



**DPA-2023-JANUARY-1715**  
**DPA-2023-JANUARY-1716**  
Delivery Point Network Study

Published on 5/30/2024

By SPP Engineering, Transmission Services

# REVISION HISTORY

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| DATE OR<br>VERSION NUMBER | AUTHOR | CHANGE<br>DESCRIPTION | COMMENTS |
|---------------------------|--------|-----------------------|----------|
| 5/30/2024                 | SPP    | Original              |          |
|                           |        |                       |          |
|                           |        |                       |          |

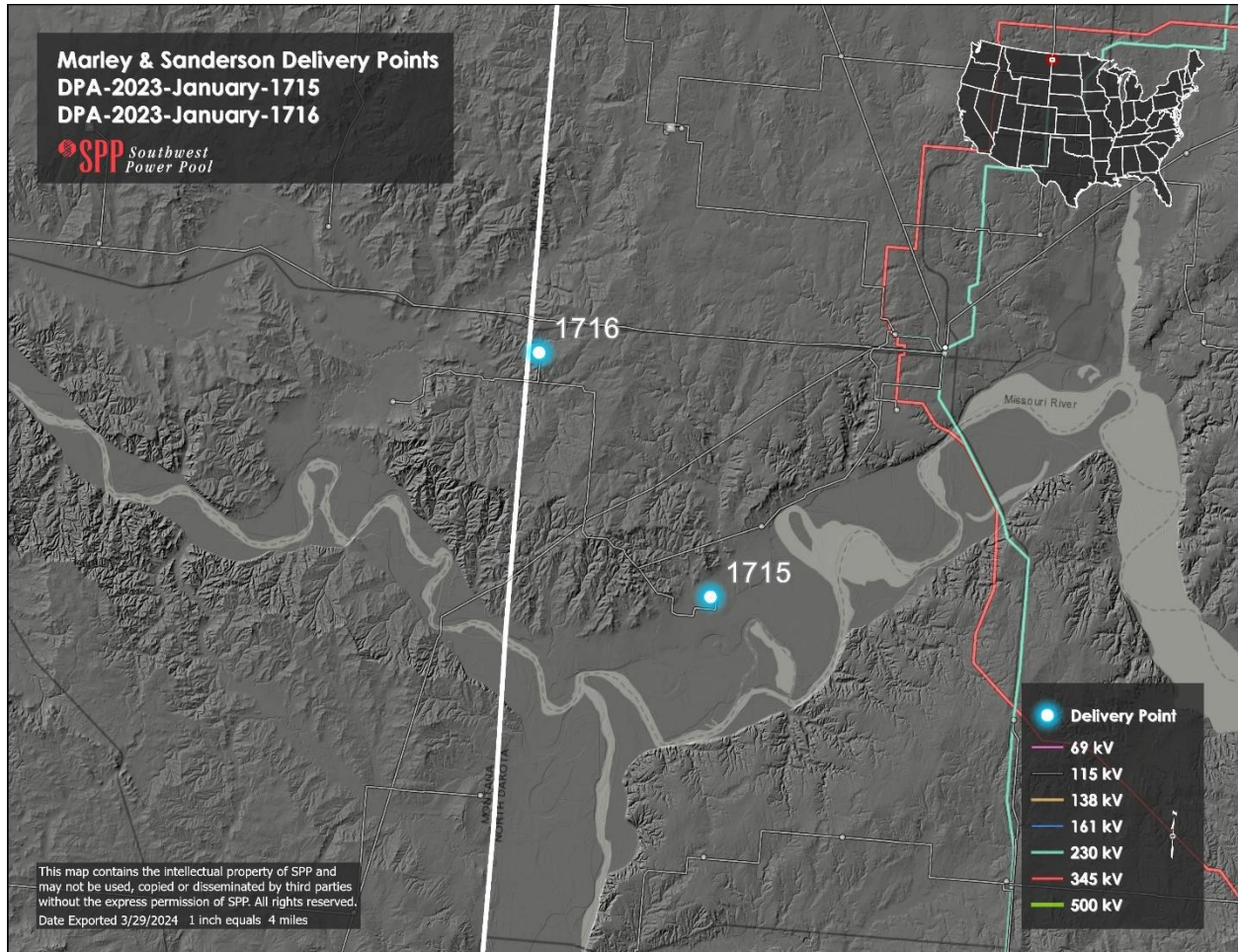
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## SECTION 1: INTRODUCTION

This report outlines the results of an evaluation of regional transmission impacts from delivery point requests DPA-2023-January-1715 Marley and DPA-2023-January-1716 Sanderson. The requesting entity plans to add new loads to the existing delivery points called Marley and Sanderson. The Marley and Sanderson delivery points are in the Basin Electric Power Cooperative (BEPC) transmission system.



The load flow models used for the evaluation were 2023 ITP models. SPP performed an AC contingency analysis on these models using PSS@E.

## SECTION 2: STUDY METHODOLOGY

### OBJECTIVE

The purpose of this study was to determine the regional transmission system impacts within the SPP footprint due to the new loads served by BEPC. SPP performed a Delivery Point Network Study (DPNS) with the configurations shown in Table 2-1 below.

### STUDY PROCESS

- Model Assumptions
  - 2023 ITP models
    - Model years 2024, 2027, and 2032
    - Summer Peak (2027S and 2032S), Winter Peak (2024W, 2027W, and 2032W), and Light Load (2027L and 2032L)
    - DPA-2021-June-1322 Load and upgrades
    - New generation from the 2023-AG2 Aggregate Study
  - 2023 ITP Short Circuit model set
    - 2027 Summer Max Fault
  - 2024 TPL Dynamic model set
    - 2025 and 2033 Summer Peak Base and Change Cases

| Case Name                   | Study Year | Season      | Scenario         | Load (MW/MVAR)                            |
|-----------------------------|------------|-------------|------------------|---|
| 2023ITPPF-24W.sav           | 2024       | Winter Peak | Base Reliability | Base Case                                 |
| 2023ITPPF-27L.sav           | 2027       | Light Load  | Base Reliability | Base Case                                 |
| 2023ITPPF-27S.sav           | 2027       | Summer Peak | Base Reliability | Base Case                                 |
| 2023ITPPF-27W.sav           | 2027       | Winter Peak | Base Reliability | Base Case                                 |
| 2023ITPPF-32L.sav           | 2032       | Light Load  | Base Reliability | Base Case                                 |
| 2023ITPPF-32S.sav           | 2032       | Summer Peak | Base Reliability | Base Case                                 |
| 2023ITPPF-32W.sav           | 2032       | Winter Peak | Base Reliability | Base Case                                 |
| 2023ITPPF-24W_1715.sav      | 2024       | Winter Peak | Base Reliability | MARLEY: 37.0/12.16                        |
| 2023ITPPF-27L_1715_1716.sav | 2027       | Light Load  | Base Reliability | MARLEY: 86.0/28.27<br>SANDERSON: 40.0/8.1 |
| 2023ITPPF-27S_1715_1716.sav | 2027       | Summer Peak | Base Reliability | MARLEY: 86.0/28.27<br>SANDERSON: 40.0/8.1 |
| 2023ITPPF-27W_1715_1716.sav | 2027       | Winter Peak | Base Reliability | MARLEY: 86.0/28.27<br>SANDERSON: 40.0/8.1 |
| 2023ITPPF-32L_1715_1716.sav | 2032       | Light Load  | Base Reliability | MARLEY: 290.0/95.3<br>SANDERSON: 40.0/8.1 |
| 2023ITPPF-32S_1715_1716.sav | 2032       | Summer Peak | Base Reliability | MARLEY: 290.0/95.3<br>SANDERSON: 40.0/8.1 |
| 2023ITPPF-32W_1715_1716.sav | 2032       | Winter Peak | Base Reliability | MARLEY: 290.0/95.3<br>SANDERSON: 40.0/8.1 |

**Table 2-1: Study Cases**

- Steady State Analysis
  - Assumptions (consistent with the ITP analysis)
    - AC contingency analysis on all load flow models using PSS@E
    - Monitored Elements
      - SPP facilities 69 kV and above
      - First-tier companies 100 kV and above
    - Contingencies (consistent with the ITP analysis)
      - Provided for the ITP by SPP members and first-tier companies
    - Apply SPP Criteria and NERC reliability standards
  - Compare thermal overloads and voltage violations that occur with and without the Marley and Sanderson delivery point changes to determine thermal overloads and voltage violations resulting from the load addition to the transmission system.
- Dynamics Analysis
  - Assumptions
    - 2024 TPL Dynamics Model Set
      - 2025 and 2033 Summer Peak Base Case and Change Case
  - Analyses
    - Fast Fault Screening using POM Studio
- Short Circuit Analysis
  - Assumptions
    - Used 2023 Final ITP Short Circuit models (Max Fault)
      - Placed all available facilities in service
        - Generation
        - Transmission lines
        - Transformers
        - Buses
      - Short Circuit Output
        - Physical
      - Short Circuit Coordinates
        - Polar
      - Short Circuit Parameters
        - 3 Phase
      - FLAT – classical fault analysis conditions
  - Analyses
    - Three-phase fault

## SECTION 3: RESULTS OF ANALYSIS

### POTENTIAL THERMAL OVERLOADS AND VOLTAGE VIOLATIONS

The analysis identified potential thermal overloads and voltage violations resulting from the new Marley and Sanderson load additions. Table 3-1 details the potential thermal violations and Table 3-2 details the potential voltage violations resulting from the load addition.

| Year | Season | Facility Name                   | Contingency Name | Rate A, Rate B (MVA) | Max Flow (MVA) | Change Case Max Loading (%) |
|------|--------|---------------------------------|------------------|----------------------|----------------|-----------------------------|
| 2024 | Winter | WILISTN7 - REN -LY7 - 1         | BASE CASE        | 120/120              | 176.76         | 147.3                       |
| 2027 | Light  | MARLEY -LY7 - REN -LY7 - 1      | BASE CASE        | 120/120              | 205.32         | 171.1                       |
| 2027 | Light  | WILISTN7 - REN -LY7 - 1         | BASE CASE        | 120/120              | 320.04         | 266.7                       |
| 2027 | Summer | MARLEY -LY7 - REN -LY7 - 1      | BASE CASE        | 120/120              | 199.92         | 166.6                       |
| 2027 | Summer | WILISTN7 - REN -LY7 - 1         | BASE CASE        | 120/120              | 305.52         | 254.6                       |
| 2027 | Summer | MARLEY -LY7 - REN -LY7 - 1      | BASE CASE        | 120/120              | 199.92         | 166.6                       |
| 2027 | Winter | MARLEY -LY7 - REN -LY7 - 1      | BASE CASE        | 120/120              | 244.92         | 204.1                       |
| 2027 | Winter | WILISTN7 - REN -LY7 - 1         | BASE CASE        | 120/120              | 365.4          | 304.5                       |
| 2027 | Winter | MARLEY -LY7 - REN -LY7 - 1      | BASE CASE        | 120/120              | 244.92         | 204.1                       |
| 2032 | Light  | EASTFORK-BE3 - 652: E3T8210 - 1 | BASE CASE        | 333/398              | 338.328        | 101.6                       |
| 2032 | Light  | WILISTN4 - 652: W3T8186 - 1     | BASE CASE        | 200/250              | 210.2          | 105.1                       |
| 2032 | Light  | WILISTN4 - 652: W3T8185 - 1     | BASE CASE        | 200/250              | 211.6          | 105.8                       |
| 2032 | Light  | MARLEY -LY7 - REN -LY7 - 1      | BASE CASE        | 120/120              | 346.32         | 288.6                       |
| 2032 | Light  | JUDSON_-BE4 - JUDSON KU3A - 1   | BASE CASE        | 600/717              | 632.4          | 105.4                       |
| 2032 | Light  | JUDSON_-BE3 - JUDSON KU3A - 1   | BASE CASE        | 600/717              | 654            | 109                         |
| 2032 | Light  | WILLISTON27 - WILISTN7 - Z1     | BASE CASE        | 201/201              | 388.533        | 193.3                       |
| 2032 | Light  | WILISTN7 - REN -LY7 - 1         | BASE CASE        | 120/120              | 669.72         | 558.1                       |
| 2032 | Light  | MARLEY -LY7 - REN -LY7 - 1      | BASE CASE        | 120/120              | 346.32         | 288.6                       |
| 2032 | Summer | MARLEY -LY7 - REN -LY7 - 1      | BASE CASE        | 120/120              | 377.88         | 314.9                       |
| 2032 | Summer | JUDSON_-BE4 - JUDSON KU3A - 1   | BASE CASE        | 600/717              | 612            | 102                         |
| 2032 | Summer | JUDSON_-BE3 - JUDSON KU3A - 1   | BASE CASE        | 600/717              | 629.4          | 104.9                       |
| 2032 | Summer | WILLISTON27 - WILISTN7 - Z1     | BASE CASE        | 201/201              | 362.604        | 180.4                       |
| 2032 | Summer | WILISTN7 - REN -LY7 - 1         | BASE CASE        | 120/120              | 705            | 587.5                       |
| 2032 | Summer | MARLEY -LY7 - REN -LY7 - 1      | BASE CASE        | 120/120              | 377.88         | 314.9                       |
| 2032 | Winter | WILLISTON27 - WILISTN7 - Z1     | BASE CASE        | 274/274              | 351.816        | 128.4                       |
| 2032 | Winter | JUDSON_-BE4 - JUDSON KU3A - 1   | BASE CASE        | 600/717              | 626.4          | 104.4                       |
| 2032 | Winter | MARLEY -LY7 - REN -LY7 - 1      | BASE CASE        | 120/120              | 373.08         | 310.9                       |
| 2032 | Winter | JUDSON_-BE3 - JUDSON KU3A - 1   | BASE CASE        | 600/717              | 644.4          | 107.4                       |
| 2032 | Winter | WILISTN7 - REN -LY7 - 1         | BASE CASE        | 120/120              | 704.52         | 587.1                       |

Table 3-1: Potential Thermal Violations

| Year | Season | Facility Name | Facility Voltage (kV) | Contingency Name | Voltage Maximum (pu) | Voltage Minimum (pu) | Bus Voltage (pu) |
|------|--------|---------------|-----------------------|------------------|----------------------|----------------------|------------------|
| 2024 | Winter | NE.WLSTN-MW7  | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.94996          |
| 2024 | Winter | MARLEY -LY7   | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.92191          |
| 2024 | Winter | ROMO -LY7     | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.9042           |
| 2024 | Winter | STIMPY -LY7   | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.92178          |
| 2024 | Winter | REN -LY7      | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.92729          |
| 2024 | Winter | SANDRSON-LY7  | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.90452          |
| 2027 | Light  | MARLEY -LY7   | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.85416          |
| 2027 | Light  | SANDRSON-LY7  | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.82153          |
| 2027 | Light  | STIMPY -LY7   | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.85394          |
| 2027 | Light  | REN -LY7      | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.86483          |
| 2027 | Light  | ROMO -LY7     | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.8213           |
| 2027 | Summer | SANDRSON-LY7  | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.85418          |
| 2027 | Summer | REN -LY7      | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.89499          |
| 2027 | Summer | STIMPY -LY7   | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.88718          |
| 2027 | Summer | MARLEY -LY7   | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.8874           |
| 2027 | Summer | ROMO -LY7     | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.85347          |
| 2027 | Winter | SANDRSON-LY7  | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.81977          |
| 2027 | Winter | REN -LY7      | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.86508          |
| 2027 | Winter | ROMO -LY7     | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.81939          |
| 2027 | Winter | STIMPY -LY7   | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.85448          |
| 2027 | Winter | MARLEY -LY7   | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.85471          |
| 2032 | Light  | ALKABO -SH7   | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.91725          |
| 2032 | Light  | BARRBUTE-MW7  | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.91182          |
| 2032 | Light  | BLKTLTAP-MW7  | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.93754          |
| 2032 | Light  | CULB_GEN-BE7  | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.89374          |
| 2032 | Light  | CULBRTSN-UM7  | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.90047          |
| 2032 | Light  | CULBSN.E-BE7  | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.89219          |
| 2032 | Light  | E.SIDNEY-LY7  | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.94225          |
| 2032 | Light  | ROMO -LY7     | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.43844          |
| 2032 | Light  | EASTFORK-MW7  | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.93821          |
| 2032 | Light  | ELLISVIL-MW7  | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.94342          |
| 2032 | Light  | EPPING -MW7   | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.94649          |
| 2032 | Light  | FOLVAG -MW7   | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.93048          |
| 2032 | Light  | REN -LY7      | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.51916          |
| 2032 | Light  | FORTUNA -SH7  | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.91702          |
| 2032 | Light  | GRENORA -UM7  | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.91424          |
| 2032 | Light  | HELMUT -LY7   | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.93691          |
| 2032 | Light  | JUDSON -MW7   | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.84684          |
| 2032 | Light  | KOCH_OIL-BE7  | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.94722          |
| 2032 | Light  | STIMPY -LY7   | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.4876           |
| 2032 | Light  | MARMON -MW7   | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.9492           |
| 2032 | Light  | MONT -MW7     | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.88245          |
| 2032 | Light  | N.MISRDRG-MW7 | 115                   | BASE CASE        | 1.05                 | 0.95                 | 0.91049          |



| Year | Season | Facility Name | Facility Voltage (kV) | Contingency Name            | Voltage Maximum (pu) | Voltage Minimum (pu) | Bus Voltage (pu) |
|------|--------|---------------|-----------------------|-----------------------------|----------------------|----------------------|------------------|
| 2032 | Light  | N.TWELVE-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.9262           |
| 2032 | Light  | N.WILSTN-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.90277          |
| 2032 | Light  | N.WLST_T-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.90153          |
| 2032 | Light  | NE.WLSTN-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.91072          |
| 2032 | Light  | NOHLEY -LY7   | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.91073          |
| 2032 | Light  | MARLEY -LY7   | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.48795          |
| 2032 | Light  | SANDRSON-LY7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.4388           |
| 2032 | Light  | NW.WLSTN-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.88521          |
| 2032 | Light  | OWAN -MW4     | 230                   | BASE CASE                   | 1.05                 | 0.95                 | 0.94575          |
| 2032 | Light  | PIONEER1-BE7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.87948          |
| 2032 | Light  | PIONEER2-BE7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.87998          |
| 2032 | Light  | REDBANK -SH7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.89154          |
| 2032 | Light  | RICHLAND-BE7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.93693          |
| 2032 | Light  | SE.WLSTN-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.9142           |
| 2032 | Light  | SLETTE -MW7   | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.92075          |
| 2032 | Light  | SNAKEBTT-SH7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.89175          |
| 2032 | Light  | SPRINGLK-LY7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.91431          |
| 2032 | Light  | STATELIN-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.87948          |
| 2032 | Light  | STRNDAHL-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.89685          |
| 2032 | Light  | SW.WLSTN-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.84652          |
| 2032 | Light  | TWELVE_M-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.92209          |
| 2032 | Light  | TYRONE -MW7   | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.93707          |
| 2032 | Light  | WILISTN4      | 230                   | BASE CASE                   | 1.05                 | 0.95                 | 0.94014          |
| 2032 | Light  | WILISTN7      | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.84232          |
| 2032 | Light  | WILLISTON27   | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.84329          |
| 2032 | Light  | ZAHL -MW7     | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.93806          |
| 2032 | Light  | CHRRYCRK-MK7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.89784          |
| 2032 | Light  | CRESTWD_-MK7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.89167          |
| 2032 | Light  | DPLWC_-MK7    | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.89752          |
| 2032 | Light  | DPLWCTAP-MK7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.89756          |
| 2032 | Light  | FARMVALE-MW7  | 115                   | TIOGA.N_-W.BANK_T-MW7       | 1.05                 | 0.90                 | 0.89973          |
| 2032 | Light  | FARMVALE-MW7  | 115                   | W.BANK_T - HESSRTAP         | 1.05                 | 0.90                 | 0.89956          |
| 2032 | Light  | GARDN-FB-MK7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.8861           |
| 2032 | Light  | GOLIATH -MW7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.8893           |
| 2032 | Light  | GOLIATH -MW7  | 115                   | EASTFORK-MW7-EASTFORK-BE3   | 1.05                 | 0.90                 | 0.88291          |
| 2032 | Light  | GRDNCRK2-MK7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.8869           |
| 2032 | Light  | HEADRESS-CM7  | 115                   | WOLFPT 7 - HEADRESS-CM7 - 1 | 1.05                 | 0.90                 | 0.84165          |
| 2032 | Light  | HESSRAIL-MW7  | 115                   | W.BANK_T - HESSRTAP         | 1.05                 | 0.90                 | 0.89132          |
| 2032 | Light  | HESSRAIL-MW7  | 115                   | TIOGA.N - W.BANK_T          | 1.05                 | 0.90                 | 0.89155          |
| 2032 | Light  | HESSRTAP-MW7  | 115                   | W.BANK_T - HESSRTAP         | 1.05                 | 0.90                 | 0.89327          |
| 2032 | Light  | HESSRTAP-MW7  | 115                   | TIOGA.N - W.BANK_T          | 1.05                 | 0.90                 | 0.8935           |
| 2032 | Light  | LITTLMS4-MK7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.89335          |

| Year | Season | Facility Name | Facility Voltage (kV) | Contingency Name           | Voltage Maximum (pu) | Voltage Minimum (pu) | Bus Voltage (pu) |
|------|--------|---------------|-----------------------|----------------------------|----------------------|----------------------|------------------|
| 2032 | Light  | OASIS__ -MK7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4  | 1.05                 | 0.90                 | 0.88704          |
| 2032 | Light  | ROOSEVLT-MK7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4  | 1.05                 | 0.90                 | 0.89259          |
| 2032 | Light  | SATHERDM-MK7  | 115                   | BICNTNIL-SQUAWGAP-BE7      | 1.05                 | 0.90                 | 0.89747          |
| 2032 | Light  | SATHERDM-MK7  | 115                   | RICHLAND-BE7 - LEWIS 7 - 1 | 1.05                 | 0.90                 | 0.89761          |
| 2032 | Light  | SATHERDM-MK7  | 115                   | BICNTNIL-ROUGHHRDR-BE7     | 1.05                 | 0.90                 | 0.89899          |
| 2032 | Light  | SCHAFFER -MK7 | 115                   | JUDSON_-BE3 - JUDSON_-BE4  | 1.05                 | 0.90                 | 0.89125          |
| 2032 | Light  | SKAAR__ -MK7  | 115                   | RICHLAND-BE7 - LEWIS 7 - 1 | 1.05                 | 0.90                 | 0.89932          |
| 2032 | Light  | SKAAR__ -MK7  | 115                   | BICNTNIL-SQUAWGAP-BE7      | 1.05                 | 0.90                 | 0.89918          |
| 2032 | Light  | SQUAWGAP-BE7  | 115                   | RICHLAND-BE7 - LEWIS 7 - 1 | 1.05                 | 0.90                 | 0.89932          |
| 2032 | Light  | SQUAWGAP-BE7  | 115                   | BICNTNIL-SQUAWGAP-BE7      | 1.05                 | 0.90                 | 0.89918          |
| 2032 | Light  | TRUEOIL -MK7  | 115                   | BICNTNIL-ROUGHHRDR-BE7     | 1.05                 | 0.90                 | 0.89726          |
| 2032 | Light  | TRUEOIL -MK7  | 115                   | RICHLAND-BE7 - LEWIS 7 - 1 | 1.05                 | 0.90                 | 0.89587          |
| 2032 | Light  | TRUEOIL -MK7  | 115                   | BICNTNIL-SQUAWGAP-BE7      | 1.05                 | 0.90                 | 0.89573          |
| 2032 | Light  | W.BANK_-MW7   | 115                   | W.BANK_T - HESSRTAP        | 1.05                 | 0.90                 | 0.89773          |
| 2032 | Light  | W.BANK_-MW7   | 115                   | TIOGA.N - W.BANK_T         | 1.05                 | 0.90                 | 0.89792          |
| 2032 | Light  | W.BANK_T-MW7  | 115                   | TIOGA.N - W.BANK_T         | 1.05                 | 0.90                 | 0.89351          |
| 2032 | Light  | WHEELLOCK-BE7 | 115                   | EASTFORK-MW7-EASTFORK-BE3  | 1.05                 | 0.90                 | 0.88919          |
| 2032 | Light  | WHEELLOCK-BE7 | 115                   | JUDSON_-BE3 - JUDSON_-BE4  | 1.05                 | 0.90                 | 0.89081          |
| 2032 | Light  | WHEELS_T-MW7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4  | 1.05                 | 0.90                 | 0.88875          |
| 2032 | Light  | WHEELS_T-MW7  | 115                   | EASTFORK-MW7-EASTFORK-BE3  | 1.05                 | 0.90                 | 0.88373          |
| 2032 | Summer | JUDSON -MW7   | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.89308          |
| 2032 | Summer | MONT -MW7     | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.93458          |
| 2032 | Summer | N.MISRDRG-MW7 | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.94527          |
| 2032 | Summer | N.TWELVE-MW7  | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.94537          |
| 2032 | Summer | N.WILSTN-MW7  | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.93514          |
| 2032 | Summer | N.WLST_T-MW7  | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.93437          |
| 2032 | Summer | NE.WLSTN-MW7  | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.9402           |
| 2032 | Summer | NOHLEY -LY7   | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.93541          |
| 2032 | Summer | NW.WLSTN-MW7  | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.9201           |
| 2032 | Summer | MARLEY -LY7   | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.53124          |
| 2032 | Summer | SANDRSON-LY7  | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.47919          |
| 2032 | Summer | REN -LY7      | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.56257          |
| 2032 | Summer | STIMPY -LY7   | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.53089          |
| 2032 | Summer | ROMO -LY7     | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.47813          |
| 2032 | Summer | SE.WLSTN-MW7  | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.93922          |
| 2032 | Summer | SLETTE -MW7   | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.94122          |
| 2032 | Summer | SPRINGLK-LY7  | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.94025          |
| 2032 | Summer | SW.WLSTN-MW7  | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.89268          |
| 2032 | Summer | TWELVE_M-MW7  | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.94274          |
| 2032 | Summer | WILISTN7      | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.88309          |
| 2032 | Summer | WILLISTON27   | 115                   | BASE CASE                  | 1.05                 | 0.95                 | 0.88396          |

| Year | Season | Facility Name | Facility Voltage (kV) | Contingency Name            | Voltage Maximum (pu) | Voltage Minimum (pu) | Bus Voltage (pu) |
|------|--------|---------------|-----------------------|-----------------------------|----------------------|----------------------|------------------|
| 2032 | Summer | BARRBUTE-MW7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.88235          |
| 2032 | Summer | BLKTLTAP-MW7  | 115                   | EASTFORK-MW7-EASTFORK-BE3   | 1.05                 | 0.90                 | 0.86449          |
| 2032 | Summer | ELLISVIL-MW7  | 115                   | EASTFORK-MW7-EASTFORK-BE3   | 1.05                 | 0.90                 | 0.88819          |
| 2032 | Summer | EPPING -MW7   | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.89919          |
| 2032 | Summer | EPPING -MW7   | 115                   | WHEELS_T - EPPING           | 1.05                 | 0.90                 | 0.89661          |
| 2032 | Summer | GRENORA_-UM7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.88507          |
| 2032 | Summer | HELMUT -LY7   | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.89928          |
| 2032 | Summer | HELMUT -LY7   | 115                   | WILLISTON27 - WILISTN7 - Z1 | 1.05                 | 0.90                 | 0.89129          |
| 2032 | Summer | HELMUT -LY7   | 115                   | RICHLAND-BE7 - LEWIS 7 - 1  | 1.05                 | 0.90                 | 0.89387          |
| 2032 | Summer | OWAN -MW4     | 230                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.82962          |
| 2032 | Summer | REDBANK -SH7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.87582          |
| 2032 | Summer | REDBANK -SH7  | 115                   | STATELIN- PIONEER1          | 1.05                 | 0.90                 | 0.89079          |
| 2032 | Summer | RICHLAND-BE7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.89932          |
| 2032 | Summer | RICHLAND-BE7  | 115                   | WILLISTON27 - WILISTN7 - Z1 | 1.05                 | 0.90                 | 0.89133          |
| 2032 | Summer | RICHLAND-BE7  | 115                   | RICHLAND-BE7 - LEWIS 7 - 1  | 1.05                 | 0.90                 | 0.8939           |
| 2032 | Summer | STATELIN-MW7  | 115                   | STATELIN- PIONEER1          | 1.05                 | 0.90                 | 0.87848          |
| 2032 | Summer | STATELIN-MW7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.86835          |
| 2032 | Summer | STRNDAHL-MW7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.86402          |
| 2032 | Summer | STRNDAHL-MW7  | 115                   | STATELIN- PIONEER1          | 1.05                 | 0.90                 | 0.89221          |
| 2032 | Summer | STRNDAHL-MW7  | 115                   | EASTFORK-MW7-EASTFORK-BE3   | 1.05                 | 0.90                 | 0.89051          |
| 2032 | Winter | FOLVAG -MW7   | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.94758          |
| 2032 | Winter | JUDSON -MW7   | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.88455          |
| 2032 | Winter | MONT -MW7     | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.92554          |
| 2032 | Winter | N.MISRDG-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.93561          |
| 2032 | Winter | N.TWELVE-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.9362           |
| 2032 | Winter | N.WILSTN-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.92527          |
| 2032 | Winter | N.WLST_T-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.92452          |
| 2032 | Winter | NE.WLSTN-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.93037          |
| 2032 | Winter | NOHLEY -LY7   | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.93055          |
| 2032 | Winter | NW.WLSTN-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.91031          |
| 2032 | Winter | SE.WLSTN-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.92947          |
| 2032 | Winter | SLETTE -MW7   | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.93203          |
| 2032 | Winter | SPRINGLK-LY7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.93594          |
| 2032 | Winter | STRNDAHL-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.94184          |
| 2032 | Winter | ROMO -LY7     | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.46521          |
| 2032 | Winter | SANDRSON-LY7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.46577          |
| 2032 | Winter | SW.WLSTN-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.88396          |
| 2032 | Winter | MARLEY -LY7   | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.51848          |
| 2032 | Winter | TWELVE_M-MW7  | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.93332          |
| 2032 | Winter | STIMPY -LY7   | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.51812          |

| Year | Season | Facility Name | Facility Voltage (kV) | Contingency Name            | Voltage Maximum (pu) | Voltage Minimum (pu) | Bus Voltage (pu) |
|------|--------|---------------|-----------------------|-----------------------------|----------------------|----------------------|------------------|
| 2032 | Winter | WILISTN7      | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.87493          |
| 2032 | Winter | WILLISTON27   | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.87579          |
| 2032 | Winter | REN -LY7      | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.55011          |
| 2032 | Winter | ZAHL -MW7     | 115                   | BASE CASE                   | 1.05                 | 0.95                 | 0.9485           |
| 2032 | Winter | BARBUTE-MW7   | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.87021          |
| 2032 | Winter | BARBUTE-MW7   | 115                   | EASTFORK-MW7-EASTFORK-BE3   | 1.05                 | 0.90                 | 0.89148          |
| 2032 | Winter | BLKTLTAP-MW7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.89844          |
| 2032 | Winter | BLKTLTAP-MW7  | 115                   | EASTFORK-MW7-EASTFORK-BE3   | 1.05                 | 0.90                 | 0.84568          |
| 2032 | Winter | ELLISVIL-MW7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.89179          |
| 2032 | Winter | ELLISVIL-MW7  | 115                   | EASTFORK-MW7-EASTFORK-BE3   | 1.05                 | 0.90                 | 0.87062          |
| 2032 | Winter | EPPING -MW7   | 115                   | EASTFORK-MW7-EASTFORK-BE3   | 1.05                 | 0.90                 | 0.89395          |
| 2032 | Winter | EPPING -MW7   | 115                   | WHEELS_T - EPPING           | 1.05                 | 0.90                 | 0.88344          |
| 2032 | Winter | EPPING -MW7   | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.89048          |
| 2032 | Winter | GOLIATH -MW7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.89686          |
| 2032 | Winter | GRENORA_UM7   | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.87291          |
| 2032 | Winter | GRENORA_UM7   | 115                   | EASTFORK-MW7-EASTFORK-BE3   | 1.05                 | 0.90                 | 0.89451          |
| 2032 | Winter | HELMUT -LY7   | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.89141          |
| 2032 | Winter | HELMUT -LY7   | 115                   | RICHLAND-BE7 - LEWIS 7 - 1  | 1.05                 | 0.90                 | 0.87726          |
| 2032 | Winter | HELMUT -LY7   | 115                   | WILLISTON27 - WILISTN7 - Z1 | 1.05                 | 0.90                 | 0.88777          |
| 2032 | Winter | HESSRAIL-MW7  | 115                   | W.BANK_T - HESSRTAP         | 1.05                 | 0.90                 | 0.89457          |
| 2032 | Winter | HESSRAIL-MW7  | 115                   | TIOGA.N - W.BANK_T          | 1.05                 | 0.90                 | 0.8948           |
| 2032 | Winter | HESSRTAP-MW7  | 115                   | TIOGA.N - W.BANK_T          | 1.05                 | 0.90                 | 0.89682          |
| 2032 | Winter | HESSRTAP-MW7  | 115                   | W.BANK_T - HESSRTAP         | 1.05                 | 0.90                 | 0.89658          |
| 2032 | Winter | KOCH_OIL-BE7  | 115                   | RICHLAND-BE7 - LEWIS 7 - 1  | 1.05                 | 0.90                 | 0.89087          |
| 2032 | Winter | MARMON -MW7   | 115                   | EASTFORK-MW7-EASTFORK-BE3   | 1.05                 | 0.90                 | 0.88819          |
| 2032 | Winter | MARMON -MW7   | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.89328          |
| 2032 | Winter | OWAN -MW4     | 230                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.81839          |
| 2032 | Winter | REDBANK -SH7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.86515          |
| 2032 | Winter | REDBANK -SH7  | 115                   | EASTFORK-MW7-EASTFORK-BE3   | 1.05                 | 0.90                 | 0.89082          |
| 2032 | Winter | RICHLAND-BE7  | 115                   | RICHLAND-BE7 - LEWIS 7 - 1  | 1.05                 | 0.90                 | 0.87729          |
| 2032 | Winter | RICHLAND-BE7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.89144          |
| 2032 | Winter | RICHLAND-BE7  | 115                   | WILLISTON27 - WILISTN7 - Z1 | 1.05                 | 0.90                 | 0.8878           |
| 2032 | Winter | SATHERDM-MK7  | 115                   | RICHLAND-BE7 - LEWIS 7 - 1  | 1.05                 | 0.90                 | 0.89984          |
| 2032 | Winter | STATELIN-MW7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4   | 1.05                 | 0.90                 | 0.85911          |
| 2032 | Winter | STATELIN-MW7  | 115                   | EASTFORK-MW7-EASTFORK-BE3   | 1.05                 | 0.90                 | 0.88703          |
| 2032 | Winter | TRUEOIL -MK7  | 115                   | RICHLAND-BE7 - LEWIS 7 - 1  | 1.05                 | 0.90                 | 0.8973           |

| Year | Season | Facility Name | Facility Voltage (kV) | Contingency Name          | Voltage Maximum (pu) | Voltage Minimum (pu) | Bus Voltage (pu) |
|------|--------|---------------|-----------------------|---------------------------|----------------------|----------------------|------------------|
| 2032 | Winter | W.BANK_T-MW7  | 115                   | TIOGA.N - W.BANK_T        | 1.05                 | 0.90                 | 0.89682          |
| 2032 | Winter | WHEELock-BE7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4 | 1.05                 | 0.90                 | 0.89862          |
| 2032 | Winter | WHEELS_T-MW7  | 115                   | JUDSON_-BE3 - JUDSON_-BE4 | 1.05                 | 0.90                 | 0.89657          |

**Table 3-2: Potential Voltage Violations**

**SHORT CIRCUIT**

SPP performed short circuit analysis for the 2027 Summer Peak with the new load additions. The analysis identified the currents as listed in Table 3-3.

| Season | Model     | Fault       | Bus             | Current (Amps) |
|--------|-----------|-------------|-----------------|----------------|
| 27S    | Max Fault | Three Phase | WATFORD4 23     | 7,695          |
| 27S    | Max Fault | Three Phase | WILLISTON27 11  | 19,772         |
| 27S    | Max Fault | Three Phase | WILISTN4 23     | 13,925         |
| 27S    | Max Fault | Three Phase | DAWSONC7 11     | 7,199          |
| 27S    | Max Fault | Three Phase | WATFORD7 11     | 13,744         |
| 27S    | Max Fault | Three Phase | WILISTN7 11     | 19,772         |
| 27S    | Max Fault | Three Phase | WATFORD9 13     | 12,128         |
| 27S    | Max Fault | Three Phase | WATFORD29 13    | 12,128         |
| 27S    | Max Fault | Three Phase | WILISTN9 13     | 22,467         |
| 27S    | Max Fault | Three Phase | WILISTN29 13    | 22,467         |
| 27S    | Max Fault | Three Phase | FAIRVIEW 7 11   | 4,619          |
| 27S    | Max Fault | Three Phase | ALKABO -SH711   | 2,906          |
| 27S    | Max Fault | Three Phase | SNAKEBTT-SH711  | 5,341          |
| 27S    | Max Fault | Three Phase | REDBANK -SH711  | 3,609          |
| 27S    | Max Fault | Three Phase | HELMUT -LY711   | 5,020          |
| 27S    | Max Fault | Three Phase | SPRINGLK-LY711  | 1,863          |
| 27S    | Max Fault | Three Phase | NOHLEY -LY711   | 3,311          |
| 27S    | Max Fault | Three Phase | MARLEY -LY711   | 11,428         |
| 27S    | Max Fault | Three Phase | SANDRSON-LY711  | 11,921         |
| 27S    | Max Fault | Three Phase | ROMO -LY711     | 6,895          |
| 27S    | Max Fault | Three Phase | CHRRYCRK-MK711  | 13,744         |
| 27S    | Max Fault | Three Phase | OASIS__ -MK711  | 10,421         |
| 27S    | Max Fault | Three Phase | COYOTCHR-MK711  | 11,712         |
| 27S    | Max Fault | Three Phase | BARRBUTE-MW711  | 4,616          |
| 27S    | Max Fault | Three Phase | STATELIN-MW711  | 15,351         |
| 27S    | Max Fault | Three Phase | JUDSON -MW711   | 15,669         |
| 27S    | Max Fault | Three Phase | SW.WLSTN-MW711  | 11,338         |
| 27S    | Max Fault | Three Phase | N.MISR DG-MW711 | 14,692         |
| 27S    | Max Fault | Three Phase | N.WLST_T-MW711  | 13,505         |
| 27S    | Max Fault | Three Phase | NW.WLSTN-MW711  | 12,066         |
| 27S    | Max Fault | Three Phase | N.WILSTN-MW711  | 13,192         |
| 27S    | Max Fault | Three Phase | MONT -MW711     | 14,313         |

| Season | Model     | Fault       | Bus             | Current (Amps) |
|--------|-----------|-------------|-----------------|----------------|
| 27S    | Max Fault | Three Phase | STRNDAHL-MW711  | 5,815          |
| 27S    | Max Fault | Three Phase | WHEELS_T-MW711  | 8,774          |
| 27S    | Max Fault | Three Phase | EASTFORK-MW711  | 16,783         |
| 27S    | Max Fault | Three Phase | GOLIATH -MW711  | 8,003          |
| 27S    | Max Fault | Three Phase | OWAN -MW423     | 14,535         |
| 27S    | Max Fault | Three Phase | CULBRTSN-UM711  | 4,326          |
| 27S    | Max Fault | Three Phase | NESET__-BE423   | 10,982         |
| 27S    | Max Fault | Three Phase | BLAISDEL-BE423  | 5,593          |
| 27S    | Max Fault | Three Phase | GRENORA_-UM711  | 4,591          |
| 27S    | Max Fault | Three Phase | PIONER_1-BEG13  | 52,539         |
| 27S    | Max Fault | Three Phase | RICHLAND-BE711  | 5,053          |
| 27S    | Max Fault | Three Phase | PIONER_2-BEG13  | 37,677         |
| 27S    | Max Fault | Three Phase | PIONEE_3-BEG13  | 37,677         |
| 27S    | Max Fault | Three Phase | KOCH_OIL-BE711  | 4,226          |
| 27S    | Max Fault | Three Phase | CHARL_CK-BE334  | 10,605         |
| 27S    | Max Fault | Three Phase | E.SIDNEY-LY711  | 4,333          |
| 27S    | Max Fault | Three Phase | HEADRESS-CM711  | 3,154          |
| 27S    | Max Fault | Three Phase | CULBSN.E-BE711  | 5,611          |
| 27S    | Max Fault | Three Phase | CULB_GEN-BE711  | 5,485          |
| 27S    | Max Fault | Three Phase | CULBRTSN-BEG13  | 54,439         |
| 27S    | Max Fault | Three Phase | CHARL_CK-BE423  | 11,382         |
| 27S    | Max Fault | Three Phase | CCR.KV3A-BE913  | 23,062         |
| 27S    | Max Fault | Three Phase | CCR.KV4A-BE913  | 30,605         |
| 27S    | Max Fault | Three Phase | EASTFORK-BE334  | 8,683          |
| 27S    | Max Fault | Three Phase | JUDSON_-BE334   | 11,546         |
| 27S    | Max Fault | Three Phase | JUDSON_-BE423   | 14,535         |
| 27S    | Max Fault | Three Phase | JDS.KU6A-BE913  | 17,112         |
| 27S    | Max Fault | Three Phase | PIONEER1-BE711  | 15,351         |
| 27S    | Max Fault | Three Phase | WHEELLOCK-BE423 | 7,584          |
| 27S    | Max Fault | Three Phase | WHEELLOCK-BE711 | 8,954          |
| 27S    | Max Fault | Three Phase | WEL.T1_-BE913   | 27,424         |
| 27S    | Max Fault | Three Phase | PATENTGT-BE334  | 10,069         |
| 27S    | Max Fault | Three Phase | PIONEER2-BE711  | 14,815         |
| 27S    | Max Fault | Three Phase | PS_RCP.A-BEG13  | 38,215         |
| 27S    | Max Fault | Three Phase | PS_RCP.B-BEG13  | 38,215         |
| 27S    | Max Fault | Three Phase | WATFRDSOUTH423  | 7,600          |
| 27S    | Max Fault | Three Phase | LEWIS 7 11      | 4,855          |
| 27S    | Max Fault | Three Phase | POPLAR 7 11     | 2,771          |
| 27S    | Max Fault | Three Phase | PLNTYWD7 11     | 1,684          |
| 27S    | Max Fault | Three Phase | TIOGA4 4 23     | 10,982         |
| 27S    | Max Fault | Three Phase | TIOGA4 7 11     | 12,201         |
| 27S    | Max Fault | Three Phase | TIOGA7 7 11     | 9,544          |
| 27S    | Max Fault | Three Phase | RAY JCT7 11     | 5,546          |
| 27S    | Max Fault | Three Phase | LTLMUDY7 11     | 6,824          |
| 27S    | Max Fault | Three Phase | J405_LEWIS2G13  | 40,430         |
| 27S    | Max Fault | Three Phase | TIOGA4 9 13     | 18,133         |
| 27S    | Max Fault | Three Phase | BDV 423         | 4,728          |

| Season | Model     | Fault       | Bus            | Current (Amps) |
|--------|-----------|-------------|----------------|----------------|
| 27S    | Max Fault | Three Phase | JDS.KU6A-BE913 | 17,112         |

**Table 3-3: Short Circuit Results**

***STABILITY***

SPP performed a Fast Fault Screening (FFS) for the base case and change case models. The change case models include the Marley and Sanderson delivery point changes. The FFS was performed for the 2025 and 2033 Summer Peaks. There were no significant differences in the critical clearing times between the base and change cases. Therefore, a transient stability analysis is not required.

### ***TRANSMISSION SOLUTIONS***

The addition of the loads at the Marley and Sanderson delivery points caused potential thermal overloads and low voltages on the 115 kV systems around Marley and Sanderson. SPP's solutions consisted of adding two new 115 kV or 230 kV transmission lines into the load area at Marley. Each option assumes a 2<sup>nd</sup> 345/230 kV transformer at the Judson 345 kV substation that resulted from the 2023-AG2 Aggregate Study in the base case. The addition of this 2<sup>nd</sup> transformer solves multiple overloads caused when the current 345/230 kV transformer is under contingency. The complete solutions are listed below.

#### **Solution #1:** Total cost \$47,108,551

- New Sanderson - Pioneer 115 kV line Ckt 1 (8.4 miles)
- Rebuild Williston – Ren 115 kV line (8.7 miles)
- New 50 MVAR cap bank at Marley 115 kV
- New 30 MVAR cap bank at Sanderson 115 kV
- Rebuild Marley – Ren 115 kV line (1.2 miles)
- New SW Williston – Marley 115 kV line Ckt 1 (12 miles)
- Reconductor Williston27 – Williston7 Z1 115 kV line (0.08 miles)
- Rebuild SW Williston – Judson 115 kV line (7 miles)
- Rebuild North Missouri Ridge -Eastfork 115 kV line (4.7 miles)
- New 230/115 kV Transformer at Williston Ckt 2

#### **Solution #2:** Total cost \$78,168,617

- New Williston - Marley 230 kV line Ckt 1 (18 miles)
- New Judson - Marley 230 kV line Ckt 1 (15 miles)
- New Marley 230 kV substation
- 2 new 230/115 kV Transformers at new Marley substation
- New Sanderson - Pioneer 115 kV line Ckt 1 (8.4 miles)
- Rebuild Marley - Ren 115 kV line (1.2 miles)
- Rebuild Williston - Ren 115 kV line (8.7 miles)



SPP chose to move forward with Solution #1. This solution solves all issues identified in Table 3-1 and Table 3-2 in the most cost-effective manner.

| <b>New Upgrade Description*</b>                     | <b>Mileage</b> | <b>MVA<br/>(Rate B)</b> | <b>Date<br/>Needed**</b> | <b>Host<br/>Transmission<br/>Owner</b> | <b>Estimated<br/>Cost***</b> |
|---|----------------|-------------------------|--------------------------|--|------------------------------|
| New Sanderson – Pioneer 115 kV Line Ckt 1           | 8.4            | 398                     | 12/1/2024                | -                                      | \$8,004,141                  |
| Rebuild Williston – Ren 115 kV Line                 | 8.7            | 321                     | 12/1/2024                | BEPC                                   | \$5,435,009                  |
| New 50 MVAR Cap Bank at Marley 115 kV               | -              | -                       | 12/1/2024                | WAPA                                   | \$4,960,524                  |
| New 30 MVAR Cap Bank at Sanderson 115 kV            | -              | -                       | 12/1/2024                | WAPA                                   | \$2,976,314                  |
| Rebuild Marley – Ren 115 kV Line                    | 1.2            | 218                     | 4/1/2025                 | BEPC                                   | \$749,656                    |
| New SW Williston – Marley 115 kV Line Ckt 1         | 12             | 460                     | 1/1/2026                 | -                                      | \$11,434,486                 |
| Reconductor Williston27 – Williston7 Z1 115 kV Line | .08            | 312                     | 4/1/2029                 | WAPA                                   | \$49,977                     |
| Rebuild SW Williston – Judson 115 kV Line           | 7              | 398                     | 10/1/2029                | BEPC                                   | \$4,372,996                  |
| Rebuild North Missouri Ridge - Eastfork 115 kV Line | 4.7            | 398                     | 4/1/2031                 | BEPC                                   | \$3,246,319                  |
| New 230/115 kV Transformer at Williston Ckt 2       | -              | 250                     | 4/1/2031                 | WAPA                                   | \$5,879,128                  |
| <b>TOTAL NEW UPGRADE COST</b>                       |                |                         |                          |  | <b>\$47,108,551</b>          |

**Table 3-4: Recommended Upgrade Solution #1**

\*All requests with a Network Upgrade(s) identified in the DPNS will be subject to further evaluation in the soonest available Integrated Transmission Planning Assessment that is able to include the load changes, if it is determined that the Network Upgrade(s) will be able to meet the study timeframe requirements pursuant to the standardized project timelines in SPP Business Practices, based on the SPP determined Network Upgrade(s) need date. If it is determined that a Network Upgrade(s) identified from a DPNS is unable to be further evaluated pursuant to the Integrated Transmission Planning Assessment, the DPNS report will be posted on the SPP website once SPP is notified by the Transmission Customer to update the applicable Network Integration Transmission Service Agreement to reflect the changes in delivery points and the Network Upgrade(s).

Pursuant to Attachment AQ of the Tariff, the Transmission provider is responsible for assessing the impacts on the Transmission System caused by modifying an existing delivery point or establishing the new delivery point through the DPNS. The DPNS may determine the need for a Network Upgrade(s) necessary for the modification of an existing delivery point or the establishment of a new delivery point. A Network Upgrade(s) that the Transmission Customer or Host Transmission Owner desires that exceeds the needed Network Upgrade(s) identified in the DPNS will need to be studied through the Transmission Provider's Sponsored Upgrade study process to evaluate the impacts of the desired changes on the Transmission System.

\*\*If the project need date specified in this study cannot be met, the Transmission Owner will be required to submit mitigations pursuant to the SPP Project Tracking process. All upgrades or mitigations must be in place prior to the dates shown in Table 3-4.

\*\*\*Note that the estimated new upgrade cost provided in this report is an SPP Conceptual Cost Estimate only; this is preliminary, and a more refined Study Cost Estimate will be developed after issuance of this report through a Standardized Cost Estimate Reporting Template (SCERT).

## SECTION 4: CONCLUSION

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The AC analysis revealed potential thermal and voltage violations associated with the Marley and Sanderson load additions. The study shows that the following upgrades are required to reliably serve the load additions:

- New Sanderson – Pioneer 115 kV line Ckt 1 (8.4 miles)
- Rebuild Williston – Ren 115 kV line (8.7 miles)
- New 50 MVAR cap bank at Marley 115 kV
- New 30 MVAR cap bank at Sanderson 115 kV
- Rebuild Marley – Ren 115 kV line (1.2 miles)
- New SW Williston – Marley 115 kV line Ckt 1 (12 miles)
- Reconductor Williston27 – Williston7 Z1 115 kV line (0.08 miles)
- Rebuild SW Williston – Judson 115 kV line (7 miles)
- Rebuild North Missouri Ridge – Eastfork 115 kV line (4.7 miles)
- New 230/115 kV Transformer at Williston Ckt 2

The transmission upgrades in Table 3-4 are recommended to mitigate the potential voltage and thermal violations.