Submission of Supplemental Projects for Inclusion in the Local Plan

ATSI Transmission Zone M-3 Process
Cuyahoga Falls 138 kV Planning Area- Solution

Need Number: ATSI-2019-010

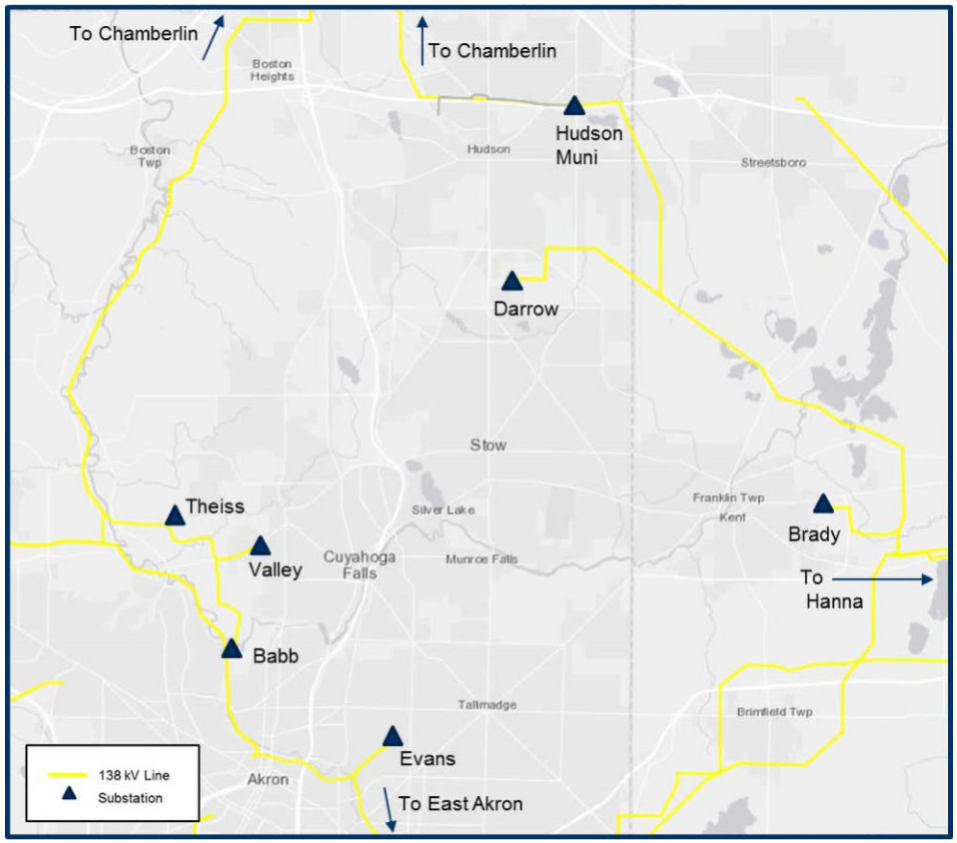
Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan – 06/18/2021

Previously Presented: Need Meeting – 01/11/2019
Solutions Meeting – 11/22/2019

Supplemental 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 line



ATSI Transmission Zone M-3 Process
Cuyahoga Falls 138 kV Planning Area- Solution

Need Number: ATSI-2019-010

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan – 06/18/2021

Previously Presented: Need Meeting – 01/11/2019
Solutions Meeting – 11/22/2019

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.

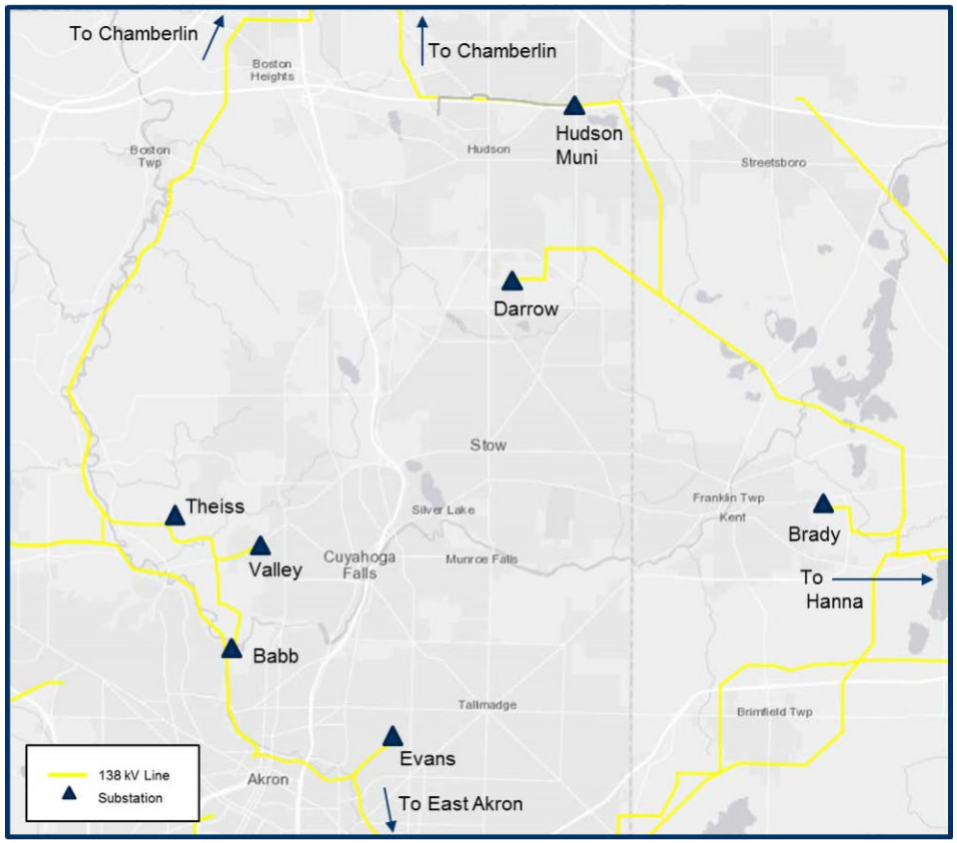
Evans & Darrow 138 kV Substation Area

- 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.

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 M-3 Process
Cuyahoga Falls 138 kV Planning Area- Solution

Need Number: ATSI-2019-010

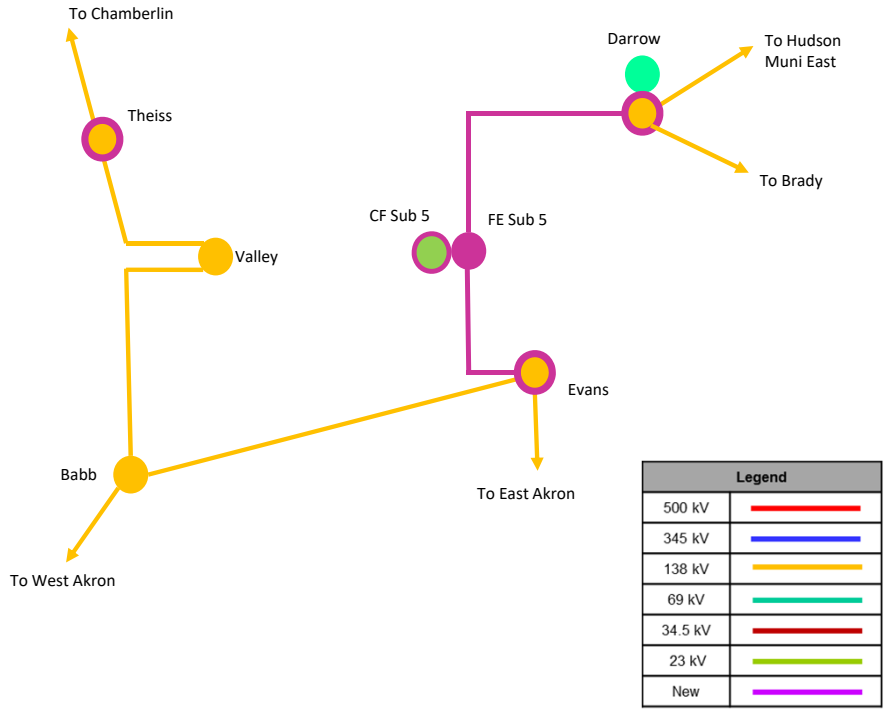
Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan – 06/18/2021

Previously Presented: Need Meeting – 01/11/2019
Solutions Meeting – 11/22/2019

Selected Solution:

New 138 kV Line & Sub 5 Expansion

- Build FE Sub 5 138kV four (4) breaker ring bus adjacent to the CF Sub5 substation
- Cuyahoga Falls Muni to expand CF Sub 5 substation to a 138/23 kV substation
- Convert Evans 138kV substation into five (future 6) breaker ring bus
- Convert the proposed Darrow five (future 6) breaker ring bus (s1708) into six breaker ring bus
- Build a new 138kV line from Evans to new FE Sub5 (Approximately 4.4 miles)
- Build a new 138kV line from Darrow to new FE Sub5 (Approximately 6.6 miles)
- Add a 28 MVAR 138 kV capacitor bank at Theiss substation.



Estimated Project Cost: $44 M

Transmission Line Ratings:

- Darrow-FE Sub 5 138 kV Line
  - After Proposed Solution: 278 MVA SN / 339 MVA SE
- Evans-FE Sub 5 138 kV Line
  - After Proposed Solution: 278 MVA SN / 339 MVA SE

Alternatives Considered:

- Bring a third 138 kV transmission line into Valley substation. This alternative was not selected due to lack of route diversity, limited substation expansion, limited easement rights, and siting concerns.

Projected In-Service: 06/01/2025

Project Status: Conceptual

Supplemental Project ID: s2387

Model: 2018 Series 2023 Summer RTEP 50/50

ATSI Transmission Zone M-3 Process
Multiple Relay Misoperation

Need Number: ATSI-2020-Mutiple (See next slide)

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan – 06/18/2021

Previously Presented: Need Meeting – 08/14/2020
Solution Meeting – 11/20/2020

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.

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Map Not Shown
Multiple Locations

ATSI Transmission Zone M-3 Process
Multiple Relay Misoperation

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ATSI-2020	Transmission Line / Substation Locations	Existing Line/Terminal Equipment MVA Rating (SN / SE)	Existing Conductor/Transformer MVA Rating (SN / SE)	Limiting Terminal Equipment
-014	Galion 138/69 kV Transformer #1	112 / 132 143 (WN) / 143 (WE)	126 / 132 151 (WN) / 157 (WE)	Substation conductor and relay at 69 kV
-015	Masury – Maysville 138 kV Line	124 / 124 124 (WN) / 124 (WE)	273 / 332 309 (WN) / 393 (WE)	Metering and substation conductor
-016	Babb Substation 1. Valley Terminal Upgrade	200 / 223 223 (WN) / 223 (WE)	200 / 242 226 (WN) / 286 (WE)	Relay
-017	Highland – Mahoningside 138 kV Line	200 / 223 223 (WN) / 223 (WE)	200 / 242 226 (WN) / 286 (WE)	Relay
-018	Highland – GM Lordstown 138 kV Line 1. Highland-Tod 2. GM Lordstown-Tod	1. 329 / 413 430 (WN) / 430 (WE) 2. 267 / 352 387 (WN) / 430 (WE)	1. 376 / 465 430 (WN) / 520 (WE) 2. 430 / 494 430 (WN) / 520 (WE)	1. Disconnect switch and relay 2. Substation conductor and relay
-019	Dale – West Canton 138 kV Line (AEP)	233 / 282 263 (WN) / 287 (WE)	233 / 282 263 (WN) / 333 (WE)	Relay
-020	Dale – South Akron 138 kV Line 1. Dale-Moore 138 kV section 2. Moore-South Akron 138 kV section	1. 233 / 282 263 (WN) / 284 (WE) 2. 225 / 282 263 (WN) / 306 (WE)	1. 233 / 282 263 (WN) / 333 (WE) 2. 233 / 282 263 (WN) / 333 (WE)	Substation conductor and relay

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ATSI Transmission Zone M-3 Process
Multiple Relay Misoperation

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ATSI-2020	Transmission Line / Substation Locations	Existing Line/Terminal Equipment MVA Rating (SN / SE)	Existing Conductor/Transformer MVA Rating (SN / SE)	Limiting Terminal Equipment
-021	Avery – Shinrock 138 kV Line	233 / 282 263 (WN) / 287 (WE)	233 / 282 263 (WN) / 333 (WE)	Relay
-022	Central – Packard 138 kV Line	157 / 196 198 (WN) / 210 (WE)	157 / 196 198 (WN) / 255 (WE)	Relay
-023	Wauseon – Delta 138 kV Line 1. Wauseon – Lear 2. Delta-Nature Fresh Farms	1. 327 (WN) / 396 (WE) 2. 327 (WN) / 396 (WE)	1. 327 (WN) / 420 (WE) 2. 327 (WN) / 420 (WE)	Substation conductor and relay
-025	Cardington (Galion) 138 kV Line	145 / 145 145 (WN) 145 (WE)	233 / 282 263 (WN) 333 (WE)	Substation conductor and relay
-026	Brookside – Longview East 138 kV Line	153 / 192 180 (WN) 210 (WE)	160 / 192 180 (WN) 228 (WE)	Substation conductor and relay
-027	Hanna – West Ravenna No1 138 kV Line	295 / 369 367 (WE) / 373 (WE)	376 / 432 376 (WE) / 455 (WE)	Substation conductor, disconnect switch, line drop and relay
-034	Masury – Maysville 138 kV Line	124 / 124 124 (WN) / 124 (WE)	273 / 332 309 (WN) / 393 (WE)	Metering, substation conductor, relays, and CTs

ATSI Transmission Zone M-3 Process
Multiple Relay Misoperation

Selected Solution:

ATSI-2020	Transmission Line / Substation Locations	Supplemental Project ID	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost ($ M)	Target ISD
-014	Galion 138/69 kV Transformer #1	s2447	126/132 MVA	Replace existing electromechanical relaying for Galion 138/69 kV TR#1 using SEL-351A for 51G tertiary relay. Also, replace limiting 750 CU substation conductors between TR & bus-side DS with 954 kcmil SAC.	1.2	12/1/2021
-015	Masury – Maysville 138 kV Line	s2448	273 / 332 MVA 309 / 393 MVA (WN/WE)	Masury: Replace (2) 138 kV 1200 A disconnect switches (D133 & D132) with 2000 A switches. Replace one (1) 138 kV 3000 A SF6 breaker (B85). Replace (1) 138 kV CVT. Replace (1) 138 kV wave trap with a 2000 A unit. Replace substation conductor. Upgrade Masury - Maysville 138 kV line relaying.	0.8	06/01/2021
-016	Babb –Valley 138 kV Substation Terminal Upgrade	s2449	200 / 242 MVA 226 / 286 MVA (WN/WE)	Babb: Replace (2) 138 kV disconnect switches (D8 & D10). Replace (1) 138 kV air-break switch (A11). Replace (3) 138 kV CVTs (CC12, CC13, & CC14). Replace line drops to breaker. Replace (3) rod gaps with (3) 108 kV, 84 kV MCOV, surge arresters. Valley: Replace (1) 138 kV circuit breaker (B1). Replace (1) 138 kV line side disconnect switch (D4) with a 2000 A disconnect switch. Replace (3) 138 kV CVTs (CC14, CC15, & CC16). Replace (3) rod gaps with (3) 108 kV, 84 kV MCOV, surge arresters.	1.3	12/31/2021

Model: 2020 RTEP model for 2025 Summer (50/50)

ATSI Transmission Zone M-3 Process
Multiple Relay Misoperation

Selected Solution:

ATSI-2020	Transmission Line / Substation Locations	Supplemental Project ID	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost ($ M)	Target ISD
-017	Highland – Mahoningside 138 kV Line	s2450	200 / 242 MVA 226 / 286 MVA (WN/WE)	Highland: Replace (1) 138 kV breaker (B158). Replace (1) 138 kV disconnect switch (D159). Replace (3) CCVTs. Replace Highland-Mahoningside 138 kV line relaying. Mahoningside: Replace (1) 138 kV breaker (B67). Replace (1) 138 kV disconnect switch (D68). Replace (3) CCVTs. Replace Highland-Mahoningside 138 kV line relaying.	1.4	06/01/2022
-018	Highland – GM Lordstown 138 kV Line 1. Highland-Tod 2. GM Lordstown-Tod	s2451	1. 376 / 465 MVA 430 / 520 MVA (WN/WE) 2. 430 / 494 MVA 430/ 520 MVA (WN/WE)	Highland: Replace (1) 138 kV breaker (B2). Replace substation conductor. Replace (1) 138 kV disconnect switch (D3). Replace (3) CCVTs. Replace Highland-GM Lordstown 138 kV line relaying. Tod: Replace 1200 A line switches (A7 & A9) with 2000 A switches. GM Lordstown: Replace (1) 138 kV disconnect switch (D68). Replace (1) 138 kV transfer bus disconnect switch (A16) Replace (3) CCVTs. Replace substation conductor. Replace Highland-GM Lordstown 138 kV Line relaying.	1.2	06/01/2022

Model: 2020 RTEP model for 2025 Summer (50/50)

ATSI Transmission Zone M-3 Process
Multiple Relay Misoperation

Selected Solution:

ATSI-2020	Transmission Line / Substation Locations	Supplemental Project ID	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost ($ M)	Target ISD
-019	Dale – West Canton 138 kV Line (AEP)	s2452	233 / 282 MVA 263 / 333 MVA (WN/WE)	Dale: On the Dale - West Canton 138 kV line exit, install AMETEK Smartgap. Replace Dale - West Canton 138 kV line primary and backup line relays with FE standard dual SEL-421 protection schemes. Install Power Comm PCM 5350.	0.42	03/31/2022
-020	Dale – South Akron 138 kV Line 1. Dale-Moore 138 kV section 2. Moore-South Akron 138 kV section	s2453	1. 233 / 282 MVA 263 / 333 MVA (WN/WE) 2. 233 / 282 MVA 263 / 333 MVA (WN/WE)	Dale: Replace spark gap arresters with surge arresters. Replace three (3) 138 kV CVTs . Replace line relaying and control with standard relay panel for the Dale – South Akron 138 kV line, include breaker failure relaying for breaker B29. South Akron: Replace (1) 138 kV line-side disconnect switch (D320). Replace limiting 750 Cuconductor between bus and disconnect switch. Replace (3) 138 kV CVTs. Replace line relaying and control with standard relay panel for the Dale – South Akron 138 kV line, include breaker failure relaying for breaker B2. Replace existing spark sap arresters with surge arresters. Replace 138 kV insulators.	1.0	12/30/2021

Model: 2020 RTEP model for 2025 Summer (50/50)

ATSI Transmission Zone M-3 Process
Multiple Relay Misoperation

Selected Solution:

ATSI-2020	Transmission Line / Substation Locations	Supplemental Project ID	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost ($ M)	Target ISD
-021	Avery – Shinrock 138 kV Line	s2454	233 / 282 MVA 263 / 333 MVA (WN/WE)	Avery: Replace three (3) 138 kV CVTs . Replace three (3) spark gap arresters with new surge arresters. Install AMETEK Smartgap. Replace disconnect switches (D35 & D63). Replace line relaying with dual SEL-421 with DCB over PLC. Install new SEL-501 BFT scheme for 138 kV breaker (B36). Install PowerComm PCM5350. Shinrock: Install AMETEK Smartgap. Install PowerComm PCM5350.	0.6	03/31/2022
-022	Central – Packard 138 kV Line	s2455	157 / 196 MVA 198 / 255 MVA (WN/WE)	Niles Central Muni: Replace (1) 138 kV line trap and tuner. Replace (3) CCVTs. Replace Central - Packard 138 kV line relaying. Packard: Replace (1) 138 kV breaker (B13) and associated disconnect switches (D12 & D14). Replace (1) 138 kV line trap and tuner. Replace (3) CCVTs. Replace Central - Packard 138 kV line relaying.	1.4	03/31/2022
-023	Wauseon – Delta 138 kV Line 1. Wauseon – Lear 2. Delta-Nature Fresh Farms	s2456	1. 278 / 343 MVA 327 / 420 MVA (WN/WE) 2. 278 / 343 MVA 327/ 420 MVA (WN/WE)	Delta: Replace (1) 138 kV breaker (B13430). Replace 138 kV Wauseon line CCVT. Upgrade (1) 138 kV wave trap and line tuner. Upgrade substation conductor. Replace Delta-Wauseon 138 kV line relaying. Wauseon: Replace (1) 138 kV line trap. Replace 138 kV line CCVT. Upgrade substation conductor. Replace Delta line disconnect switch. Replace Delta-Wauseon 138 kV line relaying.	1.4	06/01/2022

Model: 2020 RTEP model for 2025 Summer (50/50)

ATSI Transmission Zone M-3 Process
Multiple Relay Misoperation

Selected Solution:

ATSI-2020	Transmission Line / Substation Locations	Supplemental Project ID	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost ($ M)	Target ISD
-025	Cardington (Galion) 138 kV Line	s2457	233 / 282 MVA	Cardington: Replace Cardington (Galion) 138 kV line relaying. Galion: Upgrade substation conductor.	1.1	12/1/2022
-026	Brookside – Longview East 138 kV Line	s2458	160 / 192 MVA	Brookside: Upgrade relay package. Upgrade the CCVTs, Wavetrap, tuner, co-ax cables, and carrier set. Upgrade 400 CU substation conductor, disconnect switches (D76 & D77). Longview: Upgrade relay package. Upgrade the CCVTs, Wavetrap, tuner, co-ax cables, and carrier set. Upgrade relay packages at Brookside and Longview Terminals, the CCVTs, Wavetrap, tuner, co-ax cables and carrier set. Include Smartgap and PCM 5350.	1.5	12/20/2022

Model: 2020 RTEP model for 2025 Summer (50/50)

ATSI Transmission Zone M-3 Process
Multiple Relay Misoperation

Selected Solution:

ATSI-2020	Transmission Line / Substation Locations	Supplemental Project ID	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost ($ M)	Target ISD
-027	Hanna – West Ravenna No1 138 kV Line	s2459	376 MVA / 432 MVA (SN/SE) 376 / 455 MVA (WN/WE)	Hanna: Replace 138 kV breaker (B7) foundation and conduit. Upgrade (2) 138 kV disconnect switches (D84 & D85) to 138 kV, 2000 A DSWs. Replace (1) 138 kV circuit breaker (B7). Replace line relaying and control consisting of dual SEL-421 over DCB and SEL-501 (BF/B7) for the Hanna - West Ravenna No1 138 kV line with a new prewired standard line relaying panel. West Ravenna: Upgrade (2) 138 kV disconnect switches (D60 & D59) to 138 kV, 2000 A DSWs. Replace line relaying and control consisting of dual SEL-421 over DCB and SEL-501 (BF/B21) for the Hanna - West Ravenna No1 138 kV line, using a prewired standard line relaying panel. Upgrade (1) 138 kV Transfer Bus Switch (A61) to 138 kV, 2000 A DSW due to condition. Upgrade limiting conductors between the dead end and the disconnect switches.	1.5	04/06/2021
-034	Masury – Maysville 138 kV Line	s2460	273 / 332 MVA (SN/SE) 309 / 393 MVA (WN/WE)	Maysville: Replace (2) 138 kV 1200 A disconnect switches (A1 & D3) with 2000 A switches. Replace (1) 138 kV wave trap with a 2000 A unit. Replace (1) 138 kV CVT. Replace substation conductor. Upgrade Masury-Maysville 138 kV line relaying.	1.0	06/01/2021

Model: 2020 RTEP model for 2025 Summer (50/50)

ATSI Transmission Zone M-3 Process
Ayersville Weston Network and 69 kV Conversion Project

Need Number: ATSI-2019-009

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/07/2021

Re-present Solution: 11/20/2020

Solutions Meeting: 03/28/2019

Needs Meeting: 01/14/2019

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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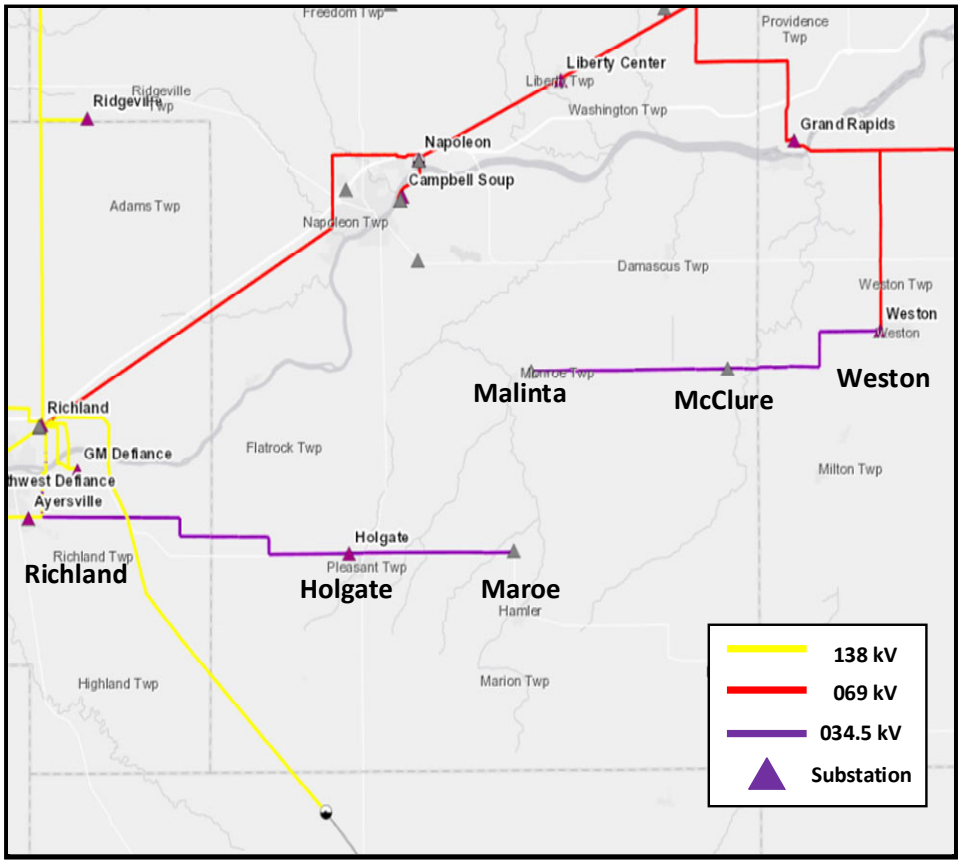


ATSI Transmission Zone M-3 Process
Ayersville Weston Network and 69 kV Conversion Project

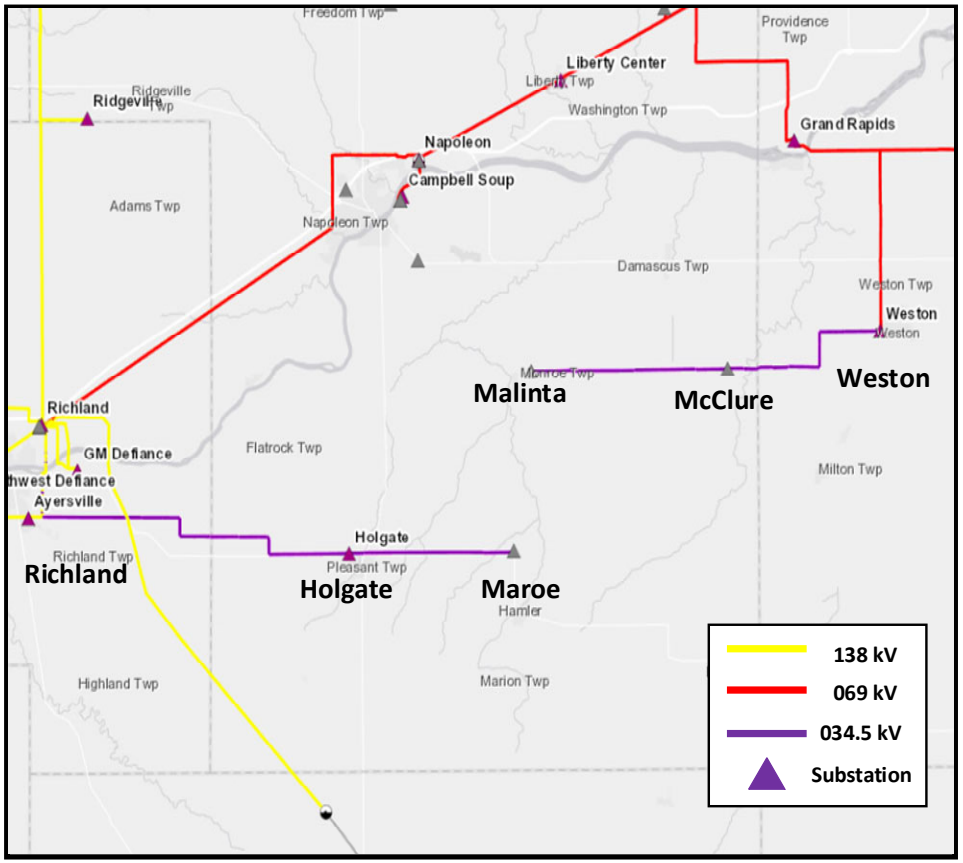
Need Number: ATSI-2019-009

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/07/2021

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 M-3 Process
Ayersville Weston Network and 69 kV Conversion Project

Need Number: ATSI-2019-009

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/07/2021

Selected Solution:

The scope change is driven by the challenges discovered for the constructability of the 69 kV line across the Maumee River to Richland substation. Additionally the scope of work to prevent a three-terminal line at the Weston Tap on the Bowling Green No2-Midway 69 kV line was not originally included.

Ayersville-Weston 69 kV Line - Conversion from 34.5 kV

- **Ayersville Substation**: Install one (1) new 69 kV breaker. Install one (1) new 138 – 69 kV transformer. Install four (4) new 138 kV breakers and reconfigure the 138 kV yard to a four (4) breaker ring bus with a new 69 kV line exit to Weston substation. Close in the N.O. switch A13404 at Ayersville to network Ayersville 138 kV substation to Richland 138 kV K Bus. Remove all 34.5 kV equipment post conversion (ex: Richland 138 - 34.5 kV transformer #1 and circuit breakers).
- **Weston Substation:** Expand Weston substation to a four (4) breaker, future six (6) breaker ring bus with 69 kV line exits for the new Ayersville line, and the Midway and Tontogany 69 kV lines. Remove all 34.5 kV equipment post conversion (ex: Weston 69/34.5 kV transformer #3, circuit breakers, …etc).
- **Bowling Green No2-Midway 69 kV Line:**
  - Rebuild 5.0 miles of 69 kV transmission line from Weston substation to the Weston tap on the Bowling Green No2-Midway 69 kV line as double circuit to eliminate the three-terminal line from Weston, Midway and Bowling Green No2

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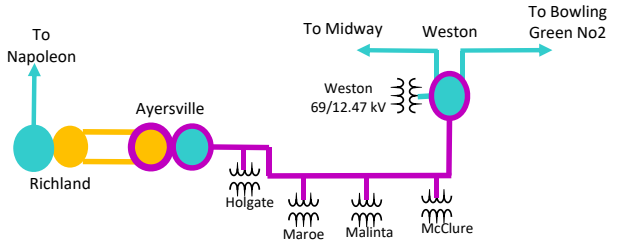


Convert existing 34.5 kV line and delivery points to 69 kV
Remove 34.5 kV Equipment.

Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

ATSI Transmission Zone M-3 Process
Ayersville Weston Network and 69 kV Conversion Project

Need Number: ATSI-2019-009

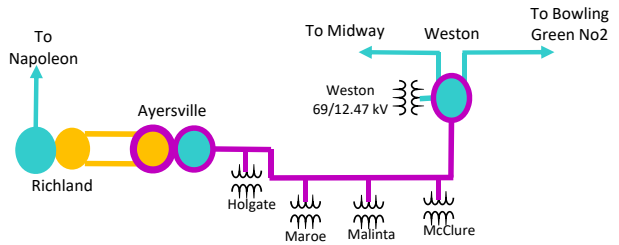
Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/07/2021

Selected Solution:

- **New Ayersville-Weston 69 kV Line:**
  - Build new 5.6 miles 69 kV line to network Ayersville-Maroe and Weston-Malinta radial lines.
  - Rebuild 0.5 miles of 138 kV transmission line as double circuit 138 kV and 69 kV to network the Maroe radial line to Ayersville substation; de-energize and retire the 34.5 kV line section from to Richland.
  - Convert the existing Richland-Maroe 34.5 kV line to 69 kV (Approximately 17 miles) and re-terminate line from Maroe to Ayersville; customers to upgrade existing substation equipment at Holgate and Maroe to 69 kV.
  - Convert the existing Weston-Malinta 34.5 kV line to 69 kV (Approximately 13 miles) ; customers to upgrade existing substation equipment at Weston, McClure, and Malinta substations.
  - Remove all 34.5 kV equipment post conversion.
  - Install eight (8) SCADA and MOAB controlled switches on the new Ayersville-Weston 69 kV line.

Transmission Line Ratings:

- Ayersville-Weston 69 kV Line
  - After Proposed Solution: 111 MVA SN / 134 MVA SE
  - After Proposed Solution: 125 MVA SN / 159 MVA SE



Convert existing 34.5 kV line and delivery points to 69 kV
Remove 34.5 kV Equipment.

Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

Estimated Project Cost: $103 M

Supplemental Project ID: s1953

Projected IS Date: 6/1/2025

ATSI Transmission Zone M-3 Process
Boardman-Sammis 138 kV Line

Need Number: ATSI-2020-005

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/07/2021

Previously Presented: Need Meeting – 04/20/2020
Solution Meeting – 09/11/2020

Supplemental Project Driver(s):

Operational Flexibility and Efficiency

Equipment Material Condition, Performance and Risk

Specific Assumption Reference(s)

Global Considerations

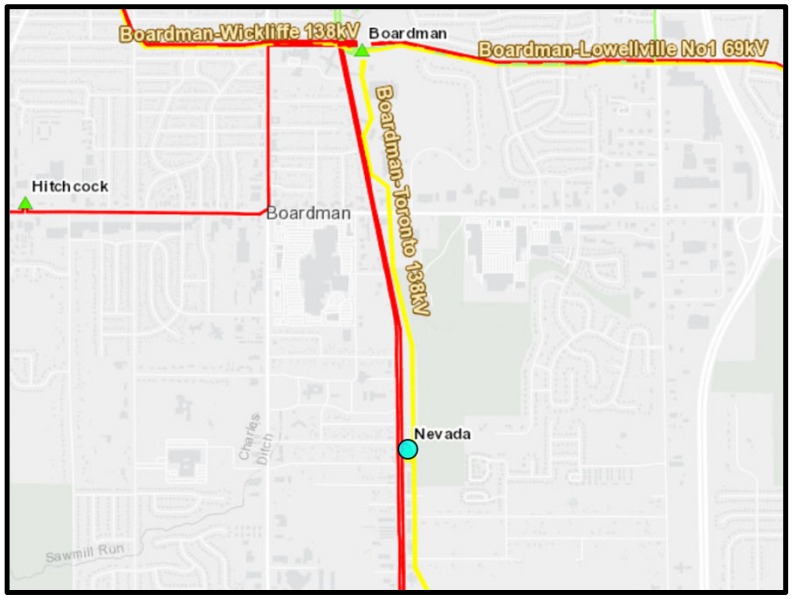
- System Reliability and Performance
- Substation/line equipment limits
- Reliability of Non-BES Facilities
- Load at risk in planning and operational scenarios.
- Load and/or customers at risk on single transmission lines

Add/Expand Bus Configuration

- Loss of substation bus adversely impacts transmission system performance

Automatic Sectionalizing Scheme

- Projects are developed under this methodology by evaluating load at risk and/or customers impacted



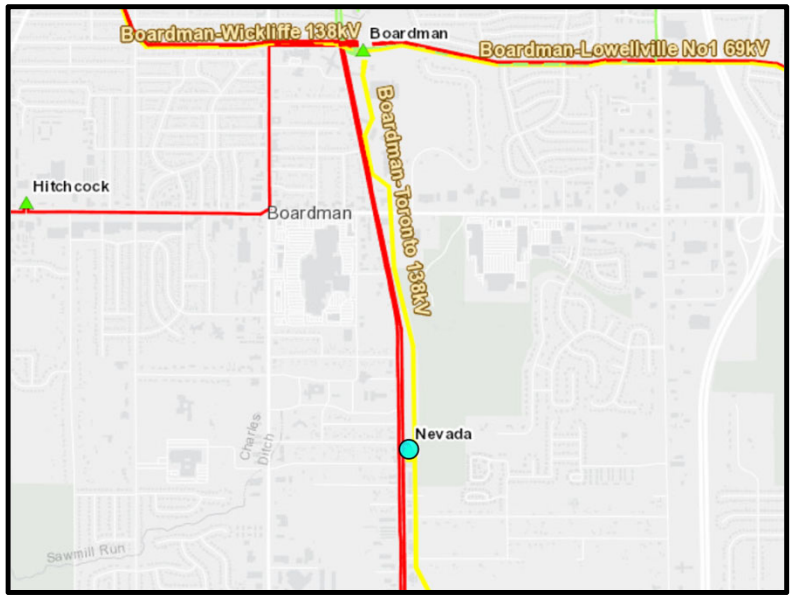
Legend	
345 kV	
138 kV	
69 kV	

ATSI Transmission Zone M-3 Process
Boardman-Sammis 138 kV Line

Need Number: ATSI-2020-005

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/0/2021

Previously Presented: Need Meeting – 04/20/2020
Solution Meeting – 09/11/2020



Problem Statement

Boardman-Sammis 138 kV Line

- The Nevada substation serves 42 MW and 5,729 customers via the Boardman-Sammis 138 kV Line.
- The P1-2 contingency (ATSI-P1-2-OEE-138-024) for the loss of the Boardman-Sammis 138 kV Line will outage roughly 42 MW and 5,729 customers.
- Boardman-Sammis 138 kV Line has experienced seven outages in the past five years (two sustained)
- Circuit limiting substation conductor located at Nevada substation for both the Boardman-Nevada and Nevada-Sammis 138 kV circuit

Model: 2019 Series 2024 Summer RTEP 50/50

Legend	
345 kV	
138 kV	
69 kV	

ATSI Transmission Zone M-3 Process
Boardman-Sammis 138 kV Line

Need Number: ATSI-2020-005

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/07/2021

Selected Solution:

Nevada 138 kV Ring Bus

- Convert the Nevada 138 kV substation into a 4-breaker ring bus, using two existing 138 kV breakers
- Upgrade substation conductor at the Nevada substation from 795 ACSR to 954 ACSR
- Establish two redundant fiber paths between Boardman and Nevada for line relaying
- Upgrade relays at Sammis and Boardman

Transmission Line Ratings:

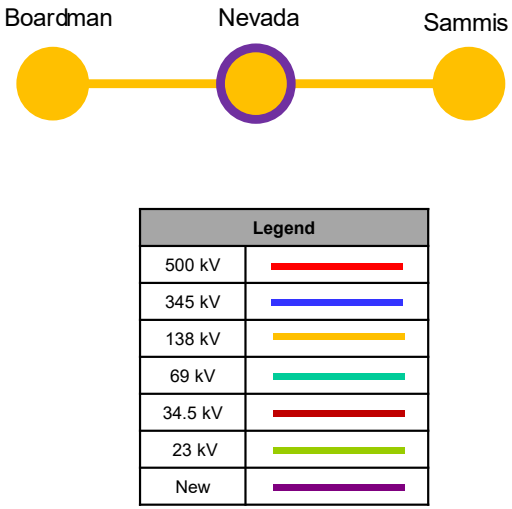
- **Boardman-Nevada 138 kV Line**
  - Before Proposed Solution: 265 MVA SN / 316 MVA SE
  - After Proposed Solution: 278 MVA SN / 339 MVA SE
- **Nevada-Sammis 138 kV Line**
  - Before Proposed Solution: 265 MVA SN / 316 MVA SE
  - After Proposed Solution: 278 MVA SN / 339 MVA SE

Estimated Project Cost: $7.8 M

Projected In-Service: 06/01/2023

Supplemental Project ID: s2388

Model: 2019 Series 2024 Summer RTEP 50/50



ATSI Transmission Zone M-3 Process
Lincoln Park 138 kV

Need Number: ATSI-2020-039

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/07/2021

Previously Presented: Need Meeting – 11/20/2020
Solution Meeting – 02/17/2021

Supplemental Project Driver(s):

Equipment Material Condition, Performance, and Risk

Infrastructure Resilience

Specific Assumption Reference(s):

Global Factors

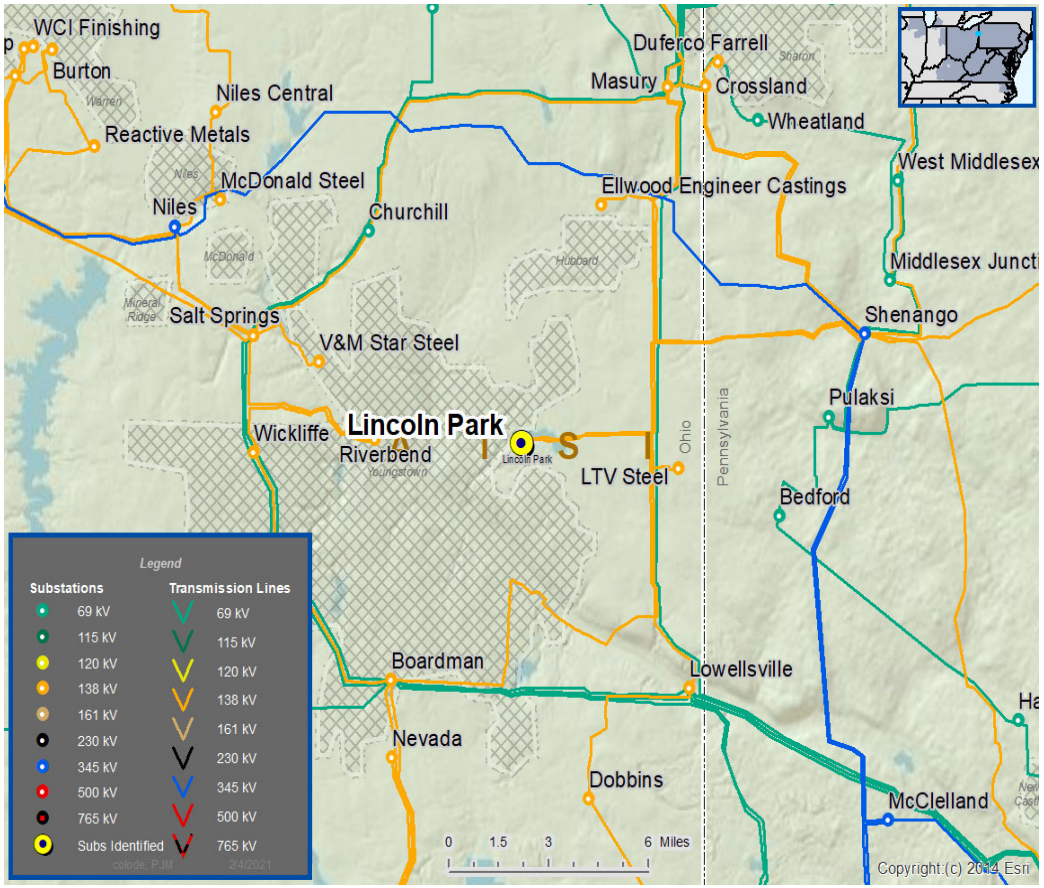
- Increasing negative trend in maintenance findings and/or costs
- Failure risk, to the extent caused by asset design characteristics, or historical industry/ company performance data, or application design error

Substation Condition Rebuild/Replacement

- Circuit breakers and other fault interrupting devices
- Switches

Problem Statement

- McGraw Edison oil circuit breakers B-67, B-68, and associated disconnect switches at Lincoln Park are experiencing increasing maintenance concerns; hydraulic fluid issues, deteriorated operating mechanisms and increasing maintenance trends.
  - Breakers B-67 and B-68 are 48 years old
  - Associated terminal equipment line arrestors and substation conductor



ATSI Transmission Zone M-3 Process
Lincoln Park 138 kV

Need Number: ATSI-2020-039

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/07/2021

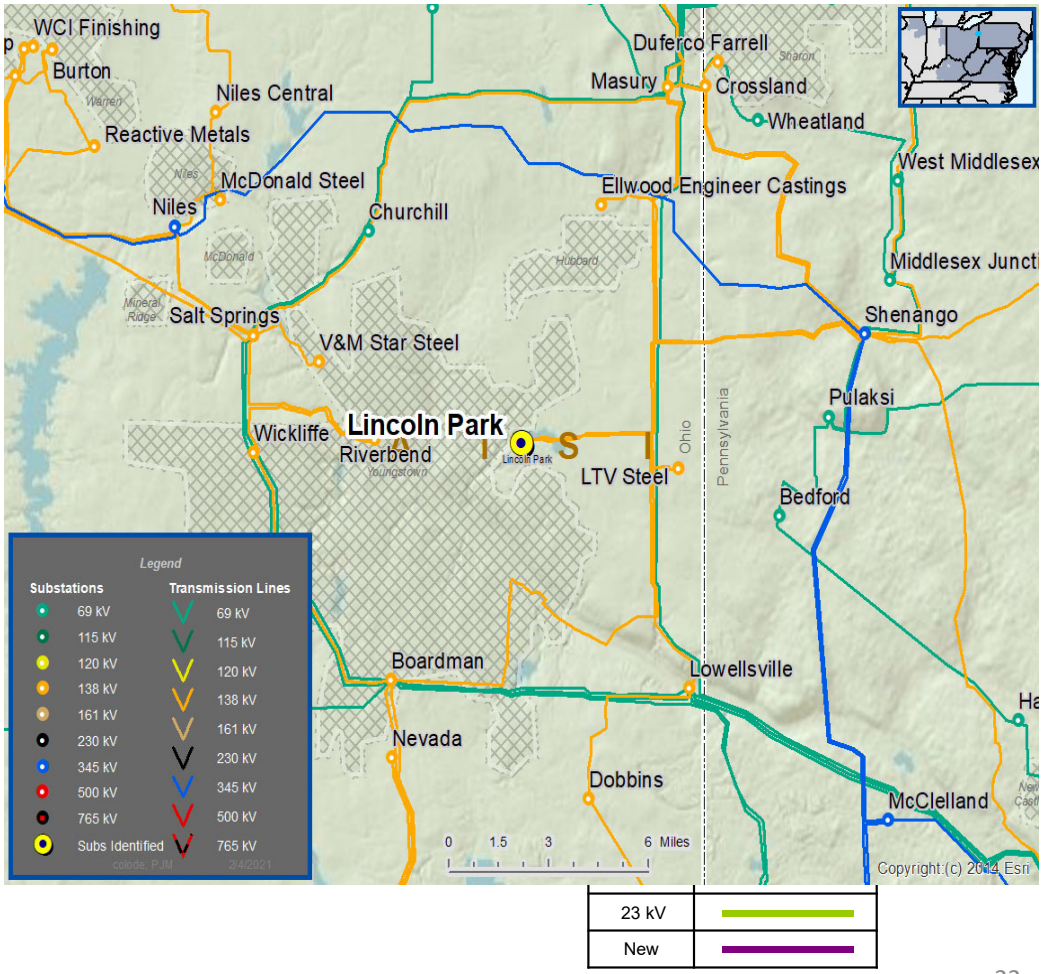
Selected Solution:

- Replace two (2) 138 kV breakers (B67 & B68) with two (2) 138 kV, 40 kA, 3000 A breakers
- Upgrade relays at Lincoln Park for the Lincoln Park-Lowellville line terminal
- Replace four (4) 138 kV disconnect switches (D82, D81, D99 & D100) with 2000 A switches
- Replace (3) 138 kV CVTs (CC91, CC92, & CC93).
- Install a 138 kV 1200 A Lowellville line terminal MOABS and support structure
- Replace leads and bus connection with conductor at least 278MVA/SN, 339MVA/SE

Transmission Line Ratings:

- Lincoln Park-Lowellville 138 kV Line
  - Before Proposed Solution: 155 MVA SN / 155 MVA SE
  - After Proposed Solution: 187 MVA SN / 191 MVA SE

Estimated Project Cost: $1.4 M
Projected IS Date: 12/31/2021
Supplemental Project ID: s2547



ATSI Transmission Zone M-3 Process
Victoria Road New Customer

Need Number: ATSI-2020-040

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/07/2021

Previously Presented: Need Meeting – 09/11/2020
Solution Meeting – 02/17/2021

Supplemental Project Driver(s):
Customer Service

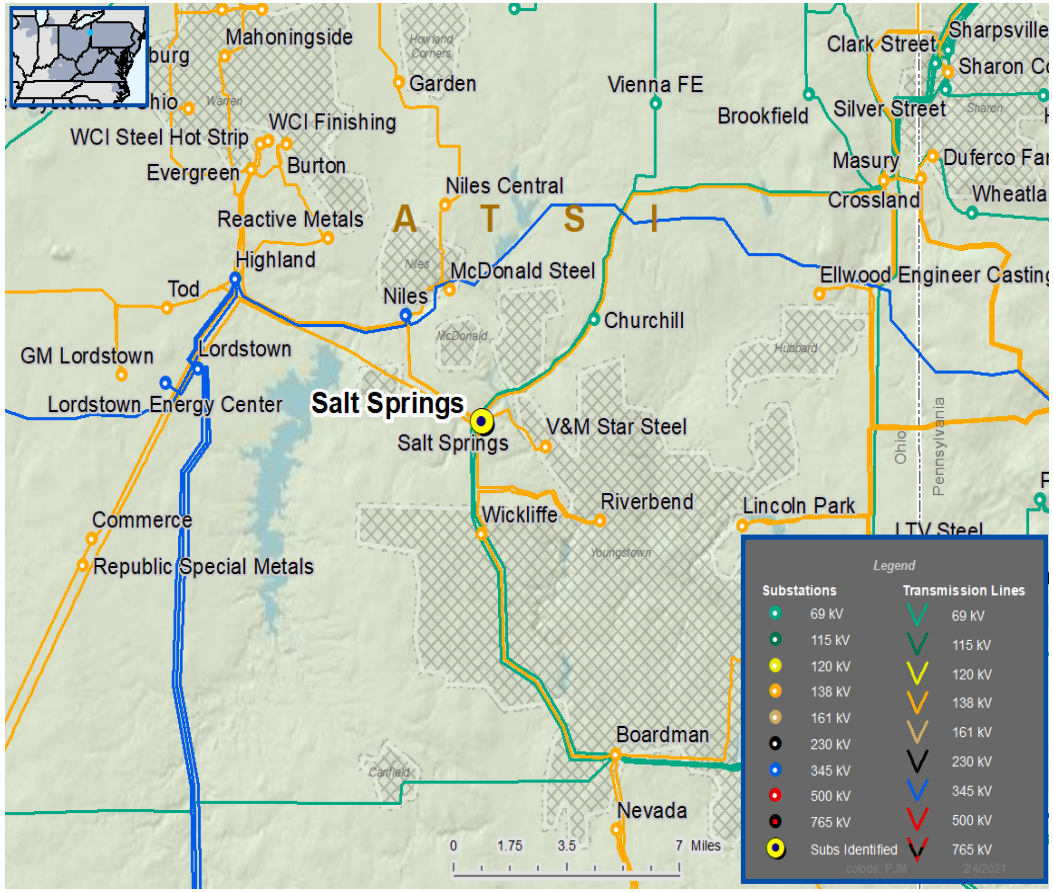
Specific Assumption Reference(s)

Customer connection requests will be evaluated per FirstEnergy's "Requirements for Transmission Connected Facilities" document and "Transmission Planning Criteria" document.

Problem Statement

New Customer Connection – A customer requested 69 kV transmission service for approximately 4.2 MVA of total load near the Kimberly-Salt Springs 69 kV Line.

Requested In-Service Date: April 6, 2020



ATSI Transmission Zone M-3 Process
Victoria Road New Customer

Need Number: ATSI-2020-040

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/07/2021

Selected Solution:

Victoria Road 69 kV Transmission Line Tap

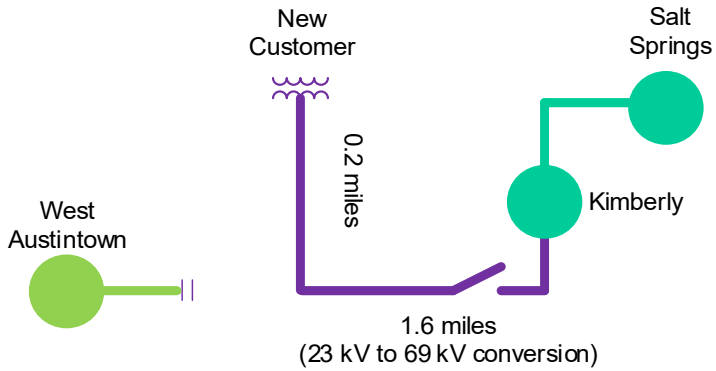
- Convert and rebuild the Meander-West Austintown 23 kV line to 69 kV between Kimberly substation and West Austintown substation
- Tap the Kimberly-West Austintown 23 kV Line at or near Victoria Rd.
- Build ~0.2 miles of 336 ACSR 69 kV line from the tap location to the customer substation

Estimated Project Cost: $4.3 M

Projected In-Service: 05/31/2021

Supplemental Project ID: s2548

Model: 2019 Series 2024 Summer RTEP 50/50



Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

ATSI Transmission Zone M-3 Process
Eastlake – Lloyd Q13 138 kV Line Misoperation

Need Number: ATSI-2020-024

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/07/2021

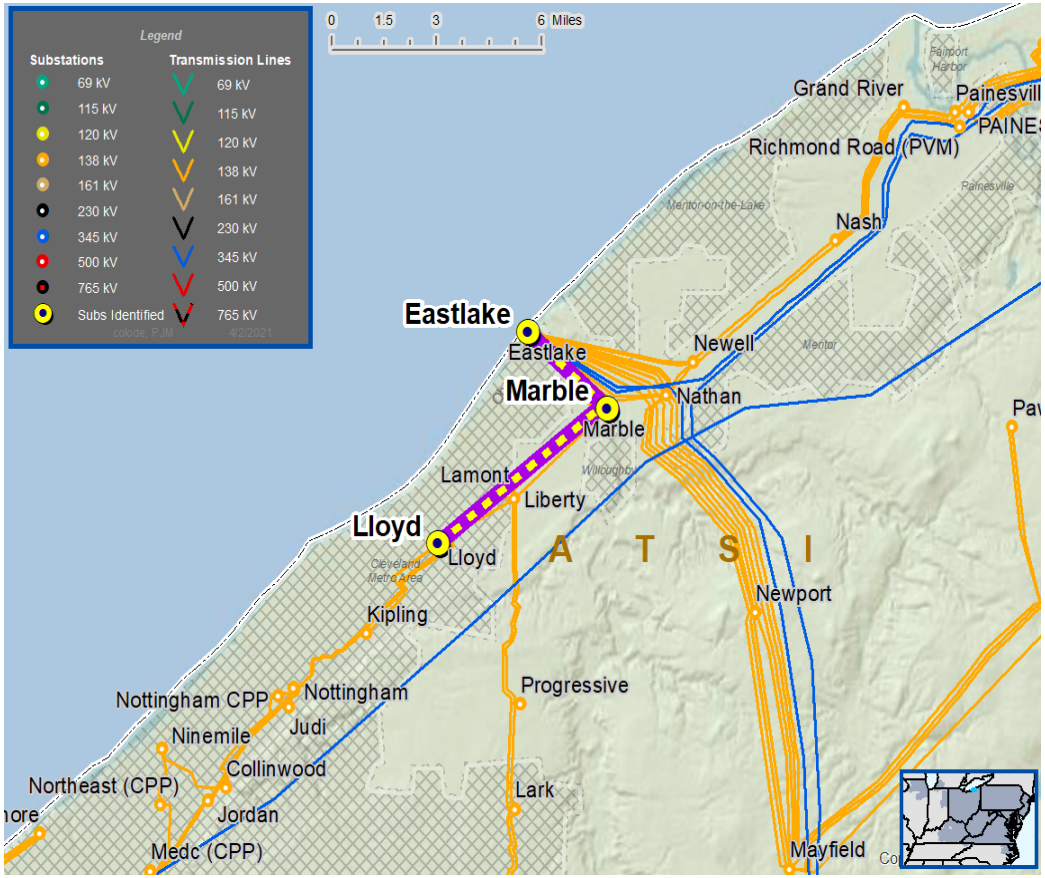
Previously Presented: Need Meeting – 08/14/2020
Solution Meeting – 04/16/2021

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.



ATSI Transmission Zone M-3 Process
Eastlake – Lloyd Q13 138 kV Line Misoperation

Selected Solution:

ATSI-2020	Transmission Line / Substation Locations	Supplemental Project ID	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost ($ M)	Target ISD
-024	Eastlake – Lloyd Q13 138 kV Line 1. Eastlake – Marble	s2545	278 / 339 315 (WN) / 401 (WE)	Eastlake-Lloyd 138kV Q-13: Replace the line relaying and replace Terminal Equipment such as : Breakers, associated disconnects, Wave Traps, CCVTs, and Line Tuners as needed.	1.0	3/4/2022

Model: 2020 RTEP model for 2025 Summer (50/50)

ATSI Transmission Zone M-3 Process
New Customer Substation

Need Number: ATSI-2021-007

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/07/2021

Previously Presented: Need Meeting – 03/19/2021
Solution Meeting – 04/16/2021

Supplemental Project Driver(s):
Customer Service

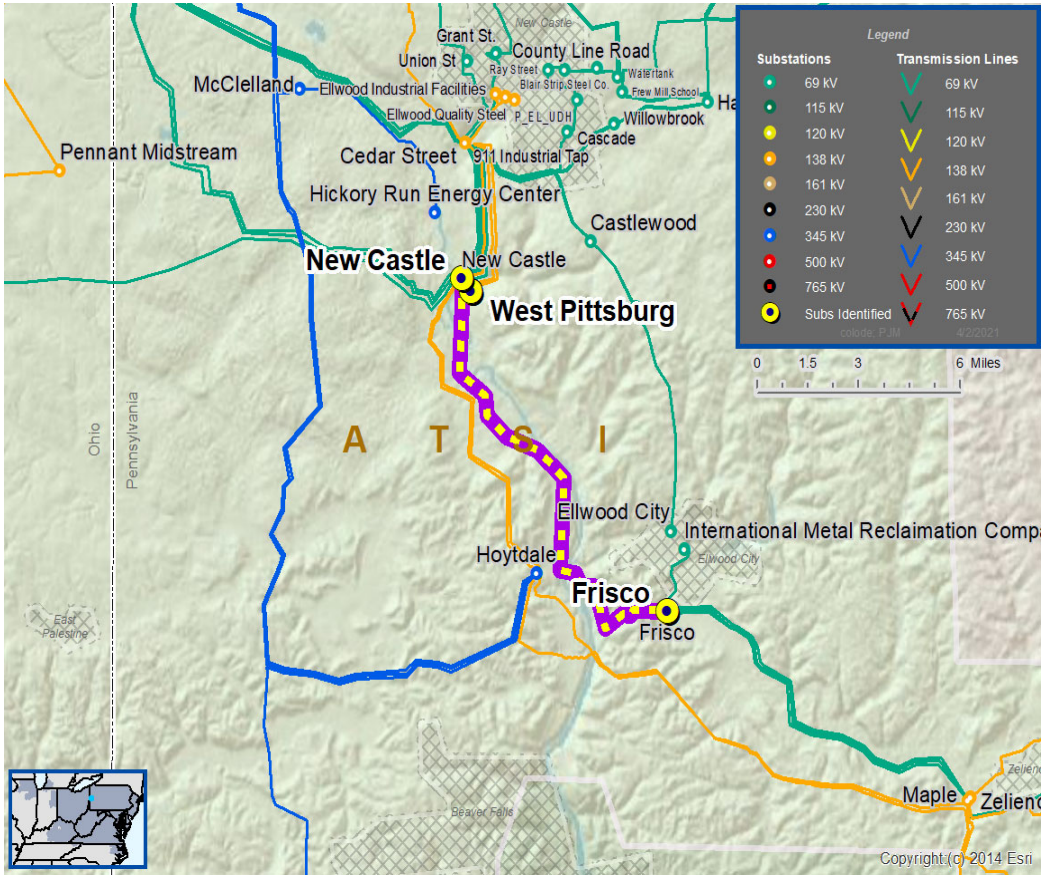
Specific Assumption Reference(s)

Customer connection requests will be evaluated per FirstEnergy's "Requirements for Transmission Connected Facilities" document and "Transmission Planning Criteria" document.

Problem Statement

New Customer Connection – Penn Power Distribution has requested a new 69 kV delivery point due to a thermal overload identified on the West Pittsburg #1 23-8.32 kV transformer. The anticipated load of the new customer connection is 4 MVA.

Requested in-service date is 12/1/2021



ATSI Transmission Zone M-3 Process
New Customer Substation

Need Number: ATSI-2021-007

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/07/2021

Selected Solution:

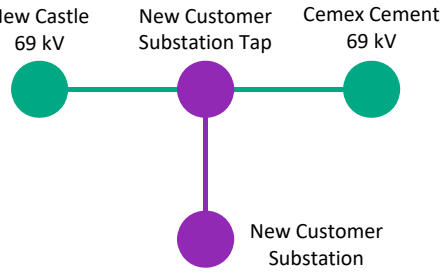
- Tap the Frisco – New Castle Y-205 69 kV line between New Castle and Cemex Cement
- Install two 69 kV disconnect switches with SCADA
- Construct ~1 span of 69 kV into new substation
- Replace two 69 kV disconnect switches at Frisco substation
- Adjust relaying at Frisco and New Castle substations

Estimated Project Cost: $1.05M

Projected In-Service: 12/01/2021

Supplemental Project ID: s2546

Model: 2020 RTEP model for 2025 Summer (50/50)



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

ATSI Transmission Zone M-3 Process
NLMK 138/69 kV Substation

Need Number: ATSI-2018-008 (s1795)

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/07/2021

Re-present Solution: 11/20/2020

Solutions Meeting: 10/26/2018

Needs Meeting: 09/28/2018

Supplemental Project Driver(s):

Equipment Material Condition, Performance and Risk

Operational Flexibility and Efficiency

Specific Assumption Reference(s)

Add/Expand Bus Configuration

- Loss of substation bus adversely impacts transmission system performance
- Eliminate simultaneous outages to multiple networked elements under N-1 analysis

Substation Condition Rebuild/Replacement

- Power Transformers and Load Tap Changers (LTC)
- Circuit Breaker and Other Fault Interrupting Devices

Line Condition Rebuild/Replacement

- Assessment of existing transmission lines for equipment characteristics that are at, or beyond their existing service life, or contain components that are obsolete.

Continued on next slide…

ATSI Transmission Zone M-3 Process
NLMK 138/69 kV Substation

Need Number: ATSI-2018-008 (s1795)

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/07/2021

Re-present Solution: 11/20/2020

Solutions Meeting: 10/26/2018

Needs Meeting: 09/28/2018

Problem Statement

NLMK Load at Risk

- Reduce the amount of local load loss under contingency conditions
  - – Loss of Crossland-NLMK 138 kV line
  - – Results in loss of approximately 58 MWs of load.

  Or
  - – Masury 69 kV bus fault
  - – Results in potential local voltage collapse of the Masury 69 kV area

- Equipment Material Condition, Performance and Risk
  - – NLMK 69 kV system cable trenches are deteriorated and in need of replacement
  - – 69 kV breakers in need of replacement (bus-tie breaker has already failed)
  - – NLMK 138/69 kV transformer # 6 and # 12 are aged (> 50 years) and not standard design.
  - – Transformer #6 has elevated gas levels.
  - – Existing 69 kV transmission line conductor around NLMK is corroded and deteriorated with multiple splice locations.
  - – Need to upgrade to current standards

ATSI Transmission Zone M-3 Process
NLMK 138/69 kV Substation

Need Number: ATSI-2018-008 (s1795)

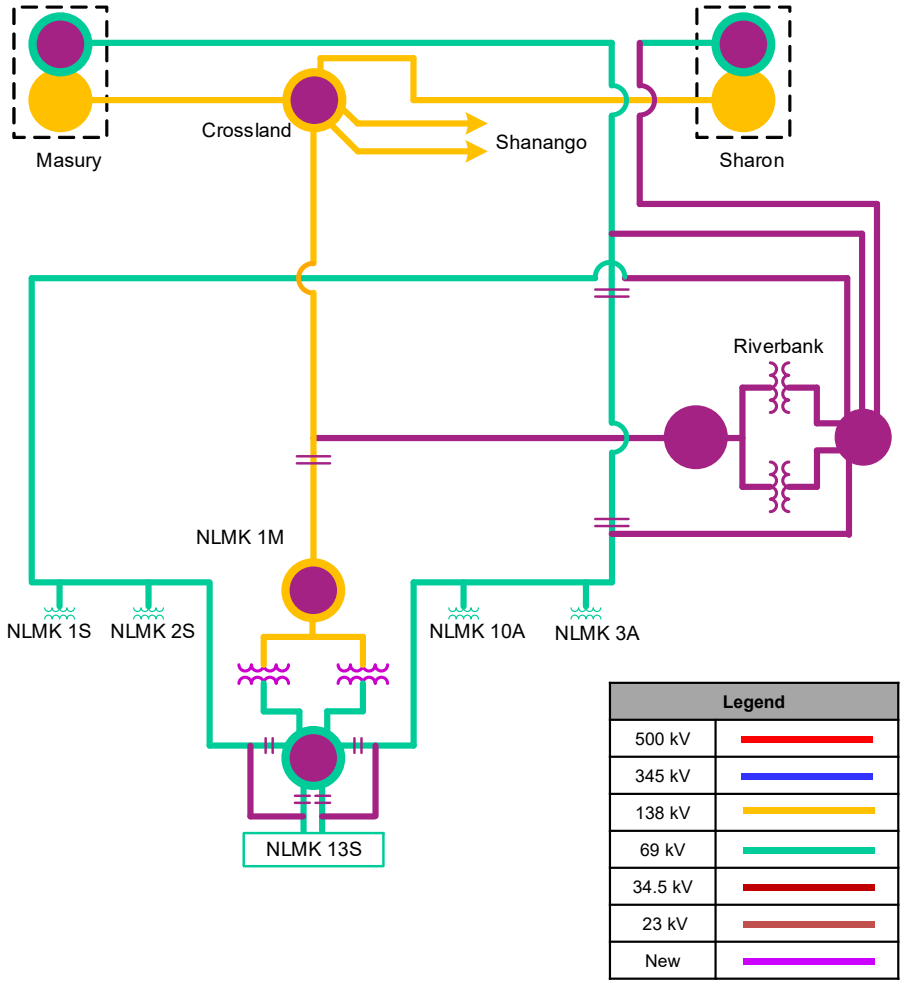
Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/07/2021

Selected Solution:

The scope change is driven by the condition of the existing NLMK 1M substation and challenges with keeping NLMK energized throughout the duration of construction.

Riverbank 138/69 kV Substation

- Replace existing NLMK 138/69 kV 1M substation with new a 138/69 kV substation (Riverbank)
  - — Install a 138 kV 3-breaker ring bus
  - — 2-138/69 kV transformers (134 MVA)
  - — Six (6) breaker 69 kV ring bus
  - — New control building
  - — Install two revenue metering packages
- Re-configure existing 69 kV lines around NLMK
  - — Masury-Riverbank 69 kV Line: 76 MVA SN / 92 MVA SE
  - — Sharon-NLMK 69 kV Line: 80 MVA SN / 96 MVA SE
  - — Crossland-Riverbank 138 kV Line: 96 MVA SN / 105 MVA SE
  - — NLMK 1S (Riverbank) 69 kV Line: 80 MVA SN / 96 MVA SE
  - — NLMK 3S (Riverbank) 69 kV Line: 80 MVA SN / 96 MVA SE
- Add a 138 kV breaker at Crossland for the Crossland-NLMK 138 kV Line
- Install transfer bus and breaker at Crossland 138 kV
- Upgrade 69 kV relays at Masury and Sharon substations
- Install line switches for each NLMK tap (SCADA at 13S, 2S, and 10A)
- Build 0.8 miles of 795 ACSR 69 kV line to loop into the Riverbank substation
- Rebuild the NLMK loop using 795 ACSR (~1.3 miles) reconfiguring lines as required
- Remove/retire NLMK 1M and 2M substations



Need Number: ATSI-2018-008 (s1795)

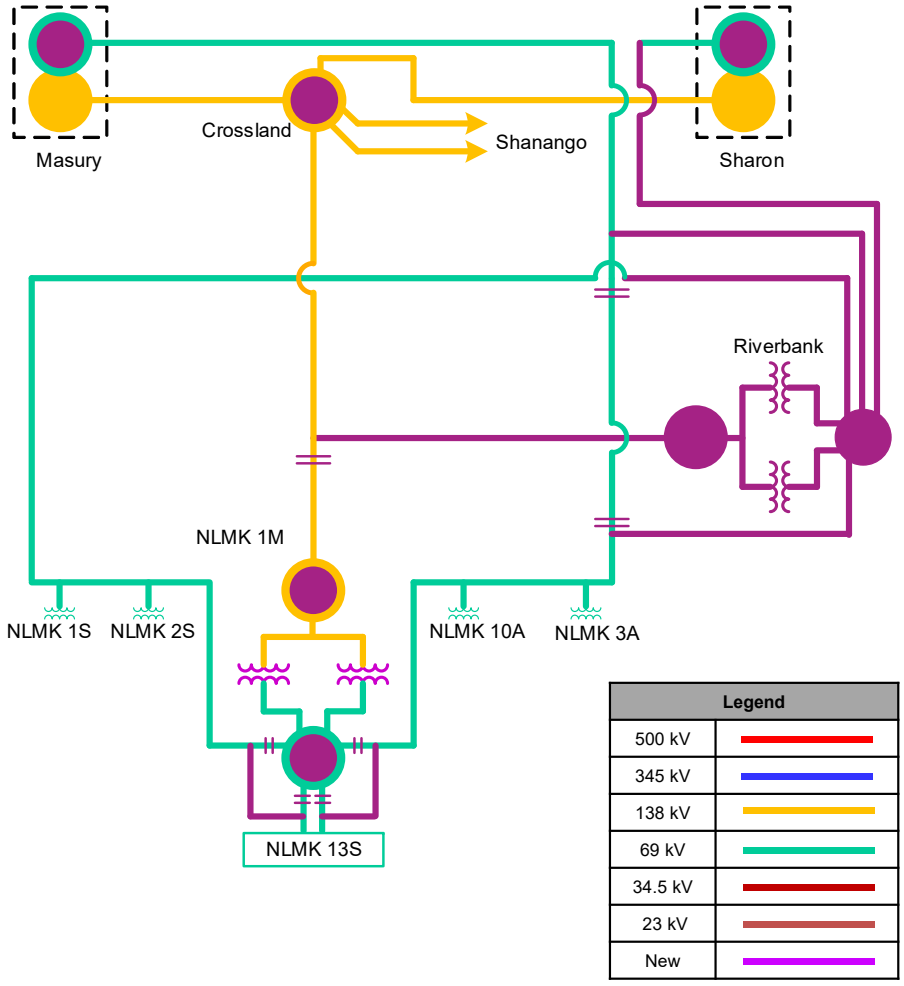
Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/07/2021

Estimated Project Cost: $40 M

Projected IS Date: 12/31/2022

Supplemental Project ID: s1795

ATSI Transmission Zone M-3 Process
NLMK 138/69 kV Substation



ATSI Transmission Zone M-3 Process
Delta – Wauseon 138 kV New Customer

Need Number: ATSI-2021-013

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/07/2021

Previously Presented: Need Meeting – 06/15/2021
Solution Meeting – 07/16/2021

Supplemental Project Driver(s):
Customer Service

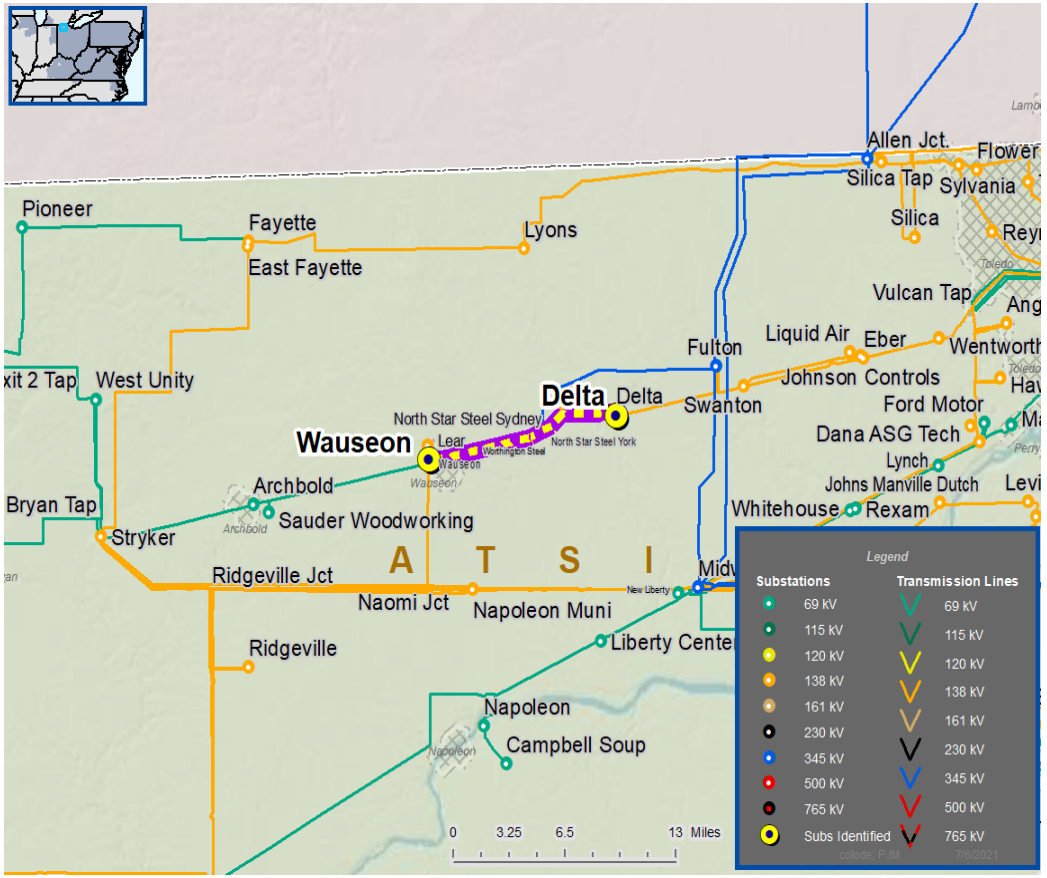
Specific Assumption Reference(s)

Customer connection request evaluated per FirstEnergy's "Requirements for Transmission Connected Facilities" document and "Transmission Planning Criteria" document.

Problem Statement

New Customer Connection – A customer requested 138 kV transmission service for approximately 6.6 MVA of total load near the Delta – Wauseon 138 kV line.

Requested In-Service Date: February 28, 2022



ATSI Transmission Zone M-3 Process
Delta – Wauseon 138 kV New Customer

Need Number: ATSI-2021-013

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 09/07/2021

Selected Solution:

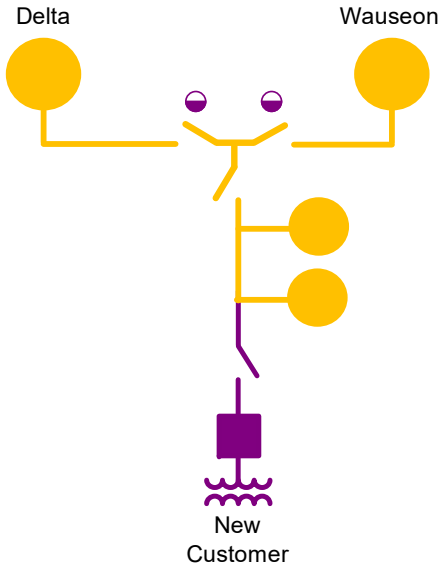
New 138 kV Customer

- Construct a 138 kV tap off the Delta – Wauseon 138 kV line to the customer substation. The customer substation tap location is approximately an 0.8 mile extension from the existing structures to the new customer substation. Provide one 138 kV metering package and add MOAB and SCADA to two existing switches on the Delta – Wauseon 138 kV line.

Estimated Project Cost: $3.2M

Projected In-Service: 02/15/2022

Supplemental Project ID: s2553



Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

ATSI Transmission Zone M-3 Process
Customer - North Star BlueScope Steel 345 kV Expansion

Need Number: ATSI-2019-082

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 10/08/2021

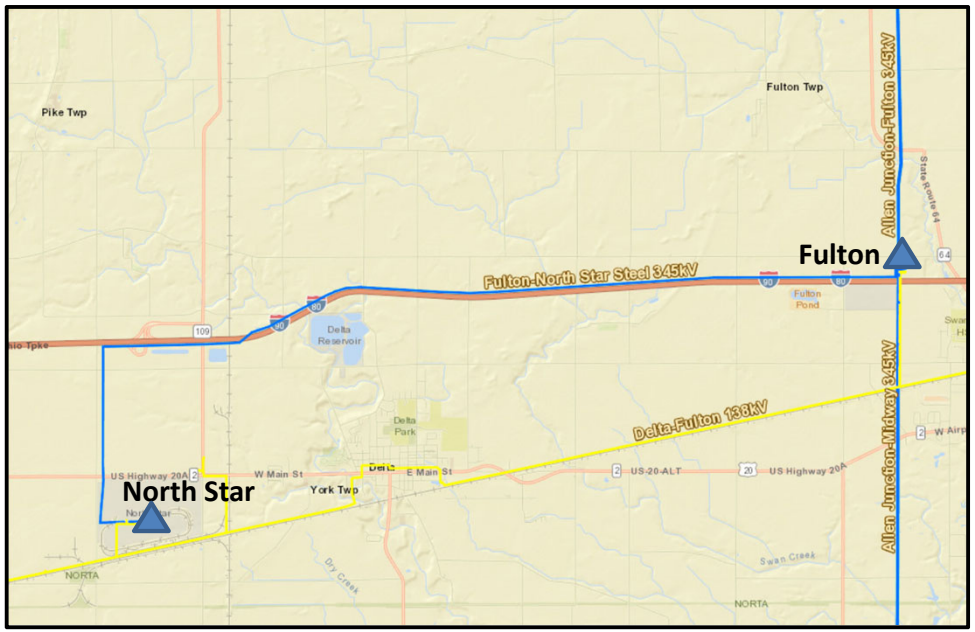
Previously Presented: Need Meeting – 11/22/2019
Solutions Meeting – 03/19/2020
Re-Present Solutions Meeting – 11/04/2020

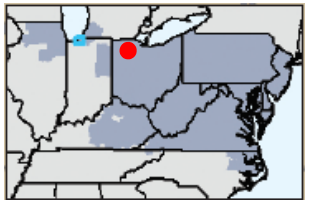
Supplemental Project Driver(s):
Customer Service

Specific Assumption Reference(s)
Customer connection request will be evaluated per FirstEnergy's "Requirements for Transmission Connected Facilities" document and "Transmission Planning Criteria" document.

Problem Statement
Existing Customer Connection – Load Increase
An existing transmission customer (North Star BlueScope Steel) is requesting load demand increase for the existing 345/34.5 kV substation to a new peak of 300 MVA on the Fulton-North Star Steel 345 kV line.
Requested In-Service Date: 03/01/2021

The customer is also requesting load demand increase for its existing 138/34.5 kV substation to a new peak load of 40 MVA on the Delta-Wauseon 138 kV line.
Requested In-Service Date: 11/01/2020





Legend	
345 kV	
138 kV	
69 kV	

ATSI Transmission Zone M-3 Process
Customer - North Star BlueScope Steel 345 kV Expansion

Need Number: ATSI-2019-082

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 10/08/2021

Selected Solution:

When the additional 40 MVA from the customer is energized on the Delta-Wauseon 138 kV line, a N-1-1 contingency of results in voltage of 0.90 PU.

- Install two (2) 26 MVAR Capacitor Bank at Delta 138 kV substation.

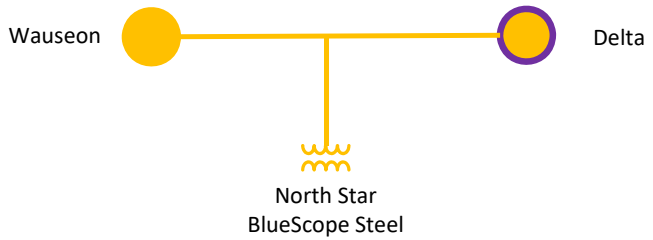
Estimated Project Cost: $2.3 M

Projected In-Service: 5/21/2021

Status: Engineering

Model: 2019 Series 2024 Winter RTEP 50/50

Supplemental Project ID: s2237



Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

ATSI Transmission Zone M-3 Process
Customer - North Star BlueScope Steel 345 kV Expansion

New additional scope to mitigate load loss criteria violation:

Selected Solution - Continued:

- Construct a new 345 kV four breaker ring bus.
- De-energize approx. 1.0 mile of the Dowling-Fulton 345 kV line.
- Construct 8.7 miles of 345 kV line to connect the Dowling 345 kV line into the new 345 kV station with 954 ACSR 45/7 bundled (2 conductors per phase). New 345 kV line to be built and share structures with the Delta-Wauseon 138 kV line and Delta – Fulton 138 kV line.
- Replace the wave trap at Dowling 345 kV line to ensure the Dowling-New 345 kV station 345 kV transmission line is the limiting element.
- Re-terminate the Fulton 345 kV line that serves North Star Steel Sydney into the new 345 kV station.
- Provide two feeds from the new 345 kV station to North Star Steel Sydney with 954 ACSR 45/7 bundled (2 conductors per phase).

Transmission Line Ratings:

Dowling-New 345 kV Station Rating:

- 1542/1878 MVA SN/SE, 1746/2225 MVA WN/WE

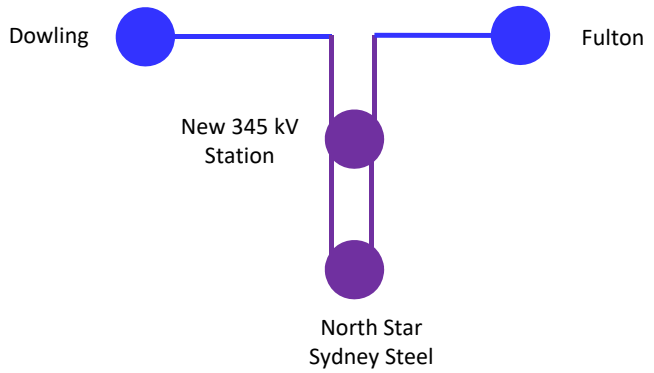
Fulton-New 345 kV Station Rating:

- 1542/1878 MVA SN/SE, 1746/2225 MVA WN/WE

Estimated Project Cost: $67M

Projected In-Service: 6/1/2024

Supplemental Project ID: s2237.2



Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

ATSI Transmission Zone M-3 Process
GM Powertrain – Jackman 138 kV Line

Need Number: ATSI-2021-008

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 11/12/2021

Previously Presented: Need Meeting – 04/16/2021
Solution Meeting – 08/16/2021

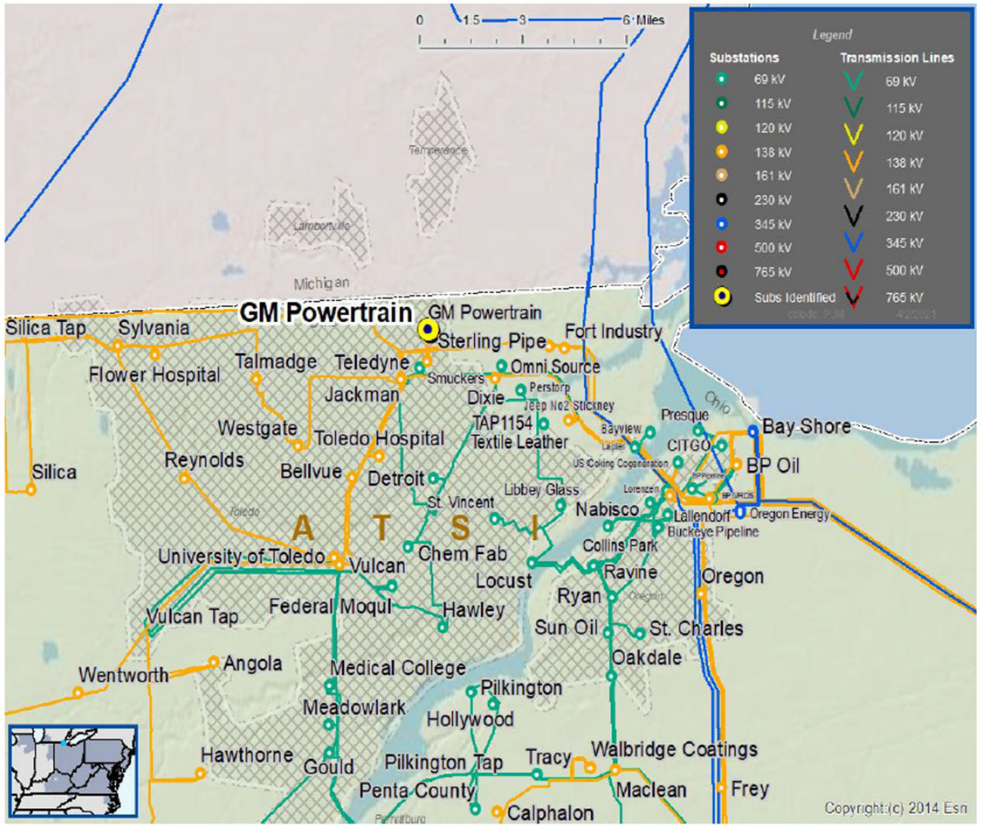
Supplemental Project Driver(s):
Equipment Material Condition, Performance, and Risk
Infrastructure Resilience

Specific Assumption Reference(s):
Global Factors

- Increasing negative trend in maintenance findings and/or costs
- Failure risk, to the extent caused by asset design characteristics, or historical industry/ company performance data, or application design error
- Expected service life (at or beyond) or obsolescence

Substation Condition Rebuild/Replacement

- Circuit breakers and other fault interrupting devices
- Switches



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ATSI Transmission Zone M-3 Process
GM Powertrain – Jackman 138 kV Line

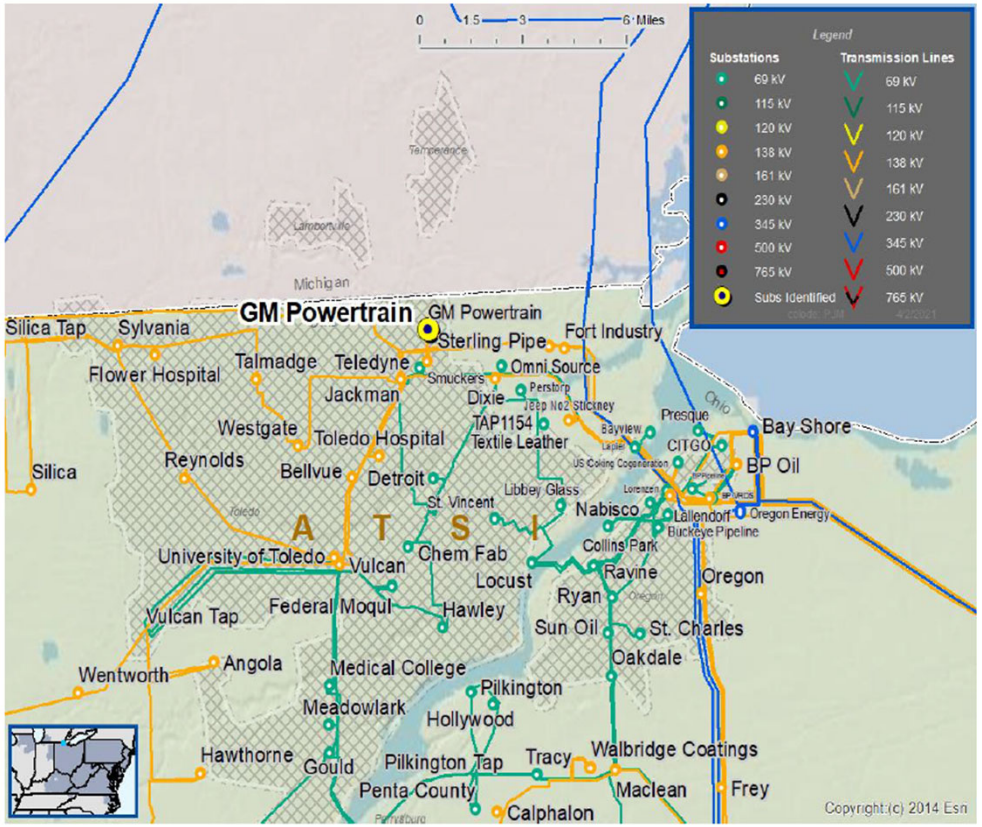
Need Number: ATSI-2021-008

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 11/12/2021

Previously Presented: Need Meeting – 04/16/2021
Solution Meeting – 08/16/2021

Problem Statement

- Breakers B-13295, B-13296, B-13297, and associated disconnect switches at GM Powertrain Substation
  - Increasing maintenance concerns; hydraulic fluid issues, deteriorated operating mechanisms and increasing maintenance trends.
  - Breaker B-13295 is 52 years old, Breaker B-13296 is 52 years old, Breaker B-13297 is 48 years old
  - Associated terminal equipment line arrestors and substation conductor
- Breaker B-13329 and associated disconnect switches at Jackman Substation
  - Increasing maintenance concerns; hydraulic pump issues, valve issues, deteriorated operating mechanisms and increasing maintenance trends
  - Breaker B-13329 is 48 years old



ATSI Transmission Zone M-3 Process
GM Powertrain – Jackman 138 kV Line

Need Number: ATSI-2021-008

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 11/12/2021

Selected Solution:

- Replace breakers B-13295, B-13296, B-13297 and associated disconnects at GM Powertrain Substation.
- Replace breaker B-13329 and associated disconnects at Jackman Substation.
- Replace limiting substation conductors to exceed associated line ratings.

Transmission Line Ratings:

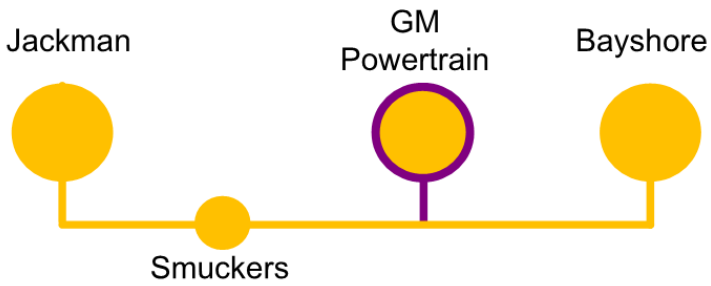
- GM Powertrain – Smuckers 138 kV Line
  - Before Proposed Solution: 327 MVA WN / 396 MVA WE
  - After Proposed Solution: 327 MVA WN / 420 MVA WE
- Bayshore - GM Powertrain 138 kV Line
  - Before Proposed Solution: 327 MVA WN / 396 MVA WE
  - After Proposed Solution: 327 MVA WN / 420 MVA WE

Estimated Project Cost: $1.5M

Projected In-Service: 05/02/2022

Supplemental Project ID: s2595

Model: 2020 Series 2025 Summer RTEP 50/50



Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

ATSI Transmission Zone M-3 Process
West Akron Transfer Breaker B-22

Need Number: ATSI-2021-010

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 11/12/2021

Previously Presented: Need Meeting – 04/16/2021
Solution Meeting – 08/16/2021

Supplemental Project Driver(s):

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

Specific Assumption Reference(s)

Global Considerations

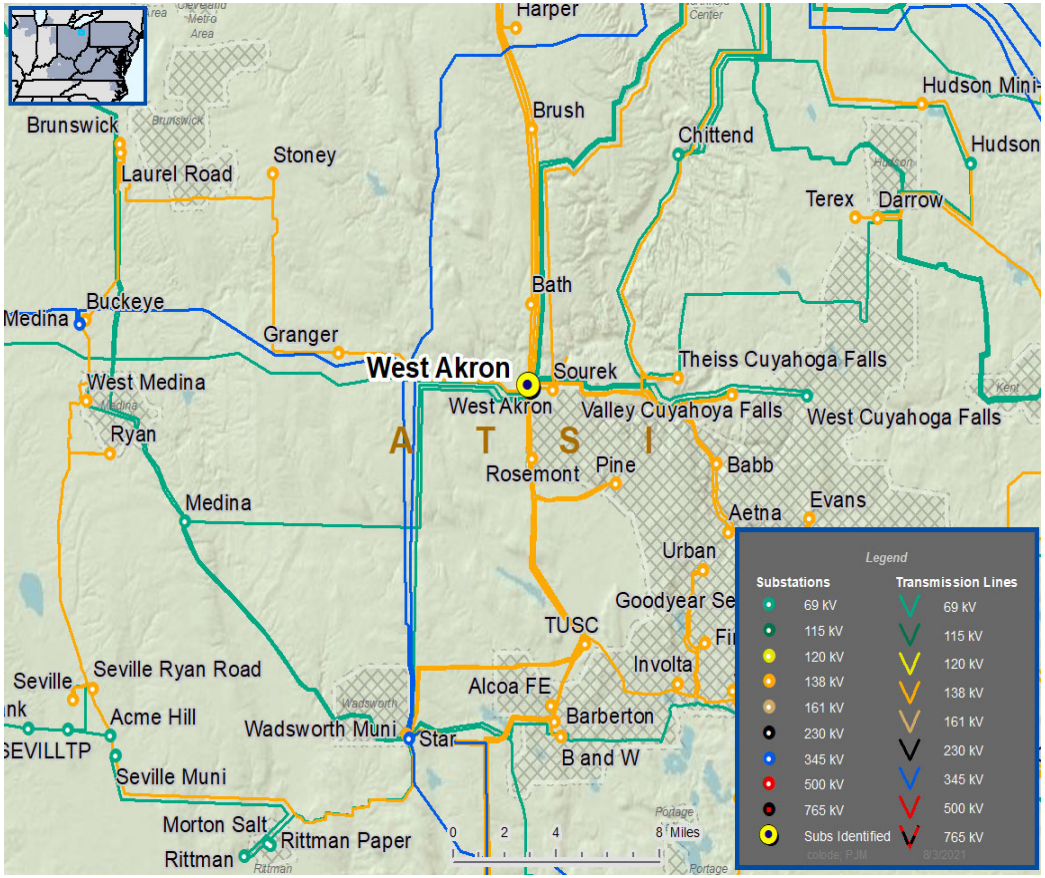
- System reliability and performance
- Load at risk in planning and operational scenarios

Substation Condition Rebuild/Replacement

- Increasing negative trend in maintenance findings and/or costs.
- Expected service life (at or beyond) or obsolescence

Add/Expand Bus Configuration

- Loss of substation bus adversely impacts transmission system performance
- Eliminate simultaneous outages to multiple networked elements under N-1 analysis
- Capability to perform system maintenance



ATSI Transmission Zone M-3 Process
West Akron Transfer Breaker B-22

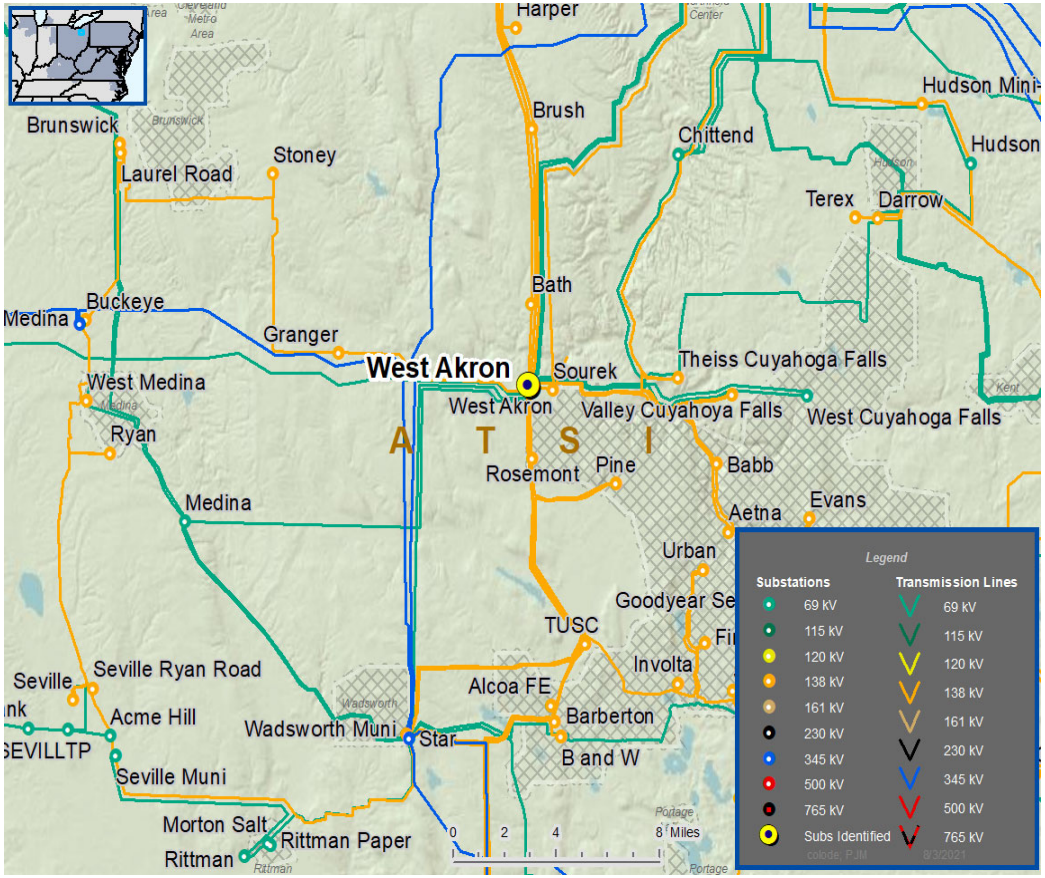
Need Number: ATSI-2021-010

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 11/12/2021

Previously Presented: Need Meeting – 04/16/2021
Solution Meeting – 08/16/2021

Problem Statement *continued…*

- West Akron 138 kV Breaker Transfer Breaker B-22 and associated disconnect switches
  - Oil Circuit Breaker (OCB) with increasing maintenance concerns; compressor issues, deteriorated operating mechanisms and increasing maintenance trends
  - Breaker B-22 is 40 years old



ATSI Transmission Zone M-3 Process
West Akron Transfer Breaker B-22

Need Number: ATSI-2021-010

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 11/12/2021

Selected Solution:

- Replace 138 kV bus tie circuit breaker B-22 and breaker leads
- Replace disconnect switch D-108 and D-109
- Install new SEL-501 breaker failure relying for 138 kV breaker B-22
- Replace transfer breaker line relaying for 138 kV breaker B-22

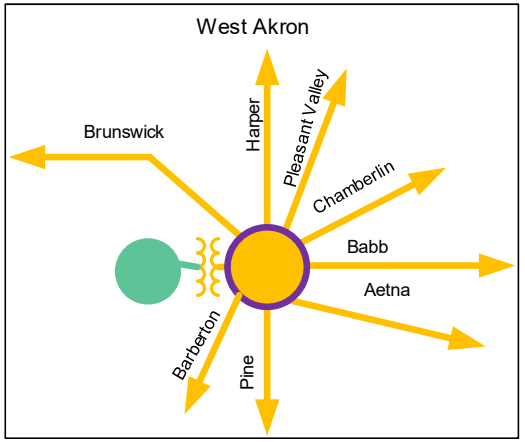
Transmission Line Ratings:

- Old 191MVA/SN 191MVA/SE
- New 221MVA/SN 262MVA/SE

Estimated Project Cost: $0.7M

Projected IS Date: 02/25/2022

Supplemental Project ID: s2596



Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

ATSI Transmission Zone M-3 Process
Eastlake 138 kV Substation

Need Number: ATSI-2021-011

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 11/12/2021

Previously Presented: Need Meeting – 04/16/2021
Solution Meeting – 08/16/2021

Supplemental Project Driver(s):

Equipment Material Condition, Performance and Risk

Infrastructure Resilience

Specific Assumption Reference(s):

Global Factors

- Increasing negative trend in maintenance findings and/or costs
- Failure risk, to the extent caused by asset design characteristics, or historical industry/ company performance data, or application design error
- Expected service life (at or beyond) or obsolescence

Substation Condition Rebuild/Replacement

- Circuit breakers and other fault interrupting devices
- Switches

Problem Statement

- Breakers B-19, B-35, B-22, B-25, B-24, B-28, B-27, and associated disconnect switches at Eastlake Substation:
  - Increasing maintenance concerns; compressor issues, valve issues, heater issues, deteriorated operating mechanisms, and increasing maintenance trends
  - Breaker B-19 is 50 years old; Breaker B-35 is 41 years old; Breakers B-22, B-25, B-24, and B-28 are 49 years old; and Breaker B-27 is 47 years old

ATSI Transmission Zone M-3 Process
Eastlake 138 kV Substation

Need Number: ATSI-2021-011

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan

11/12/2021

Selected Solution:

Eastlake Breaker Replacements & Bus Upgrades

- Replace B-25, B-28, B-19, B-35, B-22, B-24, and B-27 with associated disconnect switches.
- Replace and install associated FE standard bus relaying panels, transmission line relying panels, capacitor bank panels, and BF relay panels.
- Replace limiting substation conductors to exceed associated line ratings.

Transmission Line Ratings:

- Eastlake – Nathan Q3 138 kV Line
  - Before Proposed Solution: 225 MVA SN / 295 MVA SE / 309 MVA WN / 367 MVA WE
  - After Proposed Solution: 273 MVA SN / 332 MVA SE / 309 MVA WN / 393 MVA WE
- Nathan – Mayfield Q3 138 kV Line
  - Before Proposed Solution: 265 MVA SN / 316 MVA SE / 309 MVA WN / 361 MVA WE
  - After Proposed Solution: 273 MVA SN / 332 MVA SE / 309 MVA WN / 393 MVA WE
- Nathan – Mayfield Q4 138 kV Line
  - Before Proposed Solution: 265 MVA SN / 316 MVA SE / 309 MVA WN / 361 MVA WE
  - After Proposed Solution: 273 MVA SN / 332 MVA SE / 309 MVA WN / 393 MVA WE

Estimated Project Cost: $7.9M

Projected In-Service: 03/02/2023

Supplemental Project ID: s2597

Model: 2020 Series 2025 Summer RTEP 50/50

ATSI Transmission Zone M-3 Process
Relay Misoperation Solution

Need Number: ATSI-2019-073

Process Stage: Submission of Supplemental Project for Inclusion in the Local Plan 11/12/2021

Previously Presented: Need Meeting – 11/22/2019
Solution Meeting – 03/19/2020
Re-Present Solution Meeting – 08/16/2021

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption References:

Global Factors

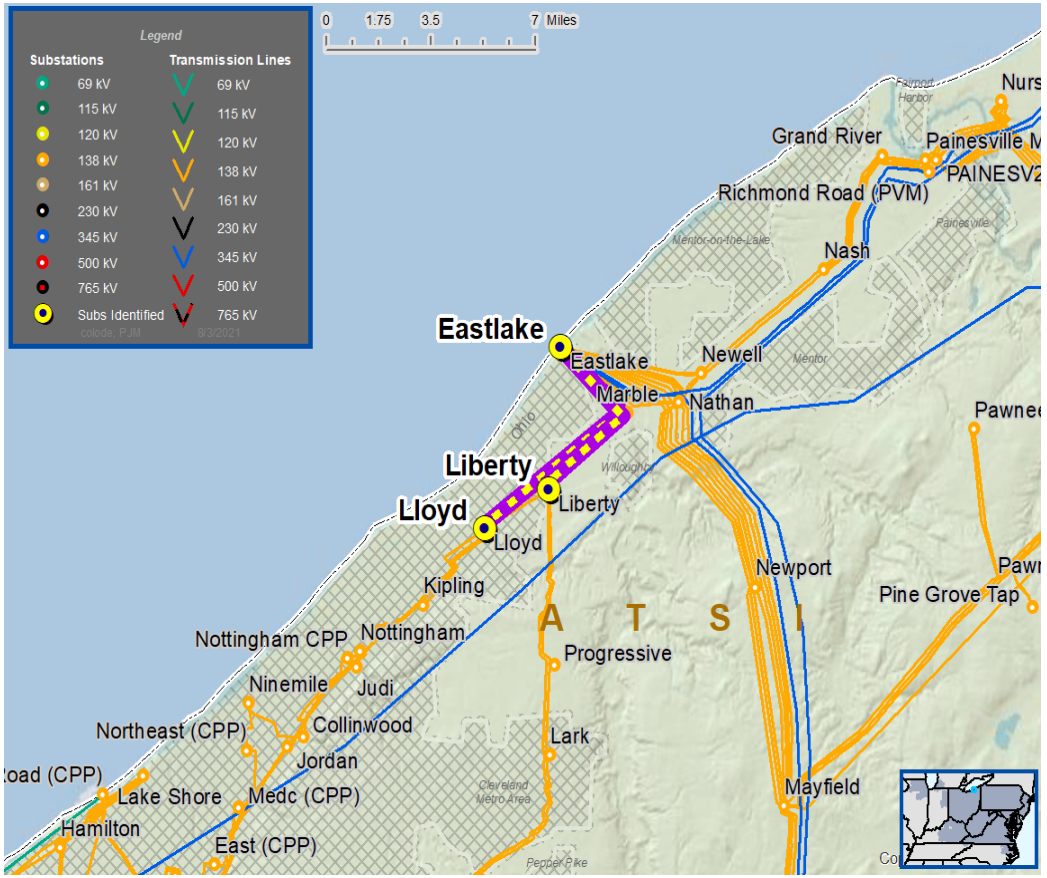
- System reliability and performance
- Substation / line equipment limits

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.



ATSI Transmission Zone M-3 Process
Relay Misoperation Solution

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ATSI-2019	Transmission Line / Substation Locations	Existing Line/Terminal Equipment MVA Rating (SN / SE)	Existing Conductor/Transformer MVA Rating (SN / SE)	Limiting Terminal Equipment
-073	Eastlake-Lloyd 138 kV Q12 Line 1. Eastlake – Liberty 2. Lamont – Lloyd	1. 273 / 287 2. 103 / 132	1. 273 / 332 2. 148 / 151	Substation Conductor, Relay, CTs @ Lloyd

ATSI Transmission Zone M-3 Process
Relay Misoperation Solution

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ATSI-2019	Transmission Line / Substation Locations	New MVA Line Rating (SN / SE)	Proposed Solution	Estimated Costs ($ M)	Target ISD
-073 (s2228)	Eastlake-Lloyd 138 kV Q12 Line 1. Eastlake – Liberty 2. Lamont – Lloyd	1. 273 / 332 2. 147 (WN) / 164 (WE)	At Eastlake replace the Q-12 circuit breaker, line disconnect switch, relaying, line terminal arresters, and line CVTs. At Lloyd remove the Q12 line relaying due to Lloyd TR#2 moving to the Q11 bay position.	$1.1	03/03/2023

Projected In-Service: See table

Supplemental Project ID: s2228

Revision History

6/23/2021 – V1 – Local Plan posted to pjm.com (s2387,s2447 → s2260)

09/07/2021 – V2- Local Plan posted on pjm.com (s1953, s2388, s2547, s2548, s2545, s2546, s1795 & s2553)

10/08/2021 – V3 – Local Plan posted on pjm.com (s2237.2) and added geographical maps where missing

11/16/2021 – V4 – Local Plan posted on pjm.com (s2595, s2596, s2597 and s2228)