BASIN ELECTRIC POWER COOPERATIVE

Tioga-Williston-Charlie Creek 230kV Line and Tioga 230/115kV Transformer #2 Analysis

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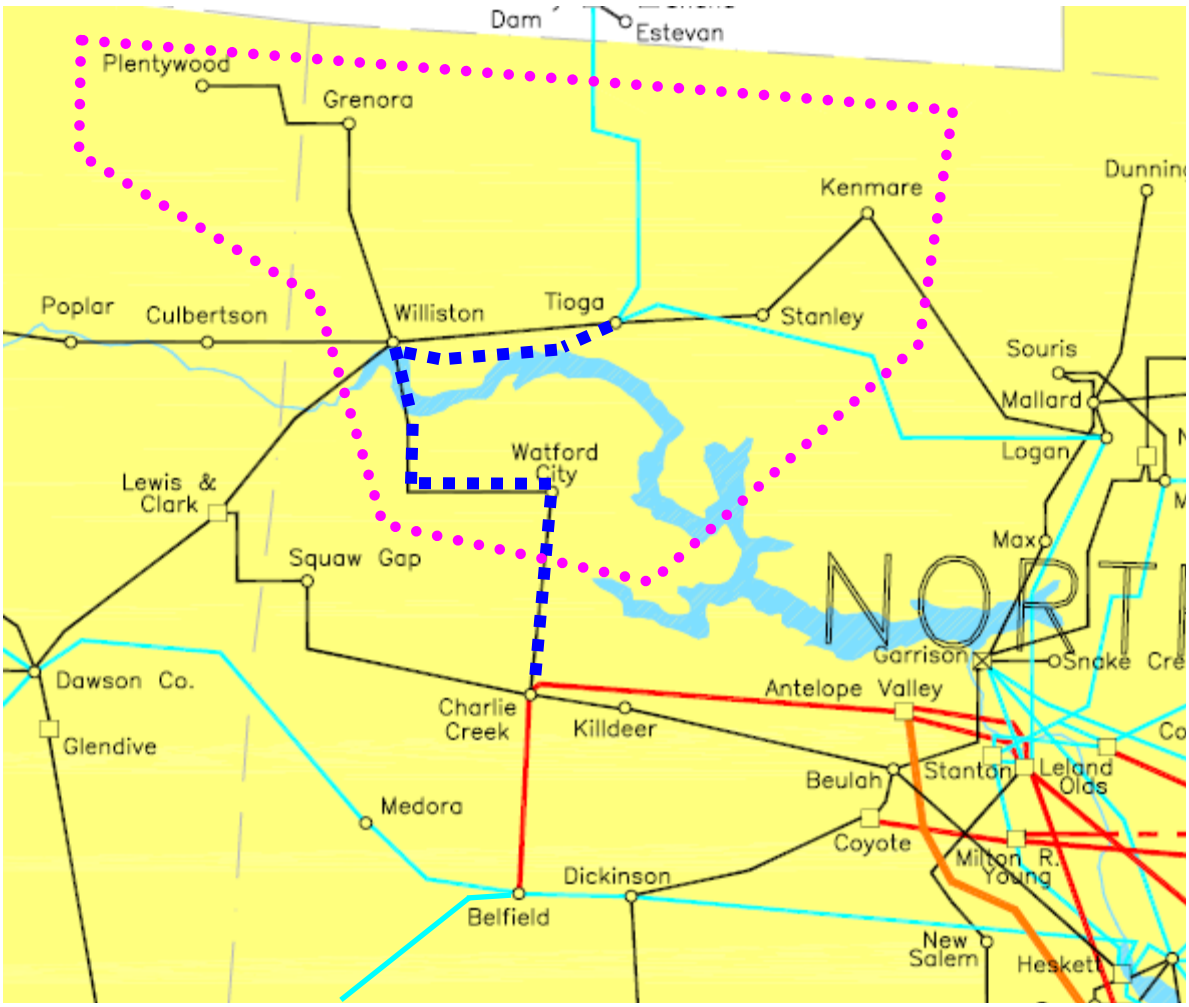
September 2008

1.0 Executive Summary

This project consists of a new 230kV line between Tioga and Williston Substations and a rebuild of the existing Western Area Power Administration 115kV line between Williston and Charlie Creek Substations to 230kV. The Tioga-Williston 230kV line will be approximately 50 miles long. Williston Substation will be upgraded to include a 230/115kV transformer. Also, a second 230/115kV transformer will be added at Tioga Substation. The Williston-Charlie Creek 230kV line will be approximately 75 miles long. The Watford City Substation will be converted to a 230/115/69kV Substation. A 345/230kV transformer will be added at Charlie Creek Substation. The geographic location is provided in Figure #1.



Proposed 230kV line
Northwest ND Load Area

Figure #1 – Geographic Location

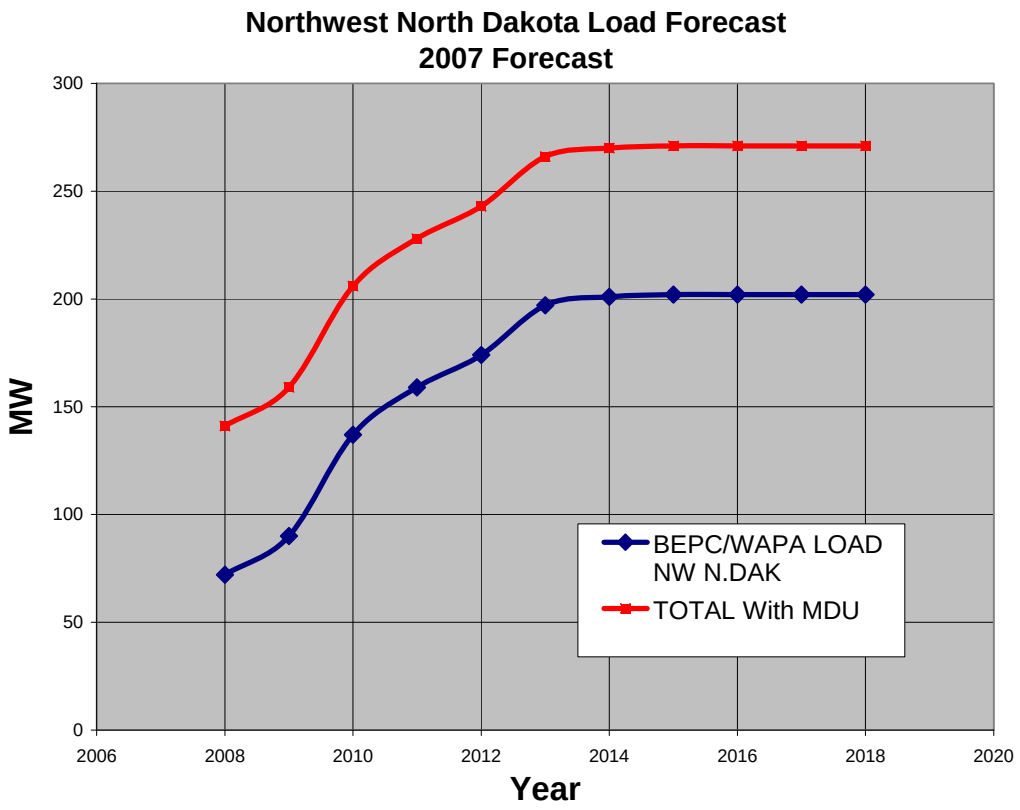


Table #1 – Northwest North Dakota Load Forecast

2.0 Introduction

The purpose of this study is to analyze the impact of the latest load forecast for the northwest North Dakota area. This area is defined as the area bounded by the pink dotted line in Figure #1. Electrical network load related to oil and gas extraction and delivery is growing at a fast rate. The 2007 load forecast for this area is provided in Table #1.

This study is the second phase in a larger effort to analyze the impact of the 2007 Basin Electric load forecast. The first phase was the analysis of the southwestern North Dakota area that showed a need for the Belfield-Rhame 230kV line.

3.0 Base Cases

3.1 Steady State

The steady state base cases are the 2011 heavy summer and 2011 heavy winter from the 2006 series. The latest updates from the MAPP website and other updates are added. The new capacitor banks are added at Dawson 115kV (2 x 20MVAR) and Little Missouri 115kV (2 x 20MVAR) buses.

The Miles City DC steady state powerflow model behavior complicates the steady state analysis. During solution iterations it blocks its power transfer during low voltage conditions. In block mode the steady state voltage usually recovers and the results appear to meet criteria. This only happens for east-west transfers. Therefore, in Miles City DC east-west transfer cases the Miles City DC model is replaced with a load with an equivalent MW and MVAR. For 200MW east-west operation the tie consumes 90MVAR, therefore a 200MW and 90MVAR load will be used. Shunt filter bank modeling is not changed. Miles City will also be tested operating in the west-east direction at 200MW.

RCDC Tie is scheduled 130MW east to west in all cases.

Saskatchewan schedules are tested 165MW north to south and 165MW south to north on the B10T path.

Area generation is set at the following levels;

Generation	2011 Heavy Summer MW	2011 Heavy Winter MW
Miles City CT	0	0
Ft Peck Hydro	60	60
Lewis & Clark	44	44
Glendive CT	0	0
Diamond Willow Wind	0	0

Table #2

Several cases are constructed to include the parameters listed in this section. The following table describes each case.

Case Naming Convention				
Case Name	Year/Season	B10T	MCDC	Tioga-Williston-Charlie Creek 230
1	2011 Summer	165MW south-north	200MW east-west	
2	2011 Summer	165MW north-south	200MW east-west	
3	2011 Summer	165MW south-north	150MW west-east	
4	2011 Summer	165MW north-south	150MW west-east	
5	2011 Summer	165MW south-north	200MW east-west	In Service
6	2011 Summer	165MW north-south	200MW east-west	In Service
7	2011 Summer	165MW south-north	150MW west-east	In Service
8	2011 Summer	165MW north-south	150MW west-east	In Service
9	2011 Winter	165MW south-north	200MW east-west	
10	2011 Winter	165MW north-south	200MW east-west	
11	2011 Winter	165MW south-north	150MW west-east	
12	2011 Winter	165MW north-south	150MW west-east	
13	2011 Winter	165MW south-north	200MW east-west	In Service
14	2011 Winter	165MW north-south	200MW east-west	In Service
15	2011 Winter	165MW south-north	150MW west-east	In Service
16	2011 Winter	165MW north-south	150MW west-east	In Service

Table #3

The Miles City DC tie limit is 200MW east-west and 150MW west-east.

3.2 Stability Case

The stability case is based on the 2006 NMORWG package 2008 summer off peak URGE case. NDEX is set to 2080MW. Additions required to support the 2080MW limit are added including the 60MVAR capacitors at Groton and the 75MVAR capacitors are Watertown. The “setexport” routine is run to establish the benchmark case with NDEX at 2080 and MHEX at 2180MW.

The Tioga-Williston-Charlie Creek 230kV line is added to the benchmark case to create the study case. The Setexport routine is run to re-establish NDEX at 2080MW.

4.0 Proposed Alternative

The WAPA Williston-Charlie Creek 115kV line is in poor physical condition and was scheduled for rebuilding several years ago, prior to the identification of this project. Subsequently, as part of this project, the rebuilding will be accelerated. The replacement transmission line will be built for 230kV operation.

The Tioga 230/115kV transformer overload is an existing limit to Saskatchewan imports. The normal import capability is 165MW. The increased 115kV network load has increased loading on the Tioga 230/115kV transformer to the extent the 165MW Saskatchewan import can no longer be accommodated. Also the loss of the Tioga 230/115kV transformer causes low

voltage on the 115kV system. Therefore a parallel transformer will provide additional thermal capacity to mitigate the existing overload and provide a back up for loss of the existing transformer to mitigate the low voltage issue.

The proposed Tioga-Williston 230kV line will complete the 230kV loop from Tioga to Charlie Creek. Without this facility the existing Williston-Tioga 115kV line is subject to overload.

5.0 Criteria

Voltage Criteria:

Normal Voltage Levels: The normal voltage range is a minimum of 0.95 PU and a maximum of 1.05 PU.

Emergency Voltage Limits: For periods less than 30 minutes, the emergency voltage range is a minimum of 0.90 PU and a maximum of 1.10 PU.

Loading Criteria:

Normal Loading Levels: The limit is 100% of normal ratings for transformers, conductors and line/substation related equipment.

Emergency Loading Limits: Not all facilities have an emergency limit. Continuous ratings (Rate A) will be monitored in the analysis. Facilities that are flagged as overloads will be checked for the presence of an emergency limit. If such a limit exists it will be noted in the results.

6.0 Methodology

The forced outage list includes all branches in western North Dakota plus the Tioga 230/115kV Transformer Trip with loss of the Tioga-Logan 230kV line and also the Leland Olds 345/230kV double outage. For the MCDC-Dawson 230kV outage the MCDC tie is auto-ramped to 60MW east-west and for the Dawson-Medora-Belfield 230kV outage the MCDC tie is auto-ramped to 100MW east-west. All of the buses and branches in the WAPA control area and adjacent control areas in central North Dakota are monitored.

Voltage stability in northwestern North Dakota will also be tested. The most critical voltage stability scenario is with MCDC east-west and B10T south-north. Referring to Table #3, cases #1 and #5 represent the critical scenario. PV curves will be created for each of these cases.

Fault duty at Tioga 230kV and 115kV, Williston 115kV, and Charlie Creek 115kV and 345kV buses will be calculated before and after the addition of the Tioga-Williston-Charlie Creek 230kV line.

A check on stability performance will be performed. A summer off peak, high transfer case (NDEX=2080), URGE case from the 2006 package will be used as a benchmark.

7.0 Steady State Contingency Results

Detailed Results are provided in Appendix A. The following is a summary of the results. The limiting condition for each case is listed.

7.1 2011 Summer Peak

CASE 1 B10T = 165 South - North MCDC = 200 East - West	
Outage	Violation
System Intact	Stanley 115 Volts = 0.948
Tioga 230/115	Not Solved
AVS-C.Creek 345	Not Solved
Logan-Tioga 230 with Tioga 230/115 Cross Trip	Not Solved
Tioga-Stanley 115	Stanley 115 Volts = 0.843

CASE 2 B10T = 165 North - South MCDC = 200 East - West	
Outage	Violation
Tioga 230/115	Tioga 115 Volts = 0.749 + others
Logan-Tioga 230 with Tioga 230/115 CrossTrip	Tioga 115 Volts = 0.728 + others
Tioga-Stanley 115	Stanley 115 Volts = 0.895

CASE 3 B10T = 165 South - North MCDC = 150 West - East	
Outage	Violation
Tioga 230/115	Tioga 115 Volts = 0.698 + others
Logan-Tioga 230 with Tioga 230/115 CrossTrip	Tioga 115 Volts = 0.636 + others Logan-Kenmare 115 = 107.2% of 100MVA
Tioga-Stanley 115	Stanley 115 Volts = 0.854

CASE 4 B10T = 165 North - South MCDC = 150 West - East	
Outage	Violation
Tioga 230/115	Tioga 115 Volts = 0.749 + others
Logan-Tioga 230 with Tioga 230/115 CrossTrip	Tioga 115 Volts = 0.725 + others
Tioga-Stanley 115	Stanley 115 Volts = 0.895

CASE 5 – Add Tioga-Williston-Charlie Creek 230 and 2nd Tioga 230/115kV Transformer B10T = 165 South - North MCDC = 200 East - West	
No Violations	

CASE 6 – Add Tioga-Williston-Charlie Creek 230 and 2nd Tioga 230/115kV Transformer B10T = 165 North - South MCDC = 200 East - West	
No Violations	

CASE 7 – Add Tioga-Williston-Charlie Creek 230 and 2nd Tioga 230/115kV Transformer B10T = 165 South - North MCDC = 150 West - East	
No Violations	

CASE 8 – Add Tioga-Williston-Charlie Creek 230 and 2nd Tioga 230/115kV Transformer B10T = 165 North - South MCDC = 150 West - East	
No Violations	

7.2 2011 Winter Peak

CASE 9 B10T = 165 South - North MCDC = 200 East - West	
Outage	Violation
System Intact	Not Solved

CASE 10 B10T = 165 North - South MCDC = 200 East - West	
Outage	Violation
System Intact	Tioga 230/115 @ 160% of 100MVA
AVS-CCR345, Tioga-BDV230, Tioga230/115	Not Solved
Tioga-Stanley 115	Stanley 115 volts = 0.830 pu

CASE 11 B10T = 165 South - North MCDC = 150 West - East	
Outage	Violation
System Intact	Not Solved

CASE 12 B10T = 165 North - South MCDC = 150 West - East	
Outage	Violation
System Intact	Tioga 230/115 @ 160% of 100MVA
Tioga230/115	Numerous 115kV low voltage
Tioga-Tiogajct 115	Tiogajct 115 volts = 0.862 pu
Tioga-BDV230	Numerous 115kV low voltage
Tioga-Stanley 115	Stanley 115 volts = 0.823 pu
Tioga-Logan with Tioga 230/115 cross trip	Numerous 115kV low voltage

CASE 13 – Add Tioga-Williston-Charlie Creek 230 and 2nd Tioga 230/115kV Transformer B10T = 165 South - North MCDC = 200 East - West	
No Violations	

CASE 14 – Add Tioga-Williston-Charlie Creek 230 and 2nd Tioga 230/115kV Transformer B10T = 165 North - South MCDC = 200 East - West	
No Violations	

CASE 15 – Add Tioga-Williston-Charlie Creek 230 and 2nd Tioga 230/115kV Transformer B10T = 165 South - North MCDC = 150 West - East	
No Violations	

CASE 16 – Add Tioga-Williston-Charlie Creek 230 and 2nd Tioga 230/115kV Transformer B10T = 165 North - South MCDC = 150 West - East	
No Violations	

In the summer and winter peak base cases there are numerous criteria violations, including unsolved cases. The worst outages are the AVS-Charlie Creek 345kV line, the Tioga 230/115kV Transformer, Tioga-Boundary Dam 230kV Line, or the Tioga-Logan 230kV line. These violations occur during each combination of MCDC and Saskatchewan powerflow.

Addition of the Tioga-Williston- Charlie Creek 230kV line completes a 230kV loop between Tioga and the North Dakota coal field 345kV transmission system and thereby provides enough transmission system redundancy to maintain load serving capacity during contingencies.

8.0 Voltage Stability Results

PV curves are provided in Appendix B.

In the base case the AVS-Charlie Creek 345kV outage does not solve. Therefore the base case has inadequate voltage stability performance. Addition of the Tioga-Williston-Charlie Creek 230kV line allows the AVS-Charlie Creek 345kV outage to solve with loads at the 2011 summer peak level (220MW). However, the Dickinson 115kV voltage is barely above criteria and there is not adequate capacity to support projected load growth beyond 2012. Addition of 40MVARs of capacitance improves the voltage stability performance and increases the area load serving capability to 300MW. This allows the load growth to be accommodated through the end of the projected load forecast time period of 2020.

9.0 Stability Results

The following Table #4 shows that the addition of the Tioga-Williston-Charlie Creek 230kV line does not change any of the transient voltages for the regional faults. Three critical buses that have been noted with low voltages in the past are compared.

	Groton 345 kV (PU) Transient Voltage Minimum			Wahpeton 115 kV (PU) Transient Voltage Minimum			Watertown 345 kV (PU) Transient Voltage Minimum		
	Disturbance			**Disturbance**			**Disturbance**		
	ag1	**ei2**	**nmz**	**ag1**	**Ei2**	**nmz**	**ag1**	**ei2**	**nmz**
Base Case	0.85	0.83	0.85	0.96	0.88	0.89	0.93	0.88	0.90
Befield-Rhame 230kV Added	0.86	0.83	0.86	0.96	0.88	0.89	0.94	0.88	0.90
Delta Impact	+0.01	0.00	+0.01	0.00	0.00	0.00	+0.01	0.00	0.00

Table #4 - Transient Voltages at Critical Buses in MAPP Region

The results indicate a slightly positive impact. The transient low voltage increased by 0.01 p.u. or remained the same for each disturbance.

10.0 Fault Duty

The addition of the Tioga-Williston-Charlie Creek 230kV line will increase fault current in the area. The following table provides the three phase fault duties at Tioga, Williston, Watford City, and Charlie Creek.

Three Phase Fault Duty - MVA		
Bus	Pre – Tioga-Charlie Creek 230	Tioga-Charlie Creek 230 In Service
Tioga 230kV	1316	1750
Tioga 115kV	879	1189
Williston 115kV	724	1053
Watford City 115kV	590	651
Charlie Creek 115kV	1897	1929
Charlie Creek 345kV	2716	2975

Table #5

11.0 – Conclusion

The existing system is not able to accommodate the 2011 forecasted load in the Northwestern North Dakota area. Addition of the Tioga-Williston- Charlie Creek 230kV line completes a 230kV loop between Tioga and the North Dakota coal field 345kV transmission system and thereby provides enough transmission system redundancy to maintain load serving capacity during contingencies.

12.0 – Listing of Appendices

Appendix A – Powerflow Results
Appendix B – PV Results
Appendix C – Stability Results Table

Appendix A

CASE #1
2011 Summer Peak
Saskatchewan 165MW South-North, MCDC 200MW East-West

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 CELL NAME = 1A1A2,B10T=-161,LOAD=253 NC, NC, DC-EW, B10T=165SN, JUL11

 STATUS                                          VIOLATED ELEMENT              PU
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 OUTAGES:

 4_1A1A2*NOT SOLVED* OUTAGE: BELFELDT 345 -BELFELD4 230      ****DID NOT SOLVE*****

 11_1A1A2 OUTAGE: BISMARK4 230 -BISMARK7 115     BISMARK4 230-BISMARK7 115     114.5 % OF  100.0 MVA RATING
                                                 Rate C = 125MVA
 12_1A1A2 OUTAGE: BISMARK4 230 -BISMARK7 115     BISMARK4 230-BISMARK7 115     119.1 % OF  100.0 MVA RATING
                                                 Rate C = 125MVA

 15_1A1A2 OUTAGE: TIOGA4 4 230 -TIOGA4 7 115     WATFORD7 115                  0.854 VOLTAGE LOWER THAN  0.9
                                                 WILISTN7 115                  0.786 VOLTAGE LOWER THAN  0.9
                                                 RICHLND7 115                  0.885 VOLTAGE LOWER THAN  0.9
                                                 GRENORA7 115                  0.768 VOLTAGE LOWER THAN  0.9
                                                 PLNTYWD7 115                  0.766 VOLTAGE LOWER THAN  0.9
                                                 KOCH   7 115                  0.881 VOLTAGE LOWER THAN  0.9
                                                 INDNHLS7 115                  0.798 VOLTAGE LOWER THAN  0.9
                                                 SQUAWGP7 115                  0.887 VOLTAGE LOWER THAN  0.9
                                                 BTHOLD 7 115                  0.791 VOLTAGE LOWER THAN  0.9
                                                 CLBRTSN7 115                  0.837 VOLTAGE LOWER THAN  0.9
                                                 KENMARE7 115                  0.681 VOLTAGE LOWER THAN  0.9
                                                 LEWIS  7 115                  0.895 VOLTAGE LOWER THAN  0.9
                                                 STANLEY7 115                  0.622 VOLTAGE LOWER THAN  0.9
                                                 TIOGA4 7 115                  0.622 VOLTAGE LOWER THAN  0.9
                                                 TIOGA7 7 115                  0.626 VOLTAGE LOWER THAN  0.9
                                                 LOGAN  7 115-BTHOLD 7 115     115.7 % OF  100.0 MVA RATING
                                                 BTHOLD 7 115-KENMARE7 115     115.4 % OF  100.0 MVA RATING

 18_1A1A2 OUTAGE: LELANDO4 230 -LELND2TY 345     LELANDO3 345-LELND1TY 345     123.2 % OF  250.0 MVA RATING
                                                 LELANDO4 230-LELND1TY 345     123.2 % OF  250.0 MVA RATING
                                                 Overload of L.Olds transformers initiates tripping scheme
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20_1A1A2 OUTAGE: CHAR.CK7 115 -CHARCKTY 345     BELFELDT 345-BELFELD3 345     117.0 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230     117.0 % OF  319.0 MVA RATING
                                                Rate C = 122%

40_1A1A2*NOT SOLVED* OUTAGE: DAWSONC4 230 -MI CTYE4 230    ****DID NOT SOLVE*****
                                               Outage initiates MCDC ramp which enables solution


47_1A1A2 OUTAGE: DICKNSN4 230 -BELFELD4 230     BELFELDT 345-BELFELD3 345     115.1 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230     115.1 % OF  319.0 MVA RATING
                                                Rate C = 122%

48_1A1A2 OUTAGE: DICKNSN4 230 -HESKETT4 230     BELFELDT 345-BELFELD3 345     121.7 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230     121.7 % OF  319.0 MVA RATING
                                                Rate C = 122%
                                                COYOTE 7 115-DICKSWH7 115     100.1 % OF  101.41 MVA RATING
                                                Coyote overload initiates unit runback

49_1A1A2*NOT SOLVED* OUTAGE: BELFELD3 345 -CHAR.CK3 345    ****DID NOT SOLVE*****

50_1A1A2*NOT SOLVED* OUTAGE: BELFELD4 230 -RHAME  4 230    ****DID NOT SOLVE*****

61_1A1A2 OUTAGE: BISON  4 230 -MAURINE4 230     BELFELDT 345-BELFELD3 345     102.1 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230     102.1 % OF  319.0 MVA RATING
                                                Rate C = 122%

62_1A1A2 OUTAGE: BISON  4 230 -HETINGR4 230     BELFELDT 345-BELFELD3 345     101.0 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230     101.0 % OF  319.0 MVA RATING
                                                Rate C = 122%

66_1A1A2 OUTAGE: CENTER 4 230 -HESKETT4 230     BELFELDT 345-BELFELD3 345     103.8 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230     103.8 % OF  319.0 MVA RATING
                                                Rate C = 122%

67_1A1A2 OUTAGE: CENTER 3 345 -COYOTE 3 345     COYOTE 3 345-COYOTE 7 115     240.4 % OF  168.0 MVA RATING
                                                DKSN-ND7 115-DICKSWH7 115     131.4 % OF  101.41 MVA RATING
                                                BEULAH 7 115-COYOTE 7 115     254.0 % OF  101.4 MVA RATING
                                                COYOTE 7 115-DICKSWH7 115     137.8 % OF  101.41 MVA RATING
                                                Coyote overload initiates unit runback

71_1A1A2*NOT SOLVED* OUTAGE: ANTELOP3 345 -CHAR.CK3 345    ****DID NOT SOLVE*****

72_1A1A2 OUTAGE: TIOGA4 4 230 -LOGAN  4 230     BTHOLD 7 115                  0.887 VOLTAGE LOWER THAN  0.9
                                                KENMARE7 115                  0.853 VOLTAGE LOWER THAN  0.9
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                                                STANLEY7 115                    0.860 VOLTAGE LOWER THAN  0.9
                                                LOGAN  7 115-BTHOLD 7 115       127.2 % OF  100.0 MVA RATING
                                                BTHOLD 7 115-KENMARE7 115       126.4 % OF  100.0 MVA RATING
                                                KENMARE7 115-STANLEY7 115       105.2 % OF  101.67 MVA RATING

77_1A1A2 OUTAGE: LELANDO4 230 -LOGAN  4 230     MALLARD7 115-MAX    7 115       111.7 % OF  120.0 MVA RATING
                                                Line Thermal Rating = 199MVA
                                                MALLARD7 115-LOGAN  7 115       126.9 % OF  159.0 MVA RATING
                                                Line Thermal Rating = 218MVA
                                                GARRISN7 115-MAX    7 115       117.2 % OF  120.0 MVA RATING
                                                Line Thermal Rating = 199MVA

79_1A1A2*NOT SOLVED* OUTAGE: LTLMISS4 230 -RHAME  4 230     ****DID NOT SOLVE*****

82_1A1A2 OUTAGE: BOWMAN 4 230 -HETINGR4 230     BELFELDT 345-BELFELD3 345       101.6 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230       101.6 % OF  319.0 MVA RATING
                                                Rate C = 122%

95_1A1A2 OUTAGE: TIOGA4 7 115 -STANLEY7 115     KENMARE7 115                    0.880 VOLTAGE LOWER THAN  0.9
                                                STANLEY7 115                    0.847 VOLTAGE LOWER THAN  0.9

100_1A1A2 OUTAGE: DICKSWH7 115 -COYOTE 7 115    BELFELDT 345-BELFELD3 345       105.0 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230       105.0 % OF  319.0 MVA RATING
                                                Rate C = 122%

104_1A1A2*NOT SOLVED*OUTAGE:TIOGA-LOGAN230 & TIOGA TRANS    ****DID NOT SOLVE*****

105_1A1A2 OUTAGE: CHAR.CK7 115 -WATFORD7 115    BELFELDT 345-BELFELD3 345       105.1 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230       105.1 % OF  319.0 MVA RATING
                                                Rate C = 122%

106_1A1A2 OUTAGE: CHAR.CK7 115 -R.RIDER7 115    BELFELDT 345-BELFELD3 345       104.8 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230       104.8 % OF  319.0 MVA RATING
                                                Rate C = 122%
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CASE #2
2011 Summer Peak
Saskatchewan 165MW North-South, MCDC 200MW East-West

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 CELL NAME = 1A1B2,B10T=164,LOAD=235 NC, NC, DC-EW, B10T=165NS, JUL11

 STATUS                                          VIOLATED ELEMENT              PU
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 OUTAGES:

 4_1A1B2 OUTAGE: BELFELDT 345 -BELFELD4 230      DKSN-ND7 115-DICKSWH7 115     118.5 % OF  101.41 MVA RATING
                                                 COYOTE 7 115-DICKSWH7 115     124.9 % OF  101.41 MVA RATING
                                                 Coyote overload initiates unit runback

 11_1A1B2 OUTAGE: BISMARK4 230 -BISMARK7 115     BISMARK4 230-BISMARK7 115     112.4 % OF  100.0 MVA RATING
                                                 Rate C = 125MVA

 12_1A1B2 OUTAGE: BISMARK4 230 -BISMARK7 115     BISMARK4 230-BISMARK7 115     116.8 % OF  100.0 MVA RATING
                                                 Rate C = 125MVA

 15_1A1B2 OUTAGE: TIOGA4 4 230 -TIOGA4 7 115     WATFORD7 115                  0.859 VOLTAGE LOWER THAN  0.9
                                                 WILISTN7 115                  0.793 VOLTAGE LOWER THAN  0.9
                                                 RICHLND7 115                  0.889 VOLTAGE LOWER THAN  0.9
                                                 GRENORA7 115                  0.775 VOLTAGE LOWER THAN  0.9
                                                 PLNTYWD7 115                  0.773 VOLTAGE LOWER THAN  0.9
                                                 KOCH   7 115                  0.885 VOLTAGE LOWER THAN  0.9
                                                 INDNHLS7 115                  0.804 VOLTAGE LOWER THAN  0.9
                                                 SQUAWGP7 115                  0.890 VOLTAGE LOWER THAN  0.9
                                                 BTHOLD 7 115                  0.796 VOLTAGE LOWER THAN  0.9
                                                 CLBRTSN7 115                  0.842 VOLTAGE LOWER THAN  0.9
                                                 KENMARE7 115                  0.676 VOLTAGE LOWER THAN  0.9
                                                 LEWIS  7 115                  0.899 VOLTAGE LOWER THAN  0.9
                                                 STANLEY7 115                  0.616 VOLTAGE LOWER THAN  0.9
                                                 TIOGA4 7 115                  0.620 VOLTAGE LOWER THAN  0.9
                                                 TIOGA7 7 115                  0.625 VOLTAGE LOWER THAN  0.9
                                                 BELFELDT 345-BELFELD3 345     100.9 % OF  319.0 MVA RATING
                                                 BELFELDT 345-BELFELD4 230     100.9 % OF  319.0 MVA RATING
                                                 Rate C = 122%
                                                 LOGAN  7 115-BTHOLD 7 115     126.2 % OF  100.0 MVA RATING
                                                 BTHOLD 7 115-KENMARE7 115     126.0 % OF  100.0 MVA RATING
                                                 Line Thermal Rating = 144MVA
                                                 KENMARE7 115-STANLEY7 115     101.2 % OF  101.67 MVA RATING
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18_1A1B2 OUTAGE: LELANDO4 230 -LELND2TY 345     LELANDO3 345-LELND1TY 345     102.8 % OF  250.0 MVA RATING
                                                LELANDO4 230-LELND1TY 345     102.8 % OF  250.0 MVA RATING
                                                Overload of L.Olds transformers initiates tripping scheme

20_1A1B2 OUTAGE: CHAR.CK7 115 -CHARCKTY 345     BELFELDT 345-BELFELD3 345     111.4 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230     111.4 % OF  319.0 MVA RATING
                                                Rate C = 122%

33_1A1B2 OUTAGE: STANTON4 230 -LELANDO4 230     BELFELDT 345-BELFELD3 345     100.5 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230     100.5 % OF  319.0 MVA RATING
                                                Rate C = 122%

37_1A1B2 OUTAGE: JAMESTN3 345 -CENTER 3 345     COYOTE 3 345-COYOTE 7 115     103.9 % OF  168.0 MVA RATING
                                                Coyote overload initiates unit runback

40_1A1B2*NOT SOLVED* OUTAGE: DAWSONC4 230 -MI CTYE4 230    ****DID NOT SOLVE*****
                                               Outage initiates MCDC ramp which enables solution

47_1A1B2 OUTAGE: DICKNSN4 230 -BELFELD4 230     BELFELDT 345-BELFELD3 345     111.1 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230     111.1 % OF  319.0 MVA RATING
                                                Rate C = 122%

48_1A1B2 OUTAGE: DICKNSN4 230 -HESKETT4 230     BELFELDT 345-BELFELD3 345     118.6 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230     118.6 % OF  319.0 MVA RATING
                                                Rate C = 122%

49_1A1B2 OUTAGE: BELFELD3 345 -CHAR.CK3 345     DKSN-ND7 115-DICKSWH7 115     118.6 % OF  101.41 MVA RATING
                                                COYOTE 7 115-DICKSWH7 115     125.0 % OF  101.41 MVA RATING
                                                Coyote overload initiates unit runback

66_1A1B2 OUTAGE: CENTER 4 230 -HESKETT4 230     BELFELDT 345-BELFELD3 345     104.9 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230     104.9 % OF  319.0 MVA RATING
                                                Rate C = 122%

67_1A1B2 OUTAGE: CENTER 3 345 -COYOTE 3 345     COYOTE 3 345-COYOTE 7 115     240.2 % OF  168.0 MVA RATING
                                                DKSN-ND7 115-DICKSWH7 115     131.3 % OF  101.41 MVA RATING
                                                BEULAH 7 115-COYOTE 7 115     253.4 % OF  101.4 MVA RATING
                                                BEULAH 7 115-HESKETT7 115     105.1 % OF  88.0 MVA RATING
                                                COYOTE 7 115-DICKSWH7 115     137.7 % OF  101.41 MVA RATING
                                                Coyote overload initiates unit runback

70_1A1B2 OUTAGE: ANTELOP3 345 -BRDLAND3 345     BELFELDT 345-BELFELD3 345     100.1 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230     100.1 % OF  319.0 MVA RATING
                                                Rate C = 122%
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71_1A1B2*NOT SOLVED* OUTAGE: ANTELOP3 345 -CHAR.CK3 345     ****DID NOT SOLVE*****

79_1A1B2*NOT SOLVED* OUTAGE: LTLMISS4 230 -RHAME  4 230     ****DID NOT SOLVE*****

95_1A1B2 OUTAGE: TIOGA4 7 115 -STANLEY7 115      STANLEY7 115                  0.896 VOLTAGE LOWER THAN  0.9

100_1A1B2 OUTAGE: DICKSWH7 115 -COYOTE 7 115     BELFELDT 345-BELFELD3 345     105.1 % OF  319.0 MVA RATING
                                                 BELFELDT 345-BELFELD4 230     105.1 % OF  319.0 MVA RATING
                                                 Rate C = 122%

104_1A1B2OUTAGE:TIOGA-LOGAN230 & TIOGA TRANS     WATFORD7 115                  0.853 VOLTAGE LOWER THAN  0.9
                                                 WILISTN7 115                  0.785 VOLTAGE LOWER THAN  0.9
                                                 RICHLND7 115                  0.884 VOLTAGE LOWER THAN  0.9
                                                 GRENORA7 115                  0.766 VOLTAGE LOWER THAN  0.9
                                                 PLNTYWD7 115                  0.764 VOLTAGE LOWER THAN  0.9
                                                 KOCH   7 115                  0.880 VOLTAGE LOWER THAN  0.9
                                                 BICNTNL7 115                  0.900 VOLTAGE LOWER THAN  0.9
                                                 INDNHLS7 115                  0.797 VOLTAGE LOWER THAN  0.9
                                                 SQUAWGP7 115                  0.886 VOLTAGE LOWER THAN  0.9
                                                 BTHOLD 7 115                  0.786 VOLTAGE LOWER THAN  0.9
                                                 CLBRTSN7 115                  0.836 VOLTAGE LOWER THAN  0.9
                                                 KENMARE7 115                  0.668 VOLTAGE LOWER THAN  0.9
                                                 LEWIS  7 115                  0.895 VOLTAGE LOWER THAN  0.9
                                                 STANLEY7 115                  0.609 VOLTAGE LOWER THAN  0.9
                                                 TIOGA4 7 115                  0.612 VOLTAGE LOWER THAN  0.9
                                                 TIOGA7 7 115                  0.617 VOLTAGE LOWER THAN  0.9
                                                 BELFELDT 345-BELFELD3 345     100.3 % OF  319.0 MVA RATING
                                                 BELFELDT 345-BELFELD4 230     100.3 % OF  319.0 MVA RATING
                                                 Rate C = 122%
                                                 LOGAN  7 115-BTHOLD 7 115     122.9 % OF  100.0 MVA RATING
                                                 BTHOLD 7 115-KENMARE7 115     122.6 % OF  100.0 MVA RATING
                                                 Line Thermal Rating = 144MVA

105_1A1B2 OUTAGE: CHAR.CK7 115 -WATFORD7 115     BELFELDT 345-BELFELD3 345     102.1 % OF  319.0 MVA RATING
                                                 BELFELDT 345-BELFELD4 230     102.1 % OF  319.0 MVA RATING
                                                 Rate C = 122%
                                                 TIOGA4 7 115-TIOGA7 7 115     100.4 % OF  120.0 MVA RATING

106_1A1B2 OUTAGE: CHAR.CK7 115 -R.RIDER7 115     BELFELDT 345-BELFELD3 345     103.2 % OF  319.0 MVA RATING
                                                 BELFELDT 345-BELFELD4 230     103.2 % OF  319.0 MVA RATING
                                                 Rate C = 122%
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CASE #3
2011 Summer Peak
Saskatchewan 165MW South-North, MCDC 200MW West-East

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 CELL NAME = 1A2A2,B10T=-159,LOAD=248 NC, NC, DC-WE, B10T=165SN, JUL11

 STATUS                                          VIOLATED ELEMENT              PU
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 OUTAGES:

 11_1A2A2 OUTAGE: BISMARK4 230 -BISMARK7 115     BISMARK4 230-BISMARK7 115     107.5 % OF  100.0 MVA RATING
                                                 Rate C = 125MVA

 12_1A2A2 OUTAGE: BISMARK4 230 -BISMARK7 115     BISMARK4 230-BISMARK7 115     111.8 % OF  100.0 MVA RATING
                                                 Rate C = 125MVA

 15_1A2A2 OUTAGE: TIOGA4 4 230 -TIOGA4 7 115     KENMARE7 115                  0.846 VOLTAGE LOWER THAN  0.9
                                                 STANLEY7 115                  0.809 VOLTAGE LOWER THAN  0.9
                                                 TIOGA4 7 115                  0.808 VOLTAGE LOWER THAN  0.9
                                                 TIOGA7 7 115                  0.811 VOLTAGE LOWER THAN  0.9

 18_1A2A2 OUTAGE: LELANDO4 230 -LELND2TY 345     LELANDO3 345-LELND1TY 345     139.1 % OF  250.0 MVA RATING
                                                 LELANDO4 230-LELND1TY 345     139.1 % OF  250.0 MVA RATING
                                                 Overload of L.Olds transformers initiates tripping scheme

 67_1A2A2 OUTAGE: CENTER 3 345 -COYOTE 3 345     COYOTE 3 345-COYOTE 7 115     238.7 % OF  168.0 MVA RATING
                                                 DKSN-ND7 115-DICKSWH7 115     100.1 % OF  101.41 MVA RATING
                                                 BEULAH 7 115-COYOTE 7 115     280.4 % OF  101.4 MVA RATING
                                                 BEULAH 7 115-HESKETT7 115     113.1 % OF  88.0 MVA RATING
                                                 COYOTE 7 115-DICKSWH7 115     106.3 % OF  101.41 MVA RATING
                                                 Coyote overload initiates unit runback

 72_1A2A2 OUTAGE: TIOGA4 4 230 -LOGAN  4 230     KENMARE7 115                  0.888 VOLTAGE LOWER THAN  0.9
                                                 STANLEY7 115                  0.887 VOLTAGE LOWER THAN  0.9
                                                 LOGAN  7 115-BTHOLD 7 115     108.9 % OF  100.0 MVA RATING
                                                 BTHOLD 7 115-KENMARE7 115     108.1 % OF  100.0 MVA RATING
                                                 Line Thermal Rating = 144MVA

 77_1A2A2 OUTAGE: LELANDO4 230 -LOGAN  4 230     MALLARD7 115-MAX    7 115     108.1 % OF  120.0 MVA RATING
                                                 Line Thermal Rating = 199MVA
                                                 MALLARD7 115-LOGAN  7 115     105.9 % OF  159.0 MVA RATING
                                                 Line Thermal Rating = 218MVA
                                                 GARRISN7 115-MAX    7 115     113.6 % OF  120.0 MVA RATING
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Line Thermal Rating = 199MVA

95_1A2A2 OUTAGE: TIOGA4 7 115 -STANLEY7 115	KENMARE7 115	0.892	VOLTAGE LOWER THAN	0.9
	STANLEY7 115	0.860	VOLTAGE LOWER THAN	0.9
104_1A2A2OUTAGE:TIOGA-LOGAN230 & TIOGA TRANS	TIOGA4 4 230	1.139	VOLTAGE HIGHER THAN	1.1
	GRENORA7 115	0.896	VOLTAGE LOWER THAN	0.9
	PLNTYWD7 115	0.897	VOLTAGE LOWER THAN	0.9
	BTHOLD 7 115	0.896	VOLTAGE LOWER THAN	0.9
	KENMARE7 115	0.832	VOLTAGE LOWER THAN	0.9
	STANLEY7 115	0.792	VOLTAGE LOWER THAN	0.9
	TIOGA4 7 115	0.793	VOLTAGE LOWER THAN	0.9
	TIOGA7 7 115	0.796	VOLTAGE LOWER THAN	0.9

CASE #4
2011 Summer Peak
Saskatchewan 165MW North-South, MCDC 200MW West-East

CELL NAME = 1A2B2,B10T=163,LOAD=230 NC, NC, DC-WE, B10T=165NS, JUL11

STATUS	VIOLATED ELEMENT	PU
OUTAGES:		
11_1A2B2 OUTAGE: BISMARK4 230 -BISMARK7 115	BISMARK4 230-BISMARK7 115	105.7 % OF 100.0 MVA RATING
	Rate C = 125MVA	
12_1A2B2 OUTAGE: BISMARK4 230 -BISMARK7 115	BISMARK4 230-BISMARK7 115	109.9 % OF 100.0 MVA RATING
	Rate C = 125MVA	
15_1A2B2 OUTAGE: TIOGA4 4 230 -TIOGA4 7 115	KENMARE7 115	0.853 VOLTAGE LOWER THAN 0.9
	STANLEY7 115	0.817 VOLTAGE LOWER THAN 0.9
	TIOGA4 7 115	0.820 VOLTAGE LOWER THAN 0.9
	TIOGA7 7 115	0.823 VOLTAGE LOWER THAN 0.9
18_1A2B2 OUTAGE: LELANDO4 230 -LELND2TY 345	LELANDO3 345-LELND1TY 345	119.6 % OF 250.0 MVA RATING
	LELANDO4 230-LELND1TY 345	119.6 % OF 250.0 MVA RATING
	Overload of L.Olds transformers initiates tripping scheme	
67_1A2B2 OUTAGE: CENTER 3 345 -COYOTE 3 345	SQBUTTE4 230-CENTER 3 345	100.5 % OF 336.0 MVA RATING
	COYOTE 3 345-COYOTE 7 115	238.8 % OF 168.0 MVA RATING
	DKSN-ND7 115-DICKSWH7 115	100.5 % OF 101.41 MVA RATING
	BEULAH 7 115-COYOTE 7 115	280.1 % OF 101.4 MVA RATING
	BEULAH 7 115-HESKETT7 115	120.1 % OF 88.0 MVA RATING
	COYOTE 7 115-DICKSWH7 115	106.7 % OF 101.41 MVA RATING
	Coyote overload initiates unit runback	
95_1A2B2 OUTAGE: TIOGA4 7 115 -STANLEY7 115	STANLEY7 115	0.896 VOLTAGE LOWER THAN 0.9
104_1A2B2OUTAGE:TIOGA-LOGAN230 & TIOGA TRANS	KENMARE7 115	0.847 VOLTAGE LOWER THAN 0.9
	STANLEY7 115	0.811 VOLTAGE LOWER THAN 0.9
	TIOGA4 7 115	0.813 VOLTAGE LOWER THAN 0.9
	TIOGA7 7 115	0.816 VOLTAGE LOWER THAN 0.9

CASE #5
2011 Summer Peak

Tioga-Williston-Charlie Creek 230kV In Service
Saskatchewan 165MW South-North, MCDC 200MW East-West

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 CELL NAME = 1B1A2,B10T=-160,LOAD=240 NC, T-W-CCR230, DC-EW, B10T=165SN, JUL11

 STATUS                                          VIOLATED ELEMENT              PU
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 OUTAGES:

 4_1B1A2 OUTAGE: BELFELDT 345 -BELFELD4 230      DKSN-ND7 115-DICKSWH7 115     116.1 % OF  101.41 MVA RATING
                                                 COYOTE 7 115-DICKSWH7 115     122.6 % OF  101.41 MVA RATING
                                                 Coyote overload initiates unit runback

 11_1B1A2 OUTAGE: BISMARK4 230 -BISMARK7 115     BISMARK4 230-BISMARK7 115     114.6 % OF  100.0 MVA RATING
                                                 Rate C = 125MVA

 12_1B1A2 OUTAGE: BISMARK4 230 -BISMARK7 115     BISMARK4 230-BISMARK7 115     119.2 % OF  100.0 MVA RATING
                                                 Rate C = 125MVA

 18_1B1A2 OUTAGE: LELANDO4 230 -LELND2TY 345     LELANDO3 345-LELND1TY 345     107.3 % OF  250.0 MVA RATING
                                                 LELANDO4 230-LELND1TY 345     107.3 % OF  250.0 MVA RATING
                                                 Rate C = 120%

 21_1B1A2 OUTAGE: CHAR.CK3 345 -CHAR.CK4 230     BELFELDT 345-BELFELD3 345     102.2 % OF  319.0 MVA RATING
                                                 BELFELDT 345-BELFELD4 230     102.2 % OF  319.0 MVA RATING
                                                 Rate C = 122%

 40_1B1A2*NOT SOLVED* OUTAGE: DAWSONC4 230 -MI CTYE4 230    ****DID NOT SOLVE*****
                                                Outage initiates MCDC ramp which enables solution

 47_1B1A2 OUTAGE: DICKNSN4 230 -BELFELD4 230     BELFELDT 345-BELFELD3 345     106.9 % OF  319.0 MVA RATING
                                                 BELFELDT 345-BELFELD4 230     106.9 % OF  319.0 MVA RATING
                                                 Rate C = 122%
                                                 ANTELOP3 345-CHAR.CK3 345     101.7 % OF  538.0 MVA RATING
                                                 Line Thermal Rating = 1135MVA

 48_1B1A2 OUTAGE: DICKNSN4 230 -HESKETT4 230     BELFELDT 345-BELFELD3 345     112.3 % OF  319.0 MVA RATING
                                                 BELFELDT 345-BELFELD4 230     112.3 % OF  319.0 MVA RATING
                                                 Rate C = 122%
                                                 ANTELOP3 345-CHAR.CK3 345     105.0 % OF  538.0 MVA RATING
                                                 Line Thermal Rating = 1135MVA
                                                 COYOTE 7 115-DICKSWH7 115     101.1 % OF  101.41 MVA RATING
                                                 Coyote overload initiates unit runback
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49_1B1A2 OUTAGE: BELFELD3 345 -CHAR.CK3 345     DKSN-ND7 115-DICKSWH7 115     116.3 % OF  101.41 MVA RATING
                                                COYOTE 7 115-DICKSWH7 115     122.7 % OF  101.41 MVA RATING
                                                Coyote overload initiates unit runback

67_1B1A2 OUTAGE: CENTER 3 345 -COYOTE 3 345     COYOTE 3 345-COYOTE 7 115     240.4 % OF  168.0 MVA RATING
                                                DKSN-ND7 115-DICKSWH7 115     133.3 % OF  101.41 MVA RATING
                                                BEULAH 7 115-COYOTE 7 115     252.0 % OF  101.4 MVA RATING
                                                COYOTE 7 115-DICKSWH7 115     139.7 % OF  101.41 MVA RATING
                                                Coyote overload initiates unit runback

71_1B1A2 OUTAGE: ANTELOP3 345 -CHAR.CK3 345     COYOTE 3 345-COYOTE 7 115     108.5 % OF  168.0 MVA RATING
                                                DICKNSN4 230-BELFELD4 230     101.6 % OF  319.0 MVA RATING
                                                DKSN-ND7 115-DICKSWH7 115     115.8 % OF  101.41 MVA RATING
                                                HALIDAY7 115-BEULAH 7 115     100.1 % OF  120.0 MVA RATING
                                                COYOTE 7 115-DICKSWH7 115     122.3 % OF  101.41 MVA RATING
                                                Coyote overload initiates unit runback

72_1B1A2 OUTAGE: TIOGA4 4 230 -LOGAN  4 230     ANTELOP3 345-CHAR.CK3 345     104.2 % OF  538.0 MVA RATING
                                                Line Thermal Rating = 1135MVA

77_1B1A2 OUTAGE: LELANDO4 230 -LOGAN  4 230     ANTELOP3 345-CHAR.CK3 345     102.0 % OF  538.0 MVA RATING
                                                Line Thermal Rating = 1135MVA

79_1B1A2*NOT SOLVED* OUTAGE: LTLMISS4 230 -RHAME  4 230    ****DID NOT SOLVE*****
                                                Fix by Shifting Local Load From Little Missouri To Rhame

85_1B1A2 OUTAGE: CHAR.CK4 230 -WATFORD4 230     BELFELDT 345-BELFELD3 345     102.3 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230     102.3 % OF  319.0 MVA RATING
                                                Rate C = 122%

86_1B1A2 OUTAGE: WATFORD4 230 -INDNHLS4 230     BELFELDT 345-BELFELD3 345     100.9 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230     100.9 % OF  319.0 MVA RATING
                                                Rate C = 122%

87_1B1A2 OUTAGE: INDNHLS4 230 -WILISTN4 230     BELFELDT 345-BELFELD3 345     100.5 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230     100.5 % OF  319.0 MVA RATING
                                                Rate C = 122%

104_1B1A2OUTAGE:TIOGA-LOGAN230 & TIOGA TRANS    ANTELOP3 345-CHAR.CK3 345     104.2 % OF  538.0 MVA RATING
                                                Line Thermal Rating = 1135MVA
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CASE #6
2011 Summer Peak
Tioga-Williston-Charlie Creek 230kV In Service
Saskatchewan 165MW North-South, MCDC 200MW East-West

CELL NAME = 1B1B2,B10T=163,LOAD=229 NC, T-W-CCR230, DC-EW, B10T=165NS, JUL11

STATUS	VIOLATED ELEMENT	PU
OUTAGES:		
4_1B1B2 OUTAGE: BELFELDT 345 -BELFELD4 230	DKSN-ND7 115-DICKSWH7 115	113.0 % OF 101.41 MVA RATING
	COYOTE 7 115-DICKSWH7 115	119.4 % OF 101.41 MVA RATING
	Coyote overload initiates unit runback	
11_1B1B2 OUTAGE: BISMARK4 230 -BISMARK7 115	BISMARK4 230-BISMARK7 115	111.6 % OF 100.0 MVA RATING
	Rate C = 125MVA	
12_1B1B2 OUTAGE: BISMARK4 230 -BISMARK7 115	BISMARK4 230-BISMARK7 115	116.0 % OF 100.0 MVA RATING
	Rate C = 125MVA	
18_1B1B2 OUTAGE: LELANDO4 230 -LELND2TY 345	LELANDO3 345-LELND1TY 345	107.1 % OF 250.0 MVA RATING
	LELANDO4 230-LELND1TY 345	107.1 % OF 250.0 MVA RATING
	Overload of L.Olds transformers initiates tripping scheme	
37_1B1B2 OUTAGE: JAMESTN3 345 -CENTER 3 345	COYOTE 3 345-COYOTE 7 115	102.1 % OF 168.0 MVA RATING
	Coyote overload initiates unit runback	
40_1B1B2*NOT SOLVED* OUTAGE: DAWSONC4 230 -MI CTYE4 230	****DID NOT SOLVE*****	
	Outage initiates MCDC ramp which enables solution	
47_1B1B2 OUTAGE: DICKNSN4 230 -BELFELD4 230	BELFELDT 345-BELFELD3 345	106.6 % OF 319.0 MVA RATING
	BELFELDT 345-BELFELD4 230	106.6 % OF 319.0 MVA RATING
	Rate C = 122%	
48_1B1B2 OUTAGE: DICKNSN4 230 -HESKETT4 230	BELFELDT 345-BELFELD3 345	113.9 % OF 319.0 MVA RATING
	BELFELDT 345-BELFELD4 230	113.9 % OF 319.0 MVA RATING
	Rate C = 122%	
49_1B1B2 OUTAGE: BELFELD3 345 -CHAR.CK3 345	DKSN-ND7 115-DICKSWH7 115	113.2 % OF 101.41 MVA RATING
	COYOTE 7 115-DICKSWH7 115	119.6 % OF 101.41 MVA RATING

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                                                Coyote overload initiates unit runback

66_1B1B2 OUTAGE: CENTER 4 230 -HESKETT4 230     BELFELDT 345-BELFELD3 345     102.3 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230     102.3 % OF  319.0 MVA RATING
                                                Rate C = 122%

67_1B1B2 OUTAGE: CENTER 3 345 -COYOTE 3 345     COYOTE 3 345-COYOTE 7 115     239.9 % OF  168.0 MVA RATING
                                                DKSN-ND7 115-DICKSWH7 115     130.1 % OF  101.41 MVA RATING
                                                BEULAH 7 115-COYOTE 7 115     254.0 % OF  101.4 MVA RATING
                                                BEULAH 7 115-HESKETT7 115     106.7 % OF  88.0 MVA RATING
                                                COYOTE 7 115-DICKSWH7 115     136.5 % OF  101.41 MVA RATING
                                                Coyote overload initiates unit runback

71_1B1B2 OUTAGE: ANTELOP3 345 -CHAR.CK3 345     COYOTE 7 115-DICKSWH7 115     104.5 % OF  101.41 MVA RATING
                                                Coyote overload initiates unit runback

100_1B1B2 OUTAGE: DICKSWH7 115 -COYOTE 7 115    BELFELDT 345-BELFELD3 345     102.3 % OF  319.0 MVA RATING
                                                BELFELDT 345-BELFELD4 230     102.3 % OF  319.0 MVA RATING
                                                Rate C = 122%
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CASE #7
2011 Summer Peak
Tioga-Williston-Charlie Creek 230kV In Service
Saskatchewan 165MW South-North, MCDC 200MW West-East

CELL NAME = 1B2A2,B10T=-162,LOAD=237 NC, T-W-CCR230, DC-WE, B10T=165SN, JUL11

STATUS	VIOLATED ELEMENT	PU
OUTAGES:		
11_1B2A2 OUTAGE: BISMARK4 230 -BISMARK7 115	BISMARK4 230-BISMARK7 115	107.9 % OF 100.0 MVA RATING
	Rate C = 125MVA	
12_1B2A2 OUTAGE: BISMARK4 230 -BISMARK7 115	BISMARK4 230-BISMARK7 115	112.2 % OF 100.0 MVA RATING
	Rate C = 125MVA	
18_1B2A2 OUTAGE: LELANDO4 230 -LELND2TY 345	LELANDO3 345-LELND1TY 345	119.9 % OF 250.0 MVA RATING
	LELANDO4 230-LELND1TY 345	119.9 % OF 250.0 MVA RATING
	Overload of L.Olds transformers initiates tripping scheme	
67_1B2A2 OUTAGE: CENTER 3 345 -COYOTE 3 345	COYOTE 3 345-COYOTE 7 115	238.9 % OF 168.0 MVA RATING
	DKSN-ND7 115-DICKSWH7 115	103.1 % OF 101.41 MVA RATING
	BEULAH 7 115-COYOTE 7 115	277.6 % OF 101.4 MVA RATING
	BEULAH 7 115-HESKETT7 115	113.4 % OF 88.0 MVA RATING
	COYOTE 7 115-DICKSWH7 115	109.4 % OF 101.41 MVA RATING
	Coyote overload initiates unit runback	

CASE #8
2011 Summer Peak
Tioga-Williston-Charlie Creek 230kV In Service
Saskatchewan 165MW North-South, MCDC 200MW West-East

CELL NAME = 1B2B2,B10T=163,LOAD=226 NC, T-W-CCR230, DC-WE, B10T=165NS, JUL11

STATUS	VIOLATED ELEMENT	PU
OUTAGES:		
11_1B2B2 OUTAGE: BISMARK4 230 -BISMARK7 115	BISMARK4 230-BISMARK7 115	105.4 % OF 100.0 MVA RATING
	Rate C = 125MVA	
12_1B2B2 OUTAGE: BISMARK4 230 -BISMARK7 115	BISMARK4 230-BISMARK7 115	109.5 % OF 100.0 MVA RATING
	Rate C = 125MVA	
18_1B2B2 OUTAGE: LELANDO4 230 -LELND2TY 345	LELANDO3 345-LELND1TY 345	120.7 % OF 250.0 MVA RATING
	LELANDO4 230-LELND1TY 345	120.7 % OF 250.0 MVA RATING
	Overload of L.Olds transformers initiates tripping scheme	
67_1B2B2 OUTAGE: CENTER 3 345 -COYOTE 3 345	SQBUTTE4 230-CENTER 3 345	100.6 % OF 336.0 MVA RATING
	COYOTE 3 345-COYOTE 7 115	238.8 % OF 168.0 MVA RATING
	DKSN-ND7 115-DICKSWH7 115	100.1 % OF 101.41 MVA RATING
	BEULAH 7 115-COYOTE 7 115	280.3 % OF 101.4 MVA RATING
	BEULAH 7 115-HESKETT7 115	121.1 % OF 88.0 MVA RATING
	COYOTE 7 115-DICKSWH7 115	106.4 % OF 101.41 MVA RATING
	Coyote overload initiates unit runback	

CASE #9
2011 Winter Peak
Saskatchewan 165MW South-North, MCDC 200MW East-West

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 CELL NAME = 1A1A2*NOT SOLVED*,B10T=-17 NC, NC, DC-EW, B10T=165SN, JAN11

 STATUS                                          VIOLATED ELEMENT            PU
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 SYSTEM INTACT                                    ***DID NOT SOLVE***
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CASE #10
2011 Winter Peak
Saskatchewan 165MW North-South, MCDC 200MW East-West

CELL NAME = 1A1B2,B10T=165 NC, NC, DC-EW, B10T=165NS, JAN11

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 STATUS                                          VIOLATED ELEMENT              PU
========                                        ==================            ====

SYSTEM INTACT                                  TIOGA4 4 230-TIOGA4 7 115     160.2 % OF  100.0 MVA RATING

 OUTAGES:

 15_1A1B2*NOT SOLVED* OUTAGE: TIOGA4 4 230 -TIOGA4 7 115     ****DID NOT SOLVE*****

 16_1A1B2 OUTAGE: TIOGA4 7 115 -TIOGA7 7 115     GRENORA7 115                  0.895 VOLTAGE LOWER THAN  0.9
                                                 PLNTYWD7 115                  0.899 VOLTAGE LOWER THAN  0.9
                                                 INDNHLS7 115                  0.899 VOLTAGE LOWER THAN  0.9
                                                 TIOGA7 7 115                  0.803 VOLTAGE LOWER THAN  0.9

 18_1A1B2 OUTAGE: LELANDO4 230 -LELND2TY 345     LELANDO3 345-LELND1TY 345     170.1 % OF  250.0 MVA RATING
                                                 LELANDO4 230-LELND1TY 345     170.1 % OF  250.0 MVA RATING
                                                 Overload of L.Olds transformers initiates tripping scheme

 20_1A1B2 OUTAGE: CHAR.CK7 115 -CHARCKTY 345     BELFELDT 345-BELFELD3 345     107.9 % OF  319.0 MVA RATING
                                                 BELFELDT 345-BELFELD4 230     107.9 % OF  319.0 MVA RATING
                                                 Rate C = 122%
                                                 TIOGA4 7 115-TIOGA7 7 115     107.4 % OF  108.9 MVA RATING

 37_1A1B2 OUTAGE: JAMESTN3 345 -CENTER 3 345     COYOTE 3 345-COYOTE 7 115     101.9 % OF  168.0 MVA RATING
                                                 Coyote overload initiates unit runback

 40_1A1B2 OUTAGE: DAWSONC4 230 -MI CTYE4 230     DAWSONCT 230                  0.851 VOLTAGE LOWER THAN  0.9
                                                 FALLON T 115                  0.688 VOLTAGE LOWER THAN  0.9
                                                 MICTYE1T 230                  0.505 VOLTAGE LOWER THAN  0.9
                                                 MI CTYE857.0                  0.496 VOLTAGE LOWER THAN  0.9
                                                 BELFELDT 345                  0.888 VOLTAGE LOWER THAN  0.9
                                                 BISON  869.0                  0.831 VOLTAGE LOWER THAN  0.9
                                                 CIRCLE 7 115                  0.881 VOLTAGE LOWER THAN  0.9
                                                 DAWSONC4 230                  0.872 VOLTAGE LOWER THAN  0.9
                                                 DAWSONC7 115                  0.853 VOLTAGE LOWER THAN  0.9
                                                 FALLON 7 115                  0.709 VOLTAGE LOWER THAN  0.9
                                                 MI CTYE4 230                  0.490 VOLTAGE LOWER THAN  0.9
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                                        MI CTYE7 115                  0.505 VOLTAGE LOWER THAN  0.9
                                        MEDORA 4 230                  0.888 VOLTAGE LOWER THAN  0.9
                                        DKSN-ND7 115                  0.886 VOLTAGE LOWER THAN  0.9
                                        BELFELD4 230                  0.894 VOLTAGE LOWER THAN  0.9
                                        BISON  4 230                  0.844 VOLTAGE LOWER THAN  0.9
                                        MAURINE4 230                  0.888 VOLTAGE LOWER THAN  0.9
                                        LTLMISS7 115                  0.681 VOLTAGE LOWER THAN  0.9
                                        LTLMISS4 230                  0.680 VOLTAGE LOWER THAN  0.9
                                        BAKER  4 230                  0.653 VOLTAGE LOWER THAN  0.9
                                        BAKER  7 115                  0.710 VOLTAGE LOWER THAN  0.9
                                        BOWMAN 4 230                  0.755 VOLTAGE LOWER THAN  0.9
                                        DICKSWH7 115                  0.899 VOLTAGE LOWER THAN  0.9
                                        DICKNTH7 115                  0.899 VOLTAGE LOWER THAN  0.9
                                        GLENDCT7 115                  0.831 VOLTAGE LOWER THAN  0.9
                                        HETINGR4 230                  0.806 VOLTAGE LOWER THAN  0.9
                                        HETINGR7 115                  0.858 VOLTAGE LOWER THAN  0.9
                                        GASCOYN7 115                  0.859 VOLTAGE LOWER THAN  0.9
                                        N ENGLN7 115                  0.872 VOLTAGE LOWER THAN  0.9
                                        RHAME  7 115                  0.707 VOLTAGE LOWER THAN  0.9
                                        RHAME  4 230                  0.730 VOLTAGE LOWER THAN  0.9
                                        DAWSONC7 115-FALLON 7 115     138.5 % OF  80.0 MVA RATING
                                        FALLON 7 115-MI CTYE7 115     137.3 % OF  80.0 MVA RATING
                                        MI CTYE4 230-BAKER  4 230     123.7 % OF  200.0 MVA RATING
                                        LTLMISS4 230-RHAME  4 230     123.7 % OF  240.0 MVA RATING
                                        Outage initiates MCDC ramp which clears violations

42_1A1B2 OUTAGE: DAWSONC4 230 -MEDORA 4 230     LTLMISS4 230-RHAME  4 230     109.2 % OF  240.0 MVA RATING
                                        Minimum Line Thermal Rating = 322MVA

45_1A1B2 OUTAGE: MEDORA 4 230 -BELFELD4 230     LTLMISS4 230-RHAME  4 230     114.2 % OF  240.0 MVA RATING
                                        Line Thermal Rating = 1135MVA
                                        TIOGA4 7 115-TIOGA7 7 115     101.0 % OF  108.9 MVA RATING
                                        Rate A line rating = 120MVA after 2008 reconductor

47_1A1B2 OUTAGE: DICKNSN4 230 -BELFELD4 230     BELFELDT 345-BELFELD3 345     100.2 % OF  319.0 MVA RATING
                                        BELFELDT 345-BELFELD4 230     100.2 % OF  319.0 MVA RATING
                                        Rate C = 122%

48_1A1B2 OUTAGE: DICKNSN4 230 -HESKETT4 230     BELFELDT 345-BELFELD3 345     107.3 % OF  319.0 MVA RATING
                                        BELFELDT 345-BELFELD4 230     107.3 % OF  319.0 MVA RATING
                                        Rate C = 122%

50_1A1B2 OUTAGE: BELFELD4 230 -RHAME  4 230     MEDORA 4 230-BELFELD4 230     101.4 % OF  239.0 MVA RATING
                                        Minimum Line Thermal Rating = 322MVA
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67_1A1B2 OUTAGE: CENTER 3 345 -COYOTE 3 345     COYOTE 3 345-COYOTE 7 115     238.9 % OF  168.0 MVA RATING
                                                STANTON4 230-LELANDO4 230     100.8 % OF  478.0 MVA RATING
                                                DKSN-ND7 115-DICKSWH7 115     103.8 % OF  119.51 MVA RATING
                                                BEULAH 7 115-COYOTE 7 115     219.8 % OF  119.5 MVA RATING
                                                COYOTE 7 115-DICKSWH7 115     109.5 % OF  119.51 MVA RATING
                                                Coyote overload initiates unit runback

71_1A1B2*NOT SOLVED* OUTAGE: ANTELOP3 345 -CHAR.CK3 345    ****DID NOT SOLVE*****

75_1A1B2*NOT SOLVED* OUTAGE: TIOGA4 4 230 -BDV    4 230    ****DID NOT SOLVE*****

79_1A1B2*NOT SOLVED* OUTAGE: LTLMISS4 230 -RHAME  4 230    ****DID NOT SOLVE*****

95_1A1B2 OUTAGE: TIOGA4 7 115 -STANLEY7 115     KENMARE7 115                  0.865 VOLTAGE LOWER THAN  0.9
                                                STANLEY7 115                  0.830 VOLTAGE LOWER THAN  0.9

104_1A1B2*NOT SOLVED*OUTAGE:TIOGA-LOGAN230 & TIOGA TRANS    ****DID NOT SOLVE*****

105_1A1B2 OUTAGE: CHAR.CK7 115 -WATFORD7 115    TIOGA4 7 115-TIOGA7 7 115     108.5 % OF  108.9 MVA RATING
                                                Rate A line rating = 120MVA after 2008 reconductor
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CASE #11
2011 Winter Peak
Saskatchewan 165MW South-North, MCDC 200MW West-East

CELL NAME = 1A2A2*NOT SOLVED*,B10T=-13 NC, NC, DC-WE, B10T=165SN, JAN11

STATUS	VIOLATED ELEMENT	PU
SYSTEM INTACT	***DID NOT SOLVE***	

CASE #12
2011 Winter Peak
Saskatchewan 165MW North-South, MCDC 200MW West-East

CELL NAME = 1A2B2,B10T=164 NC, NC, DC-WE, B10T=165NS, JAN11

STATUS	VIOLATED ELEMENT	PU
SYSTEM INTACT	TIOGA4 4 230-TIOGA4 7 115	159.8 % OF 100.0 MVA RATING
OUTAGES:		
15_1A2B2 OUTAGE: TIOGA4 4 230 -TIOGA4 7 115	WATFORD7 115	0.855 VOLTAGE LOWER THAN 0.9
	WILISTN7 115	0.730 VOLTAGE LOWER THAN 0.9
	RICHLND7 115	0.873 VOLTAGE LOWER THAN 0.9
	GRENORA7 115	0.701 VOLTAGE LOWER THAN 0.9
	PLNTYWD7 115	0.700 VOLTAGE LOWER THAN 0.9
	KOCH 7 115	0.883 VOLTAGE LOWER THAN 0.9
	INDNHLS7 115	0.761 VOLTAGE LOWER THAN 0.9
	SQUAWGP7 115	0.897 VOLTAGE LOWER THAN 0.9
	BTHOLD 7 115	0.717 VOLTAGE LOWER THAN 0.9
	CLBRTSN7 115	0.789 VOLTAGE LOWER THAN 0.9
	KENMARE7 115	0.563 VOLTAGE LOWER THAN 0.9
	LEWIS 7 115	0.884 VOLTAGE LOWER THAN 0.9
	POPLAR 7 115	0.876 VOLTAGE LOWER THAN 0.9
	STANLEY7 115	0.478 VOLTAGE LOWER THAN 0.9
	TIOGA4 7 115	0.460 VOLTAGE LOWER THAN 0.9
	TIOGA7 7 115	0.464 VOLTAGE LOWER THAN 0.9
	WILISTN7 115-RICHLND7 115	113.9 % OF 80.0 MVA RATING
	WILISTN7 115-TIOGA7 7 115	169.0 % OF 79.67 MVA RATING
	RICHLND7 115-LEWIS 7 115	110.1 % OF 79.67 MVA RATING
	LOGAN 7 115-BTHOLD 7 115	158.9 % OF 80.0 MVA RATING
	BTHOLD 7 115-KENMARE7 115	158.4 % OF 80.0 MVA RATING
	KENMARE7 115-STANLEY7 115	120.8 % OF 79.7 MVA RATING
16_1A2B2 OUTAGE: TIOGA4 7 115 -TIOGA7 7 115	TIOGA7 7 115	0.862 VOLTAGE LOWER THAN 0.9
17_1A2B2 OUTAGE: LELANDO4 230 -LELND1TY 345	LELANDO3 345-LELND2TY 345	107.8 % OF 500.0 MVA RATING
	LELANDO4 230-LELND2TY 345	105.1 % OF 500.0 MVA RATING
	Overload of L.Olds transformers initiates tripping scheme	
18_1A2B2 OUTAGE: LELANDO4 230 -LELND2TY 345	LELANDO3 345-LELND1TY 345	189.5 % OF 250.0 MVA RATING

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                                          LELANDO4 230-LELND1TY 345     189.5 % OF  250.0 MVA RATING
                                          Overload of L.Olds transformers initiates tripping scheme

19_1A2B2 OUTAGE: LOGAN  7 115 -LOGAN TY 230   STANTON4 230-LELANDO4 230     100.3 % OF  478.0 MVA RATING
                                          Rate C = 110%

30_1A2B2 OUTAGE: COAL TP4 230 -MCHENRY4 230   GARRISN7 115-VOLTAIR7 115     103.9 % OF  109.0 MVA RATING
                                          Minimum Thermal Rating = 128MVA

52_1A2B2 OUTAGE: BISMARK4 230 -WASHBRN4 230   STANTON4 230-LELANDO4 230     102.2 % OF  478.0 MVA RATING
                                          Rate C = 110%

60_1A2B2 OUTAGE: WASHBRN4 230 -LELANDO4 230   STANTON4 230-LELANDO4 230     103.7 % OF  478.0 MVA RATING
                                          Rate C = 110%

67_1A2B2 OUTAGE: CENTER 3 345 -COYOTE 3 345   SQBUTTE4 230-CENTER 3 345     103.5 % OF  352.0 MVA RATING
                                          COYOTE 3 345-COYOTE 7 115     238.0 % OF  168.0 MVA RATING
                                          STANTON4 230-LELANDO4 230     114.9 % OF  478.0 MVA RATING
                                          BEULAH 7 115-COYOTE 7 115     243.6 % OF  119.5 MVA RATING
                                          Coyote overload initiates unit runback

71_1A2B2 OUTAGE: ANTELOP3 345 -CHAR.CK3 345   STANTON4 230-LELANDO4 230     105.1 % OF  478.0 MVA RATING
                                          Rate C = 110%

75_1A2B2 OUTAGE: TIOGA4 4 230 -BDV    4 230   WATFORD7 115                  0.855 VOLTAGE LOWER THAN  0.9
                                          WILISTN7 115                  0.729 VOLTAGE LOWER THAN  0.9
                                          RICHLND7 115                  0.872 VOLTAGE LOWER THAN  0.9
                                          TIOGA4 4 230                  0.459 VOLTAGE LOWER THAN  0.9
                                          GRENORA7 115                  0.701 VOLTAGE LOWER THAN  0.9
                                          PLNTYWD7 115                  0.700 VOLTAGE LOWER THAN  0.9
                                          KOCH   7 115                  0.883 VOLTAGE LOWER THAN  0.9
                                          INDNHLS7 115                  0.761 VOLTAGE LOWER THAN  0.9
                                          SQUAWGP7 115                  0.897 VOLTAGE LOWER THAN  0.9
                                          BTHOLD 7 115                  0.717 VOLTAGE LOWER THAN  0.9
                                          CLBRTSN7 115                  0.789 VOLTAGE LOWER THAN  0.9
                                          KENMARE7 115                  0.563 VOLTAGE LOWER THAN  0.9
                                          LEWIS  7 115                  0.884 VOLTAGE LOWER THAN  0.9
                                          POPLAR 7 115                  0.876 VOLTAGE LOWER THAN  0.9
                                          STANLEY7 115                  0.478 VOLTAGE LOWER THAN  0.9
                                          TIOGA4 7 115                  0.459 VOLTAGE LOWER THAN  0.9
                                          TIOGA7 7 115                  0.464 VOLTAGE LOWER THAN  0.9
                                          WILISTN7 115-RICHLND7 115     113.9 % OF  80.0 MVA RATING
                                          WILISTN7 115-TIOGA7 7 115     169.1 % OF  79.67 MVA RATING
                                          RICHLND7 115-LEWIS  7 115     110.1 % OF  79.67 MVA RATING
                                          LOGAN  7 115-BTHOLD 7 115     158.9 % OF  80.0 MVA RATING
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	BTHOLD 7 115-KENMARE7 115	158.4 % OF	80.0 MVA RATING	
	KENMARE7 115-STANLEY7 115	120.8 % OF	79.7 MVA RATING	
95_1A2B2 OUTAGE: TIOGA4 7 115 -STANLEY7 115	KENMARE7 115	0.858 VOLTAGE LOWER THAN	0.9	
	STANLEY7 115	0.823 VOLTAGE LOWER THAN	0.9	
104_1A2B2OUTAGE:TIOGA-LOGAN230 & TIOGA TRANS	WATFORD7 115	0.855 VOLTAGE LOWER THAN	0.9	
	WILISTN7 115	0.730 VOLTAGE LOWER THAN	0.9	
	RICHLND7 115	0.873 VOLTAGE LOWER THAN	0.9	
	GRENORA7 115	0.701 VOLTAGE LOWER THAN	0.9	
	PLNTYWD7 115	0.700 VOLTAGE LOWER THAN	0.9	
	KOCH 7 115	0.883 VOLTAGE LOWER THAN	0.9	
	INDNHLS7 115	0.761 VOLTAGE LOWER THAN	0.9	
	SQUAWGP7 115	0.897 VOLTAGE LOWER THAN	0.9	
	BTHOLD 7 115	0.717 VOLTAGE LOWER THAN	0.9	
	CLBRTSN7 115	0.789 VOLTAGE LOWER THAN	0.9	
	KENMARE7 115	0.563 VOLTAGE LOWER THAN	0.9	
	LEWIS 7 115	0.884 VOLTAGE LOWER THAN	0.9	
	POPLAR 7 115	0.876 VOLTAGE LOWER THAN	0.9	
	STANLEY7 115	0.478 VOLTAGE LOWER THAN	0.9	
	TIOGA4 7 115	0.460 VOLTAGE LOWER THAN	0.9	
	TIOGA7 7 115	0.464 VOLTAGE LOWER THAN	0.9	
	WILISTN7 115-RICHLND7 115	113.9 % OF	80.0 MVA RATING	
	WILISTN7 115-TIOGA7 7 115	169.0 % OF	79.67 MVA RATING	
	RICHLND7 115-LEWIS 7 115	110.1 % OF	79.67 MVA RATING	
	LOGAN 7 115-BTHOLD 7 115	158.9 % OF	80.0 MVA RATING	
	BTHOLD 7 115-KENMARE7 115	158.4 % OF	80.0 MVA RATING	
	KENMARE7 115-STANLEY7 115	120.8 % OF	79.7 MVA RATING	

CASE #13
2011 Winter Peak
Tioga-Williston-Charlie Creek 230kV In Service
Saskatchewan 165MW South-North, MCDC 200MW East-West

CELL NAME = 1B1A2,B10T=-161 NC, T-W-CCR230, DC-EW, B10T=165SN, JAN11

STATUS	VIOLATED ELEMENT	PU
OUTAGES:		
18_1B1A2 OUTAGE: LELANDO4 230 -LELND2TY 345	LELANDO3 345-LELND1TY 345	168.7 % OF 250.0 MVA RATING
	LELANDO4 230-LELND1TY 345	168.7 % OF 250.0 MVA RATING
	Overload of L.Olds transformers initiates tripping scheme	
21_1B1A2 OUTAGE: CHAR.CK3 345 -CHAR.CK4 230	LELANDO4 230-LOGAN 4 230	100.5 % OF 319.0 MVA RATING
	Line Thermal Rating = 445MVA	
	LOGAN 4 230-NETIOGA4 230	110.1 % OF 240.0 MVA RATING
33_1B1A2 OUTAGE: STANTON4 230 -LELANDO4 230	ANTELOP3 345-CHAR.CK3 345	101.4 % OF 538.0 MVA RATING
	Line Thermal Rating = 1135MVA	
40_1B1A2 OUTAGE: DAWSONC4 230 -MI CTYE4 230	DAWSONCT 230	0.861 VOLTAGE LOWER THAN 0.9
	FALLON T 115	0.696 VOLTAGE LOWER THAN 0.9
	MICTYE1T 230	0.510 VOLTAGE LOWER THAN 0.9
	MI CTYE857.0	0.501 VOLTAGE LOWER THAN 0.9
	BELFELDT 345	0.888 VOLTAGE LOWER THAN 0.9
	BISON 869.0	0.822 VOLTAGE LOWER THAN 0.9
	CIRCLE 7 115	0.895 VOLTAGE LOWER THAN 0.9
	DAWSONC4 230	0.880 VOLTAGE LOWER THAN 0.9
	DAWSONC7 115	0.862 VOLTAGE LOWER THAN 0.9
	FALLON 7 115	0.717 VOLTAGE LOWER THAN 0.9
	MI CTYE4 230	0.493 VOLTAGE LOWER THAN 0.9
	MI CTYE7 115	0.510 VOLTAGE LOWER THAN 0.9
	MEDORA 4 230	0.889 VOLTAGE LOWER THAN 0.9
	DKSN-ND7 115	0.883 VOLTAGE LOWER THAN 0.9
	BELFELD4 230	0.894 VOLTAGE LOWER THAN 0.9
	BISON 4 230	0.835 VOLTAGE LOWER THAN 0.9
	MAURINE4 230	0.878 VOLTAGE LOWER THAN 0.9
	LTLMISS7 115	0.681 VOLTAGE LOWER THAN 0.9
	LTLMISS4 230	0.680 VOLTAGE LOWER THAN 0.9
	BAKER 4 230	0.654 VOLTAGE LOWER THAN 0.9

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                                        BAKER  7 115                  0.714 VOLTAGE LOWER THAN  0.9
                                        BOWMAN 4 230                  0.752 VOLTAGE LOWER THAN  0.9
                                        DICKSWH7 115                  0.896 VOLTAGE LOWER THAN  0.9
                                        DICKNTH7 115                  0.896 VOLTAGE LOWER THAN  0.9
                                        GLENDCT7 115                  0.839 VOLTAGE LOWER THAN  0.9
                                        HETINGR4 230                  0.800 VOLTAGE LOWER THAN  0.9
                                        HETINGR7 115                  0.853 VOLTAGE LOWER THAN  0.9
                                        GASCOYN7 115                  0.854 VOLTAGE LOWER THAN  0.9
                                        N ENGLN7 115                  0.869 VOLTAGE LOWER THAN  0.9
                                        RHAME  7 115                  0.706 VOLTAGE LOWER THAN  0.9
                                        RHAME  4 230                  0.729 VOLTAGE LOWER THAN  0.9
                                        DAWSONC7 115-FALLON 7 115     138.7 % OF  80.0 MVA RATING
                                        FALLON 7 115-MI CTYE7 115     137.6 % OF  80.0 MVA RATING
                                        MI CTYE4 230-BAKER  4 230     123.5 % OF  200.0 MVA RATING
                                        LTLMISS4 230-RHAME  4 230     123.8 % OF  240.0 MVA RATING
                                        Outage initiates MCDC ramp which clears violations

42_1B1A2 OUTAGE: DAWSONC4 230 -MEDORA 4 230     LTLMISS4 230-RHAME  4 230     108.0 % OF  240.0 MVA RATING
                                        Minimum Line Thermal Rating = 322MVA

45_1B1A2 OUTAGE: MEDORA 4 230 -BELFELD4 230     LTLMISS4 230-RHAME  4 230     113.3 % OF  240.0 MVA RATING
                                        Minimum Line Thermal Rating = 322MVA

47_1B1A2 OUTAGE: DICKNSN4 230 -BELFELD4 230     ANTELOP3 345-CHAR.CK3 345     103.4 % OF  538.0 MVA RATING
                                        Line Thermal Rating = 1135MVA

48_1B1A2 OUTAGE: DICKNSN4 230 -HESKETT4 230     BELFELDT 345-BELFELD3 345     100.6 % OF  319.0 MVA RATING
                                        BELFELDT 345-BELFELD4 230     100.6 % OF  319.0 MVA RATING
                                        Rate C = 122%
                                        ANTELOP3 345-CHAR.CK3 345     106.5 % OF  538.0 MVA RATING
                                        Line Thermal Rating = 1135MVA

50_1B1A2 OUTAGE: BELFELD4 230 -RHAME  4 230     MEDORA 4 230-BELFELD4 230     100.3 % OF  239.0 MVA RATING
                                        Minimum Line Thermal Rating = 322MVA

61_1B1A2 OUTAGE: BISON  4 230 -MAURINE4 230     ANTELOP3 345-CHAR.CK3 345     102.1 % OF  538.0 MVA RATING
                                        Line Thermal Rating = 1135MVA

62_1B1A2 OUTAGE: BISON  4 230 -HETINGR4 230     ANTELOP3 345-CHAR.CK3 345     101.1 % OF  538.0 MVA RATING
                                        Line Thermal Rating = 1135MVA

67_1B1A2 OUTAGE: CENTER 3 345 -COYOTE 3 345     COYOTE 3 345-COYOTE 7 115     239.3 % OF  168.0 MVA RATING
                                        DKSN-ND7 115-DICKSWH7 115     106.3 % OF  119.51 MVA RATING
                                        BEULAH 7 115-COYOTE 7 115     218.1 % OF  119.5 MVA RATING
                                        COYOTE 7 115-DICKSWH7 115     112.1 % OF  119.51 MVA RATING
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                                                Coyote overload initiates unit runback

71_1B1A2 OUTAGE: ANTELOP3 345 -CHAR.CK3 345     LELANDO3 345-LELND1TY 345     122.2 % OF  250.0 MVA RATING
                                                LELANDO3 345-LELND2TY 345     119.0 % OF  500.0 MVA RATING
                                                LELANDO4 230-LELND1TY 345     122.2 % OF  250.0 MVA RATING
                                                LELANDO4 230-LELND2TY 345     116.0 % OF  500.0 MVA RATING
                                                COYOTE 3 345-COYOTE 7 115     106.5 % OF  168.0 MVA RATING
                                                DICKNSN4 230-BELFELD4 230     101.2 % OF  319.0 MVA RATING
                                                HALIDAY7 115-BEULAH 7 115     102.3 % OF  120.0 MVA RATING
                                                LELANDO4 230-LOGAN  4 230     108.6 % OF  319.0 MVA RATING
                                                Line Thermal Rating = 445MVA
                                                LOGAN  4 230-NETIOGA4 230     118.3 % OF  240.0 MVA RATING

77_1B1A2 OUTAGE: LELANDO4 230 -LOGAN  4 230     MALLARD7 115-MAX    7 115     108.2 % OF  120.0 MVA RATING
                                                GARRISN7 115-MAX    7 115     115.6 % OF  120.0 MVA RATING
                                                ANTELOP3 345-CHAR.CK3 345     105.9 % OF  538.0 MVA RATING
                                                Line Thermal Rating = 1135MVA

79_1B1A2*NOT SOLVED* OUTAGE: LTLMISS4 230 -RHAME  4 230    ****DID NOT SOLVE*****

85_1B1A2 OUTAGE: CHAR.CK4 230 -WATFORD4 230     LELANDO4 230-LOGAN  4 230     100.3 % OF  319.0 MVA RATING
                                                Line Thermal Rating = 445MVA
                                                LOGAN  4 230-NETIOGA4 230     112.0 % OF  240.0 MVA RATING
                                                Line Thermal Rating = 445MVA

86_1B1A2 OUTAGE: WATFORD4 230 -INDNHLS4 230     LOGAN  4 230-NETIOGA4 230     108.5 % OF  240.0 MVA RATING
                                                Line Thermal Rating = 445MVA

87_1B1A2 OUTAGE: INDNHLS4 230 -WILISTN4 230     LOGAN  4 230-NETIOGA4 230     107.7 % OF  240.0 MVA RATING
                                                Line Thermal Rating = 445MVA
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CASE #14
2011 Winter Peak
Tioga-Williston-Charlie Creek 230kV In Service
Saskatchewan 165MW North-South, MCDC 200MW East-West

CELL NAME = 1B1B2,B10T=162 NC, T-W-CCR230, DC-EW, B10T=165NS, JAN11

STATUS	VIOLATED ELEMENT	PU
OUTAGES:		
10_1B1B2 OUTAGE: WILISTN7 115 -WILISTN4 230	TIOGA4 4 230-TIOGA4 7 115	104.0 % OF 100.0 MVA RATING
	New Tioga 230/115 Transformer Rate A = 150MVA	
	TIOGA4 7 115-TIOGA7 7 115	115.3 % OF 108.9 MVA RATING
	Line is being reconductored	
18_1B1B2 OUTAGE: LELANDO4 230 -LELND2TY 345	LELANDO3 345-LELND1TY 345	172.1 % OF 250.0 MVA RATING
	LELANDO4 230-LELND1TY 345	172.1 % OF 250.0 MVA RATING
	Overload of L.Olds transformers initiates tripping scheme	
26_1B1B2 OUTAGE: NETIOGA4 230 -NETIOGA7 115	TIOGA4 4 230-TIOGA4 7 115	134.9 % OF 100.0 MVA RATING
	New Tioga 230/115 Transformer Rate A = 150MVA	
45_1B1B2 OUTAGE: MEDORA 4 230 -BELFELD4 230	LTLMISS4 230-RHAME 4 230	101.6 % OF 240.0 MVA RATING
	Minimum Line Thermal Rating = 322MVA	
48_1B1B2 OUTAGE: DICKNSN4 230 -HESKETT4 230	BELFELDT 345-BELFELD3 345	101.3 % OF 319.0 MVA RATING
	BELFELDT 345-BELFELD4 230	101.3 % OF 319.0 MVA RATING
	Rate C = 122%	
67_1B1B2 OUTAGE: CENTER 3 345 -COYOTE 3 345	COYOTE 3 345-COYOTE 7 115	238.7 % OF 168.0 MVA RATING
	DKSN-ND7 115-DICKSWH7 115	103.0 % OF 119.51 MVA RATING
	BEULAH 7 115-COYOTE 7 115	220.3 % OF 119.5 MVA RATING
	COYOTE 7 115-DICKSWH7 115	108.8 % OF 119.51 MVA RATING
	Coyote overload initiates unit runback	
71_1B1B2 OUTAGE: ANTELOP3 345 -CHAR.CK3 345	LELANDO3 345-LELND1TY 345	113.2 % OF 250.0 MVA RATING
	LELANDO3 345-LELND2TY 345	110.2 % OF 500.0 MVA RATING
	LELANDO4 230-LELND1TY 345	113.2 % OF 250.0 MVA RATING
	LELANDO4 230-LELND2TY 345	107.5 % OF 500.0 MVA RATING
	STANTON4 230-LELANDO4 230	104.3 % OF 478.0 MVA RATING
	Overload of L.Olds transformers initiates tripping scheme	

79_1B1B2*NOT SOLVED* OUTAGE: LTLMISS4 230 -RHAME 4 230   ****DID NOT SOLVE*****

Fix by Shifting Local Load From Little Missouri To Rhame

CASE #15
2011 Winter Peak
Tioga-Williston-Charlie Creek 230kV In Service
Saskatchewan 165MW South-North, MCDC 200MW West-East

CELL NAME = 1B2A2,B10T=-162 NC, T-W-CCR230, DC-WE, B10T=165SN, JAN11

STATUS	VIOLATED ELEMENT	PU	
OUTAGES:			
17_1B2A2 OUTAGE: LELANDO4 230 -LELND1TY 345	LELANDO3 345-LELND2TY 345	104.0 % OF	500.0 MVA RATING
	LELANDO4 230-LELND2TY 345	101.4 % OF	500.0 MVA RATING
	Overload of L.Olds transformers initiates tripping scheme		
18_1B2A2 OUTAGE: LELANDO4 230 -LELND2TY 345	LELANDO3 345-LELND1TY 345	181.4 % OF	250.0 MVA RATING
	LELANDO4 230-LELND1TY 345	181.4 % OF	250.0 MVA RATING
	Overload of L.Olds transformers initiates tripping scheme		
21_1B2A2 OUTAGE: CHAR.CK3 345 -CHAR.CK4 230	WILISTN7 115-RICHLND7 115	117.2 % OF	80.0 MVA RATING
	Minimum Thermal Rating = 116MVA		
67_1B2A2 OUTAGE: CENTER 3 345 -COYOTE 3 345	COYOTE 3 345-COYOTE 7 115	238.1 % OF	168.0 MVA RATING
	BEULAH 7 115-COYOTE 7 115	240.4 % OF	119.5 MVA RATING
	Coyote overload initiates unit runback		
71_1B2A2 OUTAGE: ANTELOP3 345 -CHAR.CK3 345	LELANDO3 345-LELND1TY 345	107.3 % OF	250.0 MVA RATING
	LELANDO3 345-LELND2TY 345	104.5 % OF	500.0 MVA RATING
	LELANDO4 230-LELND1TY 345	107.3 % OF	250.0 MVA RATING
	LELANDO4 230-LELND2TY 345	101.9 % OF	500.0 MVA RATING
	Overload of L.Olds transformers initiates tripping scheme		
77_1B2A2 OUTAGE: LELANDO4 230 -LOGAN 4 230	MALLARD7 115-MAX 7 115	102.4 % OF	120.0 MVA RATING
	GARRISN7 115-MAX 7 115	109.8 % OF	120.0 MVA RATING
	Minimum Thermal Rating = 199MVA		
85_1B2A2 OUTAGE: CHAR.CK4 230 -WATFORD4 230	WILISTN7 115-RICHLND7 115	116.6 % OF	80.0 MVA RATING
	Minimum Thermal Rating = 116MVA		
86_1B2A2 OUTAGE: WATFORD4 230 -INDNHLS4 230	WILISTN7 115-RICHLND7 115	112.0 % OF	80.0 MVA RATING
	Minimum Thermal Rating = 116MVA		

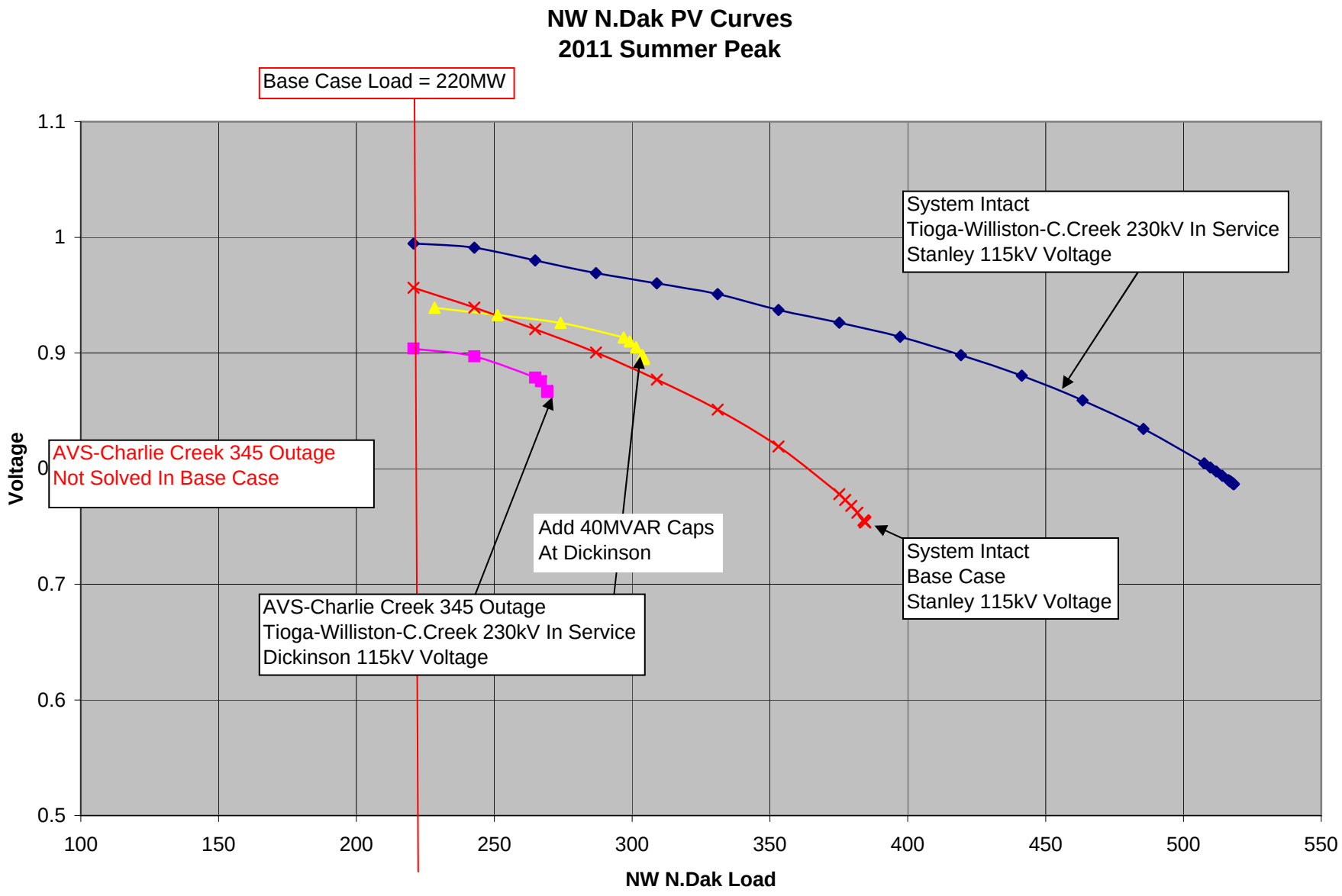
87_1B2A2 OUTAGE: INDNHLS4 230 -WILISTN4 230 WILISTN7 115-RICHLND7 115 110.9 % OF 80.0 MVA RATING
Minimum Thermal Rating = 116MVA

CASE #16
2011 Winter Peak
Tioga-Williston-Charlie Creek 230kV In Service
Saskatchewan 165MW North-South, MCDC 200MW West-East

CELL NAME = 1B2B2,B10T=163 NC, T-W-CCR230, DC-WE, B10T=165NS, JAN11

STATUS	VIOLATED ELEMENT	PU
OUTAGES:		
17_1B2B2 OUTAGE: LELANDO4 230 -LELND1TY 345	LELANDO3 345-LELND2TY 345	105.7 % OF 500.0 MVA RATING
	LELANDO4 230-LELND2TY 345	103.1 % OF 500.0 MVA RATING
	Overload of L.Olds transformers initiates tripping scheme	
18_1B2B2 OUTAGE: LELANDO4 230 -LELND2TY 345	LELANDO3 345-LELND1TY 345	184.5 % OF 250.0 MVA RATING
	LELANDO4 230-LELND1TY 345	184.5 % OF 250.0 MVA RATING
	Overload of L.Olds transformers initiates tripping scheme	
26_1B2B2 OUTAGE: NETIOGA4 230 -NETIOGA7 115	TIOGA4 4 230-TIOGA4 7 115	127.8 % OF 100.0 MVA RATING
	New Tioga 230/115 Transformer Rate A = 150MVA	
52_1B2B2 OUTAGE: BISMARK4 230 -WASHBRN4 230	STANTON4 230-LELANDO4 230	101.5 % OF 478.0 MVA RATING
	Rate C = 110%	
60_1B2B2 OUTAGE: WASHBRN4 230 -LELANDO4 230	STANTON4 230-LELANDO4 230	103.0 % OF 478.0 MVA RATING
	Rate C = 110%	
67_1B2B2 OUTAGE: CENTER 3 345 -COYOTE 3 345	SQBUTTE4 230-CENTER 3 345	103.5 % OF 352.0 MVA RATING
	COYOTE 3 345-COYOTE 7 115	238.0 % OF 168.0 MVA RATING
	STANTON4 230-LELANDO4 230	114.6 % OF 478.0 MVA RATING
	BEULAH 7 115-COYOTE 7 115	243.2 % OF 119.5 MVA RATING
	Coyote overload initiates unit runback	
71_1B2B2 OUTAGE: ANTELOP3 345 -CHAR.CK3 345	STANTON4 230-LELANDO4 230	102.7 % OF 478.0 MVA RATING
	Rate C = 110%	
74_1B2B2 OUTAGE: TIOGA4 4 230 -NETIOGA4 230	TIOGA4 4 230-TIOGA4 7 115	118.0 % OF 100.0 MVA RATING
	New Tioga 230/115 Transformer Rate A = 150MVA	

Appendix B


NW N.Dak PV Curves
2011 Summer Peak
Base Case Load = 220MW
System Intact
Tioga-Williston-C.Creek 230kV In Service
Stanley 115kV Voltage
AVS-Charlie Creek 345 Outage
Not Solved In Base Case
Add 40MVAR Caps
At Dickinson
System Intact
Base Case
Stanley 115kV Voltage
AVS-Charlie Creek 345 Outage
Tioga-Williston-C.Creek 230kV In Service
Dickinson 115kV Voltage
Voltage
NW N.Dak Load
1.1
1
0.9
0
0.7
0.6
0.5
100
150
200
250
300
350
400
450
500
550

Appendix C
Transient Stability Results Table

1	**Case No.**	1	2	3	4	5	6	7	8	9	10
2	**Case Name**	w00-so08aa-ag1	w01-so08aa-ag1	w00-so08aa-ag3	w01-so08aa-ag3	w00-so08aa-ei2	w01-so08aa-ei2	w00-so08aa-fds	w01-so08aa-fds	w00-so08aa-nmz	w01-so08aa-nmz
3	**Disturbance**	ag1	ag1	ag3	ag3	ei2	ei2	fds	fds	nmz	nmz
4	**Prior Outage**	None	None	None	None	None	None	None	None	None	None
5	**Date/Time**	SEP 17 2008 10:25	SEP 17 2008 10:35	SEP 17 2008 10:27	SEP 17 2008 10:37	SEP 17 2008 10:29	SEP 17 2008 10:39	SEP 17 2008 10:31	SEP 17 2008 10:41	SEP 17 2008 10:33	SEP 17 2008 10:43
6	**Comments**										
7											
8	**Steady State Flows**										
9	NDEX / EAST BIAS	2080 / 279	2081 / 279	2080 / 279	2081 / 279	2080 / 279	2081 / 279	2080 / 279	2081 / 279	2080 / 279	2081 / 279
10	MHEX / L20D	2173 / 263	2173 / 263	2173 / 263	2173 / 263	2173 / 263	2173 / 263	2173 / 263	2173 / 263	2173 / 263	2173 / 263
11	ECL-ARP / PRI-BYN	565 / 741	566 / 742	565 / 741	566 / 742	565 / 741	566 / 742	565 / 741	566 / 742	565 / 741	566 / 742
12	MWEX / AHD-SLK	1522 / 642	1524 / 642	1522 / 642	1524 / 642	1522 / 642	1524 / 642	1522 / 642	1524 / 642	1522 / 642	1524 / 642
13	D602F / F601C	1739 / 1472	1738 / 1471	1739 / 1472	1738 / 1471	1739 / 1472	1738 / 1471	1739 / 1472	1738 / 1471	1739 / 1472	1738 / 1471
14	B10T / MH>SPC	166 / 62	166 / 63	166 / 62	166 / 63	166 / 62	166 / 63	166 / 62	166 / 63	166 / 62	166 / 63
15	OH E-W / OH>MH	189 / -196	189 / -196	189 / -196	189 / -196	189 / -196	189 / -196	189 / -196	189 / -196	189 / -196	189 / -196
16	R50M / OH>MP	150 / 150	150 / 150	150 / 150	150 / 150	150 / 150	150 / 150	150 / 150	150 / 150	150 / 150	150 / 150
17	G82R	20	21	20	21	20	21	20	21	20	21
18	Dorsey bipole / CU bipole	3246 / 1104	3247 / 1104	3246 / 1104	3247 / 1104	3246 / 1104	3247 / 1104	3246 / 1104	3247 / 1104	3246 / 1104	3247 / 1104
19	Dorsey Reserve / Wtrtn SVC	293 / 5	294 / 5	293 / 5	294 / 5	293 / 5	294 / 5	293 / 5	294 / 5	293 / 5	294 / 5
20	Forbes SVC / MSC	24 / 600	24 / 600	24 / 600	24 / 600	24 / 600	24 / 600	24 / 600	24 / 600	24 / 600	24 / 600
21	RCDC	0	0	0	0	0	0	0	0	0	0
22	**Steady State Vltgs**										
23	Dorsey 500/Dorsey 230	1.004 / 1.045	1.004 / 1.045	1.004 / 1.045	1.004 / 1.045	1.004 / 1.045	1.004 / 1.045	1.004 / 1.045	1.004 / 1.045	1.004 / 1.045	1.004 / 1.045
24	Roseau 500/Forbes 500	1.028 / 1.009	1.028 / 1.009	1.028 / 1.009	1.028 / 1.009	1.028 / 1.009	1.028 / 1.009	1.028 / 1.009	1.028 / 1.009	1.028 / 1.009	1.028 / 1.009
25	Chisago 500/EauClaire 345	1.011 / 1.004	1.011 / 1.003	1.011 / 1.004	1.011 / 1.003	1.011 / 1.004	1.011 / 1.003	1.011 / 1.004	1.011 / 1.003	1.011 / 1.004	1.011 / 1.003
26	Int Falls 115/Badoura 115	1.014 / 1.032	1.017 / 1.032	1.014 / 1.032	1.017 / 1.032	1.014 / 1.032	1.017 / 1.032	1.014 / 1.032	1.017 / 1.032	1.014 / 1.032	1.017 / 1.032
27	Drayton 230/Groton 345	1.026 / 1.010	1.026 / 1.010	1.026 / 1.010	1.026 / 1.010	1.026 / 1.010	1.026 / 1.010	1.026 / 1.010	1.026 / 1.010	1.026 / 1.010	1.026 / 1.010
28	**SS OS Relay Margins**										
29	D602F at Forbes/Dorsey	233% / 363%	234% / 364%	233% / 363%	234% / 364%	233% / 363%	234% / 364%	233% / 363%	234% / 364%	233% / 363%	234% / 364%
30	82R at Rugby/L20D at Drayton	999% / 767%	999% / 766%	999% / 767%	999% / 766%	999% / 767%	999% / 766%	999% / 767%	999% / 766%	999% / 767%	999% / 766%
31	R50M/F3M	857% / 318%	858% / 321%	857% / 318%	858% / 321%	857% / 318%	858% / 321%	857% / 318%	858% / 321%	857% / 318%	858% / 321%
32	B10T	334%	340%	334%	340%	334%	340%	334%	340%	334%	340%
33	**Min/MaxTransientVltg**										
34	Arrowhd 230	0.97 | 1.03	0.97 | 1.02	0.97 | 1.03	0.97 | 1.03	0.95 | 1.04	0.95 | 1.04	0.95 | 1.04	0.95 | 1.04	0.93 | 1.06	0.93 | 1.06
35	Boise 115	0.99 | 1.03	0.99 | 1.03	0.99 | 1.03	0.99 | 1.03	0.97 | 1.03	0.97 | 1.03	1.00 | 1.03	1.00 | 1.03	0.92 | 1.03	0.92 | 1.03
36	Dorsey 230	1.02 | 1.06	1.02 | 1.06	1.02 | 1.06	1.02 | 1.06	1.02 | 1.06	1.02 | 1.06	1.03 | 1.07	1.03 | 1.07	1.04 | 1.16	1.04 | 1.16
37	Forbes 230	0.99 | 1.03	0.99 | 1.03	0.99 | 1.03	0.99 | 1.03	0.96 | 1.03	0.96 | 1.03	0.99 | 1.03	0.99 | 1.03	0.99 | 1.04	0.99 | 1.04
38	Riverton 230	0.98 | 1.05	0.98 | 1.05	0.98 | 1.06	0.98 | 1.05	0.91 | 1.06	0.91 | 1.06	0.95 | 1.06	0.95 | 1.06	0.92 | 1.06	0.92 | 1.06
39	Coal Creek 230	0.96 | 1.12	0.96 | 1.12	0.96 | 1.12	0.96 | 1.12	1.01 | 1.13	1.01 | 1.13	0.95 | 1.14	0.95 | 1.14	0.95 | 1.10	0.95 | 1.10
40	Jamestown 345	0.88 | 1.05	0.88 | 1.05	0.87 | 1.05	0.88 | 1.05	0.81 | 1.06	0.81 | 1.05	0.78 | 1.07	0.78 | 1.06	0.83 | 1.05	0.83 | 1.05
41	Drayton 230	0.99 | 1.09	0.99 | 1.09	0.99 | 1.09	0.99 | 1.09	0.95 | 1.09	0.95 | 1.10	1.00 | 1.11	1.00 | 1.11	0.98 | 1.09	0.98 | 1.09
42	Groton 345	0.85 | 1.05	0.86 | 1.04	0.85 | 1.05	0.85 | 1.05	0.83 | 1.11	0.83 | 1.10	0.88 | 1.07	0.88 | 1.07	0.85 | 1.07	0.86 | 1.07
43	Minong 161	0.99 | 1.05	0.99 | 1.03	0.99 | 1.05	0.99 | 1.05	1.00 | 1.06	1.00 | 1.06	0.98 | 1.05	0.98 | 1.05	0.98 | 1.09	0.98 | 1.09
44	Wahpeton 115	0.96 | 1.10	0.96 | 1.10	0.95 | 1.10	0.96 | 1.10	0.88 | 1.11	0.88 | 1.11	0.92 | 1.11	0.92 | 1.10	0.89 | 1.11	0.89 | 1.10
45	Watertown 345	0.93 | 1.05	0.94 | 1.05	0.94 | 1.05	0.94 | 1.05	0.88 | 1.10	0.88 | 1.09	0.93 | 1.07	0.93 | 1.06	0.90 | 1.07	0.90 | 1.07
46	**Dynamic Voltage Warnings**										
47		none	none	none	none	none	none	none	none	none	none
48											
49											
50											
51											
52											
53											
54	Worst Case Angle Damping										
55	Dorsey SUVP / UdHold							/ 0.175	/ 0.166	/ 0.133	/ 0.133
56	Forbes DC Red (DCAR)	394%	392%	390%	387%	507%	507%	389%	394%	507%	507%
57	K22W (max +dP @ t, d-ang)	10.6@(2.51666,1.7)	9.0@(2.49999,2.5)	12.2@(2.48332,1.6)	12.1@(2.45832,1.8)	63.6@(1.87500,-27.5)	63.8@(1.87500,-27.7)	16.7@(2.58332,-1.6)	16.2@(2.56665,-1.6)	123.5@(2.22499,-53.7)	122.4@(2.24166,-53.8)
58	K22W (max -dP @ t, d-ang)	22.5@(0.80000,5.8)	22.6@(0.79166,5.8)	22.6@(0.75000,6.4)	22.9@(0.73333,6.3)	8.2@(0.60000,1.1)	8.4@(0.60000,1.2)	16.4@(0.60833,2.2)	16.9@(0.60833,2.2)	84.6@(0.23333,6.8)	84.5@(0.23333,6.7)
59	K22W (max d-ang @ t, dP)	8.2@(1.06666,-10.6)	8.4@(1.06666,-10.5)	8.6@(1.00833,-11.8)	8.7@(1.00000,-11.9)	-31.4@(2.23333,58.5)	-31.8@(2.24999,60.7)	5.8@(1.04166,-10.5)	5.9@(1.03333,-10.8)	-53.8@(2.22499,122.4)	-53.9@(2.24166,121.3)
60	**OS Rel Trip / Marg**										
61	MH - OH										
62	D602F at Forbes/Dorsey	172% / 263%	175% / 268%	170% / 259%	171% / 261%	131% / 197%	131% / 196%	189% / 292%	190% / 294%	0.18333 sec / 0.18333 sec	0.18333 sec / 0.18333 sec
63	82R at Rugby/L20D at Drayton	999% / 582%	999% / 583%	999% / 569%	999% / 570%	999% / 473%	999% / 489%	999% / 584%	999% / 593%	999% / 526%	999% / 531%
64	R50M / F3M	679% / 259%	690% / 266%	672% / 258%	677% / 261%	605% / 209%	605% / 213%	692% / 269%	694% / 271%	368% / 136%	366% / 137%
65	B10T	178%	163%	165%	149%	80%	70%	157%	146%	110%	100%
66	**FSCAPS (SS/Unav/Final)**										
67	Balta 230	(0 | 0 | 0)	(0 | 0 | 0)	(0 | 1 | 0)	(0 | 1 | 0)	(0 | 0 | 0)	(0 | 0 | 0)	(0 | 1 | 0)	(0 | 1 | 0)	(0 | 0 | 0)	(0 | 0 | 0)
68	Eau Cl 345 / Park Lk 115	(3 | 3 | 3) / (0 | 0 | 0)	(3 | 3 | 3) / (0 | 0 | 0)	(3 | 3 | 3) / (0 | 0 | 0)	(3 | 3 | 3) / (0 | 0 | 0)	(3 | 3 | 2) / (0 | 0 | 0)	(3 | 3 | 3) / (0 | 0 | 0)	(3 | 3 | 3) / (0 | 0 | 0)	(3 | 3 | 3) / (0 | 0 | 0)	(3 | 3 | 1) / (0 | 0 | 0)	(3 | 3 | 1) / (0 | 0 | 0)
69	Prairie 115 / Ramsey 230	(1 | 3 | 1) / (0 | 1 | 0)	(1 | 5 | 1) / (0 | 1 | 0)	(1 | 3 | 1) / (0 | 2 | 0)	(1 | 3 | 1) / (0 | 2 | 0)	(1 | 5 | 1) / (0 | 1 | 0)	(1 | 5 | 1) / (0 | 1 | 0)	(1 | 4 | 1) / (0 | 2 | 1)	(1 | 4 | 1) / (0 | 2 | 1)	(1 | 3 | 1) / (0 | 1 | 0)	(1 | 3 | 1) / (0 | 1 | 0)
70	Roseau 230 / Running 230	(0 | 0 | 0) / (1 | 1 | 1)	(0 | 0 | 0) / (1 | 1 | 1)	(0 | 0 | 0) / (1 | 1 | 1)	(0 | 0 | 0) / (1 | 1 | 1)	(0 | 1 | 0) / (1 | 2 | 2)	(0 | 1 | 1) / (1 | 2 | 2)	(0 | 0 | 0) / (1 | 1 | 1)	(0 | 0 | 0) / (1 | 1 | 1)	(0 | 2 | 0) / (1 | 4 | 1)	(0 | 2 | 0) / (1 | 4 | 1)
71	Shey 115 / Split Rock 115	(1 | 5 | 2) / (1 | 1 | 1)	(1 | 5 | 2) / (1 | 1 | 1)	(1 | 5 | 2) / (1 | 2 | 2)	(1 | 5 | 2) / (1 | 2 | 2)	(1 | 5 | 0) / (1 | 2 | 2)	(1 | 5 | 0) / (1 | 2 | 2)	(1 | 5 | 1) / (1 | 1 | 1)	(1 | 5 | 1) / (1 | 1 | 1)	(1 | 5 | 1) / (1 | 2 | 2)	(1 | 5 | 1) / (1 | 2 | 2)
72	**Damping Performance**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Case	w00-so08aa-ag1	w01-so08aa-ag1	w00-so08aa-ag3	w01-so08aa-ag3	w00-so08aa-ei2	w01-so08aa-ei2	w00-so08aa-fds	w01-so08aa-fds	w00-so08aa-nmz	w01-so08aa-nmz
Disturbance	ag1	ag1	ag3	ag3	ei2	ei2	fds	fds	nmz	nmz
System Response	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
70% or 120% Violations										
ORWG Criteria Violations										
Line Tripping									(5T)(6T)	(5T)(6T)