

# ***Generation Interconnection Feasibility Study Report Queue Request(s) AC2-185 & AC2-184***

The Interconnection Customer (IC) has proposed two solar generating projects; AC2-184, a 20 MW MFO (7.6 MW Capacity) facility, and AC2-185, also a 20 MW MFO (7.6 MW Capacity) facility to be located near Smyrna, Kent County, Delaware. PJM studied the two projects as one totaling 40 MW MFO (15.2 MW Capacity) into the Delmarva Power and Light Company (DPL) system at the Cedar 138 kV Substation and evaluated it for compliance with reliability criteria for summer peak conditions in 2020. The AC2-184 and AC2-185 projects will utilize the same Point of Interconnection as the Interconnection Customer's prior queue position AC1-091. The planned in-service date, as requested by the IC during the project kick-off call, is December 2018. This date may not be attainable due to additional PJM studies and the Transmission Owner's construction schedule.

## **Point of Interconnection**

The Interconnection Customer requested that queue projects AC2-184 and 185 utilize the same Point of Interconnection as their prior queue positions AC1-091, 092, 093, and 094 a new terminal position at the Delmarva Power and Light Cedar Creek 138 kV Substation.

## **Transmission Owner Scope of Direct Connection Work**

No additional Transmission Owner work is required for AC2-185 over what has been previously identified for the AC1-091 thru 094 projects.

## **Required Relaying and Communications**

Relaying and communications costs are the same as those included in the reports for AC1-091 thru 094.

## **Metering**

Three phase 138 kV revenue metering points will need to be established. DPL will purchase and install all metering instrument transformers as well as construct a metering structure. The secondary wiring connections at the instrument transformers will be completed by DPL's metering technicians. The metering control cable and meter cabinets will be supplied and installed by DPL. DPL will install conduit for the control cable between the instrument transformers and the metering enclosure. The location of the metering enclosure will be determined in the construction phase. DPL will provide both the Primary and the Backup meters. DPL's meter technicians will program and install the Primary & Backup solid state multi-function meters for each new metering position. Each meter will be equipped with load profile, telemetry, and DNP outputs. The IC will be provided with one meter DNP output for each meter. DPL will own the metering equipment for the interconnection point, unless the IC asserts its right to install, own, and operate the metering system.

The Interconnection Customer will be required to make provisions for a voice quality phone line within approximately 3 feet of each Company metering position to facilitate remote interrogation and data collection.

It is the IC's responsibility to send the data that PJM and DPL requires directly to PJM. The IC will grant permission for PJM to send DPL the following telemetry that the IC sends to PJM: real time MW, MVAR, volts, amperes, generator status, and interval MWH and MVARH.

The estimate for DPL to design, purchase, and install metering as specified in the aforementioned scope for metering is included in the Substation Interconnection Estimate.

### **Interconnection Customer Scope of Work**

The Interconnection Customer is responsible for all design and construction related to activities on their side of the Point of Interconnection. Site preparation, including grading and an access road, as necessary, is assumed to be by the IC. Route selection, line design, and right-of-way acquisition of the direct connect facilities is not included in this report, and is the responsibility of the IC. Protective relaying and metering design and installation must comply with DPL's applicable standards. The IC is also required to provide revenue metering and real-time telemetering data to PJM in conformance with the requirements contained in PJM Manuals M-01 and M-14 and the PJM Tariff.

### **DPL Interconnection Customer Scope of Direct Connection Work Requirements:**

- DPL requires that an IC circuit breaker is located within 500 feet of the DPL substation to facilitate the relay protection scheme between DPL and the IC at the Point of Interconnection (POI).

### **Special Operating Requirements**

1. DPL will require the capability to remotely disconnect the generator from the grid by communication from its System Operations facility. Such disconnection may be facilitated by a generator breaker, or other method depending upon the specific circumstances and the evaluation by DPL.
2. DPL reserves the right to charge the Interconnection Customer operation and maintenance expenses to maintain the Interconnection Customer attachment facilities, including metering and telecommunications facilities, owned by DPL.

## **Summer Peak Analysis - 2020**

### **Transmission Network Impacts**

Potential transmission network impacts are as follows:

### **Generator Deliverability**

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

None

### **Multiple Facility Contingency**

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

1. (DP&L - DP&L) The KENT-NMEREDTH 69 kV line (from bus 232215 to bus 232812 ckt 1) loads from 97.31% to 98.83% (DC power flow) of its emergency rating (93 MVA) for the line fault with failed breaker contingency outage of 'DP11'. This project contributes approximately 3.15 MW to the thermal violation.

CONTINGENCY 'DP11'/\*STEELE BUS BREAKER TO MILFORD  
DISCONNECT BRANCH FROM BUS 232004 TO BUS 232000 CKT 1/\*MILFORD STEELE  
230 230  
DISCONNECT BRANCH FROM BUS 232000 TO BUS 232005 CKT 1/\*STEELE VIENNA  
230 230  
END

2. (DP&L - DP&L) The AB2-037 TAP-KEEN\_230 230 kV line (from bus 923960 to bus 231003 ckt 2) loads from 99.47% to 100.57% (DC power flow) of its emergency rating (727 MVA) for the tower line contingency outage of 'DBL\_4NC'. This project contributes approximately 17.68 MW to the thermal violation.

CONTINGENCY 'DBL\_4NC'/\* RED LION-CEDAR CREEK 230;RED LION-CARTANZA  
230  
OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1  
OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1  
END

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

### **Contribution to Previously Identified Overloads**

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

1. (DP&L - DP&L) The MILF\_230-STEELE 230 kV line (from bus 232004 to bus 232000 ckt 1) loads from 178.38% to 183.21% (DC power flow) of its emergency rating (551 MVA) for the tower line contingency outage of 'DBL\_4NC'. This project contributes approximately 26.61 MW to the thermal violation.

CONTINGENCY 'DBL\_4NC'/\* RED LION-CEDAR CREEK 230;RED LION-CARTANZA  
230  
OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1  
OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1  
END

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

2. (DP&L - DP&L) The MIDLTNTP-MT PLSNT 138 kV line (from bus 232106 to bus 232104 ckt 1) loads from 112.71% to 115.24% (DC power flow) of its emergency rating (348 MVA) for the tower line contingency outage of 'DBL\_4NC'. This project contributes approximately 8.79 MW to the thermal violation.

CONTINGENCY 'DBL\_4NC'/\* RED LION-CEDAR CREEK 230;RED LION-CARTANZA  
230  
OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1  
OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1  
END

Please refer to Appendix 3 for a table containing the generators having contribution to this flowgate.

3. (DP&L - DP&L) The TOWNSEND-MIDLTNTP 138 kV line (from bus 232107 to bus 232106 ckt 1) loads from 123.46% to 125.99% (DC power flow) of its emergency rating (348 MVA) for the tower line contingency outage of 'DBL\_4NC'. This project contributes approximately 8.79 MW to the thermal violation.

CONTINGENCY 'DBL\_4NC'/\* RED LION-CEDAR CREEK 230;RED LION-CARTANZA  
230  
OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1  
OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1  
END

Please refer to Appendix 4 for a table containing the generators having contribution to this flowgate.

4. (DP&L - DP&L) The KENT-NMEREDTH 69 kV line (from bus 232215 to bus 232812 ckt 1) loads from 132.13% to 138.48% (DC power flow) of its emergency rating (93 MVA) for the tower line contingency outage of 'DBL\_4NC'. This project contributes approximately 5.91 MW to the thermal violation.

CONTINGENCY 'DBL\_4NC'/\* RED LION-CEDAR CREEK 230;RED LION-CARTANZA  
230  
OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1  
OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1  
END

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

5. (DP&L - DP&L) The NMEREDTH-AB2-135 TAP 69 kV line (from bus 232812 to bus 924820 ckt 1) loads from 106.97% to 113.32% (DC power flow) of its emergency rating (93 MVA) for the tower line contingency outage of 'DBL\_4NC'. This project contributes approximately 5.91 MW to the thermal violation.

CONTINGENCY 'DBL\_4NC'/\* RED LION-CEDAR CREEK 230;RED LION-CARTANZA  
230  
OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1  
OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1  
END

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

6. (DP&L - DP&L) The AB2-135 TAP-CHURC\_69 69 kV line (from bus 924820 to bus 232203 ckt 1) loads from 157.66% to 164.01% (DC power flow) of its emergency rating (93 MVA) for the tower line contingency outage of 'DBL\_4NC'. This project contributes approximately 5.91 MW to the thermal violation.

CONTINGENCY 'DBL\_4NC'/\* RED LION-CEDAR CREEK  
230;RED LION-CARTANZA 230  
OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1  
OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1  
END

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

## **Summer Peak Load Flow Analysis Reinforcements**

### **New System Reinforcements**

*(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)*

1. To mitigate the (DP&L) KENT-NMEREDTH 69 kV line (from bus 232215 to bus 232812 ckt 1) overload will require increasing the emergency rating of the Kent to New Meredith 69 kV line by rebuilding the circuit. The rebuild includes the installation of new poles, new disconnect switches, and new relays. The estimate to perform this work is **\$9,720,000** and will take **24-36 months** to complete.
2. To mitigate the (DP&L) AB2-037 TAP-KEEN\_230 230 kV line (from bus 923960 to bus 231003 ckt 2) overload will require relay upgrades at the Keeney substation. The estimate to perform this work is **\$800,000** and will take **12 months** to complete.

### **Contribution to Previously Identified System Reinforcements**

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

1. To mitigate the (DP&L) MILF\_230-STEELE 230 kV line (from bus 232004 to bus 232000 ckt 1) overload will require increasing the emergency rating of the Milford to Steele 230 kV line by rebuilding the circuit. The rebuild includes the replacement of poles. The estimate to perform this work is **\$43,965,000** and will take **4 years** to complete.
2. To mitigate the (DP&L) MIDLTNTP-MT PLSNT 138 kV line (from bus 232106 to bus 232104 ckt 1) overload will require increasing the emergency rating of the Townsend to Middletown Tap 138 kV line by rebuilding of a small section of the circuit. The rebuild includes the installation of new poles and the re-mounting of 138 kV disconnect switches. The estimate to perform this work is **\$800,000** and will take **18 months** to complete.
3. To mitigate the (DP&L) TOWNSEND-MIDLTNTP 138 kV line (from bus 232107 to bus 232106 ckt 1) overload will require increasing the emergency rating of the Townsend to Middletown Tap 138 kV line by rebuilding of a small section of the circuit. The rebuild includes the installation of new poles and the re-mounting of 138 kV disconnect switches. The estimate to perform this work is **\$800,000** and will take **18 months** to complete.
4. To mitigate the (DP&L) KENT-NMEREDTH 69 kV line (from bus 232215 to bus 232812 ckt 1) overload will require increasing the emergency rating of the Kent to New Meredith 69 kV line by rebuilding of the circuit. The rebuild includes the installation of new poles, new disconnect switches, and new relays. The estimate to perform this work is **\$9,720,000** and will take **24-36 months** to complete.
5. To mitigate the (DP&L) NMEREDTH-AB2-135 TAP 69 kV line (from bus 232812 to bus 924820 ckt 1) overload will require increasing the emergency rating of the AB2-135 to New Meredith 69 kV line. Work scope will include the installation of new poles and a new disconnect switch. Estimated Cost: **\$8,674,000**; Estimated Time: **36 months**.
6. To mitigate the (DP&L) AB2-135 TAP-CHURC\_69 69 kV line (from bus 924820 to bus 232203 ckt 1) overloads will require increasing the emergency rating of the AB2-135 to Church 69 kV line by rebuilding the circuit. The rebuild includes the installation of new poles and a new disconnect switch. The estimate to perform this work is **\$8,674,000** and will take **3 years** to complete.

### **Steady-State Voltage Requirements**

To be performed during later study phases.

### **Short Circuit**

No issues identified.

## **Stability and Reactive Power Requirement**

To be performed during later study phases.

## **Light Load Analysis - 2020**

Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

## **Facilities Study Estimate**

7 months: \$100,000

## **Delivery of Energy Portion of Interconnection Request**

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

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

1. (DP&L - DP&L) The CARTANZA-RL\_230 230 kV line (from bus 232003 to bus 231004 ckt 1) loads from 98.4% to 100.18% (DC power flow) of its emergency rating (790 MVA) for the single line contingency outage of 'CKT 23030'. This project contributes approximately 14.03 MW to the thermal violation.

CONTINGENCY 'CKT 23030'

OPEN LINE FROM BUS 232002 TO BUS 231004 CIRCUIT 1 /CEDAR CREEK - RED LION  
230  
END

2. (DP&L - DP&L) The MILF\_230-STEELE 230 kV line (from bus 232004 to bus 232000 ckt 1) loads from 109.21% to 109.85% (DC power flow) of its emergency rating (551 MVA) for the single line contingency outage of 'CKT 23032'. This project contributes approximately 7.81 MW to the thermal violation.

CONTINGENCY 'CKT 23032'

OPEN LINE FROM BUS 231004 TO BUS 232003 CIRCUIT 1/RED LION - CARTANZA 230  
END

## **Delmarva Power and Light Costs**

Cost estimates will further be refined as a part of the Impact Study and Facilities Study for this project. The Interconnection Customer will be responsible for all costs incurred by DPL in connection with the AC2-185 project. Such costs may include, but are not limited to, any transmission system assets currently in DPL's rate base that are prematurely retired due to the AC1-091 project. PJM shall work with DPL to identify these retirement costs and any additional expenses.

DPL reserves the right to reassess issues presented in this document and, upon appropriate justification, submit additional costs related to the AC2-185 project.

## **Appendices**

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gauge other generators impact.

It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

### **Appendix 1**

(DP&L - DP&L) The AB2-037 TAP-KEEN\_230 230 kV line (from bus 923960 to bus 231003 ckt 2) loads from 99.47% to 100.57% (DC power flow) of its emergency rating (727 MVA) for the tower line contingency outage of 'DBL\_4NC'. This project contributes approximately 17.68 MW to the thermal violation.

CONTINGENCY 'DBL\_4NC'

/\* RED LION-CEDAR CREEK

230;RED LION-CARTANZA 230

OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1

OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931161            | AC2-023 C       | 12.                      |
| 931162            | AC2-023 E       | 22.65                    |
| 932631            | AC2-185 C       | 6.72                     |
| 932632            | AC2-185 E       | 10.96                    |
| 932641            | AC2-186 C       | 1.69                     |
| 932642            | AC2-186 E       | 2.76                     |
| 932651            | AC2-187 C OP    | 3.31                     |
| 932652            | AC2-187 E OP    | 5.39                     |
| 932661            | AC2-188 C       | 3.38                     |
| 932662            | AC2-188 E       | 5.52                     |
| 932671            | AC2-189 C1 O    | 0.32                     |
| 932673            | AC2-189 C2 O    | 4.37                     |
| 932672            | AC2-189 E O     | 0.59                     |
| 932691            | AC2-191         | 8.7                      |
| 232926            | CRISFLD1        | 0.74                     |
| 232923            | MR1             | 7.73                     |
| 232924            | MR2             | 7.73                     |
| 232912            | OH NUG1         | 3.34                     |



|        |           |        |
|--------|-----------|--------|
| 232913 | OH NUG2   | 3.3    |
| 232914 | OH NUG3   | 3.34   |
| 232915 | OH NUG4   | 3.34   |
| 232916 | OH NUG5   | 3.34   |
| 232917 | OH NUG6   | 3.33   |
| 232918 | OH NUG7   | 3.32   |
| 232921 | TASLEY2G  | 2.29   |
| 297077 | V2-028 E  | 1.68   |
| 904212 | V4-022 E  | 1.41   |
| 232907 | VN8       | 11.43  |
| 901003 | W1-003 C  | 0.21   |
| 901004 | W1-003 E  | 2.07   |
| 901013 | W1-004 C  | 0.21   |
| 901014 | W1-004 E  | 2.07   |
| 901023 | W1-005 C  | 0.21   |
| 901024 | W1-005 E  | 2.07   |
| 901033 | W1-006 C  | < 0.01 |
| 901034 | W1-006 E  | 2.07   |
| 907052 | X1-032 E  | 1.82   |
| 907323 | X1-096 C  | 1.45   |
| 907324 | X1-096 E  | 42.34  |
| 910572 | X3-008 E  | 5.51   |
| 910592 | X3-015 E  | 5.42   |
| 910822 | X3-066 E  | 1.31   |
| 913362 | Y1-079 E  | 2.4    |
| 913412 | Y1-080 E  | 0.94   |
| 915542 | Y3-058 E  | 4.22   |
| 920582 | Z1-076 C  | 2.42   |
| 920583 | Z1-076 E  | 3.95   |
| 920592 | Z1-077 C  | 1.73   |
| 920593 | Z1-077 E  | 2.82   |
| 916441 | Z1-100    | 0.31   |
| 916451 | Z1-101    | 0.31   |
| 916461 | Z1-102    | 0.31   |
| 920602 | Z1-103    | 0.31   |
| 917082 | Z2-012 E  | 5.64   |
| 920763 | Z2-076 E  | 0.91   |
| 920773 | Z2-077 E  | 0.91   |
| 920812 | Z2-097 C  | 1.11   |
| 920813 | Z2-097 E  | 0.46   |
| 920952 | AA1-025   | 0.28   |
| 920962 | AA1-026   | 0.28   |
| 920972 | AA1-027   | 0.28   |
| 920982 | AA1-028   | 0.28   |
| 921122 | AA1-059 C | 1.96   |

|        |              |        |
|--------|--------------|--------|
| 921123 | AA1-059 E    | 0.77   |
| 921142 | AA1-061 C    | 5.96   |
| 921143 | AA1-061 E    | 2.94   |
| 918831 | AA1-102      | 2.79   |
| 921442 | AA1-110 C    | 1.25   |
| 921443 | AA1-110 E    | 0.63   |
| 921592 | AA1-140 C    | 3.45   |
| 921593 | AA1-140 E    | 5.63   |
| 921602 | AA1-141 C    | 2.59   |
| 921603 | AA1-141 E    | 4.23   |
| 921872 | AA2-069      | 240.92 |
| 922213 | AA2-129 E    | 9.1    |
| 922222 | AA2-130      | 0.91   |
| 922752 | AB1-056 C OP | 29.24  |
| 922753 | AB1-056 E OP | 83.27  |
| 922762 | AB1-057 C    | 29.69  |
| 922763 | AB1-057 E    | 84.63  |
| 923282 | AB1-137 C    | 1.91   |
| 923283 | AB1-137 E    | 0.82   |
| 923322 | AB1-141 C OP | 4.63   |
| 923323 | AB1-141 E OP | 2.16   |
| 923332 | AB1-142 C OP | 4.63   |
| 923333 | AB1-142 E OP | 2.16   |
| 923452 | AB1-162 C OP | 2.23   |
| 923453 | AB1-162 E OP | 3.64   |
| 923602 | AB1-176 C    | 1.19   |
| 923603 | AB1-176 E    | 1.97   |
| 923902 | AB2-030 E    | 1.82   |
| 923921 | AB2-032 C    | 4.66   |
| 923922 | AB2-032 E    | 2.19   |
| 923931 | AB2-033 C    | 3.26   |
| 923932 | AB2-033 E    | 1.29   |
| 923951 | AB2-036 C    | 15.26  |
| 923952 | AB2-036 E    | 24.95  |
| 923961 | AB2-037 C    | 42.83  |
| 923962 | AB2-037 E    | 69.96  |
| 924191 | AB2-063 C    | 2.67   |
| 924192 | AB2-063 E    | 4.35   |
| 924361 | AB2-084 C    | 1.73   |
| 924362 | AB2-084 E    | 2.82   |
| 924681 | AB2-120 C OP | 17.29  |
| 924682 | AB2-120 E OP | 28.21  |
| 924781 | AB2-130 C OP | 14.58  |
| 924782 | AB2-130 E OP | 23.78  |
| 924801 | AB2-133 C OP | 7.71   |

|        |              |       |
|--------|--------------|-------|
| 924802 | AB2-133 E OP | 9.78  |
| 924821 | AB2-135 C    | 10.07 |
| 924822 | AB2-135 E    | 11.48 |
| 924831 | AB2-136 C OP | 11.11 |
| 924832 | AB2-136 E OP | 11.78 |
| 924881 | AB2-142 C    | 2.24  |
| 924882 | AB2-142 E    | 3.65  |
| 924971 | AB2-153 C    | 2.61  |
| 924972 | AB2-153 E    | 4.25  |
| 925091 | AB2-166 C    | 0.91  |
| 925092 | AB2-166 E    | 1.59  |
| 925101 | AB2-167 C    | 2.41  |
| 925102 | AB2-167 E    | 3.96  |
| 925151 | AB2-172 C OP | 8.44  |
| 925152 | AB2-172 E OP | 13.76 |
| 925231 | AB2-177 C    | 1.14  |
| 925232 | AB2-177 E    | 1.86  |
| 925261 | AB2-180 C    | 6.35  |
| 925262 | AB2-180 E    | 2.72  |
| 925271 | AB2-185 C OP | 5.42  |
| 925272 | AB2-185 E OP | 2.32  |
| 925381 | AC1-009 C    | 3.46  |
| 925382 | AC1-009 E    | 5.64  |
| 925651 | AC1-041 C    | 0.86  |
| 925652 | AC1-041 E    | 1.41  |
| 925731 | AC1-049 C    | 0.68  |
| 925732 | AC1-049 E    | 1.13  |
| 925741 | AC1-050 C    | 0.86  |
| 925742 | AC1-050 E    | 1.4   |
| 925761 | AC1-052 C    | 4.55  |
| 925762 | AC1-052 E    | 1.82  |
| 926131 | AC1-091 C    | 3.32  |
| 926132 | AC1-091 E    | 5.44  |
| 926141 | AC1-092 C    | 3.32  |
| 926142 | AC1-092 E    | 5.44  |
| 926151 | AC1-093 C    | 3.14  |
| 926152 | AC1-093 E    | 5.17  |
| 926161 | AC1-094 C    | 2.65  |
| 926162 | AC1-094 E    | 4.38  |
| 926171 | AC1-095 C    | 2.74  |
| 926172 | AC1-095 E    | 2.08  |
| 926721 | AC1-154 C    | 0.4   |
| 926722 | AC1-154 E    | 0.67  |
| 926911 | AC1-177      | 1.82  |
| 927031 | AC1-190 C    | 15.56 |

|        |              |      |
|--------|--------------|------|
| 927032 | AC1-190 E    | 6.67 |
| 927191 | AC1-213 C    | 1.59 |
| 927192 | AC1-213 E    | 0.82 |
| 927241 | AC1-220 C OP | 5.44 |
| 927242 | AC1-220 E OP | 3.86 |
| 927272 | AC1-224 E    | 0.77 |
| 927311 | AC1-228 C    | 0.49 |
| 927312 | AC1-228 E    | 0.84 |
| 927321 | AC1-229 C    | 1.72 |
| 927322 | AC1-229 E    | 2.81 |

## **Appendix 2**

(DP&L - DP&L) The MILF\_230-STEELE 230 kV line (from bus 232004 to bus 232000 ckt 1) loads from 178.38% to 183.21% (DC power flow) of its emergency rating (551 MVA) for the tower line contingency outage of 'DBL\_4NC'. This project contributes approximately 26.61 MW to the thermal violation.

CONTINGENCY 'DBL\_4NC'

/\* RED LION-CEDAR CREEK

230;RED LION-CARTANZA 230

OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1

OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931161            | AC2-023 C       | 11.13                    |
| 931162            | AC2-023 E       | 20.99                    |
| 932631            | AC2-185 C       | 10.11                    |
| 932632            | AC2-185 E       | 16.5                     |
| 932641            | AC2-186 C       | 2.49                     |
| 932642            | AC2-186 E       | 4.06                     |
| 932651            | AC2-187 C OP    | 4.57                     |
| 932652            | AC2-187 E OP    | 7.45                     |
| 932661            | AC2-188 C       | 4.98                     |
| 932662            | AC2-188 E       | 8.12                     |
| 932671            | AC2-189 C1 O    | 0.32                     |
| 932673            | AC2-189 C2 O    | 4.43                     |
| 932672            | AC2-189 E O     | 0.6                      |
| 932691            | AC2-191         | 11.84                    |
| 232900            | DEMECSMY        | 5.                       |
| 232616            | GEN FOOD        | 1.83                     |
| 232904            | IR4             | 44.                      |
| 232923            | MR1             | 12.52                    |
| 232924            | MR2             | 12.52                    |
| 232922            | MR3             | 12.27                    |
| 232901            | NORTHST         | 5.41                     |

|        |              |        |
|--------|--------------|--------|
| 297077 | V2-028 E     | 1.28   |
| 904212 | V4-022 E     | 1.52   |
| 901004 | W1-003 E     | 2.22   |
| 901014 | W1-004 E     | 2.22   |
| 901024 | W1-005 E     | 2.22   |
| 901034 | W1-006 E     | 2.22   |
| 901411 | W1-062       | 5.31   |
| 903511 | W3-032A      | 37.18  |
| 907052 | X1-032 E     | 1.89   |
| 907324 | X1-096 E     | 42.95  |
| 910572 | X3-008 E     | 3.32   |
| 910592 | X3-015 E     | 3.8    |
| 913412 | Y1-080 E     | 0.68   |
| 915542 | Y3-058 E     | 4.1    |
| 920582 | Z1-076 C     | 2.63   |
| 920583 | Z1-076 E     | 4.3    |
| 920592 | Z1-077 C     | 1.88   |
| 920593 | Z1-077 E     | 3.07   |
| 917082 | Z2-012 E     | 6.09   |
| 920763 | Z2-076 E     | 1.22   |
| 920773 | Z2-077 E     | 1.22   |
| 921122 | AA1-059 C    | 1.99   |
| 921123 | AA1-059 E    | 0.79   |
| 921142 | AA1-061 C    | 3.72   |
| 921143 | AA1-061 E    | 1.83   |
| 921592 | AA1-140 C    | 4.6    |
| 921593 | AA1-140 E    | 7.51   |
| 921602 | AA1-141 C    | 2.84   |
| 921603 | AA1-141 E    | 4.63   |
| 921872 | AA2-069      | 390.46 |
| 922213 | AA2-129 E    | 9.83   |
| 922222 | AA2-130      | 0.92   |
| 922752 | AB1-056 C OP | 41.89  |
| 922753 | AB1-056 E OP | 119.28 |
| 922762 | AB1-057 C    | 42.54  |
| 922763 | AB1-057 E    | 121.23 |
| 923282 | AB1-137 C    | 2.63   |
| 923283 | AB1-137 E    | 1.13   |
| 923902 | AB2-030 E    | 1.96   |
| 923931 | AB2-033 C    | 3.52   |
| 923932 | AB2-033 E    | 1.39   |
| 924361 | AB2-084 C    | 1.79   |
| 924362 | AB2-084 E    | 2.93   |
| 924681 | AB2-120 C OP | 18.78  |
| 924682 | AB2-120 E OP | 30.64  |

|        |              |       |
|--------|--------------|-------|
| 924781 | AB2-130 C OP | 16.78 |
| 924782 | AB2-130 E OP | 27.37 |
| 924831 | AB2-136 C OP | 7.6   |
| 924832 | AB2-136 E OP | 8.06  |
| 925091 | AB2-166 C    | 0.95  |
| 925092 | AB2-166 E    | 1.66  |
| 925101 | AB2-167 C    | 2.63  |
| 925102 | AB2-167 E    | 4.31  |
| 925151 | AB2-172 C OP | 5.08  |
| 925152 | AB2-172 E OP | 8.29  |
| 925231 | AB2-177 C    | 1.25  |
| 925232 | AB2-177 E    | 2.04  |
| 925261 | AB2-180 C    | 6.18  |
| 925262 | AB2-180 E    | 2.65  |
| 925381 | AC1-009 C    | 3.73  |
| 925382 | AC1-009 E    | 6.09  |
| 925651 | AC1-041 C    | 0.95  |
| 925652 | AC1-041 E    | 1.55  |
| 925731 | AC1-049 C    | 0.91  |
| 925732 | AC1-049 E    | 1.51  |
| 925741 | AC1-050 C    | 0.74  |
| 925742 | AC1-050 E    | 1.21  |
| 925761 | AC1-052 C    | 4.91  |
| 925762 | AC1-052 E    | 1.96  |
| 926131 | AC1-091 C    | 4.99  |
| 926132 | AC1-091 E    | 8.18  |
| 926141 | AC1-092 C    | 4.99  |
| 926142 | AC1-092 E    | 8.18  |
| 926151 | AC1-093 C    | 4.72  |
| 926152 | AC1-093 E    | 7.78  |
| 926161 | AC1-094 C    | 3.99  |
| 926162 | AC1-094 E    | 6.59  |
| 926171 | AC1-095 C    | 4.12  |
| 926172 | AC1-095 E    | 3.13  |
| 926911 | AC1-177      | 1.85  |
| 927031 | AC1-190 C    | 9.6   |
| 927032 | AC1-190 E    | 4.11  |
| 927191 | AC1-213 C    | 1.65  |
| 927192 | AC1-213 E    | 0.85  |
| 927311 | AC1-228 C    | 0.29  |
| 927312 | AC1-228 E    | 0.51  |
| 927321 | AC1-229 C    | 2.39  |
| 927322 | AC1-229 E    | 3.89  |

### **Appendix 3**

(DP&L - DP&L) The MIDLTNTP-MT PLSNT 138 kV line (from bus 232106 to bus 232104 ckt 1) loads from 112.71% to 115.24% (DC power flow) of its emergency rating (348 MVA) for the tower line contingency outage of 'DBL\_4NC'. This project contributes approximately 8.79 MW to the thermal violation.

CONTINGENCY 'DBL\_4NC'

/\* RED LION-CEDAR CREEK

230;RED LION-CARTANZA 230

OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1

OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931161            | AC2-023 C       | 5.32                     |
| 931162            | AC2-023 E       | 10.04                    |
| 932631            | AC2-185 C       | 3.34                     |
| 932632            | AC2-185 E       | 5.45                     |
| 932641            | AC2-186 C       | 0.82                     |
| 932642            | AC2-186 E       | 1.33                     |
| 932651            | AC2-187 C OP    | 1.77                     |
| 932652            | AC2-187 E OP    | 2.88                     |
| 932661            | AC2-188 C       | 1.63                     |
| 932662            | AC2-188 E       | 2.66                     |
| 932671            | AC2-189 C1 O    | 0.14                     |
| 932673            | AC2-189 C2 O    | 1.89                     |
| 932672            | AC2-189 E O     | 0.26                     |
| 932691            | AC2-191         | 3.85                     |
| 232900            | DEMECSMY        | 1.79                     |
| 232851            | DUP-SFR1        | 0.34                     |
| 232902            | EASTMUNI        | 2.84                     |
| 232923            | MR1             | 3.37                     |
| 232924            | MR2             | 3.37                     |
| 232910            | NRG_G1          | 2.03                     |
| 232911            | NRG_G2          | 2.03                     |
| 292089            | T-011           | 0.14                     |
| 297076            | V2-028 C        | 0.08                     |
| 297077            | V2-028 E        | 0.75                     |
| 904212            | V4-022 E        | 0.61                     |
| 232813            | VAUGHN          | 0.13                     |
| 232919            | VN10            | 0.47                     |
| 901004            | W1-003 E        | 0.89                     |
| 901014            | W1-004 E        | 0.89                     |
| 901024            | W1-005 E        | 0.89                     |
| 901034            | W1-006 E        | 0.89                     |
| 901411            | W1-062          | 1.9                      |
| 907052            | X1-032 E        | 0.79                     |

|        |              |        |
|--------|--------------|--------|
| 907324 | X1-096 E     | 18.29  |
| 910571 | X3-008 C     | 0.27   |
| 910572 | X3-008 E     | 2.68   |
| 910591 | X3-015 C     | 0.25   |
| 910592 | X3-015 E     | 2.52   |
| 910821 | X3-066 C     | 0.14   |
| 910822 | X3-066 E     | 1.41   |
| 913361 | Y1-079 C     | 0.2    |
| 913362 | Y1-079 E     | 1.96   |
| 913411 | Y1-080 C     | 0.04   |
| 913412 | Y1-080 E     | 0.43   |
| 915541 | Y3-058 C     | 0.19   |
| 915542 | Y3-058 E     | 1.86   |
| 920582 | Z1-076 C     | 1.05   |
| 920583 | Z1-076 E     | 1.71   |
| 920592 | Z1-077 C     | 0.75   |
| 920593 | Z1-077 E     | 1.22   |
| 917082 | Z2-012 E     | 2.45   |
| 920763 | Z2-076 E     | 0.4    |
| 920773 | Z2-077 E     | 0.4    |
| 920812 | Z2-097 C     | 1.57   |
| 920813 | Z2-097 E     | 0.65   |
| 921122 | AA1-059 C    | 0.85   |
| 921123 | AA1-059 E    | 0.33   |
| 921142 | AA1-061 C    | 2.88   |
| 921143 | AA1-061 E    | 1.42   |
| 921442 | AA1-110 C    | 1.78   |
| 921443 | AA1-110 E    | 0.89   |
| 921592 | AA1-140 C    | 1.52   |
| 921593 | AA1-140 E    | 2.47   |
| 921602 | AA1-141 C    | 1.13   |
| 921603 | AA1-141 E    | 1.84   |
| 921872 | AA2-069      | 104.94 |
| 922213 | AA2-129 E    | 3.94   |
| 922222 | AA2-130      | 0.39   |
| 922752 | AB1-056 C OP | 12.81  |
| 922753 | AB1-056 E OP | 36.48  |
| 922762 | AB1-057 C    | 13.01  |
| 922763 | AB1-057 E    | 37.07  |
| 923282 | AB1-137 C    | 0.84   |
| 923283 | AB1-137 E    | 0.36   |
| 923322 | AB1-141 C OP | 5.3    |
| 923323 | AB1-141 E OP | 2.47   |
| 923332 | AB1-142 C OP | 5.3    |
| 923333 | AB1-142 E OP | 2.47   |



|        |              |       |
|--------|--------------|-------|
| 923452 | AB1-162 C OP | 2.4   |
| 923453 | AB1-162 E OP | 3.92  |
| 923602 | AB1-176 C    | 1.29  |
| 923603 | AB1-176 E    | 2.12  |
| 923902 | AB2-030 E    | 0.79  |
| 923921 | AB2-032 C    | 5.34  |
| 923922 | AB2-032 E    | 2.51  |
| 923931 | AB2-033 C    | 1.41  |
| 923932 | AB2-033 E    | 0.56  |
| 923951 | AB2-036 C    | 11.73 |
| 923952 | AB2-036 E    | 19.19 |
| 923961 | AB2-037 C    | 12.75 |
| 923962 | AB2-037 E    | 20.82 |
| 924191 | AB2-063 C    | 2.87  |
| 924192 | AB2-063 E    | 4.69  |
| 924361 | AB2-084 C    | 0.75  |
| 924362 | AB2-084 E    | 1.22  |
| 924681 | AB2-120 C OP | 7.49  |
| 924682 | AB2-120 E OP | 12.23 |
| 924781 | AB2-130 C OP | 6.58  |
| 924782 | AB2-130 E OP | 10.74 |
| 924801 | AB2-133 C OP | 10.92 |
| 924802 | AB2-133 E OP | 13.86 |
| 924821 | AB2-135 C    | 12.06 |
| 924822 | AB2-135 E    | 13.76 |
| 924831 | AB2-136 C OP | 5.2   |
| 924832 | AB2-136 E OP | 5.51  |
| 924881 | AB2-142 C    | 1.14  |
| 924882 | AB2-142 E    | 1.85  |
| 924971 | AB2-153 C    | 2.98  |
| 924972 | AB2-153 E    | 4.87  |
| 925091 | AB2-166 C    | 0.4   |
| 925092 | AB2-166 E    | 0.7   |
| 925101 | AB2-167 C    | 1.05  |
| 925102 | AB2-167 E    | 1.72  |
| 925151 | AB2-172 C OP | 4.11  |
| 925152 | AB2-172 E OP | 6.71  |
| 925231 | AB2-177 C    | 0.49  |
| 925232 | AB2-177 E    | 0.81  |
| 925251 | AB2-179 C OP | 26.3  |
| 925252 | AB2-179 E OP | 8.67  |
| 925261 | AB2-180 C    | 2.8   |
| 925262 | AB2-180 E    | 1.2   |
| 925271 | AB2-185 C OP | 4.42  |
| 925272 | AB2-185 E OP | 1.9   |

|        |              |      |
|--------|--------------|------|
| 925381 | AC1-009 C    | 1.5  |
| 925382 | AC1-009 E    | 2.45 |
| 925651 | AC1-041 C    | 0.38 |
| 925652 | AC1-041 E    | 0.61 |
| 925731 | AC1-049 C    | 0.3  |
| 925732 | AC1-049 E    | 0.5  |
| 925741 | AC1-050 C    | 0.38 |
| 925742 | AC1-050 E    | 0.62 |
| 925761 | AC1-052 C    | 1.97 |
| 925762 | AC1-052 E    | 0.79 |
| 926131 | AC1-091 C    | 1.65 |
| 926132 | AC1-091 E    | 2.7  |
| 926141 | AC1-092 C    | 1.65 |
| 926142 | AC1-092 E    | 2.7  |
| 926151 | AC1-093 C    | 1.56 |
| 926152 | AC1-093 E    | 2.57 |
| 926161 | AC1-094 C    | 1.32 |
| 926162 | AC1-094 E    | 2.18 |
| 926171 | AC1-095 C    | 1.36 |
| 926172 | AC1-095 E    | 1.03 |
| 926721 | AC1-154 C    | 0.49 |
| 926722 | AC1-154 E    | 0.82 |
| 926911 | AC1-177      | 0.79 |
| 927031 | AC1-190 C    | 7.53 |
| 927032 | AC1-190 E    | 3.23 |
| 927191 | AC1-213 C    | 0.7  |
| 927192 | AC1-213 E    | 0.36 |
| 927241 | AC1-220 C OP | 5.86 |
| 927242 | AC1-220 E OP | 4.16 |
| 927272 | AC1-224 E    | 0.63 |
| 927311 | AC1-228 C    | 0.24 |
| 927312 | AC1-228 E    | 0.41 |
| 927321 | AC1-229 C    | 0.76 |
| 927322 | AC1-229 E    | 1.24 |

## **Appendix 4**

(DP&L - DP&L) The TOWNSEND-MIDLTNTP 138 kV line (from bus 232107 to bus 232106 ckt 1) loads from 123.46% to 125.99% (DC power flow) of its emergency rating (348 MVA) for the tower line contingency outage of 'DBL\_4NC'. This project contributes approximately 8.79 MW to the thermal violation.

CONTINGENCY 'DBL\_4NC'

/\* RED LION-CEDAR CREEK

230;RED LION-CARTANZA 230

OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1

OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1  
END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931161            | AC2-023 C       | 5.32                     |
| 931162            | AC2-023 E       | 10.04                    |
| 932631            | AC2-185 C       | 3.34                     |
| 932632            | AC2-185 E       | 5.45                     |
| 932641            | AC2-186 C       | 0.82                     |
| 932642            | AC2-186 E       | 1.33                     |
| 932651            | AC2-187 C OP    | 1.77                     |
| 932652            | AC2-187 E OP    | 2.88                     |
| 932661            | AC2-188 C       | 1.63                     |
| 932662            | AC2-188 E       | 2.66                     |
| 932671            | AC2-189 C1 O    | 0.14                     |
| 932673            | AC2-189 C2 O    | 1.89                     |
| 932672            | AC2-189 E O     | 0.26                     |
| 932691            | AC2-191         | 3.85                     |
| 232900            | DEMECSMY        | 1.79                     |
| 232851            | DUP-SFR1        | 0.34                     |
| 232902            | EASTMUNI        | 2.84                     |
| 232923            | MR1             | 3.37                     |
| 232924            | MR2             | 3.37                     |
| 232910            | NRG_G1          | 2.03                     |
| 232911            | NRG_G2          | 2.03                     |
| 292089            | T-011           | 0.14                     |
| 297076            | V2-028 C        | 0.08                     |
| 297077            | V2-028 E        | 0.75                     |
| 904212            | V4-022 E        | 0.61                     |
| 232813            | VAUGHN          | 0.13                     |
| 232919            | VN10            | 0.47                     |
| 901004            | W1-003 E        | 0.89                     |
| 901014            | W1-004 E        | 0.89                     |
| 901024            | W1-005 E        | 0.89                     |
| 901034            | W1-006 E        | 0.89                     |
| 901411            | W1-062          | 1.9                      |
| 907052            | X1-032 E        | 0.79                     |
| 907324            | X1-096 E        | 18.29                    |
| 910571            | X3-008 C        | 0.27                     |
| 910572            | X3-008 E        | 2.68                     |
| 910591            | X3-015 C        | 0.25                     |
| 910592            | X3-015 E        | 2.52                     |
| 910821            | X3-066 C        | 0.14                     |
| 910822            | X3-066 E        | 1.41                     |
| 913361            | Y1-079 C        | 0.2                      |
| 913362            | Y1-079 E        | 1.96                     |

|        |              |        |
|--------|--------------|--------|
| 913411 | Y1-080 C     | 0.04   |
| 913412 | Y1-080 E     | 0.43   |
| 915541 | Y3-058 C     | 0.19   |
| 915542 | Y3-058 E     | 1.86   |
| 920582 | Z1-076 C     | 1.05   |
| 920583 | Z1-076 E     | 1.71   |
| 920592 | Z1-077 C     | 0.75   |
| 920593 | Z1-077 E     | 1.22   |
| 917082 | Z2-012 E     | 2.45   |
| 920763 | Z2-076 E     | 0.4    |
| 920773 | Z2-077 E     | 0.4    |
| 920812 | Z2-097 C     | 1.57   |
| 920813 | Z2-097 E     | 0.65   |
| 921122 | AA1-059 C    | 0.85   |
| 921123 | AA1-059 E    | 0.33   |
| 921142 | AA1-061 C    | 2.88   |
| 921143 | AA1-061 E    | 1.42   |
| 921442 | AA1-110 C    | 1.78   |
| 921443 | AA1-110 E    | 0.89   |
| 921592 | AA1-140 C    | 1.52   |
| 921593 | AA1-140 E    | 2.47   |
| 921602 | AA1-141 C    | 1.13   |
| 921603 | AA1-141 E    | 1.84   |
| 921872 | AA2-069      | 104.94 |
| 922213 | AA2-129 E    | 3.94   |
| 922222 | AA2-130      | 0.39   |
| 922752 | AB1-056 C OP | 12.81  |
| 922753 | AB1-056 E OP | 36.48  |
| 922762 | AB1-057 C    | 13.01  |
| 922763 | AB1-057 E    | 37.07  |
| 923282 | AB1-137 C    | 0.84   |
| 923283 | AB1-137 E    | 0.36   |
| 923322 | AB1-141 C OP | 5.3    |
| 923323 | AB1-141 E OP | 2.47   |
| 923332 | AB1-142 C OP | 5.3    |
| 923333 | AB1-142 E OP | 2.47   |
| 923452 | AB1-162 C OP | 2.4    |
| 923453 | AB1-162 E OP | 3.92   |
| 923602 | AB1-176 C    | 1.29   |
| 923603 | AB1-176 E    | 2.12   |
| 923902 | AB2-030 E    | 0.79   |
| 923921 | AB2-032 C    | 5.34   |
| 923922 | AB2-032 E    | 2.51   |
| 923931 | AB2-033 C    | 1.41   |
| 923932 | AB2-033 E    | 0.56   |

|        |              |       |
|--------|--------------|-------|
| 923951 | AB2-036 C    | 11.73 |
| 923952 | AB2-036 E    | 19.19 |
| 923961 | AB2-037 C    | 12.75 |
| 923962 | AB2-037 E    | 20.82 |
| 924191 | AB2-063 C    | 2.87  |
| 924192 | AB2-063 E    | 4.69  |
| 924361 | AB2-084 C    | 0.75  |
| 924362 | AB2-084 E    | 1.22  |
| 924681 | AB2-120 C OP | 7.49  |
| 924682 | AB2-120 E OP | 12.23 |
| 924781 | AB2-130 C OP | 6.58  |
| 924782 | AB2-130 E OP | 10.74 |
| 924801 | AB2-133 C OP | 10.92 |
| 924802 | AB2-133 E OP | 13.86 |
| 924821 | AB2-135 C    | 12.06 |
| 924822 | AB2-135 E    | 13.76 |
| 924831 | AB2-136 C OP | 5.2   |
| 924832 | AB2-136 E OP | 5.51  |
| 924881 | AB2-142 C    | 1.14  |
| 924882 | AB2-142 E    | 1.85  |
| 924971 | AB2-153 C    | 2.98  |
| 924972 | AB2-153 E    | 4.87  |
| 925091 | AB2-166 C    | 0.4   |
| 925092 | AB2-166 E    | 0.7   |
| 925101 | AB2-167 C    | 1.05  |
| 925102 | AB2-167 E    | 1.72  |
| 925151 | AB2-172 C OP | 4.11  |
| 925152 | AB2-172 E OP | 6.71  |
| 925231 | AB2-177 C    | 0.49  |
| 925232 | AB2-177 E    | 0.81  |
| 925251 | AB2-179 C OP | 26.3  |
| 925252 | AB2-179 E OP | 8.67  |
| 925261 | AB2-180 C    | 2.8   |
| 925262 | AB2-180 E    | 1.2   |
| 925271 | AB2-185 C OP | 4.42  |
| 925272 | AB2-185 E OP | 1.9   |
| 925381 | AC1-009 C    | 1.5   |
| 925382 | AC1-009 E    | 2.45  |
| 925651 | AC1-041 C    | 0.38  |
| 925652 | AC1-041 E    | 0.61  |
| 925731 | AC1-049 C    | 0.3   |
| 925732 | AC1-049 E    | 0.5   |
| 925741 | AC1-050 C    | 0.38  |
| 925742 | AC1-050 E    | 0.62  |
| 925761 | AC1-052 C    | 1.97  |

|        |              |      |
|--------|--------------|------|
| 925762 | AC1-052 E    | 0.79 |
| 926131 | AC1-091 C    | 1.65 |
| 926132 | AC1-091 E    | 2.7  |
| 926141 | AC1-092 C    | 1.65 |
| 926142 | AC1-092 E    | 2.7  |
| 926151 | AC1-093 C    | 1.56 |
| 926152 | AC1-093 E    | 2.57 |
| 926161 | AC1-094 C    | 1.32 |
| 926162 | AC1-094 E    | 2.18 |
| 926171 | AC1-095 C    | 1.36 |
| 926172 | AC1-095 E    | 1.03 |
| 926721 | AC1-154 C    | 0.49 |
| 926722 | AC1-154 E    | 0.82 |
| 926911 | AC1-177      | 0.79 |
| 927031 | AC1-190 C    | 7.53 |
| 927032 | AC1-190 E    | 3.23 |
| 927191 | AC1-213 C    | 0.7  |
| 927192 | AC1-213 E    | 0.36 |
| 927241 | AC1-220 C OP | 5.86 |
| 927242 | AC1-220 E OP | 4.16 |
| 927272 | AC1-224 E    | 0.63 |
| 927311 | AC1-228 C    | 0.24 |
| 927312 | AC1-228 E    | 0.41 |
| 927321 | AC1-229 C    | 0.76 |
| 927322 | AC1-229 E    | 1.24 |

## **Appendix 5**

(DP&L - DP&L) The KENT-NMEREDTH 69 kV line (from bus 232215 to bus 232812 ckt 1) loads from 132.13% to 138.48% (DC power flow) of its emergency rating (93 MVA) for the tower line contingency outage of 'DBL\_4NC'. This project contributes approximately 5.91 MW to the thermal violation.

CONTINGENCY 'DBL\_4NC'

/\* RED LION-CEDAR CREEK

230;RED LION-CARTANZA 230

OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1

OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931161            | AC2-023 C       | 1.64                     |
| 931162            | AC2-023 E       | 3.09                     |
| 932631            | AC2-185 C       | 2.24                     |
| 932632            | AC2-185 E       | 3.66                     |
| 932641            | AC2-186 C       | 0.49                     |
| 932642            | AC2-186 E       | 0.8                      |

|        |              |       |
|--------|--------------|-------|
| 932651 | AC2-187 C OP | 1.42  |
| 932652 | AC2-187 E OP | 2.31  |
| 932661 | AC2-188 C    | 0.99  |
| 932662 | AC2-188 E    | 1.61  |
| 932671 | AC2-189 C1 O | 0.04  |
| 932673 | AC2-189 C2 O | 0.62  |
| 932672 | AC2-189 E O  | 0.08  |
| 932691 | AC2-191      | 1.52  |
| 232900 | DEMECSMY     | 1.37  |
| 232851 | DUP-SFR1     | 0.17  |
| 232923 | MR1          | 1.32  |
| 232924 | MR2          | 1.32  |
| 232910 | NRG_G1       | 2.52  |
| 232911 | NRG_G2       | 2.52  |
| 297077 | V2-028 E     | 0.2   |
| 904212 | V4-022 E     | 0.21  |
| 232813 | VAUGHN       | 0.14  |
| 901004 | W1-003 E     | 0.3   |
| 901014 | W1-004 E     | 0.3   |
| 901024 | W1-005 E     | 0.3   |
| 901034 | W1-006 E     | 0.3   |
| 901411 | W1-062       | 1.46  |
| 907052 | X1-032 E     | 0.26  |
| 907324 | X1-096 E     | 5.96  |
| 913412 | Y1-080 E     | 0.11  |
| 915542 | Y3-058 E     | 0.6   |
| 920582 | Z1-076 C     | 0.36  |
| 920583 | Z1-076 E     | 0.58  |
| 920592 | Z1-077 C     | 0.25  |
| 920593 | Z1-077 E     | 0.41  |
| 917082 | Z2-012 E     | 0.82  |
| 920763 | Z2-076 E     | 0.15  |
| 920773 | Z2-077 E     | 0.15  |
| 921122 | AA1-059 C    | 0.28  |
| 921123 | AA1-059 E    | 0.11  |
| 921592 | AA1-140 C    | 0.58  |
| 921593 | AA1-140 E    | 0.95  |
| 921602 | AA1-141 C    | 0.38  |
| 921603 | AA1-141 E    | 0.62  |
| 921872 | AA2-069      | 41.16 |
| 922213 | AA2-129 E    | 1.33  |
| 922222 | AA2-130      | 0.13  |
| 922752 | AB1-056 C OP | 4.98  |
| 922753 | AB1-056 E OP | 14.19 |
| 922762 | AB1-057 C    | 5.06  |

|        |              |       |
|--------|--------------|-------|
| 922763 | AB1-057 E    | 14.42 |
| 923282 | AB1-137 C    | 0.33  |
| 923283 | AB1-137 E    | 0.14  |
| 923902 | AB2-030 E    | 0.27  |
| 923931 | AB2-033 C    | 0.47  |
| 923932 | AB2-033 E    | 0.19  |
| 924361 | AB2-084 C    | 0.25  |
| 924362 | AB2-084 E    | 0.4   |
| 924681 | AB2-120 C OP | 2.53  |
| 924682 | AB2-120 E OP | 4.12  |
| 924781 | AB2-130 C OP | 2.66  |
| 924782 | AB2-130 E OP | 4.34  |
| 925091 | AB2-166 C    | 0.14  |
| 925092 | AB2-166 E    | 0.24  |
| 925101 | AB2-167 C    | 0.35  |
| 925102 | AB2-167 E    | 0.58  |
| 925231 | AB2-177 C    | 0.17  |
| 925232 | AB2-177 E    | 0.28  |
| 925261 | AB2-180 C    | 0.9   |
| 925262 | AB2-180 E    | 0.38  |
| 925381 | AC1-009 C    | 0.5   |
| 925382 | AC1-009 E    | 0.82  |
| 925651 | AC1-041 C    | 0.13  |
| 925652 | AC1-041 E    | 0.21  |
| 925731 | AC1-049 C    | 0.12  |
| 925732 | AC1-049 E    | 0.19  |
| 925741 | AC1-050 C    | 0.11  |
| 925742 | AC1-050 E    | 0.18  |
| 925761 | AC1-052 C    | 0.66  |
| 925762 | AC1-052 E    | 0.27  |
| 926131 | AC1-091 C    | 1.11  |
| 926132 | AC1-091 E    | 1.82  |
| 926141 | AC1-092 C    | 1.11  |
| 926142 | AC1-092 E    | 1.82  |
| 926151 | AC1-093 C    | 1.05  |
| 926152 | AC1-093 E    | 1.73  |
| 926161 | AC1-094 C    | 0.89  |
| 926162 | AC1-094 E    | 1.46  |
| 926171 | AC1-095 C    | 0.92  |
| 926172 | AC1-095 E    | 0.69  |
| 926911 | AC1-177      | 0.26  |
| 927191 | AC1-213 C    | 0.23  |
| 927192 | AC1-213 E    | 0.12  |
| 927321 | AC1-229 C    | 0.3   |
| 927322 | AC1-229 E    | 0.49  |



## **Appendix 6**

(DP&L - DP&L) The NMEREDTH-AB2-135 TAP 69 kV line (from bus 232812 to bus 924820 ckt 1) loads from 106.97% to 113.32% (DC power flow) of its emergency rating (93 MVA) for the tower line contingency outage of 'DBL\_4NC'. This project contributes approximately 5.91 MW to the thermal violation.

CONTINGENCY 'DBL\_4NC'

/\* RED LION-CEDAR CREEK

230;RED LION-CARTANZA 230

OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1

OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931161            | AC2-023 C       | 1.64                     |
| 931162            | AC2-023 E       | 3.09                     |
| 932631            | AC2-185 C       | 2.24                     |
| 932632            | AC2-185 E       | 3.66                     |
| 932641            | AC2-186 C       | 0.49                     |
| 932642            | AC2-186 E       | 0.8                      |
| 932651            | AC2-187 C OP    | 1.42                     |
| 932652            | AC2-187 E OP    | 2.31                     |
| 932661            | AC2-188 C       | 0.99                     |
| 932662            | AC2-188 E       | 1.61                     |
| 932671            | AC2-189 C1 O    | 0.04                     |
| 932673            | AC2-189 C2 O    | 0.62                     |
| 932672            | AC2-189 E O     | 0.08                     |
| 932691            | AC2-191         | 1.52                     |
| 232900            | DEMECSMY        | 1.37                     |
| 232851            | DUP-SFR1        | 0.17                     |
| 232923            | MR1             | 1.32                     |
| 232924            | MR2             | 1.32                     |
| 232910            | NRG_G1          | 2.52                     |
| 232911            | NRG_G2          | 2.52                     |
| 297077            | V2-028 E        | 0.2                      |
| 904212            | V4-022 E        | 0.21                     |
| 232813            | VAUGHN          | 0.14                     |
| 901004            | W1-003 E        | 0.3                      |
| 901014            | W1-004 E        | 0.3                      |
| 901024            | W1-005 E        | 0.3                      |
| 901034            | W1-006 E        | 0.3                      |
| 901411            | W1-062          | 1.46                     |
| 907052            | X1-032 E        | 0.26                     |
| 907324            | X1-096 E        | 5.96                     |
| 913412            | Y1-080 E        | 0.11                     |

|        |              |       |
|--------|--------------|-------|
| 915542 | Y3-058 E     | 0.6   |
| 920582 | Z1-076 C     | 0.36  |
| 920583 | Z1-076 E     | 0.58  |
| 920592 | Z1-077 C     | 0.25  |
| 920593 | Z1-077 E     | 0.41  |
| 917082 | Z2-012 E     | 0.82  |
| 920763 | Z2-076 E     | 0.15  |
| 920773 | Z2-077 E     | 0.15  |
| 921122 | AA1-059 C    | 0.28  |
| 921123 | AA1-059 E    | 0.11  |
| 921592 | AA1-140 C    | 0.58  |
| 921593 | AA1-140 E    | 0.95  |
| 921602 | AA1-141 C    | 0.38  |
| 921603 | AA1-141 E    | 0.62  |
| 921872 | AA2-069      | 41.16 |
| 922213 | AA2-129 E    | 1.33  |
| 922222 | AA2-130      | 0.13  |
| 922752 | AB1-056 C OP | 4.98  |
| 922753 | AB1-056 E OP | 14.19 |
| 922762 | AB1-057 C    | 5.06  |
| 922763 | AB1-057 E    | 14.42 |
| 923282 | AB1-137 C    | 0.33  |
| 923283 | AB1-137 E    | 0.14  |
| 923902 | AB2-030 E    | 0.27  |
| 923931 | AB2-033 C    | 0.47  |
| 923932 | AB2-033 E    | 0.19  |
| 924361 | AB2-084 C    | 0.25  |
| 924362 | AB2-084 E    | 0.4   |
| 924681 | AB2-120 C OP | 2.53  |
| 924682 | AB2-120 E OP | 4.12  |
| 924781 | AB2-130 C OP | 2.66  |
| 924782 | AB2-130 E OP | 4.34  |
| 925091 | AB2-166 C    | 0.14  |
| 925092 | AB2-166 E    | 0.24  |
| 925101 | AB2-167 C    | 0.35  |
| 925102 | AB2-167 E    | 0.58  |
| 925231 | AB2-177 C    | 0.17  |
| 925232 | AB2-177 E    | 0.28  |
| 925261 | AB2-180 C    | 0.9   |
| 925262 | AB2-180 E    | 0.38  |
| 925381 | AC1-009 C    | 0.5   |
| 925382 | AC1-009 E    | 0.82  |
| 925651 | AC1-041 C    | 0.13  |
| 925652 | AC1-041 E    | 0.21  |
| 925731 | AC1-049 C    | 0.12  |

|        |           |      |
|--------|-----------|------|
| 925732 | AC1-049 E | 0.19 |
| 925741 | AC1-050 C | 0.11 |
| 925742 | AC1-050 E | 0.18 |
| 925761 | AC1-052 C | 0.66 |
| 925762 | AC1-052 E | 0.27 |
| 926131 | AC1-091 C | 1.11 |
| 926132 | AC1-091 E | 1.82 |
| 926141 | AC1-092 C | 1.11 |
| 926142 | AC1-092 E | 1.82 |
| 926151 | AC1-093 C | 1.05 |
| 926152 | AC1-093 E | 1.73 |
| 926161 | AC1-094 C | 0.89 |
| 926162 | AC1-094 E | 1.46 |
| 926171 | AC1-095 C | 0.92 |
| 926172 | AC1-095 E | 0.69 |
| 926911 | AC1-177   | 0.26 |
| 927191 | AC1-213 C | 0.23 |
| 927192 | AC1-213 E | 0.12 |
| 927321 | AC1-229 C | 0.3  |
| 927322 | AC1-229 E | 0.49 |

## Appendix 7

(DP&L - DP&L) The AB2-135 TAP-CHURC\_69 69 kV line (from bus 924820 to bus 232203 ckt 1) loads from 157.66% to 164.01% (DC power flow) of its emergency rating (93 MVA) for the tower line contingency outage of 'DBL\_4NC'. This project contributes approximately 5.91 MW to the thermal violation.

CONTINGENCY 'DBL\_4NC'

/\* RED LION-CEDAR CREEK

230;RED LION-CARTANZA 230

OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1

OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1

END

| <i>Bus Number</i> | <i>Bus Name</i> | <i>Full Contribution</i> |
|-------------------|-----------------|--------------------------|
| 931161            | AC2-023 C       | 1.64                     |
| 931162            | AC2-023 E       | 3.09                     |
| 932631            | AC2-185 C       | 2.24                     |
| 932632            | AC2-185 E       | 3.66                     |
| 932641            | AC2-186 C       | 0.49                     |
| 932642            | AC2-186 E       | 0.8                      |
| 932651            | AC2-187 C OP    | 1.42                     |
| 932652            | AC2-187 E OP    | 2.31                     |
| 932661            | AC2-188 C       | 0.99                     |
| 932662            | AC2-188 E       | 1.61                     |
| 932671            | AC2-189 C1 O    | 0.04                     |
| 932673            | AC2-189 C2 O    | 0.62                     |
| 932672            | AC2-189 E O     | 0.08                     |
| 932691            | AC2-191         | 1.52                     |
| 232900            | DEMECSMY        | 1.37                     |
| 232851            | DUP-SFR1        | 0.17                     |
| 232923            | MR1             | 1.32                     |
| 232924            | MR2             | 1.32                     |
| 232910            | NRG_G1          | 2.52                     |
| 232911            | NRG_G2          | 2.52                     |
| 904212            | V4-022 E        | 0.21                     |
| 232813            | VAUGHN          | 0.14                     |
| 901004            | W1-003 E        | 0.3                      |
| 901014            | W1-004 E        | 0.3                      |
| 901024            | W1-005 E        | 0.3                      |
| 901034            | W1-006 E        | 0.3                      |
| 901411            | W1-062          | 1.46                     |
| 907052            | X1-032 E        | 0.26                     |
| 907324            | X1-096 E        | 5.96                     |
| 915542            | Y3-058 E        | 0.6                      |
| 920582            | Z1-076 C        | 0.36                     |
| 920583            | Z1-076 E        | 0.58                     |

|        |              |       |
|--------|--------------|-------|
| 920592 | Z1-077 C     | 0.25  |
| 920593 | Z1-077 E     | 0.41  |
| 917082 | Z2-012 E     | 0.82  |
| 920763 | Z2-076 E     | 0.15  |
| 920773 | Z2-077 E     | 0.15  |
| 921122 | AA1-059 C    | 0.28  |
| 921123 | AA1-059 E    | 0.11  |
| 921592 | AA1-140 C    | 0.58  |
| 921593 | AA1-140 E    | 0.95  |
| 921602 | AA1-141 C    | 0.38  |
| 921603 | AA1-141 E    | 0.62  |
| 921872 | AA2-069      | 41.16 |
| 922213 | AA2-129 E    | 1.33  |
| 922222 | AA2-130      | 0.13  |
| 922752 | AB1-056 C OP | 4.98  |
| 922753 | AB1-056 E OP | 14.19 |
| 922762 | AB1-057 C    | 5.06  |
| 922763 | AB1-057 E    | 14.42 |
| 923282 | AB1-137 C    | 0.33  |
| 923283 | AB1-137 E    | 0.14  |
| 923902 | AB2-030 E    | 0.27  |
| 923931 | AB2-033 C    | 0.47  |
| 923932 | AB2-033 E    | 0.19  |
| 924361 | AB2-084 C    | 0.25  |
| 924362 | AB2-084 E    | 0.4   |
| 924681 | AB2-120 C OP | 2.53  |
| 924682 | AB2-120 E OP | 4.12  |
| 924781 | AB2-130 C OP | 2.66  |
| 924782 | AB2-130 E OP | 4.34  |
| 924821 | AB2-135 C    | 22.27 |
| 924822 | AB2-135 E    | 25.39 |
| 925091 | AB2-166 C    | 0.14  |
| 925092 | AB2-166 E    | 0.24  |
| 925101 | AB2-167 C    | 0.35  |
| 925102 | AB2-167 E    | 0.58  |
| 925231 | AB2-177 C    | 0.17  |
| 925232 | AB2-177 E    | 0.28  |
| 925261 | AB2-180 C    | 0.9   |
| 925262 | AB2-180 E    | 0.38  |
| 925381 | AC1-009 C    | 0.5   |
| 925382 | AC1-009 E    | 0.82  |
| 925651 | AC1-041 C    | 0.13  |
| 925652 | AC1-041 E    | 0.21  |
| 925731 | AC1-049 C    | 0.12  |
| 925732 | AC1-049 E    | 0.19  |

|        |           |      |
|--------|-----------|------|
| 925761 | AC1-052 C | 0.66 |
| 925762 | AC1-052 E | 0.27 |
| 926131 | AC1-091 C | 1.11 |
| 926132 | AC1-091 E | 1.82 |
| 926141 | AC1-092 C | 1.11 |
| 926142 | AC1-092 E | 1.82 |
| 926151 | AC1-093 C | 1.05 |
| 926152 | AC1-093 E | 1.73 |
| 926161 | AC1-094 C | 0.89 |
| 926162 | AC1-094 E | 1.46 |
| 926171 | AC1-095 C | 0.92 |
| 926172 | AC1-095 E | 0.69 |
| 926911 | AC1-177   | 0.26 |
| 927191 | AC1-213 C | 0.23 |
| 927192 | AC1-213 E | 0.12 |
| 927321 | AC1-229 C | 0.3  |
| 927322 | AC1-229 E | 0.49 |