



**Generation Interconnection
Feasibility Study Report
for
Queue Project AE2-299
ERIE EAST 230 KV
32 MW Capacity / 160 MW Energy**

July, 2019

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1 Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 36.2, as well as the Feasibility Study Agreement between, the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Pennsylvania Electric Company (PENELEC).

2 Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement. Cost allocation rules for network upgrades can be found in PJM Manual 14A, Attachment B. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

An Interconnection Customer with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification and, where applicable, for compliance with low voltage ride through requirements. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment B of Manual 14G. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in order to reduce delays to the System Impact Study process timeline for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a \$10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System Impact Study (See

Section 4.3 for starting dates) for the Interconnection Request which shall specify the use of the new model. The Interconnection Customer will be required to submit a completed dynamic model study request form (Attachment B-1 of Manual 14G) in order to document the request for the study.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

3 General

The Interconnection Customer (IC) has proposed a Storage generating facility located in Erie County, Pennsylvania. The installed facilities will have a total capability of 160 MW with 32 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is March 1, 2022. This study does not imply a Transmission Owner (TO) commitment to this in-service date.

Queue Number	AE2-299
Project Name	ERIE EAST 230 KV
Interconnection Customer	
State	Pennsylvania
County	Erie
Transmission Owner	PENELEC
MFO	160
MWE	160
MWC	32
Fuel	Storage
Basecase Study Year	2022

3.1 Point of Interconnection

The interconnection of the project at the Primary POI will be accomplished by installing a new 230 kV breaker at Erie East substation to expand the substation to a five breaker 230 kV ring bus. The project will also require non-direct connection upgrades at Four Mile Jct. substation. National Grid will need to provide any relay and protection upgrades on their system.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AE2-299 generation project to connect to the FirstEnergy ("FE") transmission system. Attachment 2 provides the proposed location for the point of interconnection. IC will be responsible for constructing the facilities on its side of the POI, including the attachment facilities which connect the generator to the FE transmission system's direct connection facilities.

3.2 Cost Summary

The AE2-299 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$667,250
Direct Connection Network Upgrade	\$667,250
Non-Direct Connection Network Upgrades	\$219,300
Total Costs	\$1,553,800

In addition, the AE2-299 project may be responsible for a contribution to the following costs

Description	Total Cost
System Upgrades	\$312,262,700

Cost allocations for these upgrades will be provided in the System Impact Study Report.

The costs provided above exclude the Contribution in Aid of Construction ("CIAC") Federal Income Tax Gross Up charge. If, at a future date, it is determined that the CIAC Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

The required Attachment Facilities and Direct and Non-Direct Connection work for the interconnection of the AE2-299 generation project to the FE Transmission System is detailed in the following sections. The associated one-line with the generation project Attachment Facilities and the Primary Direct and Non-Direct Connection facilities are shown in Attachment 1.

4 Transmission Owner Scope of Work

The interconnection of the project at the Primary POI will be accomplished by installing a new 230 kV breaker at Erie East substation to expand the substation to a five breaker 230 kV ring bus. The project will also require non-direct connection upgrades at Four Mile Jct. substation. National Grid will need to provide any relay and protection upgrades on their system.

Attachment 1 shows a one-line diagram of the proposed primary direct connection facilities for the AE2-299 generation project to connect to the FirstEnergy (“FE”) transmission system. Attachment 2 provides the proposed location for the point of interconnection. IC will be responsible for constructing the facilities on its side of the POI, including the attachment facilities which connect the generator to the FE transmission system’s direct connection facilities.

5 Attachment Facilities

The total preliminary cost estimate for the Attachment work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Install line exit take-off structure, foundations, disconnect switch and associated equipment at ring bus substation	\$667,250
Total Attachment Facility Costs	\$667,250

6 Direct Connection Cost Estimate

The total preliminary cost estimate for the Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Install one (1) 230 kV breaker and add a new 230 kV line terminal at Erie East to create a five breaker ring bus.	\$667,250
Total Direct Connection Facility Costs	\$667,250

7 Non-Direct Connection Cost Estimate

The total preliminary cost estimate for the Non-Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Install anti-islanding (transfer trip) equipment at Four Mile Jct substation.	\$219,300
Total Non-Direct Connection Facility Costs	\$219,300

8 System Reinforcement Cost Estimates

Upgrade Description	Cost
WP-0006 (177) : Reconductor 4/0 Cu Line Project Type : FAC Cost : \$20,150,000 Time Estimate : 22.0 Months	\$20,150,000
WP-0009 (184) : Reconductor 4/0 Cu Line Project Type : FAC Cost : \$15,600,000 Time Estimate : 20.0 Months WP-0009a (185) : Replace line drops into All Dam 6 Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months	\$15,730,000
<u>NYISO</u> NonPJM Area (783) : The external (i.e. Non-PJM) Transmission Owner, NYISO, will not evaluate this violation until the impact study phase. Project Type : FAC Cost : \$0 Time Estimate : N/A Months <u>PENELEC</u> PN-0001 (787) : Reconductor line with 1033 ACSS high temperature conductor (21.52 miles). At East Towanda, replace the wave trap and bus conductor. Project Type : FAC Cost : \$50,700,000 Time Estimate : 36.0 Months	\$50,700,000
CEI-002A (286) : Reconductor the Leroy Center-Perry S6 345 kV Line (~10 miles from Leroy Center to Perry). The existing conductor is (2) 954 ACSR conductor and the new conductor is (2) 954 kcmil ACSS conductor. Upgrade terminals as required. Project Type : FAC Cost : \$28,600,000 Time Estimate : 30.0 Months	\$28,600,000
CEI-003A (287) : Reconductor the Eastlake-Perry S8 345 kV Line (~22 miles from Eastlake to Perry). The existing conductor is (2) 954 ACSR conductor and the new conductor is (2) 954 kcmil ACSS conductor. Upgrade terminals as required. Project Type : FAC Cost : \$65,000,000 Time Estimate : 48.0 Months	\$65,000,000
OEC-002A (289) : Build a new 138 kV line from Black River to Astor substation Project Type : FAC Cost : \$20,152,700 Time Estimate : 30.0 Months	\$20,152,700
OEC-002A (289) : Build a new 138 kV line from Black River to Astor substation Project Type : FAC Cost : \$20,152,700 Time Estimate : 30.0 Months	\$20,152,700

Upgrade Description	Cost
WP-0001 (169) : Reconductor 7.3 miles of 4/0 Cu Line Conductor Project Type : FAC Cost : \$13,000,000 Time Estimate : 20.0 Months WP-0001a (170) : Replace 4/0 Line Exit Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months	\$13,130,000
PN-0012 (800) : Upgrade 1033 ASCR bus conductor at Glade and Warren substations Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months	\$130,000
WP-0007 (178) : Reconductor 336 ACSR Line Project Type : FAC Cost : \$26,000,000 Time Estimate : 30.0 Months WP-0007a (179) : Replace line and bus side disconnect switches at Butler Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months WP-0007b (180) : Replace Bus Side Disconnect Switches at Butler Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months WP-0007c (181) : Replace Wavetrap at Butler Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months WP-0007d (182) : Replace Wavetrap Leads at Butler Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months	\$26,520,000
<u>ATSI</u> CEI-001A (285) : Reconductor the ATSI owned portion of the Erie West-Ashtabula 3-point tap 345 kV Line (~ 15 miles from Ashtabula to structure 13083). The existing conductor is (2) 954 ACSR conductor and the new conductor is (2) 954 kcmil ACSS conductor. Project Type : FAC Cost : \$42,900,000 Time Estimate : 36.0 Months <u>PENELEC</u> PN-0004 (790) : Reconductor line with high temperature conductor (MAIT Portion - 7.17 miles) Project Type : FAC Cost : \$20,800,000 Time Estimate : 20.0 Months	\$63,700,000

Upgrade Description	Cost
WP-0004 (174) : Reconductor 4/0 Cu Line Project Type : FAC Cost : \$7,800,000 Time Estimate : 18.0 Months	
WP-0004a (175) : Replace KD-4 Project Type : FAC Cost : \$325,000 Time Estimate : 12.0 Months	\$8,450,000
WP-0004b (176) : Replace KD-41 Line Relays Project Type : FAC Cost : \$325,000 Time Estimate : 12.0 Months	
TOTAL COST	\$312,262,700

9 Schedule

Based on the scope of work for the Attachment Facilities and the Direct and/or Non-Direct Connection facilities, it is expected to take a minimum of 23 months after the signing of an Interconnection Construction Service Agreement to complete the installation. This includes the requirement for the IC to make a preliminary payment that compensates FE for the first three months of the engineering design work that is related to the Attachment Facilities and Direct and Non-Direct Connection work. This assumes that there will be no environmental issues with any of the new properties associated with this project, that there will be no delays in acquiring the necessary permits for implementing the defined direct connection and network upgrades, and that all transmission system outages will be allowed when requested.

The schedule for the required Network Impact Reinforcements will be more clearly identified in future study phases. The estimate elapsed time to complete each of the required reinforcements is identified in the “System Reinforcements” section of the report.

10 Transmission Owner Analysis

10.1 Power Flow Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AE2-299 project did not contribute to any overloads on the FE transmission <100 kV system.

11 Interconnection Customer Requirements

11.1 System Protection

The IC must design its Customer Facilities in accordance with all applicable standards, including the standards in FE's "Requirements for Transmission Connected Facilities" document located at:

<http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx>.

Preliminary Protection requirements will be provided as part of the Facilities Study. Detailed Protection Requirements will be provided once the project enters the construction phase.

The IC has requested a non-standard GSU transformer winding configuration. This transformer is in violation of section 14.2.6 of FE's "Requirements for Transmission Connected Facilities" document and will not be accepted. The GSU transformer must have a grounded wye connection on the high (utility) side and a delta connection on the low (generator) side.

11.2 Compliance Issues and Interconnection Customer Requirements

The proposed Customer Facilities must be designed in accordance with FE's "Requirements for Transmission Connected Facilities" document located at: <http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx>. In particular, the IC is responsible for the following:

1. The purchase and installation of a fully rated 230 kV circuit breaker to protect the AE2-299 generator lead line. A single circuit breaker must be used to protect this line; if the project has several GSU transformers, the individual GSU transformer breakers cannot be used to protect this line.
2. The purchase and installation of the minimum required FE generation interconnection relaying and control facilities. This includes over/under voltage protection, over/under frequency protection, and zero sequence voltage protection relays.
3. The purchase and installation of supervisory control and data acquisition ("SCADA") equipment to provide information in a compatible format to the FE Transmission System Control Center.
4. Compliance with the FE and PJM generator power factor and voltage control requirements.
5. The execution of a back-up service agreement to serve the customer load supplied from the AE2-299 generation project metering point when the units are out-of-service. This assumes the intent of the IC is to net the generation with the load.

The IC will also be required to meet all PJM, ReliabilityFirst, and NERC reliability criteria and operating procedures for standards compliance. For example, the IC will need to properly locate and report the over and under voltage and over and under frequency system protection elements for its units as well as the submission of the generator model and protection data required to satisfy the PJM and ReliabilityFirst audits.

Failure to comply with these requirements may result in a disconnection of service if the violation is found to compromise the reliability of the FE system.

11.3 Power Factor Requirements

The IC shall design its non-synchronous Customer Facility with the ability to maintain a power factor of at least 0.95 leading (absorbing VARs) to 0.95 lagging (supplying VARs) measured at the high-side of the facility substation transformer(s) connected to the FE transmission system.

12 Revenue Metering and SCADA Requirements

12.1 PJM Requirements

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Section 8 of Attachment O.

12.2 FE Requirements

The IC will be required to comply with all FE revenue metering requirements for generation interconnection customers which can be found in FE's "Requirements for Transmission Connected Facilities" document located at: <http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx>.

13 Network Impacts

The Queue Project AE2-299 was evaluated as a 160 MW (Capacity 32.0 MW) injection at the Erie East 230kV substation in the PENELEC area. Project AE2-299 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-299 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Load Flow

13.1 Generation Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7388444	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	PJM_P1_APS_B_G692	single	1900.0	99.93	100.67	DC	14.0
7388737	235204	01KITTAN	AP	235139	01AL&D6T	AP	1	ATSI-P1-2-CEI-345-700T	single	151.0	99.95	101.16	DC	1.83
7388738	235204	01KITTAN	AP	235139	01AL&D6T	AP	1	PN-P1-2-PN-345-107T	single	151.0	99.95	101.16	DC	1.83

13.2 Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7387887	200928	26FOURMILE	PENELEC	200819	26ERIE SE	PENELEC	1	PN-P2-3-PN-345-003A	breaker	666.0	86.62	101.44	DC	98.68

13.3 Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7387762	135251	S RIPLEY	NYISO	200654	26ERIE E	PENELEC	1	PN-P2-3-PN-345-003A	breaker	607.0	103.32	110.65	DC	44.43
7387763	135251	S RIPLEY	NYISO	200654	26ERIE E	PENELEC	1	PN-P2-3-PN-345-3A	breaker	607.0	102.09	109.4	DC	44.3
7387764	135251	S RIPLEY	NYISO	200654	26ERIE E	PENELEC	1	PN-P2-3-PN-345-002A	breaker	607.0	102.09	109.4	DC	44.3
7387640	200654	26ERIE E	PENELEC	903645	W3-099 TAP	PENELEC	1	PN-P2-3-PN-345-003A	breaker	592.0	101.38	120.7	DC	115.65
7387641	200654	26ERIE E	PENELEC	903645	W3-099 TAP	PENELEC	1	PN-P2-3-PN-345-3A	breaker	592.0	100.13	119.47	DC	115.77
7387642	200654	26ERIE E	PENELEC	903645	W3-099 TAP	PENELEC	1	PN-P2-3-PN-345-002A	breaker	592.0	100.13	119.47	DC	115.77
7387358	200675	26E.TWANDA	PENELEC	130763	HILSD230	NYISO	1	PN-P2-3-PN-115-19H	breaker	531.0	142.62	143.79	DC	13.25
7388924	200675	26E.TWANDA	PENELEC	130763	HILSD230	NYISO	1	PL:03:P71:001017	tower	531.0	144.63	145.54	DC	10.99
7387835	200811	26WARREN	PENELEC	200918	26ERIE S TIE	PENELEC	1	PN-P2-3-PN-345-003A	breaker	621.0	102.61	105.46	DC	17.61
7387313	200927	26FOURMILE	PENELEC	200820	26ERIE SE	PENELEC	1	PN-P2-3-PN-230-6G	breaker	245.0	129.23	150.31	DC	51.61
7388589	235139	01AL&D6T	AP	235138	01AL 4J	AP	1	PN-P1-2-PN-345-107T	single	151.0	108.55	109.76	DC	1.83
7388590	235139	01AL&D6T	AP	235138	01AL 4J	AP	1	ATSI-P1-2-CEI-345-700T	single	151.0	108.55	109.76	DC	1.83
7388281	235197	01KARNSC	AP	235152	01BUTLER	AP	1	PN-P1-2-PN-345-107T	single	179.0	130.99	132.4	DC	2.52
7388282	235197	01KARNSC	AP	235152	01BUTLER	AP	1	ATSI-P1-2-CEI-345-700T	single	179.0	130.99	132.4	DC	2.52
7388337	235240	01COLMBGPN	AP	235202	01KISKIV	AP	1	PN-P1-2-PN-345-107T	single	151.0	125.43	126.86	DC	2.16
7388338	235240	01COLMBGPN	AP	235202	01KISKIV	AP	1	ATSI-P1-2-CEI-345-700T	single	151.0	125.43	126.86	DC	2.16

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPAC T
7388262	235282	01GAR RN	AP	235240	01COLMBGP N	AP	1	ATSI-P1-2-CEI-345-700T	single	151.0	133.64	135.07	DC	2.16
7388263	235282	01GAR RN	AP	235240	01COLMBGP N	AP	1	PN-P1-2-PN-345-107T	single	151.0	133.64	135.07	DC	2.16
8959761	239036	02PERRY	ATSI	239334	02L.CENTER	ATSI	1	ATSI-P7-1-CEI-345-012	tower	1667.0	127.93	130.99	DC	51.58
8959773	239036	02PERRY	ATSI	238684	02EASTLK	ATSI	1	ATSI-P7-1-CEI-345-016	tower	1667.0	120.9	123.87	DC	49.98
8959796	239082	02S8-ATT	ATSI	238544	02ASH_3	ATSI	8	ATSI-P7-1-CEI-345-016	tower	423.0	116.13	117.62	DC	14.04
8959905	239728	02BLKVR	ATSI	239734	02USSTEEL	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	659.0	104.63	105.29	DC	8.18
8959840	239734	02USSTEEL	ATSI	238915	02LRN Q2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	593.0	111.86	112.59	DC	8.18
7387496	903645	W3-099 TAP	PENELE C	200928	26FOURMILE	PENELE C	1	PN-P2-3-PN-345-003A	breake r	592.0	111.31	129.36	DC	115.65
7387497	903645	W3-099 TAP	PENELE C	200928	26FOURMILE	PENELE C	1	PN-P2-3-PN-345-3A	breake r	592.0	110.11	128.2	DC	115.77
7387498	903645	W3-099 TAP	PENELE C	200928	26FOURMILE	PENELE C	1	PN-P2-3-PN-345-002A	breake r	592.0	110.11	128.2	DC	115.77

13.4 Potential Congestion due to Local Energy Deliverability

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7388688	135251	S RIPLEY	NYISO	200654	26ERIE E	PENELEC	1	PN-P1-2-PN-345-003	operation	607.0	102.02	109.33	DC	44.3
7388437	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	Base Case	operation	1560.0	117.76	122.21	DC	70.34
7388439	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	235104 01CABOT 500 239280 02CRNBRY 500 1	operation	1900.0	105.7	109.38	DC	70.74
7388527	200654	26ERIE E	PENELEC	903645	W3-099 TAP	PENELEC	1	PN-P1-2-PN-345-003	operation	592.0	100.05	119.39	DC	115.77
7388229	200675	26E.TWANDA	PENELEC	130763	HILSD230	NYISO	1	PN-P1-2-PN-115-038	operation	531.0	142.6	143.78	DC	13.25
7388238	200675	26E.TWANDA	PENELEC	130763	HILSD230	NYISO	1	Base Case	operation	483.0	130.87	131.9	DC	11.48
7388670	200767	26HOMER CT	PENELEC	200795	26SHELOCTA	PENELEC	1	AP-P1-2-WP-345-311T	operation	917.0	109.42	110.16	DC	14.61
7388793	200927	26FOURMILE	PENELEC	200820	26ERIE SE	PENELEC	1	PN-P1-2-PN-230-027	operation	245.0	78.06	100.79	DC	55.7

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7388796	235129	01ARMSTRONG	AP	235121	01ARMSTR	AP	2	PN-P1-2-PN-345-107T	operation	659.0	97.82	99.29	DC	21.27
7388797	235129	01ARMSTRONG	AP	235121	01ARMSTR	AP	2	ATSI-P1-2-CEI-345-700T	operation	659.0	97.82	99.29	DC	21.27
7388283	235197	01KARNSC	AP	235152	01BUTLER	AP	1	PN-P1-2-PN-345-107T	operation	179.0	95.19	98.36	DC	12.61
7388284	235197	01KARNSC	AP	235152	01BUTLER	AP	1	ATSI-P1-2-CEI-345-700T	operation	179.0	95.19	98.36	DC	12.61
8959645	238547	02AT	ATSI	239036	02PERRY	ATSI	1	Base Case	operation	1534.0	96.64	100.58	DC	61.21
8959646	238547	02AT	ATSI	239036	02PERRY	ATSI	1	ATSI-P1-3-SYS-345-722	operation	1891.0	93.61	97.2	DC	68.74
7388400	903645	W3-099 TAP	PENELEC	200928	26FOURMILE	PENELEC	1	PN-P1-2-PN-345-003	operation	592.0	110.03	128.11	DC	115.77
7388404	903645	W3-099 TAP	PENELEC	200928	26FOURMILE	PENELEC	1	Base Case	operation	488.0	87.16	111.2	DC	118.57

13.5 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
7388263,7388262	12	01GAR RN 138.0 kV - 01COLMBGPN 138.0 kV Ckt 1	WP-0006 (177) : Reconductor 4/0 Cu Line Project Type : FAC Cost : \$20,150,000 Time Estimate : 22.0 Months	\$20,150,000
7388738,7388737	2	01KITTAN 138.0 kV - 01AL&D6T 138.0 kV Ckt 1	WP-0009 (184) : Reconductor 4/0 Cu Line Project Type : FAC Cost : \$15,600,000 Time Estimate : 20.0 Months WP-0009a (185) : Replace line drops into All Dam 6 Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months	\$15,730,000
7387313	8	26FOURMILE 115.0 kV - 26ERIE SE 115.0 kV Ckt 1	n5174 (808) ¹ : New 230kV series reactor and required associated substation equipment at Erie East substation, ISD 4/08/2019 Project Type : CON Cost : \$0 Time Estimate : 0.0 Months	\$0
7387498,7387497,7387496	18	W3-099 TAP 230.0 kV - 26FOURMILE 230.0 kV Ckt 1	n5174 (808) ¹ : New 230kV series reactor and required associated substation equipment at Erie East substation, ISD 4/08/2019 Project Type : CON Cost : \$0 Time Estimate : 0.0 Months	\$0
7387763,7387762,7387764	4	S RIPLEY 230.0 kV - 26ERIE E 230.0 kV Ckt 1	<u>NYISO</u> NonPJMArea (783) : The external (i.e. Non-PJM) Transmission Owner, NYISO, will not evaluate this violation until the impact study phase. Project Type : FAC Cost : \$0 Time Estimate : N/A Months <u>PENELEC</u> n5174 (808) ¹ : New 230kV series reactor and required associated substation equipment at Erie East substation, ISD 4/08/2019 Project Type : CON Cost : \$0 Time Estimate : 0.0 Months	\$0

¹ The network upgrade reinforcement (n5174) identified may resolve the overload violations but has not been tested in the Feasibility Study phase. PJM will analyze if this network project alleviates the identified overload violations in the System Impact phase. If n5174 does not resolve the overload, then new system reinforcement(s) may be required and will be specified in the System Impact Study report.

ID	Index	Facility	Upgrade Description	Cost
7387358,7388924	6	26E.TWANDA 230.0 kV - HILSD230 230.0 kV Ckt 1	<u>NYISO</u> NonPJM Area (783) : The external (i.e. Non-PJM) Transmission Owner, NYISO, will not evaluate this violation until the impact study phase. Project Type : FAC Cost : \$0 Time Estimate : N/A Months <u>PENELEC</u> PN-0001 (787) : Reconductor line with 1033 ACSS high temperature conductor (21.52 miles). At East Towanda, replace the wave trap and bus conductor. Project Type : FAC Cost : \$50,700,000 Time Estimate : 36.0 Months	\$50,700,000
7387642,7387640,7387641	5	26ERIE E 230.0 kV - W3- 099 TAP 230.0 kV Ckt 1	n5174 (808)¹ : New 230kV series reactor and required associated substation equipment at Erie East substation, ISD 4/08/2019 Project Type : CON Cost : \$0 Time Estimate : 0.0 Months	\$0
8959761	13	02PERRY 345.0 kV - 02L.CENTER 345.0 kV Ckt 1	CEI-002A (286) : Reconductor the Leroy Center-Perry S6 345 kV Line (~10 miles from Leroy Center to Perry). The existing conductor is (2) 954 ACSR conductor and the new conductor is (2) 954 kcmil ACSS conductor. Upgrade terminals as required. Project Type : FAC Cost : \$28,600,000 Time Estimate : 30.0 Months	\$28,600,000
8959773	14	02PERRY 345.0 kV - 02EASTLK 345.0 kV Ckt 1	CEI-003A (287) : Reconductor the Eastlake-Perry S8 345 kV Line (~22 miles from Eastlake to Perry). The existing conductor is (2) 954 ACSR conductor and the new conductor is (2) 954 kcmil ACSS conductor. Upgrade terminals as required. Project Type : FAC Cost : \$65,000,000 Time Estimate : 48.0 Months	\$65,000,000
8959796	15	02S8-ATT 345.0 kV - 02ASH_3 138.0 kV Ckt 8	<u>8959796</u> ATSI Rating Correction: [Rate A: 620, Rate B: 701, Rate C: 896]	\$0
8959840	17	02USSTEEL 138.0 kV - 02LRN Q2 138.0 kV Ckt 1	OEC-002A (289) : Build a new 138 kV line from Black River to Astor substation Project Type : FAC Cost : \$20,152,700 Time Estimate : 30.0 Months	\$20,152,700

ID	Index	Facility	Upgrade Description	Cost
7387887	3	26FOURMILE 230.0 kV - 26ERIE SE 230.0 kV Ckt 1	n5174 (808) ¹ : New 230kV series reactor and required associated substation equipment at Erie East substation, ISD 4/08/2019 Project Type : CON Cost : \$0 Time Estimate : 0.0 Months	\$0
8959905	16	02BLKRVR 138.0 kV - 02USSTEEL 138.0 kV Ckt 1	OEC-002A (289) : Build a new 138 kV line from Black River to Astor substation Project Type : FAC Cost : \$20,152,700 Time Estimate : 30.0 Months	\$20,152,700
7388589,7388590	9	01AL&D6T 138.0 kV - 01AL 4J 138.0 kV Ckt 1	WP-0001 (169) : Reconductor 7.3 miles of 4/0 Cu Line Conductor Project Type : FAC Cost : \$13,000,000 Time Estimate : 20.0 Months WP-0001a (170) : Replace 4/0 Line Exit Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months	\$13,130,000
7387835	7	26WARREN 230.0 kV - 26ERIE S TIE 230.0 kV Ckt 1	PN-0012 (800) : Upgrade 1033 ASCR bus conductor at Glade and Warren substations Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months	\$130,000
7388282,7388281	10	01KARNSC 138.0 kV - 01BUTLER 138.0 kV Ckt 1	WP-0007 (178) : Reconductor 336 ACSR Line Project Type : FAC Cost : \$26,000,000 Time Estimate : 30.0 Months WP-0007a (179) : Replace line and bus side disconnect switches at Butler Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months WP-0007b (180) : Replace Bus Side Disconnect Switches at Butler Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months WP-0007c (181) : Replace Wavetrap at Butler Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months WP-0007d (182) : Replace Wavetrap Leads at Butler Project Type : FAC Cost : \$130,000 Time Estimate : 9.0 Months	\$26,520,000

ID	Index	Facility	Upgrade Description	Cost
7388444	1	26ERIE W 345.0 kV - 02AT 345.0 kV Ckt 1	<u>ATSI</u> CEI-001A (285) : Reconductor the ATSI owned portion of the Erie West-Ashtabula 3-point tap 345 kV Line (~ 15 miles from Ashtabula to structure 13083). The existing conductor is (2) 954 ACSR conductor and the new conductor is (2) 954 kcmil ACSS conductor. Project Type : FAC Cost : \$42,900,000 Time Estimate : 36.0 Months <u>PENELEC</u> PN-0004 (790) : Reconductor line with high temperature conductor (MAIT Portion - 7.17 miles) Project Type : FAC Cost : \$20,800,000 Time Estimate : 20.0 Months	\$63,700,000
7388337,7388338	11	01COLMBGPN 138.0 kV - 01KISKIV 138.0 kV Ckt 1	WP-0004 (174) : Reconductor 4/0 Cu Line Project Type : FAC Cost : \$7,800,000 Time Estimate : 18.0 Months WP-0004a (175) : Replace KD-4 Project Type : FAC Cost : \$325,000 Time Estimate : 12.0 Months WP-0004b (176) : Replace KD-41 Line Relays Project Type : FAC Cost : \$325,000 Time Estimate : 12.0 Months	\$8,450,000
			TOTAL COST	\$312,262,700

13.6 Flow Gate Details

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact. It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

13.6.1 Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7388444	200599	26ERIE W	PENELEC	238547	02AT	ATSI	1	PJM_P1_APS_B_G692	single	1900.0	99.93	100.67	DC	14.0

Bus #	Bus	MW Impact
200608	26PINEY #1	0.85
200642	26SENECA#1	8.34
200643	26SENECA#2	8.89
200644	26SENECA#3	0.67
200662	26SCRUB GR	3.31
200805	26COLVER13	15.28
200823	26MHP_X3-003	8.11
200828	26HNSMLK 1	2.3
200829	26HNSMLK 2	2.3
200830	26HNSMLK 3	2.3
200831	26HNSMLK 4	2.3
200832	26HNSMLK 5	2.3
200849	26LAKVU GN	0.29
201201	26WRREN CT	2.4
903643	W3-099 C OP1	5.79
914101	Y2-055	10.01
915951	Y3-092 FTIR	561.94
916351	Z1-091	3.28
919201	AA1-144 O1	25.96
919491	AA2-000	78.65
920341	AA2-132	3.58
930411	AB1-082	4.51
930511	AB1-092	2.89
932571	AC2-077	4.15
935191	AD1-154	3.66
936421	AD2-055	5.95
936991	AD2-133 C	2.58
938951	AE1-123	3.9
939171	AE1-147 C	1.76
939291	AE1-160 C	4.39
939381	AE1-169 C O1	17.05
940201	AE2-001 C	1.76
940681	AE2-055 C	1.71
940801	AE2-067 C	2.7
940861	AE2-074 C O1	3.42
941191	AE2-113 C O1	14.42
941251	AE2-119 C	2.02
941261	AE2-120 C	1.76
941271	AE2-121 C	0.94
941321	AE2-126 C	2.29
941331	AE2-129 C	1.86
941351	AE2-131 C	1.86

Bus #	Bus	MW Impact
941421	AE2-139 C O1	10.09
941491	AE2-146 C	16.39
942351	AE2-248 C	1.38
942491	AE2-262 C	8.11
942501	AE2-263 C	7.62
942811	AE2-299 C	14.0
942961	AE2-316 C	7.72
943151	AE2-344 C O1	33.24
BLUEG	BLUEG	21.79
CALDERWOOD	CALDERWOOD	1.87
CANNELTON	CANNELTON	1.3
CATAWBA	CATAWBA	0.96
CBM-N	CBM-N	8.04
CHEOAH	CHEOAH	1.71
CHILHOWEE	CHILHOWEE	0.61
COFFEEN	COFFEEN	2.33
COTTONWOOD	COTTONWOOD	7.99
DUCKCREEK	DUCKCREEK	5.25
EDWARDS	EDWARDS	2.41
ELMERSMITH	ELMERSMITH	2.23
FARMERCITY	FARMERCITY	1.52
G-007A	G-007A	11.26
GIBSON	GIBSON	0.91
HAMLET	HAMLET	1.41
NEWTON	NEWTON	6.07
NYISO	NYISO	35.16
PRAIRIE	PRAIRIE	10.99
SANTEETLA	SANTEETLA	0.5
SMITHLAND	SMITHLAND	0.84
TATANKA	TATANKA	2.8
TILTON	TILTON	2.86
TRIMBLE	TRIMBLE	2.43
TVA	TVA	6.49
UNIONPOWER	UNIONPOWER	2.84
VFT	VFT	30.85

13.6.2 Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7388738	235204	01KITTAN	AP	235139	01AL&D6T	AP	1	PN-P1-2-PN-345-107T	single	151.0	99.95	101.16	DC	1.83

Bus #	Bus	MW Impact
200608	26PINEY #1	0.32
200642	26SENECA#1	1.48
200643	26SENECA#2	1.58
200644	26SENECA#3	0.12
200662	26SCRUB GR	0.78
200828	26HNSMLK 1	0.49
200829	26HNSMLK 2	0.49
200830	26HNSMLK 3	0.49
200831	26HNSMLK 4	0.49
200832	26HNSMLK 5	0.49
200849	26LAKVU GN	0.04
201201	26WRREN CT	0.38
235030	01MHNG-T155	0.13
903643	W3-099 C OP1	0.75
914101	Y2-055	1.59
915951	Y3-092 FTIR	63.05
935191	AD1-154	1.25
938951	AE1-123	1.46
939291	AE1-160 C	0.91
939381	AE1-169 C O1	3.72
942811	AE2-299 C	1.83
942961	AE2-316 C	3.48
943151	AE2-344 C O1	4.43
BLUEG	BLUEG	2.51
CALDERWOOD	CALDERWOOD	0.24
CANNELTON	CANNELTON	0.15
CATAWBA	CATAWBA	0.14
CBM-N	CBM-N	1.32
CHEOAH	CHEOAH	0.22
CHILHOWEE	CHILHOWEE	0.08
COFFEEN	COFFEEN	0.26
COTTONWOOD	COTTONWOOD	0.97
DUCKCREEK	DUCKCREEK	0.58
EDWARDS	EDWARDS	0.26
ELMERSMITH	ELMERSMITH	0.26
FARMERCITY	FARMERCITY	0.17
G-007A	G-007A	1.49
GIBSON	GIBSON	0.1
HAMLET	HAMLET	0.21
NEWTON	NEWTON	0.69
NYISO	NYISO	5.77

Bus #	Bus	MW Impact
PRAIRIE	PRAIRIE	1.26
SANTEETLA	SANTEETLA	0.06
SMITHLAND	SMITHLAND	0.1
TATANKA	TATANKA	0.31
TILTON	TILTON	0.32
TRIMBLE	TRIMBLE	0.28
TVA	TVA	0.8
UNIONPOWER	UNIONPOWER	0.35
VFT	VFT	4.12

13.6.3 Index 3

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7387887	200928	26FOURMILE	PENELEC	200819	26ERIE SE	PENELEC	1	PN-P2-3-PN-345-003A	breaker	666.0	86.62	101.44	DC	98.68

Bus #	Bus	MW Impact
200823	26MHP_X3-003	4.93
200887	26ARMNA MT	0.26
200894	26K02	4.19
203999	P-047 E	8.49
294573	P-028 E	9.97
903643	W3-099 C OP1	8.25
903644	W3-099 E OP1	55.19
915952	Y3-092 FTWR	58.69
915953	Y3-092 NFTWR	58.69
916202	Z1-069 E	5.44
916351	Z1-091	2.25
916361	Z1-092	0.32
918682	AA1-082 E	5.55
919201	AA1-144 O1	15.49
919491	AA2-000	23.91
920341	AA2-132	2.57
923821	AB2-019	3.29
930411	AB1-082	1.71
930511	AB1-092	0.88
931092	AB1-160 E	1.55
932571	AC2-077	1.93
935061	AD1-142	0.02
936421	AD2-055	1.81
940801	AE2-067 C	1.63
940802	AE2-067 E	0.01
940861	AE2-074 C O1	1.3
940862	AE2-074 E O1	1.71
941191	AE2-113 C O1	3.81
941192	AE2-113 E O1	4.1
941421	AE2-139 C O1	6.14
941422	AE2-139 E O1	4.09
941491	AE2-146 C	6.99
941492	AE2-146 E	9.85
942811	AE2-299 C	19.72
942812	AE2-299 E	78.96
AA3-300	AA3-300	15.61
AA3-700	AA3-700	12.14
BLUEG	BLUEG	6.12
CALDERWOOD	CALDERWOOD	0.54
CANNELTON	CANNELTON	0.37
CATAWBA	CATAWBA	0.28

Bus #	Bus	MW Impact
CBM-N	CBM-N	5.41
CHEOAH	CHEOAH	0.49
CHILHOWEE	CHILHOWEE	0.18
COFFEEN	COFFEEN	0.65
COTTONWOOD	COTTONWOOD	2.27
DUCKCREEK	DUCKCREEK	1.47
EDWARDS	EDWARDS	0.68
ELMERSMITH	ELMERSMITH	0.63
FARMERCITY	FARMERCITY	0.43
G-007A	G-007A	3.72
GIBSON	GIBSON	0.26
HAMLET	HAMLET	0.41
NEWTON	NEWTON	1.7
NYISO	NYISO	23.9
PRAIRIE	PRAIRIE	3.09
SANTEETLA	SANTEETLA	0.14
SMITHLAND	SMITHLAND	0.24
TATANKA	TATANKA	0.79
TILTON	TILTON	0.8
TRIMBLE	TRIMBLE	0.68
TVA	TVA	1.84
UNIONPOWER	UNIONPOWER	0.81
VFT	VFT	10.34

13.6.4 Index 4

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7387762	135251	S RIPLEY	NYISO	200654	26ERIE E	PENELEC	1	PN-P2-3-PN-345-003A	breaker	607.0	103.32	110.65	DC	44.43

Bus #	Bus	MW Impact
200823	26MHP_X3-003	5.52
200887	26ARMNA MT	0.29
200894	26K02	4.53
200949	26X1-109	10.07
203261	26BLOSSBCT	0.25
203283	26MANOR_T86	0.02
203999	P-047 E	9.48
294573	P-028 E	11.17
915952	Y3-092 FTWR	58.38
915953	Y3-092 NFTWR	58.38
916201	Z1-069 C	0.17
916202	Z1-069 E	5.91
916351	Z1-091	2.55
916361	Z1-092	0.36
918682	AA1-082 E	6.21
919201	AA1-144 O1	17.3
919491	AA2-000	24.06
920341	AA2-132	2.92
923821	AB2-019	3.27
930411	AB1-082	1.81
930511	AB1-092	0.88
931091	AB1-160 C	0.05
931092	AB1-160 E	1.69
932571	AC2-077	2.1
935061	AD1-142	0.02
936421	AD2-055	1.82
940801	AE2-067 C	1.83
940802	AE2-067 E	0.01
940861	AE2-074 C O1	1.37
940862	AE2-074 E O1	1.81
941191	AE2-113 C O1	3.72
941192	AE2-113 E O1	4.0
941421	AE2-139 C O1	6.88
941422	AE2-139 E O1	4.59
941491	AE2-146 C	7.51
941492	AE2-146 E	10.59
942813	AE2-299 BAT	44.43
AA3-300	AA3-300	18.41
AA3-700	AA3-700	14.21
BLUEG	BLUEG	6.3
CALDERWOOD	CALDERWOOD	0.55

Bus #	Bus	MW Impact
CANNELTON	CANNELTON	0.38
CATAWBA	CATAWBA	0.29
CBM-N	CBM-N	6.12
CHEOAH	CHEOAH	0.5
CHILHOWEE	CHILHOWEE	0.18
COFFEEN	COFFEEN	0.67
COTTONWOOD	COTTONWOOD	2.34
DUCKCREEK	DUCKCREEK	1.51
EDWARDS	EDWARDS	0.69
ELMERSMITH	ELMERSMITH	0.65
FARMERCITY	FARMERCITY	0.44
G-007A	G-007A	3.95
GIBSON	GIBSON	0.26
HAMLET	HAMLET	0.43
NEWTON	NEWTON	1.75
NYISO	NYISO	27.06
PRAIRIE	PRAIRIE	3.18
SANTEETLA	SANTEETLA	0.15
SMITHLAND	SMITHLAND	0.24
TATANKA	TATANKA	0.81
TILTON	TILTON	0.82
TRIMBLE	TRIMBLE	0.7
TVA	TVA	1.9
UNIONPOWER	UNIONPOWER	0.83
VFT	VFT	10.99

13.6.5 Index 5

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7387640	200654	26ERIE E	PENELEC	903645	W3-099 TAP	PENELEC	1	PN-P2-3-PN-345-003A	breaker	592.0	101.38	120.7	DC	115.65

Bus #	Bus	MW Impact
200823	26MHP_X3-003	5.52
200887	26ARMNA MT	0.29
200894	26K02	4.53
200949	26X1-109	10.07
203261	26BLOSSBCT	0.25
203283	26MANOR_T86	0.02
203999	P-047 E	9.48
294573	P-028 E	11.17
915952	Y3-092 FTWR	58.38
915953	Y3-092 NFTWR	58.38
916202	Z1-069 E	5.91
916351	Z1-091	2.55
916361	Z1-092	0.36
918682	AA1-082 E	6.21
919201	AA1-144 O1	17.3
919491	AA2-000	24.06
920341	AA2-132	2.92
923821	AB2-019	3.27
930411	AB1-082	1.81
930511	AB1-092	0.88
931092	AB1-160 E	1.69
932571	AC2-077	2.1
935061	AD1-142	0.02
936421	AD2-055	1.82
940801	AE2-067 C	1.83
940802	AE2-067 E	0.01
940861	AE2-074 C O1	1.37
940862	AE2-074 E O1	1.81
941191	AE2-113 C O1	3.72
941192	AE2-113 E O1	4.0
941421	AE2-139 C O1	6.88
941422	AE2-139 E O1	4.59
941491	AE2-146 C	7.51
941492	AE2-146 E	10.59
942811	AE2-299 C	23.11
942812	AE2-299 E	92.53
AA3-300	AA3-300	18.41
AA3-700	AA3-700	14.21
BLUEG	BLUEG	6.3
CALDERWOOD	CALDERWOOD	0.55
CANNELTON	CANNELTON	0.38

Bus #	Bus	MW Impact
CATAWBA	CATAWBA	0.29
CBM-N	CBM-N	6.12
CHEOAH	CHEOAH	0.5
CHILHOWEE	CHILHOWEE	0.18
COFFEEN	COFFEEN	0.67
COTTONWOOD	COTTONWOOD	2.34
DUCKCREEK	DUCKCREEK	1.51
EDWARDS	EDWARDS	0.69
ELMERSMITH	ELMERSMITH	0.65
FARMERCITY	FARMERCITY	0.44
G-007A	G-007A	3.95
GIBSON	GIBSON	0.26
HAMLET	HAMLET	0.43
NEWTON	NEWTON	1.75
NYISO	NYISO	27.06
PRAIRIE	PRAIRIE	3.18
SANTEETLA	SANTEETLA	0.15
SMITHLAND	SMITHLAND	0.24
TATANKA	TATANKA	0.81
TILTON	TILTON	0.82
TRIMBLE	TRIMBLE	0.7
TVA	TVA	1.9
UNIONPOWER	UNIONPOWER	0.83
VFT	VFT	10.99

13.6.6 Index 6

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7388924	200675	26E.TWANDA	PENELEC	130763	HILSD230	NYISO	1	PL:03:P71:001017	tower	531.0	144.63	145.54	DC	10.99

Bus #	Bus	MW Impact
200823	26MHP_X3-003	7.64
200851	26MEHOOP3	0.93
200894	26K02	9.25
200917	26MTNTP_P28	0.47
200949	26X1-109	23.15
203283	26MANOR_T86	0.03
210706	HOLD	1.27
294573	P-028 E	15.46
916541	Z1-110	0.32
917072	Z2-011	0.32
917661	WAYM E	3.56
918602	AA1-077 E	5.05
918682	AA1-082 E	14.28
919201	AA1-144 O1	39.47
919491	AA2-000	40.05
920351	AA2-133	0.35
925951	AC1-071 C	0.55
925952	AC1-071 E	3.71
930511	AB1-092	1.47
934801	AD1-108	0.02
934811	AD1-109	0.02
936421	AD2-055	3.03
938331	AE1-051	0.34
938401	AE1-059 C O1	14.19
938402	AE1-059 E O1	14.19
940801	AE2-067 C	2.62
940802	AE2-067 E	0.01
941421	AE2-139 C O1	6.75
941422	AE2-139 E O1	4.5
942301	AE2-243 C	0.15
942302	AE2-243 E	0.91
942311	AE2-244 C	0.15
942312	AE2-244 E	0.91
942813	AE2-299 BAT	5.83
AA3-200	AA3-200	47.57
AA3-300	AA3-300	7.92
AA3-700	AA3-700	11.33
BLUEG	BLUEG	4.41
CALDERWOOD	CALDERWOOD	0.42
CANNELTON	CANNELTON	0.26
CARR	CARR	2.27
CATAWBA	CATAWBA	0.24
CHEOAH	CHEOAH	0.38

Bus #	Bus	MW Impact
CHILHOWEE	CHILHOWEE	0.14
COFFEEN	COFFEEN	0.47
COTTONWOOD	COTTONWOOD	1.69
DUCKCREEK	DUCKCREEK	1.03
EDWARDS	EDWARDS	0.47
ELMERSMITH	ELMERSMITH	0.45
FARMERCITY	FARMERCITY	0.3
G-007A	G-007A	2.41
GIBSON	GIBSON	0.18
HAMLET	HAMLET	0.36
NEWTON	NEWTON	1.22
PRAIRIE	PRAIRIE	2.23
RENSSELAER	RENSSELAER	1.83
SANTEETLA	SANTEETLA	0.11
SMITHLAND	SMITHLAND	0.17
TATANKA	TATANKA	0.56
TILTON	TILTON	0.56
TRIMBLE	TRIMBLE	0.49
TVA	TVA	1.39
UNIONPOWER	UNIONPOWER	0.61
VFT	VFT	6.39

13.6.7 Index 7

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7387835	200811	26WARREN	PENELEC	200918	26ERIE S TIE	PENELEC	1	PN-P2-3-PN-345-003A	breaker	621.0	102.61	105.46	DC	17.61

Bus #	Bus	MW Impact
200642	26SENECA#1	7.63
200643	26SENECA#2	8.12
200644	26SENECA#3	0.61
200649	26PENNTech	0.71
200894	26K02	2.99
201201	26WRREN CT	2.23
236828	01GRAYMONT	0.29
290086	Q-036 E	2.39
914101	Y2-055	9.33
915952	Y3-092 FTWR	51.58
915953	Y3-092 NFTWR	51.58
916202	Z1-069 E	4.25
919491	AA2-000	35.13
923821	AB2-019	2.89
925512	AC1-025 E	0.11
930411	AB1-082	2.08
930511	AB1-092	1.29
931092	AB1-160 E	1.22
932571	AC2-077	1.46
936421	AD2-055	2.66
936991	AD2-133 C	1.08
936992	AD2-133 E	4.92
939171	AE1-147 C	0.89
939172	AE1-147 E	0.59
940201	AE2-001 C	0.89
940202	AE2-001 E	0.59
940681	AE2-055 C	0.85
940682	AE2-055 E	0.56
940861	AE2-074 C O1	1.58
940862	AE2-074 E O1	2.08
941191	AE2-113 C O1	8.24
941192	AE2-113 E O1	8.87
941251	AE2-119 C	1.02
941252	AE2-119 E	0.68
941261	AE2-120 C	0.88
941262	AE2-120 E	0.59
941271	AE2-121 C	0.47
941272	AE2-121 E	0.32
941321	AE2-126 C	1.31
941322	AE2-126 E	0.88
941331	AE2-129 C	0.86

Bus #	Bus	MW Impact
941332	AE2-129 E	0.57
941351	AE2-131 C	0.86
941352	AE2-131 E	0.57
941491	AE2-146 C	6.58
941492	AE2-146 E	9.28
942351	AE2-248 C	0.69
942352	AE2-248 E	0.46
942491	AE2-262 C	4.23
942492	AE2-262 E	2.84
942501	AE2-263 C	3.98
942502	AE2-263 E	2.66
942813	AE2-299 BAT	17.61
942961	AE2-316 C	3.27
942962	AE2-316 E	4.66
BLUEG	BLUEG	5.17
CALDERWOOD	CALDERWOOD	0.45
CANNELTON	CANNELTON	0.31
CATAWBA	CATAWBA	0.24
CBM-N	CBM-N	1.01
CHEOAH	CHEOAH	0.41
CHILHOWEE	CHILHOWEE	0.15
COFFEEN	COFFEEN	0.55
COTTONWOOD	COTTONWOOD	1.91
DUCKCREEK	DUCKCREEK	1.24
EDWARDS	EDWARDS	0.57
ELMERSMITH	ELMERSMITH	0.53
FARMERCITY	FARMERCITY	0.36
G-007A	G-007A	2.38
GIBSON	GIBSON	0.22
HAMLET	HAMLET	0.35
NEWTON	NEWTON	1.44
NYISO	NYISO	4.33
PRAIRIE	PRAIRIE	2.61
SANTEETLA	SANTEETLA	0.12
SMITHLAND	SMITHLAND	0.2
TATANKA	TATANKA	0.66
TILTON	TILTON	0.68
TRIMBLE	TRIMBLE	0.57
TVA	TVA	1.55
UNIONPOWER	UNIONPOWER	0.68
VFT	VFT	6.5

13.6.8 Index 8

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7387313	200927	26FOURMILE	PENELEC	200820	26ERIE SE	PENELEC	1	PN-P2-3-PN-230-6G	breaker	245.0	129.23	150.31	DC	51.61

Bus #	Bus	MW Impact
200642	26SENECA#1	3.09
200643	26SENECA#2	3.29
200644	26SENECA#3	0.25
200823	26MHP_X3-003	3.14
200894	26K02	3.21
201201	26WRREN CT	1.05
203999	P-047 E	5.52
294573	P-028 E	6.36
903643	W3-099 C OP1	4.3
903644	W3-099 E OP1	28.79
914101	Y2-055	4.38
916202	Z1-069 E	4.37
916351	Z1-091	1.39
918682	AA1-082 E	3.6
919201	AA1-144 O1	10.15
919491	AA2-000	23.96
920341	AA2-132	1.57
930411	AB1-082	1.65
930511	AB1-092	0.88
931092	AB1-160 E	1.25
932571	AC2-077	1.54
936421	AD2-055	1.81
940801	AE2-067 C	1.04
940802	AE2-067 E	0.01
940861	AE2-074 C O1	1.25
940862	AE2-074 E O1	1.65
941191	AE2-113 C O1	4.94
941192	AE2-113 E O1	5.32
941321	AE2-126 C	0.64
941322	AE2-126 E	0.43
941421	AE2-139 C O1	3.96
941422	AE2-139 E O1	2.64
941491	AE2-146 C	6.04
941492	AE2-146 E	8.51
942811	AE2-299 C	10.31
942812	AE2-299 E	41.29
AA3-300	AA3-300	8.07
AA3-700	AA3-700	6.92
BLUEG	BLUEG	4.04
CALDERWOOD	CALDERWOOD	0.36
CANNELTON	CANNELTON	0.24

Bus #	Bus	MW Impact
CATAWBA	CATAWBA	0.19
CBM-N	CBM-N	3.25
CHEOAH	CHEOAH	0.33
CHILHOWEE	CHILHOWEE	0.12
COFFEEN	COFFEEN	0.43
COTTONWOOD	COTTONWOOD	1.51
DUCKCREEK	DUCKCREEK	0.96
EDWARDS	EDWARDS	0.44
ELMERSMITH	ELMERSMITH	0.41
FARMERCITY	FARMERCITY	0.28
G-007A	G-007A	2.38
GIBSON	GIBSON	0.17
HAMLET	HAMLET	0.29
NEWTON	NEWTON	1.12
NYISO	NYISO	14.36
PRAIRIE	PRAIRIE	2.04
SANTEETLA	SANTEETLA	0.1
SMITHLAND	SMITHLAND	0.16
TATANKA	TATANKA	0.52
TILTON	TILTON	0.53
TRIMBLE	TRIMBLE	0.45
TVA	TVA	1.23
UNIONPOWER	UNIONPOWER	0.54
VFT	VFT	6.62

13.6.9 Index 9

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7388590	235139	01AL&D6T	AP	235138	01AL 4J	AP	1	ATSI-P1-2-CEI-345-700T	single	151.0	108.55	109.76	DC	1.83

Bus #	Bus	MW Impact
200608	26PINEY #1	0.32
200642	26SENECA#1	1.48
200643	26SENECA#2	1.57
200644	26SENECA#3	0.12
200662	26SCRUB GR	0.78
200828	26HNSMLK 1	0.49
200829	26HNSMLK 2	0.49
200830	26HNSMLK 3	0.49
200831	26HNSMLK 4	0.49
200832	26HNSMLK 5	0.49
200849	26LAKVU GN	0.04
201201	26WRREN CT	0.38
235030	01MHNG-T155	0.13
235134	01AL&D6	0.75
903643	W3-099 C OP1	0.75
914101	Y2-055	1.59
915951	Y3-092 FTIR	62.98
935191	AD1-154	1.25
938951	AE1-123	1.46
939291	AE1-160 C	0.91
939381	AE1-169 C O1	3.72
942811	AE2-299 C	1.83
942961	AE2-316 C	3.47
943151	AE2-344 C O1	4.43
BLUEG	BLUEG	2.55
CALDERWOOD	CALDERWOOD	0.24
CANNELTON	CANNELTON	0.15
CATAWBA	CATAWBA	0.14
CBM-N	CBM-N	1.32
CHEOAH	CHEOAH	0.22
CHILHOWEE	CHILHOWEE	0.08
COFFEEN	COFFEEN	0.27
COTTONWOOD	COTTONWOOD	0.98
DUCKCREEK	DUCKCREEK	0.59
EDWARDS	EDWARDS	0.27
ELMERSMITH	ELMERSMITH	0.26
FARMERCITY	FARMERCITY	0.17
G-007A	G-007A	1.47
GIBSON	GIBSON	0.11
HAMLET	HAMLET	0.21
NEWTON	NEWTON	0.7

Bus #	Bus	MW Impact
NYISO	NYISO	5.74
PRAIRIE	PRAIRIE	1.28
SANTEETLA	SANTEETLA	0.07
SMITHLAND	SMITHLAND	0.1
TATANKA	TATANKA	0.32
TILTON	TILTON	0.32
TRIMBLE	TRIMBLE	0.28
TVA	TVA	0.81
UNIONPOWER	UNIONPOWER	0.36
VFT	VFT	4.07

13.6.10 Index 10

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7388282	235197	01KARNSC	AP	235152	01BUTLER	AP	1	ATSI-P1-2-CEI-345-700T	single	179.0	130.99	132.4	DC	2.52

Bus #	Bus	MW Impact
200608	26PINEY #1	0.63
200642	26SENECA#1	2.06
200643	26SENECA#2	2.2
200644	26SENECA#3	0.17
200662	26SCRUB GR	1.32
200805	26COLVER13	7.31
200828	26HNSMLK 1	0.62
200829	26HNSMLK 2	0.62
200830	26HNSMLK 3	0.62
200831	26HNSMLK 4	0.62
200832	26HNSMLK 5	0.62
200849	26LAKVU GN	0.05
201201	26WRREN CT	0.53
235030	01MHNG-T155	0.14
903643	W3-099 C OP1	1.03
914101	Y2-055	2.21
915951	Y3-092 FTIR	85.82
919491	AA2-000	26.52
930411	AB1-082	1.22
930511	AB1-092	0.97
932571	AC2-077	1.12
935191	AD1-154	2.38
936421	AD2-055	2.0
936991	AD2-133 C	0.92
938951	AE1-123	2.87
939171	AE1-147 C	0.62
939291	AE1-160 C	1.54
939381	AE1-169 C O1	6.35
940201	AE2-001 C	0.62
940861	AE2-074 C O1	0.93
941191	AE2-113 C O1	4.25
941251	AE2-119 C	0.75
941261	AE2-120 C	0.62
941271	AE2-121 C	0.33
941321	AE2-126 C	0.8
941331	AE2-129 C	0.67
941351	AE2-131 C	0.67
941491	AE2-146 C	4.43
942351	AE2-248 C	0.48
942491	AE2-262 C	2.91
942501	AE2-263 C	2.74

Bus #	Bus	MW Impact
942811	AE2-299 C	2.52
942961	AE2-316 C	4.42
943151	AE2-344 C O1	6.23
BLUEG	BLUEG	3.44
CALDERWOOD	CALDERWOOD	0.32
CANNELTON	CANNELTON	0.21
CATAWBA	CATAWBA	0.18
CBM-N	CBM-N	1.7
CHEOAH	CHEOAH	0.29
CHILHOWEE	CHILHOWEE	0.11
COFFEEN	COFFEEN	0.36
COTTONWOOD	COTTONWOOD	1.31
DUCKCREEK	DUCKCREEK	0.8
EDWARDS	EDWARDS	0.37
ELMERSMITH	ELMERSMITH	0.35
FARMERCITY	FARMERCITY	0.24
G-007A	G-007A	1.67
GIBSON	GIBSON	0.14
HAMLET	HAMLET	0.27
NEWTON	NEWTON	0.94
NYISO	NYISO	7.42
PRAIRIE	PRAIRIE	1.73
SANTEETLA	SANTEETLA	0.09
SMITHLAND	SMITHLAND	0.13
TATANKA	TATANKA	0.43
TILTON	TILTON	0.44
TRIMBLE	TRIMBLE	0.38
TVA	TVA	1.08
UNIONPOWER	UNIONPOWER	0.47
VFT	VFT	4.64

13.6.11 Index 11

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7388338	235240	01COLMBGPN	AP	235202	01KISKIV	AP	1	ATSI-P1-2-CEI-345-700T	single	151.0	125.43	126.86	DC	2.16

Bus #	Bus	MW Impact
200608	26PINEY #1	0.38
200642	26SENECA#1	1.73
200643	26SENECA#2	1.84
200644	26SENECA#3	0.14
200662	26SCRUB GR	0.92
200828	26HNSMLK 1	0.58
200829	26HNSMLK 2	0.58
200830	26HNSMLK 3	0.58
200831	26HNSMLK 4	0.58
200832	26HNSMLK 5	0.58
200849	26LAKVU GN	0.04
201201	26WRREN CT	0.45
235030	01MHNG-T155	0.15
235134	01AL&D6	0.27
903643	W3-099 C OP1	0.88
914101	Y2-055	1.86
915951	Y3-092 FTIR	74.81
930411	AB1-082	1.04
935191	AD1-154	1.43
938951	AE1-123	1.74
939291	AE1-160 C	1.09
939381	AE1-169 C O1	4.42
940861	AE2-074 C O1	0.79
941191	AE2-113 C O1	3.53
941321	AE2-126 C	0.63
942811	AE2-299 C	2.16
942961	AE2-316 C	4.19
943151	AE2-344 C O1	5.25
BLUEG	BLUEG	2.71
CALDERWOOD	CALDERWOOD	0.26
CANNELTON	CANNELTON	0.16
CATAWBA	CATAWBA	0.15
CBM-N	CBM-N	1.46
CHEOAH	CHEOAH	0.24
CHILHOWEE	CHILHOWEE	0.09
COFFEEN	COFFEEN	0.28
COTTONWOOD	COTTONWOOD	1.05
DUCKCREEK	DUCKCREEK	0.62
EDWARDS	EDWARDS	0.28
ELMERSMITH	ELMERSMITH	0.28
FARMERCITY	FARMERCITY	0.18

Bus #	Bus	MW Impact
G-007A	G-007A	1.44
GIBSON	GIBSON	0.11
HAMLET	HAMLET	0.23
NEWTON	NEWTON	0.74
NYISO	NYISO	6.37
PRAIRIE	PRAIRIE	1.36
SANTEETLA	SANTEETLA	0.07
SMITHLAND	SMITHLAND	0.11
TATANKA	TATANKA	0.34
TILTON	TILTON	0.34
TRIMBLE	TRIMBLE	0.3
TVA	TVA	0.86
UNIONPOWER	UNIONPOWER	0.38
VFT	VFT	3.99

13.6.12 Index 12

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7388263	235282	01GAR RN	AP	235240	01COLMBGPN	AP	1	PN-P1-2-PN-345-107T	single	151.0	133.64	135.07	DC	2.16

Bus #	Bus	MW Impact
200608	26PINEY #1	0.38
200642	26SENECA#1	1.73
200643	26SENECA#2	1.84
200644	26SENECA#3	0.14
200662	26SCRUB GR	0.92
200828	26HNSMLK 1	0.58
200829	26HNSMLK 2	0.58
200830	26HNSMLK 3	0.58
200831	26HNSMLK 4	0.58
200832	26HNSMLK 5	0.58
200849	26LAKVU GN	0.04
201201	26WRREN CT	0.45
235030	01MHNG-T155	0.15
235134	01AL&D6	0.27
903643	W3-099 C OP1	0.88
914101	Y2-055	1.86
915951	Y3-092 FTIR	74.81
930411	AB1-082	1.04
935191	AD1-154	1.43
938951	AE1-123	1.74
939291	AE1-160 C	1.09
939381	AE1-169 C O1	4.42
940861	AE2-074 C O1	0.79
941191	AE2-113 C O1	3.53
941321	AE2-126 C	0.63
942811	AE2-299 C	2.16
942961	AE2-316 C	4.19
943151	AE2-344 C O1	5.25
BLUEG	BLUEG	2.71
CALDERWOOD	CALDERWOOD	0.26
CANNELTON	CANNELTON	0.16
CATAWBA	CATAWBA	0.15
CBM-N	CBM-N	1.46
CHEOAH	CHEOAH	0.24
CHILHOWEE	CHILHOWEE	0.09
COFFEEN	COFFEEN	0.28
COTTONWOOD	COTTONWOOD	1.05
DUCKCREEK	DUCKCREEK	0.62
EDWARDS	EDWARDS	0.28
ELMERSMITH	ELMERSMITH	0.28
FARMERCITY	FARMERCITY	0.18

Bus #	Bus	MW Impact
G-007A	G-007A	1.44
GIBSON	GIBSON	0.11
HAMLET	HAMLET	0.23
NEWTON	NEWTON	0.74
NYISO	NYISO	6.37
PRAIRIE	PRAIRIE	1.36
SANTEETLA	SANTEETLA	0.07
SMITHLAND	SMITHLAND	0.11
TATANKA	TATANKA	0.34
TILTON	TILTON	0.34
TRIMBLE	TRIMBLE	0.3
TVA	TVA	0.86
UNIONPOWER	UNIONPOWER	0.38
VFT	VFT	3.99

13.6.13 Index 13

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
8959761	239036	02PERRY	ATSI	239334	02L.CENTER	ATSI	1	ATSI-P7-1-CEI-345-012	tower	1667.0	127.93	130.99	DC	51.58

Bus #	Bus	MW Impact
200805	26COLVER13	10.93
200823	26MHP_X3-003	5.73
200828	26HNSMLK 1	1.69
200829	26HNSMLK 2	1.69
200830	26HNSMLK 3	1.69
200831	26HNSMLK 4	1.69
200832	26HNSMLK 5	1.69
200849	26LAKVU GN	0.22
200894	26K02	6.61
203999	P-047 E	10.43
236828	01GRAYMONT	0.42
239035	02PERRG1	844.93
290086	Q-036 E	4.08
294573	P-028 E	11.59
903643	W3-099 C OP1	4.27
903644	W3-099 E OP1	28.55
914101	Y2-055	7.35
915951	Y3-092 FTIR	415.19
916202	Z1-069 E	8.55
916351	Z1-091	2.34
918682	AA1-082 E	6.52
919201	AA1-144 O1	18.53
919491	AA2-000	56.63
920341	AA2-132	2.57
925512	AC1-025 E	0.15
930411	AB1-082	3.27
930511	AB1-092	2.08
931092	AB1-160 E	2.44
932571	AC2-077	3.0
935191	AD1-154	2.69
936421	AD2-055	4.28
936991	AD2-133 C	1.84
936992	AD2-133 E	8.4
938951	AE1-123	2.91
939171	AE1-147 C	1.26
939172	AE1-147 E	0.84
939291	AE1-160 C	3.25
939292	AE1-160 E	1.87
939381	AE1-169 C O1	12.63
939382	AE1-169 E O1	8.42
940201	AE2-001 C	1.26

Bus #	Bus	MW Impact
940202	AE2-001 E	0.84
940681	AE2-055 C	1.22
940682	AE2-055 E	0.81
940801	AE2-067 C	1.91
940802	AE2-067 E	0.01
940861	AE2-074 C O1	2.48
940862	AE2-074 E O1	3.27
941191	AE2-113 C O1	10.49
941192	AE2-113 E O1	11.3
941251	AE2-119 C	1.46
941252	AE2-119 E	0.97
941261	AE2-120 C	1.26
941262	AE2-120 E	0.84
941271	AE2-121 C	0.67
941272	AE2-121 E	0.45
941321	AE2-126 C	1.66
941322	AE2-126 E	1.11
941331	AE2-129 C	1.33
941332	AE2-129 E	0.89
941351	AE2-131 C	1.33
941352	AE2-131 E	0.89
941421	AE2-139 C O1	7.22
941422	AE2-139 E O1	4.81
941491	AE2-146 C	11.87
941492	AE2-146 E	16.72
942351	AE2-248 C	0.99
942352	AE2-248 E	0.66
942491	AE2-262 C	5.83
942492	AE2-262 E	3.92
942501	AE2-263 C	5.48
942502	AE2-263 E	3.66
942811	AE2-299 C	10.31
942812	AE2-299 E	41.27
942961	AE2-316 C	5.7
942962	AE2-316 E	8.13
943151	AE2-344 C O1	24.54
943152	AE2-344 E O1	16.36
BLUEG	BLUEG	14.06
CALDERWOOD	CALDERWOOD	1.21
CANNELTON	CANNELTON	0.84
CATAWBA	CATAWBA	0.62
CBM-N	CBM-N	5.58
CHEOAH	CHEOAH	1.1
CHILHOWEE	CHILHOWEE	0.4
COFFEEN	COFFEEN	1.51
COTTONWOOD	COTTONWOOD	5.16
DUCKCREEK	DUCKCREEK	3.4
EDWARDS	EDWARDS	1.56
ELMERSMITH	ELMERSMITH	1.44
FARMERCITY	FARMERCITY	0.98
G-007A	G-007A	7.06
GIBSON	GIBSON	0.59

Bus #	Bus	MW Impact
HAMLET	HAMLET	0.91
NEWTON	NEWTON	3.93
NYISO	NYISO	24.45
PRAIRIE	PRAIRIE	7.11
SANTEETLA	SANTEETLA	0.32
SMITHLAND	SMITHLAND	0.54
TATANKA	TATANKA	1.81
TILTON	TILTON	1.85
TRIMBLE	TRIMBLE	1.56
TVA	TVA	4.19
UNIONPOWER	UNIONPOWER	1.83
VFT	VFT	19.4

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ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
8959773	239036	02PERRY	ATSI	238684	02EASTLK	ATSI	1	ATSI-P7-1-CEI-345-016	tower	1667.0	120.9	123.87	DC	49.98

Bus #	Bus	MW Impact
200805	26COLVER13	10.57
200823	26MHP_X3-003	5.55
200828	26HNSMLK 1	1.64
200829	26HNSMLK 2	1.64
200830	26HNSMLK 3	1.64
200831	26HNSMLK 4	1.64
200832	26HNSMLK 5	1.64
200849	26LAKVU GN	0.21
200894	26K02	6.4
203999	P-047 E	10.1
236828	01GRAYMONT	0.41
239035	02PERRG1	804.58
290086	Q-036 E	3.95
294573	P-028 E	11.22
903643	W3-099 C OP1	4.13
903644	W3-099 E OP1	27.67
914101	Y2-055	7.12
915951	Y3-092 FTIR	402.42
916202	Z1-069 E	8.28
916351	Z1-091	2.27
918682	AA1-082 E	6.31
919201	AA1-144 O1	17.94
919491	AA2-000	54.83
920341	AA2-132	2.49
925512	AC1-025 E	0.15
930411	AB1-082	3.17
930511	AB1-092	2.01
931092	AB1-160 E	2.37
932571	AC2-077	2.9
935191	AD1-154	2.61
936421	AD2-055	4.15
936991	AD2-133 C	1.78
936992	AD2-133 E	8.13
938951	AE1-123	2.81
939171	AE1-147 C	1.22
939172	AE1-147 E	0.81
939291	AE1-160 C	3.15
939292	AE1-160 E	1.81
939381	AE1-169 C O1	12.23
939382	AE1-169 E O1	8.16
940201	AE2-001 C	1.22

Bus #	Bus	MW Impact
940202	AE2-001 E	0.81
940681	AE2-055 C	1.18
940682	AE2-055 E	0.79
940801	AE2-067 C	1.85
940802	AE2-067 E	0.01
940861	AE2-074 C O1	2.41
940862	AE2-074 E O1	3.17
941191	AE2-113 C O1	10.16
941192	AE2-113 E O1	10.94
941251	AE2-119 C	1.41
941252	AE2-119 E	0.94
941261	AE2-120 C	1.22
941262	AE2-120 E	0.81
941271	AE2-121 C	0.65
941272	AE2-121 E	0.44
941321	AE2-126 C	1.61
941322	AE2-126 E	1.07
941331	AE2-129 C	1.29
941332	AE2-129 E	0.86
941351	AE2-131 C	1.29
941352	AE2-131 E	0.86
941421	AE2-139 C O1	6.99
941422	AE2-139 E O1	4.66
941491	AE2-146 C	11.49
941492	AE2-146 E	16.2
942351	AE2-248 C	0.96
942352	AE2-248 E	0.64
942491	AE2-262 C	5.65
942492	AE2-262 E	3.8
942501	AE2-263 C	5.31
942502	AE2-263 E	3.54
942811	AE2-299 C	9.99
942812	AE2-299 E	39.99
942961	AE2-316 C	5.52
942962	AE2-316 E	7.87
943151	AE2-344 C O1	23.78
943152	AE2-344 E O1	15.85
BLUEG	BLUEG	13.55
CALDERWOOD	CALDERWOOD	1.16
CANNELTON	CANNELTON	0.81
CATAWBA	CATAWBA	0.6
CBM-N	CBM-N	5.4
CHEOAH	CHEOAH	1.06
CHILHOWEE	CHILHOWEE	0.38
COFFEEN	COFFEEN	1.45
COTTONWOOD	COTTONWOOD	4.97
DUCKCREEK	DUCKCREEK	3.28
EDWARDS	EDWARDS	1.51
ELMERSMITH	ELMERSMITH	1.39
FARMERCITY	FARMERCITY	0.95
G-007A	G-007A	6.81
GIBSON	GIBSON	0.57

Bus #	Bus	MW Impact
HAMLET	HAMLET	0.88
NEWTON	NEWTON	3.78
NYISO	NYISO	23.65
PRAIRIE	PRAIRIE	6.85
SANTEETLA	SANTEETLA	0.31
SMITHLAND	SMITHLAND	0.52
TATANKA	TATANKA	1.75
TILTON	TILTON	1.78
TRIMBLE	TRIMBLE	1.51
TVA	TVA	4.04
UNIONPOWER	UNIONPOWER	1.77
VFT	VFT	18.7

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ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
8959796	239082	02S8-ATT	ATSI	238544	02ASH_3	ATSI	8	ATSI-P7-1-CEI-345-016	tower	423.0	116.13	117.62	DC	14.04

Bus #	Bus	MW Impact
239035	02PERRG1	85.1
903643	W3-099 C OP1	1.16
903644	W3-099 E OP1	7.77
914101	Y2-055	2.0
915951	Y3-092 FTIR	112.97
939291	AE1-160 C	0.88
939292	AE1-160 E	0.51
939381	AE1-169 C O1	3.44
939382	AE1-169 E O1	2.29
942811	AE2-299 C	2.81
942812	AE2-299 E	11.23
943151	AE2-344 C O1	6.68
943152	AE2-344 E O1	4.45
BLUEG	BLUEG	3.87
CALDERWOOD	CALDERWOOD	0.33
CANNELTON	CANNELTON	0.23
CATAWBA	CATAWBA	0.17
CBM-N	CBM-N	1.53
CHEOAH	CHEOAH	0.3
CHILHOWEE	CHILHOWEE	0.11
COFFEEN	COFFEEN	0.42
COTTONWOOD	COTTONWOOD	1.42
DUCKCREEK	DUCKCREEK	0.94
EDWARDS	EDWARDS	0.43
ELMERSMITH	ELMERSMITH	0.4
FARMERCITY	FARMERCITY	0.27
G-007A	G-007A	1.94
GIBSON	GIBSON	0.16
HAMLET	HAMLET	0.25
NEWTON	NEWTON	1.08
NYISO	NYISO	6.68
PRAIRIE	PRAIRIE	1.96
SANTEETLA	SANTEETLA	0.09
SMITHLAND	SMITHLAND	0.15
TATANKA	TATANKA	0.5
TILTON	TILTON	0.51
TRIMBLE	TRIMBLE	0.43
TVA	TVA	1.15
UNIONPOWER	UNIONPOWER	0.5
VFT	VFT	5.33

13.6.16 Index 16

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
8959905	239728	02BLKRVR	ATSI	239734	02USSTEEL	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	659.0	104.63	105.29	DC	8.18

Bus #	Bus	MW Impact
238571	02BEAVGA	1.2
238572	02BEAVGB	1.22
238670	02DVBSG1	89.84
238979	02NAPMUN	2.71
239174	02WLORG-5	1.43
239175	02WLORG-6	1.85
240968	02BG2 GEN	0.57
240969	02BG4 G1	0.14
240973	02BG6 AMPO	2.25
240975	02PGE GEN	2.96
241908	02LLF_W4-004	0.4
247548	V4-010 C	2.07
247940	U4-028 E	6.02
247941	U4-029 E	6.02
247947	V4-010 E	13.88
900041	V4-011	0.19
925751	AC1-051 C	0.47
925752	AC1-051 E	3.12
931951	AB1-107 1	22.49
931961	AB1-107 2	49.34
932051	AC2-015 C	3.24
932052	AC2-015 E	3.84
932791	AC2-103 C	4.81
932792	AC2-103 E	32.21
934251	AD1-052 C1	1.16
934261	AD1-052 C2	1.16
934461	AD1-070 C O1	2.33
934462	AD1-070 E O1	10.94
934761	AD1-103 C O1	8.09
934762	AD1-103 E O1	54.14
934891	AD1-118	5.63
937021	AD2-136 C O1	3.24
937022	AD2-136 E O1	21.67
937381	AD2-191 C	1.53
937382	AD2-191 E	10.23
938911	AE1-119	44.28
939161	AE1-146 C O1	4.9
939162	AE1-146 E O1	2.33
940841	AE2-072 C	4.71
940842	AE2-072 E	3.14
941741	AE2-174 C	2.78

Bus #	Bus	MW Impact
941742	AE2-174 E	13.01
941761	AE2-176 C	8.91
941762	AE2-176 E	5.94
941781	AE2-181 C	2.14
941782	AE2-181 E	1.43
942661	AE2-282 C O1	3.19
942662	AE2-282 E O1	1.68
942813	AE2-299 BAT	4.33
CARR	CARR	0.77
CBM-S1	CBM-S1	5.02
CBM-S2	CBM-S2	1.13
CBM-W1	CBM-W1	20.54
CBM-W2	CBM-W2	44.21
CIN	CIN	5.39
CPL	CPL	0.3
G-007	G-007	1.57
IPL	IPL	3.46
LGEE	LGEE	1.34
MEC	MEC	10.64
MECS	MECS	20.91
O-066	O-066	10.16
RENSSELAER	RENSSELAER	0.6
WEC	WEC	1.72

13.6.17 Index 17

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
8959840	239734	02USSTEEL	ATSI	238915	02LRN Q2	ATSI	1	ATSI-P7-1-CEI-345-001-A	tower	593.0	111.86	112.59	DC	8.18

Bus #	Bus	MW Impact
238571	02BEAVGA	1.2
238572	02BEAVGB	1.22
238670	02DVBSG1	89.84
238979	02NAPMUN	2.71
239174	02WLORG-5	1.43
239175	02WLORG-6	1.85
240968	02BG2 GEN	0.57
240969	02BG4 G1	0.14
240973	02BG6 AMPO	2.25
240975	02PGE GEN	2.96
241908	02LLF_W4-004	0.4
247548	V4-010 C	2.07
247940	U4-028 E	6.02
247941	U4-029 E	6.02
247947	V4-010 E	13.88
900041	V4-011	0.19
925751	AC1-051 C	0.47
925752	AC1-051 E	3.12
931951	AB1-107 1	22.49
931961	AB1-107 2	49.34
932051	AC2-015 C	3.24
932052	AC2-015 E	3.84
932791	AC2-103 C	4.81
932792	AC2-103 E	32.21
934251	AD1-052 C1	1.16
934261	AD1-052 C2	1.16
934461	AD1-070 C O1	2.33
934462	AD1-070 E O1	10.94
934761	AD1-103 C O1	8.09
934762	AD1-103 E O1	54.14
934891	AD1-118	5.63
937021	AD2-136 C O1	3.24
937022	AD2-136 E O1	21.67
937381	AD2-191 C	1.53
937382	AD2-191 E	10.23
938911	AE1-119	44.28
939161	AE1-146 C O1	4.9
939162	AE1-146 E O1	2.33
940841	AE2-072 C	4.71
940842	AE2-072 E	3.14
941741	AE2-174 C	2.78

Bus #	Bus	MW Impact
941742	AE2-174 E	13.01
941761	AE2-176 C	8.91
941762	AE2-176 E	5.94
941781	AE2-181 C	2.14
941782	AE2-181 E	1.43
942661	AE2-282 C O1	3.19
942662	AE2-282 E O1	1.68
942813	AE2-299 BAT	4.33
CARR	CARR	0.77
CBM-S1	CBM-S1	5.02
CBM-S2	CBM-S2	1.13
CBM-W1	CBM-W1	20.54
CBM-W2	CBM-W2	44.21
CIN	CIN	5.39
CPL	CPL	0.3
G-007	G-007	1.57
IPL	IPL	3.46
LGEE	LGEE	1.34
MEC	MEC	10.64
MECS	MECS	20.91
O-066	O-066	10.16
RENSSELAER	RENSSELAER	0.6
WEC	WEC	1.72

13.6.18 Index 18

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
7387496	903645	W3-099 TAP	PENELEC	200928	26FOURMILE	PENELEC	1	PN-P2-3-PN-345-003A	breaker	592.0	111.31	129.36	DC	115.65

Bus #	Bus	MW Impact
200823	26MHP_X3-003	5.52
200887	26ARMNA MT	0.29
200894	26K02	4.53
200949	26X1-109	10.07
203261	26BLOSSBCT	0.25
203283	26MANOR_T86	0.02
203999	P-047 E	9.48
294573	P-028 E	11.17
903643	W3-099 C OP1	9.67
903644	W3-099 E OP1	64.7
915952	Y3-092 FTWR	58.38
915953	Y3-092 NFTWR	58.38
916202	Z1-069 E	5.91
916351	Z1-091	2.55
916361	Z1-092	0.36
918682	AA1-082 E	6.21
919201	AA1-144 O1	17.3
920341	AA2-132	2.92
923821	AB2-019	3.27
930411	AB1-082	1.81
931092	AB1-160 E	1.69
932571	AC2-077	2.1
935061	AD1-142	0.02
940801	AE2-067 C	1.83
940802	AE2-067 E	0.01
940861	AE2-074 C O1	1.37
940862	AE2-074 E O1	1.81
941191	AE2-113 C O1	3.72
941192	AE2-113 E O1	4.0
941421	AE2-139 C O1	6.88
941422	AE2-139 E O1	4.59
941491	AE2-146 C	7.51
941492	AE2-146 E	10.59
942811	AE2-299 C	23.11
942812	AE2-299 E	92.53
AA3-300	AA3-300	18.41
AA3-700	AA3-700	14.21
BLUEG	BLUEG	6.3
CALDERWOOD	CALDERWOOD	0.55
CANNELTON	CANNELTON	0.38
CATAWBA	CATAWBA	0.29

Bus #	Bus	MW Impact
CBM-N	CBM-N	6.12
CHEOAH	CHEOAH	0.5
CHILHOWEE	CHILHOWEE	0.18
COFFEEN	COFFEEN	0.67
COTTONWOOD	COTTONWOOD	2.34
DUCKCREEK	DUCKCREEK	1.51
EDWARDS	EDWARDS	0.69
ELMERSMITH	ELMERSMITH	0.65
FARMERCITY	FARMERCITY	0.44
G-007A	G-007A	3.95
GIBSON	GIBSON	0.26
HAMLET	HAMLET	0.43
NEWTON	NEWTON	1.75
NYISO	NYISO	27.06
PRAIRIE	PRAIRIE	3.18
SANTEETLA	SANTEETLA	0.15
SMITHLAND	SMITHLAND	0.24
TATANKA	TATANKA	0.81
TILTON	TILTON	0.82
TRIMBLE	TRIMBLE	0.7
TVA	TVA	1.9
UNIONPOWER	UNIONPOWER	0.83
VFT	VFT	10.99

Affected Systems

13.7 Affected Systems

13.7.1 LG&E

LG&E Impacts to be determined during later study phases (as applicable).

13.7.2 MISO

MISO Impacts to be determined during later study phases (as applicable).

13.7.3 TVA

TVA Impacts to be determined during later study phases (as applicable).

13.7.4 Duke Energy Progress

Duke Energy Progress Impacts to be determined during later study phases (as applicable).

13.7.5 NYISO

NYISO Impacts to be determined during later study phases (as applicable).

13.8 Contingency Descriptions

Contingency Name	Contingency Definition
PN-P2-3-PN-345-003A	CONTINGENCY 'PN-P2-3-PN-345-003A' /* WAYNE 345KV STUCK BREAKER DISCONNECT BUS 200595 /* 26WAYNE 345 END
PN-P2-3-PN-345-002A	CONTINGENCY 'PN-P2-3-PN-345-002A' /* HANDSOME LAKE 345KV STUCK BREAKER DISCONNECT BUS 200826 /* 26HANDSMLK 345 DISCONNECT BUS 200830 /* 26HNSMLK 3 14 DISCONNECT BUS 200828 /* 26HNSMLK 1 14 DISCONNECT BUS 200829 /* 26HNSMLK 2 14 DISCONNECT BUS 200831 /* 26HNSMLK 4 14 DISCONNECT BUS 200832 /* 26HNSMLK 5 14 END
ATSI-P1-3-SYS-345-722	CONTINGENCY 'ATSI-P1-3-SYS-345-722' /* TRAN 02S8-ATT 345 TO 02ASH_3 138 CK 8 DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /* 02S8-ATT 345 02ASH_3 138 END

Contingency Name	Contingency Definition
PN-P1-2-PN-345-003	CONTINGENCY 'PN-P1-2-PN-345-003' /* HANDSOME LAKE - WAYNE 345KV DISCONNECT BRANCH FROM BUS 200826 TO BUS 200595 CKT 1 /* 26HANDSMLK 345 26WAYNE 345 END
ATSI-P1-2-CEI-345-700T	CONTINGENCY 'ATSI-P1-2-CEI-345-700T' /* PN/ATSI ERIE WEST - ASHTABULA - PERRY 345KV DISCONNECT BRANCH FROM BUS 239036 TO BUS 238547 CKT 1 /* 02PERRY 345 02AT 345 DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /* 02AT 345 02S8-ATT 345 DISCONNECT BRANCH FROM BUS 239082 TO BUS 238544 CKT 8 /* 02S8-ATT 345 02ASH_3 138 DISCONNECT BRANCH FROM BUS 238547 TO BUS 200599 CKT 1 /* 02AT 345 26ERIE W 345 END
PL:03:P71:001017	CONTINGENCY 'PL:03:P71:001017' /* LACK-HOPA 500KV & PAUP-BLGR 230KV DISCONNECT BRANCH FROM BUS 200074 TO BUS 200098 CKT 1 /* LACKAW-LACHOP_T 500 DISCONNECT BRANCH FROM BUS 200091 TO BUS 200098 CKT 1 /* HOPAKONG-LACHOP_T 500 DISCONNECT BRANCH FROM BUS 208049 TO BUS 207919 CKT 1 /* PAUP-BLGR TR2 230 DISCONNECT BRANCH FROM BUS 207919 TO BUS 211394 CKT 2 /* BLGR-BLGR 230/69KV T2 END
ATSI-P7-1-CEI-345-012	CONTINGENCY 'ATSI-P7-1-CEI-345-012' /* PERRY-EASTLAKE AND PERRY-NORTHFIELD 345KV LINE OUTAGES DISCONNECT BRANCH FROM BUS 238684 TO BUS 239036 CKT 1 /* 02EASTLK 345 02PERRY 345 DISCONNECT BRANCH FROM BUS 239358 TO BUS 239036 CKT 1 /* 02NFIELD 345 02PERRY 345 END
AP-P1-2-WP-345-311T	CONTINGENCY 'AP-P1-2-WP-345-311T' /* ARMSTRONG -HOMERCITY 345KV DISCONNECT BRANCH FROM BUS 235129 TO BUS 200769 CKT 1 /* 01ARMSTRONG 345 26HOMER CY 345 END
PN-P2-3-PN-115-19H	CONTINGENCY 'PN-P2-3-PN-115-19H' /* EAST TOWANDA STUCK 115KV BKR (BUS 2/EAST SAYRE) OPEN BRANCH FROM BUS 200674 TO BUS 200676 CKT 1 /* EAST TOWANDA - EAST SAYRE 115KV LINE OPEN BRANCH FROM BUS 200674 TO BUS 200689 CKT 5 /* EAST TOWANDA #5 115/34.5KV XFMR REDUCE BUS 200674 SHUNT BY 100 PERCENT /* EAST TOWANDA 115KV CAP END
235104 01CABOT 500 239280 02CRNBRY 500 1	CONTINGENCY '235104 01CABOT 500 239280 02CRNBRY 500 1' / 8388 OPEN BRANCH FROM BUS 235104 TO BUS 239280 CKT 1 / 235104 01CABOT 500 239280 02CRNBRY 500 1 END
PJM_P1_APS_B_G692	CONTINGENCY 'PJM_P1_APS_B_G692' / 200011 KEYSTONE 500 235104 01CABOT 500 1 OPEN BRANCH FROM BUS 200011 TO BUS 235104 CKT 1 END

Contingency Name	Contingency Definition
ATSI-P7-1-CEI-345-016	CONTINGENCY 'ATSI-P7-1-CEI-345-016' /* PERRY-NORTHFEILD AND PERRY-LC 345KV LINE OUTAGES DISCONNECT BRANCH FROM BUS 239036 TO BUS 239358 CKT 1 /* 02PERRY 345 02NFIELD 345 DISCONNECT BRANCH FROM BUS 239036 TO BUS 239334 CKT 1 /* 02PERRY 345 02L.CENTER 345 END
ATSI-P7-1-CEI-345-001-A	CONTINGENCY 'ATSI-P7-1-CEI-345-001-A' /* AVON-BEAVER #1 AND #2 345KV LINE OUTAGES DISCONNECT BRANCH FROM BUS 238551 TO BUS 239725 CKT 1 /* 02AVON 345 02LAKEAVE 345 DISCONNECT BRANCH FROM BUS 238551 TO BUS 239725 CKT 2 /* 02AVON 345 02LAKEAVE 345 END
PN-P1-2-PN-115-038	CONTINGENCY 'PN-P1-2-PN-115-038' /* EAST TOWANDA - EAST SAYRE 115KV DISCONNECT BRANCH FROM BUS 200674 TO BUS 200676 CKT 1 /* 26TOWANDA 115 26E.SAYRE 115 END
PN-P2-3-PN-345-3A	CONTINGENCY 'PN-P2-3-PN-345-3A' /* 724 DISCONNECT BRANCH FROM BUS 200826 TO BUS 200828 TO BUS 200829 CKT 1/* 26HANDSMLK 345 26HNSMLK 1 14 26HNSMLK 2 13.80 DISCONNECT BRANCH FROM BUS 200826 TO BUS 200830 CKT 1 /* 26HANDSMLK 345 26HNSMLK 3 14 DISCONNECT BRANCH FROM BUS 200826 TO BUS 200831 TO BUS 200832 CKT 1/* 26HANDSMLK 345 26HNSMLK 4 14 26HNSMLK 5 13.80 DISCONNECT BRANCH FROM BUS 200595 TO BUS 200826 CKT 1 /* 26WAYNE 345 26HANDSMLK 345 REMOVE MACHINE 1 FROM BUS 200828 /* 26HNSMLK 1 14 REMOVE MACHINE 2 FROM BUS 200829 /* 26HNSMLK 2 14 REMOVE MACHINE 3 FROM BUS 200830 /* 26HNSMLK 3 14 REMOVE MACHINE 4 FROM BUS 200831 /* 26HNSMLK 4 14 REMOVE MACHINE 5 FROM BUS 200832 /* 26HNSMLK 5 14 END
PN-P2-3-PN-230-6G	CONTINGENCY 'PN-P2-3-PN-230-6G' /* ERIE SOUTH 230KV SB 35 OPEN BUS 200819 /*ERIE SOUTH 1 230KV BUS OPEN BUS 200918 /*ERIE SOUTH 230 KV BUS TIE END
Base Case	
PN-P1-2-PN-345-107T	CONTINGENCY 'PN-P1-2-PN-345-107T' /* ERIE WEST - ASHTABULA - PERRY 345KV DISCONNECT BRANCH FROM BUS 200599 TO BUS 238547 CKT 1 /* 26ERIE W 345 02AT 345 DISCONNECT BRANCH FROM BUS 238547 TO BUS 239082 CKT 1 /* 02AT 345 02S8-ATT 345 DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1 /* 02AT 345 02PERRY 345 DISCONNECT BUS 238547 /* 02AT 345 END
PN-P1-2-PN-230-027	CONTINGENCY 'PN-P1-2-PN-230-027' /* ERIE SOUTH - FOUR MILE JCT. 230KV LINE DISCONNECT BRANCH FROM BUS 200928 TO BUS 200819 CKT 1 /* 26FOURMILE 230 26ERIE SE 230 END

Short Circuit

13.9 Short Circuit

The following Breakers are overduty:

None

14 Attachment 1 – One Line Diagram

15 Attachment 2 – Project Location