#Y3-063 – State Line 138kV
Generation Interconnection

General

The Interconnection Customer is proposing an 1161MW Capacity combined cycle natural gas facility to be interconnected to the ComEd transmission system and located in Lake County, IN. The proposed in-service date for this project is June 1, 2018.

This Generation Interconnection Feasibility Study provides analysis results to aid the Interconnection Customer in assessing the practicality and cost of incorporating the facility into the PJM system.

Facilities to Accommodate the Interconnection

Scope of Direct Connection Work

The Y3-063 project will connect directly to the Station 7 State Line 138kV substation. To accommodate this interconnection, installation of a three new 138kV breakers at the Station 7 State Line substation, along with relaying, metering, RTU, SCADA and other miscellaneous supporting equipment will be required. The direct connects are estimated to cost approximately **$9,000,000** to interconnect and take a minimum of **18 to 24 months** after the receipt of an executed Construction Service Agreement to complete this work. The cost estimate above does not include any of the upgrades listed in the Network Impacts section of the report.

The Interconnection Customer is responsible for constructing all of the Interconnection Customer-owned facilities on the Interconnection Customer's side of the Point of Interconnection.

Revenue Metering and SCADA Requirements

For PJM: The Interconnection Customer will install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for Interconnection Customer's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Section 24.1 to 24.2.

For ComEd: The Interconnection Customer will install equipment necessary to provide bi-directional Revenue Metering (KWH, KVARH) and real time data (KW, KVAR, circuit breaker status, and 138 kV voltage) for IC's generating Resource. See ComEd Applicable Standards available on the PJM website ("TO Standards") – "Exelon Energy Delivery Interconnection Guidelines (Generators Greater than 20 MW)".

Network Impacts

The Y3-063 project was studied as an 1161MW (1161MW Capacity) injection into the ComEd area at the State Line substation. Project Y3-063 was evaluated for compliance with reliability criteria for summer peak conditions in 2017.

Potential network impacts were as follows:

Table 2: Contingency List	
Contingency Name	**Description**
023-65-BT2-3__	CONTINGENCY '023-65-BT2-3__' TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765 TRIP BRANCH FROM BUS 270607 TO BUS 270630 CKT 1 / COLLI; 765 PLANO; 765 END
023-65-BT4-5__	CONTINGENCY '023-65-BT4-5__' TRIP BRANCH FROM BUS 275168 TO BUS 270607 CKT 1 / COLLI;2M 345 COLLI; 765 TRIP BRANCH FROM BUS 275168 TO BUS 270697 CKT 1 / COLLI;2M 345 COLLI; R 345 TRIP BRANCH FROM BUS 275168 TO BUS 275268 CKT 1 / COLLI;2M 345 COLLI;2C 33 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765 END
112-65-BT2-3__	CONTINGENCY '112-65-BT2-3__' TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1 / WILTO; 765 COLLI; 765 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1 / WILTO;3M 345 WILTO; 765 TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1 / WILTO;3M 345 WILTO; B 345 TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1 / WILTO;3M 345 WILTO;3C 33 END
112-65-BT3-4__	CONTINGENCY '112-65-BT3-4__' TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765

	TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1 345 WILTO; 765	/ WILTO;3M
	TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1 345 WILTO; B 345	/ WILTO;3M
	TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1 345 WILTO;3C 33	/ WILTO;3M
	END	
112-65-BT4-5__	CONTINGENCY '112-65-BT4-5__'	
	TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 765 05DUMONT 765	/ WILTO;
	TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1 345 WILTO; 765	/ WILTO;4M
	TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1 345 WILTO; R 345	/ WILTO;4M
	TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1 345 WILTO;4C 33	/ WILTO;4M
	END	
112-65-BT5-6__	CONTINGENCY '112-65-BT5-6__'	
	TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1 765 COLLI; 765	/ WILTO;
	TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1 345 WILTO; 765	/ WILTO;4M
	TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1 345 WILTO; R 345	/ WILTO;4M
	TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1 345 WILTO;4C 33	/ WILTO;4M
	END	
138-L0703__B-C	CONTINGENCY '138-L0703__B-C'	
	TRIP BRANCH FROM BUS 271926 TO BUS 274780 CKT 1 138 RIVER;BU 138	/ Z494 ; B
	TRIP BRANCH FROM BUS 272480 TO BUS 271652 CKT 1 138 HEGEW; B 138	/ Z715 ;BT
	TRIP BRANCH FROM BUS 272480 TO BUS 272482 CKT 1 138 Z715 ; B 138	/ Z715 ;BT
	TRIP BRANCH FROM BUS 272482 TO BUS 271926 CKT 1 138 Z494 ; B 138	/ Z715 ; B
	TRIP BRANCH FROM BUS 272502 TO BUS 272480 CKT 1 138 Z715 ;BT 138	/ SLINE; B

	MOVE 100 PERCENT LOAD FROM BUS 272482 TO BUS 272483 / Z715 ; B 138 Z715 ; R 138 END
138-L0708__B-C	CONTINGENCY '138-L0708__B-C' TRIP BRANCH FROM BUS 271636 TO BUS 271172 CKT 1 / HARBO;BT 138 CALUM; B 138 TRIP BRANCH FROM BUS 271636 TO BUS 271634 CKT 1 / HARBO;BT 138 HARBO; B 138 TRIP BRANCH FROM BUS 272502 TO BUS 271636 CKT 1 / SLINE; B 138 HARBO;BT 138 TRIP BRANCH FROM BUS 272502 TO BUS 272504 CKT 1 / SLINE; B 138 SLINE;3B 138 END
1733_C2_A	CONTINGENCY '1733_C2_A' OPEN BRANCH FROM BUS 907040 TO BUS 243207 CKT 1 / 243206 05DUMONT 765 243207 05GRNTWN 765 1 OPEN BRANCH FROM BUS 243207 TO BUS 252004 CKT 1 / 243207 05GRNTWN 765 252004 08GRNTWN 1.00 1 OPEN BRANCH FROM BUS 249619 TO BUS 252004 CKT 1 / 249619 08GRNTWN 230 252004 08GRNTWN 1.00 1 OPEN BRANCH FROM BUS 249741 TO BUS 252004 CKT 1 / 249741 08GRTOW2 138 252004 08GRNTWN 1.00 1 END
1750_C2	CONTINGENCY '1750_C2' OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTO; 765 1 OPEN BRANCH FROM BUS 243206 TO BUS 243219 CKT 1 / 243206 05DUMONT 765 243219 05DUMONT 345 1 END
2978_C2_A	CONTINGENCY '2978_C2_A' OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1 / 243206 05DUMONT 765 243207 05GRNTWN 765 1 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTO; 765 1 END
6189_C2_05HANG R 765-D1	CONTINGENCY '6189_C2_05HANG R 765-D1' OPEN BRANCH FROM BUS 242921 TO BUS 242924 CKT 1 / 242921

	05CORNU 765 242924 05HANG R 765 1 OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1 END
6991_C2_05GRNTWN 765-T1_A	CONTINGENCY '6991_C2_05GRNTWN 765-T1_A' OPEN BRANCH FROM BUS 907040 TO BUS 243207 CKT 1 / 243206 05DUMONT 765 243207 05GRNTWN 765 1 OPEN BRANCH FROM BUS 243207 TO BUS 249742 CKT 1 / 243207 05GRNTWN 765 249742 08GRTOWN 138 1 OPEN BRANCH FROM BUS 243312 TO BUS 249742 CKT 1 / 243312 05HUMMEL 138 249742 08GRTOWN 138 1 OPEN BRANCH FROM BUS 249742 TO BUS 247523 CKT Z1 / 249742 08GRTOWN 138 247523 U4-039 C 138 Z1 REMOVE UNIT 1C FROM BUS 247523 / 247523 U4-039 C 138 END
7022_B2_TOR8001689	CONTINGENCY '7022_B2_TOR8001689' OPEN BRANCH FROM BUS 256019 TO BUS 247502 CKT 1 / 256019 18PALISD 345 247502 T-094 345 1 END
7024_B2_TOR8201690	CONTINGENCY '7024_B2_TOR8201690' OPEN BRANCH FROM BUS 256019 TO BUS 247502 CKT 2 / 256019 18PALISD 345 247502 T-094 345 2 END
709_C2_05HANG R 765-D2	CONTINGENCY '709_C2_05HANG R 765-D2' OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1 END
C5-TWL-CR040_A	CONTINGENCY 'C5-TWL-CR040_A' /* DAVIS BESSE-BEAVER + DAVIS BESSE-HAYES 345KV DISCONNECT BRANCH FROM BUS 238654 TO BUS 239289 CKT 1 /* 02DAV-BE 345.00 02HAYES 345.00 DISCONNECT BRANCH FROM BUS 238654 TO BUS 907060 CKT 1 /* 02DAV-BE 345.00 02BEAVER 345.00 END
C5-TWL-CR040_B	CONTINGENCY 'C5-TWL-CR040_B' /* DAVIS BESSE-BEAVER + DAVIS BESSE-HAYES 345KV DISCONNECT BRANCH FROM BUS 238654 TO BUS 239289 CKT 1 /*

	02DAV-BE 345.00 02HAYES 345.00 DISCONNECT BRANCH FROM BUS 907060 TO BUS 238569 CKT 1 /* 02DAV-BE 345.00 02BEAVER 345.00 END
C5-TWL-CR041_A	CONTINGENCY 'C5-TWL-CR041_A' /* DAVIS BESSE-BEAVER + BEAVER-HAYES 345KV DISCONNECT BRANCH FROM BUS 238569 TO BUS 239289 CKT 1 /* 02BEAVER 345.00 02HAYES 345.00 DISCONNECT BRANCH FROM BUS 238654 TO BUS 907060 CKT 1 /* 02DAV-BE 345.00 02BEAVER 345.00 END
C5-TWL-CR041_B	CONTINGENCY 'C5-TWL-CR041_B' /* DAVIS BESSE-BEAVER + BEAVER-HAYES 345KV DISCONNECT BRANCH FROM BUS 238569 TO BUS 239289 CKT 1 /* 02BEAVER 345.00 02HAYES 345.00 DISCONNECT BRANCH FROM BUS 907060 TO BUS 238569 CKT 1 /* 02DAV-BE 345.00 02BEAVER 345.00 END

Generator Deliverability

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

Table 3: Generator Deliverability Impact

	Contingency			Bus			Loading		Rating			
Item #	Type	Name	Overloaded Element	From	To	Ckt	Initial	Final	Type	MVA	MW Contribution	Appendix #
1a	N-1	138-L0703__B-C	SLINE; B-17ROXANA 138 kV line	272502	255172	1	1.38	100.61	ER	253	258.04	1
1b	N-1	138-L0708__B-C	SLINE;2S-WASHI; B 138 kV line	272506	272726	1	87.83	114.06	ER	253	66.38	11
1c	N-1	138-L0708__B-C	SLINE;3B-SLINE;2S 138 kV line	272504	272506	1	87.91	114.14	ER	253	66.38	14

Item 1a. (CE - MISO NIPS) The SLINE; B-17ROXANA 138 kV line (from bus 272502 to bus 255172 ckt 1) loads from 1.38% to 100.61% (**DC power flow**) of its emergency rating (253 MVA) for the single line contingency outage of '138-L0703__B-C'. This project contributes approximately 258.04 MW to the thermal violation.

CONTINGENCY '138-L0703__B-C'
TRIP BRANCH FROM BUS 271926 TO BUS 274780 CKT 1 / Z494 ; B 138 RIVER;BU 138

TRIP BRANCH FROM BUS 272480 TO BUS 271652 CKT 1 / Z715 ;BT 138 HEGEW; B 138
TRIP BRANCH FROM BUS 272480 TO BUS 272482 CKT 1 / Z715 ;BT 138 Z715 ; B 138
TRIP BRANCH FROM BUS 272482 TO BUS 271926 CKT 1 / Z715 ; B 138 Z494 ; B 138
TRIP BRANCH FROM BUS 272502 TO BUS 272480 CKT 1 / SLINE; B 138 Z715 ;BT 138
MOVE 100 PERCENT LOAD FROM BUS 272482 TO BUS 272483 / Z715 ; B 138 Z715 ; R 138
END

Please refer to Appendix 1 for a table containing the generators having contribution to this flowgate.

Item 1b. (CE - CE) The SLINE;2S-WASHI; B 138 kV line (from bus 272506 to bus 272726 ckt 1) loads from 87.83% to 114.06% (**DC power flow**) of its emergency rating (253 MVA) for the single line contingency outage of '138-L0708__B-C'. This project contributes approximately 66.38 MW to the thermal violation.

CONTINGENCY '138-L0708__B-C'
TRIP BRANCH FROM BUS 271636 TO BUS 271172 CKT 1 / HARBO;BT 138 CALUM; B 138
TRIP BRANCH FROM BUS 271636 TO BUS 271634 CKT 1 / HARBO;BT 138 HARBO; B 138
TRIP BRANCH FROM BUS 272502 TO BUS 271636 CKT 1 / SLINE; B 138 HARBO;BT 138
TRIP BRANCH FROM BUS 272502 TO BUS 272504 CKT 1 / SLINE; B 138 SLINE;3B 138
END

Please refer to Appendix 11 for a table containing the generators having contribution to this flowgate.

Item 1c. (CE - CE) The SLINE;3B-SLINE;2S 138 kV line (from bus 272504 to bus 272506 ckt 1) loads from 87.91% to 114.14% (**DC power flow**) of its emergency rating (253 MVA) for the single line contingency outage of '138-L0708__B-C'. This project contributes approximately 66.38 MW to the thermal violation.

CONTINGENCY '138-L0708__B-C'
TRIP BRANCH FROM BUS 271636 TO BUS 271172 CKT 1 / HARBO;BT 138 CALUM; B 138
TRIP BRANCH FROM BUS 271636 TO BUS 271634 CKT 1 / HARBO;BT 138 HARBO; B 138

TRIP BRANCH FROM BUS 272502 TO BUS 271636 CKT 1 / SLINE; B 138 HARBO;BT 138
TRIP BRANCH FROM BUS 272502 TO BUS 272504 CKT 1 / SLINE; B 138 SLINE;3B 138
END

Please refer to Appendix 14 for a table containing the generators having contribution to this flowgate.

Multiple Facility Contingency

(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)

Table 4: Multiple Facility Contingency

	Contingency			Bus			Loading		Rating			
Item #	Type	Name	Overloaded Element	From	To	Ckt	Initial	Final	Type	MVA	MW Contribution	Appendix #
2a	DCTL	C5-TWL-CR041_A	02HAYES-W3-059A_AT6 138 kV line	239290	903510	1	97.23	98.54	ER	194	12.37	2
2b	DCTL	C5-TWL-CR041_B	02HAYES-W3-059A_AT6 138 kV line	239290	903510	1	97.23	98.54	ER	194	12.37	3
2c	LFFB	112-65-BT4-5__	17GRNACR-GACR; T 345 kV line	255104	270771	1	95.13	105.6	ER	1237	129.45	4
2d	LFFB	112-65-BT3-4__	17GRNACR-GACR; T 345 kV line	255104	270771	1	95.13	105.59	ER	1237	129.45	5
2e	LFFB	2978_C2_A	17GRNACR-GACR; T 345 kV line	255104	270771	1	95.79	105.99	ER	1237	126.2	6

Item 2a. (FE - FE) The 02HAYES-W3-059A_AT6 138 kV line (from bus 239290 to bus 903510 ckt 1) loads from 97.23% to 98.54% (**DC power flow**) of its emergency rating (194 MVA) for the tower line contingency outage of 'C5-TWL-CR041_A'. This project contributes approximately 12.37 MW to the thermal violation.

CONTINGENCY 'C5-TWL-CR041_A' /* DAVIS BESSE-BEAVER + BEAVER-HAYES 345KV
DISCONNECT BRANCH FROM BUS 238569 TO BUS 239289 CKT 1 /* 02BEAVER 345.00 02HAYES 345.00
DISCONNECT BRANCH FROM BUS 238654 TO BUS 907060 CKT 1 /* 02DAV-BE 345.00 02BEAVER 345.00
END

Please refer to Appendix 2 for a table containing the generators having contribution to this flowgate.

Item 2b. (FE - FE) The 02HAYES-W3-059A_AT6 138 kV line (from bus 239290 to bus 903510 ckt 1) loads from 97.23% to 98.54% (**DC power flow**) of its emergency rating (194 MVA) for the tower line contingency outage of 'C5-TWL-CR041_B'. This project contributes approximately 12.37 MW to the thermal violation.

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CONTINGENCY 'C5-TWL-CR041_B'                    /* DAVIS BESSE-BEAVER +
BEAVER-HAYES 345KV
  DISCONNECT BRANCH FROM BUS 238569 TO BUS 239289 CKT 1        /* 02BEAVER
345.00 02HAYES 345.00
  DISCONNECT BRANCH FROM BUS 907060 TO BUS 238569 CKT 1        /* 02DAV-BE
345.00 02BEAVER 345.00
  END
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Please refer to Appendix 3 for a table containing the generators having contribution to this flowgate.

Item 2c. (MISO NIPS - CE) The 17GRNACR-G ACR; T 345 kV line (from bus 255104 to bus 270771 ckt 1) loads from 95.13% to 105.6% (**DC power flow**) of its emergency rating (1237 MVA) for the line fault with failed breaker contingency outage of '112-65-BT4-5__'. This project contributes approximately 129.45 MW to the thermal violation.

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CONTINGENCY '112-65-BT4-5__'
  TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765
05DUMONT 765
  TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1          / WILTO;4M 345
WILTO; 765
  TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1          / WILTO;4M 345
WILTO; R 345
  TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1          / WILTO;4M 345
WILTO;4C 33
  END
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Please refer to Appendix 4 for a table containing the generators having contribution to this flowgate.

Item 2d. (MISO NIPS - CE) The 17GRNACR-G ACR; T 345 kV line (from bus 255104 to bus 270771 ckt 1) loads from 95.13% to 105.59% (**DC power flow**) of its emergency rating (1237 MVA) for the line fault with failed breaker contingency outage of '112-65-BT3-4__'. This project contributes approximately 129.45 MW to the thermal violation.

CONTINGENCY '112-65-BT3-4__'
TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765
TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1 / WILTO;3M 345 WILTO; 765
TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1 / WILTO;3M 345 WILTO; B 345
TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1 / WILTO;3M 345 WILTO;3C 33
END

Please refer to Appendix 5 for a table containing the generators having contribution to this flowgate.

Item 2e. (MISO NIPS - CE) The 17GRNACR-G ACR; T 345 kV line (from bus 255104 to bus 270771 ckt 1) loads from 95.79% to 105.99% (**DC power flow**) of its emergency rating (1237 MVA) for the line fault with failed breaker contingency outage of '2978_C2_A'. This project contributes approximately 126.2 MW to the thermal violation.

CONTINGENCY '2978_C2_A'
OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1 / 243206 05DUMONT 765 243207 05GRNTWN 765 1
OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTO; 765 1
END

Please refer to Appendix 6 for a table containing the generators having contribution to this flowgate.

Short Circuit
(Summary of impacted circuit breakers)

PJM has completed the feasibility short circuit analysis of the Y3-063 queue project **STATE LINE 138 kV.** The feasibility short circuit analysis does no incorporate the impacts of existing ComEd System Planning Operating Guides (SPOG). PJM will perform a more detailed analysis as a part of the System Impact Study which could identify additional circuit breaker upgrades. One option was considered during this study: the option was a direct connection to STLIN38R 781 for the Steam Turbine Generator and a direct connection to STLIN38B for the Combustion Turbine Generators. PJM analysis found **10 new breakers,** to be over-duty in the COMED transmission area. The new over-duty breakers are listed below:

Bus_NO	BUS	BREAKER	Duty % with Y3-063_ComEd	Duty % without Y3-063_ComEd	Duty % Difference	Notes
0	STLIN38R 138.kV	7 L0703	119.30%	84.30%	35.00%	New Over-duty
0	STLIN38R 138.kV	7 L0706	113.00%	80.90%	32.10%	New Over-duty
0	STLIN38R 781 138.kV	7 L0707	106.30%	91.90%	14.40%	New Over-duty
0	STLIN38R 727 138.kV	7 L0716	105.90%	91.50%	14.40%	New Over-duty
0	STLIN38B 138.kV	7 32-34B732	103.80%	81.60%	22.20%	New Over-duty
0	STLIN38B 779 138.kV	7 732 L0708	103.70%	94.10%	9.60%	New Over-duty
0	STLIN38R 138.kV	7 TR 4R	103.70%	<80.00%	>23.70%	New Over-duty
0	HARBR38B 138.kV	170 BT4-5	103.10%	89.60%	13.50%	New Over-duty
0	HGWSCH38 770 138.kV	55 1-2 L0703	102.90%	94.40%	8.50%	New Over-duty
0	STLIN38R 138.kV	7 L13853	102.20%	<80.00%	>22.20%	New Over-duty

The following upgrades in **Table 5** below will mitigate the ComEd over-duty breakers listed above:

Table 5. Breaker Replacement Cost Estimate	
Description	**Total Cost**
Replace breaker 7 L0703 at Station 7 State Line substation.	$1,500,000
Replace breaker 7 L0706 at Station 7 State Line substation.	$1,500,000
Replace breaker 7 L0707 at Station 7 State Line substation.	$1,500,000
Replace breaker 7 L0716 at Station 7 State Line substation.	$1,500,000
Replace breaker 7 32-34B732 at Station 7 State Line substation.	$1,500,000
Replace breaker 7 732 L0708 at Station 7 State Line substation.	$1,500,000
Replace breaker 7 TR 4R at Station 7 State Line substation.	$1,500,000
Replace breaker 170 BT4-5 at TSS 170 Harbor substation.	$1,500,000
Replace breaker 55 1-2 L0703 at TSS 55 Hegewisch substation.	$1,500,000
Replace breaker 7 L13853 at Station 7 State Line substation.	$1,500,000
Total	**$15,000,000**

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)

Table 6: Contribution to Previously Identified												
	Contingency			Bus			Loading		Rating			
Item #	Type	Name	Overloaded Element	From	To	Ckt	Initial	Final	Type	MVA	MW Contribution	Appendix #
3a	LFFB	112-65-BT4-5__	05OLIVE-05COOK 345 kV line	243229	243215	1	108.29	109.48	ER	1409	103.87	7
3b	LFFB	112-65-BT3-4__	05OLIVE-05COOK 345 kV line	243229	243215	1	108.29	109.48	ER	1409	103.87	8
3c	LFFB	2978_C2_A	05OLIVE-05COOK 345 kV line	243229	243215	1	109.02	110.15	ER	1409	98.81	9
3d	LFFB	709_C2_05HANG R 765-D2	05SORENS-05MARYSV 765 kV line	246999	242928	1	111.39	112.27	ER	4465	309.67	10
3e	LFFB	6991_C2_05GRNTWN 765-T1_A	05DUMONT-05SORENS 765 kV line	243206	246999	1	111.52	112.49	ER	4465	309.13	12
3f	LFFB	1733_C2_A	05DUMONT-05SORENS 765 kV line	243206	246999	1	111.54	112.53	ER	4465	313.79	13
3g	DCTL	C5-TWL-CR041_A	W3-059A_AT6-02AVERY 138 kV line	903510	238549	1	110.68	111.98	ER	194	12.37	15
3h	DCTL	C5-TWL-CR041_B	W3-059A_AT6-02AVERY 138 kV line	903510	238549	1	110.68	111.98	ER	194	12.37	16
3i	LFFB	6189_C2_05HANGR 765-D1	05DUMONT-05SORENS 765 kV line	243206	246999	1	113.78	114.65	ER	4465	278.72	17
3j	LFFB	6189_C2_05HANGR 765-D1	05SORENS-05MARYSV 765 kV line	246999	242928	1	114.37	115.24	ER	4465	308.68	18
3k	N-1	7024_B2_TOR8201690	T-094-18PALISD 345 kV line	247502	256019	1	109.45	115.47	ER	1409	84.78	19
3l	N-1	7022_B2_TOR8001689	T-094-18PALISD 345 kV line	247502	256019	2	109.64	115.67	ER	1409	84.94	20
3m	LFFB	1750_C2	05OLIVE-05COOK 345 kV line	243229	243215	1	114.73	116.07	ER	1409	116.21	21
3n	LFFB	112-65-BT3-4__	G ACR; T-05OLIVE 345 kV line	270771	243229	1	105.3	116.89	ER	1117	129.45	22

3o	LFFB	112-65-BT4-5__	G ACR; T-05OLIVE 345 kV line	270771	243229	1	105.31	116.89	ER	1117	129.45	23
3p	LFFB	2978_C2_A	G ACR; T-05OLIVE 345 kV line	270771	243229	1	106.03	117.33	ER	1117	126.2	24
3q	DCTL	C5-TWL-CR040_B	05HOWARD-02BRKSID 138 kV line	243024	238586	1	116.31	117.57	ER	179	10.74	25
3r	DCTL	C5-TWL-CR040_A	05HOWARD-02BRKSID 138 kV line	243024	238586	1	116.31	117.57	ER	179	10.74	26
3s	LFFB	112-65-BT5-6__	WILTO; 765/345 kV transformer	275232	270644	1	128.03	129.78	ER	1601	173.95	27
3t	LFFB	112-65-BT2-3__	WILTO; 765/345 kV transformer	275233	270644	1	130.62	132.41	ER	1601	177.59	28
3u	LFFB	112-65-BT5-6__	WILTO; B-WILTO;3M 345 kV line	270926	275232	1	142.18	143.93	ER	1601	173.95	29
3v	LFFB	112-65-BT2-3__	WILTO; R-WILTO;4M 345 kV line	270927	275233	1	145.05	146.84	ER	1601	177.59	30
3w	DCTL	C5-TWL-CR041_B	02HAYES 345/138 kV transformer	239289	239290	1	144.9	146.04	ER	408	26.37	31
3x	LFFB	023-65-BT4-5__	17STLWEL-05DUMONT 345 kV line	255113	243219	1	155.03	173.99	ER	1409	267.13	32
3y	LFFB	023-65-BT2-3__	17STLWEL-05DUMONT 345 kV line	255113	243219	1	155.29	174.26	ER	1409	267.2	33
3z	LFFB	2978_C2_A	17STLWEL-05DUMONT 345 kV line	255113	243219	1	159.21	177.37	ER	1409	255.87	34
3aa	DCTL	C5-TWL-CR040_B	02OTTAWA-02LAKVEW 138 kV line	239030	238874	1	196.37	197.05	ER	375	33.55	35
3bb	DCTL	C5-TWL-CR040_B	02LAKVEW-02GRNFLD 138 kV line	238874	238768	1	212.38	213.18	ER	316	33.55	36

Item 3a. (AEP - AEP) The 05OLIVE-05COOK 345 kV line (from bus 243229 to bus 243215 ckt 1) loads from 108.29% to 109.48% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of '112-65-BT4-5__'. This project contributes approximately 103.87 MW to the thermal violation.

CONTINGENCY '112-65-BT4-5__'
TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765
TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1 / WILTO;4M 345 WILTO; 765

TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1 / WILTO;4M 345 WILTO; R 345
TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1 / WILTO;4M 345 WILTO;4C 33
END

Please refer to Appendix 7 for a table containing the generators having contribution to this flowgate.

Item 3b. (AEP - AEP) The 05OLIVE-05COOK 345 kV line (from bus 243229 to bus 243215 ckt 1) loads from 108.29% to 109.48% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of '112-65-BT3-4__'. This project contributes approximately 103.87 MW to the thermal violation.

CONTINGENCY '112-65-BT3-4__'
TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765
TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1 / WILTO;3M 345 WILTO; 765
TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1 / WILTO;3M 345 WILTO; B 345
TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1 / WILTO;3M 345 WILTO;3C 33
END

Please refer to Appendix 8 for a table containing the generators having contribution to this flowgate.

Item 3c. (AEP - AEP) The 05OLIVE-05COOK 345 kV line (from bus 243229 to bus 243215 ckt 1) loads from 109.02% to 110.15% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of '2978_C2_A'. This project contributes approximately 98.81 MW to the thermal violation.

CONTINGENCY '2978_C2_A'
OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1 / 243206 05DUMONT 765 243207 05GRNTWN 765 1
OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTO; 765 1
END

Please refer to Appendix 9 for a table containing the generators having contribution to this flowgate.

Item 3d. (AEP - AEP) The 05SORENS-05MARYSV 765 kV line (from bus 246999 to bus 242928 ckt 1) loads from 111.39% to 112.27% (**DC power flow**) of its emergency rating

(4465 MVA) for the line fault with failed breaker contingency outage of '709_C2_05HANG R 765-D2'. This project contributes approximately 309.67 MW to the thermal violation.

CONTINGENCY '709_C2_05HANG R 765-D2'
OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1
END

Please refer to Appendix 10 for a table containing the generators having contribution to this flowgate.

Item 3e. (AEP - AEP) The 05DUMONT-05SORENS 765 kV line (from bus 243206 to bus 246999 ckt 1) loads from 111.52% to 112.49% (**DC power flow**) of its emergency rating (4465 MVA) for the line fault with failed breaker contingency outage of '6991_C2_05GRNTWN 765-T1_A'. This project contributes approximately 309.13 MW to the thermal violation.

CONTINGENCY '6991_C2_05GRNTWN 765-T1_A'
OPEN BRANCH FROM BUS 907040 TO BUS 243207 CKT 1 / 243206 05DUMONT 765 243207 05GRNTWN 765 1
OPEN BRANCH FROM BUS 243207 TO BUS 249742 CKT 1 / 243207 05GRNTWN 765 249742 08GRTOWN 138 1
OPEN BRANCH FROM BUS 243312 TO BUS 249742 CKT 1 / 243312 05HUMMEL 138 249742 08GRTOWN 138 1
OPEN BRANCH FROM BUS 249742 TO BUS 247523 CKT Z1 / 249742 08GRTOWN 138 247523 U4-039 C 138 Z1
REMOVE UNIT 1C FROM BUS 247523 / 247523 U4-039 C 138
END

Please refer to Appendix 12 for a table containing the generators having contribution to this flowgate.

Item 3f. (AEP - AEP) The 05DUMONT-05SORENS 765 kV line (from bus 243206 to bus 246999 ckt 1) loads from 111.54% to 112.53% (**DC power flow**) of its emergency rating (4465 MVA) for the line fault with failed breaker contingency outage of '1733_C2_A'. This project contributes approximately 313.79 MW to the thermal violation.

CONTINGENCY '1733_C2_A'
OPEN BRANCH FROM BUS 907040 TO BUS 243207 CKT 1 / 243206 05DUMONT 765 243207 05GRNTWN 765 1
OPEN BRANCH FROM BUS 243207 TO BUS 252004 CKT 1 / 243207 05GRNTWN 765 252004 08GRNTWN 1.00 1
OPEN BRANCH FROM BUS 249619 TO BUS 252004 CKT 1 / 249619 08GRNTWN 230 252004 08GRNTWN 1.00 1
OPEN BRANCH FROM BUS 249741 TO BUS 252004 CKT 1 / 249741 08GRTOW2 138 252004 08GRNTWN 1.00 1

END

Please refer to Appendix 13 for a table containing the generators having contribution to this flowgate.

Item 3g. (FE - FE) The W3-059A_AT6-02AVERY 138 kV line (from bus 903510 to bus 238549 ckt 1) loads from 110.68% to 111.98% (**DC power flow**) of its emergency rating (194 MVA) for the tower line contingency outage of 'C5-TWL-CR041_A'. This project contributes approximately 12.37 MW to the thermal violation.

CONTINGENCY 'C5-TWL-CR041_A' /* DAVIS BESSE-BEAVER + BEAVER-HAYES 345KV
DISCONNECT BRANCH FROM BUS 238569 TO BUS 239289 CKT 1 /* 02BEAVER 345.00 02HAYES 345.00
DISCONNECT BRANCH FROM BUS 238654 TO BUS 907060 CKT 1 /* 02DAV-BE 345.00 02BEAVER 345.00
END

Please refer to Appendix 15 for a table containing the generators having contribution to this flowgate.

Item 3h. (FE - FE) The W3-059A_AT6-02AVERY 138 kV line (from bus 903510 to bus 238549 ckt 1) loads from 110.68% to 111.98% (**DC power flow**) of its emergency rating (194 MVA) for the tower line contingency outage of 'C5-TWL-CR041_B'. This project contributes approximately 12.37 MW to the thermal violation.

CONTINGENCY 'C5-TWL-CR041_B' /* DAVIS BESSE-BEAVER + BEAVER-HAYES 345KV
DISCONNECT BRANCH FROM BUS 238569 TO BUS 239289 CKT 1 /* 02BEAVER 345.00 02HAYES 345.00
DISCONNECT BRANCH FROM BUS 907060 TO BUS 238569 CKT 1 /* 02DAV-BE 345.00 02BEAVER 345.00
END

Please refer to Appendix 16 for a table containing the generators having contribution to this flowgate.

Item 3i. (AEP - AEP) The 05DUMONT-05SORENS 765 kV line (from bus 243206 to bus 246999 ckt 1) loads from 113.78% to 114.65% (**DC power flow**) of its emergency rating (4465 MVA) for the line fault with failed breaker contingency outage of '6189_C2_05HANG R 765-D1'. This project contributes approximately 278.72 MW to the thermal violation.

CONTINGENCY '6189_C2_05HANG R 765-D1'
OPEN BRANCH FROM BUS 242921 TO BUS 242924 CKT 1 / 242921 05CORNU 765 242924 05HANG R 765 1

OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1
END

Please refer to Appendix 17 for a table containing the generators having contribution to this flowgate.

Item 3j. (AEP - AEP) The 05SORENS-05MARYSV 765 kV line (from bus 246999 to bus 242928 ckt 1) loads from 114.37% to 115.24% (**DC power flow**) of its emergency rating (4465 MVA) for the line fault with failed breaker contingency outage of '6189_C2_05HANG R 765-D1'. This project contributes approximately 308.68 MW to the thermal violation.

CONTINGENCY '6189_C2_05HANG R 765-D1'
OPEN BRANCH FROM BUS 242921 TO BUS 242924 CKT 1 / 242921 05CORNU 765 242924 05HANG R 765 1
OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1
END

Please refer to Appendix 18 for a table containing the generators having contribution to this flowgate.

Item 3k. (AEP - MISO METC) The T-094-18PALISD 345 kV line (from bus 247502 to bus 256019 ckt 1) loads from 109.45% to 115.47% (**DC power flow**) of its emergency rating (1409 MVA) for the single line contingency outage of '7024_B2_TOR8201690'. This project contributes approximately 84.78 MW to the thermal violation.

CONTINGENCY '7024_B2_TOR8201690'
OPEN BRANCH FROM BUS 256019 TO BUS 247502 CKT 2 / 256019 18PALISD 345 247502 T-094 345 2
END

Please refer to Appendix 19 for a table containing the generators having contribution to this flowgate.

Item 3l. (AEP - MISO METC) The T-094-18PALISD 345 kV line (from bus 247502 to bus 256019 ckt 2) loads from 109.64% to 115.67% (**DC power flow**) of its emergency rating (1409 MVA) for the single line contingency outage of '7022_B2_TOR8001689'. This project contributes approximately 84.94 MW to the thermal violation.

CONTINGENCY '7022_B2_TOR8001689'
OPEN BRANCH FROM BUS 256019 TO BUS 247502 CKT 1 / 256019 18PALISD 345 247502 T-094 345 1
END

Please refer to Appendix 20 for a table containing the generators having contribution to this flowgate.

Item 3m. (AEP - AEP) The 05OLIVE-05COOK 345 kV line (from bus 243229 to bus 243215 ckt 1) loads from 114.73% to 116.07% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of '1750_C2'. This project contributes approximately 116.21 MW to the thermal violation.

CONTINGENCY '1750_C2'
OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTO; 765 1
OPEN BRANCH FROM BUS 243206 TO BUS 243219 CKT 1 / 243206 05DUMONT 765 243219 05DUMONT 345 1
END

Please refer to Appendix 21 for a table containing the generators having contribution to this flowgate.

Item 3n. (CE - AEP) The G ACR; T-05OLIVE 345 kV line (from bus 270771 to bus 243229 ckt 1) loads from 105.3% to 116.89% (**DC power flow**) of its emergency rating (1117 MVA) for the line fault with failed breaker contingency outage of '112-65-BT3-4__'. This project contributes approximately 129.45 MW to the thermal violation.

CONTINGENCY '112-65-BT3-4__'
TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765
TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1 / WILTO;3M 345 WILTO; 765
TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1 / WILTO;3M 345 WILTO; B 345
TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1 / WILTO;3M 345 WILTO;3C 33
END

Please refer to Appendix 22 for a table containing the generators having contribution to this flowgate.

Item 3o. (CE - AEP) The G ACR; T-05OLIVE 345 kV line (from bus 270771 to bus 243229 ckt 1) loads from 105.31% to 116.89% (**DC power flow**) of its emergency rating (1117 MVA) for the line fault with failed breaker contingency outage of '112-65-BT4-5__'. This project contributes approximately 129.45 MW to the thermal violation.

CONTINGENCY '112-65-BT4-5__'
TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765

TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1 / WILTO;4M 345 WILTO; 765
TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1 / WILTO;4M 345 WILTO; R 345
TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1 / WILTO;4M 345 WILTO;4C 33
END

Please refer to Appendix 23 for a table containing the generators having contribution to this flowgate.

Item 3p. (CE - AEP) The G ACR; T-05OLIVE 345 kV line (from bus 270771 to bus 243229 ckt 1) loads from 106.03% to 117.33% (**DC power flow**) of its emergency rating (1117 MVA) for the line fault with failed breaker contingency outage of '2978_C2_A'. This project contributes approximately 126.2 MW to the thermal violation.

CONTINGENCY '2978_C2_A'
OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1 / 243206 05DUMONT 765 243207 05GRNTWN 765 1
OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTO; 765 1
END

Please refer to Appendix 24 for a table containing the generators having contribution to this flowgate.

Item 3q. (AEP - FE) The 05HOWARD-02BRKSID 138 kV line (from bus 243024 to bus 238586 ckt 1) loads from 116.31% to 117.57% (**DC power flow**) of its emergency rating (179 MVA) for the tower line contingency outage of 'C5-TWL-CR040_B'. This project contributes approximately 10.74 MW to the thermal violation.

CONTINGENCY 'C5-TWL-CR040_B' /* DAVIS BESSE-BEAVER + DAVIS BESSE-HAYES 345KV
DISCONNECT BRANCH FROM BUS 238654 TO BUS 239289 CKT 1 /* 02DAV-BE 345.00 02HAYES 345.00
DISCONNECT BRANCH FROM BUS 907060 TO BUS 238569 CKT 1 /* 02DAV-BE 345.00 02BEAVER 345.00
END

Please refer to Appendix 25 for a table containing the generators having contribution to this flowgate.

Item 3r. (AEP - FE) The 05HOWARD-02BRKSID 138 kV line (from bus 243024 to bus 238586 ckt 1) loads from 116.31% to 117.57% (**DC power flow**) of its emergency rating (179 MVA) for the tower line contingency outage of 'C5-TWL-CR040_A'. This project contributes approximately 10.74 MW to the thermal violation.

CONTINGENCY 'C5-TWL-CR040_A' /* DAVIS BESSE-BEAVER + DAVIS BESSE-HAYES 345KV
DISCONNECT BRANCH FROM BUS 238654 TO BUS 239289 CKT 1 /* 02DAV-BE 345.00 02HAYES 345.00
DISCONNECT BRANCH FROM BUS 238654 TO BUS 907060 CKT 1 /* 02DAV-BE 345.00 02BEAVER 345.00
END

Please refer to Appendix 26 for a table containing the generators having contribution to this flowgate.

Item 3s. (CE - CE) The WILTO; 765/345 kV transformer (from bus 275232 to bus 270644 ckt 1) loads from 128.03% to 129.78% (**DC power flow**) of its emergency rating (1601 MVA) for the line fault with failed breaker contingency outage of '112-65-BT5-6__'. This project contributes approximately 173.95 MW to the thermal violation.

CONTINGENCY '112-65-BT5-6__'
TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1 / WILTO; 765 COLLI; 765
TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1 / WILTO;4M 345 WILTO; 765
TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1 / WILTO;4M 345 WILTO; R 345
TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1 / WILTO;4M 345 WILTO;4C 33
END

Please refer to Appendix 27 for a table containing the generators having contribution to this flowgate.

Item 3t. (CE - CE) The WILTO; 765/345 kV transformer (from bus 275233 to bus 270644 ckt 1) loads from 130.62% to 132.41% (**DC power flow**) of its emergency rating (1601 MVA) for the line fault with failed breaker contingency outage of '112-65-BT2-3__'. This project contributes approximately 177.59 MW to the thermal violation.

CONTINGENCY '112-65-BT2-3__'
TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1 / WILTO; 765 COLLI; 765
TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1 / WILTO;3M 345 WILTO; 765
TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1 / WILTO;3M 345 WILTO; B 345
TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1 / WILTO;3M 345 WILTO;3C 33
END

Please refer to Appendix 28 for a table containing the generators having contribution to this flowgate.

Item 3u. (CE - CE) The WILTO; B-WILTO;3M 345 kV line (from bus 270926 to bus 275232 ckt 1) loads from 142.18% to 143.93% (**DC power flow**) of its emergency rating (1601 MVA) for the line fault with failed breaker contingency outage of '112-65-BT5-6__'. This project contributes approximately 173.95 MW to the thermal violation.

CONTINGENCY '112-65-BT5-6__'
TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1 / WILTO; 765 COLLI; 765
TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1 / WILTO;4M 345 WILTO; 765
TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1 / WILTO;4M 345 WILTO; R 345
TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1 / WILTO;4M 345 WILTO;4C 33
END

Please refer to Appendix 29 for a table containing the generators having contribution to this flowgate.

Item 3v. (CE - CE) The WILTO; R-WILTO;4M 345 kV line (from bus 270927 to bus 275233 ckt 1) loads from 145.05% to 146.84% (**DC power flow**) of its emergency rating (1601 MVA) for the line fault with failed breaker contingency outage of '112-65-BT2-3__'. This project contributes approximately 177.59 MW to the thermal violation.

CONTINGENCY '112-65-BT2-3__'
TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1 / WILTO; 765 COLLI; 765
TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1 / WILTO;3M 345 WILTO; 765
TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1 / WILTO;3M 345 WILTO; B 345
TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1 / WILTO;3M 345 WILTO;3C 33
END

Please refer to Appendix 30 for a table containing the generators having contribution to this flowgate.

Item 3w. (FE - FE) The 02HAYES 345/138 kV transformer (from bus 239289 to bus 239290 ckt 1) loads from 144.9% to 146.04% (**DC power flow**) of its emergency rating (408 MVA) for the tower line contingency outage of 'C5-TWL-CR041_B'. This project contributes approximately 26.37 MW to the thermal violation.

CONTINGENCY 'C5-TWL-CR041_B' /* DAVIS BESSE-BEAVER + BEAVER-HAYES 345KV
DISCONNECT BRANCH FROM BUS 238569 TO BUS 239289 CKT 1 /* 02BEAVER 345.00 02HAYES 345.00
DISCONNECT BRANCH FROM BUS 907060 TO BUS 238569 CKT 1 /* 02DAV-BE 345.00 02BEAVER 345.00
END

Please refer to Appendix 31 for a table containing the generators having contribution to this flowgate.

Item 3x. (MISO NIPS - AEP) The 17STLWEL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 155.03% to 173.99% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of '023-65-BT4-5__'. This project contributes approximately 267.13 MW to the thermal violation.

CONTINGENCY '023-65-BT4-5__'
TRIP BRANCH FROM BUS 275168 TO BUS 270607 CKT 1 / COLLI;2M 345 COLLI; 765
TRIP BRANCH FROM BUS 275168 TO BUS 270697 CKT 1 / COLLI;2M 345 COLLI; R 345
TRIP BRANCH FROM BUS 275168 TO BUS 275268 CKT 1 / COLLI;2M 345 COLLI;2C 33
TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765
END

Please refer to Appendix 32 for a table containing the generators having contribution to this flowgate.

Item 3y. (MISO NIPS - AEP) The 17STLWEL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 155.29% to 174.26% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of '023-65-BT2-3__'. This project contributes approximately 267.2 MW to the thermal violation.

CONTINGENCY '023-65-BT2-3__'
TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1 / WILTO; 765 05DUMONT 765
TRIP BRANCH FROM BUS 270607 TO BUS 270630 CKT 1 / COLLI; 765 PLANO; 765
END

Please refer to Appendix 33 for a table containing the generators having contribution to this flowgate.

Item 3z. (MISO NIPS - AEP) The 17STLWEL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 159.21% to 177.37% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of '2978_C2_A'. This project contributes approximately 255.87 MW to the thermal violation.

CONTINGENCY '2978_C2_A'
OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1 / 243206 05DUMONT 765 243207 05GRNTWN 765 1
OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1 / 243206 05DUMONT 765 270644 WILTO; 765 1
END

Please refer to Appendix 34 for a table containing the generators having contribution to this flowgate.

Item 3aa. (FE - FE) The 02OTTAWA-02LAKVEW 138 kV line (from bus 239030 to bus 238874 ckt 1) loads from 196.37% to 197.05% (**DC power flow**) of its emergency rating (375 MVA) for the tower line contingency outage of 'C5-TWL-CR040_B'. This project contributes approximately 33.55 MW to the thermal violation.

CONTINGENCY 'C5-TWL-CR040_B' /* DAVIS BESSE-BEAVER + DAVIS BESSE-HAYES 345KV
DISCONNECT BRANCH FROM BUS 238654 TO BUS 239289 CKT 1 /* 02DAV-BE 345.00 02HAYES 345.00
DISCONNECT BRANCH FROM BUS 907060 TO BUS 238569 CKT 1 /* 02DAV-BE 345.00 02BEAVER 345.00
END

Please refer to Appendix 35 for a table containing the generators having contribution to this flowgate.

Item 3bb. (FE - FE) The 02LAKVEW-02GRNFLD 138 kV line (from bus 238874 to bus 238768 ckt 1) loads from 212.38% to 213.18% (**DC power flow**) of its emergency rating (316 MVA) for the tower line contingency outage of 'C5-TWL-CR040_B'. This project contributes approximately 33.55 MW to the thermal violation.

CONTINGENCY 'C5-TWL-CR040_B' /* DAVIS BESSE-BEAVER + DAVIS BESSE-HAYES 345KV
DISCONNECT BRANCH FROM BUS 238654 TO BUS 239289 CKT 1 /* 02DAV-BE 345.00 02HAYES 345.00
DISCONNECT BRANCH FROM BUS 907060 TO BUS 238569 CKT 1 /* 02DAV-BE 345.00 02BEAVER 345.00
END

Please refer to Appendix 36 for a table containing the generators having contribution to this flowgate.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, I.e. "Network Impacts", initially caused by the addition of this project's generation.)

Generator Deliverability

For Item 1a, the overload of the SLINE; B-17ROXANA 138 kV line does not have a required ComEd upgrade. The limiting facility is owned by NIPSCO. This violation will be further analyzed in the SIS phase.

For Items 1b and 1c, the overloads of the SLINE;2S-WASHI; B 138 kV line and the SLINE;3B-SLINE;2S 138 kV line can be relieved by installing a 138 kV circuit breaker on line 0708. The total estimated cost is **$4,500,000** and will take approximately **18 to 24 months** to complete this work.

Multiple Facility Contingency

For Items 2a and 2b, the overload of the 02HAYES-W3-059A_AT6 138 kV line can be relieved by an existing RTEP baseline upgrade b1930, with an in-service date of 6/1/2015. The circuit rating will increase from 194 MVA to 282 MVA, removing the Y3-063 overloads. As long as the baseline goes in service, this project does not have a contribution to this mitigation. Should the baseline be cancelled, analysis will have to be reviewed again.

For Items 2c, 2c, and 2d, the overloads of the 17GRNACR-G ACR; T 345 kV line does not have a required ComEd upgrade. The ALDR for ComEd's portion of L6615 is 1423 MVA and is based on sag limits on 1414 kcmil ACAR. The limiting facility is owned by NIPSCO. This violation will be further analyzed in the SIS phase.

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contributions to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study.)

For Items 3a, 3b, 3c, and 3m, the overloads of the 05OLIVE-05COOK 345 kV line can be relieved by the following:

The Bundled ACSR 954 conductor is the limiting element.

A sag check is required to determine if the line section can be operated above its emergency rating. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 25 mile section of line would need to be rebuilt. Estimated Cost (2013 Dollars) for the sag study: **$100,000**.

For Items 3d and 3j, the overloads of the 05SORENS-05MARYSV 765 kV line can be relieved by the following:

An engineering study will need to be conducted to determine if the relay thermal limit settings can be adjusted to mitigate the overload. A new relay package will be required if the relay thermal settings cannot be adjusted. Estimated Cost (2013 Dollars) for the relay package: **$300,000**. Replace the Marysville 765 kV Wavetrap (3150A). Estimated Cost (2013 Dollars): **$200,000**. The total estimated cost(2013 Dollars) to complete this work is **$500,000**.

For Items 3e, 3f, and 3i, the overloads of the 05DUMONT-05SORENS 765 kV line can be relieved by replacing the Dumont 765 kV Wavetrap (3150A). The total estimated cost(2013 Dollars) to complete this work is **$200,000**.

For Items 3g, and 3h, the overloads of the W3-059A_AT6-02AVERY 138 kV line can be relieved by an existing RTEP baseline upgrade b1930, with an in-service date of 6/1/2015. The circuit rating will increase from 194 MVA to 282 MVA, removing the Y3-063 overloads. As long as the baseline goes in service, this project does not have a contribution to this mitigation. Should the baseline be cancelled, analysis will have to be reviewed again.

For Items 3k and 3l, the overloads of the T-094-18PALISD 345 kV line. MISO and PJM are working on a coordinated effort for IPP T-094 whose Point of Interconnection is in METC territory. Total cost and cost responsibilities will be determined during the System Impact Study.

For Items 3n, 3o, and 3p, the overloads of the G ACR; T-05OLIVE 345 kV line can be relieved by the following:

AEP: A sag study will be required for the ACSR/PE 1414 conductor section 1 to determine if the line section can be operated above its emergency rating of 971 MVA. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 40.64 mile section of line would need to be rebuilt. The total estimated cost(2013 Dollars) to complete this work is **$162,560**.

ComEd: No ComEd upgrade required; the ALDR for ComEd's portion of L6615 is 1423 MVA and is based on sag limits on 1414 kcmil ACAR.

For Items 3q and 3r, the overloads of the 05HOWARD-02BRKSID 138 kV line can be relieved by an existing RTEP baseline upgrade b2122, with an in-service date of 6/1/2015. The circuit rating will increase from 179 MVA to 228 MVA, removing the Y3-063 overloads. As long as the baseline goes in service, this project does not have a contribution to this mitigation. Should the baseline be cancelled, analysis will have to be reviewed again.

For Items 3s, 3t, 3u, and 3v, the overloads of WILTO; 765/345 kV transformer, WILTO; B-WILTO;3M 345 kV line, and WILTO; R-WILTO;4M 345 kV line can be relieved by adding two new 345 kV bus tie circuit breakers and move L11216 to bus 8. The total estimated cost is **$15,000,000** and will take approximately **18 to 24 months** to complete this work.

For Item 3w, the overload of the 02HAYES 345/138 kV transformer can be relieved by installing a 2nd 345-138kV transformer at Hayes substation (PJM RTEP n3308). The total estimated cost is **$5,502,000** and will take approximately **20 months** to complete this work.

For Items 3x, 3y, and 3z, the overloads of the 17STLWEL-05DUMONT 345 kV line can be relieved by the following:

A sag check will be required for the ACSR 954 conductor section 1 to determine if the line section can be operated above its emergency rating of 1409 MVA. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 8.5 mile section of line would need to be rebuilt. The total estimated cost(2013 Dollars) to complete this work is $34,000.

For Items 3aa and 3bb, the overloads of the 02OTTAWA-02LAKVEW 138 kV line and the 02LAKVEW-02GRNFLD 138 kV line can be relieved by building the West Fremont-Groton-Hayes 138kV circuit, as well as Groton 138/69kV substation (PJM RTEP b1959), with a scheduled in-service date of 6/1/2018. The total estimated cost is **$55,825,000** and will take approximately **75 months** to complete this work. As long as the baseline goes in service, this project does not have a contribution to this mitigation. Should the baseline be cancelled, analysis will have to be reviewed again.

Delivery of Energy Portion of Interconnection Request

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.

As a result of the aggregate energy resources in the area, no violations were identified.