Subregional RTEP Committee
FirstEnergy Supplemental Projects

Submission of Supplemental Projects for Inclusion in the Local Plan

2024 Data Center Projects to be modeled in the 2024 RTEP Series Case

PE Transmission Zone M-3 Process
Sage 230 kV Customer Load Increase

Need Number: APS-2023-017

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Re-Present Solutions Meeting – 02/06/2024

Solution Meeting – 8/8/2023

Need Meeting – 6/6/2023

Project Driver(s):

Customer Service

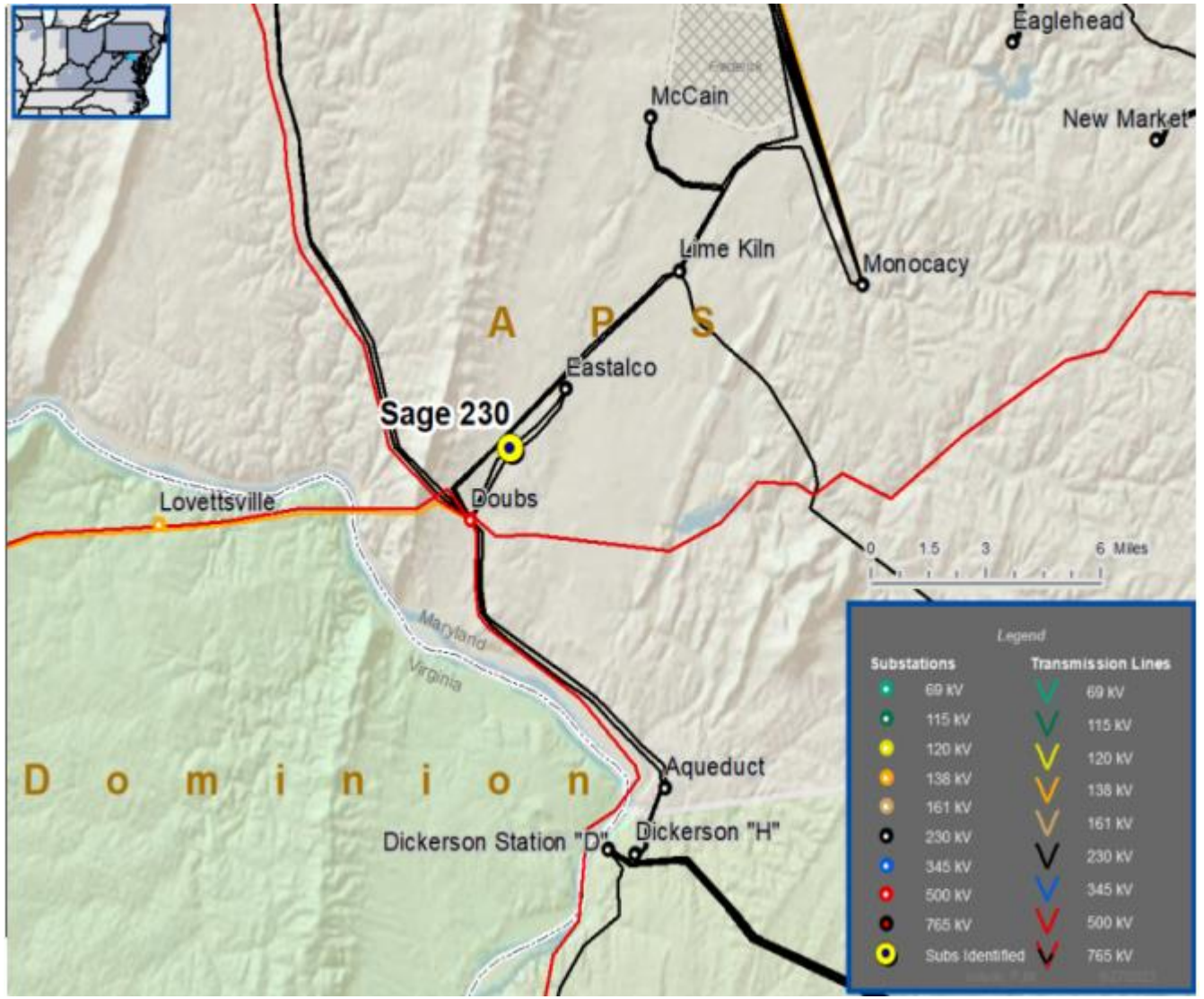
Specific Assumption Reference(s)

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

Problem Statement

Existing Customer Connection load increase - has requested a load addition to the 230 kV delivery point Sage Substation (s2881). The anticipated load increase is 336 MW with a total site load of 576 MW.

Requested in-service date is 02/13/2026.



APS Transmission Zone M-3 Process
Sage 230 kV Customer Load Increase- Solution Phase 2

Need Number: APS-2023-017

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Selected Solution 1 of 2:

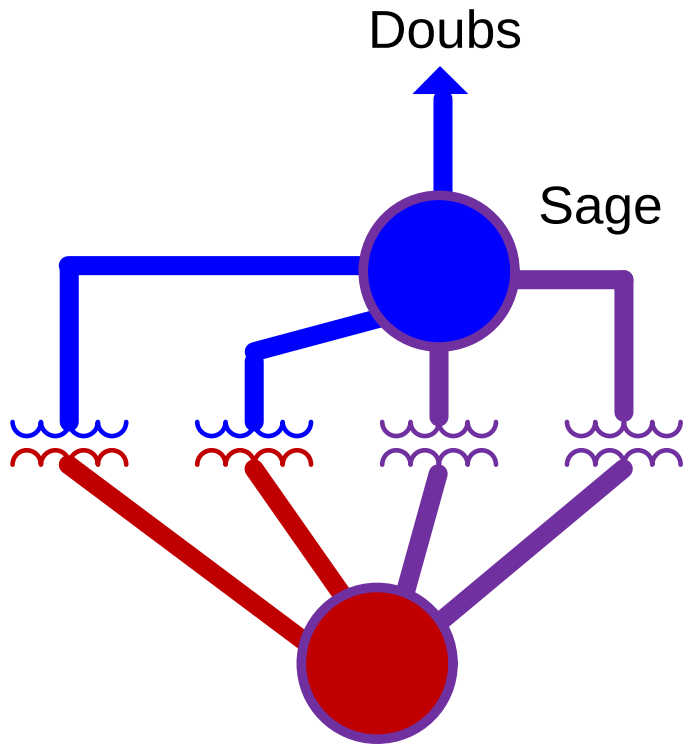
230 kV Transmission substation Expansion

- Expand the existing 3-breaker ring bus into a 6 breaker, breaker-and-a-half substation by installing three new 230 kV circuit breakers
- Install 2 230-34.5 kV transformers
- Construct 2 34.5 kV busses on the low side of transformers

Estimated Project Cost: $1.5M

Projected In-Service: 10/01/2025

Supplemental Project ID: s3152.1



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

APS Transmission Zone M-3 Process
Sage 230 kV Customer load addition- Solution Phase 3

Need Number: APS-2023-017

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Selected Solution 2 of 2 :

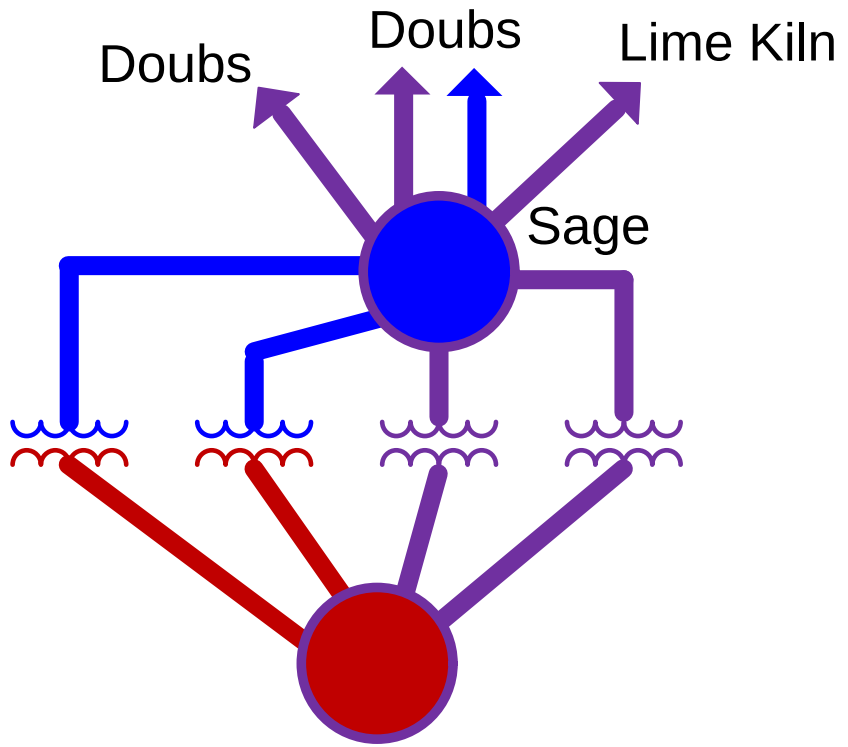
230 kV Transmission substation Expansion

- Expand the six breaker, breaker-and-a-half substation to 15 breakers by adding nine 230 kV circuit breakers.
- Terminate the Doubs-Eastalco 206 230 kV Line into the Sage Substation
- Loop in the Doubs-Lime Kiln 207 230 kV Line into the Sage Substation

Estimated Project Cost: $25M

Projected In-Service: 12/31/2027

Supplemental Project ID: s3152.2



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

APS Transmission Zone M-3 Process
Doubs – Sage 230 kV New Customer

Need Number: APS-2023-029

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 7/11/2023

Solution Meeting – 10/31/2023

Re-Present Solutions Meeting – 02/06/2024

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- A customer has requested 230 kV transmission service for approximately 300 MW of load near the Doubs-Sage #206 230 kV Line.

Requested in-service date is May 15, 2025

Need Number: APS-2023-029

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Selected Solution:

230 kV Transmission Substation (Quantum 400)

Selected Solution:

- Build a six breaker, two bay (expandable to four bays), breaker-and-a-half substation (Quantum 400)
- Loop the Doubs – Lime Kiln #231 230 kV Line in and out of the new substation
- Modify line relay settings at Doubs and Lime Kiln substations
- Provide two feeds to the customer facility

Estimated Project Cost: $20.8M

Projected In-Service: 09/01/2025

Supplemental Project ID: s3150.2

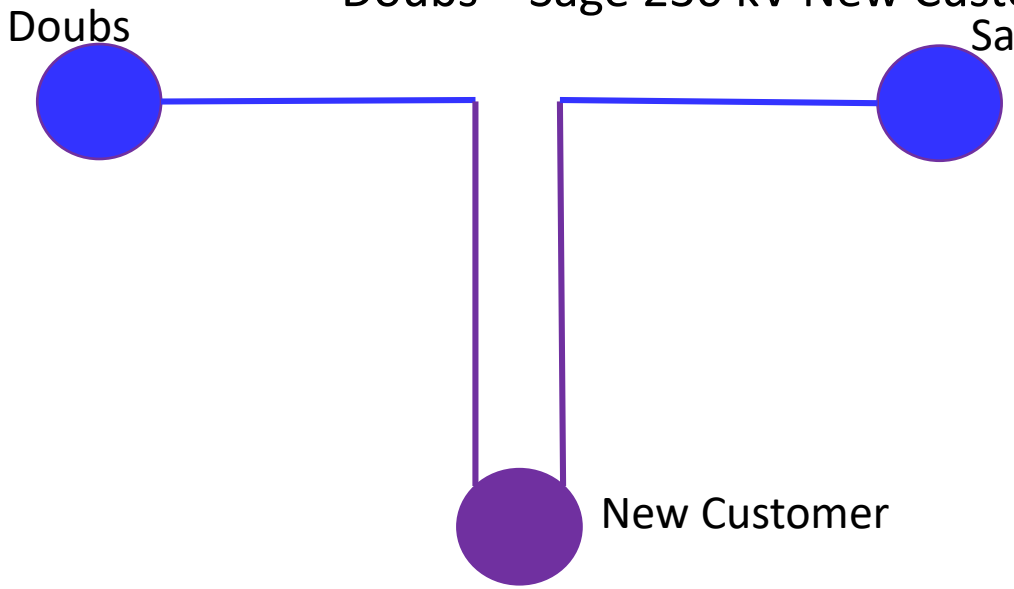
- Expand Quantum 400 station to a nine breaker, breaker-and-a-half substation
- Loop the Doubs – Sage #206 230 kV Line in and out of the new substation
- Modify line relay settings at Doubs and Sage substations

Estimated Project Cost: $14.6M

Projected In-Service: 12/31/2027 (coordinate with APS-2023-017)

Supplemental Project ID: s3150.1

APS Transmission Zone M-3 Process
Doubs – Sage 230 kV New Customer



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

APS Transmission Zone M-3 Process
Doubs – Lime Kiln 230 kV #231 Line New Customer

Need Number: APS-2023-031

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 09/05/2023

Solution Meeting – 10/31/2023

Supplemental Project Driver(s):

Customer Service

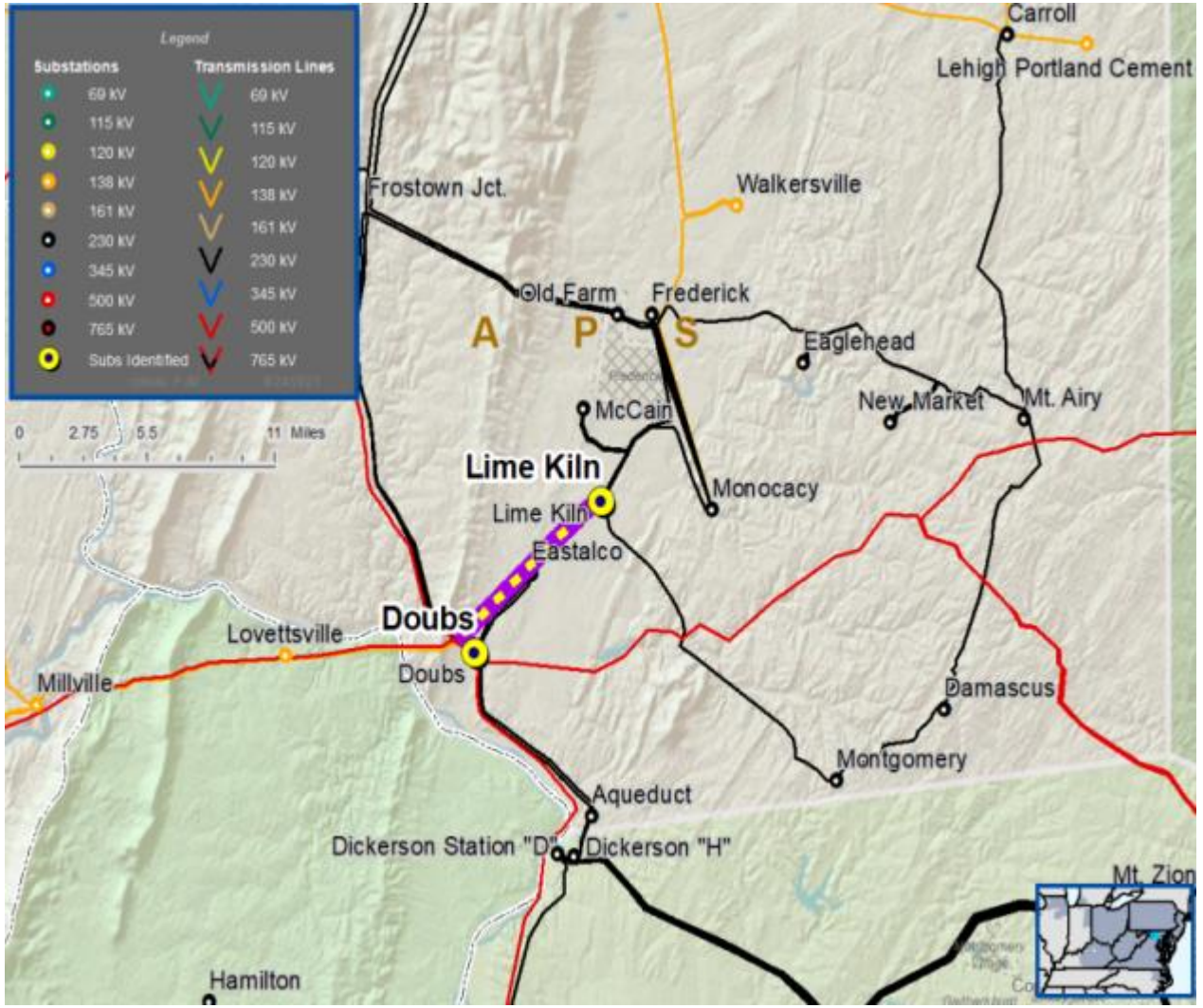
Specific Assumption Reference(s):

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 230 kV transmission service for approximately 360 MW of total load near the Doubs – Lime Kiln 230 kV 231 Line.

Requested in-service date is December 31, 2025



APS Transmission Zone M-3 Process
Doubs – Lime Kiln 230 kV #231 Line New Customer

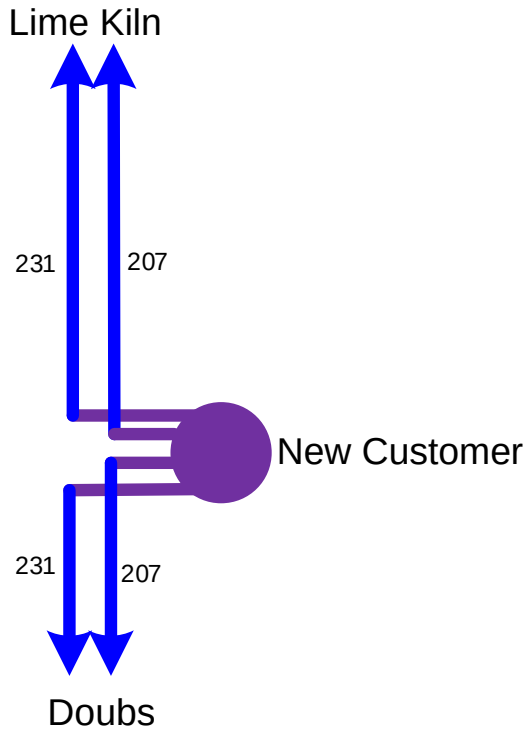
Need Number: APS-2023-031

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Selected Solution:

230 kV Transmission Substation

- Build a new eleven (future fifteen) breaker, breaker-and-a-half 230 kV substation
- Cut and loop the Doubs – Lime Kiln 230 kV #231 and #207 230 kV Lines in and out of the new substation
- Modify relay settings in Doubs and Lime Kiln substations
- Provide three 230 kV feeds to customer facility



Estimated Project Cost: $28.7M

Projected In-Service: 12/31/2025

Supplemental Project ID: s3153.1

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

Submission of Supplemental Projects for Inclusion in the Local Plan

APS Transmission Zone M-3 Process
Stoner Junction 138 kV Line

Need Number: APS-2023-006

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 04/21/2023

Solution Meeting – 07/21/2023

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

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)

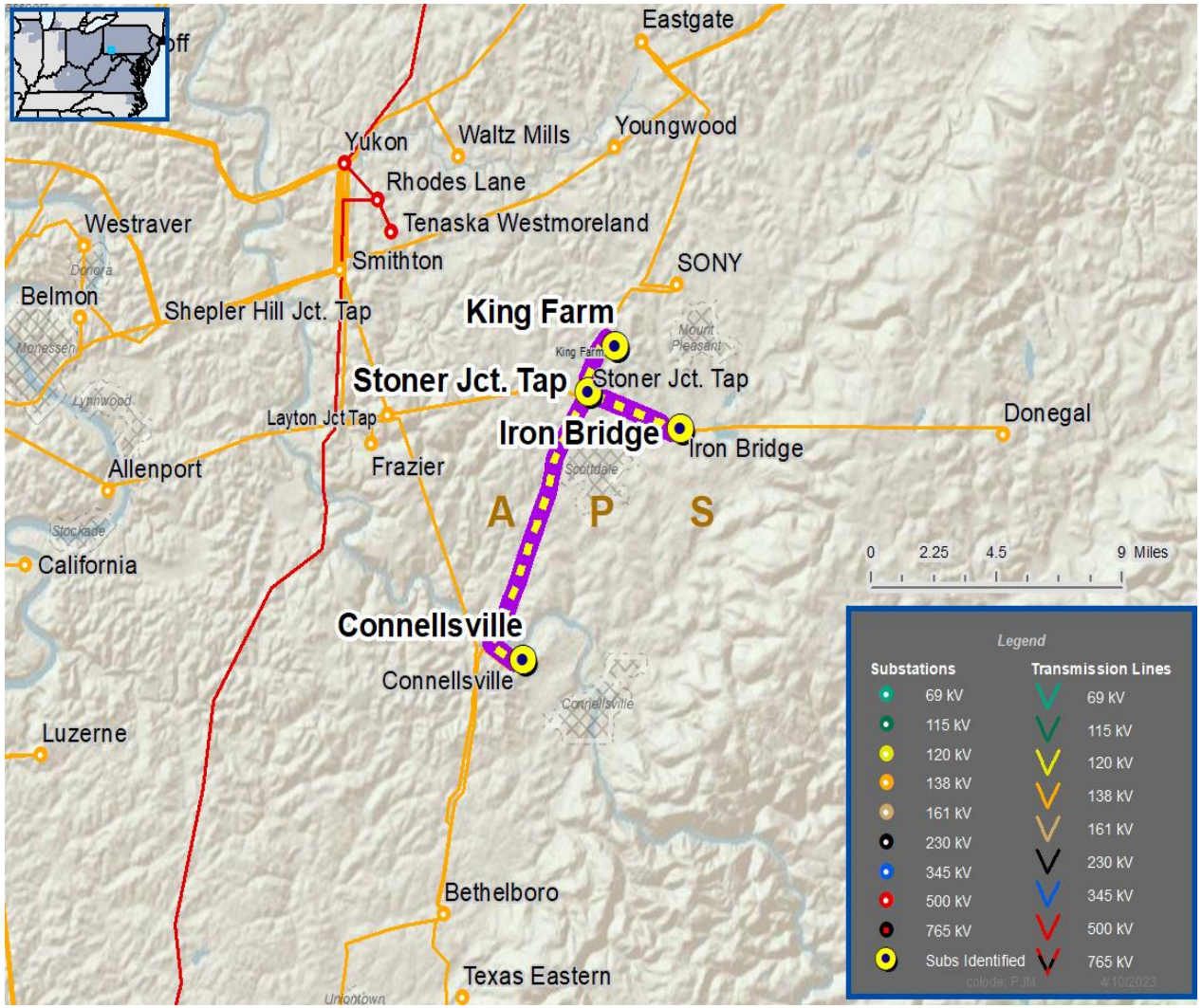
System Performance Projects Global Factors

- Substation/line equipment limits

Problem Statement:

The Connellsville – Iron Bridge – King Farm (Stoner Junction) 138 kV Line is exhibiting deterioration and has significant outage history

- Approximately 15 miles of this line is on wood structures nearing end of life. They are recommended for rebuild.
- 78% of structures (89 of 114) did not meet one or more assessment criteria.
- The 4.3-mile balance of line is on lattice towers where 15 of 21 had correctable defects.
- The original conductor is 336.4 26/7 ACSR with original and maintenance splices and should be considered for replacement.
- There are 31 recent maintenance conditions, primarily due to wood pole conditions or rusted hardware. Conditions are expected to deteriorate as equipment approaches end of life.



APS Transmission Zone M-3 Process
Stoner Junction 138 kV Line

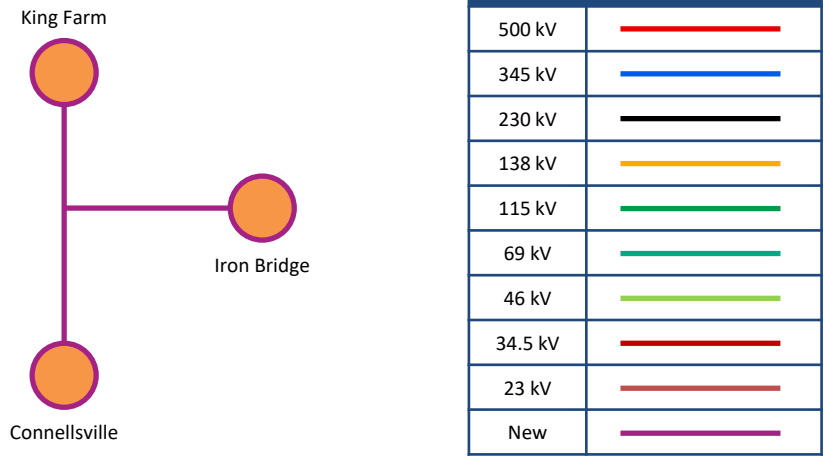
Need Number: APS-2023-006

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan – 4/26/2024

Selected Solution:

- Rebuild/rehab the Connellsville – Stoner Junction 138 kV Line. Replace existing transmission line conductor with larger size.
- Rebuild/rehab the Stoner Junction – King Farm 138 kV Line.
- Rebuild/rehab the Stoner Junction – Iron Bridge 138 kV Line. Replace existing transmission line conductor with larger size.

Need #	Transmission Line	Existing Line Rating (SN / SE)	Post Project Line Rating (SN / SE)
APS-2023-006	Connellsville – Stoner Junction 138 kV	160 / 192	308 / 376
	Stoner Junction – King Farm 138 kV	308 / 376	308 / 376
	Stoner Junction – Iron Bridge 138 kV	221 / 268	308 / 376



Estimated Project Cost: $ 31.5 M

Projected In-Service: 12/31/2025

Supplemental Project ID: s3123.1

APS Transmission Zone M-3 Process
Penn-North Oakford 138 kV New Customer

Need Number: APS-2023-008

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan – 4/26/2024

Previously Presented:

Need Meeting – 4/21/2023

Solution Meeting – 7/21/2023

Project Driver(s):

Customer Service

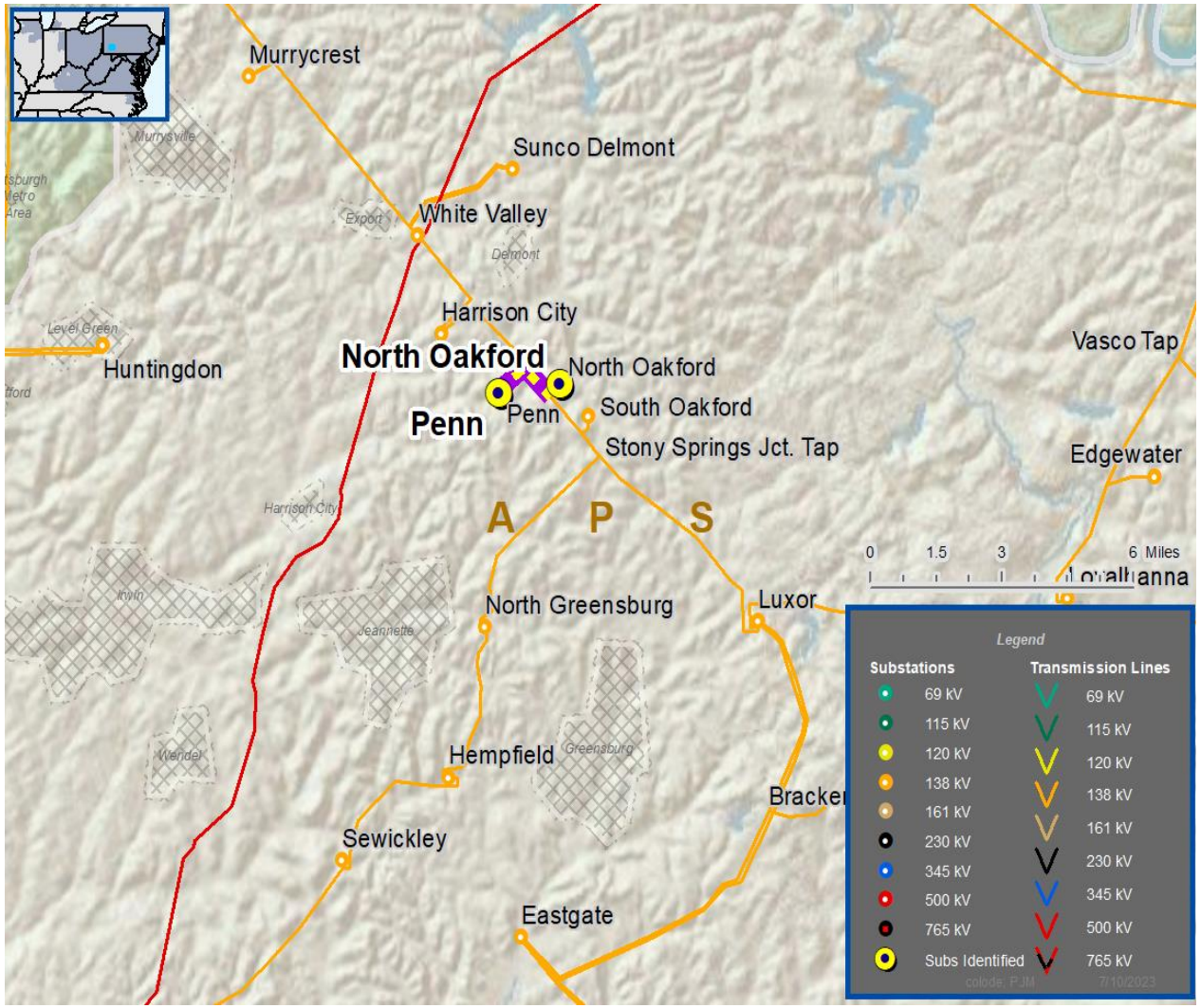
Specific Assumption Reference(s)

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 - has requested a new 138 kV delivery point near the Penn-North Oakford 138 kV line. The anticipated load of the new customer connection is 100 MVA.

Requested in-service date is 12/31/2024.



APS Transmission Zone M-3 Process
Penn-North Oakford 138 kV New Customer

Need Number: APS-2023-008

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan – 4/26/2024

Selected Solution:

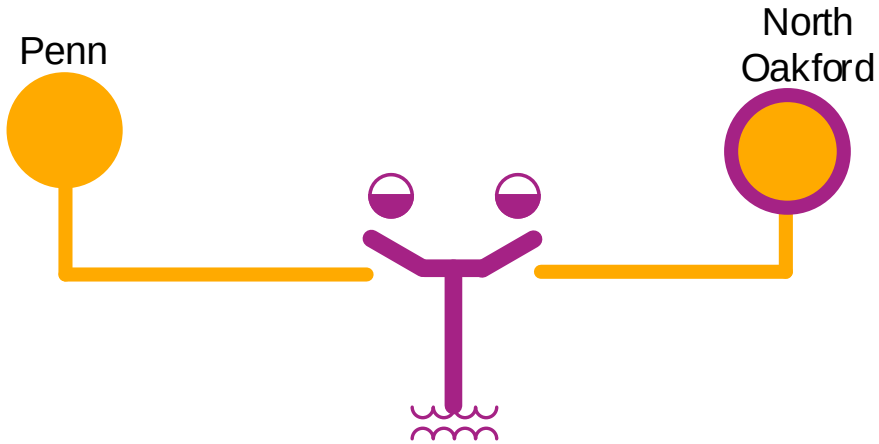
138 kV Transmission Line Tap

- Install three SCADA controlled transmission line switches
- Construct approximately 0.75 miles of transmission line using 1590 ACSR 45/7 from tap point to customer substation
- Install one 138 kV revenue metering package at customer substation

Estimated Project Cost: $5.4M

Projected In-Service: 12/31/2024

Supplemental Project ID: s3125.1



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

APS Transmission Zone M-3 Process
Greenwood-Redbud 138 kV New Customer

Need Number: APS-2023-013

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan – 4/26/2024

Previously Presented:

Need Meeting – 05/19/2023

Solution Meeting – 07/21/2023

Project Driver(s):

Customer Service

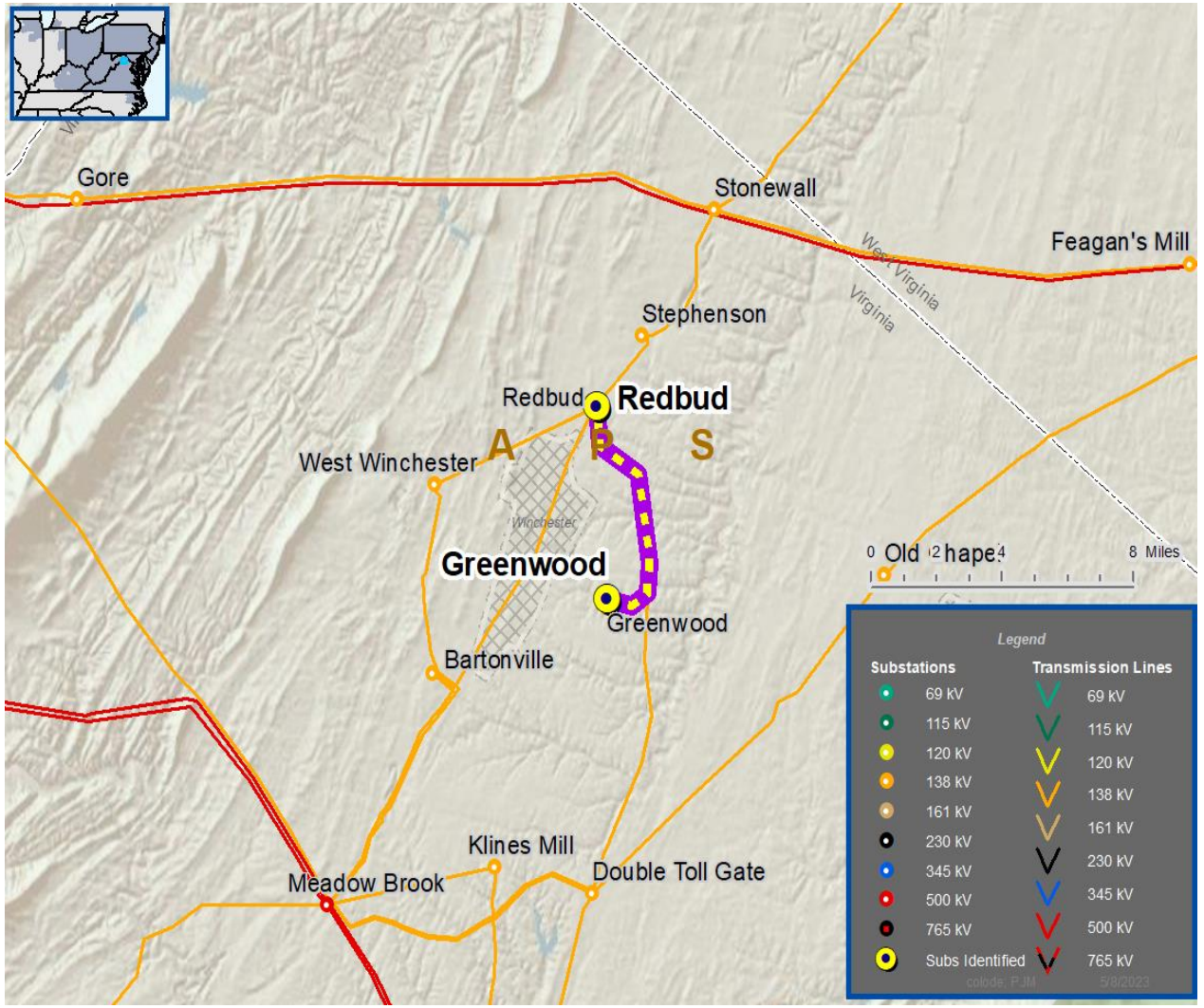
Specific Assumption Reference(s)

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 - has requested a new 138 kV delivery point near the Greenwood-Redbud 138 kV line. The anticipated load of the new customer connection is 35 MVA.

Requested in-service date is 05/3/2024.



APS Transmission Zone M-3 Process
Greenwood-Redbud 138 kV New Customer

Need Number: APS-2023-013

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan – 4/26/2024

Selected Solution:

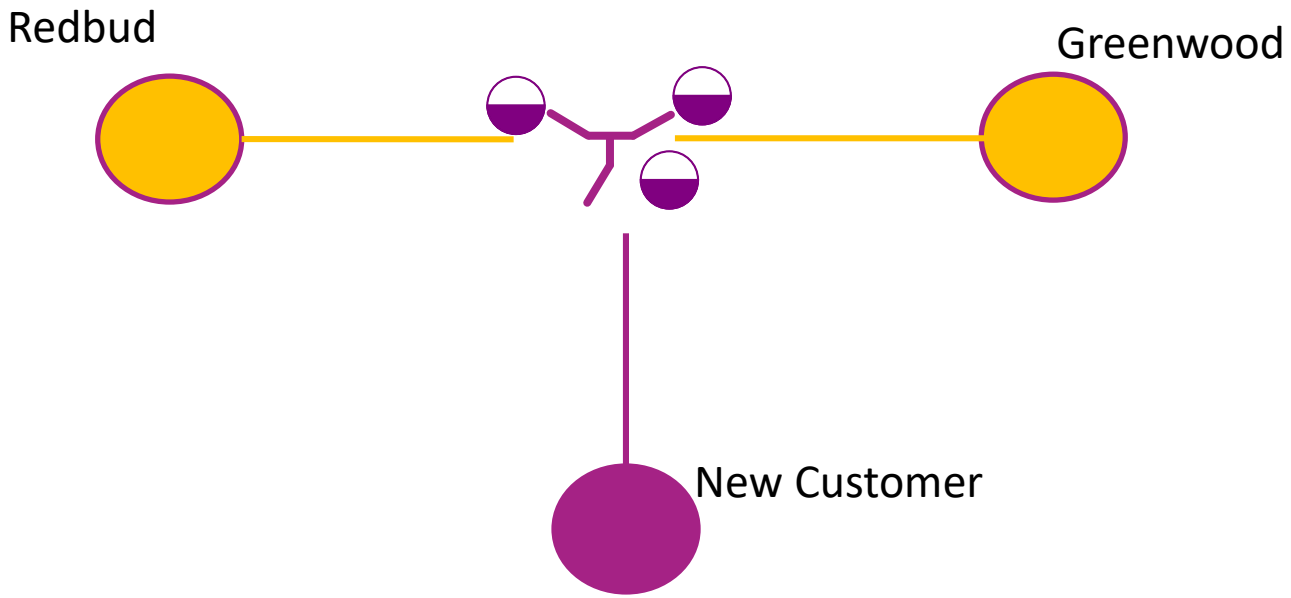
138 kV Transmission Line Tap

- Install a three-switch tap along the Greenwood – Redbud 138 kV Line with three 1200 A SCADA load break switches
- Install 138 kV line extension from the three-switch tap to the Customer's substation
- Install 138 kV revenue metering in Customer's substation
- Modify line relay settings in Greenwood and Redbud substations

Estimated Project Cost: $1.6M

Projected In-Service: 05/3/2024

Supplemental Project ID: s3126.1



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

APS Transmission Zone M-3 Process
Page-Riverton 138 kV New Customer

Need Number: APS-2023-014

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 05/19/2023

Solution Meeting – 07/21/2023

Project Driver(s):

Customer Service

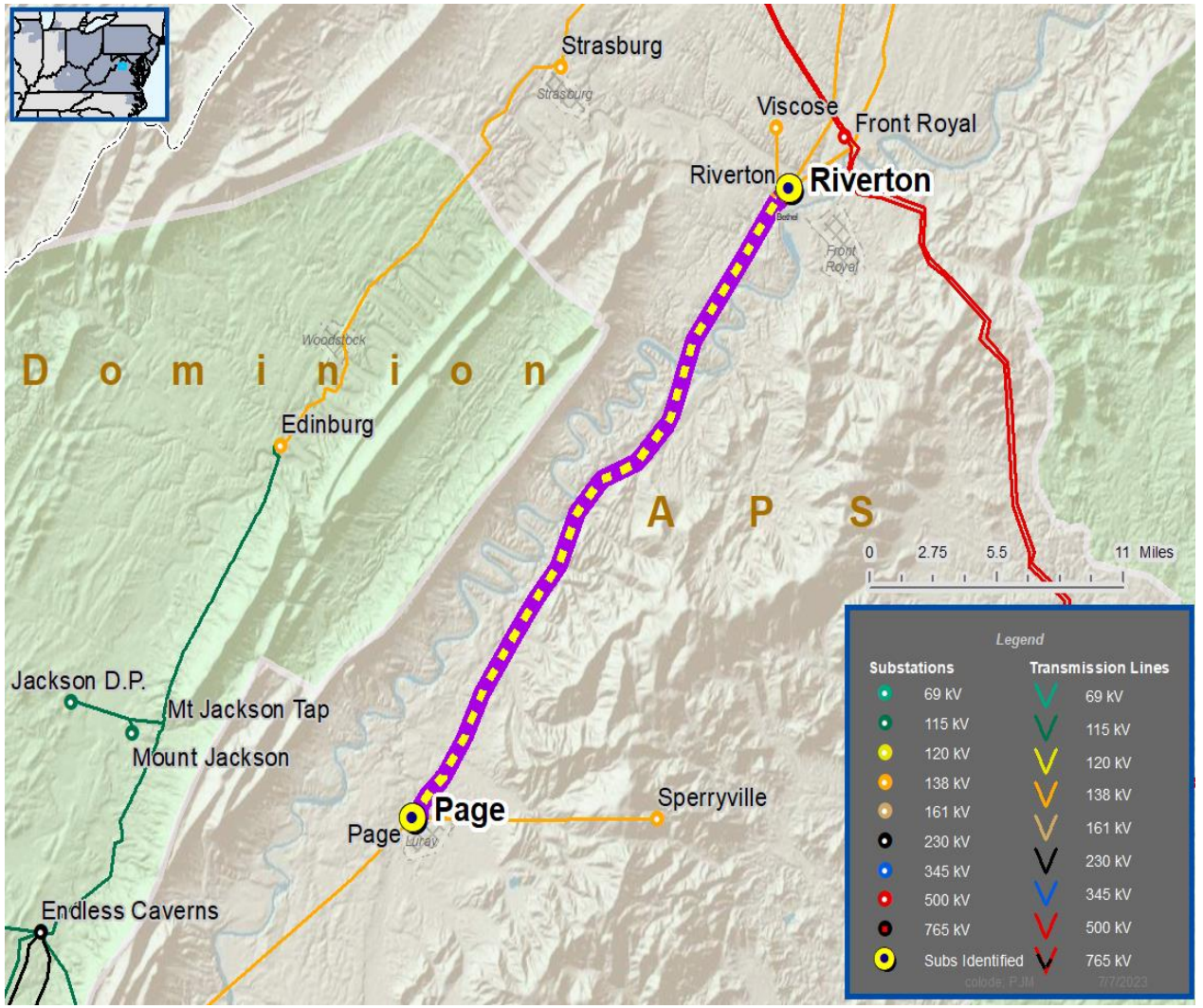
Specific Assumption Reference(s)

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 - has requested a new 138 kV delivery point near the Page-Riverton 138 kV line. The anticipated load of the new customer connection is 35 MVA.

Requested in-service date is 05/30/2025.



APS Transmission Zone M-3 Process
Page-Riverton 138 kV New Customer

Need Number: APS-2023-014

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Selected Solution:

138 kV Transmission Line Tap

- Install a new 4-breaker ring bus named Catlett Mountain near 85 Russ Johnson Rd, Front Royal, VA 22630
- Cut the Page – Riverton RLU 138 kV Line near pole RLU-154 and extend 0.3-mile line in and out of the new Catlett Mountain Substation
- Protection/terminal end relay settings review required
- Install revenue metering in Customer's facilities

Line Ratings:

Catlett Mountain – Page 138 kV Line

After project completion 160 MVA SN/ 192 MVA SE

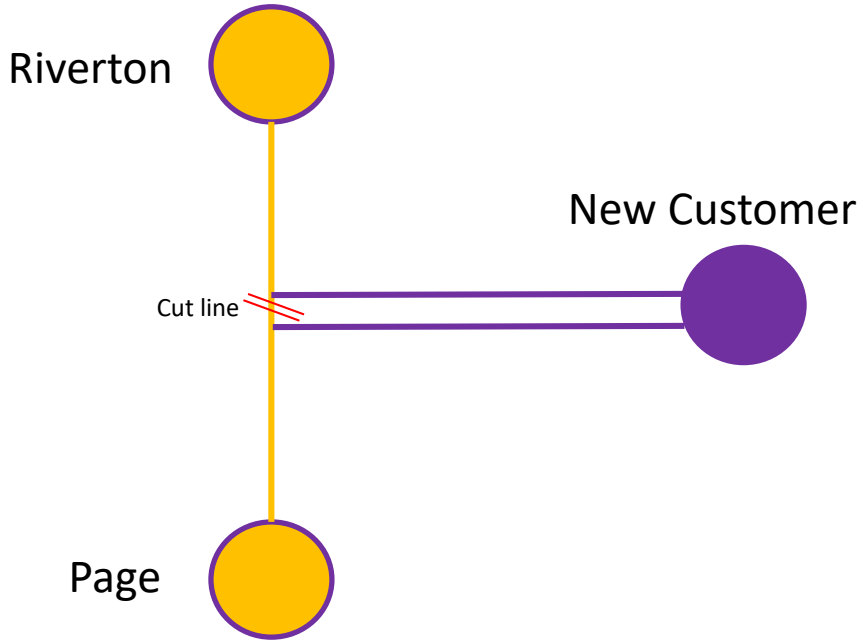
Catlett Mountain – Riverton 238 kV Line

After project completion 153 MVA SN/ 153 MVA SE

Estimated Project Cost: $16M

Projected In-Service: 05/30/2025

Supplemental Project ID: s3127.1



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

APS Transmission Zone M-3 Process
Messick Road – Morgan 138 kV New Customer

Need Number: APS-2023-015

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 05/19/2023

Solution Meeting – 07/21/2023

Project Driver(s):

Customer Service

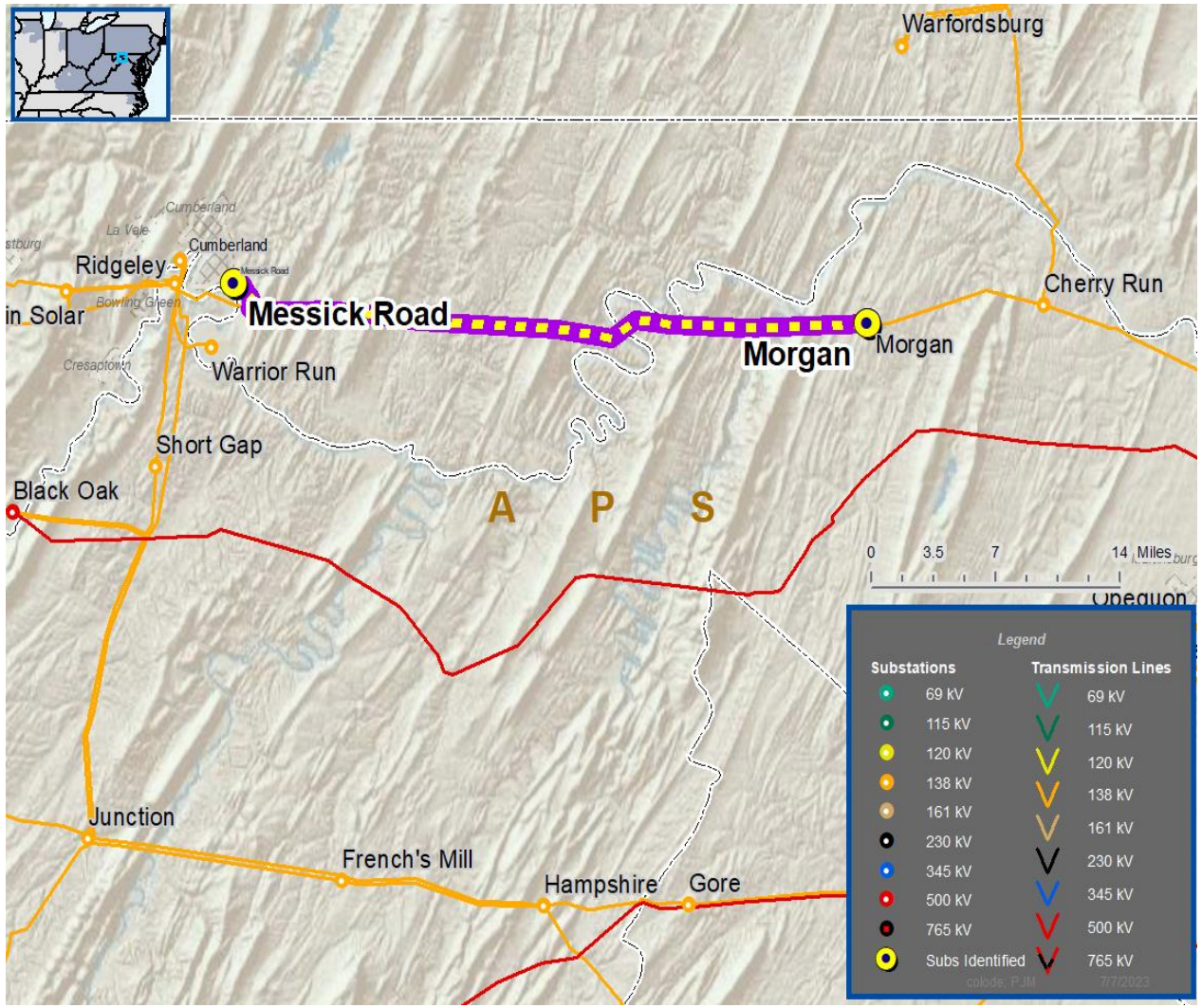
Specific Assumption Reference(s):

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 Messick Road – Morgan 138 kV line. The anticipated load of the new customer connection is 5 MW.

Requested in-service date is 12/31/2024.



APS Transmission Zone M-3 Process
Messick Road – Morgan 138 kV New Customer

Need Number: APS-2023-015

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Selected Solution:

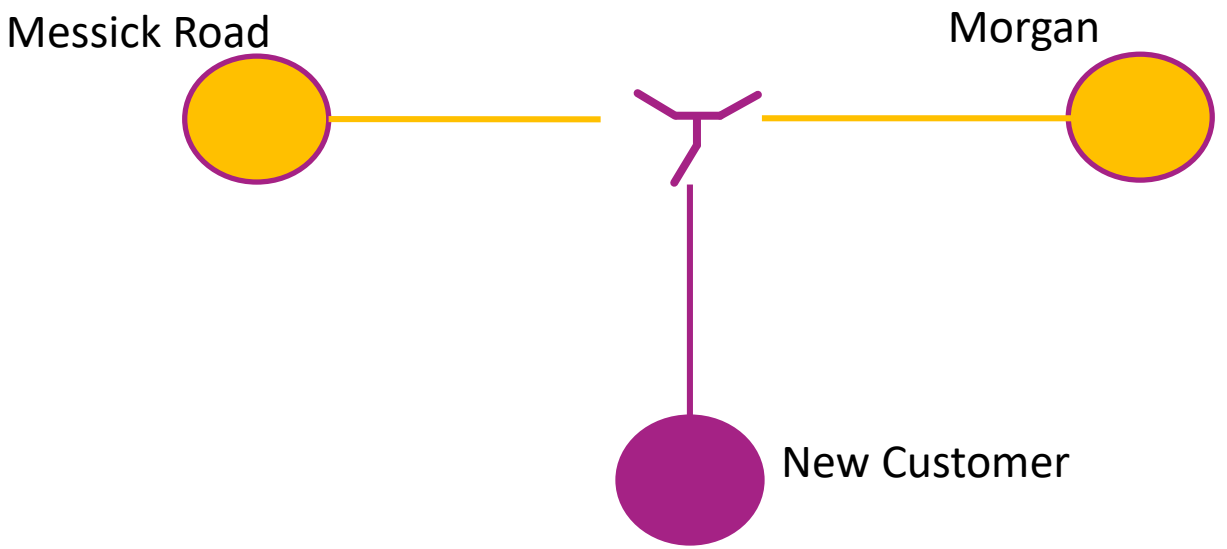
138 kV Transmission Line Tap

- Install three-way tap using three 2000 A SCADA switches
- Construct 0.1 miles of 556 ACSR 26/7 from tap location to new substation

Estimated Project Cost: $1.8M

Projected In-Service: 12/31/2024

Supplemental Project ID: s3128.1



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

APS Transmission Zone M-3 Process
Marlowe Substation

Need Number: APS-2023-027

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 7/21/2023

Solution 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

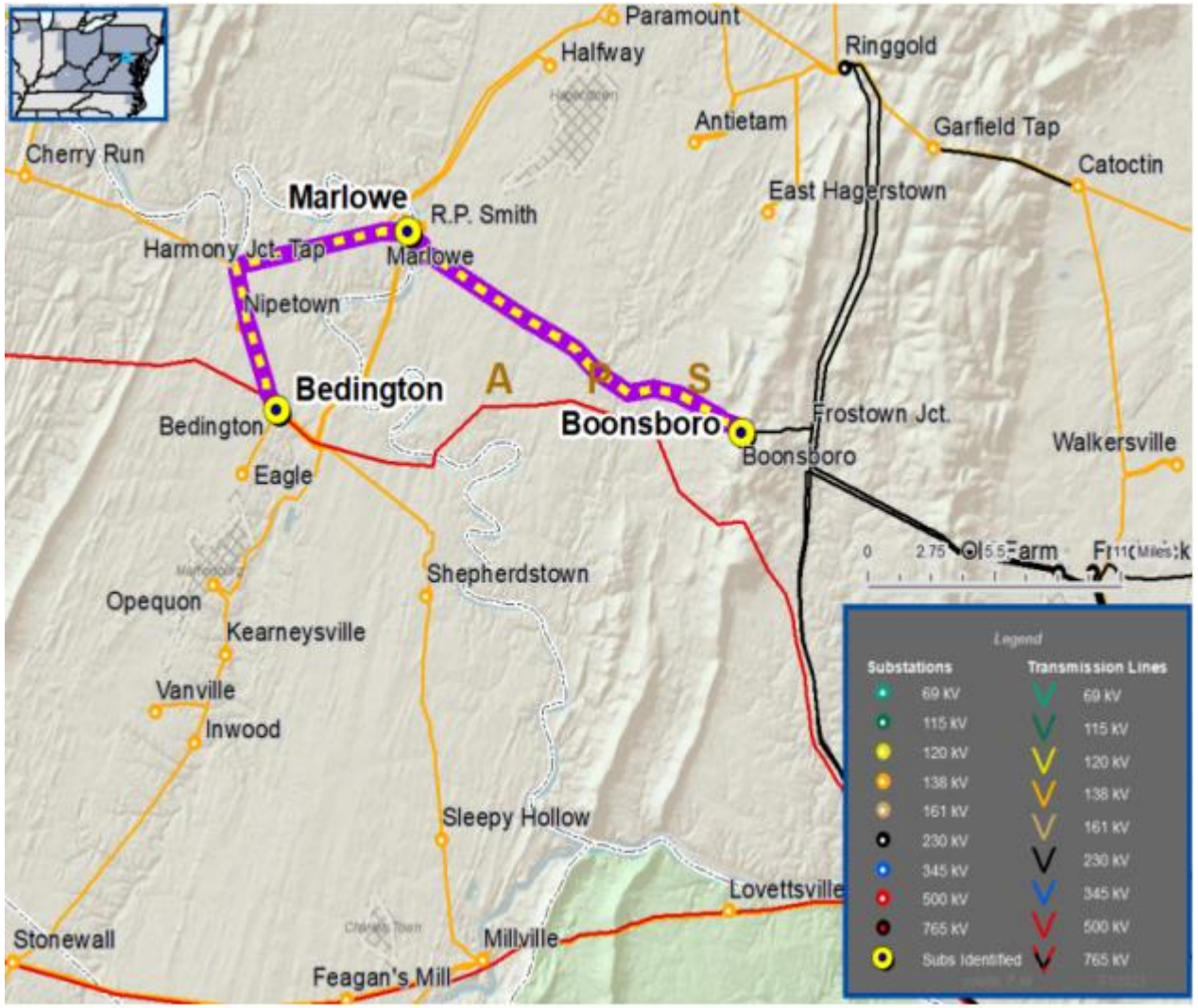
- Existing switches are beyond reliable operation.
    - Severe alignment issues result in improper closures, requiring a hammer to manually close, resulting in a safety issues
    - Switch mounting insulators often break during this process, resulting in live parts falling, creating a potential accidents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

The Boonsboro – Marlowe 138 kV line is limited by Substation conductor

- Existing line rating:
    - 300/358/349/410 MVA (SN/SE/WN/WE)

The Bedington – Marlowe 138 kV line is limited by Substation conductor

- Existing line rating:
    - 265/349/349/410 MVA (SN/SE/WN/WE)



APS Transmission Zone M-3 Process
Marlowe Substation

Need Number: APS-2023-027

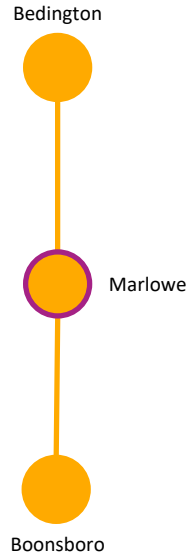
Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Selected Solution:

- At Marlowe Substation:
  - On the Boonsboro 138 kV line exit, replace:
    - 1200 A manual disconnect switches with (2) 2000 A motor-operated disconnect switches
    - Limiting substation conductor
  - On the Bedington BMA 138 kV line exit, replace:
    - 1200 A manual disconnect switches with (2) 2000 A motor-operated disconnect switches
    - Limiting substation conductor

Transmission Line Ratings:

- Boonsboro – Marlowe 138 kV Line
  - Before Proposed Solution: 300 / 358 / 349 / 410 MVA (SN / SE / WN / WE)
  - After Proposed Solution: 300 / 358 / 369 / 410 MVA (SN / SE / WN / WE)
- Bedington – Marlowe BMA 138 kV Line
  - Before Proposed Solution: 265 / 349 / 349 / 410 MVA (SN / SE / WN / WE)
  - After Proposed Solution: 265 / 349 / 349 / 435 MVA (SN / SE / WN / WE)



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

Estimated Project Cost: $ 0.3 M

Projected In-Service: 10/27/2023

Supplemental Project ID: s3131.1

APS Transmission Zones M-3 Process
Damascus – Mount Airy 230 kV Misoperation Relays

Need Numbers: APS-2023-026

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 07/11/2023

Solution Meeting – 09/05/2023

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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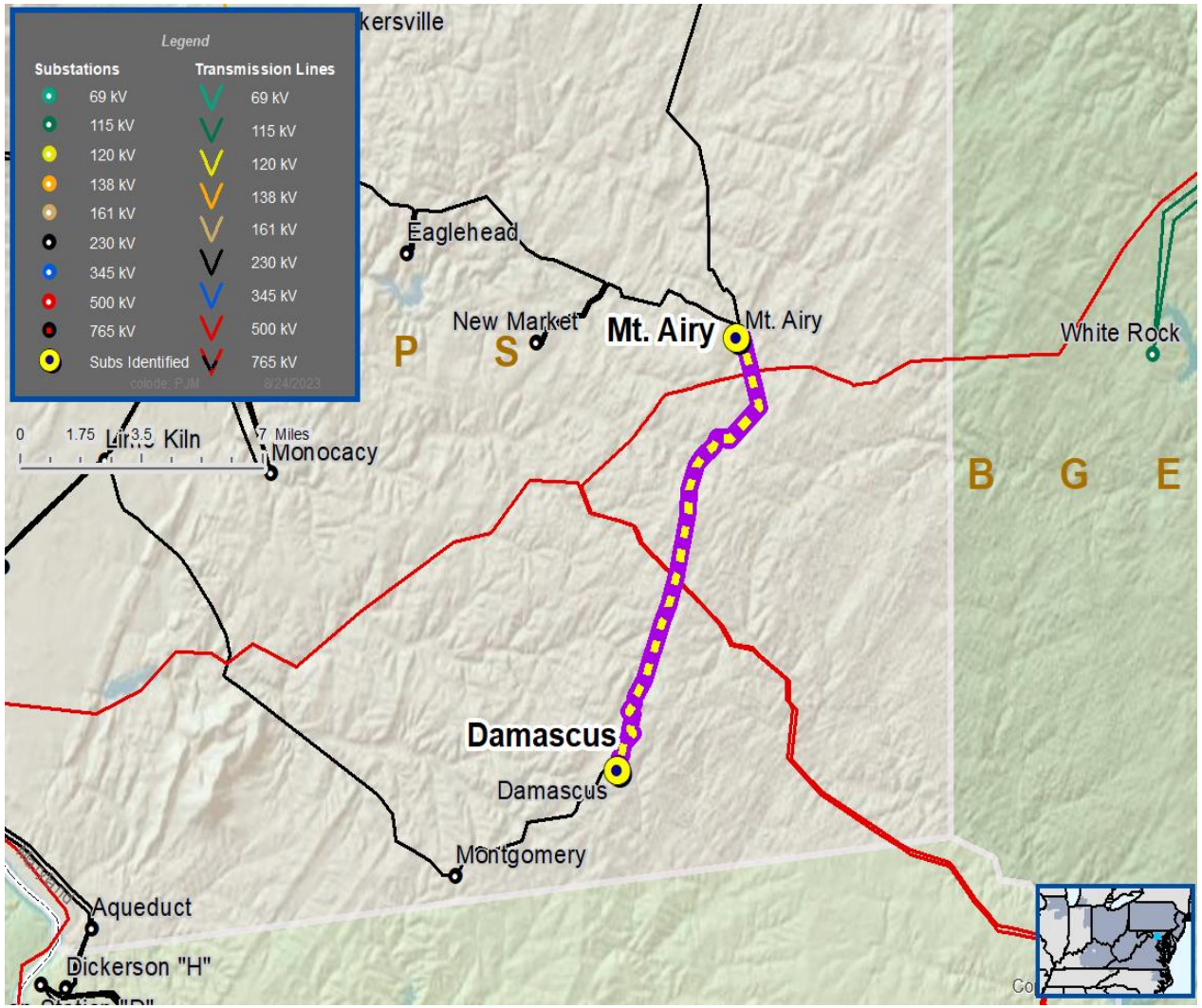


Damascus – Mount Airy 230 kV Misoperation Relays

Need #	Transmission Line / Substation Locations	Existing Line Rating (SN / SE)	Existing Conductor Rating (SN / SE)
APS-2023-026	Damascus – Mount Airy 230 kV	478/523	617/754

APS Transmission Zones M-3 Process
Damascus – Mount Airy 230 kV Misoperation Relays

Need Numbers: APS-2023-026

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Selected Solution:

- Replace circuit switcher and limiting substation conductor at Damascus
- Replace wave trap, disconnect switches, and limiting substation conductor at Mount Airy

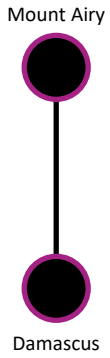
Transmission Line Ratings:

- Damascus – Mount Airy 230 kV Line
  - Before Proposed Solution: 478 / 523 MVA (SN / SE)
  - After Proposed Solution: 548 / 688 MVA (SN / SE)

Estimated Project Cost: $ 2.2 M

Projected In-Service: 12/22/2023

Supplemental Project ID: s3091.1



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

APS Transmission Zones M-3 Process
Meadow Brook Substation

Need Numbers: APS-2023-037

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 09/05/2023

Solution Meeting – 10/03/2023

Project Driver:

Performance and Risk, Operational Flexibility and Efficiency

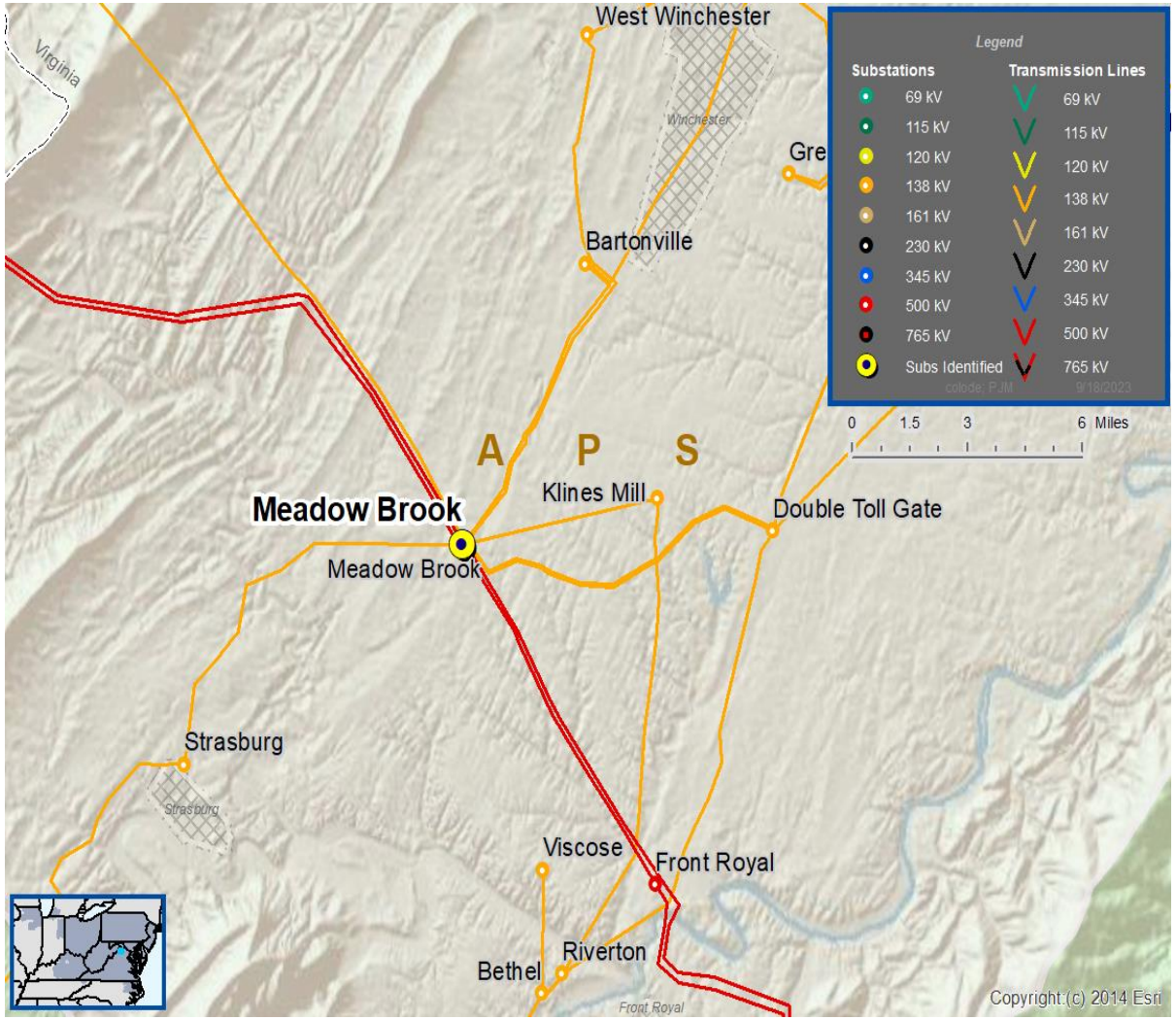
Specific Assumption Reference:

System Performance Projects Global Factors

- System reliability and performance
- Substation/line equipment limits
- Upgrade Relay Schemes

Problem Statement:

- The protective equipment on the Meadow Brook No. 1 500/138 kV and Meadow Brook No. 4 500/138 kV transformers are electro-mechanical and vintage.
  - The protective equipment cannot be easily repaired due to a lack of replacement parts and available expertise in the outdated technology.
- FirstEnergy has identified operational constraints when a single breaker is out of service for maintenance.
- The Meadow Brook No. 1 500/138 kV transformer is limited by terminal equipment:
  - Normal Ratings: 470/567/579/612 MVA (SN/SSTE/WN/WSTE)
  - Single Breaker Outage: 306/306/306/306 MVA (SN/SSTE/WN/WSTE)
- The Meadow Brook No. 4 500/138 kV transformer is limited by terminal equipment:
  - Normal Ratings: 461/567/539/611 MVA (SN/SSTE/WN/WSTE)
  - Single Breaker Outage: 306/306/306/306 MVA (SN/SSTE/WN/WSTE)



APS Transmission Zones M-3 Process
Meadow Brook Substation

Need Number: APS-2023-037

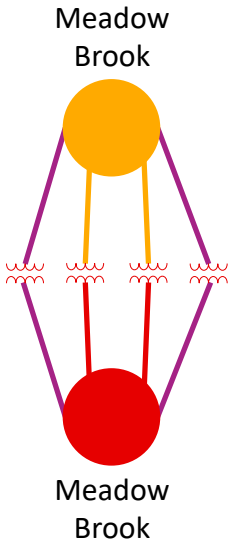
Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Selected Solution:

- At Meadow Brook Substation:
  - On the No. 1 500/138 kV Transformer Circuit, replace:
    - Circuit Breakers
    - Relaying
    - Limiting substation conductor
  - On the No. 4 500/138 kV Transformer Circuit, replace:
    - Relaying
    - Limiting substation conductor

Transformer Ratings:

- No. 1 500/138 kV Transformer
  - Before Proposed Solution:
    - Normal Ratings: 470/567/579/612 MVA (SN/SSTE/WN/WSTE)
    - Single Breaker Outage: 306/306/306/306 MVA (SN/SSTE/WN/WSTE)
  - After Proposed Solution:
    - Normal Ratings: 519/592/621/702 MVA (SN/SSTE/WN/WSTE)
    - Single Breaker Outage: 519/592/621/702 MVA (SN/SSTE/WN/WSTE)
- No. 4 500/138 kV Transformer
  - Before Proposed Solution:
    - Normal Ratings: 461/567/539/611 MVA (SN/SSTE/WN/WSTE)
    - Single Breaker Outage: 306/306/306/306 MVA (SN/SSTE/WN/WSTE)
  - After Proposed Solution:
    - Normal Ratings: 461/571/539/611 MVA (SN/SSTE/WN/WSTE)
    - Single Breaker Outage: 461/571/539/611 MVA (SN/SSTE/WN/WSTE)



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

Estimated Project Cost: $ 2.3 M

Projected In-Service: 12/20/2024

Supplemental Project ID: s3092.1

APS Transmission Zone M-3 Process
Doubs Substation

Need Number: APS-2023-016

Process Stage: Submission of Supplemental Projects for Inclusion in Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 6/6/2023

Solution Meeting – 10/31/2023

Project Driver(s):

Performance and Risk, Operational Flexibility and Efficiency

Specific Assumption Reference(s):

System Performance Projects Global Factors

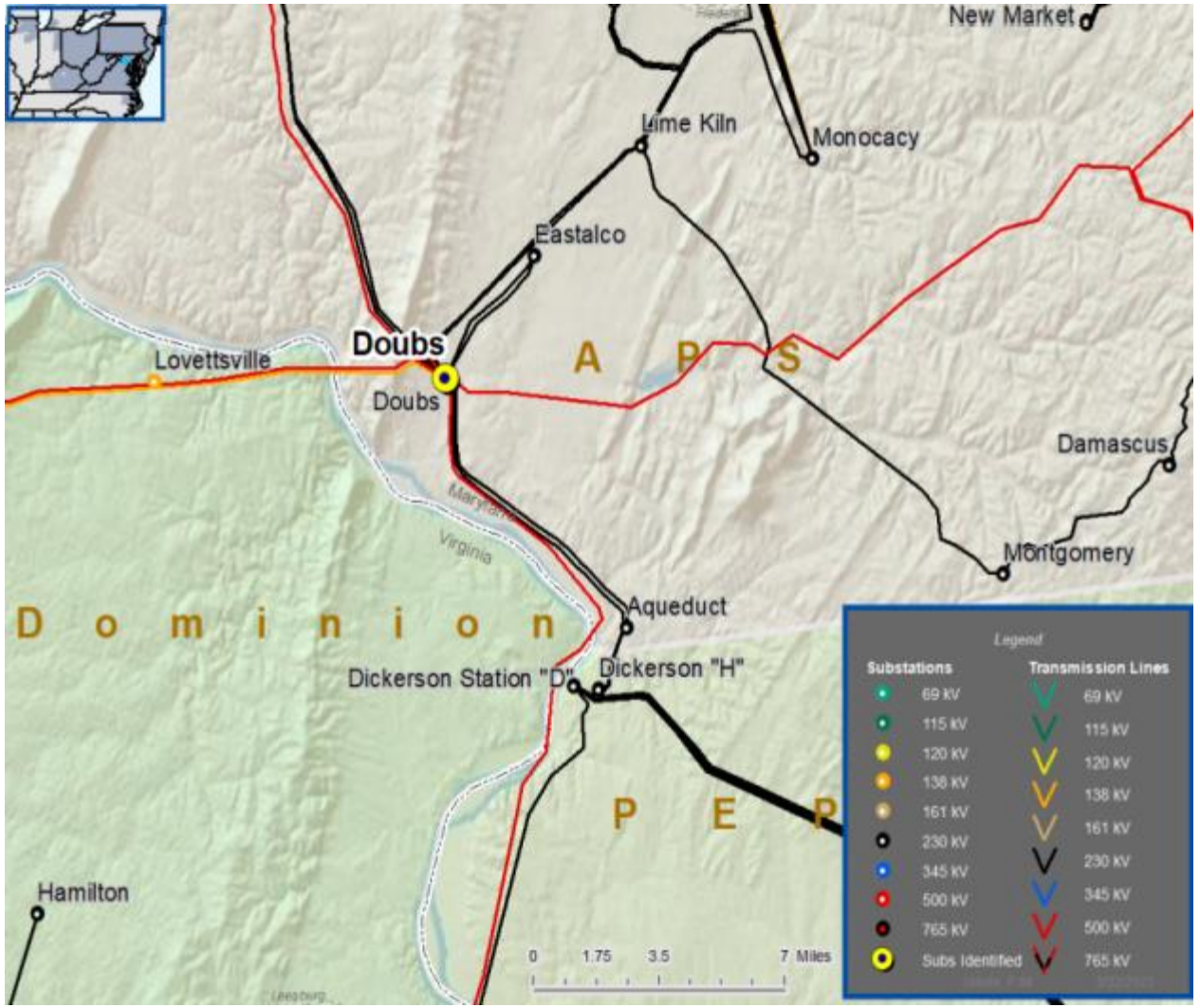
- System reliability and performance
- Reliability of Non-Bulk Electric System (Non-BES) Facilities

Add/Replace Transformers

Past System Reliability/Performance

Problem Statement:

- The 230/138 kV No. 5 Transformer at Doubs was installed 60 years ago and is approaching end of life.
- The transformer exhibits multiple maintenance issues including:
  - Elevated levels of methane and ethane gases
  - Wet oil
  - Low dielectric
- Existing TR Ratings:
  - 257 / 338 MVA (SN / SSTE)



APS Transmission Zone M-3 Process
Doubs Substation

Need Number: APS-2023-016

Process Stage: Submission of Supplemental Projects for Inclusion in Local Plan– 4/26/2024

Selected Solution:

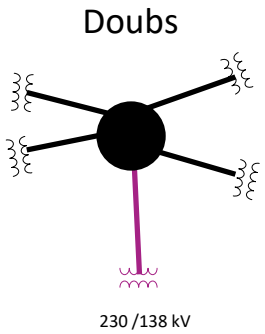
- Replace 230/138 kV No. 5 transformer at Doubs with a 225 MVA unit
- Upgrade transformer relaying

Need #	Substation	Existing XFMR Rating (SN / SE)	Post Project XFMR Rating (SN / SE)
APS-2023-016	Doubs	257 /338	303 /384

Estimated Project Cost: $5.43M

Projected In-Service: 06/07/2024

Supplemental Project ID: s3093.1



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
Black Oak - Hatfield 500 kV Misoperation Relays

Need Numbers: APS-2023-038

Process Stage: Submission of Supplemental Projects for Inclusion in Local Plan– 4/26/2024

Previously Presented:
Need Meeting – 10/03/2023
Solution Meeting – 10/31/2023

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:
System Performance Projects Global Factors

- System reliability and performance
- Substation/line equipment limits

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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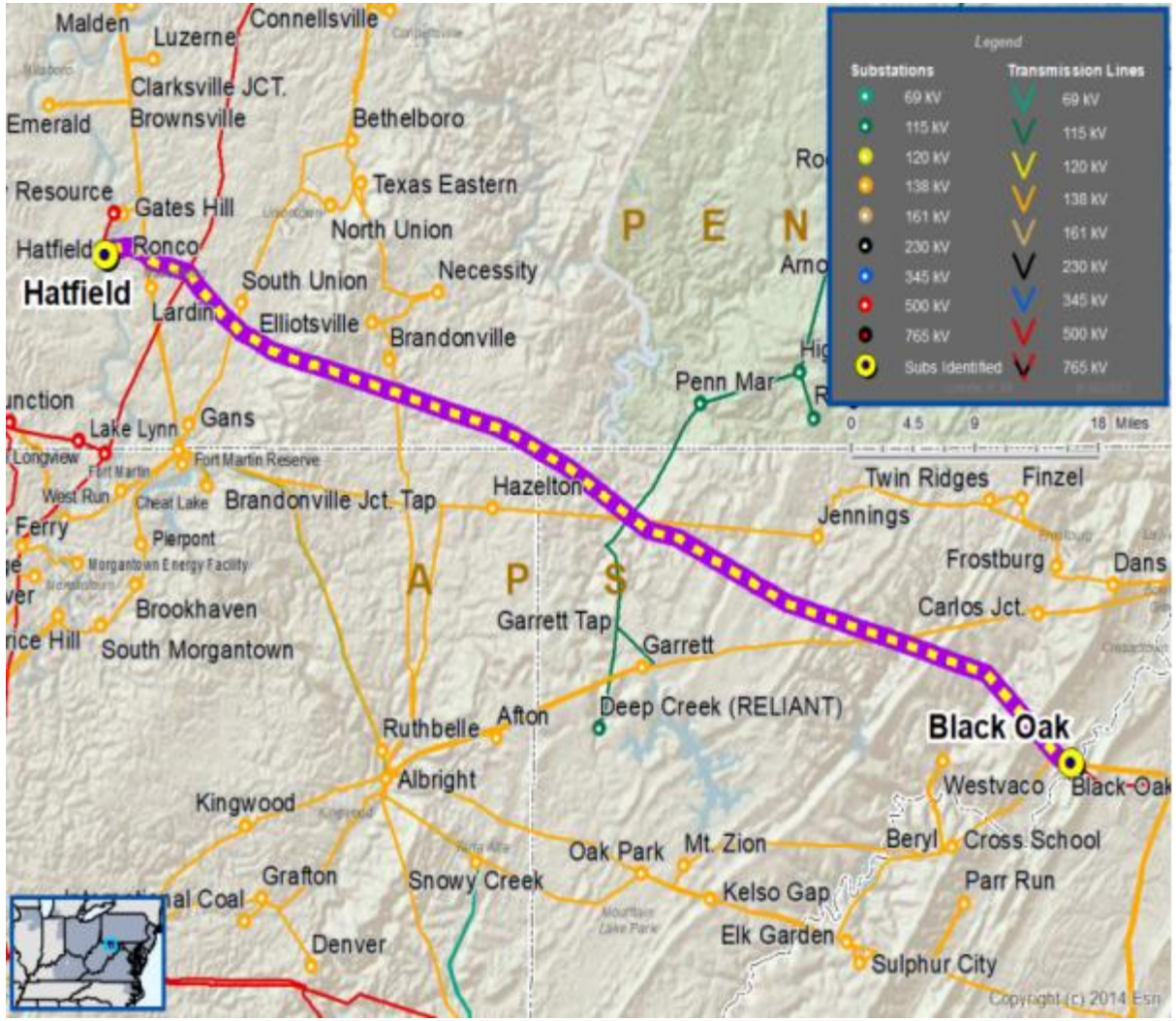


APS Transmission Zone M-3 Process
Black Oak - Hatfield 500 kV Misoperation Relays

Need Number: APS-2023-038

Process Stage: Submission of Supplemental Projects for Inclusion in Local Plan – 4/26/2024

Selected Solution:

- Replace limiting substation conductor, wave trap, disconnect switch, and relaying at Black Oak Substation
- Replace limiting substation conductor, wave trap, disconnect switch, circuit breaker, and relaying at Hatfield Substation

Need #	Transmission Line	Existing Line Rating (SN / SE)	Post Project Line Rating (SN / SE)
APS-2023-038	Black Oak – Hatfield 500 kV	3526 / 3792	3573 / 4379

Estimated Project Cost: $ 11.8 M

Projected In-Service: 4/27/2026

Supplemental Project ID: s3094.1

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
Buckhannon-Pruntytown 138 kV New Customer

Need Number: APS-2021-012

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 08/15/2021

Solution Meeting – 10/20/2023

Project Driver(s):

Customer Service

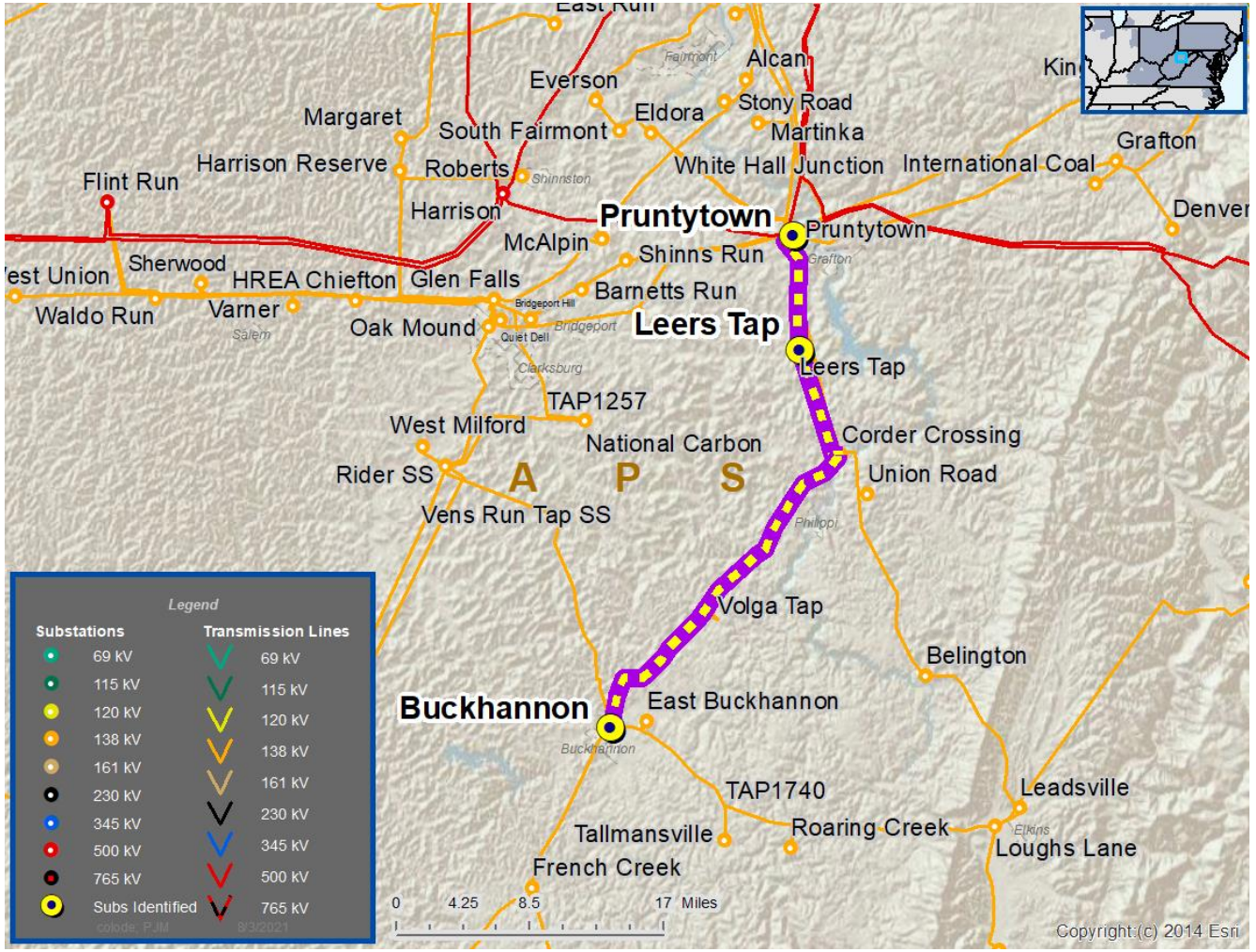
Specific Assumption Reference(s):

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

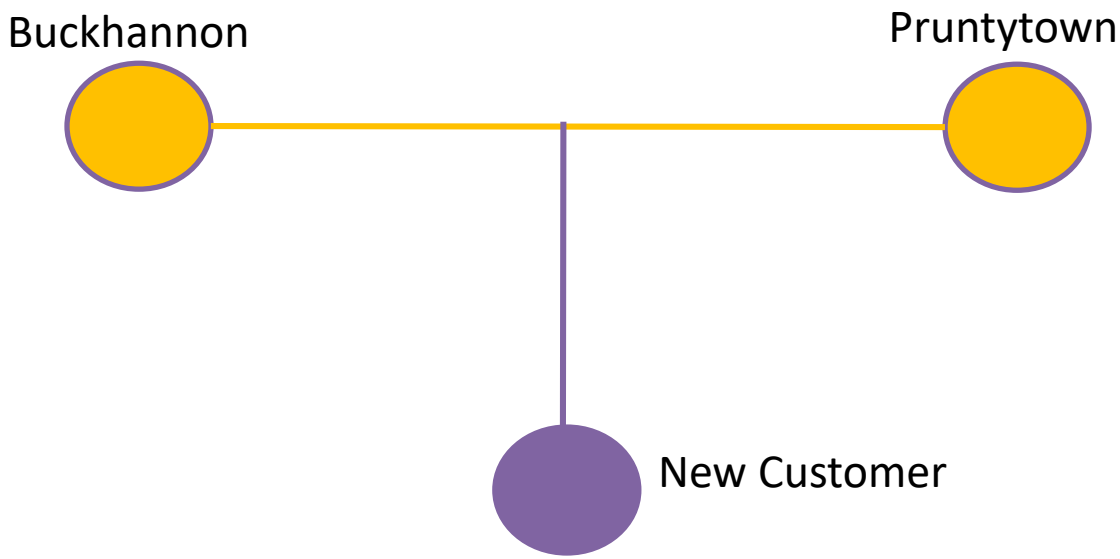
Need Number: APS-2021-012

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Selected 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



Estimated Project Cost: $5.0M

Projected In-Service: 07/02/2025

Supplemental Project ID: s3095.1

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: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 04/21/2023

Solution Meeting – 10/20/2023

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 Substation and one to Ethel Springs Substation.

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

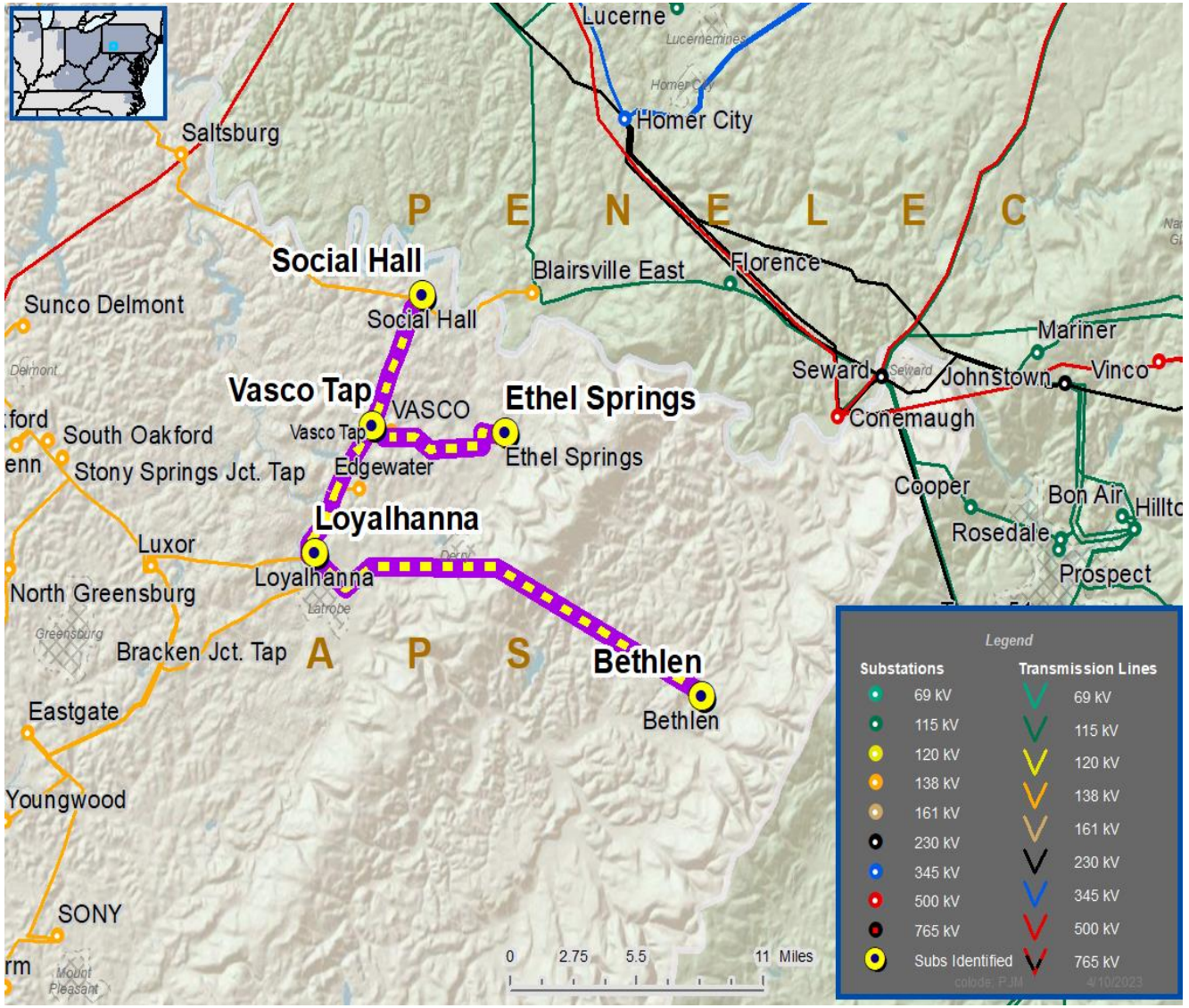
Transmission line ratings are limited by terminal equipment.

Vasco Tap – Social Hall 138 kV Line:

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

Bethlen – Loyalhanna 138 kV Line:

- 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: Submission of Supplemental Projects for Inclusion in the Local Plan – 4/26/2024

Selected Solution:

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

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

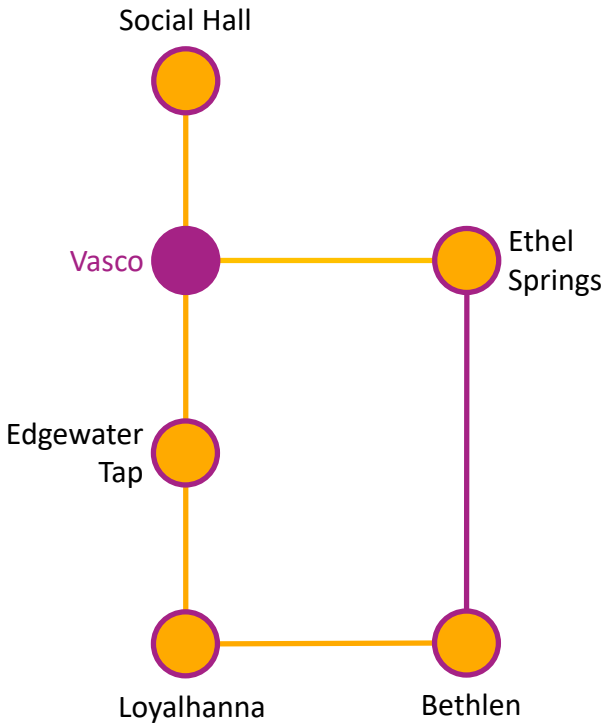
New line ratings:

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

Estimated Project Cost: $59.6M

Projected In-Service: 12/31/2025

Supplemental Project ID: s3096.1



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 Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 6/16/2023

Solution 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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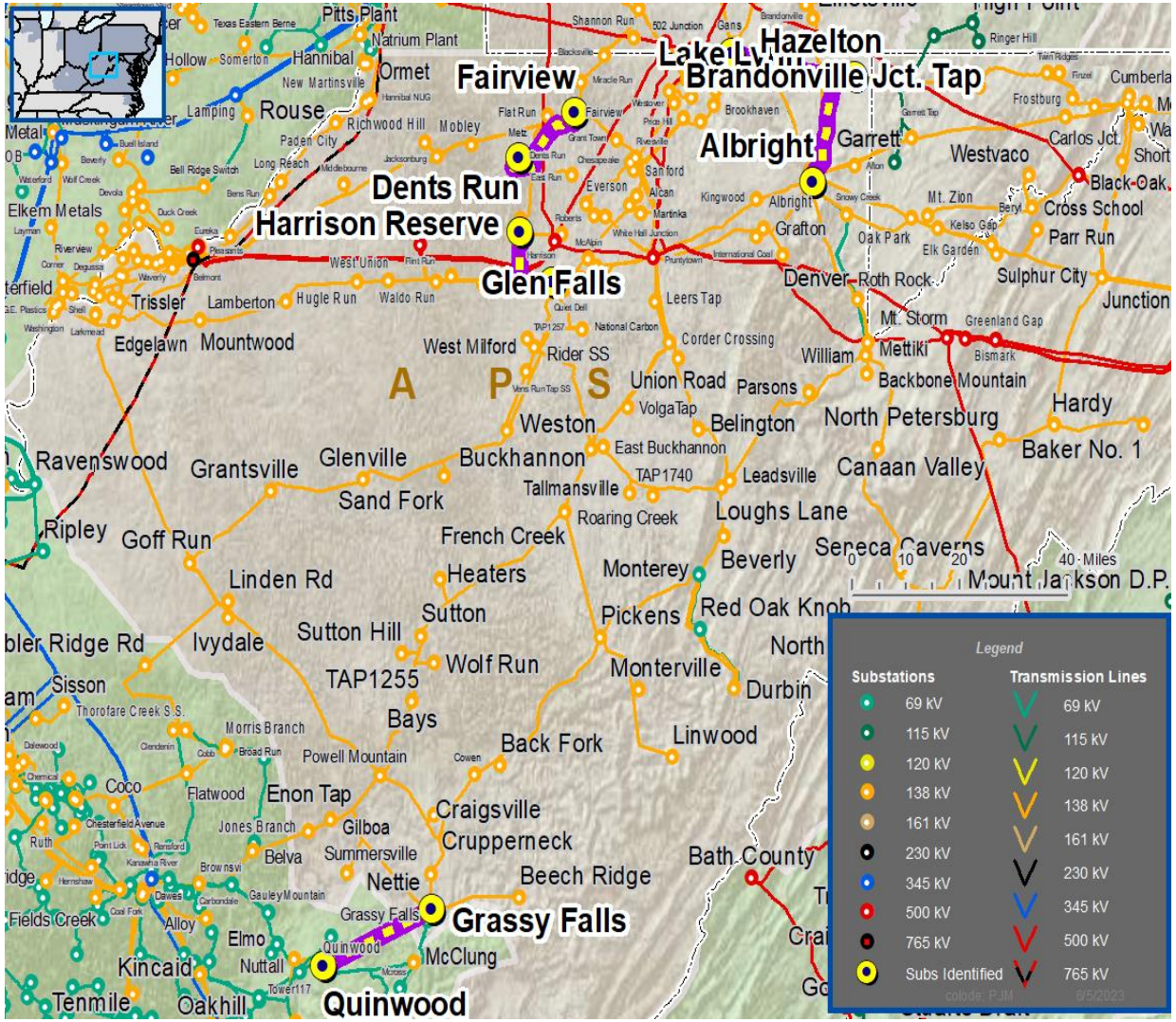

APS Transmission Zone M-3 Process Misoperation Relay Projects

Need #	Transmission Line / Substation Locations	Existing Line Rating (SN / SE)	Existing Conductor Rating (SN / SE)
APS-2023-018	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

Selected Solution:

Need Number	Transmission Line / Substation Locations	Supplemental Project ID	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost ($ M)	Target ISD
APS-2023-018	Albright – Brandonville Junction 138 kV	s3097.1	181 / 225	• At Albright Substation, replace wave trap, substation conductor, & relaying	$1.3 M	12/1/2025
	Brandonville Junction – Hazelton 138 kV		308 / 376	• At Hazelton Substation, replace substation conductor & relaying		
	Brandonville Junction – Lake Lynn 138 kV		308 / 376	• At Lake Lynn Substation, replace substation conductor & relaying	$1.5 M	12/1/2025
APS-2023-019	Grassy Falls – Quinwood 138 kV	s3098.1	282 / 376	• At Grassy Falls Substation, replace wave trap, circuit breaker, substation conductor, & relaying		
APS-2023-020	Fairview – Dents Run Tap 138 kV	s3099.1	221 / 268	• At Fairview Substation, 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 Substation, replace wave trap, disconnect switch, & relaying		

APS Transmission Zone M-3 Process Misoperation Relay Projects

Need Numbers: APS-2023-023, APS-2023-024, APS-2023-025

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 7/21/2023

Solution 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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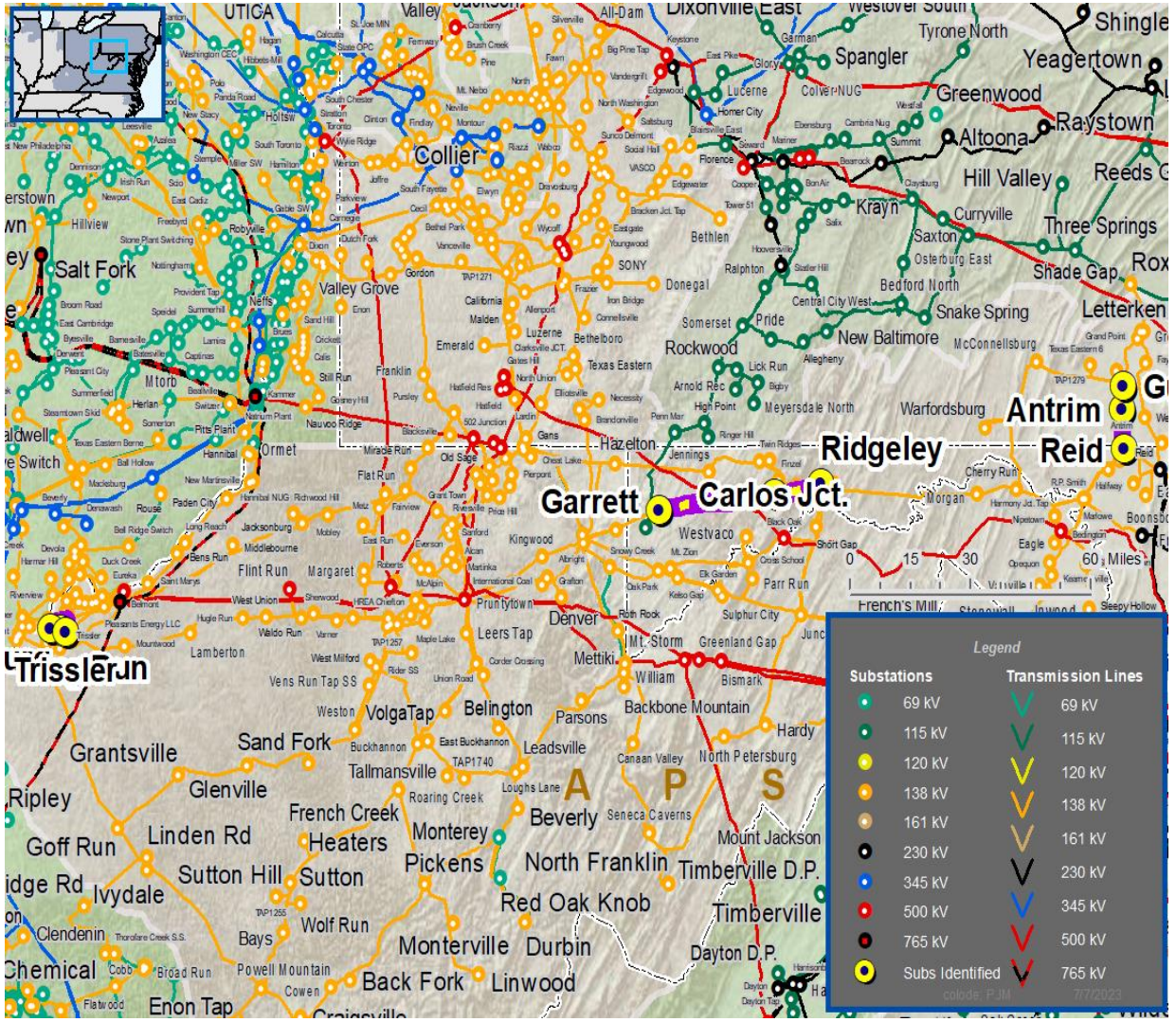


APS Transmission Zone M-3 Process Misoperation Relay Projects

Need #	Transmission Line / Substation Locations	Existing Line Rating (SN / SE)	Existing Conductor Rating (SN / SE)
APS-2023-023	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

APS Transmission Zone M-3 Process
Misoperation Relay Projects

Selected Solution:

Need Number	Transmission Line / Substation Locations	Supplemental Project ID	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost ($ M)	Target ISD
APS-2023-023	Parkersburg – Jug Run 138 kV Line	s3100.1	308 / 376	• At Parkersburg Substation, 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 Substation, replace circuit breaker, wave trap, disconnect switch, substation conductor, & relaying		
APS-2023-024	Guilford – Antrim 138 kV Line	s3101.1	308 / 376	• At Guilford Substation, 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 Substation, replace wave trap, disconnect switches, substation conductor, & relaying		
APS-2023-025	Garrett – Carlos Junction 138 kV Line	s3102.1	164 / 206	• At Garrett Substation, replace wave trap & relaying	$4.2 M	04/26/2024
	Carlos Junction – Ridgeley 138 kV Line		164 / 206	• At Ridgeley Substation, replace wave trap, disconnect switches, substation conductor, & relaying		

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

Need Number: APS-2023-030

Process Stage: Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 08/18/2023

Solution Meeting – 10/20/2023

Supplemental Project Driver(s):

Customer Service

Specific Assumption Reference(s):

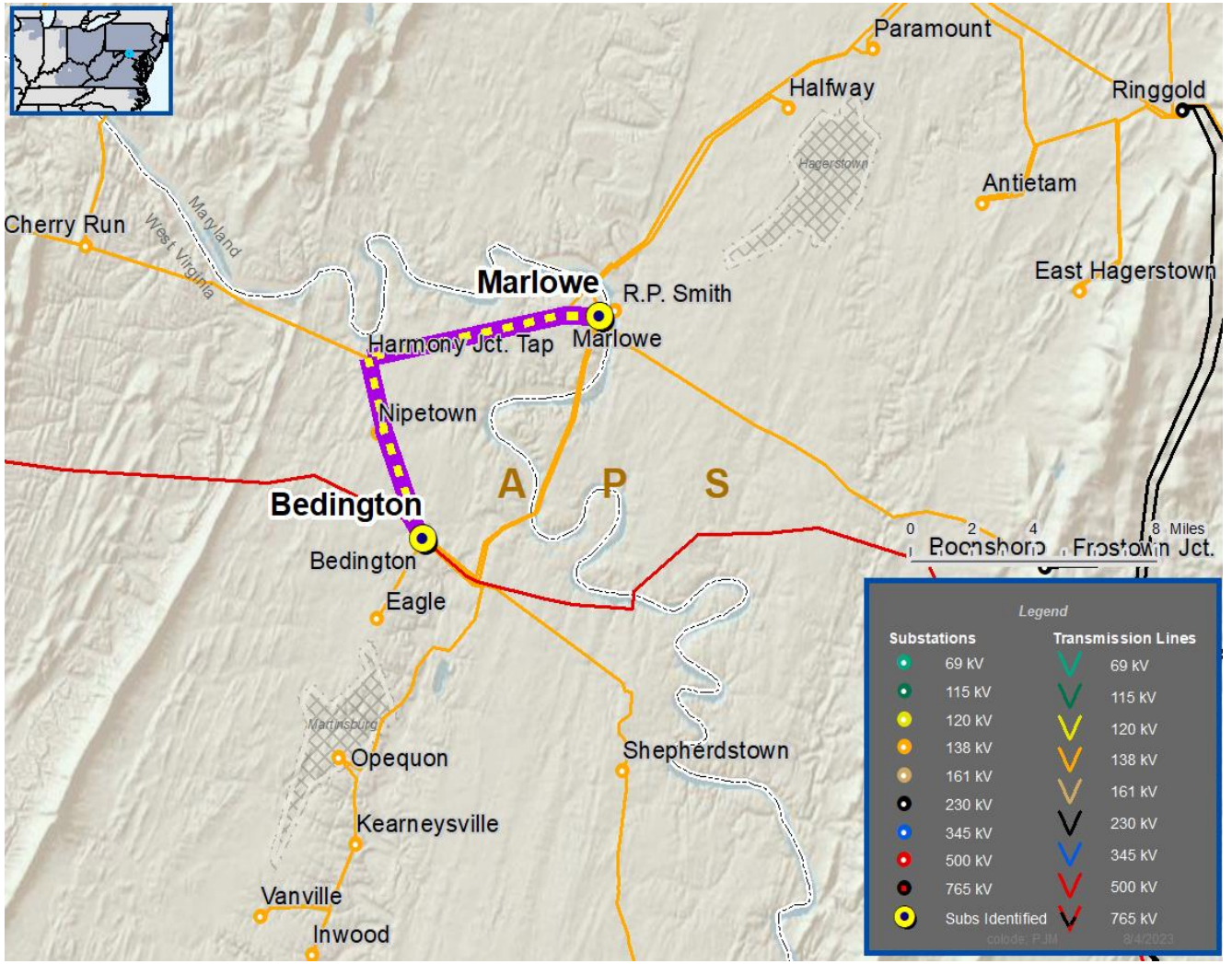
New customer connection request will be evaluated per FirstEnergy's "Requirements for Transmission Connected Facilities" document and "Transmission Planning Criteria" document.

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: Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Selected Solution:

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

Projected In-Service: 2/28/2025

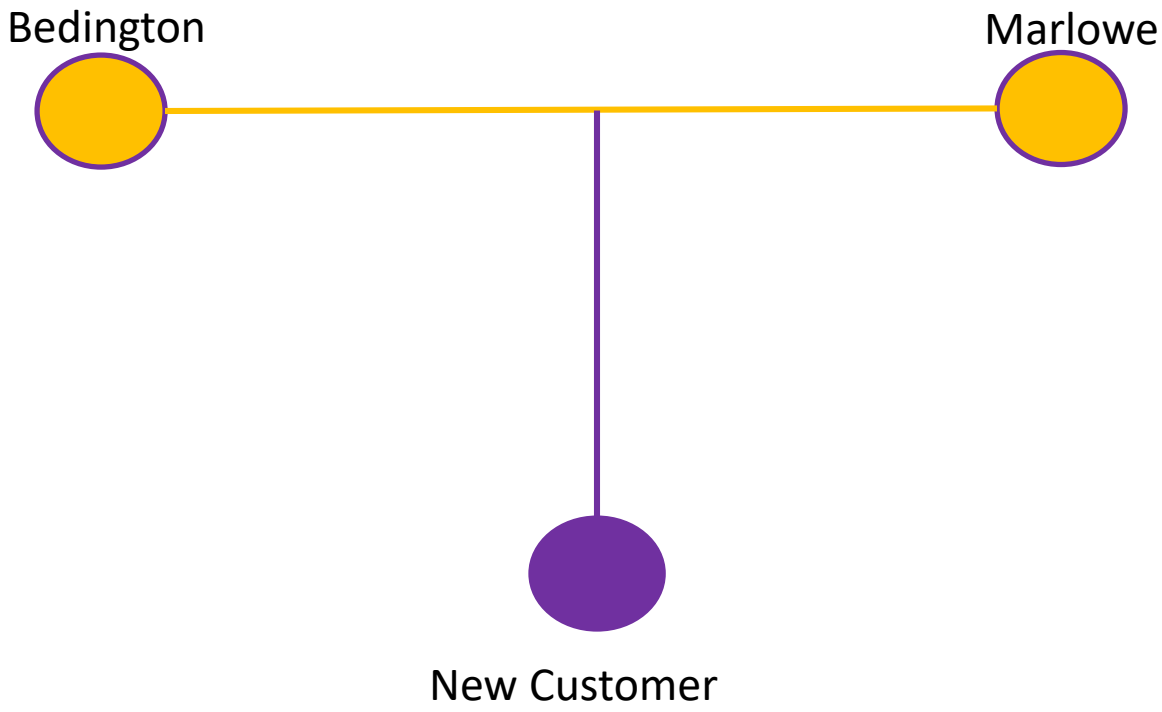
Phase 2 (Final Configuration): 138 kV Line Transmission Tap

- 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.

Projected In-Service: 6/30/2026

Total Estimated Project Cost (Phase 1 + Phase 2): $30.4M

Supplemental Project ID: s3103.1



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: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 08/18/2023

Solution Meeting – 10/20/2023

Supplemental Project Driver(s):

Customer Service

Specific Assumption Reference(s):

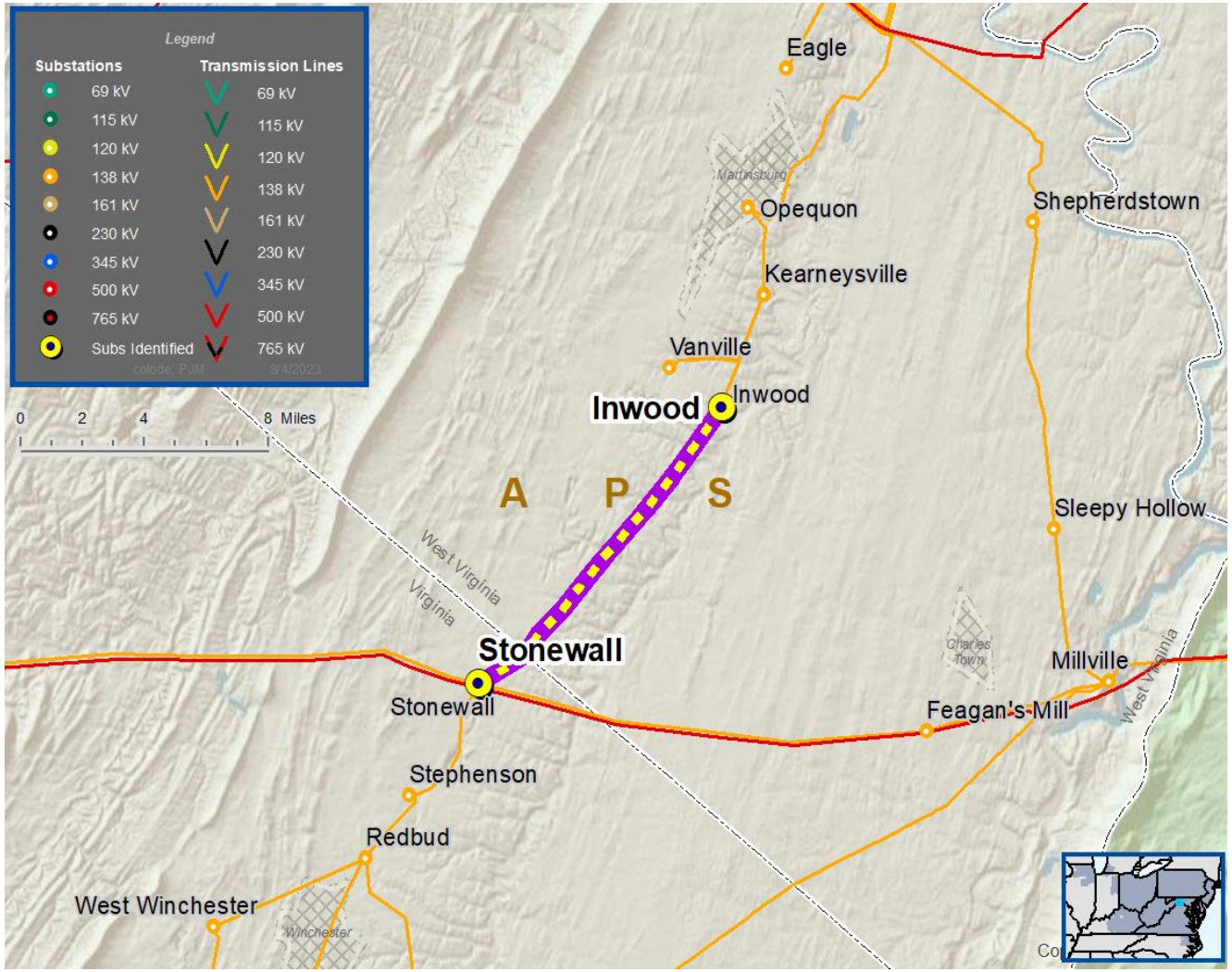
New customer connection request will be evaluated per FirstEnergy's "Requirements for Transmission Connected Facilities" document and "Transmission Planning Criteria" document.

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: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Selected Solution:

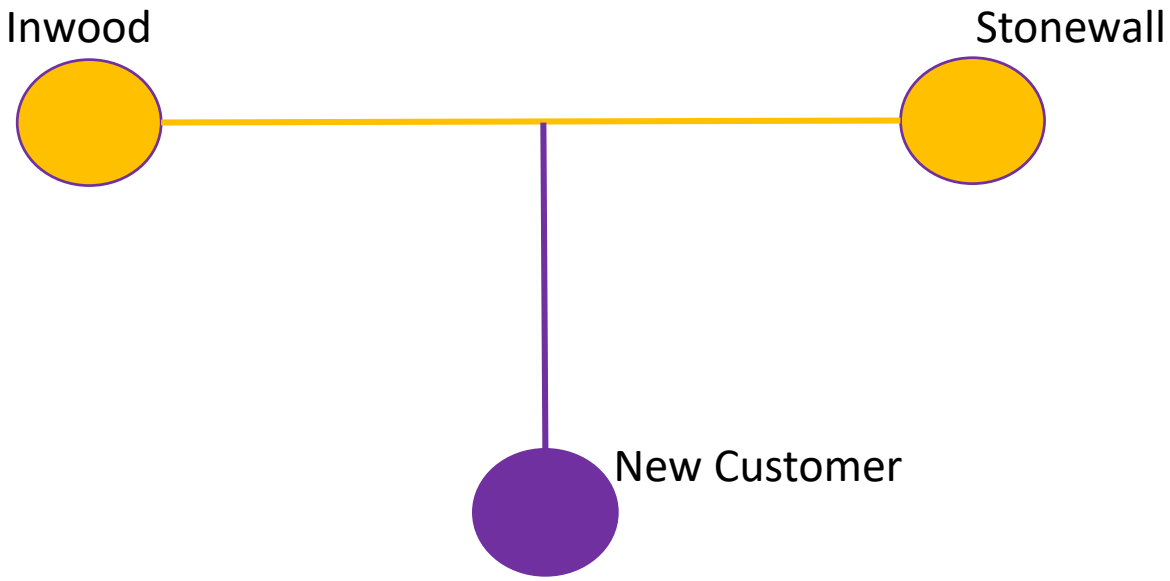
138 kV Transmission Line Tap

- 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

Estimated Project Cost: $1.1M

Projected In-Service: 4/17/2024

Supplemental Project ID: s3104.1



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

APS Transmission Zone M-3 Process
Millville Substation

Need Number: APS-2023-040

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 08/18/2023

Solution Meeting – 10/20/2023

Project Driver(s):

- *Equipment Material Condition, Performance and Risk*

Specific Assumption Reference(s)

- Substation Condition Rebuild/Replacement
- Substation/line equipment limits

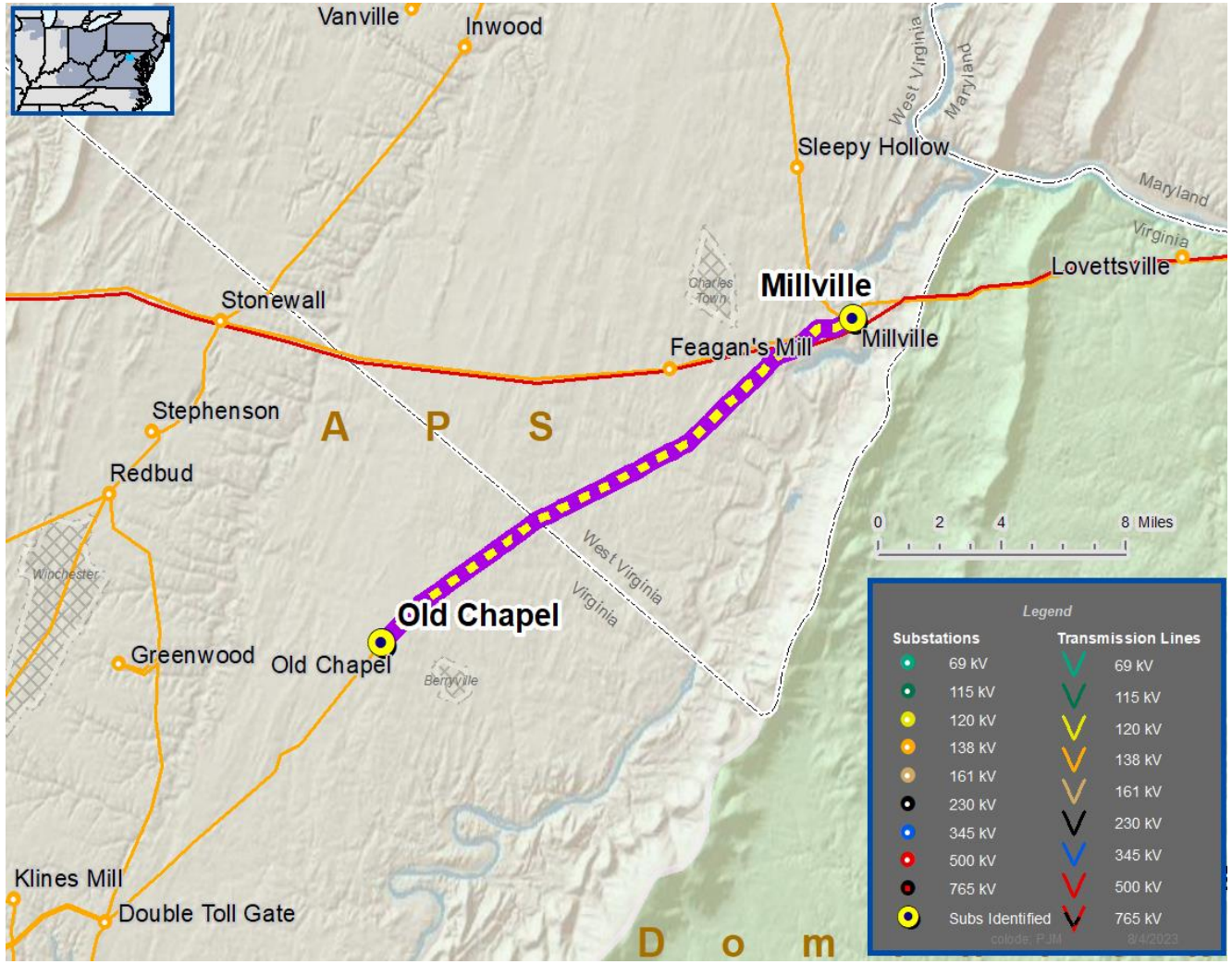
Problem Statement

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 Substation

Need Number: APS-2023-040

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Selected 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)

Estimated Project Cost: $0.7M

Projected In-Service: 04/15/2024

Supplemental Project ID: s3105.1

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-2023-036, APS-2023-041 to APS-2023-043, APS-2023-045 to APS-2023-049

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 10/20/2023

Solution Meeting – 11/17/2023

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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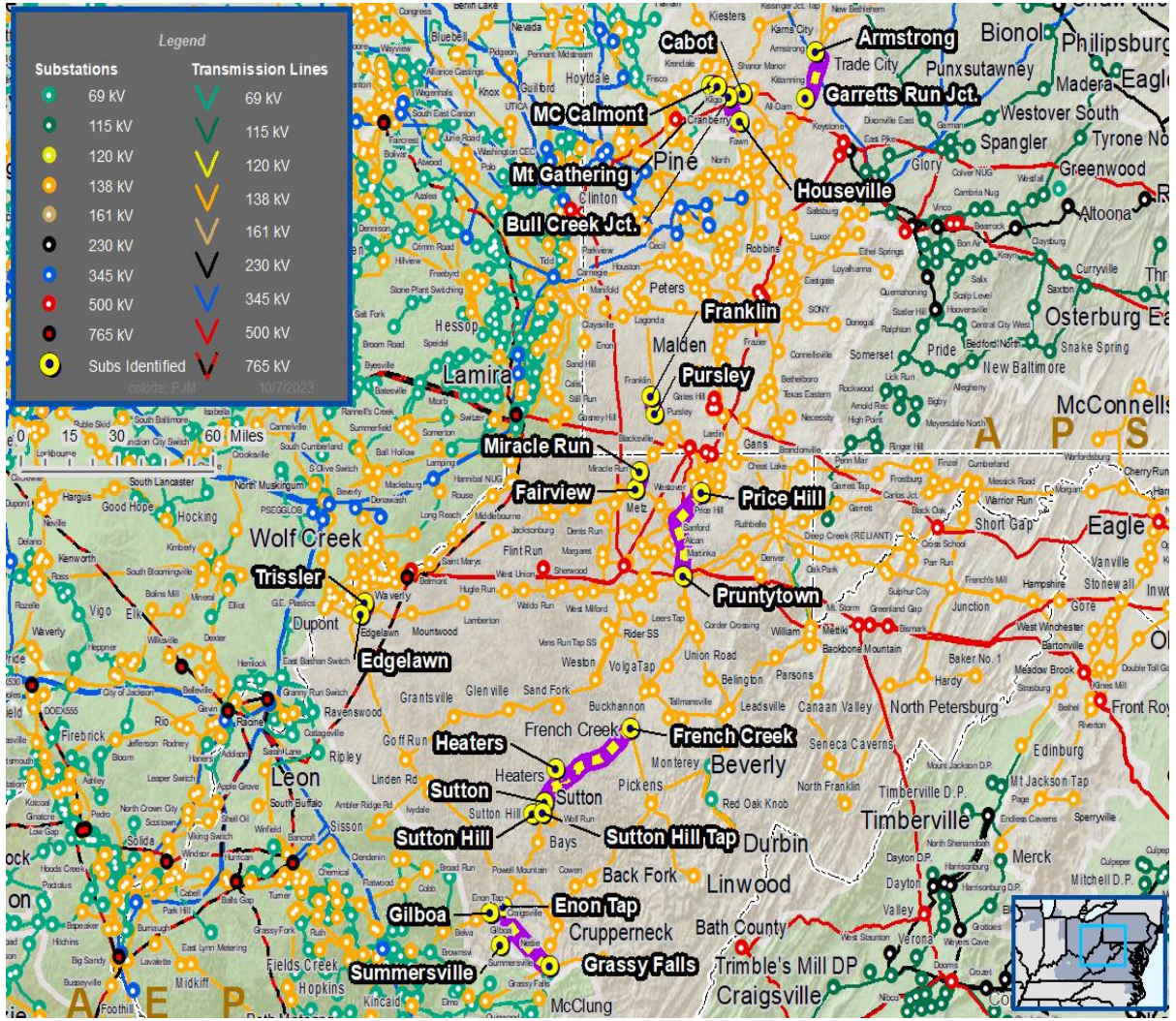


APS Transmission Zone M-3 Process Misoperation Relay Projects

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
Misoperation Relay Projects

Selected Solution:

Need #	Transmission Line / Substation Locations	Supplemental Project ID	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost	Target ISD
APS-2023-036	Franklin – Pursley 138 kV	s3107.1	308 / 376	• At Franklin Substation, replace circuit breaker, disconnect switches, line trap, substation conductor and relaying • At Pursely Substation, replace substation conductor and relaying	$2.2 M	11/29/2024
APS-2023-041	Fairview – Miracle Run Tap 138 kV	s3108.1	308 / 376	• At Fairview Substation, replace circuit breaker, disconnect switches, substation conductor and relaying	$2.8 M	06/16/2023
APS-2023-042	Armstrong – Garretts Run Junction 138 kV	s3109.1	308 / 376	• At Armstrong Substation, replace disconnect switches, substation conductor and relaying	$2.5 M	05/26/2023
APS-2023-043	Trissler– Edgelawn 90 138 kV	s3110.1	294 / 350	• At Trissler Substation, replace wave trap, disconnect switches and relaying • At Edgelawn Substation, replace circuit breaker, line trap and relaying	$3.3 M	12/01/2022
APS-2023-045	Heaters Tap – Sutton 138 kV	s3111.1	107 / 128	• At Sutton Substation, replace line trap and relaying	$1.5 M	05/10/2024
APS-2023-046	Gilboa – 304 Junction 138 kV	s3112.1	278 / 339	• At Gilboa Substation, replace circuit breaker, disconnect switches, line trap and relaying	$4.3 M	12/01/2023
	Grassy Falls – Summersville 138 kV		309 / 376	• At Grassy Falls Substation, replace circuit breaker, disconnect switches, line trap and relaying		

APS Transmission Zone M-3 Process
Misoperation Relay Projects

Selected Solution:

Need #	Transmission Line / Substation Locations	Supplemental Project ID	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost	Target ISD
APS-2023-047	Price Hill – Pruntytown 138 kV	s3113.1	221 / 268	• At Pruntytown Substation, replace line trap and relaying • At Price Hill Substation, replace line trap and relaying	$2.3 M	12/19/2023
APS-2023-048	Cabot – Bull Creek Junction 138 kV	s3114.1	308 / 376	• At Cabot Substation, replace circuit breakers, disconnect switches, substation conductor and relaying	$5.3 M	12/15/2023
	Bull Creek Junction – Houseville 138 kV		297 / 365	• At Houseville Substation, replace circuit breaker, disconnect switches, substation conductor and relaying		
	Mountain Gathering – McCalmont 138 kV		297 / 365	• At McCalmont Substation, replace circuit breaker, disconnect switches, line trap, substation conductor and relaying		
APS-2023-049	Sutton Hill T – Sutton 138 kV	s3115.1	85 / 106	• At Sutton Substation, replace circuit breaker, line trap and relaying	$1.8 M	01/29/2024

APS Transmission Zone M-3 Process
Cumberland Substation

Need Numbers: APS-2023-051

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 10/20/2023

Solution Meeting – 11/17/2023

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)

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
Cumberland Substation

Need Number: APS-2023-051

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Selected Solution:

- At Cumberland Substation:
  - Replace conductor and disconnect switches on Short Gap 138 kV line terminal

Transmission Line Ratings:

- Cumberland – Short Gap 138 kV Line:
  - Before Proposed Solution: 299 / 358 / 349 / 410 MVA (SN/SE/WN/WE)
  - After Proposed Solution: 299 / 360 / 349 / 422 MVA (SN/SE/WN/WE)

Estimated Project Cost: $ 0.4 M

Projected In-Service: 12/31/2023

Supplemental Project ID: s3116.1

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

APS Transmission Zones M-3 Process
Bedington Substation

Need Number: APS-2023-028

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Solution Meeting – 12/05/2023

Need Meeting – 09/05/2023

Project Driver:

Performance and Risk, Operational Flexibility and Efficiency

Specific Assumption Reference:

System Performance Projects Global Factors

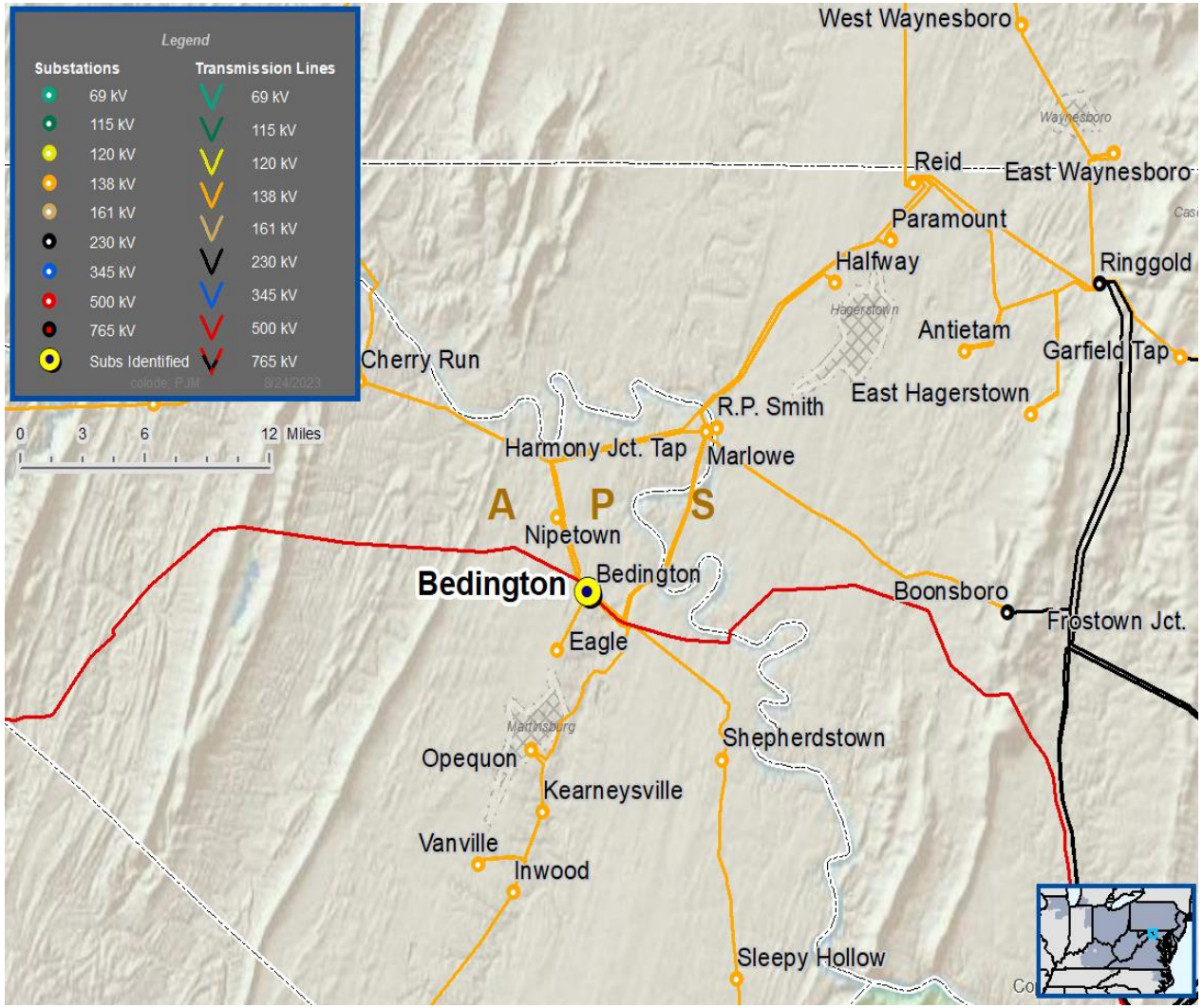
- System reliability and performance
- Reliability of Non-Bulk Electric System (Non-BES) Facilities

Add/Replace Transformers

Past System Reliability/Performance

Problem Statement:

- The 500/138 kV No. 1 Transformer at Bedington was manufactured 47 years ago and is approaching end of life.
  - 500 kV and 138 kV protective devices are ~50 years old which produces reliability and safety concerns.
- The transformer exhibits multiple maintenance issues including:
  - Elevated methane and ethane gas levels compared with IEEE Standards
  - Equipment degradation and obsolete replacement parts
  - Oil leaks
- Existing TR Ratings:
  - 485 / 619 MVA (SN / SSTE)



APS Transmission Zones M-3 Process
Bedington Substation

Need Number: APS-2023-028

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Selected Solution:

- Replace the Bedington No. 1 500/138 kV Transformer with a 425 MVA unit
- Upgrade transformer relaying

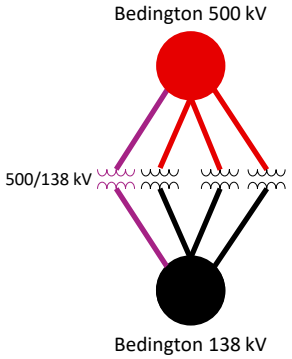
Transformer Ratings:

- Bedington No. 1 500/138 kV Transformer:
  - Before Selected Solution: 485 / 619 MVA (SN / SSTE)
  - After Selected Solution (anticipated): 576 / 699 MVA (SN / SSTE)

Estimated Project Cost: $21.8M

Projected In-Service: 06/01/2027

Supplemental Project ID: s3162.1



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
Bedington – Doubs 500 kV Misoperation Relays

Need Number: APS-2023-057

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Solution Meeting 12/05/2023

Need Meeting 10/31/2023

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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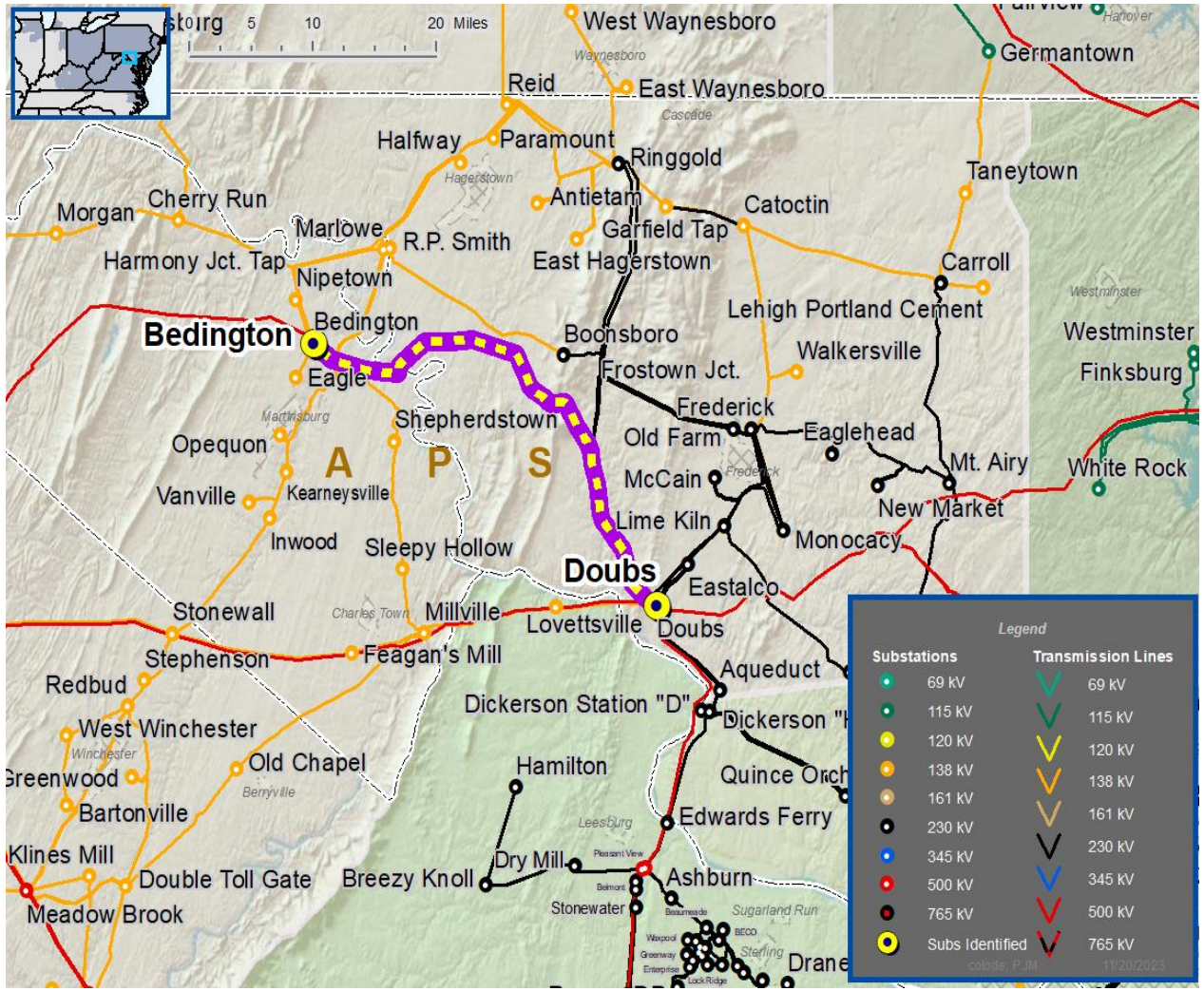

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APS Transmission Zone M-3 Process
Bedington – Doubs 500 kV Misoperation Relays

Need #	Transmission Line / Substation Locations	Existing Line Rating (SN / SE)	Existing Conductor Rating (SN / SE)
APS-2023-057	Bedington – Doubs 500 kV	3526 / 3792	3573 / 4379

APS Transmission Zone M-3 Process
Bedington – Doubs 500 kV Misoperation Relays

Need Numbers: APS-2023-057

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Selected Solution:

- Replace circuit breakers, disconnect switches, line trap, substation conductor and relaying at Bedington Substation
- Replace circuit breakers, disconnect switches, line trap, substation conductor and relaying at Doubs Substation

Transmission Line Ratings:

- Bedington – Doubs 500 kV Line:
  - Before Selected Solution: 3526 / 3792 / 3928 / 4140 MVA (SN/SE/WN/WE)
  - After Selected Solution: 3573 / 4379 / 4050 / 5194 MVA (SN/SE/WN/WE)

Estimated Project Cost: $ 6.95 M

Projected In-Service: 02/28/2025

Supplemental Project ID: s3163.1

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-2023-064 to APS-2023-066, APS-2023-069

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Solution Meeting 12/15/2023

Need Meeting 11/17/2023

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

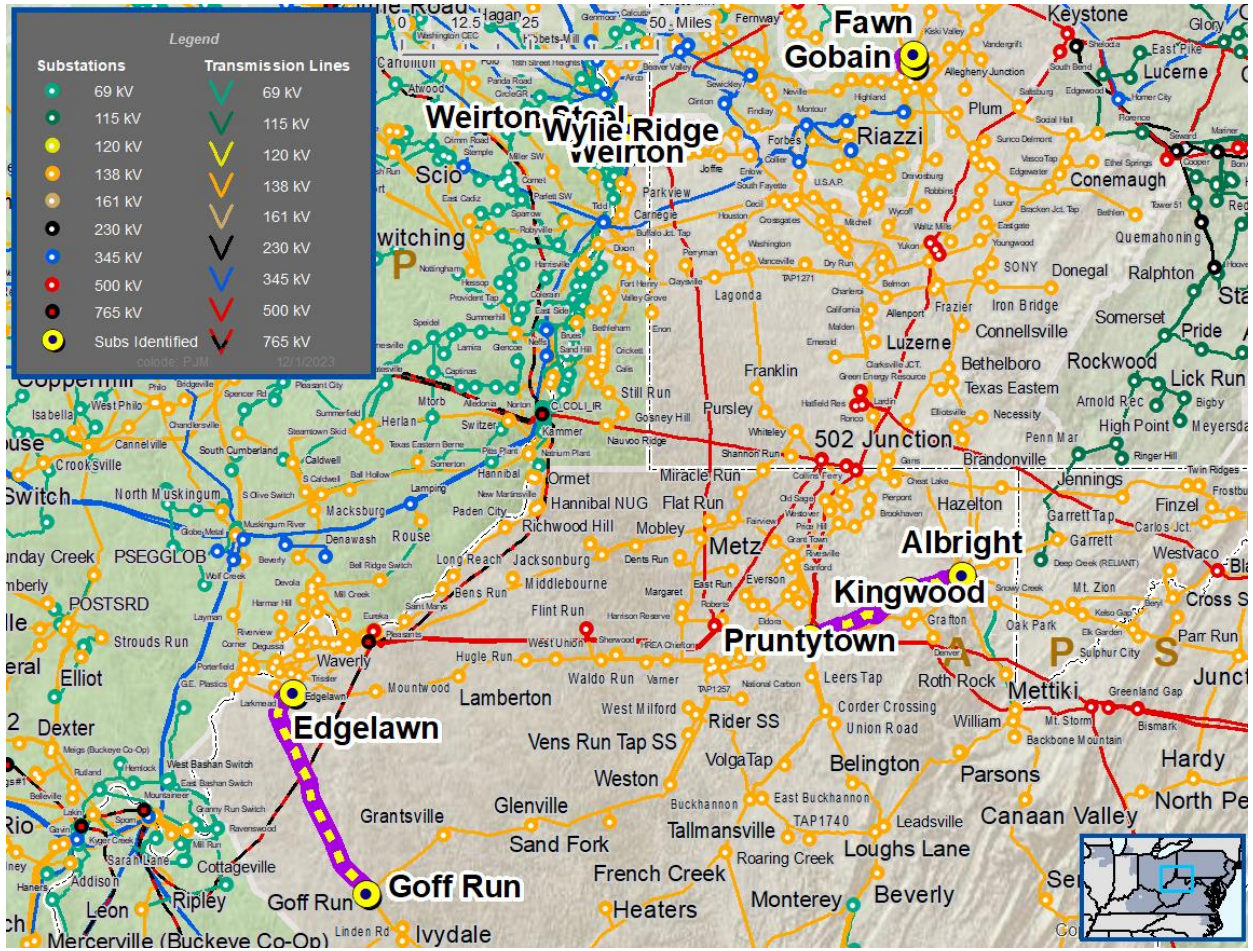
- Substation Condition Rebuild/Replacement

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 / WN / WE)	Existing Conductor Rating (SN / SE / WN / WE)
APS-2023-064	Weirton – Weirton JCT 138 kV	292 / 314 / 325 / 343	308 / 376 / 349 / 445
	Weirton JCT – Wylie Ridge 138 kV	292 / 314 / 325 / 343	308 / 376 / 349 / 445
APS-2023-065	Edgelawn – Goff Run 138 kV	195 / 209 / 217 / 229	221 / 268 / 250 / 317
APS-2023-066	Albright – Kingwood 138 kV	187 / 209 / 217 / 229	221 / 268 / 250 / 317
	Kingwood – Pruntytown 138 kV	221 / 268 / 250 / 287	221 / 268 / 250 / 317
APS-2023-069	Fawn – Gobain 138 kV	287 / 287 / 287 / 287	297 / 365 / 345 / 441

APS Transmission Zone M-3 Process
Misoperation Relay Projects

Selected Solutions:

Need #	Transmission Line / Substation Locations	New MVA Line Rating (SN/SE/WN/WE)	Supplemental Project ID	Scope of Work	Estimated Cost ($ M)	Target ISD
APS-2023-064	Weirton – Weirton JCT 138 kV	308 / 376 / 349 / 445	s3158.1	• At Weirton Substation, replace line trap and relaying	$1.7	06/01/2024
	Weirton JCT – Wylie Ridge 138 kV	308 / 376 / 349 / 445		• At Wylie Ridge Substation, replace circuit breaker, disconnect switches, line trap and relaying		
APS-2023-065	Edgelawn – Goff Run 138 kV	221 / 268 / 250 / 317	s3159.1	• At Edgelawn Substation, replace disconnect switches, line trap, substation conductor and relaying • At Goff Run Substation, replace line trap, substation conductor and relaying	$2.1	07/31/2024

Selected Solution:

Need #	Transmission Line / Substation Locations	New MVA Line Rating (SN/SE/WN/WE)	Supplemental Project ID	Scope of Work	Estimated Cost ($ M)	Target ISD
APS-2023-066	Albright – Kingwood 138 kV	221 / 268 / 250 / 317	s3160.1	• At Albright Substation, replace disconnect switches, line trap, substation conductor and relaying • At Kingwood Substation, replace disconnect switches and relaying	$3.9	10/09/2024
	Kingwood – Pruntytown 138 kV	221 / 268 / 250 / 317		• At Pruntytown Substation, replace disconnect switches, line trap, substation conductor and relaying • At Kingwood Substation, replace disconnect switches and relaying		
APS-2023-069	Fawn – Gobain 138 kV	297 / 365 / 345 / 441	s3161.1	• At Fawn Substation, replace circuit breaker, disconnect switches, line trap, substation conductor and relaying • At Gobain Substation, replace circuit breaker, disconnect switches, line trap, substation conductor and relaying	$3.5	10/31/2025

APS Transmission Zone M-3 Process
Carroll – Mount Airy 230 kV Misoperation Relays

Need Number: APS-2023-034
Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024
Previously Presented: Solution Meeting 01/09/2024
Need Meeting 09/05/2023

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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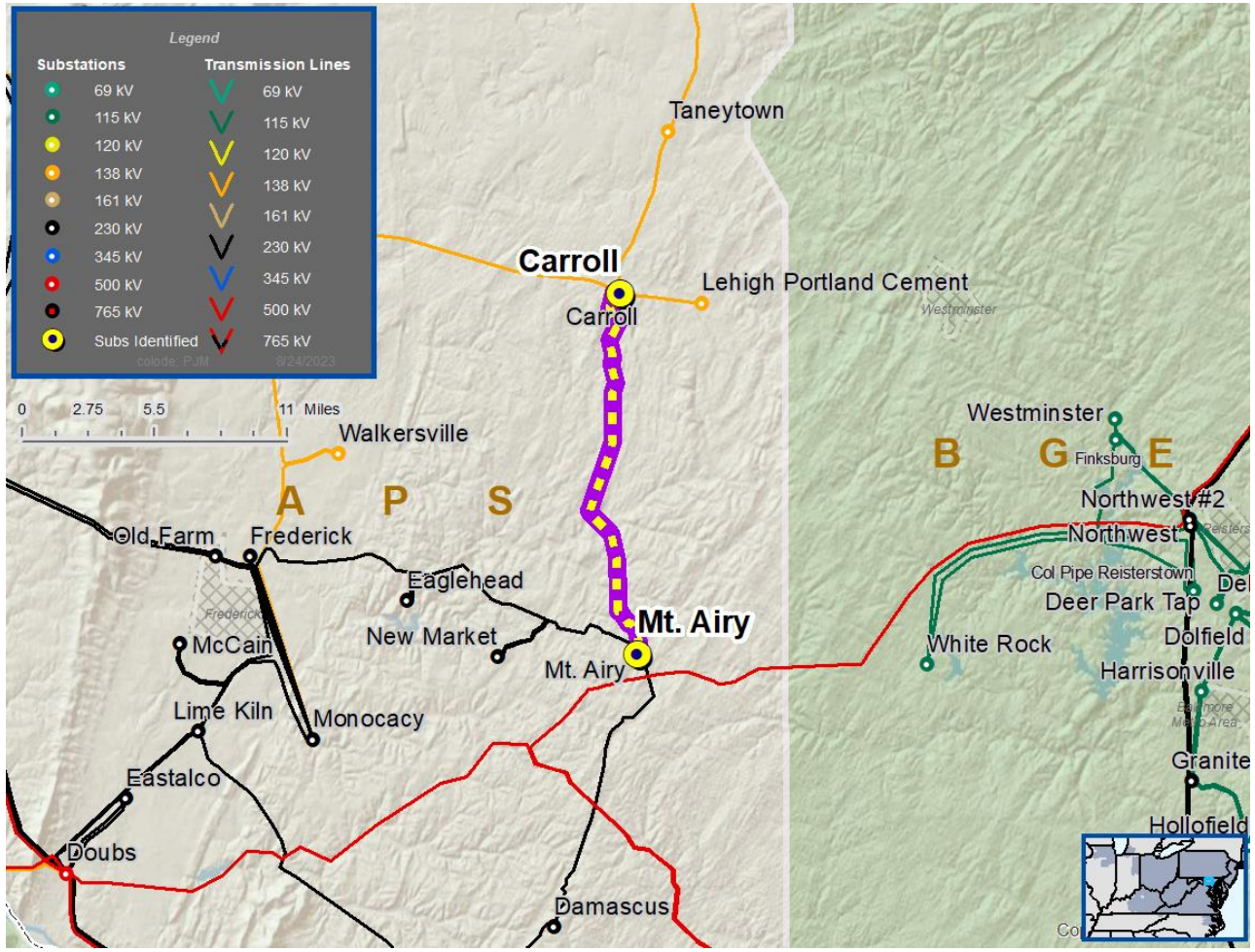


APS Transmission Zone M-3 Process
Carroll – Mount Airy 230 kV Misoperation Relays

Need #	Transmission Line / Substation Locations	Existing Line Rating (SN / SE)	Existing Conductor Rating (SN / SE)
APS-2023-034	Carroll – Mount Airy 230 kV	251/343	617/754

APS Transmission Zone M-3 Process
Carroll 230/138 kV Transformer #4

Need Number: APS-2023-063

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented: Solution Meeting 01/09/2024
Need Meeting 10/31/2023

Project Driver:

Performance and Risk

Operational Flexibility and Efficiency

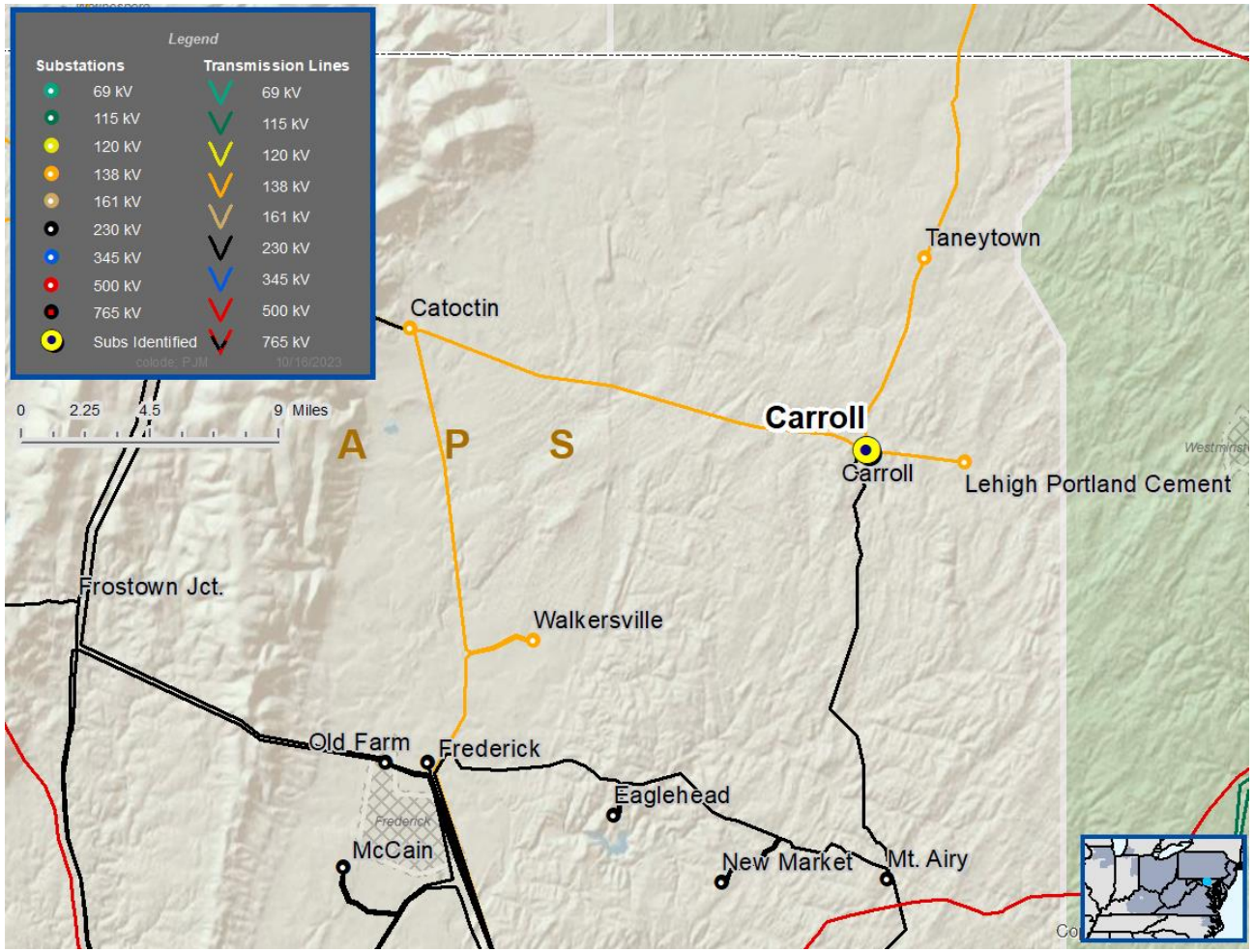
Specific Assumption Reference:

System Performance Projects Global Factors

- System Reliability and Performance
- Substation/line equipment limits
- Upgrade Relay Schemes

Problem Statement:

- The 230/138 kV No. 4 Transformer at Carroll was manufactured over 50 years ago and is approaching end of life.
  - The dielectric is below the acceptable norm of 50 kV.
- The transformer exhibits multiple maintenance issues including:
  - Elevated methane and ethane gas levels compared with IEEE Standards
  - Equipment degradation and obsolete replacement parts.
- Existing TR Ratings:
  - 251/343 MVA (SN/SE)



APS Transmission Zone M-3 Process
Carroll 230/138 kV Transformer #4 and Misoperation Relays

Need Numbers: APS-2023-034 and APS-2023-063

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Selected Solution:

- At Carroll Substation:
  - Replace 200 MVA 230/138 kV Transformer No. 4 with a new 224 MVA 230/138 kV transformer
  - Replace limiting transformer conductor
  - Replace line tuner and coax, wave trap, circuit breaker, disconnect switch, and relaying
- At Mt. Airy Substation :
  - Replace line tuner and coax, wave trap, circuit breaker, disconnect switch, and relaying

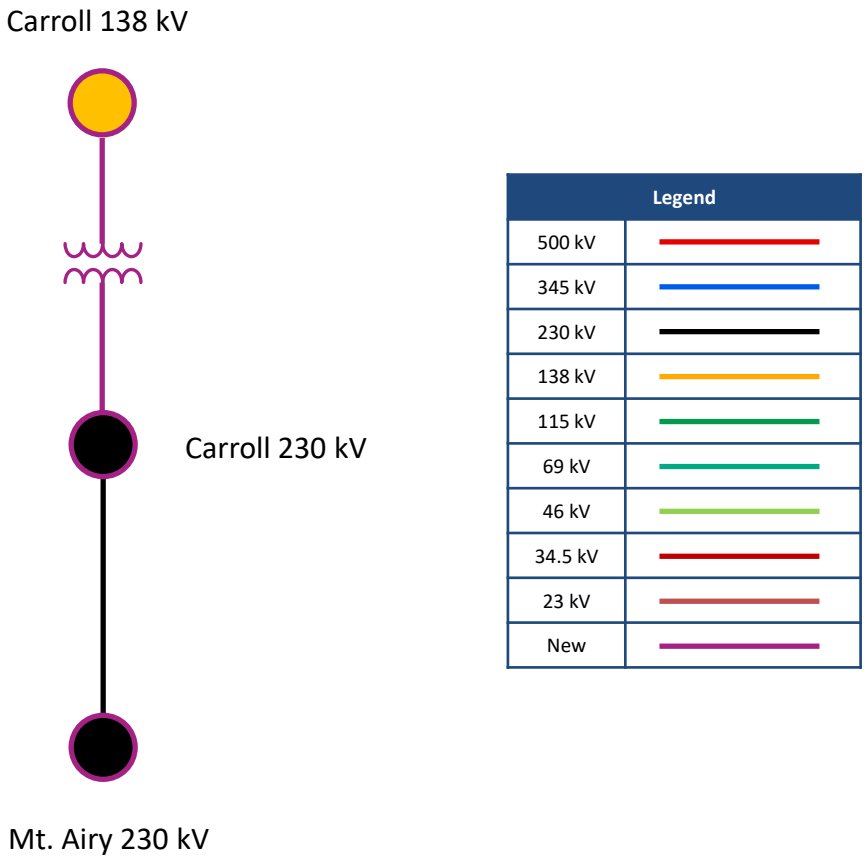
Anticipated Transformer Circuit and Transmission Line Ratings:

- 230/138 kV Transformer No. 4 and Carroll – Mount Airy 230 kV Line :
  - Before Selected Solution: 251 / 343 / 302 / 370 MVA (SN / SE / WN / WE)
  - After Selected Solution: 281 / 384 / 338 / 414 MVA (SN / SE / WN / WE)

Estimated Project Cost: $8.6M

Projected In-Service: 12/31/2026

Supplemental Project ID: s3189.1, s3190.1



APS Transmission Zone M-3 Process
Harrison – Pruntytown 500 kV Misoperation Relays

Need Number: APS-2023-056

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented: Solution Meeting 01/09/2024
Need Meeting 10/31/2023

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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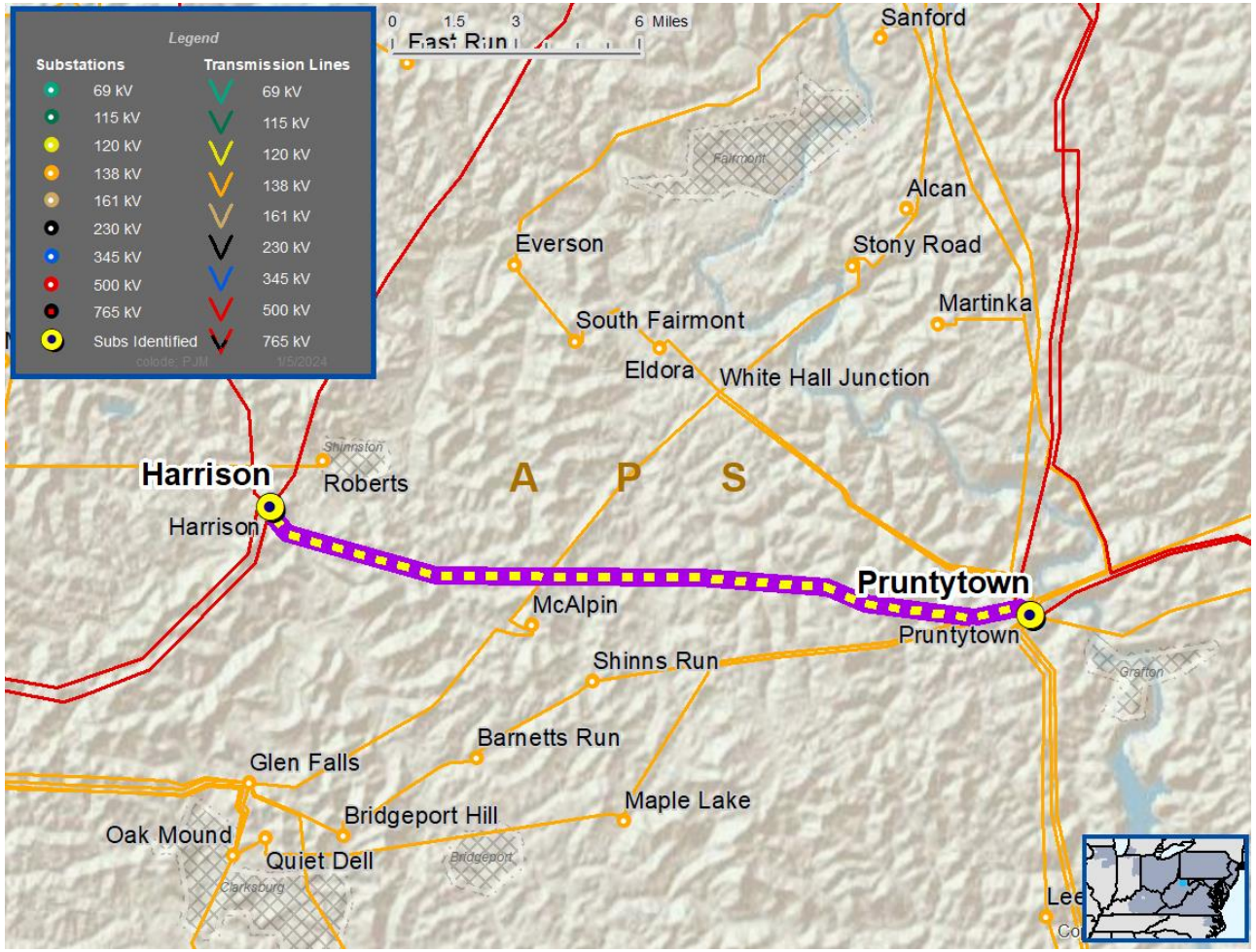

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APS Transmission Zone M-3 Process
Harrison – Pruntytown 500 kV Misoperation Relays

Need #	Transmission Line / Substation Locations	Existing Line Rating (SN / SE)	Existing Conductor Rating (SN / SE)
APS-2023-056	Harrison – Pruntytown 500 kV	3464 / 3464	3573 / 4379

APS Transmission Zone M-3 Process
Harrison – Pruntytown 500 kV Misoperation Relays

Need Number: APS-2023-056

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Selected Solution:

- Replace wave trap, line metering and relaying at Harrison Substation
- Replace wave trap, line metering and relaying at Pruntytown Substation

Transmission Line Ratings:

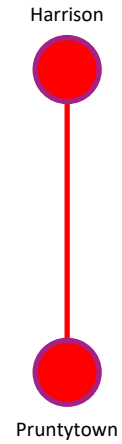
Harrison – Pruntytown 500 kV Line:

- Before Selected Solution: 3464 / 3464 / 3464 / 3464 MVA (SN / SE / WN / WE)
- After Selected Solution: 3573 / 4379 / 4050 / 5194 MVA (SN / SE / WN / WE)

Estimated Project Cost: $0.86M

Projected In-Service: 11/29/2024

Supplemental Project ID: s3191.1



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-2023-075, APS-2023-079 to APS-2023-084, APS-2023-086, APS-2023-087

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented: Solution Meeting 01/19/2024
Need Meeting 12/15/2023

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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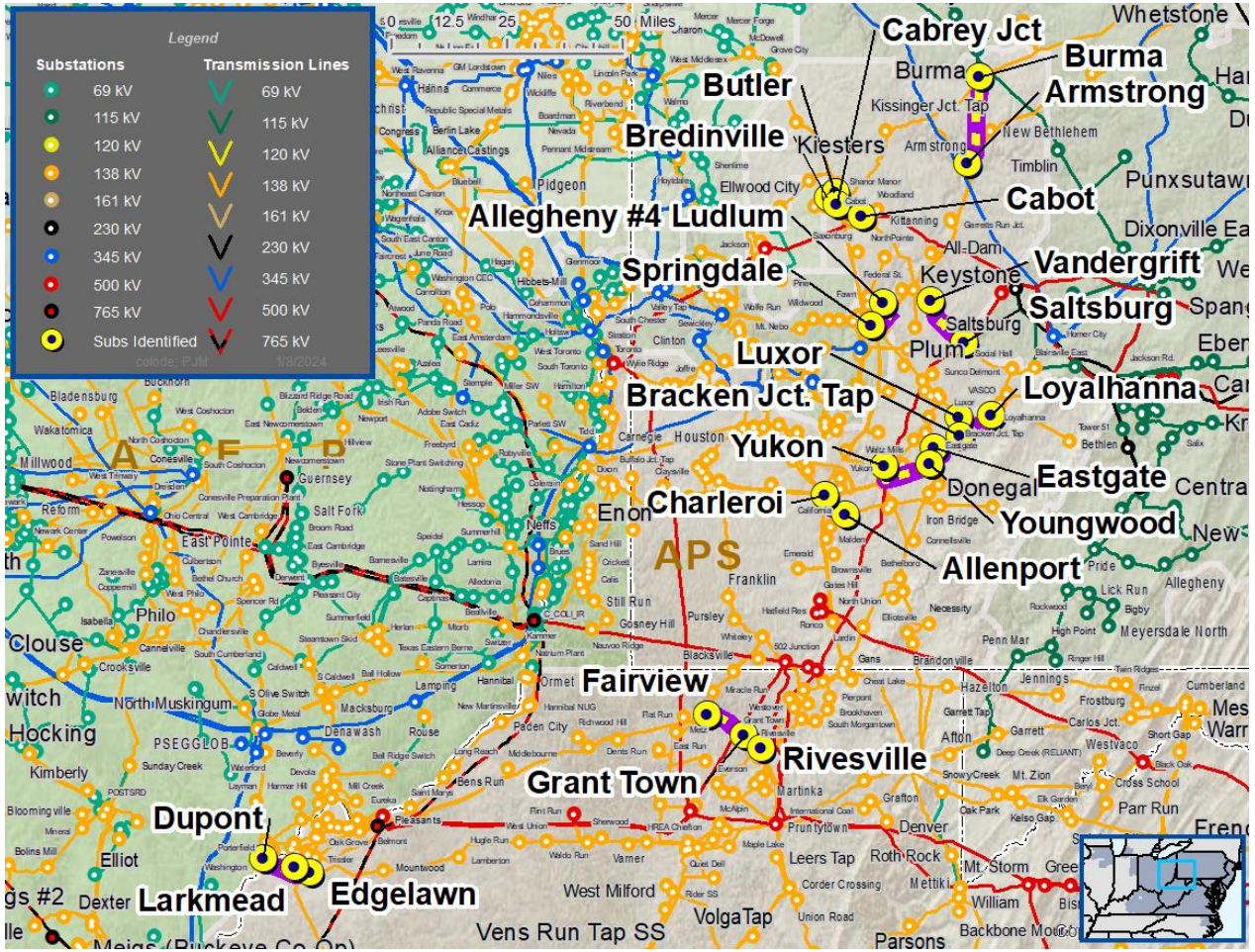


APS Transmission Zone M-3 Process Misoperation Relay Projects

Need #	Transmission Line / Substation Locations	Existing Line Rating (SN / SE / WN / WE)	Existing Conductor Rating (SN / SE / WN / WE)
APS-2023-075	Butler – Cabrey JCT 138 kV	224 / 293 / 323 / 343	297 / 365 / 345 / 441
	Bredinville – Cabrey JCT 138 kV	225 / 287 / 287 / 287	297 / 365 / 345 / 441
	Cabot – Cabrey JCT 138 kV	287 / 287 / 287 / 287	297 / 365 / 345 / 441
APS-2023-079	All Ludlum 4 JCT – Springdale 138 kV	292 / 306 / 306 / 306	297 / 365 / 345 / 441
APS-2023-080	Charleroi – Allenport 138 kV	274 / 314 / 325 / 343	501 / 577 / 501 / 607
APS-2023-081	Loyalhanna – Bracken JCT 138 kV	195 / 209 / 217 / 229	308 / 376 / 349 / 445
	Luxor – Bracken JCT 138 kV	141 / 147 / 162 / 162	160 / 192 / 180 / 228
	Youngwood – Eastgate T 138 kV	265 / 314 / 325 / 343	289 / 357 / 339 / 435
APS-2023-082	Saltsburg – Vandergrift 138 kV	225 / 229 / 229 / 229	237 / 301 / 306 / 398
APS-2023-083	Armstrong – Burma 138 kV	292 / 314 / 325 / 343	308 / 376 / 349 / 445
APS-2023-084	Youngwood – Yukon 138 kV	234 / 287 / 287 / 287	234 / 297 / 301 / 392
APS-2023-086	Fairview – Grant Town 138 kV	175 / 209 / 217 / 229	221 / 268 / 250 / 317
	Rivesville – Grant Town 138 kV	176 / 229 / 250 / 285	221 / 268 / 250 / 317
APS-2023-087	Dupont – Larkmead 138 kV	292 / 314 / 325 / 343	308 / 376 / 349 / 445
	Larkmead – Edgelawn 138 kV	292 / 314 / 325 / 343	308 / 376 / 349 / 445

APS Transmission Zone M-3 Process Misoperation Relay Projects

Selected Solution:

Need #	Transmission Line / Substation Locations	New MVA Line Rating (SN / SE / WN / WE)	Scope of Work	Supplemental Project ID	Estimated Cost ($ M)	Target ISD
APS-2023-075	Butler – Cabrey JCT 138 kV	294 / 350 / 345 / 401	• At Butler, replace circuit breaker, disconnect switches, line trap, substation conductor and relaying	s3194.1	$4.9	12/31/2026
	Bredinville – Cabrey JCT 138 kV	297 / 358 / 345 / 410	• At Bredinville, replace circuit breaker, disconnect switches, line trap, substation conductor and relaying			
	Cabot – Cabrey JCT 138 kV	297 / 365 / 345 / 441	• At Cabot, replace circuit breaker, disconnect switches, line trap, substation conductor and relaying			
APS-2023-079	All Ludlum 4 JCT – Springdale 138 kV	292 / 314 / 325 / 343	• At Springdale, replace relaying	s3195.1	$0.8	12/01/2025

APS Transmission Zone M-3 Process Misoperation Relay Projects

Selected Solution:

Need #	Transmission Line / Substation Locations	New MVA Line Rating (SN / SE / WN / WE)	Scope of Work	Supplemental Project ID	Estimated Cost ($ M)	Target ISD
APS-2023-080	Charleroi – Allenport 138 kV	501 / 577 / 501 / 607	• At Charleroi, replace circuit breaker, disconnect switches, line trap, substation conductor and relaying • At Allenport, replace circuit breaker, disconnect switches, line trap, line turner and coax, substation conductor and relaying	s3196.1	$3.4	12/01/2025
APS-2023-081	Loyalhanna – Bracken JCT 138 kV	308 / 376 / 349 / 445	• At Loyalhanna, replace circuit breaker, disconnect switches, line trap, substation conductor and relaying	s3197.1	$4.0	05/15/2026
	Luxor – Bracken JCT 138 kV	160 / 192 / 180 / 228	• At Luxor, replace circuit breaker, disconnect switches, line trap, substation conductor and relaying			
	Youngwood – Eastgate T 138 kV	289 / 357 / 339 / 435	• At Youngwood, replace circuit breaker, disconnect switches, line trap, substation conductor and relaying			

APS Transmission Zone M-3 Process
Misoperation Relay Projects

Selected Solution:

Need #	Transmission Line / Substation Locations	New MVA Line Rating (SN / SE / WN / WE)	Scope of Work	Supplemental Project ID	Estimated Cost ($ M)	Target ISD
APS-2023-082	Saltsburg – Vandergrift 138 kV	237 / 301 / 306 / 398	• At Saltsburg, replace disconnect switches, line trap, and relaying • At Vandergrift, replace circuit breaker, disconnect switches, line trap, substation conductor and relaying	s3198.1	$2.9	12/31/2025
APS-2023-083	Armstrong – Burma 138 kV	308 / 376 / 349 / 445	• At Armstrong, replace disconnect switches, line trap, substation conductor and relaying • At Burma, replace circuit breaker, disconnect switches, line trap, substation conductor and relaying	s3199.1	$3.0	6/1/2026
APS-2023-084	Youngwood – Yukon 138 kV	234 / 297 / 301 / 392	• At Youngwood, replace circuit breaker, line trap, substation conductor and relaying • At Yukon, replace line trap and relaying	s3200.1	$2.1	3/28/2026

APS Transmission Zone M-3 Process Misoperation Relay Projects

Selected Solution:

Need #	Transmission Line / Substation Locations	New MVA Line Rating (SN / SE / WN / WE)	Scope of Work	Supplemental Project ID	Estimated Cost ($ M)	Target ISD
APS-2023-086	Fairview – Grant Town 138 kV	221 / 268 / 250 / 317	• At Fairview, replace circuit breaker, disconnect switches, line trap, substation conductor and relaying • At Grant Town, replace circuit breaker, disconnect switches, line trap and relaying	s3201.1	$4.2	5/15/2026
	Rivesville – Grant Town 138 kV	221 / 268 / 250 / 317	• At Rivesville, replace circuit breaker, line trap, substation conductor and relaying • At Grant Town, replace circuit breaker, disconnect switches, line trap and relaying			
APS-2023-087	Dupont – Larkmead 138 kV	308 / 376 / 349 / 445	• At Dupont, replace circuit breaker, line trap, substation conductor and relaying • At Larkmead, replace disconnect switches and relaying	s3202.1	$4.8	12/31/2025
	Larkmead – Edgelawn 138 kV	308 / 376 / 349 / 445	• At Edgelawn, replace circuit breaker, line trap, substation conductor and relaying • At Larkmead, replace disconnect switches and relaying			

APS Transmission Zone M-3 Process
Misoperation Relay Project

Need Number: APS-2021-007

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 08/16/2021

Solution Meeting – 04/21/2023

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

Global Factors

- System reliability and performance
- Substation and line equipment limits
- Upgrade Relay Schemes
  - Relay schemes that have a history of misoperation
  - Obsolete and difficult to repair communication equipment (DTT, Blocking, etc.)
  - Communication technology upgrades
  - Bus protection schemes

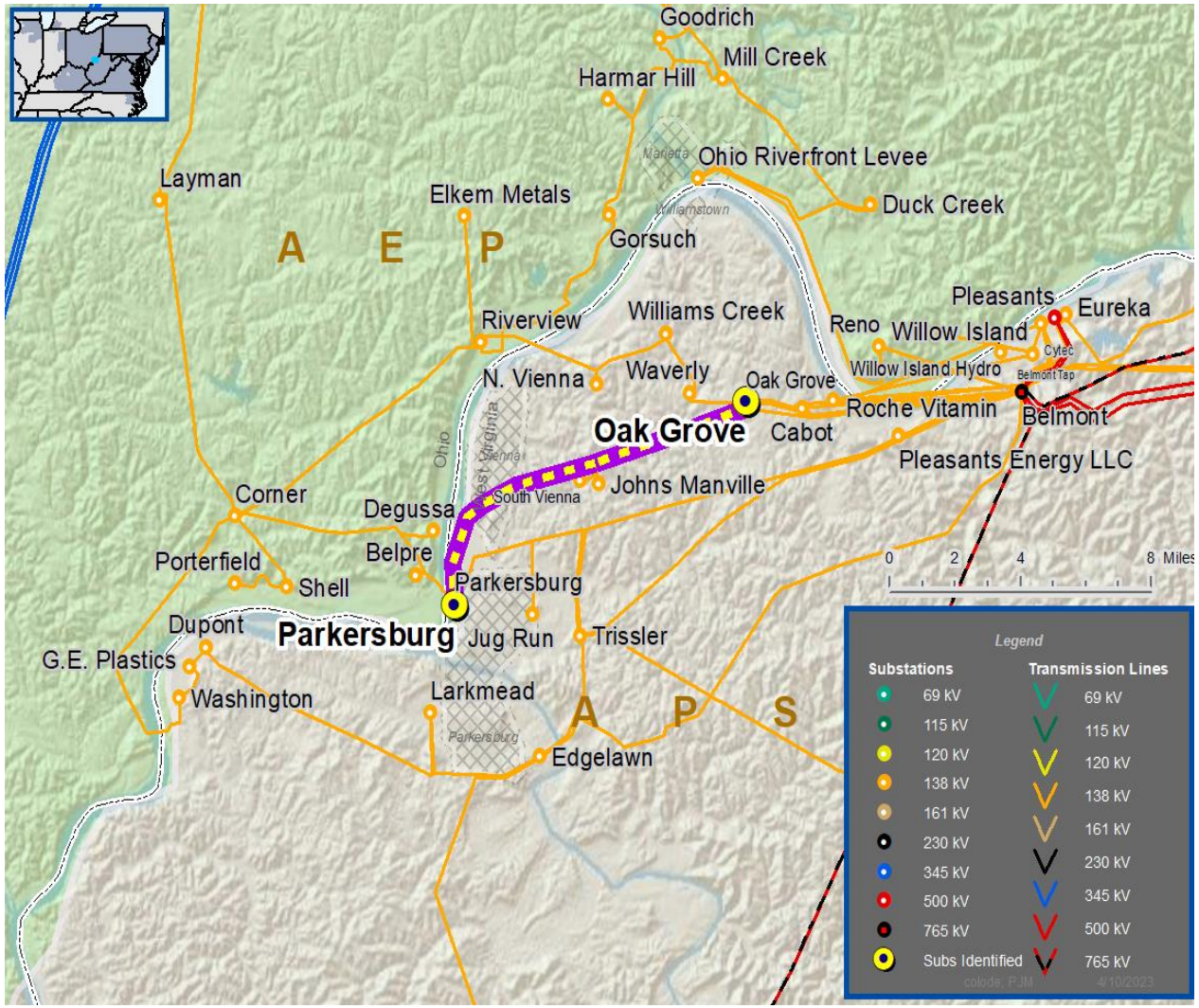
Problem Statement:

- 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 properly together during a fault
- The identified protection equipment cannot be effectively repaired for reasons such as lack of replacement parts and available expertise in the outdated technology.
- Newer equipment provides better monitoring, enhances capability of system event analysis, and performs more reliably

- Transmission line ratings are limited by terminal equipment

Oak Grove – Parkersburg 638 138 kV Line (substation conductor)

- Existing line rating: 225 / 287 MVA (SN / SE)
- Existing Transmission conductor rating: 308 / 376 MVA (SN / SE)



APS Transmission Zone M-3 Process Misoperation Relay Project

Need Number: APS-2021-008

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 08/16/2021

Solution Meeting – 04/21/2023

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

Global Factors

- System reliability and performance
- Substation and line equipment limits
- Upgrade Relay Schemes
  - Relay schemes that have a history of misoperation
  - Obsolete and difficult to repair communication equipment (DTT, Blocking, etc.)
  - Communication technology upgrades
  - Bus protection schemes

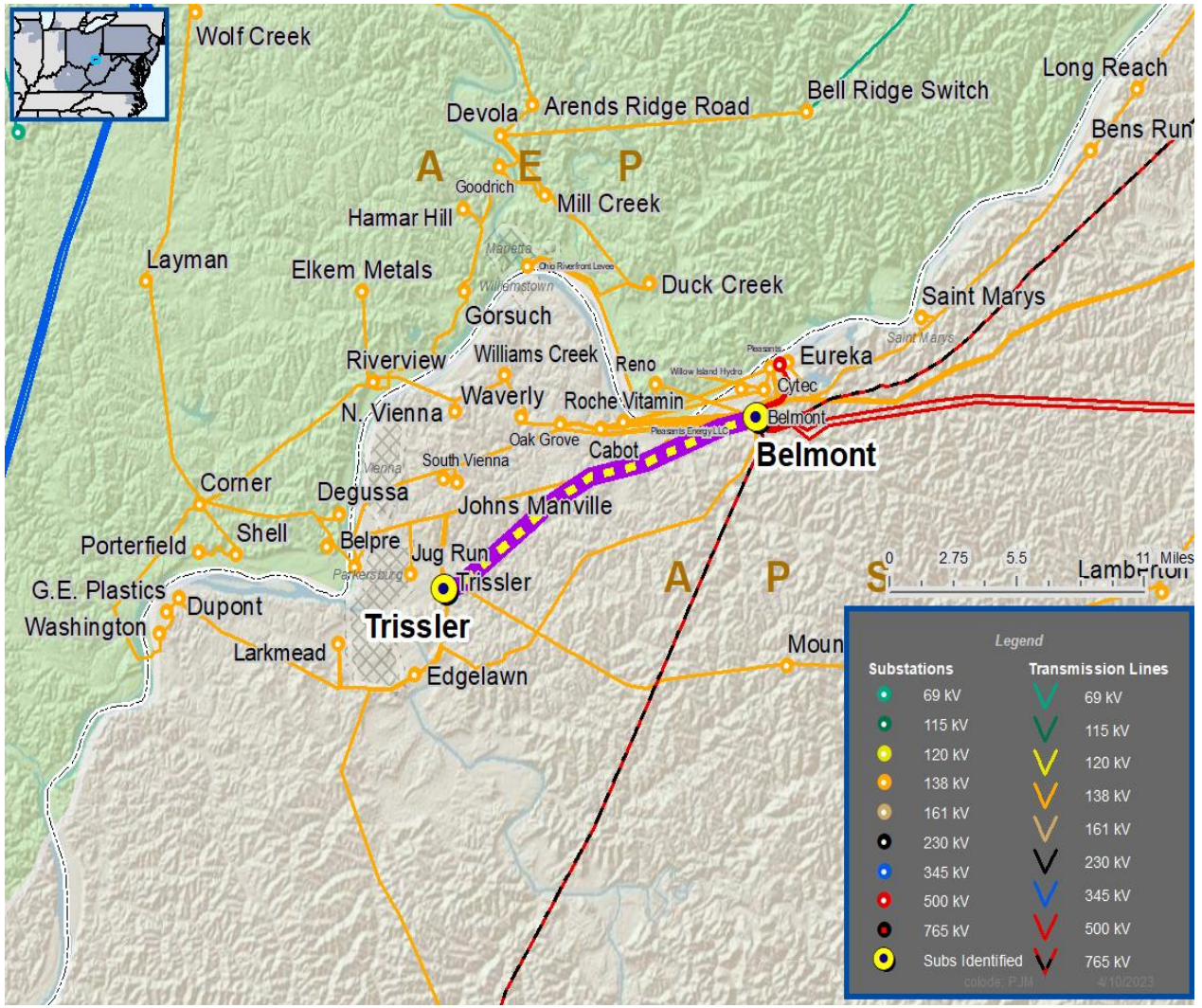
Problem Statement:

- 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 properly together during a fault
- The identified protection equipment cannot be effectively repaired for reasons such as lack of replacement parts and available expertise in the outdated technology.
- Newer equipment provides better monitoring, enhances capability of system event analysis, and performs more reliably

- Transmission line ratings are limited by terminal equipment

Belmont – Trissler 648 138 kV Line (substation conductor)

- Existing line rating: 293 / 342 MVA (SN / SE)
- Existing Transmission conductor rating: 308 / 376 MVA (SN / SE)



APS Transmission Zone M-3 Process Misoperation Relay Project

Need Number: APS-2021-009

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 08/16/2021

Solution Meeting – 04/21/2023

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

Global Factors

- System reliability and performance
- Substation and line equipment limits
- Upgrade Relay Schemes
  - Relay schemes that have a history of misoperation
  - Obsolete and difficult to repair communication equipment (DTT, Blocking, etc.)
  - Communication technology upgrades
  - Bus protection schemes

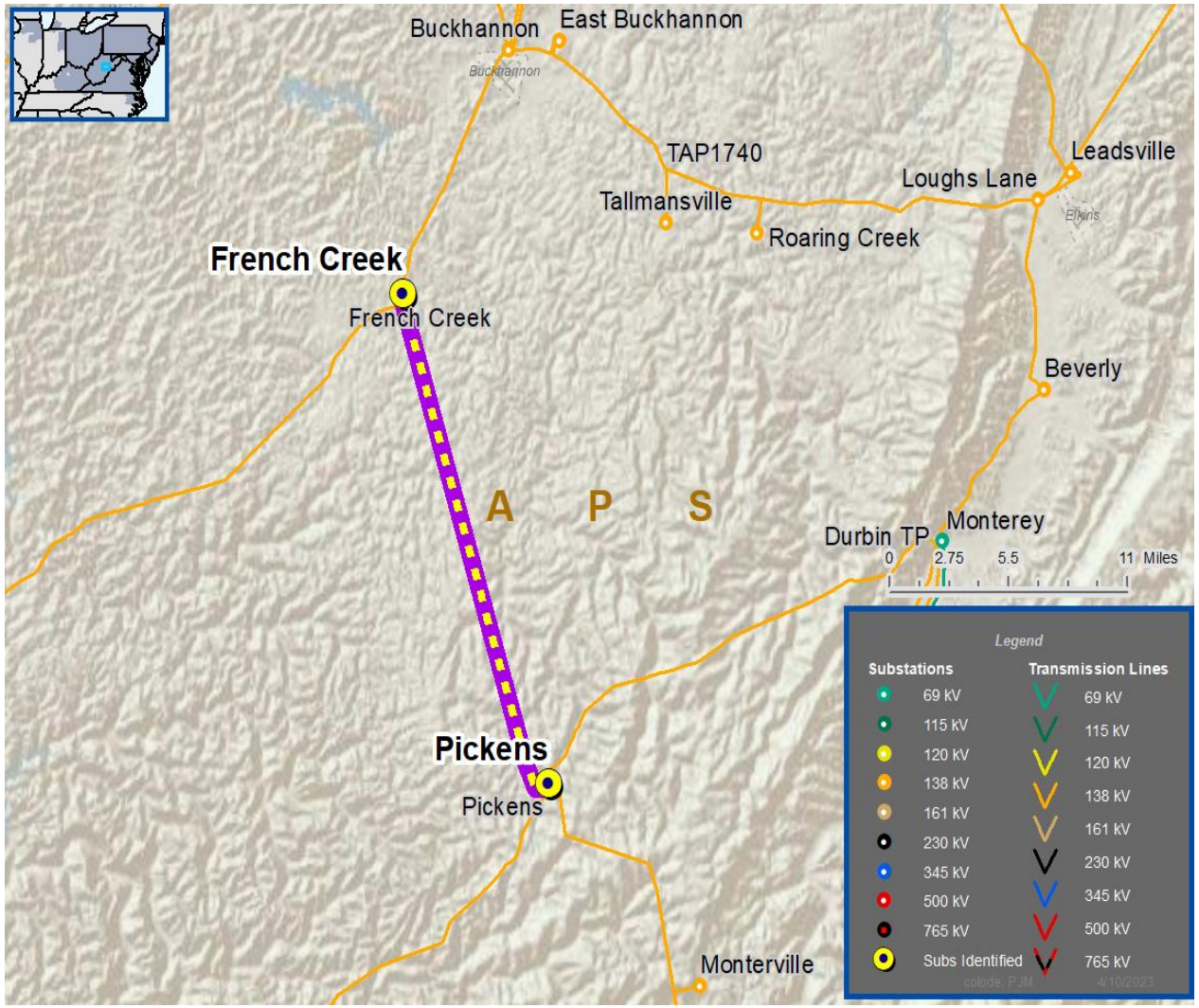
Problem Statement:

- 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 properly together during a fault
- The identified protection equipment cannot be effectively repaired for reasons such as lack of replacement parts and available expertise in the outdated technology.
- Newer equipment provides better monitoring, enhances capability of system event analysis, and performs more reliably

- Transmission line ratings are limited by terminal equipment

French Creek - Pickens 56 138 kV Line (substation conductor)

- Existing line rating: 292 / 306 MVA (SN / SE)
- Existing Transmission conductor rating: 308 / 376 MVA (SN / SE)



APS Transmission Zone M-3 Process Misoperation Relay Projects

Selected Solution:

Need Number	Transmission Line / Substation Locations	New MVA Line Rating (SN / SE)	Scope of Work	Supplemental Project ID	Estimated Cost ($ M)	Target ISD
APS-2021-007	Oak Grove – Johns Jct 138 kV Line	292 / 314	• Oak Grove 138 kV Substation – Replace substation conductor	s2930	$ 1.10 M	IN SERVICE
	Johns Jct – Parkersburg 138 kV Line	292 / 314	• Parkersburg 138 kV Substation – Replace substation conductor			
APS-2021-008	Belmont – Trissler 648 138 kV Line	308 / 376	• Belmont 138 kV Substation – Replace substation conductor and wave trap • Trissler 138 kV Substation – Replace substation conductor, circuit breaker, and wave trap	s2931	$ 2.08 M	IN SERVICE
APS-2021-009	French Creek – Pickens 138 kV Line	308 / 376	• French Creek 138 kV Substation – Replace substation conductor, circuit breaker, and wave trap • Pickens 138 kV Substation – Replace substation conductor, circuit breaker, and wave trap	s2932	$ 2.15 M	4/21/2023

APS Transmission Zone M-3 Process

Need Number: APS-2023-003

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 2/17/2023

Solution Meeting – 04/21/2023

Project Driver:

Customer Service

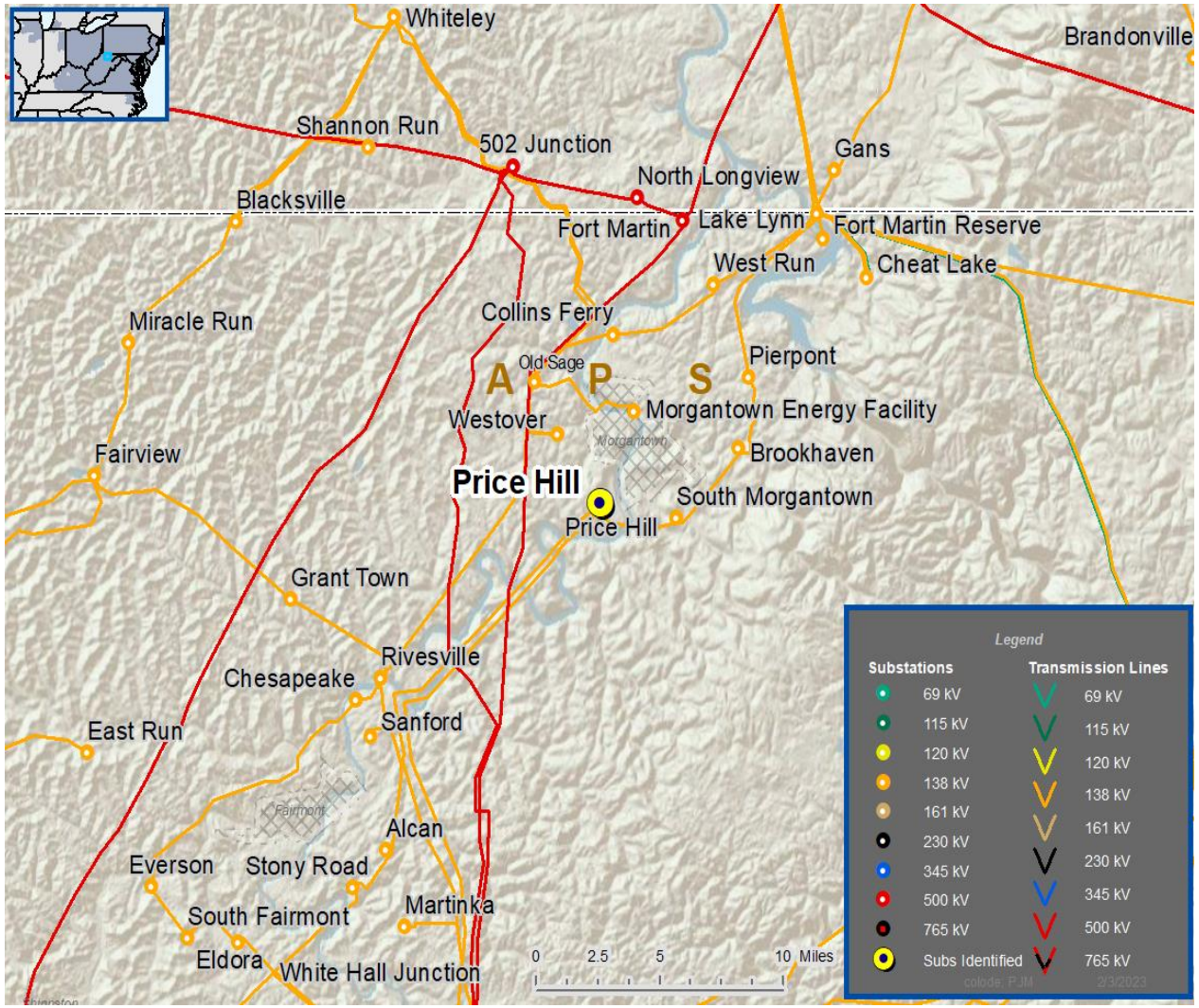
Specific Assumption Reference:

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

Problem Statement:

New Customer Connection – A customer requested 138 kV service to support 8 MVA of load at a site near Price Hill 138 kV substation in the Mon Power service territory.

Requested in-service date: 3/17/2023



APS Transmission Zone M-3 Process

Need Number: APS-2023-003

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Proposed Solution:

- Extend the Price Hill 138 kV bus by installing (1) 138 kV breaker and associated facilities to provide service to the Customer.

Alternatives Considered:

- Serve the customer via the 12 kV distribution system

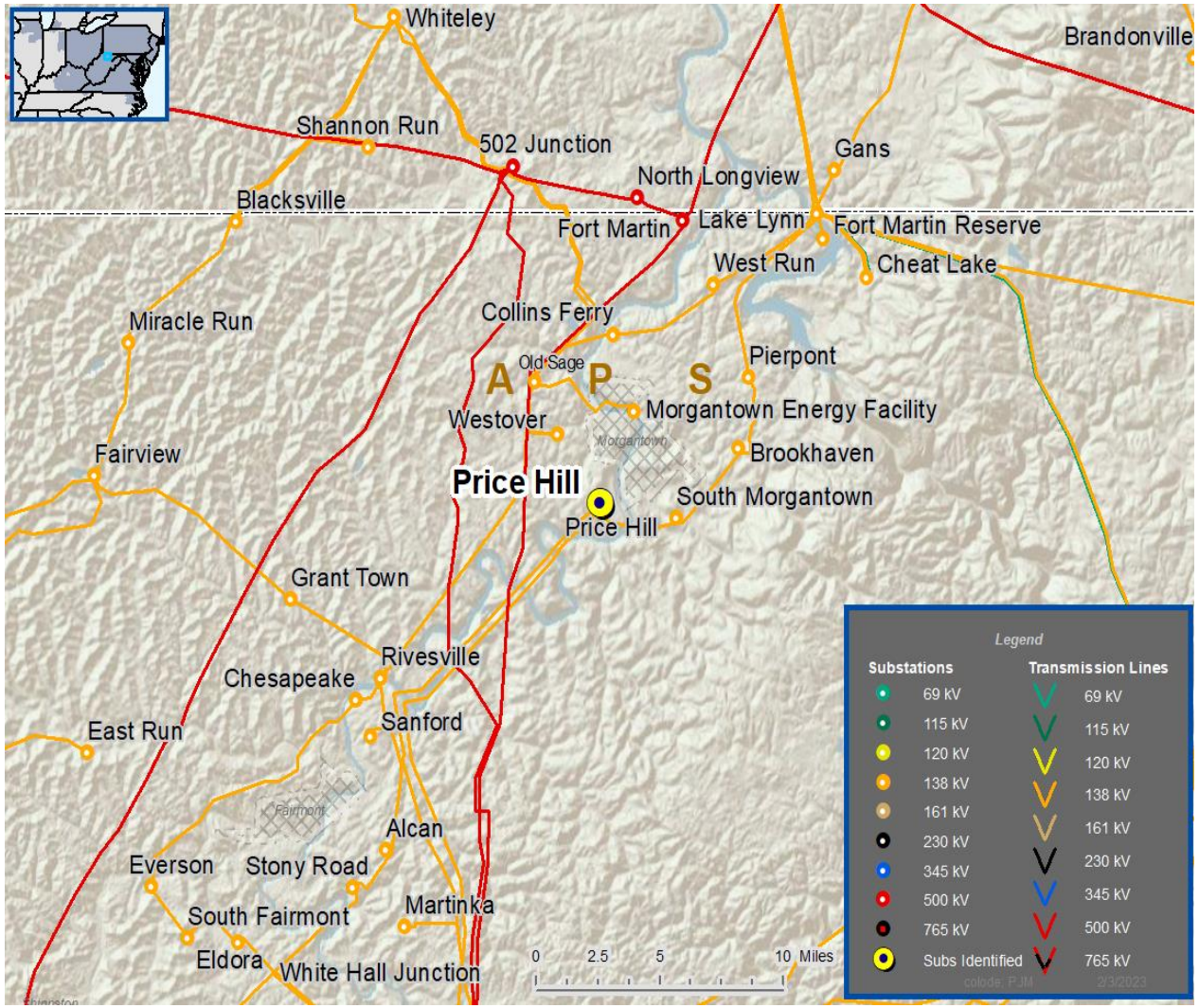
Anticipated Rating Changes:

- None

Estimated Project Cost: $0.3M

Projected In-Service: 5/8/2023

Supplemental Project ID: s2933



APS Transmission Zone M-3 Process

Need Number: APS-2023-004

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 3/17/2023

Solution Meeting – 04/21/2023

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

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)

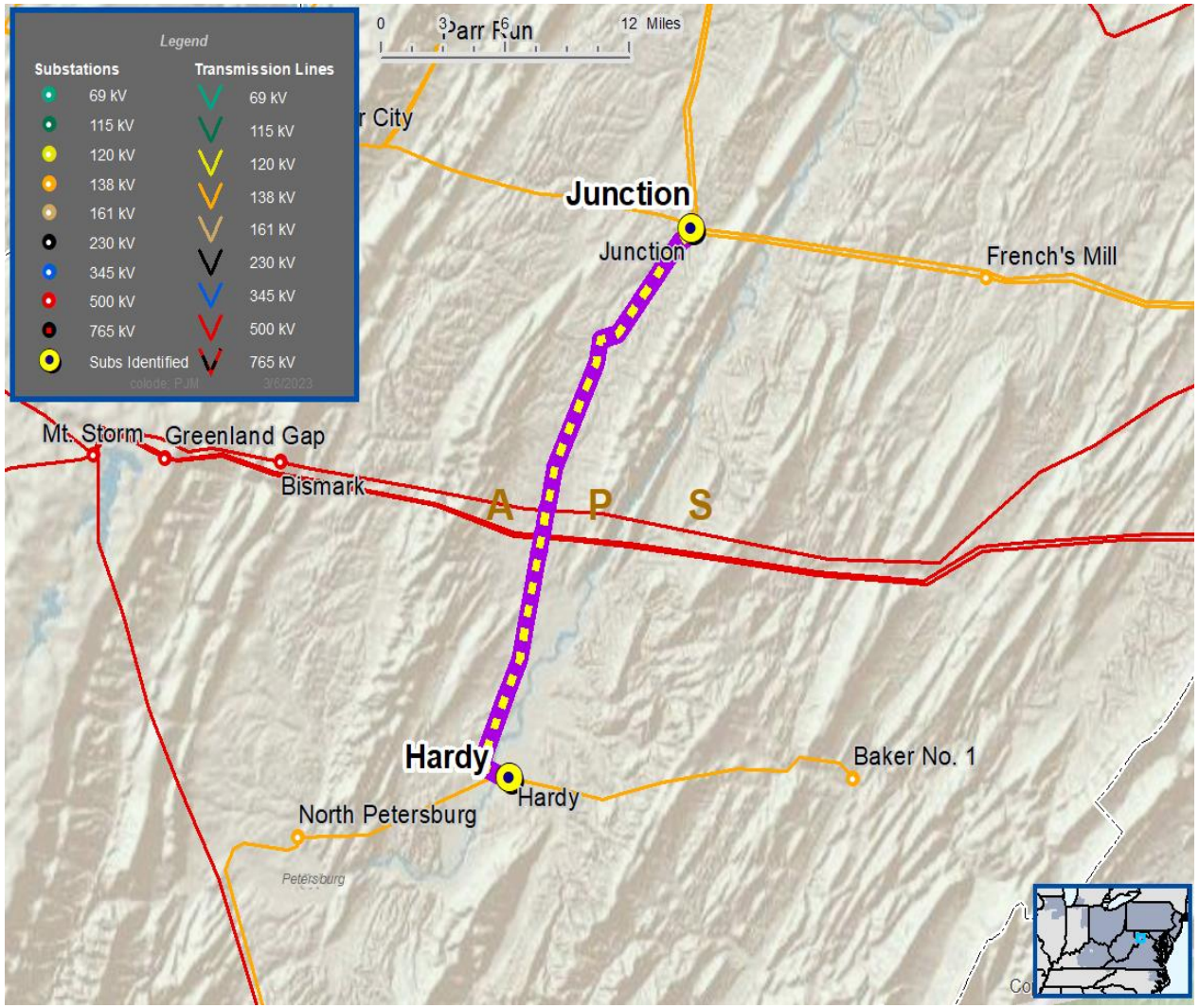
System Performance Projects Global Factors

- Substation/line equipment limits

Problem Statement:

The Hardy – Junction 138 kV line is exhibiting deterioration

- Total line distance is approximately 21.5 miles
- 157 of 164 structures failed assessment:
  - 145 structures are approaching expected end of life
  - 132 failed assessment due to multiple defects
  - 74 failed assessment due to decay
  - 132 failed assessment due to woodpecker holes



APS Transmission Zone M-3 Process

Need Number: APS-2023-004

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Proposed Solution:

- Rebuild the Junction-Hardy 138kV line, approximately 21.5 miles, with wood pole equivalent steel structures.
- Replace limiting substation conductor and disconnect switch at Junction 138 kV substation
- Replace limiting substation conductor at Hardy 138 kV substation

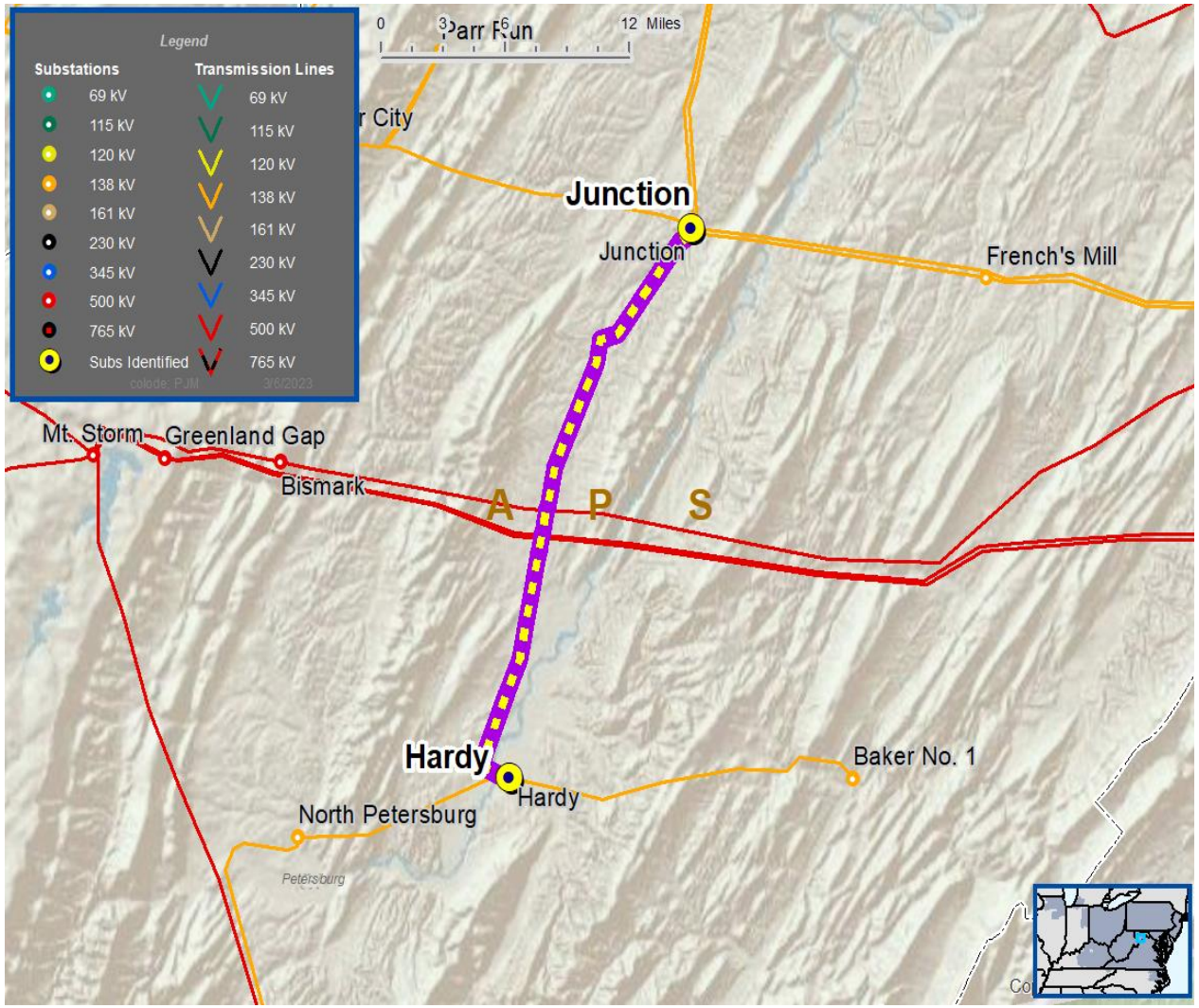
Transmission Line Ratings:

- Junction – Hardy 138 kV Line
  - Before Proposed Solution: 159 / 191 MVA (SN / SE)
  - After Proposed Solution: 221 / 268 MVA (SN / SE)

Alternatives Considered:

- Build a new greenfield line
- Maintain line in existing condition

Estimated Project Cost: $ 42.6 M
Projected In-Service: 12/1/2027
Supplemental Project ID: s2934



APS Transmission Zone M-3 Process

Need Number: APS-2023-005

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Previously Presented:

Need Meeting – 3/17/2023

Solution Meeting – 04/21/2023

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

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)

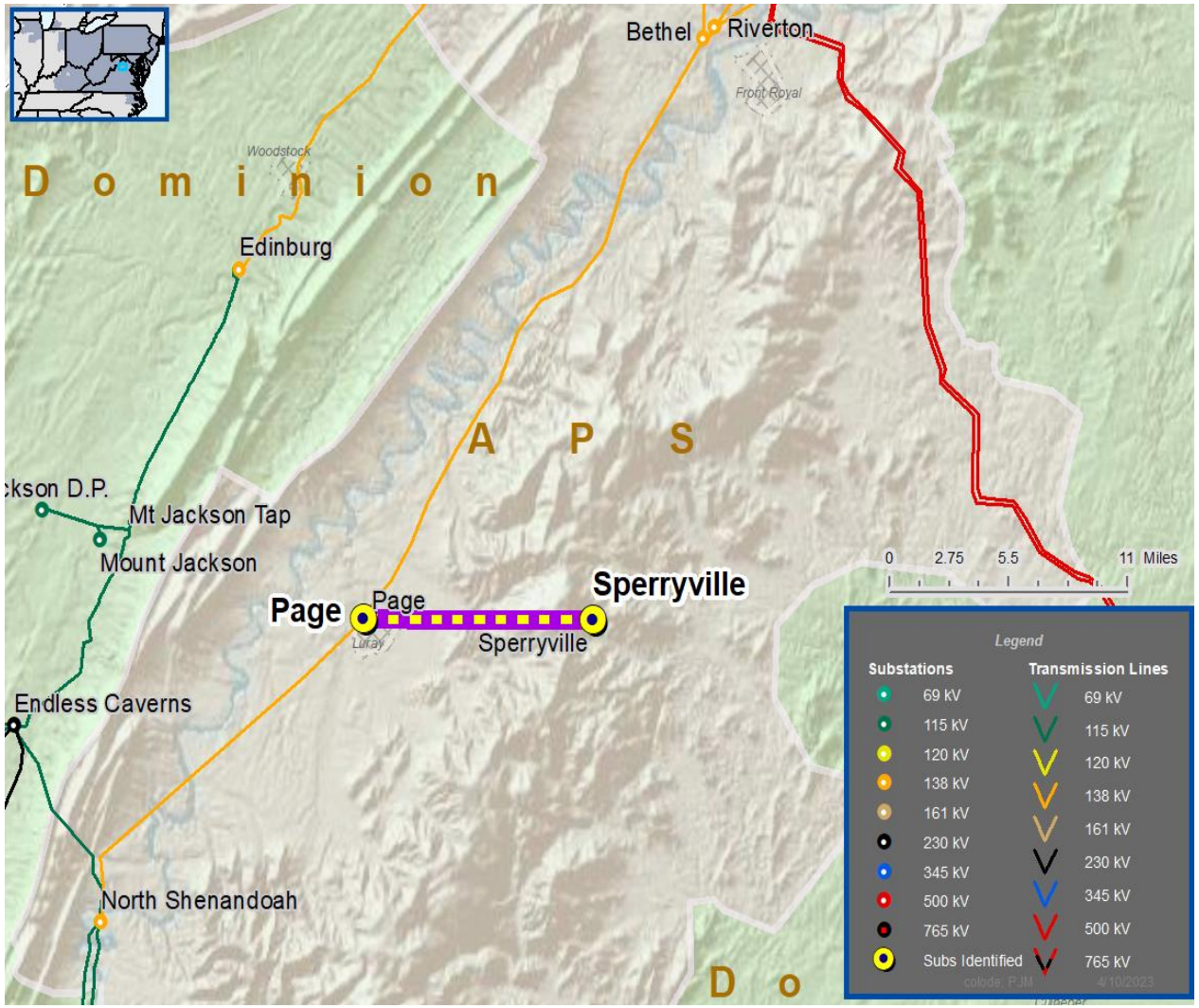
System Performance Projects Global Factors

- Substation/line equipment limits

Problem Statement:

The Page – Sperryville 138 kV line is exhibiting deterioration and has significant outage history

- Total line distance is approximately 13.8 miles.
- There is significant exposure to unplanned outages due to equipment failures and off ROW trees. Since 2014, there have been 15 outages including 5 equipment failures and 7 off ROW fall-ins
- Existing equipment is approaching expected end of life
- The terrain is extremely challenging, limiting access and extending outage durations to the supported municipal interconnection. The locations and design of structures further impedes repairs.



APS Transmission Zone M-3 Process

Need Number: APS-2023-005

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan– 4/26/2024

Proposed Solution:

- Rebuild the Page – Sperryville 138kV line, approximately 21.5 miles, with wood pole equivalent steel structures.
- Replace limiting substation conductor, wave trap, circuit breaker and relaying at Page 138 kV substation
- Replace limiting substation conductor, wave trap, and circuit switcher at Hardy 138 kV substation

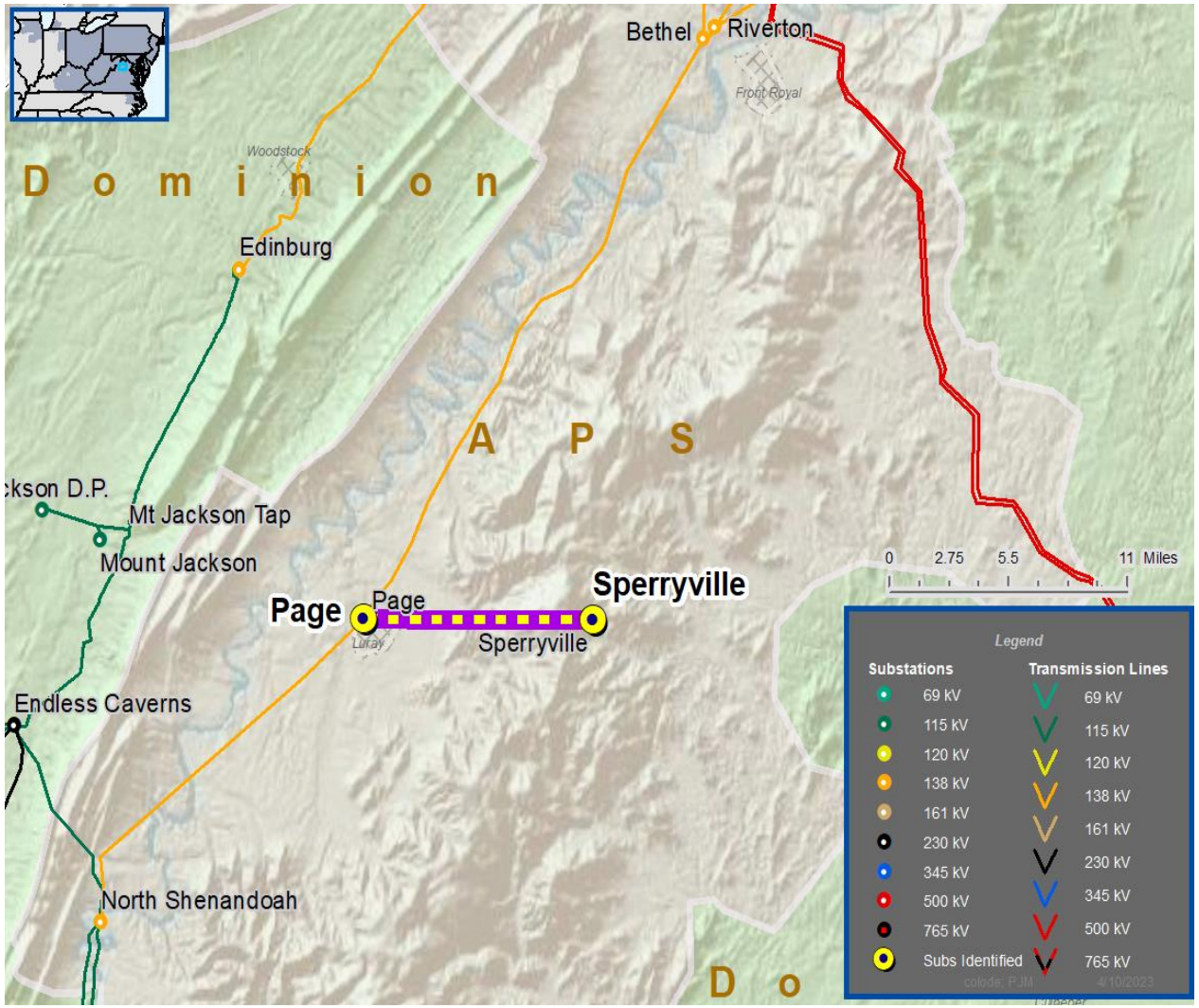
Transmission Line Ratings:

- Page – Sperryville 138 kV Line
  - Before Proposed Solution: 97 / 105 MVA (SN / SE)
  - After Proposed Solution: 309 / 376 MVA (SN / SE)

Alternatives Considered:

- Build a new greenfield line
- Maintain line in existing condition

Estimated Project Cost: $ 45.8 M
Projected In-Service: 6/1/2026
Supplemental Project ID: s2935



Revision History

4/26/2024– V1 – Added original slides