

# Goldthwaite to Lampasas

## Transmission Line Upgrade

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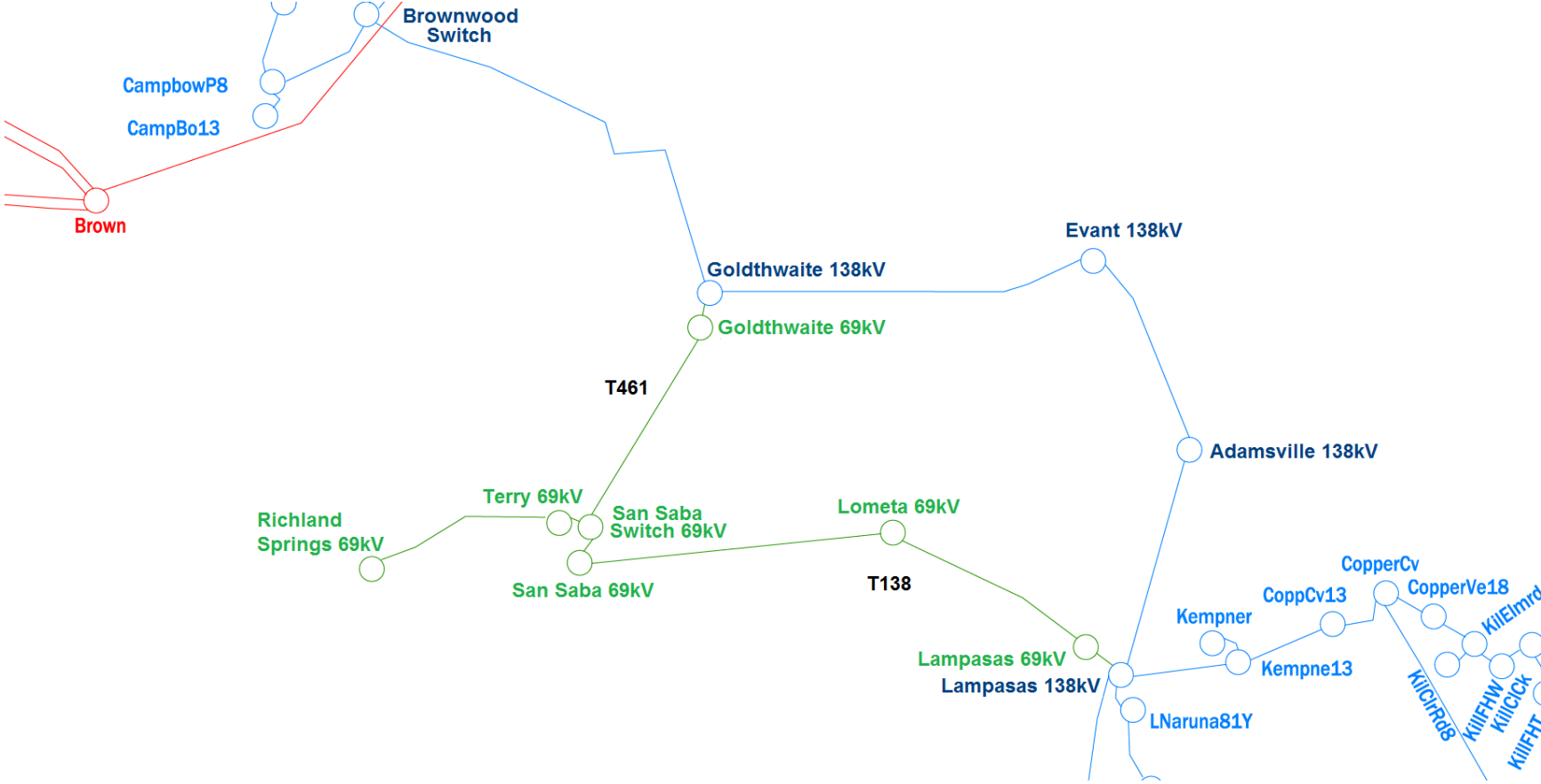
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**LCRA Dynamic and VAR Planning**

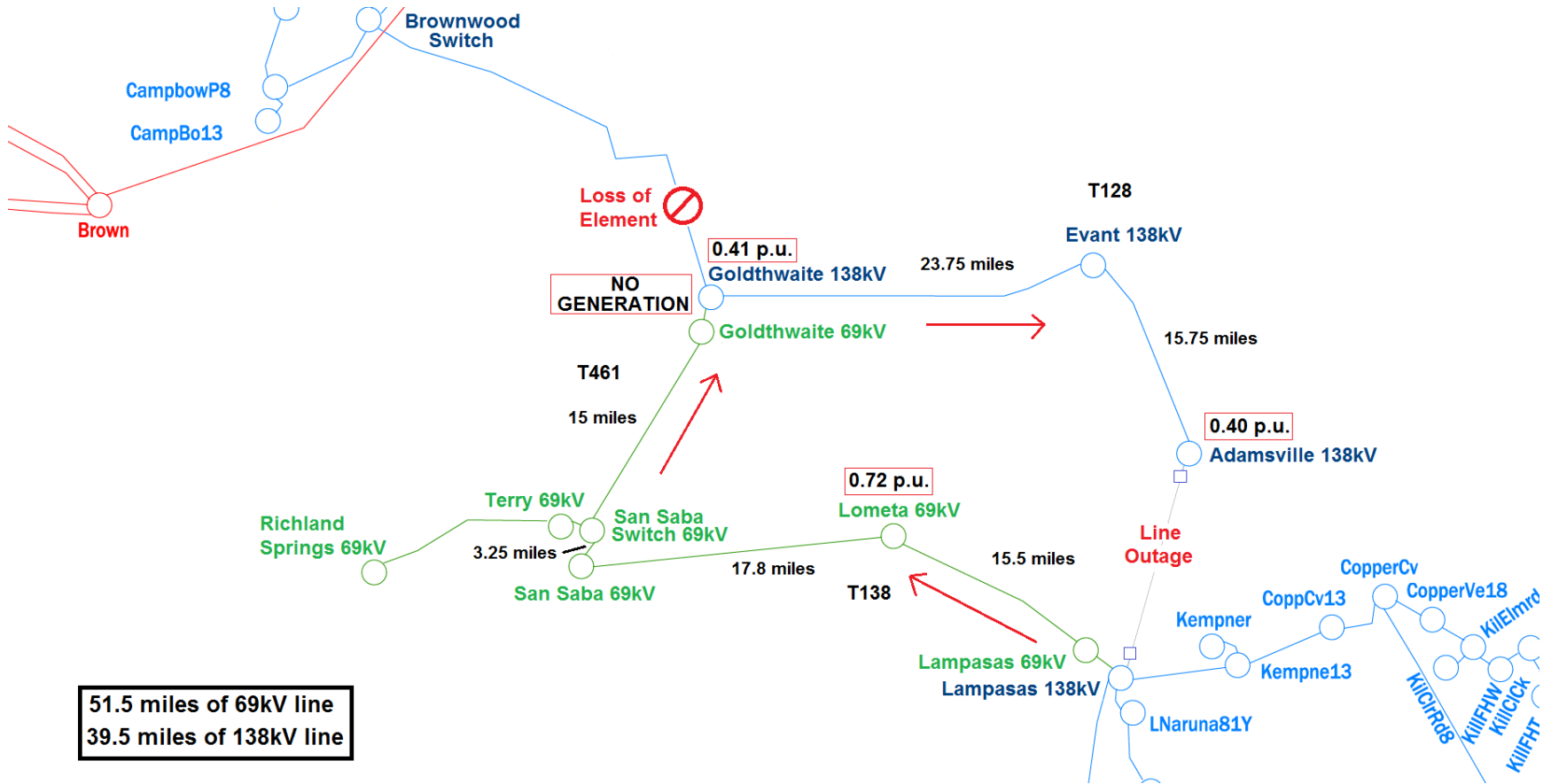
# Objectives

- Background
- Summary of Problem
- Proposed Solution
- Results of the Proposed Solution
- Benefits of the Proposed Solution

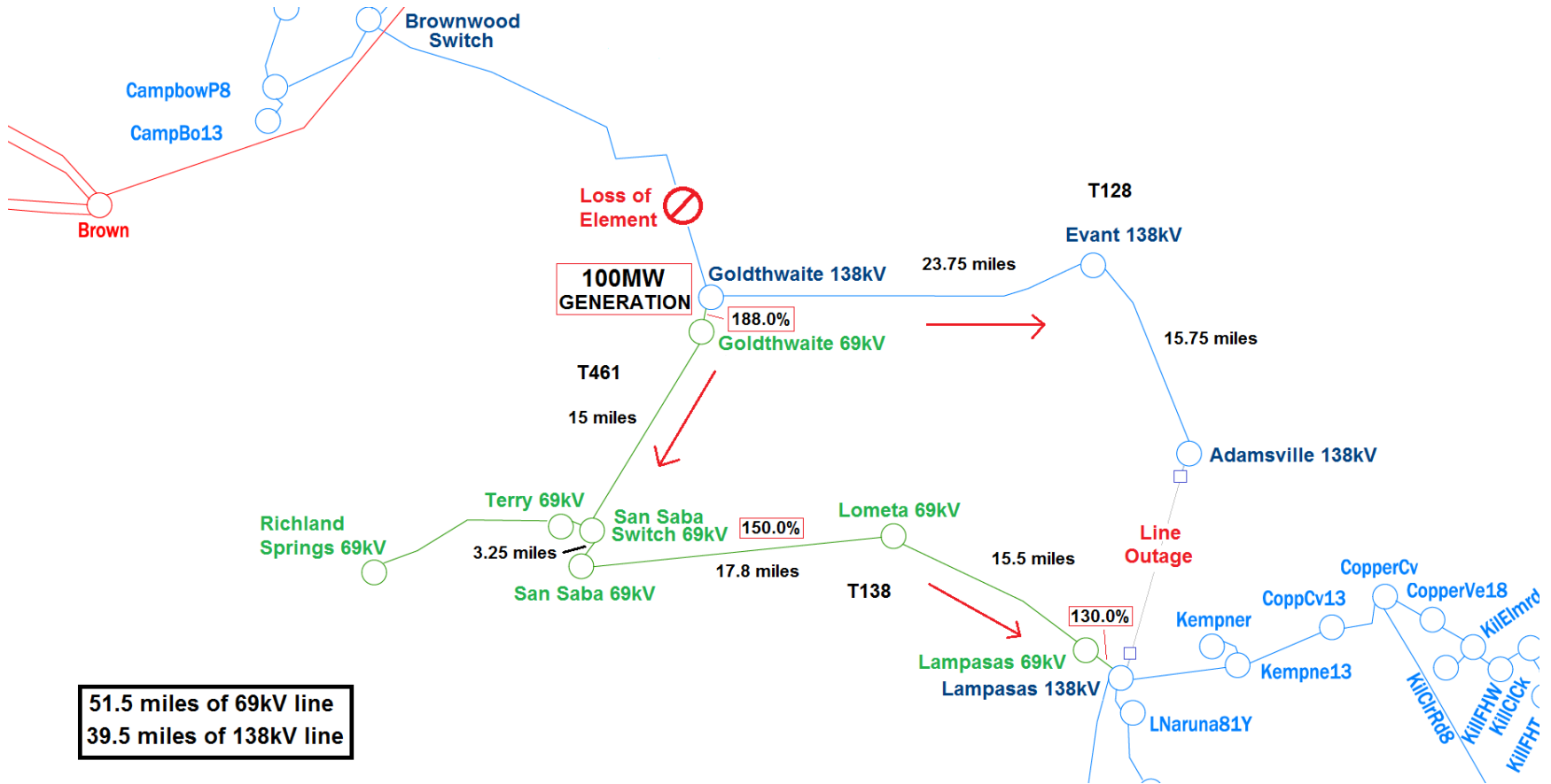
# Background



# Post Contingency Power Flow



# Post Contingency Power Flow



# Thermal and Voltage Violations

**Summer Peak Loading Based on 105° F Rating of 42 MVA for T-461 and T-138 (80° F Rating = 48 MVA)**

<b>Wind in Service + Lampasas to Adamsville Maintenance Outage + Loss of Goldthwaite to Brownwood SW</b>						
<b>Summer 2014 Peak Load Case</b>	<b>Wind Gen OFF</b>	<b>20 MW Wind</b>	<b>40 MW Wind</b>	<b>60 MW Wind</b>	<b>80 MW Wind</b>	<b>100 MW Wind</b>
<b>Element</b>	<b>LOADING</b>	<b>LOADING</b>	<b>LOADING</b>	<b>LOADING</b>	<b>LOADING</b>	<b>LOADING</b>
Goldthwaite AUTO XFMR	72.00% 13MVA	3.00% 0.4MW	50.00% 20MW	93.00% 40MVA	136.00% 60MVA	188.00% 80MVA
Goldthwaite to San Saba SW	75.00% 15MVA	3.00% 0.4MW	52.00% 20MW	97.00% 40MVA	143.00% 60MVA	197.00% 79MVA
San Saba SW to San Saba	93.00% 19MVA	11.00% 4.4MW	43.00% 15MW	88.00% 32MVA	133.00% 48MVA	185.00% 62MVA
San Saba to Lometa	123.00% 34MVA	45.00% 15MW	14.00% 5.1MW	54.00% 22MVA	99.00% 38MVA	150.00% 50MVA
Lometa to Lampasas	142.00% 47MVA	55.00% 21MW	5.00% 0.7MW	42.00% 15MVA	88.00% 28MVA	140.00% 35MVA
Lampasas AUTO XFMR	132.00% 47MVA	51.00% 21MW	5.00% 0.7MW	39.00% 15MVA	81.00% 25MVA	130.00% 28MVA

**Summer Peak Voltage Violations Less than 0.92 p.u.**

<b>Wind in Service + Lampasas to Adamsville Maintenance Outage + Loss of Goldthwaite to Brownwood SW</b>						
<b>Summer 2014 Peak Load Case</b>	<b>Wind Gen OFF</b>	<b>20 MW Wind</b>	<b>40 MW Wind</b>	<b>60 MW Wind</b>	<b>80 MW Wind</b>	<b>100 MW Wind</b>
<b>BUS</b>	<b>Voltage</b>	<b>Voltage</b>	<b>Voltage</b>	<b>Voltage</b>	<b>Voltage</b>	<b>Voltage</b>
LAMPASAS 138kV	0.9722	1.0033	1.0026	0.9977	0.9888	0.9739
LAMPASAS 69kV	0.9016	1.0195	1.0067	0.9798	0.9388	0.8742
LOMETA 69kV	0.7207	1.0068	1.0106	0.985	0.9298	0.8213
SAN SABA 69kV	0.5534	1.0142	1.0307	1.0129	0.9606	0.8447
SAN SABA SW 69kV	0.5282	1.0116	1.0298	1.0146	0.966	0.8559
TERRY 69kV	0.5279	1.0114	1.0296	1.0145	0.9658	0.8557
RICHLAND SPRINGS 69kV	0.5182	1.0061	1.0244	1.0091	0.9601	0.8491
GOLDTHWAITE 138kV	0.4077	1.0062	1.0127	1.0115	1.0027	0.9809
GOLDTHWAITE 69kV	0.4363	1.0096	1.0381	1.0423	1.0231	0.9638
EVANT 138kV	0.4028	1.0054	1.0119	1.0107	1.0018	0.9799
ADAMSVILLE 138kV	0.4012	1.0048	1.0114	1.0101	1.0012	0.9793

# Contingency Analysis

2017 High Wind Low Load N-1 Overload Violations (GWEC Wind Dispatch = 137 MW)

FROM BUS	TO BUS	CKT	Type	Contingency 1	Contingency 2	105°F Rating	Flow	%
L_GOLDTH9_1Y69.0	L_SASASW9_1Y69.0	1	N-1	Goldthwaite - Lampasas 138kV	NONE	42	49.5	116
L_GOLDTH8_1Y138.0	L_GOLDTH9_1Y69.0	1	N-1	Goldthwaite - Lampasas 138kV	NONE	44	49.5	112
L_SASASW9_1Y69.0	L_SANSAB9_1Y69.0	1	N-1	Goldthwaite - Lampasas 138kV	NONE	42	42.3	109
L_SANSAB9_1Y69.0	L_LOMETA9_1Y69.0	1	N-1	Goldthwaite - Lampasas 138kV	NONE	42	36.4	99

2017 High Wind Low Load N-1-1 Overload Violations (GWEC Wind Dispatch = 137 MW)

FROM BUS	TO BUS	CKT	Type	Contingency 1	Contingency 2	105°F Rating	Flow	%
L_GOLDTH9_1Y69.0	L_SASASW9_1Y69.0	1	N-1-1	Goldthwaite - Lampasas 138kV	Lampasas - Copperas Cove	42	54.5	128
L_GOLDTH8_1Y138.0	L_GOLDTH9_1Y69.0	1	N-1-1	Goldthwaite - Lampasas 138kV	Lampasas - Copperas Cove	44	54.7	124
L_SASASW9_1Y69.0	L_SANSAB9_1Y69.0	1	N-1-1	Goldthwaite - Lampasas 138kV	Lampasas - Copperas Cove	42	46.3	121
L_SANSAB9_1Y69.0	L_LOMETA9_1Y69.0	1	N-1-1	Goldthwaite - Lampasas 138kV	Lampasas - Copperas Cove	42	40.3	111
L_LAMPAS8_1Y138.0	L_LAMPAS9_1Y69.0	1	N-1-1	Goldthwaite - Lampasas 138kV	Lampasas - Copperas Cove	45	29.3	101
L_LOMETA9_1Y69.0	L_LAMPAS9_1Y69.0	1	N-1-1	Goldthwaite - Lampasas 138kV	Lampasas - Copperas Cove	42	33.2	106





# Results of Line Upgrade

## Fall, Spring, and Summer Rate A Element Loadings

Convert Goldthwaite to Lampasas	Wind Gen OFF	100 MW Wind	Wind Gen OFF	100 MW Wind	Wind Gen OFF	100 MW Wind
ELEMENT	SPRING LOADING	SPRING LOADING	FALL LOADING	FALL LOADING	SUMMER LOADING	SUMMER LOADING
Goldthwaite to San Saba SW	7.00% 16MVA	38.00% 84MVA	7.00% 15MVA	38.00% 85MVA	9.00% 20MVA	36.00% 80MVA
San Saba SW to San Saba	9.00% 20MVA	36.00% 79MVA	9.00% 19MVA	37.00% 81MVA	11.00% 25MVA	34.00% 75MVA
San Saba to Lometa	13.00% 28MVA	33.00% 72MVA	12.00% 27MVA	34.00% 74MVA	16.00% 34MVA	30.00% 66MVA
Lometa to Lampasas	15.00% 33MVA	31.00% 67MVA	14.00% 31MVA	32.00% 70MVA	18.00% 40MVA	27.00% 60MVA

## Fall, Spring, and Summer Bus Voltages

Convert Goldthwaite to Lampasas	Wind Gen OFF	100 MW Wind	Wind Gen OFF	100 MW Wind	Wind Gen OFF	100 MW Wind
BUS	SPRING VOLTAGE	SPRING VOLTAGE	FALL VOLTAGE	FALL VOLTAGE	SUMMER VOLTAGE	SUMMER VOLTAGE
L_LAMPAS8_1Y	0.9992	1.0055	1.0205	1.0189	0.9946	1.0013
L_ADAMSV8_1Y	0.992	1.0047	1.0161	1.01	0.981	1.0012
L_EVANT_8_1Y	0.9924	1.0051	1.0164	1.0103	0.9816	1.0018
L_GOLDTH8_1Y	0.9927	1.0053	1.0163	1.0103	0.9826	1.0027
L_SASASW9_1Y	0.9921	1.0008	1.0156	1.0086	0.9823	0.9969
L_SASASW8_1Y	0.9935	1.0022	1.0167	1.0097	0.9844	0.9989
L_TERRY_9_1Y	0.992	1.0006	1.0155	1.0084	0.9821	0.9967
L_RICHSP9_1Y	0.9875	0.9963	1.0115	1.0044	0.9765	0.9913
L_SANSAB8_1Y	0.9937	1.0018	1.0168	1.0099	0.9849	0.9984
L_LOMETA8_1Y	0.9964	1.0027	1.0187	1.0137	0.9896	0.999

# Results of Line Upgrade

**2017 High Wind Low Load N-1 with Line Upgrade (GWEC Wind Dispatch = 137 MW)**

FROM BUS	TO BUS	CKT	Type	Contingency 1	Contingency 2	105°F Rating	Flow	%
L_GOLDTH8_1Y138.0	L_SASASW8_1Y138.0	1	N-1	Goldthwaite - Lampasas 138kV	NONE	220	178.8	80
L_SASASW8_1Y138.0	L_SANSAB8_1Y138.0	1	N-1	Goldthwaite - Lampasas 138kV	NONE	220	173	78
L_SANSAB8_1Y138.0	L_LOMETA8_1Y138.0	1	N-1	Goldthwaite - Lampasas 138kV	NONE	220	167.4	76
L_LOMETA8_1Y138.0	L_LAMPAS8_1Y138.0	1	N-1	Goldthwaite - Lampasas 138kV	NONE	220	161.9	75

**2017 High Wind Low Load N-1-1 with Line Upgrade (GWEC Wind Dispatch = 137 MW)**

FROM BUS	TO BUS	CKT	Type	Contingency 1	Contingency 2	105°F Rating	Flow	%
L_GOLDTH8_1Y138.0	L_SASASW8_1Y138.0	1	N-1-1	Goldthwaite - Lampasas 138kV	Lampasas - Copperas Cove	220	188.8	84
L_SASASW8_1Y138.0	L_SANSAB8_1Y138.0	1	N-1-1	Goldthwaite - Lampasas 138kV	Lampasas - Copperas Cove	220	182.6	83
L_SANSAB8_1Y138.0	L_LOMETA8_1Y138.0	1	N-1-1	Goldthwaite - Lampasas 138kV	Lampasas - Copperas Cove	220	176.9	80
L_LOMETA8_1Y138.0	L_LAMPAS8_1Y138.0	1	N-1-1	Goldthwaite - Lampasas 138kV	Lampasas - Copperas Cove	220	171.1	79

# Benefits

- Eliminate thermal and voltage violations
- Maximizes generation deliverability in the area
- Eliminate a ~\$15 million 69-kV line overhaul
- Optimizes the existing right-of-way
- Accommodates future load growth