



***Feasibility Study  
For  
Generation Interconnection  
Request  
GEN-2007-008***

***SPP Tariff Studies  
(#GEN-2007-008)***

**August, 2007**

## **Executive Summary**

<OMITTED TEXT> (Customer) has requested a Feasibility Study for the purpose of interconnecting 300 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 230 kV breaker and terminal at the existing Grapevine 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 300 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 60 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 300 MW of wind generation into the existing Grapevine Interchange consists of adding a new 230 kV breaker and terminal. The Customer did not propose a specific route for the 230 kV line extending to serve its 230/34.5 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 300 MW of generation is \$651,758. These costs are shown in Table 2. Network constraints in the American Electric Power West (AEPW), SPS, Sunflower Electric Power Corporation (SUNC), West Plains (WEPL), 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 230 kV line from the Customer 230/34.5 kV collector substation into the point of interconnection. This cost also does not include the Customer's 230/34.5 kV collector substation or the 34.5 kV, 60 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 300 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 230 kV breaker and terminal at the existing Grapevine 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 300 MW consist of adding a new 230 kV breaker and terminal at the existing Grapevine Interchange, owned by SPS. The Customer did not propose a specific route of its 230 kV line to serve its 230/34.5 kV collection system facilities. It is assumed that obtaining all necessary right-of-way for construction of the Customer 230 kV transmission line and the 230/34.5 kV collector substation will not be a significant expense.

The minimum cost for adding a new breaker and terminating the transmission line serving GEN-2007-008 facilities is estimated at \$651,758. 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 230 kV transmission line extending from the point of interconnection to serve its 230/34.5 kV collection facilities. This cost also does not include the Customer's 230/34.5 kV collector substation or the 60 Mvar of capacitor bank(s), all of which should be determined by the Customer. The Customer is responsible for these 230 – 34.5 kV facilities up to the point of interconnection. Other Network Constraints in the American Electric Power West (AEPW), SPS, Sunflower Electric Power Corporation (SUNC), West Plains (WEPL), 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

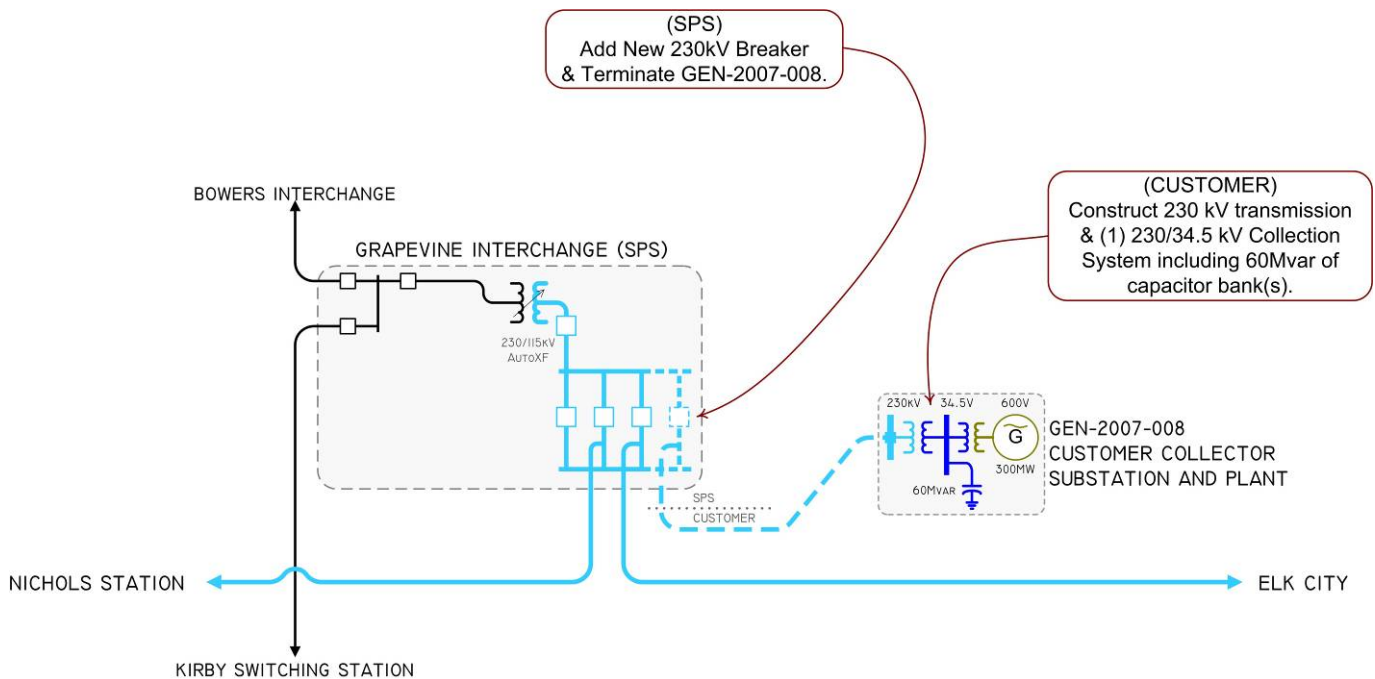
**TABLE 1: Direct Assignment Facilities**

FACILITY	ESTIMATED COST (2007 DOLLARS)
Customer – (1) 230/34.5 kV Customer collector substation facilities.	*
Customer – (1) 230 kV transmission line from Customer collector substation to the Pringle Interchange.	*
Customer – 34.5 kV, 60 Mvar capacitor bank(s) to be installed in the Customer 230/34.5 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 – (1) 230 kV breaker and terminal for GEN-2007-008 at Grapevine Interchange.	\$651,758
<b>TOTAL</b>	<b>\$651,758</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 230kV line and the parallel 115kV line there are over 1,400MW 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 300 MW and location, additional criteria violations will occur on the existing AEPW, SPS, SUNC, WEPL, 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 60 Mvar of capacitor bank(s) in the Customer's 230/34.5 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	CARNEGIE - HOBART JUNCTION 138KV CKT 1
AEPW	CHILDRESS - LAKE PAULINE 138KV 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 CITY - FOSS TAP 69KV CKT 1
AEPW	CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1
AEPW	CLINTON JUNCTION - ELK CITY 138KV CKT 1
AEPW	CLINTON JUNCTION - FOSS TAP 69KV CKT 1
AEPW	ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1
AEPW	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
AEPW	HOBART JUNCTION - TAMARAC TAP 138KV 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	ELK CITY - ELK CITY 69KV CKT 1
AEPW/WFEC	ELK CITY - MOREWOOD SW 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	CONWAY SUB - YARNELL SUB 115KV CKT 1
SPS	DALHART INTERCHANGE (DALHRT3) 115/69KV TRANSFORMER CKT 1
SPS	DALLAM COUNTY INTERCHANGE 115/69KV TRANSFORMER 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	ETTER RURAL SUB - MOORE COUNTY INTERCHANGE E. 115KV CKT 1
SPS	GRAPEVINE INTERCHANGE - KIRBY SWITCHING STATION 115KV CKT 1
SPS	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1
SPS	GRAPEVINE INTERCHANGE (GRAPEVN6) 230/115KV TRANSFORMER CKT 1
SPS	HANSFORD 3 115.00 - SPEARMAN INTERCHANGE 115KV CKT 1
SPS	HANSFORD 3 115.00 - TEXAS COUNTY INTERCHANGE 115KV CKT 1
SPS	HAPPY INTERCHANGE - PALO DURO SUB 115KV CKT 1
SPS	HERRING TAP - RIVERVIEW INTERCHANGE 115KV CKT 1
SPS	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1
SPS	MANHATTAN SUB - MANHATTAN TAP 115KV CKT 1
SPS	MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1
SPS	MCCULLOUGH SUB - BOWERS INTERCHANGE 69KV CKT 1
SPS	MOORE COUNTY INTERCHANGE 230/115KV TRANSFORMER 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	RITA BLANCA REC-HOGUE - DALHART INTERCHANGE 115KV CKT 1
SPS	RITA BLANCA REC-HOGUE - MOORE COUNTY INTERCHANGE E. 115KV CKT 1
SPS	TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1
SUNC/WEPL	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1
WFEC	CARTER JCT - DILL JCT 69KV CKT 1
WFEC	CARTER JCT - LAKE CREEK 69KV CKT 1
WFEC	DILL JCT - ELK CITY 69KV CKT 1
WFEC	MOREWOOD SW 138/69KV TRANSFORMER CKT 1
AEPW	American Electric Power West
SPS	Southwestern Public Service
SUNC	Sunflower Electric Power Corporation
WEPL	West Plains
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	264	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
09WP	CLINTON JUNCTION - ELK CITY 138KV CKT 1	143	234	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
09WP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	319	227	0	BASE CASE
09WP	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	225	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	351	216	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
09WP	SHAMROCK (SHAMRCK2) 138/69/14.4KV TRANSFORMER CKT 1	69	204	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1	107	199	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1	107	197	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	MCLEAN RURAL SUB - SHAMROCK 115KV CKT 1	107	193	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	LAKE PAULINE - RUSSELL 138KV CKT 1	72	176	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	105	145	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
09WP	ELK CITY - MOREWOOD SW 138KV CKT 1	158	139	0	CLINTON JUNCTION - ELK CITY 138KV CKT 1
09WP	ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1	72	135	0	ELK CITY - MOREWOOD SW 138KV CKT 1
09WP	DILL JCT - ELK CITY 69KV CKT 1	61	135	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
09WP	CARTER JCT - DILL JCT 69KV CKT 1	61	129	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
09WP	TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1	560	128	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	ELK CITY - ELK CITY 69KV CKT 1	72	128	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
09WP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	218	116	0	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1
09WP	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	606	191	5	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
09WP	CHILDRESS - LAKE PAULINE 138KV CKT 1	141	114	37	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1	172	117	59	BASE CASE
09WP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	84	113	62	BASE CASE
09WP	CARTER JCT - LAKE CREEK 69KV CKT 1	61	115	71	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
09WP	CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1	172	115	83	BASE CASE
09WP	CONWAY SUB - YARNELL SUB 115KV CKT 1	198	107	84	BASE CASE
09WP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	198	107	88	BASE CASE
09WP	MOREWOOD SW 138/69KV TRANSFORMER CKT 1	56	113	95	MOORELAND - MOREWOOD SW 138KV CKT 1
09WP	CARNEGIE - HOBART JUNCTION 138KV CKT 1	143	116	107	CLINTON JUNCTION - ELK CITY 138KV CKT 1
09WP	CLINTON JUNCTION - FOSS TAP 69KV CKT 1	72	110	109	WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1
09WP	GRAPEVINE INTERCHANGE (GRAPEVN6) 230/115KV TRANSFORMER CKT 1	140	128	147	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	105	154	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	ELK CITY - MOREWOOD SW 138KV CKT 1	130	112	155	BASE CASE
09WP	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1	192	109	168	NICHOLS STATION - YARNELL SUB 115KV CKT 1
09WP	CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1	143	107	176	CLINTON - CLINTON JUNCTION 138KV CKT 1
09WP	CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1	192	108	188	NICHOLS STATION - YARNELL SUB 115KV CKT 1
09WP	POTTER COUNTY INTERCHANGE (POTTR CO) 345/230/13.2KV TRANSFORMER CKT 1	560	105	226	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12SP	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	252	0	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
12SP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	351	235	0	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
12SP	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1	90	222	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12SP	MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1	90	220	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12SP	MCLEAN RURAL SUB - SHAMROCK 115KV CKT 1	90	211	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1



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

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
12SP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	319	210	0	BASE CASE
12SP	CLINTON JUNCTION - ELK CITY 138KV CKT 1	143	209	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
12SP	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	200	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12SP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	97	188	0	CONWAY SUB - YARNELL SUB 115KV CKT 1
12SP	SHAMROCK (SHAMRCK2) 138/69/14.4KV TRANSFORMER CKT 1	69	181	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12SP	RITA BLANCA REC-HOGUE - MOORE COUNTY INTERCHANGE E. 115KV CKT 1	99	169	0	ETTER RURAL SUB - MOORE COUNTY INTERCHANGE E. 115KV CKT 1
12SP	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1	170	157	0	CLINTON JUNCTION - ELK CITY 138KV CKT 1
12SP	CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1	170	154	0	CLINTON JUNCTION - ELK CITY 138KV CKT 1
12SP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	84	153	0	BASE CASE
09WP	GRAPEVINE INTERCHANGE (GRAPEVN6) 230/115KV TRANSFORMER CKT 1	129	153	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12SP	RITA BLANCA REC-HOGUE - DALHART INTERCHANGE 115KV CKT 1	99	151	0	ETTER RURAL SUB - MOORE COUNTY INTERCHANGE E. 115KV CKT 1
12SP	LAKE PAULINE - RUSSELL 138KV CKT 1	72	151	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12SP	CONWAY SUB - YARNELL SUB 115KV CKT 1	180	150	0	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1
12SP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	180	150	0	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1
12SP	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	497	147	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12SP	CONWAY SUB - YARNELL SUB 115KV CKT 1	164	127	0	BASE CASE
12SP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	164	127	0	BASE CASE
12SP	DILL JCT - ELK CITY 69KV CKT 1	61	124	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
12SP	ELK CITY - ELK CITY 69KV CKT 1	72	120	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
12SP	HERRING TAP - RIVERVIEW INTERCHANGE 115KV CKT 1	180	103	0	MOORE COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1
12SP	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1	147	123	8	BASE CASE
12SP	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	112	21	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12SP	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1	161	113	26	CONWAY SUB - YARNELL SUB 115KV CKT 1
12SP	CARTER JCT - DILL JCT 69KV CKT 1	61	116	36	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
12SP	CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1	147	120	43	BASE CASE
12SP	ELK CITY - MOREWOOD SW 138KV CKT 1	158	113	157	CLINTON JUNCTION - ELK CITY 138KV CKT 1
12SP	ALTUS JCT TAP - RUSSELL 138KV CKT 1	72	113	165	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
09WP	GRAPEVINE INTERCHANGE - KIRBY SWITCHING STATION 115KV CKT 1	161	110	197	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
12SP	DALLAM COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	46	104	266	ETTER RURAL SUB - MOORE COUNTY INTERCHANGE E. 115KV CKT 1
12SP	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1	99	100	290	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
12WP	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	271	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
12WP	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	242	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	CLINTON JUNCTION - ELK CITY 138KV CKT 1	143	239	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
12WP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	319	234	0	BASE CASE
12WP	SHAMROCK (SHAMRCK2) 138/69/14.4KV TRANSFORMER CKT 1	69	224	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1	107	223	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	351	222	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
12WP	MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1	107	222	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	MCLEAN RURAL SUB - SHAMROCK 115KV CKT 1	107	218	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	LAKE PAULINE - RUSSELL 138KV CKT 1	72	187	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1	192	161	0	CLINTON JUNCTION - ELK CITY 138KV CKT 1
12WP	CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1	192	160	0	CLINTON JUNCTION - ELK CITY 138KV CKT 1

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

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
12WP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	105	141	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
12WP	DILL JCT - ELK CITY 69KV CKT 1	61	140	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
12WP	ELK CITY - MOREWOOD SW 138KV CKT 1	158	137	0	CLINTON JUNCTION - ELK CITY 138KV CKT 1
12WP	CARTER JCT - DILL JCT 69KV CKT 1	61	134	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
12WP	ELK CITY - ELK CITY 69KV CKT 1	72	132	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
12WP	POTTER COUNTY INTERCHANGE (POTTR CO) 345/230/13.2KV TRANSFORMER CKT 1	560	122	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1	172	122	0	BASE CASE
12WP	ELK CITY (ELKCTY-4) 138/69/13.8KV TRANSFORMER CKT 1	72	121	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
12WP	CHILDRESS - LAKE PAULINE 138KV CKT 1	141	121	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1	172	121	0	BASE CASE
12WP	CARTER JCT - LAKE CREEK 69KV CKT 1	61	120	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
12WP	CONWAY SUB - YARNELL SUB 115KV CKT 1	218	112	0	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1
12WP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	218	112	0	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1
12WP	GRAPEVINE INTERCHANGE - KIRBY SWITCHING STATION 115KV CKT 1	161	111	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
12WP	TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1	560	126	2	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	84	115	25	BASE CASE
12WP	CARNEGIE - HOBART JUNCTION 138KV CKT 1	143	120	36	CLINTON JUNCTION - ELK CITY 138KV CKT 1
12WP	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	497	122	56	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	GRAPEVINE INTERCHANGE (GRAPEVN6) 230/115KV TRANSFORMER CKT 1	129	138	87	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	CLINTON JUNCTION - FOSS TAP 69KV CKT 1	72	109	133	WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1
12WP	MCLEAN RURAL SUB - SHAMROCK 115KV CKT 1	107	107	145	JERICHO (JERIC2WT) 115/69/14.4KV TRANSFORMER CKT 1
12WP	SPEARVILLE (SPEARVL) 345/230/13.8KV TRANSFORMER CKT 1	336	106	150	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	CONWAY SUB - YARNELL SUB 115KV CKT 1	198	105	162	BASE CASE
12WP	ELK CITY - MOREWOOD SW 138KV CKT 1	130	112	162	BASE CASE
12WP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	198	105	166	BASE CASE
12WP	CLINTON JUNCTION - CLINTON NATURAL GAS TAP 138KV CKT 1	143	107	187	CLINTON - CLINTON JUNCTION 138KV CKT 1
12WP	ALTUS JCT TAP - RUSSELL 138KV CKT 1	72	105	255	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
17SP	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	275	0	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
17SP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	351	231	0	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
17SP	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1	90	223	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
17SP	MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1	90	222	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
17SP	MCLEAN RURAL SUB - SHAMROCK 115KV CKT 1	90	214	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
17SP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	319	211	0	BASE CASE
17SP	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	210	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
17SP	CLINTON JUNCTION - ELK CITY 138KV CKT 1	143	208	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
17SP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	97	203	0	CONWAY SUB - YARNELL SUB 115KV CKT 1
17SP	RITA BLANCA REC-HOGUE - MOORE COUNTY INTERCHANGE E. 115KV CKT 1	99	195	0	ETTER RURAL SUB - MOORE COUNTY INTERCHANGE E. 115KV CKT 1
17SP	SHAMROCK (SHAMRCK2) 138/69/14.4KV TRANSFORMER CKT 1	69	180	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
17SP	RITA BLANCA REC-HOGUE - DALHART INTERCHANGE 115KV CKT 1	99	174	0	ETTER RURAL SUB - MOORE COUNTY INTERCHANGE E. 115KV CKT 1
17SP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	84	165	0	BASE CASE

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

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
17SP	GRAPEVINE INTERCHANGE (GRAPEVN6) 230/115KV TRANSFORMER CKT 1	129	159	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
17SP	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1	170	157	0	CLINTON JUNCTION - ELK CITY 138KV CKT 1
17SP	CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1	170	155	0	CLINTON JUNCTION - ELK CITY 138KV CKT 1
17SP	LAKE PAULINE - RUSSELL 138KV CKT 1	72	148	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
17SP	GRAPEVINE INTERCHANGE - NICHOLS STATION 230KV CKT 1	497	145	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
17SP	CONWAY SUB - YARNELL SUB 115KV CKT 1	180	142	0	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1
17SP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	180	142	0	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1
17SP	CONWAY SUB - YARNELL SUB 115KV CKT 1	164	124	0	BASE CASE
17SP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	164	124	0	BASE CASE
17SP	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1	147	123	0	BASE CASE
17SP	DILL JCT - ELK CITY 69KV CKT 1	61	123	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
17SP	EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1	161	122	0	EAST PLANT INTERCHANGE - MANHATTAN SUB 115KV CKT 1
17SP	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1	161	121	0	CONWAY SUB - YARNELL SUB 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	ELK CITY - ELK CITY 69KV CKT 1	72	120	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
17SP	NICHOLS STATION - WHITAKER SUB 115KV CKT 1	249	118	0	CHERRY SUB - NICHOLS STATION 115KV CKT 1
17SP	EAST PLANT INTERCHANGE - WHITAKER SUB 115KV CKT 1	249	110	0	CHERRY SUB - NICHOLS STATION 115KV CKT 1
17SP	OSAGE SWITCHING STATION - PIERCE STREET TAP 115KV CKT 1	161	108	0	EAST PLANT INTERCHANGE - MANHATTAN SUB 115KV CKT 1
17SP	CARTER JCT - DILL JCT 69KV CKT 1	61	115	1	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
17SP	HANSFORD 3 115.00 - TEXAS COUNTY INTERCHANGE 115KV CKT 1	180	106	4	SPEARMAN SUB - TEXAS FARMS SUB 115KV CKT 1
17SP	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1	99	111	4	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
17SP	HANSFORD 3 115.00 - SPEARMAN INTERCHANGE 115KV CKT 1	180	106	9	SPEARMAN SUB - TEXAS FARMS SUB 115KV CKT 1
17SP	CLINTON AIR FORCE BASE TAP - HOBART JUNCTION 138KV CKT 1	147	121	27	BASE CASE
17SP	CLINTON JUNCTION - FOSS TAP 69KV CKT 1	72	111	27	WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1
17SP	HOBART JUNCTION - TAMARAC TAP 138KV CKT 1	105	108	28	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1
17SP	HAPPY INTERCHANGE - PALO DURO SUB 115KV CKT 1	99	110	34	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
17SP	DALLAM COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	46	122	72	PERRYTON INTERCHANGE - TEXAS FARMS SUB 115KV CKT 1
17SP	MOORE COUNTY INTERCHANGE 230/115KV TRANSFORMER CKT 1	252	108	94	PERRYTON INTERCHANGE - TEXAS FARMS SUB 115KV CKT 1
17SP	MANHATTAN SUB - MANHATTAN TAP 115KV CKT 1	161	104	132	EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1
17SP	ELK CITY - MOREWOOD SW 138KV CKT 1	158	109	197	CLINTON JUNCTION - ELK CITY 138KV CKT 1
17SP	ETTER RURAL SUB - MOORE COUNTY INTERCHANGE E. 115KV CKT 1	99	107	206	PERRYTON INTERCHANGE - TEXAS FARMS SUB 115KV CKT 1
17SP	GRAPEVINE INTERCHANGE - KIRBY SWITCHING STATION 115KV CKT 1	161	109	226	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
17SP	CARTER JCT - LAKE CREEK 69KV CKT 1	61	103	250	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
17SP	DALHART INTERCHANGE (DALHRT3) 115/69KV TRANSFORMER CKT 1	46	107	257	ETTER RURAL SUB - MOORE COUNTY INTERCHANGE E. 115KV CKT 1
17SP	CLINTON CITY - FOSS TAP 69KV CKT 1	79	101	273	WEATHERFORD TAP - WEATHERFORD WIND FARM 138KV CKT 1
17SP	MCCULLOUGH SUB - BOWERS INTERCHANGE 69KV CKT 1	97	100	299	CONWAY SUB - YARNELL SUB 115KV CKT 1

## **Conclusion**

The minimum cost of interconnecting the Customer's interconnection request is estimated at \$651,758 for Direct Assignment Facilities and Network Upgrades. At this time, the cost estimates for other Direct Assignment facilities including those in Tables 1 and 2 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 60 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