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September 11, 2009

Docket Control
Arizona Corporation Commission
1200 West Washington
Phoenix, Arizona 85007

RE: SWAT Studies for 2010 Biennial Electric Transmission Assessment 2010-2019
Docket No. E-00000D-09-0020

Dear Sir/Madam:

The Southwest Area Transmission (SWAT) Sub-Regional Transmission Planning Group is comprised of transmission regulators/governmental entities, transmission users, transmission owners, transmission providers, transmission operators, transmission developers, generation developers, and environmental entities. The group was formed to promote regional planning across the entire Southwest area of the Western Electricity Coordinating Council. SWAT operates in a public forum and is open to any entity or persons interested in the development and future of the electric transmission system. SWAT encourages collaborative efforts and joint participation to address issues. A key goal of SWAT is to maximize use and benefits of the existing and future regional transmission system.

As members of SWAT, the Arizona Transmission Providers have participated in various SWAT Technical Subcommittees, Task Forces, Work Groups and the Oversight Committee. The Subcommittees, Task Forces, and Work Groups have been involved in study efforts investigating renewable energy resources such as solar and wind energy, new base load generation, transmission to access renewable resources, and how to meet load growth and enhance the utilization of the existing transmission system. Due to the nature of performing joint study work, Arizona Transmission Providers are dependent on the technical studies performed under the direction of SWAT for development of their Ten Year Plans. The attached study work and reports have been approved by the sponsoring Subcommittee and the SWAT Oversight Committee at its August 18, 2009 meeting.

The attached 2009 study work was prepared by the SWAT sub-committee, Central Arizona Transmission System – High Voltage (CATS-HV) and Central Arizona Transmission System – Extra

High Voltage (CATS-EHV). The attached reports have been prepared to support Transmission Provider's Ten Year Plan submittals in January 2010 and for use during the ACC's Sixth Biennial Transmission Assessment.

The CATS-HV 2009 Transmission Study provides an analysis of ten-year (2019) transmission plan projects, including 69kV detail, primarily in the Pinal County area.

The CATS-EHV 2009 Transmission Study fulfills the BTA requirement to study the ten-year transmission plan projects and includes "Project Outage" (formerly known as N-1-1) analysis, for the state of Arizona.

SWAT strongly supports the coordinated effort between the utilities and stakeholders and supports the enclosed study reports.

Sincerely,

Robert E. Kondziolka

Robert E. Kondziolka
Chairman of the SWAT Sub-Regional Transmission Planning Group

REK:LVT

Enclosure

cc: Prem Bahl (ACC)
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Ron Moulton (Western)

Original and 13 copies of the foregoing filed with Docket Control.

CATS HV

2009 Transmission Study

Analysis of Ten-Year (2019)
Transmission Plan Projects

For
Central Arizona Transmission System – High Voltage
"CATS-HV"

A sub-committee of the Southwest Area Transmission
("SWAT") sub regional planning group

SWAT
Southwest Area Transmission

FINAL REPORT
August 18, 2009

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Acknowledgements

This study could not have been performed without the assistance and participation of the following organizations. Their help was instrumental in the development and completion of the study:

Arizona Corporation Commission (ACC) Staff

Arizona Power Authority (APA)

Arizona Public Service Company (APS)

Central Arizona Project (CAP)

Electrical District #2 of Pinal County (ED2)

Electrical District #3 of Pinal County (ED3)

Electrical District #4 of Pinal County (ED4)

Electrical District #5 of Pinal County (ED5)

Pinal County Planning Department Staff

Salt River Project (SRP)

Southwest Transmission Cooperative (SWTC)

Southwest Public Power Resources Group (SPPR)

Tucson Electric Power Company (TEP)

Western Area Power Administration (Western)

Executive Summary

Previous CATS-HV subcommittee reports have included a "saturated load" study to identify what the total electric load between Phoenix and Tucson could ultimately be if land development occurs according to county and municipal General Plans in the region, as well as the expected performance of the regional transmission system for the 2016 Ten-Year Plans. There have been significant changes within the CATS-HV region and a significant swing in load growth in multiple directions; however the continual review of the long term (ten years and beyond) requirements to meet the expected loads and resources for the multiple load serving entities serving this area will continually give the visibility for all of the planning jurisdictions within the CATS-HV area.

The 2007 and 2008 CATS-HV study efforts, two key issues had been identified and addressed as a component of the 2008 CATS-HV Transmission Plan. Specifically, the 2008 Transmission Plan included additional detailed 69kV subtransmission facilities as a component of the coordinated CATS-HV 2008 Ten-Year Transmission Plan; as well as the potential impacts of the CATS-HV transmission system with new generation resources to serve local and regional loads.

For 2009, the CATS-HV technical planning efforts included a coordinated Ten-Year Plan analysis that included the expected facilities, loads and resource conditions for the 2019 time frame. The analysis included continuous (N-0) and emergency (N-1 only) to determine any voltage or thermal issues within the CATS-HV area.

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Introduction

Previous CATS-HV subcommittee reports have included a "saturated load" study to identify what the total electric load between Phoenix and Tucson could ultimately be if land development occurs according to county and municipal General Plans in the region, as well as the expected performance of the regional transmission system for the 2016 Ten-Year Plans. There have been significant changes within the CATS-HV region and a significant swing in load growth in multiple directions; however the continual review of the long term (ten years and beyond) requirements to meet the expected loads and resources for the multiple load serving entities serving this area will continually give the visibility for all of the planning jurisdictions within the CATS-HV area.

The 2007 and 2008 CATS-HV study efforts, two key issues had been identified and addressed as a component of the 2008 CATS-HV Transmission Plan. Specifically, the 2008 Transmission Plan included additional detailed 69kV subtransmission facilities as a component of the coordinated CATS-HV 2008 Ten-Year Transmission Plan; as well as the potential impacts of the CATS-HV transmission system with new generation resources to serve local and regional loads.

For 2009, the CATS-HV technical planning efforts included a coordinated Ten-Year Plan analysis that included the expected facilities, loads and resource conditions for the 2019 time frame. The analysis included continuous (N-0) and emergency (N-1 only) to determine any voltage or thermal issues within the CATS-HV area. The specific tasks identified in the 2009 Study Plan are included below.

Task 1

Prepare a coordinated Ten-Year Transmission Plan (specifically 2019) for the CATS-HV study area to be included in the 2009 SWAT Transmission Plan. The coordination of the 2009 CATS-HV Transmission Plan will require (but is not limited to) the following steps:

- Coordinate 2019 base case development for the CATS-HV region; including individual stakeholders ten-year transmission plans, subtransmission facilities and the associated system representations. The 2009 WestConnect coordinated base case will be used as the source for this case development.
- In addition to incorporating the detailed system representation, each LSE will be responsible for supplying their respective load and resource information for the 2019 heavy summer season.
- Conduct an assessment of the coordinated 2019 CATS-HV Transmission Plan in accordance with NERC/WECC planning criteria. Specifically for 2009, Category A and Category B contingencies will be included for this assessment.[1]

[1] The 2008 CATS-HV Ten-Year Plan included an analysis of multiple contingencies. Due to fact that the system configuration for the CATS-HV has not significantly changed for the 2009 Ten-Year Plan, the decision was made to not include multiple contingencies as a component of the 2009 CATS-HV Ten-Year Plan.

Task 2

The final task for the 2009 SWAT CATS-HV Transmission Plan is to document the findings of the analysis identified in this Study Plan as a component of the overall 2009 SWAT Transmission Plan assessment, specifically:

- Document the findings of the 2009 CATS-HV Transmission Plan and coordinate the final report with the overall 2009 SWAT/WestConnect Transmission Plan report.

Base Case Assumptions

The following sections identify the assumptions used in performing this study. The 2019 CATS-HV base case development was initiated using with the approved CATS-HV 2018 base case (the seed case was the July 2008 Western Electricity Coordinating Council (WECC) approved 2018HS1A base case). A "round robin" approach was used to develop the CATS-HV base case among the regional CATS-HV transmission owners and load serving entities (WECC members only due to confidentiality of the power flow case information). Each entity updated the case to reflect their expected 2019 heavy summer loads and resources, as well as planned transmission additions (69kV and above). Entities include in the detailed review included were ED2, ED3, ED4, ED5, SPPR, APS, SRP, Western, TEP, and SWTC.

Transmission and Generation Configurations

The coordinated 2019 CATS-HV base case was reviewed by Arizona entities and included the companies' ten year plan elements that would be in service by 2019. A few note-worthy transmission and generation items include:

Significant Additions or Exclusions:

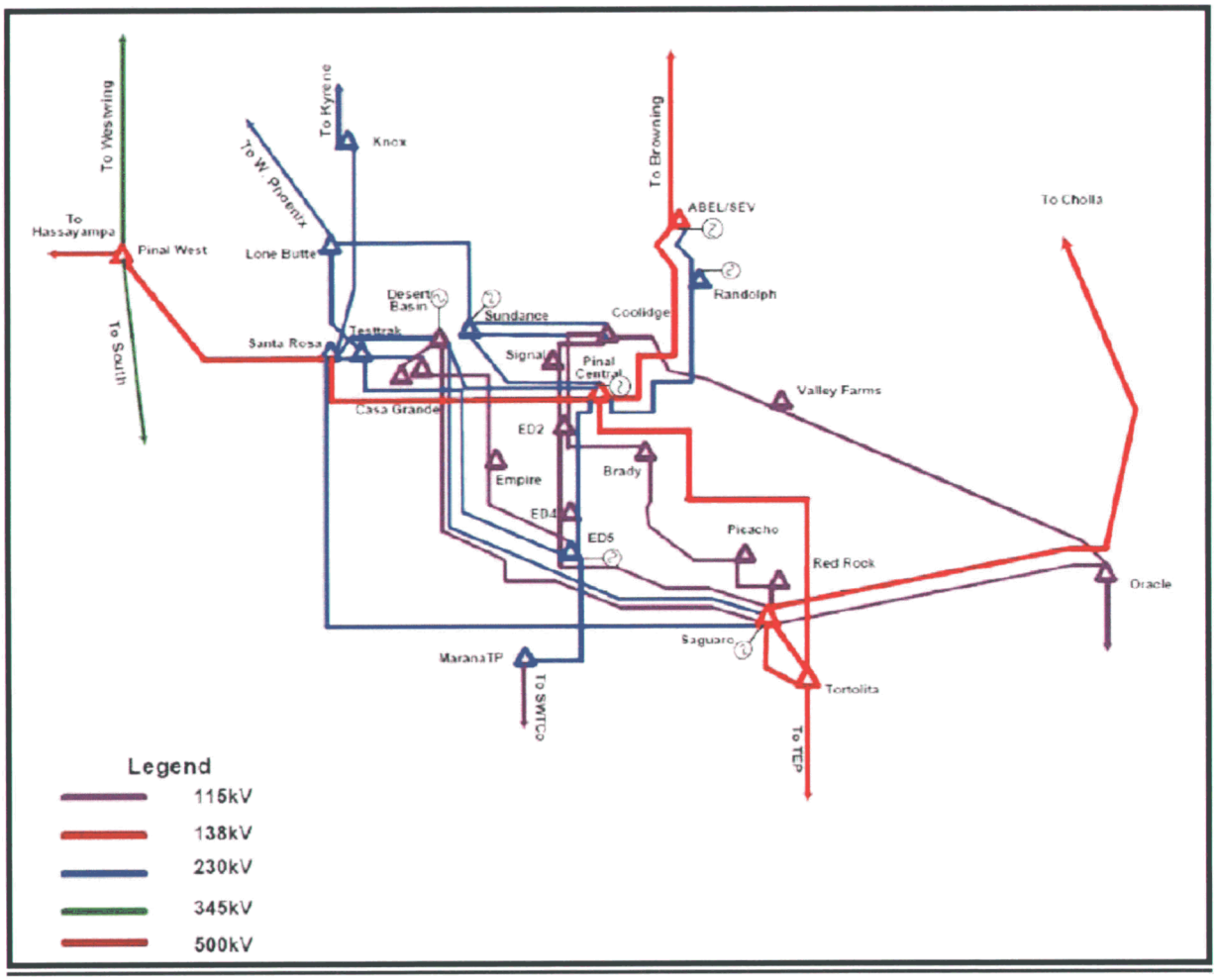
- Southeast Valley (SEV) 500kV line (Pinal West-Santa Rosa-Pinal Central-Abel-Browning) was included.
- Pinal Central 230kV lines to Desert Basin, Sundance, and Randolph/Browning were included.
- The SPPR "Three-Terminal" transmission plan (Pinal Central to ED5 230kV, ED5 to Test Track 230kV, ED5 to Marana 230kV) was included.
- Planned generation at Coolidge Energy (Randolph), Abel, Pinal Central, SPPR and Bowie were included in the base case and dispatched as needed to meet load and resource requirements for the region. Specific CATS HV area generation included in the base case is shown in Table 1.
- The SunZia Southwest and other EHV injections (transmission) into the state of Arizona were not included in this transmission configuration as none of these projects had been classified as in Phase 2 of the WECC Three-Phase Rating process or "Planned" projects in the WestConnect model at the time of the base case development.
- Total Arizona Generation (dispatched): 33,802 MW
- Total Arizona Load (w/o losses): 25,183 MW

Table 1: CATS-HV Area Base Case Generation Assumptions

Generation Location	Existing or Planned	Base Case Dispatch Level (MW)	Max Generation Available (MW)
Desert Basin	Existing	570	630
Sundance	Existing	394.6	437
Saguaro	Existing	398	398
Randolph (Coolidge)	Planned	561.6	561.6
Abel	Planned	780	842
Pinal Central	Planned	1200	1394
SPPR Gen	Planned	0	627

The transmission configuration for the 2019 CATS-HV base case was reviewed by Arizona entities and included the companies' ten year plan elements that would be in service by 2019. Figure 1 depicts the CATS-HV region and associated transmission configuration.

Figure 1: 2019 CATS-HV Regional Transmission Configuration



Methodology

With the CATS-HV loads and resources incorporated into the 2019 heavy summer base case, an initial base case screening was performed to document transmission facility overloads during normal operating conditions. Following the initial screening, power flow contingency analyses were performed to review for reliability criteria violations. Specific studies conducted and their evaluation criteria are outlined below:

Contingency Analysis

The CATS-HV 2019 base case was used to perform a reliability assessment under normal operating conditions (NERC Category A, N-0), as well as, single (NERC Category B, N-1) contingencies. These outages included:

- All single (69-500kV) transmission circuit outages within Arizona (1938 line contingencies, via PSLF generated outage list).
- All single transformer outages within the Arizona area (297 transformer contingencies, via PSLF generated outage list).
- All single generation unit (G-1) outages within the Arizona area (171 generator contingencies, via PSLF generated outage list).

The WECC/NERC planning standards were used to assess the adequacy of the study results. The power flow analysis related evaluation criteria that were used are summarized below:

- Pre-contingency bus voltage must be between 0.95 per unit and 1.05 per unit (although note that several 500kV buses operate at approximately 1.06 per unit).
- Maximum voltage deviation allowed at all buses under contingency conditions will be 5% for N-1 contingencies.
- Pre-disturbance loading to remain within continuous ratings of all equipment and line conductors; specifically referencing Rating 1 as included in the CATS-HV base case.
- Post-disturbance (N-1 contingencies) loading to remain within emergency ratings of all equipment and line conductors; specifically referencing Rating 2 as included in the CATS-HV base case.

Task 1 – Reliability Assessment of Ten-Year Plans

The CATS-HV 2019 heavy summer base case was initially screened for any NERC Category A (N-0) thermal overloads based on the ratings contained in the base case to ensure it meets reliability criteria during normal operating conditions. NERC Category B (N-1) were also conducted; it should be noted however that a full outage listing (i.e. contingency list) is not included with this report due to the magnitude of outages taken but are available upon request. The detailed summary output tables are included in Appendix A.

Key findings from the power flow studies using the CATS-HV 2019 heavy summer base case are:

- As shown in Table 3, no CATS-HV area facilities were identified as overloaded under normal, all lines in service, conditions.

Table 3: NERC Category A Overloads within CATS-HV Area

Outage	Overloaded Facility	Recommended Mitigation
NERC Category A (N-0)		
ALL LINES IN SERVICE	None	N/A

Following the base case screening, power flow contingency simulations were conducted on the CATS-HV 2019 heavy summer base case. Power flow solutions were achieved for all N-1 outages simulated.

- As shown in Table 4, no CATS-HV area facilities were identified as overloaded under emergency conditions for a single contingency.

Table 4: NERC Category B Overloads within CATS-HV Area

Outage	Overloaded Facility	Recommended Mitigation
NERC Category B (N-1)		
N/A	None	

- Multiple transmission facility overloads were identified outside of the CATS-HV area under emergency operating conditions for a single contingency outage. These overloads will be addressed as part of the other subregional transmission planning efforts.

- Table 5 summarizes the findings related to violations within the CATS-HV area of "delta Voltages" greater than 5% voltage deviation and "Voltage Magnitude" for load buses less than 0.90 p.u. The load serving entity for these facilities has confirmed that power factor correction will be required and examined as part of the routine planning cycle.

Table 5: NERC Category B Voltage Violations within CATS-HV Area

Outage	Substation	Delta Voltage		Voltage Magnitude		Recommended Mitigation (shunt caps)
		No Caps	w/caps	No Caps	w/caps	
NERC Category B (N-1)						
Coolidge to Valley Farms 115kV line	Merrill 69kV SE5 69kV Valley Farms 69kV	14.4 % 14.8 % 14.8 %	2.2 % 2.2 % 4.0 %	0.86 p.u. 0.86 p.u. 0.88 p.u.	0.99 p.u. 0.99 p.u. 0.99 p.u.	Merrill 2 x 7.2MVAR SE5 1 x 7.2MVAR

- A few other voltage violations were identified outside of the CATS-HV area (south of Marana) under emergency operating conditions for a single contingency outage. These violations will be addressed as part of the SATS transmission plan.

Conclusions

In summary for the 2009 CATS-HV Ten-Year Plan analysis found there were no voltage or thermal issues within the CATS-HV area in the coordinated SWAT 2019 base case under pre and post outage conditions.

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APPENDIX A
TASK 1

CATS HV N-0 Violations

CATS HV N-1 Flow Violations

CATS HV N-1 Delta Voltage Flow Violations

CATS HV N-1 Voltage Magnitude Violations

CATS HV N-0 VIOLATIONS

NONE NOTED WITHIN CATS HV AREA

CATS HV N-1 FLOW VIOLATIONS

NONE NOTED WITHIN CATS HV AREA

CATS HV N-1 DELTA VOLTAGE VIOLATIONS

BUS NUMBER	BUS NAME	BU	BU	BUS	CONT	CONTINGE	CONTINGENCY DESCRIPTION	Catshv_rev4
84875	MERRIL	69	14	845	336	"line_335"	Line COOLIDGE 115.0 to VLYFARMS 115.	-14.81%
84904	SE5	69	14	845	336	"line_335"	Line COOLIDGE 115.0 to VLYFARMS 115.	-14.79%
84926	MERRILTP	69	14	845	336	"line_335"	Line COOLIDGE 115.0 to VLYFARMS 115.	-14.74%
84908	VLYFARMS	69	14	845	336	"line_335"	Line COOLIDGE 115.0 to VLYFARMS 115.	-14.37%

*** NOTE: Above outage does not include shunt capacitors at Merrill (2 x 7.2MVAR) and SE5 (1 x 7.2MVAR). No violations were noted with these capacitors switched on for this outage.**

CATS HV N-1 VOLTAGE MAGNITUDE VIOLATIONS

NUMBER	NAME	KV	AREA	ZONE	OTG	OTG DESCRIPTION	CONTINGENCY DESCRIPTION	Catshv rev4
84908	VLYFARMS	69	14	845	336	"line_335"	Line COOLIDGE 115.0 to VLYFARMS 115.0 Circuit 1	0.886
84926	MERRILTP	69	14	845	336	"line_335"	Line COOLIDGE 115.0 to VLYFARMS 115.0 Circuit 1	0.867
84875	MERRIL	69	14	845	336	"line_335"	Line COOLIDGE 115.0 to VLYFARMS 115.0 Circuit 1	0.864
84904	SE5	69	14	845	336	"line_335"	Line COOLIDGE 115.0 to VLYFARMS 115.0 Circuit 1	0.864

*** NOTE: Above outage does not include shunt capacitors at Merrill (2 x 7.2MVAR) and SE5 (1 x 7.2MVAR). No violations were noted with these capacitors switched on for this outage.**

August 4, 2009

2009 Ten Year Snapshot Study

A report to address Arizona Corporation Commission Biennial Transmission Assessment (BTA) requirements

Rev #4

Salt River Project

SWAT
Southwest Area Transmission

Central Arizona Transmission System – Extra High Voltage (CATS-EHV) Subcommittee

Chairman: LeeAnn Torkelson

Executive Summary

The Ten Year Snapshot Study is an assessment of the ten year high voltage and extra high voltage transmission plans developed by transmission owners in Arizona. The developed plans used a coordinated base case, which models the expected transmission system in 2019. The 2018 Western Electricity Coordinating Council (WECC) base case was used as the seed base case. Forecasted loads, resources, underlying transmission system, as well as planned facilities for all transmission owners in the 2019 timeframe were added to the seed case to develop the 2019 Central Arizona Transmission System (CATS) case used in this study.

Though the Ten Year Snapshot Study Area has historically focused on the central Arizona region (an area bounded by the Phoenix Metropolitan area to the north, the Tucson Metropolitan area to the south, the Palo Verde Generating Station to the west and the Arizona/New Mexico border to the east), this year's study has expanded to include reviewing impacts statewide. A state-wide view will assist in coordinating this and other study efforts (and results) among the various planning groups in Arizona.

The assessment of the ten year plan consisted of conducting N-0 and N-1 power flow analyses on the coordinated 2019 detail CATS base case to verify that there were no thermal overloads or voltage problems for the 2019 time frame with all participants' 2019 planned facilities. Project Outage (N-1-1) power flow analyses were conducted to show the impact on the surrounding transmission system by removing an individual participant's Project from the ten year plan.

The base case showed prior to any outages (N-0 conditions) there are a few busses outside of voltage criteria, but no overloaded elements. Single contingency (N-1) analysis showed overloads on transmission elements that can be addressed by upgrading the facilities, implementing switching solutions, or by implementing existing generation tripping solutions. Voltage deviations were noted for contingencies in the base case. The voltage deviations were a result of the simulated outage causing a radial condition, needed voltage support, and/or were indicative of a modeling error that will need further investigation. These thermal violations and voltage deviation issues have been seen by the utilities in internal studies and have solutions either identified or being investigated.

The Project Outage (N-1-1) portion of the study, taking out facilities associated with a Ten Year Planned Project and running contingencies, showed that delay of a single Project would generally not cause significant impact to the remaining transmission system. Fifteen Project Outages were studied, nine APS Projects, four SRP Projects, one TEP Project, and delay of the Palo Verde-Devers #2 500kV line. Delay of the following projects beyond the ten year window had the greatest impact (5% or greater loading as compared to the base case for the same contingency) to the transmission system:

Case # - Description
APS #3 - Raceway-Avery-Pinnacle Peak 230kV line
APS #5 - Raceway-Pinnacle Peak 500kV line
TEP #1 - Pinal Central – Tortolita 500 kV line

The results of this study indicate the planned 2019 Arizona transmission system is robust as shown by limited voltage and thermal violations in the base case. Additionally, the Project Outage scenarios indicate that a delay of any one Project does not have a significant negative impact on the remaining transmission system.

2009 Ten Year Snapshot Study

A report to address Biennial Transmission Assessment (BTA) requirements

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Introduction

The Ten Year Snapshot Study was performed to coincide with CATS-EHV biennial filings with the Arizona Corporate Commission (ACC). The Ten Year Snapshot Study is a collaborative effort to assess the CATS-EHV ten-year transmission plan for Arizona.

The objective of the study is to analyze how the participants' ten year plans perform as whole in a regional environment and the effect of omitting an individual planned transmission project from the plan.

The transmission system performance is assessed by studying N-0, N-1 and Project Outage (N-1-1) conditions on a transmission system topography, load level, and generation dispatch forecasted in a tenth year. The study consisted of a screening of voltage and thermal violations for N-0, N-1, and the Project Outage scenarios. The system performance is assessed by reviewing thermal and voltage violations under all lines in service and outage conditions. The violations are identified if thermal or voltage excursions exceed criteria determined by the North American Electric Reliability Council (NERC) transmission planning (TPL) standards.

This report is one of a series of reports required to be filed with the ACC on a biennial basis as result of Orders issued by the Arizona Corporation Commission from previous Biennial Transmission Assessments. Other reports, including the Corridor Outage Studies and Extreme Contingencies Studies, are not included with this report but will be submitted separately under separate cover.

Study Methodology

Case building

The study began with development of a power flow case that reflected a 2019 timeframe and included participant's Ten Year Plan (TYP) projects. Annually, entities planning to build transmission or generation above 100kV or 100MW must file a TYP with the Arizona Corporation Commission (ACC).

This year's planning case, reflective of a 2019 transmission and generation topology, was a 2018 case modified by Arizona Public Service (APS), Salt River Project (SRP), Electrical District #3 (ED3), Tucson Electric Power (TEP), Southwest Transmission Cooperative (SWTC), and Western Area Power Administration (WAPA).

After a round-robin approach to updating the case, the study work began with reviewing the system under "all lines in service" or "ALIS" conditions. Overloads or voltage violations were corrected to alleviate any ALIS issues. This analysis is also known as "N-0" analysis which indicates the number of lines out of service is "0", zero.

Case Highlights for Arizona

Generation

The generation capacity modeled for Arizona was 37,851MW with 33,967MW online.

Planned Generation

The following announced generation was modeled in the case:

Fuel Type	Project Name	Modeled	MW Dispatched
Coal	Desert Rock	Yes	1400
Natural Gas	Bowie	Yes	0
Natural Gas	TransCanada Coolidge	Yes	561
Natural Gas	Pinal Central	Yes	900
Natural Gas	San Luis Rio Colorado	Yes	300
Natural Gas	Abel	Yes	600
Solar	Solana-Gila Bend area	Yes	280

Table 1 - Announced Generation in 2019 case

Load

The state of Arizona was modeled with 25,340 MW of load in this 2019 study. The originating case, a 2018 coordinated case, had 26,029MW of load. The modest load reduction of 689MW, about 3%, is in part due to estimates of load reductions expected in the ten year time frame in response to the recession. The load reduction doesn't appear very large, and is in part due to the fact that the full depth of the recession wasn't yet accounted for in load forecasts at the time case building for this study began. Further, it has been utility experience that even in a recession, while near term load forecasts can be dramatically affected; longer term forecasts tend to rebound close to pre-recession forecasts.

State Status

The 2019 case shows Arizona generating nearly 7600MW more than required to serve Arizona loads. Arizona continues to export generation, primarily to California.

N-1 and Project Outage (N-1-1) Contingency Analysis

Once a base case was finalized contingency analysis was performed. Contingency analysis (also known as N-1 analysis) simulates taking an element out of service (maintenance, fire, storm damage, etc.) and assessing the impact to the remainder of the system due to the loss of that facility. The utilities reviewed the resultant violations and provided mitigation.

The last step of the study was the Project Outage analysis (also known as N-1-1) which resulted in fifteen additional cases. Each Project Outage case removed a Project (transmission facility/ies) and single contingencies were applied. The following Project Outages (separated into two tables) were considered for this analysis:

APS Project Outage cases included:

Case Code	Planned Project modeled as initially out of service for N-1-1 analysis • **Bullet items are facilities identified for removal for the project**	In service Date
APS01	Palo Verde-Sun Valley (formerly TS5) 500 and 230 kV system • Delany-Sun Valley 500 kV line • Sun Valley 500/230kV transformer • Sun Valley 500/230 kV transformer • Sun Valley-Trilby Wash 230kV line • Trilby Wash 230/69 kV transformer	2014
APS02	Palo Verde-Sun Valley –Raceway 500 and 230 kV systems • All of APS01 plus • Sun Valley – Raceway 500 kV line	2014
APS03	Raceway-Avery-Pinnacle Peak 230kV line • Raceway-Avery 230kV line • Avery-TS6 230kV line • TS6-Pinnacle Peak 230kV line • Both TS6 230/69 kV transformers	2010 or 2012
APS04	Palm Valley-TS2-Trilby Wash (TS1) 230kV line • Palm Valley-TS2 230kV line • TS2-Trilby Wash 230kV line	2015
APS05	Raceway-Pinnacle Peak 500kV line • Raceway-Pinnacle Peak (APS) 500kV line • All 3 Pinnacle Peak 500/230kV transformers	2010
APS06	Raceway 500kV to 230kV transformer • Raceway 500/230kV transformer	2016
APS07	Sun Valley (TS5) –Raceway (TS9) 500kV line • Sun Valley – Raceway 500kV line	2016
APS08	Hassayampa-North Gila 500kV ckt 2 • Hassayampa-North Gila 500kV line (ckt 2)	2014
APS09	Pinal Central – Sundance 230kV line • Pinal Central-Sundance 230kV line	2013

Table 2 - APS Project Outage Cases

Project Outage cases for SRP , TEP and other Projects are shown below:

Case Code	Planned Project modeled as initially out of service for N-1-1 analysis • Bullet items are facilities identified for removal for the project	In service Date
SRP01	Desert Basin-Pinal Central 230kV line • Pinal Central -Desert Basin 230kV line	2013
SRP02	PC Gen 500/230 kV transformer and all generation • PC Gen 500/230kV transformer • All PC gen	2018
SRP03	Pinal West – Pinal Central 500kV line • Pinal West – Santa Rosa • Santa Rosa – Pinal Central • Santa Rosa 500/230kV transformers	2013
SRP04	RS24 All 230 kV lines and 230/69kV transformers at RS24 • RS24-Abel (1 and 2) • RS24 230/69 • RS24-Schrader • RS24-Santan	2012
TEP01	Pinal Central-Tortolita 500kV line • Pinal Central-Tortolita 500kV line	2013
PVD2	Palo Verde Devers #2 500kV line • Harquahala-Devers 500kV line	TBD

Table 3 – SRP, TEP, and other Project Outage Cases

Monitoring Criteria

This analysis monitors thermal loading of transmission facilities and voltage deviation at substations caused by system disturbances (contingencies). The criteria in Table 4 - Monitoring criteria highlights the criteria used to identify violations for this study. Exceeding the criteria below can cause damage to the electric system. Elements that exceed the criteria indicate where problems in the system may exist and that need further review to appropriately address the thermal or voltage deviation issue. The voltage and thermal criteria are WECC criteria, which have the following limits:

Outage Type		Thermal Criteria	Voltage Criteria
N-0	No Outage, All lines in service	No element exceeding 100% of its normal rating	Less than .95 or Greater than 1.05 [1]
N-1	Single Element Outage	No element exceeding 100% of its emergency rating	No voltage deviation greater than 5%
Project Outage (N-1-1)	Project Outage (with system adjustments) followed by another contingency	Reducing loadings to 100% (or less) of normal rating following the removal of a project and 100% or less of the emergency rating for the subsequent outage	No voltage deviation greater than 5%

Table 4 - Monitoring criteria

All thermal overloading results were screened to show only elements above 115kV. Voltage results were also screened for bus voltages 115kV and higher. Voltage deviation calculated as the difference in voltage between post and pre outage voltage on buses. If the voltage deviation exceeds 5%, the bus is listed as exceeding criteria.

The Project Outage (N-1-1) thermal overload results were benchmarked against the N-1 results to distinguish loadings that were only associated with the N-1-1 and were not pre-existing in the N-1 base case. Highlighting was applied to the results where flow increased 5% or more in the Project Outage scenario on the same element for the same contingency as compared to the base case.

The N-1-1 voltage deviation results were also benchmarked against N-1 results. Highlighting was applied on the same busses where voltage deviations were greater than three percent more as compared to the base case for the same bus and contingency.

Monitored Elements

All transmission facilities in Arizona with voltage greater than 115kV were monitored for thermal and voltage criteria.

System Disturbances (Contingencies)

The contingencies studied included all Arizona transmission facilities (lines, transformers, and capacitors) with voltages equal to or greater than 115kV.Study Results

[1] Arizona utilities typically screen for voltage below 0.95 per unit and above 1.05 per unit on all systems less than 500kV. The 500kV system is typically operated at 525kV which results in a per unit voltage acceptable at 1.10 per unit.

Base case results

The base case results include voltage and thermal results with all lines in service (no contingencies) as well as voltage and thermal results under simulated contingency conditions.

The Base case showed no thermal violations (flow on elements exceeding an element's normal rating). Voltage violations in the base case were typically high voltage violations due to modeling issues on the system north of Phoenix. The high voltages can be addressed by adjusting transformer taps or removing capacitors. Two low voltage busses were noted, but are south of the CATS EHV study area. The suggestion to improve voltage at the two busses south of the CATS EHV study area was to turn on generation at Valencia.

Voltage Violations (per unit voltage)				
Name	**kV**	**CONTINGENCY DESCRIPTION**	**Base Voltage**	**SOLUTIONS**
VALNCIA	138	Base system (n-0)	0.94	Turn on generation at Valencia
SONOITA	138	Base system (n-0)	0.95	Turn on generation at Valencia
PRESCOTT	115	Base system (n-0)	1.06	Turn off capacitors at BAGCAP for n-0
CHOLLA	345	Base system (n-0)	1.06	Adjust taps on the two 500/345kV transformers
NAVAJO	500	Base system (n-0)	1.11	Adjust three generator step-up transformer taps
BAGDAD	115	Base system (n-0)	1.13	Turn off capacitors at BAGCAP for n-0
BAGCAP	115	Base system (n-0)	1.13	Turn off capacitors at BAGCAP for n-0

Table 5 - Base Case voltage violations

Under contingency conditions, the following busses showed voltage deviations in excess of 5% (.05) for the simulated outages. The voltage deviations shown in Table 6 – Base Case Voltage Violations indicate solutions for these violations.

Delta Voltage Violations (voltage drop, per unit)				
Name	**kV**	**CONTINGENCY DESCRIPTION**	**Voltage Deviation**	**SOLUTIONS**
BAGDAD	115	Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.15	Fix modeling errors on radial Bagdad system
BAGCAP	115	Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.15	Fix modeling errors on radial Bagdad system
VLYFARMS	115	Line COOLIDGE 115 to VLYFARMS 115 Ckt 1	-0.14	Switch in capacitors at Merrill 69kV
BAGCAP	115	Line PRESCOTT 115 to BAGCAP 115 Ckt 1	-0.13	Radial Bagdad system should be dropped
BAGCAP	115	Tran PRESCOTT 2300 to PRESCOTT 115 Ckt 1	-0.13	Fix modeling errors on radial Bagdad system
BAGDAD	115	Line PRESCOTT 115 to BAGCAP 115 Ckt 1	-0.13	Radial Bagdad system should be dropped
BAGDAD	115	Line BAGCAP 115 to BAGDAD 115 Ckt 1	-0.13	Radial Bagdad system should be dropped
BAGDAD	115	Tran PRESCOTT 2300 to PRESCOTT 115 Ckt 1	-0.13	Fix modeling errors on radial Bagdad system
GILABEND	230	Line GILARIVR 230 to GILABEND 230 Ckt 1	-0.11	Switch In existing capacitor at Gila Bend 69kV
PRESCOTT	115	Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.10	Fix modeling errors on radial Bagdad system
WILOWLKE	230	Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.09	Fix modeling errors on radial Bagdad system; Switch in multiple capacitors on local 69kV system
WILOWLKW	230	Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.09	Fix modeling errors on radial Bagdad system; Switch in multiple capacitors on local 69kV system
PRESCOTT	230	Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.09	Fix modeling errors on radial Bagdad system
BUCKEYE	230	Line BUCKEYE 230 to LIBERTY 230 Ckt 1	-0.09	Close backup tap at Buckeye
PRSCOTWA	230	Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.09	Fix modeling errors on radial Bagdad system
RED TAIL	230	Line APACHE 230 to RED TAIL 230 Ckt 1	-0.09	Add 50MVAR shunt at Hackberry
HACKBERY	230	Line HACKBERY 230 to MORENCI 230 Ckt 1	-0.08	Add 50MVAR shunt at Hackberry
DOSCONDO	230	Line HACKBERY 230 to MORENCI 230 Ckt 1	-0.07	Add 50MVAR shunt at Hackberry
DOSCONDO	230	Line APACHE 230 to RED TAIL 230 Ckt 1	-0.06	Add 50MVAR shunt at Hackberry
HACKBERY	230	Line APACHE 230 to RED TAIL 230 Ckt 1	-0.06	Add 50MVAR shunt at Hackberry
PRESCOTT	115	Tran PRESCOTT 230 to PRESCOTT 115 Ckt 1	-0.06	Fix modeling errors on radial Bagdad system
VERDE N	230	Line YAVAPAI 230 to VERDE N 230 Ckt 1	-0.06	Switch in capacitors at Verde 69kV
VERDE S	230	Line YAVAPAI 230 to VERDE N 230 Ckt 1	-0.06	Switch in capacitors at Verde 69kV

Table 6 – Base Case Voltage Violations

Thermal overloads due to contingencies are shown in Table 7 - Base Case Thermal Violations along with the solution to the overload. For the facilities in the Southeast Arizona Transmission System (SATS) study area, it is reasonable to allow the SATS membership to identify and address these overloads in their forum.

Thermal Violations (overloads, per unit)									
Fname	FkV	Tname	TkV	ckt	CONTINGENCY DESCRIPTION	RTG #	MVA RTG	Overload	Solutions
PINPK	230	PINPKSRP	230	2	Line PINPK 230 to PINPKSRP 230 Ckt 1	2	658	1.36	Upgrade conductor
PINPK	230	PINPKSRP	230	1	Line PINPK 230 to PINPKSRP 230 Ckt 2	2	658	1.36	Upgrade conductor
YAVAPAI	500	YAVAPAI	230	2	Tran YAVAPAI 500 to YAVAPAI 230 Ckt 1	2	336	1.35	Replace transformers
YAVAPAI	500	YAVAPAI	230	1	Tran YAVAPAI 500 to YAVAPAI 230 Ckt 2	2	336	1.35	Replace transformers
TWNTYSEC	138	E. LOOP	138	1	Line LOSREALS 138 to VAIL 138 Ckt 1	2	225	1.15	Up-rate to min 540MVA by 2010
N. LOOP	138	RILLITO	138	1	Line N. LOOP 138 to NARANJA 138 Ckt 1	2	382	1.15	Up-rate to min. 553MVA by 2016
N. LOOP	138	RILLITO	138	1	Line RANVISTO 138 to NARANJA 138 Ckt 1	2	382	1.10	Up-rate to min. 553MVA by 2016
TORTOLIT	138	N. LOOP	138	3	Line TORTOLIT 138 to N. LOOP 138 Ckt 1A	2	406	1.08	Planned reconfiguration
TORTOLIT	138	N. LOOP	138	3	Line TORTOLIT 138 to N. LOOP 138 Ckt 2A	2	406	1.08	Planned reconfiguration
BRANDOW	230	WARD	230	1	Line BRANDOW 230 to WARD 230 Ckt 2	2	438	1.02	Upgrade conductor
BRANDOW	230	WARD	230	2	Line BRANDOW 230 to WARD 230 Ckt 1	2	438	1.02	Upgrade conductor
TWNTYSEC	138	E. LOOP	138	1	Line VAIL 138 to CIENEGA 138 Ckt 1	2	225	1.02	Up-rate to min 540MVA by 2010
TWNTYSEC	138	E. LOOP	138	1	Line PANTANO 138 to LOSREALS 138 Ckt 1	2	225	1.01	Up-rate to min 540MVA by 2010
DMP	138	N. LOOP	138	1	Line N. LOOP 138 to WESTINA 138 Ckt 1	2	311	1.01	Up-rate to min 382MVA by 2015

Table 7 - Base Case Thermal Violations

Project Outage (N-1-1) followed by single contingency

The tables below highlight the impact due to the delay of a project beyond 2019 on the remaining transmission system. The Project Outage analysis is a screening tool to assist in identifying criticality of projects to the interconnected system if not in service at the end of the ten year timeframe.

Similar to the Base case results, tables below show voltage and thermal violations. The shaded cells indicate where thermal violations were 5% greater than the Base case results or 3% greater than the Base case results for voltage deviations.

The Projects showing the greatest impact to voltage violations are

- APS01 Palo Verde-Sun Valley (formerly TS5) 500 and 230 kV system
- APS04 Palm Valley-TS2-Trilby Wash (TS1) 230kV line
- APS07 Sun Valley (TS5) –Raceway (TS9) 500kV line

While these Project Outage cases indicate a lower voltage due to an outage, further investigation reveals these outages result in a radial connection. The voltage deviation shown occurred at the bus at the end of the radial connection and the bus has no load. The violations do not create cascading problems in the remaining system.

Delta Voltage Violations (voltage drop, per unit) – APS Cases

Name	kV	CONTINGENCY DESCRIPTION	APS01	APS02	APS03	APS04	APS05	APS06	APS07	APS08	APS09
TRLBY	230	Line TRLBY 230 to SNVLY 230 Ckt 1	0.00	0.00	-0.04	-0.08	-0.04	-0.04	-0.04	-0.04	-0.04
SNVLY	500	Line DELANY 500 to SNVLY 500 Ckt 1	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.07	-0.01	-0.01
SNVLY	500	Line SNVLY 500 to RACEWAY 500 Ckt 1	-0.08	0.00	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01

Table 8 – Voltage Violations - APS Project Outage cases

The following tables (Tables 9 and 10) show thermal overloads due to the Project Outage analyses. Highlighting on these tables indicate where overloads exceed base case loading by 5%. These thermal overload results indicate a delay in the following Projects could increase loading on the remaining system under contingency conditions:

APS #3 - Raceway-Avery-Pinnacle Peak 230kV line
APS #5 - Raceway-Pinnacle Peak 500kV line
TEP #1 - Pinal Central – Tortolita 500 kV line

Thermal Violations (overloads, per unit) – APS Cases

Fname	FkV	Tname	Tkv	ckt	CONTINGENCY DESCRIPTION	RTG #	MVA RTG	APS01	APS02	APS03	APS04	APS05	APS06	APS07	APS08	APS09
PINPK	230	PINPKSRP	230	2	Line PINPK 230 to PINPKSRP 230 Ckt 1	2	658	1.36	1.36	1.41	1.36	1.58	1.30	1.35	1.35	1.35
YAVAPAI	500	YAVAPAI	230	1	Tran YAVAPAI 500 to YAVAPAI 230 Ckt 2	2	336	1.36	1.36	1.36	1.35	1.44	1.35	1.34	1.34	1.35
RACEWAY [2,3]	500	RACEWAY	230	1	Tran WESTWING 500 to WESTWNGE 230 Ckt 1	2	598	0.98	0.98	0.92	0.99	1.34	DNE	0.94	0.98	0.99
YAVAPAI	230	WILOWLKE	230	1	Line PRSCOTWA 230 to RNDVLYTP 230 Ckt 1	2	355	0.99	0.99	0.99	0.98	1.05	0.98	0.98	0.97	0.98
YAVAPAI	230	WILOWLKE	230	1	Line RNDVLYTP 230 to PEACOCK 230 Ckt 1	2	355	0.99	0.99	0.99	0.98	1.05	0.98	0.98	0.97	0.98
RACEWYWA[3]	230	WESTWNGE	230	1	Tran WESTWING 500 to WESTWNGE 230 Ckt 1	2	403	0.88	0.88	1.00	0.86	1.04	0.20	0.83	0.86	0.86

Table 9 - Thermal Overloads APS Project Outage Cases

Thermal Violations (overloads, per unit) – SRP and TEP Cases

Fname	FkV	Tname	TkV	ckt	CONTINGENCY DESCRIPTION	Rtg #	MVA RTG	PVDV2	SRP01	SRP02	SRP03	SRP04	TEP01
TWNTYSEC [4]	138	E. LOOP	138	1	Line LOSREALS 138 to VAIL 138 Ckt 1	2	225	1.15	1.15	1.18	1.17	1.15	1.25
TWNTYSEC [4]	138	E. LOOP	138	1	Line VAIL 138 to CIENEGA 138 Ckt 1	2	225	1.01	1.02	1.04	1.03	1.02	1.09
TWNTYSEC [4]	138	E. LOOP	138	1	Line PANTANO 138 to LOSREALS 138 Ckt 1	2	225	1.02	1.01	1.04	1.03	1.01	1.11
TWNTYSEC [4]	138	E. LOOP	138	1	Line DMP 138 to NE.LOOP 138 Ckt 1	2	225	0.97	0.97	0.99	0.99	0.97	1.03
TWNTYSEC [4]	138	E. LOOP	138	1	Line E. LOOP 138 to PANTANO 138 Ckt 1	2	225	0.95	0.95	0.98	0.97	0.95	1.04

Table 10 - Thermal Overloads - SRP and TEP Project Outage cases

[2] Rating is incorrect. Rating should be 702MVA (not 598MVA). The higher rating would reduce, but not eliminate the overload noted.
[3] APS closes the 230kV West Wing bus tie to mitigate overloads on Raceway transformers and Raceway-Westwing 230kV line.
[4] Planned uprate (to 540 MVA normal/606 MVA emergency) of the Twenty Second-East Loop line in 2010 mitigate these overloads.

Study Findings

The Ten Year Snapshot study (aka the BTA study) investigating the coordinated impact of utilities ten year plans on the Arizona extra high voltage (EHV) system found that:

- The 2019 system is robust
- Planned projects support the loads estimated for the 2019 timeframe

The Project Outage analysis (an N-1-1 analysis) indicated that the delay of any one project beyond the 2019 timeframe results in consistent thermal and voltage violations of the base case, with the exception of:

Case # - Description
APS #3 - Raceway-Avery-Pinnacle Peak 230kV line
APS #5 - Raceway-Pinnacle Peak 500kV line
TEP #1 - Pinal Central – Tortolita 500 kV line

A delay of any one of the three Planned Projects listed above resulted in thermal loadings 5% or more than the base case (for contingencies). Because the contingencies related to these thermal violations were already causing thermal violations in the base case (without removal of the planned project), these findings are not surprising. Solutions that correct the base case loadings will be solutions for the Project Outage scenarios. As a screening analysis the Project Outage portion of the Ten Year Snapshot study indicates that the EHV system can support changes in the timing of some of the transmission and generation projects without significant adverse effects on the remaining system.

The results of this study could be interpreted that the delay of one project doesn't have a negative impact on the remaining system and therefore that particular project isn't needed. This interpretation of the data presented would be false. Utilities plan their transmission systems for reliability, redundancy, transmission scheduling capability, and economic considerations. This ten year snapshot is intended to view the combined impact of a state-wide collaboration of projects that perhaps individual utilities might not see when planning for the near term (5-6 years). Because all utilities' planned projects are modeled in this longer term view, and with the interconnected nature of the transmission system, removal of a single project results in redistribution of power on the remaining projects and system. This redistribution reduces the impact of the delay of an individual project and does not point to a conclusion supporting a lack of need for that individual project.

The results of the Ten Year Snapshot study indicates the planned 2019 Arizona transmission system is robust as shown by limited voltage and thermal violations in the base case. Additionally, the Project Outage scenarios indicate that a delay of any one Project does not have a significant impact on the remaining transmission system.

Appendices

Appendix A: Contingency List

```
# Contingency Selection Criteria: From area 14 to 14; 100 kV to 999 kV
# Contingency Selection Criteria: From area 14 to 14; 100 kV to 999 kV
line 1            "Line SAN_JUAN     345.0 to MCKINLEY     345.0 Ckt 1"
 line     10292     16102   "1 "  1 0
0
line 2            "Line SAN_JUAN     345.0 to MCKINLEY     345.0 Ckt 2"
 line     10292     16102   "2 "  1 0
0
line 3            "Line HIDALGO      345.0 to GREENLEE     345.0 Ckt 1"
 line     11080     16101   "1 "  1 0
0
line 4            "Line CHOLLA       500.0 to SAGUARO      500.0 Ckt 1"
 line     14000     14004   "1 "  1 0
0
line 5            "Line FOURCORN     500.0 to MOENKOPI     500.0 Ckt 1"
 line     14001     14002   "1 "  1 0
0
line 6            "Line FOURCORN     500.0 to FCW          500.0 Ckt 1"
 line     14001     14030   "1 "  1 0
0
line 7            "Line MOENKOPI     500.0 to YAVAPAI      500.0 Ckt 1"
 line     14002     14006   "1 "  1 0
0
line 8            "Line MOENKOPI     500.0 to RME          500.0 Ckt 1"
 line     14002     14032   "1 "  1 0
0
line 9            "Line MOENKOPI     500.0 to ELDORDO      500.0 Ckt 1"
 line     14002     24042   "1 "  1 0
0
line 10           "Line MOENKOPI     500.0 to MARKETPL     500.0 Ckt 1"
 line     14002     26044   "1 "  1 0
0
line 11           "Line NAVAJO       500.0 to MOENKOPI     500.0 Ckt 1"
 line     14003     14002   "1 "  1 0
0
line 12           "Line NAVAJO       500.0 to RME          500.0 Ckt 1"
 line     14003     14032   "1 "  1 0
0
line 13           "Line NAVAJO       500.0 to CRYSTAL      500.0 Ckt 1"
 line     14003     26123   "1 "  1 0
0
line 14           "Line SAGUARO      500.0 to TORTOLIT     500.0 Ckt 1"
 line     14004     16000   "1 "  1 0
0
line 15           "Line SAGUARO      500.0 to TORTOLIT     500.0 Ckt 2"
 line     14004     16000   "2 "  1 0
0
line 16           "Line SAGUARO      500.0 to TORTLIT2     500.0 Ckt 1"
 line     14004     16001   "1 "  1 0
0
line 17           "Line YAVAPAI      500.0 to WESTWING     500.0 Ckt 1"
 line     14006     14005   "1 "  1 0
0
line 18           "Line SNVLY        500.0 to RACEWAY      500.0 Ckt 1"
 line     14010     14011   "1 "  1 0
0
line 19           "Line RACEWAY      500.0 to WESTWING     500.0 Ckt 1"
 line     14011     14005   "1 "  1 0
0
line 20           "Line RACEWAY      500.0 to PNPKAPS      500.0 Ckt 1"
 line     14011     14016   "1 "  1 0
0
line 21           "Line SGRLF        500.0 to CHOLLA       500.0 Ckt 1"
 line     14017     14000   "1 "  1 0
0
line 22           "Line DRPP         500.0 to FCW          500.0 Ckt 1"
 line     14031     14030   "1 "  1 0
```



```
0
line 23           "Line DRPP         500.0 to FCW          500.0 Ckt 2"
 line     14031     14030   "2 "  1 0
0
line 24           "Line RME          500.0 to FCW          500.0 Ckt 1"
 line     14032     14030   "1 "  1 0
0
line 25           "Line CHOLLA       345.0 to PNPKAPS      345.0 Ckt 1"
 line     14100     14102   "1 "  1 0
0
line 26           "Line CHOLLA       345.0 to PRECHCYN     345.0 Ckt 1"
 line     14100     14103   "1 "  1 0
0
line 27           "Line FOURCORN     345.0 to SAN_JUAN     345.0 Ckt 1"
 line     14101     10292   "1 "  1 0
0
line 28           "Line FOURCORN     345.0 to WESTMESA     345.0 Ckt 1"
 line     14101     10369   "1 "  1 0
0
line 29           "Line FOURCORN     345.0 to RIOPUERC     345.0 Ckt 1"
 line     14101     10390   "1 "  1 0
0
line 30           "Line FOURCORN     345.0 to CHOLLA       345.0 Ckt 1"
 line     14101     14100   "1 "  1 0
0
line 31           "Line FOURCORN     345.0 to CHOLLA       345.0 Ckt 2"
 line     14101     14100   "2 "  1 0
0
line 32           "Line BUCKEYE      230.0 to LIBERTY      230.0 Ckt 1"
 line     14201     19052   "1 "  1 0
0
line 33           "Line CACTUS       230.0 to OCOTILLO     230.0 Ckt 1"
 line     14202     14219   "1 "  1 0
0
line 34           "Line CHOLLA       230.0 to LEUPP        230.0 Ckt 1"
 line     14204     14215   "1 "  1 0
0
line 35           "Line VERDE S      230.0 to COCONINO     230.0 Ckt 1"
 line     14247     14205   "1 "  1 0
0
line 36           "Line CTRYCLUB     230.0 to LINCSTRT     230.0 Ckt 1"
 line     14206     14216   "1 "  1 0
0
line 37           "Line CTRYCLUB     230.0 to GRNDTRML     230.0 Ckt 1"
 line     14206     14270   "1 "  1 0
0
line 38           "Line DEERVALY     230.0 to WESTWNGE     230.0 Ckt 1"
 line     14207     14259   "1 "  1 0
0
line 39           "Line DEERVALY     230.0 to ALEXANDR     230.0 Ckt 1"
 line     14207     15202   "1 "  1 0
0
line 40           "Line DEERVALY     230.0 to PINPKSRP     230.0 Ckt 1"
 line     14207     15211   "1 "  1 0
0
line 41           "Line EAGLEYE      230.0 to LIBERTY      230.0 Ckt 1"
 line     14209     19052   "1 "  1 0
0
line 42           "Line EL SOL       230.0 to AGUAFRIA     230.0 Ckt 1"
 line     14210     15201   "1 "  1 0
0
line 43           "Line FOURCORN     230.0 to PILLAR       230.0 Ckt 1"
 line     14211     10248   "1 "  1 0
0
line 44           "Line GLENDALE     230.0 to GRNDTRML     230.0 Ckt 1"
 line     14212     14270   "1 "  1 0
0
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line 45          "Line LEUPP        230.0 to COCONINO     230.0 Ckt 1"
 line     14215     14205   "1 "  1 0
0
line 46          "Line LINCSTRT     230.0 to OCOTILLO     230.0 Ckt 1"
 line     14216     14219   "1 "  1 0
0
line 47          "Line LINCSTRT     230.0 to WPHXAPSN     230.0 Ckt 1"
 line     14216     14239   "1 "  1 0
0
line 48          "Line LONEPEAK     230.0 to SUNYSLOP     230.0 Ckt 1"
 line     14217     14227   "1 "  1 0
0
line 49          "Line MEADOWBK     230.0 to CTRYCLUB     230.0 Ckt 1"
 line     14218     14206   "1 "  1 0
0
line 50          "Line MEADOWBK     230.0 to SUNYSLOP     230.0 Ckt 1"
 line     14218     14227   "1 "  1 0
0
line 51          "Line REACH        230.0 to LONEPEAK     230.0 Ckt 1"
 line     14220     14217   "1 "  1 0
0
line 52          "Line PNPKAPS      230.0 to PINPK        230.0 Ckt 1"
 line     14221     19062   "1 "  1 0
0
line 53          "Line JOJOBA       230.0 to GILARIVR     230.0 Ckt 1"
 line     14224     14238   "1 "  1 0
0
line 54          "Line SAGUARO      230.0 to TATMOMLI     230.0 Ckt 1"
 line     14225     14229   "1 "  1 0
0
line 55          "Line SNTAROSA     230.0 to TATMOMLI     230.0 Ckt 1"
 line     14226     14229   "1 "  1 0
0
line 56          "Line SURPRISE     230.0 to EL SOL       230.0 Ckt 1"
 line     14228     14210   "1 "  1 0
0
line 57          "Line SURPRISE     230.0 to WESTWNGW     230.0 Ckt 1"
 line     14228     14231   "1 "  1 0
0
line 58          "Line VERDE S      230.0 to VERDE N      230.0 Ckt 1"
 line     14247     14230   "1 "  1 0
0
line 59          "Line WESTWNGW     230.0 to EL SOL       230.0 Ckt 1"
 line     14231     14210   "1 "  1 0
0
line 60          "Line WESTWNGW     230.0 to WESTWNGE     230.0 Ckt 1"
 line     14231     14259   "1 "  1 0
0
line 61          "Line WESTWNGW     230.0 to PINPK        230.0 Ckt 1"
 line     14231     19062   "1 "  1 0
0
line 62          "Line WHTNKAPS     230.0 to EL SOL       230.0 Ckt 1"
 line     14232     14210   "1 "  1 0
0
line 63          "Line WHTNKAPS     230.0 to RUDD         230.0 Ckt 1"
 line     14232     15230   "1 "  1 0
0
line 64          "Line WPHXAPSS     230.0 to WPHXAPSN     230.0 Ckt 1"
 line     14233     14239   "1 "  1 0
0
line 65          "Line WPHXAPSS     230.0 to RUDD         230.0 Ckt 1"
 line     14233     15230   "1 "  1 0
0
line 66          "Line YAVAPAI      230.0 to VERDE N      230.0 Ckt 1"
 line     14234     14230   "1 "  1 0
0
line_67          "Line YAVAPAI      230.0 to WILOWLKE     230.0 Ckt 1"
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 line     14234     14249   "1 "  1 0
0
line 68          "Line KYR-NEW      230.0 to OCOTILLO     230.0 Ckt 1"
 line     14236     14219   "1 "  1 0
0
line 69          "Line KYR-NEW      230.0 to KNOX         230.0 Ckt 1"
 line     14236     15219   "1 "  1 0
0
line 70          "Line GILARIVR     230.0 to GILABEND     230.0 Ckt 1"
 line     14238     14235   "1 "  1 0
0
line 71          "Line WPHXAPSN     230.0 to WHTNKAPS     230.0 Ckt 1"
 line     14239     14232   "1 "  1 0
0
line 72          "Line FORTROCK     230.0 to ROUNDVLY     230.0 Ckt 1"
 line     14240     14223   "1 "  1 0
0
line 73          "Line FORTROCK     230.0 to JUNIPRMT     230.0 Ckt 1"
 line     14240     14264   "1 "  1 0
0
line 74          "Line ALEXNDR      230.0 to ALEXANDR     230.0 Ckt 1"
 line     14241     15202   "1 "  1 0
0
line 75          "Line GLENDALW     230.0 to GLENDALE     230.0 Ckt 1"
 line     14248     14212   "1 "  1 0
0
line 76          "Line GLENDALW     230.0 to AGUAFRIA     230.0 Ckt 1"
 line     14248     15201   "1 "  1 0
0
line 77          "Line WILOWLKW     230.0 to PRESCOTT     230.0 Ckt 1"
 line     14250     14222   "1 "  1 0
0
line 78          "Line WILOWLKW     230.0 to WILOWLKE     230.0 Ckt 1"
 line     14250     14249   "1 "  1 0
0
line 79          "Line AVERY        230.0 to RACEWAY      230.0 Ckt 1"
 line     14253     14246   "1 "  1 0
0
line 80          "Line AVERY        230.0 to TS6          230.0 Ckt 1"
 line     14253     14257   "1 "  1 0
0
line 81          "Line TRLBY        230.0 to TS2          230.0 Ckt 1"
 line     14254     14255   "1 "  1 0
0
line 82          "Line TRLBY        230.0 to SNVLY        230.0 Ckt 1"
 line     14254     14265   "1 "  1 0
0
line 83          "Line TS2          230.0 to PLMVLY       230.0 Ckt 1"
 line     14255     14252   "1 "  1 0
0
line 84          "Line TS6          230.0 to PNPKAPS      230.0 Ckt 1"
 line     14257     14221   "1 "  1 0
0
line 85          "Line TS4          230.0 to JOJOBA       230.0 Ckt 1"
 line     14258     14224   "1 "  1 0
0
line 86          "Line TS4          230.0 to PLMVLY       230.0 Ckt 1"
 line     14258     14252   "1 "  1 0
0
line 87          "Line JUNIPRMT     230.0 to SELIGMAN     230.0 Ckt 1"
 line     14264     14244   "1 "  1 0
0
line 88          "Line ADAMS        115.0 to ADAMS TP     115.0 Ckt 1"
 line     14350     19060   "1 "  1 0
0
line 89          "Line SAG.EAST     115.0 to SAG.WEST     115.0 Ckt 1"
 line     14356     14357   "1 "  1 0
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0
line 90          "Line SAG.EAST     115.0 to NAVISKA      115.0 Ckt 1"
 line     14356     17665   "1 "  1 0
0
line 91          "Line SAG.EAST     115.0 to ORACLE       115.0 Ckt 1"
 line     14356     19057   "1 "  1 0
0
line 92          "Line SAG.WEST     115.0 to SNMANUEL     115.0 Ckt 1"
 line     14357     14358   "1 "  1 0
0
line 93          "Line SAG.WEST     115.0 to ED-5         115.0 Ckt 1"
 line     14357     19067   "1 "  1 0
0
line 94          "Line SNMANUEL     115.0 to HAYDENAZ     115.0 Ckt 1"
 line     14358     15108   "1 "  1 0
0
line 95          "Line VLYFARMS     115.0 to ORACLE       115.0 Ckt 1"
 line     14359     19057   "1 "  1 0
0
line 96          "Line BOOTHILL     115.0 to ADAMS        115.0 Ckt 1"
 line     14362     14350   "1 "  1 0
0
line 97          "Line BOOTHILL     115.0 to MURAL        115.0 Ckt 1"
 line     14362     14353   "1 "  1 0
0
line 98          "Line CORONADO     500.0 to SGRLF        500.0 Ckt 1"
 line     15001     14017   "1 "  1 0
0
line 99          "Line CORONADO     500.0 to SILVERKG     500.0 Ckt 1"
 line     15001     15041   "1 "  1 0
0
line 100         "Line PALOVRDE     500.0 to WESTWING     500.0 Ckt 1"
 line     15021     14005   "1 "  1 0
0
line 101         "Line PALOVRDE     500.0 to WESTWING     500.0 Ckt 2"
 line     15021     14005   "2 "  1 0
0
line 102         "Line PALOVRDE     500.0 to RUDD         500.0 Ckt 1"
 line     15021     15061   "1 "  1 0
0
line 103         "Line PALOVRDE     500.0 to DEVERS       500.0 Ckt 1"
 line     15021     24801   "1 "  1 0
0
line 104         "Line PERK PS2     500.0 to PERKINPS     500.0 Ckt 1"
 line     15032     15033   "1 "  1 0
0
line 105         "Line PERKINPS     500.0 to WESTWING     500.0 Ckt 1"
 line     15033     14005   "1 "  1 0
0
line 106         "Line SILVERKG     500.0 to BROWNING     500.0 Ckt 1"
 line     15041     15051   "1 "  1 0
0
line 107         "Line BROWNING     500.0 to KYRENE       500.0 Ckt 1"
 line     15051     15011   "1 "  1 0
0
line 108         "Line ABEL         500.0 to BROWNING     500.0 Ckt 1"
 line     15070     15051   "1 "  1 0
0
line 109         "Line PC GEN       500.0 to ABEL         500.0 Ckt 1"
 line     15095     15070   "1 "  1 0
0
line 110         "Line PINAL C      500.0 to TORTOLIT     500.0 Ckt 1"
 line     15080     16000   "1 "  1 0
0
line 111         "Line JOJOBA       500.0 to GILARIVR     500.0 Ckt 1"
 line     15089     14007   "1 "  1 0
0
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line 112         "Line JOJOBA       500.0 to GILARIVR     500.0 Ckt 2"
 line     15089     14007   "2 "  1 0
0
line 113         "Line JOJOBA       500.0 to KYRENE       500.0 Ckt 1"
 line     15089     15011   "1 "  1 0
0
line 114         "Line HASSYAMP     500.0 to REDHAWK      500.0 Ckt 1"
 line     15090     14009   "1 "  1 0
0
line 115         "Line HASSYAMP     500.0 to PALOVRDE     500.0 Ckt 1"
 line     15090     15021   "1 "  1 0
0
line 116         "Line HASSYAMP     500.0 to PALOVRDE     500.0 Ckt 2"
 line     15090     15021   "2 "  1 0
0
line 117         "Line HASSYAMP     500.0 to PALOVRDE     500.0 Ckt 3"
 line     15090     15021   "3 "  1 0
0
line 118         "Line HASSYAMP     500.0 to PINAL_W      500.0 Ckt 1"
 line     15090     15088   "1 "  1 0
0
line 119         "Line HASSYAMP     500.0 to JOJOBA       500.0 Ckt 1"
 line     15090     15089   "1 "  1 0
0
line 120         "Line HASSYAMP     500.0 to ARLINTON     500.0 Ckt 1"
 line     15090     15092   "1 "  1 0
0
line 121         "Line HASSYAMP     500.0 to MESQUITE     500.0 Ckt 1"
 line     15090     15094   "1 "  1 0
0
line 122         "Line HASSYAMP     500.0 to N.GILA       500.0 Ckt 1"
 line     15090     22536   "1 "  1 0
0
line 123         "Line HARQUAHA     500.0 to DEVERS       500.0 Ckt 1"
 line     15093     24801   "1 "  1 0
0
line 124         "Line BONNEYTP     115.0 to BONNEYBK     115.0 Ckt 1"
 line     15103     14352   "1 "  1 0
0
line 125         "Line BONNEYTP     115.0 to COOLIDGE     115.0 Ckt 1"
 line     15103     19044   "1 "  1 0
0
line 126         "Line ELLISON      115.0 to 843E2.7N     115.0 Ckt 1"
 line     15105     15133   "1 "  1 0
0
line 127         "Line FRAZIER      115.0 to MOONSHIN     115.0 Ckt 1"
 line     15106     15115   "1 "  1 0
0
line 128         "Line FRAZIER      115.0 to ROOSEVLT     115.0 Ckt 1"
 line     15106     15134   "1 "  1 0
0
line 129         "Line GOLDFELD     115.0 to HORSMESA     115.0 Ckt 1"
 line     15107     15109   "1 "  1 0
0
line 130         "Line HAYDENAZ     115.0 to ASARCOTP     115.0 Ckt 1"
 line     15108     15102   "1 "  1 0
0
line 131         "Line HAYDENAZ     115.0 to KEARNYTP     115.0 Ckt 1"
 line     15108     15112   "1 "  1 0
0
line 132         "Line HORSMESA     115.0 to FRAZIER      115.0 Ckt 1"
 line     15109     15106   "1 "  1 0
0
line 133         "Line HORSMESA     115.0 to MRMNFLAT     115.0 Ckt 1"
 line     15109     15117   "1 "  1 0
0
line_134         "Line KEARNYTP     115.0 to KEARNY       115.0 Ckt 1"
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 line     15112     15111   "1 "  1 0
0
line 135          "Line KEARNYTP     115.0 to MORRISAZ     115.0 Ckt 1"
 line     15112     15116   "1 "  1 0
0
line 136          "Line KNOLL        115.0 to MORRISAZ     115.0 Ckt 1"
 line     15113     15116   "1 "  1 0
0
line 137          "Line MIAMI        115.0 to PINTOVLY     115.0 Ckt 1"
 line     15114     15121   "1 "  1 0
0
line 138          "Line MOONSHIN     115.0 to PINAL        115.0 Ckt 1"
 line     15115     15119   "1 "  1 0
0
line 138a          "Line MOONSHIN     115.0 to PINAL  115.0 Ckt 1 & load trip"
 line     15115     15119   "1 "  1 0
 load    "ELLISON  115.00"  "SR"  1 11.3  4.81
0
line 139          "Line MOONSHIN     115.0 to 842E2.7N     115.0 Ckt 1"
 line     15115     15132   "1 "  1 0
0
line 140          "Line OAKFLAT      115.0 to SILVERT1     115.0 Ckt 1"
 line     15118     15126   "1 "  1 0
0
line 141          "Line PINAL        115.0 to SILVERT1     115.0 Ckt 1"
 line     15119     15126   "1 "  1 0
0
line 142          "Line RAY          115.0 to KNOLL        115.0 Ckt 1"
 line     15122     15113   "1 "  1 0
0
line 143          "Line RAY          115.0 to SUPERIOR     115.0 Ckt 1"
 line     15122     15129   "1 "  1 0
0
line 144          "Line REFINERY     115.0 to 842E2.7N     115.0 Ckt 1"
 line     15123     15132   "1 "  1 0
0
line 145          "Line SILVERK1     115.0 to SILVERT1     115.0 Ckt 1"
 line     15124     15126   "1 "  1 0
0
line 146          "Line SILVERK2     115.0 to PINTOVLY     115.0 Ckt 1"
 line     15125     15121   "1 "  1 0
0
line 147          "Line SILVERK2     115.0 to SUPERIOR     115.0 Ckt 1"
 line     15125     15129   "1 "  1 0
0
line 148          "Line SPURLOCK     115.0 to SUPERIOR     115.0 Ckt 1"
 line     15127     15129   "1 "  1 0
0
line 149          "Line 842E2.7N     115.0 to 843E2.7N     115.0 Ckt 1"
 line     15132     15133   "1 "  1 0
0
line 150          "Line SNYDHLAZ     115.0 to SNYDHILL     115.0 Ckt 1"
 line     15181     19214   "1 "  1 0
0
line 151          "Line AGUAFRIA     230.0 to WESTWNGW     230.0 Ckt 1"
 line     15201     14231   "1 "  1 0
0
line 152          "Line AGUAFRIA     230.0 to ALEXANDR     230.0 Ckt 1"
 line     15201     15202   "1 "  1 0
0
line 153          "Line AGUAFRIA     230.0 to WHITETNK     230.0 Ckt 1"
 line     15201     15218   "1 "  1 0
0
line 154          "Line ANDERSON     230.0 to ORME         230.0 Ckt 1"
 line     15203     15208   "1 "  1 0
0
line_155          "Line BRANDOW      230.0 to KYRENE       230.0 Ckt 1"
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 line     15204     15207   "1 "  1 0
0
line 156          "Line BRANDOW      230.0 to PAPAGOBT     230.0 Ckt 1"
 line     15204     15209   "1 "  1 0
0
line 157          "Line BRANDOW      230.0 to WARD         230.0 Ckt 1"
 line     15204     15217   "1 "  1 0
0
line 158          "Line BRANDOW      230.0 to WARD         230.0 Ckt 2"
 line     15204     15217   "2 "  1 0
0
line 159          "Line CORBELL      230.0 to KYRENE       230.0 Ckt 1"
 line     15205     15207   "1 "  1 0
0
line 160          "Line KYRENE       230.0 to KYR-NEW      230.0 Ckt 1"
 line     15207     14236   "1 "  1 0
0
line 161          "Line KYRENE       230.0 to SCHRADER     230.0 Ckt 1"
 line     15207     15214   "1 "  1 0
0
line 162          "Line ORME         230.0 to ANDERSON     230.0 Ckt 2"
 line     15208     15203   "2 "  1 0
0
line 163          "Line ORME         230.0 to RUDD         230.0 Ckt 1"
 line     15208     15230   "1 "  1 0
0
line 164          "Line ORME         230.0 to RUDD         230.0 Ckt 2"
 line     15208     15230   "2 "  1 0
0
line 165          "Line PAPAGOBT     230.0 to PINPKSRP     230.0 Ckt 1"
 line     15209     15211   "1 "  1 0
0
line 166          "Line BRANDOW      230.0 to PINPKSRP     230.0 Ckt 1"
 line     15204     15211   "1 "  1 0
0
line 167          "Line PINPKSRP     230.0 to BRANDOW      230.0 Ckt 2"
 line     15211     15204   "2 "  1 0
0
line 168          "Line ROGERS       230.0 to THUNDRST     230.0 Ckt 1"
 line     15212     15216   "1 "  1 0
0
line 169          "Line ROGERS       230.0 to ROGSWAPA     230.0 Ckt 1"
 line     15212     19502   "1 "  1 0
0
line 170          "Line ROGERS       230.0 to ROGSWAPA     230.0 Ckt 2"
 line     15212     19502   "2 "  1 0
0
line 171          "Line SANTAN       230.0 to CORBELL      230.0 Ckt 1"
 line     15213     15205   "1 "  1 0
0
line 172          "Line SANTAN       230.0 to THUNDRST     230.0 Ckt 1"
 line     15213     15216   "1 "  1 0
0
line 173          "Line SCHRADER     230.0 to SANTAN       230.0 Ckt 1"
 line     15214     15213   "1 "  1 0
0
line 174          "Line SILVERKG     230.0 to GOLDFELD     230.0 Ckt 1"
 line     15215     15206   "1 "  1 0
0
line 175          "Line THUNDRST     230.0 to GOLDFELD     230.0 Ckt 1"
 line     15216     15206   "1 "  1 0
0
line 176          "Line THUNDRST     230.0 to GOLDFELD     230.0 Ckt 2"
 line     15216     15206   "2 "  1 0
0
line 177          "Line KNOX         230.0 to SNTAROSA     230.0 Ckt 1"
 line     15219     14226   "1 "  1 0
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0
line 178          "Line RS17          230.0 to SCHRADER     230.0 Ckt 1"
 line     15221     15214   "1 "  1 0
0
line 179          "Line RS17          230.0 to SCHRADER     230.0 Ckt 2"
 line     15221     15214   "2 "  1 0
0
line 180          "Line BROWNING      230.0 to SANTAN       230.0 Ckt 1"
 line     15222     15213   "1 "  1 0
0
line 181          "Line DINOSAUR      230.0 to BROWNING     230.0 Ckt 1"
 line     15223     15222   "1 "  1 0
0
line 182          "Line ABEL          230.0 to DINOSAUR     230.0 Ckt 1"
 line     15224     15223   "1 "  1 0
0
line 183          "Line RUDD          230.0 to PLMVLY       230.0 Ckt 1"
 line     15230     14252   "1 "  1 0
0
line 184          "Line RUDD          230.0 to WHITETNK     230.0 Ckt 1"
 line     15230     15218   "1 "  1 0
0
line 185          "Line RUDD          230.0 to LIBERTY      230.0 Ckt 1"
 line     15230     19052   "1 "  1 0
0
line 186          "Line GREENLEE      345.0 to WINCHSTR     345.0 Ckt 1"
 line     16101     16109   "1 "  1 0
0
line 187          "Line GREENLEE      345.0 to WILLOW       345.0 Ckt 1"
 line     16101     16112   "1 "  1 0
0
line 188          "Line GREENLEE      345.0 to COPPERVR     345.0 Ckt 1"
 line     16101     16900   "1 "  1 0
0
line 189          "Line MCKINLEY      345.0 to SPRINGR      345.0 Ckt 1"
 line     16102     16104   "1 "  1 0
0
line 190          "Line MCKINLEY      345.0 to SPRINGR      345.0 Ckt 2"
 line     16102     16104   "2 "  1 0
0
line 191          "Line SOUTH         345.0 to GATEWAY      345.0 Ckt 1"
 line     16103     16108   "1 "  1 0
0
line 192          "Line SOUTH         345.0 to GATEWAY      345.0 Ckt 2"
 line     16103     16108   "2 "  1 0
0
line 193          "Line SPRINGR       345.0 to LUNA         345.0 Ckt 1"
 line     16104     11093   "1 "  1 0
0
line 194          "Line SPRINGR       345.0 to CORONADO     345.0 Ckt 1"
 line     16104     16100   "1 "  1 0
0
line 195          "Line SPRINGR       345.0 to GREENLEE     345.0 Ckt 1"
 line     16104     16101   "1 "  1 0
0
line 196          "Line SPRINGR       345.0 to VAIL2        345.0 Ckt 1"
 line     16104     16106   "1 "  1 0
0
line 197          "Line VAIL          345.0 to SOUTH        345.0 Ckt 1"
 line     16105     16103   "1 "  1 0
0
line 198          "Line WESTWING      345.0 to PINALWES     345.0 Ckt 1"
 line     16107     16114   "1 "  1 0
0
line 199          "Line WINCHSTR      345.0 to VAIL         345.0 Ckt 1"
 line     16109     16105   "1 "  1 0
0
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line 200          "Line WINCHSTR      345.0 to WILLOW       345.0 Ckt 1"
 line     16109     16112   "1 "  1 0
0
line 201          "Line WILLOW        345.0 to BOWIE        345.0 Ckt 1"
 line     16112     16111   "1 "  1 0
0
line 202          "Line WILLOW        345.0 to BOWIE        345.0 Ckt 2"
 line     16112     16111   "2 "  1 0
0
line 203          "Line PINALWES      345.0 to SOUTH        345.0 Ckt 1"
 line     16114     16103   "1 "  1 0
0
line 204          "Line DMP           138.0 to N. LOOP      138.0 Ckt 1"
 line     16200     16207   "1 "  1 0
0
line 205          "Line DMP           138.0 to NE.LOOP      138.0 Ckt 1"
 line     16200     16208   "1 "  1 0
0
line 206          "Line DMP           138.0 to SN.CRUZ      138.0 Ckt 1"
 line     16200     16214   "1 "  1 0
0
line 207          "Line DMP           138.0 to TUCSON       138.0 Ckt 1"
 line     16200     16218   "1 "  1 0
0
line 208          "Line DREXEL        138.0 to IRVNGTN      138.0 Ckt 1"
 line     16201     16204   "1 "  1 0
0
line 209          "Line DREXEL        138.0 to MIDVALE      138.0 Ckt 1"
 line     16201     16206   "1 "  1 0
0
line 210          "Line E. LOOP       138.0 to NE.LOOP      138.0 Ckt 1"
 line     16202     16208   "1 "  1 0
0
line 211          "Line E. LOOP       138.0 to ROBERTS      138.0 Ckt 1"
 line     16202     16211   "1 "  1 0
0
line 212          "Line E. LOOP       138.0 to PANTANO      138.0 Ckt 1"
 line     16202     16224   "1 "  1 0
0
line 213          "Line E. LOOP       138.0 to HARRISON     138.0 Ckt 1"
 line     16202     16247   "1 "  1 0
0
line 214          "Line IRVNGTN       138.0 to SOUTH        138.0 Ckt 1"
 line     16204     16216   "1 "  1 0
0
line 215          "Line IRVNGTN       138.0 to TUCSON       138.0 Ckt 1"
 line     16204     16218   "1 "  1 0
0
line 216          "Line IRVNGTN       138.0 to VAIL         138.0 Ckt 2"
 line     16204     16220   "2 "  1 0
0
line 217          "Line IRVNGTN       138.0 to TECHPARK     138.0 Ckt 1"
 line     16204     16233   "1 "  1 0
0
line 218          "Line IRVNGTN       138.0 to KINO         138.0 Ckt 1"
 line     16204     16246   "1 "  1 0
0
line 219          "Line N. LOOP       138.0 to RILLITO      138.0 Ckt 1"
 line     16207     16210   "1 "  1 0
0
line 220          "Line N. LOOP       138.0 to WESTINA      138.0 Ckt 1"
 line     16207     16221   "1 "  1 0
0
line 221          "Line N. LOOP       138.0 to MARANA       138.0 Ckt 1"
 line     16207     16244   "1 "  1 0
0
line_222          "Line NE.LOOP       138.0 to RILLITO      138.0 Ckt 1"
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 line     16208     16210   "1 "  1 0
0
line 223          "Line NE.LOOP      138.0 to NELP_SVC     138.0 Ckt 1"
 line     16208     16298   "1 "  1 0
0
line 224          "Line RANVISTO     138.0 to LACANADA     138.0 Ckt 1"
 line     16209     16205   "1 "  1 0
0
line 225          "Line RANVISTO     138.0 to SUN_CITY     138.0 Ckt 1"
 line     16209     16226   "1 "  1 0
0
line 226          "Line RANVISTO     138.0 to NARANJA      138.0 Ckt 1"
 line     16209     16245   "1 "  1 0
0
line 227          "Line RILLITO      138.0 to LACANADA     138.0 Ckt 1"
 line     16210     16205   "1 "  1 0
0
line 228          "Line ROBERTS      138.0 to HARRISON     138.0 Ckt 1"
 line     16211     16247   "1 "  1 0
0
line 229          "Line S.TRAIL      138.0 to ROBERTS      138.0 Ckt 1"
 line     16213     16211   "1 "  1 0
0
line 230          "Line SN.CRUZ      138.0 to IRVNGTN      138.0 Ckt 1"
 line     16214     16204   "1 "  1 0
0
line 231          "Line SNYDER       138.0 to E. LOOP      138.0 Ckt 1"
 line     16215     16202   "1 "  1 0
0
line 232          "Line SNYDER       138.0 to NE.LOOP      138.0 Ckt 1"
 line     16215     16208   "1 "  1 0
0
line 233          "Line SNYDER       138.0 to CRYCROFT     138.0 Ckt 1"
 line     16215     16239   "1 "  1 0
0
line 234          "Line SOUTH        138.0 to MIDVALE      138.0 Ckt 1"
 line     16216     16206   "1 "  1 0
0
line 235          "Line SOUTH        138.0 to ASARCO       138.0 Ckt 1"
 line     16216     16225   "1 "  1 0
0
line 236          "Line SOUTH        138.0 to CYPRUS       138.0 Ckt 1"
 line     16216     16228   "1 "  1 0
0
line 237          "Line SOUTH        138.0 to GREENVLY     138.0 Ckt 1"
 line     16216     16232   "1 "  1 0
0
line 238          "Line SOUTH        138.0 to HARTT        138.0 Ckt 1"
 line     16216     16242   "1 "  1 0
0
line 239          "Line TORTOLIT     138.0 to N. LOOP      138.0 Ckt 1"
 line     16217     16207   "1 "  1 0
0
line 240          "Line TORTOLIT     138.0 to N. LOOP      138.0 Ckt 2"
 line     16217     16207   "2 "  1 0
0
line 241          "Line TORTOLIT     138.0 to RANVISTO     138.0 Ckt 1"
 line     16217     16209   "1 "  1 0
0
line 242          "Line TORTOLIT     138.0 to MARANA       138.0 Ckt 1"
 line     16217     16244   "1 "  1 0
0
line 243          "Line TUCSON       138.0 to WESTINA      138.0 Ckt 1"
 line     16218     16221   "1 "  1 0
0
line 244          "Line TUCSON       138.0 to DELCERRO     138.0 Ckt 1"
 line     16218     16229   "1 "  1 0
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0
line 245          "Line TUCSON       138.0 to KINO         138.0 Ckt 1"
 line     16218     16246   "1 "  1 0
0
line 246          "Line TWNTYSEC     138.0 to E. LOOP      138.0 Ckt 1"
 line     16219     16202   "1 "  1 0
0
line 247          "Line TWNTYSEC     138.0 to IRVNGTN      138.0 Ckt 1"
 line     16219     16204   "1 "  1 0
0
line 248          "Line VAIL         138.0 to S.TRAIL      138.0 Ckt 1"
 line     16220     16213   "1 "  1 0
0
line 249          "Line VAIL         138.0 to FT.HUACH     138.0 Ckt 1"
 line     16220     16230   "1 "  1 0
0
line 250          "Line VAIL         138.0 to CIENEGA      138.0 Ckt 1"
 line     16220     16243   "1 "  1 0
0
line 251          "Line RBWILMOT     138.0 to VAIL         138.0 Ckt 1"
 line     16222     16220   "1 "  1 0
0
line 252          "Line LOSREALS     138.0 to VAIL         138.0 Ckt 1"
 line     16223     16220   "1 "  1 0
0
line 253          "Line PANTANO      138.0 to LOSREALS     138.0 Ckt 1"
 line     16224     16223   "1 "  1 0
0
line 254          "Line CANOARCH     138.0 to CYPRUS       138.0 Ckt 1"
 line     16227     16228   "1 "  1 0
0
line 255          "Line DELCERRO     138.0 to WESTINA      138.0 Ckt 1"
 line     16229     16221   "1 "  1 0
0
line 256          "Line GREENVLY     138.0 to CANOARCH     138.0 Ckt 1"
 line     16232     16227   "1 "  1 0
0
line 257          "Line TECHPARK     138.0 to VAIL         138.0 Ckt 1"
 line     16233     16220   "1 "  1 0
0
line 258          "Line CORONA       138.0 to IRVNGTN      138.0 Ckt 1"
 line     16238     16204   "1 "  1 0
0
line 259          "Line CORONA       138.0 to SOUTH        138.0 Ckt 1"
 line     16238     16216   "1 "  1 0
0
line 260          "Line CRYCROFT     138.0 to NE.LOOP      138.0 Ckt 1"
 line     16239     16208   "1 "  1 0
0
line 261          "Line HARTT        138.0 to GREENVLY     138.0 Ckt 1"
 line     16242     16232   "1 "  1 0
0
line 262          "Line CIENEGA      138.0 to S.TRAIL      138.0 Ckt 1"
 line     16243     16213   "1 "  1 0
0
line 263          "Line COPPERVR     230.0 to FRISCO       230.0 Ckt 1"
 line     16901     16902   "1 "  1 0
0
line 264          "Line PD-MORNC     230.0 to FRISCO       230.0 Ckt 1"
 line     16903     16902   "1 "  1 0
0
line 265          "Line APACHE       115.0 to SNMANUEL     115.0 Ckt 1"
 line     17001     14358   "1 "  1 0
0
line 266          "Line APACHE       230.0 to BUTERFLD     230.0 Ckt 1"
 line     17002     17007   "1 "  1 0
0
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line 267          "Line APACHE       230.0 to RED TAIL     230.0 Ckt 1"
 line     17002     17018   "1 "  1 0
0
line 268          "Line APACHE       230.0 to WINCHSTR     230.0 Ckt 1"
 line     17002     17105   "1 "  1 0
0
line 269          "Line AVRA         115.0 to MARANA       115.0 Ckt 1"
 line     17003     17012   "1 "  1 0
0
line 270          "Line AVRA         115.0 to SNDARIO      115.0 Ckt 1"
 line     17003     17089   "1 "  1 0
0
line 271          "Line BICKNELL     345.0 to VAIL         345.0 Ckt 1"
 line     17005     16105   "1 "  1 0
0
line 272          "Line BUTERFLD     230.0 to SAN RAF      230.0 Ckt 1"
 line     17007     17020   "1 "  1 0
0
line 273          "Line DOSCONDO     230.0 to HACKBERY     230.0 Ckt 1"
 line     17008     17044   "1 "  1 0
0
line 274          "Line MORENCI      230.0 to PD-MORNC     230.0 Ckt 1"
 line     17014     16903   "1 "  1 0
0
line 275          "Line MORENCI      230.0 to GREEN-SW     230.0 Ckt 1"
 line     17014     17009   "1 "  1 0
0
line 276          "Line PANTANO      115.0 to KARTCHNR     115.0 Ckt 1"
 line     17015     17039   "1 "  1 0
0
line 277          "Line PANTANO      230.0 to NEWTUCSN     230.0 Ckt 1"
 line     17016     17676   "1 "  1 0
0
line 278          "Line RED TAIL     230.0 to DOSCONDO     230.0 Ckt 1"
 line     17018     17008   "1 "  1 0
0
line 279          "Line THREEPNT     115.0 to SNDARIO      115.0 Ckt 1"
 line     17022     17089   "1 "  1 0
0
line 280          "Line VALEN-SW     115.0 to BLACKMTN     115.0 Ckt 1"
 line     17023     19201   "1 "  1 0
0
line 281          "Line HACKBERY     230.0 to MORENCI      230.0 Ckt 1"
 line     17044     17014   "1 "  1 0
0
line 282          "Line SNDARIO      115.0 to BRAWLEY      115.0 Ckt 1"
 line     17089     19203   "1 "  1 0
0
line 283          "Line SNDARIO      115.0 to SANDARIO     115.0 Ckt 1"
 line     17089     19212   "1 "  1 0
0
line 284          "Line SAHUARIT     230.0 to BICKNELL     230.0 Ckt 1"
 line     17102     17004   "1 "  1 0
0
line 285          "Line S.BRKRCH     115.0 to SNMANUEL     115.0 Ckt 1"
 line     17608     14358   "1 "  1 0
0
line 286          "Line NAVISKA      115.0 to ADONIS       115.0 Ckt 1"
 line     17665     17674   "1 "  1 0
0
line 287          "Line SAN JOAQ     115.0 to SANXAVER     115.0 Ckt 1"
 line     17668     19213   "1 "  1 0
0
line 288          "Line NEWTUCSN     230.0 to SAHUARIT     230.0 Ckt 1"
 line     17676     17102   "1 "  1 0
0
line_289          "Line HENDRSON     230.0 to MEAD N       230.0 Ckt 1"
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 line     18006     19011   "1 "  1 0
0
line 290          "Line BC TAP       230.0 to MEAD N       230.0 Ckt 1"
 line     18055     19011   "1 "  1 0
0
line 291          "Line H ALLEN      500.0 to MEAD         500.0 Ckt 1"
 line     18450     19038   "1 "  1 0
0
line 292          "Line EQUEST N     500.0 to MEAD         500.0 Ckt 1"
 line     18455     19038   "1 "  1 0
0
line 293          "Line MEAD N       230.0 to ARDEN        230.0 Ckt 1"
 line     19011     18004   "1 "  1 0
0
line 294          "Line MEAD N       230.0 to DECATUR      230.0 Ckt 1"
 line     19011     18015   "1 "  1 0
0
line 295          "Line MEAD N       230.0 to EASTSIDE     230.0 Ckt 1"
 line     19011     18016   "1 "  1 0
0
line 296          "Line MEAD N       230.0 to NEWPORT      230.0 Ckt 1"
 line     19011     18021   "1 "  1 0
0
line 297          "Line MEAD N       230.0 to EQUEST       230.0 Ckt 2"
 line     19011     18600   "2 "  1 0
0
line 298          "Line MEAD N       230.0 to MGM-CC       230.0 Ckt 1"
 line     19011     18618   "1 "  1 0
0
line 299          "Line MEAD N       230.0 to HVRA3A4      230.0 Ckt 1"
 line     19011     19043   "1 "  1 0
0
line 300          "Line MEAD S       230.0 to PAHRUMP      230.0 Ckt 1"
 line     19012     18023   "1 "  1 0
0
line 301          "Line MEAD S       230.0 to EQUEST       230.0 Ckt 1"
 line     19012     18600   "1 "  1 0
0
line 302          "Line MEAD S       230.0 to GREENWAY     230.0 Ckt 1"
 line     19012     18674   "1 "  1 0
0
line 303          "Line MEAD S       230.0 to DIAMOND      230.0 Ckt 1"
 line     19012     18915   "1 "  1 0
0
line 304          "Line MEAD S       230.0 to DIAMOND      230.0 Ckt 2"
 line     19012     18915   "2 "  1 0
0
line 305          "Line MEAD S       230.0 to MEAD N       230.0 Ckt 1"
 line     19012     19011   "1 "  1 0
0
line 306          "Line MEAD S       230.0 to ELDORDO      230.0 Ckt 1"
 line     19012     24041   "1 "  1 0
0
line 307          "Line MEAD S       230.0 to ELDORDO      230.0 Ckt 2"
 line     19012     24041   "2 "  1 0
0
line 308          "Line MEAD S       230.0 to MCCULLGH     230.0 Ckt 1"
 line     19012     26046   "1 "  1 0
0
line 309          "Line MEAD S       230.0 to MCCULLGH     230.0 Ckt 2"
 line     19012     26046   "2 "  1 0
0
line 310          "Line BLYTHE       161.0 to BUCKBLVD     161.0 Ckt 1"
 line     19020     19101   "1 "  1 0
0
line 311          "Line BLYTHE       161.0 to GLT TAP      161.0 Ckt 1"
 line     19020     19105   "1 "  1 0
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0
line 312          "Line BLYTHE       161.0 to HEADGATE     161.0 Ckt 1"
 line     19020     19206   "1 "  1 0
0
line 313          "Line BLYTHE       161.0 to NILAND       161.0 Ckt 1"
 line     19020     21047   "1 "  1 0
0
line 314          "Line BLYTHE       161.0 to BLYTHESC     161.0 Ckt 1"
 line     19020     24017   "1 "  1 0
0
line 315          "Line DAVIS        230.0 to RIVIERA      230.0 Ckt 1"
 line     19022     17087   "1 "  1 0
0
line 316          "Line DAVIS        230.0 to MEAD N       230.0 Ckt 1"
 line     19022     19011   "1 "  1 0
0
line 317          "Line DAVIS        230.0 to ZORB         230.0 Ckt 1"
 line     19022     19224   "1 "  1 0
0
line 318          "Line DAVIS        230.0 to TOPOCK       230.0 Ckt 2"
 line     19022     19320   "2 "  1 0
0
line 319          "Line DAVIS        230.0 to MCCULLGH     230.0 Ckt 1"
 line     19022     26046   "1 "  1 0
0
line 320          "Line HOVRA5A6     230.0 to MEAD S       230.0 Ckt 1"
 line     19029     19012   "1 "  1 0
0
line 321          "Line HOVRA7-9     230.0 to MEAD S       230.0 Ckt 1"
 line     19030     19012   "1 "  1 0
0
line 322          "Line MEAD         500.0 to MARKETPL     500.0 Ckt 1"
 line     19038     26044   "1 "  1 0
0
line 323          "Line PARKER       161.0 to BLYTHE       161.0 Ckt 1"
 line     19041     19020   "1 "  1 0
0
line 324          "Line PARKER       161.0 to BOUSE        161.0 Ckt 1"
 line     19041     19046   "1 "  1 0
0
line 325          "Line PARKER       161.0 to HEADGATE     161.0 Ckt 1"
 line     19041     19206   "1 "  1 0
0
line 326          "Line PARKER       161.0 to PARKERAZ     161.0 Ckt 1"
 line     19041     19602   "1 "  1 0
0
line 327          "Line PARKER       230.0 to EAGLEYE      230.0 Ckt 1"
 line     19042     14209   "1 "  1 0
0
line 328          "Line PARKER       230.0 to BLK MESA     230.0 Ckt 1"
 line     19042     19019   "1 "  1 0
0
line 329          "Line PARKER       230.0 to HAVASU       230.0 Ckt 1"
 line     19042     19075   "1 "  1 0
0
line 330          "Line PARKER       230.0 to HARCUVAR     230.0 Ckt 1"
 line     19042     19204   "1 "  1 0
0
line 331          "Line PARKER       230.0 to GENE         230.0 Ckt 1"
 line     19042     25402   "1 "  1 0
0
line 332          "Line COOLIDGE     115.0 to VLYFARMS     115.0 Ckt 1"
 line     19044     14359   "1 "  1 0
0
line 333          "Line COOLIDGE     115.0 to ED-2         115.0 Ckt 1"
 line     19044     19065   "1 "  1 0
0
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line 334          "Line COOLIDGE     115.0 to SIGNAL       115.0 Ckt 1"
 line     19044     19066   "1 "  1 0
0
line 335          "Line COOLIDGE     115.0 to COOLDGAZ     115.0 Ckt 1"
 line     19044     19600   "1 "  1 0
0
line 336          "Line COOLIDGE     230.0 to SUN ARIZ     230.0 Ckt 1"
 line     19045     19410   "1 "  1 0
0
line 337          "Line COOLIDGE     230.0 to SUN ARIZ     230.0 Ckt 2"
 line     19045     19410   "2 "  1 0
0
line 338          "Line BOUSE        161.0 to KOFA         161.0 Ckt 1"
 line     19046     19100   "1 "  1 0
0
line 339          "Line BOUSE        161.0 to BOUSE AZ     161.0 Ckt 1"
 line     19046     19601   "1 "  1 0
0
line 340          "Line DEL BAC      115.0 to NOGALES      115.0 Ckt 1"
 line     19047     19221   "1 "  1 0
0
line 341          "Line GILA         161.0 to KNOB         161.0 Ckt 1"
 line     19050     19051   "1 "  1 0
0
line 342          "Line GILA         161.0 to DOME TAP     161.0 Ckt 1"
 line     19050     19070   "1 "  1 0
0
line 343          "Line KNOB         161.0 to PILOTKNB     161.0 Ckt 1"
 line     19051     21059   "1 "  1 0
0
line 344          "Line LIBERTY      230.0 to WESTWNGW     230.0 Ckt 1"
 line     19052     14231   "1 "  1 0
0
line 345          "Line LIBERTY      230.0 to TS4          230.0 Ckt 1"
 line     19052     14258   "1 "  1 0
0
line 346          "Line LIBERTY      230.0 to LONE BUT     230.0 Ckt 1"
 line     19052     19055   "1 "  1 0
0
line 347          "Line LIBERTY      230.0 to PHXWAPA      230.0 Ckt 1"
 line     19052     19061   "1 "  1 0
0
line 348          "Line LIBERTY      345.0 to PEACOCK      345.0 Ckt 1"
 line     19053     19315   "1 "  1 0
0
line 349          "Line LONE BUT     230.0 to TESTTRAK     230.0 Ckt 1"
 line     19055     19068   "1 "  1 0
0
line 350          "Line LONE BUT     230.0 to SUN ARIZ     230.0 Ckt 1"
 line     19055     19410   "1 "  1 0
0
line 351          "Line MCCONICO     230.0 to DAVIS        230.0 Ckt 1"
 line     19056     19022   "1 "  1 0
0
line 352          "Line MCCONICO     230.0 to GRIFFITH     230.0 Ckt 1"
 line     19056     19310   "1 "  1 0
0
line 353          "Line MCCONICO     230.0 to HARRIS       230.0 Ckt 1"
 line     19056     19651   "1 "  1 0
0
line 354          "Line ORACLE       115.0 to S.BRKRCH     115.0 Ckt 1"
 line     19057     17608   "1 "  1 0
0
line 355          "Line ORACLE       115.0 to ORACLEAZ     115.0 Ckt 1"
 line     19057     19652   "1 "  1 0
0
line_356          "Line PHXWAPA      230.0 to LONE BUT     230.0 Ckt 1"
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 line     19061     19055   "1 "  1 0
0
line 357          "Line PINPK        230.0 to PINPKSRP     230.0 Ckt 1"
 line     19062     15211   "1 "  1 0
0
line 358          "Line PINPK        230.0 to PINPKSRP     230.0 Ckt 2"
 line     19062     15211   "2 "  1 0
0
line 359          "Line WLTNMOHK     161.0 to GILA         161.0 Ckt 1"
 line     19063     19050   "1 "  1 0
0
line 360          "Line WLTNMOHK     161.0 to DOME TAP     161.0 Ckt 1"
 line     19063     19070   "1 "  1 0
0
line 361          "Line TUCSON       115.0 to DEL BAC      115.0 Ckt 1"
 line     19064     19047   "1 "  1 0
0
line 362          "Line TUCSON       115.0 to ORACLE       115.0 Ckt 1"
 line     19064     19057   "1 "  1 0
0
line 363          "Line ED-2         115.0 to SIGNAL       115.0 Ckt 1"
 line     19065     19066   "1 "  1 0
0
line 364          "Line ED-2         115.0 to ED-4         115.0 Ckt 1"
 line     19065     19071   "1 "  1 0
0
line 365          "Line ED-2         115.0 to BRADY        115.0 Ckt 1"
 line     19065     19202   "1 "  1 0
0
line 366          "Line ED-5         115.0 to ED-5 AZ      115.0 Ckt 1"
 line     19067     15171   "1 "  1 0
0
line 367          "Line TESTTRAK     230.0 to CASAGRND     230.0 Ckt 1"
 line     19068     19218   "1 "  1 0
0
line 368          "Line ED-4         115.0 to ED-4 AZ      115.0 Ckt 1"
 line     19071     15170   "1 "  1 0
0
line 369          "Line ED-4         115.0 to ED-5         115.0 Ckt 1"
 line     19071     19067   "1 "  1 0
0
line 370          "Line HILLTOP      230.0 to MCCONICO     230.0 Ckt 1"
 line     19072     19056   "1 "  1 0
0
line 371          "Line N.HAVASU     230.0 to PARKER       230.0 Ckt 1"
 line     19074     19042   "1 "  1 0
0
line 372          "Line N.HAVASU     230.0 to TOPOCK       230.0 Ckt 1"
 line     19074     19320   "1 "  1 0
0
line 373          "Line HOVRN7N8     230.0 to MEAD S       230.0 Ckt 1"
 line     19079     19012   "1 "  1 0
0
line 374          "Line HOVRN5N6     230.0 to MEAD S       230.0 Ckt 1"
 line     19080     19012   "1 "  1 0
0
line 375          "Line HOVRN3N4     230.0 to MEAD S       230.0 Ckt 1"
 line     19081     19012   "1 "  1 0
0
line 376          "Line HOVRN1N2     230.0 to MEAD S       230.0 Ckt 1"
 line     19082     19012   "1 "  1 0
0
line 377          "Line HOVRA1A2     230.0 to MEAD S       230.0 Ckt 1"
 line     19083     19012   "1 "  1 0
0
line 378          "Line KOFA         161.0 to DOME TAP     161.0 Ckt 1"
 line     19100     19070   "1 "  1 0
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0
line 379          "Line GLT TAP      161.0 to KNOB         161.0 Ckt 1"
 line     19105     19051   "1 "  1 0
0
line 380          "Line PRSCOTWA     230.0 to PRESCOTT     230.0 Ckt 1"
 line     19106     14222   "1 "  1 0
0
line 381          "Line PRSCOTWA     230.0 to RNDVLYTP     230.0 Ckt 1"
 line     19106     19501   "1 "  1 0
0
line 382          "Line GAVLINWA     230.0 to GAVILNPK     230.0 Ckt 1"
 line     19107     14243   "1 "  1 0
0
line 383          "Line GAVLINWA     230.0 to PINPK        230.0 Ckt 1"
 line     19107     19062   "1 "  1 0
0
line 384          "Line GAVLINWA     230.0 to PRSCOTWA     230.0 Ckt 1"
 line     19107     19106   "1 "  1 0
0
line 385          "Line BLACKMTN     115.0 to BLKMTNAZ     115.0 Ckt 1"
 line     19201     15182   "1 "  1 0
0
line 386          "Line BLACKMTN     115.0 to DEL BAC      115.0 Ckt 1"
 line     19201     19047   "1 "  1 0
0
line 387          "Line BLACKMTN     115.0 to SNYDHILL     115.0 Ckt 1"
 line     19201     19214   "1 "  1 0
0
line 388          "Line BRADY        115.0 to BRADYAZ      115.0 Ckt 1"
 line     19202     15174   "1 "  1 0
0
line 389          "Line BRADY        115.0 to PICACHOW     115.0 Ckt 1"
 line     19202     19209   "1 "  1 0
0
line 390          "Line BRAWLEY      115.0 to BRAWLYAZ     115.0 Ckt 1"
 line     19203     15179   "1 "  1 0
0
line 391          "Line BRAWLEY      115.0 to SAN JOAQ     115.0 Ckt 1"
 line     19203     17668   "1 "  1 0
0
line 392          "Line HARCUVAR     230.0 to HARCU AZ     230.0 Ckt 1"
 line     19204     15172   "1 "  1 0
0
line 393          "Line HARCUVAR     230.0 to HASSYTAP     230.0 Ckt 1"
 line     19204     19500   "1 "  1 0
0
line 394          "Line PICACHOW     115.0 to PICACHAZ     115.0 Ckt 1"
 line     19209     15175   "1 "  1 0
0
line 395          "Line PICACHOW     115.0 to RED ROCK     115.0 Ckt 1"
 line     19209     19211   "1 "  1 0
0
line 396          "Line RATTLSNK     115.0 to TUCSON       115.0 Ckt 1"
 line     19210     19064   "1 "  1 0
0
line 397          "Line RATTLSNK     115.0 to TWINPEAK     115.0 Ckt 1"
 line     19210     19216   "1 "  1 0
0
line 398          "Line RED ROCK     115.0 to SAG.EAST     115.0 Ckt 1"
 line     19211     14356   "1 "  1 0
0
line 399          "Line RED ROCK     115.0 to REDRCKAZ     115.0 Ckt 1"
 line     19211     15176   "1 "  1 0
0
line 400          "Line SANDARIO     115.0 to SANDARAZ     115.0 Ckt 1"
 line     19212     15178   "1 "  1 0
0
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line 401          "Line SANXAVER     115.0 to SANXAVAZ     115.0 Ckt 1"
 line     19213     15180   "1 "  1 0
0
line 402          "Line SANXAVER     115.0 to SNYDHILL     115.0 Ckt 1"
 line     19213     19214   "1 "  1 0
0
line 403          "Line SPKHILTP     230.0 to COOLIDGE     230.0 Ckt 1"
 line     19215     19045   "1 "  1 0
0
line 404          "Line TWINPEAK     115.0 to TWINPKAZ     115.0 Ckt 1"
 line     19216     15177   "1 "  1 0
0
line 405          "Line ZORB         230.0 to TOPOCK       230.0 Ckt 1"
 line     19224     19320   "1 "  1 0
0
line 406          "Line GRIFFITH     230.0 to PEACOCK      230.0 Ckt 1"
 line     19310     19314   "1 "  1 0
0
line 407          "Line PEACOCK      230.0 to HILLTOP      230.0 Ckt 1"
 line     19314     19072   "1 "  1 0
0
line 408          "Line PEACOCK      345.0 to MEAD         345.0 Ckt 1"
 line     19315     19037   "1 "  1 0
0
line 409          "Line TOPOCK       230.0 to BLK MESA     230.0 Ckt 1"
 line     19320     19019   "1 "  1 0
0
line 410          "Line TOPOCK       230.0 to SOPOINT      230.0 Ckt 1"
 line     19320     19316   "1 "  1 0
0
line 411          "Line TOPOCK       230.0 to SOPOINT      230.0 Ckt 2"
 line     19320     19316   "2 "  1 0
0
line 412          "Line HASSYTAP     230.0 to HASSY AZ     230.0 Ckt 1"
 line     19500     15173   "1 "  1 0
0
line 413          "Line HASSYTAP     230.0 to LIBERTY      230.0 Ckt 1"
 line     19500     19052   "1 "  1 0
0
line 414          "Line RNDVLYTP     230.0 to ROUNDVLY     230.0 Ckt 1"
 line     19501     14223   "1 "  1 0
0
line 415          "Line RNDVLYTP     230.0 to PEACOCK      230.0 Ckt 1"
 line     19501     19314   "1 "  1 0
0
line 416          "Line ROGSWAPA     230.0 to PINPK        230.0 Ckt 1"
 line     19502     19062   "1 "  1 0
0
line 417          "Line ROGSWAPA     230.0 to PINPK        230.0 Ckt 2"
 line     19502     19062   "2 "  1 0
0
line 418          "Line ROGSWAPA     230.0 to SPKHILTP     230.0 Ckt 1"
 line     19502     19215   "1 "  1 0
0
line 419          "Line CAMINO       230.0 to MEAD S       230.0 Ckt E"
 line     24019     19012   "E "  1 0
0
line 420          "Line CAMINO       230.0 to MEAD S       230.0 Ckt W"
 line     24019     19012   "W "  1 0
0
line 421          "Line PINTO PS     345.0 to FOURCORN     345.0 Ckt 1"
 line     66235     14101   "1 "  1 0
0
line 422          "Line SIGURDPS     230.0 to GLENCANY     230.0 Ckt 1"
 line     66355     79031   "1 "  1 0
0
line_423          "Line FLAGSTAF     345.0 to GLENCANY     345.0 Ckt 1"
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 line     79024     79032   "1 "  1 0
0
line 424          "Line FLAGSTAF     345.0 to GLENCANY     345.0 Ckt 2"
 line     79024     79032   "2 "  1 0
0
line 425          "Line FLAGSTAF     345.0 to PINPKBRB     345.0 Ckt 1"
 line     79024     79053   "1 "  1 0
0
line 426          "Line FLAGSTAF     345.0 to PINPKBRB     345.0 Ckt 2"
 line     79024     79053   "2 "  1 0
0
line 427          "Line GALLEGOS     115.0 to BERGIN       115.0 Ckt 1"
 line     79027     79098   "1 "  1 0
0
line 428          "Line GLEN PS      230.0 to NAVAJO       230.0 Ckt 1"
 line     79028     79093   "1 "  1 0
0
line 429          "Line KAYENTA      230.0 to SHIPROCK     230.0 Ckt 1"
 line     79043     79063   "1 "  1 0
0
line 430          "Line KAYENTA      230.0 to LNGHOUSE     230.0 Ckt 1"
 line     79043     79096   "1 "  1 0
0
line 431          "Line SHIPROCK     115.0 to FRUITAP      115.0 Ckt 1"
 line     79062     79101   "1 "  1 0
0
line 432          "Line SHIPROCK     115.0 to MESA FM      115.0 Ckt 1"
 line     79062     79112   "1 "  1 0
0
line 433          "Line SHIPROCK     345.0 to SAN_JUAN     345.0 Ckt 1"
 line     79064     10292   "1 "  1 0
0
line 434          "Line SHIPROCK     345.0 to FOURCORN     345.0 Ckt 1"
 line     79064     14101   "1 "  1 0
0
line 435          "Line NAVAJO       230.0 to LNGHOUSE     230.0 Ckt 1"
 line     79093     79096   "1 "  1 0
0
line 436          "Line ANIMAS       115.0 to MESA FM      115.0 Ckt 1"
 line     79097     79112   "1 "  1 0
0
line 437          "Line ANIMAS       115.0 to SULLIVAN     115.0 Ckt 1"
 line     79097     79116   "1 "  1 0
0
line 438          "Line BERGIN       115.0 to FOOTHILS     115.0 Ckt 1"
 line     79098     79100   "1 "  1 0
0
line 439          "Line BERGIN       115.0 to SAN JUAN     115.0 Ckt 1"
 line     79098     79114   "1 "  1 0
0
line 440          "Line FOOTHILS     115.0 to HOODMESA     115.0 Ckt 1"
 line     79100     79106   "1 "  1 0
0
line 441          "Line FRUITAP      115.0 to FRUITLND     115.0 Ckt 1"
 line     79101     79102   "1 "  1 0
0
line 442          "Line FRUITAP      115.0 to HOODMESA     115.0 Ckt 1"
 line     79101     79106   "1 "  1 0
0
line 443          "Line GLADETAP     115.0 to HOODMESA     115.0 Ckt 1"
 line     79105     79106   "1 "  1 0
0
line 444          "Line GLADETAP     115.0 to LAPLATA      115.0 Ckt 1"
 line     79105     79109   "1 "  1 0
0
line 445          "Line GLADETAP     115.0 to ELPASOTP     115.0 Ckt 1"
 line     79105     79260   "1 "  1 0
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0
line 446          "Line HOODMESA     115.0 to SULLIVAN     115.0 Ckt 1"
 line     79106     79116   "1 "  1 0
0
line 447          "Line NAVAJO       115.0 to SAN JUAN     115.0 Ckt 1"
 line     79113     79114   "1 "  1 0
0
line 448          "Line NAVAJO       500.0 to DUGAS        500.0 Ckt 1"
 line     14003     14018   "1 "  1 0
0
line 449          "Line DUGAS        500.0 to RACEWAY      500.0 Ckt 1"
 line     14018     14011   "1 "  1 0
0
line 450          "Line PRECHCYN     345.0 to MAZATZAL     345.0 Ckt 1"
 line     14103     14107   "1 "  1 0
0
line 451          "Line MAZATZAL     345.0 to PNPKAPS      345.0 Ckt 1"
 line     14107     14102   "1 "  1 0
0
line 452          "Line SAGUARO      230.0 to MILLIGAN     230.0 Ckt 1"
 line     14225     14271   "1 "  1 0
0
line 453          "Line RACEWAY      230.0 to RACEWYWA     230.0 Ckt 1"
 line     14246     19115   "1 "  1 0
0
line 454          "Line MILLIGAN     230.0 to CASGRAPS     230.0 Ckt 1"
 line     14271     14203   "1 "  1 0
0
line 455          "Line SAG.WEST     115.0 to ED-5B        115.0 Ckt 1"
 line     14357     19069   "1 "  1 0
0
line 456          "Line VAIL NOG     138.0 to VAIL         138.0 Ckt 1"
 line     16718     16220   "1 "  1 0
0
line 457          "Line VAIL NOG     138.0 to NOGALES      138.0 Ckt 1"
 line     16718     16719   "1 "  1 0
0
line 458          "Line NOGALES      138.0 to KANTOR       138.0 Ckt 1"
 line     16719     16720   "1 "  1 0
0
line 459          "Line KANTOR       138.0 to CANEZ        138.0 Ckt 1"
 line     16720     16721   "1 "  1 0
0
line 460          "Line CANEZ        138.0 to SONOITA      138.0 Ckt 1"
 line     16721     16722   "1 "  1 0
0
line 461          "Line SONOITA      138.0 to VALNCIA      138.0 Ckt 1"
 line     16722     16723   "1 "  1 0
0
line 462          "Line GATEWAY      138.0 to VALNCIA      138.0 Ckt 1"
 line     16724     16723   "1 "  1 0
0
line 463          "Line MEAD         500.0 to PERKINPS     500.0 Ckt 1"
 line     19038     15033   "1 "  1 0
0
line 464          "Line EMPIRE       115.0 to CASAGRND     115.0 Ckt 1"
 line     19048     19222   "1 "  1 0
0
line 465          "Line ED-5         115.0 to ED-5B        115.0 Ckt 1"
 line     19067     19069   "1 "  1 0
0
line 466          "Line ED-5B        115.0 to EMPIRE       115.0 Ckt 1"
 line     19069     19048   "1 "  1 0
0
line 467          "Line RACEWYWA     230.0 to WESTWNGE     230.0 Ckt 1"
 line     19115     14259   "1 "  1 0
0
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line 468          "Line N.WADDEL     230.0 to RACEWYWA     230.0 Ckt 1"
 line     19208     19115   "1 "  1 0
0
line 469          "Line SUN ARIZ     230.0 to PINAL_C      230.0 Ckt 1"
 line     19410     15098   "1 "  1 0
0
line 470          "Line GOLDFELD     115.0 to 461E5.1N     115.0 Ckt 1"
 line     15107     15848   "1 "  1 0
0
line 471          "Line 461E5.1N     115.0 to MRMNFLAT     115.0 Ckt 1"
 line     15848     15117   "1 "  1 0
0
line 472          "Line 461E5.1N     115.0 to STEWMTN1     115.0 Ckt 1"
 line     15848     15128   "1 "  1 0
0
line 473          "Line MIAMI  4     115.0 to 843E2.7N     115.0 Ckt 1"
 line     15135     15133   "1 "  1 0
0
line 474          "Line ASARCOSR     115.0 to ASARCOTP     115.0 Ckt 1"
 line     15101     15102   "1 "  1 0
0
line 475          "Line ASARCOTP     115.0 to CRUSHER      115.0 Ckt 1"
 line     15102     15138   "1 "  1 0
0
line 476          "Line MIAMI  3     115.0 to MIAMI  4     115.0 Ckt 1"
 line     15008     15009   "1 "  1 0
0
line 477          "Line MIAMI  3     115.0 to PINAL        115.0 Ckt 1"
 line     15008     15119   "1 "  1 0
0
line 478          "Line HASSYAMP     500.0 to REDHAWK      500.0 Ckt 2"
 line     15090     14009   "2 "  1 0
0
line 479          "Line ABEL         230.0 to RANDOLPH     230.0 Ckt 1"
 line     15224     15240   "1 "  1 0
0
line 480          "Line PINAL C      230.0 to RANDOLPH     230.0 Ckt 1"
 line     15098     15240   "1 "  1 0
0
line 481          "Line ANDERSON     230.0 to KYR-NEW      230.0 Ckt 1"
 line     15203     14236   "1 "  1 0
0
line 482          "Line PAPAGOBT     230.0 to KYR-NEW      230.0 Ckt 1"
 line     15209     14236   "1 "  1 0
0
line 483          "Line CARREL       115.0 to GOLDFELD     115.0 Ckt 1"
 line     15130     15107   "1 "  1 0
0
line 484          "Line SPURLOCK     115.0 to GOLDFELD     115.0 Ckt 1"
 line     15127     15107   "1 "  1 0
0
line 485          "Line SCHRADER     230.0 to RS-24        230.0 Ckt 1"
 line     15214     15225   "1 "  1 0
0
line 486          "Line ABEL         230.0 to RS-24        230.0 Ckt 1"
 line     15224     15225   "1 "  1 0
0
line 487          "Line ABEL         230.0 to RS-24        230.0 Ckt 2"
 line     15224     15225   "2 "  1 0
0
line 488          "Line SANTAN       230.0 to RS-24        230.0 Ckt 1"
 line     15213     15225   "1 "  1 0
0
line 489          "Line HASSYAMP     500.0 to N.GILA       500.0 Ckt 2"
 line     15090     22536   "2 "  1 0
0
line_490          "Line BONNEYTP     115.0 to CRUSHER      115.0 Ckt 1"
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 line     15103     15138   "1 "  1 0
0
line 491          "Line CARLOTA      115.0 to PINTOVLY     115.0 Ckt 1"
 line     15104     15121   "1 "  1 0
0
line 492          "Line CARLOTA      115.0 to SILVERK2     115.0 Ckt 1"
 line     15104     15125   "1 "  1 0
0
line 493          "Line CARREL       115.0 to SPURLOCK     115.0 Ckt 1"
 line     15130     15127   "1 "  1 0
0
line 494          "Line MIAMI  3     115.0 to MIAMI        115.0 Ckt 1"
 line     15008     15114   "1 "  1 0
0
line 495          "Line OAKFLAT      115.0 to TRASK        115.0 Ckt 1"
 line     15118     15131   "1 "  1 0
0
line 496          "Line SUPERIOR     115.0 to TRASK        115.0 Ckt 1"
 line     15129     15131   "1 "  1 0
0
line 497          "Line PINAL C      500.0 to PC GEN       500.0 Ckt 1"
 line     15080     15095   "1 "  1 0
0
line 498          "Line SNVLY        230.0 to HASSY AZ     230.0 Ckt 1"
 line     14265     15173   "1 "  1 0
0
line 499          "Line DELANY       500.0 to SNVLY        500.0 Ckt 1"
 line     14012     14010   "1 "  1 0
0
line 500          "Line DELANY       500.0 to HARQUAHA     500.0 Ckt 1"
 line     14012     15093   "1 "  1 0
0
line 501          "Line HASSYAMP     500.0 to DELANY       500.0 Ckt 1"
 line     15090     14012   "1 "  1 0
0
line 502          "Line SNTAROSA     500.0 to PINAL_C      500.0 Ckt 1"
 line     15087     15080   "1 "  1 0
0
line 503          "Line SNTAROSA     500.0 to PINAL_W      500.0 Ckt 1"
 line     15087     15088   "1 "  1 0
0
line 504          "Line SNTAROSA     230.0 to TESTTRAK     230.0 Ckt 1"
 line     14226     19068   "1 "  1 0
0
line 505          "Line ED5-230      230.0 to PINAL_C      230.0 Ckt 1"
 line     88006     15098   "1 "  1 0
0
line 506          "Line ED5-230      230.0 to MARANATP     230.0 Ckt 1"
 line     88006     88007   "1 "  1 0
0
line 507          "Line TESTTRAK     230.0 to ED5-230      230.0 Ckt 1"
 line     19068     88006   "1 "  1 0
0
line 508          "Line BLYTHE       161.0 to BLYTHEAZ     161.0 Ckt 1"
 line     19020     14302   "1 "  1 0
0
line 509          "Line BOUSE        161.0 to BLACK PK     161.0 Ckt 1"
 line     19046     14301   "1 "  1 0
0
line 510          "Line PRESCOTT     115.0 to BAGCAP       115.0 Ckt 1"
 line     14355     14361   "1 "  1 0
0
line 511          "Line BAGCAP       115.0 to BAGDAD       115.0 Ckt 1"
 line     14361     14351   "1 "  1 0
0
line 512          "Line CASGRAPS     230.0 to DBG          230.0 Ckt 1"
 line     14203     15235   "1 "  1 0
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0
line 513          "Line SNTAROSA     230.0 to DBG          230.0 Ckt 1"
 line     14226     15235   "1 "  1 0
0
line 514          "Line DBG          230.0 to PINAL_C      230.0 Ckt 1"
 line     15235     15098   "1 "  1 0
0
line 515          "Line TS12         230.0 to SAGUARO      230.0 Ckt 1"
 line     14277     14225   "1 "  1 0
0
line 516          "Line MILLIGAN     230.0 to TS12         230.0 Ckt 1"
 line     14271     14277   "1 "  1 0
0
line 517          "Line ED-4         115.0 to ELOY         115.0 Ckt 1"
 line     19071     14360   "1 "  1 0
0
line 518          "Line GILA         230.0 to NGL-E        230.0 Ckt 1"
 line     19124     19125   "1 "  1 0
0
line 519          "Line GILA         230.0 to NGL-W        230.0 Ckt 1"
 line     19124     19126   "1 "  1 0
0
line 520          "Line GILA         230.0 to TS8          230.0 Ckt 1"
 line     19124     14214   "1 "  1 0
0
line 521          "Line SLRC         230.0 to TS8          230.0 Ckt 1"
 line     19120     14214   "1 "  1 0
0
line 522          "Line SLRC         230.0 to GILA         230.0 Ckt 1"
 line     19120     19124   "1 "  1 0
0
line 523          "Line PNPKAPS      230.0 to PPAPS C      230.0 Ckt 1"
 line     14221     14260   "1 "  1 0
0
line 524          "Line PPAPS C      230.0 to PPAPS E      230.0 Ckt 1"
 line     14260     14261   "1 "  1 0
0
line 525          "Line SPURLOCK     115.0 to PIERCE       115.0 Ckt 1"
 line     15127     15136   "1 "  1 0
0
line 526          "Line PIERCE       115.0 to SUPERIOR     115.0 Ckt 1"
 line     15136     15129   "1 "  1 0
0
line 527          "Line GOLDFELD     230.0 to 40E15.5N     230.0 Ckt 1"
 line     15206     15227   "1 "  1 0
0
line 528          "Line ADAMS TP     115.0 to NOGALES      115.0 Ckt 1"
 line     19060     19221   "1 "  1 0
0
line 529          "Line SAG.EAST     115.0 to MARANATP     115.0 Ckt 1"
 line     14356     17013   "1 "  1 0
0
line 530          "Line BICKNELL     115.0 to THREEPNT     115.0 Ckt 1"
 line     17006     17022   "1 "  1 0
0
line 531          "Line BUTERFLD     230.0 to PANTANO      230.0 Ckt 1"
 line     17007     17016   "1 "  1 0
0
line 532          "Line MARANATP     115.0 to MARANA       115.0 Ckt 1"
 line     17013     17012   "1 "  1 0
0
line 533          "Line MARANATP     115.0 to RATTLSNK     115.0 Ckt 1"
 line     17013     19210   "1 "  1 0
0
line 534          "Line THREEPNT     115.0 to VALEN-SW     115.0 Ckt 1"
 line     17022     17023   "1 "  1 0
0
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line 535          "Line PICTROCK     115.0 to SANDARIO     115.0 Ckt 1"
 line     17670     19212   "1 "  1 0
0
line 536          "Line ADONIS       115.0 to RATTLSNK     115.0 Ckt 1"
 line     17674     19210   "1 "  1 0
0
line 537          "Line ADAMS TP     115.0 to APACHE       115.0 Ckt 1"
 line     19060     17001   "1 "  1 0
0
line 538          "Line ADAMS TP     115.0 to NOGALES      115.0 Ckt N"
 line     19060     19221   "N "  1 0
0
line 539          "Line TWINPEAK     115.0 to PICTROCK     115.0 Ckt 1"
 line     19216     17670   "1 "  1 0
0
line 540          "Line TORTOLIT     345.0 to NLOOP345     345.0 Ckt 1"
 line     16115     16124   "1 "  1 0
0
line 541          "Line DMP          138.0 to ANKLAM       138.0 Ckt 1"
 line     16200     16253   "1 "  1 0
0
line 542          "Line MIDVALE      138.0 to SPNCER       138.0 Ckt 1"
 line     16206     16235   "1 "  1 0
0
line 543          "Line MIDVALE      138.0 to RAYTHEON     138.0 Ckt 1"
 line     16206     16257   "1 "  1 0
0
line 544          "Line N. LOOP      138.0 to RANVISTO     138.0 Ckt 1"
 line     16207     16209   "1 "  1 0
0
line 545          "Line N. LOOP      138.0 to RANVISTO     138.0 Ckt 1A"
 line     16207     16209   "1A"  1 0
0
line 546          "Line N. LOOP      138.0 to NARANJA      138.0 Ckt 1"
 line     16207     16245   "1 "  1 0
0
line 547          "Line SN.CRUZ      138.0 to ANKLAM       138.0 Ckt 1"
 line     16214     16253   "1 "  1 0
0
line 548          "Line SOUTH        138.0 to SPNCER       138.0 Ckt 1"
 line     16216     16235   "1 "  1 0
0
line 549          "Line SOUTH        138.0 to MEDINA       138.0 Ckt 1"
 line     16216     16255   "1 "  1 0
0
line 550          "Line SOUTH        138.0 to RAYTHEON     138.0 Ckt 1"
 line     16216     16257   "1 "  1 0
0
line 551          "Line SOUTH        138.0 to ROSEMONT     138.0 Ckt 1"
 line     16216     16920   "1 "  1 0
0
line 552          "Line TORTOLIT     138.0 to N. LOOP      138.0 Ckt 1A"
 line     16217     16207   "1A"  1 0
0
line 553          "Line TORTOLIT     138.0 to N. LOOP      138.0 Ckt 2A"
 line     16217     16207   "2A"  1 0
0
line 554          "Line TORTOLIT     138.0 to N. LOOP      138.0 Ckt 3"
 line     16217     16207   "3 "  1 0
0
line 555          "Line TORTOLIT     138.0 to N. LOOP      138.0 Ckt 4"
 line     16217     16207   "4 "  1 0
0
line 556          "Line TORTOLIT     138.0 to RANVISTO     138.0 Ckt 1A"
 line     16217     16209   "1A"  1 0
0
line_557          "Line VAIL         138.0 to ROSEMONT     138.0 Ckt 1"
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 line     16220     16920   "1 "  1 0
0
line 558          "Line RBWILMOT     138.0 to IRVNGTN      138.0 Ckt 1"
 line     16222     16204   "1 "  1 0
0
line 559          "Line SPNCER       138.0 to MEDINA       138.0 Ckt 1"
 line     16235     16255   "1 "  1 0
0
line 560          "Line ORNGROVE     138.0 to LACANADA     138.0 Ckt 1"
 line     16251     16205   "1 "  1 0
0
line 561          "Line ORNGROVE     138.0 to RILLITO      138.0 Ckt 1"
 line     16251     16210   "1 "  1 0
0
line 562          "Line ORNGROVE     138.0 to EASTINA      138.0 Ckt 1"
 line     16251     16254   "1 "  1 0
0
line 563          "Line THRNDALE     138.0 to N. LOOP      138.0 Ckt 1"
 line     16252     16207   "1 "  1 0
0
line 564          "Line THRNDALE     138.0 to MARANA       138.0 Ckt 1"
 line     16252     16244   "1 "  1 0
0
line 565          "Line UA MED       138.0 to TUCSON       138.0 Ckt 1"
 line     16256     16218   "1 "  1 0
0
line 566          "Line UA MED       138.0 to KINO         138.0 Ckt 1"
 line     16256     16246   "1 "  1 0
0
line 567          "Line RAYTHEON     138.0 to MEDINA       138.0 Ckt 1"
 line     16257     16255   "1 "  1 0
0
line 568          "Line KANTOR       138.0 to TUBAC        138.0 Ckt 1"
 line     16720     16725   "1 "  1 0
0
line 569          "Line TUBAC        138.0 to CANEZ        138.0 Ckt 1"
 line     16725     16721   "1 "  1 0
0
line 570          "Line FRANCONI     230.0 to N.HAVASU     230.0 Ckt 1"
 line     16805     19074   "1 "  1 0
0
line 571          "Line FRANCONI     230.0 to GRIFFITH     230.0 Ckt 1"
 line     16805     19310   "1 "  1 0
0
line 572          "Line WHTHILLS     230.0 to MERC230      230.0 Ckt 1"
 line     16843     16841   "1 "  1 0
0
line 573          "Line MCCONICO     230.0 to MERC230      230.0 Ckt 1"
 line     19056     16841   "1 "  1 0
0
line 574          "Line BLACKMTN     115.0 to SPNCER       115.0 Ckt 1"
 line     19201     16414   "1 "  1 0
0
line 575          "Line BUCKEYE      230.0 to BUCKEYE2     230.0 Ckt 1"
 line     14201     14213   "1 "  1 0
0
line 576          "Line CACTUS       230.0 to PPAPS N      230.0 Ckt 1"
 line     14202     14278   "1 "  1 0
0
line 577          "Line EAGLEYE      230.0 to BUCKEYE2     230.0 Ckt 1"
 line     14209     14213   "1 "  1 0
0
line 578          "Line BUCKEYE2     230.0 to LIBERTY      230.0 Ckt 1"
 line     14213     19052   "1 "  1 0
0
line 579          "Line LONEPEAK     230.0 to PPAPS E      230.0 Ckt 1"
 line     14217     14261   "1 "  1 0
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0
line 580          "Line REACH        230.0 to PPAPS C      230.0 Ckt 1"
 line     14220     14260   "1 "  1 0
0
line 581          "Line PPAPS E      230.0 to PPAPS N      230.0 Ckt 1"
 line     14261     14278   "1 "  1 0
0
line 582          "Line PPAPS N      230.0 to OCOTILLO     230.0 Ckt 1"
 line     14278     14219   "1 "  1 0
0
line 583          "Line PPAPS N      230.0 to PINPKSRP     230.0 Ckt 1"
 line     14278     15211   "1 "  1 0
0
line 584          "Line PPAPS N      230.0 to PINPKSRP     230.0 Ckt 2"
 line     14278     15211   "2 "  1 0
0
line 585          "Line Q044         230.0 to GILARIVR     230.0 Ckt 1"
 line     86010     14238   "1 "  1 0
0
tran 586          "Tran GALLEGOS     230.00 to GALLEGOS     115.00 Ckt 1              0.0
 tran     10111     79027   "1 "  0       -1
0
tran 587          "Tran CHOLLA       500.00 to CHOLLA       345.00 Ckt 1              0.0
 tran     14000     14100   "1 "  0       -1
0
tran 588          "Tran CHOLLA       500.00 to CHOLLA       345.00 Ckt 2              0.0
 tran     14000     14100   "2 "  0       -1
0
tran 589          "Tran FOURCORN     500.00 to FOURCORN     345.00 Ckt 1              0.0
 tran     14001     14101   "1 "  0       -1
0
tran 590          "Tran SAGUARO      500.00 to SAG.EAST     115.00 Ckt 1              0.0
 tran     14004     14356   "1 "  0       -1
0
tran 591          "Tran SAGUARO      500.00 to SAG.WEST     115.00 Ckt 1              0.0
 tran     14004     14357   "1 "  0       -1
0
tran 592          "Tran WESTWING     500.00 to WESTWNGW     230.00 Ckt 2WESTWG 4      34.5
 tran     14005     14231   "2 "  0    14409
0
tran 593          "Tran WESTWING     500.00 to WESTWNGW     230.00 Ckt 3WESTWG10      34.5
 tran     14005     14231   "3 "  0    14410
0
tran 594          "Tran WESTWING     500.00 to WESTWNGE     230.00 Ckt 1WESTWG 1      34.5
 tran     14005     14259   "1 "  0    14408
0
tran 595          "Tran WESTWING     500.00 to WESTWING     345.00 Ckt 1              0.0
 tran     14005     16107   "1 "  0       -1
0
tran 596          "Tran YAVAPAI      500.00 to YAVAPAI      230.00 Ckt 1              0.0
 tran     14006     14234   "1 "  0       -1
0
tran 597          "Tran YAVAPAI      500.00 to YAVAPAI      230.00 Ckt 2              0.0
 tran     14006     14234   "2 "  0       -1
0
tran 598          "Tran GILARIVR     500.00 to GILARIVR     230.00 Ckt 1              0.0
 tran     14007     14238   "1 "  0       -1
0
tran 599          "Tran SNVLY        500.00 to SNVLY        230.00 Ckt 1SNVLYT1T      12.4
 tran     14010     14265   "1 "  0    85988
0
tran 600          "Tran SNVLY        500.00 to SNVLY        230.00 Ckt 2SNVLYT2T      12.4
 tran     14010     14265   "2 "  0    85989
0
tran 601          "Tran RACEWAY      500.00 to RACEWAY      230.00 Ckt 1RACEWY1T      12.4
 tran     14011     14246   "1 "  0    85990
0
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tran 602          "Tran RACEWAY      500.00 to RACEWAY      230.00 Ckt 2RACEWY2T      12.4
 tran     14011     14246   "2 "  0    85991
0
tran 603          "Tran PNPKAPS      500.00 to PNPKAPS      230.00 Ckt 1              0.0
 tran     14016     14221   "1 "  0       -1
0
tran 604          "Tran CHOLLA       345.00 to CHOLLA       230.00 Ckt 1              0.0
 tran     14100     14204   "1 "  0       -1
0
tran 605          "Tran CHOLLA       345.00 to CHOLLA       230.00 Ckt 2              0.0
 tran     14100     14204   "2 "  0       -1
0
tran 606          "Tran FOURCORN     345.00 to FOURCORN     230.00 Ckt 1              0.0
 tran     14101     14211   "1 "  0       -1
0
tran 607          "Tran FOURCORN     345.00 to FOURCORN     230.00 Ckt 2              0.0
 tran     14101     14211   "2 "  0       -1
0
tran 608          "Tran PRESCOTT     230.00 to PRESCOTT     115.00 Ckt 1              0.0
 tran     14222     14355   "1 "  0       -1
 tran     14222     14355   "2 "  0       -1
0
tran 610          "Tran SAGUARO      230.00 to SAG.EAST     115.00 Ckt 1              0.0
 tran     14225     14356   "1 "  0       -1
0
tran 611          "Tran SAGUARO      230.00 to SAG.WEST     115.00 Ckt 1SAG   1T      12.5
 tran     14225     14357   "1 "  0    85921
0
tran 612          "Tran CORONADO     500.00 to CORONADO     345.00 Ckt 1              0.0
 tran     15001     16100   "1 "  0       -1
0
tran 613          "Tran CORONADO     500.00 to CORONADO     345.00 Ckt 2              0.0
 tran     15001     16100   "2 "  0       -1
0
tran 614          "Tran KYRENE       500.00 to KYRENE       230.00 Ckt 6KYRENE6       34.5
 tran     15011     15207   "6 "  0    15013
0
tran 615          "Tran KYRENE       500.00 to KYRENE       230.00 Ckt 7KYRENE7       34.5
 tran     15011     15207   "7 "  0    15015
0
tran 616          "Tran KYRENE       500.00 to KYR-NEW      230.00 Ckt 8KYRENE8       34.5
 tran     15011     14236   "8 "  0    15017
0
tran 617          "Tran PERKINS      500.00 to PERK PS1     500.00 Ckt 1              0.0
 tran     15034     15031   "1 "  0       -1
0
tran 618          "Tran PERKINS      500.00 to PERK PS2     500.00 Ckt 1              0.0
 tran     15034     15032   "1 "  0       -1
0
tran 619          "Tran SILVERKG     500.00 to SILVERKG     230.00 Ckt 1SILVERKG      34.5
 tran     15041     15215   "1 "  0    15043
0
tran 620          "Tran BROWNING     500.00 to BROWNING     230.00 Ckt 1BROWNIN1      12.4
 tran     15051     15222   "1 "  0    15053
0
tran 621          "Tran BROWNING     500.00 to BROWNING     230.00 Ckt 2BROWNIN2      12.4
 tran     15051     15222   "2 "  0    15055
0
tran 622          "Tran RUDD         500.00 to RUDD         230.00 Ckt 1RUDD   1      12.4
 tran     15061     15230   "1 "  0    15063
0
tran 623          "Tran RUDD         500.00 to RUDD         230.00 Ckt 2RUDD   2      12.4
 tran     15061     15230   "2 "  0    15064
0
tran 624          "Tran RUDD         500.00 to RUDD         230.00 Ckt 3RUDD   3      12.4
 tran     15061     15230   "3 "  0    15066
0
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tran 625          "Tran RUDD          500.00 to RUDD          230.00 Ckt 4                0.0
 tran     15061     15230   "4 "  0       -1
0
tran 626          "Tran RUDD          500.00 to RUDD          230.00 Ckt 5RUDD5          12.4
 tran     15061     15230   "5 "  0    15060
0
tran 627          "Tran ABEL          500.00 to ABEL          230.00 Ckt 1ABEL 1         12.4
 tran     15070     15224   "1 "  0    15071
0
tran 628          "Tran ABEL          500.00 to ABEL          230.00 Ckt 2ABEL 2         12.4
 tran     15070     15224   "2 "  0    15073
0
tran 629          "Tran PINAL W       500.00 to PINALWES      345.00 Ckt 1                0.0
 tran     15088     16114   "1 "  0       -1
0
tran 630          "Tran MESQUITE      500.00 to MESQUITE      230.00 Ckt 1                0.0
 tran     15094     15163   "1 "  0       -1
0
tran 631          "Tran GOLDFELD      230.00 to GOLDFELD      115.00 Ckt 1                0.0
 tran     15206     15107   "1 "  0       -1
0
tran 632          "Tran GOLDFELD      230.00 to GOLDFELD      115.00 Ckt 2                0.0
 tran     15206     15107   "2 "  0       -1
0
tran 633          "Tran SILVERKG      230.00 to SILVERK1      115.00 Ckt 1                0.0
 tran     15215     15124   "1 "  0       -1
0
tran 634          "Tran SILVERKG      230.00 to SILVERK2      115.00 Ckt 1                0.0
 tran     15215     15125   "1 "  0       -1
0
tran 635          "Tran MCKINLEY      345.00 to YAHTAHEY      115.00 Ckt 1                0.0
 tran     16102     10382   "1 "  0       -1
0
tran 636          "Tran SOUTH         345.00 to SOUTH         138.00 Ckt 1SOUTH2         13.8
 tran     16103     16216   "1 "  0    16627
0
tran 637          "Tran SOUTH         345.00 to SOUTH         138.00 Ckt 2SOUTH2         13.8
 tran     16103     16216   "2 "  0    16627
0
tran 638          "Tran VAIL2         345.00 to VAIL          138.00 Ckt 1                0.0
 tran     16106     16220   "1 "  0       -1
0
tran 639          "Tran WINCHSTR      345.00 to WINCHSTR      230.00 Ckt 1                0.0
 tran     16109     17105   "1 "  0       -1
0
tran 640          "Tran TORTOLIT      138.00 to SAG.EAST      115.00 Ckt 1                0.0
 tran     16217     14356   "1 "  0       -1
0
tran 641          "Tran TORTOLIT      138.00 to SAG.WEST      115.00 Ckt 1                0.0
 tran     16217     14357   "1 "  0       -1
0
tran 642          "Tran TORTOLIT      138.00 to TORTOLIT      500.00 Ckt 1                0.0
 tran     16217     16000   "1 "  0       -1
0
tran 643          "Tran TORTOLIT      138.00 to TORTOLIT      500.00 Ckt 2                0.0
 tran     16217     16000   "2 "  0       -1
0
tran 644          "Tran TORTOLIT      138.00 to TORTLIT2      500.00 Ckt 1                0.0
 tran     16217     16001   "1 "  0       -1
0
tran 645          "Tran IRVMID3       138.00 to IRVNGTN       138.00 Ckt 1                0.0
 tran     16333     16204   "1 "  0       -1
0
tran 646          "Tran IRVMID4       138.00 to IRVNGTN       138.00 Ckt 1                0.0
 tran     16334     16204   "1 "  0       -1
0
tran_647          "Tran COPPERVR      345.00 to COPPERVR      230.00 Ckt 1                0.0
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 tran     16900     16901   "1 "  0       -1
0
tran 648          "Tran APACHE        230.00 to APACHE        115.00 Ckt 1                0.0
 tran     17002     17001   "1 "  0       -1
0
tran 649          "Tran APACHE        230.00 to APACHE        115.00 Ckt 2                0.0
 tran     17002     17001   "2 "  0       -1
0
tran 650          "Tran BICKNELL      230.00 to BICKNELL      115.00 Ckt 1                0.0
 tran     17004     17006   "1 "  0       -1
0
tran 651          "Tran BICKNELL      230.00 to BICKNELL      115.00 Ckt 2                0.0
 tran     17004     17006   "2 "  0       -1
0
tran 652          "Tran BICKNELL      345.00 to BICKNELL      230.00 Ckt 1                0.0
 tran     17005     17004   "1 "  0       -1
0
tran 653          "Tran GREEN-SW      345.00 to GREEN-SW      230.00 Ckt 1                0.0
 tran     17010     17009   "1 "  0       -1
0
tran 654          "Tran PANTANO       230.00 to PANTANO       115.00 Ckt 1                0.0
 tran     17016     17015   "1 "  0       -1
0
tran 655          "Tran MEAD S        230.00 to MEAD          287.00 Ckt 1                0.0
 tran     19012     26051   "1 "  0       -1
0
tran 656          "Tran MEAD          345.00 to MEAD N        230.00 Ckt 1                0.0
 tran     19037     19011   "1 "  0       -1
0
tran 657          "Tran MEAD          500.00 to MEAD N        230.00 Ckt 1                0.0
 tran     19038     19011   "1 "  0       -1
0
tran 658          "Tran MEAD          500.00 to MEAD N        230.00 Ckt 2                0.0
 tran     19038     19011   "2 "  0       -1
0
tran 659          "Tran PARKER        161.00 to PARKER        230.00 Ckt 1                0.0
 tran     19041     19042   "1 "  0       -1
0
tran 660          "Tran PARKER        161.00 to PARKER        230.00 Ckt 2                0.0
 tran     19041     19042   "2 "  0       -1
0
tran 661          "Tran COOLIDGE      230.00 to COOLIDGE      115.00 Ckt 1COL12-1        12.5
 tran     19045     19044   "1 "  0    19097
0
tran 662          "Tran COOLIDGE      230.00 to COOLIDGE      115.00 Ckt 2COL12-2        12.5
 tran     19045     19044   "2 "  0    19098
0
tran 663          "Tran LIBERTY       345.00 to LIBTYPHS      230.00 Ckt 1                0.0
 tran     19053     19054   "1 "  0       -1
0
tran 664          "Tran LIBTYPHS      230.00 to LIBERTY       230.00 Ckt 1                0.0
 tran     19054     19052   "1 "  0       -1
0
tran 665          "Tran CASAGRND      230.00 to CASAGRND      115.00 Ckt 1                0.0
 tran     19218     19222   "1 "  0       -1
0
tran 666          "Tran PEACOCK       345.00 to PEACOCK       230.00 Ckt 1                0.0
 tran     19315     19314   "1 "  0       -1
0
tran 667          "Tran GLEN PS       230.00 to GLENCANY      230.00 Ckt 1                0.0
 tran     79028     79031   "1 "  0       -1
0
tran 668          "Tran GLENCANY      345.00 to GLENCANY      230.00 Ckt 1                0.0
 tran     79032     79031   "1 "  0       -1
0
tran 669          "Tran GLENCANY      345.00 to GLENCANY      230.00 Ckt 2                0.0
 tran     79032     79031   "2 "  0       -1
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0
tran 670          "Tran PINPKBRB     345.00 to PINPK        230.00 Ckt 1              0.0
 tran     79053     19062   "1 "  0       -1
0
tran 671          "Tran PINPKBRB     345.00 to PINPK        230.00 Ckt 2              0.0
 tran     79053     19062   "2 "  0       -1
0
tran 672          "Tran PINPKBRB     345.00 to PINPK        230.00 Ckt 3              0.0
 tran     79053     19062   "3 "  0       -1
0
tran 673          "Tran SHIP PS      230.00 to SHIPROCK     230.00 Ckt 1              0.0
 tran     79061     79063   "1 "  0       -1
0
tran 674          "Tran SHIPROCK     230.00 to SHIPROCK     115.00 Ckt 1              0.0
 tran     79063     79062   "1 "  0       -1
0
tran 675          "Tran SHIPROCK     345.00 to SHIPROCK     230.00 Ckt 1              0.0
 tran     79064     79063   "1 "  0       -1
0
tran 676          "Tran VAIL         345.00 to VAIL_NOG     138.00 Ckt 1VAIL         13.8
 tran     16105     16718   "1 "  0    16630
0
tran 677          "Tran GATEWAY      138.00 to GATEWAY      345.00 Ckt 1              0.0
 tran     16724     16108   "1 "  0       -1
0
tran 678          "Tran PC GEN       500.00 to PINAL_CG     230.00 Ckt 1              0.0
 tran     15095     15191   "1 "  0       -1
0
tran 679          "Tran PINAL C      500.00 to PINAL_C      230.00 Ckt 1PINAL_C1     12.5
 tran     15080     15098   "1 "  0    15081
0
tran 680          "Tran PINAL C      500.00 to PINAL_C      230.00 Ckt 2PINAL_C2     12.5
 tran     15080     15098   "2 "  0    15083
0
tran 681          "Tran SNTAROSA     500.00 to SNTAROSA     230.00 Ckt 1SNTAROS1     12.5
 tran     15087     14226   "1 "  0    88001
0
tran 682          "Tran SNTAROSA     500.00 to SNTAROSA     230.00 Ckt 2SNTAROS2     12.5
 tran     15087     14226   "2 "  0    88003
0
tran 683          "Tran PINAL C      230.00 to ED-2         115.00 Ckt 1              0.0
 tran     15098     19065   "1 "  0       -1
0
tran 684          "Tran SNMANUEL     115.00 to SNMANUEL     100.00 Ckt 1              0.0
 tran     14358     14550   "1 "  0       -1
0
tran 685          "Tran NGL-E        230.00 to N.GILA       500.00 Ckt 1              0.0
 tran     19125     22536   "1 "  0       -1
0
tran 686          "Tran NGL-W        230.00 to N.GILA       500.00 Ckt 1              0.0
 tran     19126     22536   "1 "  0       -1
0
tran 687          "Tran GILA         161.00 to GILA         230.00 Ckt 1              0.0
 tran     19050     19124   "1 "  0       -1
0
tran 688          "Tran GREEN-SW     345.00 to GREEN-SW     230.00 Ckt 2              0.0
 tran     17010     17009   "2 "  0       -1
0
tran 689          "Tran TORTOLIT     500.00 to TORTOLIT     345.00 Ckt 1              0.0
 tran     16000     16115   "1 "  0       -1
0
tran 690          "Tran VAIL         345.00 to VAIL         138.00 Ckt 2VAIL         13.8
 tran     16105     16220   "2 "  0    16630
0
tran 691          "Tran VAIL2        345.00 to VAIL         138.00 Ckt 2              0.0
 tran     16106     16220   "2 "  0       -1
0
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tran 692          "Tran TORTOLIT     138.00 to TORTOLIT     500.00 Ckt 3              0.0
 tran     16217     16000   "3 "  0       -1
0
tran 693          "Tran TORTOLIT     138.00 to TORTOLIT     500.00 Ckt 4              0.0
 tran     16217     16000   "4 "  0       -1
0
tran 694          "Tran SPNCER       138.00 to SPNCER       115.00 Ckt 1SPNCER       13.8
 tran     16235     16414   "1 "  0    16669
0
tran 695          "Tran WHTHILLS     345.00 to WHTHILLS     230.00 Ckt 1              0.0
 tran     16842     16843   "1 "  0       -1
0
tran 696          "Tran COPPERVR     345.00 to COPPERVR     230.00 Ckt 2              0.0
 tran     16900     16901   "2 "  0       -1
0
tran 697          "Tran PNPKAPS      500.00 to PPAPS E      230.00 Ckt 2              0.0
 tran     14016     14261   "2 "  0       -1
0
tran 698          "Tran PNPKAPS      500.00 to PPAPS N      230.00 Ckt 3              0.0
 tran     14016     14278   "3 "  0       -1
0
tran 699          "Tran PNPKAPS      345.00 to PPAPS C      230.00 Ckt 1PNPK  7T     14.4
 tran     14102     14260   "1 "  0    85911
0
tran 700          "Tran PNPKAPS      345.00 to PPAPS E      230.00 Ckt 3PNPK T14     14.4
 tran     14102     14261   "3 "  0    14402
0
tran 701          "Tran PNPKAPS      345.00 to PPAPS N      230.00 Ckt 2PNPK  T4     14.4
 tran     14102     14278   "2 "  0    14403
0
svd 800           "SVD  THUNDERSTONE 69                                  "
 svd  "THUNDRST 69.0"  "v "  0
0
svd 801           "SVD  SCHRADER 69                                      "
 svd "SCHRADER 69.0"  "v "  0
0
svd 802           "SVD  ORME  69                                         "
 svd "ORME  RS 69.0"  "v "  0
0
svd 803           "SVD  CORBELL 69                                       "
 svd "CORBELRS  69.0"  "v "  0
0
SVD 804           "SVD  ANDERSON 69                                      "
 svd "ANDERSRS  69.0"  "v "  0
0
svd 805           "SVD  ALEXANDR 69                                      "
 svd "ALEXANDR 69.0"  "v "  0
0
svd 806           "SVD  KNOLL  115                                        "
 svd "KNOLL  115.0"  "v "  0
0
svd 807           "SVD  KYRENE 230                                       "
 svd "KYRENE 230.0"  "v "  0
0
svd 808           "SVD  NELP_SVC 138                                      "
 svd "NELP_SVC 138.0"  "SV"  0
0
end
# End of Contingency List, 701 Contingencies Added to List
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Appendix B: Contingency Results

Central Arizona Transmission System - 2019 BTA Study Work

Voltage Violations (per unit voltage)

#	Name	KV	CONTINGENCY DESCRIPTION	BASE
16723	VALNCIA	138	Base system (n-0)	0.94
16722	SONOITA	138	Base system (n-0)	0.95
14215	LEUPP	230	Base system (n-0)	1.05
14204	CHOLLA	230	Base system (n-0)	1.05
14355	PRESCOTT	115	Base system (n-0)	1.06
14100	CHOLLA	345	Base system (n-0)	1.06
14032	RME	500	Base system (n-0)	1.10
14003	NAVAJO	500	Base system (n-0)	1.11
14351	BAGDAD	115	Base system (n-0)	1.13
14361	BAGCAP	115	Base system (n-0)	1.13

Central Arizona Transmission System - 2019 BTA Study Work

Thermal Violations (overloads, per unit)

Fname	FkV	Tname	Tkv	ckt	CONTINGENCY DESCRIPTION	RTG MVA RTG	BASE	APS01	APS02	APS03	APS04	APS05	APS06	APS07	APS08	APS09
PINPK	230	PINPKSRP	230	2	"line_357"Line PINPK 230 to PINPKSRP 230 Ckt 1	2 658	1.36	1.36	1.36	1.41	1.36	1.58	1.30	1.35	1.35	1.35
PINPK	230	PINPKSRP	230	1	"line_358"Line PINPK 230 to PINPKSRP 230 Ckt 2	2 658	1.36	1.36	1.36	1.41	1.36	1.58	1.30	1.35	1.35	1.35
YAVAPAI	500	YAVAPAI	230	2	"tran_596"Tran YAVAPAI 500 to YAVAPAI 230 Ckt 1	2 336	1.35	1.36	1.36	1.36	1.35	1.44	1.35	1.35	1.34	1.35
YAVAPAI	500	YAVAPAI	230	1	"tran_597"Tran YAVAPAI 500 to YAVAPAI 230 Ckt 2	2 336	1.35	1.36	1.36	1.36	1.35	1.44	1.35	1.34	1.34	1.35
TWNTYSEC	138	E. LOOP	138	1	"line_252"Line LOSREALS 138 to VAIL 138 Ckt 1	2 225	1.15	1.15	1.15	1.15	1.15	1.16	1.15	1.15	1.15	1.15
N. LOOP	138	RILLITO	138	1	"line_546"Line N. LOOP 138 to NARANJA 138 Ckt 1	2 382	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
N. LOOP	138	RILLITO	138	1	"line_226"Line RANVISTO 138 to NARANJA 138 Ckt 1	2 382	1.10	1.10	1.10	1.10	1.10	1.09	1.10	1.10	1.10	1.10
TORTOLIT	138	N. LOOP	138	3	"line_552"Line TORTOLIT 138 to N. LOOP 138 Ckt 1A	2 406	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
TORTOLIT	138	N. LOOP	138	3	"line_553"Line TORTOLIT 138 to N. LOOP 138 Ckt 2A	2 406	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
BRANDOW	230	WARD	230	1	"line_158"Line BRANDOW 230 to WARD 230 Ckt 2	2 438	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
BRANDOW	230	WARD	230	2	"line_157"Line BRANDOW 230 to WARD 230 Ckt 1	2 438	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
TWNTYSEC	138	E. LOOP	138	1	"line_250"Line VAIL 138 to CIENEGA 138 Ckt 1	2 225	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
TWNTYSEC	138	E. LOOP	138	1	"line_253"Line PANTANO 138 to LOSREALS 138 Ckt 1	2 225	1.01	1.01	1.01	1.01	1.01	1.02	1.01	1.01	1.01	1.01
DMP	138	N. LOOP	138	1	"line_220"Line N. LOOP 138 to WESTINA 138 Ckt 1	2 311	1.01	1.01	1.01	1.01	1.01	1.00	1.01	1.01	1.01	1.01
FLAGSTAF	345	PINPKBRB	345	1	"line_426"Line FLAGSTAF 345 to PINPKBRB 345 Ckt 2	2 1219	0.99	0.99	0.99	0.99	0.99	1.03	0.99	0.99	0.98	0.99
FLAGSTAF	345	PINPKBRB	345	2	"line_425"Line FLAGSTAF 345 to PINPKBRB 345 Ckt 1	2 1219	0.99	0.99	0.99	0.99	0.99	1.03	0.99	0.99	0.98	0.99
RACEWAY	500	RACEWAY	230	1	"tran_594"Tran WESTWING 500 to WESTWNGE 230 Ckt	2 598	0.98	0.98	0.98	0.92	0.99	1.34	DNE	0.94	0.98	0.99
YAVAPAI	230	WILOWLKE	230	1	"line_381"Line PRSCOTWA 230 to RNDVLYTP 230 Ckt 1	2 355	0.98	0.99	0.99	0.99	0.98	1.05	0.98	0.98	0.97	0.98
YAVAPAI	230	WILOWLKE	230	1	"line_415"Line RNDVLYTP 230 to PEACOCK 230 Ckt 1	2 355	0.98	0.99	0.99	0.99	0.98	1.05	0.98	0.98	0.97	0.98
FOURCORN	500	FOURCORN	345	1	"line_24"Line RME 500 to FCW 500 Ckt 1	2 840	0.96	0.96	0.96	0.97	0.96	1.01	0.97	0.96	0.96	0.96
YAVAPAI	500	YAVAPAI	230	2	"line_17"Line YAVAPAI 500 to WESTWING 500 Ckt 1	2 336	0.96	0.96	0.97	0.96	0.96	1.01	0.96	0.96	0.95	0.96
YAVAPAI	500	YAVAPAI	230	1	"line_17"Line YAVAPAI 500 to WESTWING 500 Ckt 1	2 336	0.96	0.96	0.96	0.96	0.96	1.01	0.96	0.96	0.95	0.96
RACEWYWA	230	WESTWNGE	230	1	"tran_594"Tran WESTWING 500 to WESTWNGE 230 Ckt	2 403	0.86	0.88	0.88	1.00	0.86	1.04	0.20	0.83	0.86	0.86

colored cells indicate where flows increased by 5% or more, as compared to the base case flows

Central Arizona Transmission System - 2019 BTA Study Work

Thermal Violations (overloads, per unit)

F#	Fname	FkV	T#	Tname	TkV	ckt	CONTINGENCY DESCRIPTION	RTG#	RTG	BASE	PVDV2	SRP01	SRP02	SRP03	SRP04	TEP01
19062	PINPK	230	15211	PINPKSRP	230	2	"line_357"Line PINPK 230.0 to PINPKSRP 230.0 Ckt 1	2	658	1.36	1.33	1.35	1.38	1.37	1.36	1.37
19062	PINPK	230	15211	PINPKSRP	230	1	"line_358"Line PINPK 230.0 to PINPKSRP 230.0 Ckt 2	2	658	1.36	1.33	1.35	1.38	1.37	1.36	1.37
14006	YAVAPAI	500	14234	YAVAPAI	230	2	"tran_596"Tran YAVAPAI 500 to YAVAPAI 230 Ckt 1	2	336	1.35	1.33	1.35	1.37	1.36	1.35	1.36
14006	YAVAPAI	500	14234	YAVAPAI	230	1	"tran_597"Tran YAVAPAI 500 to YAVAPAI 230 Ckt 2	2	336	1.35	1.33	1.35	1.37	1.36	1.35	1.36
16219	TWNTYSEC	138	16202	E. LOOP	138	1	"line_252"Line LOSREALS 138.0 to VAIL 138.0 Ckt 1	2	225	1.15	1.15	1.15	1.18	1.17	1.15	1.25
16207	N. LOOP	138	16210	RILLITO	138	1	"line_546"Line N. LOOP 138.0 to NARANJA 138.0 Ckt 1	2	382	1.15	1.15	1.15	1.12	1.13	1.15	1.07
16207	N. LOOP	138	16210	RILLITO	138	1	"line_226"Line RANVISTO 138.0 to NARANJA 138.0 Ckt 1	2	382	1.10	1.10	1.10	1.07	1.08	1.10	1.02
16217	TORTOLIT	138	16207	N. LOOP	138	3	"line_552"Line TORTOLIT 138.0 to N. LOOP 138.0 Ckt 1A	2	406	1.08	1.09	1.08	1.05	1.06	1.09	1.01
16217	TORTOLIT	138	16207	N. LOOP	138	3	"line_553"Line TORTOLIT 138.0 to N. LOOP 138.0 Ckt 2A	2	406	1.08	1.09	1.08	1.05	1.06	1.09	1.01
79032	GLENCANY	345	79031	GLENCANY	230	1	"tran_669"Tran GLENCANY 345.00 to GLENCANY 230 Ckt 2	2	300	1.06	1.01	1.06	1.05	1.06	1.06	1.03
79032	GLENCANY	345	79031	GLENCANY	230	2	"tran_668"Tran GLENCANY 345.00 to GLENCANY 230Ckt 1	2	300	1.06	1.01	1.06	1.05	1.06	1.06	1.03
15204	BRANDOW	230	15217	WARD	230	1	"line_158"Line BRANDOW 230.0 to WARD 230.0 Ckt 2	2	438	1.02	1.02	1.02	1.02	1.02	1.02	1.02
15204	BRANDOW	230	15217	WARD	230	2	"line_157"Line BRANDOW 230.0 to WARD 230.0 Ckt 1	2	438	1.02	1.02	1.02	1.02	1.02	1.02	1.02
79024	FLAGSTAF	345	79032	GLENCANY	345	1	"line_424"Line FLAGSTAF 345.0 to GLENCANY 345.0 Ckt 2	2	1089	1.02	1.01	1.02	1.02	1.02	1.02	1.01
16219	TWNTYSEC	138	16202	E. LOOP	138	1	"line_250"Line VAIL 138.0 to CIENEGA 138.0 Ckt 1	2	225	1.02	1.02	1.02	1.04	1.03	1.02	1.09
79024	FLAGSTAF	345	79032	GLENCANY	345	2	"line_423"Line FLAGSTAF 345.0 to GLENCANY 345.0 Ckt 1	2	1089	1.02	1.00	1.02	1.01	1.02	1.02	1.01
16219	TWNTYSEC	138	16202	E. LOOP	138	1	"line_253"Line PANTANO 138.0 to LOSREALS 138.0 Ckt 1	2	225	1.01	1.01	1.01	1.04	1.03	1.01	1.11
16200	DMP	138	16207	N. LOOP	138	1	"line_220"Line N. LOOP 138.0 to WESTINA 138.0 Ckt 1	2	311	1.01	1.01	1.01	0.96	0.98	1.01	0.88
14011	RACEWAY	500	14246	RACEWAY	230	1	"tran_594"Tran WESTWING 50 to WESTWNGE 230 Ckt 1	2	598	0.98	0.99	0.98	1.01	1.01	0.99	0.99
16219	TWNTYSEC	138	16202	E. LOOP	138	1	"line_205"Line DMP 138.0 to NE.LOOP 138.0 Ckt 1	2	225	0.97	0.97	0.97	0.99	0.99	0.97	1.03
16219	TWNTYSEC	138	16202	E. LOOP	138	1	"line_212"Line E. LOOP 138.0 to PANTANO 138.0 Ckt 1	2	225	0.95	0.95	0.95	0.98	0.97	0.95	1.04

colored cells indicate where flows increased by 5% or more, as compared to the base case flows

Central Arizona Transmission System - 2019 BTA Study Work

Delta Voltage Violations (voltage drop, per unit)

#	Name	kV	CONTINGENCY DESCRIPTION	BASE	APS01	APS02	APS03	APS04	APS05	APS06	APS07	APS08	APS09
14351	BAGDAD	115	"line_67"Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.15	-0.16	-0.16	-0.16	-0.15	-0.16	-0.15	-0.15	-0.15	-0.15
14361	BAGCAP	115	"line_67"Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.15	-0.16	-0.16	-0.16	-0.15	-0.16	-0.15	-0.15	-0.15	-0.15
14359	VLYFARMS	115	"line_332"Line COOLIDGE 115 to VLYFARMS 115 Ckt 1	-0.14	-0.14	-0.14	-0.14	-0.14	-0.14	-0.14	-0.14	-0.14	-0.14
14361	BAGCAP	115	"line_510"Line PRESCOTT 115 to BAGCAP 115 Ckt 1	-0.13	-0.12	-0.12	-0.12	-0.13	-0.12	-0.13	-0.13	-0.13	-0.13
14361	BAGCAP	115	"tran_608"Tran PRESCOTT 2300 to PRESCOTT 115 Ckt 1	-0.13	-0.12	-0.12	-0.12	-0.13	-0.12	-0.13	-0.13	-0.13	-0.13
14351	BAGDAD	115	"line_510"Line PRESCOTT 115 to BAGCAP 115 Ckt 1	-0.13	-0.12	-0.12	-0.12	-0.13	-0.12	-0.12	-0.13	-0.13	-0.13
14351	BAGDAD	115	"line_511"Line BAGCAP 115 to BAGDAD 115 Ckt 1	-0.13	-0.12	-0.12	-0.12	-0.13	-0.12	-0.12	-0.13	-0.13	-0.13
14351	BAGDAD	115	"tran_608"Tran PRESCOTT 2300 to PRESCOTT 115 Ckt 1	-0.13	-0.12	-0.12	-0.12	-0.13	-0.12	-0.12	-0.13	-0.13	-0.13
14235	GILABEND	230	"line_70"Line GILARIVR 230 to GILABEND 230 Ckt 1	-0.11	-0.12	-0.13	-0.11	-0.11	-0.12	-0.11	-0.11	-0.11	-0.11
14355	PRESCOTT	115	"line_67"Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.10	-0.11	-0.11	-0.11	-0.10	-0.11	-0.10	-0.10	-0.10	-0.10
14249	WILOWLKE	230	"line_67"Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.09	-0.09	-0.10	-0.10	-0.09	-0.10	-0.09	-0.09	-0.09	-0.09
14250	WILOWLKW	230	"line_67"Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.09	-0.09	-0.10	-0.09	-0.09	-0.10	-0.09	-0.09	-0.09	-0.09
14222	PRESCOTT	230	"line_67"Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.09	-0.09	-0.09	-0.09	-0.09	-0.10	-0.09	-0.09	-0.09	-0.09
14201	BUCKEYE	230	"line_32"Line BUCKEYE 230 to LIBERTY 230 Ckt 1	-0.09	-0.10	-0.10	-0.09	-0.09	-0.10	-0.09	-0.09	-0.09	-0.09
19106	PRSCOTWA	230	"line_67"Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.09	-0.09	-0.09	-0.09	-0.09	-0.10	-0.09	-0.09	-0.09	-0.09
17018	RED TAIL	230	"line_267"Line APACHE 230 to RED TAIL 230 Ckt 1	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
17044	HACKBERY	230	"line_281"Line HACKBERY 230 to MORENCI 230 Ckt 1	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08
17008	DOSCONDO	230	"line_281"Line HACKBERY 230 to MORENCI 230 Ckt 1	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07
15032	PERK PS2	500	"line_104"Line PERK PS2 500 to PERKINPS 500 Ckt 1	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07
17008	DOSCONDO	230	"line_267"Line APACHE 230 to RED TAIL 230 Ckt 1	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
17044	HACKBERY	230	"line_267"Line APACHE 230 to RED TAIL 230 Ckt 1	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
14355	PRESCOTT	115	"tran_608"Tran PRESCOTT 230 to PRESCOTT 115 Ckt 1	-0.06	-0.05	-0.05	-0.05	-0.06	-0.05	-0.06	-0.06	-0.06	-0.06
14230	VERDE N	230	"line_66"Line YAVAPAI 230 to VERDE N 230 Ckt 1	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
14247	VERDE S	230	"line_66"Line YAVAPAI 230 to VERDE N 230 Ckt 1	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
14243	GAVILNPK	230	"line_382"Line GAVLINWA 230 to GAVILNPK 230 Ckt 1	-0.06	-0.06	-0.06	-0.07	-0.05	-0.06	-0.06	-0.06	-0.06	-0.05
14353	MURAL	115	"line_537"Line ADAMS TP 115 to APACHE 115 Ckt 1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
14205	COCONINO	230	"line_66"Line YAVAPAI 230 to VERDE N 230 Ckt 1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
14254	TRLBY	230	"line_82"Line TRLBY 230 to SNVLY 230 Ckt 1	-0.04	0.00	0.00	-0.04	-0.08	-0.04	-0.04	-0.04	-0.04	-0.04
14010	SNVLY	500	"line_499"Line DELANY 500 to SNVLY 500 Ckt 1	-0.01	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.07	-0.01	-0.01
14010	SNVLY	500	"line_18"Line SNVLY 500 to RACEWAY 500 Ckt 1	-0.01	-0.08	0.00	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01
14018	DUGAS	500	"line_449"Line DUGAS 500 to RACEWAY 500 Ckt 1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
16720	KANTOR	138	"line_461"Line SONOITA 138 to VALNCIA 138 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
15008	MIAMI 3	115	"line_491"Line CARLOTA 115 to PINTOVLY 115 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
15009	MIAMI 4	115	"line_491"Line CARLOTA 115 to PINTOVLY 115 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
15114	MIAMI	115	"line_491"Line CARLOTA 115 to PINTOVLY 115 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16720	KANTOR	138	"line_457"Line VAIL_NOG 138 to NOGALES 138 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16720	KANTOR	138	"line_458"Line NOGALES 138 to KANTOR 138 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16720	KANTOR	138	"line_460"Line CANEZ 138 to SONOITA 138 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16720	KANTOR	138	"line_459"Line KANTOR 138 to CANEZ 138 Ckt 1	0.06	0.06	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06
15121	PINTOVLY	115	"line_492"Line CARLOTA 115 to SILVERK2 115 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
14361	BAGCAP	115	"line_511"Line BAGCAP 115 to BAGDAD 115 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16721	CANEZ	138	"line_461"Line SONOITA 138 to VALNCIA 138 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
15104	CARLOTA	115	"line_492"Line CARLOTA 115 to SILVERK2 115 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16721	CANEZ	138	"line_457"Line VAIL_NOG 138 to NOGALES 138 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16721	CANEZ	138	"line_458"Line NOGALES 138 to KANTOR 138 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16721	CANEZ	138	"line_459"Line KANTOR 138 to CANEZ 138 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16722	SONOITA	138	"line_461"Line SONOITA 138 to VALNCIA 138 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16722	SONOITA	138	"line_457"Line VAIL_NOG 138 to NOGALES 138 Ckt 1	0.07	0.08	0.08	0.08	0.07	0.08	0.08	0.07	0.07	0.07
16722	SONOITA	138	"line_458"Line NOGALES 138 to KANTOR 138 Ckt 1	0.07	0.08	0.08	0.08	0.07	0.08	0.08	0.07	0.07	0.07
16722	SONOITA	138	"line_459"Line KANTOR 138 to CANEZ 138 Ckt 1	0.07	0.08	0.08	0.08	0.07	0.08	0.08	0.07	0.07	0.07
16722	SONOITA	138	"line_460"Line CANEZ 138 to SONOITA 138 Ckt 1	0.07	0.08	0.08	0.08	0.07	0.08	0.08	0.07	0.07	0.07
16721	CANEZ	138	"line_460"Line CANEZ 138 to SONOITA 138 Ckt 1	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
15121	PINTOVLY	115	"line_491"Line CARLOTA 115 to PINTOVLY 115 Ckt 1	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
16723	VALNCIA	138	"line_457"Line VAIL_NOG 138 to NOGALES 138 Ckt 1	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
16723	VALNCIA	138	"line_458"Line NOGALES 138 to KANTOR 138 Ckt 1	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
16723	VALNCIA	138	"line_459"Line KANTOR 138 to CANEZ 138 Ckt 1	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
16723	VALNCIA	138	"line_460"Line CANEZ 138 to SONOITA 138 Ckt 1	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
16723	VALNCIA	138	"line_461"Line SONOITA 138 to VALNCIA 138 Ckt 1	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
16106	VAIL2	345	"tran_638"Tran VAIL2 345 to VAIL 138 Ckt 1 0.00	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11

Colored cells indicate where voltage deviation increased by >3% as compared to voltage deviation in the base case.

Central Arizona Transmission System - 2019 BTA Study Work

Delta Voltage Violations (voltage drop, per unit)

#	Name	kV	CONTINGENCY DESCRIPTION	BASE	PVDV2	SRP01	SRP02	SRP03	SRP04	TEP01
14351	BAGDAD	115	"line_67"Line YAVAPAI 230.0 to WILOWLKE 230.0 Ckt 1	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15
14361	BAGCAP	115	"line_67"Line YAVAPAI 230.0 to WILOWLKE 230.0 Ckt 1	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15
14359	VLYFARMS	115	"line_332"Line COOLIDGE 115.0 to VLYFARMS 115.0 Ckt 1	-0.14	-0.14	-0.14	-0.14	-0.14	-0.14	-0.15
14361	BAGCAP	115	"line_510"Line PRESCOTT 115.0 to BAGCAP 115.0 Ckt 1	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13
14361	BAGCAP	115	"tran_608"Tran PRESCOTT 230 to PRESCOTT 115.00 Ckt 1	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13
14351	BAGDAD	115	"line_510"Line PRESCOTT 115.0 to BAGCAP 115.0 Ckt 1	-0.13	-0.13	-0.13	-0.13	-0.12	-0.12	-0.13
14351	BAGDAD	115	"line_511"Line BAGCAP 115.0 to BAGDAD 115.0 Ckt 1	-0.13	-0.13	-0.13	-0.13	-0.12	-0.12	-0.13
14351	BAGDAD	115	"tran_608"Tran PRESCOTT 230 to PRESCOTT 115.00 Ckt 1	-0.13	-0.13	-0.13	-0.13	-0.12	-0.12	-0.13
15105	ELLISON	115	"line_138"Line MOONSHIN 115.0 to PINAL 115.0 Ckt 1	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11
15133	843E2.7N	115	"line_138"Line MOONSHIN 115.0 to PINAL 115.0 Ckt 1	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11
15135	MIAMI 4	115	"line_138"Line MOONSHIN 115.0 to PINAL 115.0 Ckt 1	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11
15123	REFINERY	115	"line_138"Line MOONSHIN 115.0 to PINAL 115.0 Ckt 1	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11
15132	842E2.7N	115	"line_138"Line MOONSHIN 115.0 to PINAL 115.0 Ckt 1	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11
15115	MOONSHIN	115	"line_138"Line MOONSHIN 115.0 to PINAL 115.0 Ckt 1	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11
14235	GILABEND	230	"line_70"Line GILARIVR 230.0 to GILABEND 230.0 Ckt 1	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11
14355	PRESCOTT	115	"line_67"Line YAVAPAI 230.0 to WILOWLKE 230.0 Ckt 1	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10
14249	WILOWLKE	230	"line_67"Line YAVAPAI 230.0 to WILOWLKE 230.0 Ckt 1	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
14250	WILOWLKW	230	"line_67"Line YAVAPAI 230.0 to WILOWLKE 230.0 Ckt 1	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
14222	PRESCOTT	230	"line_67"Line YAVAPAI 230.0 to WILOWLKE 230.0 Ckt 1	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
14201	BUCKEYE	230	"line_32"Line BUCKEYE 230.0 to LIBERTY 230.0 Ckt 1	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
19106	PRSCOTWA	230	"line_67"Line YAVAPAI 230.0 to WILOWLKE 230.0 Ckt 1	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
17018	RED TAIL	230	"line_267"Line APACHE 230.0 to RED TAIL 230.0 Ckt 1	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
17044	HACKBERY	230	"line_281"Line HACKBERY 230.0 to MORENCI 230.0 Ckt 1	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08
17008	DOSCONDO	230	"line_281"Line HACKBERY 230.0 to MORENCI 230.0 Ckt 1	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07
15032	PERK PS2	500	"line_104"Line PERK PS2 500.0 to PERKINPS 500.0 Ckt 1	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07
17008	DOSCONDO	230	"line_267"Line APACHE 230.0 to RED TAIL 230.0 Ckt 1	-0.06	-0.06	-0.06	-0.07	-0.06	-0.06	-0.07
17044	HACKBERY	230	"line_267"Line APACHE 230.0 to RED TAIL 230.0 Ckt 1	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
14355	PRESCOTT	115	"tran_608"Tran PRESCOTT 230 to PRESCOTT 115.00 Ckt 1	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
14230	VERDE N	230	"line_66"Line YAVAPAI 230.0 to VERDE N 230.0 Ckt 1	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
14247	VERDE S	230	"line_66"Line YAVAPAI 230.0 to VERDE N 230.0 Ckt 1	-0.06	-0.05	-0.06	-0.06	-0.06	-0.06	-0.06
14243	GAVILNPK	230	"line_382"Line GAVLINWA 230.0 to GAVILNPK 230.0 Ckt 1	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
14353	MURAL	115	"line_537"Line ADAMS TP 115.0 to APACHE 115.0 Ckt 1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.06
15106	FRAZIER	115	"line_138"Line MOONSHIN 115.0 to PINAL 115.0 Ckt 1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
14362	BOOTHILL	115	"line_537"Line ADAMS TP 115.0 to APACHE 115.0 Ckt 1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.06
15134	ROOSEVLT	115	"line_138"Line MOONSHIN 115.0 to PINAL 115.0 Ckt 1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
14350	ADAMS	115	"line_537"Line ADAMS TP 115.0 to APACHE 115.0 Ckt 1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
19060	ADAMS TP	115	"line_537"Line ADAMS TP 115.0 to APACHE 115.0 Ckt 1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
17020	SAN RAF	230	"line_266"Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	-0.05	-0.04	-0.05	-0.05	-0.05	-0.05	-0.05
17007	BUTERFLD	230	"line_266"Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	-0.04	-0.04	-0.04	-0.05	-0.04	-0.04	-0.05