Subregional RTEP Committee – Western
FirstEnergy Supplemental Projects

April 21, 2023

Needs

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

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

Need Number: APS-2023-006

Process Stage: Need 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 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.

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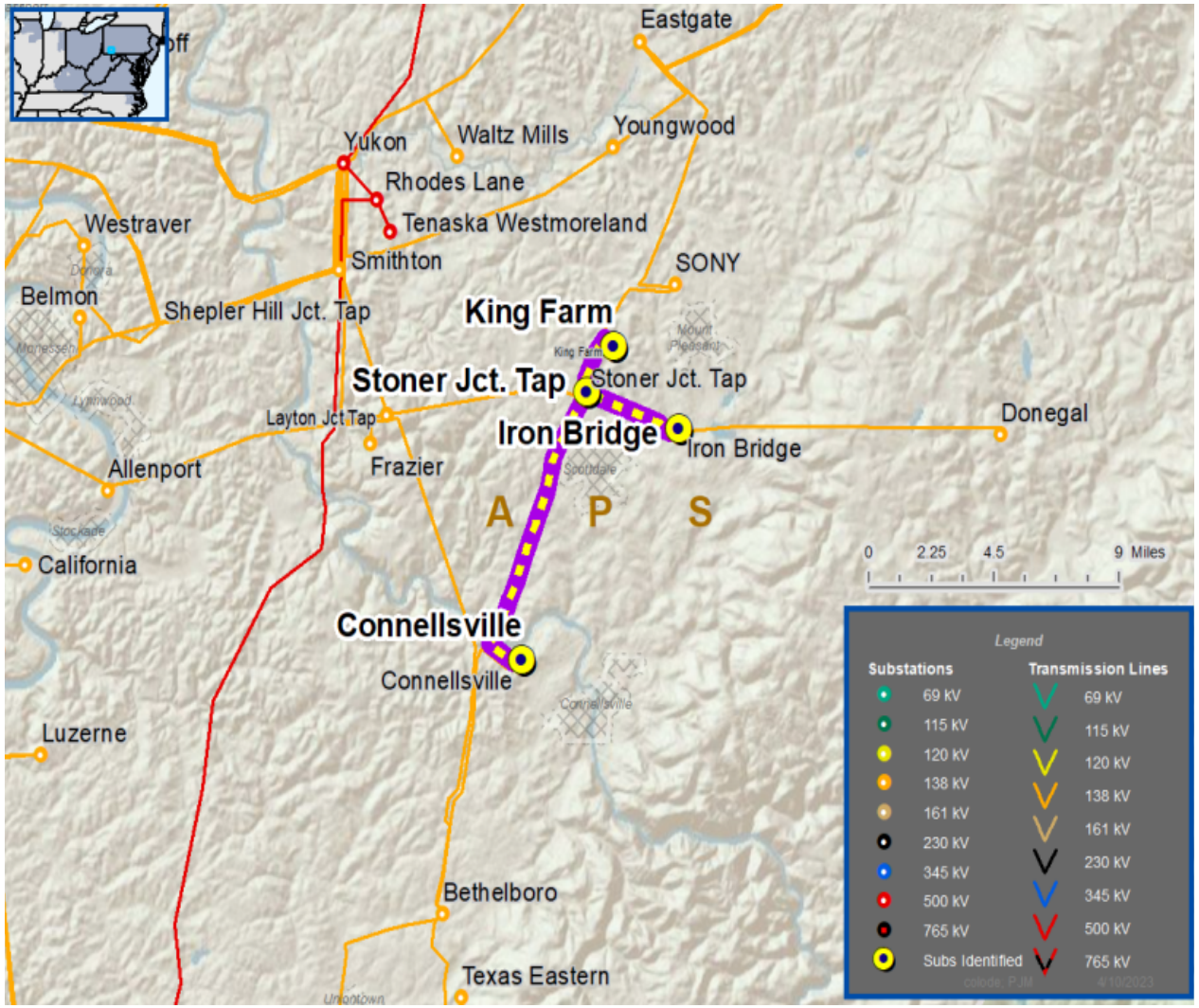

APS Transmission Zones M-3 Process
Stoner Junction 138 kV Misoperation Relays

Need Numbers: APS-2023-011

Process State: Need Meeting 04/21/2023

Project Driver: *Equipment Material Condition, Performance and Risk*

Specific Assumption Reference:

System Performance Projects Global Factors

- System reliability and performance
- Substation/line equipment limits

System Condition Projects

- Substation Condition Rebuild/Replacement

Upgrade Relay Schemes

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

Problem Statement:

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cases the protection equipment cannot be repaired due to a lack of replacement parts and available expertise in the outdated technology.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

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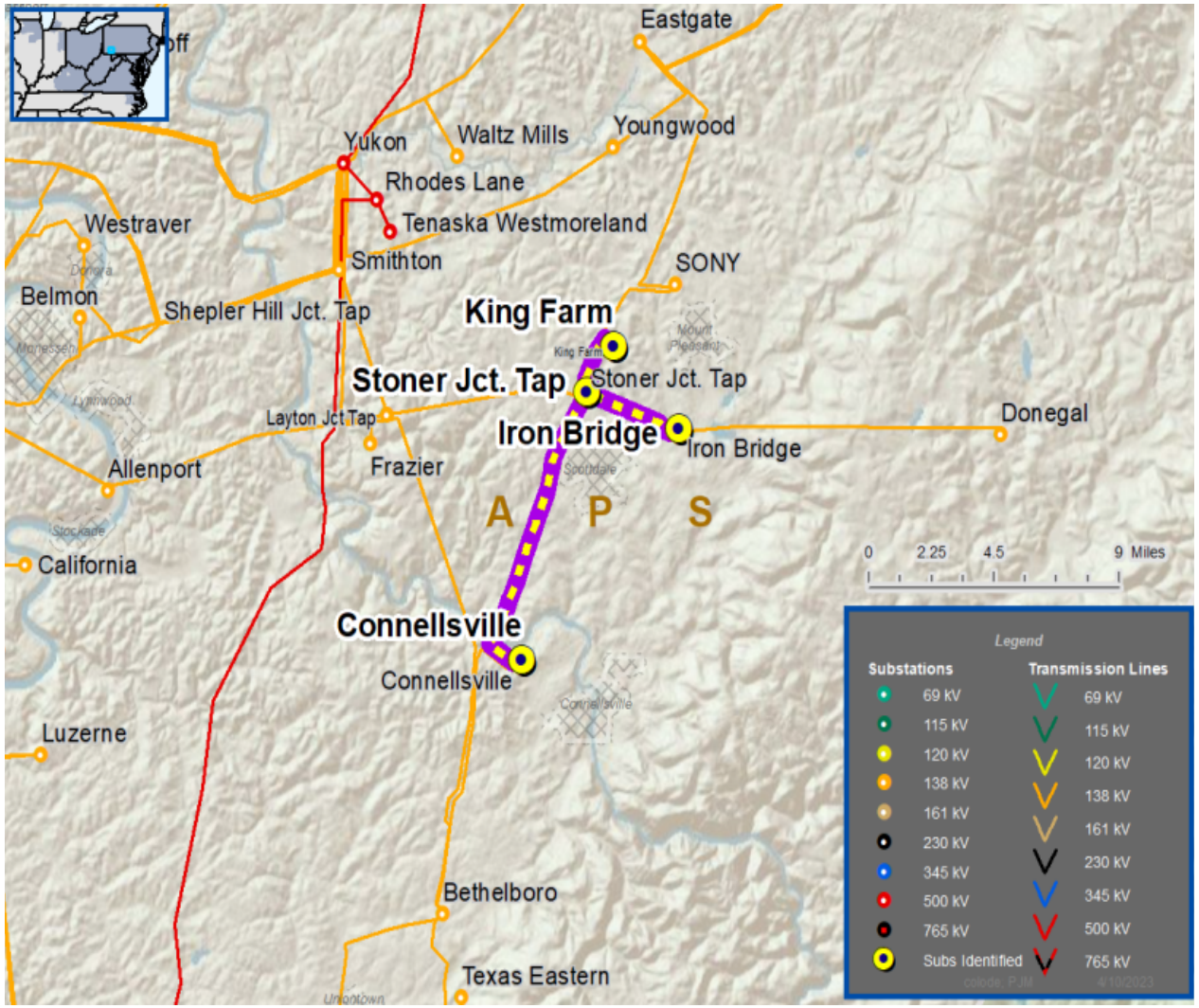


APS Transmission Zone M-3 Process
Stoner Junction 138 kV Line

Need #	Transmission Line / Substation Locations	Existing Line Rating (SN / SE)	Existing Conductor Rating (SN / SE)	Limiting Terminal Equipment
APS-2023-006 APS-2023-011	Connellsville – Stoner Junction 138 kV	160 / 192	308 / 376	Substation Conductor, Wave Trap, Relaying
	Stoner Junction – King Farm 138 kV	293 / 343	308 / 376	Substation Conductor, Circuit Breaker, Wave Trap, Relaying
	Stoner Junction – Iron Bridge 138 kV	210 / 250	221 / 268	Substation Conductor, Circuit Breaker, Wave Trap, Relaying

APS Transmission Zone M-3 Process
Dutch Fork-Washington 138 kV New Customer

Need Number: APS-2023-007

Process Stage: Need Meeting – 4/21/2023

Project Driver(s): *Customer Service*

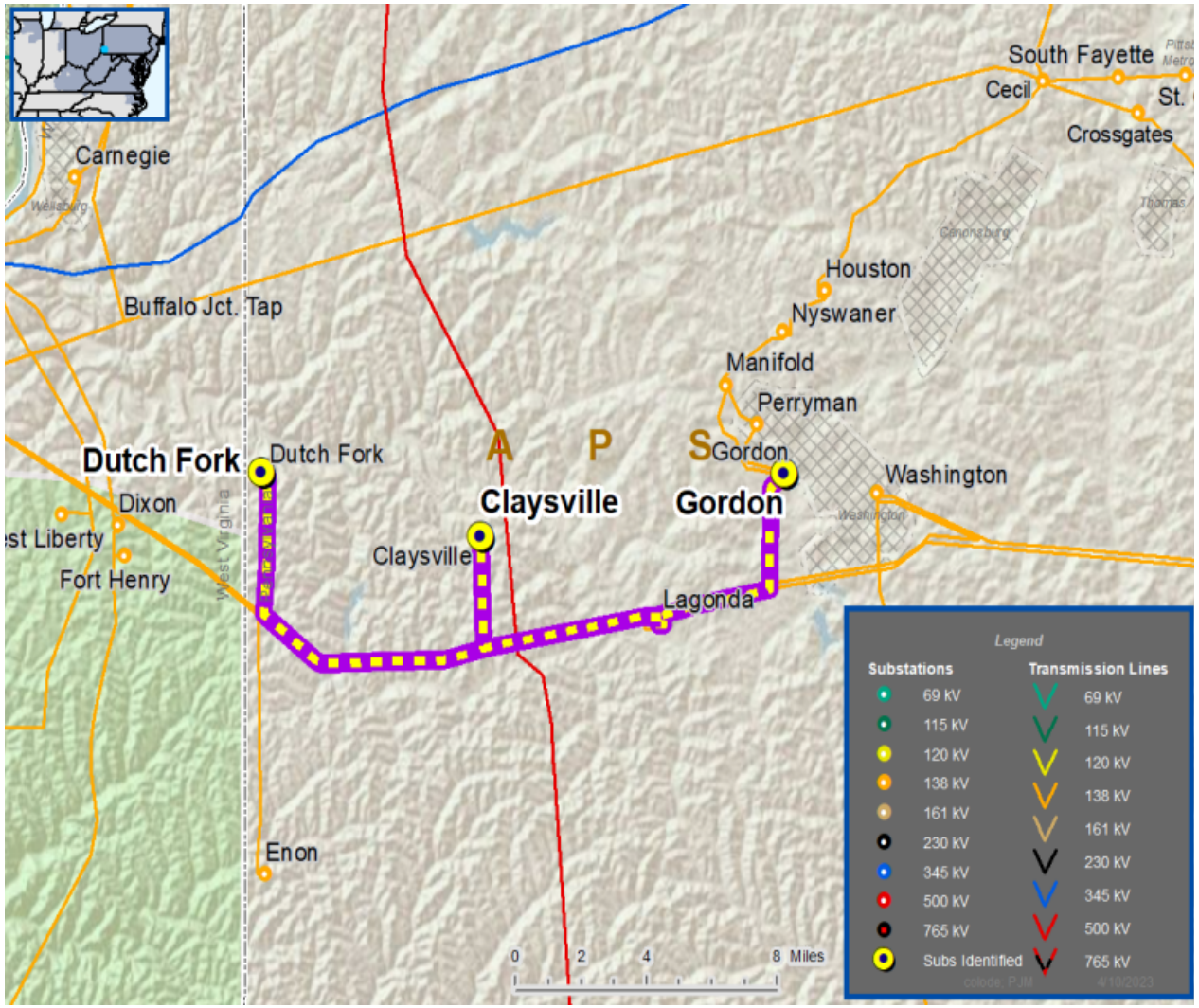
Specific Assumption Reference(s):

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 Claysville-Washington 138 kV line. The anticipated load of the new customer connection is 25 MVA.

Requested in-service date is 07/10/2024.



APS Transmission Zone M-3 Process
Penn-Harrison City 138 kV New Customer

Need Number: APS-2023-008

Process Stage: Need Meeting – 4/21/2023

Project Driver(s):

Customer Service

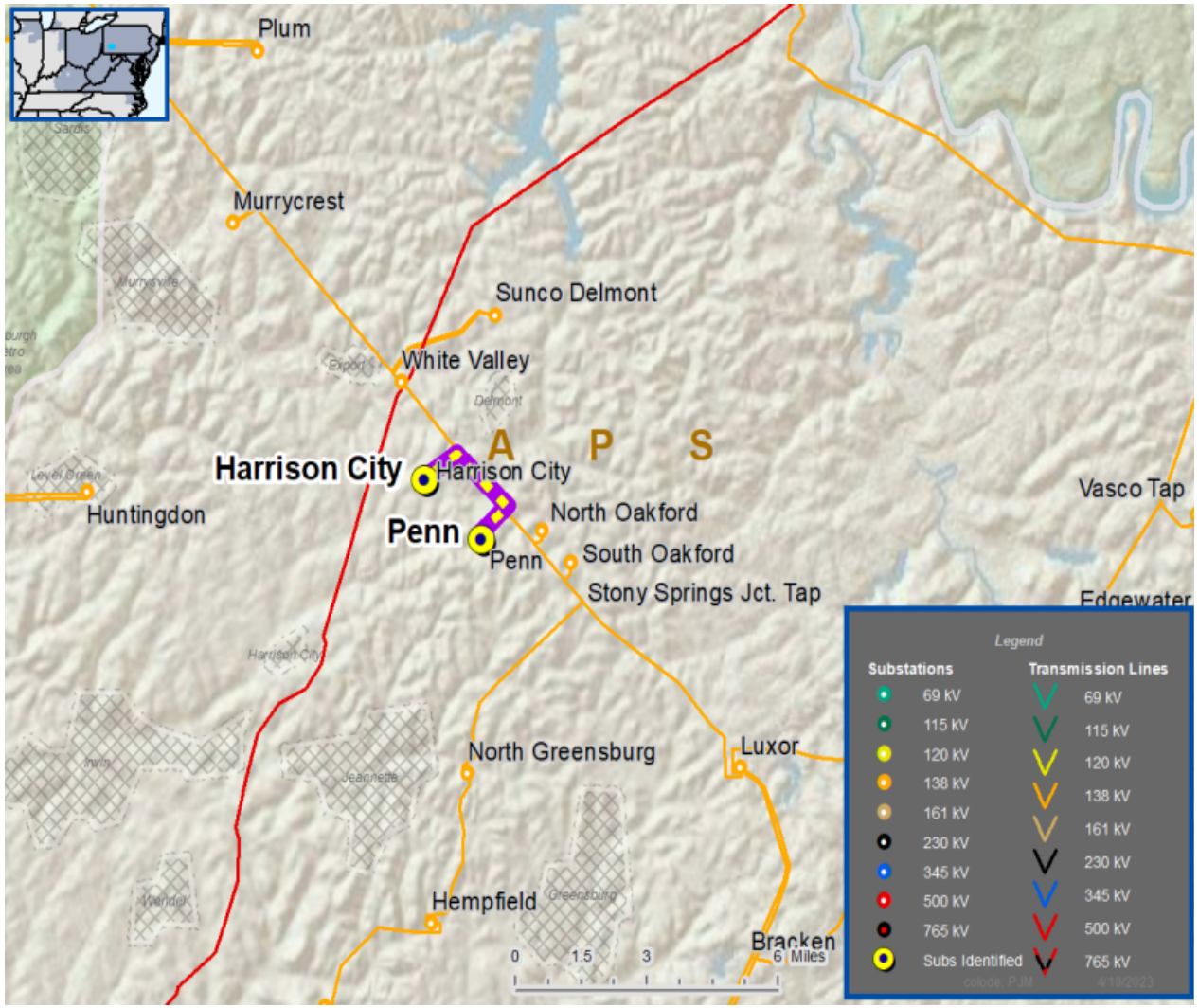
Specific Assumption Reference(s):

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-Harrison City 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
Ethel Springs – Bethlen 138 kV Network

Need Number: APS-2023-009

Process Stage: Need Meeting – 4/21/2023

Project Driver(s):

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

Specific Assumption Reference(s):

System Performance

- Network radial lines

Operational Flexibility

Problem Statement:

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

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

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

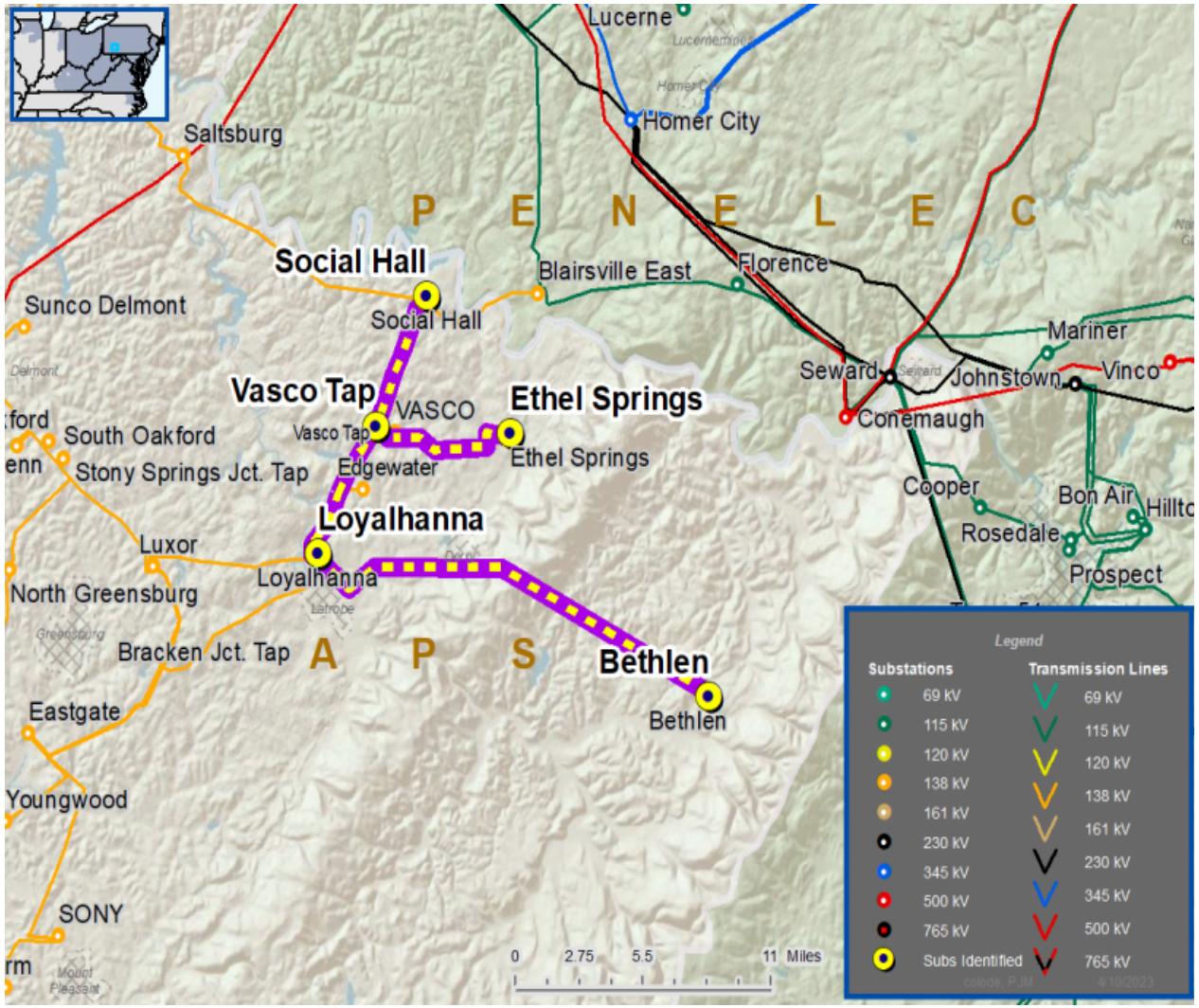
Transmission line ratings are limited by terminal equipment.

Vasco Tap – Social Hall 138 kV (Substation conductor, wave trap, CB, relaying):

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

Bethlen – Loyalhanna 138 kV (Substation conductor, relaying):

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



APS Transmission Zone M-3 Process
Guilford – Grand Point 138: Upgrade limiting terminal equipment

Need Number: APS-2023-010

Process Stage: Need Meeting – 4/21/2023

Project Driver(s):
- *Performance and risk*
- *Operational Flexibility and Efficiency*

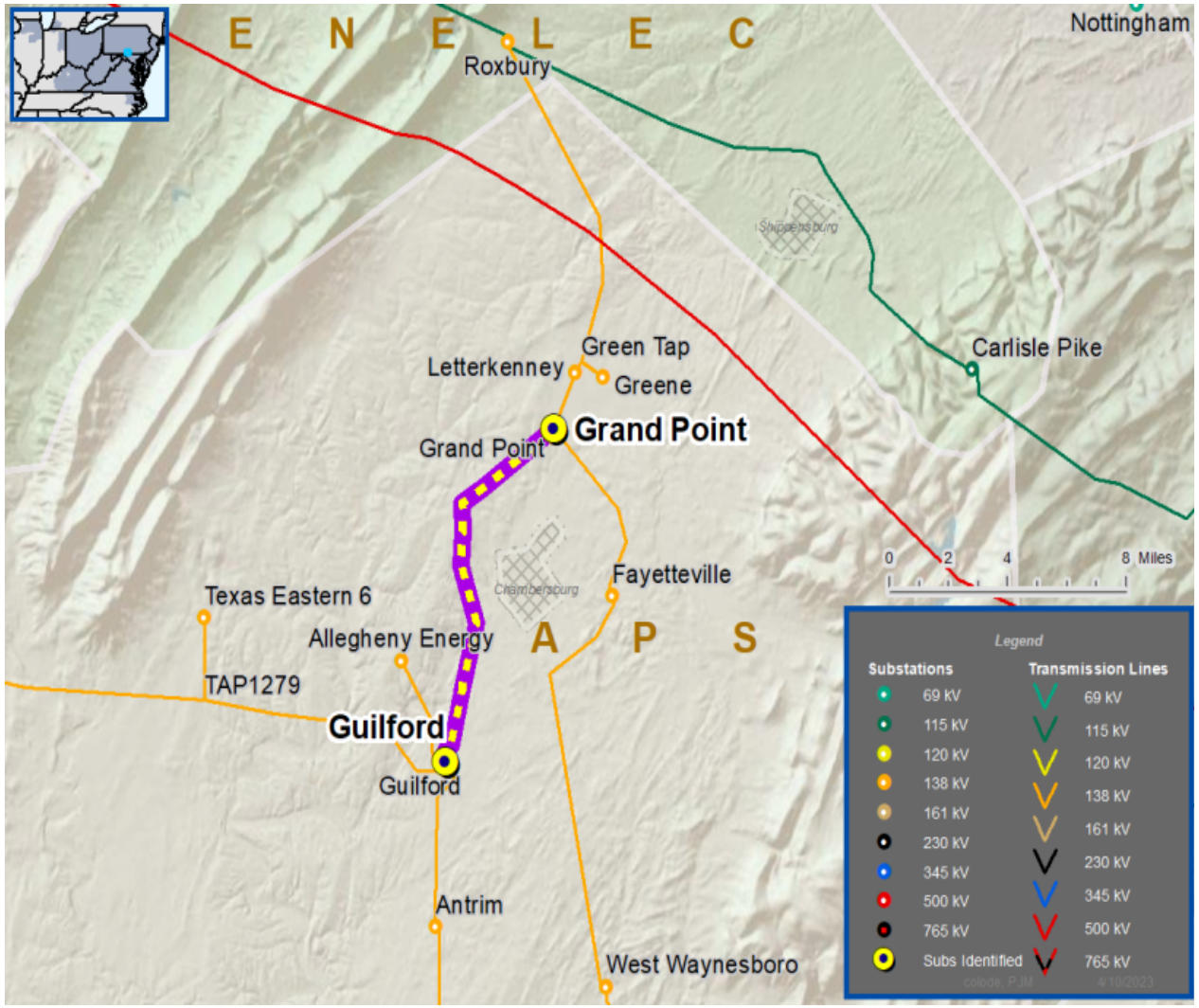
Specific Assumption Reference(s)
- System reliability and performance
- Substation/line equipment limits

Problem Statement

A new customer connection causes a thermal violation on the Guilford – Grandpoint 138 kV line.

Transmission line ratings are limited by terminal equipment.

Guilford – Grand Point 138 kV (Substation conductor, wave trap):
- Existing line rating: 195 / 209 MVA (SN / SE)
- Existing conductor rating: 221 / 268 MVA (SN / SE)



APS Transmission Zone M-3 Process
Windsor Substation

Need Number: APS-2023-012

Process Stage: Need Meeting 04/21/2023

Project Driver: *Equipment Material Condition, Performance and Risk*

Specific Assumption Reference:

Substation Condition Rebuild/Replacement

- Age/condition of structural components and their associated foundations

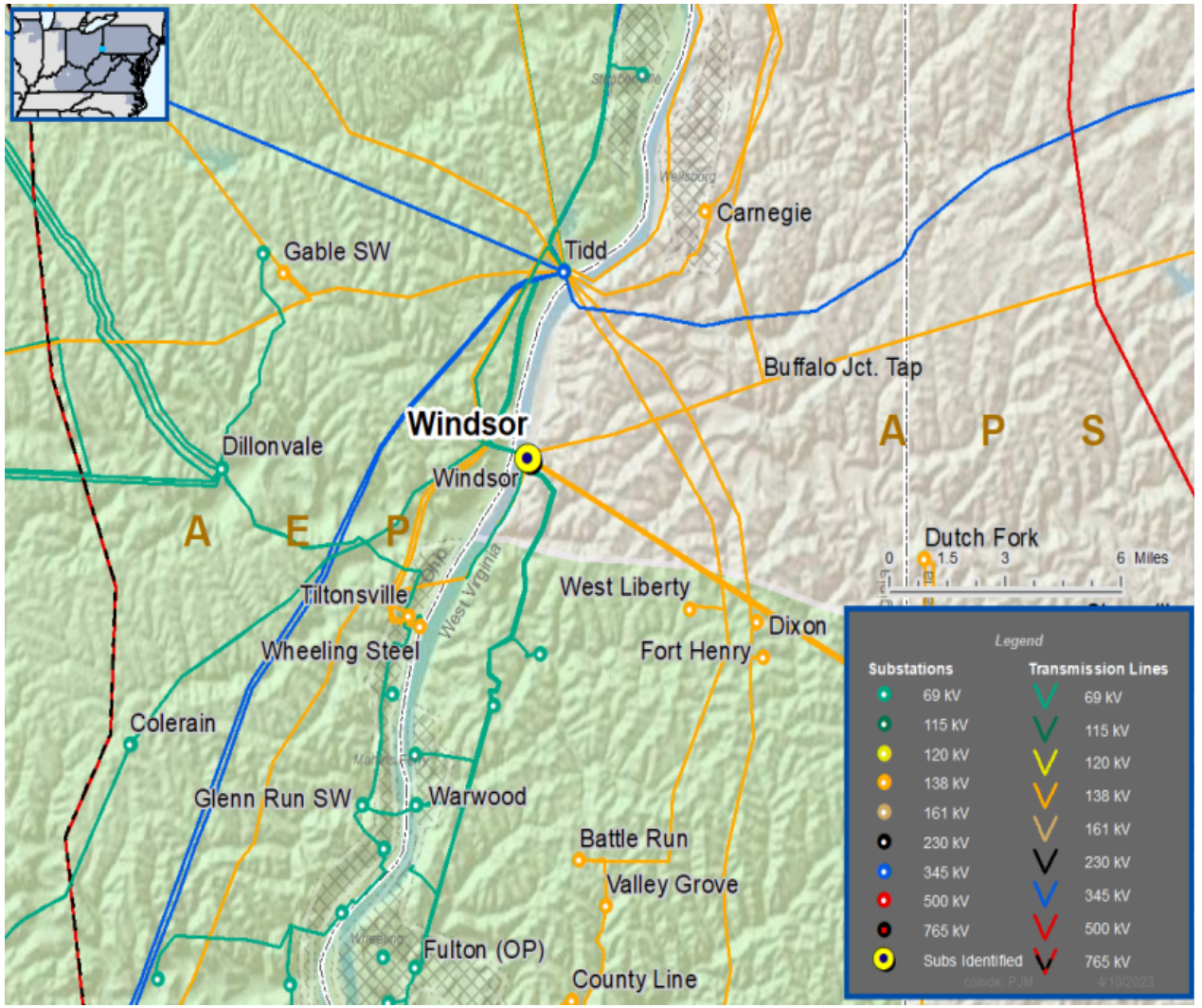
System Performance Projects Global Factors

- Substation/line equipment limits

Problem Statement:

The Windsor Substation in West Virginia is exhibiting significant deterioration and soil erosion.

- Windsor Substation was constructed in 1915.
- A condition assessment has shown eroded soil, deteriorated ground grid, crumbling structure foundations, and steel structure deterioration.
- Windsor Substation has four networked 138 kV lines, two networked 25 kV lines, and one 138/25 kV transformer.



Solution

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

APS Transmission Zone M-3 Process Misoperation Relay Project

Need Number: APS-2021-007
Process State: Solution Meeting 04/21/2023
Previously Presented: Need Meeting 08/16/2021

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

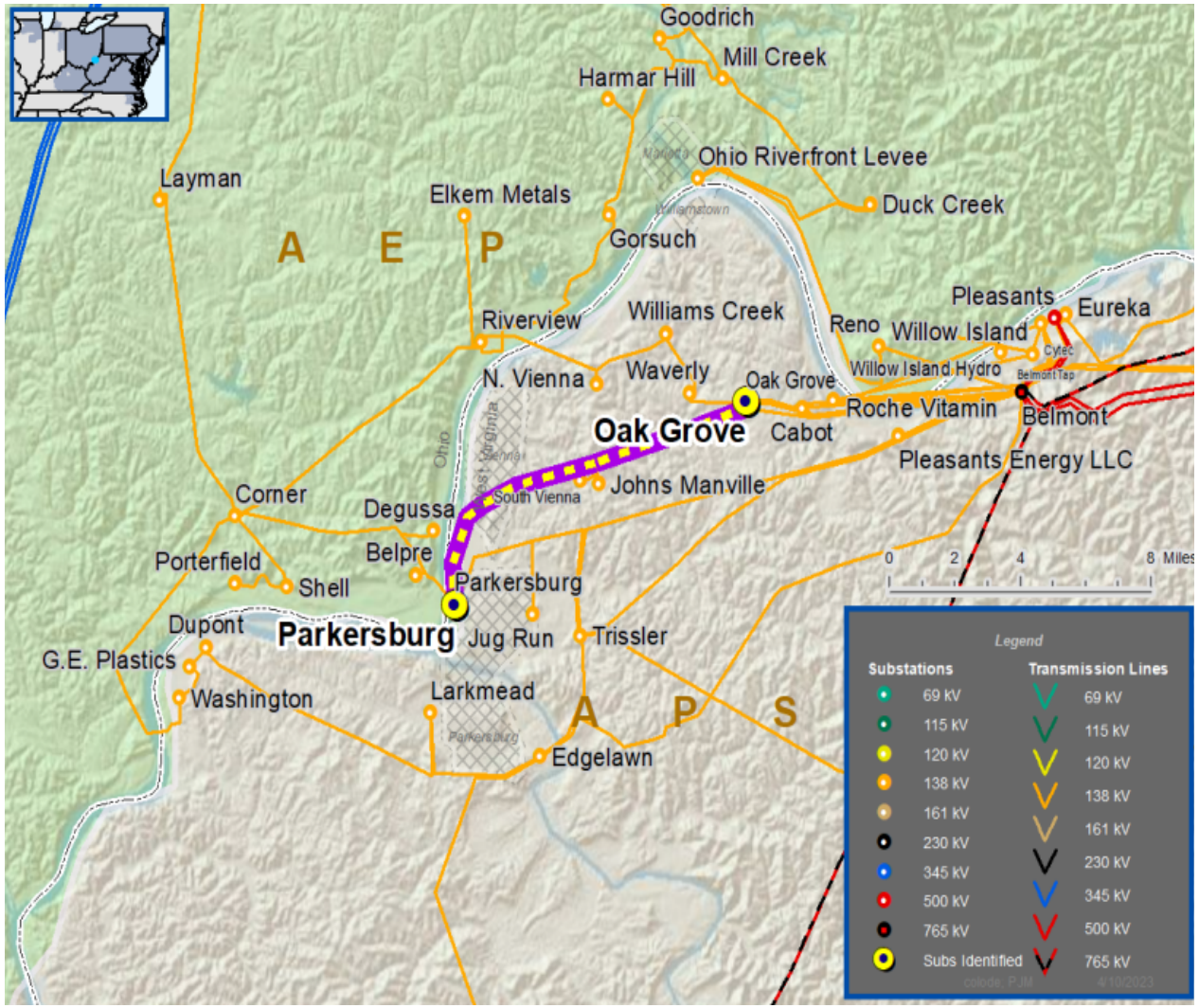
Problem Statement:

- 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 State: Solution Meeting 04/21/2023
Previously Presented: Need Meeting 08/16/2021

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

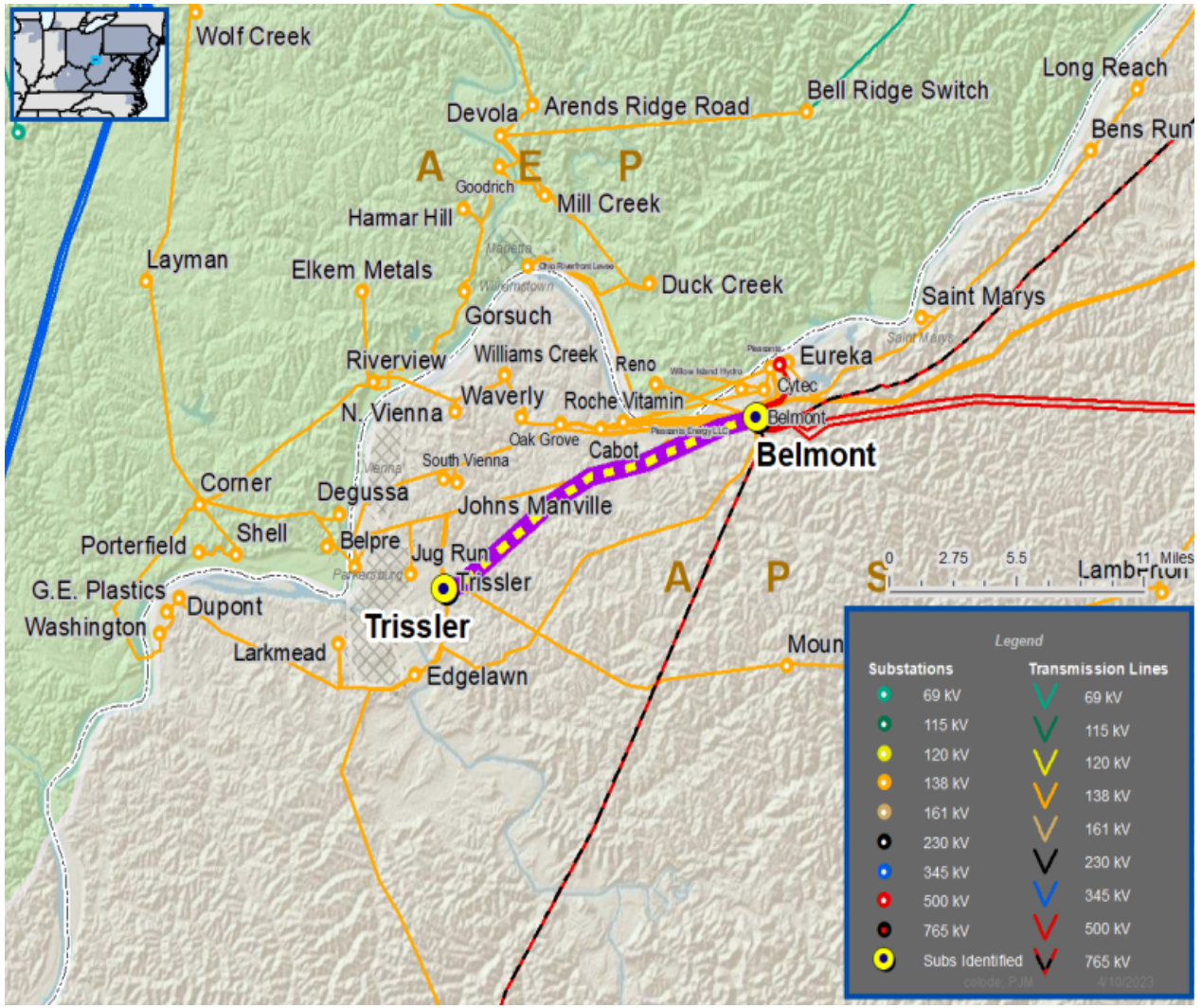
Problem Statement:

- 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 State: Solution Meeting 04/21/2023
Previously Presented: Need Meeting 08/16/2021

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

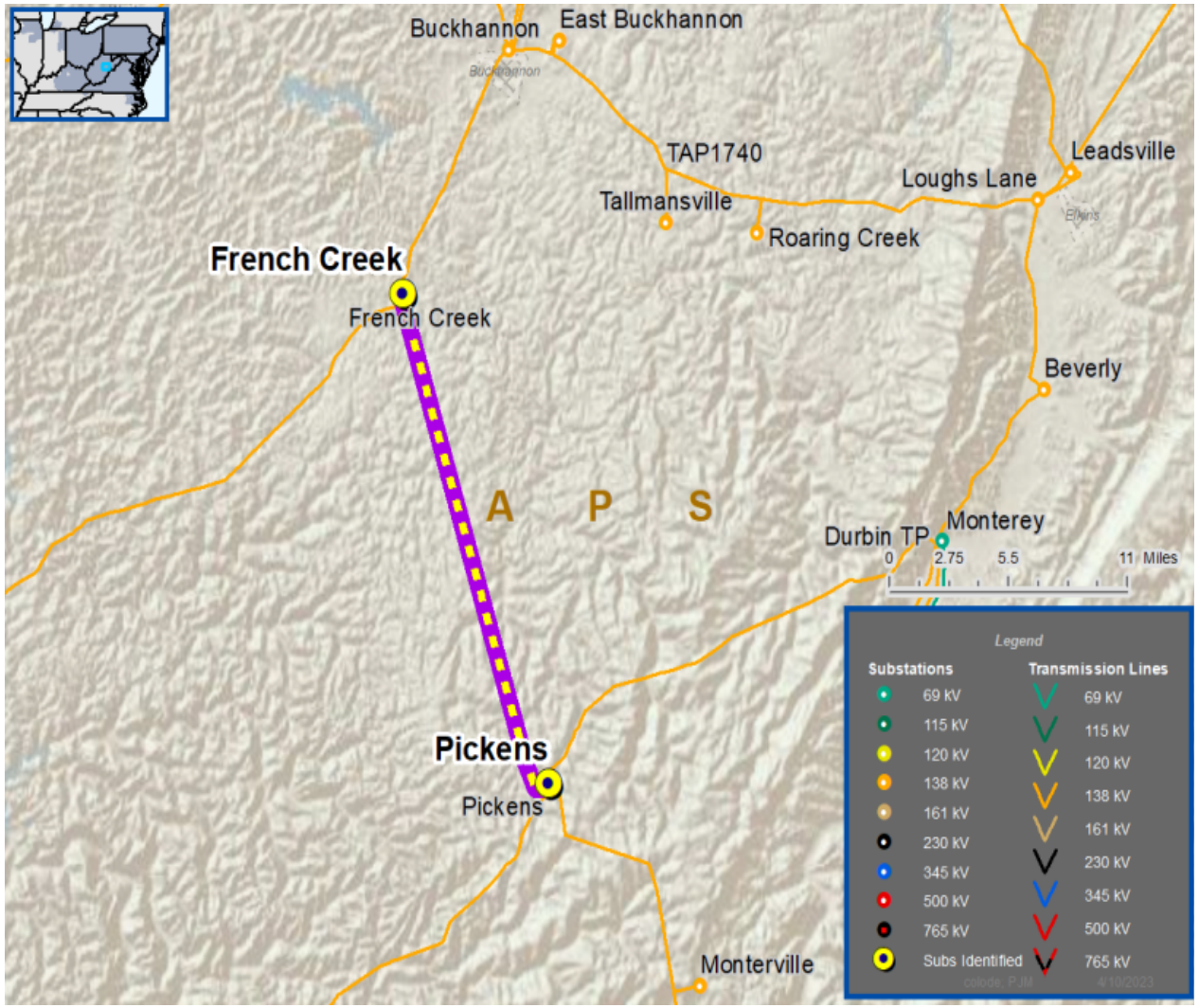
Problem Statement:

- 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

Need Number	Transmission Line / Substation Locations	New MVA Line Rating (SN / SE)	Scope of Work	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	$ 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	$ 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	$ 2.15 M	4/21/2023

Alternatives Considered: Maintain existing condition

Project Status: In construction

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

APS Transmission Zone M-3 Process

Need Number: APS-2023-003

Process Stage: Solution Meeting 4/21/2023

Previously Presented: Need Meeting 2/17/2023

Project Driver:

Customer Service

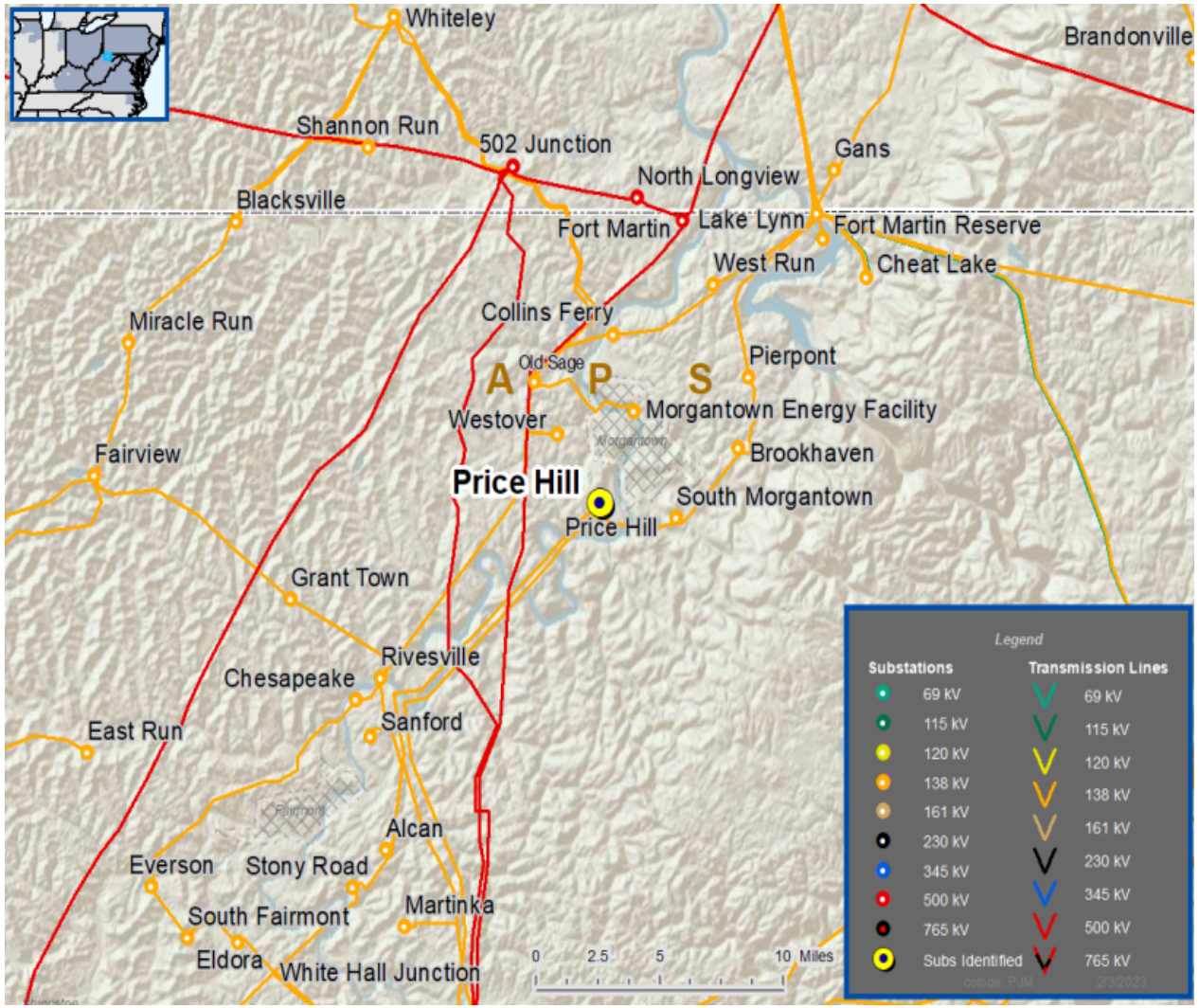
Specific Assumption Reference:

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 is 3/17/2023



APS Transmission Zone M-3 Process

Need Number: APS-2023-003

Process Stage: Solution Meeting 4/21/2023

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:

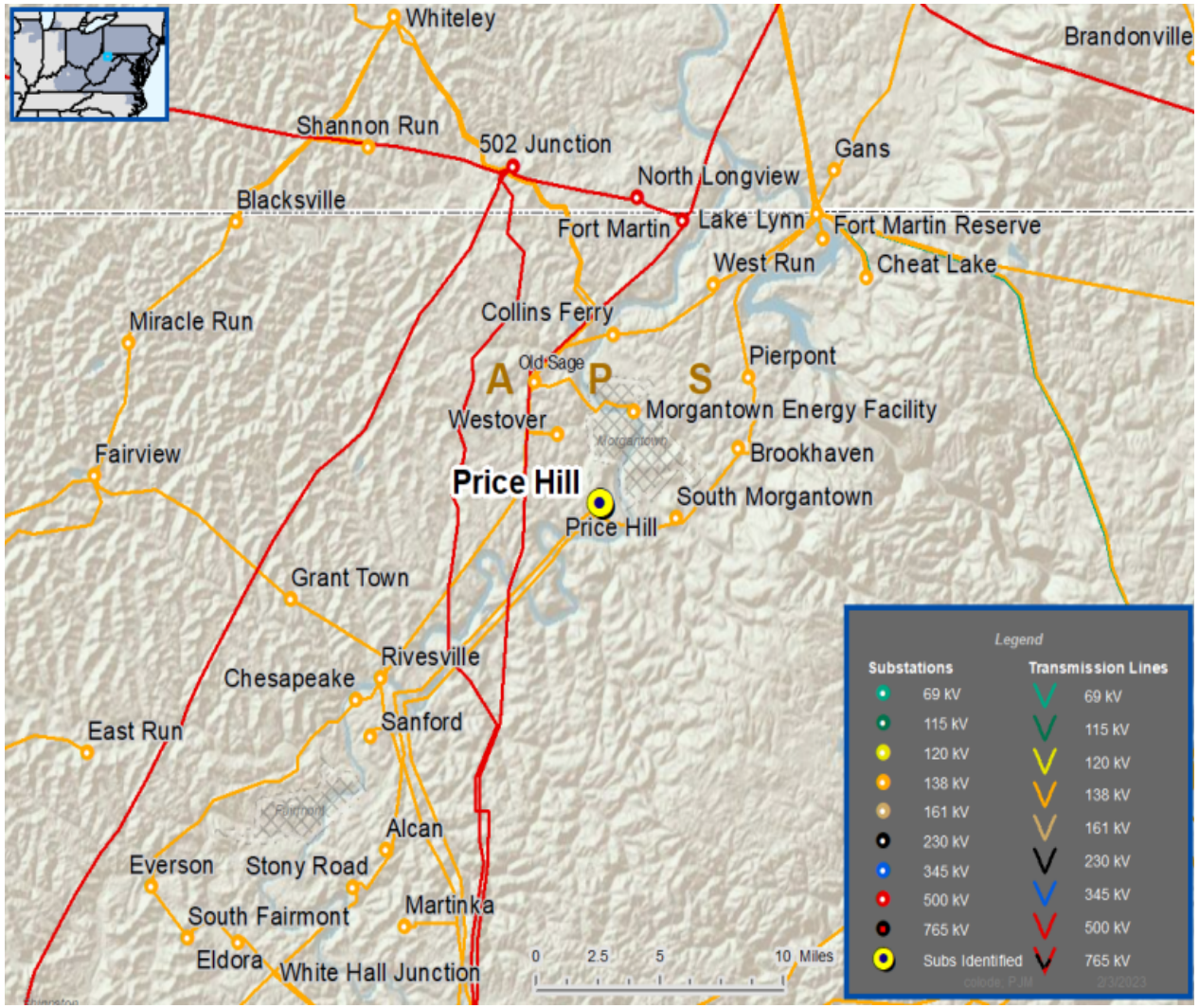
- None

Estimated Project Cost: $0.3M

Projected In-Service: 5/8/2023

Project Status: Under Construction

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



APS Transmission Zone M-3 Process

Need Number: APS-2023-004

Process Stage: Solution Meeting 04/21/2023

Previously Presented: Need Meeting 03/17/2023

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)

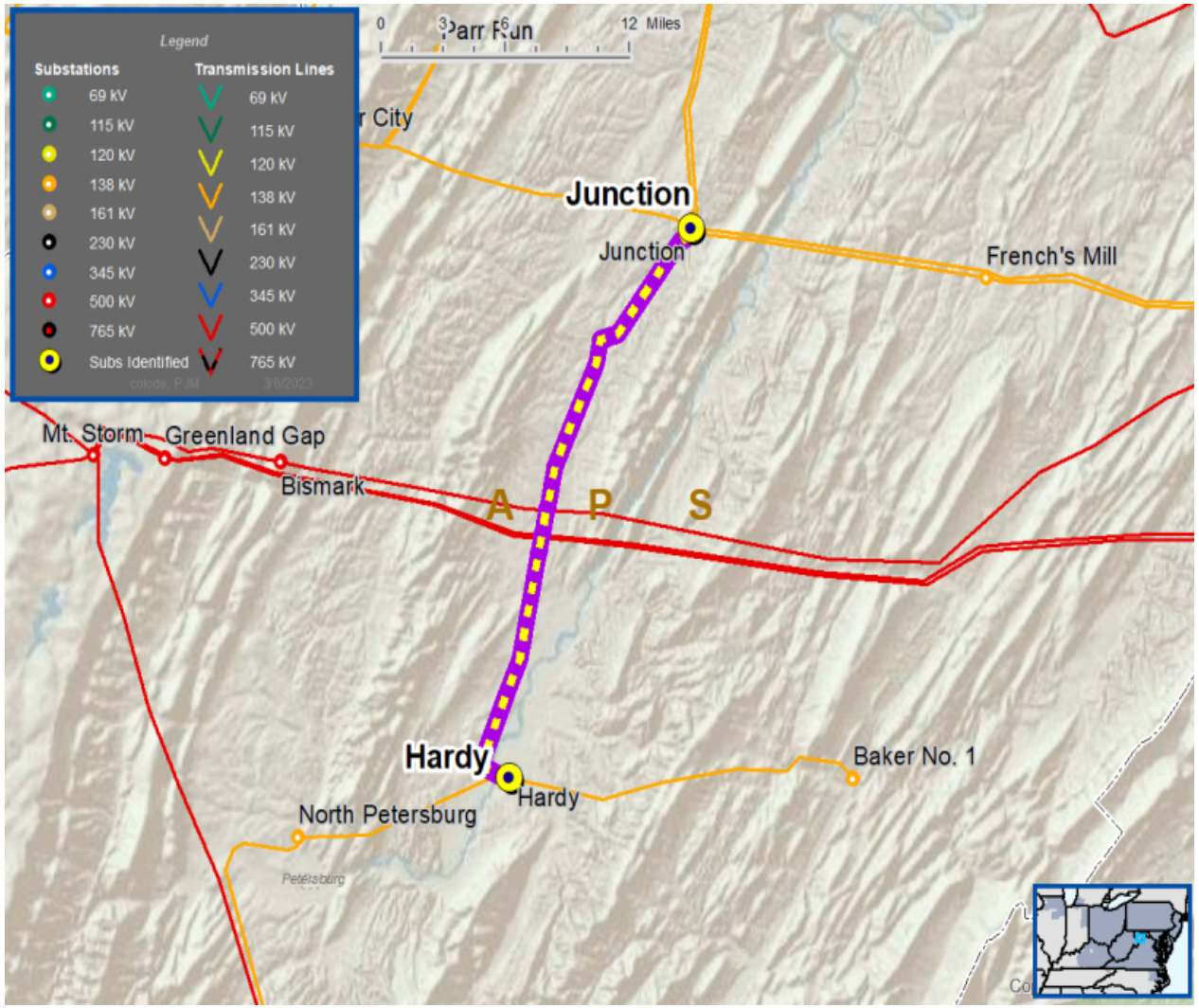
System Performance Projects Global Factors

- 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: Solution Meeting 04/21/2023

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

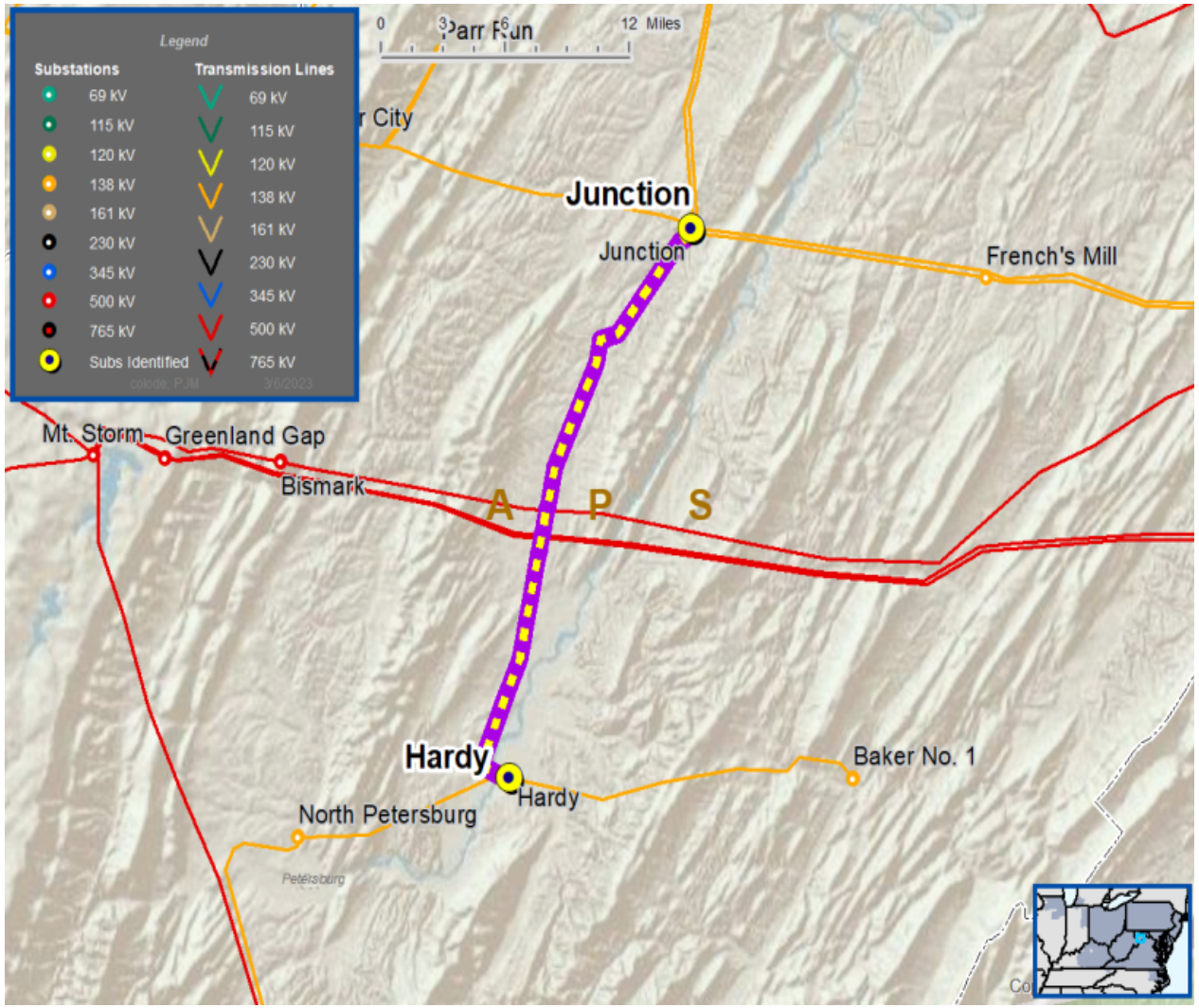
Transmission Line Ratings:

- 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
Project Status: Conceptual
Model: 2022 RTEP model for 2027 Summer (50/50)



APS Transmission Zone M-3 Process

Need Number: APS-2023-005

Process Stage: Solution Meeting 04/21/2023

Previously Presented: Need Meeting 03/17/2023

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)

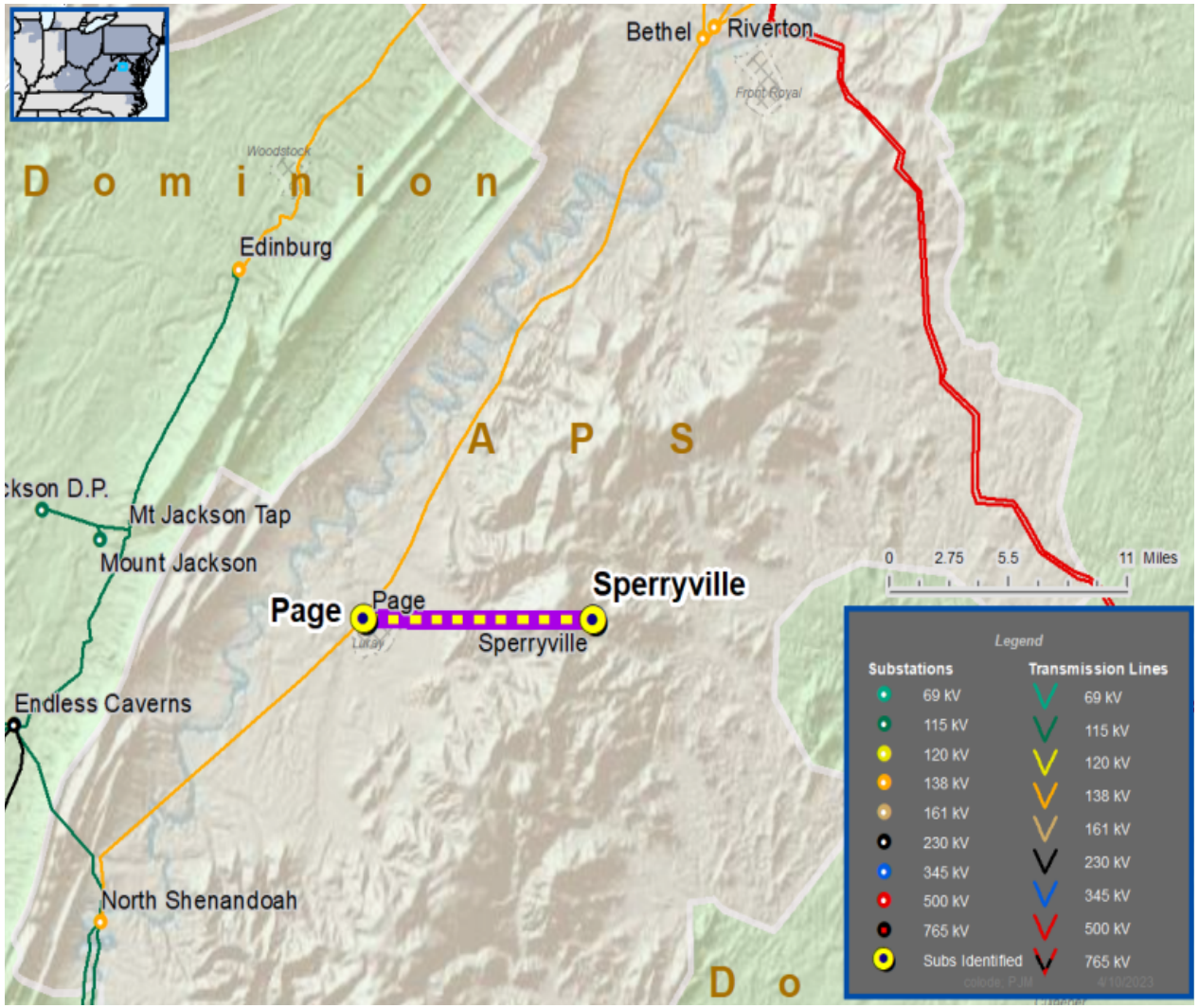
System Performance Projects Global Factors

- 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: Solution Meeting 04/21/2023

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

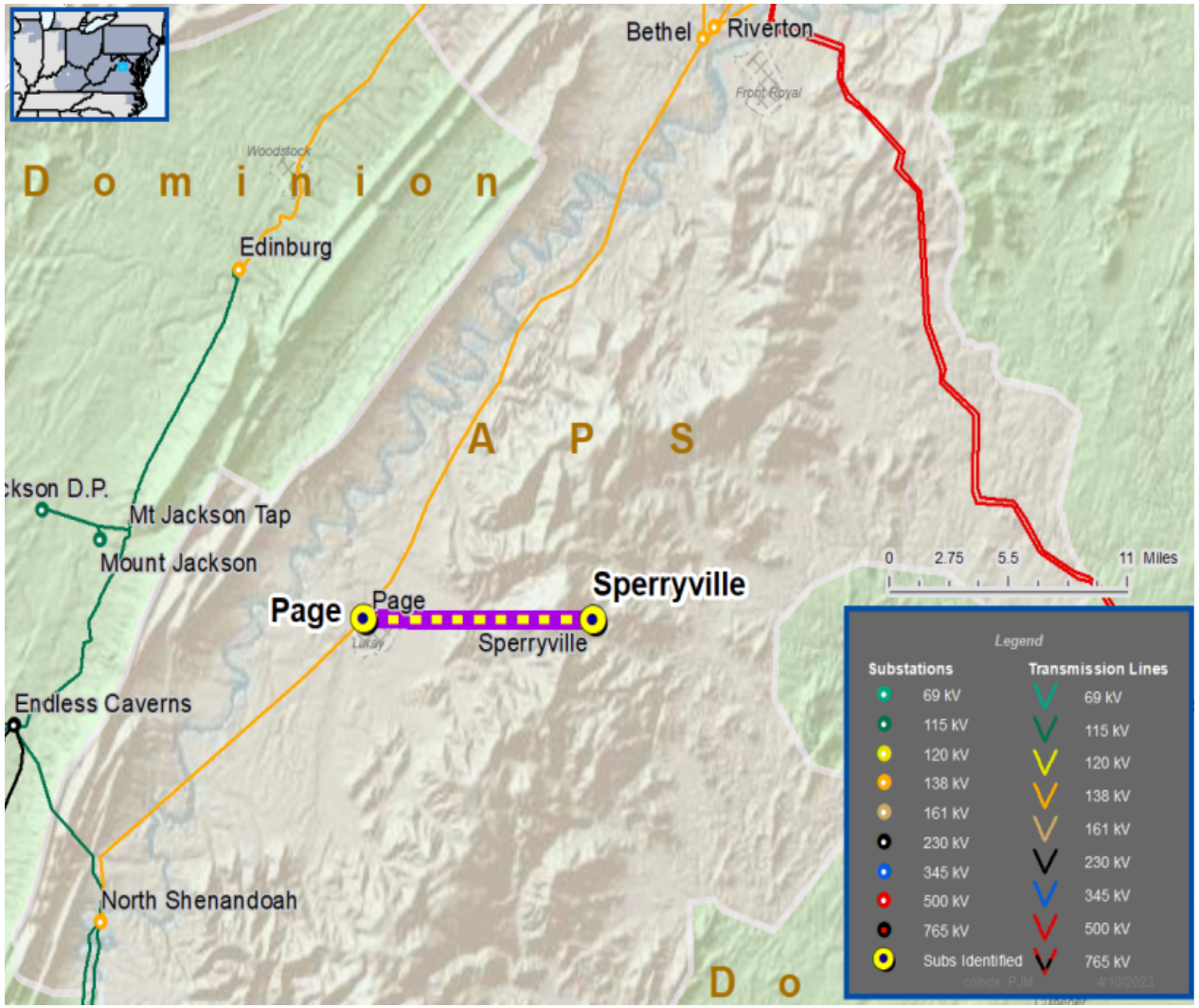
Transmission Line Ratings:

- 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
Project Status: Conceptual
Model: 2022 RTEP model for 2027 Summer (50/50)



Appendix

High Level M-3 Meeting Schedule

Assumptions

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

Needs

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

Solutions

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

Submission of Supplemental Projects & Local Plan

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

Revision History

4/xx/2022– V1 – Original version posted to pjm.com