Subregional RTEP Committee - Western
FirstEnergy Supplemental Projects

October 20, 2023

Needs

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

APS Transmission Zone M-3 Process
Loughs Lane – Pickens 138 kV Line

Need Number: APS-2023-032

Process Stage: Need Meeting – 10/20/2023

Supplemental Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s):

Line Condition Rebuild/Replacement

- Age/condition of wood pole transmission line structures

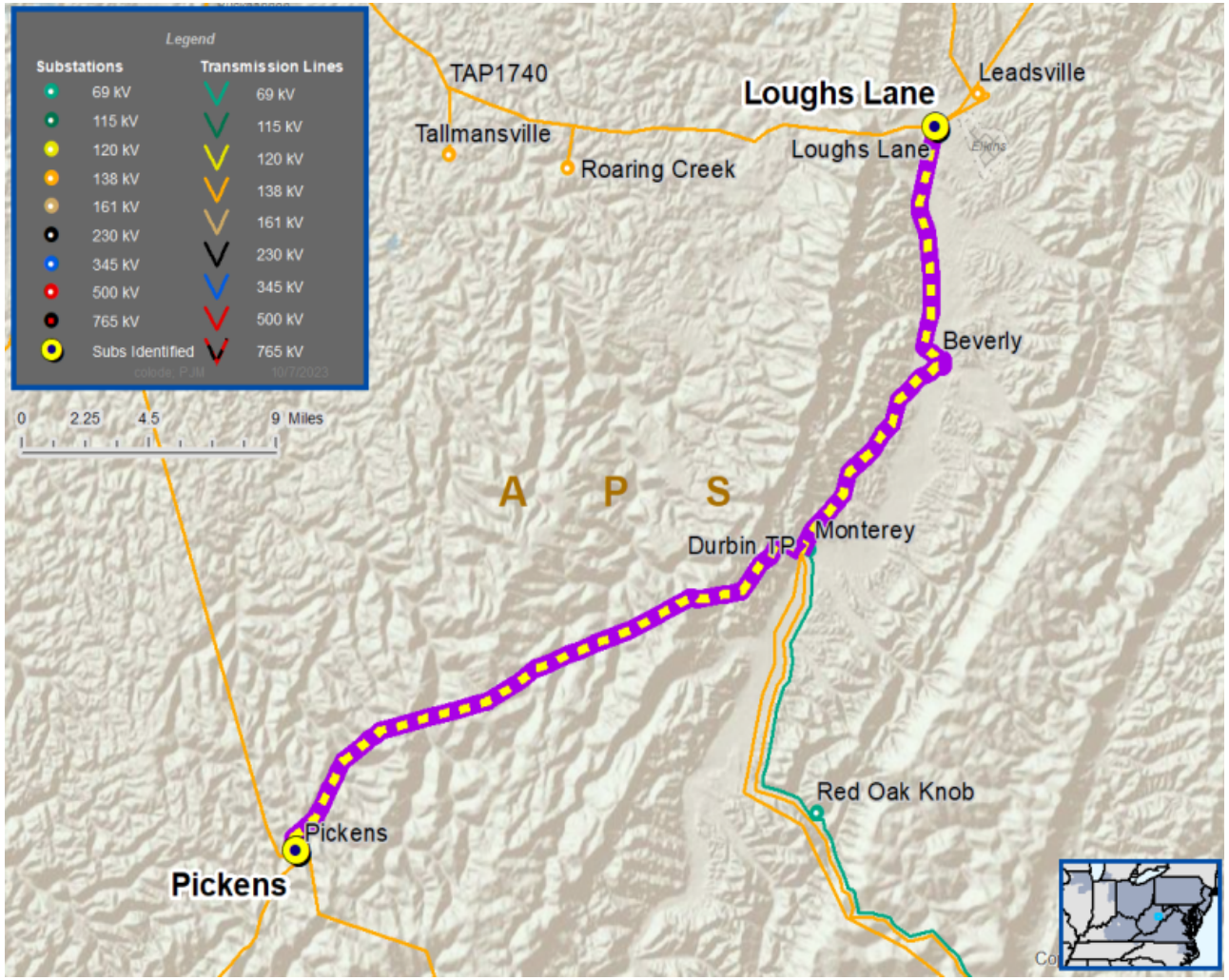
System Performance Projects Global Factors

- Substation/line equipment limits

Problem Statement

Loughs Lane – Pickens 138 kV Line wood pole structures are nearing end of life. The line has exhibited increase trend in maintenance conditions.

- Total line distance is approximately 47.2 miles.
- 296 of 380 structures failed inspection (78% failure rate).



APS Transmission Zone M-3 Process
Misoperation Relay Projects

Need Numbers: APS-2023-036, APS-2023-041 to APS-2023-043, APS-2023-045 to APS-2023-049

Process State: Need Meeting – 10/20/2023

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

System Performance Projects Global Factors

- System reliability and performance
- Substation/line equipment limits

System Condition Projects

- Substation Condition Rebuild/Replacement

Upgrade Relay Schemes

- Obsolete and difficult to repair communication equipment (DTT, Blocking, etc.)
- Communication technology upgrades

Problem Statement:

- FirstEnergy has identified protection schemes using a certain vintage of relays and communication equipment that have a history of misoperation.
- Proper operation of the protection scheme requires all the separate components perform adequately during a fault.
- In many cases the protection equipment cannot be repaired due to a lack of replacement parts and available expertise in the outdated technology.
- Transmission line ratings are limited by terminal equipment.

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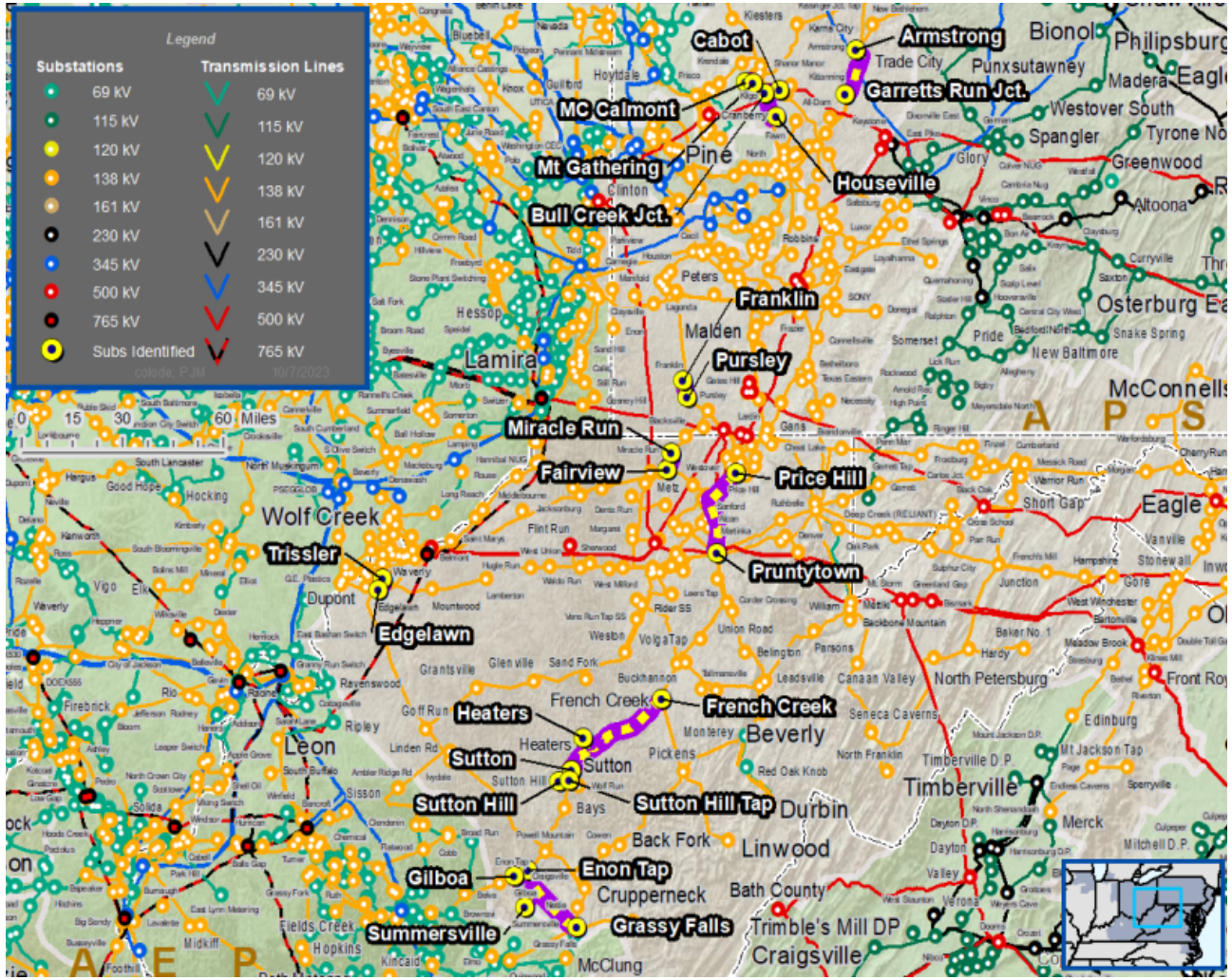


APS Transmission Zone M-3 Process Misoperation Relay Projects

Need #	Transmission Line / Substation Locations	Existing Line Rating (SN / SE)	Existing Conductor Rating (SN / SE)
APS-2023-036	Franklin – Pursley 138 kV	287 / 314	308 / 376
APS-2023-041	Fairview – Miracle Run Tap 138 kV	175 / 228	308 / 376
APS-2023-042	Armstrong – Garretts Run Junction 138 kV	294 / 350	308 / 376
APS-2023-043	Trissler– Edgelawn 90 138 kV	225 / 295	308 / 376
APS-2023-045	Heaters Tap – Sutton 138 kV	97 / 105	107 / 128
APS-2023-046	Gilboa – 304 Junction 138 kV	229 / 229	278 / 339
	Grassy Falls – Summersville 138 kV	229 / 229	309 / 376
APS-2023-047	Price Hill – Pruntytown 138 kV	221 / 268	221 / 268
APS-2023-048	Cabot – Bull Creek Junction 138 kV	308 / 376	308 / 376
	Bull Creek Junction – Houseville 138 kV	294 / 350	297 / 365
	Mountain Gathering – McCalmont 138 kV	267 / 352	297 / 365
APS-2023-049	Sutton Hill Tap – Sutton 138 kV	85 / 105	85 / 106
	Sutton Hill Tap – Sutton Hill 138 kV	89 / 96	107 / 128

APS Transmission Zone M-3 Process
Cumberland Substation

Need Numbers: APS-2023-051

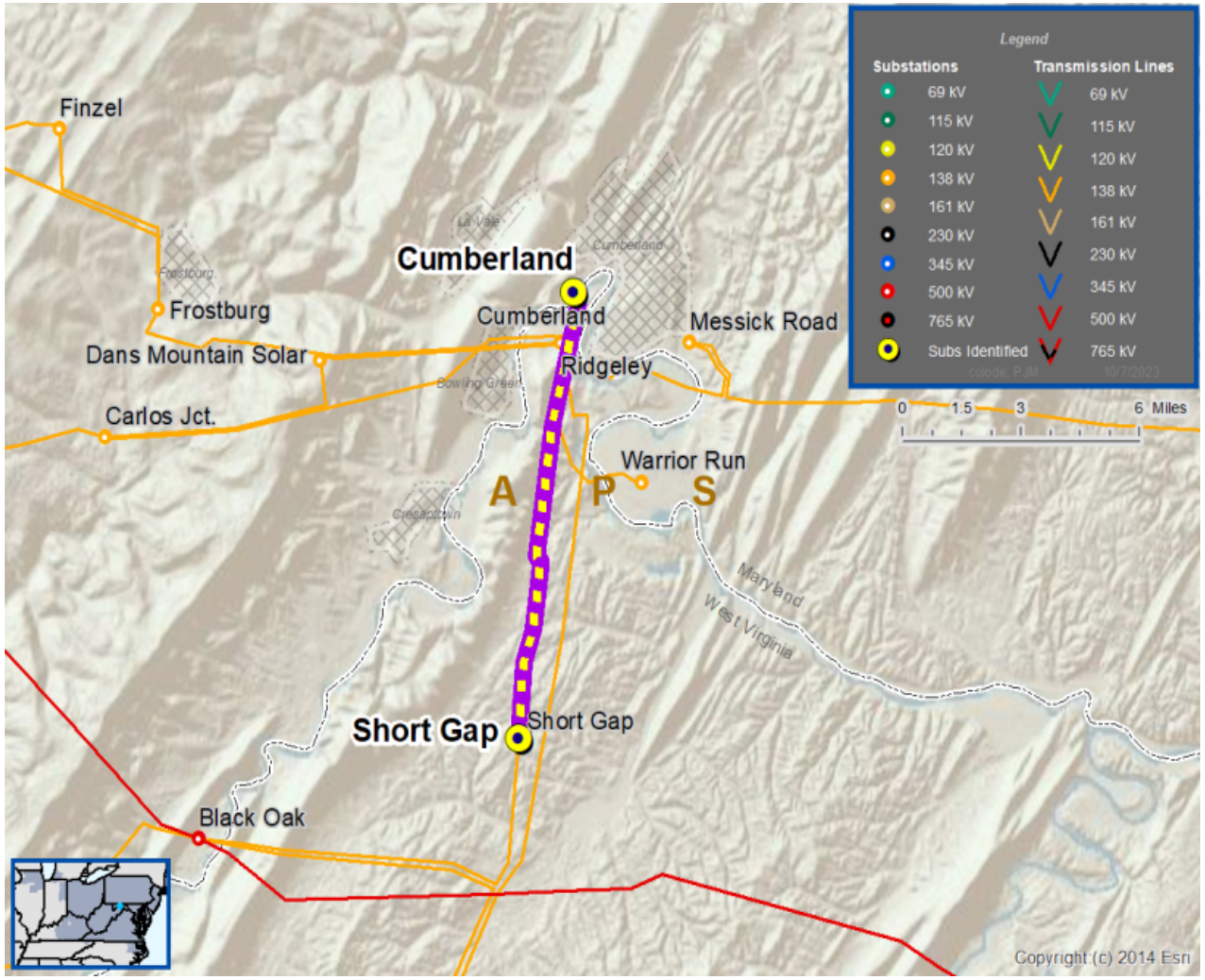
Process State: Need Meeting – 10/20/2023

Project Driver:
- *Equipment Material Condition*
- *Performance and Risk*
- *Infrastructure resilience*

Specific Assumption Reference:
- Substation Condition Rebuild/Replacement
  - Age/condition of structural components
- System Performance Projects Global Factors
  - System reliability and performance

Problem Statement:
- Existing switches at Cumberland Substation are beyond reliable operation.
  - Severe alignment issues result in improper closures, requiring a hammer to manually close, resulting in a safety issues
  - Switch mounting insulators often break during this process, resulting in live parts falling, creating a potential for accidents and system faults.

The Short Gap – Cumberland 138 kV Line is limited by substation conductor
- Existing line rating:
  - 299/358/349/410 MVA (SN/SE/WN/WE)
- Existing conductor rating:
  - 308/376/349/445 MVA (SN/SE/WN/WE)



APS Transmission Zone M-3 Process
Dutch Fork – Enon 138 kV Line

Need Number: APS-2023-033

Process Stage: Need Meeting 10/20/2023

Supplemental Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s):

Line Condition Rebuild/Replacement

- Age/condition of wood pole transmission line structures
- System characteristics including lightning and grounding performance, galloping overlap, insulation coordination, structural capacity needs, clearance margins, and future needs (e.g., fiber path)

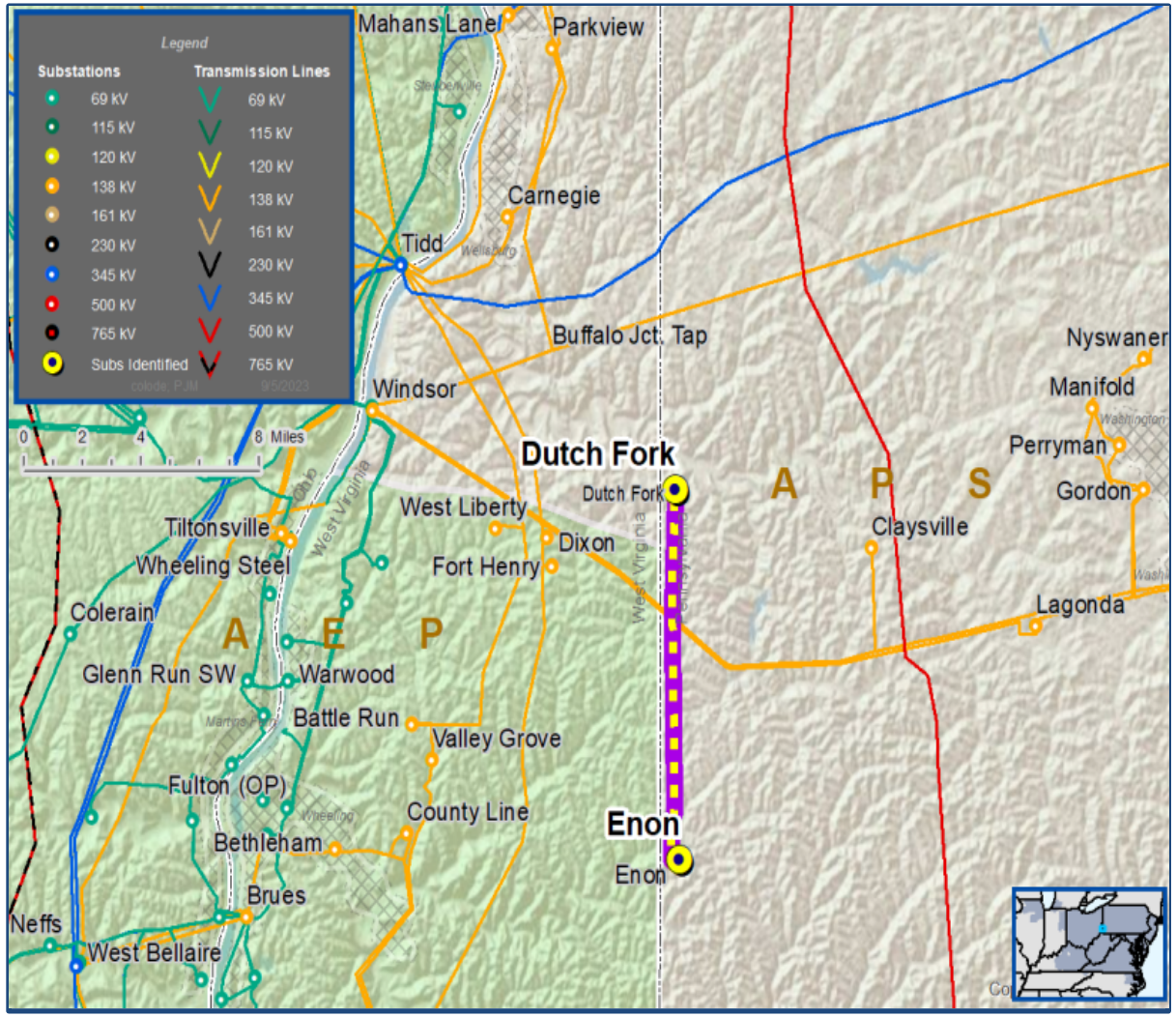
System Performance Projects Global Factors

- Substation/line equipment limits

Problem Statement:

Enon Substation is fed radially from Dutch Fork. With an N-1 outage of the Dutch Fork – Enon 138 kV Line, 93 MW is lost at Enon. The Dutch Fork – Enon 138 kV Line is exhibiting deterioration.

- Total line distance is approximately 12.5 miles.
- 39 of 79 structures failed inspection.



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

APS Transmission Zone M-3 Process
Buckhannon-Pruntytown 138 kV New Customer

Need Number: APS-2021-012

Process Stage: Solution Meeting – 10/20/2023

Previously Presented: Need Meeting – 08/15/2021

Project Driver(s):

Customer Service

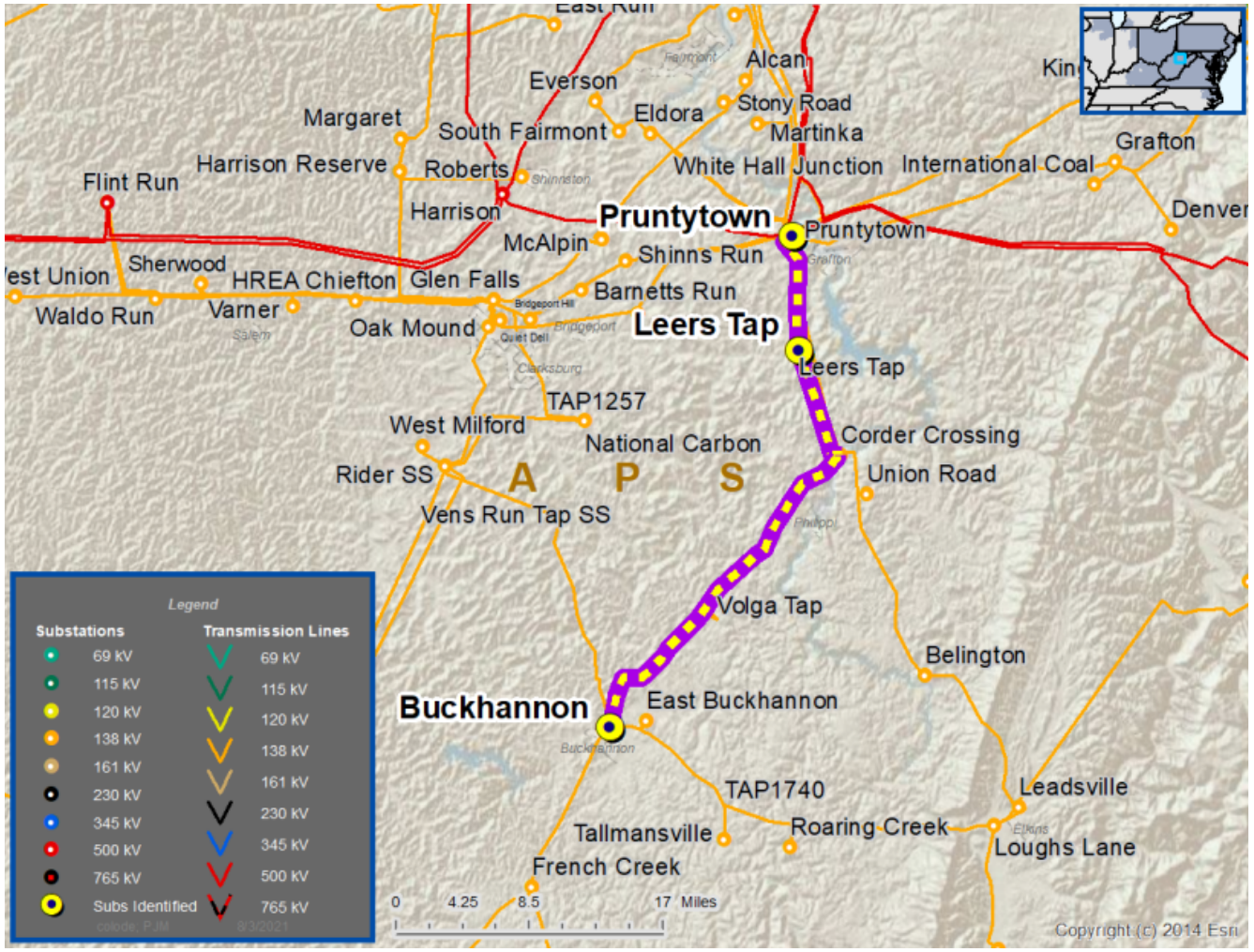
Specific Assumption Reference(s):

Customer request will be evaluated per FirstEnergy's "Requirements for Transmission Connected Facilities" document and "Transmission Planning Criteria" document.

Problem Statement:

A customer has requested a new 138 kV delivery point near the Buckhannon – Pruntytown (PR-BKH-12) 138 kV Line. The anticipated load of the new customer connection is 40 MW.

Requested in-service date is 7/2/2025.



APS Transmission Zone M-3 Process
Buckhannon-Pruntytown 138 kV New Customer

Need Number: APS-2021-012

Process Stage: Solution Meeting – 10/20/2023

Proposed Solutions:

138 kV Transmission Line Tap

- Install three-way tap using three switches
- Construct 1 mile of 138 kV line from tap location to new delivery point
- Install revenue metering in Customer's facilities
- Revise remote end relay settings at Buckhannon Substation and Pruntytown Substation

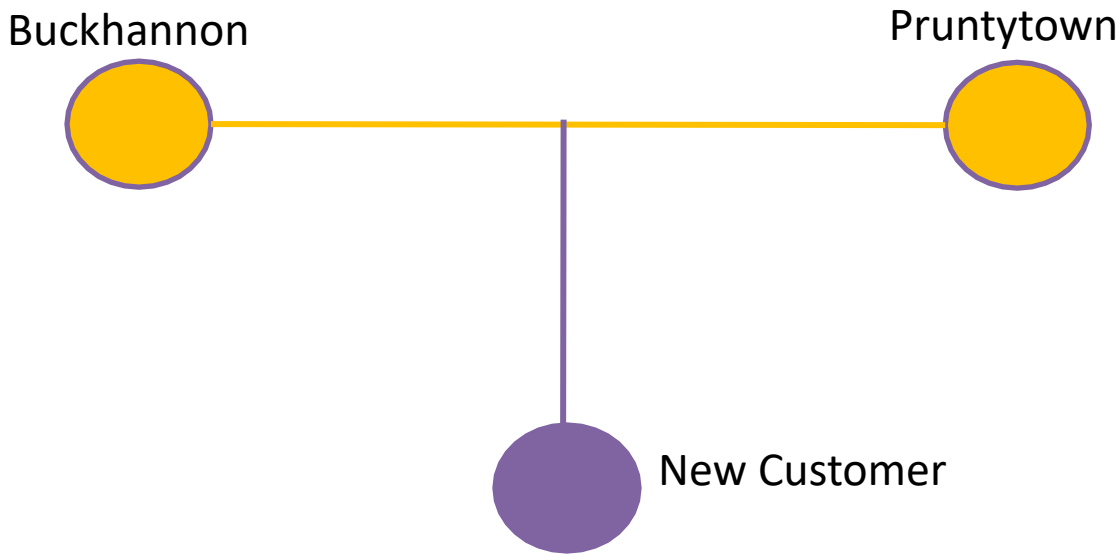
Alternatives Considered:

- No other feasible alternatives to serve the customer's load

Estimated Project Cost: $5.0M

Projected In-Service: 07/02/2025

Status: Engineering



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

APS Transmission Zone M-3 Process
Ethel Springs – Bethlen 138 kV Network

Need Number: APS-2023-009

Process Stage: Solution Meeting – 10/20/2023

Previously Presented: Need Meeting – 4/21/2023

Project Driver(s):

- *Equipment material condition, performance and risk*
- *Operational Flexibility and Efficiency*

Specific Assumption Reference(s)

System Performance

- Network radial lines

Operational Flexibility

Problem Statement

The are two radial feeds: one to Bethlen and one to Ethel Spring.

A fault on the Loyalhanna - Social Hall 138 kV line will outage multiple 138 kV stations, which puts significant stress on the networked distribution system.

A fault on the Loyalhanna - Social Hall 138 kV line will outage radial load at Ethel Springs, and a fault on the Bethlen – Loyalhanna 138 kV line will outage radial load at Bethlen. Ethel Springs serves 6,105 customers and 14.43 MW, and Bethlen serves 5,110 customers and 11.76 MW.

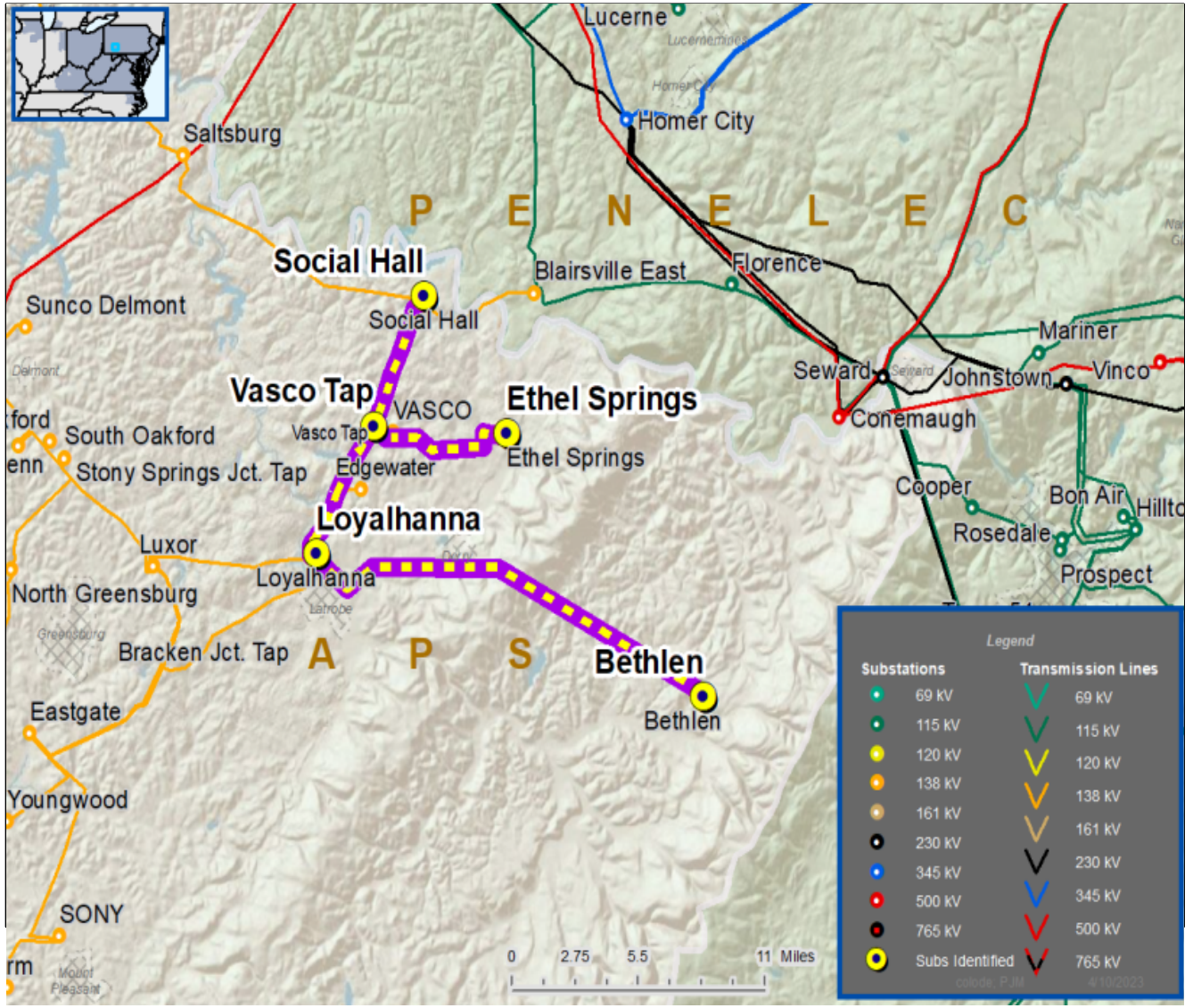
Transmission line ratings are limited by terminal equipment.

Vasco Tap – Social Hall 138 kV:

- Existing line rating: 225 / 287 MVA (SN / SE)
- Existing conductor rating: 297 / 365 MVA (SN / SE)

Bethlen – Loyalhanna 138 kV:

- Existing line rating: 205 / 242 MVA (SN / SE)
- Existing conductor rating: 309 / 376 MVA (SN / SE)



APS Transmission Zone M-3 Process
Ethel Springs – Bethlen 138 kV Network

Need Number: APS-2023-009

Process Stage: Solution Meeting – 10/20/2023

Previously Presented: Need Meeting – 4/21/2023

Proposed Solution:

Construct a new 8-mile 138 kV line between Ethel Springs and Bethlen substations using 954 ACSR conductor. The following work will be performed at neighboring substations:

- At Social Hall:
  - Replace substation conductor, wave trap, and circuit breaker
- At Vasco:
  - Construct a 4-breaker 138 kV ring bus
- At Edgewater Tap:
  - Install (3) SCADA controlled switches
- At Loyalhanna:
  - Replace substation conductor on the Bethlen 138 kV line terminal
- At Ethel Springs:
  - Convert the 138 kV yard into a 4-breaker ring bus
- At Bethlen:
  - Convert the 138 kV yard into a 3-breaker ring bus

New line ratings:

- Vasco Tap – Social Hall 138 kV: 297 / 365 MVA (SN / SE)
- Bethlen – Loyalhanna 138 kV: 309 / 376 MVA (SN / SE)
- Bethlen – Ethel Springs: 308 / 376 MVA (SN / SE)

Alternatives Considered

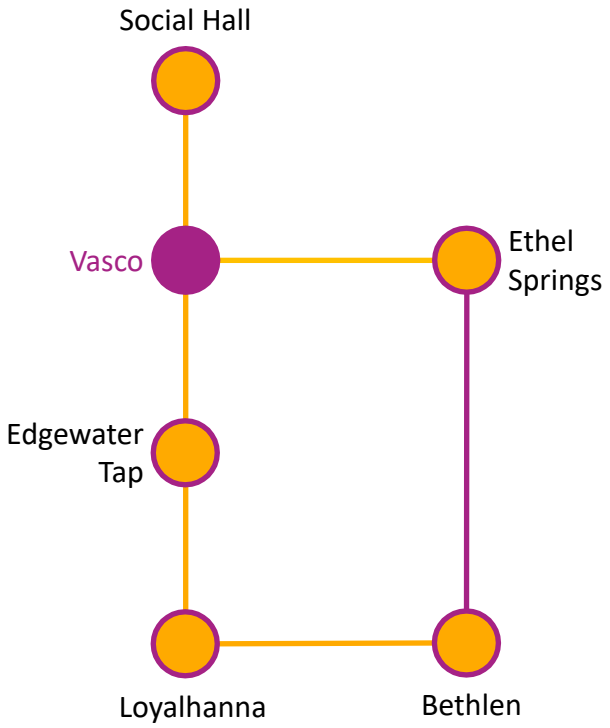
- Maintain line in existing configuration, putting distribution customers/load at risk

Estimated Project Cost: $59.6 M

Projected In-Service: 12/31/2025

Project Status: Conceptual

Model: 2022 RTEP model for 2027 Summer (50/50)



Legend	
500 kV	
345 kV	
230 kV	
138 kV	
115 kV	
69 kV	
46 kV	
34.5 kV	
23 kV	
New	

APS Transmission Zone M-3 Process Misoperation Relay Projects

Need Numbers: APS-2023-018, APS-2023-019, APS-2023-020

Process State: Solution Meeting – 10/20/2023

Previously Presented: Need Meeting 6/16/2023

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

System Performance Projects Global Factors

- System reliability and performance
- Substation/line equipment limits

System Condition Projects

- Substation Condition Rebuild/Replacement

Upgrade Relay Schemes

- Obsolete and difficult to repair communication equipment (DTT, Blocking, etc.)
- Communication technology upgrades

Problem Statement:

- FirstEnergy has identified protection schemes using a certain vintage of relays and communication equipment that have a history of misoperation.
- Proper operation of the protection scheme requires all the separate components perform adequately during a fault.
- In many cases the protection equipment cannot be repaired due to a lack of replacement parts and available expertise in the outdated technology.
- Transmission line ratings are limited by terminal equipment.

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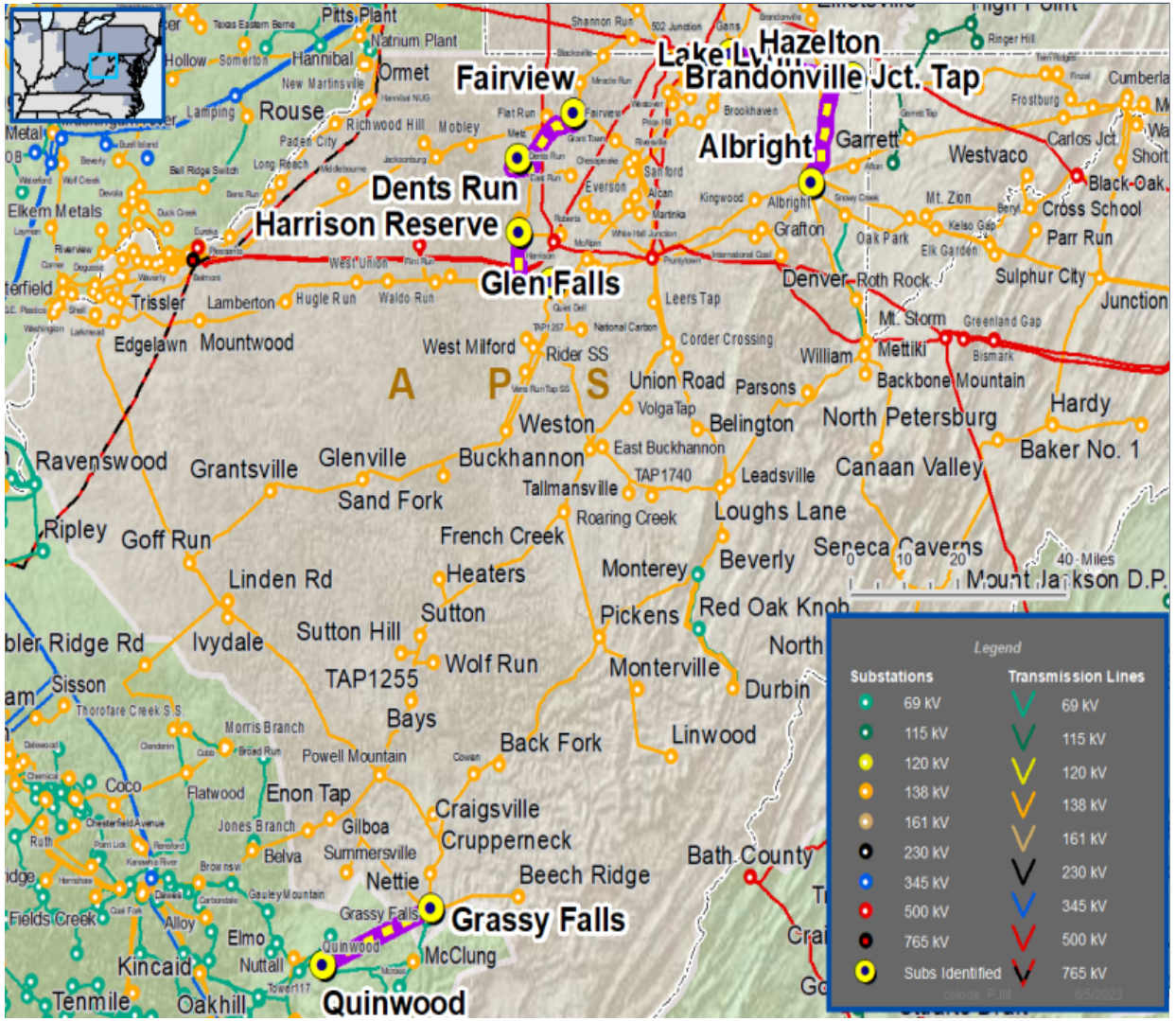

APS Transmission Zone M-3 Process
Misoperation Relay Projects

Need #	Transmission Line / Substation Locations	Existing Line Rating (SN / SE)	Existing Conductor Rating (SN / SE)	Limiting Terminal Equipment
APS-2023-018	Albright – Brandonville Junction 138 kV	141 / 182	181 / 225	
	Brandonville Junction – Hazelton 138 kV	261 / 311	308 / 376	
	Brandonville Junction – Lake Lynn 138 kV	219 / 271	308 / 376	
APS-2023-019	Grassy Falls – Quinwood 138 kV	282 / 314	282 / 376	
APS-2023-020	Fairview – Dents Run Tap 138 kV	175 / 191	221 / 268	
	Harrison Reserve Tap – Glen Falls 138 kV	191 / 191	221 / 268	

APS Transmission Zone M-3 Process Misoperation Relay Projects

Proposed Solution:

Need Number	Transmission Line / Substation Locations	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost ($ M)	Target ISD
APS-2023-018	Albright – Brandonville Junction 138 kV	181 / 225	• At Albright, replace wave trap, substation conductor, & relaying	$1.3 M	12/1/2025
	Brandonville Junction – Hazelton 138 kV	308 / 376	• At Hazelton, replace substation conductor & relaying		
	Brandonville Junction – Lake Lynn 138 kV	308 / 376	• At Lake Lynn, replace substation conductor & relaying	$1.5 M	12/1/2025
APS-2023-019	Grassy Falls – Quinwood 138 kV	282 / 376	• At Grassy Falls, replace wave trap, circuit breaker, substation conductor, & relaying		
APS-2023-020	Fairview – Dents Run Tap 138 kV	221 / 268	• At Fairview, replace wave trap, disconnect switches, substation conductor, & relaying	$2.5 M	11/22/2023
	Harrison Reserve Tap – Glen Falls 138 kV	221 / 268	• At Glen Falls, replace wave trap, disconnect switch, & relaying		

Alternatives Considered: Maintain equipment in existing condition

Project Status: Engineering/Construction

Model: 2022 RTEP model for 2027 Summer (50/50)

APS Transmission Zone M-3 Process Misoperation Relay Projects

Need Numbers: APS-2023-023 … APS-2023-025

Process State: Solution Meeting – 10/20/2023

Previously Presented: Need Meeting – 7/21/2023

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

System Performance Projects Global Factors

- System reliability and performance
- Substation/line equipment limits

System Condition Projects

- Substation Condition Rebuild/Replacement

Upgrade Relay Schemes

- Obsolete and difficult to repair communication equipment (DTT, Blocking, etc.)
- Communication technology upgrades

Problem Statement:

- FirstEnergy has identified protection schemes using a certain vintage of relays and communication equipment that have a history of misoperation.
- Proper operation of the protection scheme requires all the separate components perform adequately during a fault.
- In many cases the protection equipment cannot be repaired due to a lack of replacement parts and available expertise in the outdated technology.
- Transmission line ratings are limited by terminal equipment.

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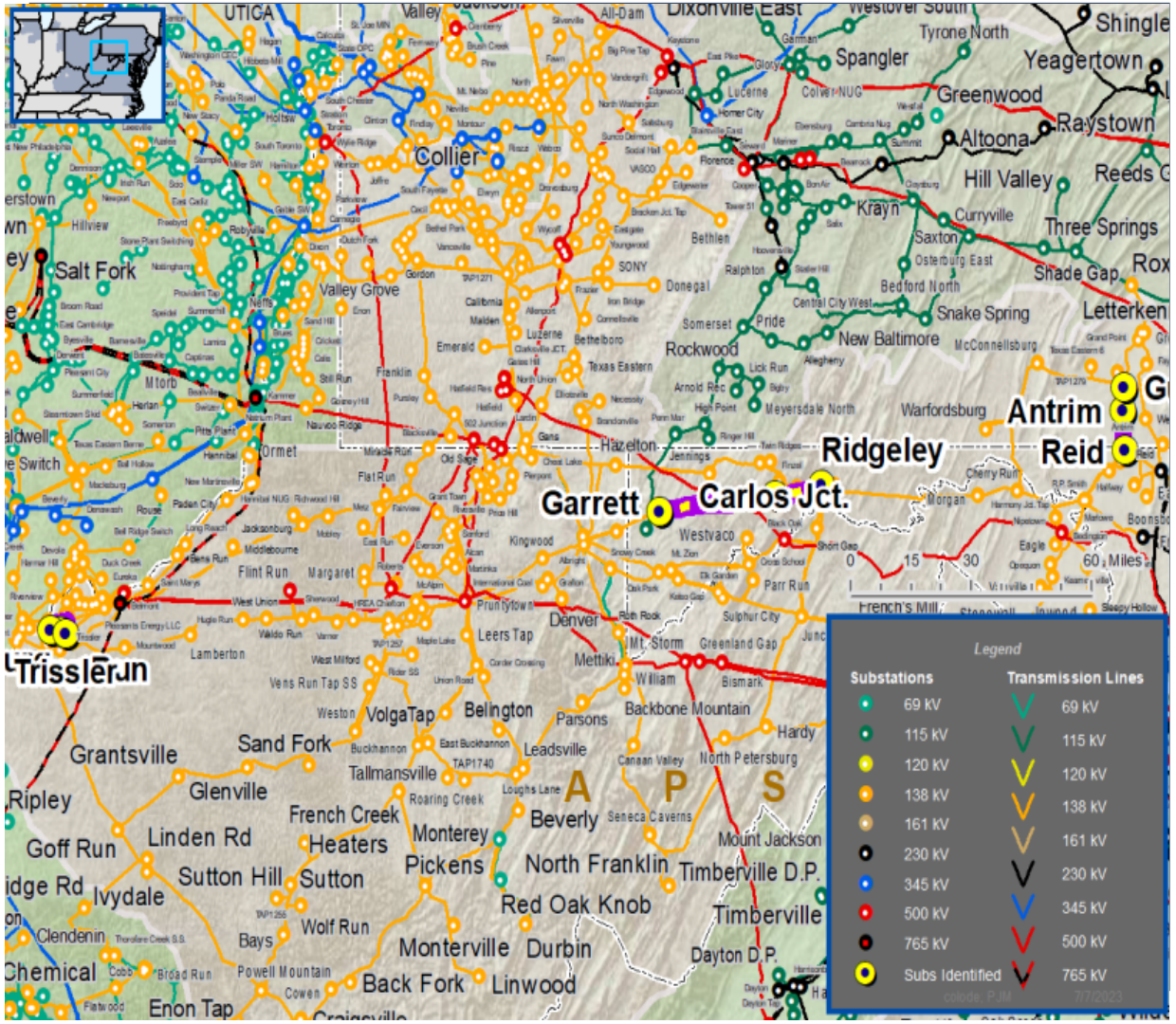


APS Transmission Zone M-3 Process Misoperation Relay Projects

Need #	Transmission Line / Substation Locations	Existing Line Rating (SN / SE)	Existing Conductor Rating (SN / SE)	Limiting Terminal Equipment
APS-2023-023	Parkersburg – Jug Run 138 kV Line	225/295	308/376	
	Jug Run – Trissler 138 kV Line	292/314	308/376	
APS-2023-024	Guilford – Antrim 138 kV Line	292/314	308/376	
	Antrim – Reid 138 kV Line	292/314	308/376	
APS-2023-025	Garrett – Carlos Junction 138 kV Line	164/206	221/268	
	Carlos Junction – Ridgeley 138 kV Line	141/182	221/268	

Proposed Solution:

Need Number	Transmission Line / Substation Locations	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost ($ M)	Target ISD
APS-2023-023	Parkersburg – Jug Run 138 kV Line	308 / 376	• At Parkersburg, replace circuit breaker, wave trap, disconnect switch, substation conductor, & relaying	$3.2 M	11/17/2023
	Jug Run – Trissler 138 kV Line	308 / 376	• At Trissler, replace circuit breaker, wave trap, disconnect switch, substation conductor, & relaying		
APS-2023-024	Guilford – Antrim 138 kV Line	308 / 376	• At Guilford, replace circuit breaker, wave trap, disconnect switch, substation conductor, & relaying	$2.8 M	05/15/2024
	Antrim – Reid 138 kV Line	308 / 376	• At Reid, replace wave trap, disconnect switches, substation conductor, & relaying		
APS-2023-025	Garrett – Carlos Junction 138 kV Line	164 / 206	• At Garrett, replace wave trap & relaying	$4.2 M	04/26/2024
	Carlos Junction – Ridgeley 138 kV Line	164 / 206	• At Ridgeley, replace wave trap, disconnect switches, substation conductor, & relaying		

Alternatives Considered: Maintain equipment in existing condition

Project Status: Engineering/Construction

Model: 2022 RTEP model for 2027 Summer (50/50)

APS Transmission Zone M-3 Process
Bedington – Marlowe BMA 138 kV Line New Customer

Need Number: APS-2023-030

Process Stage: Solution Meeting – 10/20/2023

Previously Presented: Need Meeting – 8/18/2023

Supplemental Project Driver(s):

Customer Service

Specific Assumption Reference(s):

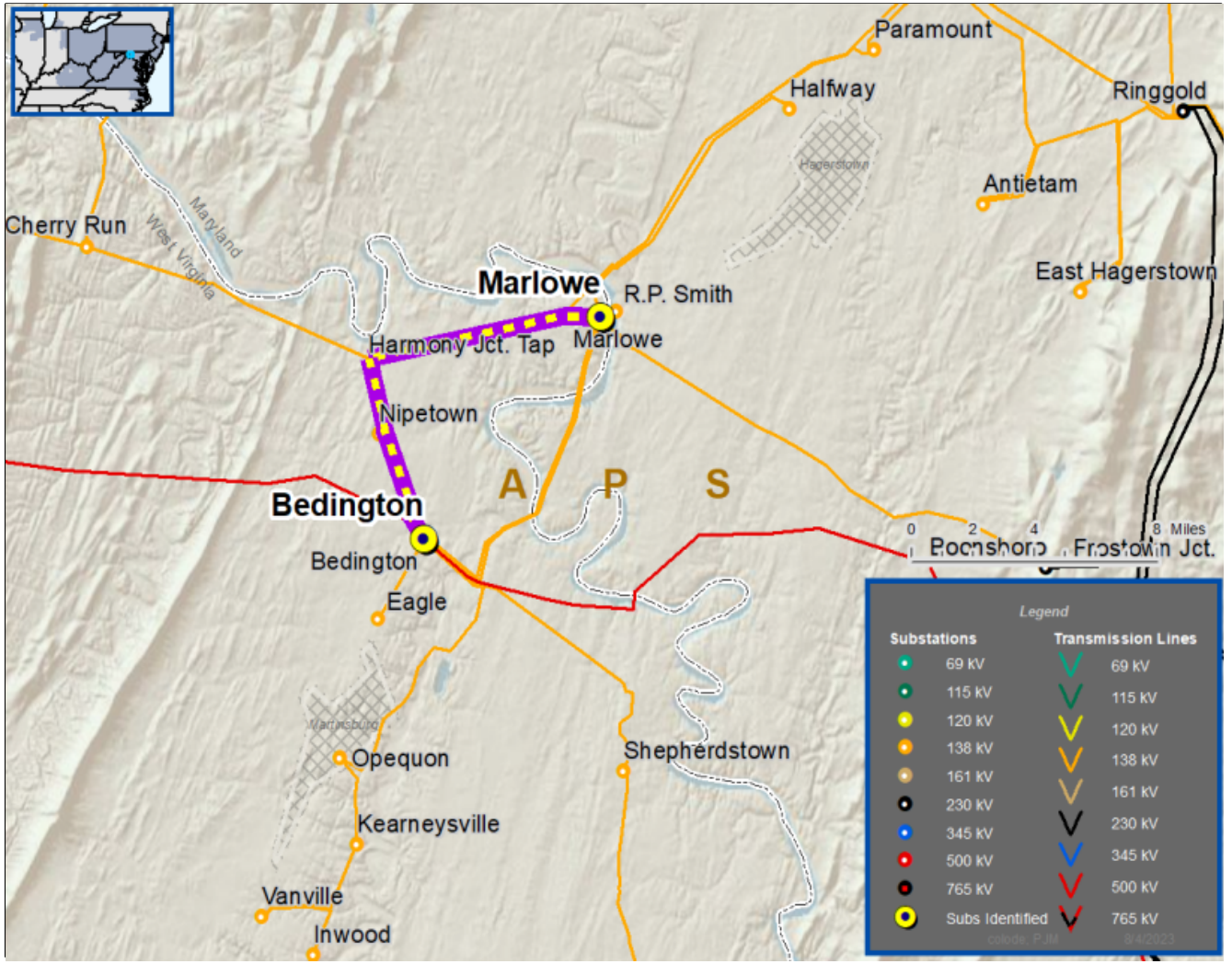
New customer connection request will be evaluated per FirstEnergy's "Requirements for Transmission Connected Facilities" document and "Transmission Planning Criteria" document.

Problem Statement

New Customer Connection – Customer requested 138 kV transmission service for approximately 64 MVA of total load near the Bedington – Marlowe BMA 138 kV Line.

Requested In-Service Date:

2/28/2025



APS Transmission Zone M-3 Process
Bedington – Marlowe BMA 138 kV Line New Customer Phase 1

Need Number: APS-2023-030
Process Stage: Solution Meeting – 10/20/2023
Previously Presented: Need Meeting – 8/18/2023

Proposed Solutions:

Phase 1 (Temporary Configuration): 138 kV Line Transmission Taps

- Install two 2000 A load-break air switches on the Bedington – Marlowe BMA 138 kV Line
- Build approximately 2.2 miles of double circuit 138 kV Line to the point of interconnection with Customer
- Revise relay settings at Bedington and Marlowe substations

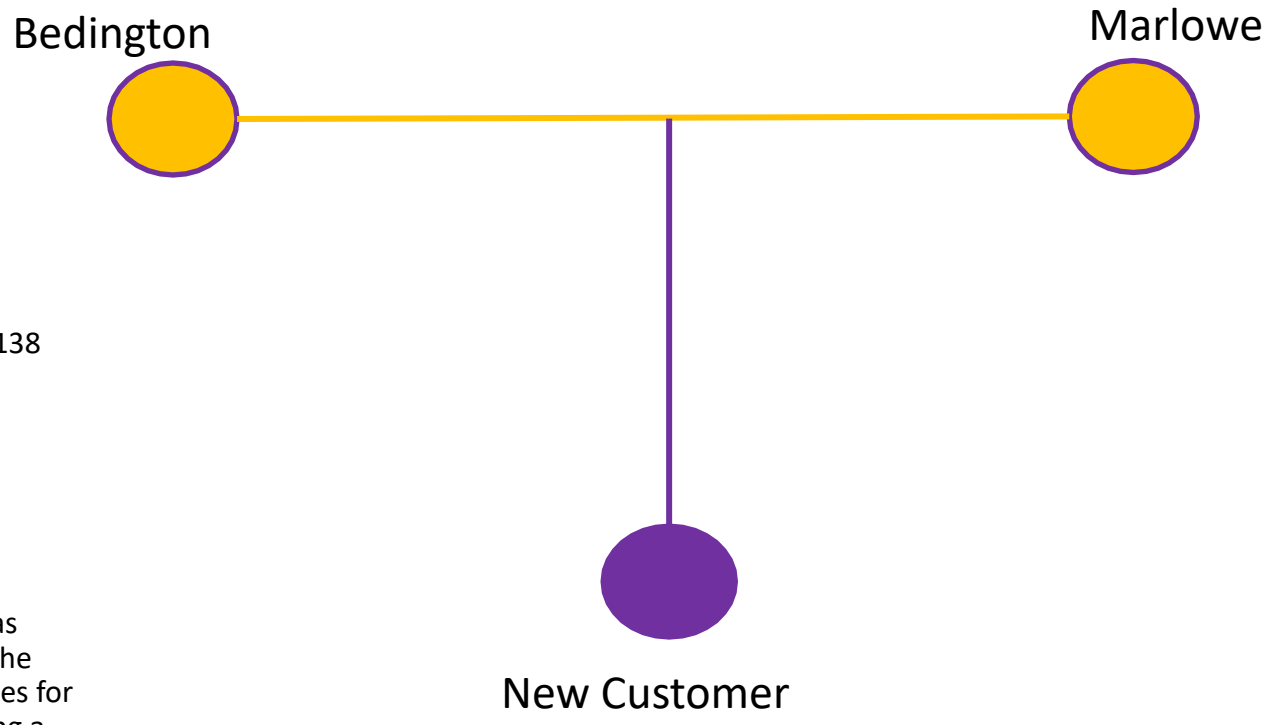
Alternatives Considered:

- Providing transmission service by looping the Bedington – Reid 138 kV line was considered. However, this was deemed as not the preferred solution due to the length of line required (approximately 3.3 miles), cost, and feasibility challenges for a new transmission route to be built to the Customer site location by traversing a densely populated area.

Estimated Project Cost: $11.9M

Projected In-Service: 2/28/2025

Status: Engineering



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

APS Transmission Zone M-3 Process
Bedington – Marlowe BMA 138 kV Line New Customer Phase 1

Need Number: APS-2023-030
Process Stage: Solution Meeting – 10/20/2023
Previously Presented: Need Meeting – 8/18/2023

Proposed Solutions:

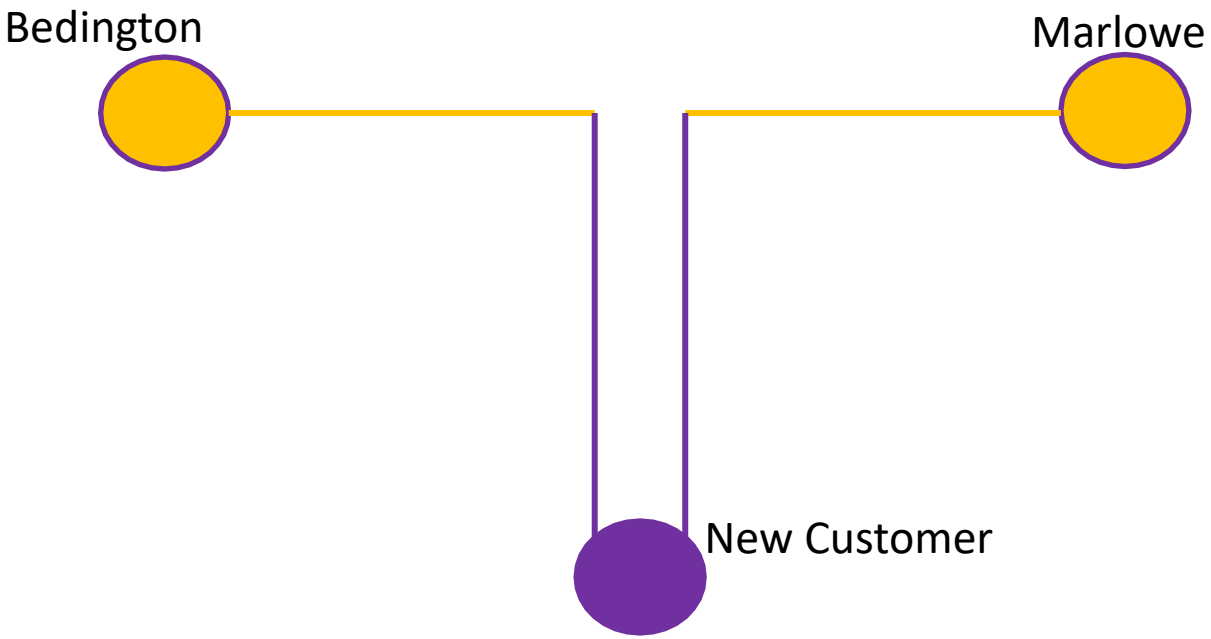
Phase 2 (Final Configuration): 138 kV Line Transmission Tap

- Build a new three-breaker 138 kV ring bus substation.
- Replace two breakers and relay panels at Bedington Substation
- Replace one breaker and relay panel at Marlowe Substation.
- Terminate the two tap lines from Phase 1 into the new ring bus substation.
- Customer to connect directly to the ring bus substation.

Alternatives Considered:

- Please see previous slide for alternative considered

Estimated Project Cost: $18.5M
Total Estimated Project Cost (Phase 1 + Phase 2): $30.4M
Projected In-Service: 6/30/2026
Status: Pre-Engineering



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

APS Transmission Zone M-3 Process
Inwood – Stonewall 138 kV Line New Customer

Need Number: APS-2023-039

Process Stage: Solution Meeting – 10/20/2023

Previously Presented: Need Meeting – 8/18/2023

Supplemental Project Driver(s):

Customer Service

Specific Assumption Reference(s):

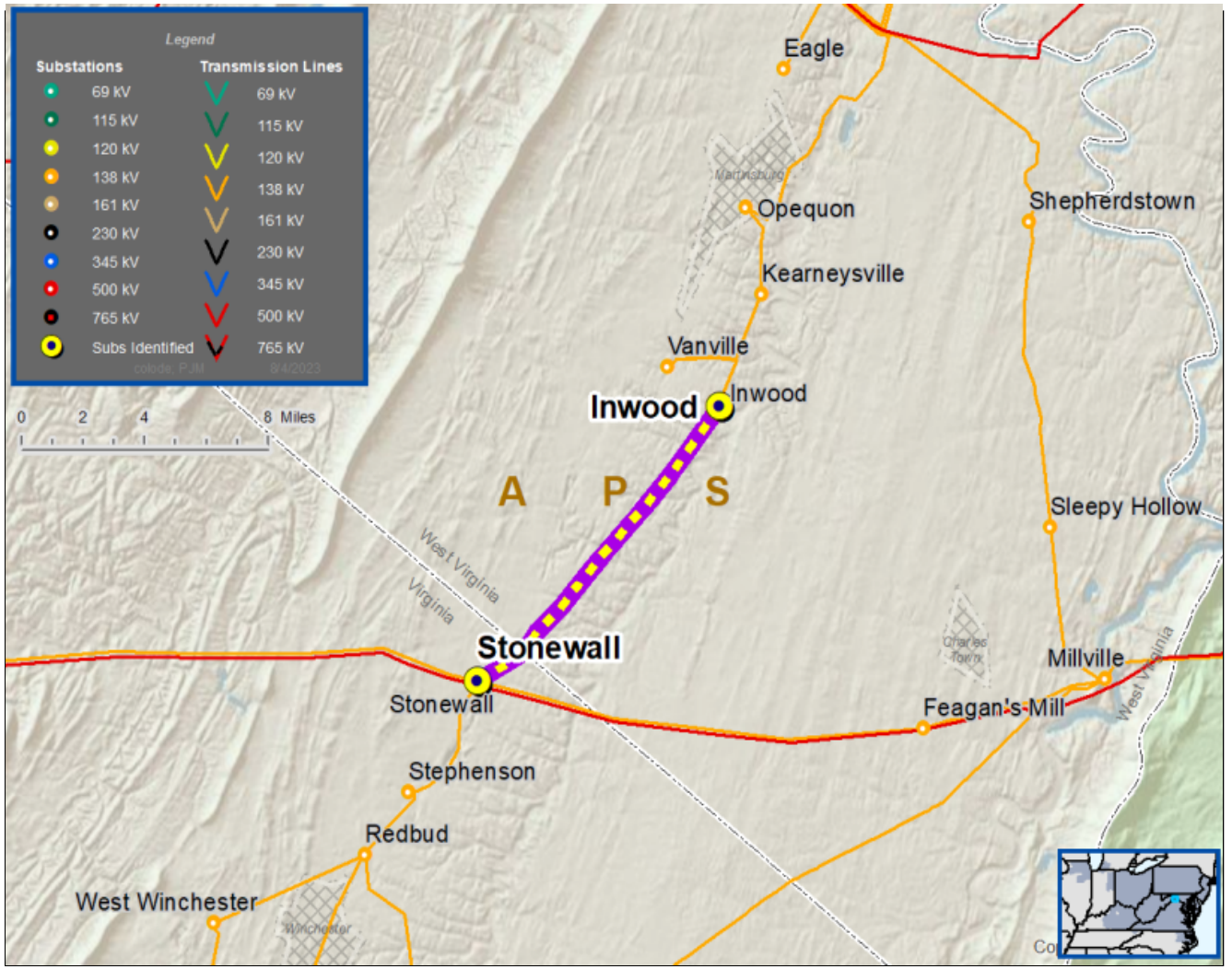
New customer connection request will be evaluated per FirstEnergy's "Requirements for Transmission Connected Facilities" document and "Transmission Planning Criteria" document.

Problem Statement

New Customer Connection – Potomac Edison Distribution has requested a new 138 kV delivery point near the Inwood – Stonewall 138 kV Line. The anticipated load of the new customer connection is 12 MVA.

Requested In-Service Date:

2/23/2024



APS Transmission Zone M-3 Process
Inwood – Stonewall 138 kV Line New Customer

Need Number: APS-2023-039

Process Stage: Solution Meeting – 10/20/2023

Previously Presented: Need Meeting – 8/18/2023

Proposed Solutions:

138 kV Transmission Line Tap

- Install a three-switch tap along the Inwood – Stonewall 138 kV Line with three 1200 A SCADA load break switches
- Install 1-2 spans of transmission line from tap point to Customer substation
- Install a 138 kV wave trap

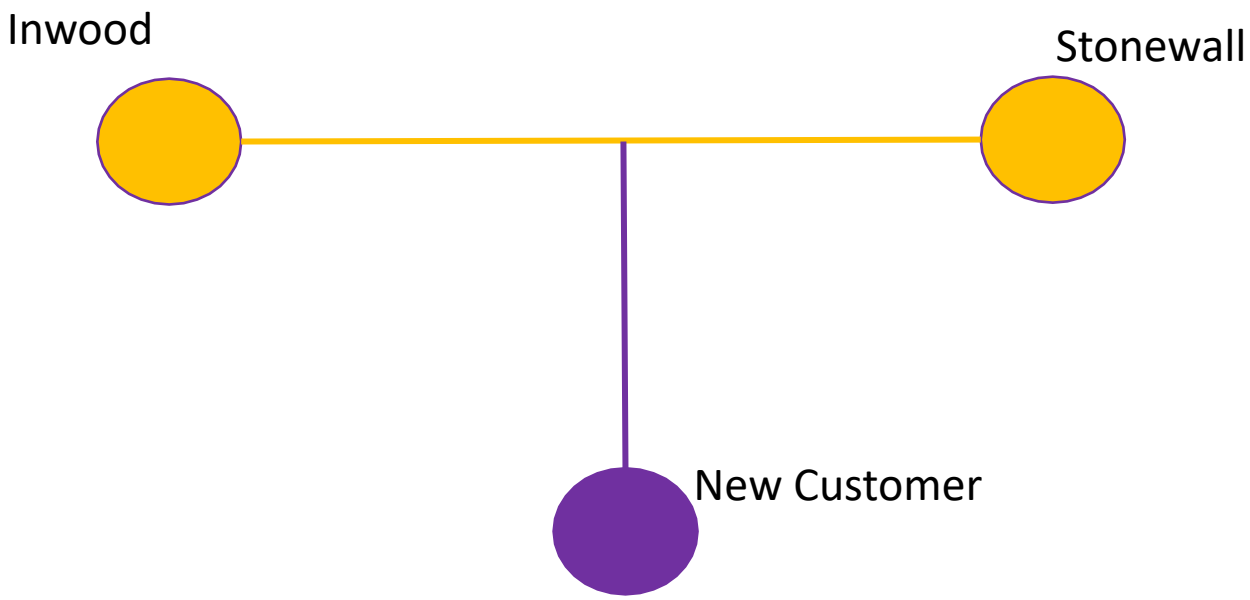
Alternatives Considered:

- The next nearest transmission line facility to serve the Customer's load is at least two miles away from the Customer's site. As a result, the nearby Inwood-Stonewall 138 kV Line was selected as the preferred solution.

Estimated Project Cost: $1.1M

Projected In-Service: 4/17/2024

Status: Engineering



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

APS Transmission Zone M-3 Process
Millville 138 kV Substation

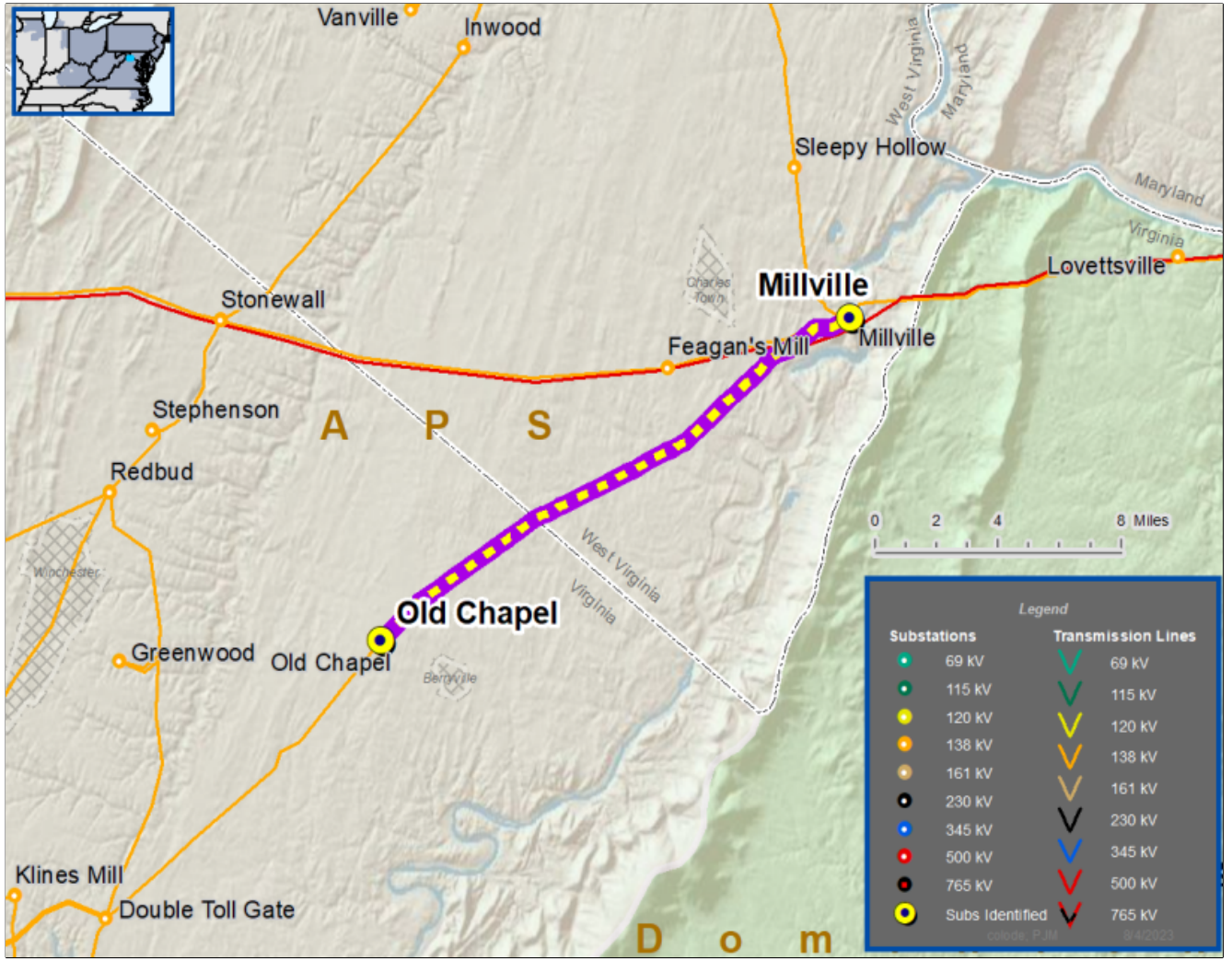
Need Number: APS-2023-040
Process Stage: Solution Meeting 10/20/2023
Previously Presented: Need Meeting 8/18/2023

Project Driver(s):
- *Equipment Material Condition*
- *Performance and Risk*

Specific Assumption Reference(s)
- Substation Condition Rebuild/Replacement
- Substation/line equipment limits

Problem Statement
- Existing switches at Millville Substation cannot be operated reliably.
    - Severe alignment issues result in improper closures, requiring a hammer to manually close, resulting in a safety issues
    - Switch mounting insulators often break during this process, resulting in live parts falling, creating potential safety incidents and system faults.

The Old Chapel – Millville 138 kV line is limited by terminal equipment
- Existing line rating:
    - 299/358/353/410 MVA (SN/SE/WN/WE)
- Existing conductor rating:
    - 353/406/353/428 MVA (SN/SE/WN/WE)



APS Transmission Zone M-3 Process
Millville 138 kV Substation

Need Number: APS-2023-040

Process Stage: Solution Meeting 10/20/2023

Proposed Solution:

- At Millville Substation:
  - On the Old Chapel 138 kV line exit, replace:
    - 1200 A manual disconnect switches with (2) 2000 A motor-operated disconnect switches
    - Limiting substation conductor

Transmission Line Ratings:

- Millville – Old Chapel 138 kV Line:
  - Before Proposed Solution: 299 / 358 / 353/ 410 MVA (SN / SE / WN / WE)
  - After Proposed Solution: 299 / 360 / 353/ 422 MVA (SN / SE / WN / WE)

Alternatives Considered:

- No other feasible solutions.

Estimated Project Cost: $0.7 M

Projected In-Service: 04/15/2024

Project Status: Engineering

Model: 2022 RTEP model for 2027 Summer (50/50)

Legend	
500 kV	
345 kV	
230 kV	
138 kV	
115 kV	
69 kV	
46 kV	
34.5 kV	
23 kV	
New	

Appendix

High Level M-3 Meeting Schedule

Assumptions

Activity	Timing
Posting of TO Assumptions Meeting information	20 days before Assumptions Meeting
Stakeholder comments	10 days after Assumptions Meeting

Needs

Activity	Timing
TOs and Stakeholders Post Needs Meeting slides	10 days before Needs Meeting
Stakeholder comments	10 days after Needs Meeting

Solutions

Activity	Timing
TOs and Stakeholders Post Solutions Meeting slides	10 days before Solutions Meeting
Stakeholder comments	10 days after Solutions Meeting

Submission of Supplemental Projects & Local Plan

Activity	Timing
Do No Harm (DNH) analysis for selected solution	Prior to posting selected solution
Post selected solution(s)	Following completion of DNH analysis
Stakeholder comments	10 days prior to Local Plan Submission for integration into RTEP
Local Plan submitted to PJM for integration into RTEP	Following review and consideration of comments received after posting of selected solutions

Revision History

9/7/2023 – V1 – Original version posted to pjm.com

10/10/2023 – V2-

Addition of APS-2023-032, APS-2023-041 to APS-2023-043, APS-2023-046 to APS-2023-049, APS-2023-051 as needs

Addition of APS-2021-012 as solutions

Removal of APS-2023-035.