Sub Regional RTEP Committee
Western Region
ATSI

January 11, 2019

ATSI Supplemental Needs

ATSI Transmission Zone

Need Number: ATSI-2019-001

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Operational Flexibility and Efficiency

Infrastructure Resilience

Specific Assumption Reference(s)

Global Considerations

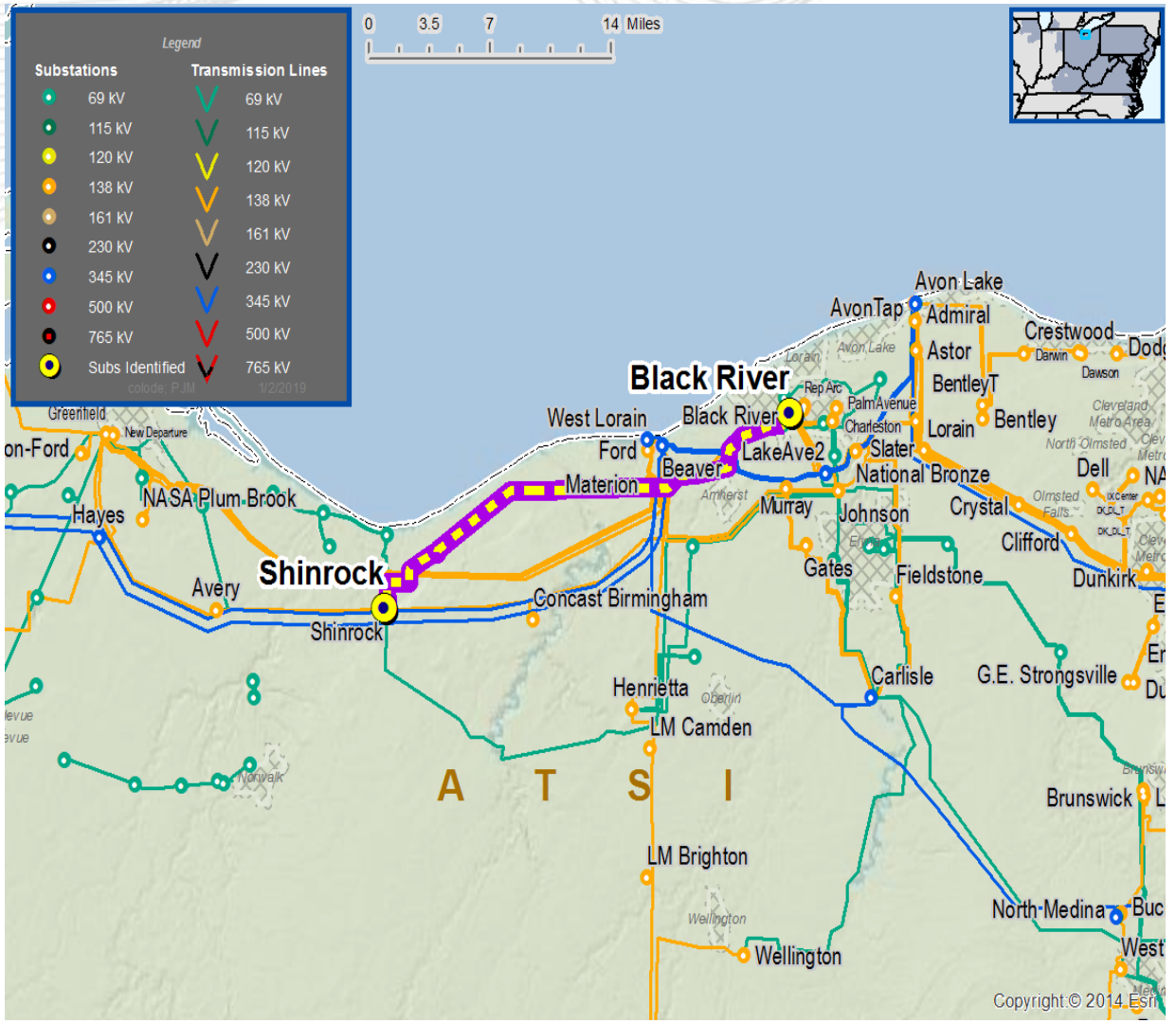
- System reliability and performance
- Substation / Line equipment limits
- Reliability of Non-Bulk Electric System (Non-BES) facilities
- Load and risk in planning and operational scenarios
- Load and/or customers at risk on single transmission lines

Problem Statement

Black River-Shinrock 69 kV Line

The Black River-Shinrock 69 kV line is approximately 24 miles long and serves five (5) transmission customers. The transmission line conductor is the limiting element.

- A Black River-Shinrock 69 kV line outage (N-1) results in approximately 47 MW and 14,200 customers being interrupted.
- Over the past five years, the Black River-Shinrock 69 kV line has experienced approximately 17 outages (9 sustained , 8 momentary).



ATSI Transmission Zone

Need Number: ATSI-2019-002

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Operational Flexibility and Efficiency

Infrastructure Resilience

Specific Assumption Reference(s)

Global Considerations

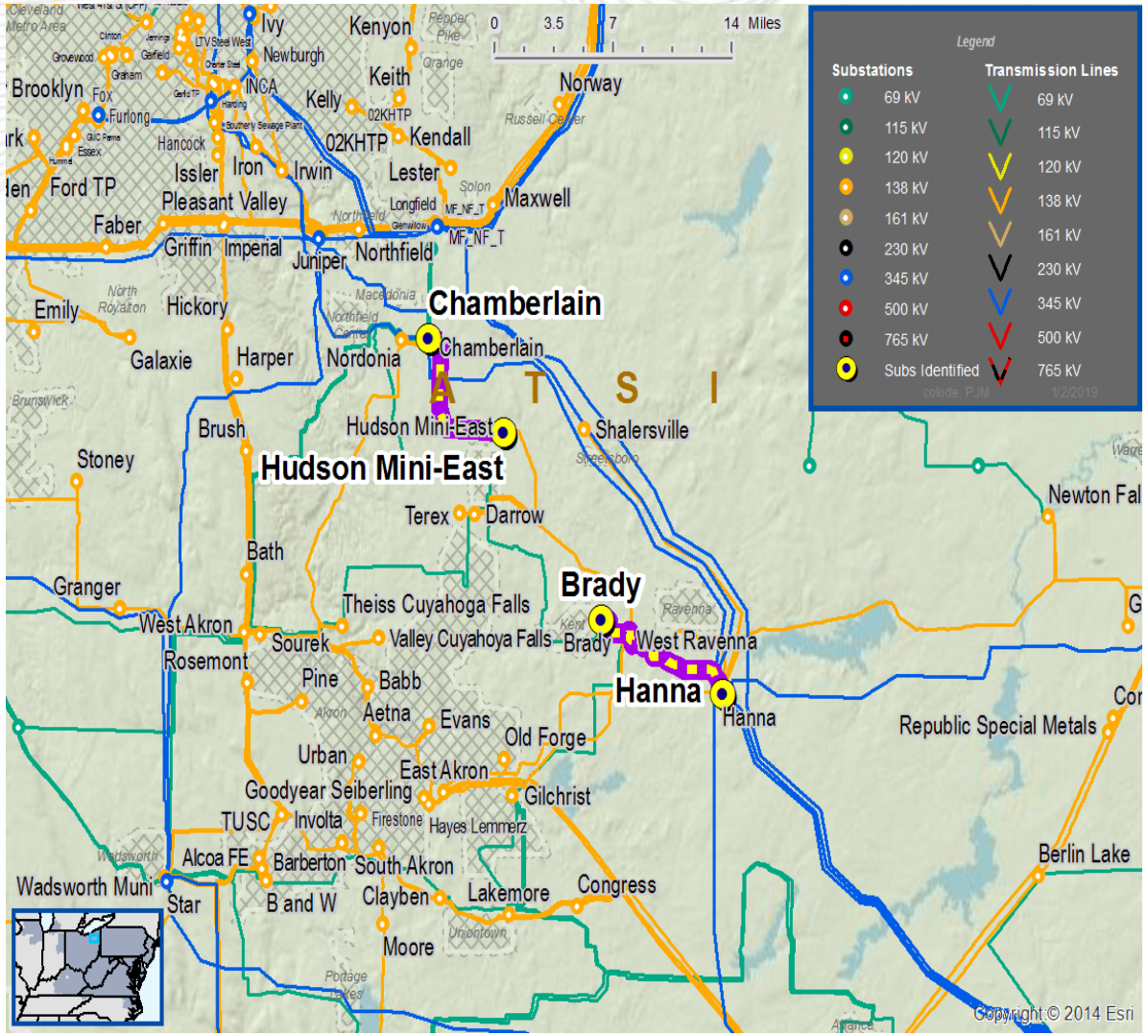
- System reliability and performance
- Substation / Line equipment limits
- Reliability of Non-Bulk Electric System (Non-BES) facilities
- Load and risk in planning and operational scenarios

Problem Statement

Brady 138 kV Area

PJM has issued PCLLRW to potentially drop 20 MW of load at Brady substation for the (N-1-1) outage of the Brady-Hanna 138 kV line and the Chamberlin-Hudson Muni 138kV line.

- Post-contingency voltage at Brady drops below 0.92 p.u. under this back-feed condition from Darrow 138 / 69 kV substation.
- The overall load at risk is approximately 61 MW, and the number of customers impacted is approximately 18,800.



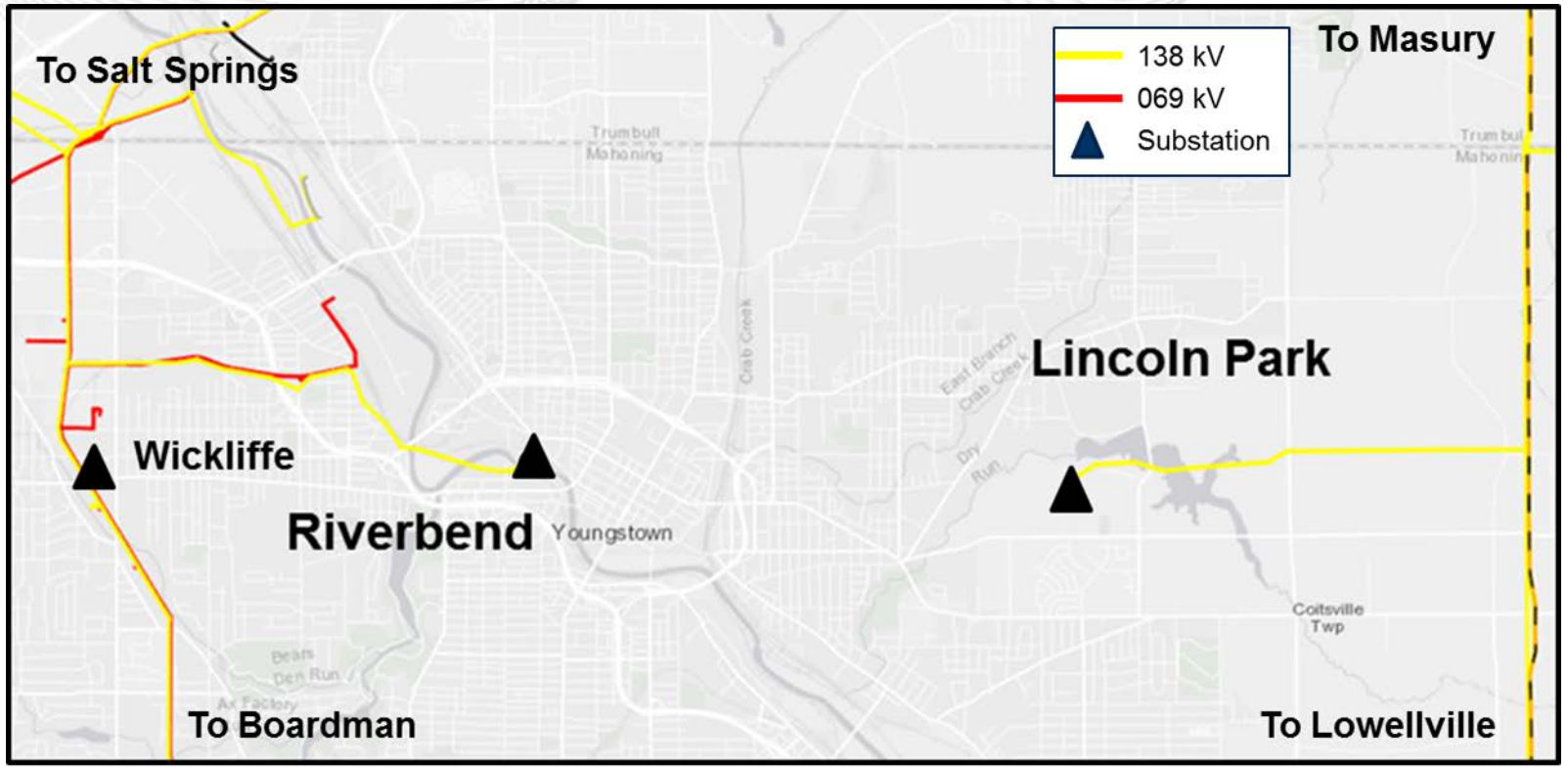
ATSI Transmission Zone

Need Number: ATSI-2019-003
Process Stage: Need Meeting
Date: 01/11/2019

Project Driver(s):
Operational Flexibility and Efficiency
Infrastructure Resilience

Specific Assumption Reference(s)
Global Considerations

- System reliability and performance
- Substation / Line equipment limits
- Reliability of Non-Bulk Electric System (Non-BES) facilities
- Load and risk in planning and operational scenarios
- Load and/or customers at risk on single transmission lines



Problem Statement

Lincoln Park and Riverbend 138 kV Area

Lincoln Park 138 - 23 kV substation presently serves approximately 35 MW and 5,000 customers

- The loss of the Lincoln Park-Masury 138 kV line followed by the loss of the Lincoln Park-Lowellville 138 kV line (N-1-1) results in the loss of approximately 35 MW and 5,000 customers.

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ATSI Transmission Zone

Need Number: ATSI-2019-003

Process Stage: Need Meeting

Date: 01/11/2019

Problem Statement - Continued

Riverbend 138 - 23 kV substation presently serves approximately 40 MW and 9,100 customers. Additionally the Wickliffe 138 kV substation serves approximately 22 MW and 10,000 customers.

- The loss of the Boardman-Wickliffe 138 kV line followed by the loss of the Riverbend-Salt Springs 138 kV line (N-1-1) results in the loss of roughly 62 MW and 19,100 customers.

System Performance

- Over the past 5 years, the Lincoln Park-Masury 138 kV line has experienced 1 outage
  (0 sustained , 1 momentary).
- Over the past 5 years, the Lincoln Park-Lowellville 138 kV line has experienced 4 outages
  (3 sustained , 1 momentary).
- Over the past 5 years, the Boardman-Wickliffe 138 kV line has experienced 2 outages
  (2 sustained , 0 momentary).
- Over the past 5 years, the Riverbend-Salt Springs 138 kV line has experienced 1 outage
  (1 sustained , 0 momentary).

ATSI Transmission Zone

Need Number: ATSI-2019-004

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Operational Flexibility and Efficiency

Infrastructure Resilience

Specific Assumption Reference(s)

Global Considerations

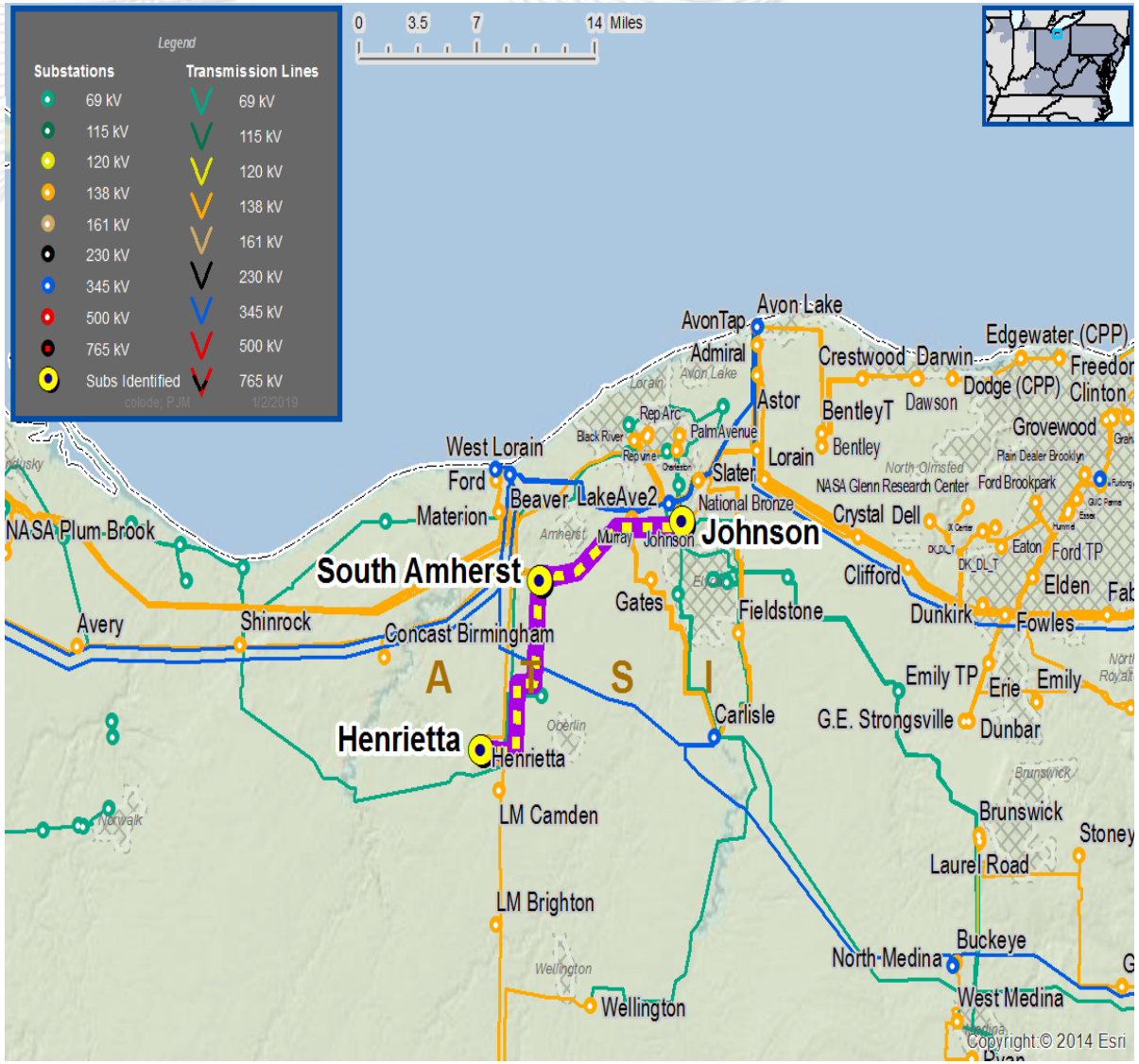
- System reliability and performance
- Substation / Line equipment limits
- Reliability of Non-Bulk Electric System (Non-BES) facilities
- Load and risk in planning and operational scenarios
- Load and/or customers at risk on single transmission lines

Problem Statement

Amherst 69 kV Area

The Amherst 69 kV substation is owned by Amherst Municipality with transmission service from a tapped 69 kV transmission line. The Henrietta-Johnson 69 kV line outage (N-1) results in approximately 39 MW & 9,195 customers at three transmission service points being interrupted.

- Over the past five years, the Henrietta-Johnson 69 kV line has experienced approximately 21 outages (13 sustained , 8 momentary).



ATSI Transmission Zone

Need Number: ATSI-2019-005
Process Stage: Needs Meeting
Date: 01/11/2019

Project Driver(s):
Equipment Material Condition
Performance and Risk

Specific Assumption Reference(s)

Global Considerations

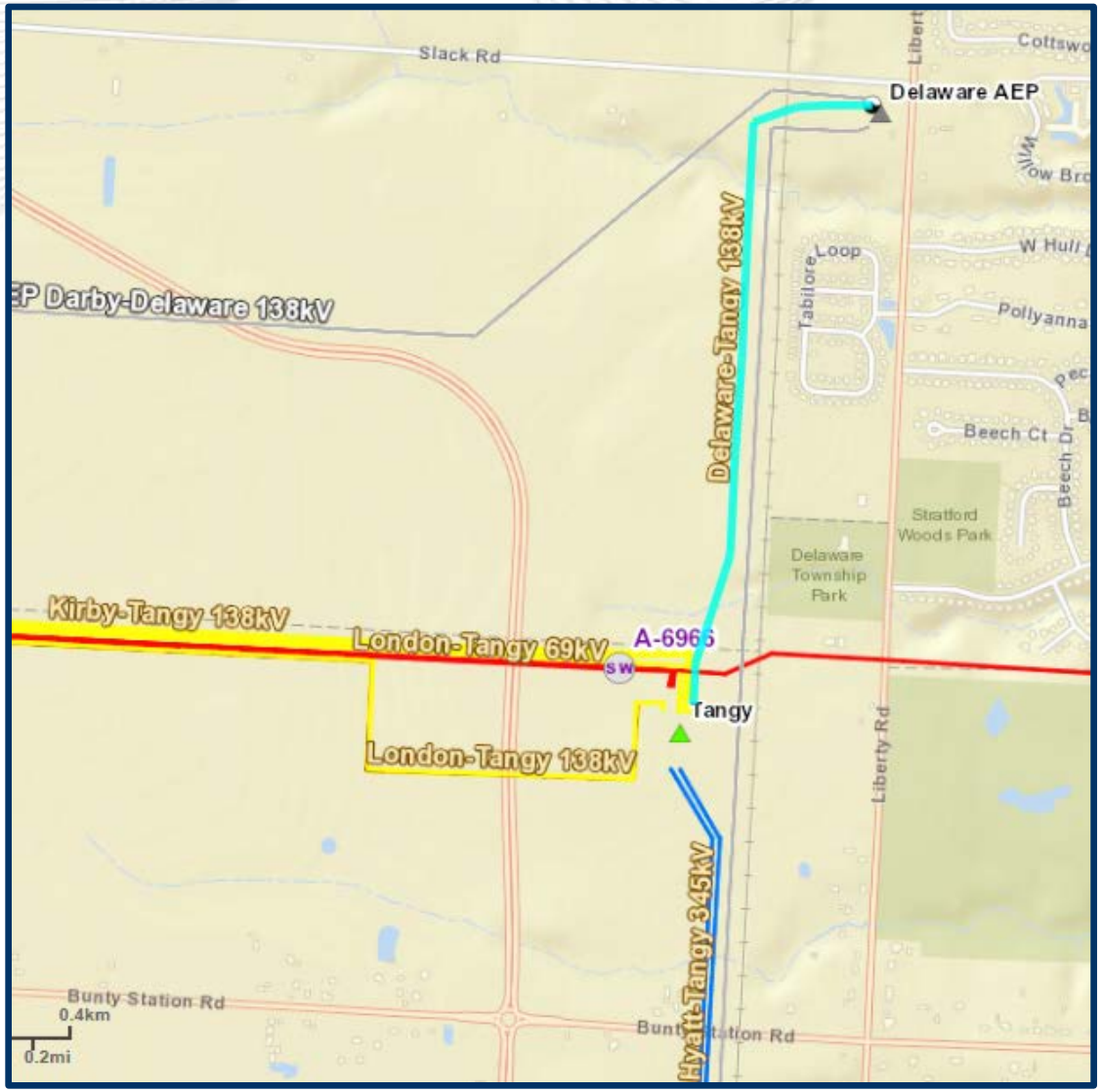
- Level of criticality to system performance and operations
- Expected service life (at or beyond) or obsolescence

Problem Statement

The Delaware – Tangy 138 kV Line is an ~1.0 mile tie line between FirstEnergy and AEP.

The line is operated normally open and has not been closed since 2014.

Failing pilot wire relays and phone line communications are near or beyond their expected service life or obsolete.



ATSI Transmission Zone

Need Number: ATSI-2019-006

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Operational Flexibility and Efficiency

Infrastructure Resilience

Specific Assumption Reference(s)

Global Considerations

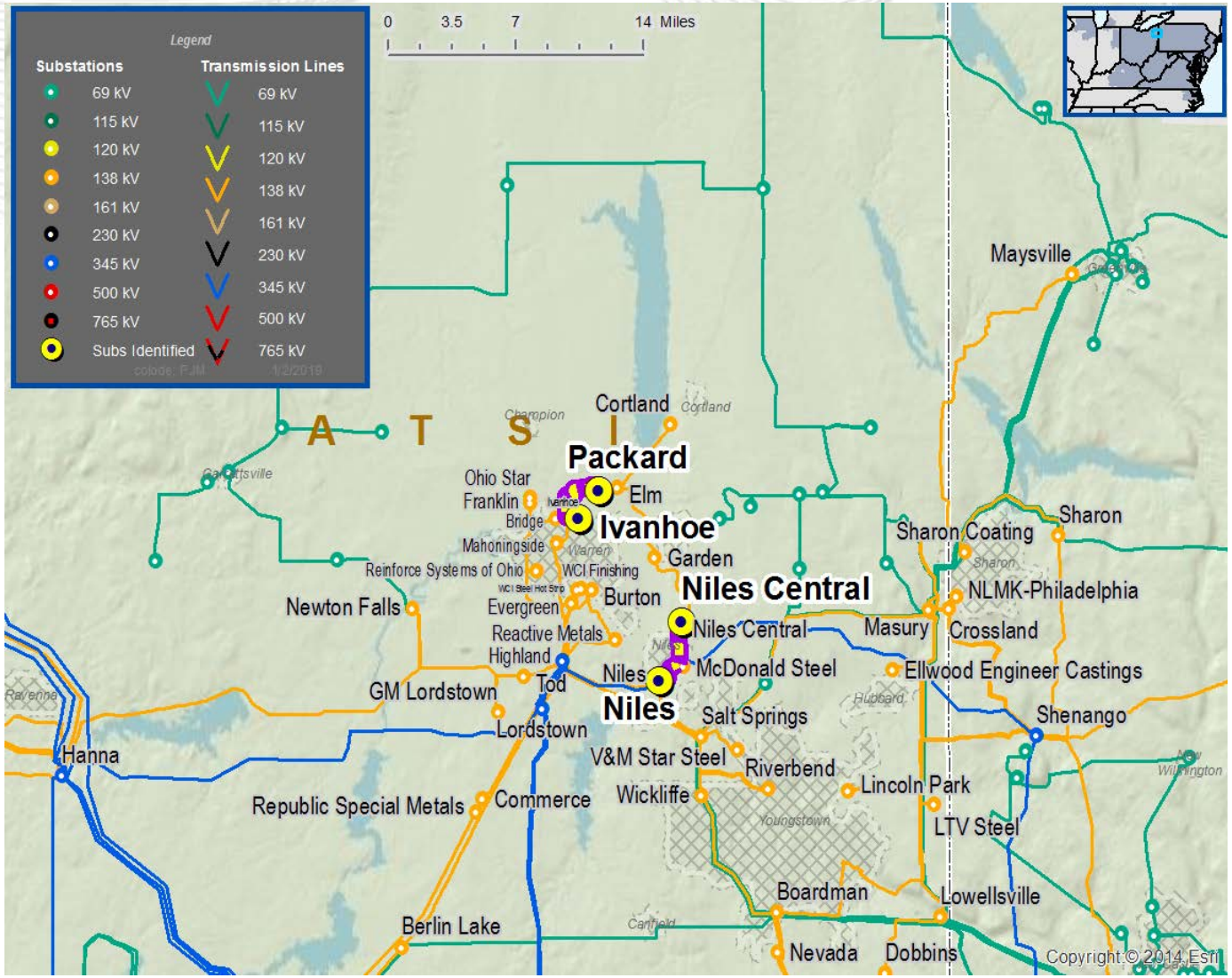
- System reliability and performance
- Substation / Line equipment limits
- Reliability of Non-Bulk Electric System (Non-BES) facilities
- Load and risk in planning and operational scenarios
- Load and/or customers at risk on single transmission lines

Problem Statement

Elm 138 kV Area

The contingency loss of the Ivanhoe-Packard 138 kV line followed by the loss of the Niles-Niles Central Muni 138 kV line results in the loss of approximately 137 MW and 28,600 customers at six (6) transmission service points.

- Over the past five years, the Ivanhoe-Packard 138 kV line has experienced approximately 2 outages (1 sustained , 1 momentary).
- Over the past five years, the Niles-Niles Central Muni 138 kV line has experienced approximately 4 outages (1 sustained , 3 momentary).



ATSI Transmission Zone

Need Number: ATSI-2019-007

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Operational Flexibility and Efficiency

Infrastructure Resilience

Specific Assumption Reference(s)

Global Considerations

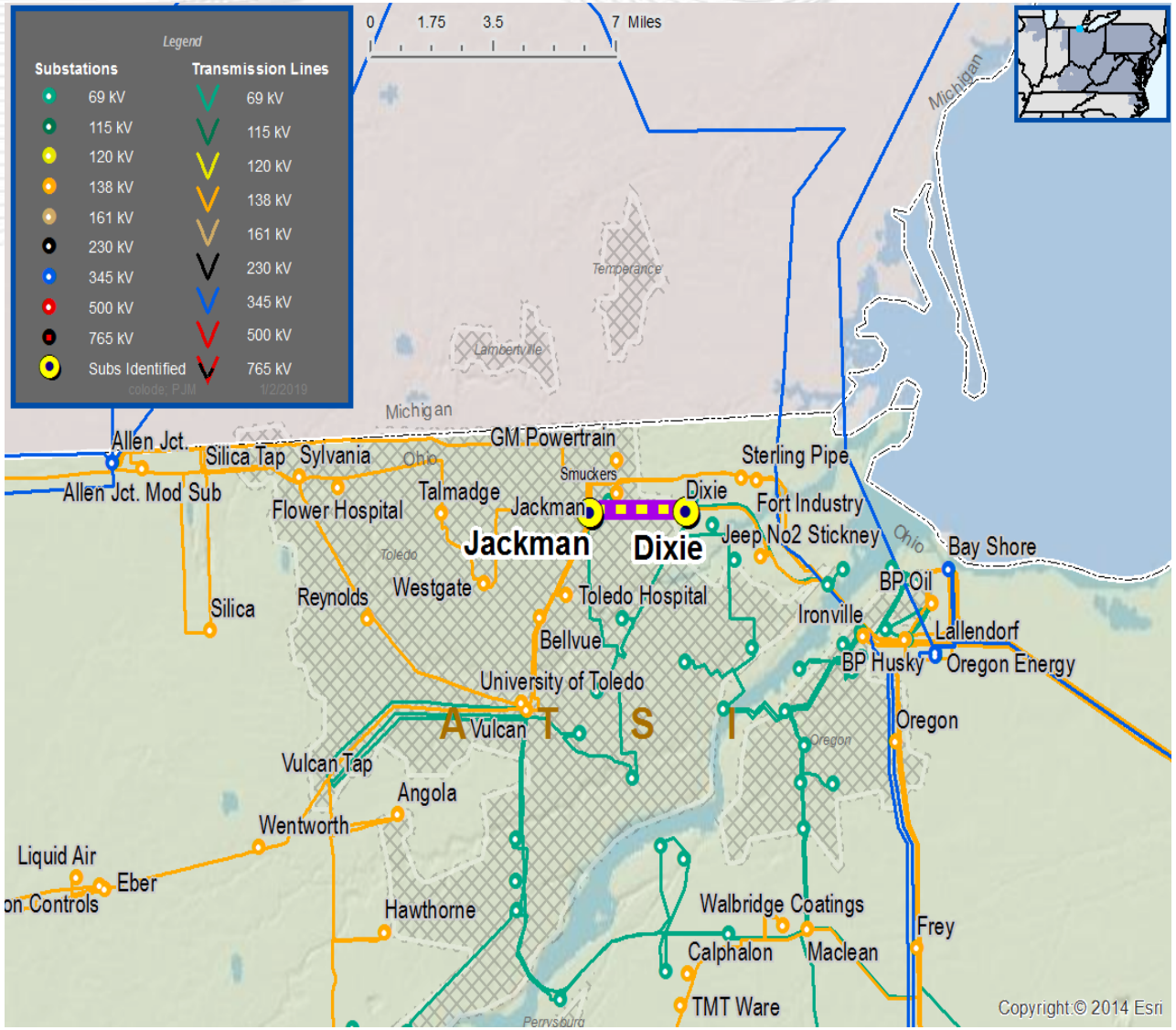
- System reliability and performance
- Substation / Line equipment limits
- Reliability of Non-Bulk Electric System (Non-BES) facilities
- Load and risk in planning and operational scenarios
- Load and/or customers at risk on single transmission lines

Problem Statement

Jackman 138 / 69 kV Area

The Jackman 69 kV substation is electrically isolated from the Jackman 138 kV substation; it is sourced from Dixie 69 kV substation. The contingency loss of the Dixie-Jackman 69 kV line or a stuck breaker at Dixie substation results in the loss of approximately 43 MW and 19,000 customers at three transmission service points.

- Over the past five years, the Dixie-Jackman 69 kV line has experienced approximately 1 outage (1 sustained , 0 momentary).



ATSI Transmission Zone

Need Number: ATSI-2019-008

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Operational Flexibility and Efficiency

Infrastructure Resilience

Specific Assumption Reference(s)

Global Considerations

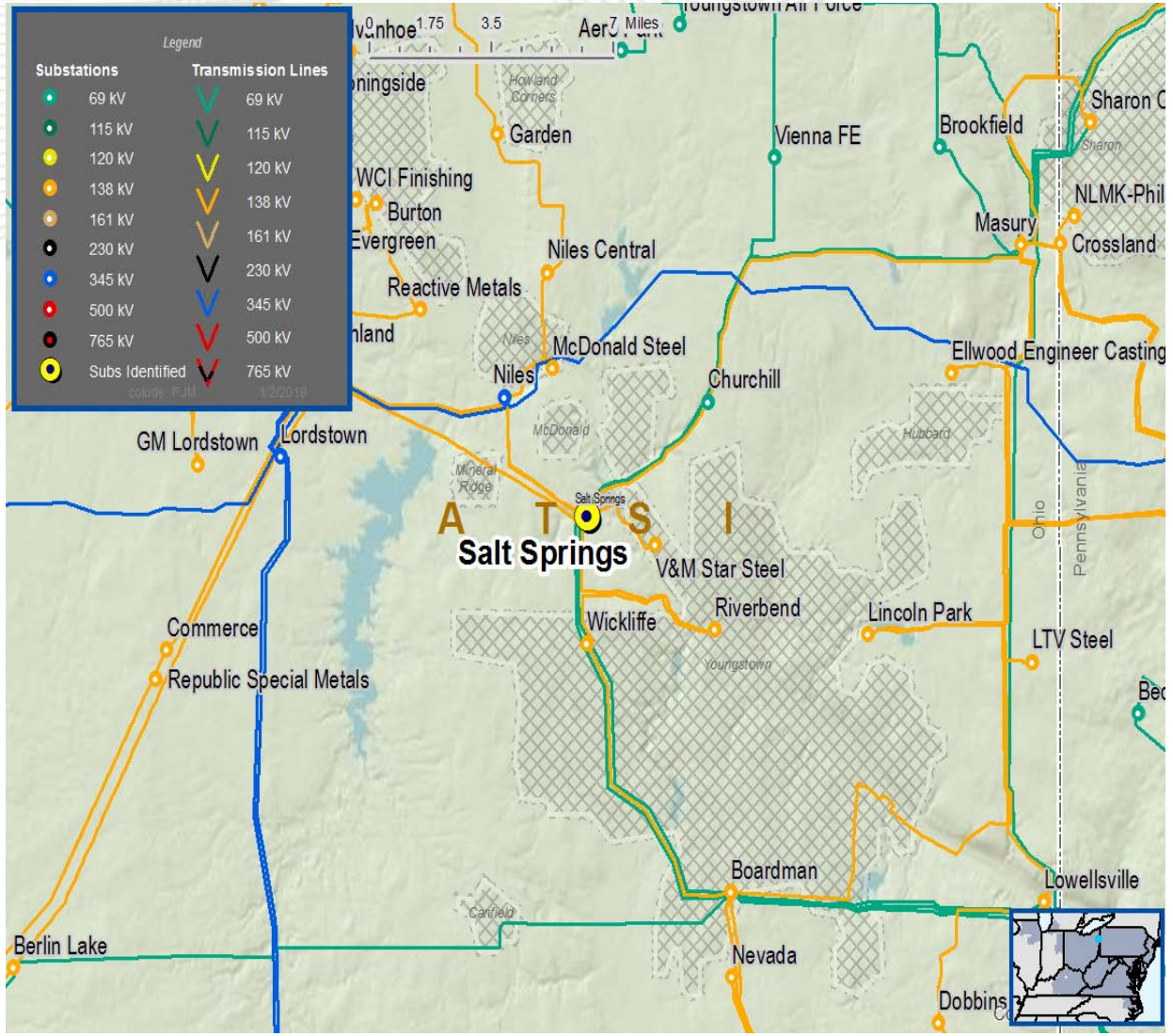
- System reliability and performance
- Substation / Line equipment limits
- Reliability of Non-Bulk Electric System (Non-BES) facilities
- Load and risk in planning and operational scenarios
- Load and/or customers at risk on single transmission lines

Problem Statement

Kimberly 69 kV Area

The Kimberly 69 kV substation is served from a 3.6 mile radial transmission line from Salt Springs 138 / 69 kV substation with 19 MW and 5, 500 customers at risk.

Additionally, the contingency loss of the nearby Berlin Lake-Boardman 69 kV line results in the loss of approximately 46 MW and 12,500 customers at four (4) transmission service points.



ATSI Transmission Zone

Need Number: ATSI-2019-009

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Operational Flexibility and Efficiency

Infrastructure Resilience

Specific Assumption Reference(s)

Global Considerations

- System reliability and performance
- Substation / Line equipment limits
- Reliability of Non-Bulk Electric System (Non-BES) facilities
- Load and risk in planning and operational scenarios
- Load and/or customers at risk on single transmission lines

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ATSI Transmission Zone

Need Number: ATSI-2019-009

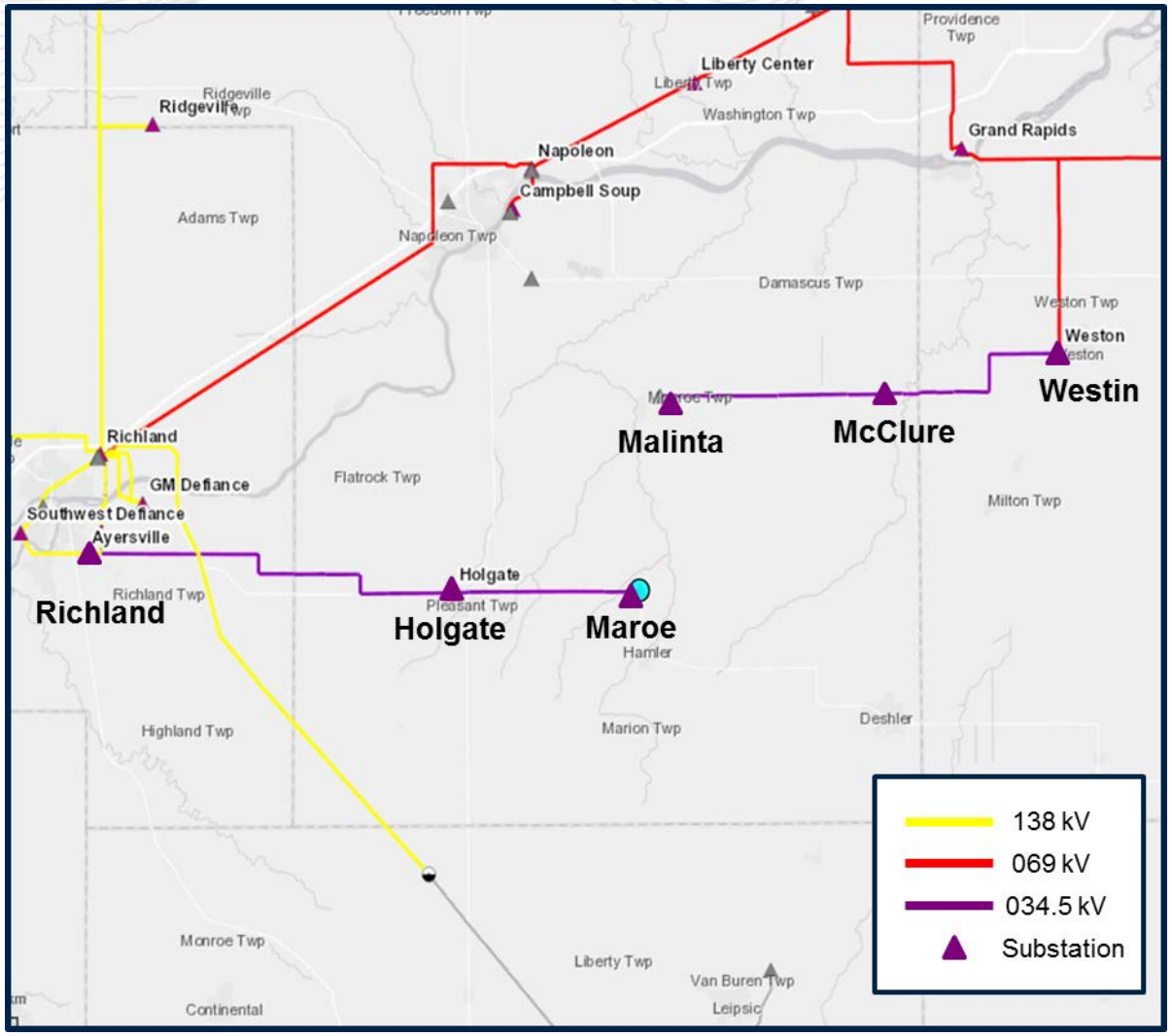
Process Stage: Need Meeting

Date: 01/11/2019

Problem Statement

Maroe-Malinta 34.5 kV Area

- *The existing Richland-Maroe 34.5kV line is a radial line with limited capability of transferring load onto different circuits for emergency restoration and scheduling of routine maintenance.*
- *The loss of the Richland-Maroe 34.5 kV radial line results in the loss of approximately 8 MW and 2,550 customers at two (2) sub-transmission service points.*
- *The existing Weston-Malinta 34.5 kV line is a radial line with limited capability of transferring load onto a different circuits for emergency restoration and scheduling of routine maintenance.*
- *The loss of the Weston-Malinta 34.5 kV radial line results in the of approximately 6 MW and 1,000 customers at two (2) sub-transmission service points.*
- *The 138 / 34.5 kV transformer #1 at Richland substation is greater than 70 years old and is showing signs of end of life; including oil leaks, failing components, and increasing maintenance.*
- *The 69 / 34.5 kV transformer #3 at Westin substation is greater than 74 years old and is showing signs of end of life; including oil leaks and deteriorating components.*
- *Customers taking sub-transmission service on these two radial lines have requested additional reliability and operational flexibility.*
  - *The 34.5kV radial lines cannot be networked due to insufficient short circuit current.*
  - *The Westin 69 / 34.5 kV transformer #3 (end of life) does not have the capacity to carry the entire load on a networked 34.5 kV system for a path end outage at Richland substation.*



ATSI Transmission Zone

Need Number: ATSI-2019-010

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Operational Flexibility and Efficiency

Infrastructure Resilience

Specific Assumption Reference(s)

Global Considerations

- System reliability and performance
- Substation / Line equipment limits
- Reliability of Non-Bulk Electric System (Non-BES) facilities
- Load and risk in planning and operational scenarios
- Load and/or customers at risk on single transmission lines

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Area Map on Next Slide

ATSI Transmission Zone

Need Number: ATSI-2019-010

Process Stage: Need Meeting

Date: 01/11/2019

Problem Statement

Valley & Thiess 138 kV Substation Area

The Valley and Thiess 138 kV substations are presently owned by Cuyahoga Falls Municipality with transmission service from the ATSI Babb-Chamberlin 138 kV line.

- A transmission line outage of the double circuit networked 138 kV tap (approximately 1 mile) to Valley substation could result in approximately 86 MW and 25,000 Customers interrupted for an extended period of time.
- The loss of the Chamberlin-Thiess 138 kV line, followed by the loss of the Babb-Valley 138 kV line (N-1-1) could result in approximately 106 MW and 25,000 customers interrupted for an extended period of time.

Evans & Darrow 138 kV Substation Area

- The loss of the Babb-Evans 138 kV line, followed by the loss of the East Akron-Evans 138 kV line (N-1-1) results in approximately 25 MW and 4,834 customers interrupted.
- The loss of the Chamberlin-Hudson Muni 138 kV line, followed by the loss of the Brady-Hanna 138 kV line (N-1-1), results in approximately 61 MW and 18,800 customers interrupted. Post-contingency voltage drops below 0.92 p.u. in the Darrow substation area.

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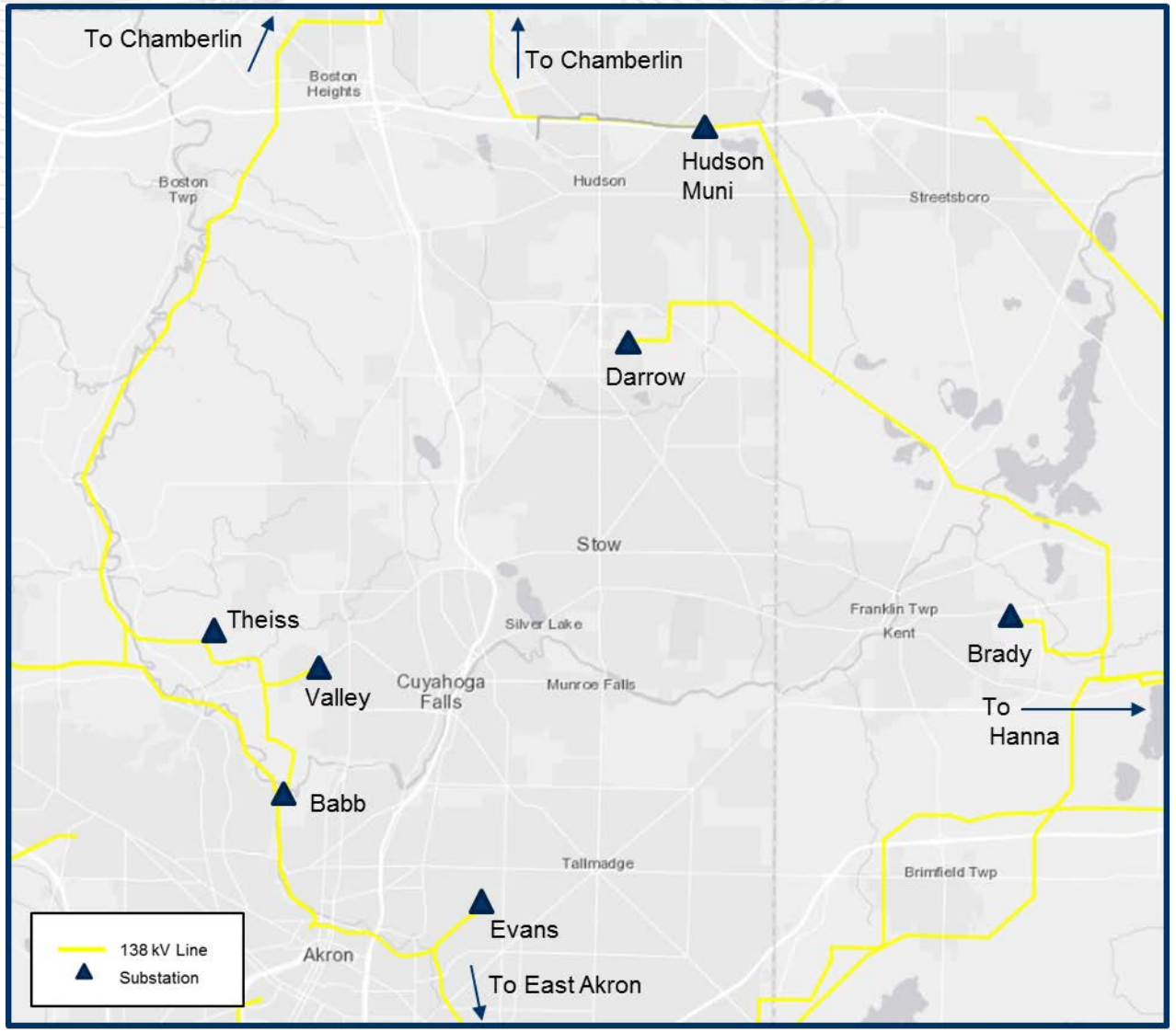


ATSI Transmission Zone

Need Number: ATSI-2019-010

Process Stage: Need Meeting

Date: 01/11/2019

System Performance

- Over the past five years,
  - The Chamberlin-Theiss 138 kV line has experienced five (5) outages (3 sustained, 2 momentary)
  - The Theiss-Valley 138 kV line has experienced one (1) outage (1 sustained, 0 momentary)
  - The Chamberlin-Hudson Muni 138 kV line has experienced four (4) outages (2 sustained, 2 momentary)
  - The Babb-Evans 138 kV line has experienced one (1) outage (1 sustained, 0 momentary)

ATSI Transmission Zone

Need Number: ATSI-2019-011

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Equipment Material, Condition, Performance and Risk

Operational Flexibility and Efficiency

Infrastructure Resilience

Specific Assumption Reference(s)

Global Considerations

- System reliability and performance
- Substation / Line equipment limits

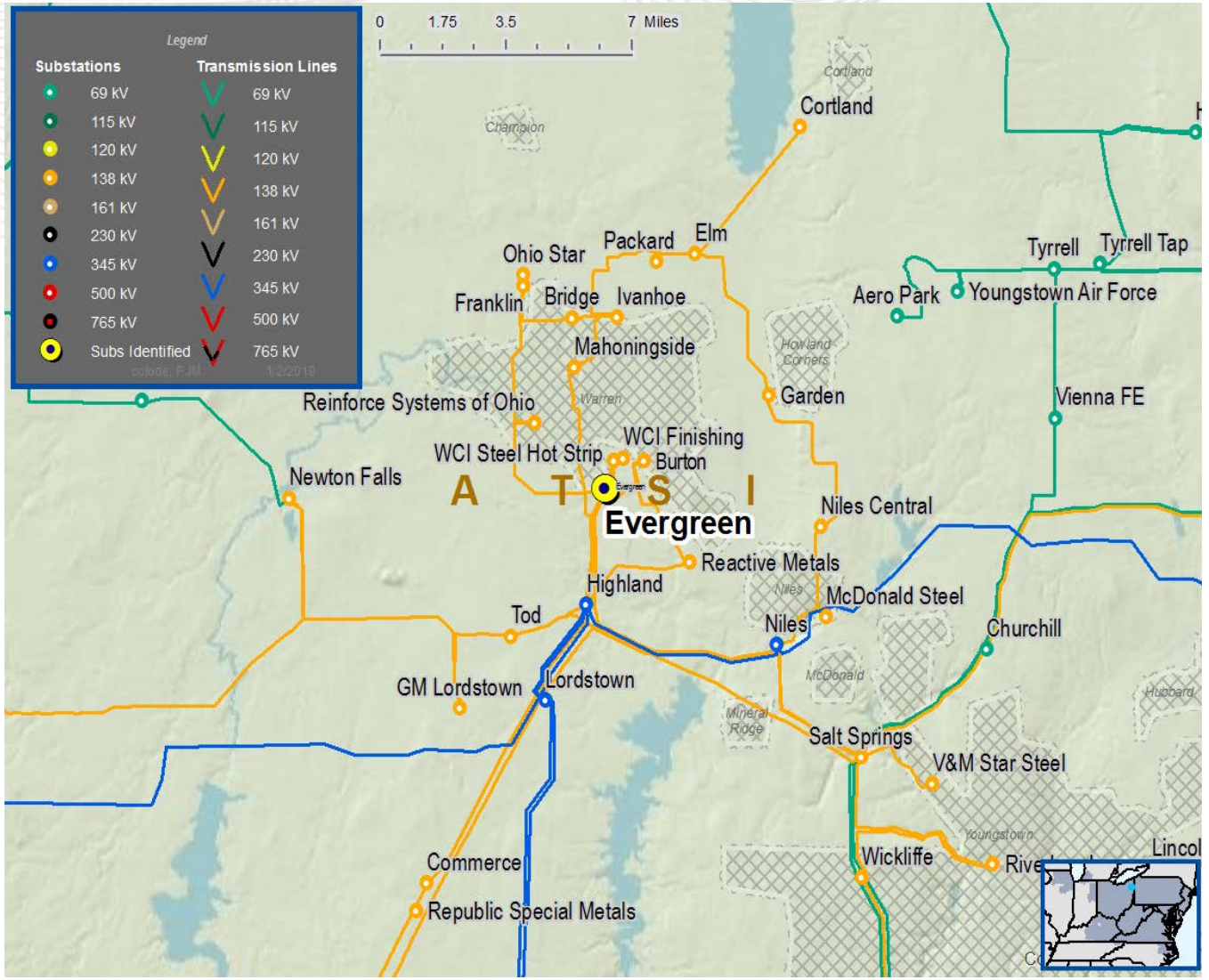
Upgrade Relay Schemes

- Bus protection schemes
- Relay schemes that have a history of misoperation

Problem Statement

Evergreen Substation 138 kV Equipment and Protection

- BES bus protection is presently performed by a complex scheme that has a history of causing misoperations at other substations. The scheme uses distributed electromechanical relays to exclude a bus fault rather than detecting the bus fault directly.



ATSI Transmission Zone

Need Number: ATSI-2019-012

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Equipment Material, Condition, Performance and Risk

Operational Flexibility and Efficiency

Infrastructure Resilience

Specific Assumption Reference(s)

Global Considerations

- System reliability and performance
- Substation / Line equipment limits

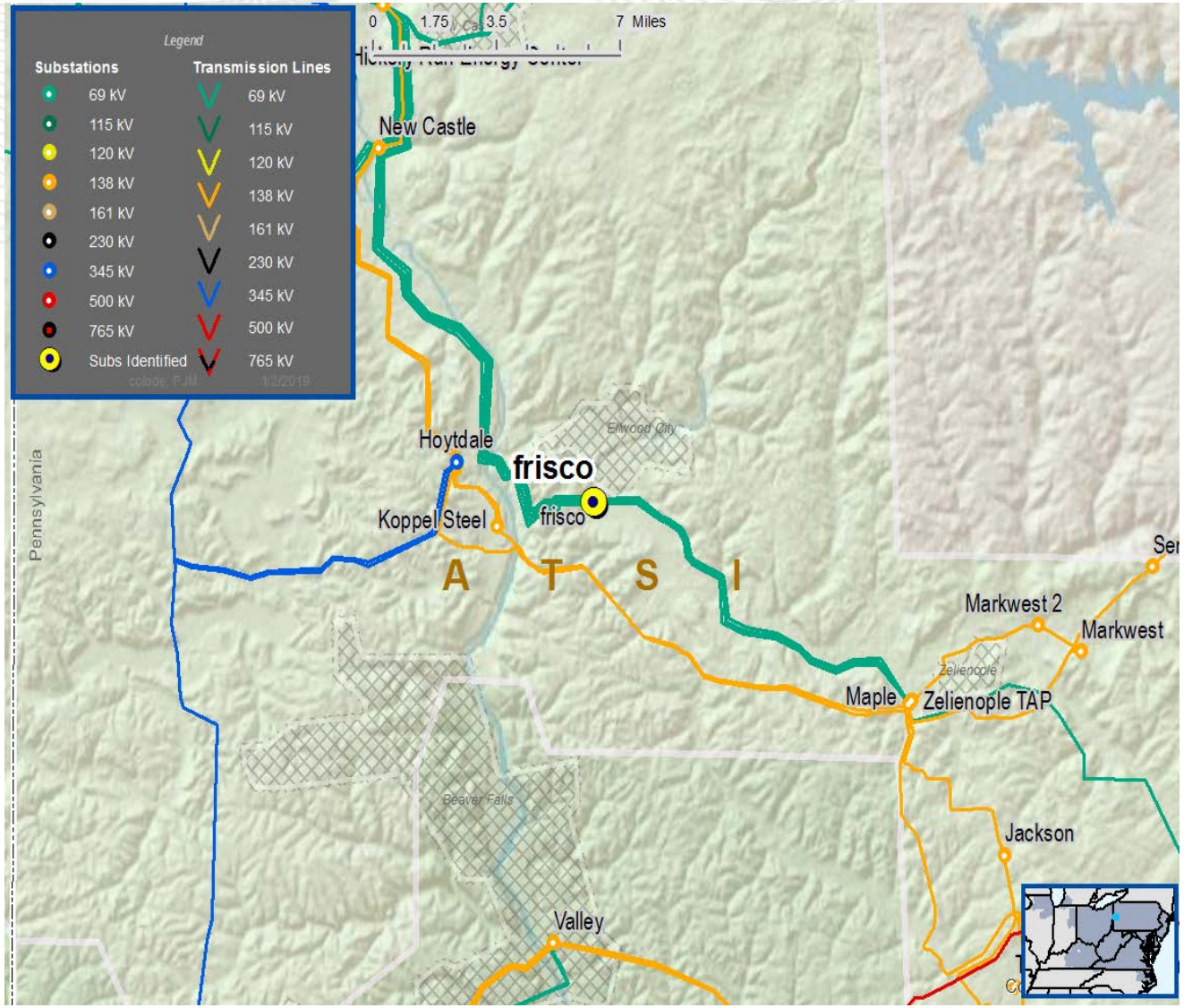
Upgrade Relay Schemes

- Protection system with single point of failure

Problem Statement

Frisco Substation 69 kV Protection

- Line protection at Frisco substation consists of a single relay protection scheme. A recent relay failure during a fault at a nearby substation led to delayed fault clearing and a larger number of customers affected than necessary. There is not backup relay schemes to reduce customer exposure to a similar single point of failure.



ATSI Transmission Zone

Need Number: ATSI-2019-013

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Equipment Material, Condition, Performance and Risk

Operational Flexibility and Efficiency

Infrastructure Resilience

Specific Assumption Reference(s)

Global Considerations

- System reliability and performance
- Substation / Line equipment limits

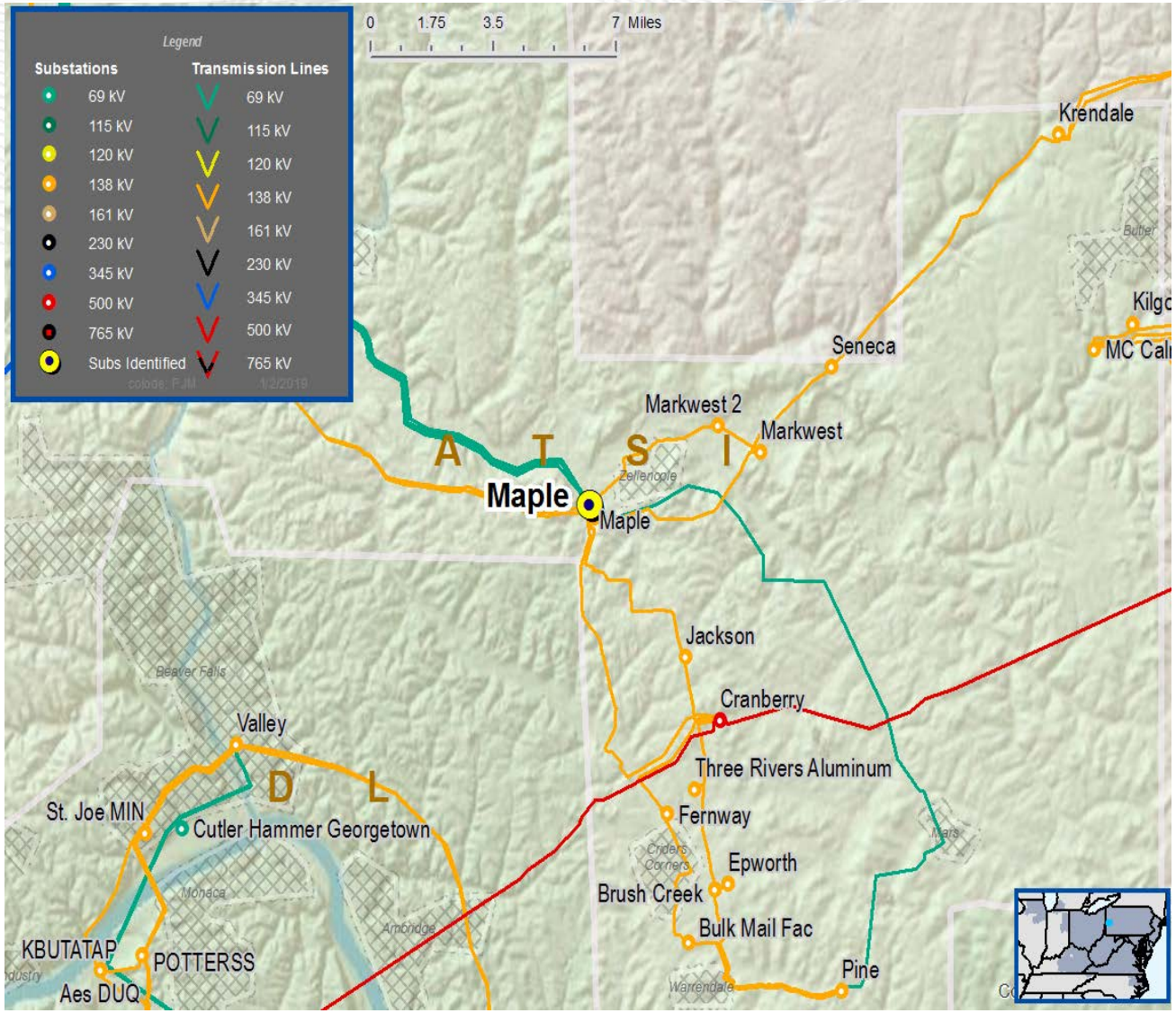
Upgrade Relay Schemes

- Protection system with single point of failure

Problem Statement

Maple Substation 69 kV Protection

- Line protection at Maple substation consists of a single relay protection scheme. A recent relay failure during a fault at a nearby substation led to delayed fault clearing and a larger number of customers affected than necessary. There is not backup relay schemes to reduce customer exposure to a similar single point of failure.



ATSI Transmission Zone

Need Number: ATSI-2019-026 to 049

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Operational Flexibility and Efficiency

Infrastructure Resilience

Specific Assumption Reference(s)

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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ATSI Transmission Zone

Problem Statement

PJM Zone - ATSI

- 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.

ATSI-2019-	Transmission Line / Substation Locations	Existing Line Rating (SN / SE)	Existing Conductor Rating (SN / SE)	Limiting Terminal Equipment
026	Allen Junction-Vulcan 138 kV Line	290 / 325	290 / 346	Line Relay, Substation Conductor / Drops
027	Avery 138 / 69 kV Substation	153 / 153	177 / 177	Relay, Substation Conductor / Drops, Disconnect Switches
028	Bayshore-GM Powertrain 138 kV Line	278 / 342	278 / 343	Line Relay
029	Bayshore-Jeep 138 kV Line	297 / 326	297 / 365	Line Relay, Substation Conductor / Drops
030	Blue Jacket-Kirby 138 kV Line	218 / 269	278 / 339	External Company Equipment
031	Carlisle-Gates 138 kV Line	196 / 210	233 / 282	Line Relay, Wave-trap, Substation Conductor / Drops
032	Cedar Street-New Castle 138 kV Line	294 / 350	370 / 452	Line Relay, CT, Circuit Breaker, Substation Conductor / Drops, Disconnect Switches
033	East Akron-West Ravenna 138 kV Line	176 / 229	200 / 242	Substation Conductor / Drops
034	GM Defiance-Richland #1 138 kV Line	216 / 229	216 / 264	Line Relay
035	GM Defiance-Richland #2 138 kV Line	216 / 229	216 / 264	Line Relay

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ATSI Transmission Zone

Problem Statement – Continued from previous slide

ATSI-2019-	Transmission Line / Substation Locations	Existing MVA Line Rating (SN / SE)	Existing MVA Conductor Rating (SN / SE)	Limiting Terminal Equipment
036	Greenfield-New Departure 138 kV Line	153 / 199	200 / 242	Substation Conductor / Drops
037	Hanna-West Ravenna 138 kV Line	295 / 369	324 / 395	Substation Conductor / Drops
038	Hoytdale-Maple 138 kV Line	278 / 332	278 / 339	Wave-trap
039	Hyatt-Tangy 345 kV Line	971 / 971	1560 / 1900	External Company Equipment
040	Ivanhoe-Mahoningside 138 kV Line	196 / 222	200 / 242	Wave-trap
041	Ivanhoe-Packard 138 kV Line	196 / 210	200 / 242	Line Relay, Wave-trap
042	Jennings-LTV West Q-12 138 kV Line	43 / 43	256 / 262	Line Relay, CT, Circuit Breaker
043	Jennings-LTV West Q-14 138 kV Line	43 / 43	256 / 262	Line Relay, CT, Circuit Breaker
044	Kirby-Tangy 138 kV Line	265 / 273	278 / 339	Line Relay, Substation Conductor / Drops
045	Midway-Levis Park 138 kV Line	278 / 286	308 / 376	Line Relay, Substation Conductor / Drops
046	Midway-Napoleon 138 kV Line	161 / 179	161 / 194	Meter
047	Salt Springs-Riverbend 138 kV Line	223 / 223	278 / 339	Line Relay, CT, Substation Conductor / Drops
048	Star-Wadsworth Muni 138 kV Line	221 / 262	233 / 282	Substation Conductor / Drops
049	West Akron-Babb 138 kV Line	190 / 223	200 / 242	Line Relay, Wave-trap, Substation Conductor / Drops

ATSI Transmission Zone

Need Number: ATSI-2019-015

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Equipment Material, Condition, Performance and Risk

Specific Assumption Reference(s)

Global Factors

- At or beyond expected service life or obsolete
- Failure risk, to the extent caused by asset design characteristics, or historical industry/company performance data, or application design error
- Show a high level of criticality to system performance and operations

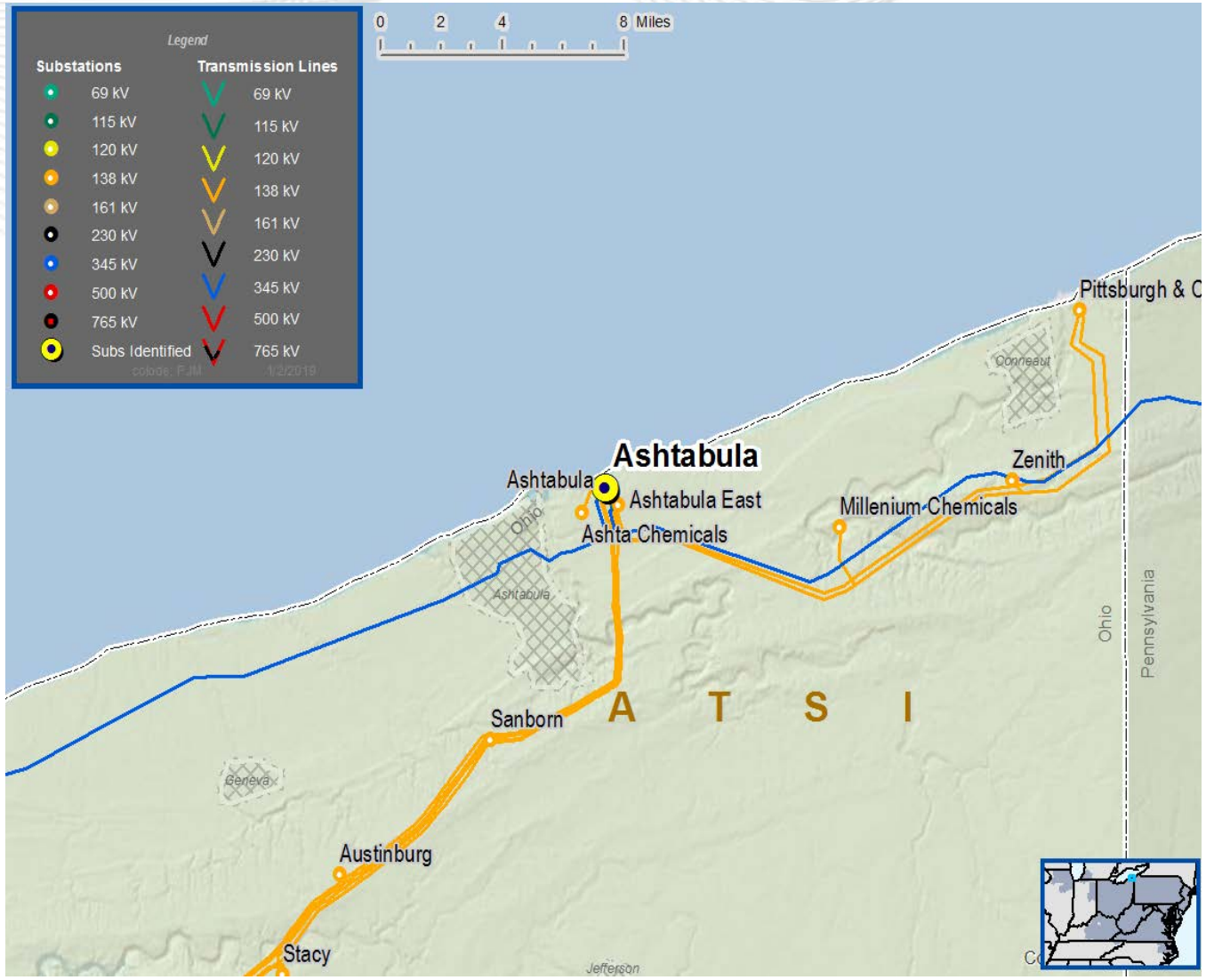
Substation Condition Rebuild / Replacement

- Circuit breakers and other fault interrupting devices
- Switches
- Station system protection and controls

Problem Statement

Ashtabula 138 kV Substation Equipment and Protection

- *Two (2) 138 kV breakers (B143 & B149), lightning arresters and associated switches, and control wiring are showing degrading performance, increasing maintenance, age (46-63 years), and obsolescence of equipment and spare parts.*



ATSI Transmission Zone

Need Number: ATSI-2019-016

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Equipment Material, Condition, Performance and Risk

Specific Assumption Reference(s)

Global Factors

- At or beyond expected service life or obsolete
- Failure risk, to the extent caused by asset design characteristics, or historical industry/company performance data, or application design error
- Show a high level of criticality to system performance and operations

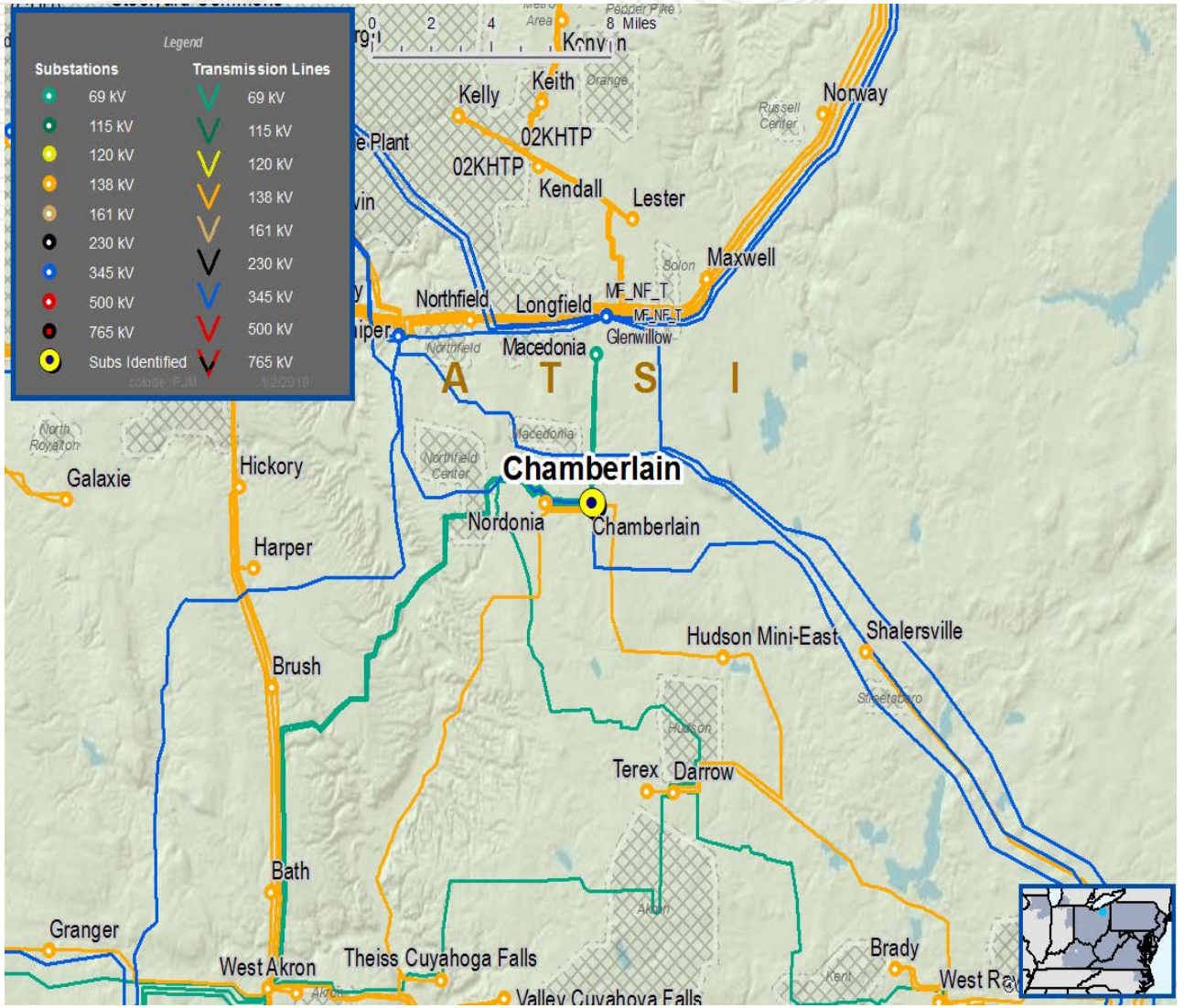
Substation Condition Rebuild / Replacement

- Circuit breakers and other fault interrupting devices
- Switches
- Risers and connections

Problem Statement

Chamberlin 138 kV Substation

- *Two (2) 138 kV Oil Circuit Breaker (OCB) breakers (B86 & B69) and MOAB Switch A-19 at Chamberlin are showing degrading performance, increasing maintenance, age (> 30 years), and obsolescence of equipment and spare parts.*



ATSI Transmission Zone

Need Number: ATSI-2019-017

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Equipment Material, Condition, Performance and Risk

Specific Assumption Reference(s)

Global Factors

- At or beyond expected service life or obsolete
- Failure risk, to the extent caused by asset design characteristics, or historical industry/company performance data, or application design error
- Show a high level of criticality to system performance and operations

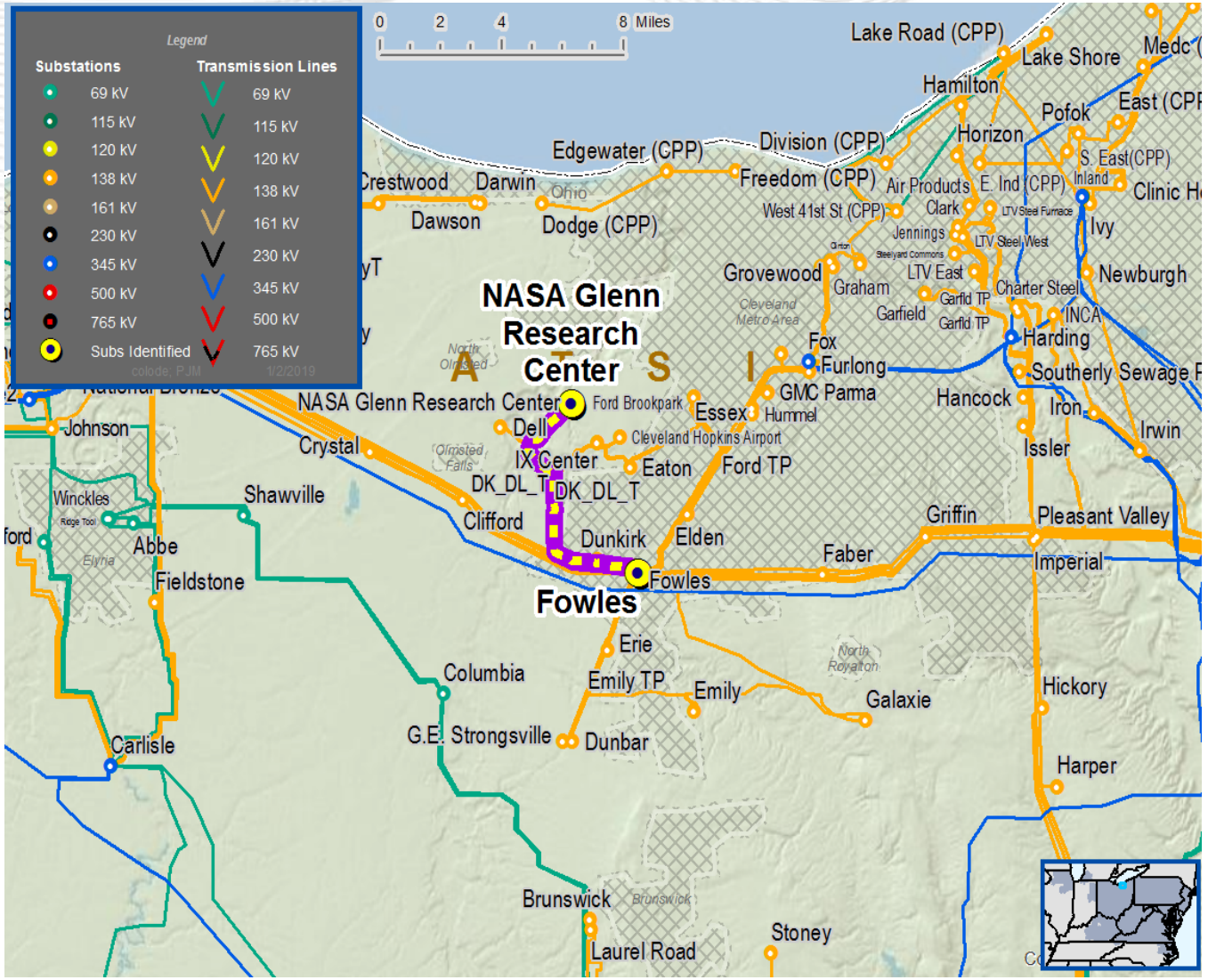
Substation Condition Rebuild / Replacement

- Circuit breakers and other fault interrupting devices
- Switches
- Relays
- CCVTs

Problem Statement

Fowles – NASA Q16 138 kV Terminal Equipment

- *One (1) 138 kV breaker at Fowles (Q16), associated switches, relays, and CCVTs are showing degrading performance, increasing maintenance, age (60 years), and obsolescence of equipment and spare parts.*



ATSI Transmission Zone

Need Number: ATSI-2019-019

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Equipment Material, Condition, Performance and Risk

Specific Assumption Reference(s)

Global Factors

- At or beyond expected service life or obsolete
- Failure risk, to the extent caused by asset design characteristics, or historical industry/company performance data, or application design error
- Show a high level of criticality to system performance and operations

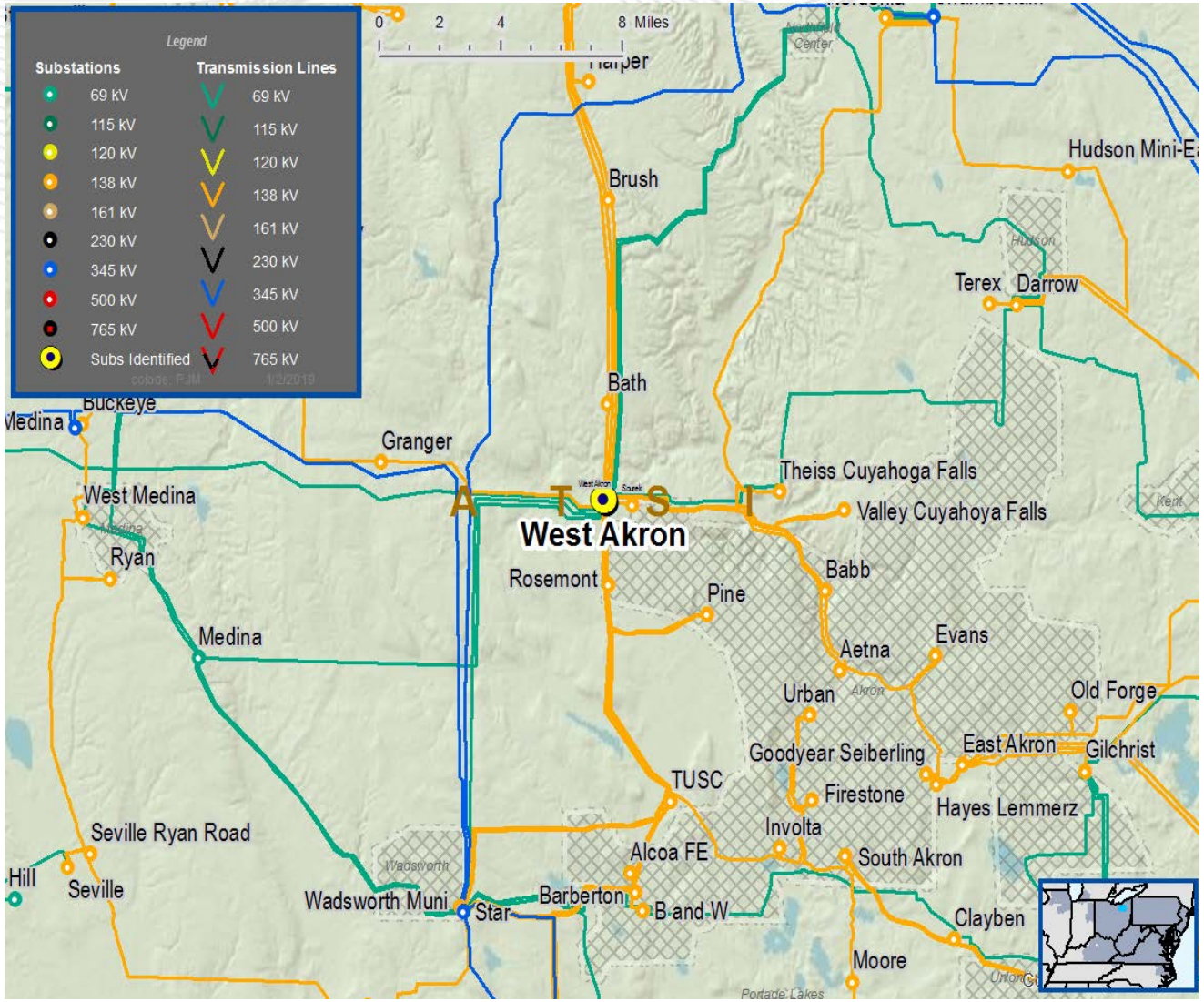
Substation Condition Rebuild / Replacement

- Circuit breakers and other fault interrupting devices
- Switches
- Current transformers (CTs), control cables, and cable trays
- Carrier sets and associated wave-traps
- Line Arresters, Risers and connections

Problem Statement

West Akron 138 kV Substation

One (1) 138 kV Oil Circuit Breaker (OCB) breaker (B1) at West Akron, lightning arresters and associated switches, and CCVTs are showing degrading performance, increasing maintenance, age (30 years), and obsolescence of equipment and spare parts.



ATSI Transmission Zone

Need Number: ATSI-2019-020

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Equipment Material, Condition, Performance and Risk

Specific Assumption Reference(s)

Global Factors

- At or beyond expected service life or obsolete
- Show a high level of criticality to system performance and operations
- Impact customer outage frequency and/or duration

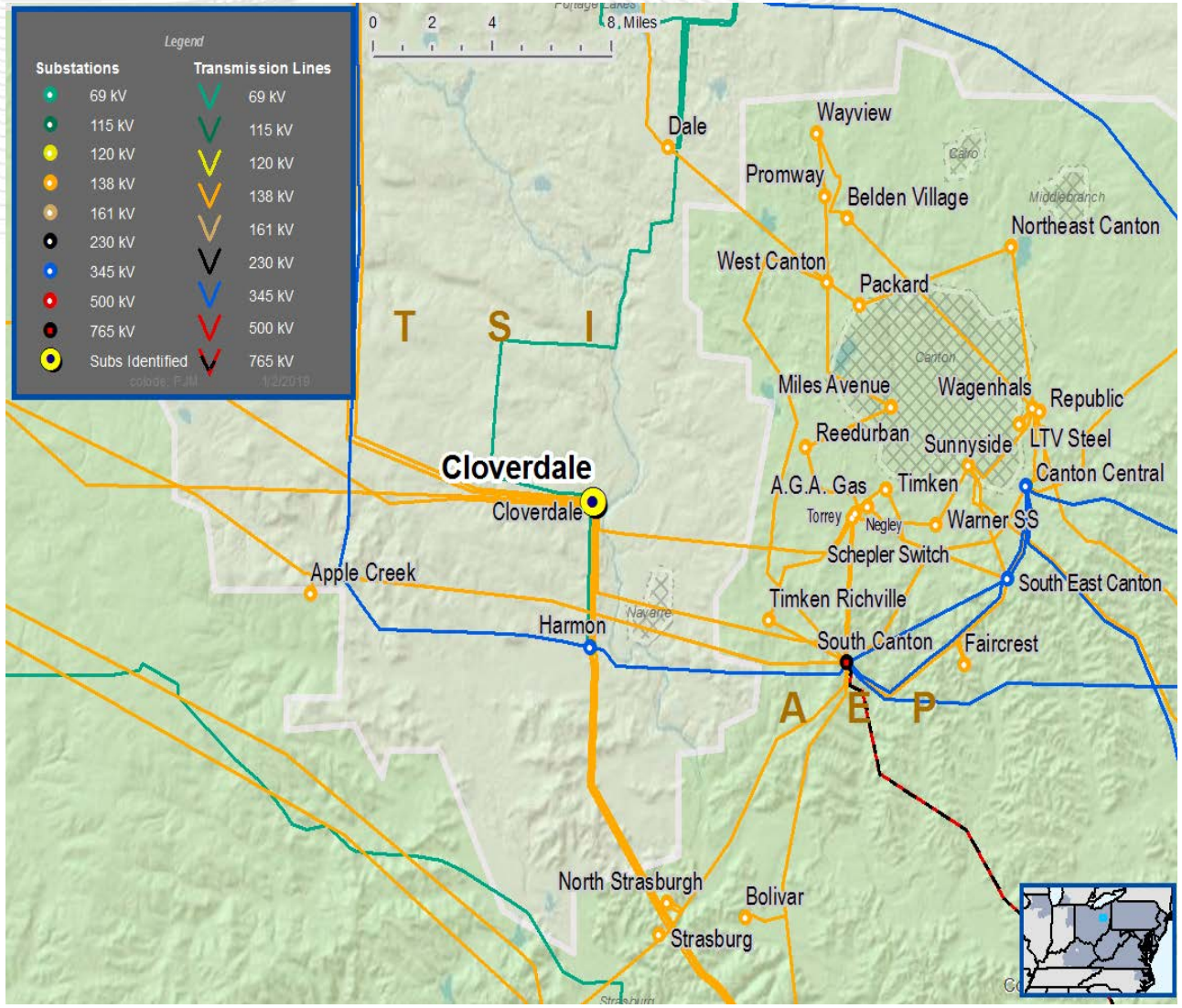
Upgrade Relay Schemes

- 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

Cloverdale 69 kV Substation Assessment

The electromechanical relays and communication equipment at the 69 kV Cloverdale substation have been identified to be prone to misoperation. The disconnect switches have operation difficulty and are greater than 40 years of age. The 69 kV Bus PTs are nearing end of life with increased risk of failure.



ATSI Transmission Zone

Need Number: ATSI-2019-021

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Equipment Material, Condition, Performance and Risk

Specific Assumption Reference(s)

Global Factors

- Level of criticality to system performance and operations
- Negative impact on equipment health and/or system reliability
- Customer outage frequency and/or durations
- Expected service life (at or beyond) or obsolescence

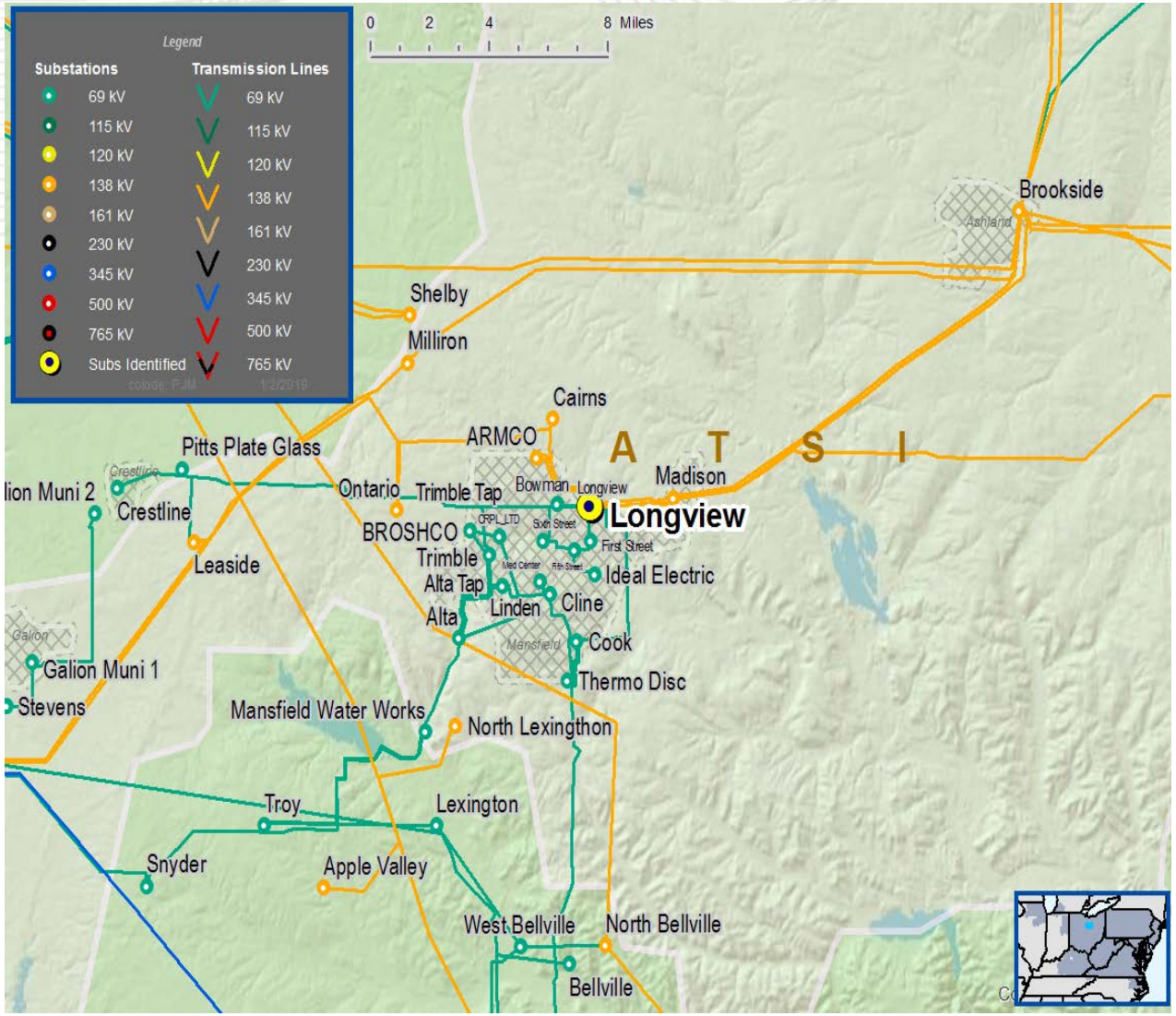
Upgrade Relay Schemes

- 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

Longview 69 kV Substation Assessment

- *The electromechanical relays and communication equipment at the 69 kV Longview substation have been identified to be prone to misoperation. The disconnect switches have operation difficulty and the 69 kV Bus PTs are nearing end of life with increased risk of failure.*



ATSI Transmission Zone

Need Number: ATSI-2019-022

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Equipment Material, Condition, Performance and Risk

Specific Assumption Reference(s)

Global Factors

- Level of criticality to system performance and operations
- Equipment installation times (long lead and/or extended)
- Environmental considerations
- Expected service life (at or beyond) or obsolescence

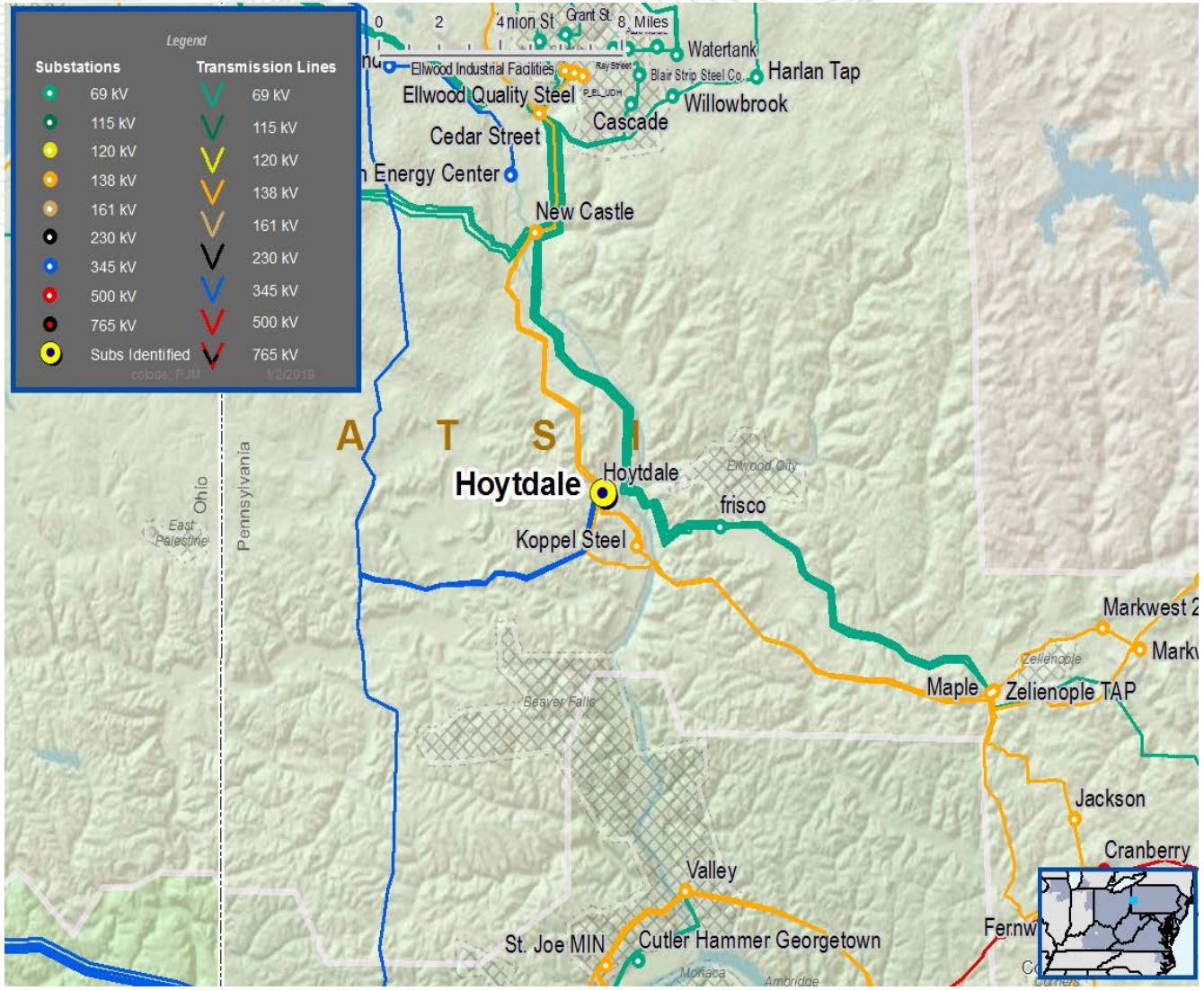
Substation Condition Rebuild / Replacement

- Power transformers and load tap changers (LTCs)

Problem Statement

Hoytdale Substation Transformer Assessment

- *The existing 345 / 138 kV Hoytdale transformer #1 is showing end of service life issues; including oil leaks, moisture ingress, problematic cooling controls, unreliable gauges / annunciators, failing pumps and relays that are prone to misoperations.*



ATSI Transmission Zone

Need Number: ATSI-2019-023

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Equipment Material, Condition, Performance and Risk

Specific Assumption Reference(s)

Global Factors

- Increasing negative trend in maintenance findings and/or costs
- Limited availability of spare parts, software obsolescence and/or compatibility, or vendor technical support
- Expected service life (at or beyond) or obsolescence

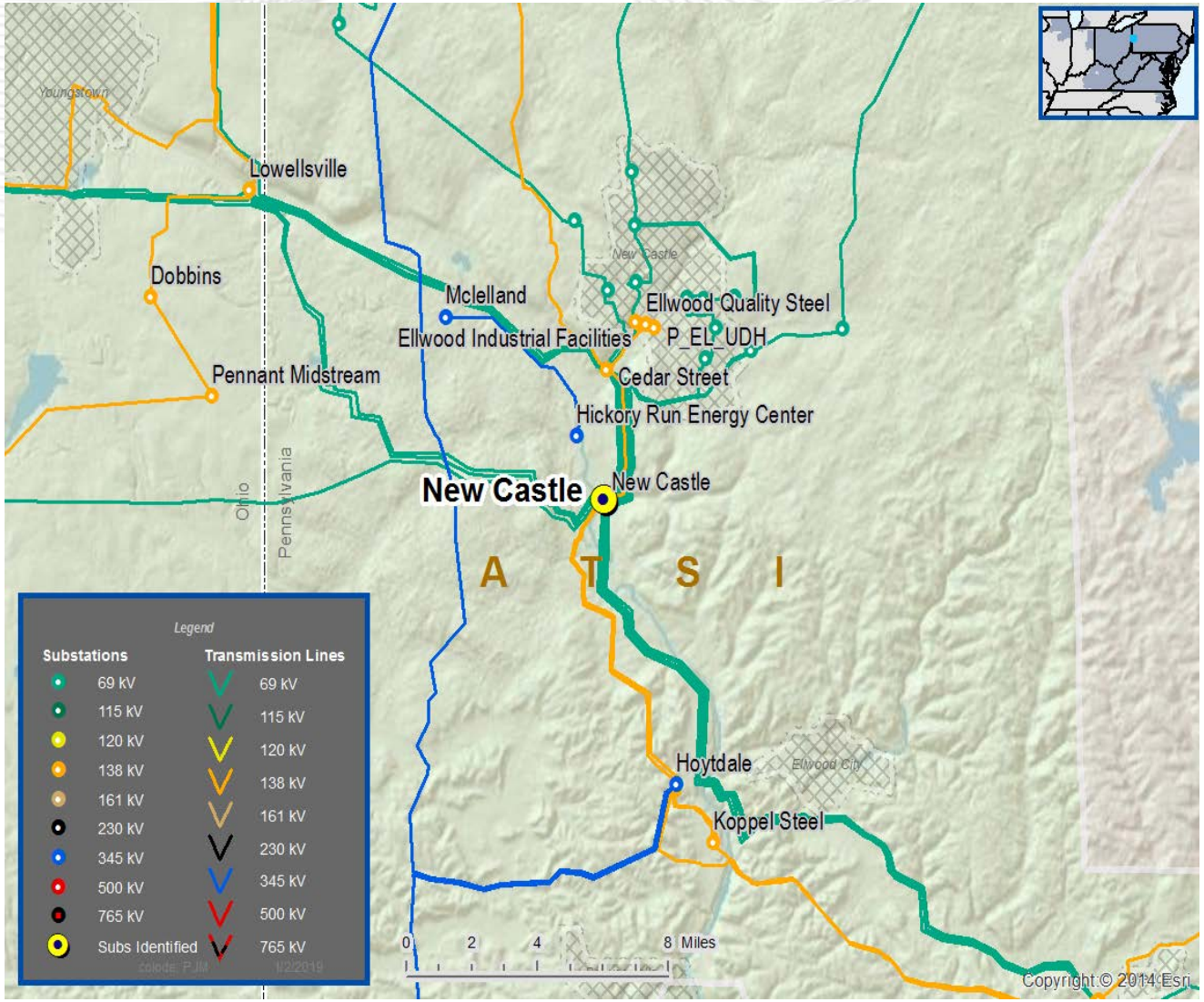
Substation Condition Rebuild / Replacement

- Circuit breakers and other fault interrupting devices
- Switches
- Risers and connections

Problem Statement

New Castle 138 kV and 69 kV Substation Assessment

- *One (1) 138 kV OCB breaker (B166) and five (5) 69 kV OCB breakers (B32, B86, B90, B96 and B106) at New Castle are showing end of life characteristics; including deteriorated bushings, mechanism, oil leaks, and age (> 30 years) with increasing maintenance and obsolescence of equipment and spare parts. Associated disconnect switches are also deteriorating with failures and operating difficulties.*



ATSI Transmission Zone

Need Number: ATSI-2019-024

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Equipment Material, Condition, Performance and Risk

Specific Assumption Reference(s)

Global Factors supporting Line Rebuild

- Negative impact on equipment health and/or system reliability
- Age/condition of wood pole structures and line hardware
- Increasing negative trend in maintenance findings and/or costs
- Limited availability of spare parts and/or vendor technical support
- Current design criteria, applicable codes, and industry best practices

Problem Statement

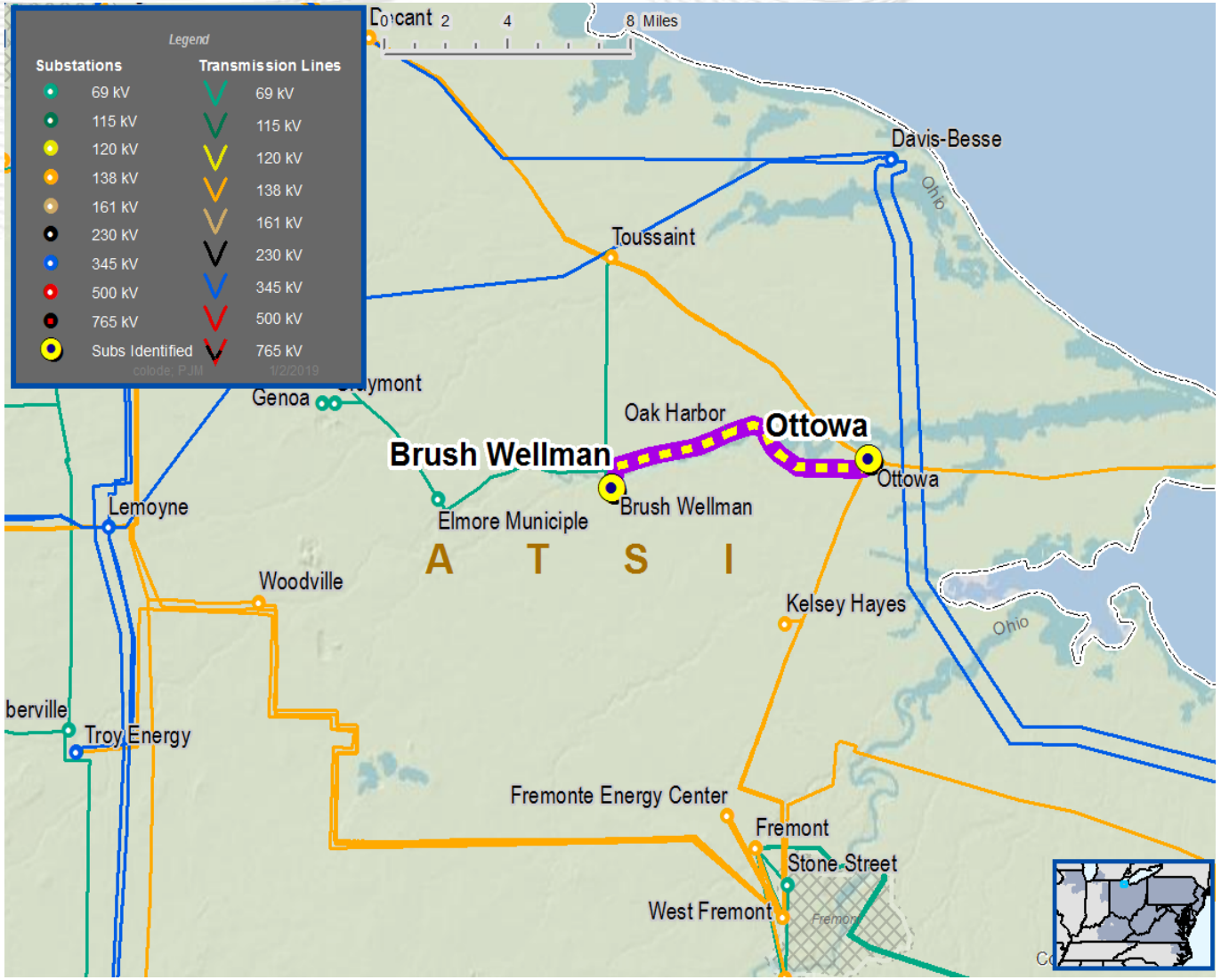
Coulter-Longview 69 kV Line Assessment

- *The poles and associated hardware on this line have reached end of life with 90% of the poles greater than 60 years.*
- *Maintenance and repairs are trending upward in frequency and severity.*
- *Four Air Break switches are obsolete and no longer supported for parts.*
- *Conductor (1/0 and 2/0 Copper) dates to original construction*

System Performance

- Over the past 5 years, the Coulter-Longview 69 kV line has experienced 10 outages

  (6 sustained , 4 momentary).



ATSI Transmission Zone

Need Number: ATSI-2019-025

Process Stage: Need Meeting

Date: 01/11/2019

Project Driver(s):

Equipment Material, Condition, Performance and Risk

Specific Assumption Reference(s)

Global Factors supporting Line Rebuild

- Negative impact on equipment health and/or system reliability
- Age/condition of wood pole structures and line hardware
- Increasing negative trend in maintenance findings and/or costs
- Limited availability of spare parts and/or vendor technical support
- Current design criteria, applicable codes, and industry best practices

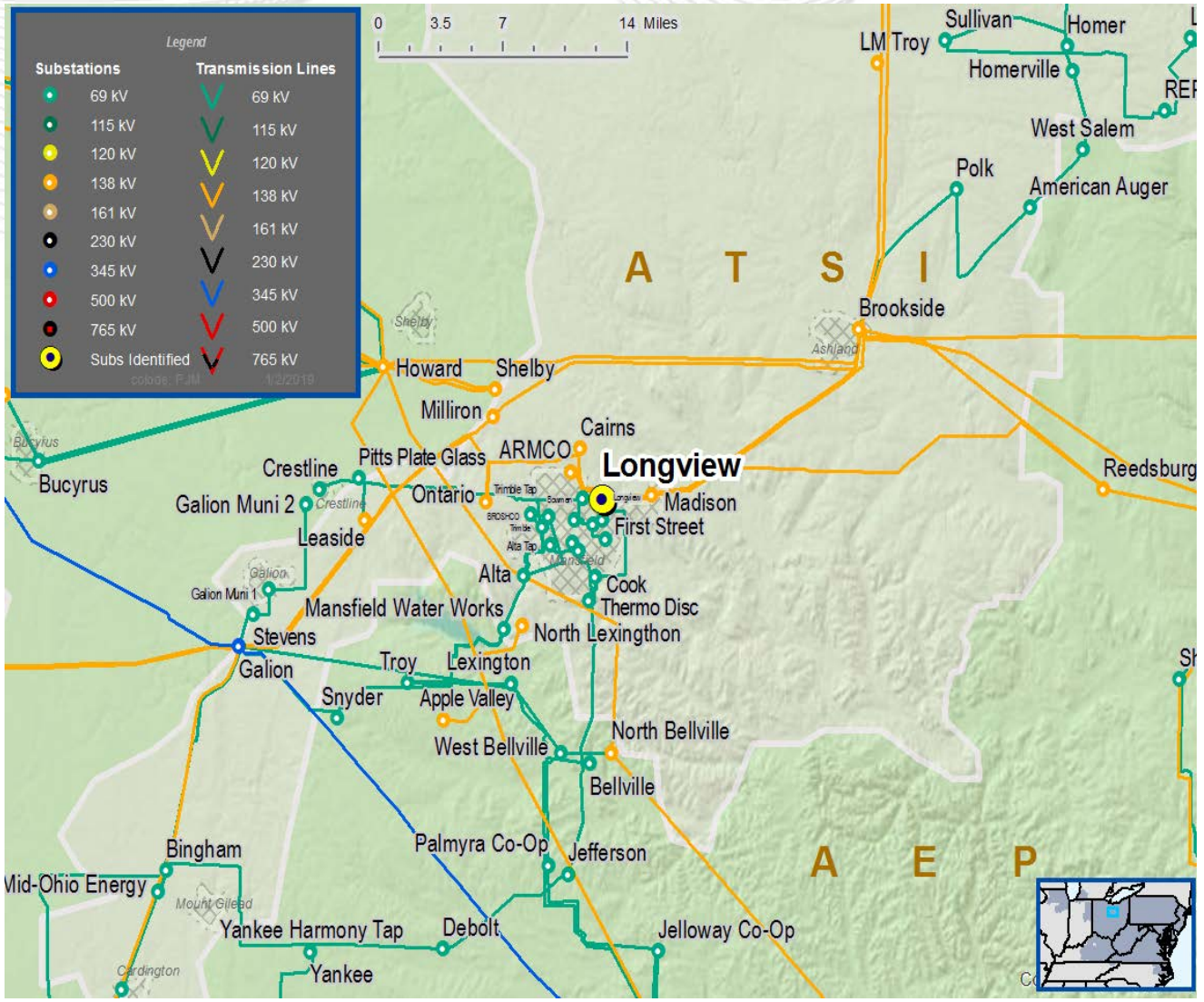
Problem Statement

Brush Wellman-Ottawa 69 kV Line Assessment

- *The poles and associated hardware on this line have reached end of life with 92% of the poles greater than 60 years.*
- *Maintenance and repairs are trending upward in frequency and severity.*
- *Four Air Break switches are obsolete and no longer supported for parts.*

System Performance

- Over the past 5 years, the Brush Wellman-Ottawa 69 line has experienced 4 outages (3 sustained , 1 momentary).



Revision History

- 12/27/2018 – V1 – Original version posted to pjm.com – Map updates expected after 1/1/2019
- 1/3/2019 – V2: Added Maps and ATSI-2019-023; ATSI-2019-014 has been broken down into “-026” through “-049”