

Power Flow Study

Proposed Large Load Development
Hansford County, Texas

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1.0 Executive Summary

This steady-state assessment evaluates one potential POI and the existing system capacity available to support its interconnection. The interconnection was evaluated on a **853 MW load** in 2028 via a direct connection to the **Garrymore 345 kV substation**. In 2030, the load was evaluated at **1345 MW** via the same direct connection. Two ERCOT-provided base cases were analyzed to represent the interconnection year and reliability planning horizons:

- **Case 1 (2028 Summer, ERCOT Year 3):** SSWG Baseline based on the ERCOT Year-3 Model.
- **Case 2 (2030 Summer, ERCOT Year 5):** SSWG Baseline based on the ERCOT Year-5 Model.

Thermal Results:

- **N-0:** All base case overloads within the utility region secured to within thermal limits with generation re-dispatch. Any pre-existing overloads were recorded and evaluated to see if the addition of the load project exacerbated these overloads. Findings indicate that the addition of the load does not have an impact on the pre-existing overloads.
- **N-1:** All post-contingency overloads within the utility region secured to within thermal limits with generation re-dispatch. Any pre-existing overloads were recorded and evaluated to see if the addition of the load project exacerbated these overloads. Findings indicate that the addition of the load does not have an impact on the pre-existing overloads.
- **Voltage Results:**
Steady-state voltage violations were identified in 2030. Specifically, the project exacerbated violations on the Oncor 69 kV system.

Conclusion:

Based on the steady-state thermal and voltage assessment, the interconnection of the 853 MW load in 2028 and 1345 MWs in 2030 is likely to require transmission system upgrades to mitigate voltage violations caused by the interconnection of the new facility. The proposed mitigation is one 10 MVAR shunt capacitor bank on the 69 kV system, with an estimated cost of approximately \$1.5 million. It is possible that Oncor proposes alternative solutions to provide voltage support through their own transmission planning processes. Final interconnection requirements remain subject to Oncor short-circuit and stability reviews.

2.0 Introduction

This study evaluates the steady-state impact of interconnecting a **853 MW** load in 2028 at the **Garrymore 345 kV substation** and **1345 MWs** in 2030. The objective is to identify thermal or voltage criteria violations attributable to the new loads and, if needed, the likely mitigation measures.

Methods and criteria follow Oncor's Transmission Planning Criteria and standard ERCOT and SSWG steady-state practices.

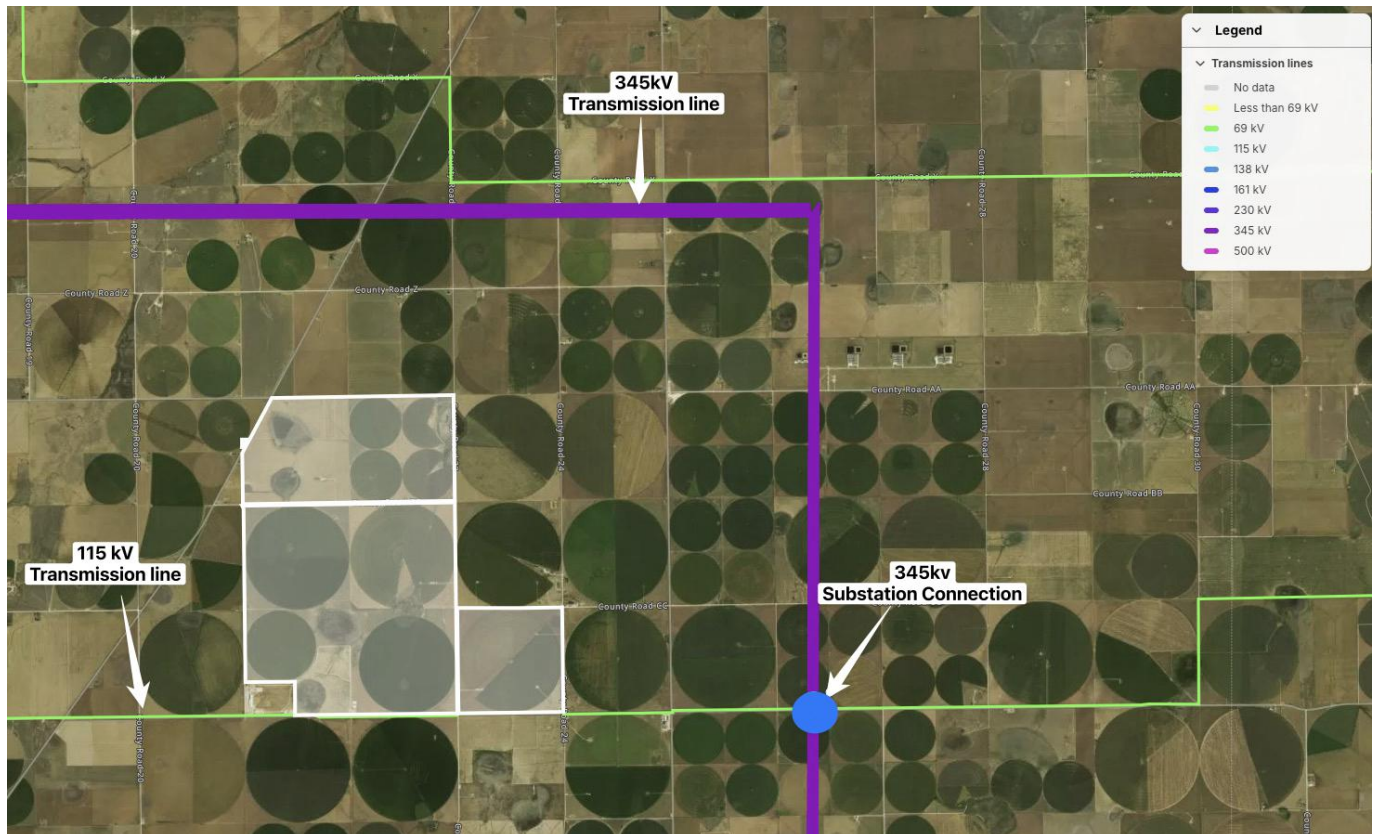


Figure 1: 345 kV Substation Connection Location (Bottom Right Corner)

3.0 Study Scope and Methodology

3.1 Overview

Attribute	Data
Latitude and Longitude	36.1087, -101.1842
County	Hansford
Utility	Oncor Electric
POI	Garrymore 345 kV Substation
Target Power	853 MW Load (2028), 1345 MW Load (2030)
Power Factor	0.97

Case Building:

The following ERCOT provided base cases were used to evaluate the reliability impact of the proposed load:

Base Case	Name	Case Assumptions/Inclusions
Case 1	<i>25SSWG_2028_SUM1_Final_07082025.raw</i>	SSWG Summer 2028 base including all active queue projects that have met ERCOT Planning Guide Section 6.9 requirements as of July 2025 and approved TPIT projects.
Case 2	<i>25SSWG_2030_SUM1_Final_07082025.raw</i>	SSWG Summer 2030 base including all active queue projects that have met ERCOT Planning Guide Section 6.9 requirements as of July 2025 and approved TPIT projects.

Tools & auxiliary files:

PowerGEM **TARA** was used for AC/DC contingency analysis. Relevant monitored-element and contingency files were applied for each planning year.

Dispatch Scenarios:

In each case, the load was added at the prevailing 0.97 lagging power factor and dispatched against generation within the relevant utility area in order to maintain power balance. One dispatch scenario was evaluated. This used Pmax-based participation factors derived from TARA's Proportional Transfer Limit module, scaling units in proportion to Pmax so larger units contribute a greater share of overall generation dispatch. This approach preserves base-case participation and reflects the RTO's expected dispatch for the study year.

3.2 Benchmark Analysis: Thermal and Voltage

To distinguish existing system constraints from load-attributed impacts, a benchmark case was first evaluated under N-0 and N-1 conditions. Where thermal constraints existed, SCRD was applied to secure elements within the applicable emergency ratings. Similarly, the benchmark case was evaluated for pre-contingency voltage violations present. Elements that could not be secured in the benchmark case were recorded as existing N-0 and N-1 constraints and not attributed to the load interconnection request.

3.3 N-0 Analysis: Thermal and Voltage

The study cases with the 853-1345 MW load additions were evaluated under the N-0 system intact conditions. Where new violations were observed, SCRD was applied to determine whether a relieving generator dispatch pattern exists. Elements that remained unsecurable after SCRD in the study case were identified as candidates for system upgrades.

3.4 N-1 Analysis: Thermal

N-1 contingency analysis was performed consistent with the Oncor Transmission Planning procedures outlined in the Oncor Transmission Planning Criteria.

All relevant NERC P1-7 N-1 level contingencies were incorporated via the SSWG planning contingency files. Oncor specific thermal limitations seen below were also applied accordingly.

Thermal Limits

Element	Loading	Single	Multiple
		P0, P1, P2, P4, P5, P7 EP1, EP7 OP1, OP2, OP7	P3, P6 EP3, EP6 OP3, OP6, LLT, KO, ERCOT_98
Autotransformer, Transmission Lines and Series Reactors	100%	Rate 1	Rate 2

Table 3.4.1: Oncor Ratings for Power Flow Models

The study cases with the 853 MW load addition and the 1345 MW load additions for the 2028 and 2030 cases respectively were evaluated under the same N-1 contingency set. Where new violations were observed, SCRD was applied to determine whether a relieving generator dispatch pattern exists. Elements that remained unsecurable after SCRD in the study case were identified as candidates for system upgrades.

3.5 N-1 Analysis: Voltage

Benchmark Case and Study cases were screened for steady-state voltage criteria on all buses at or above 60kV in the study footprint. Per-unit voltages were recorded pre and post-contingency then compared to the according to Oncor criteria seen below,

1. Check for high/low violations against the applicable maximum and minimum in pre-contingency (N-0) and post-contingency (N-1).
2. Evaluate the pre- to post-contingency voltage deviation at each bus against the Oncor maximum deviation limit for that kV level.

Voltage Limits

Element	Normal System	Post Contingency ERCOT	Post Contingency Oncor		Deviation ERCOT ²
			P0, P1, P2, P4, P5, P7 EP1, EP7 OP1, OP2, OP7	P3, P6 EP3, EP6 OP3, OP6 LLT, KO, ERCOT_98	
Bus	0.95 ¹ - 1.05 ¹	0.90 ¹ - 1.05 ¹	0.95 ¹ - 1.05 ¹	0.90 ¹ - 1.05 ¹	x
Load Serving Bus	x	X	x		8%

Notes:

¹ Per ERCOT System Operating Limit (SOL) Methodology, Oncor provides to ERCOT any voltage limits it utilizes in its operations that deviate from the default limits, and these non-default voltage limits are also utilized in Planning Assessments. Some examples for Oncor include UVLS buses and NUC-001/STA-629 requirements.

² Only applies to contingencies with the lowest kV element above 100 kV. If a step-up transformer is part of the contingency definition, the transformer high side kV level needs to be above 100 kV.

Table 3.5.1: Oncor Voltage Criteria

3.6 Planned Upgrades Sensitivity

If N-0 or N-1 violations remain in study after security-constrained redispatch (SCRD), an upgrade sensitivity is performed to evaluate feasible mitigations consistent with ERCOT/TO planning practice. Mitigation cases are created by modeling (i) **planned TPIT/Local Plan** upgrades per current postings; (ii) **queue-driven** reinforcements; and, where needed for scoping, (iii) **conceptual** reinforcements consistent with TO standards (e.g., reconductoring/transformer upgrades, dynamic/reactive additions). A mitigation is considered effective if N-0 flows are within **Rate 1** and post-contingency flows are securable within **Rate 2** without introducing secondary thermal or voltage violations.

4.0 Steady-State Results

4.1 Benchmark Analysis: Thermal and Voltage

Per Oncor procedure, all taps, shunts, reactive power devices and DC lines were allowed to adjust post contingency while phase shifters were allowed to adjust if they were deemed capable of impacting the utility area. Several voltage and thermal constraints were noted in the benchmark ERCOT SSWG Cases in both 2028 and 2030.

4.2 N-0 Analysis: Thermal

Case 1: ERCOT SSWG 2028

With the 853 MW load addition modeled in the study case, the system intact (N-0) AC solution resulted in **zero** new thermal constraints or thermal constraints exacerbated by the project.

Therefore, N-0 system upgrades are unlikely to be required in the **2028** scenario.

Case 2: ERCOT SSWG 2030

With the 853 MW load addition modeled in the study case, the system intact (N-0) AC solution resulted in **zero** new thermal constraints or thermal constraints exacerbated by the project.

Therefore, N-0 system upgrades are unlikely to be required in the **2030** scenario.

4.3 N-1 Analysis: Thermal

Case 1: ERCOT SSWG 2028

AC Contingency Analysis was performed on the study case with the 853 MW Load Addition. The dispatch showed numerous thermal violations occurring, all previously identified at a nearly equal loading level prior to the addition of the project. A security constrained re-dispatch was applied to attempt at securing these elements to within applicable ratings. **Therefore, N-1 system upgrades are unlikely to be required in the 2028 scenario.**

Case 2: ERCOT SSWG 2030

AC Contingency Analysis was performed on the study case with the 1345 MW Load Addition. The dispatch showed numerous thermal violations occurring, but all were previously identified at a nearly equal loading level prior to the addition of the project. A security constrained re-dispatch was applied

to attempt at securing these elements to within applicable ratings. **Therefore, N-1 system upgrades are unlikely to be required in the 2030 scenario.**

4.4 N-0 Analysis: Voltage

Several N-0 voltage violations were noted in the baseline case without the inclusion of the load project in both cases. These were recorded and evaluated with the load additions in both scenarios and showed that the project does **not create or exacerbate** any issues.

4.5 N-1 Analysis: Voltage

Case 1: ERCOT SSWG 2028: The addition of the 500 MW Load does **not create or exacerbate** any voltage issues in the Oncor and surrounding areas.

Case 2: ERCOT SSWG 2030-Westfield - Mullang 345 kV: The addition of the 1345 MW load causes the exacerbation of voltage issues on the Oncor system. Below are the violations and the impact the project had on them:

Bus Name	Voltage Level	Cont Name	Type	Benchmark Cont Volt	Study Cont Volt	Difference
GARRYGS_8	69	DB_ID_56766	Exacerbated	0.88741	0.87771	-0.010
MOORE	69	DB_ID_56766	Exacerbated	0.88744	0.87777	-0.010

Considering the low voltage profile on the 69 kV system in the vicinity of the bus existing in the case, it is likely that TO mitigation will be helpful in also mitigating the violation at this bus. However, a potential solution is proposed in case TO mitigation is ineffective.

4.6 Planned Upgrades Sensitivity

Across all cases, all thermal violations were secured via **SCRD** within applicable ratings, and any pre-existing violations were not exacerbated by the addition of the project. The proposed mitigation for these violations is one (1) shunt capacitor banks rated at 10 MVAR to provide a reactive power injection that will support the terminal bus voltage. These will have to be installed locally on the 69 kV system to ensure appropriate voltage support. The cost estimate, derived from ISO-released cost information for new equipment installation, is approximately **\$1.5 million**.

5.0 Conclusions

Steady-state thermal and voltage analysis indicates the proposed 853 MW load interconnection in 2028 has adequate thermal and voltage performance, but the 1345 MW load in 2030 has low-voltage violations observed under contingency in the 2030 case. One (1) 10 MVAR shunt capacitor bank was identified as a potential mitigation to support local voltage.

- **2028 SSWG Case:**

- **N-0:** All base case overloads within the utility region secured to within thermal limits with generation re-dispatch. Any pre-existing overloads were recorded and evaluated to see if the addition of the load project exacerbated these overloads. Findings indicate that the addition of the load does not have an impact on the pre-existing overloads.
- **N-1:** The dispatch showed numerous thermal violations occurring but they were previously identified at a nearly equal loading level prior to the addition of the project. A security constrained re-dispatch mitigation capable of securing each constraint to within its respective thermal loading was applied. **Therefore, N-1 system upgrades are unlikely to be required in the 2028 scenario.**
- **Voltage (N-0/N-1):** No exacerbation of pre-existing issues or new voltage violations were noted in the analysis.
- **Upgrade Implications:** None

- **2030 SSWG Case:**

- **N-0:** All base case overloads within the utility region secured to within thermal limits with generation re-dispatch. Any pre-existing overloads were recorded and evaluated to see if the addition of the load project exacerbated these overloads. Findings indicate that the addition of the load does not have an impact on the pre-existing overloads.
- **N-1:** The dispatch showed numerous thermal violations occurring but they were previously identified at a nearly equal loading level prior to the addition of the project. A security constrained re-dispatch mitigation capable of securing each constraint to within its respective thermal loading was applied. **Therefore, N-1 system upgrades are unlikely to be required in the 2030 scenario.**

- **Voltage (N-0/N-1):** Steady-State voltage violations were identified. In particular, low voltage violations that were exacerbated by the project were identified on the Oncor 69 kV system in 2030.
- **Upgrade Implications:** One (1) 10 MVAR Shunt Capacitor bank on the 69 kV system was identified as an upgrade at a cost of ~\$1.5 million.

Implications:

- **Upgrades:** One (1) shunt capacitor of ~10 MVAR at 69 kV is the only likely reinforcement needed to address the single observed voltage violation. No additional thermal upgrades are required across any of the study years once SCRD is applied.
- **Interconnection cost/schedule:** Beyond the standard Oncor/ERCOT interconnection process costs, upgrade exposure is expected to be limited.
- **Remaining studies:** Final requirements remain contingent on ERCOT/Oncor short-circuit and stability assessments, and on ERCOT's formal solution selection process.

Case	N-0 Thermal Violations	N-0 Mitigation	N-1 Thermal Violations	N-1 Mitigation	Voltage (N-0/N-1) Violations	Upgrade
2028 SSWG	Multiple Base Case Overloads	Not required	Multiple overloads observed at all voltage levels	SCRD secured within Rate 2	Multiple base case voltage violations identified	No upgrades expected
2030 SSWG	Multiple Base Case Overloads	Not required	Multiple overloads observed at all voltage levels	SCRD secured within Rate 2	Multiple base case voltage violations identified. Voltages exacerbated by the project identified.	One (1) 10 MVAR Capacitor Bank, ~\$1.5 million

Table 5.1: N-0, N-1 Results Summary

Note, this study is based on a real powerflow on a substation chosen at random with names and locations anonymized.