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A Touchstone Energy® Cooperative 

# TEN-YEAR TRANSMISSION PLAN

2013 - 2022

Arizona Corporation Commission  
**DOCKETED**

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**Docket No. E0000D-13-0002**

**JANUARY 29, 2013**

**SOUTHWEST TRANSMISSION COOPERATIVE, INC.**

**TEN-YEAR TRANSMISSION PLAN**

**2013 – 2022**

Prepared for the

**ARIZONA CORPORATION COMMISSION**

**Docket No. E-00000D-13-0002**

**TRANSMISSION PLANNING**

**JANUARY 29, 2013**

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# **SOUTHWEST TRANSMISSION COOPERATIVE, INC.**

## **TEN-YEAR TRANSMISSION PLAN**

### **GENERAL INFORMATION**

This Ten-Year Plan is submitted to the Arizona Corporation Commission (“Commission”) to satisfy the requirements of section 40-360.02 of the Arizona Revised Statutes (“A.R.S.”), relating to power plant and transmission line siting requirements. It outlines the plans of Southwest Transmission Cooperative, Inc. (“SWTC”) to install electric facilities required to meet anticipated system load growth of its Distribution Cooperative Members (“Members”) and other network and point to point customers.

This report contains transmission projects that SWTC anticipates may be constructed over the next ten-year period. As noted in A.R.S. section 40-360.02.F, the plans contained in this report are tentative information only and are subject to change at any time at the discretion of SWTC. SWTC anticipates that any changes to this plan will likely to be due to changes in load forecasts, environmental constraints, economic considerations and/or regulatory and legal developments. All projects are subject to a peer-review by SWTC’s Class A Operating Committee (“CAOC”) prior to submittal to the SWTC Board for approval. Meetings of the CAOC are held quarterly, or as needed, and changes to these projects are reviewed as necessary to meet the Member needs. One of the responsibilities of the CAOC is to review the preparation of a Construction Work Plan (“CWP”) that is then submitted to the SWTC Board for approval. Once the CWP is approved, the projects are considered by SWTC as “planned” projects. Conceptual projects, or those that have not been vetted by the CAOC for placement into a CWP, will not be included in ten year plan filings. However, should there be changes of any significance that occur prior to the next Ten-Year Plan filing, these will be discussed with the Commission Staff.

This specific report is divided into two sections, as outlined in the Table of Contents on page 2. Section I describes planned transmission lines and projects SWTC may construct over the ten-

year plan period, whose nominal rating is equal to or greater than one hundred fifteen thousand volts ("115 kV").

Section II contains SWTC's internal planning criteria and facility ratings, pursuant to Commission Decision #63876, dated July 25, 2001.

The technical study report of the planned transmission projects contained in Section I, to satisfy the requirements of paragraph C.7 of A.R.S. Section 40-360.02, has been prepared as a stand-alone document and will be filed jointly with this document to the Commission.

The planned transmission lines that are listed in Section I are needed to maintain system reliability, meet reliability standards, and to serve load of SWTC Members and other customers. Due to the proximity of the new lines to the Member load being served, studies conducted show little impact to the overall interconnected system.

## **REGIONAL PLANNING**

SWTC has been an active participant in regional and sub-regional transmission planning efforts within the Western Interconnection for many years. This participation has been through the Southwest Area Transmission ("SWAT"), membership in the Western Electricity Coordinating Council ("WECC") and WestConnect. SWTC is involved in the following subcommittees of SWAT, either through active participation or copy interest:

- Central Arizona Transmission Subcommittee ("CATS")
- Colorado River Transmission Subcommittee ("CRT")
- New Mexico Subcommittee ("NM")
- Southeast Arizona Transmission Subcommittee ("SATS")
- Short-circuit Work Group ("SCWG")

SWTC is an active participant within the following committees of WECC: the Operating Committee (“OC”), the Planning Coordination Committee (“PCC”), the Technical Studies Subcommittee (“TSS”) and the System Review Work Group (“SRWG”). In addition, SWTC continues to monitor the efforts of the Transmission Expansion Planning Policy Committee (“TEPPC”) which has been tasked with the development of 10- and 20-year transmission plans for the Western Interconnection.

SWTC was one of the original twelve signatories to the WestConnect Project Agreement for Subregional Transmission Planning (“STP Agreement”) and participates regularly in various WestConnect meetings and/or conference calls. Formation of WestConnect was done to assess stakeholder and market needs and develop cost-effective enhancements to the Western wholesale electricity market. WestConnect coordinates its efforts with other regional planning entities within the Western Interconnection and its most recent efforts have focused on compliance with the provisions of the Federal Energy Regulatory Commission (“FERC”) Order No. 1000 “Transmission Planning and Cost Allocation by Transmission Owning and Operating Public Utilities” that was issued July 21, 2001. A Planning Management Committee (“PMC”), made up of one representative from each of the signatories to the STP Agreement, has been tasked with implementation of the regional and interregional planning processes outlined in Order No. 1000. A new Planning Participation Agreement (“PPA”) is being developed to replace the current STP Agreement. The responsibilities of the PMC, through this new PPA, include approving a Regional Transmission Plan that includes cost allocation processes, developing and approving budgets for the planning processes, and creating ad hoc workgroups and/or subcommittees. The structure of the PMC will initially include two subcommittees, the Planning Subcommittee and the Cost Allocation Subcommittee.

At the WestConnect Annual Planning Workshop, held November 14, 2012, SWTC presented its 2013-2022 Ten-Year Transmission Plan for inclusion into the 2013 WestConnect Transmission Plan. The WestConnect plan is scheduled for approval at the February 21, 2013 WestConnect Annual Planning Meeting. The projects that are included in this ten year plan filing to the

Commission contain some minor changes to those originally presented at the WestConnect Annual Planning Workshop. These changes relate to conceptual projects that SWTC did not include in this ten year plan filing as they lie beyond the ten year plan horizon.

## **7<sup>th</sup> BTA REQUIREMENTS**

On December 11, 2012, the Commission approved the 7<sup>th</sup> BTA Report with Decision #73625 that adopted staff's recommendations, the Commission ordered studies, and one new order. The specific recommendations and orders applying to SWTC are listed below, along with SWTC's response:

### **Recommendation #7C:**

Continue to require the jurisdictional utilities to report relevant findings in future BTAs regarding compliance with transmission planning standards (TPL-001 through TPL-004) from NERC/WECC reliability audits that have been finalized and filed with FERC.

### **SWTC's Response:**

SWTC was audited during the period of January 30, 2012 – February 9, 2012. The following table shows the results of the items SWTC was audited on, as it regards the TPL Standards:

<u>Standard</u>	<u>Requirement</u>	<u>Audit Finding</u>
TPL-003-0a	R3	No finding
TPL-004-0	R2	No finding

### **Recommendation #7E:**

Continue to require the jurisdictional utilities to include planned transmission reconductor projects, transformer capacity upgrade projects and reactive power compensation facility additions at 115 kV and above in future 10-year plan filings.

**SWTC's Response:**

There are no transmission reconductor projects or transformer capacity upgrade projects in this ten year plan filing.

Reactive power compensation facility additions at 115 kV and above for this ten-year plan filing, are as per the following schedule:

<u>Year</u>	<u>Substation</u>	<u>MVAR Quantity</u>
2014	Avra Valley	9.45
2013	Butterfield	14.4
2014	Sahuarita	14.4

Additional studies conducted during 2013, due to a potential change in the 2012 load forecast or other circumstances that may tend to refine these values and/or suggest the need to adjust locations for reactive support to the SWTC system, will be reported in the next ten-year plan filing.

The requirements for VAR support on the SWTC system are less than what was presented in last year's ten year plan. This is because the studies conducted in support of this year's ten year plan used a corrected power factor of Member System load of approximately 98%, which more correctly models the existing transmission system topology, as it takes into account existing distribution system capacitor banks.

**Recommendation #7H:**

Enter the following order: Arizona utilities are directed to advise each interconnection applicant of the need to contact the Commission for appropriate ACC filing requirements at the time the applicant files for interconnection.

**SWTC Response:**

As directed by the Commission, SWTC will advise each interconnection applicant of the need to contact the Commission for the associated ACC filing requirements by including an advisory notice to this effect on the SWTC OASIS site, as well as in any SWTC initial written correspondence responding to any applicant. The wording of both statements will include that the applicant, and not SWTC, is solely responsible for compliance with any ACC filing requirements associated with its interconnection application.

**PRIOR BTA ORDER REQUIREMENTS**

The 6<sup>th</sup> BTA contained an order, approved by the Commission in Decision #72031, known as Recommendation #8, which applies to SWTC and other jurisdictional utilities, that is to be discussed in future BTAs. It is listed below along with the SWTC response:

**Recommendation #8:**

In addition, we believe that the jurisdictional utilities shall include the effects of distributed renewable generation and energy efficiency programs on future transmission needs in future ten-year plan filings, beginning in January 2011, and that these effects be discussed in future BTAs.

**SWTC Response:**

As noted in last year's ten year plan filing, SWTC is a wholesale transmission only cooperative and therefore does not develop energy efficiency or distributed renewable generation programs. These programs are put in place by SWTC's Class A Members. In addition, each Class A Member files with the ACC an individual Renewable Energy Standard and Tariff which includes plans for such programs. Each Class A Member provides the effect of each respective plan for inclusion in SWTC's annual Member approved load forecast. Transmission projects

developed in response to load forecasts are net of any energy efficiency or distributed renewable generation programs.

## **CHANGES FROM 2012 TEN-YEAR PLAN FILING**

There are several changes to the projects considered by SWTC for inclusion in this Ten-Year Plan filing over last year's ("2012-2021") Ten-Year Plan filing. These are noted below and are mostly due to the economic downturn which continues to have an effect upon projects that SWTC and its Members are considering. The changes are noted below:

**Marana to Avra 115 kV Line Upgrade.** This project, which involved an upgrade of the Marana to Avra 115 kV line, from 4/0 ACSR to 1272 ACSR, was placed into service on March 5, 2012.

**Avra to Sandario Tap 115 kV Line Upgrade.** This project, which involved an upgrade of the Avra to Sandario Tap 115 kV line, from 4/0 ACSR to 1272 ACSR, was placed into service on March 20, 2012.

**Saguaro to Tucson 115 kV Line Loop-in To Marana.** This project loops in the Western Area Power Administration Saguaro to Tucson 115 kV line into the SWTC Marana Substation, a distance of 0.2 miles. SWTC is currently involved with Western in a joint study of this project and the in-service date has changed from 2013 to 2014.

**Sandario Tap to Three Points 115 kV Line Upgrade.** This project has been deferred from 2015 to beyond the ten year plan timeframe, and has been removed from this report.

**Bicknell 345/230 kV Transformer Replacement.** This project has been deferred from 2015 to beyond the ten year plan timeframe, pending further study and need. As noted in the previous ten year plan, SWTC sees no current justification for building this project on its own and it has been removed from this report.

**Greenlee 2<sup>nd</sup> 345/230 kV Transformer.** This project has been deferred from 2015 to beyond the ten year plan timeframe, pending further study and need. As noted in the previous ten year plan, SWTC sees no current justification for building this project on its own and it has been removed from this report.

**Apache/Hayden 115 kV Line Loop-in to San Manuel.** This project has been deferred from 2017 to beyond the ten year plan timeframe, and has been removed from this report.

**Three Points to Bicknell 115 kV Line Upgrade.** This project has been deferred from 2020 to beyond the ten year plan timeframe, and has been removed from this report.

**San Rafael 2<sup>nd</sup> 230/69 kV Transformer.** This project has been deferred from 2021 to beyond the ten year plan timeframe, and has been removed from this report.

## **PROJECT MAPS**

The following maps are included to show the location of existing and future transmission projects. These maps have historically resided in the Technical Study Report, but will also be included in this document for ease of reference when reviewing the proposed projects that are listed in the next Section.

The maps included in this report are:

Figure 1 - SWTC Northern Area

Figure 2 - SWTC Southern Area

Figure 3 - SWTC Western Area

**SWTC CURRENT & PLANNED SYSTEM  
NORTHERN AREA  
2013-2022**

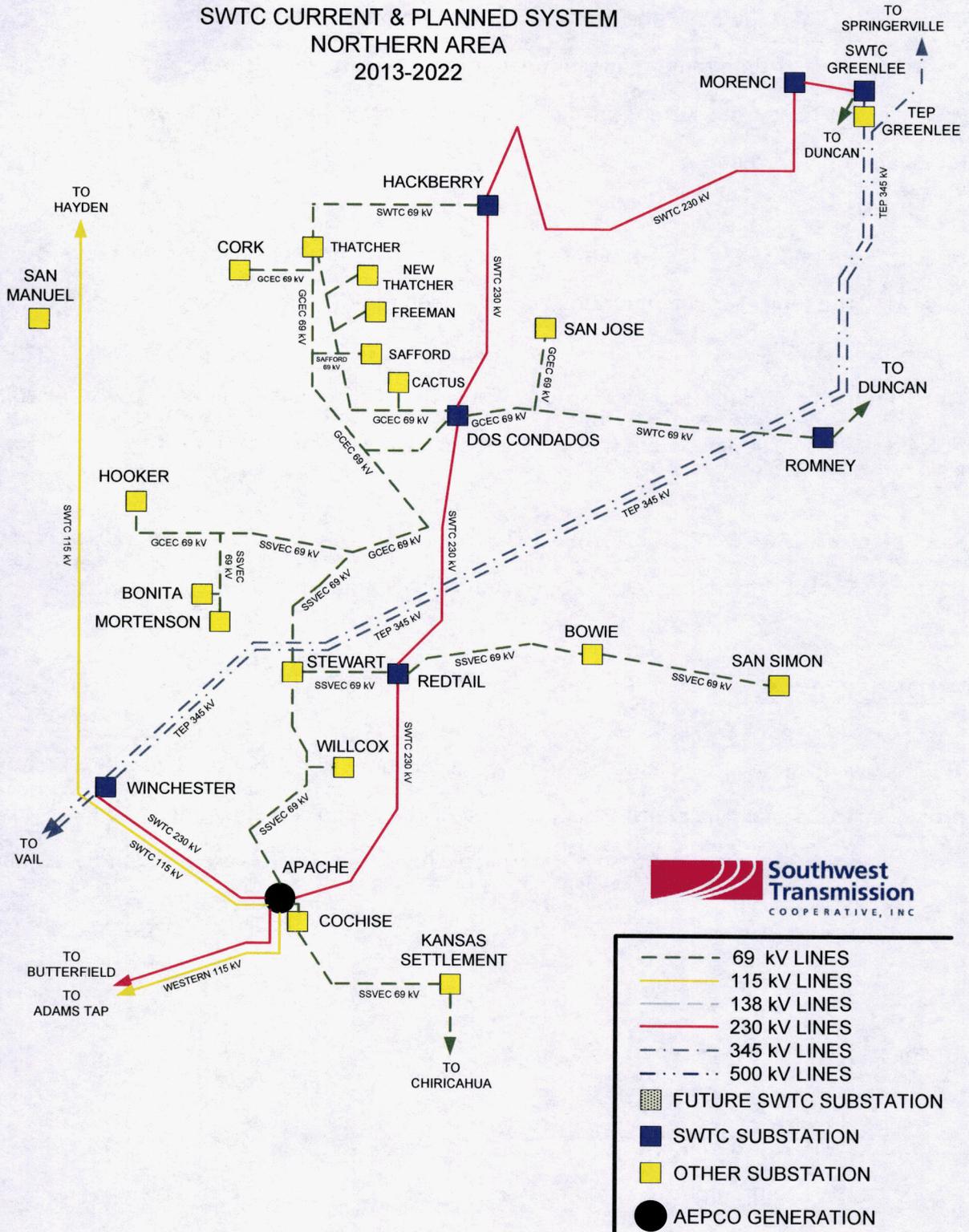


Figure 1 – SWTC Northern Area

# SWTC CURRENT & PLANNED SYSTEM SOUTHERN AREA 2013-2022

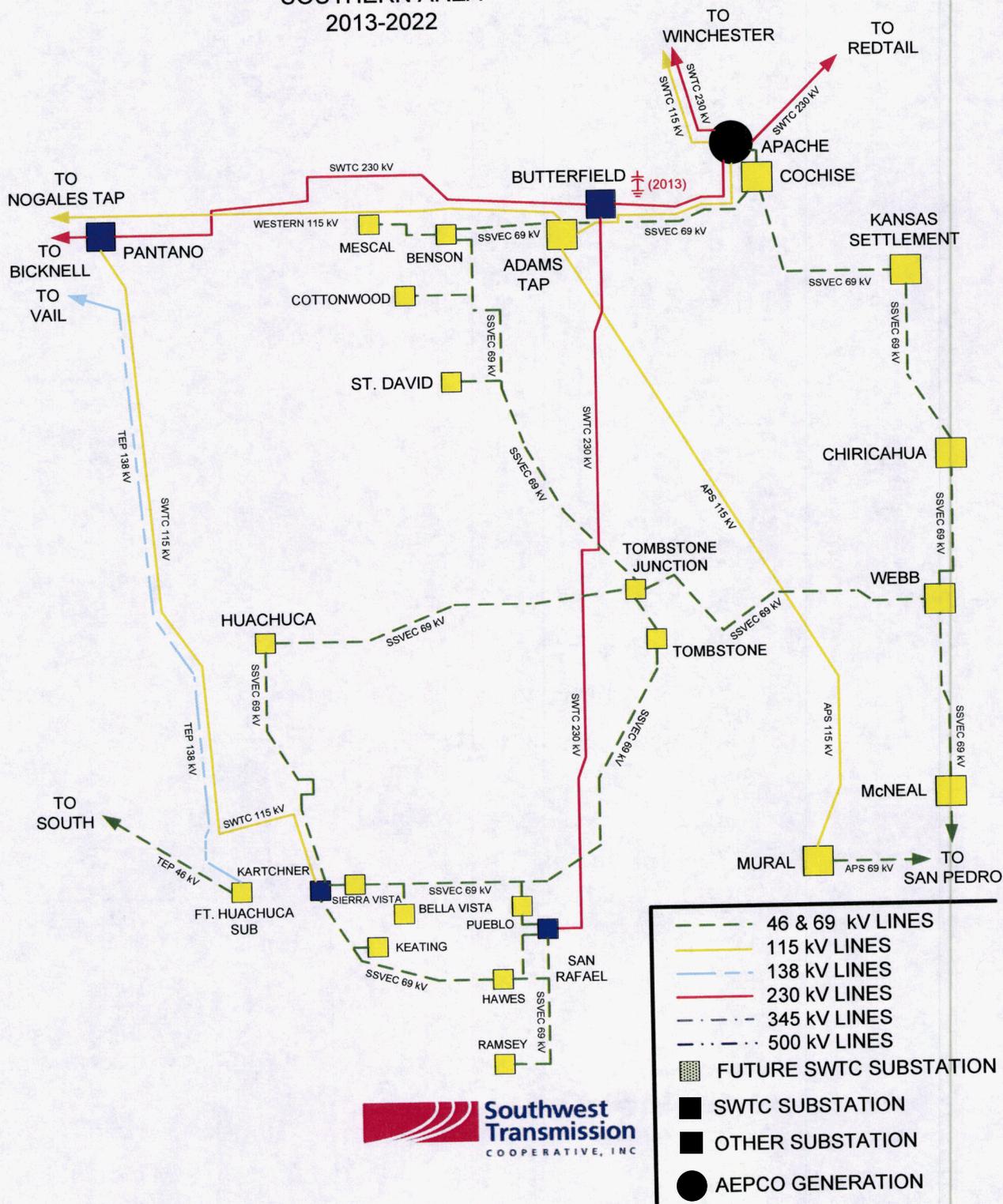


Figure 2 – SWTC Southern Area

**SWTC CURRENT & PLANNED SYSTEM  
WESTERN AREA  
2013-2022**

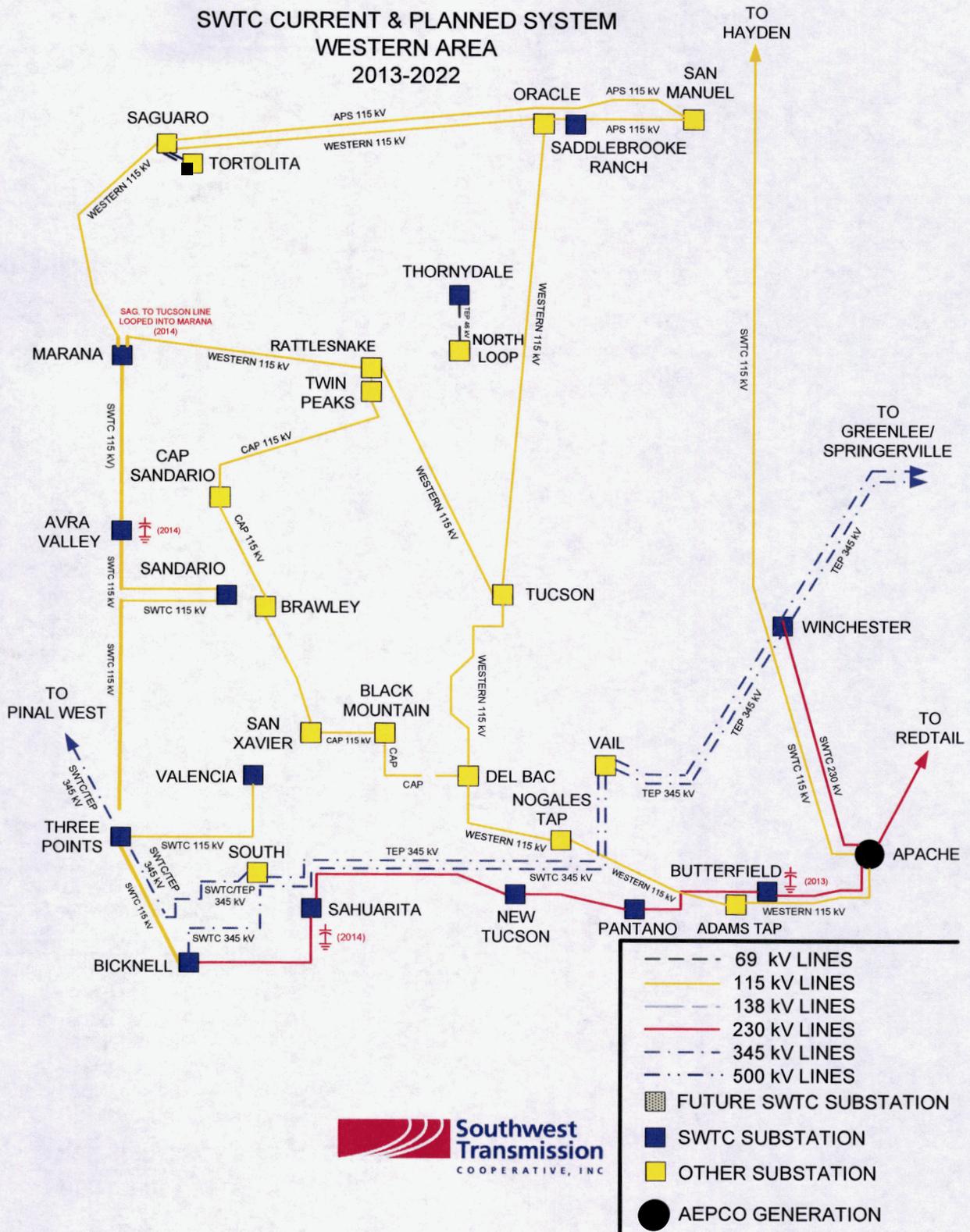


Figure 3 – SWTC Western Area



## **SECTION I - PLANNED TRANSMISSION LINES**

## SAGUARO TO TUCSON 115 kV LINE LOOP-IN TO MARANA

**Line Designation:** Saguaro to Tucson 115 kV Line Loop-in to Marana  
(Formerly the Marana Tap to Marana 115 kV Line Upgrade)

**Size:**

- a) Voltage 115 kV
- b) Capacity 219 MVA
- c) Point of Origin Marana Tap  
Sec. 26 T11S R10E
- d) Point of Termination Marana Substation  
Sec. 26 T11S R10E
- e) Length Approximately 0.2 miles

**Routing:** Western's Marana Tap, west to the SWTC Marana Substation.

**Purpose:** To provide system reliability, increased transfer capability and voltage support for the SWTC system and to provide for anticipated Member load growth.

**Dates:**

- a) Construction Start 2014
- b) In-Service Date 2014

**Notes:** The Marana Tap to Marana project was approved by the ACC Line Siting Committee on May 3, 2011 and by the Commission (Case #161, Decision #72447) on June 28, 2011. The Saguaro to Tucson 115 kV line loop-in to Marana Project is considered to be a minor modification to this original project approval as it utilizes the same line path. This planned project is currently under study with the Western Area Power Administration.

## **SECTION II - INTERNAL PLANNING CRITERIA AND FACILITY RATINGS**

SWTC's current internal planning criteria and facility ratings have been documented in its "Facility Ratings Methodology and Establish and Communicate Facility Ratings (FAC-008-1 and FAC-009-1)," dated February 11, 2009, and revised June 4, 2012, to meet requirements of the North American Reliability Corporation ("NERC") Planning Standards. Portions of the document are reprinted below, which identify the assumptions and methodologies used by SWTC to determine electrical facility ratings and also describe the electrical load limits for SWTC on the various power system transmission lines, power transformers, and other facility equipment under normal and emergency operating conditions.

## **1.0 Introduction**

In accordance with NERC and Western Electricity Coordinating Council ("WECC") standards, this document sets forth the methodology used by SWTC to rate its facilities. It is the method by which the Rating of SWTC major Bulk Electric System ("BES") equipment is determined.

- 1.1 The facilities addressed in this document include transmission conductors, transformers, relay protective devices, terminal equipment, and compensation devices.
- 1.2 This methodology addresses Normal and Emergency ratings for the facilities that comprise SWTC's BES.
- 1.3 This Facility Ratings Methodology considers the ratings provided by equipment manufacturers, IEEE and ANSI standards, ambient conditions for solar input, temperature and wind speed, design criteria, operating limitations, and other assumptions, as applicable.
- 1.4 The ratings for all of SWTC BES facilities, including but not limited to lines, transformers, and shunt compensation devices, shall be equal to the most limiting applicable equipment rating of the individual equipment that comprises the facility.
- 1.5 This methodology will be made available for inspection and technical review within 15 business days of receipt of a request from SWTC's Loveland Reliability Coordination Center ("LLRC"), Transmission Planners, Planning Authorities/Coordinators, and any other FERC jurisdictional entity that has responsibility for the area in which the facilities are located. Requests and responses for the methodology will be tracked by the Director of System Operations at SWTC.
- 1.6 A written response to any comments regarding this Facility Ratings Methodology will be sent to the commenting entity within 45 calendar days of the comment receipt. The response shall indicate whether a change will be made to the Facility Ratings Methodology and, if no change will be made to that Facility Ratings Methodology, the reason why. Comments and responses regarding the methodology will be tracked by the Director of System Operations at SWTC.

- 1.7 In cases where a facility is jointly owned, the operator of the facility determines the rating and shares the rating with the other joint owners.

In cases where a facility is owned in segments (such as a transmission line being owned by one party with the breaker being owned by a different party), each owner will determine the rating for their segment and coordinate with the other owners to determine the most limiting segment. The rating for the most limiting segment would be used for the entire facility.

## 2.0 Facility Rating Methodologies for Transmission Facilities

The following sections describe the rating method for SWTC facilities.

### 2.1 Generation Facilities

SWTC does not own generation facilities. However, generation facilities, including step-up transformers, which are owned by Arizona Electric Power Cooperative, Inc. (AEPSCO), are modeled in the SWTC power flow base case models according to AEPSCO's facility ratings methodology.

### 2.2 Transmission Lines

SWTC owns transmission facilities. The rating of transmission lines involves comparison of the ratings of all elements which make up the line between the two identified busses, including the terminal equipment. The overall line rating is limited by the rating of the component with the lowest rating element or the stability limit of the line, whichever is lower. The bulk of SWTC's transmission lines are thermally limited. The sag rating of the line is used when appropriate. SWTC calculates its thermal transmission line ratings based upon the parameters outlined in Table 2. The calculations for normal operating conditions use the design criteria of 75°C, and the emergency operating conditions use a conductor design temperature rating of 100°C. SWTC incorporates the calculations used in the IEEE Standard 738 in its analysis of determining the current-temperature relationship of its lines, given the parameters noted in Table 2. The ratings can be found in Table 1 below.

SWTC ensures that its transmission line ratings are aligned with current design tolerances based on the National Electric Safety Code ("NESC") and likewise ensures that actual field conditions do not create conditions that will cause the facilities to be non-compliant with the NESC clearance requirements.

Based on historical, conservative design practices, SWTC has incorporated additional design margin to compensate for minor variations between design conditions and actual field conditions. In addition, SWTC verifies its "as-built" conditions by scheduled field visits. Each line segment part of the BES is monitored on an annual basis. SWTC's current

maintenance practices include an annual inspection on concrete and steel structures and a semi-annual inspection on wood structures. The inspection is a visual inspection designed to monitor the integrity, reliability, and compliance with NESC standards checking minimum conductor sag distances at key points throughout the system. Findings are documented, reported, and addressed as issues arise. In addition to on-ground line inspections, SWTC also performs regular aerial bucket or climbing inspections in high risk areas outlined in SWTC's Transmission Vegetation Management Plan ("TVMP").

#### 2.2.1 Transmission Line Conductors

The transmission line conductor ratings are found below in Table 1:

TABLE 1: Conductor Thermal Ratings			
At 75 Deg. Celsius Operating Temperature			
Based on 4 ft. per second Wind Velocity			
and 40 deg. Celsius Air Temperature			
ACSR Conductor		Copper Conductor	
SIZE	AMPS (Normal/Emergency)	SIZE	AMPS (Normal/Emergency)
1/0 – 105.7 MCM	216/281	#2 – 3 Strand	221/287
2/0 – 133.0 MCM	247/321	#2 – 7 Strand	209/272
3/0 – 167.7 MCM	282/367	4/0 – 211.6 MCM	426/554
4/0 – 211.6 MCM	322/419	350 MCM	578/751
266.8 MCM	400/520		
336.4 MCM	461/599		
397.5 MCM	510/663		
477.0 MCM	570/741		
556.0 MCM	626/814		
636.0 MCM	678/881		
795.0 MCM	776/1009		
954.0 MCM	849/1104		
1033.5 MCM	891/1158		
1192.5 MCM	970/1261		
1272.0 MCM	1009/1312		
1351.5 MCM	1047/1361		
1590.0 MCM	1153/1499		
2167.0 MCM	1366/1776		
2 – 954 MCM	1699/2209		

TABLE 2: Conductor Rating Parameters		
Parameters Common to All Locations/Conductors		
Parameter	Continuous Rating	Emergency Rating
Wind Direction	70° to Line	70° to Line
Emissivity	0.5	0.5
Absorptivity	0.7	0.7
Date	July 1	July 1
Time	12 PM	12 PM
Latitude and Longitude	32.5° North	32.5° North
Elevation	2500 Ft	2500 Ft
Solar Input	Clear	Clear
Allowable Cond. Temp (ACSR)	75°C	100° C or sag limit
Wind Speed	4 ft/s	4 ft/s
Ambient Temperature	40°C	40°C

The following items are pertinent with regard to the conductor rating method:

- a. The thermal ratings from Table 1, used by SWTC to rate its transmission lines, are considered to be conservative. If through internal studies it is determined that a line will become stability limited, (at a value lower than the thermal limit) its rating will be based on its particular stability limit.
- b. The weather parameters shown in Table 2 for development of the existing conductor thermal ratings are based on the values for wind direction, absorptivity and wind speed. The conductor ratings are based on a 75° C operating temperature with a 4 ft. per second wind speed and a 40° C air temperature. Emergency ratings are based on a 100° C operating temperature with a 4 ft. per second wind speed and a 40° C air temperature. SWTC can exceed its emergency ratings for up to 30 minutes. Where a transmission line, or line section, is constructed or upgraded with more than one size conductor, the overall line rating is determined by the rating of the most limiting sized conductor. If other equipment (switches, series capacitors, etc) in series with the transmission conductor is more limiting, the lowest limitation defines the transmission line rating.
- c. The transmission line rating program is based on the classical House and Tuttle method of line rating which uses a heat balance equation to determine the allowable line current for a specified conductor temperature. This is also the basis for IEEE Standard 738 that was used to develop the line ratings listed above.
- d. Rigid Bus and Strain Bus design are determined by the RUS Design Guide for Rural Substations Bulletin 1724E-300 (Bulletin) and National Electric Safety Code as a minimum. The design involves many factors, which are spelled out in the Bulletin. For new 115 kV substations, SWTC uses a standard schedule 40 aluminum pipe conductor size of 3", which is rated at approximately 1900 A. For new 230 kV substations, SWTC uses an aluminum pipe conductor size of 4", which is rated at approximately 2,500A. There is currently no case on the SWTC system where the rigid bus or strain bus is a limiting factor for any of SWTC's transmission line ratings.

### 2.3 Transformers

SWTC owns the following types of power transformers:

- a. Load serving transformers with LTC
  - Conventional
  - Auto
- b. Tie Autotransformers

The Normal and Emergency Ratings for transformers are determined as follows:

Equipment	Normal Rating	Emergency Rating
SWTC Transformers	100% Manufacturer's Nameplate Rating @ 45°C or 55°C rise	100% Manufacturer's Nameplate Rating @ 55°C or 65°C rise

Transformers in the SWTC system have a normal and emergency rating which is based on the manufacturer's nameplate data. During All Lines In Service ("ALIS") operation the loading of the transformer should not exceed its Normal Rating. During system contingencies the loading of the transformer should not exceed its Emergency Rating.

Under special circumstances, SWTC may wish to evaluate other sources in regard to manufacturer's specifications, such as the latest applicable versions of IEEE Standards C57.13-2209, 57.91-1995, or C57.119-2001.

#### 2.4 Relay Protective Devices

None of SWTC BES facilities have ratings that are limited by protection or monitoring devices. SWTC's relays will not trip (trip on Zone 3) due to normal or emergency load current (See PRC-023-1 Transmission Relay Loadability). New facilities and protection schemes are reviewed by SWTC to ensure that loadability requirements are met.

#### 2.5 Terminal Equipment (switches, breakers, etc)

The Normal and Emergency Ratings for terminal equipment are determined as follows:

Equipment	Normal Rating	Emergency Rating
Power Circuit breakers	100% of Manufacturer's Nameplate Rating	100% of Manufacturer's Nameplate Rating
Power Circuit switchers	100% of Manufacturer's Nameplate Rating	100% of Manufacturer's Nameplate Rating
Air Disconnect switches	100% of Manufacturer's Nameplate Rating	100% of Manufacturer's Nameplate Rating
Current transformers	100% of Manufacturer's Nameplate Rating	100% of Manufacturer's Nameplate Rating

SWTC shall consult the most current and applicable IEEE standards as deemed necessary regarding the rating of its terminal equipment: IEEE Std. C37.010-1999 (R2005), IEEE Std C37.37-1996, IEEE Std. C57.13-2008, IEEE Std. C93.3-1995, or RUS Bulletin 1724E-300.

## 2.6 Shunt Compensation Devices

### a. Shunt compensation

The normal and emergency ratings for shunt compensation devices are determined as follows:

Equipment	Normal Rating	Emergency Rating
Shunt Capacitors	100% of Manufacturer's Test Report Rating	100% of Manufacturer's Test Report Rating

### b. Series compensation

SWTC has no series compensation devices on its system.

## 3.0 Internal Planning Criteria for Facility Ratings

The factors used to determine equipment ratings were outlined above. They represent criteria that SWTC has used for a number of years, to meet requirements of the NERC, WECC, and the FERC.

The following is SWTC's internal transmission reliability planning criteria as published in the FERC FORM #715 filing:

### 1) Nominal Operating Limit

- Transmission lines should not be loaded greater than 100% of the thermal rating of the conductors.
- Transformers, circuit breakers, current transformers, and other equipment should not be loaded above their continuous nameplate rating.
- Transmission system voltages should not fall below 0.95 per unit (p.u.) of nominal rating nor rise above 1.05 p.u. of nominal rating.
- For long range planning system studies, an appropriate power factor for the planning period will be used.
- For operating system studies, an appropriate power factor for the operating planning period will be used.

## 2) Emergency Operating Limit

- Transmission lines should not be loaded greater than 110% of the thermal rating of the conductors.
- Transmission system voltages should not fall below 0.90 per unit (p.u.) of nominal rating nor rise above 1.10 p.u. of nominal rating.
- For long range planning system studies, an appropriate power factor for the planning period will be used.
- For operating system studies, an appropriate power factor for the operating planning period will be used.

### 4.0 Establishment and Communication of Facility Ratings

SWTC establishes the facility ratings for its BES in accordance with the facility rating methodologies described above. SWTC submits its most up-to-date ratings as part of the WECC base case preparation process on a periodic basis as required by WECC.

SWTC shall communicate its ratings for its solely and jointly owned Facilities that are existing Facilities, new Facilities, modifications to existing Facilities and re-ratings of existing Facilities to WECC, its LLRC, its Planning Authority/Coordinator, and to other Transmission Owners, Operators, or Planners as scheduled by such requesting entities.

When SWTC has determined that updated ratings are applicable, it will communicate those ratings as part of the WECC base case preparation process, by email or by telephone, as appropriate. SWTC shall keep all superseded portions of its Facility Ratings Methodology for 12 months beyond the date of the change in that methodology and shall keep all documented comments on the Facility Ratings Methodology and associated responses for three years, in accordance with NERC Standard FAC-008-3.

The following table of SWTC Transmission Line Rating Limits is found in Appendix A of SWTC's Facility Rating Methodology:

SWTC Transmission Line Rating Limits							
Station A From	Station B To	Voltage KV	Normal Limit Amps	Emergency Limit Amps	Normal Limit MVA	Emergency Limit MVA	Limiting Equipment
HASSAYAMPA PINAL WEST	PINAL WEST HASSAYAMPA	500 500	3000 3000	3000 3000	2598 2598	2598 2598	Breaker Out for Maintenance
GREEN-SW GREENLEE	GREENLEE GREEN-SW	345 345	1699 1699	2209 2209	1015 1015	1320 1320	Conductor Conductor
BICKNELL VAIL	VAIL BICKNELL	345 345	1699 1699	2209 2209	1015 1015	1320 1320	Conductor Conductor
PINAL WEST VAIL	VAIL PINAL WEST	345 345	1548 1548	1858 1858	925 925	1110 1110	Station Terminal Equipment
PINAL WEST WESTWING	WESTWING PINAL WEST	345 345	1548 1548	1858 1858	925 925	1110 1110	Station Terminal Equipment
DOSCONDO HACKBERRY	HACKBERRY DOSCONDO	230 230	1009 1009	1312 1312	402 402	523 523	Conductor Conductor
HACKBERRY MORENCI	MORENCI HACKBERRY	230 230	1009 1009	1312 1312	402 402	523 523	Conductor Conductor
GREEN-SW MORENCI	MORENCI GREEN-SW	230 230	1009 1009	1312 1312	402 402	523 523	Conductor Conductor
MORENCI PD-MORNC	PD-MORNC MORENCI	230 230	849 849	1104 1104	338 338	440 440	Conductor Conductor
APACHE BUTERFLD	BUTERFLD APACHE	230 230	776 776	1072 1072	309 309	427 427	Conductor Conductor
APACHE RED TAIL	RED TAIL APACHE	230 230	1009 1009	1312 1312	402 402	523 523	Conductor Conductor
APACHE WINCHESTER	WINCHESTER APACHE	230 230	1009 1009	1312 1312	402 402	523 523	Conductor Conductor
BUTERFLD PANTANO	PANTANO BUTERFLD	230 230	776 776	1009 1009	309 309	402 402	Conductor Conductor
BUTERFLD	SAN RAF	230	849	1104	338	440	Conductor
PANTANO NEWTUCSN	NEWTUCSN PANTANO	230 230	776 776	1009 1009	309 309	402 402	Conductor Conductor
NEWTUCSN SAHUARITA	SAHUARITA NEWTUCSN	230 230	776 776	1009 1009	309 309	402 402	Conductor Conductor
SAHUARITA BICKNELL	BICKNELL SAHUARITA	230 230	776 776	1009 1009	309 309	402 402	Conductor Conductor
RED TAIL DOSCONDO	DOSCONDO RED TAIL	230 230	1009 1009	1312 1312	402 402	523 523	Conductor Conductor
DAVIS	RIVIERA	230	600	600	239	239	WAPA Relays wound CT
APACHE HAYDENAZ	HAYDENAZ APACHE	115 115	570 570	741 741	114 114	114 114	Conductor Conductor
MARANA MARANATP	MARANATP MARANA	115 115	461 461	599 599	92 92	119 119	Jumpers Jumpers
MARANA AVRA	AVRA MARANA	115 115	1009 1009	1312 1312	201 201	261 261	Conductor Conductor
AVRA SANDARIO	SANDARIO AVRA	115 115	776 776	1009 1009	155 155	201 201	Conductor Conductor
SANDARIO THREEPNT	THREEPNT SANDARIO	115 115	322 322	419 419	64 64	83 83	Conductor Conductor
BICKNELL THREEPNT	THREEPNT BICKNELL	115 115	570 570	741 741	114 114	148 148	Conductor Conductor
THREEPNT	VALENCIA	115	570	741	114	148	Conductor
PANTANO	KARTCHNR	115	570	741	114	148	Conductor

Notes:

- 1) SRP is the operating agent for the Hassayampa to Pinal West 500 kV line and has determined its line ratings. SWTC owns 3.85% of this line.
- 2) TEP is the operating agent for Pinal West to Vail and Pinal West to Westwing 345 kV lines and have determined their line ratings. SWTC owns 24% of these lines.
- 3) Emergency rating for Apache to Butterfield 230 kV line based on the calculated emergency rating of the conductor due to a previous re-rating process completed January 28, 2011