Sub Regional RTEP Committee
PJM Mid-Atlantic
First Energy MAAC

February 22, 2019

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

JCP&L Transmission Zone

Need Number: JCPL-2019-001 to 007
Process Stage: Need Meeting
Date: 02/22/2019

Project Driver(s):
Equipment Material Condition, Performance and Risk
Operational Flexibility and Efficiency

Specific Assumption Reference(s)
System Performance Projects 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

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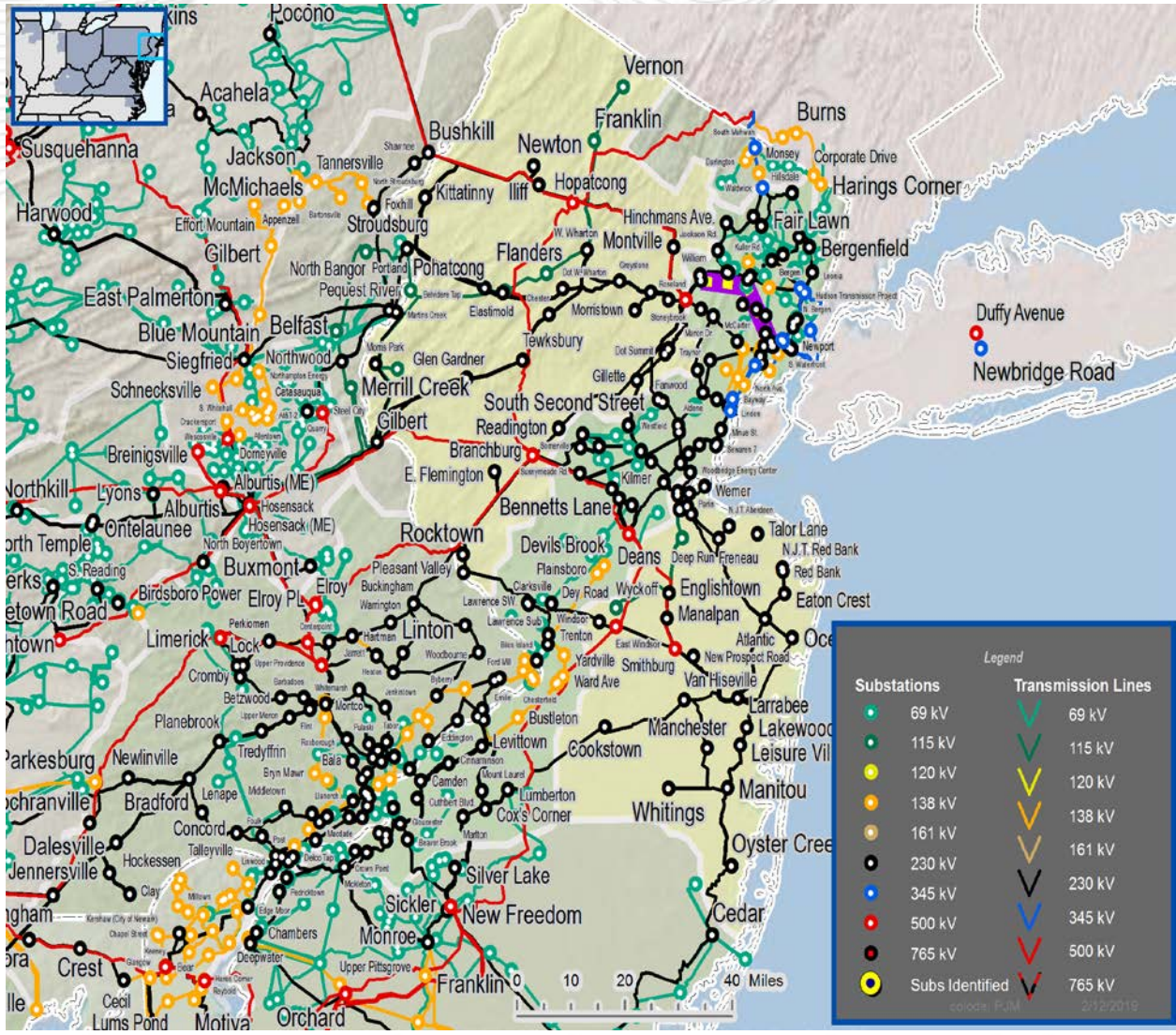

Problem Statement

- 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cases the protection equipment cannot be repaired due to a lack of replacement parts and available expertise in the outdated technology.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-2019-	Transmission Line / Substation Locations	Existing Line Rating (SN / SE)	Existing Conductor Rating (SN / SE)	Limiting Terminal Equipment
001	Atlantic – Freneau 230 kV Line	678 / 813	709 / 869	Substation Conductor
002	Kittatinny – Pohatcong 230 kV Line	650 / 817	709 / 869	Substation Conductor
003	Kittatinny – Portland 230 kV Line	1114 / 1195	1114 / 1285	Line Relaying
004	Lakewood – Leisure Village 230 kV Line	650 / 817	709 / 869	Substation Conductor
005	Leisure Village – Manitou 230 kV Line	650 / 817	709 / 869	Substation Conductor
006	Morristown – Stony Brook – Whippany 230 kV Line	678 / 802	709 / 869	Line Relaying, Substation Conductor / Drops
007	Traynor – Whippany 230 kV Line	678 / 802	709 / 869	Line Relaying, Substation Conductor / Drops

JCP&L Transmission Zone

Need Number: JCPL-2019-001
Process Stage: Need Meeting
Date: 02/22/2019

Project Driver(s):
Equipment Material Condition, Performance and Risk
Operational Flexibility and Efficiency

Specific Assumption Reference(s)

System Performance Projects Global Factors

- System reliability and performance
- Substation/line equipment limits

Upgrade Relay Schemes

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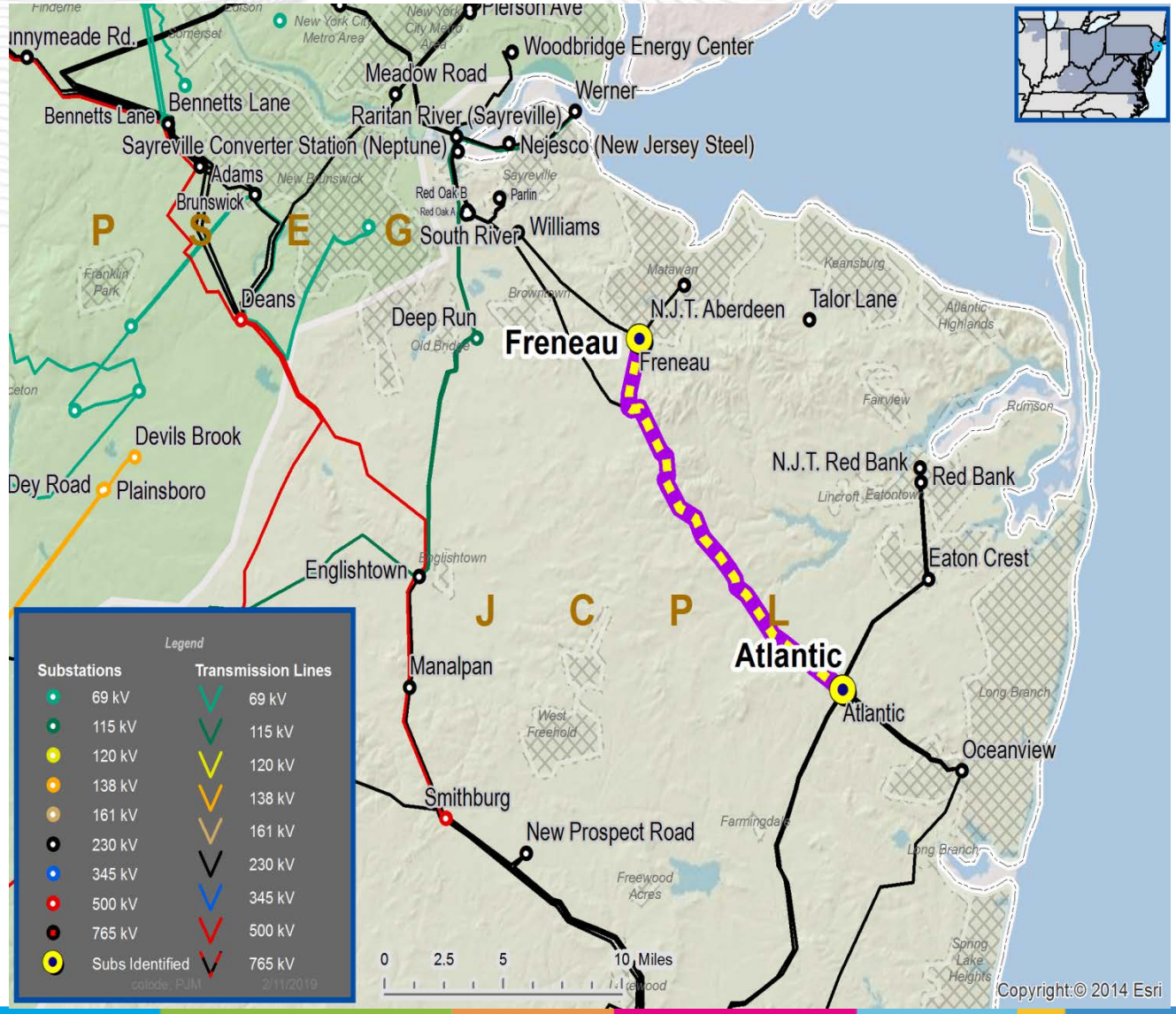

JCP&L Transmission Zone

Need Number: JCPL-2019-002
Process Stage: Need Meeting
Date: 02/22/2019

Project Driver(s):
Equipment Material Condition, Performance and Risk
Operational Flexibility and Efficiency

Specific Assumption Reference(s)

System Performance Projects Global Factors

- System reliability and performance
- Substation/line equipment limits

Upgrade Relay Schemes

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- Bus protection schemes

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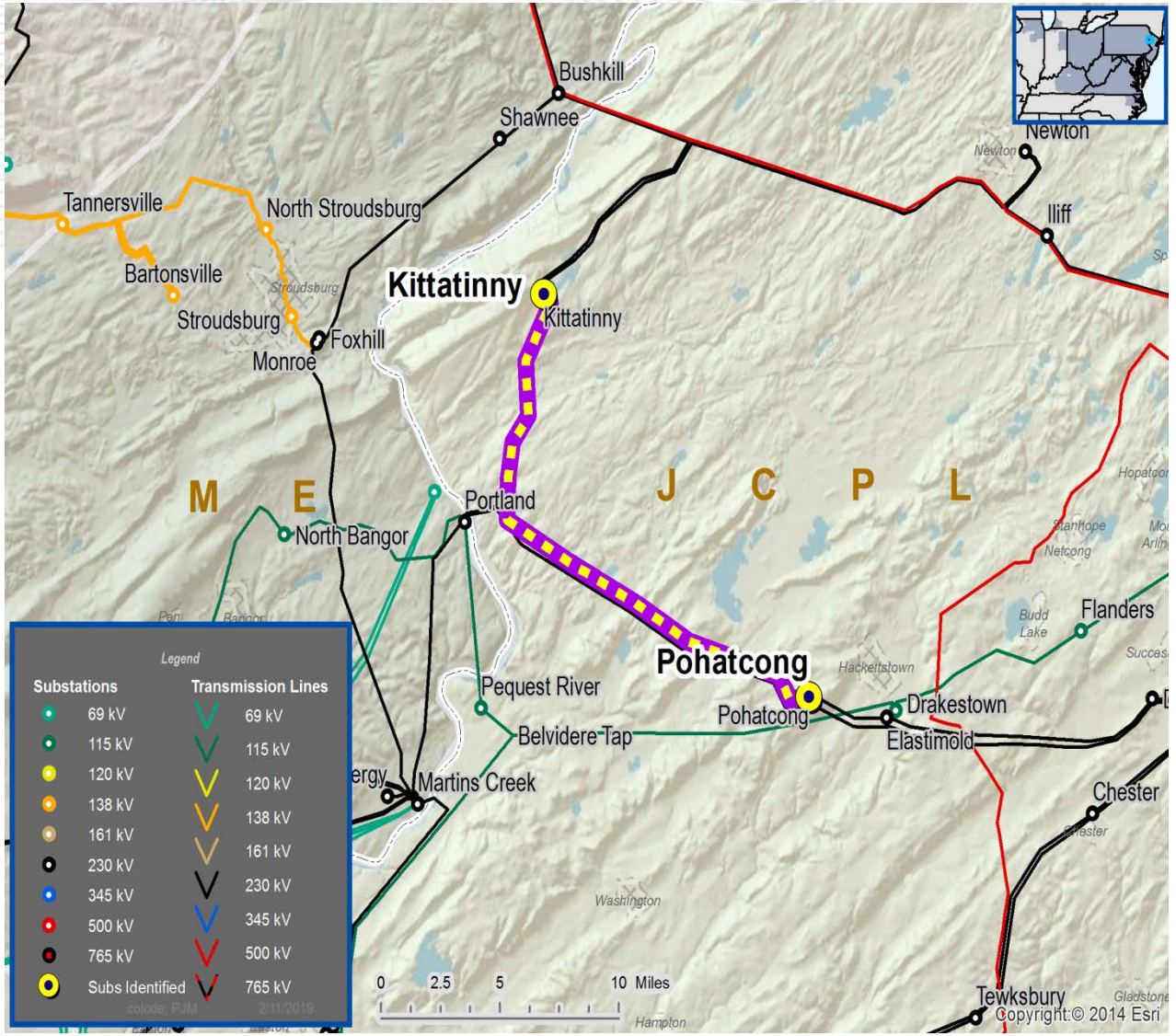

JCP&L Transmission Zone

Need Number: JCPL-2019-003
Process Stage: Need Meeting
Date: 02/22/2019

Project Driver(s):
Equipment Material Condition, Performance and Risk
Operational Flexibility and Efficiency

Specific Assumption Reference(s)

System Performance Projects Global Factors

- System reliability and performance
- Substation/line equipment limits

Upgrade Relay Schemes

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

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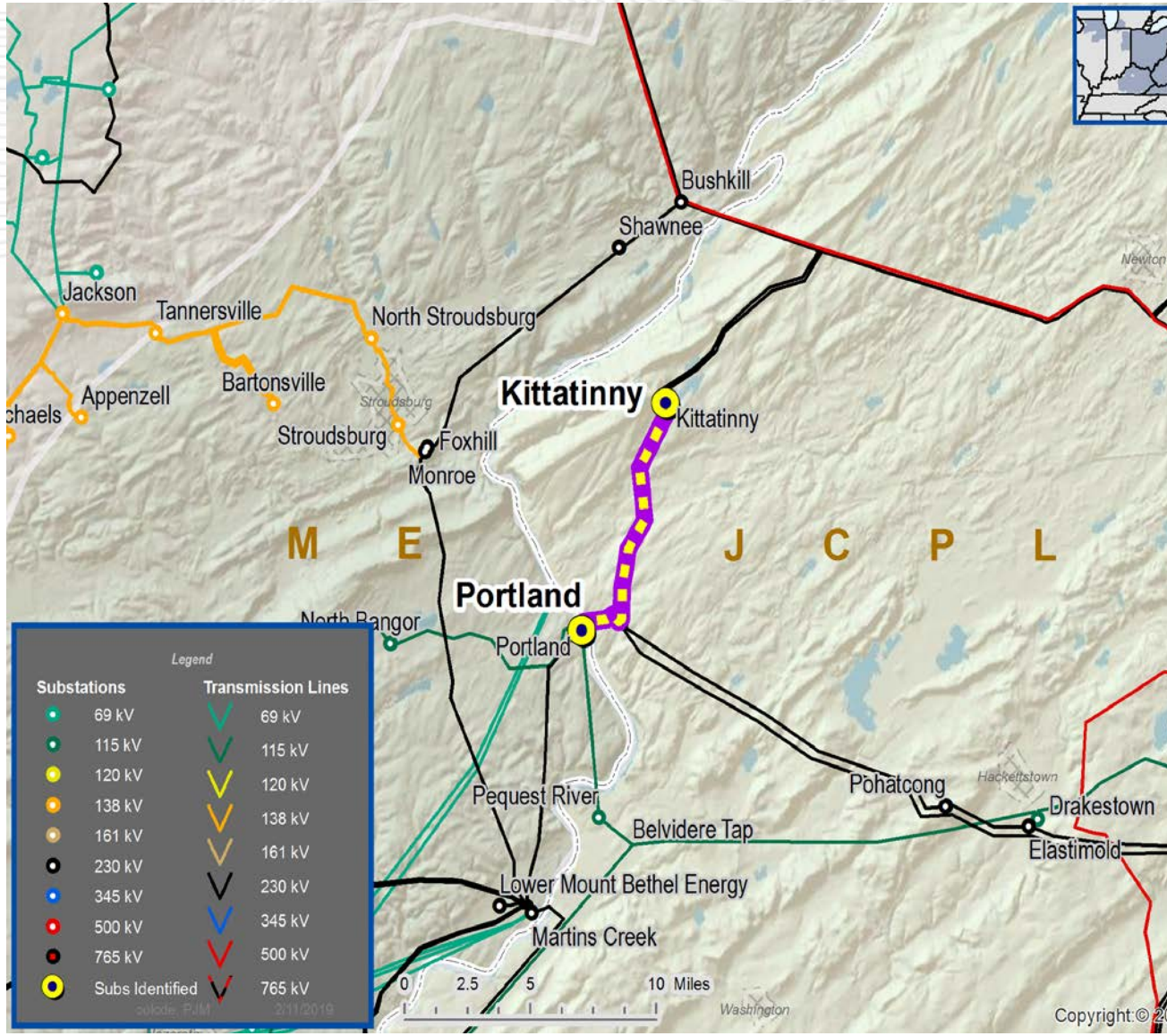

JCP&L Transmission Zone

Need Number: JCPL-2019-004
Process Stage: Need Meeting
Date: 02/22/2019

Project Driver(s):
Equipment Material Condition, Performance and Risk
Operational Flexibility and Efficiency

Specific Assumption Reference(s)

System Performance Projects Global Factors

- System reliability and performance
- Substation/line equipment limits

Upgrade Relay Schemes

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

Problem Statement

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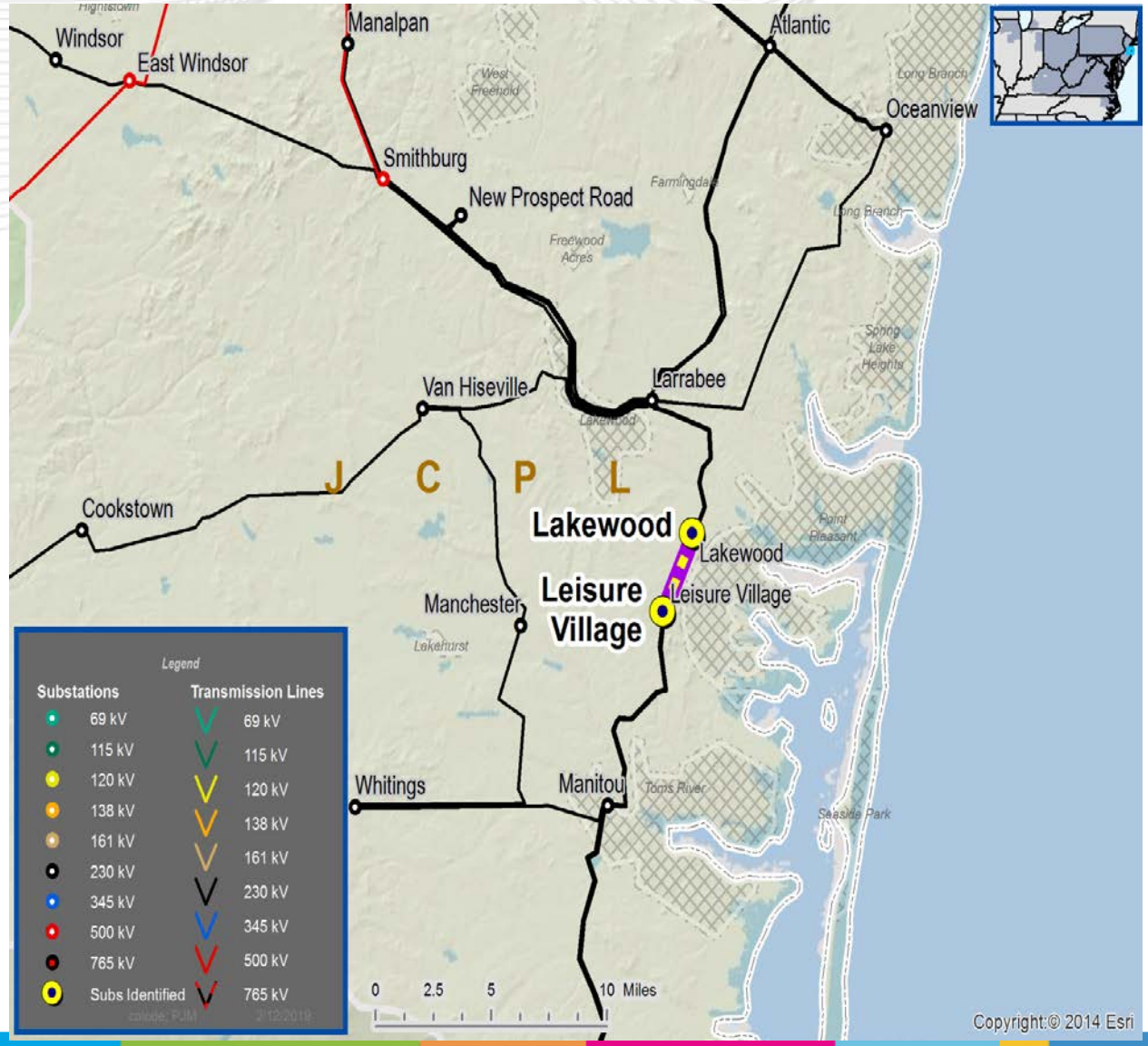

JCP&L Transmission Zone

Need Number: JCPL-2019-005
Process Stage: Need Meeting
Date: 02/22/2019

Project Driver(s):
Equipment Material Condition, Performance and Risk
Operational Flexibility and Efficiency

Specific Assumption Reference(s)

System Performance Projects 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

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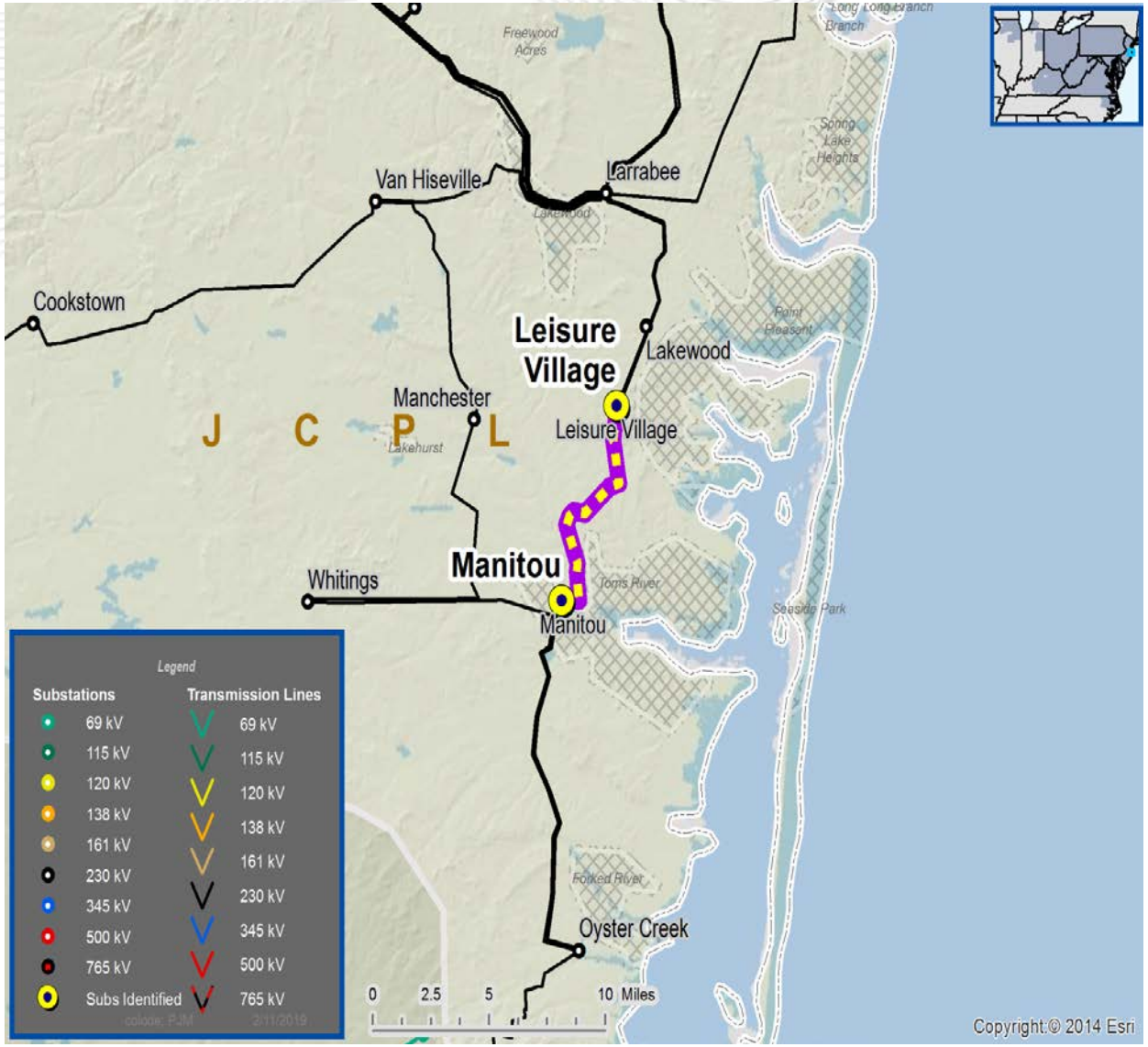

JCP&L Transmission Zone

Need Number: JCPL-2019-006
Process Stage: Need Meeting
Date: 02/22/2019

Project Driver(s):
Equipment Material Condition, Performance and Risk
Operational Flexibility and Efficiency

Specific Assumption Reference(s)

System Performance Projects 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

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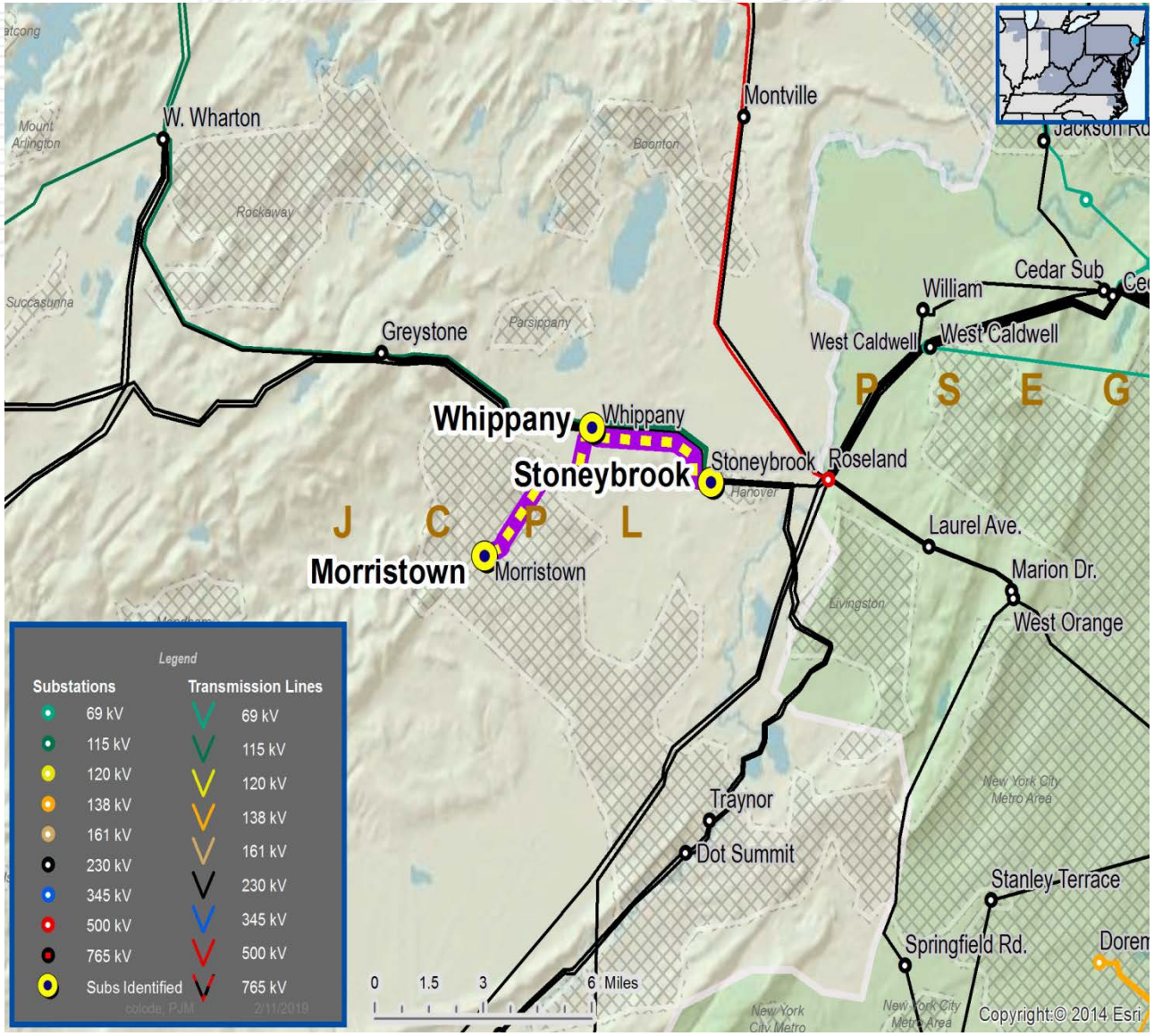

JCP&L Transmission Zone

Need Number: JCPL-2019-007
Process Stage: Need Meeting
Date: 02/22/2019

Project Driver(s):
Equipment Material Condition, Performance and Risk
Operational Flexibility and Efficiency

Specific Assumption Reference(s)

System Performance Projects 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

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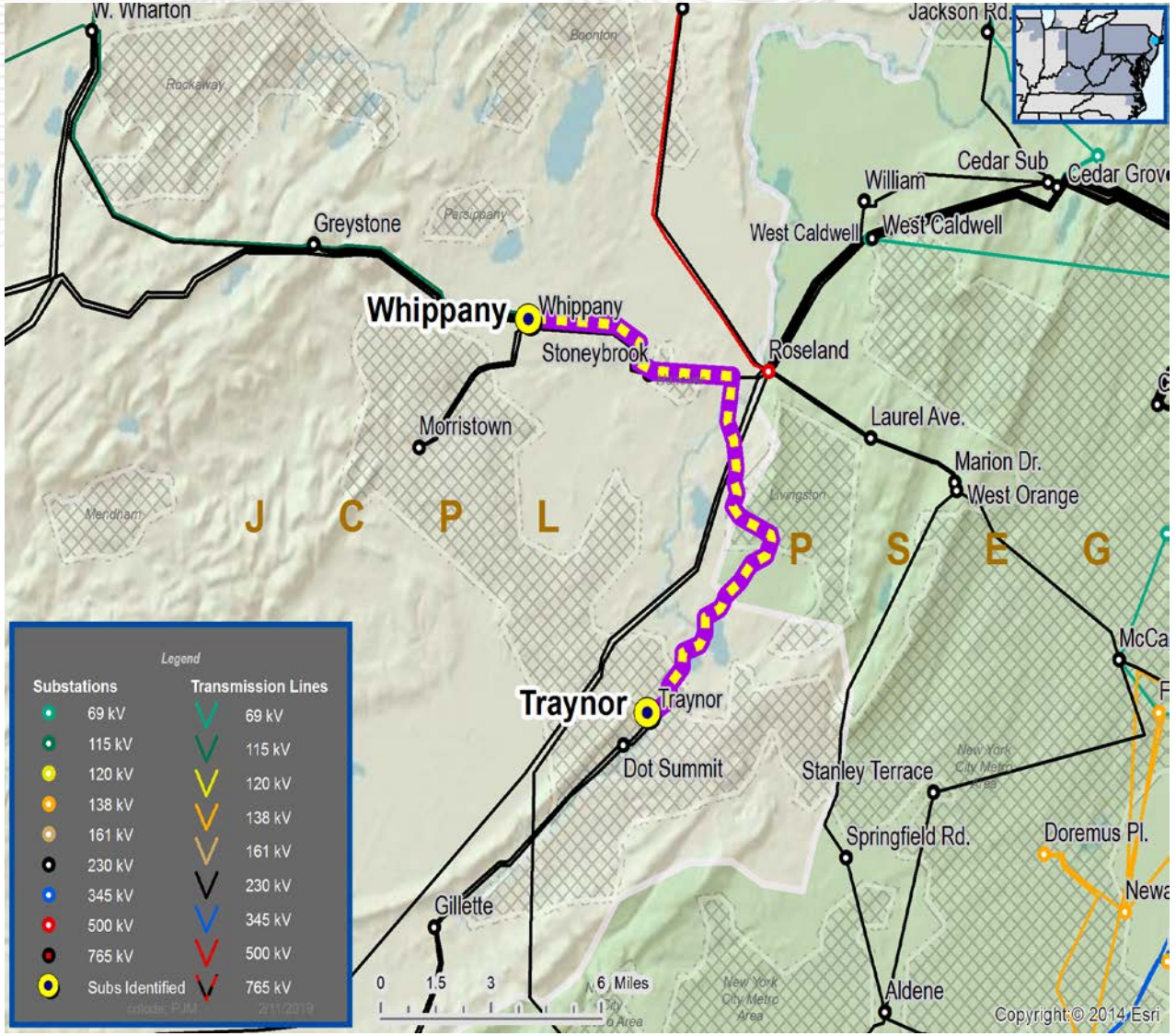


Met-Ed Transmission Zone

Need Number: ME-2019-001 to ME-2019-003
ME-2019-005 to ME-2019-014 &
ME-2019-020

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Line Condition Rebuild/Replacement

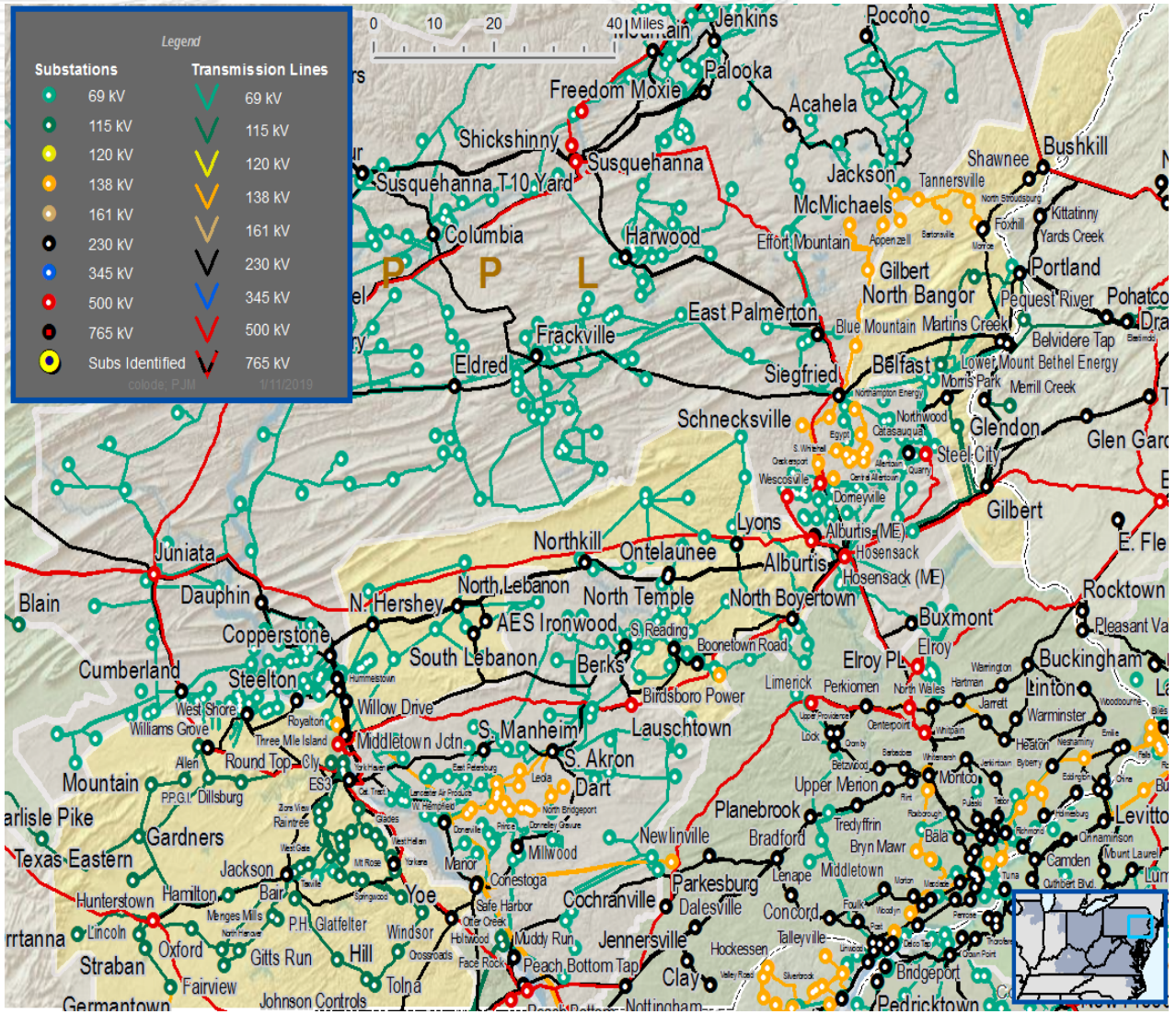
- Age/condition of wood pole transmission line structures
- Age/condition of steel tower or steel pole transmission line structures
- Age/condition of transmission line conductors

System Performance Projects

- Substation/line equipment limits

Problem Statement

- Line sections are exhibiting deterioration, increasing maintenance needs. Transmission line is approaching end of life
- Transmission line ratings are limited by terminal equipment.



ME-2019-	Transmission Line / Substation Locations	Existing Circuit Rating (SN / SE)	Existing Conductor Rating (SN / SE)	Limiting Terminal Equipment	Length of Line (miles)	Identified Structures (end of life / total)	Failure reasons
001	Adamstown – Flying Hills 69 kV Line	53 / 64	53 / 64	-	6.6	79 / 92 (86% Failure Rate)	Age, top rot, voids, woodpecker holes, etc.
	Flying Hills – South Reading 69 kV Line	53 / 64	80 / 96	Substation Conductor / Drops	2.4		
002	Baldy – Weisenberg 69 kV Line	62 / 62	80 / 96	Relays, Substation Conductor	9.1	180 / 514 (35% Failure Rate)	Top rot, voids, woodpecker holes, etc.
	Weisenberg – Lynnville 69 kV Line	89 / 107	89 / 107	-	5.0		
	Lynnville – South Hamburg 69 kV Line	51 / 66	74 / 90	Substation Conductor	15.1		
003	North Temple – Berkley Tap 69 kV Line	113 / 148	139 / 169	Substation Conductor	1.0	43 / 150 (29% Failure Rate)	Top rot, voids, woodpecker holes, etc.
	Berkley Tap - Berkley 69 kV Line	51 / 66	55 / 56	Substation Conductor	0.01		
	Berkley Tap – Cambridge Lee 69 kV Line	139 / 169	139 / 169	-	0.1		
	Cambridge Lee – Bern Church 69 kV Line	55 / 56	55 / 56	-	4.8		
	Bern Church – Northkill 69 kV line	80 / 96	80 / 96	-	6.4		
005	Carsonia – South Reading 813 69 kV Line	78 / 94	162 / 198	Substation Conductor / Drops	3.7	3 / 37 (8% Failure Rate)	Top rot
006	East Topton – Huffs Church 69 kV Line	50 / 50	80 / 96	Relays, Substation Conductor	5.3	92 / 227 (41% Failure Rate)	Top rot, bottom rot, woodpecker holes, etc.
	Huffs Church – Barto 69 kV Line	80 / 96	80 / 96	-	5.4		
	Barto – North Boyertown 69 kV Line	80 / 96	80 / 96	-	3.9		

ME-2019-	Transmission Line / Substation Locations	Existing CIrcuit Rating (SN / SE)	Existing Conductor Rating (SN / SE)	Limiting Terminal Equipment	Length of Line (miles)	Identified Structures (end of life / total)	Failure reasons
007	Alcoa – South Lebanon 69 kV Line	82 / 103	111 / 134	Disconnect Switches, Relays	4.0	93 / 103 (90% Failure Rate)	Age, decay, woodpecker holes
008	Bernville – State Street 69 kV Line	52 / 66	60 / 75	Substation Conductor	10.7	155 / 181 (86% Failure Rate)	Age, sound, woodpecker holes
	State Street – South Hamburg 69 kV Line	88 / 93	139 / 169	Substation Conductor, Relays	0.8		
009	Campbelltown – Swatara Hill 69 kV Line	71 / 90	74 / 90	Substation Conductor	10.5	57 / 288 (20% Failure Rate)	Age, top rot, voids, woodpecker holes
	Swatara Hill – Middletown Junction 69 kV Line	71 / 91	121 / 150	Substation Conductor, Disconnect Switches	2.5		
010	Middletown Junction – York Haven 115 kV Line	129 / 156	129 / 156	-	4.0	100 / 120 (83% Failure Rate)	Age, bad/cut/missing grounds, etc.
	York Haven – Zions View 115 kV Line	129 / 156	129 / 156	-	4.8		
	Zions View – Smith Street 115 kV Line	126 / 149	129 / 156	Substation Conductor	6.6		
011	Allentown Cement – St Peters 69 kV Line	53 / 64	53 / 64	-	2.0	148 / 225 (70% Failure Rate)	Age, bad/cut/missing grounds, sound, woodpecker holes, etc.
	St Peters – South Hamburg 69 kV Line	51 / 64	53 / 64	Substation Conductor	7.5		
	St Peters – Moselem 69 kV Line	132 / 158	139 / 169	Substation Conductor	1.5		
	Moselem – Lyons 69 kV Line	51 / 64	53 / 64	Substation Conductor	4.2		
012	North Temple – Royal Green Tap 69 kV Line	82 / 103	139 / 169	Disconnect Switches, Substation Conductor, Relays	0.4	159 / 208 (76% Failure Rate)	Age, bad/cut/missing grounds, rot, sound, woodpecker holes
	Royal Green Tap – Royal Green 69 kV Line	82 / 103	89 / 107	Disconnect Switch	0.1		
	Royal Green Tap – Berkley Tap 69 kV Line	82 / 103	139 / 169	Disconnect Switch	0.6		
	Berkley Tap – Berkley 69 kV Line	51 / 64	53 / 64	Substation Conductor	0.01		
	Berkley Tap – Leesport 69 kV Line	53 / 64	53 / 64	-	3.6		
	Leesport – South Hamburg 69 kV Line	51 / 64	53 / 64	Substation Conductor	7.2		

ME-2019-	Transmission Line / Substation Locations	Existing Circuit Rating (SN / SE)	Existing Conductor Rating (SN / SE)	Limiting Terminal Equipment	Length of Line (miles)	Identified Structures (end of life / total)	Failure reasons
013	Alcoa – North Cornwall 69 kV Line	82 / 103	102 / 124	Disconnect Switches	3.1	126 / 164 (77% Failure Rate)	Age, bad/cut/missing grounds, top rot/decay, woodpecker holes, etc.
	North Cornwall – Broad Street 69 kV Line	82 / 103	111 / 134	Disconnect Switches, Substation Conductor	2.0		
014	North Hershey – Grantville 69 kV Line	80 / 96	80 / 96	-	1.5	79 / 91 (87% Failure Rate)	Age, bad/cut/missing grounds, decay, woodpecker holes, etc.
	Grantville – Turf Club 69 kV Line	64 / 65	64 / 65	-	3.0		
020	South Lebanon – Bayer Labs 69 kV Line	51/56	55/56	Substation Conductor	5.9	163 / 203 (80% Failure Rate)	Age, bad/cut/missing grounds, decay, split top, static bayonet, woodpecker holes, etc.
	Bayer Labs – Myerstown 69 kV Line	55/56	55/56	-	1.1		

Met-Ed Transmission Zone

Need Number: ME-2019-001

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Line Condition Rebuild/Replacement

- Age/condition of wood pole transmission line structures
- Age/condition of steel tower or steel pole transmission line structures
- Age/condition of transmission line conductors

System Performance Projects

- Substation/line equipment limits

Problem Statement

- Line sections are exhibiting deterioration, increasing maintenance needs. Transmission line is approaching end of life
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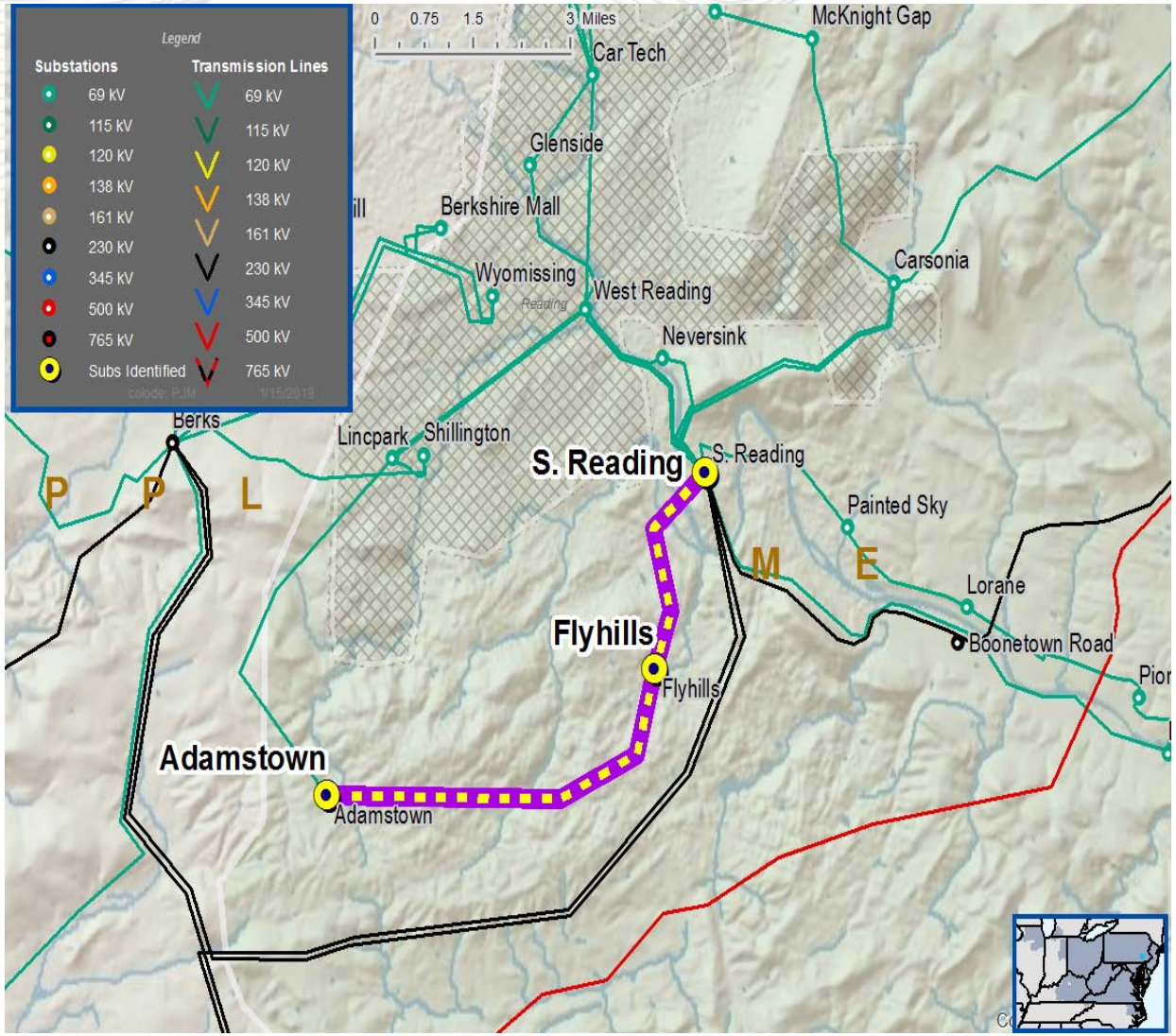

Met-Ed Transmission Zone

Need Number: ME-2019-002

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

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- Age/condition of transmission line conductors

System Performance Projects

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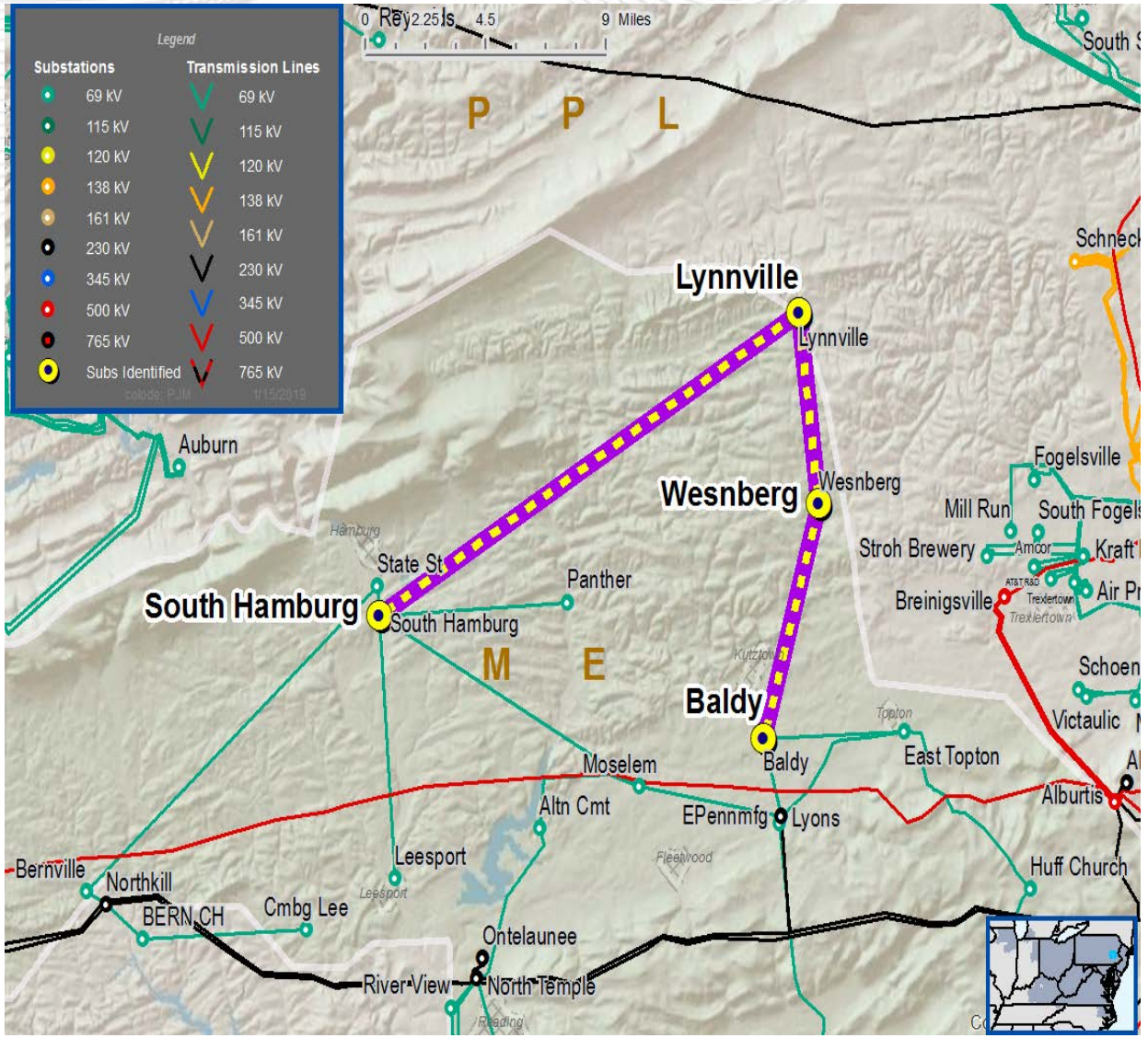

Met-Ed Transmission Zone

Need Number: ME-2019-003

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Line Condition Rebuild/Replacement

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- Age/condition of steel tower or steel pole transmission line structures
- Age/condition of transmission line conductors

System Performance Projects

- Substation/line equipment limits

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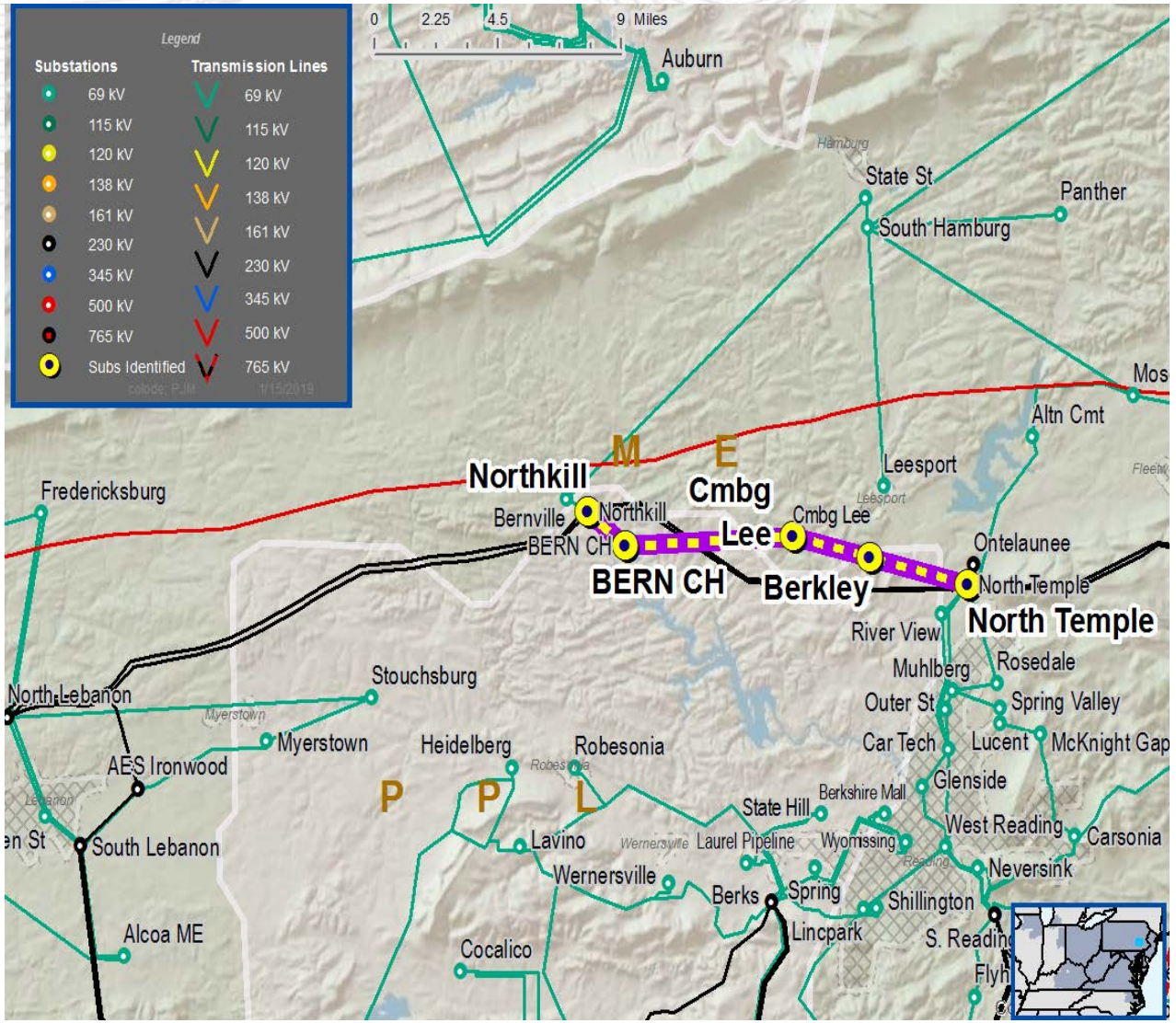

Met-Ed Transmission Zone

Need Number: ME-2019-005

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Line Condition Rebuild/Replacement

- Age/condition of wood pole transmission line structures
- Age/condition of steel tower or steel pole transmission line structures
- Age/condition of transmission line conductors

System Performance Projects

- Substation/line equipment limits

Problem Statement

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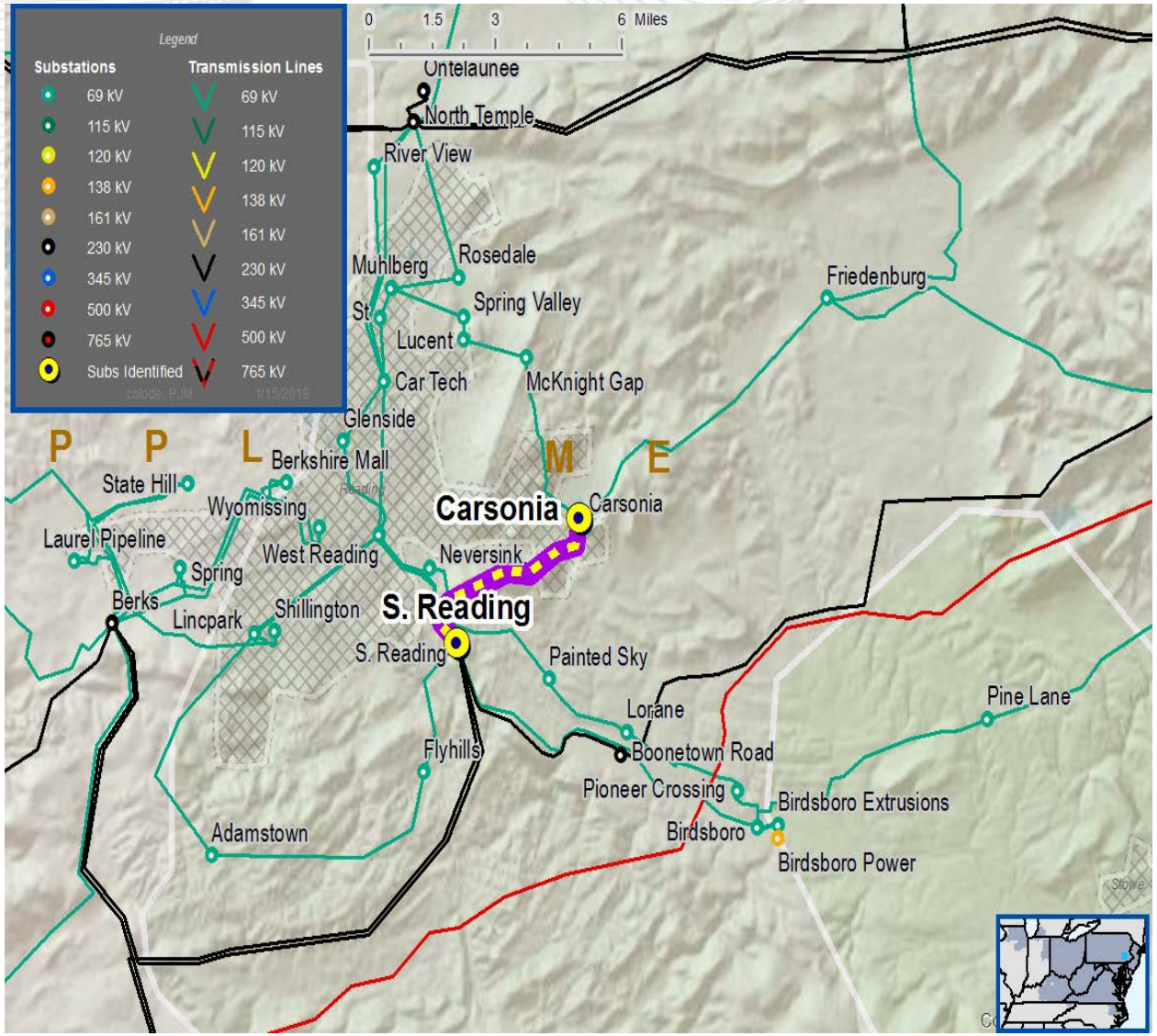

Met-Ed Transmission Zone

Need Number: ME-2019-006

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Line Condition Rebuild/Replacement

- Age/condition of wood pole transmission line structures
- Age/condition of steel tower or steel pole transmission line structures
- Age/condition of transmission line conductors

System Performance Projects

- Substation/line equipment limits

Problem Statement

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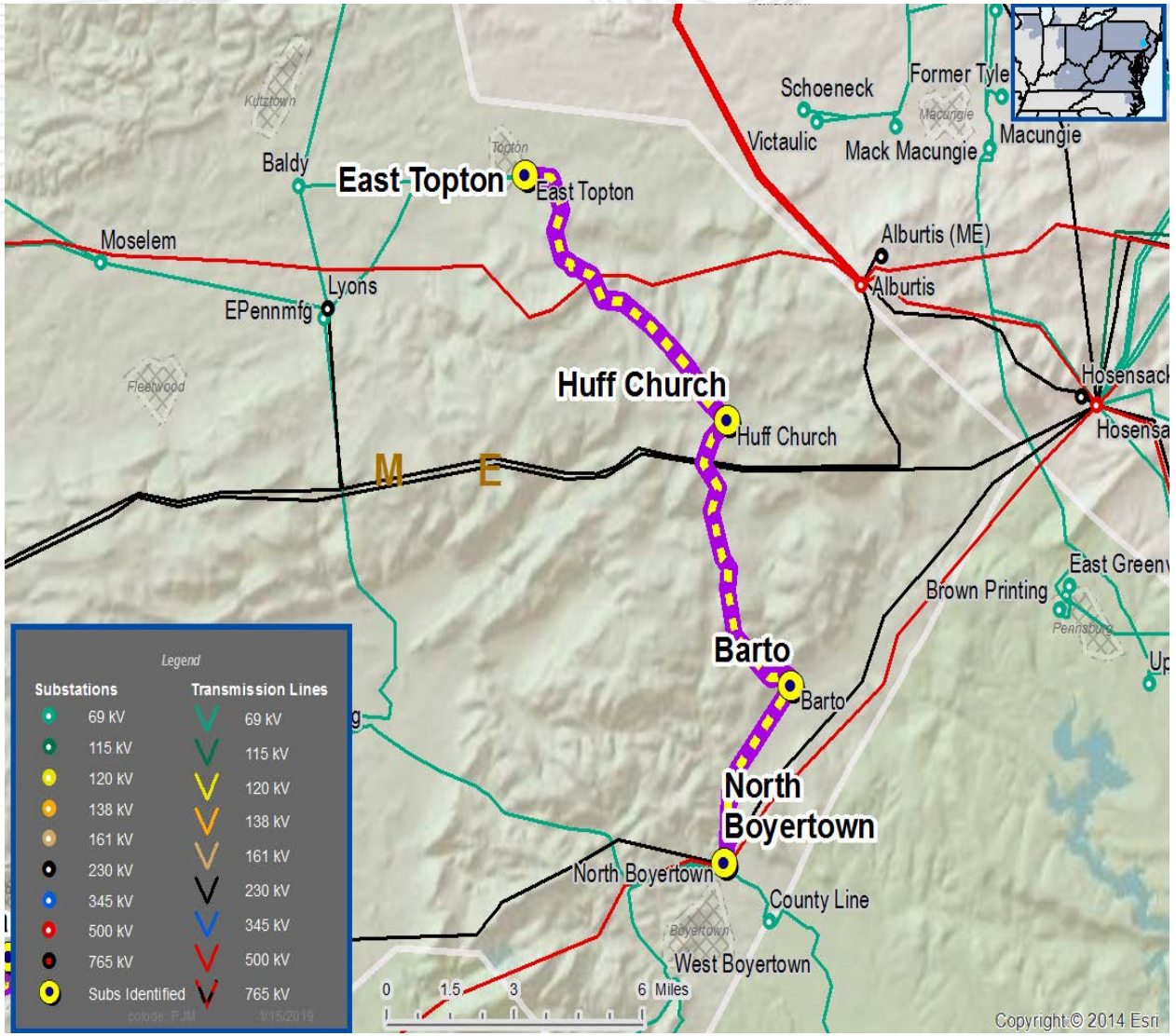

Met-Ed Transmission Zone

Need Number: ME-2019-007

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Line Condition Rebuild/Replacement

- Age/condition of wood pole transmission line structures
- Age/condition of steel tower or steel pole transmission line structures
- Age/condition of transmission line conductors

System Performance Projects

- Substation/line equipment limits

Problem Statement

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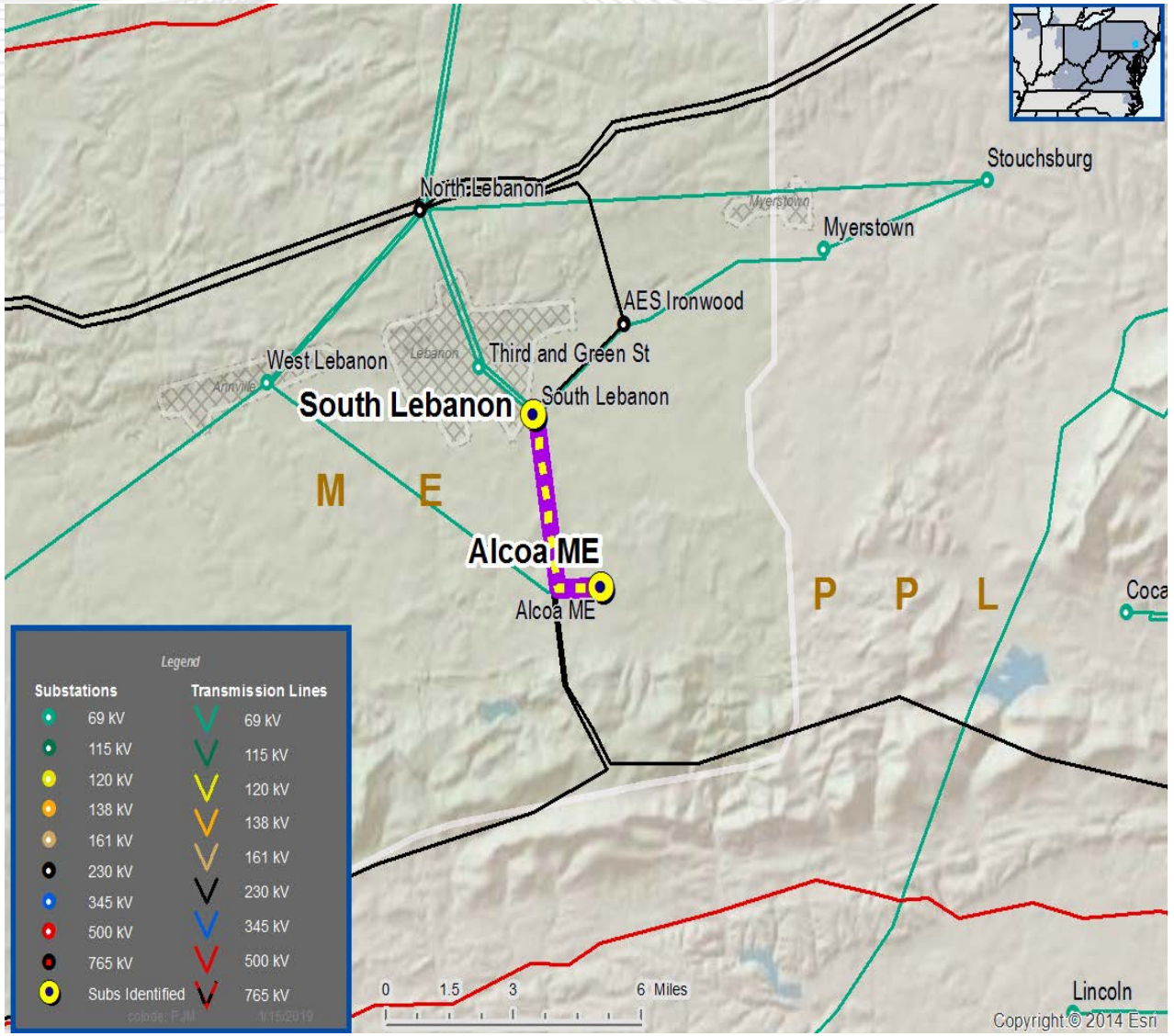

Met-Ed Transmission Zone

Need Number: ME-2019-008

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Line Condition Rebuild/Replacement

- Age/condition of wood pole transmission line structures
- Age/condition of steel tower or steel pole transmission line structures
- Age/condition of transmission line conductors

System Performance Projects

- Substation/line equipment limits

Problem Statement

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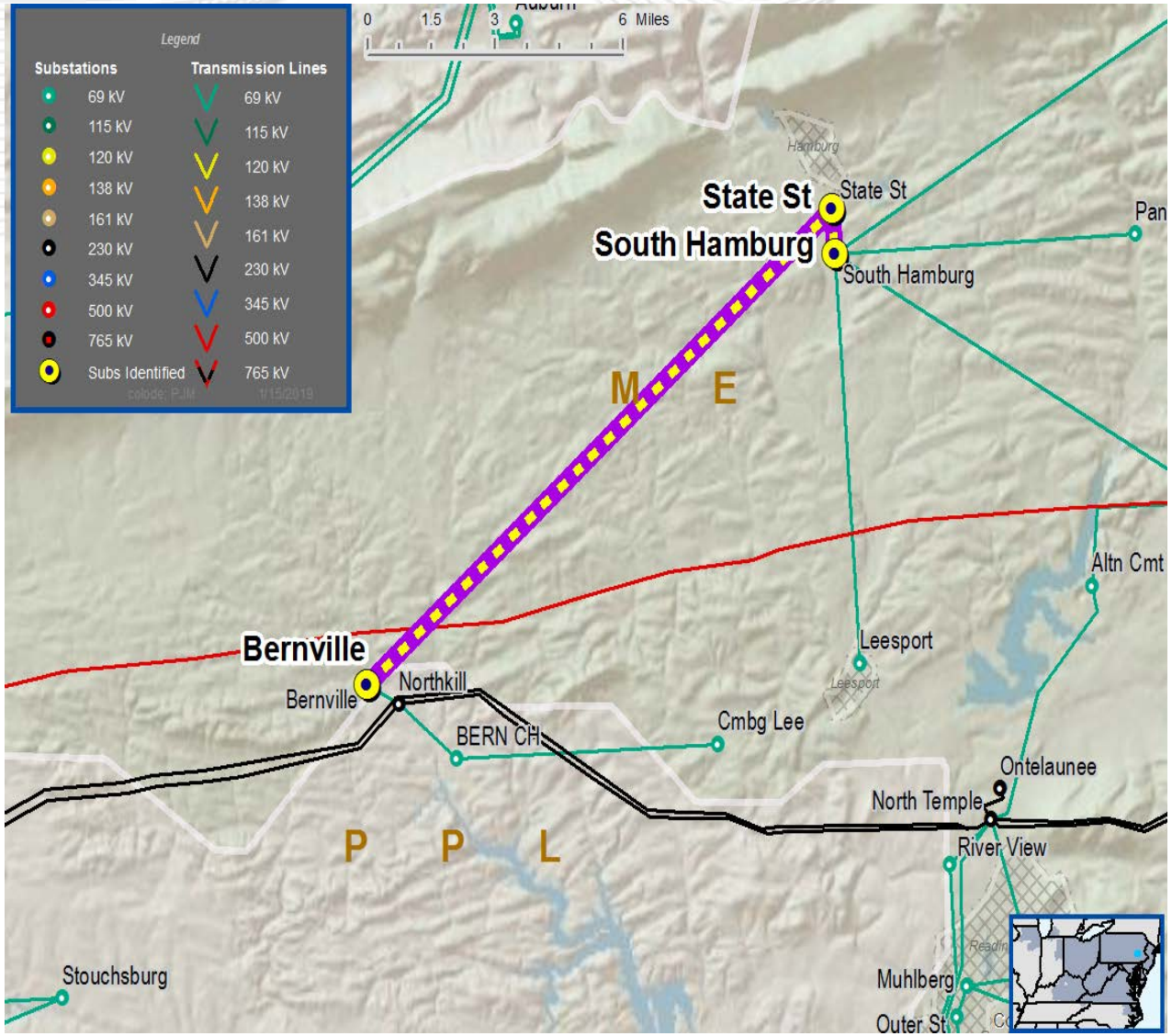

Met-Ed Transmission Zone

Need Number: ME-2019-009

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Line Condition Rebuild/Replacement

- Age/condition of wood pole transmission line structures
- Age/condition of steel tower or steel pole transmission line structures
- Age/condition of transmission line conductors

System Performance Projects

- Substation/line equipment limits

Problem Statement

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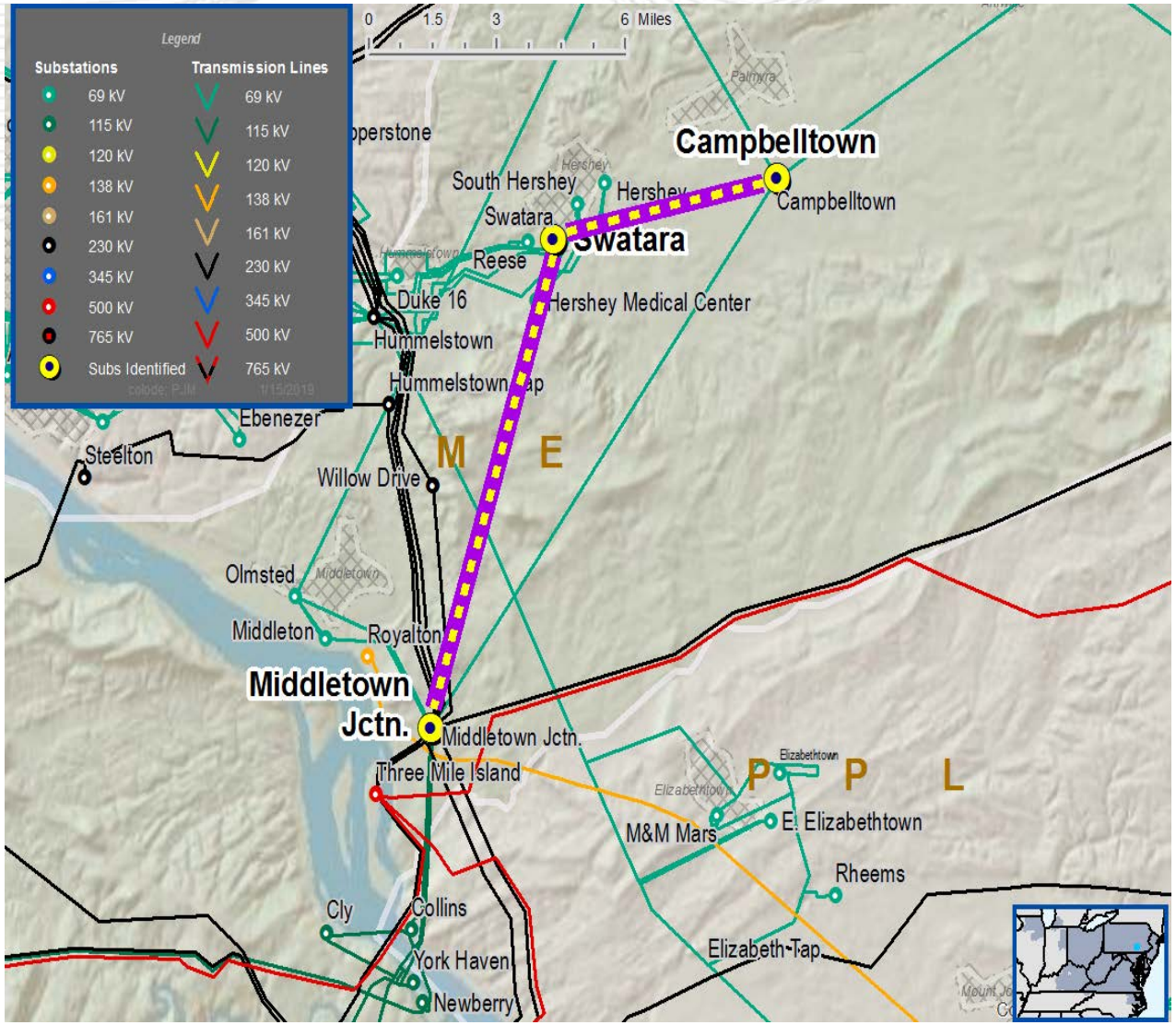

Met-Ed Transmission Zone

Need Number: ME-2019-010

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Line Condition Rebuild/Replacement

- Age/condition of wood pole transmission line structures
- Age/condition of steel tower or steel pole transmission line structures
- Age/condition of transmission line conductors

System Performance Projects

- Substation/line equipment limits

Problem Statement

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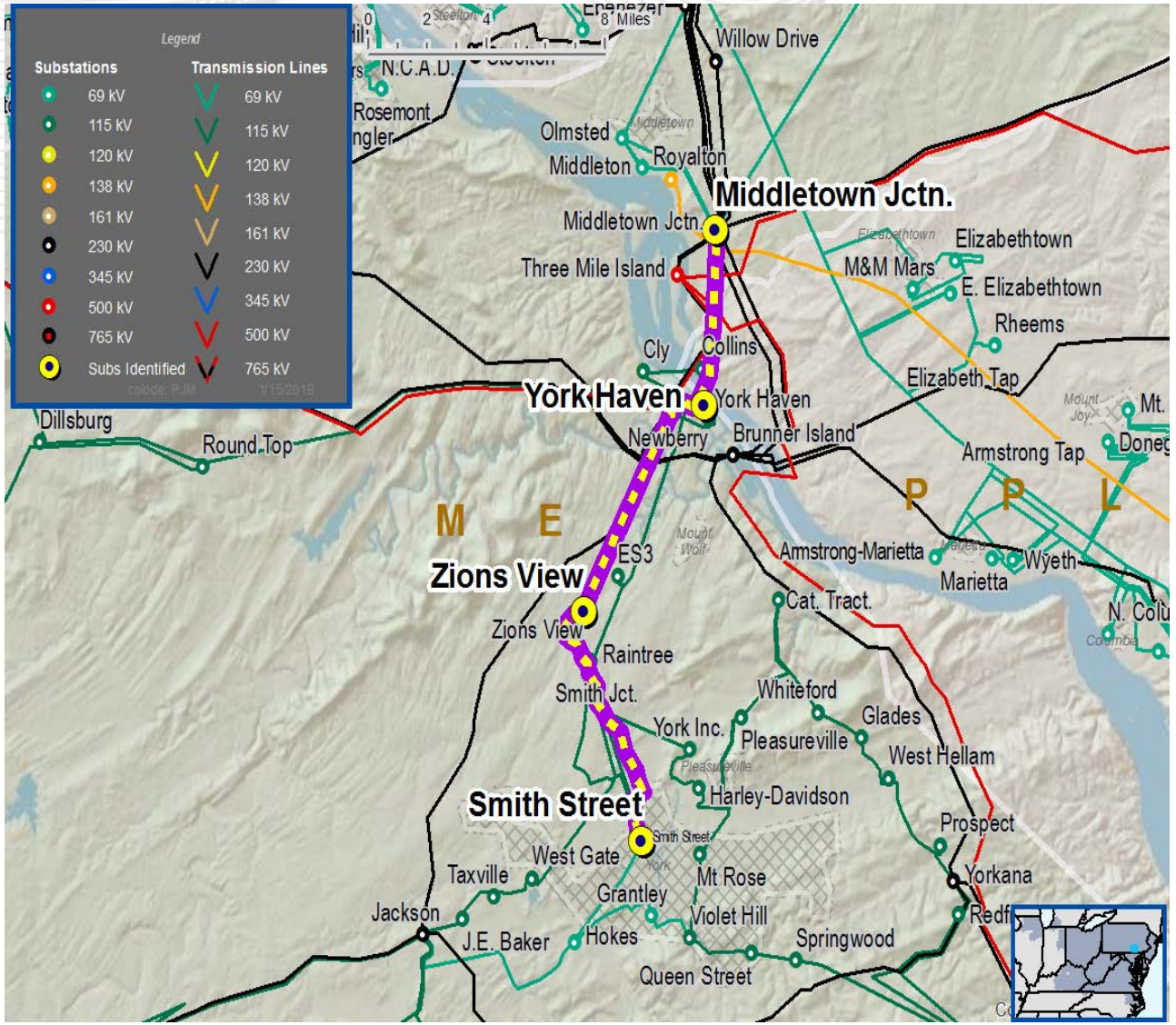

Met-Ed Transmission Zone

Need Number: ME-2019-011

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Line Condition Rebuild/Replacement

- Age/condition of wood pole transmission line structures
- Age/condition of steel tower or steel pole transmission line structures
- Age/condition of transmission line conductors

System Performance Projects

- Substation/line equipment limits

Problem Statement

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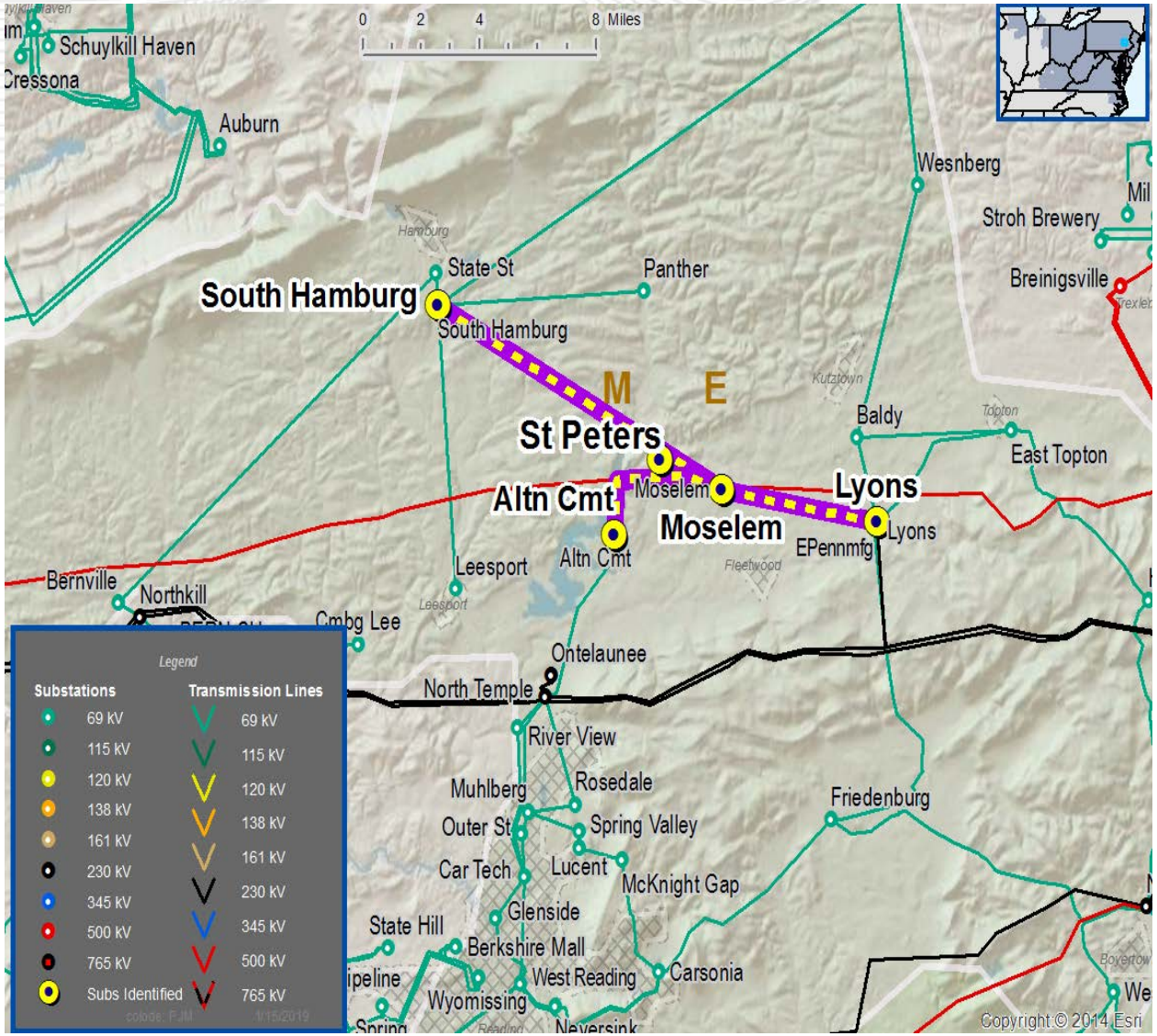


Met-Ed Transmission Zone

Need Number: ME-2019-012

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Line Condition Rebuild/Replacement

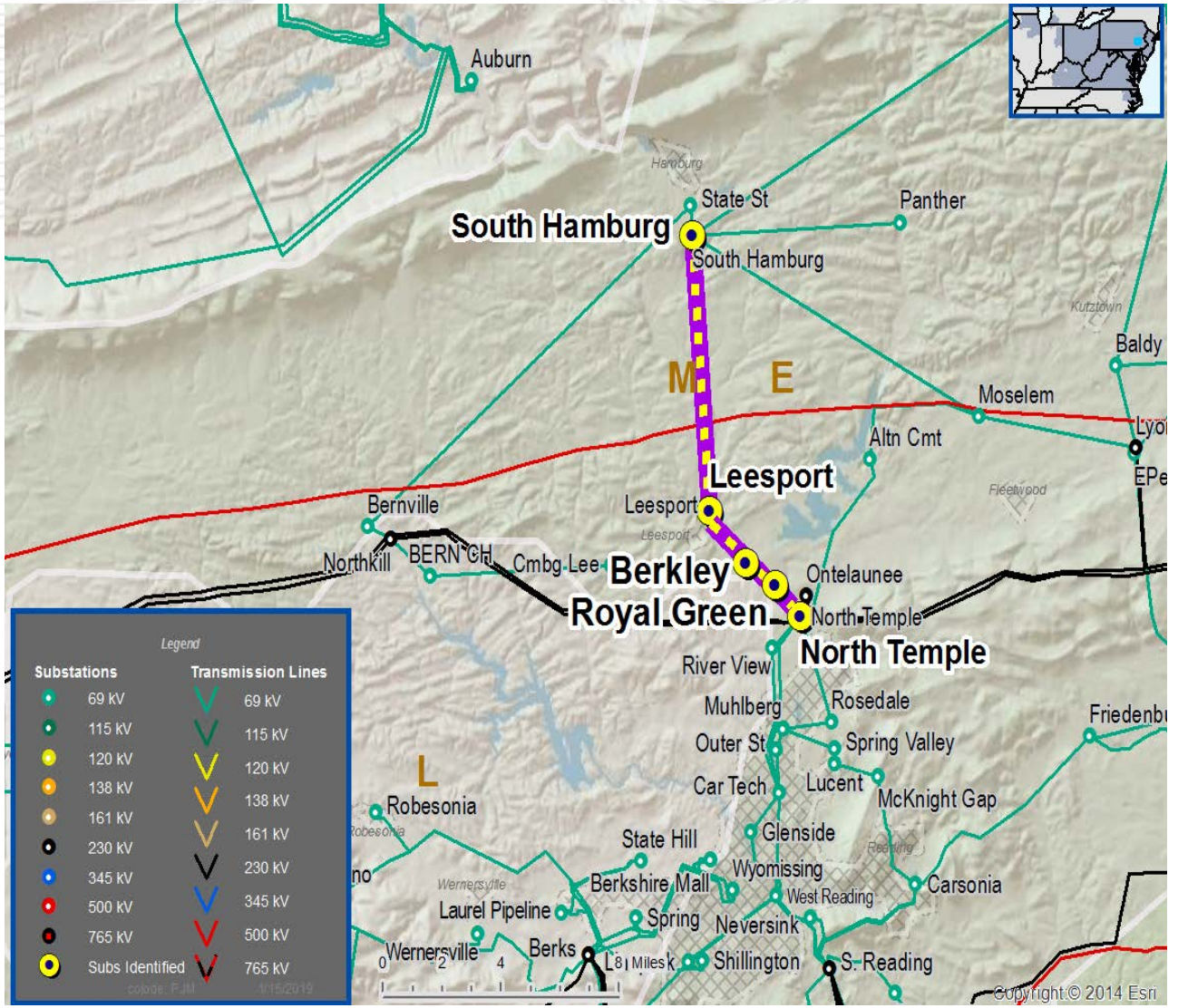
- Age/condition of wood pole transmission line structures
- Age/condition of steel tower or steel pole transmission line structures
- Age/condition of transmission line conductors

System Performance Projects

- Substation/line equipment limits

Problem Statement

- Line sections are exhibiting deterioration, increasing maintenance needs. Transmission line is approaching end of life
- Transmission line ratings are limited by terminal equipment.



Met-Ed Transmission Zone

Need Number: ME-2019-013

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Line Condition Rebuild/Replacement

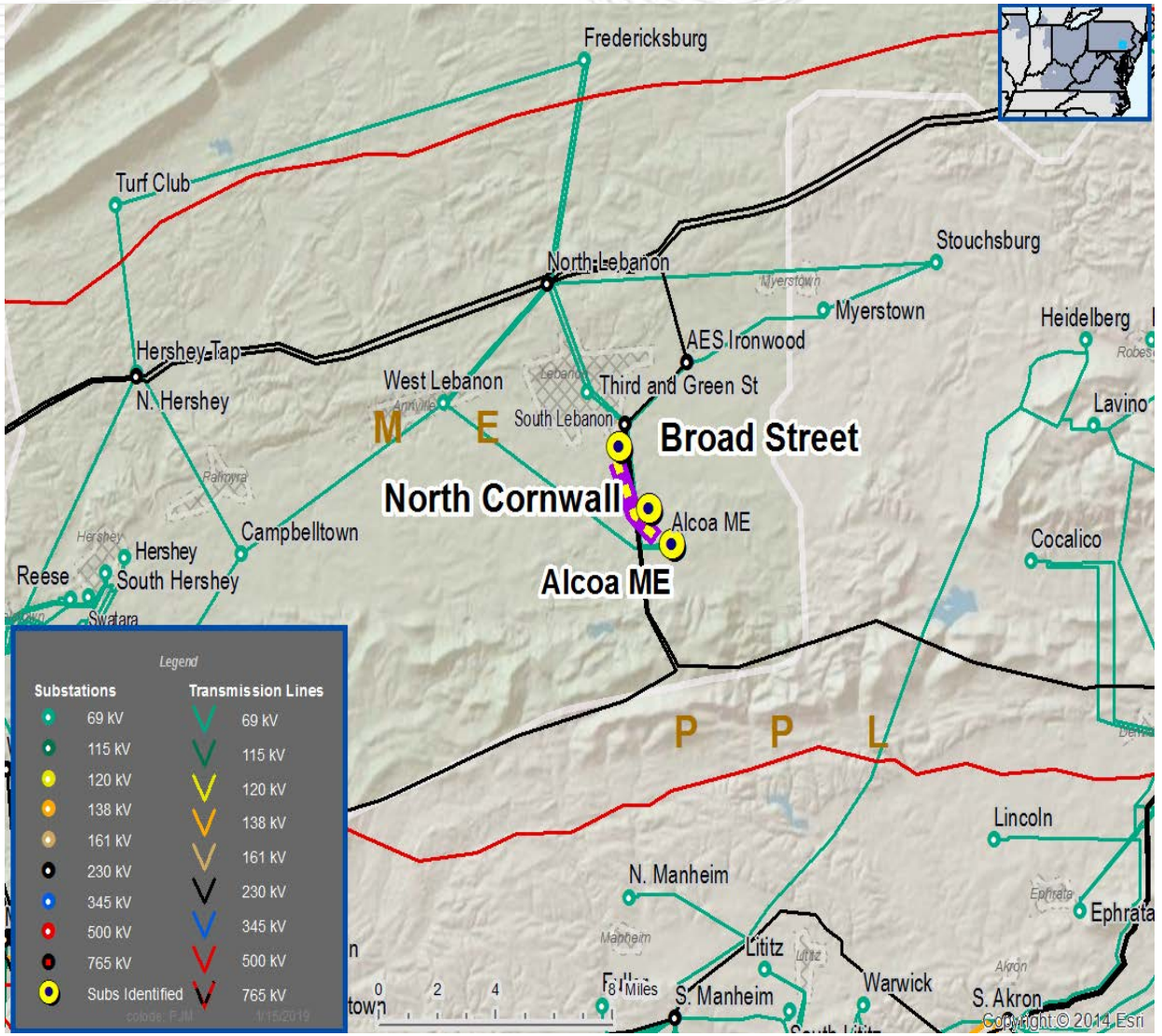
- Age/condition of wood pole transmission line structures
- Age/condition of steel tower or steel pole transmission line structures
- Age/condition of transmission line conductors

System Performance Projects

- Substation/line equipment limits

Problem Statement

- Line sections are exhibiting deterioration, increasing maintenance needs. Transmission line is approaching end of life
- Transmission line ratings are limited by terminal equipment.



Met-Ed Transmission Zone

Need Number: ME-2019-014

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Line Condition Rebuild/Replacement

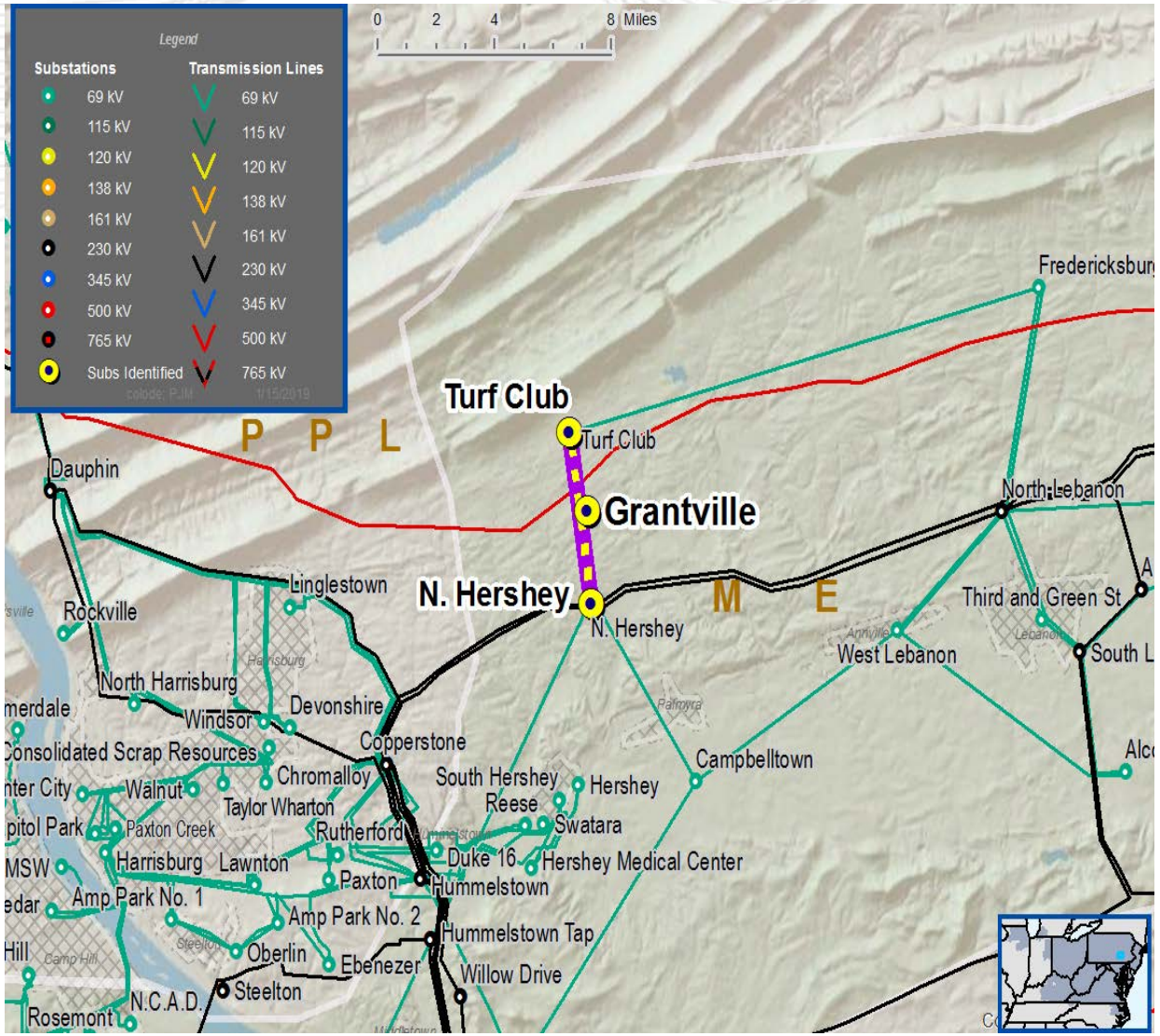
- Age/condition of wood pole transmission line structures
- Age/condition of steel tower or steel pole transmission line structures
- Age/condition of transmission line conductors

System Performance Projects

- Substation/line equipment limits

Problem Statement

- Line sections are exhibiting deterioration, increasing maintenance needs. Transmission line is approaching end of life
- Transmission line ratings are limited by terminal equipment.



Met-Ed Transmission Zone

Need Number: ME-2019-015

Process Stage: Need Meeting

Date: 2/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

- Line Condition Rebuild/Replacement – Age/condition of transmission line conductors, wood pole transmission line structures
- System Performance Projects – Substation/Line Equipment Limits
- Reconductor/Rebuild Transmission Lines – Transmission lines with high loading

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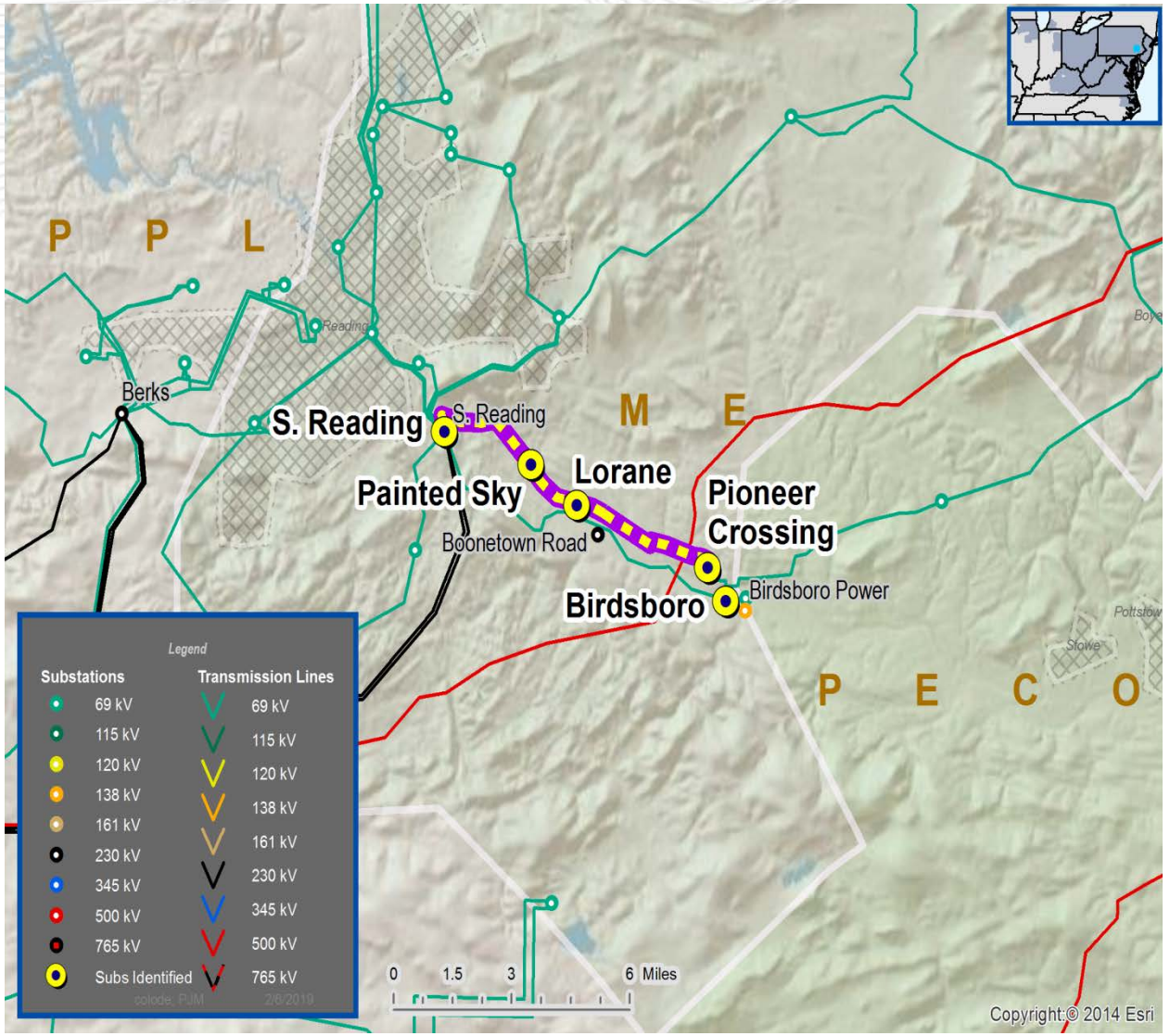

Met-Ed Transmission Zone

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Problem Statement

The South Reading-Painted Sky-Lorane-Pioneer Crossing-Birdsboro 69 kV line is exhibiting deterioration resulting in increased maintenance. The Transmission line is approaching end of life

- 28 out of 125 structures failed inspection (22% Failure Rate).
- Failure reasons include bad/cut/missing grounds, static bayonet, broken guy, woodpecker damage, etc.
- Total line distance is approximately 7.5 miles.

Thermal loading on the Lorane-Pioneer Crossing 69 kV section is ~115% of the SE rating for loss of the N. Boyertown 230-69 kV transformer & S. Reading-Birdsboro 828 69 kV line.

(2018 RTEP Model – 2023 Summer)

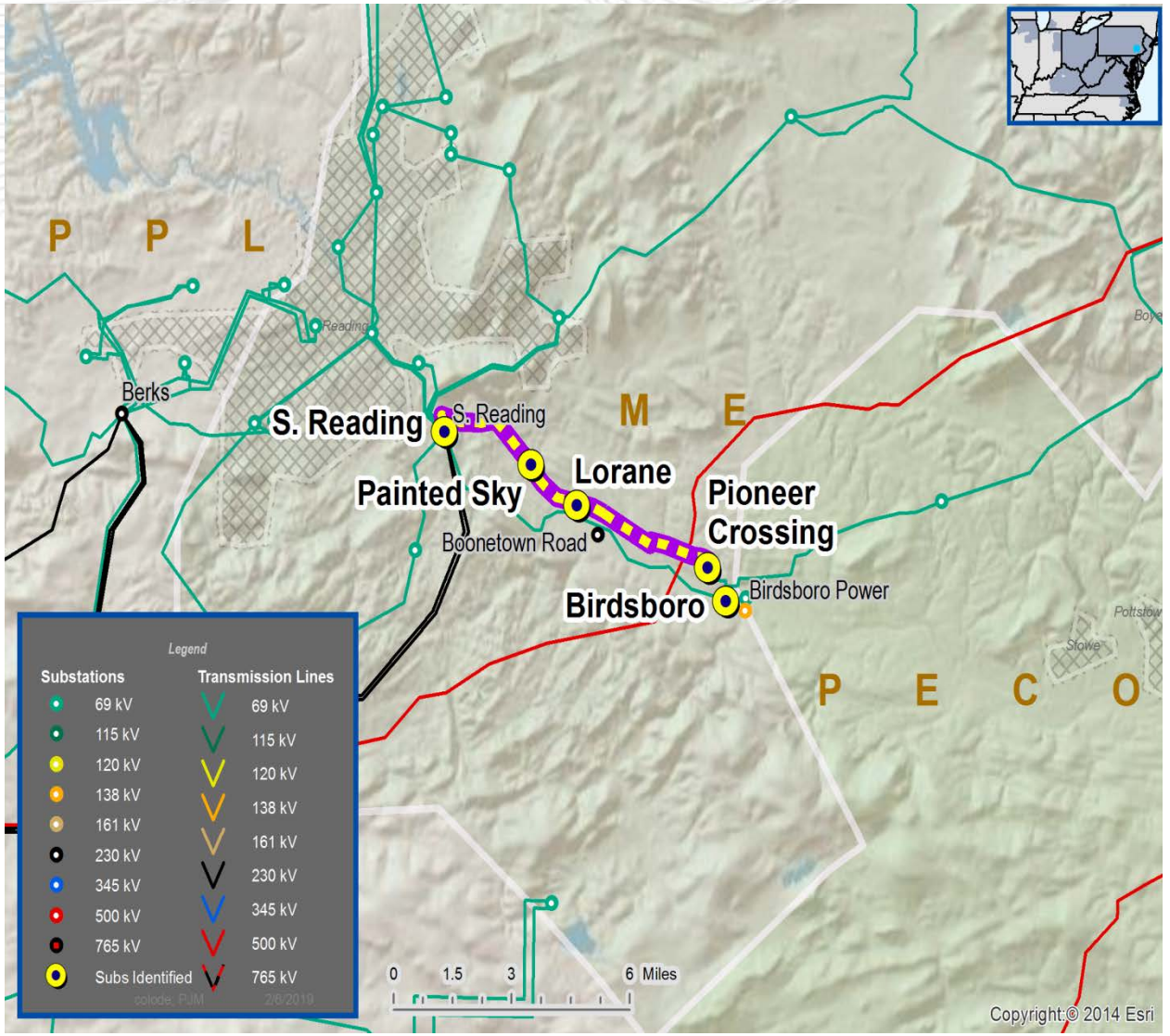
Transmission line rating is limited by terminal equipment.

South Reading-Painted Sky 69 kV line: *(substation conductor)*

- Existing line rating is 88 / 114 MVA (SN / SE).
- Existing conductor rating is 139 / 169 MVA (SN / SE).

Painted Sky-Lorane 69 kV line: *(substation conductor)*

- Existing line rating is 137 / 169 MVA (SN / SE).
- Existing conductor rating is 139 / 169 MVA (SN / SE).



Met-Ed Transmission Zone

Need Number: ME-2019-016

Process Stage: Need Meeting

Date: 2/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

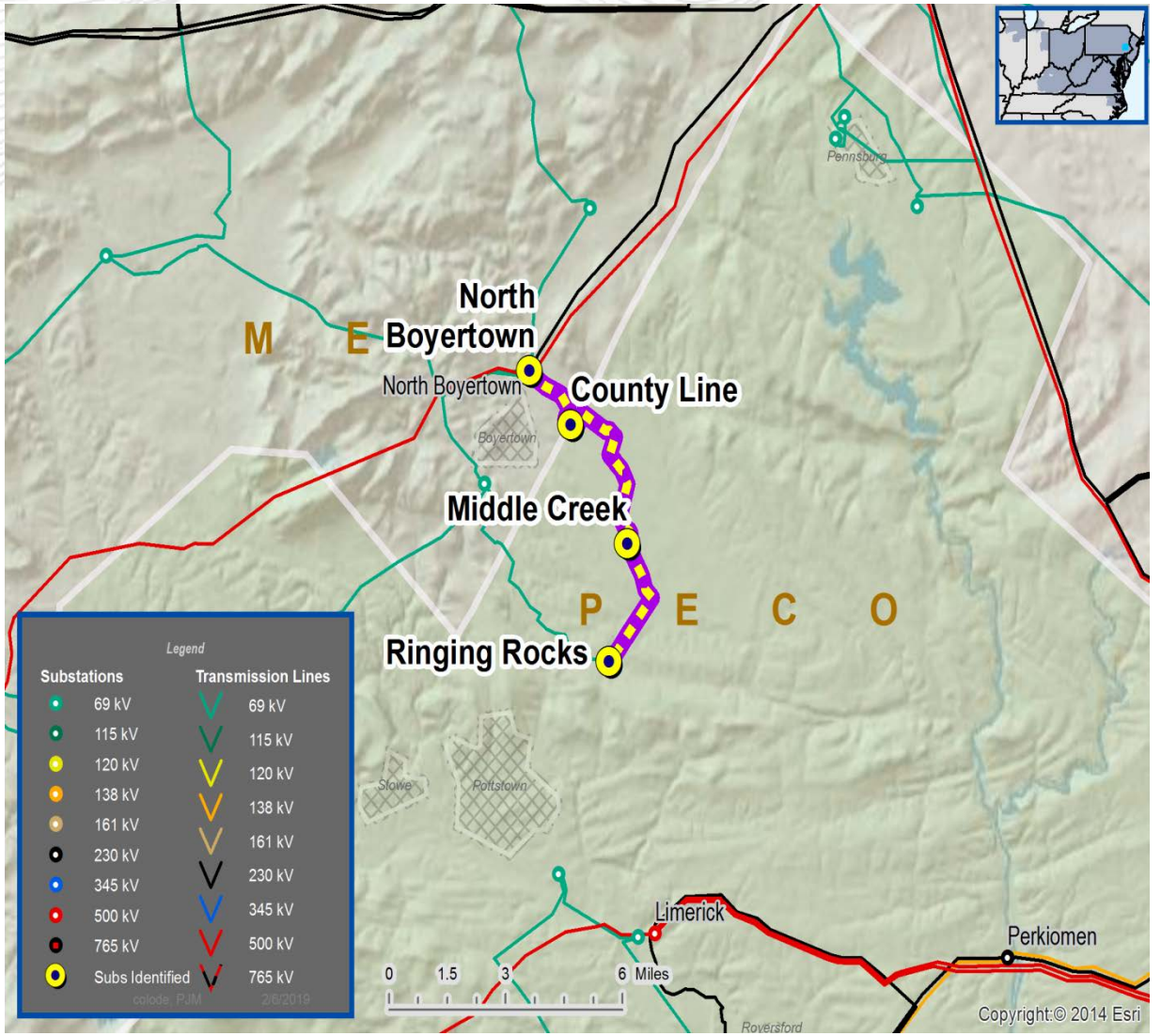
- Line Condition Rebuild/Replacement – Age/condition of transmission line conductors, wood pole transmission line structures, and steel pole transmission line structures
- System Performance Projects – Substation/Line Equipment Limits
- Reconductor/Rebuild Transmission Lines – Transmission lines with high loading

Problem Statement

The N. Boyertown-Cabot-County Line-Middle Creek-Ringing Rocks 69 kV line is exhibiting deterioration resulting in increased maintenance. The Transmission line is approaching end of life

- 41 out of 147 structures failed inspection (28% Failure Rate).
- Failure reasons include split top, cracking, etc.
- Total line distance is approximately 7.7 miles.

- Continued on next slide…



Met-Ed Transmission Zone

Continued from previous slide…

Thermal loading on North Boyertown-Cabot 69 kV section and Cabot-County Line 69 kV sections are loaded to approximately 112% and 100% of their SE ratings respectively for loss of the North Boyertown-West Boyertown 69 kV line & Birdsboro-West Boyertown 69 kV line.

(2018 RTEP Model – 2023 Summer)

Transmission line rating is limited by terminal equipment.

North Boyertown – Cabot Tap 69 kV line: *(relay and substation conductor)*

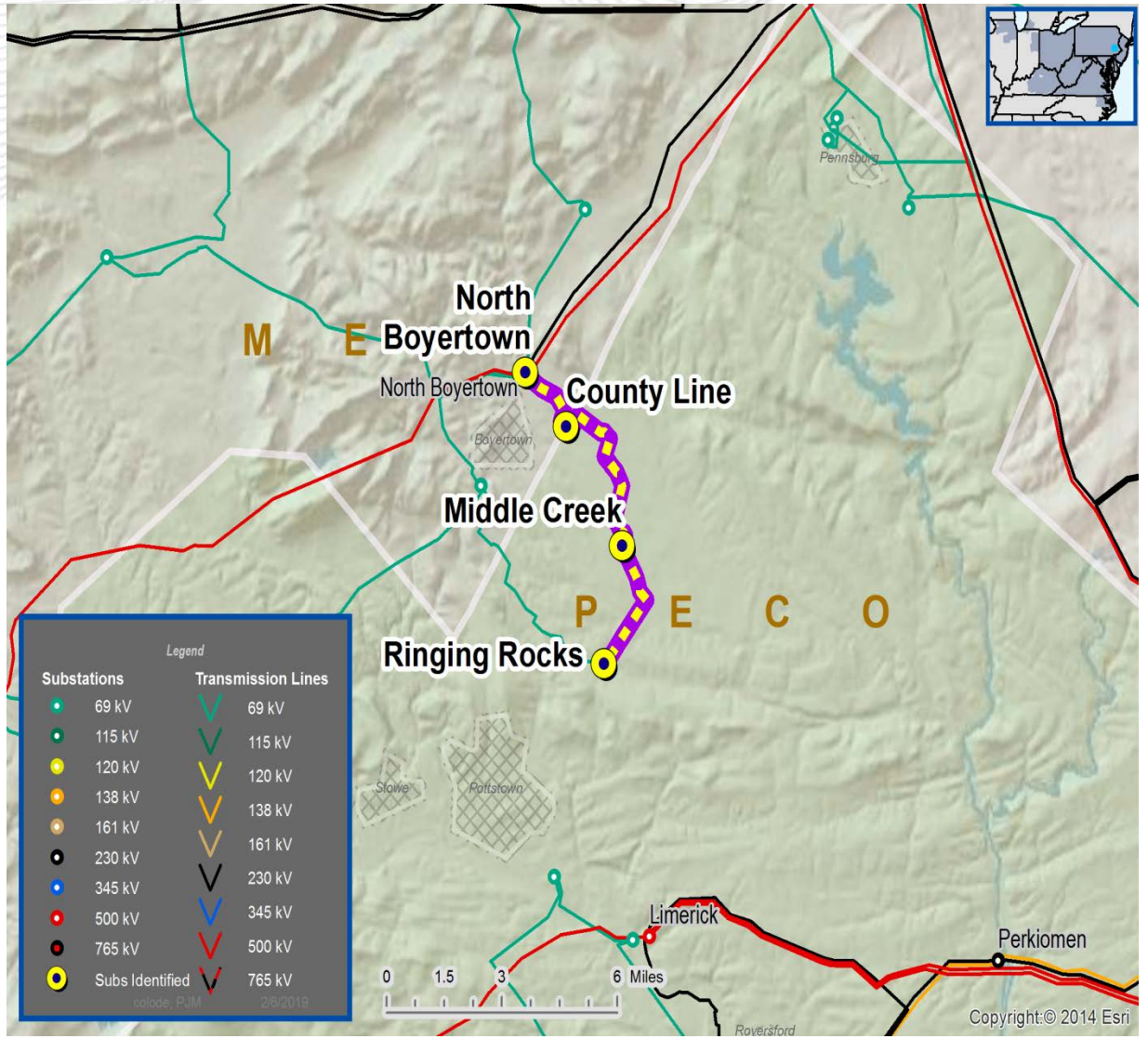
- Existing line rating is 62 / 72 MVA (SN / SE).
- Existing conductor rating is 72 / 72 MVA (SN / SE).

County Line – Middle Creek 69 kV line: *(substation conductor)*

- Existing line rating is 132 / 158 MVA (SN / SE).
- Existing conductor rating is 139 / 169 MVA (SN / SE).

Middle Creek – Ringing Rocks 69 kV line: *(relay, disconnect switch)*

- Existing line rating is 62 / 62 MVA (SN / SE).
- Existing conductor rating is 99 / 99 MVA (SN / SE).



Met-Ed Transmission Zone

Need Number: ME-2019-017

Process Stage: Need Meeting

Date: 2/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

- Line Condition Rebuild/Replacement – Age/condition of transmission line conductors, wood pole transmission line structures
- System Performance Projects – Substation/Line Equipment Limits
- Reconductor/Rebuild Transmission Lines – Transmission lines with high loading

Problem Statement

The N. Lebanon-Cleona-W. Lebanon 69 kV line is exhibiting deterioration resulting in increased maintenance. The Transmission line is approaching end of life

- 58 out of 73 structures failed inspection (79% Failure Rate).
- Failure reasons include top rot, voids, woodpecker holes, etc.
- Total line distance is approximately 7.1 miles.

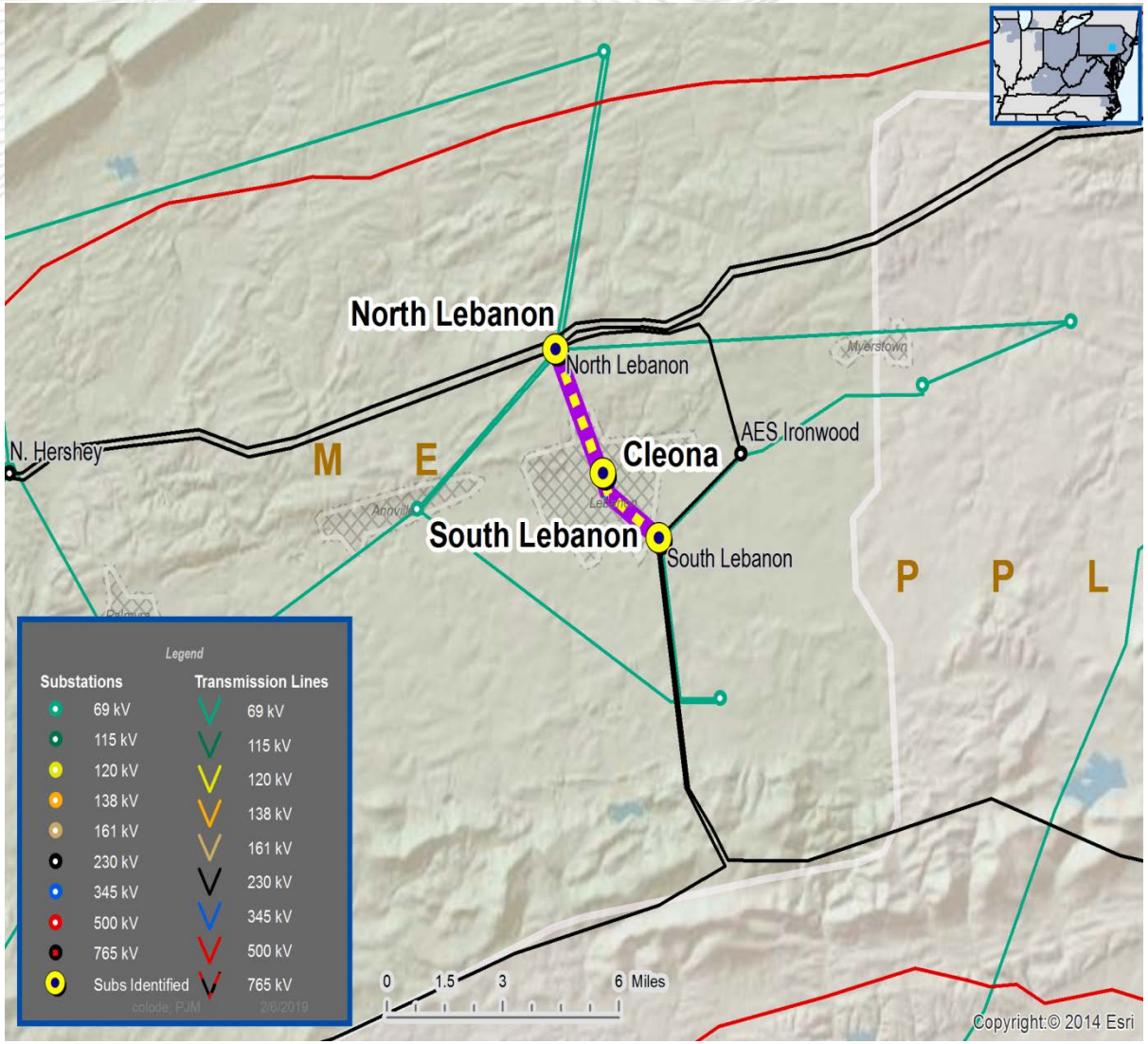
Thermal loading on Cleona-West Lebanon 69 kV section is approximately 98% of the SE rating for loss of the South Lebanon 230-69 kV #1 & #2 transformers.

(2018 RTEP Model – 2023 Summer)

Transmission line rating is limited by terminal equipment.

North Lebanon – Cleona 69 kV line: *(relay and disconnect switches)*

- Existing line rating is 78 / 82 MVA (SN / SE).
- Existing conductor rating is 105 / 125 MVA (SN / SE).



Met-Ed Transmission Zone

Need Number: ME-2019-018

Process Stage: Need Meeting

Date: 2/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Operational Flexibility and Efficiency

Specific Assumption Reference(s)

- Substation Condition Rebuild/Replacement
- Add/Expand Bus Configuration

- Eliminate simultaneous outages to multiple networked elements for stuck breakers, bus outages, N-2 events, etc...

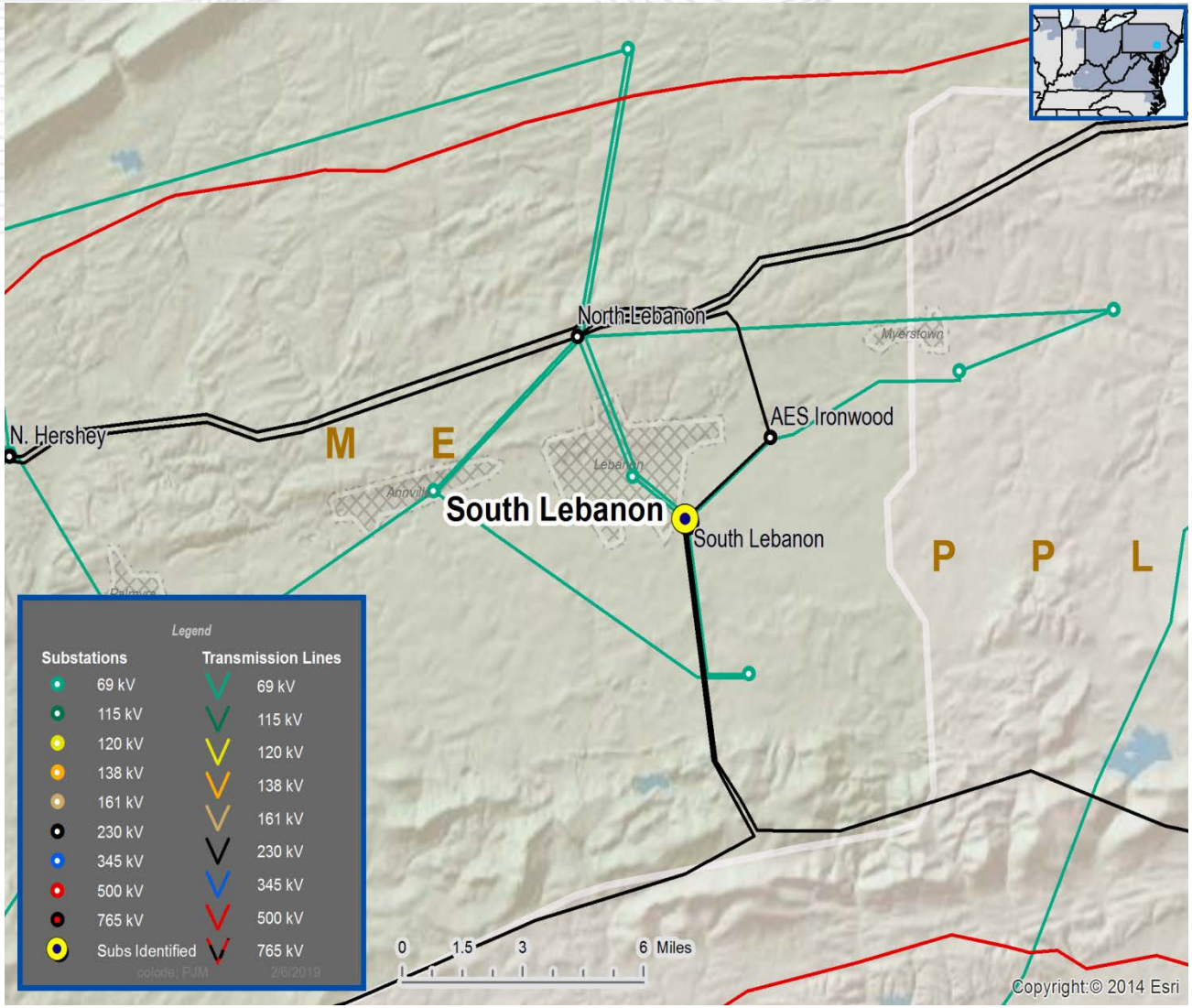
Problem Statement

South Lebanon #1 230-69 kV:

- Transformer is 49 years old
- Experiencing dissolved gasses in oil
- Analysis shows breaking down of paper insulation
- Approximately $72,000 spent on maintenance orders since 2004

South Lebanon #2 230-69 kV:

- Transformer is 50 years old and at end of life
- History of oil leaks
- Analysis shows breaking down of paper insulation
- Broken fans and deteriorating bushings
- Tank temp has to be read with a thermal gun
- Approximately $32,000 spent on maintenance orders since 2004



Met-Ed Transmission Zone

Need Number: ME-2019-019

Process Stage: Need Meeting

Date: 2/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Operational Flexibility and Efficiency

Specific Assumption Reference(s)

System Performance Projects 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

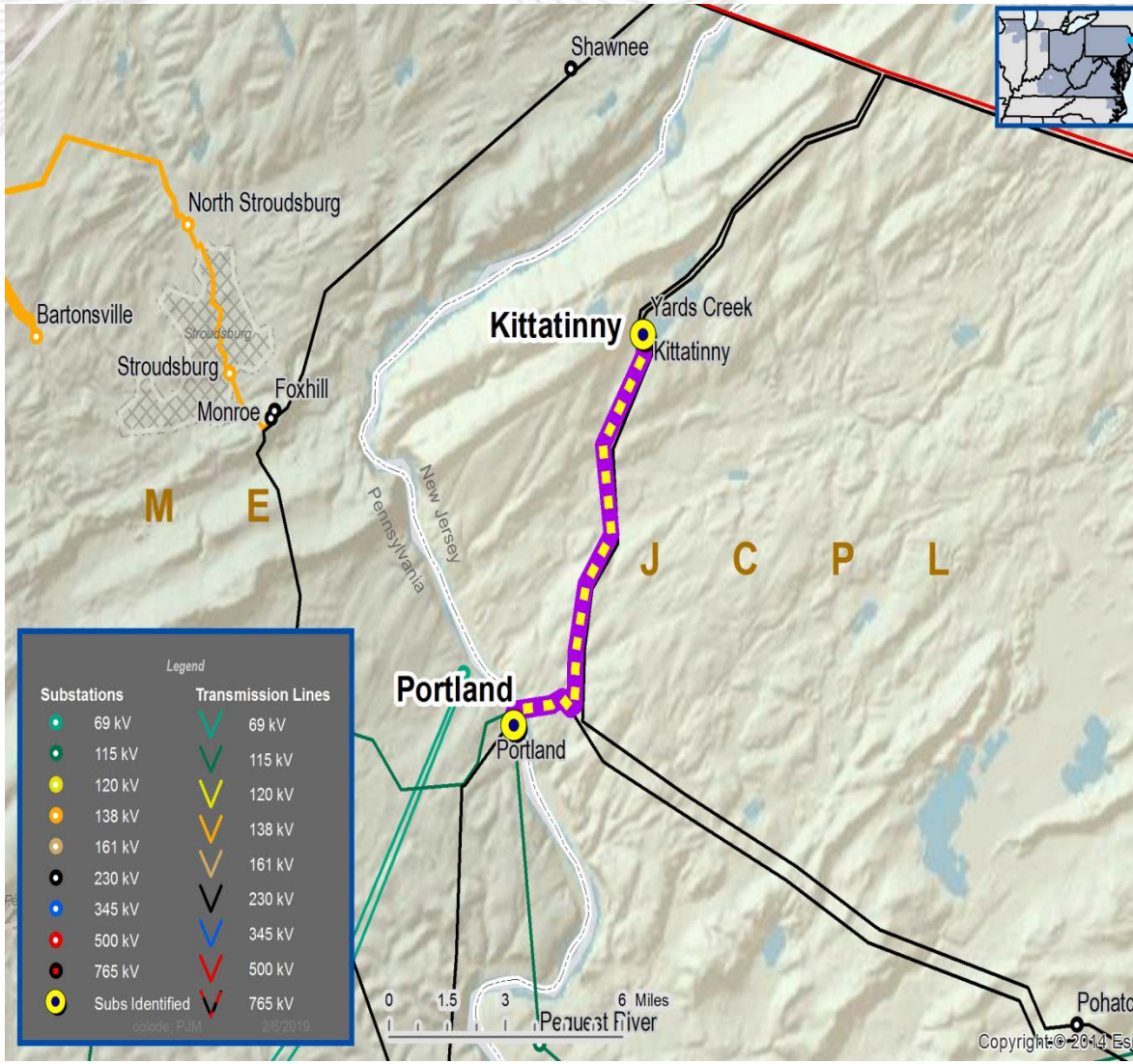
Relays on Kittatinny – Portland 230 kV line have been identified as protection schemes using a certain vintage of relays and communication equipment that have a history of misoperation. Proper operation of the protection scheme requires all the separate components perform adequately during a fault.

- Kittatinny – Portland 230 kV line:

  Existing line rating: 1114 / 1195 MVA (SN / SE).

  Existing conductor rating: 1114 / 1285 MVA (SN / SE).

  (relaying)



Met-Ed Transmission Zone

Need Number: ME-2019-020

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Line Condition Rebuild/Replacement

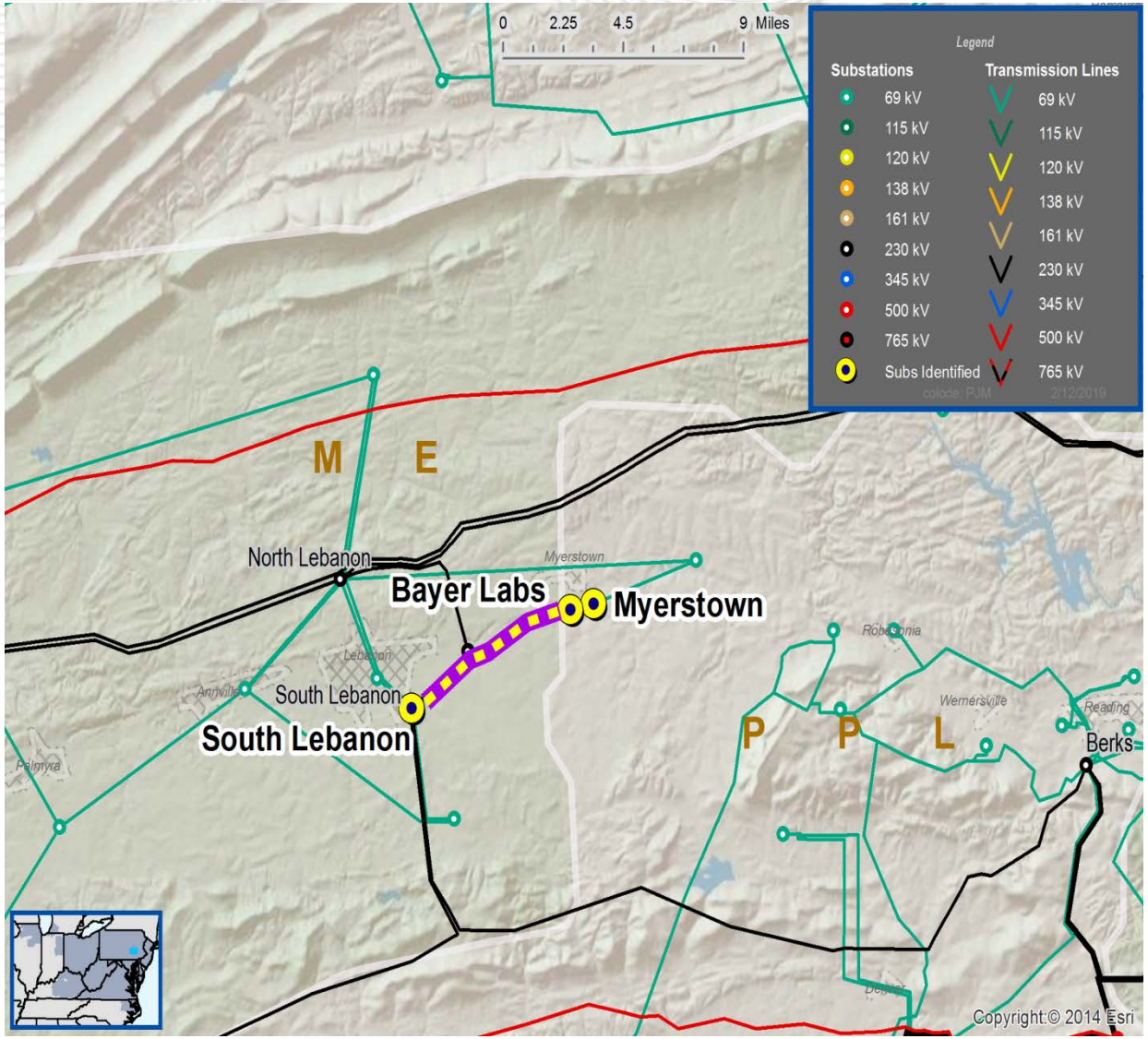
- Age/condition of wood pole transmission line structures
- Age/condition of steel tower or steel pole transmission line structures
- Age/condition of transmission line conductors

System Performance Projects

- Substation/line equipment limits

Problem Statement

- Line sections are exhibiting deterioration, increasing maintenance needs. Transmission line is approaching end of life
- Transmission line ratings are limited by terminal equipment.



Met-Ed Transmission Zone

Need Number: ME-2019-021

Process Stage: Need Meeting

Date: 2/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

- Line Condition Rebuild/Replacement – Age/condition of transmission line conductors, wood pole transmission line structures, and steel pole transmission line structures
- System Performance Projects – Substation/Line Equipment Limits
- Reconductor/Rebuild Transmission Lines – Transmission lines with high loading

Problem Statement

The North Lebanon – Turf Club 69 kV line is exhibiting deterioration resulting in increased maintenance. The Transmission line is approaching end of life

- 236 out of 360 structures failed inspection. (66% Failure Rate)
- Failure reasons include decay, woodpecker holes, cracking, bad/cut/missing ground wires, etc.
- Total line distance is approximately 7.7 miles.

Thermal loading on Turf Club – Indiantown Gap 69 kV and Indiantown Gap – Lickdale 69 kV line sections are approximately 97% and 86% of their SE ratings respectively for loss of North Lebanon – Fredericksburg 69 kV line section.

(2018 RTEP Model – 2023 Summer)

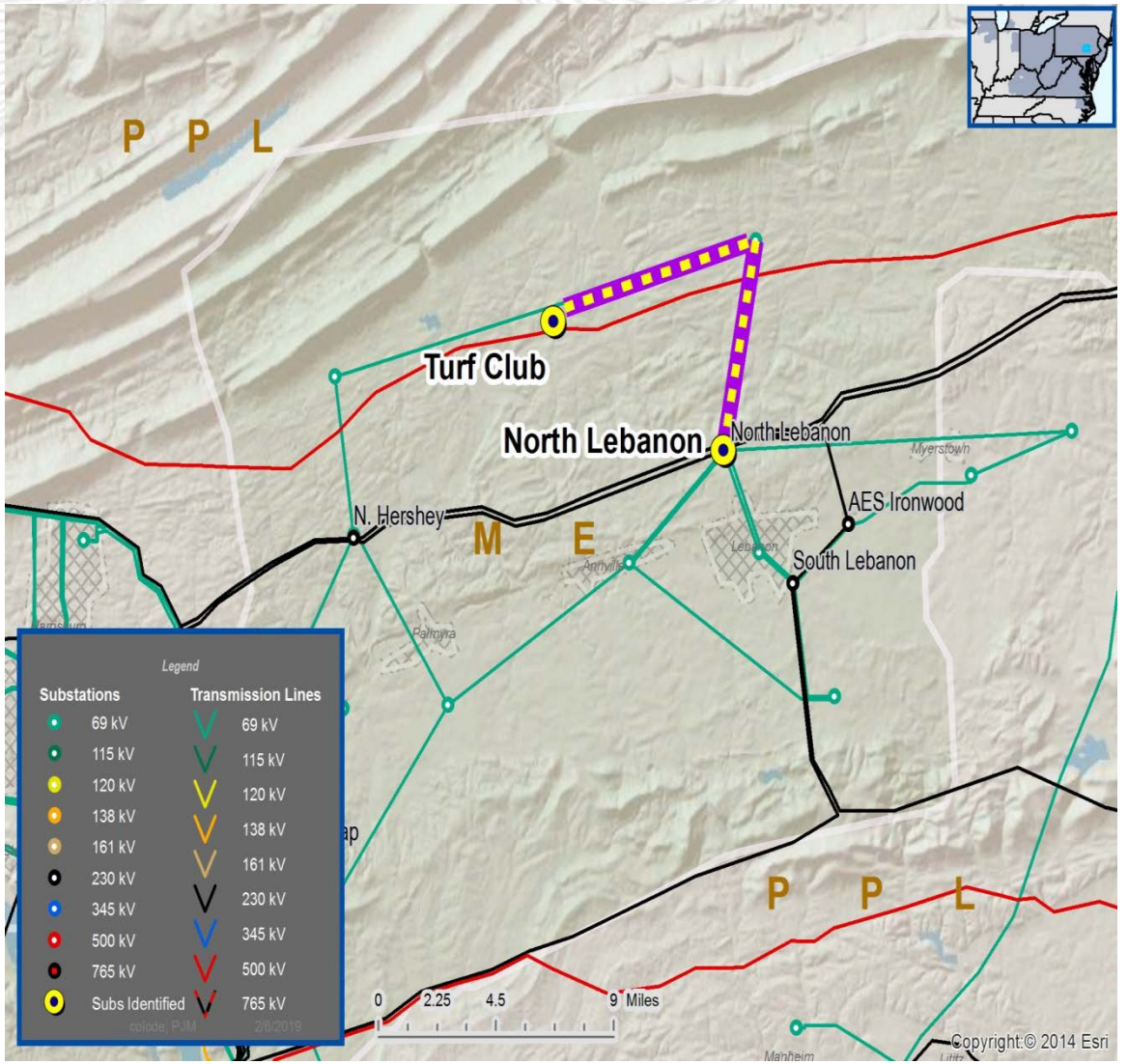
Transmission line ratings limited by terminal equipment.

- North Lebanon – Fredericksburg 69 kV line:

  Existing line rating: 82 / 103 MVA (SN / SE).

  Existing conductor rating is 139 / 169 MVA (SN / SE).

  (disconnect switches)



Met-Ed Transmission Zone

Need Number: ME-2019-022

Process Stage: Need Meeting

Date: 2/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

- Line Condition Rebuild/Replacement – Age/condition of transmission line conductors, wood pole transmission line structures
- Reconductor/Rebuild Transmission Lines – Transmission lines with high loading

Problem Statement

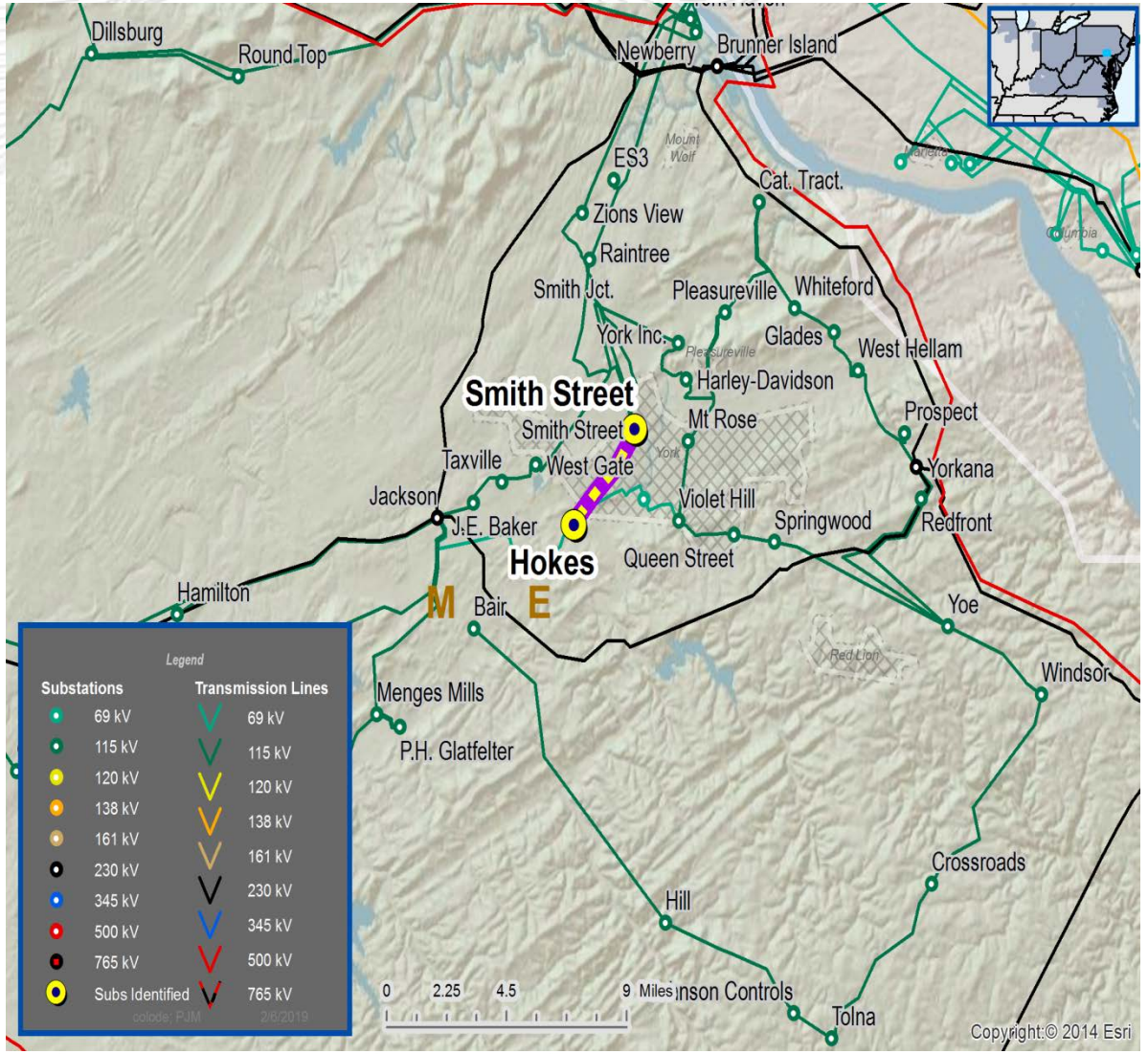
The Hokes – Smith St 69 kV is exhibiting deterioration resulting in increased maintenance. The Transmission line is approaching end of life.

- 83 out of 122 structures failed inspection. (68% Failure Rate)
- Failure reasons include contamination, sound, bad/cut/missing ground wires, etc.
- Total line distance is approximately 5.4 miles.

Thermal loading on Hokes-Smith Street 69 kV line is loaded to approximately 158% of the SE rating for loss of the Jackson-Hokes 69 kV line & the Violet Hill 69 kV transformer.

(2018 RTEP Model – 2023 Summer)

Transmission line rating is currently limited by the conductor: 43 / 44 MVA (SN / SE).



Penelec Transmission Zone

Need Number: PN-2019-001

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Substation Condition Rebuild/Replacement

- Power transformers and load tap changers (LTCs)

System Performance Projects Global Factors

- Substation/line equipment limits

Problem Statement

East Towanda #4 230/115 kV Transformer

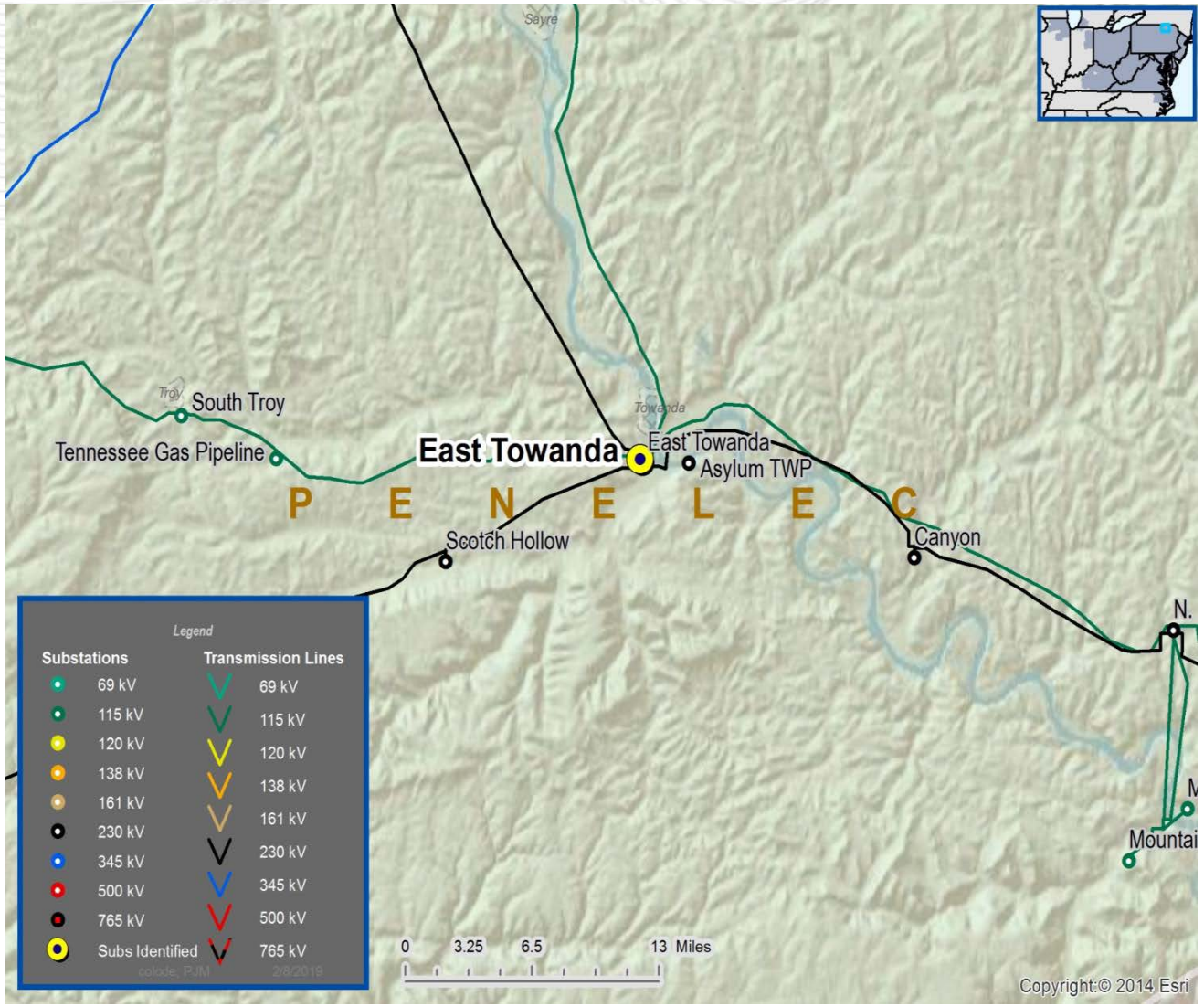
- Transformer has an increased failure probability due to type “U” bushings, dielectric breakdown, and is exhibiting high ethylene gas.
- Transformer is 45 years old.
- Approximately $64,000 spent on maintenance orders since 2003.

Transformer circuit rating is limited by terminal equipment.

Existing transformer circuit rating is 190 / 226 MVA (SN / SE).

Existing transformer rating is 195 / 244 MVA (SN / SE).

(substation conductor)



Penelec Transmission Zone

Need Number: PN-2019-002

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Substation Condition Rebuild/Replacement

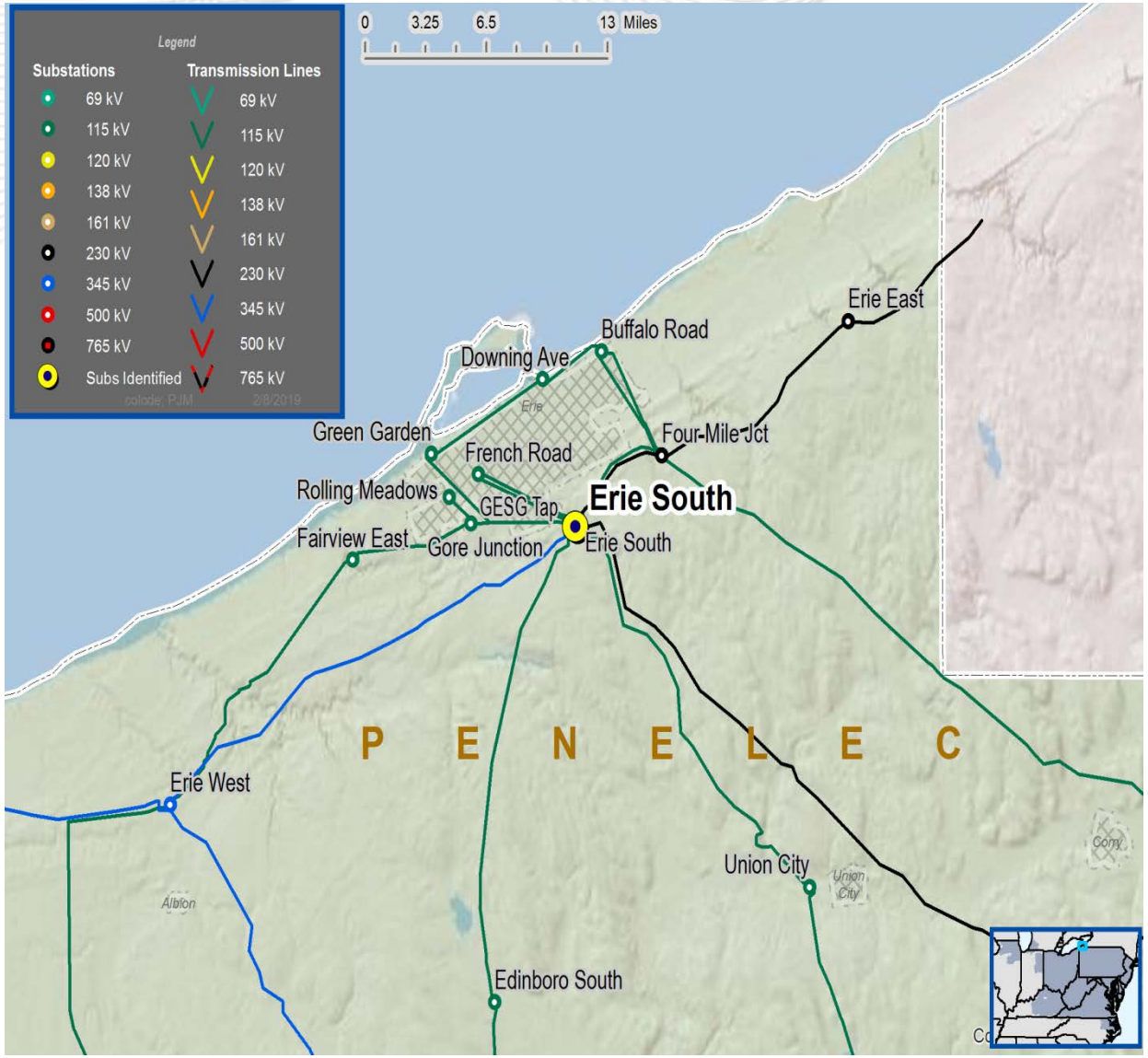
- Power transformers and load tap changers (LTCs)

Problem Statement

Erie South #6 230/115 kV Transformer

- Transformer has an increased failure probability due to type “U” bushings, nitrogen leaks, and is exhibiting an increase in ethylene gas. Power factor test results show deterioration of insulation.
- Transformer is 41 years old.
- Approximately $821,000 spent on maintenance orders since 2003.

Transformer circuit rating is the existing transformer rating of 262/ 326 MVA (SN / SE).



Penelec Transmission Zone

Need Number: PN-2019-003

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Substation Condition Rebuild/Replacement

- Power transformers and load tap changers (LTCs)

System Performance Projects Global Factors

- Substation/line equipment limits

Problem Statement

Lewistown #1 230/115-46 kV Transformer

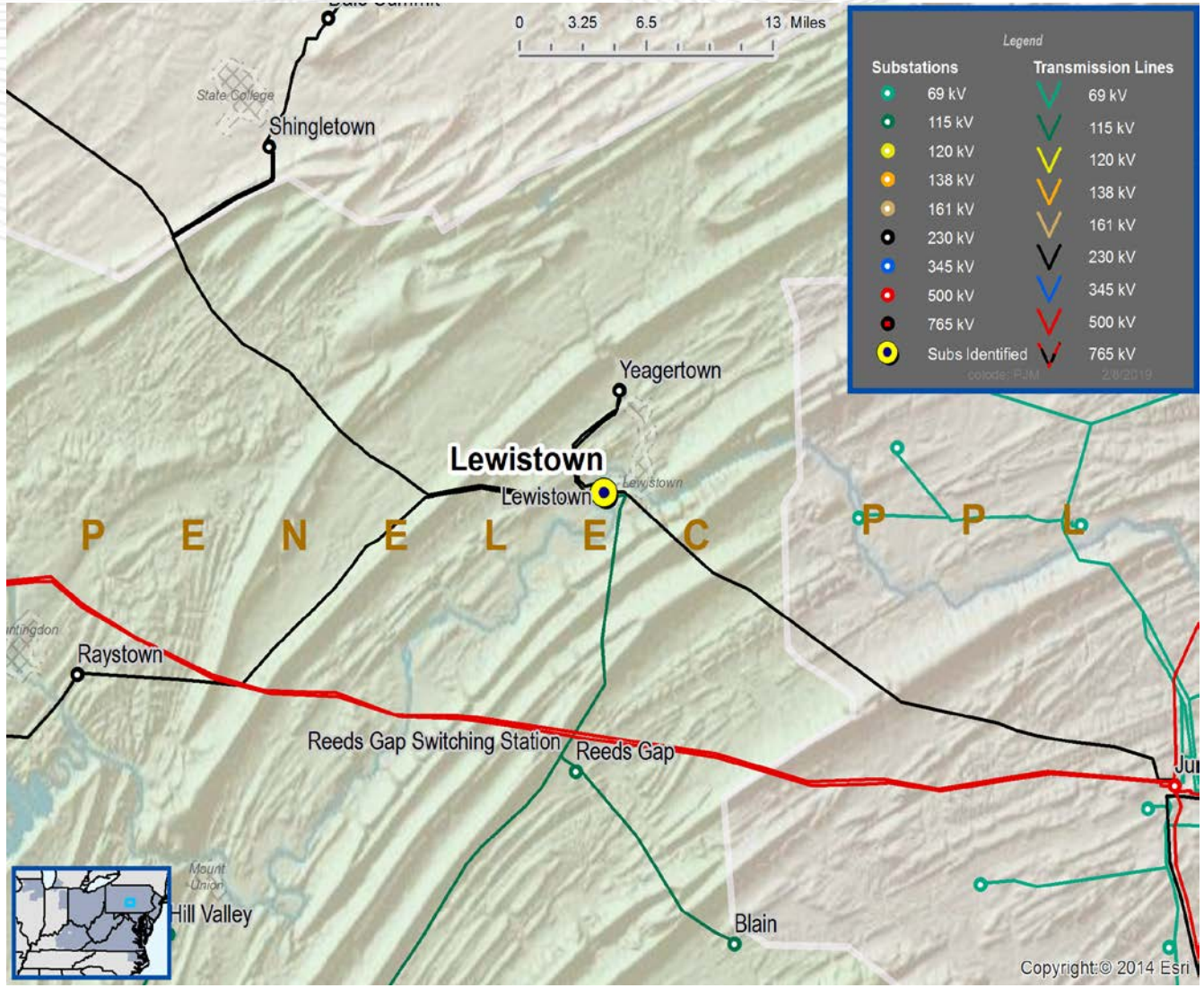
- Transformer has an increased failure probability due to high levels of combustible and ethylene gases and decrease in dielectric strength.
- Transformer is 66 years old.
- Approximately $137,000 spent on maintenance orders since 2003.

Transformer circuit rating is limited by terminal equipment on 46 kV winding.

Existing transformer circuit rating is 55 / 67 MVA (SN / SE).

Existing transformer rating is 62 / 67 MVA (SN / SE).

(disconnect switches, transformer relaying)



Penelec Transmission Zone

Need Number: PN-2019-004

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Substation Condition Rebuild/Replacement

- Power transformers and load tap changers (LTCs)

Problem Statement

Westfall #3 115/46 kV Transformer

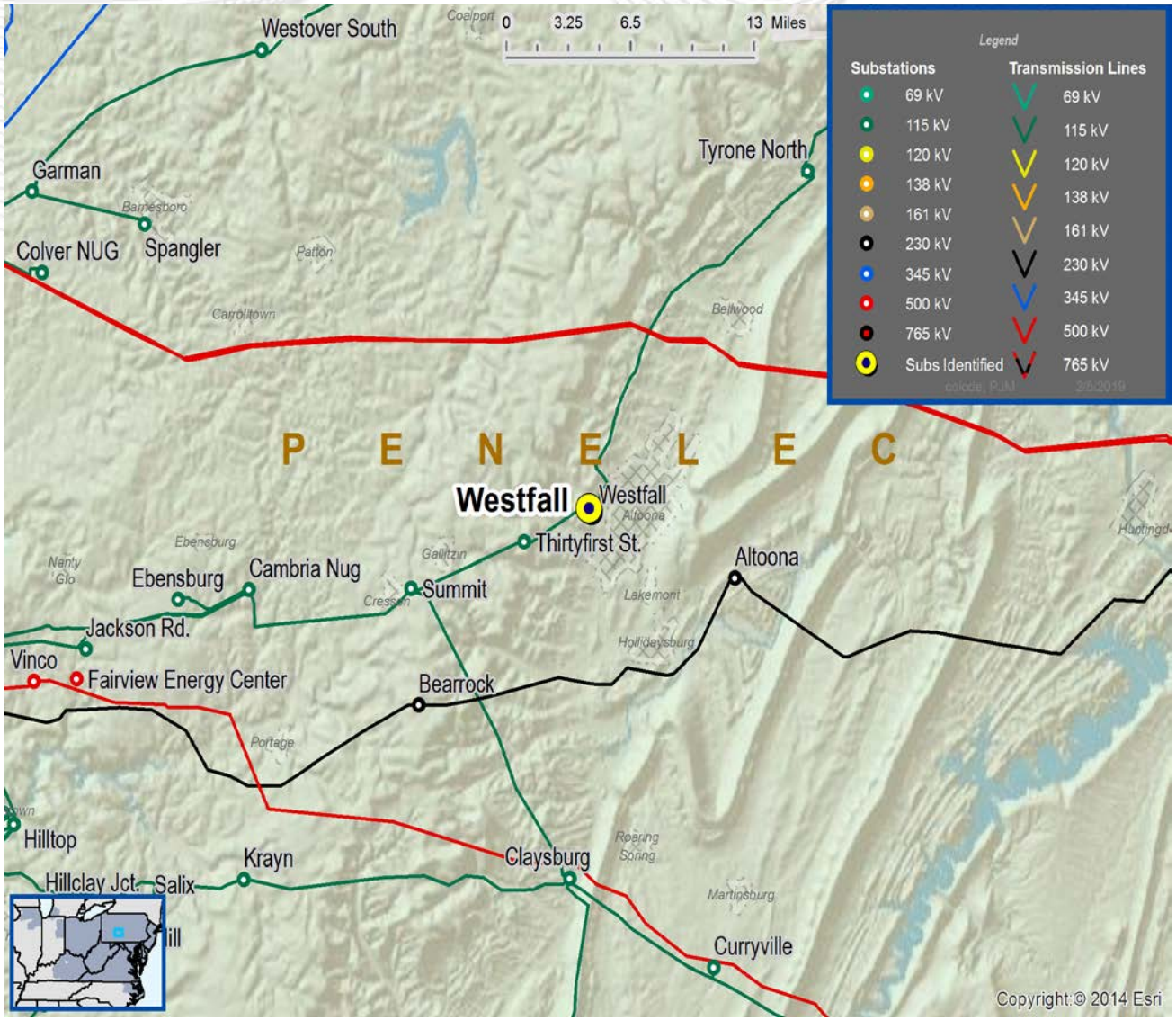
- Power factor test results show deterioration of windings and bushings.
- Transformer is 47 years old.
- Approximately $79,000 spent on maintenance orders since 2004.

Transformer circuit rating is the existing transformer rating of 38 / 41 MVA (SN / SE).

Westfall #4 115/46 kV Transformer

- Power factor test results show deterioration of type “U” bushings.
- Transformer is 50 years old.
- Approximately $18,000 spent on maintenance orders since 2003.

Transformer circuit rating is the existing transformer rating of 31 / 34 MVA (SN / SE).



Penelec Transmission Zone

Need Number: PN-2019-005

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Line Condition Rebuild/Replacement

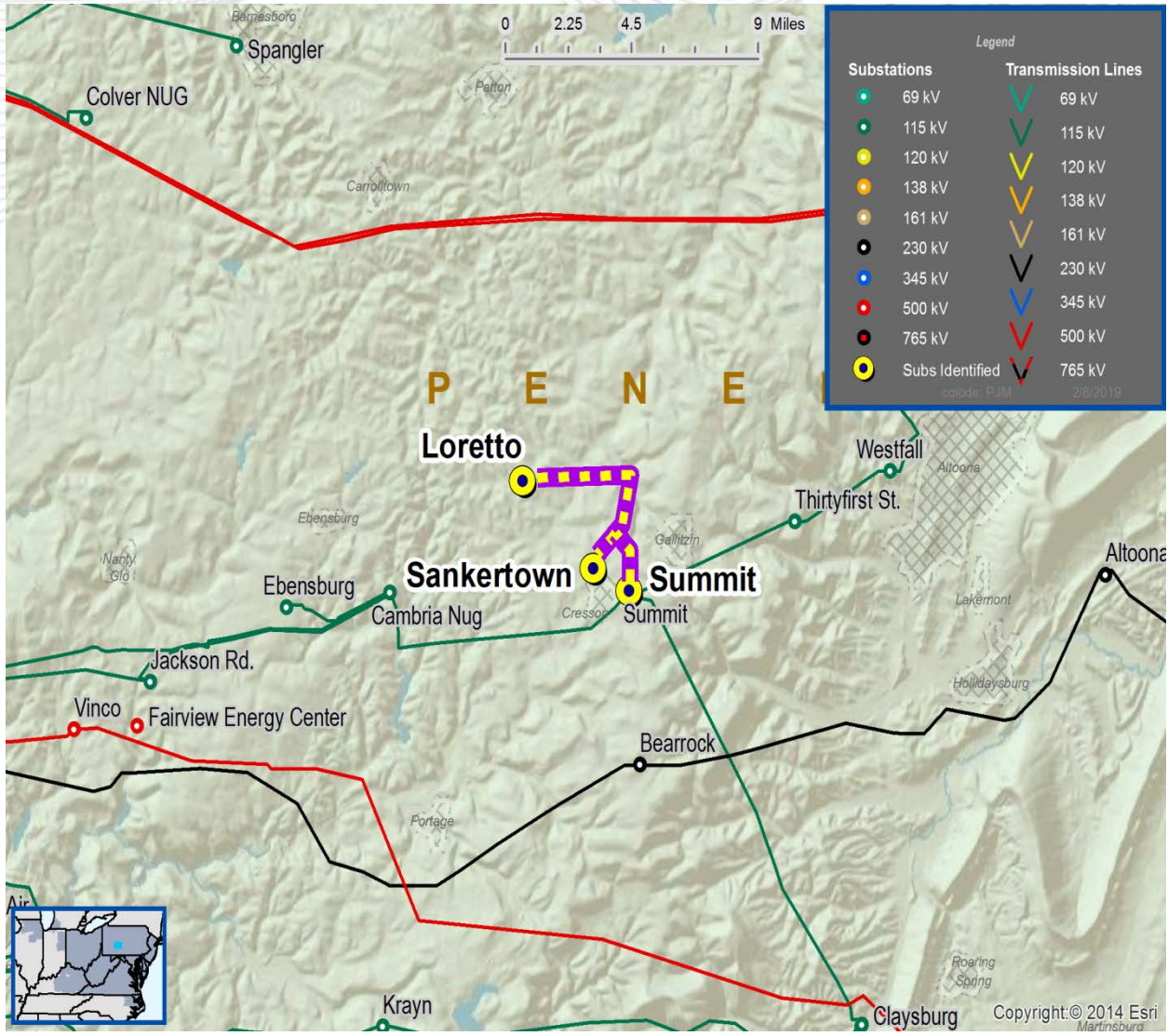
- Age/condition of wood pole transmission line structures

Problem Statement

The Loretto – Sankertown Bypass – Summit 46 kV line is exhibiting deterioration resulting in increased maintenance. The transmission line is approaching end of life.

- Total line distance is approximately 5.7 miles
  - 79 wood structures and 2 towers
  - Average age of failed structures is 51 years
- 81 out of 122 structures failed inspection (66% failure rate)
- Failure reasons include sound test, bad/cut/missing grounds, bayonet for static, woodpecker damage, etc.

Transmission line rating is the existing conductor rating 32 / 32 MVA (SN / SE).



Penelec Transmission Zone

Need Number: PN-2019-006

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Substation Condition Rebuild/Replacement Global Factors

- Limited availability of spare parts, software obsolescence and/or compatibility, or vendor technical support
- Expected service life (at or beyond) or obsolescence

Substation Condition Rebuild/Replacement – Asset Types

- Circuit breakers and other fault interrupting devices, switches, carrier sets and associated wave-traps, line arresters

System Performance Projects Global Factors

- Substation/line equipment limits

Problem Statement

East Pike – Glory 115 kV Line – Terminal equipment is exhibiting an increase risk of failure and due to obsolescence of equipment, spare parts are limited.

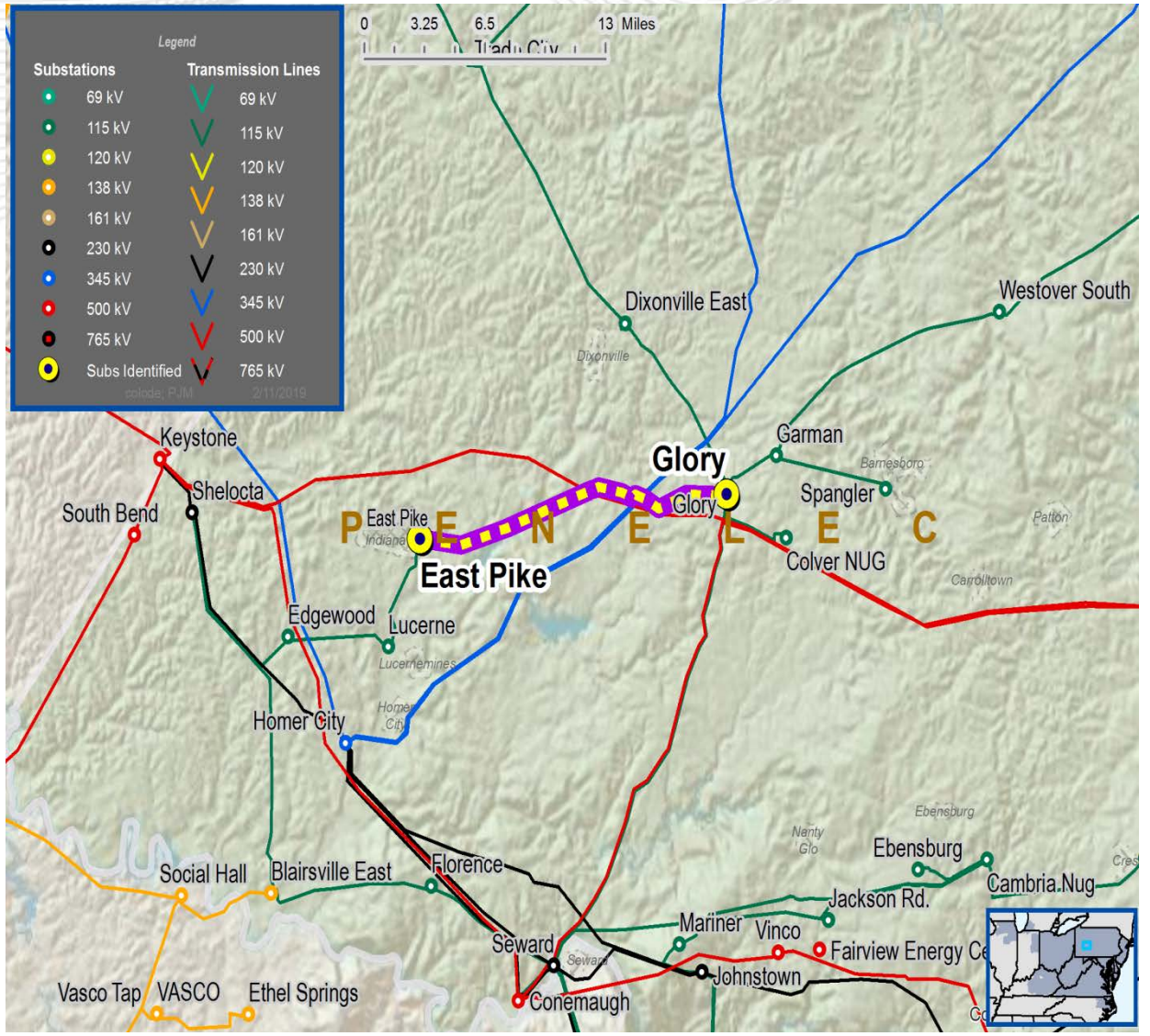
- At East Pike 115 kV substation – bus section breaker disconnect switches, CVTs, line trap, and surge arresters
- At Glory 115 kV substation – line side breaker disconnect switches

Transmission line rating is limited by terminal equipment.

Existing line rating is 163 / 185 MVA (SN / SE).

Existing conductor rating is 202 / 245 MVA (SN / SE).

(line trap, substation conductor, CTs)



Penelec Transmission Zone

Need Number: PN-2019-007 to 012
Process Stage: Need Meeting
Date: 02/22/2019

Project Driver(s):
Equipment Material Condition, Performance and Risk
Operational Flexibility and Efficiency

Specific Assumption Reference(s)
System Performance Projects 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

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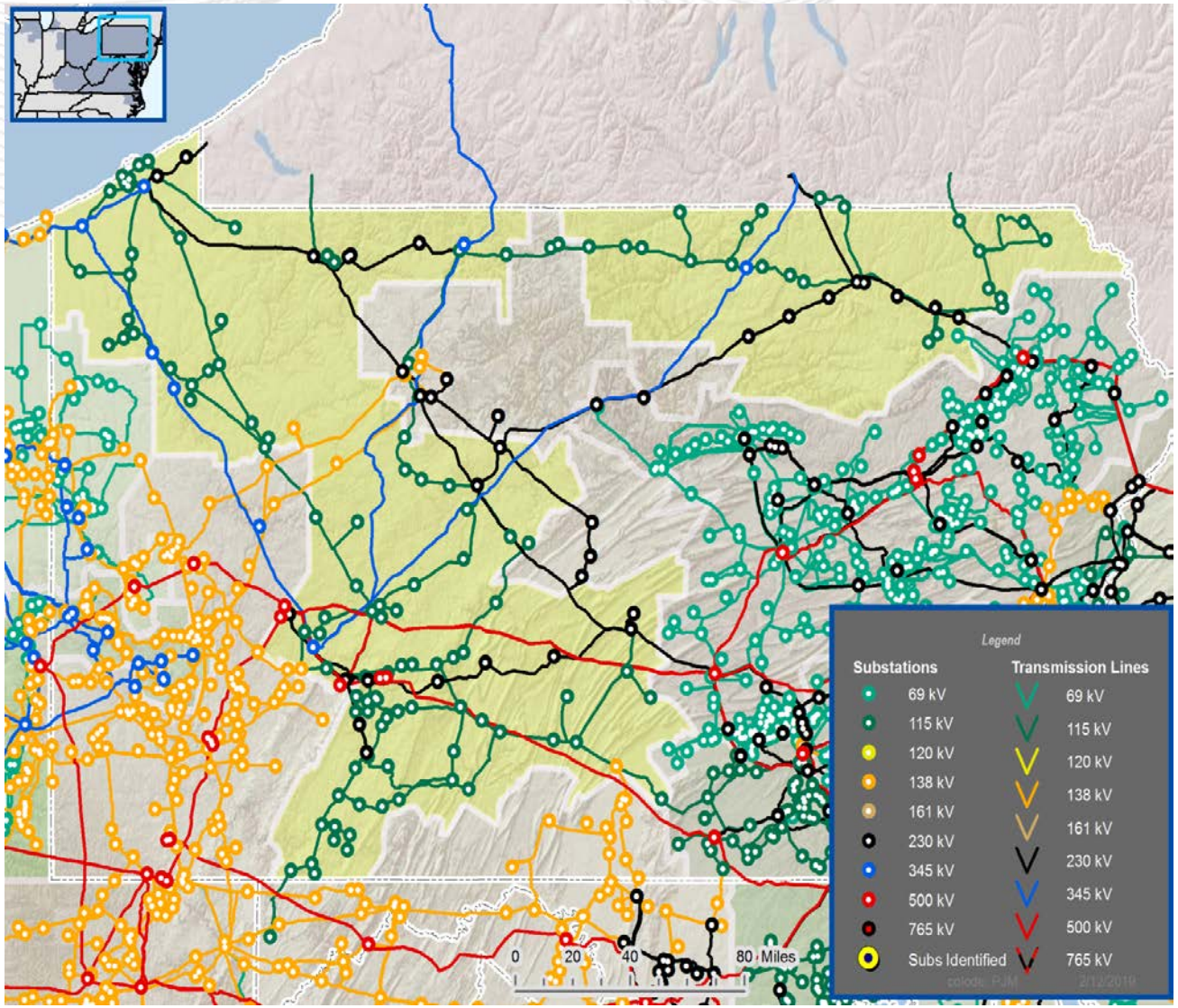


Problem Statement

- 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.
- [1]Line has failed carrier equipment that cannot be repaired or replaced

PN-2019-	Transmission Line / Substation Locations	Existing Line Rating (SN / SE)	Existing Conductor Rating (SN / SE)	Limiting Terminal Equipment
007	Lenox – North Meshoppen 115 kV Line	136 / 189	167 / 202	Line Relaying, Substation Conductor / Drops, Line Trap
008	Ridgway – Whetstone 115 kV Line	193 / 239	202 / 245	Line Relaying
009[1]	Union City – Titusville 115 kV Line	120 / 120	202 / 245	Line Relaying, Substation Conductor, Line Trap
010[1]	Grandview – Titusville 115 kV Line	147 / 149	202 / 245	Line Relaying, Substation Conductor, Line Trap
011	Cooper – Seward 115 kV Line	222 / 277	273 / 333	Line Relaying, Substation Conductor / Drops, Line Trap, Circuit Breaker
012	Erie South – Union City 115 kV Line	176 / 224	232 / 282	Line Relaying, Substation Conductor / Drops

Penelec Transmission Zone

Need Number: PN-2019-007

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Operational Flexibility and Efficiency

Specific Assumption Reference(s)

System Performance Projects Global Factors

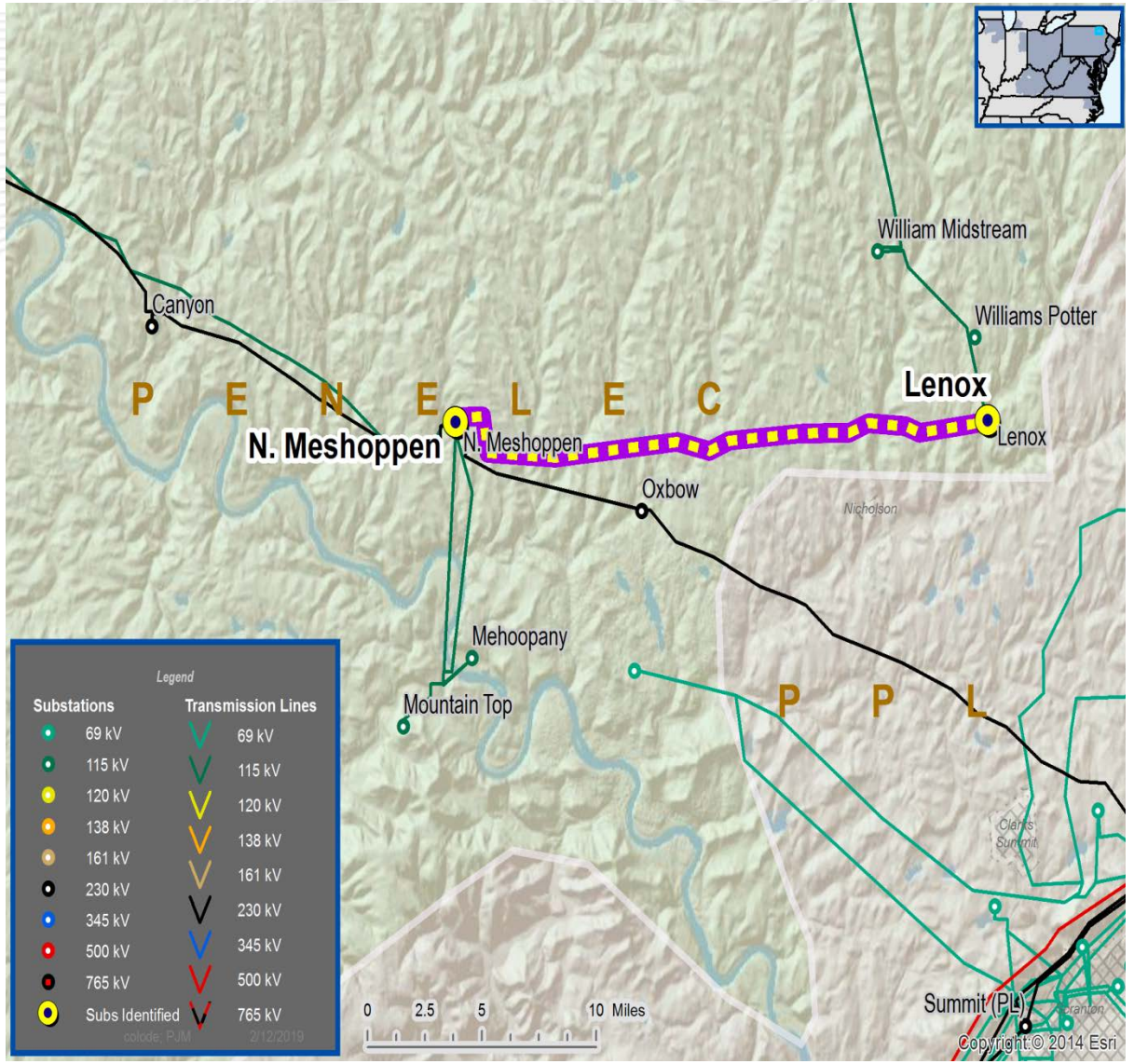
- System reliability and performance
- Substation/line equipment limits

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.
- [1]Line has failed carrier equipment that cannot be repaired or replaced



Penelec Transmission Zone

Need Number: PN-2019-008

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Operational Flexibility and Efficiency

Specific Assumption Reference(s)

System Performance Projects Global Factors

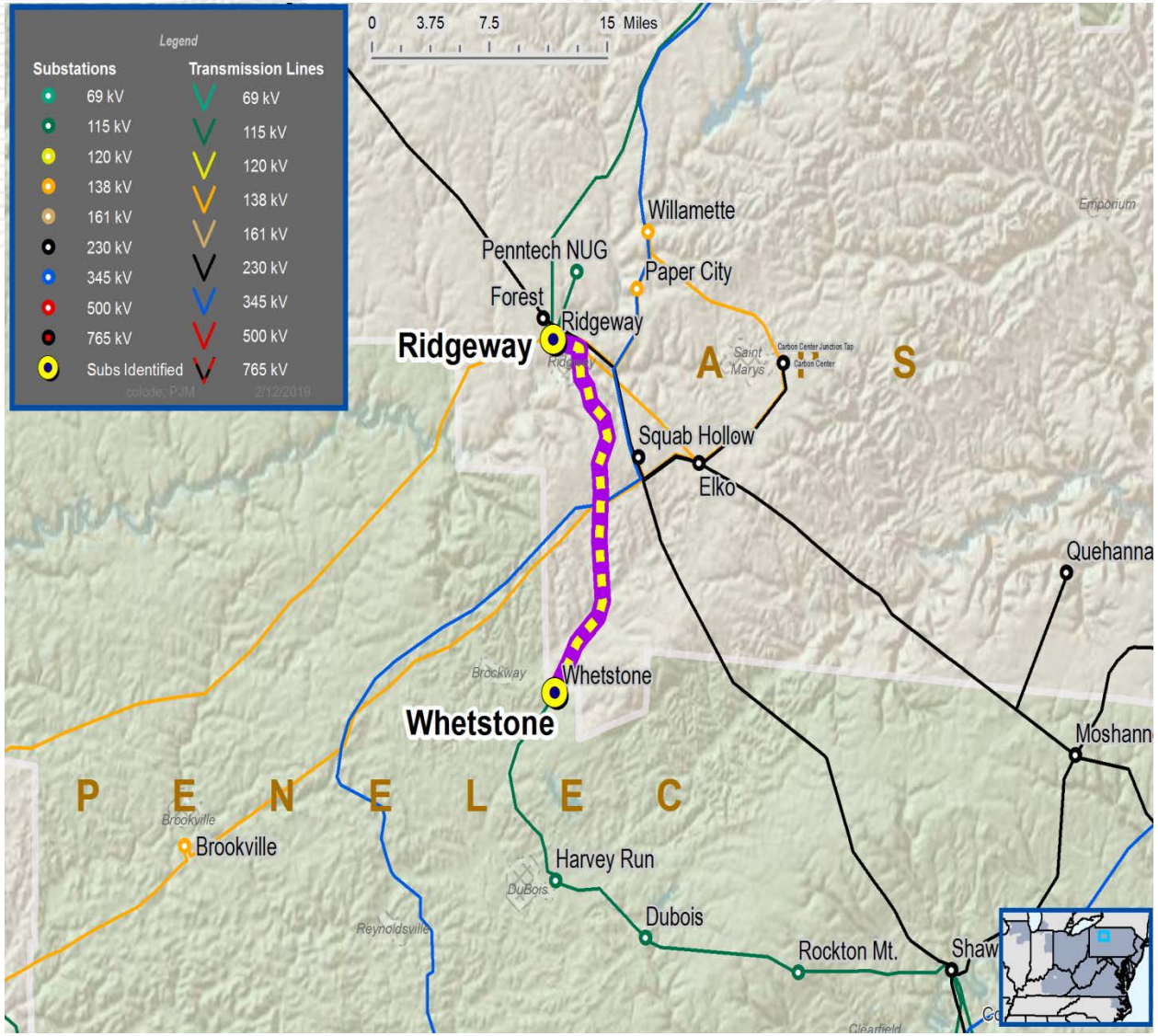
- System reliability and performance
- Substation/line equipment limits

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.
- [1]Line has failed carrier equipment that cannot be repaired or replaced



Penelec Transmission Zone

Need Number: PN-2019-009

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Operational Flexibility and Efficiency

Specific Assumption Reference(s)

System Performance Projects 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.
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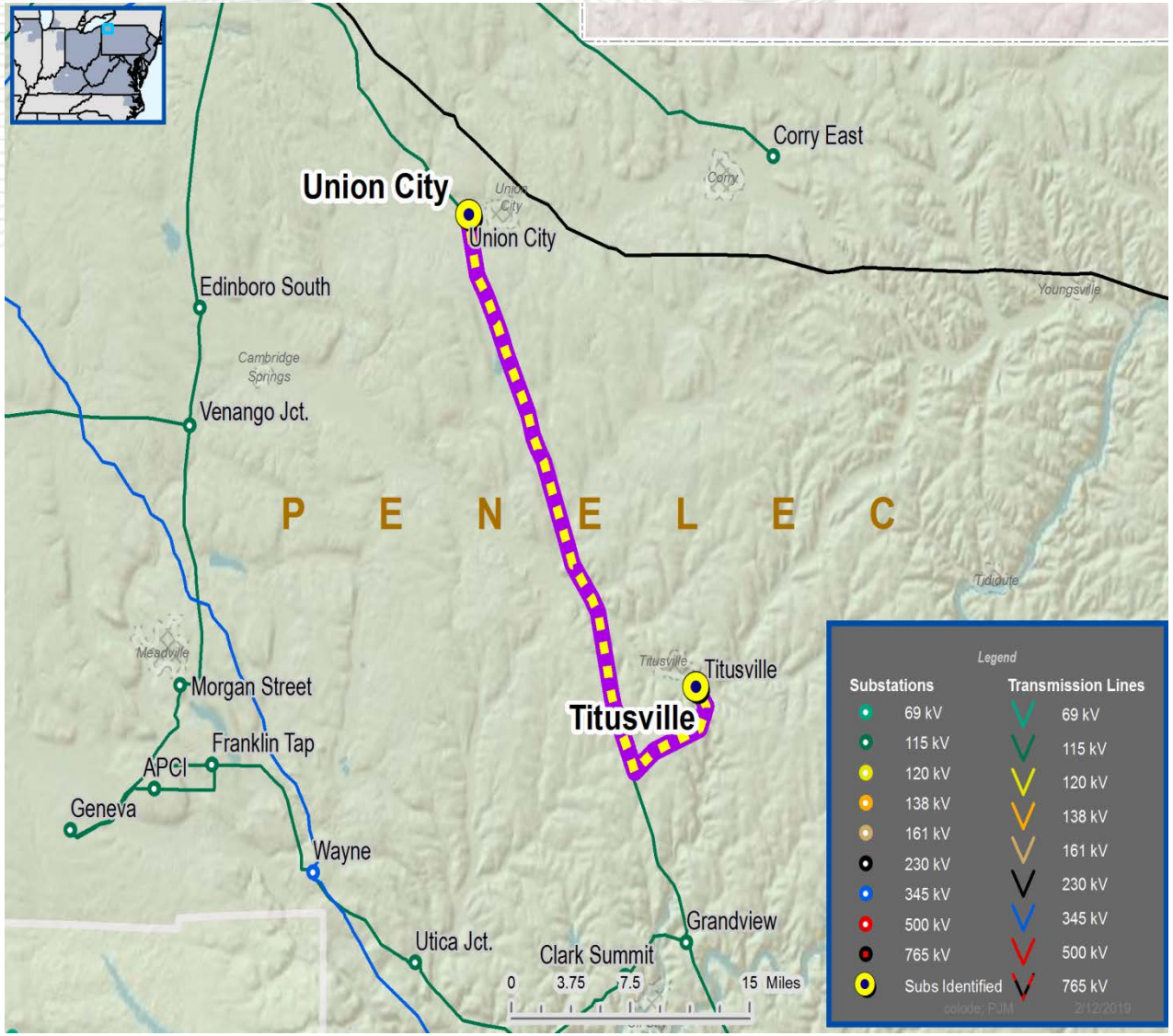

Penelec Transmission Zone

Need Number: PN-2019-010

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Operational Flexibility and Efficiency

Specific Assumption Reference(s)

System Performance Projects 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.)
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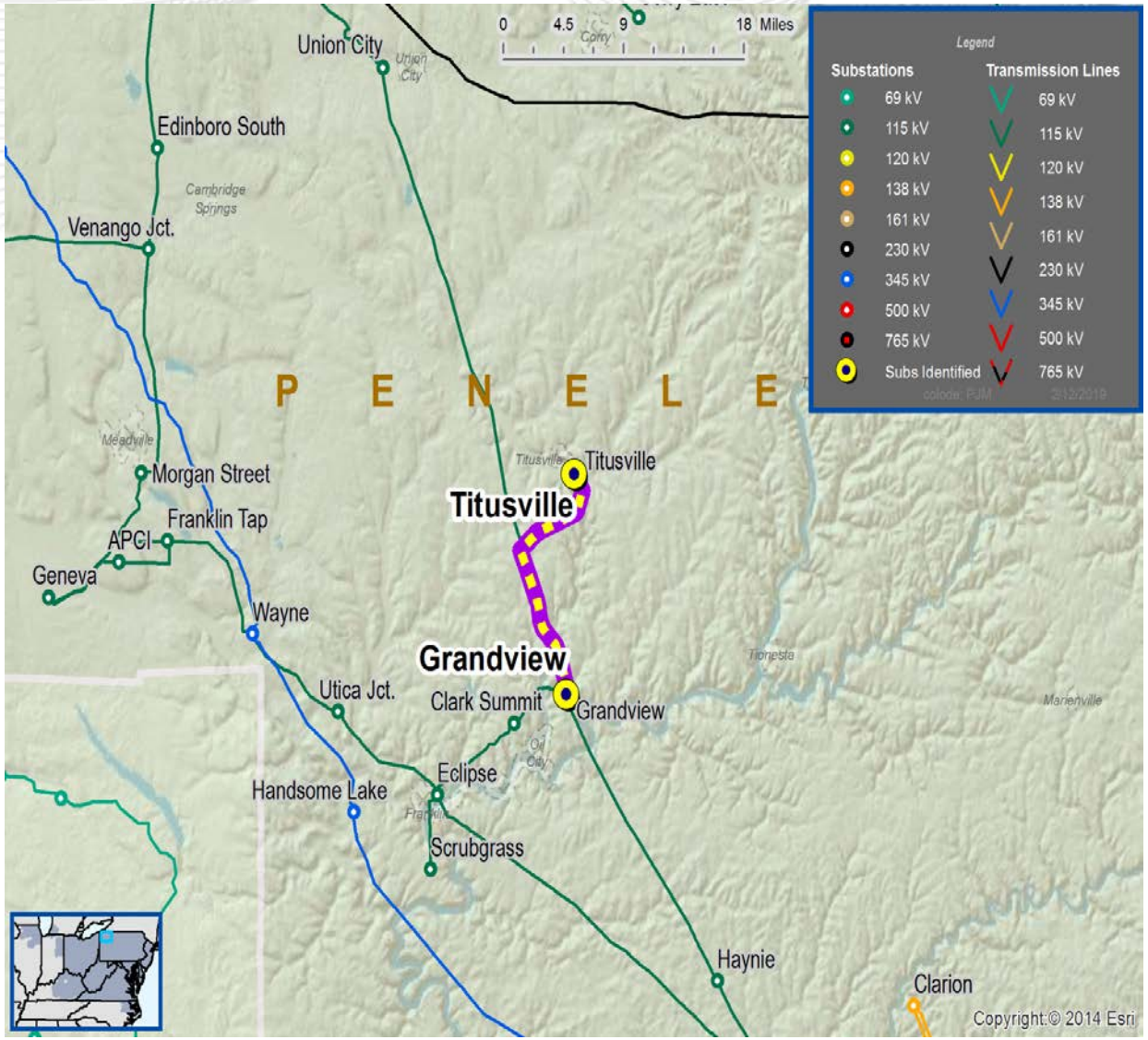

Penelec Transmission Zone

Need Number: PN-2019-011

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Operational Flexibility and Efficiency

Specific Assumption Reference(s)

System Performance Projects 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

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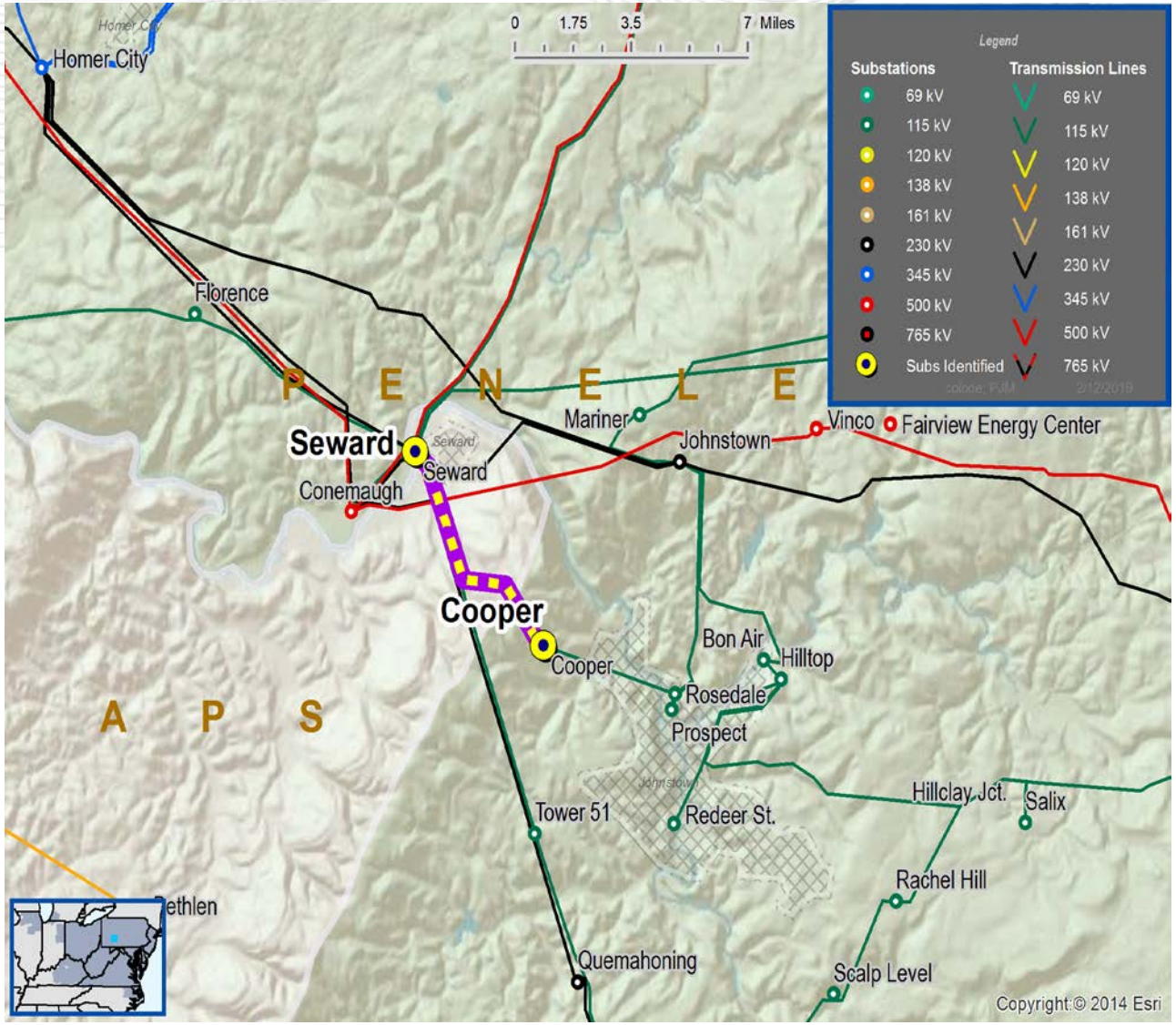

Penelec Transmission Zone

Need Number: PN-2019-012

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Equipment Material Condition, Performance and Risk

Operational Flexibility and Efficiency

Specific Assumption Reference(s)

System Performance Projects 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.)
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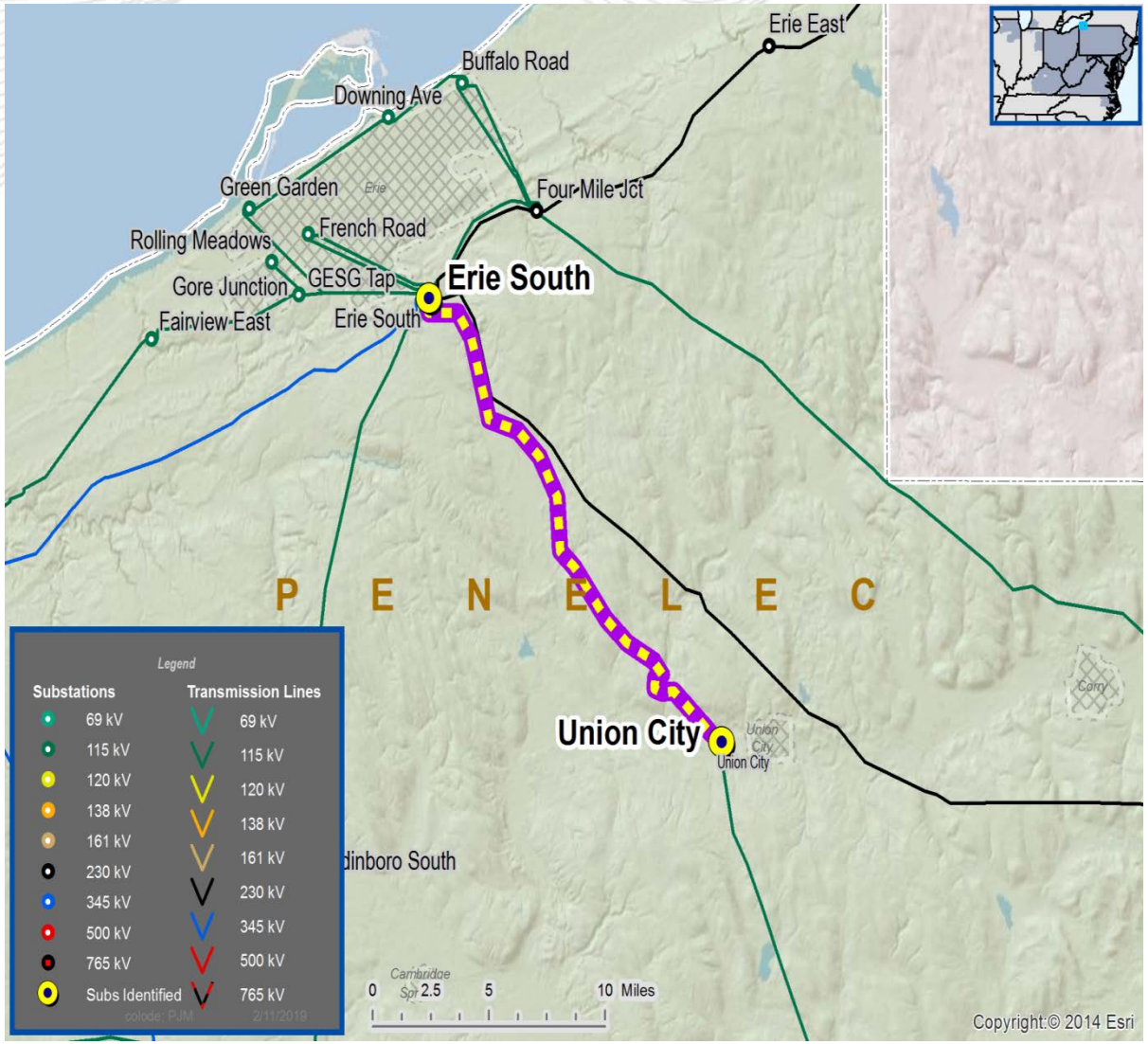


Penelec Transmission Zone

Need Number: PN-2019-013

Process Stage: Need Meeting

Date: 02/22/2019

Project Driver(s):

Operational Flexibility and Efficiency

Specific Assumption Reference(s)

System Performance Projects Global Factors

- Substation/line equipment limits
- Load at risk in planning and operational scenarios
- Load and/or customers at risk on single transmission line

System Conversion Methodology

- Customer feedback

Problem Statement

– Titusville 115 kV substation serves approximately 45 MW of load to 5,300 customers. A stuck bus tie breaker at Titusville will outage both #1 and #2 115-34.5 kV transformers and 115 kV network path.

– PJM has issued a PCLLRW to potentially drop 8 MW of load in the Titusville/Union City area to mitigate thermal overloads on the Titusville – Union City 115 kV line for the outage of Erie West – Erie South 345 kV line and Glade – Warren 230 kV line on July 24, 2018 and August 9, 2018.

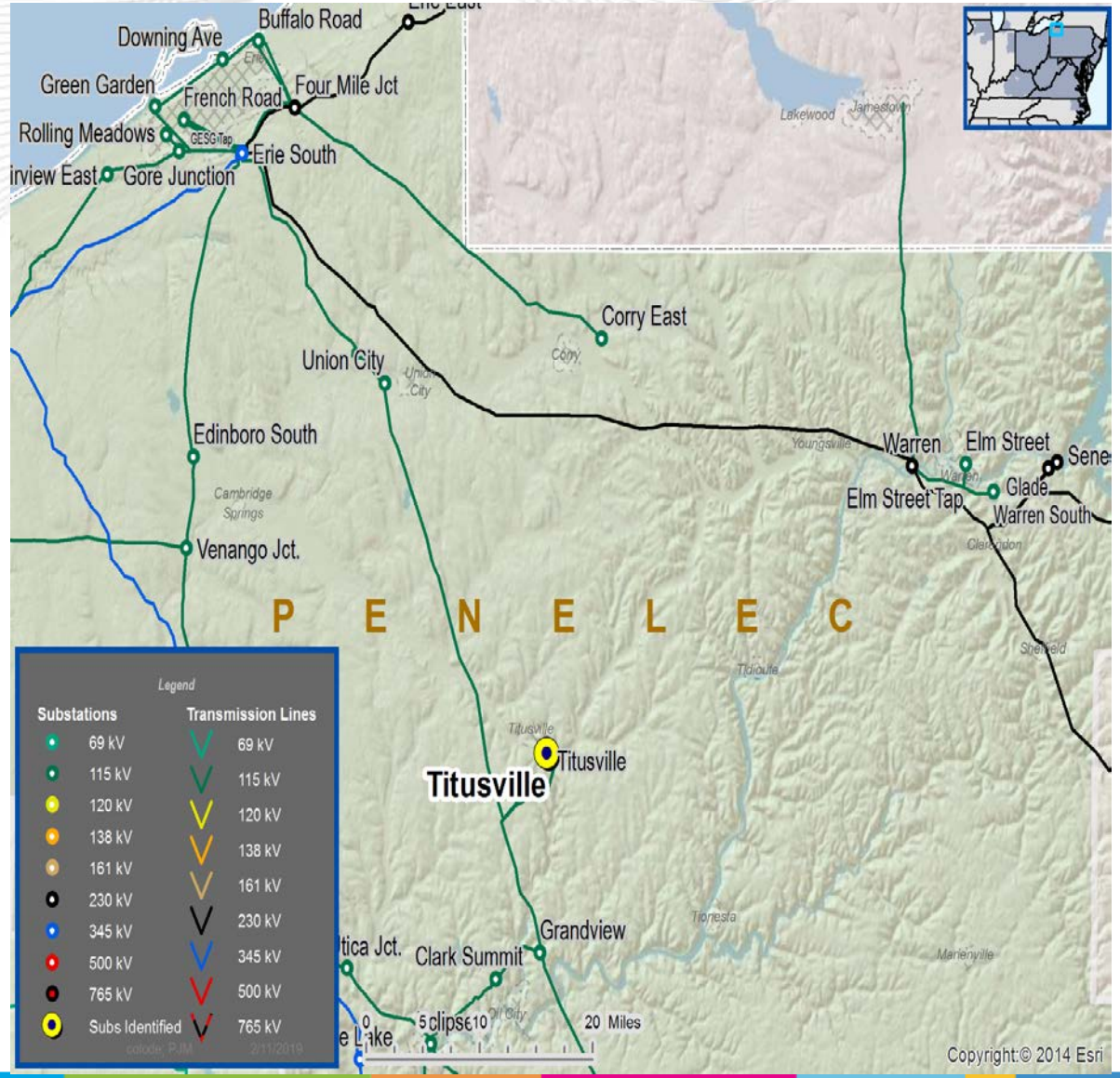
Transmission line ratings are limited by terminal equipment.

- Union City – Titusville 115 kV line: Existing line rating is 120 / 120 MVA (SN / SE). Existing conductor rating is 202 / 245 MVA (SN / SE)

  (line relaying, substation conductor, line trap)

- Grandview – Titusville 115 kV line: Existing line rating is 147 / 149 MVA (SN / SE). Existing conductor rating is 202 / 245 MVA (SN / SE)

  (line relaying, substation conductor, line trap)



Questions?

Appendix

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

2/12/2019 – V1 – Original version posted to pjm.com