DPA-2025-OCTOBER-2223

Delivery Point Network Study

Published on 03/27/2026

By SPP Engineering, Transmission Services

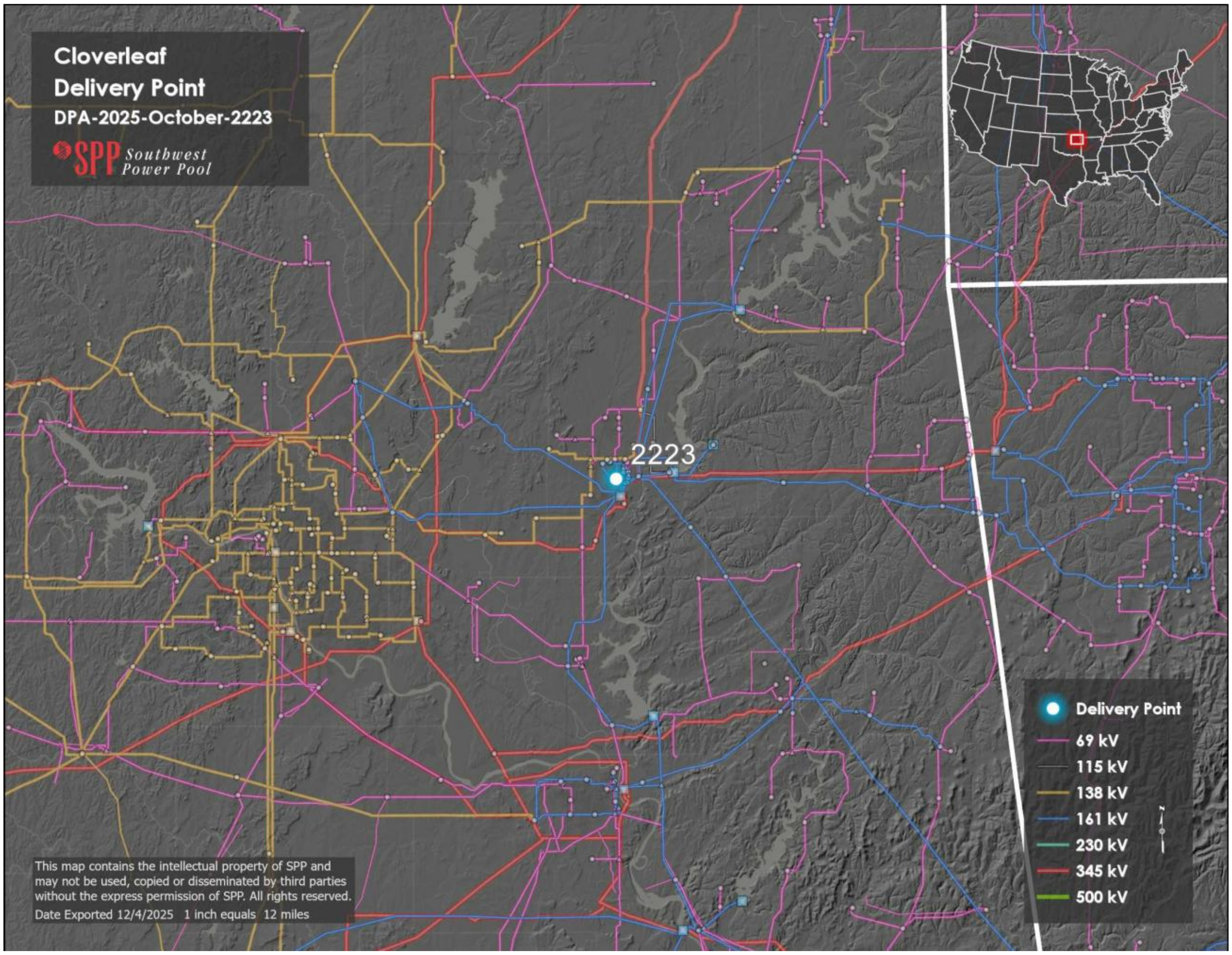
REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION	COMMENTS
03/27/2026	SPP	Original	

CONTENTS

SECTION 1: INTRODUCTION

This report outlines the results of an evaluation of regional transmission impacts from delivery point request DPA-2025-October-2223. The requesting entity plans to add a new delivery point called Cloverleaf with an in-service date of 12/01/2026. The Cloverleaf delivery point is in the Grand River Dam Authority (GRDA) Transmission System.



The load flow models used for the evaluation were 2025 Integrated Transmission Planning (ITP) base reliability models. Southwest Power Pool (SPP) performed an Alternating Current (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 load served by GRDA. SPP performed a Delivery Point Network Study (DPNS) with the configurations shown in Table 2-1 below.

STUDY PROCESS

- Model Assumptions
    - 2025 ITP Base Reliability Model Series
        - Model years 2026, 2029, and 2034
        - Summer Peak (2029S and 2034S), Winter Peak (2026W, 2029W, and 2034W), and Light Load (2029L, and 2034L)
    - 2025 ITP Short Circuit Model Series
        - 2029 Summer Max Fault
    - 2025 Transmission System Planning (TPL) Dynamic Model Series
        - 2034 Summer Peak Base and Change Cases

Table 2-1: Study Cases

Case Name	Study Year	Season	Scenario	Load (MW/MVAR)
2025ITPFinal-26W.sav	2026	Winter Peak	Base Reliability	Base Case
2025ITPFinal-29L.sav	2029	Light Load	Base Reliability	Base Case
2025ITPFinal-29S.sav	2029	Summer Peak	Base Reliability	Base Case
2025ITPFinal-29W.sav	2029	Winter Peak	Base Reliability	Base Case
2025ITPFinal-34L.sav	2034	Light Load	Base Reliability	Base Case
2025ITPFinal-34S.sav	2034	Summer Peak	Base Reliability	Base Case
2025ITPFinal-34W.sav	2034	Winter Peak	Base Reliability	Base Case
2025ITPFinal-26W_2223.sav	2026	Winter Peak	Base Reliability	Cloverleaf = 20/2.85
2025ITPFinal-29L_2223.sav	2029	Light Load	Base Reliability	Cloverleaf = 375/53.43
2025ITPFinal-29S_2223.sav	2029	Summer Peak	Base Reliability	Cloverleaf = 375/53.43
2025ITPFinal-29W_2223.sav	2029	Winter Peak	Base Reliability	Cloverleaf = 375/53.43
2025ITPFinal-34L_2223.sav	2034	Light Load	Base Reliability	Cloverleaf = 375/53.43
2025ITPFinal-34S_2223.sav	2034	Summer Peak	Base Reliability	Cloverleaf = 375/53.43
2025ITPFinal-34W_2223.sav	2034	Winter Peak	Base Reliability	Cloverleaf = 375/53.43

- 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 National American Electric Reliability Corporation (NERC) reliability standards
    - Compare thermal and voltage violations that occur with and without the Cloverleaf delivery point change to determine thermal and voltage violations resulting from the load addition to the Transmission System.
- Dynamics Analysis
    - Assumptions
        - 2025 TPL Dynamics Model Series
            - 2034 Summer Peak Base and Change Cases
    - Analyses
        - Fast Fault Screening using Physical and Operational Margins Studio
- Short Circuit Analysis
    - Assumptions
        - Used 2024 Final ITP Short Circuit models (2029 Summer 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 AND VOLTAGE VIOLATIONS

The analysis identified potential thermal and voltage violations resulting from the new load at the Cloverleaf delivery point. Table 3-1 details the potential thermal violations and Table 3-2 details the potential voltage violations resulting from the load addition.

Table 3-1: Potential Thermal Violations

Year	Voltage Level (kV)	Facility Name	Contingency Name	Rate A, Rate B (MVA)	Max Flow (MVA)	Change Case Max Loading (%)
29S	161	GRDA1 5 - WMAIN ST5 – 1	MAID 5 - PATROLRD 5 – 1	713/837	847.881	101.3
34S	161	GRDA1 5 - WMAIN ST5 – 1	MAID 5 - PATROLRD 5 – 1	713/837	1005.2369	120.1
34W	161	GRDA1 5 - WMAIN ST5 - 1	MAID 5 - PATROLRD 5 - 1	713/837	1004.4	120

SHORT CIRCUIT

SPP performed short circuit analysis for the 2029 Summer Peak with the new load addition. The analysis identified the currents as listed in Table 3-3.

Table 3-3: Short Circuit Results

Season	Model	Fault	Bus	Current (Amps)
29S	Max Fault	Three Phase	1CHOTCT4 16.000	13,008
29S	Max Fault	Three Phase	1CHOTCT5 16.000	12,392
29S	Max Fault	Three Phase	1CHOTST6 16.000	11,082
29S	Max Fault	Three Phase	1CHOTST3 16.000	9,766
29S	Max Fault	Three Phase	1CHOTCT1 16.000	9,604
29S	Max Fault	Three Phase	1CHOTCT2 16.000	9,331
29S	Max Fault	Three Phase	5CHOTEAU1 161.00	42,532
29S	Max Fault	Three Phase	7BLACKBERRY 345.00	15,476
29S	Max Fault	Three Phase	7SPORTSMAN 345.00	24,298
29S	Max Fault	Three Phase	5SPORTSMAN 161.00	40,482
29S	Max Fault	Three Phase	2LOWERY 69.000	4,677
29S	Max Fault	Three Phase	2PEGGS 69.000	6,081
29S	Max Fault	Three Phase	2WAGNERW 69.000	4,542
29S	Max Fault	Three Phase	5ELMCRK 161.00	13,692
29S	Max Fault	Three Phase	5KETONVL 161.00	11,618
29S	Max Fault	Three Phase	5PARK 161.00	7,901
29S	Max Fault	Three Phase	1SPORTT1 13.200	30,543

Season	Model	Fault	Bus	Current (Amps)
29S	Max Fault	Three Phase	1SPORTT2 13.200	30,650
29S	Max Fault	Three Phase	5CDRCRST 161.00	10,193
29S	Max Fault	Three Phase	2CDRCRST 69.000	7,954
29S	Max Fault	Three Phase	5CHOTEAU2 161.00	42,532
29S	Max Fault	Three Phase	1CDRCRSTTR 13.200	8,782
29S	Max Fault	Three Phase	2GRAY TP 69.000	7,495
29S	Max Fault	Three Phase	5BRIGGSTAP 161.00	7,352
29S	Max Fault	Three Phase	FT GIB 5 161.00	10,490
29S	Max Fault	Three Phase	FLINTCR7 345.00	16,024
29S	Max Fault	Three Phase	SPNKY CK4 138.00	28,292
29S	Max Fault	Three Phase	INOLATP4 138.00	9,439
29S	Max Fault	Three Phase	LLAN ET4 138.00	24,706
29S	Max Fault	Three Phase	CATOOSA4 138.00	37,257
29S	Max Fault	Three Phase	CATOOSA2 69.000	10,848
29S	Max Fault	Three Phase	E 11TH ST 4 138.00	29,577
29S	Max Fault	Three Phase	TERNITP4 138.00	20,337
29S	Max Fault	Three Phase	PCATSAT4 138.00	21,356
29S	Max Fault	Three Phase	CATOO1-1 13.800	17,801
29S	Max Fault	Three Phase	OWAS88_4 138.00	17,718
29S	Max Fault	Three Phase	L GROVE3 115.00	17,553
29S	Max Fault	Three Phase	KERR_U2 1 13.200	17,013
29S	Max Fault	Three Phase	KERR_U3 1 13.200	16,859
29S	Max Fault	Three Phase	PENSA_U1 1 13.200	14,253
29S	Max Fault	Three Phase	PENSA_U2 1 13.200	14,253
29S	Max Fault	Three Phase	PENSA_U3 1 13.200	14,253
29S	Max Fault	Three Phase	PENSA_U4 1 13.200	12,041
29S	Max Fault	Three Phase	PENSA_U6 1 13.200	12,041
29S	Max Fault	Three Phase	PENSA_U5 1 13.200	12,041
29S	Max Fault	Three Phase	SALINA_U1 1 13.400	20,786
29S	Max Fault	Three Phase	SALINA_U2 1 13.400	20,437
29S	Max Fault	Three Phase	SALINA_U3 1 13.400	20,609
29S	Max Fault	Three Phase	SALINA_U4 1 13.400	20,269
29S	Max Fault	Three Phase	SALINA_U5 1 13.400	20,352
29S	Max Fault	Three Phase	SALINA_U6 1 13.400	20,395
29S	Max Fault	Three Phase	GRECCTG_1 20.000	19,704
29S	Max Fault	Three Phase	GRECSTG_1 21.000	83,022
29S	Max Fault	Three Phase	CATSAGD4 138.00	37,257
29S	Max Fault	Three Phase	MAIDTP2 69.000	11,995
29S	Max Fault	Three Phase	MAID 2 69.000	14,806
29S	Max Fault	Three Phase	COLINS 5 161.00	12,582
29S	Max Fault	Three Phase	PENSA 2 69.000	13,229

Season	Model	Fault	Bus	Current (Amps)
29S	Max Fault	Three Phase	DRYGULCH5 161.00	15,708
29S	Max Fault	Three Phase	AFTON 5 161.00	8,408
29S	Max Fault	Three Phase	KERR GR3 115.00	18,674
29S	Max Fault	Three Phase	KERR GR5 161.00	29,943
29S	Max Fault	Three Phase	CATSAGR4 138.00	37,257
29S	Max Fault	Three Phase	412SUB 5 161.00	11,772
29S	Max Fault	Three Phase	CATSAGR5 161.00	26,299
29S	Max Fault	Three Phase	OKAYGR 5 161.00	9,832
29S	Max Fault	Three Phase	SILSPWW5 161.00	14,872
29S	Max Fault	Three Phase	OKAYGR 2 69.000	11,944
29S	Max Fault	Three Phase	TAHLQH 2 69.000	11,167
29S	Max Fault	Three Phase	MAID 5 161.00	47,640
29S	Max Fault	Three Phase	GRDA1 7 345.00	26,815
29S	Max Fault	Three Phase	CLARMR 5 161.00	13,248
29S	Max Fault	Three Phase	PENSA 5 161.00	13,060
29S	Max Fault	Three Phase	TAHLQH 5 161.00	8,754
29S	Max Fault	Three Phase	GRDA1 5 161.00	47,022
29S	Max Fault	Three Phase	CPPTAP 2 69.000	13,925
29S	Max Fault	Three Phase	KETCHUM5 161.00	10,553
29S	Max Fault	Three Phase	HUNT 2 69.000	13,908
29S	Max Fault	Three Phase	CLARMR 2 69.000	12,626
29S	Max Fault	Three Phase	AMERCAST S2 69.000	13,647
29S	Max Fault	Three Phase	AMERCAST N2 69.000	13,602
29S	Max Fault	Three Phase	CASTING TAP269.000	13,909
29S	Max Fault	Three Phase	SALINA 5 161.00	18,112
29S	Max Fault	Three Phase	GRDA17-1 22.800	61,433
29S	Max Fault	Three Phase	GRDA15-1 22.800	21,055
29S	Max Fault	Three Phase	WAGNRTP2 69.000	7,183
29S	Max Fault	Three Phase	CLEORTP2 69.000	7,386
29S	Max Fault	Three Phase	ADARNEO2 69.000	4,688
29S	Max Fault	Three Phase	WAGNOR 2 69.000	7,092
29S	Max Fault	Three Phase	REDDEN 2 69.000	13,210
29S	Max Fault	Three Phase	PRYORCHEM2 69.000	13,614
29S	Max Fault	Three Phase	WAGNOR 5 161.00	9,575
29S	Max Fault	Three Phase	COLLINS4 138.00	7,890
29S	Max Fault	Three Phase	CLARMR 4 138.00	13,506
29S	Max Fault	Three Phase	KANSATP5 161.00	11,627
29S	Max Fault	Three Phase	KANSAS 5 161.00	11,008
29S	Max Fault	Three Phase	GRDA1 2 69.000	12,324
29S	Max Fault	Three Phase	WMAIN ST5 161.00	35,865
29S	Max Fault	Three Phase	TONECE7 345.00	15,693

Season	Model	Fault	Bus	Current (Amps)
29S	Max Fault	Three Phase	TONECE5 161.00	15,419
29S	Max Fault	Three Phase	TONECE1 13.200	52,424
29S	Max Fault	Three Phase	NWMAID5 161.00	33,859
29S	Max Fault	Three Phase	WAGCTY22 69.000	6,524
29S	Max Fault	Three Phase	GERALDGAY5 161.00	33,232
29S	Max Fault	Three Phase	PATROLRD 5 161.00	38,737
29S	Max Fault	Three Phase	KERR BRK1 5 161.00	29,943
29S	Max Fault	Three Phase	KERR BRK4 5 161.00	29,943
29S	Max Fault	Three Phase	GEN-2017-061161.00	20,785
29S	Max Fault	Three Phase	G17-061XFMR134.500	12,012
29S	Max Fault	Three Phase	SALNCRK5 161.00	18,782
29S	Max Fault	Three Phase	CLARMR4 13.800	4,729
29S	Max Fault	Three Phase	CLARMR1 13.800	17,658
29S	Max Fault	Three Phase	CLARMR2 13.800	16,943
29S	Max Fault	Three Phase	GRDA1 1 13.800	14,244
29S	Max Fault	Three Phase	WAGNOR1 13.800	9,467
29S	Max Fault	Three Phase	GRDA1 13.800	16,058
29S	Max Fault	Three Phase	TAHLQH2 1 13.800	15,634
29S	Max Fault	Three Phase	GRDA2 1 13.800	16,959
29S	Max Fault	Three Phase	CATTER1 1 13.800	5,988
29S	Max Fault	Three Phase	CATTER2 1 13.800	6,069
29S	Max Fault	Three Phase	CATTER3 1 13.800	10,079
29S	Max Fault	Three Phase	MAITER1 1 13.200	32,453
29S	Max Fault	Three Phase	MAITER2 1 13.200	11,909
29S	Max Fault	Three Phase	COLLIN1 1 13.800	990
29S	Max Fault	Three Phase	COLLIN2 1 13.800	13,909
29S	Max Fault	Three Phase	COLLIN3 1 13.800	9,573
29S	Max Fault	Three Phase	PENSA 1 13.800	17,474
29S	Max Fault	Three Phase	KERR1 1 13.800	19,662
29S	Max Fault	Three Phase	KERR2 1 13.800	19,592
29S	Max Fault	Three Phase	OKAY1 13.800	13,608
29S	Max Fault	Three Phase	TAHLQH1 13.800	11,200
29S	Max Fault	Three Phase	GEN-2017-073161.00	14,568
29S	Max Fault	Three Phase	G17-073XFMR134.500	8,402
29S	Max Fault	Three Phase	G17-073-GSU134.500	8,283
29S	Max Fault	Three Phase	GREC TAP7 345.00	25,815
29S	Max Fault	Three Phase	COLNSGR2 69.000	10,213
29S	Max Fault	Three Phase	LOCSTGV 5 161.00	13,381
29S	Max Fault	Three Phase	CHOUTEAUCRK5161.00	20,787
29S	Max Fault	Three Phase	CUSTDAY2 5 161.00	31,504
29S	Max Fault	Three Phase	CUSTDAY1 5 161.00	31,509

Season	Model	Fault	Bus	Current (Amps)
29S	Max Fault	Three Phase	HERRON 5 161.00	34,819
29S	Max Fault	Three Phase	IGLOOV1 5 161.00	29,304
29S	Max Fault	Three Phase	IGLOOV2 5 161.00	29,304
29S	Max Fault	Three Phase	IGLOOV 7 345.00	21,681
29S	Max Fault	Three Phase	7CLANS 5 161.00	8,598

STABILITY

SPP performed a Fast Fault Screening (FFS) using the 2034 Summer Peak for the base case and change case models. The change case models include the Cloverleaf delivery point changes. SPP determined 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 load at the new Cloverleaf delivery point caused potential thermal overloads on the 161 kV systems around Cloverleaf. SPP's solutions consisted of addressing these thermal overloads. The solutions are listed below.

Solution #1: Project 1 (Total cost $1.05M) GRDA cost estimate: $9.3M

- New W Main to Herron 161 kV line circuit 1

Solution #2 Project 2 (Total cost $7.05M) GRDA cost estimate: $13.8M

- Rebuild W Main to GRDA1 161 kV line circuit 1

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.

Table 3-4: Recommended Upgrade Solution 1

New Upgrade Description*	Mileage	MVA (Rate B)	Date Needed**	Host Transmission Owner	Estimated Cost***
New W Main to Herron 161 kV line circuit 1	0.5	837	6/1/2029	GRDA	$1,050,000
TOTAL NEW UPGRADE COST					**$1,050,000**

*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 Delivery Point Network Study ("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

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

- New W Main to Herron 161 kV line circuit 1

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