BALANCING AUTHORITY OF NORTHERN CALIFORNIA

FAC-014-3, R6 Process Document

Version 1.0

03/29/24

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Terms

BA	Balancing Authority
BANC	Balancing Authority of Northern California
BANC PC Assessment	The BANC PC Area Annual TPL-001-5 Assessment of Near-Term Transmission Planning Horizon for years 2 and 5
CAISO RC	California Independent System Operator Reliability Coordinator
MID	Modesto Irrigation District
Near-Term Transmission Planning Horizon	Year 2 through year 5 according to the NERC's definition
NERC	North American Electric Reliability Corporation
PC	Planning Coordinator
PC Participants	SMUD, MID, RE, and RDNG
RE	Roseville Electric
RDNG	Redding Electric Utility
SOL	System Operating Limit
SMUD	Sacramento Municipal Utility District
WECC	Western Electricity Coordinating Council

1. Introduction

The Balancing Authority of Northern California (BANC) is a Joint Powers Authority (JPA) consisting of the Sacramento Municipal Utility District (SMUD), Modesto Irrigation District (MID), Roseville Electric (RE), Redding Electric Utility (RDNG), Trinity Public Utilities District, and the City of Shasta Lake utilities. BANC assumed the Balancing Authority (BA) responsibilities on May 1, 2011, with SMUD providing the BA operator services on a contract basis.

On January 1, 2017, BANC registered as the NERC Planning Coordiantor (PC) for four of its members with the goal of becoming fully compliant with all PC-related reliability standards by January 1, 2018. The four BANC members that are in the BANC PC area are SMUD, MID, RE, and RDNG (individually "PC Participants" and collectively "PC Participants"). The City of Shasta Lake and Trinity Public Utility District are BANC members, but are not part of the BANC PC.[1] SMUD provides the PC services for BANC on a contract basis.

The NERC FAC-014-3 reliability standard requirement R6 states:

R6. Each Planning Coordinator and each Transmission Planner shall implement a documented process to use Facility Ratings, System steady-state voltage limits and stability criteria in its Planning Assessment of Near-Term Transmission Planning Horizon that are equally limiting or more limiting than the criteria for Facility Ratings, System Voltage Limits and stability described in its respective Reliability Coordinator's SOL methodology.

This document is to comply with R6 of the FAC-014-3 standard for BANC PC. To meet requirement R6 of FAC-014-3, this documents the methodology and criteria which will be used for the Planning Assessment of the Near-Term Transmission Planning Horizon, which are the same methodology and criteria used in the BANC PC Annual TPL-001-5 Assessment of the Near-Term Transmission Planning Horizon (BANC PC Assessment).

In addition, this document lists the California Independent System Operator (CAISO) Reliablity Coordinator (RC) System Operating Limit (SOL) Methodology (CAISO RC SOL Methodology) and performance requirements for Facility Ratings, System steady-state voltage limits, stability criteria, and compares them with the criteria in this document for required Planning Assessment of Near-Term Transmission Planning Horizon. This process demonstrates that the Facility Ratings, System steady-state voltage limits, stability criteria used in the Planning Assessment of Near-Term Transmission Planning Horizon are equally limiting or more limiting than the criteria described in the CAISO RC SOLs Methodology for the Operations Horizon. The criteria used for the Planning Assessment of Near-Term Transmission Planning Horizon required by the R6 of the FAC-014-3 is the same as the BANC PC Annual TPL-001-5 Assessment for the Near-Term Transmisison Planning Horizon (BANC PC Assessment), so the annual BANC PC Assessment will be used as BANC's Near-Term horizon planning assesment to comply with FAC-014-3, R6.

[1] The Western Area Power Administration – Sierra Nevada Region (WAPA-SNR) is also inside the BANC BA, however, it is not a member of the BANC JPA. WAPA-SNR is an active participant in BANC activities. Additionally, WAPA-SNR is a registered PC and serves as the PC for the Trinity Public Utilities District and the City of Shasta Lake. Thus, all BANC members are covered under either the BANC or WAPA-SNR PC registrations.

This document will be effective on 04/01/24, and could be revised as needed to ensure continual compliance with FAC-014-3, R6.

2. Scope

The scope of this document is to document Facility Ratings, System steady-state voltage limits and stability criteria used in the BANC PC Planning Assessment of the Near-Term Transmission Planning Horizon. Then compare the criteria used between the CAISO RC SOLs methodology for the operations horizon and the BANC PC Planning Assessment of the Near-Term Transmission Planning Horizon. The comparison shall conclude if Facility Ratings, System steady-state voltage limits and stability criteria used in the BANC PC's Planning Assessment of the Near-Term Transmission Planning Horizon are equally limiting or more limiting than the criteria for Facility Ratings, System Voltage Limits and stability described in its respective Reliability Coordinator's (CAISO RC) SOL methodology.

SOLs are defined as:

The value (such as MW, MVAr, Amperes, Frequency or Volts) that satisfies the most limiting of the prescribed operating criteria for a specified system configuration to ensure operation within acceptable reliability criteria. System Operating Limits are based upon certain operating criteria. These include, but are not limited to:

- Facility Ratings (Applicable pre- and post-Contingency equipment or facility ratings)
- Transient Stability Ratings (Applicable pre- and post-Contingency Stability Limits)
- Voltage Stability Ratings (Applicable pre- and post-Contingency Voltage Stability)
- System Voltage Limits (Applicable pre- and post-Contingency Voltage Limits)

3. NERC Reliability Standard to Comply

This process documents the criteria and methodology used in the BANC PC Planning Assessment Near-Term Transmission Planning Horizon to comply with the following NERC Reliability Standard:

- FAC-014-3 System Operating Limits (R6)

  FAC-014-3 R6 states: Each Planning Coordinator and each Transmission Planner shall implement a documented process to use Facility Ratings, System steady-state voltage limits and stability criteria in its Planning Assessment of Near-Term Transmission Planning Horizon that are equally limiting or more limiting than the criteria for Facility Ratings, System Voltage Limits and stability described in its respective Reliability Coordinator's SOL methodology.

• The Planning Coordinator may use less limiting Facility Ratings, System steady-state voltage limits and stability criteria if it provides a technical rationale to each affected Transmission Planner, Transmission Operator and ReliabilityCoordinator.

• The Transmission Planner may use less limiting Facility Ratings, System steady-state voltage limits and stability criteria if it provides a technical rationale to each affected Planning Coordinator, Transmission Operator and ReliabilityCoordinator.

4. BANC PC Planning Assessment of Near-Term Transmission Planning Horizon Methodology and Criteria

The BANC PC Planning Assessment of Near-Term Transmission Planning Horizon uses the same methodology and criteria as the BANC PC Annual TPL-001-5 Assessment (BANC PC Assessment), which is conducted to ensure the BANC PC area transmission system is in compliance with the TPL-001-5 NERC standard, WECC regional criteria TPL-001-WECC-CRT-4, and each BANC PC Participant's individual planning standards listed below in Section 4.3 across the near and long-term planning horizons. The BANC PC Assessment Report documents power flow study results acquired using Facility Ratings, System steady-state voltage limits and stability criteria in its Near-Term Transmission Planning Horizon which complies with the FAC-014-3, R6 reliability standard.

4.1 NERC Criteria

The BANC PC Assessment is conducted annually to ensure that performance of the BANC PC area will meet or exceed the criteria specified in TPL-001-5 Transmission System Planning Performance Requirements.

4.2 WECC Regional Criteria

The BANC PC Assessment uses the default planning criteria specified in WECC Criterion TPL-001-WECC-CRT-4, Transmission System Planning Performance [1] for acceptable voltages, voltage deviations, and transient voltage responses.

The only criteria the BANC PC Assessment uses that are different from the default criteria are RDNG's normal voltage limits. Annual Planning Assessment results have indicated that RDNG's voltage criteria will not violate equipment ratings or cause instability, uncontrolled islanding, or Cascading in its own system and/or adjacent system.

BANC PC will notify adjacent Transmission Planners and Planning Coordinators that criteria different from WR1 were used by sending them BANC's completed Transmission Planning Assessment and making the different criteria available within 30 days of a request.

RDNG Voltage Criteria:

Table 1 – RDNG Differing Voltage Criteria

System	Nominal Voltage	Normal Conditions		Contingency Conditions		Voltage Deviation
		Vmin (pu)	Vmax (pu)	Vmin (pu)	Vmax (pu)	P1 & P2.1
RDNG	115 kV	0.974	1.078	0.923	1.10	≤ 8%

WECC's Voltage Criteria:

TPL-001-WECC-CRT-4—Transmission System Planning Performance

Requirements and Measures

WR1. Each Transmission Planner and Planning Coordinator shall use the following *default* base planning criteria:

1.1. Steady-state voltages at all applicable Bulk-Electric System (BES) buses shall stay within each of the following limits:

1.1.1. 95 percent to 105 percent of nominal[1] for P0[2] event (system normal pre-contingency event powerflow).

1.1.2. 90 percent to 110 percent of nominal for P1-P7 events (post-contingency event powerflow).

4.3 PC Participant Planning Criteria

The default planning criteria defined in Sections 4.1 and 4.2 shall be superseded by the PC Participant's own planning criteria defined in this section when it is more stringent than the default criteria defined in Sections 4.1 and 4.2, in accordance with TPL-001-WECC-CRT-4 WR4. The only criteria that the BANC PC Assessment uses that is more stringent or differ than the default criteria, are SMUD's, MID's and RDNG's voltage limits.

SMUD uses voltage limits more stringent than the default planning criteria in accordance with its operating procedure, OP-204. These stricter voltage limits are in place for the protection of SMUD's equipment and facilities and will not result in violations of equipment ratings, instability, uncontrolled islanding, or Cascading on its own and adjacent systems.

MID also uses voltage limits more stringent than the default planning criteria in accordance with its Operating Bulletin 48. These stricter upper voltage limits are in place for the protection of MID's facilities and will not result in violations of equipment ratings, instability, uncontrolled islanding, or Cascading on its own and adjacent systems.

RDNG's voltage limits can be found in Standard Operating Procedure SOP-07 115kV Transmission System Normal Operations. RDNG's voltage criteria differs, and is more limiting than the WECC Reliability Criterion from WECC-CRT-4 WR1 because RDNG typically sees a median operating voltage of 117.875 kV, which differs from the nominal transmission voltage of 115 kV by +2.5%. To accommodate this shift, all substation power transformers have their primary taps set at 117.875. In addition, the established voltage limits are shifted to accommodate the system voltage offset by increasing the per-unit normal condition, the

minimum and maximum voltages, and the contingency minimum voltage. However, the WECC contingency high voltage limit is not shifted to eliminate the possibility of exceeding the operating limits of equipment at the point of interconnection.

4.3.1 Voltage Criteria

The voltage criteria that shall be used for each of the PC Participant's systems are listed in the Table 1 below.

For the pre-contingency, the BANC PC Assessment uses pre-contingency system voltage criteria which is more stringent than the normal system voltage criteria used in the CAISO RC SOLs Methodology (refer to Section 5) because BANC PC Assessment does not use Emergency System Voltage Limits under the pre-contingency conditions to adjust the system to return the voltage within its normal System Voltage Limits within the specified time duration of those Emergency System Voltage Limits.

Table 2 - Voltage Criteria

System	Nominal Voltage	Normal Conditions		Contingency Conditions		Voltage Deviation
		Vmin (pu)	Vmax (pu)	Vmin (pu)	Vmax (pu)	P1 & P2.1
SMUD	230 kV	0.95	1.05	0.90[2]	1.05	≤ 8%
	115 kV	0.95	1.05	0.90	1.05	≤ 8%
MID	230 kV	0.95	1.05	0.90	1.052	≤ 8%
	115 kV	0.95	1.05	0.90	1.052	≤ 8%
RE	230 kV	0.95	1.05	0.90	1.10	≤ 8%
RDNG	115 kV	0.974	1.078	0.923	1.10	≤ 8%

4.3.2 Thermal Violation Criteria

The thermal criteria that shall be used for each of the PC Participant's systems is listed in Table 2 below.

For the pre-contingency condition, BANC PC Assessment uses criteria which is more stringent than the criteria used in the CAISO RC SOLs Methodology (refer to Section 5) under the pre-contingency conditions because the BANC PC Assessment does not use Emergency Ratings under the pre-contingency conditions to adjust the system to return the flow within its Normal Rating within the specified time duration of those Emergency Ratings.

[2] SMUD 230 kV buses that have a UVLS scheme associated with it are limited to Vmin of 0.948 PU, these buses include Carmichael, Elk Grove, Elverta, Foothill, Hurley, Orangevale, and Pocket.

Table 3 – Thermal Violation Criteria

Thermal Loading	Normal Conditions	Single and Multiple Contingencies
Contingency	P0	P1-P7[3]
Percentage Loading	≤ 100% of Normal facility Rating	≤ 100% of Emergency facility Rating

4.3.3 Transient Stability Criteria

The transient stability criteria that the BANC PC Assessment uses for each of the PC Participant's systems are listed in WECC Criterion TPL-001-WECC-CRT-4. These criterion are the same as used in the CAISO RC SOLs Methodology (refer to Section 5) that stability limits are not exceeded, and the system must demonstrate positive damping as well as no cascading to be considered a stable response to contingencies. Instability, cascading, or uncontrolled separation that adversely impact the reliability of the Bulk Electric System does not occur.

5. CAISO RC SOLs Methodology and Criteria

The details of the CAISO RC SOLs Methodology for the operations horizon, performance requirements, and contingencies to determine SOLs is available on the CAISO website and known as the System Operating Limits Methodology for the Operations Horizon (CAISO SOLs Methodology). (https://www.caiso.com/Documents/RC0610-040124.pdf)

The CAISO establishes SOLs per it's methodology. For Steady State pre and post contingency, the following system performance are to be observed:

- All facilities normal and emergency ratings.
- System voltage limits.
- Voltage and transient stability limits.

According to the CAISO RC methodology: In the pre-contingency state with all facilities in service, the Bulk Electic System (BES) shall demonstrate transient, dynamic and voltage stability; all Facilities shall be within their Facility Ratings and within their thermal, voltage and stability limits. Specifically, Section G of the CAISO RC SOLs Methodology stated followings:

Pre-Contingency:

Acceptable system performance for the pre-Contingency state in the Operations Horizon is characterized by the following [NERC Standard FAC-011-4 R6.1]:

[3] NERC Category P3 and P6 allow for system adjustments to allow for operator in-between these N-1-1 contingencies

1. Steady state flow through all facilities shall be within their normal Facility Ratings. Emergency Ratings may be used when system adjustments to return the flow within its Normal Rating could be executed and completed within the specified time duration of those Emergency Ratings. [NERC Standard FAC-011-4 R6.1.1].

2. Steady state voltages of all facilities shall be within their normal System Voltage Limits, and emergency System Voltage Limits may be used when system adjustments to return the voltage within its normal System Voltage Limits could be executed and completed within the specified time duration of those emergency System Voltage Limits. [NERC Standard FAC-011-4 R6.1.2].
3. Predetermined stability limits are not exceeded [NERC Standard FAC-011-4 R6.1.3].
4. Instability, Cascading or uncontrolled separation that adversely impact the reliability of the Bulk Electric System does not occur. [NERC Standard FAC-011-4 R6.1.4].

Post-Contingency:

Acceptable system performance for the post-Contingency state for Single Contingencies (SCs) and Credible Multiple Contingencies (MCs) in the Operations Horizon is characterized by the following. [NERC Standard FAC-011-4 R6.2,R6.3]:

1. All facilities shall be within applicable emergency Facility Ratings. Steady state postContingency flow through a facility must not be above the Facility's highest Emergency Rating. [NERC Standard FAC-011-4 R6.2.1]

2. All facilities shall be within their emergency System Voltage Limits. [NERC Standard FAC-011-4 R6.2.2].
3. All facilities shall be within their Stability Limits [NERC Standard FAC-011-4 R6.2.3].
4. Instability, cascading or uncontrolled separation that adversely impact the reliability of the Bulk Electric System does not occur. [NERC Standard FAC-011-4 R6.2.4]

6. Study Contingencies Comparison

The BANC PC Assessment system performance is evaluated under normal (pre-contingency) conditions and following the loss of single or multiple BES elements (post-contingency) as defined by the TPL-001-5 NERC Reliability Standard. Table 3 below summarizes the contingencies that are studied by the BANC PC Assessment. Contingencies for each BANC PC participants' system are studied, along with neighboring system contingencies. The BANC PC Assessment studies all applicable study contingencies of P1 to P7 as described in TPL-001-5.

Table 4 - Study Contingencies of BANC PC Assessment

Contingencies	Description
P0 (No contingency)	All Elements in Service

Contingencies	Description
P1 (Single Contingency)	• Loss of one generator (P1.1) • Loss of one transmission circuit (P1.2) • Loss of one transformer (P1.3) • Loss of one shunt or SVC/STATCOM device (P1.4) • Loss of a single pole of DC lines (P1.5)
P2 (Single Contingency)	• Loss of one transmission circuit without a fault (P2.1) • Loss of one bus section (P2.2) • Loss of one breaker (internal fault) (non-bus-tie-breaker) (P2.3) • Loss of one breaker (internal fault) (bus-tie-breaker) (P2.4)
P3 (Multiple Contingency)	Loss of a generator unit followed by system adjustments and the loss of the followings: • Loss of one transmission circuit (P1.2) • Loss of one transformer (P1.3) • Loss of one shunt or SVC/STATCOM device (P1.4) • Loss of a single pole of DC lines (P1.5)
P4 (Multiple Contingency)	Loss of multiple elements caused by a study breaker attempting to clear a fault on one of the following: • Loss of one generator (P4.1) • Loss of one transmission circuit (P4.2) • Loss of one transformer (P4.3) • Loss of one shunt device (P4.4) • Loss of one bus section (P4.5) • Loss of a bus-tie-breaker (P4.6)
P5 (Multiple Contingency)	Contingencies with delayed fault clearing due to the failure of a non-redundant component of the protection system protecting the faulted element to operate as designed for one of the following: • Loss of one generator (P5.1) • Loss of one transmission circuit (P5.2) • Loss of one transformer (P5.3) • Loss of one shunt device (P5.4) • Loss of one bus section (P5.5)
P6 (Multiple Contingency)	Loss of two or more (non-generator unit) elements with system adjustment between them, which produce the more severe system results
P7 (Multiple Contingency)	Loss of a common structure as follows: • Any two adjacent circuits on common structure (P7.1) • Loss of a bipolar DC lines (P7.2)
Extreme	Steady State & Stability events as defined in Table 1 of TPL-001-5 or by specific request of BANC PC members

According to the CAISO RC SOLs Methodology for the Operations Horizon, Section F of Selection of Applicable Contingencies, the following Contingencies, at a minimum, are applicable to TOP assessments within the Operations Horizon [NERC Standard FAC-011-4 5]:

1. Single Contingencies internal to the TOP Area [NERC Standard FAC-011-4 5.1],

2. Credible Multiple Contingencies[4] (MCs) internal to the TOP Area [NERC Standard FAC-011-4 5.2],
3. Any single Contingencies and Credible MCs external to the TOP Area that are known to impact the TOP Area or system under study, as determined by the TOP or RC. TOPs are responsible for determining the external modeling necessary to support the evaluation of those Contingencies [NERC Standard FAC-011-4 5.2], and
4. Any contingencies provided by Planning Coordinators/Transmission Planner according to [NERC Standard FAC-014-3 R7] that are also deemed credible based on the RC SOL methodology for the Operations Horizon [NERC Standard FAC-011-4 5.3].
5. The single Contingencies that shall be studied for assessments within the Operations Horizon include the following [NERC Standard FAC-011-4 5.1.1]:

   Loss of any of the following either by single phase to ground or three phase Fault (whichever is more severe) with Normal Clearing, or without a Fault:

   i. generator;

   ii. transmission circuit;

   iii. transformer;

   iv. shunt device; or

   v. single pole block in a monopolar or bipolar high voltage direct current system.
6. The Credible MCs that shall be studied for assessments within the Operations Horizon include the following two types [NERC Standard FAC-011-4 5.2]:

   a. Always Credible MCs, and

   b. Conditionally Credible MCs. [5]

Comparing the study contingencies used between the BANC PC Assessment and the CAISO RC SOLs Methodology, the BANC PC Assessment performs all P1 to P7 contingencies while the CAISO RC SOLs Methodology utilized selected contingencies including credible MCs and conditionally credible MCs.

7. Conclusion

In conclusion, this document serves as compliance with NERC Standard FAC-014-3, requirement R6, demonstrating that Facility Ratings and System steady-state voltage limits under the pre-contingency conditions as well as study contingencies in the BANC PC's Planning Assessment of the Near-Term Transmission Planning Horizon are equal or more limiting than

[4] Credible Multiple Contingencies (As defined in the CAISO RC SOL Methodology) – a MC whose Credibility is considered sufficiently high to warrant protecting against.
[5] Conditionally Credible Multiple Contingencies (As defined in the CAISO RC SOL Methodology) - a MC whose Credibility is a function of Observable System Conditions. Conditionally Credible MCs are only Credible when the Observable System Conditions are present. When the Observable System Conditions are not present, the MC is not Credible.

the criteria for Facility Ratings and System Voltage Limits as well as study contingencies described in its respective Reliability Coordinator's SOL methodology.

In addition, under the post-contingency conditions, Facility Ratings, System steady-state voltage limits and stability criteria in the BANC PC's Planning Assessment of the Near-Term Transmission Planning Horizon are equally limiting when comparing to the criteria for Facility Ratings, System Voltage Limits and stability described in its respective Reliability Coordinator's SOL methodolog.

Therefore, this document concludes the BANC PC's Planning Assessment of the Near-Term Transmission Planning Horizon uses Facility Ratings, System steady-state voltage limits and stability criteria that are equally limiting or more limiting than the criteria for Facility Ratings, System Voltage Limits and stability described in its respective Reliability Coordinator's SOL methodology. Since the BANC PC's Planning Assessment of the Near-Term Transmission Planning Horizon uses the same criteria and methodology as the BANC PC TPL-001-5 Assessment, the BANC PC TPL-001-5 Assessment will be used as BANC PC Planning Assessment of Near-Term Transmission Planning Horizon to comply with the FAC-014-3, R6 reliability standard.

Version History

Version	Change	By	Effective Date
1.0	Initial	Prabal Singh	04/01/2024

References

[1] *WECC Criterion TPL-001-WECC-CRT-4.* Transmission System Planning Performance. https://www.wecc.org/Reliability/TPL-001-WECC-CRT-4.pdf

[2] *CAISO RC SOL Methodology*. System Operating Limits Methodology for the Operations Horizon https://www.caiso.com/Documents/RC0610-040124.pdf

[3] *FAC-014-3 SOLs*. Establish System Operating Limits for the Planning Horizon https://www.nerc.com/pa/Stand/Reliability%20Standards/FAC-014-3.pdf

[4] *TPL-001-5*. Transmission System Planning Performance Requirements https://www.nerc.com/pa/Stand/Reliability%20Standards/TPL-001-5.pdf

[5] *SMUD OP-204*. SMUD Operating Procedures (Voltage Limits)

[6] *RDNG SOP-07*. RDNG Standard Operating Procedure 115 kV Transmission System Normal Operations (Voltage Limits)

[6] *MID OP-48*. MID Operating Bulletin 48 (Voltage Limits)