



PJM Western Sub-Regional RTEP Committee AEP Supplemental Upgrades

March 25, 2019

Needs

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



Need Number: AEP-2019-AP006

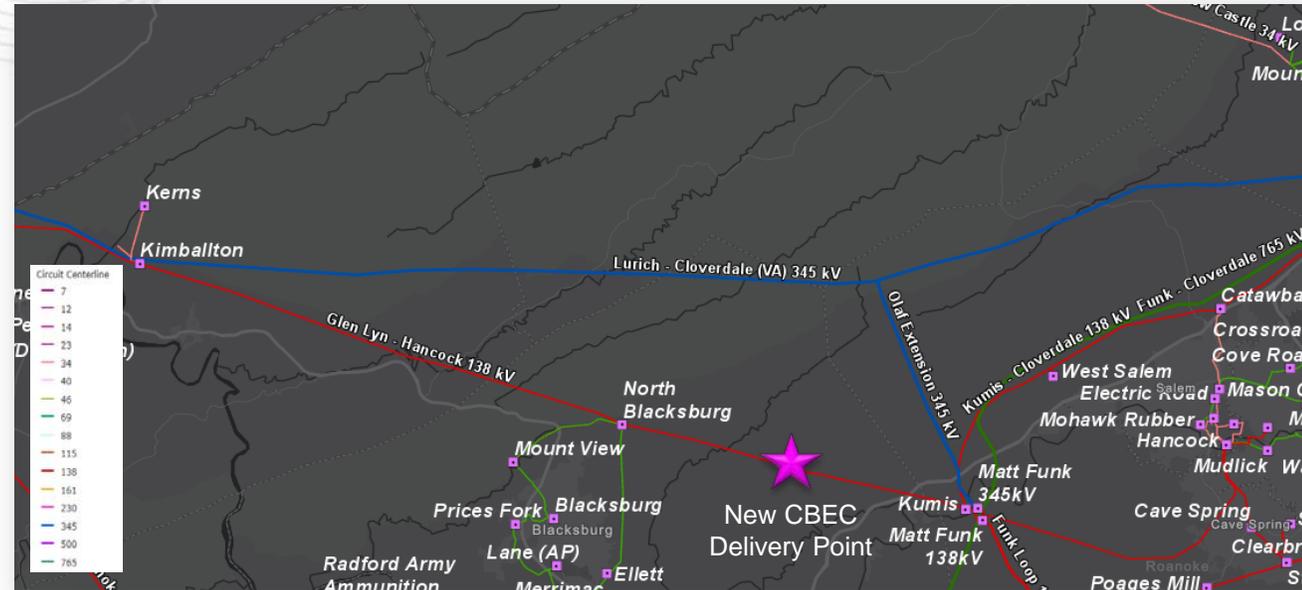
Process Stage: Needs Meeting 03/25/2019

Supplemental Project Driver: Customer Service

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

Problem Statement:

Craig-Botetourt Electric Cooperative (CBEC) requested a new delivery point from AEP to be located in Montgomery County, Virginia. The new station will serve approximately 10 MVA.



Need Number: AEP-2019-AP007

Process Stage: Needs Meeting 03/25/2019

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

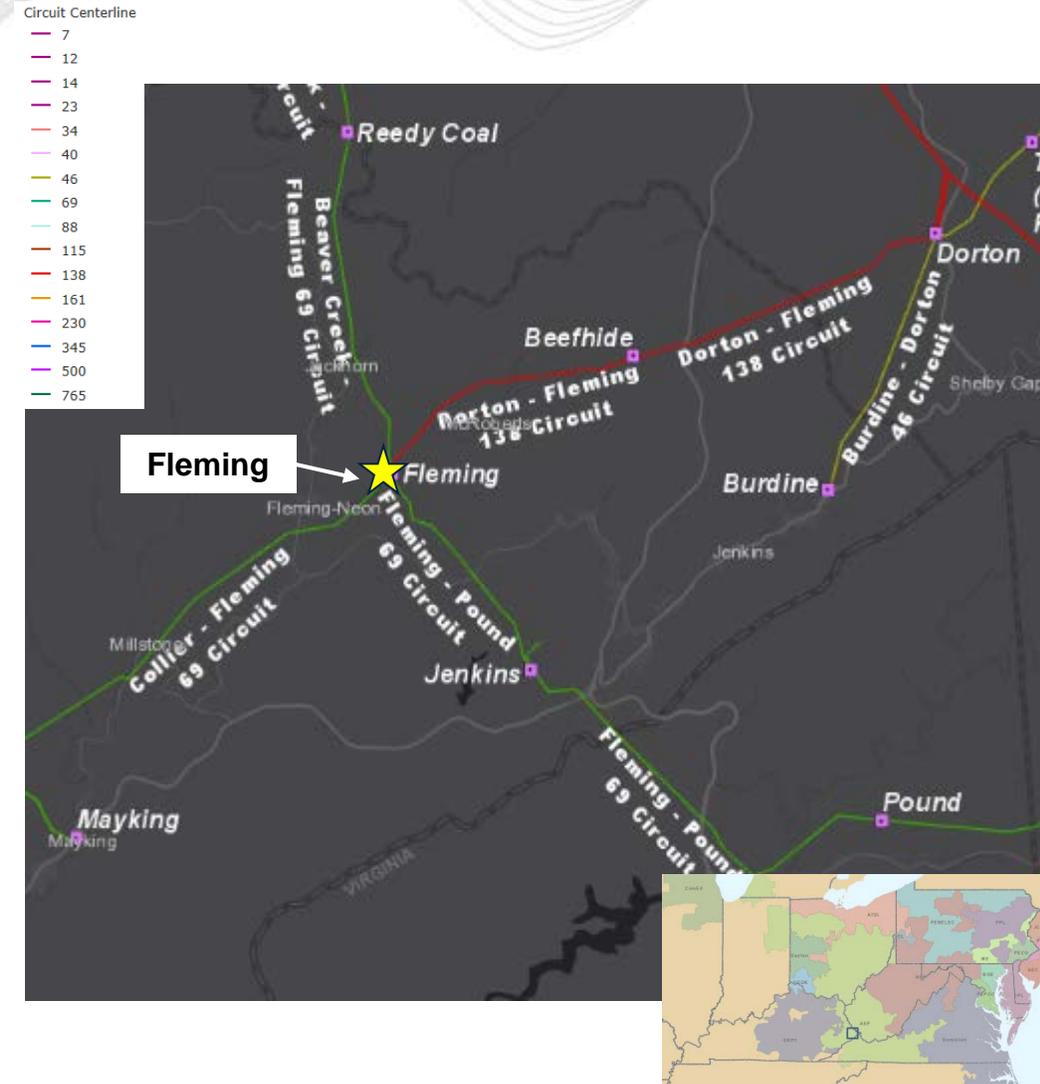
Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 8)

Problem Statement:

Fleming Station

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

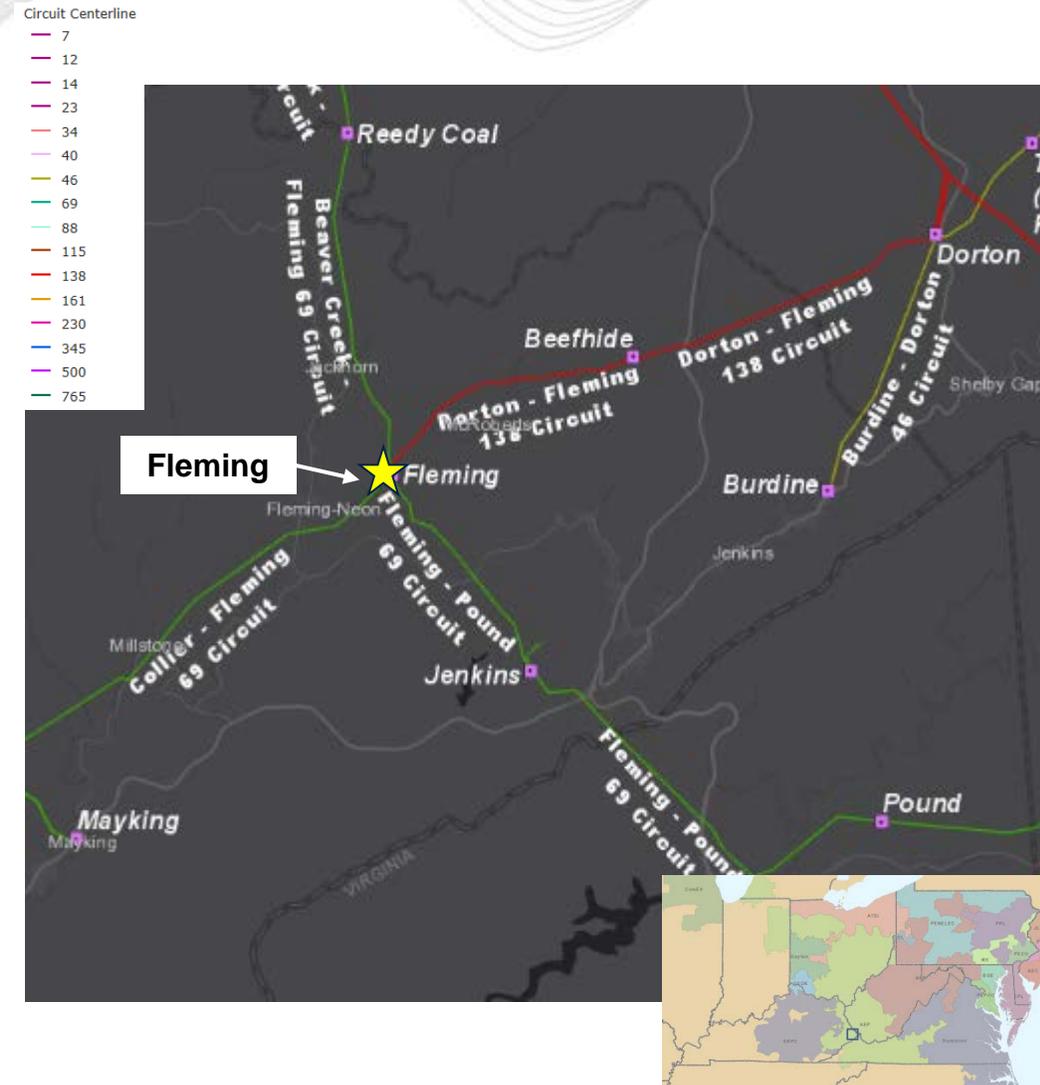
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Fleming Station

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



Need Number: AEP-2019-AP008
Process Stage: Needs Meeting 03/25/2019

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

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

Problem Statement:

Racine 69 kV circuit breaker B

- CG-48 oil type breakers that was manufactured in 1980.
- Oil breakers are more difficult to maintain as oil spills have the potential to occur during maintenance which can be an environmental and safety hazard.
- Experienced 43 fault operations, exceeding the manufacturer's designed number of fault operations of 10.

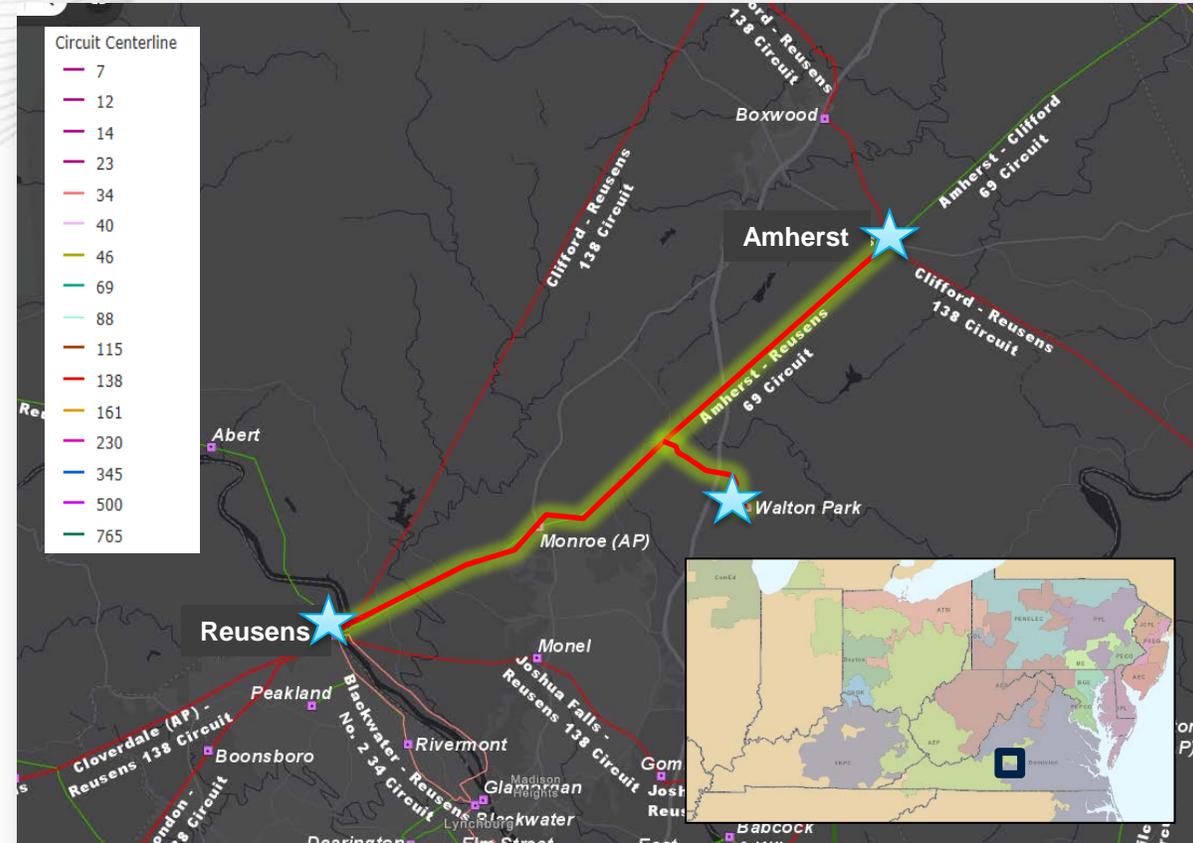


Need Number: AEP-2019-AP009
Process Stage: Needs Meeting 03/25/2019

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

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

Problem Statement:
 The 14.2 mile long Amherst-Reusens 69 kV circuit was originally constructed in 1946 using wood pole structures with the lack of shielding on most (98%) of the circuit. Within the last 3 years it has experienced 33 momentary outages and 3 permanent outages with an average outage duration of 78.4 hours. The circuit currently has 26 open conditions. The majority (84.1%) of overhead conductor consists of 4/0 ACSR, also from 1946.





AEP Transmission Zone: Supplemental Canton, Ohio

Need Number: AEP-2019-OH004

Process Stage: Needs Meeting 03/25/2019

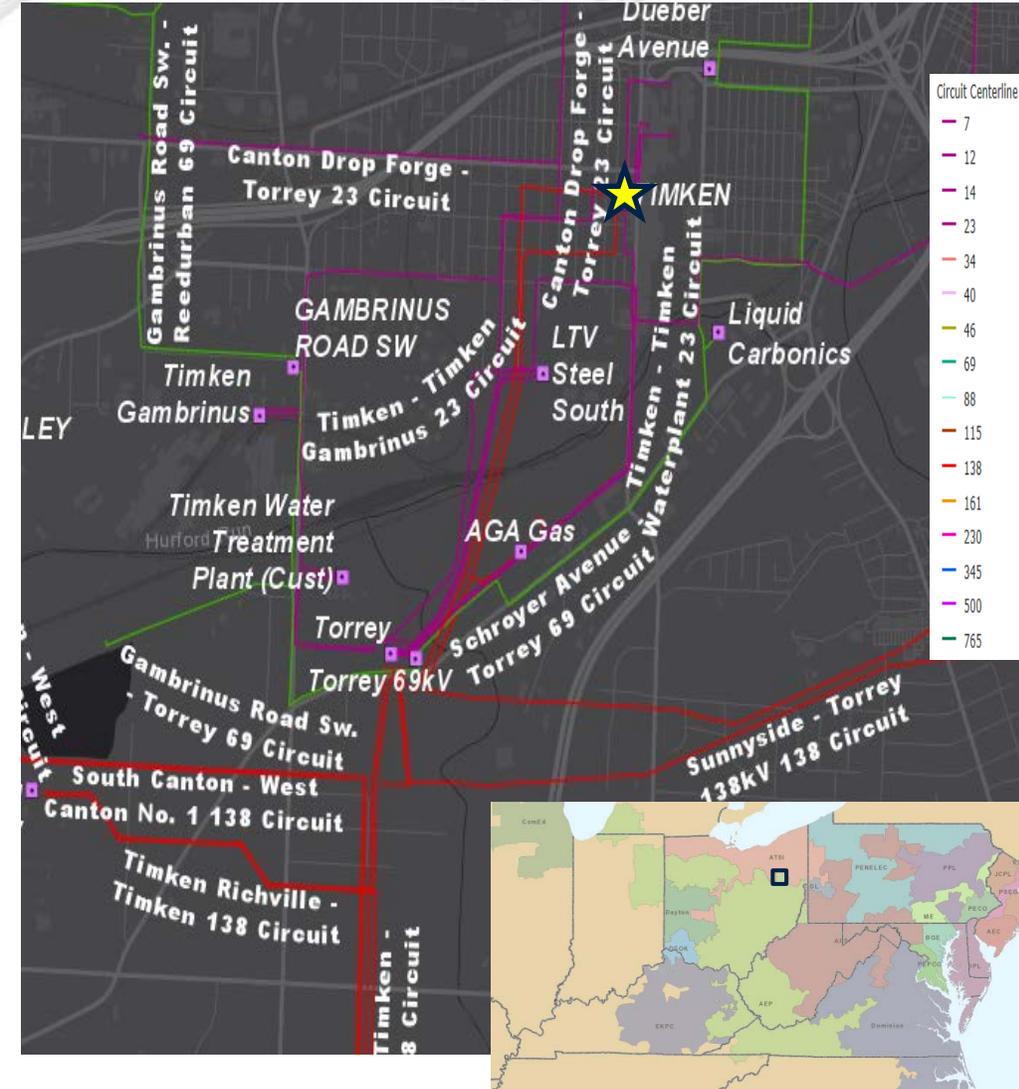
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk; Operational Flexibility; Customer Service

Specific Assumption References:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

- Timken 138/23kV Station (vintage 1966) has many asset renewal issues, which is a concern, as the Station serves one of AEP's largest industrial customers.
- The 138/23 kV transformer #3 (vintage 1966) has had overheating events, insulating paper carbonization, and signs of gassing.
- The 138/23 kV transformer #1 (vintage 1966) has dielectric strength breakdown from numerous through-fault events.
- There are two oil-filled 138kV circuit breakers (A & B, GE 'FK' type, rated 1200A / 20.9kA) that actually pre-date the station (1953-vintage, as they were transferred from an older station). There are no oil-containment systems for the transformers or breakers.
- The protection & control system is very antiquated, and comprises of 59 electromechanical relays, 1 static relay, and an obsolete RTU. EM relays have no spare part availability, lack vendor support, have no SCADA functionality, and lack fault data collection ability. The control house has no fenced boundary which is a security concern.
- An outdated pilot wire scheme connects to the two 138kV remote-ends.
- Timken is also space constrained making any improvements/modifications to the Station difficult.
- Timken is a 3 breaker Station in a straight-bus configuration (2- 138kV sources, 4- 138-23kV transformers). This configuration has several instances of dissimilar zones of protection (bus, line, and transformer) which can cause miss-operations and over tripping. In addition, a lack of sectionalizing makes maintenance a concern from an customer outage perspective.



Need Number: AEP-2019-OH005

Process Stage: Needs Meeting 03/25/2019

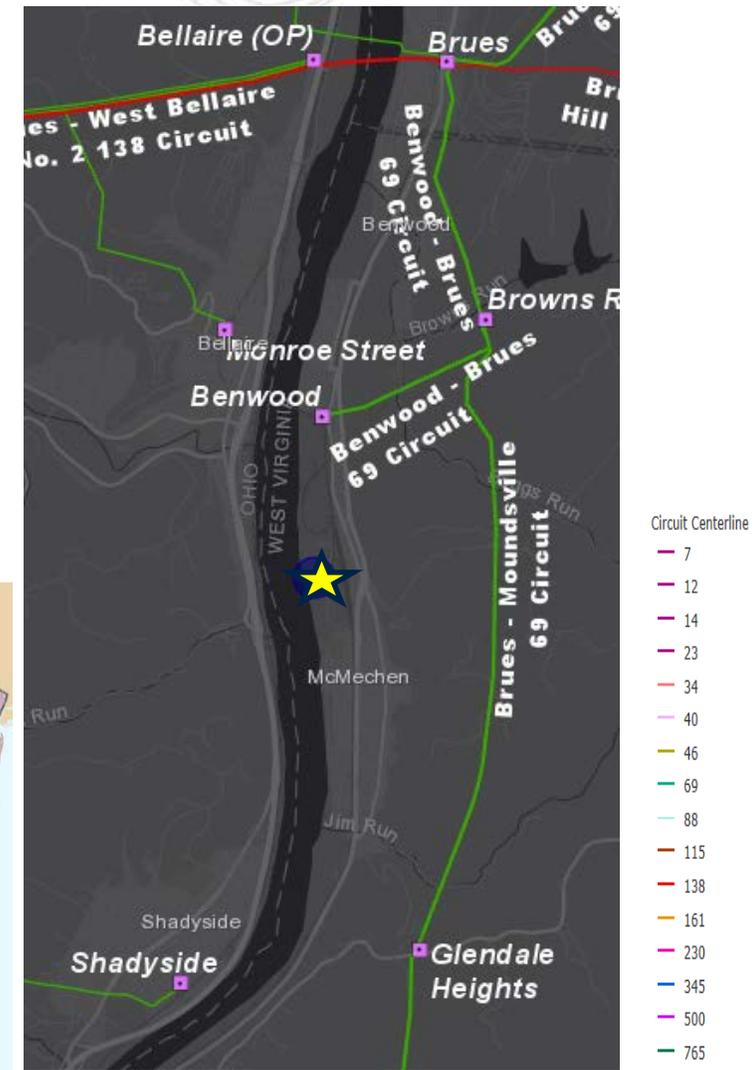
Supplemental Project Driver: Customer Service

Specific Assumption References:

AEP Connection Requirements for the AEP Transmission System

Problem Statement:

A customer has requested new service south of Benwood, West Virginia. The forecasted peak demand is 8 MVA.



Need Number: AEP-2019-OH006

Process Stage: Needs Meeting 03/25/2019

Supplemental Project Driver: Customer Service

Specific Assumption References:

AEP Connection Requirements for the AEP Transmission System

Problem Statement:

A customer has requested new service four miles east of Moundsville, West Virginia. The forecasted peak demand is 20 MVA.



Need Number: AEP-2019-OH007
 Process Stage: Needs Meeting 03/25/2019

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

Specific Assumption References: AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

Findlay Center Station:

- 34.5 kV CB's A, B, C, and D are oil type breakers (vintage 1962). Many of these breakers have exceeded the manufacturers recommended number of fault operations (10): "A" (37), "B" (7), "C" (6), and "D" (39).
- 34.5 kV cap switcher AA is a MARK-V model (2004) which has been identified for replacement due to lack of spare parts, operational and reliability concerns, and maintenance issues.

Findlay Station:

- 34.5 kV CB's A, B, D, and E are oil type breakers (vintage 1953– 1955). Many of these breakers have exceeded the manufacturers recommended number of fault operations (10): "A" (20), "B" (33), "D" (41), and "E" (3).
- 34.5 kV cap switcher AA is a VBM model (1988) which has been identified for replacement due to lack of spare parts, operational and reliability concerns, and maintenance issues.

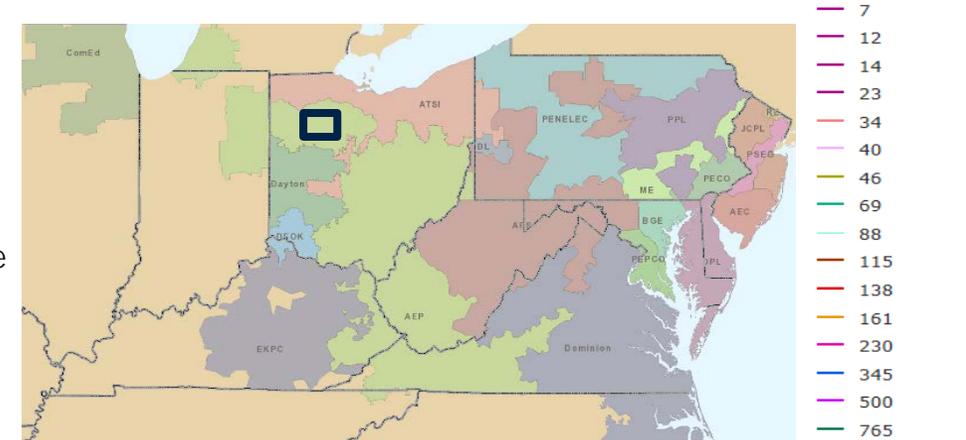
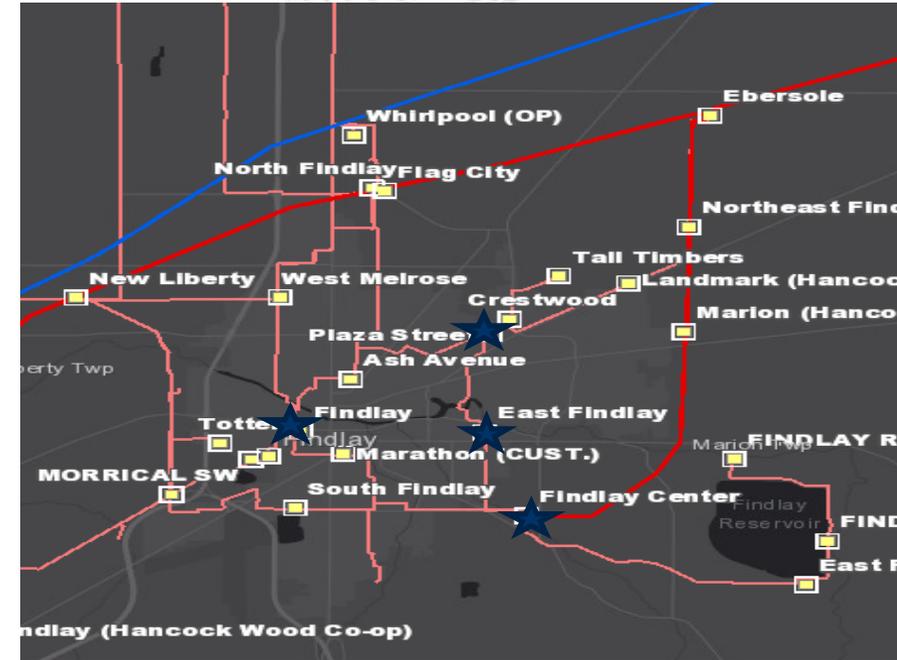
Plaza Street Station:

- 34.5 kV CB A is an oil type breaker (vintage 1948). This breaker has exceeded the manufacturers recommended number of fault operations (10): "A" (13).

East Findlay Station:

- The three-way switch (1958) has ongoing difficulties maintaining proper alignment of switches. The insulators are cap-and-pin type which often physically failing during switching operations.

**Oil breaker maintenance is difficult due to the oil handling requirements and there is a risk for oil spills during failures and maintenance. These breakers are FK model breakers that have historical reliability concerns and lack of spare part availability.



Need Number: AEP-2019-OH008

Process Stage: Needs Meeting 03/25/2019

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

Specific Assumption References:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

- Meigs 69 kV CB "1" is a 1954 oil-filled circuit breaker. Oil breakers are difficult to maintain due to oil handling requirements and risk of oil spills during maintenance and failures. This model (G.E. FK-439-69-1000-4) is also recommended for replacement due to reliability issues, lack of vendor support, and lack of spare part availability. In addition, this CB has exceeded the manufacturers recommended number of fault operations: CB 1 (20).
- ~~Coolville 69kV station is radially served on a 1954 vintage line (~12.6 miles) utilizing 4/0 ACSR 6/1 (Penguin) conductor (50/63 MVA SNAWN). This radial line has 84 structures, 22 of which have pole related open conditions and 28 of which have ground lead wire issues/concerns. It has experienced 4.4 million CMI over the last three years. Radial lines restricts the ability to perform routine maintenance and restoration activities. **Moved to AEP-2019-OH028.**~~



Need Number: AEP-2019-OH009

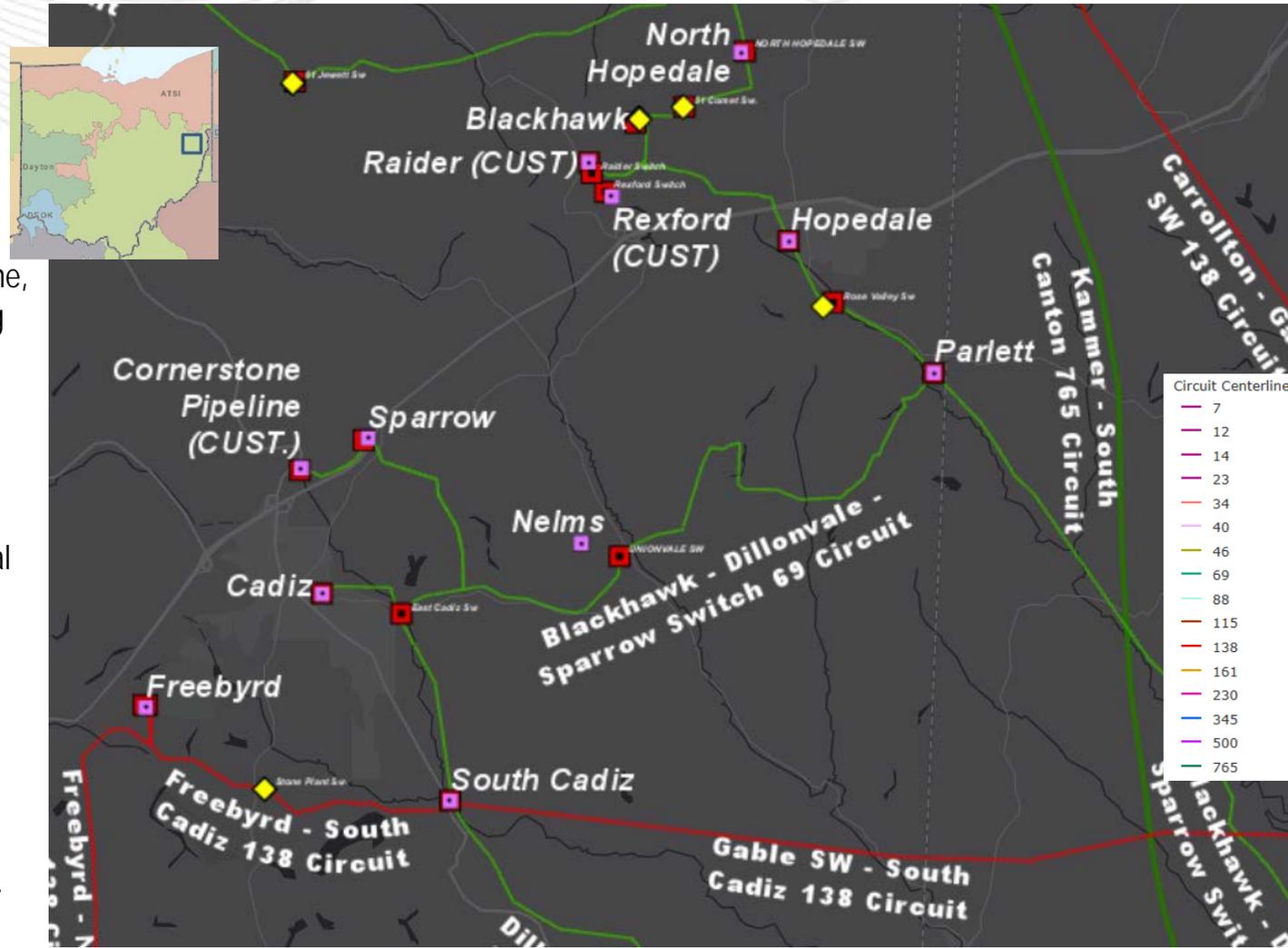
Process Stage: Needs Meeting 03/25/2019

Supplemental Project Driver: Customer Service, Equipment Condition, and Operational Flexibility

Specific Assumptions Reference: AEP Guidelines for Owner Identified Needs

Problem Statement:

- East Cadiz Switch (1950's) serves Cadiz station on a mile long radial line, which is in a remote part of our system. In addition, this switch is sitting in an area prone to flooding.
- The Parlett-East Cadiz 69kV line, approximately 8 miles long, is comprised of deteriorated 1929 vintage wood structures and still has original 1/0 Cu and 4/0 ACSR conductor on it.
- The South Cadiz-East Cadiz 69kV line, approximately 2 miles long, is comprised of deteriorated 1954 vintage wood structures with the original 4/0 ACSR conductor on it.
- The Parlett-South Cadiz 69kV line has 190 open conditions.
- All load at Nelms Station has been removed.
- The Blackhawk – Miller Switch 69 kV line section, approximately 2.5 miles long, has some of the original 1918 conductor still on it (1/0 Cu). More than half of the wood pole structures on this sections are of pre-1980 vintage and are affected by heavy rot, woodpecker, & insect damage through the years. There are 22 open conditions on this circuit.



Need Number: AEP-2019-OH011

Process Stage: Needs Meeting 03/25/2019

Supplemental Project Driver: Equipment

Material/Condition/Performance/Risk

Specific Assumptions Reference: AEP Guidelines for Transmission
Owner Identified Needs

Problem Statement:

- The Apple Valley (Licking Co-op) 138 kV delivery point serves approximately 2,300 customers with a peak demand of 6.5 MW. Apple Valley isn't 100% transferrable during all times of the year and can take several hours to complete the required switching. This delivery point has experienced 971,280 customer minutes of interruption.
- This delivery point is connected with a hard tap which limits sectionalizing during outages and maintenance. In addition, relay coordination can be difficult with hard taps.



Need Number: AEP-2019-OH012

Process Stage: Needs Meeting 03/25/2019

Supplemental Project Driver: Customer Service

Specific Assumptions Reference: AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

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



Need Number: AEP-2019-OH028

Process Stage: Needs Meeting 03/25/2019

Process Chronology: Needs Meeting 03/25/2019

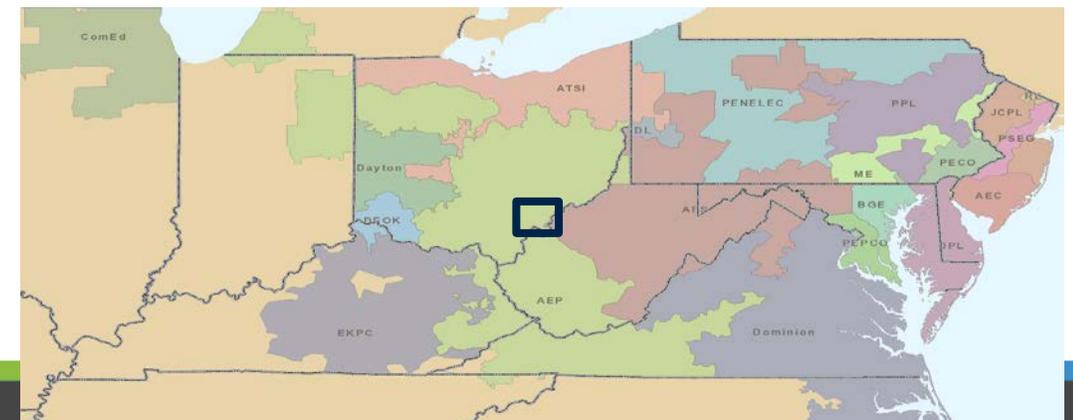
Supplemental Project Driver: Equipment Material/Condition/Performance/Risk

Specific Assumption References:

AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

- Coolville 69kV station is radially served on a 1954 vintage line (~12.6 miles) utilizing 4/0 ACSR 6/1 (Penguin) conductor (50/63 MVA SN/WN). This radial line has 84 structures, 22 of which have pole related open conditions and 28 of which have ground lead wire issues/concerns. It has experienced 4.4 million CMI over the last three years. Radial lines restricts the ability to perform routine maintenance and restoration activities.



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-2018-OH019

Process Stage: Solutions Meeting 3/25/2019

Process Chronology:

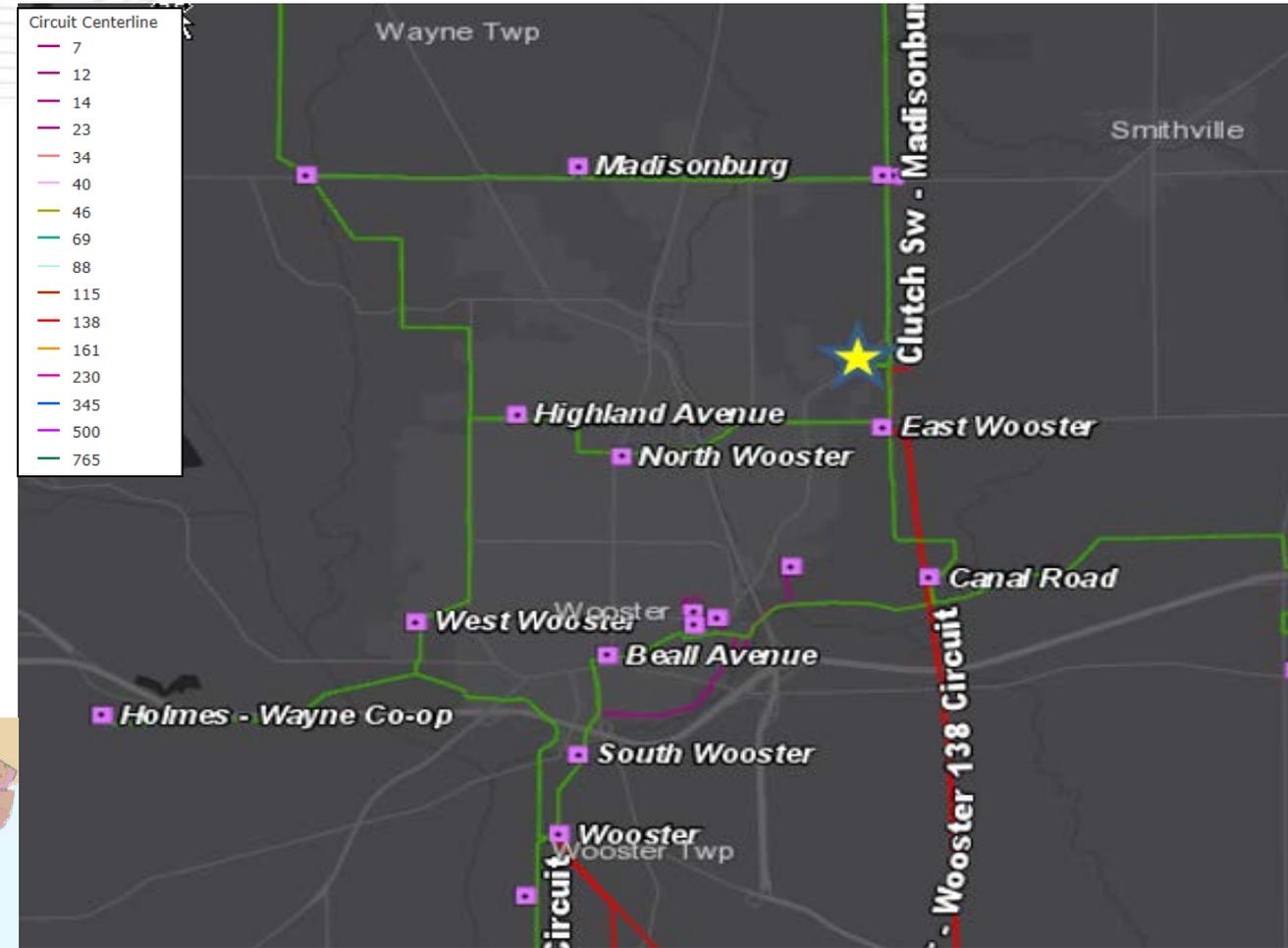
Need Meeting: 11/29/2018

Supplemental Project Driver: Customer Service

Specific Assumptions Reference: AEP Connection Requirements for the AEP Transmission System

Problem Statement:

A transmission customer has requested new 69kV service on the northeast side of Wooster, Ohio. The total peak demand is 11 MVA. The customer is paying to install a 2nd 69kV power transformer in their station and need a 2nd 69kV service point from AEP Transmission.





AEP Transmission Zone: Supplemental Wooster, Ohio

Need Number: AEP-2018-OH019

Process Stage: Solutions Meeting 3/25/2019

Proposed Solution:

Clutch Switch 69kV:

Extend a 2nd 69kV service to the customer (1 span) to serve their 2nd transformer. Install a 2nd set of 69kV revenue metering equipment. Install a 69kV bus-tie breaker at Clutch Switch station, separating the two feeds to the customer.

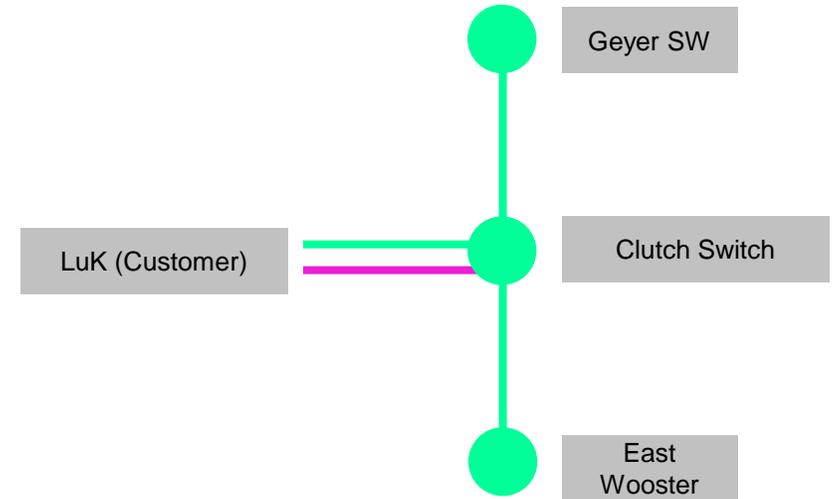
Alternatives:

No viable alternatives. The customer requires enhanced redundancy and reliability due to their complex manufacturing processes. AEP worked with the customer to develop a cost-effective service plan.

Total Estimated Transmission Cost: \$0.7M

Projected IS Date: 7/7/19

Project Status: Scoping



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

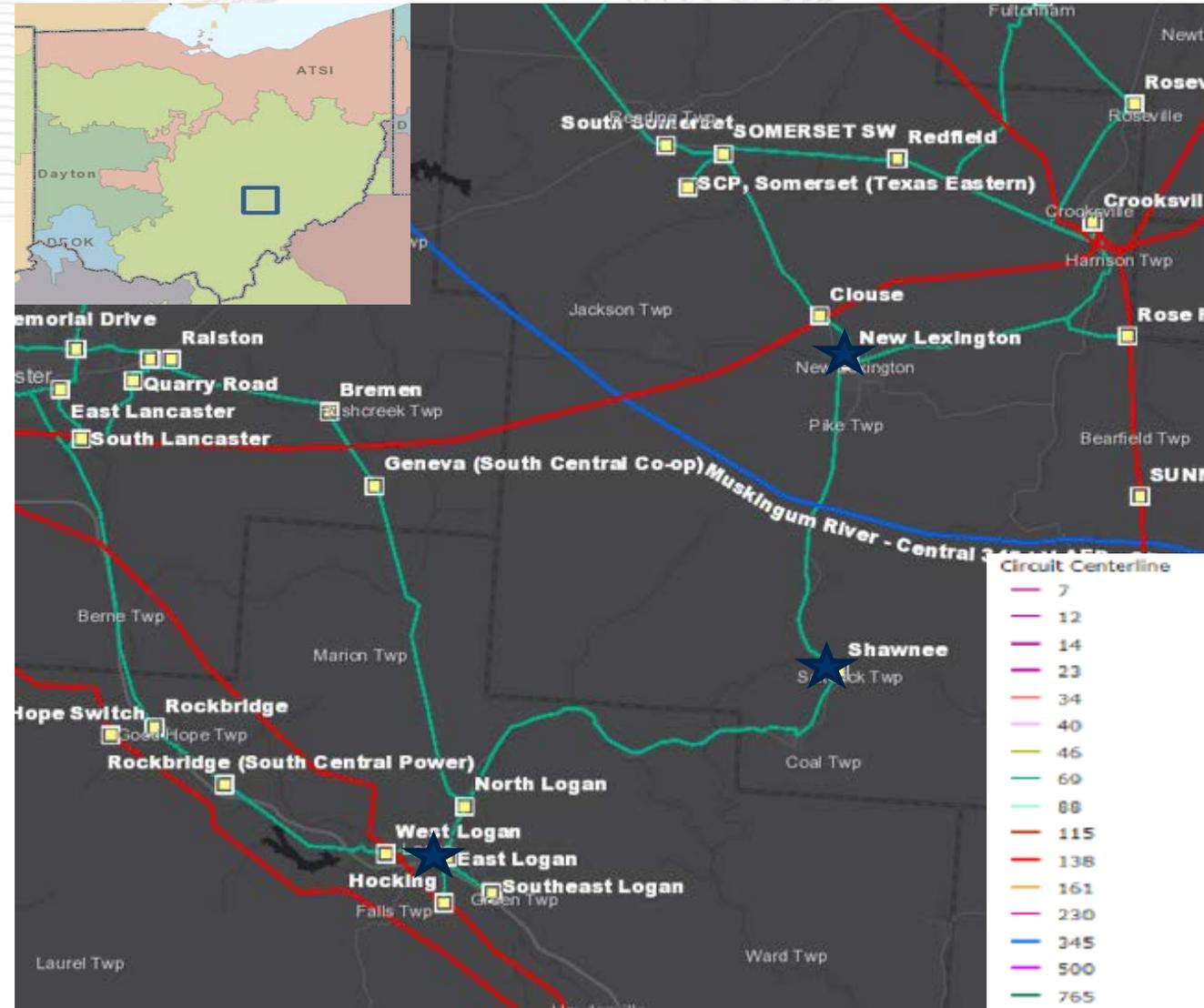
Need Number: AEP-2018-OH026
 Process Stage: Solutions Meeting 3/25/2019
 Process Chronology:
 Need Meeting: 11/29/2018

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

Specific Assumption References:
 AEP Guidelines for Transmission Owner Identified Needs

Problem Statement:

- The New Lexington – East Logan 22.3 mile 69 kV (vintage 1916) was built using wood pole structures with conductors ranging from #1 Copper 3 conductor (31 MVA rating) to 336.4 KCM ACSR 18/1 (73 MVA rating).
- There are 333 open A conditions on this line, including burnt/broken conductors, and broken structures. The New Lexington – East Logan 69 kV circuit has experienced over three million customer minutes of interruption in the past three years.



Need Number: AEP-2018-OH026

Process Stage: Solutions Meeting 3/25/2019

Proposed Solution:

Transmission Line Description:

- Rebuild approximately 8.7 miles of the East Logan-New Lexington 69 kV circuit between New Lexington and Shawnee with 795 ASCR 26/7.

Transmission Station Description:

- Replace the Shawnee 69 kV Moab 1200A switches with 2000 A switches.
- Replace the New Lexington 69 kV line riser towards East Logan.
- Replace the New Lexington 600 A breaker disconnects for CBs "A" with 2000 A switches.

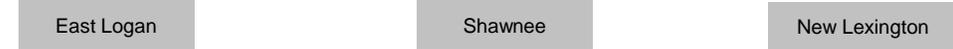
Total Estimated Transmission Cost: \$20.2M

Projected ISD Date: 12/31/2021

Project Status: Scoping

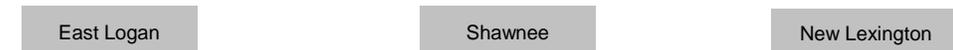
Alternatives:

No viable cost-effective transmission alternative was identified.



Existing:

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



Proposed:

Need Number: AEP-2018-OH026

Process Stage: Solutions Meeting 3/25/2019

Proposed Solution:

Transmission Line Description:

- Rebuild approximately 8.7 miles of the East Logan-New Lexington 69 kV circuit between New Lexington and Shawnee with 795 ASCR 26/7.

Transmission Station Description:

- Replace the Shawnee 69 kV Moab 1200A switches with 2000 A switches.
- Replace the New Lexington 69 kV line riser towards East Logan.
- Replace the New Lexington 600 A breaker disconnects for CBs "A" with 2000 A switches.

Total Estimated Transmission Cost: \$20.2M

Projected ISD Date: 12/31/2021

Project Status: Scoping

Alternatives:

No viable cost-effective transmission alternative was identified.



Existing:

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



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

3/14/2019 – V1 – Original version posted to pjm.com

- 3/19/2019 – V2 – Slide #8, Change AEP-2019-OH0004 to AEP-2019-OH004
 - Slide #9, Change AEP-2019-OH0005 to AEP-2019-OH005
 - Slide #10, Change AEP-2019-OH0006 to AEP-2019-OH006
 - Slide #11, Change AEP-2019-OH0007 to AEP-2019-OH007
 - Slide #12, Change AEP-2019-OH0008 to AEP-2019-OH008
 - Slide #13, Change AEP-2019-OH0009 to AEP-2019-OH009
 - Slide #14, Change AEP-2019-OH0011 to AEP-2019-OH011
 - Slide #15, Change AEP-2019-OH0012 to AEP-2019-OH012
 - Slides #17,18, Change AEP-2018-OH0019 to AEP-2018-OH019
 - Slides #19, 20, 21, Change AEP-2018-OH0026 to AEP-2018-OH026

3/21/2019 – V3 – Slide #13, Update map

3/22/2019 – V4 – Slide #13, Change “Meigs County/Coolville, Ohio” to “Cadiz, Ohio”

5/16/2019–V5 – Slide #12, Changes are as marked

- Slide #16, New slide