# Transmission Expansion Advisory Committee FirstEnergy Supplemental Projects

October 31, 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
# Misoperation Relays

**Need Numbers:** APS-2023-056, APS-2023-057

**Process State:** 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cases the protection equipment cannot be repaired due to a lack of replacement parts and available expertise in the outdated technology.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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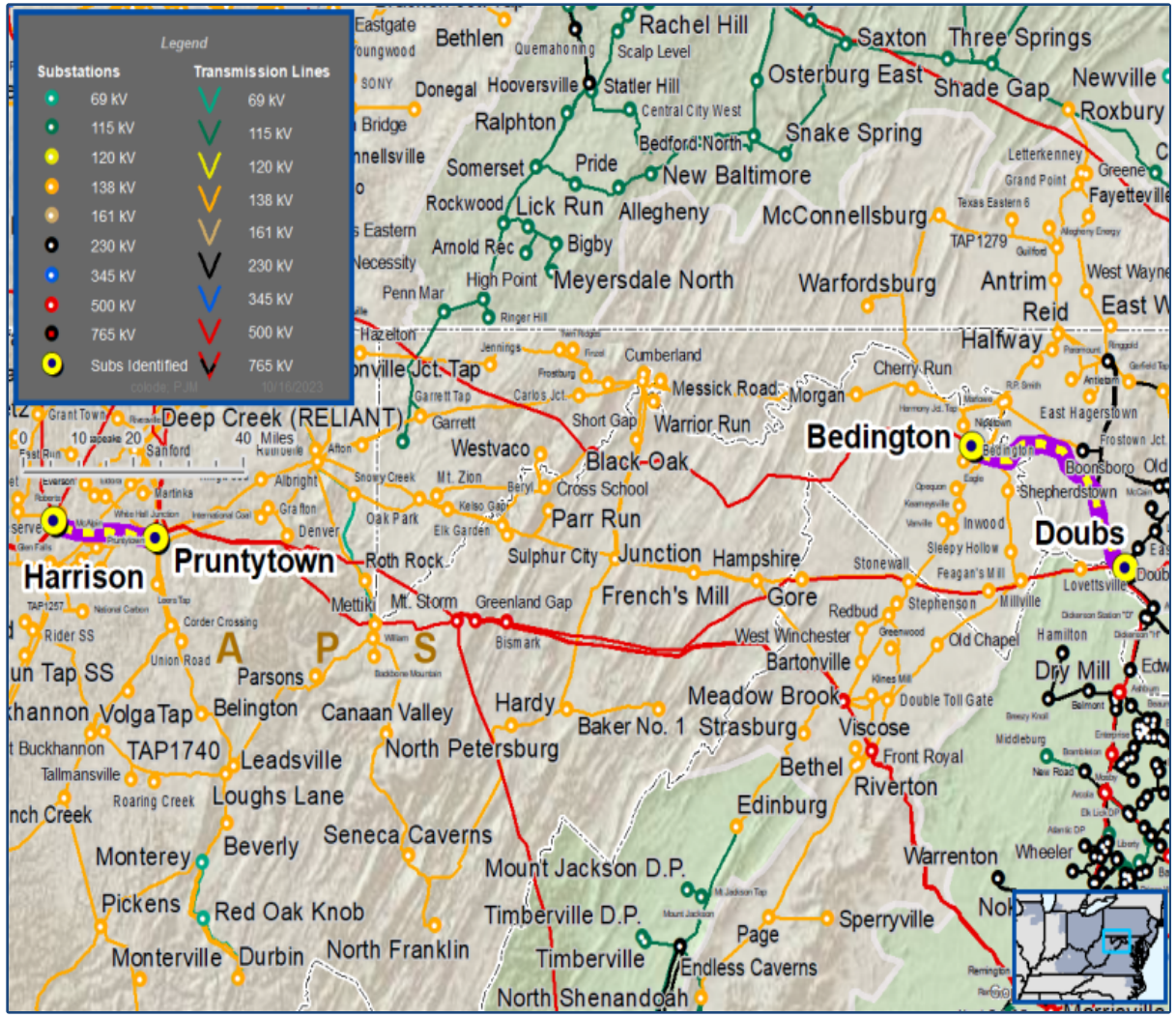

# APS Transmission Zone M-3 Process
# Misoperation Relays

| 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-2023-057 | Bedington – Doubs 500 kV | 3526 / 3792 | 3573 / 4379 |

# APS Transmission Zone M-3 Process
# Carroll – Mount Airy 230 kV Line

**Need Numbers:** APS-2023-058

**Process State:** Need Meeting 10/31/2023

**Project Driver:**
- *Equipment Material Condition, Performance and Risk*
- *Operational Flexibility and Efficiency*

**Specific Assumption Reference:**

System Performance Projects Global Factors
- System Reliability and Performance
  - Line Condition Rebuild/Replacement
- Substation/line equipment limits
- Upgrade Relay Schemes

**Problem Statement:**
- Carroll - Mount Airy 230 kV line was constructed in 1965 with wood pole H-Frame and has evidence of accelerated wood pole decay and woodpecker damage.
- 93 out of 112 structures failed inspection.
- Rebuild is needed for approximately 12.7 miles of wood pole construction on the line based on condition and equipment caused outage history.

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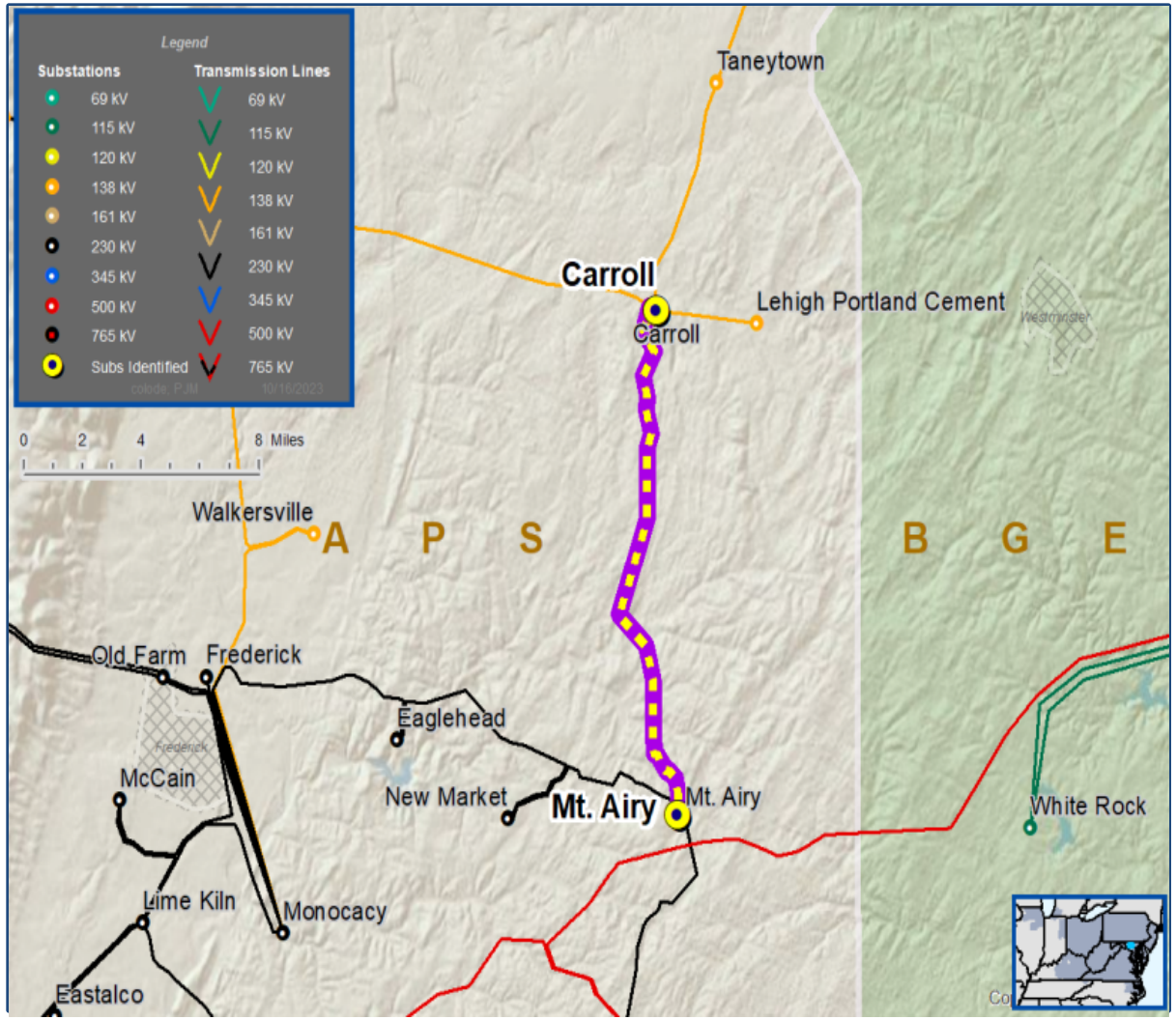


# APS Transmission Zone M-3 Process
# Carroll – Mount Airy 230 kV Line

| Need # | Transmission Line / Substation Locations | Existing Line Rating (SN / SE) | Existing Conductor Rating (SN / SE) |
|---|---|---|---|
| APS-2023-058 | Carroll – Mt Airy 230 kV | 251 / 343 | 617 / 754 |

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

**Need Numbers:** APS-2023-063

**Process State:** Need Meeting 10/31/2023

**Project Driver:**

- *Performance and Risk*
- *Operational Flexibility and Efficiency*

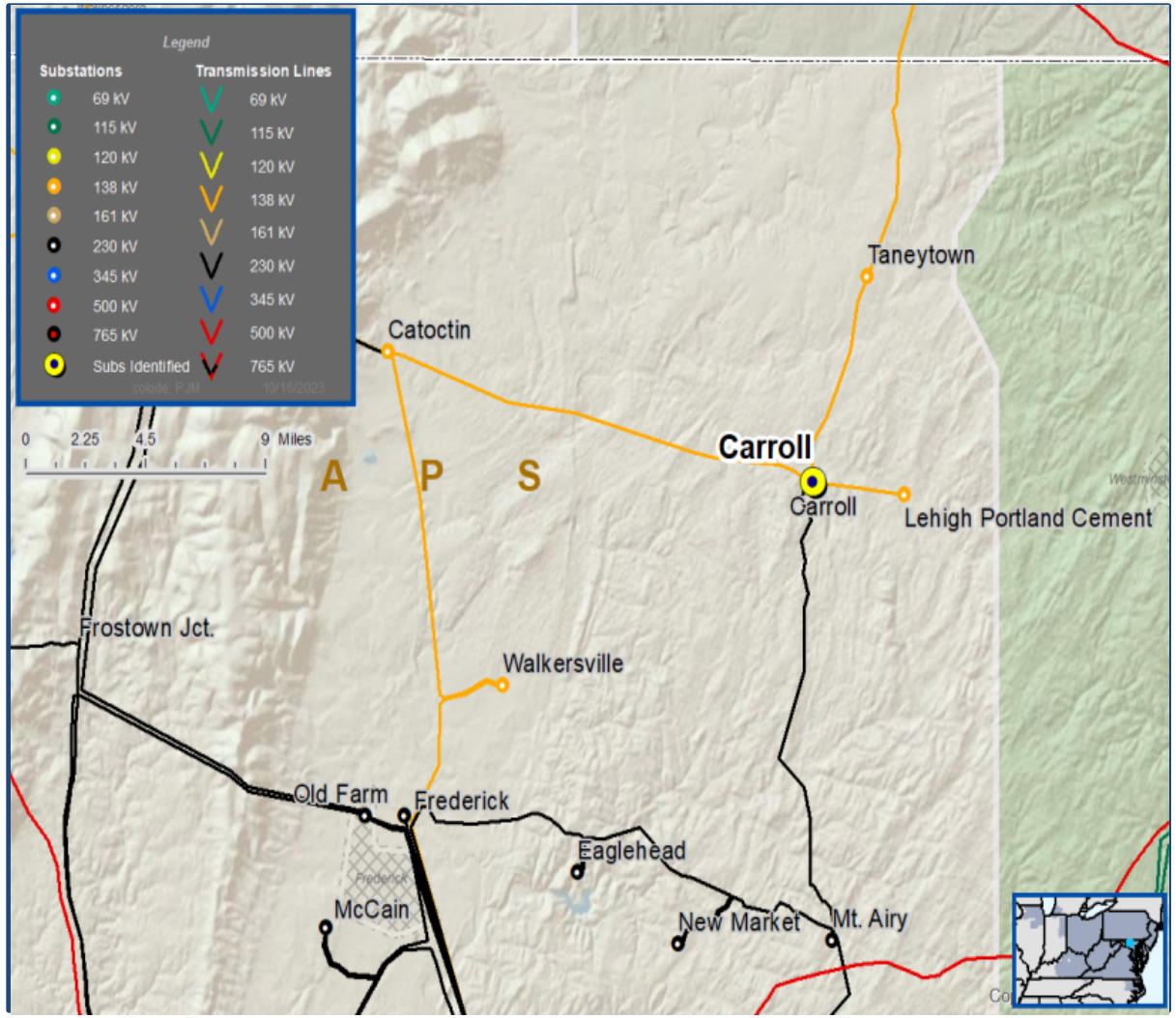
**Specific Assumption Reference:**

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 Zones M-3 Process
# Shingletown Substation

**Need Number:** APS-2023-059, PN-2023-022

**Process Stage:** Need Meeting 10/31/2023

**Project Driver:**

*System Performance and Operational Flexibility*

**Specific Assumption Reference:**

*Global Factors*

- System reliability and performance
- Substation and line equipment limits
- Add/Expand Bus Configuration

**Problem Statement:**

- The existing 230 kV yard at Shingletown is configured as a straight bus. Shingletown serves approximately 82.7 MW of load and 1,152 customers. With a stuck breaker contingency, the entire Shingletown substation will be outaged.
- Transmission line ratings are limited by terminal equipment:

Dale Summit – Shingletown 230 kV Line

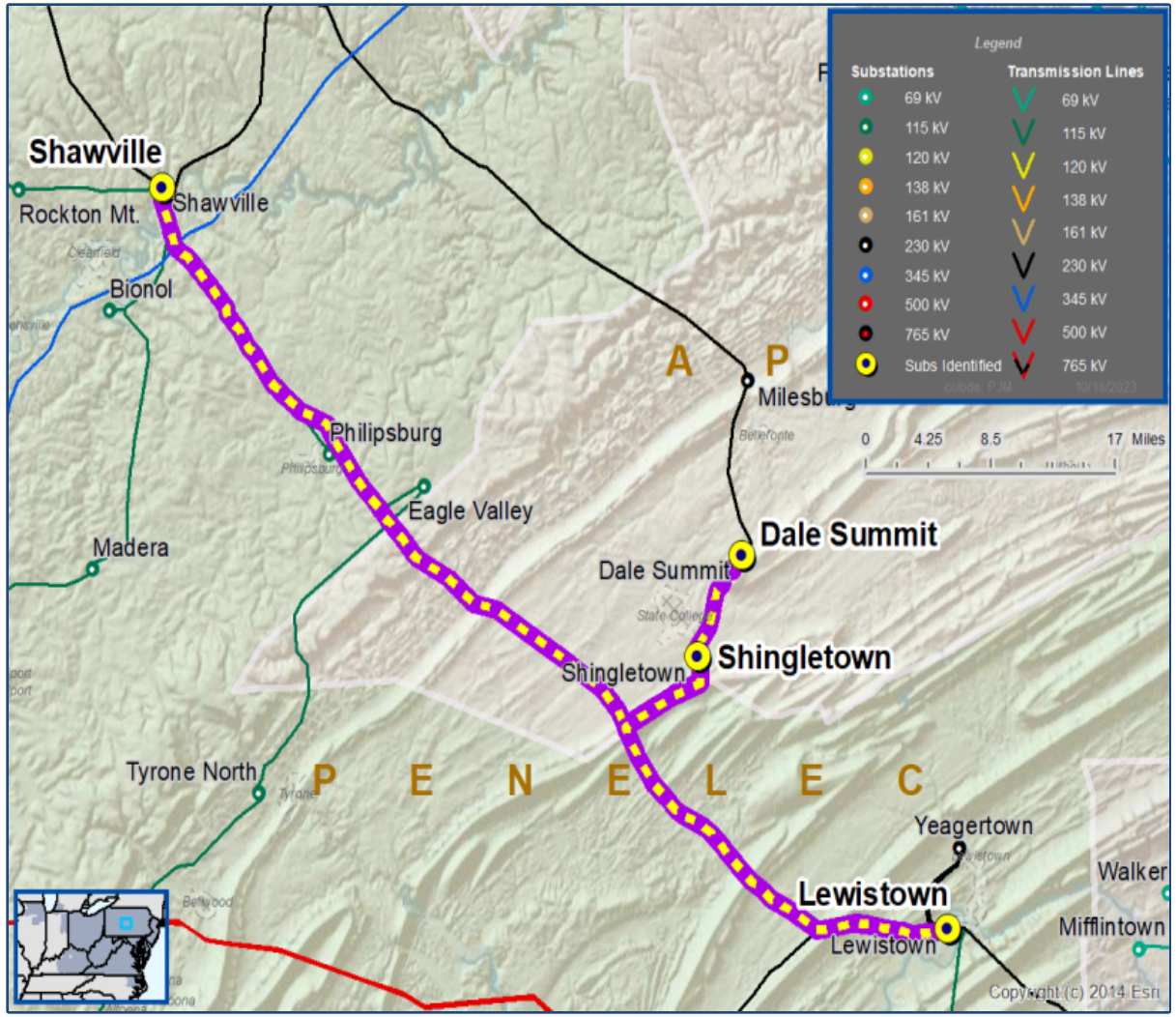
- Existing line rating: 486 / 523 MVA (SN / SE)
- Existing Transmission Conductor Rating: 617/ 754 MVA (SN / SE)

Lewistown – Shingletown 230 kV Line

- Existing line rating: 512 / 612 MVA (SN / SE)
- Existing Transmission Conductor Rating: 546 / 666 MVA (SN / SE)

Shawville – Shingletown 230 kV Line

- Existing line rating: 445 / 587 MVA (SN / SE)
- Existing Transmission Conductor Rating: 546 / 666 MVA (SN / SE)



# APS Transmission Zone M-3 Process
# Cabot #2 500/138 kV Transformer

**Need Numbers:** APS-2023-060

**Process State:** Need Meeting 10/31/2023

**Project Driver:**

- *Performance and Risk*
- *Operational Flexibility and Efficiency*
- *Infrastructure Resilience*

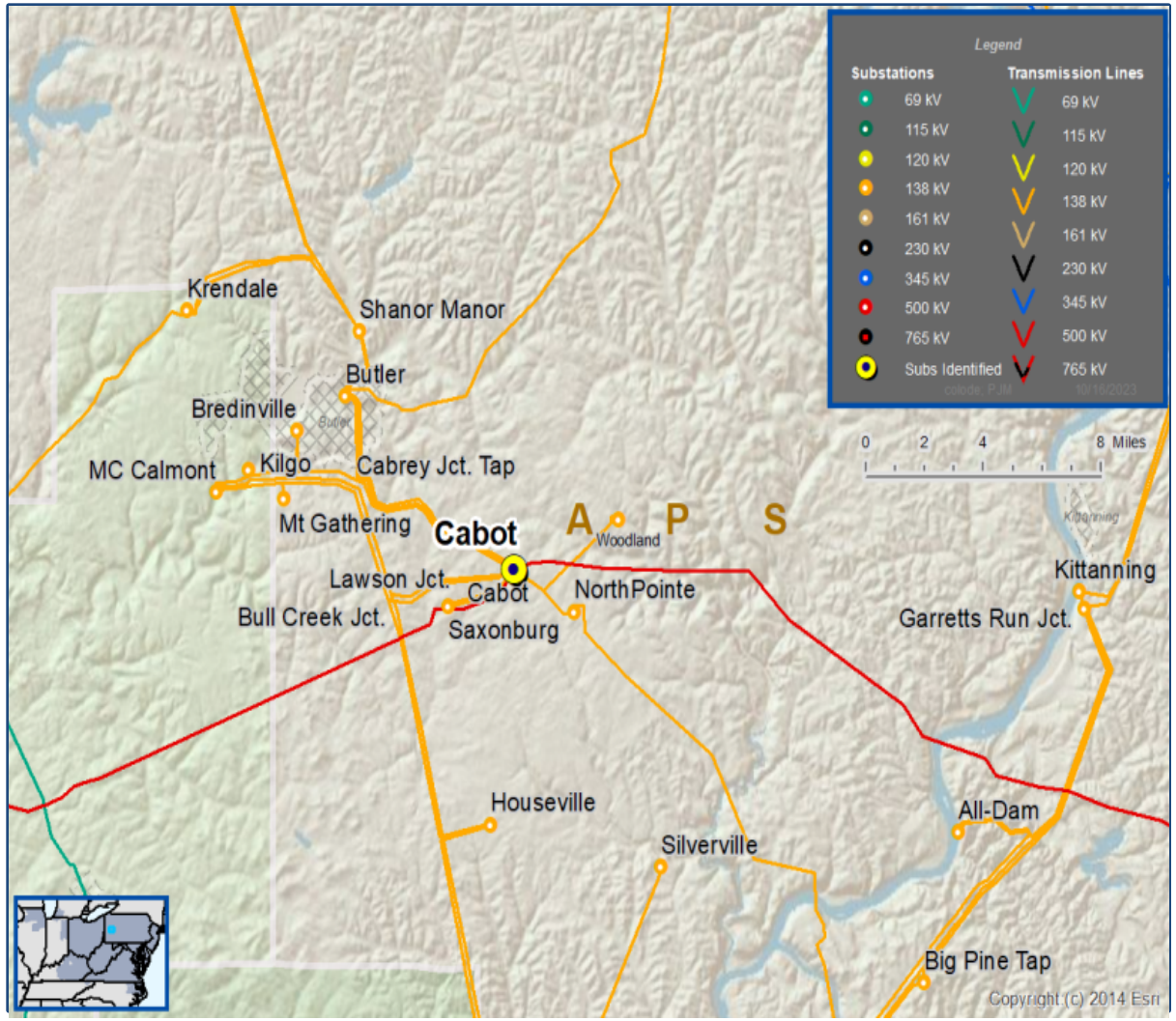
**Specific Assumption Reference:**

System Performance Projects Global Factors

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

**Problem Statement:**

- The 500/138 kV Transformer #2 at Cabot is approximately 53 years old and is approaching end of life.
- The transformer exhibits multiple maintenance issues including:
  - Elevated methane and ethane gas levels compared with IEEE Standards
  - Equipment degradation and obsolete replacement parts.
- Existing transformer ratings:
  - 458 / 600 MVA (SN/SSTE)



# APS Transmission Zone M-3 Process
# Cabot #4 500/138 kV Transformer

**Need Numbers:** APS-2023-061

**Process State:** Need Meeting 10/31/2023

**Project Driver:**

- *Performance and Risk*
- *Operational Flexibility and Efficiency*
- *Infrastructure Resilience*

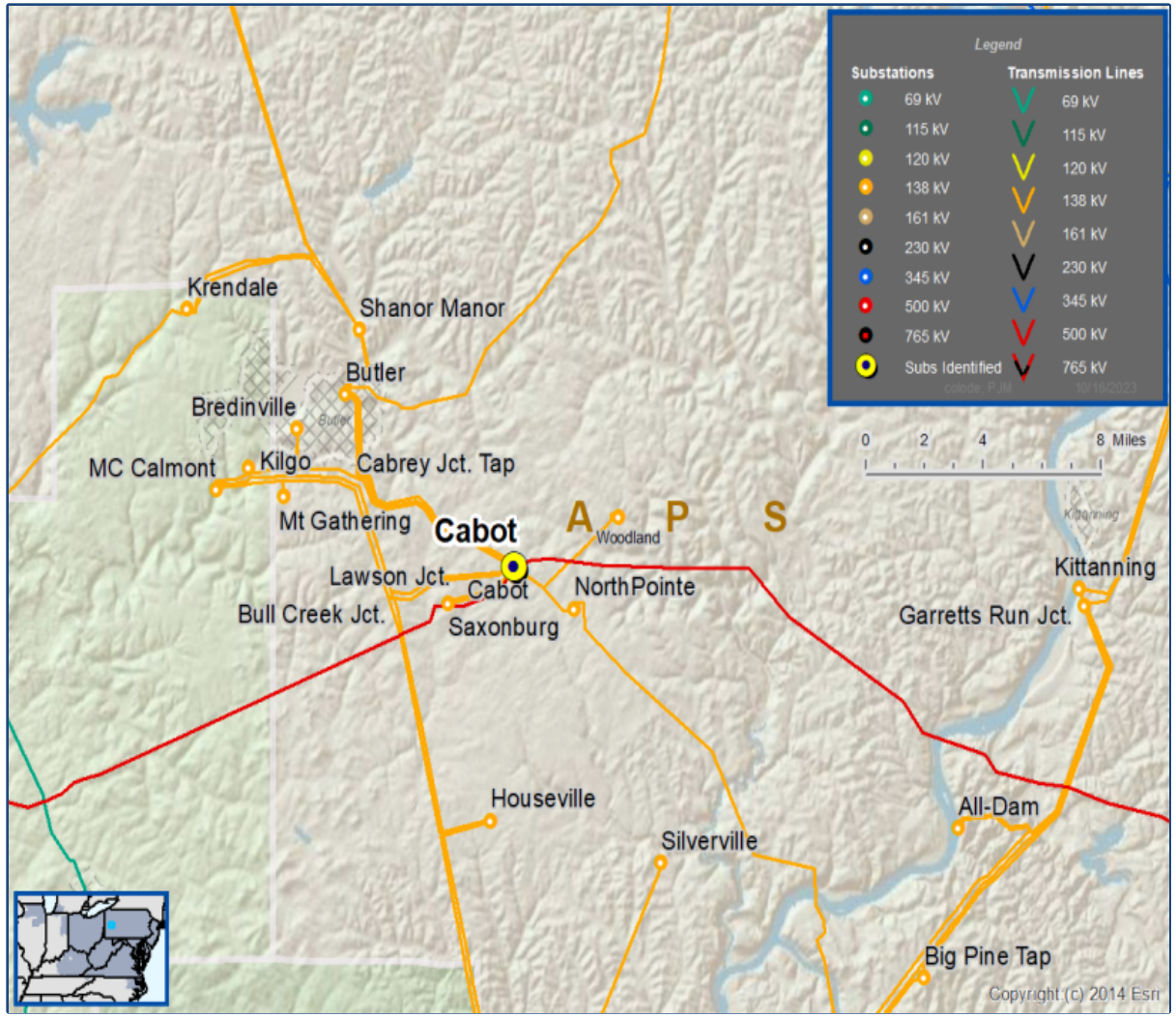
**Specific Assumption Reference:**

System Performance Projects Global Factors

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

**Problem Statement:**

- The 500/138 kV Transformer #4 at Cabot is approximately 57 years old and is approaching end of life.
- The transformer exhibits multiple maintenance issues including:
  - Elevated methane and ethane gas levels compared with IEEE Standards
  - Equipment degradation and obsolete replacement parts.
- Existing transformer ratings:
  - 467 / 585 MVA (SN/SSTE)



# APS Transmission Zone M-3 Process
# Cabot #1 500/138 kV Transformer

**Need Numbers:** APS-2023-062

**Process State:** Need Meeting 10/31/2023

**Project Driver:**

- *Performance and Risk*
- *Operational Flexibility and Efficiency*
- *Infrastructure Resilience*

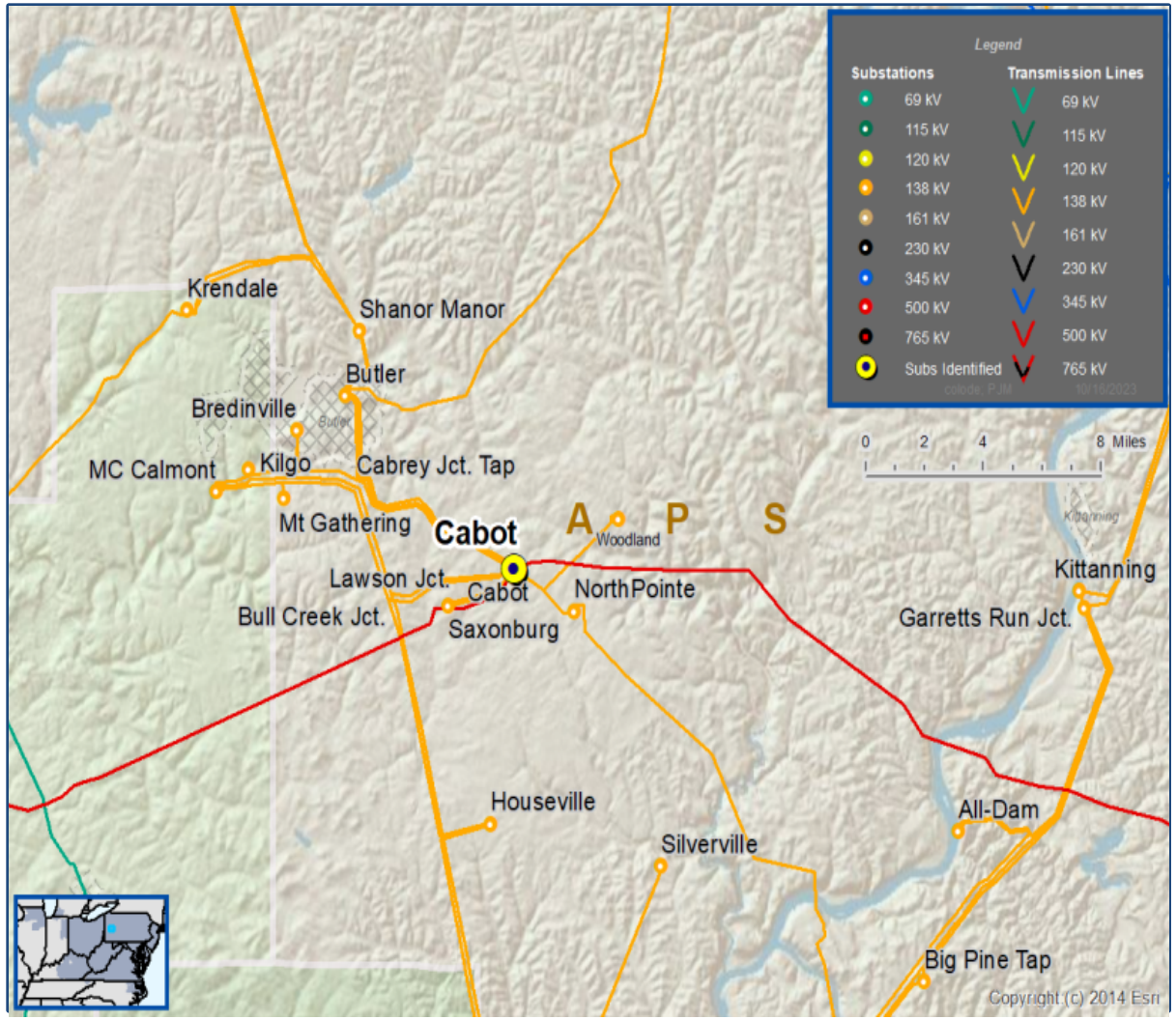
**Specific Assumption Reference:**

System Performance Projects Global Factors

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

**Problem Statement:**

- The 500/138 kV Transformer #1 at Cabot is approximately 51 years old and is approaching end of life.
- The transformer exhibits multiple maintenance issues including:
  - Elevated methane and ethane gas levels compared with IEEE Standards
  - Equipment degradation and obsolete replacement parts.
- Existing transformer ratings:
  - 390 / 525 MVA (SN/SSTE)



# Solutions

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

# APS Transmission Zone M-3 Process
# Doubs Substation

**Need Number:** APS-2023-016
**Process Stage:** Solution Meeting 10/31/2023
**Previously Presented:** Need Meeting 6/6/2023

**Project Driver(s):**

*Performance and Risk, Operational Flexibility and Efficiency*

**Specific Assumption Reference(s):**

System Performance Projects Global Factors

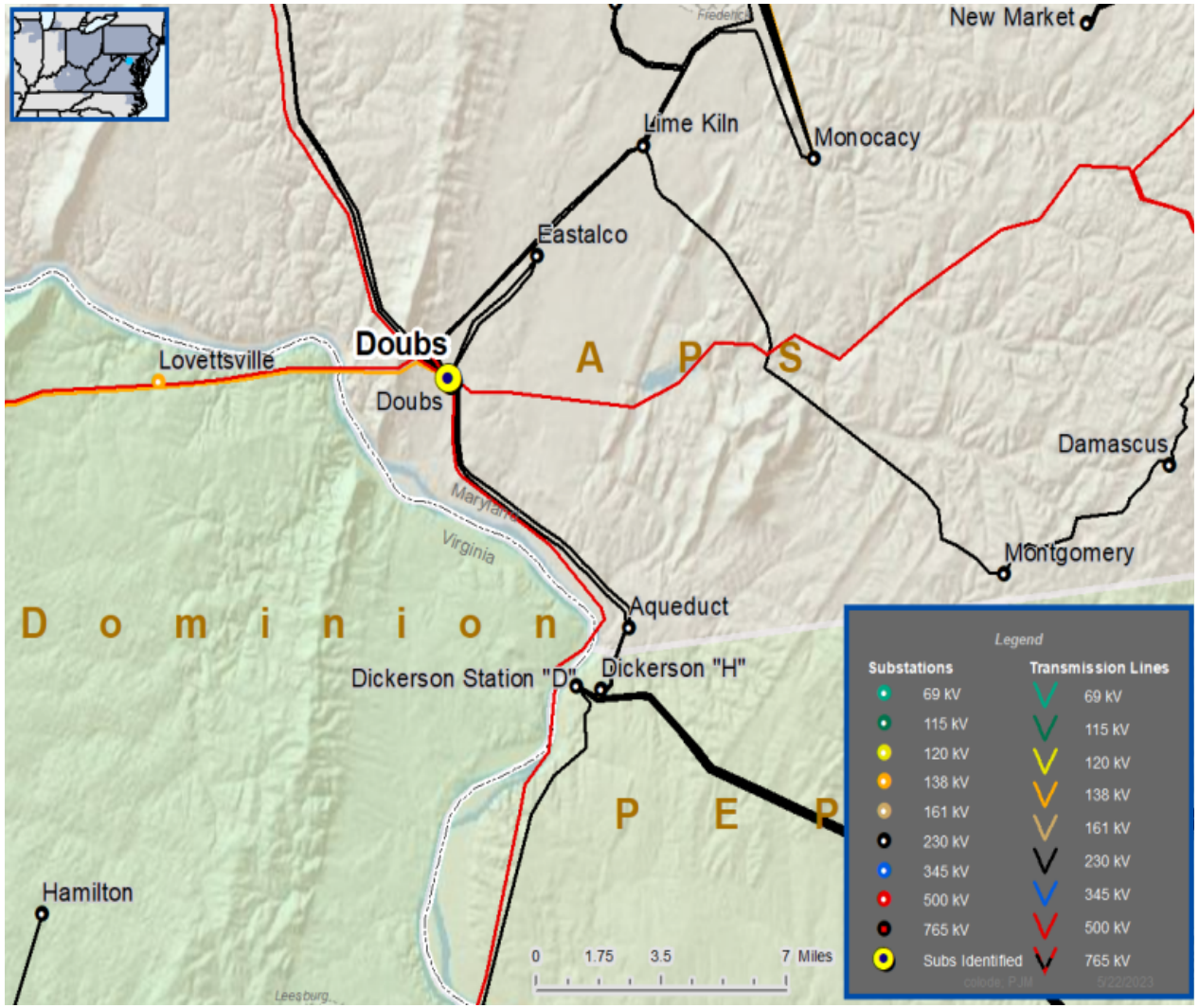
- System reliability and performance
- Reliability of Non-Bulk Electric System (Non-BES) Facilities

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:** Solution Meeting – 10/31/2023

**Proposed Solutions:**

- 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 |

**Alternatives Considered:**

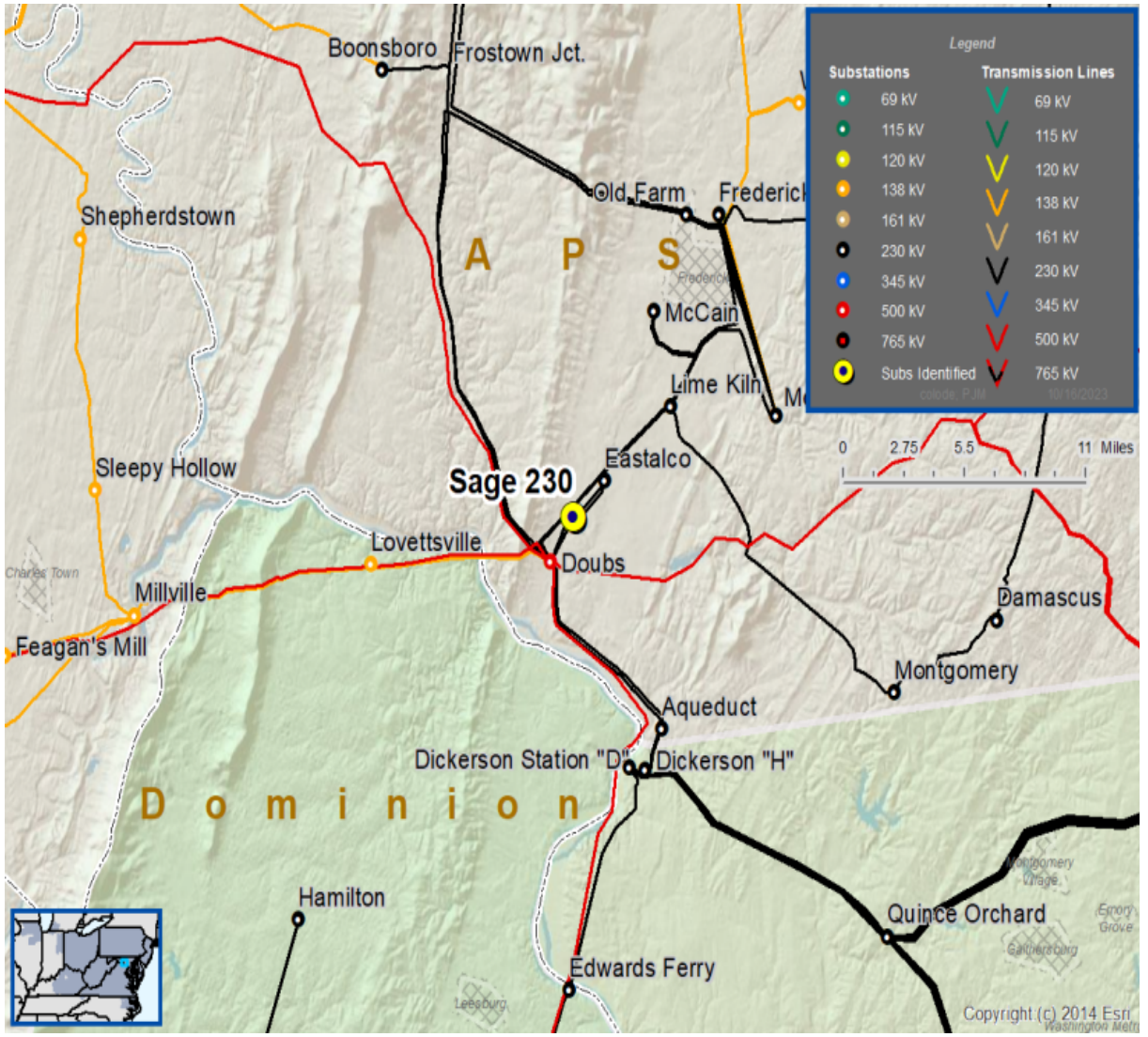
- Maintain existing condition and increasing risk of failure

**Estimated Project Cost:** $5.43M

**Projected In-Service:** 06/07/2024

**Status:** Engineering

**Model:** 2023 RTEP model for 2028 Summer (50/50)



# APS Transmission Zone M-3 Process
# Doubs-Sage #206 230 kV New Customer

**Need Number:** APS-2023-029

**Process Stage:** Solution Meeting – 10/31/2023

**Previously Presented:** Need Meeting – 7/11/2023

**Project Driver(s):**

*Customer Service*

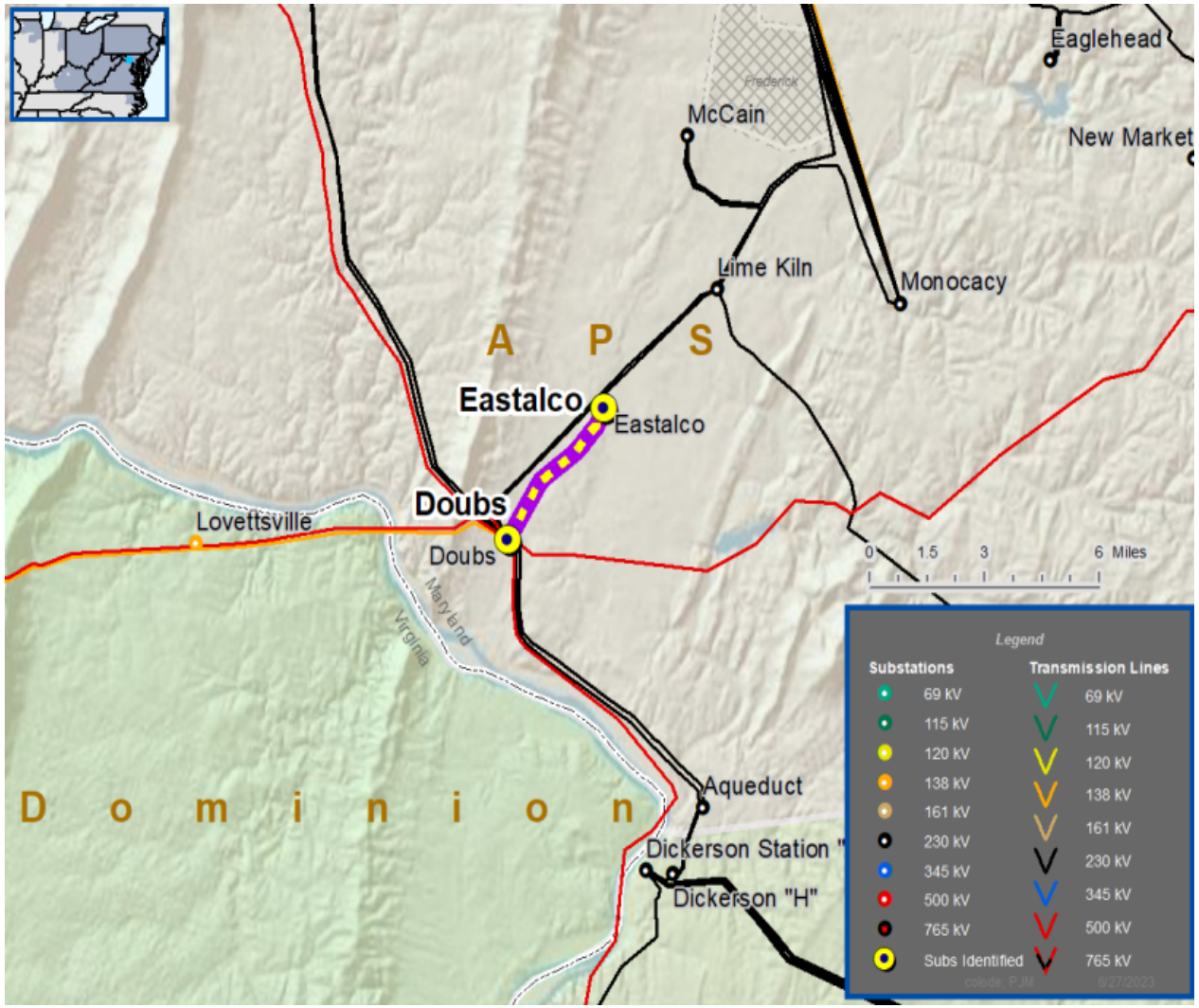
**Specific Assumption Reference(s)**

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- 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:** May 15, 2025



# APS Transmission Zone M-3 Process
# Doubs-Sage #206 230 kV New Customer

**Need Number:** APS-2023-029
**Process Stage:** Solution Meeting – 10/31/2023
**Previously Presented:** Need Meeting – 7/11/2023

**Proposed Solution:**

***230 kV Transmission Substation***

- Build a six breaker, two bay (expandable to four bays), breaker-and-a-half 230 kV 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
- Provide two 230 kV feeds to the customer facility

**Violations Identified during load study:**

- Thermal violation on the Doubs-Sage #206 230 kV Line
- Thermal violation on the #1, #2, and #4 500/230 kV transformers at Doubs Substation
- Thermal violation on the Doubs-Lime Kiln #207 230 kV Line

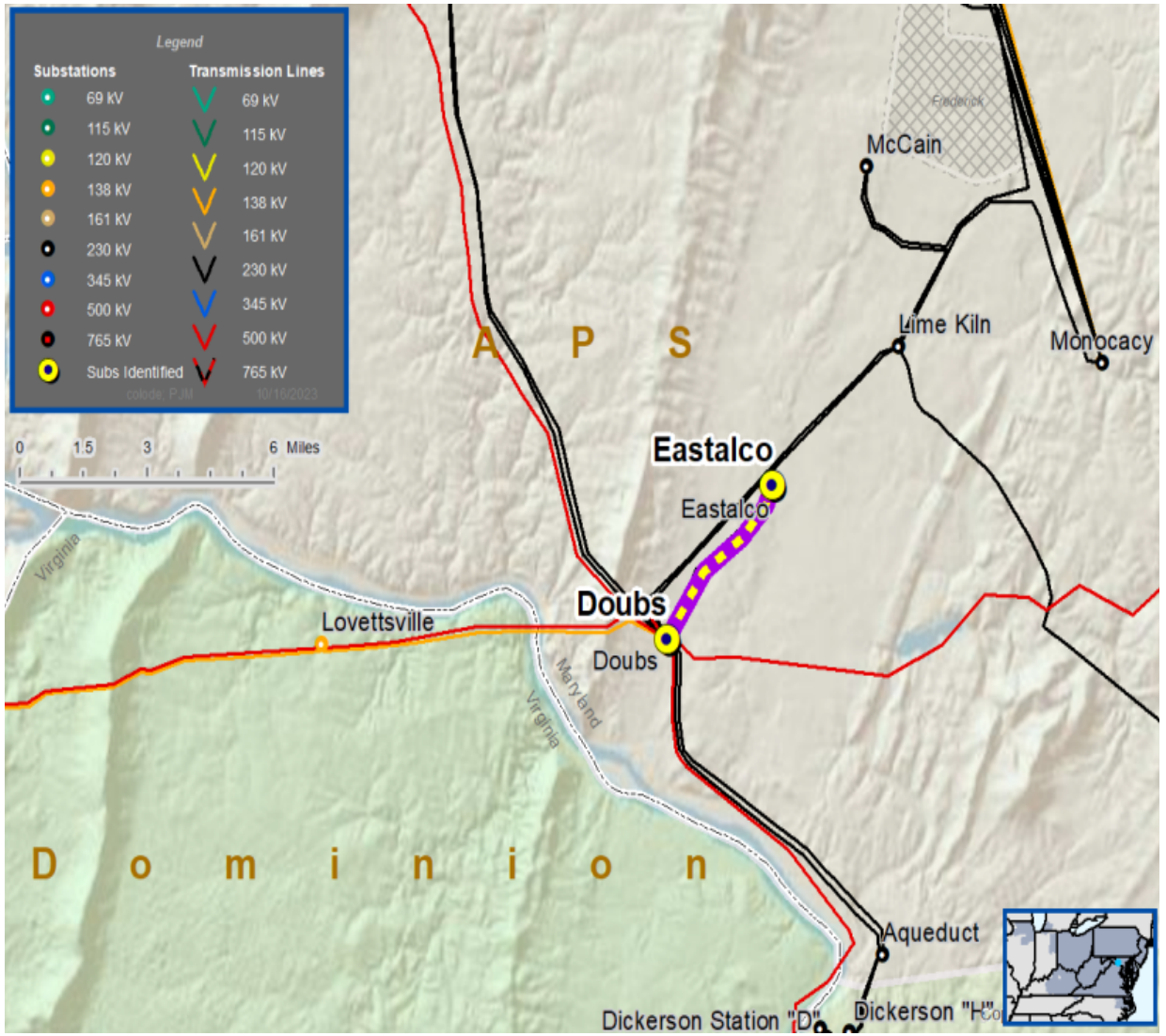
**Alternatives Considered:**

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

**Estimated Project Cost:** $20.8M

**Projected In-Service:** 3/3/2025

**Status:** Pre-Engineering
**Model:** 2023 RTEP model for 2028 Summer (50/50)



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

**Need Number:** APS-2023-031

**Process Stage:** Solution Meeting – 10/31/2023

**Previously Presented:** Need Meeting – 09/05/2023

**Supplemental Project Driver(s):**

*Customer Service*

**Specific Assumption Reference(s):**

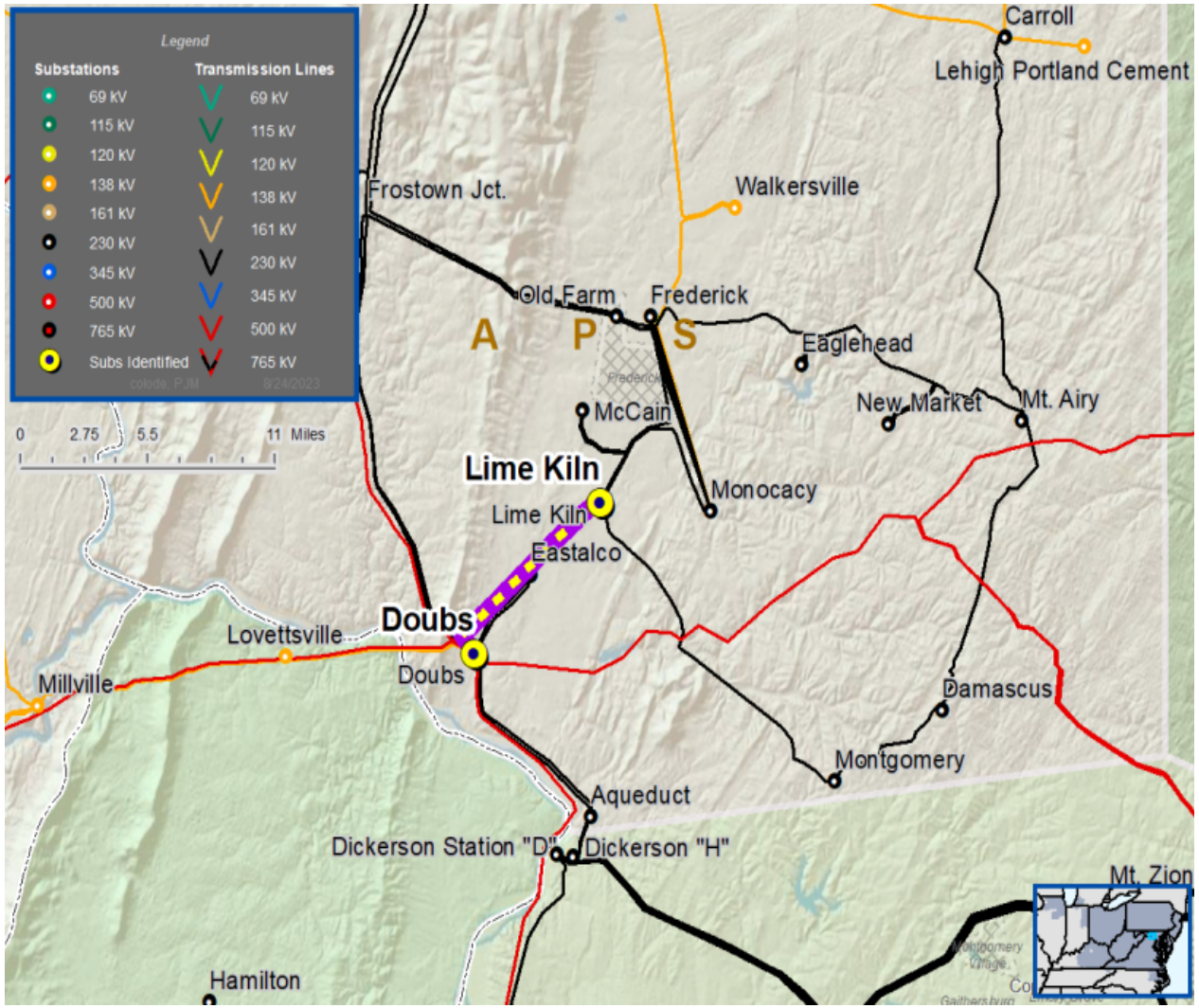
New customer connection request will be evaluated per FirstEnergy's "Requirements for Transmission Connected Facilities" document and "Transmission Planning Criteria" document.

**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:**

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:** Solution Meeting – 10/31/2023
**Previously Presented:** Need Meeting – 09/05/2023

**Proposed Solutions 1 of 3:**
***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

**Violations Identified during load study:**

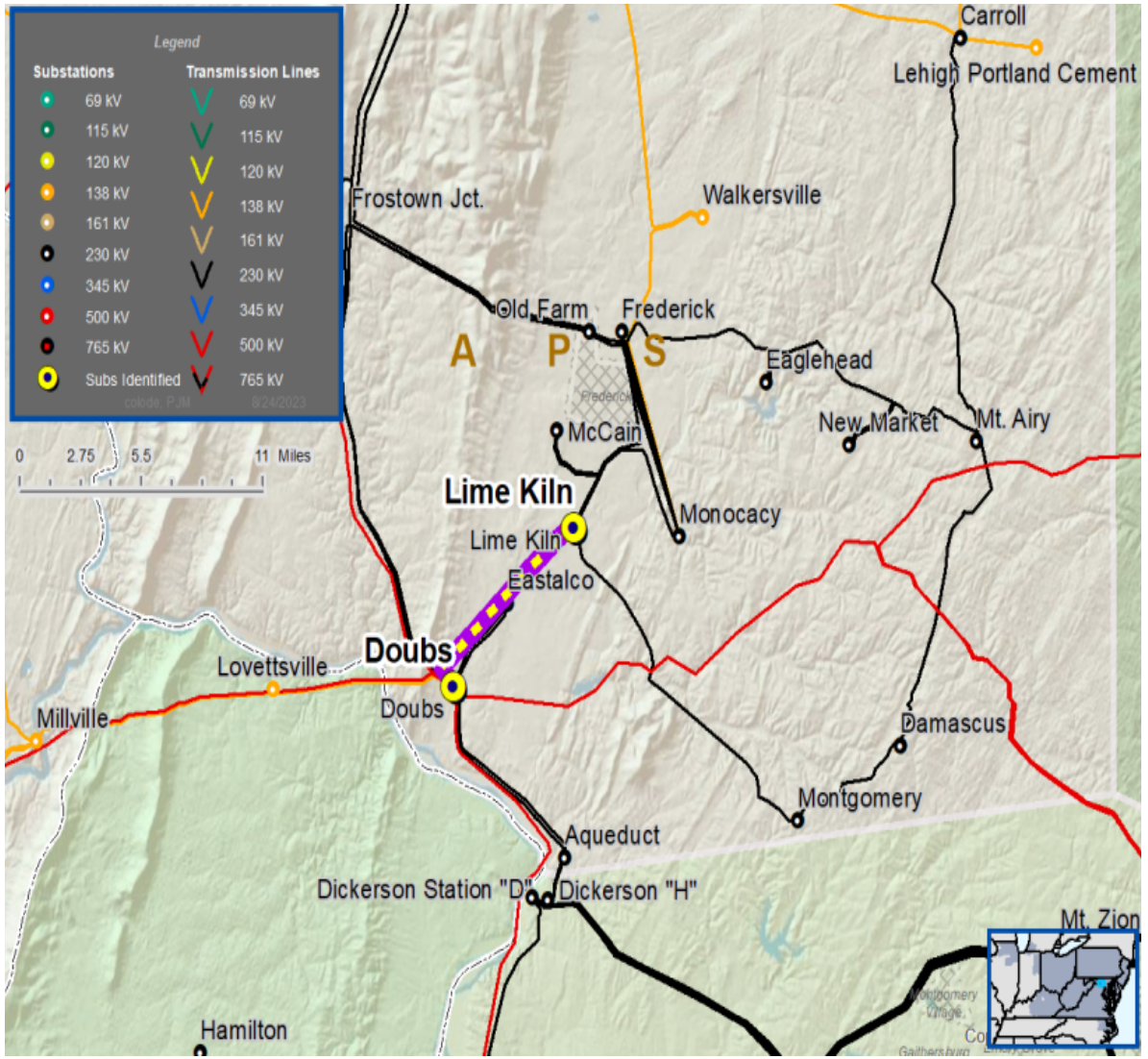
- Thermal violation on the Albright-Cross School AFA 138 kV Line
- Thermal violation on the Doubs-Lime Kiln #231 230 kV Line

**Alternatives Considered:**

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

**Estimated Project Cost:** $28.7M

**Projected In-Service:** 12/31/2025
**Status:** Pre-Engineering
**Model:** 2023 RTEP model for 2028 Summer (50/50)



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

**Need Numbers:** APS-2023-038

**Process Stage:** Solution Meeting 10/31/2023

**Previously Presented:** Need Meeting 10/03/2023

**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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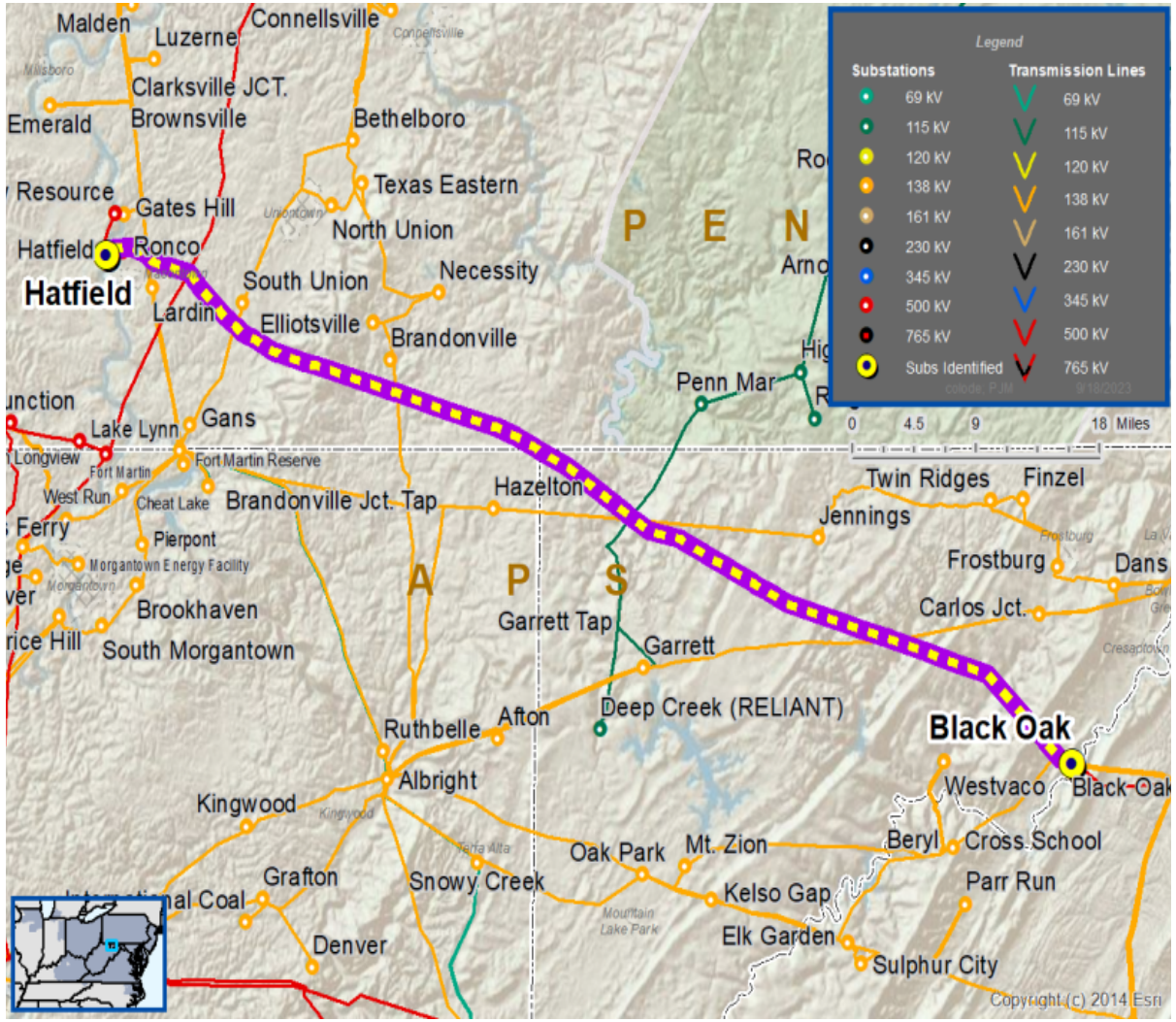


# APS Transmission Zone M-3 Process
# Black Oak - Hatfield 500 kV Misoperation Relays

**Need Number:** APS-2023-038

**Process Stage:** Solution Meeting 10/31/2023

**Proposed Solution:**

- Replace limiting substation conductor, wave trap, disconnect switch, and relaying at Black Oak 500 kV substation
- Replace limiting substation conductor, wave trap, disconnect switch, circuit breaker, and relaying at Hatfield 500 kV 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 |

**Alternatives Considered:**

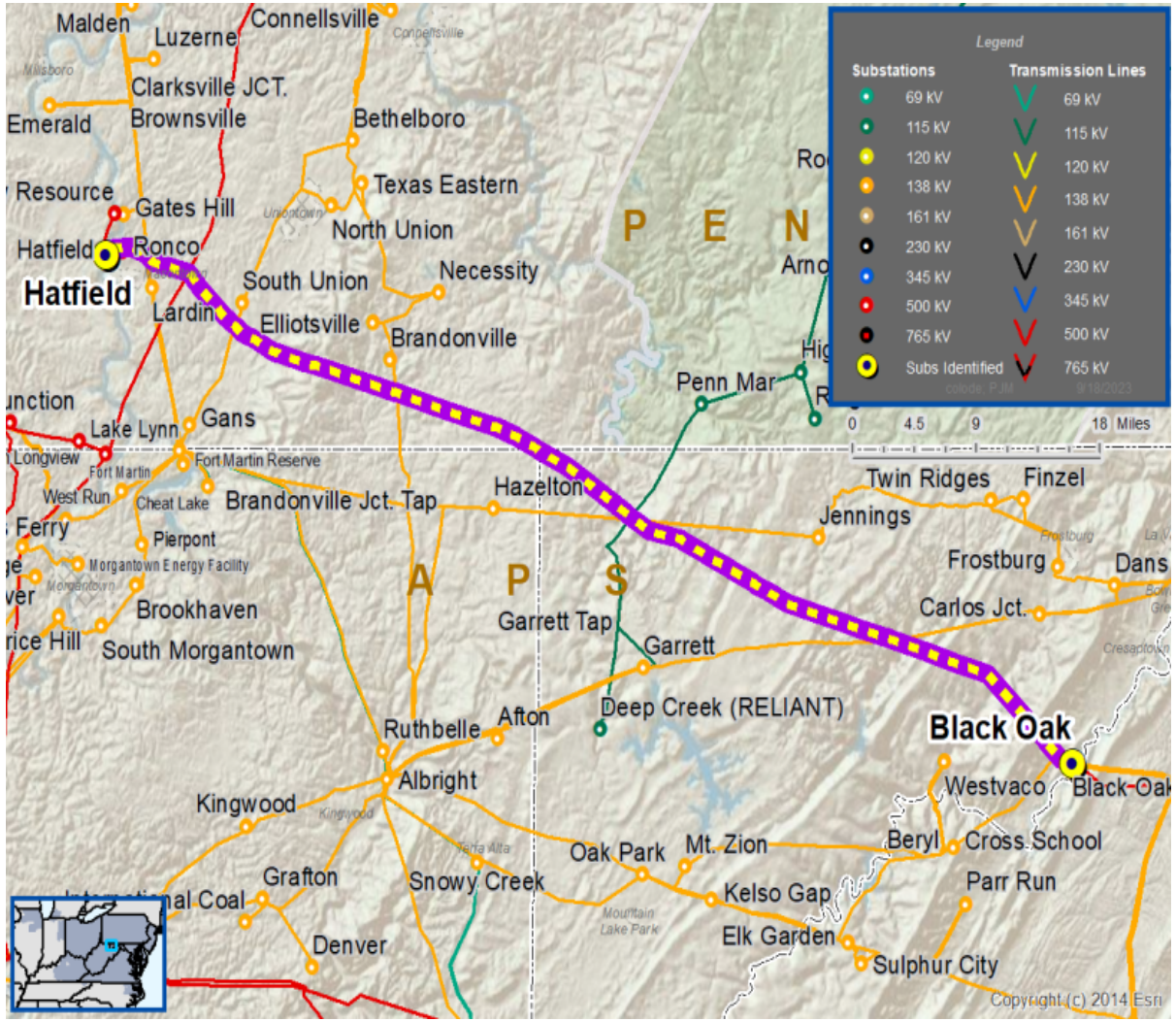
- Maintain line and vintage relay schemes in existing condition

**Estimated Project Cost:** $ 11.8 M

**Projected In-Service:** 4/27/2026

**Project Status:** Engineering

**Model:** 2023 RTEP model for 2028 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

10/20/2023 – V1 – Original version posted to pjm.com

10/31/2023 – V2 – Corrected map on slide 20