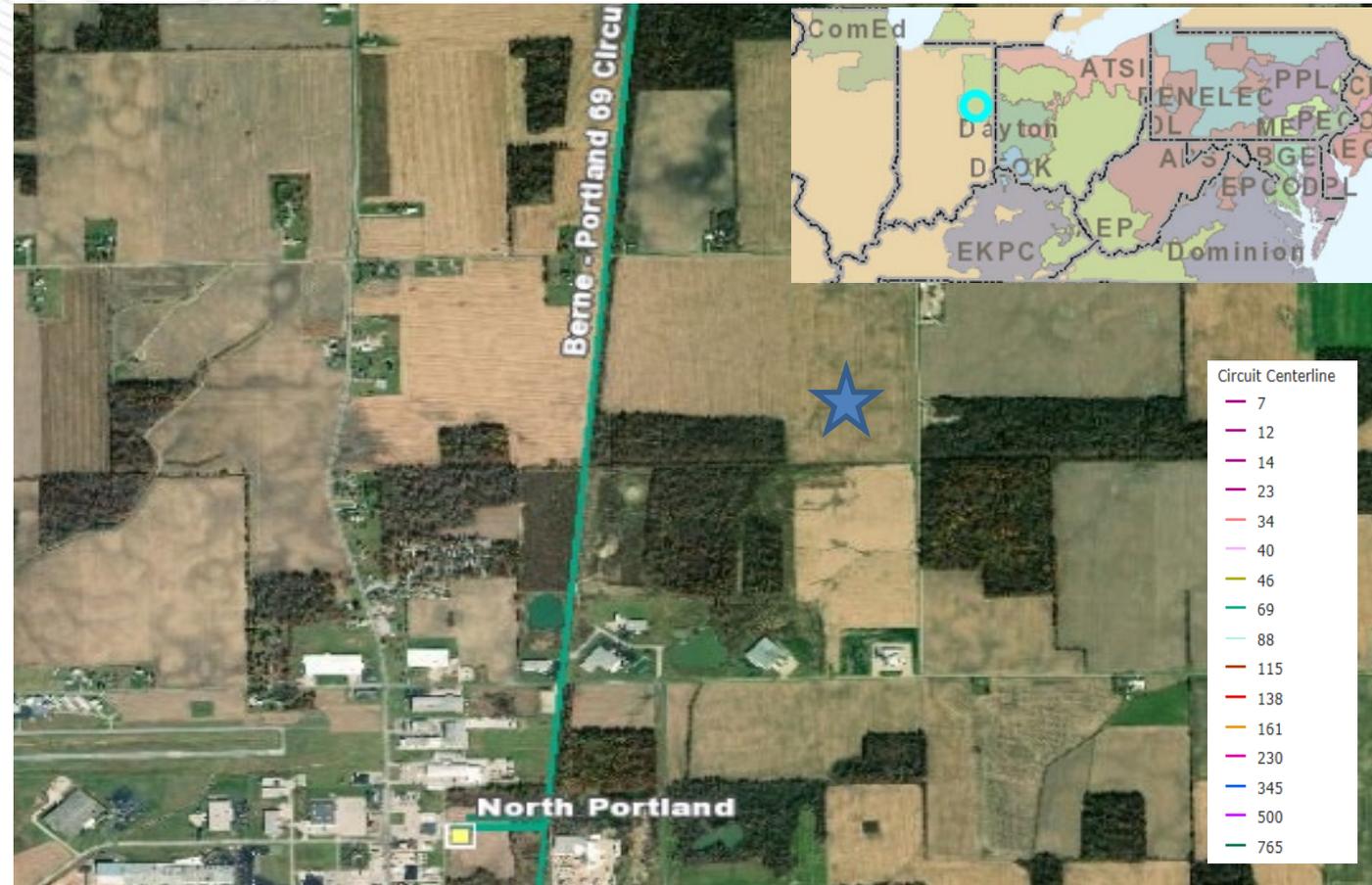
Process Chronology: Needs Meeting 10/26/18

Supplemental Project Driver: Customer Request

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

Problem Statement:

A customer has requested connection of a 2.3MVA load off of the Berne – Portland 69kV line.





AEP Transmission Zone: Supplemental Muncie, Indiana

Need Number: AEP-2018-IM007

Process Stage: Needs Meeting 10/26/18

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:

Medford Station

- Transformer 1 – 1959 Vintage
 - Extremely high values of combustible gasses
 - Overheating faults have occurred within the unit.
 - Interfacial tension and the power factor values are at concerning levels proving the oil quality degradation

- Breakers “A” “B” and “C”
 - 1943-53 vintage FK oil breakers without containment
 - Fault Operations: CB A(53) CB B(27) CB C(21) – Recommended(10)

23rd Street Station

- Breakers “B”, “C”, “D”, “E”, “G”, “J” and “K”
 - 1971 vintage FK oil breakers without containment
 - Fault Operations: CB B(30) CB C(44) CB D(16) CB E(0) CB G(25) CB J(18) CB K(28) – Recommended(10)

Arnold Hogan

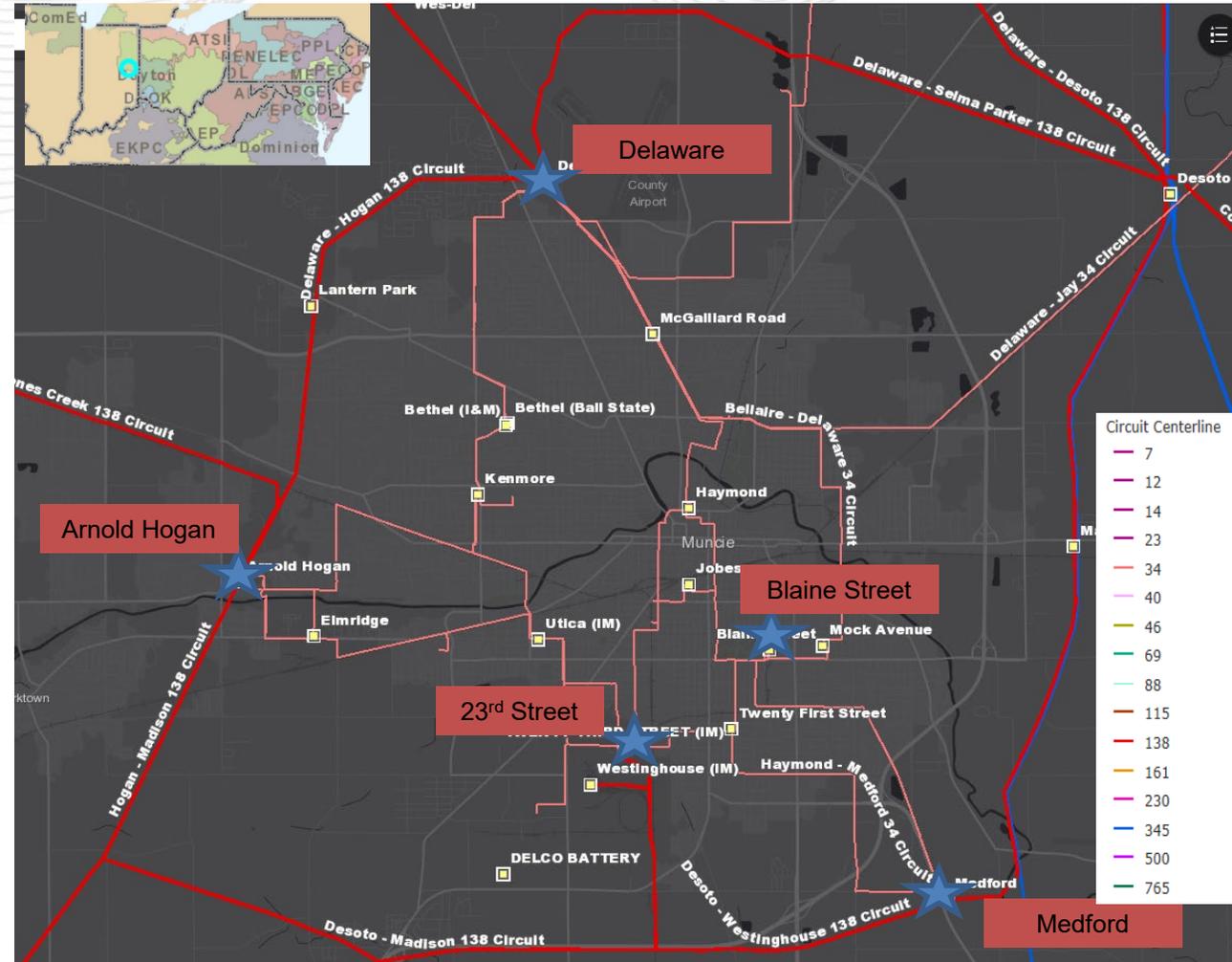
- Distribution XF 2 – 1970 Vintage
 - Experienced a failure in 1999

Blaine Street Station

- Breaker “E”
 - 1970 vintage oil filled FK-breakers without oil containment
 - Fault Operations: CB E(29) – Recommended(10)

Delaware (IM) Station

- Breakers “C”, “H”, “I”, “L”, “M” & “N”
 - 1963-1971 FK oil breakers without oil containment
 - Fault Operations: CB C(6) CB H(27) CB I(50) CB L(164) CB M(57) – Recommended(10) **Moved to AEP-2018-IM020**





AEP Transmission Zone: Supplemental Muncie, Indiana

Need Number: AEP-2018-IM007

Process Stage: Needs Meeting 10/26/18

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:

Arnold Hogan – 23rd Street

- 1963 wood crossarm construction
- 3/0 copper and 4/0 ACSR
- Subject to 20 open A conditions
- Subject to 26 open B conditions
- In the past 10 years, 47 structures have had active maintenance performed. This is expected to increase as line ages.

Delaware – Haymond **Moved to AEP-2018-IM020**

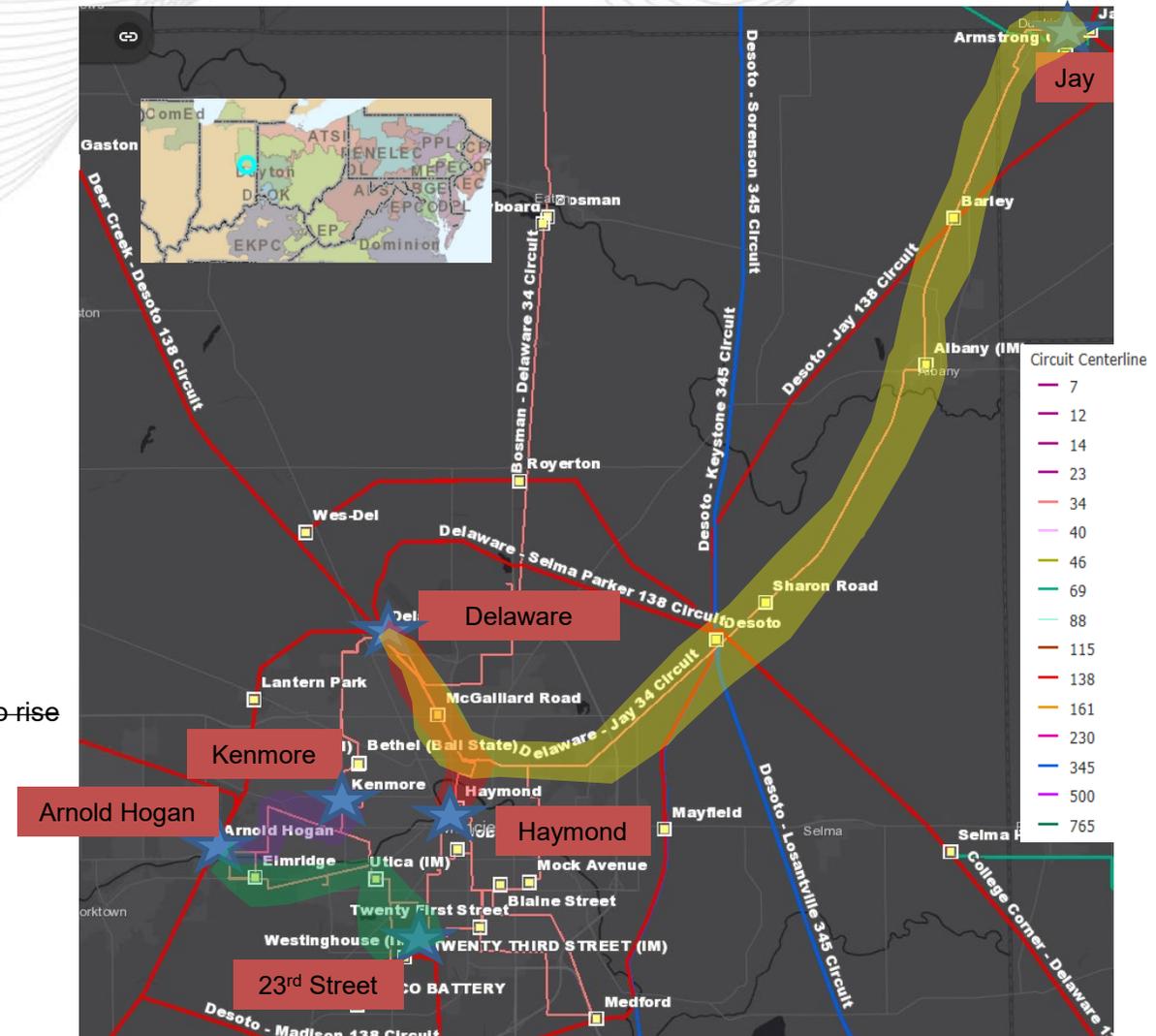
- 1948 wood 5-circuit construction
- 3/0 Copper
- 22 open A conditions
- 13 open B conditions

Delaware – Jay **Moved to AEP-2018-IM020**

- 1920's Vintage wood crossarm construction
- 1/0 Copper conductor
- 100 structures had to undergo active maintenance in the last 10 years and this trend is expected to rise as the line ages.
- 55 open A conditions
- 33 open B conditions
- 556,661 CMI

Arnold Hogan – Kenmore **Moved to AEP-2018-IM021**

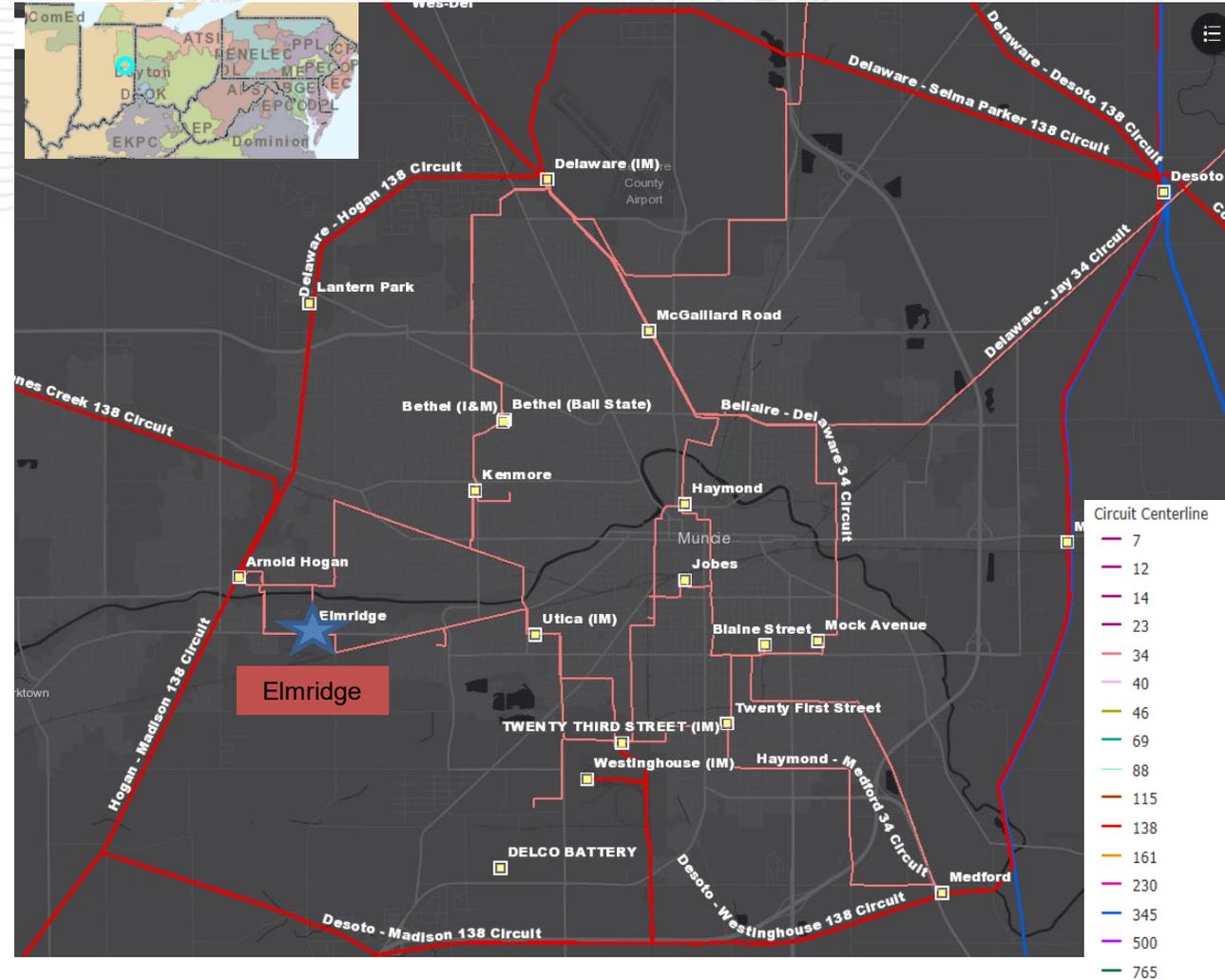
- 1930's and 1960's vintage construction
- 3/0 copper and 336.4 ACSR conductor
- 15 of the 47 structures had to undergo active maintenance in the last 10 years and this trend is expected to rise as the line ages.
- Majority of current and past maintenance concerns relate to integrity of structures and crossarms





AEP Transmission Zone: Supplemental Muncie, Indiana

Need Number: AEP-2018-IM007
Process Stage: Needs Meeting 10/26/18
Process Chronology: Needs Meeting 10/26/18
Supplemental Project Driver: Operational Flexibility and Efficiency
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)
Problem Statement:
 Elmridge Tap
 • 3 terminal line outside of Elmridge Station.





AEP Transmission Zone: Supplemental Muncie, Indiana

Need Number: AEP-2018-IM007

Process Stage: Needs Meeting 10/26/18

Process Chronology: Needs Meeting 10/26/18

Supplemental Project Driver: Customer Service

Specific Assumptions Reference: Obligation to serve

Problem Statement:

Arnold Hogan Station

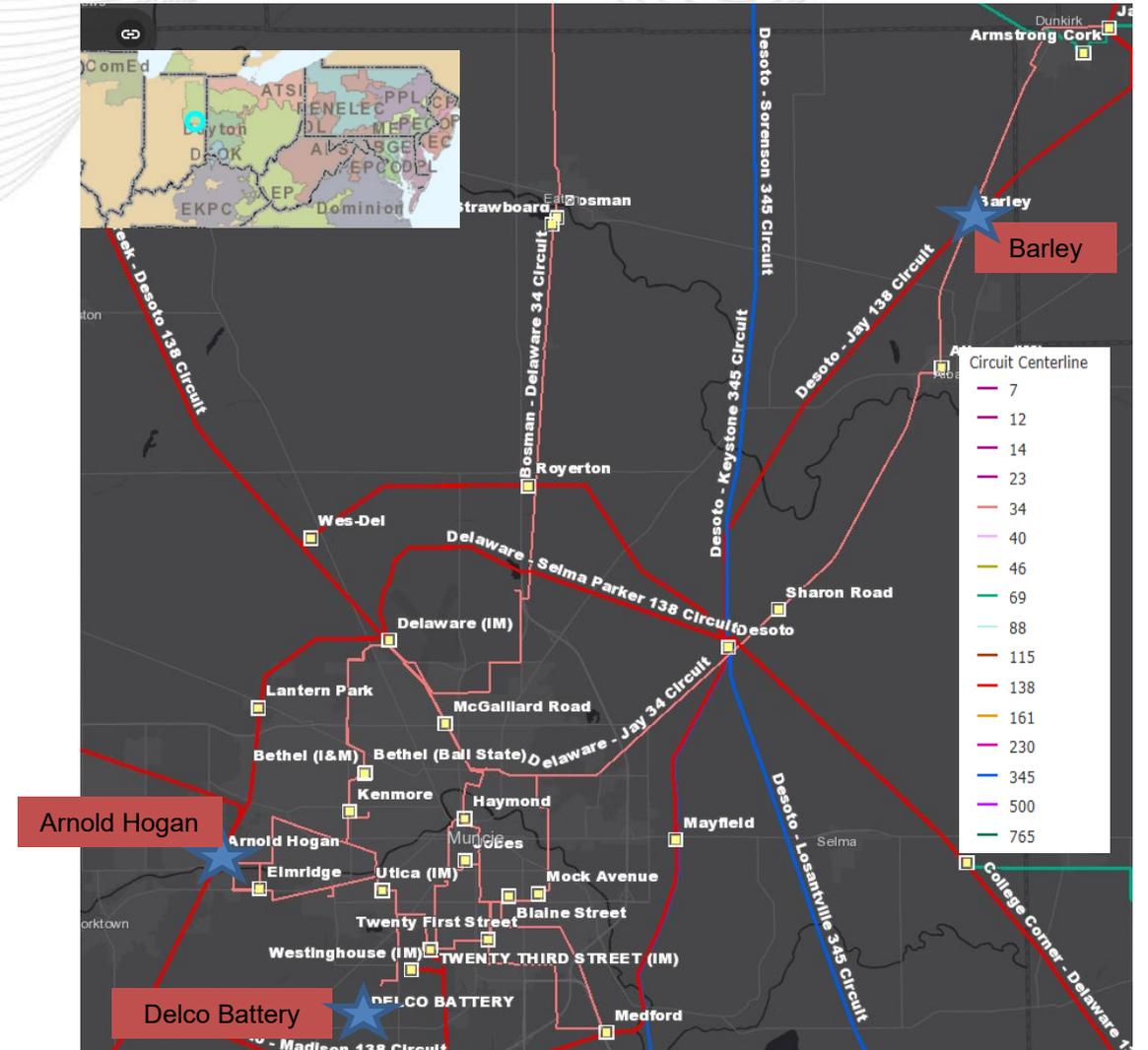
- AEP Distribution has requested a new delivery point at Arnold Hogan Station

Delco Battery Site

- AEP Distribution has requested a new delivery point at the old Delco site to facilitate the industrial load pocket
- Transmission has received multiple customer requests at the industrial park near Delco Battery Site

~~Barley Station~~ **Moved to AEP-2018-IM020**

- AEP Distribution has requested a new delivery point off of the 138kV line near Barley station.



Need Number: AEP-2018-IM008

Process Stage: Needs Meeting 10/26/18

Process Chronology: Needs Meeting 10/26/18

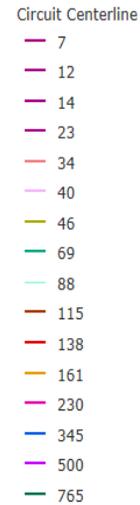
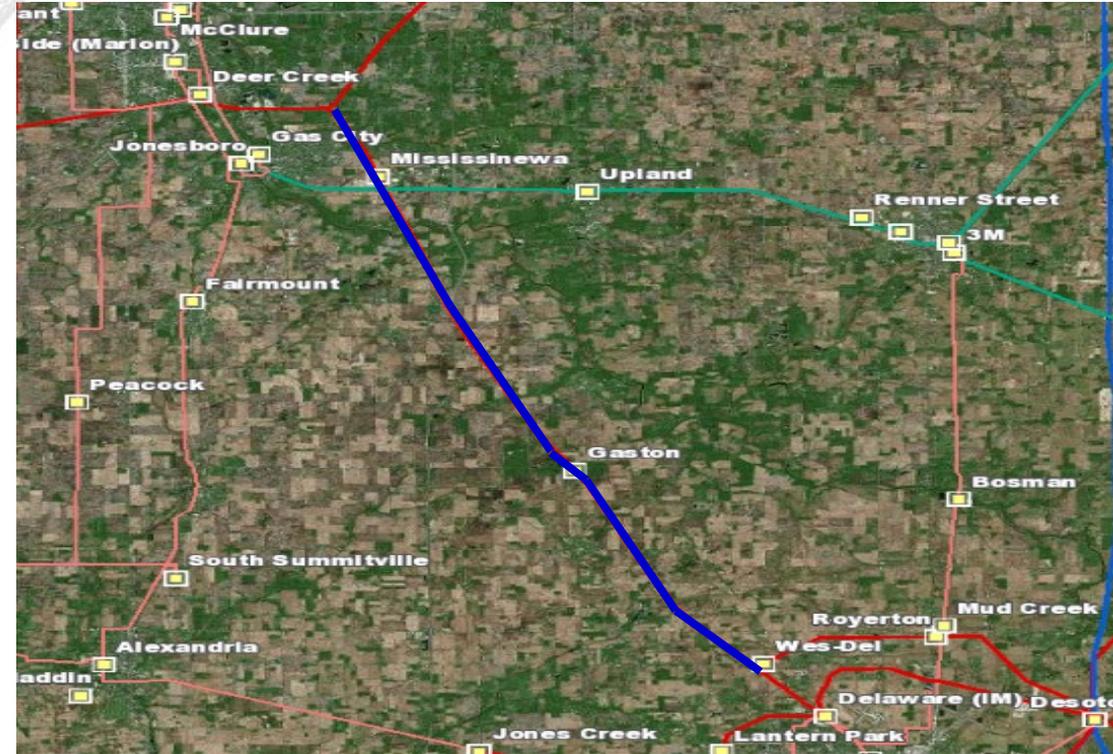
Supplemental Project Driver: Equipment Condition/Performance/Risk

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

Problem Statement:

Portions of Deer Creek – Delaware

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



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AEP Transmission Zone: Supplemental Elwood, Indiana Area

Need Number: AEP-2018-IM010
Process Stage: Needs Meeting 10/26/18
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:

- Jonesboro – South Summitville
- 1930's wood crossarm construction
 - #2 copper
 - Over the past 10 years this line has had 128 structures require active maintenance with the majority being wood rot. This trend is expected to increase as the line ages.
 - 68 structures currently have an open condition

- South Elwood
- Breaker "C"
 - 1951 FK oil type with no oil containment
 - Fault Operations: CB C(19) – Recommended (10)
 - Transformer 1 – 1955 vintage
 - Type O Westinghouse bushings
 - Increasing power factor
 - Increasing Carbon Monoxide
 - Failed internal heater circuit.
 - Physically obstructs other station assets.

- Fairmount
- Breakers "A" and "B"
 - Fault Operations: A(75) B(99) – Recommended(10)
 - Transformer 1 – 1972 vintage
 - High Carbon Dioxide level
 - Dielectric issues

- Peacock
- Breaker "A"
 - 1969 PR Oil breaker without containment
 - Fault Operations: A(154) – Recommended(10)
 - Transformer 1 – 1951 Vintage
 - High levels of Ethane, Methane, and CO2.
 - Increasing Insulation power factor.



Need Number: AEP-2018-IM010

Process Stage: Needs Meeting 10/26/18

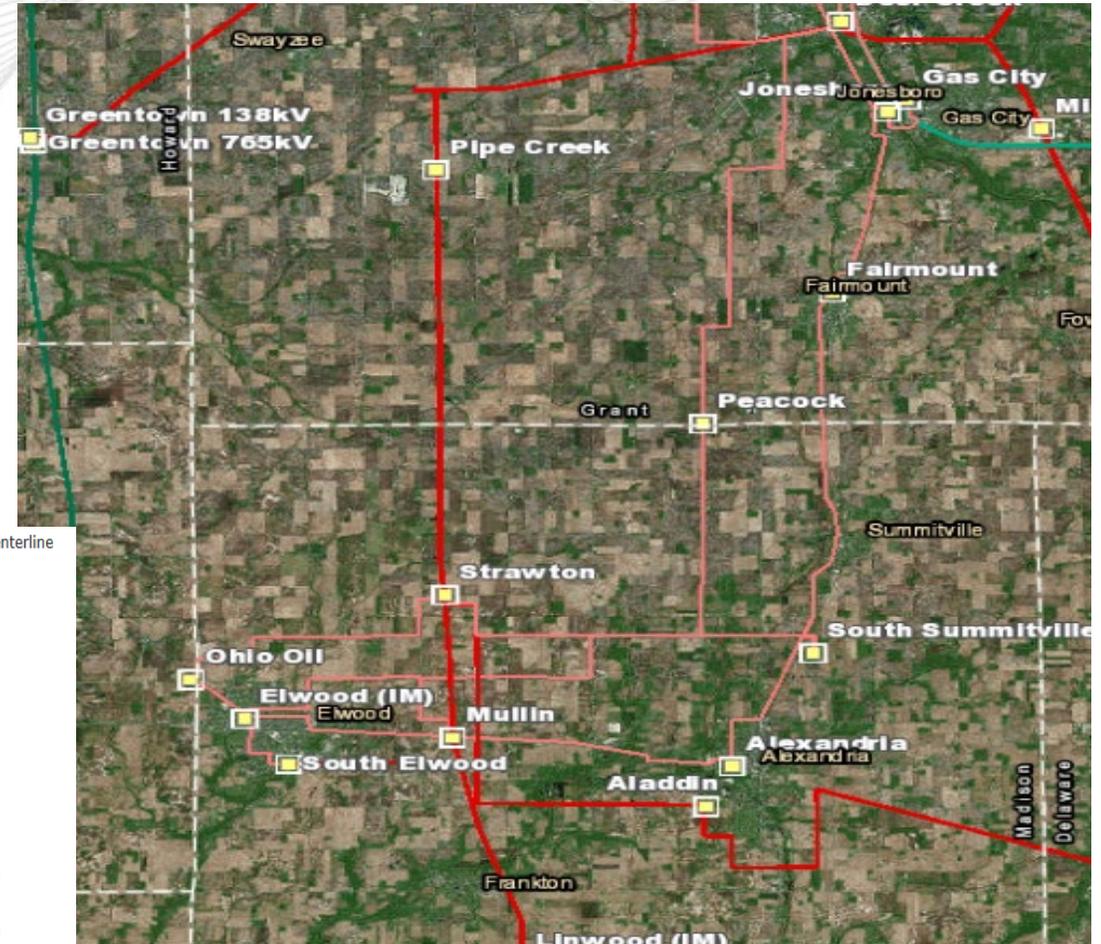
Process Chronology: Needs Meeting 10/26/18

Supplemental Project Driver: Customer Service/Operational Flexibility & Efficiency

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

Problem Statement:

- Both AEP Transmission and AEP distribution have received multiple inquiries about future economic development in the area around South Summitville.
- The current system would require significant rework in order to facilitate these requests, and the timeline for those fixes are not conducive to customer timelines.
- The 34.5kV system is subject to “Drop and Pick” operating procedure due to being out of phase with the 138 kV system. This operating procedure has been an issue for I&M Distribution operations as it results in less reliable service for the customer and causes outages that could otherwise be avoided.



Need Number: AEP-2018-IM012

Meeting Date: Needs Meeting 10/26/18

Process Stage: Needs Meeting 10/26/18

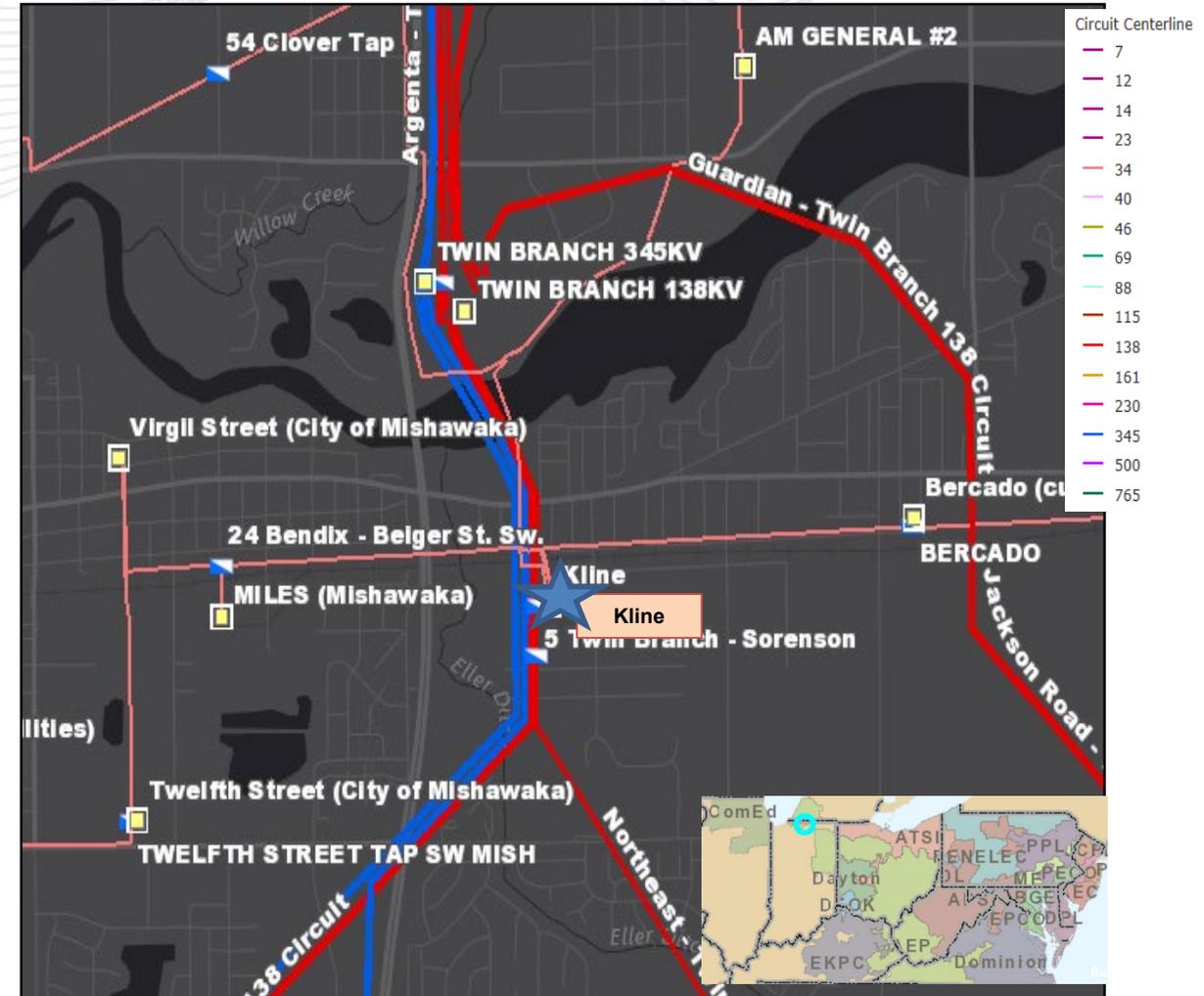
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

Kline Station

- Transformer #1 138/34.5kV
 - 1978 vintage
 - High levels of Carbon Dioxide
 - Interfacial tension is below the acceptable limit
 - Oil is severely aged
 - Accelerating aging of insulation
 - Transformer rusted due to leaking issues
 - Cooling system does not work due to failed fuse box.
- Circuit Breakers A, B and C
 - Vintage 1968
 - GE FK type oil-filled breakers – without oil containment
 - Fault operations: CB A(95), CB B(28) & CB C(15) – Recommended (10)
 - Bushing Problem
 - Unavailability of spare parts
 - High moisture reading
- Cap Switcher AA
 - 1989 vintage
 - Mark V type
 - Doesn't coordinate with AEP's standard relaying package



Need Number: AEP-2018-IM012

Meeting Date: Needs Meeting 10/26/18

Process Stage: Needs Meeting 10/26/18

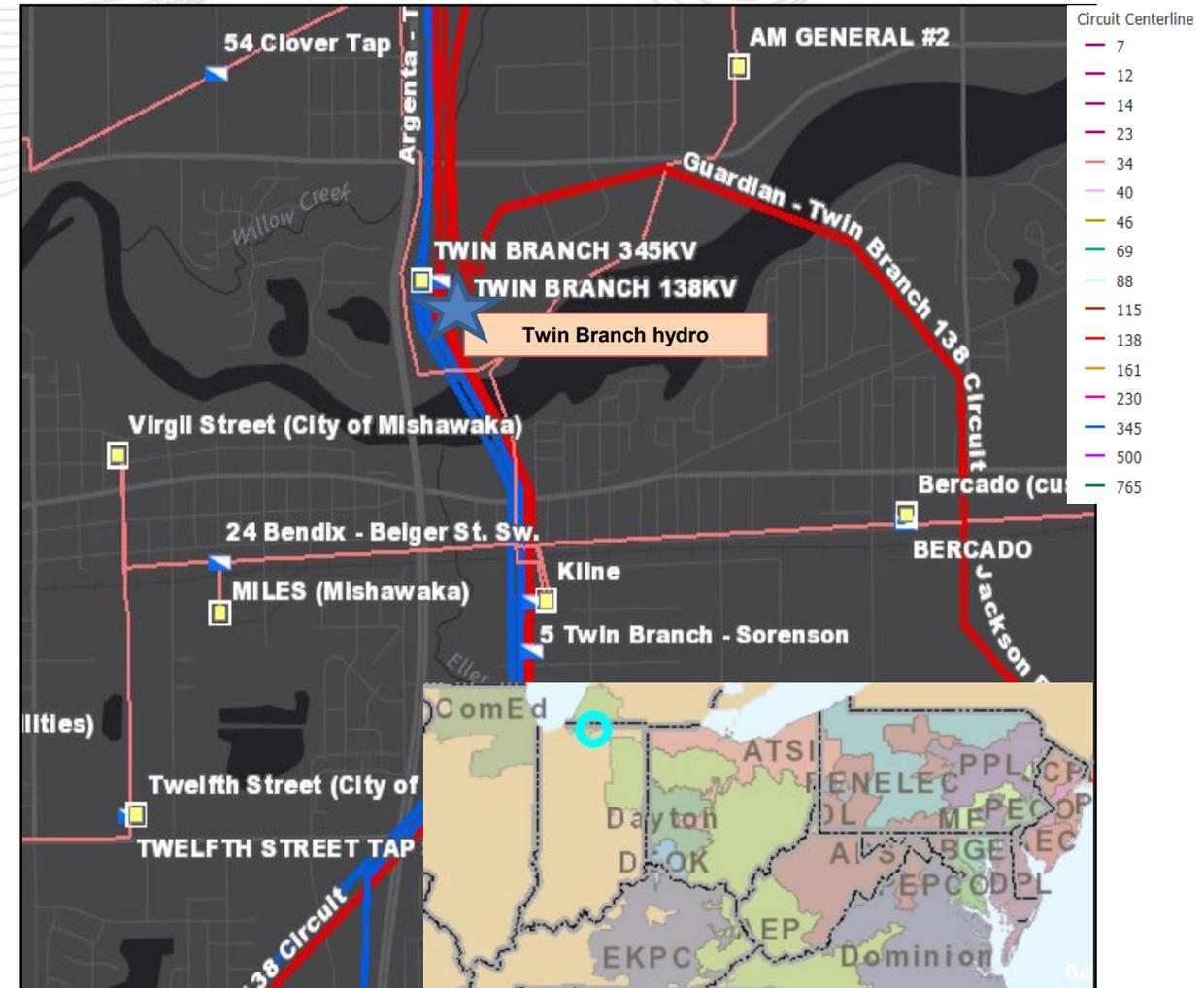
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

Twin Branch Hydro Station

- Transformer #4 34.5/4kV
 - 1947 vintage
 - Interfacial tension is below the acceptable limit
 - Oil is severely aged
- Circuit Breakers BB, DD & NN 34.5kV
 - Vintage 1950
 - GE FK type oil-filled breakers – without oil containment
 - Fault operations: CB BB(5), CB DD(18) & CB NN(6) – Recommended (10)
 - Bushing Problem
 - Unavailability of spare parts
 - High moisture reading
- Circuit Breaker CC 34.5kV
 - 1996 vintage
 - Fault operations: CB CC(88) – Recommended (10)
 - Main tank has moisture leaks cause SF6 contamination



Need Number: AEP-2018-IM014

Meeting Date: Needs Meeting 10/26/18

Process Stage: Needs Meeting 10/26/18

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

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

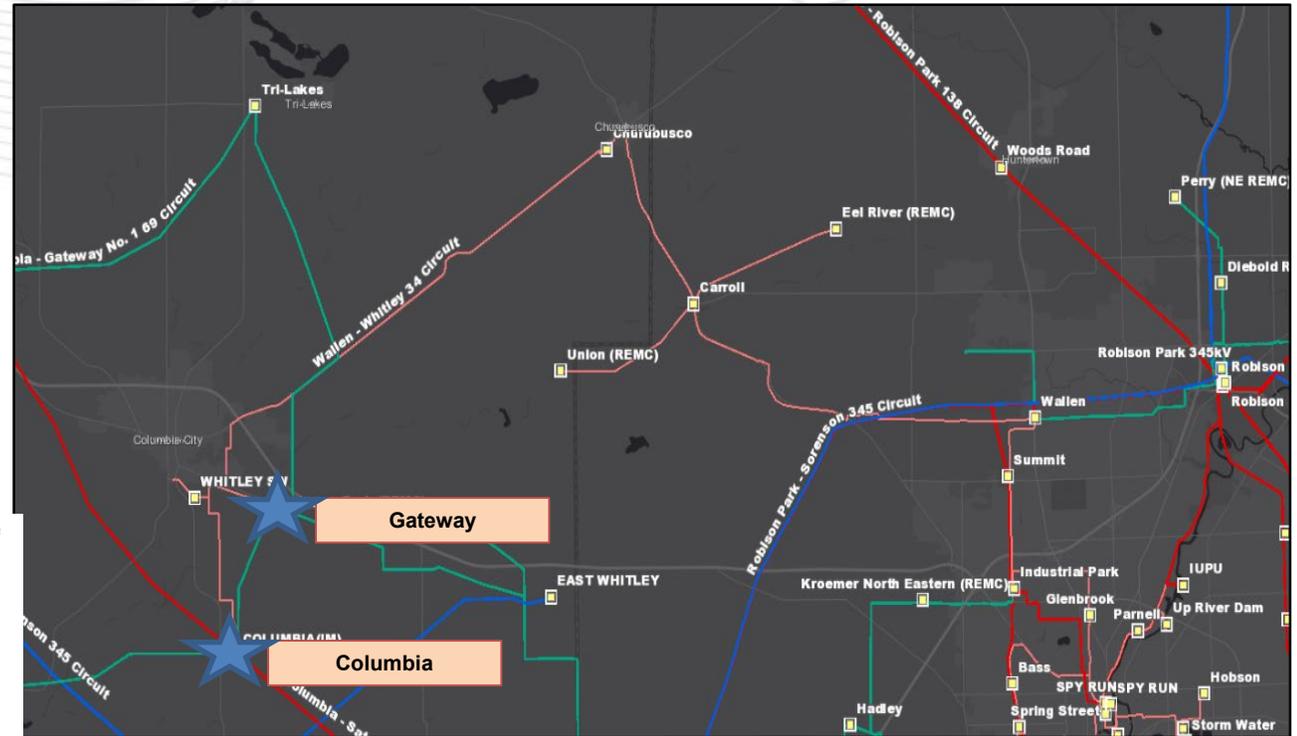
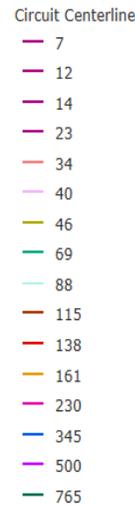
Problem Statement:

Columbia Station

- Circuit Breakers J 69kV
 - Vintage 1968
 - GE FKA type oil-filled breakers – without oil containment
 - Fault operations: CB A(95) – Recommended (10)
 - Trip coil failure
 - Spring charging motor failure

Gateway Station

- Circuit Breaker E 69kV
 - 1975 vintage
 - GE FKA type oil-filled breakers – without oil containment
 - Fault operations: CB E(49) – Recommended (10)
 - Three documented instances of breaker failing to close



Need Number: AEP-2018-IM014

Meeting Date: Needs Meeting 10/26/18

Process Stage: Needs Meeting 10/26/18

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

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

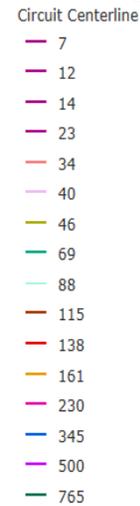
Problem Statement:

Wallen-Whitley 34.5 kV circuit

- 1945 vintage wood pole construction
- Total Structures – 689
- Total Open Conditions – 124
- Customer Outage Minutes – 613,727
- Insect Damage, Rotten Poles, Broken/Burnt cross-arm, Woodpecker holes, broken/burnt insulators and stolen/broken ground wires

Gateway-Whitley 34.5 kV circuit

- 1965 vintage wood pole construction
- Total Structures – 37
- Total Open Conditions – 11
- Broken Strands, Split Cross-arm, Rotten Poles and Broken Insulators.



Need Number: AEP-2018-IM014

Meeting Date: Needs Meeting 10/26/18

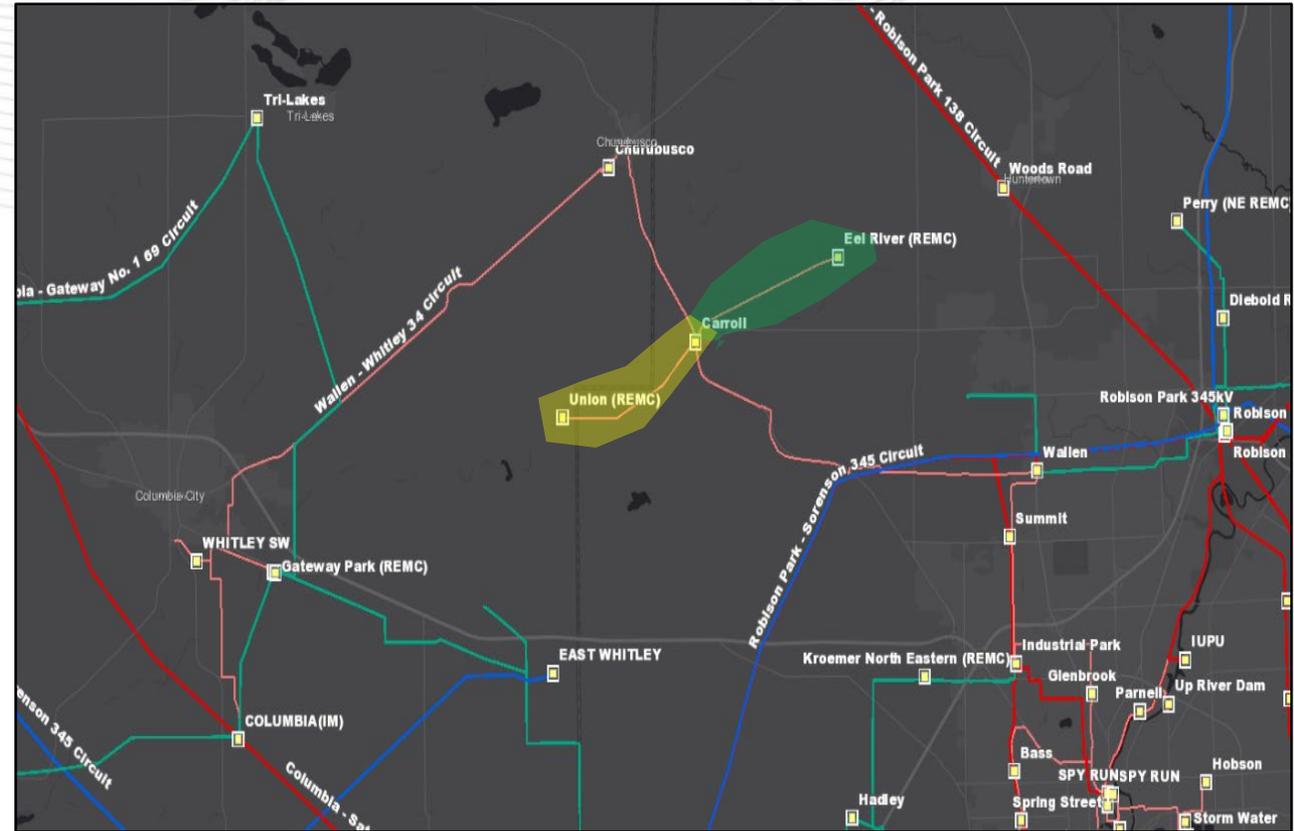
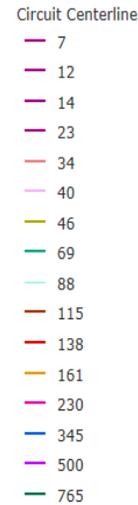
Process Stage: Needs Meeting 10/26/18

Supplemental Project Driver: Operational Flexibility and Efficiency

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

Problem Statement:

Currently, two delivery points to Northeastern REMC (Eel River and Union Stations) are served radially out of Carroll Station by two separate 4 mile 34.5 kV radial lines, leaving each delivery point susceptible to single event outages.



Need Number: AEP-2018-AP001

Process Stage: Needs Meeting 10/26/18

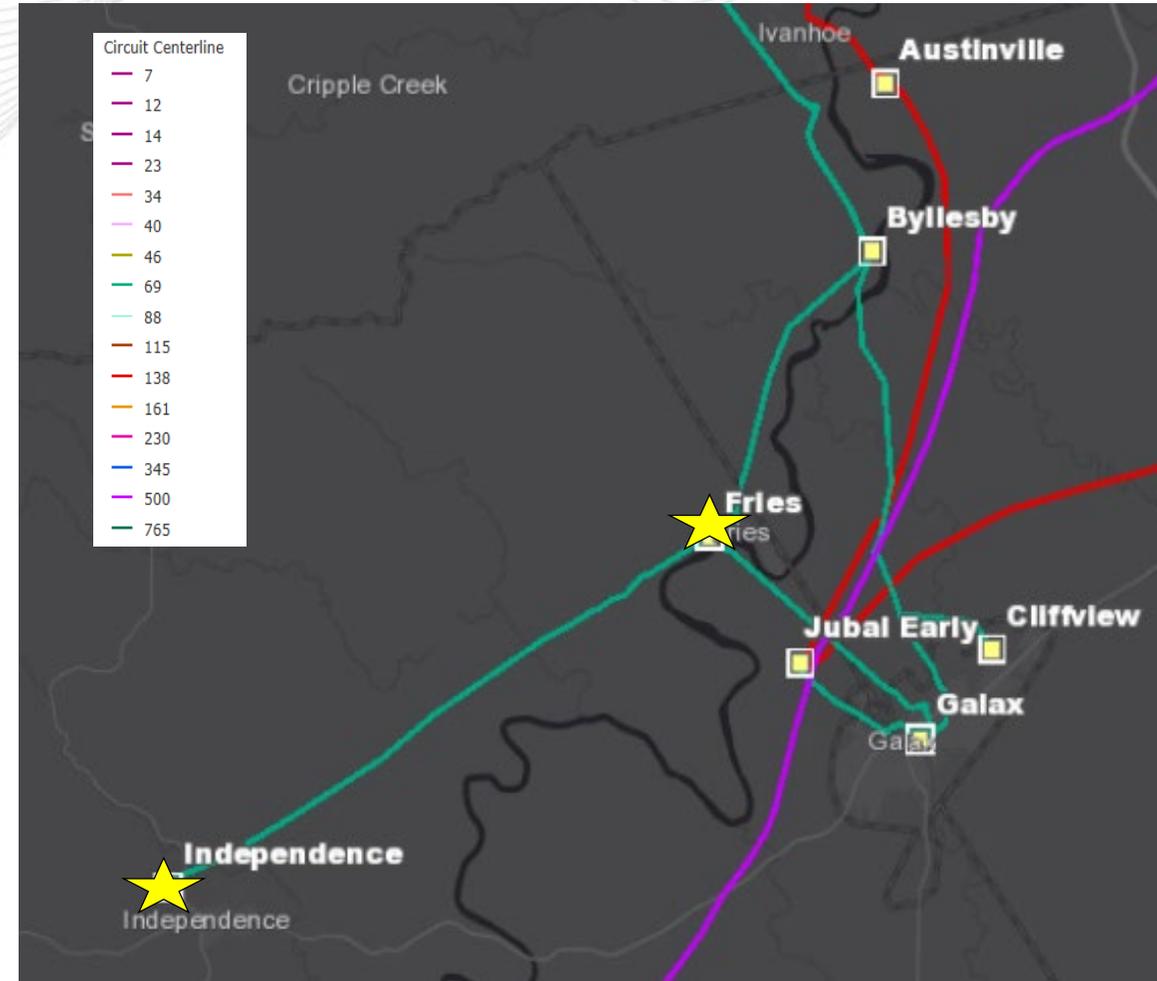
Process Chronology: Needs Meeting 10/26/18

Supplemental Project Driver: Equipment Condition/Performance/Risk

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

Problem Statement:

The Fries – Independence 69kV line is an 11 mile long radial line and maintenance cannot be performed due to a lack of outages available on the line. Approximately 20 MVA is served out of Independence during winter peak conditions and is dropped for outages on this circuit. From 2013-2018, the Fries – Independence 69 kV circuit has experienced 5 permanent outages and 4 momentary outages, resulting in approximately 5.7M customer minutes interrupted. Fries – Independence 69 kV line has 23 open conditions associated with the structures that make up the line. Conditions include woodpecker damage and rot top. Majority of the circuit utilizes 1950s wood structures



Need Number: AEP-2018-AP002

Process Stage: Needs Meeting 10/26/18

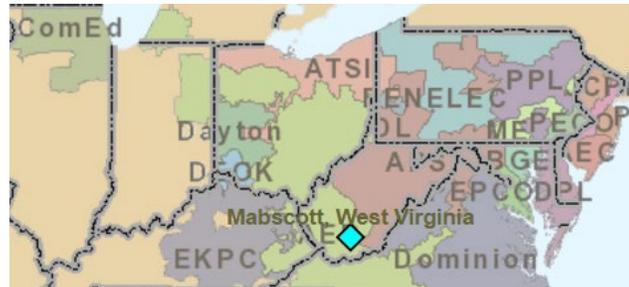
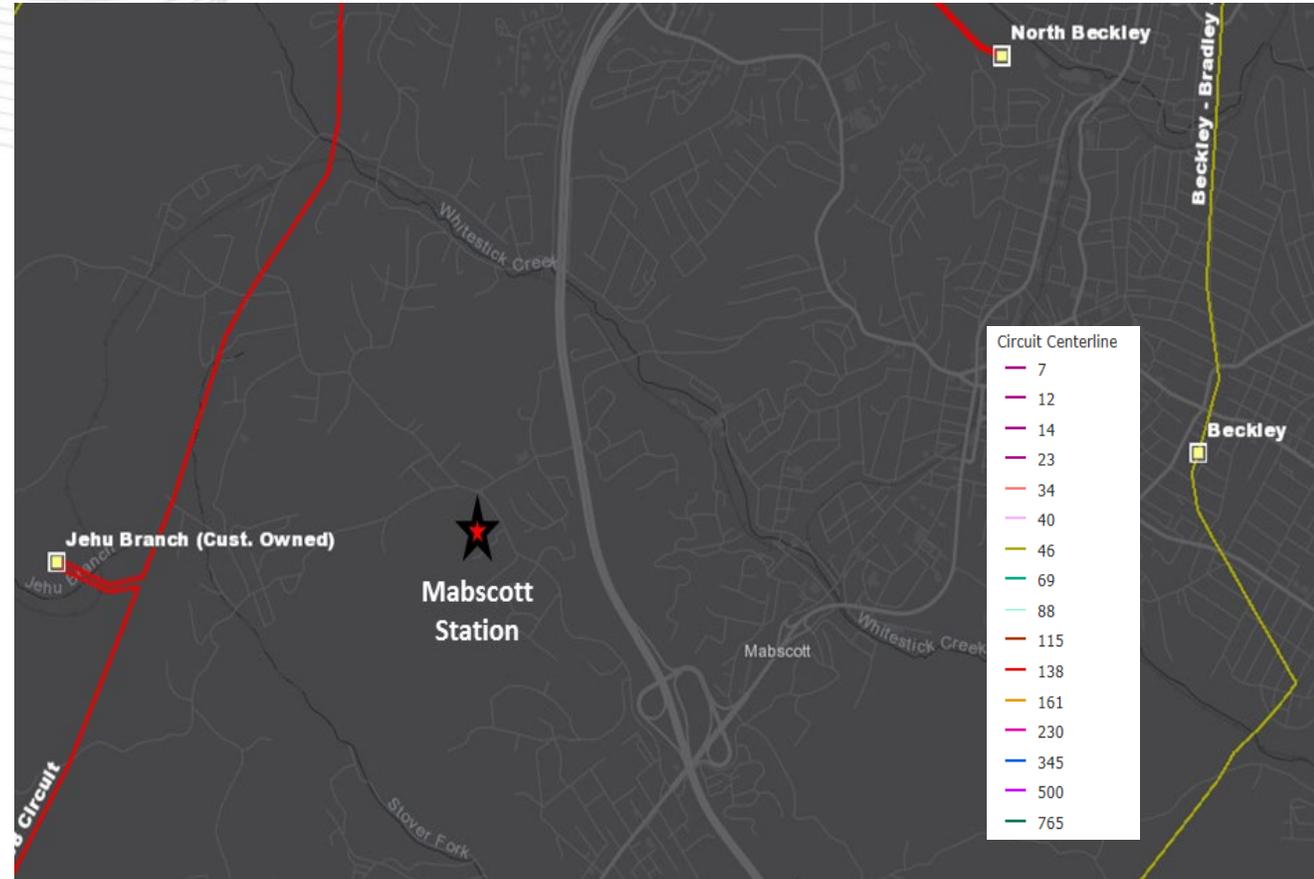
Process Chronology: Needs Meeting 10/26/18

Supplemental Project Driver: Customer Service

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

Problem Statement:

APCO Distribution has requested a new distribution station located in Mabscott, West Virginia. Winter projected load 15 MVA.



Need Number: AEP-2018-AP003

Process Stage: Needs Meeting 10/26/18

Process Chronology: Needs Meeting 10/26/18

Supplemental Project Driver: Equipment Condition/Performance/Risk

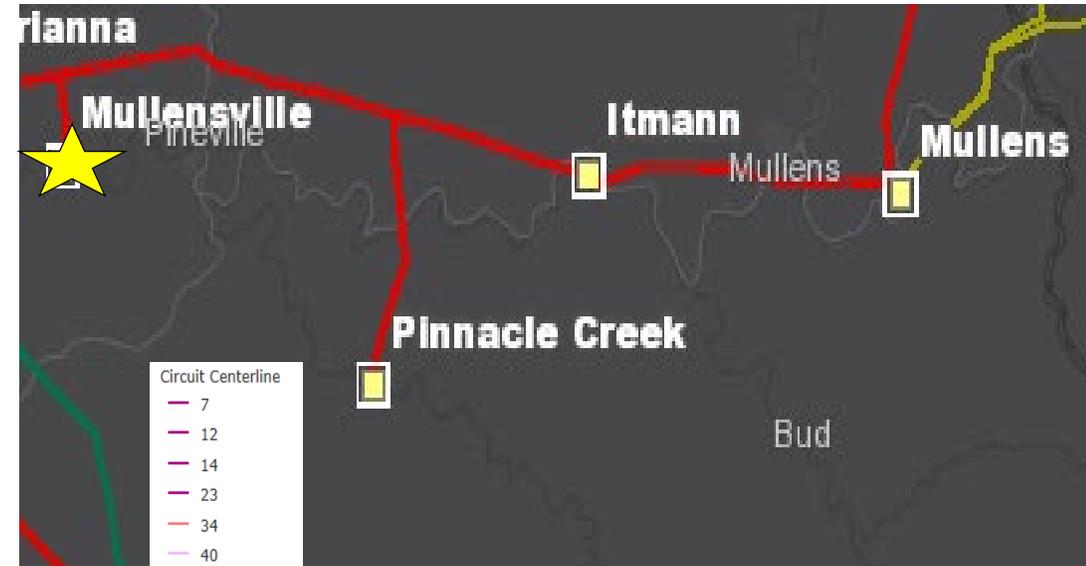
Specific Assumption References: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

The need to address Mullensville transformer #1 is driven by the short circuit strength breakdown caused by the amount of electrical discharges of high energy has led to rising gas levels in the tank oil and carbonization of the insulating paper. Acetylene is at IEEE Condition 3 and Ethylene is at IEEE Condition 2 per the latest DGA readings in 2018 which contributes to poor dielectric strength. The rising presence of these hot metal gasses can be caused by poor connections, shorted turns, broken winding strands, or inadvertent core grounding from damage to the core ground insulation during through faults events; all of these are indicative of circulating currents in the core resulting in hotspots of the core and surrounding internal components. High energy discharges can be caused by flashovers, tracking or arcing, or short circuits between a number of internal components.

In addition to the 2018 compressor failure on CB A, IPS malfunction records indicate that the compressor motor burnt up in 2008 and failed again in 2009. There are only 13 of these FK-69-1500-3 types on the AEP system, making replacement parts difficult or impossible to obtain. This oil filled breaker has no oil containment and requires O&M costs to maintain the unit's oil that similar SF6 type breakers do not require.

The Ground-Switch MOAB on the high side of the 138/46 kV transformer at Mullensville are obsolete and create an overlap in the zones of protection.



Need Number: AEP-2018-AP004

Process Stage: Needs Meeting 10/26/18

Process Chronology: Needs Meeting 10/26/18

Supplemental Project Driver: Equipment Condition/Performance/Risk

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

Problem Statement:

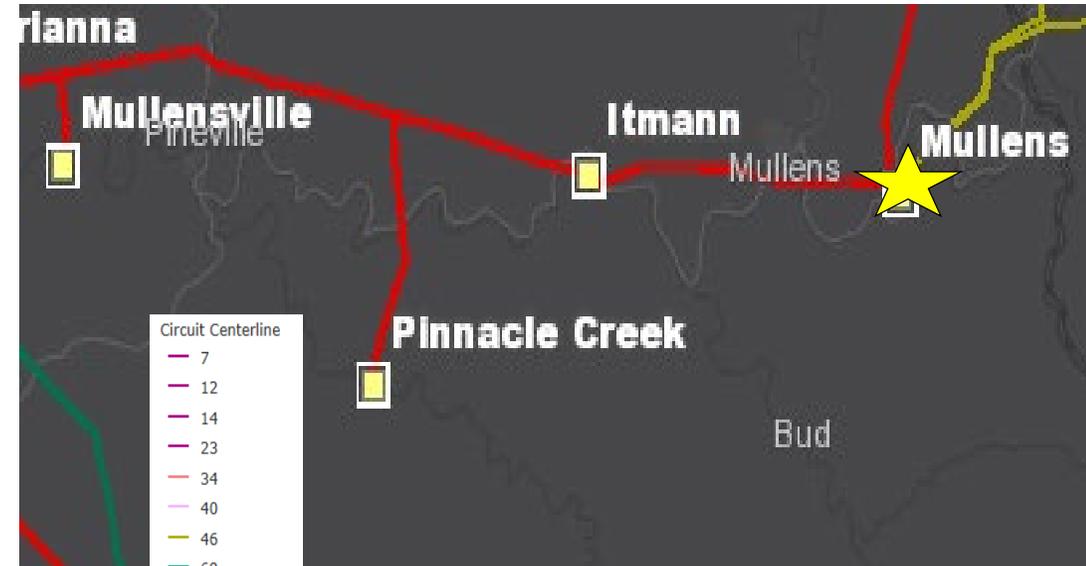
The need to address Mullens transformer #4 is driven by the short circuit strength breakdown caused by the amount of high energy electrical through fault events, and major upward trending gassing of the unit. Numerous gases are at the IEEE level 2 condition level with acetylene and ethylene being at the highest condition level 4, which negatively impacts the oil dielectric. Acetylene has been at or above this threshold since October 2012, and ethylene has generally been at or above this threshold since August 2014. 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. The low side bushings are trending near the .5 power factor level. There is a bad fan on transformer #4, on the bottom of cooling group 2.

The need to address Mullens transformer #3 grounding bank is driven by an upward trending of oil moisture content resulting in downward trending to the oil dielectric strength. Increasing moisture content is a resultant of water ingress and/or break down of paper insulation of TF windings. The moisture content has since decreased with little improvement to the dielectric strength. Short circuit strength breakdown caused by the amount of thermal through fault events, mostly in the 300°C to 700°C range, has lead to minor gassing of the unit, the CO/CO2 ratio being consistently above the warning level, and carbonization of the insulating paper. All of this indicates that the transformer is near the end of its useful life.

The 13.2kV CBs R & S at Mullens Substation are oil filled breakers without oil containment. These breakers have significantly exceeded the designed number of fault operations.

The Ground-Switch MOABs on the high side of the 138/46 kV transformer and the 138/34.5 kV transformer at Mullens are obsolete and create an overlap in the zones of protection.

Mullens Substation currently deploys 74 relays, implemented to ensure the adequate protection and operation of the substation. Currently, 63 of the 74 relays (85% of all station relays) are of the electromechanical type which have significant limitations with regards to fault data collection and retention.



Need Number: AEP-2018-AP005

Process Stage: Needs Meeting 10/26/18

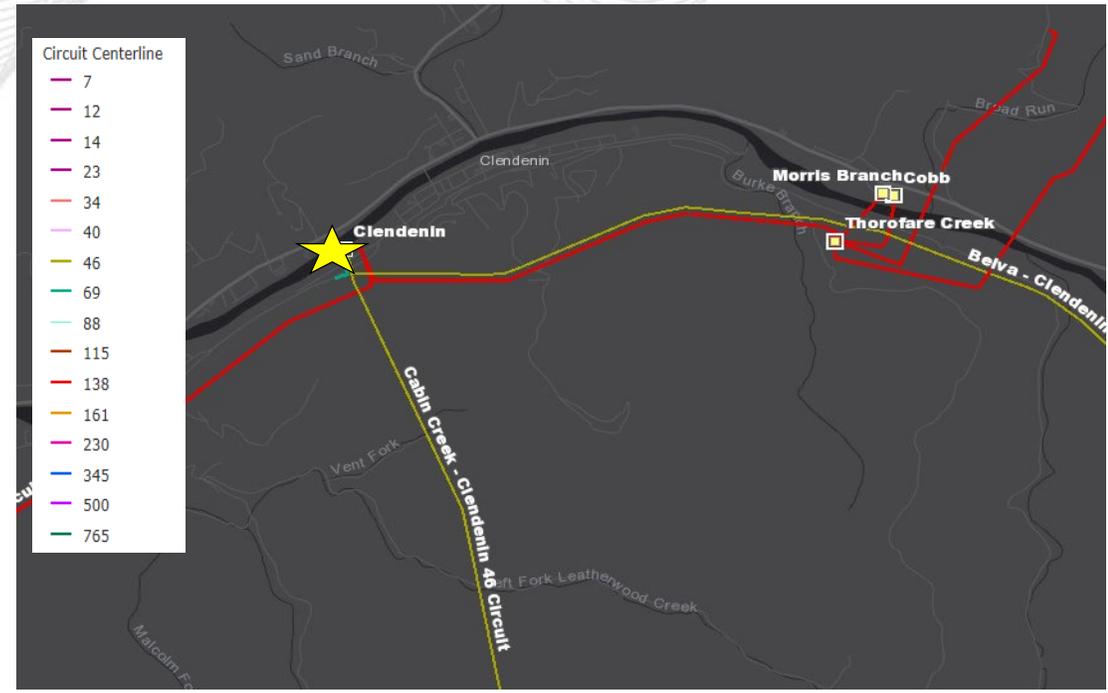
Process Chronology: Needs Meeting 10/26/18

Supplemental Project Driver: Equipment Condition/Performance/Risk

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

Problem Statement:

On Thursday, June 23, 2016, sustained heavy rain caused severe flooding along the Elk River in West Virginia. The flood waters engulfed much of the town of Clendenin, including Clendenin Station, which sustained significant damage. Clendenin station lies well under the FEMA 100 year flood plain.



Need Number: AEP-2018-AP006

Process Stage: Needs Meeting 10/26/18

Process Chronology: Needs Meeting 10/26/18

Supplemental Project Driver: Equipment Condition/Performance/Risk

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

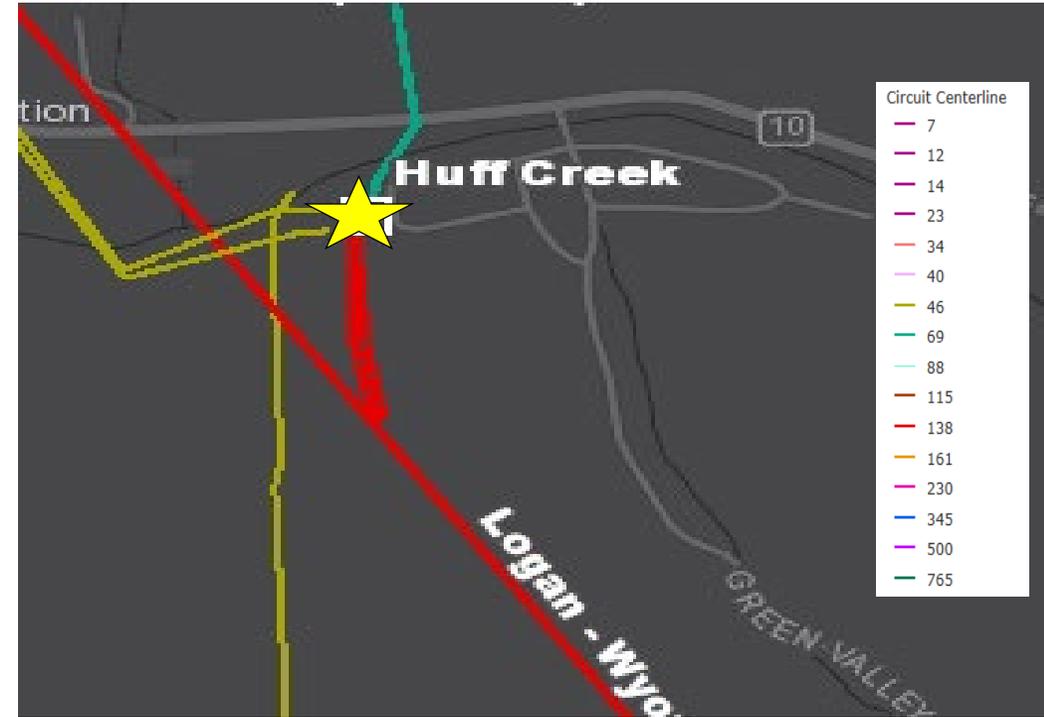
Problem Statement:

The need to address Huff Creek transformer #1 is driven by the oil's interfacial tension, which has been consistently below 30 mN/m (the acceptable limit for this voltage class). This is an indication of sludge beginning to form from oil contaminants, which will lead to accelerated aging of the unit; the sludge will impair oil circulation and lead to more frequent overheating. In addition, the moisture content and CO levels have begun a rapid increase over the past four years. CO is now at IEEE Condition 2 and dielectric strength is trending down. The presence of increased CO and moisture levels occurring over the same span of time is indicative of the cellulose breakdown from the insulating paper; this increases the risk of future shorts in the windings due to decreased insulating material.

The need to address Huff Creek ground transformer #2 is driven by Thermal through fault events, mostly in excess of 700°C, have led to, steady increases in gasses including the now IEEE Condition 3 levels of ethylene in PH A, IEEE Condition 2 levels of carbon monoxide in PH A, methane in PH B, and ethylene and methane in PH C. These faults have also generated carbonization of the insulating paper. In addition, all phases have seen sustained and elevated moisture levels which has resulted in low and decreasing dielectric strength.

The 69kV circuit breaker D is an FK type oil filled circuit breaker with no oil containment. Oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require. Circuit breaker D is 1 of the 13 remaining FK-69-1500-3 model family remaining on the AEP system. This circuit breaker family is no longer supported by their original vendor and spare parts are scarce to non-existent. In addition, CB D has seen at least 148 faults; based on the maximum fault current levels available for this circuit breaker location, it has likely exceeded the manufactured life expectancy of cumulative fault current, 113kA.

Huff Creek Substation currently deploys 74 relays, implemented to ensure the adequate protection and operation of the substation. Currently, all 74 (100% of all station relays) are in need of replacement. There are 60 of the electromechanical and 4 of the static type which have significant limitations with regards to spare part availability and fault data collection and retention in addition to a lack of vendor support. The remaining 10 microprocessor relays were commissioned in 1997 and 2007; the warranties are now expired and the firmware is no longer supported by the vendor. There appears to be little available panel space in the existing control house.



Need Number: AEP-2018-AP007

Process Stage: Needs Meeting 10/26/18

Process Chronology: Needs Meeting 10/26/18

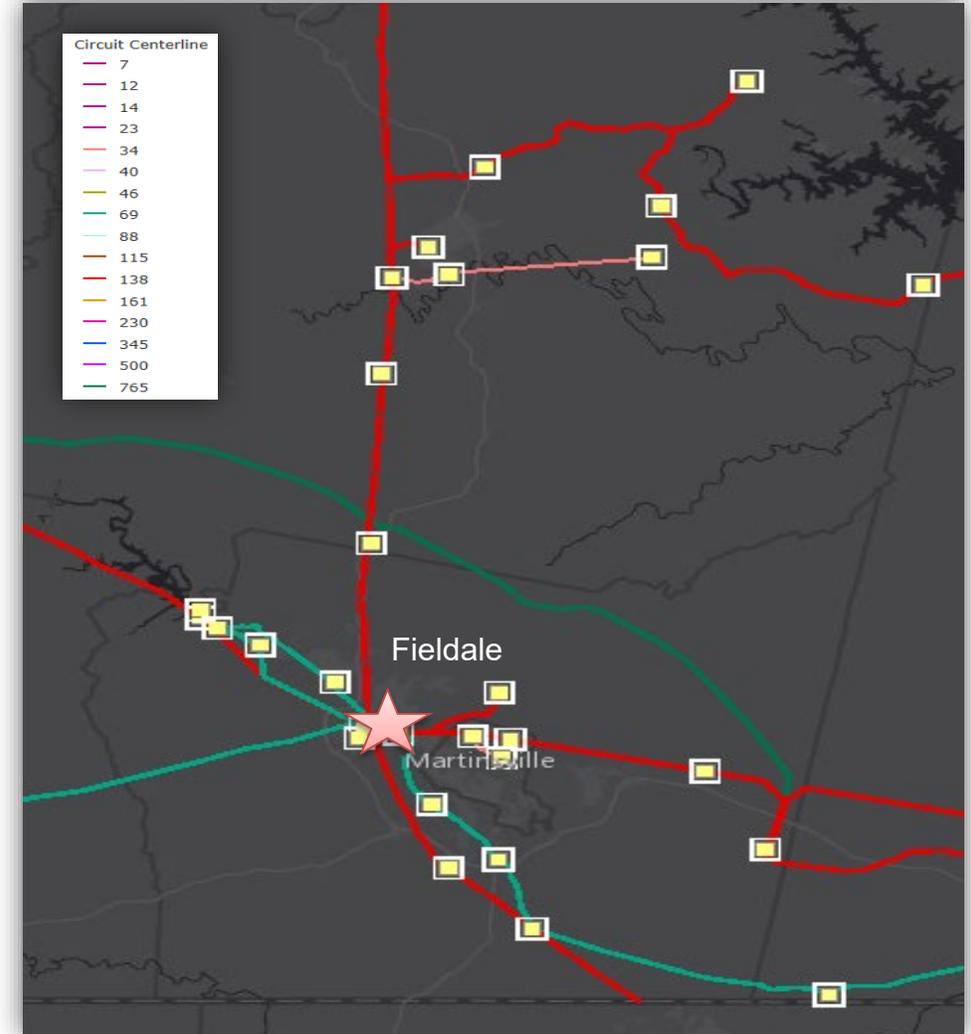
Supplemental Project Driver: Equipment Condition/Performance/Risk

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

Problem Statement:

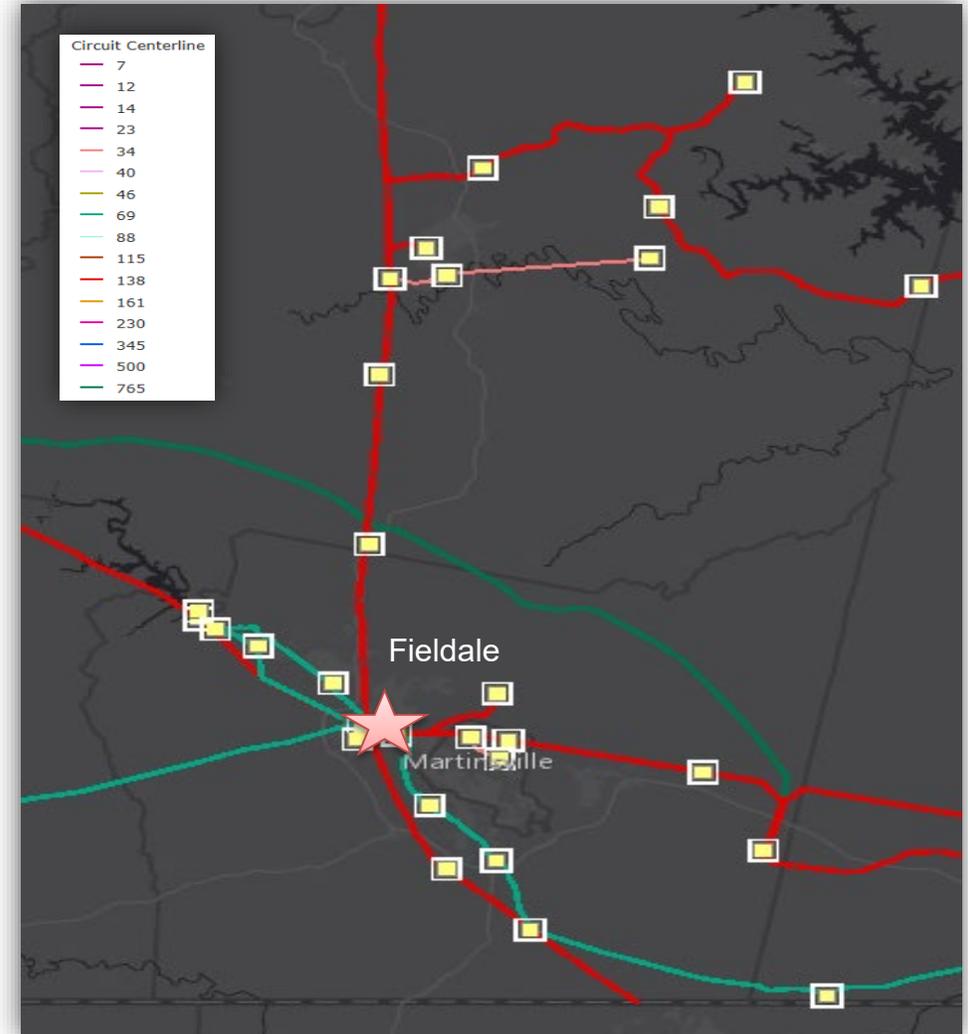
Fieldale Station: Circuit breakers “J” (recently failed), “T” (39 operations), and “F” (15 operations) are FK type oil breakers. The drivers for replacement are age, bushing damage, no repair part availability and PCB (polychlorinated biphenyl) content. PCB was used as coolant and lubricant in electrical equipment because of their insulation capabilities. Their manufacturing was stopped in 1977 because of evidence of environment issues and harmful health effects. 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. 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 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 coming out of Fieldale still 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. Consequently, we are avoiding like-kind replacement of pilot wire because the technology will be increasingly difficult to maintain.



Need Number: AEP-2018-AP007
Process Stage: Needs Meeting 10/26/18
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:

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 138kV system around Glen Lyn and Roanoke, VA. 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.



Need Number: AEP-2018-AP007

Process Stage: Needs Meeting 10/26/18

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)

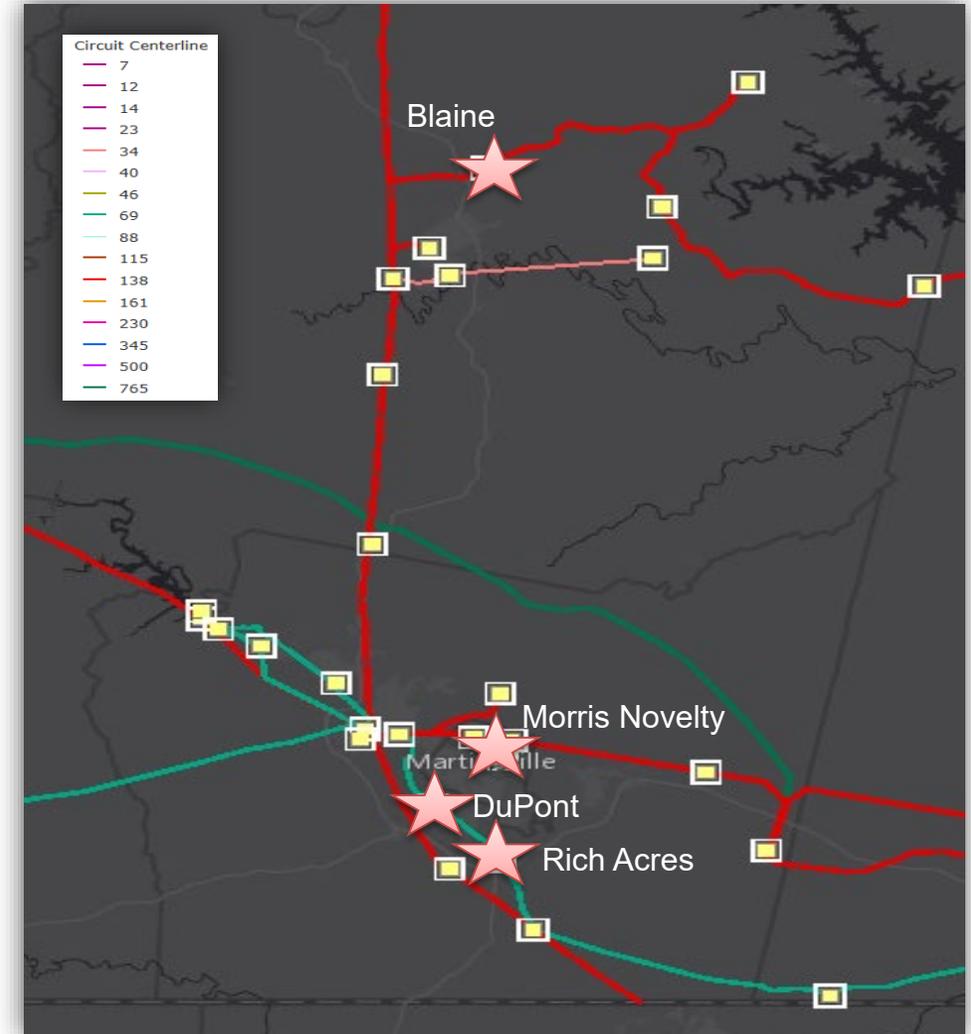
Problem Statement:

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.



Need Number: AEP-2018-AP008
Process Stage: Needs Meeting 10/26/18
Process Chronology: Needs Meeting 10/26/18
Supplemental Project Driver: Customer service
Specific Assumptions Reference: AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 7)
Problem Statement:

Customer Service:
 Virginia Tech Electric Service (VTES) requested a new 69 kV delivery point from AEP's Lane substation located in Blacksburg, VA to serve 5 MW of new load.



Need Number: AEP-2018-OH001

Process Stage: Needs Meeting 10/26/18

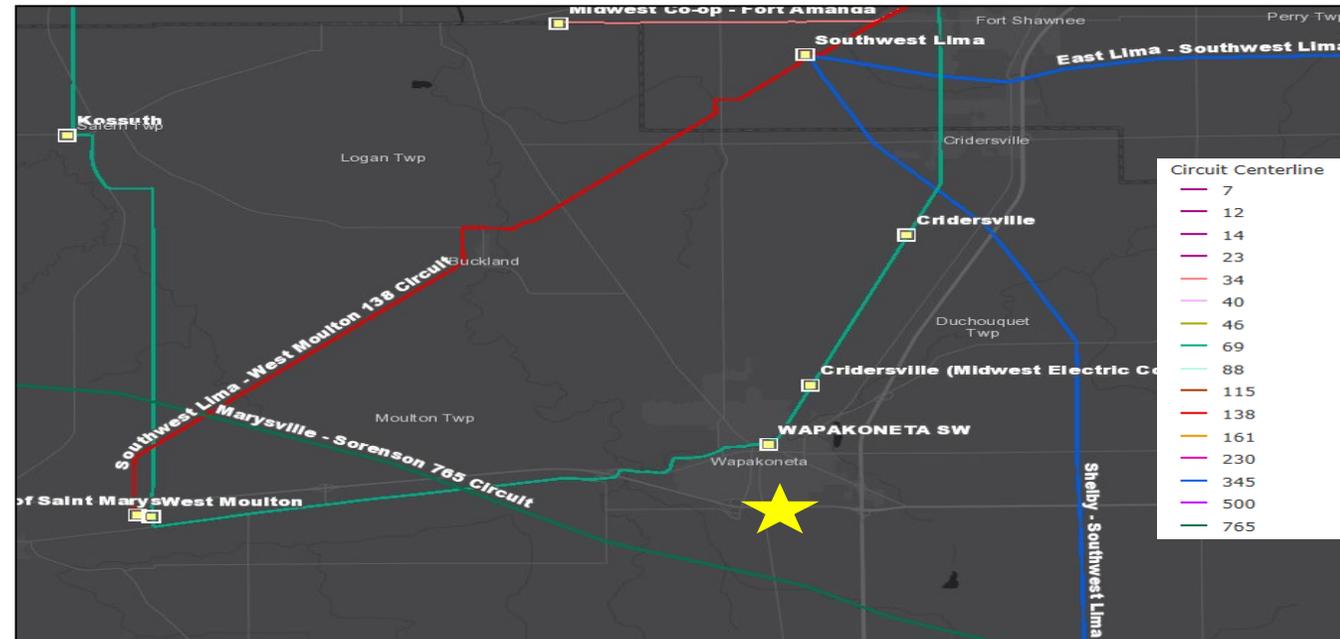
Process Chronology: Needs Meeting 10/26/18

Supplemental Project Driver: Customer Service

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

Problem Statement:

Obligation to serve a new 80 MW customer load request near the City of Wapakoneta. Two additional customers have inquired about service in this area totaling 48 MW.



Need Number: AEP-2018-OH002

Process Stage: Needs Meeting 10/26/18

Process Chronology: Needs Meeting 10/26/18

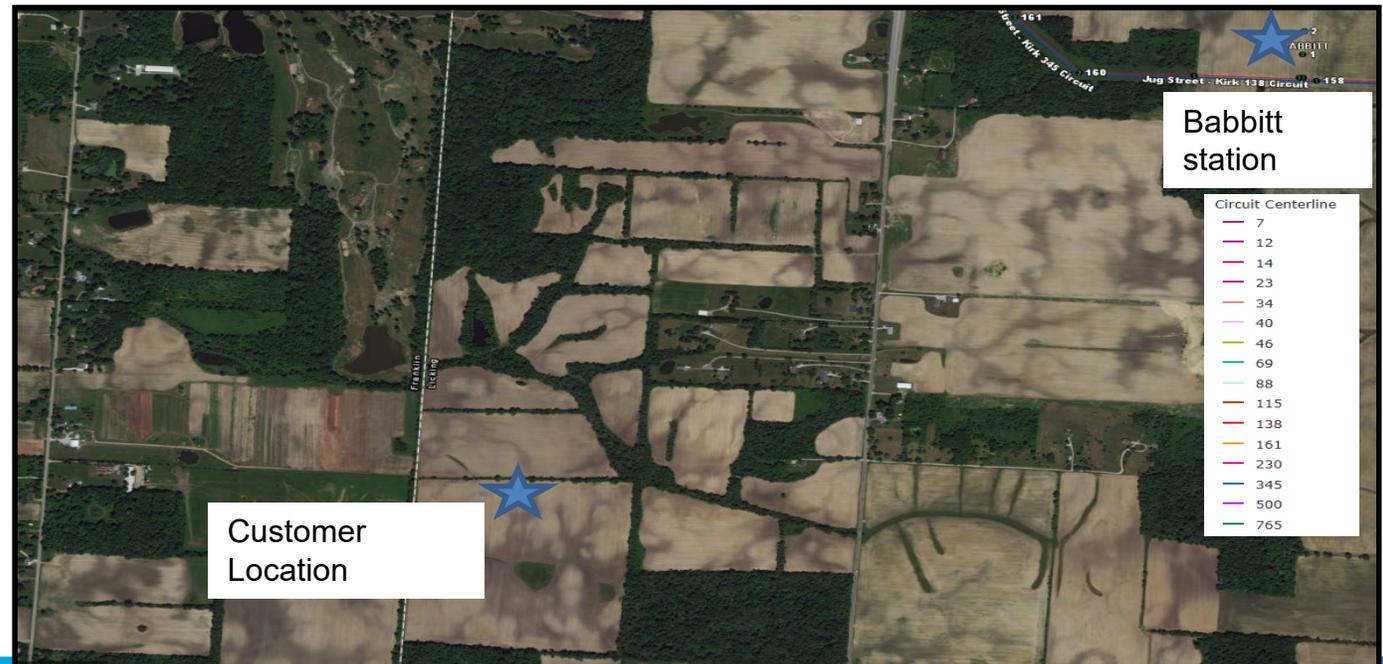
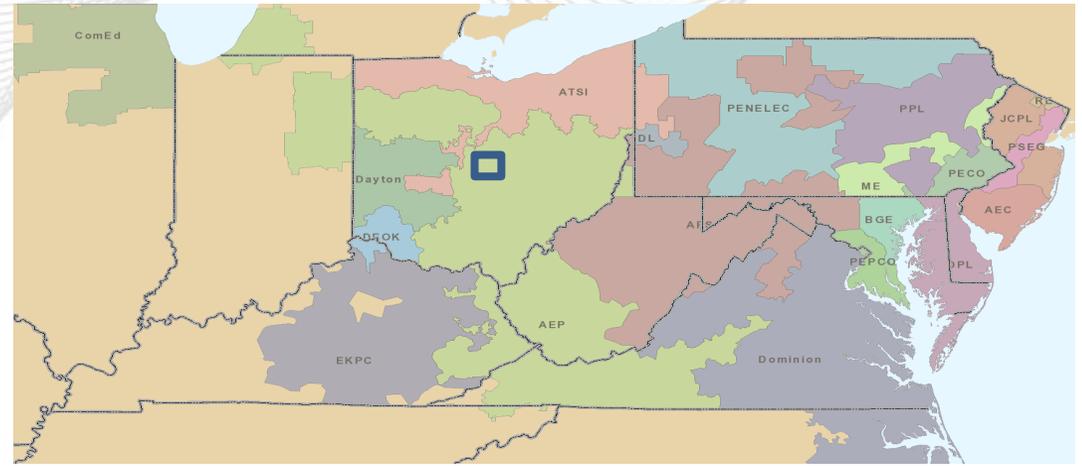
Supplemental Project Driver: Customer Service

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

Problem Statement:

A new customer has signed an agreement requesting service for 150 MW load by 2/15/2020.

- Customer is located approx. 1.5 miles southwest of AEP's Babbitt station.
- Customer indicates their load could grow to 720 MW in the next 5-10 years.



Need Number: AEP-2018-OH003

Process Stage: Needs Meeting 10/26/18

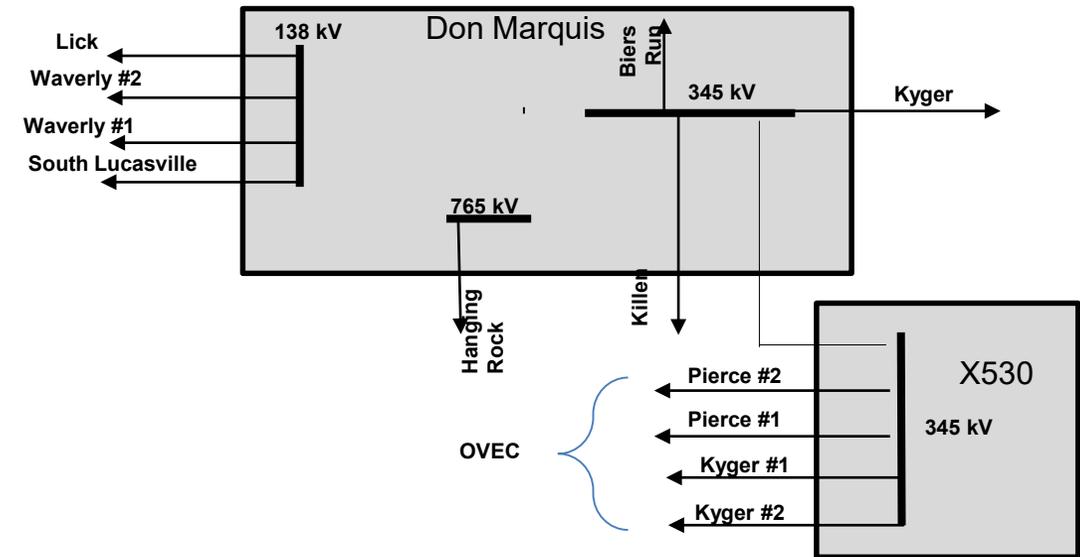
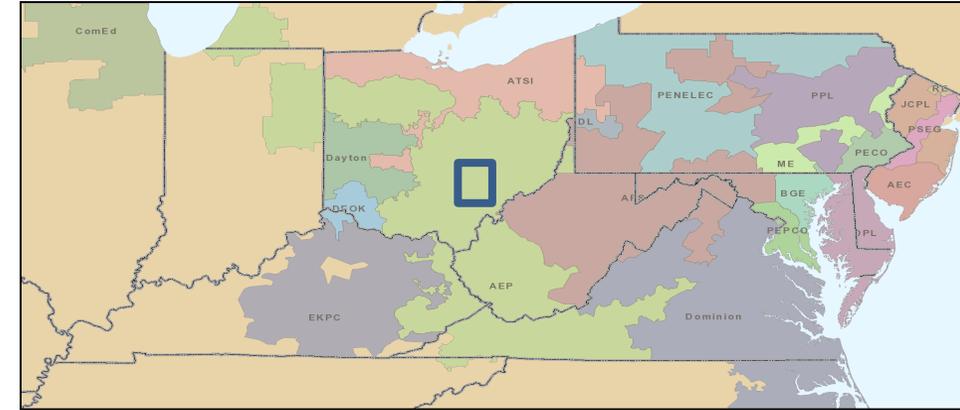
Process Chronology: Needs Meeting 10/26/18

Supplemental Project Driver: Customer Service

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

Problem Statement:

The US Department of Energy has informed AEP of its intention to retire its existing X-530 345 kV Station, adjacent to AEP's Don Marquis Substation. The DOE has requested a new 138 kV delivery point at the same location.





Need Number: AEP-2018-OH004

Process Stage: Needs Meeting 10/26/18

Process Chronology: Needs Meeting 10/26/18

Supplemental Project Driver: Customer Service

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

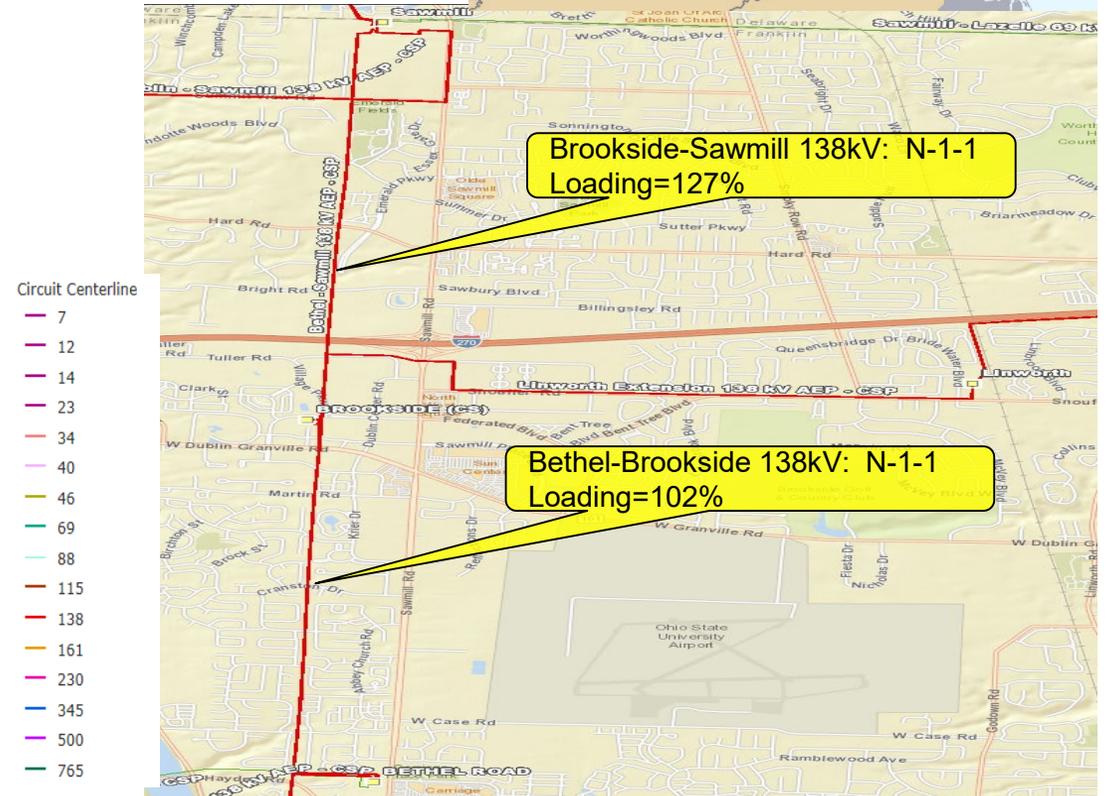
Problem Statement:

AEP has received requests for increased demand in the Dublin, Ohio area. Analysis shows Bethel – Sawmill 138 kV will be a constraint. Consequent inspection identified clearance violations along the Bethel – Sawmill 138 kV line. AEP has de-rated the thermal capacity of the line to mitigate potential safety issues.

- Brookside-Sawmill → N-1-1=127%, N-1=117%
- Bethel-Brookside → N-1-1=102%, N-1=92%

(N-1-1: Bethel – Roberts 138 kV + Davidson - Roberts 138 kV)

AEP believes that the loading issues exist today due to the recent 30% de-rate of the line. Newly connected customer loads are scheduled to ramp up, significantly contributing to area thermal concerns.



Need Number: AEP-2018-OH005

Process Stage: Needs Meeting 10/26/18

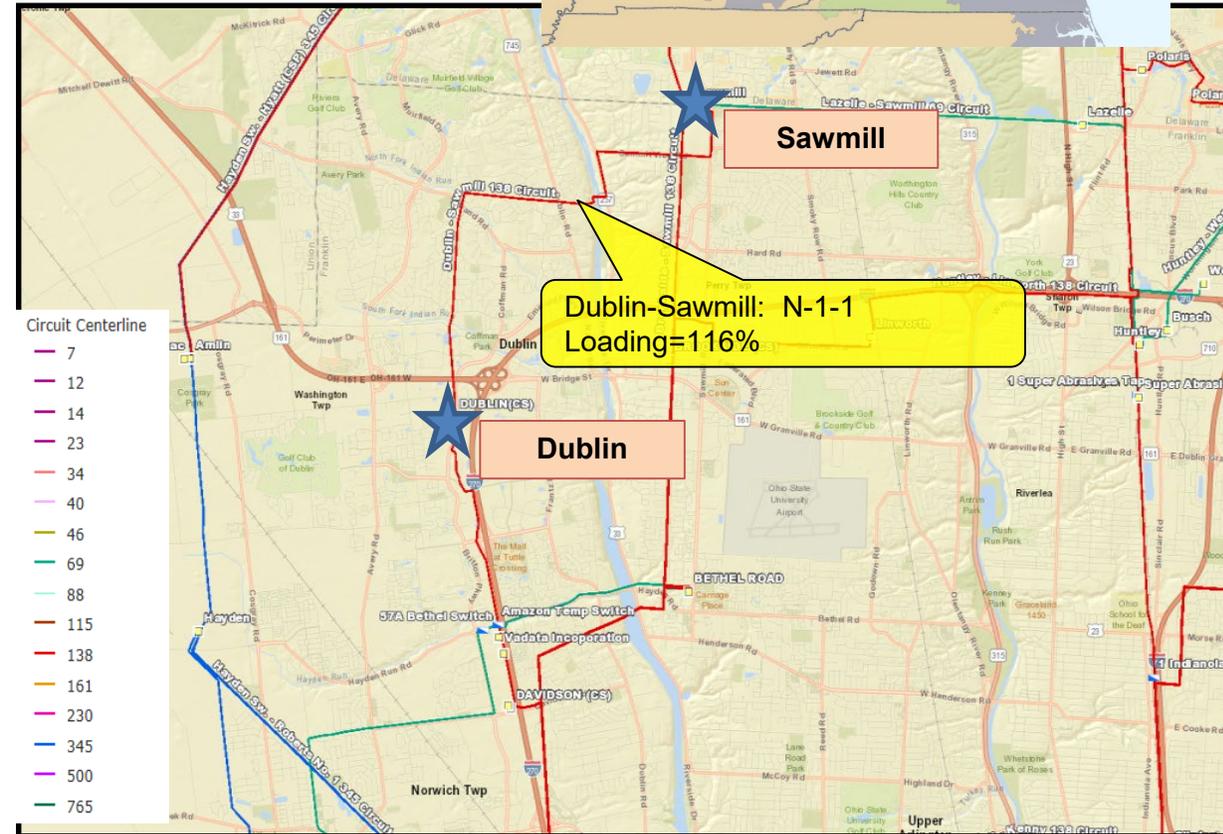
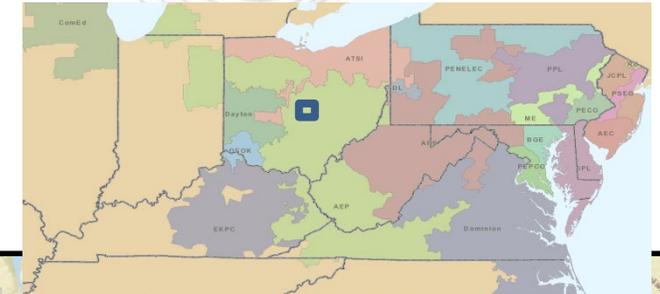
Process Chronology: Needs Meeting 10/26/18

Supplemental Project Driver: Customer Service

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

Problem Statement:

- The Dublin-Sawmill 138kV circuit will experience loading of 116% under N-1-1 conditions involving the loss of Bethel-Davidson 138kV & Davidson-Roberts 138kV circuits. With load growth in the area, we anticipate this line to overload starting in 2022.
- AEP-Ohio has requested a third 138kV source to Dublin station to maintain acceptable reliability levels for the load at risk.
- Dublin Station serves 75 MVA of peak demand with minimal load transfer capability. Dublin station serves some critical loads.
- Newly connected customer loads are scheduled to ramp, significantly contributing to area thermal concerns.



Need Number: AEP-2018-OH006

Process Stage: Needs Meeting 10/26/18

Process Chronology: Needs Meeting 10/26/18

Supplemental Project Driver: Equipment Condition/Performance/Risk and Customer Service.

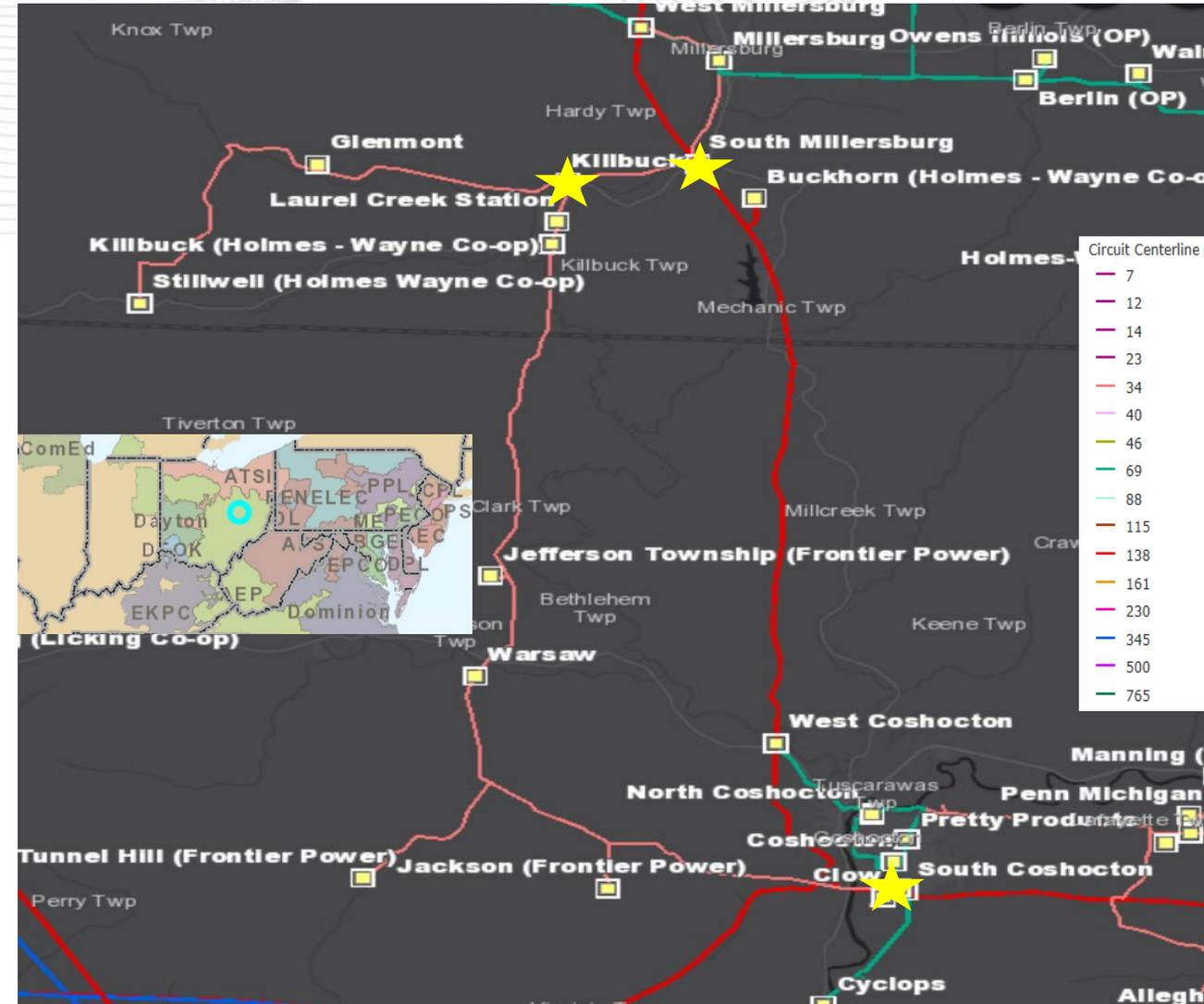
Specific Assumptions Reference: AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 7)

Problem Statement:

The Killbuck – South Coshocton 34 kV line (30.18 mi) was constructed in 1926 using wood pole structures and conductor ranging from 3/0 Copper (23 MVA rating) to 336.4 ACSR (37 MVA rating). There are 144 open A conditions on this line, including rotten cross-arms, burnt/broken insulators, and loose/broken conductor hardware. The Killbuck – South Coshocton 34 kV line has experienced over 1 million CMI over the past three years.

The Killbuck – South Millersburg 34 kV (2.59 mi) line was constructed in the 1920's using wood pole structures with 336.4 ACSR (36 MVA rating). There are 53 open A conditions on this line, including rotten cross-arms, burnt/broken insulators, and loose/broken conductor hardware. The Killbuck – South Millersburg 34 kV line has experienced over 1 million CMI over the past three years.

At South Coshocton 69 kV circuit breaker 'K' (fault ops 18), 34.5 kV circuit breakers 'A' (fault ops 3), 'B' (fault ops 7), 'C' (fault ops 72), 'D' (fault ops 0), 'E' (fault ops 0), and 'G' (fault ops 2) are 'FK' oil-filled breaker (vintage 1946 -1973). These oil type breakers have extensive maintenance and oil handling requirements. There is a potential for oil spills during fault operations and maintenance. The FK model is no longer supported by the manufacturer making spare part availability scarce.

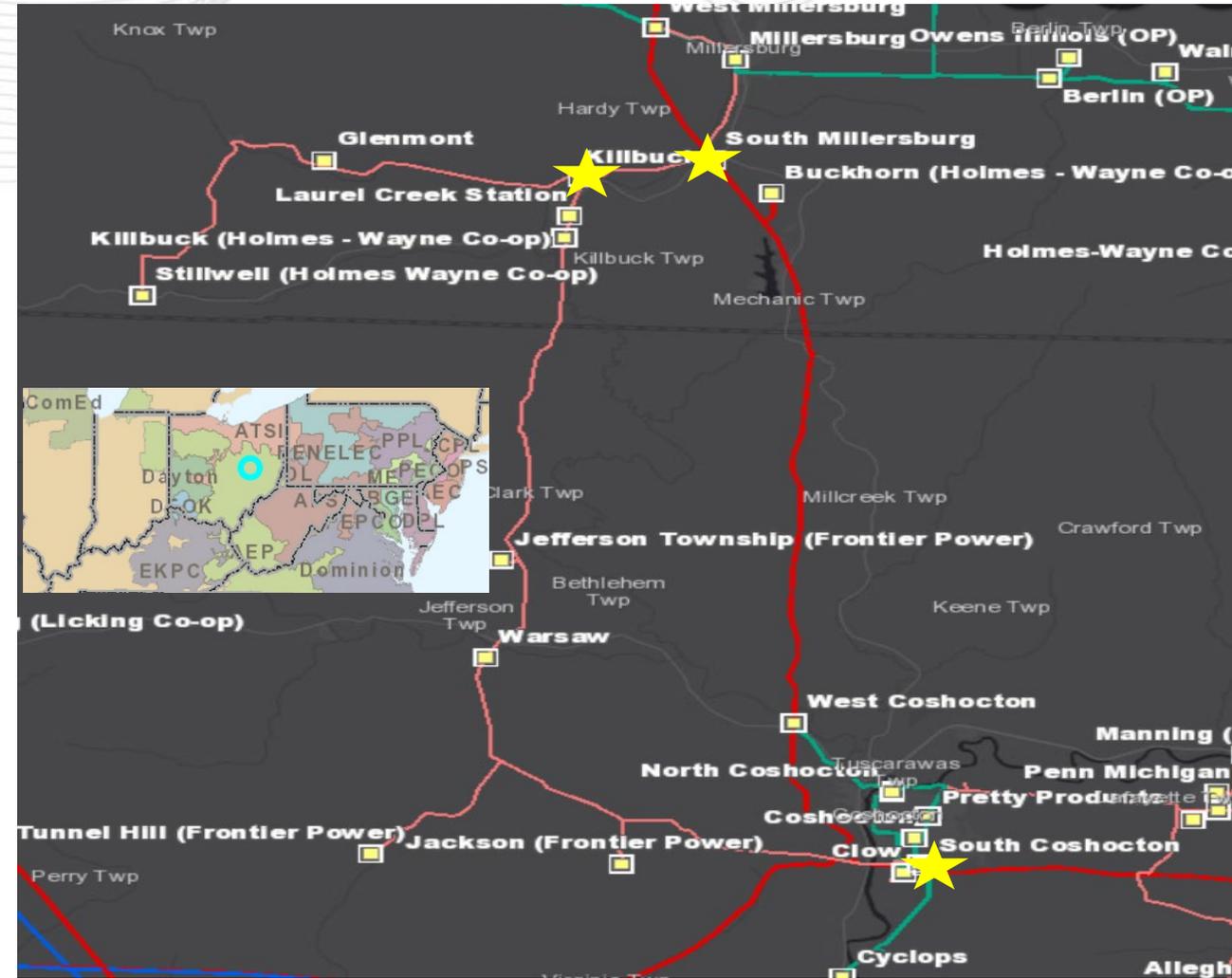
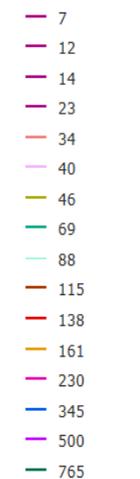


The South Coshocton 138 kV circuit breaker 'H' has had 11 malfunctions, 3 of which are confirmed to be related to low gas. This HS145-3000 model is prone to low gas malfunctions. The South Coshocton 138/34.5 kV transformer's dielectric strength has declined for the past seven years. Concentrations of CO2 are elevated as well. These conditions indicate that the insulating paper is deteriorating.

The South Millersburg 34.5 kV circuit breakers 'A' (fault ops 3) and 'B' (fault ops 21) are 'FK' oil-filled breakers (vintage 1951 and 1953 respectively). These oil type breakers extensive maintenance and oil handling requirements. The FK model is no longer supported by the manufacturer making spare part availability scarce.

The South Millersburg 138/34.5 kV transformer has elevated moisture levels for at least seven years with a recent sharp increase. The dielectric strength has corresponding decreased since 2016. Concentrations of CO2 are also elevated.

Circuit Centerline



Customer Service: Customer #1

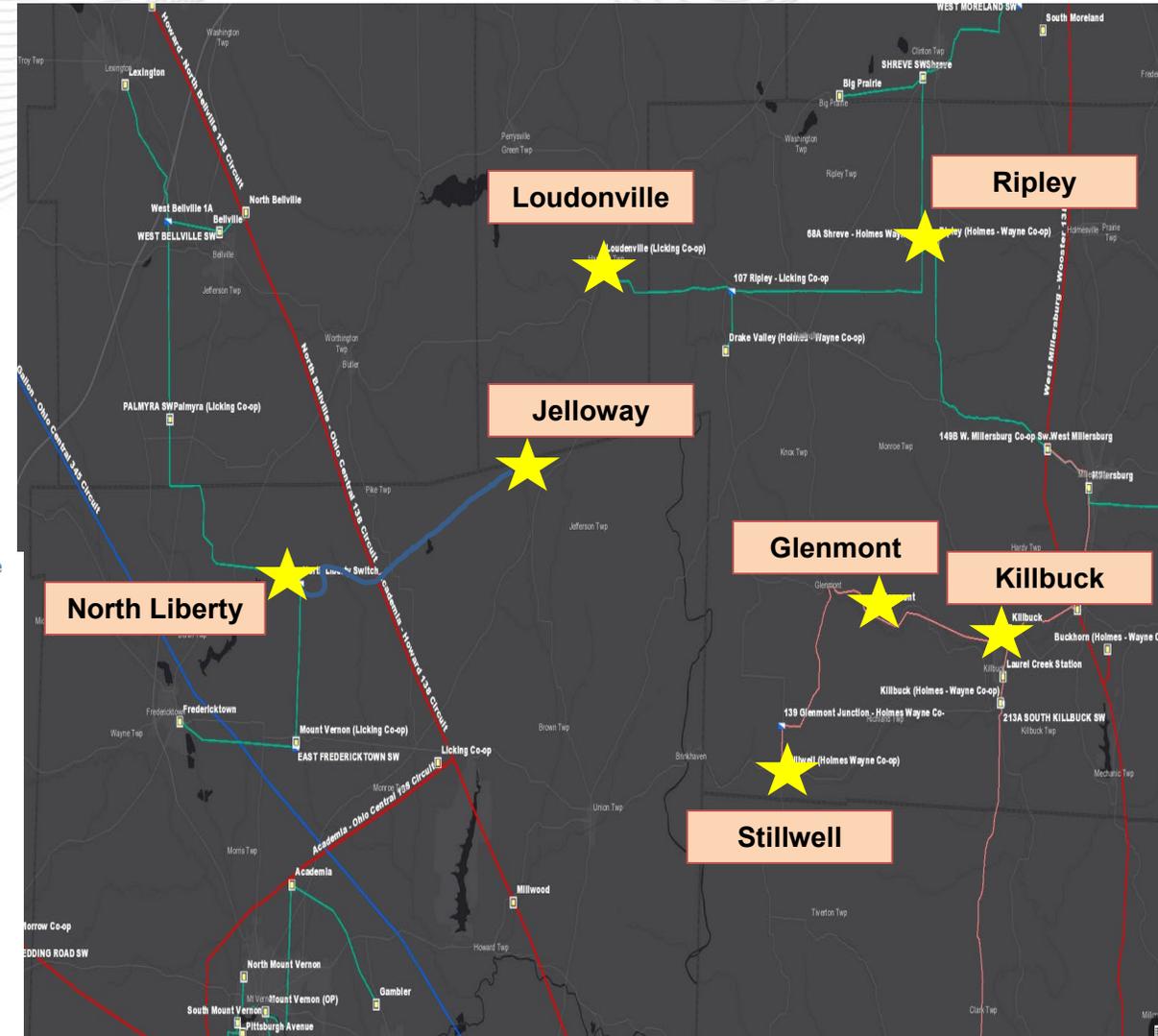
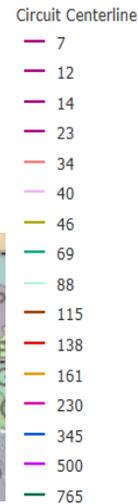
A recent customer service request of 2.5 MW has been made on the Killbuck – South Coshocton 34.5 kV circuit. **Moved to AEP-2018-OH035**

Customer Service: Customer #2

Holmes-Wayne Co-op (at Stillwell) and AEP Ohio (at Glenmont) are currently served via a radial 34.5 kV (12.58 mi) line. The Stillwell delivery point has accumulated 1.7 million CMI over the past five years. Over the last 10 years (2008-2017), Stillwell delivery point has averaged nearly 875,000 CMI/year.

Customer Service: Customer #3

Licking and Holmes-Wayne members are currently served via a radial 69 kV (24.1 mi) line. The North Liberty to Jelloway radial line is 9.50 miles and the Ripley to Loudonville radial line is 14.16 miles. Their total load is 8.73 MVA and they have experienced 1.13 million CMI over the last three years.



Need Number: AEP-2018-OH007

Meeting Date: 10/26/2018

Process Chronology: Needs Meeting 10/26/2018

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

Specific Assumption References:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

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

North Findlay Station:

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

New Liberty Station:

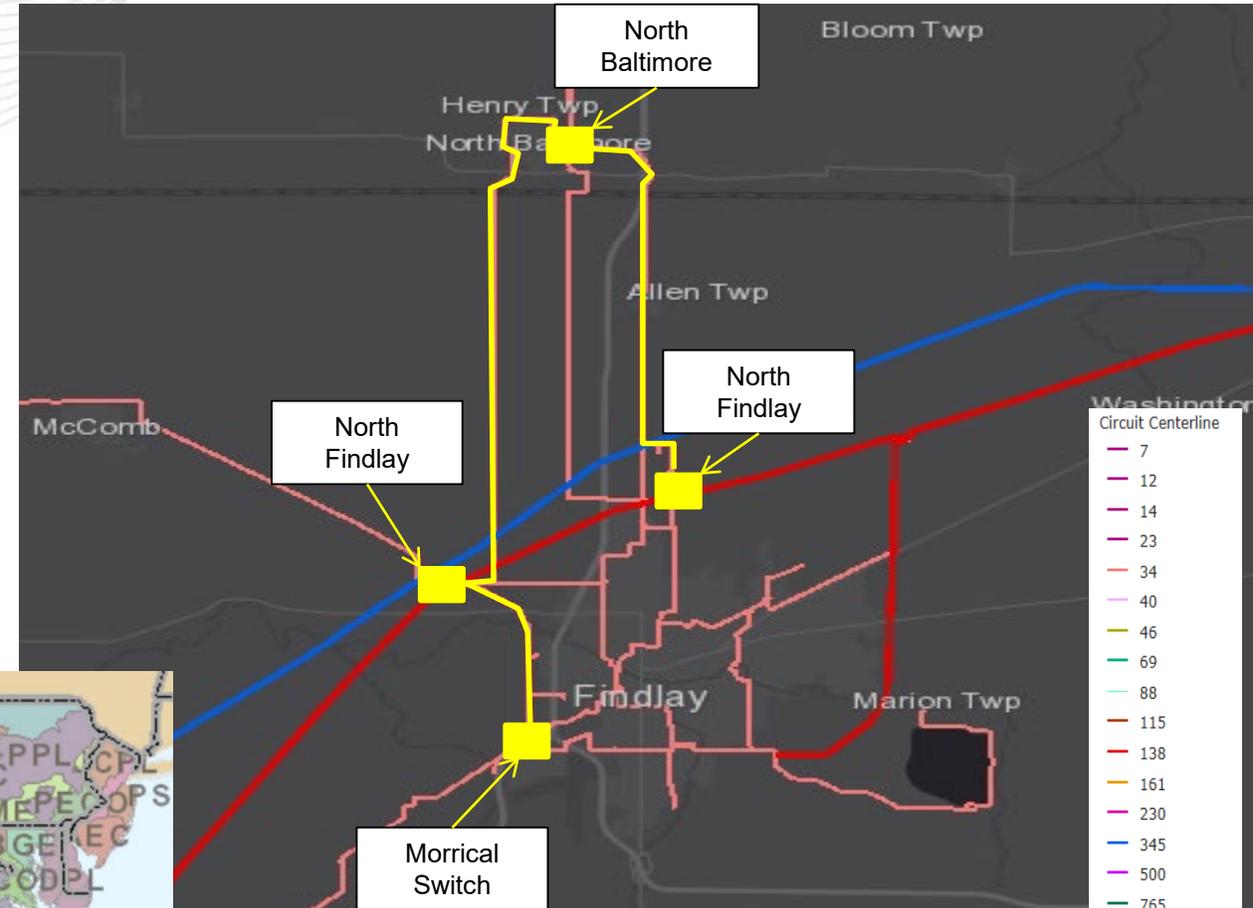
- 34.5kV CBs C, E, G, H, I, J
- Transformers #1 and 2

North Baltimore Station:

- 34.5kV CBs A, B, C, E

Morrical Switch

- 34.5kV CB A



Problem Statement (Continued):

Morrical Switch

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

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

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

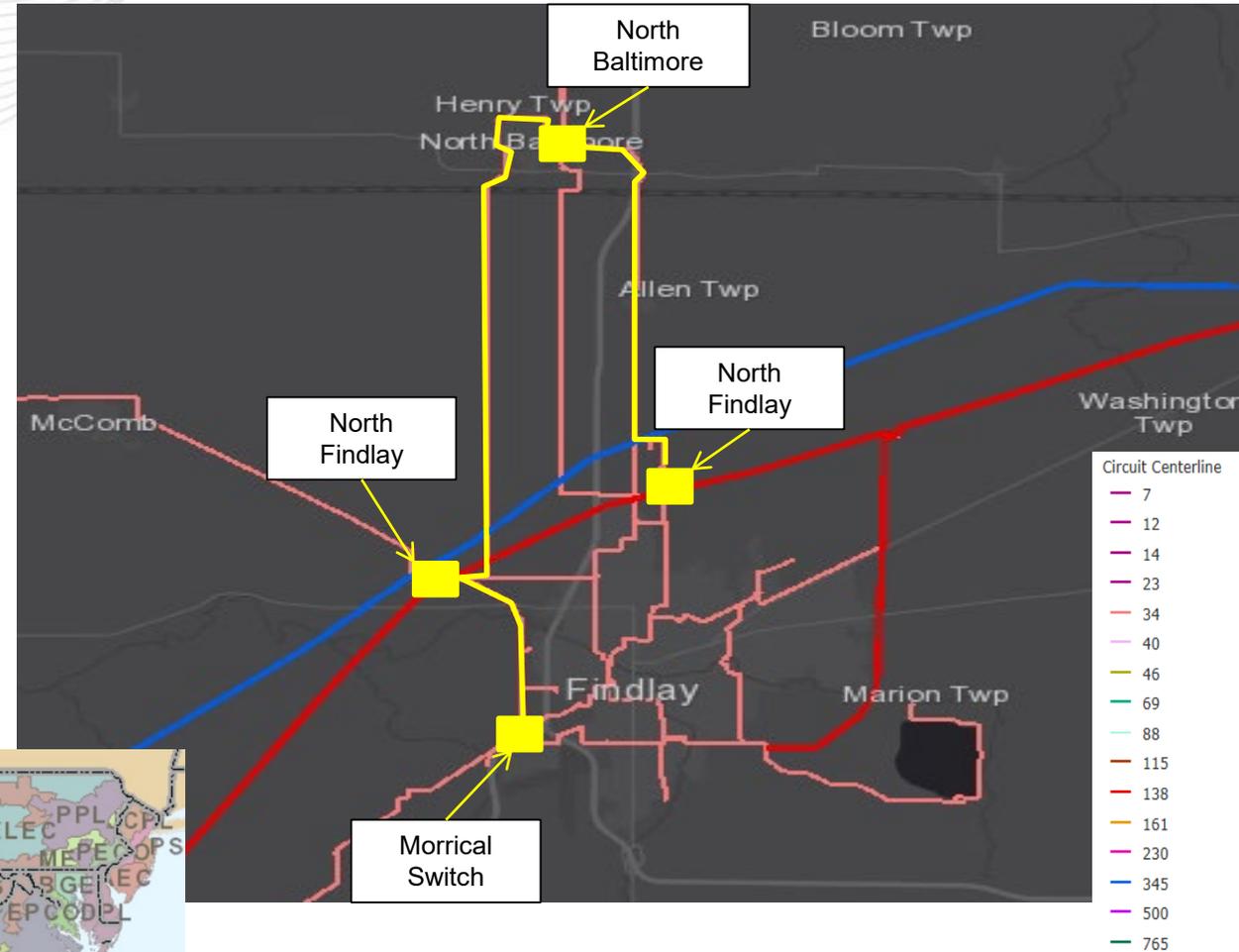
North Findlay – North Baltimore 34.5kV #1: The 8 mile circuit identified is predominately 4/0 ACSR (circa 1961) with small portions of 2/0 Copper, 336 ACSR, 556 ACSR, and 795 ACSR. This line has predominantly wood structures (ranging from 1920's – 2000's) with 14 open A conditions.

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

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

Operational Flexibility and Efficiency

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



Need Number: AEP-2018-OH008

Process Stage: Needs Meeting 10/26/18

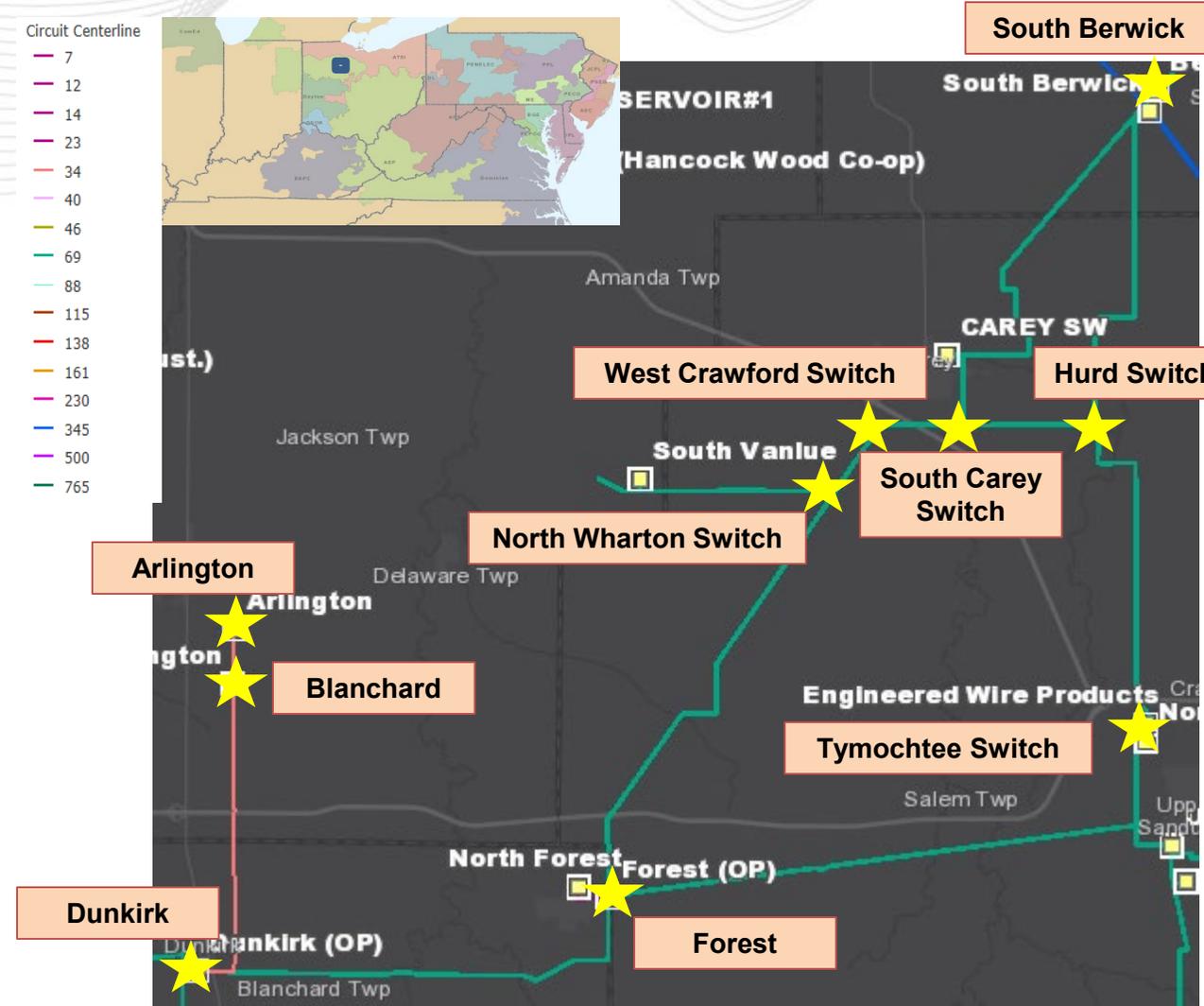
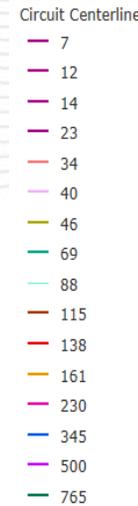
Process Chronology: Needs Meeting 10/26/18

Supplemental Project Driver: Equipment Condition/Performance/Risk, Operational Flexibility and Efficiency, and Customer Service.

Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8) and AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 7)

Problem Statement:

- The Dunkirk – Arlington 34.5 kV line has a combination of #2 ACSR (vintage 1980) and 1/0 CU (vintage 1920's) and is built to distribution standards.
- The Forest – South Berwick 69 kV line has a combination of 1/0 ACSR, # 1 CU (vintage 1920's), 4/0 ACSR (vintage 1920's – 1960), and 556 ACSR (vintage 1971 – 2003).
- There are 10 open A conditions on the Arlington – Dunkirk 34.5 kV line (~ 7.29 miles) & 29 open A conditions on the Forest – South Berwick 69 kV line (~29.3 miles).
- There is a three-terminal hard just west of Hurd Switch.
- South Carey Switch and North Wharton Switch are both three-terminal lines.
- West Crawford Switch and Hurd Switch are set in an N.O. position to prevent thermal overloads.
- The City of Carey has reliability concerns, where both feeds to the city can be lost for a single outage.
- Hancock-Wood Co-op has reliability and maintenance concerns due to radial loads at Arlington and Blanchard Stations.
- Arlington – Dunkirk Circuit:
 - Peak Load Impact: 6.57 MW
 - CMI (2015 – 2018): 162,840
- Forest – South Berwick Circuit:
 - Peak Load Impact: 7.68 MW
 - CMI (2015 – 2018): 1,713



Need Number: AEP-2018-OH009

Meeting Date: 10/26/2018

Process Chronology: Needs Meeting 10/26/2018

Supplemental Project Driver: Operational Flexibility and Efficiency, Customer Service.

Specific Assumption References:

Equipment Condition, Operational Flexibility

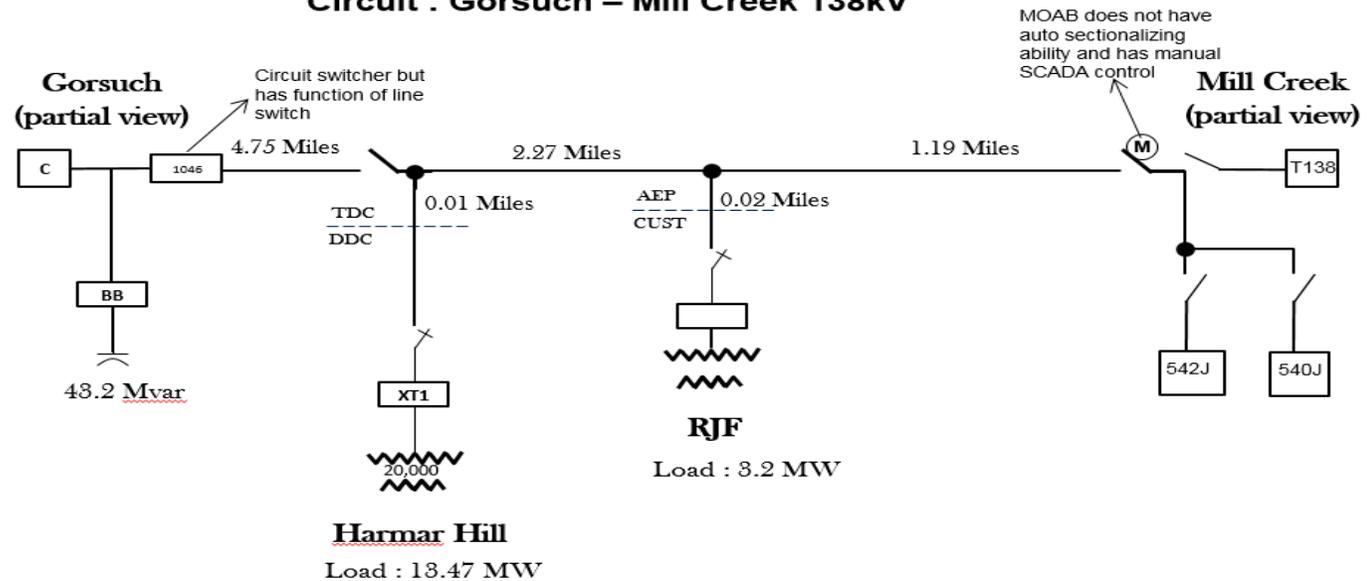
Problem Statement:

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 that is currently inoperable. 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).



Circuit : Gorsuch – Mill Creek 138kV



Need Number: AEP-2018-OH010

Meeting Date: 10/26/2018

Process Chronology: Needs Meeting 10/26/2018

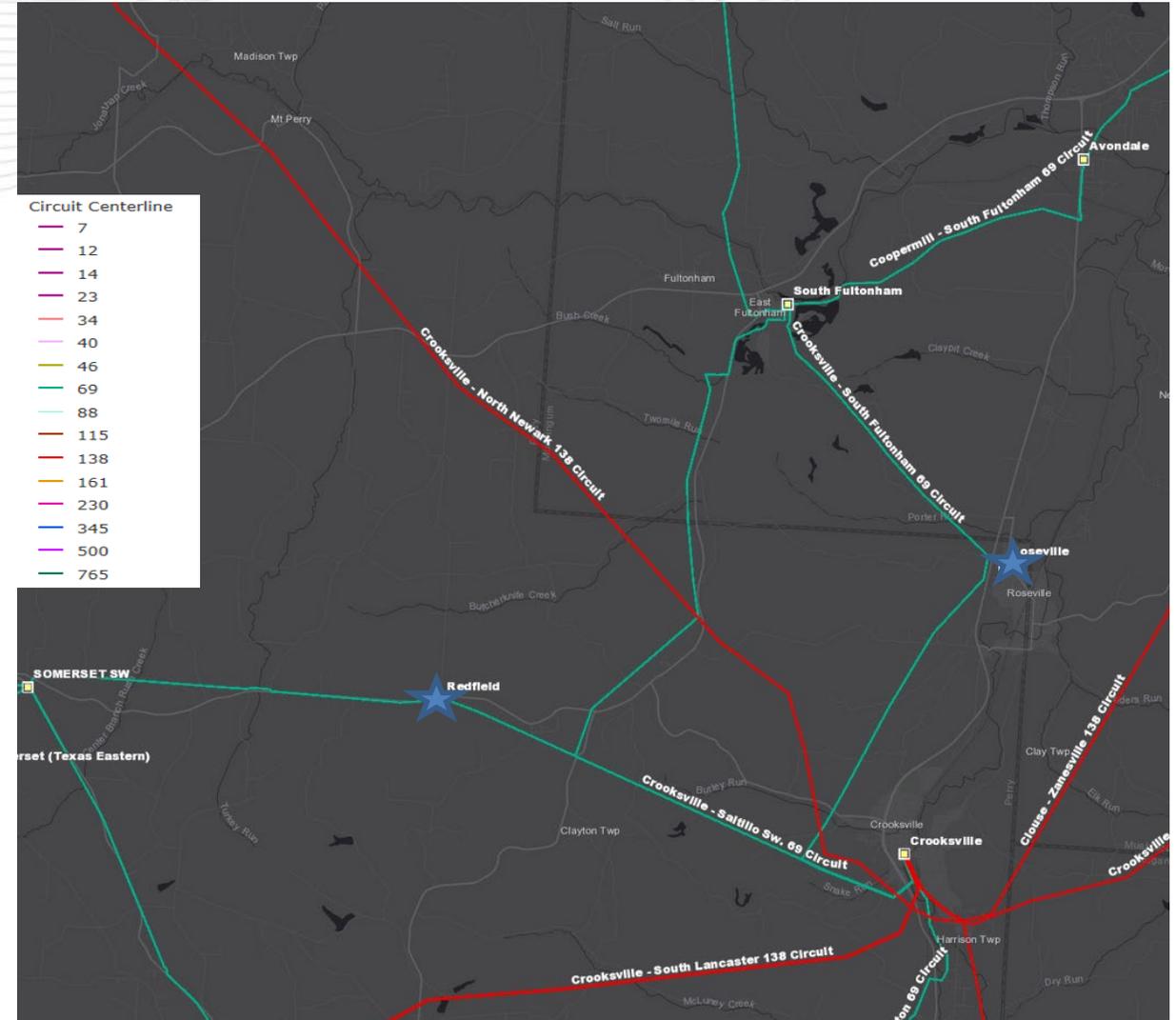
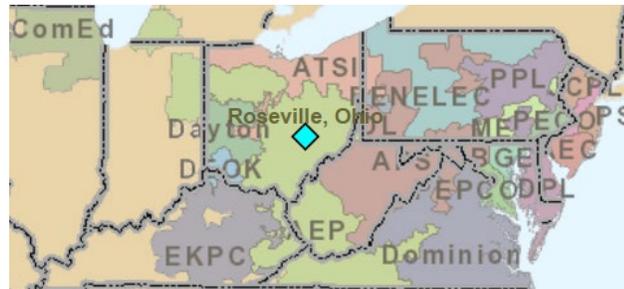
Supplemental Project Driver: Customer Service

Specific Assumption References:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

- **Customer Service #1:** AEP Ohio has requested a new more reliable connection that is closer to their load center. In addition, the existing Redfield Distribution equipment is in need of rehab. The existing 69 kV Redfield Station has experienced 1,730,000 CMI over a three year period. Requested in-service by date is 06/01/2019.
- **Customer Service #2:** AEP Ohio has requested improved reliability at their Roseville 69 kV delivery point. The current load is 3.2 MVA with a projected load near 5.5 MVA. Currently for an outage at Roseville Station, the load cannot be transferred to adjacent Station under peak conditions. **Moved to AEP-2018-OH034**



Need Number: AEP-2018-OH011

Process Stage: Needs Meeting 10/26/18

Process Chronology: Needs Meeting 10/26/18

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

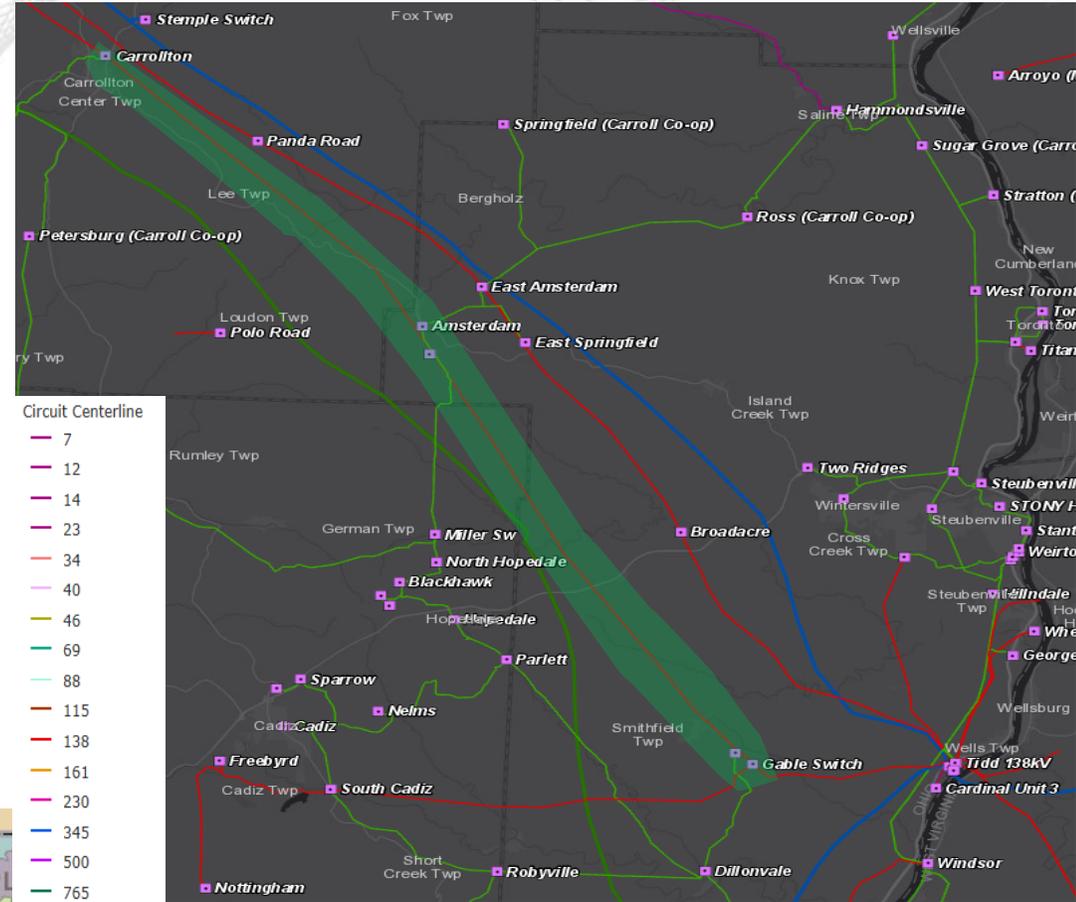
Specific Assumption References:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

The Gable-Carrollton (vintage 1917) 138kV circuit (29 miles) is in poor condition and is a reliability risk to the transmission system. The circuit consists of lattice towers and 6-wired 200 kcmil copper conductor. After a century in the field, the lattice towers have degraded significantly, with heavy rusting and broken tower legs. The copper conductor has become very brittle and is difficult for crews to repair. Some towers are sitting in water. The suspension insulators and hardware are also heavily worn.

The circuit has 39 open conditions, with the majority being structural issues (e.g., degraded tower parts & broken insulators). The circuit has experienced 4 outages in the last 3 years (2016-18), including a 50-hour outage due to broken conductor.



Need Number: AEP-2018-OH012

Process Stage: Needs Meeting 10/26/2018

Process Chronology: Needs Meeting 10/26/2018

Supplemental Project Driver: Equipment

Material/Condition/Performance/Risk

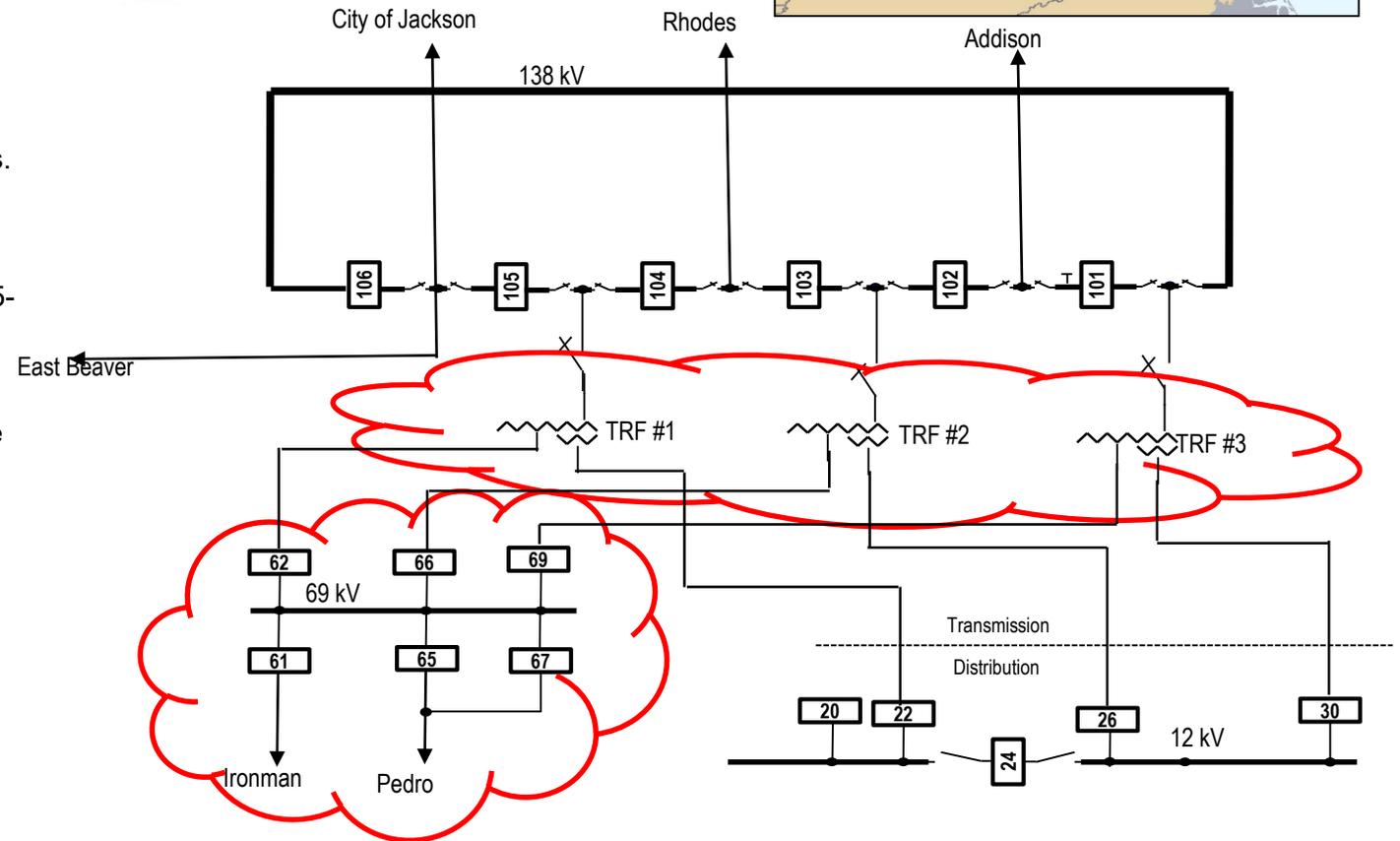
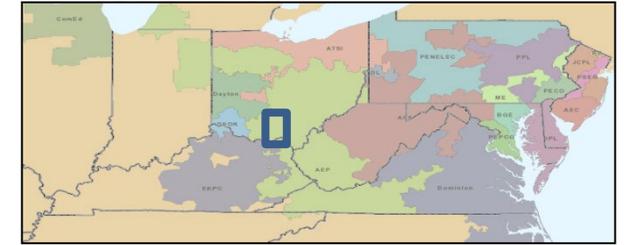
Specific Assumption References:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

At Lick substation there are six 69 kV circuit breakers with condition issues. CB's 61, 62, 65, 66, 67, and 69 are oil type breakers that were manufactured between 1956 - 1967. There is a potential for oil spills during routine maintenance and fault operations. In addition, spare parts are difficult to obtain. The breakers' fault operation counts are as follows: {61-126, 62-11, 65-26, 66-8, 67-19 and 69-4}. For most of these breakers, the number of fault operations exceed the manufacturers recommended number of 10.

There are three 138/69 kV, 18 MVA transformers at Lick. T#1 is a Westinghouse transformer manufactured in 1956. Transformers #2 and #3 are both GE transformers manufactured in 1950. All three transformers have maintenance issues with their LTCs and have significant oil leaks. In addition, loss of two of the transformers can load the remaining transformers tertiary winding above it's rating.



Need Number: AEP-2018-OH013

Process Stage: Needs Meeting 10/26/18

Process Chronology: Needs Meeting 10/26/18

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

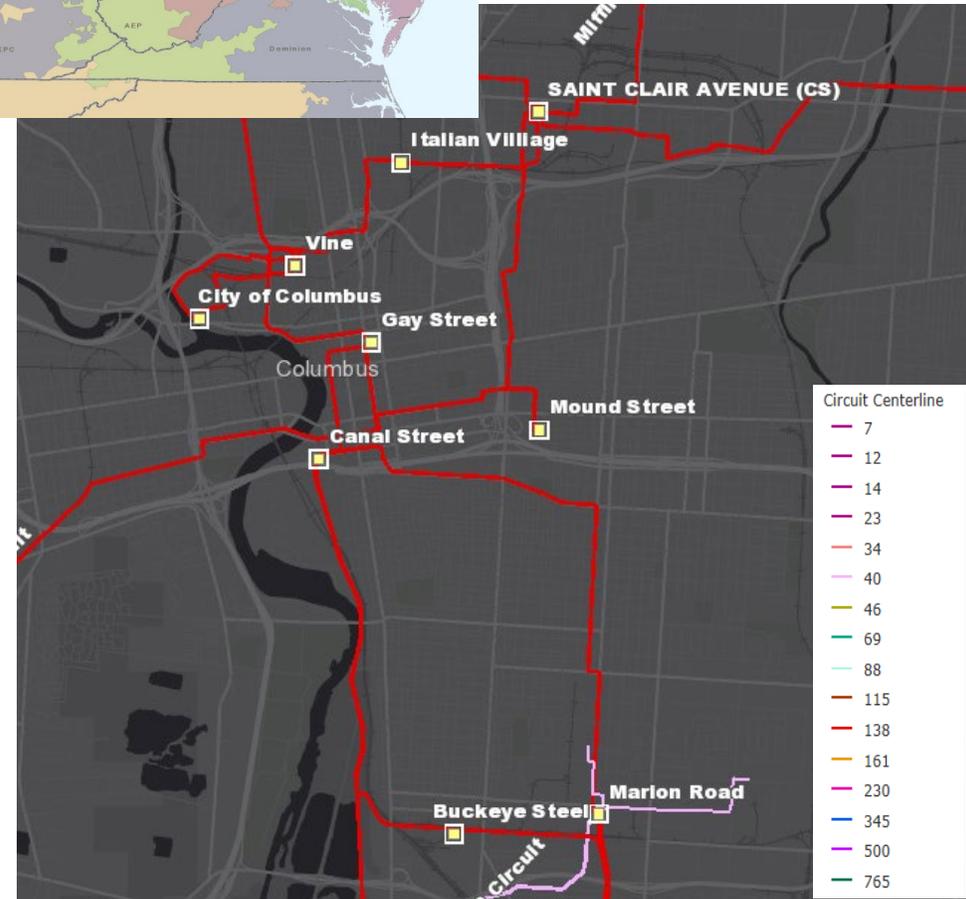
Specific Assumption References:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

The 138kV CB-101 at Mound Street is the last remaining oil breaker at the station. This oil breaker doesn't have oil containment. Oil breaker maintenance has become more difficult due to the oil handling required to maintain them. Oil spills can occur with breaker failures and routine maintenance which has the potential for an environmental risk. This breaker is a model that has identified reliability concerns due to past failures and lack of spare part availability.

This CB separates two transformers that serve critical hospital loads. A failure could cause a sustained outage to the entire facility.



Need Number: AEP-2018-OH014

Meeting Date: 10/26/2018

Process Chronology: Needs Meeting 10/26/2018

Supplemental Project Driver: Operational Flexibility and Efficiency, Customer Service.

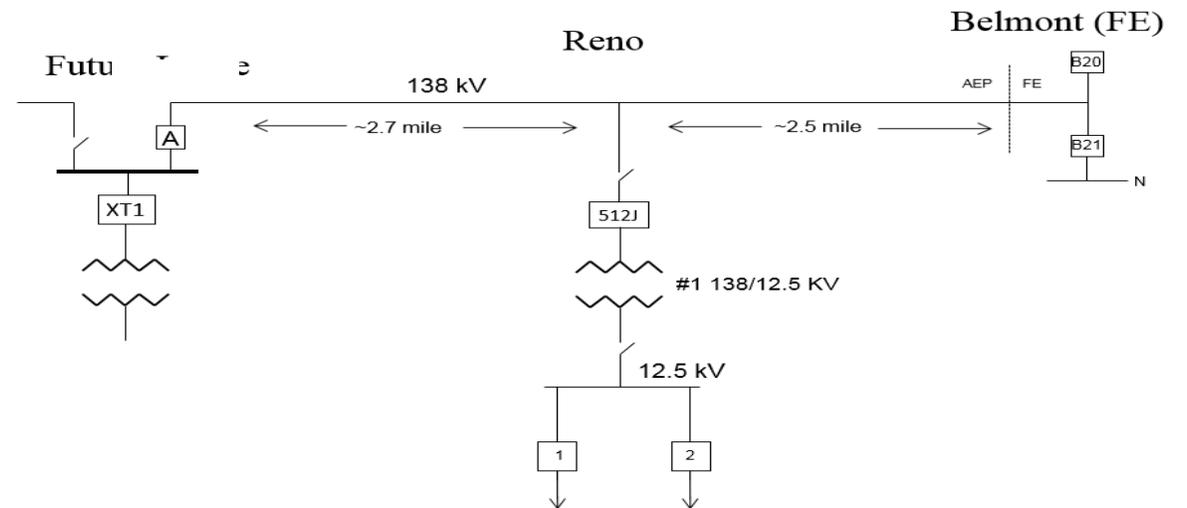
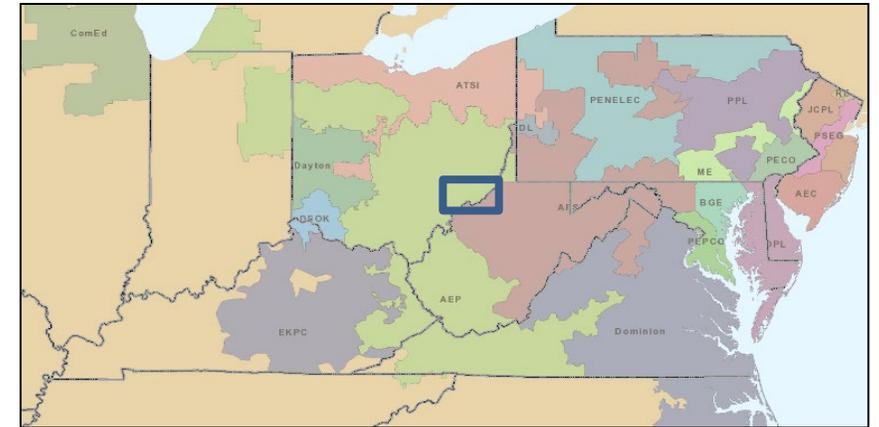
Specific Assumption References:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

Reno Substation is served off a 138kV hard tap. If there is an outage, planned or unplanned on the line sections between Belmont and Levee, the Reno load will be dropped. There is partial transfer capability for Reno during light load periods only. Levee Station cannot take all Reno's load because the distribution circuits are over five miles between the two stations dictated by geography.

The nearby 23 kV Wade station is being retired as part of an unrelated project. Levee Station will take a portion of Wade's load and the remaining load will be served from Reno Station.



Need Number: AEP-2018-OH015

Process Stage: Needs Meeting 10/26/18

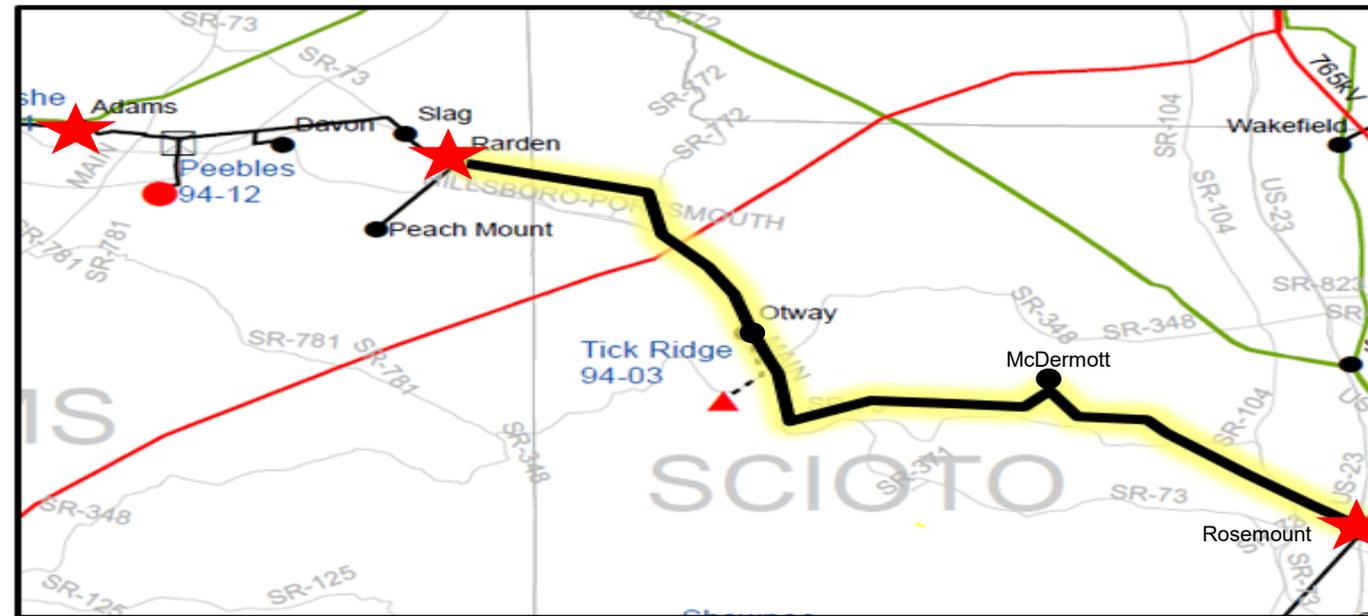
Process Chronology: Needs Meeting 10/26/18

Supplemental Project Driver: Operational Flexibility and Efficiency, Customer Service.

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

Problem Statement:

- Rarden and Rosemount Stations are connected by a 34.5 kV line with four 34.5/12 kV substations and several distribution customers served directly from the line. The total load served along this 24 mile line is 26/30 MVA (summer/winter).
- There is a normal-open point near Otway.
- The area suffers from reliability issues due to the rugged terrain and remote access. Customers have experienced over four million customer minutes of interruption over the past three years.
- The area's peak load can exceed the source transformers (Rarden and Rosemount). The 336 AAC conductor has already been overloaded (115% on 2014).
- The two 69-34.5 kV transformers at Rarden are protected with high-speed ground switches which can cause through-faults on the transmission system.



Need Number: AEP-2018-OH016

Meeting Date: 10/26/2018

Process Chronology: Needs Meeting 10/26/2018

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

Specific Assumption References:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

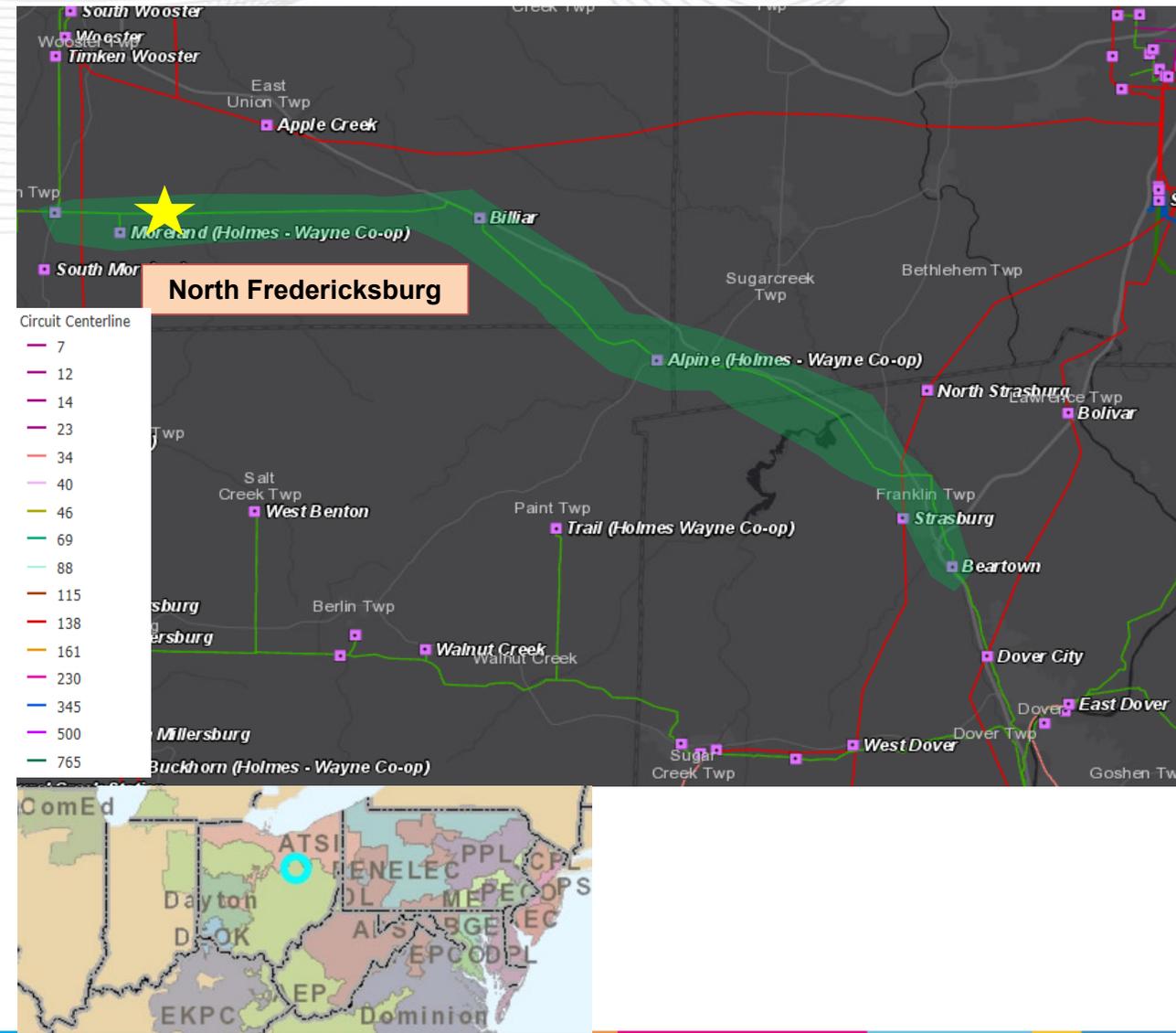
The ~~Beartown—Moreland~~ Beartown- West Wilmont 69kV ~~circuit~~ section is ~~28.2~~ 10.5 miles long and serves ~~2~~ 1 AEP Ohio distribution station and ~~2~~ 1 Holmes-Wayne Co-op station in northeast Ohio. Over the past several years, the circuit has experienced below-average reliability. For the 2017-2018 YTD period, it has experienced 7 sustained outages, an additional 8 momentary interruptions, and 2 emergency repair incidents on the entire circuit. The majority of the outages were due to T-Line structural issues and forestry.

The ~~circuit~~ line section consists of primarily ~~4/0-copper-conductor (1940-vintage)~~ and 336 ACSR (1962-64 vintage); it is entirely wood pole construction, with the majority being installed in the 1960's ~~or-earlier~~.

The ~~circuit~~ section has a reported CMI of 2.0M between 2014 – 2018 and currently has ~~218~~ 52 open conditions (~~177~~ 25 Category A, ~~36~~ 25 Category B, 5 Forestry). Examples of the conditions include: rotted poles, missing ground-leads, and damaged conductor. During the 2010-2018 period, 112 prior conditions were repaired/addressed ~~on the circuit as a whole~~.

~~Also, at the North Fredericksburg station, the two 69kV line switches can only be operated when the line is de-energized, due to issues with the vacuum bottles and obsolete design.~~

Remaining needs on the full circuit are referenced as part of need number AEP-2018-OH036.



Need Number: AEP-2018-OH017

Meeting Date: 10/26/2018

Process Stage: Needs Meeting 10/26/2018

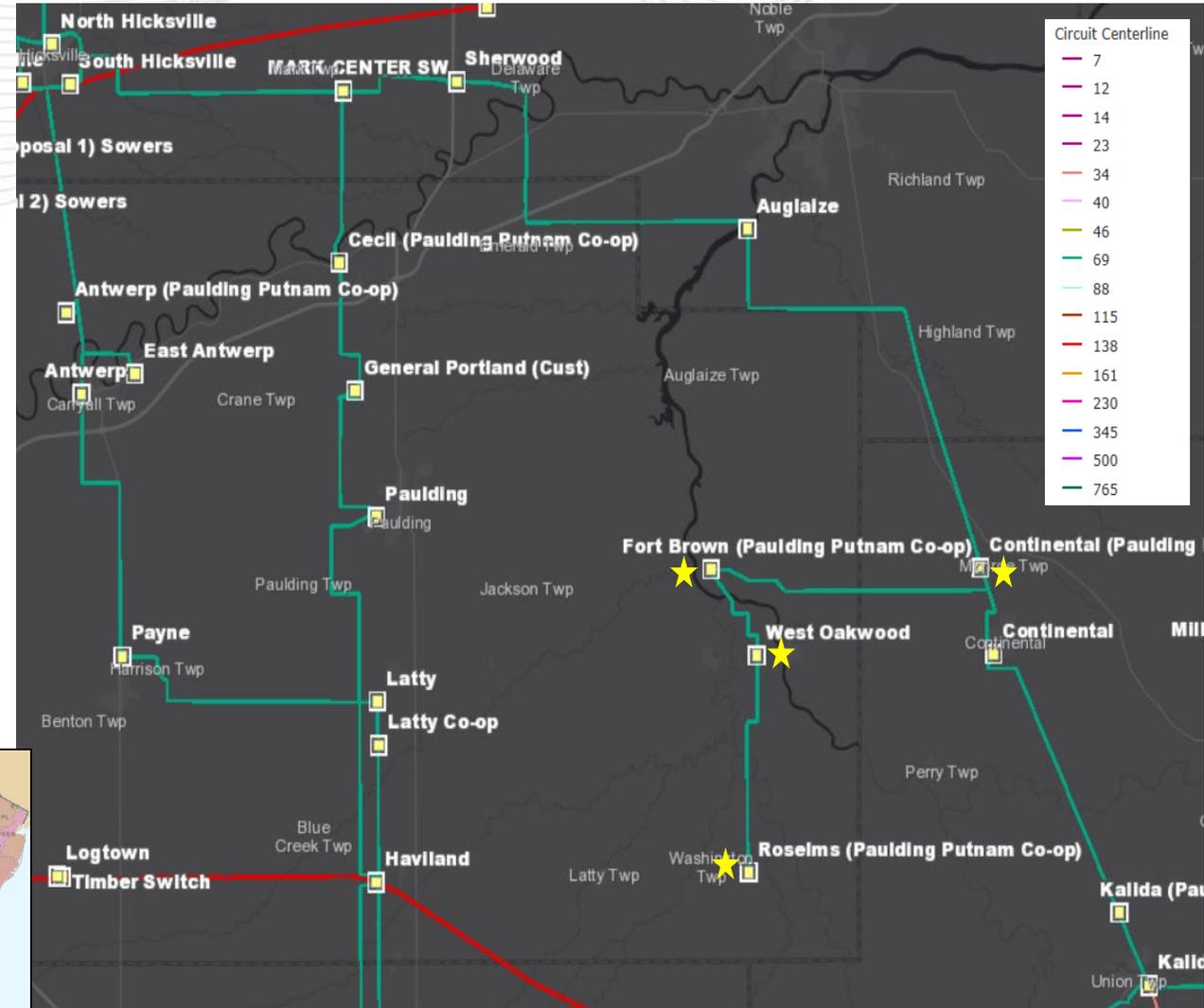
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk and Customer Service

Specific Assumption References: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8) and AEP Connection Requirements for the AEP Transmission System (AEP Assumptions Slide 7)

Problem Statement:

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

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





AEP Transmission Zone: Supplemental Northern Muncie, Indiana

Need Number: AEP-2018-IM020
Process Stage: Needs Meeting 10/26/18
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:

Delaware Station

- Breakers "C", "H", "I", "L", "M" & "N"
 - 1963-1971 FK oil breakers without oil containment
 - Fault Operations: CB C(6) CB H(27) CB I(50) CB M(57)– Recommended(10)

Delaware – Haymond

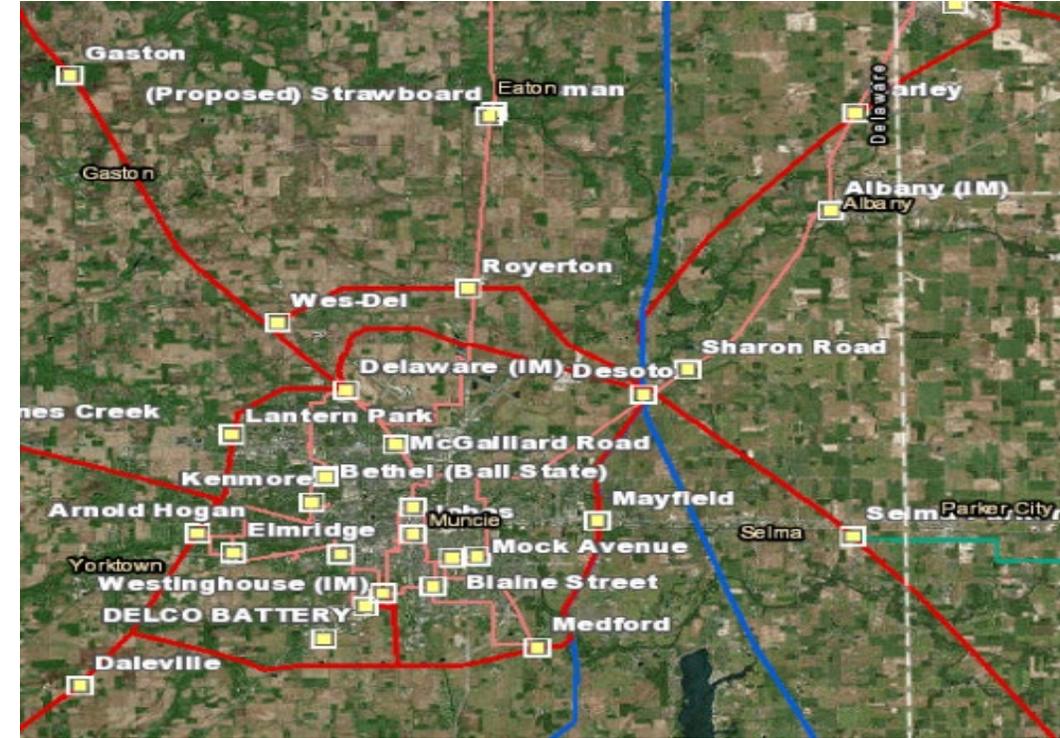
- 1948 wood 5 circuit construction
- 3/0 Copper
- 22 open A conditions
- 13 open B conditions

Delaware – Jay

- 1920's Vintage wood crossarm construction
- 1/0 Copper conductor
- 100 structures had to undergo active maintenance in the last 10 years and this trend is expected to rise as the line ages.
- 55 open A conditions
- 33 open B conditions
- 556,661 CMI

Barley Station

- AEP Distribution has requested a new delivery point off of the 138kV line near Barley station.



Need Number: AEP-2018-IM021

Process Stage: Needs Meeting 10/26/18

Process Chronology: Needs Meeting 10/26/18

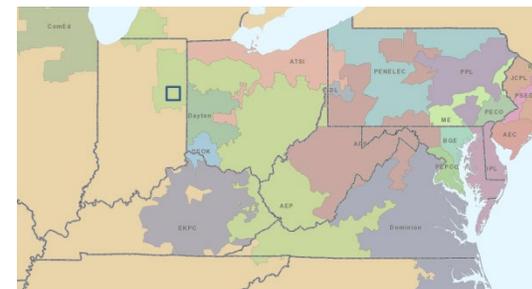
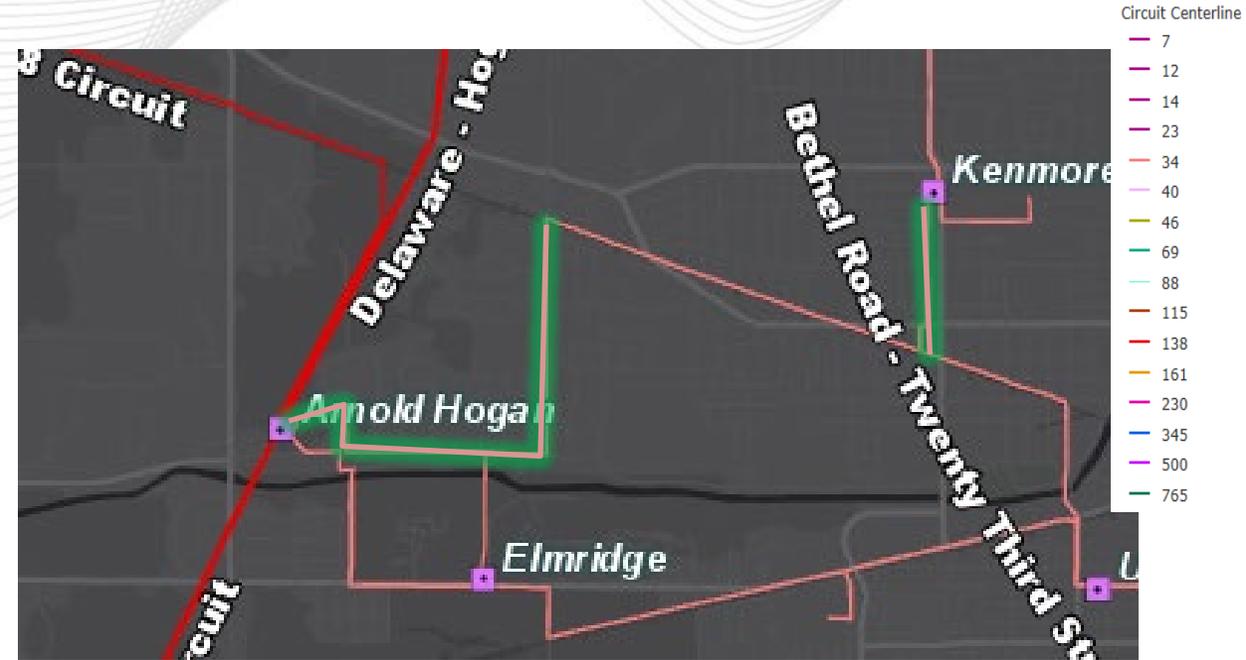
Supplemental Project Driver: Equipment Condition/Performance/Risk

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

Problem Statement:

Arnold Hogan – Kenmore

- 1930's and 1960's vintage construction
- 3/0 copper and 336.4 ACSR conductor
- 15 of the 47 structures had to undergo active maintenance in the last 10 years and this trend is expected to rise as the line ages.
- Majority of current and past maintenance concerns relate to integrity of structures and crossarms



Need Number: AEP-2018-OH034

Meeting Date: 10/26/2018

Process Chronology: Needs Meeting 10/26/2018

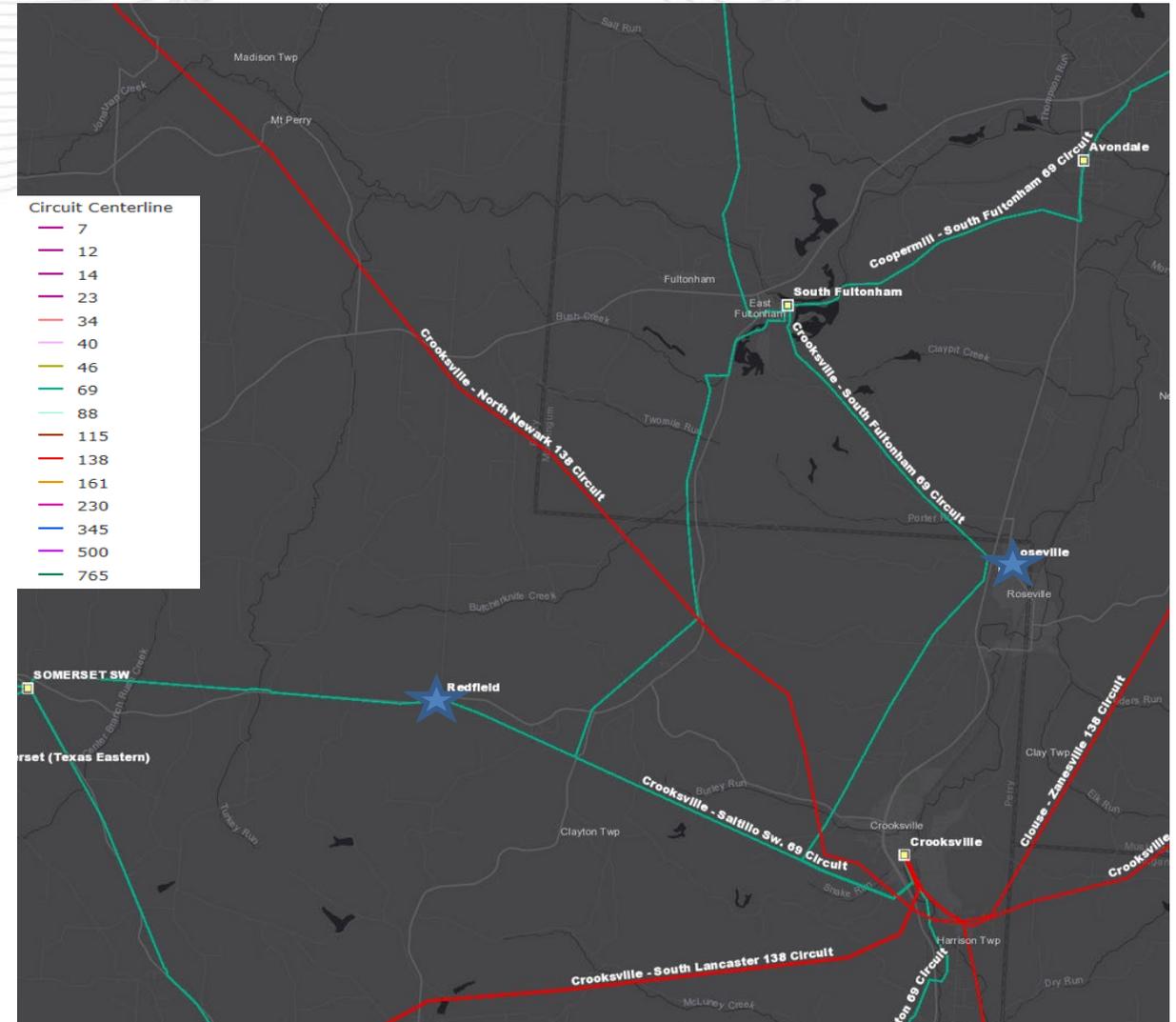
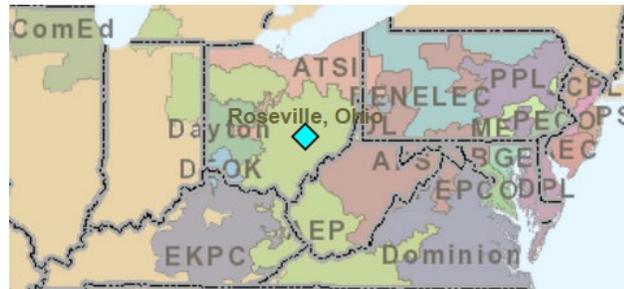
Supplemental Project Driver: Customer Service

Specific Assumption References:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

- **Customer Service :** AEP Ohio has requested improved reliability at their Roseville 69 kV delivery point. The current load is 3.2 MVA with a projected load near 5.5 MVA. Currently for an outage at Roseville Station, the load cannot be transferred to adjacent Station under peak conditions.





Need Number: AEP-2018-OH035

Process Stage: Needs Meeting 10/26/18

Process Chronology: Needs Meeting 10/26/18

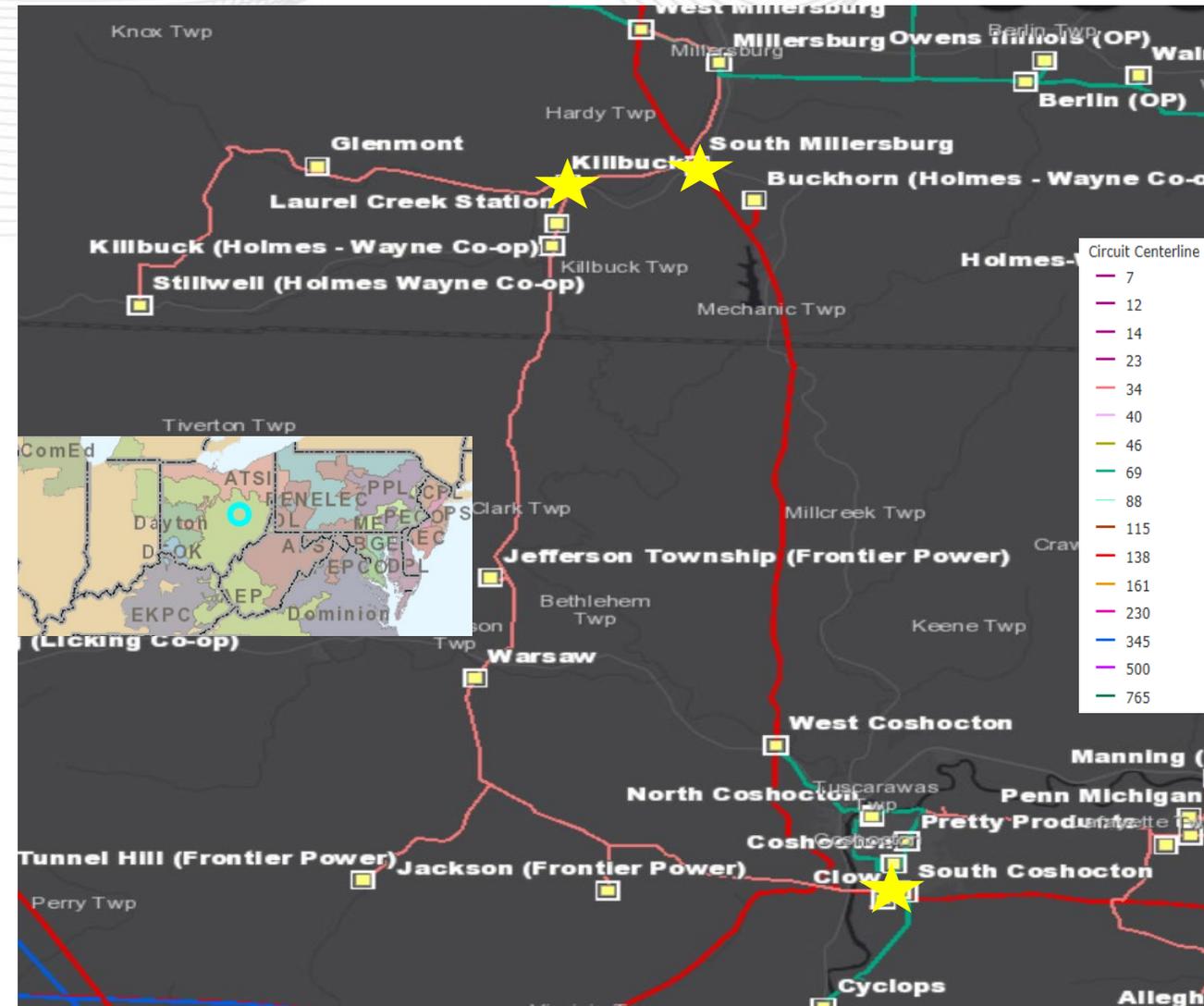
Supplemental Project Driver: Customer Service

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

Problem Statement:

Customer Service: Customer #1

A recent customer service request of 2.5 MW has been made on the Killbuck – South Coshocton 34.5 kV circuit.



Need Number: AEP-2018-OH036

Process Stage: Solutions Meeting 09/25/2019

Previously Presented:

Needs Meeting 10/26/2018

Supplemental Project Driver:

Equipment Condition

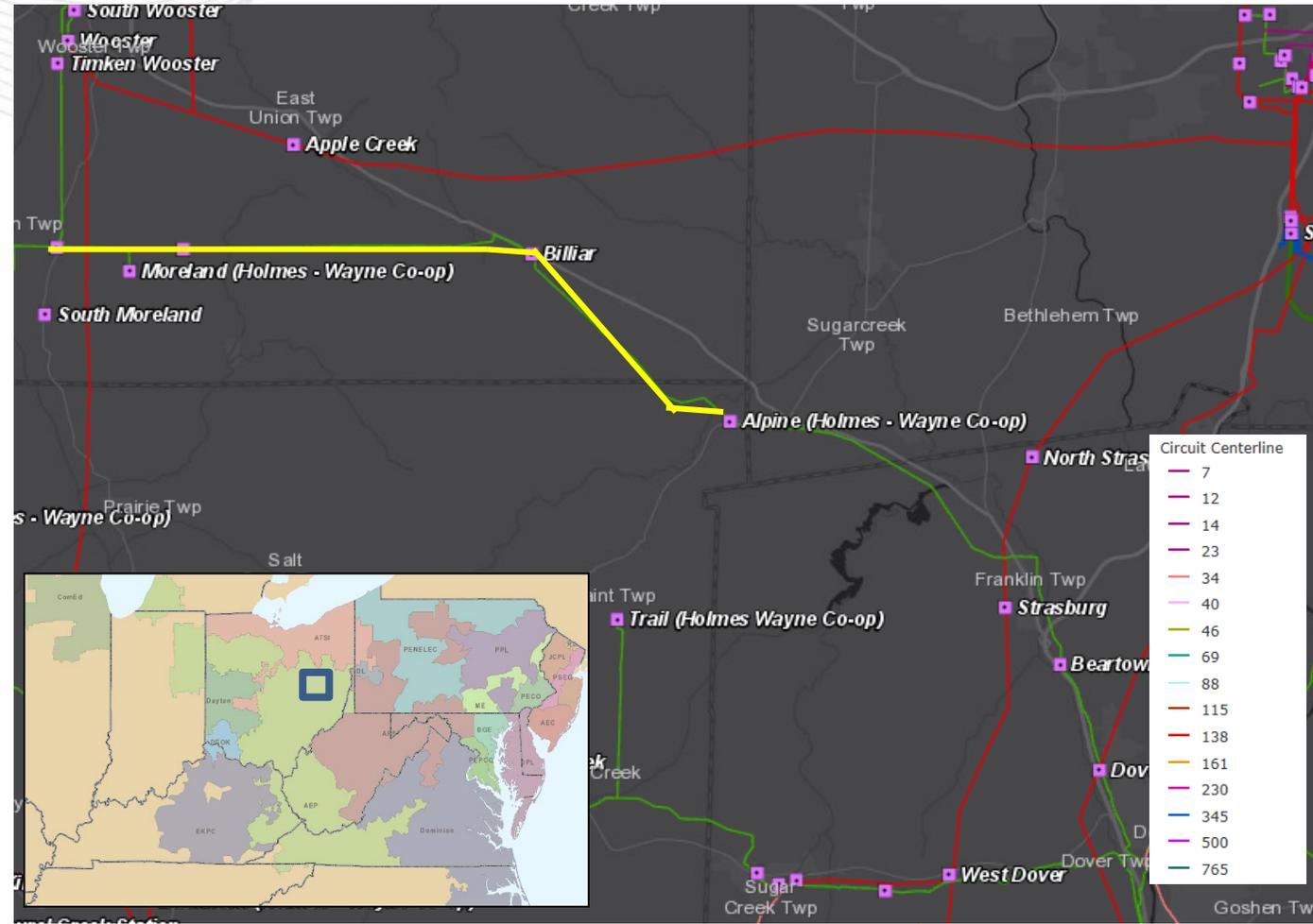
Specific Assumption References:

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

Problem Statement:

The Moreland- West Wilmont 69kV section is 17.7 miles long and serves 1 AEP Ohio distribution station and 1 Holmes-Wayne Co-op station in northeast Ohio. Over the past several years, the circuit has experienced below-average reliability. For the 2017-2018 YTD period, it has experienced 7 sustained outages, an additional 8 momentary interruptions, and 2 emergency repair incidents on the entire circuit. The majority of the outages were due to T-Line structural issues and forestry. The line section consists of primarily 4/0 copper conductor (1940 vintage) and 336 ACSR (1962-64 vintage); it is entirely wood pole construction, with the majority being installed in the 1960's or earlier. The circuit has a reported CMI of 2.0M between 2014 – 2018 and currently has 166 open conditions (152 Category A, 11 Category B). Examples of the conditions include: rotted poles, missing ground-leads, and damaged conductor. During the 2010-2018 period, 112 prior conditions were repaired/addressed on the circuit as a whole.

Also, at the North Fredericksburg station, the two 69kV line switches can only be operated when the line is de-energized, due to issues with the vacuum bottles and obsolete design.



Revision History

- 10/16/2018 – V1 – Original version posted to pjw.com
- 10/22/2018 – V2 – Update all the maps
- 10/23/2018 – V3 – Remove Slide #11
- 10/29/2018 – V4 – Slide #4&5, Corrected Date to 10/26
 - Slide #29, Updated locational map
- 3/19/2019 – V5 – Slide #41, Change AEP-2018-OH0010 to AEP-2018-OH010
 - Slide #42, Change AEP-2018-OH0011 to AEP-2018-OH011
 - Slide #43, Change AEP-2018-OH0012 to AEP-2018-OH012
 - Slide #44, Change AEP-2018-OH0013 to AEP-2018-OH013
 - Slide #45, Change AEP-2018-OH0014 to AEP-2018-OH014
 - Slide #46, Change AEP-2018-OH0015 to AEP-2018-OH015
 - Slide #47, Change AEP-2018-OH0016 to AEP-2018-OH016
 - Slide #48, Change AEP-2018-OH0017 to AEP-2018-OH017
- 5/15/2019 – V6 – Slide #6, 7 and 9, Changes are marked in the slides
 - Slide #49 and 50, New slides
- 9/16/2019 – V7 – Slide #5, Changes AEP Assumptions Slide number from 8 to 7
 - Slide #41, Changes are marked in the slides
 - Slide #51, New slide
- 11/12/2019 – V8 – Slide #36, Changes are marked in the slides
 - Slide #52, New slide
- 11/21/2019 – V9 – Slide #47, Changes are marked in the slides
 - Slide #53, New slide