

# Transmission Expansion Advisory Committee FirstEnergy Supplemental Projects

January 9, 2024

# 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

**Need Number:** JCPL-2024-001

**Process Stage:** Need Meeting 01/09/2024

**Project Driver:**

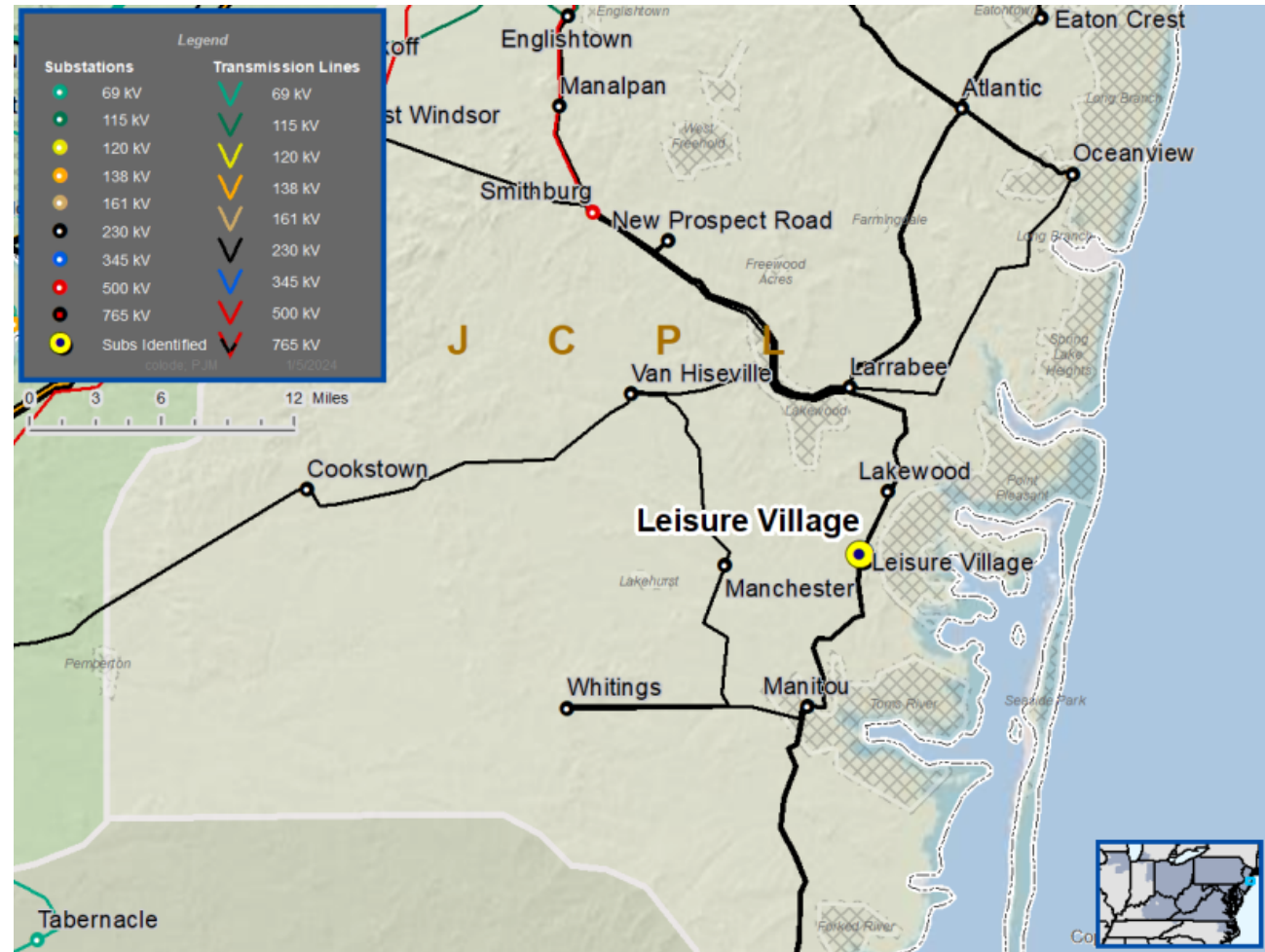
*Equipment Material Condition, Performance and Risk  
Operational Flexibility and Efficiency  
Infrastructure Resilience*

**Specific Assumption Reference:**

- System reliability and performance
- Load at risk in planning and operational scenarios
- Add/Expand Bus Configuration
  - Loss of substation bus adversely impacts transmission system performance
  - Eliminate simultaneous outages to multiple networked elements under N-1 analysis

**Problem Statement:**

- The existing Leisure Village Substation is a 230-34.5-12.47 kV substation and has four 230 kV lines, two 230-34.5 kV transformers, and two 230-12.47 kV distribution transformers.
- Leisure Village Substation serves approximately 52 MW and 10,787 customers.
- The existing Leisure Village Substation configuration removes multiple facilities from service including the 230 kV circuits and step-down transformers under different N-1 contingency scenarios due to overlapping protection zones. Overlapping protection zones create challenges when attempting to clear a fault and can lend more equipment to be out of service than necessary when a fault occurs.



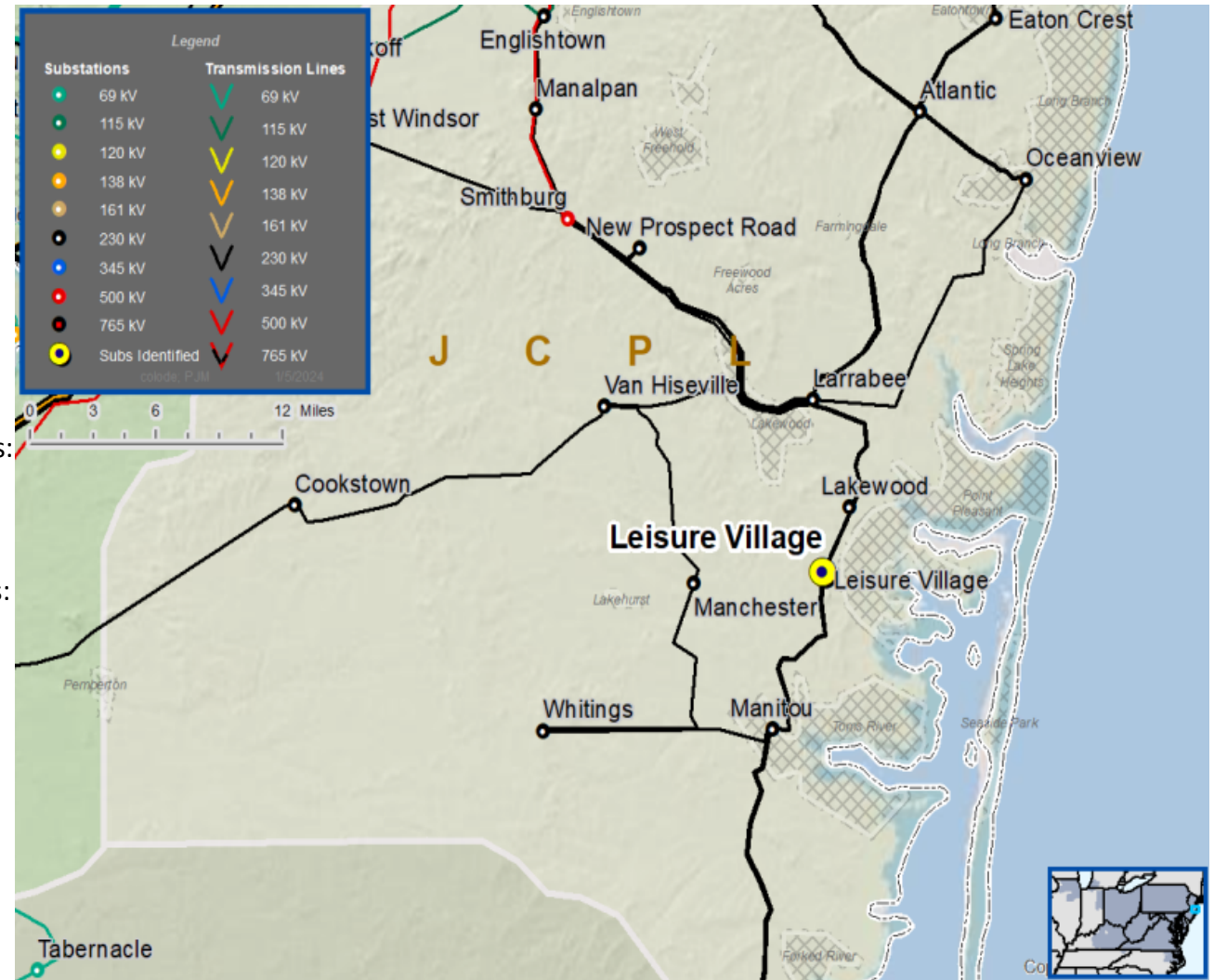
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**Need Number:** JCPL-2024-001

**Process Stage:** Need Meeting 01/09/2024

**Problem Statement:**

- Multiple N-1-1 contingency results in approximately 52 MW of consequential load loss, loss of 230 kV sources to the station, and multiple 34.5 kV lines to be loaded >90% and >100% of their SE rating in the Leisure Village Substation area.
- Since 2018, the following lines out of Leisure Village Substation had the following outages:
  - Lakewood-Leisure Village D2030 230 kV Line experienced two outages: one momentary and one sustained.
  - Lakewood-Leisure Village U2021 230 kV Line experienced three outages: one momentary and two sustained.
  - Leisure Village – Manitou A2027 230 kV Line experienced two outages: one momentary and one sustained.
  - Leisure Village – Manitou C2029 230 kV Line experienced three outages: three sustained.



**Need Number:** JCPL-2024-002

**Process Stage:** Need Meeting 01/09/2024

**Project Driver:**

*Equipment Material Condition, Performance and Risk*

**Specific Assumption References:**

System Performance Projects Global Factors

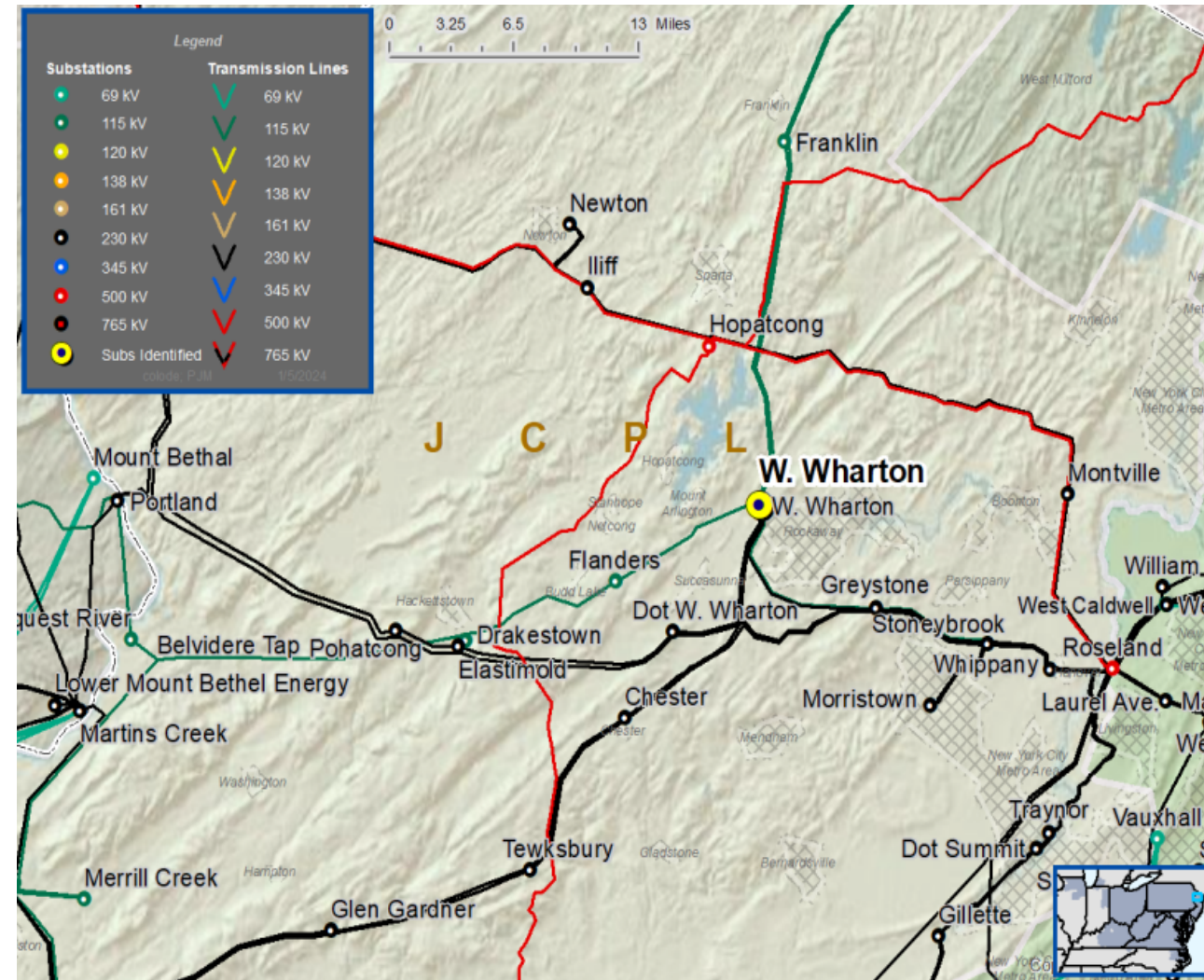
- System reliability and performance
- Reliability of Non-Bulk Electric System (Non-BES) Facilities

Add/Replace Transformers

Past System Reliability/Performance

**Problem Statement:**

- The 230-34.5 kV No. 1 Transformer at West Wharton Substation is approximately 45 years old and is reaching end of life.
- Dielectric strength of the transformer is measuring below acceptable IEEE limits.
  - Low measured dielectric strength reduces breakdown voltage and greatly increases risk of failure from arcing.
- Existing transformer ratings:
  - 156/194/197/216 MVA (SN/SSTE/WN/WSTE)



# Solutions

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

**Need Number:** JCPL-2023-046

**Process Stage:** Solutions Meeting 01/09/2024

**Previously Presented:** Need Meeting 10/31/2023

**Project Driver:**

*Equipment Material Condition, Performance and Risk*

**Specific Assumption References:**

*Global Factors*

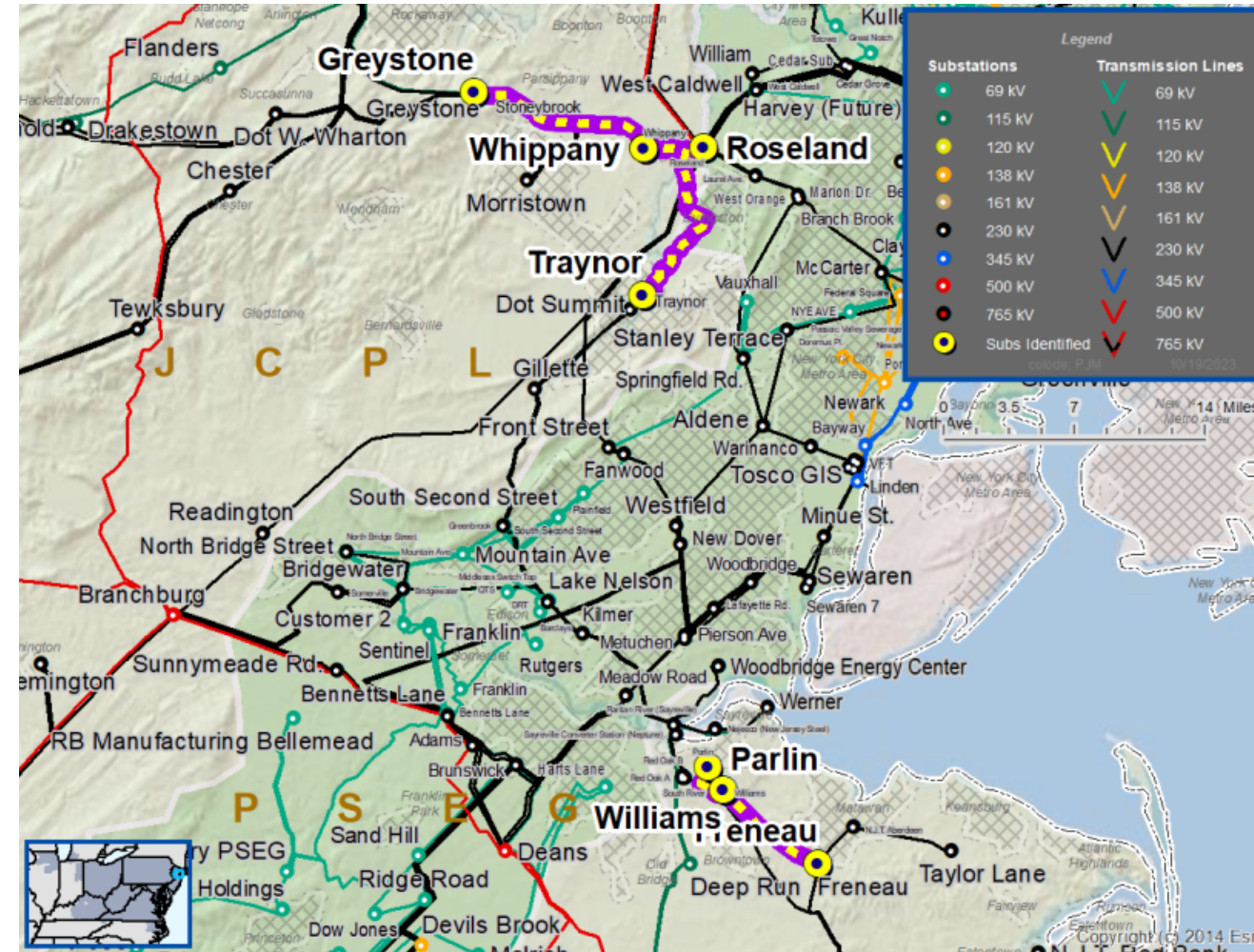
- System reliability and performance
- Substation / line equipment limits

*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 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.





# JCPL Transmission Zone M-3 Process Misoperation Relay Project

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Need Number	Transmission Line / Substation Locations	Existing Line Rating (SN / SE / WN / WE)	Existing Conductor Rating (SN / SE / WN / WE)
JCPL-2023-046	Roseland – Whippany 230 kV A941 Line	1306 / 1697 / 1610 / 1905	2228 / 2570 / 2232 / 2704



**Need Number:** JCPL-2023-046

**Process Stage:** Solution Meeting 01/09/2024

**Proposed Solution:**

- Replace relaying and limiting substation conductor at Whippany Substation.

**Transmission Line Ratings:**

- Roseland – Whippany A941 230 kV Line
  - Before Proposed Solution: 1306/1697/1610/1905 MVA (SN/SE/WN/WE)
  - After Proposed Solution: 1593/1850/1789/1994 MVA (SN/SE/WN/WE)

**Alternatives Considered:**

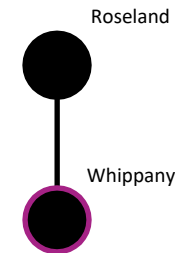
- Maintain line and vintage relay schemes in existing condition with risk of misoperation

**Estimated Project Cost:** \$2.33M

**Projected In-Service:** 5/30/2025

**Project Status:** Engineering

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



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

**Need Number:** JCPL-2023-049

**Process Stage:** Solution Meeting 01/09/2024

**Previously Presented:** Need Meeting 10/31/2023

**Project Driver:**

*Performance and Risk, Operational Flexibility and Efficiency*

**Specific Assumption Reference:**

System Performance Projects Global Factors

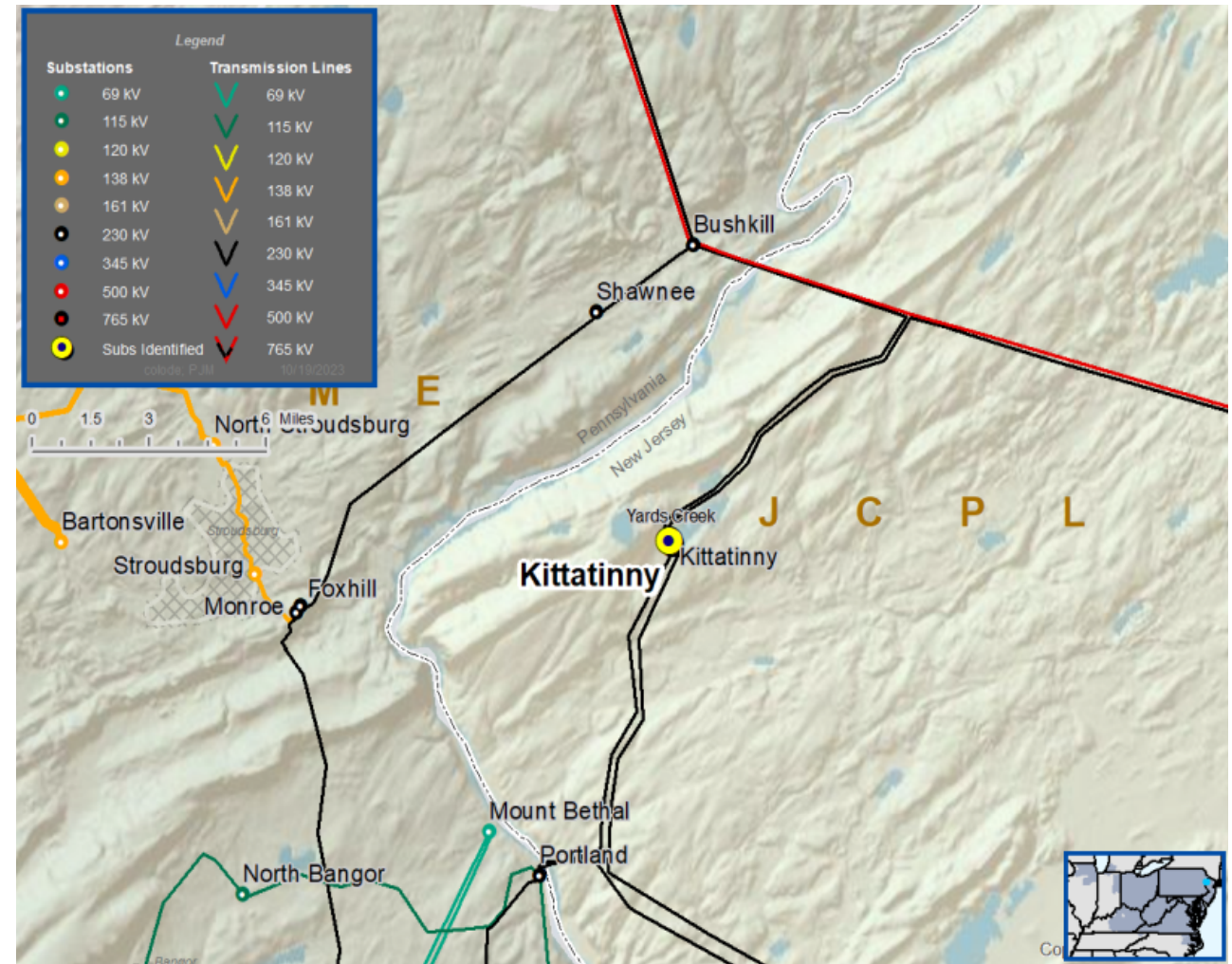
- System reliability and performance
- Reliability of Non-Bulk Electric System (Non-BES) Facilities

Add/Replace Transformers

Past System Reliability/Performance

**Problem Statement:**

- The 230-34.5 kV No. 1 Transformer at Kittatinny is approximately 60 years old and is reaching end of life.
- Recent dissolved gas analysis (DGA) showed elevated Ethane gas levels compared to IEEE standards.
- Carbon oxide gas production also suggests thermal stressing of paper insulation.
- Existing transformer ratings:
  - 60/63/76/77 MVA (SN/SLTE/WN/WLTE)



**Need Number:** JCPL-2023-049

**Process Stage:** Solution Meeting 12/05/2023

**Proposed Solution:**

- Replace the 230-34.5 kV No. 1 Transformer at Kittatinny Substation with a 90 MVA unit.
- Replace high side switch with a circuit breaker.
- Upgrade transformer relaying

**Transformer Ratings:**

- Kittatinny 230-34.5 kV No. 1 Transformer:
  - Before Proposed Solution: 60/63/76/77 MVA (SN/SLTE/WN/WLTE)
  - After Proposed Solution: 123/142/148/166 MVA (SN/SE/WN/WLTE)

**Alternatives Considered:**

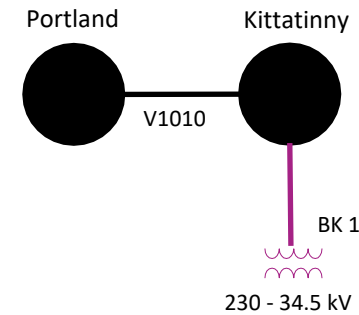
- Maintain transformer in existing condition with elevated risk of failure

**Estimated Project Cost:** \$7.0M

**Projected In-Service:** 12/31/2024

**Project Status:** Engineering

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



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

**Need Number:** JCPL-2023-051

**Process Stage:** Solutions Meeting 12/05/2023

**Previously Presented:** Needs Meeting 10/31/2023

**Project Driver:**

*Performance and Risk, Operational Flexibility and Efficiency*

**Specific Assumption Reference:**

System Performance Projects Global Factors

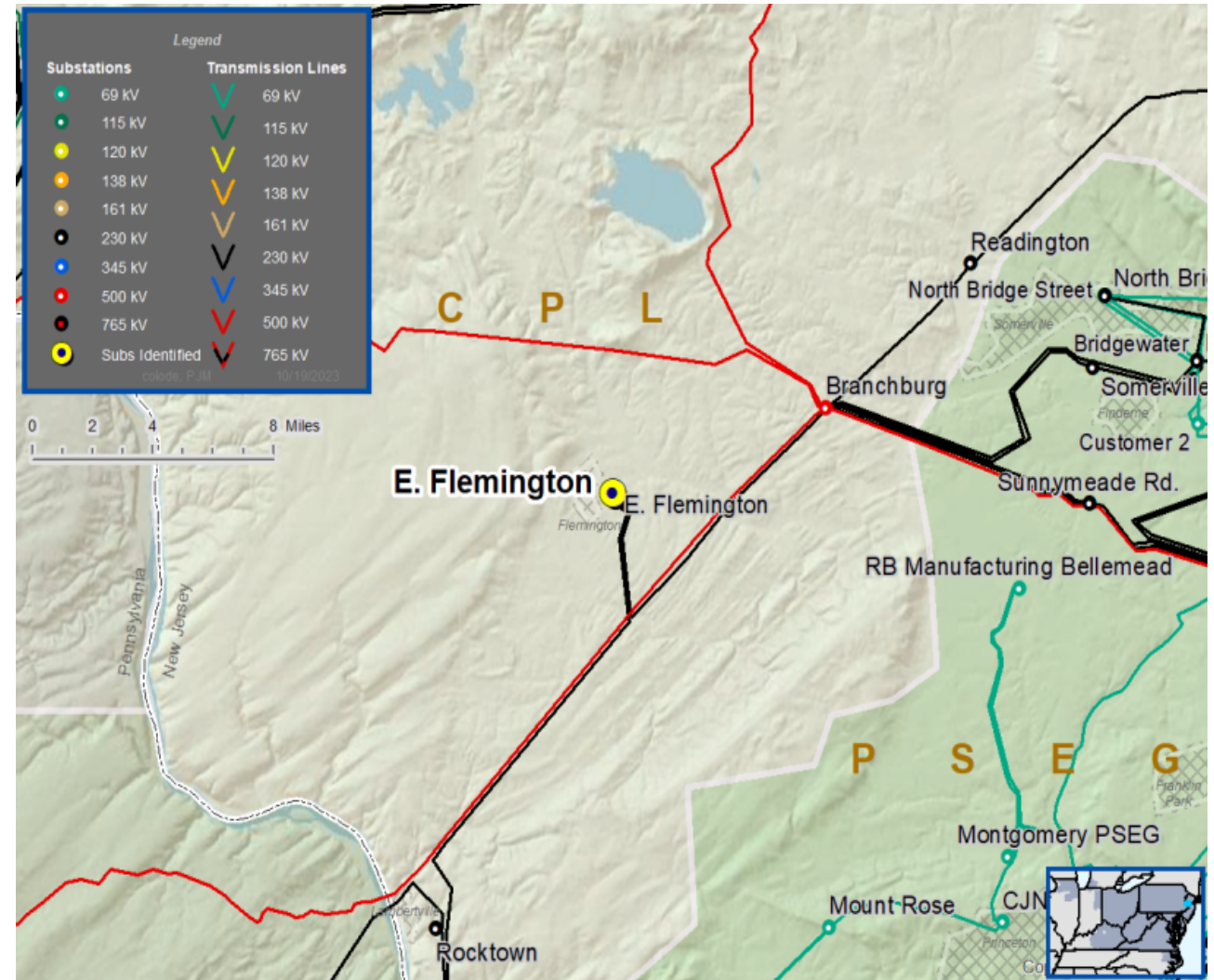
- System reliability and performance
- Reliability of Non-Bulk Electric System (Non-BES) Facilities

Add/Replace Transformers

Past System Reliability/Performance

**Problem Statement:**

- The 230-34.5 kV No. 3 Transformer at East Flemington is approximately 45 years old and is reaching end of life.
- Recent dissolved gas analysis (DGA) showed elevated Ethane gas levels compared to IEEE standards.
- Existing transformer ratings:
  - 77/81/97/99 MVA (SN/SLTE/WN/WLTE)



**Need Number:** JCPL-2023-051

**Process Stage:** Solution Meeting 12/05/2023

**Proposed Solution:**

- Replace the 230-34.5 kV No. 3 Transformer at East Flemington Substation with a 125 MVA unit.
- Install a 34.5 kV breaker with SCADA control
- Upgrade transformer relaying

**Transformer Ratings:**

- East Flemington 230-34.5 kV No. 3 Transformer:
  - Before Proposed Solution: 77/81/97/99 MVA (SN/SLTE/WN/WLTE)
  - After Proposed Solution: 162/169/209/214 MVA (SN/SE/WN/WLTE)

**Alternatives Considered:**

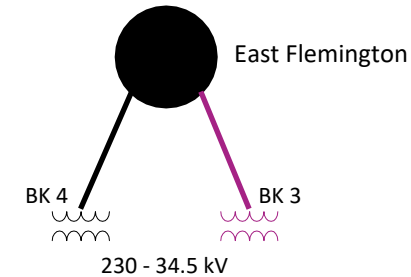
- Maintain transformer in existing condition with elevated risk of failure

**Estimated Project Cost:** \$7.18M

**Projected In-Service:** 12/31/2026

**Project Status:** Engineering

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



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

**Need Number:** JCPL-2023-052

**Process Stage:** Solution Meeting 01/09/2024

**Previously Presented:** Need Meeting 10/31/2023

**Project Driver:**

*Performance and Risk, Operational Flexibility and Efficiency*

**Specific Assumption Reference:**

System Performance Projects Global Factors

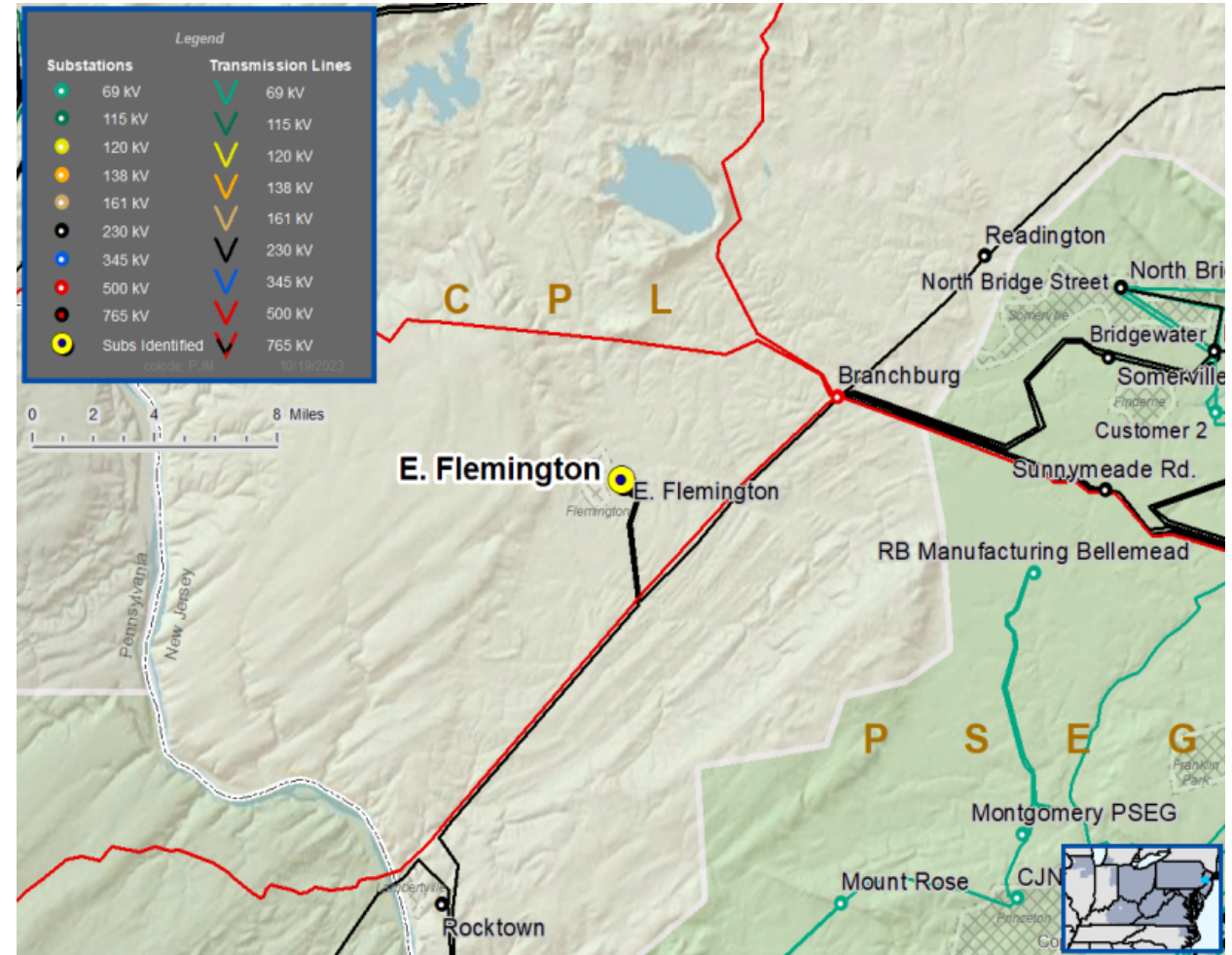
- System reliability and performance
- Reliability of Non-Bulk Electric System (Non-BES) Facilities

Add/Replace Transformers

Past System Reliability/Performance

**Problem Statement:**

- The 230-34.5 kV No. 4 Transformer at East Flemington is approximately 45 years old and is reaching end of life.
- In recent months, the transformer exhibited oil leaks that needed repaired. Incidental oil leaks at end-of-life period increases risk of failure.
- Existing transformer ratings:
  - 76/81/97/99 MVA (SN/SLTE/WN/WLTE)



**Need Number:** JCPL-2023-052

**Process Stage:** Solution Meeting 01/09/2024

**Proposed Solution:**

- Replace the 230-34.5 kV No. 4 Transformer at East Flemington Substation with a 125 MVA unit.
- Install a 34.5 kV breaker with SCADA control
- Upgrade transformer relaying

**Transformer Ratings:**

- East Flemington 230-34.5 kV No. 4 Transformer:
  - Before Proposed Solution: 76/81/97/99 MVA (SN/SLTE/WN/WLTE)
  - After Proposed Solution: 162/169/209/214 MVA (SN/SE/WN/WLTE)

**Alternatives Considered:**

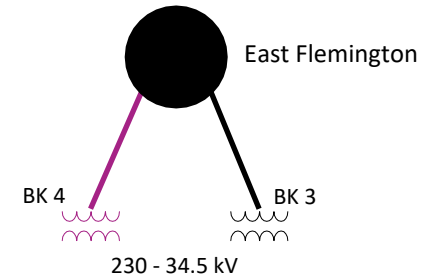
- Maintain transformer in existing condition with elevated risk of failure

**Estimated Project Cost:** \$7.18M

**Projected In-Service:** 12/31/2027

**Project Status:** Engineering

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



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

**Need Number:** JCPL-2023-060

**Process Stage:** Solution Meeting 01/09/2024

**Previously Presented:** Need Meeting 12/05/2023

**Project Driver:**

*Equipment Material Condition, Performance and Risk*

**Specific Assumption References:**

System Performance Projects Global Factors

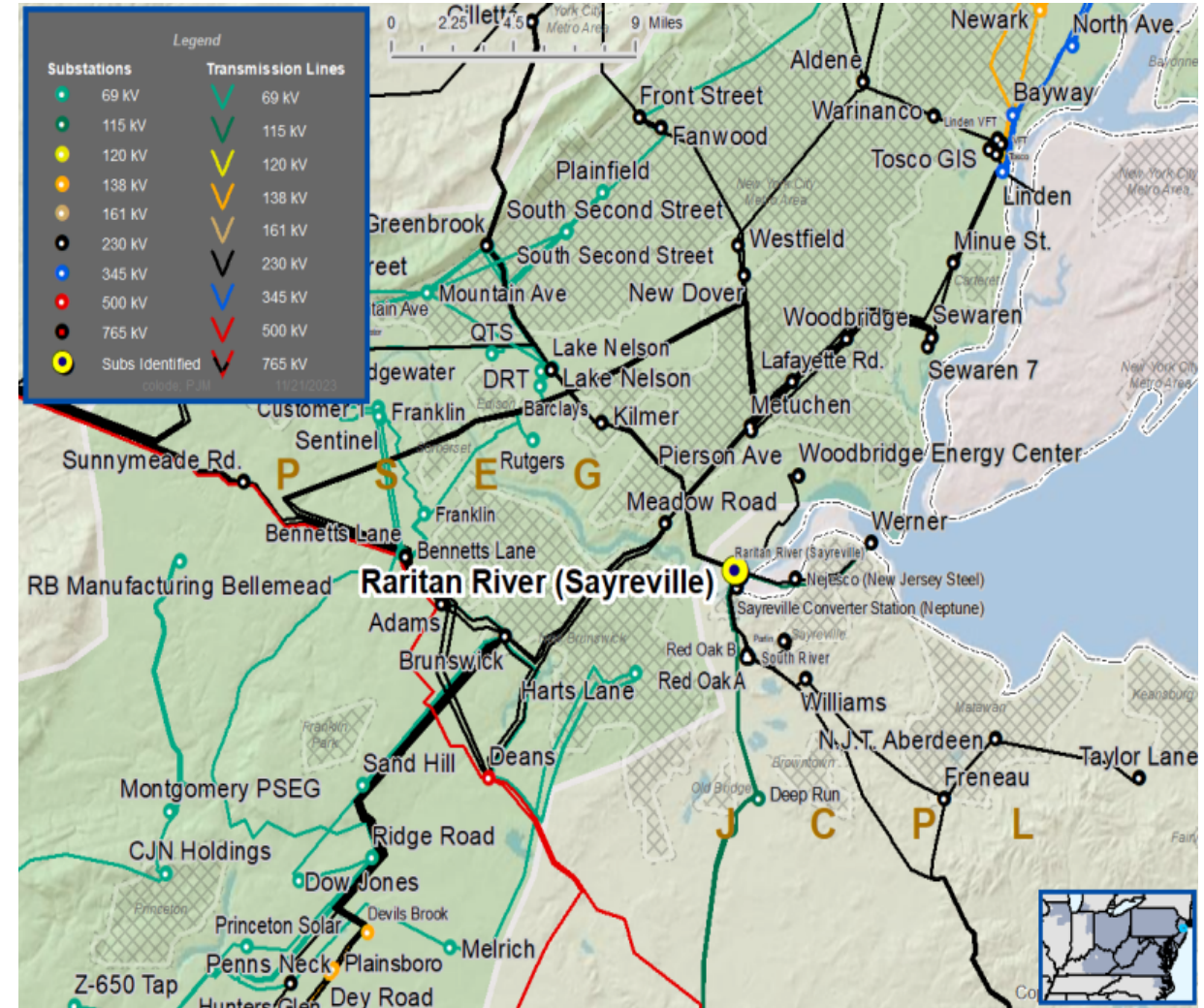
- System reliability and performance
- Reliability of Bulk Electric System (BES) Facilities

Add/Replace Transformers

Past System Reliability/Performance

**Problem Statement:**

- The 230/115 kV No. 13 Transformer at Raritan River Substation was manufactured over 60 years ago and is reaching end of life.
- The transformer has exhibited heavy oil leaks that have been difficult to repair due to the condition of the transformer.
- The transformers measured dielectric strength is below acceptable IEEE limits.
- Incidental oil leaks at end-of-life period along with current dielectric strength greatly increases risk of failure.
- Existing transformer ratings:
  - 256/323/324/361 MVA (SN/SSTE/WN/WSTE)





**Need Number:** JCPL-2023-060

**Process Stage:** Solution Meeting 01/09/2024

**Proposed Solution:**

- Replace the 230-115 kV No. 13 Transformer at Raritan River Substation with a 224 MVA unit.
- Replace high side switch with a circuit breaker
- Upgrade transformer relaying

**Transformer Ratings:**

- Raritan River 230-115 kV No. 13 Transformer:
  - Before Proposed Solution: 256/323/324/361 MVA (SN/SSTE/WN/WSTE)
  - After Proposed Solution: 280/334/354/390 MVA (SN/SSTE/WN/WSTE)

**Alternatives Considered:**

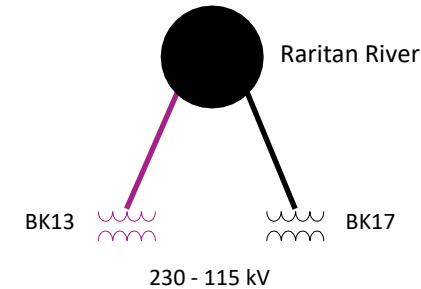
- Maintain transformer in existing condition with elevated risk of failure

**Estimated Project Cost:** \$5.4M

**Projected In-Service:** 06/30/2026

**Project Status:** Engineering

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



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

# Questions?



# 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

12/27/2024 - V1 – Original version posted to pjm.com

1/5/2024 – V2 – Added map on slide # 3 ,4 and 5