Avista System Planning Assessment

2017 Study Plan

Prepared By: Transmission System Planning

Version History

<table>
<thead>
<tr>
<th>Version</th>
<th>Version Date</th>
<th>Action</th>
<th>Change Tracking</th>
<th>Reviewed By</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Mar 1, 2017</td>
<td>New study plan</td>
<td>Prepared for year 1 meeting 1</td>
<td>JRG</td>
</tr>
<tr>
<td>B</td>
<td>Mar 22, 2017</td>
<td>Updated following internal meeting</td>
<td>Added criteria table and clarified language</td>
<td>JRG</td>
</tr>
<tr>
<td>C</td>
<td>Apr 20, 2017</td>
<td>Initial update following Study Development meeting</td>
<td>Added comments and response section</td>
<td>JRG</td>
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<td>0</td>
<td>May 15, 2017</td>
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<td>Added comments from stakeholders</td>
<td>JRG</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS

## I Introduction ................................................................................................................................. 3

1. **Point of Contact** ......................................................................................................................... 3
2. **Access to Planning Data** ................................................................................................................ 4

## II Process Overview .......................................................................................................................... 4

1. **Phase 1 – Study Plan** .................................................................................................................... 4
2. **Phase 2 – Technical Analysis** ........................................................................................................ 4
3. **Phase 3 – Stakeholder Review** ...................................................................................................... 5
4. **General Timeline** .......................................................................................................................... 6
5. **Special Requests** ............................................................................................................................ 6

## III Data Collection .............................................................................................................................. 7

## IV Assumptions ...................................................................................................................................... 8

1. **System Conditions (TPL-001-4, R1.1.1)** ...................................................................................... 8
2. **Outages (TPL-001-4, R1.1.2)** ..................................................................................................... 9
3. **Projects (TPL-001-4, R1.1.3)** ..................................................................................................... 9
4. **Native and Network Loads (TPL-001-4, R1.1.4)** ...................................................................... 9
5. **Additional Transmission Uses (TPL-001-4, R1.1.5)** ................................................................. 12
6. **Resources (TPL-001-4, R1.1.6)** .................................................................................................. 12
7. **Criteria (TPL-001-4, R5, R6)** ..................................................................................................... 13
8. **Identification of Analytical Tools** ................................................................................................ 16

## V Technical Studies ............................................................................................................................ 17

1. **Steady State Contingency Analysis (TPL-001-4, R2.1, R3)** ....................................................... 17
2. **Spare Equipment Analysis (TPL-001-4, R2.1.5)** ...................................................................... 17
3. **Short Circuit Analysis (TPL-001-4, R2.3)** .................................................................................. 18
4. **Stability Contingency Analysis (TPL-001-4, R2.4, R4)** ............................................................... 18
5. **Voltage Stability Analysis** ............................................................................................................ 19

## APPENDIX A - Stakeholder Comments .............................................................................................. 21
I  INTRODUCTION

Development of Avista’s annual transmission System Planning Assessment (Planning Assessment) encompasses the processes of the following:

- The Avista Local Transmission Planning Process – as provided in Attachment K, Part III of Avista’s Open Access Transmission Tariff (OATT),
- The ColumbiaGrid transmission planning process – as provided in the ColumbiaGrid Planning and Expansion Functional Agreement (PEFA) and the ColumbiaGrid Order 1000 Functional Agreement,
- The requirements associated with the preparation of the annual Planning Assessment of the Avista portion of the Bulk Electric System.

The Planning Assessment, or Local Planning Report, is prepared as part of a two-year process as defined in Avista’s OATT Attachment K. The Planning Assessment identifies the Transmission System facility additions required to reliably interconnect forecasted generation resources, serve the forecasted loads of Avista’s Network Customers and Native Load Customers, and meet all other Transmission Service and non-OATT transmission service requirements, including rollover rights, over a ten (10) year planning horizon. The Planning Assessment process is open to all Interested Stakeholders, including, but not limited to, Transmission Customers, Interconnection Customers, and state authorities. The Western Electric Coordinating Council (WECC) facilitates interconnection wide planning and development of wide-area planning proposals.

Avista combines the results of all of its Attachment K Planning studies with the results of the annual Planning Assessment studies. Annually a single document (i.e. the Avista System Planning Assessment) is issued documenting the results of the various Planning processes.

Avista’s OATT is located on its Open Access Same-time Information System (OASIS) at http://www.oatioasis.com/avat. Additional information regarding Avista’s Transmission System Planning work is located in the Transmission Planning folder on Avista’s OASIS. The annual Avista System Planning Assessment is posted on OASIS.

1  POINT OF CONTACT

A point of contact for questions regarding the Planning Assessment and the projects described within has been designated. Please contact the party named below for any questions:

Transmission Planning Department
PO Box 3727, MSC-16
Spokane, WA 99220
TransmissionPlanning@avistacorp.com
2 ACCESS TO PLANNING DATA
The Transmission System models used in the Planning Assessment can be provided within 10 calendar days, via email or other media, to any WECC member that makes a request. Non-WECC members will be required to sign a confidentiality agreement with the WECC before any base cases can be shared. Once the WECC confirms a confidentiality agreement has been signed, the requested base case(s) can be provided within 10 calendar days. Any additional information needed to replicate the technical study results of the Planning Assessment can be provided upon written request.

II PROCESS OVERVIEW

1 PHASE 1 – STUDY PLAN
Phase 1 includes establishing the assumptions and models for use in the technical studies, developing and finalizing a Study Plan, and specifying the public policy mandates planners will adopt as objectives in the current study cycle.

Any stakeholder may submit data to be evaluated for inclusion in the Study Plan1. Stakeholders may provide comments to the Study Plan at the Study Development Meeting, or during the 30 days following.

Deliverables

- Study Plan

Milestones

- Study Development Meeting - April 14
- Finalize Study Plan - May 14

2 PHASE 2 – TECHNICAL ANALYSIS
Phase 2 includes performing necessary technical studies and development of a draft Planning Assessment. Guided by the Avista document TP-SPP-04 – Data for Power System Modeling and Analysis and NERC Standard MOD-032-1, and with input from stakeholders, transmission system models will be developed. Customer load, demand resources, and generation data received from customers will be included as appropriate in the development of the transmission system models used to perform the studies identified in Section V. The results of the technical studies are documented in a draft Planning Assessment. The Planning

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1 Per Avista’s OATT, Attachment K, Part III Section 2.2.3
Assessment may also include additional information regarding projects and system modifications developed through means other than the technical studies².

### Deliverables
- Transmission System models
- Draft Planning Assessment

### Milestones
- Posting Transmission System models - July 1
- Posting draft Planning Assessment - September 15

## 3 PHASE 3 – STAKEHOLDER REVIEW
Phase 3 includes providing a draft Planning Assessment report to stakeholders. Stakeholders may provide comments at the Review of Study Results/Draft Transmission Plans Meeting, or during the 30 days following. A final Planning Assessment will be posted and submitted to applicable regulatory entities and other entities participating in regional transmission system planning.

### Deliverables
- Planning Assessment
- Stakeholder Comment Feedback

### Milestones
- Review of Study Results/Draft Transmission Plans Meeting - October 1
- Post Final Planning Assessment - December 20

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² Such other means may include, for example, generation interconnection or transmission service request study processes under the OATT, or joint study team processes under the ColumbiaGrid PEFA.
4 GENERAL TIMELINE

FIGURE 1: PLANNING ASSESSMENT TIMELINE.

5 SPECIAL REQUESTS

5.1 Economic
Customers or stakeholders may submit a request for an Economic Planning Study to evaluate potential upgrades or other investments that could reduce congestion or integrate new resources and loads on an aggregated or regional basis. All such requests will be forwarded to ColumbiaGrid for consideration.3

5.2 Enhanced Reliability Upgrades
Customers may request upgrades not identified through technical studies. Such requests shall be constituted Enhanced Reliability Upgrades.4

3 Per Avista’s OATT, Attachment K, Part VI
4 Per Avista’s OATT, Attachment K, Part III Section 10
### III DATA COLLECTION

The following data sources have been identified as inputs to the Planning Assessment:

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Description</th>
<th>Owner</th>
<th>Development Process</th>
<th>Applicable Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avista Master Case</td>
<td>Data submission in accordance with MOD-032 is compiled into a centralized database</td>
<td>Avista Planning Coordinator</td>
<td>TP-SPP-04</td>
<td>TPL-001-4, R1.1.1 &amp; MOD-032</td>
</tr>
<tr>
<td>WECC Base Cases</td>
<td>Interconnection-wide steady state and dynamic models representing various system conditions</td>
<td>WECC</td>
<td>WECC Base Case Compilation Schedule</td>
<td></td>
</tr>
<tr>
<td>Outages List</td>
<td>List of known outages of Transmission Facilities with a duration of at least six months</td>
<td>Avista Transmission Operator</td>
<td></td>
<td>TPL-001-4, R1.1.2, R2.1.3</td>
</tr>
<tr>
<td>Avista Forecast Spreadsheet</td>
<td>Spreadsheet including projected load forecasts and generation resource dispatch</td>
<td>Avista Transmission Planning</td>
<td>TP-SPP-07</td>
<td>TPL-001-4, R1.1.4 &amp; R1.1.6</td>
</tr>
<tr>
<td>Generator Interconnection Applications Queue</td>
<td>List of Generator Interconnection Applications and projected in-service dates</td>
<td>Avista Transmission Service Provider</td>
<td>OATT</td>
<td></td>
</tr>
<tr>
<td>Transmission Service Queue</td>
<td>List of transmission service requests</td>
<td>Avista Transmission Service Provider</td>
<td>OATT</td>
<td>TPL-001-4, R1.1.5</td>
</tr>
</tbody>
</table>

**TABLE 1: DATA SOURCES.**
IV ASSUMPTIONS

The initial assumptions used in the technical studies are listed in the following sections.

1 SYSTEM CONDITIONS (TPL-001-4, R1.1.1)

1.1 Summary

- Planning Cases are developed from WECC approved cases
- Planning Cases represent a P0 (all lines in service) condition with associated operating procedures

1.2 Narrative

Avista’s Transmission Planning Department develops a set of transmission system models (Planning Cases) biannually to model its Transmission Planner and Planning Coordinator areas as well as the regional Transmission System. The Planning Case development process outlined in the internal document TP-SPP-04 – Data Preparation for Steady State and Dynamic Studies outlines the use of WECC approved base cases and the modification of steady state and dynamic data as required to represent existing facilities for the desired scenario. The resulting Planning Cases represent a normal system condition (P0). All established pre-contingency operating procedures are represented. Manual application of each operating procedure is followed in the process of developing each Planning Case. Table 2 identifies the scenarios and associated WECC base cases to be used in the technical studies.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>WECC Case</th>
<th>WECC Approved Date</th>
<th>TPL-001-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>One Year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018 Heavy Summer</td>
<td>17HS2a</td>
<td>9/22/2016</td>
<td>R2.1.1, R2.4.1</td>
</tr>
<tr>
<td>2018 Light Summer</td>
<td>17LS1a</td>
<td>12/06/2016</td>
<td>R2.1.2, R2.4.2</td>
</tr>
<tr>
<td>2018-2019 Heavy Winter</td>
<td>17HW3b</td>
<td>5/17/2016</td>
<td>R2.1.1, R2.4.1</td>
</tr>
<tr>
<td>2018-2019 Light Winter</td>
<td>17LW2a</td>
<td>5/23/2016</td>
<td>R2.1.2, R2.4.2</td>
</tr>
<tr>
<td>Five Year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2022 Heavy Summer</td>
<td>22HS2a</td>
<td>9/1/2016</td>
<td>R2.1.1, R2.4.1</td>
</tr>
<tr>
<td>2022 Light Summer</td>
<td>17LS1a</td>
<td>12/06/2016</td>
<td>R2.1.2, R2.4.2</td>
</tr>
<tr>
<td>2022-2023 Heavy Winter</td>
<td>22HW2a</td>
<td>8/19/2016</td>
<td>R2.1.1, R2.4.1</td>
</tr>
<tr>
<td>2022-2023 Light Winter</td>
<td>17LW2a</td>
<td>5/23/2016</td>
<td>R2.1.2, R2.4.2</td>
</tr>
<tr>
<td>Ten Year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2027 Heavy Summer</td>
<td>22HS2a</td>
<td>9/1/2016</td>
<td>R2.2.1, R2.5</td>
</tr>
<tr>
<td>2027-2028 Heavy Winter</td>
<td>22HW2a</td>
<td>8/19/2016</td>
<td>R2.2.1, R2.5</td>
</tr>
<tr>
<td>Twenty Year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2037 Heavy Summer</td>
<td>22HS2a</td>
<td>9/1/2016</td>
<td>R2.1.1, R2.4.1</td>
</tr>
<tr>
<td>2037-2038 Heavy Winter</td>
<td>22HW2a</td>
<td>8/19/2016</td>
<td>R2.1.1, R2.4.1</td>
</tr>
<tr>
<td>Generation Dispatch Sensitivity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018 Heavy Summer, Low Hydro</td>
<td>17HS2a</td>
<td>9/22/2016</td>
<td>R2.1.1, R2.4.1</td>
</tr>
<tr>
<td>2022 Heavy Summer, Low Hydro</td>
<td>22HS2a</td>
<td>9/1/2016</td>
<td>R2.1.4 for R2.1.1 and R2.4.1</td>
</tr>
<tr>
<td>2027 Heavy Summer, Low Hydro</td>
<td>22HS2a</td>
<td>9/1/2016</td>
<td>R2.1.4 for R2.1.1</td>
</tr>
</tbody>
</table>
2 OUTAGES (TPL-001-4, R1.1.2)

2.1 Summary

- No known outages beyond the operations planning horizon will be included in the 2017 technical studies

2.2 Narrative
Known outages of generation or transmission facilities with a duration of at least six months need to be represented in the technical studies. Presently, Avista does not have planned outages outside the operations planning horizon. Long duration outages outside of Avista’s Transmission Planner or Planning Coordinator areas are typically modeled in WECC approved base cases.

3 PROJECTS (TPL-001-4, R1.1.3)

3.1 Summary

- Studies are conducted assuming no projects are constructed
- Project target in-service dates are used to evaluate acceptable performance

3.2 Narrative
All technical studies are performed assuming no projects are constructed within the planning horizon. After establishing a list of system deficiencies, new planned facilities and changes to existing facilities are represented to evaluate the impact to the deficiencies. The Transmission System models are updated to incorporate constructed projects if they are constructed prior to the finalization of the study plan.

4 NATIVE AND NETWORK LOADS (TPL-001-4, R1.1.4)

4.1 Summary

- Most recent Integrated Resource Plan (IRP) will be used for native load forecast
- Balancing Authority Area (BAA) load combines native load and Network Load
Projected spot customer growth is not included in the forecast

4.2 Narrative

Load forecasts incorporating all BAA load are developed according to the process outlined in the internal document *TP-SPP-07 – Loads and Resources Data for Steady State and Dynamic Studies Preparation*. Spot customer growth and the associated new distribution stations are not included in the technical studies. Figure 2 illustrates the native load forecast as provided in the 2015 Avista Integrated Resource Plan.

![Figure 2: 2016 Avista Electric Integrated Resource Plan Peak Native Load Forecast with 1 in 20 High/Low Bounds, 2017-2042.](image)

The BAA load forecast includes Avista’s native load forecast and Network Loads represented by the Bonneville Power Administration. Figure 3 provides the BAA load forecast to be used in the technical studies.
FIGURE 3: ACTUAL AND FORECASTED PEAK BALANCING AUTHORITY AREA LOAD.
5 ADDITIONAL TRANSMISSION USES (TPL-001-4, R1.1.5)

5.1 Summary
- No Transmission Service requests will be included in the 2017 technical studies

5.2 Narrative
Any known commitments for Firm Transmission Service and interchange are included in the technical studies. Developing sensitivity cases with WECC Rated Paths at their limits represents scenarios with all existing known commitments modeled. Future commitments that may exceed the limit of a WECC Rated Path are not studied. Avista’s current queue of Transmission Service requests is used to identify potential future commitments.

6 RESOURCES (TPL-001-4, R1.1.6)

6.1 Summary
- No future generation resources are included in the 2017 technical studies
- Resource dispatch is based on historical data

6.2 Narrative
Generation dispatch scenarios are developed according to the process outlined in the internal document TP-SPP-07 – Loads and Resources Data for Steady State and Dynamic Studies Preparation. Each dispatch scenario is developed based on historical data and is intended to represent typical operating conditions.

Only potential generation projects in Avista’s queue of generation interconnection requests that have executed an Interconnection Agreement are modeled (with corresponding upgrades) in the base cases for technical studies. There are presently no potential generation projects with executed Interconnection Agreements. The preferred resource strategy from the 2015 Avista IRP is not represented in the technical studies.

Figure 4 illustrates the comparison of the summer scenarios modeled to the historical BAA load and BAA interchange excluding dynamic imports used in the 2016 technical studies. The 2017 technical studies will include similar summer scenarios.
7 CRITERIA (TPL-001-4, R5, R6)

7.1 Summary
- NERC Standard TPL-001-4 provides the baseline performance criteria
- Emergency ratings are not used in the planning horizon
- Operating procedures (applied in the pre-contingent case) may be evaluated to achieve performance criteria

7.2 Narrative
The criteria used in evaluating the performance of the Transmission System are the current North American Electric Reliability Corporation (NERC) Reliability Standards, WECC regional criterion and internal Avista policies, including the following:

- TPL-001-WECC-CRT-3 – Transmission System Planning Performance
- TPL-001-4 – Transmission System Planning Performance Requirements
- FAC-010 – System Operating Limit Methodology for the Planning Horizon
- TP-SPP-01 – Avista Bulk Power System Planning Standards

Table 3 provides a summary of the Transmission System performance criteria.
<table>
<thead>
<tr>
<th>Category</th>
<th>Initial Condition</th>
<th>Event</th>
<th>Fault Type</th>
<th>Thermal Performance</th>
<th>Voltage Performance</th>
<th>Transient Performance</th>
<th>Interruption of Firm Transmission Service Allowed*</th>
<th>Non-Consequential Load Loss Allowed*</th>
<th>Steady State Consequential Load Loss**</th>
<th>Operating Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P0 - No Contingency</strong></td>
<td>Normal System</td>
<td>None</td>
<td>N/A</td>
<td>&lt; 80% Continuous Rating*</td>
<td>0.95 &lt; Avista 115 kV &lt; 1.05</td>
<td>0.95 &lt; Avista 230 kV &lt; 1.05</td>
<td>0.99 &lt; 500 kV &lt; 1.11</td>
<td>0.95 &lt; All Other &lt; 1.05</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>P1 - Single Contingency</strong></td>
<td>Normal System</td>
<td>Loss of one of the following: 1. Generator 2. Transmission Circuit 3. Transformer 4. Shunt Device</td>
<td>3Φ</td>
<td>0.95 &lt; Avista 115 kV &lt; 1.05 0.95 &lt; Avista 230 kV &lt; 1.05 0.99 &lt; 500 kV &lt; 1.11 0.95 &lt; All Other &lt; 1.05</td>
<td>No BES generator shall lose synchronism*</td>
<td>Same requirements as P2-P7$^{**}$</td>
<td>No</td>
<td>No</td>
<td>&lt; 75 MW$^{**}$</td>
<td>Stakeholder process must be followed for any non-consequential load loss</td>
</tr>
<tr>
<td><strong>P2 - Single Contingency</strong></td>
<td>Normal System</td>
<td>Opening of a line section w/o a fault</td>
<td>N/A</td>
<td>0.95 &lt; Avista 115 kV &lt; 1.05 0.95 &lt; Avista 230 kV &lt; 1.05 0.99 &lt; 500 kV &lt; 1.11 0.95 &lt; All Other &lt; 1.05</td>
<td>&lt; 8% deviation (load stations)*</td>
<td>Positive damping within 30 seconds</td>
<td>Yes</td>
<td>Yes</td>
<td>&lt; 200 MW$^{**}$</td>
<td>No pre-contingency non-consequential load loss</td>
</tr>
<tr>
<td><strong>P3 - Multiple Contingency</strong></td>
<td>Loss of generator unit (no System adjustments)</td>
<td>Loss of one of the following: 1. Generator 2. Transmission Circuit 3. Transformer 4. Shunt Device</td>
<td>3Φ</td>
<td>&lt; 100% Continuous Rating*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Same as P1 and P2.1</td>
</tr>
<tr>
<td><strong>P4 - Multiple Contingency</strong></td>
<td>Normal System</td>
<td>Loss of multiple elements caused by a stuck breaker (non-Bus-tie Breaker) attempting to clear a fault on one of the following: 1. Generator 2. Transmission Circuit 3. Transformer 4. Shunt Device 5. Bus Section 6. Loss of multiple elements caused by a stuck breaker (Bus-tie Breaker) attempting to clear a fault on the associated bus</td>
<td>SLG</td>
<td>0.95 &lt; Avista 115 kV &lt; 1.05 0.95 &lt; Avista 230 kV &lt; 1.05 0.99 &lt; 500 kV &lt; 1.11 0.95 &lt; All Other &lt; 1.05</td>
<td></td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>&lt; 200 MW$^{**}$</td>
<td>Same as P2-P2.4</td>
</tr>
<tr>
<td><strong>P5 - Multiple Contingency</strong></td>
<td>Normal System</td>
<td>Delayed Fault Clearing due to the failure of a non-redundant relay protecting the Faulted element to operate as designed, for one of the following: 1. Generator 2. Transmission Circuit 3. Transformer 4. Shunt Device 5. Bus Section</td>
<td>SLG</td>
<td>0.95 &lt; Avista 115 kV &lt; 1.05 0.95 &lt; Avista 230 kV &lt; 1.05 0.99 &lt; 500 kV &lt; 1.11 0.95 &lt; All Other &lt; 1.05</td>
<td></td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>P6 - Multiple Contingency</strong></td>
<td>Normal System</td>
<td>Loss of any two adjacent circuits on common structure</td>
<td>3Φ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt; 150 MW$^{**}$</td>
<td>No non-consequential load loss allowed as system adjustment for initial condition</td>
</tr>
<tr>
<td><strong>P7 - Multiple Contingency</strong></td>
<td>Normal System</td>
<td>The loss of any two adjacent circuits on common structure</td>
<td>SLG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt; 200 MW$^{**}$</td>
<td>Same as P2-P2.4</td>
</tr>
</tbody>
</table>

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* Fault Type
+ Thermal Performance
- Voltage Performance
< Continuous Rating
** Steady State Consequential Load Loss

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TABLE 3: TRANSMISSION SYSTEM PERFORMANCE CRITERIA FOR THE PLANNING HORIZON (TPL-401-4, R5)
i TPL-001-4 Table 1 defines requirements for interruption of Firm Transmission Service.

ii TPL-001-4 Table 1 defines requirements for non-consequential load loss. Footnote 12 from Table 1 is not repeated intentionally to state Avista will not pursue the use of non-consequential load loss for P1, P2.1 and P3 events in the Planning Horizon.

iii Steady state consequential load loss is an Avista criteria not required to be met for compliance with TPL-001-4, Attachment K, or other regulatory standard.

iv 80% of continuous rating for thermal performance of a P0 condition was selected to provide some thermal capacity likely to be utilized during contingency events. Alternatively, 100% of continuous ratings could have been selected where contingency events will repeatedly cause criteria violations. 80% is also identified as an initial condition required to utilize emergency ratings of Avista owned transmission lines.

v Low voltage criteria for Avista 115 kV stations was selected to be 0.95 pu (109.3 kV) to align with Avista system operating procedure SOP-05 and associated SCADA alarm points. 0.95 pu allows for voltage drop across the distribution transformers and sufficient bandwidth for distribution voltage regulators to boost voltage to required service levels for customers. High voltage criteria for Avista 115 kV stations was selected to be 1.052 pu (121 kV) to represent the applicable facility ratings of 115 kV equipment.

vi Low voltage criteria for Avista 230 kV stations was selected to be 1.01 pu (232.3 kV) to align with Avista system operating procedure SOP-05 and associated SCADA alarm points. Operating above 1.01 pu on the 230 kV system pre-contingency allows for reliable operation of the 115 kV system following contingency events. High voltage criteria for Avista 230 kV station was selected to be 1.052 pu (242 kV) to represent the applicable facility ratings of 230 kV equipment.

vii 500 kV voltage limits are selected to match criteria used in ColumbiaGrid Planning Assessments.

viii Non-Avista owned equipment voltage criteria are selected to be 0.95 pu to 1.05 pu to align with TPL-001-WECC-CRT-3.1 WR1.1.1.

ix 100% of continuous ratings for thermal performance of P1 – P7 events was selected to align with note f in Table 1 of TPL-001-4 which states “Applicable Facility Ratings shall not be exceeded.” Exceeding 100% of continuous ratings will need to be addressed by referencing a standing Operating Procedure or a Corrective Action Plan.

x Low voltage criteria for Avista 230 kV stations is changed from 1.01 pu to 0.95 pu (218.5 kV) for contingency events allowing operators to utilize the bandwidth reserved by operating above 1.01 pu pre-contingency.

xi TPL-001-WECC-CRT-3.1 WR1.2.

xii TPL-001-4 R4.1.1.

xiii TPL-001-WECC-CRT-3.1 WR1.3, 1.4, 1.5, 1.6

xiv 75 MW consequential load loss was selected for P1, P2.1, and P3 events to align with TPL-001-4 Table 1 footnote 12.

xv 200 MW consequential load loss was selected for P2, P4, P5, and P7 events as a meaningful substantive parameter to govern transmission system planning.

xvi 150 MW consequential load loss was selected for P6 events to represent the limit for two P1 events.
8 IDENTIFICATION OF ANALYTICAL TOOLS

The following analytical tools will be used to perform technical studies:

- **PowerWorld Simulator Software** – PowerWorld Simulator is an interactive power systems simulation package designed to simulate high voltage power systems operation on a time frame ranging from several minutes to several days. The software contains a highly effective power flow analysis package capable of efficiently solving systems with up to 100,000 buses using mathematical calculations based on system impedances, load levels and generation output. PowerWorld provides the user with a variety of sophisticated study tools such as an automated contingency processor, an Available Transfer Capability (ATC) tool, an Optimal Power Flow tools, various voltage stability tools (i.e. PV and QV tools), and a Transient Stability Analysis tool.
V TECHNICAL STUDIES

1 STEADY STATE CONTINGENCY ANALYSIS (TPL-001-4, R2.1, R3)

The contingencies evaluated for steady state studies are a standard contingency set used by Avista’s Transmission Planning Department, reviewed and updated annually. Documentation on the contingency set is outlined in the internal document TP-SPP-06 – Contingency Analysis. The standard contingency set includes outages in Avista’s Transmission System as well as outages in adjacent Planning Coordinator and Transmission Planner areas. TP-SPP-06 – Contingency Analysis provides a detailed explanation of the contingencies evaluated. Steady state studies are performed to determine whether the Bulk Electric System (BES)\(^5\) meets the performance requirements stated in Section IV-7 (TPL-001-4, R3.1, R3.4):

The steady state studies simulate the removal of all elements that the protection system and other automatic controls are expected to disconnect for each contingency without operator intervention. Transformer load tap changers and phase shifters within Avista’s Transmission System and those within neighboring systems are controlled by manual operator intervention. Shunt capacitors and reactors are allowed to switch in the studies at their automatic relay control points. (TPL-001-4, R3.3.1, R3.3.2)

Technical studies will include evaluating the tripping of generators where simulations show generator bus voltages or high side of the generation step up (GSU) voltages are less than known or assumed minimum generator steady state or ride through voltage limitations. Voltage ride through limits are monitored according to PRC-024 – Attachment 2. (TPL-001-4, R3.3.1.1)

Technical studies will include evaluating the tripping of transmission elements where relay loadability limits were exceeded. Transmission elements will be monitored at 115% of their maximum ratings. (TPL-001-4, R3.3.1.2)

2 SPARE EQUIPMENT ANALYSIS (TPL-001-4, R2.1.5)

Avista’s spare equipment strategy is summarized in Table 4 by identifying if the equipment can be replaced in less than one year. The 230/115 kV autotransformer spare equipment strategy is to purchase a new transformer upon failure resulting in potential lead times exceeding one year or more. Therefore, a study assessing the impact of the unavailability of transformers is conducted for each area. The study methodology involves each transformer in an area being taken out of service and all subsequent single transmission line, single transformer, bus outage, and breaker failure contingencies assessed (P0, P1, and P2) using the steady state

\(^5\) The Bulk Electric System is defined in the Glossary of Terms Used in NERC Reliability Standards
contingency analysis methodology described above. Only the Heavy Summer scenario in the five year planning horizon is studied.

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Spare available less than one year?</th>
<th>Replacement Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static VAR Compensators (SVC)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Series Capacitor Bank</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Shunt Capacitor</td>
<td>Yes</td>
<td>6 months</td>
</tr>
<tr>
<td>Shunt Reactor</td>
<td>Yes</td>
<td>9 months</td>
</tr>
<tr>
<td>Circuit Breaker</td>
<td>Yes</td>
<td>1-4 weeks</td>
</tr>
<tr>
<td>230/115 kV Autotransformer</td>
<td>No</td>
<td>12 months</td>
</tr>
<tr>
<td>Generator Step Up Transformer</td>
<td>Yes</td>
<td>3 months</td>
</tr>
<tr>
<td>Synchronous Condenser</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

TABLE 4: SPARE EQUIPMENT AVAILABILITY.

3 SHORT CIRCUIT ANALYSIS (TPL-001-4, R2.3)

A short circuit analysis will be performed to determine whether circuit breakers have interrupting capability for faults that they will be expected to interrupt with any planned generation and transmission facilities in service which could impact the study area. Balanced three phase faults will be simulated on all buses within Avista’s Planning Coordinator and Transmission Planner area using the same models developed for all other technical studies (protection specific models will not be used.) Simulations will be repeated in models representing the short and long term planning horizons with projects represented. Results will be provided to the appropriate interconnected parties (e.g. other Transmission Owners, load-serving utilities or Generating Facilities) for their use in assessing equipment interrupting capability. The Avista Protection Engineering group will be consulted for further guidance and to verify order of magnitude accuracy.

4 STABILITY CONTINGENCY ANALYSIS (TPL-001-4, R2.4, R4)

For the stability portion of the Planning Assessment, Avista performs contingency analysis based on computer simulation models. The same Transmission System models used for steady state contingency analysis will be used for stability contingency analysis. The loads represented include models which represent the expected dynamic behavior of loads that could impact the study area, considering the behavior of induction motor loads. WECC approved base cases have historically used an 80% induction motor load model. During 2014, WECC began to use the composite load model which more accurately captures the characteristics of the loads. (TPL-001-4, R2.4.1)

The contingencies evaluated for stability studies are a standard contingency set used by Avista’s Transmission Planning Department, reviewed and updated annually. The standard contingency set includes outages in Avista’s Transmission System as well as outages in adjacent Planning Coordinator and Transmission Planner areas. TP-SPP-06 – Contingency Analysis provides a detailed explanation of the contingencies evaluated. The stability studies are
performed to determine whether the BES meets the performance requirements stated in Section IV-7 (TPL-001-4, R4.1, R4.4):

Stability studies simulate the removal of all elements expected to disconnect for each contingency without operator intervention. Generator exciter control and power system stabilizers, static var compensators, power flow controllers and DC Transmission controllers are included in the simulations. (TPL-001-4, R4.3.1, R4.3.2)

Technical studies will include evaluating successful and unsuccessful high speed reclosing. Avista’s typical reclosing practice is to reclose at one second. (TPL-001-4, R4.3.1.1)

Technical studies will evaluate the tripping of generators where simulations show generator bus voltages or high side of the generation step up (GSU) voltages are less than known or assumed minimum generator steady state or ride through voltage limitations. Voltage ride through limits are monitored according to PRC-024 – Attachment 2 and then verified with actual data when limits are exceeded. (TPL-001-4, R4.3.1.2)

Technical studies will evaluate the tripping of transmission lines and transformers where transient swings cause protection system operation based on generic or actual relay models. (TPL-001-4, R4.3.1.3)

5 VOLTAGE STABILITY ANALYSIS

Steady state analysis techniques are used to evaluate the voltage stability performance of the transmission system. PV analysis of a particular area or of a particular transfer path reveals the static stability margin of the area or of the path under study.

A PV curve is obtained in steady state simulation by monitoring a voltage at a bus of interest and varying (increasing) the power (load or transfer) in small increments until power-flow divergence is encountered. Each equilibrium point represents a steady-state operating condition. For each area, all loads within the area were increased until voltage collapse occurred. An assumption was made that all additional generation necessary to supply the increase in load came from a distribution of all generation in WECC. Each area will include a Load Ramp PV Curve analysis with the five year heavy summer scenario. Transfer Path PV Curve analysis will be conducted on the sensitivity scenario representing WECC paths operating at their limits.

A set of contingencies depicting one or more transmission outages will be used to produce a series of PV curves for both the Load Ramp and Transfer Path PV Curve analysis. The operating limit can be established as the lowest of the following as obtained from the PV analysis results:

1. 5% below the area load magnitude at the ‘nose-point’ for Category P0 performance,

2. 5% below the area load magnitude at the ‘nose-point’ on the PV curve representing the worst Category P1 contingency,
3. 2.5% below the area load magnitude at the ‘nose-point’ on the PV curve representing the worst Category P2-P7 contingency.
## APPENDIX A - STAKEHOLDER COMMENTS

<table>
<thead>
<tr>
<th>Commenter</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avista Resource Planning</td>
<td>There is a 2016 IRP load forecast which includes an update from the 2015 forecast. The new forecast represents a smaller growth rate than previous years.</td>
</tr>
<tr>
<td></td>
<td>The 2016 IRP load forecast will be incorporated in the assumptions for the 2017 technical studies.</td>
</tr>
<tr>
<td>Avista Transmission Owner</td>
<td>It would be beneficial to document within the study plan how the performance criteria were selected. There is specific concern with specifying the new criteria for consequential load loss.</td>
</tr>
<tr>
<td></td>
<td>Documenting the methodology for selecting the performance criteria would be beneficial. The performance criteria table has been supplemented with the requested information including explaining the selection of consequential load loss amounts.</td>
</tr>
<tr>
<td>Avista Transmission Owner</td>
<td>The performance criteria table could be improved by distinguishing Avista specific criteria from regulatory designated criteria.</td>
</tr>
<tr>
<td></td>
<td>The performance criteria table has been updated to distinguish the regulatory designated criteria from Avista criteria.</td>
</tr>
<tr>
<td>Avista Transmission Owner</td>
<td>The short circuit analysis process should include coordinating with network customers connected to Avista’s transmission system so they can evaluate their equipment to the study results.</td>
</tr>
<tr>
<td></td>
<td>The short circuit analysis is a new analysis and the process is continuing to evolve as we gain experience. The short circuit analysis section of the study plan was updated with a minor change to include sharing the study results with Transmission Owners and other equipment owners. The addition of “other equipment owners” is intended to cover entities primarily focused on distribution level voltage class equipment but also own transformers connected to Avista’s 115 kV transmission system. It is expected to develop Corrective Action Plans (either Avista Transmission Owner or other entity) to mitigate available short circuit exceeding equipment ratings. The execution of the Corrective Action Plan and risks of not executing should be determined by the equipment owner. Clarification within Avista’s documentation may be helpful to ensure non-Avista equipment owners know who their Transmission Planner and Planning Coordinator are.</td>
</tr>
<tr>
<td>Avista Transmission Owner</td>
<td>Are Under Frequency Load Shedding (UFLS) trip points represented in the stability analysis performed and if so can the results be provided to review and coordinate relay protection settings if applicable?</td>
</tr>
<tr>
<td>Commenter</td>
<td>Comment</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>UFLS relays are represent in the models used for stability analysis. Data is collected through the PRC-006-WECC-CRT-2 data submittal process allowing the models used by Avista’s Transmission Planning group to include a complete interconnection-wide data set. We will work on sharing the results, specifically the instances when the models indicated the UFLS relays would function.</td>
<td></td>
</tr>
<tr>
<td>Avista Transmission Owner</td>
<td>The contingency list developed for steady state and stability analysis should be shared and coordinated with stakeholders including neighboring Planning Coordinators and Transmission Planners.</td>
</tr>
<tr>
<td>Avista Transmission Owner</td>
<td>The contingency list as documented in TP-SPP-06 – Contingency Analysis will be shared as suggested. Input received by stakeholders will be reviewed and the contingency list will be updated as appropriate.</td>
</tr>
<tr>
<td>Bonneville Power Administration</td>
<td>Is there a way to be notified when newly posted documentation related to Attachment K and announcements of meetings are put on Avista’s OASIS?</td>
</tr>
<tr>
<td>Avista Transmission Operator</td>
<td>There is presently no functionality on Avista’s OASIS to be automatically notified of newly posted information. Avista will determine if there is some process improvement to assist their customers and stakeholders.</td>
</tr>
<tr>
<td>Avista Transmission Operator</td>
<td>Year one winter scenarios should be clear on the year they are intended to represent. i.e. 2018-2019 Winter</td>
</tr>
<tr>
<td>Avista Transmission Operator</td>
<td>TPL-001-4 R2.1.1 allows the Planning Assessment analysis to include System peak Load for either Year One or year two. Avista Transmission Planning has historically selected Year One and intends to continue its past practice. For winter scenarios Year One is interpreted to be 2018-2019 winter for the 2017 study year. Table 2 has been update to clarify the intended years the winter scenarios will represent.</td>
</tr>
<tr>
<td>Avista Transmission Operator</td>
<td>The load represented in the transmission system models should not include an additional scale factor above the expected load forecast; specifically in the Year One scenarios.</td>
</tr>
<tr>
<td>Avista Transmission Operator</td>
<td>The transmission system models compiled for analysis do not include any intentional inflation of load represented in the model. The load forecast developed through the TP-SPP-07 – Loads and Resources Data for Steady State and Dynamic Studies is used directly in the models.</td>
</tr>
<tr>
<td>Avista Transmission Operator</td>
<td>Can you please provide further explanation on the load forecasting methodology? If the Integrated Resource Plan load forecast is used, there is some concern on its accuracy to represent the near term planning horizon.</td>
</tr>
</tbody>
</table>
### Commenter | Comment
--- | ---
The load forecasting process followed is documented in TP-SPP-07 – Loads and Resources Data for Steady State and Dynamic Studies. The Integrated Resource Plan load forecast is used to represent the sum of Avista native load. The Transmission Planning group is developing a model validation process as required by MOD-033. Through the model validation, there should be some definitive data on the accuracy of the load forecast used in the models.

Avista Transmission Operator | The Avista Transmission Operator uses 80% of facility ratings as alarms points and will take appropriate action following an alarm. Eighty percent of facility ratings is also the assumption for pre-loading of transmission lines to establish emergency ratings.

The thermal performance for a P0 event has been modified in Table 3 to reflect the 80% alarm point. It had previously stated 90% as the criteria.

Avista Transmission Operator | Does the criteria “No generator shall lose synchronism” for P1 and P2.1 transient performance include non-Bulk Electric System generators?

The criteria as drafted was unclear on inclusion of non-Bulk Electric System generators for the transient performance criteria of P1 and P2.1 events. Table 3 has been updated to state the criteria only applies to BES generators.

Avista Transmission Operator | The operating plan criteria for P1 and P2.1 events to have “no generator re-dispatch” seems un-aligned with existing practices. Please explain further.

The intent with stating “no generator re-dispatch” in the P1 and P2.1 operating plan section of Table 3 is to prevent relying on changing generation dispatch to reduce loading on facilities which had their continuous facility rating exceeded as a direct cause of the P1 or P2.1 event. Generator re-dispatch in preparation for the next credible outage is not intended to be prohibited.

Avista Transmission Operator | The use of the term emergency rating is suggested to be replaced with the term highest rating. It is possible to use of emergency ratings, specifically five minute ratings, will not be available in the future.

The term “emergency rating” used in the operating plans column of Table 3 has been replaced with “highest seasonal rating.”

Avista Transmission Operator | Please clarify if the NERC TPL Table 1 category P2.1 event includes only the open of a circuit breaker or if it also includes the opening of any transmission line section.
**Commenter**  | **Comment**  
--- | ---
Avista’s Transmission Planning group presently only studies the opening of circuit breakers for category P2.1 but recognizes there may be other rational applied to determine the appropriate events. Further documentation is provided in TP-SPP-06 – Contingency Analysis.

Avista Transmission Operator  | Does the annual Planning Assessment as described in the study plan also fulfill requirements of NERC Standard FAC-010? Specifically, does the contingency list used for analysis include the additional events provided in the WECC regional variance of FAC-010?

The contingency list developed for use in technical analysis is intended to cover both FAC-010 and TPL-001-4. TP-SPP-06 – Contingency Analysis Table 1 outlines the applicable standard requirement for each type of contingency defined.

Avista Transmission Operator  | Has there been consideration to establishing a limit on transmission service curtailment following an event?

The Avista Transmission Planning group or any other group has not established a limit for transmission service curtailment following an event and does not have plans to establish a limit in the future. Further discussion may be warranted.

Avista Transmission Operator  | Why do the transmission planning studies vary from the WECC process for voltage stability?

Avista Transmission Planning uses the WECC Criterion TPL-001-WECC-CRT-3.1 WR5 to identify voltage stability.