



***Feasibility Study
For
Generation Interconnection
Request
GEN-2006-033***

***SPP Tariff Studies
(#GEN-2006-033)***

January, 2007

Executive Summary

<OMITTED TEXT> (Customer) has requested a Feasibility Study for the purpose of interconnecting 150MW of wind generation within the control area of Westar Energy (WESTAR) in Geary County, Kansas. The proposed point of interconnection is at the existing McDowell Creek Switching Station, which is owned by WESTAR. The proposed in-service date is December, 2008.

Power flow analysis has indicated that for the powerflow cases studied, it is possible to interconnect the 150MW of generation with transmission system reinforcements within the local transmission system. In order to maintain acceptable reactive power compensation, the customer will need to install 30Mvars of 34.5kV capacitor banks in the Customer's collector substation on the 34.5kV bus. Dynamic Stability studies performed as part of the 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 150MW of generation at the existing McDowell Creek Switching Station consists of adding a new 115kV terminal, including one circuit breaker and associated equipment. Customer did not propose a specific 115kV line extending to serve its 115-34.5kV facilities. It is assumed that obtaining all necessary right-of-way for the new switching station will not be a significant expense.

The total minimum cost for building the required facilities for this 150MW of generation is \$300,000. These costs are shown in Table 2. Other Network Constraints in the WESTAR, Missouri Public Service Company (MIPU), Oklahoma Gas and Electric Company (OKGE), and Kansas City Power and Light Company (KACP) transmission systems that may be verified with a transmission service request and associated studies are listed in Table 3. These 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 (TSR), this list of Network Constraints will be refined and expanded to account for all Network Upgrade requirements. This cost does not include building 115kV line from the Customer substation into the McDowell Creek Switching Station. This cost does not include the Customer's 115-34.5kV substation or the 34.5kV, 30Mvar 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 WESTAR, West Plains (WEPL), and Midwest Electric Cooperative (MIDW) 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.

Introduction

<OMITTED TEXT> (Customer) has requested a feasibility study for the purpose of interconnecting 150MW of generation within the control area of Westar Energy (WESTAR) in Geary County, Kansas. The proposed method of interconnection is to add a new 115kV terminal in the existing McDowell Creek Switching Station, which is owned by WESTAR. The proposed in-service date is December, 2008.

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 150MW consist of adding a new 115kV terminal including one (1) 115kV circuit breaker and associated equipment in the existing McDowell Creek Switching Station owned by WESTAR. The Customer did not propose a route of its 115kV line to serve its 115/34.5kV facilities. It is assumed that obtaining all necessary right-of-way for the substation construction will not be a significant expense.

The total cost for adding a new 115kV terminal at the McDowell Creek Switching Station and reconfiguring the required interconnection facilities, is estimated at \$300,000. Other Network Constraints in the WESTAR, Missouri Public Service Company (MIPU), Oklahoma Gas and Electric Company (OKGE), and Kansas City Power and Light Company (KACP) transmission systems that were identified are listed in Table 3. These estimates will be refined during the development of the impact study based on the final designs. This cost does not include building the 115kV facilities from the Customer substation into the existing McDowell Creek Switching Station. The Customer is responsible for these 115kV facilities up to the point of interconnection. This cost also does not include the Customer's 115-34.5kV substation, which should be determined by the Customer.

The costs of interconnecting the facility to the WESTAR transmission system are listed in Table 1 & 2. **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 and direct assigned facilities are shown in Figure 1.

Table 1: Direct Assignment Facilities

| Facility | ESTIMATED COST (2006 DOLLARS) |
|---|----------------------------------|
| Customer – 115-34.5 kV Substation facilities. | * |
| Customer – 115kV transmission line facilities between Customer facilities and McDowell Creek Switching Station. | * |
| Customer - Right-of-Way for Customer facilities. | * |
| Customer – 34.5kV, 30Mvar capacitor bank(s) in Customer substation. | * |
| WESTAR – Add one 115kV terminal including one 115kV circuit breakers, associated switches, buswork, relaying and all miscellaneous equipment at McDowell Creek Switching Station. | \$300,000 |
| Total | * |

Note: *Estimates of cost to be determined by Customer.

Table 2: Required Interconnection Network Upgrade Facilities

| Facility | ESTIMATED COST (2006 DOLLARS) |
|-------------------------------|----------------------------------|
| None identified at this time. | * |
| Total | * |

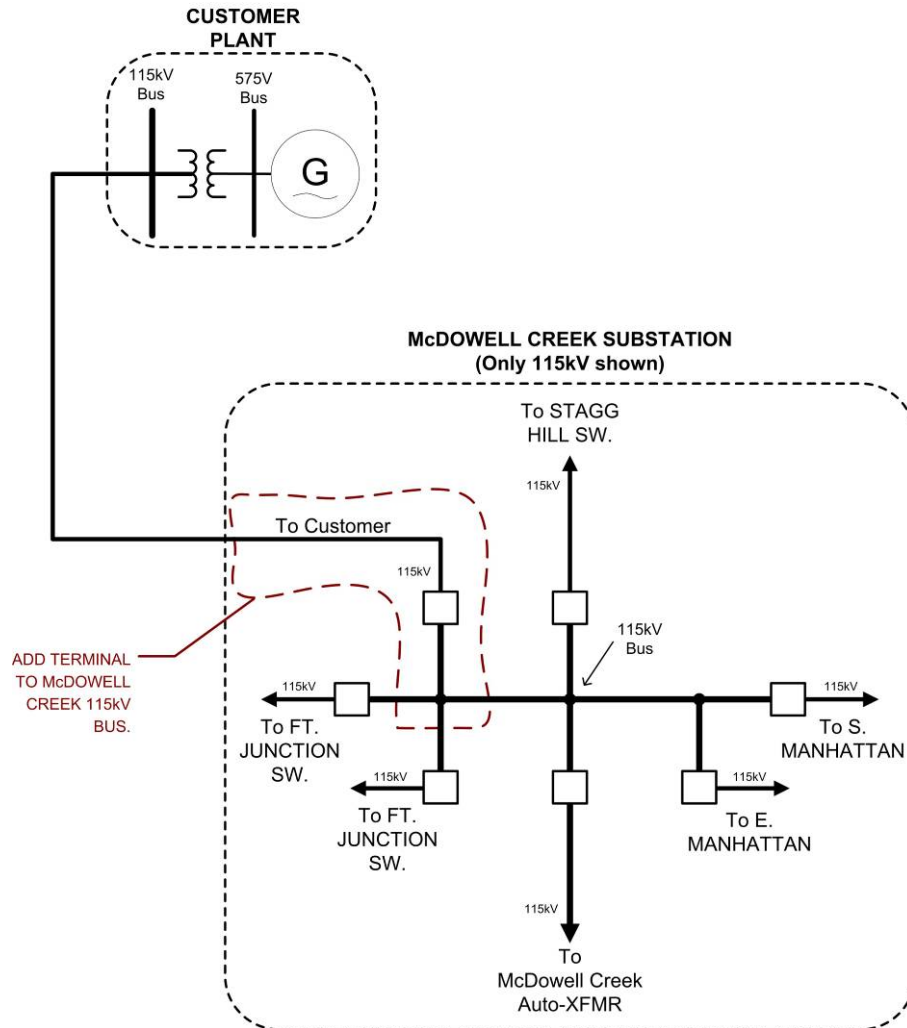


Figure 1: Proposed Interconnection
(Final substation design to be determined)

Powerflow Analysis

A powerflow analysis was conducted for the facility using modified versions of the 2008 winter peak, the 2011 summer and winter peak, and 2016 summer peak models. 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, 2008. The available seasonal models used were through the 2016 Summer Peak of which is the end of the current SPP planning horizon.

The analysis of the Customer’s project indicates that, given the requested generation level of 150MW and location, additional criteria violations will occur on the existing Westar,

MIPU, OKGE, and KACP transmission systems under steady state and contingency conditions in the peak seasons.

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.

In order to maintain a zero reactive power flow exchanged at the point of interconnection, additional reactive compensation is required at the point of interconnection. The Customer will be required to install 30Mvar of capacitor banks in their substation on the 34.5kV buses in the Customer substation. Dynamic Stability studies performed as part of the 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. Those 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 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), Western Farmers Electric Cooperative (WFEC) and other control areas WESTAR applied and the resulting scenarios analyzed. This satisfies the 'more probable' contingency testing criteria mandated by NERC and the SPP criteria.

Table 3: Network Constraints

| AREA | ELEMENT |
|--------|--|
| WESTAR | 17TH & FAIRLAWN - INDIAN HILLS 115KV CKT 1 |
| WESTAR | 29TH & EVENINGSIDE JUNCTION - 29TH & GAGE 115KV CKT 1 |
| WESTAR | 95TH & WAVERLY - CAPTAIN JUNCTION 115KV CKT 1 |
| WESTAR | AUBURN ROAD - JEFFREY ENERGY CENTER 230KV CKT 1 |
| WESTAR | AUBURN ROAD - SHERWOD 115KV CKT 1 |
| WESTAR | EVANS ENERGY CENTER SOUTH - LAKERIDGE 138KV CKT 1 |
| WESTAR | HOYT - JEFFERY ENERGY CENTER 345KV CKT 1 |
| MIPU | IATAN - ST JOE 345KV CKT 1 |
| WESTAR | LAWRENCE ENERGY CENTER UNIT 5 - LAWRENCE HILL 230KV CKT 1 |
| WESTAR | LAWRENCE HILL (LAWHL29X) 230/115/13.8KV TRANSFORMER CKT 1 |
| WESTAR | MIDIAN - WILLIAMS BROTHERS PIPELINE 161KV CKT 1 |
| WESTAR | MIDIAN (MIDIAN3X) 161/138/12.47KV TRANSFORMER CKT 1 |
| WESTAR | NORTH AMERICAN PHILIPS - NORTH AMERICAN PHILIPS JUNCTION (SOUTH) 115KV CKT 1 |
| WESTAR | NORTH AMERICAN PHILIPS JUNCTION (SOUTH) - WEST MCPHERSON 115KV CKT 1 |
| WESTAR | NORTH AMERICAN PHILIPS JUNCTION (SOUTH) - WEST MCPHERSON 115KV CKT 2 |
| OKGE | PECAN CREEK (PECANCK1) 345/161/13.8KV TRANSFORMER CKT 1 |
| KACP | STILWELL - SWISSVALE 345KV CKT 1 |
| WESTAR | TECUMSEH HILL - WILLIAMS BROTHERS PIPELINE 161KV CKT 1 |

Table 4: Contingency Analysis

| ELEMENT | SEASON | RATE (MVA) | LOADING (%) | ATC (MW) | CONTINGENCY |
|--|--------|------------|-------------|----------|--|
| <u>2008 WINTER PEAK</u> | | | | | |
| LAWRENCE HILL (LAWHL29X) 230/115/13.8KV TRANSFORMER CKT 1 | 08wp | 308 | 121.3 | 0 | LAWRENCE HILL - MIDLAND JUNCTION 230KV CKT 1 |
| HOYT - JEFFERY ENERGY CENTER 345KV CKT 1 | 08wp | 1076 | 114.5 | 0 | JEFFERY ENERGY CENTER - MORRIS COUNTY 345KV CKT 1 |
| STILWELL - SWISSVALE 345KV CKT 1 | 08wp | 721 | 110.8 | 0 | LANG - WICHITA 345KV CKT 1 |
| 95TH & WAVERLY - CAPTAIN JUNCTION 115KV CKT 1 | 08wp | 118 | 102.1 | 104.3 | STILWELL - SWISSVALE 345KV CKT 1 |
| <u>2011 SUMMER PEAK</u> | | | | | |
| AUBURN ROAD - JEFFREY ENERGY CENTER 230KV CKT 1 | 11sp | 565 | 125.7 | 0 | HOYT - JEFFERY ENERGY CENTER 345KV CKT 1 |
| LAWRENCE HILL (LAWHL29X) 230/115/13.8KV TRANSFORMER CKT 1 | 11sp | 308 | 125.5 | 0 | MIDLAND JUNCTION (MIDJ126X) 230/115/18.0KV TRANSFORMER CKT 1 |
| 95TH & WAVERLY - CAPTAIN JUNCTION 115KV CKT 1 | 11sp | 118 | 124.1 | 0 | MONTICELLO - PENTAGON 115KV CKT 1 |
| HOYT - JEFFERY ENERGY CENTER 345KV CKT 1 | 11sp | 1076 | 110.9 | 0 | JEFFERY ENERGY CENTER - MORRIS COUNTY 345KV CKT 1 |
| LAWRENCE ENERGY CENTER UNIT 5 - LAWRENCE HILL 230KV CKT 1 | 11sp | 478 | 110.3 | 0 | GILL ENERGY CENTER EAST (GEC3 GSU) 138/69/14.4KV TRANSFORMER CKT 1 |
| TECUMSEH HILL - WILLIAMS BROTHERS PIPELINE 161KV CKT 1 | 11sp | 84 | 108.9 | 0 | LANG - WICHITA 345KV CKT 1 |
| POTTER COUNTY INTERCHANGE (POTTR CO) 345/230/13.2KV TRANSFORMER CKT 1 | 11sp | 560 | 104.8 | 0 | GEN:51442 1 |
| EVANS ENERGY CENTER SOUTH - LAKERIDGE 138KV CKT 1 | 11sp | 382 | 104.6 | 0 | SPP-WESTAR-29 |
| MIDIAN - WILLIAMS BROTHERS PIPELINE 161KV CKT 1 | 11sp | 84 | 106.2 | 20.5 | LANG - WICHITA 345KV CKT 1 |
| 29TH & EVENINGSIDE JUNCTION - 29TH & GAGE 115KV CKT 1 | 11sp | 141 | 102.5 | 103.4 | HOYT - JEFFERY ENERGY CENTER 345KV CKT 1 |
| AUBURN ROAD - SHERWOD 115KV CKT 1 | 11sp | 240 | 101.1 | 125.6 | HOYT - JEFFERY ENERGY CENTER 345KV CKT 1 |
| STILWELL - SWISSVALE 345KV CKT 1 | 11sp | 721 | 100.2 | 146.7 | HOYT - JEFFERY ENERGY CENTER 345KV CKT 1 |
| <u>2011 WINTER PEAK</u> | | | | | |
| NORTH AMERICAN PHILIPS JUNCTION (SOUTH) - WEST MCPHERSON 115KV CKT 1 | 11wp | 68 | 141.6 | 0 | 2004-16T 230 - EAST MCPHERSON 230KV CKT 1 |
| NORTH AMERICAN PHILIPS - NORTH AMERICAN PHILIPS JUNCTION (SOUTH) 115KV CKT 1 | 11wp | 160 | 131.2 | 0 | 2004-16T 230 - EAST MCPHERSON 230KV CKT 1 |
| TECUMSEH HILL - WILLIAMS BROTHERS PIPELINE 161KV CKT 1 | 11wp | 84 | 127.1 | 0 | LANG - WICHITA 345KV CKT 1 |
| MIDIAN - WILLIAMS BROTHERS PIPELINE 161KV CKT 1 | 11wp | 84 | 125.4 | 0 | LANG - WICHITA 345KV CKT 1 |

Table 4: Contingency Analysis (continued)

| ELEMENT | SEASON | RATE (MVA) | LOADING (%) | ATC (MW) | CONTINGENCY |
|---|--------|------------|-------------|----------|--|
| NORTH AMERICAN PHILIPS JUNCTION (SOUTH) - WEST MCPHERSON 115KV CKT 2 | 11wp | 92 | 123.5 | 0 | 2004-16T 230 - EAST MCPHERSON 230KV CKT 1 |
| STILWELL - SWISSVALE 345KV CKT 1 | 11wp | 721 | 117.4 | 0 | LANG - WICHITA 345KV CKT 1 |
| 95TH & WAVERLY - CAPTAIN JUNCTION 115KV CKT 1 | 11wp | 118 | 115.7 | 0 | STILWELL - SWISSVALE 345KV CKT 1 |
| MIDIAN (MIDIAN3X) 161/138/12.47KV TRANSFORMER CKT 1 | 11wp | 87 | 114.8 | 0 | LANG - WICHITA 345KV CKT 1 |
| HOYT - JEFFERY ENERGY CENTER 345KV CKT 1 | 11wp | 1076 | 111.6 | 0 | JEFFERY ENERGY CENTER - MORRIS COUNTY 345KV CKT 1 |
| IATAN - ST JOE 345KV CKT 1 | 11wp | 956 | 100.7 | 115.7 | CRAIG - STRANGER CREEK 345KV CKT 1 |
| 2016 SUMMER PEAK | | | | | |
| LAWRENCE HILL (LAWHL29X) 230/115/13.8KV TRANSFORMER CKT 1 | 16sp | 308 | 127.6 | 0 | MIDLAND JUNCTION (MIDJ126X) 230/115/18.0KV TRANSFORMER CKT 1 |
| 17TH & FAIRLAWN - INDIAN HILLS 115KV CKT 1 | 16sp | 152 | 110.6 | 0 | AUBURN ROAD - SHERWOD 115KV CKT 1 |
| HOYT - JEFFERY ENERGY CENTER 345KV CKT 1 | 16sp | 1076 | 110.2 | 0 | AUBURN ROAD - JEFFREY ENERGY CENTER 230KV CKT 1 |
| LAWRENCE ENERGY CENTER UNIT 5 - LAWRENCE HILL 230KV CKT 1 | 16sp | 478 | 109.0 | 0 | GILL ENERGY CENTER EAST (GEC3 GSU) 138/69/14.4KV TRANSFORMER CKT 1 |
| PECAN CREEK (PECANCK1) 345/161/13.8KV TRANSFORMER CKT 1 | 16sp | 370 | 106.7 | 0 | CLARKSVILLE - MUSKOGEE 345KV CKT 1 |
| POTTER COUNTY INTERCHANGE (POTTR CO) 345/230/13.2KV TRANSFORMER CKT 1 | 16sp | 560 | 103.7 | 0 | GEN:51971 1 |
| AUBURN ROAD - SHERWOD 115KV CKT 1 | 16sp | 240 | 105.0 | 17.9 | AUBURN ROAD - INDIAN HILLS 115KV CKT 1 |

Note: 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.

Conclusion

The minimum cost of interconnecting the Customer's interconnection request is estimated at \$300,000 for Direct Assignment facilities listed in Table 1. These costs exclude upgrades of other transmission facilities by WESTAR, MIPU, OKGE, and KACP listed in Table 3 of which are Network Constraints. 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 30Mvar of 34.5kV capacitors in the Customer substation for reactive support. Dynamic stability analysis will determine if a portion of this should be dynamic (SVC). 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.

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.

The required interconnection costs listed in Table 2 and other upgrades associated with Network Constraints listed in Table 3 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 requests transmission service through Southwest Power Pool's OASIS.

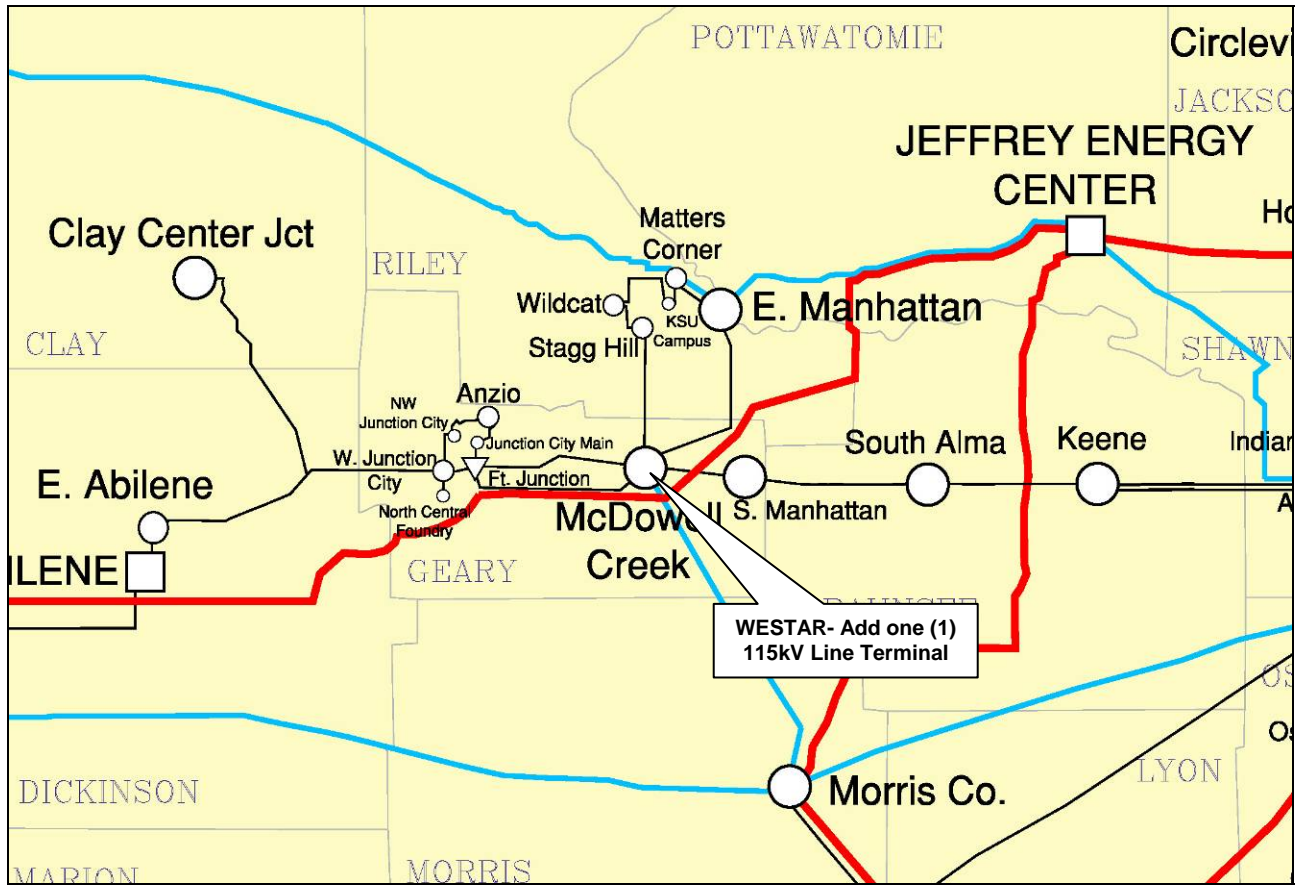


FIGURE 2. MAP OF THE LOCAL AREA