APPENDIX A CONNECTION ASSESSMENT

Engineering Connection Assessment

Garden Plain Wind Power Project

TransAlta Corporation

AESO Project 1909

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NOTE:

The conclusions and recommendations in this report are based on the results presented in *Attachment A: Engineering Connection Assessment: Study Results*, which was prepared by a third party consultant in accordance with the AESO Connection Process.

The AESO has reviewed the *Engineering Connection Assessment: Study Results*, and finds it acceptable for the purpose of assessing the potential impacts of the proposed connection on the performance of the Alberta interconnected electric system.

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Attachments

Attachment A: Engineering Connection Assessment Results

1 Introduction

This AESO Engineering Connection Assessment describes the engineering studies that were completed to assess the impact of the Project (as defined below) on the performance of the Alberta interconnected electric system (AIES). This report also provides the AESO's conclusions and recommendations based on the results of the engineering studies.

Attached to this Engineering Connection Assessment are the results of the engineering studies (see Attachment A) and the scope and methodology used to perform the studies (see Attachment A1 to Attachment A). These attachments provide details regarding the technical criteria, assumptions, and methods for performing these engineering studies, and the results of the engineering studies.

1.1 Project Overview

TransAlta Corporation (Market Participant) has submitted a request for system access service to the Alberta Electric System Operator (AESO) to connect its proposed Garden Plain Wind Power Project (Facility) to the AIES in the Castor area. The Facility is located in the AESO planning area of Hanna (Area 42). The Facility includes the proposed collector substation, to be designated the Garden Plain 1045S substation.

The Market Participant's request includes: a request for a new system access service in the area, with a Rate STS, *Supply Transmission Service*, contract capacity of 130 MW and a Rate DTS, *Demand Transmission Service*, contract capacity of 4 MW; and a request for transmission development (collectively, the Project).

The scheduled in-service date (ISD) for the Project is July 1, 2022.

2 Assessment Scope

2.1 Objectives

The objectives of the AESO Engineering Connection Assessment are as follows:

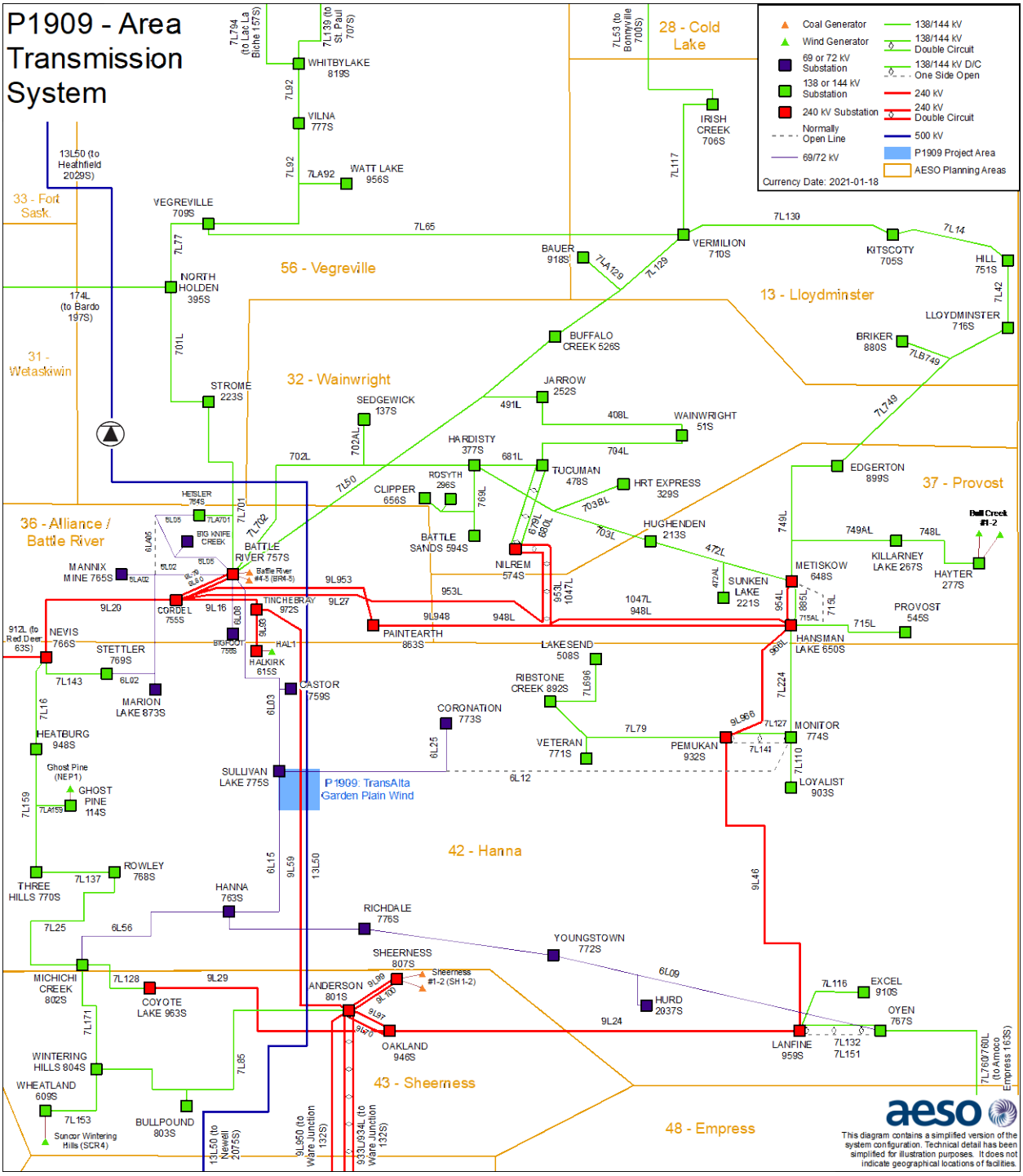
- Assess the impact of the Project on the performance of the AIES.
- Evaluate Project connection alternatives and identify the AESO's preferred alternative.
- Recommend mitigation measures, if required, to reliably connect the Project to the AIES.
- Identify Project dependencies, including any TFO projects or AESO plans to expand or enhance the transmission system that must be completed prior to connection.

2.2 Existing System

Geographically, the Project is located in the AESO planning area of Hanna (Area 42), which is part of the AESO Central planning region. The region is served by 240 kV, 138/144kV and 69/72kV transmission networks.

The existing transmission system in the Study Area is shown in Figure 2-1.

Figure 2-1: Existing transmission system in the Study Area



2.3 Study Area

The Study Area consists of the AESO Planning areas of Lloydminster (Area 13), Wainwright (Area 32), Alliance/Battle River (Area 36), Provost (Area 37), Hanna (Area 42), Sheerness (Area 43), and Vegreville (Area 56), including the tie lines connecting these planning areas to the rest of the AIES. All transmission facilities within the Study Area will be studied and monitored for violations of the Reliability Criteria (defined in Section 3.1 of Attachment A1).

3 Connection Alternatives

3.1 Overview

The AESO, in consultation with the TFO in the Study Area and the Market Participant, examined two transmission alternatives to meet the Market Participant's request for system access service, as detailed in Section 3.2.

3.2 Connection Alternatives Examined

Below is a description of the developments associated with the transmission alternatives that were examined for the Project.

Alternative 1 – In-and-out connection to the 240 kV transmission line 9L59

This connection alternative includes the following developments:

- Add a new switching station, including three 240 kV circuit breakers.
- Add two 240 kV transmission circuits to connect the new switching substation to the existing transmission line 9L59 (between the Tincherbray 972S and Anderson 801S substations) using an in-and-out configuration.
- Add a 240 kV circuit, approximately 160 metres[1] in length, to connect the approved Facility to the proposed switching substation using a radial configuration; and
- Add or modify associated equipment as required for the above transmission developments.

The proposed connection configuration is shown in Figure 3-1.

Alternative 2 – T-tap connection to the 240 kV transmission line 9L59

This connection alternative includes the following developments:

- Add one 240 kV transmission circuit, approximately 160 metres[2] in length, to connect the Facility to the existing 240 kV transmission line 9L59 using a T-tap configuration.
- Add or modify associated equipment as required for the above transmission developments.

The proposed connection configuration is shown in Figure 3-2.

[1] Exact line length to be determined by the TFO

[2] Exact line length to be determined by the TFO

Figure 3-1: Connection Alternative 1

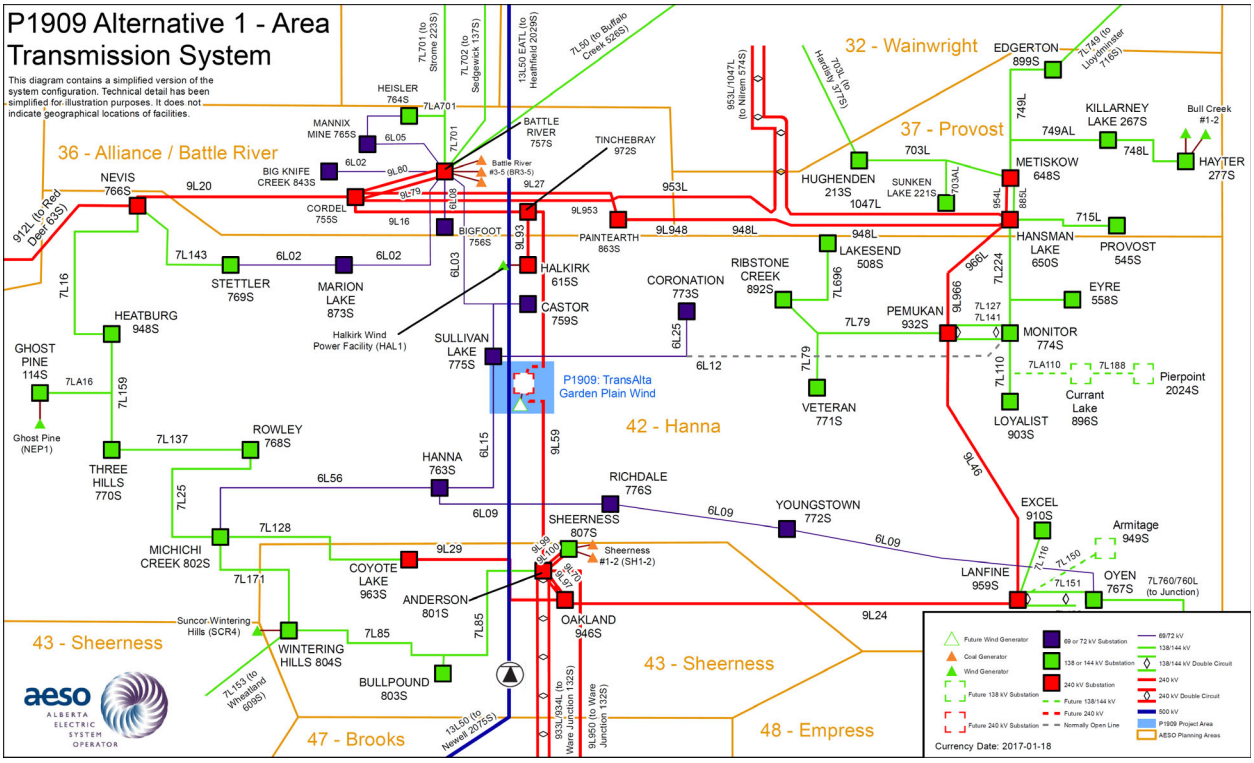
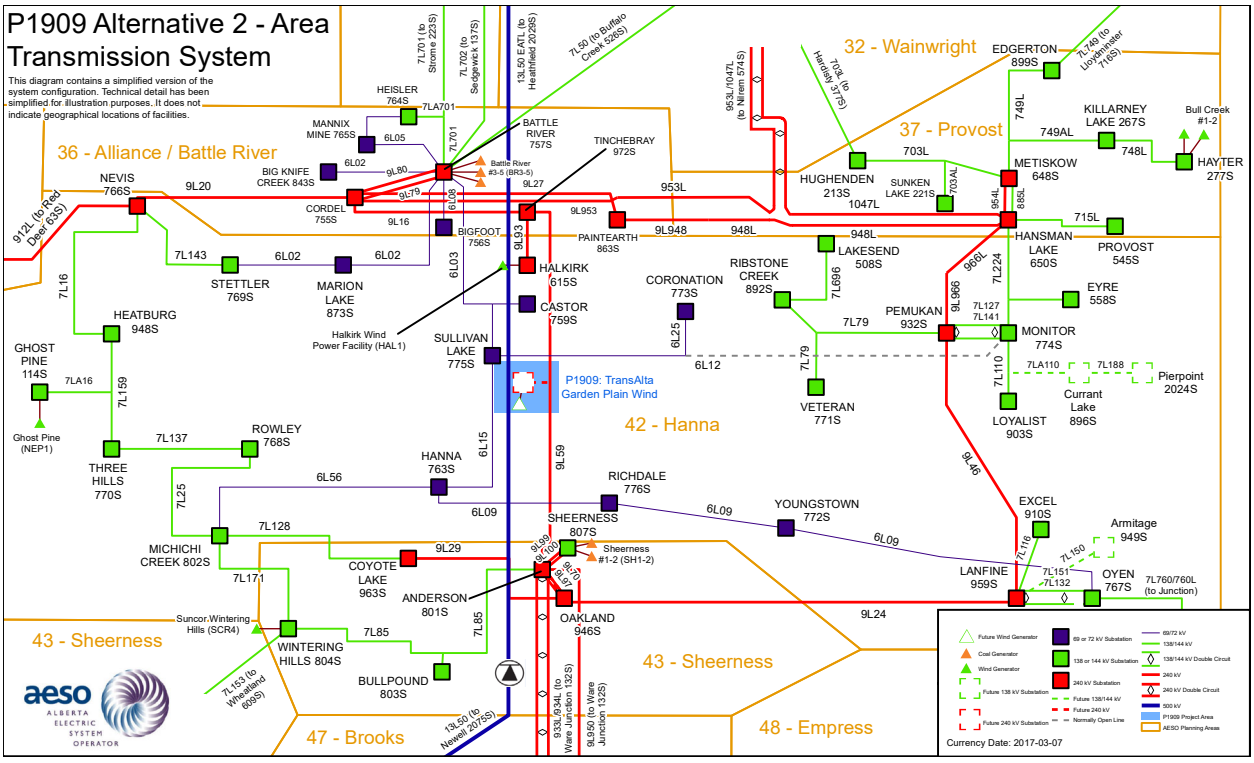


Figure 3-2: Connection Alternative 2



3.3 Connection Alternatives Selected for Further Study

Alternative 2 is considered technically feasible and was selected for further study.

3.4 Connection Alternatives Not Selected for Further Study

Alternative 1 would involve increased transmission development and hence, increased cost compared to Alternative 2. Therefore, Alternative 1 was not selected for further study.

4 Assessment Approach

4.1 Standards, Criteria and Assumptions

A detailed description of the standards, criteria, and assumptions that were used for the connection assessment is provided in Attachment A (see Attachment A1).

4.2 Studies Performed

When the base scenarios (Scenarios 1 – 7) were studied, the scheduled ISD for the Project was June 20, 2020. Therefore, base scenario studies were performed using scenarios for 2020 Summer Peak (SP), Summer Light (SL), and Winter Peak (WP). Sensitivity scenarios (Scenario 8 - 10) that included the Paintearth Wind Project Connection (AESO project 1704) and the Provost to Edgerton and Nilrem to Vermilion (PENV) Transmission Development system project, were also studied. SP was the only season studied in the sensitivity scenarios, as the most severe constraints were observed during SP.

After the studies for Scenario 1 to Scenario 10 were completed, the scheduled ISD was changed to October 1, 2021. To assess whether the mitigations assigned in the Scenarios 1 to 10 would still be effective, post-project sensitivity studies were added (Scenarios 11 to 13) to study the new ISD, renewable (wind and solar) project additions (P2009, P1812, and P1879), and the impacts of the PENV Transmission Development system project and the Central East Transfer-out (CETO) Transmission Development system project. As pre-Project to post-Project comparisons were already conducted in Scenario 1 to Scenario 10 studies (to determine required mitigation), only post-Project scenarios were studied. SP was the only season studied due to the most severe constraints being observed during SP.

After all the scenario studies were completed, the scheduled ISD was changed to July 1, 2022. The AESO determined that the ISD change would not have a material impact on the connection alternative and the mitigation measures and the conclusions for the base and sensitivity scenario studies conducted.

Short-circuit studies were performed using the 2020 WP and the 2028 WP scenarios.

Table 4-1 lists the study scenarios. Post-Project scenarios reflect the requested Rate STS contract capacity of 130 MW.

Table 4-1: Connection Study Scenarios

Scenario No.	Year/Season	System Generation Dispatch Conditions	Scenario Name	Project Load (MW)	Project Generation (MW)
Pre-Project Base Scenarios					
1	2020 SL	High Wind (HW), Economic Coal (EC)	2020 SL Pre-Project	0	0
2	2020 SP		2020 SP Pre-Project	0	0
3	2020 WP		2020 WP Pre-Project	0	0
Post-Project Base Scenarios					
4	2020 SL	HW, EC	2020 SL Post-Project	0	130
5	2020 SP		2020 SP Post-Project	0	130

Scenario No.	Year/Season	System Generation Dispatch Conditions	Scenario Name	Project Load (MW)	Project Generation (MW)
6	2020 WP		2020 WP Post-Project	0	130
7	2028 WP	All generation in the Study Area in-service	2028 WP Post-Project	0	130
Pre-Project Sensitivity Scenarios with P1704[a]					
8	2020 SP	HW, EC	2020 SP Pre-Project Wind (P1704)	0	0
Post-Project Sensitivity Scenarios with P1704					
9	2020 SP	HW, EC	2020 SP Post-Project Wind (P1704)	0	130
10			2020 SP Post-Project Wind (P1704) and PENV	0	130
Post-Project Sensitivity Scenarios with additional generation projects: P1879,[b] P1812,[c] and P2009[d]					
11	2021 SP	HW, EC	2021 SP Post-Project with additional generation projects	0	130
12			2021 SP Post-Project with additional generation projects and PENV	0	130
13			2021 SP Post-Project with Additional generation projects, PENV and CETO	0	130

Notes:

[a] Paintearth Wind Power Connection (AESO project 1704). AUC decision 23206-D01-2021.

[b] Claresholm Solar Connection (AESO project 1879). AUC decision 24679-D01-2019.

[c] Suncor Forty Mile Granlea WAGF Connection (AESO project 1812). AUC decision 24120-D01-2019.

[d] Greengate Travers MPC Solar Connection (AESO project 2009). AUC decision 24848-D01-2019.

The AESO Planning Region load forecasts used for the base scenarios (Scenarios 1 to 7) and the sensitivity scenarios with P1704 (Scenarios 8 to 10) were based on the *2017 Long-Term Outlook* (2017 LTO).

The AESO has updated its regional forecasts since the base connection studies were performed. The AESO determined that the use of the current AESO forecast would not materially alter the connection study results (in terms of alternative selection) or affect the conclusions and recommendations in this report. However, given that the ISD of the Project changed, the AESO determined that post-Project sensitivities were required, as explained above. The updated 2019 LTO was available when the new studies were scoped, therefore the 2019 LTO was used for the sensitivity scenarios with additional generation projects (Scenarios 11 to 13).

4.2.1 Power Flow Studies

The purpose of the power flow studies is to identify and quantify any thermal and voltage criteria violations in the Study Area.

In addition, power flow studies are also used to identify point of delivery (POD) low voltage bus voltage deviations beyond the limits listed in Table 3-1 of Attachment A1.[3]

Power flow studies were performed for the Scenarios 1 - 6, and 8 – 13.

4.2.2 Transient Stability Studies

The purpose of the transient stability studies is to assess the post-Project stability of the transmission system after three-phase to ground faults are applied on select transmission lines in the Study Area.

Transient stability studies were performed for the Scenario 6.

4.2.3 Short-Circuit Current Level Studies

The purpose of short-circuit current level studies is to determine the expected system short-circuit current levels in the vicinity of the Project.

Short circuit studies were performed for the Scenarios 3, 6, and 7.

4.3 Mitigation Measure Development and Evaluation

As explained in Section 6 of Attachment A1, mitigation measures were developed to address system performance issues that were identified in the post-Project scenarios. Studies performed to assess the effectiveness of mitigation measures are briefly outlined below.

4.3.1 Post-Mitigation Studies

Power flow studies were performed to assess the impact of the Project on the performance of the AIES following the implementation of the AESO's proposed mitigation measures.

4.3.2 Constraint Effective Factor Studies

Constraint effective factor studies were used to determine the generator and load constraint effective factors and to identify the most effective generators or loads to manage thermal criteria violations that were observed under Category B conditions.

[3] The AESO's desired post-contingency voltage deviations for low voltage busses represent guidelines rather than criteria. A POD bus voltage deviation that exceeds the desired limits shown in Table 3-1 of Attachment A1 does not represent a Reliability Criteria violation. Mitigation measures would not be developed to specifically address POD bus voltage deviations that exceed the desired values in Table 3-1 of Attachment A1.

5 Interpretation of Results

5.1 Results Overview

This section provides an assessment of the impact of the Project on the performance of the AIES. The Reliability Criteria violations observed during the connection assessment studies, and the proposed mitigation measures are summarized in Table 5-1, Table 5-2, and Table 5-3.

- Section 5.2 includes an overview of the studies results.
- Section 5.3 includes an overview of the post-mitigation studies results.

Detailed study results are provided in Attachment A.

Table 5-1: Summary of Reliability Criteria Violations, Project Impact and Mitigation Measures based on the Base Study Scenarios (Scenarios 1 - 6)

Scenario	Type of Reliability Criteria Violation		Contingency (System Element Lost)	Details of Violation	Project Impact	Pre-Project Mitigation Measures	Post-Project Mitigation Measures
	Pre-Project	Post-Project					
2020 SL	No violation	Thermal - above emergency rating	9L20 (Nevis 766S - Cordel 755S)	901T (Nevis 766S 240/138 kV Transformer)	New violation	None	Modified planned RAS 139
	Thermal - above emergency rating	Thermal - above emergency rating	9L20 (Nevis 766S - Cordel 755S)	901T (Nevis 766S 240/138 kV Transformer)	Materially increased violation	Planned RAS 138, 139	Modified planned RAS 134, 138, 139
	No violation	Thermal - above normal rating	9L20 (Nevis 766S - Cordel 755S)	7L16 (Nevis 766S - Heatburg 948S)	New violation	None	Modified planned RAS 134, 138, 139
	Thermal - above normal rating	Thermal - above normal rating	9L20 (Nevis 766S - Cordel 755S)	7L159 (Ghost Pine 114S - Heatburg 948S)	Materially increased violation	Planned RAS 138, 139	Modified planned RAS 134, 138, 139
	No violation	Thermal - above normal rating	9L20 (Nevis 766S - Cordel 755S)	701L (North Holden 395S- Strome 223S)	New violation	None	Modified planned RAS 134, 138, 139
	Thermal - above normal rating	Thermal - above normal rating	9L20 (Nevis 766S - Cordel 755S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Materially increased violation	Planned RAS 138, 139	Modified planned RAS 134, 138, 139
	No violation	Thermal - above normal rating	912L/9L912 (Red Deer 63S - Nevis 766S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	New violation	None	Modified planned RAS 134, 138
	Thermal - above normal rating	Thermal - above emergency rating	912L/9L912 (Red Deer 63S - Nevis 766S)	701L (North Holden 395S- Strome 223S)	Materially increased violation	Planned RAS 134, 138	Modified planned RAS 134, 138
	Thermal - above normal rating	Thermal - above emergency rating	912L/9L912 (Red Deer 63S - Nevis 766S)	174L (Bardo 197S - North Holden 395S)	Materially increased violation	Planned RAS 134, 138	Modified planned RAS 134, 138
	Thermal - above normal rating	Thermal - above normal rating	912L/9L912 (Red Deer 63S - Nevis 766S)	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	Materially increased violation	Planned RAS 134, 138	Modified planned RAS 134, 138
	Thermal - above normal rating	Thermal - above emergency rating	912L/9L912 (Red Deer 63S - Nevis 766S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Materially increased violation	Planned RAS 134, 138	Modified planned RAS 134, 138
	Thermal - above normal rating	Thermal - above normal rating	7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Materially increased violation	Planned RAS 138	Modified planned RAS 138
	Thermal - above normal rating	Thermal - above normal rating	966L/9L966 (Hansman Lake 650S - Pemukan 932S)	7L224 (Monitor 774S - Hansman Lake 650S)	Marginally reduced violation	Real-time operational practices	Real-time operational practices
2020 SP	No violation	Thermal - above normal rating	701L (North Holden 395S- Strome 223S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	New violation	None	Modified planned RAS 138
	No violation	Thermal - above normal rating	7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	New violation	None	Real-time operational practices
	Thermal - above normal rating	Thermal - above emergency rating	749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Materially increased violation	Planned RAS 138	Modified planned RAS 138
	Thermal - above normal rating	Thermal - above normal rating	7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Materially increased violation	Planned RAS 138	Modified planned RAS 138
	Thermal - above normal rating	Thermal - above normal rating	EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	Materially increased violation	Planned RAS 134, 138	Modified planned RAS 134, 138, 139
	No violation	Thermal - above emergency rating	EATL HVDC	901T (Nevis 766S 240/138 kV Transformer)	New violation	None	Modified planned RAS 134, 138, 139
	Thermal - above normal rating	Thermal - above emergency rating	EATL HVDC	912L/9L912 (Red Deer 63S - Nevis 766S)	Materially increased violation	Planned RAS 134, 138	Modified planned RAS 134, 138, 139
	No violation	Thermal - above normal rating	EATL HVDC	7L16 (Nevis 766S - Heatburg 948S)	New violation	None	Modified planned RAS 134, 138, 139
	Thermal - above normal rating	Thermal - above normal rating	EATL HVDC	704L (Wainwright 51S - Tucuman 478S)	Marginally increased violation	Planned RAS 134, 138	Modified planned RAS 134, 138, 139
	Thermal - above normal rating	Thermal - above normal rating	EATL HVDC	7L159 (Ghost Pine 114S - Heatburg 948S)	Marginally increased violation	Planned RAS 134, 138	Modified planned RAS 134, 138, 139
	Thermal - above emergency rating	Thermal - above emergency rating	EATL HVDC	701L (North Holden 395S- Strome 223S)	Materially increased violation	Planned RAS 134, 138	Modified planned RAS 134, 138, 139
	Thermal - above normal rating	Thermal - above normal rating	EATL HVDC	174L (Bardo 197S - North Holden 395S)	Materially increased violation	Planned RAS 134, 138	Modified planned RAS 134, 138, 139
	Thermal - above normal rating	Thermal - above normal rating	EATL HVDC	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	Materially increased violation	Planned RAS 134, 138	Modified planned RAS 134, 138, 139
	Thermal - above emergency rating	Thermal - above emergency rating	EATL HVDC	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Marginally increased violation	Planned RAS 134, 138	Modified planned RAS 134, 138, 139

Scenario	Type of Reliability Criteria Violation		Contingency (System Element Lost)	Details of Violation	Project Impact	Pre-Project Mitigation Measures	Post-Project Mitigation Measures
	Pre-Project	Post-Project					
	No violation	Thermal - above normal rating	766S901T (Nevis 766S 240/138 kV Transformer)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	New violation	None	Modified planned RAS 134, 138
	Thermal - above normal rating	Thermal - above emergency rating	766S901T (Nevis 766S 240/138 kV Transformer)	701L (North Holden 395S- Strome 223S)	Materially increased violation	Planned RAS 134, 138	Modified planned RAS 134, 138
	Thermal - above normal rating	Thermal - above emergency rating	766S901T (Nevis 766S 240/138 kV Transformer)	174L (Bardo 197S - North Holden 395S)	Materially increased violation	Planned RAS 134, 138	Modified planned RAS 134, 138
	Thermal - above normal rating	Thermal - above normal rating	766S901T (Nevis 766S 240/138 kV Transformer)	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	Materially increased violation	Planned RAS 134, 138	Modified planned RAS 134, 138
	Thermal - above normal rating	Thermal - above emergency rating	766S901T (Nevis 766S 240/138 kV Transformer)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Materially increased violation	Planned RAS 134, 138	Modified planned RAS 134, 138
2020 WP	Thermal - above emergency rating	Thermal - above emergency rating	9L20 (Nevis 766S - Cordel 755S)	901T (Nevis 766S 240/138 kV Transformer)	Materially increased violation	Planned RAS 134, 139	Modified planned RAS 134, 139
	No violation	Thermal - above normal rating	9L20 (Nevis 766S - Cordel 755S)	701L (North Holden 395S- Strome 223S)	New violation	None	Modified planned RAS 134, 139
	Thermal - above normal rating	Thermal - above emergency rating	9L20 (Nevis 766S - Cordel 755S)	174L (Bardo 197S - North Holden 395S)	Materially increased violation	Planned RAS 13, 139	Modified planned RAS 134, 139
	No violation	Thermal - above normal rating	912L/9L912 (Red Deer 63S - Nevis 766S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	New violation	None	Modified planned RAS 134, 138
	Thermal - above normal rating	Thermal - above emergency rating	912L/9L912 (Red Deer 63S - Nevis 766S)	701L (North Holden 395S- Strome 223S)	Materially increased violation	Planned RAS 134	Modified planned RAS 134, 138
	Thermal - above emergency rating	Thermal - above emergency rating	912L/9L912 (Red Deer 63S - Nevis 766S)	174L (Bardo 197S - North Holden 395S)	Materially increased violation	Planned RAS 134	Modified planned RAS 134, 138
	Thermal - above emergency rating	Thermal - above emergency rating	912L/9L912 (Red Deer 63S - Nevis 766S)	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	Materially increased violation	Planned RAS 134	Modified planned RAS 134, 138
	No violation	Thermal - above normal rating	912L/9L912 (Red Deer 63S - Nevis 766S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	New violation	None	Modified planned RAS 134, 138
	Thermal - above normal rating	Thermal - above normal rating	7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	Marginally increased violation	Real-time operational practices	Real-time operational practices
	No violation	Thermal - above normal rating	7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)	7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	New violation	None	Real-time operational practices
	No violation	Thermal - above normal rating	7L129 (Vermilion 710S to Bauer 918S/Buffalo Creek 526S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	New violation	None	Real-time operational practices
	Thermal - above emergency rating	Thermal - above emergency rating	EATL HVDC	9L20 (Nevis 766S - Cordel 755S)	Materially increased violation	Planned RAS 134	Modified planned RAS 134, 138
	Thermal - above emergency rating	Thermal - above emergency rating	EATL HVDC	912L/9L912 (Red Deer 63S - Nevis 766S)	Materially increased violation	Planned RAS 134	Modified planned RAS 134, 138
	No violation	Thermal - above normal rating	EATL HVDC	704L (Wainwright 51S - Tucuman 478S)	New violation	None	Modified planned RAS 134, 138
	Thermal - above normal rating	Thermal - above normal rating	EATL HVDC	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	Marginally increased violation	Planned RAS 134	Modified planned RAS 134, 138
	Thermal - above normal rating	Thermal - above normal rating	EATL HVDC	701L (North Holden 395S- Strome 223S)	Materially increased violation	Planned RAS 134	Modified planned RAS 134, 138
	Thermal - above emergency rating	Thermal - above emergency rating	EATL HVDC	174L (Bardo 197S - North Holden 395S)	Materially increased violation	Planned RAS 134	Modified planned RAS 134, 138
	No violation	Thermal - above emergency rating	EATL HVDC	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	New violation	None	Modified planned RAS 134, 138
	No violation	Thermal - above normal rating	EATL HVDC	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	New violation	None	Modified planned RAS 134, 138
	No violation	Thermal - above normal rating	766S901T (Nevis 766S 240/138 kV Transformer)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	New violation	None	Modified planned RAS 134, 138
	Thermal - above normal rating	Thermal - above emergency rating	766S901T (Nevis 766S 240/138 kV Transformer)	701L (North Holden 395S- Strome 223S)	Materially increased violation	Planned RAS 134	Modified planned RAS 134, 138
	Thermal - above emergency rating	Thermal - above emergency rating	766S901T (Nevis 766S 240/138 kV Transformer)	174L (Bardo 197S - North Holden 395S)	Materially increased violation	Planned RAS 134	Modified planned RAS 134, 138
	Thermal - above emergency rating	Thermal - above emergency rating	766S901T (Nevis 766S 240/138 kV Transformer)	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	Materially increased violation	Planned RAS 134	Modified planned RAS 134, 138
	No violation	Thermal - above normal rating	766S901T (Nevis 766S 240/138 kV Transformer)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	New violation	None	Modified planned RAS 134, 138

Notes:

- Marginally increased or marginally decreased refers to a percent loading difference (post-Project percent loading minus pre-Project percent loading) below 3%.

- Materially increased or materially decreased refers to a percent loading difference (post-Project percent loading minus pre-Project percent loading) above or equal to 3%.
- RAS 134, 138, and 139 are existing RASs (see Section 1.2.2 of Attachment A1). Modifications to existing RAS 134, 138 and 139 were proposed for the approved Sharp Hills Wind Facility in the *Sharp Hills Wind Farm Connection NID*. These modified versions of RAS 134, 138 and 139 are referred to herein as “Planned RAS 134”, “Planned RAS 138”, and “Planned RAS 139.”
- “Modified” refers to adding the Project to the logic of the respective RAS

Table 5-2: Summary of Reliability Criteria Violations and Mitigation Measures based on the 2020 SP Sensitivity Study Scenarios with P1704 (Scenarios 8 -9). Impact of PENV (Scenario 10)

Type of Reliability Criteria Violation			Contingency (System Element Lost)	Details of Violation	Project Impact	PENV Impact	Pre-Project Mitigation Measures	Post-Project Mitigation Measures	Post-PENV Mitigation Measures
Pre-Project	Post-Project	Post-PENV							
Thermal - above normal rating	Thermal - above normal rating	No violation	7L42 (Hill 751S - Lloydminster 716S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Materially increased violation	Removed violation	Planned RAS 138	Modified planned RAS 138	None
Thermal - above normal rating	Thermal - above emergency rating	Thermal - above normal rating	9L20 (Nevis 766S - Cordel 755S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	Materially increased violation	Materially reduced violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139
Thermal - above emergency rating	Thermal - above emergency rating	Thermal - above emergency rating	9L20 (Nevis 766S - Cordel 755S)	901T (Nevis 766S 240/138 kV Transformer)	Materially increased violation	Materially reduced violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139
Thermal - above normal rating	Thermal - above normal rating	Thermal - above normal rating	9L20 (Nevis 766S - Cordel 755S)	7L16 (Nevis 766S - Heatburg 948S)	Materially increased violation	Marginally reduced violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139
Thermal - above normal rating	Thermal - above emergency rating	Thermal - above normal rating	9L20 (Nevis 766S - Cordel 755S)	7L159 (Ghost Pine 114S - Heatburg 948S)	Materially increased violation	Marginally reduced violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139
Thermal - above emergency rating	Thermal - above emergency rating	Thermal - above normal rating	9L20 (Nevis 766S - Cordel 755S)	701L (North Holden 395S- Strome 223S)	Materially increased violation	Materially reduced violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139
Thermal - above normal rating	Thermal - above emergency rating	Thermal - above emergency rating	9L20 (Nevis 766S - Cordel 755S)	174L (Bardo 197S - North Holden 395S)	Materially increased violation	Materially increased violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139
Thermal - above normal rating	Thermal - above emergency rating	Thermal - above normal rating	9L20 (Nevis 766S - Cordel 755S)	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	Materially increased violation	Materially reduced violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139
Thermal - above emergency rating	Thermal - above emergency rating	No violation	9L20 (Nevis 766S - Cordel 755S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Materially increased violation	Removed violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	None
Thermal - above normal rating	Thermal - above emergency rating	Thermal - above normal rating	912L/9L912 (Red Deer 63S - Nevis 766S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	Materially increased violation	Materially reduced violation	Planned RAS 134, 138	Modified planned RAS 134, 138	Modified planned RAS 134
No violation	Thermal - above normal rating	No violation	912L/9L912 (Red Deer 63S - Nevis 766S)	704L (Wainwright 51S - Tucuman 478S)	New violation	Removed violation	None	Modified planned RAS 134, 138	None
Thermal - above emergency rating	Thermal - above emergency rating	Thermal - above emergency rating	912L/9L912 (Red Deer 63S - Nevis 766S)	701L (North Holden 395S- Strome 223S)	Materially increased violation	Materially reduced violation	Planned RAS 134, 138	Modified planned RAS 134, 138	Modified planned RAS 134
Thermal - above emergency rating	Thermal - above emergency rating	Thermal - above emergency rating	912L/9L912 (Red Deer 63S - Nevis 766S)	174L (Bardo 197S - North Holden 395S)	Materially increased violation	Materially increased violation	Planned RAS 134, 138	Modified planned RAS 134, 138	Modified planned RAS 134
Thermal - above emergency rating	Thermal - above emergency rating	Thermal - above emergency rating	912L/9L912 (Red Deer 63S - Nevis 766S)	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	Materially increased violation	Materially reduced violation	Planned RAS 134, 138	Modified planned RAS 134, 138	Modified planned RAS 134
No violation	Thermal - above normal rating	No violation	912L/9L912 (Red Deer 63S - Nevis 766S)	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	New violation	Removed violation	None	Modified planned RAS 134, 138	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	912L/9L912 (Red Deer 63S - Nevis 766S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Materially increased violation	Removed violation	Planned RAS 134, 138	Modified planned RAS 134, 138	None
No violation	Thermal - above normal rating	No violation	912L/9L912 (Red Deer 63S - Nevis 766S)	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	New violation	Removed violation	None	Modified planned RAS 134, 138	None
No violation	No violation	No violation	9L16 (Cordel 755S - Tincherbray 972S)	901T (Nevis 766S 240/138 kV Transformer)	Materially increased violation	Removed violation	None	None	None
No violation	Thermal - above normal rating	Thermal - above normal rating	9L16 (Cordel 755S - Tincherbray 972S)	7L159 (Ghost Pine 114S - Heatburg 948S)	New violation	Marginally reduced violation	None	Real-time operational practices	Real-time operational practices
No violation	Thermal - above normal rating	No violation	912T (Battle River 757S 240/138 kV Transformer)	704L (Wainwright 51S - Tucuman 478S)	New violation	Removed violation	None	Real-time operational practices	None
No violation	Thermal - above normal rating	No violation	9L80 (Battle River 757S - Cordel 755S)	704L (Wainwright 51S - Tucuman 478S)	New violation	Removed violation	None	Real-time operational practices	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Materially increased violation	Removed violation	Planned RAS 138	Modified planned RAS 138	None
No violation	Thermal - above normal rating	No violation	7L77 (North Holden 395S - Vegreville 709S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	New violation	Removed violation	None	Modified planned RAS 138	None
Thermal - above normal rating	Thermal - above normal rating	No violation	701L (North Holden 395S- Strome 223S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Materially increased violation	Removed violation	Planned RAS 138	Modified planned RAS 138	None
Thermal - above normal rating	Thermal - above normal rating	No violation	7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	Marginally increased violation	Removed violation	Real-time operational practices	Real-time operational practices	None

Type of Reliability Criteria Violation			Contingency (System Element Lost)	Details of Violation	Project Impact	PENV Impact	Pre-Project Mitigation Measures	Post-Project Mitigation Measures	Post-PENV Mitigation Measures
Pre-Project	Post-Project	Post-PENV							
			526S)						
No violation	Thermal - above normal rating	No violation	7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)	7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	New violation	Removed violation	None	Real-time operational practices	None
No violation	Thermal - above normal rating	No violation	749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)	704L (Wainwright 51S - Tucuman 478S)	New violation	Removed violation	None	Modified planned RAS 138	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Materially increased violation	Removed violation	Planned RAS 138	Modified planned RAS 138	None
Thermal - above normal rating	Thermal - above emergency rating	No violation	7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Materially increased violation	Removed violation	Planned RAS 138	Modified planned RAS 138	None
Thermal - above emergency rating	Thermal - above emergency rating	Thermal - above normal rating	EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	Materially increased violation	Materially reduced violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139
Thermal - above emergency rating	Thermal - above emergency rating	Thermal - above emergency rating	EATL HVDC	901T (Nevis 766S 240/138 kV Transformer)	Marginally increased violation	Marginally increased violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139
Thermal - above emergency rating	Thermal - above emergency rating	Thermal - above emergency rating	EATL HVDC	9L20 (Nevis 766S - Cordel 755S)	Materially increased violation	Marginally reduced violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139
Thermal - above emergency rating	Thermal - above emergency rating	Thermal - above emergency rating	EATL HVDC	912L/9L912 (Red Deer 63S - Nevis 766S)	Materially increased violation	Materially reduced violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139
Thermal - above normal rating	Thermal - above normal rating	Thermal - above normal rating	EATL HVDC	7L16 (Nevis 766S - Heatburg 948S)	Marginally increased violation	Marginally reduced violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139
Thermal - above emergency rating	Thermal - above emergency rating	Thermal - above emergency rating	EATL HVDC	9L16 (Cordel 755S - Tincherbray 972S)	Materially increased violation	Marginally increased violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139
Thermal - above normal rating	Thermal - above normal rating	No violation	EATL HVDC	704L (Wainwright 51S - Tucuman 478S)	Marginally increased violation	Removed violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	None
Thermal - above normal rating	Thermal - above normal rating	No violation	EATL HVDC	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	Marginally increased violation	Removed violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	None
Thermal - above normal rating	Thermal - above normal rating	Thermal - above normal rating	EATL HVDC	7L159 (Ghost Pine 114S - Heatburg 948S)	Marginally increased violation	Marginally reduced violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139
Thermal - above emergency rating	Thermal - above emergency rating	Thermal - above emergency rating	EATL HVDC	701L (North Holden 395S- Strome 223S)	Materially increased violation	Materially reduced violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139
Thermal - above emergency rating	Thermal - above emergency rating	Thermal - above emergency rating	EATL HVDC	174L (Bardo 197S - North Holden 395S)	Materially increased violation	Materially increased violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139
Thermal - above emergency rating	Thermal - above emergency rating	Thermal - above normal rating	EATL HVDC	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	Materially increased violation	Materially reduced violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139
Thermal - above normal rating	Thermal - above normal rating	No violation	EATL HVDC	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	Marginally increased violation	Removed violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	EATL HVDC	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Materially increased violation	Removed violation	Planned RAS 134, 138, 139	Modified planned RAS 134, 138, 139	None
No violation	Thermal - above normal rating	No violation	EATL HVDC	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	New violation	Removed violation	None	Modified planned RAS 134, 138, 139	None
Thermal - above emergency rating	Thermal - above emergency rating	Thermal - above normal rating	766S901T (Nevis 766S 240/138 kV Transformer)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	Materially increased violation	Materially reduced violation	Planned RAS 134, 138	Modified planned RAS 134, 138	Modified planned RAS 134
No violation	Thermal - above normal rating	No violation	766S901T (Nevis 766S 240/138 kV Transformer)	704L (Wainwright 51S - Tucuman 478S)	New violation	Removed violation	None	Modified planned RAS 134, 138	None
Thermal - above emergency rating	Thermal - above emergency rating	Thermal - above emergency rating	766S901T (Nevis 766S 240/138 kV Transformer)	701L (North Holden 395S- Strome 223S)	Materially increased violation	Materially reduced violation	Planned RAS 134, 138	Modified planned RAS 134, 138	Modified planned RAS 134
Thermal - above emergency rating	Thermal - above emergency rating	Thermal - above emergency rating	766S901T (Nevis 766S 240/138 kV Transformer)	174L (Bardo 197S - North Holden 395S)	Materially increased violation	Materially increased violation	Planned RAS 134, 138	Modified planned RAS 134, 138	Modified planned RAS 134
Thermal - above emergency rating	Thermal - above emergency rating	Thermal - above emergency rating	766S901T (Nevis 766S 240/138 kV Transformer)	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	Materially increased violation	Materially reduced violation	Planned RAS 134, 138	Modified planned RAS 134, 138	Modified planned RAS 134
No violation	Thermal - above normal rating	No violation	766S901T (Nevis 766S 240/138 kV Transformer)	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	New violation	Removed violation	None	Modified planned RAS 134, 138	None

Type of Reliability Criteria Violation			Contingency (System Element Lost)	Details of Violation	Project Impact	PENV Impact	Pre-Project Mitigation Measures	Post-Project Mitigation Measures	Post-PENV Mitigation Measures
Pre-Project	Post-Project	Post-PENV							
Thermal - above emergency rating	Thermal - above emergency rating	No violation	766S901T (Nevis 766S 240/138 kV Transformer)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Materially increased violation	Removed violation	Planned RAS 134, 138	Modified planned RAS 134, 138	None
No violation	Thermal - above normal rating	No violation	766S901T (Nevis 766S 240/138 kV Transformer)	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	New violation	Removed violation	None	Modified planned RAS 134, 138	None

Notes:

- Marginally increased or marginally decreased refers to a percent loading difference (post-Project percent loading minus pre-Project percent loading) below 3%.
- Materially increased or materially decreased refers to a percent loading difference (post-Project percent loading minus pre-Project percent loading) above or equal to 3%.
- RAS 134, 138, and 139 are existing RASs (see Section 1.2.2 of Attachment A1). Modifications to existing RAS 134, 138 and 139 were proposed for the approved Sharp Hills Wind Facility in the *Sharp Hills Wind Farm Connection NID.* These modified versions of RAS 134, 138 and 139 are referred to herein as “Planned RAS 134”, “Planned RAS 138”, and “Planned RAS 139.”
- “Modified” refers to adding the Project to the logic of the respective RAS

Table 5-3: Summary of Reliability Criteria Violations and Mitigation Measures based on the 2021 SP Sensitivity Study Scenarios with Additional Generation Projects (Scenarios 11 -13). Imapct of PENV and CETO.

Type of Reliability Criteria Violation			Contingency (System Element Lost)	Details of Violation	PENV Impact	CETO Impact	Post-Project Mitigation Measures	Post-PENV Mitigation Measures	Post-CETO Mitigation Measures
Post-Project	Post-PENV	Post-CETO							
Thermal - above normal rating	No violation	No violation	7L14 (Kitscoty 705S - Hill 751S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Removed violation	None	Modified planned RAS 138	None	None
Thermal - above emergency rating	No violation	No violation	7L42 (Hill 751S - Lloydminster 716S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Removed violation	None	Modified planned RAS 138	None	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	9L20 (Nevis 766S - Cordel 755S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	Materially reduced	None	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	9L20 (Nevis 766S - Cordel 755S)	901T (Nevis 766S 240/138 kV Transformer)	Materially reduced	Removed violation	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139	None
Thermal - above normal rating	Thermal - above normal rating	No violation	9L20 (Nevis 766S - Cordel 755S)	7L16 (Nevis 766S - Heatburg 948S)	Marginally reduced	Removed violation	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139	None
Thermal - above normal rating	No violation	No violation	9L20 (Nevis 766S - Cordel 755S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	Removed violation	None	Modified planned RAS 134, 138, 139	None	None
Thermal - above emergency rating	Thermal - above normal rating	No violation	9L20 (Nevis 766S - Cordel 755S)	7L159 (Ghost Pine 114S - Heatburg 948S)	Marginally reduced	Removed violation	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	9L20 (Nevis 766S - Cordel 755S)	701L (North Holden 395S- Strome 223S)	Materially reduced	Removed violation	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	9L20 (Nevis 766S - Cordel 755S)	174L (Bardo 197S - North Holden 395S)	Materially increase	Removed violation	Modified planned RAS 134, 138, 139	Modified Planned RAS 134, 139	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	9L20 (Nevis 766S - Cordel 755S)	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	Materially reduced	Removed violation	Modified planned RAS 134, 138, 139	Modified planned RAS 134, 139	None
Thermal - above normal rating	No violation	No violation	9L20 (Nevis 766S - Cordel 755S)	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	Removed violation	None	Modified planned RAS 134, 138, 139	None	None
Thermal - above emergency rating	No violation	No violation	9L20 (Nevis 766S - Cordel 755S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Removed violation	None	Modified planned RAS 134, 138, 139	None	None
Thermal - above normal rating	No violation	No violation	9L20 (Nevis 766S - Cordel 755S)	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	Removed violation	None	Modified planned RAS 134, 138, 139	None	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	912L/9L912 (Red Deer 63S - Nevis 766S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	Materially reduced	None	Modified planned RAS 134, 138	Modified planned RAS 134	None
Thermal - above normal rating	No violation	No violation	912L/9L912 (Red Deer 63S - Nevis 766S)	704L (Wainwright 51S - Tucuman 478S)	Removed violation	None	Modified planned RAS 134, 138	None	None
Thermal - above normal rating	No violation	No violation	912L/9L912 (Red Deer 63S - Nevis 766S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	Removed violation	None	Modified planned RAS 134, 138	None	None
Thermal - above normal rating	No violation	No violation	912L/9L912 (Red Deer 63S - Nevis 766S)	7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	Removed violation	None	Modified planned RAS 134, 138	None	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	912L/9L912 (Red Deer 63S - Nevis 766S)	701L (North Holden 395S- Strome 223S)	Materially reduced	None	Modified planned RAS 134, 138	Modified planned RAS 134	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	912L/9L912 (Red Deer 63S - Nevis 766S)	174L (Bardo 197S - North Holden 395S)	Materially increase	None	Modified planned RAS 134, 138	Modified planned RAS 134	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	912L/9L912 (Red Deer 63S - Nevis 766S)	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	Materially reduced	None	Modified planned RAS 134, 138	Modified planned RAS 134r	None
Thermal - above emergency rating	No violation	No violation	912L/9L912 (Red Deer 63S - Nevis 766S)	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	Removed violation	None	Modified planned RAS 134, 138	None	None
Thermal - above emergency rating	No violation	No violation	912L/9L912 (Red Deer 63S - Nevis 766S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Removed violation	None	Modified planned RAS 134, 138	None	None
Thermal - above emergency rating	No violation	No violation	912L/9L912 (Red Deer 63S - Nevis 766S)	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	Removed violation	None	Modified planned RAS 134, 138	None	None
Thermal - above normal rating	No violation	No violation	912T (Battle River 757S 240/138 kV Transformer)	704L (Wainwright 51S - Tucuman 478S)	Removed violation	None	Real-time operational practices	None	None
Thermal - above normal rating	No violation	No violation	9L80 (Battle River 757S - Cordel 755S)	704L (Wainwright 51S - Tucuman 478S)	Removed violation	None	Real-time operational practices	None	None

Type of Reliability Criteria Violation			Contingency (System Element Lost)	Details of Violation	PENV Impact	CETO Impact	Post-Project Mitigation Measures	Post-PENV Mitigation Measures	Post-CETO Mitigation Measures
Post-Project	Post-PENV	Post-CETO							
Thermal - above normal rating	No violation	No violation	7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	Removed violation	None	Modified planned RAS 138	None	None
Thermal - above emergency rating	No violation	No violation	7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Removed violation	None	Modified planned RAS 138 and Real-time operational practices	None	None
Thermal - above normal rating	No violation	No violation	7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	Removed violation	None	Modified planned RAS 138	None	None
Thermal - above emergency rating	Thermal - above emergency rating	Thermal - above emergency rating	966L/9L966 (Hansman Lake 650S - Pemukan 932S)	7L224 (Monitor 774S - Hansman Lake 650S)	Materially increase	Materially increased	Planned RAS for 7L224	Planned RAS for 7L224	Planned RAS for 7L224
Thermal - above normal rating	No violation	No violation	7L77 (North Holden 395S - Vegreville 709S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Removed violation	None	Modified planned RAS 138	None	None
Thermal - above normal rating	No violation	No violation	701L (North Holden 395S- Strome 223S)	912L/9L912 (Red Deer 63S - Nevis 766S)	Removed violation	None	Modified planned RAS 138	None	None
Thermal - above emergency rating	No violation	No violation	701L (North Holden 395S- Strome 223S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Removed violation	None	Modified planned RAS 138	None	None
Thermal - above normal rating	No violation	No violation	7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	Removed violation	None	Real-time operational practices	None	None
Thermal - above normal rating	No violation	No violation	7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)	7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	Removed violation	None	Real-time operational practices	None	None
Thermal - above normal rating	No violation	No violation	7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)	701L (North Holden 395S- Strome 223S)	Removed violation	None	Real-time operational practices	None	None
Thermal - above normal rating	No violation	No violation	769L/769AL (Hardisty 377S to Clipper 656S/Rosyth 296S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Removed violation	None	Modified planned RAS 138	None	None
Thermal - above normal rating	No violation	No violation	749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)	704L (Wainwright 51S - Tucuman 478S)	Removed violation	None	Modified planned RAS 138	None	None
Thermal - above normal rating	No violation	No violation	749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	Removed violation	None	Modified planned RAS 138	None	None
Thermal - above emergency rating	No violation	No violation	749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Removed violation	None	Modified planned RAS 138	None	None
Thermal - above emergency rating	No violation	No violation	749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	Removed violation	None	Modified planned RAS 138	None	None
Thermal - above normal rating	No violation	No violation	7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)	912L/9L912 (Red Deer 63S - Nevis 766S)	Removed violation	None	Modified planned RAS 138	None	None
Thermal - above emergency rating	No violation	No violation	7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Removed violation	None	Modified planned RAS 138	None	None
Thermal - above normal rating	No violation	No violation	7L129 (Vermilion 710S to Bauer 918S/Buffalo Creek 526S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	Removed violation	None	Real-time operational practices	None	None
Thermal - above normal rating	No violation	No violation	7L129 (Vermilion 710S to Bauer 918S/Buffalo Creek 526S)	7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	Removed violation	None	Real-time operational practices	None	None
Thermal - above normal rating	No violation	No violation	7L129 (Vermilion 710S to Bauer 918S/Buffalo Creek 526S)	701L (North Holden 395S- Strome 223S)	Removed violation	None	Real-time operational practices	None	None
Thermal - above emergency rating	Thermal - above normal rating	No violation	EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	Materially reduced	None	Modified planned RAS 134, 138	Modified planned RAS 134	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	EATL HVDC	9L20 (Nevis 766S - Cordel 755S)	Materially reduced	None	Modified planned RAS 134, 138	Modified planned RAS 134	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	EATL HVDC	912L/9L912 (Red Deer 63S - Nevis 766S)	Materially reduced	None	Modified planned RAS 134, 138 and Real-time operational practices	Modified planned RAS 134	None

Type of Reliability Criteria Violation			Contingency (System Element Lost)	Details of Violation	PENV Impact	CETO Impact	Post-Project Mitigation Measures	Post-PENV Mitigation Measures	Post-CETO Mitigation Measures
Post-Project	Post-PENV	Post-CETO							
Thermal - above emergency rating	Thermal - above emergency rating	No violation	EATL HVDC	9L16 (Cordel 755S - Tincherbray 972S)	Marginally increased	None	Modified planned RAS 134, 138	Modified planned RAS 134	None
Thermal - above normal rating	No violation	No violation	EATL HVDC	704L (Wainwright 51S - Tucuman 478S)	Removed violation	None	Modified planned RAS 134, 138	None	None
Thermal - above normal rating	No violation	No violation	EATL HVDC	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	Removed violation	None	Modified planned RAS 134, 138 and Real-time operational practices	None	None
Thermal - above normal rating	No violation	No violation	EATL HVDC	7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	Removed violation	None	Modified planned RAS 134, 138	None	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	EATL HVDC	701L (North Holden 395S- Strome 223S)	Materially reduced	None	Modified planned RAS 134, 138	Modified planned RAS 134	None
Thermal - above emergency rating	Thermal - above emergency rating	Thermal - above emergency rating	EATL HVDC	174L (Bardo 197S - North Holden 395S)	Materially increase	Materially reduced	Modified planned RAS 134, 138	Modified planned RAS 134	Planned RAS 134
Thermal - above emergency rating	Thermal - above emergency rating	No violation	EATL HVDC	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	Materially reduced	None	Modified planned RAS 134, 138	Modified planned RAS 134	None
Thermal - above emergency rating	No violation	No violation	EATL HVDC	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	Removed violation	None	Modified planned RAS 134, 138	None	None
Thermal - above emergency rating	No violation	No violation	EATL HVDC	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Removed violation	None	Modified planned RAS 134, 138	None	None
Thermal - above emergency rating	No violation	No violation	EATL HVDC	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	Removed violation	None	Modified planned RAS 134, 138	None	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	766S901T (Nevis 766S 240/138 kV Transformer)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	Materially reduced	None	Modified planned RAS 134, 138	Modified planned RAS 134	None
Thermal - above normal rating	No violation	No violation	766S901T (Nevis 766S 240/138 kV Transformer)	704L (Wainwright 51S - Tucuman 478S)	Removed violation	None	Modified planned RAS 134, 138	None	None
Thermal - above normal rating	No violation	No violation	766S901T (Nevis 766S 240/138 kV Transformer)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	Removed violation	None	Modified planned RAS 134, 138	None	None
Thermal - above normal rating	No violation	No violation	766S901T (Nevis 766S 240/138 kV Transformer)	7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	Removed violation	None	Modified planned RAS 134, 138	None	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	766S901T (Nevis 766S 240/138 kV Transformer)	701L (North Holden 395S- Strome 223S)	Materially reduced	Removed violation	Modified planned RAS 134, 138	Modified planned RAS 134	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	766S901T (Nevis 766S 240/138 kV Transformer)	174L (Bardo 197S - North Holden 395S)	Materially increase	Removed violation	Modified planned RAS 134, 138	Modified planned RAS 134	None
Thermal - above emergency rating	Thermal - above emergency rating	No violation	766S901T (Nevis 766S 240/138 kV Transformer)	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	Materially reduced	Removed violation	Modified planned RAS 134, 138	Modified planned RAS 134	None
Thermal - above emergency rating	No violation	No violation	766S901T (Nevis 766S 240/138 kV Transformer)	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	Removed violation	None	Modified planned RAS 134, 138	None	None
Thermal - above emergency rating	No violation	No violation	766S901T (Nevis 766S 240/138 kV Transformer)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	Removed violation	None	Modified planned RAS 134, 138	None	None
Thermal - above emergency rating	No violation	No violation	766S901T (Nevis 766S 240/138 kV Transformer)	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	Removed violation	None	Modified planned RAS 134, 138	None	None

Notes:

- Marginally increased or marginally decreased refers to a percent loading difference (post-Project percent loading minus pre-Project percent loading) below 3%.
- Materially increased or materially decreased refers to a percent loading difference (post-Project percent loading minus pre-Project percent loading) above or equal to 3%.
- RAS 134, 138, and 139 are existing RASs (see Section 1.2.2 of Attachment A1). Modifications to existing RAS 134, 138 and 139 were proposed for the approved Sharp Hills Wind Facility in the *Sharp Hills Wind Farm Connection NID*. These modified versions of RAS 134, 138 and 139 are referred to herein as “Planned RAS 134”, “Planned RAS 138”, and “Planned RAS 139.”
- The RAS for 7L224 Thermal Overload was proposed for the *Pattern Lanfine North Wind Power Project Connection NID*. This RAS is referred to herein as “Planned RAS for 7L224”.
- “Modified” refers to adding the Project to the logic of the respective RAS

5.2 Study Results

5.2.1 Base Scenarios

The results for the base scenarios are summarized in Table 5-1.

5.2.1.1 Pre-Project

Category A Conditions

No Reliability Criteria violations were observed under Category A conditions (i.e., all elements in service) for any of the pre-Project scenarios. The short-circuit fault levels were found to be within the typical capabilities of the nearby facilities.

Category B Conditions

The pre-Project power flow studies identified a number of thermal violations under Category B conditions (i.e., loss of a single system element).

No voltage deviations were observed that were beyond the limits listed in Table 3-1 of Attachment A1 (hereafter referred to as point of delivery (POD) bus voltage deviations) under Category B conditions.

5.2.1.2 Post-Project

Category A Conditions

No Reliability Criteria violations were observed under Category A conditions for any post-Project scenarios. Post-Project short-circuit fault levels were not significantly higher than pre-Project levels.

The long-term short circuit levels were found to be within the designed capabilities of the nearby facilities.

Category B Conditions

The post-Project power flow studies identified a number of thermal violations under Category B conditions.

No POD bus voltage deviations were observed under Category B conditions.

The results did not indicate any transient stability concerns, and the system showed acceptable dynamic response to all Category B conditions studied

5.2.2 Sensitivity Scenarios with P1704

The results for the sensitivity scenarios with P1704 are summarized in Table 5-2.

5.2.2.1 Pre-Project – Scenario 8

Category A Conditions

No Reliability Criteria violations were observed under Category A conditions (i.e., all elements in service) for the pre-Project scenario.

Category B Conditions

The pre-Project power flow studies identified a number of thermal violations under Category B conditions (i.e., loss of a single system element).

No POD bus voltage deviations were observed under Category B conditions.

5.2.2.2 Post-Project – Scenario 9

Category A Conditions

No Reliability Criteria violations were observed under Category A conditions for any post-Project scenarios.

Category B Conditions

The post-Project power flow studies identified a number of thermal violations under Category B conditions.

No POD bus voltage deviations were observed under Category B conditions.

5.2.2.3 Post-Project, with PENV – Scenario 10

Category A Conditions

No Reliability Criteria violations were observed under Category A conditions for any post-Project scenarios.

Category B Conditions

The post-Project power flow studies identified a number of thermal violations under Category B conditions.

Most thermal violations observed on Scenario 9 were not observed on Scenario 10. Most of the remaining thermal violations were materially reduced. The thermal violations observed on 174L transmission line were materially increased when considering PENV in service.

No POD bus voltage deviations were observed under Category B conditions.

5.2.3 Sensitivity Scenarios with Additional Generation Projects

The results for the sensitivity scenarios with additional generation projects are summarized in Table 5-3.

5.2.3.1 Post-Project – Scenario 11

Category A Conditions

For Scenario 11 (2021 SP post-Project sensitivity scenario with additional generation projects), one Category A thermal criteria violation was observed on the 7L50 transmission line.

Category B Conditions

Due to the Category A thermal violation observed for Scenario 11, the TCM Rule was first applied to mitigate the violation by re-dispatching effective generation prior to simulating any contingency. The power flow studies for Scenario 11 identified a number of thermal violations under Category B conditions (i.e., loss of a single system element).

No POD bus voltage deviations were observed under Category B conditions.

5.2.3.2 Post-Project, with PENV – Scenario 12

Category A Conditions

No Reliability Criteria violations were observed under Category A conditions for Scenario 12 (2021 SP post-Project sensitivity scenario with additional generation projects and PENV in service). The Category A thermal criteria violation observed in Scenario 11 was not observed when considering PENV in service.

Category B Conditions

The same generation adjustment that was applied to Scenario 11 was applied for Scenario 12. Following that adjustment, the power flow studies for Scenario 12 identified a number of thermal violations under Category B conditions.

Most thermal violations observed on Scenario 9 were not observed on Scenario 10. Most of the remaining thermal violations were materially reduced. The thermal violations observed on 174L transmission line were materially increased when considering PENV in service.

No POD bus voltage deviations were observed under Category B conditions.

5.2.3.3 Post-Project, with PENV and CETO – Scenario 13

Category A Conditions

No Reliability Criteria violations were observed under Category A conditions for Scenario 13 (2021 SP post-Project sensitivity scenario with additional generation projects, and PENV and CETO in service).

Category B Conditions

The same generation adjustment that was applied to Scenario 11 and Scenario 12 was applied for Scenario 13. Following that adjustment, the power flow studies for Scenario 13 identified a number of thermal violations under Category B conditions.

Most thermal violations observed on Scenario 12 were not observed on Scenario 13. Most of the remaining thermal violations were materially reduced. The thermal violations observed on 174L transmission line on Scenario 12 were either materially reduced or removed when considering CETO in service. The thermal overloads observed on 7L224 transmission line were materially increased.

No POD bus voltage deviations were observed under Category B conditions.

5.3 Mitigation Measures

This section discusses the AESO's proposed mitigation measures to address the system performance issues that were identified in the pre-Project and post-Project scenarios.

Notable Study Assumptions

Currently, the 240 kV transmission line 912L is temporarily derated, affecting the overall rating of 912L/9L912. While this derating is expected to end prior to the ISD of the Project, the studies assumed that the rating of the 240 kV transmission line 912L is restored. If the rating of the 240 kV transmission line 912L is not restored prior to the ISD of the Project and the CETO system project is not in service, modifications to the planned mitigation measures or new mitigation measures may be required, as this would result in Category A and Category B thermal violations, based on the studies.

The studied ratings for the 240 kV transmission line 9L20 assumed post clearance mitigation work would be completed by the TFO. If the additional connection projects materialize with the clearance mitigation work not completed, and the CETO system project is not in service, modifications to the planned mitigation measures or new mitigations may be required, as this would result in Category A and Category B thermal violations, based on the studies.

The AESO will monitor changes related to these constraints and update, add, or remove mitigations as required.

5.3.1 Base Scenarios

The mitigation measures for the base scenarios are summarized in Table 5-1.

5.3.1.1 Pre-Project

Prior to the connection of the Project, some of the observed thermal criteria violations can be managed by using real-time operational practices.

The remaining thermal criteria violations can be mitigated with the planned RAS 134, 138, and 139.

5.3.1.2 Post-Project

After the connection of the Project, some of the thermal criteria violations observed can continue to be mitigated by using real-time operational practices.

Some of the remaining thermal criteria violations can be mitigated by modifying the planned RAS 134, 138, and 139, by including the Project in the RAS logic.

With the addition of the Project, the total amount of generation tied to RAS 134, 138 and 139 exceeds the Most Severe Single Contingency (MSSC) limit of 466 MW. However, the post-Project studies indicate that all thermal violations can be mitigated by generation curtailment -by the combined actions of RAS 134, 138 and 139- below the MSSC limit.

5.3.2 Sensitivity Scenarios with P1704

The mitigation measures for the sensitivity scenarios with P1704 are summarized in Table 5-2.

The sensitivity scenarios with P1704 are intended to study what changes to mitigations or additional mitigations would be required in the event that P1704, or other wind generation projects in the Study Area, materialize ahead of the Project. The Summer Peak scenario was chosen, as it represented the most stressed scenario.

With the addition of P1704, the total amount of generation tied to RAS 134, 138 and 139 exceeds the MSSC limit of 466 MW.

5.3.2.1 Pre-Project – Scenario 8

Prior to the connection of the Project, some of the observed thermal criteria violations can be managed by using real-time operational practices.

The remaining thermal criteria violations can be mitigated with the planned RAS 134, 138, and 139.

Pre-contingency generation curtailment under normal conditions may be required using real-time operational practices to prevent generation curtailment by RAS action above the MSSC limit.

5.3.2.2 Post-Project – Scenario 9

After the connection of the Project, some of the thermal criteria violations observed can continue to be mitigated by using real-time operational practices.

Some of the remaining thermal criteria violations can be mitigated by modifying the planned RAS 134, 138, and 139, by including the Project in the RAS logic.

With the addition of the Project, the total amount of generation tied to RAS 134, 138 and 139 further exceeds the MSSC limit of 466 MW. The post-Project studies indicate that, in order to mitigate the thermal violations following certain major contingencies (EATL, 912L/9L912, Nevis 766S 240/138 kV Transformer, 9L20), the combined actions of RAS 134, 138 and 139 may result in generation curtailment in excess of the MSSC limit. Pre-contingency generation curtailment under normal conditions may be required using real-time operational practices to prevent generation curtailment by RAS action above the MSSC limit. The probability of pre-curtailment being required would be dependent on generation profiles and operating conditions.

5.3.2.3 Post-Project, with PENV – Scenario 10

With PENV in service, some of the thermal criteria violations observed can continue to be mitigated by using real-time operational practices.

Some of the remaining thermal criteria violations can be mitigated by the modified planned RAS 134 and 139.

The studies indicate that, in order to mitigate the thermal violations following the EATL contingency, the combined actions of RAS 134 and 139 may result in generation curtailment in excess of the MSSC limit. Pre-contingency generation curtailment under normal conditions may be required using real-time operational practices to prevent generation curtailment by RAS action above the MSSC limit. The probability of pre-curtailment being required would be dependent on generation profiles and operating conditions.

5.3.3 Sensitivity Scenarios with Additional Generation Projects

The mitigation measures for the sensitivity scenarios with additional generation projects are summarized in Table 5-3.

The post-Project sensitivity scenarios with additional generation projects are intended to study what changes to the mitigation measures or if additional mitigation measures are required in the event that additional renewable (wind and solar) connection projects materialize ahead of the Project. While these additional connection projects are outside of the Study Area, they contribute to the outflow (i.e. 9L912/912L/9L20) constraints in the Central East subregion as well as on the 138/144 kV paths in the Central East subregion. The Summer Peak scenario was chosen, as it represented the most stressed scenario, with the additional projects dispatched to 100% of their capacity.

5.3.3.1 Post-Project – Scenario 11

The Category A violation observed in the study (see subsection 5.2.3) was mitigated by applying the TCM Rule to dispatch down effective generation. The forecast study conditions represent the credible worst case scenario, which assumes high renewable generation as well as economic coal generation dispatch. The probability of this scenario occurring is dependent on real-time conditions, specifically the generation

profiles of effective generators and the Facility. Should this Category A violation materialize, temporary mitigations would be required to address this thermal criteria violation until PENV is in service.

The studies indicate that some of the thermal criteria violations observed can continue to be mitigated by using real-time operational practices.

Some of the remaining thermal criteria violations can be mitigated by modification of planned RAS 134, 138, and 139, by including the Project in the RAS logic, and the use of the planned RAS for 7L224.

Some thermal criteria violations were observed on 912L/9L912, 7L50 and 749L transmission lines after the combined actions of the modified RAS 134, 138, and 139. These thermal criteria violations can be mitigated by the use of real-time operational practices following the RAS actions. Similar to the Category A violation discussed above, the probability of these post-RAS thermal violations would be dependent on generation profiles and operating conditions.

With the addition of the Project, the total amount of generation tied to RAS 134, 138 and 139 exceeds the Most Severe Single Contingency (MSSC) limit of 466 MW. The studies indicate that, in order to mitigate the thermal violations following certain major contingencies (EATL, 912L/9L912, Nevis 766S 240/138 kV Transformer, 9L20), the combined actions of RAS 134, 138 and 139 may result in generation curtailment in excess of the MSSC limit. Pre-contingency generation curtailment under normal conditions may be required using real-time operational practices to prevent generation curtailment by RAS action above the MSSC limit. The probability of pre-curtailment being required would be dependent on generation profiles and operating conditions.

5.3.3.2 Post-Project, with PENV – Scenario 12

With PENV in service, some of the thermal criteria violations observed can continue to be mitigated by using real-time operational practices.

Some of the remaining thermal criteria violations can be mitigated by the modified planned RAS 134 and 139, and the planned RAS for 7L224.

Some thermal criteria violations were observed on 912L/9L912 transmission lines after the combined actions of the modified RAS 134, and 139. These thermal criteria violations can be mitigated by the use of real-time operational practices following the RAS actions. The probability of these post-RAS thermal violations would be dependent on generation profiles and operating conditions. With PENV in service, the magnitude of this thermal criteria violation is materially reduced.

The studies indicate that, in order to mitigate the thermal violations following certain major contingencies (EATL, 912L/9L912, Nevis 766S 240/138 kV Transformer, 9L20), the combined actions of RAS 134 and 139 may result in generation curtailment in excess of the MSSC limit. Pre-contingency generation curtailment under normal conditions may be required using real-time operational practices to prevent generation curtailment by RAS action above the MSSC limit. The probability of pre-curtailment being required would be dependent on generation profiles and operating conditions.

5.3.3.3 Post-Project, with PENV and CETO – Scenario 13

With CETO in service, most of the thermal criteria violations observed in Scenario 10 and Scenario 11 are not observed. The observed thermal criteria violations can be alleviated by the modified planned RAS 134, and the planned RAS for 7L224.

Scenario 13 indicates that, after CETO is in service, real-time operational practices are not required in addition to RAS action. Additionally, generation curtailment in excess of the MSSC limit was not observed for any of the studied category B conditions.

6 Project Dependencies

The Project does not require the completion of any other AESO plans to expand or enhance the transmission system prior to connection.

Currently, the planned ISD of the Project is prior to the ISD of PENV. After the Project connection, and until PENV energizes, the AESO may determine that mitigation is required to address Category A thermal criteria violations. In that case, the AESO will develop operational procedures or other mitigation measures closer to the ISD of the Project.

7 Conclusions and Recommendations

Based on the study results, Alternative 2 is technically viable.

The studies identified a number of Category A issues:

- With the addition of the Project, the total amount of generation tied to the planned RAS 134, 138, and 139 exceeds the MSSC limit of 466 MW. Pre-contingency generation curtailment under Category A conditions may be required using real-time operational practices to prevent generation curtailment by RAS action above the MSSC limit.
- If additional renewable generation projects energize prior to the Project, system performance issues could arise during Category A conditions prior to PENV energization.
- If the ratings of the 9L912/912L and 9L20 transmission lines are not restored prior to the ISD of the Project, in addition to renewable generation projects materializing as scheduled, system performance issues could arise during Category A conditions.

At this time, the identified Category A issues are not expected to result in congestion. However, closer to the ISD, if the AESO determines that congestion will arise under Category A conditions, the AESO will make an application to the AUC to obtain approval for an “exception” under Section 15(2) of the Transmission Regulation.

The connection assessment also identified a number of pre-Project and post-Project Category B system performance issues. These issues can be mitigated through the modification of planned RAS 134, 138, and 139, real-time operational practices, alone or in combination, as appropriate, and the planned RAS for 7L224. With the implementation of these mitigation measures, connecting the project with Alternative 2 does not adversely affect the performance of the AIES.

The AESO recommends proceeding with the Project using Alternative 2 as the preferred alternative to respond to the Market Participant’s request for system access service. Real-time operational practices and the RAS mentioned above are recommended to mitigate the identified system performance issues.

Alternative 2 involves the addition of one 240 kV circuit, approximately 160 meters in length, to connect the Facility to the existing transmission line 9L59, using a T-tap configuration.

The conductor used for the new 240 kV circuit should have a minimum thermal rating of 145 MVA.

Attachment A:
Engineering Connection Assessment Results

Engineering Connection Assessment: Study Results

P1909 Transalta Garden Plain Wind

TransAlta Coporation

Date: March 30, 2021

Version: V5D3

Classification: Public

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Mar. 31, 2021

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Attachments

Attachment A1 Engineering Connection Assessment: Study Scope

Attachment A2 Pre-Project Power Flow Diagrams

Attachment A3 Post-Project Power Flow Diagrams

Attachment A4 Post-Project Transient Stability Diagrams

Attachment A5 Dynamic Data and Assumptions

Attachment A6 Post-Mitigation Power Flow Diagrams

Attachment A7 Constraint Effective Factors Table

1 Introduction

This report presents the results of the engineering studies that were completed by CF Power Ltd. (the Studies Consultant) to assess the impact of the Project (as defined in Attachment A1: AESO Engineering Connection Assessment: Study Scope) on the performance of the Alberta interconnected electric system (AIES). The studies were performed in accordance with Attachment A1: AESO Engineering Connection Assessment: Study Scope, which was prepared by the AESO.

The power system network analysis tool that was used for the studies in this connection assessment was PSS/E version 33.

2 Pre-Project Study Results

This section describes the results of the pre-Project power flow studies.

2.1 Power Flow Studies

Power flow diagrams illustrating the pre-Project power flow studies results for Category A and Category B conditions are provided in Attachment A2.

2.1.1 Scenario 1: 2020 Summer Light Pre-Project

Category A Condition

No Reliability Criteria (as defined in Section 3.1 of Attachment A1) violations were observed under the Category A condition.

Category B Conditions

No thermal criteria violations were observed under Category B conditions.

No voltage range violations or point of delivery (POD) bus voltage deviations beyond the limits listed in Table 3-1 of Attachment A1 (hereafter referred to as POD bus voltage deviations) were observed under studied Category B conditions.

2.1.2 Scenario 2: 2020 Summer Peak Pre-Project

Category A Condition

No Reliability Criteria violations were observed under the Category A condition.

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions as shown in Table 2- 1.

No voltage range violations or POD bus voltage deviations were observed under studied Category B conditions.

Table 2-1: Thermal Criteria Violations under Category B Conditions for Scenario 2

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings[a] (MVA)		Pre-Project Results	
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow[a] (MVA)	% Loading[b]
9L20 (Nevis 766S - Cordel 755S)	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	121.53	121.53
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	108.42	101.02
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	114.09	104.38
912L/9L912 (Red Deer 63S - Nevis 766S)	701L (North Holden 395S-Strome 223S)	119.03	131.00	127.92	107.47
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	87.25	102.53
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	145.50	104.00
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	123.54	113.03
7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	116.65	106.73
966L/9L966 (Hansman Lake 650S - Pemukan 932S)	7L224 (Monitor 774S - Hansman Lake 650S)	110.21	122.67	113.78	103.24
749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	122.26	111.86
7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	110.90	101.46
EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	146.25	103.11
	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	98.90	98.90
	912L/9L912 (Red Deer 63S - Nevis 766S)	507.00	553.00	522.42	103.04
	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	75.62	100.83
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	110.49	102.94
	701L (North Holden 395S-Strome 223S)	119.03	131.00	133.55	112.19
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	88.61	104.13
	701L (Strome 223S - 7LA701 Heisler 764S	139.90	158.00	151.62	108.38

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings[a] (MVA)		Pre-Project Results	
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow[a] (MVA)	% Loading[b]
	Substation Tap-point)				
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	130.33	119.24
766S901T (Nevis 766S 240/138 kV Transformer)	701L (North Holden 395S-Strome 223S)	119.03	131.00	127.83	107.39
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	87.08	102.34
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	145.38	103.92
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	123.54	113.03

Notes:

[a] The facility ratings shown in Attachment A1 have been adjusted from a 72/144 kV voltage base to a 69/138 kV voltage base, as is used by the power system network analysis tool.

[b] % loading is reported as a percentage of the observed power flow (in MVA ie. S =√3 x Vbase x Iactual) relative to the transmission line's Normal Rating (also in MVA), as shown in Attachment A1.

2.1.3 Scenario 3: 2020 Winter Peak Pre-Project

Category A Condition

No Reliability Criteria violations were observed under the Category A condition.

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions as shown in Table 2-2.

No voltage range violations or POD bus voltage deviations were observed under studied Category B conditions.

Table 2-2: Thermal Criteria Violations under Category B Conditions for Scenario 3

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Pre-Project Results	
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading
9L20 (Nevis 766S - Cordel 755S)	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	134.18	134.18
	174L (Bardo 197S - North Holden 395S)	90.11	99.00	98.10	108.87

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Pre-Project Results	
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading
912L/9L912 (Red Deer 63S - Nevis 766S)	701L (North Holden 395S-Strome 223S)	146.04	161.00	157.46	107.82
	174L (Bardo 197S - North Holden 395S)	90.11	99.00	114.59	127.17
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	169.00	169.00	173.89	102.89
7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	143.00	101.76	106.00
EATL HVDC	9L20 (Nevis 766S - Cordel 755S)	498.00	498.00	545.41	109.52
	912L/9L912 (Red Deer 63S - Nevis 766S)	623.00	623.00	625.79	100.45
	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	143.00	99.57	103.71
	701L (North Holden 395S-Strome 223S)	146.04	161.00	148.87	101.93
	174L (Bardo 197S - North Holden 395S)	90.11	99.00	101.96	113.15
766S901T (Nevis 766S 240/138 kV Transformer)	701L (North Holden 395S-Strome 223S)	146.04	161.00	157.63	107.94
	174L (Bardo 197S - North Holden 395S)	90.11	99.00	114.88	127.48
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	169.00	169.00	174.07	103.00

2.1.4 Scenario 8: 2020 Summer Peak Pre-Project Wind (P1704) Sensitivity

Category A Condition

No Reliability Criteria violations were observed under the Category A condition.

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions as shown in Table 2-3.

No voltage range violations or POD bus voltage deviations were observed under studied Category B conditions.

Table 2- 3: Thermal Criteria Violations under Category B Conditions for Scenario 8

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Pre-Project Results	
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading
7L42 (Hill 751S - Lloydminster 716S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	115.57	105.73
9L20 (Nevis 766S - Cordel 755S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	152.19	107.30
	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	136.97	136.97
	7L16 (Nevis 766S - Heatburg 948S)	107.33	119.79	112.82	105.11
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	116.26	108.32
	701L (North Holden 395S- Strome 223S)	119.03	131.00	132.15	111.02
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	91.48	107.51
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	149.80	107.08
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	128.46	117.53
912L/9L912 (Red Deer 63S - Nevis 766S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	158.96	112.08
	701L (North Holden 395S- Strome 223S)	119.03	131.00	150.72	126.62
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	108.17	127.12
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	168.64	120.54
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	139.25	127.41
7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	127.04	116.23
701L (North Holden 395S- Strome 223S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	118.32	108.25
7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	134.00	100.46	104.65
749L/749AL (Edgerton 899S to Killarney Lake	7L50 (Buffalo Creek 526S - 491L Jarrow 252S	109.30	123.60	132.69	121.40

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Pre-Project Results	
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading
267S/Metiskow 648S)	Substation Tap-point)				
7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	122.39	111.98
EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	159.85	112.70
	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	100.95	100.95
	9L20 (Nevis 766S - Cordel 755S)	488.02	499.00	502.81	103.03
	912L/9L912 (Red Deer 63S - Nevis 766S)	507.00	553.00	591.96	116.76
	7L16 (Nevis 766S - Heatburg 948S)	107.33	119.79	107.99	100.62
	9L16 (Cordel 755S - Tincherbray 972S)	499.00	499.00	527.20	105.65
	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	80.19	106.92
	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	134.00	96.47	100.49
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	111.43	103.82
	701L (North Holden 395S-Strome 223S)	119.03	131.00	147.51	123.92
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	100.94	118.62
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	165.78	118.50
	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	109.30	123.63	109.87	100.52
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	140.28	128.34
766S901T (Nevis 766S 240/138 kV Transformer)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	159.55	112.50
	701L (North Holden 395S-Strome 223S)	119.03	131.00	150.70	126.61
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	108.15	127.10
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	168.61	120.52

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Pre-Project Results	
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	139.39	127.53

3 Post-Project Study Results

This section describes the results of the post-Project power flow studies and transient stability studies.

As described in Section 2 of Attachment A1, the post-Project studies were performed using Alternative 1.

3.1 Power Flow Studies

Power flow diagrams illustrating the post-Project power flow studies results for Category A and Category B conditions are included in Attachment A3.

3.1.1 Scenario 4: 2020 Summer Light Post-Project

Category A Condition

No Reliability Criteria violations were observed under the Category A condition.

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions as shown in Table 3-1.

No voltage range violations or POD bus voltage deviations were observed under studied Category B conditions.

Table 3-1: Thermal Criteria Violations under Category B Conditions for Scenario 4

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
9L20 (Nevis 766S - Cordel 755S)	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	98.67	98.67	107.47	107.47	8.80

3.1.2 Scenario 5: 2020 Summer Peak Post-Project

Category A Condition

No Reliability Criteria violations were observed under the Category A condition.

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions as shown in Table 3-2.

No voltage range violations or POD bus voltage deviations were observed under studied Category B conditions.

Table 3- 2: Thermal Criteria Violations under Category B Conditions for Scenario 5

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
9L20 (Nevis 766S - Cordel 755S)	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	121.53	121.53	130.15	130.15	8.62
	7L16 (Nevis 766S - Heatburg 948S)	107.33	119.79	104.99	97.82	109.55	102.07	4.25
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	108.42	101.02	112.99	105.27	4.26
	701L (North Holden 395S-Strome 223S)	119.03	131.00	111.58	93.74	120.43	101.17	7.43
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	114.09	104.38	120.00	109.79	5.41
912L/9L912 (Red Deer 63S - Nevis 766S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	137.53	96.97	147.23	103.81	6.84
	701L (North Holden 395S-Strome 223S)	119.03	131.00	127.92	107.47	138.16	116.07	8.61
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	87.25	102.53	97.08	114.09	11.55
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	145.50	104.00	155.90	111.44	7.44
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	123.54	113.03	130.29	119.20	6.17
7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	116.65	106.73	120.33	110.09	3.36
966L/9L966 (Hansman Lake 650S - Pemukan 932S)	7L224 (Monitor 774S - Hansman Lake 650S)	110.21	122.67	113.78	103.24	111.90	101.53	-1.71

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
701L (North Holden 395S- Strome 223S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	106.84	97.75	111.06	101.61	3.86
7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	134.00	94.10	98.02	96.42	100.44	2.42
749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	122.26	111.86	125.96	115.25	3.39
7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	110.90	101.46	115.14	105.34	3.88
EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	146.25	103.11	150.94	106.42	3.31
	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	98.90	98.90	100.98	100.98	2.08
	912L/9L912 (Red Deer 63S - Nevis 766S)	507.00	553.00	522.42	103.04	556.63	109.79	6.75
	7L16 (Nevis 766S - Heatburg 948S)	107.33	119.79	107.05	99.74	108.10	100.72	0.98
	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	75.62	100.83	77.15	102.87	2.04
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	110.49	102.94	111.54	103.92	0.98
	701L (North Holden 395S- Strome 223S)	119.03	131.00	133.55	112.19	138.30	116.19	3.99
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	88.61	104.13	93.09	109.40	5.27
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	151.62	108.38	156.42	111.81	3.43
	7L50 (Buffalo Creek 526S -	109.30	123.60	130.33	119.24	133.59	122.22	2.98

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
	491L Jarrow 252S Substation Tap-point)							
766S901T (Nevis 766S 240/138 kV Transformer)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	137.47	96.93	147.45	103.96	7.04
	701L (North Holden 395S-Strome 223S)	119.03	131.00	127.83	107.39	138.10	116.02	8.63
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	87.08	102.34	96.97	113.96	11.62
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	145.38	103.92	155.81	111.38	7.46
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	123.54	113.03	130.34	119.25	6.22

3.1.3 Scenario 6: 2020 Winter Peak Post-Project

Category A Condition

No Reliability Criteria violations were observed under the Category A condition.

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions as shown in Table 3-3.

No voltage range violations or POD bus voltage deviations were observed under studied Category B conditions.

Table 3-3: Thermal Criteria Violations under Category B Conditions for Scenario 6

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
9L20 (Nevis 766S - Cordel 755S)	901T (Nevis 766S 240/138 kV	100.00	100.00	134.18	134.18	142.66	142.66	8.48

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
	Transformer)							
	701L (North Holden 395S-Strome 223S)	146.04	161.00	139.03	95.20	147.77	101.18	5.99
	174L (Bardo 197S - North Holden 395S)	90.11	99.00	98.10	108.87	106.56	118.25	9.39
912L/9L912 (Red Deer 63S - Nevis 766S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	143.00	93.33	97.22	96.24	100.25	3.03
	701L (North Holden 395S-Strome 223S)	146.04	161.00	157.46	107.82	167.47	114.67	6.85
	174L (Bardo 197S - North Holden 395S)	90.11	99.00	114.59	127.17	124.12	137.74	10.58
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	169.00	169.00	173.89	102.89	184.07	108.91	6.02
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	139.00	150.50	138.15	99.39	144.90	104.24	4.85
7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	143.00	101.76	106.00	104.05	108.38	2.38
	7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	96.00	140.00	94.92	98.88	97.17	101.22	2.34
7L129 (Vermilion 710S to Bauer 918S/Buffalo Creek 526S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	143.00	93.96	97.88	96.26	100.27	2.39
EATL HVDC	9L20 (Nevis 766S - Cordel 755S)	498.00	498.00	545.41	109.52	578.81	116.23	6.71
	912L/9L912 (Red Deer 63S - Nevis 766S)	623.00	623.00	625.79	100.45	662.25	106.30	5.85
	704L (Wainwright 51S - Tucuman 478S)	79.00	87.00	78.42	99.26	80.30	101.64	2.38
	749L (Edgerton 899S - 749AL Killarney Lake	96.00	143.00	99.57	103.71	101.29	105.51	1.80

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
	267S Tap-point)							
	701L (North Holden 395S-Strome 223S)	146.04	161.00	148.87	101.93	153.97	105.43	3.49
	174L (Bardo 197S - North Holden 395S)	90.11	99.00	101.96	113.15	106.81	118.53	5.38
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	169.00	169.00	165.40	97.87	170.58	100.93	3.06
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	139.00	150.50	135.79	97.69	139.47	100.34	2.65
766S901T (Nevis 766S 240/138 kV Transformer)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	143.00	93.59	97.49	96.54	100.56	3.07
	701L (North Holden 395S-Strome 223S)	146.04	161.00	157.63	107.94	167.68	114.82	6.88
	174L (Bardo 197S - North Holden 395S)	90.11	99.00	114.88	127.48	124.47	138.13	10.65
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	169.00	169.00	174.07	103.00	184.29	109.04	6.05
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	139.00	150.50	138.56	99.68	145.35	104.57	4.89

3.1.4 Scenario 9: 2020 Summer Peak Post-Project Wind (P1704) Sensitivity

Category A Condition

No Reliability Criteria violations were observed under the Category A condition.

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions as shown in Table 3-4.

No voltage range violations or POD bus voltage deviations were observed under studied Category B conditions.

Table 3-4: Thermal Criteria Violations under Category B Conditions for Scenario 9

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
7L42 (Hill 751S - Lloydminster 716S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	115.57	105.73	119.28	109.13	3.39
9L20 (Nevis 766S - Cordel 755S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	152.19	107.30	161.55	113.91	6.60
	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	136.97	136.97	145.57	145.57	8.60
	7L16 (Nevis 766S - Heatburg 948S)	107.33	119.79	112.82	105.11	117.35	109.33	4.22
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	116.26	108.32	120.80	112.55	4.22
	701L (North Holden 395S- Strome 223S)	119.03	131.00	132.15	111.02	140.99	118.45	7.43
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	91.48	107.51	100.03	117.56	10.05
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	149.80	107.08	158.80	113.51	6.43
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	128.46	117.53	134.45	123.01	5.48
912L/9L912 (Red Deer 63S - Nevis 766S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	158.96	112.08	168.58	118.86	6.78
	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	73.28	97.70	76.29	101.73	4.03
	701L (North Holden 395S- Strome 223S)	119.03	131.00	150.72	126.62	160.83	135.12	8.50
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	108.17	127.12	117.79	138.43	11.30
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-	139.90	158.00	168.64	120.54	178.95	127.91	7.37

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
	point)							
	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	109.30	123.63	108.94	99.67	115.53	105.70	6.03
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	139.25	127.41	146.01	133.59	6.18
	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	123.63	132.25	120.46	97.43	127.22	102.90	5.47
9L16 (Cordel 755S - Tincherbray 972S)	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	91.50	91.50	96.46	96.46	4.96
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	105.87	98.64	110.41	102.87	4.23
912T (Battle River 757S 240/138 kV Transformer)	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	73.09	97.45	76.98	102.64	5.19
9L80 (Battle River 757S - Cordel 755S)	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	73.09	97.45	76.95	102.61	5.16
7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	127.04	116.23	130.74	119.62	3.39
7L77 (North Holden 395S - Vegreville 709S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	108.21	99.00	111.28	101.81	2.81
701L (North Holden 395S- Strome 223S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	118.32	108.25	122.59	112.16	3.91
7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	134.00	100.46	104.65	102.78	107.06	2.42
	7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	96.00	130.00	95.02	98.98	97.31	101.37	2.39
749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	74.12	98.82	76.01	101.35	2.53
	7L50 (Buffalo Creek 526S - 491L Jarrow	109.30	123.60	132.69	121.40	136.42	124.81	3.41

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
	252S Substation Tap-point)							
7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	122.39	111.98	126.69	115.91	3.93
EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	159.85	112.70	164.61	116.06	3.36
	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	100.95	100.95	102.78	102.78	1.83
	9L20 (Nevis 766S - Cordel 755S)	488.02	499.00	502.81	103.03	534.99	109.62	6.59
	912L/9L912 (Red Deer 63S - Nevis 766S)	507.00	553.00	591.96	116.76	626.44	123.56	6.80
	7L16 (Nevis 766S - Heatburg 948S)	107.33	119.79	107.99	100.62	109.03	101.58	0.97
	9L16 (Cordel 755S - Tincherbray 972S)	499.00	499.00	527.20	105.65	575.98	115.43	9.77
	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	80.19	106.92	81.76	109.01	2.09
	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	134.00	96.47	100.49	97.95	102.03	1.54
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	111.43	103.82	112.47	104.79	0.97
	701L (North Holden 395S- Strome 223S)	119.03	131.00	147.51	123.92	152.34	127.98	4.06
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	100.94	118.62	105.48	123.96	5.35
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	165.78	118.50	170.66	121.99	3.49
	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	109.30	123.63	109.87	100.52	113.12	103.49	2.98
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	140.28	128.34	143.62	131.40	3.06

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	123.63	132.25	121.68	98.42	125.01	101.12	2.69
766S901T (Nevis 766S 240/138 kV Transformer)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	159.55	112.50	169.48	119.49	7.00
	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	73.39	97.85	76.50	102.00	4.15
	701L (North Holden 395S- Strome 223S)	119.03	131.00	150.70	126.61	160.89	135.17	8.56
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	108.15	127.10	117.87	138.53	11.43
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	168.61	120.52	179.00	127.95	7.43
	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	109.30	123.63	109.07	99.79	115.73	105.88	6.09
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	139.39	127.53	146.23	133.79	6.26
	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	123.63	132.25	120.60	97.55	127.42	103.07	5.52

3.1.5 Scenario 10: 2020 Summer Peak Post-Project Wind (P1704) and PENV Sensitivity

Category A Condition

No Reliability Criteria violations were observed under the Category A condition.

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions as shown in Table 3-5.

No voltage range violations or POD bus voltage deviations were observed under studied Category B conditions.

Table 3- 5: Thermal Criteria Violations under Category B Conditions for Scenario 10

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Post-Project Pre-PENV Results		Post-Project Post-PENV Results		% Loading Difference (Post – Pre PENV)
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
9L20 (Nevis 766S - Cordel 755S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	161.55	113.91	148.15	104.45	-9.45
	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	145.57	145.57	142.12	142.12	-3.45
	7L16 (Nevis 766S - Heatburg 948S)	107.33	119.79	117.35	109.33	115.14	107.28	-2.05
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	120.80	112.55	118.59	110.49	-2.06
	701L (North Holden 395S- Strome 223S)	119.03	131.00	140.99	118.45	126.92	106.62	-11.82
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	100.03	117.56	109.44	128.61	11.06
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	158.80	113.51	144.62	103.37	-10.14
912L/9L912 (Red Deer 63S - Nevis 766S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	168.58	118.86	154.14	108.68	-10.18
	701L (North Holden 395S- Strome 223S)	119.03	131.00	160.83	135.12	145.22	122.00	-13.12
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	117.79	138.43	127.34	149.64	11.22
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	178.95	127.91	163.18	116.64	-11.27
9L16 (Cordel 755S - Tincherbray 972S)	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	110.41	102.87	110.37	102.84	-0.04
EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	164.61	116.06	151.87	107.08	-8.98
	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	102.78	102.78	102.86	102.86	0.08
	9L20 (Nevis 766S - Cordel 755S)	488.02	499.00	534.99	109.62	515.67	105.66	-3.96
	912L/9L912 (Red Deer 63S - Nevis	507.00	553.00	626.44	123.56	606.89	119.70	-3.86

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Post-Project Pre-PENV Results		Post-Project Post-PENV Results		% Loading Difference (Post – Pre PENV)
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
	766S)							
	7L16 (Nevis 766S - Heatburg 948S)	107.33	119.79	109.03	101.58	108.47	101.07	-0.52
	9L16 (Cordel 755S - Tincherbray 972S)	499.00	499.00	575.98	115.43	580.21	116.27	0.85
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	112.47	104.79	111.92	104.27	-0.52
	701L (North Holden 395S- Strome 223S)	119.03	131.00	152.34	127.98	138.56	116.41	-11.57
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	105.48	123.96	117.90	138.56	14.59
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	170.66	121.99	156.82	112.10	-9.89
766S901T (Nevis 766S 240/138 kV Transformer)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	169.48	119.49	154.75	109.11	-10.39
	701L (North Holden 395S- Strome 223S)	119.03	131.00	160.89	135.17	145.18	121.97	-13.20
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	117.87	138.53	127.32	149.63	11.10
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	179.00	127.95	163.13	116.61	-11.34

3.1.6 Scenario 11: 2021 Summer Peak Post-Project Sensitivity

Category A Condition

Initial 2021 Post-Project Sensitivity Study Results:

During initial post-Project Sensitivity power flow studies, thermal criteria violations were observed on 144 kV line 7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point) under Category A condition, as shown in Table 3-6.

Table 3-6: Post-Project Sensitivity Thermal Loading under Category A Conditions for Scenario 11

Contingency (System Element Lost)	Monitored Element	Thermal Ratings (MVA)		Post-Project Results	
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading
N-0	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	112.94	103.33

Generation Assumption Adjustment:

To alleviate the observed thermal criteria violations under Category A conditions, the AESO adjusted the generation assumptions for Battle River generation units. For the purposes of this study, the total generation dispatch for Battle River generation unit # 4 (originally dispatched to 134.8 MW output) and # 5 (originally dispatched to 356.3 MW output) were reduced by approximately 30 MW and 50 MW respectively for all the 2021 post-Project sensitivity scenarios. Meanwhile, an equivalent amount of generation was dispatched up from the generation units in AESO planning area Wabamun (Area 40) to maintain the intertie flow assumption.

The adjusted planned renewable generation assumptions are shown in Table 3-7.

Table 3-7: Adjusted Non-Renewable Generation Dispatch Conditions for Battle River

Facility Name	Unit No.	Bus No.	Pmax (MW)	AESO Planning Area No.	Unit Net Generation[a] (MW) per 2021 SP Scenario	
					Original Assumption	Adjusted Assumption
Battle River	4	1496	155	36	134.8	104.8
Battle River	5	70001	385	36	356.3	306.3

Notes:

[a] "Unit Net Generation" refers to gross generating unit output (MW) less unit service load.

Post Generation Assumption Adjustment Results:

Post-Project power flow studies were repeated with the adjusted generation assumptions. Reliability Criteria violations were no longer observed on 7L50 line under Category A conditions, as shown in Table 3-8. All subsequent analysis for 2021 summer peak sensitivity scenarios (scenario 11, 12, and 13) contained in this report was based on the above noted adjusted generation assumptions.

Table 3-8: Post-Project Sensitivity Thermal Loading under Category A Conditions for Scenario 11 before and after Generation Assumptions were Adjusted

Contingency (System Element Lost)	Monitored Element	Thermal Ratings (MVA)		Post-Project Results with Original Assumptions		Post-Project Results with Adjusted Assumptions	
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading
N-0	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	112.94	103.33	107.14	98.02

No Reliability Criteria violations were observed under the Category A condition after the generation adjustment described above.

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions as shown in Table 3-9.

No voltage range violations or POD bus voltage deviations were observed under studied Category B conditions.

Table 3-9: Thermal Criteria Violations under Category B Conditions for Scenario 11

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Post-Project Results	
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading
7L14 (Kitscoty 705S - Hill 751S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	109.65	100.32
7L42 (Hill 751S - Lloydminster 716S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	130.30	119.21
9L20 (Nevis 766S - Cordel 755S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	174.60	123.11
	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	146.49	146.49
	7L16 (Nevis 766S - Heatburg 948S)	107.33	119.79	116.16	108.23
	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	134.00	101.25	105.47
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	120.77	112.52
	701L (North Holden 395S-Strome 223S)	119.03	131.00	158.26	132.96

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Post-Project Results	
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	117.20	137.74
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	170.46	121.84
	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	109.30	123.63	118.83	108.72
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	145.13	132.79
	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	123.63	132.25	130.74	105.75
912L/9L912 (Red Deer 63S - Nevis 766S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	180.35	127.16
	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	77.65	103.53
	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	134.00	105.67	110.08
	7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	96.00	130.00	99.35	103.49
	701L (North Holden 395S-Strome 223S)	119.03	131.00	179.33	150.66
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	135.95	159.77
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	191.80	137.10
	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	109.30	123.63	130.69	119.57
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	157.20	143.82
	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	123.63	132.25	142.97	115.64
912T (Battle River 757S 240/138 kV Transformer)	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	75.86	101.15
9L80 (Battle River 757S - Cordel 755S)	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	76.55	102.07
7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	109.30	123.63	117.01	107.05
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S	109.30	123.60	142.75	130.60

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Post-Project Results	
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading
	Substation Tap-point)				
	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	123.63	132.25	127.68	103.28
966L/9L966 (Hansman Lake 650S - Pemukan 932S)	7L224 (Monitor 774S - Hansman Lake 650S)	110.21	122.67	125.99	114.31
7L77 (North Holden 395S - Vegreville 709S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	117.36	107.38
701L (North Holden 395S- Strome 223S)	912L/9L912 (Red Deer 63S - Nevis 766S)	507.00	553.00	512.41	101.07
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	129.77	118.73
7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	134.00	116.45	121.30
	7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	96.00	130.00	110.39	114.99
	701L (North Holden 395S- Strome 223S)	119.03	131.00	128.16	107.67
769L/769AL (Hardisty 377S to Clipper 656S/Rosyth 296S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	109.77	100.43
749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	76.78	102.38
	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	109.30	123.63	121.23	110.91
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	147.17	134.65
	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	123.63	132.25	132.33	107.04
7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)	912L/9L912 (Red Deer 63S - Nevis 766S)	507.00	553.00	518.06	102.18
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	132.43	121.16
7L129 (Vermilion 710S to Bauer 918S/Buffalo Creek 526S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	134.00	109.49	114.05
	7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	96.00	130.00	103.54	107.85
	701L (North Holden 395S- Strome 223S)	119.03	131.00	122.94	103.29

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Post-Project Results	
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading
EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	171.19	120.70
	9L20 (Nevis 766S - Cordel 755S)	488.02	499.00	604.57	123.88
	912L/9L912 (Red Deer 63S - Nevis 766S)	507.00	553.00	690.04	136.10
	9L16 (Cordel 755S - Tincherbray 972S)	499.00	499.00	507.34	101.67
	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	82.38	109.84
	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	134.00	111.71	116.36
	7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	96.00	130.00	105.28	109.67
	701L (North Holden 395S- Strome 223S)	119.03	131.00	165.20	138.79
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	117.53	138.13
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	177.75	127.06
	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	109.30	123.63	125.77	115.06
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	152.46	139.49
	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	123.63	132.25	138.14	111.73
766S901T (Nevis 766S 240/138 kV Transformer)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	182.42	128.62
	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	78.08	104.11
	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	134.00	105.87	110.28
	7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	96.00	130.00	99.54	103.69
	701L (North Holden 395S- Strome 223S)	119.03	131.00	179.24	150.59
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	136.01	159.85
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	191.71	137.04

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Post-Project Results	
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading
	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	109.30	123.63	130.96	119.81
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	157.47	144.07
	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	123.63	132.25	143.24	115.86

3.1.7 Scenario 12: 2021 Summer Peak Post-Project PENV Sensitivity

Category A Condition

No Reliability Criteria violations were observed under the Category A condition.

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions as shown in Table 3- 10.

No voltage range violations or POD bus voltage deviations were observed under studied Category B conditions.

Table 3- 10: Thermal Criteria Violations under Category B Conditions for Scenario 12

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Post-Project Pre-PENV Results		Post-Project Post-PENV Results		% Loading Difference (Post – Pre PENV)
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
7L92 (Vegreville 709S to Vilna 777S/Watt Lake 956S/A819S WHITBY LAKE)	174L (Bardo 197S - North Holden 395S)	85.09	94.00	75.19	88.36	85.84	100.88	12.5
9L20 (Nevis 766S - Cordel 755S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	174.60	123.11	160.37	113.07	-10.0
	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	146.49	146.49	142.88	142.88	-3.6
	7L16 (Nevis 766S - Heatburg 948S)	107.33	119.79	116.16	108.23	113.89	106.11	-2.1

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Post-Project Pre-PENV Results		Post-Project Post-PENV Results		% Loading Difference (Post – Pre PENV)
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	120.77	112.52	118.48	110.39	-2.1
	701L (North Holden 395S-Strome 223S)	119.03	131.00	158.26	132.96	143.24	120.34	-12.6
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	117.20	137.74	127.52	149.86	12.1
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	170.46	121.84	155.36	111.05	-10.8
912L/9L912 (Red Deer 63S - Nevis 766S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	180.35	127.16	164.91	116.27	-10.9
	701L (North Holden 395S-Strome 223S)	119.03	131.00	179.33	150.66	162.51	136.53	-14.1
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	135.95	159.77	146.20	171.82	12.0
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	191.80	137.10	174.87	125.00	-12.1
966L/9L966 (Hansman Lake 650S - Pemukan 932S)	7L127 (Pemukan 932S - Monitor 774S)	144.71	185.92	143.77	99.35	147.69	102.06	2.7
	7L224 (Monitor 774S - Hansman Lake 650S)	110.21	122.67	125.99	114.31	129.51	117.51	3.2
EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	171.19	120.70	157.70	111.19	-9.5
	9L20 (Nevis 766S - Cordel 755S)	488.02	499.00	604.57	123.88	584.65	119.80	-4.1
	912L/9L912 (Red Deer 63S - Nevis 766S)	507.00	553.00	690.04	136.10	669.70	132.09	-4.0
	9L16 (Cordel 755S - Tincherbray 972S)	499.00	499.00	507.34	101.67	511.77	102.56	0.9
	701L (North Holden 395S-	119.03	131.00	165.20	138.79	150.68	126.59	-12.2

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Post-Project Pre-PENV Results		Post-Project Post-PENV Results		% Loading Difference (Post – Pre PENV)
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
	Strome 223S)							
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	117.53	138.13	130.42	153.27	15.1
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	177.75	127.06	163.14	116.61	-10.4
766S901T (Nevis 766S 240/138 kV Transformer)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	182.42	128.62	166.99	117.74	-10.9
	701L (North Holden 395S-Strome 223S)	119.03	131.00	179.24	150.59	162.68	136.67	-13.9
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	136.01	159.85	146.61	172.30	12.5
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	191.71	137.04	175.04	125.12	-11.9

3.1.8 Scenario 13: 2021 Summer Peak Post-Project PENV CETO phase 1 Sensitivity

Category A Condition

No Reliability Criteria violations were observed under the Category A condition.

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions as shown in Table 3- 11.

No voltage range violations or POD bus voltage deviations were observed under studied Category B conditions.

Table 3-11: Thermal Criteria Violations under Category B Conditions for Scenario 13

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Thermal Ratings (MVA)		Post-Project Post-PENV Pre-CETO Results		Post-Project Post-PENV Post-CETO Results		% Loading Difference (Post – Pre CETO)
		Normal Rating (MVA)	Emergency Rating (MVA)	Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
966L/9L966 (Hansman Lake 650S - Pemukan 932S)	7L127 (Pemukan 932S - Monitor 774S)	144.71	185.92	147.84	102.16	160.53	110.93	8.77
966L/9L966 (Hansman Lake 650S - Pemukan 932S)	7L224 (Monitor 774S - Hansman Lake 650S)	110.21	122.67	129.62	117.61	142.21	129.03	11.4
EATL HVDC	174L (Bardo 197S - North Holden 395S)	85.09	94.00	130.26	153.08	95.72	112.49	-40.59

3.2 Transient Stability Studies

Transient stability studies were completed for Scenario 6 (2020 Winter Peak Post-Project).

The system showed acceptable dynamic response to all Category B conditions studied, as shown in Table 3-12.

The post-Project transient stability plots are provided in Attachment A4. The dynamic data and assumptions of all equipment proposed for the Facility are provided in Attachment A5.

Table 3-12: Transient Stability Study Results under Category B Conditions for Scenario 6

Studied Contingency (System Element Lost)	Fault Description and Location	Results
9L24 (Oakland 946S – Lanfine 959S)	3-phase fault at Oakland 946S	Stable
	3-phase fault at Lanfine 959S	Stable
9L29 (Oakland 946S to Coyote Lake 963S)	3-phase fault at Oakland 946S	Stable
	3-phase fault at Coyote Lake 963S	Stable
9L20 (Cordel 755S – Nevis 766S)	3-phase fault at Cordel 755S	Stable
	3-phase fault at Nevis 766S	Stable
9L16 (Cordel 755S – Tincherbray 972S)	3-phase fault at Cordel 755S	Stable
	3-phase fault at Tinchebray 972S	Stable
9L966 (Pemukan 932S – Hansman Lake 650S)	3-phase fault at Pemukan 932S	Stable
	3-phase fault at Hansman Lake 650S	Stable

Studied Contingency (System Element Lost)	Fault Description and Location	Results
912L/9L912 (Red Deer 63S – Nevis 766S)	3-phase fault at Red Deer 63S	Stable
	3-phase fault at Nevis 766S	Stable
9L59 (Tinchebray 972S – Anderson 801S)	3-phase fault at Tinchebray 972S	Stable
	3-phase fault at Anderson 801S	Stable

4 Short Circuit Studies

4.1 Pre-Project Results

Pre-Project short-circuit current levels are provided in Table 4-1[1] for Scenario 1 (2020 WP Pre-Project).

Table 4-1: Pre-Project Short-Circuit Current Levels for Scenario 3

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3-Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)[2]	1-Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
Anderson 801S 240 kV	240	257.46	13.775	0.0031778+0.0205309j	15.304	0.0015048+0.0150666j
Anderson 801S 144 kV	138	149.12	5.019	0.0104409+0.0990537j	5.375	0.0039989+0.0803574j
Cordel 755S 240 kV	240	255.6	10.347	0.0048307+0.0253937j	11.284	0.0017323+0.0194476j
Coyote Lake 963S 240 kV	240	258.78	6.805	0.0059153+0.0417158j	6.441	0.0073359+0.0491276j
Coyote Lake 963S 144 kV	138	148.73	6.795	0.0091094+0.0725664j	7.799	0.0047671+0.0450487j
Michichi Creek 802S	138	148.53	4.481	0.0301185+0.1052973j	2.933	0.1387472+0.2503620j
Oakland 946S	240	257.71	12.518	0.0034425+0.0225859j	12.408	0.0042803+0.0234623j
Tinchebray 972S	240	256.23	9.01	0.0053471+0.0294253j	8.769	0.0049460+0.0320154j
Rowley 768S	138	148.35	3.012	0.0560108+0.1503251j	1.194	0.5893307+0.6912056j
Sheerness 807S G1	240	257.52	13.357	0.0032230+0.0211683j	14.708	0.0015565+0.0161039j
Sheerness 807S G2	240	257.52	13.318	0.0032464+0.0212309j	14.571	0.0017667+0.0164727j
Wintering Hills 804S	138	148.65	3.607	0.0361929+0.1316309j	2.354	0.1236121+0.3333145j

4.2 Post-Project Results

Post-Project short-circuit current levels are provided in Table 4-2 for Scenario 6 (2020 WP Post-Project).

[1] Short-circuit current studies were based on modeling information provided to the AESO by third parties. The authenticity of the modeling information has not been validated. Fault levels could change as a result of system developments, new customer connections, or additional generation in the area. It is recommended that these changes be monitored and fault levels reviewed to ensure that the fault levels are within equipment operating limits. The information provided in this study should not be used as the sole source of information for electrical equipment specifications or for the design of safety-grounding systems.

[2] impedance p.u. is calculated based on base voltage and system base 100 MVA

Table 4- 2: Post-Project Short-Circuit Current Levels for Scenario 6

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3-Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	1-Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
Anderson 801S 240 kV	240	257.42	13.76	0.0032013+0.0205818j	15.389	0.0015002+0.0147298j
Anderson 801S 144 kV	138	149.11	5.023	0.0104650+0.0991002j	5.385	0.0039926+0.0801728j
Cordel 755S 240 kV	240	255.6	10.347	0.0048394+0.0254140j	11.327	0.0017453+0.0191951j
Coyote Lake 963S 240 kV	240	258.74	6.806	0.0059386+0.0417643j	6.45	0.0073488+0.0490319j
Coyote Lake 963S 144 kV	138	148.72	6.8	0.0091331+0.0726116j	7.808	0.0047721+0.0450064j
Michichi Creek 802S	138	148.5	4.484	0.0301415+0.1053331j	2.936	0.1387335+0.2503113j
Oakland 946S	240	257.67	12.508	0.0034655+0.0226356j	12.454	0.0042863+0.0231999j
Tinchebray 972S	240	255.86	8.999	0.0053582+0.0294513j	8.894	0.0047700+0.0306522j
Rowley 768S	138	148.26	3.012	0.0560339+0.1503508j	1.194	0.5892466+0.6910886j
Sheerness 807S G1	240	257.52	13.346	0.0032458+0.0212183j	14.777	0.0015640+0.0158205j
Sheerness 807S G2	240	257.52	13.307	0.0032693+0.0212810j	14.64	0.0017716+0.0161819j
Wintering Hills 804S	138	148.64	3.61	0.0362133+0.1316668j	2.356	0.1236187+0.3332652j
Garden Plain 1045S	240	255.39	7.245	0.0063284+0.0376980j	6.497	0.0102925+0.0505559j

Post-Project short-circuit current levels are provided in Table 4- 3 for Scenario 7 (2028 WP Post-Project).

Table 4- 3: Post-Project Short-Circuit Current Levels for Scenario 7

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3-Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	1-Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
Anderson 801S 240 kV	240	256.19	14.325	0.0023466+0.0178623j	15.211	0.0015317+0.0147124j
Anderson 801S 144 kV	138	149.96	4.695	0.0096149+0.0968080j	4.981	0.0040321+0.0803548j
Cordel 755S 240 kV	240	254.31	11.329	0.0037755+0.0222441j	11.857	0.0024020+0.0194856j
Coyote Lake 963S 240 kV	240	255.35	6.955	0.0045622+0.0366912j	6.34	0.0069006+0.0470716j
Coyote Lake 963S 144 kV	138	149.32	6.547	0.0078305+0.0690110j	7.414	0.0046509+0.0446835j
Michichi Creek 802S	138	149.96	4.258	0.0290901+0.1032015j	2.755	0.1382984+0.2501661j
Oakland 946S	240	255.86	13.082	0.0025175+0.0195367j	13.062	0.0029271+0.0193925j
Tinchebray 972S	240	254.85	9.513	0.0043930+0.0265694j	9.021	0.0051058+0.0309453j
Rowley 768S	138	149.82	2.873	0.0553279+0.1487974j	1.131	0.5868381+0.6906606j
Sheerness 807S G1	240	256.19	13.542	0.0025066+0.0188924j	13.644	0.0024817+0.0183825j

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3-Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	1-Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
Sheerness 807S G2	240	256.19	13.541	0.0025166+0.0188924j	13.64	0.0025218+0.0183926j
Wintering Hills 804S	138	149.75	3.387	0.0355407+0.1298153j	2.19	0.1240630+0.3336557j
Garden Plain 1045S	240	254.11	7.16	0.0055127+0.0352831j	6.23	0.0103346+0.0505909j

5 Mitigation Measure Development and Evaluation

The Studies Consultant, in consultation with the AESO, developed mitigation measures to address the system performance issues that were identified in the post-Project scenarios. Existing remedial action schemes (RASs) are described in Section 1.2.2 of Attachment A1.

5.1 Pre-Project

Pre-Project mitigation measures for the base study scenarios are summarized in Table 5-1.

Table 5-1: Pre-Project Mitigation Measures

Mitigation Measure	Details of Reliability Criteria Violation
Planned RAS 134[a]	701L (North Holden 395S- Strome 223S)
	174L (Bardo 197S - North Holden 395S)
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)
	9L20 (Nevis 766S - Cordel 755S)
	912L/9L912 (Red Deer 63S - Nevis 766S)
	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)
Planned RAS 134 and 138[b]	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)
	701L (North Holden 395S- Strome 223S)
	174L (Bardo 197S - North Holden 395S)
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)
	912L/9L912 (Red Deer 63S - Nevis 766S)
	704L (Wainwright 51S - Tucuman 478S)
	7L159 (Ghost Pine 114S - Heatburg 948S)
Planned RAS 134 and 139[c]	901T (Nevis 766S 240/138 kV Transformer)
	174L (Bardo 197S - North Holden 395S)
Planned RAS 134, 138, and 139	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)
	901T (Nevis 766S 240/138 kV Transformer)
	9L20 (Nevis 766S - Cordel 755S)
	912L/9L912 (Red Deer 63S - Nevis 766S)
	9L16 (Cordel 755S - Tincherbray 972S)

Mitigation Measure	Details of Reliability Criteria Violation
	701L (North Holden 395S- Strome 223S)
	174L (Bardo 197S - North Holden 395S)
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)
Planned RAS 138	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)
Planned RAS 138 and 139	901T (Nevis 766S 240/138 kV Transformer)
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)
	7L159 (Ghost Pine 114S - Heatburg 948S)
Real Time Operational Practices	7L224 (Monitor 774S - Hansman Lake 650S)
	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)

Notes:

[a] RAS 134 is an existing RAS (see Section 1.2.2 of Attachment A1). Modifications to RAS 134 are proposed for multiple connection projects, including the planned Sharp Hills Wind Project. This modified version of RAS 134 is referred to herein as “Planned RAS 134”,

[b] RAS 138 is an existing RAS (see Section 1.2.2 of Attachment A1). Modifications to RAS 138 are proposed for multiple connection projects, including the planned Sharp Hills Wind Project. This modified version of RAS 138 is referred to herein as “Planned RAS 138”,

[c] RAS 139 is an existing RAS (see Section 1.2.2 of Attachment A1). Modifications to RAS 139 are proposed for multiple connection projects, including the planned Sharp Hills Wind Project. This modified version of RAS 139 is referred to herein as “Planned RAS 139”,

5.2 Post-Project

Post-Project mitigation measures for the base study scenarios are summarized in Table 5- 2 which shows all instances found in the post-Project state which require mitigation either by RAS or by Real Time Operational Practices (RTOP). The mitigation analysis of the post-Project scenarios indicated that the planned RAS 134, RAS 138 and RAS 139 would need to be modified to include the Project. Additionally, the analysis of the post-Project sensitivity scenarios also showed that in several instances these modified RAS did not fully mitigate the overloads and that post-RAS Real Time Operational Practices need to be relied upon to mitigate the residual overloads after the RAS was executed.

Table 5- 2: Post-Project Mitigation Measures

Mitigation Measure	Details of Reliability Criteria Violation
Modify[a] Planned RAS 134 and 138	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)
	701L (North Holden 395S- Strome 223S)
	174L (Bardo 197S - North Holden 395S)
	701L (Strome 223S - 7LA701 Heisler 764S

Mitigation Measure	Details of Reliability Criteria Violation
	Substation Tap-point)
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)
	9L20 (Nevis 766S - Cordel 755S)
	912L/9L912 (Red Deer 63S - Nevis 766S)
	704L (Wainwright 51S - Tucuman 478S)
	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)
Modify[a] Planned RAS 134, 138, and 139	901T (Nevis 766S 240/138 kV Transformer)
	7L16 (Nevis 766S - Heatburg 948S)
	7L159 (Ghost Pine 114S - Heatburg 948S)
	701L (North Holden 395S- Strome 223S)
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)
	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)
	912L/9L912 (Red Deer 63S - Nevis 766S)
	704L (Wainwright 51S - Tucuman 478S)
	174L (Bardo 197S - North Holden 395S)
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)
Modify[a] Planned RAS 138	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)
Modify[a] Planned RAS 139	901T (Nevis 766S 240/138 kV Transformer)
Real Time Operational Practices	7L224 (Monitor 774S - Hansman Lake 650S)
	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)
	7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)

Notes:

[a] "Modify" refers to adding the Project to the logic of the corresponding planned RASs 134, 138 and 139.

5.3 Evaluation of Mitigation Measures

This section describes the results of the power flow and transient stability studies that were performed to assess the impact of the Project on the performance of the AIES following the implementation of proposed mitigation measures.

- Modify Planned RAS 134 for 174L and 701L - 395S North Holden Thermal Overload. This RAS monitors the loading of the 174L and 701L transmission lines.

- Modify Planned RAS 138 for 7L50 - 526S Buffalo Creek Thermal Overload. This RAS monitors the loading of the 7L50 transmission line.
- Modify Planned RAS 139 for 901T - 766S Nevis transformer Thermal Overload. This RAS monitors the loading of the Nevis 766S 240/138 kV transformer 901T.

Planned RAS for 7L224 Thermal Overload[3]. This RAS monitors the loading of the 7L224 transmission line. The post-mitigation power flow diagrams for selected Category B conditions are provided in Attachment A6. Post-mitigation power flow diagrams present only those post-Project contingencies that result in thermal criteria violations that require RAS mitigation. Post-Project contingencies that result in thermal criteria violations that can be mitigated by real-time operational practices or TFO capital maintenance projects were not studied.

5.3.1 Scenario 4: 2020 Summer Light Post-Project

Category B Conditions

Thermal criteria violations observed under certain Category B conditions in the post-Project studies were mitigated by RASs as shown in Table 5-3. Following the implementation of mitigation measures, no thermal criteria violations, voltage criteria violations or POD bus voltage deviations were observed under Category B conditions.

Table 5-3: Post-RAS Power Flow Study Results for Scenario 4

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading
9L20 (Nevis 766S - Cordel 755S)	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	107.47	107.47	96.83	96.83

5.3.2 Scenario 5: 2020 Summer Peak Post-Project

Category B Conditions

Thermal criteria violations observed under certain Category B conditions in the post-Project studies were mitigated by RASs as shown in Table 5-4. Following the implementation of mitigation measures, no thermal criteria violations, voltage criteria violations or POD bus voltage deviations were observed under Category B conditions.

[3] The planned RAS for 7L224 Thermal Overload was only required on the Sensitivity Scenarios with Additional Generation Projects.

Table 5-4: Post-RAS Power Flow Study Results for Scenario 5

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading
9L20 (Nevis 766S - Cordel 755S)	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	130.15	130.15	99.17	99.17
	7L16 (Nevis 766S - Heatburg 948S)	107.33	119.79	109.55	102.07	92.43	86.11
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	112.99	105.27	95.86	89.31
	701L (North Holden 395S-Strome 223S)	119.03	131.00	120.43	101.17	90.77	76.26
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	120.00	109.79	99.87	91.37
912L/9L912 (Red Deer 63S - Nevis 766S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	147.23	103.81	115.18	81.21
	701L (North Holden 395S-Strome 223S)	119.03	131.00	138.16	116.07	103.89	87.28
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	97.08	114.09	62.83	73.84
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	155.90	111.44	121.23	86.66
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	130.29	119.20	107.47	98.33
7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	120.33	110.09	105.32	96.36
701L (North Holden 395S-Strome 223S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	111.06	101.61	106.00	96.98
749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	125.96	115.25	97.30	89.02
7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	115.14	105.34	100.60	92.04
EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	150.94	106.42	103.79	73.18

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading
	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	100.98	100.98	94.33	94.33
	912L/9L912 (Red Deer 63S - Nevis 766S)	507.00	553.00	556.63	109.79	476.02	93.89
	7L16 (Nevis 766S - Heatburg 948S)	107.33	119.79	108.10	100.72	89.22	83.13
	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	77.15	102.87	23.32	31.09
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	111.54	103.92	106.30	99.04
	701L (North Holden 395S-Strome 223S)	119.03	131.00	138.30	116.19	88.62	74.45
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	93.09	109.40	N/A	N/A
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	156.42	111.81	106.07	75.82
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	133.59	122.22	99.93	91.43
766S901T (Nevis 766S 240/138 kV Transformer)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	147.45	103.96	114.79	80.93
	701L (North Holden 395S-Strome 223S)	119.03	131.00	138.10	116.02	103.85	87.25
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	96.97	113.96	62.67	73.65
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	155.81	111.38	121.16	86.61
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	130.34	119.25	107.43	98.29

5.3.3 Scenario 6: 2020 Winter Peak Post-Project

Category B Conditions

Thermal criteria violations observed under certain Category B conditions in the post-Project studies were mitigated by RASs as shown in Table 5-5. Following the implementation of mitigation measures, no thermal criteria violations, voltage criteria violations or POD bus voltage deviations were observed under Category B conditions.

Table 5-5: Post-RAS Power Flow Study Results for Scenario 6

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading
9L20 (Nevis 766S - Cordel 755S)	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	142.66	142.66	68.10	68.10
	701L (North Holden 395S-Strome 223S)	146.04	161.00	147.77	101.18	116.15	79.53
	174L (Bardo 197S - North Holden 395S)	90.11	99.00	106.56	118.25	74.56	82.74
912L/9L912 (Red Deer 63S - Nevis 766S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	143.00	96.24	100.25	81.48	84.87
	701L (North Holden 395S-Strome 223S)	146.04	161.00	167.47	114.67	133.12	91.15
	174L (Bardo 197S - North Holden 395S)	90.11	99.00	124.12	137.74	89.93	99.80
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	169.00	169.00	184.07	108.91	149.18	88.27
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	139.00	150.50	144.90	104.24	121.51	87.42
EATL HVDC	9L20 (Nevis 766S - Cordel 755S)	498.00	498.00	578.81	116.23	469.86	94.35
	912L/9L912 (Red Deer 63S - Nevis 766S)	623.00	623.00	662.25	106.30	542.82	87.13
	704L (Wainwright 51S - Tucuman 478S)	79.00	87.00	80.30	101.64	70.23	88.90
	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	143.00	101.29	105.51	91.18	94.98
	701L (North Holden 395S-Strome 223S)	146.04	161.00	153.97	105.43	136.59	93.53
	174L (Bardo 197S - North Holden 395S)	90.11	99.00	106.81	118.53	89.04	98.81
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	169.00	169.00	170.58	100.93	152.96	90.51
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	139.00	150.50	139.47	100.34	127.06	91.41
766S901T (Nevis 766S 240/138 kV Transformer)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	143.00	96.54	100.56	77.95	81.20
	701L (North Holden 395S-Strome 223S)	146.04	161.00	167.68	114.82	93.54	64.05
	174L (Bardo 197S - North Holden 395S)	90.11	99.00	124.47	138.13	N/A	N/A
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	169.00	169.00	184.29	109.04	110.07	65.13
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	139.00	150.50	145.35	104.57	117.68	84.66

5.3.4 Scenario 9: 2020 Summer Peak Post-Project Wind (P1704) Sensitivity

Category B Conditions

Thermal criteria violations observed under certain Category B conditions in the post-Project studies were mitigated by RASs as shown in Table 5-6.

Table 5-6: Post-RAS Power Flow Study Results for Scenario 9

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading
7L42 (Hill 751S - Lloydminster 716S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	119.28	109.13	107.99	98.80
9L20 (Nevis 766S - Cordel 755S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	161.55	113.91	121.66	85.78
	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	145.57	145.57	68.40	68.40
	7L16 (Nevis 766S - Heatburg 948S)	107.33	119.79	117.35	109.33	54.17	50.47
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	120.80	112.55	57.66	53.72
	701L (North Holden 395S-Strome 223S)	119.03	131.00	140.99	118.45	101.87	85.58
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	100.03	117.56	61.81	72.64
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	158.80	113.51	119.25	85.24
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	134.45	123.01	107.79	98.62
912L/9L912 (Red Deer 63S - Nevis 766S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	168.58	118.86	126.62	89.27
	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	76.29	101.73	23.42	31.22
	701L (North Holden 395S-Strome 223S)	119.03	131.00	160.83	135.12	116.55	97.91
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	117.79	138.43	71.15	83.62
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	178.95	127.91	133.89	95.71
	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	109.30	123.63	115.53	105.70	70.21	64.24
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	146.01	133.59	99.94	91.44

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading
	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	123.63	132.25	127.22	102.90	81.24	65.71
7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	130.74	119.62	97.65	89.34
7L77 (North Holden 395S - Vegreville 709S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	111.28	101.81	107.58	98.43
701L (North Holden 395S-Strome 223S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	122.59	112.16	105.11	96.17
749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	76.01	101.35	23.33	31.11
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	136.42	124.81	102.32	93.61
7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	126.69	115.91	109.11	99.83
EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	164.61	116.06	108.45	76.46
	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	102.78	102.78	97.40	97.40
	9L20 (Nevis 766S - Cordel 755S)	488.02	499.00	534.99	109.62	423.36	86.75
	912L/9L912 (Red Deer 63S - Nevis 766S)	507.00	553.00	626.44	123.56	506.75	99.95
	7L16 (Nevis 766S - Heatburg 948S)	107.33	119.79	109.03	101.58	105.51	98.30
	9L16 (Cordel 755S - Tincherbray 972S)	499.00	499.00	575.98	115.43	421.52	84.47
	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	81.76	109.01	23.20	30.93
	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	134.00	97.95	102.03	90.12	93.87
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	112.47	104.79	108.82	101.39
	701L (North Holden 395S-Strome 223S)	119.03	131.00	152.34	127.98	93.31	78.39
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	105.48	123.96	n/a	n/a

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	170.66	121.99	110.93	79.29
	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	109.30	123.63	113.12	103.49	73.82	67.54
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	143.62	131.40	103.71	94.89
	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	123.63	132.25	125.01	101.12	85.32	69.01
766S901T (Nevis 766S 240/138 kV Transformer)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	169.48	119.49	126.31	89.06
	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	76.50	102.00	23.43	31.24
	701L (North Holden 395S-Strome 223S)	119.03	131.00	160.89	135.17	116.43	97.81
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	117.87	138.53	70.92	83.35
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	179.00	127.95	133.74	95.60
	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	109.30	123.63	115.73	105.88	70.19	64.22
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	146.23	133.79	99.92	91.42
	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	123.63	132.25	127.42	103.07	81.19	65.67

5.3.5 Scenario 10: 2020 Summer Peak Post-Project Wind (P1704) and PENV Sensitivity

Category B Conditions

Thermal criteria violations observed under certain Category B conditions in the post-Project studies were mitigated by RASs as shown in Table 5-7. Following the implementation of mitigation measures, no thermal criteria violations, voltage criteria violations or POD bus voltage deviations were observed under Category B conditions.

Table 5-7: Post-RAS Power Flow Study Results for Scenario 10

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading
9L20 (Nevis 766S - Cordel 755S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	148.15	104.45	121.63	85.76
	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	142.12	142.12	77.06	77.06
	7L16 (Nevis 766S - Heatburg 948S)	107.33	119.79	115.14	107.28	58.74	54.73
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	118.59	110.49	62.23	57.98
	701L (North Holden 395S-Strome 223S)	119.03	131.00	126.92	106.62	100.80	84.68
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	109.44	128.61	81.14	95.36
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	144.62	103.37	118.19	84.48
912L/9L912 (Red Deer 63S - Nevis 766S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	154.14	108.68	117.62	82.93
	701L (North Holden 395S-Strome 223S)	119.03	131.00	145.22	122.00	106.48	89.45
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	127.34	149.64	84.55	99.36
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	163.18	116.64	123.88	88.55
EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	151.87	107.08	92.14	64.97
	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	102.86	102.86	98.33	98.33
	9L20 (Nevis 766S - Cordel 755S)	488.02	499.00	515.67	105.66	409.70	83.95
	912L/9L912 (Red Deer 63S - Nevis 766S)	507.00	553.00	606.89	119.70	494.63	97.56
	7L16 (Nevis 766S - Heatburg 948S)	107.33	119.79	108.47	101.07	104.88	97.72
	9L16 (Cordel 755S - Tincherbray 972S)	499.00	499.00	580.21	116.27	424.50	85.07
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	111.92	104.27	108.46	101.06
	701L (North Holden 395S-Strome 223S)	119.03	131.00	138.56	116.41	75.32	63.28
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	117.90	138.56	n/a	n/a
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	156.82	112.10	93.00	66.47

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading
766S901T (Nevis 766S 240/138 kV Transformer)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	154.75	109.11	117.16	82.61
	701L (North Holden 395S-Strome 223S)	119.03	131.00	145.18	121.97	106.37	89.36
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	127.32	149.63	84.26	99.02
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	163.13	116.61	123.72	88.44

5.3.6 Scenario 11: 2021 Summer Peak Post-Project Sensitivity

Category B Conditions

Thermal criteria violations observed under certain Category B conditions in the post-Project studies were mitigated by RASs as shown in Table 5-8.

Table 5-8: Post-RAS Power Flow Study Results for Scenario 11

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading
7L14 (Kitscoty 705S - Hill 751S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	109.65	100.32	104.40	95.52
7L42 (Hill 751S - Lloydminster 716S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	130.30	119.21	100.29	91.76
9L20 (Nevis 766S - Cordel 755S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	174.60	123.11	110.19	77.69
	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	146.49	146.49	80.58	80.58
	7L16 (Nevis 766S - Heatburg 948S)	107.33	119.79	116.16	108.23	57.56	53.63
	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	134.00	101.25	105.47	88.67	92.36
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	120.77	112.52	61.80	57.58
	701L (North Holden 395S-Strome 223S)	119.03	131.00	158.26	132.96	89.93	75.55
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	117.20	137.74	N/A	N/A

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	170.46	121.84	101.57	72.6
	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	109.30	123.63	118.83	108.72	76.25	69.76
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	145.13	132.79	102.21	93.51
	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	123.63	132.25	130.74	105.75	87.46	70.74
912L/9L912 (Red Deer 63S - Nevis 766S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	180.35	127.16	98.26	69.28
	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	77.65	103.53	17.39	23.18
	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	134.00	105.67	110.08	87.39	91.03
	7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	96.00	130.00	99.35	103.49	81.56	84.96
	701L (North Holden 395S-Strome 223S)	119.03	131.00	179.33	150.66	90.81	76.29
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	135.95	159.77	N/A	N/A
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	191.80	137.10	102.43	73.22
	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	109.30	123.63	130.69	119.57	76.06	69.59
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	157.20	143.82	102.01	93.33
	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	123.63	132.25	142.97	115.64	87.27	70.59
7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	109.30	123.63	117.01	107.05	79.31	72.56
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	142.75	130.60	104.85	95.93
	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	123.63	132.25	127.68	103.28	89.40	72.31
966L/9L966 (Hansman Lake 650S - Pemukan 932S)	7L224 (Monitor 774S - Hansman Lake 650S)	110.21	122.67	125.99	114.31	n/a	n/a

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading
7L77 (North Holden 395S - Vegreville 709S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	117.36	107.38	105.79	96.79
701L (North Holden 395S-Strome 223S)	912L/9L912 (Red Deer 63S - Nevis 766S)	507.00	553.00	512.41	101.07	388.87	76.70
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	129.77	118.73	101.33	92.71
769L/769AL (Hardisty 377S to Clipper 656S/Rosyth 296S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	109.77	100.43	105.31	96.35
749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	76.78	102.38	17.45	23.26
	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	109.30	123.63	121.23	110.91	82.84	75.79
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	147.17	134.65	108.55	99.31
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	-	-	110.50	101.10
	7L129 (Battle River 757S - 7LA129 Bauer 918S Tap-point)	123.63	132.25	132.33	107.04	93.35	75.51
7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)	912L/9L912 (Red Deer 63S - Nevis 766S)	507.00	553.00	518.06	102.18	394.45	77.8
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	132.43	121.16	103.88	95.04
EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	171.19	120.70	107.82	76.02
	9L20 (Nevis 766S - Cordel 755S)	488.02	499.00	604.57	123.88	464.16	95.11
	912L/9L912 (Red Deer 63S - Nevis 766S)	507.00	553.00	690.04	136.10	538.33	106.18
	9L16 (Cordel 755S - Tincherbray 972S)	499.00	499.00	507.34	101.67	346.71	69.48
	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	82.38	109.84	17.58	23.44
	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	134.00	111.71	116.36	100.42	104.60
	7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	96.00	130.00	105.28	109.67	94.30	98.23
	701L (North Holden 395S-Strome 223S)	119.03	131.00	165.20	138.79	98.15	82.46

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	117.53	138.13	N/A	N/A
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	177.75	127.06	110.17	78.75
	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	109.30	123.63	125.77	115.06	81.02	74.13
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	152.46	139.49	107.23	98.11
	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	123.63	132.25	138.14	111.73	92.57	74.88
766S901T (Nevis 766S 240/138 kV Transformer)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	182.42	128.62	99.37	70.06
	704L (Wainwright 51S - Tucuman 478S)	75.00	83.00	78.08	104.11	17.39	23.18
	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	96.00	134.00	105.87	110.28	87.59	91.24
	7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	96.00	130.00	99.54	103.69	81.75	85.16
	701L (North Holden 395S-Strome 223S)	119.03	131.00	179.24	150.59	90.95	76.41
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	136.01	159.85	N/A	N/A
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	191.71	137.04	102.59	73.33
	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	109.30	123.63	130.96	119.81	76.27	69.78
	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	109.30	123.60	157.47	144.07	102.23	93.53
	7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	123.63	132.25	143.24	115.86	87.48	70.76

5.3.7 Scenario 12: 2021 Summer Peak Post-Project PENV Sensitivity

Category B Conditions

Thermal criteria violations observed under certain Category B conditions in the post-Project studies were mitigated by RASs as shown in Table 5-9.

Table 5- 9: Post-RAS Power Flow Study Results for Scenario 12

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading
7L92 (Vegreville 709S to Vilna 777S/Watt Lake 956S/A819S WHITBY LAKE)	174L (Bardo 197S - North Holden 395S)	85.09	94.00	85.84	100.88	78.51	92.27
9L20 (Nevis 766S - Cordel 755S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	160.37	113.07	94.29	91.26
	901T (Nevis 766S 240/138 kV Transformer)	100.00	100.00	142.88	142.88	78.62	68.14
	7L16 (Nevis 766S - Heatburg 948S)	107.33	119.79	113.89	106.11	55.70	48.23
	7L159 (Ghost Pine 114S - Heatburg 948S)	107.33	118.83	118.48	110.39	59.93	52.14
	701L (North Holden 395S-Strome 223S)	119.03	131.00	143.24	120.34	72.70	94.57
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	127.52	149.86	N/A	108.41
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	155.36	111.05	84.29	88.88
912L/9L912 (Red Deer 63S - Nevis 766S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	164.91	116.27	91.88	64.78
	701L (North Holden 395S-Strome 223S)	119.03	131.00	162.51	136.53	83.15	69.86
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	146.20	171.82	N/A	N/A
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	174.87	125.00	94.98	67.89
966L/9L966 (Hansman Lake 650S - Pemukan 932S)	7L127 (Pemukan 932S - Monitor 774S)	144.71	185.92	147.69	102.06	0.00	15.38
	7L224 (Monitor 774S - Hansman Lake 650S)	110.21	122.67	129.51	117.51	N/A	n/a

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading
EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	157.70	111.19	90.59	63.87
	9L20 (Nevis 766S - Cordel 755S)	488.02	499.00	584.65	119.80	448.78	91.96
	912L/9L912 (Red Deer 63S - Nevis 766S)	507.00	553.00	669.70	132.09	523.27	103.21
	9L16 (Cordel 755S - Tincherbray 972S)	499.00	499.00	511.77	102.56	348.45	69.83
	701L (North Holden 395S-Strome 223S)	119.03	131.00	150.68	126.59	79.31	66.63
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	130.42	153.27	N/A	N/A
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	163.14	116.61	91.20	65.19
766S901T (Nevis 766S 240/138 kV Transformer)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	141.83	159.08	166.99	117.74	93.17	65.69
	701L (North Holden 395S-Strome 223S)	119.03	131.00	162.68	136.67	83.15	69.86
	174L (Bardo 197S - North Holden 395S)	85.09	94.00	146.61	172.30	N/A	N/A
	701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	139.90	158.00	175.04	125.12	94.99	67.90

5.3.8 Scenario 13: 2021 Summer Peak Post-Project PENV CETO Phase 1 Sensitivity

Category B Conditions

Thermal criteria violations observed under certain Category B conditions in the post-Project studies were mitigated by RASs as shown in Table 5-10. Following the implementation of mitigation measures, no thermal criteria violations, voltage criteria violations or POD bus voltage deviations were observed under Category B conditions.

Table 5- 10: Post-RAS Power Flow Study Results for Scenario 13

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading
966L/9L966 (Hansman Lake 650S - Pemukan 932S)	7L127 (Pemukan 932S - Monitor 774S)	144.71	185.92	160.53	110.93	22.26	15.38
	7L224 (Monitor 774S - Hansman Lake 650S)	110.21	122.67	142.21	129.03	n/a	n/a
EATL HVDC	174L (Bardo 197S - North Holden 395S)	85.09	94.00	95.72	112.49	81.85	96.19

5.4 Constraint Effective Factor Studies

Constraint effective factor studies were conducted for all post-Project scenarios (scenario 4, 5, and 6). The constraint effective factors were calculated for all Category B conditions when the loadings of the monitored transmission elements in the Study Area exceeded 100% (i.e., for all of the contingencies that resulted in thermal criteria violations). The results of the constraint effective factor studies are provided in Attachment A7.

Attachment A1
Engineering Connection Assessment: Study Scope

Engineering Connection Assessment: Study Scope

Garden Plain Wind Power Project Connection

TransAlta Coporation

AESO Project 1909

Date: March 29, 2021

Version: V5 Final

Classification: Public

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Attachments

Attachment A: Transmission Planning Criteria – Basis and Assumptions

1 Introduction

This Study Scope provides an overview of the engineering studies to be completed by CF Power Ltd. (the Studies Consultant) to assess the impact of the Project (as defined in section 1.1) on the performance of the Alberta interconnected electric system (AIES). Technical criteria, assumptions, and methods for performing these engineering studies are provided in this document.

1.1 Project Overview

TransAlta Corporation (Market Participant) has submitted a request for system access service to the Alberta Electric System Operator (AESO) to connect its approved Garden Plain Wind Power Project (the Facility) to the AIES in the Castor area. The Facility is located in the AESO transmission planning area of Hanna (Area 42). The Facility includes the proposed collector substation to be designated the Garden Plain 1045S substation.

The Market Participant's request includes: a request for a new system access service in the area, with a Rate STS, *Supply Transmission Service*, contract capacity of 130 MW, and a Rate DTS, *Demand Transmission Service*, contract capacity of 4.0 MW, and a request for transmission development (collectively, the Project).

The scheduled in-service date (ISD) for the Project is July 1, 2022.

Load and generation components of the Project are listed in Table 1-1.

Table 1-1: Project Load and Generation Details

Project Component		Description
Load	Existing Rate DTS, *Demand Transmission Service,* contract capacity	No existing contract
	Requested Rate DTS	4 MW
	Type	Industrial
	Motors (number and size)	-
	Power factor	0.9
	Future load expansion plans	-
Generation	Generation type	Wind
	Existing Rate STS, *Supply Transmission Service,* contract capacity	No existing contract
	Requested Rate STS	130 MW
	Number and size of generating units	36, 3.63 MW wind turbines
	Maximum authorized real power (MARP)	130 MW
	Maximum capability (MC)	130 MW
	Reactive power capability	62.96 MVAr (0.9 pf absorbing)

Project Component		Description
		42.73 MVAr (0.95 pf reducing)
	Future generation expansion plans	No

Note:

MARP and MC are defined in the AESO's *Consolidated Authoritative Document Glossary*, which can be found on the AESO's website.

1.2 Existing System Overview

1.2.1 Study Area

Geographically, the Project is located in the AESO planning area of Hanna (42).

The Study Area consists of the AESO planning area(s) of Lloydminster (Area 13), Wainwright (Area 32), Alliance/Battle River (Area 36), Provost (Area 37), Hanna (Area 42), Sheerness (Area 43), and Vegreville (Area 56).

The region is currently served by 240 kV, 138/144 kV and 69/72 kV networks. The major sources of power supply to the study area are the coal-fired plants at Sheerness and Battle River.

The existing transmission system in the Study Area is shown in Figure 1-1.

1.2.2 Existing Constraints

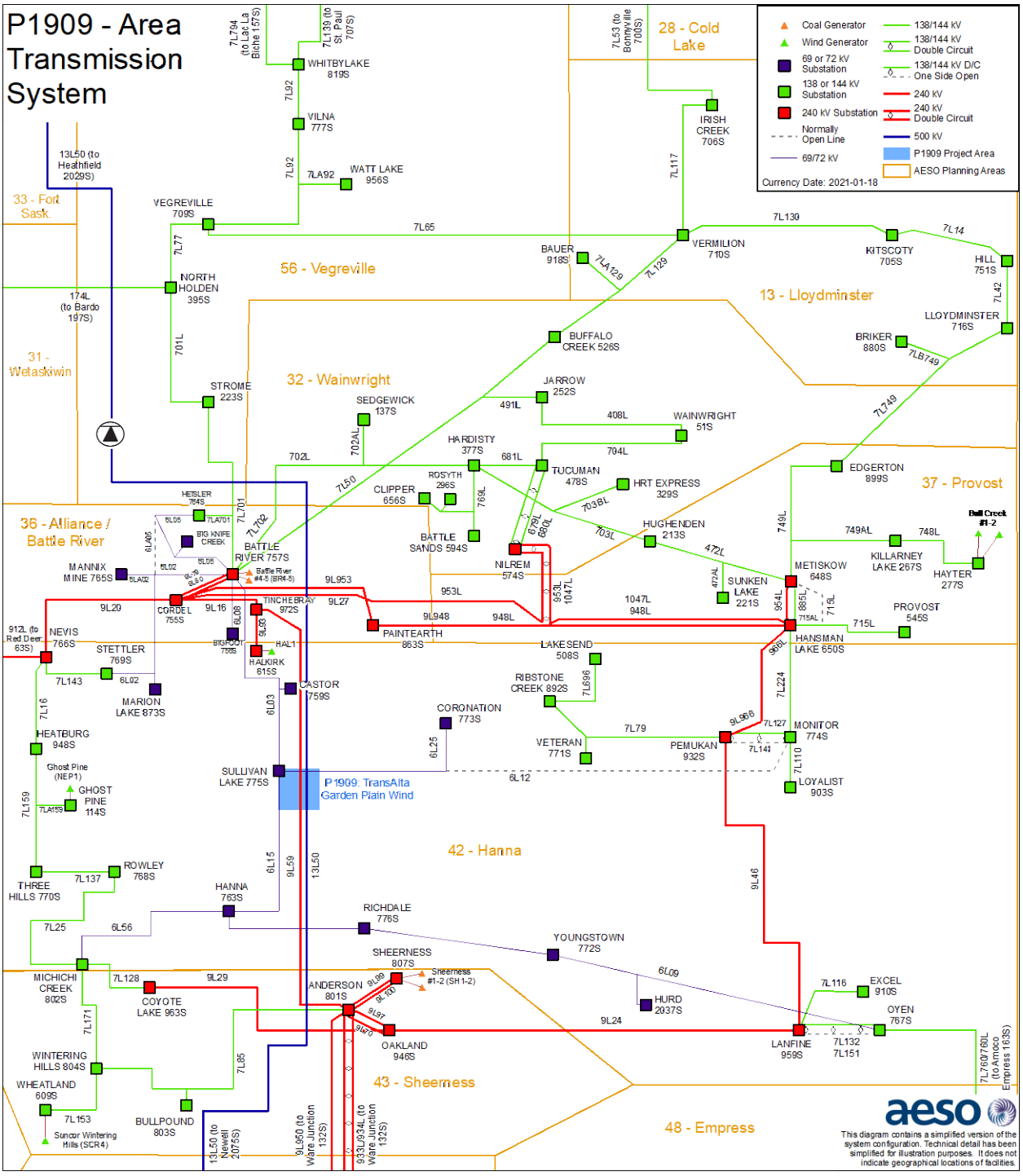
Existing constraints in the Study Area are managed in accordance with the procedures set out in Section 302.1 of the ISO rules, *Real Time Transmission Constraint Management* (TCM Rule).

There are a number of constraints in the Study Area that are mitigated by existing remedial action schemes (RASs) and/or other protection schemes.

The following existing RASs and/or other protection schemes are used to manage constraints in the area:

- RAS 32: Battle River 757S 7L50 and 7L701 thermal protection scheme
- RAS 134: 174L-395S North Holden overload mitigation scheme
- RAS 138: 7L50-526S Buffalo Creek overload mitigation scheme
- RAS 139: 901T-766S Nevis overload mitigation scheme
- RAS 149: Eastern Alberta Transmission Line (EATL) HVDC

Figure 1-1: Existing Transmission System in the Study Area



2 Connection Alternative to be Studied

The following alternative will be studied:

2.1 Alternative 2 – T-tap connection to the 240 kV transmission line 9L59

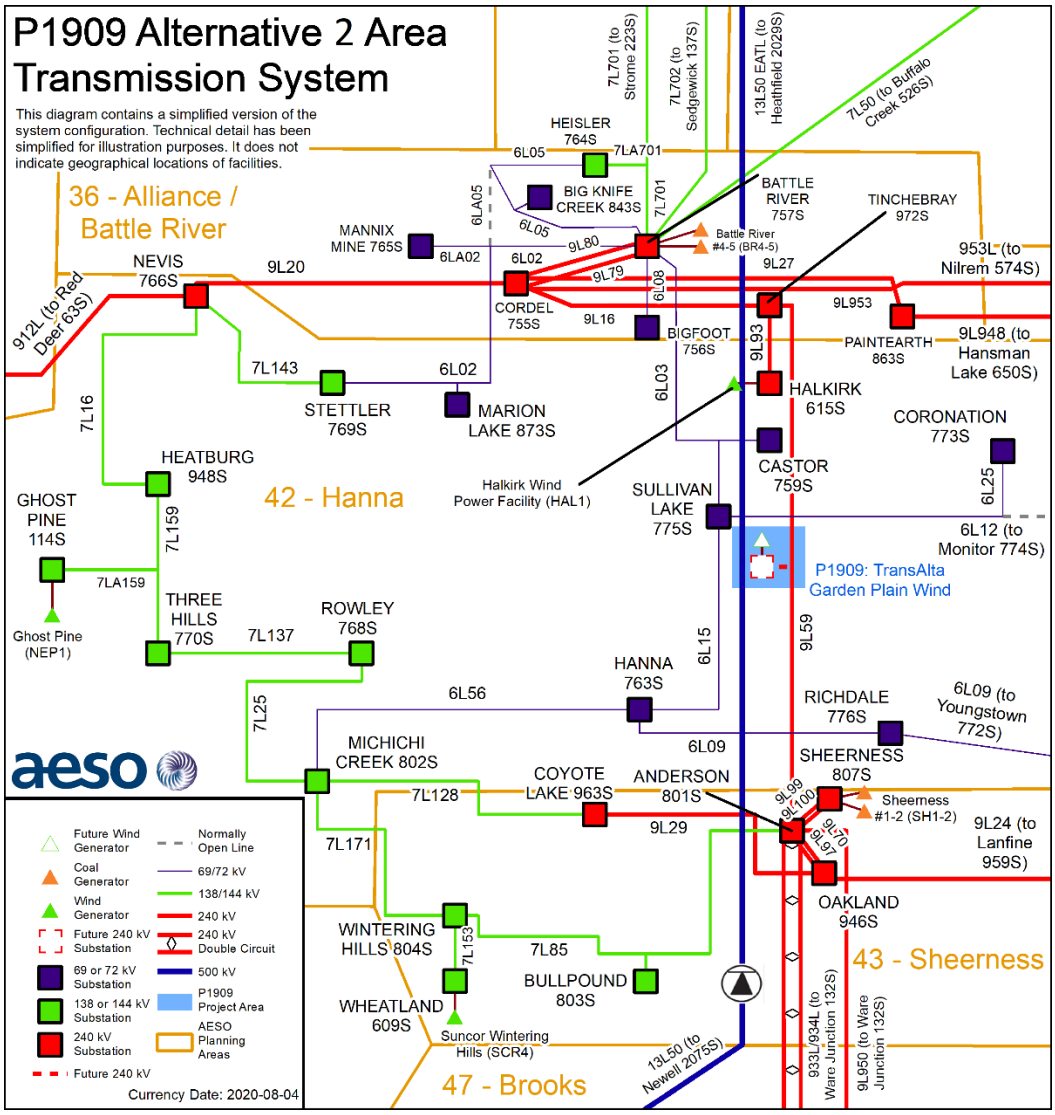
This alternative includes the following developments:

- Add one 240 kV transmission circuit, approximately 160 metres[1] in length, to connect the Facility to the existing 240 kV transmission line 9L59 using a T-tap configuration.
- Add or modify associated equipment as required for the above transmission developments.

The proposed connection configuration is shown in Figure 2-1.

[1] TFO to determine the actual length.

Figure 2-1: Connection Alternative 2



3 Criteria, Standards and Requirements

3.1 AESO Reliability Criteria

The Transmission Planning (TPL) Standards, which are included in the Alberta Reliability Standards, and *Transmission Planning Criteria – Basis and Assumptions (see Attachment A),* (collectively, the Reliability Criteria) will be applied to evaluate system performance under Category A system conditions (i.e., all elements in-service) and following Category B contingencies (i.e., single element outage), prior to and following the studied alternatives. Below is a summary of Category A and Category B system conditions.

Category A, often referred to as the N-0 condition, represents a normal system with no contingencies and all facilities in service. Under this condition, the system must be able to supply all firm load and firm transfers to other areas. All equipment must operate within its applicable rating, voltages must be within their applicable range, and the system must be stable with no cascading outages.

Category B events, often referred to as an N-1 or N-G-1 with the most critical generator out of service, result in the loss of any single specified system element under specified fault conditions with normal clearing. These elements are a generator, a transmission circuit, a transformer, or a single pole of a DC transmission line. The acceptable impact on the system is the same as Category A. Planned or controlled interruptions of electric supply to radial customers or some local network customers, connected to or supplied by the faulted element or by the affected area, may occur in certain areas without impacting the overall reliability of the interconnected transmission systems. To prepare for the next contingency, system adjustments are permitted, including curtailments of contracted firm (non-recallable reserved) transmission service electric power transfers.

The TPL standards, TPL-001-AB-0 and TPL-002-AB1-0, have referenced Applicable Ratings when specifying the required system performance under Category A and Category B events. For the purpose of applying the TPL standards to the studies documented in this report, Applicable Ratings are defined as follows:

- Normal thermal rating of the line's loading limits for each season.
- The highest specified loading limits for transformers.
- For Category A conditions: Voltage range under normal operating condition per AESO Information Document #2010-007RS, *General Operating Practices – Voltage Control* (ID #2010-007RS). For the busses not listed in ID #2010-007RS, Table 2-1 in the *Transmission Planning Criteria – Basis and Assumptions* applies.
- For Category B conditions: The extreme voltage range values per Table 2-1 in the *Transmission Planning Criteria – Basis and Assumptions.*
- Desired post-contingency voltage deviation limits for three defined post-event timeframes as provided in Table 3-1.

Table 3-1: Post-Contingency Voltage Deviation Guidelines for Low Voltage Busses

Parameter and reference point	Time Period		
	Post Transient (up to 30 sec)	Post Auto Control (30 sec to 5 min)	Post Manual Control (Steady State)
Voltage deviation from steady state at Point of Delivery (POD) low voltage bus.	±10%	±7%	±5%

3.2 ISO Rules and Information Documents

ID #2010-007RS will be used to establish system normal (i.e., pre-contingency) voltage profiles for the Study Area.

The TCM Rule will be followed to set up the study scenarios and assess the impact of the Project. In addition, due regard will be given to the following:

- The AESO's *Connection Study Requirements*;
- Section 502.1 of the ISO rules, *Aggregated Generating Facilities Technical Requirements*;
- Section 502.16 of the ISO rules, *Aggregated Generating Facilities Operating Requirements*;
- Section 502.5 of the ISO rules *Generating Unit Technical Requirements*;
- Section 502.6 of the ISO rules *Generating Unit Operating Requirements*;

4 Scenarios and Assumptions

4.1 Scenarios

The following section describes the scenarios to be studied and the assumptions to be used in the studies.

The AESO has updated its regional forecasts since the base connection studies were performed. The AESO determined that the use of the current AESO forecast would not materially alter the connection study results (in terms of alternative selection) or affect the conclusions and recommendations in this report. However, given that the ISD of the Project changed, the AESO determined that post-Project sensitivities representing the worst case Summer Peak post-Project conditions, as well as sensitivity studies modelling the PENV and CETO system projects would be required to study the impact of the change to the ISD and update the mitigations if required.

Connection scenarios must be studied as outlined in Table 4-1.

Table 4-1: Connection Study Scenarios

Scenario No.	Year/Season	System Generation Dispatch Conditions	Scenario Name	Project Load (MW)	Project Generation (MW)
Pre-Project Base Scenarios					
1	2020 Summer Light (SL)	High Wind (HW), Economic Coal (EC)	2020 SL Pre-Project	0	0
2	2020 Summer Peak (SP)		2020 SP Pre-Project	0	0
3	2020 Winter Peak (WP)		2020 WP Pre-Project	0	0
Post-Project Base Scenarios					
4	2020 SL	HW, EC	2020 SL Post-Project	0	130
5	2020 SP		2020 SP Post-Project	0	130
6	2020 WP		2020 WP Post-Project	0	130
7	2028 WP	All generation in the Study Area in-service	2028 WP Post-Project	0	130
Pre-Project Sensitivity Scenarios with P1704					
8	2020 SP	HW, EC	2020 SP Pre-Project Wind (P1704)	0	0
Post-Project Sensitivity Scenarios with P1704					
9	2020 SP	HW, EC	2020 SP Post-Project Wind (P1704)	0	130
10			2020 SP Post-Project Wind (P1704) and PENV	0	130
Post-Project Sensitivity Scenarios with additional generation projects: P1879, P1812, and P2009					
11	2021 SP	HW, EC	2021 SP Post-Project with additional generation projects	0	130

Scenario No.	Year/Season	System Generation Dispatch Conditions	Scenario Name	Project Load (MW)	Project Generation (MW)
12			2021 SP Post-Project with additional generation projects and PENV	0	130
13			2021 SP Post-Project with additional generation projects, PENV and CETO	0	130

4.2 Assumptions

4.2.1 System Project Assumptions

Table 4-2 lists the system transmission projects that will be included in the sensitivity scenarios.

Table 4-2: Planned System Transmission Projects to be Included in the Sensitivity Studies

AESO Project No.	Project Name/Description	Scheduled ISD	AUC NID Decision No.
P1781	Provost to Edgerton & Nilrem to Vermilion Transmission Development	Dec. 31, 2022 (Stage 1)	23429-D01-2019
P7001	Central East Transfer-out Transmission Development	2023 (Stage 1)	N/A

4.2.2 Connection Project Assumptions

The connection projects included in this study are listed in Table 4-3.

Table 4-3: Planned Connection Projects in the Study Area Included in the Studies

AESO Project No.	AESO Project Name	AESO Planning Area No.	Generation (MW)	Load (MW)	Scheduled ISD	AUC Decision No.
851	TransCanada Keystone KXL Pumpstation #2-Eyre	37	0.0	0.0	Nov 1, 2021	2011-104
851	TransCanada Keystone KXL Pumpstation #2-Eyre	37	0.0	25.0	Nov 1, 2021	2011-104
863	TransCanada Keystone KXL Pumpstation #3-Current	42	0.0	25.0	Nov 1, 2021	2011-372
864	TransCanada Keystone KXL Pumpstation #4-Armitage	42	0.0	25.0	Nov 1, 2021	2011-372
1250	E.ON Grizzly Bear Wind	13	120.0	1.5	Oct 1, 2022	21643-D01-2016
1410	ATCO Heartland Pump Station Connection	56	0.0	20.0	Nov 1, 2021	21166-D01-2016

AESO Project No.	AESO Project Name	AESO Planning Area No.	Generation (MW)	Load (MW)	Scheduled ISD	AUC Decision No.
1567	EDPR Sharp Hills Wind Farm New Facility Generator Capacity	42	248.4	1.0	Apr,15 2022	23066-D01-2018
1567	EDPR Sharp Hills Wind Farm New Facility Generator Capacity	42	51.6	0.0	Apr,15 2022	23066-D01-2018
1718	Wheatland WAGF Project	43	120.0	0.0	Sep 30, 2022	24040-D01-2019
1782	Fortis Provost Reliability	37	0.0	0.0	May 1, 2021	23339-D01-2019
1704*	Paintearth Wind Power	42	150.0	1.0	Apr 1, 2023	23206-D01-2021
1812**	Suncor Forty Mile Granlea WAGF	4	200.0	0.3	Nov 16, 2021	24120-D01-2019
1879**	Claresholm Solar Connection	49	130.0	0.6	In service	24679-D01-2019
2009**	Greengate Travers MPC Solar	49	400.0	0.5	Aug 1, 2021	24848-D01-2019

*Only included in the sensitivity scenarios with P1704

**Only included in the Post-Project sensitivity scenarios with additional generation projects

4.2.3 Load Assumptions

The load forecast to be used for the base scenario studies is shown in Table 4-4 and is a forecast for the AESO Central Planning Region peak based on the *AESO 2017 Long-term Outlook* (2017 LTO)[2].

As the *AESO 2019 Long-Term Outlook* (2019 LTO[3]) was available when the sensitivity studies were scoped, the 2019 LTO was used for the sensitivity studies. Therefore the load forecast to be used for the post-Project sensitivity scenario studies is shown in Table 4-5 and is a forecast for the AESO Central Planning Region peak based on the 2019 LTO.

For the studies, when loads for the Alberta Internal Load (AIL) are modified to align with the load forecast in the 2017 LTO or the 2019 LTO, the active power to reactive power ratio in the base case scenarios will be maintained.

[2] The 2017 LTO is available on the AESO website.

[3] The 2019 LTO is available on the AESO website.

Table 4-4: Forecast Load for 2020 (2017LTO at AESO Central Planning Region Peak)

AESO Planning Area or Region Name	Forecast Peak Load by Year/Season (MW)		
	2020 SL	2020 SP	2020 WP
Central Planning Region[1]	1,421	1,918	2,184

Note:
[1] The Central Region comprises the following AESO planning areas: Vegreville (Area 56), Lloydminster (Area 13), Wainwright (Area 32), Provost (Area 37), Alliance/Battle River (Area 36), Hanna (Area 42), Red Deer (Area 35), Didsbury (Area 39), Caroline (Area 38), Drayton Valley (Area 30), Hinton/Edson (Area 29), Abraham Lake (Area 34) and Cold Lake (Area 28).

Table 4-5: Forecast Load for 2021 Sensitivity (2019 LTO at AESO Central Planning Region Peak)

AESO Planning Region Name	Forecast Peak Load by Year/Season (MW)
	2021 SP
Central Planning Region	2,078

IDEV files contain non-motor loads in zones 34 and 36. These loads are not accounted for in the forecasted peak loads shown above and should not be considered when scaling load. The AESO engineer will provide guidance to load scaling procedures as required.

4.2.4 Generation Assumptions

The generation forecast to be used for the studies is based on the 2017 LTO. The generation assumptions for the studies will assume High wind and Economic Coal (EC) dispatch conditions. Additional studies may be required in the event of changes to the AESO's corporate forecast.

4.2.4.1 Non-renewable Generation Assumptions

The non-renewable generation dispatch conditions for the study scenarios are described in Table 4-6.

Table 4-6: Non-Renewable Generation Dispatch Conditions

Facility Name	Unit No.	Bus No.	Pmax (MW)	AESO Planning Area No.	Unit Net Generation[a] (MW) per Scenario			
					2020 SL	2020 SP	2020 WP	2021 SP
Battle River	3	1495	149	36	offline	offline	Offline	Offline
Battle River	4	1496	155	36	60.0	83.0	153.0	134.8
Battle River	5	1497/ 70001	385	36	92.6	209.8	388.8	356.3
Sheerness	1	1482	400	43	239.5	382.5	392.5	381.3
Sheerness	2	1487	390	43	234.7	375.6	384.4	378.3

Notes:
[a] "Unit Net Generation" refers to gross generating unit output (MW) less unit service load.

4.2.4.2 Base Scenario Renewable Generation Assumptions

Per the 2017 LTO, the total forecast wind and solar electricity generation in 2020 is 2594 MW. Per the 2019 LTO, the total forecast wind electricity generation in 2021SP is 2764.7 MW and the total forecast solar electricity generation in 2021SP is 636 MW. This includes existing, under construction and planned wind and solar electricity generation facilities.

Using the 2017 LTO's 2020 renewable generation forecast of 2,594 MW, the generation assumptions will dispatch the renewable electricity generation facilities in order to yield the credible worst-case power flow conditions for the Study Area. Pre-Project dispatch levels for the existing and under-construction renewable electricity generation facilities are shown in Table 4-7.

Table 4-7: Dispatch Conditions for Existing Renewable Generation Facilities

Facility Name and Code	AESO Planning Area No.	Bus Number	MC (MW)	Unit Net Generation[s] (MW) per Scenario
				2020 SP/SL/WP EC
Ardenville Wind (ARD1)	53	4735, 4740	68	68
Blackspring Ridge (BSR1)	49	61736, 61737	300	300
Blue Trail Wind (BTR1)	53	66328, 67328	66	66
Castle River #1 (CR1)	53	2234, 3234	39	0
Castle Rock Wind Farm (CRR1)	53	67221	77	77
Cowley Ridge (CRWD)	53	4264	20	20
Enmax Taber (TAB1)	52	15343, 16343	81	81
Kettles Hill (KHW1)	53	2402, 3402	63	63
McBride Lake Windfarm (AKE1)	53	2901, 3901, 4901	75	75
Soderglen Wind (GWW1)	53	12358, 13358	71	71
Summerview 1 (IEW1)	53	2338, 3338	66	66
Summerview 2 (IEW2)	53	4339, 5337	66	66
Suncor Chin Chute (SCR3)	54	2389	30	30
Suncor Magrath (SCR2)	53	11002	30	30
Suncor Wintering Hills (SCR4)	43	60789, 60791, 60793, 60846, 60848, 60850	88	88
Oldman 2 Wind Farm 1 (OWF)	53	61543	46	2.8
Brooks Solar (BSC1)	47	3256	15	15
AESO South Planning Region Subtotal			1201	1118.8
Ghost Pine (NEP1)	42	2621 to 2625	82	82
Halkirk (HAL1)	42	66435, 67435	150	150

Facility Name and Code	AESO Planning Area No.	Bus Number	MC (MW)	Unit Net Generation[a] (MW) per Scenario
				2020 SP/SL/WP EC
Bull Creek (BUL1 and BUL2)	37	55003,550004	29.5	29.5
AESO Central Planning Region Subtotal			261.5	261.5
Total			1462.5	1380.3

Note:
[a] "Unit Net Generation" refers to gross generating unit output (MW) less unit service load.

Table 4-8 lists the pre-Project dispatch levels for the planned renewable generation projects in the AESO South and Central planning regions that are included in the study scenarios. Planned renewable generation projects not listed in Table 4-8 are not included in the study and will not be dispatched.

Table 4-8: Dispatch Conditions for Planned Renewable Generation Projects

Project Number	Project Name	Project Type	Planned ISD	Planning Area	Bus No.	Pmax (MW)	Unit Net Generation Dispatch[a] (MW)
							2020 SP/SL/WP
South Planning Region							
462	Enel Alberta Castle Rock Wind Farm	Connection	In Service	53	550006	31	0
524	Enel Alberta Riverview Wind Farm	Connection	In Service	53	69221	115	0
1533	Joss MPC WAGF	Connection	Aug 31, 2022	48	60798, 60799	120	122.4
1698	Joss Jenner WAGF - Phase 2	Connection	Aug 31, 2022	48	61798, 61799	180	71.4
1719	Stirling WAGF Project	Connection	Nov 1, 2022	54	61630	113	113
1800	Capital Power Whitla Wind	Connection	In Service	4	60990	201.6	201.6
1800	Capital Power Whitla Wind Phase 2	Connection	Aug 1, 2021	4	60990	97.2	0
1853	Fortis Buffalo Atlee Cluster 1 WAGF	BTF	Dec 1, 2021	48	552260	18.3	17.25
1892	Fortis Buffalo Atlee Cluster 3 WAGF DER	BTF	Dec 1, 2021	48	553260	17.3	17.25
2199	Fortis Buffalo Atlee Cluster 2 WAGF DER	BTF	Dec 1, 2021	48	60799	17.3	13.8
2041	TransAlta Windrise MPC Wind	Connection	Apr 1, 2021	53	990001, 990004	220	207
2122	EDF Cypress Wind	Connection	Nov 1, 2022	4	962122	450	201.6
Subtotal (Southern Alberta)							965.3
Central Planning Region							
1567	Sharp Hills Wind Facility	Connection	Apr 15, 2022	42	60831, 60832	300	248.4
Subtotal (Central Alberta)							248.4

Project Number	Project Name	Project Type	Planned ISD	Planning Area	Bus No.	Pmax (MW)	Unit Net Generation Dispatch[a] (MW)
							2020 SP/SL/WP
Total Planned							**1213.7**
Total Planned, Existing and Under Construction							**2,594**

The post-Project scenario renewable generation dispatch levels will be identical to the pre-Project scenario dispatch levels shown in Table 4 7 and Table 4 8, except that Blue Trail Wind and Kettles Hill Wind Farms will be turned off, and Oldman 2 wind Farm 1 will be dispatched to 1.8 MW. The Facility will be dispatched to 130 MW in all post-Project scenarios. This will result in a total renewable dispatch consistent with the 2017 LTO's renewable generation forecast of 2,594 MW for 2020.

4.2.4.3 Sensitivity Scenarios Renewable Generation Assumptions

Per the 2019 LTO, the total forecast wind electricity generation in 2021 SP is 2764.7 MW and the total forecast solar electricity generation in 2021 SP is 635.5 MW. This includes existing, under construction and planned wind and solar electricity generation facilities.

Using the 2019LTO's 2021 SP wind and solar generation forecast of 2,764.7 MW and 636MW, the generation assumptions will dispatch the wind and solar electricity generation facilities in order to yield the credible worst-case power flow conditions for the Study Area. 2021 Pre-Project dispatch levels for the existing and under-construction wind and solar generation facilities are shown in Table 4-9, Table 4-10, Table 4-11 and Table 4-12.

Table 4-9: Dispatch Conditions for Existing and Under Construction Wind Generation Facilities

Facility Name and Code	Bus No.	MC (MW)	AESO Planning Area No.	Unit Net Generationa[a] (MW) by Scenario
				2021 (SL, SP & WP)
Ardenville Wind (ARD1)	4735, 4740	68	53	68
Blue Trail Wind (BTR1)	66328, 67328	66	53	66
Castle River #1 (CR1)	2234, 3234	39	53	0
Castle Rock Wind Farm (CRR1)	67221	77	53	77
Cowley Ridge (CRWD)	4264	20	53	0
Enmax Taber (TAB1)	15343, 16343	81	52	81
Kettles Hill (KHW1)	2402, 3402	63	53	63
McBride Lake Wind Farm (AKE1)	2901, 3901, 4901	73	53	73
Soderglen Wind (GWW1)	12358, 13358	71	53	71
Summerview 1 (IEW1)	2338, 3338	66	53	66
Summerview 2 (IEW2)	4339, 5337	66	53	66

Facility Name and Code	Bus No.	MC (MW)	AESO Planning Area No.	Unit Net Generation[a] (MW) by Scenario
				2021 (SL, SP & WP)
Suncor Chin Chute (SCR3)	2389	30	54	30
Suncor Magrath (SCR2)	11002	30	53	30
Suncor Wintering Hills (SCR4)	60789, 60791, 60793, 60846, 60848, 60850	88	43	88
Old Man 2 Wind Farm 1 (OWF1)	61543	46	53	46
Blackspring Ridge (BSR1)	61736, 61737	300	49	300
Capital Power Whitla Wind Power Facility (WHT1)	60990	202	4	202
Riverview (RIV1)	69221	115	53	0
Castle Rock Ridge 2 (CRR2)	567221	29	53	25.1
AESO South Planning Region Subtotal				**1352.1**
Ghost Pine (NEP1)	2621, 2622, 2623, 2624, 2625	82	42	82
Halkirk (HAL1)	66435, 67435	150	42	150
Bull Creek (BUL1 and BUL2)	550003, 550004	29	37	29
AESO Central Planning Region Subtotal				**261**
Total				**1613.1**

Note:
[a] "Unit Net Generation" refers to gross generating unit output (MW) less unit service load.

Table 4-10: Dispatch Conditions for Existing and Under Construction Solar Generation Facilities

Facility Name and Code	Bus No.	MC (MW)	AESO Planning Area No.	Unit Net Generation[a] (MW) by Scenario		
				2021 SL	2021 SP	2021 WP
Brooks Solar (BSC1)	553257	15	47	12	15	4
AESO South Planning Region Subtotal				**12**	**15**	**4**
Total				**12**	**15**	**4**

Note:
[a] "Unit Net Generation" refers to gross generating unit output (MW) less unit service load.

Table 4-8 and Table 4-12 list the pre-Project dispatch levels for the planned wind and solar generation projects respectively, in the AESO South and Central planning regions that are included in the study scenarios.

Table 4-11: Dispatch Conditions for Planned Wind Generation Projects

Project Number	Project Name	Project Type	Planned ISD	Bus No.	MC (MW)	AESO Planning Area No.	Unit Net Generation Dispatch[a] (MW) by Scenario
							2021 (SL, SP & WP)
South Planning Region							
P1892	Fortis Buffalo Atlee Cluster 3 WAGF DER (REP #2)	Wind	Dec 1, 2021	553260	17.3	47 - Brooks	17.25
P1853	Fortis Buffalo Atlee Cluster 1 WAGF (REP #2)	Wind	Dec 1, 2021	552260	18.3	48-Empress	17.25
P2199	FortisAlberta Buffalo Atlee Cluster 2 (REP #2)	Wind	Dec 1, 2021	557261	13.8	48-Empress	13.8
P1719	Stirling WAGF Project (REP #2)	Wind	Nov 1, 2022	61630	113	54-Lethbridge	113
P2122	Cypress Wind Project Connection (REP #2)	Wind	Nov 1, 2022	560003	201.6	4-Medicine Hat	201.6
P1533	Joss MPC WAGF (REP #3)	Wind	Aug 31, 2022	60798, 60799	120	48-Empress	122.4
P1698	Joss Jenner WAGF - Phase 2 (REP #3)	Wind	Aug 31, 2022	61798, 61799	180	48-Empress	71.4
P2041	TransAlta Windrise MPC Wind (REP #3)	Wind	Apr 1, 2021	567031	220	53-Fort Macleod	146.5
P1812	Suncor Forty Mile Granlea	Wind	Nov 16, 2021	61994, 62994	200	4-Medicine Hat	200
Subtotal (Southern Alberta)							**903.2**
Central Planning Region							
P1567	Sharp Hills Wind Farm	Wind	Apr 15, 2022	60831, 60832	300	42-Hanna	248.4
Subtotal (Central Alberta)							**248.4**
Total Planned							**1151.6**
Total Planned, Existing and Under Construction							**2764.7**

Note:

[a] "Unit Net Generation" refers to gross generating unit output (MW) less unit service load.

Table 4-12: Dispatch Conditions for Planned Solar Generation Projects

Project Number	Project Name	Project Type	Planned ISD	Bus No.	MC (MW)	AESO Planning Area No.	Unit Net Generation Dispatch[a] (MW) by Scenario		
							2021 SL	2021 SP	2021 WP
South Planning Region									
P1878	Fortis 257S Hull DER Solar	Solar	In Service	552402	24.5	52-Vauxhall	19.6	24.5	6.6

Project Number	Project Name	Project Type	Planned ISD	Bus No.	MC (MW)	AESO Planning Area No.	Unit Net Generation Dispatch[a] (MW) by Scenario		
							2021 SL	2021 SP	2021 WP
P1922	FortisAlberta Vauxhall Solar DER	Solar	In Service	554273	22	52-Vauxhall	17.6	22	5.9
P1879	Claresholm Solar	Solar	In Service	60894	130	49-Stavely	104	130	35.1
P2009	Greengate Travers MPC Solar	Solar	Aug 1, 2021	560026, 561026, 562026	400	49-Stavely	320	400	108
P1838	Fortis 895S Suffield DG PV	Solar	In Service	557270	22	4-Medicine Hat	17.6	22	5.9
Subtotal (Southern Alberta)							**478.8**	**598.5**	**161.9**
Central Planning Region									
P2097	Innisfail Solar DER	Solar	In Service	557120	22	39-Didsbury	17.6	22	5.9
Subtotal (Central Alberta)									
Total Planned							**496.4**	**620.5**	**167.4**
Total Planned, Existing and Under Construction							**508.8**	**636**	**171.7**

The post-Project scenario renewable generation dispatch levels will be identical to the pre-Project scenario dispatch levels shown in Table 4-7 and Table 4-8, except that Blue Trail Wind and Kettles Hill Wind Farms will be turned off, and Oldman 2 Wind Farm 1 will be dispatched to 1.8 MW. The Facility will be dispatched to 130 MW in all post-Project scenarios. This will result in a total renewable dispatch consistent with the 2019 LTO's renewable generation forecast for 2021 SP.

4.2.5 Intertie Flow Assumptions

The intertie flow assumptions for the Alberta-British Columbia (AB-BC), Alberta-Saskatchewan (AB-SK), and Alberta-Montana (MATL) interties are shown in Table 4-13.

For the 2028 scenario (Scenario 7), the intertie flows should be as per the published AESO base cases.

Table 4-13: Intertie Flows by Scenario

Scenario Number	Scenario Name	Import (-) / Export (+) by Intertie		
		AB-BC	AB-SK	MATL
1	2020 SL Pre-Project	700	150	300
2	2020 SP Pre-Project	-280	-150	-300
3	2020 WP Pre-Project	-280	-150	-300
4	2020 SL Post-Project	700	150	300
5	2020 SP Post-Project	-280	-150	-300
6	2020 WP Post-Project	-280	-150	-300

Scenario Number	Scenario Name	Import (-) / Export (+) by Intertie		
		AB-BC	AB-SK	MATL
8-10	2020 SP Post-Project Wind (P1704)	-280	-150	-300
11-13	2021 SP Post-Project with additional connection projects	0	-150	-130

4.2.6 HVDC Power Order Assumptions

The Western Alberta Transmission Line (WATL) and the Eastern Alberta Transmission Line (EATL) are high-voltage direct current (HVDC) transmission lines. The HVDC power order assumptions for the studies will be set to minimize losses for the pre-Project and post-Project study scenarios.

For the 2028 scenario (Scenario 7), the intertie flows should be as per the published AESO base cases.

Table 4-14: HVDC Power Order by Scenario

Scenario Number	Scenario Name	WATL (MW)*	EATL (MW)*
1	2020 SL Pre-Project	550 N → S	450 S → N
2	2020 SP Pre-Project	200 S → N	1000 S → N
3	2020 WP Pre-Project	100 S → N	1000 S → N
4	2020 SL Post-Project	550 N → S	450 S → N
5	2020 SP Post-Project	200 S → N	1000 S → N
6	2020 WP Post-Project	100 S → N	1000 S → N
8-10	2020 SP Post-Project Wind (P1704)	200 S → N	1000 S → N
11-13	2021 SP Post-Project with additional connection projects	600 S → N	1000 S → N

Notes:
N → S: HVDC flow direction is North to South
S → N: HVDC flow direction is South to North

The reactive power limits of the MVAr exchanges between the HVDC terminals (WATL and EATL) and the connected alternating current (AC) transmission systems are shown in Table 4-15. These limits must be maintained when performing the studies.

Table 4-15: HVDC to Adjacent AC System MVAr Exchange Limits

HVDC Facility	North Terminal Reactive Power Limit (MVAr)	South Terminal Reactive Power Limit (MVAr)
EATL	-85 to 75	-35 to 35
WATL	-75 to 75	-35 to 35

4.2.7 Transmission Facility Ratings

The legal owners of transmission facilities (TFOs) provided the thermal ratings assumptions for the existing transmission lines in the Study Area. Table 4-16 shows the normal ratings and emergency ratings for the key transmission lines in the Study Area, which will be used to perform the engineering studies.

In June 2020 ATCO submitted updates to facility ratings, after the base studies were completed and after the sensitivity studies began. ATCO submitted a few further updates to facility ratings in November 2020. These updated ratings are shown in the table below, but sensitivity study results were only updated for the most limiting facilities for each contingency and where the updated facility rating is lower than the previous facility rating.

Table 4-16: Thermal Rating Assumptions for Key Transmission Lines in the Study Area

Line ID	Line Description	Voltage Class (kV)	Normal Rating (MVA)		Emergency Rating (MVA)	
			Summer	Winter	Summer	Winter
174L	Bardo 197S - North Holden 395S	138	85	90	94	99
408L[a]	Jarrow 252S - Wainwright 51S	138	75	79	83	87
472L	Metiskow 648S - Sunken Lake 221S tap	138	121	150	133	153
472L	Sunken Lake 221S tap - Hughenden 213S	138	121	150	133	165
679L	Nilrem 574S - Tucuman 478S	138	167CT	191	184	218
680L	Nilrem 574S - Tucuman 478S	138	167CT	191	184	218
681L	Tucuman 478S - Hardisty 377S	138	143	172	184	218
701L	North Holden 395S - Strome 223S	138	119	146	131	161
6L02	Battle River 757S - Marion Lake 873S	72	59	74	67	74
6L02	Marion Lake 873S - Stettler 769S	72	59	66CT	66CT	66CT
6L03	Battle River 757S - Sullivan Lake 775S	72	49CT	49CT	49CT	49CT
6L05	Heisler 764S - Battle River 757S	72	57	72	64	74CT
6L09	Oyen 767S - Hanna 763S	72	24CT	24CT	24CT	24CT
6L12	Sulivan Lake 775S - Coronation 773S	72	24CT	24CT	24CT	24CT
6L15	Hanna 763S - Sulivan Lake 775S	72	24CT	24CT	24CT	24CT
6L56	Hanna 763S - Michichi Creek 802S	72	37CT	37CT	37CT	37CT
701L	Heisler T-tap - Strome 223S	138	158	191	174	213
703L	Hughenden 213S - HRT Express 329S tap	138	121	145	133	160
703L	HRT Express 329S tap - Hardisty 377S	138	96CT	96CT	133	143
704L	Wainwright 51S - Tucuman 478S	138	75	79	83	87
704L	Jarrow 252S - Jarrow 252S tap	138	85	90	94	99
748L	Killarney Lake 267S - Hayter 277S	138	119	146	131	161

Line ID	Line Description	Voltage Class (kV)	Normal Rating (MVA)		Emergency Rating (MVA)	
			Summer	Winter	Summer	Winter
749L	Metiskow 648S - Killarney 267S tap	138	122	150	134	163
749L	Edgerton 899S - Killarney 267 S tap	138	96CT	96CT	134	143
749L/ 7L749	Edgerton 899S - Briker 880S tap	138	96CT	96CT	130	140
760L	Empress Liquid 164S tap - Bindloss 914S tap	138	120	142	132	156
760L	Empress Liquid 164S tap - Amoco Empress 163S	138	120	148	132	163
760L	Amoco Empress 163S - Empress 394S	138	119	146	131	161
760L/ 7L760	Empress Liquid 164S tap - Bindloss 914S tap	138	109.3	139	123.6	142.8CT
769L	Hardisty 377S – Rosyth 296S	138	86	115	95	127
7L110	Monitor 774S - Loyalist 903S	144	99CT	99CT	99CT	99CT
7L116	Excel 910S - Lanfine 959S	144	99CT	99CT	99CT	99CT
7L117	Vermilion 710S - Irish Creek 706S	144	131	166	147	189
7L127	Pemukan 932S - Monitor 774S	144	151 bus cond.	190 bus cond.	194 bus cond.	254 bus cond.
7L128	Coyote Lake 963S - Michichi Creek 802S	144	117 bus cond.	147 bus cond.	144 bus cond.	185 bus cond.
7L129	Buffalo Creek 526S - Vermilion 710S	144	129	161	138	178
7L130	Vermilion 710S - Kitscoty 705S	144	114	151	125	170
7L132	Lanfine 959S - Oyen 767S	144	117 bus cond.	147 bus cond.	144 Bus cond.	179 Prot.
7L137	Three Hills 770S - Rowley 768S	144	113	149	126	171
7L139	Whitby Lake 819S - Norberg 936S tap	144	114	151	127	173
7L139	Norberg 936S tap - St. Paul 707S	144	114	151	127	173
7L14	Kitscoty 705S - Hill 751S	144	114	151	125	170
7L143	Nevis 766S - Stettler 769S	144	100CT	100CT	100CT	100CT
7L153	Wintering Hils 804S - Wheatland 609S	144	185	199CT	199CT	1199CT
7L159	Three Hills 770S – Ghost Pine 114S tap	144	112	149	124	150CT
7L159	Heatburg 948S – Ghost Pine 114S tap	144	112	149	124	167CT
7L16	Nevis 766S - Heatburg 948S	144	112	133CT	125	133CT
7L171	Michichi Creek 802S - Wintering Hills 804S	144	112	150CT	127	150CT
7L224	Hansman Lake 650S - Monitor 774S	144	113	150	125	171

Line ID	Line Description	Voltage Class (kV)	Normal Rating (MVA)		Emergency Rating (MVA)	
			Summer	Winter	Summer	Winter
7L25	Michichi Creek 802S - Rowley 768S	144	114	154	128	177
7L134 (Future Line)	Future Vincent 2019S - Vegreville 709S	144	114	146	127	157
7L42	Hill 751S - Lloydminster 716S	144	130	150CT	142	150CT
7L50	Battle River 757S - Jarrow 252S tap	144	114	150GS	122	150GS
7L53	Irish Creek 706S - Lindberg 969S tap	144	130	162	145	185
7L53	Lindberg 969S tap - Bonnyville 700S	144	130	162	145	185
7L65	Vermilion 710S - Future Vincent 2019S	144	114	146	127	172
7L70	St. Paul 707S - Bonnyville 700S	144	115	152	128	174
7L77	North Holden 395S - Vegreville 709S	138	114	151	125	169
7L701	Battle River 757S - Strome 223S	144	148	200	166	239
7L702	Battle River 757S - Sedgewick 137S tap	144	115	155	128	177
702L	Sedgewick 137S tap - Hardisty 377S	138	87	135	96	146
7L749	Lloydminster 716S - Briker 880S tap	144	114	151	126	170
7L760	Oyen 767S - Bindloss 914S tap	144	115	153	128	175
7L79	Pemukan 932S - Ribstone Creek 892S	144	114	145	129	157
7L85	Wintering Hills 804S - Bullpound 803S tap	144	117 bus cond.	147 bus cond.	144 bus cond.	184 bus cond.
7L85	Bullpound 803S tap - Anderson 801S	144	145	192	170	199CT
7L92	Vegreville 709S - Whitby Lake 819S (All segments)	144	114	133CT	126	133CT
7LA159	Ghost Pine 114S - Ghost Pine 114S tap	144	114	145	129	149CT
7LA701	Heisler 764S - Heisler 764S tap	144	133CT	133CT	133CT	133CT
885L	Metiskow 648S - Hansman Lake 650S	138	287	287	344	373
912L/ 9L912	Nevis 766S - Red Deer 63S*	240	507	624CT (ATCO)	553	624CT (ATCO)
931L	Ware Junction 132S - West Brooks 28S	240	592	665	654	773
953L	Cordel 755S - Nilrem 574S	240	544	663CT	641	663CT
954L	Metiskow 648S - Hansman Lake 650S	240	333CT	333CT	499CT	499CT
9L16	Tinchebray 972S - Cordel 755S	240	499CT	499CT	499CT	499CT
9L20*	Nevis 766S - Cordel 755S	240	488	623.5CT	558	623.5CT

Line ID	Line Description	Voltage Class (kV)	Normal Rating (MVA)		Emergency Rating (MVA)	
			Summer	Winter	Summer	Winter
9L24	Oakland 946S - Lanfine 959S	240	740	831SG	831SG	831SG
9L27	Paintearth 863S - Cordel 755S	240	442CT	442CT	442CT	442CT
9L29	Oakland 946S - Coyote Lake 963S	240	740	831SG	831SG	831SG
9L46	Lanfine 959S - Pemukan 932S	240	755	831CT	831CT	831CT
9L51[b]	Sedalia 363S - Pemukan 932S	240	753	831	866	1049
9L59	Tinchebray 972S - Anderson 801S	240	499SG	499SG	499SG	499SG
9L70	Anderson 801S - Oakland 946S	240	499SG	499SG	499SG	499SG
9L79	Battle River 757S - Cordel 755S	240	499CT	499CT	499CT	499CT
9L80	Battle River 757S - Cordel 755S	240	499CT	499CT	499CT	499CT
9L93	Halkirk 615S - Tinchebray 972S	240	378	520	517	733
9L933	Anderson 801S - Ware Junction 132S	240	550	748	651	831SG
9L934	Anderson 801S - Ware Junction 132S	240	499SG	499SG	499SG	499SG
9L948	Paintearth 863S - Hansman Lake 650S	240	442CT	442CT	442CT	442CT
9L950	Anderson 801S - Ware Junction 132S	240	499SG	499SG	499SG	499SG
9L953	Cordel 755S - Nilrem 574S	240	544	663CT	641	663CT
9L966	Pemukan 932S - Hansman Lake 650S	240	442CT	442CT	442CT	442CT
9L97	Anderson 801S - Oakland 946S	240	499SG	499SG	499SG	499SG
9L99	Sheerness 807S - Anderson 801S	240	470	499SG	499SG	499SG
9L100	Sheerness 807S - Anderson 801S	240	470	499SG	499SG	499SG
1047L	Nilrem 574S - Hansman Lake 650S	240	499CT	499CT	680	748CT

Note:

*Ratings for 912L/9L912 and 9L20 are assumed to be restored prior to the in-service date of the Project and are discussed in further detail in Appendix A
“CT” indicates that the transmission line is limited by current transformer.

“L” indicates that the transmission line is limited by the line.

“SG” indicates that the transmission line is limited by gang switch.

“Bus Cond” indicates that the transmission line is limited by bus conductor.

“M” indicates that the transmission line rating is limited by reasons other than protection equipment, transformer, current transformer, line, ganged switch, circuit breaker, or regulator.

The TFOs provided the details of the substation transformers in the Study Area. The key transformers in the Study Area are shown in Table 4-17.

Table 4-17: Summary of Key Transformer Ratings in the Study Area

Substation Name and Number	Transformer ID	Transformer Voltages (kV)	Transformer Rating (MVA)
Anderson 801S	901T	240/144	125CT
Battle River 757S	912T	240/144	299CT
	701T	144/72	75
Nevis 766S	901T	240/144	100CT
	701T	144/25	12/16/20
Nilrem 574S	T1	240/138	400
	T2	240/138	400
Metiskow 648S	T3	240/138	200
Hansman Lake 650S	T1	240/138	200
	T3	240/18	200

The TFOs provided the details of the shunt elements in the Study Area. The key shunt elements in the Study Area are shown in Table 4-18.

Table 4-18: Summary of Key Shunt Elements in the Study Area

Substation Name and Number	Voltage Class (kV)	Capacitors		Reactors	
		Number of Switched Shunt Blocks	Total at Nominal Voltage (MVAr)	Number of Switched Shunt Blocks	Total at Nominal Voltage (MVAr)
Buffalo Creek 526S	138	1 x 15.00 MVAr	15.00	-	-
Sunken Lake 221S	138	1 x 18.00 MVAr	18.00	-	-
Halkirk 615S	34.5	1 x 6.00 MVAr + 3 x 18.00 MVAr	60.00	2 x -14.00 MVAr	-14.00
	0.5	2 x 12.50 MVAr	25.00	2 x -12.50 MVAr	-25.00
Hansman Lake 650S	18.0	1 x 200.0 MVAr	200.0	1 x -100.0 MVAr	-100.0
Hardisty 377S	138	1 x 27.02 MVAr	27.02	-	-
Hill 751S	138	1 x 18.37 MVAr + 1 x 22.96 MVAr	41.33	-	-
Stettler 769S	138	1 x 13.78 MVAr	13.78	-	-
Killarney Lake 267S	138	1 x 9.10 MVAr + 2 x	30.90	-	-

Substation Name and Number	Voltage Class (kV)	Capacitors		Reactors	
		Number of Switched Shunt Blocks	Total at Nominal Voltage (MVAr)	Number of Switched Shunt Blocks	Total at Nominal Voltage (MVAr)
		10.90 MVAr			
Lloydminster 716S	138	1 x 18.37 MVAr	18.37	-	-
Tucuman 478S	138	1 x 27.17 MVAr	27.17	-	-
Vermilion 710S	138	1 x 22.96 MVAr	22.96	-	-
Lanfine 959S	34.5	1 x 200 MVAr	200	1 x -100 MVAr	-100
	138	2 x 27.55 MVAr	55.10	-	-
Monitor 774S	138	1 x 18.38 MVAr + 1 x 27.55 MVAr	45.93	-	-
Pemukan 932S	138	2 x 27.55 MVAr	55.10	-	-

4.2.8 Protection Fault Clearing Times

The transient stability studies will be performed using the actual fault clearing times for the selected contingencies, as provided by the TFOs and as shown in Table 4-19. Only those contingencies shown in Table 4-19 will be studied for transient stability studies. If the TFOs did not specify the fault clearing times (e.g. for new transmission lines) for a selected contingency, then the studies for that contingency will be performed using the standard fault clearing times that are specified in Table 2-3 of the AESO's *Transmission Planning Criteria – Basis and Assumptions*.

Table 4-19: Protection Fault Clearing Times

Contingency (System Element Lost)				Fault Location	Clearing Times	
Transmission Line ID	Nominal Bus Voltage (kV)	Terminal Location				
		Terminal 1	Terminal 2		Terminal 1	Terminal 2
9L24	240	Oakland 946S	Lanfine 959S	Oakland 946S	5 cycles	6 cycles

9L24	240	Lanfine 959S	Oakland 946S	Lanfine 959S	5 cycles	6 cycles
9L29	240	Oakland 946S	Coyote Lake 963S	Oakland 946S	5 cycles	6 cycles
9L29	240	Coyote Lake 963S	Oakland 946S	Coyote Lake 963S	5 cycles	6 cycles
9L16	240	Cordel 755S	Tinchebray 972S	Cordel 755S	5 cycles	6 cycles
9L16	240	Tinchebray 972S	Cordel 755S	Tinchebray 972S	5 cycles	6 cycles
9L966	240	Pemukan 932S	Hansman Lake 650S	Pemukan 932S	5 cycles	6 cycles
9L966	240	Hansman Lake 650S	Pemukan 932S	Hansman Lake 650S	5 cycles	6 cycles
9L20	240	Cordel 755S	Nevis 766S	Cordel 755S	5 cycles	6 cycles
9L20	240	Nevis 766S	Cordel 755S	Nevis 766S	5 cycles	6 cycles
912L	240	Red Deer 63S	Nevis 766S	Red Deer 63S	5 cycles	6 cycles
912L	240	Nevis 766S	Red Deer 63S	Nevis 766S	5.5 cycles	6.5 cycles
9L59	240	Tinchebray 972S	Anderson 801S	Tinchebray 972S	5 cycles	6 cycles
9L59	240	Anderson 801S	Tinchebray 972S	Anderson 801S	5 cycles	6 cycles

4.2.9 Project Dynamic Data

Dynamic data for the Project can be found in Attachment A7.

4.2.10 Voltage Profile Assumption

ID #2010-007RS will be used to establish system normal (i.e., pre-contingency) voltage profiles for key area busses prior to commencing any studies. Table 2-1 of the *Transmission Planning Criteria – Basis and Assumptions* applies for the busses not included in ID #2010-007RS. These voltages will be used to set the voltage profile for the study base cases prior to the power flow studies.

5 Study Methodology

The engineering studies to be performed for this connection assessment are identified in Table 5-1.

Table 5-1: Summary of Engineering Studies to be Performed

Scenario No. and Name		Power Flow		Voltage Stability		Transient Stability		Motor Starting		Short Circuit
		Category		Category		Category		Category		Category A
		A	B	A	B	A	B	A	B	
1	2020 SP Pre-Project	X	X							
2	2020 SL Pre-Project	X	X							
3	2020 WP Pre-Project	X	X			X*	X*			X
4	2020 SP Post-Project	X	X							
5	2020 SL Post - Project	X	X							
6	2020 WP Post - Project	X	X			X	X			X
7	2028 WP Post-Project									X
8	2020 SP Pre-Project Wind (P1704)	X	X							
9	2020 SP Post-Project Wind (P1704)	X	X							
10	2020 SP Post-Project Wind (P1704) and PENV	X	X							
11	2021 SP Post-Project with additional generation projects	X	X							

Scenario No. and Name		Power Flow		Voltage Stability		Transient Stability		Motor Starting		Short Circuit
		Category		Category		Category		Category		Category A
		A	B	A	B	A	B	A	B	
12	2021 SP Post-Project with additional generation projects and PENV	X	X							
13	2021 SP Post-Project with additional generation projects and PENV and CETO	X	X							

*Pre-project transient stability studies will be conducted if issues are observed in the post-Project transient stability studies

For the engineering studies, all transmission facilities 69 kV and above, within the Study Area and the transmission lines connecting these planning areas to neighboring planning areas will be studied and monitored to assess the impact of the Project on the performance of the AIES, including any violations of the Reliability Criteria (as defined in Section 3.1).

5.1 Power Flow Studies

Power flow studies will be performed to identify thermal and voltage criteria violations as per the Reliability Criteria, and any deviations from the limits listed in Table 3-1.

For the Category B power flow studies, the transformer taps and switched shunt reactive compensating devices such as shunt capacitors and reactors will be locked, and continuous shunt devices will be enabled.

Voltage deviations at point-of-delivery (POD) low voltage busses will also be assessed for both the pre-Project and post-Project networks by first locking all tap changers and area shunt reactive compensating devices to identify any post-transient voltage deviations above 10%. Second, tap changers will be allowed to move while shunt reactive compensating devices remained locked to determine if any voltage deviations above 7% would occur in the area. Third, all the taps and shunt reactive compensating devices will be allowed to adjust, and voltage deviations above 5% will be reported.

The scenarios and cases to be studied are shown in Table 5-1.

5.1.1 Contingencies to be Studied

Power flow studies will be performed for the Category A and all Category B conditions in the Study Area as well as for the loss of the EATL HVDC transmission line.

5.2 Transient Stability Studies

The Keephills Unit 3 in Wabamun (Area 40) will be used as the reference for the studies.

The report presenting the results of the transient stability studies must provide response plots for various variables including rotor angle, and active and reactive power output for:

- The two Sheerness units in Sheerness (Area 43)
- The three Battle River generating units in Alliance/Battle River (Area 36)
- The Facility

The results report must also provide the 500 kV, 240 kV and 138 kV bus voltage levels for substations near the point of connection. Other busses will be monitored and will be reported as determined by the results. The results report must also provide the key branch active and reactive power flow surrounding the Facility.

Transient stability studies will be performed for the 2020 WP post-Project scenario as shown in Table 5-1. If any transient stability issues are observed, transient stability analysis will be performed for the corresponding pre-Project scenarios.

5.2.1 Contingencies to be Studied

Transient stability studies will be performed for the contingencies shown in Table 4-19

5.3 Short-Circuit Current Level Studies

A maximum fault level must be provided for the substations in the vicinity of the Project assuming normal system operation with all transmission elements in service and generation dispatched. Three-phase faults and single line-to-ground faults will be simulated. Polar coordinates and per-unit values will be used for reporting the results.

Winter peak scenarios will be used for the short-circuit studies because winter peak scenarios generally produce higher short-circuit current levels than summer peak scenarios.

Estimated maximum three-phase faults and single line-to-ground short-circuit current levels will be reported for all 138 kV and above buses within the following substations:

- Anderson 801S
- Cordel 755S
- Coyote Lake 963S
- Garden Plain 1045S (post-project only)
- Michichi Creek 802S
- Oakland 946S
- Tinchebray 972S
- Rowley 768S
- Sheerness 807S

- Wintering Hills 804S

Further sensitivity studies, in consultation with the TFOs, may be required if the primary short-circuit analysis indicates a potential to exceed or approach the existing fault rating of the transmission facilities.

The scenarios to be studied are as shown in Table 5-1.

6 Mitigation Measures

6.1 Development

Mitigation measures may be required if the post-Project study results identify system performance issues. Mitigation measures for the Project may involve modifying or adding real-time operational practices and/or remedial action schemes (RASs).

The Studies Consultant must notify the AESO of any system performance issues in a timely manner, following which the AESO Studies Engineer may instruct the Studies Consultant as follows:

- Develop tables showing the constraint effective factors[4] for generation or load based on thermal criteria violations that are observed.
- Collaborate with the AESO to propose changes, if any, to the connection alternatives that could remove the requirement for a RAS.
- Collaborate with the AESO to study modifications to existing and/or planned RASs, proposed by the AESO, to ensure the coordination of existing protection schemes with the addition of any proposed protection schemes.
- Collaborate with the AESO to identify and study new RASs, if any, that may be required to ensure system reliability is maintained after connecting the Project to the AIES.

The AESO Studies Engineer will work closely with the Studies Consultant and guide the development and/or modifications of the proposed mitigation measures to ensure system reliability, security and compliance with AESO ID #2018-018T, *Provision of System Access Service and the Connection Process*.

6.2 Evaluation

6.2.1 Post-Mitigation Studies

Studies to evaluate the effectiveness of mitigation measures, if required, will be performed in accordance with the technical criteria, assumptions, and methods provided in this Study Scope and in accordance with further instructions from the AESO.

6.2.2 Constraint Effective Factor Studies

Constraint effective factor analysis are used to determine the generator- and load- constraint effective factors and to identify the most effective generators or loads to manage the thermal criteria violations, if any, that are observed under Category B conditions.

[4] Constraint effective factor studies are performed to determine the generator- and load- constraint effective factors. Constraint effective factors are used to estimate the ability of generators and loads to manage transmission constraints. A generator's or load's constraint effective factor is defined as the change in power flow over a specific transmission line following a change in the generator's energy production or in the load's energy consumption. The greater the constraint effective factor, the more effective a generator or load can be in managing a thermal criteria violation on the specific transmission line.

7 Changes to Study Assumptions

This study will utilize the AESO's planning base cases, which include both the AESO's previous and current corporate forecasts (2017 LTO and 2019 LTO). Sensitivity studies or restudy may be required in the event of revisions to the AESO's corporate forecast. Additional engineering studies may also be required to assess new connection alternatives, changes to project ISD, or delays in proposed system developments. Any additional or revised study requirements shall be captured in a signed Study Scope Amendment document.

Attachment A: Transmission Planning Criteria – Basis and Assumptions

Transmission Planning Criteria – Basis and Assumptions

Date: July 9, 2019

Version: V1.2

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1. Introduction

This document presents the reliability standards, criteria, and assumptions to be used as the basis for planning the Alberta Transmission System. The criteria, standards and assumptions identified in this document supersede those previously established.

2. Transmission Reliability Standards and Criteria[1]

The AESO applies the following Alberta Reliability Standards to ensure that the transmission system is planned to meet applicable performance requirements under a defined set of system conditions and contingencies. A brief description of each of these standards is given below:

1. **TPL-001-AB-0: System Performance Under Normal Conditions**

   Category A represents a normal system condition with all elements in service (N-0). All equipment must be within its applicable rating, voltages must be within their applicable ratings and the system must be stable with no cascading outages. Under Category A, electric supply to load cannot be interrupted and generating units cannot be removed from service.

2. **TPL-002-AB1-0: System Performance Following Loss of a Single BES Element**

   Category B events result in the loss of any single element (N-1) under specified fault conditions with normal clearing. The specified elements are a generating unit, a transmission circuit, a transformer or a single pole of a direct current transmission line. The acceptable impact on the system is the same as Category A with the exception that radial customers or some local network customers, including loads or generating units, are allowed to be disconnected from the system if they are connected through the faulted element. The loss of opportunity load or opportunity interchanges is allowed. No cascading can occur.

3. **TPL-003-AB-0: System Performance Following Loss of Two or More BES Elements**

   Category C events result in the loss of two or more bulk electric system elements (sequential, N-1-1 or concurrent, N-2) under specified fault conditions and include both normal and delayed fault clearing. All of the system limits for Category A and B events apply with the exception that planned and controlled loss of firm load, firm transfers and/or generation is acceptable provided there is no cascading.

4. **TPL-004-AB-0: System Performance Following Extreme BES Events**

   Category D represents a wide variety of extreme, rare and unpredictable events, which may result in the loss of load and generation in widespread areas. The system may not be able to reach a new stable steady state, which means a blackout is a possible outcome. The AESO needs to evaluate these events, at its discretion, for risks and consequences prior to creating mitigation plans.

5. **FAC-014-AB1-2: Establishing and Communicating System Operating Limits**

   The AESO is required to establish system operating limits where a contingency is not mitigated through construction of transmission facilities

[1] A complete description of the *Alberta Reliability Standards* can be found on the AESO's website: https://www.aeso.ca/rules-standards-and-tariff/alberta-reliability-standards/

2.1 Thermal Loading Criteria

The AESO Thermal Loading Criteria require that the continuous thermal rating of any transmission element is not exceeded under normal and post-contingency operating conditions. Thermal limits are assumed to be 100% of the respective normal summer and winter ratings. Emergency limits are not considered in the planning evaluations.

2.2 Voltage Range and Voltage Stability Criteria

The normal minimum and maximum voltage limits as specified in the following table are used to identify Category A system voltage violations, while the extreme minimum and maximum limits are used to identify Category B and C system violations. Table 2-1 presents the acceptable steady state and contingency state voltage ranges for the AIES. Table 2-2 provides voltage stability criteria used to test the system performance.

Table 2-1: Acceptable Range of Steady State Voltage (kV)

Nominal Voltage	Extreme Minimum	Normal Minimum	Normal Maximum	Extreme Maximum
500	475	500	525	550
240	216	234	252	264
260 (Northeast & Northwest)*	234	247	266	275
144	130	137	151	155
138	124	135	145	150
72	65	68.5	75.5	79
69	62	65.5	72.5	76

Table 2-2: Voltage Stability Criteria

Performance Level	Disturbance (1)(2)(3)(4) Initiated by: Fault of No Fault DC Disturbance	MW Margin (P-V method) (5)(6)(7)	MVAr Margin (V-Q method) (6)(7)
A	Any element such as: One Generator One Circuit One Transformer One Reactive Power Source One DC Monopole	≥5%	Worst Case Scenario(8)
B	Bus Section	≥5%	50% of Margin Requirement in Level A
C	Any combination of two elements such as: A Line and a Generator A Line and a Reactive Power Source Two Generators Two Circuits Two Transformers Two Reactive Power Sources DC Bipole	≥2.5%	50% of Margin Requirement in Level A
D	Any combination of three or more elements such as: Three or More Circuits on ROW Entire Substation Entire Plant Including Switchyard	> 0	> 0

2.3 Transient Stability Analysis Assumptions

Standard fault clearing times as shown in Table 2-3 are used for the new facilities or when the actual clearing times are not available for the existing facilities. Double line-to-ground faults are applied for the Category C5 events with normal clearing times. Single line-to-ground faults are applied for Category C6 to C9 events with delayed clearing times as depicted in Table 2-4 and Table 2-5.

Table 2-3: Fault Clearing Times

Nominal (kV)	Near End (Cycles)	Far End (Cycles)
500	4	5
240	5	6
144/138 with telecommunications	6	8
144/138 without telecommunications	6	30

Table 2-4: Stuck Breaker Clearing Times for Lines

Voltage (kV)	Fault Clearing Times (Cycles)		
	Near End	Far End	2nd Ckt (C5 and C7 only)
138/144	15	24	24
240	12	6	14
500	9	5	11

Table 2-5: Stuck Breaker Clearing Times for Transformers

Voltage (kV)	Fault Location	Fault Clearing Times (Cycles)		
		High Side	Low Side	2nd Ckt (breaker fail)
240/138	240 kV side	12	6	14
	138 kV side	5	15	24
500/240	500 kV side	9	5	11
	240 kV side	4	12	14

Attachment A2
Pre-Project Power Flow Diagrams

Attachment A2 - Pre-Project Power Flow Diagrams Index

Scenario 1: 2020 Summer Light Pre-Project Category A 1

Scenario 2: 2020 Summer Peak Pre-Project Category A 2

Scenario 3: 2020 Winter Peak Pre-Project Category A 3

Scenario 8: 2020 Summer Peak Pre-Project Wind (P1704) Sensitivity Category A 4

Scenario 2: 2020 Summer Light Pre-Project Category B 5

Contingency: 9L20 (NEVIS 766S - CORDEL 755S) 5

Contingency: 912L/9L912 (RED DEER 63S - NEVIS 766S) 6

Contingency: 7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S) 7

Contingency: 966L/9L966 (HANSMAN LAKE 650S - PEMUKAN 932S) 8

Contingency: 749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S) 9

Contingency: 766S901T (NEVIS 766S 240/138 KV TRANSFORMER) 10

Contingency: EATL HVDC 11

Contingency: 7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S) 12

Scenario 3: 2020 Winter Peak Pre-Project Category B 13

Contingency: 9L20 (NEVIS 766S - CORDEL 755S) 13

Contingency: 912L/9L912 (RED DEER 63S - NEVIS 766S) 14

Contingency: 7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S) 15

Contingency: 766S901T (NEVIS 766S 240/138 KV TRANSFORMER) 16

Contingency: EATL HVDC 17

Scenario 8: 2020 Summer Peak Pre-Project Wind (P1704) Sensitivity Category B 18

Contingency: 7L42 (HILL 751S - LLOYDMINSTER 716S) 18

Contingency: 9L20 (NEVIS 766S - CORDEL 755S) 19

Contingency: 912L/9L912 (RED DEER 63S - NEVIS 766S) 20

Contingency: 7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S) 21

Contingency: 701L (NORTH HOLDEN 395S- STROME 223S) 22

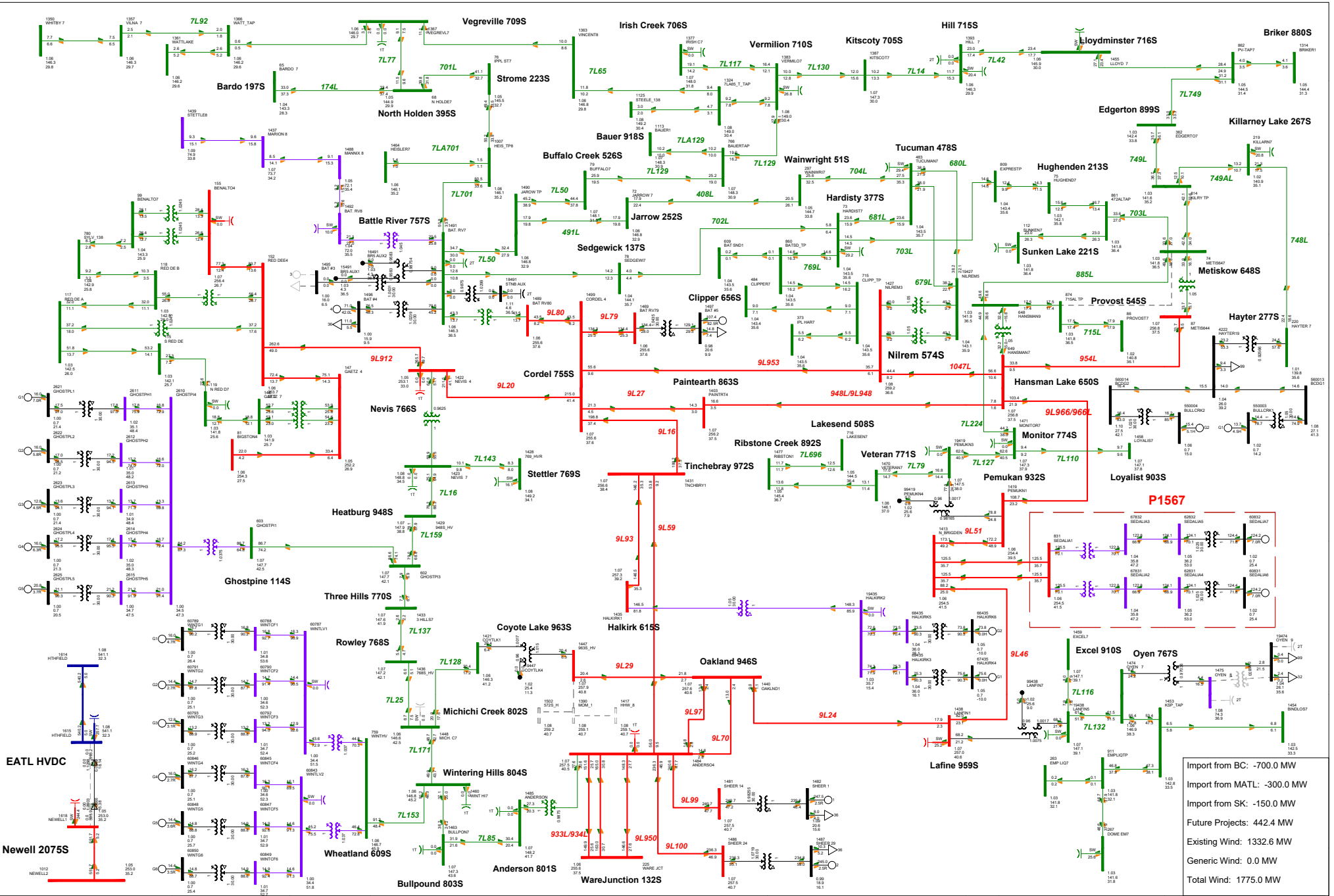
Contingency: 7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S) 23

Contingency: 749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S) 24

Contingency: 7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S) 25

Contingency: 766S901T (NEVIS 766S 240/138 KV TRANSFORMER) 26

Contingency: EATL HVDC 27

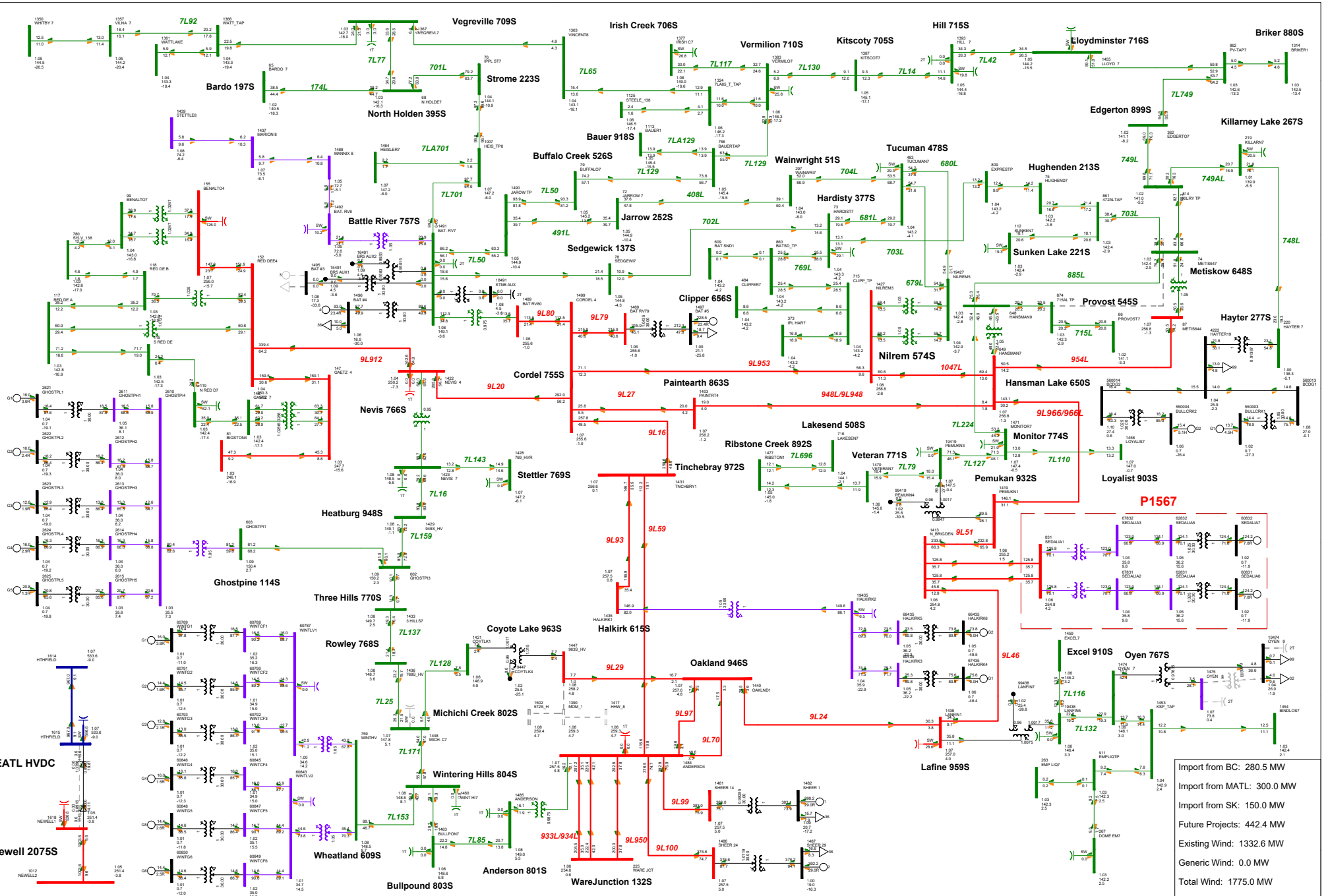


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE A-1-1: P1909_SL_PRE
CATEGORY A - NO CONTINGENCY
MON, MAR 15 2021 23:07

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.200OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

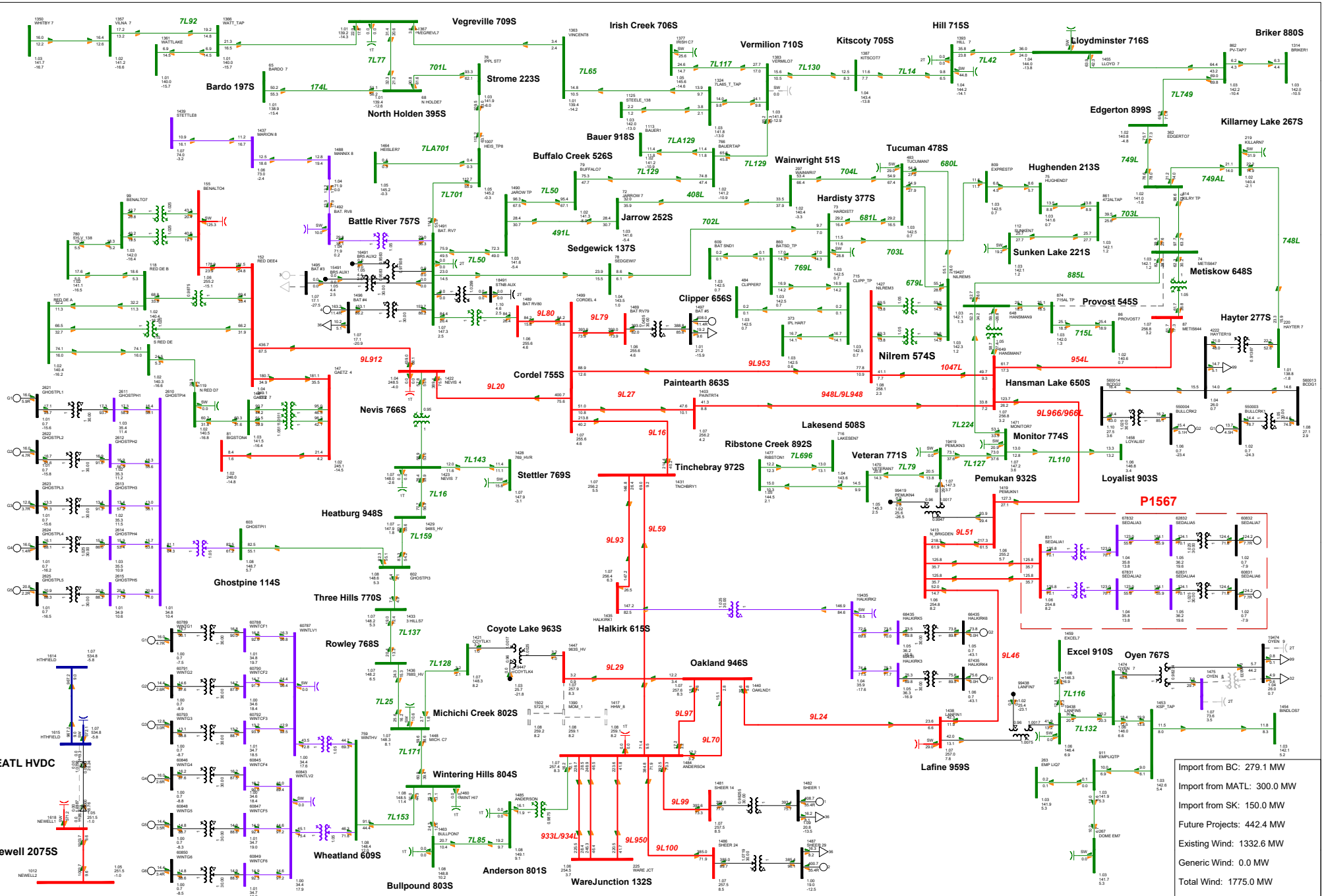


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE A-2-1: P1909_SP_PRE
CATEGORY A - NO CONTINGENCY
MON, MAR 15 2021 23:08

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



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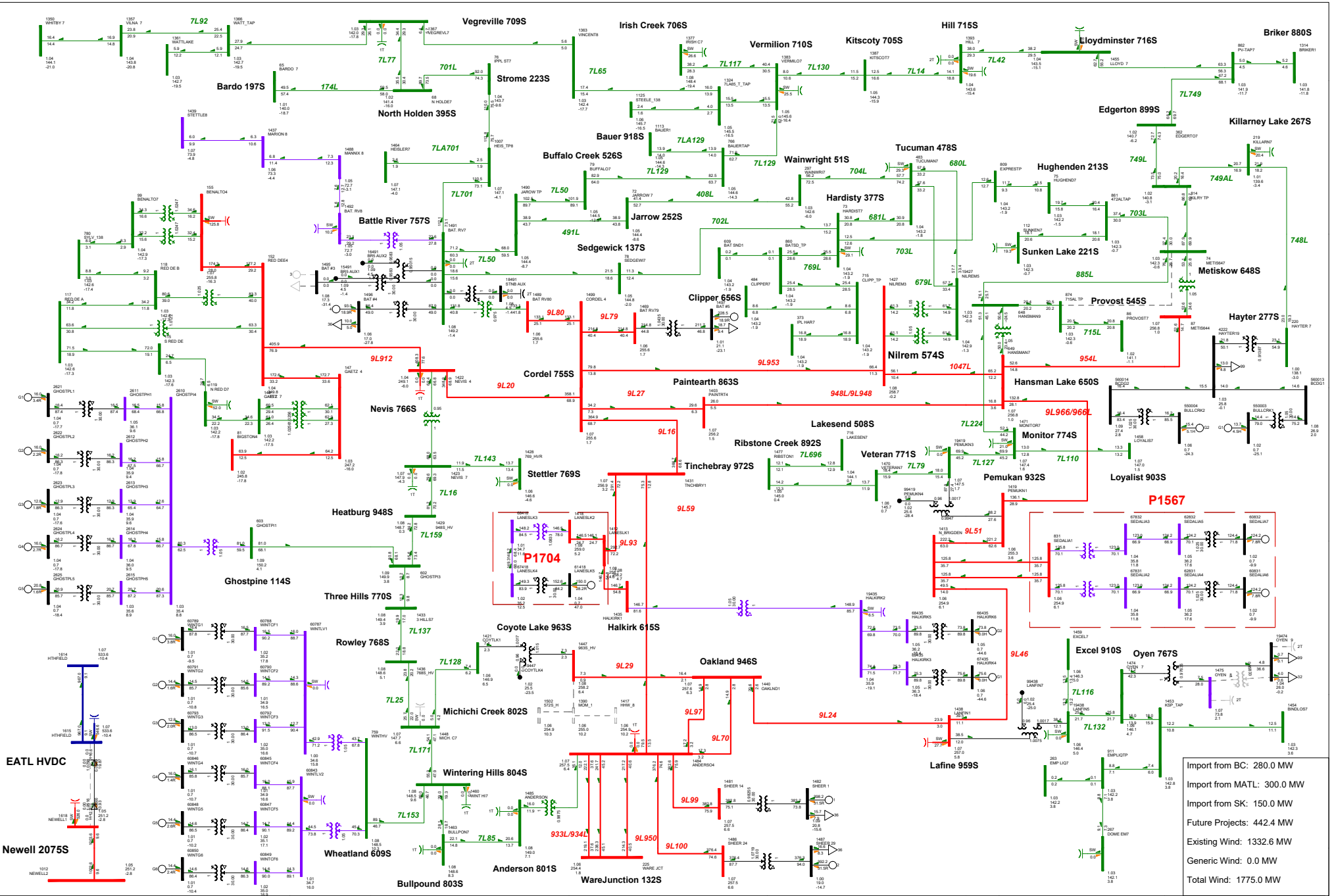
AESO Project Number: 1909

FIGURE A-3-1: P1909_WP_PRE
CATEGORY A - NO CONTINGENCY
MON, MAR 15 2021 23:13

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate B
Equipment - MW/Mvar
100.0%Rate B
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



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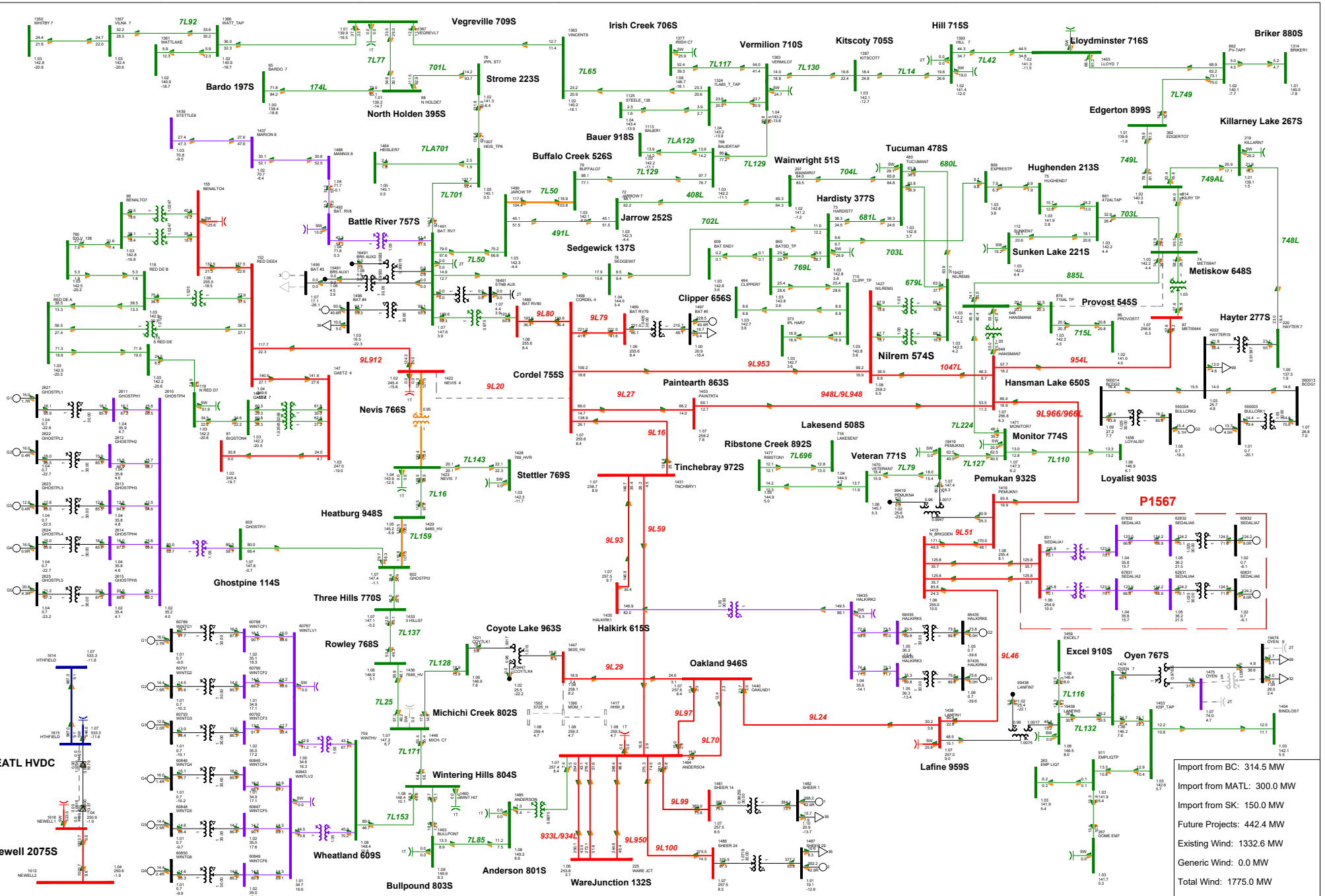
AESO Project Number: 1909

FIGURE A-8-1: P1909_SP_PRE_SEN
CATEGORY A - NO CONTINGENCY
MON, MAR 15 2021 23:16

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



TransAlta Garden Plain Wind Farm

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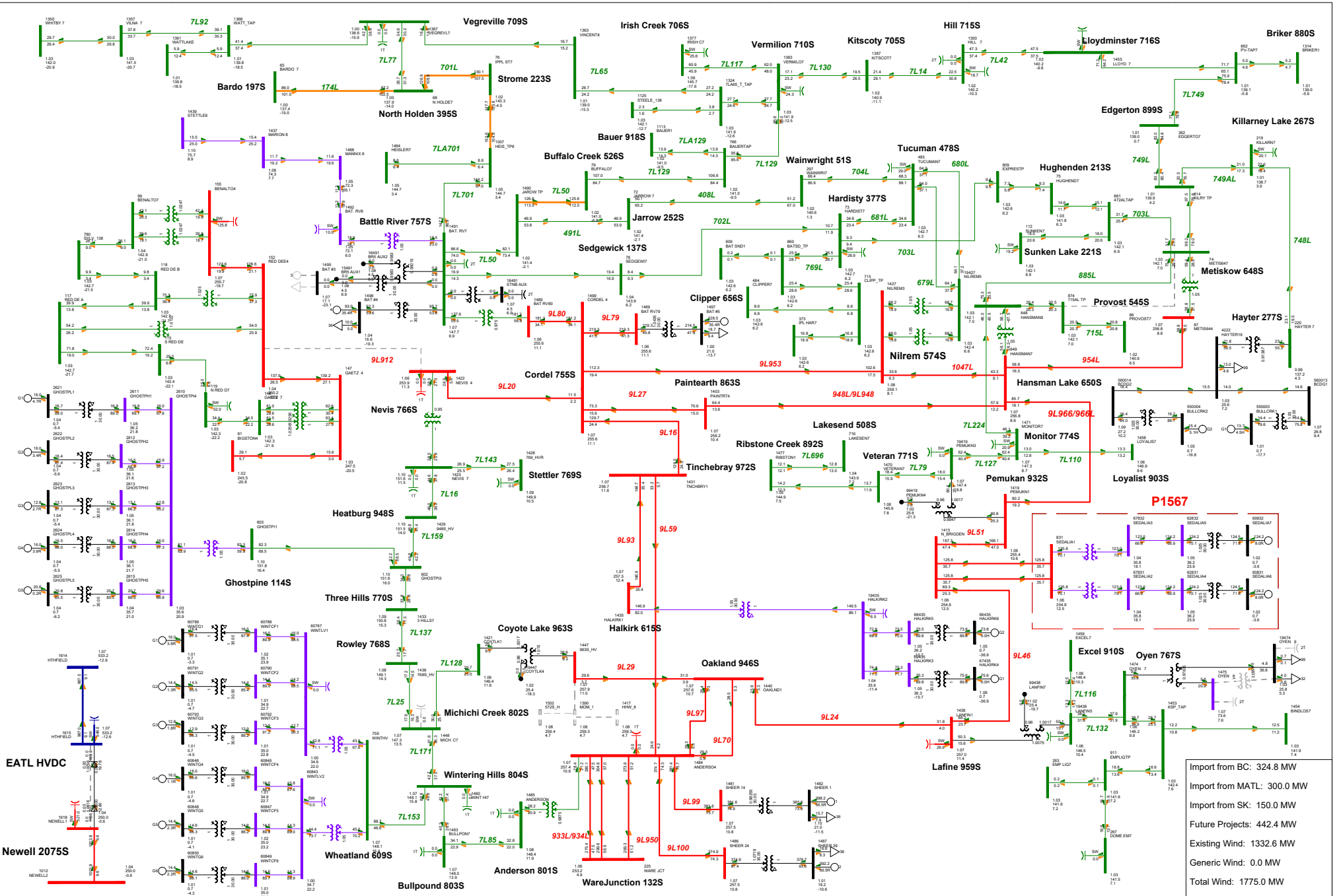
FIGURE B-2-1: P1909_SP_PRE
CATEGORY B - 9L20 (NEVIS 766S - CORDEL 755S)
MON, MAR 15 2021 23:09

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-2-2: P1909_SP_PRE
CATEGORY B - 912L/9L912 (RED DEER 63S - NEVIS 766S)
MON, MAR 15 2021 23:09

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

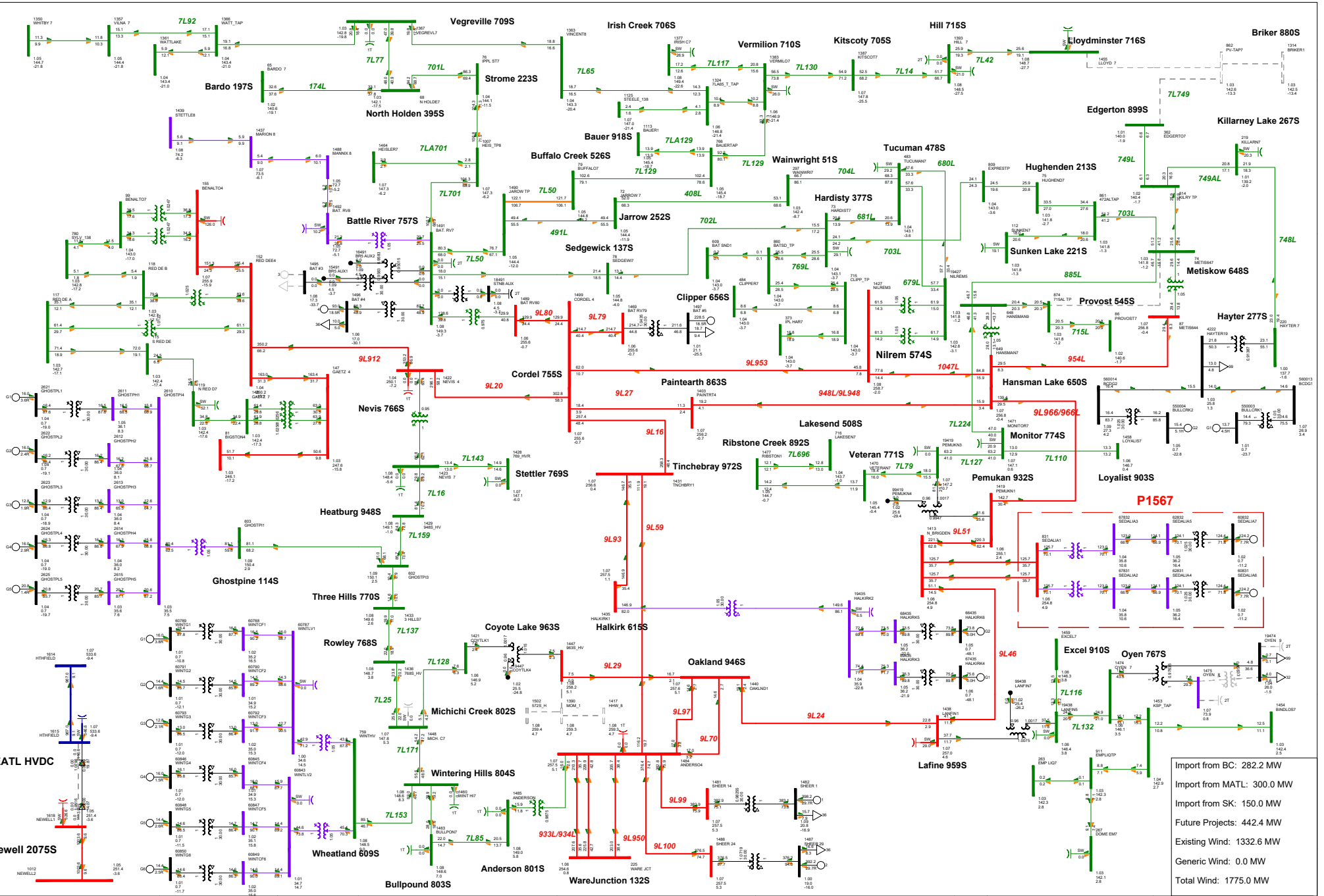


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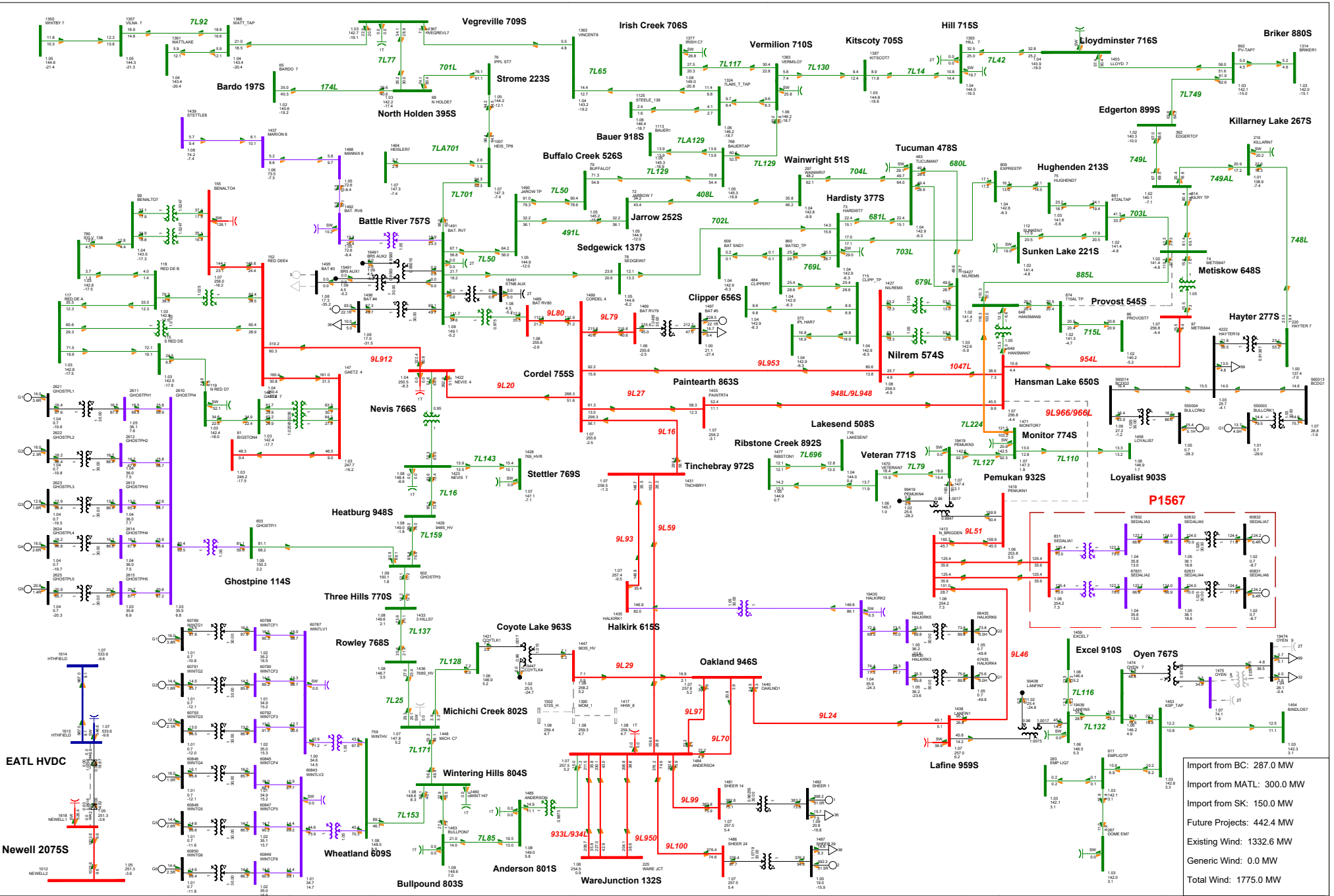
FIGURE B-2-3: P1909_SP_PRE
CATEGORY B - 7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)
MON, MAR 15 2021 23:10

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-2-4: P1909_SP_PRE
CATEGORY B - 966L/9L966 (HANSMAN LAKE 650S - PEMUKAN 932S)
MON, MAR 15 2021 23:10

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

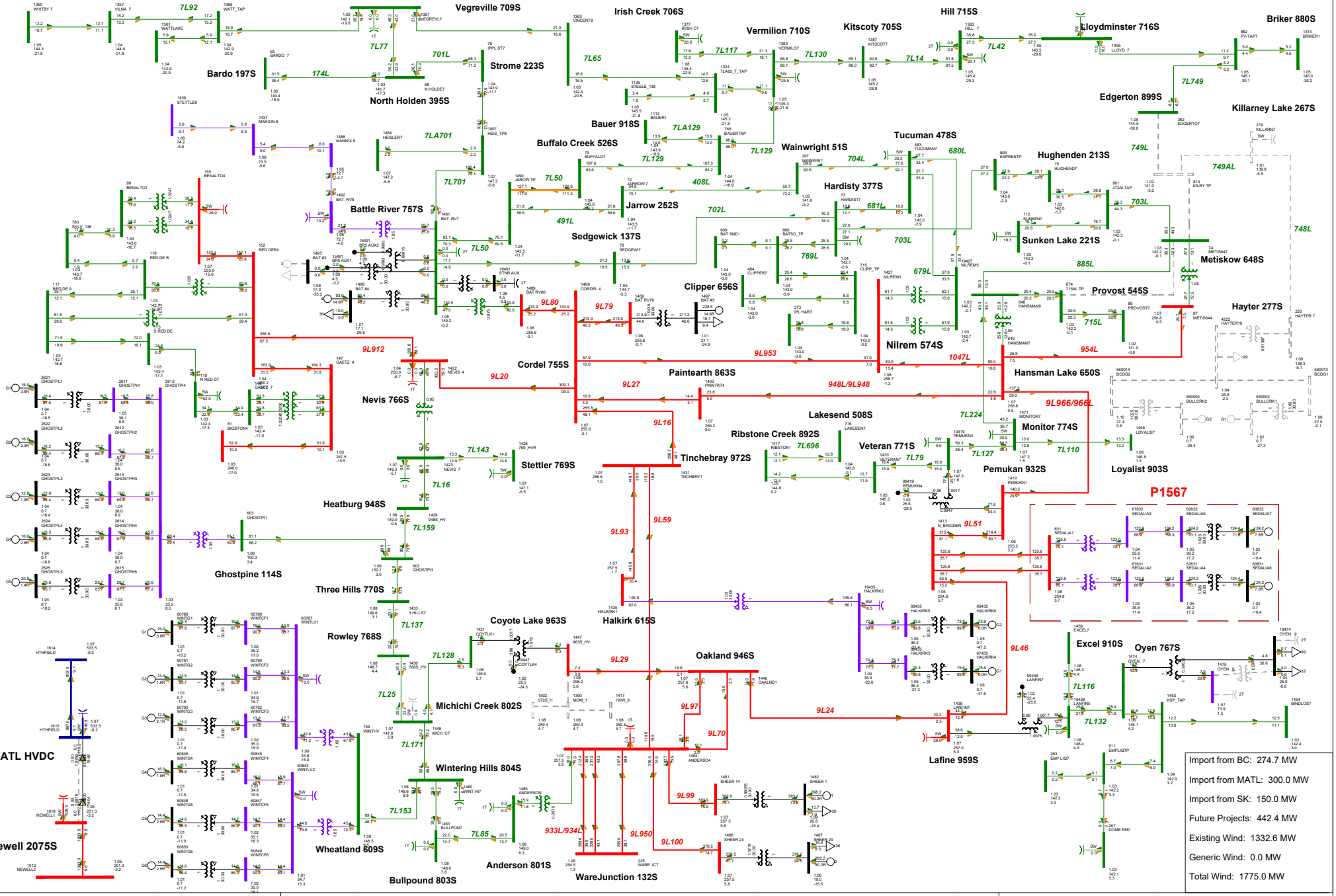


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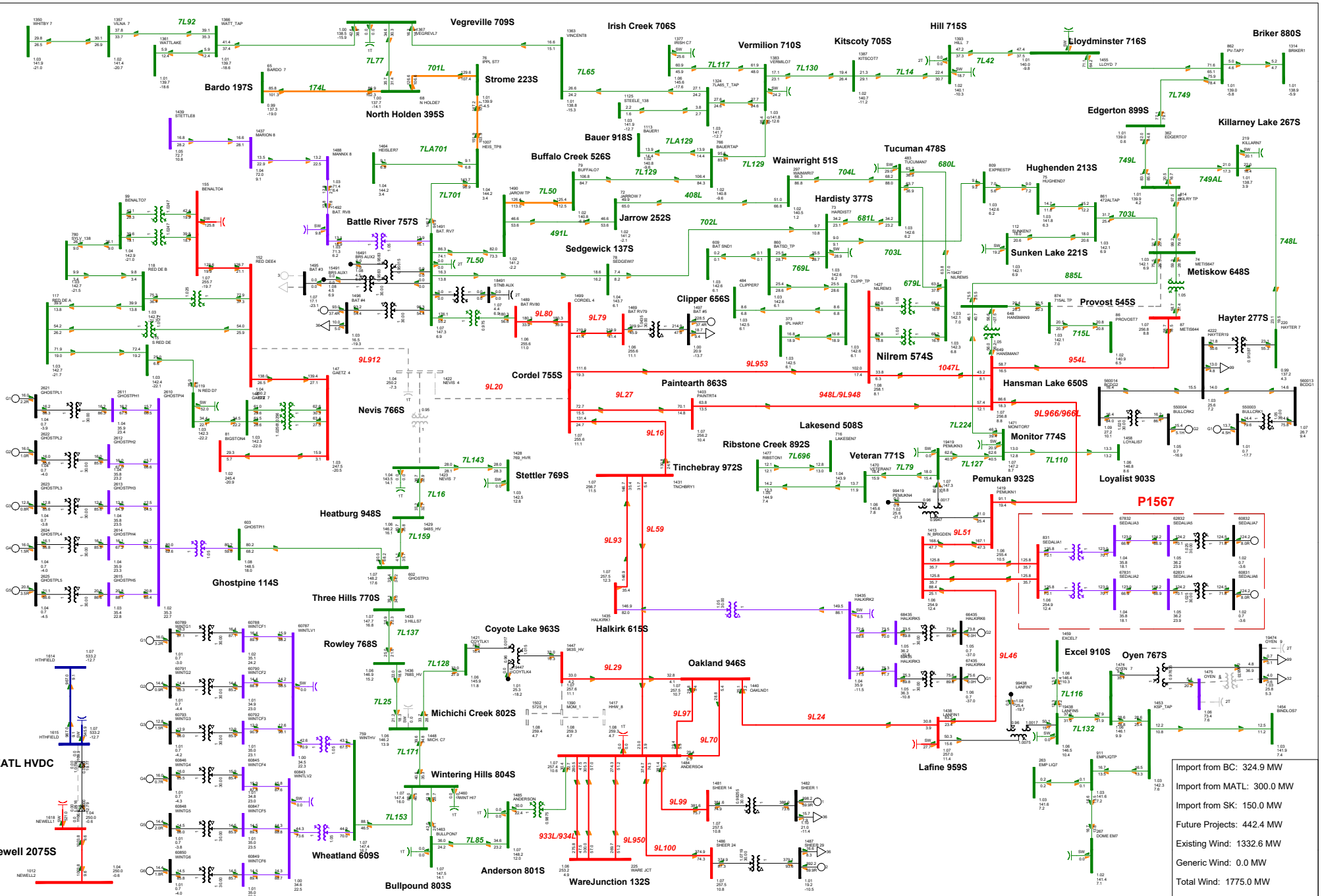
FIGURE B-2-5: P1909_SP_PRE
CATEGORY B - 749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)
MON, MAR 15 2021 23:11

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.200OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

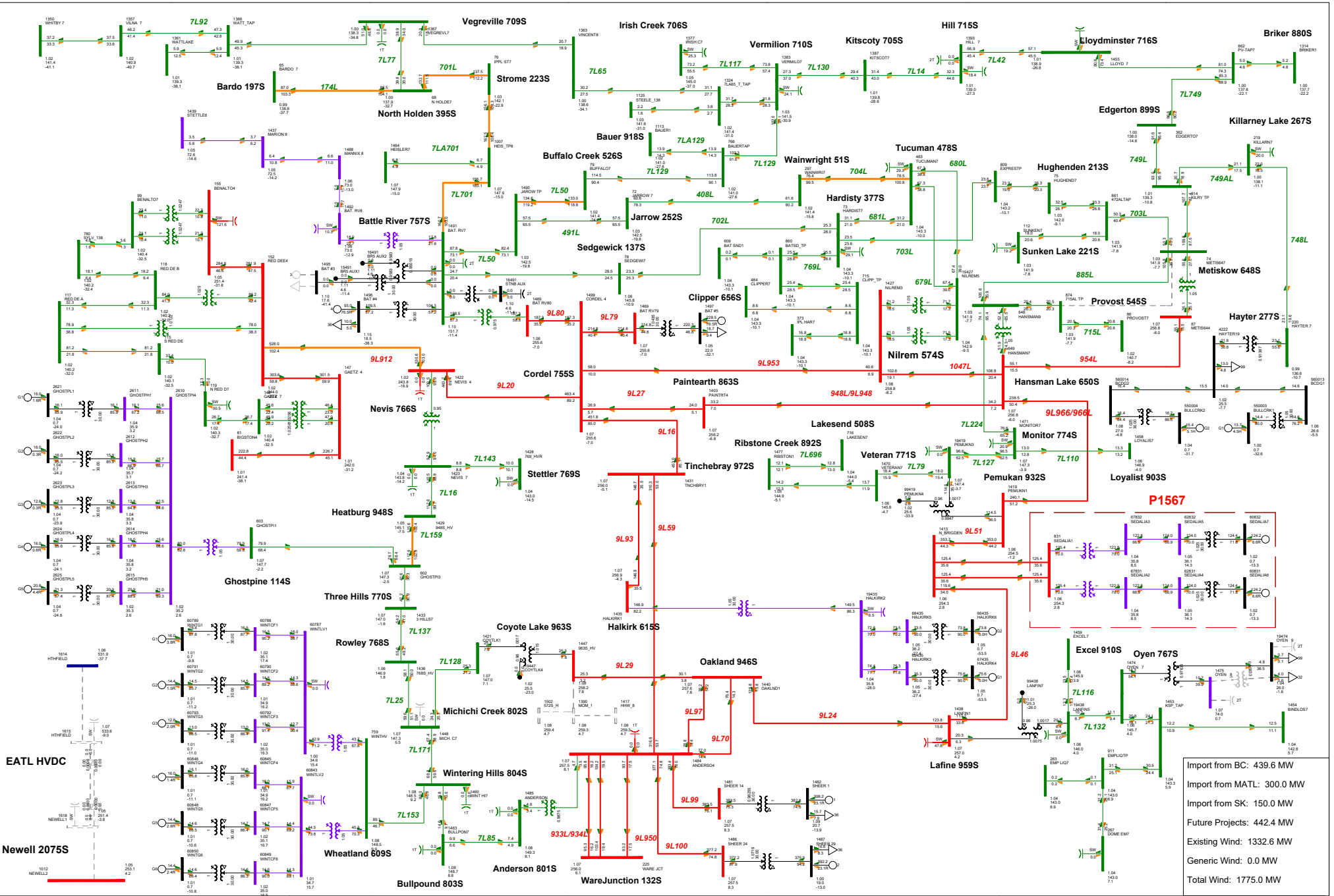


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-2-6: P1909_SP_PRE
CATEGORY B - 766S901T (NEVIS 766S 240/138 KV TRANSFORMER)
MON, MAR 15 2021 23:11

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-2-7: P1909_SP_PRE
CATEGORY B - EATL HVDC
TUE, MAR 16 2021 17:44

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

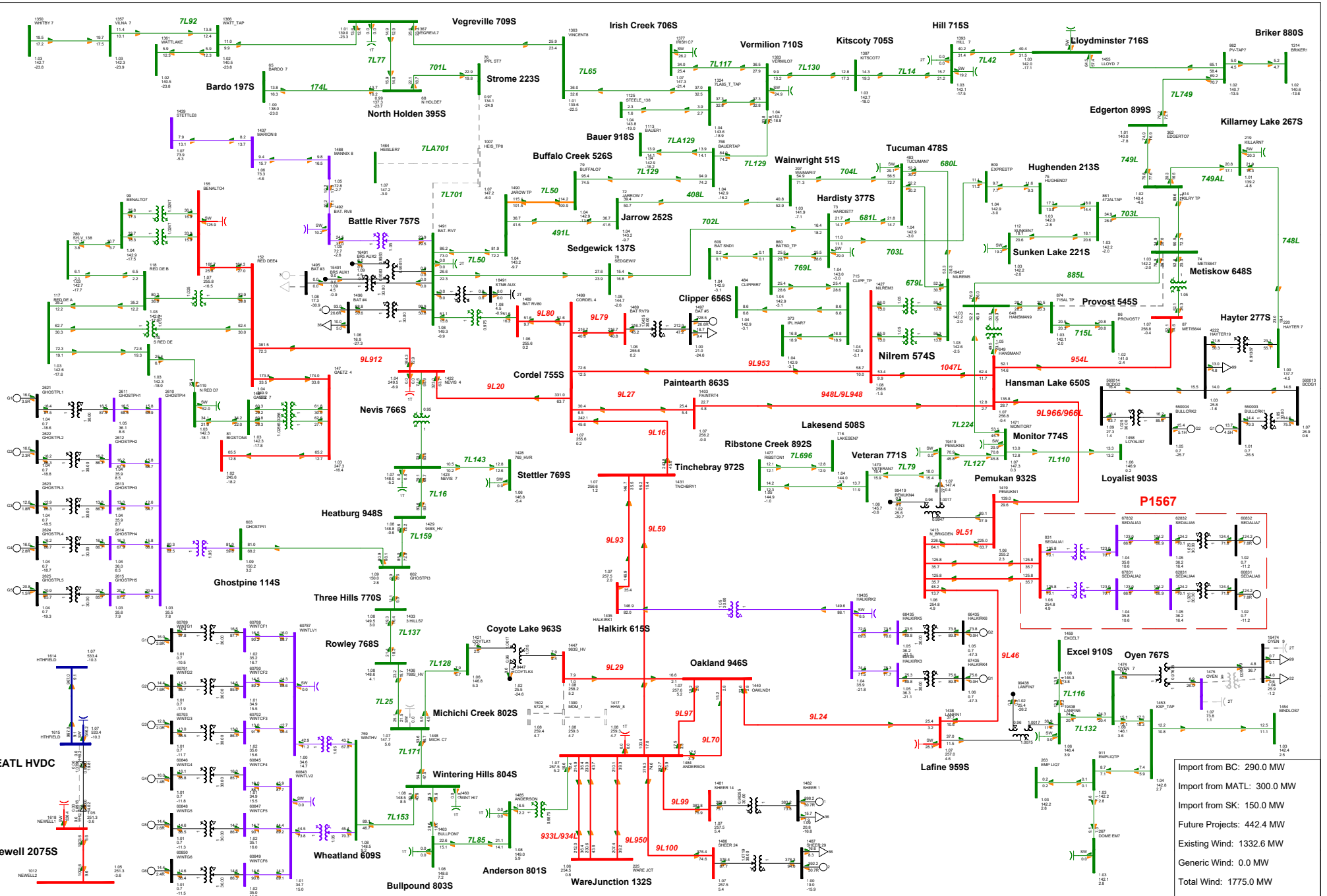


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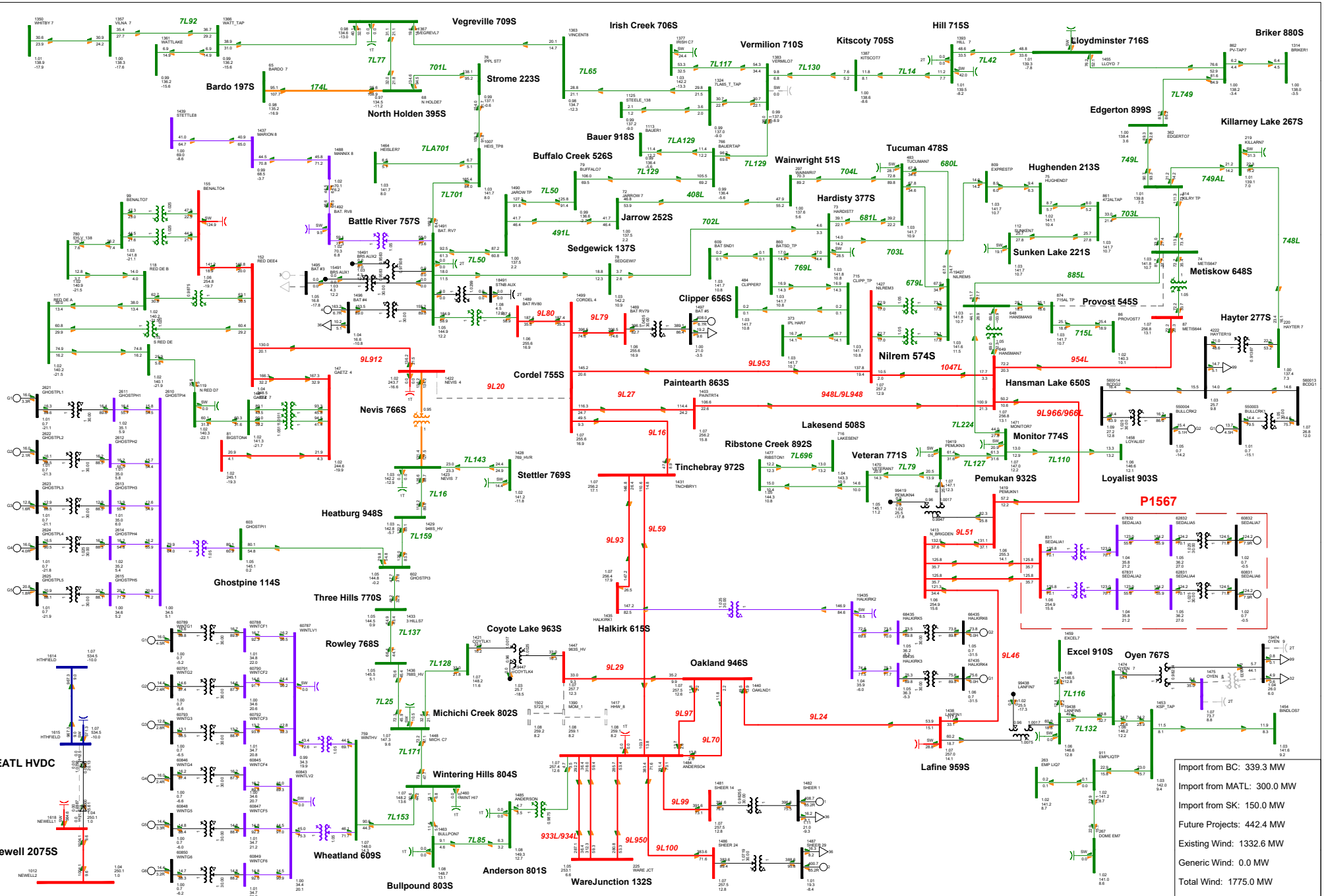
FIGURE B-2-8: P1909_SP_PRE
CATEGORY B - 7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)
MON, MAR 15 2021 23:12

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



TransAlta Garden Plain Wind Farm

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FIGURE B-3-1: P1909_WP_PRE
CATEGORY B - 9L20 (NEVIS 766S - CORDEL 755S)
MON, MAR 15 2021 23:13

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate B
Equipment - MW/Mvar
100.0%Rate B
1.200OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

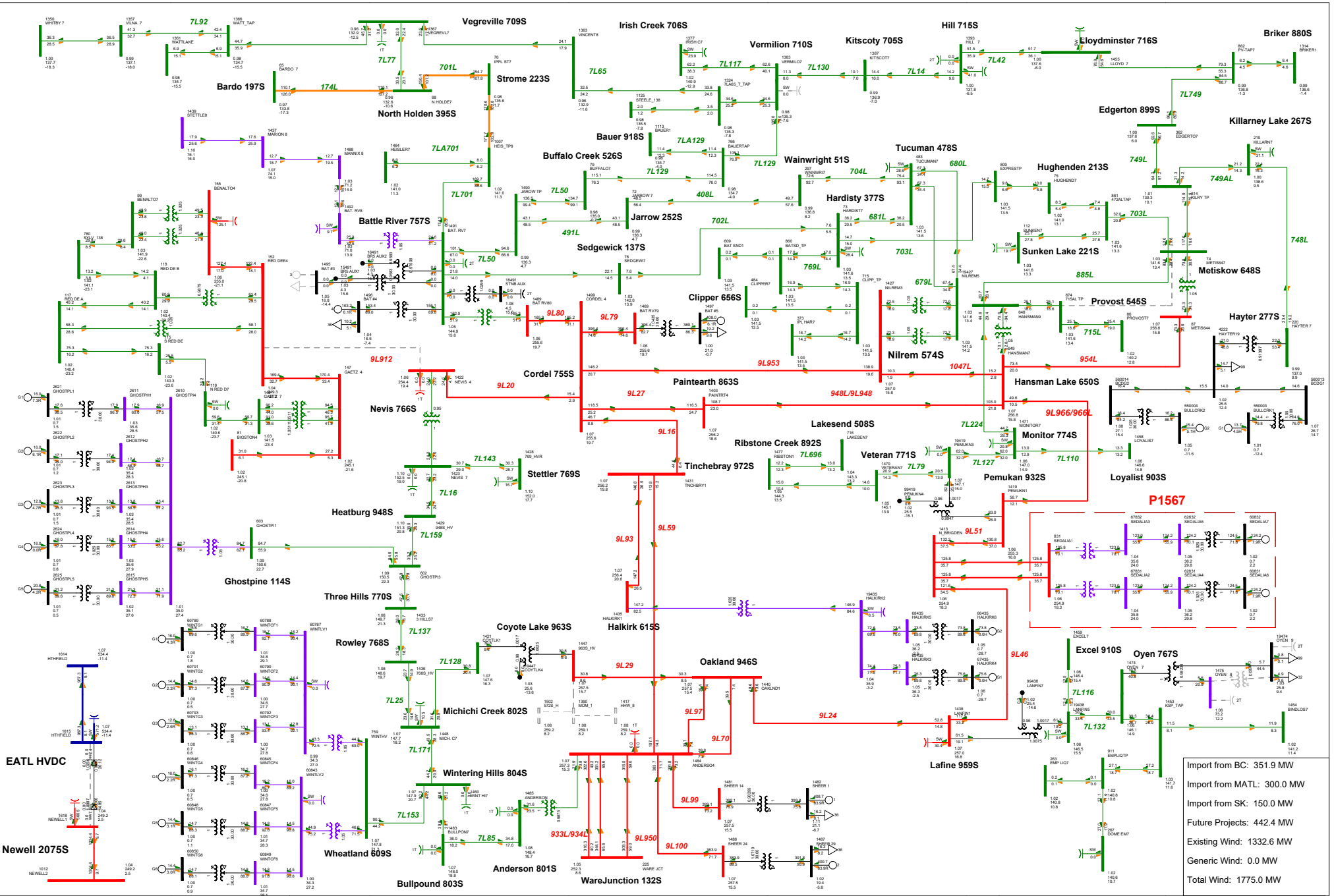

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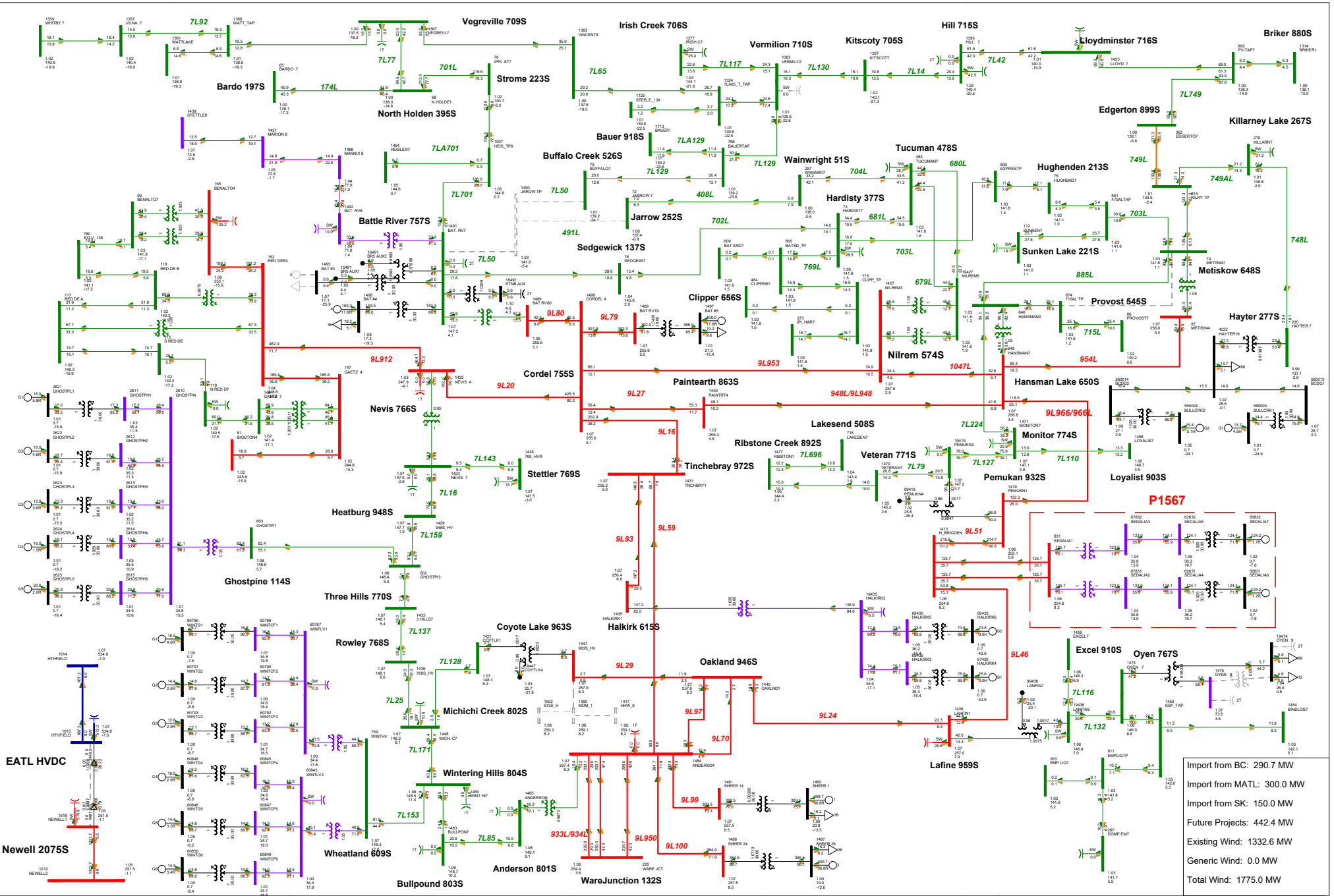
FIGURE B-3-2: P1909_WP_PRE
CATEGORY B - 912L/9L912 (RED DEER 63S - NEVIS 766S)
MON, MAR 15 2021 23:14

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate B
Equipment - MW/Mvar
100.0%Rate E
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

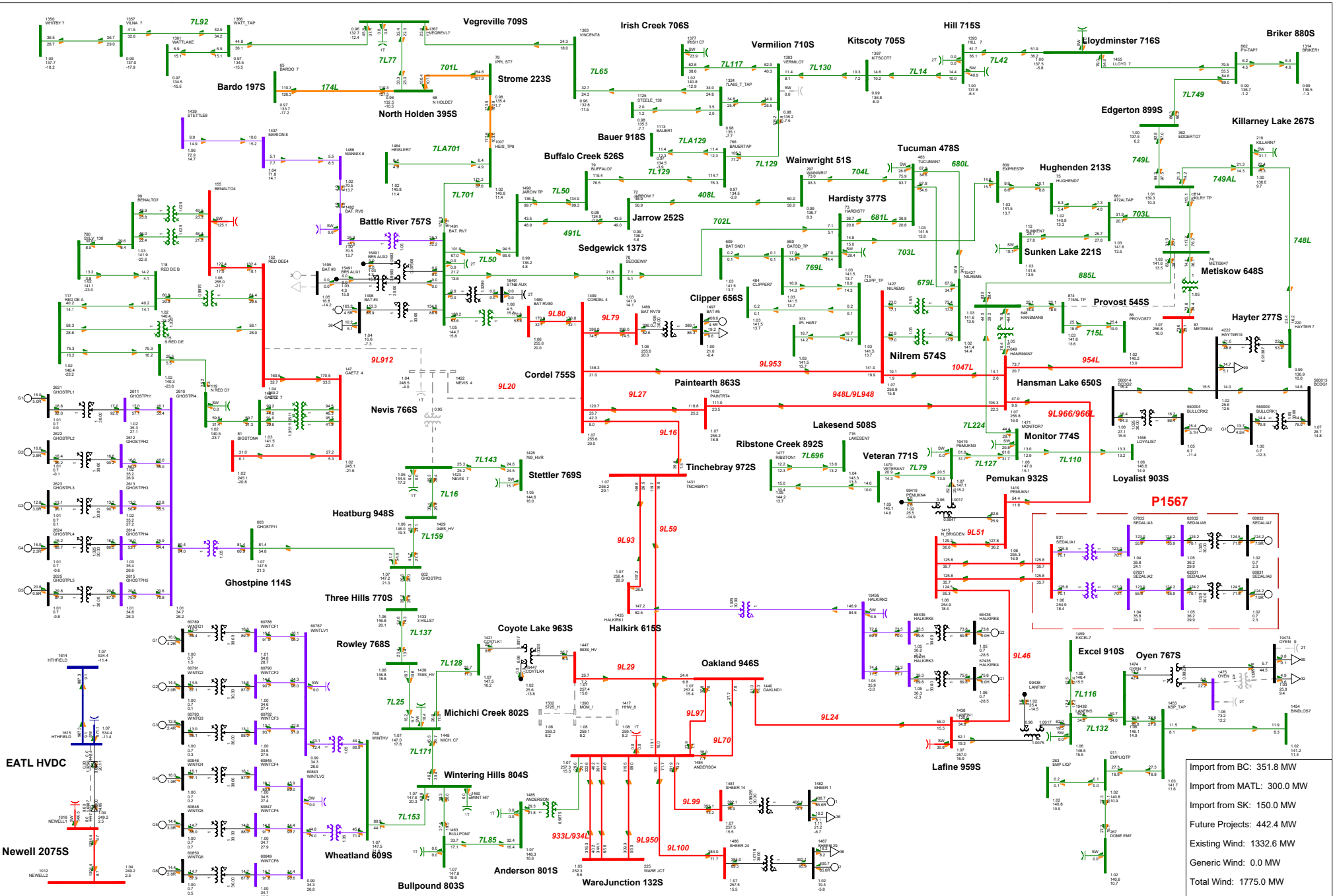


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-3-3: P1909_WP_PRE
CATEGORY B - 7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)
MON, MAR 15 2021 23:14

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate B
Equipment - MW/Mvar
100.0%Rate E
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

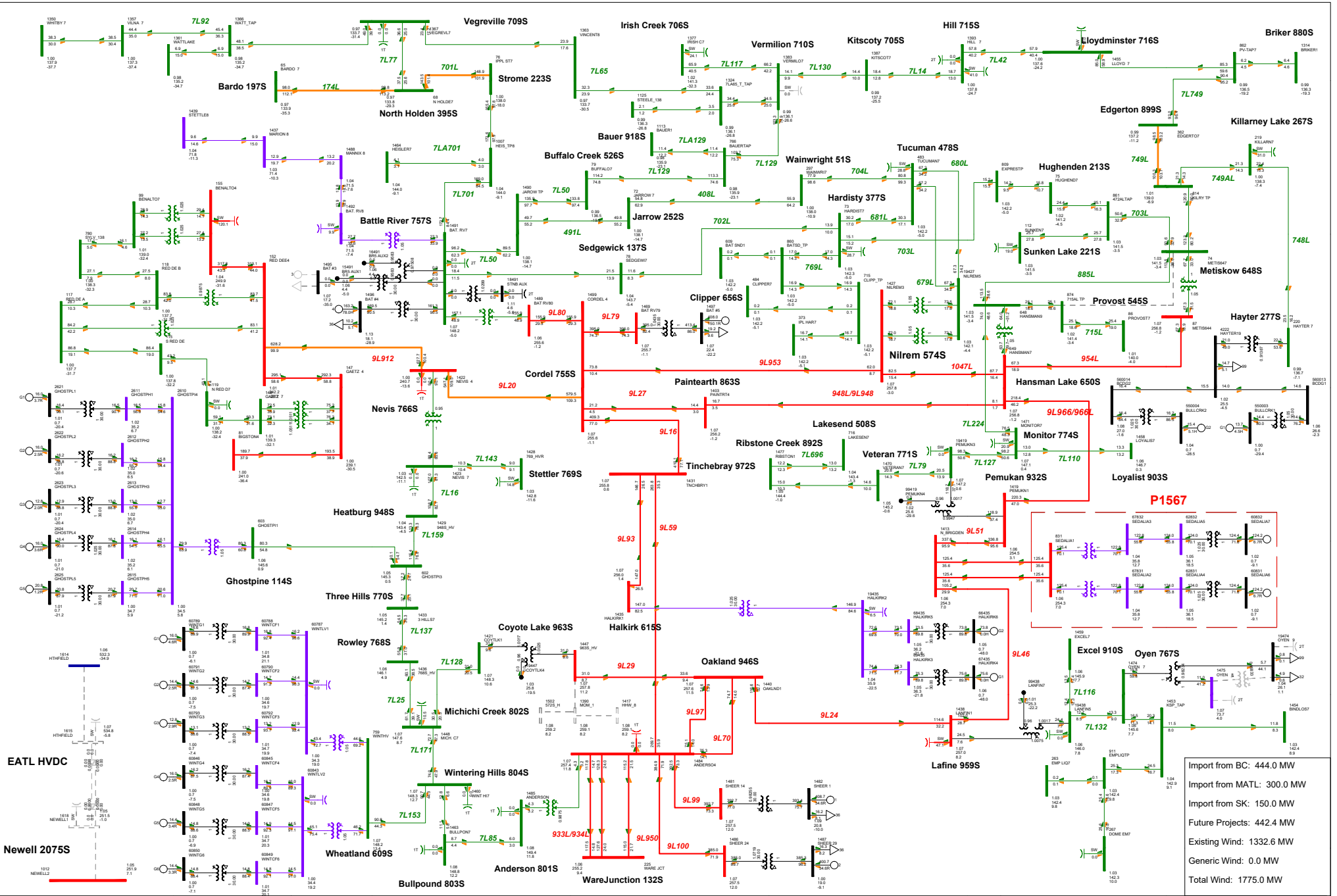


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-3-4: P1909_WP_PRE
CATEGORY B - 766S901T (NEVIS 766S 240/138 KV TRANSFORMER)
MON, MAR 15 2021 23:15

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate B
Equipment - MW/Mvar
100.0%Rate E
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

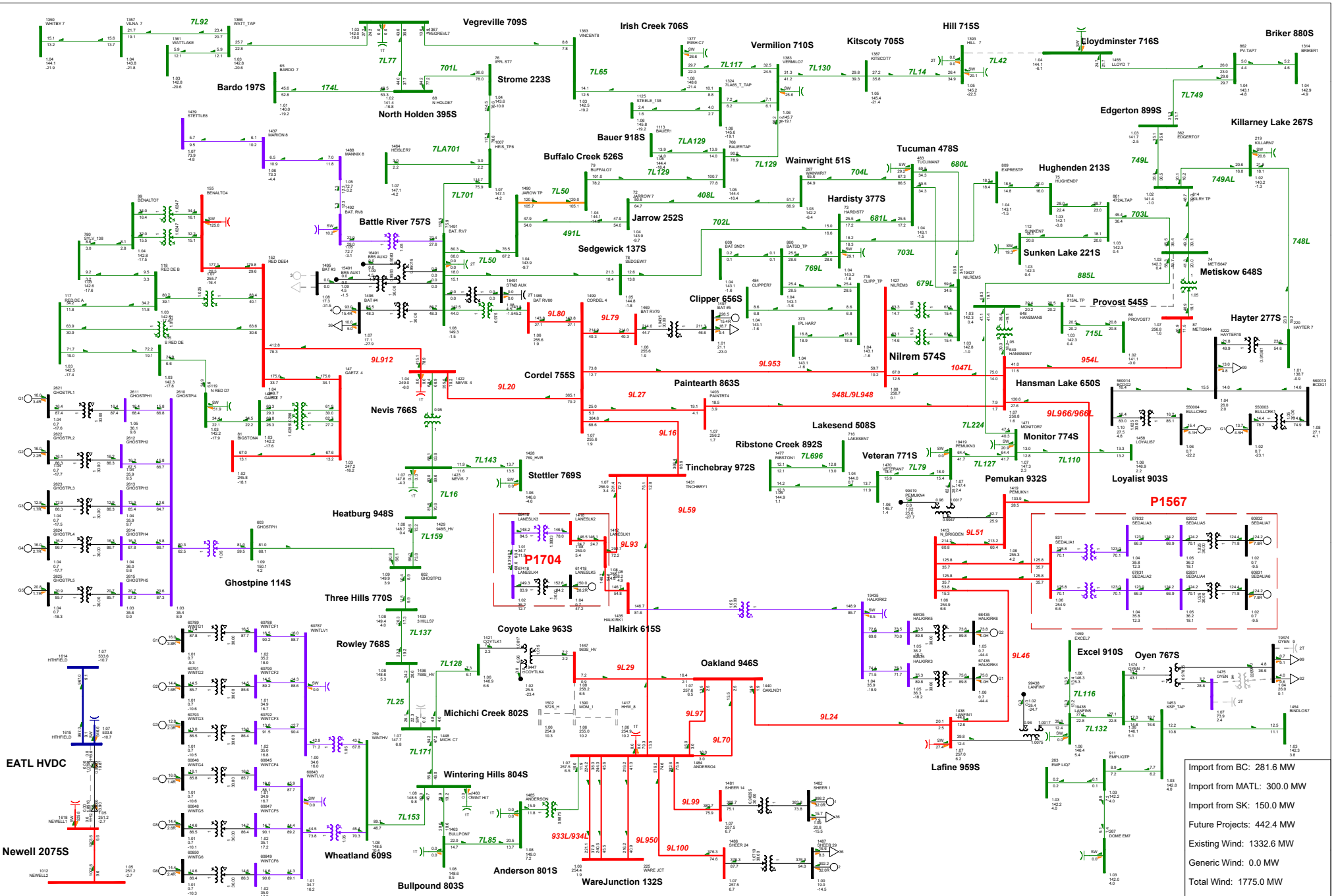


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-3-5: P1909_WP_PRE
CATEGORY B - EATL HVDC
MON, MAR 15 2021 23:15

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate B
Equipment - MW/Mvar
100.0%Rate B
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

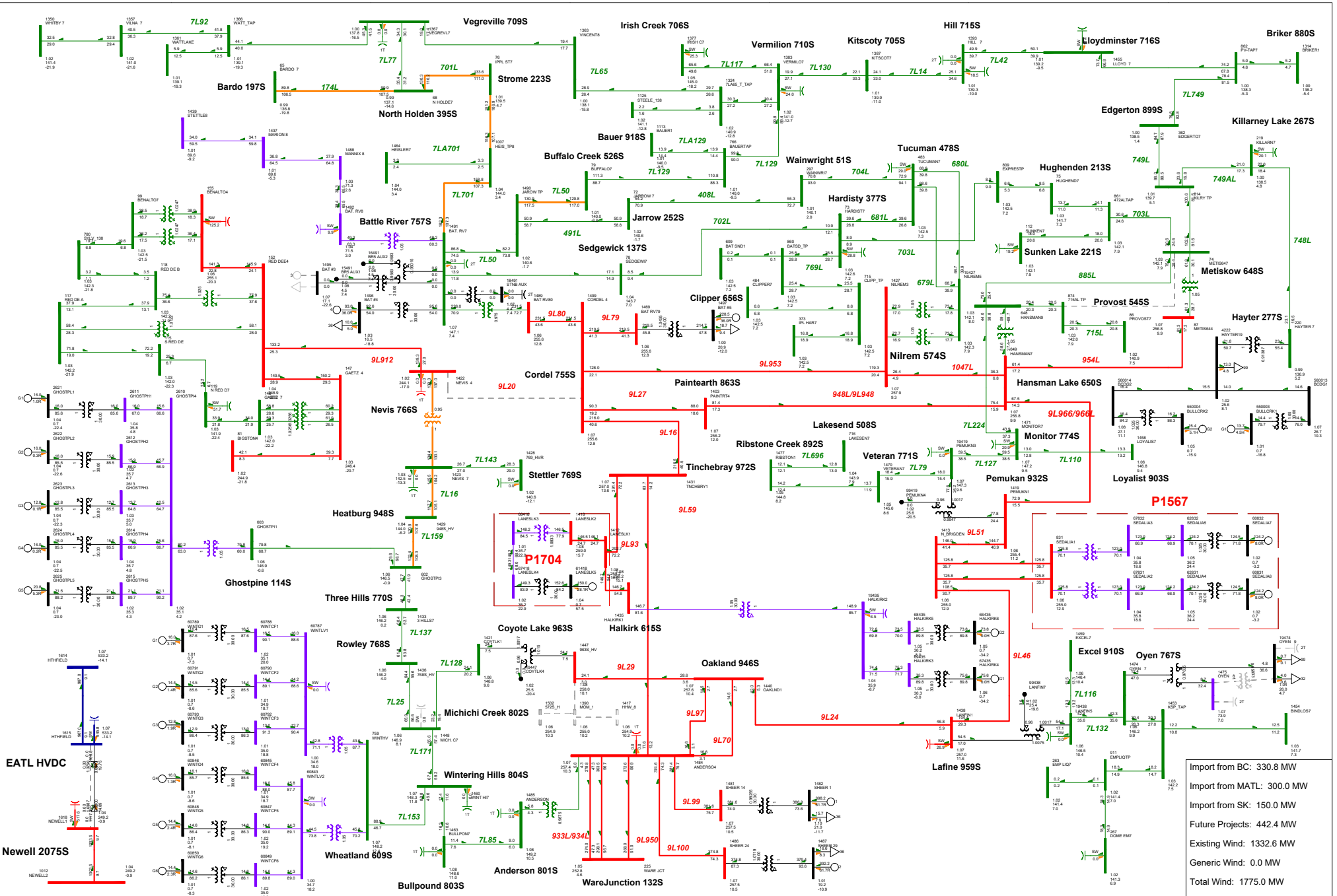


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-8-1: P1909_SP_PRE_SEN
CATEGORY B - 7L42 (HILL 751S - LLOYDMINSTER 716S)
MON, MAR 15 2021 23:17

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

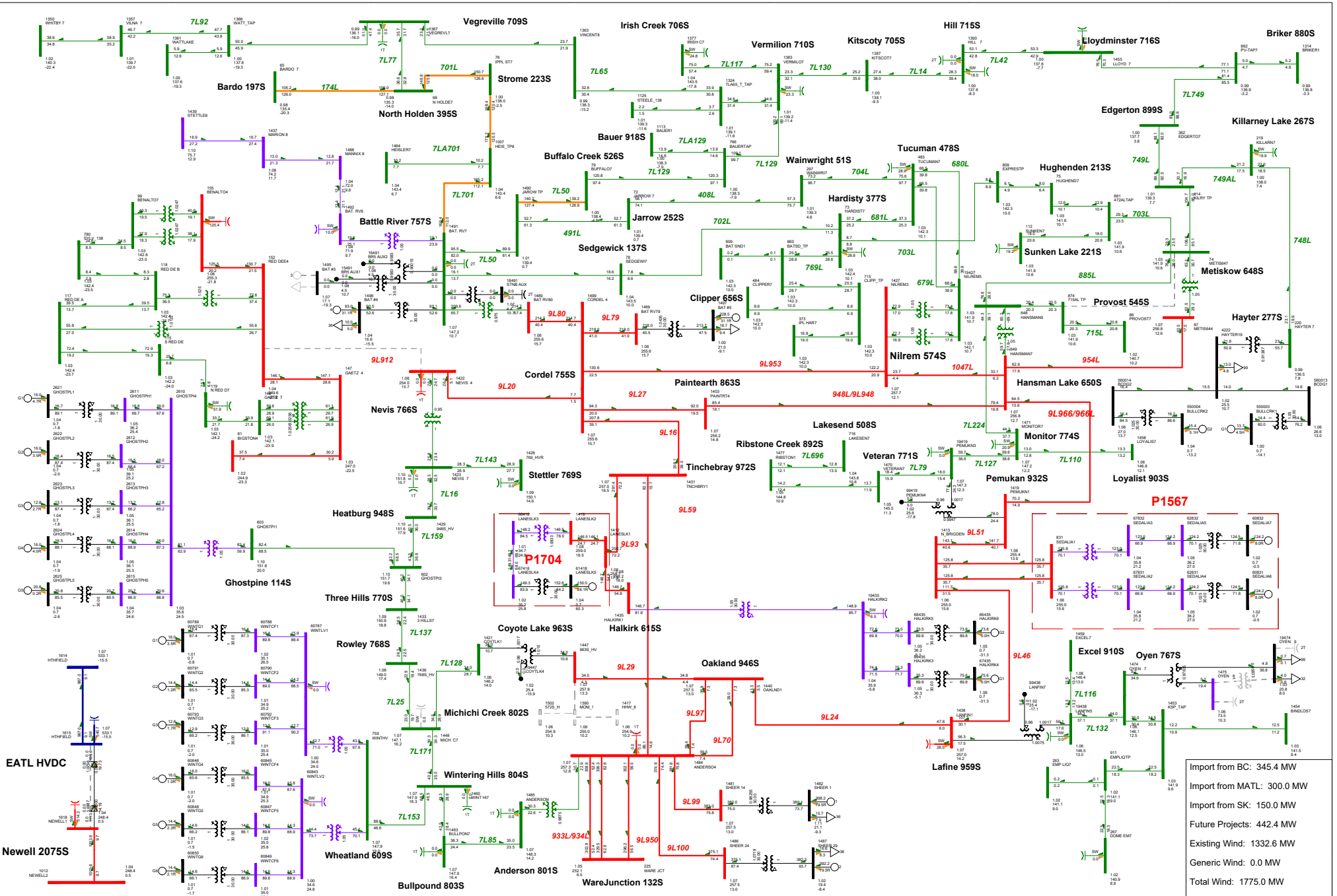


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-8-2: P1909_SP_PRE_SEN
CATEGORY B - 9L20 (NEVIS 766S - CORDEL 755S)
MON, MAR 15 2021 23:17

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

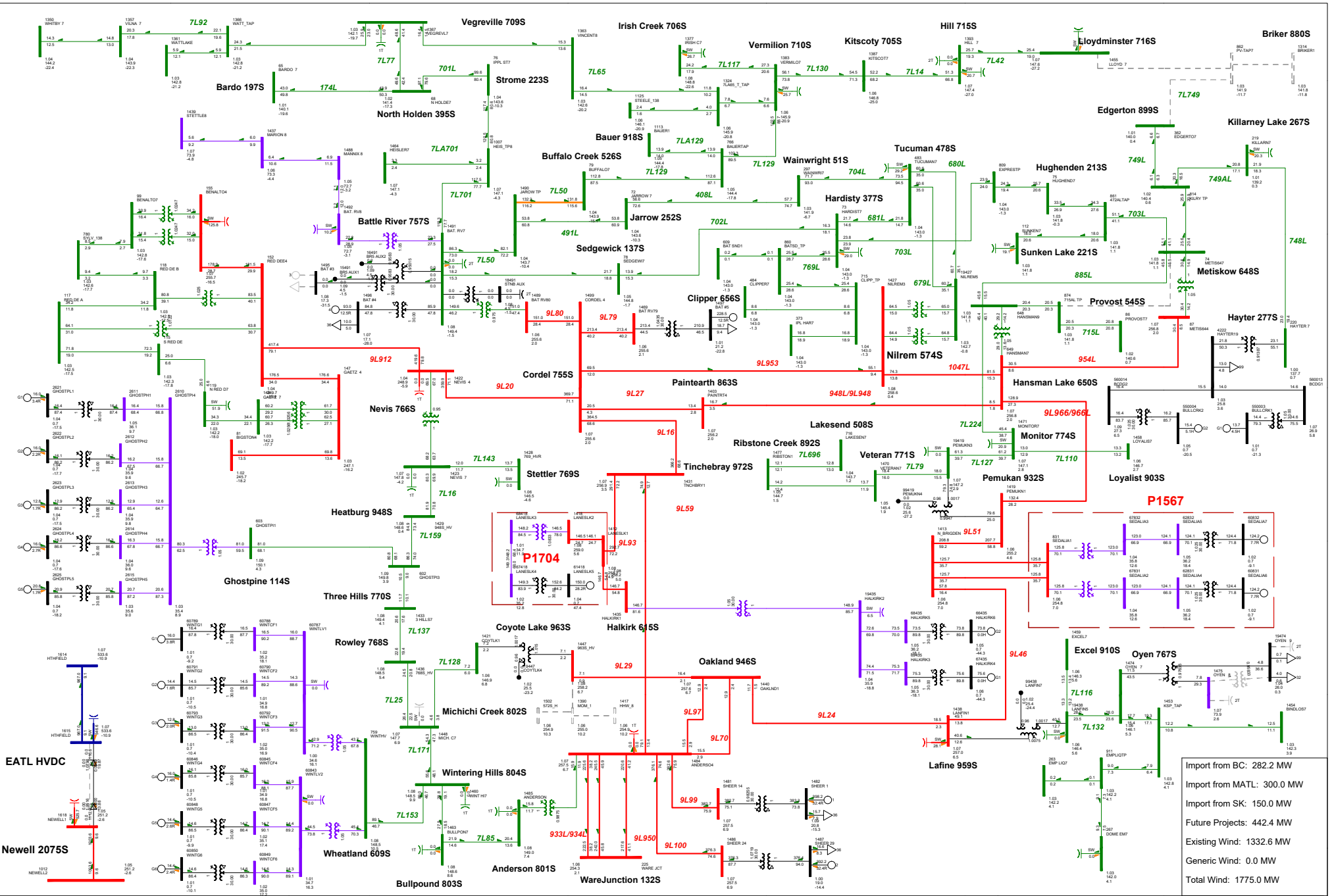


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-8-3: P1909_SP_PRE_SEN
CATEGORY B - 912L/9L912 (RED DEER 63S - NEVIS 766S)
MON, MAR 15 2021 23:17

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

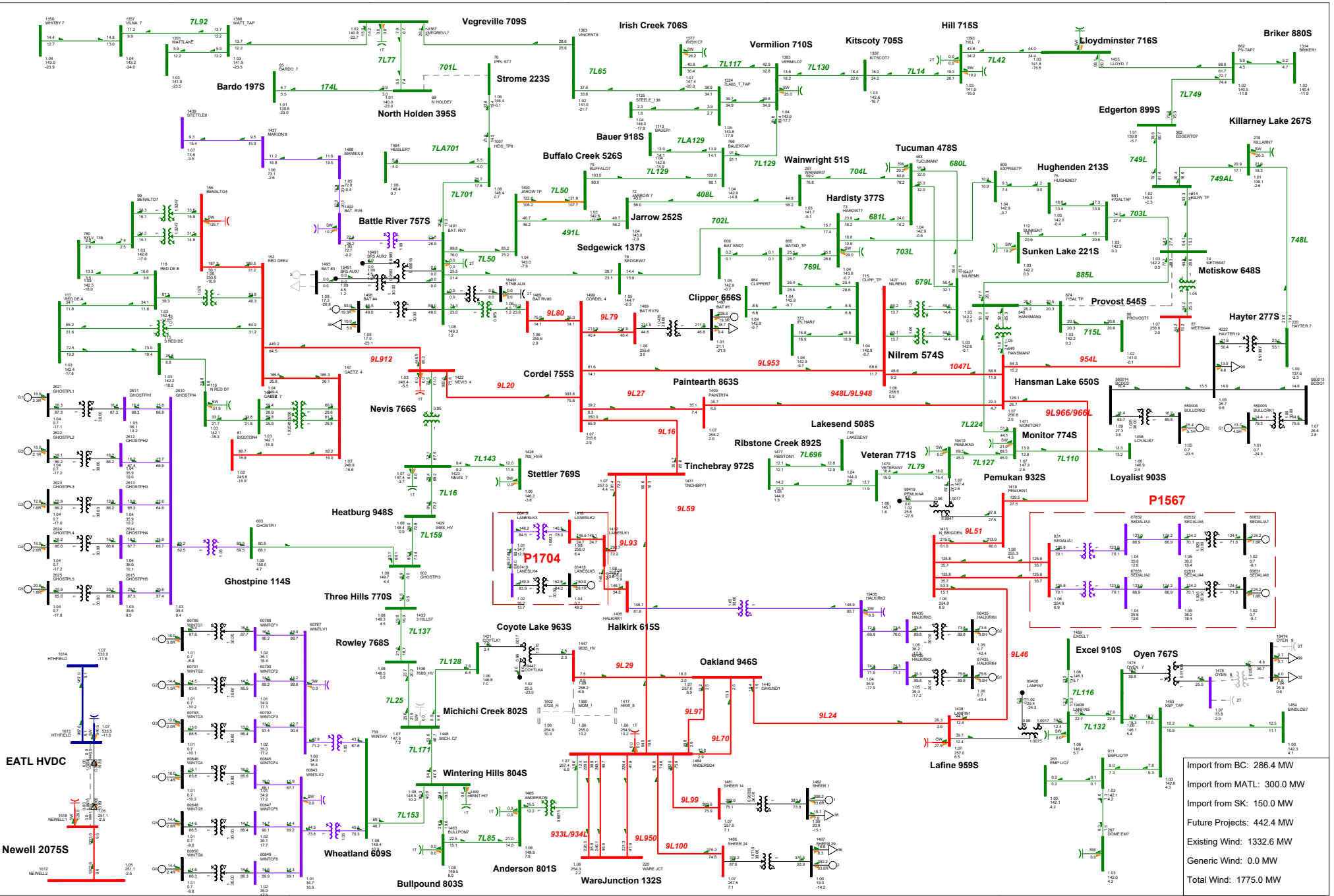


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-8-4: P1909_SP_PRE_SEN
CATEGORY B - 7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)
MON, MAR 15 2021 23:18

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-8-5: P1909_SP_PRE_SEN
CATEGORY B - 701L (NORTH HOLDEN 395S- STROME 223S)
MON, MAR 15 2021 23:18

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

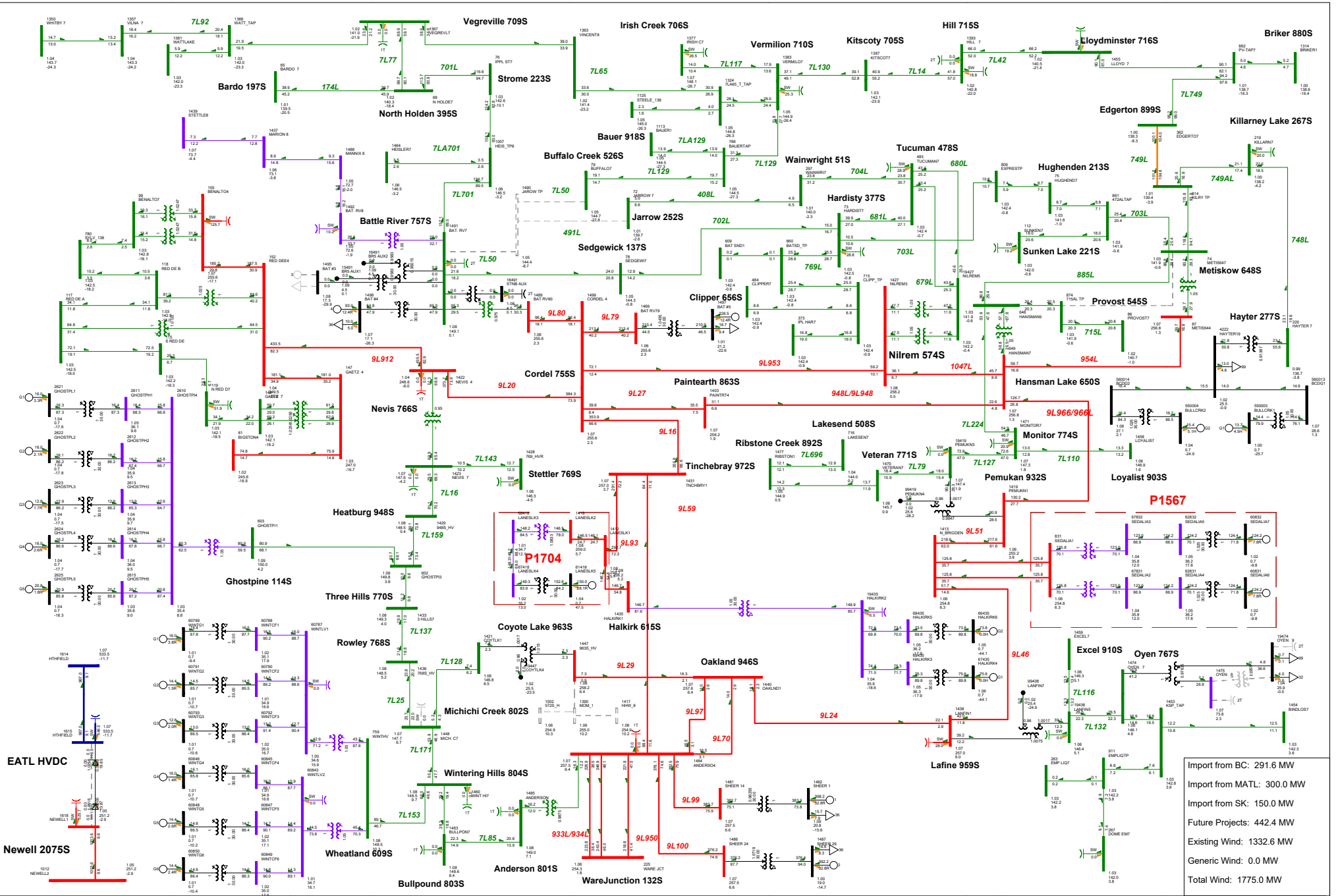


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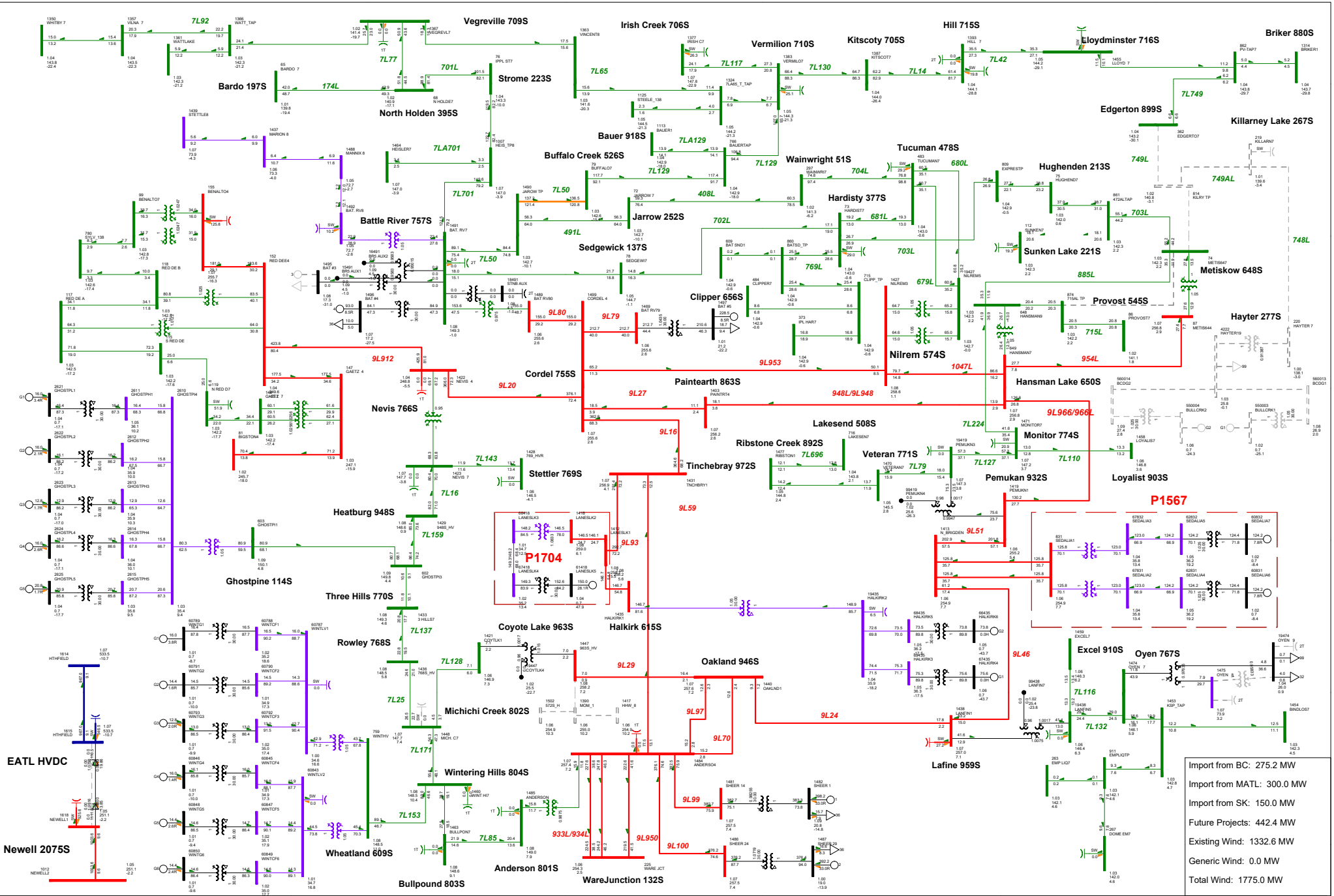
FIGURE B-8-6: P1909_SP_PRE_SEN
CATEGORY B - 7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)
MON, MAR 15 2021 23:19

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



TransAlta Garden Plain Wind Farm

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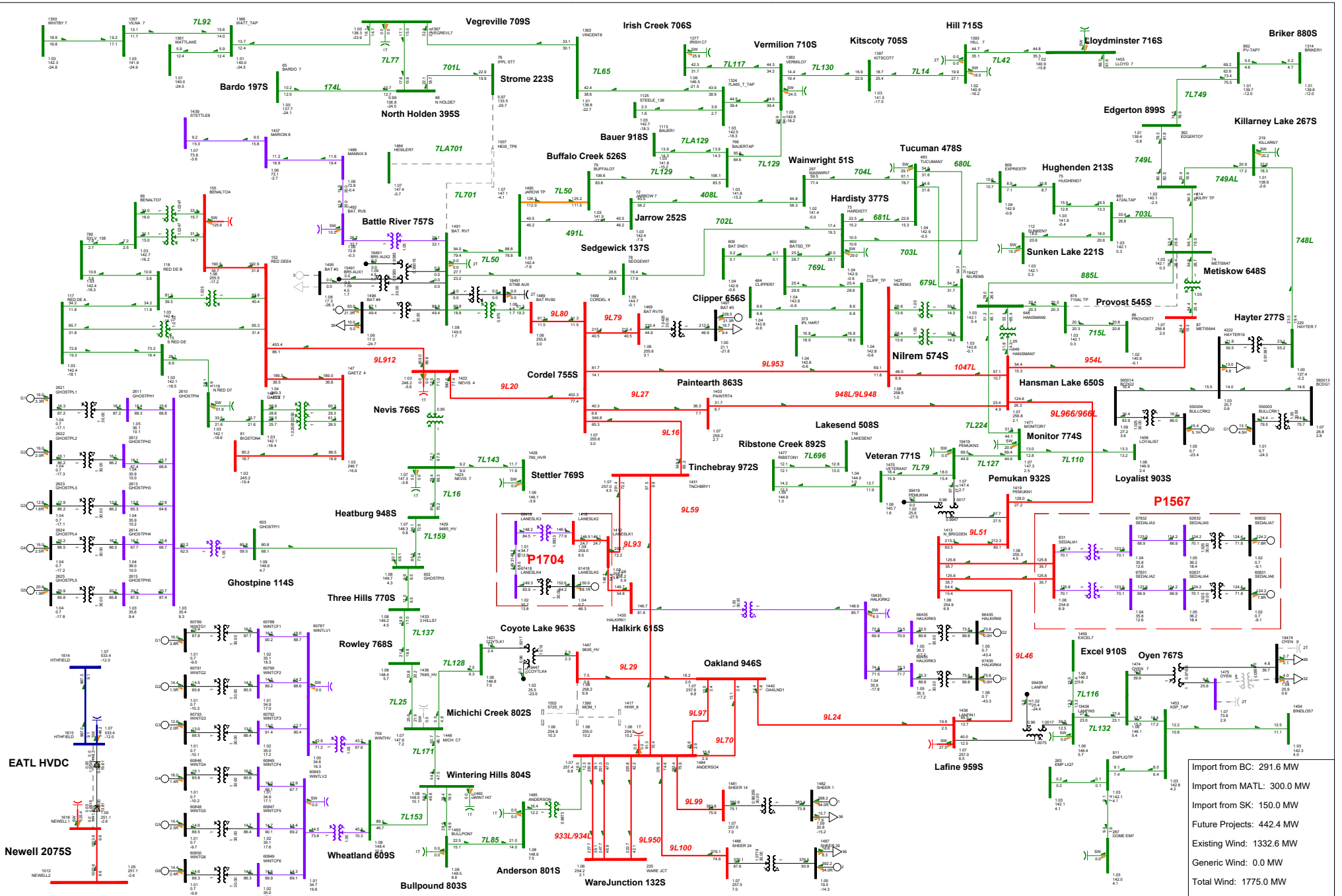
FIGURE B-8-7: P1909_SP_PRE_SEN
CATEGORY B - 749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)
MON, MAR 15 2021 23:19

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.200OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

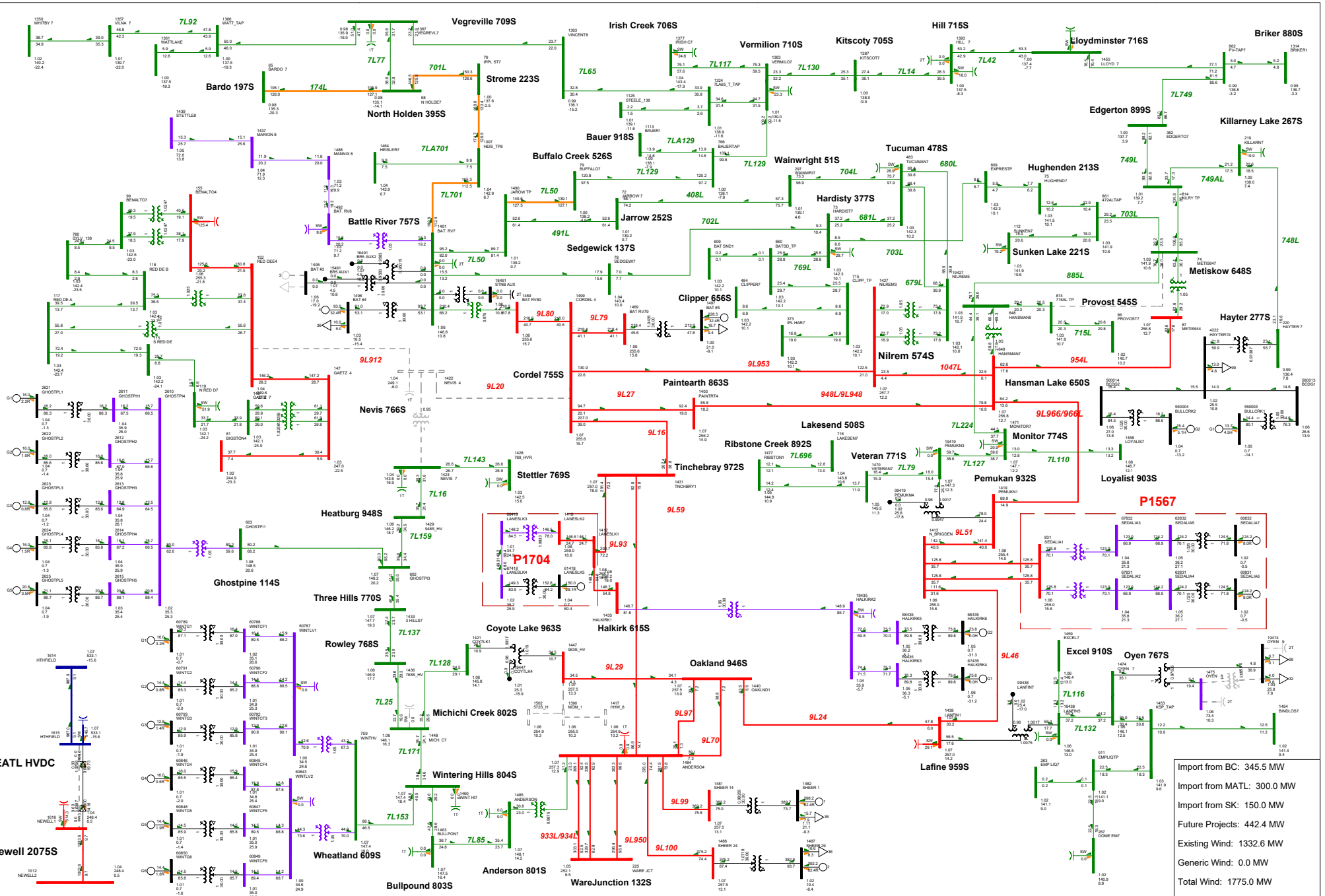


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-8-8: P1909_SP_PRE_SEN
CATEGORY B - 7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)
MON, MAR 15 2021 23:20

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



TransAlta Garden Plain Wind Farm

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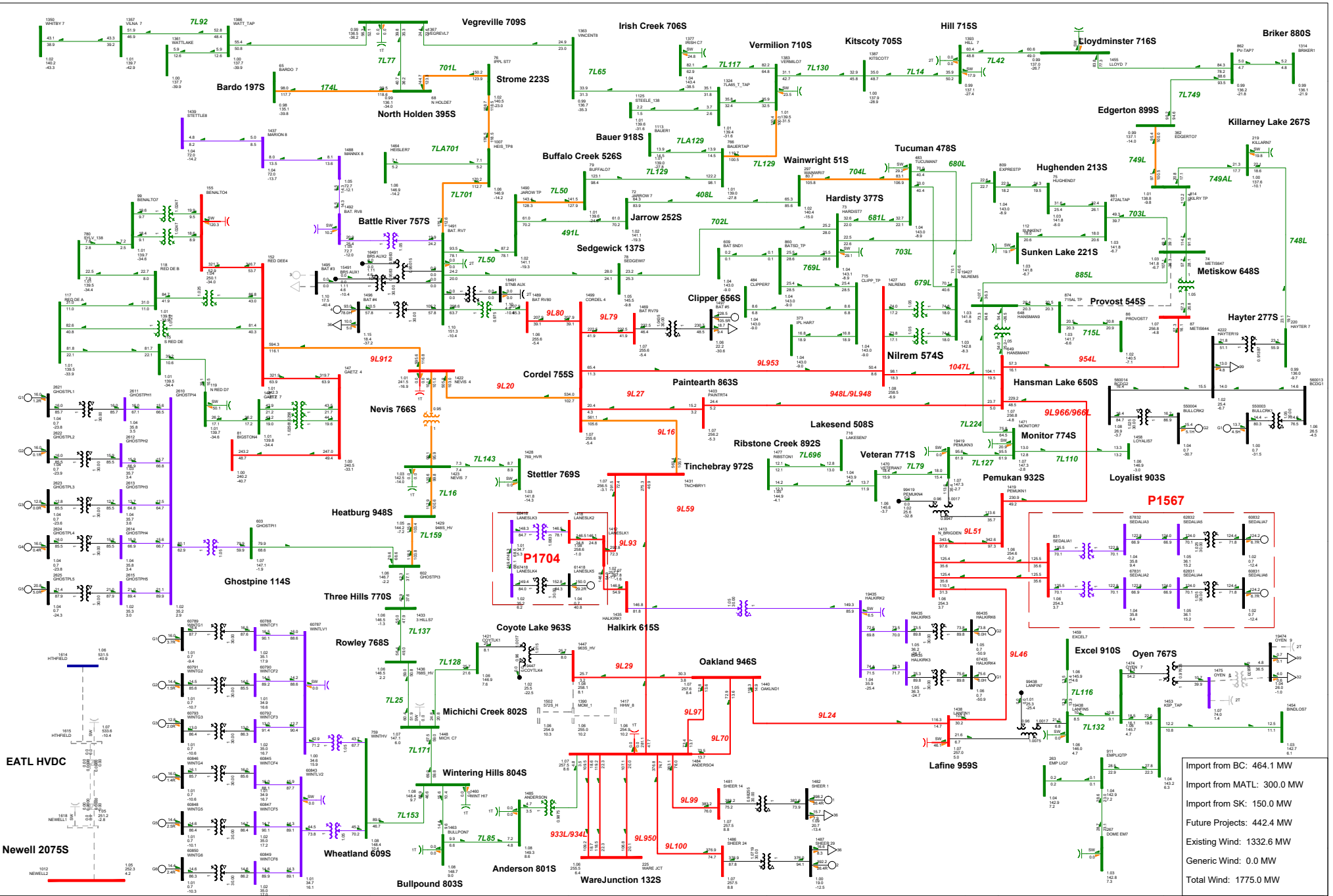
FIGURE B-8-9: P1909_SP_PRE_SEN
CATEGORY B - 766S901T (NEVIS 766S 240/138 KV TRANSFORMER)
MON, MAR 15 2021 23:20

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-8-10: P1909_SP_PRE_SEN
CATEGORY B - EATL HVDC
MON, MAR 15 2021 23:21

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

Attachment A3
Post-Project Power Flow Diagrams

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Scenario 5: 2020 Summer Peak Post-Project Category A 2

Scenario 6: 2020 Winter Peak Post-Project Category A 3

Scenario 9: 2020 Summer Peak Post-Project Wind (P1704) Sensitivity Category A 4

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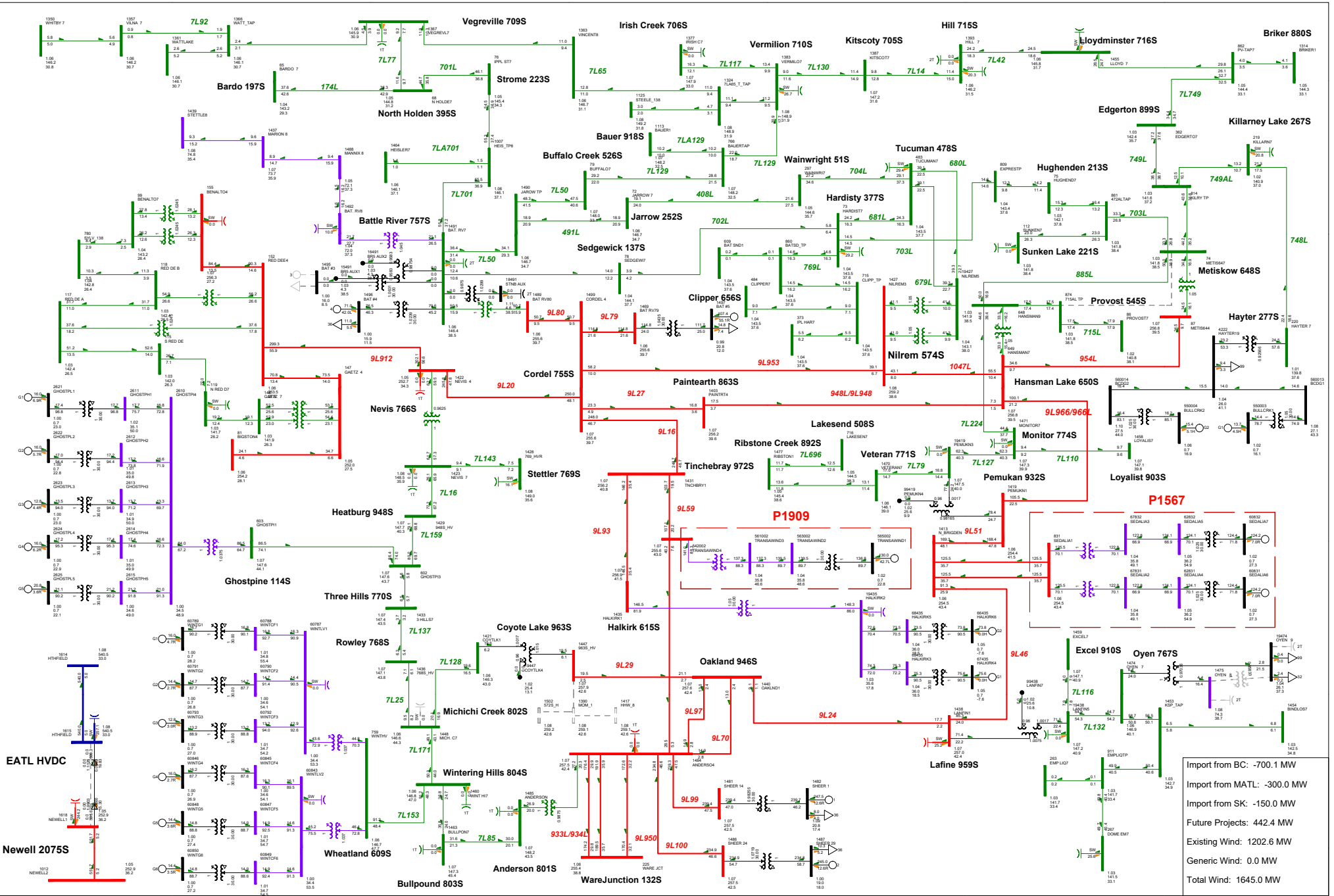

TransAlta Garden Plain Wind Farm

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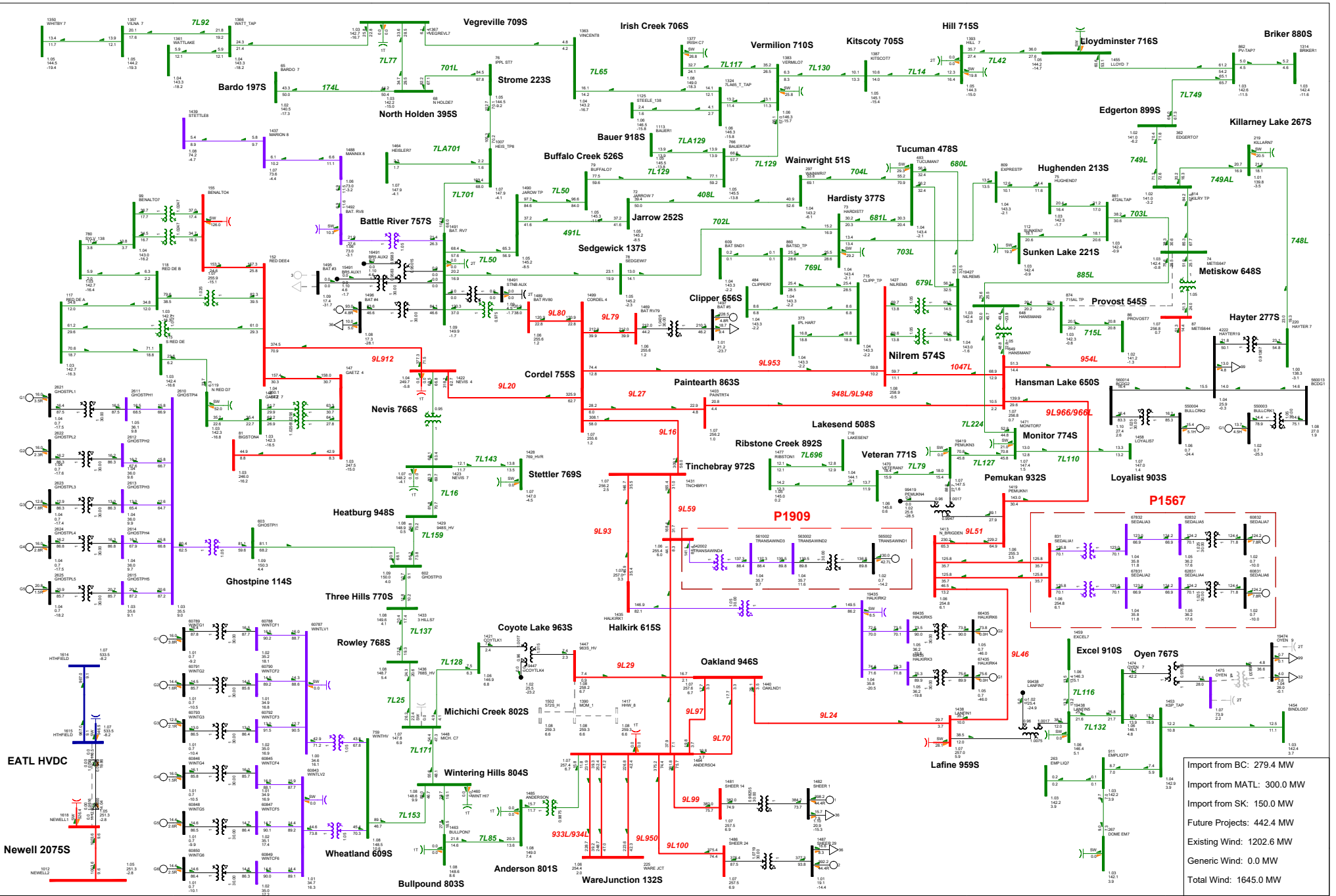
FIGURE A-4-1: P1909_SL_POST
CATEGORY A - NO CONTINGENCY
MON, MAR 15 2021 23:52

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

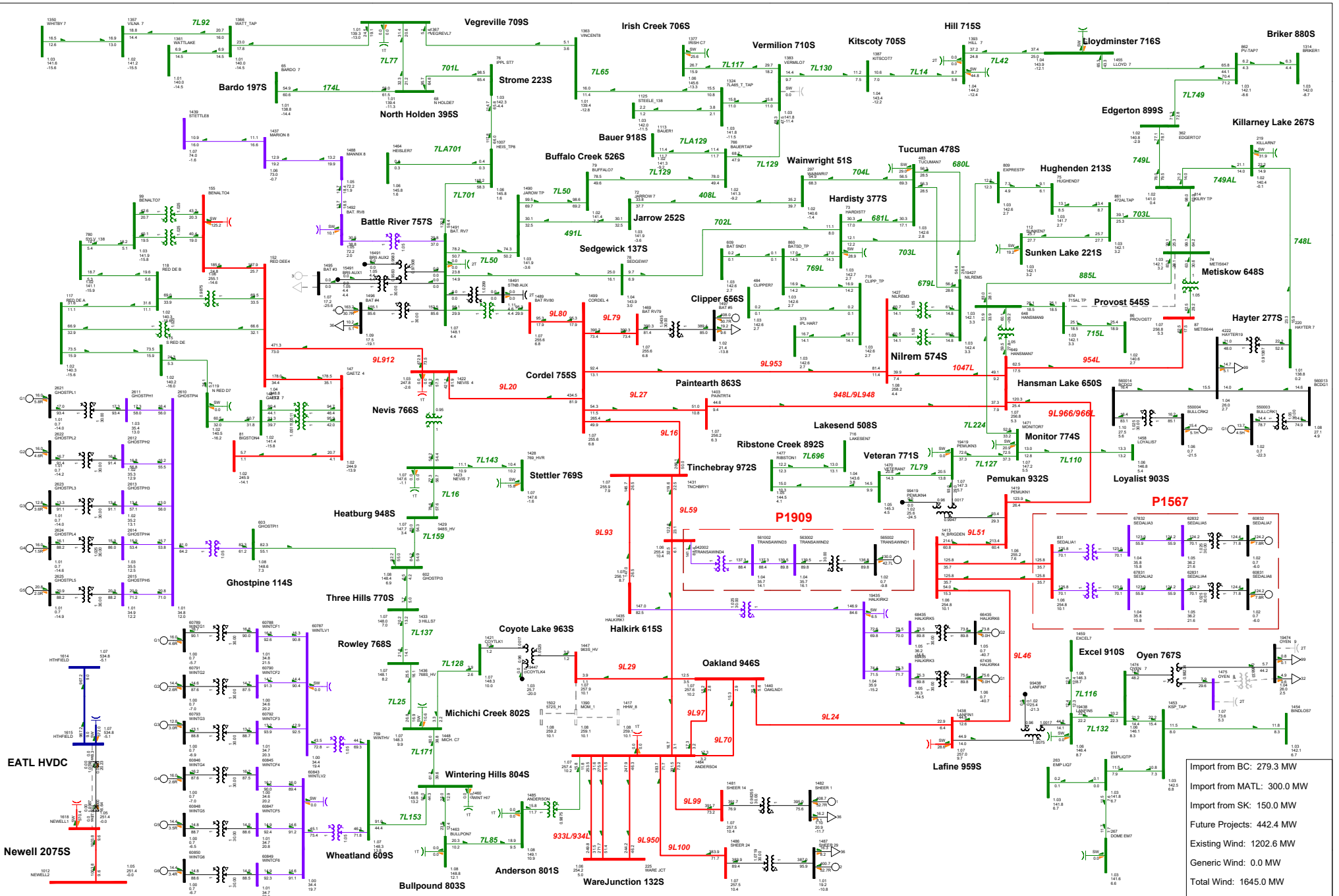


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE A-5-1: P1909_SP_POST
CATEGORY A - NO CONTINGENCY
MON, MAR 15 2021 23:53

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

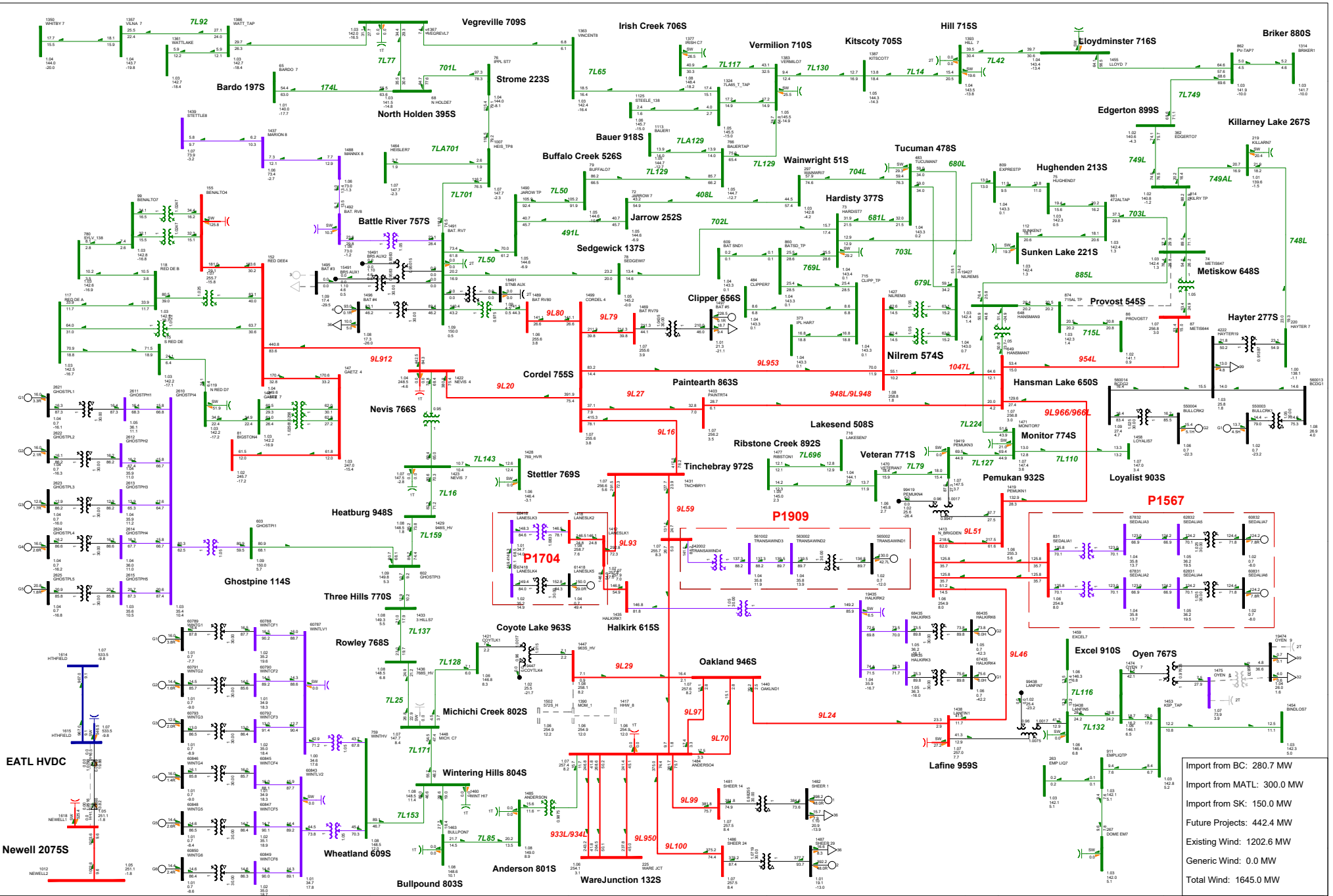


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE A-6-1: P1909_WP_POST
CATEGORY A - NO CONTINGENCY
MON, MAR 15 2021 23:58

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate B
Equipment - MW/Mvar
100.0%Rate B
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE A-9-1: P1909_SP_POST_SEN
CATEGORY A - NO CONTINGENCY
MON, MAR 15 2021 23:21

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

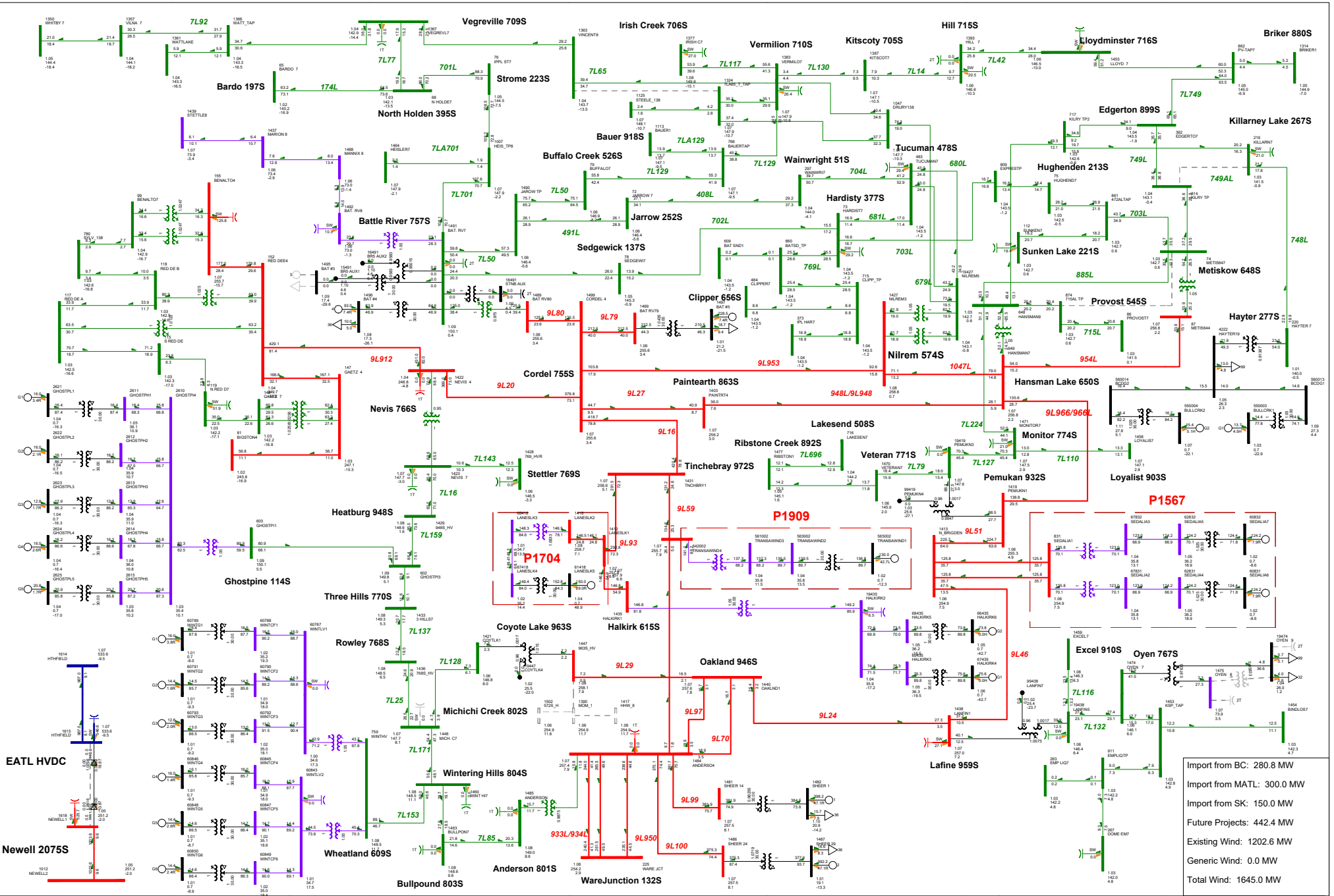


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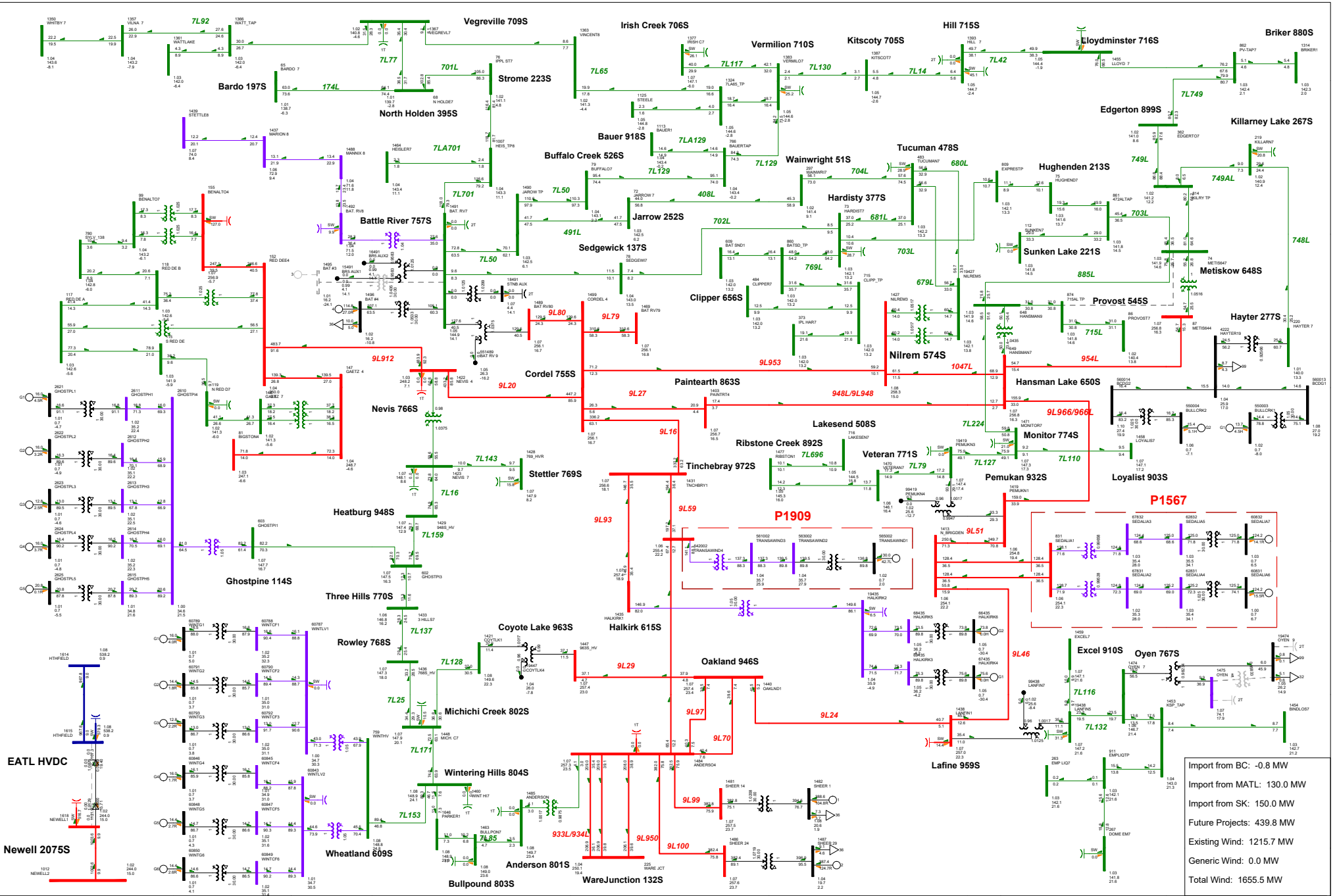
FIGURE A-10-1: P1909_SP_POST_SEN_PENV
CATEGORY A - NO CONTINGENCY
MON, MAR 15 2021 23:28

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



TransAlta Garden Plain Wind Farm

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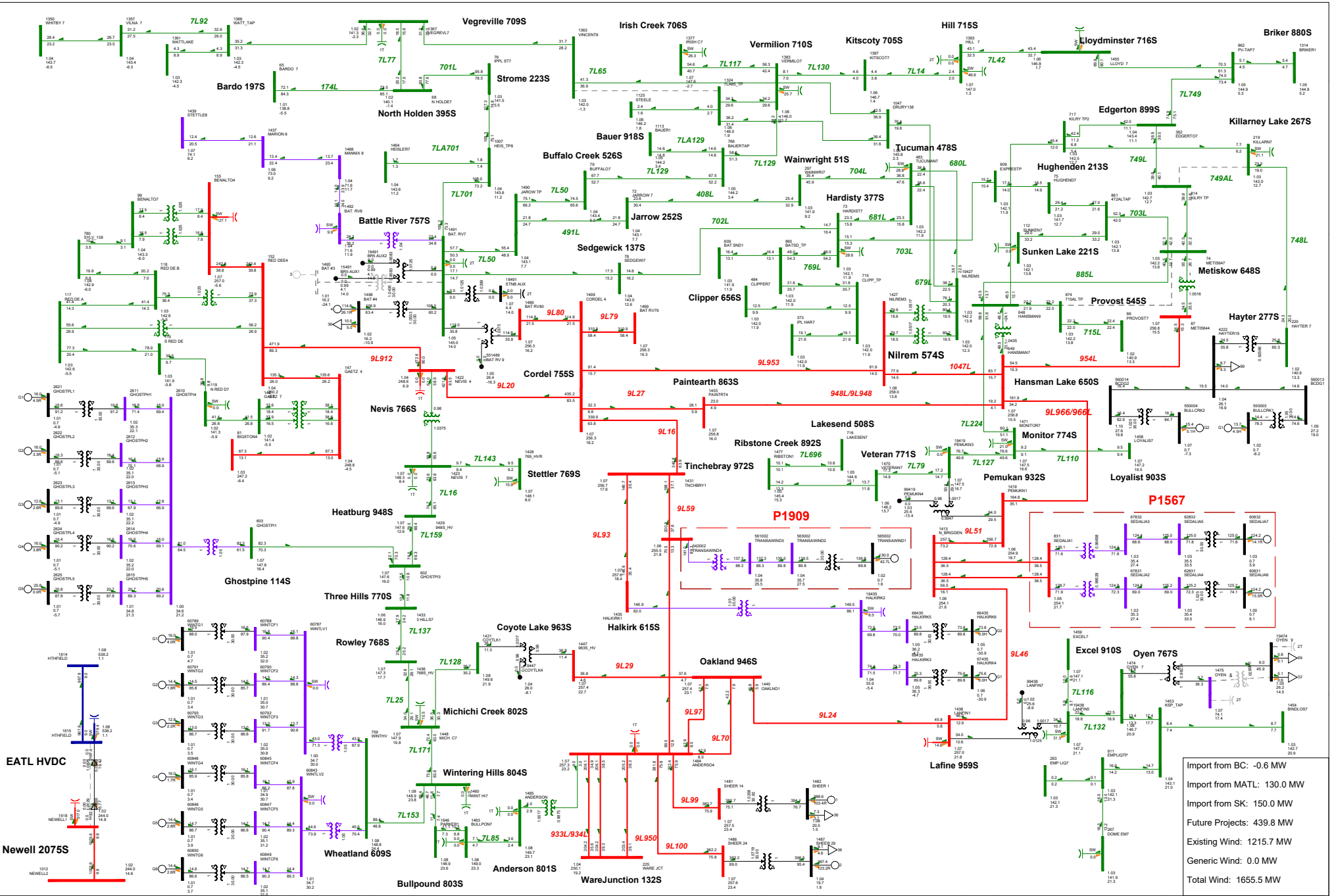
FIGURE A-11-1: P1909_SP_POST_SEN_2021
CATEGORY A - NO CONTINGENCY
MON, MAR 15 2021 23:32

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

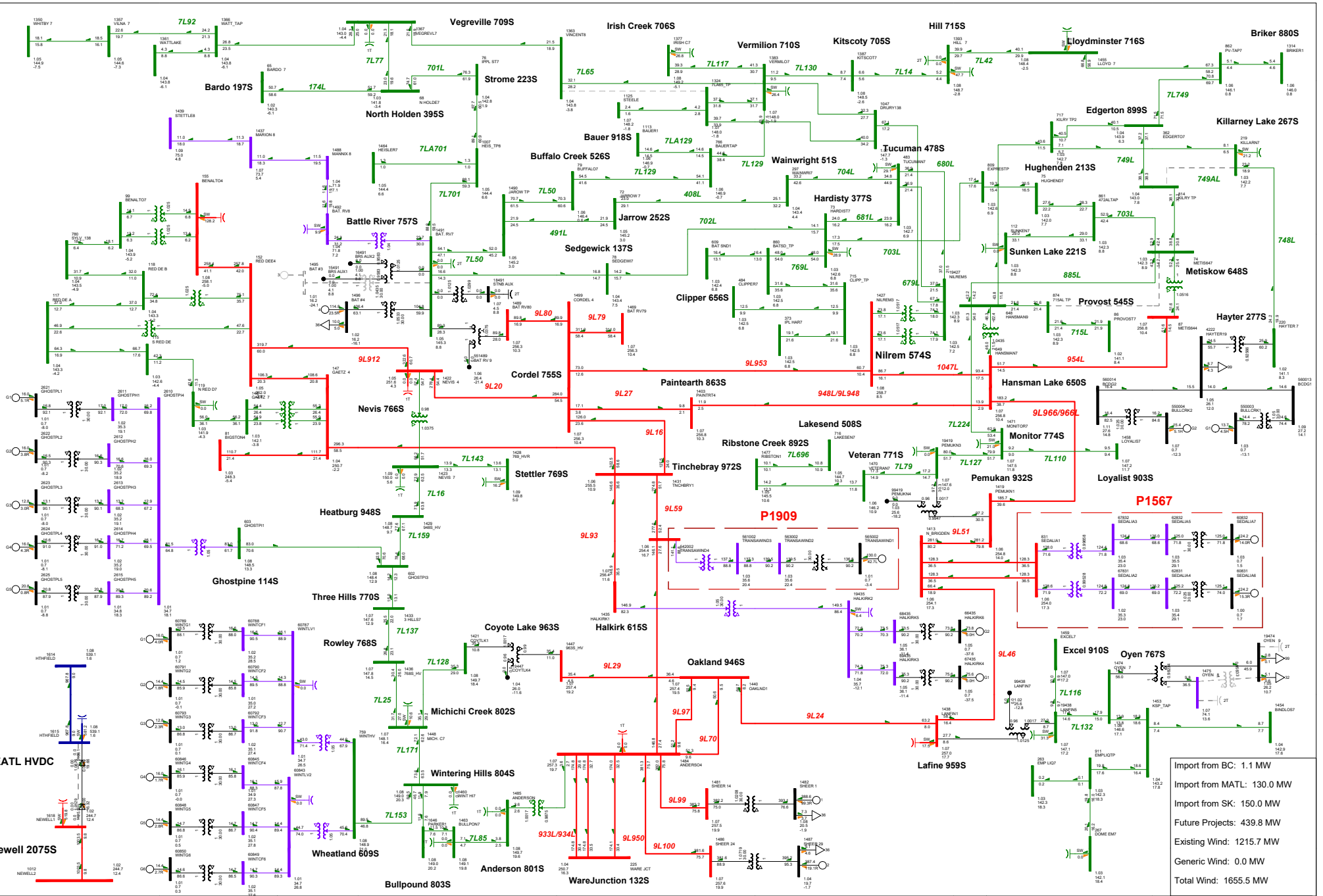


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE A-12-1: P1909_SP_POST_PENV_2021
CATEGORY A - NO CONTINGENCY
MON, MAR 15 2021 23:46

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

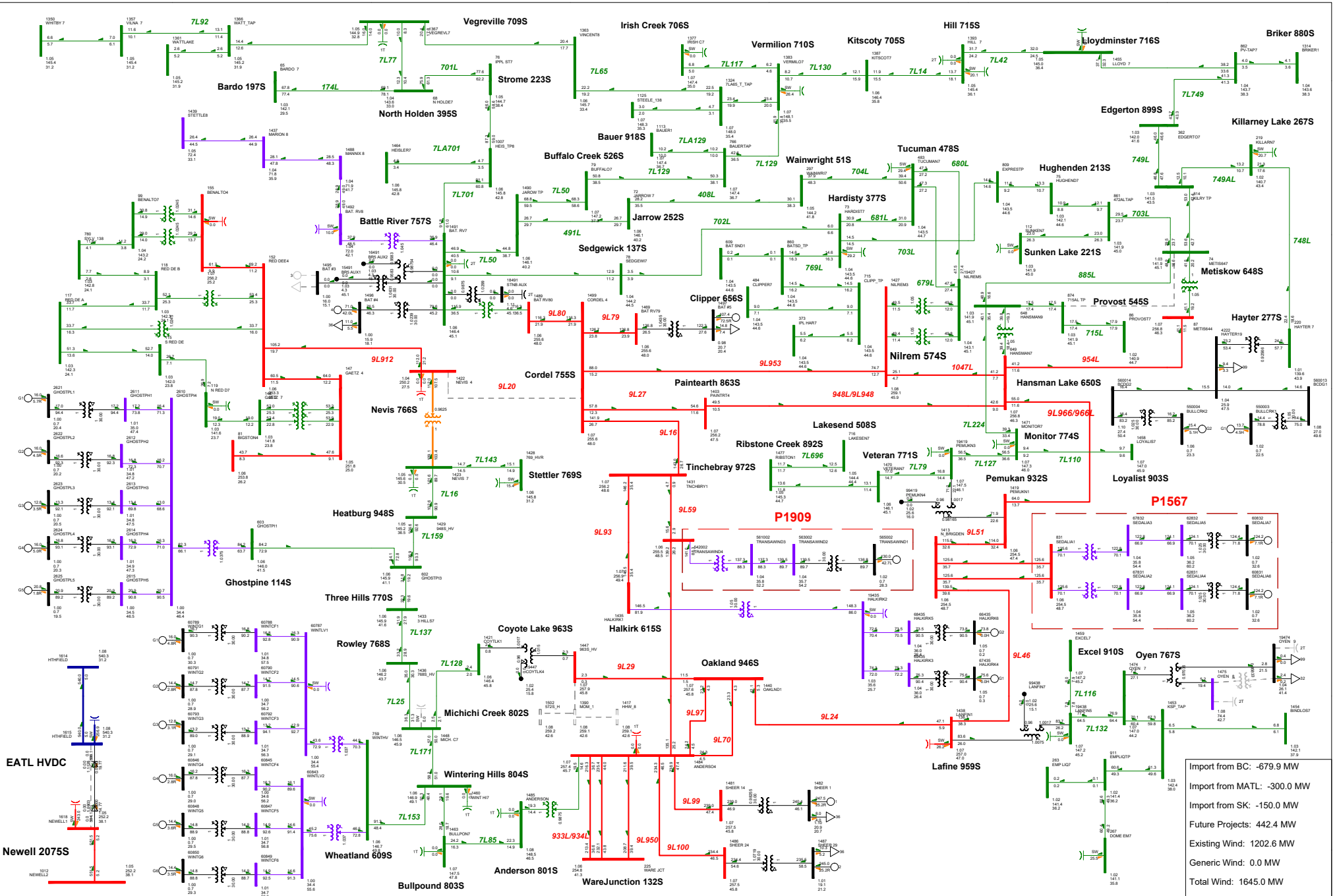


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE A-13-1: P1909_SP_POST_PENV_CETO_2021
CATEGORY A - NO CONTINGENCY
MON, MAR 15 2021 23:49

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



TransAlta Garden Plain Wind Farm

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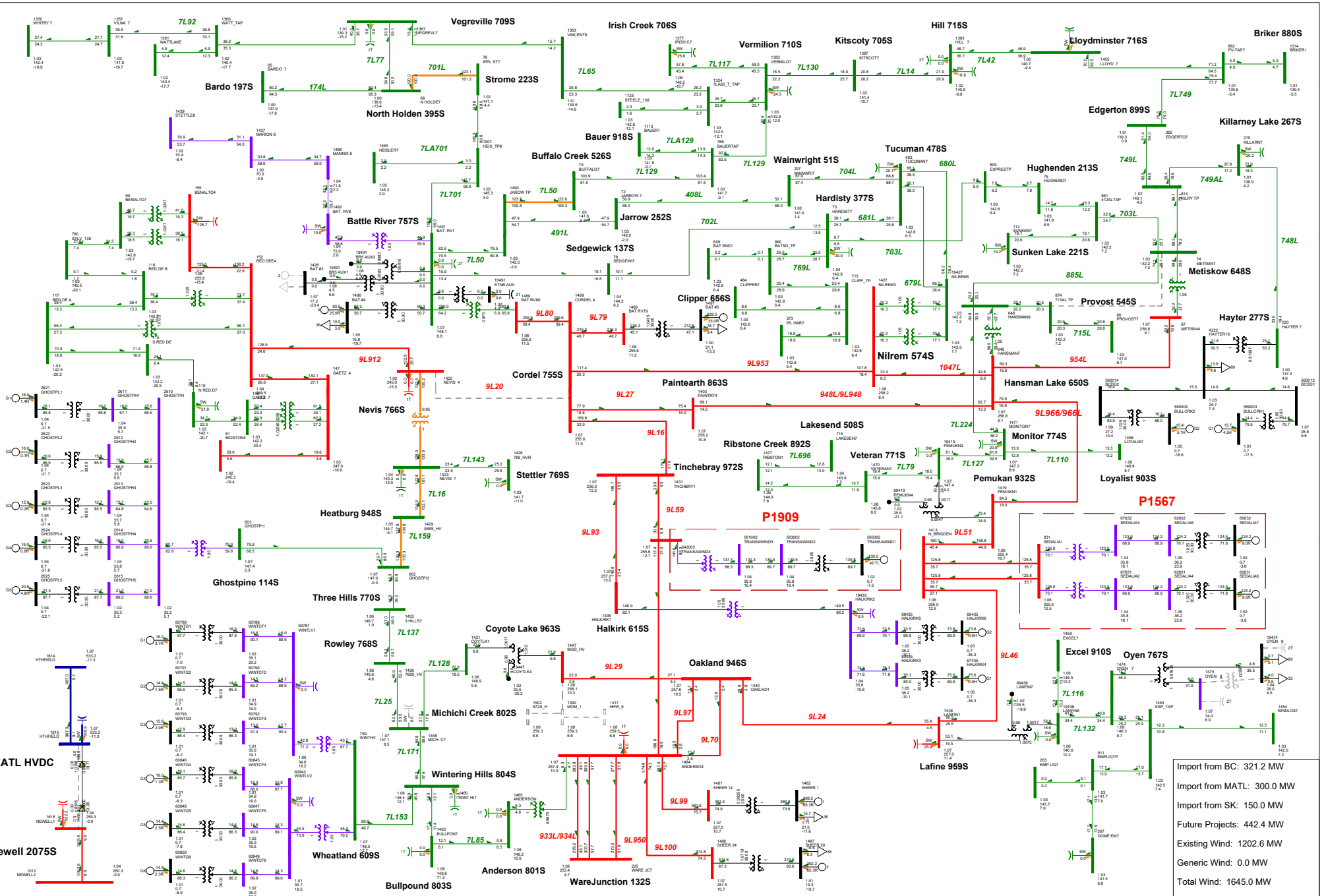
FIGURE B-4-1: P1909_SL_POST
CATEGORY B - 9L20 (NEVIS 766S - CORDEL 755S)
MON, MAR 15 2021 23:52

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



TransAlta Garden Plain Wind Farm

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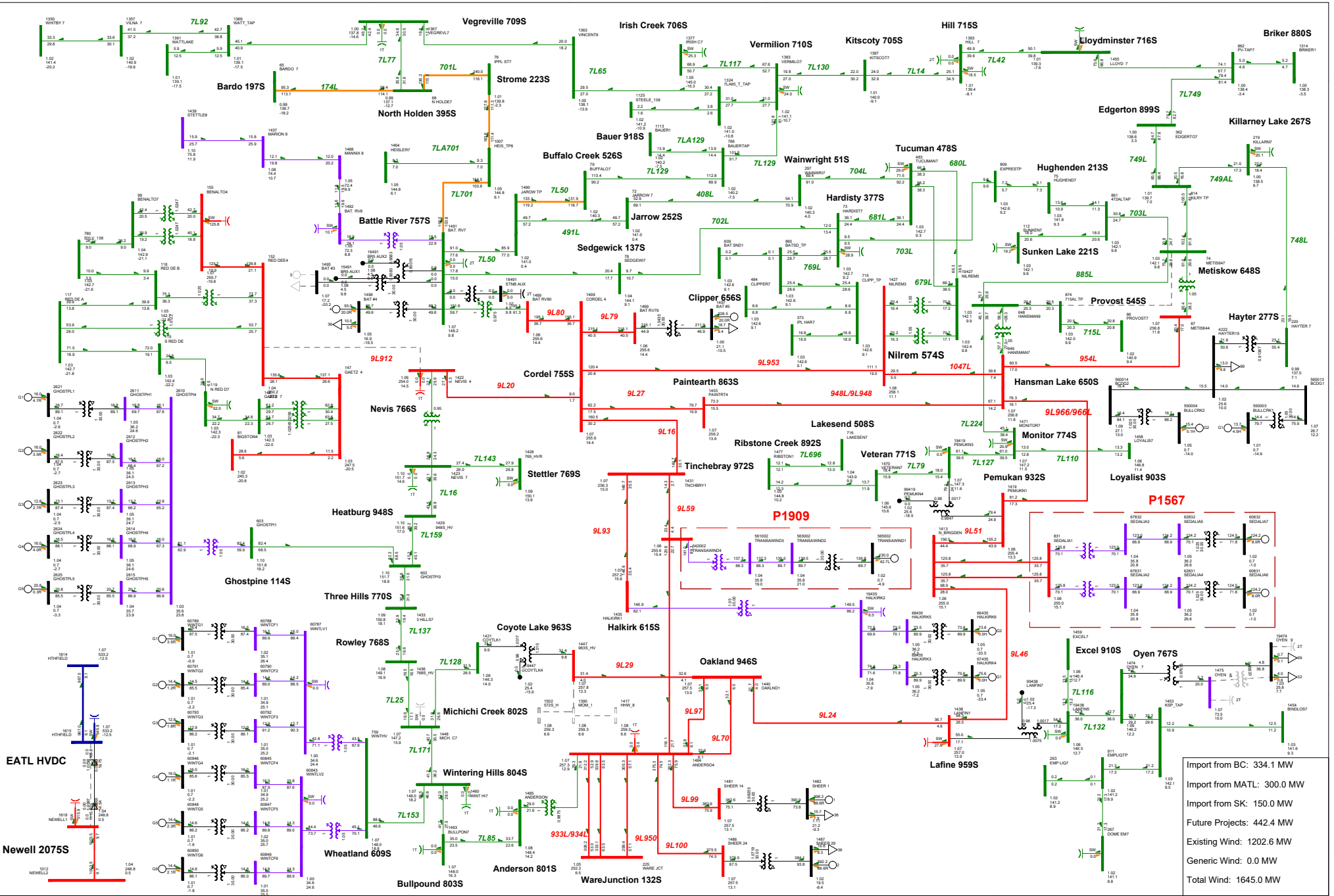
FIGURE B-5-1: P1909_SP_POST
CATEGORY B - 9L20 (NEVIS 766S - CORDEL 755S)
MON, MAR 15 2021 23:54

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

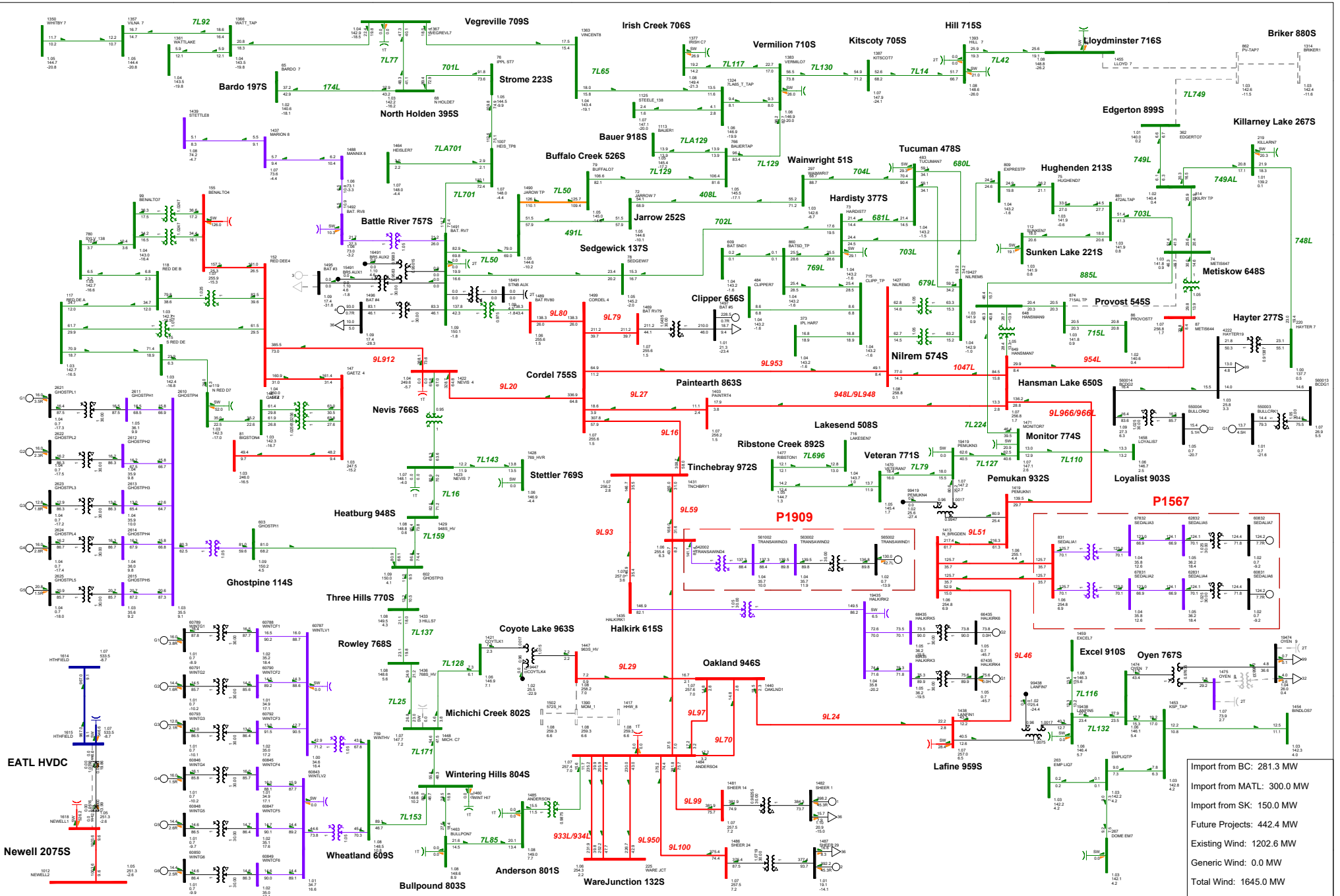


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-5-2: P1909_SP_POST
CATEGORY B - 912L/9L912 (RED DEER 63S - NEVIS 766S)
MON, MAR 15 2021 23:54

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-5-3: P1909_SP_POST
CATEGORY B - 7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)
MON, MAR 15 2021 23:54

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

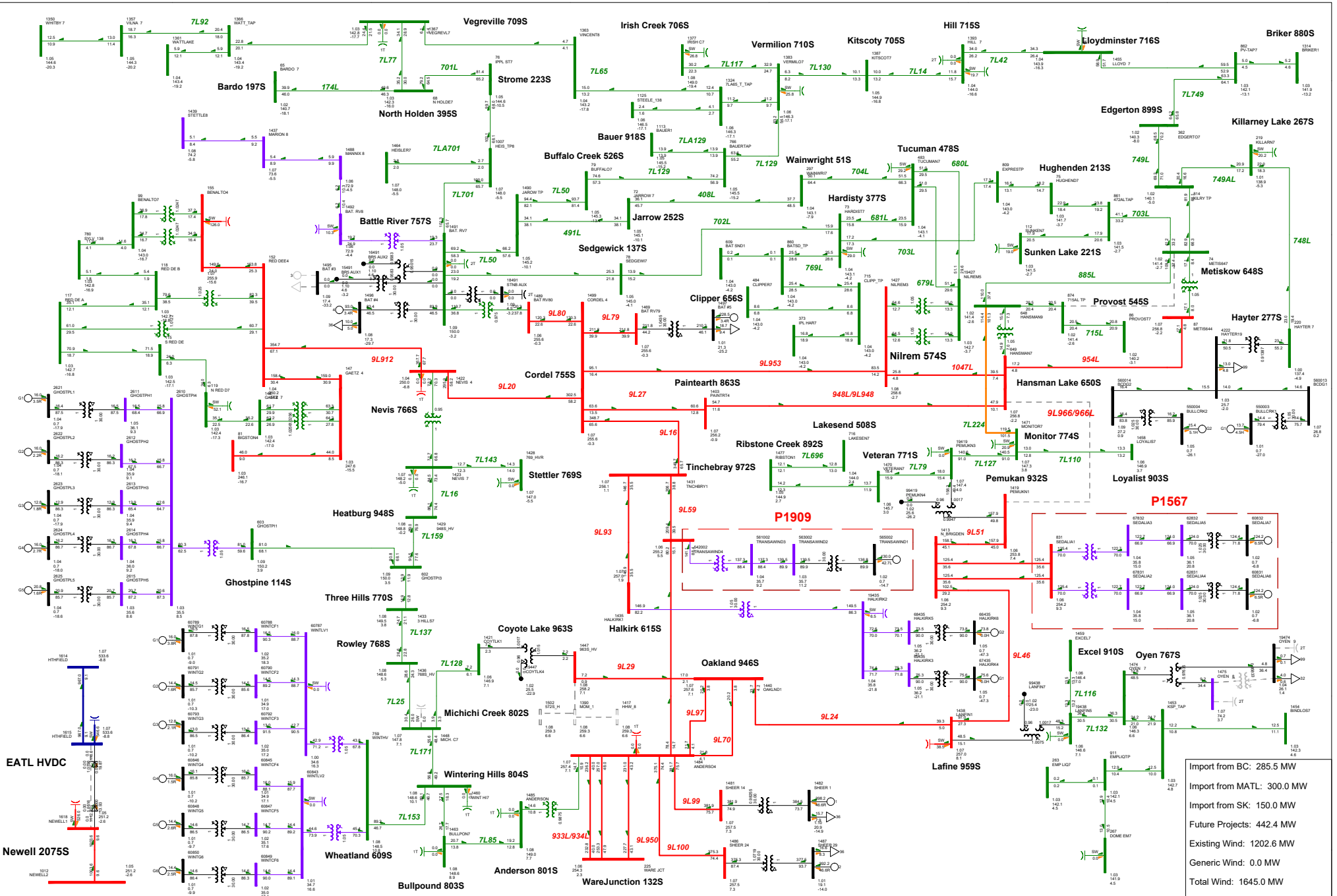


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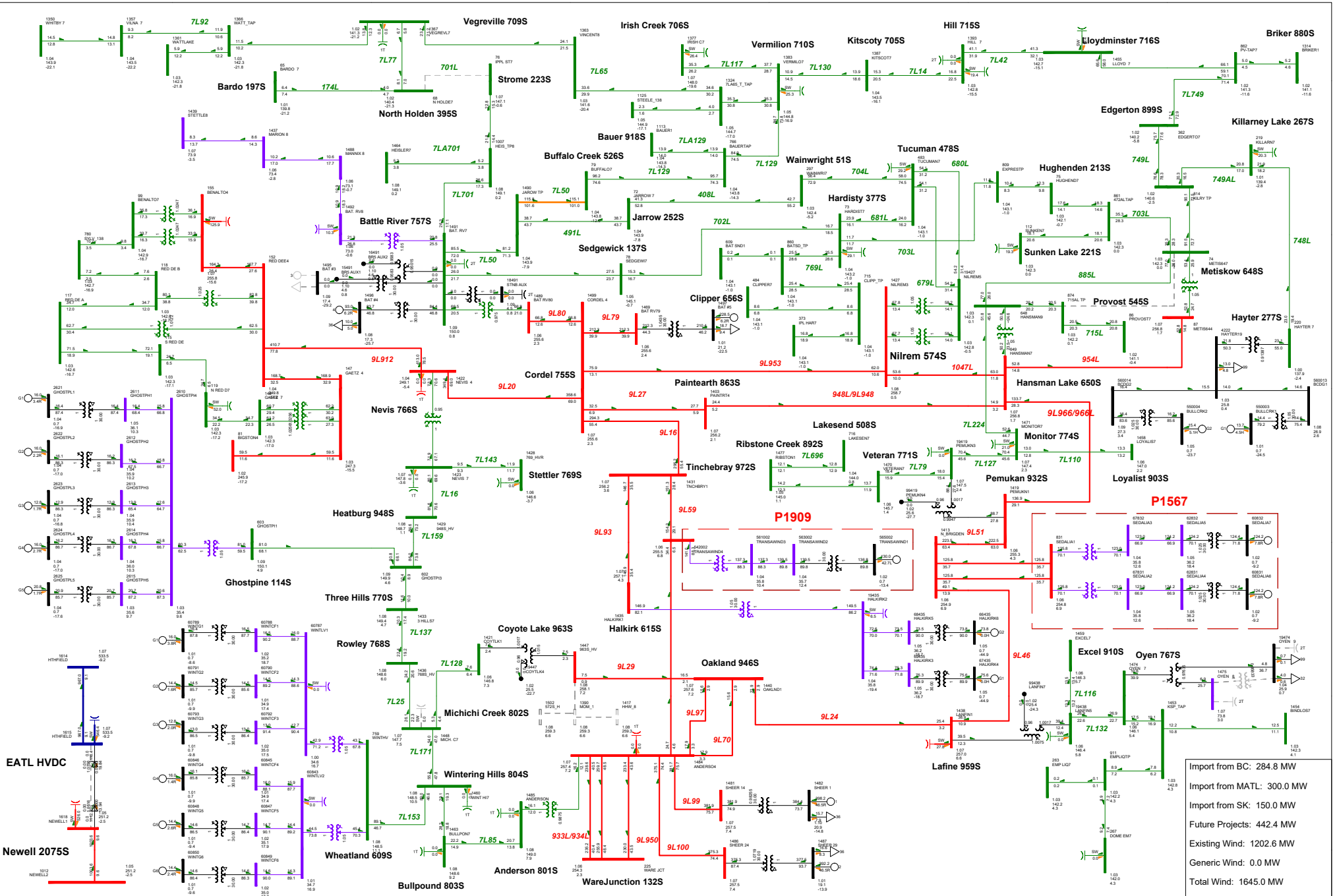
FIGURE B-5-4: P1909_SP_POST
CATEGORY B - 966L/9L966 (HANSMAN LAKE 650S - PEMUKAN 932S)
MON, MAR 15 2021 23:55

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



Import from BC: 284.8 MW
Import from MATL: 300.0 MW
Import from SK: 150.0 MW
Future Projects: 442.4 MW
Existing Wind: 1202.6 MW
Generic Wind: 0.0 MW
Total Wind: 1645.0 MW

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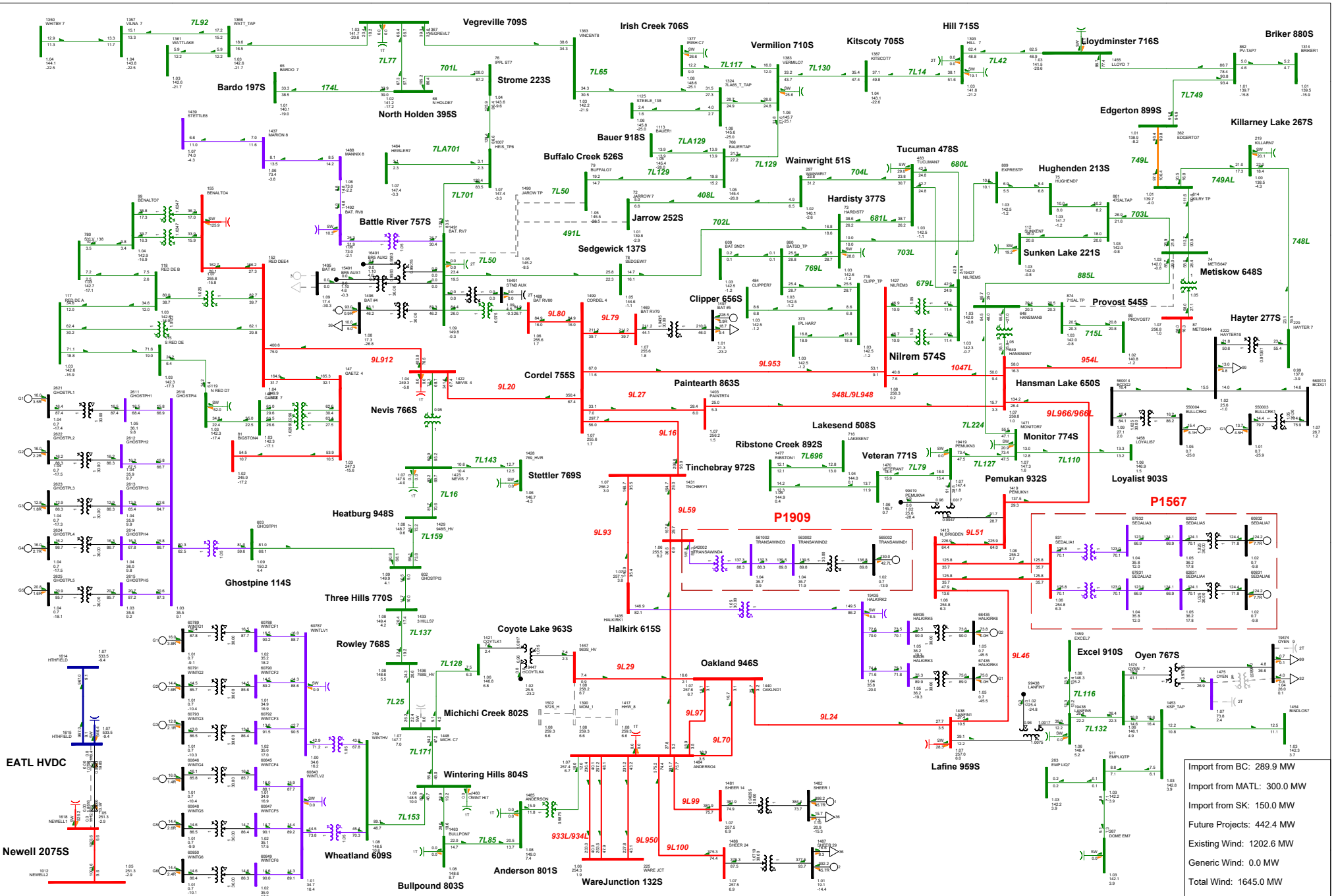
FIGURE B-5-5: P1909_SP_POST
CATEGORY B - 701L (NORTH HOLDEN 395S- STROME 223S)
MON, MAR 15 2021 23:55

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

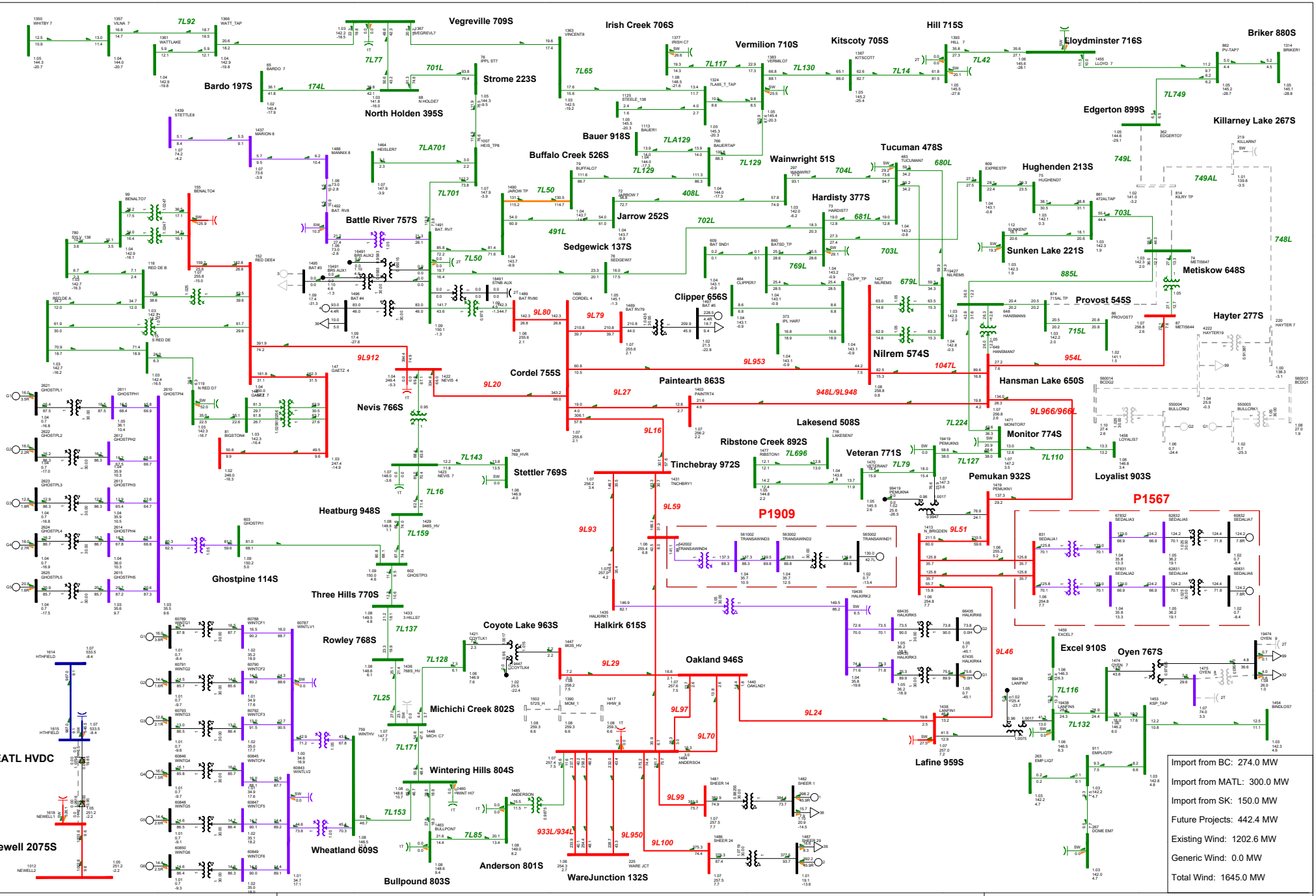


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-5-6: P1909_SP_POST
CATEGORY B - 7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)
MON, MAR 15 2021 23:56

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

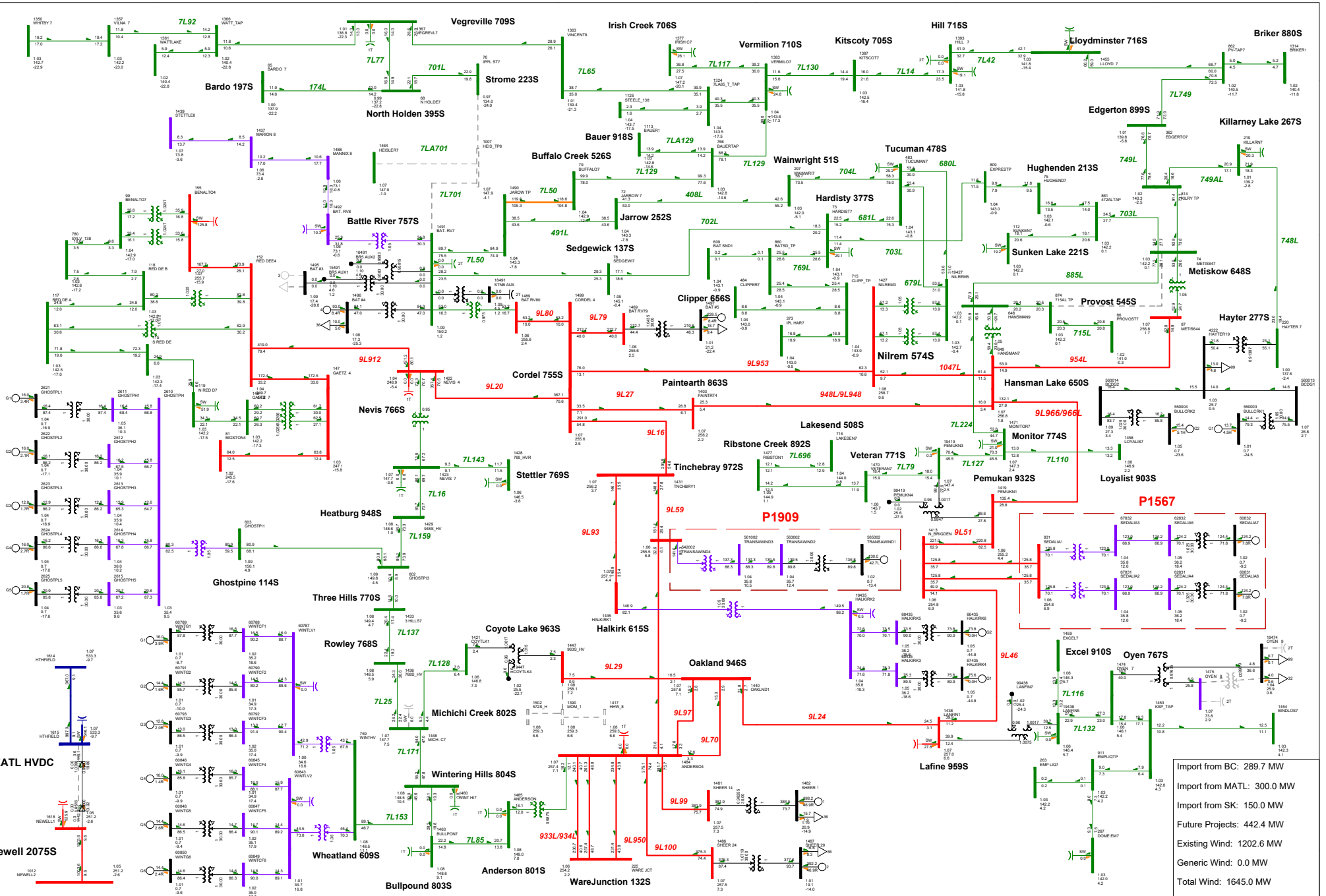


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-5-7: P1909_SP_POST
CATEGORY B - 749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)
MON, MAR 15 2021 23:56

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.200OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

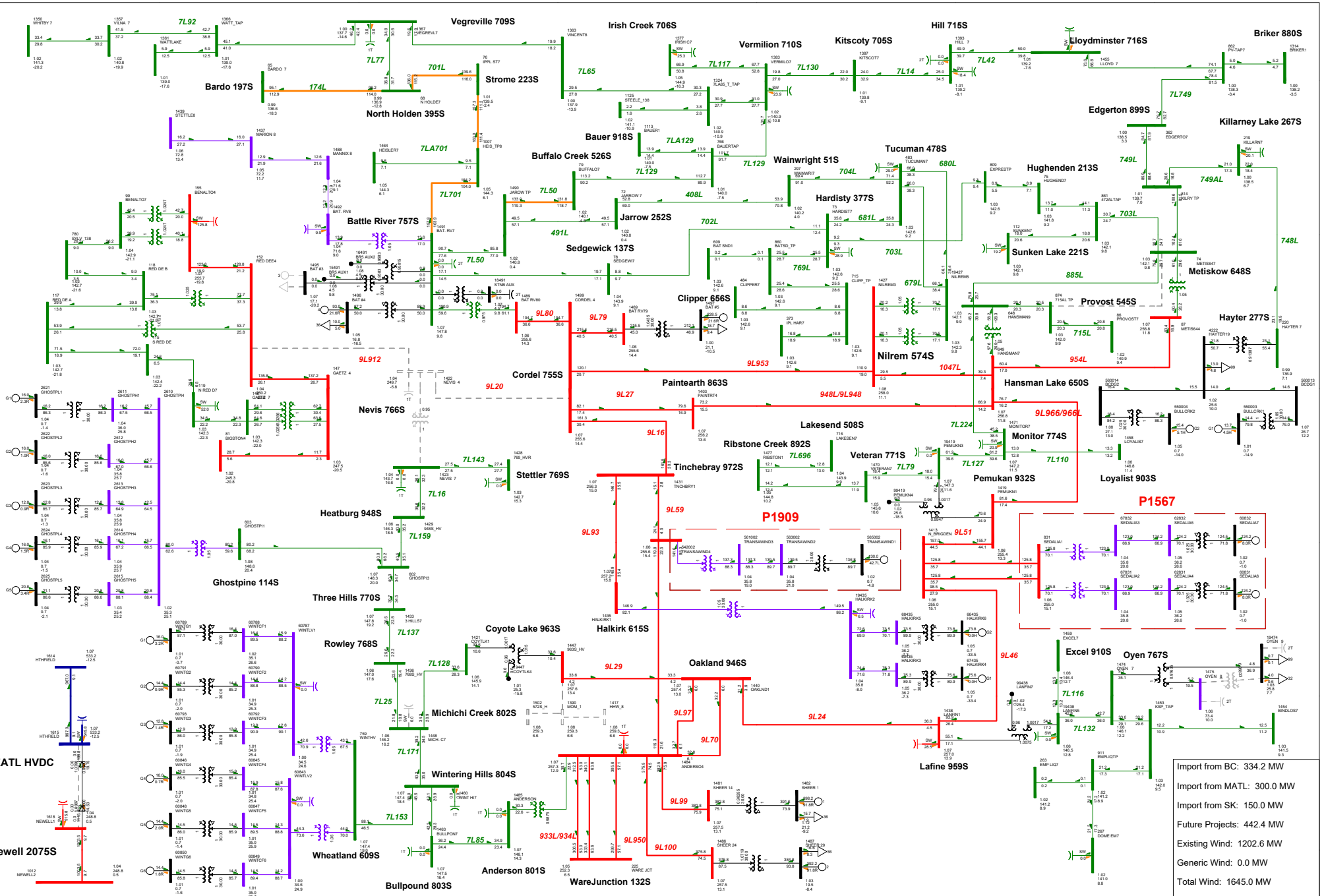


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-5-8: P1909_SP_POST
CATEGORY B - 7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)
MON, MAR 15 2021 23:57

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

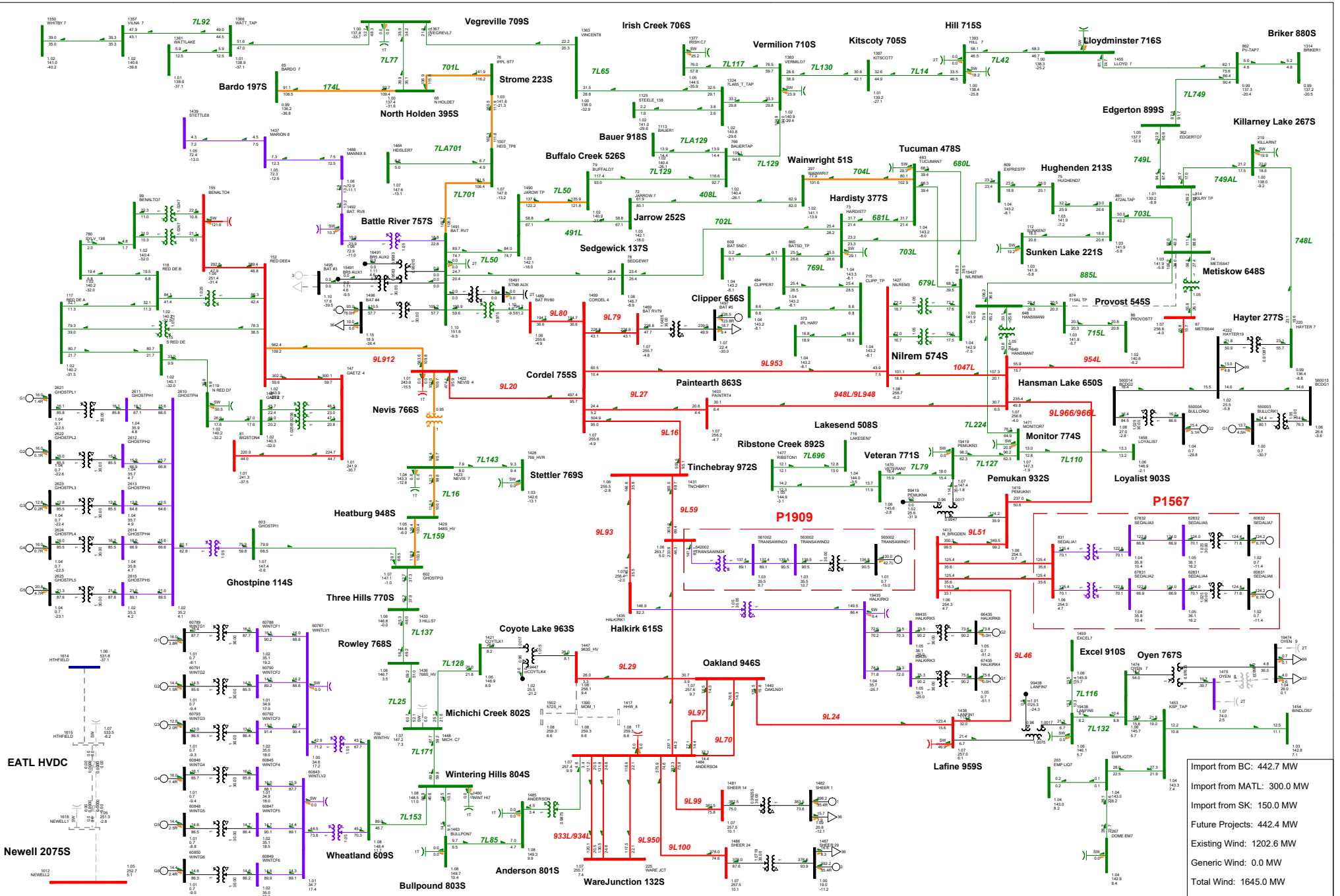


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-5-9: P1909_SP_POST
CATEGORY B - 766S901T (NEVIS 766S 240/138 KV TRANSFORMER)
MON, MAR 15 2021 23:57

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

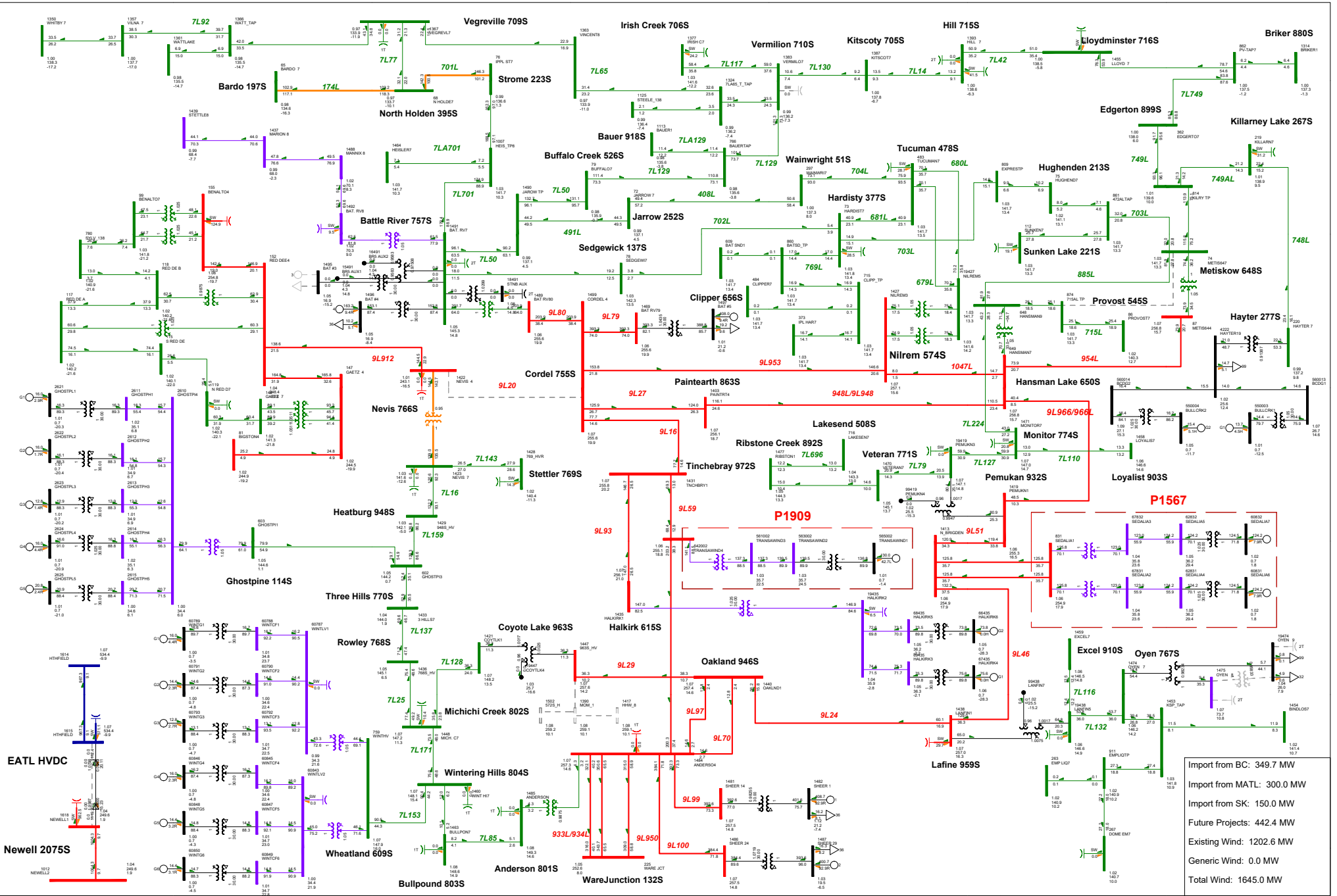


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-5-10: P1909_SP_POST
CATEGORY B - EATL HVDC
MON, MAR 15 2021 23:58

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

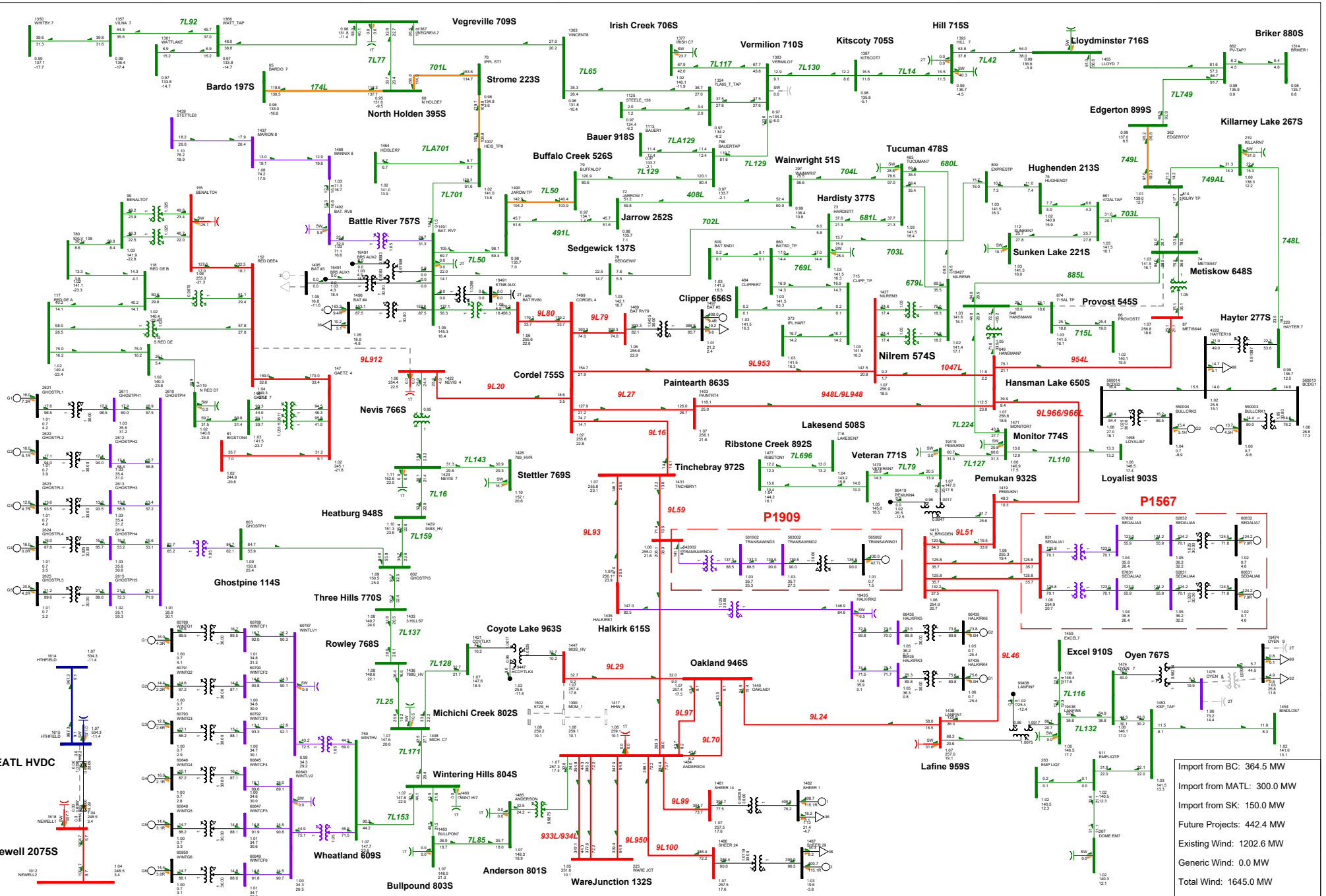


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-6-1: P1909_WP_POST
CATEGORY B - 9L20 (NEVIS 766S - CORDEL 755S)
MON, MAR 15 2021 23:59

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate B
Equipment - MW/Mvar
100.0%Rate B
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

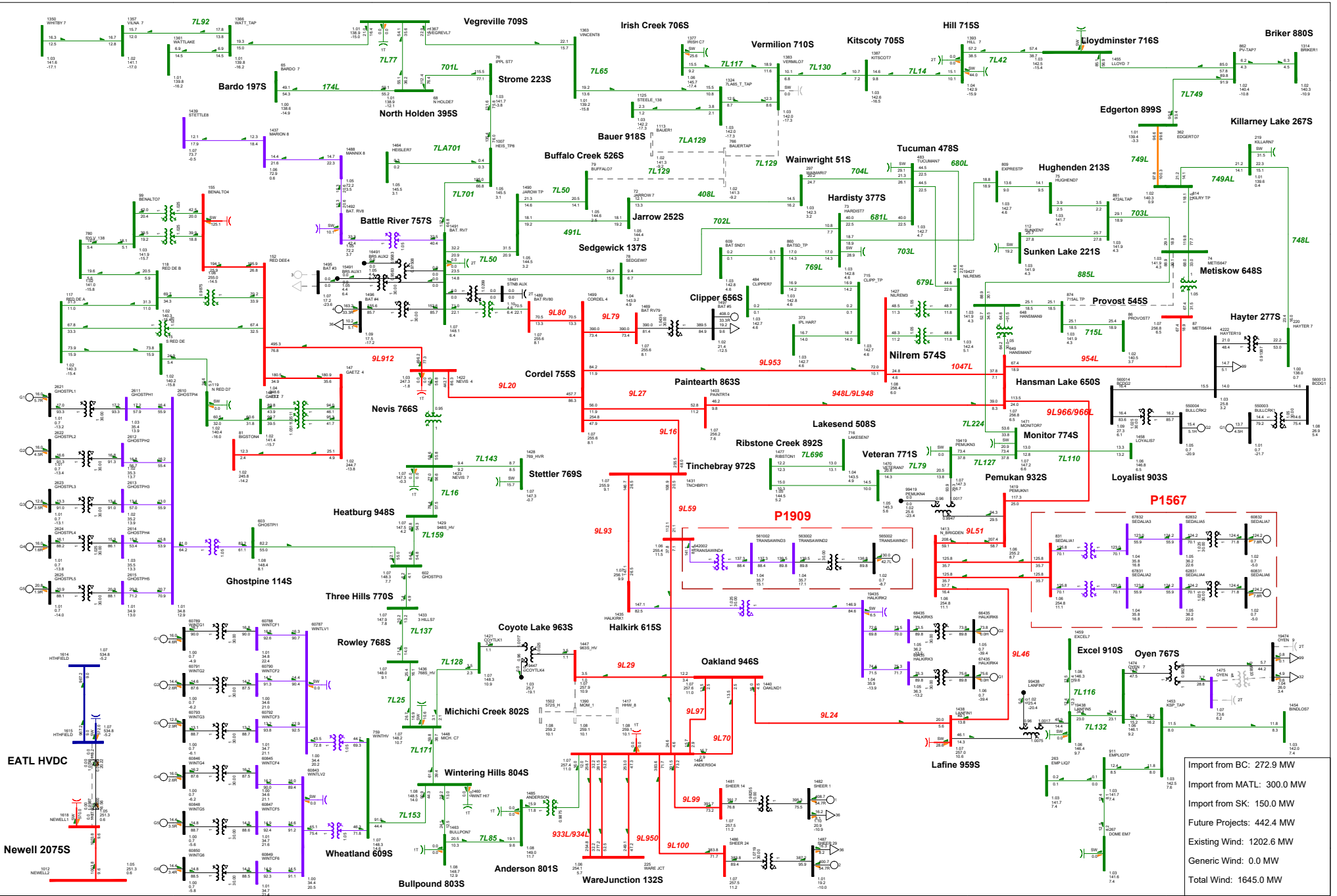


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-6-2: P1909_WP_POST
CATEGORY B - 912L/9L912 (RED DEER 63S - NEVIS 766S)
MON, MAR 15 2021 23:59

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate B
Equipment - MW/Mvar
100.0%Rate B
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

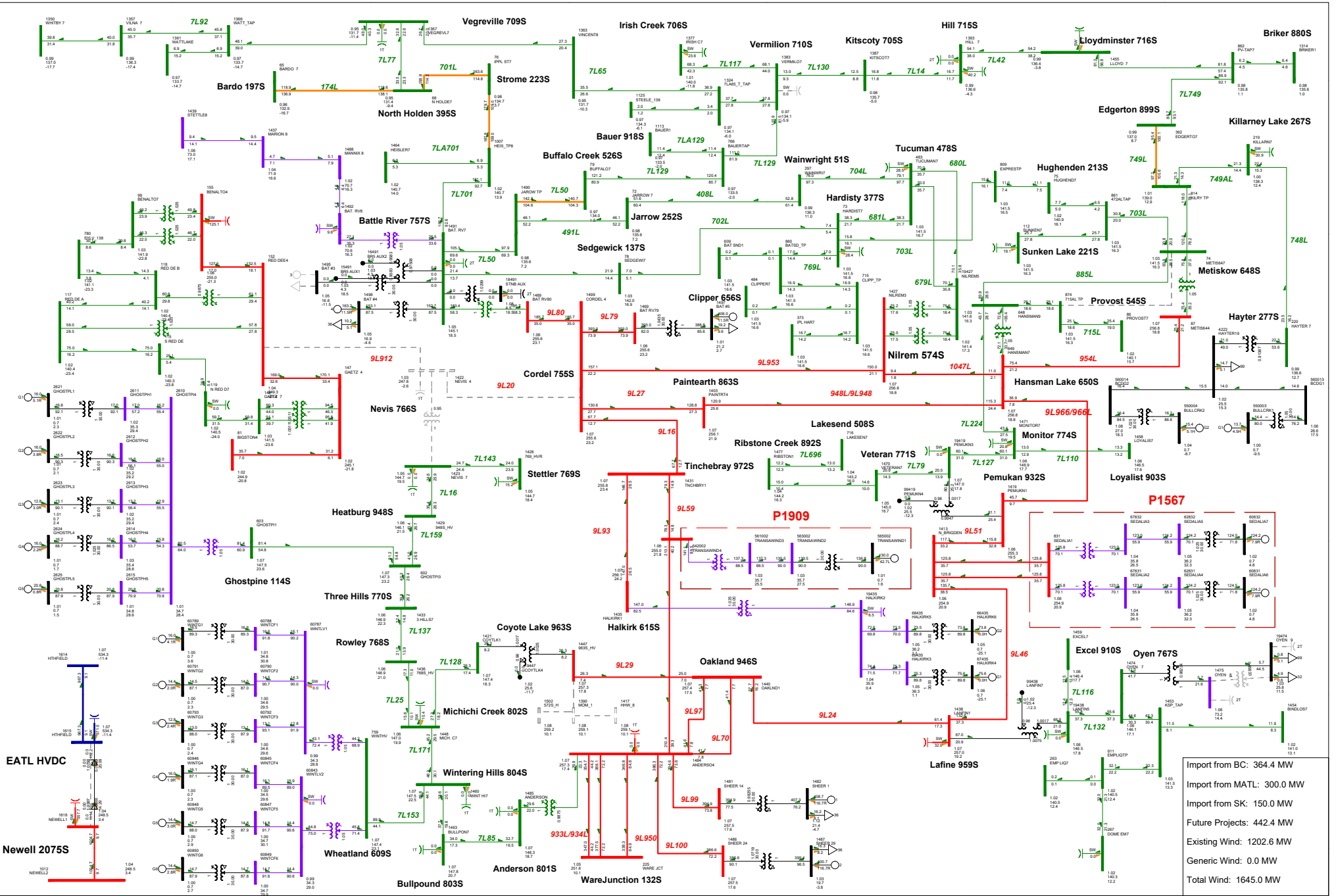


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-6-3: P1909_WP_POST
CATEGORY B - 7L129 (Vermilion 710S to Bauer 918S/Buffalo Creek 526S)
TUE, MAR 16 2021 0:00

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate B
Equipment - MW/Mvar
100.0%Rate B
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

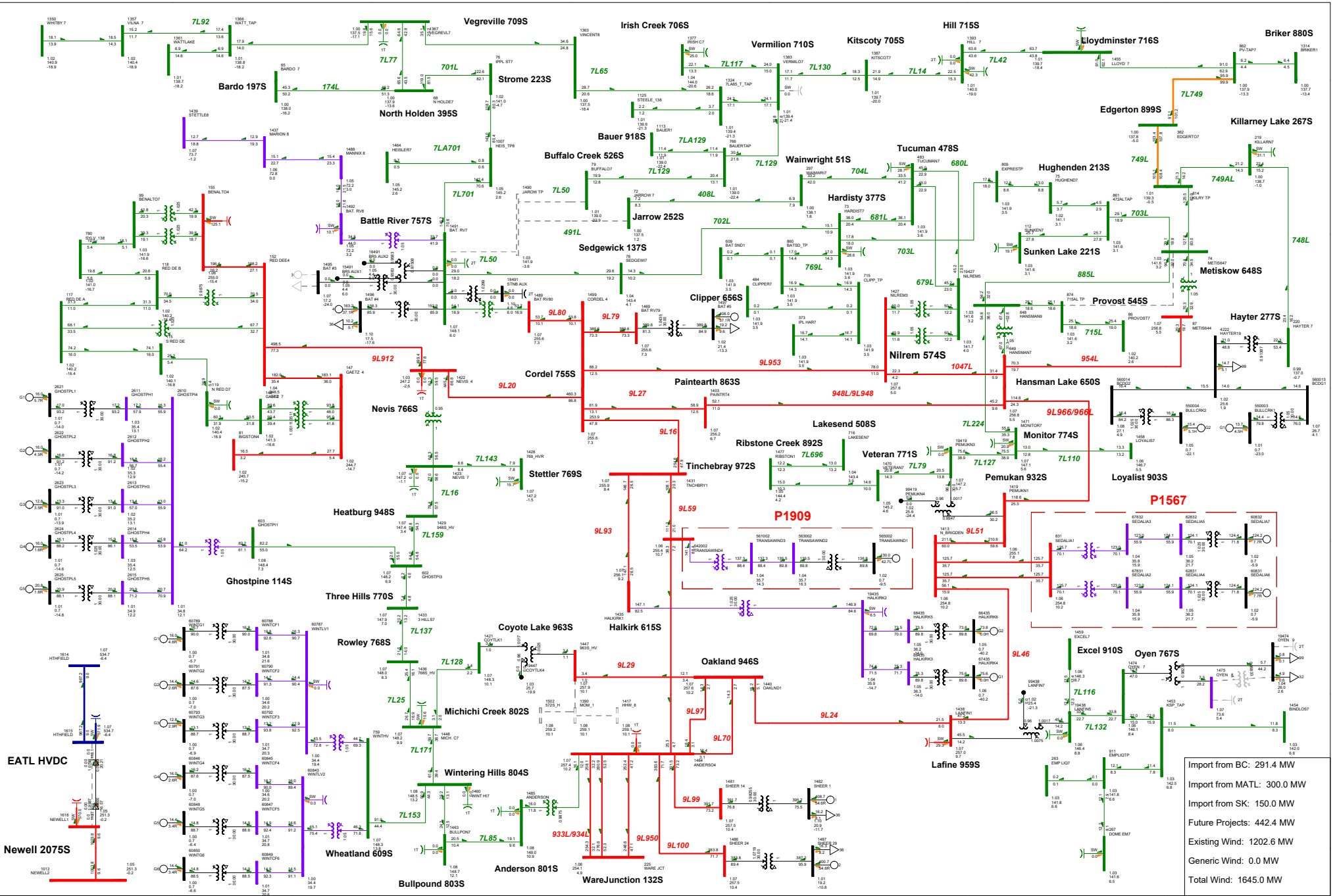


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-6-4: P1909_WP_POST
CATEGORY B - 766S901T (NEVIS 766S 240/138 KV TRANSFORMER)
TUE, MAR 16 2021 0:00

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate B
Equipment - MW/Mvar
100.0%Rate B
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

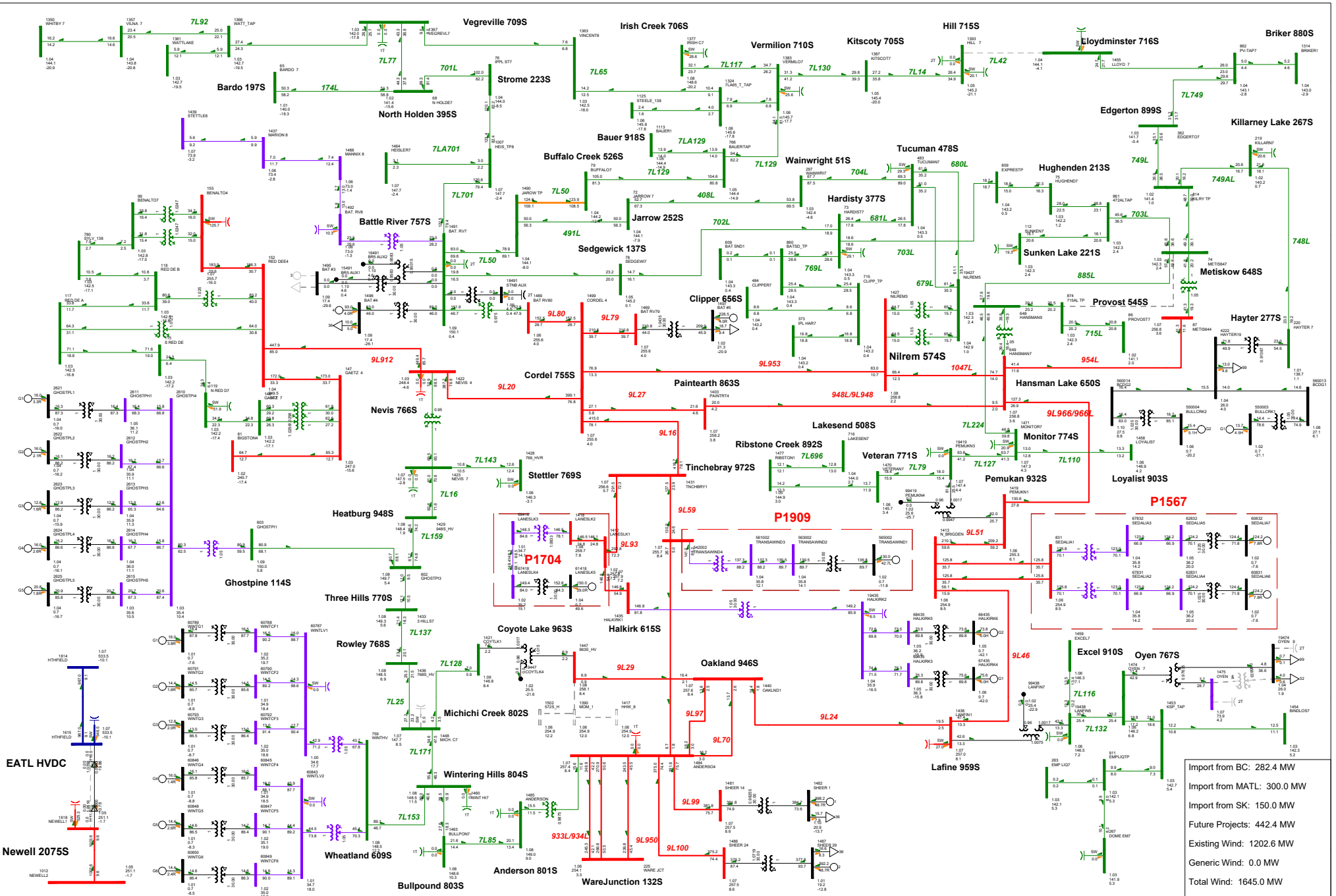


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-6-5: P1909_WP_POST
CATEGORY B - 7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)
TUE, MAR 16 2021 0:00

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate B
Equipment - MW/Mvar
100.0%Rate B
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

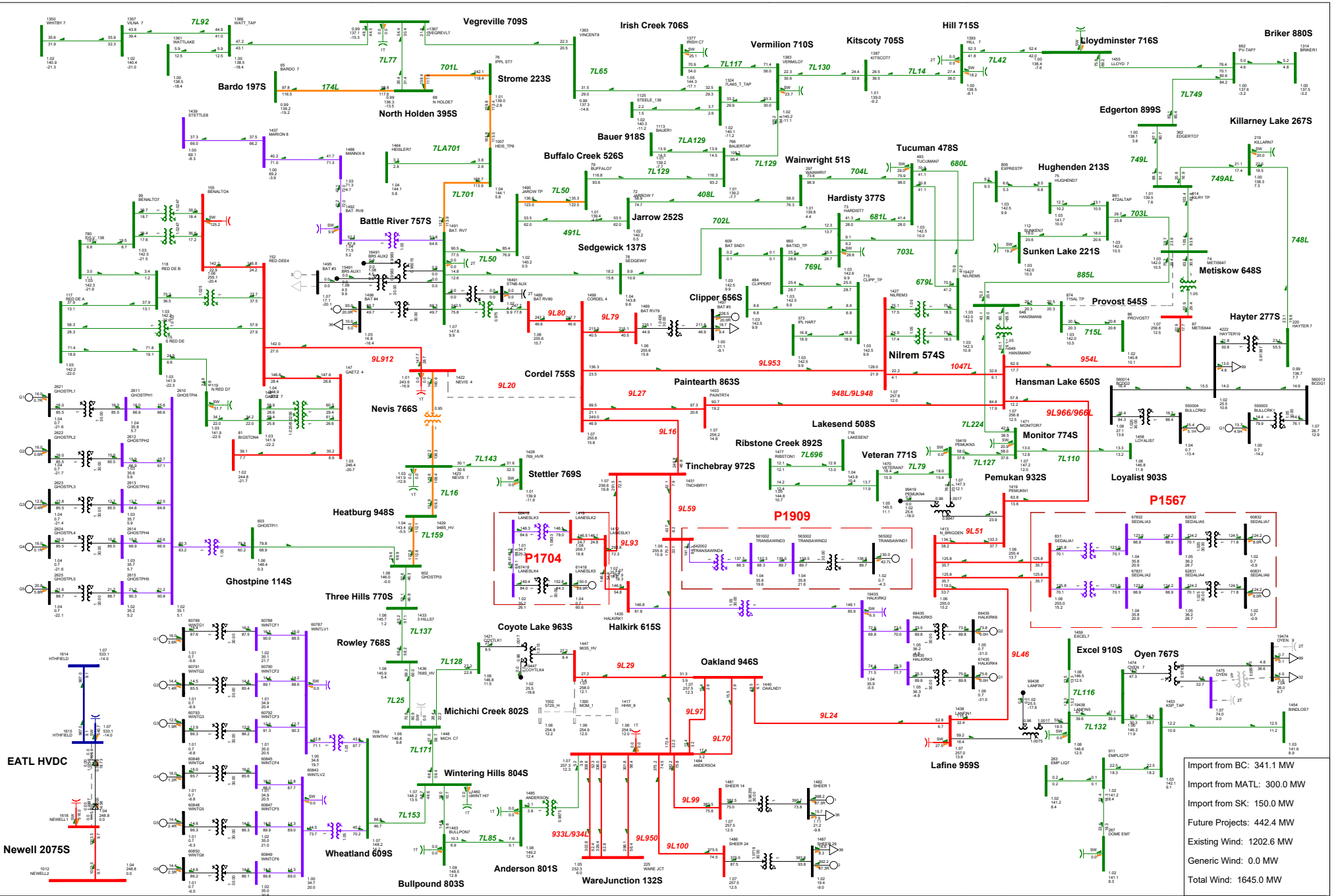


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-1: P1909_SP_POST_SEN
CATEGORY B - 7L42 (HILL 751S - LLOYDMINSTER 716S)
MON, MAR 15 2021 23:22

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

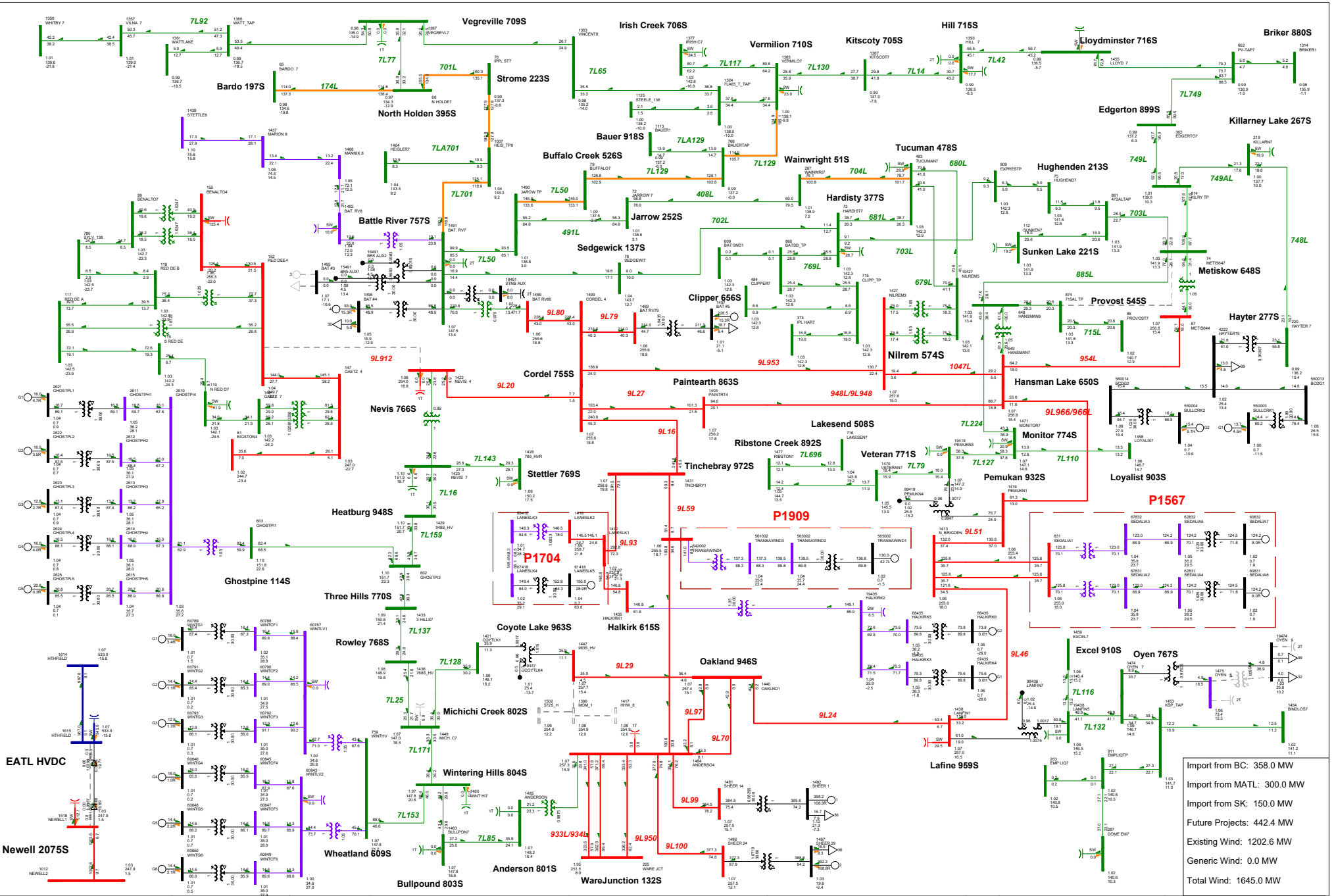


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-2: P1909_SP_POST_SEN
CATEGORY B - 9L20 (NEVIS 766S - CORDEL 755S)
MON, MAR 15 2021 23:22

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

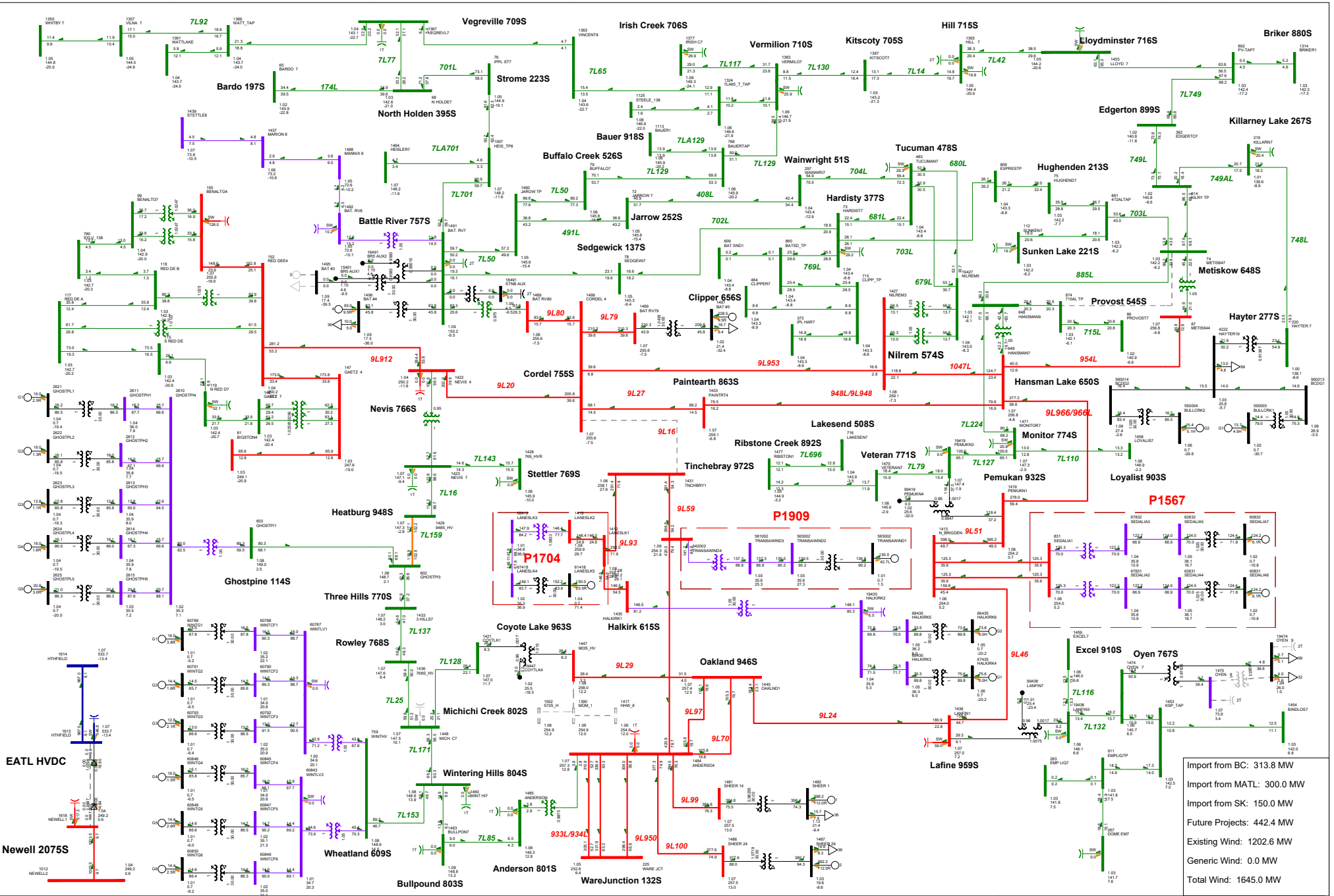


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-3: P1909_SP_POST_SEN
CATEGORY B - 912L/9L912 (RED DEER 63S - NEVIS 766S)
MON, MAR 15 2021 23:23

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0% Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

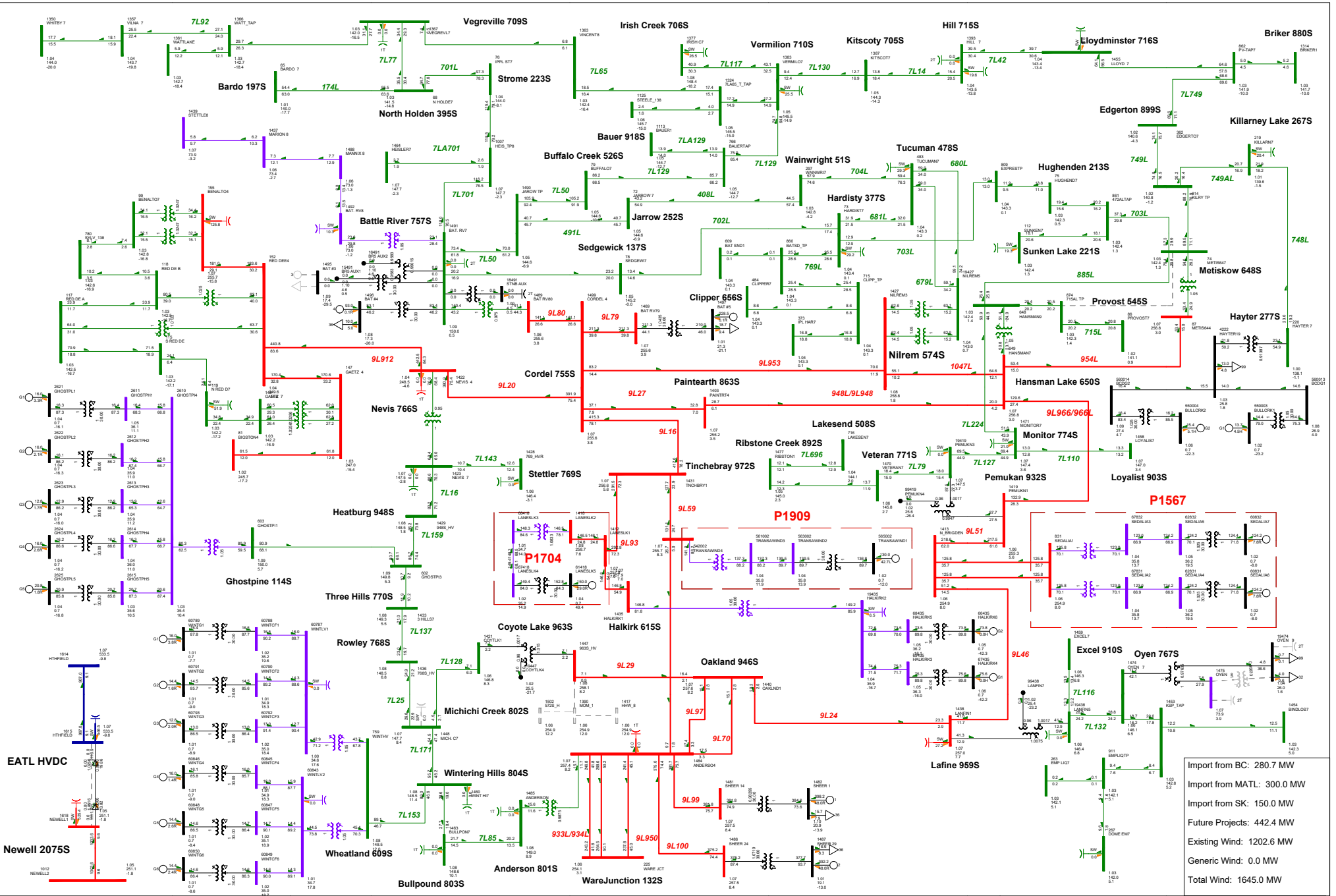


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-4: P1909_SP_POST_SEN
CATEGORY B - 9L16 (CORDEL 755S - TINCHERBRAY 972S)
TUE, MAR 16 2021 17:52

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

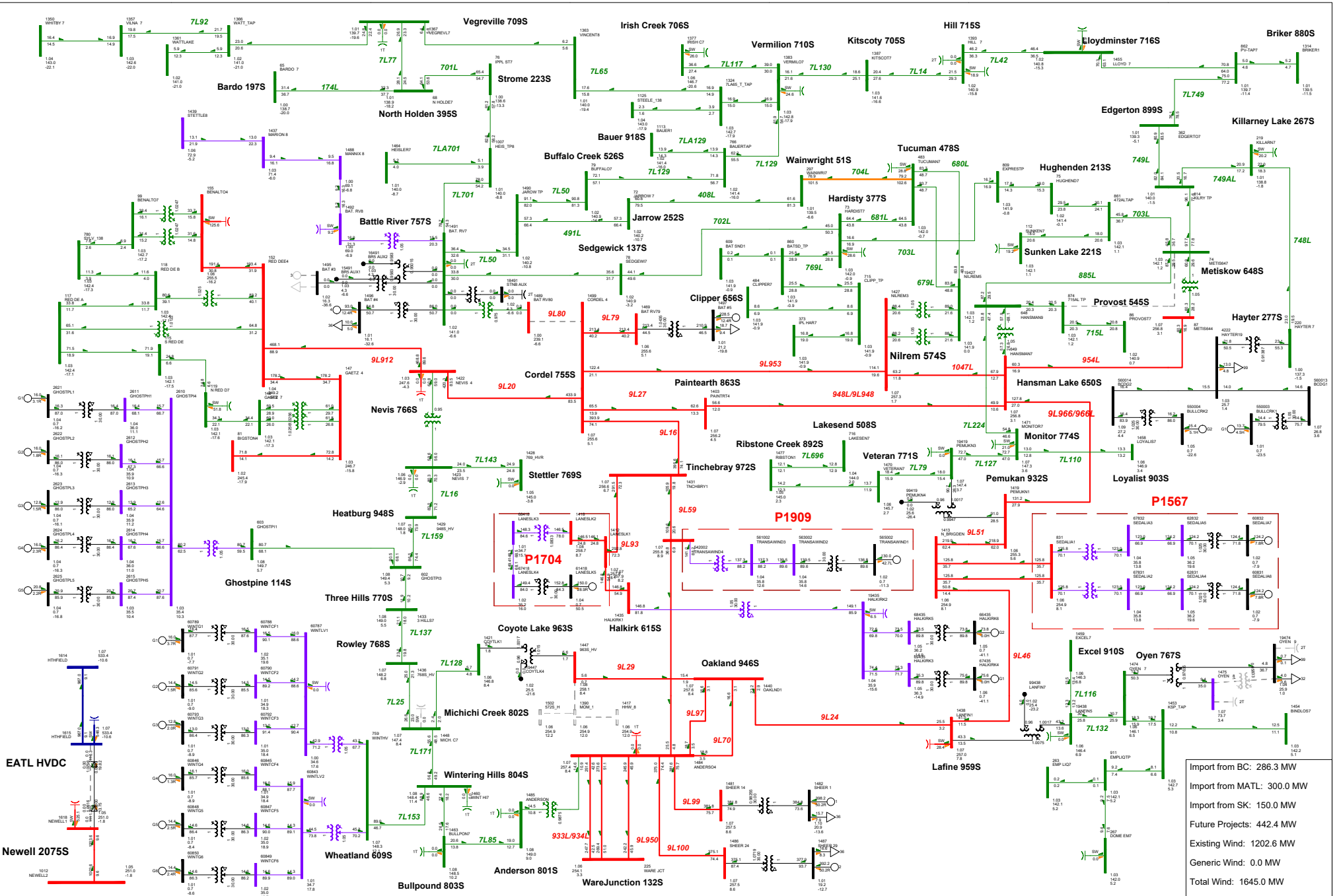


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-5: P1909_SP_POST_SEN
CATEGORY B - 912T (BATTLE RIVER 757S 240/138 KV TRANSFORMER)
MON, MAR 15 2021 23:24

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



Import from BC: 286.3 MW

Import from MATL: 300.0 MW

Import from SK: 150.0 MW

Future Projects: 442.4 MW

Existing Wind: 1202.6 MW

Generic Wind: 0.0 MW

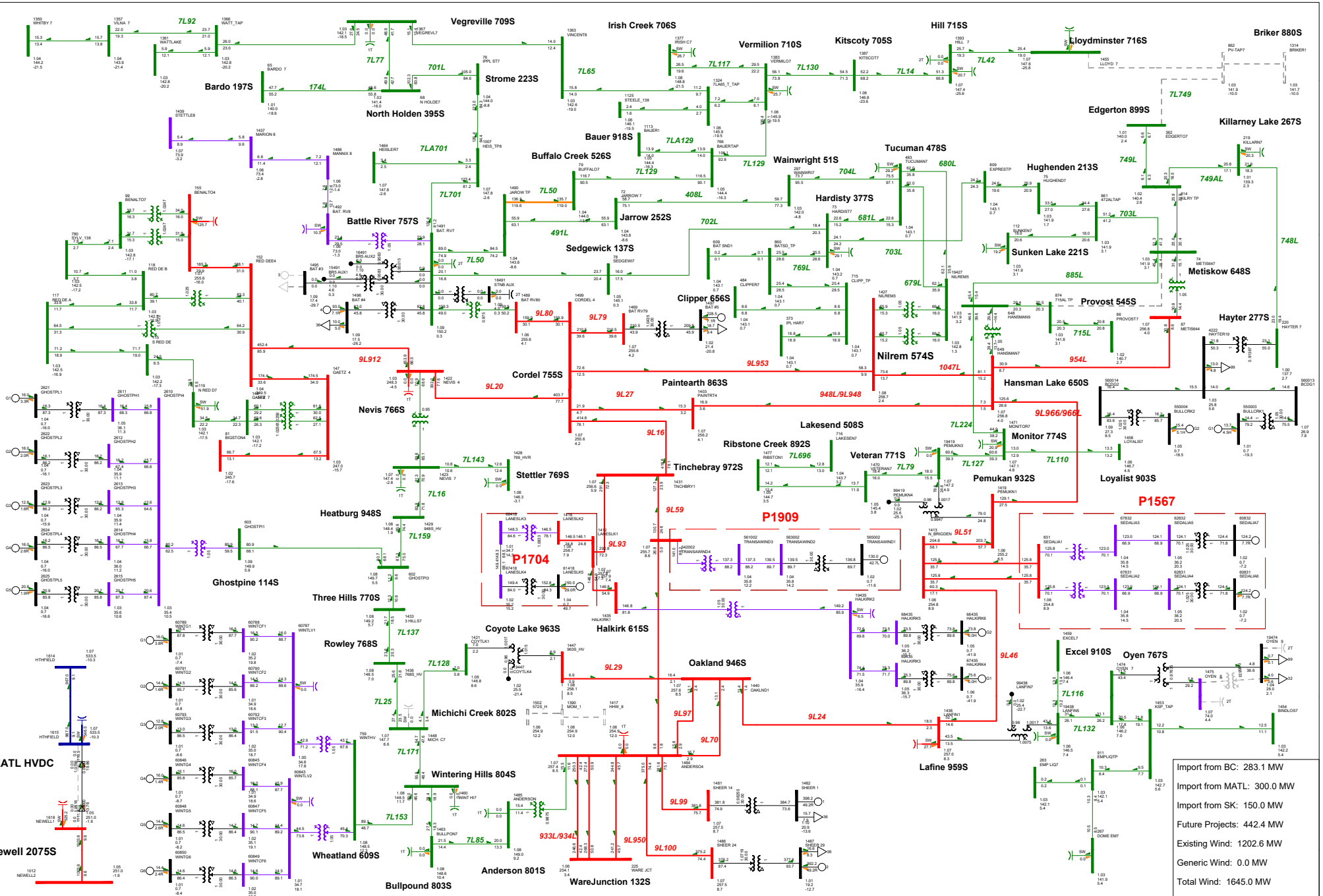
Total Wind: 1645.0 MW

TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-6: P1909_SP_POST_SEN
CATEGORY B - 9L80 (BATTLE RIVER 757S - CORDEL 755S)
MON, MAR 15 2021 23:24

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

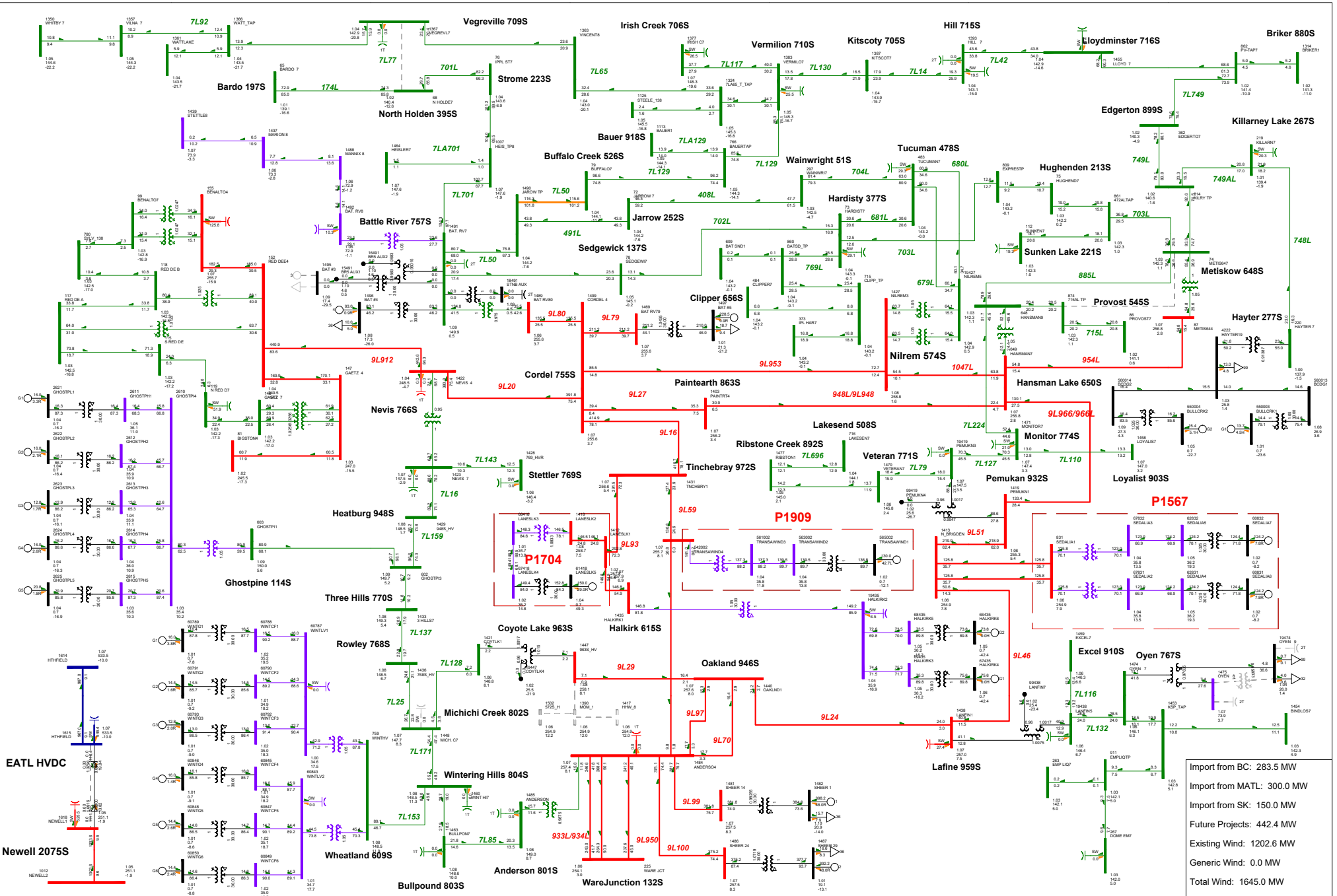


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-7: P1909_SP_POST_SEN
CATEGORY B - 7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)
MON, MAR 15 2021 23:25

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

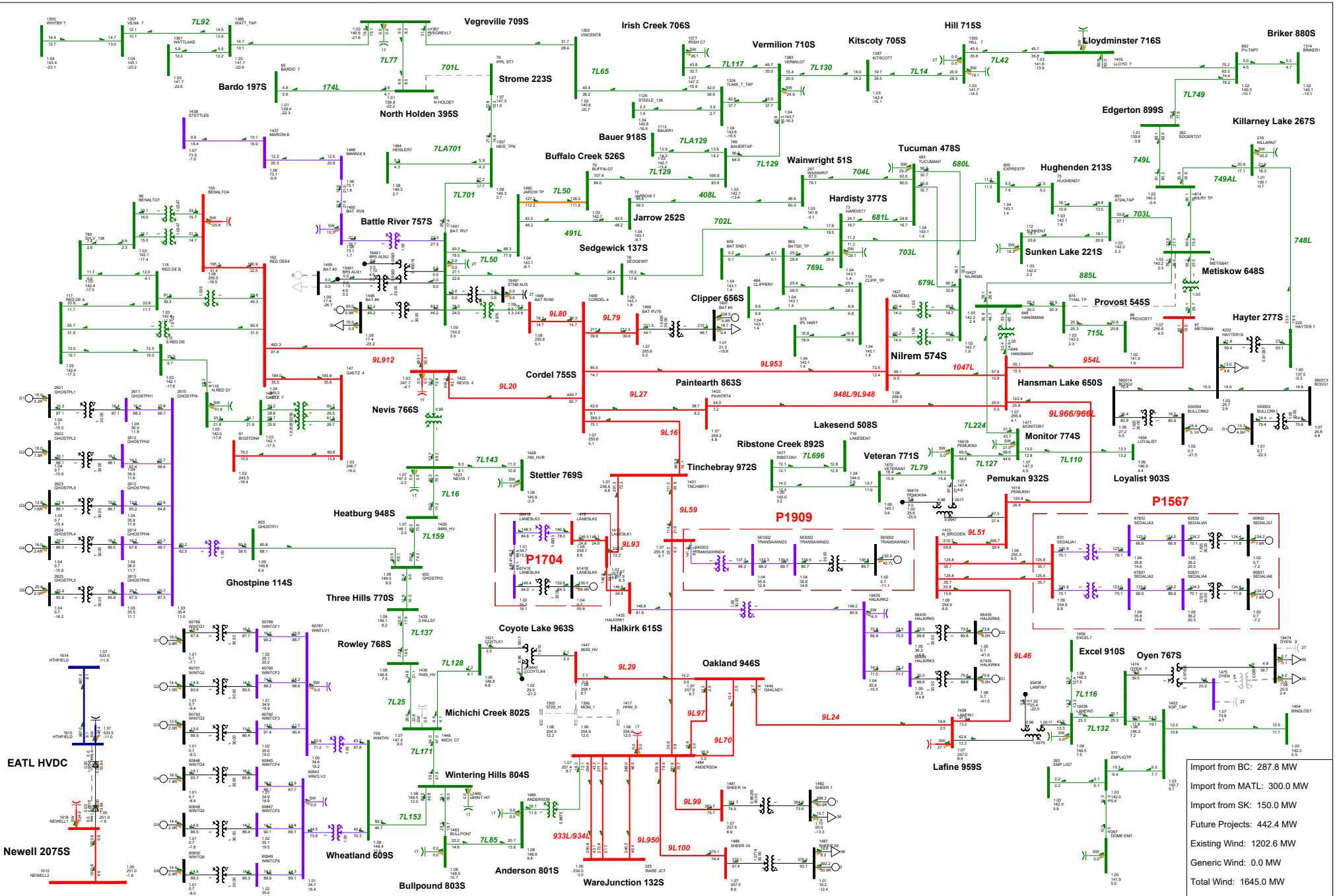


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-8: P1909_SP_POST_SEN
CATEGORY B - 7L77 (NORTH HOLDEN 395S - VEGREVILLE 709S)
MON, MAR 15 2021 23:25

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

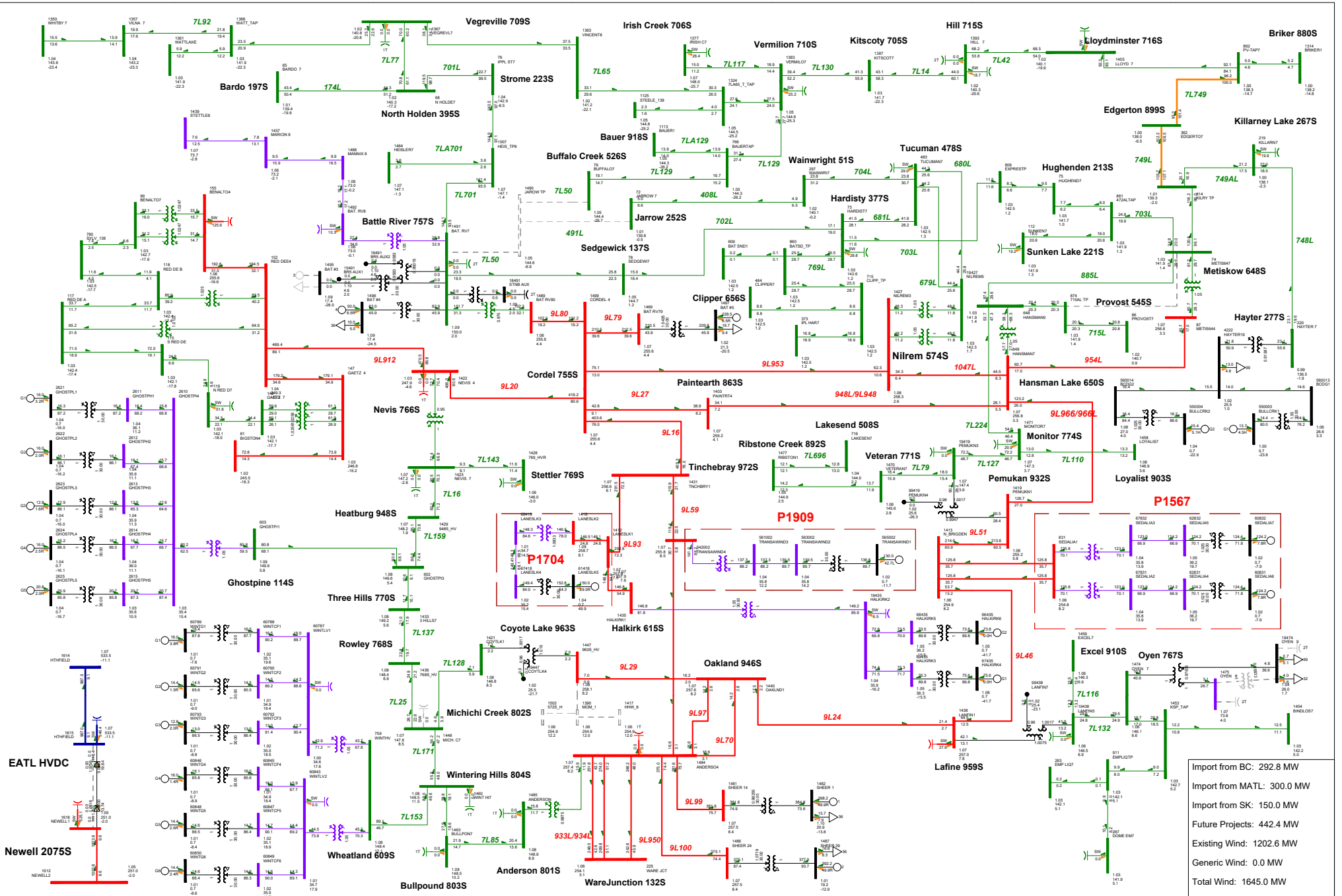


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-9: P1909_SP_POST_SEN
CATEGORY B - 701L (NORTH HOLDEN 395S- STROME 223S)
MON, MAR 15 2021 23:25

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

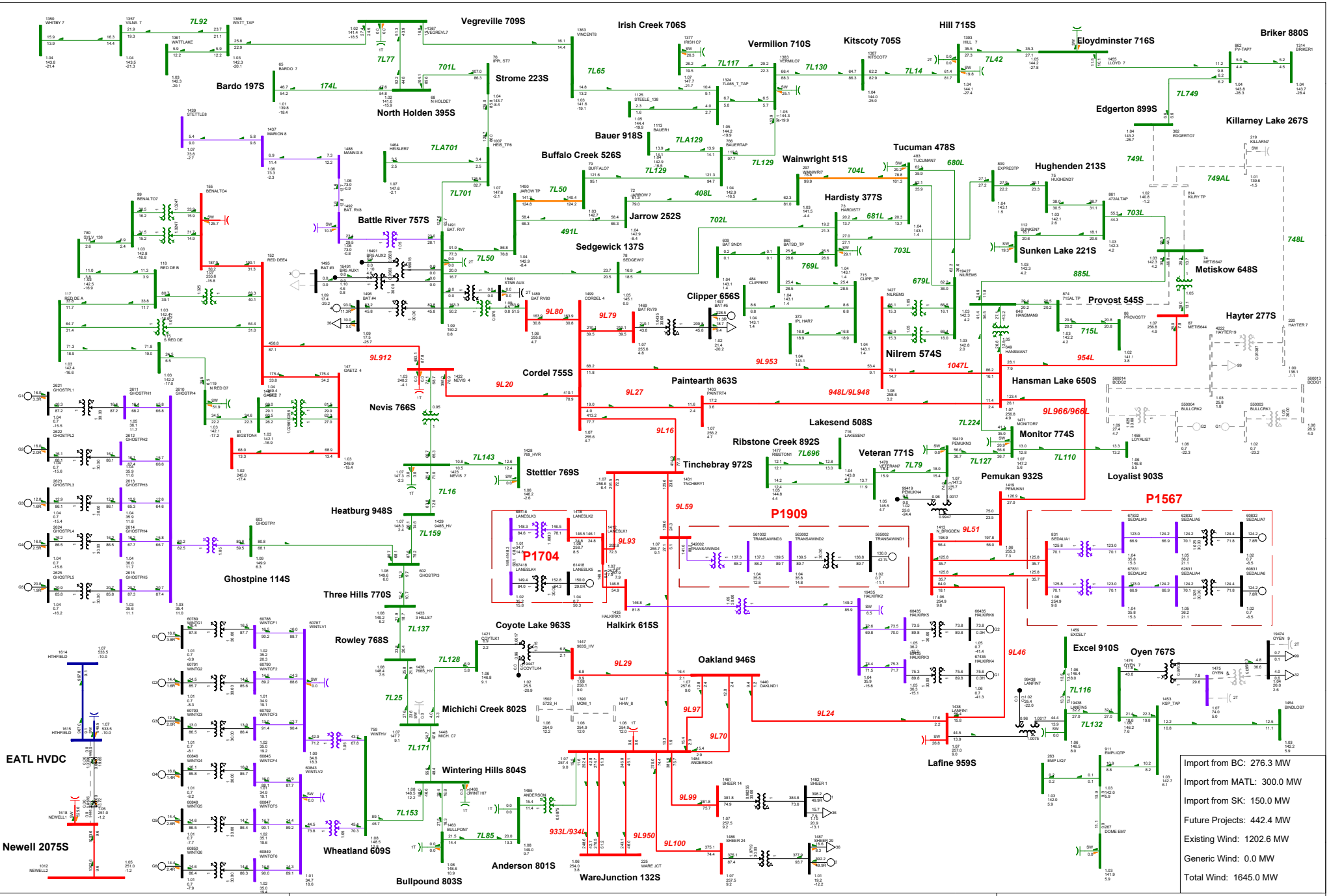


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-10: P1909_SP_POST_SEN
CATEGORY B - 7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)
MON, MAR 15 2021 23:26

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

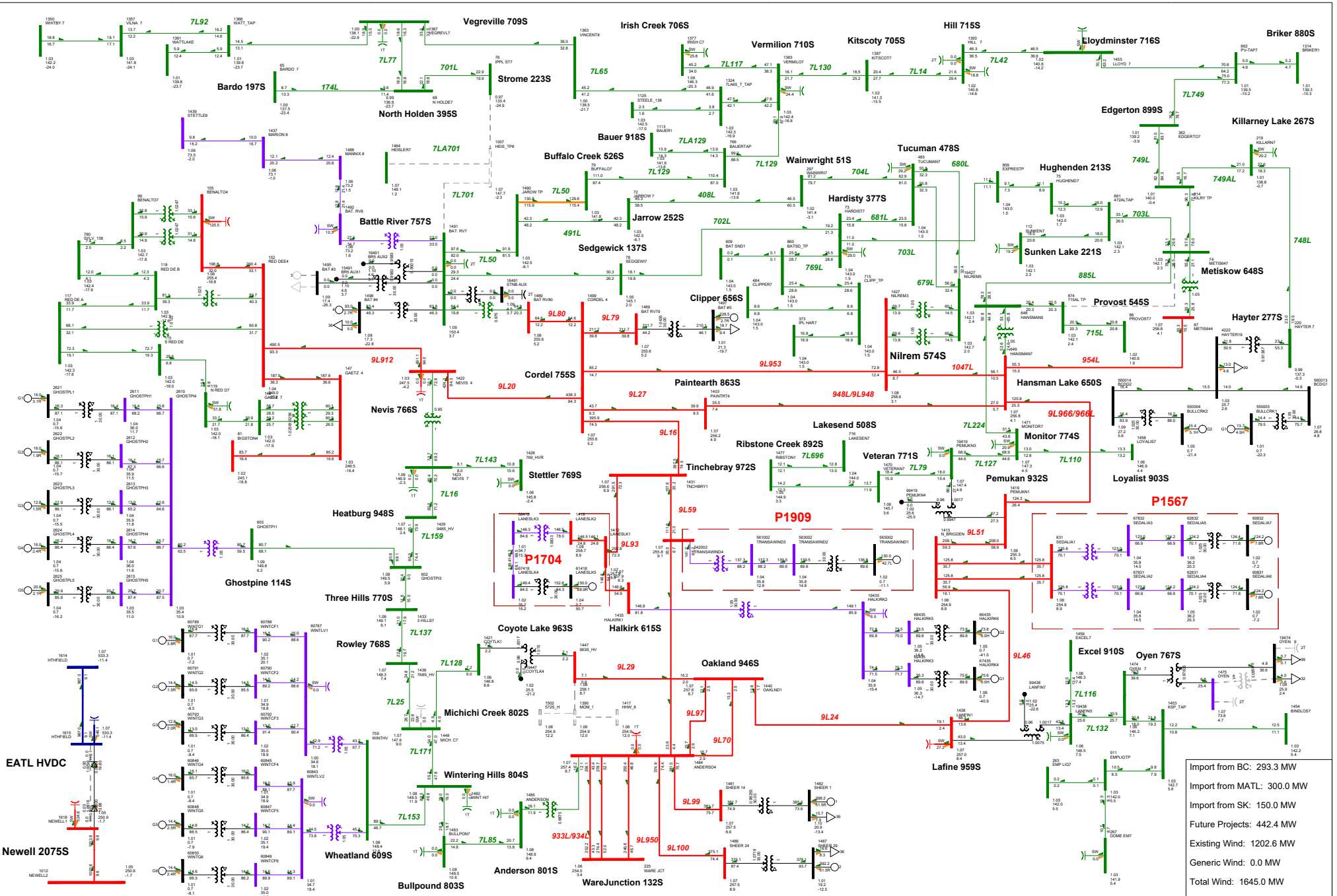


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-11: P1909_SP_POST_SEN
CATEGORY B - 749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)
MON, MAR 15 2021 23:26

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.200OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

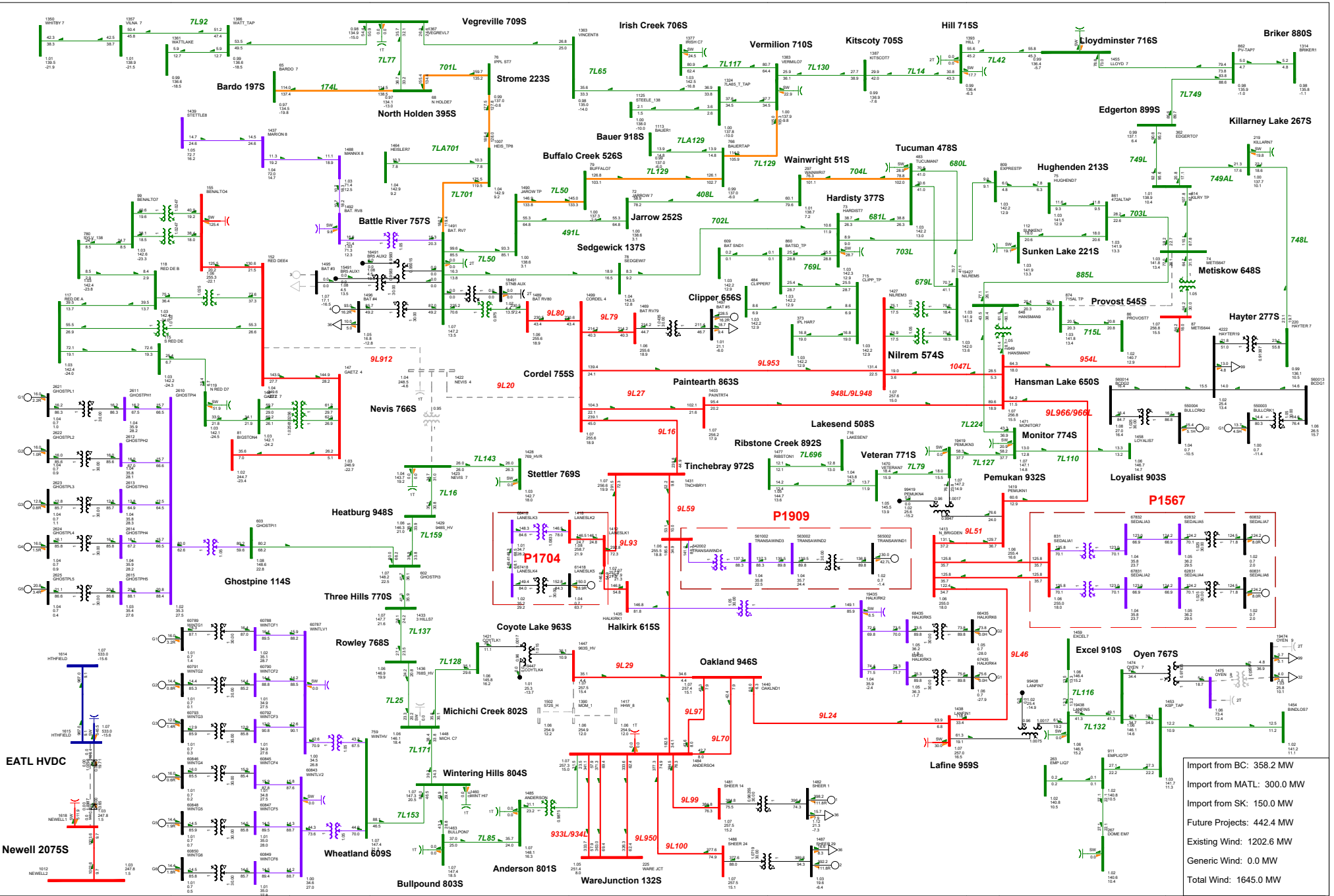


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-12: P1909_SP_POST_SEN
CATEGORY B - 7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)
MON, MAR 15 2021 23:27

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

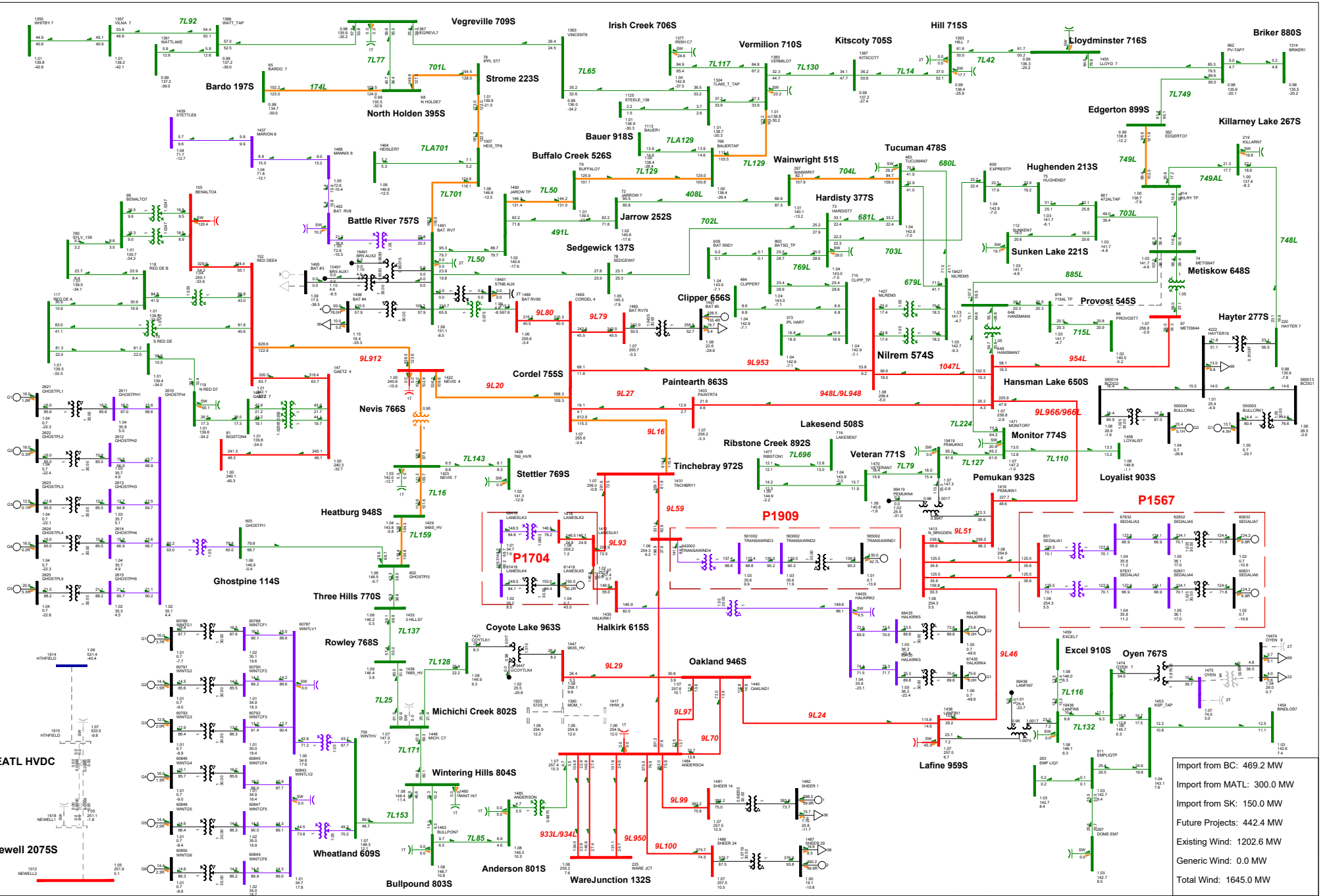


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-13: P1909_SP_POST_SEN
CATEGORY B - 766S901T (NEVIS 766S 240/138 KV TRANSFORMER)
MON, MAR 15 2021 23:27

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

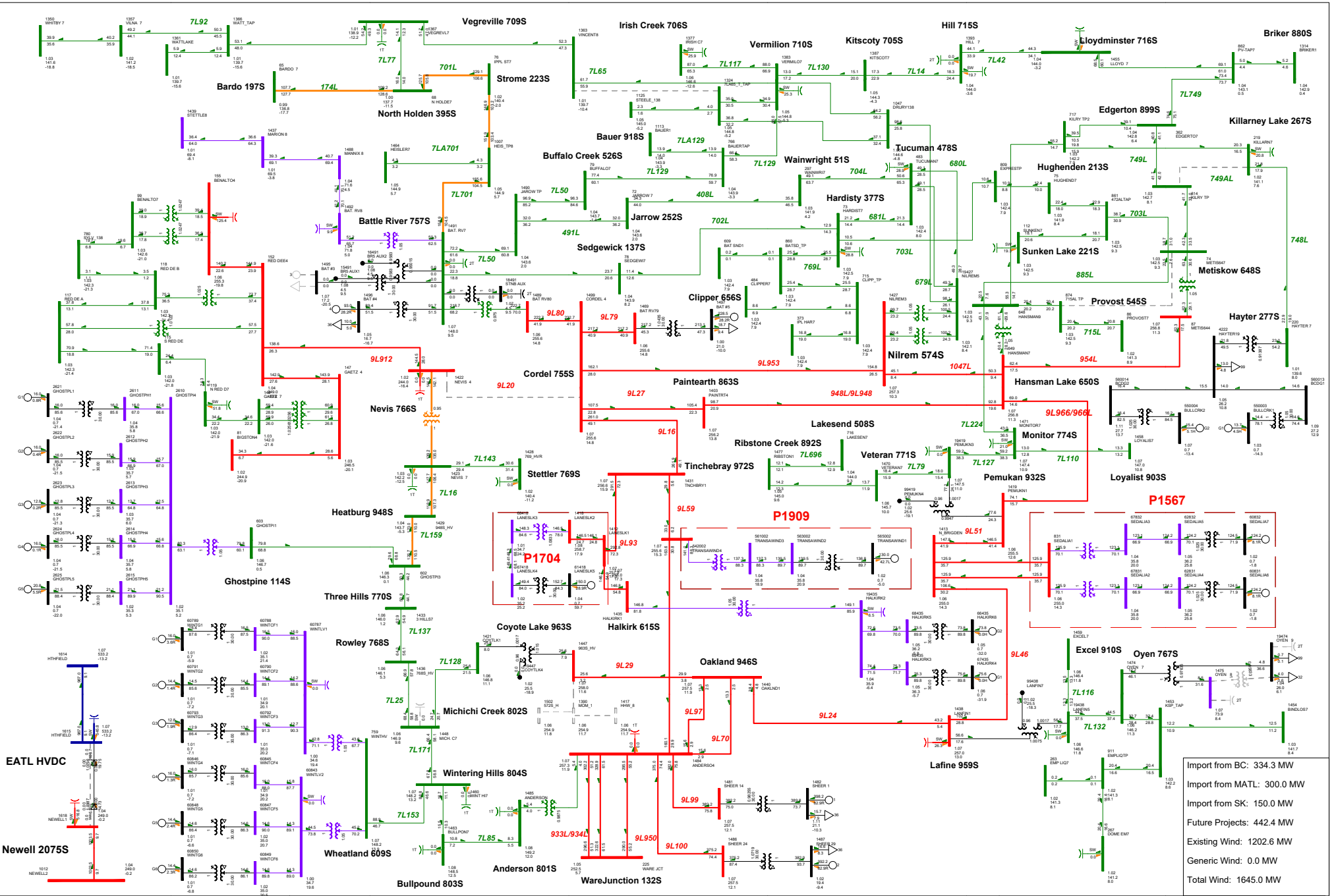


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-14: P1909_SP_POST_SEN
CATEGORY B - EATL HVDC
MON, MAR 15 2021 23:28

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

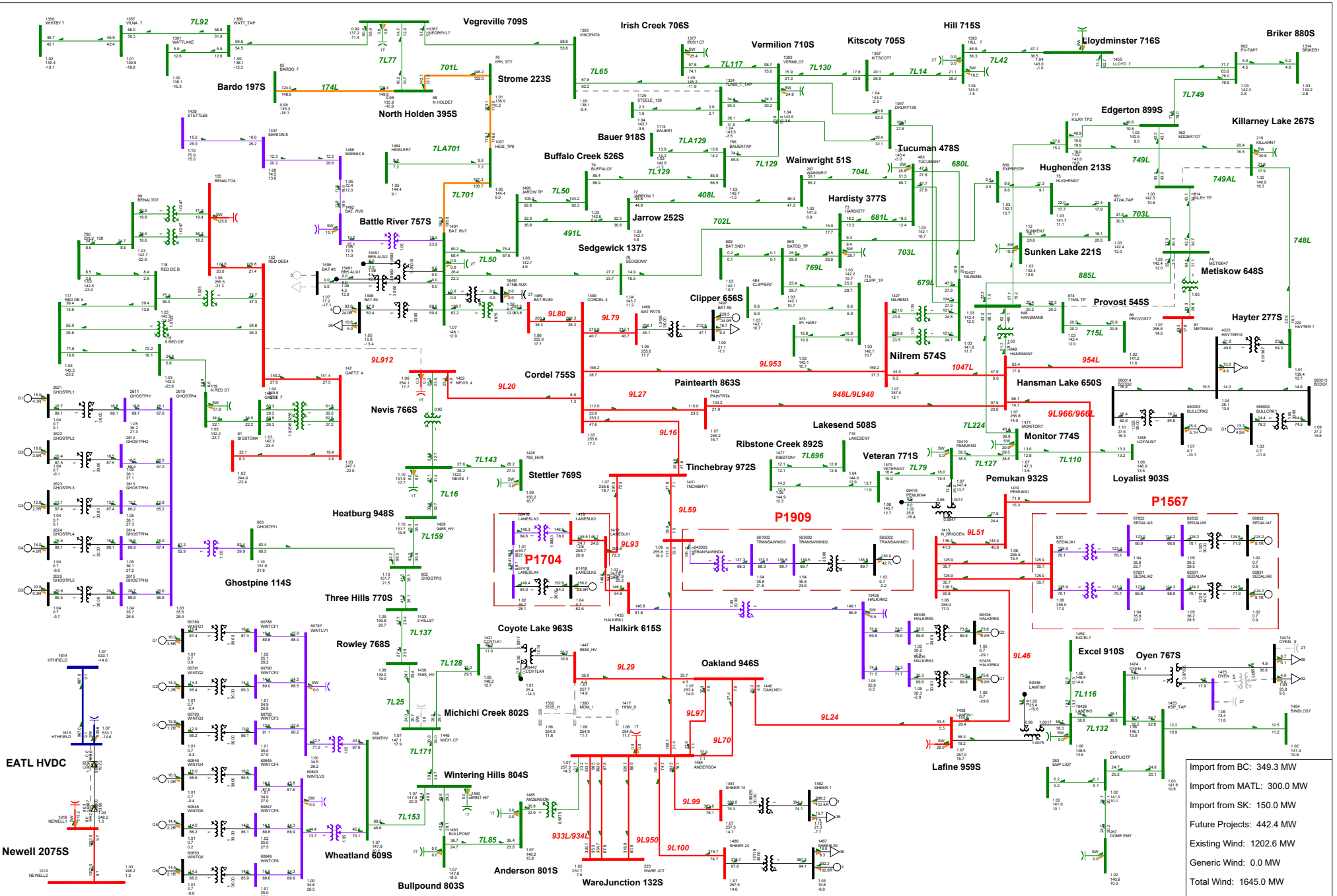


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-10-1: P1909_SP_POST_SEN_PENV
CATEGORY B - 9L20 (NEVIS 766S - CORDEL 755S)
MON, MAR 15 2021 23:29

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

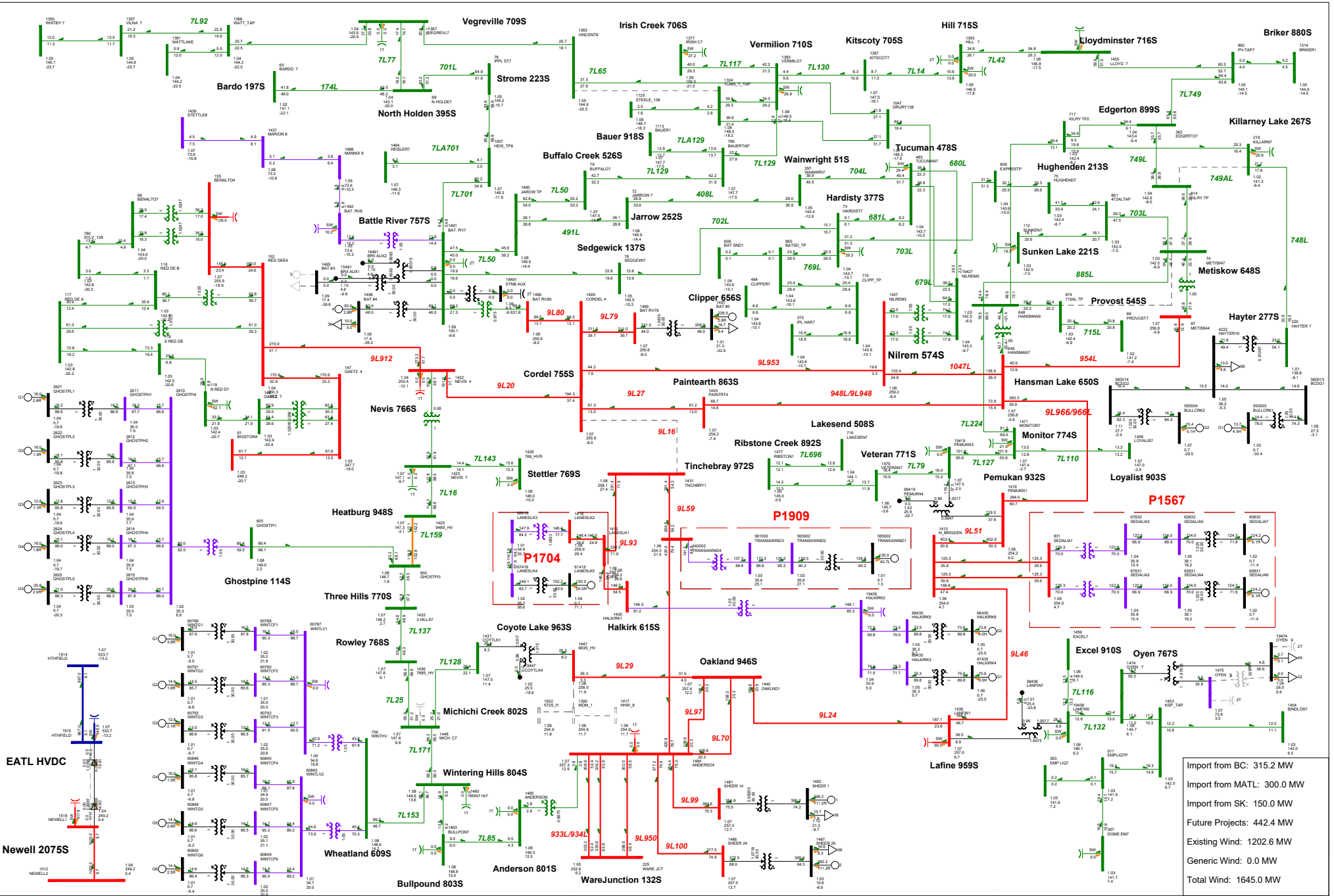


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-10-2: P1909_SP_POST_SEN_PENV
CATEGORY B - 912L/9L912 (RED DEER 63S - NEVIS 766S)
MON, MAR 15 2021 23:29

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

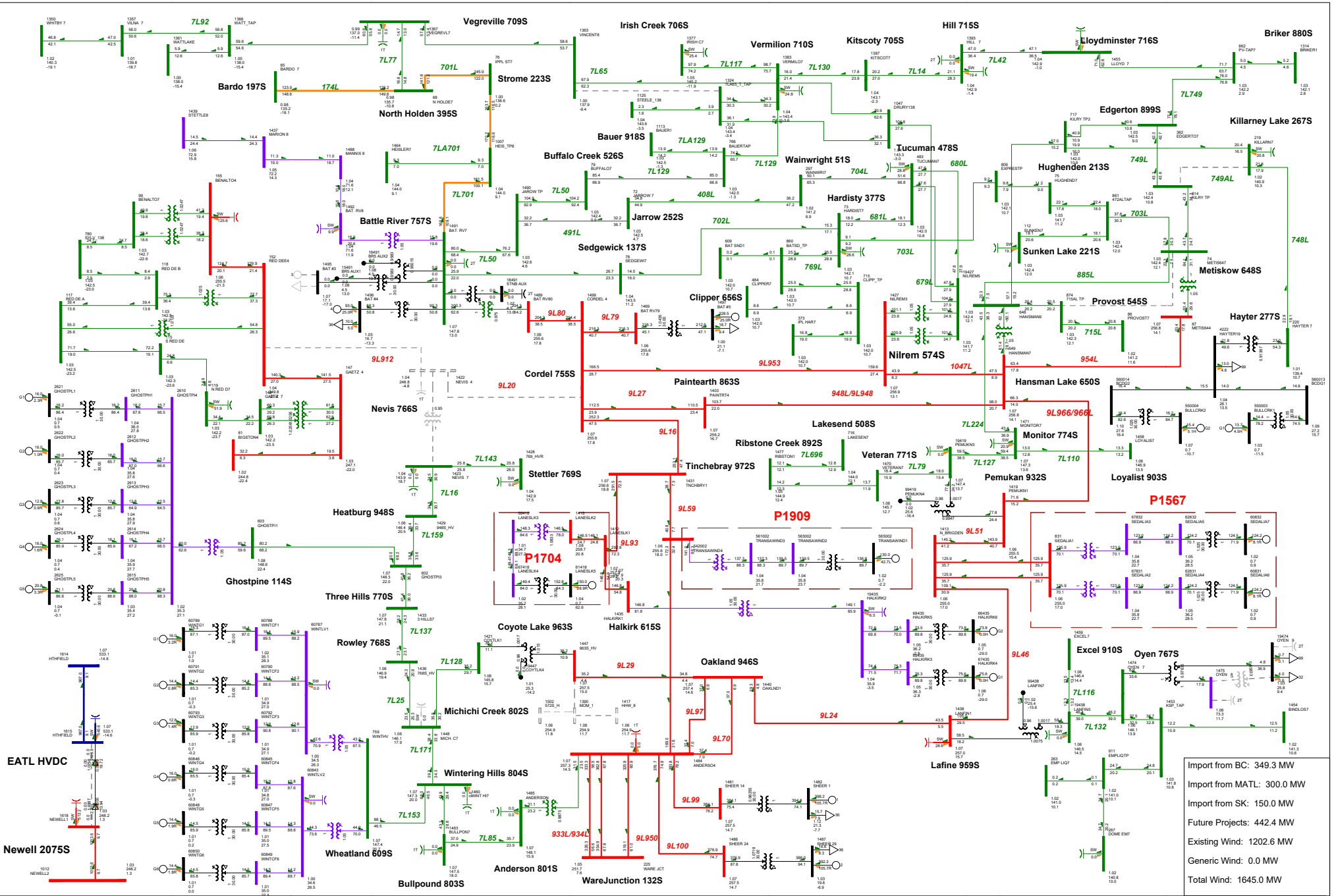


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-10-3: P1909_SP_POST_SEN_PENV
CATEGORY B - 9L16 (CORDEL 755S - TINCHERBRAY 972S)
TUE, MAR 16 2021 17:53

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

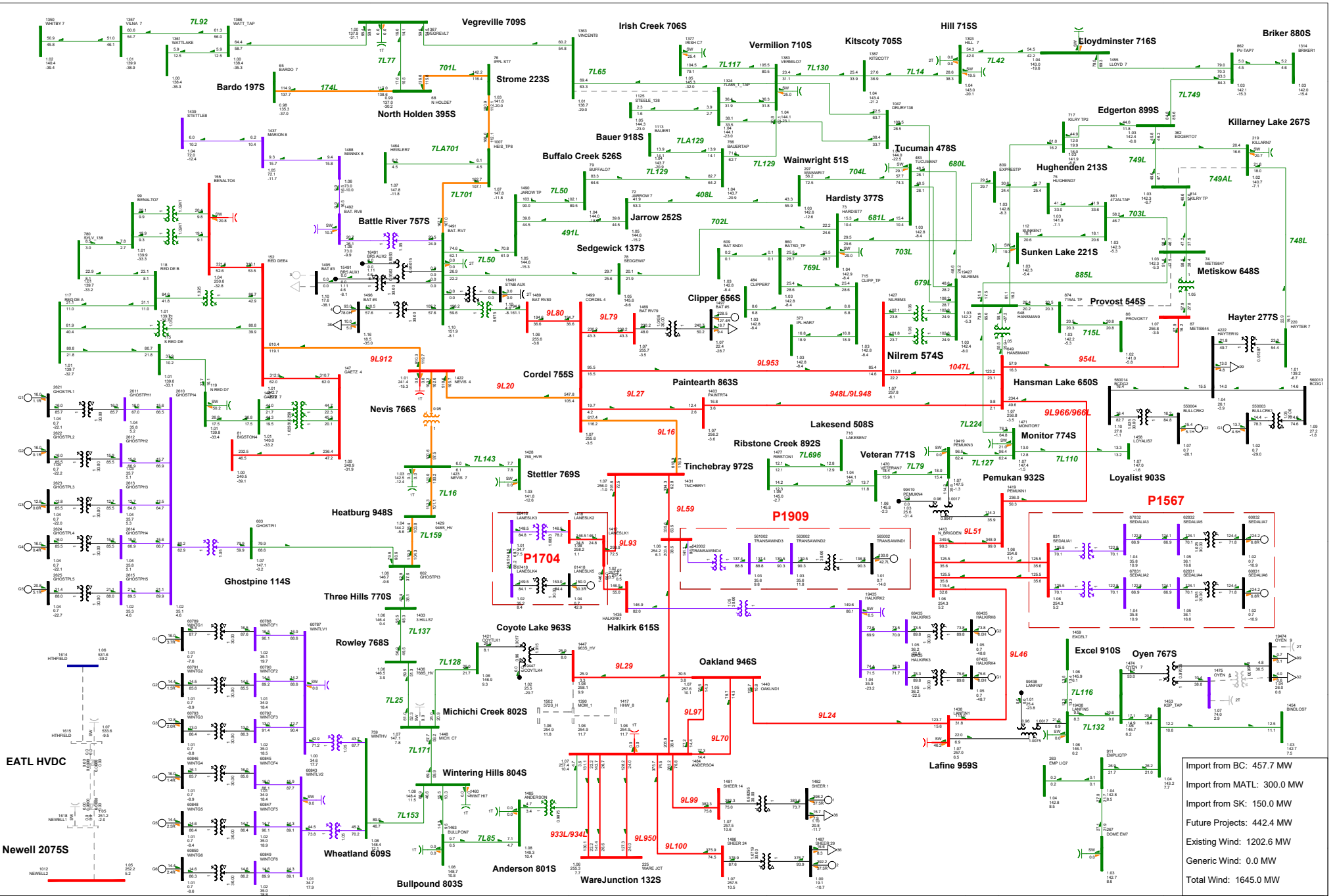


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-10-4: P1909_SP_POST_SEN_PENV
CATEGORY B - 766S901T (NEVIS 766S 240/138 KV TRANSFORMER)
MON, MAR 15 2021 23:30

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

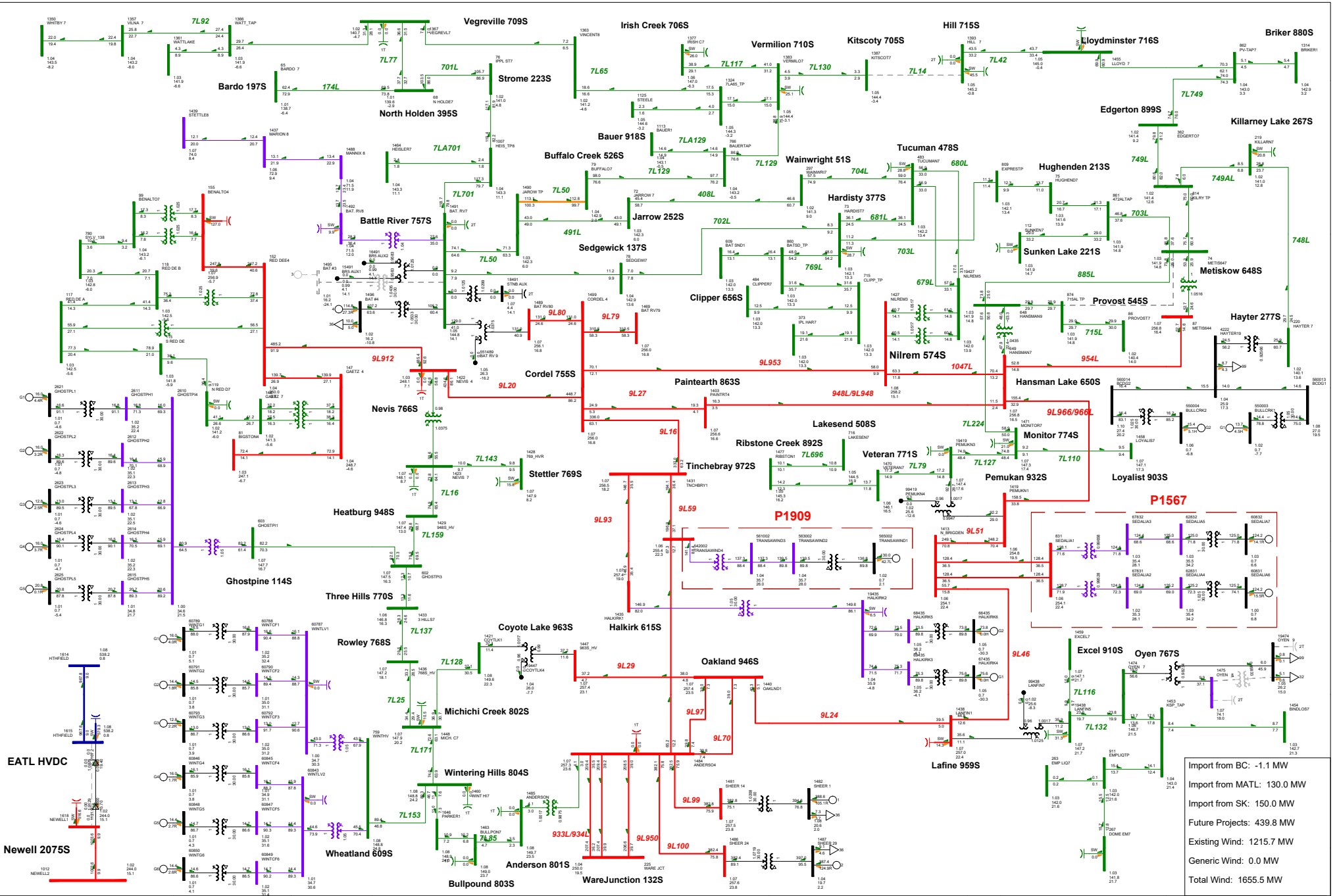


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-10-5: P1909_SP_POST_SEN_PENV
CATEGORY B - EATL HVDC
MON, MAR 15 2021 23:31

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

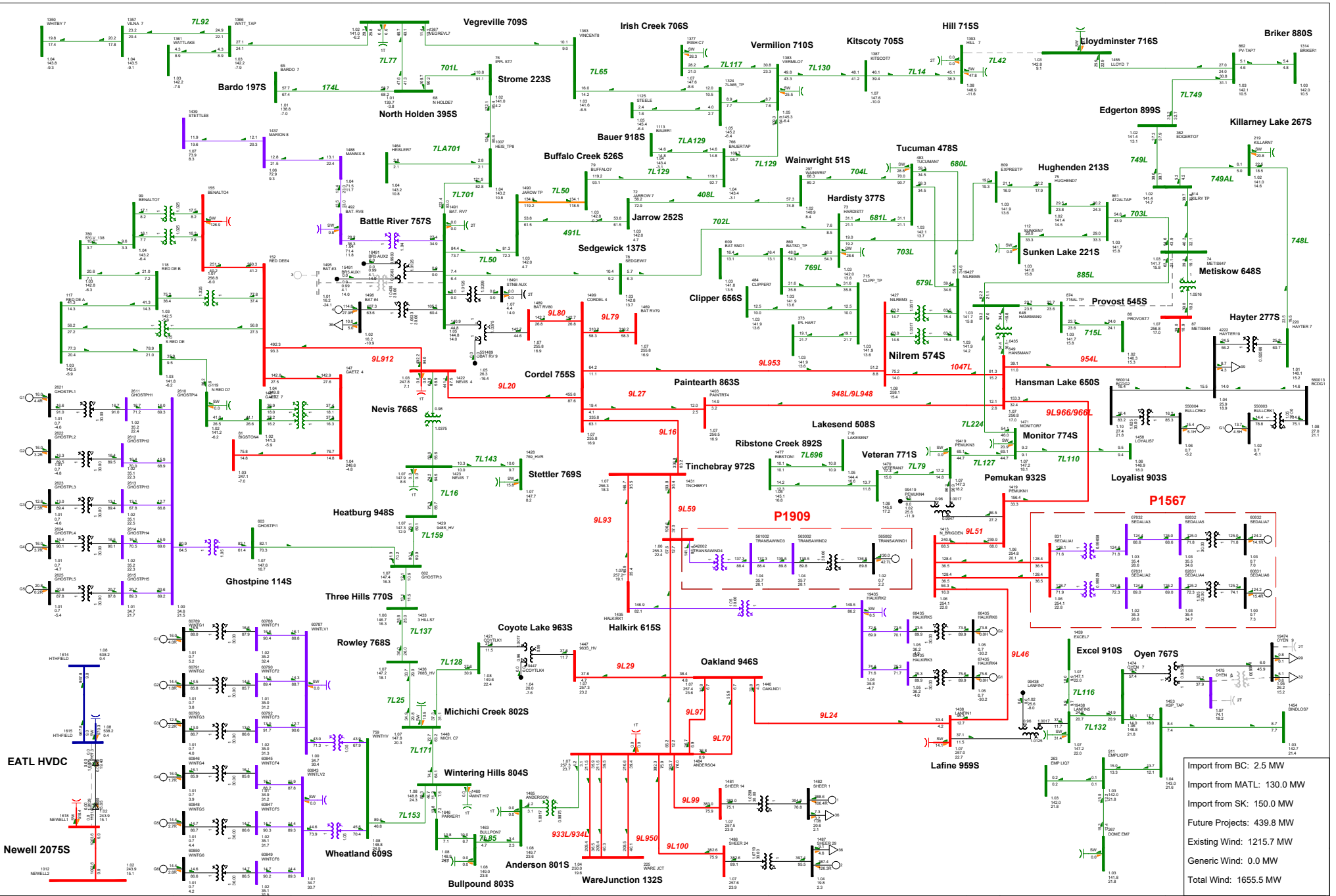


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-1: P1909_SP_POST_SEN_2021
CATEGORY B - 7L14 (KITSCOTY 705S - HILL 751S)
MON, MAR 15 2021 23:34

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

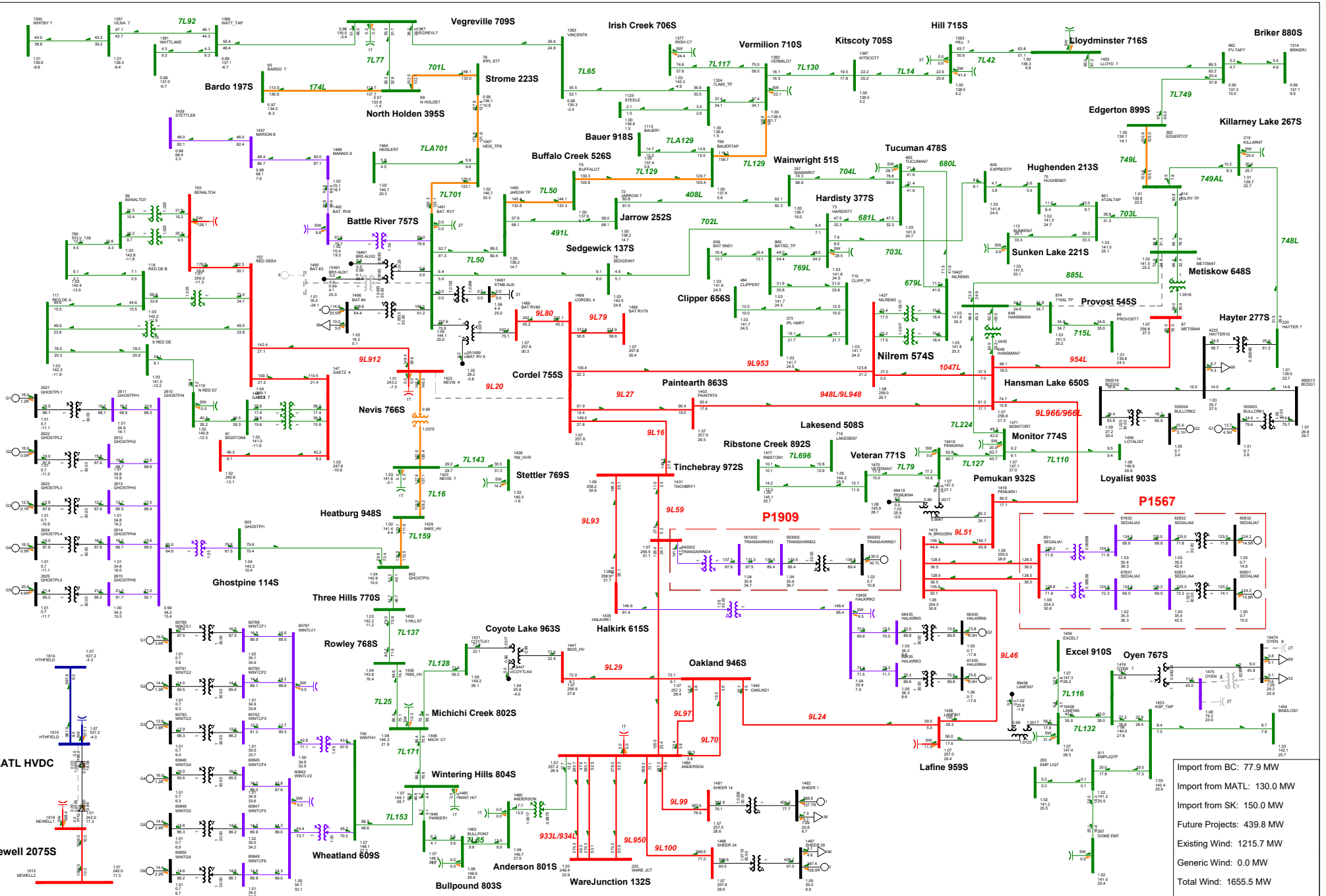


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-2: P1909_SP_POST_SEN_2021
CATEGORY B - 7L42 (HILL 751S - LLOYDMINSTER 716S)
MON, MAR 15 2021 23:34

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

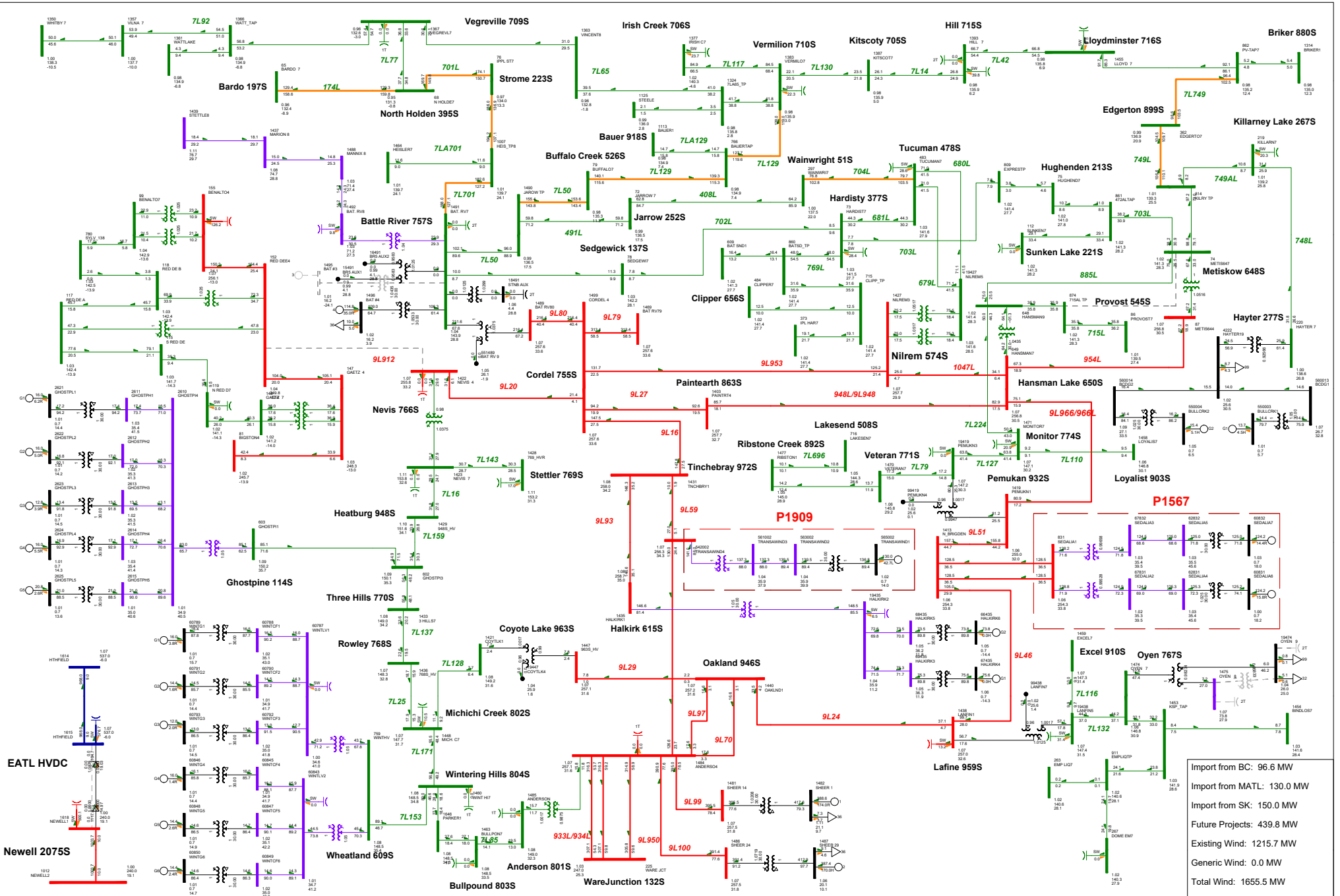


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-3: P1909_SP_POST_SEN_2021
CATEGORY B - 9L20 (NEVIS 766S - CORDEL 755S)
MON, MAR 15 2021 23:34

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

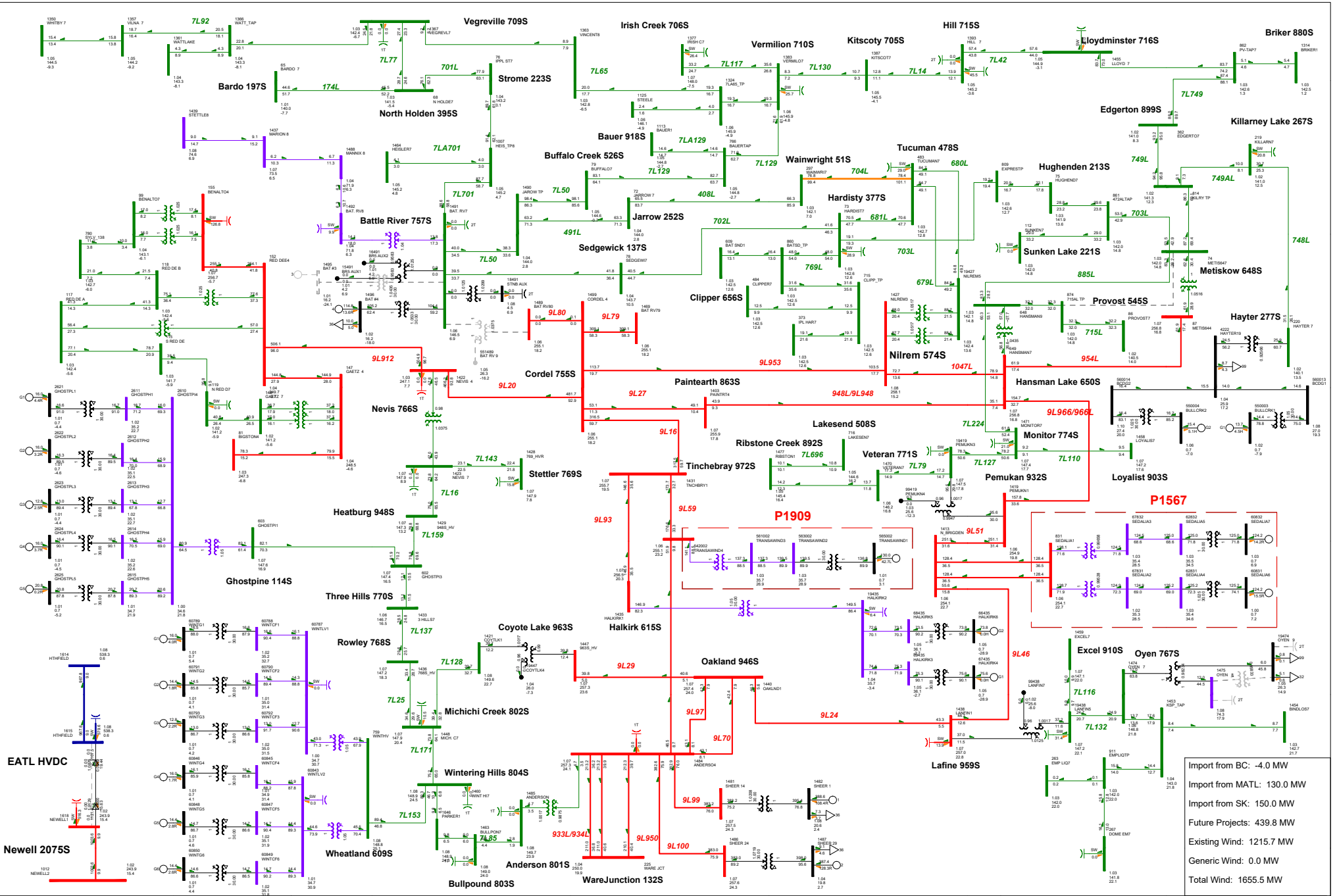


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-4: P1909_SP_POST_SEN_2021
CATEGORY B - 912L/9L912 (RED DEER 63S - NEVIS 766S)
MON, MAR 15 2021 23:35

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

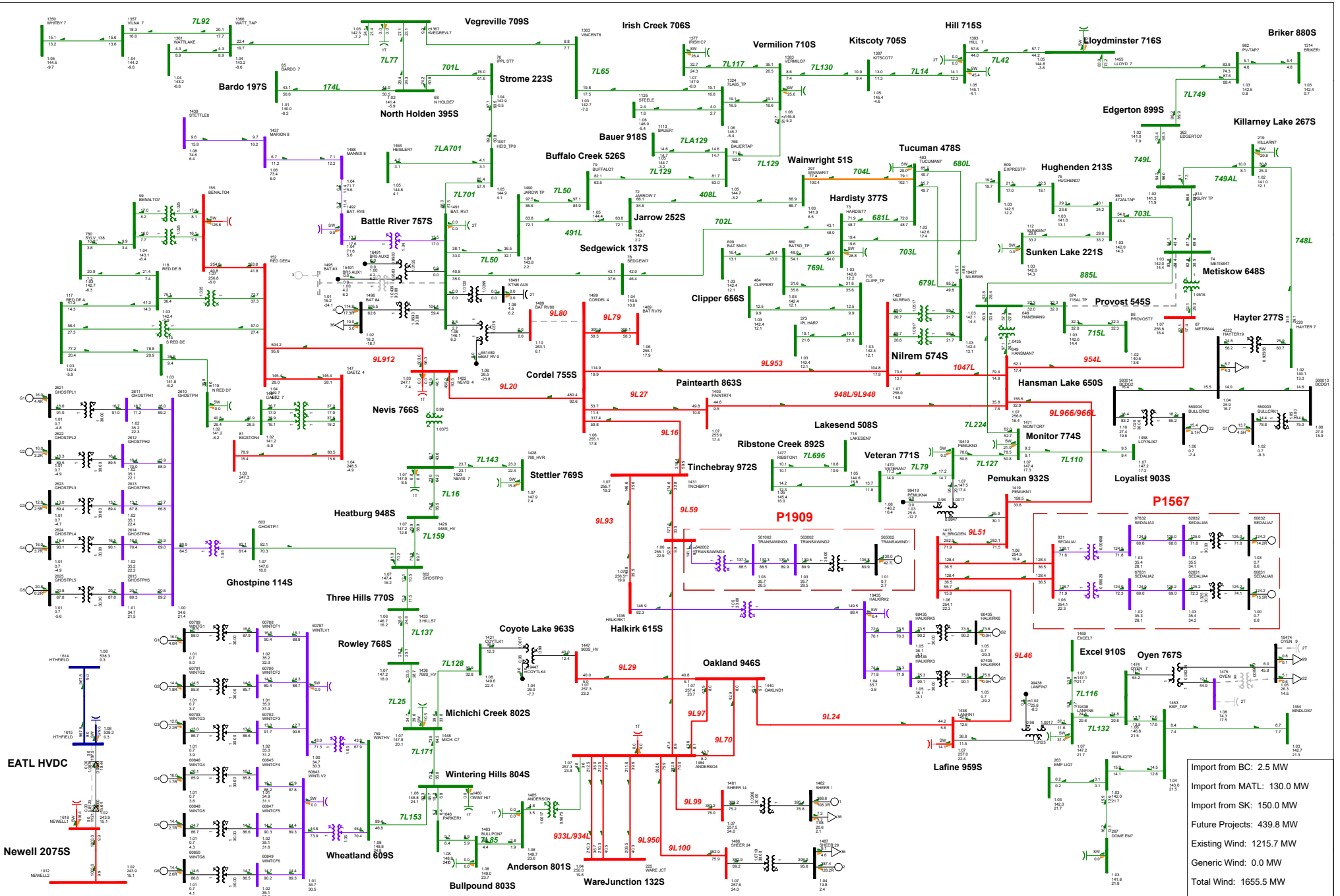


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-5: P1909_SP_POST_SEN_2021
CATEGORY B - 912T (BATTLE RIVER 757S 240/138 KV TRANSFORMER)
TUE, MAR 16 2021 17:54

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

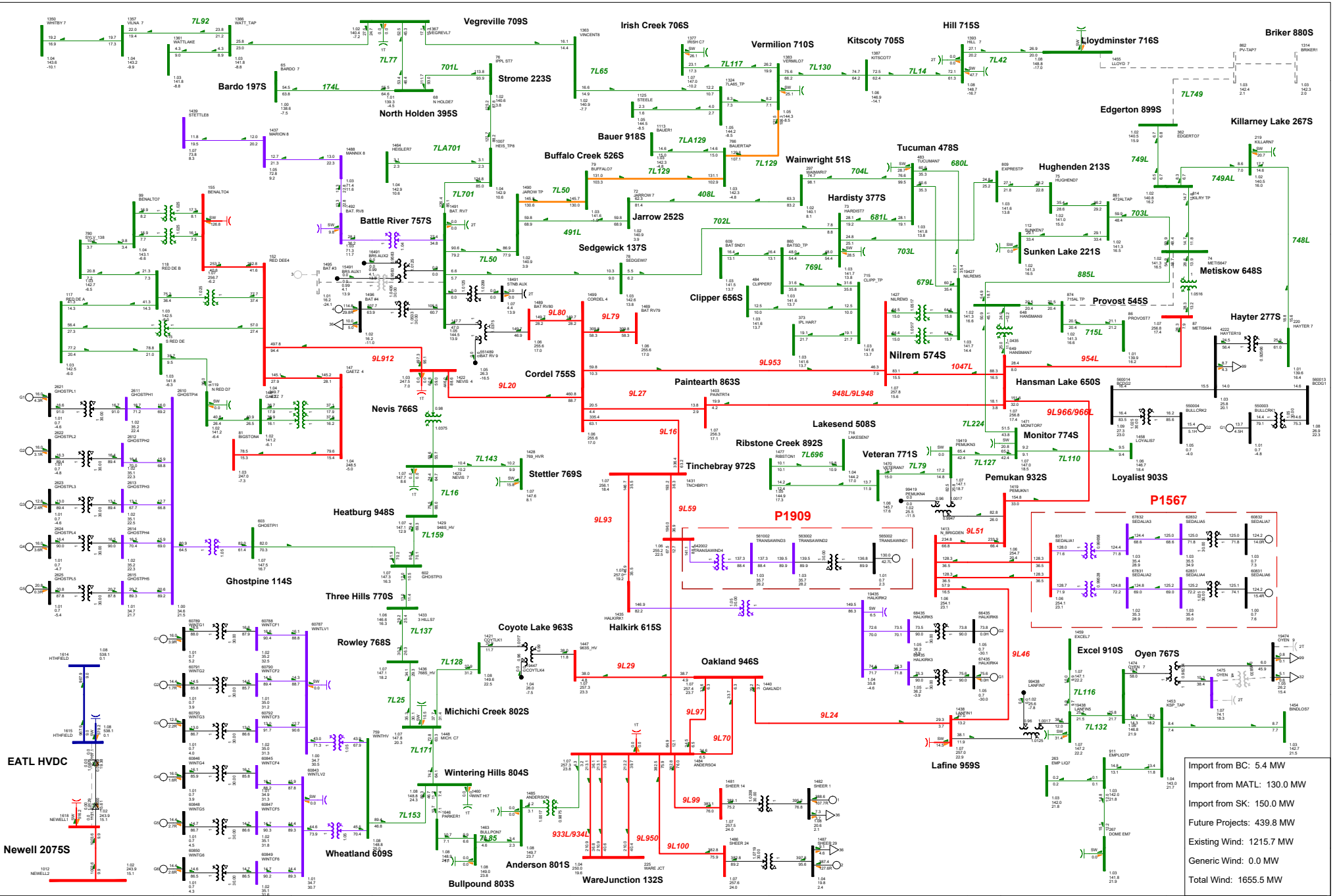


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-6: P1909_SP_POST_SEN_2021
CATEGORY B - 9L80 (BATTLE RIVER 757S - CORDEL 755S)
MON, MAR 15 2021 23:36

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

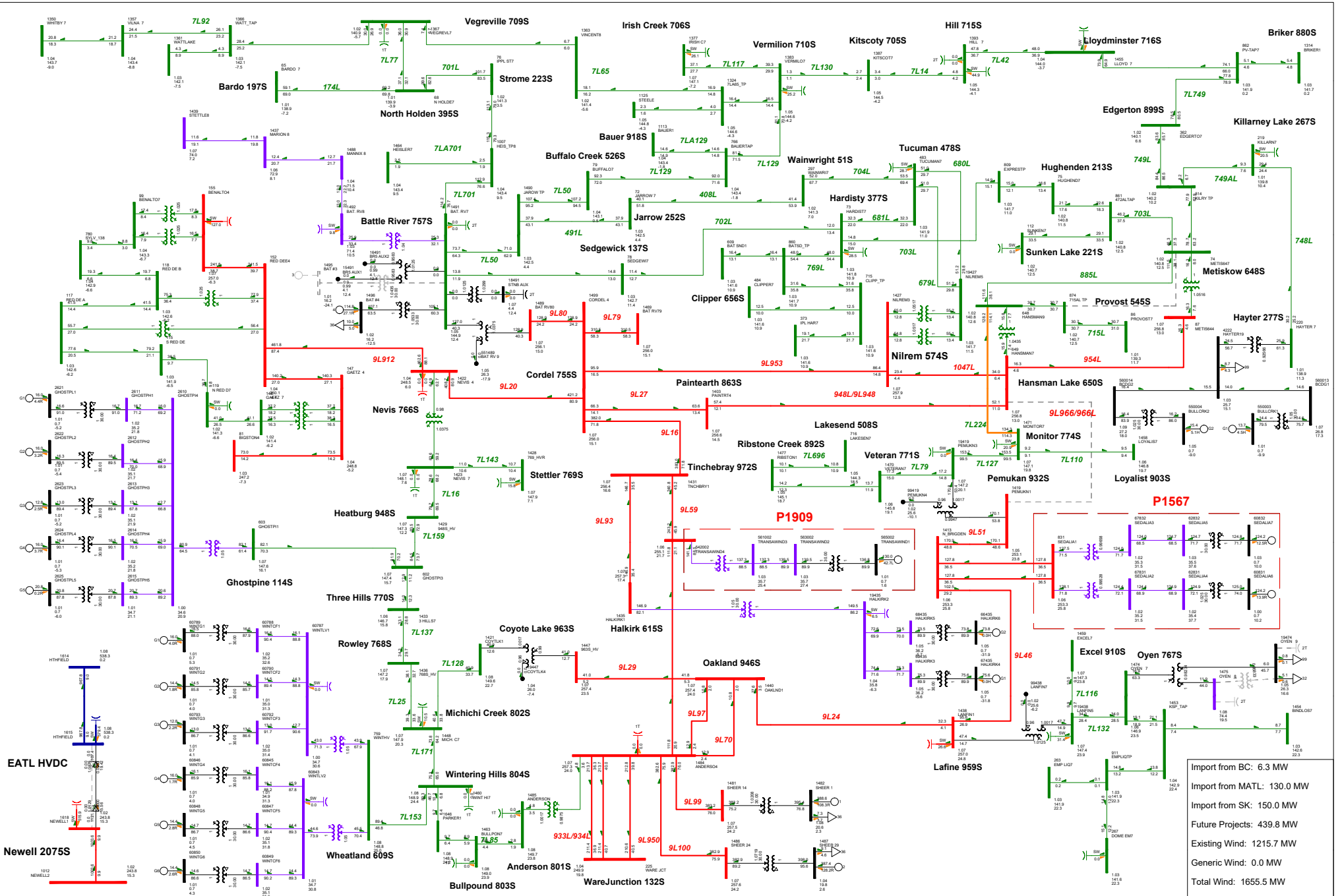


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-7: P1909_SP_POST_SEN_2021
CATEGORY B - 7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)
MON, MAR 15 2021 23:36

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

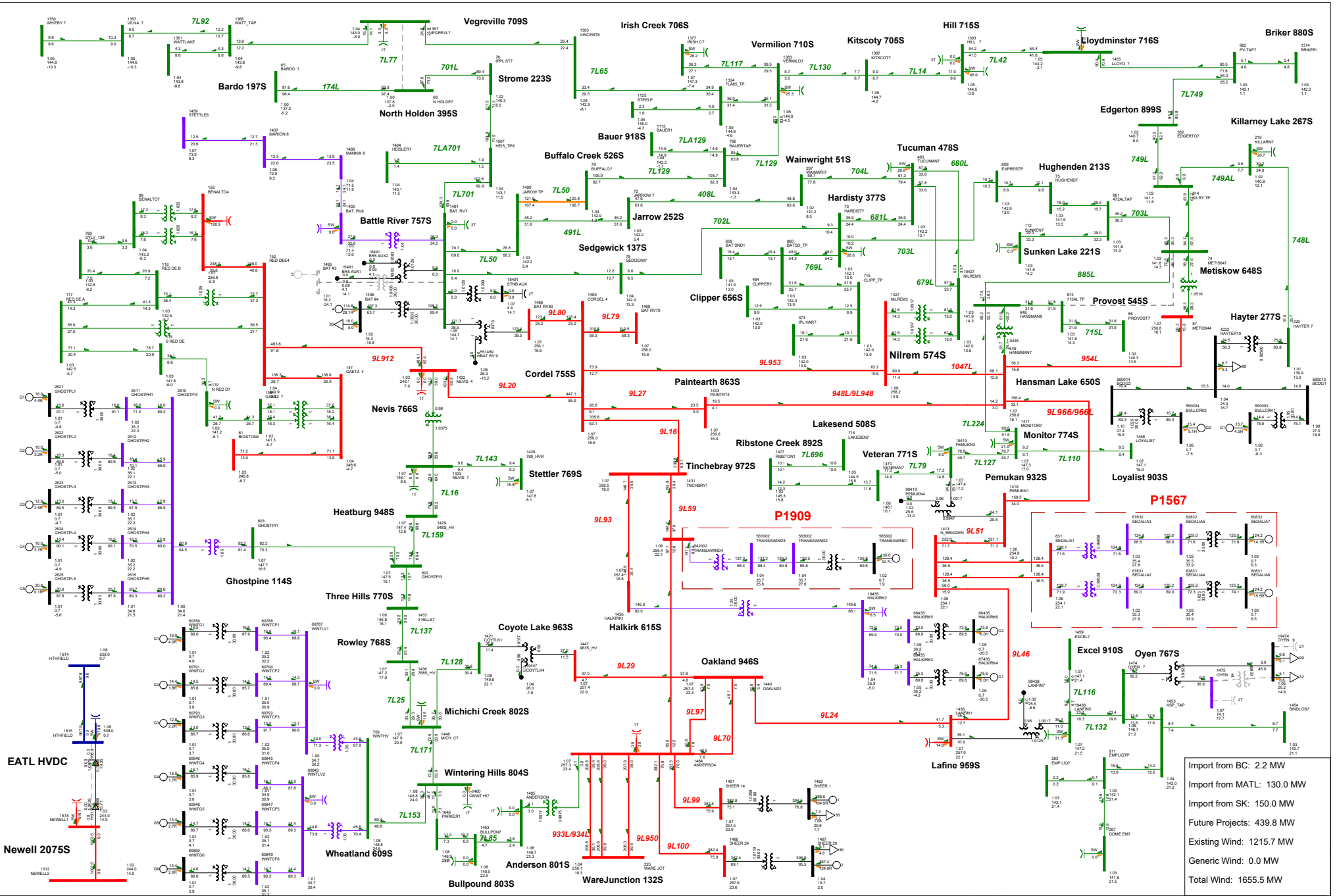


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-8: P1909_SP_POST_SEN_2021
CATEGORY B - 966L/9L966 (HANSMAN LAKE 650S - PEMUKAN 932S)
MON, MAR 15 2021 23:37

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

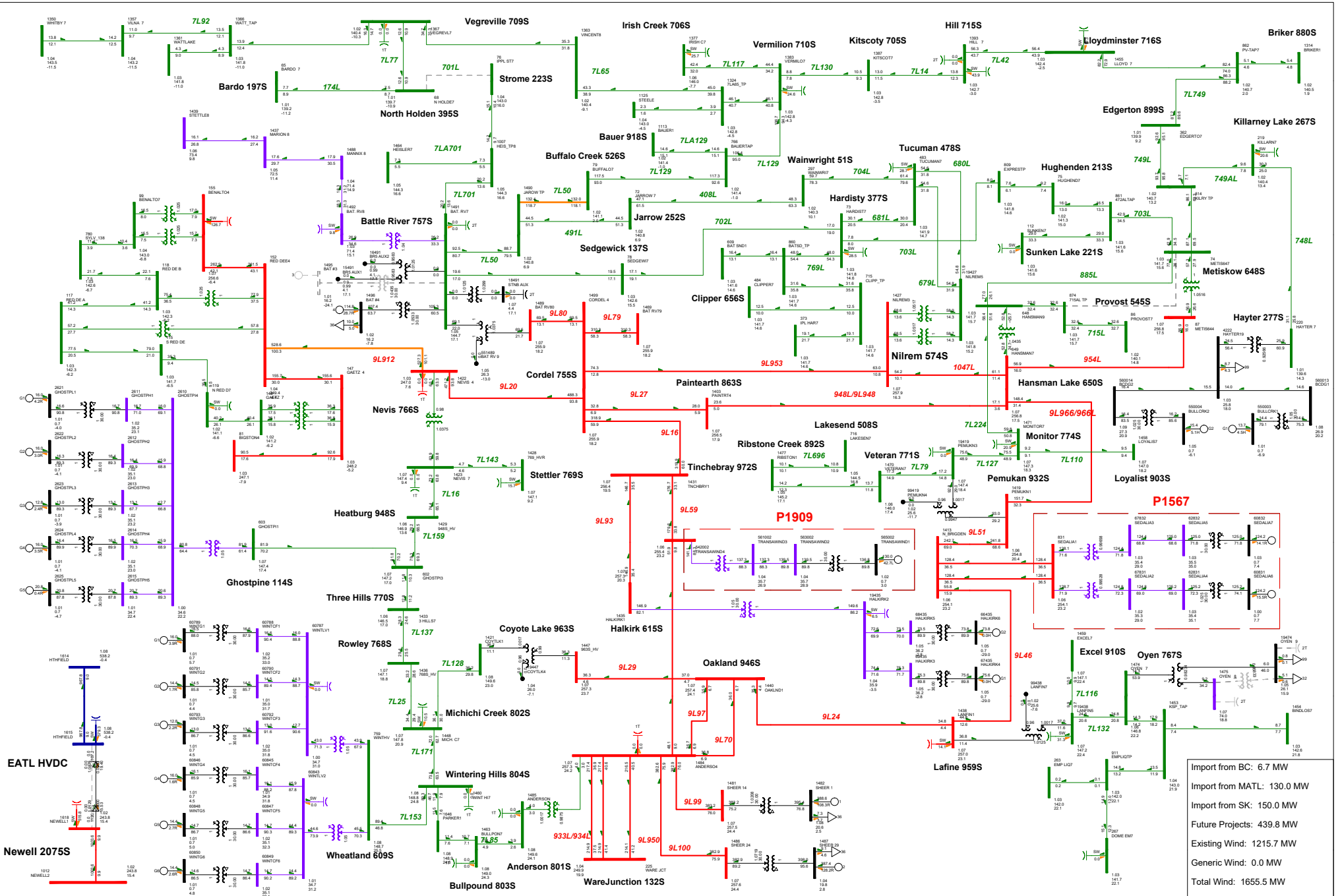


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

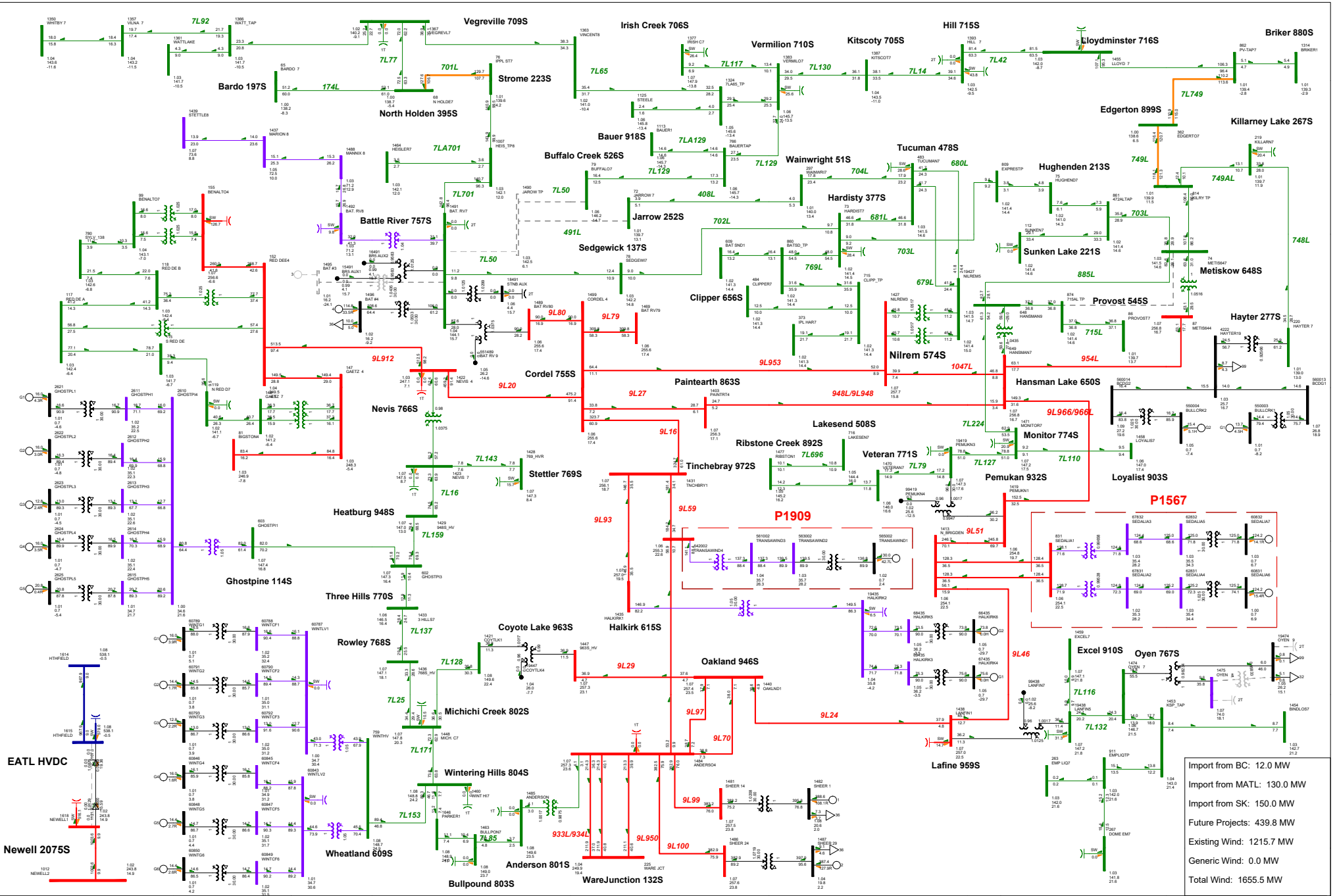
FIGURE B-11-9: P1909_SP_POST_SEN_2021
CATEGORY B - 7L77 (NORTH HOLDEN 395S - VEGREVILLE 709S)
MON, MAR 15 2021 23:37

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



TransAlta Garden Plain Wind Farm AESO Project Number: 1909	FIGURE B-11-10: P1909_SP_POST_SEN_2021 CATEGORY B - 701L (NORTH HOLDEN 395S- STROME 223S) MON, MAR 15 2021 23:37	Bus - Voltage (kV/pu)/Angle Branch - MVA/% Rate A Equipment - MW/Mvar 100.0%Rate A 1.2000V/ 0.900UV kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

Import from BC: 6.7 MW
Import from MATL: 130.0 MW
Import from SK: 150.0 MW
Future Projects: 439.8 MW
Existing Wind: 1215.7 MW
Generic Wind: 0.0 MW
Total Wind: 1655.5 MW

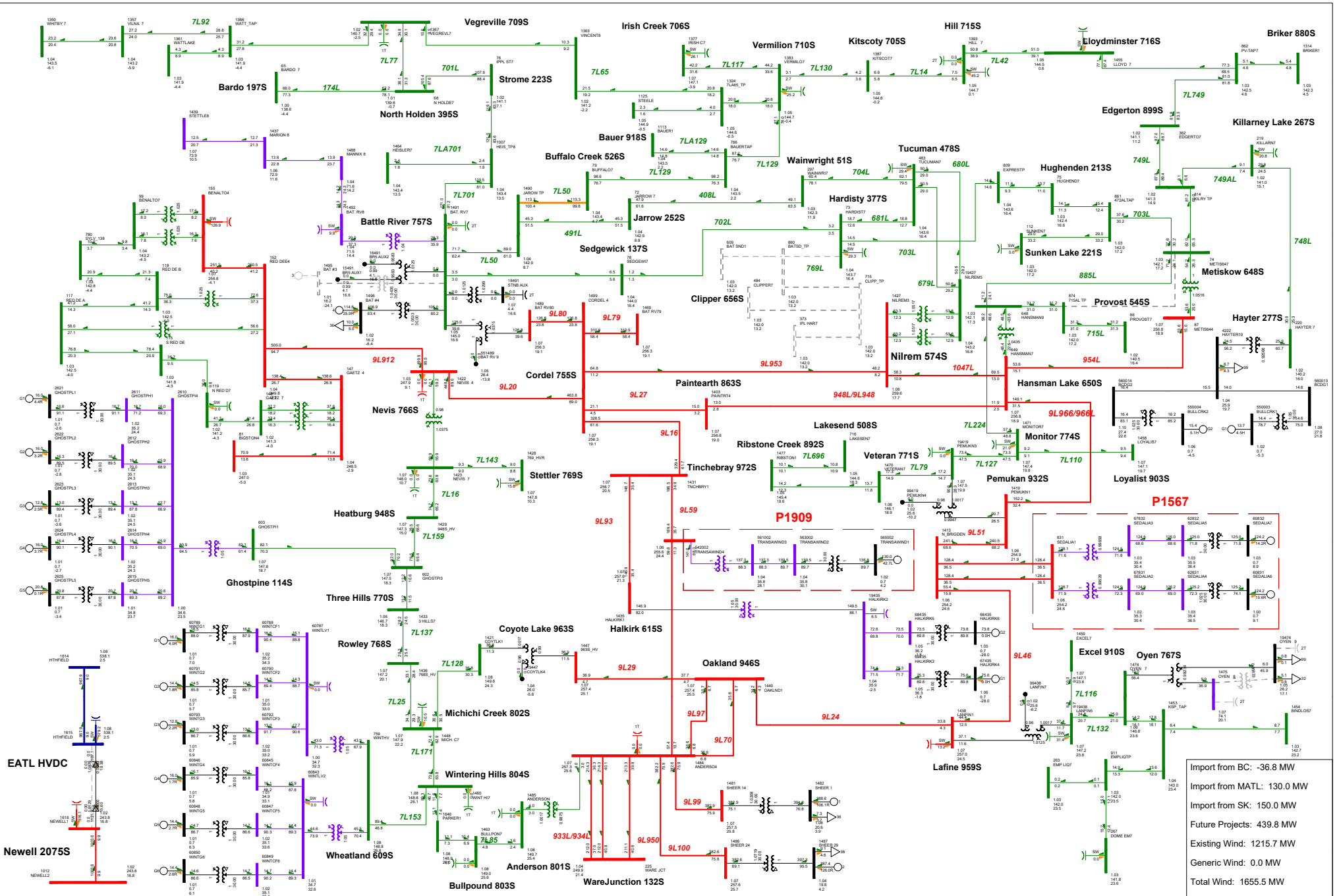


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-11: P1909_SP_POST_SEN_2021
CATEGORY B - 7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)
MON, MAR 15 2021 23:38

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

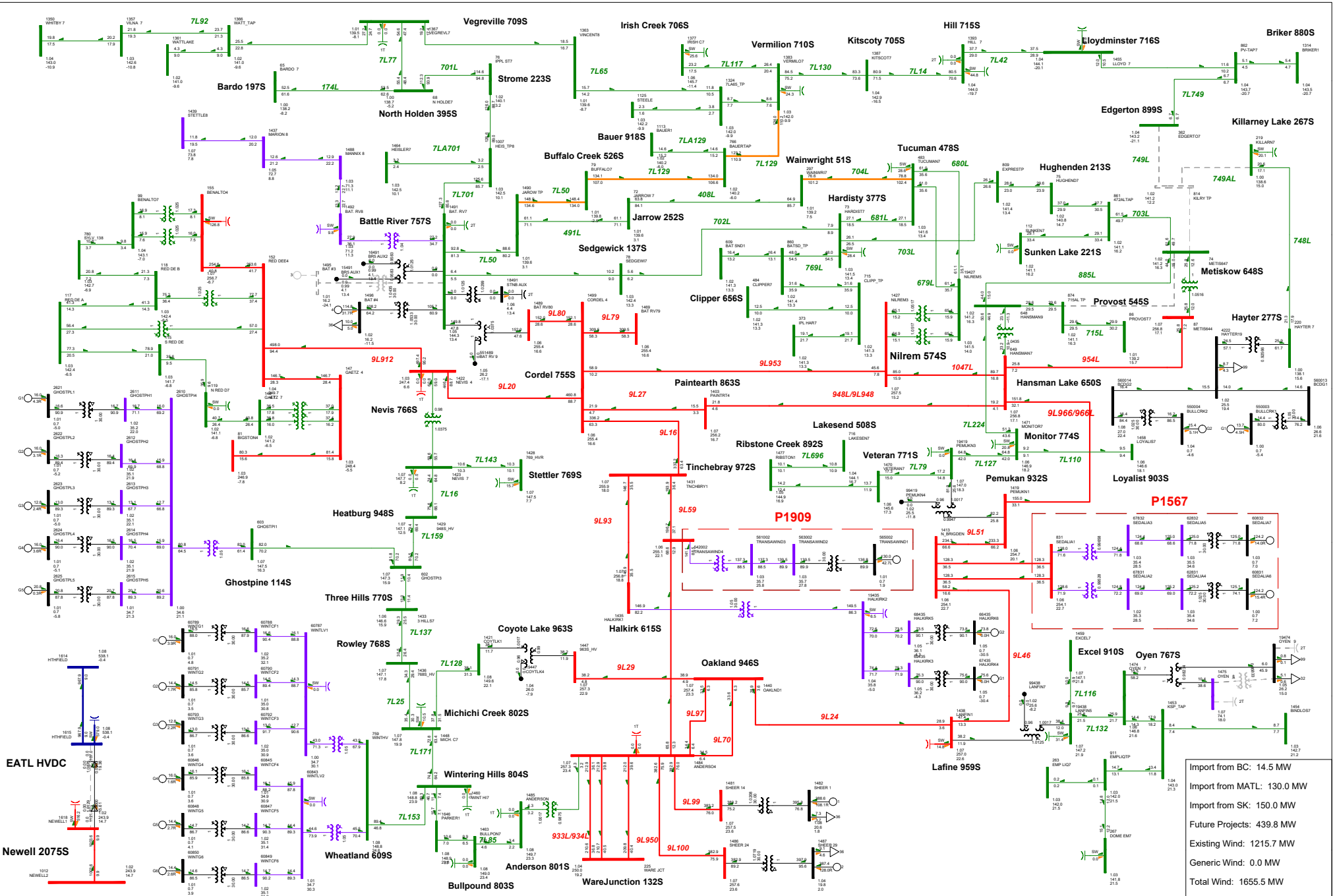


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-12: P1909_SP_POST_SEN_2021
CATEGORY B - 769L/769AL (Hardisty 377S to Clipper 656S/Rosyth 296S)
MON, MAR 15 2021 23:39

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

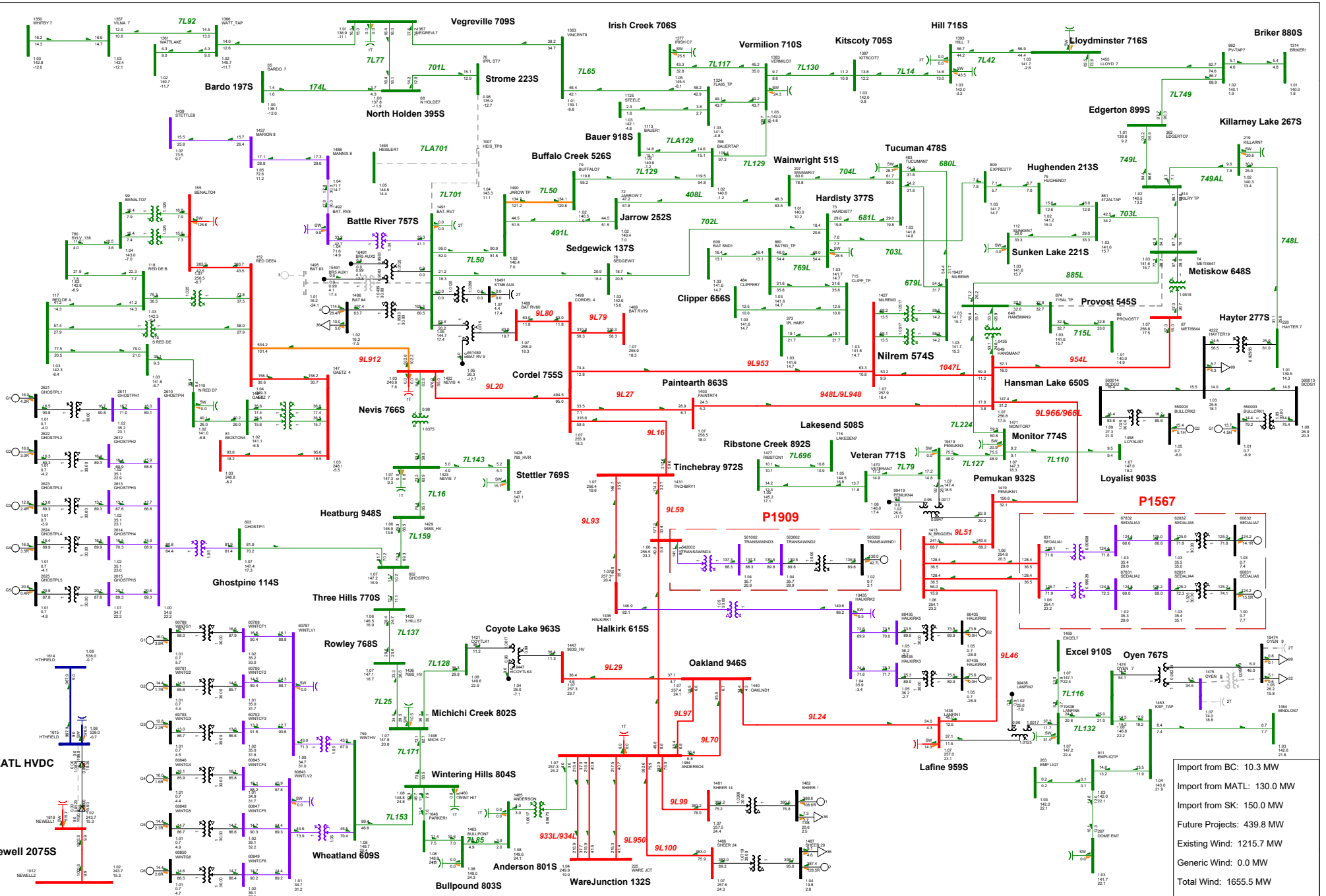


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-13: P1909_SP_POST_SEN_2021
CATEGORY B - 749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)
MON, MAR 15 2021 23:39

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

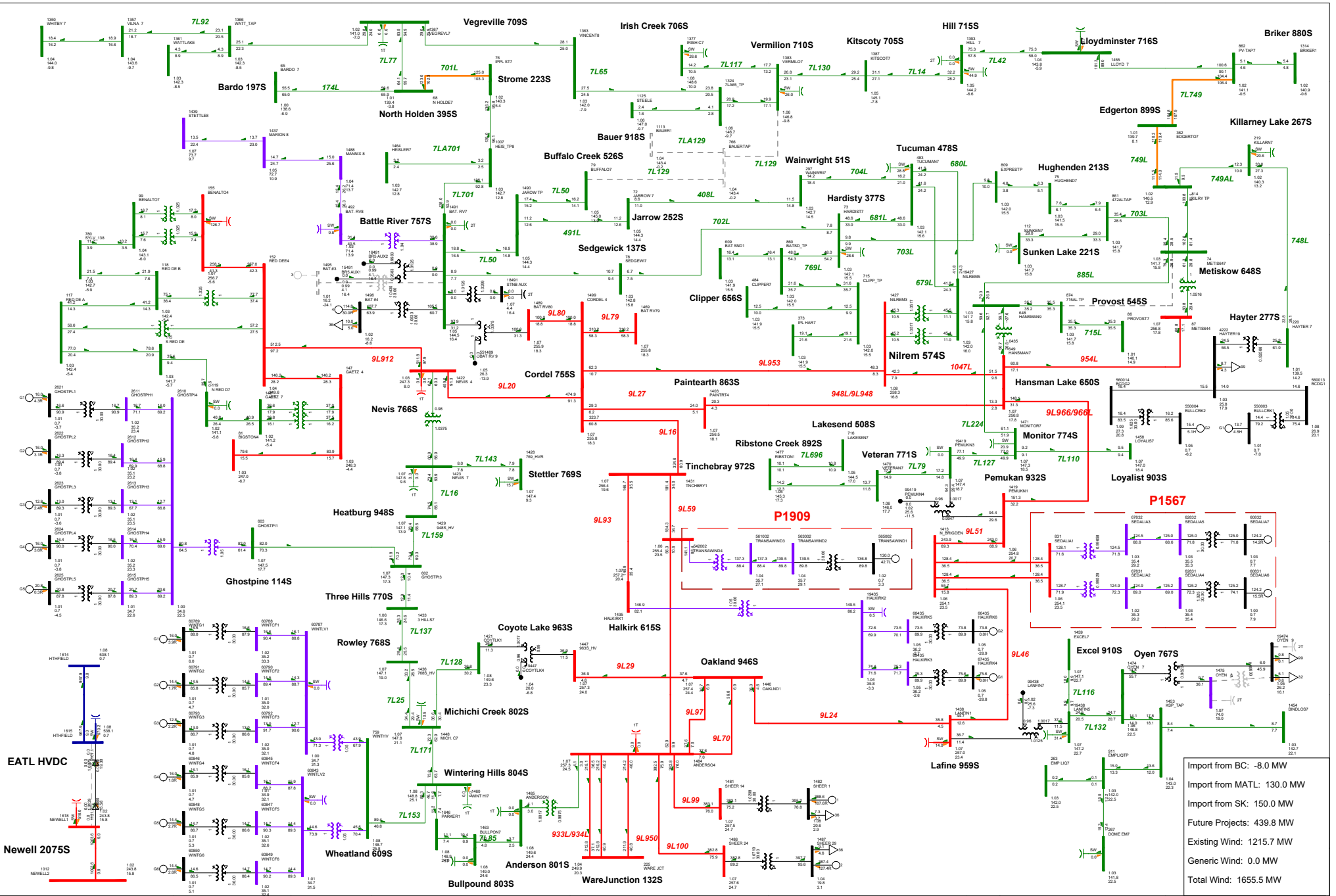


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-14: P1909_SP_POST_SEN_2021
CATEGORY B - 7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)
MON, MAR 15 2021 23:39

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

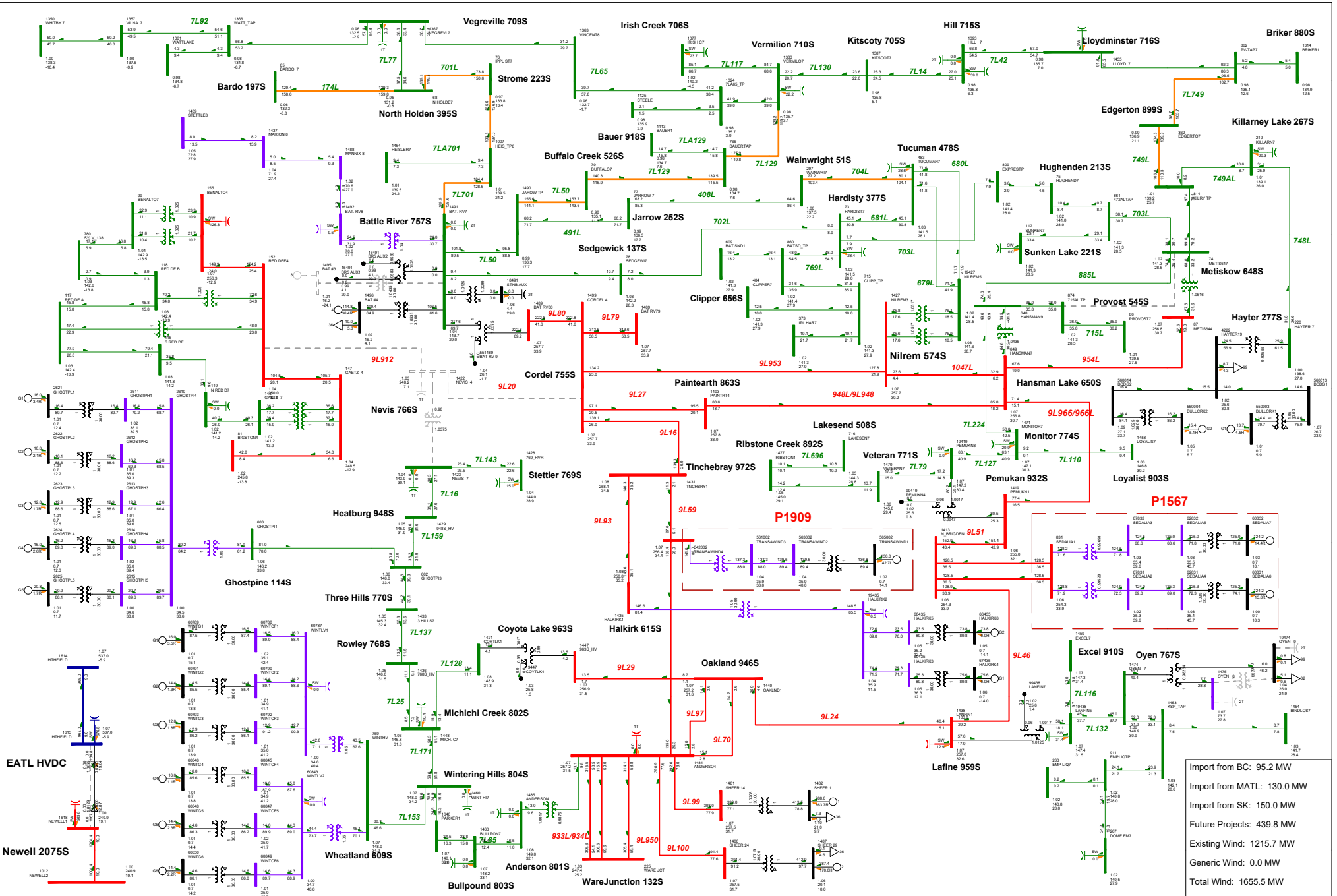


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-15: P1909_SP_POST_SEN_2021
CATEGORY B - 7L129 (Vermilion 710S to Bauer 918S/Buffalo Creek 526S)
MON, MAR 15 2021 23:40

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

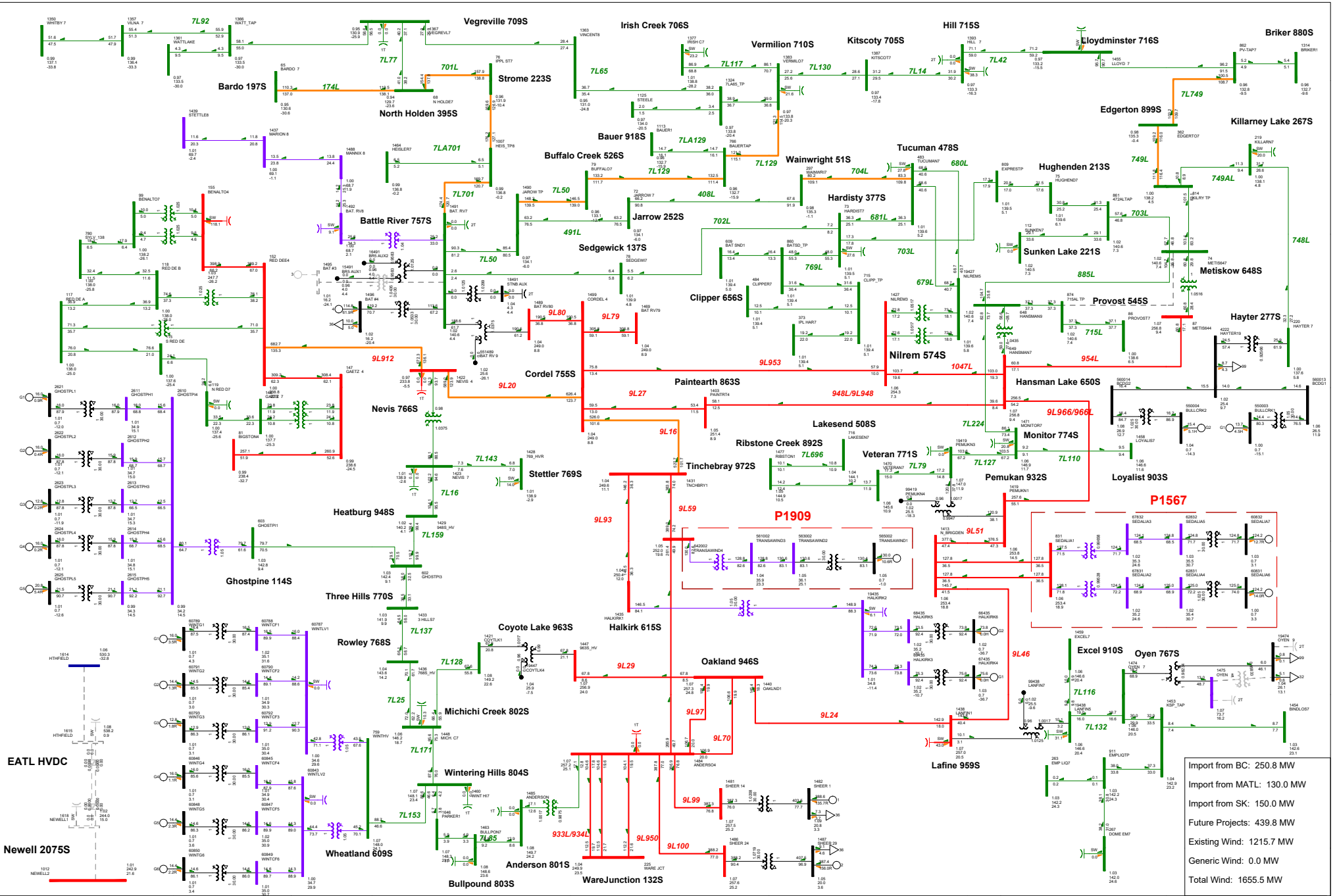


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-16: P1909_SP_POST_SEN_2021
CATEGORY B - 766S901T (NEVIS 766S 240/138 KV TRANSFORMER)
MON, MAR 15 2021 23:40

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

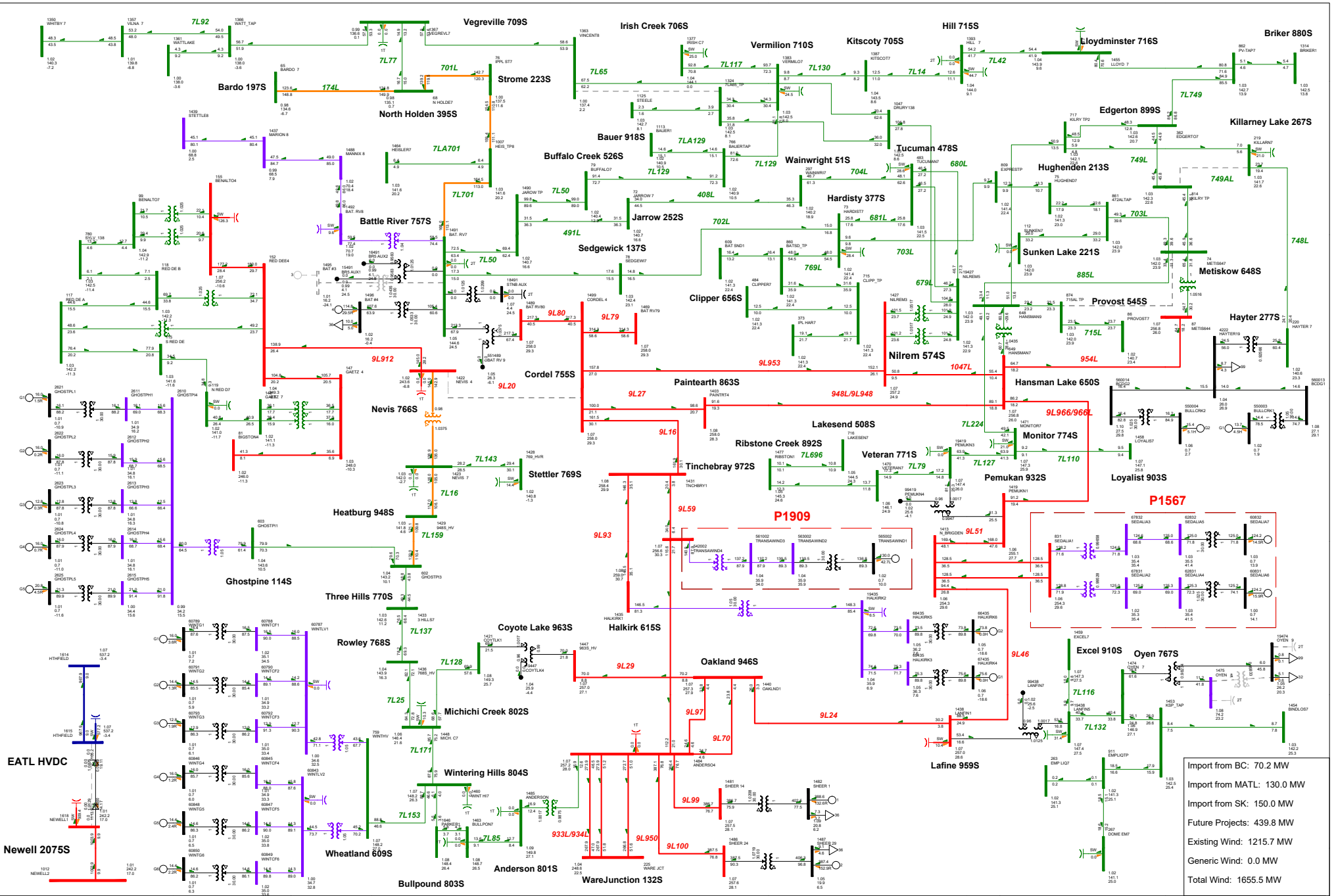


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-17: P1909_SP_POST_SEN_2021
CATEGORY B - EATL HVDC
TUE, MAR 16 2021 17:56

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

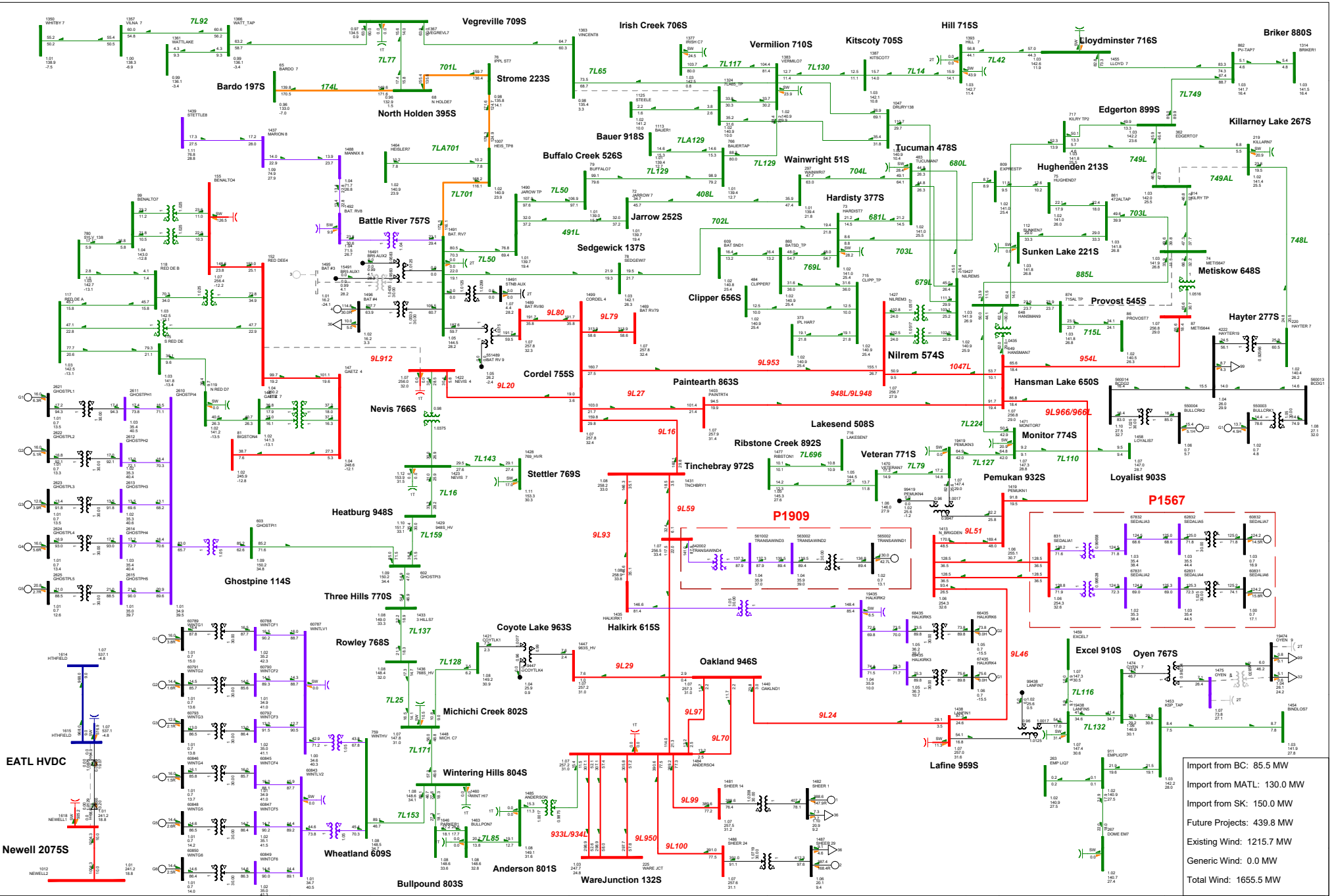


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-12-1: P1909_SP_POST_PENV_2021
CATEGORY B - 9L20 (NEVIS 766S - CORDEL 755S)
MON, MAR 15 2021 23:46

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

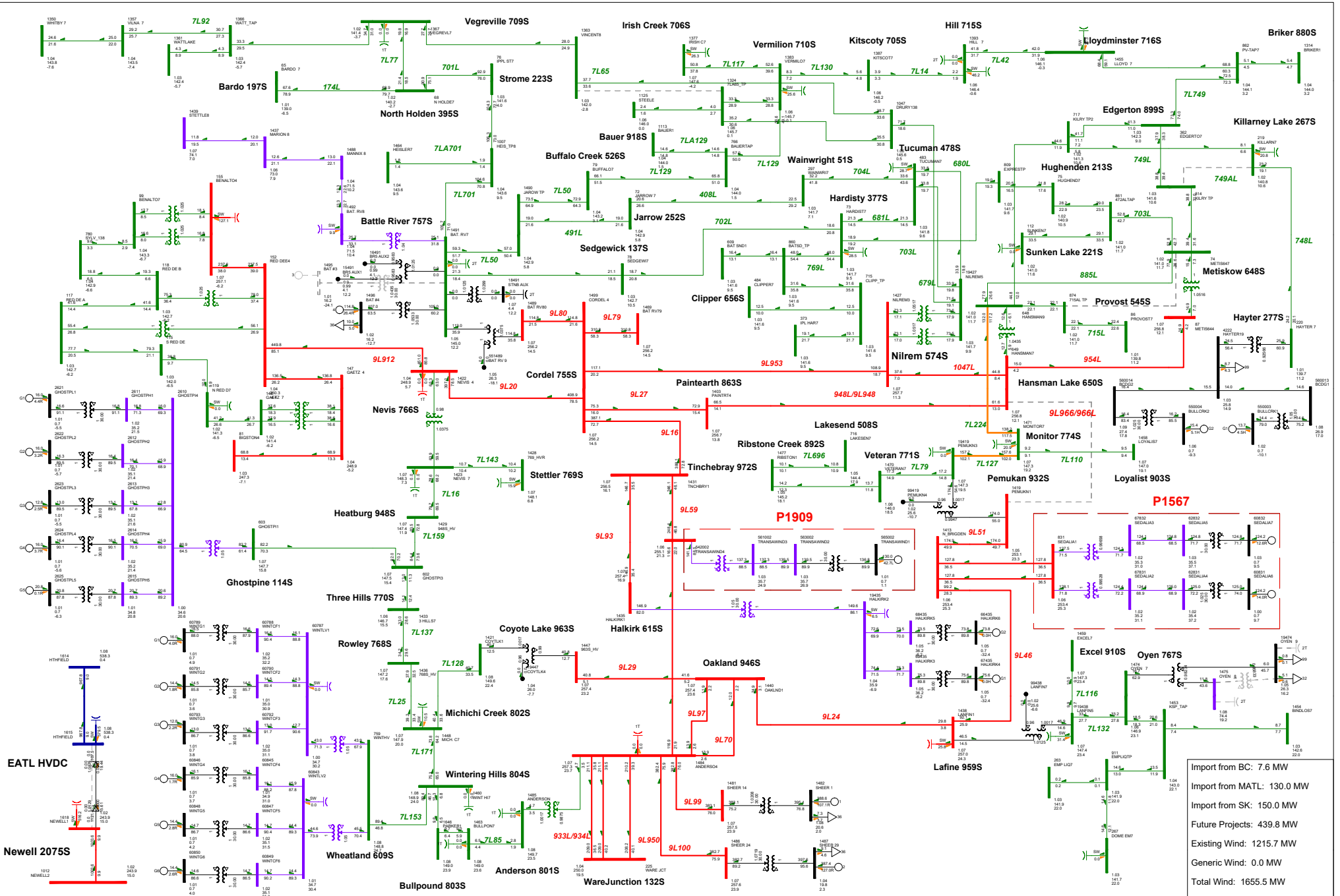


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-12-2: P1909_SP_POST_PENV_2021
CATEGORY B - 912L/9L912 (RED DEER 63S - NEVIS 766S)
MON, MAR 15 2021 23:47

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

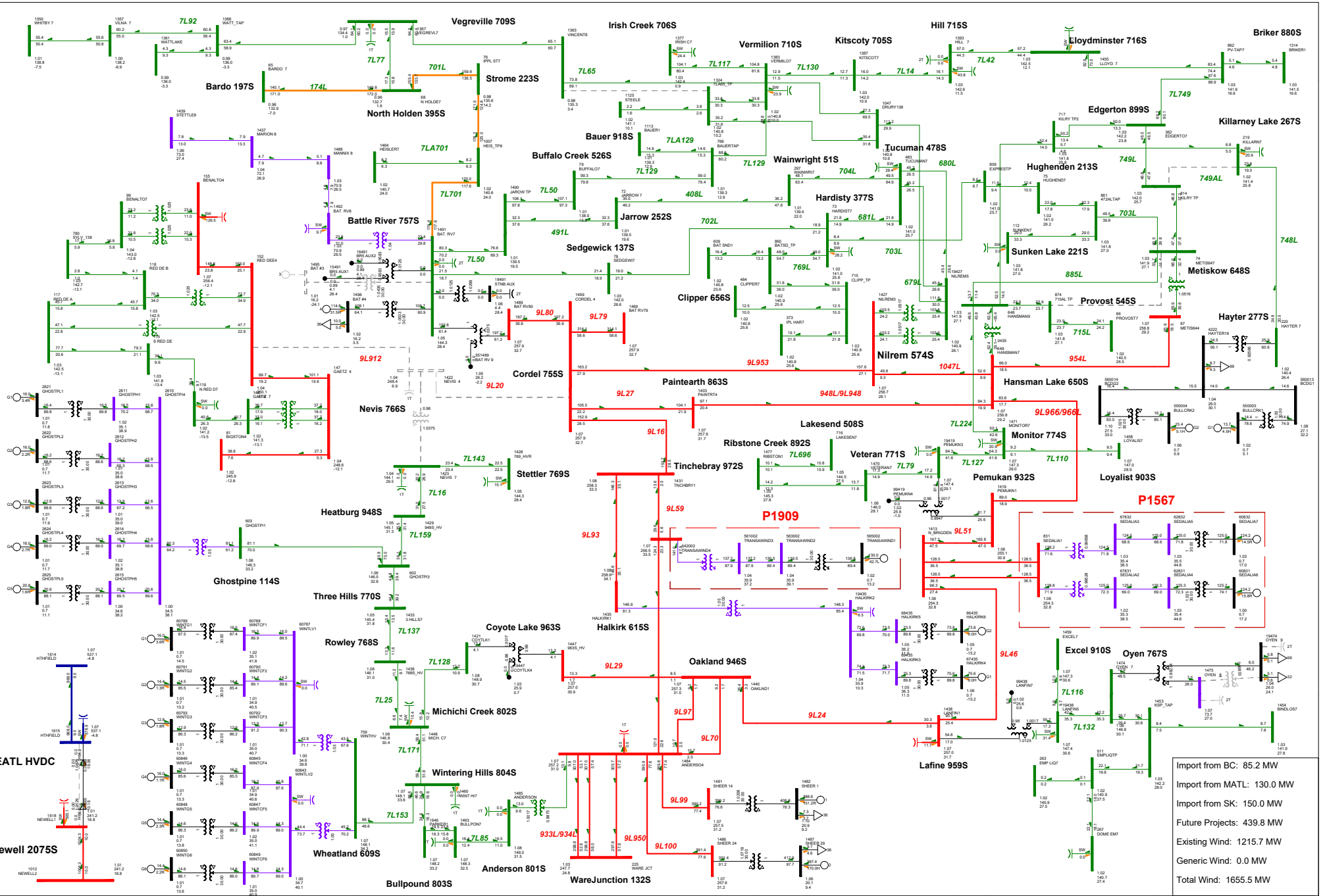


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-12-3: P1909_SP_POST_PENV_2021
CATEGORY B - 966L/9L966 (HANSMAN LAKE 650S - PEMUKAN 932S)
MON, MAR 15 2021 23:47

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

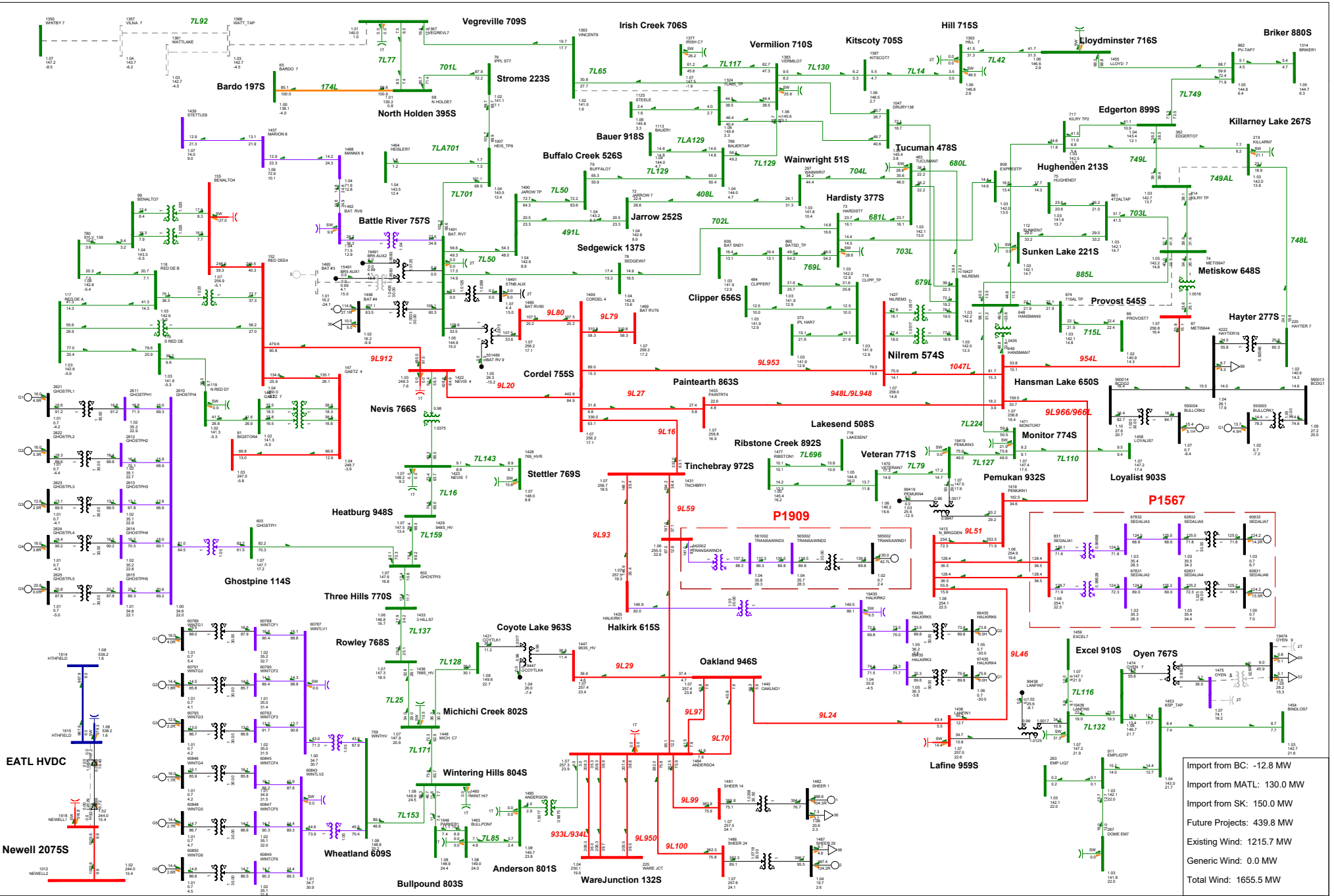


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-12-4: P1909_SP_POST_PENV_2021
CATEGORY B - 766S901T (NEVIS 766S 240/138 KV TRANSFORMER)
MON, MAR 15 2021 23:47

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



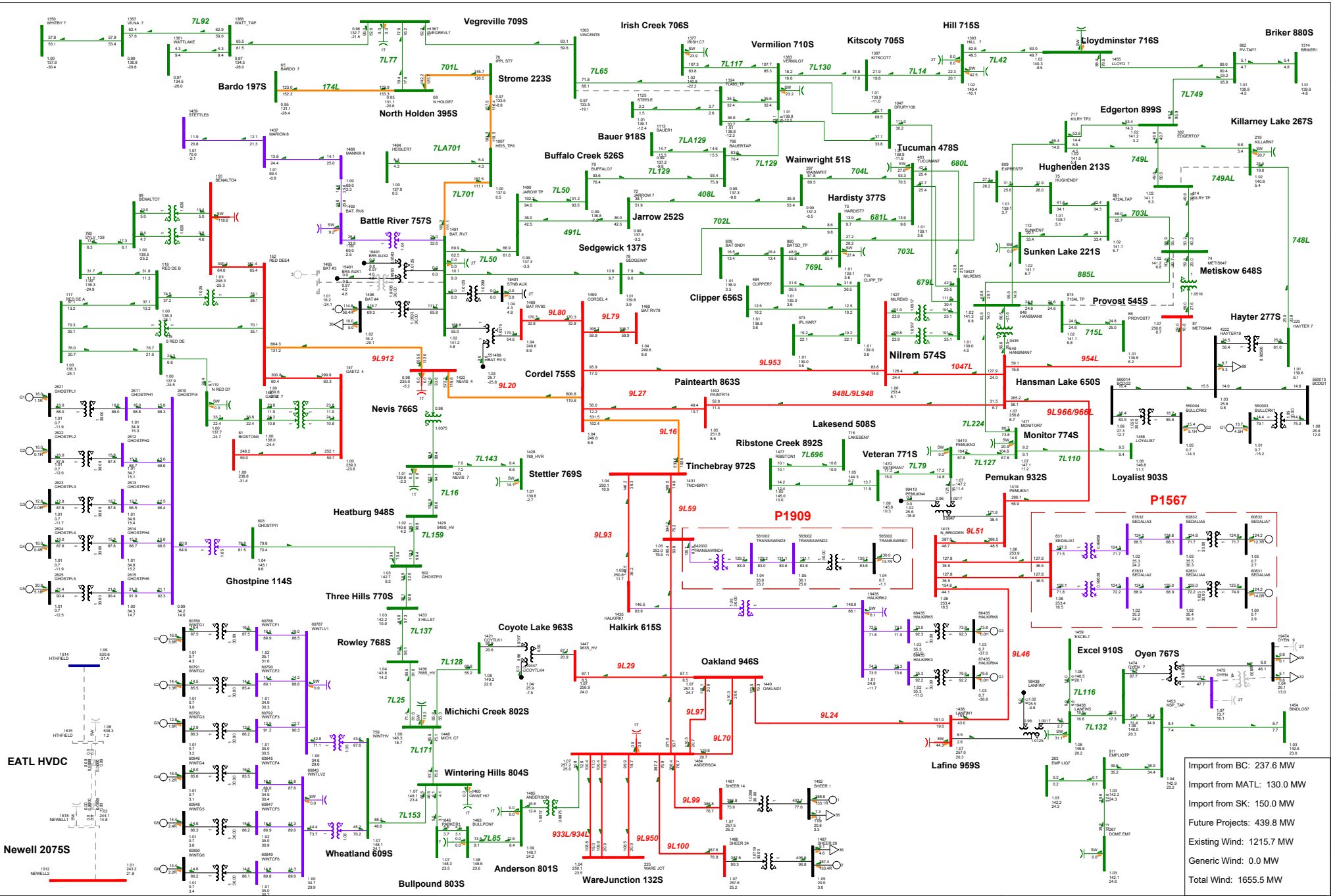
Import from BC: -12.8 MW
Import from MATL: 130.0 MW
Import from SK: 150.0 MW
Future Projects: 439.8 MW
Existing Wind: 1215.7 MW
Generic Wind: 0.0 MW
Total Wind: 1655.5 MW

TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-12-5: P1909_SP_POST_PENV_2021
CATEGORY B - 7L92 (Vegreville 709S to Vilna 777S/Watt Lake 956S/A819S WHITBY LAKE)
MON, MAR 15 2021 23:48

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

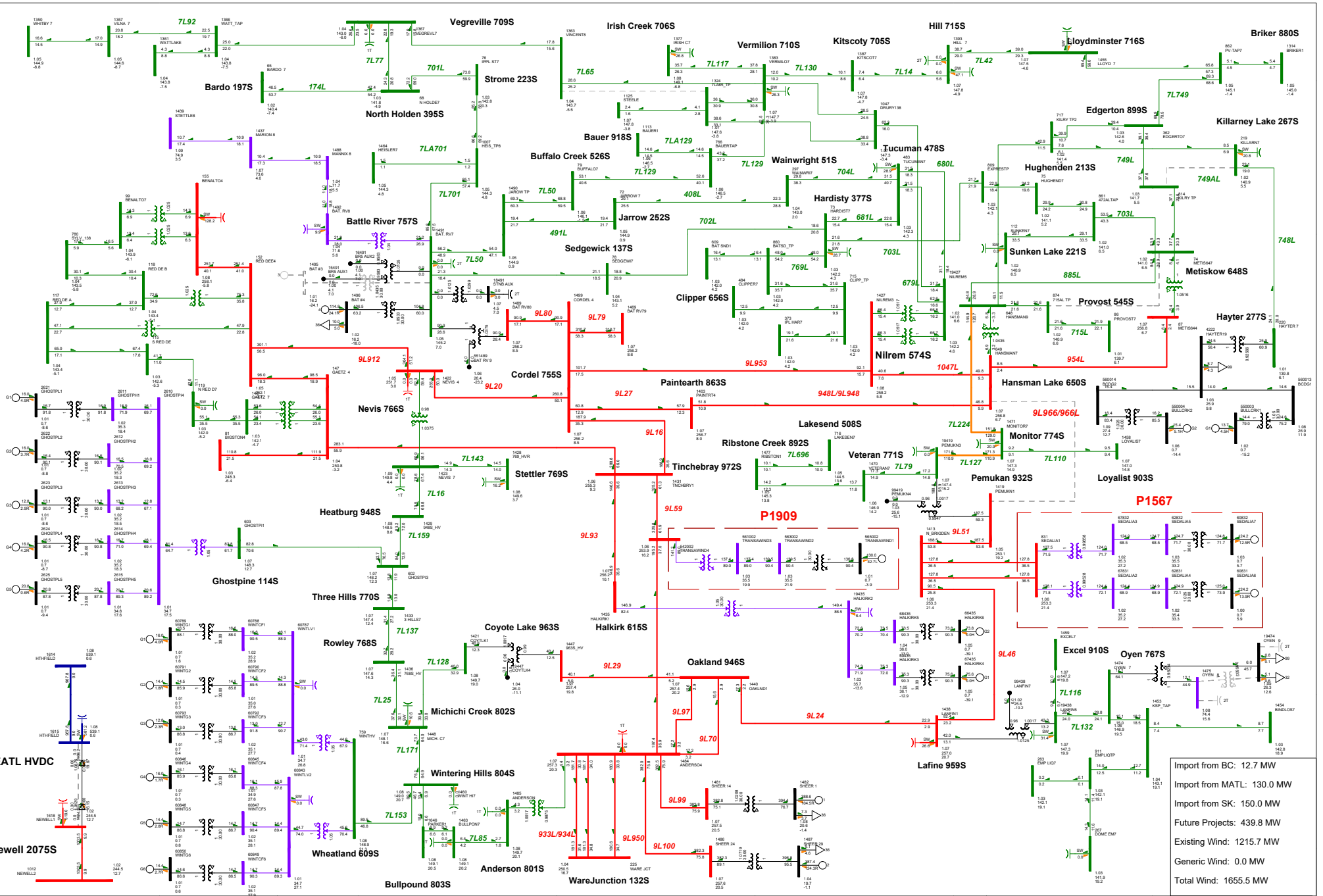


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-12-6: P1909_SP_POST_PENV_2021
CATEGORY B - EATL HVDC
TUE, MAR 16 2021 17:54

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

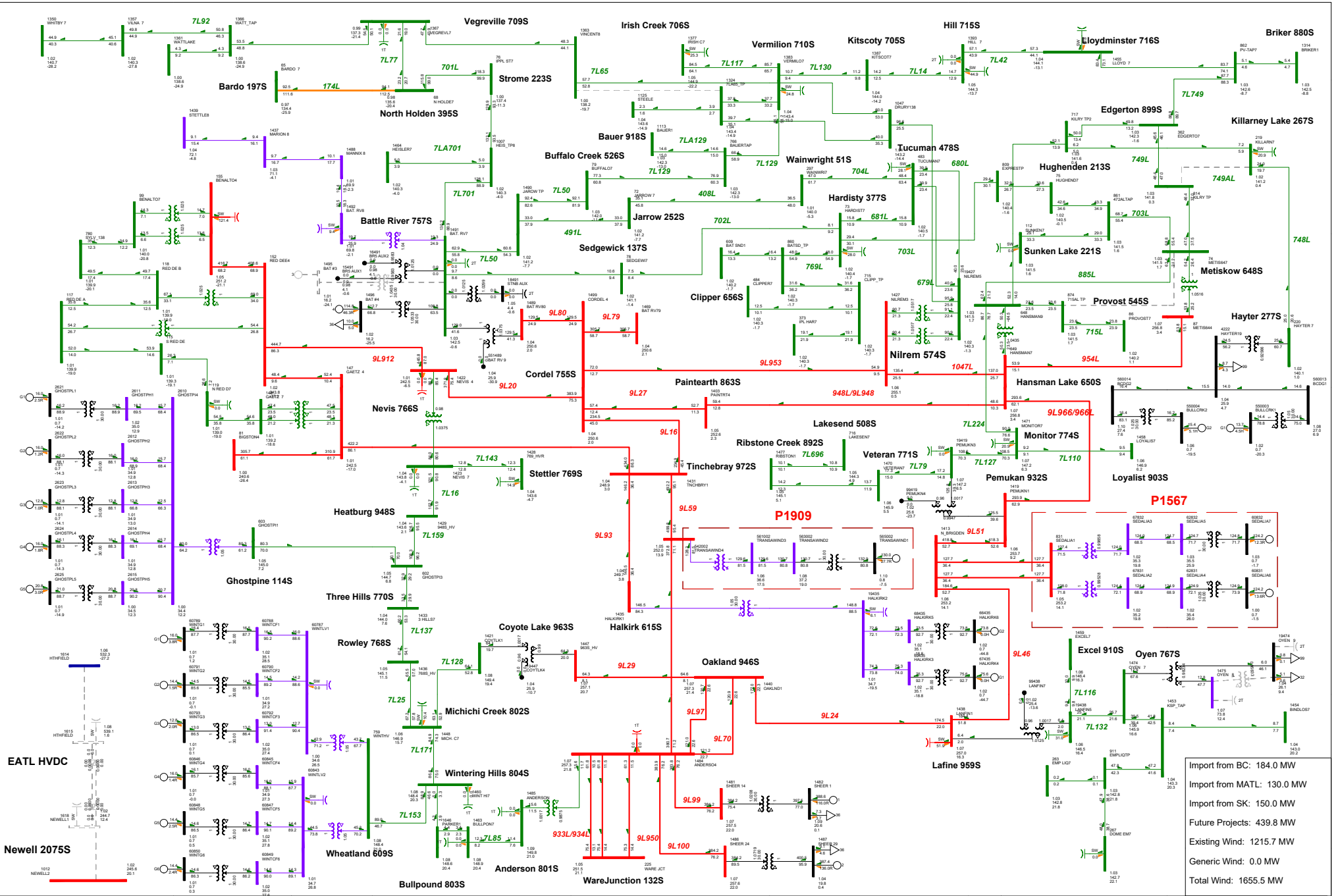


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-13-1: P1909_SP_POST_PENV_CETO_2021
CATEGORY B - 966L/9L966 (HANSMAN LAKE 650S - PEMUKAN 932S)
MON, MAR 15 2021 23:50

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-13-2: P1909_SP_POST_PENV_CETO_2021
CATEGORY B - EATL HVDC
TUE, MAR 16 2021 17:55

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

Attachment A4
Post-Project Transient Stability Diagrams

Attachment A4 - Post-Project Transient Stability Diagrams (2020 Winter Peak Post Project) Index

9L16 (Cordel 755S – Tincherbray 972S) Fault at Cordel 755S 1

9L16 (Cordel 755S – Tincherbray 972S) Fault at Tincherbray 972S 3

9L20 (Cordel 755S – Nevis 766S) Fault at Cordel 755S 5

9L20 (Cordel 755S – Nevis 766S) Fault at Nevis 766S 7

9L24 (Oakland 946S – Lanfine 959S) Fault at Lanfine 959S 10

9L24 (Oakland 946S – Lanfine 959S) Fault at Oakland 946S 12

9L29 (Oakland 946S to Coyote Lake 963S) Fault at Coyote Lake 963S 14

9L29 (Oakland 946S to Coyote Lake 963S) Fault at Oakland 946S 16

9L59 (Tinchebray 972S – Anderson 801S) Fault at Anderson 801S 19

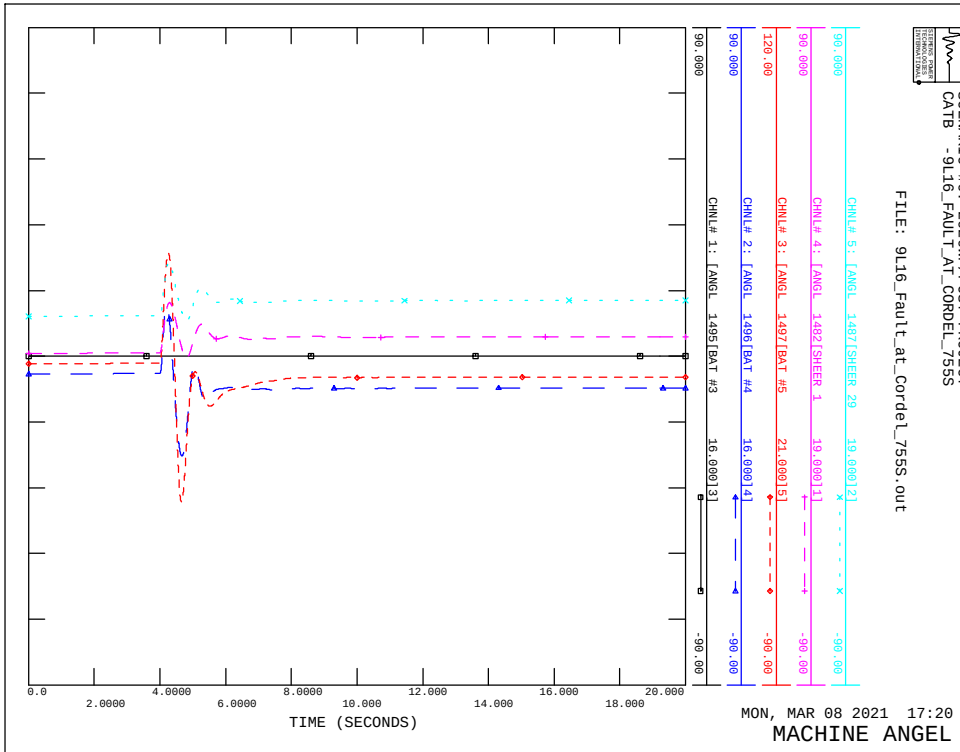
9L59 (Tinchebray 972S – Anderson 801S) Fault at Tinchebray 972S 21

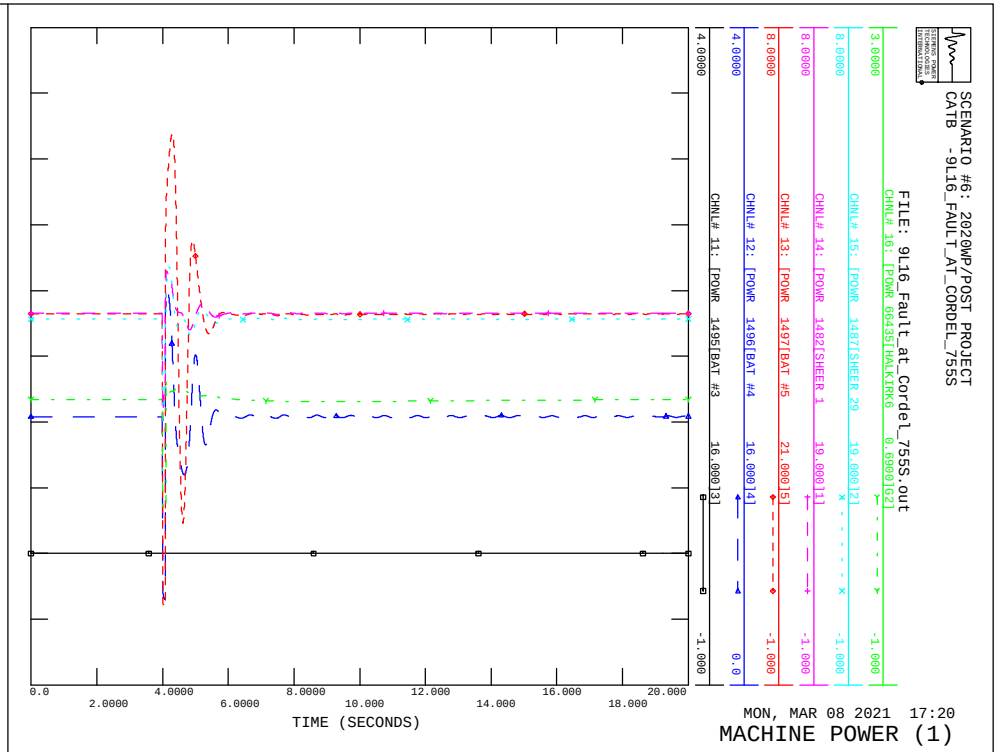
9L966 (Pemukan 932S – Hansman Lake 650S) Fault at Hansman Lake 650S 23

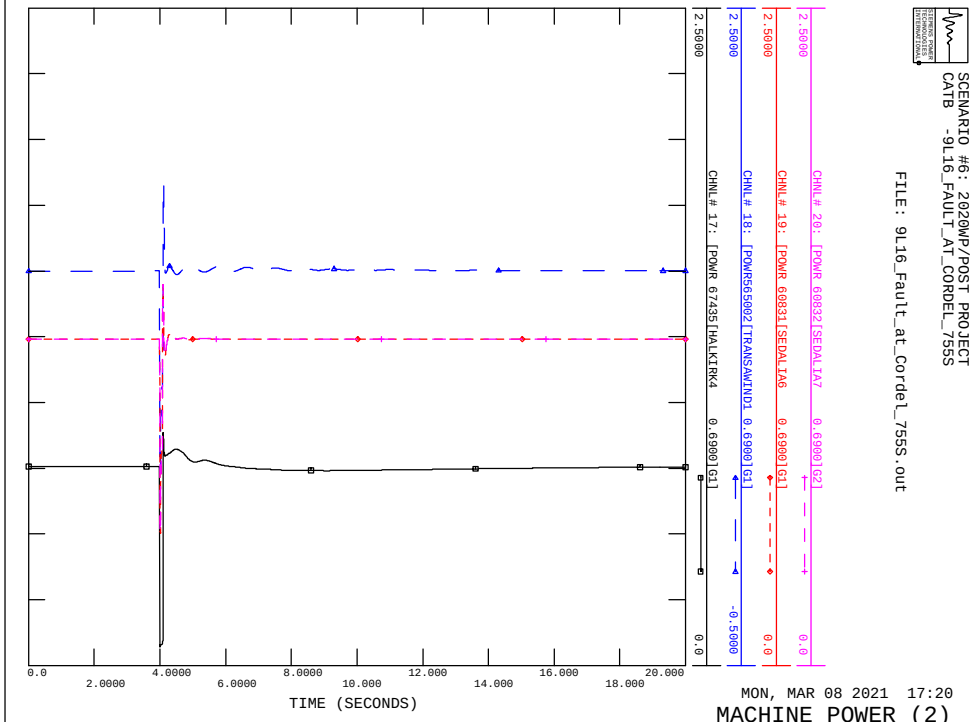
9L966 (Pemukan 932S – Hansman Lake 650S) Fault at Pemukan 932S 25

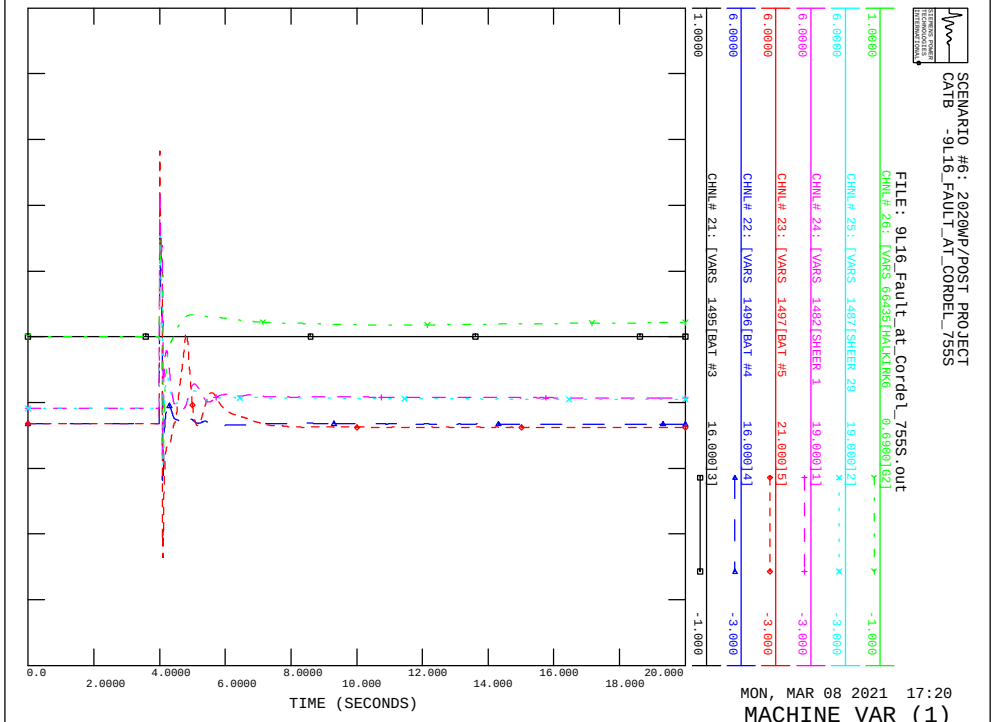
912L/9L912 (Red Deer 63S – Nevis 766S) Fault at Nevis 766S 28

912L/9L912 (Red Deer 63S – Nevis 766S) Fault at Red Deer 63S 30


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L16_FAULT_AT_CORDEL_755S
FILE: 9L16_Fault_at_Cordel_755S.out
CHNL# 1: [ANGL 1495]BAT #3 16.000[3] -90.00
CHNL# 2: [ANGL 1496]BAT #4 16.000[4] -90.00
CHNL# 3: [ANGL 1497]BAT #5 21.000[5] -90.00
CHNL# 4: [ANGL 1482]SHEER 1 19.000[1] -90.00
CHNL# 5: [ANGL 1487]SHEER 29 19.000[2] -90.00
TIME (SECONDS)
MON, MAR 08 2021 17:20
MACHINE ANGEL


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L16_FAULT_AT_CORDEL_755S
FILE: 9L16_Fault_at_Cordel_755S.out
CHNL# 11: [POWR 1495]BAT #3 16.000[3] -1.000
CHNL# 12: [POWR 1496]BAT #4 16.000[4] 0.0
CHNL# 13: [POWR 1497]BAT #5 21.000[5] -1.000
CHNL# 14: [POWR 1482]SHEER 1 19.000[1] -1.000
CHNL# 15: [POWR 1487]SHEER 29 19.000[2] -1.000
CHNL# 16: [POWR 66435]HALKIRK6 0.6900[G2] -1.000
TIME (SECONDS)
MON, MAR 08 2021 17:20
MACHINE POWER (1)


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L16_FAULT_AT_CORDEL_755S
FILE: 9L16_Fault_at_Cordel_755S.out
CHNL# 17: [POWR 67435]HALKIRK4 0.6900[G1] 0.0
CHNL# 18: [POWR56502]TRANSAWIND1 0.6900[G1] -0.5000
CHNL# 19: [POWR 60831]SEDALIA6 0.6900[G1] 0.0
CHNL# 20: [POWR 60832]SEDALIA7 0.6900[G2] 0.0
TIME (SECONDS)
MON, MAR 08 2021 17:20
MACHINE POWER (2)


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L16_FAULT_AT_CORDEL_755S
FILE: 9L16_Fault_at_Cordel_755S.out
CHNL# 21: [VARS 1495]BAT #3 16.000[3] -1.000
CHNL# 22: [VARS 1496]BAT #4 16.000[4] -3.000
CHNL# 23: [VARS 1497]BAT #5 21.000[5] -3.000
CHNL# 24: [VARS 1482]SHEER 1 19.000[1] -3.000
CHNL# 25: [VARS 1487]SHEER 29 19.000[2] -3.000
CHNL# 26: [VARS 66435]HALKIRK6 0.6900[G2] -1.000
TIME (SECONDS)
MON, MAR 08 2021 17:20
MACHINE VAR (1)

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L16_FAULT_AT_CORDEL_755S

FILE: 9L16_Fault_at_Cordel_755S.out

MON, MAR 08 2021 17:20

BUS VOLTAGE (1)

CHNL# 37: [VOLT 1440 [OAKLND1 240.00]]
CHNL# 36: [VOLT 1431 [TNCHBRY1 240.00]]
CHNL# 35: [VOLT 1403 [PAINTRT4 240.00]]
CHNL# 34: [VOLT 1499 [CORDEL 4 240.00]]
CHNL# 33: [VOLT 1423 [NEVIS 7 138.00]]
CHNL# 31: [VOLT 152 [RED DEE4 240.00]]

1.5000 -0.5000

0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

TIME (SECONDS)

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L16_FAULT_AT_CORDEL_755S

FILE: 9L16_Fault_at_Cordel_755S.out

MON, MAR 08 2021 17:20

LINE POWER

CHNL# 75: [POWR 1440 TO 1447 CKT '29']
CHNL# 83: [POWR 152 TO 1422 CKT '12']
CHNL# 77: [POWR 1422 TO 1499 CKT '20']
CHNL# 79: [POWR 1431 TO 1499 CKT '16']
CHNL# 87: [POWR 1484 TO 542002 CKT '35']
CHNL# 85: [POWR 1431 TO 542002 CKT '59']

100.00 -100.0
400.00 -900.0
200.00 -800.0
600.00 -100.0
300.00 -400.0
200.00 -400.0

0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

TIME (SECONDS)

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L16_FAULT_AT_CORDEL_755S

FILE: 9L16_Fault_at_Cordel_755S.out

MON, MAR 08 2021 17:20

MACHINE VAR (2)

CHNL# 30: [VARS 60832[SEDALIA7 0.6900]G2]
CHNL# 29: [VARS 60831[SEDALIA6 0.6900]G1]
CHNL# 28: [VARS565002[TRANSAWIND1 0.6900]G1]
CHNL# 27: [VARS 67435[HALKIRK4 0.6900]G1]

1.5000 -1.000

0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

TIME (SECONDS)

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L16_FAULT_AT_CORDEL_755S

FILE: 9L16_Fault_at_Cordel_755S.out

MON, MAR 08 2021 17:20

BUS VOLTAGE (2)

CHNL# 47: [VOLT 1484 [ANDERSO4 240.00]]
CHNL# 46: [VOLT 1413 [N_BRIGDEN 240.00]]
CHNL# 45: [VOLT 649 [HANSMAN7 240.00]]
CHNL# 42: [VOLT 1419 [PEMUKN1 240.00]]
CHNL# 40: [VOLT 1438 [LANFIN1 240.00]]
CHNL# 38: [VOLT 1447 [963S_HV 240.00]]

1.5000 -0.5000

0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

TIME (SECONDS)

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L16_FAULT_AT_TINCHEBRAY_972S

FILE: 9L16_Fault_at_Tinchebray_972S.out

MON, MAR 08 2021 17:20

MACHINE ANGEL

CHNL# 5: [ANGL 1487[SHEER 29 19.000]2]
90.000 -90.00

CHNL# 4: [ANGL 1482[SHEER 1 19.000]1]
90.000 -90.00

CHNL# 3: [ANGL 1497[BAT #5 21.000]5]
120.00 -90.00

CHNL# 2: [ANGL 1496[BAT #4 16.000]4]
90.000 -90.00

CHNL# 1: [ANGL 1495[BAT #3 16.000]3]
90.000 -90.00

0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

TIME (SECONDS)

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L16_FAULT_AT_TINCHEBRAY_972S

FILE: 9L16_Fault_at_Tinchebray_972S.out

MON, MAR 08 2021 17:20

MACHINE POWER (2)

CHNL# 20: [POWR 60832[SEDALIA7 0.6900]G2]
2.5000 0.0

CHNL# 19: [POWR 60831[SEDALIA6 0.6900]G1]
2.5000 0.0

CHNL# 18: [POWR565002[TRANSAWIND1 0.6900]G1]
2.5000 -0.5000

CHNL# 17: [POWR 67435[HALKIRK4 0.6900]G1]
2.5000 0.0

0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

TIME (SECONDS)

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L16_FAULT_AT_CORDEL_755S

FILE: 9L16_Fault_at_Cordel_755S.out

MON, MAR 08 2021 17:20

LINE VAR

CHNL# 76: [VARS 1440 TO 1447 CKT '29']
100.00 -100.0

CHNL# 84: [VARS 152 TO 1422 CKT '12']
1200.0 -150.0

CHNL# 78: [VARS 1422 TO 1499 CKT '20']
600.00 -400.0

CHNL# 80: [VARS 1431 TO 1499 CKT '16']
450.00 -650.0

CHNL# 88: [VARS 1484 TO 542002 CKT '35']
1200.0 -250.0

CHNL# 86: [VARS 1431 TO 542002 CKT '59']
700.00 -450.0

0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

TIME (SECONDS)

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L16_FAULT_AT_TINCHEBRAY_972S

FILE: 9L16_Fault_at_Tinchebray_972S.out

MON, MAR 08 2021 17:20

MACHINE POWER (1)

CHNL# 16: [POWR 66435[HALKIRK6 0.6900]G2]
3.0000 -1.000

CHNL# 15: [POWR 1487[SHEER 29 19.000]2]
8.0000 -1.000

CHNL# 14: [POWR 1482[SHEER 1 19.000]1]
8.0000 -1.000

CHNL# 13: [POWR 1497[BAT #5 21.000]5]
8.0000 -1.000

CHNL# 12: [POWR 1496[BAT #4 16.000]4]
4.0000 0.0

CHNL# 11: [POWR 1495[BAT #3 16.000]3]
4.0000 -1.000

0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

TIME (SECONDS)

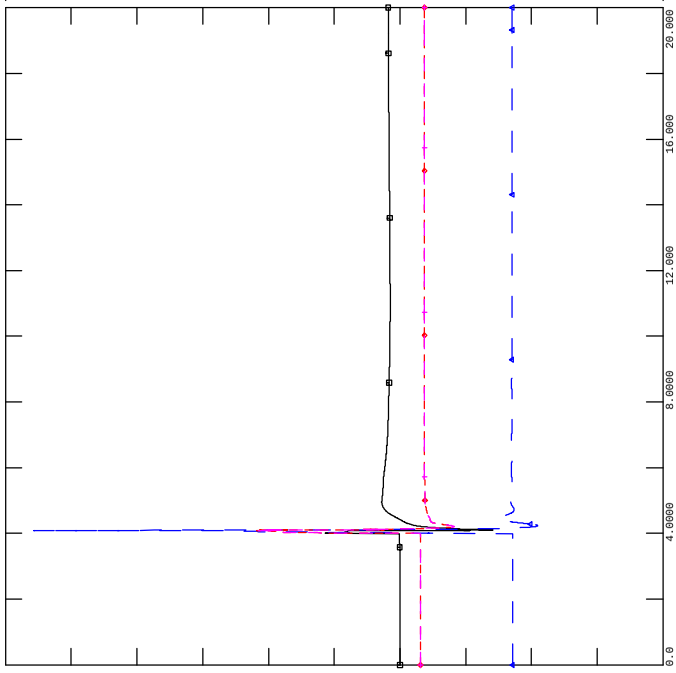
SCENARIO #6: 2020WP/POST PROJECT
CATB -9L16_FAULT_AT_TINCHEBRAY_972S

FILE: 9L16_Fault_at_Tinchebray_972S.out

MON, MAR 08 2021 17:20

MACHINE VAR (2)

CHNL# 30: [VARS 60832[SEDALIA7 0.6900]G2] 1.5000 -1.000
CHNL# 29: [VARS 60831[SEDALIA6 0.6900]G1] 1.5000 -1.000
CHNL# 28: [VARS565002[TRANSAWIND1 0.6900]G1] 1.5000 -1.000
CHNL# 27: [VARS 67435[HALKIRK4 0.6900]G1] 1.5000 -1.000



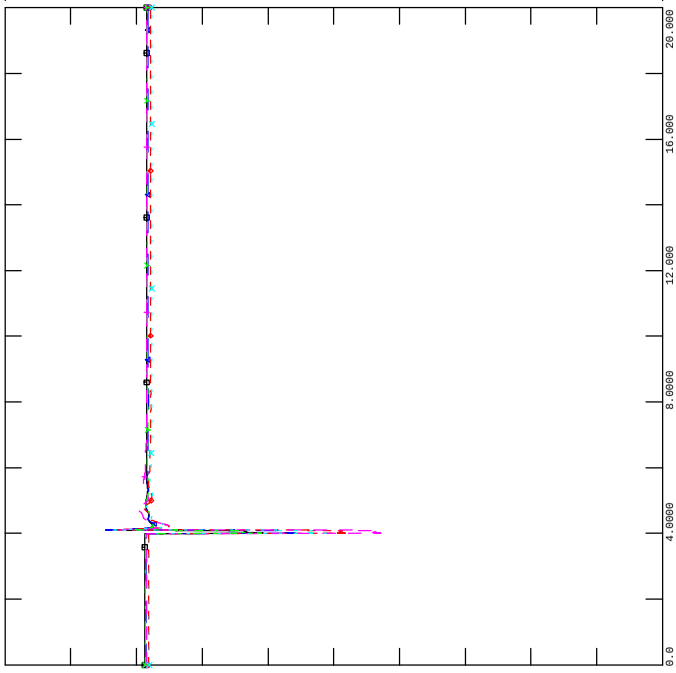
SCENARIO #6: 2020WP/POST PROJECT
CATB -9L16_FAULT_AT_TINCHEBRAY_972S

FILE: 9L16_Fault_at_Tinchebray_972S.out

MON, MAR 08 2021 17:20

BUS VOLTAGE (2)

CHNL# 47: [VOLT 1484 [ANDERSO4 240.00]] 1.5000 -0.5000
CHNL# 46: [VOLT 1413 [N_BRIGDEN 240.00]] 1.5000 -0.5000
CHNL# 45: [VOLT 649 [HANSMAN7 240.00]] 1.5000 -0.5000
CHNL# 42: [VOLT 1419 [PEMUKN1 240.00]] 1.5000 -0.5000
CHNL# 40: [VOLT 1438 [LANFIN1 240.00]] 1.5000 -0.5000
CHNL# 38: [VOLT 1447 [963S_HV 240.00]] 1.5000 -0.5000



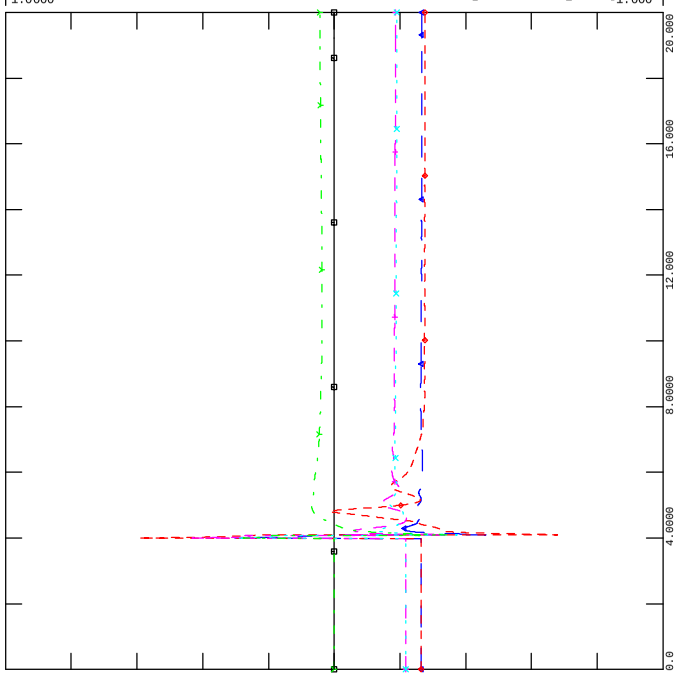
SCENARIO #6: 2020WP/POST PROJECT
CATB -9L16_FAULT_AT_TINCHEBRAY_972S

FILE: 9L16_Fault_at_Tinchebray_972S.out

MON, MAR 08 2021 17:20

MACHINE VAR (1)

CHNL# 26: [VARS 66435[HALKIRK6 0.6900]G2] 1.0000 -1.000
CHNL# 25: [VARS 1487[SHEER 29 19.000]2] 6.0000 -3.000
CHNL# 24: [VARS 1482[SHEER 1 19.000]1] 6.0000 -3.000
CHNL# 23: [VARS 1497[BAT #5 21.000]5] 6.0000 -3.000
CHNL# 22: [VARS 1496[BAT #4 16.000]4] 6.0000 -3.000
CHNL# 21: [VARS 1495[BAT #3 16.000]3] 1.0000 -1.000



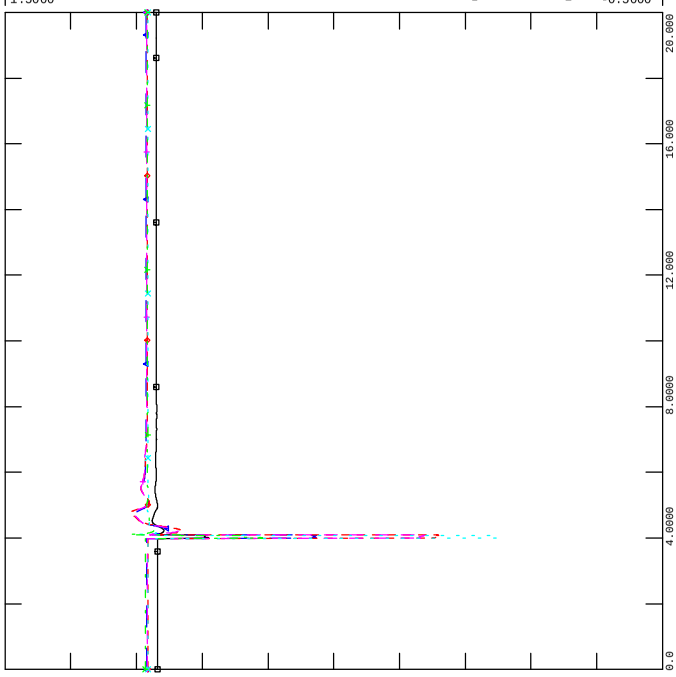
SCENARIO #6: 2020WP/POST PROJECT
CATB -9L16_FAULT_AT_TINCHEBRAY_972S

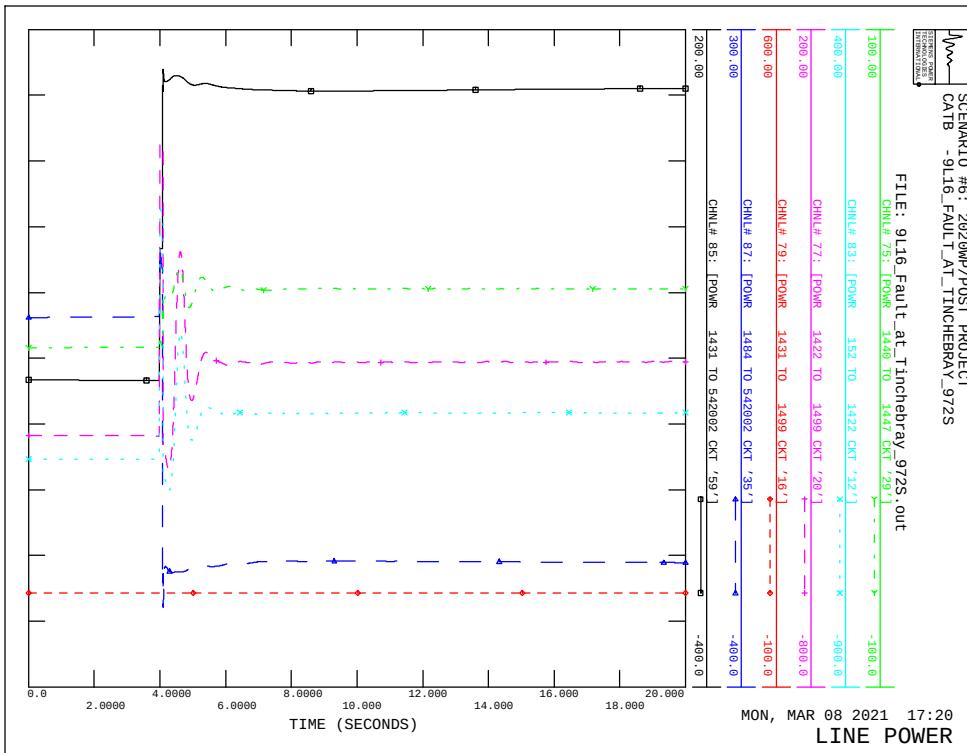
FILE: 9L16_Fault_at_Tinchebray_972S.out

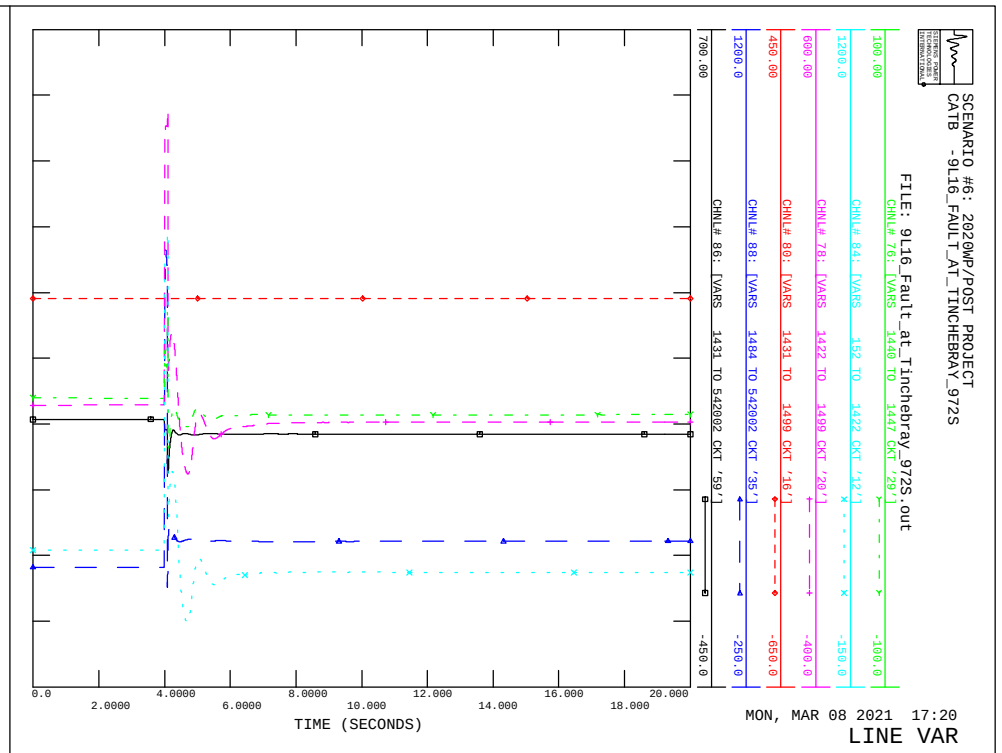
MON, MAR 08 2021 17:20

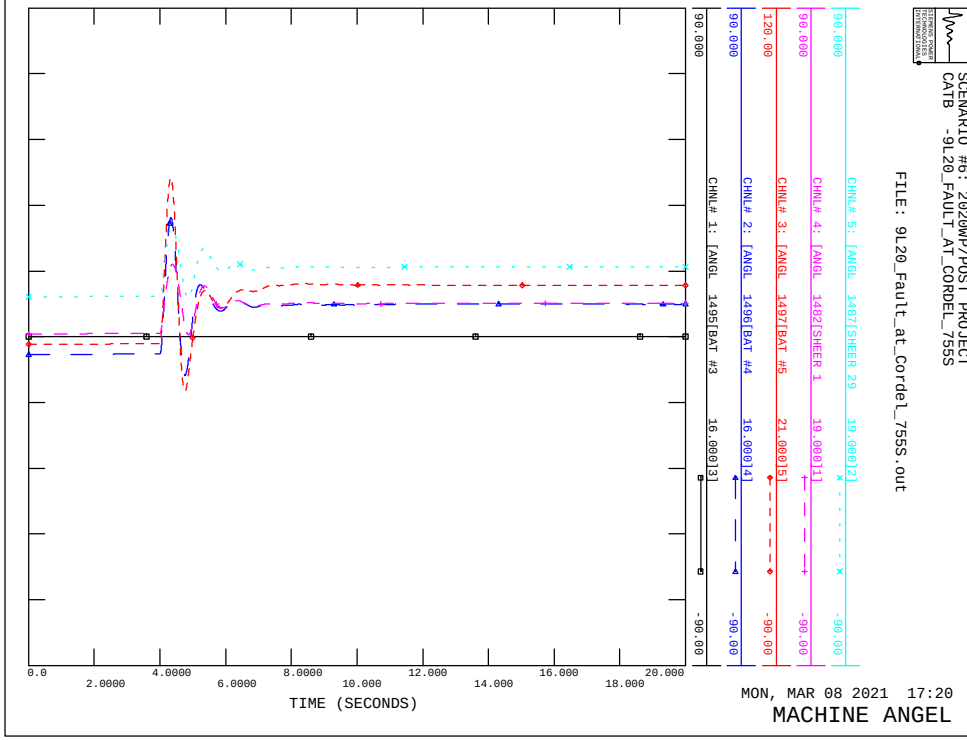
BUS VOLTAGE (1)

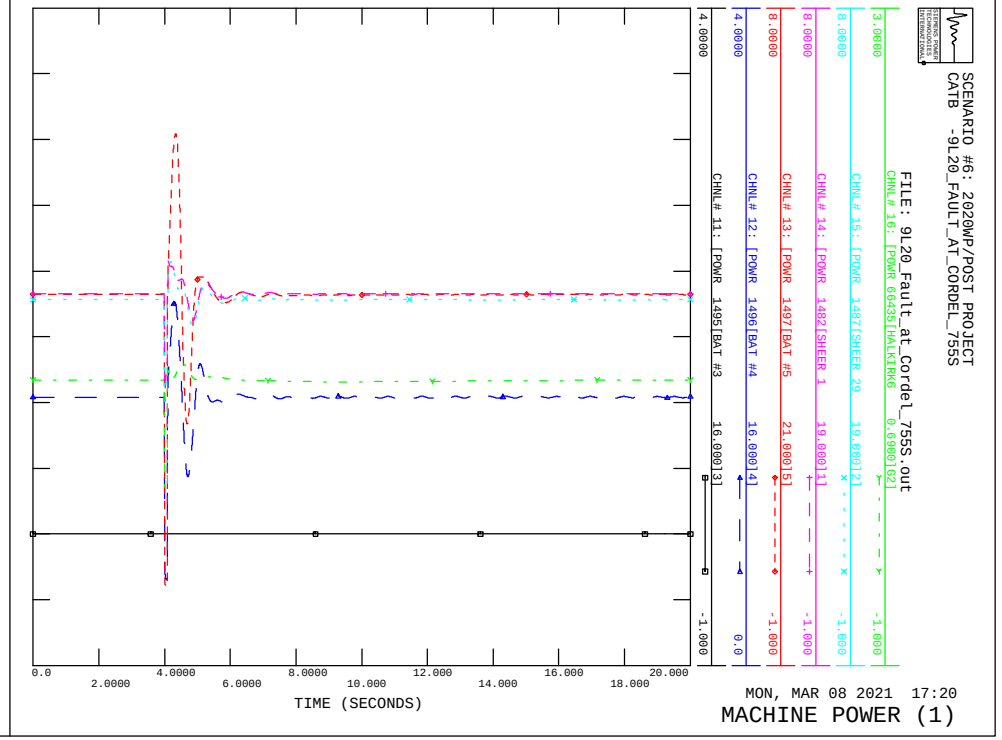
CHNL# 37: [VOLT 1440 [OAKLND1 240.00]] 1.5000 -0.5000
CHNL# 36: [VOLT 1431 [TNCHBRY1 240.00]] 1.5000 -0.5000
CHNL# 35: [VOLT 1403 [PAINTRT4 240.00]] 1.5000 -0.5000
CHNL# 34: [VOLT 1499 [CORDEL 4 240.00]] 1.5000 -0.5000
CHNL# 33: [VOLT 1423 [NEVIS 7 138.00]] 1.5000 -0.5000
CHNL# 31: [VOLT 152 [RED DEE4 240.00]] 1.5000 -0.5000




SCENARIO #6: 2020WP/POST PROJECT
CATB -9L16_FAULT_AT_TINCHEBRAY_972S
FILE: 9L16_Fault_at_Tinchebray_972S.out
CHNL# 85: [POWR 1431 TO 5420902 CKT '59']
CHNL# 86: [VARS 1431 TO 5420902 CKT '59']
CHNL# 87: [POWR 1484 TO 5420902 CKT '35']
CHNL# 88: [VARS 1484 TO 5420902 CKT '35']
CHNL# 79: [POWR 1431 TO 1499 CKT '16']
CHNL# 80: [VARS 1431 TO 1499 CKT '16']
CHNL# 77: [POWR 1422 TO 1499 CKT '20']
CHNL# 78: [VARS 1422 TO 1499 CKT '20']
CHNL# 75: [POWR 1440 TO 1447 CKT '29']
CHNL# 76: [VARS 1440 TO 1447 CKT '29']
CHNL# 83: [POWR 152 TO 1422 CKT '12']
CHNL# 84: [VARS 152 TO 1422 CKT '12']
TIME (SECONDS)
MON, MAR 08 2021 17:20
LINE POWER


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L16_FAULT_AT_TINCHEBRAY_972S
FILE: 9L16_Fault_at_Tinchebray_972S.out
CHNL# 85: [POWR 1431 TO 5420902 CKT '59']
CHNL# 86: [VARS 1431 TO 5420902 CKT '59']
CHNL# 87: [POWR 1484 TO 5420902 CKT '35']
CHNL# 88: [VARS 1484 TO 5420902 CKT '35']
CHNL# 79: [POWR 1431 TO 1499 CKT '16']
CHNL# 80: [VARS 1431 TO 1499 CKT '16']
CHNL# 77: [POWR 1422 TO 1499 CKT '20']
CHNL# 78: [VARS 1422 TO 1499 CKT '20']
CHNL# 75: [POWR 1440 TO 1447 CKT '29']
CHNL# 76: [VARS 1440 TO 1447 CKT '29']
CHNL# 83: [POWR 152 TO 1422 CKT '12']
CHNL# 84: [VARS 152 TO 1422 CKT '12']
TIME (SECONDS)
MON, MAR 08 2021 17:20
LINE VAR


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L20_FAULT_AT_CORDEL_755S
FILE: 9L20_Fault_at_Cordel_755S.out
CHNL# 1: [ANGL 1495[BAT #3 16.00013]
CHNL# 2: [ANGL 1496[BAT #4 16.00014]
CHNL# 3: [ANGL 1497[BAT #5 21.00015]
CHNL# 4: [ANGL 1482[SHEER 1 19.00011]
CHNL# 5: [ANGL 1487[SHEER 29 19.00012]
TIME (SECONDS)
MON, MAR 08 2021 17:20
MACHINE ANGEL


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L20_FAULT_AT_CORDEL_755S
FILE: 9L20_Fault_at_Cordel_755S.out
CHNL# 11: [POWR 1495[BAT #3 16.00013]
CHNL# 12: [POWR 1496[BAT #4 16.00014]
CHNL# 13: [POWR 1497[BAT #5 21.00015]
CHNL# 14: [POWR 1482[SHEER 1 19.00011]
CHNL# 15: [POWR 1487[SHEER 29 19.00012]
CHNL# 16: [POWR 964351[ALKIRK6 0.69001C2]
TIME (SECONDS)
MON, MAR 08 2021 17:20
MACHINE POWER (1)

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L20_FAULT_AT_CORDEL_755S

FILE: 9L20_Fault_at_Cordel_755S.out

MON, MAR 08 2021 17:20

MACHINE VAR (1)

CHNL# 26: [VARS 66435[HALKIRK6 0.6900]G2] 1.0000 -1.000
CHNL# 25: [VARS 1487[SHEER 29 19.000]2] 6.0000 -3.000
CHNL# 24: [VARS 1482[SHEER 1 19.000]1] 6.0000 -3.000
CHNL# 23: [VARS 1497[BAT #5 21.000]5] 6.0000 -3.000
CHNL# 22: [VARS 1496[BAT #4 16.000]4] 6.0000 -3.000
CHNL# 21: [VARS 1495[BAT #3 16.000]3] 1.0000 -1.000

TIME (SECONDS)

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L20_FAULT_AT_CORDEL_755S

FILE: 9L20_Fault_at_Cordel_755S.out

MON, MAR 08 2021 17:20

BUS VOLTAGE (1)

CHNL# 37: [VOLT 1440 [OAKLND1 240.00]] 1.5000 -0.5000
CHNL# 36: [VOLT 1431 [TNCHBRY1 240.00]] 1.5000 -0.5000
CHNL# 35: [VOLT 1403 [PAINTRT4 240.00]] 1.5000 -0.5000
CHNL# 34: [VOLT 1499 [CORDEL 4 240.00]] 1.5000 -0.5000
CHNL# 33: [VOLT 1423 [NEVIS 7 138.00]] 1.5000 -0.5000
CHNL# 31: [VOLT 152 [RED DEE4 240.00]] 1.5000 -0.5000

TIME (SECONDS)

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L20_FAULT_AT_CORDEL_755S

FILE: 9L20_Fault_at_Cordel_755S.out

MON, MAR 08 2021 17:20

MACHINE POWER (2)

CHNL# 20: [POWR 60832[SEDALIA7 0.6900]G2] 2.5000 0.0
CHNL# 19: [POWR 60831[SEDALIA6 0.6900]G1] 2.5000 0.0
CHNL# 18: [POWR565002[TRANSAWIND1 0.6900]G1] 2.5000 -0.5000
CHNL# 17: [POWR 67435[HALKIRK4 0.6900]G1] 2.5000 0.0

TIME (SECONDS)

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L20_FAULT_AT_CORDEL_755S

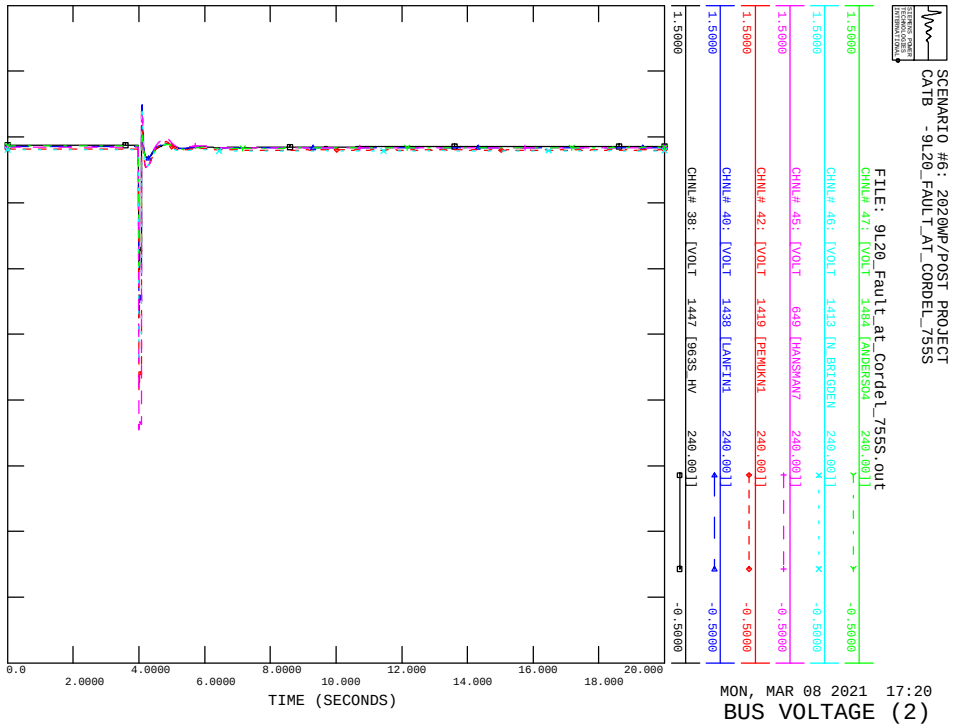
FILE: 9L20_Fault_at_Cordel_755S.out

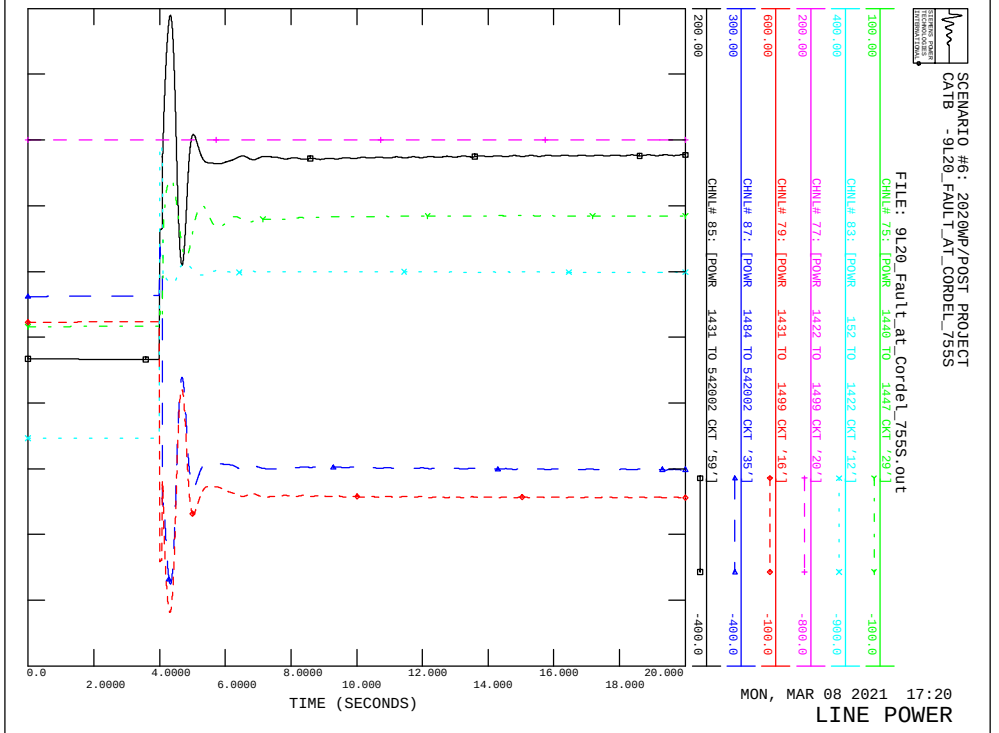
MON, MAR 08 2021 17:20

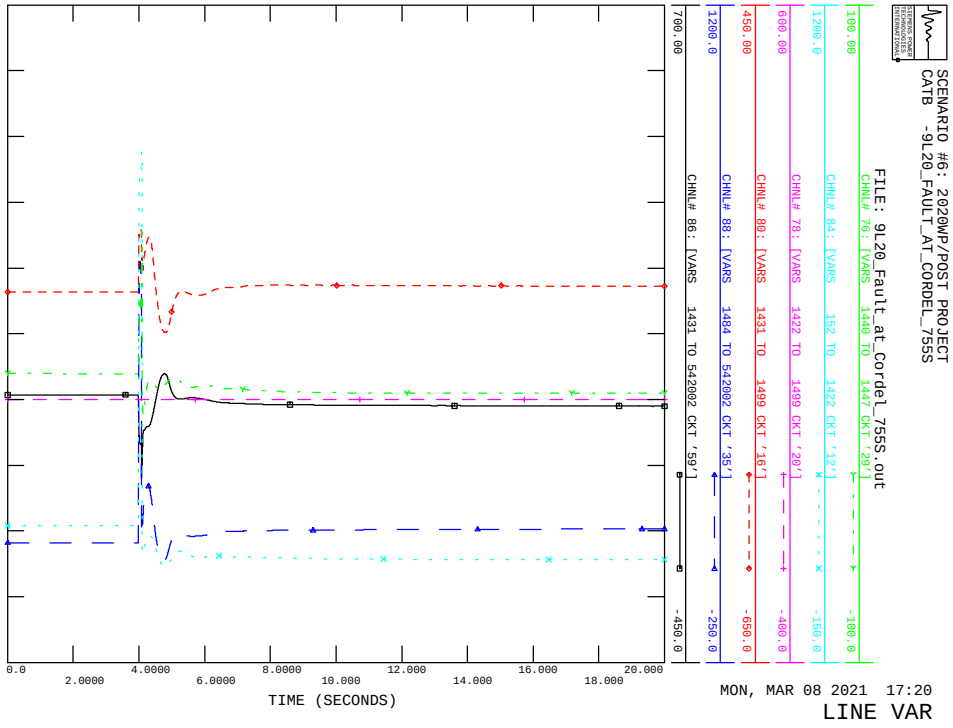
MACHINE VAR (2)

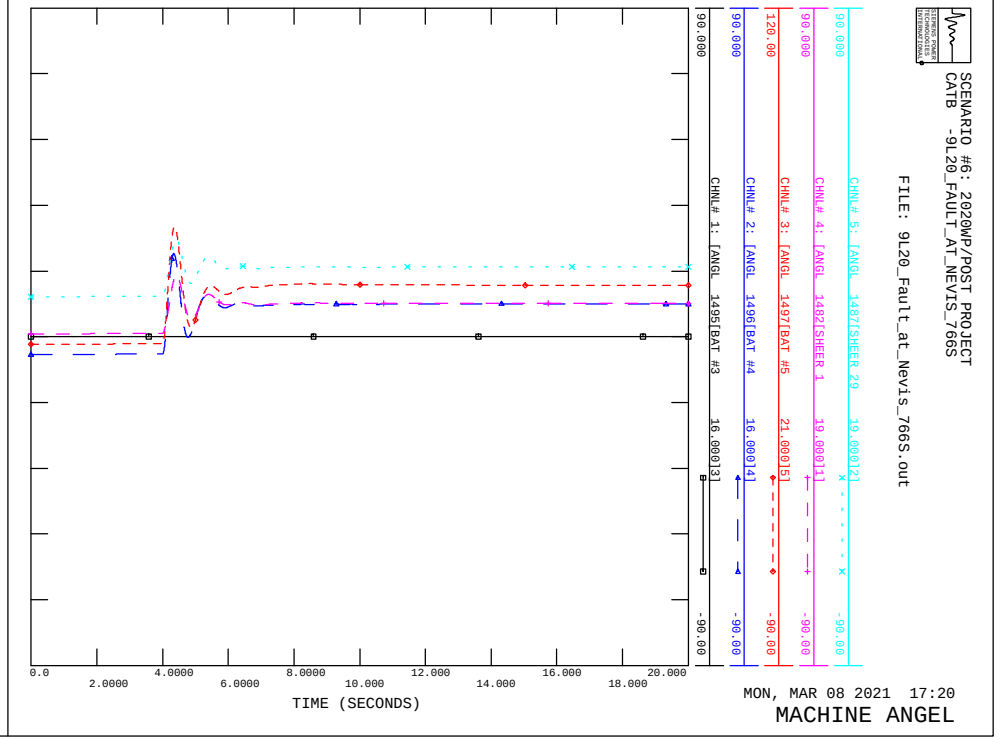
CHNL# 30: [VARS 60832[SEDALIA7 0.6900]G2] 1.5000 -1.000
CHNL# 29: [VARS 60831[SEDALIA6 0.6900]G1] 1.5000 -1.000
CHNL# 28: [VARS565002[TRANSAWIND1 0.6900]G1] 1.5000 -1.000
CHNL# 27: [VARS 67435[HALKIRK4 0.6900]G1] 1.5000 -1.000

TIME (SECONDS)


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L20_FAULT_AT_CORDEL_755S
FILE: 9L20_Fault_at_Cordel_755S.out
TIME (SECONDS)
MON, MAR 08 2021 17:20
BUS VOLTAGE (2)


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L20_FAULT_AT_CORDEL_755S
FILE: 9L20_Fault_at_Cordel_755S.out
TIME (SECONDS)
MON, MAR 08 2021 17:20
LINE POWER


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L20_FAULT_AT_CORDEL_755S
FILE: 9L20_Fault_at_Cordel_755S.out
TIME (SECONDS)
MON, MAR 08 2021 17:20
LINE VAR


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L20_FAULT_AT_NEVIS_766S
FILE: 9L20_Fault_at_Nevis_766S.out
TIME (SECONDS)
MON, MAR 08 2021 17:20
MACHINE ANGEL

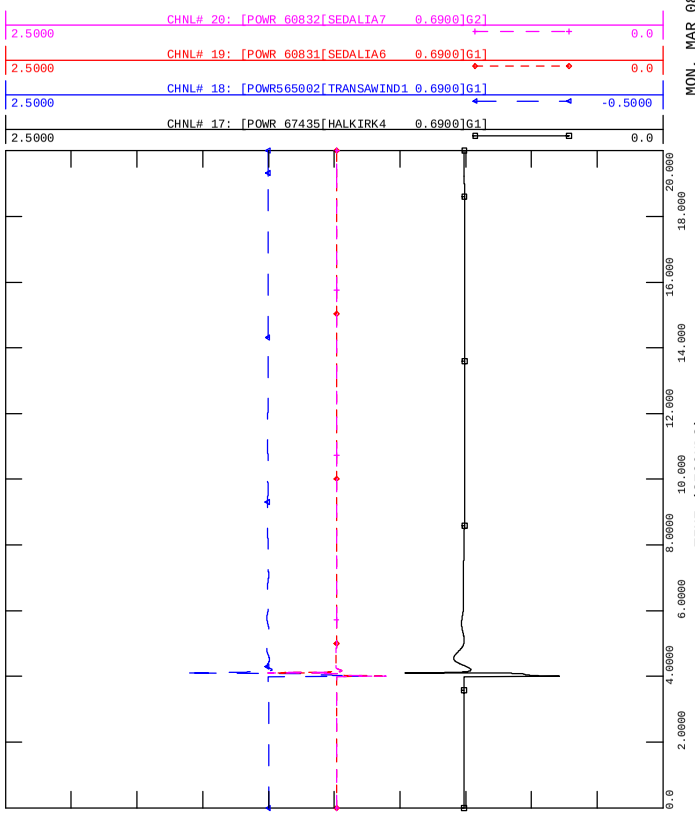
SCENARIO #6: 2020WP/POST PROJECT
CATB -9L20_FAULT_AT_NEVIS_766S

FILE: 9L20_Fault_at_Nevis_766S.out

MON, MAR 08 2021 17:20

MACHINE POWER (2)

CHNL# 20: [POWR 60832[SEDALIA7 0.6900]G2]
CHNL# 19: [POWR 60831[SEDALIA6 0.6900]G1]
CHNL# 18: [POWR565002[TRANSAWIND1 0.6900]G1]
CHNL# 17: [POWR 67435[HALKIRK4 0.6900]G1]



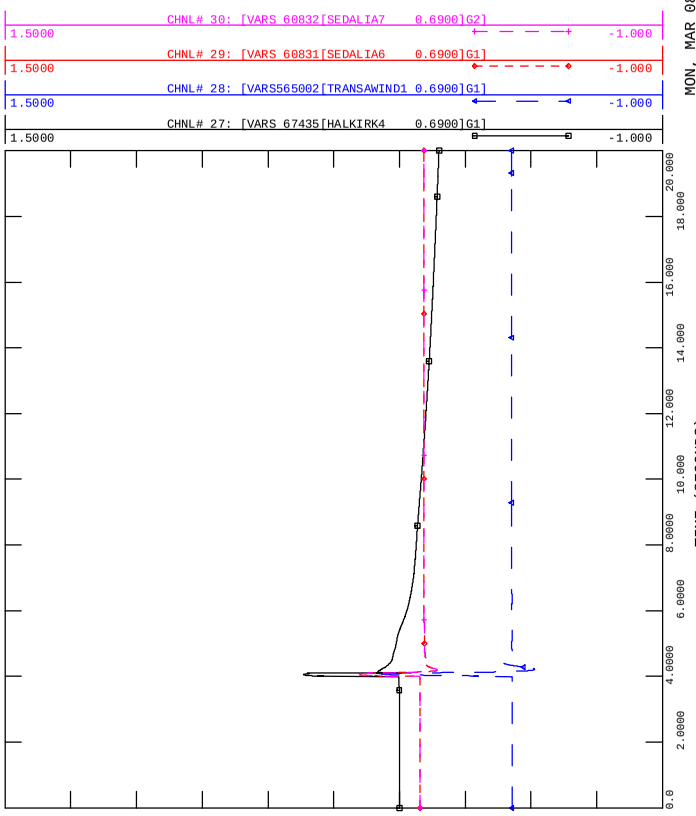
SCENARIO #6: 2020WP/POST PROJECT
CATB -9L20_FAULT_AT_NEVIS_766S

FILE: 9L20_Fault_at_Nevis_766S.out

MON, MAR 08 2021 17:20

MACHINE VAR (2)

CHNL# 30: [VARS 60832[SEDALIA7 0.6900]G2]
CHNL# 29: [VARS 60831[SEDALIA6 0.6900]G1]
CHNL# 28: [VARS565002[TRANSAWIND1 0.6900]G1]
CHNL# 27: [VARS 67435[HALKIRK4 0.6900]G1]



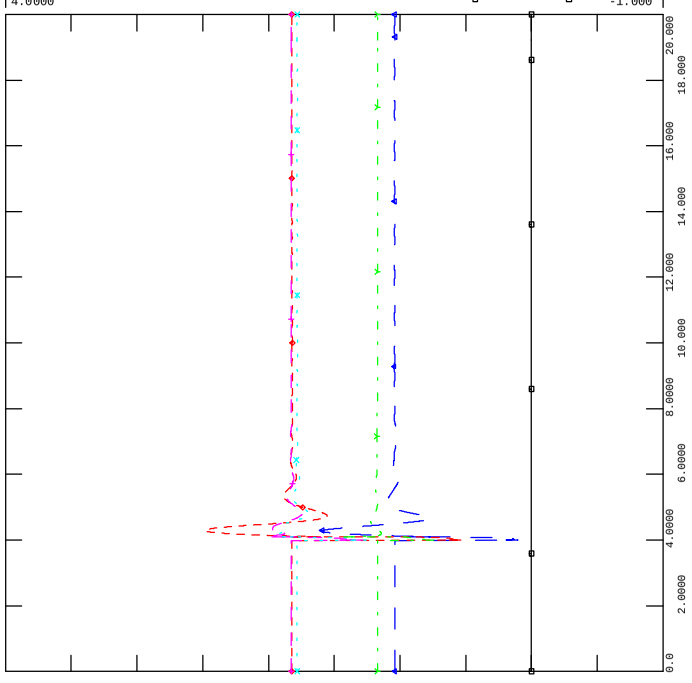
SCENARIO #6: 2020WP/POST PROJECT
CATB -9L20_FAULT_AT_NEVIS_766S

FILE: 9L20_Fault_at_Nevis_766S.out

MON, MAR 08 2021 17:20

MACHINE POWER (1)

CHNL# 16: [POWR 66435[HALKIRK6 0.6900]G2]
CHNL# 15: [POWR 1487[SHEER 29 19.000]2]
CHNL# 14: [POWR 1482[SHEER 1 19.000]1]
CHNL# 13: [POWR 1497[BAT #5 21.000]5]
CHNL# 12: [POWR 1496[BAT #4 16.000]4]
CHNL# 11: [POWR 1495[BAT #3 16.000]3]



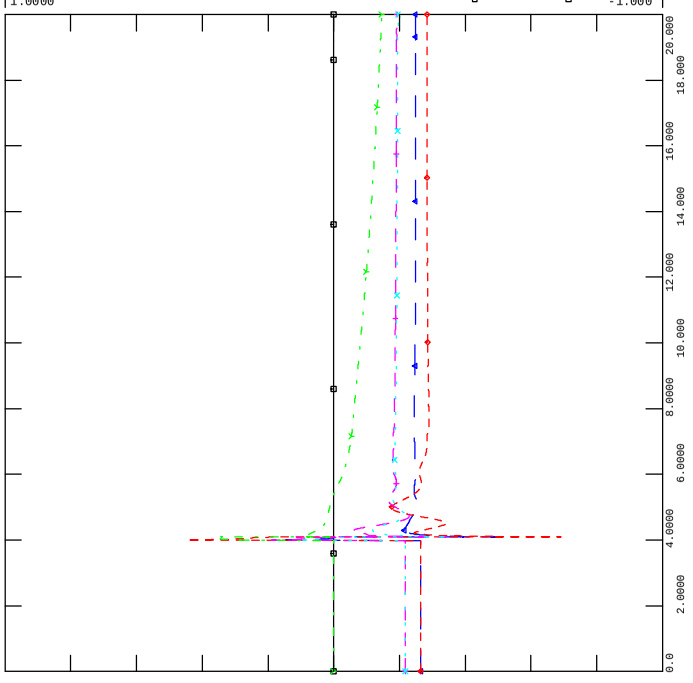
SCENARIO #6: 2020WP/POST PROJECT
CATB -9L20_FAULT_AT_NEVIS_766S

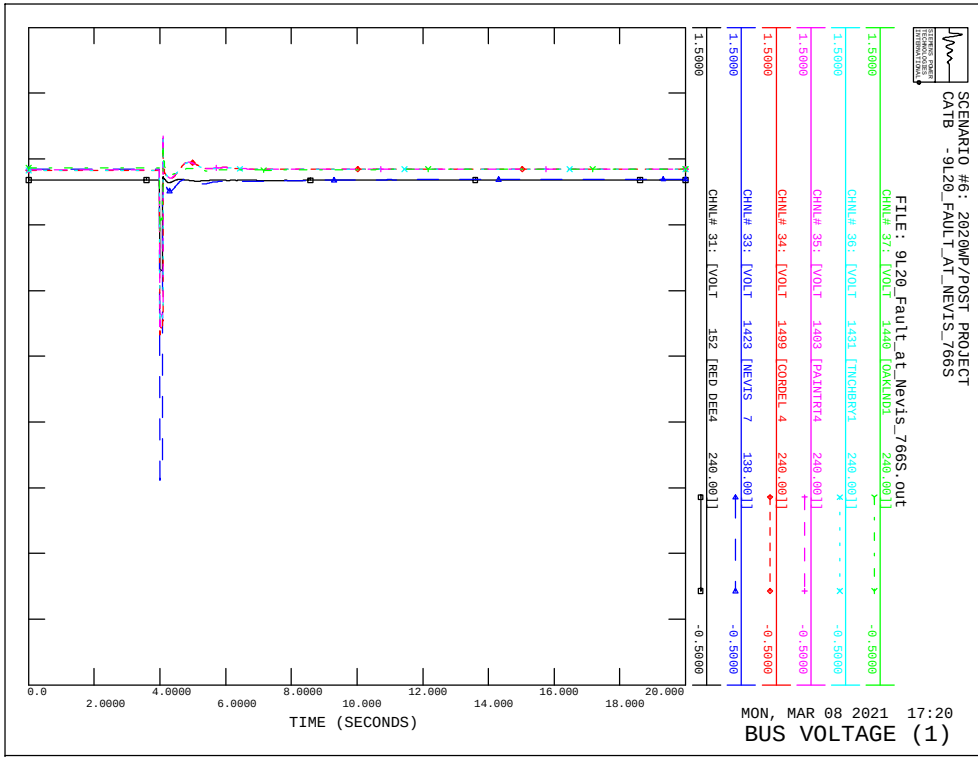
FILE: 9L20_Fault_at_Nevis_766S.out

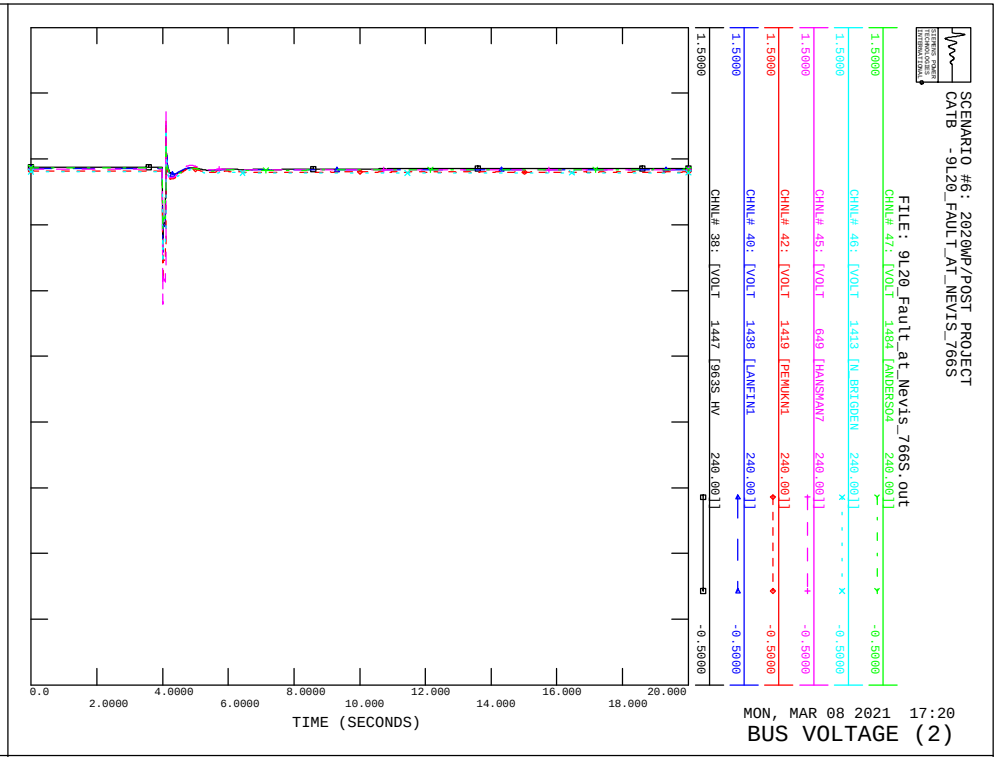
MON, MAR 08 2021 17:20

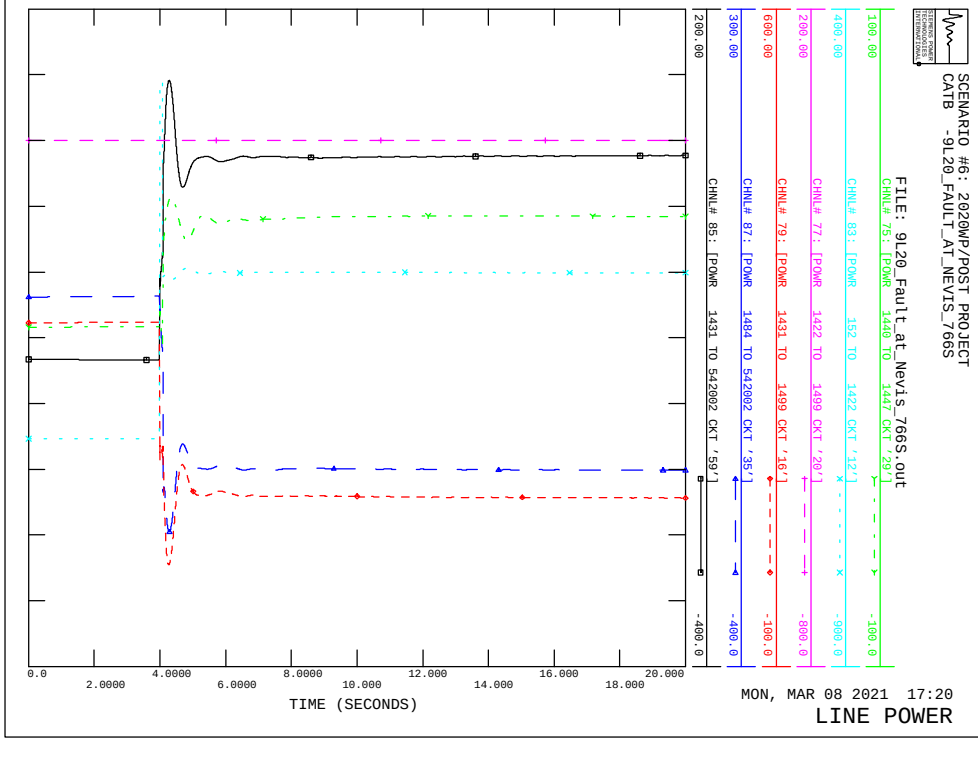
MACHINE VAR (1)

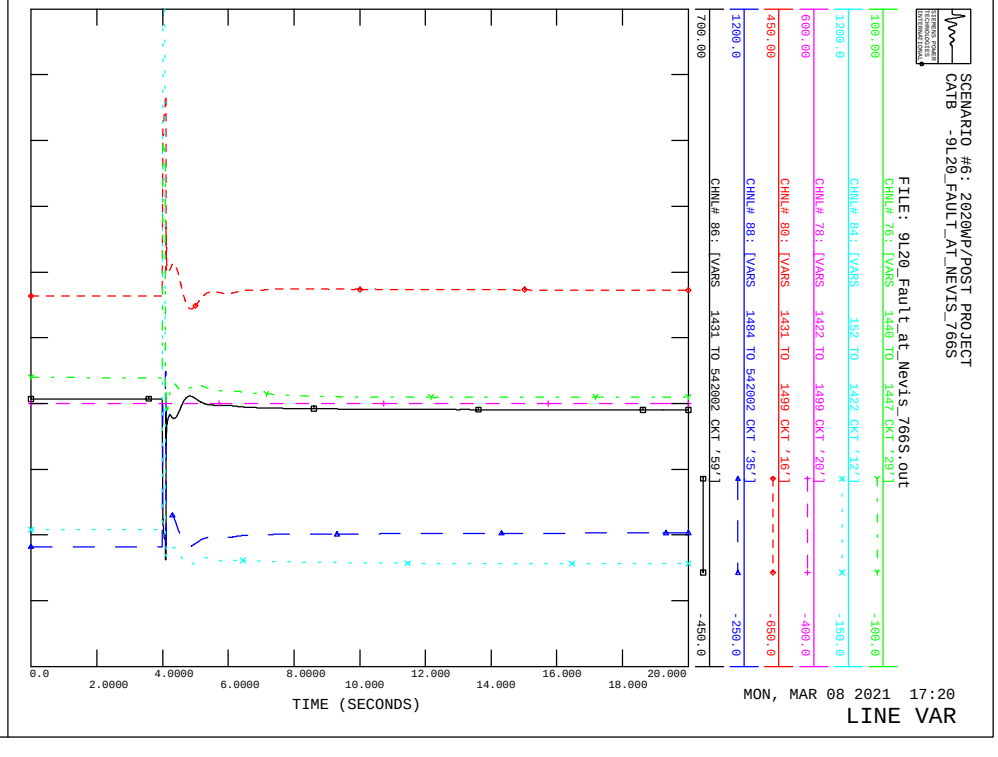
CHNL# 26: [VARS 66435[HALKIRK6 0.6900]G2]
CHNL# 25: [VARS 1487[SHEER 29 19.000]2]
CHNL# 24: [VARS 1482[SHEER 1 19.000]1]
CHNL# 23: [VARS 1497[BAT #5 21.000]5]
CHNL# 22: [VARS 1496[BAT #4 16.000]4]
CHNL# 21: [VARS 1495[BAT #3 16.000]3]




SCENARIO #6: 2020WP/POST PROJECT
CATB -9L20_FAULT_AT_NEVIS_766S
FILE: 9L20_Fault_at_Nevis_766S.out
CHNL# 31: [VOLT 152 [RED DEE4 240.00]]
CHNL# 33: [VOLT 1423 [NEVIS 7 138.00]]
CHNL# 34: [VOLT 1499 [CORDEL 4 240.00]]
CHNL# 35: [VOLT 1403 [PAINTRT4 240.00]]
CHNL# 36: [VOLT 1431 [TNCHBRY1 240.00]]
CHNL# 37: [VOLT 1440 [OAKLND1 240.00]]
TIME (SECONDS)
MON, MAR 08 2021 17:20
BUS VOLTAGE (1)


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L20_FAULT_AT_NEVIS_766S
FILE: 9L20_Fault_at_Nevis_766S.out
CHNL# 38: [VOLT 1447 [963S_HV 240.00]]
CHNL# 40: [VOLT 1438 [LANFIN1 240.00]]
CHNL# 42: [VOLT 1419 [PEMUKN1 240.00]]
CHNL# 45: [VOLT 649 [HANSMAN7 240.00]]
CHNL# 46: [VOLT 1413 [N BRIGDEN 240.00]]
CHNL# 47: [VOLT 1464 [ANDERSO4 240.00]]
TIME (SECONDS)
MON, MAR 08 2021 17:20
BUS VOLTAGE (2)


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L20_FAULT_AT_NEVIS_766S
FILE: 9L20_Fault_at_Nevis_766S.out
CHNL# 85: [PQNR 1431 TO 542002 CKT '59']
CHNL# 87: [PQNR 1484 TO 542002 CKT '35']
CHNL# 79: [PQNR 1431 TO 1499 CKT '16']
CHNL# 77: [PQNR 1422 TO 1499 CKT '20']
CHNL# 83: [PQNR 152 TO 1422 CKT '12']
CHNL# 75: [PQNR 1440 TO 1447 CKT '29']
TIME (SECONDS)
MON, MAR 08 2021 17:20
LINE POWER


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L20_FAULT_AT_NEVIS_766S
FILE: 9L20_Fault_at_Nevis_766S.out
CHNL# 86: [VARS 1431 TO 542002 CKT '59']
CHNL# 88: [VARS 1484 TO 542002 CKT '35']
CHNL# 80: [VARS 1431 TO 1499 CKT '16']
CHNL# 78: [VARS 1422 TO 1499 CKT '20']
CHNL# 84: [VARS 152 TO 1422 CKT '12']
CHNL# 76: [VARS 1440 TO 1447 CKT '29']
TIME (SECONDS)
MON, MAR 08 2021 17:20
LINE VAR

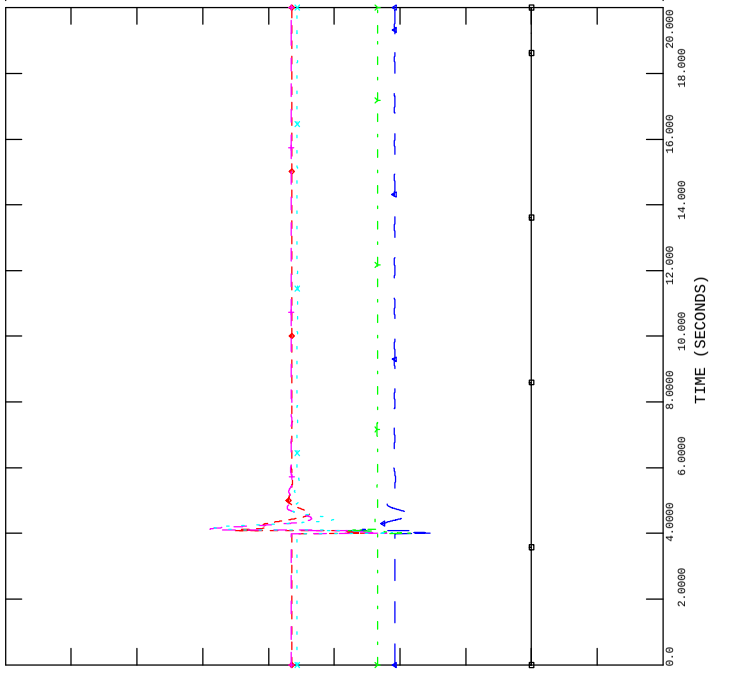
SCENARIO #6: 2020WP/POST PROJECT
CATB -9L24_FAULT_AT_LANFINE_959S

FILE: 9L24_Fault_at_Lanfine_959S.out

MON, MAR 08 2021 17:20

MACHINE POWER (1)

CHNL# 16: [POWR 66435[HALKIRK6 0.6900]G2] 3.0000 -1.000
CHNL# 15: [POWR 1487[SHEER 29 19.000]2] 8.0000 -1.000
CHNL# 14: [POWR 1482[SHEER 1 19.000]1] 8.0000 -1.000
CHNL# 13: [POWR 1497[BAT #5 21.000]5] 8.0000 -1.000
CHNL# 12: [POWR 1496[BAT #4 16.000]4] 4.0000 0.0
CHNL# 11: [POWR 1495[BAT #3 16.000]3] 4.0000 -1.000



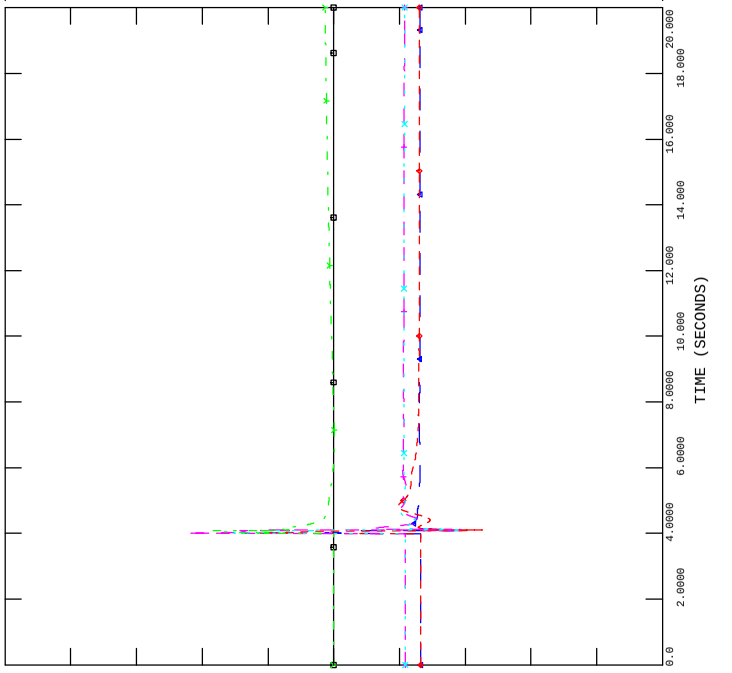
SCENARIO #6: 2020WP/POST PROJECT
CATB -9L24_FAULT_AT_LANFINE_959S

FILE: 9L24_Fault_at_Lanfine_959S.out

MON, MAR 08 2021 17:20

MACHINE VAR (1)

CHNL# 26: [VARS 66435[HALKIRK6 0.6900]G2] 1.0000 -1.000
CHNL# 25: [VARS 1487[SHEER 29 19.000]2] 6.0000 -3.000
CHNL# 24: [VARS 1482[SHEER 1 19.000]1] 6.0000 -3.000
CHNL# 23: [VARS 1497[BAT #5 21.000]5] 6.0000 -3.000
CHNL# 22: [VARS 1496[BAT #4 16.000]4] 6.0000 -3.000
CHNL# 21: [VARS 1495[BAT #3 16.000]3] 1.0000 -1.000



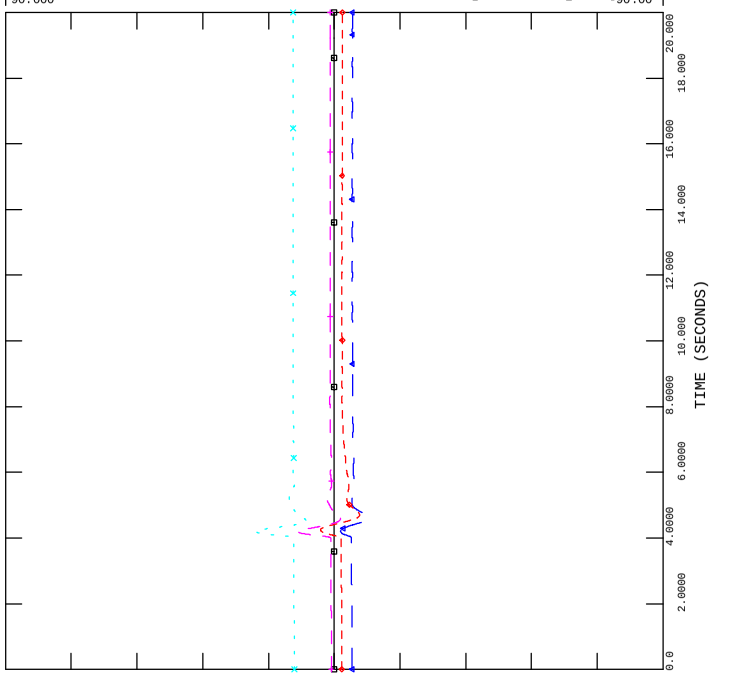
SCENARIO #6: 2020WP/POST PROJECT
CATB -9L24_FAULT_AT_LANFINE_959S

FILE: 9L24_Fault_at_Lanfine_959S.out

MON, MAR 08 2021 17:20

MACHINE ANGEL

CHNL# 5: [ANGL 1487[SHEER 29 19.000]2] 90.000 -90.00
CHNL# 4: [ANGL 1482[SHEER 1 19.000]1] 90.000 -90.00
CHNL# 3: [ANGL 1497[BAT #5 21.000]5] 120.00 -90.00
CHNL# 2: [ANGL 1496[BAT #4 16.000]4] 90.000 -90.00
CHNL# 1: [ANGL 1495[BAT #3 16.000]3] 90.000 -90.00



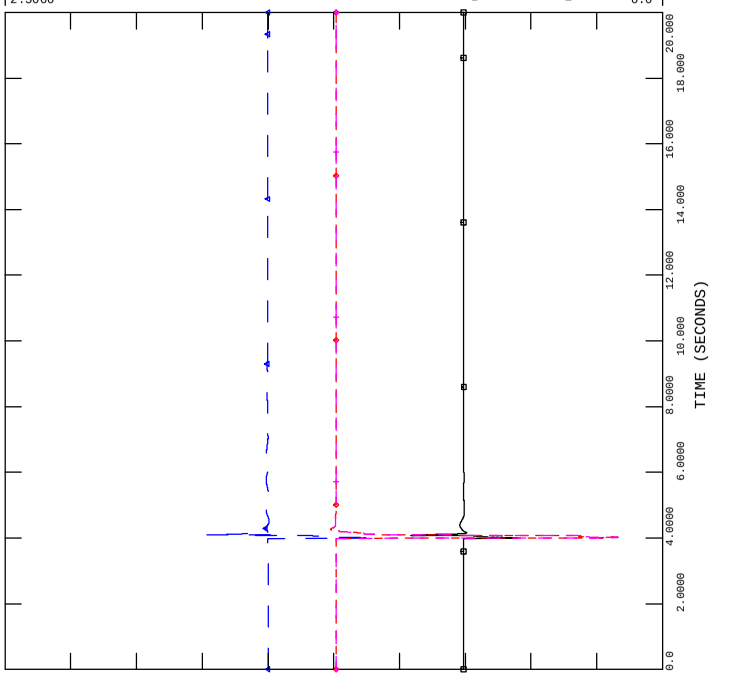
SCENARIO #6: 2020WP/POST PROJECT
CATB -9L24_FAULT_AT_LANFINE_959S

FILE: 9L24_Fault_at_Lanfine_959S.out

MON, MAR 08 2021 17:20

MACHINE POWER (2)

CHNL# 20: [POWR 60832[SEDALIA7 0.6900]G2] 2.5000 0.0
CHNL# 19: [POWR 60831[SEDALIA6 0.6900]G1] 2.5000 0.0
CHNL# 18: [POWR565002[TRANSAWIND1 0.6900]G1] 2.5000 -0.5000
CHNL# 17: [POWR 67435[HALKIRK4 0.6900]G1] 2.5000 0.0



SCENARIO #6: 2020WP/POST PROJECT
CATB -9L24_FAULT_AT_LANFINE_959S

FILE: 9L24_Fault_at_Lanfine_959S.out

MON, MAR 08 2021 17:20

BUS VOLTAGE (1)

CHNL# 37: [VOLT 1440 [OAKLND1 240.00]]
CHNL# 36: [VOLT 1431 [TNCHBRY1 240.00]]
CHNL# 35: [VOLT 1403 [PAINTRT4 240.00]]
CHNL# 34: [VOLT 1499 [CORDEL 4 240.00]]
CHNL# 33: [VOLT 1423 [NEVIS 7 138.00]]
CHNL# 31: [VOLT 152 [RED DEE4 240.00]]

1.5000 -0.5000

TIME (SECONDS)

0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L24_FAULT_AT_LANFINE_959S

FILE: 9L24_Fault_at_Lanfine_959S.out

MON, MAR 08 2021 17:20

LINE POWER

CHNL# 75: [POWR 1440 TO 1447 CKT '29']
CHNL# 83: [POWR 152 TO 1422 CKT '12']
CHNL# 77: [POWR 1422 TO 1499 CKT '20']
CHNL# 79: [POWR 1431 TO 1499 CKT '16']
CHNL# 87: [POWR 1484 TO 542002 CKT '35']
CHNL# 85: [POWR 1431 TO 542002 CKT '59']

100.00 -100.0
400.00 -900.0
200.00 -800.0
600.00 -100.0
300.00 -400.0
200.00 -400.0

TIME (SECONDS)

0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L24_FAULT_AT_LANFINE_959S

FILE: 9L24_Fault_at_Lanfine_959S.out

MON, MAR 08 2021 17:20

MACHINE VAR (2)

CHNL# 30: [VARS 60832[SEDALIA7 0.6900]G2]
CHNL# 29: [VARS 60831[SEDALIA6 0.6900]G1]
CHNL# 28: [VARS565002[TRANSAWIND1 0.6900]G1]
CHNL# 27: [VARS 67435[HALKIRK4 0.6900]G1]

1.5000 -1.000

TIME (SECONDS)

0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L24_FAULT_AT_LANFINE_959S

FILE: 9L24_Fault_at_Lanfine_959S.out

MON, MAR 08 2021 17:20

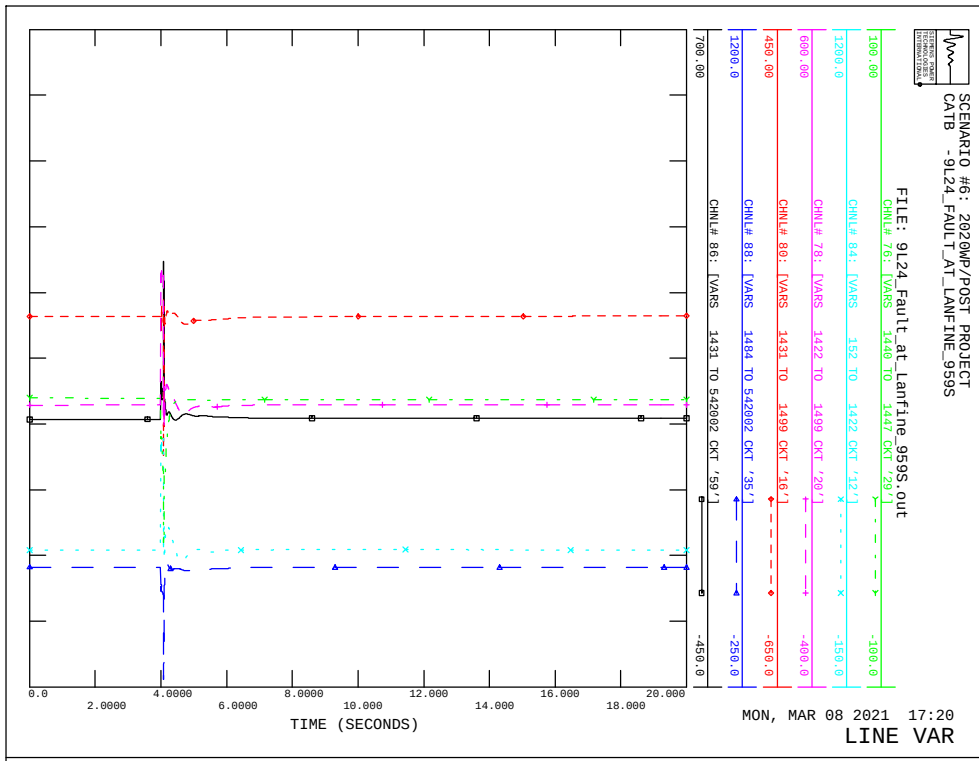
BUS VOLTAGE (2)

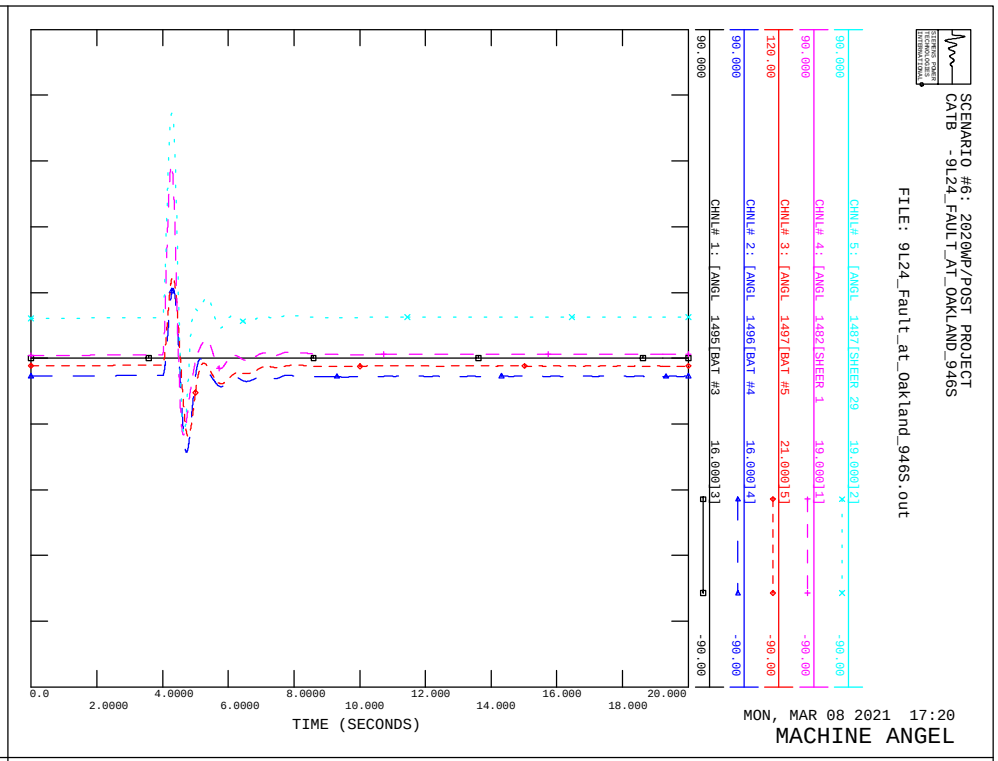
CHNL# 47: [VOLT 1484 [ANDERSO4 240.00]]
CHNL# 46: [VOLT 1413 [N_BRIGDEN 240.00]]
CHNL# 45: [VOLT 649 [HANSMAN7 240.00]]
CHNL# 42: [VOLT 1419 [PEMUKN1 240.00]]
CHNL# 40: [VOLT 1438 [LANFIN1 240.00]]
CHNL# 38: [VOLT 1447 [963S_HV 240.00]]

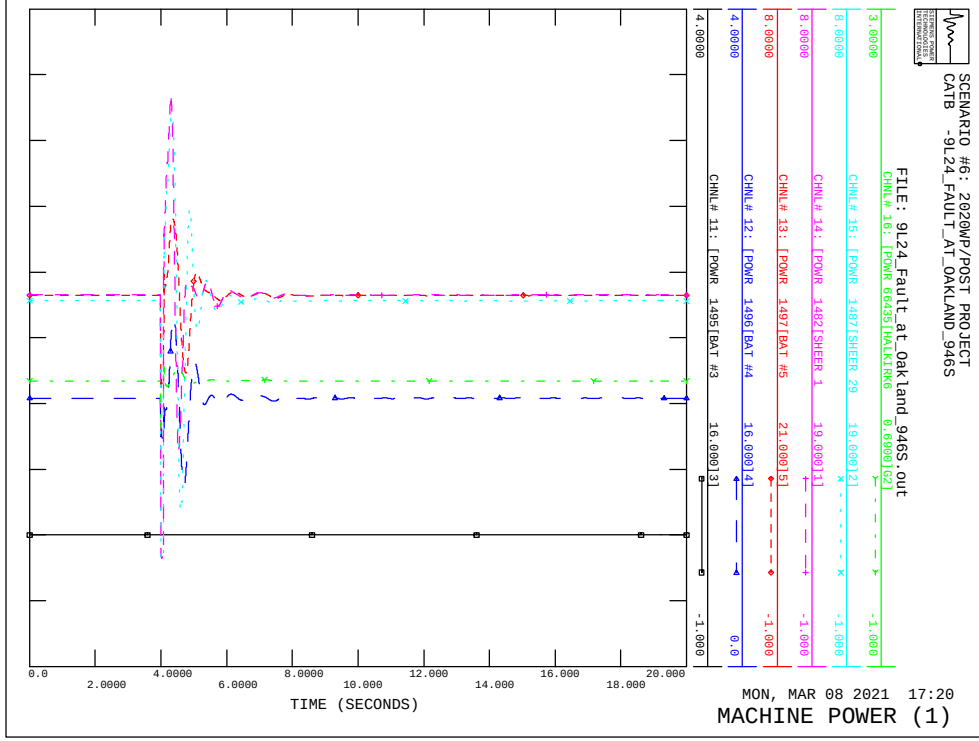
1.5000 -0.5000

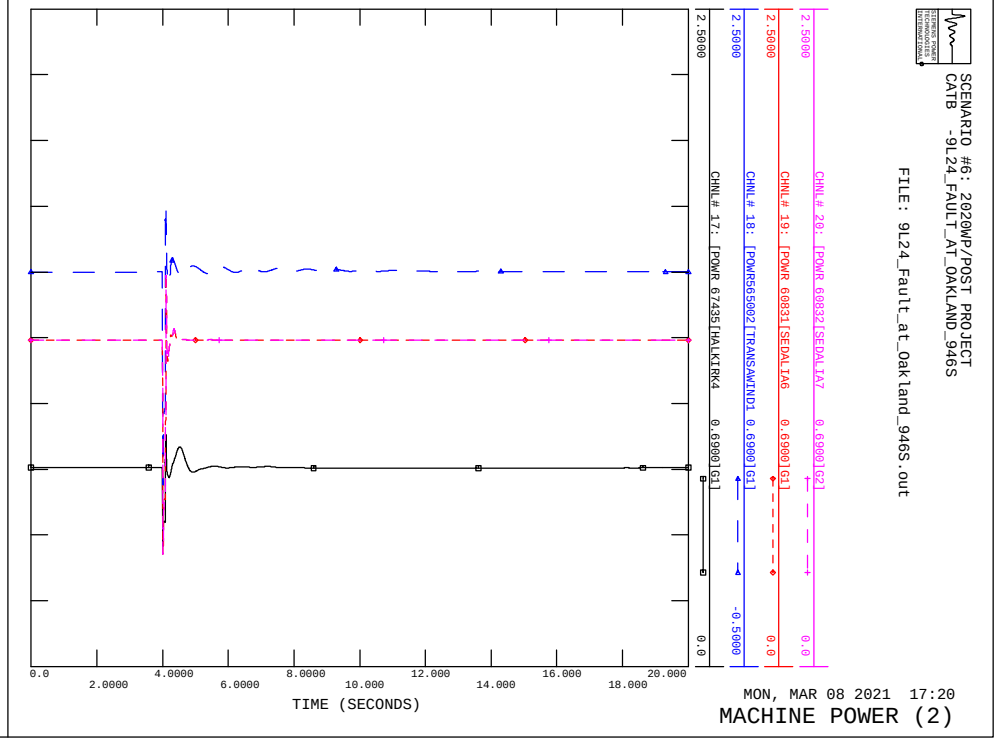
TIME (SECONDS)

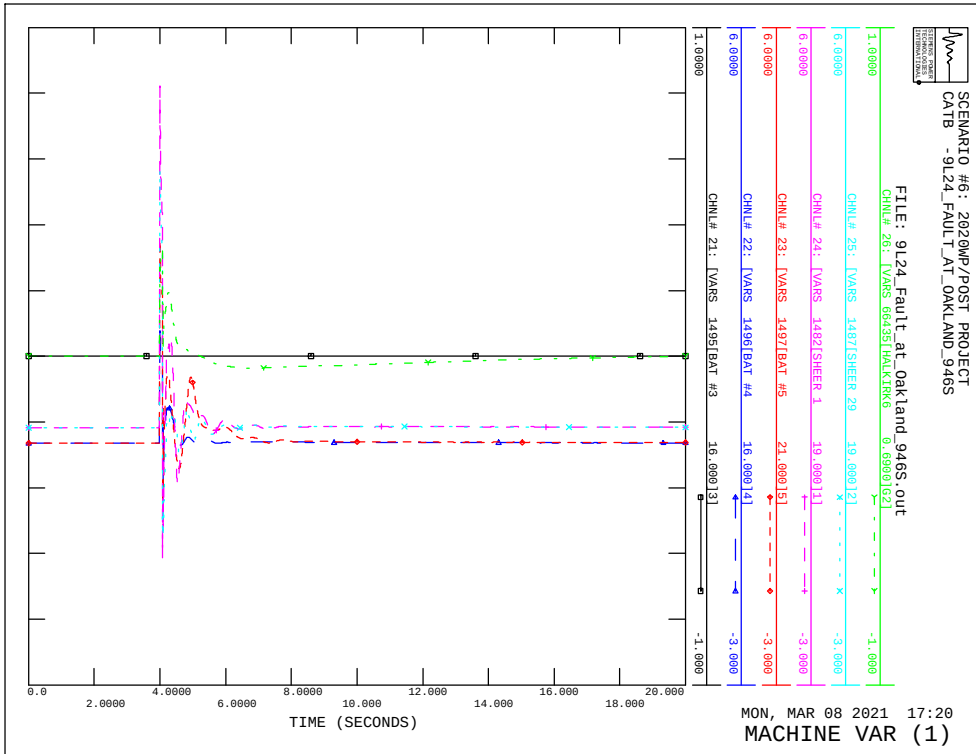
0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

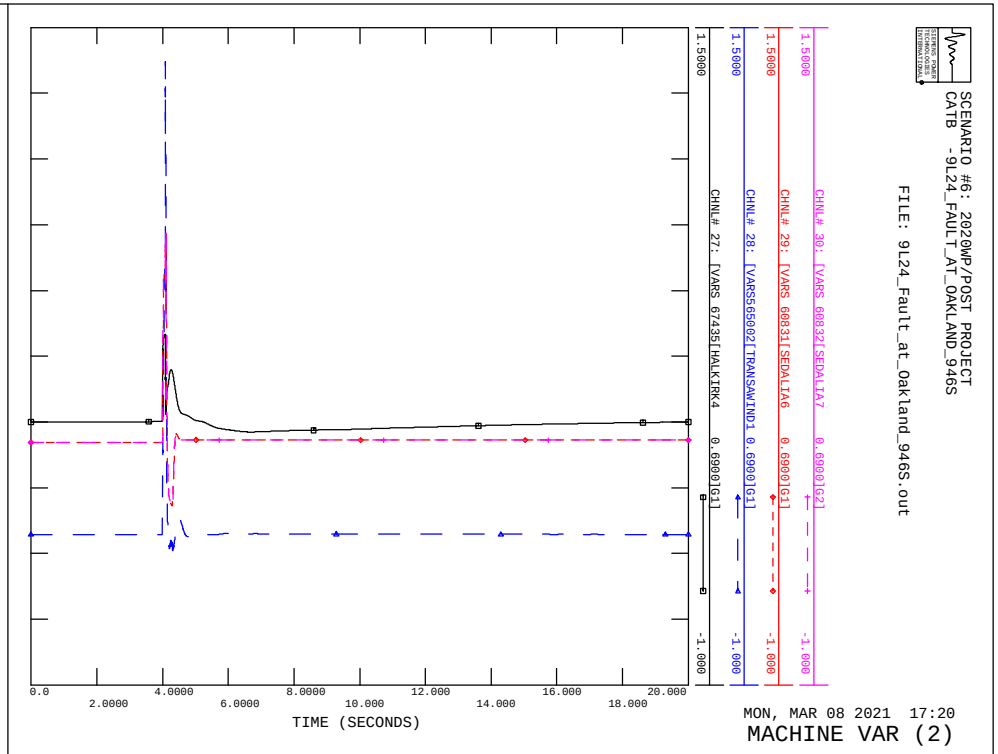

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L24_FAULT_AT_LANFINE_959S
FILE: 9L24_Fault_at_Lanfine_959S.out
TIME (SECONDS)
MON, MAR 08 2021 17:20
LINE VAR

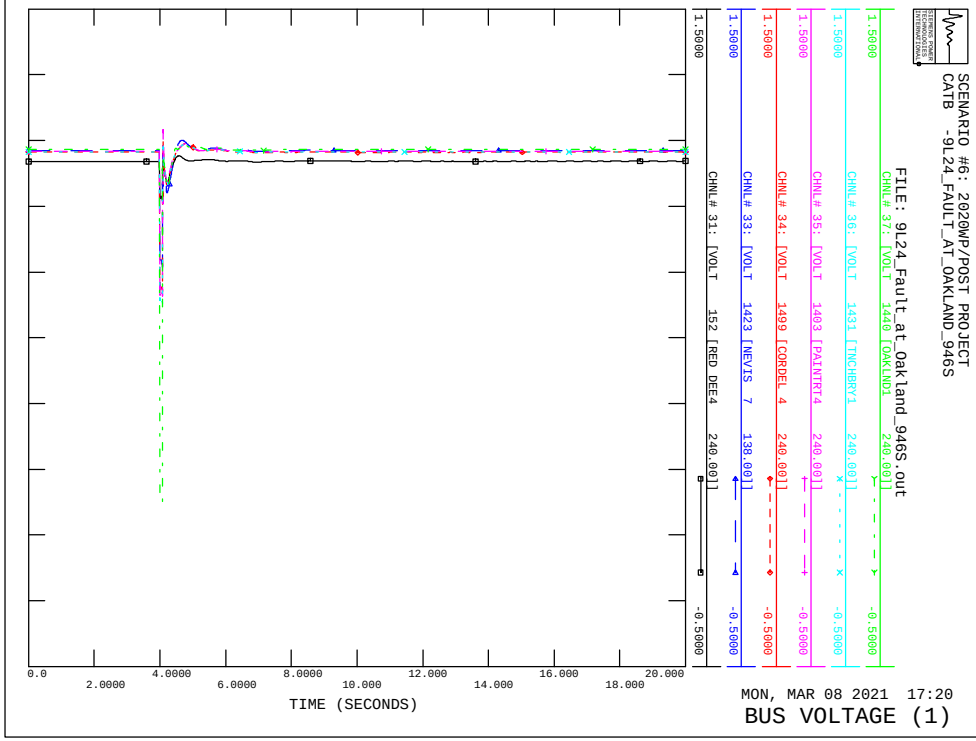

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L24_FAULT_AT_OAKLAND_946S
FILE: 9L24_Fault_at_Oakland_946S.out
TIME (SECONDS)
MON, MAR 08 2021 17:20
MACHINE ANGEL

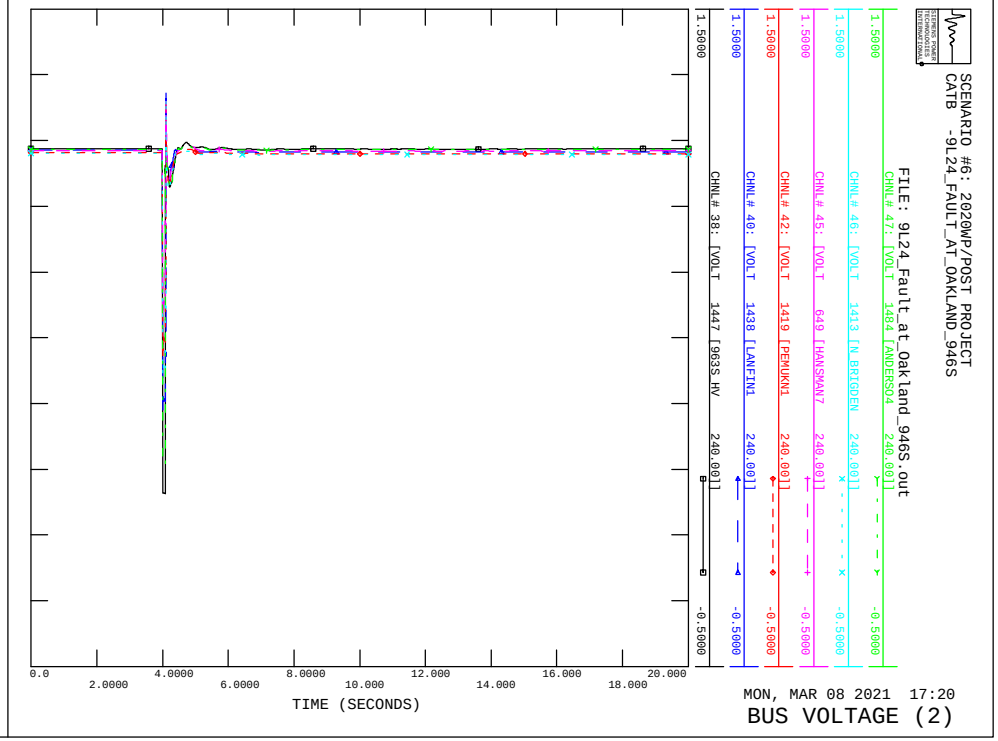

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L24_FAULT_AT_OAKLAND_946S
FILE: 9L24_Fault_at_Oakland_946S.out
TIME (SECONDS)
MON, MAR 08 2021 17:20
MACHINE POWER (1)


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L24_FAULT_AT_OAKLAND_946S
FILE: 9L24_Fault_at_Oakland_946S.out
TIME (SECONDS)
MON, MAR 08 2021 17:20
MACHINE POWER (2)


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L24_FAULT_AT_OAKLAND_946S
FILE: 9L24_Fault_at_Oakland_946S.out
CHNL# 21: [VARS 1495]BAT #3 16.0001[3] -1.000
CHNL# 22: [VARS 1496]BAT #4 16.0001[4] -3.000
CHNL# 23: [VARS 1497]BAT #5 21.0001[5] -3.000
CHNL# 24: [VARS 1482]SHEER 1 19.0001[1] -3.000
CHNL# 25: [VARS 1487]SHEER 29 19.0001[2] -3.000
CHNL# 26: [VARS 66435]HALKIRK6 0.6900[G2] -1.000
0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000
TIME (SECONDS)
MON, MAR 08 2021 17:20
MACHINE VAR (1)


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L24_FAULT_AT_OAKLAND_946S
FILE: 9L24_Fault_at_Oakland_946S.out
CHNL# 27: [VARS 67435]HALKIRK4 0.6900[G1] -1.000
CHNL# 28: [VARS65602]TRANSAWIND1 0.6900[G1] -1.000
CHNL# 29: [VARS 60831]SEDALIA6 0.6900[G1] -1.000
CHNL# 30: [VARS 60832]SEDALIA7 0.6900[G2] -1.000
0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000
TIME (SECONDS)
MON, MAR 08 2021 17:20
MACHINE VAR (2)


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L24_FAULT_AT_OAKLAND_946S
FILE: 9L24_Fault_at_Oakland_946S.out
CHNL# 31: [VOLT 152 [RED DEE4 240.00]1 -0.5000
CHNL# 33: [VOLT 1423 [NEVIS 7 138.00]1 -0.5000
CHNL# 34: [VOLT 1499 [CORDEL 4 240.00]1 -0.5000
CHNL# 35: [VOLT 1403 [PAINTRT4 240.00]1 -0.5000
CHNL# 36: [VOLT 1431 [TNCHBRY1 240.00]1 -0.5000
CHNL# 37: [VOLT 1440 [OAKLND1 240.00]1 -0.5000
0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000
TIME (SECONDS)
MON, MAR 08 2021 17:20
BUS VOLTAGE (1)


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L24_FAULT_AT_OAKLAND_946S
FILE: 9L24_Fault_at_Oakland_946S.out
CHNL# 38: [VOLT 1447 [963S HV 240.00]1 -0.5000
CHNL# 40: [VOLT 1438 [LANFIN1 240.00]1 -0.5000
CHNL# 42: [VOLT 1419 [PEMUKN1 240.00]1 -0.5000
CHNL# 45: [VOLT 649 [HANSMAN7 240.00]1 -0.5000
CHNL# 46: [VOLT 1413 [N BRIGDEN 240.00]1 -0.5000
CHNL# 47: [VOLT 1404 [ANDERSO4 240.00]1 -0.5000
0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000
TIME (SECONDS)
MON, MAR 08 2021 17:20
BUS VOLTAGE (2)

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L24_FAULT_AT_OAKLAND_946S

FILE: 9L24_Fault_at_Oakland_946S.out

CHNL# 76: [VARS 1440 TO 1447 CKT '29'] 100.00 -100.0
CHNL# 84: [VARS 152 TO 1422 CKT '12'] 1200.0 -150.0
CHNL# 78: [VARS 1422 TO 1499 CKT '20'] 600.00 -400.0
CHNL# 80: [VARS 1431 TO 1499 CKT '16'] 450.00 -650.0
CHNL# 88: [VARS 1484 TO 542002 CKT '35'] 1200.0 -250.0
CHNL# 86: [VARS 1431 TO 542002 CKT '59'] 700.00 -450.0

MON, MAR 08 2021 17:20 LINE VAR

TIME (SECONDS)

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L29_FAULT_AT_COYOTELAKE_963S

FILE: 9L29_Fault_at_CoyoteLake_963S.out

CHNL# 16: [POWR 66435[HALKIRK6 0.6900]G2] 3.0000 -1.000
CHNL# 15: [POWR 1487[SHEER 29 19.000]2] 8.0000 -1.000
CHNL# 14: [POWR 1482[SHEER 1 19.000]1] 8.0000 -1.000
CHNL# 13: [POWR 1497[BAT #5 21.000]5] 8.0000 -1.000
CHNL# 12: [POWR 1496[BAT #4 16.000]4] 4.0000 0.0
CHNL# 11: [POWR 1495[BAT #3 16.000]3] 4.0000 -1.000

MON, MAR 08 2021 17:20 MACHINE POWER (1)

TIME (SECONDS)

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L24_FAULT_AT_OAKLAND_946S

FILE: 9L24_Fault_at_Oakland_946S.out

CHNL# 75: [POWR 1440 TO 1447 CKT '29'] 100.00 -100.0
CHNL# 83: [POWR 152 TO 1422 CKT '12'] 400.00 -900.0
CHNL# 77: [POWR 1422 TO 1499 CKT '20'] 200.00 -800.0
CHNL# 79: [POWR 1431 TO 1499 CKT '16'] 600.00 -100.0
CHNL# 87: [POWR 1484 TO 542002 CKT '35'] 300.00 -400.0
CHNL# 85: [POWR 1431 TO 542002 CKT '59'] 200.00 -400.0

MON, MAR 08 2021 17:20 LINE POWER

TIME (SECONDS)

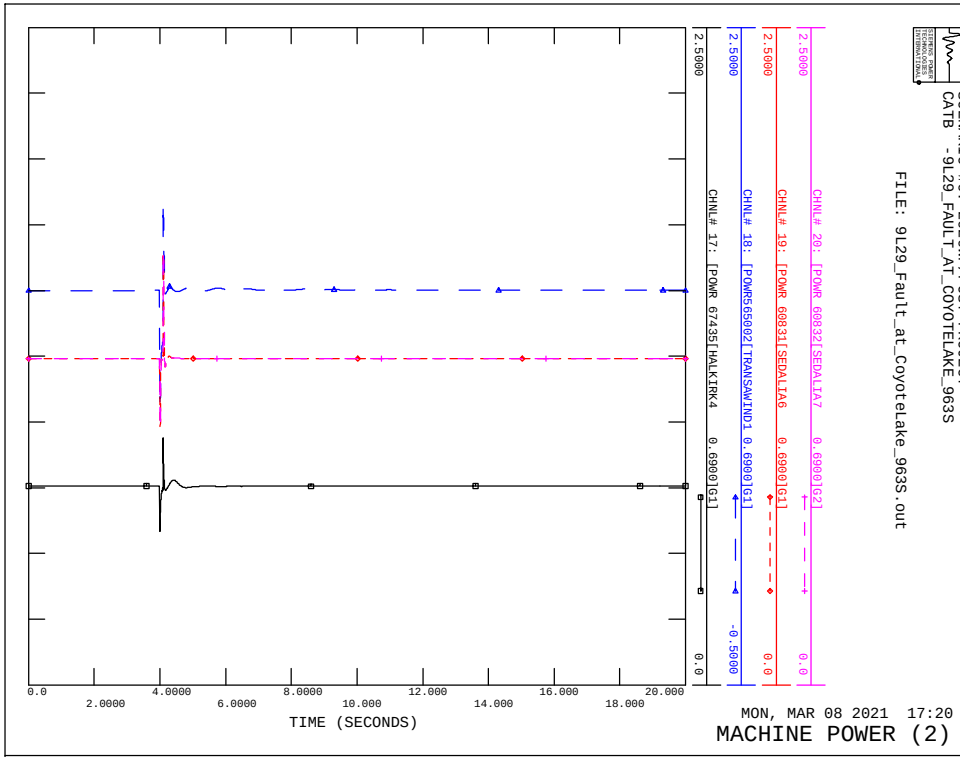
SCENARIO #6: 2020WP/POST PROJECT
CATB -9L29_FAULT_AT_COYOTELAKE_963S

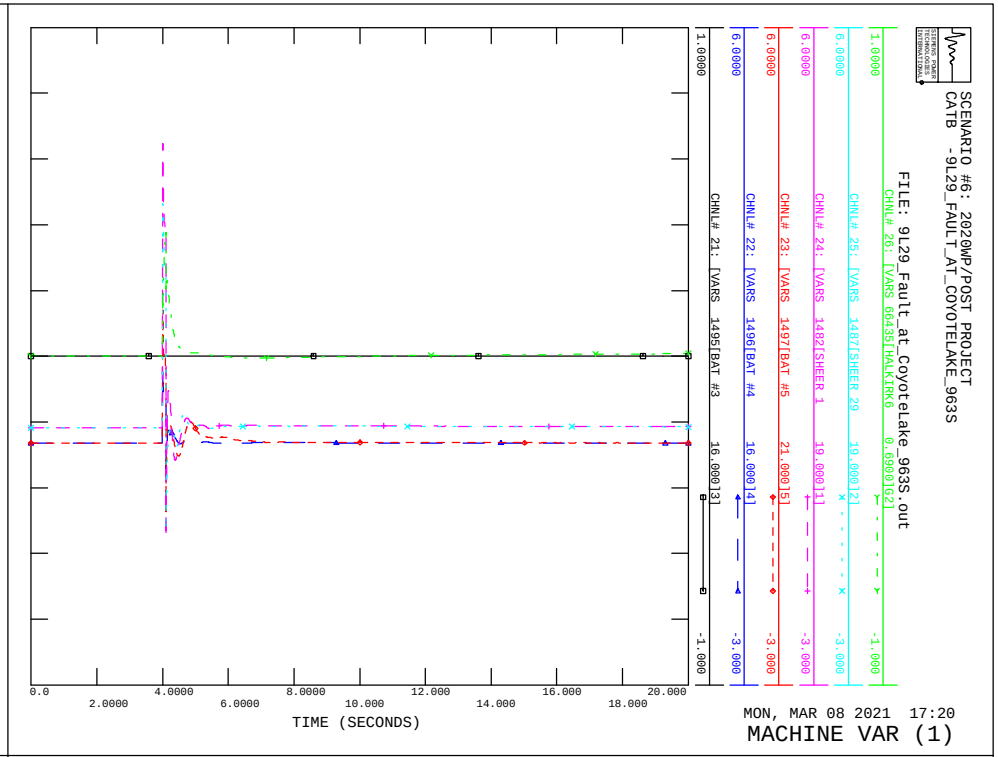
FILE: 9L29_Fault_at_CoyoteLake_963S.out

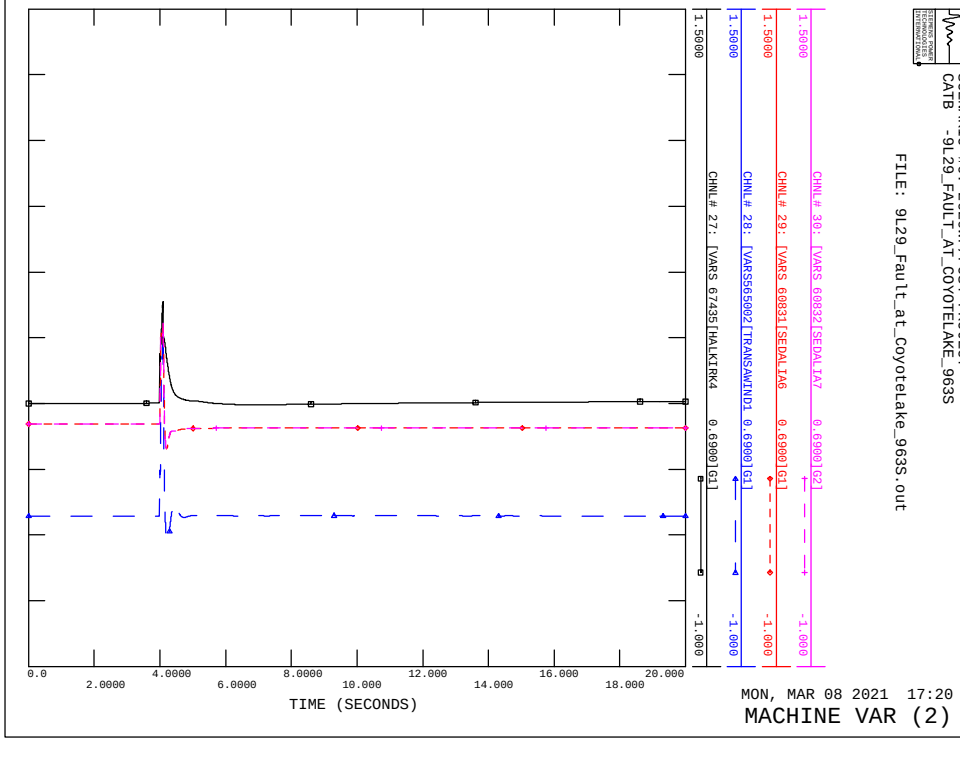
CHNL# 5: [ANGL 1487[SHEER 29 19.000]2] 90.000 -90.00
CHNL# 4: [ANGL 1482[SHEER 1 19.000]1] 90.000 -90.00
CHNL# 3: [ANGL 1497[BAT #5 21.000]5] 120.00 -90.00
CHNL# 2: [ANGL 1496[BAT #4 16.000]4] 90.000 -90.00
CHNL# 1: [ANGL 1495[BAT #3 16.000]3] 90.000 -90.00

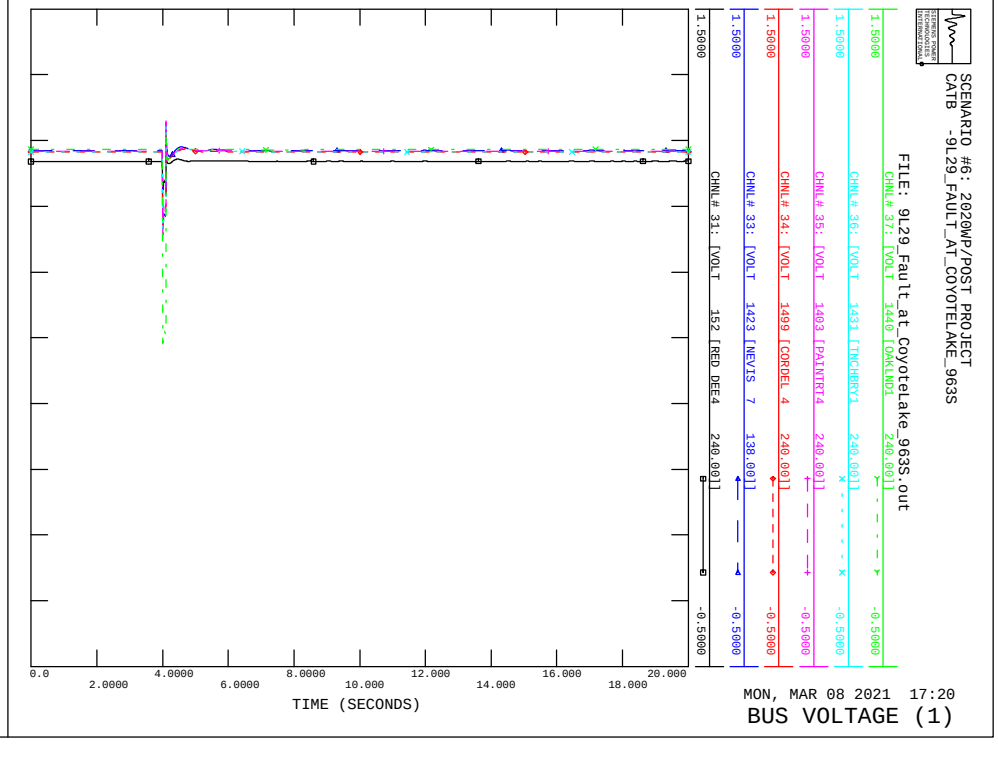
MON, MAR 08 2021 17:20 MACHINE ANGEL

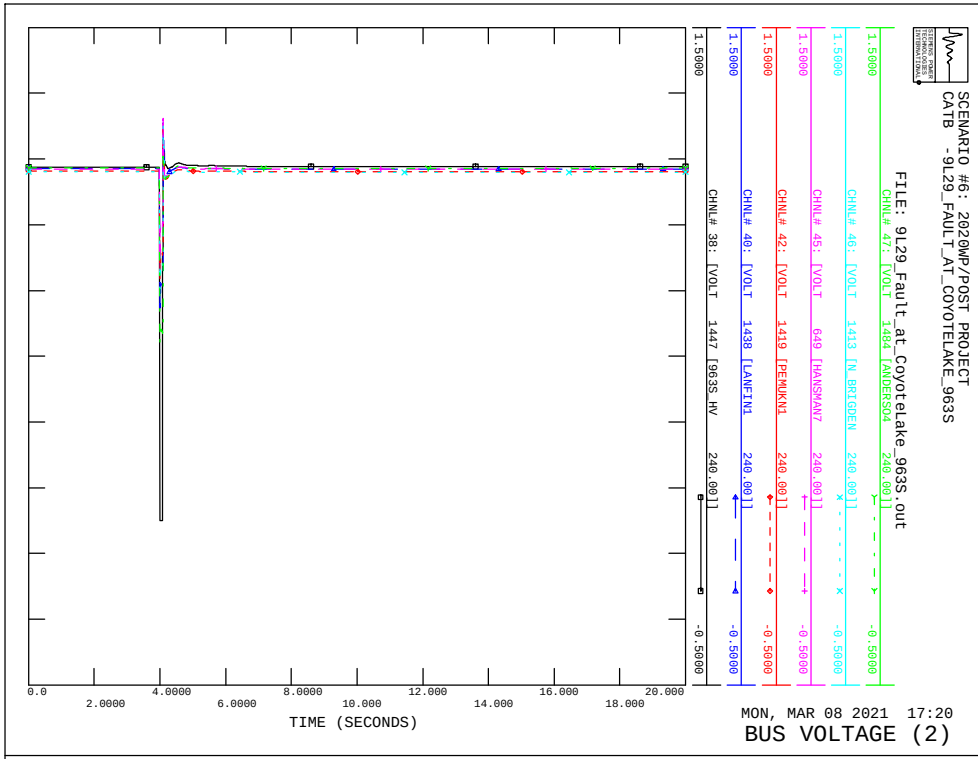
TIME (SECONDS)

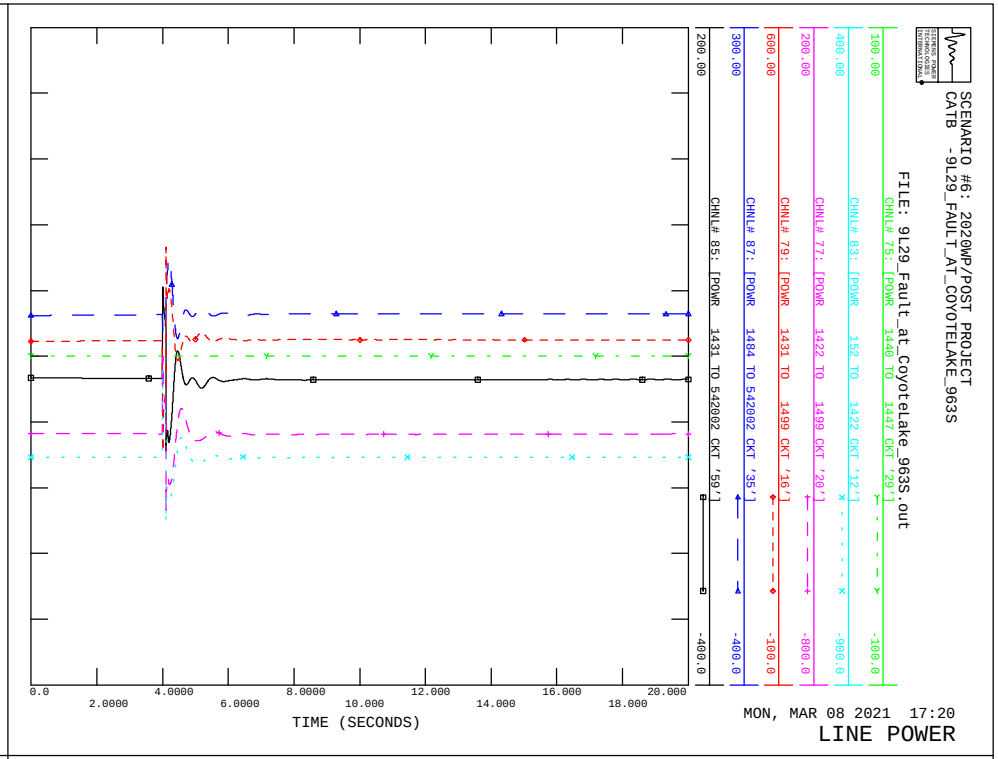

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L29_FAULT_AT_COYOTELAKE_963S
FILE: 9L29_Fault_at_Coyotelake_963S.out
MON, MAR 08 2021 17:20
MACHINE POWER (2)
TIME (SECONDS)

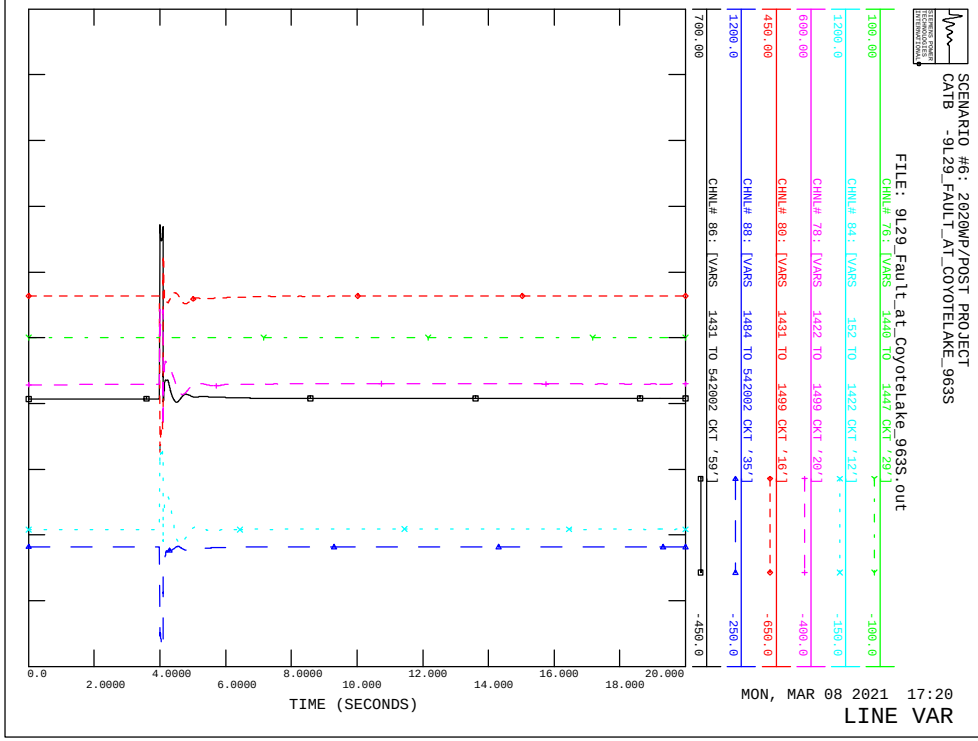

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L29_FAULT_AT_COYOTELAKE_963S
FILE: 9L29_Fault_at_Coyotelake_963S.out
MON, MAR 08 2021 17:20
MACHINE VAR (1)
TIME (SECONDS)

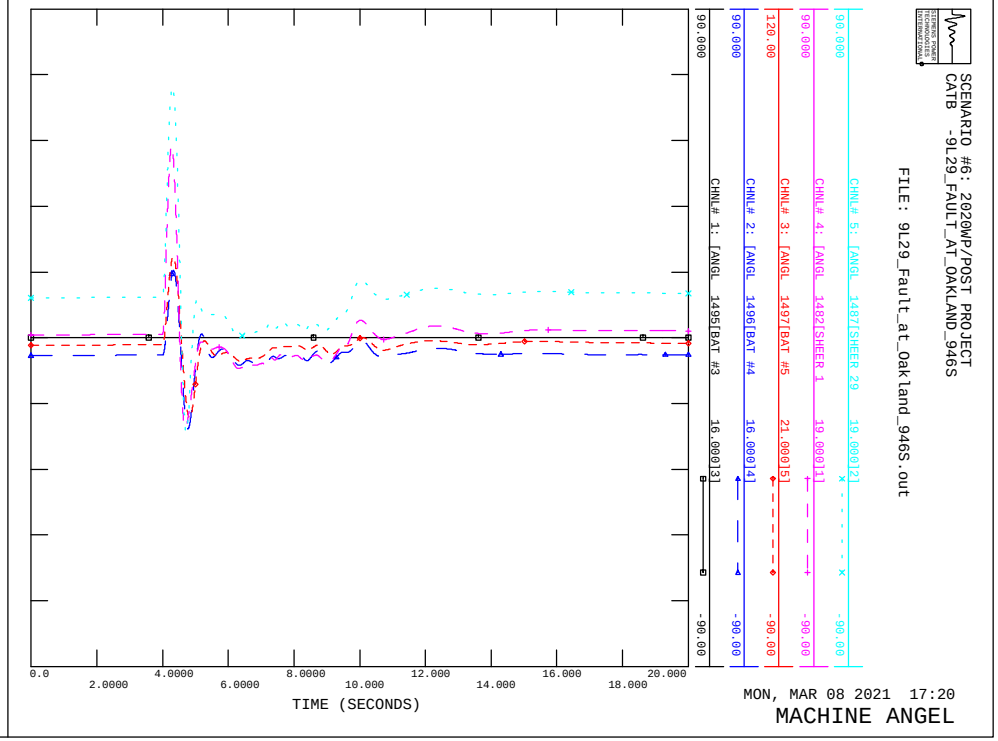

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L29_FAULT_AT_COYOTELAKE_963S
FILE: 9L29_Fault_at_Coyotelake_963S.out
MON, MAR 08 2021 17:20
MACHINE VAR (2)
TIME (SECONDS)

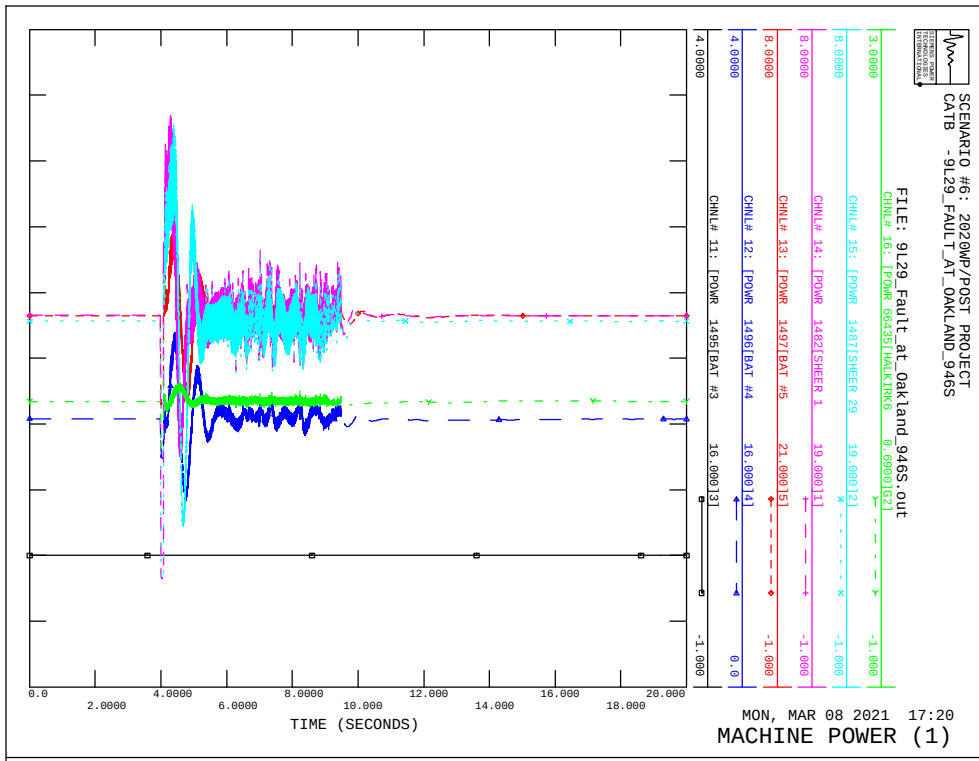

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L29_FAULT_AT_COYOTELAKE_963S
FILE: 9L29_Fault_at_Coyotelake_963S.out
MON, MAR 08 2021 17:20
BUS VOLTAGE (1)
TIME (SECONDS)

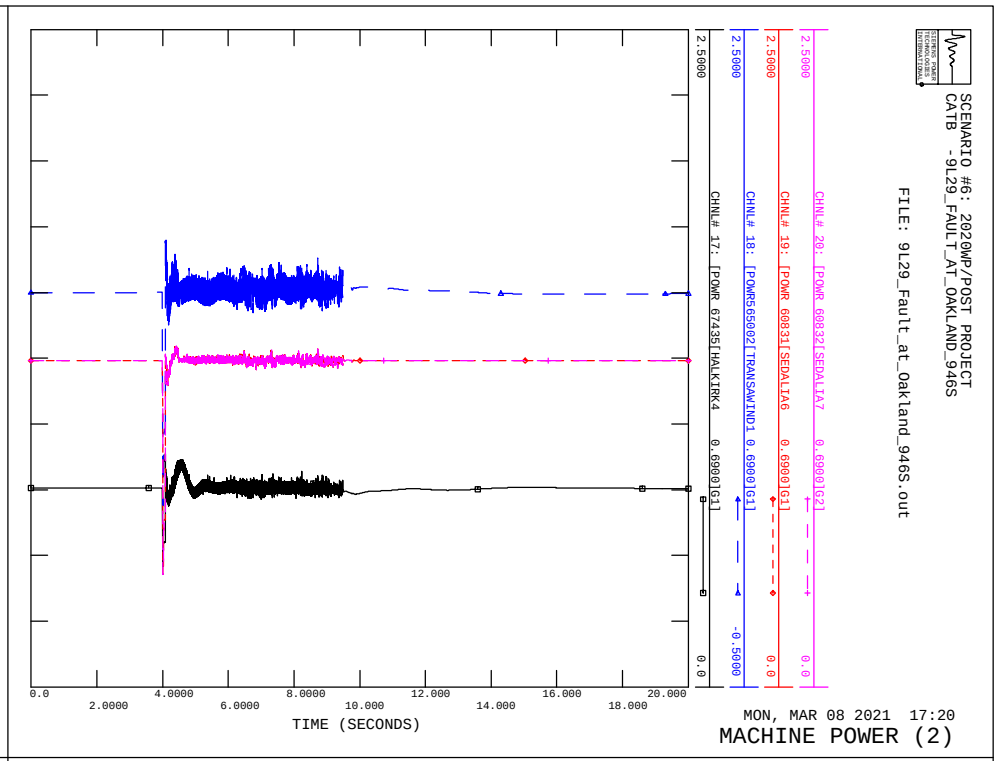

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L29_FAULT_AT_COYOTELAKE_963S
FILE: 9L29_Fault_at_Coyotelake_963S.out
TIME (SECONDS)
MON, MAR 08 2021 17:20
BUS VOLTAGE (2)

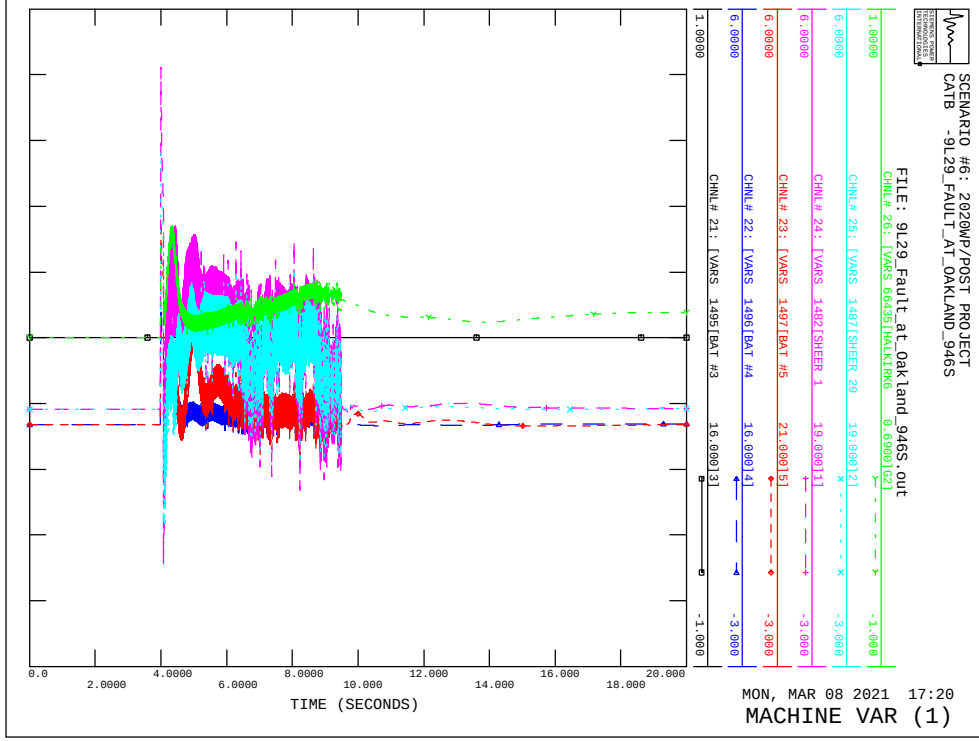

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L29_FAULT_AT_COYOTELAKE_963S
FILE: 9L29_Fault_at_Coyotelake_963S.out
TIME (SECONDS)
MON, MAR 08 2021 17:20
LINE POWER

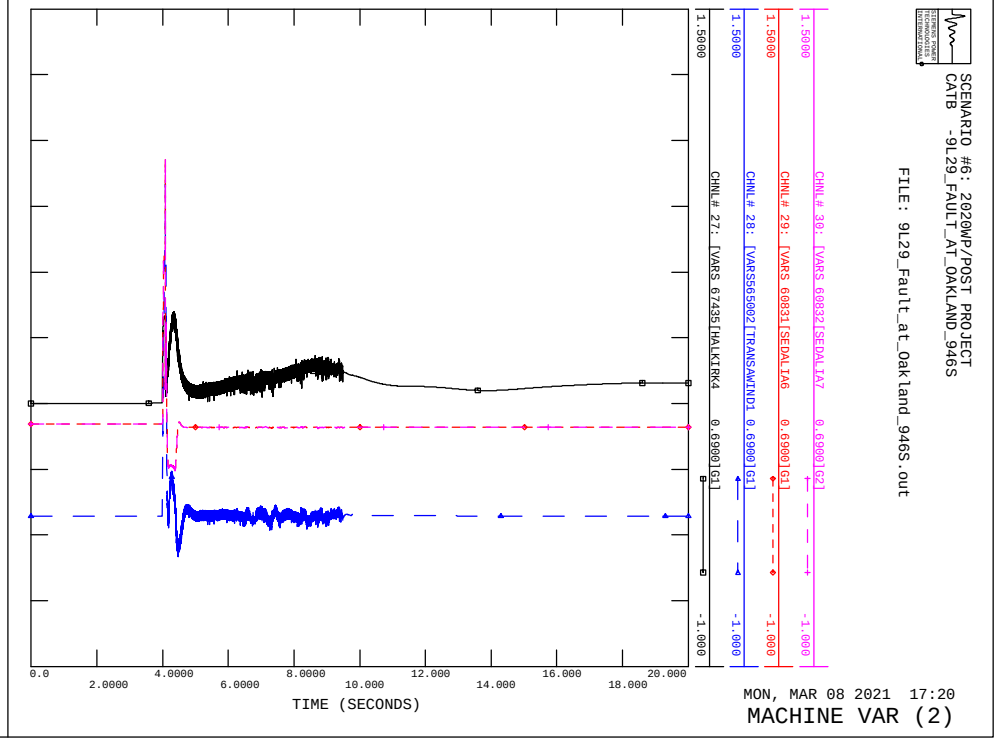

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L29_FAULT_AT_COYOTELAKE_963S
FILE: 9L29_Fault_at_Coyotelake_963S.out
TIME (SECONDS)
MON, MAR 08 2021 17:20
LINE VAR

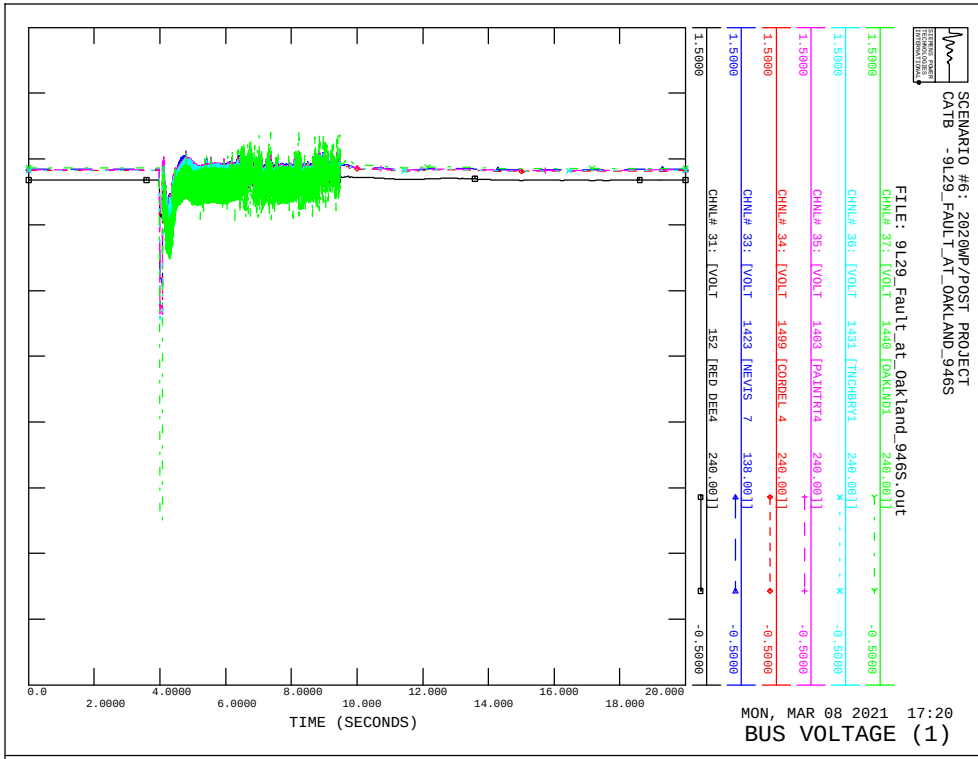

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L29_FAULT_AT_OAKLAND_946S
FILE: 9L29_Fault_at_Oakland_946S.out
TIME (SECONDS)
MON, MAR 08 2021 17:20
MACHINE ANGEL

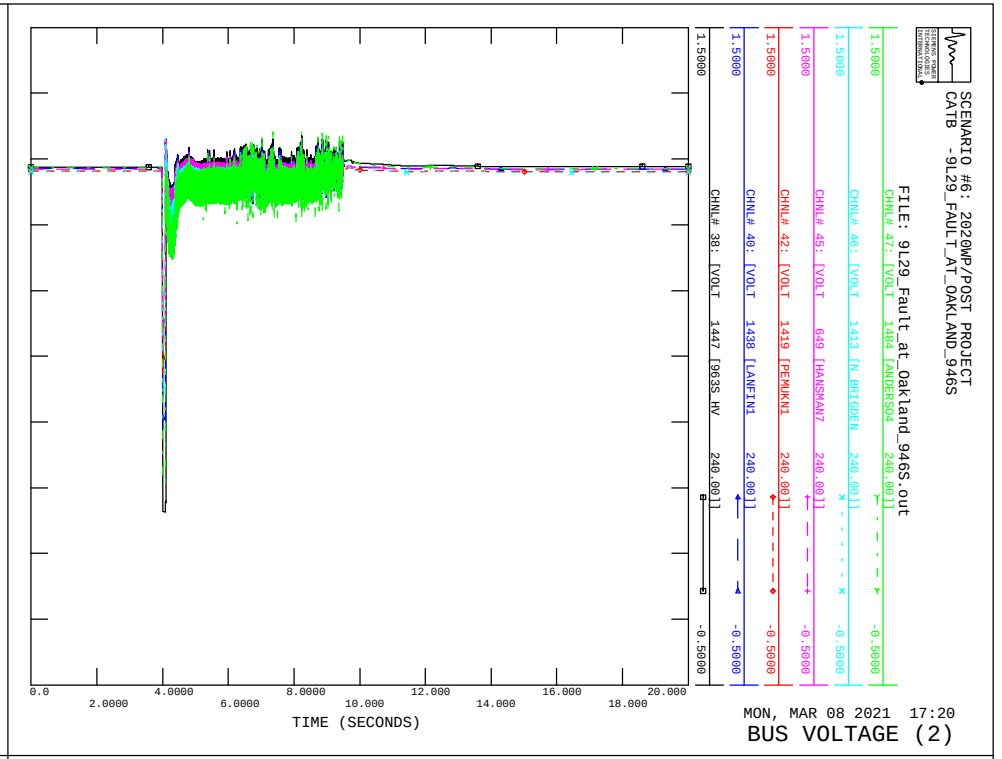

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L29_FAULT_AT_OAKLAND_946S
FILE: 9L29_Fault_at_Oakland_946S.out
TIME (SECONDS)
MON, MAR 08 2021 17:20
MACHINE POWER (1)

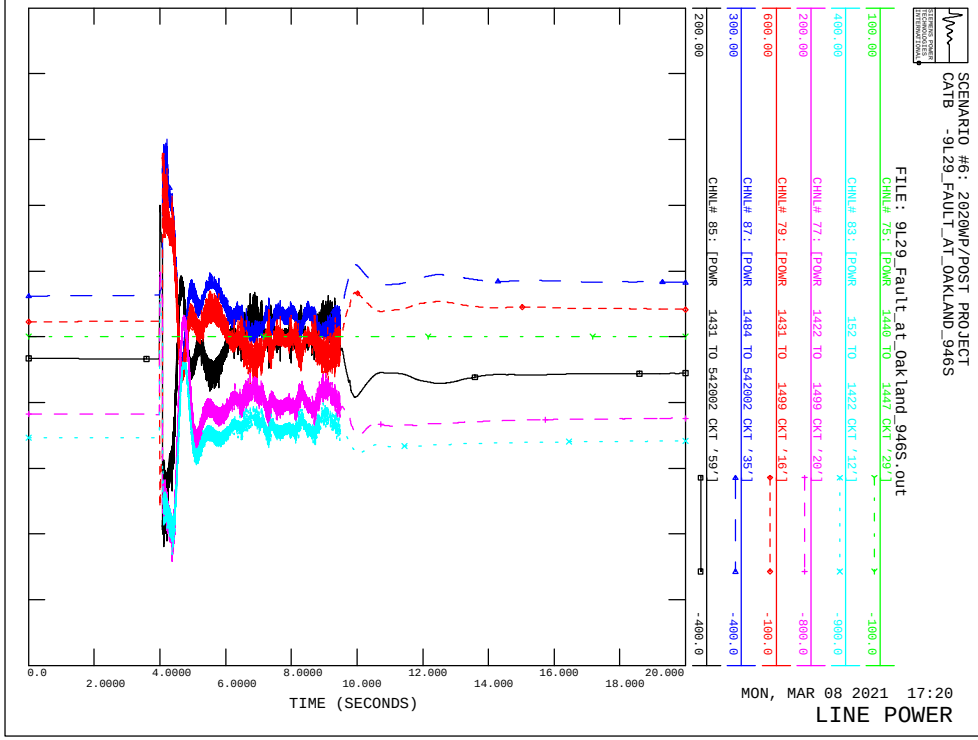

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L29_FAULT_AT_OAKLAND_946S
FILE: 9L29_Fault_at_Oakland_946S.out
TIME (SECONDS)
MON, MAR 08 2021 17:20
MACHINE POWER (2)

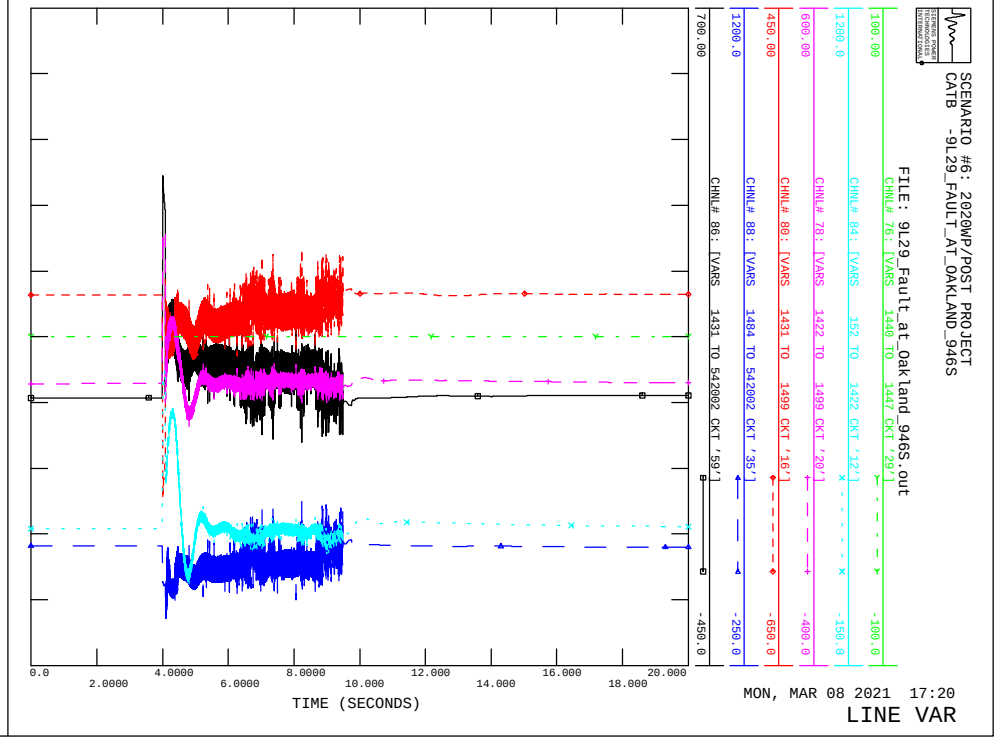

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L29_FAULT_AT_OAKLAND_946S
FILE: 9L29_Fault_at_Oakland_946S.out
TIME (SECONDS)
MON, MAR 08 2021 17:20
MACHINE VAR (1)

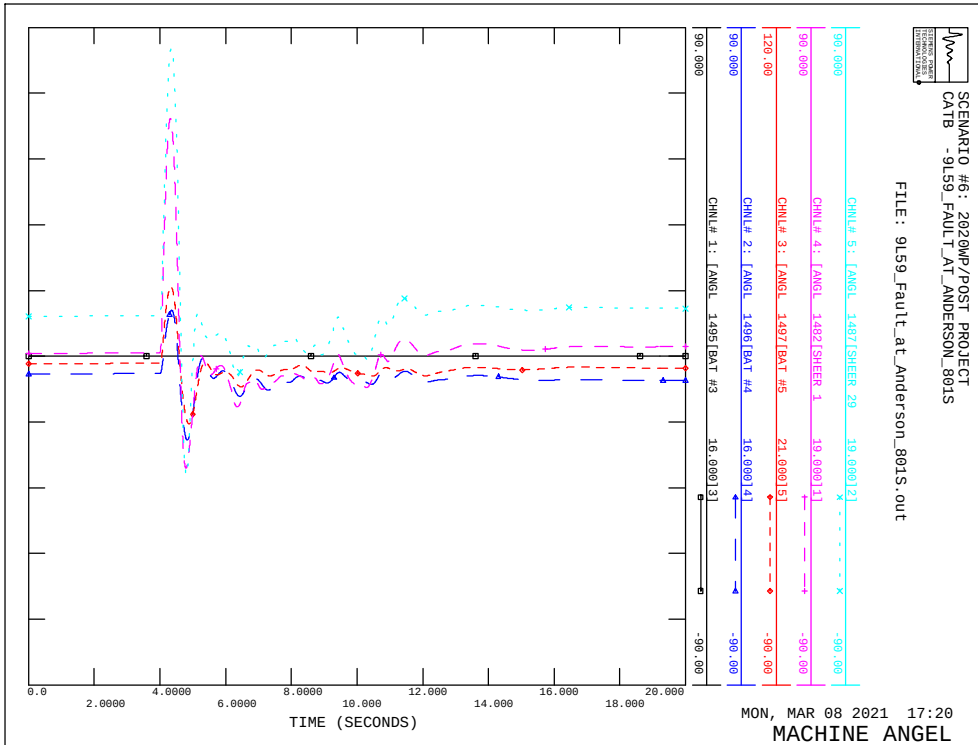

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L29_FAULT_AT_OAKLAND_946S
FILE: 9L29_Fault_at_Oakland_946S.out
TIME (SECONDS)
MON, MAR 08 2021 17:20
MACHINE VAR (2)

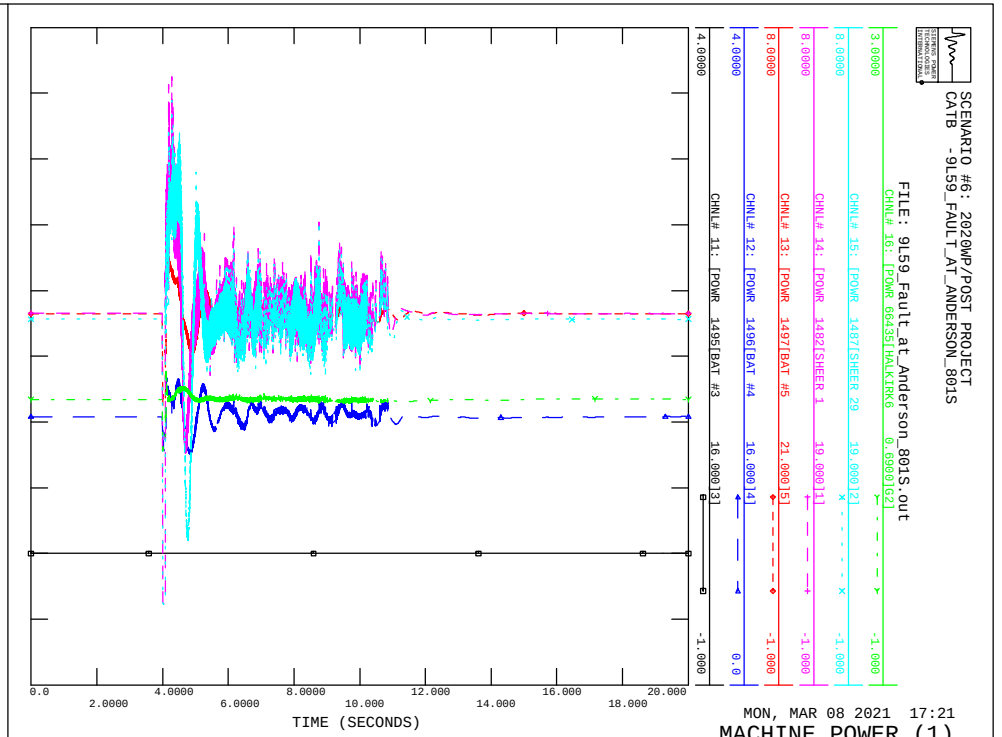

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L29_FAULT_AT_OAKLAND_946S
FILE: 9L29_Fault_at_Oakland_946S.out
CHNL# 31: [VOLT 152 [RED DEE4 240.00]]
CHNL# 33: [VOLT 1423 [NEVIS 7 138.00]]
CHNL# 34: [VOLT 1499 [CORBDEL 4 240.00]]
CHNL# 35: [VOLT 1403 [PATNTRT4 240.00]]
CHNL# 36: [VOLT 1431 [TNCHBRY1 240.00]]
CHNL# 37: [VOLT 1440 [OAKLND1 240.00]]
1.5000
-0.5000
0.0
2.0000
4.0000
6.0000
8.0000
10.000
12.000
14.000
16.000
18.000
20.000
TIME (SECONDS)
MON, MAR 08 2021 17:20
BUS VOLTAGE (1)

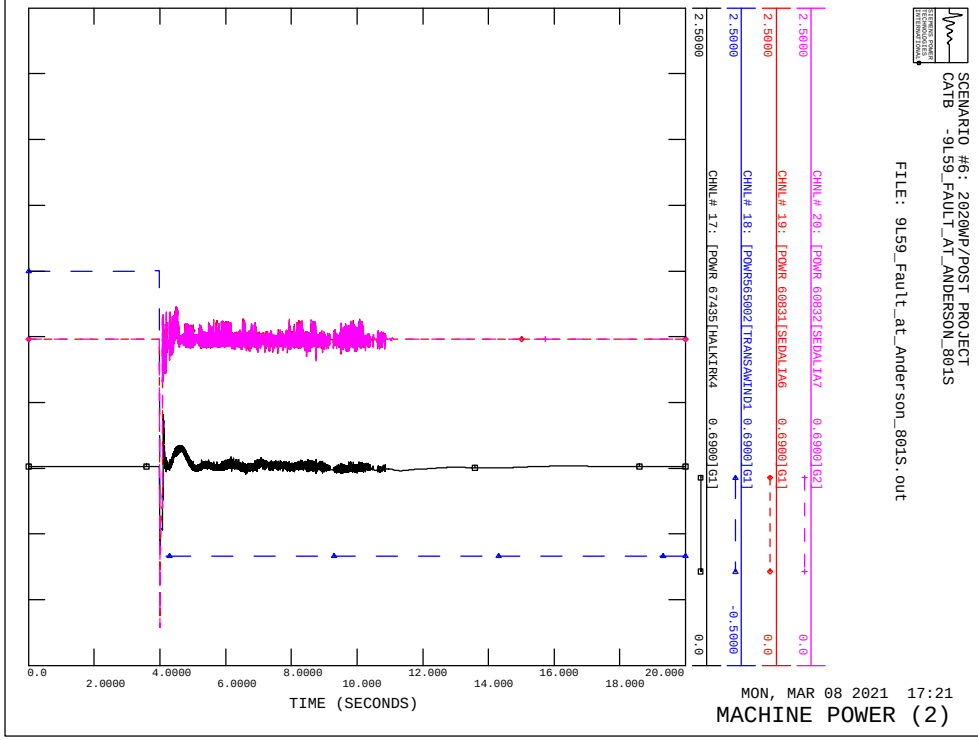

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L29_FAULT_AT_OAKLAND_946S
FILE: 9L29_Fault_at_Oakland_946S.out
CHNL# 38: [VOLT 1447 [963S HV 240.00]]
CHNL# 40: [VOLT 1438 [LANFTN1 240.00]]
CHNL# 42: [VOLT 1419 [PEMUKN1 240.00]]
CHNL# 45: [VOLT 649 [HANSMAN7 240.00]]
CHNL# 46: [VOLT 1413 [N BRIGDEN 240.00]]
CHNL# 47: [VOLT 1464 [ANDERSO4 240.00]]
1.5000
-0.5000
0.0
2.0000
4.0000
6.0000
8.0000
10.000
12.000
14.000
16.000
18.000
20.000
TIME (SECONDS)
MON, MAR 08 2021 17:20
BUS VOLTAGE (2)

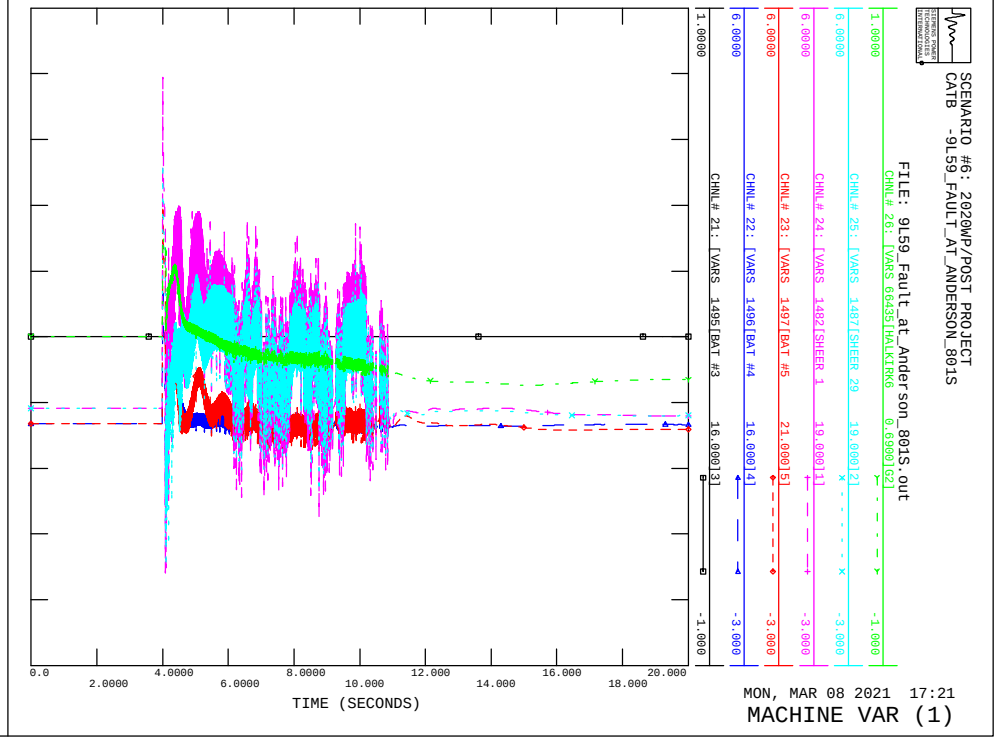

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L29_FAULT_AT_OAKLAND_946S
FILE: 9L29_Fault_at_Oakland_946S.out
CHNL# 85: [PONR 1431 TO 542002 CKT '59']
CHNL# 87: [PONR 1484 TO 542002 CKT '35']
CHNL# 79: [PONR 1431 TO 1499 CKT '16']
CHNL# 77: [PONR 1422 TO 1499 CKT '20']
CHNL# 83: [PONR 152 TO 1422 CKT '12']
CHNL# 75: [PONR 1440 TO 1447 CKT '29']
200.00
-400.0
0.0
2.0000
4.0000
6.0000
8.0000
10.000
12.000
14.000
16.000
18.000
20.000
TIME (SECONDS)
MON, MAR 08 2021 17:20
LINE POWER

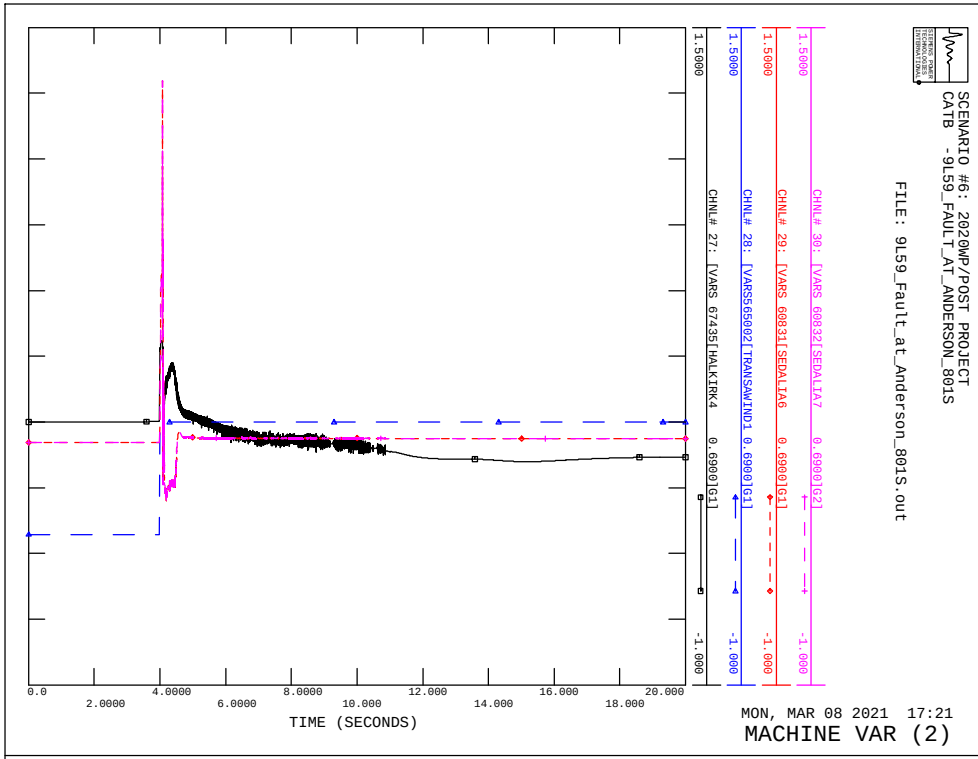

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L29_FAULT_AT_OAKLAND_946S
FILE: 9L29_Fault_at_Oakland_946S.out
CHNL# 86: [VARS 1431 TO 542002 CKT '59']
CHNL# 88: [VARS 1484 TO 542002 CKT '35']
CHNL# 80: [VARS 1431 TO 1499 CKT '16']
CHNL# 78: [VARS 1422 TO 1499 CKT '20']
CHNL# 84: [VARS 152 TO 1422 CKT '12']
CHNL# 76: [VARS 1440 TO 1447 CKT '29']
700.00
-450.0
0.0
2.0000
4.0000
6.0000
8.0000
10.000
12.000
14.000
16.000
18.000
20.000
TIME (SECONDS)
MON, MAR 08 2021 17:20
LINE VAR

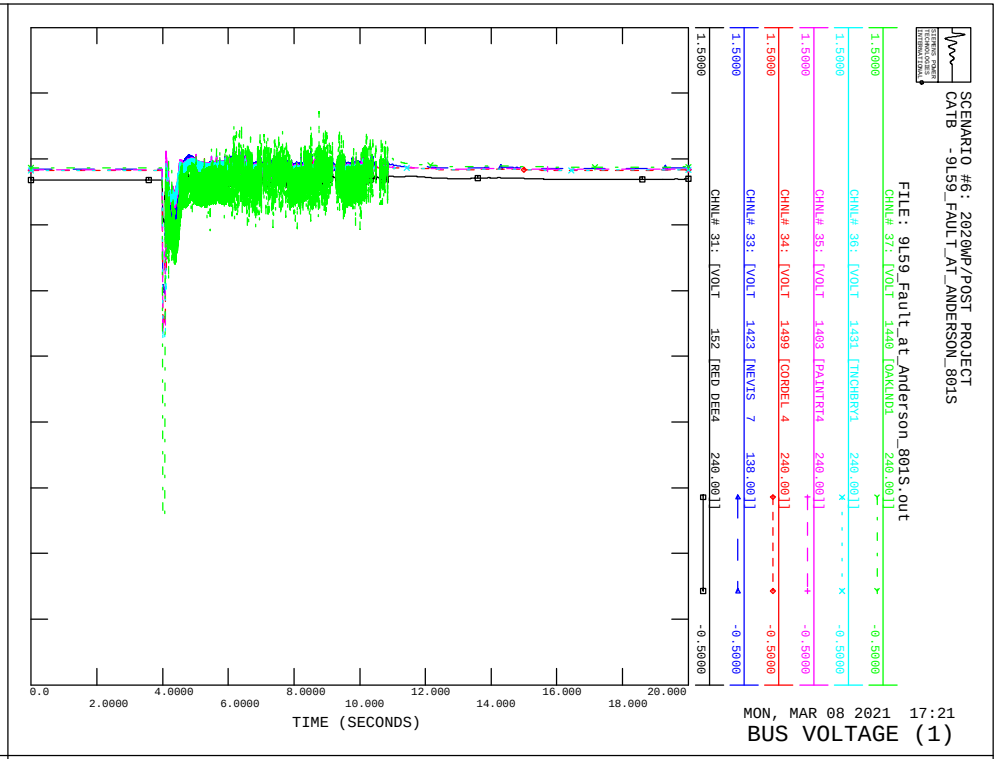

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L59_FAULT_AT_ANDERSON_801S
FILE: 9L59_Fault_at_Anderson_801S.out
TIME (SECONDS)
MON, MAR 08 2021 17:20
MACHINE ANGEL

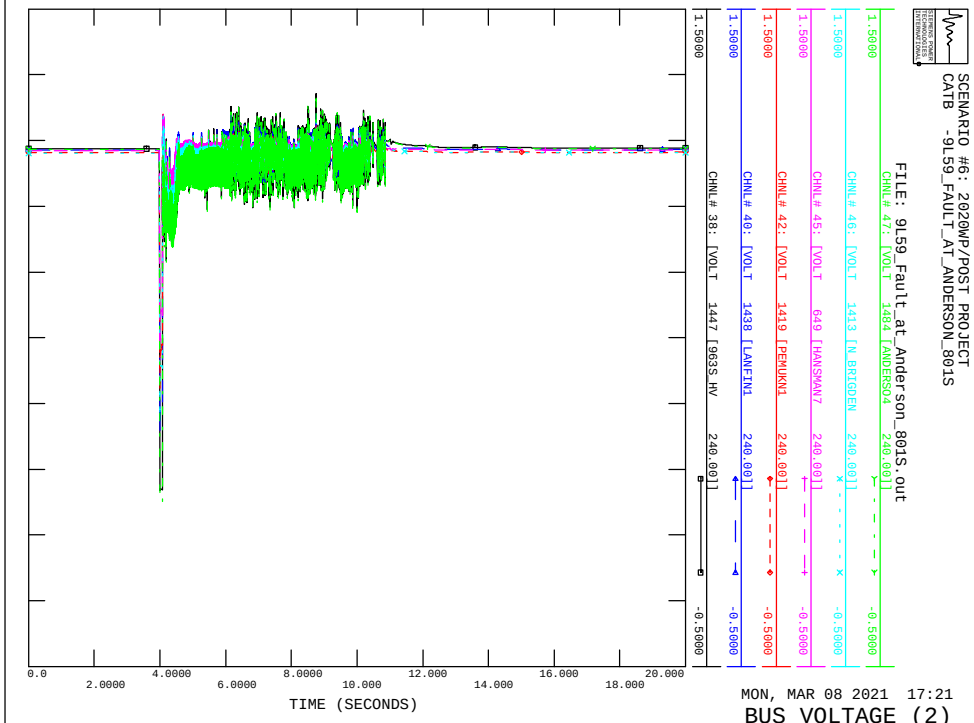

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L59_FAULT_AT_ANDERSON_801S
FILE: 9L59_Fault_at_Anderson_801S.out
TIME (SECONDS)
MON, MAR 08 2021 17:21
MACHINE POWER (1)

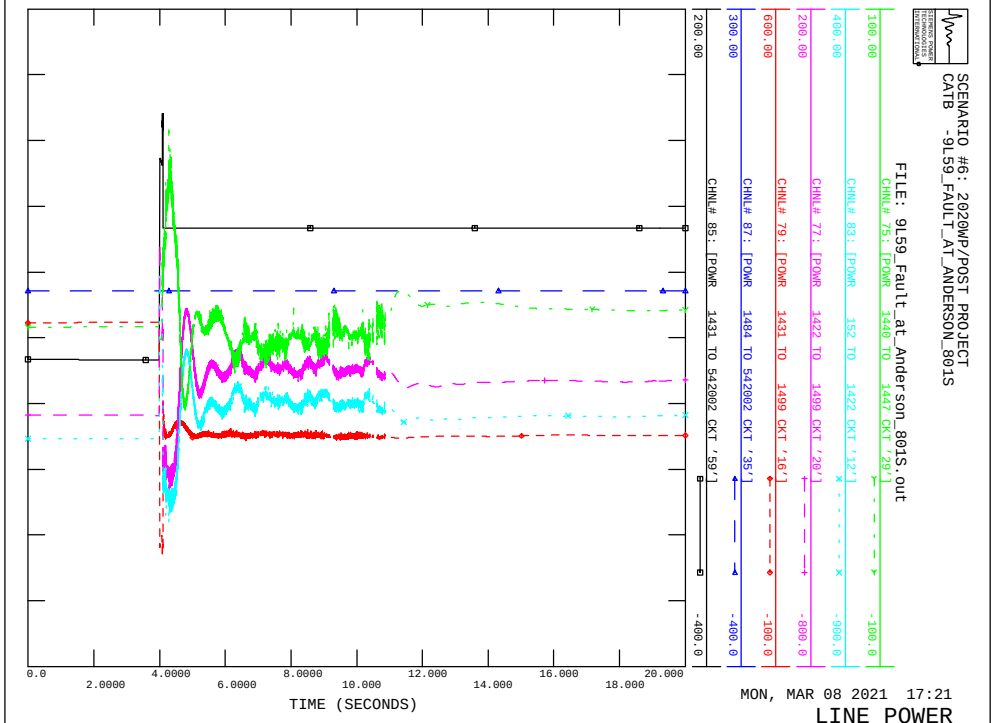

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L59_FAULT_AT_ANDERSON_801S
FILE: 9L59_Fault_at_Anderson_801S.out
TIME (SECONDS)
MON, MAR 08 2021 17:21
MACHINE POWER (2)

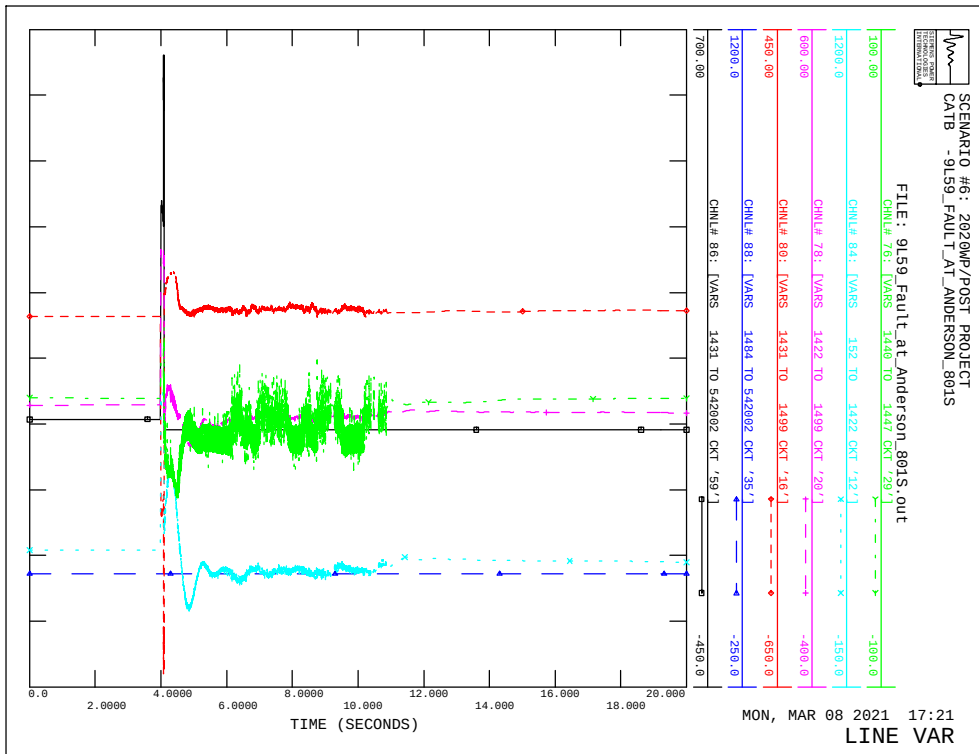

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L59_FAULT_AT_ANDERSON_801S
FILE: 9L59_Fault_at_Anderson_801S.out
TIME (SECONDS)
MON, MAR 08 2021 17:21
MACHINE VAR (1)

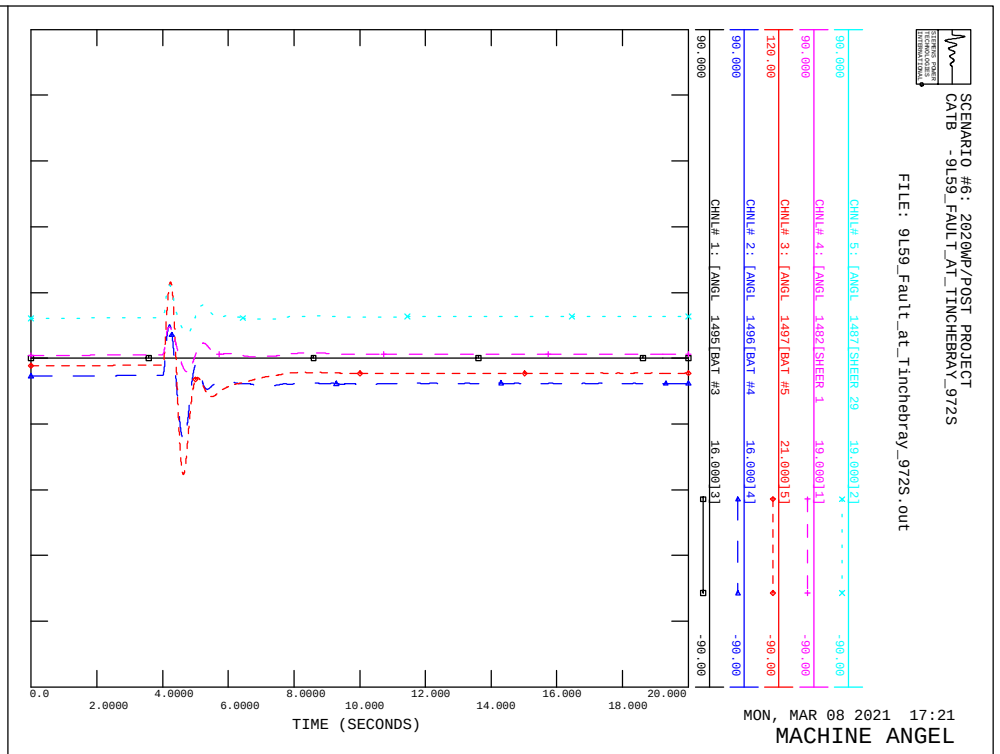

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L59_FAULT_AT_ANDERSON_801S
FILE: 9L59_Fault_at_Anderson_801S.out
CHNL# 27: [VARS 67435[HALKIRK4 0.6900[G1]
CHNL# 28: [VARS56560927[TRANSAWIND1 0.6900[G1]
CHNL# 29: [VARS 60831[SEDALIA6 0.6900[G1]
CHNL# 30: [VARS 60832[SEDALIA7 0.6900[G2]
TIME (SECONDS)
MON, MAR 08 2021 17:21
MACHINE VAR (2)

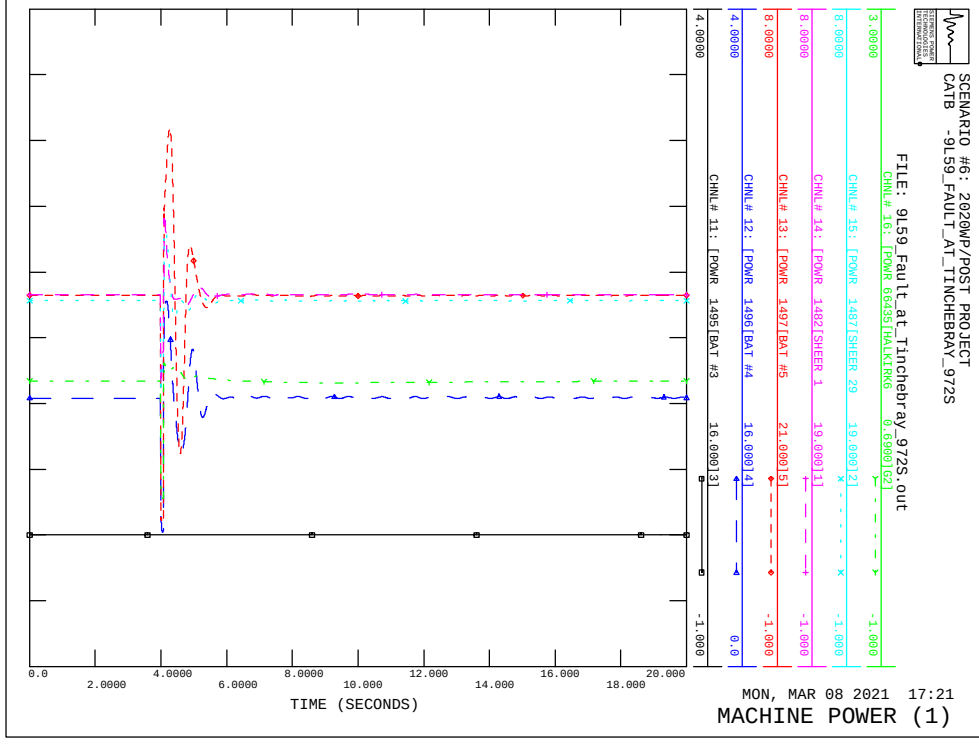

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L59_FAULT_AT_ANDERSON_801S
FILE: 9L59_Fault_at_Anderson_801S.out
CHNL# 31: [VOLT 152 [RED DEE4 240.00]]
CHNL# 33: [VOLT 1423 [NEVIS 7 138.00]]
CHNL# 34: [VOLT 1499 [CORDEL 4 240.00]]
CHNL# 35: [VOLT 1493 [PAINTRT4 240.00]]
CHNL# 36: [VOLT 1431 [TNCHBRY1 240.00]]
CHNL# 37: [VOLT 1440 [OAKLND1 240.00]]
TIME (SECONDS)
MON, MAR 08 2021 17:21
BUS VOLTAGE (1)

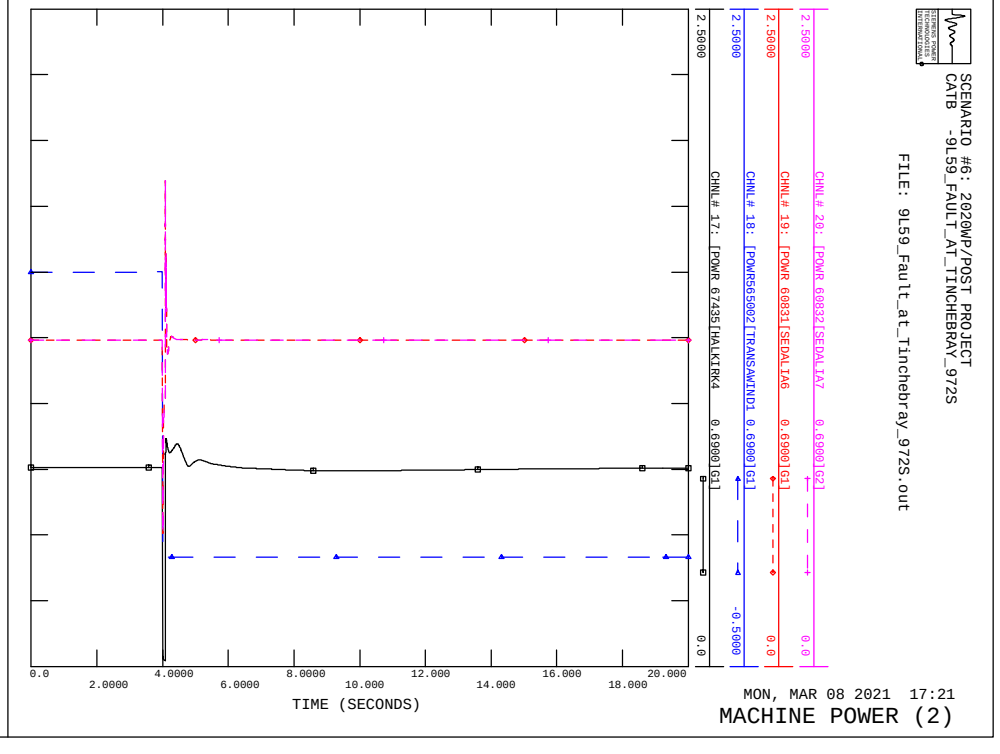

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L59_FAULT_AT_ANDERSON_801S
FILE: 9L59_Fault_at_Anderson_801S.out
CHNL# 38: [VOLT 1447 [9633_HV 240.00]]
CHNL# 40: [VOLT 1438 [LANFIN1 240.00]]
CHNL# 42: [VOLT 1419 [PEMUKN1 240.00]]
CHNL# 45: [VOLT 649 [HANSMAN7 240.00]]
CHNL# 46: [VOLT 1413 [N BRIGDEN 240.00]]
CHNL# 47: [VOLT 1484 [ANDERSO4 240.00]]
TIME (SECONDS)
MON, MAR 08 2021 17:21
BUS VOLTAGE (2)

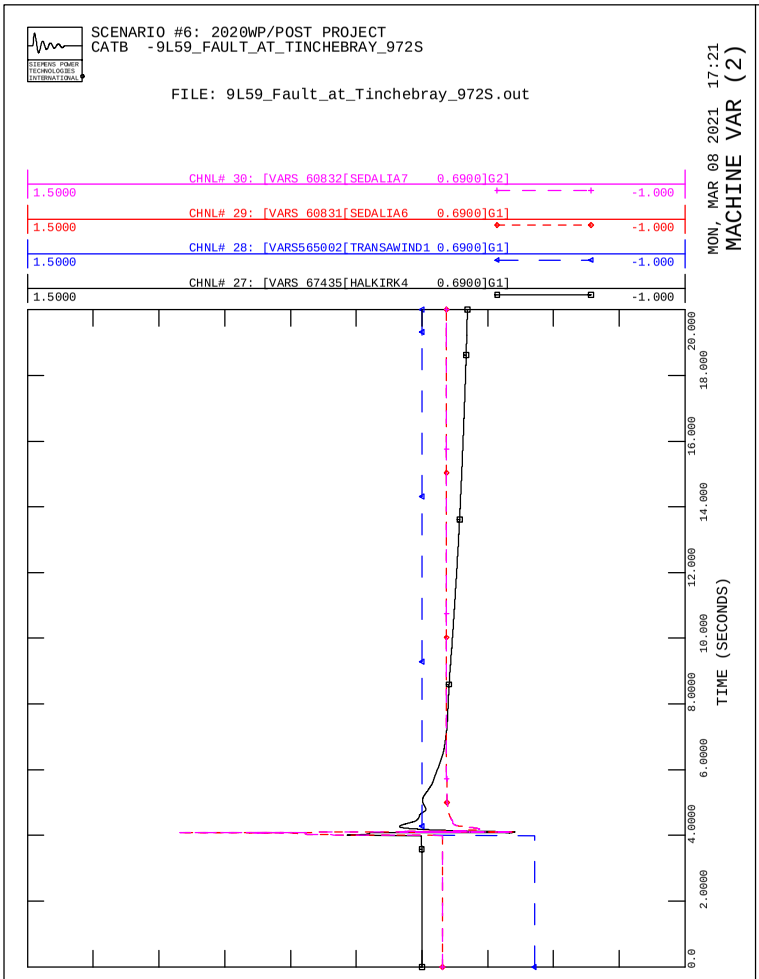

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L59_FAULT_AT_ANDERSON_801S
FILE: 9L59_Fault_at_Anderson_801S.out
CHNL# 85: [POWR 1431 TO 542002 CKT '59']
CHNL# 87: [POWR 1484 TO 542002 CKT '35']
CHNL# 79: [POWR 1431 TO 1499 CKT '16']
CHNL# 77: [POWR 1422 TO 1499 CKT '20']
CHNL# 83: [POWR 152 TO 1422 CKT '12']
CHNL# 75: [POWR 1440 TO 1447 CKT '29']
TIME (SECONDS)
MON, MAR 08 2021 17:21
LINE POWER

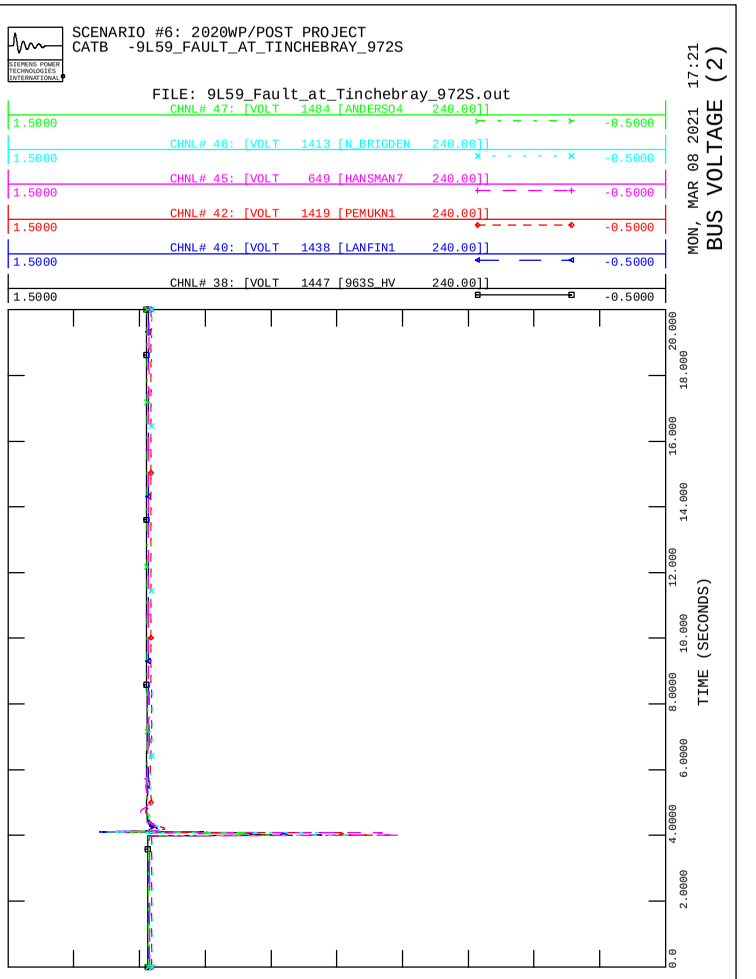

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L59_FAULT_AT_ANDERSON_801S
FILE: 9L59_Fault_at_Anderson_801S.out
CHNL# 76: [VARS 1440 TO 1447 CKT '29']
CHNL# 84: [VARS 152 TO 1422 CKT '12']
CHNL# 78: [VARS 1422 TO 1499 CKT '20']
CHNL# 80: [VARS 1431 TO 1499 CKT '16']
CHNL# 88: [VARS 1484 TO 542002 CKT '35']
CHNL# 86: [VARS 1431 TO 542002 CKT '59']
TIME (SECONDS)
MON, MAR 08 2021 17:21
LINE VAR

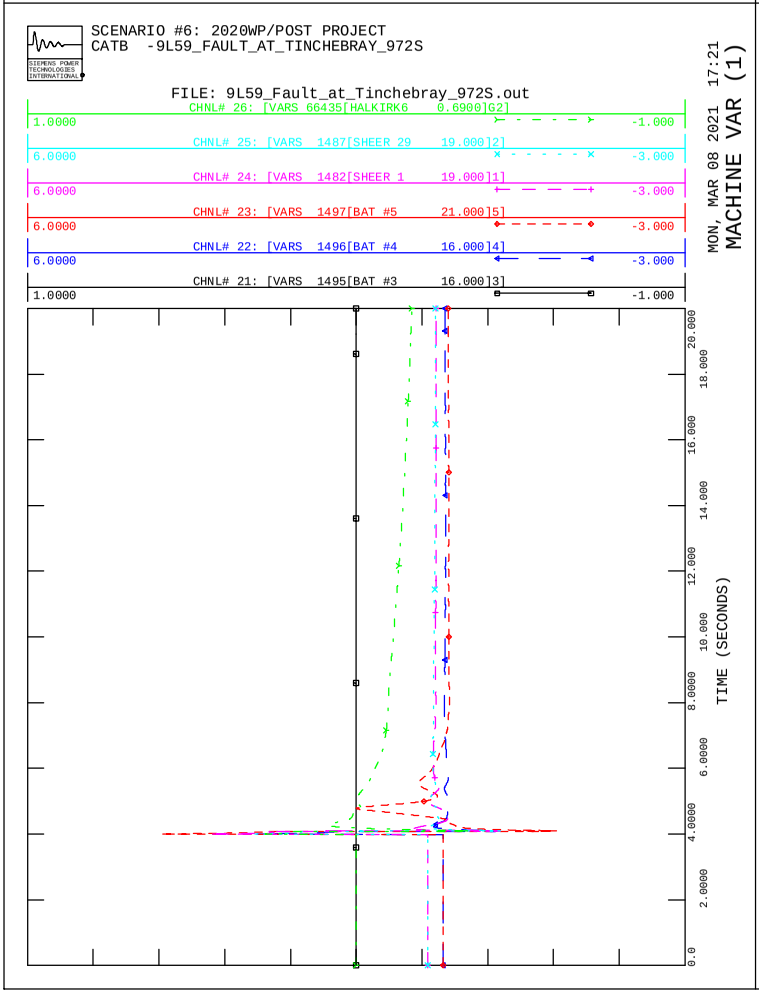

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L59_FAULT_AT_TINCHEBRAY_972S
FILE: 9L59_Fault_at_Tinchebray_972S.out
CHNL# 1: [ANGL 1495[BAT #3
CHNL# 2: [ANGL 1496[BAT #4
CHNL# 3: [ANGL 1497[BAT #5
CHNL# 4: [ANGL 1482[SHEER 1
CHNL# 5: [ANGL 1487[SHEER 29
TIME (SECONDS)
MON, MAR 08 2021 17:21
MACHINE ANGEL

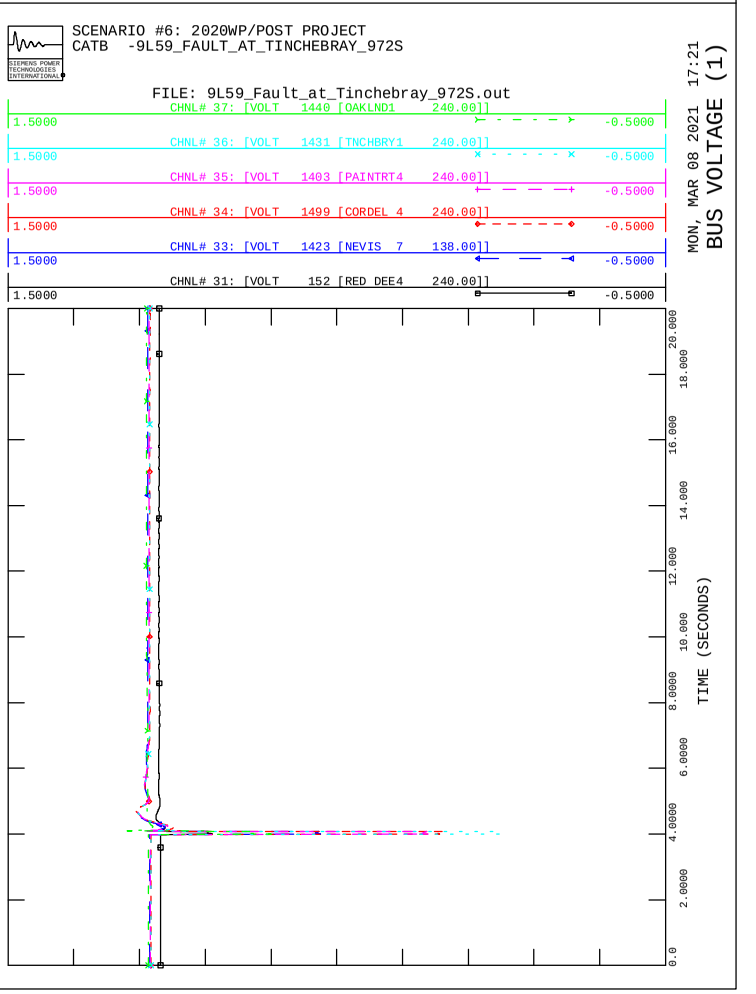

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L59_FAULT_AT_TINCHEBRAY_972S
FILE: 9L59_Fault_at_Tinchebray_972S.out
CHNL# 11: [POWR 1495[BAT #3
CHNL# 12: [POWR 1496[BAT #4
CHNL# 13: [POWR 1497[BAT #5
CHNL# 14: [POWR 1482[SHEER 1
CHNL# 15: [POWR 1487[SHEER 29
CHNL# 16: [POWR 66435[HALKIRK6
TIME (SECONDS)
MON, MAR 08 2021 17:21
MACHINE POWER (1)


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L59_FAULT_AT_TINCHEBRAY_972S
FILE: 9L59_Fault_at_Tinchebray_972S.out
CHNL# 17: [POWR 67435[HALKIRK4
CHNL# 18: [POWR565002[TRANSAWIND1
CHNL# 19: [POWR 66831[SEDALIA6
CHNL# 20: [POWR 66832[SEDALIA7
TIME (SECONDS)
MON, MAR 08 2021 17:21
MACHINE POWER (2)


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L59_FAULT_AT_TINCHEBRAY_972S
FILE: 9L59_Fault_at_Tinchebray_972S.out
CHNL# 30: [VARS 60832[SEDALIA7 0.6900]G2]
CHNL# 29: [VARS 60831[SEDALIA6 0.6900]G1]
CHNL# 28: [VARS565002[TRANSAWIND1 0.6900]G1]
CHNL# 27: [VARS 67435[HALKIRK4 0.6900]G1]
1.5000
-1.000
0.0
2.0000
4.0000
6.0000
8.0000
10.000
12.000
14.000
16.000
18.000
20.000
TIME (SECONDS)
MON, MAR 08 2021 17:21
MACHINE VAR (2)

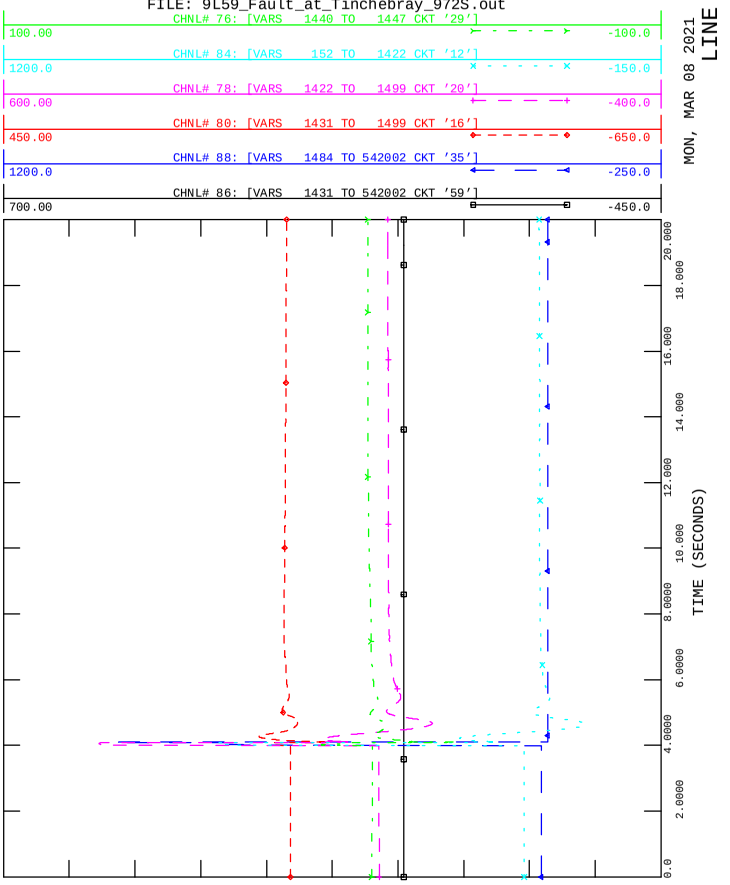

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L59_FAULT_AT_TINCHEBRAY_972S
FILE: 9L59_Fault_at_Tinchebray_972S.out
CHNL# 47: [VOLT 1484 [ANDERSO4 240.00]]
CHNL# 46: [VOLT 1413 [N_BRIGDEN 240.00]]
CHNL# 45: [VOLT 649 [HANSMAN7 240.00]]
CHNL# 42: [VOLT 1419 [PEMUKN1 240.00]]
CHNL# 40: [VOLT 1438 [LANFIN1 240.00]]
CHNL# 38: [VOLT 1447 [963S_HV 240.00]]
1.5000
-0.5000
0.0
2.0000
4.0000
6.0000
8.0000
10.000
12.000
14.000
16.000
18.000
20.000
TIME (SECONDS)
MON, MAR 08 2021 17:21
BUS VOLTAGE (2)


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L59_FAULT_AT_TINCHEBRAY_972S
FILE: 9L59_Fault_at_Tinchebray_972S.out
CHNL# 26: [VARS 66435[HALKIRK6 0.6900]G2]
CHNL# 25: [VARS 1487[SHEER 29 19.000]2]
CHNL# 24: [VARS 1482[SHEER 1 19.000]1]
CHNL# 23: [VARS 1497[BAT #5 21.000]5]
CHNL# 22: [VARS 1496[BAT #4 16.000]4]
CHNL# 21: [VARS 1495[BAT #3 16.000]3]
1.0000
6.0000
-1.000
-3.000
0.0
2.0000
4.0000
6.0000
8.0000
10.000
12.000
14.000
16.000
18.000
20.000
TIME (SECONDS)
MON, MAR 08 2021 17:21
MACHINE VAR (1)


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L59_FAULT_AT_TINCHEBRAY_972S
FILE: 9L59_Fault_at_Tinchebray_972S.out
CHNL# 37: [VOLT 1440 [OAKLND1 240.00]]
CHNL# 36: [VOLT 1431 [TNCHBRY1 240.00]]
CHNL# 35: [VOLT 1403 [PAINTRT4 240.00]]
CHNL# 34: [VOLT 1499 [CORDEL 4 240.00]]
CHNL# 33: [VOLT 1423 [NEVIS 7 138.00]]
CHNL# 31: [VOLT 152 [RED DEE4 240.00]]
1.5000
-0.5000
0.0
2.0000
4.0000
6.0000
8.0000
10.000
12.000
14.000
16.000
18.000
20.000
TIME (SECONDS)
MON, MAR 08 2021 17:21
BUS VOLTAGE (1)

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L59_FAULT_AT_TINCHEBRAY_972S

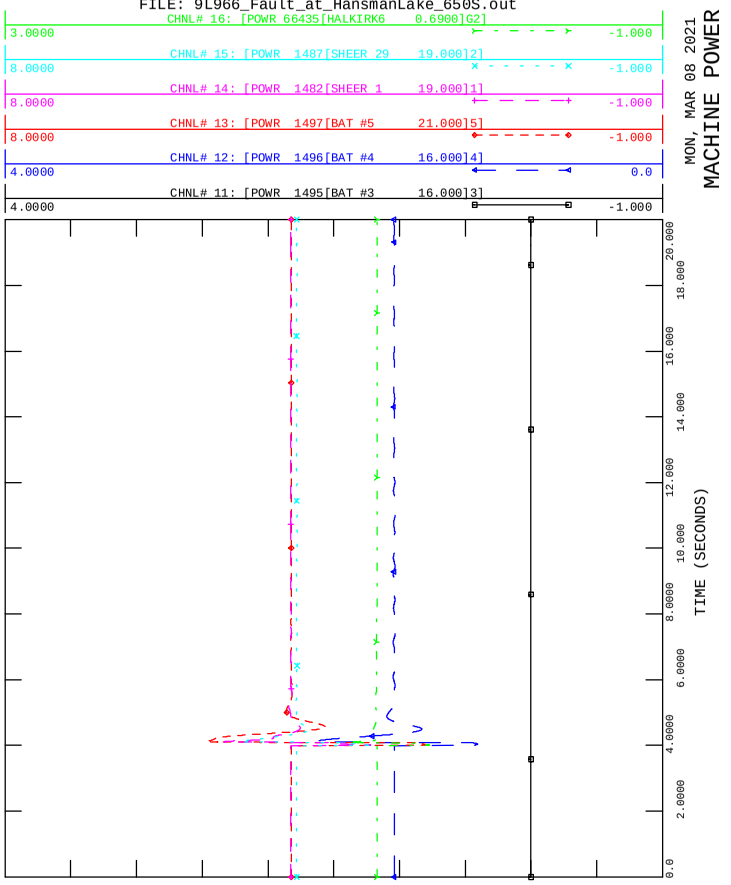
FILE: 9L59_Fault_at_Tinchebray_972S.out



MON, MAR 08 2021 17:21 LINE VAR

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L966_FAULT_AT_HANSMANLAKE_650S

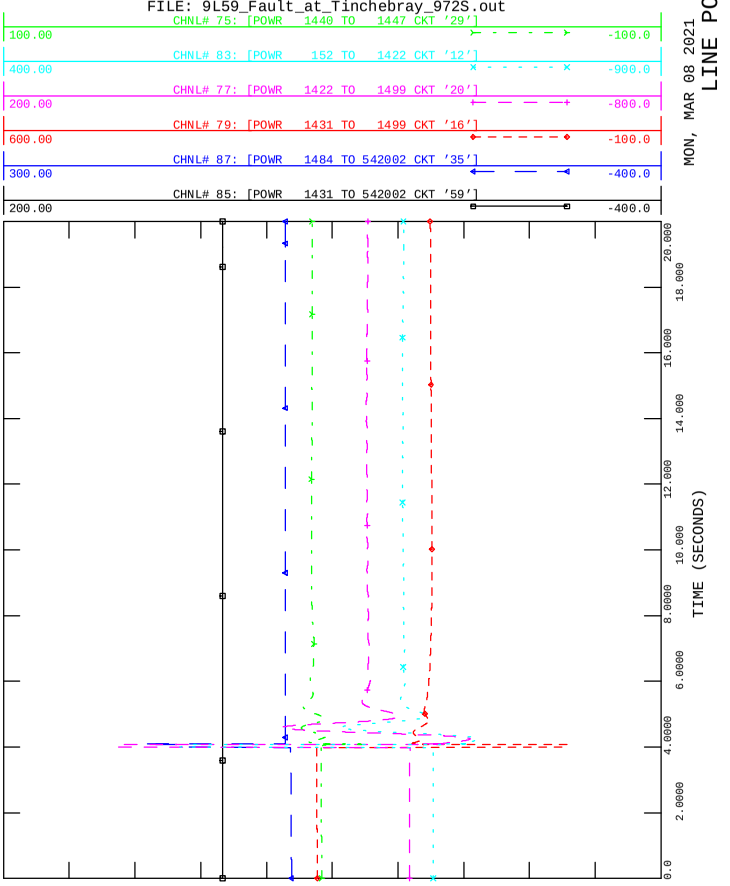
FILE: 9L966_Fault_at_HansmanLake_650S.out



MON, MAR 08 2021 17:21 MACHINE POWER (1)

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L59_FAULT_AT_TINCHEBRAY_972S

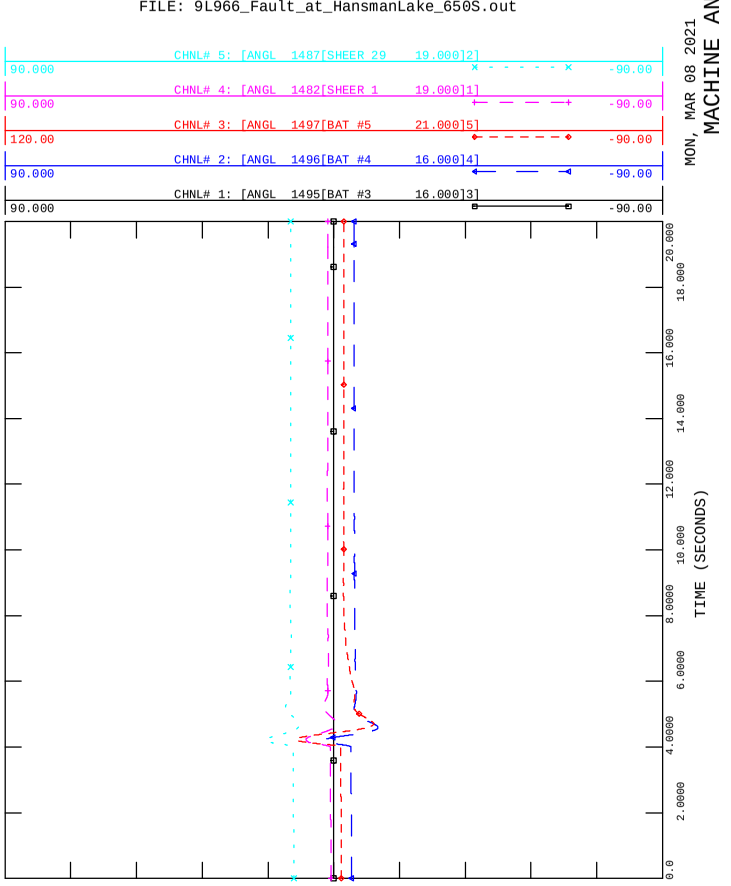
FILE: 9L59_Fault_at_Tinchebray_972S.out



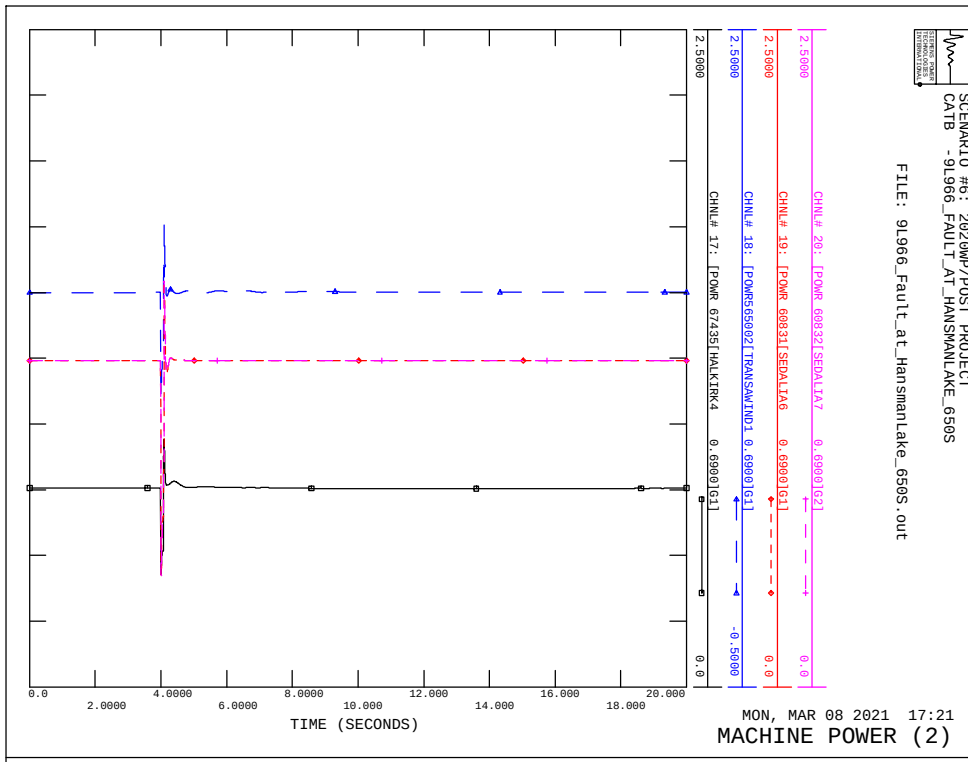
MON, MAR 08 2021 17:21 LINE POWER

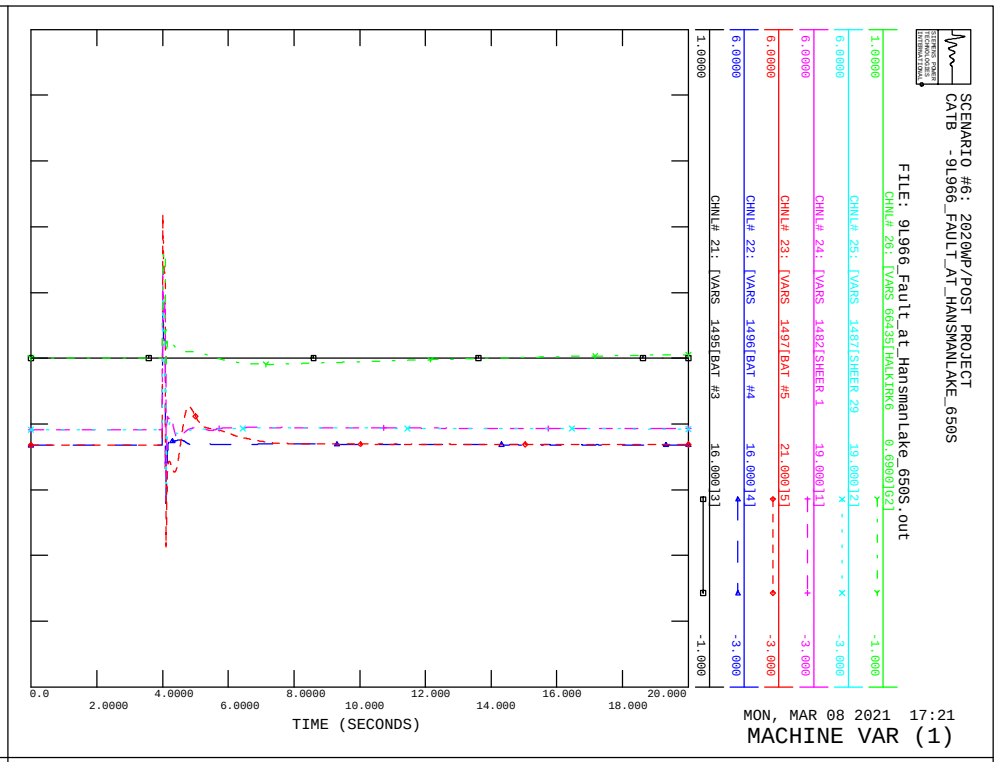
SCENARIO #6: 2020WP/POST PROJECT
CATB -9L966_FAULT_AT_HANSMANLAKE_650S

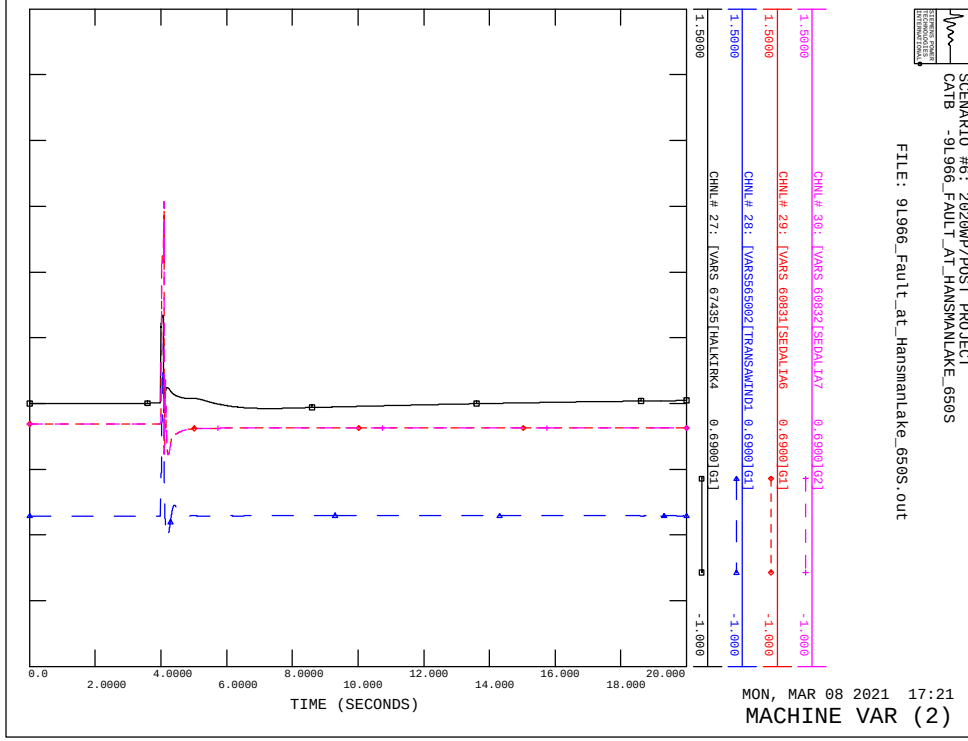
FILE: 9L966_Fault_at_HansmanLake_650S.out

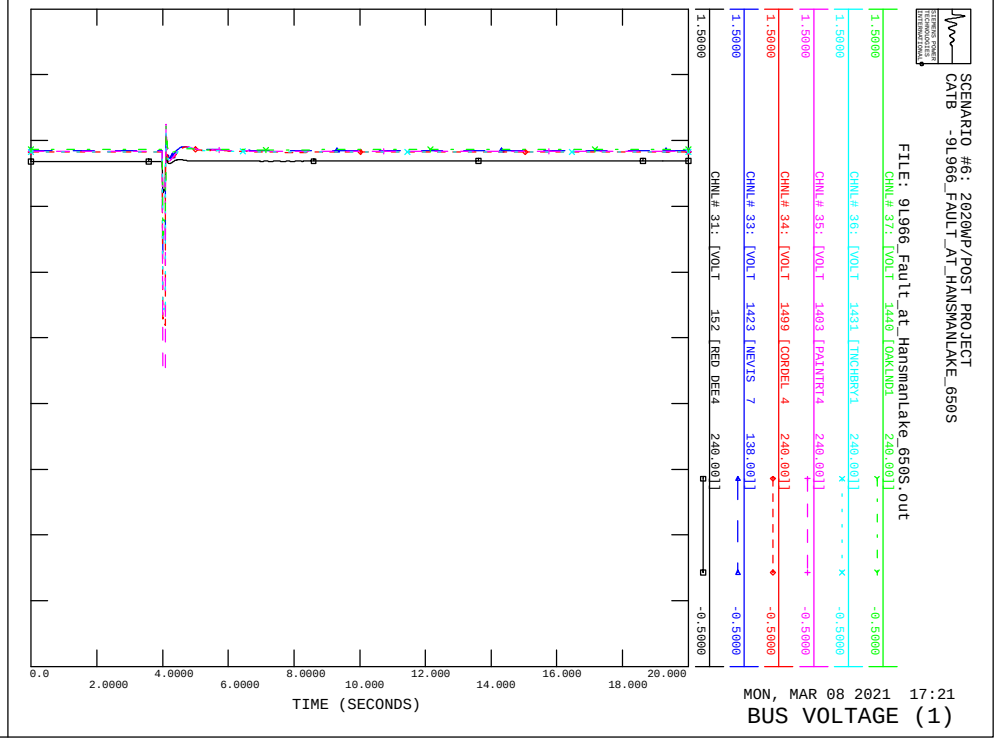


MON, MAR 08 2021 17:21 MACHINE ANGEL


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L966_FAULT_AT_HANSMANLAKE_650S
FILE: 9L966_Fault_at_HansmanLake_650S.out
MACHINE POWER (2)
MON, MAR 08 2021 17:21
TIME (SECONDS)


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L966_FAULT_AT_HANSMANLAKE_650S
FILE: 9L966_Fault_at_HansmanLake_650S.out
MACHINE VAR (1)
MON, MAR 08 2021 17:21
TIME (SECONDS)

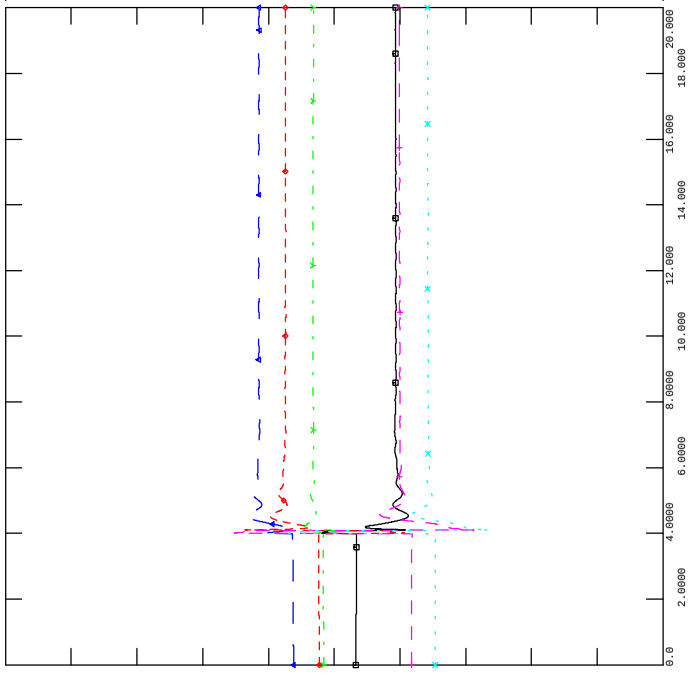

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L966_FAULT_AT_HANSMANLAKE_650S
FILE: 9L966_Fault_at_HansmanLake_650S.out
MACHINE VAR (2)
MON, MAR 08 2021 17:21
TIME (SECONDS)


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L966_FAULT_AT_HANSMANLAKE_650S
FILE: 9L966_Fault_at_HansmanLake_650S.out
BUS VOLTAGE (1)
MON, MAR 08 2021 17:21
TIME (SECONDS)

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L966_FAULT_AT_HANSMANLAKE_650S

FILE: 9L966_Fault_at_HansmanLake_650S.out

CHNL# 75: [POWR 1440 TO 1447 CKT '29']
100.00 -100.0
CHNL# 83: [POWR 152 TO 1422 CKT '12']
400.00 -900.0
CHNL# 77: [POWR 1422 TO 1499 CKT '20']
200.00 -800.0
CHNL# 79: [POWR 1431 TO 1499 CKT '16']
600.00 -100.0
CHNL# 87: [POWR 1484 TO 542002 CKT '35']
300.00 -400.0
CHNL# 85: [POWR 1431 TO 542002 CKT '59']
200.00 -400.0

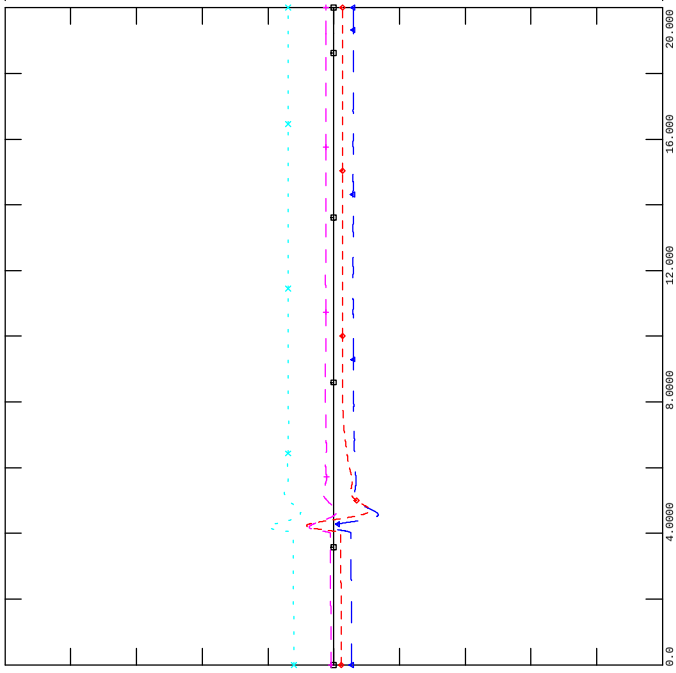


MON, MAR 08 2021 17:21
LINE POWER

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L966_FAULT_AT_PEMUKAN_932S

FILE: 9L966_Fault_at_Pemukan_932S.out

CHNL# 5: [ANGL 1487[SHEER 29 19.000]2]
90.000 -90.00
CHNL# 4: [ANGL 1482[SHEER 1 19.000]1]
90.000 -90.00
CHNL# 3: [ANGL 1497[BAT #5 21.000]5]
120.00 -90.00
CHNL# 2: [ANGL 1496[BAT #4 16.000]4]
90.000 -90.00
CHNL# 1: [ANGL 1495[BAT #3 16.000]3]
90.000 -90.00

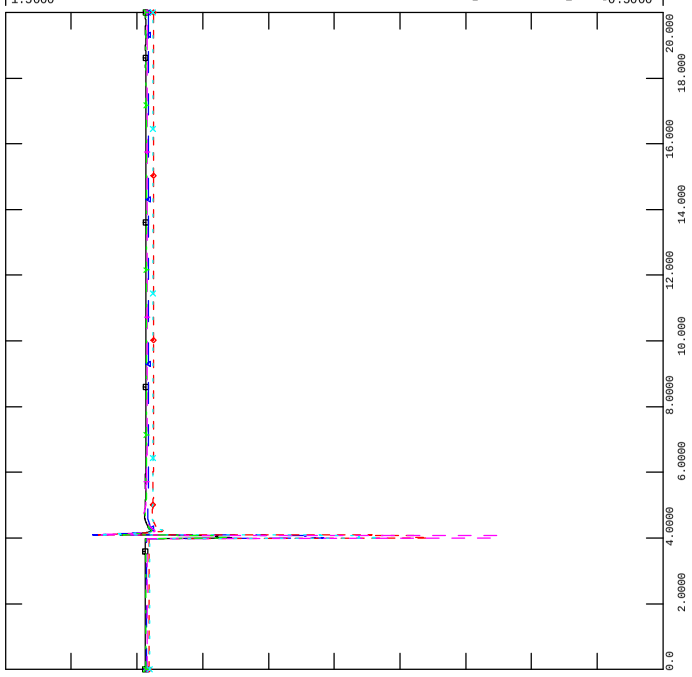


MON, MAR 08 2021 17:21
MACHINE ANGEL

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L966_FAULT_AT_HANSMANLAKE_650S

FILE: 9L966_Fault_at_HansmanLake_650S.out

CHNL# 47: [VOLT 1484 [ANDERSO4 240.00]]
1.5000 -0.5000
CHNL# 46: [VOLT 1413 [N_BRIGDEN 240.00]]
1.5000 -0.5000
CHNL# 45: [VOLT 649 [HANSMAN7 240.00]]
1.5000 -0.5000
CHNL# 42: [VOLT 1419 [PEMUKN1 240.00]]
1.5000 -0.5000
CHNL# 40: [VOLT 1438 [LANFIN1 240.00]]
1.5000 -0.5000
CHNL# 38: [VOLT 1447 [963S_HV 240.00]]
1.5000 -0.5000

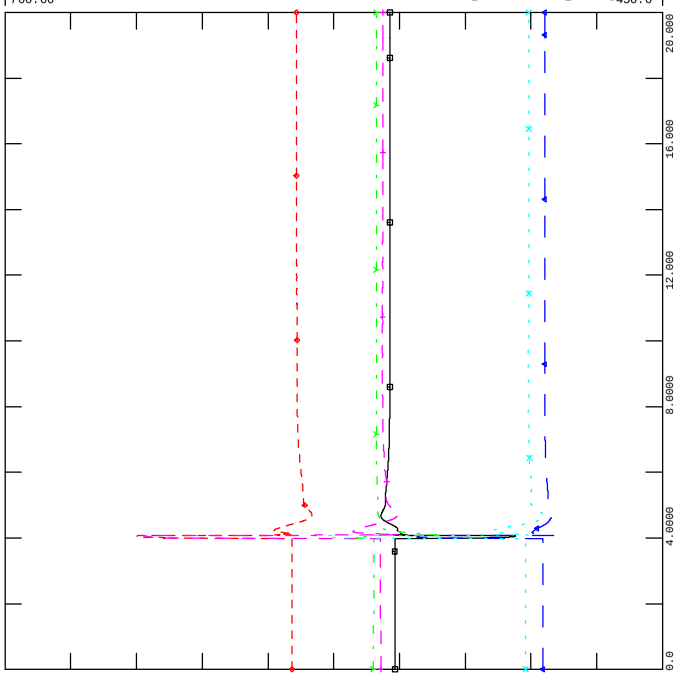


MON, MAR 08 2021 17:21
BUS VOLTAGE (2)

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L966_FAULT_AT_HANSMANLAKE_650S

FILE: 9L966_Fault_at_HansmanLake_650S.out

CHNL# 76: [VARS 1440 TO 1447 CKT '29']
100.00 -100.0
CHNL# 84: [VARS 152 TO 1422 CKT '12']
1200.0 -150.0
CHNL# 78: [VARS 1422 TO 1499 CKT '20']
600.00 -400.0
CHNL# 80: [VARS 1431 TO 1499 CKT '16']
450.00 -650.0
CHNL# 88: [VARS 1484 TO 542002 CKT '35']
1200.0 -250.0
CHNL# 86: [VARS 1431 TO 542002 CKT '59']
700.00 -450.0

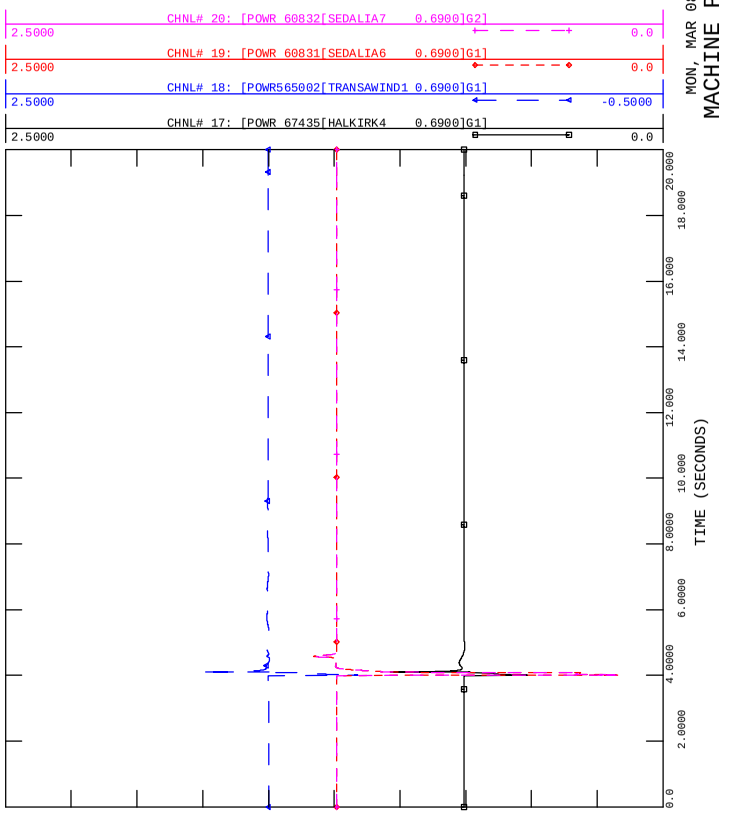


MON, MAR 08 2021 17:21
LINE VAR

SCENARIO #6: 2020WP/POST PROJECT
CATB -9L966_FAULT_AT_PEMUKAN_932S

FILE: 9L966_Fault_at_Pemukan_932S.out

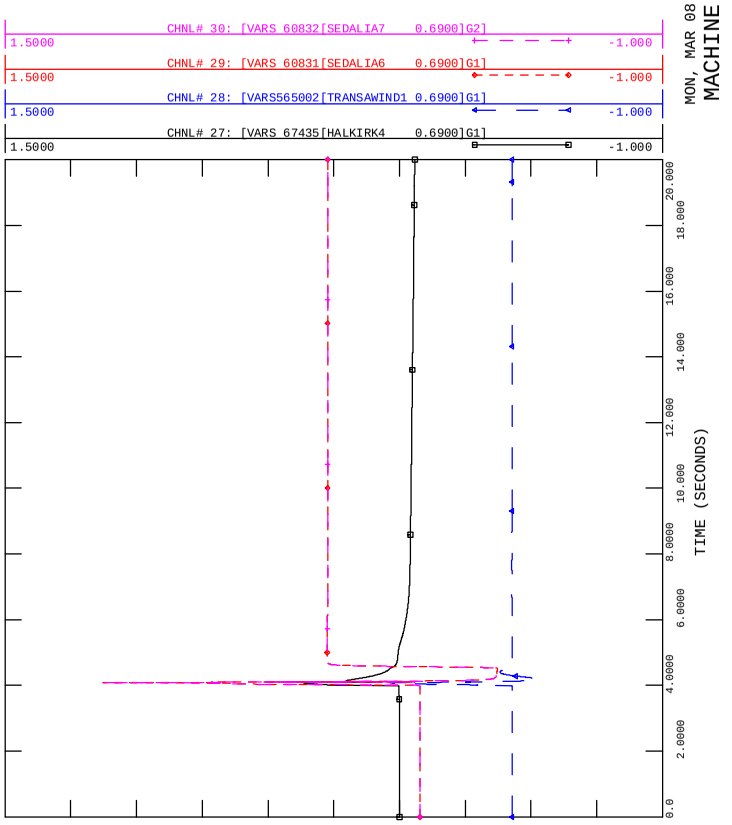
MON, MAR 08 2021 17:21
MACHINE POWER (2)



SCENARIO #6: 2020WP/POST PROJECT
CATB -9L966_FAULT_AT_PEMUKAN_932S

FILE: 9L966_Fault_at_Pemukan_932S.out

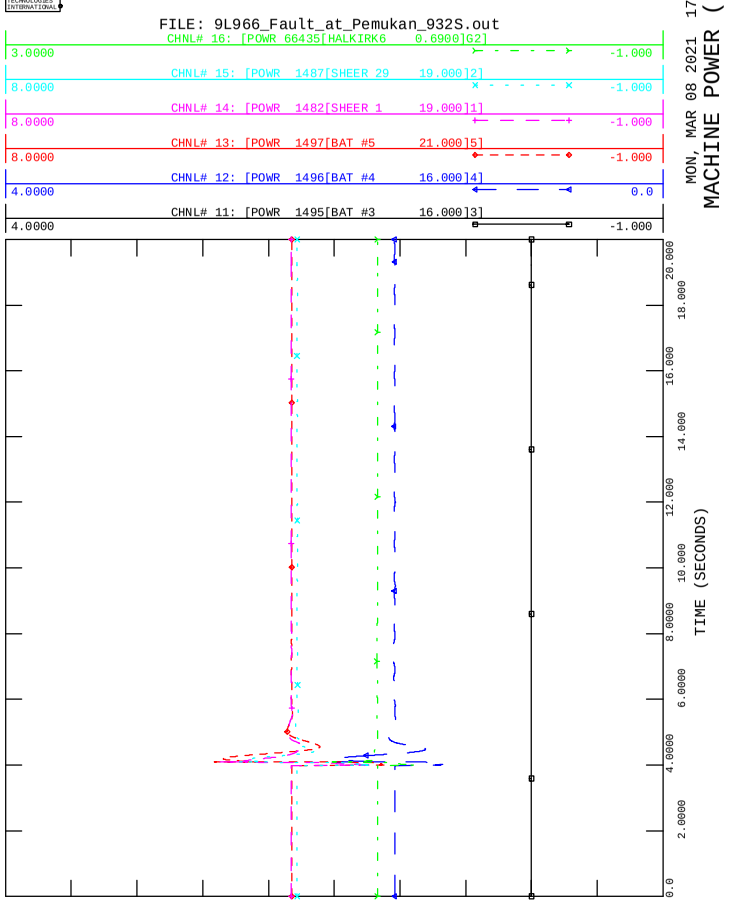
MON, MAR 08 2021 17:21
MACHINE VAR (2)



SCENARIO #6: 2020WP/POST PROJECT
CATB -9L966_FAULT_AT_PEMUKAN_932S

FILE: 9L966_Fault_at_Pemukan_932S.out

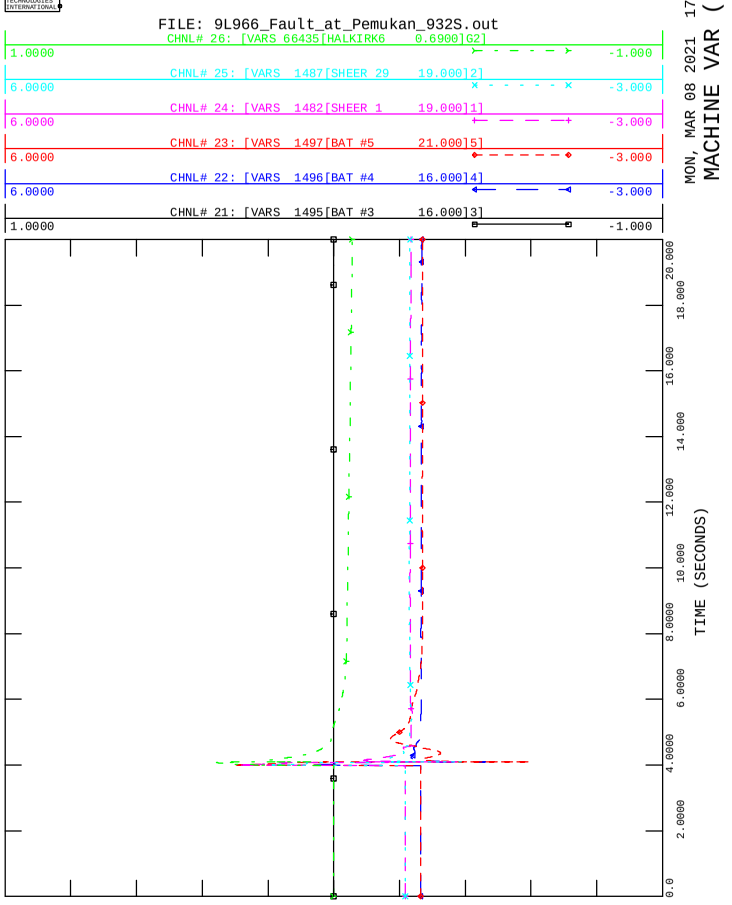
MON, MAR 08 2021 17:21
MACHINE POWER (1)

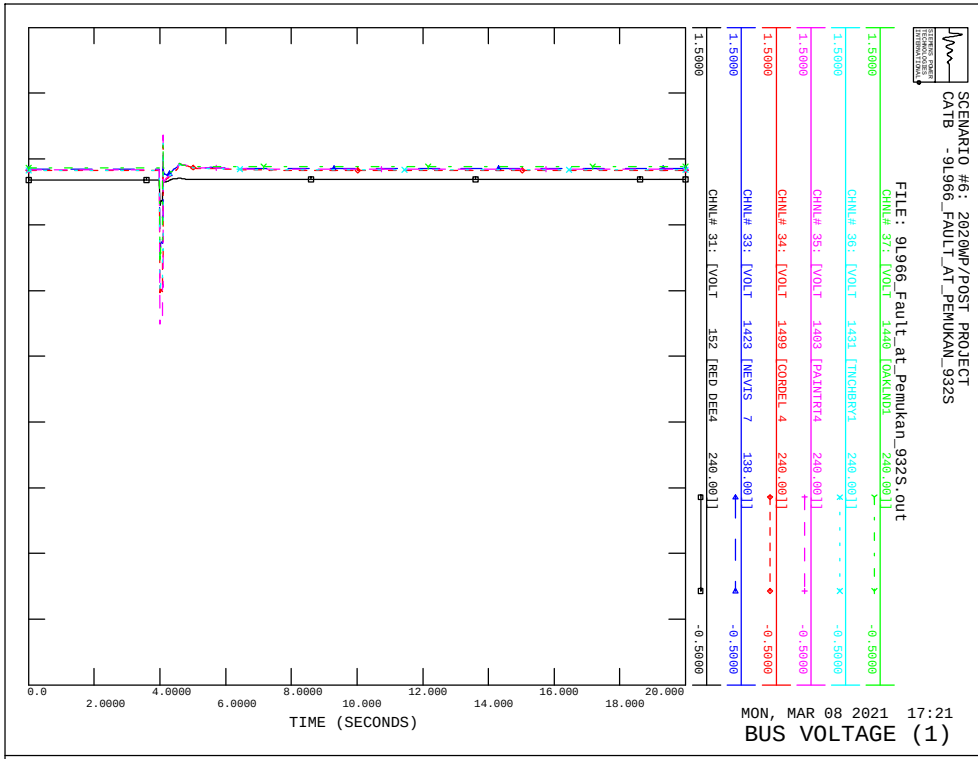


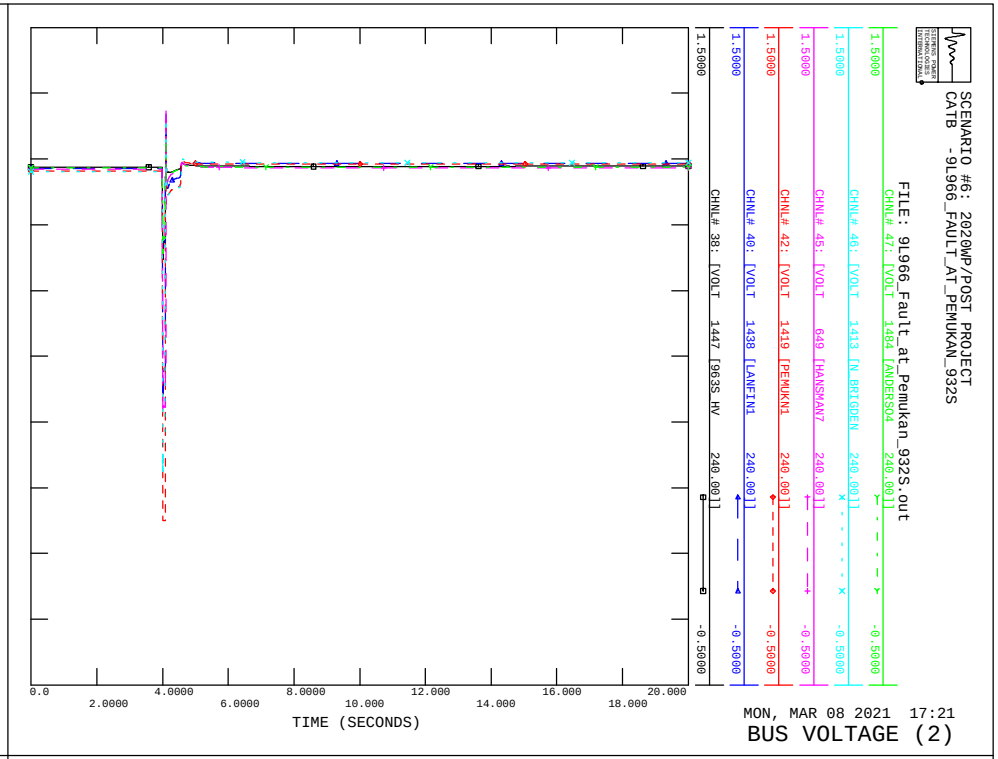
SCENARIO #6: 2020WP/POST PROJECT
CATB -9L966_FAULT_AT_PEMUKAN_932S

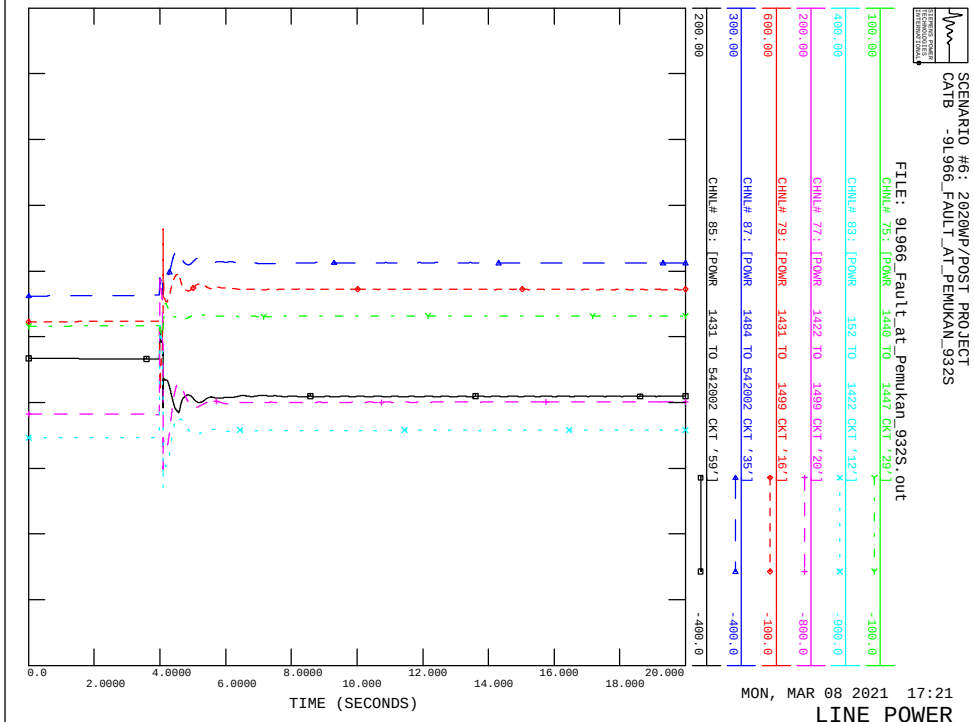
FILE: 9L966_Fault_at_Pemukan_932S.out

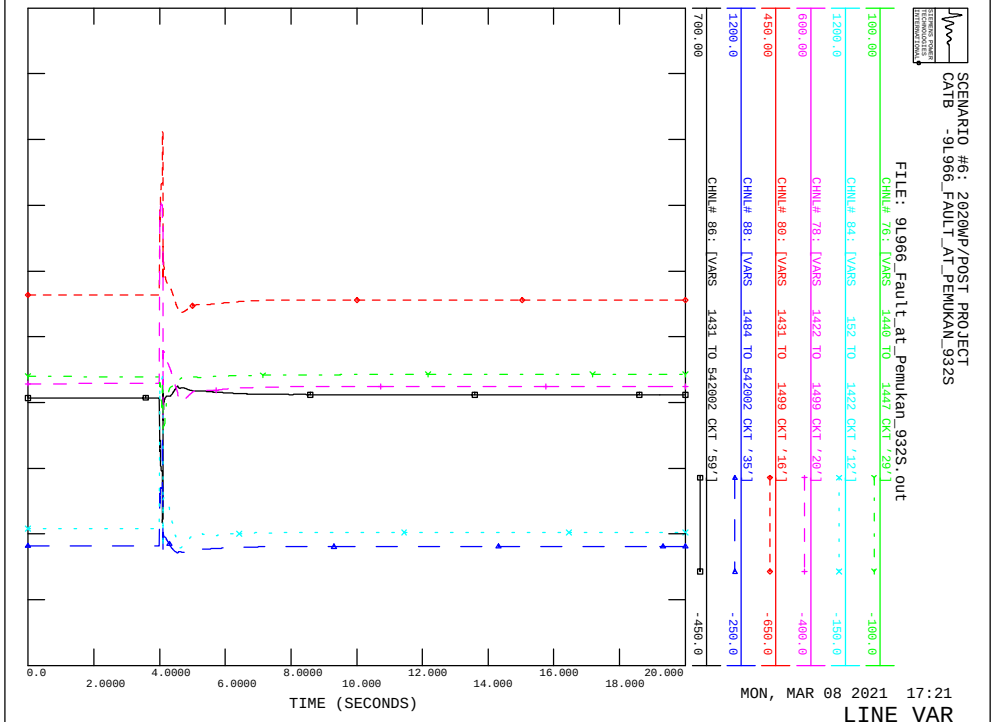
MON, MAR 08 2021 17:21
MACHINE VAR (1)




SCENARIO #6: 2020WP/POST PROJECT
CATB -9L966_FAULT_AT_PEMUKAN_932S
FILE: 9L966_Fault_at_Pemukan_932S.out
CHNL# 31: [VOLT 152 [RED DEE4 240.00]]
CHNL# 33: [VOLT 1423 [NEVIS 7 138.00]]
CHNL# 34: [VOLT 1499 [CORDEL 4 240.00]]
CHNL# 35: [VOLT 1403 [PAINTRT4 240.00]]
CHNL# 36: [VOLT 1431 [TNCHBRY1 240.00]]
CHNL# 37: [VOLT 1440 [OAKLND1 240.00]]
1.5000
-0.5000
0.0
2.0000
4.0000
6.0000
8.0000
10.000
12.000
14.000
16.000
18.000
20.000
TIME (SECONDS)
MON, MAR 08 2021 17:21
BUS VOLTAGE (1)


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L966_FAULT_AT_PEMUKAN_932S
FILE: 9L966_Fault_at_Pemukan_932S.out
CHNL# 38: [VOLT 1447 [963S HV 240.00]]
CHNL# 40: [VOLT 1438 [LANFIN1 240.00]]
CHNL# 42: [VOLT 1419 [PEMUKN1 240.00]]
CHNL# 45: [VOLT 649 [HANSMAN7 240.00]]
CHNL# 46: [VOLT 1413 [N BRIGDEN 240.00]]
CHNL# 47: [VOLT 1464 [ANDERSO4 240.00]]
1.5000
-0.5000
0.0
2.0000
4.0000
6.0000
8.0000
10.000
12.000
14.000
16.000
18.000
20.000
TIME (SECONDS)
MON, MAR 08 2021 17:21
BUS VOLTAGE (2)


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L966_FAULT_AT_PEMUKAN_932S
FILE: 9L966_Fault_at_Pemukan_932S.out
CHNL# 85: [PQNR 1431 TO 542002 CKT '59']
CHNL# 87: [PQNR 1484 TO 542002 CKT '35']
CHNL# 79: [PQNR 1431 TO 1499 CKT '16']
CHNL# 77: [PQNR 1422 TO 1499 CKT '20']
CHNL# 83: [PQNR 152 TO 1422 CKT '12']
CHNL# 75: [PQNR 1440 TO 1447 CKT '29']
200.00
-400.0
0.0
2.0000
4.0000
6.0000
8.0000
10.000
12.000
14.000
16.000
18.000
20.000
TIME (SECONDS)
MON, MAR 08 2021 17:21
LINE POWER


SCENARIO #6: 2020WP/POST PROJECT
CATB -9L966_FAULT_AT_PEMUKAN_932S
FILE: 9L966_Fault_at_Pemukan_932S.out
CHNL# 86: [VARS 1431 TO 542002 CKT '59']
CHNL# 88: [VARS 1484 TO 542002 CKT '35']
CHNL# 80: [VARS 1431 TO 1499 CKT '16']
CHNL# 78: [VARS 1422 TO 1499 CKT '20']
CHNL# 84: [VARS 152 TO 1422 CKT '12']
CHNL# 76: [VARS 1440 TO 1447 CKT '29']
700.00
-450.0
0.0
2.0000
4.0000
6.0000
8.0000
10.000
12.000
14.000
16.000
18.000
20.000
TIME (SECONDS)
MON, MAR 08 2021 17:21
LINE VAR

SCENARIO #6: 2020WP/POST PROJECT
CATB -912L_9L912_FAULT_AT_NEVIS_766S

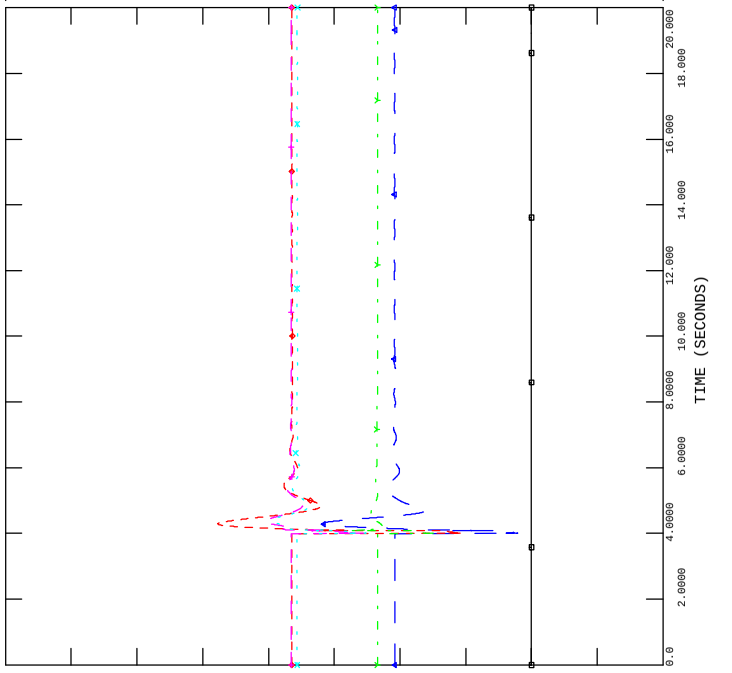
FILE: 912L_9L912_Fault_at_Nevis_766S.out

MON, MAR 08 2021 17:21

MACHINE POWER (1)

CHNL# 16: [POWR 66435[HALKIRK6 0.6900]G2] 3.0000 -1.000
CHNL# 15: [POWR 1487[SHEER 29 19.000]2] 8.0000 -1.000
CHNL# 14: [POWR 1482[SHEER 1 19.000]1] 8.0000 -1.000
CHNL# 13: [POWR 1497[BAT #5 21.000]5] 8.0000 -1.000
CHNL# 12: [POWR 1496[BAT #4 16.000]4] 4.0000 0.0
CHNL# 11: [POWR 1495[BAT #3 16.000]3] 4.0000 -1.000

TIME (SECONDS)



SCENARIO #6: 2020WP/POST PROJECT
CATB -912L_9L912_FAULT_AT_NEVIS_766S

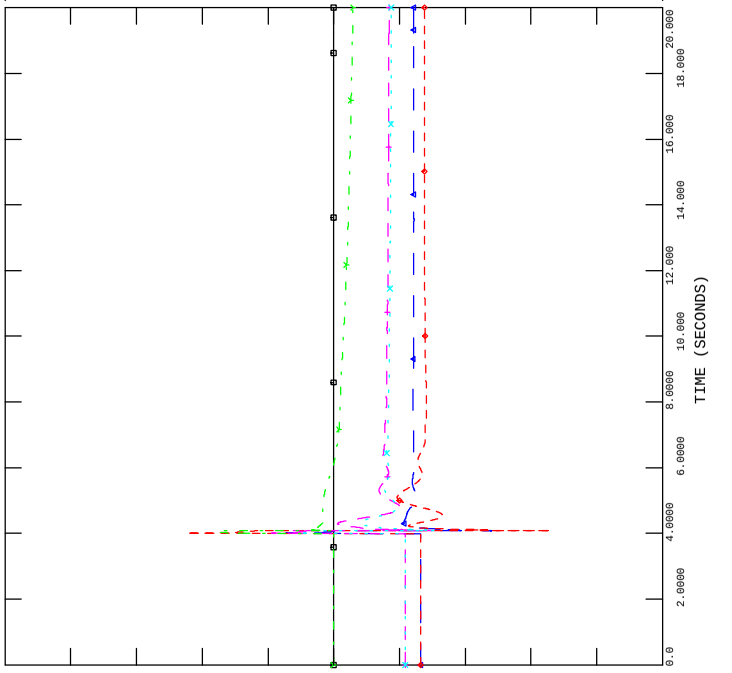
FILE: 912L_9L912_Fault_at_Nevis_766S.out

MON, MAR 08 2021 17:21

MACHINE VAR (1)

CHNL# 26: [VARS 66435[HALKIRK6 0.6900]G2] 1.0000 -1.000
CHNL# 25: [VARS 1487[SHEER 29 19.000]2] 6.0000 -3.000
CHNL# 24: [VARS 1482[SHEER 1 19.000]1] 6.0000 -3.000
CHNL# 23: [VARS 1497[BAT #5 21.000]5] 6.0000 -3.000
CHNL# 22: [VARS 1496[BAT #4 16.000]4] 6.0000 -3.000
CHNL# 21: [VARS 1495[BAT #3 16.000]3] 1.0000 -1.000

TIME (SECONDS)



SCENARIO #6: 2020WP/POST PROJECT
CATB -912L_9L912_FAULT_AT_NEVIS_766S

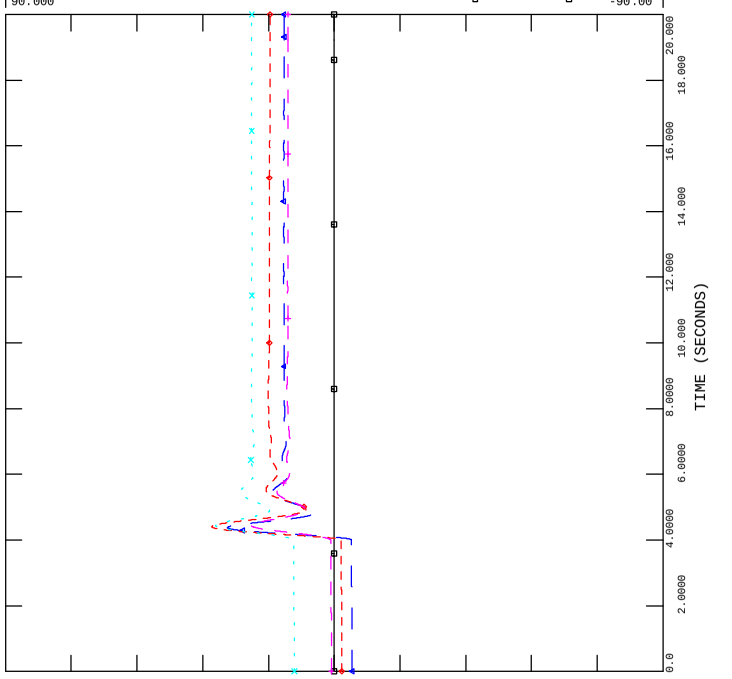
FILE: 912L_9L912_Fault_at_Nevis_766S.out

MON, MAR 08 2021 17:21

MACHINE ANGEL

CHNL# 5: [ANGL 1487[SHEER 29 19.000]2] 90.000 -90.00
CHNL# 4: [ANGL 1482[SHEER 1 19.000]1] 90.000 -90.00
CHNL# 3: [ANGL 1497[BAT #5 21.000]5] 120.00 -90.00
CHNL# 2: [ANGL 1496[BAT #4 16.000]4] 90.000 -90.00
CHNL# 1: [ANGL 1495[BAT #3 16.000]3] 90.000 -90.00

TIME (SECONDS)



SCENARIO #6: 2020WP/POST PROJECT
CATB -912L_9L912_FAULT_AT_NEVIS_766S

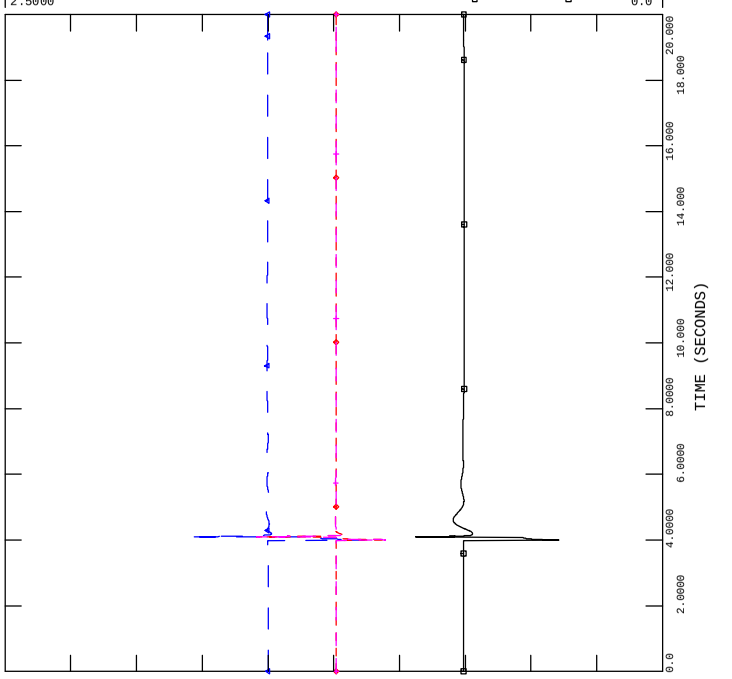
FILE: 912L_9L912_Fault_at_Nevis_766S.out

MON, MAR 08 2021 17:21

MACHINE POWER (2)

CHNL# 20: [POWR 60832[SEDALIA7 0.6900]G2] 2.5000 0.0
CHNL# 19: [POWR 60831[SEDALIA6 0.6900]G1] 2.5000 0.0
CHNL# 18: [POWR565002[TRANSAWIND1 0.6900]G1] 2.5000 -0.5000
CHNL# 17: [POWR 67435[HALKIRK4 0.6900]G1] 2.5000 0.0

TIME (SECONDS)



SCENARIO #6: 2020WP/POST PROJECT
CATB -912L_9L912_FAULT_AT_NEVIS_766S

FILE: 912L_9L912_Fault_at_Nevis_766S.out

MON, MAR 08 2021 17:21

BUS VOLTAGE (1)

CHNL# 37: [VOLT 1440 [OAKLND1 240.00]]
CHNL# 36: [VOLT 1431 [TNCHBRY1 240.00]]
CHNL# 35: [VOLT 1403 [PAINTRT4 240.00]]
CHNL# 34: [VOLT 1499 [CORDEL 4 240.00]]
CHNL# 33: [VOLT 1423 [NEVIS 7 138.00]]
CHNL# 31: [VOLT 152 [RED DEE4 240.00]]

1.5000 -0.5000

TIME (SECONDS)

0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

SCENARIO #6: 2020WP/POST PROJECT
CATB -912L_9L912_FAULT_AT_NEVIS_766S

FILE: 912L_9L912_Fault_at_Nevis_766S.out

MON, MAR 08 2021 17:21

LINE POWER

CHNL# 75: [POWR 1440 TO 1447 CKT '29']
CHNL# 83: [POWR 152 TO 1422 CKT '12']
CHNL# 77: [POWR 1422 TO 1499 CKT '20']
CHNL# 79: [POWR 1431 TO 1499 CKT '16']
CHNL# 87: [POWR 1484 TO 542002 CKT '35']
CHNL# 85: [POWR 1431 TO 542002 CKT '59']

100.00 -100.0
400.00 -900.0
200.00 -800.0
600.00 -100.0
300.00 -400.0
200.00 -400.0

TIME (SECONDS)

0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

SCENARIO #6: 2020WP/POST PROJECT
CATB -912L_9L912_FAULT_AT_NEVIS_766S

FILE: 912L_9L912_Fault_at_Nevis_766S.out

MON, MAR 08 2021 17:21

MACHINE VAR (2)

CHNL# 30: [VARS 60832[SEDALIA7 0.6900]G2]
CHNL# 29: [VARS 60831[SEDALIA6 0.6900]G1]
CHNL# 28: [VARS565002[TRANSAWIND1 0.6900]G1]
CHNL# 27: [VARS 67435[HALKIRK4 0.6900]G1]

1.5000 -1.000

TIME (SECONDS)

0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

SCENARIO #6: 2020WP/POST PROJECT
CATB -912L_9L912_FAULT_AT_NEVIS_766S

FILE: 912L_9L912_Fault_at_Nevis_766S.out

MON, MAR 08 2021 17:21

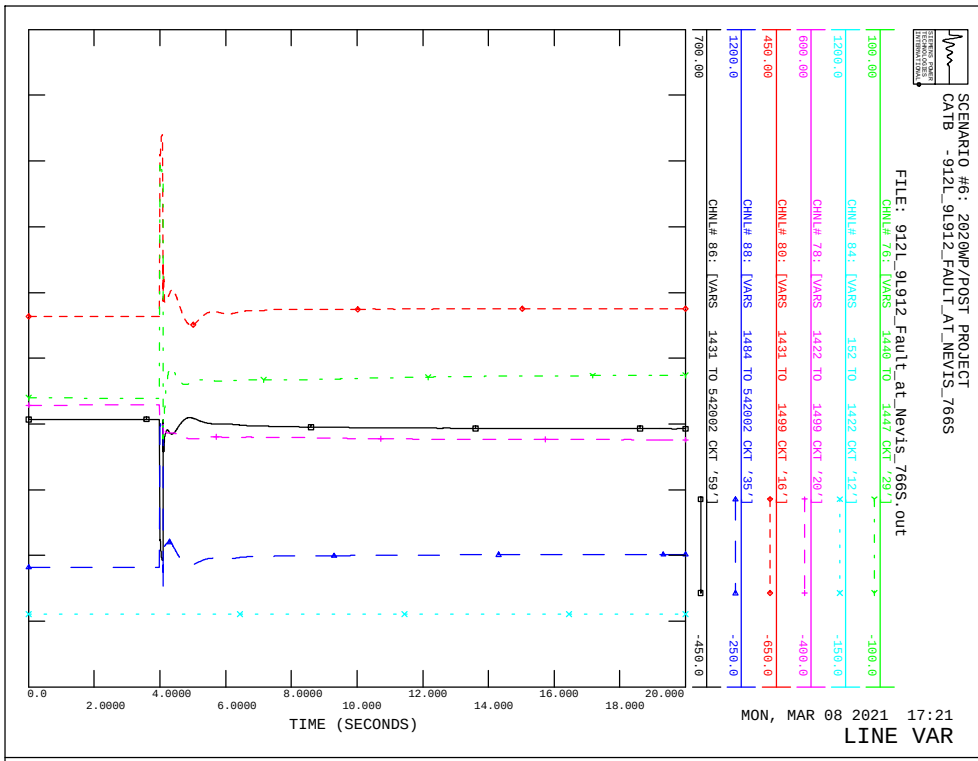
BUS VOLTAGE (2)

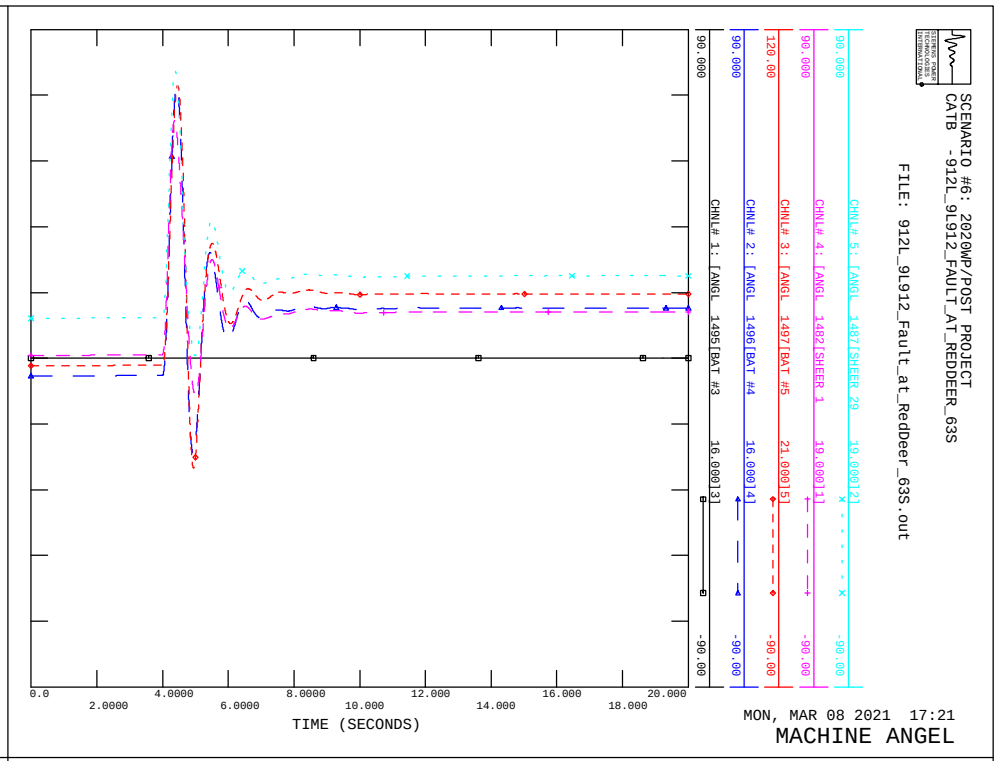
CHNL# 47: [VOLT 1484 [ANDERSO4 240.00]]
CHNL# 46: [VOLT 1413 [N_BRIGDEN 240.00]]
CHNL# 45: [VOLT 649 [HANSMAN7 240.00]]
CHNL# 42: [VOLT 1419 [PEMUKN1 240.00]]
CHNL# 40: [VOLT 1438 [LANFIN1 240.00]]
CHNL# 38: [VOLT 1447 [963S_HV 240.00]]

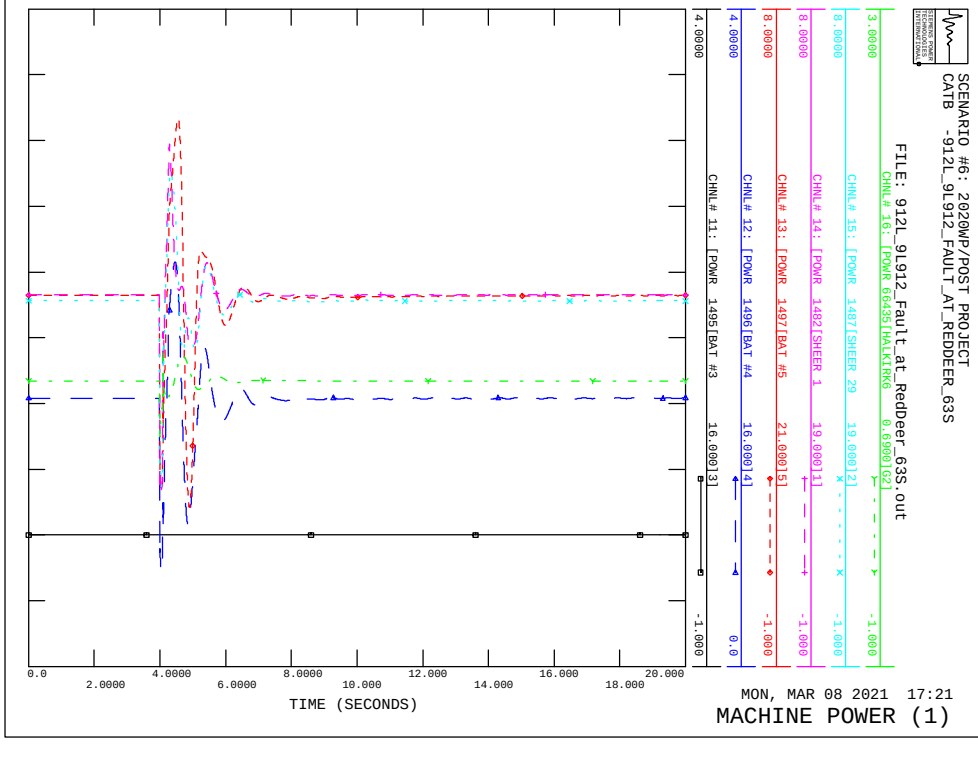
1.5000 -0.5000

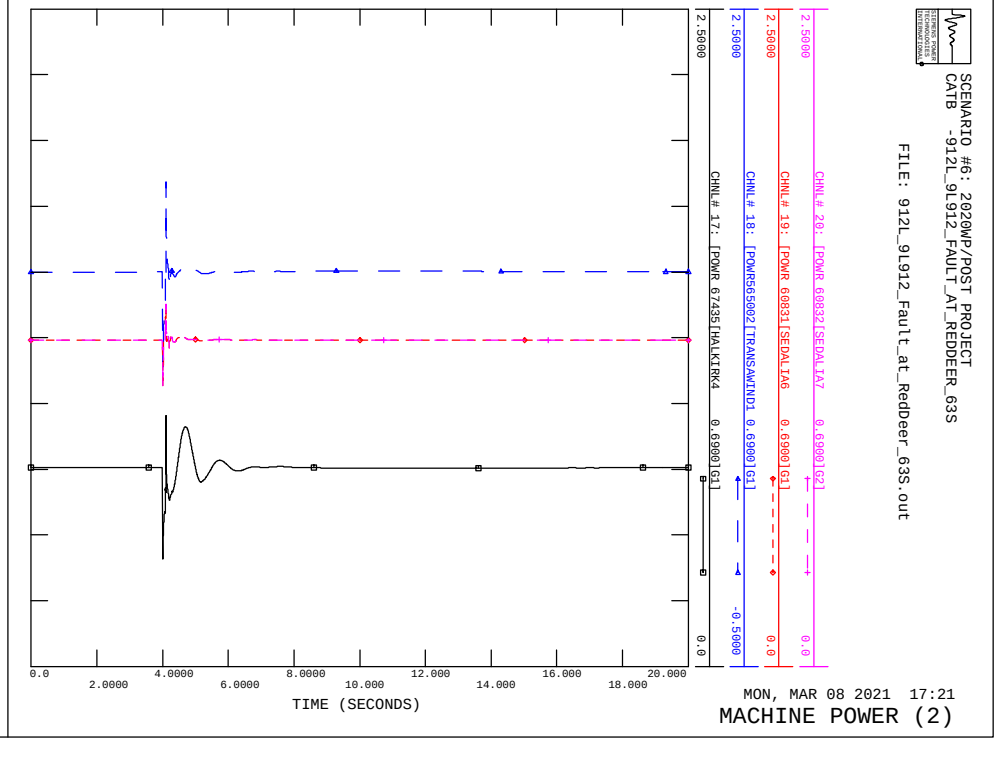
TIME (SECONDS)

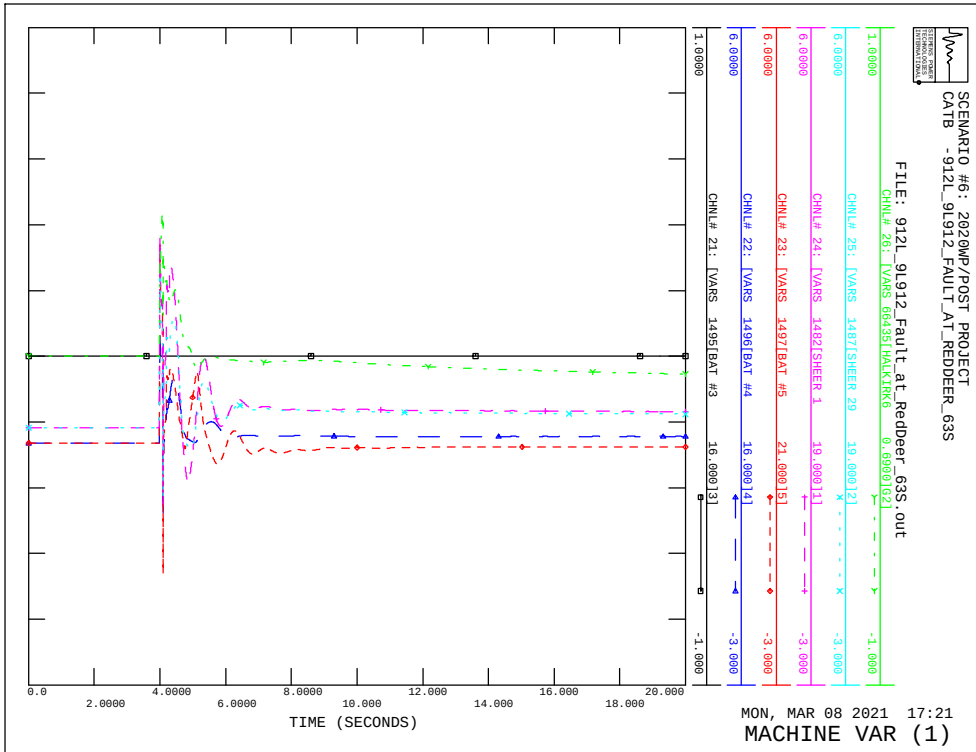
0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

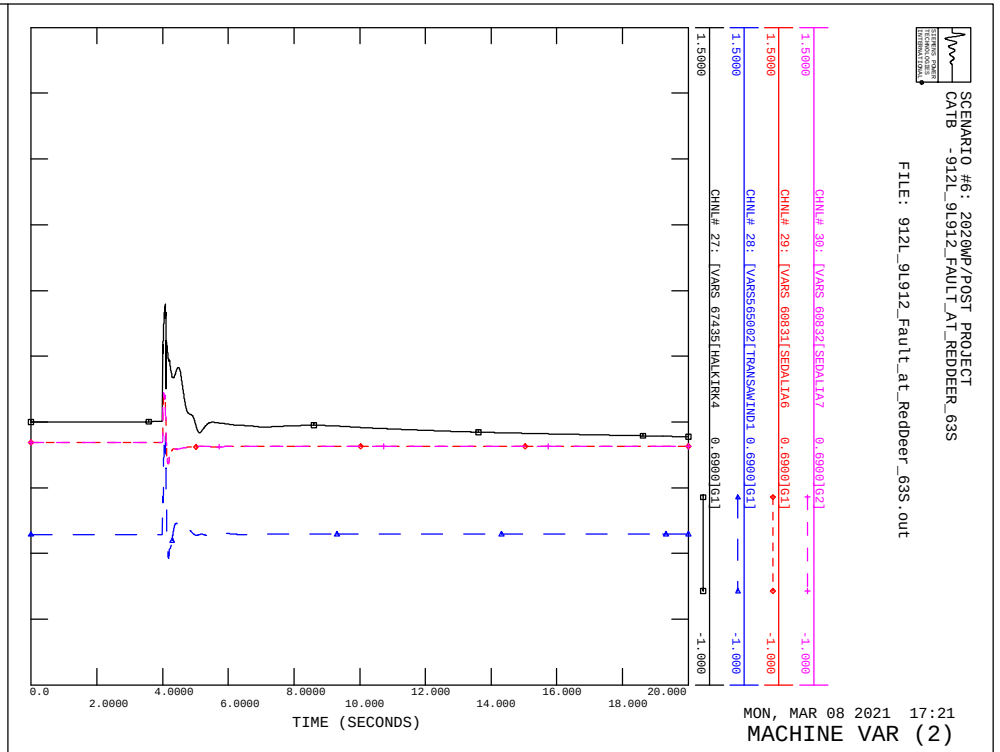

SCENARIO #6: 2020WP/POST PROJECT
CATB -912L_9L912_FAULT_AT_NEVIS_766S
FILE: 912L_9L912_Fault_at_Nevis_766S.out
CHNL# 76: [VARS 1440 TO 1447 CKT '29']
CHNL# 84: [VARS 152 TO 1422 CKT '12']
CHNL# 78: [VARS 1422 TO 1499 CKT '20']
CHNL# 80: [VARS 1431 TO 1499 CKT '16']
CHNL# 88: [VARS 1484 TO 542002 CKT '35']
CHNL# 86: [VARS 1431 TO 542002 CKT '59']
TIME (SECONDS)
MON, MAR 08 2021 17:21
LINE VAR

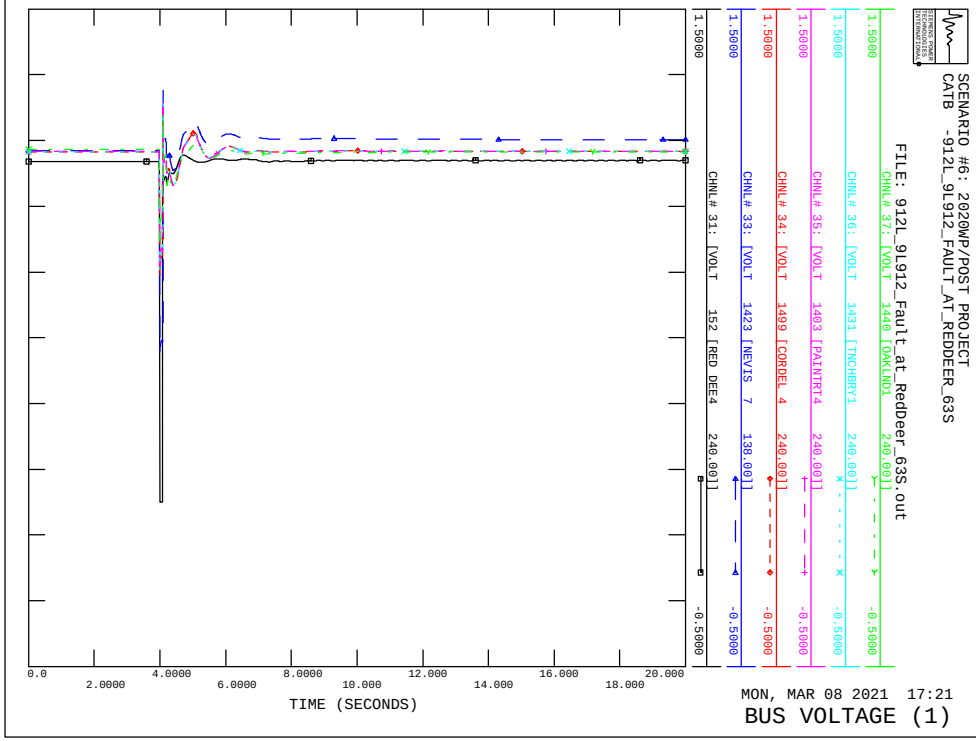

SCENARIO #6: 2020WP/POST PROJECT
CATB -912L_9L912_FAULT_AT_REDDEER_63S
FILE: 912L_9L912_Fault_at_RedDeer_63S.out
CHNL# 5: [ANGL 1487[SHEER 29
CHNL# 4: [ANGL 1482[SHEER 1
CHNL# 3: [ANGL 1497[BAT #5
CHNL# 2: [ANGL 1496[BAT #4
CHNL# 1: [ANGL 1495[BAT #3
TIME (SECONDS)
MON, MAR 08 2021 17:21
MACHINE ANGEL

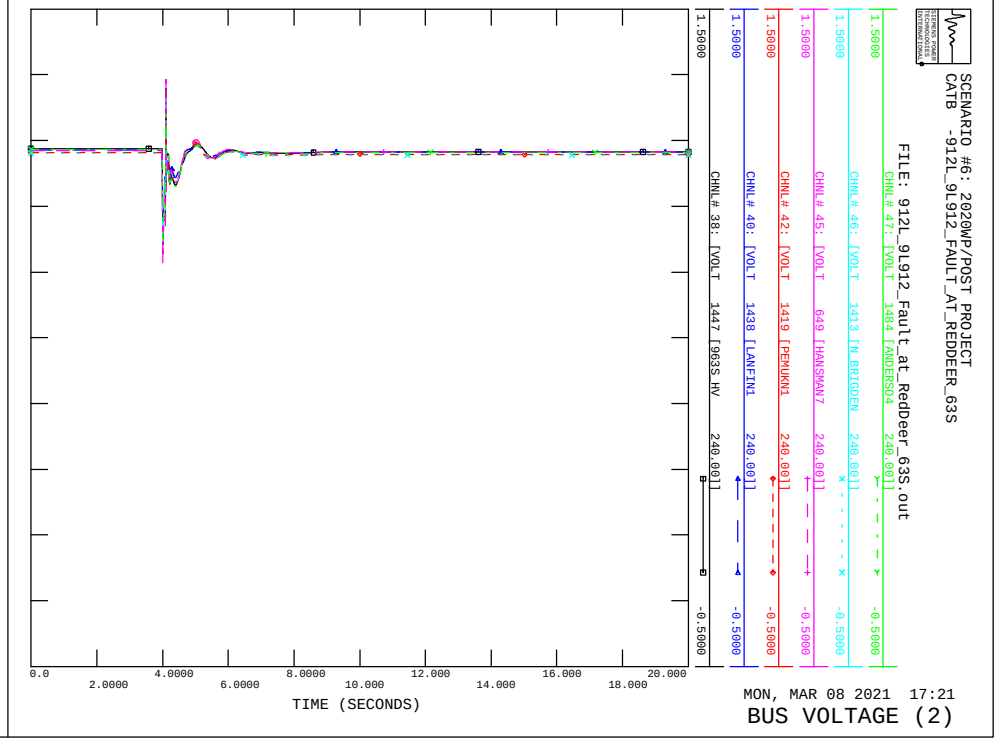

SCENARIO #6: 2020WP/POST PROJECT
CATB -912L_9L912_FAULT_AT_REDDEER_63S
FILE: 912L_9L912_Fault_at_RedDeer_63S.out
CHNL# 16: [POWR 66435[HALKIRK6
CHNL# 15: [POWR 1487[SHEER 29
CHNL# 14: [POWR 1482[SHEER 1
CHNL# 13: [POWR 1497[BAT #5
CHNL# 12: [POWR 1496[BAT #4
CHNL# 11: [POWR 1495[BAT #3
TIME (SECONDS)
MON, MAR 08 2021 17:21
MACHINE POWER (1)

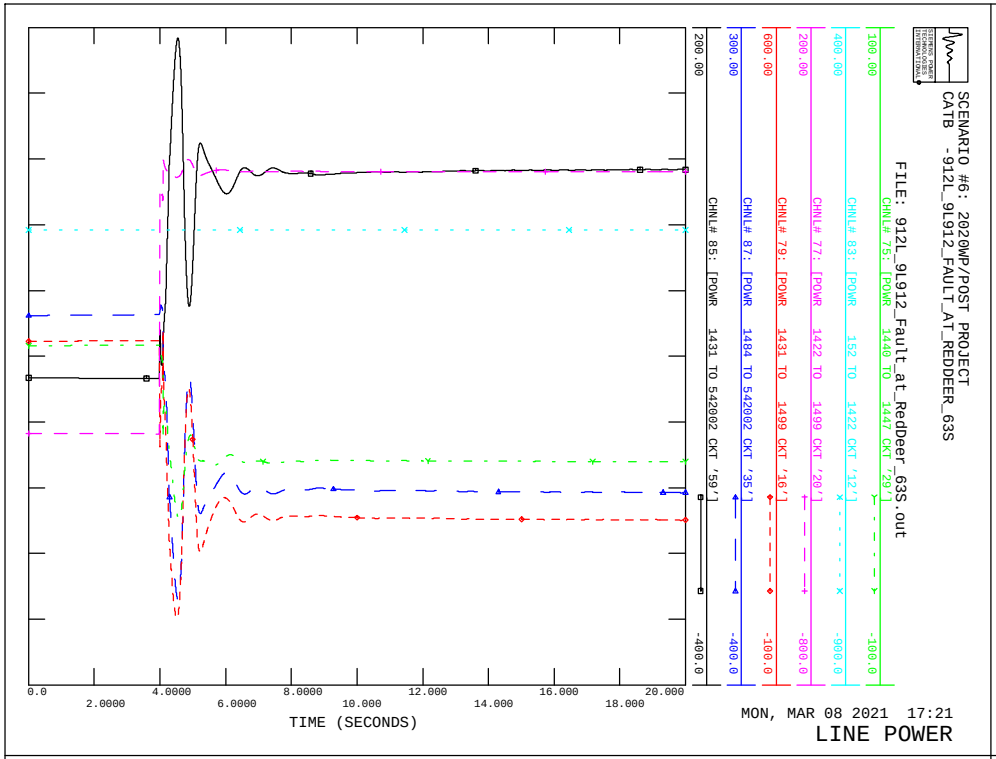

SCENARIO #6: 2020WP/POST PROJECT
CATB -912L_9L912_FAULT_AT_REDDEER_63S
FILE: 912L_9L912_Fault_at_RedDeer_63S.out
CHNL# 20: [POWR 60832[SEDALIA7
CHNL# 19: [POWR 60831[SEDALIA6
CHNL# 18: [POWR565002[TRANSAMIND1
CHNL# 17: [POWR 67435[HALKIRK4
TIME (SECONDS)
MON, MAR 08 2021 17:21
MACHINE POWER (2)

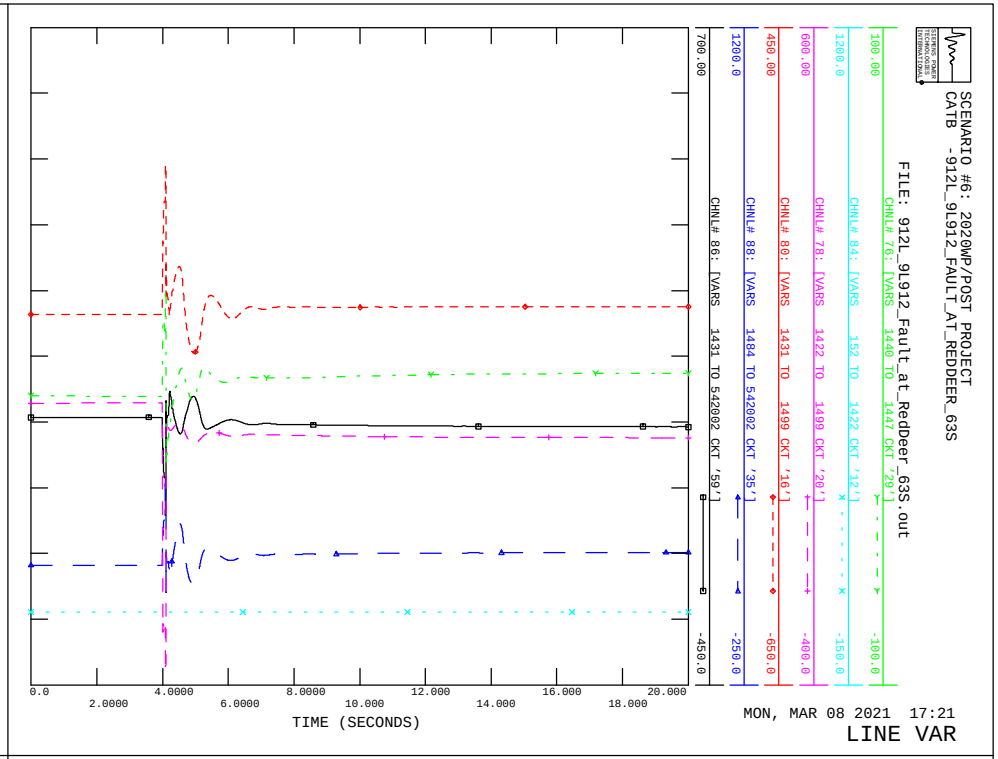

SCENARIO #6: 2020WP/POST PROJECT
CATB -912L_9L912_FAULT_AT_REDDEER_63S
FILE: 912L_9L912_Fault_at_RedDeer_63S.out
CHNL# 26: [VARS 6643S HALKIRK6 0.6900[G2]
CHNL# 25: [VARS 1487[SHEER 29 19.000[2]
CHNL# 24: [VARS 1482[SHEER 1 19.000[1]
CHNL# 23: [VARS 1497[BAT #5 21.000[5]
CHNL# 22: [VARS 1496[BAT #4 16.000[4]
CHNL# 21: [VARS 1495[BAT #3 16.000[3]
TIME (SECONDS)
MON, MAR 08 2021 17:21
MACHINE VAR (1)


SCENARIO #6: 2020WP/POST PROJECT
CATB -912L_9L912_FAULT_AT_REDDEER_63S
FILE: 912L_9L912_Fault_at_RedDeer_63S.out
CHNL# 30: [VARS 6083Z[SEDALIA7 0.6900[G2]
CHNL# 29: [VARS 6083I[SEDALIA6 0.6900[G1]
CHNL# 28: [VARS6560Z[TRANSAMIND1 0.6900[G1]
CHNL# 27: [VARS 6743S[HALKIRK4 0.6900[G1]
TIME (SECONDS)
MON, MAR 08 2021 17:21
MACHINE VAR (2)


SCENARIO #6: 2020WP/POST PROJECT
CATB -912L_9L912_FAULT_AT_REDDEER_63S
FILE: 912L_9L912_Fault_at_RedDeer_63S.out
CHNL# 37: [VOLT 1440 [OAKLND1 240.00]
CHNL# 36: [VOLT 1431 [TNCHBRY1 240.00]
CHNL# 35: [VOLT 1403 [PAINTRT4 240.00]
CHNL# 34: [VOLT 1499 [CORDEL 4 240.00]
CHNL# 33: [VOLT 1423 [NEVIS 7 138.00]
CHNL# 31: [VOLT 152 [RED DEE4 240.00]
TIME (SECONDS)
MON, MAR 08 2021 17:21
BUS VOLTAGE (1)


SCENARIO #6: 2020WP/POST PROJECT
CATB -912L_9L912_FAULT_AT_REDDEER_63S
FILE: 912L_9L912_Fault_at_RedDeer_63S.out
CHNL# 47: [VOLT 1404 [ANDERSN4 240.00]
CHNL# 46: [VOLT 1413 [N BRIGDEN 240.00]
CHNL# 45: [VOLT 649 [HANSMAN7 240.00]
CHNL# 42: [VOLT 1419 [PEMUKN1 240.00]
CHNL# 40: [VOLT 1438 [LANFIN1 240.00]
CHNL# 38: [VOLT 1447 [963S HV 240.00]
TIME (SECONDS)
MON, MAR 08 2021 17:21
BUS VOLTAGE (2)


SCENARIO #6: 2020WP/POST PROJECT
CATB -912L_9L912_FAULT_AT_REDDEER_63S
FILE: 912L_9L912_Fault_at_RedDeer_63S.out
CHNL# 75: [POWR 1440 TO 1447 CKT '29']
CHNL# 77: [POWR 1422 TO 1499 CKT '20']
CHNL# 79: [POWR 1431 TO 1499 CKT '16']
CHNL# 83: [POWR 152 TO 1422 CKT '12']
CHNL# 85: [POWR 1431 TO 5420J2 CKT '59']
CHNL# 87: [POWR 1484 TO 5420J2 CKT '35']
100.00
200.00
600.00
400.00
200.00
300.00
-100.0
-800.0
-100.0
-900.0
-400.0
-400.0
0.0
2.0000
4.0000
6.0000
8.0000
10.000
12.000
14.000
16.000
18.000
20.000
TIME (SECONDS)
MON, MAR 08 2021 17:21
LINE POWER


SCENARIO #6: 2020WP/POST PROJECT
CATB -912L_9L912_FAULT_AT_REDDEER_63S
FILE: 912L_9L912_Fault_at_RedDeer_63S.out
CHNL# 76: [VARS 1440 TO 1447 CKT '29']
CHNL# 78: [VARS 1422 TO 1499 CKT '20']
CHNL# 80: [VARS 1431 TO 1499 CKT '16']
CHNL# 84: [VARS 152 TO 1422 CKT '12']
CHNL# 86: [VARS 1431 TO 5420J2 CKT '59']
CHNL# 88: [VARS 1484 TO 5420J2 CKT '35']
100.00
1200.0
600.00
450.00
700.00
1200.0
-100.0
-150.0
-400.0
-650.0
-450.0
-250.0
0.0
2.0000
4.0000
6.0000
8.0000
10.000
12.000
14.000
16.000
18.000
20.000
TIME (SECONDS)
MON, MAR 08 2021 17:21
LINE VAR

Attachment A5
Dynamic Data and Assumptions

Table A5-1: Generic Renewable Energy Generator/Converter Model (REGCAU1)

CONs	Value	Description
J+0	0.02	Tg, Converter time constant (s)
J+1	1	Rrpwr, Low Voltage Power Logic (LVPL) ramp rate limit (pu)
J+2	0.9	Brkpt, LVPL characteristic voltage 2 (pu)
J+3	0.4	Zerox, LVPL characteristic voltage 1 (pu)
J+4	1.2	Lvpl1, LVPL gain (pu)
J+5	1.2	Volim, Voltage limit (pu) for high voltage reactive current management
J+6	0.001	Lvpnt1, High voltage point for low voltage active current management (pu)
J+7	0.0	Lvpnt0, Low voltage point for low voltage active current management (pu)
J+8	1.3	Iolim, Current limit (pu) for high voltage reactive current management (specified as a negative value)
J+9	0.02	Tfltr, Voltage filter time constant for low voltage active current management (s)
J+10	0.7	Khv, Overvoltage compensation gain used in the high voltage reactive current management
J+11	99	Iqrmax, Upper limit on rate of change for reactive current (pu)
J+12	-99	Iqrmin, Lower limit on rate of change for reactive current (pu)
J+13	1.0	Accel, acceleration factor (0 < Accel < 1)
ICON	**Value**	**Description**
M+0	0	Lvplsw (Low Voltage Power Logic) switch (0: LVPL not present, 1: LVPL present)

Table A5-2: Generic Renewable Electrical Control Model (REECAU1)

CONs	Value	Description
J+0	0.9	Vdip (pu), low voltage threshold to activate reactive current injection logic
J+1	1.1	Vup (pu), Voltage above which reactive current injection logic is activated
J+2	0.02	Trv (s), Voltage filter time constant
J+3	-0.1	dbd1 (pu), Voltage error dead band lower threshold (<=0)
J+4	0.1	dbd2 (pu), Voltage error dead band upper threshold (>=0)
J+5	2.74	Kqv (pu), Reactive current injection gain during over and undervoltage conditions
J+6	1.0	Iqhl (pu), Upper limit on reactive current injection Iqinj
J+7	-1.0	Iqll (pu), Lower limit on reactive current injection Iqinj
J+8	1.0	Vref0 (pu), User defined reference (if 0, model initializes it to initial terminal voltage)
J+9	0.0	Iqfrz (pu), Value at which Iqinj is held for Thld seconds following a voltage dip if Thld > 0
J+10	0.0	Thld (s), Time for which Iqinj is held at Iqfrz after voltage dip returns to zero
J+11	0.0	Thld2 (s) (>=0), Time for which the active current limit (IPMAX) is held at the faulted value after voltage dip returns to zero
J+12	0.05	Tp (s), Filter time constant for electrical power
J+13	99	QMax (pu), limit for reactive power regulator
J+14	-99	QMin (pu) limit for reactive power regulator

J+15	1.1	VMAX (pu), Max. limit for voltage control
J+16	0.9	VMIN (pu), Min. limit for voltage control
J+17	0.3	Kqp (pu), Reactive power regulator proportional gain
J+18	1.0	Kqi (pu), Reactive power regulator integral gain
J+19	0.3	Kvp (pu), Voltage regulator proportional gain
J+20	2.0	Kvi (pu), Voltage regulator integral gain
J+21	0.0	Vbias (pu), User-defined bias (normally 0)
J+22	0.02	Tiq (s), Time constant on delay s4
J+23	0.45	dPmax (pu/s) (>0) Power reference max. ramp rate
J+24	-0.45	dPmin (pu/s) (<0) Power reference min. ramp rate
J+25	1.1	PMAX (pu), Max. power limit
J+26	0.0	PMIN (pu), Min. power limit
J+27	1.1	Imax (pu), Maximum limit on total converter current
J+28	0.04	Tpord (s), Power filter time constant
J+29	0.1	Vq1 (pu), Reactive Power V-I pair, voltage
J+30	1.045	Iq1 (pu), Reactive Power V-I pair, current
J+31	0.2	Vq2 (pu) (Vq2>Vq1), Reactive Power V-I pair, voltage
J+32	1.045	Iq2 (pu) (Iq2>Iq1), Reactive Power V-I pair, current
J+33	0.3	Vq3 (pu) (Vq3>Vq2), Reactive Power V-I pair, voltage
J+34	1.045	Iq3 (pu) (Iq3>Iq2), Reactive Power V-I pair, current
J+35	0.4	Vq4 (pu) (Vq4>Vq3), Reactive Power V-I pair, voltage
J+36	1.045	Iq4 (pu) (Iq4>Iq3), Reactive Power V-I pair, current
J+37	0.15	Vp1 (pu), Real Power V-I pair, voltage
J+38	0.33	Ip1 (pu), Real Power V-I pair, current
J+39	0.25	Vp2 (pu) (Vp2>Vp1), Real Power V-I pair, voltage
J+40	1.0	Ip2 (pu) (Ip2>Ip1), Real Power V-I pair, current
J+41	0.3	Vp3 (pu) (Vp3>Vp2), Real Power V-I pair, voltage
J+42	1.0	Ip3 (pu) (Ip3>Ip2), Real Power V-I pair, current
J+43	0.4	Vp4 (pu) (Vp4>Vp3), Real Power V-I pair, voltage
J+44	1.2	Ip4 (pu) (Ip4>Ip3), Real Power V-I pair, current

ICONs	**Value**	**Description**
M+0	0	Bus number for voltage control; local control if 0
M+1	0	PFFLAG (Power factor control flag): 1 if power factor control 0 if Q control (which can be controlled by an external signal)
M+2	1	VFLAG: 1 if Q control, 0 if voltage control
M+3	0	QFLAG: 1 if voltage or Q control, 0 if constant pf or Q control
M+4	0	PFLAG: 1 if active current command has speed dependency 0 for no dependency
M+5	0	PQFLAG, P/Q priority flag for current limit: 0 for Q priority 1 for P priority

Table A5-3: Generic Drive Train Model (WTDTAU1)

CONs	Value	Description
J+0	5.49	H, Total inertia constant constant (s) (>0)
J+1	0.0	DAMP, Machine damping factor (pu)
J+2	0.874	Htfrac, Turbine inertia fraction (Ht/H)
J+3	1.15	Freq1, First Shaft Torsional resonant frequency (Hz)
J+4	1.8	Dshaft, Shaft damping factor (pu)

Table A5-4: Wind Turbine Pitch Control Mode (WTPTAU1)

CONs	Value	Description
J+0	2.0	Kiw, Pitch-control Integral Gain (pu)
J+1	50.0	Kpw, Pitch-control proportional gain (pu)
J+2	2.0	Kic, Pitch-compensation integral gain (pu)
J+3	40.0	Kpc, Pitch-compensation proportional gain (pu)
J+4	0.0	Kcc, Gain (pu)
J+5	0.05	Tp, Blade response time constant (s)
J+6	45	TetaMax, Maximum pitch angle (degrees)
J+7	-5	TetaMin, Minimum pitch angle (degrees)
J+8	17	RTetaMax, Maximum pitch angle rate (degrees/s)
J+9	-17	RTetaMin, Minimum pitch angle rate (degrees/s) (< 0)

Table A5-5: Wind Turbine Aerodynamic Model (WTARAU1)

CONs	Value	Description
J+0	0.007	Ka, Aerodynamic gain factor (pu/degrees)
J+1	12.0	Theta 0 Initial pitch angle (degrees)

Table A5-6: Wind Turbine Aerodynamic Model (WTARAU1)

CONs	Value	Description
J+0	0.3	Kpp, Proportional gain in torque regulator (pu)
J+1	0.05	KIP, Integrator gain in torque regulator (pu)
J+2	0.05	Tp, Electrical power filter time constant (s)
J+3	5	Twref, Speed-reference time constant (s)
J+4	1.2	Temax, Max limit in torque regulator (pu)
J+5	0.0	Temin, Min limit in torque regulator (pu)
J+6	0.13	p1, power (pu)
J+7	0.625	spd1, shaft speed for power p1 (pu)
J+8	0.38	P2, power (pu)
J+9	0.8571	Spd2, shaft speed for power p2 (pu)
J+10	0.58	P3, power (pu)
J+11	0.9732	Spd3, shaft speed for power p3 (pu)
J+12	0.78	P4, power (pu)

J+13	1	Spd4, shaft speed for power p4 (pu)
J+14	130	TRATE, Total turbine rating (MW). (*)Active Power should be modified according to the tested WTG.
ICONs	**Value**	**Description**
M+0	1	Tflag, 0: for speed control, 1: for power control

Table A5-7: Generic Renewable Plant Control Model (REPCTAU1)

CONs	Value	Description
J+0	0.02	Tfltr, Voltage or reactive power measurement filter time constant (s)
J+1	0.4	Kp, Reactive power PI control proportional gain (pu)
J+2	5.714	Ki, Reactive power PI control integral gain (pu)
J+3	-0.05	Tft, Lead time constant (s)
J+4	0.05	Tfv, Lag time constant (s)
J+5	0.85	Vfrz, Voltage below which State s2 is frozen (pu)
J+6	0	Rc, Line drop compensation resistance (pu)
J+7	0	Xc, Line drop compensation reactance (pu)
J+8	0	Kc, Reactive current compensation gain (pu)
J+9	1.0	emax, upper limit on deadband output (pu)
J+10	-1	emin, lower limit on deadband output (pu)
J+11	0	dbd1, lower threshold for reactive power control deadband (<=0)
J+12	0	dbd2, upper threshold for reactive power control deadband (>=0)
J+13	0.3275	Qmax, Upper limit on output of V/Q control (pu)
J+14	-0.3275	Qmin, Lower limit on output of V/Q control (pu)
J+15	0	Kpg, Proportional gain for power control (pu)
J+16	0.5	Kig, Proportional gain for power control (pu)
J+17	0.05	Tp, Real power measurement filter time constant (s)
J+18	0	fdbd1, Deadband for frequency control, lower threshold (<=0)
J+19	0	Fdbd2, Deadband for frequency control, upper threshold (>=0)
J+20	1	femax, frequency error upper limit (pu)
J+21	-1	femin, frequency error lower limit (pu)
J+22	1	Pmax, upper limit on power reference (pu)
J+23	0	Pmin, lower limit on power reference (pu)
J+24	0.1	Tg, Power Controller lag time constant (s)
J+25	25	Ddn, reciprocal of droop for over-frequency conditions (pu)
J+26	25	Dup, reciprocal droop for under-frequency conditions (pu)
ICONs	**Value**	**Description**
M+0	561002	Bus number for voltage control; local control if 0
M+1	563002	Monitored branch FROM bus number for line drop compensation (if 0 generator power will be used)
M+2	561002	Monitored branch TO bus number for line drop compensation (if 0 generator power will be used)

M+3	'L1'	Branch circuit id for line drop compensation (enter in single quotes) (if 0 generator power will be used)
M+4	0	VCFlag (droop flag): 0: with droop if power factor control 1: with line drop compensation 0 for no dependency
M+5	0	RefFlag (flag for V or Q control): 0: Q control 1: voltage control
M+6	1	Fflag (flag to disable frequency control): 1: Enable control 0: disable

Attachment A6
Post-Mitigation Power Flow Diagrams

Attachment A6 - Post-Mitigation Power Flow Diagrams Index

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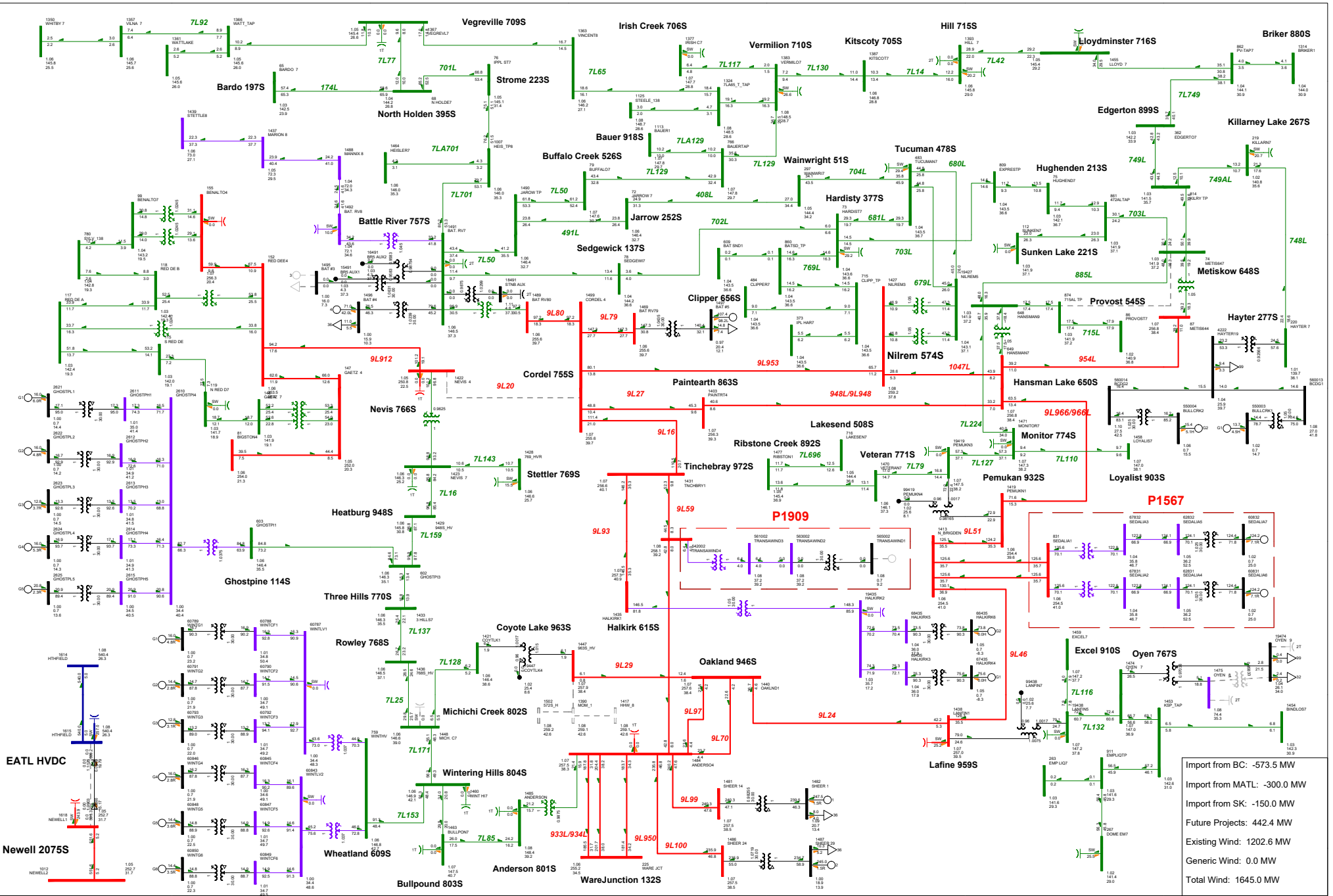

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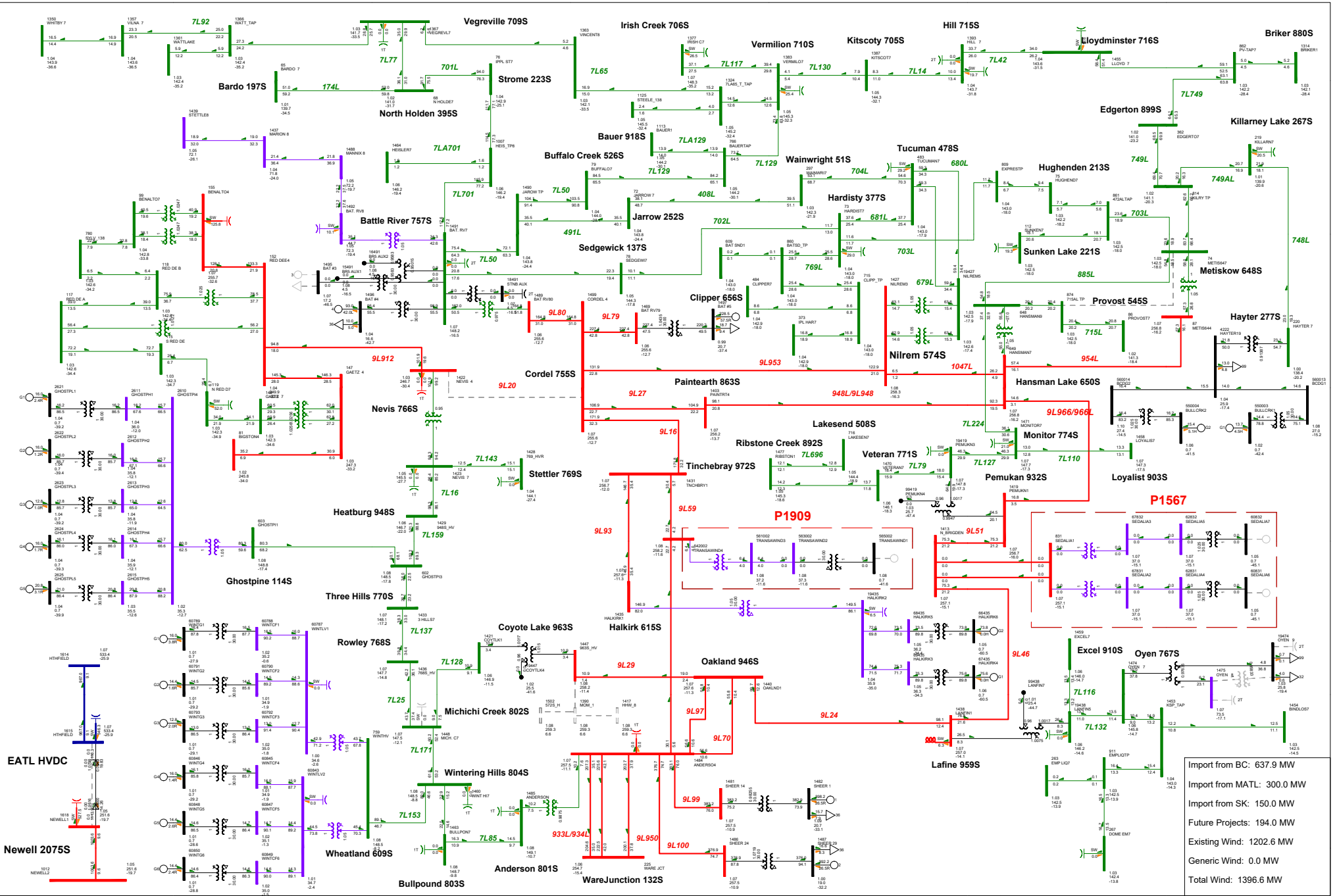
FIGURE B-4-1: P1909_SL_POST_PM
CATEGORY B - 9L20 (NEVIS 766S - CORDEL 755S)
FRI, MAR 19 2021 13:30

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



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AESO Project Number: 1909

FIGURE B-5-1: P1909_SP_POST_PM
CATEGORY B - 9L20 (NEVIS 766S - CORDEL 755S)
FRI, MAR 19 2021 13:32

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

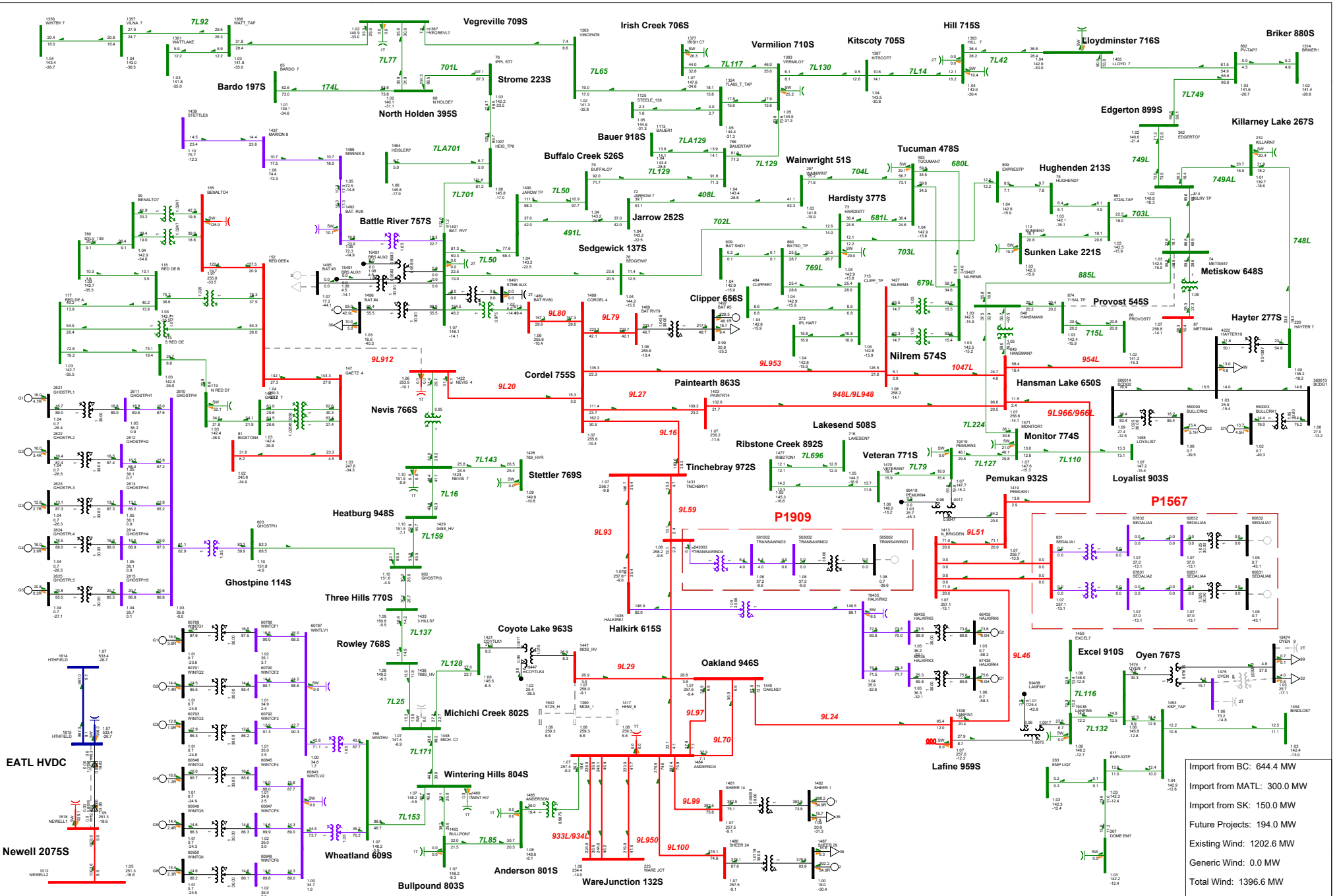

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FIGURE B-5-2: P1909_SP_POST_PM
CATEGORY B - 912L/9L912 (RED DEER 63S - NEVIS 766S)
FRI, MAR 19 2021 13:32

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

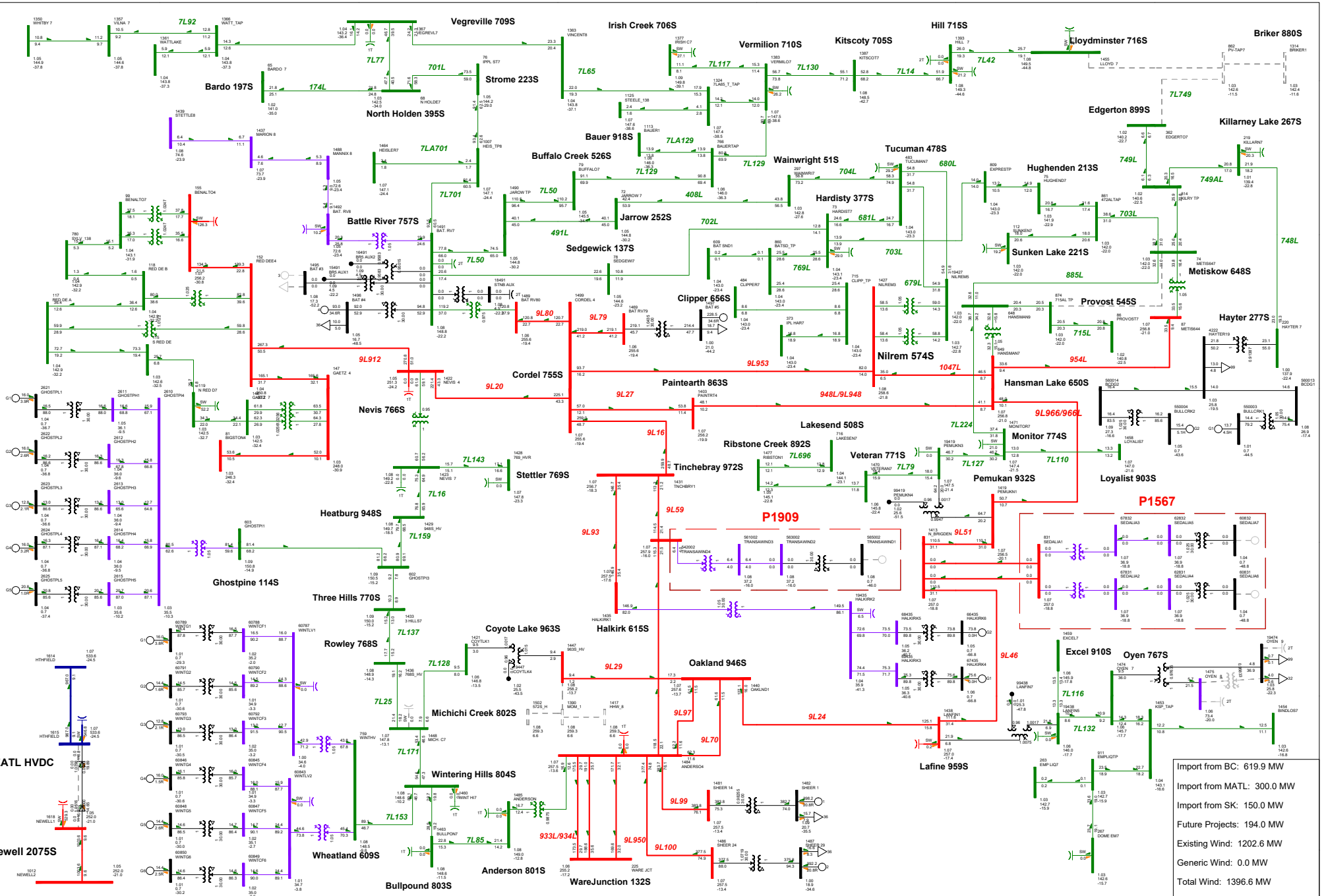

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FIGURE B-5-3: P1909_SP_POST_PM
CATEGORY B - 7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)
FRI, MAR 19 2021 13:33

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

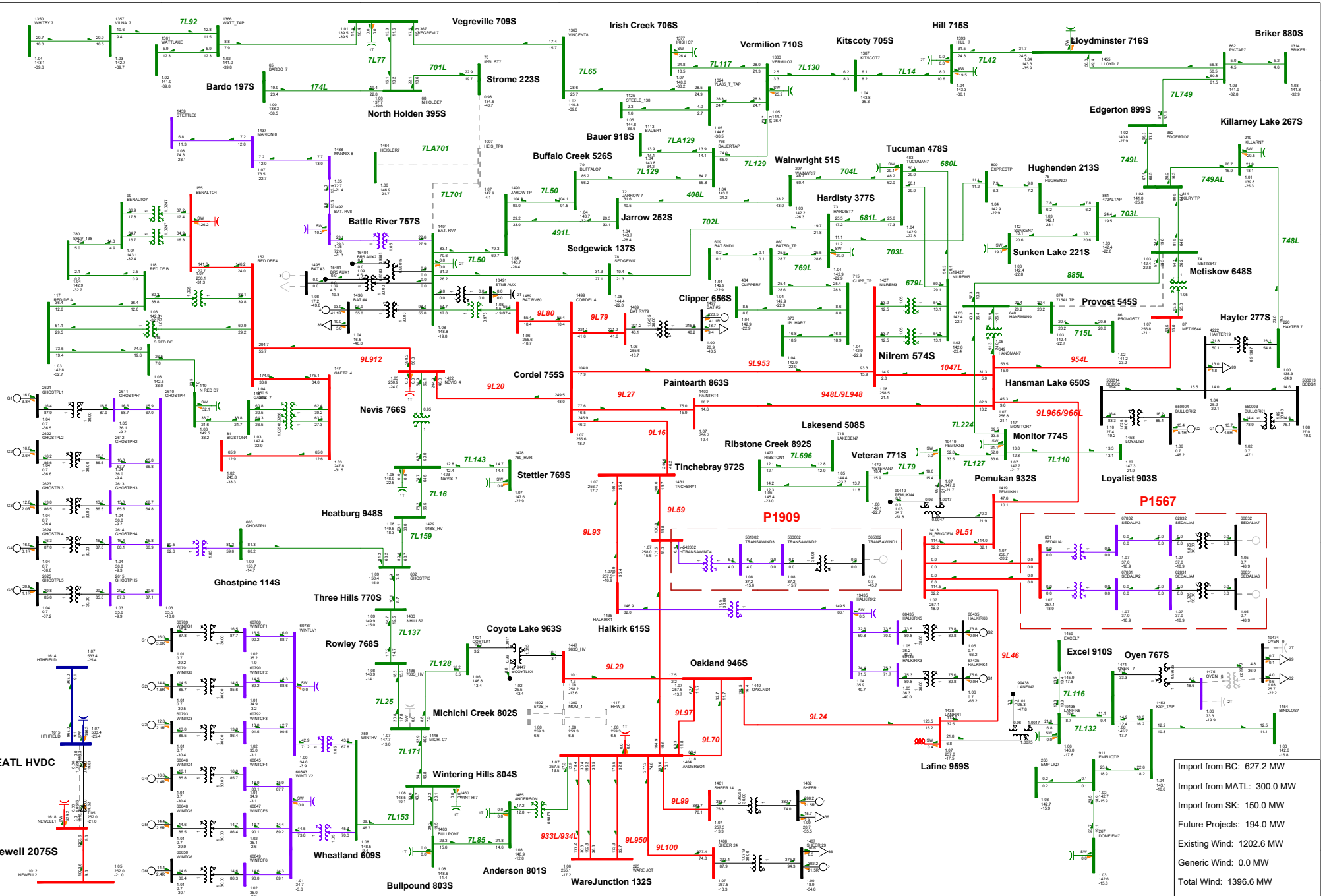

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FIGURE B-5-4: P1909_SP_POST_PM
CATEGORY B - 7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)
FRI, MAR 19 2021 13:33

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

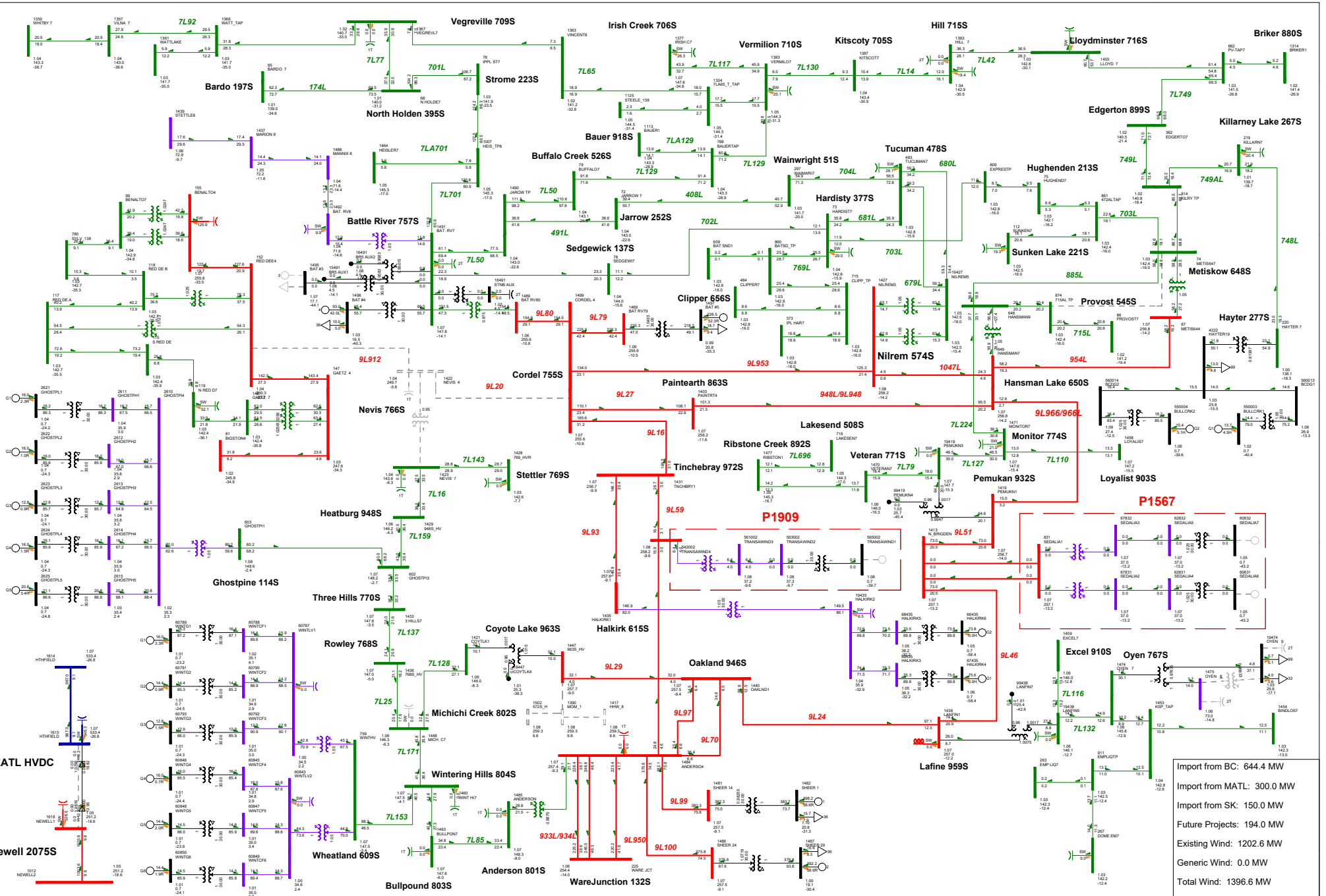

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FIGURE B-5-5: P1909_SP_POST_PM
CATEGORY B - 766S901T (NEVIS 766S 240/138 KV TRANSFORMER)
FRI, MAR 19 2021 13:34

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

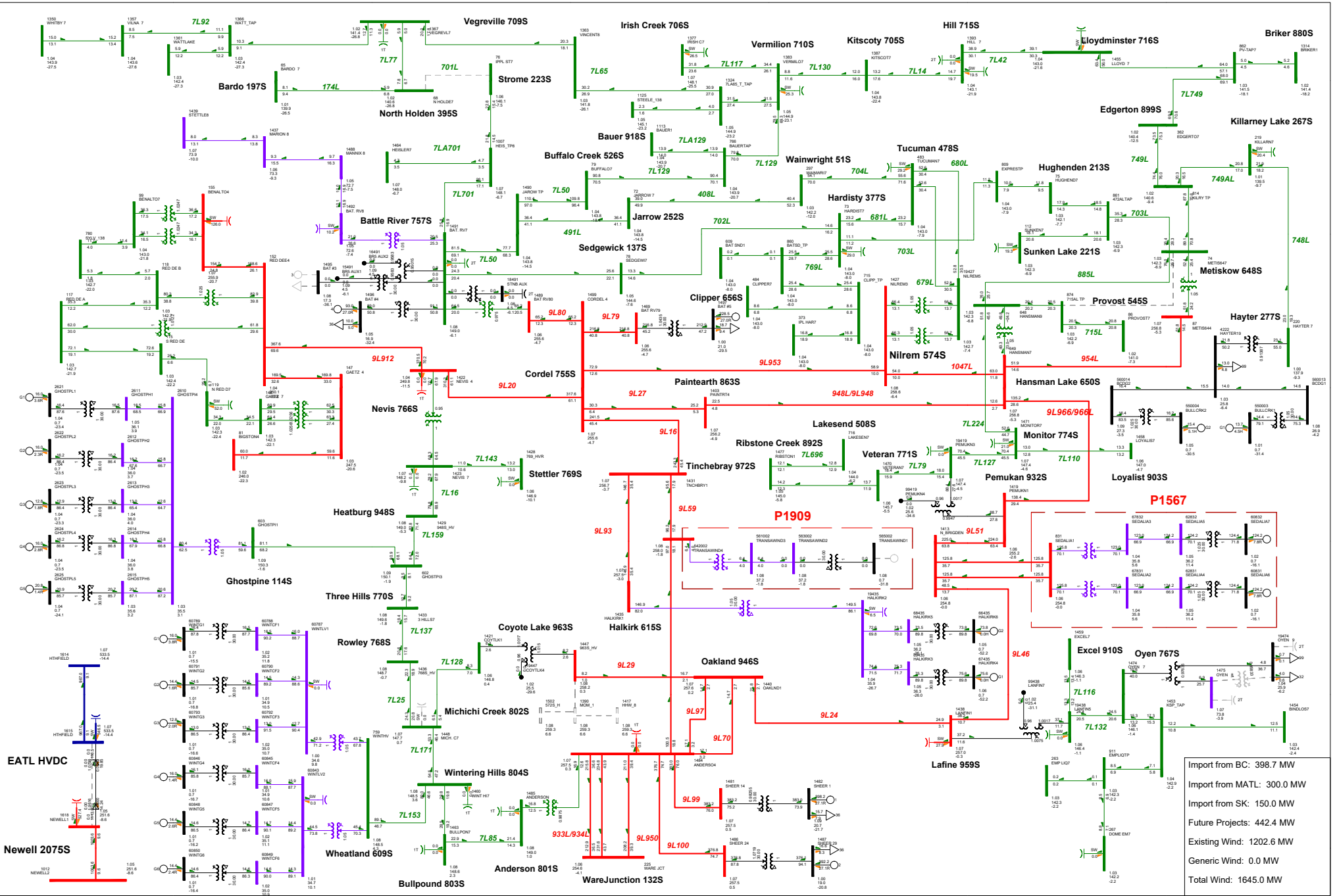

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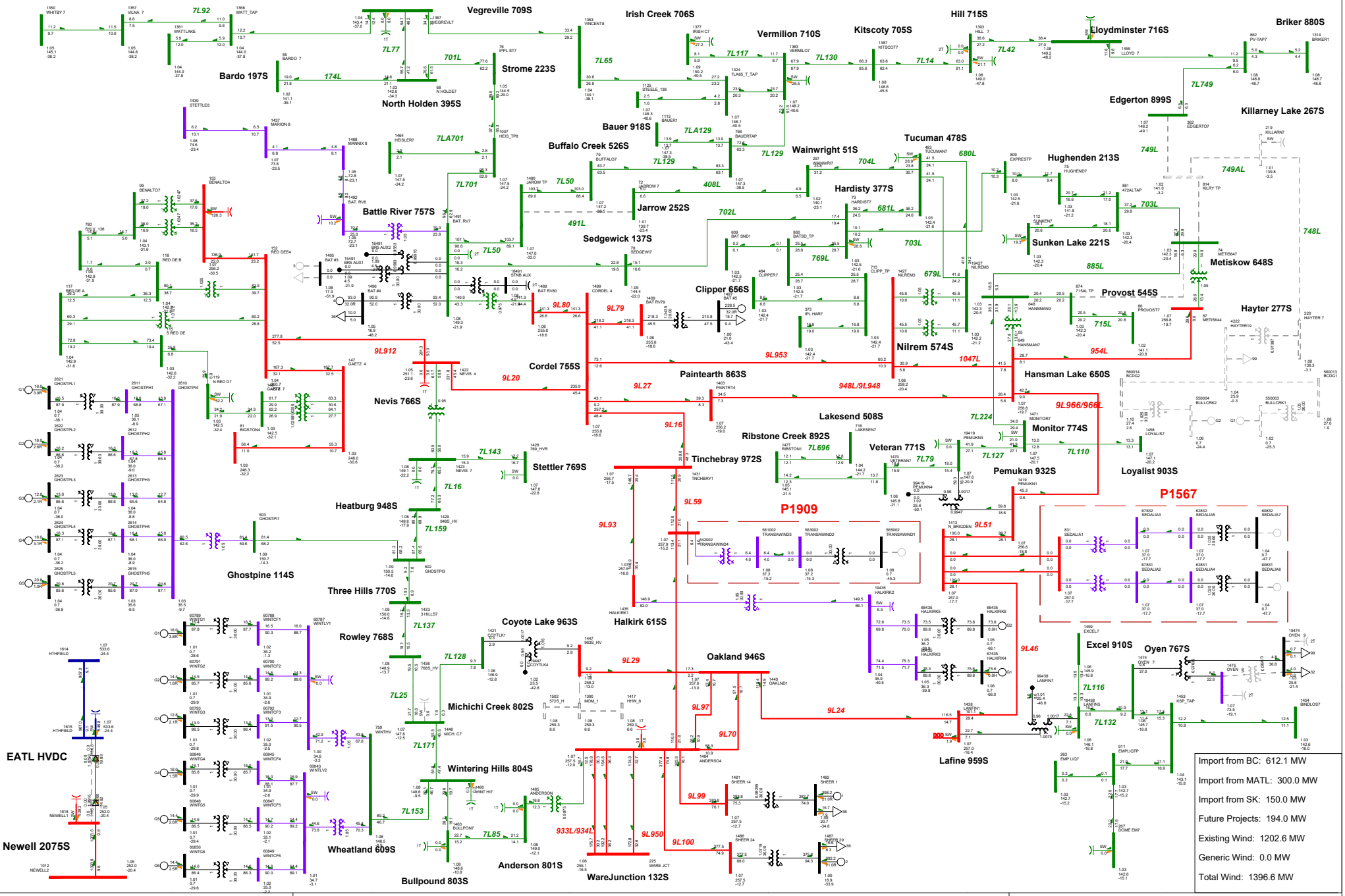
FIGURE B-5-6: P1909_SP_POST_PM
CATEGORY B - 701L (NORTH HOLDEN 395S- STROME 223S)
FRI, MAR 19 2021 13:35

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



Import from BC: 612.1 MW

Import from MATL: 300.0 MW

Import from SK: 150.0 MW

Future Projects: 194.0 MW

Existing Wind: 1202.6 MW

Generic Wind: 0.0 MW

Total Wind: 1396.6 MW

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FIGURE B-5-7: P1909_SP_POST_PM
CATEGORY B - 749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)
FRI, MAR 19 2021 13:36

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.200OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

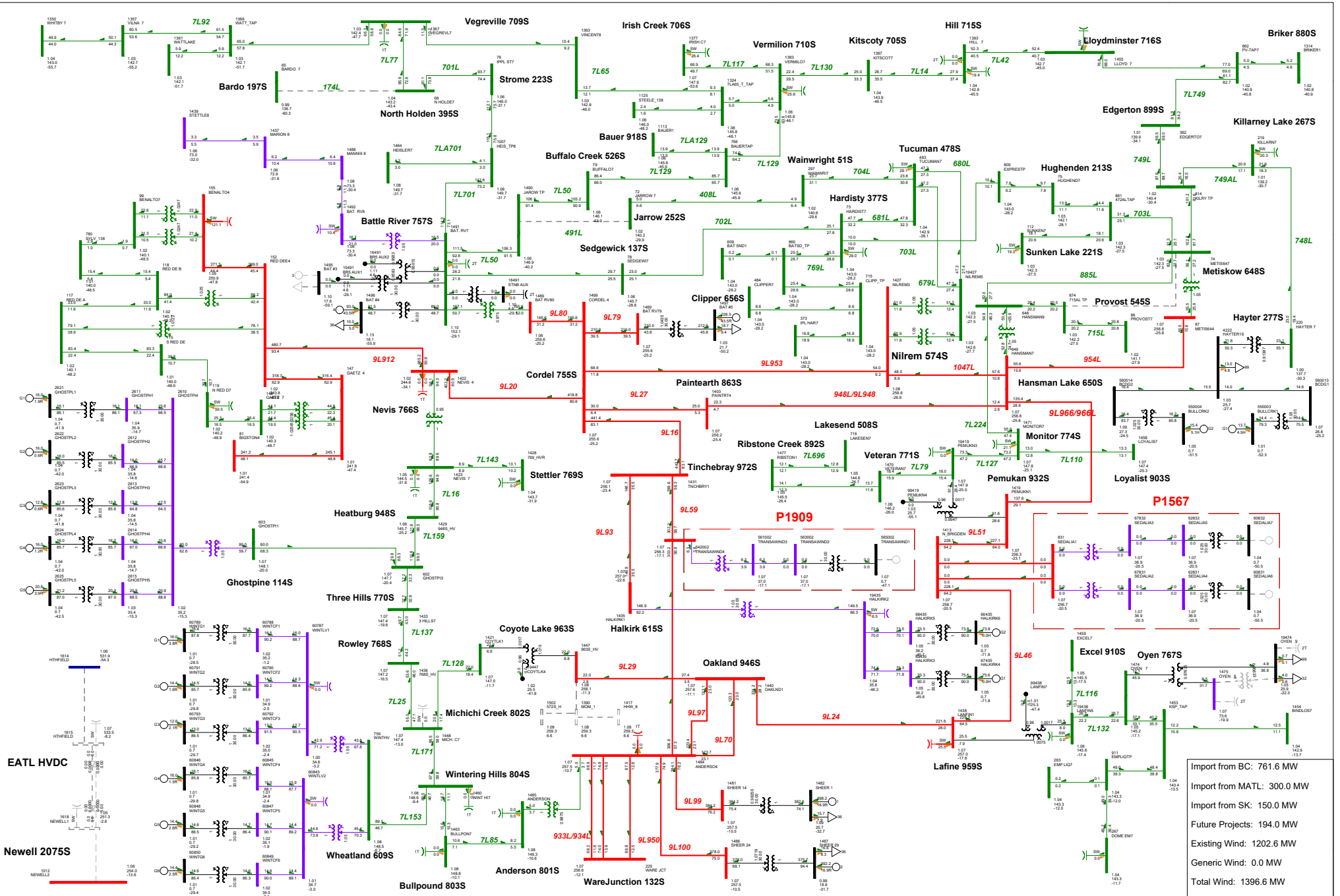

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FIGURE B-5-8: P1909_SP_POST_PM
CATEGORY B - EATL HVDC
FRI, MAR 19 2021 13:37

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

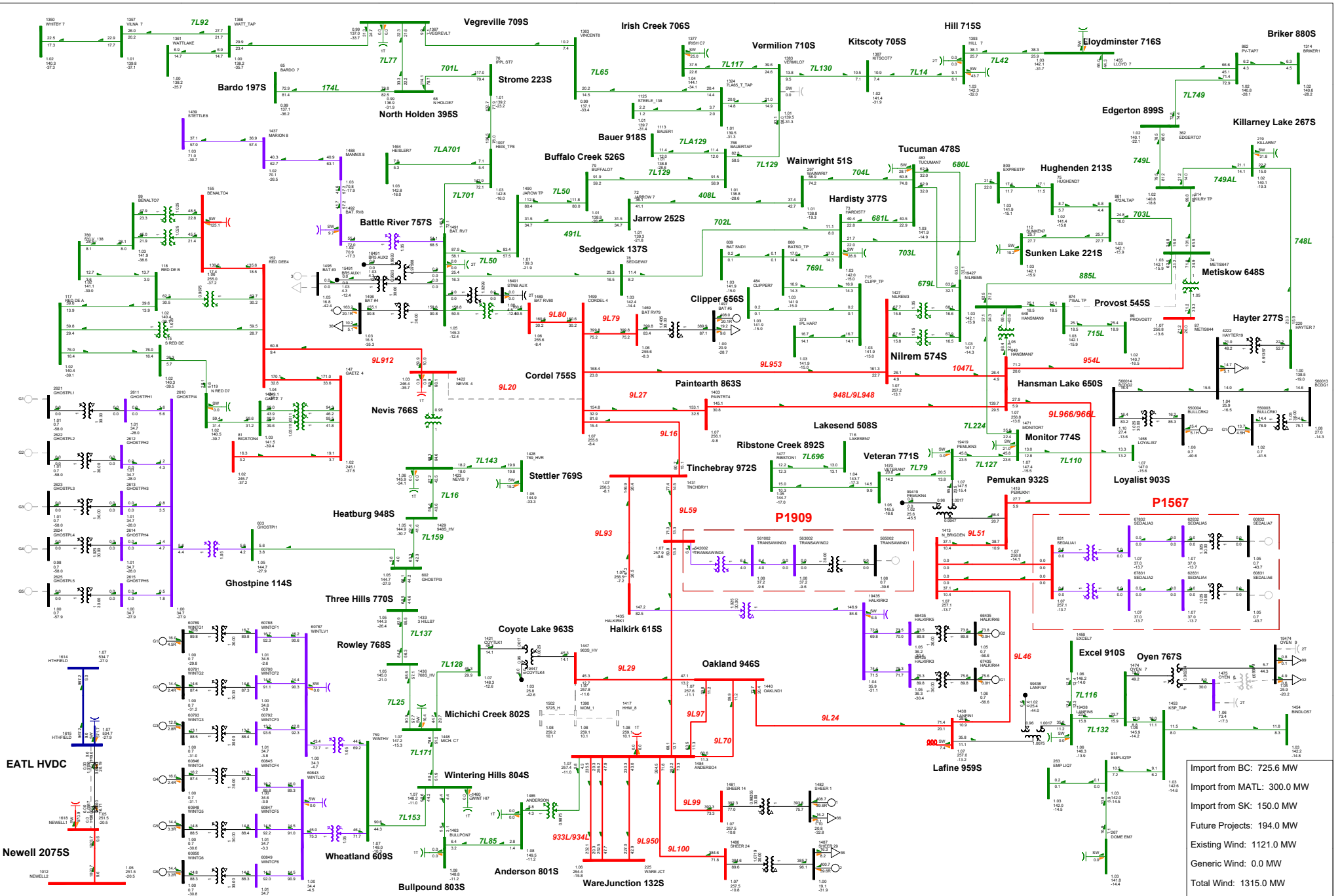

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FIGURE B-6-1: P1909_WP_POST_PM
CATEGORY B - 9L20 (NEVIS 766S - CORDEL 755S)
FRI, MAR 19 2021 13:38

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate B
Equipment - MW/Mvar
100.0%Rate B
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

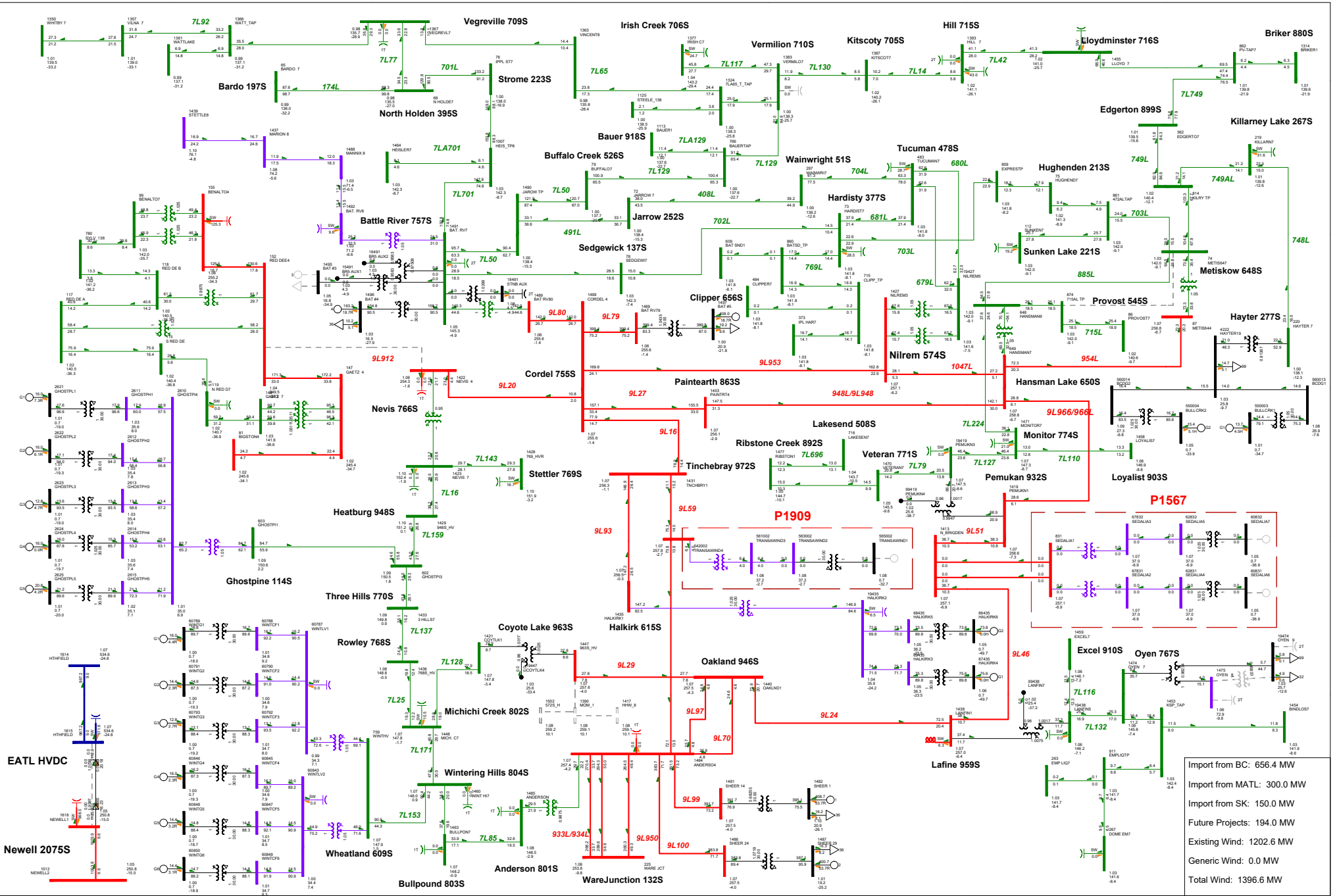

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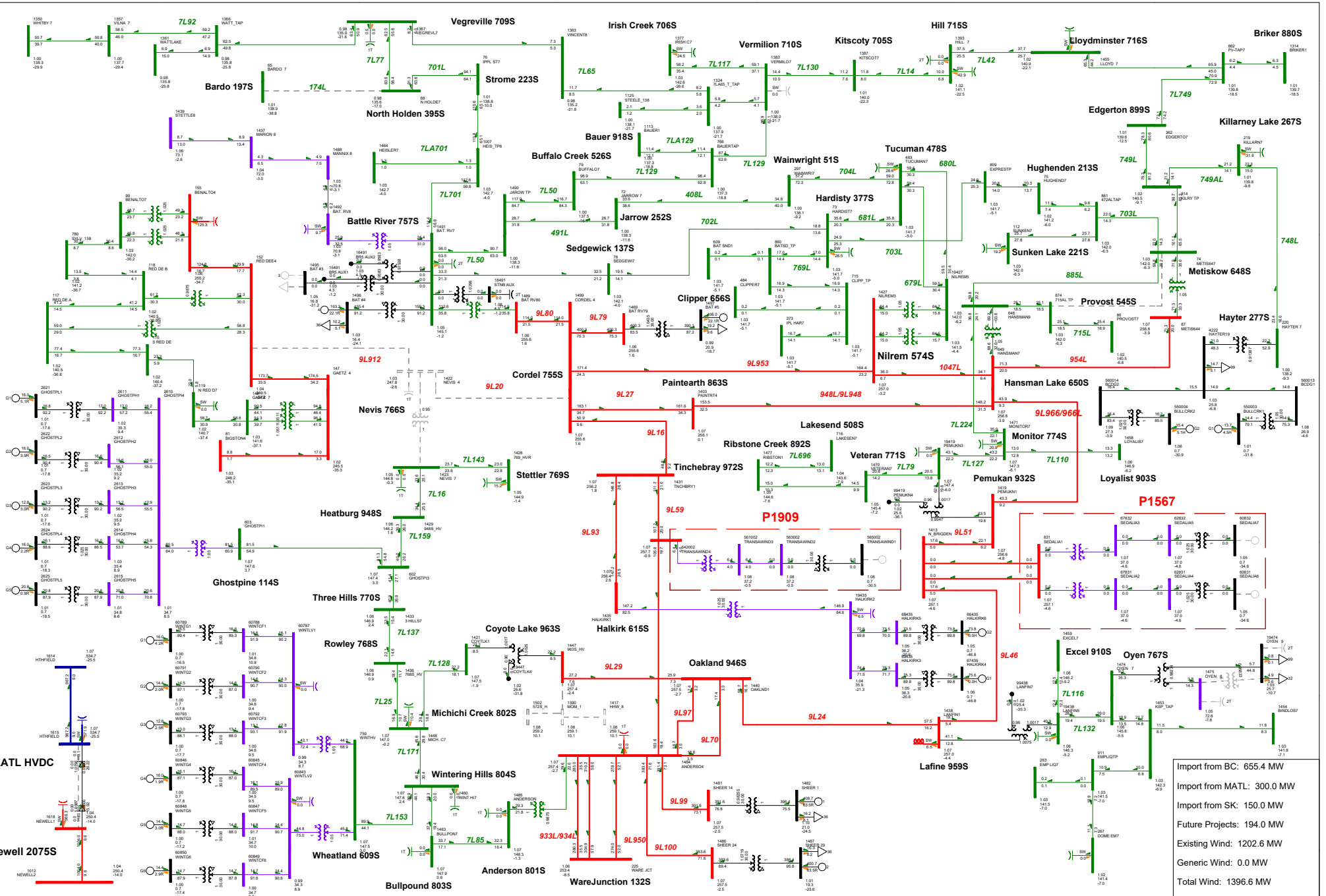
FIGURE B-6-2: P1909_WP_POST_PM
CATEGORY B - 912L/9L912 (RED DEER 63S - NEVIS 766S)
FRI, MAR 19 2021 13:39

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate B
Equipment - MW/MVar
100.0%Rate B
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



TransAlta Garden Plain Wind Farm

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FIGURE B-6-3: P1909_WP_POST_PM
CATEGORY B - 766S901T (NEVIS 766S 240/138 KV TRANSFORMER)
FRI, MAR 19 2021 13:40

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate B
Equipment - MW/Mvar
100.0%Rate B
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

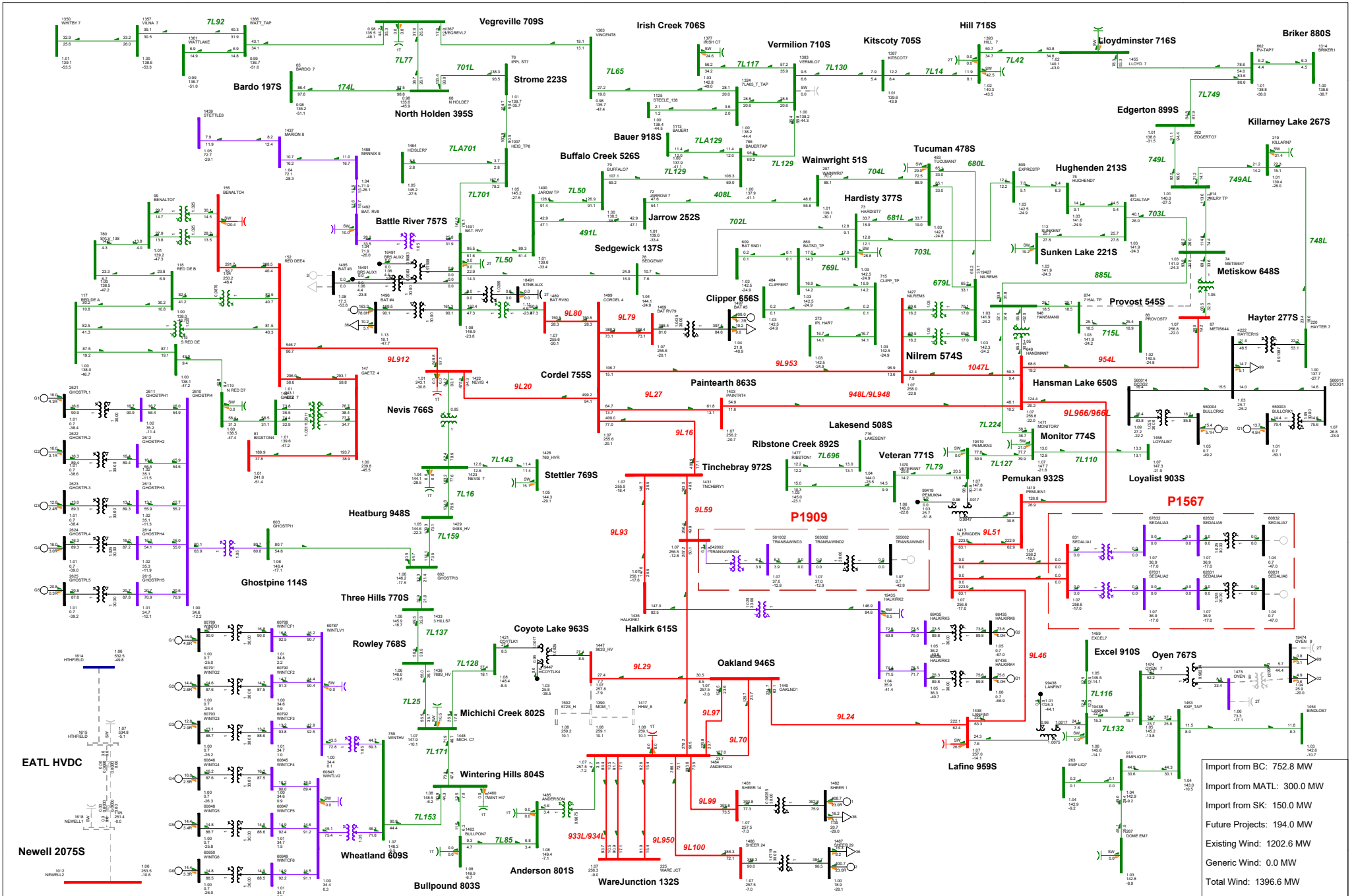

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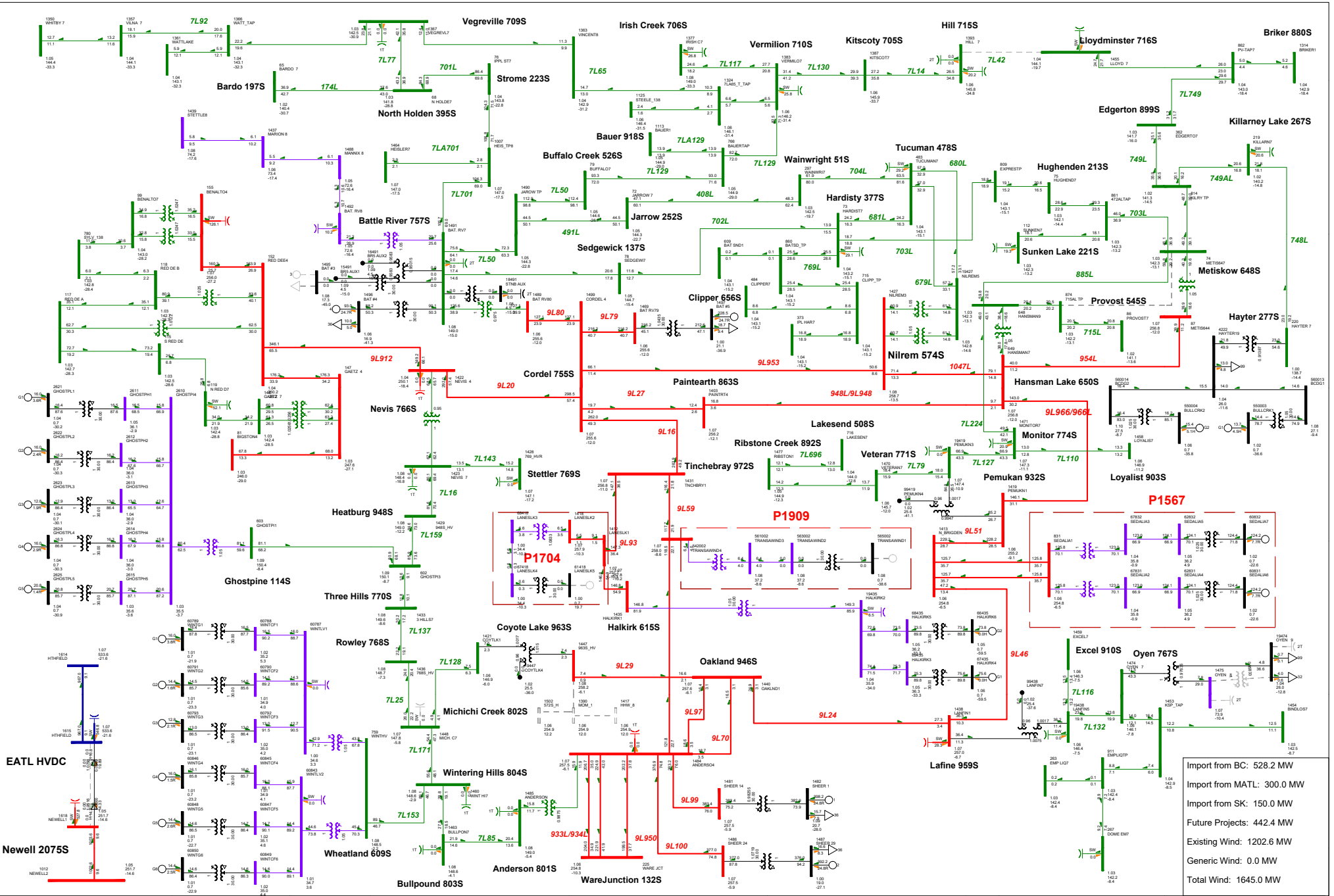
FIGURE B-6-4: P1909_WP_POST_PM
CATEGORY B - EATL HVDC
FRI, MAR 19 2021 10:37

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate B
Equipment - MW/Mvar
100.0%Rate B
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

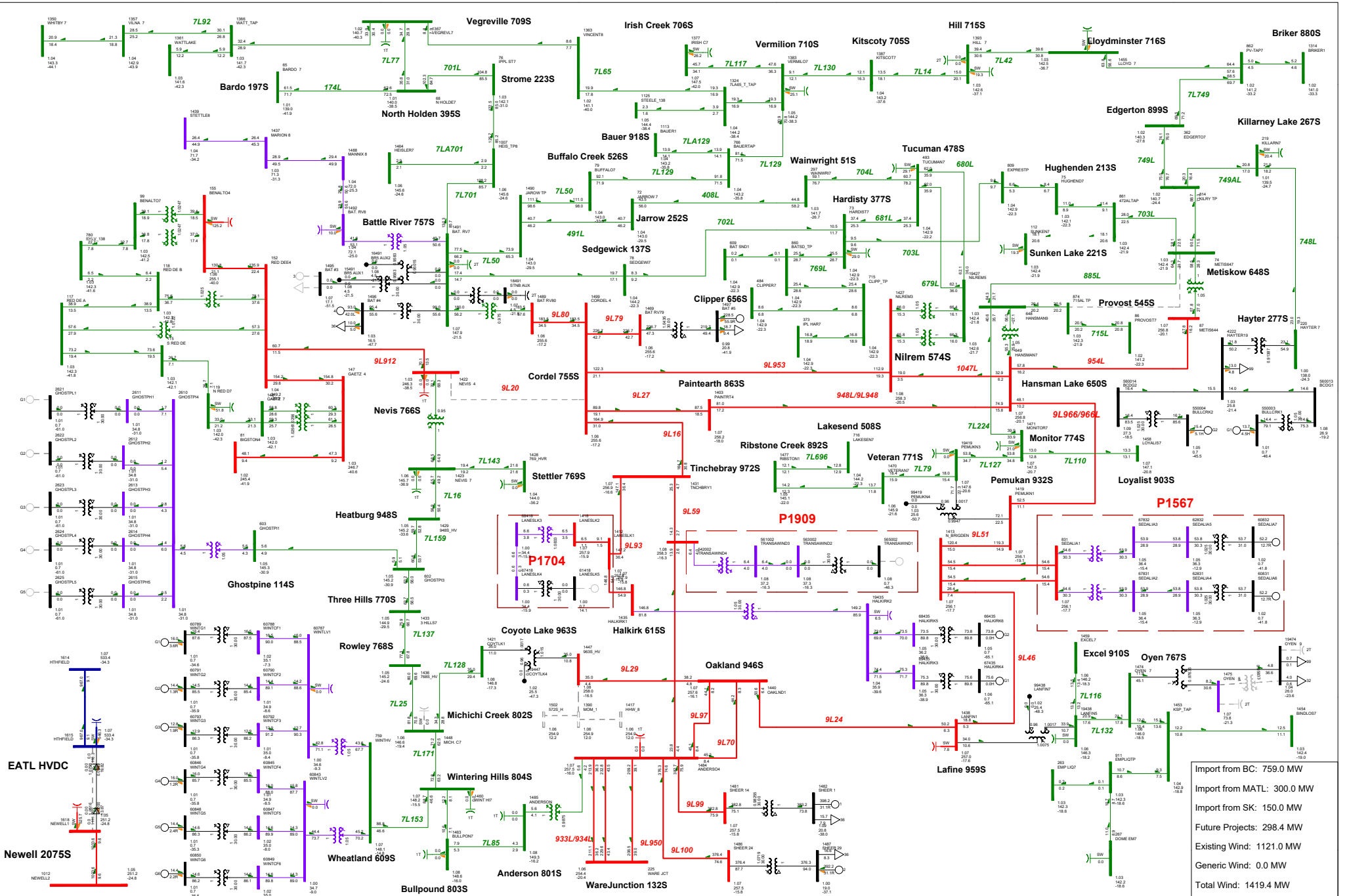


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-1: P1909_SP_POST_SEN_PM
CATEGORY B - 7L42 (HILL 751S - LLOYDMINSTER 716S)
FRI, MAR 19 2021 13:45

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

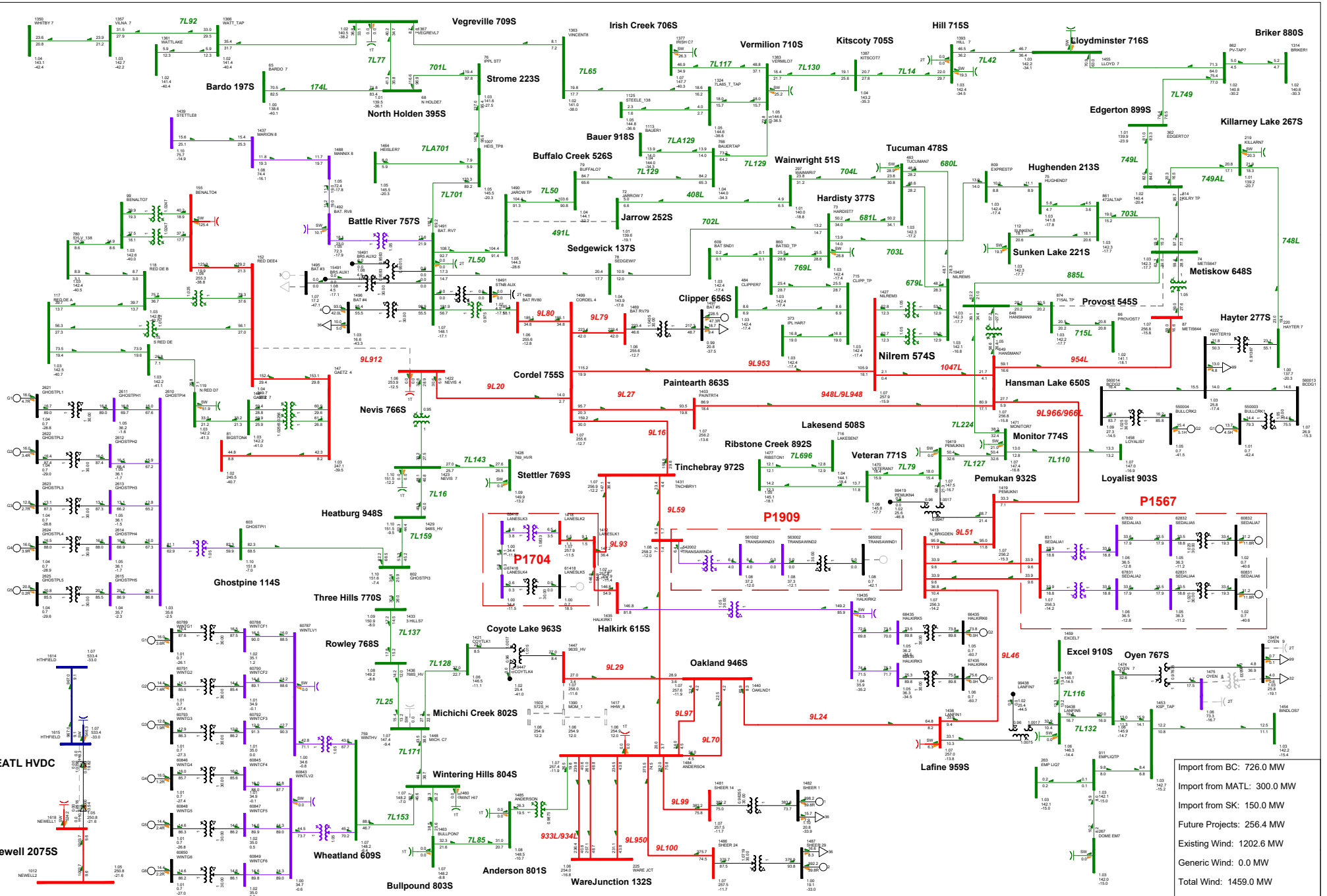


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-2: P1909_SP_POST_SEN_PM
CATEGORY B - 9L20 (NEVIS 766S - CORDEL 755S)
FRI, MAR 19 2021 13:44

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.200OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

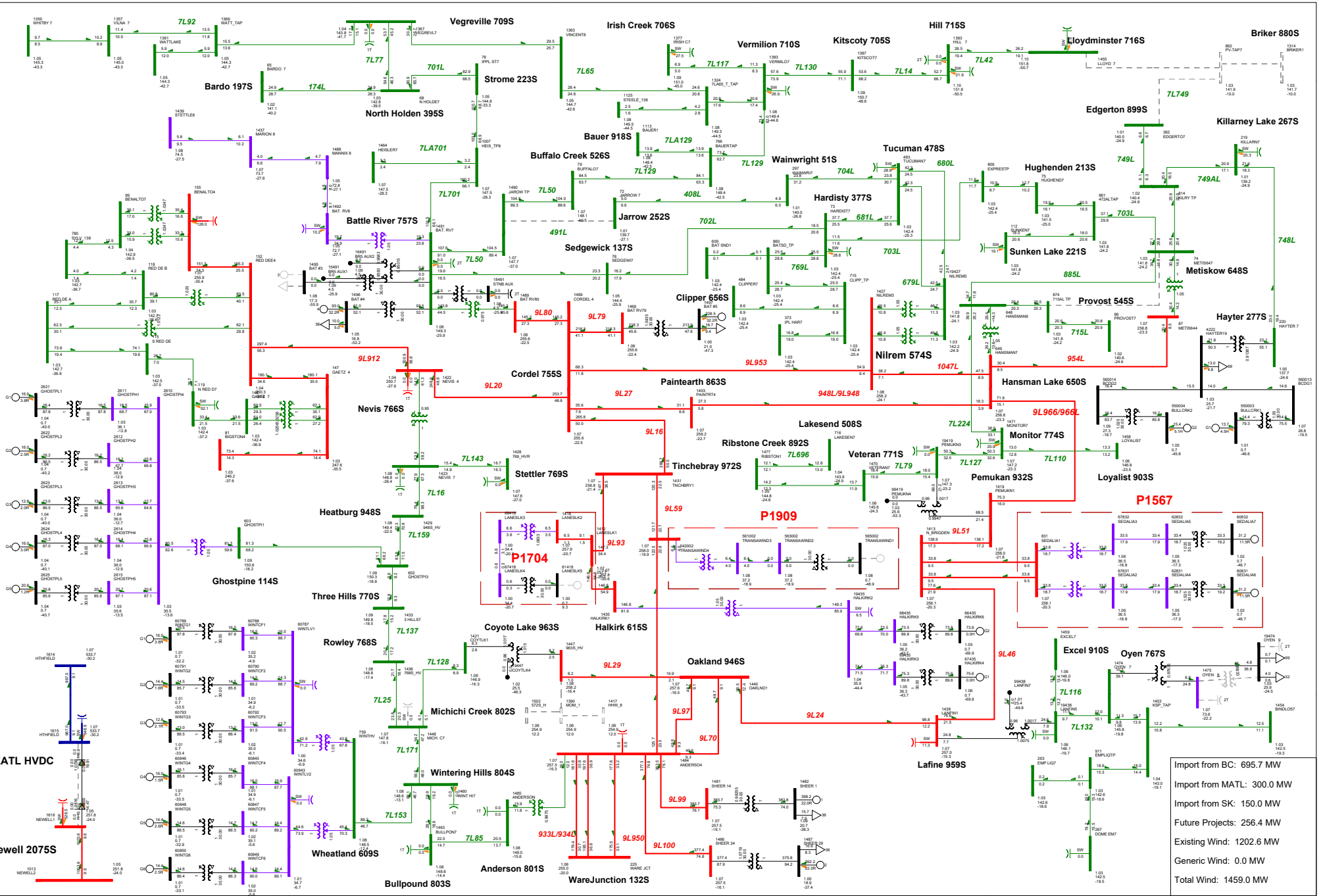


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-3: P1909_SP_POST_SEN_PM
CATEGORY B - 912L/9L912 (RED DEER 63S - NEVIS 766S)
FRI, MAR 19 2021 13:46

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

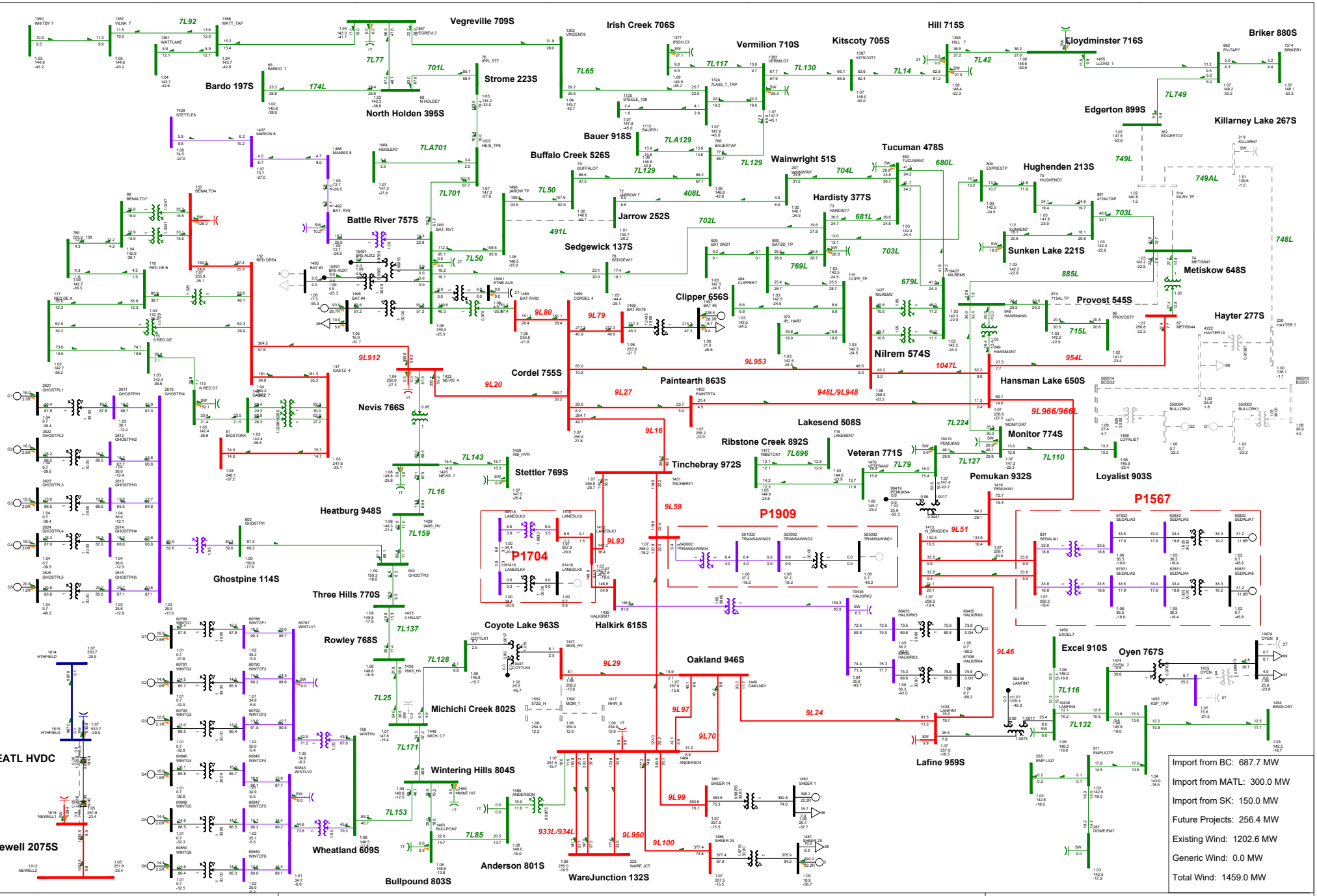


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-4: P1909_SP_POST_SEN_PM
CATEGORY B - 7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)
FRI, MAR 19 2021 13:48

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

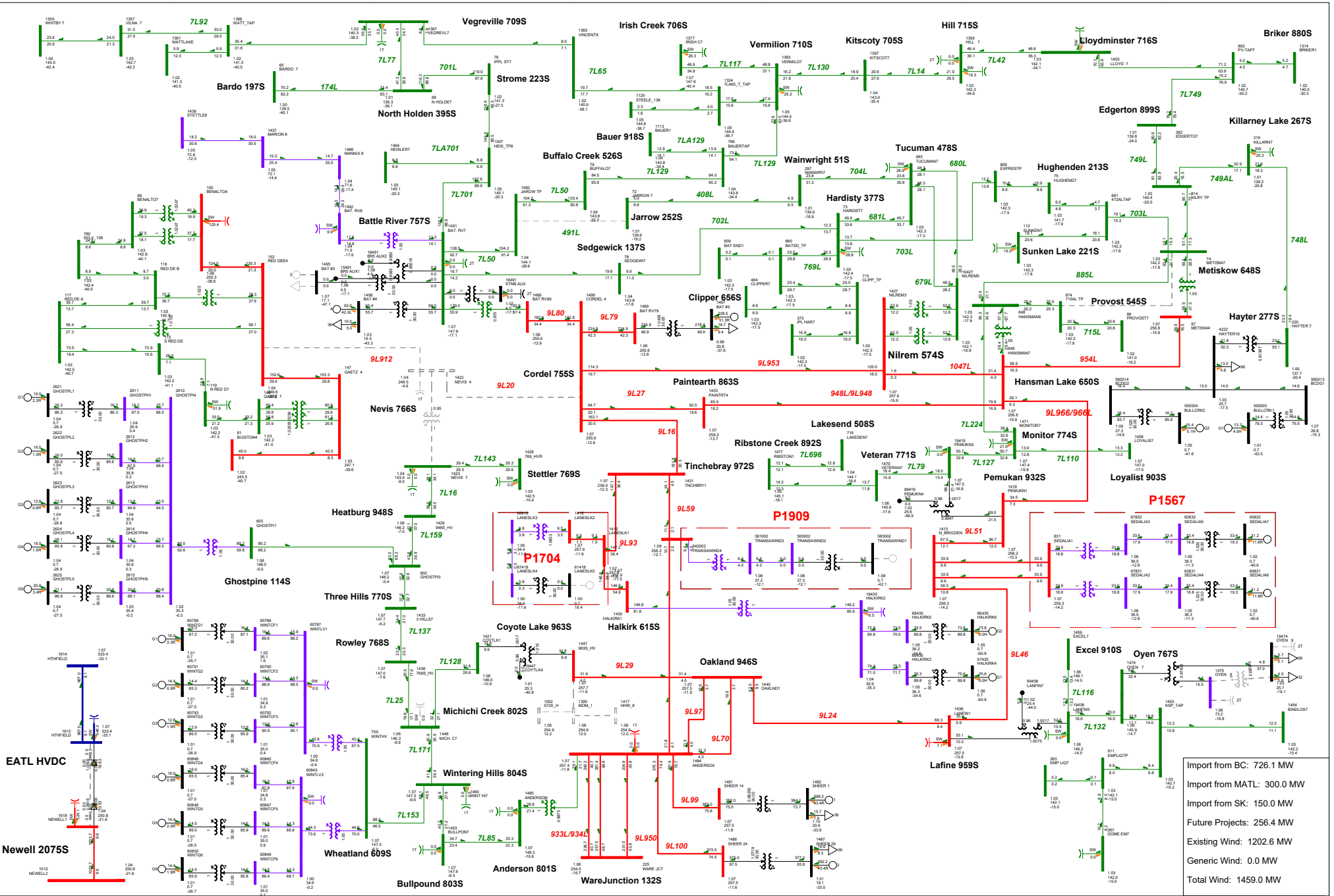


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-5: P1909_SP_POST_SEN_PM
CATEGORY B - 749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)
FRI, MAR 19 2021 13:49

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.200OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

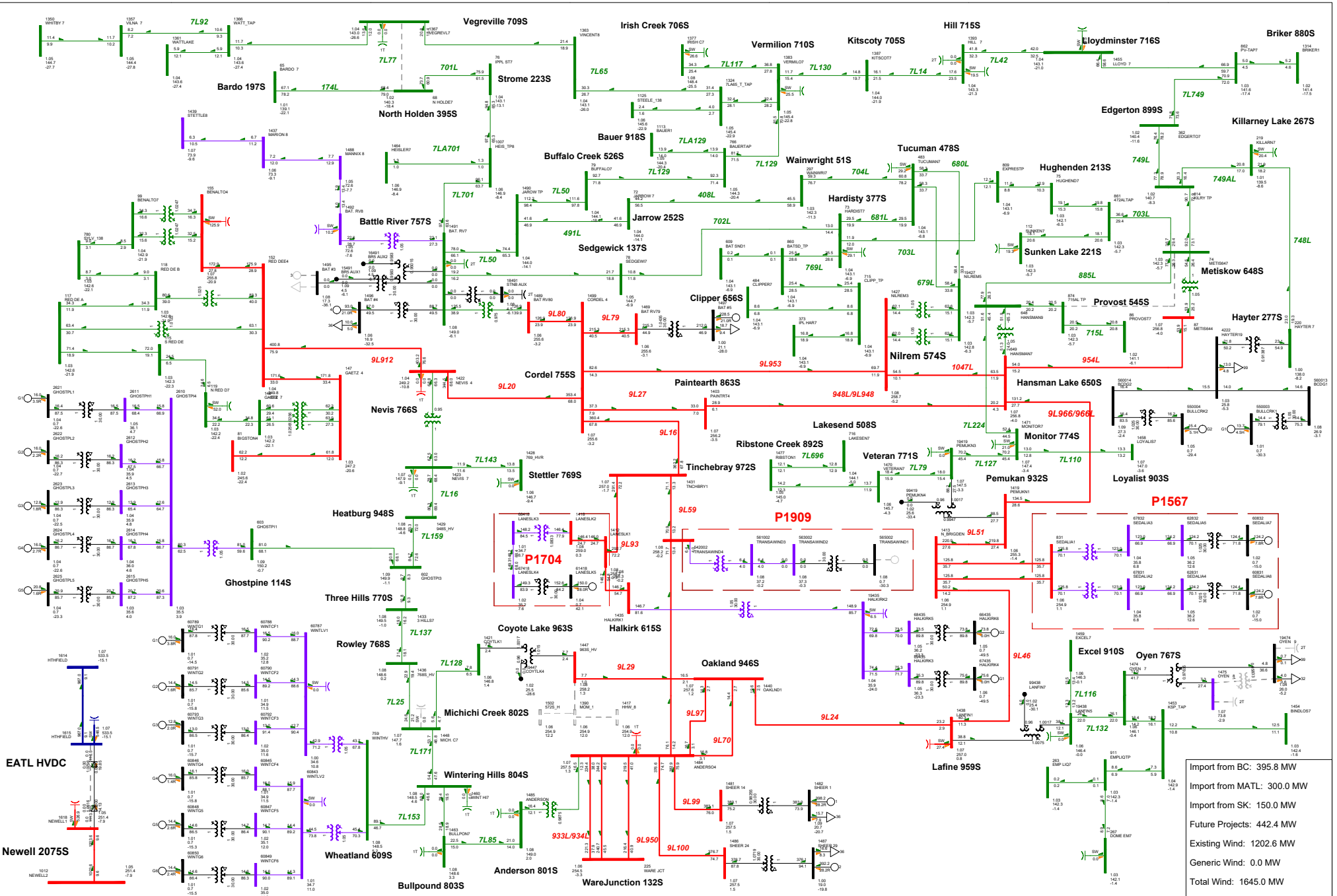


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-6: P1909_SP_POST_SEN_PM
CATEGORY B - 766S901T (NEVIS 766S 240/138 KV TRANSFORMER)
FRI, MAR 19 2021 13:50

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

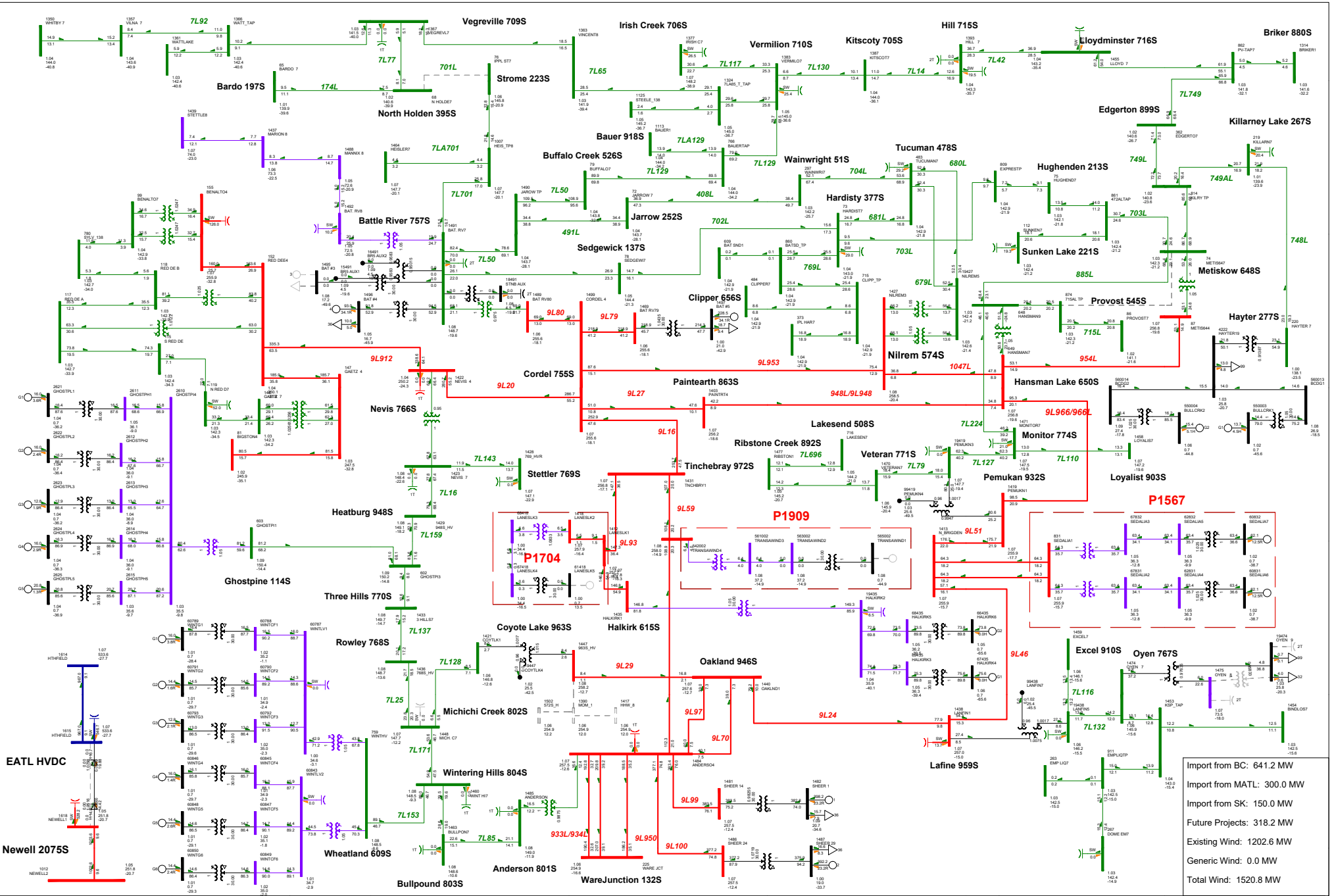


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-7: P1909_SP_POST_SEN_PM
CATEGORY B - 7L77 (NORTH HOLDEN 395S - VEGREVILLE 709S)
FRI, MAR 19 2021 13:52

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

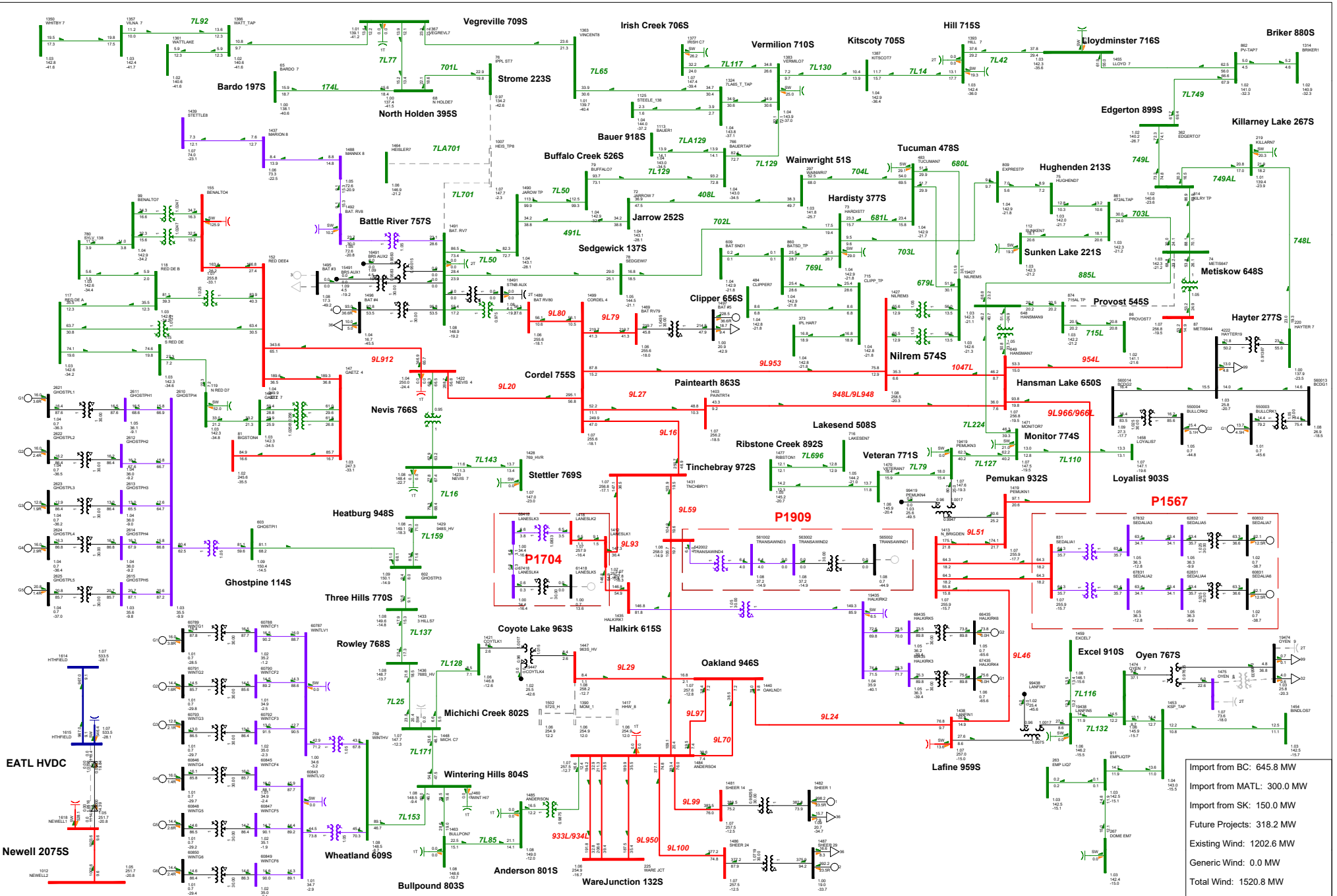


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-8: P1909_SP_POST_SEN_PM
CATEGORY B - 701L (NORTH HOLDEN 395S- STROME 223S)
FRI, MAR 19 2021 13:52

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

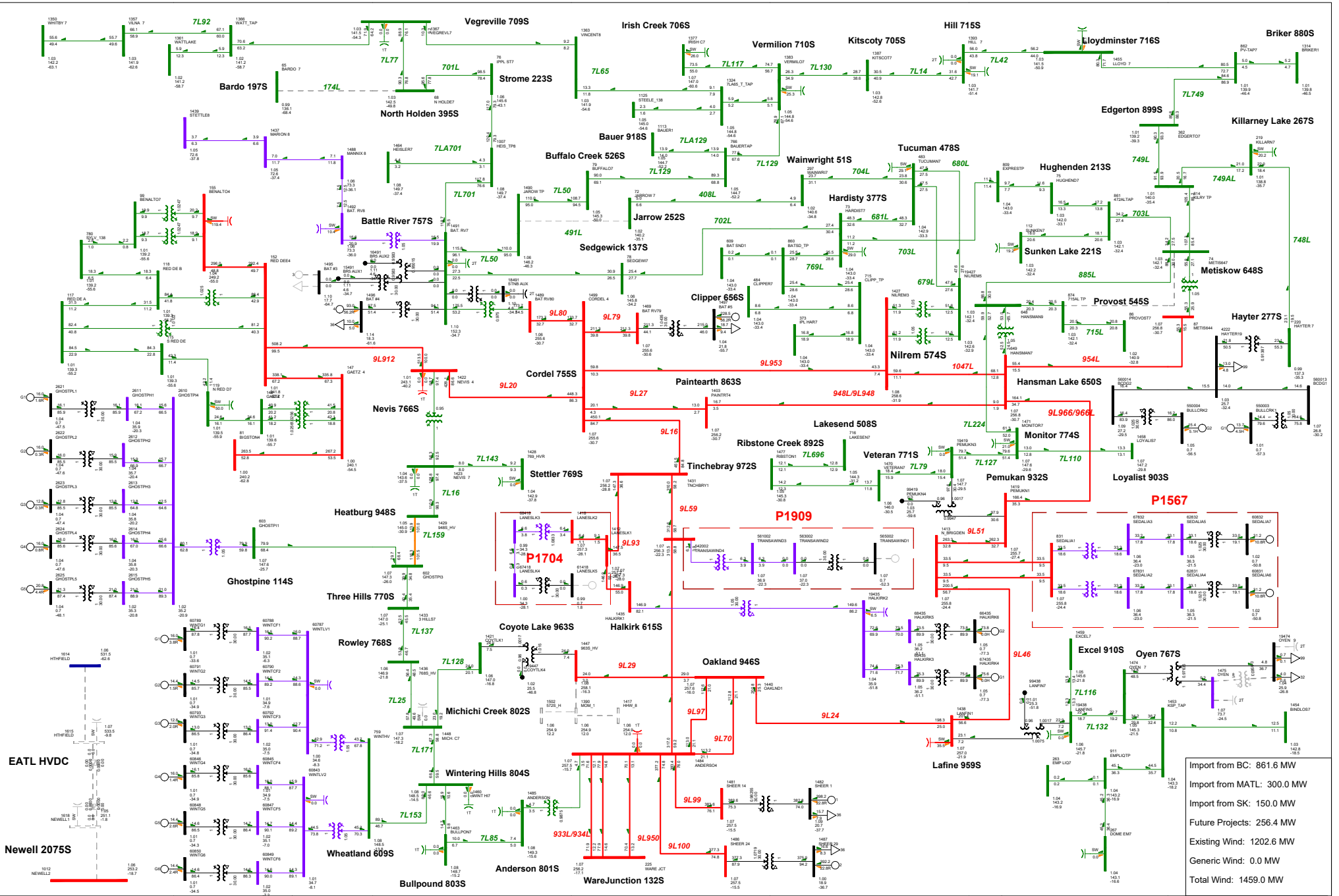


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-9: P1909_SP_POST_SEN_PM
CATEGORY B - 7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)
FRI, MAR 19 2021 13:53

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

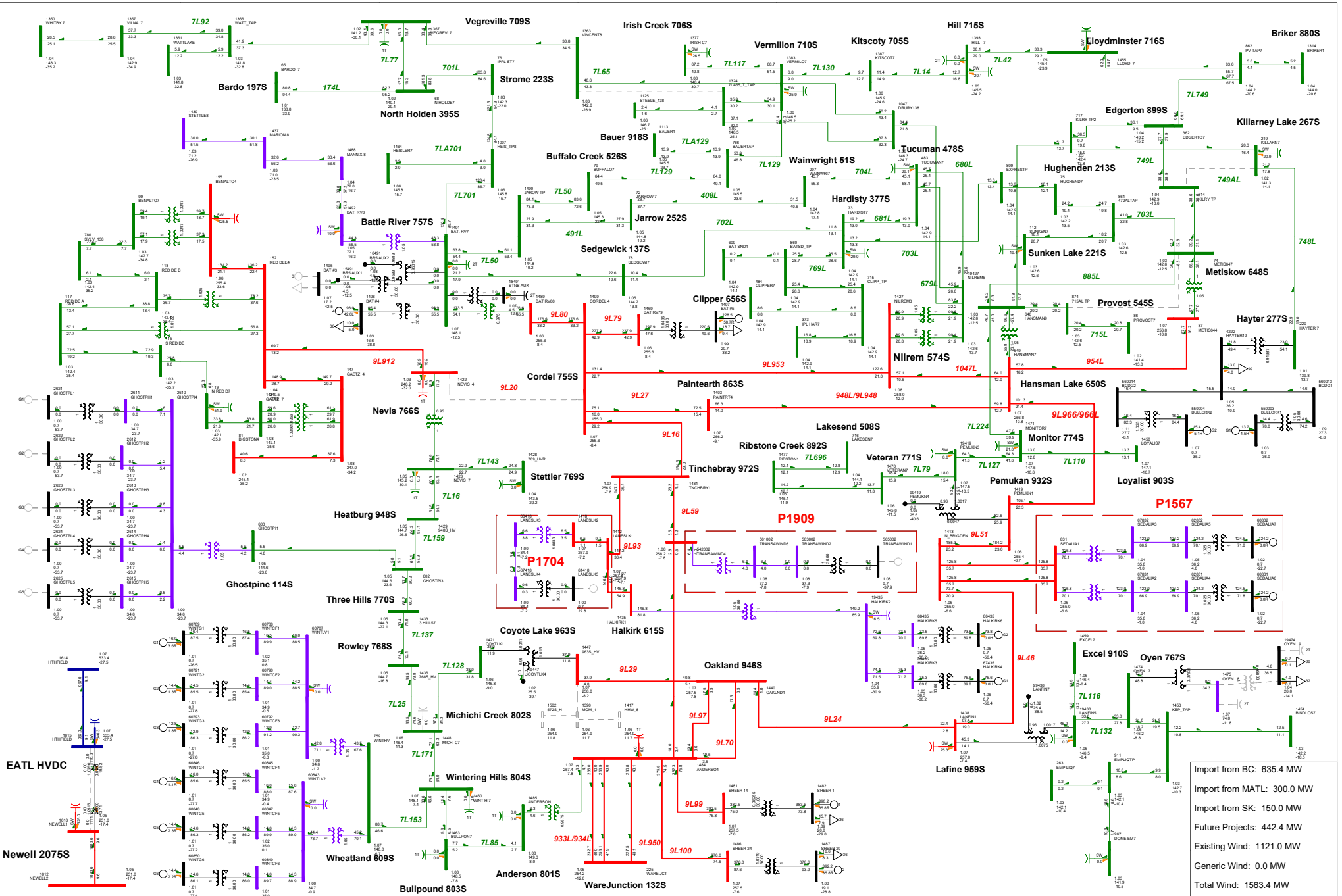


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-9-10: P1909_SP_POST_SEN_PM
CATEGORY B - EATL HVDC
FRI, MAR 19 2021 13:54

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

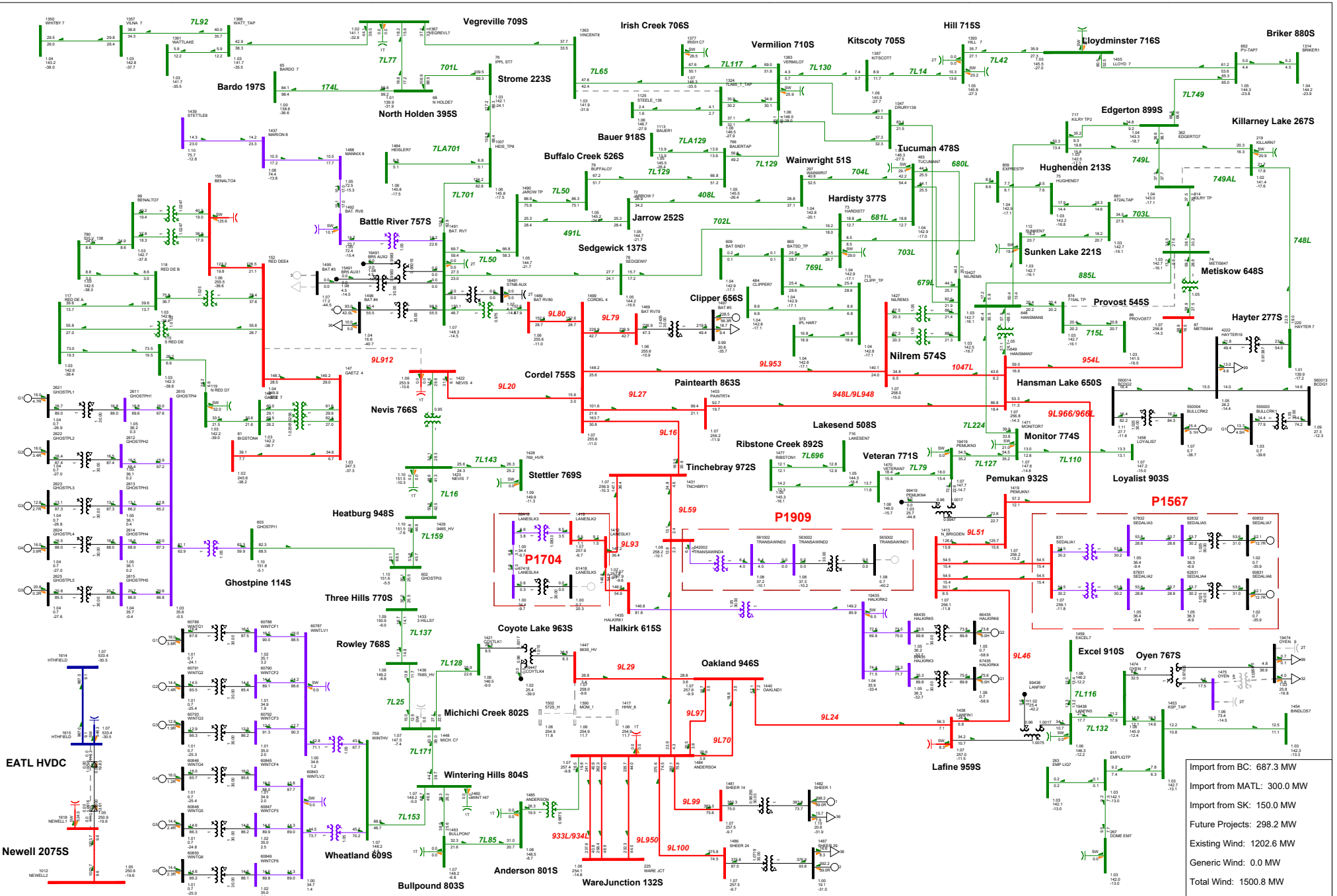


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-10-1: P1909_SP_POST_SEN_PENV_PM
CATEGORY B - 9L20 (NEVIS 766S - CORDEL 755S)
FRI, MAR 19 2021 13:55

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.200OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

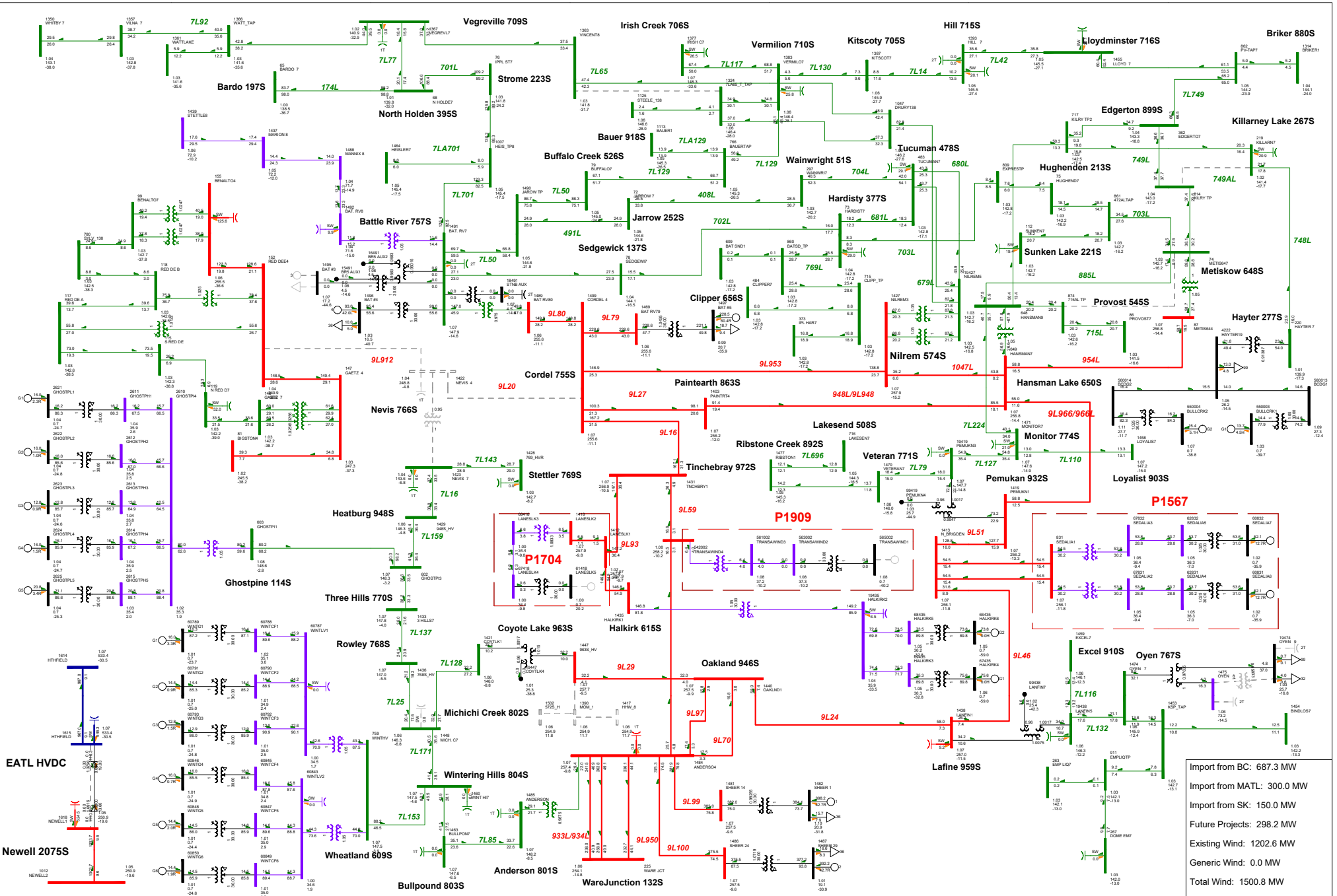


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-10-2: P1909_SP_POST_SEN_PENV_PM
CATEGORY B - 912L/9L912 (RED DEER 63S - NEVIS 766S)
FRI, MAR 19 2021 13:56

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

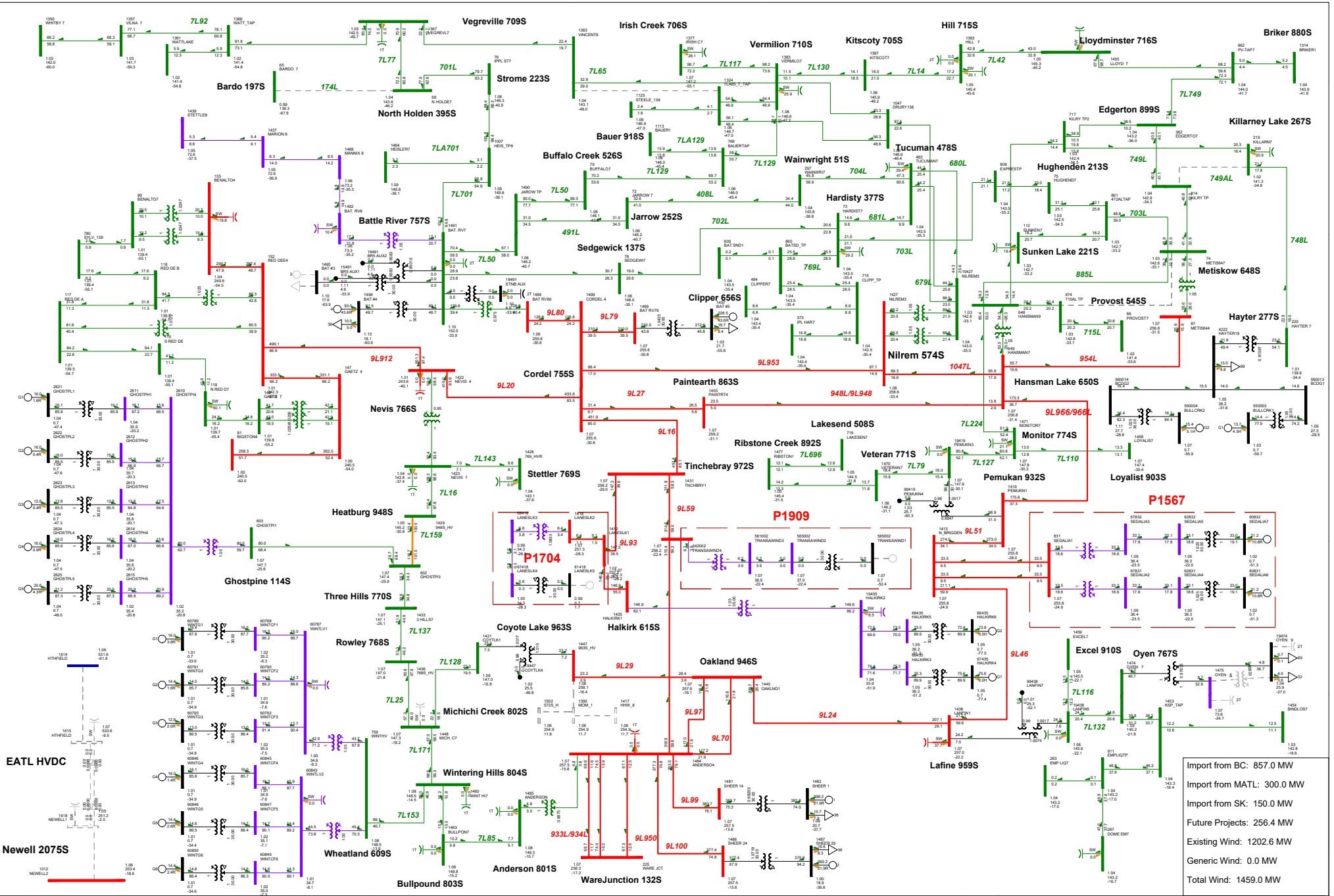


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-10-3: P1909_SP_POST_SEN_PENV_PM
CATEGORY B - 766S901T (NEVIS 766S 240/138 KV TRANSFORMER)
FRI, MAR 19 2021 13:57

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

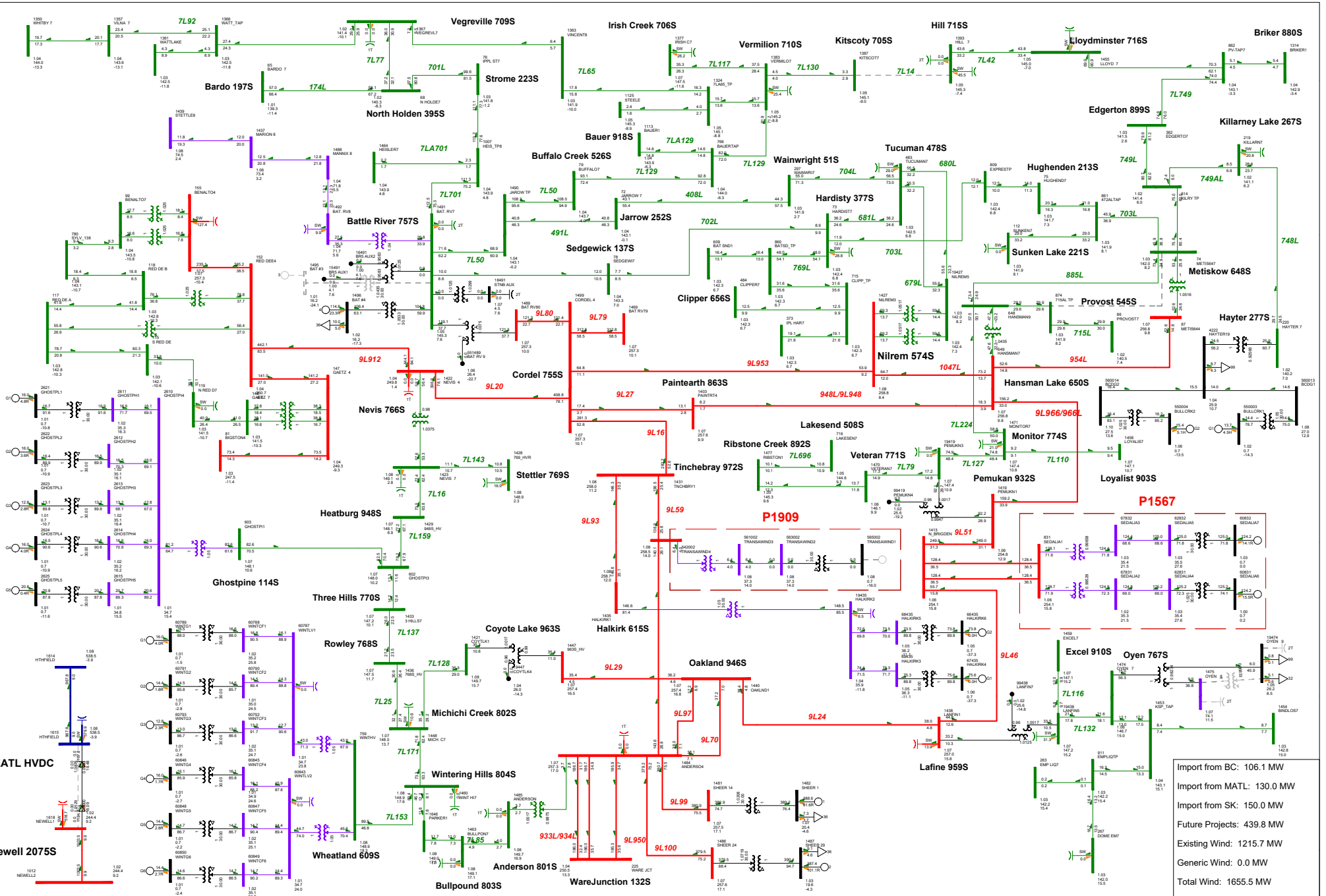


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-10-4: P1909_SP_POST_SEN_PENV_PM
CATEGORY B - EATL HVDC
FRI, MAR 19 2021 10:50

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

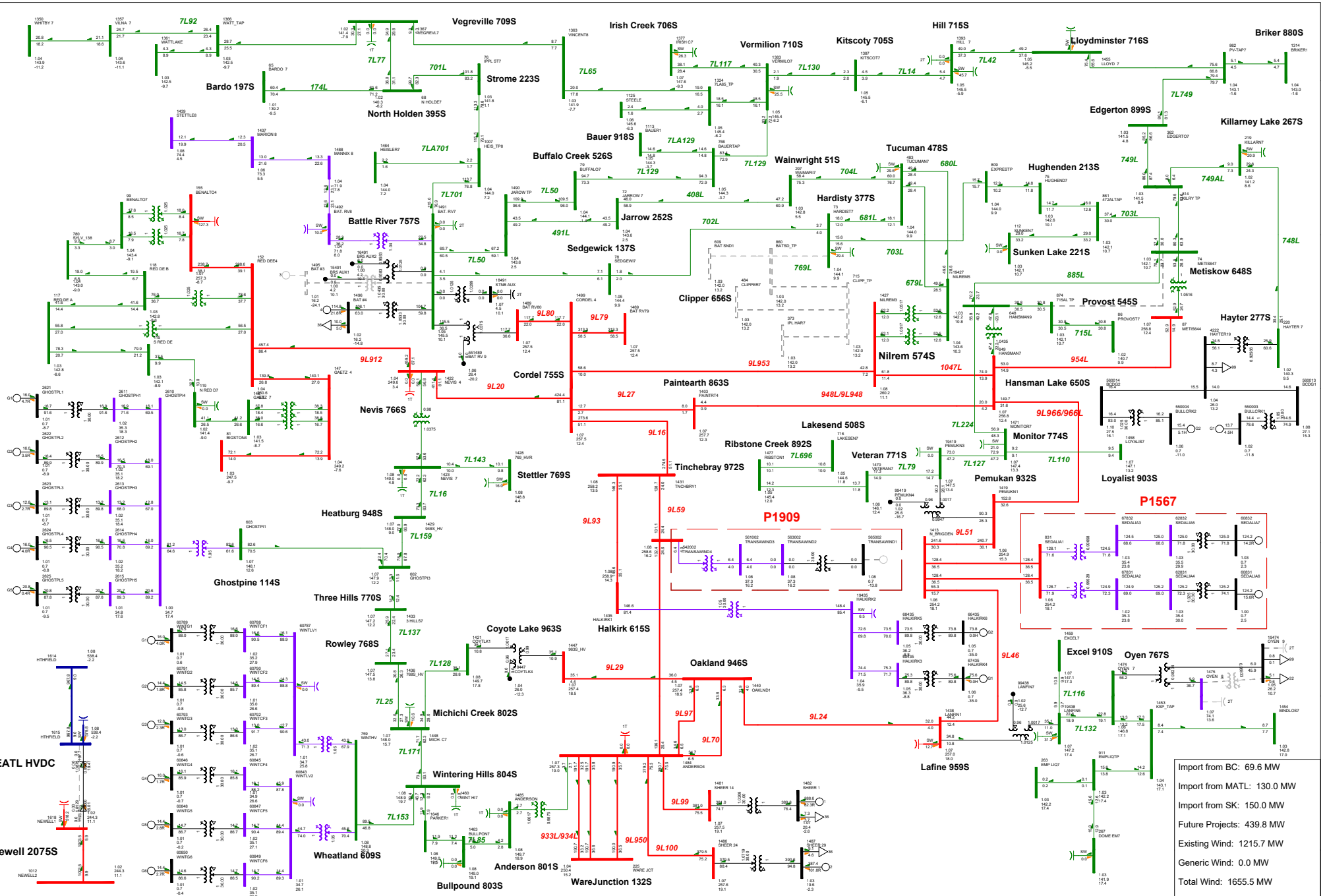


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-1: P1909_SP_POST_SEN_2021_PM
CATEGORY B - 7L14 (KITSCOTY 705S - HILL 751S)
FRI, MAR 19 2021 13:58

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

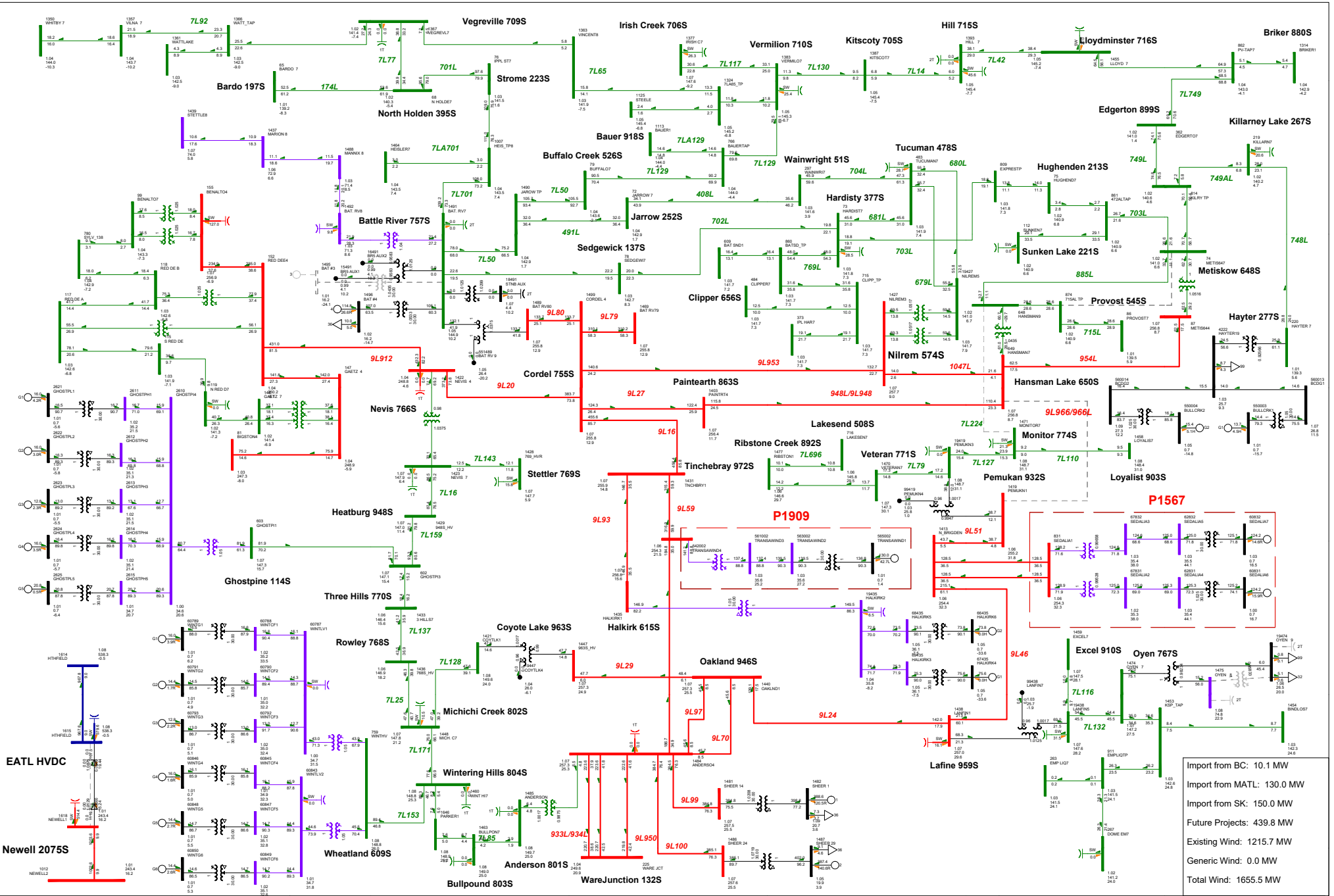


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-2: P1909_SP_POST_SEN_2021_PM
CATEGORY B - 769L/769AL (Hardisty 377S to Clipper 656S/Rosyth 296S)
FRI, MAR 19 2021 13:59

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

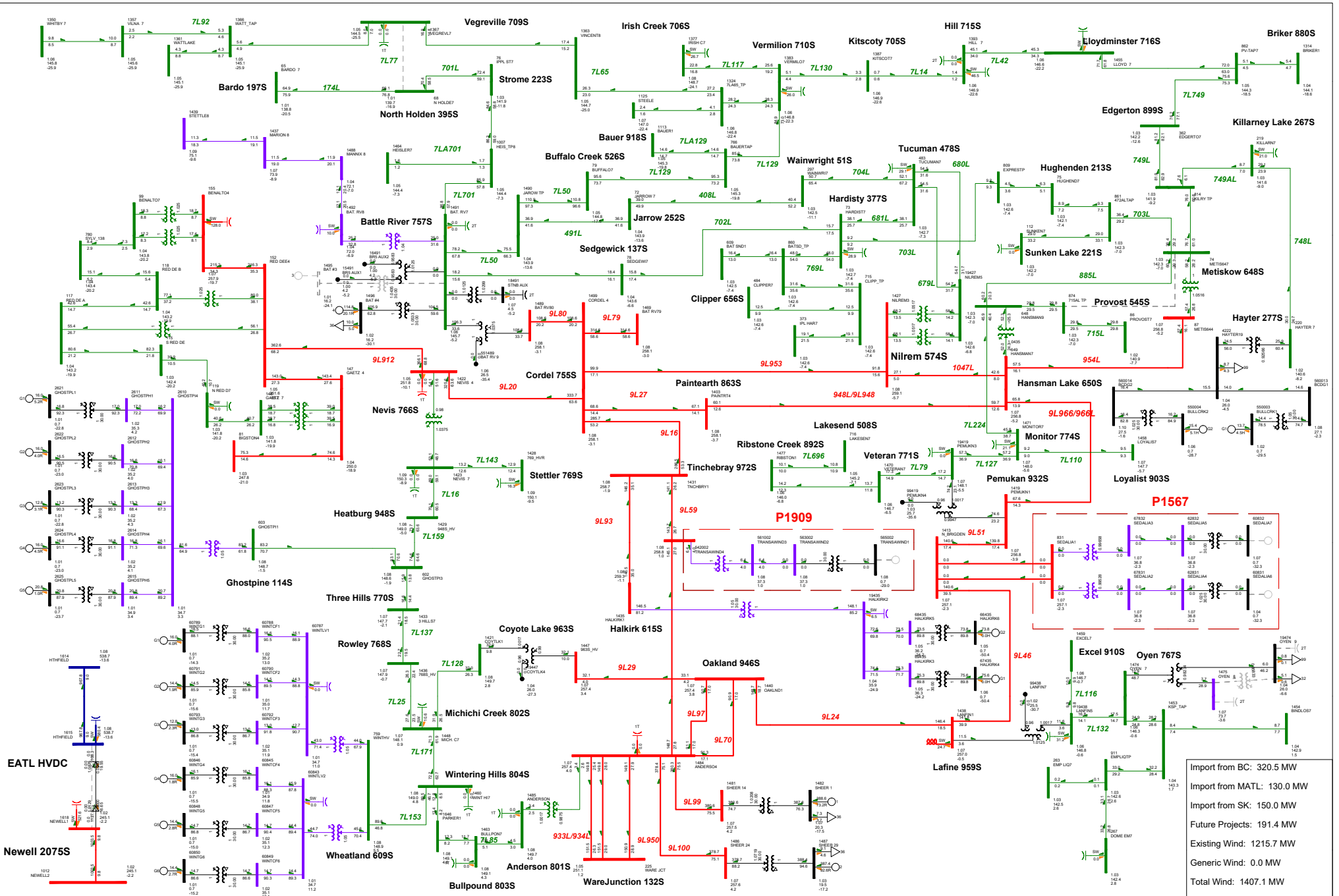


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-3: P1909_SP_POST_SEN_2021_PM
CATEGORY B - 966L/9L966 (HANSMAN LAKE 650S - PEMUKAN 932S)
FRI, MAR 19 2021 14:00

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

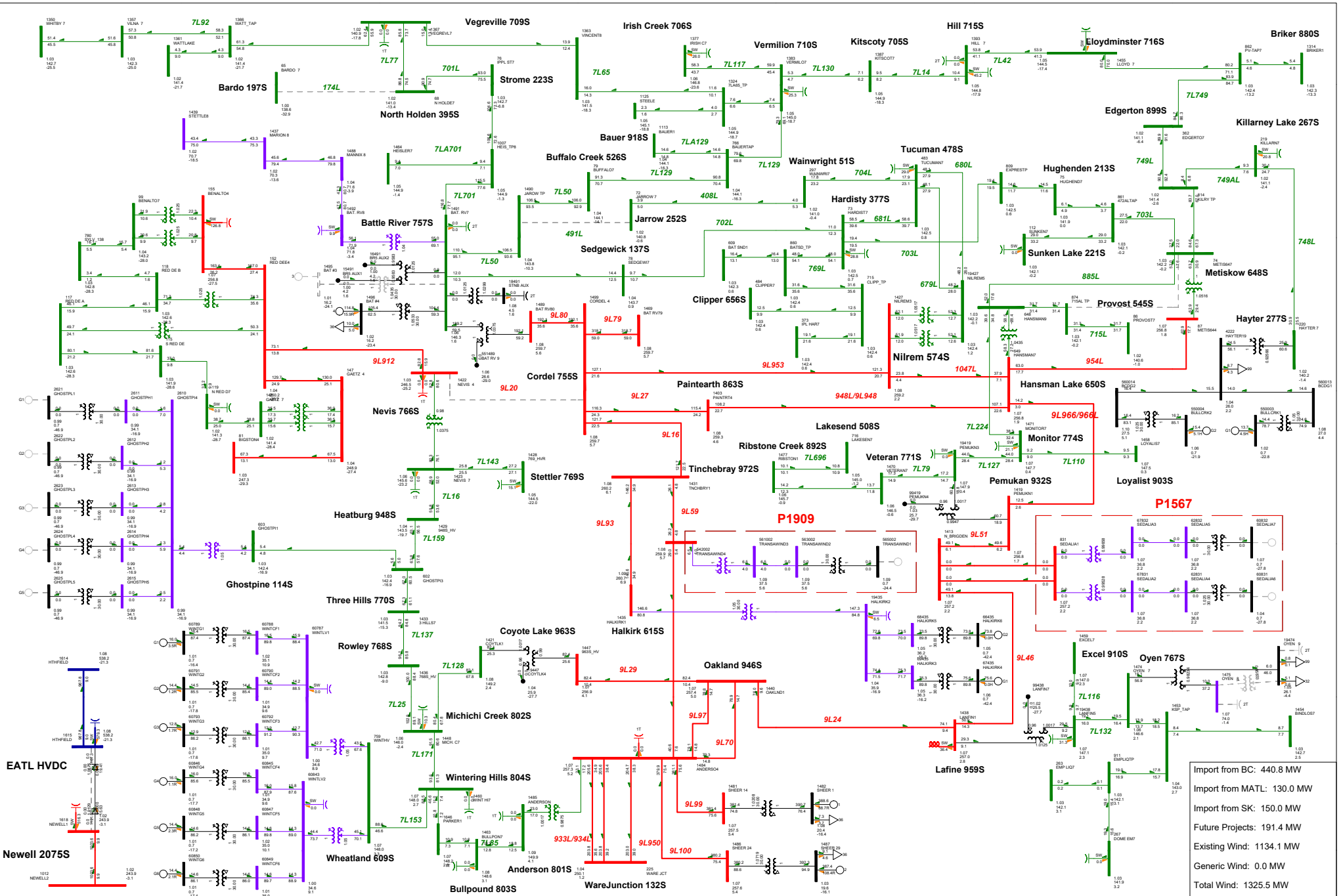


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-4: P1909_SP_POST_SEN_2021_PM
CATEGORY B - 7L77 (NORTH HOLDEN 395S - VEGREVILLE 709S)
FRI, MAR 19 2021 14:01

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

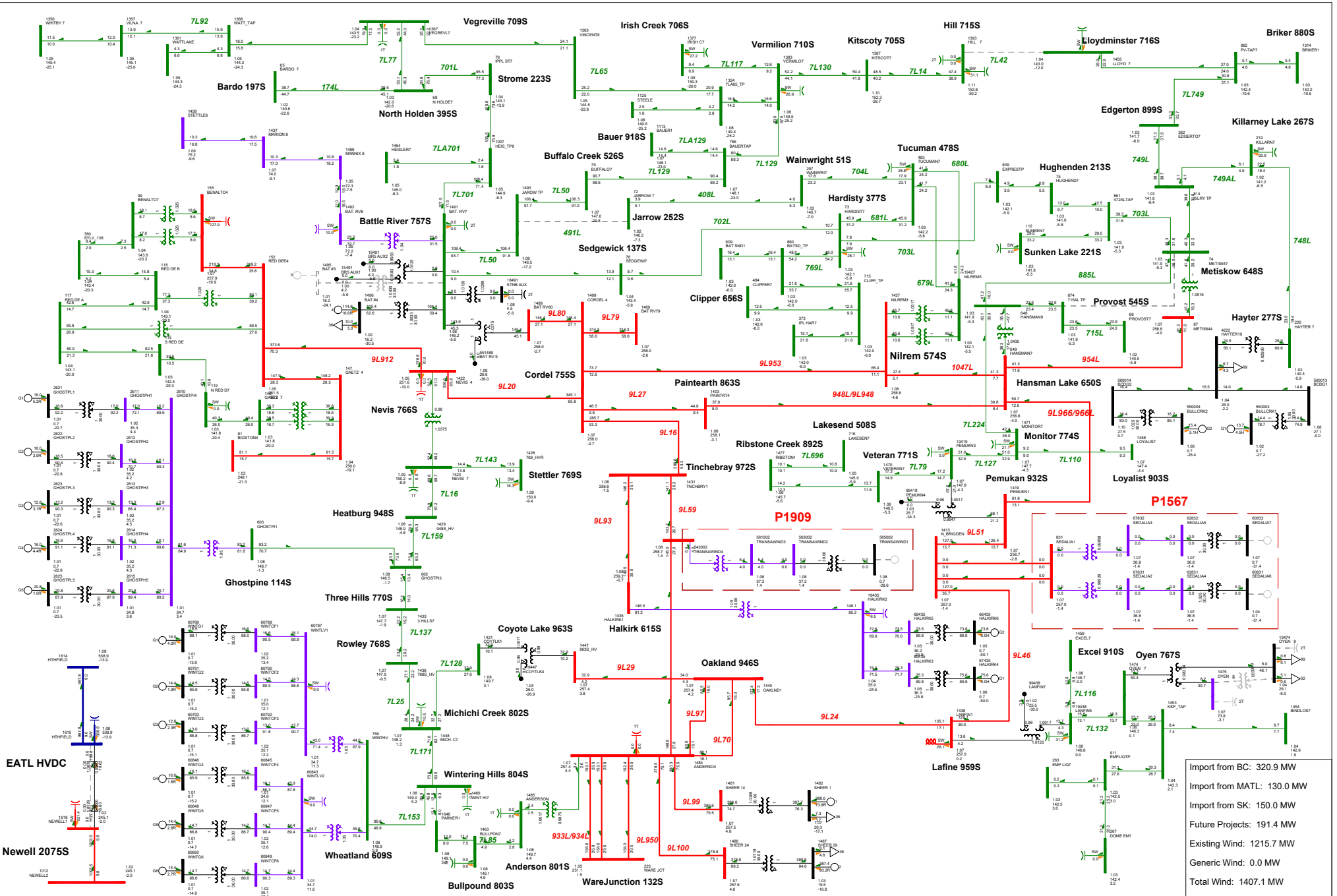


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-5: P1909_SP_POST_SEN_2021_PM
CATEGORY B - 9L20 (NEVIS 766S - CORDEL 755S)
FRI, MAR 19 2021 14:02

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.200OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

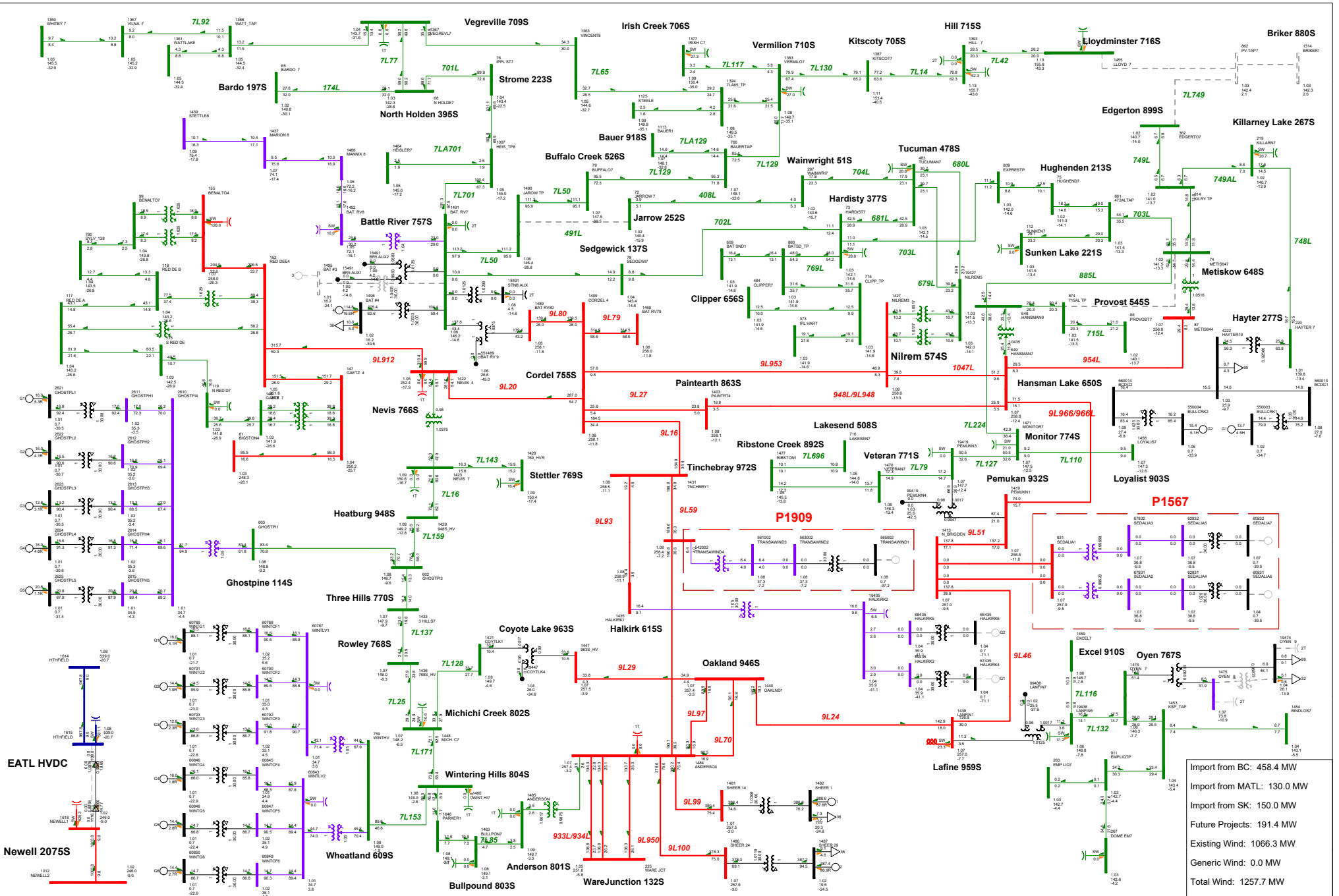


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-6: P1909_SP_POST_SEN_2021_PM
CATEGORY B - 7L42 (HILL 751S - LLOYDMINSTER 716S)
FRI, MAR 19 2021 14:02

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

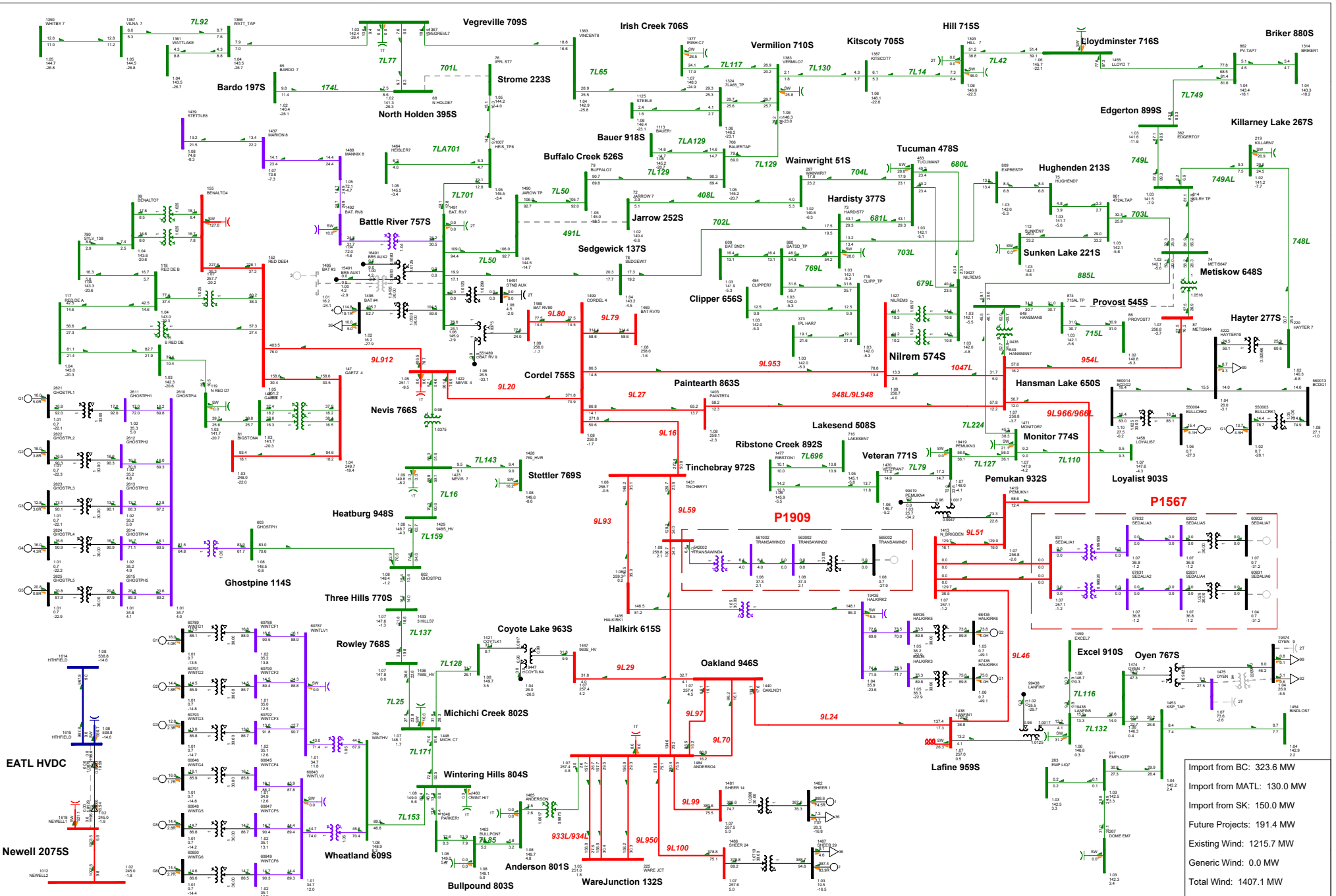


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-7: P1909_SP_POST_SEN_2021_PM
CATEGORY B - 7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)
FRI, MAR 19 2021 14:07

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

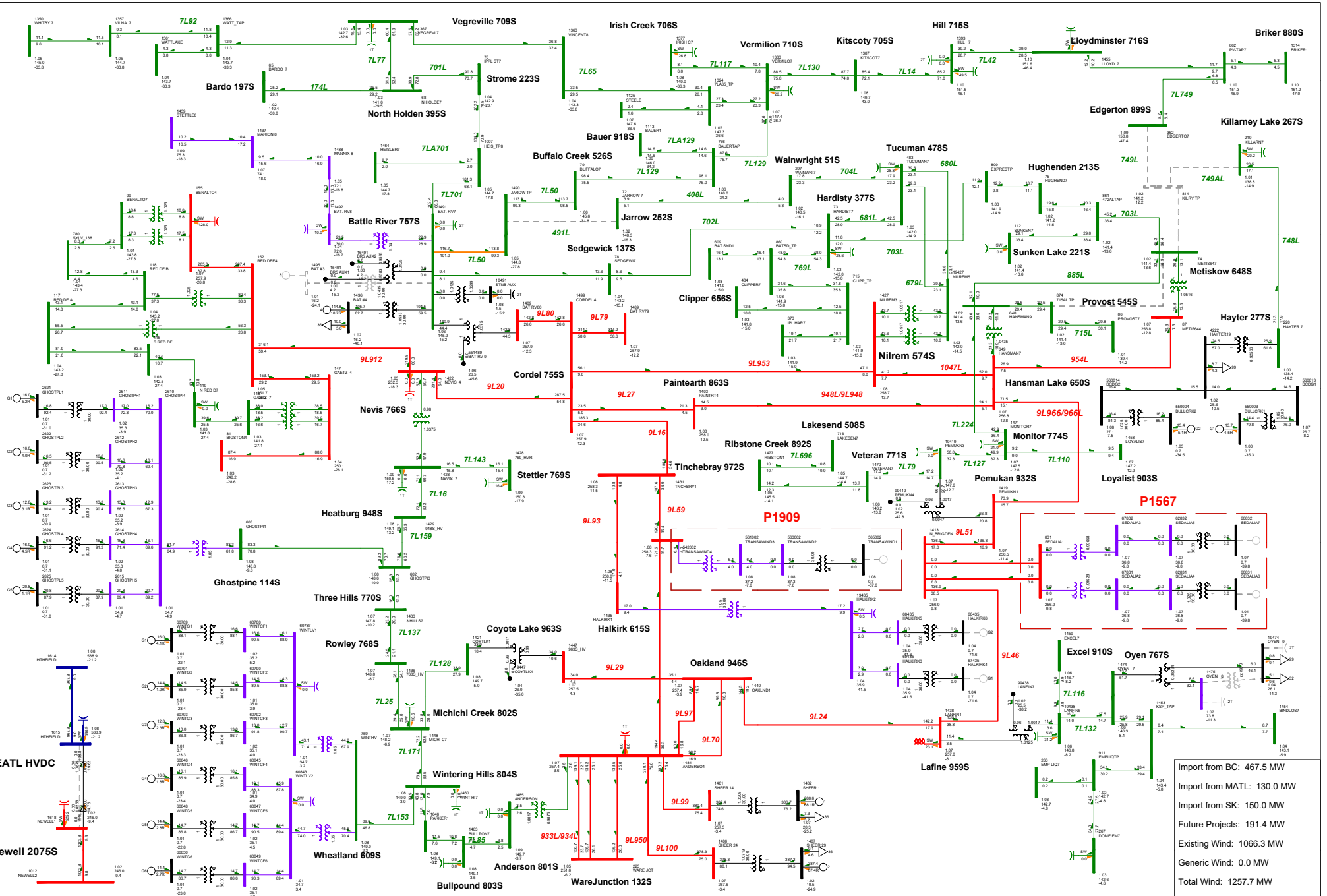


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-8: P1909_SP_POST_SEN_2021_PM
CATEGORY B - 701L (NORTH HOLDEN 395S- STROME 223S)
FRI, MAR 19 2021 14:04

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

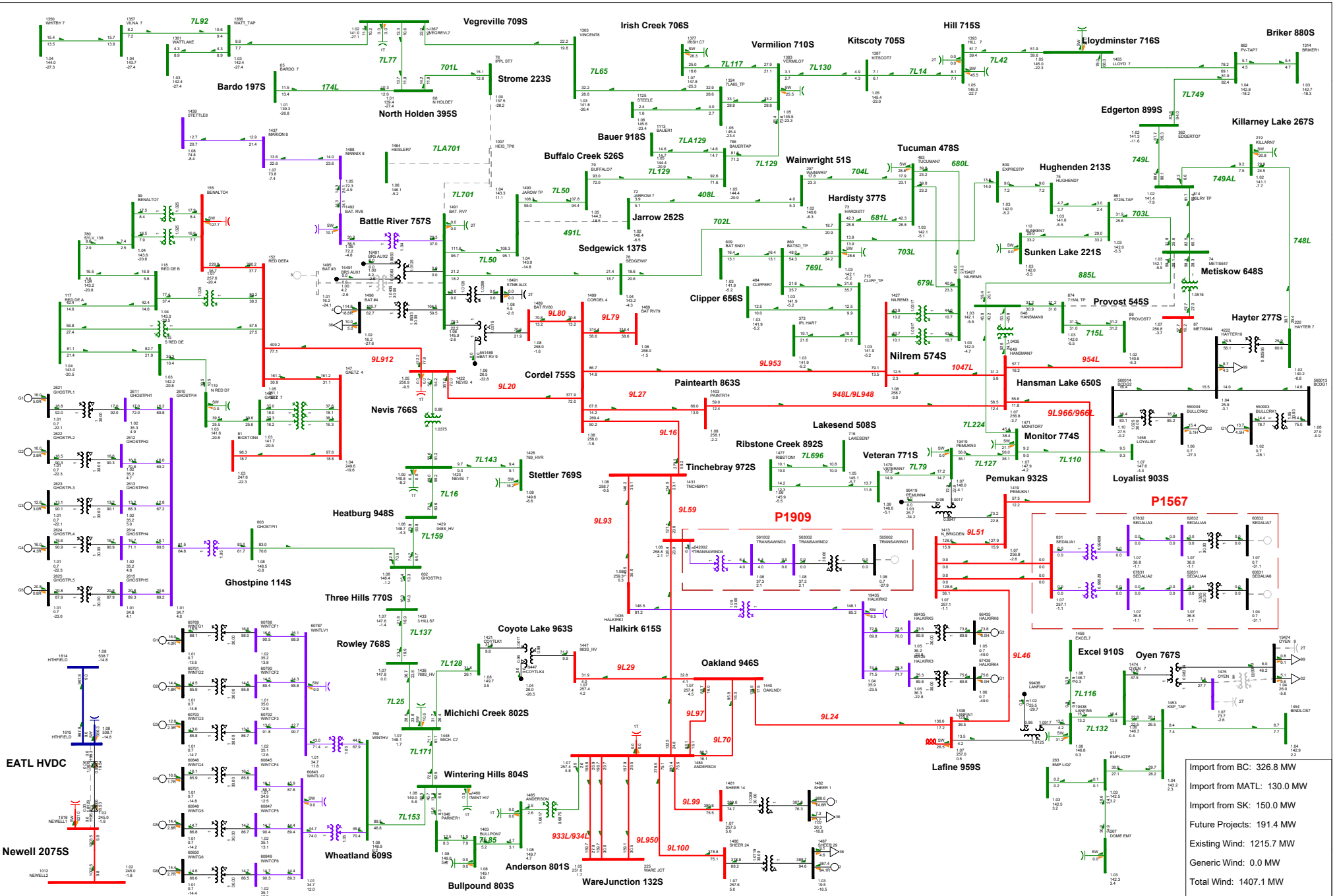


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-9: P1909_SP_POST_SEN_2021_PM
CATEGORY B - 749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)
FRI, MAR 19 2021 14:08

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

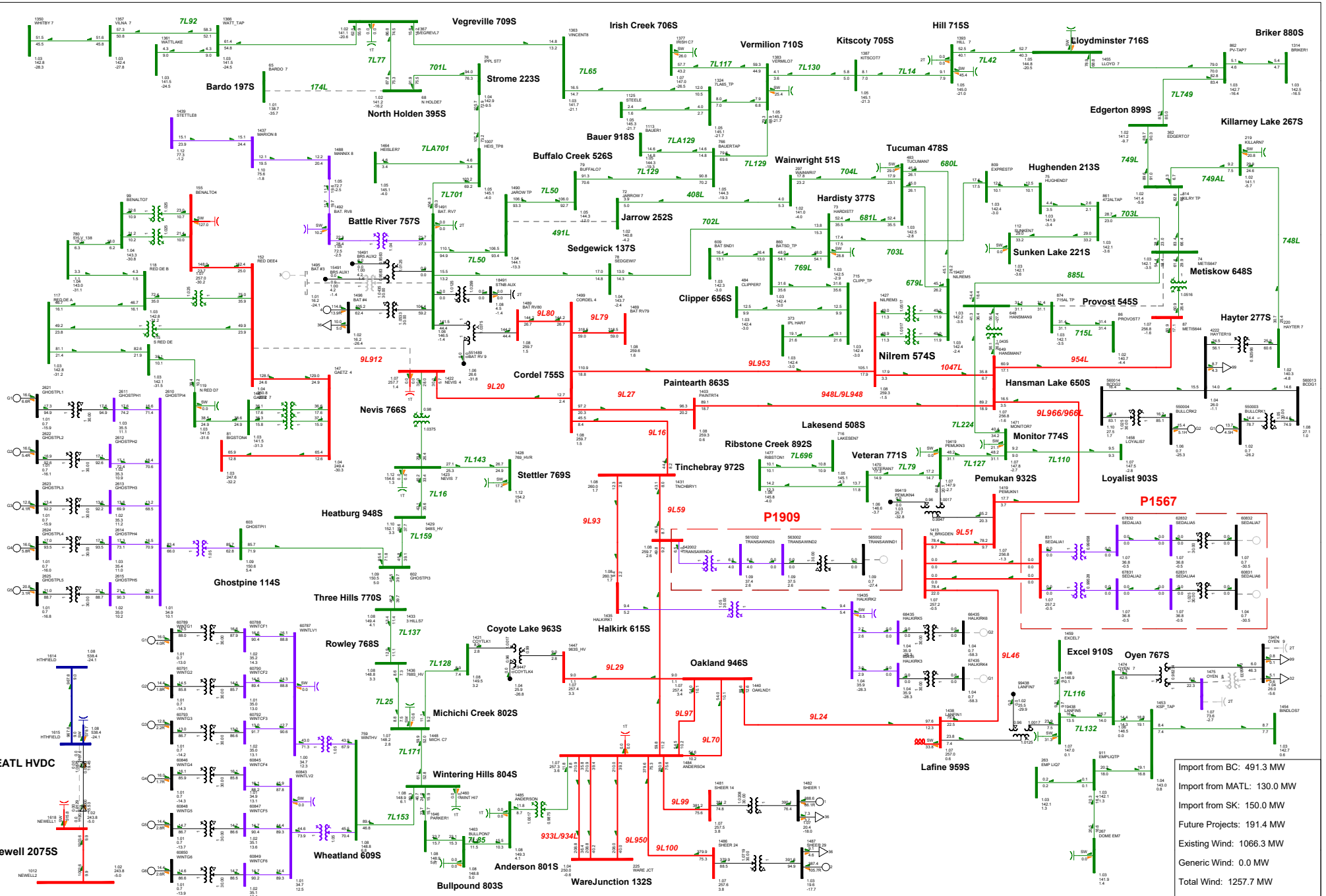


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-10: P1909_SP_POST_SEN_2021_PM
CATEGORY B - 7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)
FRI, MAR 19 2021 14:05

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

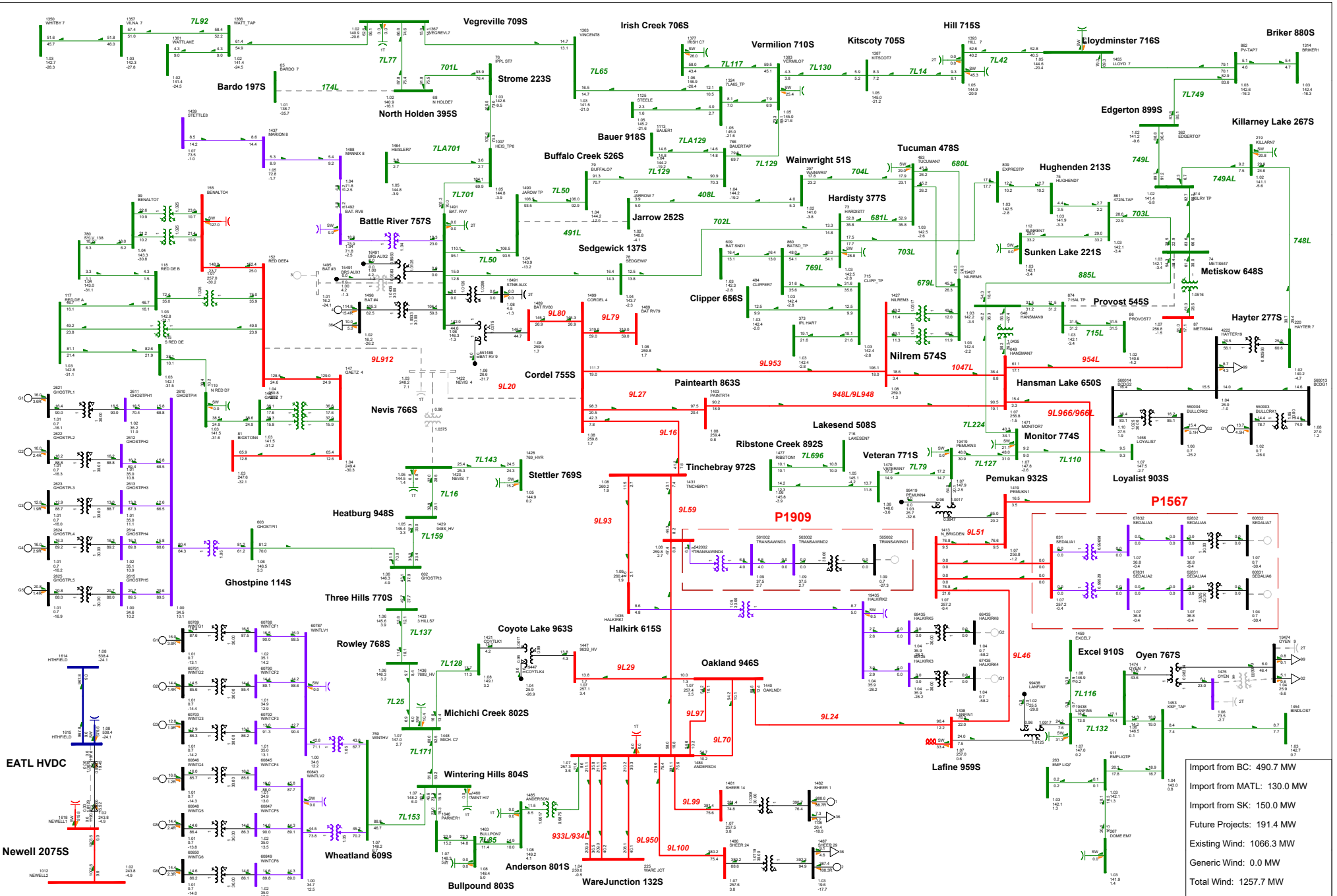


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-11: P1909_SP_POST_SEN_2021_PM
CATEGORY B - 912L/9L912 (RED DEER 63S - NEVIS 766S)
FRI, MAR 19 2021 14:09

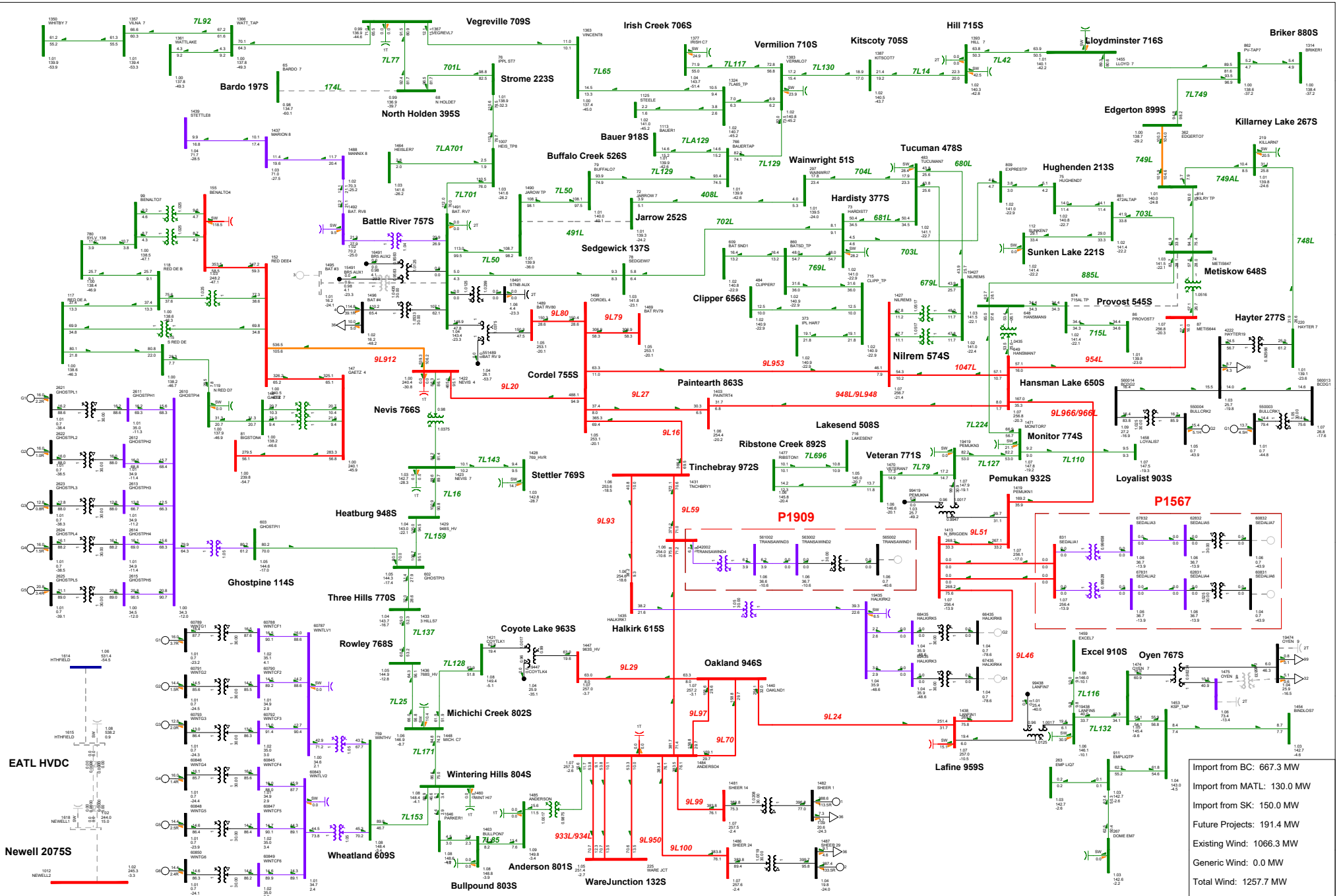
Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

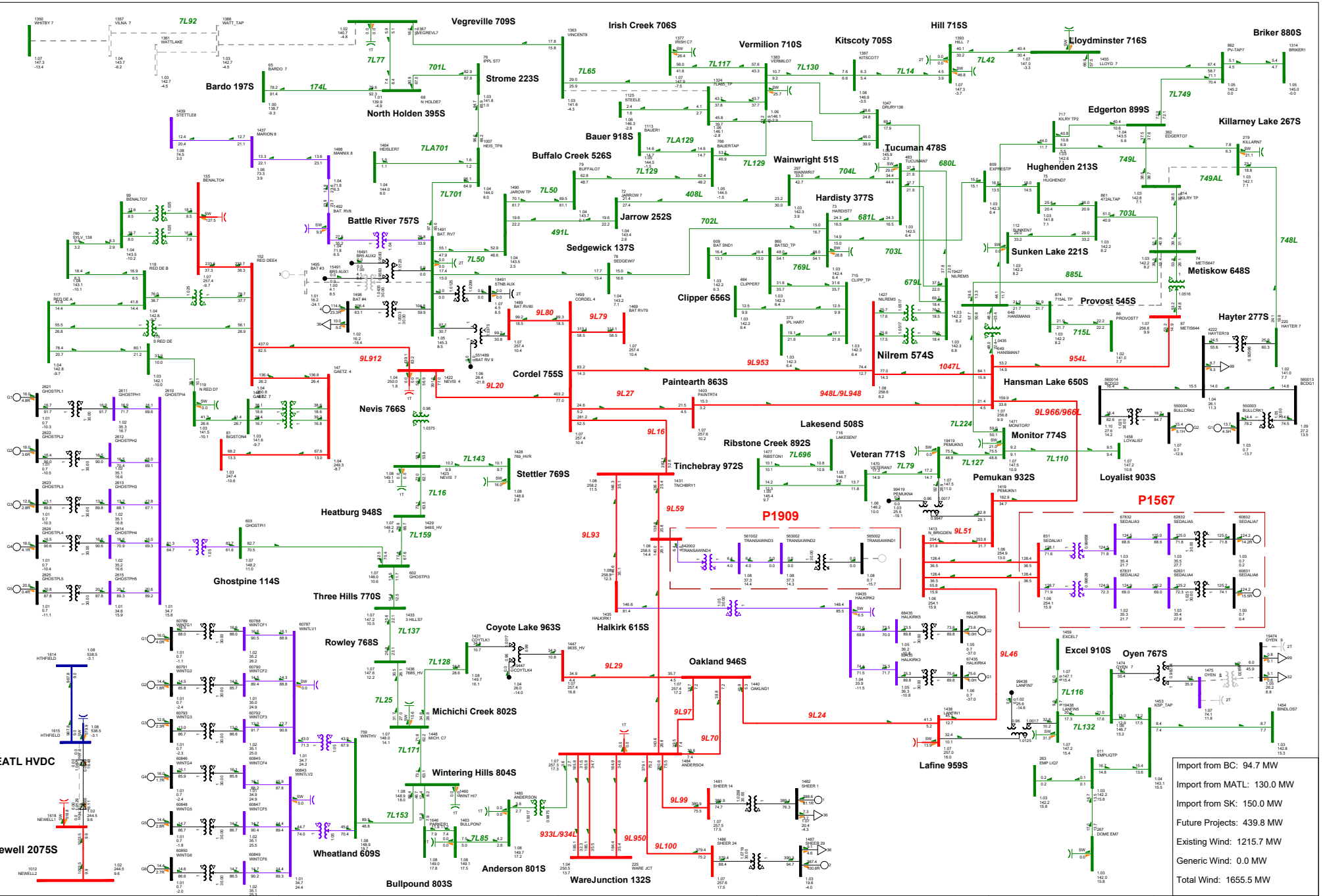
FIGURE B-11-12: P1909_SP_POST_SEN_2021_PM
CATEGORY B - 766S901T (NEVIS 766S 240/138 KV TRANSFORMER)
FRI, MAR 19 2021 14:10



TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-11-13: P1909_SP_POST_SEN_2021_PM
CATEGORY B - EATL HVDC
FRI, MAR 19 2021 14:12

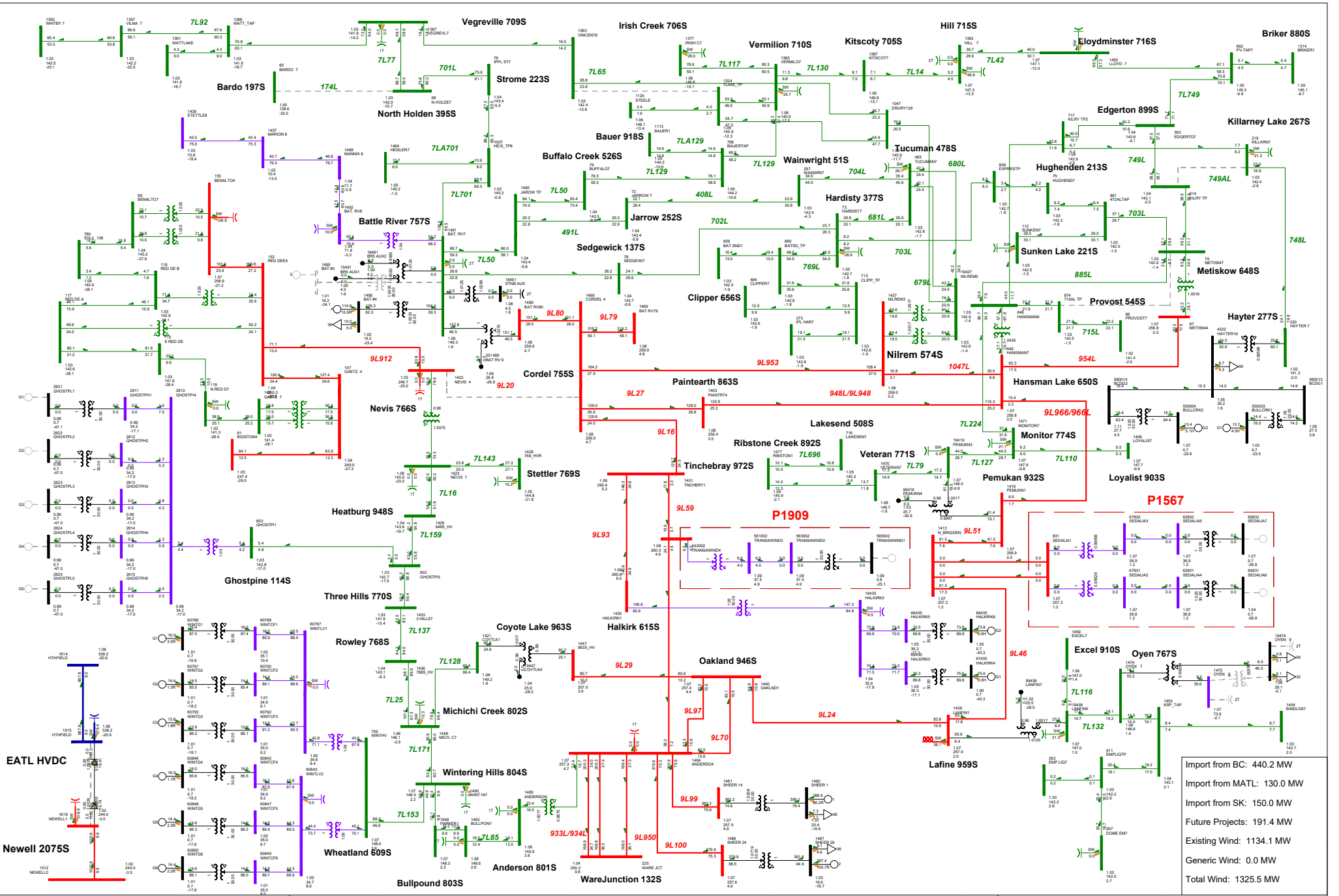


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-12-1: P1909_SP_POST_PENV_2021_PM
CATEGORY B - 7L92 (Vegreville 709S to Vilna 777S/Watt Lake 956S/A819S WHITBY LAKE)
FRI, MAR 19 2021 14:13

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

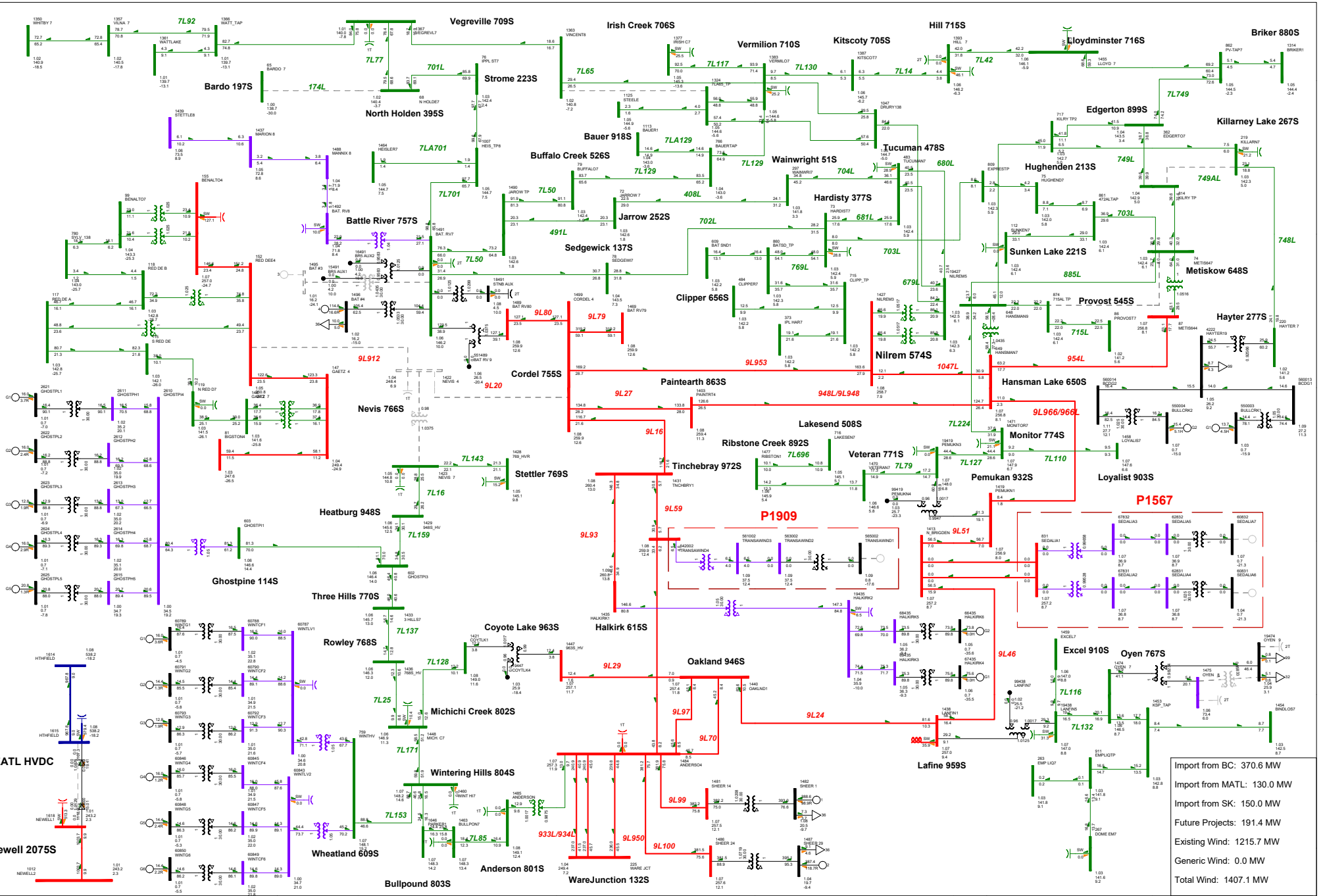


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-12-2: P1909_SP_POST_PENV_2021_PM
CATEGORY B - 9L20 (NEVIS 766S - CORDEL 755S)
FRI, MAR 19 2021 14:13

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.200OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

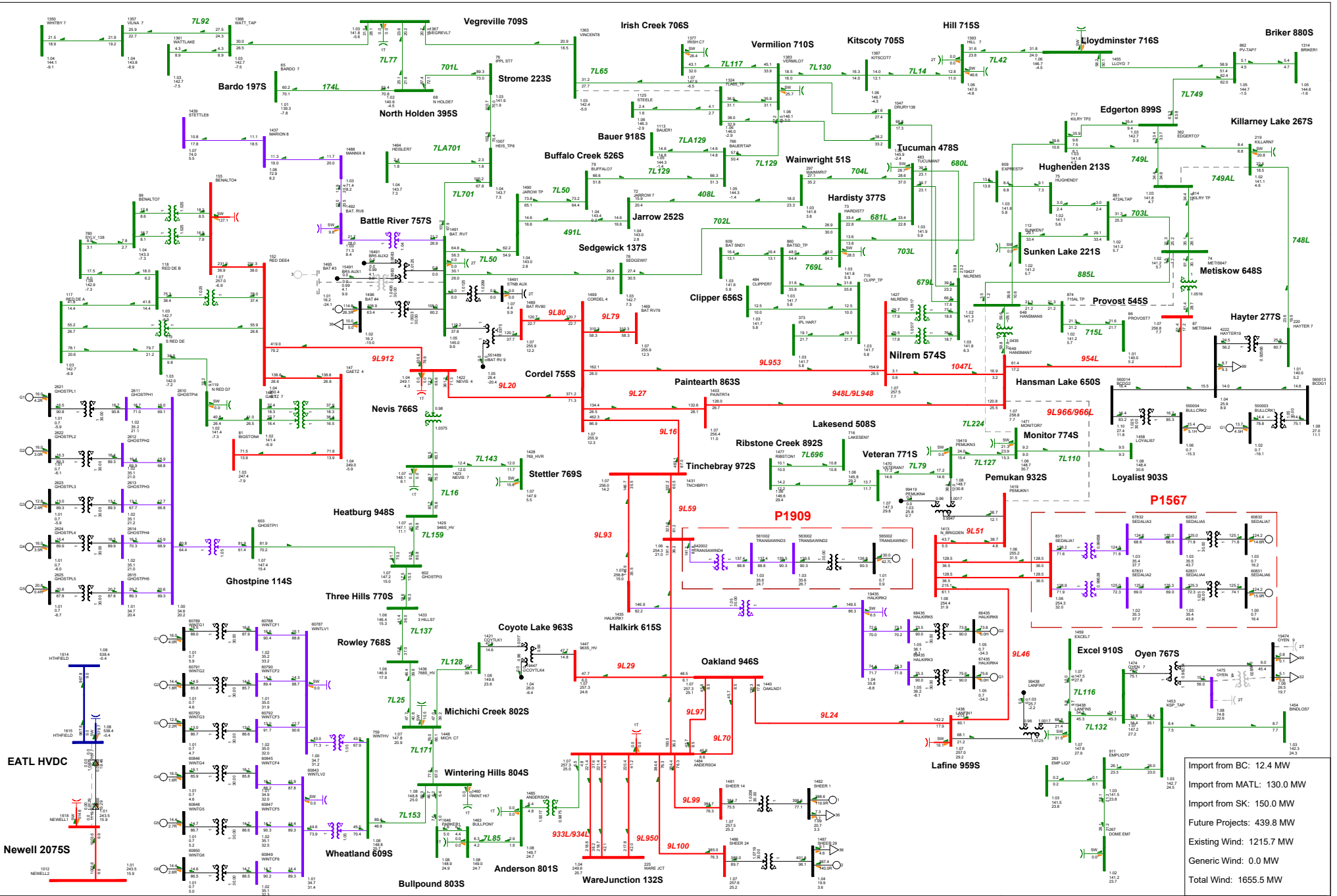


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-12-3: P1909_SP_POST_PENV_2021_PM
CATEGORY B - 766S901T (NEVIS 766S 240/138 KV TRANSFORMER)
FRI, MAR 19 2021 14:15

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

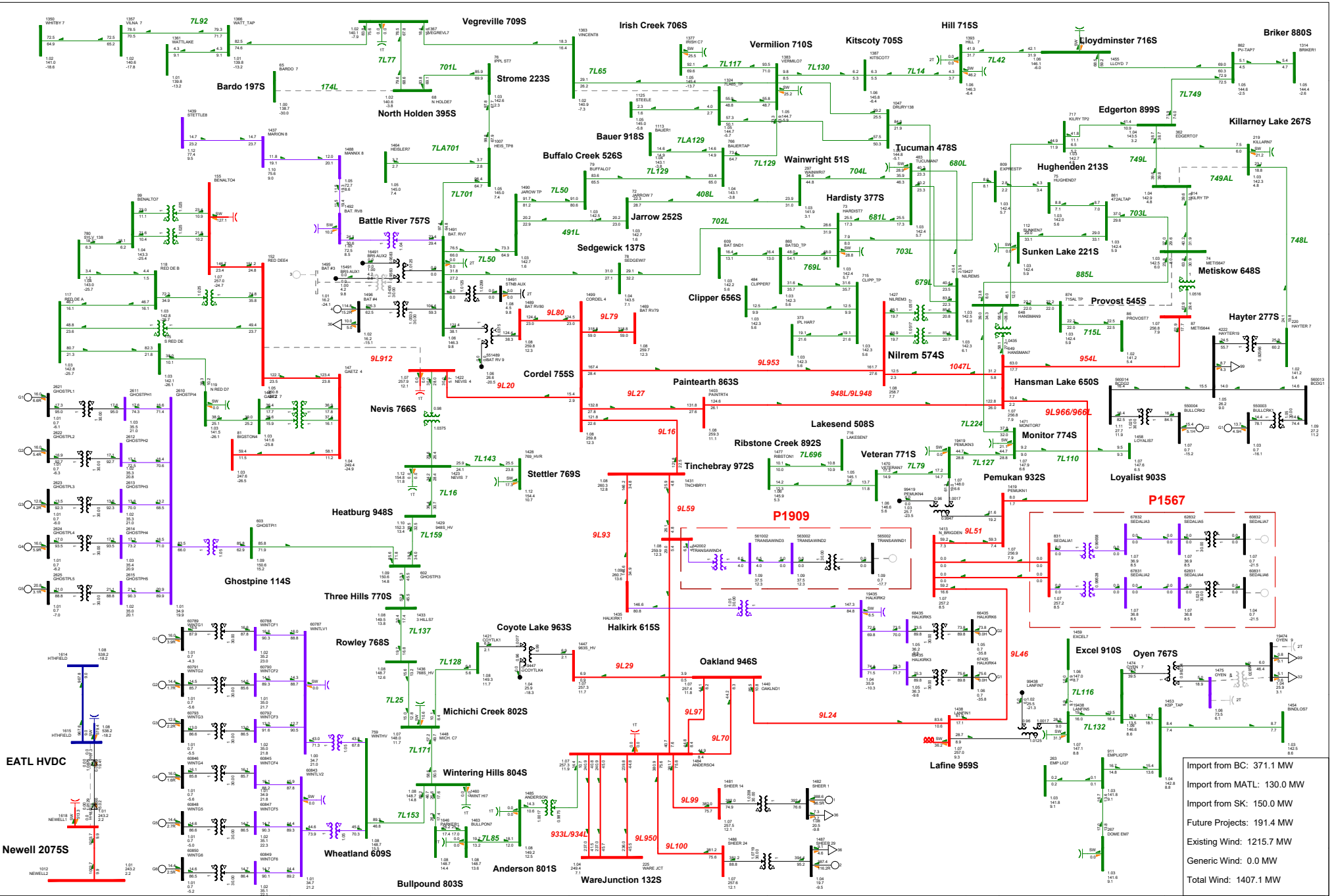


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-12-4: P1909_SP_POST_PENV_2021_PM
CATEGORY B - 966L/9L966 (HANSMAN LAKE 650S - PEMUKAN 932S)
FRI, MAR 19 2021 14:16

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

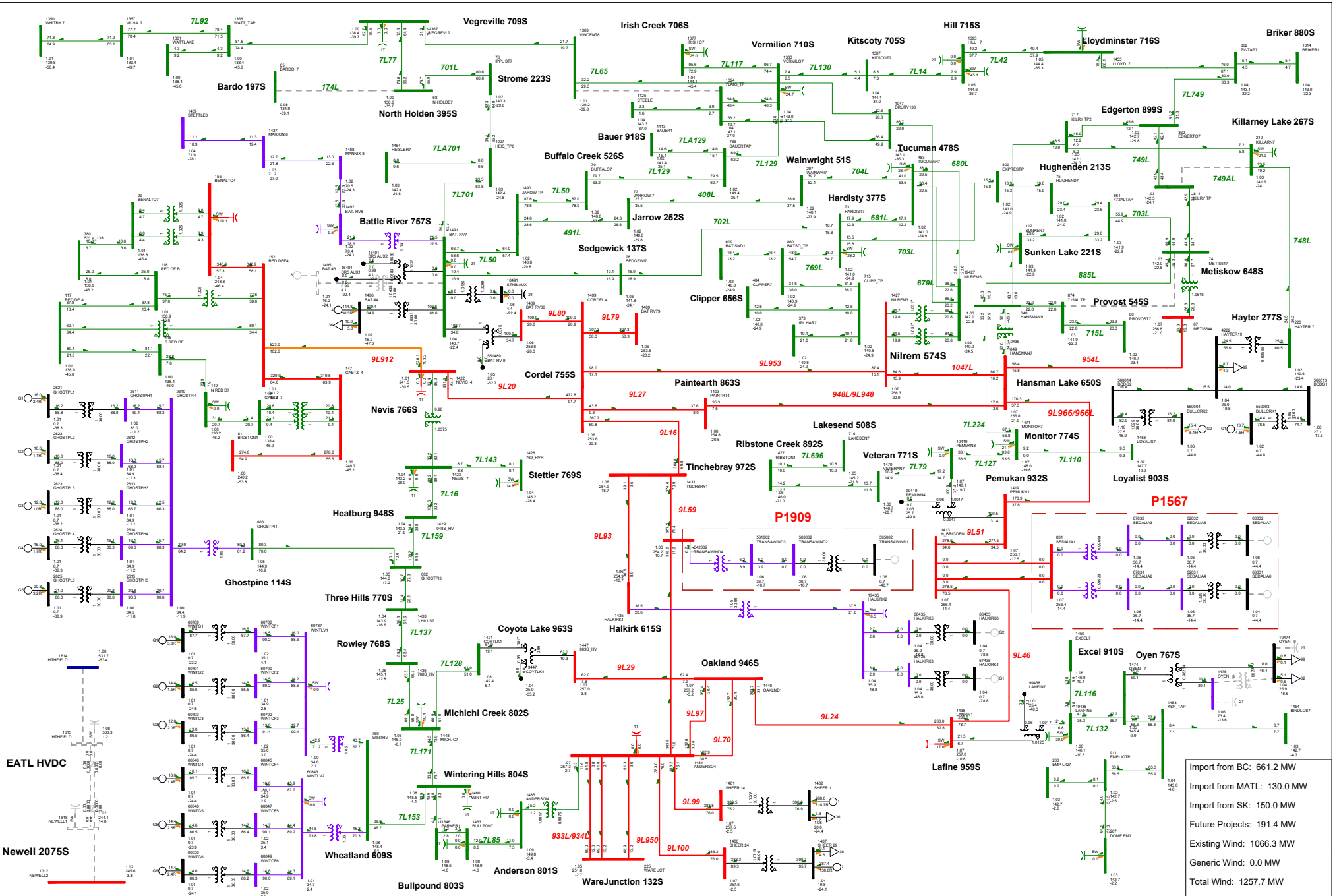


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-12-5: P1909_SP_POST_PENV_2021_PM
CATEGORY B - 912L/9L912 (RED DEER 63S - NEVIS 766S)
FRI, MAR 19 2021 14:17

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

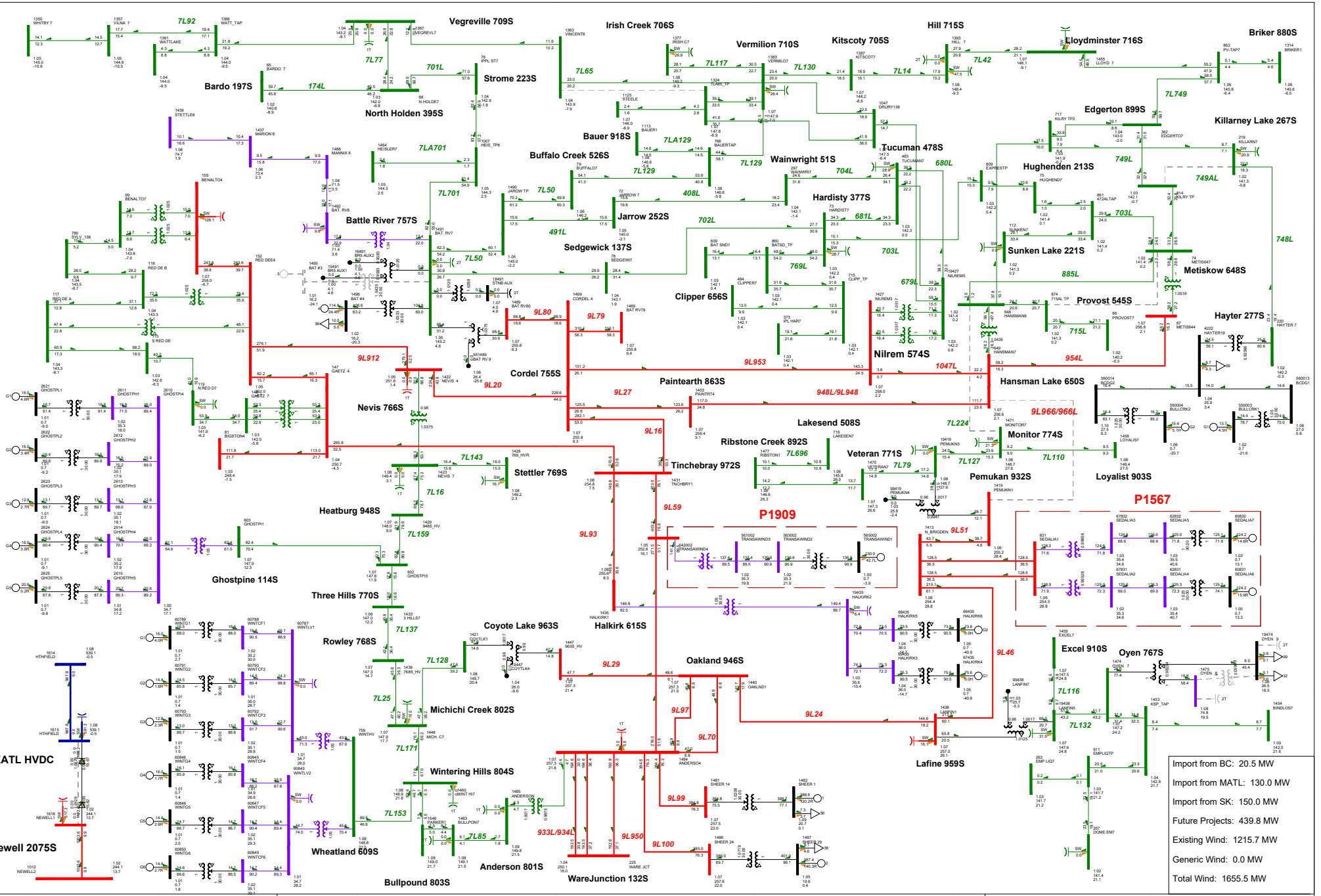


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-12-6: P1909_SP_POST_PENV_2021_PM
CATEGORY B - EATL HVDC
FRI, MAR 19 2021 14:18

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

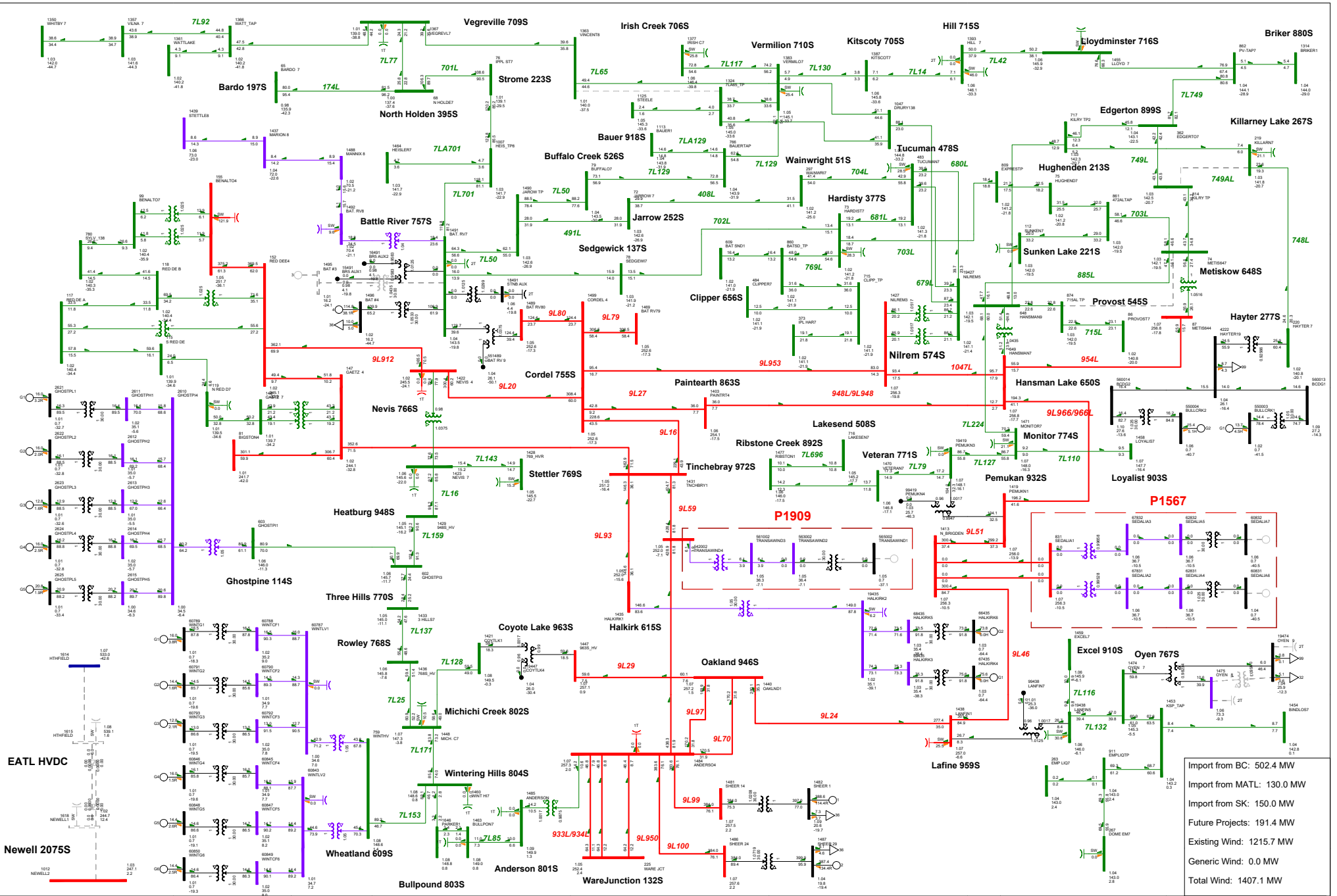


TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-13-1: P1909_SP_POST_PENV_CETO_2021_PM
CATEGORY B - 966L/9L966 (HANSMAN LAKE 650S - PEMUKAN 932S)
FRI, MAR 19 2021 14:19

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



TransAlta Garden Plain Wind Farm

AESO Project Number: 1909

FIGURE B-13-2: P1909_SP_POST_PENV_CETO_2021_PM
CATEGORY B - EATL HVDC
FRI, MAR 19 2021 14:20

Bus - Voltage (kV/pu)/Angle
Branch - MVA/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.2000V/ 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

Attachment A7
Constraint Effective Factors Table

Table A7-1: Constraint Effectiveness Factor (S5, S6, S11, S12 and S13)

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation(Violation Observed On)	Generating Facility Name and Unit Number									
			P1909	P1567 (G1)	Halkirk (HAL) (G2)	Ghost Pine (G1)	Battle River #4	Battle River #5	Sheerness #1	Sheerness #2	Suncor Wintering Hills (G1)	Fortis Bull Creek Phase 1
Scenario #5 -2020 Summer Peak Post-Project	9L20 (Nevis 766S - Cordel 755S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	4%	4%	4%	58%	3%	4%	5%	5%	14%	3%
		901T (Nevis 766S 240/138 kV Transformer)	8%	7%	10%	2%	16%	11%	5%	5%	5%	8%
		7L16 (Nevis 766S - Heatburg 948S)	5%	5%	7%	2%	9%	7%	4%	4%	3%	2%
		7L159 (Ghost Pine 114S - Heatburg 948S)	9%	8%	11%	9%	17%	12%	6%	6%	6%	9%
		701L (North Holden 395S- Strome 223S)	9%	8%	11%	9%	16%	12%	6%	6%	7%	9%
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	8%	8%	10%	9%	14%	11%	6%	6%	6%	11%
	912L/9L912 (Red Deer 63S - Nevis 766S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	9%	8%	11%	9%	16%	12%	6%	6%	7%	9%
		701L (North Holden 395S- Strome 223S)	6%	5%	7%	6%	10%	8%	4%	4%	4%	3%
		174L (Bardo 197S - North Holden 395S)	16%	42%	16%	-2%	-24%	-26%	18%	18%	13%	-34%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	4%	4%	5%	3%	7%	5%	3%	3%	3%	6%
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	0%	23%	-6%	-1%	-8%	-8%	6%	6%	4%	-20%
	9L16 (Cordel 755S - Tincherbray 972S)	9L51 (Pemukan 932S - New Brigden 2088S)	4%	4%	5%	3%	9%	6%	3%	3%	3%	1%
	7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	2%	3%	2%	1%	2%	3%	2%	2%	2%	13%
	966L/9L966 (Hansman Lake 650S - Pemukan 932S)	7L224 (Monitor 774S - Hansman Lake 650S)	4%	4%	5%	3%	7%	5%	3%	3%	3%	0%
	701L (North Holden 395S- Strome 223S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	4%	4%	5%	3%	9%	6%	3%	3%	3%	1%
	7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	4%	4%	6%	3%	13%	7%	3%	3%	3%	4%

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation(Violation Observed On)	Generating Facility Name and Unit Number									
			P1909	P1567 (G1)	Halkirk (HAL) (G2)	Ghost Pine (G1)	Battle River #4	Battle River #5	Sheerness #1	Sheerness #2	Suncor Wintering Hills (G1)	Fortis Bull Creek Phase 1
	749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	30%	29%	40%	46%	40%	44%	23%	23%	25%	35%
	7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	1%	3%	2%	1%	-3%	2%	1%	1%	1%	2%
	EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	1%	1%	-1%	60%	-1%	-1%	3%	3%	12%	0%
		912L/9L912 (Red Deer 63S - Nevis 766S)	4%	4%	6%	3%	12%	6%	3%	3%	3%	4%
		704L (Wainwright 51S - Tucuman 478S)	4%	4%	5%	3%	9%	6%	3%	3%	3%	6%
		7L159 (Ghost Pine 114S - Heatburg 948S)	4%	4%	6%	3%	12%	6%	3%	3%	3%	4%
		701L (North Holden 395S- Strome 223S)	3%	3%	4%	2%	7%	4%	2%	2%	2%	0%
		174L (Bardo 197S - North Holden 395S)	9%	8%	12%	4%	18%	13%	6%	6%	5%	9%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	9%	8%	11%	8%	16%	12%	6%	6%	6%	9%
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	8%	8%	10%	7%	14%	11%	6%	6%	6%	11%
	766S901T (Nevis 766S 240/138 kV Transformer)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	9%	8%	11%	8%	16%	12%	6%	6%	6%	9%
		701L (North Holden 395S- Strome 223S)	6%	5%	7%	5%	10%	8%	4%	4%	4%	3%
		174L (Bardo 197S - North Holden 395S)	0.08	0.08	0.1	0.07	0.14	0.11	0.06	0.06	0.06	0.11
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	0.09	0.08	0.11	0.08	0.16	0.12	0.06	0.06	0.06	0.09
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	0.06	0.05	0.07	0.05	0.1	0.08	0.04	0.04	0.04	0.03
Scenario #6 -2020 Winter Peak Post-Project	9L20 (Nevis 766S - Cordel 755S)	901T (Nevis 766S 240/138 kV Transformer)	8%	8%	8%	56%	10%	8%	8%	8%	16%	8%
		701L (North Holden 395S- Strome 223S)	7%	7%	9%	2%	14%	10%	5%	5%	4%	7%

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation(Violation Observed On)	Generating Facility Name and Unit Number									
			P1909	P1567 (G1)	Halkirk (HAL) (G2)	Ghost Pine (G1)	Battle River #4	Battle River #5	Sheerness #1	Sheerness #2	Suncor Wintering Hills (G1)	Fortis Bull Creek Phase 1
		174L (Bardo 197S - North Holden 395S)	7%	7%	9%	2%	13%	10%	5%	5%	4%	10%
	912L/9L912 (Red Deer 63S - Nevis 766S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	2%	4%	3%	2%	2%	3%	2%	2%	2%	15%
		701L (North Holden 395S- Strome 223S)	8%	7%	10%	8%	15%	11%	6%	6%	6%	8%
		174L (Bardo 197S - North Holden 395S)	8%	8%	10%	8%	14%	11%	6%	6%	6%	11%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	8%	7%	10%	9%	15%	11%	6%	6%	6%	8%
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	5%	5%	7%	6%	9%	8%	4%	4%	4%	3%
	7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	2%	3%	2%	1%	2%	3%	2%	2%	2%	14%
		7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	2%	3%	2%	1%	2%	2%	2%	2%	2%	13%
	7L129 (Vermilion 710S to Bauer 918S/Buffalo Creek 526S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	2%	3%	2%	1%	2%	3%	2%	2%	2%	14%
	EATL HVDC	9L20 (Nevis 766S - Cordel 755S)	25%	24%	36%	-9%	34%	39%	17%	17%	12%	31%
		912L/9L912 (Red Deer 63S - Nevis 766S)	31%	30%	41%	46%	40%	45%	24%	24%	25%	36%
		704L (Wainwright 51S - Tucuman 478S)	2%	3%	2%	1%	-2%	2%	1%	1%	1%	3%
		749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	1%	3%	2%	1%	0%	2%	1%	1%	1%	14%
		701L (North Holden 395S- Strome 223S)	4%	4%	5%	3%	11%	5%	3%	3%	3%	4%
		174L (Bardo 197S - North Holden 395S)	4%	4%	5%	3%	9%	6%	3%	3%	3%	7%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	4%	3%	5%	3%	11%	5%	3%	3%	2%	4%
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	3%	2%	4%	2%	6%	4%	2%	2%	2%	0%
	766S901T (Nevis 766S 240/138 kV Transformer)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	2%	4%	3%	2%	2%	3%	2%	2%	2%	15%

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation(Violation Observed On)	Generating Facility Name and Unit Number									
			P1909	P1567 (G1)	Halkirk (HAL) (G2)	Ghost Pine (G1)	Battle River #4	Battle River #5	Sheerness #1	Sheerness #2	Suncor Wintering Hills (G1)	Fortis Bull Creek Phase 1
		701L (North Holden 395S- Strome 223S)	8%	7%	10%	8%	15%	11%	6%	6%	6%	8%
		174L (Bardo 197S - North Holden 395S)	8%	8%	10%	7%	14%	11%	6%	6%	6%	11%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	8%	7%	10%	8%	15%	11%	6%	6%	6%	8%
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	5%	5%	7%	5%	9%	8%	4%	4%	4%	3%
Scenario #11 -2021 Summer Peak Post-Project Sensitivity	7L14 (Kitscoty 705S - Hill 751S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	4%	4%	5%	3%	7%	5%	3%	3%	3%	6%
	7L42 (Hill 751S - Lloydminster 716S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	3%	4%	4%	2%	6%	5%	3%	3%	2%	5%
	9L20 (Nevis 766S - Cordel 755S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	8%	7%	11%	2%	16%	12%	6%	6%	5%	9%
		901T (Nevis 766S 240/138 kV Transformer)	8%	8%	9%	57%	10%	9%	8%	8%	16%	8%
		7L16 (Nevis 766S - Heatburg 948S)	4%	4%	3%	58%	3%	3%	5%	5%	13%	3%
		749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	2%	4%	3%	1%	1%	3%	2%	2%	2%	10%
		7L159 (Ghost Pine 114S - Heatburg 948S)	4%	4%	3%	58%	3%	3%	5%	5%	13%	3%
		701L (North Holden 395S- Strome 223S)	7%	6%	9%	3%	14%	10%	5%	5%	4%	7%
		174L (Bardo 197S - North Holden 395S)	7%	7%	9%	2%	12%	10%	5%	5%	4%	9%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	7%	7%	9%	3%	14%	10%	5%	5%	4%	7%
		7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	5%	4%	6%	2%	8%	7%	3%	3%	3%	3%
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	5%	4%	6%	2%	9%	7%	4%	4%	3%	3%
		7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	5%	4%	6%	2%	9%	7%	3%	3%	3%	3%
	912L/9L912 (Red Deer 63S - Nevis 766S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation	11%	8%	10%	8%	17%	11%	9%	9%	6%	9%

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation(Violation Observed On)	Generating Facility Name and Unit Number									
			P1909	P1567 (G1)	Halkirk (HAL) (G2)	Ghost Pine (G1)	Battle River #4	Battle River #5	Sheerness #1	Sheerness #2	Suncor Wintering Hills (G1)	Fortis Bull Creek Phase 1
		Tap-point)										
		704L (Wainwright 51S - Tucuman 478S)	4%	4%	3%	3%	0%	3%	4%	4%	2%	5%
		749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	4%	4%	3%	2%	2%	3%	3%	3%	2%	10%
		7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	4%	4%	3%	2%	1%	3%	3%	3%	2%	10%
		701L (North Holden 395S- Strome 223S)	10%	7%	10%	8%	15%	11%	9%	9%	6%	8%
		174L (Bardo 197S - North Holden 395S)	10%	8%	10%	8%	13%	11%	9%	9%	6%	10%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	10%	7%	10%	8%	15%	11%	9%	9%	6%	8%
		7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	7%	4%	6%	5%	9%	7%	6%	6%	4%	3%
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	7%	5%	7%	5%	9%	7%	6%	6%	4%	4%
		7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	7%	5%	6%	5%	9%	7%	6%	6%	4%	4%
	9L16 (Cordel 755S - Tincherbray 972S)	9L51 (Pemukan 932S - New Brigden 2088S)	18%	43%	17%	-2%	-23%	-25%	19%	19%	14%	-34%
	912T (Battle River 757S 240/138 kV Transformer)	704L (Wainwright 51S - Tucuman 478S)	1%	3%	2%	1%	-2%	2%	1%	1%	1%	3%
	9L80 (Battle River 757S - Cordel 755S)	704L (Wainwright 51S - Tucuman 478S)	3%	3%	3%	1%	-12%	4%	2%	2%	2%	3%
	7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)	7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	3%	4%	4%	2%	6%	4%	3%	3%	2%	5%
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	3%	4%	4%	2%	6%	5%	3%	3%	2%	5%
		7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	3%	4%	4%	2%	6%	5%	3%	3%	2%	5%
	966L/9L966 (Hansman Lake 650S - Pemukan 932S)	7L224 (Monitor 774S - Hansman Lake 650S)	0%	24%	-6%	0%	-8%	-7%	6%	6%	5%	-21%
	7L77 (North Holden 395S - Vegreville 709S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	3%	2%	4%	2%	7%	4%	2%	2%	2%	0%

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation(Violation Observed On)	Generating Facility Name and Unit Number									
			P1909	P1567 (G1)	Halkirk (HAL) (G2)	Ghost Pine (G1)	Battle River #4	Battle River #5	Sheerness #1	Sheerness #2	Suncor Wintering Hills (G1)	Fortis Bull Creek Phase 1
	701L (North Holden 395S- Strome 223S)	912L/9L912 (Red Deer 63S - Nevis 766S)	34%	32%	44%	49%	45%	47%	26%	26%	28%	38%
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	4%	3%	5%	3%	9%	5%	3%	3%	3%	2%
	7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	2%	3%	2%	1%	2%	3%	2%	2%	2%	10%
		7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	2%	3%	2%	1%	2%	3%	2%	2%	2%	9%
		701L (North Holden 395S- Strome 223S)	5%	4%	6%	4%	13%	7%	4%	4%	3%	4%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	5%	5%	6%	4%	13%	7%	4%	4%	3%	4%
	769L/769AL (Hardisty 377S to Clipper 656S/Rosyth 296S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	3%	3%	4%	2%	7%	4%	2%	2%	2%	1%
	749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow 648S)	704L (Wainwright 51S - Tucuman 478S)	2%	3%	2%	1%	-2%	2%	2%	2%	1%	5%
		7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	3%	4%	4%	2%	6%	4%	2%	2%	2%	5%
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	3%	4%	4%	2%	6%	4%	2%	2%	2%	5%
		7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	3%	4%	4%	2%	6%	4%	2%	2%	2%	5%
	7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)	912L/9L912 (Red Deer 63S - Nevis 766S)	34%	32%	44%	49%	45%	47%	26%	26%	28%	38%
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	4%	3%	5%	3%	9%	5%	3%	3%	3%	2%
	7L129 (Vermilion 710S to Bauer 918S/Buffalo Creek 526S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	2%	3%	3%	2%	2%	3%	2%	2%	2%	10%
		7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	2%	3%	2%	1%	2%	3%	2%	2%	2%	9%
		701L (North Holden 395S- Strome 223S)	5%	5%	7%	4%	13%	7%	4%	4%	4%	5%
	EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	4%	4%	6%	3%	12%	6%	3%	3%	3%	5%
		9L51 (Pemukan 932S - New Brigden 2088S)	0%	43%	-11%	0%	-14%	-14%	11%	11%	9%	-28%

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation(Violation Observed On)	Generating Facility Name and Unit Number									
			P1909	P1567 (G1)	Halkirk (HAL) (G2)	Ghost Pine (G1)	Battle River #4	Battle River #5	Sheerness #1	Sheerness #2	Suncor Wintering Hills (G1)	Fortis Bull Creek Phase 1
		9L20 (Nevis 766S - Cordel 755S)	26%	25%	36%	-8%	35%	40%	18%	18%	13%	31%
		912L/9L912 (Red Deer 63S - Nevis 766S)	32%	30%	42%	48%	41%	46%	25%	25%	26%	36%
		704L (Wainwright 51S - Tucuman 478S)	2%	3%	2%	1%	-2%	2%	1%	1%	1%	3%
		749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	2%	3%	2%	1%	0%	2%	1%	1%	1%	9%
		7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	1%	3%	2%	1%	0%	2%	1%	1%	1%	9%
		701L (North Holden 395S- Strome 223S)	4%	4%	5%	3%	10%	6%	3%	3%	3%	4%
		174L (Bardo 197S - North Holden 395S)	4%	4%	5%	3%	9%	6%	3%	3%	3%	6%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	4%	4%	5%	3%	11%	6%	3%	3%	3%	4%
		7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	2%	2%	3%	2%	6%	4%	2%	2%	2%	1%
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	3%	2%	3%	2%	6%	4%	2%	2%	2%	1%
		7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	3%	2%	3%	2%	6%	4%	2%	2%	2%	1%
	766S901T (Nevis 766S 240/138 kV Transformer)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	8%	8%	11%	4%	17%	12%	6%	6%	5%	9%
		704L (Wainwright 51S - Tucuman 478S)	3%	4%	3%	2%	0%	4%	2%	2%	2%	5%
		749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	3%	4%	3%	2%	2%	3%	2%	2%	2%	10%
		7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	2%	4%	3%	2%	2%	3%	2%	2%	2%	10%
		701L (North Holden 395S- Strome 223S)	8%	7%	10%	8%	15%	11%	6%	6%	6%	8%
		174L (Bardo 197S - North Holden 395S)	8%	8%	10%	8%	13%	11%	6%	6%	6%	10%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	8%	7%	10%	8%	15%	11%	6%	6%	6%	8%
		7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	5%	4%	6%	4%	9%	7%	4%	4%	4%	3%

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation(Violation Observed On)	Generating Facility Name and Unit Number									
			P1909	P1567 (G1)	Halkirk (HAL) (G2)	Ghost Pine (G1)	Battle River #4	Battle River #5	Sheerness #1	Sheerness #2	Suncor Wintering Hills (G1)	Fortis Bull Creek Phase 1
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	5%	5%	7%	5%	9%	7%	4%	4%	4%	4%
		7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	5%	5%	6%	5%	9%	7%	4%	4%	4%	4%
Scenario #12 -2021 Summer Peak Post-Project PENV Sensitivity	7L92 (Vegreville 709S to Vilna 777S/Watt Lake 956S/A819S WHITBY LAKE)	174L (Bardo 197S - North Holden 395S)	5%	6%	7%	4%	11%	7%	4%	4%	4%	8%
	9L20 (Nevis 766S - Cordel 755S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	8%	7%	10%	1%	16%	11%	5%	5%	4%	8%
		901T (Nevis 766S 240/138 kV Transformer)	8%	8%	8%	56%	10%	9%	8%	8%	16%	8%
		7L16 (Nevis 766S - Heatburg 948S)	4%	4%	3%	58%	2%	3%	5%	5%	13%	3%
		7L159 (Ghost Pine 114S - Heatburg 948S)	4%	4%	3%	58%	3%	3%	5%	5%	13%	3%
		701L (North Holden 395S- Strome 223S)	7%	6%	9%	3%	14%	10%	5%	5%	4%	7%
		174L (Bardo 197S - North Holden 395S)	7%	7%	9%	2%	13%	10%	6%	6%	5%	10%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	7%	6%	9%	3%	14%	10%	5%	5%	4%	7%
	912L/9L912 (Red Deer 63S - Nevis 766S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	8%	7%	10%	7%	16%	11%	6%	6%	6%	8%
		701L (North Holden 395S- Strome 223S)	7%	7%	10%	8%	15%	10%	6%	6%	6%	8%
		174L (Bardo 197S - North Holden 395S)	8%	8%	10%	9%	14%	11%	7%	7%	7%	10%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	7%	7%	10%	8%	15%	10%	6%	6%	6%	8%
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	4%	3%	5%	4%	8%	6%	3%	3%	3%	2%
	9L16 (Cordel 755S - Tincherbray 972S)	9L51 (Pemukan 932S - New Brigden 2088S)	18%	43%	17%	-1%	-23%	-24%	19%	19%	14%	-33%
	966L/9L966 (Hansman Lake 650S - Pemukan 932S)	7L224 (Monitor 774S - Hansman Lake 650S)	0%	24%	-6%	0%	-8%	-7%	6%	6%	5%	-21%

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation(Violation Observed On)	Generating Facility Name and Unit Number									
			P1909	P1567 (G1)	Halkirk (HAL) (G2)	Ghost Pine (G1)	Battle River #4	Battle River #5	Sheerness #1	Sheerness #2	Suncor Wintering Hills (G1)	Fortis Bull Creek Phase 1
	EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	4%	4%	5%	3%	12%	6%	3%	3%	3%	4%
		9L51 (Pemukan 932S - New Brigden 2088S)	1%	44%	-10%	0%	-14%	-13%	11%	11%	9%	-28%
		9L20 (Nevis 766S - Cordel 755S)	26%	25%	36%	-8%	34%	40%	18%	18%	13%	31%
		912L/9L912 (Red Deer 63S - Nevis 766S)	32%	30%	41%	48%	41%	45%	24%	24%	26%	36%
		701L (North Holden 395S- Strome 223S)	4%	3%	5%	3%	11%	6%	3%	3%	3%	4%
		174L (Bardo 197S - North Holden 395S)	4%	5%	6%	3%	9%	6%	3%	3%	3%	6%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	4%	3%	5%	3%	11%	6%	3%	3%	3%	4%
	766S901T (Nevis 766S 240/138 kV Transformer)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	8%	7%	10%	3%	16%	11%	6%	6%	5%	9%
		701L (North Holden 395S- Strome 223S)	7%	7%	10%	8%	15%	10%	6%	6%	6%	8%
		174L (Bardo 197S - North Holden 395S)	8%	8%	10%	8%	14%	11%	7%	7%	6%	11%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	7%	7%	10%	8%	15%	10%	6%	6%	6%	8%
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	4%	3%	5%	4%	8%	6%	3%	3%	3%	2%
Scenario #13 -2021 Summer Peak Post-Project PENV CETO phase 1 Sensitivity	9L59 (Tinchebray 972S - Anderson 801S)	9L51 (Pemukan 932S - New Brigden 2088S)	0%	46%	-17%	1%	-18%	-19%	20%	20%	15%	-30%
	966L/9L966 (Hansman Lake 650S - Pemukan 932S)	7L224 (Monitor 774S - Hansman Lake 650S)	1%	25%	-5%	0%	-7%	-6%	7%	7%	5%	-20%
	EATL HVDC	9L51 (Pemukan 932S - New Brigden 2088S)	2%	45%	-8%	1%	-12%	-11%	12%	12%	10%	-26%
		174L (Bardo 197S - North Holden 395S)	3%	3%	4%	2%	8%	4%	2%	2%	2%	5%

Table A7-2: Constraint Effectiveness Factor (S9 and S10)

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation(Violation Observed On)	Generating Facility Name and Unit Number										
			P1909	P1567 (G1)	Halkirk (HAL) (G2)	Ghost Pine (G1)	Battle River #4	Battle River #5	Sheerness #1	Sheerness #2	Suncor Wintering Hills (G1)	Fortis Bull Creek Phase 1	P1704
Scenario #9 -2020 Summer Peak Post-Project Wind (P1704) Sensitivity	7L42 (Hill 751S - Lloydminster 716S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	4%	4%	5%	3%	7%	5%	3%	3%	3%	6%	5%
	9L20 (Nevis 766S - Cordel 755S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	9%	8%	11%	1%	17%	12%	6%	6%	5%	9%	11%
		901T (Nevis 766S 240/138 kV Transformer)	8%	8%	8%	56%	10%	9%	8%	8%	16%	8%	8%
		7L16 (Nevis 766S - Heatburg 948S)	4%	4%	3%	57%	3%	3%	5%	5%	13%	3%	3%
		7L159 (Ghost Pine 114S - Heatburg 948S)	4%	4%	3%	58%	3%	3%	5%	5%	13%	3%	3%
		701L (North Holden 395S- Strome 223S)	7%	7%	10%	2%	15%	10%	5%	5%	4%	7%	10%
		174L (Bardo 197S - North Holden 395S)	7%	7%	9%	2%	13%	10%	5%	5%	4%	10%	9%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	8%	7%	10%	2%	15%	11%	5%	5%	4%	7%	10%
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	5%	5%	7%	2%	9%	7%	4%	4%	3%	2%	7%
	912L/9L912 (Red Deer 63S - Nevis 766S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	9%	8%	11%	9%	17%	12%	6%	6%	6%	9%	11%
		704L (Wainwright 51S - Tucuman 478S)	3%	4%	3%	2%	-1%	3%	2%	2%	2%	4%	3%
		701L (North Holden 395S- Strome 223S)	8%	8%	10%	9%	16%	11%	6%	6%	6%	8%	11%
		174L (Bardo 197S - North Holden 395S)	8%	8%	10%	8%	14%	11%	6%	6%	6%	11%	10%

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation(Violation Observed On)	Generating Facility Name and Unit Number										
			P1909	P1567 (G1)	Halkirk (HAL) (G2)	Ghost Pine (G1)	Battle River #4	Battle River #5	Sheerness #1	Sheerness #2	Suncor Wintering Hills (G1)	Fortis Bull Creek Phase 1	P1704
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	8%	8%	10%	9%	16%	11%	6%	6%	6%	8%	11%
		7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	5%	5%	6%	5%	9%	7%	4%	4%	4%	2%	6%
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	5%	5%	7%	6%	9%	8%	4%	4%	4%	3%	7%
		7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	5%	5%	7%	6%	9%	7%	4%	4%	4%	2%	7%
	9L16 (Cordel 755S - Tincherbray 972S)	9L51 (Pemukan 932S - New Brigden 2088S)	16%	42%	16%	-2%	-24%	-26%	18%	18%	13%	-34%	15%
		7L159 (Ghost Pine 114S - Heatburg 948S)	4%	1%	4%	60%	-3%	-3%	5%	5%	14%	-1%	4%
	912T (Battle River 757S 240/138 kV Transformer)	704L (Wainwright 51S - Tucuman 478S)	4%	4%	4%	2%	-12%	4%	2%	2%	2%	3%	5%
	9L80 (Battle River 757S - Cordel 755S)	704L (Wainwright 51S - Tucuman 478S)	4%	4%	4%	2%	-12%	4%	2%	2%	2%	3%	5%
	7L749/749L/7LB749 (Edgerton 899S to Lloydminster 716S/Briker 880S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	4%	4%	4%	3%	7%	5%	3%	3%	3%	5%	5%
	7L77 (North Holden 395S - Vegreville 709S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	3%	3%	4%	2%	7%	4%	2%	2%	2%	-1%	4%
	701L (North Holden 395S- Strome 223S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	4%	4%	5%	3%	9%	6%	3%	3%	3%	1%	5%
	7L50 (Battle River 757S to Jarrow 252S/Buffalo Creek 526S)	749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	2%	3%	2%	1%	2%	3%	2%	2%	2%	13%	2%
		7L749 (Edgerton 899S - 7LB749 Paradise Valley (PV) Tap-point)	2%	3%	2%	1%	2%	2%	2%	2%	2%	13%	2%
	749L/749AL (Edgerton 899S to Killarney Lake 267S/Metiskow	704L (Wainwright 51S - Tucuman 478S)	2%	4%	2%	1%	-3%	2%	2%	2%	1%	0%	2%

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation(Violation Observed On)	Generating Facility Name and Unit Number										
			P1909	P1567 (G1)	Halkirk (HAL) (G2)	Ghost Pine (G1)	Battle River #4	Battle River #5	Sheerness #1	Sheerness #2	Suncor Wintering Hills (G1)	Fortis Bull Creek Phase 1	P1704
	648S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	4%	4%	4%	3%	7%	5%	3%	3%	3%	0%	5%
	7L701 (Battle River 757S to Heisler 764S/Strome 223S/North Holden 395S)	7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	4%	4%	5%	3%	9%	6%	3%	3%	3%	1%	5%
	EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	4%	4%	6%	3%	13%	7%	3%	3%	3%	4%	6%
		9L20 (Nevis 766S - Cordel 755S)	27%	25%	37%	-8%	34%	41%	18%	18%	13%	31%	37%
		912L/9L912 (Red Deer 63S - Nevis 766S)	30%	29%	40%	46%	40%	44%	23%	23%	25%	35%	40%
		9L16 (Cordel 755S - Tincherbray 972S)	43%	-1%	67%	-3%	-23%	-27%	19%	19%	13%	-15%	68%
		704L (Wainwright 51S - Tucuman 478S)	1%	3%	2%	1%	-2%	2%	1%	1%	1%	2%	2%
		749L (Edgerton 899S - 749AL Killarney Lake 267S Tap-point)	1%	3%	1%	1%	0%	1%	1%	1%	1%	13%	1%
		7L159 (Ghost Pine 114S - Heatburg 948S)	1%	1%	-1%	59%	-1%	-1%	3%	3%	12%	0%	-1%
		701L (North Holden 395S- Strome 223S)	4%	4%	5%	3%	11%	6%	3%	3%	3%	4%	5%
		174L (Bardo 197S - North Holden 395S)	4%	4%	5%	3%	9%	6%	3%	3%	3%	6%	5%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	4%	4%	5%	3%	11%	6%	3%	3%	3%	4%	5%
		7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	3%	2%	3%	2%	6%	4%	2%	2%	2%	-1%	3%
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	3%	3%	4%	2%	7%	4%	2%	2%	2%	0%	4%

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation(Violation Observed On)	Generating Facility Name and Unit Number										
			P1909	P1567 (G1)	Halkirk (HAL) (G2)	Ghost Pine (G1)	Battle River #4	Battle River #5	Sheerness #1	Sheerness #2	Suncor Wintering Hills (G1)	Fortis Bull Creek Phase 1	P1704
		7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	3%	2%	4%	2%	6%	4%	2%	2%	2%	-1%	3%
	766S901T (Nevis 766S 240/138 kV Transformer)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	9%	8%	12%	4%	17%	13%	7%	7%	6%	9%	12%
		704L (Wainwright 51S - Tucuman 478S)	3%	4%	3%	2%	-1%	4%	2%	2%	2%	4%	3%
		701L (North Holden 395S- Strome 223S)	9%	8%	11%	8%	16%	12%	6%	6%	6%	9%	11%
		174L (Bardo 197S - North Holden 395S)	8%	8%	10%	8%	14%	11%	6%	6%	6%	11%	10%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	9%	8%	11%	8%	16%	12%	6%	6%	6%	9%	11%
		7L129 (Vermilion 710S - 7LA129 Bauer 918S Tap-point)	5%	5%	7%	5%	9%	7%	4%	4%	4%	2%	7%
		7L50 (Buffalo Creek 526S - 491L Jarrow 252S Substation Tap-point)	6%	5%	7%	5%	10%	8%	4%	4%	4%	3%	7%
		7L129 (Buffalo Creek 526S - 7LA129 Bauer 918S Tap-point)	6%	5%	7%	5%	9%	8%	4%	4%	4%	3%	7%
Scenario #10 -2020 Summer Peak Post-Project Wind (P1704) and PENV Sensitivity	9L20 (Nevis 766S - Cordel 755S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	8%	7%	10%	1%	17%	11%	5%	5%	4%	8%	11%
		901T (Nevis 766S 240/138 kV Transformer)	8%	7%	8%	56%	10%	9%	8%	8%	16%	8%	8%
		7L16 (Nevis 766S - Heatburg 948S)	4%	4%	3%	57%	2%	3%	5%	5%	13%	3%	3%
		7L159 (Ghost Pine 114S - Heatburg 948S)	4%	4%	3%	58%	3%	3%	5%	5%	13%	3%	3%
		701L (North Holden 395S- Strome 223S)	7%	6%	9%	2%	15%	10%	5%	5%	4%	7%	9%

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation(Violation Observed On)	Generating Facility Name and Unit Number										
			P1909	P1567 (G1)	Halkirk (HAL) (G2)	Ghost Pine (G1)	Battle River #4	Battle River #5	Sheerness #1	Sheerness #2	Suncor Wintering Hills (G1)	Fortis Bull Creek Phase 1	P1704
		174L (Bardo 197S - North Holden 395S)	7%	8%	10%	2%	13%	11%	5%	5%	5%	10%	10%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	7%	6%	9%	2%	15%	10%	5%	5%	4%	7%	9%
	912L/9L912 (Red Deer 63S - Nevis 766S)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	8%	7%	10%	8%	17%	11%	6%	6%	6%	8%	11%
		701L (North Holden 395S- Strome 223S)	8%	7%	10%	8%	15%	11%	6%	6%	6%	8%	10%
		174L (Bardo 197S - North Holden 395S)	8%	8%	10%	9%	14%	11%	6%	6%	6%	10%	10%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	8%	7%	10%	8%	15%	11%	6%	6%	6%	8%	10%
	9L16 (Cordel 755S - Tincherbray 972S)	9L51 (Pemukan 932S - New Brigden 2088S)	16%	43%	16%	-2%	-24%	-25%	18%	22%	13%	-34%	16%
		7L159 (Ghost Pine 114S - Heatburg 948S)	4%	1%	4%	60%	-3%	-3%	5%	5%	14%	-1%	4%
	966L/9L966 (Hansman Lake 650S - Pemukan 932S)	7L224 (Monitor 774S - Hansman Lake 650S)	0%	24%	-6%	-1%	-8%	-8%	6%	6%	4%	-21%	-6%
	EATL HVDC	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	4%	4%	6%	3%	13%	6%	3%	3%	3%	4%	6%
		9L20 (Nevis 766S - Cordel 755S)	26%	25%	37%	-8%	34%	41%	18%	18%	12%	31%	36%
		912L/9L912 (Red Deer 63S - Nevis 766S)	30%	28%	39%	45%	39%	43%	22%	22%	24%	34%	39%
		9L16 (Cordel 755S - Tincherbray 972S)	43%	-1%	67%	-3%	-23%	-27%	19%	19%	13%	-15%	68%
		7L159 (Ghost Pine 114S - Heatburg 948S)	1%	1%	-1%	59%	-1%	-1%	3%	3%	12%	0%	-1%

Scenario and Case Name	Contingency (System Element Lost)	Details of Violation(Violation Observed On)	Generating Facility Name and Unit Number										
			P1909	P1567 (G1)	Halkirk (HAL) (G2)	Ghost Pine (G1)	Battle River #4	Battle River #5	Sheerness #1	Sheerness #2	Suncor Wintering Hills (G1)	Fortis Bull Creek Phase 1	P1704
		701L (North Holden 395S- Strome 223S)	4%	4%	5%	3%	12%	6%	3%	3%	3%	4%	5%
		174L (Bardo 197S - North Holden 395S)	4%	4%	5%	3%	9%	6%	3%	3%	3%	6%	5%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	4%	4%	5%	3%	11%	6%	3%	3%	3%	4%	5%
	766S901T (Nevis 766S 240/138 kV Transformer)	7L701 (Battle River 757S - 7LA701 Heisler 764S Substation Tap-point)	8%	7%	11%	4%	17%	12%	6%	6%	5%	9%	11%
		701L (North Holden 395S- Strome 223S)	8%	7%	10%	7%	15%	11%	6%	6%	6%	8%	10%
		174L (Bardo 197S - North Holden 395S)	8%	8%	10%	7%	14%	11%	6%	6%	6%	11%	10%
		701L (Strome 223S - 7LA701 Heisler 764S Substation Tap-point)	8%	7%	10%	7%	15%	11%	6%	6%	6%	8%	10%