

Sub Regional RTEP Committee: Western AEP Supplemental Projects

July 22, 2022

Needs

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

AEP Transmission Zone M-3 Process Hancock & Wood County, OH

Need Number: AEP-2022-OH021

Process Stage: Need Meeting 07-22-2022

Project Driver:

Equipment Material/Condition/Performance/Risk

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13), AEP's Pre-1930s Era Lattice Tower and Transmission Line System Report

Problem Statement:

Fostoria – Pemberville 138kV Line(1938):

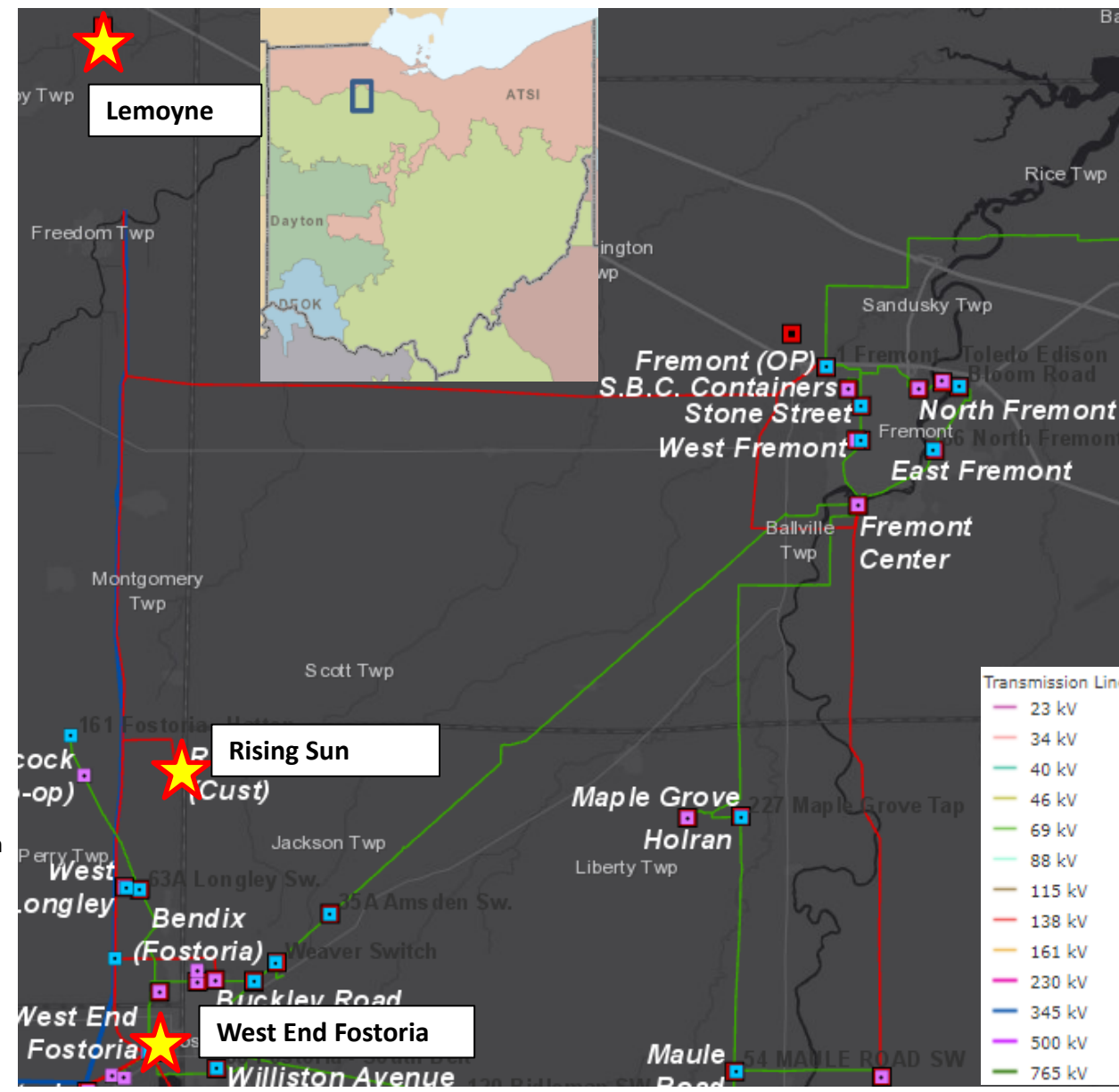
- Length of Line: 18.68 Miles
- Total Structure Count: 109
 - Double circuit steel lattice towers, Wooden three pole structure, Steel monopole
 - Vertical ceramic insulators, hook attachment
- Conductor Types: 477 ACSR 26/7 (Hawk), 334.5 ACSR 30/7 (Oriole)
- Outage History: 6 Momentary and 3 Permanent outages – average duration of 12.7 hours over the past five years.
- Open Conditions: 22 Open Conditions consisting of broken/loose/missing conductor hardware, rust/burnt/chipped/broken insulators and worn insulator hardware

This line is primarily made of the original 1938 structures (98%) and conductor(99.8%). The line is entering its accelerated deterioration phase of life. Significant deterioration results in loss of strength and performance posing a significant risk of failure under conditions the assets should be able to withstand. These failures may cause frequent and extended outages, create significant economic losses and endanger public safety.

The hanging insulators freely move and wear within the hangers. This wear results in the loss of the steel section over time. That section loss reduces the strength of the connection which can result in premature failure.

Additional Information:

The customers at Rising Sun are served from a 6.6 mile radial. 4.8 miles of this radial are part of the Fostoria - Pemberville line.



Process Stage: Need Meeting 07/22/2022

Project Driver:
 Equipment Material/Condition/Performance/Risk

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

Problem Statement:

Haviland - Paulding 69kV Line (1951 vintage):

- Length of Line: 10.73 Miles
- Total Structure Count: 175
 - Wooden, Steel Monopole Structures
- Conductor Types: 4/0 ACSR 6/1 (Penguin), 336.4 ACSR 18/1 (Merlin),
- Outage History: 7 Momentary and 3 Permanent outages – average duration of 24.6 hours, 1.185M CMI between 2015 and 2020.
- Open Conditions: 16 open conditions on 14 unique structures, including burnt insulators, conductor splice issues, broken/missing ground leads and pole rot.

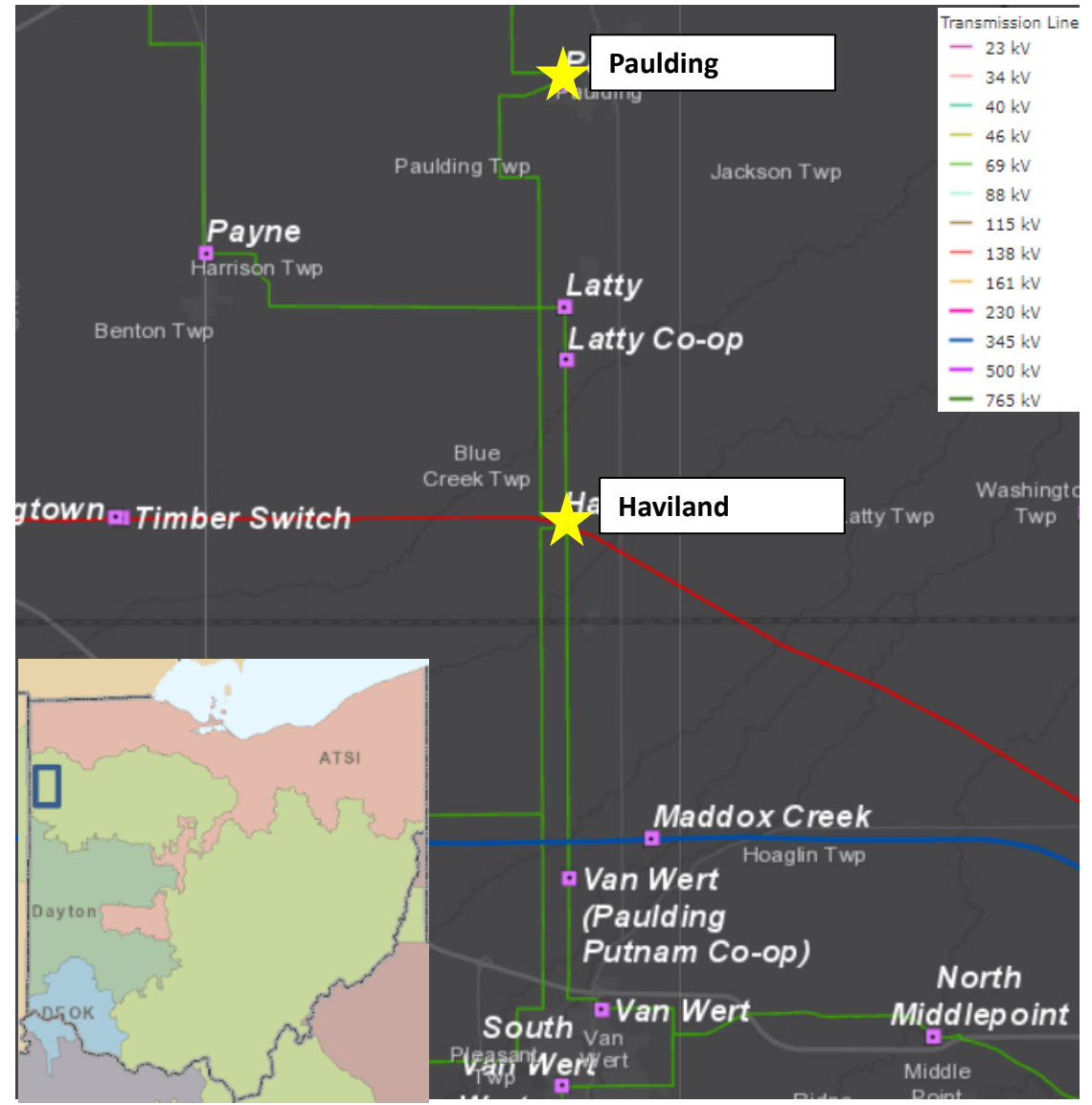
The Haviland- Paulding line does not meet 2017 NESC Grade B loading criteria or current AEP structural strength requirements. The line is insulated with mix of insulator types, many which do not meet current AEP standards for CIFO and minimum leakage distance requirements.

14 representative structures were assessed by a ground crew. 58% of those structures had reported conditions, which included the following: one structure had flashed insulators and a broken “S” downlead, one structure had a split shell near the center phase, one structure had a push-brace structure separating, one structure had brown porcelain insulators with AL bases + caps (failure risk), one structure had spliced conductors, one structure had a broken “S” downlead, one structure had anchor damage and a slacking top down guy, and one structure had a bowed pole at the distribution underbuild.

Additional Information:

During the 2012 Derecho storm Haviland - Paulding experienced multiple cascading pole failure events. These failed structures were replaced with steel monopole type structures. There are 30 newer steel structures, representing 17% of the structures on the line.

AEP Transmission Zone M-3 Process Paulding Co., OH



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

Need Number: AEP-2022-OH043

Process Stage: Need Meeting 07/22/2022

Project Driver:

Equipment Material/Condition/Performance/Risk

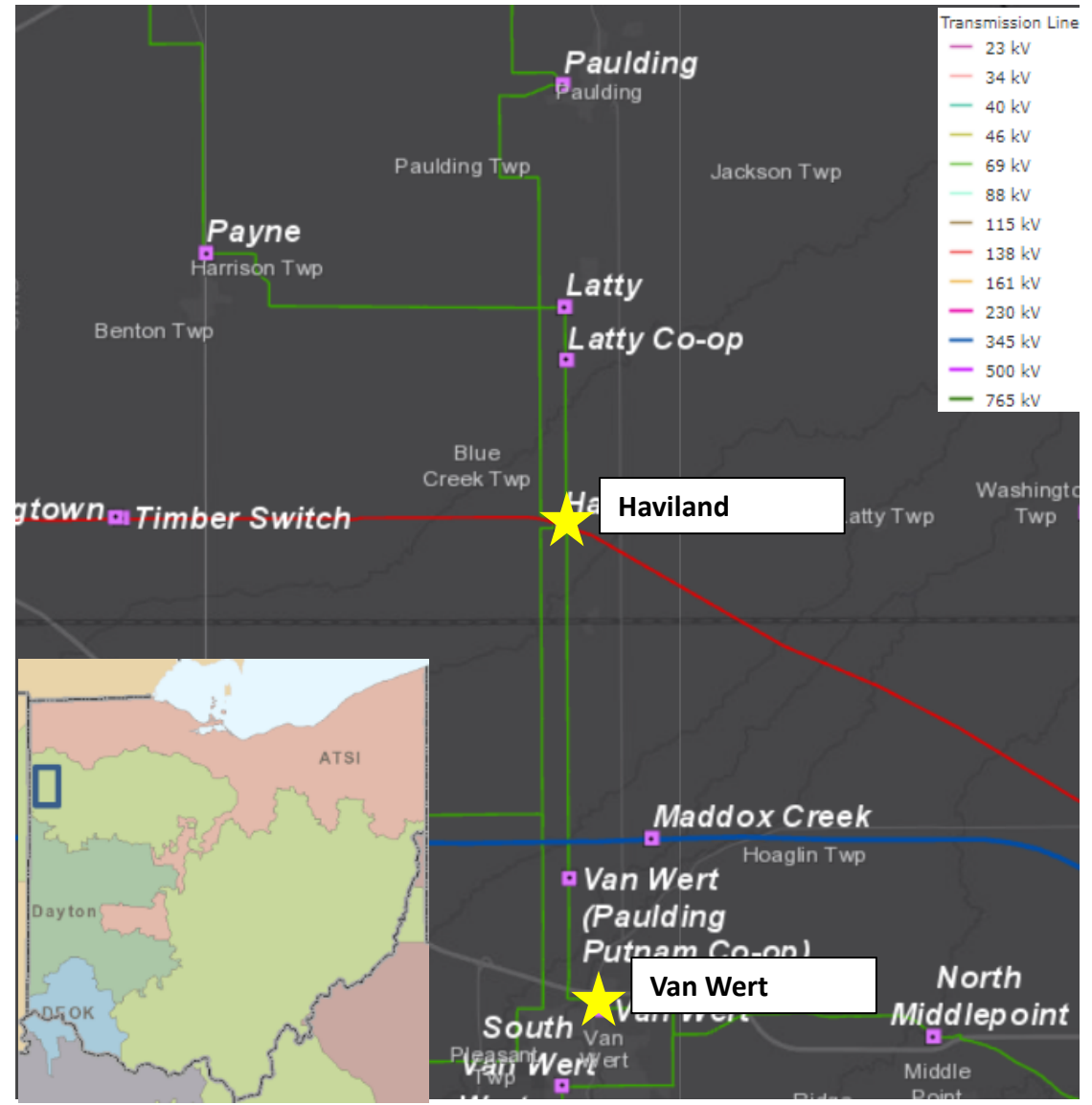
Specific Assumption Reference:

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

Problem Statement:

Van Wert - Haviland 69kV Line(1926) :

- Length of Line: 10.06 Miles
- Total Structure Count: 249
 - Wooden, Steel Monopole Structures
 - Vertical post insulators
- Conductor Types: 556.5 ACSR 18/1 (Osprey), 4/0 COOPER, 556.5 ALUMINUM 19 (Dahlia), 795 ACSR 26/7 (Drake)
- Outage History: 1 Momentary and 2 Permanent outages – average duration of 38.72 hours, 66.6K CMI between 2015 and 2020
- Open Conditions: 19, including splice/dead end conductor issues, damaged/missing ground lead wires, broken shield wire, disconnected grounding mat and chipped insulators
- The Van Wert - Haviland line fails to meet 2017 NESC Grade B loading criteria, current AEP structural strength requirements, and the current ASCE structural strength requirements. The line is insulated with vertical post insulators that do not meet current AEP standards for CIFO and minimum leakage distance requirements.



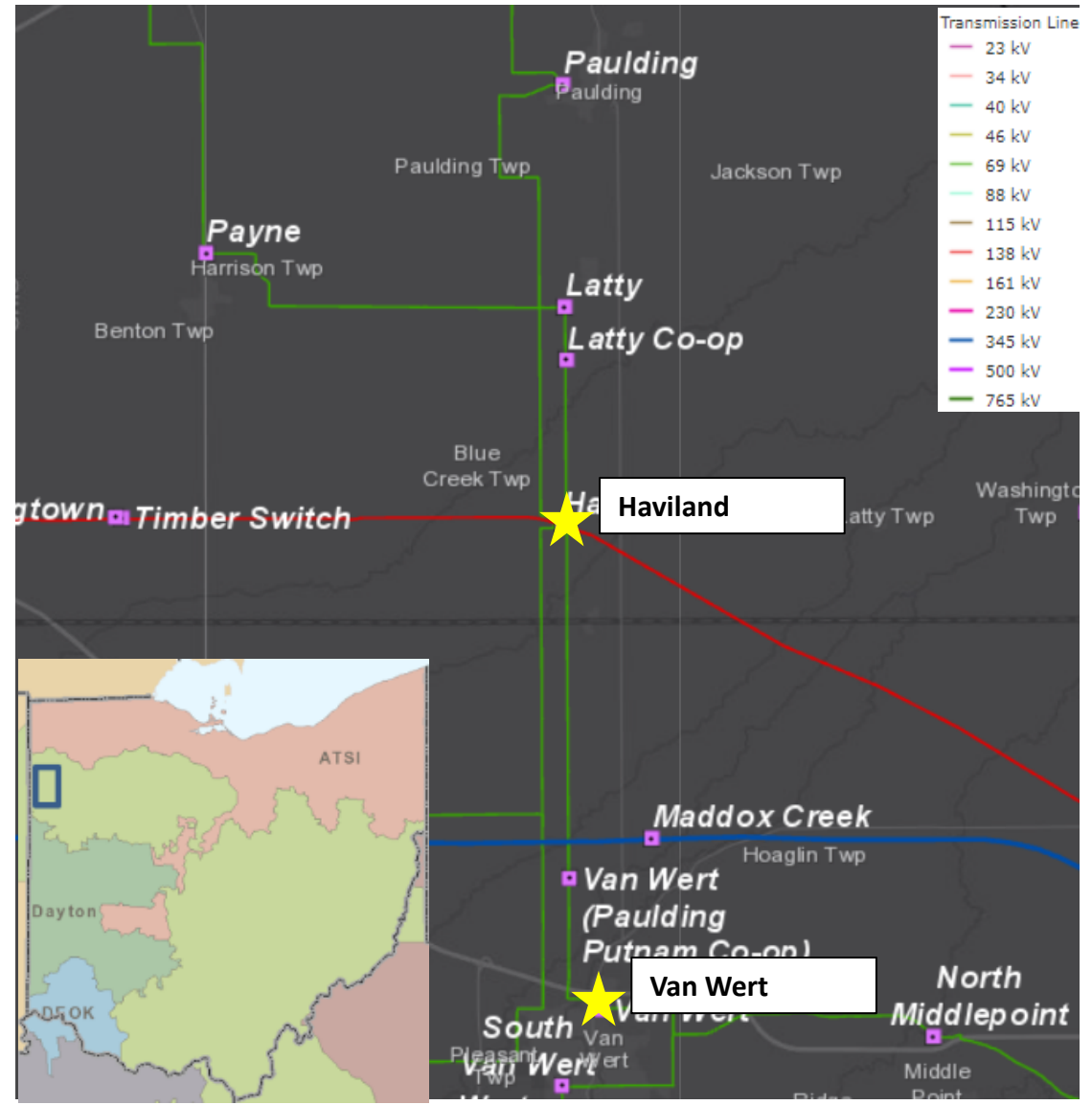
AEP Transmission Zone M-3 Process Paulding & Van Wert Co., OH

Problem Statement continued:

- 15 structures were further assessed by a ground crew. 73% of those structures had reported conditions, which included the following: one structure had PLP deadends in the shield wire, one structure had pole top decay and a twisted crossarm, one structure had pole top decay, a PLP splice in the shield wire, brown porcelain tie-top post insulators with aluminum bases (failure risk) and an insulator with broken skirts, one structure had insect damage to a crossarm, a twisted crossarm, spliced conductors, a PLP splice in the shield wire and a 2-pole brace structure with a bent anchor, one structure had a compression splice in the shield wire, one structure had a stolen "S" download, one structure had brown porcelain tie-top insulators (failure risk), one structure had crossarm splitting and rotting, one structure had un-guyed distribution primary lateral that is deflecting the pole, one structure had a distribution secondary that is deflecting the pole and one structure had a PLP splice in the shield wire.

Additional Information:

During the 2012 Derecho and 2017 straight-line wind storms Van Wert- Haviland experienced multiple cascading pole failure events. These failed structures were replaced with steel monopole type structures. There are 55 newer steel structures, representing 22% of the structures on the line.



Need Number: AEP-2022-OH055

Process Stage: Need Meeting 07/22/2022

Project Driver: Customer Service

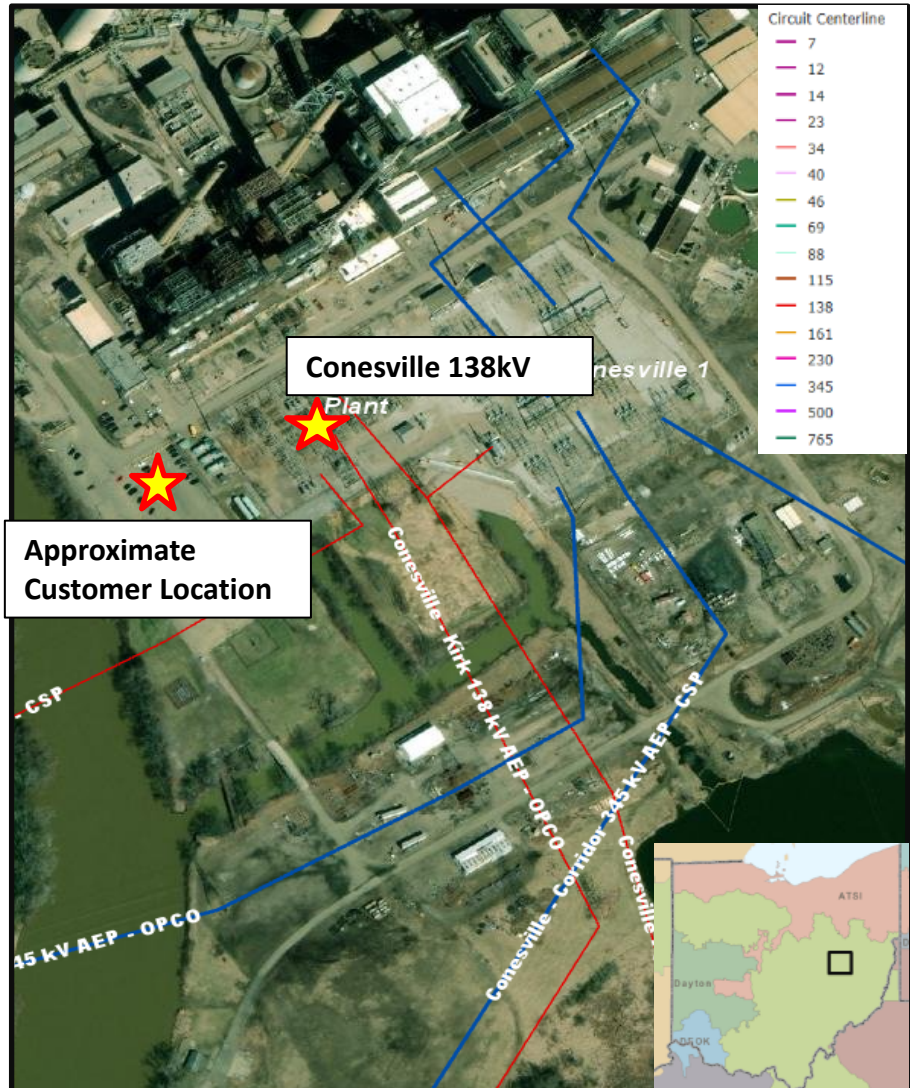
Specific Assumption Reference:

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

Problem Statement:

A customer has requested a new 138 kV service for their facility next to the existing 138 kV Conesville station. The initial peak demand will be 50 MW with an ultimate capacity of up to 300 MW.

Requested In-Service: 12/1/2022



AEP Transmission Zone M-3 Process Wheeling, West Virginia

Need Number: AEP-2022-OH060

Process Stage: Need Meeting 07/22/2022

Project Driver: Equipment Material/Condition/Performance/Risk

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

Problem Statement:

69 kV Circuit Breakers A, B, & K:

- Breaker Age: A & B 1965, K 1966
- Interrupting Medium: (Oil)
- Number of Fault Operations: These circuit breakers have exceeded the manufacturer’s designed number (10) of fault operations.
 - A: 34, B: 53, K: 30
- Additional Information:
 - These breakers are oil filled without oil containment; oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require.
 - Circuit Breakers A & B are part of the CF family. The manufacturer provides no support for the CF/CG/CGH/CH family of circuit breakers and spare parts are increasingly more difficult to obtain. This model family has experienced major malfunctions associated with their OA-3 hydraulic mechanism, which includes low-pressure readings, hydraulic leaks, pump lockouts, and failure to shut off. These mechanism malfunctions have led to several failures to close and other types of mis-operations across the AEP fleet.
 - Circuit Breaker K is part of the FK family. The manufacturer provides no support for this fleet of circuit breakers and spare parts are increasingly more difficult to obtain; components are often taken from out of service units with remaining usable parts. A common failure mode documented in AEP malfunction records are compressor failures and valve defects, which cause low pressure and oil leaks. Another failure mode includes trip or reclose failures, caused primarily by spring latching and charging motor component failures. In addition, the vacuum oil and oil breakers have a lot of oil contamination from aging gaskets allowing moisture and other particle ingress.

Relays:

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



Need Number: AEP-2022-OH061

Process Stage: Need Meeting 07/22/2022

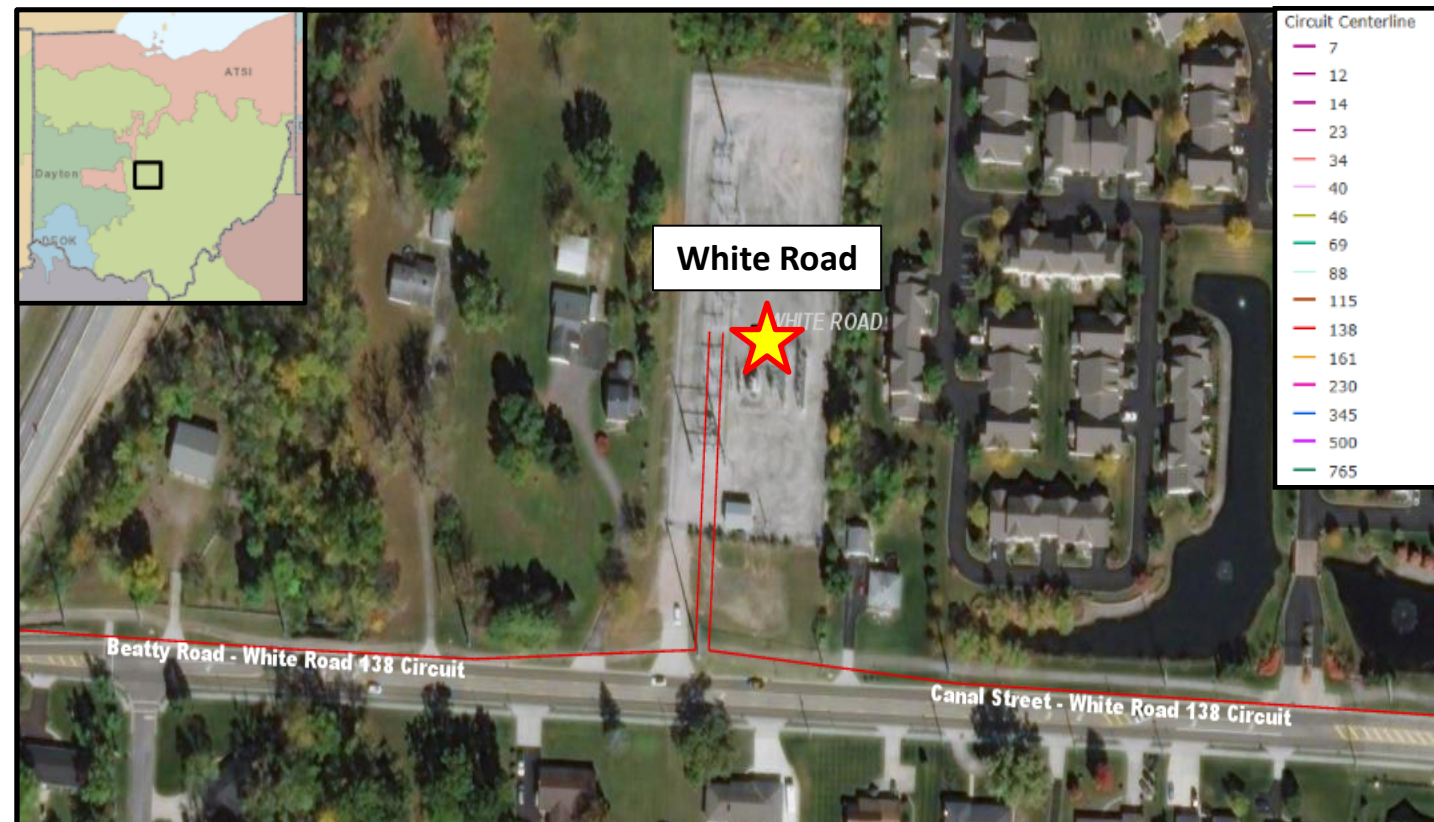
Project Driver: Customer Service

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

Problem Statement:

AEP Ohio has requested to add capacity at White Road station, due to continuous load growth in the area. The anticipated peak load is approximately 40-50 MVA. The requested in-service date is August 2023.

Model: 2026 RTEP



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-2021-OH009

Process Stage: Solution Meeting 07/22/2022

Previously Presented: Need Meeting 3/19/2021

Project Driver:

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

Specific Assumption Reference:

AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 12-14)

Problem Statement:

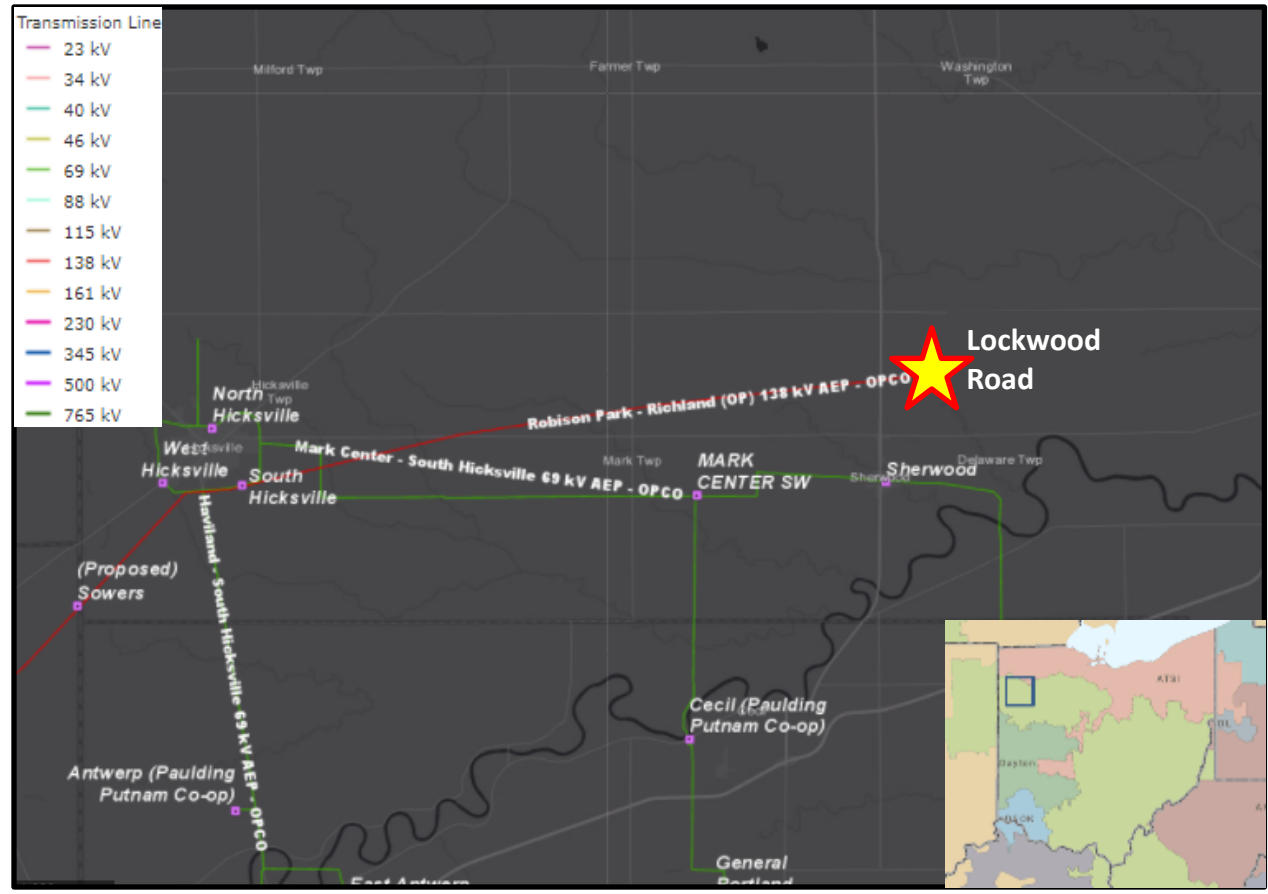
Equipment Material/Condition/Performance/Risk

Lockwood Road 138 kV Station

Circuit Breakers A:

- Manufactured Date: 1982
- Interrupting Medium: (SF6)
- Fault Operations:
 - Number of Fault Operations: 85
 - Manufacturer recommended Number of Operations: 10
- Additional Breaker Information: The expected life of the bushing gaskets and door inspection port seals is 25 years, this breaker has surpassed this age. Seals that are no longer adequate can cause SF6 leaks to become more frequent. The vendor provides no support or manufactures spare parts for this family of circuit breakers.
- Relays: Currently, 30 of the 31 relays (97% of all station relays) are in need of replacement. 25 of these are of the electromechanical type and 2 of the static type which have significant limitations with regards to spare part availability and fault data collection and retention. In addition, these relays lack of vendor support. There are also 3 microprocessor based relays commissioned in 2009 and have unsupported firmware.

AEP Transmission Zone M-3 Process Defiance, Ohio



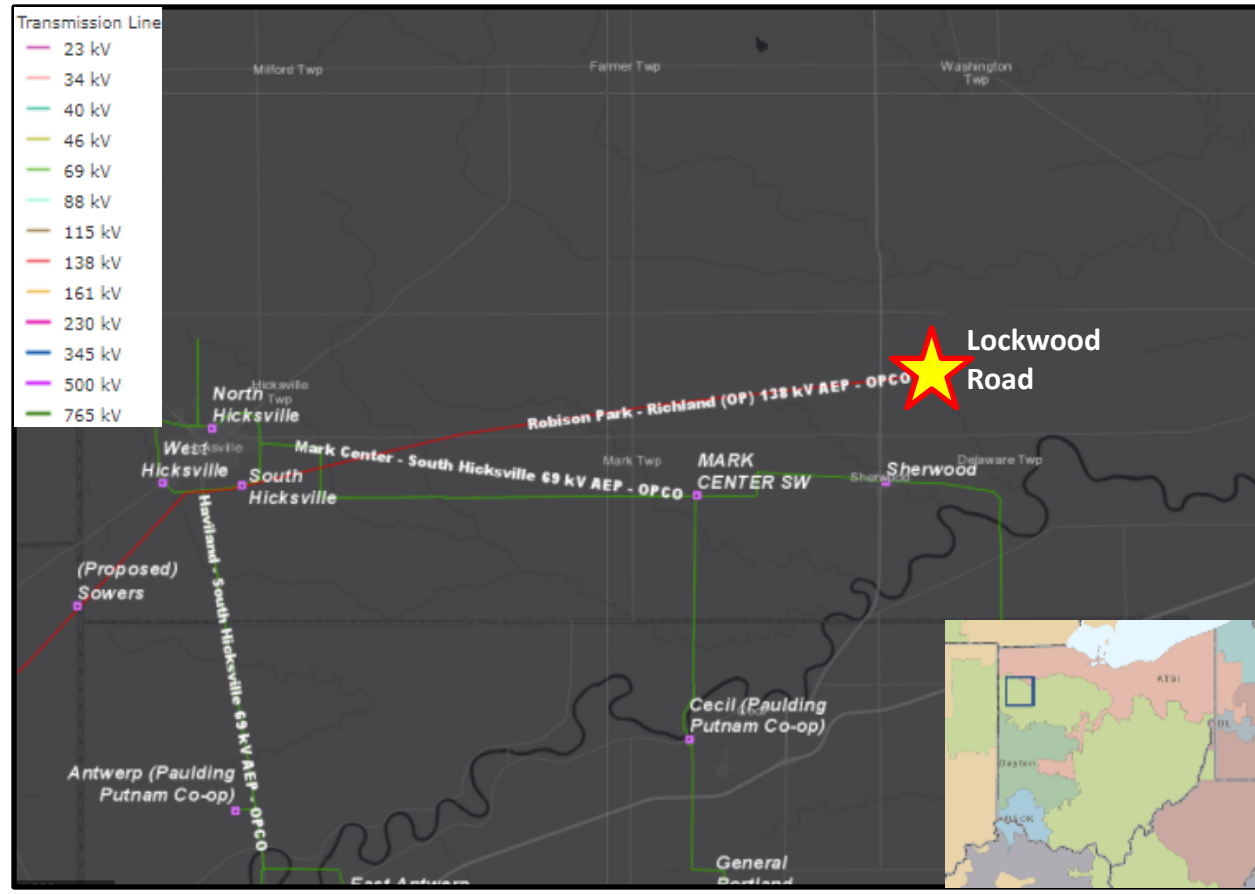
Problem Statement (Contd):

Operational Flexibility and Efficiency

- The Richland line terminal has a MOAB instead of a CB. This is a tie-line to First Energy.
- The bypass switch on CB-B complicates the bus protection. It is an operational challenge due to the City of Bryan having generation as well as a second source from the First Energy system (through Richland). Bypasses create protection reliability concerns.
- The capacitor at Lockwood Rd bank causes voltage quality issues for City of Bryan when either of the 138 kV sources into Lockwood Road are out of service due to the size of the bank.
- The radial nature of the service to the City of Brian along with the interconnect towards FE makes securing outages for reoccurring maintenance work at the station difficult.

Customer Service

- The existing Station is not expandable in its current configuration.
- There has been significant interest from large industrial load (future) to construct in this area, and specifically to connect to this station.



AEP Transmission Zone M-3 Process Defiance, Ohio

Need Number: AEP-2021-OHO09
Process Stage: Solutions Meeting 07/22/2022

Proposed Solution:

- **Lockwood Rd 138kV:** Retire the existing box bay and breaker bypass switch. Install two 138 kV 40 kA breakers in coordination with an active IPP AF1-063 project that will be installing an additional two breakers in a ring bus arrangement at the station. Install a DICM. Install a new 23MVAR capacitor bank with breaker. **Estimated Cost: \$3.713M**
- **Sowers – Lockwood Rd – Richlands 138 kV:** Relocate Lockwood Road – Sowers and Lockwood Road – Richland lines line to accommodate work at Lockwood Road station. **Estimated Cost \$1.178M**
- **Lockwood Rd – City of Bryan 138 kV:** Relocate Lockwood Road- City of Bryan line to accommodate work at Lockwood Road station. **Estimated Cost \$0.693M**

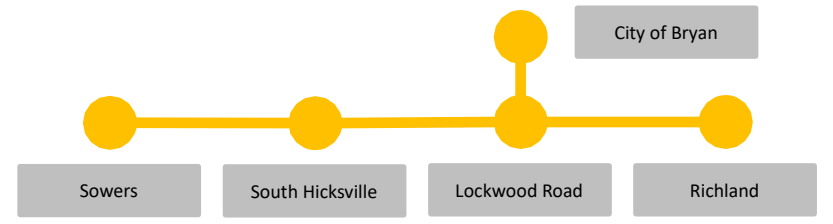
Total Estimated Transmission Cost: \$5.584M

Alternatives Considered:

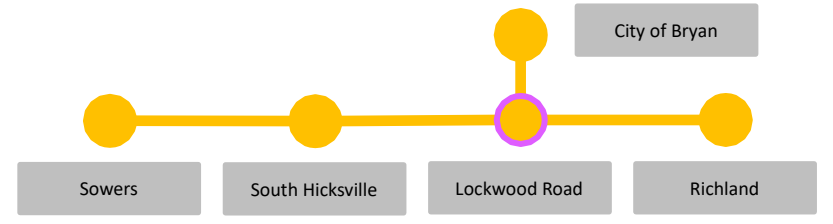
Instead of building a ring bus, an alternate plan was to add a second box bay at the Lockwood Road station to install a breaker on the interconnection towards FE. Installation of the second box bay would have interfered with the drive path and would have required relocating the cap bank. This option would not have addressed the asset renewal or future expansion needs at the station. In addition, connecting the proposed IPP generation into the existing station's single bus arrangement would only further operational challenges experienced at the station.

Projected In-Service: 06/20/2023
Project Status: Scoping

Legend	
5000 kV	
345 kV	
138 kV	
88 kV	
34.5 kV	
23 kV	
New	



Existing



Proposed

Need Number: AEP-2022-OH008

Process Stage: Solutions Meeting 07/22/2022

Previously Presented: Need Meeting 01/21/2022

Project Driver:
Equipment Material/Condition/Performance/Risk

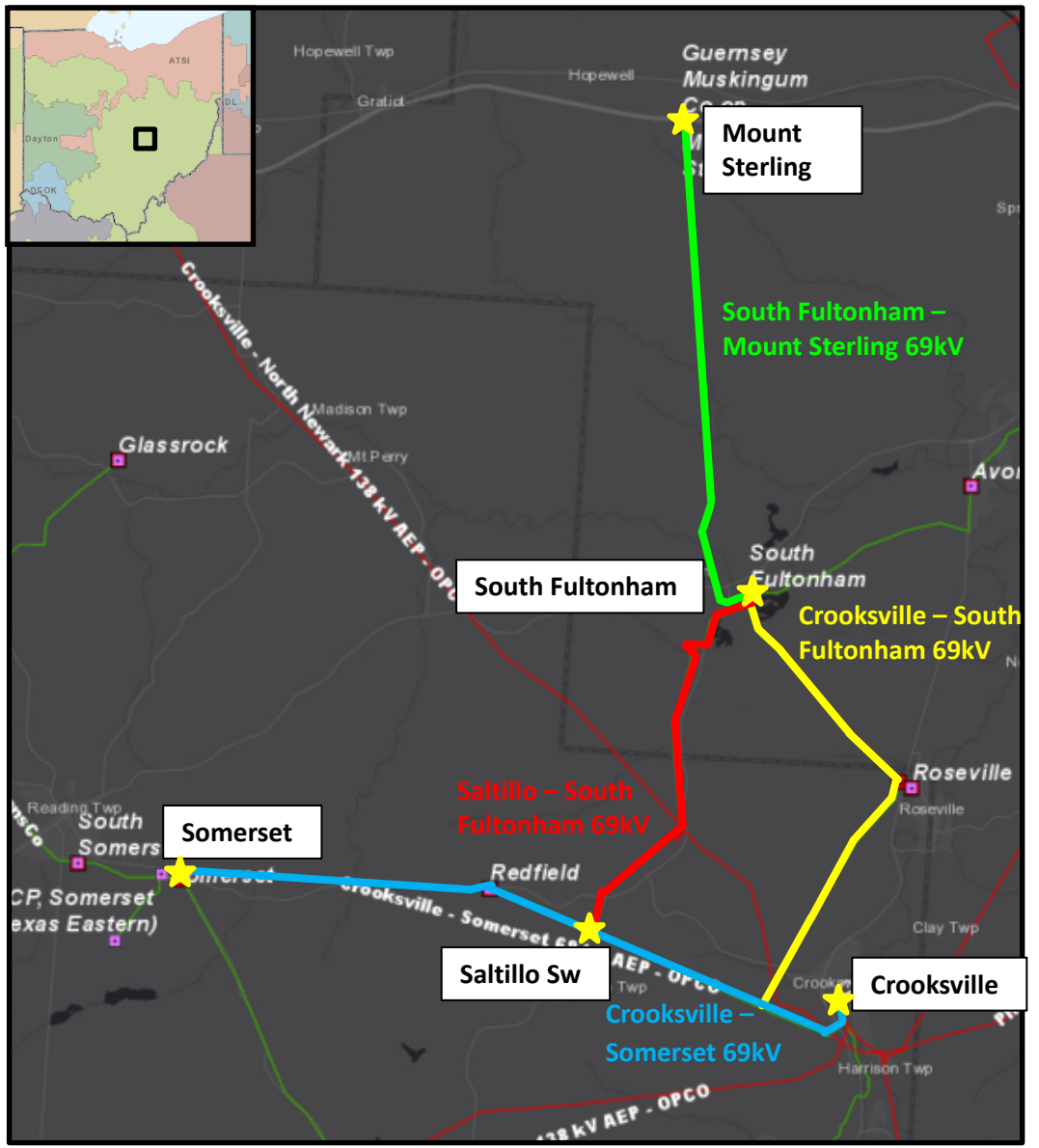
Specific Assumption Reference:
AEP Guidelines for Transmission Owner Identified Needs (AEP Assumptions Slide 13)

Problem Statement:

Crooksville – Somerset 69kV (1916):

- Line Length: ~10.4 Miles
- Total Structure Count 150
 - Structure Type: Wood / Steel Lattice
- Conductor Type: 3/0 ACSR 6/1 (Pigeon), 2/0 Cu 7 (20COP), & 4/0 ALUM/6201
- Outage History: 12 Momentary and 4 Permanent Outages, total CMI = 25,389 between 11/2016 – 11/2021.
- Open Conditions: 64 total. 13 are structure related open conditions including rust, rotted, broken, and burnt conditions, and vines, 1 open condition related to burnt conductor, 32 shielding/grounding conditions including broken and missing wires, 18 hardware based open conditions consisting of burnt, broken, missing, and chipped insulators as well as damaged guy wires.
- The line was originally constructed with wood monopoles and steel lattice towers. The ceramic horizontal post insulators on the line do not meet current AEP standards for CIFO and minimum leakage distance requirements. The conductors from Structure 41 to Structure 139A are 2/0 copper 7 with a shield wire of #1 copper 3 strand which do not meet current AEP standards for conductors and shield wires. The shield angle on a typical tangent structure is measured at 18° degrees, which is inadequate for AEP current shield angle requirements.
- 8 structures were further assessed by a ground crew. 100% of those structures had reported conditions including rusty shield wires, wear on connections, insulator deterioration, woodpecker holes, and ground line structure decay.

AEP Transmission Zone M-3 Process Muskingum & Perry Counties, OH



AEP Transmission Zone M-3 Process Muskingum & Perry Counties, OH

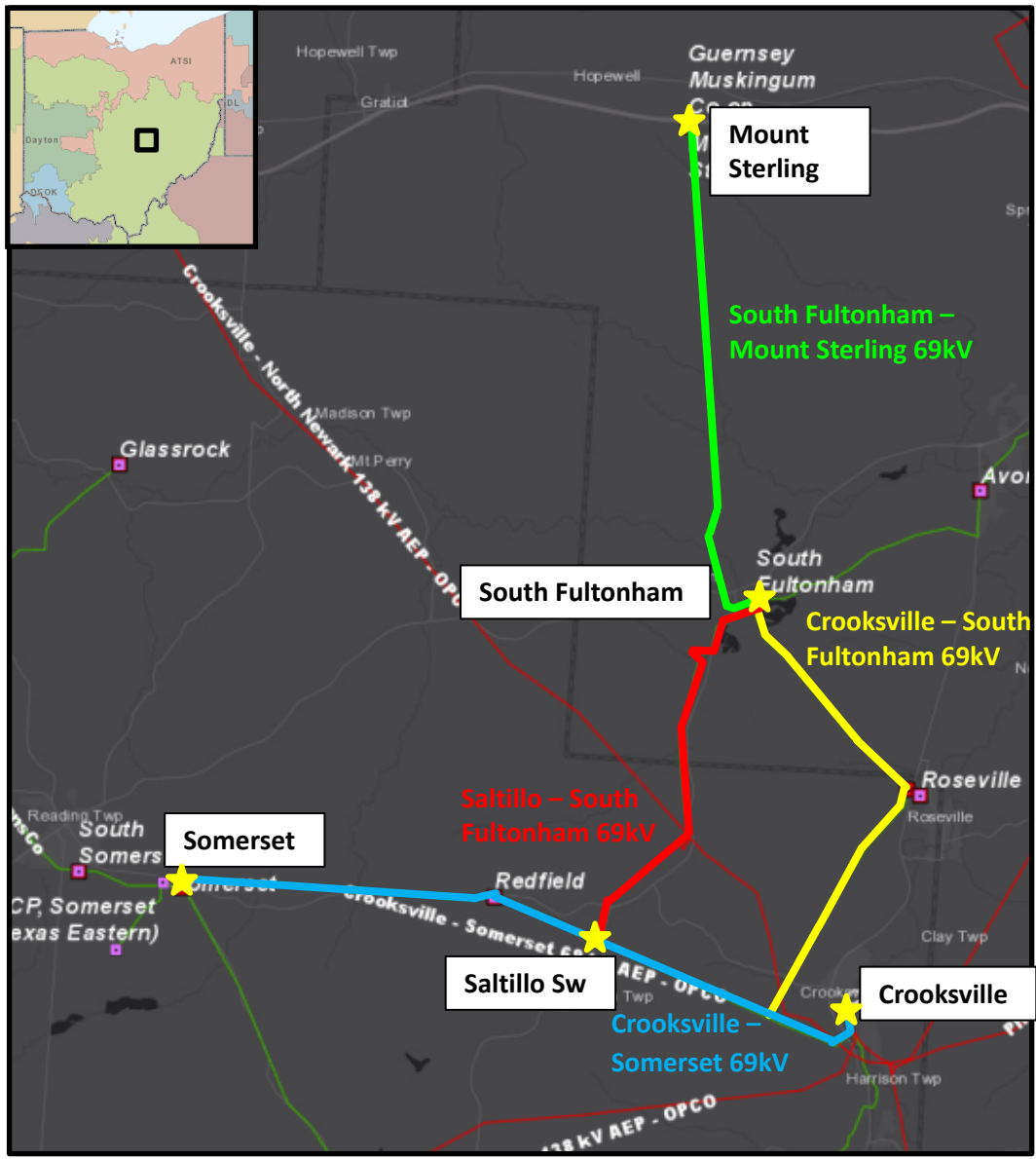
Problem Statement Continued:

Salttillo - South Fultonham 69 kV (1952):

- Line Length: ~5.91 Miles (Normally open point at Salttillo Switch towards Crooksville)
- Total Structure Count 58
 - Structure Type: Wood
- Conductor Type: 4/0 ACSR 6/1 (Penguin) and 4/0 ALUM ALLOY
- Outage History: 3 Momentary and 1 Permanent Outages between 11/2016 – 11/2021
- Open Conditions: 22 total. 5 are open structure related conditions, 2 conductor related conditions, 3 shielding/grounding conditions and 12 hardware related conditions.

South Fultonham – Mount Sterling 69kV (1958):

- Line Length: ~7.2 Miles
- Total Structure Count 75
 - Structure Type: Wood
- Conductor Type: 1/0 ACSR 6/1 (Raven), 336.4 MCM ACSR 18/1 (Merlin)
- Outage History: 12 Momentary and 7 Permanent Outages, total CMI = 1,221,812 between 11/2016 – 11/2021.
- Open Conditions: 24 total. 6 are structure related open conditions including rot top, split pole, rot heart, and burnt pole, 7 open condition related to damaged conductor splice/dead ends, 8 shielding/grounding conditions related to damaged shield wires and a broken ground lead wire, 3 hardware based open conditions consisting of burnt insulators and a chipped insulator.
- Structures on South Fultonham – Mount Sterling 69kV line does not meet 2017 NESC Grade B loading criteria, does not meet current AEP structural strength requirements, and does not meet the current ASCE structural strength requirements. The line is insulated with ceramic horizontal post insulators which do not meet current AEP standards for CIFO and minimum leakage distance requirements. The line grounding is butt wrap, which does not meet AEP standards.



AEP Transmission Zone M-3 Process Muskingum & Perry Counties, OH

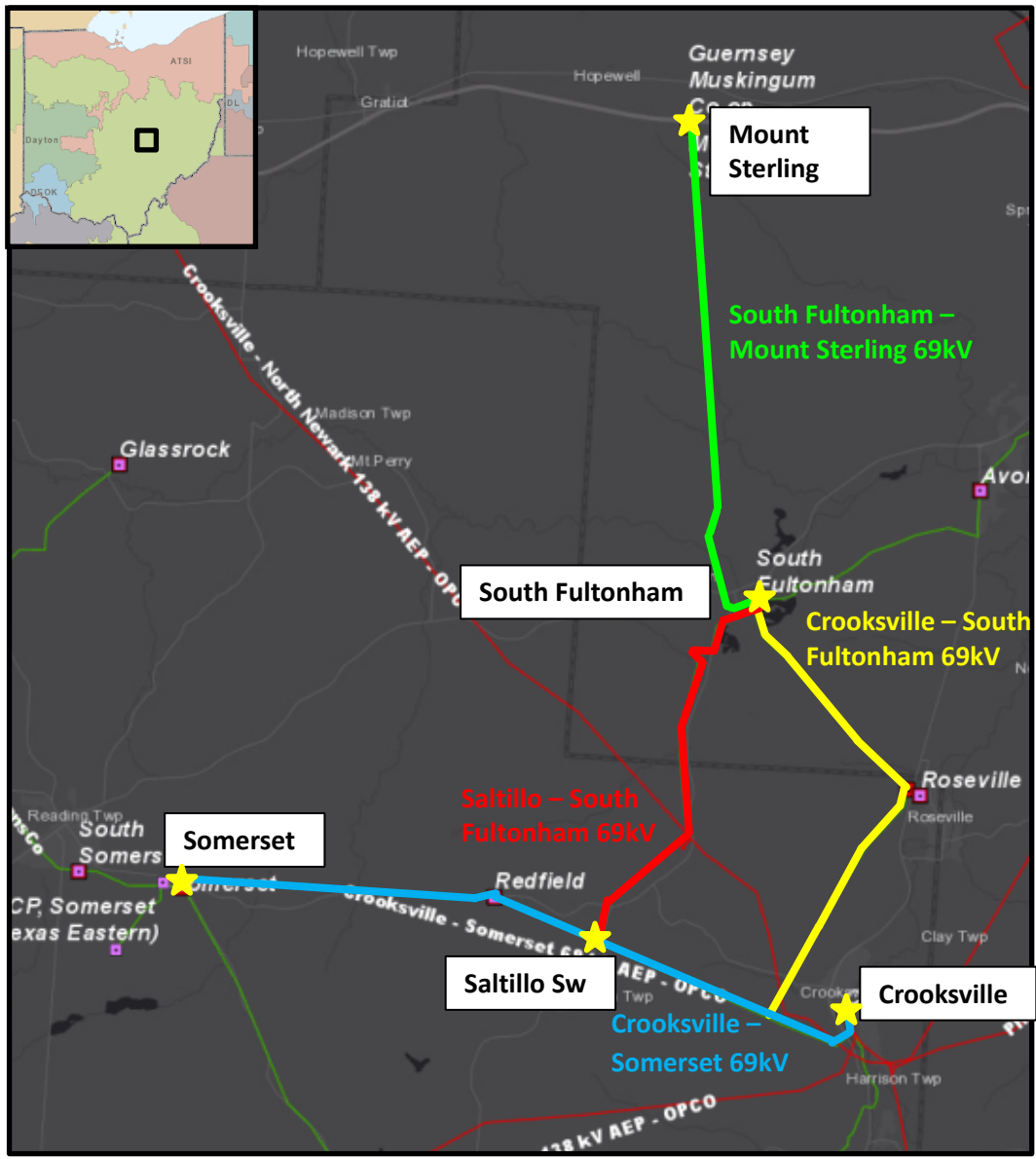
Problem Statement Continued:

Crooksville – South Fultonham 69kV (1958):

- Line Length: ~7.4 Miles
- Total Structure Count 67
 - Structure Type: Wood
- Conductor Type: 3/0 ACSR 6/1 (Pigeon), 2/0 Cu 7 (20COP), & 4/0 ACSR 6/1 (Penguin)
- Outage History: 10 Momentary and 2 Permanent Outages, total CMI = 700,805 between 11/2016 – 11/2021.
- Open Conditions: 39 total. 13 are structure related conditions rot top of poles/crossarms, split poles, insect and woodpecker damage, 12 open conditions related to conductor issues including broken strands, 14 hardware based open conditions consisting of burnt insulators and broken insulators.
- Structures on the Crooksville – South Fultonham 69kV Line fails to meet 2017 NESC Grade B loading criteria and fails to meet current AEP structural strength requirements. The ceramic horizontal post insulators on the line do not meet current AEP standards for CIFO and minimum leakage distance requirements. The line shielding angle on the typical tangent structure, H1B7, is measured at 27.2 degrees for phases one and two and 57 degrees for three, which is inadequate for AEP current shield angle requirements.
- 5 structures were further assessed by a ground crew. 100% of those structures had reported conditions including pole weathering, rot top, hardware weathering, bowing, no top present, topper deterioration, weathering at ends of crossarms, woodpecker and holes.

Crooksville 69kV Circuit Breaker “W”:

- Breaker Age: 1962
- Interrupting Medium: (Oil)
- Fault Operations: 19
- This breaker is oil filled without oil containment; oil filled breakers have much more maintenance required due to oil handling that their modern, SF6 counterparts do not require



AEP Transmission Zone M-3 Process Muskingum & Perry Counties, OH

Need Number: AEP-2022-OH008

Process Stage: Solutions Meeting 6/15/2022

Proposed Solution:

- **Crooksville Station, 69 kV:** Replace 69 kV oil filled FK type breaker CB-W with a 3000A, 40 kA breaker . **Estimated Cost: \$0.67M**
- **South Fultonham, 69 kV:** Retire CB-B. **Estimated Cost: \$0.09M**
- **Saltillo Switch, 69 kV:** Retire Saltillo Switch. **Estimated Cost: \$0.05M**
- **Crooksville – South Fultonham 69 kV line:** Rebuild approximately 7.4 miles of single circuit 69 kV line between the Crooksville and South Fultonham stations. **Estimated Cost: \$12.47M**
- **Crooksville – Somerset 69 kV line:** Rebuild approximately 8.8 miles of single circuit and 1.6 miles of double circuit 69 kV line between the Crooksville and Somerset stations. **Estimated Cost: \$19.92M**
- **South Fultonham – Mount Sterling 69 kV line:** Rebuild approximately 7.2 miles of single circuit 69 kV line between the South Fultonham and Mount Sterling stations. **Estimated Cost: \$13.88M**
- **South Fultonham – Saltillo 69 kV line:** Retire approximately 5.9 miles of single circuit 69 kV line between the South Fultonham station and Saltillo Switch. **Estimated Cost: \$3.22M**

Total Estimated Cost: \$50.3M

Alternatives Considered:

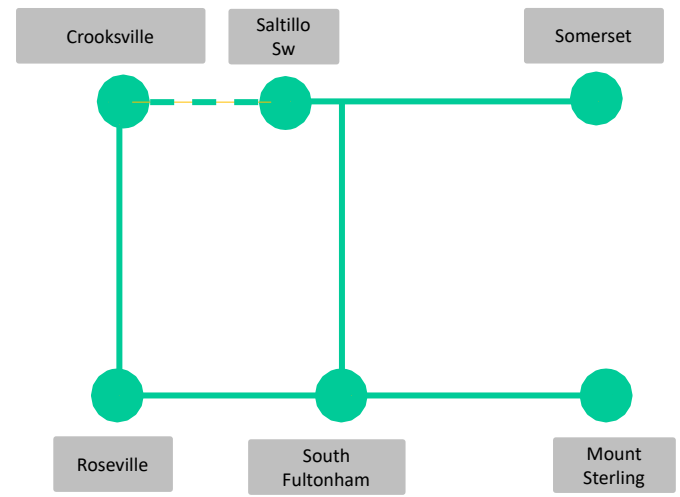
Alternatively, South Fultonham – Saltillo line asset (~5.9 miles) was considered for rebuilt instead of line section between Crooksville and Saltillo (~4.2 miles). However, a section of Crooksville – Saltillo line (~1.6 miles) will be part of Crooksville – South Fultonham circuit rebuild as the two lines are currently double circuited today. Therefore, the cost of rebuilding ~5.9 miles of 69 kV line would be higher compared to the additional ~2.6 miles of single circuit line to rebuild the remaining portions of the Crooksville – Saltillo line section.

Projected In-Service: 1/2/2026

Project Status: Scoping

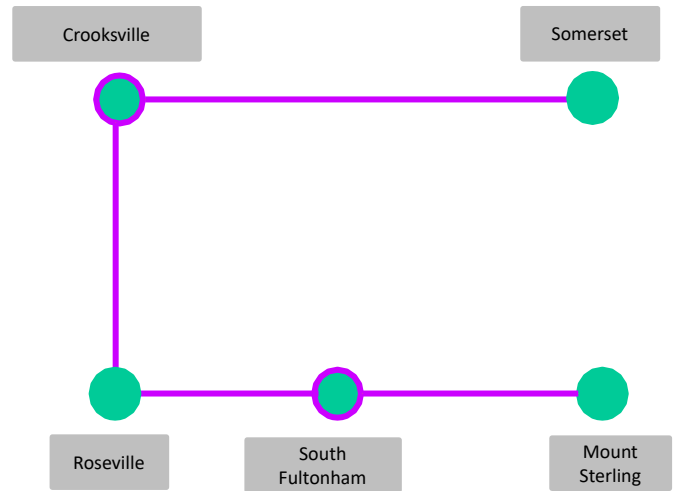
Existing:

Legend	
5000 kV	
345 kV	
138 kV	
88 kV	
34.5 kV	
23 kV	
Nsw	



Bubble Diagram

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

7/11/2022 – V1 – Original version posted to pjm.com