



***Feasibility Study  
For  
Generation Interconnection  
Request  
GEN-2007-009***

***SPP Tariff Studies  
(#GEN-2007-009)***

**August, 2007**

## **Executive Summary**

<OMITTED TEXT> (Customer) has requested a Feasibility Study for the purpose of interconnecting 200 MW of wind generation within the control area of Southwestern Public Service (SPS) located in Gray County, Texas. The proposed method and point of interconnection is to add a new 115 kV line terminal at the existing Bowers Interchange, owned by SPS. The proposed in-service date is December 1, 2009.

Power flow analysis has indicated that for the powerflow cases studied, it is possible to interconnect the 200 MW of generation with transmission system reinforcements within the local transmission system. In order to maintain acceptable reactive power compensation, the customer will be required to pay for the installation of a combined total of at least 34 Mvar of 34.5 kV capacitor bank(s) to be installed in the Customer's collector substation. Dynamic Stability studies performed as part of the System Impact Study will provide additional guidance as to whether the required reactive compensation can be static or a portion must be dynamic (such as a SVC).

The requirement to interconnect the 200 MW of wind generation into the existing Bowers Interchange consists of reconfiguring the 115 kV bus and adding a new 115 kV line terminal. This will call for the need to install two 115 kV circuit breakers. The Customer did not propose a specific route for the 115 kV line extending to serve its 115/34.5 kV facilities. It is assumed that obtaining all necessary right-of-way for the new transmission line to serve its facilities will not be a significant expense.

The total minimum cost for building the required facilities for this 200 MW of generation is \$1,357,749. These costs are shown in Table 2. Network constraints in the American Electric Power West (AEPW), SPS, and Western Farmers Electric Cooperative (WFEC) transmission systems that were identified are shown in Table 3. These Network constraints will have to be verified with a Transmission Service Request (TSR) and associated studies. Network Constraints are in the local area of the new generation when this generation is sunk throughout the SPP footprint for the Energy Resource (ER) Interconnection request. With a defined source and sink in a Transmission Service Request, this list of Network Constraints will be refined and expanded to account for all Network Upgrade requirements. This cost does not include building the 115 kV line from the Customer 115/34.5 kV collector substation into the point of interconnection. This cost also does not include the Customer's 115/34.5 kV collector substation or the 34.5 kV, 34 Mvar capacitor bank(s).

In Table 4, a value of Available Transfer Capability (ATC) associated with each overloaded facility is included. These values may be used by the Customer for future analyses including the determination of lower generation capacity levels that may be installed. When transmission service associated with this interconnection is evaluated, the loading of the facilities listed in this table may be greater due to higher priority reservations. If the loading of a facility is higher, the level of ATC will be lower.

There are several other proposed generation additions in the general area of the Customer's facility. It was assumed in this preliminary analysis that not all of these other projects within the AEPW and SPS control areas will be in service. Those previously queued projects that have advanced to nearly complete phases were included in this Feasibility Study. In the event that another request for a generation interconnection with a higher priority withdraws, then this request may have to be re-evaluated to determine the local Network Constraints.

The required interconnection costs listed in Tables 1 and 2 and other upgrades associated with Network Constraints do not include all costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies if the Customer submits a Transmission Service Request through Southwest Power Pool's OASIS.

## Introduction

<OMITTED TEXT> (Customer) has requested a Feasibility Study for the purpose of interconnecting 200 MW of wind generation within the control area of Southwestern Public Service (SPS) located in Gray County, Texas. The proposed method and point of interconnection is to add a new 115 kV breaker and terminal at the existing Bowers Interchange, owned by SPS. The proposed in-service date is December 1, 2009.

## Interconnection Facilities

The primary objective of this study is to identify the system problems associated with connecting the plant to the area transmission system. The Feasibility and other subsequent Interconnection Studies are designed to identify attachment facilities, Network Upgrades and other Direct Assignment Facilities needed to accept power into the grid at the interconnection receipt point.

The requirements for interconnection of the 200 MW consist of reconfiguring the 115 kV bus, adding two new 115 kV breakers, and one 115 kV line terminal at the existing Bowers Interchange, owned by SPS. The Customer did not propose a specific route of its 115 kV line to serve its 115/34.5 kV collection system facilities. It is assumed that obtaining all necessary right-of-way for construction of the Customer 115 kV transmission line and the 115/34.5 kV collector substation will not be a significant expense.

The minimum cost for adding the new breakers and terminating the transmission line serving GEN-2007-009 facilities is estimated at \$1,357,749. These costs are listed in Tables 1 and 2. These estimates will be refined during the development of the System Impact Study based on the final designs. This cost does not include building the Customer's 115 kV transmission line extending from the point of interconnection to serve its 115/34.5 kV collection facilities. This cost also does not include the Customer's 115/34.5 kV collector substation or the 34 Mvar of capacitor bank(s), all of which should be determined by the Customer. The Customer is responsible for these 115 – 34.5 kV facilities up to the point of interconnection. Other Network Constraints in the American Electric Power West (AEPW), SPS, Sunflower and Western Farmers Electric Cooperative (WFEC) transmission systems that were identified are shown in Table 3.

**These costs do not include any cost that might be associated with short circuit study results or dynamic stability study results.** These costs will be determined when and if a System Impact Study is conducted.

A preliminary one-line drawing of the interconnection facilities are shown in Figure 1.

# Interconnection Estimated Costs

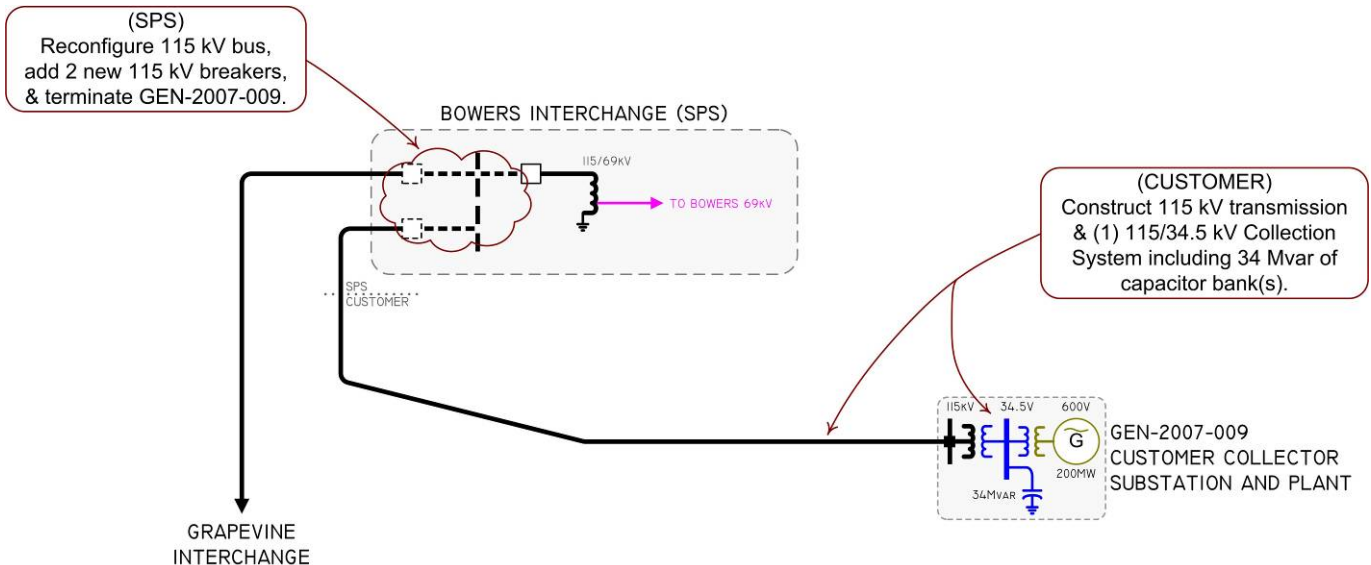
**TABLE 1: Direct Assignment Facilities**

FACILITY	ESTIMATED COST (2007 DOLLARS)
Customer – (1) 115/34.5 kV Customer collector substation facilities.	*
Customer – (1) 115 kV transmission line from Customer collector substation to the Bowers Interchange.	*
Customer – 34.5 kV, 34 Mvar capacitor bank(s) to be installed in the Customer 115/34.5 kV collector substation.	*
Customer – Right-of-Way for all Customer facilities.	*
<b>TOTAL</b>	<b>*</b>

\* Estimates of cost to be determined.

**TABLE 2: Required Interconnection Network Upgrade Facilities**

FACILITY	ESTIMATED COST (2007 DOLLARS)
SPS – Reconfigure 115 kV bus, add two new 115 kV circuit breakers, and 115 kV line terminal for GEN-2007-009 at Bowers Interchange.	\$1,357,749
<b>TOTAL</b>	<b>\$1,357,749</b>



**FIGURE 1: Proposed Method of Interconnection (Final design to be determined)**

## **Powerflow Analysis**

A powerflow analysis was conducted for the facility using modified versions of the 2009 winter peak model, the 2012 summer and winter peak models, and the 2017 summer peak model. The output of the Customer's facility was offset in each model by a reduction in output of existing online SPP generation. This method allows the request to be studied as an Energy Resource (ER) Interconnection request. The proposed in-service date of the generation is December 1, 2009. The available seasonal models used were through the 2017 Summer Peak of which is the end of the current SPP planning horizon.

The Customer's project is located in an area that has limited transmission facilities compared with the amount of generation in the previous queued requests in the SPP generation interconnection queue. Currently, in the area between Nichols and Elk City on the 230 kV line and the parallel 115 kV line there are over 1,400 MW of requested study generation. Following current practice, this analysis was conducted assuming the previous queued requests in this immediate area were in service. Currently, no new transmission facilities in this immediate area have commitments to be built. The analysis of the Customer's project indicates that, given the requested generation level of 200 MW and location, additional criteria violations will occur on the existing AEPW, SPS, and WFEC transmission systems under steady state and contingency conditions in the peak seasons. Table 3 lists these overloaded facilities.

In Table 4, a value of Available Transfer Capability (ATC) associated with each overloaded facility is included. These values may be used by the Customer to determine lower generation capacity levels that may be installed. When transmission service associated with this interconnection is evaluated, the loading of the facilities listed in this table may be greater due to higher priority reservations. When a facility is overloaded for more than one contingency, only the highest loading on the facility for each season is included in the table.

Numerous voltage violations for load serving buses within the SPP footprint were also observed for the some of the contingencies listed in Table 3. These voltage violations have not been listed in this report.

In order to maintain a zero reactive power flow exchanged at the point of interconnection, additional reactive compensation is required. The Customer will be required to install a combined total of 34 Mvar of capacitor bank(s) in the Customer's 115/34.5 kV collector substation on the 34.5 kV bus. Dynamic Stability studies performed as part of the System Impact Study will provide additional guidance as to whether the reactive compensation can be static or a portion must be dynamic (such as a SVC or STATCOM). It is possible that an SVC or STATCOM device will be required at the Customer facility because of FERC Order 661A Low Voltage Ride-Through Provisions (LVRT) which went into effect January 1, 2006. FERC Order 661A orders that wind farms stay on-line for 3-phase faults at the point of interconnection even if that requires the installation of a SVC or STATCOM device.

There are several other proposed generation additions in the general area of the Customer's facility. Some of the local projects that were previously queued were assumed to be in service in this Feasibility Study. Not all local projects that were previously queued and have advanced to nearly complete phases were included in this Feasibility Study.

## **Powerflow Analysis Methodology**

The Southwest Power Pool (SPP) criteria states that: “The transmission system of the SPP region shall be planned and constructed so that the contingencies as set forth in the Criteria will meet the applicable *NERC Planning Standards* for System Adequacy and Security – Transmission System Table I hereafter referred to as NERC Table I) and its applicable standards and measurements”.

Using the created models and the ACCC function of PSS/E, single contingencies in portions or all of the modeled control areas of Sunflower Electric Power Corporation (SUNC), Missouri Public Service (MIPU), Westar (WESTAR), Kansas City Power & Light (KCPL), West Plains (WEPL), Midwest Energy (MIDW), Oklahoma Gas and Electric OKGE, American Electric Power West (AEPW), Grand River Dam Authority (GRDA), Southwestern Public Service Company (SPS), Western Farmers Electric Cooperative (WFEC) and other control areas were applied and the resulting scenarios analyzed. This satisfies the ‘more probable’ contingency testing criteria mandated by NERC and the SPP criteria.

## Powerflow Results

**TABLE 3: Network Constraints**

AREA	OVERLOADED ELEMENT
AEPW	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
AEPW	AMOCO TAP - CHILDRESS 69KV CKT 1
AEPW	CARNEGIE - HOBART JUNCTION 138KV CKT 1
AEPW	CHILDRESS - LAKE PAULINE 138KV CKT 1
AEPW	CLARENDON - JERICHO 69KV CKT 1
AEPW	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
AEPW	CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1
AEPW	CLINTON JUNCTION - ELK CITY 138KV CKT 1
AEPW	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
AEPW	JERICHO - CLARENDON 69KV CKT 1
AEPW	JERICHO (JERIC2WT) 115/69/14.4KV TRANSFORMER CKT 1
AEPW	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1
AEPW	SHAMROCK (SHAMRCK2) 138/69/14.4KV TRANSFORMER CKT 1
AEPW/SPS	MCLEAN RURAL SUB - SHAMROCK 115KV CKT 1
AEPW/WFEC	ALTUS JCT TAP - RUSSELL 138KV CKT 1
AEPW/WFEC	ELDORADO - LAKE PAULINE 69KV CKT 1
AEPW/WFEC	ELK CITY - ELK CITY 69KV CKT 1
AEPW/WFEC	ELK CITY - MOREWOOD SW 138KV CKT 1
AEPW/WFEC	LAKE PAULINE - RUSSELL 138KV CKT 1
AEPW/WFEC	LAKE PAULINE - RUSSELL 138KV CKT 1
AEPW/WFEC	LAKE PAULINE - RUSSELL 138KV CKT 1
AEPW/WFEC	LAKE PAULINE - RUSSELL 138KV CKT 1
SPS	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1
SPS	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1
SPS	CHERRY SUB - NICHOLS STATION 115KV CKT 1
SPS	CHERRY SUB - NORTHWEST INTERCHANGE 115KV CKT 1
SPS	CONWAY SUB - YARNELL SUB 115KV CKT 1
SPS	EAST PLANT INTERCHANGE - MANHATTAN SUB 115KV CKT 1
SPS	EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1
SPS	EAST PLANT INTERCHANGE - WHITAKER SUB 115KV CKT 1
SPS	GRAPEVINE INTERCHANGE - KIRBY SWITCHING STATION 115KV CKT 1
SPS	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
SPS	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1
SPS	HAPPY INTERCHANGE - PALO DURO SUB 115KV CKT 1
SPS	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1
SPS	MANHATTAN SUB - MANHATTAN TAP 115KV CKT 1
SPS	MANHATTAN TAP - OSAGE SWITCHING STATION 115KV CKT 1
SPS	MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1
SPS	MCCULLOUGH SUB - BOWERS INTERCHANGE 69KV CKT 1
SPS	MCCULLOUGH SUB - KINGSMILL INTERCHANGE 69KV CKT 1
SPS	NICHOLS STATION - WHITAKER SUB 115KV CKT 1
SPS	NICHOLS STATION - YARNELL SUB 115KV CKT 1
SPS	OSAGE SWITCHING STATION - PIERCE STREET TAP 115KV CKT 1
SPS	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1
SPS	POTTER COUNTY INTERCHANGE (POTTR CO) 345/230/13.2KV TRANSFORMER CKT 1
SPS	TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1
WFEC	DILL JCT - ELK CITY 69KV CKT 1
WFEC	ELDORADO - ELDORADO JCT 69KV CKT 1
WFEC	ELDORADO JCT - GYPSUM 69KV CKT 1
WFEC	GYPSUM - RUSSELL 69KV CKT 1
AEPW	American Electric Power West
SPS	Southwestern Public Service
WFEC	Western Farmers Electric Cooperative

**TABLE 4: Contingency Analysis**

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
09WP	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	252	0	TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1
09WP	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1	140	246	0	CONWAY SUB - YARNELL SUB 115KV CKT 1
09WP	ELDORADO - LAKE PAULINE 69KV CKT 1	20	235	0	LAKE PAULINE - RUSSELL 138KV CKT 1
09WP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	351	231	0	TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1
09WP	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	224	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
09WP	CLINTON JUNCTION - ELK CITY 138KV CKT 1	143	213	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
09WP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	319	209	0	BASE CASE
09WP	SHAMROCK (SHAMRCK2) 138/69/14.4KV TRANSFORMER CKT 1	69	203	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
09WP	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1	107	195	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1	107	193	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	MCLEAN RURAL SUB - SHAMROCK 115KV CKT 1	107	189	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	LAKE PAULINE - RUSSELL 138KV CKT 1	72	176	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
09WP	ELDORADO - ELDORADO JCT 69KV CKT 1	26	173	0	LAKE PAULINE - RUSSELL 138KV CKT 1
09WP	CONWAY SUB - YARNELL SUB 115KV CKT 1	218	168	0	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1
09WP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	218	167	0	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1
09WP	ELDORADO JCT - GYPSUM 69KV CKT 1	26	164	0	LAKE PAULINE - RUSSELL 138KV CKT 1
09WP	GYPSUM - RUSSELL 69KV CKT 1	26	153	0	LAKE PAULINE - RUSSELL 138KV CKT 1
09WP	JERICO (JERIC2WT) 115/69/14.4KV TRANSFORMER CKT 1	46	147	0	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1
09WP	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1	192	142	0	CLINTON JUNCTION - ELK CITY 138KV CKT 1
09WP	CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1	192	140	0	CLINTON JUNCTION - ELK CITY 138KV CKT 1
09WP	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	63	124	0	BASE CASE
09WP	DILL JCT - ELK CITY 69KV CKT 1	61	124	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
09WP	ELK CITY - MOREWOOD SW 138KV CKT 1	158	123	0	CLINTON JUNCTION - ELK CITY 138KV CKT 1
09WP	TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1	560	114	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	GRAPEVINE INTERCHANGE - KIRBY SWITCHING STATION 115KV CKT 1	195	107	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
09WP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	84	141	14	BASE CASE
09WP	CHILDRESS - LAKE PAULINE 138KV CKT 1	141	114	20	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
09WP	CONWAY SUB - YARNELL SUB 115KV CKT 1	198	121	25	BASE CASE
09WP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	198	120	26	BASE CASE
09WP	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1	112	174	55	BASE CASE
09WP	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1	172	107	76	BASE CASE
09WP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	105	194	96	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1
09WP	CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1	172	105	110	BASE CASE
09WP	AMOCO TAP - CHILDRESS 69KV CKT 1	44	107	128	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	CARNEGIE - HOBART JUNCTION 138KV CKT 1	143	105	132	CLINTON JUNCTION - ELK CITY 138KV CKT 1
09WP	MCCULLOUGH SUB - BOWERS INTERCHANGE 69KV CKT 1	117	126	139	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1
09WP	MCCULLOUGH SUB - KINGSMILL INTERCHANGE 69KV CKT 1	117	117	150	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1
09WP	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	606	101	183	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	ELK CITY - MOREWOOD SW 138KV CKT 1	130	101	183	BASE CASE
09WP	SHAMROCK (SHAMRCK2) 138/69/14.4KV TRANSFORMER CKT 1	63	101	183	BASE CASE
09WP	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1	195	100	200	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1



**TABLE 4: Contingency Analysis (continued)**

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
12SP	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1	128	239	0	CONWAY SUB - YARNELL SUB 115KV CKT 1
12SP	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	238	0	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
12SP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	96	221	0	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1
12SP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	351	216	0	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
12SP	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1	90	213	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12SP	MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1	90	212	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12SP	MCLEAN RURAL SUB - SHAMROCK 115KV CKT 1	90	205	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12SP	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	195	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12SP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	319	194	0	BASE CASE
12SP	ELDORADO - LAKE PAULINE 69KV CKT 1	20	194	0	LAKE PAULINE - RUSSELL 138KV CKT 1
12SP	CLINTON JUNCTION - ELK CITY 138KV CKT 1	143	192	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
12SP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	84	184	0	BASE CASE
12SP	CONWAY SUB - YARNELL SUB 115KV CKT 1	180	183	0	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1
12SP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	180	183	0	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1
12SP	SHAMROCK (SHAMRCK2) 138/69/14.4KV TRANSFORMER CKT 1	69	172	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12SP	JERICHO (JERIC2WT) 115/69/14.4KV TRANSFORMER CKT 1	46	154	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12SP	LAKE PAULINE - RUSSELL 138KV CKT 1	72	144	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12SP	CONWAY SUB - YARNELL SUB 115KV CKT 1	164	143	0	BASE CASE
12SP	ELDORADO - ELDORADO JCT 69KV CKT 1	26	143	0	LAKE PAULINE - RUSSELL 138KV CKT 1
12SP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	164	143	0	BASE CASE
12SP	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1	170	143	0	CLINTON JUNCTION - ELK CITY 138KV CKT 1
12SP	CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1	170	140	0	CLINTON JUNCTION - ELK CITY 138KV CKT 1
12SP	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	63	120	0	BASE CASE
12SP	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	497	119	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12SP	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1	147	111	16	BASE CASE
12SP	ELDORADO JCT - GYPSUM 69KV CKT 1	26	131	45	LAKE PAULINE - RUSSELL 138KV CKT 1
12SP	CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1	147	109	52	BASE CASE
12SP	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1	112	150	79	BASE CASE
12SP	EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1	161	104	94	EAST PLANT INTERCHANGE - MANHATTAN SUB 115KV CKT 1
12SP	EAST PLANT INTERCHANGE - MANHATTAN SUB 115KV CKT 1	161	104	113	EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1
12SP	GRAPEVINE INTERCHANGE - KIRBY SWITCHING STATION 115KV CKT 1	161	119	119	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12SP	JERICHO (JERIC2WT) 115/69/14.4KV TRANSFORMER CKT 1	42	107	119	BASE CASE
12SP	GYPSUM - RUSSELL 69KV CKT 1	26	115	130	LAKE PAULINE - RUSSELL 138KV CKT 1
12SP	ALTUS JCT TAP - RUSSELL 138KV CKT 1	72	109	134	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12SP	MCCULLOUGH SUB - KINGSMILL INTERCHANGE 69KV CKT 1	97	131	136	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1
12SP	JERICHO - CLARENDON 69KV CKT 1	67	103	156	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12SP	MCCULLOUGH SUB - BOWERS INTERCHANGE 69KV CKT 1	97	113	156	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1
12SP	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1	161	121	166	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1
12SP	CHERRY SUB - NICHOLS STATION 115KV CKT 1	161	101	169	NICHOLS STATION - WHITAKER SUB 115KV CKT 1
12SP	ELK CITY - MOREWOOD SW 138KV CKT 1	158	101	182	CLINTON JUNCTION - ELK CITY 138KV CKT 1
12SP	NICHOLS STATION - WHITAKER SUB 115KV CKT 1	249	100	189	EAST PLANT INTERCHANGE 230/115KV TRANSFORMER CKT 1
12WP	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	250	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
12WP	ELDORADO - LAKE PAULINE 69KV CKT 1	20	246	0	LAKE PAULINE - RUSSELL 138KV CKT 1

**TABLE 4: Contingency Analysis (continued)**

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
12WP	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1	140	242	0	CONWAY SUB - YARNELL SUB 115KV CKT 1
12WP	CLINTON JUNCTION - ELK CITY 138KV CKT 1	143	221	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
12WP	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	221	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12WP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	319	216	0	BASE CASE
12WP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	351	204	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
12WP	SHAMROCK (SHAMRCK2) 138/69/14.4KV TRANSFORMER CKT 1	69	203	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12WP	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1	107	199	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1	107	198	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	MCLEAN RURAL SUB - SHAMROCK 115KV CKT 1	107	194	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	ELDORADO - ELDORADO JCT 69KV CKT 1	26	181	0	LAKE PAULINE - RUSSELL 138KV CKT 1
12WP	LAKE PAULINE - RUSSELL 138KV CKT 1	72	173	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12WP	ELDORADO JCT - GYPSUM 69KV CKT 1	26	172	0	LAKE PAULINE - RUSSELL 138KV CKT 1
12WP	JERICO (JERIC2WT) 115/69/14.4KV TRANSFORMER CKT 1	46	165	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	CONWAY SUB - YARNELL SUB 115KV CKT 1	218	165	0	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1
12WP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	218	165	0	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1
12WP	GYPSUM - RUSSELL 69KV CKT 1	26	160	0	LAKE PAULINE - RUSSELL 138KV CKT 1
12WP	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1	192	149	0	CLINTON JUNCTION - ELK CITY 138KV CKT 1
12WP	CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1	192	147	0	CLINTON JUNCTION - ELK CITY 138KV CKT 1
12WP	DILL JCT - ELK CITY 69KV CKT 1	61	130	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
12WP	ELK CITY - ELK CITY 69KV CKT 1	72	123	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
12WP	ELK CITY - MOREWOOD SW 138KV CKT 1	158	123	0	CLINTON JUNCTION - ELK CITY 138KV CKT 1
12WP	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1	172	112	0	BASE CASE
12WP	CHILDRESS - LAKE PAULINE 138KV CKT 1	141	112	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12WP	CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1	172	111	0	BASE CASE
12WP	ALTUS JCT TAP - RUSSELL 138KV CKT 1	72	128	1	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	84	144	4	BASE CASE
12WP	GRAPEVINE INTERCHANGE - KIRBY SWITCHING STATION 115KV CKT 1	195	108	27	NICHOLS STATION - YARNELL SUB 115KV CKT 1
12WP	CARNEGIE - HOBART JUNCTION 138KV CKT 1	143	111	42	CLINTON JUNCTION - ELK CITY 138KV CKT 1
12WP	CONWAY SUB - YARNELL SUB 115KV CKT 1	198	118	43	BASE CASE
12WP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	198	118	43	BASE CASE
12WP	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1	112	172	58	BASE CASE
12WP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	105	195	94	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1
12WP	AMOCO TAP - CHILDRESS 69KV CKT 1	44	108	113	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12WP	MCCULLOUGH SUB - BOWERS INTERCHANGE 69KV CKT 1	117	123	140	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1
12WP	SHAMROCK (SHAMRCK2) 138/69/14.4KV TRANSFORMER CKT 1	63	104	142	BASE CASE
12WP	TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1	560	103	150	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12WP	MCCULLOUGH SUB - KINGSMILL INTERCHANGE 69KV CKT 1	117	113	155	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1
12WP	POTTER COUNTY INTERCHANGE (POTTR CO) 345/230/13.2KV TRANSFORMER CKT 1	560	102	177	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	ELK CITY - MOREWOOD SW 138KV CKT 1	130	101	191	BASE CASE
12WP	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1	195	100	199	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1
17SP	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	241	0	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
17SP	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1	128	231	0	CONWAY SUB - YARNELL SUB 115KV CKT 1
17SP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	97	228	0	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1

**TABLE 4: Contingency Analysis (continued)**

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
17SP	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1	90	222	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
17SP	MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1	90	221	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
17SP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	351	220	0	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
17SP	MCLEAN RURAL SUB - SHAMROCK 115KV CKT 1	90	213	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
17SP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	84	196	0	BASE CASE
17SP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	319	194	0	BASE CASE
17SP	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	193	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
17SP	CLINTON JUNCTION - ELK CITY 138KV CKT 1	143	190	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
17SP	ELDORADO - LAKE PAULINE 69KV CKT 1	20	186	0	LAKE PAULINE - RUSSELL 138KV CKT 1
17SP	CONWAY SUB - YARNELL SUB 115KV CKT 1	180	175	0	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1
17SP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	180	175	0	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1
17SP	SHAMROCK (SHAMRCK2) 138/69/14.4KV TRANSFORMER CKT 1	69	170	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
17SP	JERICO (JERIC2WT) 115/69/14.4KV TRANSFORMER CKT 1	46	157	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
17SP	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1	170	142	0	CLINTON JUNCTION - ELK CITY 138KV CKT 1
17SP	CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1	170	140	0	CLINTON JUNCTION - ELK CITY 138KV CKT 1
17SP	CONWAY SUB - YARNELL SUB 115KV CKT 1	164	139	0	BASE CASE
17SP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	164	139	0	BASE CASE
17SP	LAKE PAULINE - RUSSELL 138KV CKT 1	72	139	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
17SP	EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1	161	121	0	EAST PLANT INTERCHANGE - MANHATTAN SUB 115KV CKT 1
17SP	NICHOLS STATION - WHITAKER SUB 115KV CKT 1	249	121	0	CHERRY SUB - NICHOLS STATION 115KV CKT 1
17SP	EAST PLANT INTERCHANGE - MANHATTAN SUB 115KV CKT 1	161	121	0	EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1
17SP	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	63	120	0	BASE CASE
17SP	CHERRY SUB - NICHOLS STATION 115KV CKT 1	161	119	0	NICHOLS STATION - WHITAKER SUB 115KV CKT 1
17SP	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	497	119	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
17SP	GRAPEVINE INTERCHANGE - KIRBY SWITCHING STATION 115KV CKT 1	161	118	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
17SP	MANHATTAN TAP - OSAGE SWITCHING STATION 115KV CKT 1	161	115	0	EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1
17SP	EAST PLANT INTERCHANGE - WHITAKER SUB 115KV CKT 1	249	112	0	CHERRY SUB - NICHOLS STATION 115KV CKT 1
17SP	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1	147	112	0	BASE CASE
17SP	CHERRY SUB - NORTHWEST INTERCHANGE 115KV CKT 1	161	109	0	NICHOLS STATION - WHITAKER SUB 115KV CKT 1
17SP	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1	99	108	0	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
17SP	OSAGE SWITCHING STATION - PIERCE STREET TAP 115KV CKT 1	161	107	0	EAST PLANT INTERCHANGE - MANHATTAN SUB 115KV CKT 1
17SP	ELDORADO - ELDORADO JCT 69KV CKT 1	26	137	15	LAKE PAULINE - RUSSELL 138KV CKT 1
17SP	HAPPY INTERCHANGE - PALO DURO SUB 115KV CKT 1	99	107	24	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
17SP	CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1	147	109	35	BASE CASE
17SP	ELDORADO JCT - GYPSUM 69KV CKT 1	26	125	71	LAKE PAULINE - RUSSELL 138KV CKT 1
17SP	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1	112	145	82	BASE CASE
17SP	MANHATTAN SUB - MANHATTAN TAP 115KV CKT 1	161	103	93	EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1
17SP	JERICO - CLARENDON 69KV CKT 1	67	105	122	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
17SP	MCCULLOUGH SUB - BOWERS INTERCHANGE 69KV CKT 1	97	126	131	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1
17SP	GYPSUM - RUSSELL 69KV CKT 1	26	113	136	LAKE PAULINE - RUSSELL 138KV CKT 1
17SP	ALTUS JCT TAP - RUSSELL 138KV CKT 1	72	106	155	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
17SP	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1	161	121	166	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1

**TABLE 4: Contingency Analysis (continued)**

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
17SP	NICHOLS STATION - WHITAKER SUB 115KV CKT 1	226	101	169	BASE CASE
17SP	MCCULLOUGH SUB - KINGSMILL INTERCHANGE 69KV CKT 1	97	105	186	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1
17SP	CLARENDON - JERICHO 69KV CKT 1	67	101	188	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1

## Conclusion

The minimum cost of interconnecting the Customer's interconnection request is estimated at \$1,357,749 for Direct Assignment Facilities and Network Upgrades. At this time, the cost estimates for other Direct Assignment facilities including those in Table 1 have not been defined by the Customer. In addition to the Customer's proposed interconnection facilities, the Customer will be responsible for installing a total of 34 Mvar of capacitor bank(s) in the Customer's substation for reactive support. As stated earlier, some but not all of the local projects that were previously queued are assumed to be in service in this Feasibility Study. These costs exclude upgrades of other transmission facilities that were listed in Table 3 of which are Network Constraints.

In Table 4, a value of Available Transfer Capability (ATC) associated with each overloaded facility is included. These values may be used by the Customer to determine lower generation capacity levels that may be installed. When transmission service associated with this interconnection is evaluated, the loading of the facilities listed in this table may be greater due to higher priority reservations. When a facility is overloaded for more than one contingency, only the highest loading on the facility for each season is included in the table.

These interconnection costs do not include any cost that may be associated with short circuit or transient stability analysis. These studies will be performed if the Customer signs a System Impact Study Agreement. At the time of the System Impact Study, a better determination of the interconnection facilities may be available.

The required interconnection costs listed in Tables 1 and 2 and other upgrades associated with Network Constraints do not include all costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies if the Customer submits a Transmission Service Request through Southwest Power Pool's OASIS.

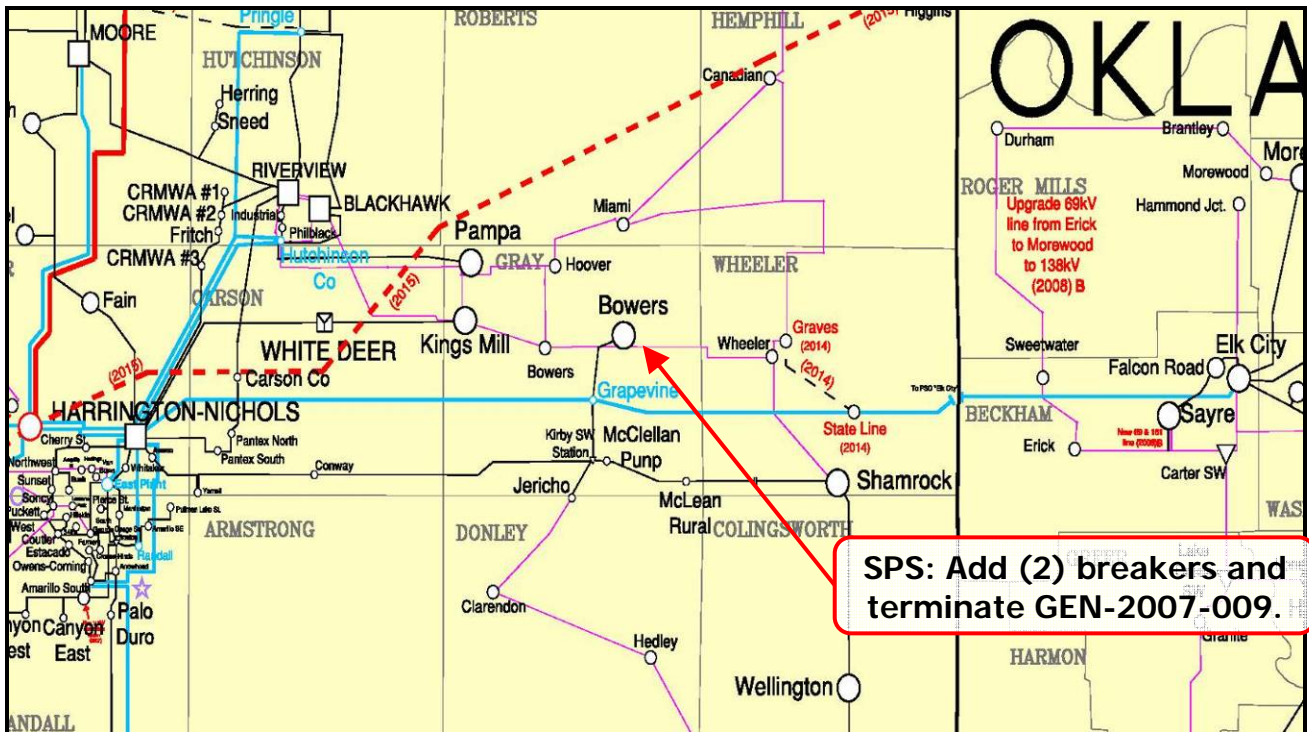


FIGURE 2. Point of Interconnection Area Map