

Memorandum

Date: Revised January 20, 2009
To: MHEB TSR Ad Hoc Study Group
CC:
From: Hari Singh & Douglas Brown
RE: MHEB TSR Out Year Benchmark Case

This memorandum documents development of the 2017 summer peak case that is being used to analyze MH to US requests in the MHEB Group TSR system impact study. The power flow case, study criteria and results of a preliminary transfer limit analysis are being provided to the study group for review and comment.

1 MH to US Requests

The MH to US direction TSRs are listed in Table 1.

Table 1: MHEB Group TSR MH to US Requests

Assignment Ref	Service Type	Start time	Stop Time	POR	POD	Capacity	Queue	Study Number
76703520	P-to-P	May-2007	May-2009	MHEB-MISO	CIN	80	11/15/2006	A339
76703521	P-to-P	May-2007	May-2009	MHEB-MISO	NSP	80	11/15/2006	A340
76703535	Network	Apr-2008	Apr-2013	MHEB-MISO	NSP	30	1/26/2007	A351
76703536	Network	Nov-2014	Nov-2024	MHEB-MISO	GRE	200	12/7/2006	A388
76703671	Network	Jun-2017	Jun-2027	MHEB-MISO	WPS	500	6/12/2007	A380
76703672	Network	Jun-2017	Jun-2037	MHEB-MISO	MP	250	7/6/2007	A383
76703685	P-to-P	Nov-2009	Nov-2014	MHEB-MISO	NSP	250	2/4/2008	A406

Assignment Ref	Service Type	Start time	Stop Time	POR	POD	Capacity	Queue	Study Number
76703686	Network	Jun-2017	Jun-2027	MHEB-MISO	NSP	50	4/17/2008	A416
76703687	Network	Jun-2017	Jun-2027	MHEB-MISO	WEC	100	4/17/2008	A417

Total (MW) 1540

2 Model Development

2.1 Benchmark Case

A 2017 benchmark case without the study TSRs or associated transmission upgrades was used for the out year scenario. The source was a MTEP08 case that includes the projects listed in Appendix A. Confirmed and study transmission service requests not already included in the MTEP08 case have been added along with miscellaneous updates and corrections described herein.

The power flow cases were solved with all controls enabled; namely, transformer tap adjustment, area interchange (ties and load), phase shifter adjustment and switched shunt adjustment.

The Interface flows in the 2017 benchmark case are shown in Table 2.

Table 2 Interface Summary of 2017 Benchmark Case

Interface	Flow (MW)
MHEX_S	1844.4
MWEX	810.9

2.1.1 Prior-Queued Midwest ISO TSRs

Table 3 shows prior-queued TSRs that were added to the 2017 benchmark case. The TSRs were modeled using sources and sinks provided by Midwest ISO. The 2017 benchmark case includes all existing firm commitments on the MHEX_S interface.

Table 3: MISO TSRs Added to the 2017 SUPK Case

OASIS	OASIS #	STUDY	POR	POD	CAPACITY REQUESTED (MW)	START	STOP
MISO	75690167 75690165	A168	MP	NSP	35 (20+15)	6/1/2006 6/1/2006	6/1/2026 6/1/2026
MISO	76541075 76541076	A204	MP	MP	50 (25+25)	2/1/2008 2/1/2011	2/1/2009 2/1/2012
MISO	76109095	A230	WAUE	GRE	108	1/1/2008	1/1/2036

OASIS	OASIS #	STUDY	POR	POD	CAPACITY REQUESTED (MW)	START	STOP
MISO	76414212	A301B	MP	GRE	100	6/1/2006	6/1/2008
MISO	76403280	A304	MHEB	MP	50	5/1/2009	5/1/2015
MISO	76434677	A316	OTP	OTP	50	2/1/2010	11/1/2028
MISO	76463020	A329	OTP	OTP	21	2/1/2007	1/1/2028
MISO	76480654	A335	GRE	GRE	68	4/1/2009	4/1/2029
MISO	76484129 76484130	A338	OTP	OTP	40 (20+20)	4/1/2014	1/1/2028
MISO	76488162	A341	WAUE	GRE	68	1/1/2008	1/1/2036
MISO	76463020	A345	WAUE	NSP	61	6/1/2009	6/1/2029
MISO	76515390	A365	WAUE	GRE	30	1/1/2009	1/1/2022
MISO	76526766	A374	OTP	OTP	49	11/1/2008	11/1/2028
MISO	76484129 76484130	A411	OTP	OTP	98 (50+48)	6/1/2009 10/1/2008	6/1/2069 10/1/2068
MISO	76659803	-	MP-ONT	MP	150	11/01/2008	11/01/2013

2.1.2 Prior-Queued WAPA TSRs

The following proposed generating facilities have TSRs under study on the WAPA OASIS and were added to the 2017 benchmark case.

- Culbertson Project GI-0708 + GI-0614a (120+10 MW)
- GI-0704 (240 MW)
- Minot (aka Mallard) Project GI-0503 + GI-0720 (100+25 MW)
- GI-0714 (100 MW)

The aggregate output of these generating facilities (595 MW) is dispatched against generation at Big Bend and Ft. Randall. Groton Unit 1 and Unit 2 are dispatched at 125 MW each.

2.1.3 Miscellaneous Updates and Corrections

Table 4 shows other miscellaneous model updates.

Table 4: Miscellaneous Updates and Corrections

Area	Description
MH	Net flow on MH-SPC ties reduced to 0 MW
WAPA	Topology corrections at Penn 115 kV and Hilken 230 kV buses
XEL	Removed extraneous BRIGO facilities
XEL	Dispatched River Falls generation

2.2 Transmission Upgrade Options

The transmission upgrade options proposed by the ad hoc study group are summarized in Table 5. The cost estimates shown in Table 6 are based on \$/mile costs taken from the JCSP 2008 Interim Stakeholder Meeting Introduction Presentation and adjusted down from 2024 dollars to 2018 dollars using a 3% escalation factor.

Six 2017 study cases were created by adding the transmission upgrade options to the benchmark case; each case includes one of the transmission upgrade options but not the study TSRs. Note that the Option 4a and 4b cases do not include the Maple River-North Appleton and Maple River-West Middleton dc lines; the dc lines were modeled in the FCITC analysis using power injections at the converter stations. Diagrams depicting the proposed upgrades are included in Appendix B.

Table 5: Transmission Upgrade Options

Project	1	2	2a	3	4a	4b
Dorsey – Riel 500 kV Line Circuit #2	X	X	X	X	X	X
Dorsey – Maple River 50% series compensated 500 kV line terminated via 500/345 kV transformer at Maple River. HVDC reduction for loss of the line or transformer.	X	X	X	X	X	X
North LaCrosse – West Middleton 345 kV Line	X	X	X	X		
Maple River – Helena 50% series compensated 500 kV line terminated via 500/345 kV transformer at Helena. HVDC reduction for loss of the line or transformer.	X					
Arrowhead – Chisago – King 345 kV line		X	X			
Maple River – Arrowhead 50% series compensated 500 kV line terminated via 500/345 kV transformer at Arrowhead. HVDC reduction for loss of the line or transformer.		X				
Maple River – Arrowhead 345 kV double circuit line			X			
Dorsey – King 50% series compensated 500 kV line terminated via 500/345 kV transformer at King. HVDC reduction for loss of the line or transformer.				X		
Maple River – North Appleton DC line (simulated as an injection at each terminal)					X	
North Appleton – Morgan 345 kV line					X	
Maple River – West Middleton DC line (simulated as an injection at each terminal)						X
North Madison – West Middleton 345 kV line						X

Table 6: Cost Estimates

Option	Cost in 2018
Option 1	\$1,434,401,161
Option 2	\$1,697,371,217
Option 2A	\$1,858,586,937
Option 3	\$1,354,944,842
Option 4A	\$2,256,810,701
Option 4B	\$2,859,171,252

3 Contingency Criteria

Contingency events considered for the steady-state linear FCITC analysis.

- NERC Category A with system intact (no contingencies)
- NERC Category B contingencies
 - Outage of single element (B.2 and B.3) associated with single contingency event in the following areas: ATCLLC (WEC, ALTE, WPS, MGE, UPPC), DPC, GRE, ITC Midwest, MH, MP, OTP, SMMPA, WAPA, XEL
 - Outage of multiple-elements (B.2 and B.3) associated with single contingency event in the Dakotas, Manitoba, Minnesota, Wisconsin

For all contingency and post-disturbance analyses, cases are solved with transformer tap adjustment enabled, area interchange adjustment disabled, phase shifter adjustment disabled and switched shunt adjustment enabled.

4 Monitored Facilities

Monitored facilities and associated thermal and voltage limits are shown in Table 7.

Table 7: Monitored Facilities and Limits

Owner/ Area	Monitored Facilities	Thermal Limits ¹		Voltage Limits
		Pre-Disturbance	Post-Disturbance	
ATC LLC	69 kV and above	95% of Rate A	95% of Rate B	1.10/0.90
BEPC	69 kV and above	100% of Rate A	100% of Rate A	1.10/0.90
DPC	69 kV and above	100% of Rate A	100% of Rate A	1.10/0.90
GRE	69 kV and above	100% of Rate A	100% of Rate B	1.10/0.92/0.90 ²
ITCMW	69 kV and above	100% of Rate A	100% of Rate B	1.10/0.90
MDU	69 kV and above	100% of Rate A	100% of Rate B	1.10/0.90
MEC	69 kV and above	100% of Rate A	100% of Rate A	1.10/0.90
MH	69 kV and above	100% of Rate A	100% of Rate A	1.15/1.10/0.94/0.90 ³
MP	69 kV and above	100% of Rate A	100% of Rate B	1.10/0.90
MPC	69 kV and above	100% of Rate A	100% of Rate A	1.10/0.90
MRES	69 kV and above	100% of Rate A	100% of Rate A	1.10/0.90
NWPS	69 kV and above	100% of Rate A	100% of Rate A	1.10/0.90
OTP	69 kV and above	100% of Rate A	100% of Rate B	1.10/0.90
RPU	69 kV and above	100% of Rate A	100% of Rate A	1.10/0.90
SMMPA	69 kV and above	100% of Rate A	100% of Rate B	1.10/0.90
SPC	69 kV and above	100% of Rate A	100% of Rate A	1.10/0.90
WAPA	69 kV and above	100% of Rate A	100% of Rate A	1.10/0.90
XEL	69 kV and above	100% of Rate A	100% of Rate B	1.10/0.90

Note 1: PSSE Rate A, Rate B or Rate C

Note 2: 0.92 limit applies to load serving buses

Note 3: Limits dependent on nominal bus voltage

5 FCITC Analysis Results

A linear FCITC analysis was performed on each 2017 study case using PSS®MUST. For transmission upgrade options 1-3, the long-term TSRs listed in Table 1 were evaluated as a single 1540 MW transfer sourced from the Dorsey 500 kV bus. In option 4, half of the transfer is modeled flowing on the two-terminal hvdc line between Maple River and Wisconsin and the TSRs were evaluated by simulating simultaneous 770 MW injections at Dorsey and at the Wisconsin hvdc line terminal. The buses selected as TSR Sinks are listed in Table 8.

The distribution factor cutoff used in the FCITC analysis is 2% of the transfer level; note that the analysis is performed on cases that include the ac transmission upgrades so impacts are due only to the TSRs. Contingencies involving dc reduction have been excluded from the FCITC analysis results.

Detailed FCITC results are shown in Appendix C and are summarized in Table 9. For each transmission upgrade option, Table 9 shows FCITC associated with each constraint, as well as an estimate of the minimum facility rating required to mitigate the constraint. A blank cell indicates that the monitored element is not a constraint for that transmission option.

Table 8: Sinks for Long Term TSR Requests

Study (POD)	Sink
A339 (CIN)	Masked
A340, A406 (NSP)	Masked
A351 (NSP)	Masked
A416 (NSP)	Masked
A388 (GRE)	Masked

Study (POD)	Sink
A383 (MP)	Masked
A380 (WPS)	Masked
A417 (WEC)	Masked

Table 9: FCITC Analysis Results

Monitored Element/Control Area	Rating	Option 1		Option 2		Option 2a		Option 3		Option 4a		Option 4b	
		FCITC	Minimum Rating	FCITC	Minimum Rating	FCITC	Minimum Rating	FCITC	Minimum Rating	FCITC	Minimum Rating	FCITC	Minimum Rating
10285:LKHJFFEAUARP	306											1482.1	308
3036:COLPO2COLPO1	281											-2341.8	440
4054:COLXF1COLXF2	193											-1049.1	249
4179:FLWSOU__PTDF	168	1459.6	171	1381.7	173	1388.9	173	1413.7	172	868.2	195	1390.4	173
601001 FORBES 2 500 601013 ROSEAUS2 500 1 XEL	1733					1447.3	1779	1535.2	1736	1444.9	1760	1419.2	1768
601012 ROSEAUN2 500 667501 RIEL 2 500 1 XEL MH	1732.1					1411.1	1796	1500.1	1752	1366.6	1782	1342.1	1790
602017 ST LAKE5 161 699450 ST LAKE 345 1 XEL WPS	399			1256.8	414								
602023 LACROSS5 161 602025 MONROCO5 161 1 XEL	167	-233.6	204					-243.6	205				
603116 WILSON 7 115 603204 WILSON TAP7 115 1 XEL	239	708.1	262	1169.1	248	1130.6	250			1114	249	1082.5	250
608666 FONDULAC 115 608676 HIBBARD7 115 1 MP	44			951.1	61	1081.2	57	1476	47	1519	45		
608721 ETCO 7 115 608722 FORBES 7 115 1 MP	107.8							1311.2	113				
620189 MAPLER1Y 345 657792 MAPLE R3 345 1 OTP	336	-455.2	464	-142.8	476	-167.4	486			-1012.3	510	-1031.9	507
620190 MAPLER2Y 345 657792 MAPLE R3 345 1 OTP	336	-454.3	464	-142.2	476	-166.7	486			-1011.3	510	-1030.9	507
620322 BSSOUTH4 230 620417 BSSOUTH3 345 1 OTP	400	471.4	423	69	446	28.1	450						
620322 BSSOUTH4 230 620417 BSSOUTH3 345 2 OTP	400	471.4	423	69	446	28.1	450						
65010:COLPORCOLPOR	275											-2488.5	440
667038 ROSSER 4 230 667039 RIDGEWY4 230 1 MH	460.5	308.8	496	421	493	274.6	500	350.7	496				
693941 FRIES138 138 699146 HAM 138 138 1 ALTE	228											1210.2	245

Monitored Element/Control Area	Rating	Option 1		Option 2		Option 2a		Option 3		Option 4a		Option 4b	
		FCITC	Minimum Rating	FCITC	Minimum Rating	FCITC	Minimum Rating	FCITC	Minimum Rating	FCITC	Minimum Rating	FCITC	Minimum Rating
693941 FRIES138 138 699170 NOR 138 138 1 ALTE	228											1356.2	238
698526 BOX ELDR 138 699121 LDN 138 138 1 ALTE	363.9											1238.6	375
698668 WMD 69 69.0 699820 WMD 138 138 1 MGE	181.4											893.1	196
698884 JEFRSN5 138 699375 CRWFSH R 138 1 UPPC ALTE	278.4											902.6	312
699118 CMT 138 138 699120 ROE 138 138 1 ALTE	382.8											1160	397
699118 CMT 138 138 699121 LDN 138 138 1 ALTE	379											1441	383
699120 ROE 138 138 699347 LKHD_CAM 138 1 ALTE	278.4											59.6	439
699145 POR 138 138 699167 COL 138 138 1 ALTE	382.8											148.6	440
699145 POR 138 138 699167 COL 138 138 2 ALTE	382.8											148.6	440
699157 COL 345 345 699167 COL 138 138 1 MGE ALTE	237.5											1010.1	249
699157 COL 345 345 699167 COL 138 138 2 MGE ALTE	474											921.2	501
699157 COL 345 345 699167 COL 138 138 3 MGE ALTE	237.5											1010.1	249
699176 SFL 345 345 699186 SFL 138 138 2 ALTE	194.8											879.9	211
699240 SAR 138 138 699808 PETENWEL 138 1 ALTE WPS	72.2	839.3	89					858.7	88				
699283 CONCRD 4 138 699375 CRWFSH R 138 1 ALTE	272.6											1434.9	279
699340 JEFRSN4 138 699347 LKHD_CAM 138 1 ALTE	367.6											124.7	425

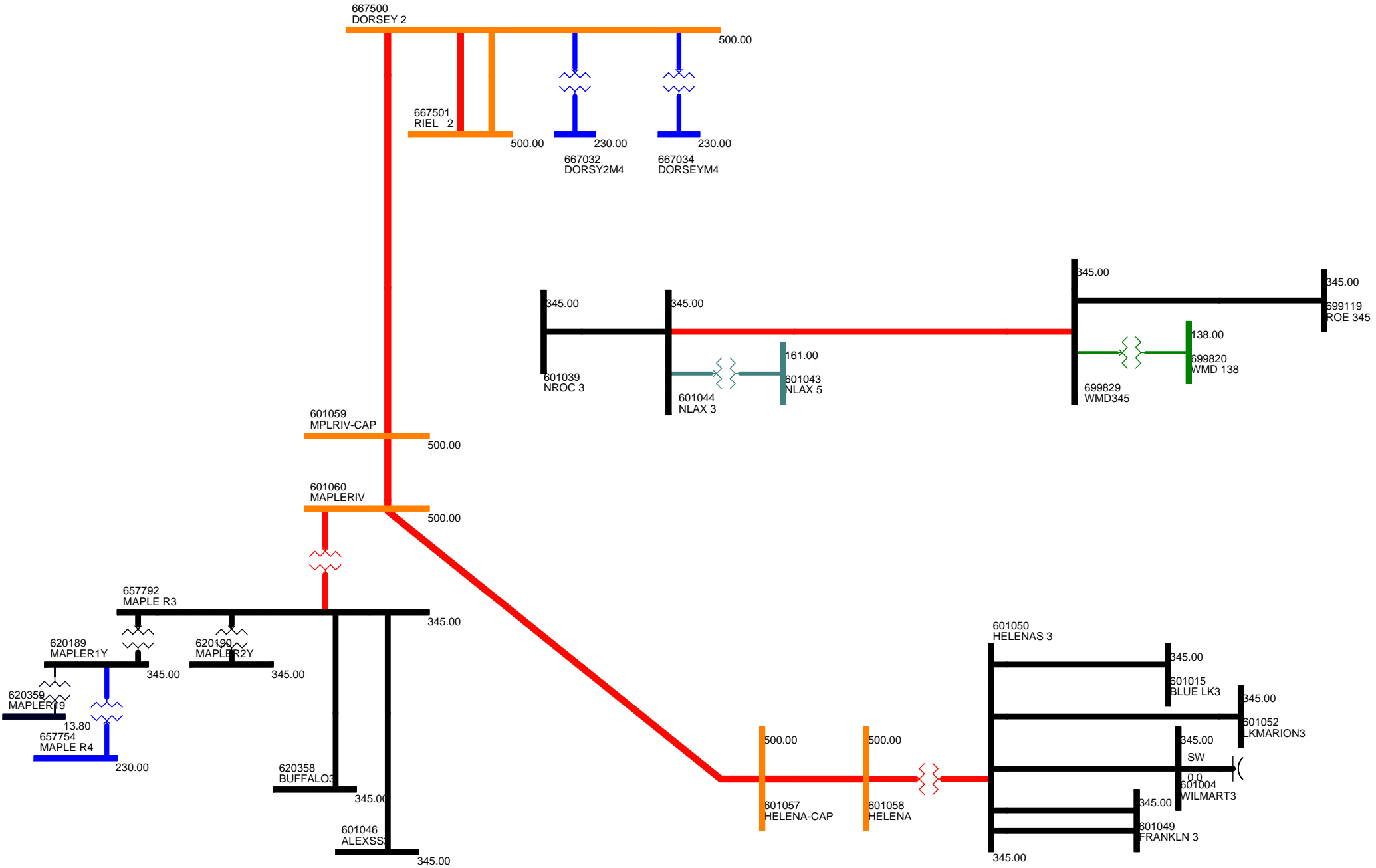
Appendix A: Projects Applied from MOD

Project ID	Project Name	Phase ID	Phase Name	Effective Date
3125	ATC_(345)_new-Clintonville-Wern	3443	ATC_(345)_new-Clintonville-Wern	11/24/2008
3520	XEL-1486-MARYLAKE-BUFFALO	3855	XEL-MARYLAKE-BUFFALO	12/1/2008
4572	XEL-GRANDMEADOW	5155	GRANDMEDOW	12/1/2008
4050	XEL-MTEP-PROJECT-2119-G417	4550	XEL-KODA-ENERGY-CENTER	12/1/2008
4588	SMP-GRANDMEADOW-WF	5172	SMP-GRANDMEADOW-WF	12/31/2008
4770	ITCT-MISO-905-MRYPP DECOMMISSIO	5338	Marysville Decommissioning	12/31/2008
4263	ALTW_1758_Beaver_Channel-2nd_AV	4810	Rebuild 2.5 mi of 69 kV to 161	12/31/2008
3644	ALTW_Hills-Washington-1755_69kV	3987	69kV Rbl'd Hills-Kalona-N_Crane	12/31/2008
4960	ITCM_1752_Jefferson_Co_69_kV_31	5547	Jefferson Co 69 kV 31.2 MVAR CA	12/31/2008
4959	ITCM_1751_Jefferson_Co_161-69_k	5546	Jefferson Co 161-69 kV 100 MVA	12/31/2008
3713	ALTW_1289_Marshalltown-Toledo_1	4074	Rbl'd Marshalltown-Toledo 1115kV	12/31/2008
4544	SMP-MISO-LAKECITY-1367-AREA [08	5127	SMP-MISO-LAKECITY-AREA-ADD	1/15/2009
3132	ATC_(352)_CON-IRGR138_v29	3450	ATC_(352)_CON-IRGR138_v29	3/12/2009
3697	ALTW_1522_6th-Beverly_161kV	4054	6th Street-Beverly	4/1/2009
4380	ATC_(570)_ROR_to_ELK_138R_Conv_	4941	ATC_(570)_ROR_to_ELK_138R_Conv_	4/15/2009
3121	ATC_(177)_J36Rebuild_WHB-CAR	3439	ATC_(177)_J36Rebuild_WHB-CAR	4/30/2009
3126	ATC_(345)_rebuilding-Badger-Cli	3444	ATC_(345)_rebuilding-Badger-Cli	4/30/2009
4508	ATC_1268_(Z3)_Artesian_138_Cap_	5089	ATC_1268_(Z3)_Artesian_138_Cap_	4/30/2009
3183	ATC_(1677)_Cornell-Chandler_167	3501	ATC_(1677)_Cornell-Chandler_167	5/1/2009
3508	XEL-1371-BLACKDOG-WILSON2-UPGRA	3841	XEL-BLACKDOG-WILSON2	6/1/2009
3527	XEL-1457-HAZEL	3865	XEL-HAZLE	6/1/2009
3533	XEL-1548-LACROSSE	3871	XEL-LACROSSE_CAPBANK	6/1/2009
3558	XEL-385-825WIND	3901	XEL-NOBLES_TR-RATING	6/1/2009
3553	XEL-1489-WOODBURY-TANNERSLAKE	3892	XEL-WOODBURY-TANNERSLAKE	6/1/2009
4958	ITCM_1341_Hazleton_161-69_kV_75	5545	Replace both Hazleton 161-69 kV	6/1/2009
3632	ALTW_Salem-1287_345-161kV_448_M	3975	345-161KV_448_MVA_Xfmr	6/1/2009
3547	XEL-1487-SOMMERSET	3886	XEL-SOMMERSET	6/1/2009
3541	XEL-1368-1369-1370-NEWRICHMOND	3879	NEW_RICHMOND_AREA_2009	6/1/2009
3539	XEL-1548-MONROECO_CAPBANK	3877	XEL-MONROECO_CAPBANK	6/1/2009
3544	XEL-1455-MERP-RIVERSIDE	3883	XEL-RIVERSIDE	6/1/2009
3542	XEL-1373-NEWULM-TS	3881	XEL-NEWULM_TS	6/1/2009
4741	XEL-1457-BRIGO	5309	XEL-BRIGO	6/1/2009
3159	ATC_(1279)_North_Beaver_Dam_Cap	3477	ATC_(1279)_North_Beaver_Dam_Cap	6/1/2009
4772	ITCT-MISO-1488-DURANT	5340	Durant	6/1/2009
3127	ATC_(345)_rebuilding-Badger-WSh	3445	ATC_(345)_rebuilding-Badger-WSh	6/1/2009
3701	XEL-552-IRONWOOD_2ND_TR	4058	XEL-IRONWOOD2NDTR	6/1/2009
3186	ATC_(1681)_Uprate_NLG_to_LG_69k	3504	ATC_(1681)_Uprate_NLG_to_LG_69k	6/1/2009
3205	ATC_(1944)_Concord_G3-4-generat	3523	ATC_(1944)_Concord_G3-4-generat	6/1/2009
4499	ATC_(1682)_Rebuild_Crivitz-HiFa	5080	ATC_(1682)_Rebuild_Crivitz-HiFa	6/1/2009
3184	ATC_(1679)_Richland_Center_Olso	3502	ATC_(1679)_Richland_Center_Olso	6/2/2009
3754	OTP-MTEPA-2091-CASSLKXFMR	4127	REPLACE XFMR	7/1/2009
3755	OTP-MTEPA-2092-SOCASCADE	4128	NEW 115 TO S CASCADE	7/1/2009
4018	GRE-MRO-PROJECT-BBP(20143)	4497	BBP-PHASE1	8/1/2009
3169	ATC_(1555)_Perkins_Cap_2x16_3_v	3487	ATC_(1555)_Perkins_Cap_2x16_3_v	8/15/2009
4777	ITCT-MISO-1871-HURST	5345	Hurst	8/31/2009
3535	XEL-1545-MANKATO_115KV_LOOP	3873	XEL-MANKATO_LOOP	9/1/2009
3182	ATC_(1676)_LAnse_Cap_1x4_08	3500	ATC_(1676)_LAnse_Cap_1x4_08	9/15/2009
3167	ATC_(1553)_Hiawatha_Cap_1x16_3_	3485	ATC_(1553)_Hiawatha_Cap_1x16_3_	9/15/2009
3134	ATC_(352)_IRGR-ASPNI38	3452	ATC_(352)_IRGR-ASPNI38	9/15/2009
3124	ATC_(339)_Remove_Boxelder_Tempo	3442	ATC_(339)_Remove_Boxelder_Tempo	9/30/2009
4396	ATC_(339)_Jefferson-Stonybrook	4958	ATC_(339)_Jefferson-Stonybrook	9/30/2009
3128	ATC_(345)_rebuilding-WhiteClay-	3446	ATC_(345)_rebuilding-WhiteClay-	10/1/2009
3165	ATC_(1463)_Twin_Creeks-G384	3483	ATC_(1463)_Twin_Creeks-G384	10/1/2009
4107	OTP-MTEPC-1792-CSLTN ETHANOL	4644	BUFFALO-CSLTN ETOH	10/1/2009
3176	ATC_(1667)_Pine_River_Ring_Bus_	3494	ATC_(1667)_Pine_River_Ring_Bus_	11/14/2009
3120	ATC_(177)_GDP-HWY22_345_T2-1113	3438	ATC_(177)_GDP-HWY22_345_T2-1113	12/1/2009
4016	GRE-PROJECT4495-ENTPPK_CRKDLK(2	4495	115/69 line and xfmr	12/1/2009
4254	XEL-1956-WILMARTH-BLUELAKE	4795	XEL-WILMARTH-BLUELAKE-UPGRADE	12/1/2009
4776	ITCT-MISO-1870-CLYDE	5344	Clyde	12/2/2009
3387	ATC_(345)_revised_Morgan-CW-Wer	3707	ATC_(345)_revised_Morgan-CW-Wer	12/2/2009
3641	ALTW_Grand_Junction-1644_161kV_	3984	Grand Junciton161kV 50MVAR	12/31/2009
3642	ALTW_Leon-1645_69kV_7MVAR	3985	Leon 69kV 7.2MVAR	12/31/2009
3640	ALTW_Anita-1643_161kV_24MVAR	3983	Anita 161kV 50MVAR	12/31/2009
3631	ALTW_Arnold-Washburn_1739-161kV	3974	Arnld-Vin-Dysart-Wash_161kV lin	12/31/2009
3638	ALTW_Ottumwa-1641_161kV_50MVAR	3981	OGS 161kV 50MVAR	12/31/2009
3645	ALTW_N_Cntrville_69kV-1772_7MVA	3988	69kV Cap	12/31/2009

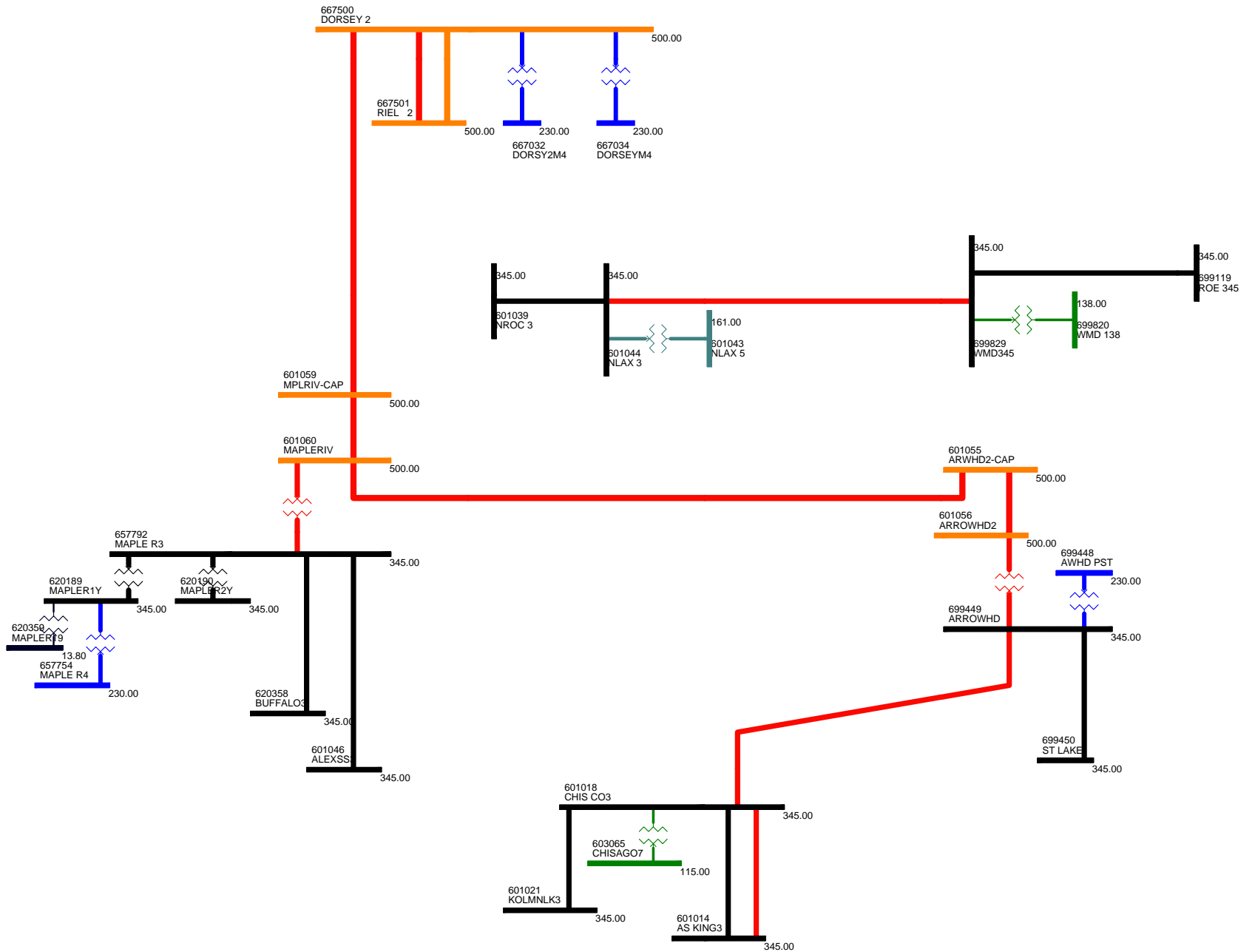
Project ID	Project Name	Phase ID	Phase Name	Effective Date
3699	ITCM_Grand_Mound-1619_161kV	4056	Add G Mnd 161-69kV TRF and Loop	12/31/2009
4871	MP-MISO-PROJECT-LL-BAD-PINE-PEQ	5444	Preliminary	1/1/2010
4017	GRE-PROJECT-TOWER(1021)(for mp)	4496	TOWER	1/1/2010
4509	ATC_1268_(Z3)_Kilbourn_138_Cap_	5090	ATC_1268_(Z3)_Kilbourn_138_Cap_	2/1/2010
3202	ATC_(1938)_Randolph-G366_Windfa	3520	ATC_(1938)_Randolph-G366_Windfa	3/1/2010
3395	ATC_(1937)_Lafayette-G282_Windf	3715	ATC_(1937)_Lafayette-G282_Windf	3/1/2010
3395	ATC_(1937)_Lafayette-G282_Windf	3716	ATC_(TtoD)_Lafayette-G282_Windf	3/2/2010
4232	ATC_(2057)_Warrens_T-D_w_line_e	4775	ATC_(2057)_Warrens_T-D_w_line_e	3/31/2010
3206	ATC_(1945)_Upgrade_Sheepskin_Ca	3524	ATC_(1945)_Upgrade_Sheepskin_Ca	4/12/2010
4502	ATC_(1680)_Walworth-North_Lake_	5083	ATC_(1680)_Walworth-North_Lake_	4/15/2010
4272	XEL-1959-YANKEEDOODLE-PILOTKNOB	4833	YANKEEDOODLE-PILOTKNOB	5/1/2010
3203	ATC_(1939)_MEWD_CT_G588	3521	ATC_(1939)_MEWD_CT_G588	5/1/2010
4018	GRE-MRO-PROJECT-BBP(20143)	4498	BBP-phase2	5/1/2010
3131	ATC_(352)_ASPN-TWFL138	3449	ATC_(352)_ASPN-TWFL138	6/1/2010
3541	XEL-1368-1369-1370-NEWRICHMOND	3880	NEW_RICHMOND_AREA_2010	6/1/2010
3135	ATC_(352)_TWFL-PLNS138	3453	ATC_(352)_TWFL-PLNS138	6/1/2010
3389	ATC_(1683)_Rebuild_SunsetPt-Pea	3709	ATC_(1683)_Rebuild_SunsetPt-Pea	6/1/2010
4779	ITCT-MISO-1873-TAHOE	5347	Tahoe	6/1/2010
2568	FE-MISO-Barborton 138 kV Cap_13	2874	BarbCap_2194	6/1/2010
4697	ITCM_1342_Hiawatha-Lws_Flds_161	5260	Lewis Fields 161-115kV TRF and	6/1/2010
3156	ATC_(1267)_Oakridge-Verona_138_	3474	ATC_(1267)_Oakridge-Verona_138_	6/1/2010
4742	XEL-56-CHISAGO-STCROIXFLS [08-1	5310	XEL-CHISAGO-STCROIXFALLS	10/1/2010
3821	OTP-973-BSII	4201	BIG STONE-CANBY 230	11/1/2010
4206	XEL-1953-SAUKRIVER-STCLOUD	4747	XEL-SAUKRIVER-STCLOUD-UPGRADE	12/1/2010
4255	XEL-1961_LAKEEMILY_CAP	4796	XEL-LAKE-EMILY-CAP	12/1/2010
4872	MP-MISO-PROJECT-1482-Pepin-Lk-r	5445	Phase 1	12/30/2010
4486	OTP-971-WINGERXFMR-20080613 [08	5067	WINGER XFMR	12/31/2010
3634	ALTW_Hazelton-1288_345-161kV_33	3977	345-161KV_335_MVA_Xfmr	12/31/2010
3714	ALTW_Toledo-Belle-1289_Plaine_S	4075	Rbld Toledo-Belle Plaine-Stoney	12/31/2010
4937	ITCM_1618_Heron Lake-Lakefield_	5524	Rbld Heron Lake-Lakefield 161kV	12/31/2010
4256	XEL-1960-TRAVERSE-STPETER	4797	XEL-TRAVERSE-STPETER-UPGRADE	4/1/2011
4385	XEL-675-SCOTTCO-WESTGATE	4946	SCOTTCO-WESTGATE	6/1/2011
4747	XEL-1285-GLENCOE-WESTWACONIA	5315	GLENCOE-WESTWACONIA	6/1/2011
4384	XEL-2109-G609	4945	G609	6/1/2011
4259	XEL-1954-WSIOUXFALLS-PATHFINDER	4801	WSIOUXFALLS-PATHFINDER	6/1/2011
3750	OTP-1033-SLVRLK	4123	NEW 230/41.6 TRANSFORMER	6/30/2011
3821	OTP-973-BSII	4202	BIG STONE-BROWNS VALLEY	7/1/2011
4194	XEL-PROJECT-1380-WWACONIA-SCOTT	4734	XEL-WWACONI-SCOTTCO	12/1/2011
4771	ITCT-MISO-907-OAKLAND	5339	Oakland	12/31/2011
3696	ALTW_Quad-RkCrk-Salem-1345_Term	4053	Quad-RkCrk-Salem Terminals	12/31/2011
3667	ALTW_Salem-Lore-Hazelton-1340_3	4010	345kV line Lore 345kV bus_335MV	12/31/2011
4847	ITCT-MISO-692-BISMARCK-TROY	5420	Bismark-Troy	12/31/2011
3821	OTP-973-BSII	4203	JOHNSON-MORRIS 230	6/1/2012
4715	ATC_(1470)_Brodhead-South_Monro	5283	ATC_(1470)_Brodhead-South_Monro	6/1/2012
4199	XEL-PROJECT-1957-EAUCLAIRE-P2	4739	EAUCLAIRE-PHASE2-2012	6/1/2012
3708	XEL-973-CANBY-HAZEL	4069	XEL-CANBY-HAZLE-GRANITEFALLS-23	6/2/2012
4160	OTP-PROJECT-279-CAPX-WILTON_BOS	4697	WILTON-BOSWELL-1	7/1/2012
4198	XEL-PROJECT-1958-STONELK-COUDER	4738	STONELAKE-COUDERAY161KVLIN	12/1/2012
3171	ATC_(1617)_NED_3_G527	3489	ATC_(1617)_NED_3_G527	2/1/2013
3142	ATC_(574)_COC-PET_Uprate	3460	ATC_(574)_COC-PET_Uprate	6/1/2013
4553	ATC_(574)_MOC-COC_161-1a	5136	ATC_(574)_MOC-COC_161-1a	6/1/2013
3136	ATC_(356)_ROE-WMD_345_kV_North_	3454	ATC_(356)_ROE-WMD_345_kV_North_	6/1/2013
3821	OTP-973-BSII	4204	BIG STONE-JOHNSON 230	11/1/2013
3703	XEL-PROJECT-286-287-CAPX-MAPLR_	4060	MAPLERIVER-MONTICELLO	1/1/2014
4199	XEL-PROJECT-1957-EAUCLAIRE-P2	4740	EAUCLAIRE-PHASE2-2014	6/1/2014
4996	XEL-1203-SWMN-TC-345KV-PROJECT	5583	XEL-SWMN-TC-345KV	1/1/2015
3821	OTP-973-BSII	4205	BIG STONE-CANBY 345	1/1/2015
3707	XEL-PROJECT-1024-CAPX-HAMP_ROCH	4068	HAMPTONCORNER_NLAX	1/2/2015
3685	OTP-585-PRTURKEY	4020	PELICAN TURKEY	7/15/2017

Appendix B: Transmission Upgrade Options

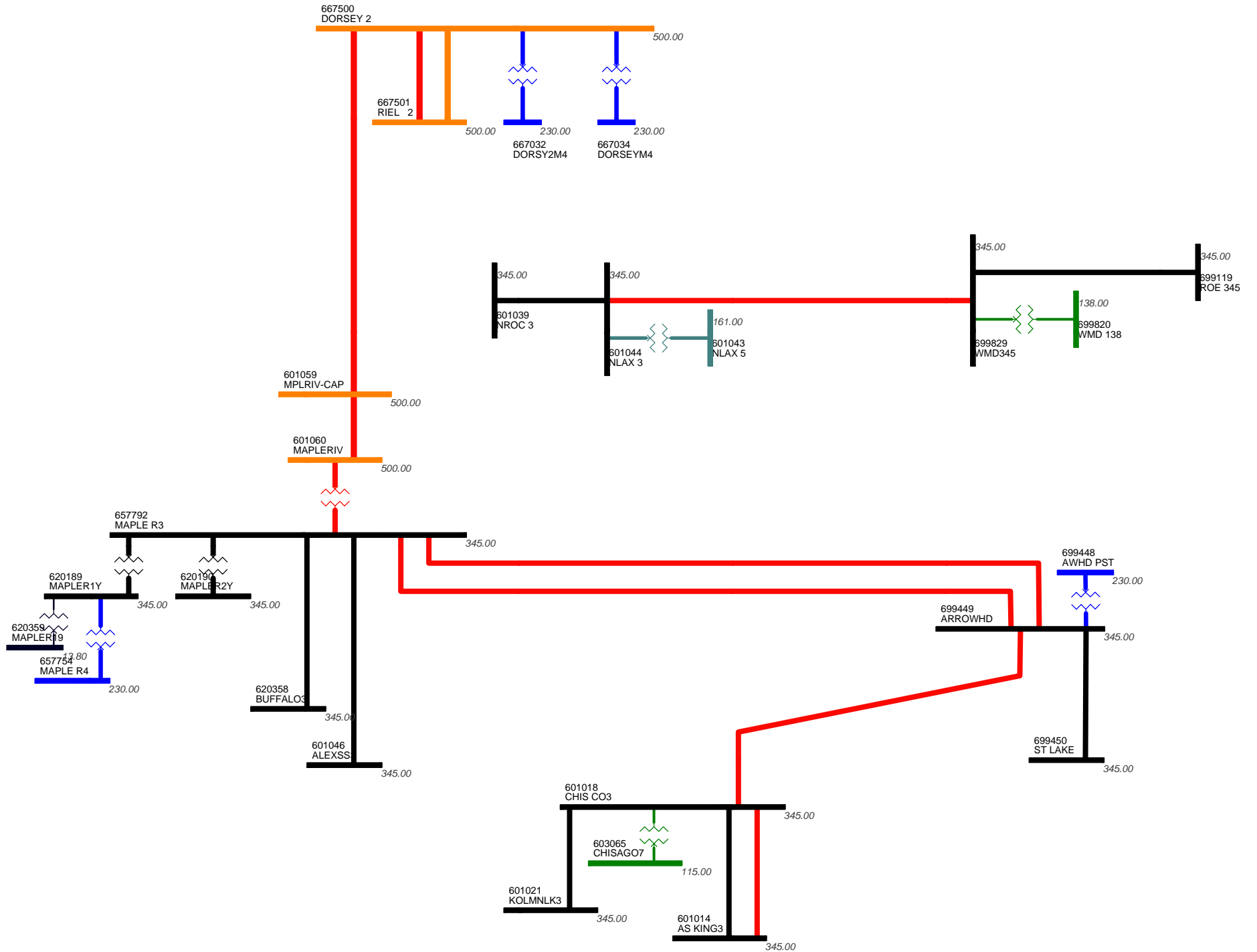
Option 1 - Proposed Transmission Upgrades shown in Red



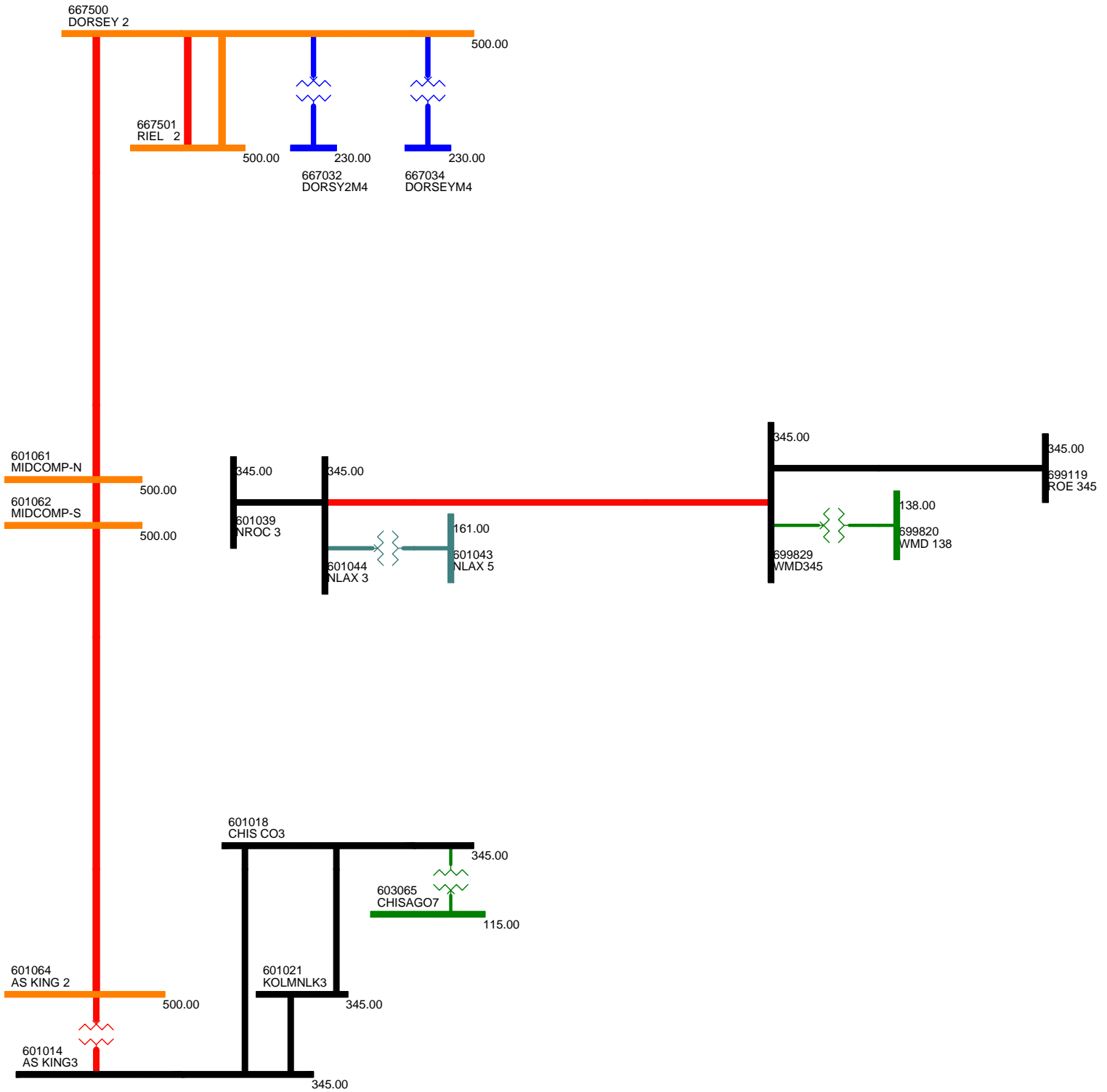
Option 2 - Proposed Transmission Upgrades shown in Red



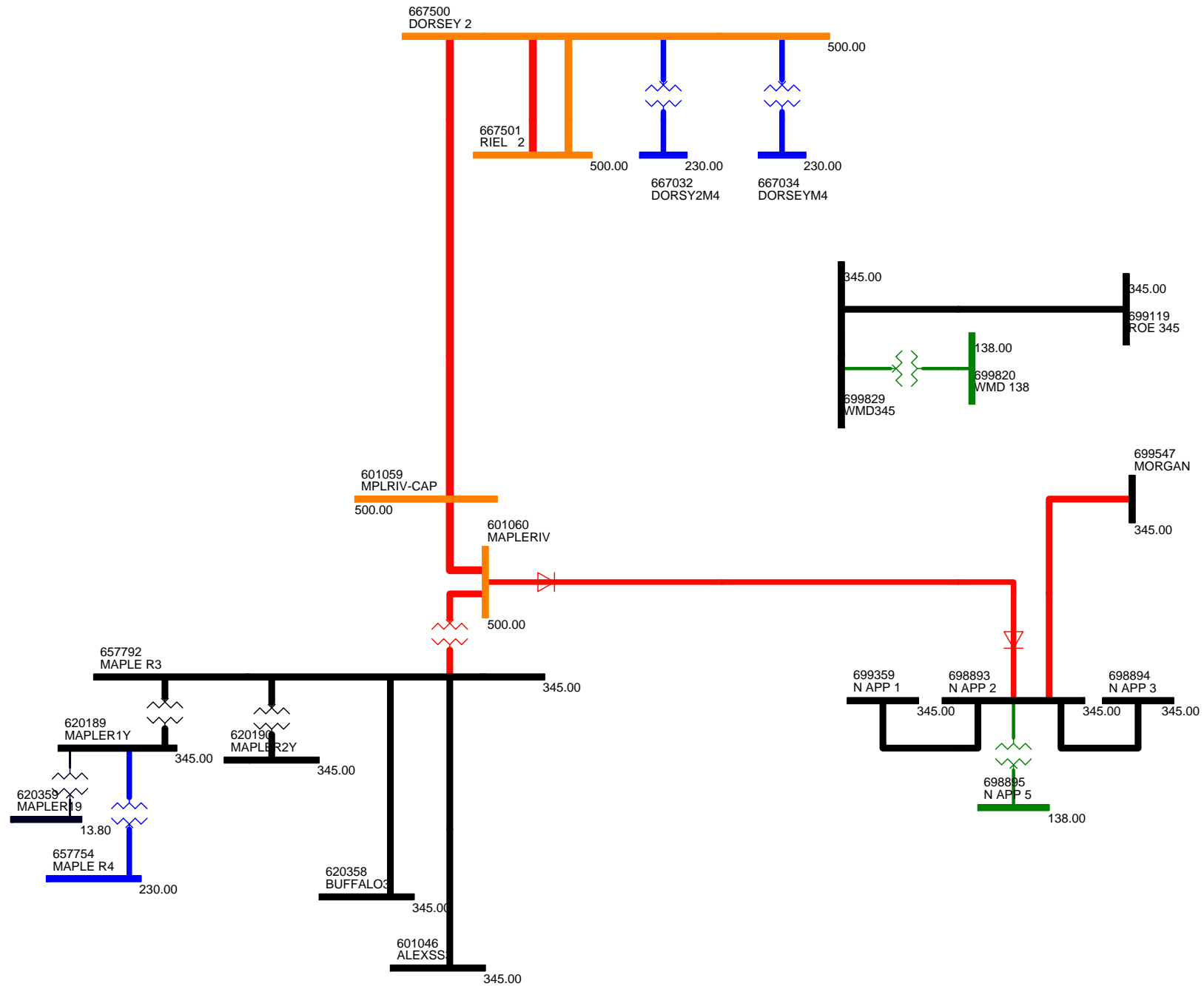
Option 2a - Proposed Transmission Upgrades shown in Red



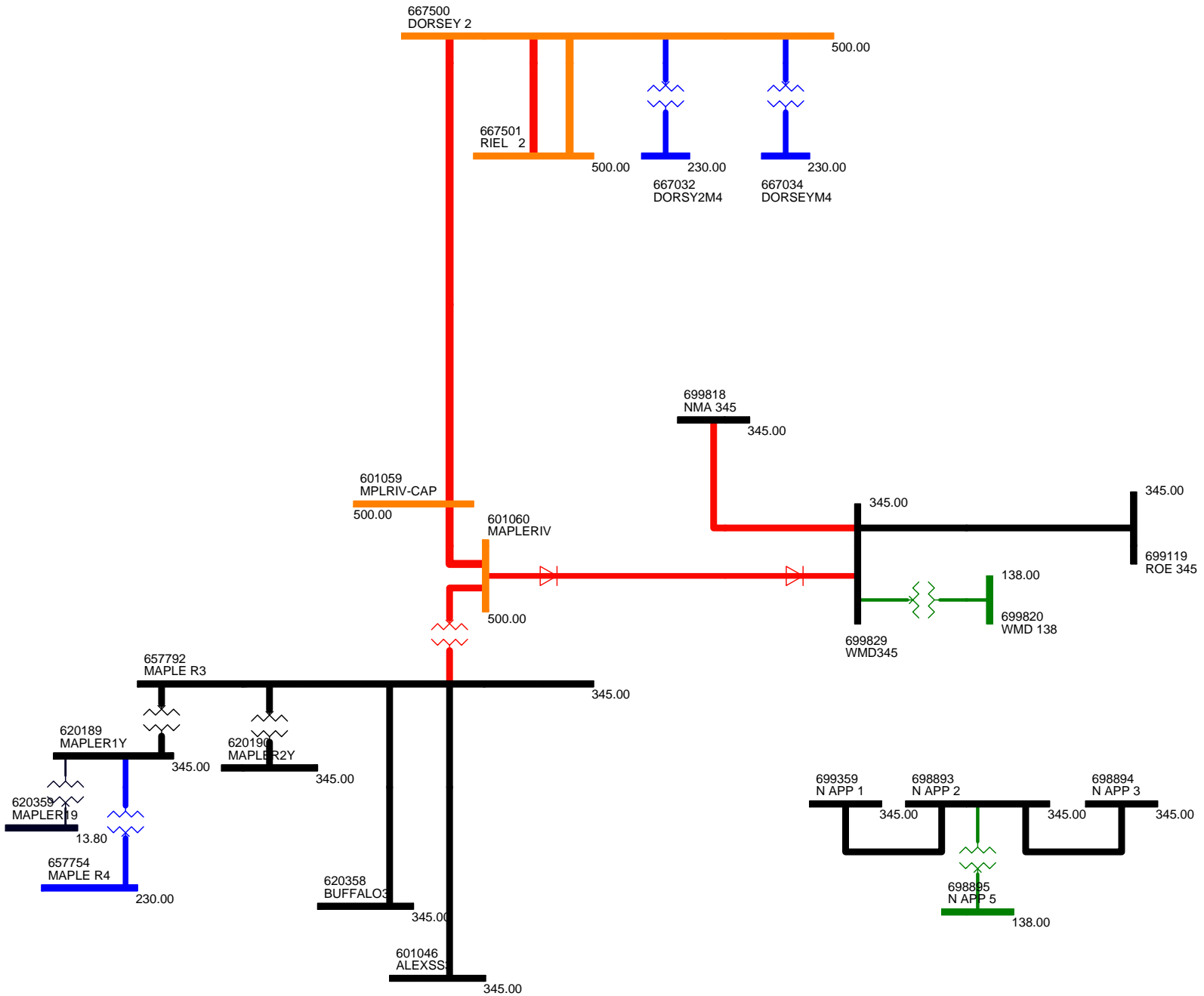
Option 3 - Proposed Transmission Upgrades shown in Red



Option 4a - Proposed Transmission Upgrades shown in Red



Option 4b - Proposed Transmission Upgrades shown in Red



Appendix C: FCITC Analysis Results

Option 1

FCITC Single Study

PSS(tm)MUST 8.3.2 -- Managing and Utilizing System Transmission -- WED, JAN 14 2009 8:02

Case.File C:\LocalDocs\MISO TSR MH\Out-Year\MH_Group_Study_Out_Year_Option-1.sav
 Subsys.File C:\LocalDocs\MISO TSR MH\Out-Year\MUST Inputs\Out_Year_sub.sub
 Monit.File C:\LocalDocs\MISO TSR MH\Out-Year\MUST Inputs\Out_Year_mon.mon
 Contin.File C:\LocalDocs\MISO TSR MH\Out-Year\MUST Inputs\Out_Year_con.con
 Exclud.File C:\LocalDocs\MISO TSR MH\Out-Year\MUST Inputs\Exclude_OutYear_rev2.exc

Study transfer. From MHEB_DORSEY To LONGTERM_SINK . Transfer level - 1540.0 MW

Violations report ordered by transfer capability. Total 46 violations

N	FCITC L: Limiting constraint				PreShift	MW	TDF		PTDF	=Base Case Flow=		
	C: Contingency description				Ncon	Flow	Rating	LODF		Init	Final	
1	-455.2 L: 620189 MAPLER1Y	345	657792	MAPLE R3	345	1	-365.0	-336.0	-0.06373	-0.03686	-211.2	-194.4
	C:620190 MAPLER2Y	345	657792	MAPLE R3	345	1	2707					
	Open 620190 MAPLER2Y	345	657792	MAPLE R3	345	1		0.72923	-0.03686	-211.0	-194.2	
2	-454.3 L: 620190 MAPLER2Y	345	657792	MAPLE R3	345	1	-365.0	-336.0	-0.06373	-0.03686	-211.0	-194.2
	C:620189 MAPLER1Y	345	657792	MAPLE R3	345	1	2705					
	Open 620189 MAPLER1Y	345	657792	MAPLE R3	345	1		0.72923	-0.03686	-211.2	-194.4	
3	-233.6 L: 602023 LACROSS5	161	602025	MONROCO5	161	1	171.9	167.0	0.02082	0.01259	147.5	144.5
	C:ATC-ARPG3						9144					
	Open 601028 EAU CL 3	345	699244	ARP 345	345	1		0.06799	0.10751	251.3	226.2	
	Open 699706 WIEN	115	699710	STRATFRD	115	1		0.04909	0.00125	22.5	22.3	
	Open 698342 COC 69	69.0	699901	TIMBERWOLF	69.0	1		-0.13107	-0.00319	-22.1	-21.4	
	Open 680121 MAUSTON	69.0	698333	HLT 69	69.0	1		0.11583	0.00341	26.9	26.1	
	Open 680242 LUBLIN	69.0	680505	LAKEHEAD	69.0	1		0.01539	0.00250	12.7	12.1	
4	-233.6 L: 602023 LACROSS5	161	602025	MONROCO5	161	1	171.9	167.0	0.02082	0.01259	147.5	144.5
	C:ATC-ARP-OG2						8587					
	Open 601028 EAU CL 3	345	699244	ARP 345	345	1		0.06799	0.10751	251.3	226.2	
	Open 699706 WIEN	115	699710	STRATFRD	115	1		0.04909	0.00125	22.5	22.3	
	Open 698342 COC 69	69.0	699901	TIMBERWOLF	69.0	1		-0.13107	-0.00319	-22.1	-21.4	
	Open 680121 MAUSTON	69.0	698333	HLT 69	69.0	1		0.11583	0.00341	26.9	26.1	
	Open 680242 LUBLIN	69.0	680505	LAKEHEAD	69.0	1		0.01539	0.00250	12.7	12.1	
5	-160.1*L: 602023 LACROSS5	161	602025	MONROCO5	161	1	170.3	167.0	0.02056	0.01259	147.5	145.4
	C:ATC-ARP-OG1						8586					
	Open 601014 AS KING3	345	601028	EAU CL 3	345	1		-0.00515	0.10494	437.9	421.1	
	Open 601028 EAU CL 3	345	699244	ARP 345	345	1		0.07065	0.10751	251.3	234.1	
	Open 699706 WIEN	115	699710	STRATFRD	115	1		0.04952	0.00125	22.5	22.3	
	Open 698342 COC 69	69.0	699901	TIMBERWOLF	69.0	1		-0.13113	-0.00319	-22.1	-21.6	
	Open 680121 MAUSTON	69.0	698333	HLT 69	69.0	1		0.11587	0.00341	26.9	26.4	

Option 1

		Open 680242 LUBLIN	69.0	680505 LAKEHEAD	69.0	1			0.01557	0.00250	12.7	12.3
9	308.8	L: 667038 ROSSER 4	230	667039 RIDGEWY4	230	1	451.8	460.5	0.02820	0.01901	286.1	292.0
		C: R32V				8659						
		Open 667035 DORSEY 4	230	667043 STVITAL4	230	1			0.30289	0.00877	191.5	194.2
		Open 667035 DORSEY 4	230	667039 RIDGEWY4	230	1			0.44629	0.01464	241.3	245.9
10	471.4	L: 620322 BSSOUTH4	230	620417 BSSOUTH3	345	1	390.3	400.0	0.02066	0.01027	194.0	198.8
		C:620322 BSSOUTH4	230	620417 BSSOUTH3	345	2	2867					
		Open 620322 BSSOUTH4	230	620417 BSSOUTH3	345	2			1.01165	0.01027	194.0	198.8
11	471.4	L: 620322 BSSOUTH4	230	620417 BSSOUTH3	345	2	390.3	400.0	0.02066	0.01027	194.0	198.8
		C:620322 BSSOUTH4	230	620417 BSSOUTH3	345	1	2866					
		Open 620322 BSSOUTH4	230	620417 BSSOUTH3	345	1			1.01165	0.01027	194.0	198.8
12	708.1	L: 603116 WILSON 7	115	603204 WILSON TAP7	115	1	-219.5	-239.0	-0.02753	-0.02295	-82.9	-99.1
		C:603061 BLK DOG7	115	603116 WILSON 7	115	1	502					
		Open 603061 BLK DOG7	115	603116 WILSON 7	115	1			-0.86694	0.00529	157.6	161.3
13	839.3	L: 699240 SAR 138	138	699808 PETENWEL	138	1	-52.8	-72.2	-0.02317	-0.01456	-33.4	-45.6
		C:ATC-ZN1-2				8585						
		Open 601014 AS KING3	345	601028 EAU CL 3	345	1			0.00409	0.10494	437.9	526.0
		Open 601028 EAU CL 3	345	699244 ARP 345	345	1			-0.08406	0.10751	251.3	341.5
14	895.7	L: 699240 SAR 138	138	699808 PETENWEL	138	1	-51.5	-72.2	-0.02310	-0.01456	-33.4	-46.5
		C:ATC-ARPG3				9144						
		Open 601028 EAU CL 3	345	699244 ARP 345	345	1			-0.08434	0.10751	251.3	347.6
		Open 699706 WIEN	115	699710 STRATFRD	115	1			-0.07051	0.00125	22.5	23.7
		Open 698342 COC 69	69.0	699901 TIMBERWOLF	69.0	1			-0.12694	-0.00319	-22.1	-25.0
		Open 680121 MAUSTON	69.0	698333 HLT 69	69.0	1			0.08126	0.00341	26.9	30.0
		Open 680242 LUBLIN	69.0	680505 LAKEHEAD	69.0	1			-0.02432	0.00250	12.7	14.9
15	895.7	*L: 699240 SAR 138	138	699808 PETENWEL	138	1	-51.5	-72.2	-0.02310	-0.01456	-33.4	-46.5
		C:ATC-ARP-OG2				8587						
		Open 601028 EAU CL 3	345	699244 ARP 345	345	1			-0.08434	0.10751	251.3	347.6
		Open 699706 WIEN	115	699710 STRATFRD	115	1			-0.07051	0.00125	22.5	23.7
		Open 698342 COC 69	69.0	699901 TIMBERWOLF	69.0	1			-0.12694	-0.00319	-22.1	-25.0
		Open 680121 MAUSTON	69.0	698333 HLT 69	69.0	1			0.08126	0.00341	26.9	30.0
		Open 680242 LUBLIN	69.0	680505 LAKEHEAD	69.0	1			-0.02432	0.00250	12.7	14.9
21	1459.6	F: 4179:FLWSOU__PTDF					127.6	168.0	0.02767			
		Non Contingent FlowGate										
22	1481.6	L: 620189 MAPLER1Y	345	657792 MAPLE R3	345	1	-263.1	-336.0	-0.04919	-0.03686	-211.2	-265.8
		C:CAPX20				8862						
		Open 601046 ALEXSS3	345	601047 WAITEPK3	345	1			0.07933	0.06958	118.1	221.2
		Open 601046 ALEXSS3	345	657792 MAPLE R3	345	1			0.24546	-0.07273	-251.0	-358.7
		Open 601046 ALEXSS3	345	658050 ALEXSS 7	115	1			0.08092	0.00000	3.5	3.5
23	1485.9	L: 620190 MAPLER2Y	345	657792 MAPLE R3	345	1	-262.9	-336.0	-0.04919	-0.03686	-211.0	-265.7
		C:CAPX20				8862						
		Open 601046 ALEXSS3	345	601047 WAITEPK3	345	1			0.07933	0.06958	118.1	221.5
		Open 601046 ALEXSS3	345	657792 MAPLE R3	345	1			0.24546	-0.07273	-251.0	-359.1
		Open 601046 ALEXSS3	345	658050 ALEXSS 7	115	1			0.08092	0.00000	3.5	3.5

Option 2a

		Open 601046 ALEXSS3	345	601047 WAITEPK3	345	1			0.07575	0.09058	121.6	230.8
		Open 601046 ALEXSS3	345	657792 MAPLE R3	345	1			0.24546	-0.09455	-251.4	-365.3
		Open 601046 ALEXSS3	345	658050 ALEXSS 7	115	1			0.07841	0.00000	3.5	3.5
10	1208.4	L: 620190 MAPLER2Y	345	657792 MAPLE R3	345	1	-255.0	-336.0	-0.06702	-0.05067	-202.8	-264.0
		C:CAPX20									8863	
		Open 601046 ALEXSS3	345	601047 WAITEPK3	345	1			0.07575	0.09058	121.6	231.1
		Open 601046 ALEXSS3	345	657792 MAPLE R3	345	1			0.24546	-0.09455	-251.4	-365.6
		Open 601046 ALEXSS3	345	658050 ALEXSS 7	115	1			0.07841	0.00000	3.5	3.5
11	1388.9	F: 4179:FLWSOU__PTDF					129.0	168.0	0.02810			
		Non Contingent FlowGate										
12	1411.1	L: 601012 ROSEAUN2	500	667501 RIEL 2	500	1	-1040.2	-1732.1	-0.49034	-0.46958	-993.9	-1656.5
		C:CAPX20									8863	
		Open 601046 ALEXSS3	345	601047 WAITEPK3	345	1			-0.07567	0.09058	121.6	249.4
		Open 601046 ALEXSS3	345	657792 MAPLE R3	345	1			0.14702	-0.09455	-251.4	-384.8
		Open 601046 ALEXSS3	345	658050 ALEXSS 7	115	1			-0.03464	0.00000	3.5	3.5
13	1425.9	L: 601012 ROSEAUN2	500	667501 RIEL 2	500	1	-1039.8	-1732.1	-0.48552	-0.46958	-993.9	-1663.5
		C:657792 MAPLE R3	345	699449 ARROWHD	345	2	5573					
		Open 657792 MAPLE R3	345	699449 ARROWHD	345	2			-0.20606	0.07735	222.6	332.9
14	1425.9	*L: 601012 ROSEAUN2	500	667501 RIEL 2	500	1	-1039.8	-1732.1	-0.48552	-0.46958	-993.9	-1663.5
		C:657792 MAPLE R3	345	699449 ARROWHD	345	1	5572					
		Open 657792 MAPLE R3	345	699449 ARROWHD	345	1			-0.20606	0.07735	222.6	332.9
17	1447.3	L: 601001 FORBES 2	500	601013 ROSEAUS2	500	1	-1023.3	-1733.0	-0.49034	-0.46958	-977.1	-1656.7
		C:CAPX20									8863	
		Open 601046 ALEXSS3	345	601047 WAITEPK3	345	1			-0.07567	0.09058	121.6	252.7
		Open 601046 ALEXSS3	345	657792 MAPLE R3	345	1			0.14702	-0.09455	-251.4	-388.2
		Open 601046 ALEXSS3	345	658050 ALEXSS 7	115	1			-0.03464	0.00000	3.5	3.5
23	1462.5	L: 601001 FORBES 2	500	601013 ROSEAUS2	500	1	-1022.9	-1733.0	-0.48552	-0.46958	-977.1	-1663.8
		C:657792 MAPLE R3	345	699449 ARROWHD	345	1	5572					
		Open 657792 MAPLE R3	345	699449 ARROWHD	345	1			-0.20606	0.07735	222.6	335.8
24	1462.5	*L: 601001 FORBES 2	500	601013 ROSEAUS2	500	1	-1022.9	-1733.0	-0.48552	-0.46958	-977.1	-1663.8
		C:657792 MAPLE R3	345	699449 ARROWHD	345	2	5573					
		Open 657792 MAPLE R3	345	699449 ARROWHD	345	2			-0.20606	0.07735	222.6	335.8

Option 3

FCITC Single Study

PSS(tm)MUST 8.3.2 -- Managing and Utilizing System Transmission -- WED, JAN 14 2009 8:35

Case.File C:\LocalDocs\MISO TSR MH\Out-Year\MH_Group_Study_Out_Year_Option-3.sav
 Subsys.File C:\LocalDocs\MISO TSR MH\Out-Year\MUST Inputs\Out_Year_sub.sub
 Monit.File C:\LocalDocs\MISO TSR MH\Out-Year\MUST Inputs\Out_Year_mon.mon
 Contin.File C:\LocalDocs\MISO TSR MH\Out-Year\MUST Inputs\Out_Year_con.con
 Exclud.File C:\LocalDocs\MISO TSR MH\Out-Year\MUST Inputs\Exclude_OutYear_rev2.exc

Study transfer. From MHEB_DORSEY To LONGTERM_SINK . Transfer level - 1540.0 MW

Violations report ordered by transfer capability. Total 48 violations

N	FCITC L: Limiting constraint				PreShift	MW	TDF		PTDF	=Base Case Flow=		
	C: Contingency description				Ncon	Flow	Rating	LODF		Init	Final	
1	-243.6 L: 602023 LACROSS5	161	602025 MONROCO5	161	1	172.1	167.0	0.02081	0.01174	146.0	143.2	
	C:ATC-ARPG3											9142
	Open 601028 EAU CL 3	345	699244 ARP 345	345	1			0.06783	0.12085	276.8	247.3	
	Open 699706 WIEN	115	699710 STRATFRD	115	1			0.04905	0.00140	22.7	22.4	
	Open 698342 COC 69	69.0	699901 TIMBERWOLF	69.0	1			-0.13108	-0.00300	-21.9	-21.1	
	Open 680121 MAUSTON	69.0	698333 HLT 69	69.0	1			0.11584	0.00320	26.6	25.9	
	Open 680242 LUBLIN	69.0	680505 LAKEHEAD	69.0	1			0.01538	0.00249	12.7	12.1	
2	-243.6 L: 602023 LACROSS5	161	602025 MONROCO5	161	1	172.1	167.0	0.02081	0.01174	146.0	143.2	
	C:ATC-ARP-OG2											8585
	Open 601028 EAU CL 3	345	699244 ARP 345	345	1			0.06783	0.12085	276.8	247.3	
	Open 699706 WIEN	115	699710 STRATFRD	115	1			0.04905	0.00140	22.7	22.4	
	Open 698342 COC 69	69.0	699901 TIMBERWOLF	69.0	1			-0.13108	-0.00300	-21.9	-21.1	
	Open 680121 MAUSTON	69.0	698333 HLT 69	69.0	1			0.11584	0.00320	26.6	25.9	
	Open 680242 LUBLIN	69.0	680505 LAKEHEAD	69.0	1			0.01538	0.00249	12.7	12.1	
3	-158.8*L: 602023 LACROSS5	161	602025 MONROCO5	161	1	170.2	167.0	0.02045	0.01174	146.0	144.2	
	C:ATC-ARPG2											9141
	Open 601014 AS KING3	345	601028 EAU CL 3	345	1			-0.00538	0.12954	485.2	464.6	
	Open 601028 EAU CL 3	345	699244 ARP 345	345	1			0.07062	0.12085	276.8	257.6	
	Open 699706 WIEN	115	699710 STRATFRD	115	1			0.04950	0.00140	22.7	22.5	
	Open 698342 COC 69	69.0	699901 TIMBERWOLF	69.0	1			-0.13114	-0.00300	-21.9	-21.4	
	Open 680121 MAUSTON	69.0	698333 HLT 69	69.0	1			0.11589	0.00320	26.6	26.1	
	Open 680242 LUBLIN	69.0	680505 LAKEHEAD	69.0	1			0.01558	0.00249	12.7	12.3	
7	350.7 L: 667038 ROSSER 4	230	667039 RIDGEWY4	230	1	450.1	460.5	0.02969	0.01982	285.1	292.0	
	C: R32V											8657
	Open 667035 DORSEY 4	230	667043 STVITAL4	230	1			0.30285	0.00923	190.4	193.7	
	Open 667035 DORSEY 4	230	667039 RIDGEWY4	230	1			0.44626	0.01585	240.6	246.1	
8	858.7 L: 699240 SAR 138	138	699808 PETENWEL	138	1	-52.6	-72.2	-0.02280	-0.01321	-31.5	-42.8	

Option 3

		C:ATC-ZN1-2								8583						
		Open 601014 AS KING3	345	601028 EAU CL 3	345	1			0.00432	0.12954	485.2	596.4				
		Open 601028 EAU CL 3	345	699244 ARP 345	345	1			-0.08403	0.12085	276.8	380.5				
9	894.0	L: 699240 SAR 138	138	699808 PETENWEL	138	1			-51.7	-72.2	-0.02290		-0.01321	-31.5	-43.3	
		C:ATC-ARP-OG2													8585	
		Open 601028 EAU CL 3	345	699244 ARP 345	345	1			-0.08418	0.12085	276.8	384.8				
		Open 699706 WIEN	115	699710 STRATFRD	115	1			-0.07047	0.00140	22.7	24.0				
		Open 698342 COC 69	69.0	699901 TIMBERWOLF	69.0	1			-0.12693	-0.00300	-21.9	-24.6				
		Open 680121 MAUSTON	69.0	698333 HLT 69	69.0	1			0.08125	0.00320	26.6	29.5				
		Open 680242 LUBLIN	69.0	680505 LAKEHEAD	69.0	1			-0.02431	0.00249	12.7	14.9				
10	894.0	*L: 699240 SAR 138	138	699808 PETENWEL	138	1			-51.7	-72.2	-0.02290		-0.01321	-31.5	-43.3	
		C:ATC-ARPG3													9142	
		Open 601028 EAU CL 3	345	699244 ARP 345	345	1			-0.08418	0.12085	276.8	384.8				
		Open 699706 WIEN	115	699710 STRATFRD	115	1			-0.07047	0.00140	22.7	24.0				
		Open 698342 COC 69	69.0	699901 TIMBERWOLF	69.0	1			-0.12693	-0.00300	-21.9	-24.6				
		Open 680121 MAUSTON	69.0	698333 HLT 69	69.0	1			0.08125	0.00320	26.6	29.5				
		Open 680242 LUBLIN	69.0	680505 LAKEHEAD	69.0	1			-0.02431	0.00249	12.7	14.9				
16	1311.2	L: 608721 ETCO 7	115	608722 FORBES 7	115	1			-79.8	-107.8	-0.02135		-0.01489	-69.1	-88.6	
		C:608615 ARROWHD4	230	608624 FORBES 4	230	1	1613									
		Open 608615 ARROWHD4	230	608624 FORBES 4	230	1							0.07988	-0.08086	-134.1	-240.1
17	1413.7	F: 4179:FLWSOU__PTDF							128.3	168.0	0.02807					
		Non Contingent FlowGate														
18	1476.0	L: 608666 FONDULAC	115	608676 HIBBARD7	115	1			7.6	-44.0	-0.03494		-0.01340	14.4	-5.3	
		C:608667 POTLTCH7	115	608668 CLOQUET7	115	1	1716									
		Open 608667 POTLTCH7	115	608668 CLOQUET7	115	1							0.77852	-0.02766	-8.8	-49.7
19	1500.1	L: 601012 ROSEAUN2	500	667501 RIEL 2	500	1			-1017.4	-1732.1	-0.47643		-0.47643	-951.6	-1666.3	
		C: BK41													8680	
		Open 668022 BRANDON7	110	668026 BK41-TP7	110	1							-0.34273	0.00000	191.9	191.9
		Open 668026 BK41-TP7	110	668027 MAPLELF7	110	1			NA							
		Open 668027 MAPLELF7	110	668028 CAN OXY7	110	1			NA							
20	1508.2	L: 601012 ROSEAUN2	500	667501 RIEL 2	500	1			-986.0	-1732.1	-0.49469		-0.47643	-951.6	-1670.2	
		C:B2_XEL_ROSEAUMP-MORNVLV-RICH2230.0													8900	
		Open 602013 ROSEAU 4	230	657757 MORANVI4	230	1							-0.45952	0.03974	73.8	133.8
		Open 602013 ROSEAU 4	230	667046 RICHER 4	230	1							-0.42902	0.00000	1.0	1.0
21	1521.2	*L: 601012 ROSEAUN2	500	667501 RIEL 2	500	1			-1007.4	-1732.1	-0.47643		-0.47643	-951.6	-1676.4	
		C:661084 TIOGA4 4	230	672603 BDV 4	230	1	8580									
		Open 661084 TIOGA4 4	230	672603 BDV 4	230	1							0.33753	0.00000	-165.1	-165.1
25	1535.2	L: 601001 FORBES 2	500	601013 ROSEAUS2	500	1			-1001.6	-1733.0	-0.47643		-0.47643	-935.8	-1667.2	
		C: BK41													8680	
		Open 668022 BRANDON7	110	668026 BK41-TP7	110	1							-0.34273	0.00000	191.9	191.9
		Open 668026 BK41-TP7	110	668027 MAPLELF7	110	1			NA							
		Open 668027 MAPLELF7	110	668028 CAN OXY7	110	1			NA							

Option 4b

FCITC Single Study

PSS(tm)MUST 8.3.2 -- Managing and Utilizing System Transmission -- WED, JAN 14 2009 9:01

Case.File C:\LocalDocs\MISO TSR MH\Out-Year\MH_Group_Study_Out_Year_Option-4b.sav
 Subsys.File C:\LocalDocs\MISO TSR MH\Out-Year\MUST Inputs\Out_Year_option4_sub.sub
 Monit.File C:\LocalDocs\MISO TSR MH\Out-Year\MUST Inputs\Out_Year_mon.mon
 Contin.File C:\LocalDocs\MISO TSR MH\Out-Year\MUST Inputs\Out_Year_con.con
 Exclud.File C:\LocalDocs\MISO TSR MH\Out-Year\MUST Inputs\Exclude_OutYear_rev2.exc

Study transfer. From OPT4B_SRC To LONGTERM_SINK . Transfer level - 1540.0 MW

Violations report ordered by transfer capability. Total 63 violations

N	FCITC L: Limiting constraint	PreShift	MW	TDF	PTDF	=Base Case Flow=
	C: Contingency description	Ncon	Flow	Rating	LODF	Init Final
1	-2488.5 F: 65010:COLPORCOLPOR C:Contingency of FlowGate 65010 Open 699145 POR 138 138 699167 COL 138	9169 138 2	376.8	275.0	0.04090	0.02301 212.0 154.8
2	-2341.8 F: 3036:COLPO2COLPO1 C:Contingency of FlowGate 3036 Open 699145 POR 138 138 699167 COL 138	9523 138 1	376.8	281.0	0.04090	0.02301 212.0 158.1
3	-1049.1 F: 4054:COLXF1COLXF2 C:Contingency of FlowGate 4054 Open 699157 COL 345 345 699167 COL 138	9331 138 2	215.7	193.0	0.02161	0.01233 123.1 110.1
4	-1031.9 L: 620189 MAPLER1Y 345 657792 MAPLE R3 345 1 C:620190 MAPLER2Y 345 657792 MAPLE R3 345 1 2703 Open 620190 MAPLER2Y 345 657792 MAPLE R3 345 1	2703 345 1	-404.6	-336.0	-0.06647	-0.03801 -231.4 -192.2
5	-1030.9 L: 620190 MAPLER2Y 345 657792 MAPLE R3 345 1 C:620189 MAPLER1Y 345 657792 MAPLE R3 345 1 2701 Open 620189 MAPLER1Y 345 657792 MAPLE R3 345 1	2701 345 1	-404.5	-336.0	-0.06647	-0.03801 -231.2 -192.0
6	59.6 L: 699120 ROE 138 138 699347 LKHD_CAM Base Case	138 1	276.6	278.4	0.02927	
7	124.7 L: 699340 JEFRSN4 138 699347 LKHD_CAM 138 1 C:699118 CMT 138 138 699120 ROE 138 138 1 7790 Open 699118 CMT 138 138 699120 ROE 138 138 1	7790 138 1	-362.6	-367.6	-0.04013	-0.02927 -262.6 -266.3
8	148.6 L: 699145 POR 138 138 699167 COL 138 138 2 C:699145 POR 138 138 699167 COL 138 138 1 7819 Open 699145 POR 138 138 699167 COL 138 138 1	7819 138 1	-376.8	-382.8	-0.04090	-0.02301 -212.0 -215.4
9	148.6 L: 699145 POR 138 138 699167 COL 138 138 1 C:699145 POR 138 138 699167 COL 138 138 2 7820 Open 699145 POR 138 138 699167 COL 138 138 2	7820 138 2	-376.8	-382.8	-0.04090	-0.02301 -212.0 -215.4
10	154.8 L: 699120 ROE 138 138 699347 LKHD_CAM 138 1	138 1	376.6	382.8	0.04013	0.02927 276.6 281.1

Option 4b

		Open 699157 COL 345	345 699167 COL 138	138 2				0.36750	0.02525	252.0	277.5
24	1082.5	L: 603116 WILSON 7	115 603204 WILSON TAP7	115 1	-214.3	-239.0	-0.02283		-0.01885	-79.8	-100.2
		C:603061 BLK DOG7	115 603116 WILSON 7	115 1 498							
		Open 603061 BLK DOG7	115 603116 WILSON 7	115 1				-0.86695	0.00459	155.1	160.1
25	1160.0	L: 699118 CMT 138	138 699120 ROE 138	138 1	-340.4	-382.8	-0.03658		-0.02259	-208.2	-234.4
		C:699120 ROE 138	138 699347 LKHD_CAM	138 1 7799							
		Open 699120 ROE 138	138 699347 LKHD_CAM	138 1				-0.47802	0.02927	276.6	310.6
26	1210.2	L: 693941 FRIES138	138 699146 HAM 138	138 1	-165.9	-228.0	-0.05134		-0.02540	-115.3	-146.1
		C:699157 COL 345	345 699176 SFL 345	345 1 7833							
		Open 699157 COL 345	345 699176 SFL 345	345 1				-0.15737	0.16482	321.3	520.7
27	1222.3	L: 699176 SFL 345	345 699186 SFL 138	138 2	162.5	194.8	0.02638		0.00619	147.1	154.6
		C:699176 SFL 345	345 699669 FTZGERLD	345 1 7854							
		Open 699176 SFL 345	345 699669 FTZGERLD	345 1				0.15475	0.13048	99.7	259.2
28	1238.6	L: 698526 BOX ELDR	138 699121 LDN 138	138 1	-318.5	-363.9	-0.03658		-0.02259	-186.3	-214.3
		C:699120 ROE 138	138 699347 LKHD_CAM	138 1 7799							
		Open 699120 ROE 138	138 699347 LKHD_CAM	138 1				-0.47802	0.02927	276.6	312.9
29	1300.7	L: 699118 CMT 138	138 699120 ROE 138	138 1	-335.3	-382.8	-0.03658		-0.02259	-208.2	-237.6
		C:ATC-Z3-3		8595							
		Open 699340 JEFRSN4	138 699347 LKHD_CAM	138 1				0.47802	-0.02927	-262.6	-300.7
		Open 699120 ROE 138	138 699347 LKHD_CAM	138 1				-0.11020	0.00000	14.0	14.0
30	1342.1	L: 601012 ROSEAUN2	500 667501 RIEL 2	500 1	-1346.0	-1732.1	-0.28769		-0.26540	-1258.6	-1614.7
		C:CAPX20		8859							
		Open 601046 ALEXSS3	345 601047 WAITEPK3	345 1				-0.11166	0.06215	161.0	244.4
		Open 601046 ALEXSS3	345 657792 MAPLE R3	345 1				0.23271	-0.06594	-296.5	-385.0
		Open 601046 ALEXSS3	345 658050 ALEXSS 7	115 1				-0.06555	0.00000	7.2	7.2
31	1342.8	*L: 699118 CMT 138	138 699120 ROE 138	138 1	-333.7	-382.8	-0.03658		-0.02259	-208.2	-238.5
		C:699340 JEFRSN4	138 699347 LKHD_CAM	138 1 8023							
		Open 699340 JEFRSN4	138 699347 LKHD_CAM	138 1				0.47802	-0.02927	-262.6	-301.9
32	1356.2	L: 693941 FRIES138	138 699170 NOR 138	138 1	158.4	228.0	0.05134		0.02540	107.8	142.3
		C:699157 COL 345	345 699176 SFL 345	345 1 7833							
		Open 699157 COL 345	345 699176 SFL 345	345 1				0.15737	0.16482	321.3	544.8
33	1379.3	L: 698526 BOX ELDR	138 699121 LDN 138	138 1	-313.4	-363.9	-0.03658		-0.02259	-186.3	-217.5
		C:ATC-Z3-3		8595							
		Open 699340 JEFRSN4	138 699347 LKHD_CAM	138 1				0.47802	-0.02927	-262.6	-303.0
		Open 699120 ROE 138	138 699347 LKHD_CAM	138 1				-0.11020	0.00000	14.0	14.0
34	1390.4	F: 4179:FLWSOU__PTDF			127.5	168.0	0.02912				
		Non Contingent FlowGate									
35	1419.2	L: 601001 FORBES 2	500 601013 ROSEAUS2	500 1	-1324.7	-1733.0	-0.28769		-0.26540	-1237.3	-1613.9
		C:CAPX20		8859							
		Open 601046 ALEXSS3	345 601047 WAITEPK3	345 1				-0.11166	0.06215	161.0	249.2
		Open 601046 ALEXSS3	345 657792 MAPLE R3	345 1				0.23271	-0.06594	-296.5	-390.1
		Open 601046 ALEXSS3	345 658050 ALEXSS 7	115 1				-0.06555	0.00000	7.2	7.2
36	1421.5	*L: 698526 BOX ELDR	138 699121 LDN 138	138 1	-311.9	-363.9	-0.03658		-0.02259	-186.3	-218.4
		C:699340 JEFRSN4	138 699347 LKHD_CAM	138 1 8023							
		Open 699340 JEFRSN4	138 699347 LKHD_CAM	138 1				0.47802	-0.02927	-262.6	-304.2
37	1434.9	L: 699283 CONCRD 4	138 699375 CRWFISH R	138 1	-199.0	-272.6	-0.05130		-0.03269	-162.8	-209.7

Option 4b

		C:699157 COL 345	345	699176 SFL 345	345	1	7833						
		Open 699157 COL 345		345 699176 SFL 345			345 1			-0.11288	0.16482	321.3	557.8
38	1441.0	L: 699118 CMT 138	138	699121 LDN 138	138	1		326.3	379.0	0.03658	0.02259	194.1	226.7
		C:699120 ROE 138	138	699347 LKHD_CAM	138	1	7799						
		Open 699120 ROE 138		138 699347 LKHD_CAM			138 1			0.47802	0.02927	276.6	318.8
39	1482.1	F:10285:LKHJFFEAUARP						262.6	306.0	0.02927			
		Non Contingent FlowGate											
40	1506.3	L: 601012 ROSEAUN2	500	667501 RIEL 2	500	1		-1332.3	-1732.1	-0.26540	-0.26540	-1258.6	-1658.3
		C: BK41					8679						
		Open 668022 BRANDON7	110	668026 BK41-TP7	110	1				-0.38432	0.00000	191.9	191.9
		Open 668026 BK41-TP7	110	668027 MAPLELF7	110	1		NA					
		Open 668027 MAPLELF7	110	668028 CAN OXY7	110	1		NA					
41	1518.7	*L: 601012 ROSEAUN2	500	667501 RIEL 2	500	1		-1289.7	-1732.1	-0.29133	-0.26540	-1258.6	-1661.6
		C:220					9068						
		Open 620358 BUFFALO3	345	620369 JAMESTN3	345	1				0.04693	0.01502	-518.9	-496.1
		Open 620358 BUFFALO3	345	657792 MAPLE R3	345	1				0.28595	-0.01708	444.2	418.3
		Open 620198 BUFFALOY	345	620358 BUFFALO3	345	1		NA					
		Open 620198 BUFFALOY	345	620258 BUFFALO7	115	1				-0.07194	0.00000	19.5	19.5
		Open 620158 BUFFALO9	41.6	620198 BUFFALOY	345	1		NA					
		Open 620189 MAPLER1Y	345	657792 MAPLE R3	345	1				0.28609	-0.03801	-231.4	-289.2
		Open 620189 MAPLER1Y	345	657754 MAPLE R4	230	1				-0.07181	0.00000	0.5	0.5
		Open 620189 MAPLER1Y	345	620359 MAPLER19	13.8	1		NA					
		Open 620190 MAPLER2Y	345	657754 MAPLE R4	230	1				-0.28609	0.03801	231.2	288.9
		Open 620190 MAPLER2Y	345	657792 MAPLE R3	345	1				-0.35789	0.00000	-0.0	-0.0
		Open 620190 MAPLER2Y	345	620360 MAPLER29	13.8	1		NA					