



***Feasibility Study  
For  
Generation Interconnection  
Request  
GEN-2006-008***

***SPP Tariff Studies  
(#GEN-2006-008)***

**September, 2006**

## Executive Summary

<OMITTED TEXT> (Customer) has requested a Feasibility Study for the purpose of interconnecting 455MW(summer)/550MW(winter) of generation within the control area of American Electric Power (AEP) in Caddo Parish, Louisiana. The proposed point of interconnection is the Arsenal Hill Power Station 138kV bus. The proposed in-service date is June 1, 2010.

Power flow analysis has indicated that for the powerflow cases studied, it is possible to interconnect the 455/550MW of generation with transmission system reinforcements within the local transmission systems. The requirements for interconnection consist of adding a new 138kV terminal to the existing ring bus configuration at Arsenal Hill Power Station. In addition, the relocation of one 138kV line within the substation is necessary to avoid transmission lines being crossed over by the new terminals to the GSU and auxiliary transformer.

The total cost for adding the new 138kV GSU terminal and relocating one 138kV line within the Arsenal Hill Power Station switchyard, the required interconnection facilities, is estimated at \$2,121,000. Other Network Constraints in the American Electric Power West (AEPW), Oklahoma Gas & Electric (OKGE), Southwestern Power Administration (SWPA), and Southwestern Public Service (SPS) 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 the 138kV, and 18kV facilities from the Customer GSU and auxiliary transformers up to the point of interconnection. **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.

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. These contingency analyses will have to be re-evaluated as part of a transmission service request.

There are several other proposed and existing generation additions in the general area of the Customer's facility. It was assumed in this preliminary analysis that these other projects within the AEPW service territories 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.

Nothing in this study should be construed as a guarantee of transmission service. If the customer wishes to sell power from the facility, a separate request for transmission service shall be requested on Southwest Power Pool's OASIS by the Customer.

## Introduction

<OMITTED TEXT> (Customer) has requested a feasibility study for the purpose of interconnecting 455MW(summer)/550MW(winter) of generation within the control area of American Electric Power (AEPW) in Caddo Parish, Louisiana. The proposed interconnection configuration is to add a new 138kV terminal to the existing 138kV bus at Arsenal Hill Power Station. The proposed in-service date is June 1, 2010.

## 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 consist of adding a new terminal to the Arsenal Hill 138kV ring bus for the addition of the generator and associated GSU. The total cost for adding a new 138kV terminal and associated line terminal relocations is \$2,121,000. Other Network Constraints in the AEPW, SPS, OKGE, WERE, and KCPL 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 138kV facilities from the Customer's 138kV and generator voltage equipment into the Arsenal Hill 138kV bus. The Customer is responsible for these facilities up to the point of interconnection.

The costs of interconnecting the facility to the AEPW 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.

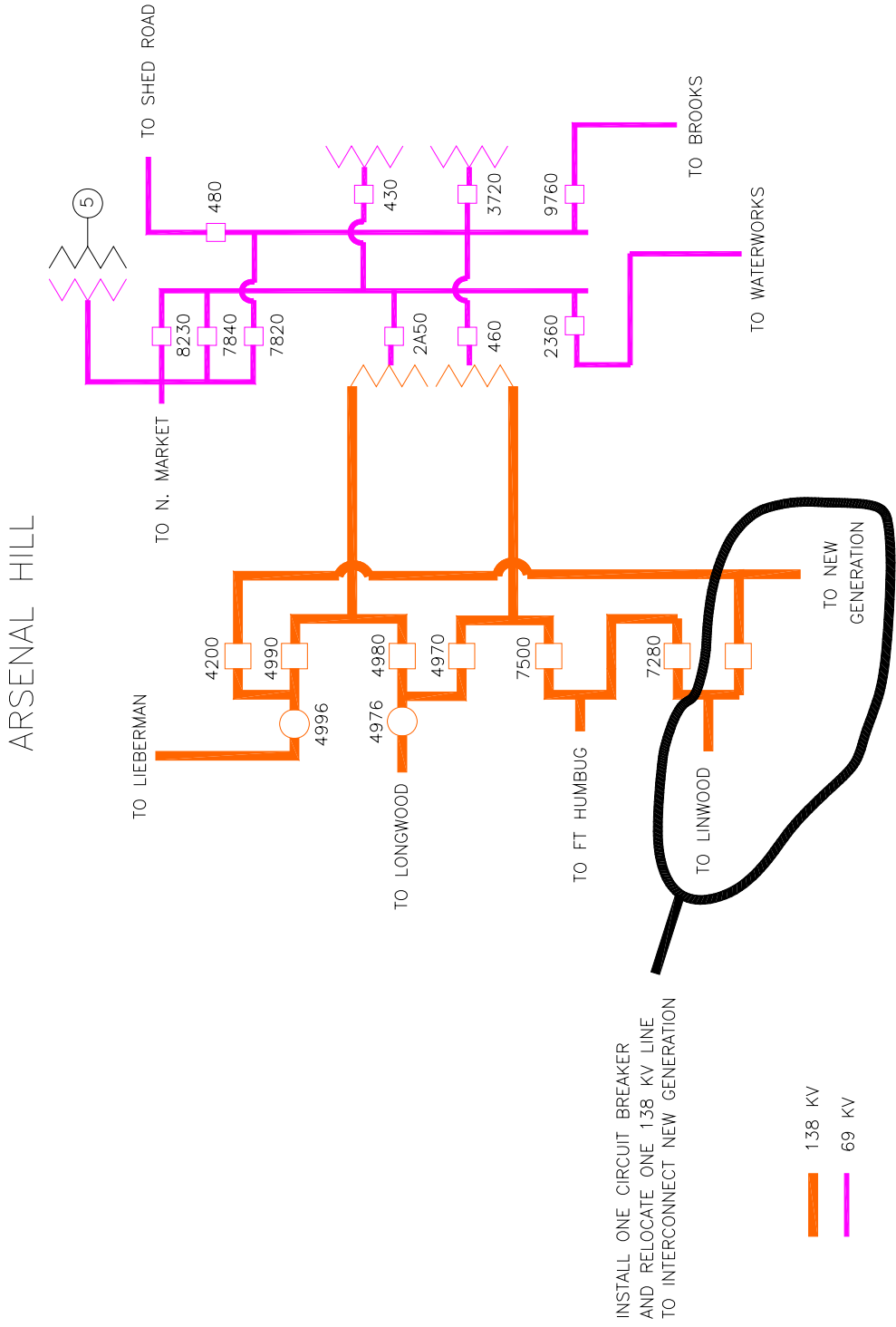
**Table 1: Direct Assignment Facilities**

| Facility   | ESTIMATED COST<br>(2006 DOLLARS) |
|--|----------------------------------|
| Customer – 138kV, 18kV equipment   | *                                |
| Customer – 138kV connection from GSU and reserve auxiliary to Arsenal Hill 138kV bus | \$950,000                        |
|  |                                  |
|  |                                  |
| <b>Total</b>   | *                                |

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

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

| Facility   | ESTIMATED COST<br>(2006 DOLLARS) |
|--|----------------------------------|
| AEP – Add 138kV terminal including one 138kV circuit breaker to the Arsenal Hill 138kV ring bus. | \$1,781,000                      |
| AEP – Relocate Arsenal Hill-Linwood 138kV line entry point into Arsenal Hill 138kV ring bus      | \$340,000                        |
|  |                                  |
|  |                                  |
| <b>Total</b>   | <b>\$2,121,000</b>               |



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

FIGURE 4  
ARSENAL HILL 138 KV GENERATION INTERCONNECTION

## **Powerflow Analysis**

A powerflow analysis was conducted for the facility using modified versions of the 2011 Summer and Winter Peak, and 2016 Summer Peak models. Five different scenarios of each of the season models were used to evaluate the request. 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 June 1, 2010. 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 455/550MW and location, additional criteria violations will occur on the existing AEPW, SPS, OKGE, and EES transmission systems under steady state and contingency conditions in the peak seasons. These contingency analyses will have to be re-evaluated as part of a transmission service request.

There are other proposed generation additions in the general area of the Customer's facility. 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 AEPW, WERE, EMDE, KACY, KCPL, MIPU, SWPS, OKGE, WFEC, GRDA, OMPA, INDN, SPRM, and SWPA were 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**

| ELEMENT  |
|--|
| ETR - '4RINGLD 138 138/115KV TRANSFORMER CKT 1'                          |
| AEP - 'ARSENAL HILL - FORT HUMBUG 138KV CKT 1'                           |
| AEP - 'ARSENAL HILL - MCWILLIE STREET 138KV CKT 1'                       |
| AEP - 'ASHDOWN WEST REC - CRAIG JUNCTION 138KV CKT 1'                    |
| AEP - 'ASHDOWN WEST REC - PATTERSON 138KV CKT 1'                         |
| AEP – SWPA - 'BETHEL - BROKEN BOW 138KV CKT 1'                           |
| AEP - 'BETHEL - NASHOBA 138KV CKT 1'                                     |
| SWPA-OKGE - 'BROWN - BROWN 138KV CKT 1'                                  |
| SWPA-WFEC - 'BROWN - RUSSETT 138KV CKT 1'                                |
| AEP - 'CLAYTON - NASHOBA 138KV CKT 1'                                    |
| AEP - 'CLAYTON - SARDIS 138KV CKT 1'                                     |
| AEP - 'CROCKETT - TENASKA RUSK COUNTY 345KV CKT 1'                       |
| ETR – AEP - 'DANVILLE (APL) - MAGAZINE REC 161KV CKT 1'                  |
| ETR – AEP - 'ELDORADO EHV - LONGWOOD 345KV CKT 1'                        |
| OKGE - 'FAIRMONT TAP - WOODRING 138KV CKT 1'                             |
| WERE - 'JARBALO JUNCTION SWITCHING STATION - STRANGER CREEK 115KV CKT 1' |
| WFEC – SWPA - 'LANE - TUPELO 138KV CKT 1'                                |
| AEP - 'LINWOOD - MCWILLIE STREET 138KV CKT 1'                            |
| AEP - 'LONE OAK - SARDIS 138KV CKT 1'                                    |
| AEP - 'LYDIA - VALLIANT 345KV CKT 1'                                     |
| AEP - 'LYDIA - WELSH 345KV CKT 1'  |
| AEP - 'NORTH NEW BOSTON - SOUTH FOREMAN REC 138KV CKT 1'                 |
| AEP - 'NORTHWEST TEXARKANA - PATTERSON 138KV CKT 1'                      |
| AEP - 'NORTHWEST TEXARKANA - WELSH 345KV CKT 1'                          |
| OKGE - 'PECAN CREEK (PECANCK1) 345/161/13.8KV TRANSFORMER CKT 1'         |
| AEP - 'PITTSBURG - VALLIANT 345KV CKT 1'                                 |
| AEP - 'RINGGOLD - SAILES 115KV CKT 1'                                    |
| WFEC – OKGE - 'RUSSETT - RUSSETT 138KV CKT 1'                            |
| SPS - 'TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1'     |
| OKGE - 'WAUKOMIS TAP - WOODRING 138KV CKT 1'                             |



**Table 4: Contingency Analysis**

| ELEMENT  | SEASON | RATE (MVA) | LOADING (%) | ATC (MW) | CONTINGENCY                                       |
|--|--------|------------|-------------|----------|---|
| <b>2011 SUMMER PEAK</b>  |        |            |             |          |   |
| 'ASHDOWN WEST REC - CRAIG JUNCTION 138KV CKT 1'                | 11sp   | 235        | 126.4       | 0        | 'LYDIA - VALLIANT 345KV CKT 1'                    |
| 'BETHEL - BROKEN BOW 138KV CKT 1'                              | 11sp   | 107        | 170.4       | 0        | 'PITTSBURG - VALLIANT 345KV CKT 1'                |
| 'BETHEL - NASHOBA 138KV CKT 1'                                 | 11sp   | 107        | 164.4       | 0        | 'PITTSBURG - VALLIANT 345KV CKT 1'                |
| 'CLAYTON - NASHOBA 138KV CKT 1'                                | 11sp   | 107        | 162.8       | 0        | 'PITTSBURG - VALLIANT 345KV CKT 1'                |
| 'CLAYTON - SARDIS 138KV CKT 1'                                 | 11sp   | 107        | 159.6       | 0        | 'PITTSBURG - VALLIANT 345KV CKT 1'                |
| 'ELDORADO EHV - LONGWOOD 345KV CKT 1'                          | 11sp   | 956        | 111.9       | 0        | 'SPP-AEPW-01'                                     |
| 'LONE OAK - SARDIS 138KV CKT 1'                                | 11sp   | 107        | 156.4       | 0        | 'PITTSBURG - VALLIANT 345KV CKT 1'                |
| 'LYDIA - WELSH 345KV CKT 1'                                    | 11sp   | 905        | 113.6       | 0        | 'BASE CASE'                                       |
| 'LYDIA - WELSH 345KV CKT 1'                                    | 11sp   | 1059       | 139.6       | 0        | 'SPP-AEPW-04'                                     |
| 'NORTHWEST TEXARKANA - PATTERSON 138KV CKT 1'                  | 11sp   | 261        | 170.1       | 0        | 'LYDIA - VALLIANT 345KV CKT 1'                    |
| 'NORTHWEST TEXARKANA - WELSH 345KV CKT 1'                      | 11sp   | 1059       | 116.6       | 0        | 'LYDIA - WELSH 345KV CKT 1'                       |
| 'CROCKETT - TENASKA RUSK COUNTY 345KV CKT 1'                   | 11sp   | 789        | 109.0       | 30       | 'SPP-AEPW-01'                                     |
| 'BROWN - BROWN 138KV CKT 1'                                    | 11sp   | 143        | 107.1       | 134      | 'PITTSBURG - VALLIANT 345KV CKT 1'                |
| 'BROWN - RUSSETT 138KV CKT 1'                                  | 11sp   | 96         | 115.3       | 203      | 'PITTSBURG - VALLIANT 345KV CKT 1'                |
| 'RUSSETT - RUSSETT 138KV CKT 1'                                | 11sp   | 96         | 112.7       | 250      | 'PITTSBURG - VALLIANT 345KV CKT 1'                |
| 'PECAN CREEK (PECANCK1) 345/161/13.8KV TRANSFORMER CKT 1'      | 11sp   | 370        | 102.6       | 269      | 'CLARKSVILLE - MUSKOGEE 345KV CKT 1'              |
| '4RINGLD 138 138/115KV TRANSFORMER CKT 1'                      | 11sp   | 125        | 104.3       | 278      | 'BASE CASE'                                       |
| 'TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1' | 11sp   | 560        | 103.7       | 283      | 'GEN:51442 1'                                     |
| 'RINGGOLD - SAILES 115KV CKT 1'                                | 11sp   | 115        | 104.6       | 296      | 'BASE CASE'                                       |
| 'ASHDOWN WEST REC - PATTERSON 138KV CKT 1'                     | 11sp   | 287        | 106.4       | 299      | 'LYDIA - VALLIANT 345KV CKT 1'                    |
| 'DANVILLE (APL) - MAGAZINE REC 161KV CKT 1'                    | 11sp   | 148        | 103.1       | 306      | 'ARKANSAS NUCLEAR ONE 500 - FT SMITH 500KV CKT 1' |
| 'BETHEL - BROKEN BOW 138KV CKT 1'                              | 11sp   | 107        | 106.9       | 311      | 'PITTSBURG - VALLIANT 345KV CKT 1'                |
| 'NORTH NEW BOSTON - SOUTH FOREMAN REC 138KV CKT 1'             | 11sp   | 209        | 105.1       | 322      | 'SPP-AEPW-01'                                     |
| 'ARSENAL HILL - FORT HUMBUG 138KV CKT 1'                       | 11sp   | 287        | 110.9       | 384      | 'ARSENAL HILL - MCWILLIE STREET 138KV CKT 1'      |
| 'BETHEL - NASHOBA 138KV CKT 1'                                 | 11sp   | 107        | 101.7       | 420      | 'PITTSBURG - VALLIANT 345KV CKT 1'                |
| 'PITTSBURG - VALLIANT 345KV CKT 1'                             | 11sp   | 956        | 101.5       | 422      | 'ELDORADO EHV - LONGWOOD 345KV CKT 1'             |

|   |      |     |       |     |  |
|---|------|-----|-------|-----|--|
| 'LINWOOD - MCWILLIE STREET 138KV CKT 1' | 11sp | 209 | 105.3 | 429 | 'ARSENAL HILL - FORT HUMBUG 138KV CKT 1' |
|---|------|-----|-------|-----|--|

| ELEMENT   | SEASON | RATE (MVA) | LOADING (%) | ATC (MW) | CONTINGENCY                                  |
|---|--------|------------|-------------|----------|--|
| 'ARSENAL HILL - FORT HUMBUG 138KV CKT 1'                          | 11sp   | 287        | 101.1       | 439      | 'LIEBERMAN - NORTH BENTON 138KV CKT 1'       |
| 'LANE - TUPELO 138KV CKT 1'                                       | 11sp   | 203        | 102.6       | 447      | 'PITTSBURG - VALLIANT 345KV CKT 1'           |
| 'LYDIA - VALLIANT 345KV CKT 1'                                    | 11sp   | 1176       | 103.4       | 452      | 'ELDORADO EHV - LONGWOOD 345KV CKT 1'        |
| 'CLAYTON - NASHOBA 138KV CKT 1'                                   | 11sp   | 107        | 100.1       | 453      | 'PITTSBURG - VALLIANT 345KV CKT 1'           |
| <b>2011 WINTER PEAK</b>   |        |            |             |          |  |
| 'BETHEL - BROKEN BOW 138KV CKT 1'                                 | 11wp   | 107        | 149.9       | 0        | 'PITTSBURG - VALLIANT 345KV CKT 1'           |
| 'BETHEL - NASHOBA 138KV CKT 1'                                    | 11wp   | 107        | 145.0       | 0        | 'PITTSBURG - VALLIANT 345KV CKT 1'           |
| 'CLAYTON - NASHOBA 138KV CKT 1'                                   | 11wp   | 107        | 143.5       | 0        | 'PITTSBURG - VALLIANT 345KV CKT 1'           |
| 'CLAYTON - SARDIS 138KV CKT 1'                                    | 11wp   | 107        | 141.3       | 0        | 'PITTSBURG - VALLIANT 345KV CKT 1'           |
| 'LONE OAK - SARDIS 138KV CKT 1'                                   | 11wp   | 107        | 138.5       | 0        | 'PITTSBURG - VALLIANT 345KV CKT 1'           |
| 'NORTHWEST TEXARKANA - PATTERSON 138KV CKT 1'                     | 11wp   | 287        | 129.7       | 0        | 'LYDIA - VALLIANT 345KV CKT 1'               |
| 'LYDIA - WELSH 345KV CKT 1'                                       | 11wp   | 1183       | 110.2       | 152      | 'SPP-AEPW-04'                                |
| 'ARSENAL HILL - FORT HUMBUG 138KV CKT 1'                          | 11wp   | 287        | 112.3       | 470      | 'ARSENAL HILL - MCWILLIE STREET 138KV CKT 1' |
| 'LINWOOD - MCWILLIE STREET 138KV CKT 1'                           | 11wp   | 236        | 112.5       | 481      | 'ARSENAL HILL - FORT HUMBUG 138KV CKT 1'     |
| 'ARSENAL HILL - MCWILLIE STREET 138KV CKT 1'                      | 11wp   | 287        | 103.4       | 531      | 'ARSENAL HILL - FORT HUMBUG 138KV CKT 1'     |
| <b>2016SUMMER PEAK</b>  |        |            |             |          |  |
| 'BETHEL - NASHOBA 138KV CKT 1'                                    | 16sp   | 107        | 141.6       | 0        | 'PITTSBURG - VALLIANT 345KV CKT 1'           |
| 'CLAYTON - NASHOBA 138KV CKT 1'                                   | 16sp   | 107        | 140.0       | 0        | 'PITTSBURG - VALLIANT 345KV CKT 1'           |
| 'CLAYTON - SARDIS 138KV CKT 1'                                    | 16sp   | 107        | 136.6       | 0        | 'PITTSBURG - VALLIANT 345KV CKT 1'           |
| 'JARBALO JUNCTION SWITCHING STATION - STRANGER CREEK 115KV CKT 1' | 16sp   | 240        | 999.0       | 0        | 'GEN:56663 1'                                |
| 'LONE OAK - SARDIS 138KV CKT 1'                                   | 16sp   | 107        | 133.2       | 0        | 'PITTSBURG - VALLIANT 345KV CKT 1'           |
| 'LYDIA - WELSH 345KV CKT 1'                                       | 16sp   | 1059       | 130.8       | 0        | 'SPP-AEPW-04'                                |
| 'NORTHWEST TEXARKANA - PATTERSON 138KV CKT 1'                     | 16sp   | 261        | 155.4       | 0        | 'LYDIA - VALLIANT 345KV CKT 1'               |
| 'TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1'    | 16sp   | 560        | 120.7       | 0        | 'GEN:52212 1'                                |
| 'BETHEL - BROKEN BOW 138KV CKT 1'                                 | 16sp   | 107        | 999.0       | 4        | 'GEN:53701 1'                                |

| ELEMENT  | SEASON | RATE (MVA) | LOADING (%) | ATC (MW) | CONTINGENCY                                  |
|--|--------|------------|-------------|----------|--|
| 'TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1' | 16sp   | 560        | 106.7       | 75       | 'FINNEY STATION - HOLCOMB 345KV CKT 1'       |
| 'ARSENAL HILL - FORT HUMBUG 138KV CKT 1'                       | 16sp   | 287        | 109.2       | 313      | 'LIEBERMAN - NORTH BENTON 138KV CKT 1'       |
| 'ASHDOWN WEST REC - CRAIG JUNCTION 138KV CKT 1'                | 16sp   | 235        | 106.5       | 318      | 'LYDIA - VALLIANT 345KV CKT 1'               |
| 'ARSENAL HILL - FORT HUMBUG 138KV CKT 1'                       | 16sp   | 287        | 108.8       | 320      | 'LIEBERMAN - NORTH BENTON 138KV CKT 1'       |
| 'LYDIA - WELSH 345KV CKT 1'                                    | 16sp   | 905        | 103.7       | 327      | 'BASE CASE'                                  |
| 'RINGGOLD - SAILES 115KV CKT 1'                                | 16sp   | 115        | 103.0       | 350      | 'BASE CASE'                                  |
| 'ARSENAL HILL - FORT HUMBUG 138KV CKT 1'                       | 16sp   | 287        | 112.2       | 374      | 'ARSENAL HILL - MCWILLIE STREET 138KV CKT 1' |
| 'WAUKOMIS TAP - WOODRING 138KV CKT 1'                          | 16sp   | 287        | 101.7       | 390      | 'FAIRMONT TAP - WOODRING 138KV CKT 1'        |
| 'LINWOOD - MCWILLIE STREET 138KV CKT 1'                        | 16sp   | 209        | 110.5       | 409      | 'ARSENAL HILL - FORT HUMBUG 138KV CKT 1'     |
| 'FAIRMONT TAP - WOODRING 138KV CKT 1'                          | 16sp   | 287        | 100.2       | 447      | 'WAUKOMIS TAP - WOODRING 138KV CKT 1'        |
| 'ARSENAL HILL - FORT HUMBUG 138KV CKT 1'                       | 16sp   | 246        | 100.7       | 447      | 'BASE CASE'                                  |
| 'TUCO INTERCHANGE (TUCO XX4) 345/230/13.2KV TRANSFORMER CKT 1' | 16sp   | 560        | 110.4       | 451      | 'GEN:51702 1'                                |
| 'BETHEL - BROKEN BOW 138KV CKT 1'                              | 16sp   | 107        | 105.8       | 453      | 'PITTSBURG - VALLIANT 345KV 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 project is estimated at \$2,121,000 for AEP's Transmission Owner interconnection facilities listed in Table 2 excluding upgrades of other transmission facilities by AEP, OKGE, SWPA, and EES listed in Table 3 of which are Network Constraints. At this time, the cost estimates for Direct Assignment facilities including those in Table 1 have not all been defined by the Customer. As stated earlier, 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. These contingency analyses will have to be re-evaluated as part of a transmission service request.

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.

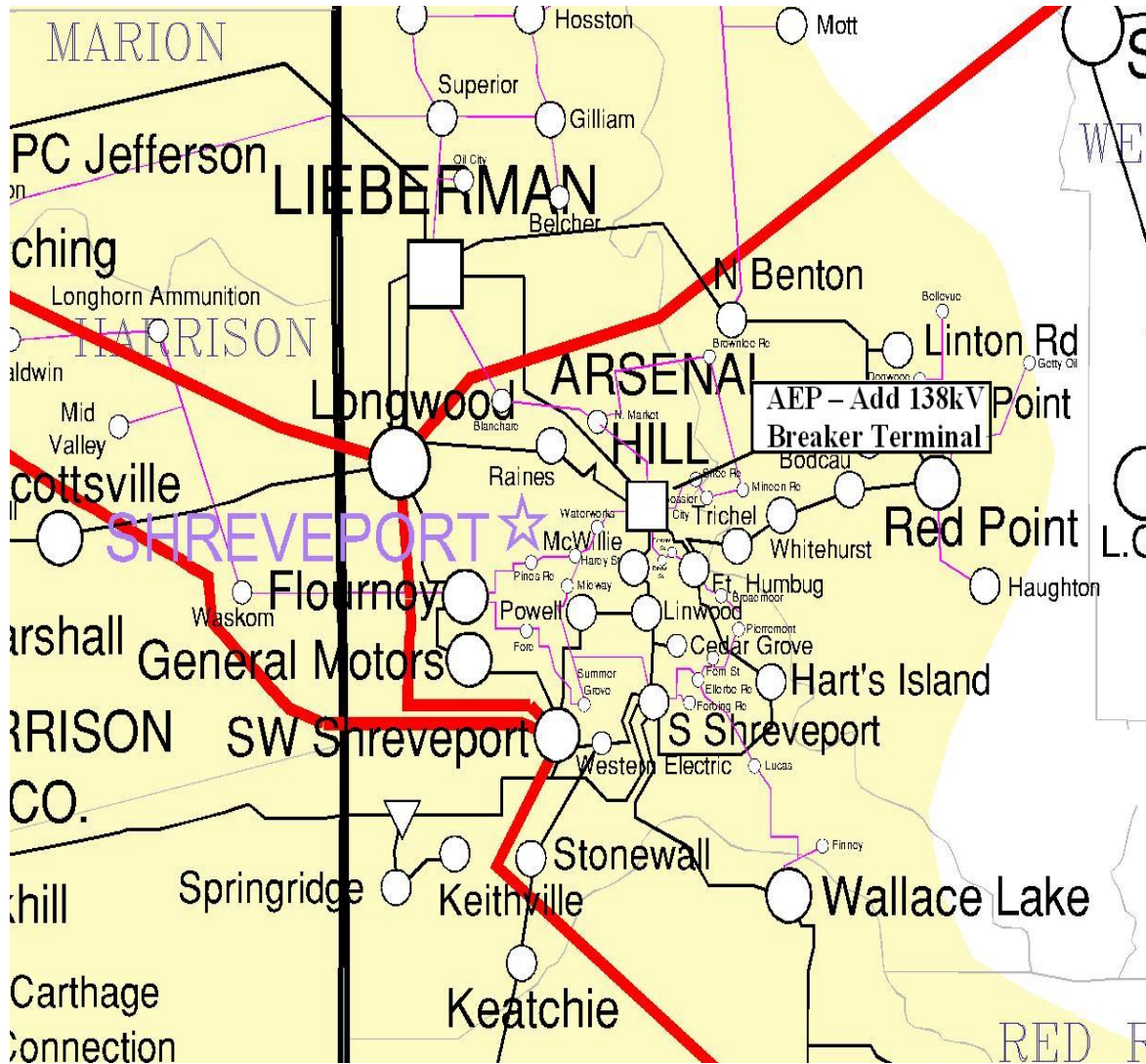


Figure 2: Map Of The Surrounding Area