

Engineering Connection Assessment

P2490 Tempest Wind Power Project Connection

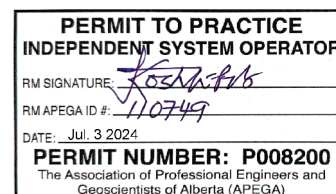
TransAlta Coaldale Wind LP

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Role	Name	Date	Signature
Prepared	Nima Safari, P. Eng.		Nima Safari -- P. Eng. - APEGA Digitally signed by Nima Safari -- P. Eng. - APEGA Date: 2024.07.03 13:20:18 -06'00'
Reviewed	Myron Jin-Li, P. Eng.		Myron Jin-Li -- P. Eng. - APEGA Digitally signed by Myron Jin-Li -- P. Eng. - APEGA Date: 2024.07.03 13:35:36 -06'00'
Approved	Pravin Koshti, P.Eng.		Pravinkumar Biharilal Koshti -- P. Eng. - APEGA Digitally signed by Pravinkumar Biharilal Koshti -- P. Eng. - APEGA Date: 2024.07.03 13:50:46 -06'00'



NOTE:

The conclusions and recommendations in this report are based on the results presented in *Attachment B: 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: Table A-1: Summary of Category B Reliability Criteria Violations, Project Impact, and Mitigation Measures-All Scenarios
Attachment B: Engineering Connection Assessment Results

1 Introduction

This Alberta Electric System Operator (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 B) and the scope and methodology used to perform the studies (see Attachment B1 to Attachment B). 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 Coaldale Wind LP (Market Participant) has submitted a request for system access service to the Alberta Electric System Operator (AESO) to connect its approved Tempest Wind Power Project (Facility) to the AIES. The Facility includes an approved collector substation, designated as the Tempest 1082S 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 100 MW and a Rate DTS, *Demand Transmission Service*, contract capacity of 1 MW; and a request for transmission development (collectively, the Project).

The scheduled in-service date (ISD) for the Project is April 01, 2025.

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 Lethbridge (Area 54) which is part of the AESO South planning region. Lethbridge (Area 54) is surrounded by the neighboring planning areas of Stavelly (Area 49), Vauxhall (Area 52), Fort Macleod (Area 53), and Glenwood (Area 55).

From a transmission system perspective, Lethbridge (Area 54) consists primarily of 240 kV and 138 kV transmission systems. Lethbridge (Area 54) is connected to Stavelly (Area 49) through a 240 kV transmission line 1041L; Lethbridge (Area 54) is connected to Vauxhall (Area 52) through the 138 kV transmission line 172L; Lethbridge (Area 54) is connected to Fort Macleod (Area 53) through 240 kV transmission lines 967L and 968L and 138 kV transmission lines 463L and 725L; Lethbridge (Area 54) is connected to Glenwood (Area 55) through a 240 kV transmission line 1005L and 138 kV transmission lines 820L and 863L.

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

2.3 Study Area

The Study Area consists of the AESO planning areas of Stavely (Area 49), Vauxhall (Area 52), Lethbridge (Area 54), and Glenwood (Area 55), 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 B1).

3 Connection Alternatives

3.1 Overview

The AESO, in consultation with the TFO in the Study Area and the Market Participant, examined 9 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 – T-tap connection to the 138 kV transmission line 172EL

This alternative includes the following developments:

- Add one 138 kV circuit, approximately 20 km in length,¹ to connect the Facility to the existing 138 kV transmission line 172EL using a T-tap connection configuration; and
- Add or modify associated equipment as required for the above transmission developments.

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

¹Exact line length will be determined by the TFO.

**P2490 Alternative 1
Area Transmission System**

aeso

49 - Stavelly

52 - Vauxhall

54 - Lethbridge

53 - Fort Macleod

55 - Glenwood

P2490: TransAlta Tempest MPC Wind

Legend:

- Future Wind Generator
- Gas Generator
- Hydro Generator
- Solar Generator
- Wind Generator
- Future 138 kV Substation
- 69 or 72 kV Substation
- Future 138/144 kV
- 69/72 kV
- 138/144 kV
- 138/144 kV Double Circuit
- 240 kV
- 240 kV Double Circuit
- P2490 Project Area
- AESO Planning Areas

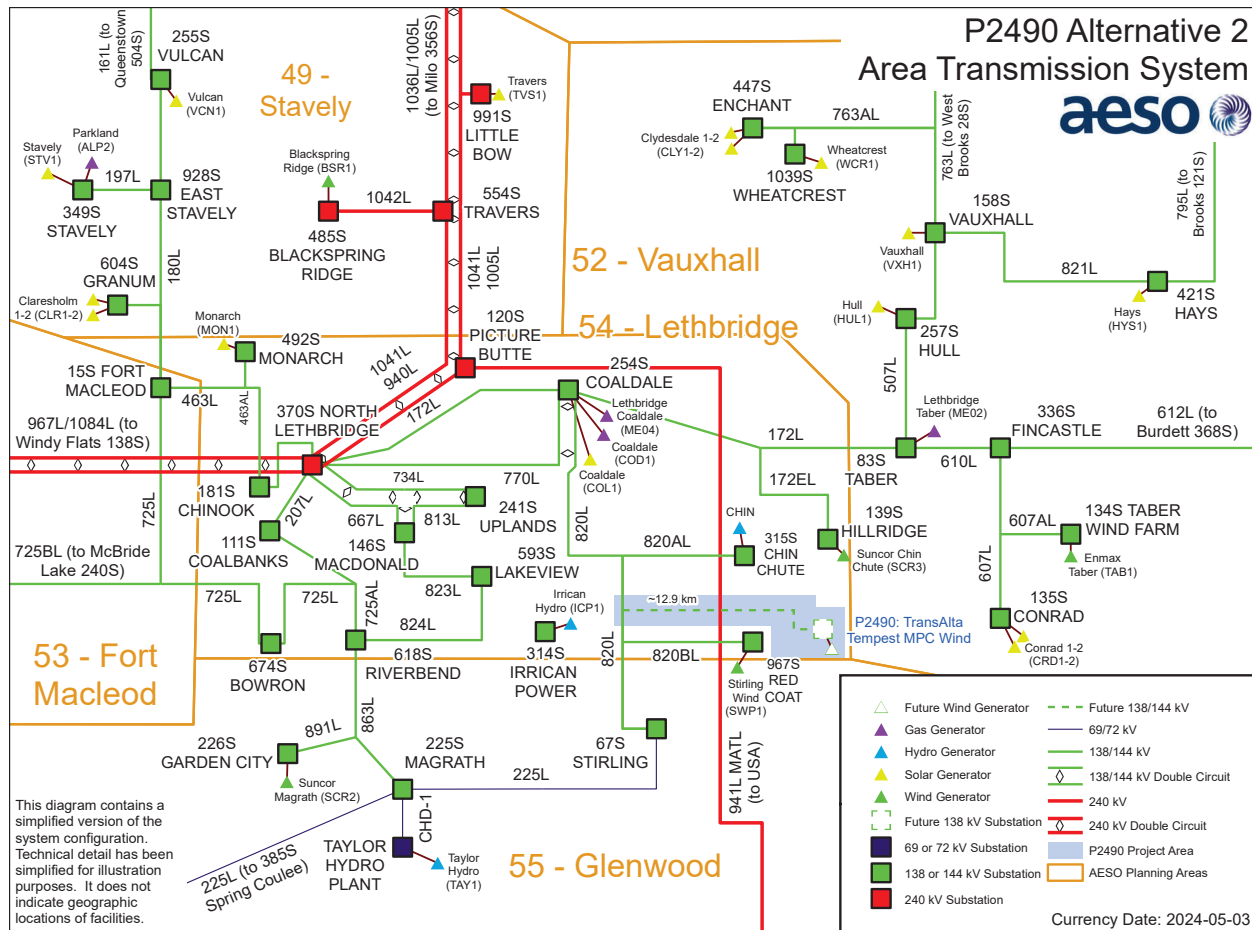
This diagram contains a simplified version of the system configuration. Technical detail has been simplified for illustration purposes. It does not indicate geographic locations of facilities.

Currency Date: 2024-05-09

- Add one 138 kV circuit, approximately 12.9 km in length,² to connect the Facility to the existing 138 kV transmission line 820L using a T-tap connection configuration which would require crossing the 240 kV transmission line 941L MATL; and
- Add or modify associated equipment as required for the above transmission developments.

²Exact line length will be determined by the TFO.

Figure 3-2: Connection Alternative 2



Alternative 3 – T-tap connection to the 138 kV transmission line 820AL

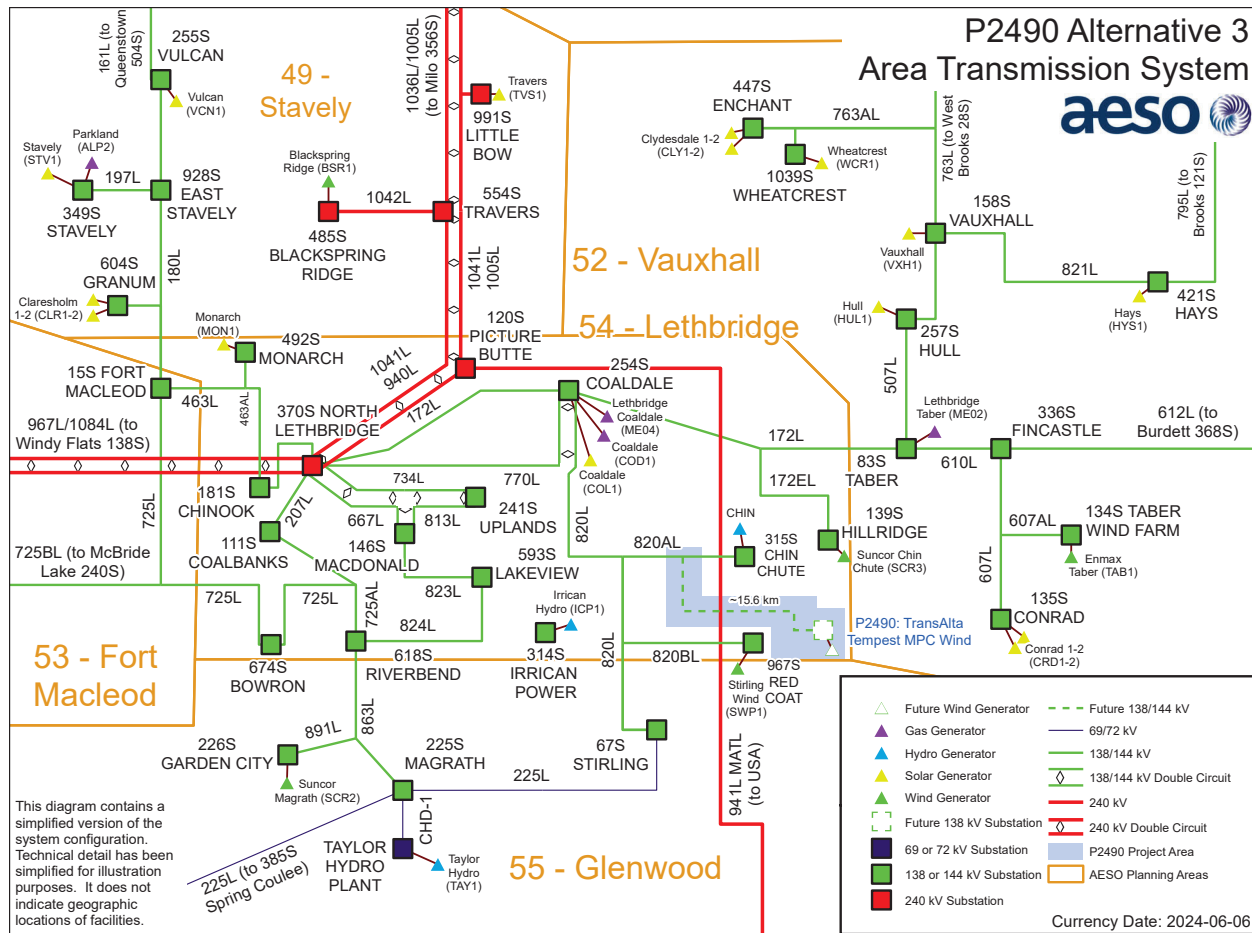
This alternative includes the following developments:

- Add one 138 kV circuit, approximately 15.6 km in length,³ to connect the Facility to the existing 138 kV transmission line 820AL using a T-tap connection configuration which would require crossing the 240 kV transmission line 941L MATL; and
- Add or modify associated equipment as required for the above transmission developments.

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

³Exact line length will be determined by the TFO.

Figure 3-3: Connection Alternative 3



Alternative 4 – Radial 138 kV connection to the Stirling 67S substation

This alternative includes the following developments:

- Add one 138 kV circuit, approximately 20.6 km in length,⁴ to connect the Facility to the existing Stirling 67S substation using a radial configuration which would require crossing the 240 kV transmission line 941L MATL;
- Modify Stirling 67S substation, including adding one 138 kV circuit breaker; and
- Add or modify associated equipment as required for the above transmission developments.

The proposed connection configuration is shown in Figure 3-4.

⁴Exact line length will be determined by the TFO.

This diagram contains a simplified version of the system configuration. Technical details have been simplified for illustration purposes. It does not indicate geographic locations of facilities.

**P2490 Alternative 4
Area Transmission System**

aeso

Legend:

- Future Wind Generator
- Gas Generator
- Hydro Generator
- Solar Generator
- Wind Generator
- Future 138 kV Substation
- 69 or 72 kV Substation
- 138 or 144 kV Substation
- 240 kV Substation
- Future 138/144 kV
- 69/72 kV
- 138/144 kV
- 138/144 kV Double Circuit
- 240 kV
- 240 kV Double Circuit
- P2490 Project Area
- AESO Planning Areas

Currency Date: 2024-06-08

- Add one 138 kV circuit, approximately 24.8 km in length,⁵ to connect the Facility to the existing 138 kV transmission line 607L using a T-tap connection configuration; and
- Add or modify associated equipment as required for the above transmission developments.

⁵Exact line length will be determined by the TFO.

**P2490 Alternative 5
Area Transmission System**

aeso

This diagram contains a simplified version of the system configuration. Technical detail has been simplified for illustration purposes. It does not indicate geographic locations of facilities.

Legend:

- Future Wind Generator
- Gas Generator
- Hydro Generator
- Solar Generator
- Wind Generator
- Future 138 kV Substation
- 69 or 72 kV Substation
- 240 kV Substation
- Future 138/144 kV
- 69/72 kV
- 138/144 kV
- 138/144 kV Double Circuit
- 240 kV
- 240 kV Double Circuit
- P2490 Project Area
- AESO Planning Areas

Currency Date: 2024-06-08

Public

**P2490 Alternative 6
Area Transmission System**

aeso

This diagram contains a simplified version of the system configuration. Technical detail has been simplified for illustration purposes. It does not indicate geographic locations of facilities.

Legend:

- Future Wind Generator
- Gas Generator
- Hydro Generator
- Solar Generator
- Wind Generator
- Future 138 kV Substation
- 69 or 72 kV Substation
- 138 or 144 kV Substation
- 240 kV Substation
- Future 138/144 kV
- 69/72 kV
- 138/144 kV
- 138/144 kV Double Circuit
- 240 kV
- 240 kV Double Circuit
- P2490 Project Area
- AESO Planning Areas

Currency Date: 2024-06-01

- Add one 138 kV circuit, approximately 55.4 km in length,⁷ to connect the Facility to the existing North Lethbridge 370S substation using a radial configuration which would require crossing the 240 kV transmission line 941L MATL and the 138 kV transmission lines 820AL and/or 820L and/or 770L and/or 823L and/ or 824L;
- Modify North Lethbridge 370S substation, including adding one 138 kV circuit breaker; and
- Add or modify associated equipment as required for the above transmission developments.

⁷Exact line length will be determined by the TFO.

**P2490 Alternative 7
Area Transmission System**

aeso

49 - Stavelly

52 - Vauxhall

54 - Lethbridge

53 - Fort Macleod

55 - Glenwood

P2490: TransAlta Tempest MPC Wind

Legend:

- Future Wind Generator
- Gas Generator
- Hydro Generator
- Solar Generator
- Wind Generator
- Future 138/144 kV
- 69/72 kV
- 138/144 kV
- 138/144 kV Double Circuit
- 240 kV
- Future 138 kV Substation
- 240 kV Double Circuit
- 69 or 72 kV Substation
- 138 or 144 kV Substation
- 240 kV Substation
- P2490 Project Area
- AESO Planning Areas

This diagram contains a simplified version of the system configuration. Technical detail has been simplified for illustration purposes. It does not indicate geographic locations of facilities.

Currency Date: 2024-06-01

- Add one 138 kV circuit, approximately 68 km in length,⁸ to connect the Facility to the existing Picture Butte 120S substation using a radial configuration which would require crossing the 240 kV transmission line 941L MATL and the 138kV transmission lines 820AL and/or 820L and/or 770L and/or 172L;
- Modify Picture Butte 120S substation, including adding one 138/240 kV transformer and one 240 kV circuit breaker; and
- Add or modify associated equipment as required for the above transmission developments.

⁸Exact line length will be determined by the TFO.

**P2490 Alternative 8
Area Transmission System**

aeso

49 - Stavelly

52 - Vauxhall

54 - Lethbridge

53 - Fort Macleod

55 - Glenwood

P2490: TransAlta Tempest MPC Wind

Legend:

- Future Wind Generator
- Gas Generator
- Hydro Generator
- Solar Generator
- Wind Generator
- Future 138 kV Substation
- 69 or 72 kV Substation
- 138 or 144 kV Substation
- 240 kV Substation
- Future 138/144 kV
- 69/72 kV
- 138/144 kV
- 138/144 kV Double Circuit
- 240 kV
- 240 kV Double Circuit
- P2490 Project Area
- AESO Planning Areas

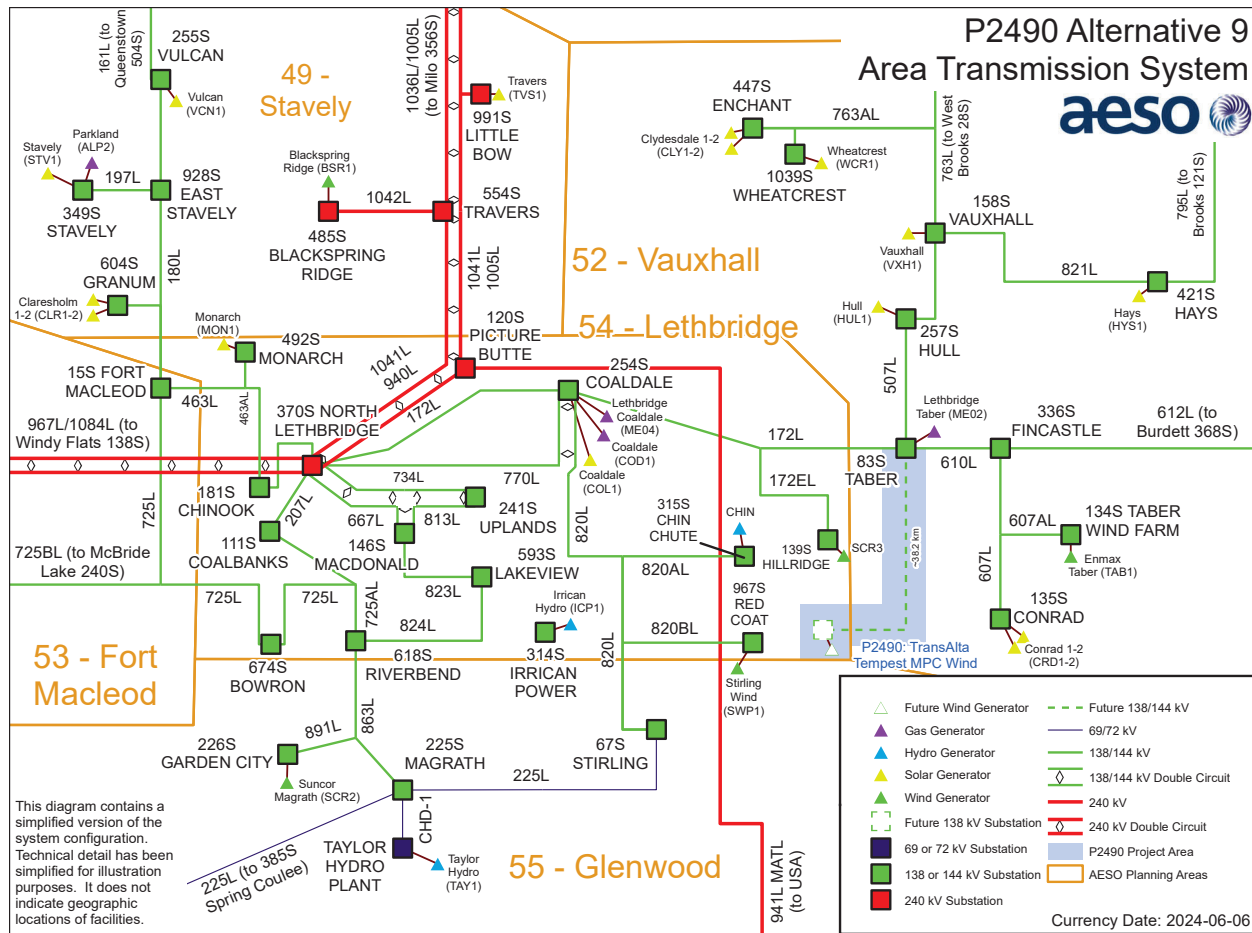
This diagram contains a simplified version of the system configuration. Technical detail has been simplified for illustration purposes. It does not indicate geographic locations of facilities.

Currency Date: 2024-06-00

- Add one 138 kV circuit, approximately 38.2 km in length,⁹ to connect the Facility to the Taber 83S substation using a radial configuration;
- Modify the Taber 83S substation, including adding one 138 kV circuit breaker; and
- Add or modify associated equipment as required for the above transmission developments.

⁹Exact line length will be determined by the TFO.

Figure 3-9: Connection Alternative 9



3.3 Connection Alternatives Selected for Further Study

Alternative 1 is considered technically feasible and was selected for further study.

3.4 Connection Alternatives Not Selected for Further Study

Alternatives 2, 3, and 4 were ruled out due to a potential higher risk of reliability criteria violations. Alternatives 2, 3, and 4 would cause Category A thermal criteria violations on multiple sections of 820L as well as on the 69 kV system in the Glenwood planning area. Additionally, Alternatives 2 and 3 create 5-terminal 138 kV lines which pose potential protection coordination challenges and may result in adverse impacts on system stability and reliability.

Alternatives 5 and 6 involve increased transmission development, and hence increased cost compared with Alternative 1. Additionally, Alternatives 5 and 6 result in a higher risk of reliability criteria violations under specific generation scenarios in the Vauxhall planning area. Compared to Alternative 1, Alternatives 5 and 6 materially increase the risk of thermal criteria violations on 610L and some sections of 172L.

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Alternatives 7, 8, and 9 involve increased transmission development, and hence increased cost, compared with Alternative 1 and were therefore ruled out.

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 B (see Attachment B1).

4.2 Studies Performed

The scheduled ISD for the Project is April 1, 2025; Therefore, studies were performed using scenarios for 2028 Summer Light (SL) and 2028 Summer Peak (SP) high wind (HW).

Short-circuit studies were performed using the 2028 Winter Peak (WP) HW pre-Project, 2028 WP HW post-Project and 2033 WP post-Project scenarios.

Table 4-1 lists the study scenarios. Post-Project scenarios reflect the requested Rate STS¹⁰ contract capacity of 100 MW¹¹ at the Tempest 1082S substation.

Table 4-1: Connection Study Scenarios

Scenario No.	Year/Season	System Generation Dispatch Conditions	Scenario Name	Project Load (MW)	Project Generation (MW)
Pre-Project					
1	2028 Summer Light (SL)	High Wind (HW)	2028 SL HW Pre-Project	0	0
2	2028 Summer Peak (SP)	HW	2028 SP HW Pre-Project	0	0
Post-Project					
4	2028 SL	HW	2028 SL HW Post-Project	0	99
5	2028 SP	HW	2028 SP HW Post-Project	0	99
6	2033 Winter Peak (WP)	All Generators in the Study Area in service	2033 WP Post-Project	0	99

The AESO Planning Region load forecasts used for the connection studies were based on the AESO's *Preliminary 2023 Long-term Outlook* (2023 LTO).

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.

¹⁰ As the requested DTS is only 1 MW which has minimal system impact, it is determined the DTS study is not required.

¹¹ Although the requested STS is 100 MW, the engineering study report was conducted for 99 MW based on the actual installed capacity of the Facility. The study conclusions are valid and appropriate for 100 MW.

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 B1.¹²

Power flow studies were performed for all scenarios listed in Table 3-1, except Scenario 7.

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 2028 Summer Light HW and 2028 Summer Peak HW post-Project scenarios (Scenarios 3 and 4) listed in Table 4-1 above.

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 2028 Summer Peak pre-Project scenario, 2028 Summer Peak post-project scenario and 2033 Winter Peak post-Project scenarios (Scenarios 2, 4 and 5) listed in Table 4-1 above.

4.3 Mitigation Measure Development and Evaluation

As explained in Section 6 of Attachment B1, 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 and transient stability studies were performed to assess the impact of the Project on the performance of the AIES following 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 constraint effective factors and to identify the most effective generators to manage thermal criteria violations that were observed under Category A conditions and Category B conditions.

¹² 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 B1 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 B1.

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 for Category A and the proposed mitigation measures are summarized in Table 5-1. Reliability Criteria violations observed during the connection assessment studies for Category B and the proposed mitigation measures are summarized in Attachment A.

- Section 5.2 includes an overview of the pre-Project studies results.
- Section 5.3 includes an overview of the post-Project studies results.
- Section 5.4 includes a description of the proposed mitigation measures to address observed Reliability Criteria violations.

Detailed study results are provided in Attachment B.



Table 5-1: Summary of Category A Reliability Criteria Violations, Project Impact and Mitigation Measures- All Scenarios

Scenario	Type of Reliability Criteria Violation Pre-Project	Type of Reliability Criteria Violation Post-Project	Details of Violation	Project Impact	Pre-Project Mitigation Measures	Post-Project Mitigation Measures
2028 Summer Light (SL)	Thermal-above emergency rating	Thermal-above emergency rating	770L (North Lethbridge 370S - Coaldale 254S)	Materially increased violation	Real-time Operating Practice (RTOP)	RTOP
	Thermal-above emergency rating	Thermal-above emergency rating	172L (Taber 83S - 172EL Tap)	Materially decreased violation	RTOP	RTOP
	Thermal-above emergency rating	Thermal-above emergency rating	172L (Coaldale 254S - 172FL Tap)	Materially increased violation	RTOP	RTOP
	Thermal-below emergency rating	Thermal-below emergency rating	607L (Fincastle 336S - 607AL Tap)	Marginally increased violation	RTOP	RTOP
	Thermal-below emergency rating	Thermal-below emergency rating	610L (Fincastle 336S - Taber 83S)	Materially decreased violation	RTOP	RTOP
	Thermal-above emergency rating	Thermal-above emergency rating	172L (Coaldale 254S - 172EL Tap)	Materially decreased violation	RTOP	RTOP
	Thermal-above emergency rating	Thermal-above emergency rating	172L (North Lethbridge 370S - 172FL Tap)	Materially increased violation	RTOP	RTOP
	None	Thermal-below emergency rating	225L (Magrath 225S - Raymond Reservoir Tap)	New violation	None	RTOP
	None	Thermal-below emergency rating	225L (Stirling 67S - Raymond Reservoir Tap)	New violation	None	RTOP
	Thermal-below emergency rating	Thermal-below emergency rating	763L (Hull 257S - 763BL Tap)	Marginally decreased violation	RTOP	RTOP
2028 Summer Peak (SP)	Thermal-above emergency rating	Thermal-above emergency rating	172L (Taber 83S - 172EL Tap)	Marginally decreased violation	RTOP	RTOP
	Thermal-above emergency rating	Thermal-above emergency rating	180L (Fort Macleod 15S - 180AL Tap)	Marginally decreased violation	RTOP	RTOP
	Thermal-above emergency rating	Thermal-above emergency rating	172L (Coaldale 254S - 172EL Tap)	Marginally increased violation	RTOP	RTOP
	Thermal-above emergency rating	Thermal-below emergency rating	507L (Taber 83S - Hull 257S)	Marginally decreased violation	RTOP	RTOP
	Thermal-below emergency rating	Thermal-below emergency rating	225L (Glenwood 229S - Spring Coulee 385S)	Marginally increased violation	RTOP	RTOP

Notes:

- Marginally increased (or marginally decreased) refers to a percent loading difference (post-Project percent loading minus pre-Project percent loading) between 0% and 3% (or -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% (or below or equal to -3%).

5.2 Pre-Project Study Results

5.2.1 Category A Conditions

A voltage stability issue was found at the 240 kV Bowmanton 244S substation under the Category A conditions for the pre-Project scenarios. To mitigate the observed voltage criteria violation, the total renewable generation connecting to the Cassils-Bowmanton-Whitla (CBW) transmission path was reduced to 1200 MW for the pre-Project scenarios. All subsequent studies were completed based on these adjusted generation assumptions.

As shown in Table 5-1, with the inclusion of additional projects planning to connect in the South region, the pre-Project power flow studies identified several thermal criteria violations under Category A conditions (i.e., all elements in service) on 138 kV transmission lines including: 770L (North Lethbridge 370S - Coaldale 254S), 172L (Taber 83S - 172EL Tap), 172L (Coaldale 254S - 172FL Tap), 172L (Coaldale 254S - 172EL Tap), 172L (North Lethbridge 370S - 172FL Tap), 607L (Fincastle 336S - 607AL Tap), 610L (Fincastle 336S - Taber 83S), 763L (Hull 257S - 763BL Tap), 180L (Fort Macleod 15S - 180AL Tap), 507L (Taber 83S - Hull 257S), and 225L (Glenwood 229S - Spring Coulee 385S).

The short-circuit fault levels were found to be within the typical capabilities of the nearby facilities.

5.2.2 Category B Conditions

The pre-Project power flow studies identified several thermal and voltage violations under Category B conditions (i.e., loss of a single system element). See Attachment A for details.

In addition, under Category B conditions, voltage deviations were observed that were beyond the limits listed in Table 3-1 of Attachment B1 at point-of-delivery (POD) low voltage busses (subsequently referred to as POD bus voltage deviations).

5.3 Post-Project Study Results

5.3.1 Category A Conditions

A voltage stability issue was found at the 240 kV Bowmanton 244S substation under the Category A condition. To mitigate the observed criteria violation, the total renewable generation connecting to the CBW transmission path was reduced to 1200 MW for the post-Project scenarios.

The post-Project power flow studies identified all of the same thermal criteria violations under Category A conditions that were observed in pre-project scenarios. Following the connection of the Project and with the inclusion of additional projects planning to connect in the South region, most thermal reliability criteria violations observed in the pre-Project scenarios were increased and some were reduced. Two new thermal criteria violations were observed on the 69 kV transmission lines 225L (Magrath 225S - Raymond Reservoir Tap) and 225L (Stirling 67S - Raymond Reservoir Tap).

A summary of thermal criteria violations observed under N-0 system conditions in Summer Light (SL) and Summer Peak (SP) is shown in Table 5-2.

Table 5-2: Thermal Criteria Violations under the N-0 Condition in the Post-Project Scenario

Scenario	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
2028 Summer Light (SL)	770L (North Lethbridge 370S - Coaldale 254S)	120	132	155.59	129.66	184.44	153.7	24.04
	172L (Taber 83S - 172EL Tap)	119	146	217.58	182.84	188.72	158.59	-24.25
	172L (Coaldale 254S - 172FL Tap)	119	146	158.18	132.93	190.58	160.15	27.23
	607L (Fincastle 336S - 607AL Tap)	123	131	125.34	101.9	125.51	102.04	0.14
	610L (Fincastle 336S - Taber 83S)	175	237	184.35	105.35	176.61	100.92	-4.43
	172L (Coaldale 254S - 172EL Tap)	119	146	239.97	201.66	303.04	254.66	53
	172L (North Lethbridge 370S - 172FL Tap)	119	146	187.43	157.5	219.82	184.72	27.22
	225L (Magrath 225S - Raymond Reservoir Tap)	25	28	23.02	92.06	25.5	102	9.94
	225L (Stirling 67S - Raymond Reservoir Tap)	25	28	23.28	93.13	25.66	102.66	9.53
2028 Summer Peak (SP)	763L (Hull 257S - 763BL Tap)	120	132	124.77	103.98	124.67	103.9	-0.08
	172L (Taber 83S - 172EL Tap)	119	146	211.95	178.11	211.87	178.05	-0.06
	180L (Fort Macleod 15S - 180AL Tap)	120	132	133.45	111.21	133.07	110.89	-0.32
	172L (Coaldale 254S - 172EL Tap)	119	146	219.63	184.56	220.42	185.23	0.67
	507L (Taber 83S - Hull 257S)	120	132	132.09	110.07	131.99	109.99	-0.08
	225L (Glenwood 229S - Spring Coulee 385S)	22	24	23.2	105.45	23.49	106.76	1.31

Post-Project short-circuit fault levels were not significantly higher than pre-Project levels.

5.3.2 Category B Conditions

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

Following the connection of the Project, one of the thermal criteria violations observed in the pre-Project scenarios was exacerbated, some voltage criteria violations observed in the pre-Project scenarios were exacerbated, and new thermal criteria violations and voltage criteria violations were observed.

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

In addition, under Category B conditions, POD bus voltage deviations were observed.

5.4 Mitigation Measures

This section discusses the AESO's proposed mitigation measures to address the system performance issues that were identified pre-Project and post-Project. As part of this Project, mitigation measures will not be specifically developed for the POD bus voltage deviations observed under certain Category B conditions during pre-Project and post-Project scenarios.

5.4.1 Pre-Project

The Category A thermal reliability criteria violations observed in pre-Project scenarios can be managed by applying Section 302.1 of the ISO rules, *Real-Time Transmission Constraint Management* (TCM Rule) to curtail generation until such a time that system developments are in place to alleviate congestion. If necessary, the AESO will file an application for an "exception" under Section 15(2) of the *Transmission Regulation*.

Prior to the connection of the Project, some of the observed Category B thermal criteria violations can be mitigated using Real-time Operating Practices (RTOPs). The remaining thermal criteria violations can be mitigated by Planned RAS 219.

Prior to the connection of the Project, some of the voltage criteria violations observed under Category B conditions can be managed using RTOPs. The remaining voltage criteria violations can be mitigated by using existing RAS 43 and RTOPs, alone or in combination, as appropriate.

5.4.2 Post-Project

The thermal reliability criteria violations observed under Category A conditions can be managed by applying the TCM Rule to curtail generation as required until such a time that system developments or other mitigations are in place to alleviate congestion. If necessary, the AESO will file an application for an "exception" under Section 15(2) of the *Transmission Regulation*.

After connection of the Project, some of the thermal criteria violations observed can be mitigated by using RTOPs. The remaining thermal criteria violations can be mitigated by modifying RAS 168 and planned RAS 219 by including the Project in the RAS logic.

After connection of the Project, some of the voltage criteria violations observed under Category B conditions can be managed using RTOPs. The remaining voltage criteria violations can be mitigated by existing RAS 43 and RTOP, alone or in combination, as appropriate.

5.4.3 Post-Project Mitigation Study Results

Under Category B conditions, all of the observed Reliability Criteria violations requiring RAS were mitigated.

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.

7 Conclusions and Recommendations

Based on the study results, Alternative 1 is technically viable. The connection assessment identified a number of pre-Project and post-Project system performance issues.

The connection assessment uses credible worst-case conditions to assess the impact of the Facility connecting on the AIES. Category A thermal criteria violations were observed, exacerbating pre-Project violations under these credible worst-case load and generation forecast conditions. The probability of Category A thermal criteria violations is highly dependent upon the production profile of the Facility and the energization of other generation facilities in the area. The AESO will continue to monitor the pace of generation development and will notify Market Participants if it determines that it is necessary to obtain approval for a Section 15(2) exception.

The thermal and voltage criteria violations observed under Category B conditions can be mitigated through the use of existing RAS 43, modified RAS 168, modified planned RAS 219, and RTOP, alone or in combination, as appropriate. With the implementation of these mitigation measures, connecting the project with the preferred alternative does not adversely affect the performance of the AIES.

The AESO recommends proceeding with the Project using Alternative 1 as the preferred alternative to respond to the Market Participant's request for system access service. Alternative 1 involves adding one 138 kV circuit to connect the Facility to the existing 138 kV transmission line 172EL in a T-tap configuration.

The conductor used for the 138 kV circuit connecting the Facility to 172EL should have a minimum rating of 112 MVA to meet the Market Participant's requested STS contract capacity.

Attachment A:

Table A-1: Summary of Category B Reliability Criteria Violations, Project Impact, and Mitigation Measures-All Scenarios

Scenario	Type of Reliability Criteria Violation		Contingency	Details of Violation	Project Impact	Pre-Project Mitigation Measures	Post-Project Mitigation Measures
	Pre-Project	Post-Project					
2028 Summer Light (SL)	None	Thermal-above emergency rating	Red Coat 967S Transformer T1	172L (Coaldale 254S - 172EL Tap)	New violation	None	Modified RAS 188
	None	Thermal-below emergency rating	1041L (North Lethbridge 370S - Travers 554S)	172L (Coaldale 254S - 172EL Tap)	New violation	None	Modified RAS 188
	None	Thermal-below emergency rating	1041L (North Lethbridge 370S - Travers 554S)	172L (North Lethbridge 370S - 172FL Tap)	New violation	None	Real-time Operating Practice (RTOP)
	None	Thermal-below emergency rating	161AL Tap (Volcan 255S - Queenstown 504S/Enterprise)	172L (North Lethbridge 370S - 172FL Tap)	New violation	None	RTOP
	None	Thermal-below emergency rating	STIRLING 67S Transformer T2	172L (North Lethbridge 370S - 172FL Tap)	New violation	None	RTOP
	None	Thermal-below emergency rating	RAYRS_TAP (Stirling 67S - Raymond Reservoir 313S/ Magrath 225S)	172L (North Lethbridge 370S - 172FL Tap)	New violation	None	RTOP
	None	Thermal-below emergency rating	RDCO_TAP(Stirling 67S - Chin Chute 315S/ Coaldale 254S)	172L (Coaldale 254S - 172EL Tap)	New violation	None	Modified RAS 188
	None	Thermal-below emergency rating	Fincastle 336S Transformer T1/T2	172L (North Lethbridge 370S - 172FL Tap)	New violation	None	RTOP
	None	Thermal-below emergency rating	Fincastle 336S Transformer T1/T2	172L (Coaldale 254S - 172EL Tap)	New violation	None	Modified RAS 188
	None	Thermal-below emergency rating	610L (Taber 83S - Fincastle 336S)	172L (North Lethbridge 370S - 172FL Tap)	New violation	None	RTOP
	None	Thermal-below emergency rating	610L (Taber 83S - Fincastle 336S)	172L (Coaldale 254S - 172EL Tap)	New violation	None	Modified RAS 188
	None	Thermal-above emergency rating	1005L (Picture Butte 120S - Travers 554S)	172L (Coaldale 254S - 172EL Tap)	New violation	None	Modified RAS 188
	None	Thermal-above emergency rating	1005L (Picture Butte 120S - Travers 554S)	172L (North Lethbridge 370S - 172FL Tap)	New violation	None	Modified RAS 188
	None	Thermal-above emergency rating	1005L (Travers 554S - Milo 356S)	172L (Coaldale 254S - 172EL Tap)	New violation	None	Modified RAS 188
	None	Thermal-below emergency rating	1005L (Travers 554S - Milo 356S)	172L (North Lethbridge 370S - 172FL Tap)	New violation	None	RTOP
	None	Thermal-below emergency rating	Coaldale 254S Transformer T2	172L (North Lethbridge 370S - 172FL Tap)	New violation	None	RTOP
	None	Thermal-above emergency rating	172L (North Lethbridge 370S - Coaldale 254S)	770L (Coaldale 254S - North Lethbridge 370S)	New violation	None	Modified Planned RAS 219
	None	Thermal-above emergency rating	770L (Coaldale 254S - North Lethbridge 370S)	172L (Coaldale 254S - 172FL Tap)	New violation	None	Modified Planned RAS 219
	Thermal-Below Emergency Rating	Thermal-above emergency rating	770L (Coaldale 254S - North Lethbridge 370S)	172L (North Lethbridge 370S - 172FL Tap)	Materially increased violation	Planned RAS 219	Modified Planned RAS 219
	None	Thermal-below emergency rating	1036L (Milo 356S - Travers 554S)	172L (Coaldale 254S - 172EL Tap)	New violation	None	Modified RAS 188
	None	Thermal-below emergency rating	1036L (Milo 356S - Travers 554S)	172L (North Lethbridge 370S - 172FL Tap)	New violation	None	RTOP
	Voltage	Voltage	Burdett 368S Transformer T1/T2	879AL Tap	Marginally decreased violation	RTOP	RTOP
	Voltage	Voltage	Fincastle 336S Transformer T1/T2	879AL Tap	Marginally decreased violation	RTOP	RTOP
	Voltage	Voltage	Fincastle 336S Transformer T1/T2	Burdett 368S	Marginally decreased violation	RTOP	RTOP
	Voltage	Voltage	Fincastle 336S Transformer T1/T2	Westfield 107S	Marginally decreased violation	RTOP	RTOP
	None	Voltage	Vauxhall 158S Transformer T	879AL Tap	Marginally decreased violation	None	RTOP
	Voltage	Voltage	172L/172EL (Coaldale 254S - Taber 83S/ Hillridge 139S)	Fincastle 336S	New violation	RTOP	RTOP
	Voltage	Voltage	172L/172EL (Coaldale 254S - Taber 83S/ Hillridge 139S)	Conard 135S	None	RTOP	RTOP
	Voltage	Voltage	172L/172EL (Coaldale 254S - Taber 83S/ Hillridge 139S)	Taber Wind Farm 134S	None	RTOP	RTOP
	Voltage	Voltage	172L/172EL (Coaldale 254S - Taber 83S/ Hillridge 139S)	607AL Tap	Marginally decreased violation	RTOP	RTOP
	Voltage	Voltage	172L/172EL (Coaldale 254S - Taber 83S/ Hillridge 139S)	Hull 257S	Marginally increased violation	RTOP	RTOP
	Voltage	Voltage	172L/172EL (Coaldale 254S - Taber 83S/ Hillridge 139S)	Taber 83S	None	RTOP	RTOP
	Voltage	Voltage	Stirling 67S Transformer T2	Warner 344S	Marginally increased violation	RAS 43	RAS 43
	Voltage	Voltage	820L/820AL (Stirling 67S - Chin Chute 315S/ Coaldale 254S)	Stirling 67S (69 kV)	Marginally increased violation	RAS 43, RTOP	RAS 43, RTOP
	Voltage	Voltage	820L/820AL (Stirling 67S - Chin Chute 315S/ Coaldale 254S)	Stirling 67S (138 kV)	Marginally decreased violation	RAS 43, RTOP	RAS 43, RTOP
	Voltage	Voltage	820L/820AL (Stirling 67S - Chin Chute 315S/ Coaldale 254S)	Stirling 67S (69 kV)	Marginally decreased Violation	RAS 43	RAS 43
	Voltage	Voltage	820L/820AL (Stirling 67S - Chin Chute 315S/ Coaldale 254S)	Warner 344S	Marginally decreased Violation	RAS 43	RAS 43
	None	Thermal-below emergency rating	940L (North Lethbridge 370S - Picture Butte 120S)	172L (Coaldale 254S - 172EL Tap)	New violation	None	Modified RAS 188

Scenario	Type of Reliability Criteria Violation		Contingency	Details of Violation	Project Impact	Pre-Project Mitigation Measures	Post-Project Mitigation Measures
	Pre-Project	Post-Project					
2028 Summer Peak (SP)	Thermal-Below Emergency Rating	None	1041L (North Lethbridge 370S - Travers 554S)	180L (Fort Macleod 15S - 180AL Tap)	Marginally decreased violation	RTOP	RTOP
	None	Thermal-above emergency rating	1041L (North Lethbridge 370S - Travers 554S)	172L (Coaldale 254S - 172EL Tap)	New violation	None	Modified RAS 168
	Thermal-Below Emergency Rating	None	463L (Fort Macleod 15S - Monarch 492S/Chinook 181S)	725L (Bowron 674S - 725BL Tap)	Marginally decreased violation	RTOP	RTOP
	None	Thermal-above emergency rating	180L (Fort Macleod 15S - East Stavelly 28S/Griatum 604S)	172L (Coaldale 254S - 172EL Tap)	New violation	RTOP	Modified RAS 168
	Thermal-Above Emergency Rating	Thermal-below emergency rating	Bowron 674S Transformer T1/T2	463L (Fort Macleod 15S - Monarch Tap)	Marginally decreased violation	RTOP	RTOP
	None	Thermal-below emergency rating	Taber 83S Transformer T1	172L (Coaldale 254S - 172EL Tap)	New violation	None	Modified RAS 168
	None	Thermal-below emergency rating	Taber 83S Transformer T3	172L (Coaldale 254S - 172EL Tap)	New violation	None	Modified RAS 168
	None	Thermal-below emergency rating	610L (Taber 83S - Fincastle 336S)	172L (Coaldale 254S - 172EL Tap)	New violation	None	Modified RAS 168
	None	Thermal-above emergency rating	Fincastle 336S Transformer T1/T2	172L (Coaldale 254S - 172EL Tap)	New violation	None	Modified RAS 168
	None	Thermal-below emergency rating	607L/607AL (Fincastle 336S - Conard 135S/ Taber Wind Farm 134S)	172L (Coaldale 254S - 172EL Tap)	New violation	None	Modified RAS 168
	Thermal-Below Emergency Rating	Thermal-below emergency rating	1005L (Picture Butte 120S - Travers 554S)	180L (Fort Macleod 15S - 180AL Tap)	Marginally decreased violation	RTOP	RTOP
	None	Thermal-above emergency rating	1005L (Picture Butte 120S - Travers 554S)	172L (Coaldale 254S - 172EL Tap)	New violation	None	Modified RAS 168
	None	Thermal-below emergency rating	725BL (MacBride Lake 640S - Fort Macleod/ Bowron 674S)	172L (Coaldale 254S - 172EL Tap)	New violation	None	Modified RAS 168
	None	Thermal-below emergency rating	Clareholm Transformer T2	172L (Coaldale 254S - 172EL Tap)	New violation	None	Modified RAS 168
	Voltage	Voltage	Stirling 67S Transformer T2	Stirling 67S (69 kV)	Marginally increased violation	None	RAS 43, RTOP
	Voltage	Voltage	Stirling 67S Transformer T2	Warner 344S	Marginally increased violation	RAS 43	RAS 43
	Voltage	Voltage	820L/820AL (Stirling 67S - Chin Chute 315S/ Coaldale 254S)	Stirling 67S (138 kV)	Marginally increased violation	RAS 43, RTOP	RAS 43, RTOP
	Voltage	Voltage	820L/820AL (Stirling 67S - Chin Chute 315S/ Coaldale 254S)	Warner 344S	Marginally increased violation	RAS 43	RAS 43
	Voltage	Voltage	820L/820AL (Stirling 67S - Chin Chute 315S/ Coaldale 254S)	Stirling 67S (69 kV)	Marginally increased violation	RAS 43, RTOP	RAS 43, RTOP
	Voltage	Voltage	Burdett 368S Transformer T1/T2	879AL Tap	Marginally decreased violation	RTOP	RTOP
	Voltage	Voltage	Fincastle 336S Transformer T1/T2	Westfield 107S	Marginally decreased violation	RTOP	RTOP
	Voltage	Voltage	Fincastle 336S Transformer T1/T2	Burdett 368S	Marginally decreased violation	RTOP	RTOP
	Voltage	Voltage	Fincastle 336S Transformer T1/T2	879AL Tap	Marginally decreased violation	RTOP	RTOP
	Voltage	Voltage	172L (Chinook 181S - North Lethbridge 370S)	Monarch Tap	Marginally increased violation	RTOP	RTOP
	Voltage	Voltage	172L (Chinook 181S - North Lethbridge 370S)	Chinook 181S	Marginally increased violation	RTOP	RTOP
	Voltage	Voltage	172L (Chinook 181S - North Lethbridge 370S)	Monarch 492S	Marginally increased violation	RTOP	RTOP
	Voltage	Voltage	Riverbend Tap (Riverbend 618S - Coalbank 111S/ Brown 674S)	Bowron 674S	Marginally increased violation	RTOP	RTOP
	None	Voltage	207L (Coalbank 111S - North Lethbridge 370S)	Coalbank 111S	New Violation	None	RTOP

- Notes:**
- Marginally increased (or marginally decreased) refers to a percent loading difference (post-Project percent loading minus pre-Project percent loading) between 0% and 3% (or -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% (or below or equal to -3%).
 - RAS 43 is an existing RAS.
 - RAS 168 is an existing RAS.
 - RAS 219 is proposed for the proposed P2629-Taber Solar. This RAS is referred to herein as "Planned RAS 219".
 - In this table, "Modify" refers to adding this Project (P2490) to the logic of the respective RAS.

Attachment B: Engineering Connection Assessment Results

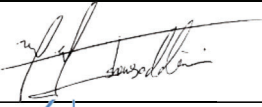
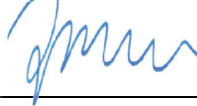
Engineering Connection Assessment: Study Results

P2490 Tempest Wind Power Project

TransAlta Coaldale Wind LP.

Date: May 28, 2024

Version: V1 Final

Role	Name	Date	Signature
Prepared	Morteza Shamsoddini	May 28, 2024	
Reviewed	Feng Chen	May 28, 2024	
Approved	Feng Chen	May 28, 2024	

PERMIT TO PRACTICE CF POWER LTD.	
RM SIGNATURE:	
RM APEGA ID #:	89403
DATE:	May 28, 2024
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The Association of Professional Engineers and Geoscientists of Alberta (APEGA)	



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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

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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 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.

As per the AESO's requirements, the total renewable generations downstream of Bowmanton 244S 240 kV should be limited to approximately 1200 MW. The curtailment details can be found in the table below:

Table 2-1: Renewable resources generation dispatch downstream of Bowmanton 244S details

Generator Name	Generator Buses	Generator capacity (MW)	2028 SL HW Pre-Project (Scenario 1) & 2028 SL HW Post-Project (Scenario 3)		2028 SP HW Pre-Project (Scenario 2) & 2028 SP HW Post-Project (Scenario 4)	
			Dispatch at CSS (MW)	Current dispatch (MW)	Dispatch at CSS (MW)	Current dispatch (MW)
P2467 Pteragen Peace Butte Wind	2294	120	118	51.4	100	52.4
P0693 Wild Rose 2 Wind Farm	3462	192	171	74.4	92	48.2
P2237 AECG Forty Mile MPC Wind	60608, 61608	266	260	113.2	110	57
Whitla 1 (WHT1)	60990	202	198	85.8	83	43.3
Whitla 2 (WHT2)	61990	151	148	64.3	62	32.4
Forty Mile Granlea (FMG1)	61994, 62994	225	192	83.6	64	33.2
P2347 Forty Mile Granlea Solar Phase 2	65994	220	136	59.1	183	95.5
Cypress 1 (CYP1)	560003	196	193	19.4	164	85.5
P2342 EDF Bull Trail Wind	560024, 560025	300	296	128.6	250	131
P2232 ENGIE Buffalo Trail North Wind	560043	200	197	85.7	167	87.3
P2337 Dunmore Solar	560044	216	134	59.3	180	93.7
P2461 Aira Solar	560058	450	278	120.9	374	195.2
Cypress 2 (CYP2)	561003	46	45	19.4	38	20

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Generator Name	Generator Buses	Generator capacity (MW)	2028 SL HW Pre-Project (Scenario 1) & 2028 SL HW Post-Project (Scenario 3)		2028 SP HW Pre-Project (Scenario 2) & 2028 SP HW Post-Project (Scenario 4)	
			Dispatch at CSS (MW)	Current dispatch (MW)	Dispatch at CSS (MW)	Current dispatch (MW)
P2568 Aura Peace Butte Solar Battery	561144	230	142	61.8	191	99.8
P2593 AECG Forty Mile Wind Phase 2	562608	134	131	57	55	28.8
P2458 Capital Power Whitla MPC Solar	564992	88	54	23.6	73	38.2
P2137 Enerfin Winnifred MPC Wind & P2465 Enerfin Winnifred Wind Modification	567034	150	131	55.4	84	43.8
P2581 TransAlta Red Rock MPC Wind	567104	100	86	37.1	28	14.7
TOTAL (MW)			2910	1200	2298	1200

2.1.1 Scenario 1: 2028 Summer Light High Wind Pre-project**Category A Conditions***Thermal Criteria Violations*

Thermal criteria violations were observed under Category A conditions for the 2028 SL High Renewable Pre-Project study scenario as shown in Table 2-2. The generation effective factors result under the Category A conditions are provided in Table A7-1 of Attachment A7.

Table 2-2: Thermal Criteria Violation under Category A Conditions for Scenario 1

Details of Violation (Violation Observed On) ^a	Normal Rating (MVA)	Pre-Project Results	
		Observed Power Flow (MVA)	% Loading
770L (North Lethbridge 370S to Coaldale 254S)	120	155.59	129.66
172L (Taber 83S to 172EL Tap)	119	217.58	182.84
172L (Coaldale 254S to 172FL Tap)	119	158.18	132.93
172L (Coaldale 254S to 172EL Tap)	119	239.97	201.66
172L (North Lethbridge 370S to 172FL Tap)	119	187.43	157.50
607L (Fincastle 336S to 607AL Tap)	123	125.34	101.90

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610L (Fincastle 336S to Taber 83S)	175	184.35	105.35
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Notes:

^a It is worth noting that although the 924L and 927L lines lie outside the study area, efforts have been made to remove their congestion, aiming to facilitate N-1 analysis and base cases solution convergence.

To mitigate the observed thermal criteria violations, units in the following Table were dispatched down from the dispatches provided in the AESO's Study Scope for SL post-project study scenarios. The pre-project generation dispatches were set to be identical to post-project generation dispatches to create the same study environment. The curtailment details can be found in Table 2-3.

Following the above generator curtailments, no Reliability Criteria violations were observed under Category A conditions.

Table 2-3: Generation Curtailment Table Under Category A Conditions for Scenario 1&3

Generator Name	Generator Buses	Generator capacity (MW)	Scenario 1 2028 SL HW Pre-Project		Scenario 3 2028 SL HW Post-Project	
			Dispatch at CSS (MW)	Current dispatch (MW)	Dispatch at CSS (MW)	Current dispatch (MW)
Empress Solar Park (EMP1)	4366	22.5	10.5	3.5	10.5	3.5
Stirling Wind (SWP1)	61630	120.4	113	108	113	108
P2235 Pembina Empress Cogen	557066	46	45.8	6.3	45.8	6.3
P2418 Greencells Estuary Solar	562418	200	93.2	9.8	93.2	9.8
BRD1 Burdett (BRD1)	2269	12.6	6.2	0	6.2	0
Hull (HUL1)	2401	24.8	15.5	0	15.5	0
Suffield (SUF1)	3270	22	14.2	0	14.2	0
Clydesdale 1 (CLY1)	3286	41	25.4	0	25.4	0
P2537 Fortis Duchess 339S DER Solar	4250	19.8	9.2	0	9.2	0
Vauxhall (VXH1)	4274	22	13.6	0	13.6	0
P2466 PR Prominence Solar	4275	23.6	11	0	11	0
Clydesdale 2 (CLY2)	4286	34	21	0	21.0	0
Chappice Lake (CHP1)	4320	13.9	8.66	0	8.66	0
Enmax Taber (TAB1)	15343 16343	81.4	76.7	0	76.7	0

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Generator Name	Generator Buses	Generator capacity (MW)	Scenario 1 2028 SL HW Pre-Project		Scenario 3 2028 SL HW Post-Project	
			Dispatch at CSS (MW)	Current dispatch (MW)	Dispatch at CSS (MW)	Current dispatch (MW)
P2629 Taber Solar	17343	46	28.5	0	28.5	0
P1926 Solar Krafte Vauxhall	60441	60	37.1	0	37.1	0
P2218 ENGIE Duchess Solar	60870	90	42	0	42	0
Rattlesnake Ridge Wind (RTL1)	60873	117.6	103.2	0	103.2	0
Brooks Solar 1 (BRK1)	553256	12.5	6.1	0	6.1	0
Brooks Solar 2 (BRK2)	554257	14	6.5	0	6.5	0
Brooks Solar (BSC1)	553257	15	6.4	0	6.4	0
Conrad 1 (CRD1)	554291	23.4	14.5	0	14.5	0
Conrad 2 (CRD2)	553291	18	11.1	0	11.1	0
Hays (HYS1)	554401	23	14.2	0	14.2	0
COL1 Coaldale (COL1)	554692 554693	25.2	13	0	13	0
P2348 BluEarth Wheatcrest MPC Solar	557051	50	30.9	0	30.9	0
BUR1 Burdett (BUR1)	557269	20	13.3	0	13.3	0
Westfield Yellow Lake (WEF1)	557277	19	13	0	13	0
COD1 Coaldale (COD1)	557690	5.28	5	0	5	0
P1828 hep Energy Alderson MPC Solar	560111	100	61.9	0	61.9	0
Hilda Wind (HLD1)	567004	102.3	35.5	0	35.5	0
Total Renewable Generation (MW)		1425.2	906.1	127.7	906.1	127.7
Total Curtailment (MW)			778.4		778.4	

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Voltage Criteria Violations

No voltage criteria violations were observed under Category A conditions.

Category B Conditions

Thermal Criteria Violations

Thermal criteria violations were observed under certain Category B conditions as shown in Table 2-4.

Table 2-4: Thermal Criteria Violations under Category B Conditions for Scenario 1

Contingency (System Element Lost)	Violation Location Details	Thermal Ratings ^a (MVA)		Pre-Project Results	
		Normal Rating	Emergency Rating	Power Flow ^b (MVA)	% Loading ^c
770L (Coaldale 254S to North Lethbridge 370S)	172L (North Lethbridge 370S to 172FL Tap)	119	131	130.16	109.38%

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 Power flow (MVA) is current expressed as MVA (i.e., $S = \sqrt{3} \times V_{\text{base}} \times I_{\text{actual}}$)

^c Reported as a percentage of the power flow (in MVA, i.e., $S = \sqrt{3} \times V_{\text{base}} \times I_{\text{actual}}$) relative to the transmission line's Normal Rating (also in MVA), as shown in Attachment A1.

Voltage Criteria Violations

Voltage criteria violations were observed under certain Category B conditions as shown in Table 2-5.

Table 2-5: Voltage Criteria Violations under Category B Conditions for Scenario 1

Contingency (System Element Lost)	Violation Location Details		Voltage Ratings (kV)			Pre-Project Results	
	Substation Name and No.	Bus No.	Nominal Voltage	Emergency Minimum Voltage	Emergency Maximum Voltage	Initial Voltage (kV)	Post-contingency Steady State (kV)
Burdett 368S T1/T2	879AL Tap	875	138	124.20	151.80	143.89	152.19
Fincastle 336S T1/T2	Westfield 107S	277	138	124.20	151.80	141.57	151.89
	Burdett 368S	269	138	124.20	151.80	141.54	151.86
	879AL_TAP	875	138	124.20	151.80	143.89	152.05
172L/172EL (Coaldale 254S to Taber 83S/ Hillridge 139S)	Hull 257S	2400	138	124.20	151.80	138.88	134.71
	Fincastle 336S	31	138	124.20	151.80	139.56	134.17
	607AL Tap	828	138	124.20	151.80	139.46	134.06

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Contingency (System Element Lost)	Violation Location Details		Voltage Ratings (kV)			Pre-Project Results	
	Substation Name and No.	Bus No.	Nominal Voltage	Emergency Minimum Voltage	Emergency Maximum Voltage	Initial Voltage (kV)	Post- contingency Steady State (kV)
	Taber 83S	272	138	128	145	139.57	133.87
	Taber Wind Farm 134S	343	138	124.20	151.80	139.46	134.06
Stirling 67S 69/138 kV T2	Conard 135S	291	138	124.20	151.80	139.25	133.84
	Warner 344S	278	69	62.1	75.9	69.38	63.35
	Stirling 67S	280	69	62.1	75.9	70.24	64.30
820L/820AL (Stirling 67S to Chin Chute 315S/ Coaldale 254S)	Stirling 67S	280	69	62.1	75.9	70.24	63.98
	Stirling 67S	293	138	124.20	151.80	142.78	130.28
	Warner 344S	278	69	62.1	75.9	69.38	63.02

POD Bus Voltage Deviations

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

2.1.2 Scenario 2: 2028 Summer Peak High Wind Pre-project

Category A Conditions

Thermal Criteria Violations

Thermal criteria violations were observed under Category A conditions for the 2028 SP High Renewable Pre-Project study scenario, as shown in Table 2-6. The generation effective factors result under the Category A conditions are provided in Table A7-1 of Attachment A7.

Table 2-6: Thermal Criteria Violations under Category A Conditions for Scenario 2

Details of Violation (Violation Observed On) ^a	Normal Rating (MVA)	Pre-Project Results	
		Observed Power Flow (MVA)	% Loading
763L (Hull 257S to 763BL_Tap)	120	124.77	103.98
172L (Taber 83S to 172EL Tap)	119	211.95	178.11
172L (Coaldale 254S to 172EL Tap)	119	219.63	184.56
180L (Fort Macleod 15S to 180AL_Tap)	120	133.45	111.21
507L (Taber 83S to Hull 257S)	120	132.09	110.07

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225L (Glenwood 229S to Spring Coulee 385S)	22	23.20	105.45
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Notes:

^a It is worth noting that although the 924L and 927L lines lie outside the study area, efforts have been made to remove their congestion, aiming to facilitate N-1 analysis and base cases solution convergence.

To mitigate the observed thermal criteria violations, units in Table 2-7 were dispatched down from the dispatches provided in the AESO's Study Scope for SP post-project study scenarios. Following the generator curtailments, no Reliability Criteria violations were observed under Category A conditions.

Table 2-7: Generation Curtailment Table Under Category A Conditions for Scenario 2&4

Generator Name	Generator Buses	Generator capacity (MW)	Scenario 2 2028 SP HW Pre-Project		Scenario 4 2028 SP HW Post-Project	
			Dispatch at CSS (MW)	Current dispatch (MW)	Dispatch at CSS (MW)	Current dispatch (MW)
P2247 Buffalo Plains MPC Wind	560041 560042	476.6	277.4	140	277.4	140
Hilda Wind (HLD1)	567004	102.3	70	27.1	70	27.1
BRD1 Burdett (BRD1)	2269	12.6	6	0	6	0
Hull (HUL1)	2401	24.8	20.8	0	20.8	0
Suffield (SUF1)	3270	22	19.1	0	19.1	0
Clydesdale 1 (CLY1)	3286	41	34.1	0	34.1	0
P2446 Fortis Tilley 498S DER Solar	4275	23.6	5.5	0	5.5	0
Clydesdale 2 (CLY2)	4286	34	28.2	0	28.2	0
Enmax Taber (TAB1)	15343 16343	81.4	32.4	0	32.4	0
P2629 Taber Solar	17343	46	38.2	0	38.2	0
Conrad 2 (CRD2)	553291	18	15	0	15	0
Conrad 1 (CRD1)	554291	23.4	19.5	0	19.5	0
Hays (HYS1)	554401	23	19.1	0	19.1	0
P2348 BluEarth Wheatcrest MPC Solar	557051	50	41.6	0	41.6	0
P1828 hep Energy Alderson MPC Solar	560111	100	83.1	0	83.1	0

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Generator Name	Generator Buses	Generator capacity (MW)	Scenario 2 2028 SP HW Pre-Project		Scenario 4 2028 SP HW Post-Project	
			Dispatch at CSS (MW)	Current dispatch (MW)	Dispatch at CSS (MW)	Current dispatch (MW)
Westfield Yellow Lake (WEF1)	557277	19	1.3	0	1.3	0
BUR1 Burdett (BUR1)	557269	20	1.4	0	1.4	0
Rattlesnake Ridge Wind (RTL1)	60873	117.6	48.9	0	48.9	0
P1926 Solar Krafte Vauxhall	60441	60	49.9	36	49.9	36
Total Renewable Generation:		1295.3	811.5	203.1	811.5	203.1
Total Curtailment:			608.4		608.4	

Voltage Criteria Violations

No voltage criteria violations were observed under Category A conditions.

Category B Conditions

Thermal Criteria Violations

Thermal criteria violations were observed under certain Category B conditions as shown in Table 2-8.

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

Contingency (System Element Lost)	Violation Location Details	Thermal Ratings ^a (MVA)		Pre-Project Results	
		Normal Rating	Emergency Rating	Power Flow ^b (MVA)	% Loading ^c
1041L (North Lethbridge 370S to Travers 554S)	180L (Fort Macleod 15S to 180AL Tap)	120	132	120.32	100.27%
463L (Fort Macleod 15S to Monarch 492S/Chinook 181S)	725L (Bowron 674S to 725BL Tap)	118	130	118.06	100.05%
Bowron 674S T1/T2	463L (Fort Macleod 15S to Monarch Tap)	107	118	119.96	112.12%
1005L (Picture Butte 120S to Travers 554S)	180L (Fort Macleod 15S to 180AL Tap)	120	132	122.76	102.30%

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.

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^b Power flow (MVA) is current expressed as MVA (i.e., $S = \sqrt{3} \times V_{\text{base}} \times I_{\text{actual}}$)

^c Reported as a percentage of the power flow (in MVA, i.e., $S = \sqrt{3} \times V_{\text{base}} \times I_{\text{actual}}$) relative to the transmission line's Normal Rating (also in MVA), as shown in Attachment A1.

Voltage Criteria Violations

Voltage criteria violations were observed under certain Category B conditions as shown in Table 2-9.

Table 2-9: Voltage Criteria Violations under Category B Conditions for Scenario 2

Contingency (System Element Lost)	Violation Location Details		Voltage Ratings (kV)			Pre-Project Results	
	Substation Name and No.	Bus No.	Nominal Voltage	Emergency Minimum Voltage	Emergency Maximum Voltage	Initial Voltage (kV)	Post- contingency Steady State (kV)
Stirling 67S T2	Stirling 67S	280	69.00	62.1	75.9	69.38	61.33
	Warner 344S	278	69.00	62.1	75.9	67.59	59.25
820L (Stirling 67S to Chin Chute 315S/ Coaldale 254S)	Stirling 67S	293	138.00	124.2	151.8	142.08	122.93
	Warner 344S	278	69.00	62.1	75.9	67.59	59.00
	Stirling 67S	280	69.00	62.1	75.9	69.38	61.08
Burdett 368S 25/138 kV T1/T2	879AL TAP	875	138.00	124.20	151.80	141.57	145.20
Fincastle 336S 25/138 kV T1/T2	Westfield 107S	277	138.00	124.20	151.80	140.54	148.85
	Burdett 368S	269	138.00	124.20	151.80	140.86	149.15
	879AL Tap	875	138.00	124.20	151.80	141.57	148.27
172L (Chinook 181S to North Lethbridge 370S)	Monarch Tap	916	138.00	124.20	151.80	139.05	135.05
	Chinook 181S	367	138.00	124.20	151.80	139.38	135.01
	Monarch 492S	400	138.00	124.20	151.80	138.31	134.29
725L/725AL (Riverbend 618S to Coalbank 111S/ Brown 674S)	Bowron 674S	698	138.00	124.20	151.80	138.95	134.36

POD Bus Voltage Deviations

Voltage deviations beyond the limits listed in Table 3-1 of Attachment A1 (hereafter referred to as point of delivery (POD) bus voltage deviations) were observed under certain Category B conditions as shown in Table 2-10.

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Table 2-10: POD Bus Voltage Deviations under Category B Conditions for Scenario 2

Contingency (System Element Lost)	Voltage Deviation Location Details			Pre-Project Results						
	Substation Name and No.	Bus No.	Nominal Bus Voltage (kV)	Initial Voltage (kV)	Voltage Deviations at POD Low Voltage Buses					
					Post Transient (kV)	% Change	Post Auto Control (kV)	% Change	Post Manual (kV)	% Change
Stirling 67S T2	Stirling 67S	4280	25	23.60	21.04	- 10.22%	19	-19.49	19	-19.49
	Warner 344S	4278	25	26.11	23.26	- 11.39%	-	-	-	-
820L(Stirling 67S to Chin Chute 315S/ Coaldale 254S)	Warner 344S	4278	25	23.60	20.52	- 12.29%	-	-	-	-
	Stirling 67S	4280	25	26.11	22.69	- 13.71%	18.9	-27.61	18.84	-27.84

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 3: 2028 Summer Light High Wind Post-Project

Category A Conditions

Thermal Criteria Violations

Thermal criteria violations were observed under Category A conditions for the 2028 SL High Renewable Post-Project study scenario. The generation effective factors result under the Category A conditions are provided in Table A7-1 of Attachment A7.

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

Details of Violation (Violation Observed On)	Normal Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
		Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
770L (North Lethbridge 370S to Coaldale 254S)	120	155.59	129.66	184.44	153.70	24.04
172L (Taber 83S to 172EL_Tap)	119	217.58	182.84	188.72	158.59	-24.25
172L (Coaldale 254S to 172FL_Tap)	119	158.18	132.93	190.58	160.15	27.23
607L (Fincastle 336S to 607AL Tap)	123	125.34	101.90	125.51	102.04	0.14
610L (Fincastle 336S to Taber 83S)	175	184.35	105.35	176.61	100.92	-4.43
172L (Coaldale 254S to 172EL_Tap)	119	239.97	201.66	303.04	254.66	53.00
172L (North Lethbridge 370S to 172FL_Tap)	119	187.43	157.50	219.82	184.72	27.22
225L (Magrath 225S to Raymond Reservoir 313S Tap)	25	23.02	92.06	25.50	102.00	9.94
225L (Stirling 67S to Raymond Reservoir Tap)	25	23.28	93.13	25.66	102.66	9.53

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It can be observed from Table 3-1, the connection of Project materially increases¹ the violation on 770L (North Lethbridge 370S to Coaldale 254S), 172L (Coaldale 254S to 172FL Tap), 172L (Coaldale 254S to 172EL_Tap), and 172L (North Lethbridge 370S to 172FL Tap), materially decreases the violation on 172L (Taber 83S to 172EL_Tap) and 610L (Fincastle 336S to Taber 83S), and creates new violations on 225L (Magrath 225S to Raymond Reservoir 313S Tap) and 225L (Stirling 67S to Raymond Reservoir Tap).

To mitigate the observed thermal criteria violations, units in Table 2-3 were dispatched down from the dispatches provided in the AESO's Study Scope for SL pre-project and post-project study scenarios. The pre-project generation dispatches were set to be identical to post-project generation dispatches to create the same study environment. Following the generator curtailments in Table 2-3, no Reliability Criteria violations were observed under Category A conditions.

Voltage Criteria Violations

No voltage criteria violations were observed under Category A conditions.

Category B Conditions

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

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

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
Red Coat 967S T1	172L (Coaldale 254S to 172EL Tap)	119	131	66.09	55.53%	131.70	110.67%	55.14%
1041L (North Lethbridge 370S to Travers 554S)	172L (Coaldale 254S to 172EL Tap)	119	131	64.72	54.39%	129.28	108.64%	54.25%
	172L (North Lethbridge 370S to 172FL Tap)	119	131	91.79	77.14%	124.97	105.02%	27.88%
161AL_Tap (Vulcan 255S to Queenstown 504S/Enterprise)	172L (North Lethbridge 370S to 172FL Tap)	119	131	86.07	72.33%	119.35	100.29%	27.97%
Stirling 67S T2	172L (North Lethbridge 370S to 540047)	119	131	92.61	77.83%	127.25	106.93%	29.11%

¹ Materially increased (or materially decreased) refers to a percent loading/voltage difference (post-Project percent loading/voltage minus pre-Project percent loading/voltage) above or equal to 3% (or below or equal to -3%)

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Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
225L/225AL (Stirling 67S to Raymond Reservoir 313S/ Magrath 225S)	172L (North Lethbridge 370S to 172FL Tap)	119	131	89.39	75.11%	123.96	104.17%	29.05%
820L/820AL (Stirling 67S to Chin Chute 315S/ Coaldale 254S)	172L (Coaldale 254S to 172EL Tap)	119	131	64.76	54.42%	130.16	109.37%	54.95%
Fincastle 336S T1/T2	172L (North Lethbridge 370S to 172FL Tap)	119	131	87.72	73.71%	123.42	103.71%	30.00%
	172L (Coaldale 254S to 172EL Tap)	119	131	55.90	46.97%	125.85	105.76%	58.79%
610L (Taber 83S to Fincastle 336S)	172L (North Lethbridge 370S to 172FL Tap)	119	131	86.80	72.94%	122.50	102.95%	30.00%
	172L (Coaldale 254S to 172EL Tap)	119	131	54.14	45.50%	124.02	104.22%	58.72%
1005L (Picture Butte 120S to Travers 554S)	172L (Coaldale 254S to 172EL Tap)	119	131	69.30	58.24%	134.16	112.74%	54.50%
	172L (North Lethbridge 370S to 172FL Tap)	119	131	93.97	78.97%	127.33	107.00%	28.03%
1005L (Travers 554S to Milo 356S)	172L (Coaldale 254S to 172EL Tap)	119	131	65.70	55.21%	134.58	113.09%	57.89%
	172L (North Lethbridge 370S to 172FL Tap)	119	131	92.42	77.66%	127.64	107.26%	29.60%
Coaldale 254S T2	172L (North Lethbridge 370S to 172FL Tap)	119	131	86.12	72.37%	119.69	100.58%	28.22%
172L (North Lethbridge 370S to Coaldale 254S)	770L (Coaldale 254S to North Lethbridge 370S)	120	132	104.18	86.81%	158.96	132.46%	45.65%
770L (Coaldale 254S to North Lethbridge 370S)	172L (Coaldale 254S to 172FL Tap)	119	131	101.27	85.10%	156.83	131.79%	46.69
	172L (North Lethbridge 370S to 172FL Tap)	119	131	130.16	109.38%	186.78	156.96%	47.58%
1036L (Milo 356S to Travers 554S)	172L (Coaldale 254S to 172EL Tap)	119	131	65.70	55.21%	129.96	109.21%	54.00%
	172L (North Lethbridge 370S to 172FL Tap)	119	131	92.42	77.66%	125.48	105.44%	27.78%

Voltage Criteria Violations

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

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Table 3-3: Voltage Criteria Violations under Category B Conditions for the Scenario 3

Contingency (System Element Lost)	Details of Violation (Violation Observed On)		Voltage Ratings (kV)				Pre-Project Results		Post-Project Results	% Voltage Difference
	Substation Name and Number	Bus No.	Nomina l Voltage	Emergenc y Minimum Voltage	Emergency Maximum Voltage	Initial Voltag e (kV)	Post- continge ncy Steady State (kV)	Initial Voltage (kV)	Post- contingency Steady State (kV)	
Burdett 368S T1/T2	879AL Tap	875	138	124.2	151.8	143.89	152.19	144.04	152.09	-0.068450
Fincastle 336S T1/T2	879AL Tap	875	138	124.2	151.8	143.89	152.05	144.04	151.93	-0.084686
	Burdett 368S	269	138	124.2	151.8	141.54	151.86	141.71	151.74	-0.084698
	Westfield 107S	277	138	124.2	151.8	141.57	151.89	141.74	151.77	-0.084257
Vauxhall 158S 138/25 kV T	879AL Tap	875	138	124.2	151.8	144.04	144.81	143.89	145.00	0.143237
172L/172EL (Coaldale 254S to Taber 83S/ Hillridge 139S)	Fincastle 336S	31	138	124.2	151.8	139.56	134.17	139.75	134.17	0.000083
	Conard 135S	291	138	124.2	151.8	139.25	133.84	139.44	133.84	0.000077
	Taber Wind Farm 134S	343	138	124.2	151.8	139.46	134.06	139.65	134.06	0.000083
	607AL Tap	828	138	128	145	139.46	134.06	139.04	134.71	0.000083
	Hull 257S	240 0	138	124.2	151.8	138.88	134.71	139.65	134.06	0.000083
	Taber 83S	272	138	128	145	139.57	133.87	139.71	133.87	0.000083
Stirling 67S 69/138 kV T2	Warner 344S	278	69	62.1	75.9	69.38	63.35	69.29	63.01	-0.496739
	Stirling 67S	280	69	62.1	75.9	70.24	64.30	70.16	63.97	-0.488311
820L/820AL (Stirling 67S to Chin Chute 315S/ Coaldale 254S)	Stirling 67S	293	138	124.2	151.8	142.78	130.28	142.43	131.11	0.600046
	Stirling 67S	280	69	62.1	75.9	70.24	63.98	70.16	64.38	0.589311
	Warner 344S	278	69	62.1	75.9	69.38	63.02	69.29	63.43	0.599468

POD Bus Voltage Deviations

No POD bus voltage deviations were observed.

3.1.2 Scenario 4: 2028 Summer Peak High Wind Post-Project

Category A Conditions

Thermal Criteria Violations

Thermal criteria violations were observed under the Category A conditions for the 2028 SP High Renewable Post-Project study scenario. The generation effective factors result under the Category A conditions are provided in Table A7-1 of Attachment A7.

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

Details of Violation (Violation Observed On)	Normal Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
		Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
763L (Hull 257S to 763BL_Tap)	120	124.77	103.98	124.67	103.90	-0.08
172L (Taber 83S to 172EL_Tap)	119	211.95	178.11	211.87	178.05	-0.06
180L (Fort Macleod 15S to 180AL_Tap)	120	133.45	111.21	133.07	110.89	-0.32
172L (Coaldale 254S to 172EL_Tap)	119	219.63	184.56	220.42	185.23	0.67
507L (Taber 83S to Hull 257S)	120	132.09	110.07	131.99	109.99	-0.08
225L (Glenwood 229S to Spring Coulee 385S)	22	23.20	105.45	23.49	106.76	1.31

It can be observed from Table 3-4, the connection of Project does materially increase or decrease the observed violations. Also, it does not create any new violations.

To mitigate the observed thermal criteria violations, units in Table 2-7 were dispatched down from the dispatches provided in the AESO's Study Scope for SP post-project study scenarios. Following the generator curtailments in Table 2-7, no Reliability Criteria violations were observed under Category A conditions.

Voltage Criteria Violations

No voltage criteria violations were observed under Category A conditions.

Category B Conditions

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

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Table 3-5: Thermal Criteria Violations under Category B Conditions for Scenario 4

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
940L (North Lethbridge 370S to Picture Butte 120S)	172L (Coaldale 254S to 172EL Tap)	119	131	59.79	50.25%	125.08	105.11%	54.87%
1041L (North Lethbridge 370S to Travers 554S)	180L (Fort Macleod 15S to 180AL Tap)	120	132	120.32	100.27%	117.66	98.05%	-2.22%
	172L (Coaldale 254S to 172EL Tap)	119	131	70.18	58.98%	135.77	114.09%	55.11%
463L (Fort Macleod 15S to Monarch 492S/Chinook 181S)	725L(Bowron 674S to 725BL Tap)	118	130	118.06	100.05%	115.92	98.23%	-1.82%
180L(Fort MacLeod 15S to East Stavely 28S/Granum 604S)	172L (Coaldale 254S to 172EL Tap)	119	131	65.99	55.45%	131.89	110.83%	55.38%
Bowron 674S T1/T2	463L (Fort Macleod 15S to Monarch Tap)	107	118	119.96	112.12%	117.65	109.95%	-2.16%
Taber 83S T1	172L (Coaldale 254S to 172EL Tap)	119	131	59.00	49.58%	125.08	105.11%	55.53%
Taber 83S T3	172L (Coaldale 254S to 172EL Tap)	119	131	59.02	49.60%	125.11	105.14%	55.54%
610L (Taber 83S to Fincastle 336S)	172L (Coaldale 254S to 172EL Tap)	119	131	58.53	49.18%	128.99	108.39%	59.21%
Fincastle 336S T1/T2	172L (Coaldale 254S to 172EL Tap)	119	131	61.36	51.56%	131.85	110.80%	59.23%
607L/607AL (Fincastle 336S to Conard 135S/ Taber Wind Farm 134S)	172L (Coaldale 254S to 172EL Tap)	119	131	54.65	45.92%	120.99	101.67%	55.75%
1005L (Picture Butte 120S to Travers 554S)	180L (Fort Macleod 15S to 180AL Tap)	120	132	122.76	102.30%	120.16	100.13%	-2.17%
	172L (Coaldale 254S to 172EL Tap)	119	131	77.40	65.04%	143.19	120.32%	55.28%
725BL (MacBride Lake 640S to Fort Macleod/ Bowron 674S)	172L (Coaldale 254S to 172EL Tap)	107	118	48.87	45.67%	108.52	101.42%	55.75%
Granum 604S T2	172L (Coaldale 254S to 172EL Tap)	119	131	54.57	45.85%	119.94	100.79%	54.94%

Voltage Criteria Violations

Voltage criteria violations were observed under certain Category B conditions as shown in Table 3-6.

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Table 3-6: Voltage Criteria Violations under Category B Conditions for the Scenario 4

Contingency (System Element Lost)	Details of Violation (Violation Observed On)		Voltage Ratings (kV)			Pre-Project Results		Post-Project Results		% Voltage Difference
	Substation Name and Number	Bus No.	Nominal Voltage	Emergency Minimum Voltage	Emergency Maximum Voltage	Initial Voltage (kV)	Post-contingency Steady State (kV)	Initial Voltage (kV)	Post-contingency Steady State (kV)	
Stirling 67S T2	Stirling 67S	280	69	62.1	75.9	69.38	61.33	69.42	60.96	-0.529543
	Warner 344S	278	69	62.1	75.9	67.59	59.25	67.63	58.88	-0.541278
820L/820AL (Stirling 67S to Chin Chute 315S/ Coaldale 254S)	Stirling 67S	293	138	124.2	151.8	142.08	122.93	141.92	122.18	-0.544548
	Warner 344S	278	69	62.1	75.9	67.59	59.00	67.63	58.61	-0.563687
	Stirling 67S	280	69	62.1	75.9	69.38	61.08	69.42	60.71	-0.542337
Burdett 368S 25/138 kV T1/T2	879AL TAP	875	138	124.2	151.8	141.57	145.20	142.22	145.16	-0.028908
Fincastle 336S 25/138 kV T1/T2	Westfield 107S	277	138	124.2	151.8	140.54	148.85	141.21	148.78	-0.050724
	Burdett 368S	269	138	124.2	151.8	140.86	149.15	141.53	149.08	-0.050581
	879AL Tap	875	138	124.2	151.8	141.57	148.27	142.22	148.21	-0.047410
172L (Chinook 181S to North Lethbridge 370S)	Monarch Tap	916	138	124.2	151.8	139.05	135.05	138.30	134.68	-0.265703
	Chinook 181S	367	138	124.2	151.8	139.38	135.01	138.60	134.64	-0.266662
	Monarch 492S	400	138	124.2	151.8	138.31	134.29	137.56	133.91	-0.271571
725L/725AL (Riverbend 618S to Coalbank 111S/ Brown 674S)	Bowron 674S	698	138	124.2	151.8	138.95	134.36	138.18	133.92	-0.313002
207L (Coalbank 111S to North Lethbridge 370S)	Coalbank 111S	679	138	124.2	151.8	142.09	135.57	138.48	134.81	-0.551552

POD Bus Voltage Deviations

Several POD bus voltage deviations were observed under certain Category B conditions as shown in Table 3-7.

Table 3-7: Voltage Deviations at POD Low Voltage Busses under Category B Conditions for the Scenario 4

Contingency (System Element Lost)	Voltage Deviation Location Details			Pre-Project Results						
	Substation Name and No.	Bus No.	Nominal Bus Voltage (kV)	Initial Voltage (kV)	Voltage Deviations at POD Low Voltage Buses					
					Post Transient (kV)	% Change	Post Auto Control (kV)	% Change	Post Manual (kV)	% Change

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Contingency (System Element Lost)	Voltage Deviation Location Details			Pre-Project Results						
	Substation Name and No.	Bus No.	Nominal Bus Voltage (kV)	Initial Voltage (kV)	Voltage Deviations at POD Low Voltage Buses					
					Post Transient (kV)	% Change	Post Auto Control (kV)	% Change	Post Manual (kV)	% Change
Stirling 67S T2	Stirling 67S	4280	25	23.61	20.48	- 10.22%	18.85	-20.13	18.85	-20.13
	Warner 344S	4278	25	26.13	22.64	- 11.39%	24.13	-7.58	24.13	-7.58
820L/820AL (Stirling 67S to Chin Chute 315S/ Coaldale 254S)	Warner 344S	4278	25	26.13	22.53	- 12.29%	-	-	-	-
	Stirling 67S	4280	25	23.61	20.38	- 13.71%	18.76	-28.15	18.76	-28.15

3.2 Transient Stability Studies

Transient stability studies were completed for Scenario 3: 2028 SL HR post-project and Scenario 4: 2028 SP HR post-project.

The results did not indicate any transient stability concerns, and the system showed acceptable dynamic response to all Category B conditions studied, as shown in Table 3-8. 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 3-8: Transient Stability Study Results under Category B Conditions for Scenarios 3 & 4

Studied Contingency	Fault Description and Location	Results
172L/172EL (Coaldale 254S to Taber 83S)	Coaldale 254S	Stable
	Taber 83S	Stable
	Hillridge 139S	Stable
820L/820AL (Coaldale 254S to Stirling 67S)	Coaldale 254S	Stable
	Stirling 67S	Stable
	Chin Chute 315S	Stable
610L (Taber 83S to Fincastle 336S)	Taber 83S	Stable
	Fincastle 336S	Stable
607L/607AL (Fincastle 336S to Conrad 135S)	Conrad 135S	Stable
	Fincastle 336S	Stable
	Taber Wind Farm 134S	Stable

4 Short Circuit Studies

4.1 Pre-Project Results

Pre-Project short-circuit current levels are provided in Table 4-1¹.

Table 4-1: Pre-Project Short-Circuit Current Levels for Scenario 2

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)
Stirling 67S	69	69.2	3.129	0.1027381+0.2585759j	2.726	0.0933434+0.3909569j
Stirling 67S	138	141.6	2.47	0.0739638+0.1646204j	2.007	0.0808516+0.2937667j
Chin Chute 315S	138	141.7	2.527	0.0709666+0.1617878j	2.104	0.058762+0.2777322j
Coaldale 254S	138	139.2	8.128	0.018896+0.0506069j	7.875	0.0143279+0.0546086j
North Lethbridge 370S	138	139.8	12.961	0.0080152+0.0328528j	12.273	0.0081497+0.036396j
North Lethbridge 370S	240	248.8	11.125	0.0048103+0.0226558j	9.562	0.0075219+0.0329173j
Hillridge 139S	138	140.1	3.648	0.0469559+0.1125368j	3.062	0.0632347+0.1786966j
Taber 83S	138	137.9	5.557	0.0350424+0.0716886j	4.545	0.0337243+0.1276869j

4.2 Post-Project Results

4.2.1 Scenario 4: 2028 SP HW Post-Project

Post-Project short-circuit current levels for Scenario 5 are provided in Table 4-2.

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

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)
Stirling 67S	69	69.4	3.143	0.102753+0.2587378j	2.741	0.0931699+0.3904074j
Stirling 67S	138	141.9	2.478	0.0740153+0.1647256j	2.016	0.0806733+0.2930299j
Chin Chute 315S	138	142.1	2.536	0.071019+0.1618852j	2.115	0.058613+0.2768616j

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.

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Coaldale 254S	138	139.7	8.159	0.0189502+0.0506998j	8.05	0.0135061+0.0518138j
North Lethbridge 370S	138	139.4	12.928	0.008034+0.0328774j	12.253	0.0081368+0.0363213j
North Lethbridge 370S	240	248.5	11.106	0.0048208+0.0226682j	9.552	0.0075128+0.0328815j
Hillridge 139S	138	144.0	3.749	0.0473476+0.1129847j	3.83	0.0291972+0.1089037j
Taber 83S	138	139.2	5.61	0.035107+0.0718871j	4.691	0.0319983+0.1217832j
P2490 Collector Substation	138	146.5	2.845	0.0649407+0.1509132j	3.294	0.0104799+0.0972378j

4.2.2 Scenario 5: 2033 SP HW Post-Project

Post-Project short-circuit current levels for Scenario 5 are provided in Table 4-3.

Table 4-3: Post-Project Short-Circuit Current Levels for Scenario 5

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)
Stirling 67S	69	69.5	3.422	0.0927192+0.2352312j	2.797	0.0997799+0.4093634j
Stirling 67S	138	137.2	2.635	0.0623606+0.1499143j	2.06	0.0794189+0.2876958j
Chin Chute 315S	138	138.5	2.717	0.0590211+0.1477266j	2.167	0.058322+0.275068j
Coaldale 254S	138	138.1	8.529	0.0168901+0.0477676j	8.359	0.0130438+0.0508919j
North Lethbridge 370S	138	138.9	13.418	0.0077123+0.031398j	12.614	0.0081593+0.0363499j
North Lethbridge 370S	240	248.3	11.433	0.0044748+0.0219814j	9.715	0.0075545+0.0330233j
Hillridge 139S	138	140.2	3.739	0.0440843+0.1093188j	3.814	0.0284457+0.106112j
Taber 83S	138	137.6	6.086	0.0279264+0.0657394j	4.99	0.0277129+0.1135194j
P2490 Collector Substation	138	141.6	2.79	0.0616883+0.1472637j	3.268	0.0092336+0.0905672j

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.

As part of this Project, mitigation measures will not be specifically developed for the POD bus voltage deviations observed under certain Category B conditions during pre-Project and post-Project scenarios.²

5.1 Pre-Project

Pre-Project mitigation measures are summarized in Table 5-1.

Table 5-1: Pre-Project Mitigation Measures

Mitigation Measure	Location of Observed Violation	Contingency
Modified Planned RAS 219 ^a	172L (North Lethbridge 370S to 172FL Tap)	770L (Coaldale 254S to North Lethbridge 370S)
RAS 43 ^b	Stirling 67S (69kV) ^c	Stirling 67S 69/138 kV T2
Real time operational practices (RTOP)	180L (Fort Macleod 15S to 180AL Tap)	1041L (North Lethbridge 370S to Travers 554S)
	725L (Bowron 674S to 725BL Tap)	463L/463AL (Fort Macleod 15S to Monarch 492S/Chinook 181S)
	463L (Fort Macleod 15S to Monarch Tap)	Bowron 674S T1/T2
	180L (Fort Macleod 15S to 180AL Tap)	1005L (Picture Butte 120S to Travers 554S)
	879AL_TAP (138kV)	Burdett 368S T1/T2
	Westfield 107S (138kV)	Fincastle 336S T1/T2
	Burdett 368S (138kV)	
	879AL_TAP (138kV)	
	Hull 257S (138kV)	172L/172EL (Coaldale 254S to Taber 83S/ Hillridge 139S)
	Fincastle 336S(138kV)	
	607AL Tap (138kV)	
	Taber 83S (138kV)	
	Taber Wind Farm 134S (138kV)	
	Conrad 135S (138kV)	172L (Chinook 181S to North Lethbridge 370S)
	463AL Tap (138kV)	
	Chinook 181S (138kV)	
	Monarch 492S (138kV)	

² 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.

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	Bowron 674S (138kV)	725L/725AL (Riverbend 618S to Coalbank 111S/ Brown 674S)
RAS 43, RTOP	Stirling 67S (69kV)	820L/820AL (Stirling 67S to Chin Chute 315S/ Coaldale 254S)
	Stirling 67S (138kV)	
	Stirling 67S (69kV) ^d	Stirling 67S 69/138 kV T2

Notes:

^a Planned RAS 219 is proposed for 172L/770L North Lethbridge to Coaldale Overload Mitigation. This RAS trips Stirling Wind (SWP1) and P2629.

^b Existing RAS 43 is to mitigate low voltage in Stirling 67s by tripping 508L and isolating Warner 344s load.

^c Scenario 1: 2028 SL HW Pre-project

^d Scenario 2: 2028 SP HW Pre-project

5.2 Post-Project

Post-Project mitigation measures are summarized in Table 5-2.

Table 5-2: Post-Project Mitigation Measures

Mitigation Measure	Location of Observed Violation	Contingency
Modified Planned 219 ^a	770L (Coaldale 254S to North Lethbridge 370S)	172L (North Lethbridge 370S to Coaldale 254S)
	172L (Coaldale 254S to 172FL Tap)	770L (Coaldale 254S to North Lethbridge 370S)
	172L (North Lethbridge 370S to 172FL Tap)	
Modified RAS 168 Logic #2 ^b	172L (Coaldale 254S to 172EL Tap)	Red Coat 967S T1
	172L (Coaldale 254S to 172EL Tap)	1041L (North Lethbridge 370S to Travers 554S)
	172L (Coaldale 254S to 172EL Tap)	820L/820AL (Stirling 67S to Chin Chute 315S/ Coaldale 254S)
	172L (Coaldale 254S to 172EL Tap)	Fincastle 336S T1/T2
	172L (Coaldale 254S to 172EL Tap)	610L (Taber 83S to Fincastle 336S)
	172L (Coaldale 254S to 172EL Tap)	1005L (Picture Butte 120S to Travers 554S)
	172L (Coaldale 254S to 172EL Tap)	1005L (Travers 554S to Milo 356S)
	172L (Coaldale 254S to 172EL Tap)	1036L (Milo 356S to Travers 554S)
	172L (Coaldale 254S to 172EL Tap)	940L (North Lethbridge 370S to Picture Butte 120S)
	172L (Coaldale 254S to 172EL Tap)	180L (Fort MacLeod 15S to East Stavely 28S/ Granum 604S)
	172L (Coaldale 254S to 172EL Tap)	Taber 83S T1
	172L (Coaldale 254S to 172EL Tap)	Taber 83S T3
	172L (Coaldale 254S to 172EL Tap)	607L/607AL (Fincastle 336S to Conard 135S/ Taber Wind Farm 134S)

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	172L (Coaldale 254S to 172EL Tap)	725BL (MacBride Lake 640S to Fort Macleod/ Bowron 674S)
	172L (Coaldale 254S to 172EL Tap)	Granum 604S T2
RAS 43°	Stirling 67S (69kV)	820L/820AL (Stirling 67S to Chin Chute 315S/ Coaldale 254S)
	Warner 344S (69kV)	Stirling 67S 69/138 kV T2
		820L/820AL (Stirling 67S to Chin Chute 315S/ Coaldale 254S)
Real time operational practices (RTOP)	172L (North Lethbridge 370S to 172FL Tap)	1041L (North Lethbridge 370S to Travers 554S)
	172L (North Lethbridge 370S to 172FL Tap)	161AL_Tap (Vulcan 255S to Queenstown 504S/Enterprise)
	172L (North Lethbridge 370S to 172FL Tap)	STIRLING 67S T2
	172L (North Lethbridge 370S to 172FL Tap)	225L225AL (Stirling 67S to Raymond Reservoir 313S/ Magrath 225S)
	172L (North Lethbridge 370S to 172FL Tap)	Fincastle 336S T1/T2
	879AL_TAP (138kV)	
	172L (North Lethbridge 370S to 172FL Tap)	610L (Taber 83S to Fincastle 336S)
	172L (North Lethbridge 370S to 172FL Tap)	1005L (Picture Butte 120S to Travers 554S)
	172L (North Lethbridge 370S to 172FL Tap)	1005L (Travers 554S to Milo 356S)
	172L (North Lethbridge 370S to 172FL Tap)	Coaldale 254S T2
	172L (North Lethbridge 370S to 172FL Tap)	1036L (Milo 356S to Travers 554S)
	463L (Fort Macleod 15S to Monarch Tap)	Bowron 674S T1/T2
	180L (Fort MacLeod 15S to 180AL Tap)	1005L (Picture Butte 120S to Travers 554S)
	879AL_TAP (138kV)	Burdett 368S T1/T2
	Hull 257S (138kV)	172L/172EL (Coaldale 254S to Taber 83S/ Hillridge 139S)
	Fincastle 336S(138kV)	
	607AL Tap (138kV)	
	Taber 83S (138kV)	

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	Taber Wind Farm 134S (138kV)	
	Conrad 135S (138kV)	
	Burdett 368S (138kV)	
	Westfield 107S (138kV)	Fincastle 336S 25/138 kV T1/T2
	879AL TAP (138kV)	
	879AL TAP (138kV)	
	463AL Tap (138kV)	Vauxhall 158S 138/25 kV T
	Chinook 181S (138kV)	
	Monarch 492S (138kV)	
	Bowron 674S (138kV)	172L (Chinook 181S to North Lethbridge 370S)
RAS 43, RTOP	Stirling 67S (69kV)	820L/820AL (Stirling 67S to Chin Chute 315S/ Coaldale 254S)
	Stirling 67S (138kV)	
	Stirling 67S (69kV)	Stirling 67S 69/138 kV T2

Notes:

^a Modified Planned RAS 219 refers to adding P2490 (the project), to the logic of the Planned RAS 219 which when there is overload in 172L/770L North Lethbridge to Coaldale Overload, it trips P2490 (the project), P2629, and Stirling Wind (SWP1).

^b Modified Planned RAS 168 Logic #2 – Logic overload on 172L at the Coaldale 254S refers adding P2490 (the project) to the logic of the Planned RAS 168 when 172L is overloaded it trips P2490 (the project).

^c Existing RAS 43 is a RAS to mitigates low voltage in Stirling 67S by tripping 508L and isolating Warner 344s load.

5.3 Evaluation of Mitigation Measures

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

The post-mitigation measures studies were performed under Category B conditions for the post-project scenarios using Alternative 1 and the RASs described in the previous section.

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 3: 2028 Summer Light High Wind Post-project

Category B Conditions

Thermal and voltage criteria violations observed under certain Category B conditions in the post-Project studies were mitigated by RASs as shown in Table 5-3 and Table 5-4.

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

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	
				Power Flow (MVA)	% Loading	Power Flow (MVA)	% Loading
Red Coat 967S T1	172L (Coaldale 254S to 172EL Tap)	119	131	131.70	110.67%	69.16	58.12%
1041L (North Lethbridge 370S to Travers 554S)	172L (Coaldale 254S to 172EL Tap)	119	131	129.28	108.64%	63.54	53.40%
820L/820AL (Stirling 67S to Chin Chute 315S/ Coaldale 254S)	172L (Coaldale 254S to 172EL Tap)	119	131	130.16	109.37%	63.95	53.74%
Fincastle 336S T1/T2	172L (Coaldale 254S to 172EL Tap)	119	131	125.85	105.76%	54.63	45.90%
610L (Taber 83S to Fincastle 336S)	172L (Coaldale 254S to 172EL Tap)	119	131	124.02	104.22%	52.85	44.41%
1005L (Picture Butte 120S to Travers 554S)	172L (Coaldale 254S to 172EL Tap)	119	131	134.16	112.74%	68.17	57.28%
1005L (Travers 554S to Milo 356S)	172L (Coaldale 254S to 172EL Tap)	119	131	134.58	113.09%	68.76	57.79%
172L (North Lethbridge 370S to Coaldale 254S)	770L (Coaldale 254S to North Lethbridge 370S)	120	132	158.96	132.46%	103.41	86.17%
770L (Coaldale 254S to North Lethbridge 370S)	172L (Coaldale 254S to 172FL Tap)	119	131	156.83	131.79%	60.68	50.99%
	172L (North Lethbridge 370S to 172FL Tap)	119	131	186.78	156.96%	64.09	53.86%
1036L (Milo 356S to Travers 554S)	172L (Coaldale 254S to 172EL Tap)	119	131	129.96	109.21%	64.46	54.17%

Table 5-4: Voltage Range Violations under Category B Conditions for Scenario 3

Contingency (System Element Lost)	Substation Name and Number	Bus Number	Nominal kV	Emergency Minimum Voltage (kV)	Emergency Maximum Voltage (kV)	Initial Voltage (kV)	Steady State Voltage (kV)	Post-Mitigation Steady State (kV)
Stirling 67S 69/138 kV T2	Stirling 67S	280	69	62.1	75.9	70.16	63.97	65.31 ^a
	Warner 344S	278	69	62.1	75.9	69.29	63.01	-

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820L/820AL (Stirling 67S to Chin Chute 315S/ Coaldale 254S)	Stirling 67S	293	138	124.2	151.8	142.43	131.11	133.82 ^a
	Warner 344S	278	69	62.1	75.9	69.29	63.43	-
	Stirling 67S	280	69	62.1	75.9	70.16	64.38	65.72

Notes:

^a The violation remained after RAS actions were completed, and real-time operational practices will mitigate the violation

5.3.2 Scenario 4: 2028 Summer Peak High Wind Post-project

Category B Conditions

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

Table 5-5: 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	
				Power Flow (MVA)	% Loading	Power Flow (MVA)	% Loading
940L (North Lethbridge 370S to Picture Butte 120S)	172L (Coaldale 254S to 172EL Tap)	119	131	125.08	105.11%	58.18	48.89%
1041L (North Lethbridge 370S to Travers 554S)	172L (Coaldale 254S to 172EL Tap)	119	131	135.77	114.09%	68.56	57.61%
180L (Fort MacLeod 15S to East Stavelly 28S/Granum 604S)	172L (Coaldale 254S to 172EL Tap)	119	131	131.89	110.83%	64.23	53.97%
Taber 83S T1	172L (Coaldale 254S to 172EL Tap)	119	131	125.08	105.11%	57.96	48.70%
Taber 83S T3	172L (Coaldale 254S to 172EL Tap)	119	131	125.11	105.14%	57.98	48.72%
610L (Taber 83S to Fincastle 336S)	172L (Coaldale 254S to 172EL Tap)	119	131	128.99	108.39%	57.47	48.29%
Fincastle 336S T1/T2	172L (Coaldale 254S to 172EL Tap)	119	131	131.85	110.80%	60.30	50.67%
607L/607AL (Fincastle 336S to Conard 135S/ Taber Wind Farm 134S)	172L (Coaldale 254S to 172EL Tap)	119	131	120.99	101.67%	53.19	44.69%
1005L (Picture Butte 120S to Travers 554S)	172L (Coaldale 254S to 172EL Tap)	119	131	143.19	120.32%	75.75	63.66%
725BL (MacBride Lake 640S to Fort	172L (Coaldale 254S to 172EL Tap)	107	118	108.52	101.42%	47.53	44.42%

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Macleod/ Bowron 674S)							
Granum 604S T2	172L (Coaldale 254S to 172EL Tap)	119	131	119.94	100.79%	52.10	43.78%

Table 5-6: Voltage Range Violations under Category B Conditions for Scenario 4

Contingency (System Element Lost)	Substation Name and Number	Bus Number	Nominal kV	Emergency Minimum Voltage (kV)	Emergency Maximum Voltage (kV)	Initial Voltage (kV)	Steady State Voltage (kV)	Post- Mitigation Steady State (kV)
Stirling 67S T2	Stirling 67S	280	69	62.1	75.9	69.42	60.96	64.40 ^a
	Warner 344S	278	69	62.1	75.9	67.63	58.88	-
820L/820AL (Stirling 67S to Chin Chute 315S/ Coaldale 254S)	Stirling 67S	293	138	124.2	151.8	141.92	122.18	129.10
	Warner 344S	278	69	62.1	75.9	67.63	58.61	-
	Stirling 67S	280	69	62.1	75.9	69.42	60.71	64.15

Notes:

^a The remaining violations exceeding the normal range but are within the emergency range will be mitigated by Real Time Operation Practice (RTOP)

5.4 Effective Factor Studies

Constraint effective factor studies were conducted for all post-Project scenarios. The constraint effective factors were calculated for all Category A and 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

P2490 Tempest Wind Power Project Study Scope

TransAlta Corp.

Date: Dec. 08, 2023

Version: V1Final

Classification: Public

Company Name	Name and Credentials	Date	Signature
CF Power Ltd. (Consultant)	Feng Chen	Jan 23, 2024	
AESO	Nima Safari, P.Eng.	1/19/2024	
AltaLink (Transmission Facility Owner)	Peter Blakeman, P.Eng.	Jan 25, 2024	
TransAlta Corp. (Market Participant)	Dmitriy Teterkin P.Eng, PMP	2024-01-25	

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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

Project overview is provided in Table 1-1.

Table 1-1: Project Overview

Market Participant	Type of Project	In-service Date (ISD)
TransAlta Corp.	Connection	Apr. 23, 2025

Load and generation components of the Project are listed in Table 1-2.

Table 1-2: Project Load and Generation Details

Project Component		Description
Load	Existing Rate DTS, <i>Demand Transmission Service</i> , contract capacity	No existing contract
	Requested Rate DTS	1 MW
	Type	Station Service
	Motors (number and size)	N/A
	Power factor	0.9 pf
	Future load expansion plans	No
Generation	Generation type	Wind
	Existing Rate STS, <i>Supply Transmission Service</i> , contract capacity	No existing contract
	Requested Rate STS	99 MW
	Number and size of generating units	22 units x 4.5 MW
	Maximum authorized real power (MARF)	99 MW
	Maximum capability (MC)	99 MW
	Reactive power capability	.95 pf absorbing
		.90 pf producing

Project Component		Description
	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 Lethbridge (Area 54).

The Study Area consists of the Glenwood (Area 55), Vauxhall (Area 52), Lethbridge (Area 54), and Stavelly (Area 49), including the tie lines connecting these planning areas to the rest of the AES.

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 36: Garden City 226s WAGF Trip Scheme
- RAS 42: 225LW O/L at 385S
- RAS 43: Stirling 67s - 508L Load Trip Scheme
- RAS 126: Magrath 225s Generation Trip Scheme
- RAS 136: Direct Transfer Trip to MATL on Loss of 1201L
- RAS 137: 120S MATL Local Detection Scheme
- RAS 167: Coaldale 254S – 820L Overload Mitigation Scheme
- RAS 168: Taber 83S – 172L Overload Mitigation Scheme
- RAS 169: 725LW-674S Overload Mitigation
- RAS 174: Queenstown 504S – 161L Overload Mitigation Scheme
- RAS 175: Milo 356S – 924L/927L Overload Mitigation Scheme
- RAS 178: 172L (370S-181S) Overload Mitigation
- RAS 180: 879L Overload Mitigation Scheme
- RAS 181: 610L Overload Mitigation Scheme

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



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*; and
- 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;* and
- Section 502.16 of the ISO rules, *Aggregated Generating Facilities 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.

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					
1	2028 Summer Light (SL)	High Wind (HW)	2028 SL HW Pre-Project	0	0
2	2028 Summer Peak (SP)	HW	2028 SP HW Pre-Project	0	0
Post-Project					
3	2028 SL	HW	2028 SL HW Post-Project	0	99
4	2028 SP	HW	2028 SP HW Post-Project	0	99
5	2033 Winter Peak (WP)	All study area generators in-service.	2033 WP Post-Project	0	99

4.2 Assumptions

4.2.1 System Project Assumptions

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

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

AESO Project No.	Project Name/Description	Scheduled ISD	AUC NID Decision No.
7083	Bowmanton 244S Substation Voltage Support Project	Q4 2024	ANAP Approval
7075	Vauxhall Area Transmission Development	Jul 1, 2024	27776-D01-2023

4.2.2 Load Assumptions

The load forecast to be used for the studies is shown in *Table 4-3*, and is a forecast for the AESO Southeast Cluster¹ based on the AESO's 2023 Long-term Outlook (2023 LTO).

Table 4-3: Forecast Load in South East Cluster

AESO Planning Region Name	Forecast Peak Load by Year/Season (MW)	
	2028 SL HR	2028 SP HR
South East Cluster	714	1,015

4.2.3 Generation Assumptions

The generation forecast to be used for the studies is based on the 2023 LTO with modifications to incorporate the latest forecast intelligence. The generation assumptions for the studies will assume High Renewable for Summer Light and Summer Peak load conditions.

The existing generation (excluding wind and solar) dispatch conditions for the study scenarios are described in Table 4-4.

Table 4-4: Existing Generation (excluding Wind and Solar) Dispatch Conditions in the Study Areas

Facility Name	Bus No.	MC (MW)	AESO Planning Area No.	Unit Net Generation ^a (MW) by Scenario	
				2028 SL HR ^b	2028 SP HR ^c
Parkland (ALP2)	4235	10	49	0	0
Chin Chute (CHIN)	407	15	54	0	0
Coaldale (COD1)	557690	5	54	5	5
Drywood (DRW1)	4226	6	55	0	0
Irrican Hydro (ICP1)	450	7	55	0	0
Lethbridge Taber (ME02)	3272	8	52	0	0
Lethbridge Burdett	4269	7	52	0	0

¹ The AESO Southeast cluster consists of AESO planning areas 4 (Medicine Hat), 48 (Empress), 43 (Sheerness), 47 (Brooks), 52 (Vauxhall), and 54 (Lethbridge), as well as the tielines from these areas.

Facility Name	Bus No.	MC (MW)	AESO Planning Area No.	Unit Net Generation ^a (MW) by Scenario	
				2028 SL HR ^b	2028 SP HR ^c
(ME03)					
Lethbridge Coaldale (ME04)	4690	6	54	0	0
Raymond Reservoir (RYMD)	414	21	55	0	0
Taylor Hydro (TAY1)	4670	14	55	0	0

Notes:

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

^b "SL HR" refers to 2028 Summer Light - High Renewable.

^c "SP HR" refers to 2028 Summer Peak - High Renewable.

Using this value, the wind and solar generation facilities will be dispatched to yield the credible worst-case generation dispatches for the study areas. Pre- and post-Project dispatch levels for the existing and planned² wind and solar generation facilities are shown in Table 4-5 and Table 4-6.

Table 4-5: Dispatch Conditions for Existing and Planned Wind Generation Facilities in the Study Areas

Facility Name and Code	Bus No.	MC (MW)	AESO Planning Area No.	Unit Net Generation ^a (MW) by Scenario	
				2028 SL HR ^b	2028 SP HR ^c
BSR1	61736, 61737	300	49	0	179
SCR2	11002	30	55	0	13
SCR3	2389	30	54	30	30
SWP1	61630	113	54	113	12
TAB1	15343, 16343	81	52	77	32

Note:

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

^b "SL HR" refers to 2028 Summer Light - High Renewable.

^c "SP HR" refers to 2028 Summer Peak - High Renewable.

² Planned generations refers to the projects which met inclusion criteria.

Table 4-6: Dispatch Conditions for Existing and Planned Solar Generation Facilities in the Study Areas

Facility Name and Code	Bus No.	MC (MW)	AESO Planning Area No.	Unit Net Generation ^a (MW) by Scenario	
				2028 SL HR ^b	2028 SP HR ^c
BRD1 Burdett (BRD1)	2269	11	52	6	6
BUR1 Burdett (BUR1)	557269	20	52	13	1
Claresholm 1 (CLR1)	60894	58	49	0	32
Claresholm 2 (CLR2)	61894	75	49	0	41
Clydesdale 1 (CLY1)	3286	41	52	25	34
Clydesdale 2 (CLY2)	4286	34	52	21	28
COL1 Coaldale 1 (COL1)	554692, 554693	23	54	13	13
Conrad 1 (CRD1)	554291	23	52	14	19
Conrad 2 (CRD2)	553291	18	52	11	15
Hull (HUL1)	2401	25	52	15	21
Hays (HYS1)	554401	23	52	14	19
Monarch (MON1)	4400	24	54	0	0
HEP Energy Alderson MPC Solar (P1828)	560111	100	52	62	83
Fortis Spring Coulee 385S Solar DG (P1862)	554246	30	55	0	25
Solar Krafte Vauxhall (P1926)	60441	60	52	37	50
Enterprise MPC Solar (P2300)	563070	65	49	0	54
Fortis Vulcan 255S DER Solar (P2335)	4244	15	49	0	12
BluEarth Wheatcrest MPC Solar (P2348)	557051	50	52	31	42
COL Chinook 181S DER Solar (P2511)	3367	9	54	4	2
Taber Solar (P2629)	17343	46	52	28	38
Stavely (STV1)	4235	17	49	9	9
Travers (TVS1)	560026, 562026, 561026	465	49	0	465

Facility Name and Code	Bus No.	MC (MW)	AESO Planning Area No.	Unit Net Generation ^a (MW) by Scenario	
				2028 SL HR ^b	2028 SP HR ^c
PR Prominence Solar (P2466)	569049	80	54	37	19
Vauxhall (VXH1)	4274	22	52	14	18
Westfield Yellow Lake (WEF1)	557277	19	52	13	1

Note:

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

^b "SL HR" refers to 2028 Summer Light - High Renewable.

^c "SP HR" refers to 2028 Summer Peak - High Renewable.

4.2.4 Intertie Flow Assumptions

The Alberta-British Columbia (AB-BC) intertie points are deemed to be too far away from the Southeast cluster to have any material impact on the connection assessment. Therefore, intertie flow values shall be set to the AESO planning base case values and will not be adjusted for the studies. The intertie flow assumptions for the Alberta-Saskatchewan (AB-SK) and Alberta-Montana (MATL) interties are shown in Table 4-7.

Table 4-7: Intertie Flows for all Study Scenarios

Scenario Name	Import (-) / Export (+) (MW) by Intertie	
	AB-SK	MATL
2028 Summer Light High Renewable	150	280
2028 Summer Peak High Renewable	150	183

4.2.5 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.

4.2.6 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 TFO and as shown in Table 4-8. Only those contingencies shown in Table 4-8 will be studied for transient stability studies. If the TFO 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 4-8: Protection Fault Clearing Times

Contingency (System Element Lost)	Fault Location	Clearing Times (Cycles)	
		Near End	Far End
172L/172EL (Coaldale 254S to Taber 83S)	Coaldale 254S	8	25
	Taber 83S	8	25
	Hillridge 139S	25	25
820L/820AL (Coaldale 254S to Stirling 67S)	Coaldale 254S	9	60
	Stirling 67S	9	60
	Chin Chute 315S	9	60
610L (Taber 83S to Fincastle 336S)	Taber 83S	9	30
	Fincastle 336S	9	30
607L/607AL (Fincastle 336S to Conrad 135S)	Conrad 135S	9	60
	Fincastle 336S	9	60
	Taber Wind Farm 134S	9	60

4.2.7 Project Dynamic Data

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

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

Table 5-1: Summary of the 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	
Pre-Project										
1	2028 SL HR	X	X			X*	X*			
2	2028 SP HR	X	X			X*	X*			X
Post-Project										
3	2028 SL HR	X	X			X	X			
4	2028 SP HR	X	X			X	X			X
5	2033 SP									X

Notes:

* Only required if post-project studies show potential transient stability issues.

For the engineering studies, all transmission facilities 69 kV and above, within the Study Area and the transmission lines connecting the study areas (as defined in Section 1.2.1) 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 Study Case Validation

The study will be conducted on the AIES system model using the AESO's planning base cases. The seasonal light/peak scenarios will be studied as required. The base cases will be modified by the AESO to include the corresponding load and generation forecast information. The resulting cases, or seed cases, will be provided by the AESO to the Studies Consultant. These cases are provided in PSS/E v34. Upon request, the AESO can provide RAW and SEQ files. Software used by the Studies Consultant must be able to read and write these file types. Manual adjustments may be required to ensure full alignment with the details outlined in this Study Scope, as described in the process outlined below. The AESO will provide guidance to the Studies Consultant with regard to the setup of the study cases should any questions arise.

The expected process for the creation of acceptable study cases is as follows:

1. The AESO provides seed cases and any other applicable information required to the Studies Consultant.

2. If the cases show N-0 violations, AESO will work with the Studies Consultants to address the issues. The Studies Consultant verifies and makes adjustments as required to ensure the study cases represent the assumptions outlined within the Study Scope.
3. Upon creating the study cases, all the study cases are forwarded to the AESO for approval.
4. The Studies Consultant proceeds with the required engineering studies only after the study cases are approved by the AESO.

5.2 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 information purposes, the Studies Consultant must also provide, as a separate file, a list of any transmission elements where the thermal loading exceeds 95% of the element's normal rating under Category A and Category B conditions.

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 to be studied are shown in Table 5-1.

5.2.1 Contingencies to be Studied

Power flow studies will be performed for the Category A and all Category B conditions in the Study Area.

5.3 Transient Stability Studies

The Shepard Generating Unit 1 in Strathmore planning area (Area 45) will be used as the reference for the studies.

The report presenting the results of the transient stability studies must provide response plots for several variables, including rotor angle, and active and reactive power output for the following generating units: Coaldale (COD1), Suncor Chin Chute (SCR3), Lethbridge Taber (ME02), Lethbridge Burdett (ME03), Lethbridge Coaldale (ME04), and Chin Chute (CHIN). 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 post-Project scenarios 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.

5.3.1 Contingencies to be Studied

Transient stability studies will be performed for the contingencies shown in Table 4-8

5.4 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.

Summer peak scenarios will be used for the short-circuit studies.

Estimated maximum three-phase faults and single line-to-ground short-circuit current levels will be reported for the following substations:

- Stirling 67S
- Chin Chute 315S
- Coaldale 254S
- North Lethbridge 370S
- Hillridge 139S
- Taber 83S
- P2490 collector substation (included in post-Project studies only)

Further sensitivity studies, in consultation with the TFO, 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.

5.5 Sub-Synchronous Interaction (SSI) Studies

Due to the location of the project being electrically far from any HVDC converter station or line with series capacitor compensation, SSI studies are not required for this Project.

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 factors³ 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 AES.

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 A and/or Category B conditions.

³ 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 are based on the AESO's current corporate forecast (2023 LTO) with modifications to incorporate the latest forecast intelligence. Sensitivity studies or restudy may be required in the event of revisions to the AESO's corporate forecast, forecast intelligence, or other study assumptions. 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

Attachment A2

Pre-Project Power Flow Diagrams

Thermal Violations

- 1- FIGURE A2-1-1: 2028 SL HW PRE-PROJECT [CATEGORY A - NO CONTINGENCY]
- 2- FIGURE A2-1-2: 2028 SL HW PRE-PROJECT [CATEGORY B: 770L (COALDALE 254S TO NORTH LETHBRIDGE 370S)]

Voltage Violations

- 3- FIGURE A2-1-3: 2028 SL HW PRE-PROJECT [CATEGORY B: Burdett 368S 25/138 kV T1/T2]
- 4- FIGURE A2-1-4: 2028 SL HW PRE-PROJECT [CATEGORY B: Fincastle 336S 25/138 kV T1/T2]

Thermal Violations

- 5- FIGURE A2-2-1: 2028 SP HW PRE-PROJECT (CATEGORY A - NO CONTINGENCY)
- 6- FIGURE A2-2-2: 2028 SP HW PRE-PROJECT [CATEGORY B: 1041L (NORTH LETHBRIDGE 370S TO TRAVERS 554S)]
- 7- FIGURE A2-2-3: 2028 SP HW PRE-PROJECT [CATEGORY B: MONARCH_TAP]
- 8- FIGURE A2-2-4: 2028 SP HW PRE-PROJECT [CATEGORY B: BOWRON 674S 13.8/138 KV T1/T2]
- 9- FIGURE A2-2-5: 2028 SP HW PRE-PROJECT [CATEGORY B: 1005L (PICTURE BUTTE 120S TO TRAVERS 554S)]

Voltage Violations

- 10- FIGURE A2-2-6: 2028 SP HW PRE-PROJECT [CATEGORY B: 820/820AL (Stirling 67S to Chin Chute 315S/Coaldale 254S)]
- 11- FIGURE A2-2-7: 2028 SP HW PRE-PROJECT [CATEGORY B: Stirling 67S 69/138 kV T2]

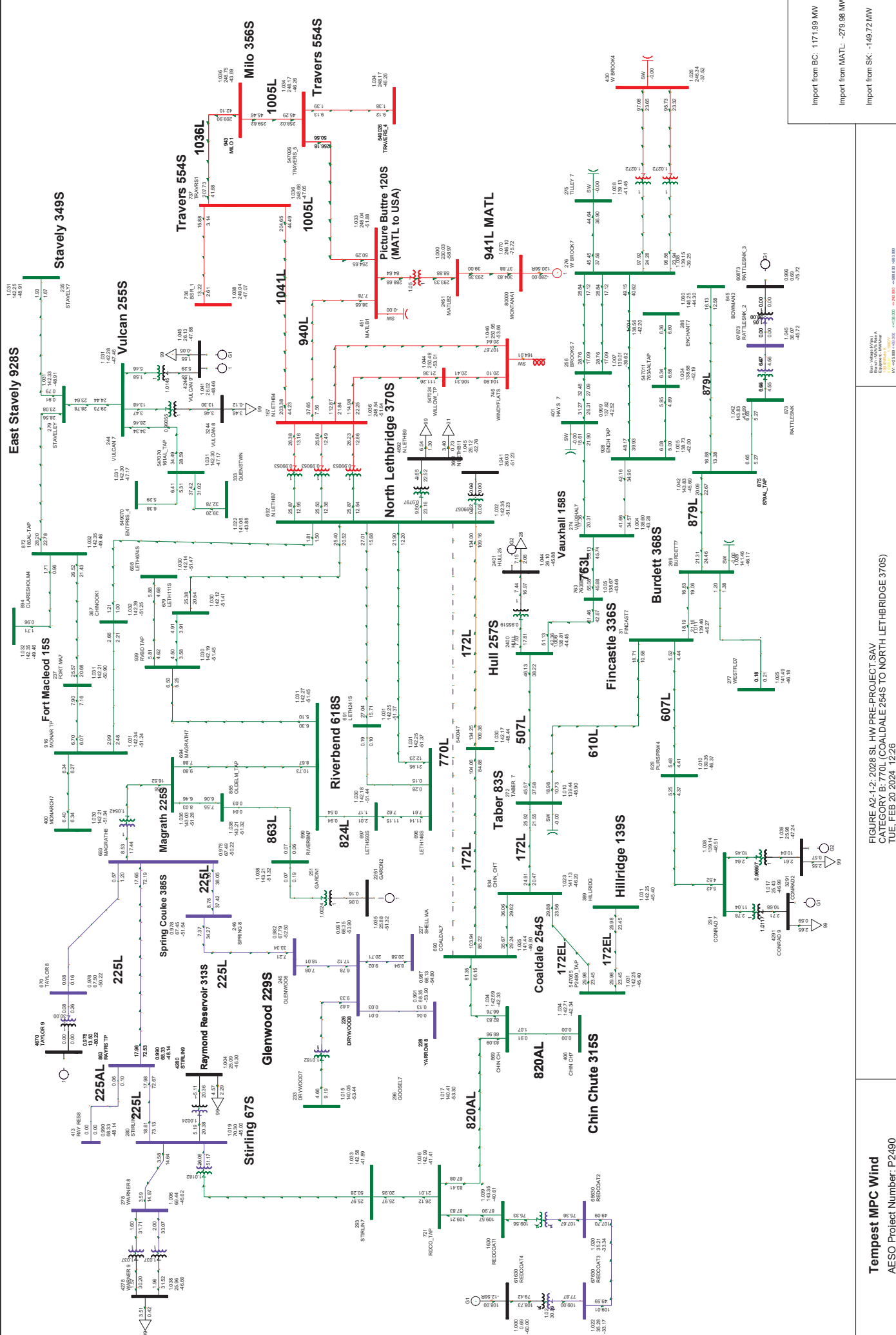


FIGURE A2-1-2: 2028 SL HW PRE-PROJECT.SAV
CATEGORY B: 770L (COALDALE 254S TO NORTH LETHBRIDGE 370S)
TUE, FEB 20 2024 12:26

Import from BC: 1171.99 MW

Import from MATL: -279.98 MW

Import from SK: -149.72 MW

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East Stavely 928S

Stavely 349S

Fort Macleod 15S

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Spring Coulee 38S

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Raymond Reservoir 313S

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Glenwood 229S

225L

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Stirling 67S

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Magrath 225S

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Riverbend 618S

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FIGURE A2-1-3: 2028 SL HW PRE-PROJECT.SAV
CATEGORY B: BURDETT 368S 25/138 KV T/172
THU, APR 11 2024 16:38

Tempest MPC Wind
AESO Project Number: P2490

Import from BC: -1165.52 MW

Import from MATL: -280.00 MW

Import from SK: -149.72 MW

East Stavelly 928S

Stavelly 349S

Fort Macleod 15S

225L

225AL

225L

225L

225AL

225L

Spring Coulee 388S

225L

225AL

225L

Raymond Reservoir 313S

225L

225AL

225L

Glenwood 229S

225L

225AL

225L

Stirling 67S

225L

225AL

225L

863L

225L

225AL

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824L

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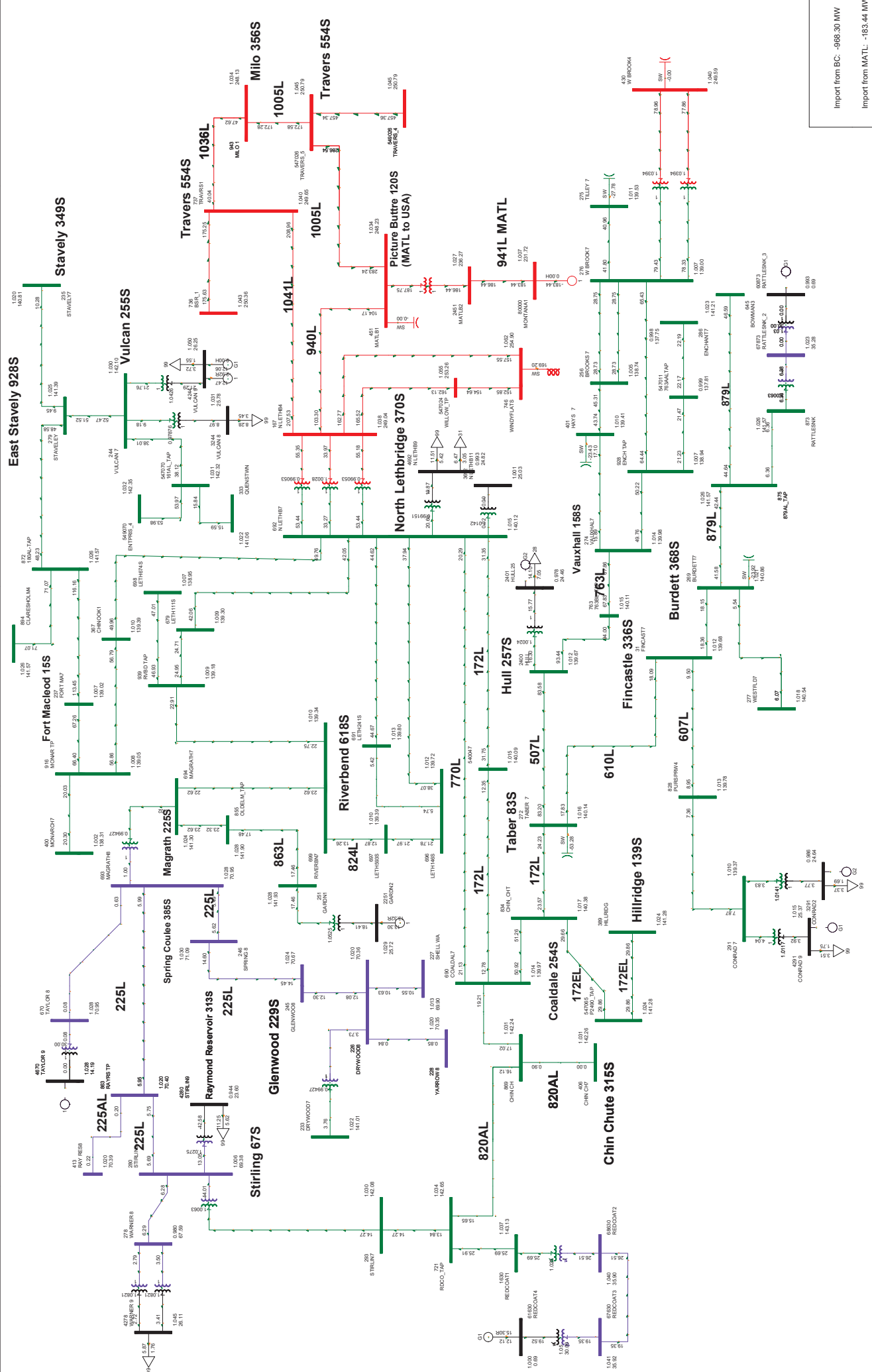
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Import from BC: -968.30 MW
Import from MATL: -183.44 MW

Import from MATL: -183.44 MW

Import from SK: -149.72 MW

FIGURE A2-2-1: 2028 SP HW PRE-PROJECT.SAV
CATEGORY A - NO CONTINGENCY
TUE, FEB 20 2024 12:33

Tempest MPC Wind
AESO Project Number: P2490

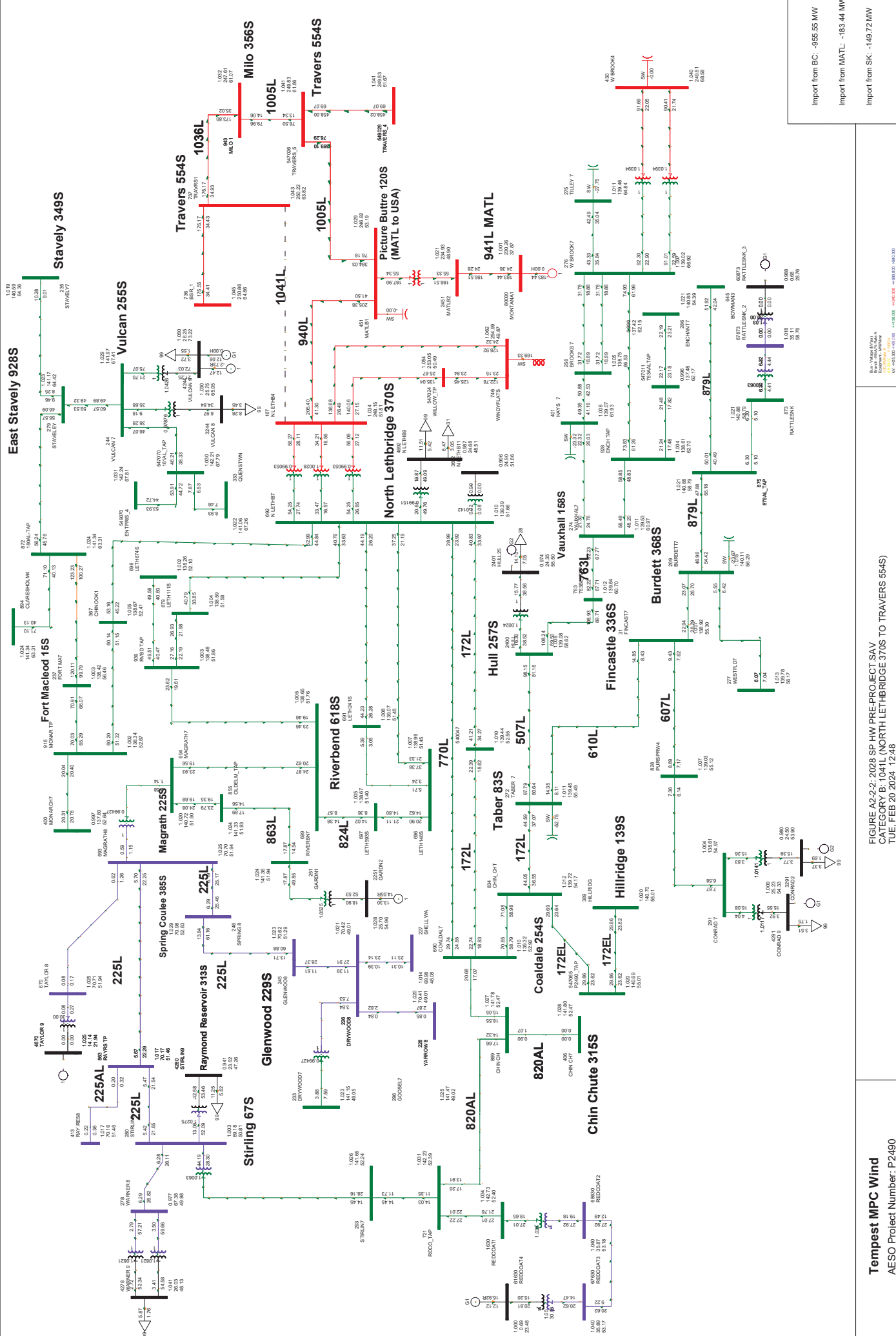


FIGURE A2-2-2: 2028 SP HW PRE-PROJECT.SAV
CATEGORY B: 1041L (NORTH LETHBRIDGE 370S TO TRAVERS 554S)
TUE, FEB 20 2024 12:48

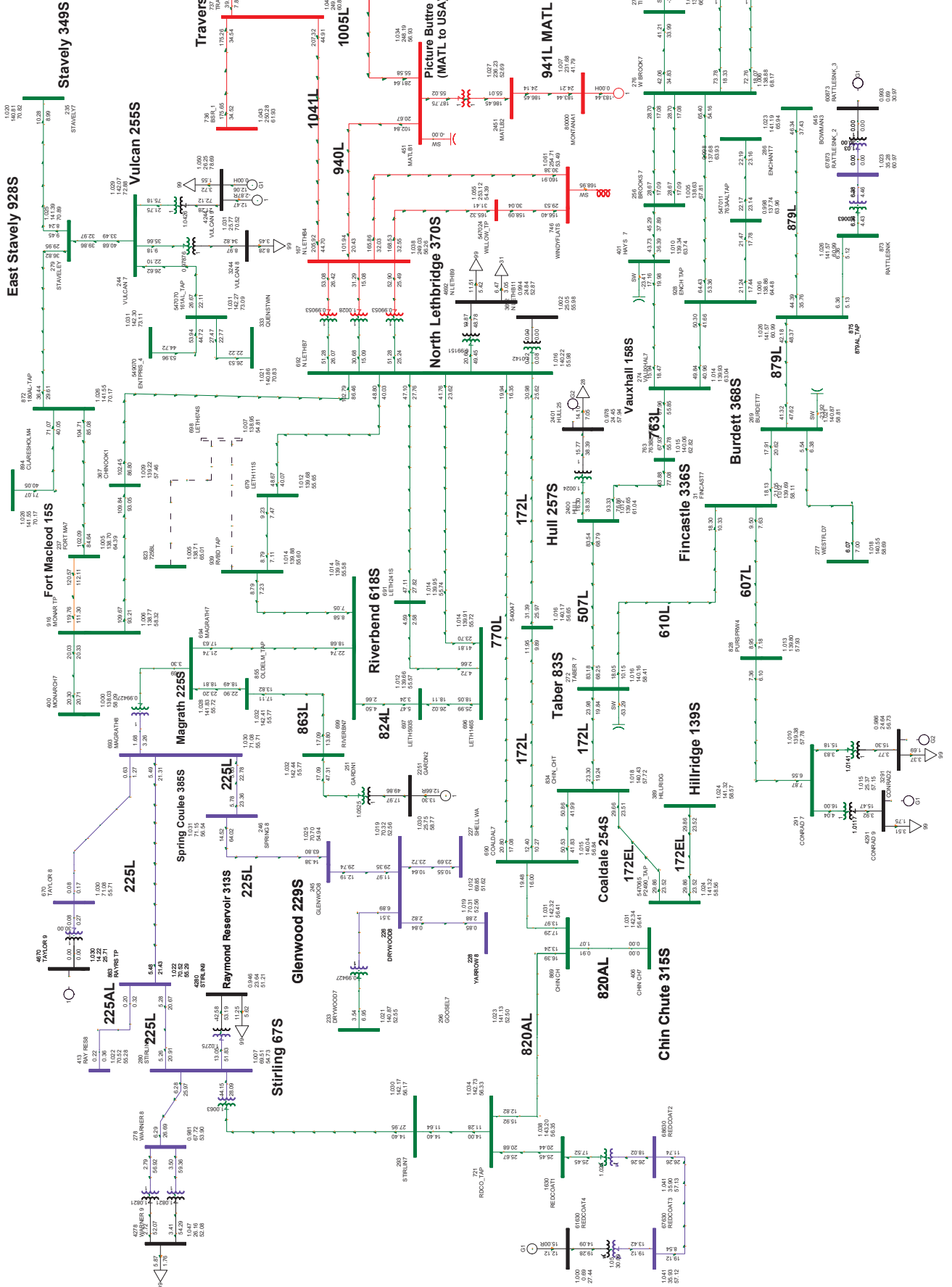
Tempest MPC Wind
AESO Project Number: P2490

Import from BC: -955.55 MW

Import from MATL: -183.44 MW

Import from SK: -149.72 MW

Bus - Voltage (kV/mv)	
Branch - MVA% Rate A	
Equipment - MNMTAver	
100.0%Rate A	
0.9000/V	1.000CV
kW = 625.0 Tons = 669.000	
	\$=+1.38 000
	\$=240.000
	\$=900.000 \$=0.0 000



Tempest MPC Wind
AESO Project Number: P2490

FIGURE A2-2-4: 2028 SP HW PRE-PROJECT.SAV
CATEGORY B: BOWRON 674S 13.8/138 KV T1/T2
TUE, FEB 20 2024 13:42

Run - Values Only
Category - Summary
KV - 42.000 13.800 13.800
MW - 42.000 13.800 13.800

Import from BC: -988.13 MW
Import from MATL: -183.44 MW
Import from SK: -149.72 MW

East Stavely 928S

Stavely 349S

Fort Macleod 15S

Magrath 225S

Spring Coulee 388S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

863L

824L

829L

770L

172L

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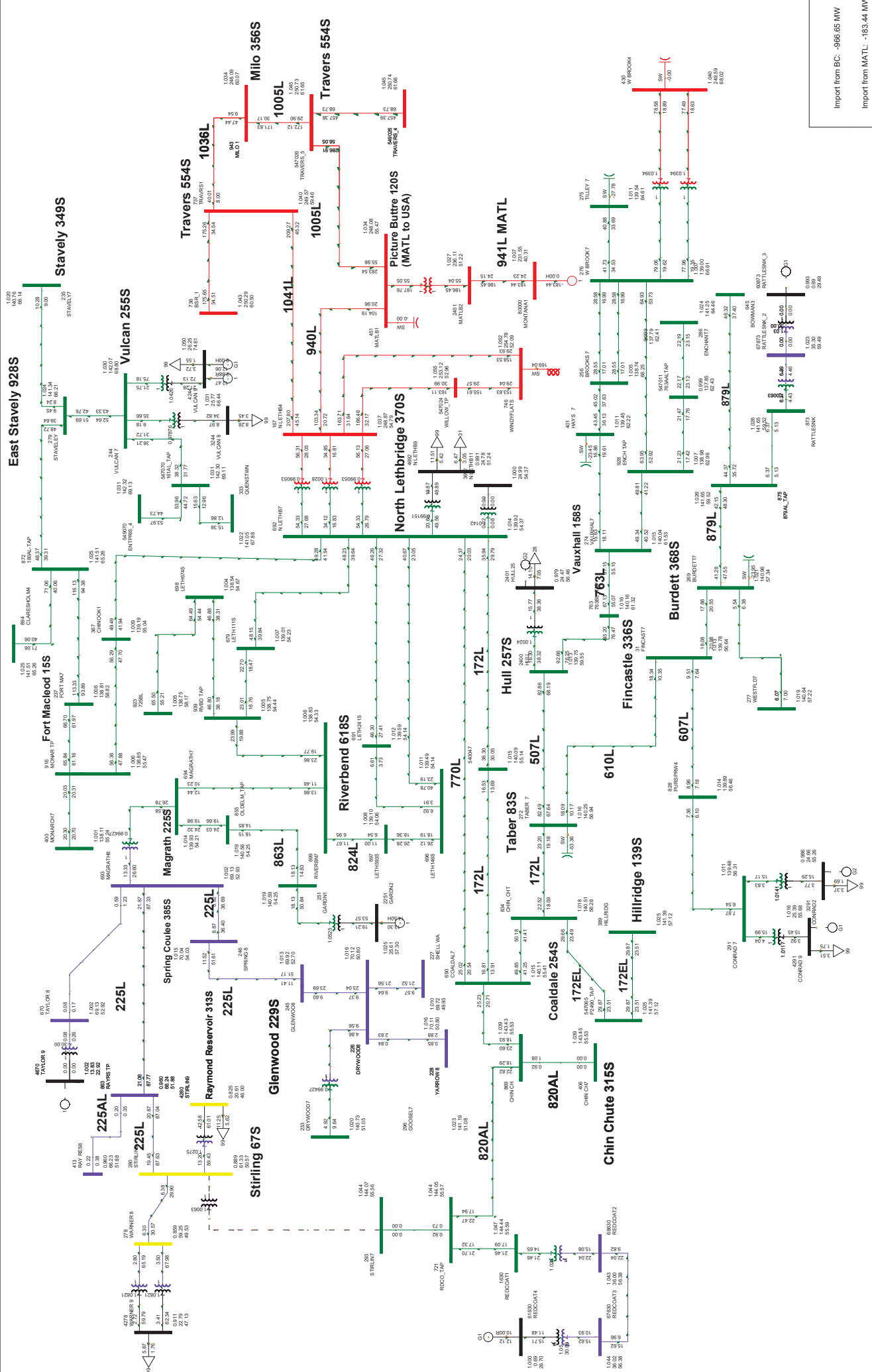
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Import from BC: -966.65 MW

Import from MATL: -183.44 MW

Import from SK: -149.72 MW

FIGURE A2-2-7: 2028 SP HW PRE-PROJECT.SAV
CATEGORY B: STIRLING 67S 69/138 KV T2
THU, APR 11 2024 16:59

Tempest MPC Wind
AESO Project Number: P2490

Attachment A3

Post-Project Power Flow Diagrams

Thermal Violations

- 1- FIGURE A3-1-1: 2028 SL HW POST-PROJECT [CATEGORY A - NO CONTINGENCY]
- 2- FIGURE A3-1-2: 2028 SL HW POST-PROJECT [CATEGORY B: Red Coat 967S T1]
- 3- FIGURE A3-1-3: 2028 SL HW POST-PROJECT [CATEGORY B: 1041L (North Lethbridge 370S to Travers 554S)]
- 4- FIGURE A3-1-4: 2028 SL HW POST-PROJECT [CATEGORY B: 161AL_Tap (Vulcan 255S to Queenstown 504S/Enterprise)]
- 5- FIGURE A3-1-5: 2028 SL HW POST-PROJECT [CATEGORY B: STIRLING 67S T2]
- 6- FIGURE A3-1-6: 2028 SL HW POST-PROJECT [CATEGORY B: RAYRS_TAP (Stirling 67S to Raymond Reservoir 313S/ Magrath 225S)]
- 7- FIGURE A3-1-7: 2028 SL HW POST-PROJECT [CATEGORY B: RDCO_TAP(Stirling 67S to Chin Chute 315S/ Coaldale 254S)]
- 8- FIGURE A3-1-8: 2028 SL HW POST-PROJECT [CATEGORY B: Fincastle 336S 25/138 kV T1/T2]
- 9- FIGURE A3-1-9: 2028 SL HW POST-PROJECT [CATEGORY B: 610L (Taber 83S to Fincastle 336S)]
- 10- FIGURE A3-1-10: 2028 SL HW POST-PROJECT [CATEGORY B: 1005L (Picture Butte 120S to Travers 554S)]
- 11- FIGURE A3-1-11: 2028 SL HW POST-PROJECT [CATEGORY B: 1005L (Travers 554S to Milo 356S)]
- 12- FIGURE A3-1-12: 2028 SL HW POST-PROJECT [CATEGORY B: Coaldale 254S 25/138 kV T2]
- 13- FIGURE A3-1-13: 2028 SL HW POST-PROJECT [CATEGORY B: 172L (North Lethbridge 370S to Coaldale 254S)]
- 14- FIGURE A3-1-14: 2028 SL HW POST-PROJECT [CATEGORY B: 770L (Coaldale 254S to North Lethbridge 370S)]
- 15- FIGURE A3-1-15: 2028 SL HW POST-PROJECT [CATEGORY B: 1036L (Milo 356S to Travers 554S)]

Voltage Violations

- 16- FIGURE A3-1-16: 2028 SL HW POST-PROJECT [CATEGORY B: Burdett 368S 25/138 kV T1/T2]
- 17- FIGURE A3-1-17: 2028 SL HW POST-PROJECT [CATEGORY B: Fincastle 336S 25/138 kV T1/T2]

Thermal Violations

- 16- FIGURE A3-2-1: 2028 SP HW POST-PROJECT [CATEGORY A - NO CONTINGENCY]
- 17- FIGURE A3-2-2: 2028 SP HW POST-PROJECT [CATEGORY B: 940L (North Lethbridge 370S to Picture Butte 120S)]
- 18- FIGURE A3-2-3: 2028 SP HW POST-PROJECT [CATEGORY B: 1041L (North Lethbridge 370S to Travers 554S)]
- 19- FIGURE A3-2-4: 2028 SP HW POST-PROJECT [CATEGORY B: Monarch TAP(Fort Macleod 15S to Monarch 492S/Chinook 181S)]
- 20- FIGURE A3-2-5: 2028 SP HW POST-PROJECT [CATEGORY B: 180L(Fort Macleod 15S to East Staveley 28S/Granum 604S)]
- 21- FIGURE A3-2-6: 2028 SP HW POST-PROJECT [CATEGORY B: Bowron 674S 13.8/138 kV T1/T2]
- 22- FIGURE A3-2-7: 2028 SP HW POST-PROJECT [CATEGORY B: Taber 83S 25/138 kV T1]
- 23- FIGURE A3-2-8: 2028 SP HW POST-PROJECT [CATEGORY B: Taber 83S 25/138 kV T3]
- 24- FIGURE A3-2-9: 2028 SP HW POST-PROJECT [CATEGORY B: 610L (Taber 83S to Fincastle 336S)]
- 25- FIGURE A3-2-10: 2028 SP HW POST-PROJECT [CATEGORY B: Fincastle 336S 25/138 kV T1/T2]
- 26- FIGURE A3-2-11: 2028 SP HW POST-PROJECT [CATEGORY B: 607L/607AL (Fincastle 336S to Conard 135S/ Taber Wind Farm 134S)]
- 27- FIGURE A3-2-12: 2028 SP HW POST-PROJECT [CATEGORY B: 1005L (Picture Butte 120S to Travers 554S)]
- 28- FIGURE A3-2-13: 2028 SP HW POST-PROJECT [CATEGORY B: 725BL (MacBride Lake 640S to Fort Macleod/ Bowron 674S)]
- 29- FIGURE A3-2-14: 2028 SP HW POST-PROJECT [CATEGORY B: Claresholm 34.5/138 kV T2]

Voltage Violations

- 30- FIGURE A3-2-15: 2028 SP HW POST-PROJECT [CATEGORY B: 820/820AL (Stirling 67S to Chin Chute 315S/ Coaldale 254S)]
- 31- FIGURE A3-2-16: 2028 SP HW POST-PROJECT [CATEGORY B: Stirling 67S 69/138 kV T2]

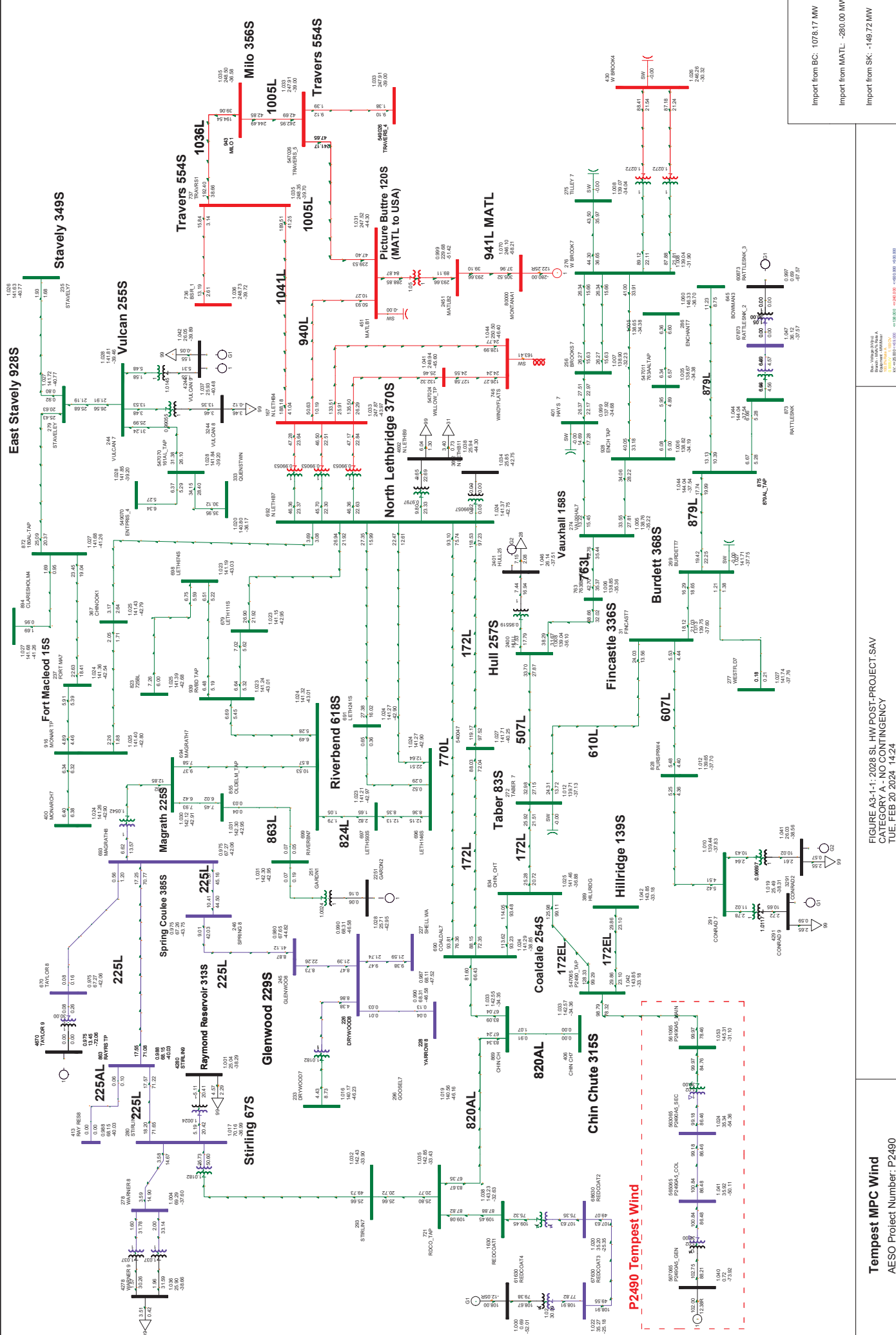


FIGURE A3-1-1: 2028 SL HW POST-PROJECT.SAV
CATEGORY A - NO CONTINGENCY
TUE, FEB 20 2024 14:24

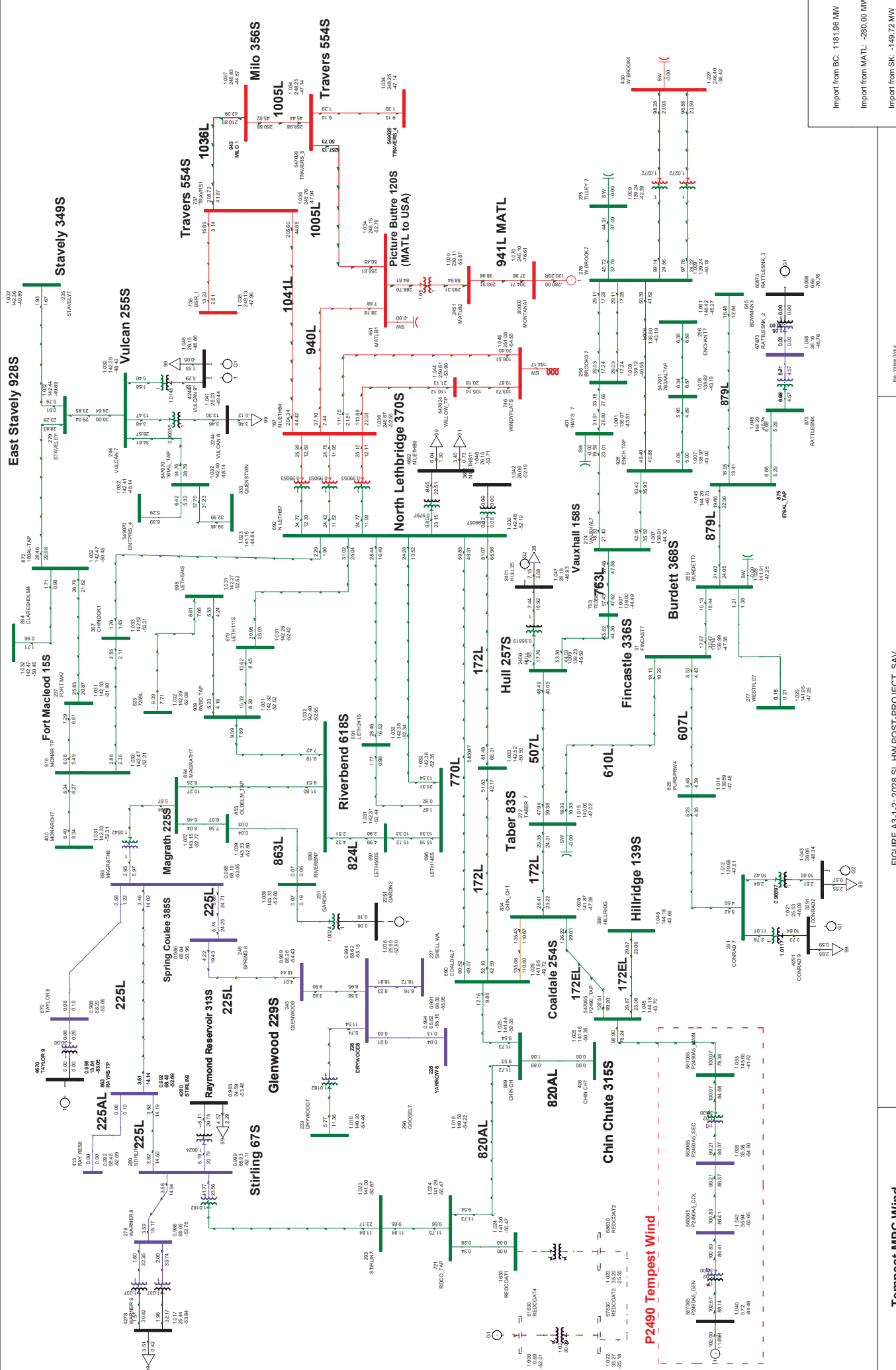


FIGURE A3-1-2: 2028 SL HW POST-PROJECT .SAV
CATEGORY B: RED COAT 967S T1
TUE, FEB 20 2024 15:10

Tempest MPC Wind
AESO Project Number: P2490

Import from BC: 1181.96 MW

Import from MATL: -280.00 MW

Import from SK: -149.72 MW

Bus - Voltage (kV@u)	
Branch - MVA% Rate A	
Equipment - MW/MVar	
100.0% Rate A	
0.0000 V	1.1000 V
kV	→ 25.00 (0.00)
	→ 240.00
	→ 139.00
	→ 450.00
	→ 0.00

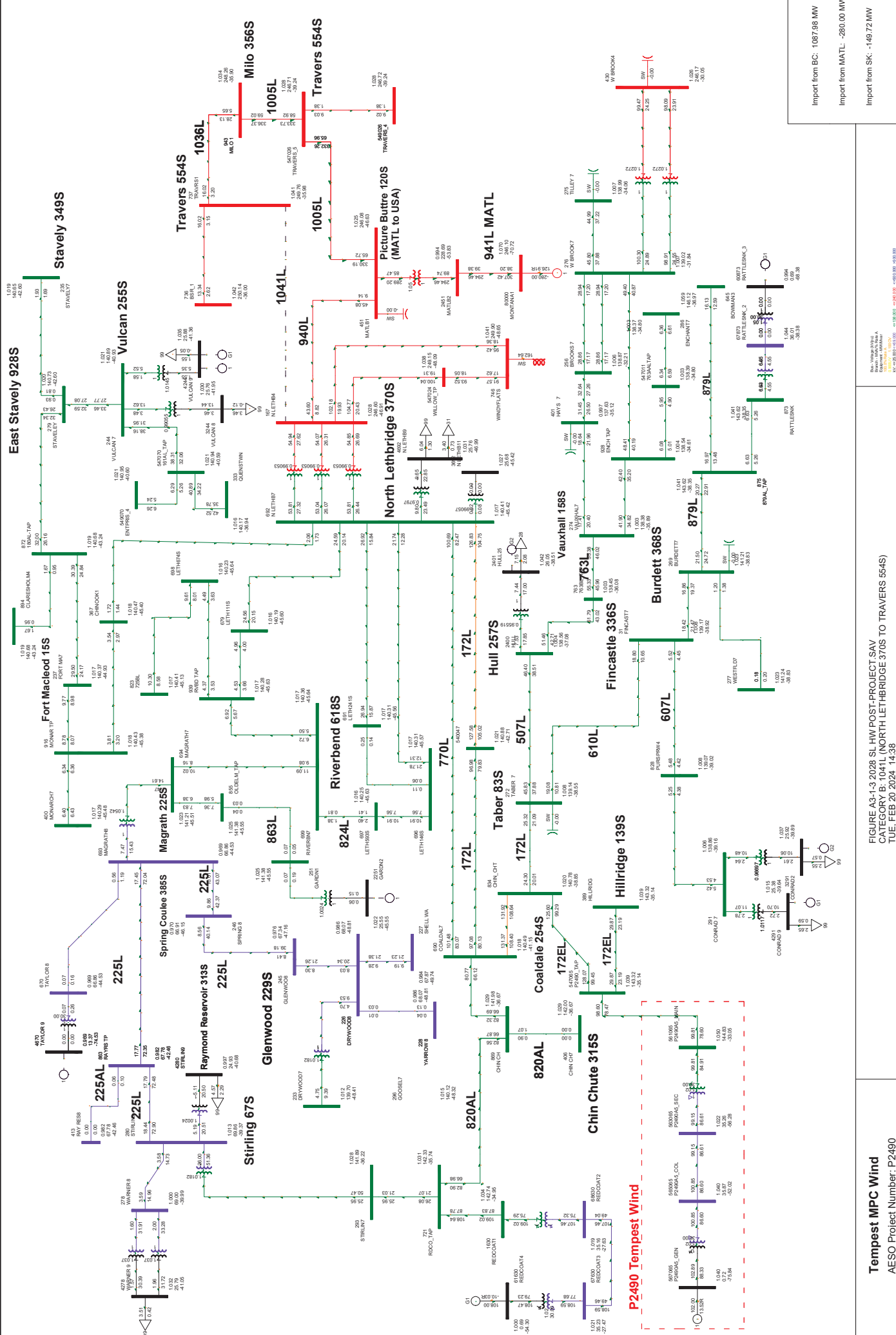


FIGURE A3-1-3 2028 SL HW POST-PROJECT.SAV
CATEGORY B: 1041L (NORTH LETHBRIDGE 370S TO TRAVERS 554S)
TUE, FEB 20 2024 14:38

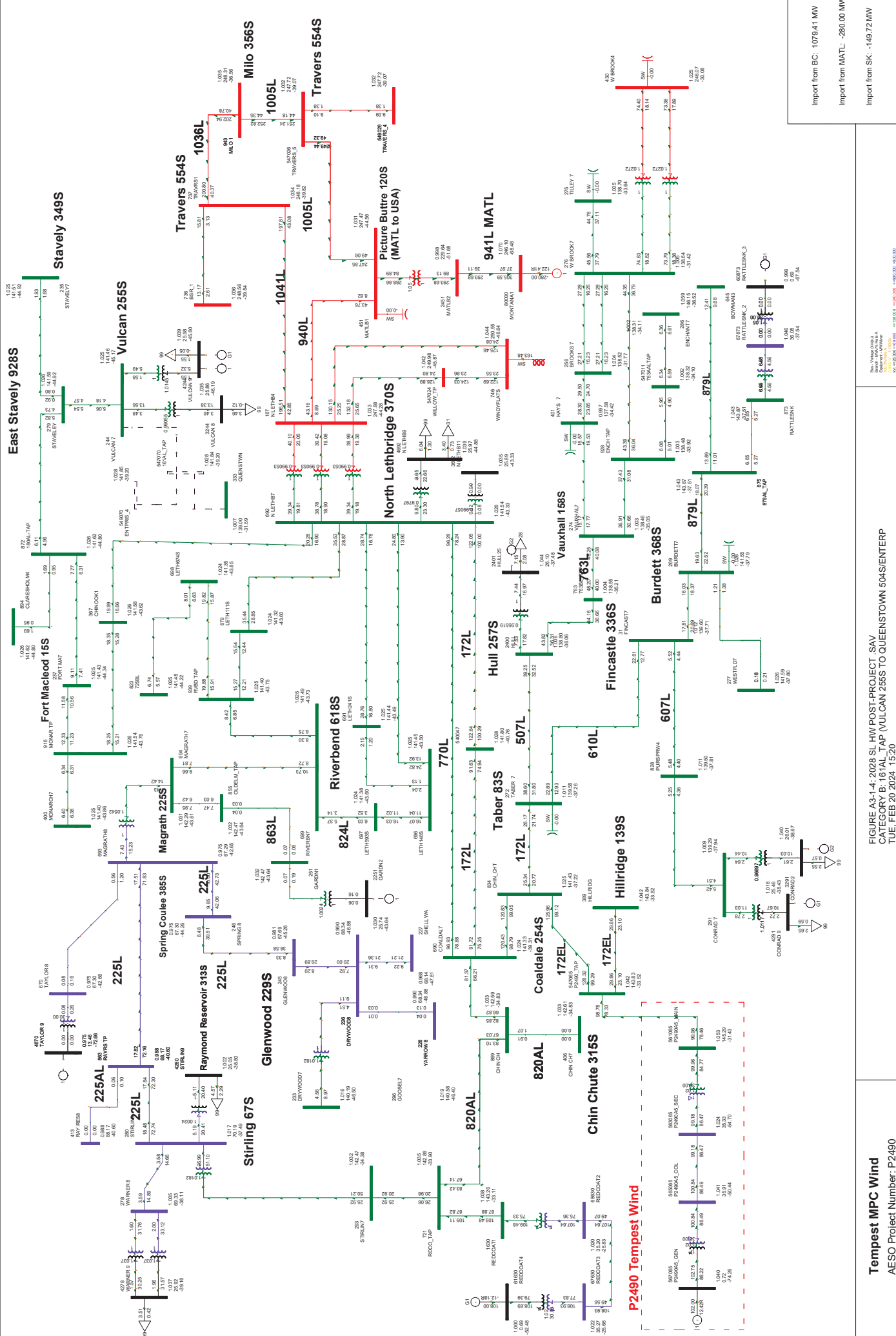


FIGURE A3-1-4: 2028 SL HW POST-PROJECT .SAV
CATEGORY B: 16'IAL_TAP (VULCAN 255S TO QUEENSTOWN 504S/INTERP
TUE FEB 20 2024 15:20

East Stavelly 928S

Stavelly 349S

Fort Macleod 15S

225L

225AL

225L

Spring Coulee 38S

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Raymond Reservoir 313S

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Glenwood 229S

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Stirling 67S

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East Stavelly 928S

Stavelly 349S

Fort Macleod 15S

Magrath 225S

Spring Coulee 388S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

Riverbend 618S

North Lethbridge 370S

Hull 257S

Taber 83S

Coaldale 254S

Chin Chute 315S

Hillridge 139S

Burdett 368S

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Vulcan 255S

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941L MATL

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Fort Macleod 15S

Magrath 225S

Spring Coulee 388S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

Riverbend 618S

North Lethbridge 370S

Hull 257S

Taber 83S

Coaldale 254S

Chin Chute 315S

Hillridge 139S

Burdett 368S

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Fort Macleod 15S

Magrath 225S

Spring Coulee 388S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

Riverbend 618S

North Lethbridge 370S

Hull 257S

Taber 83S

Coaldale 254S

Chin Chute 315S

Hillridge 139S

Burdett 368S

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Fort Macleod 15S

Magrath 225S

Spring Coulee 388S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

Riverbend 618S

North Lethbridge 370S

Hull 257S

Taber 83S

Coaldale 254S

Chin Chute 315S

Hillridge 139S

Burdett 368S

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Fort Macleod 15S

Magrath 225S

Spring Coulee 388S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

Riverbend 618S

North Lethbridge 370S

Hull 257S

Taber 83S

Coaldale 254S

Chin Chute 315S

Hillridge 139S

Burdett 368S

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Fort Macleod 15S

Magrath 225S

Spring Coulee 388S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

Riverbend 618S

North Lethbridge 370S

Hull 257S

Taber 83S

Coaldale 254S

Chin Chute 315S

Hillridge 139S

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Fort Macleod 15S

Magrath 225S

Spring Coulee 388S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

Riverbend 618S

North Lethbridge 370S

Hull 257S

Taber 83S

Coaldale 254S

Chin Chute 315S

Hillridge 139S

Burdett 368S

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Fort Macleod 15S

Magrath 225S

Spring Coulee 388S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

Riverbend 618S

North Lethbridge 370S

Hull 257S

Taber 83S

Coaldale 254S

Chin Chute 315S

Hillridge 139S

Burdett 368S

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Fort Macleod 15S

Magrath 225S

Spring Coulee 388S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

Riverbend 618S

North Lethbridge 370S

Hull 257S

Taber 83S

Coaldale 254S

Chin Chute 315S

Hillridge 139S

Burdett 368S

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Fort Macleod 15S

Magrath 225S

Spring Coulee 388S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

Riverbend 618S

North Lethbridge 370S

Hull 257S

Taber 83S

Coaldale 254S

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Hillridge 139S

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Fort Macleod 15S

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Glenwood 229S

Stirling 67S

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North Lethbridge 370S

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Taber 83S

Coaldale 254S

Chin Chute 315S

Hillridge 139S

Burdett 368S

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Fort Macleod 15S

Magrath 225S

Spring Coulee 388S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

Riverbend 618S

North Lethbridge 370S

Hull 257S

Taber 83S

Coaldale 254S

Chin Chute 315S

Hillridge 139S

Burdett 368S

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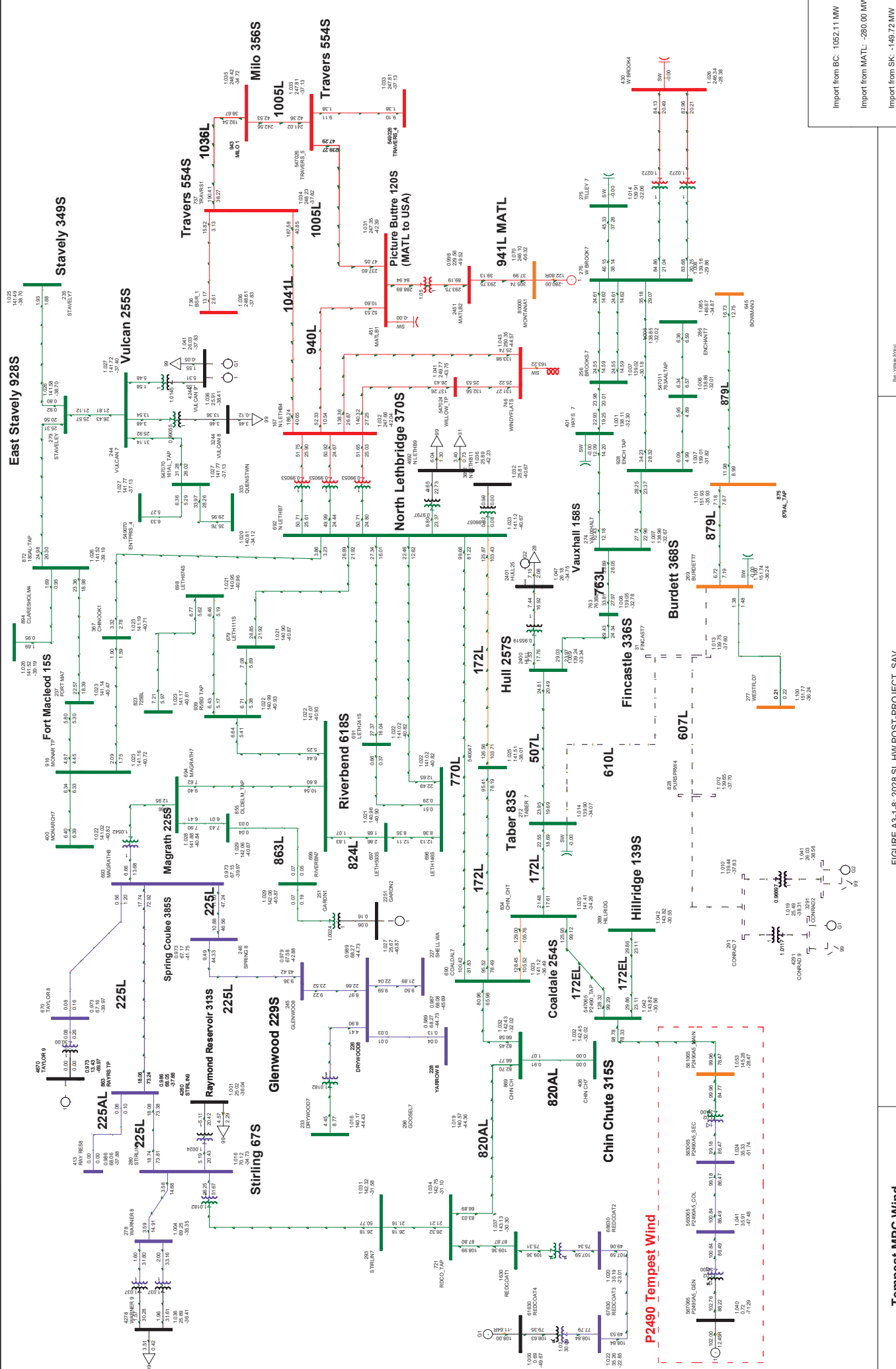


FIGURE A3-1-8: 2028 SL HW POST-PROJECT .SAV
CATEGORY B: FINCASTLE 336S 25/138 KV T1/T2
TUE, FEB 20 2024 15:49

Tempest MPC Wind
AESO Project Number: P2490

Import from BC: 1052.11 MW

Import from MATL: -280.00 MW

Import from SK: -149.72 MW

	\$
Bus - Voltage (KV)6U	
Sbranch - MVA,% Rate A	
Equipment - MW/Mvar	
100.0% Ratio A	
0.000 JV	\$ 1,000.0V
M ² = 25.000 E	= \$918.00
	= \$130.00
	= \$247.00
	= \$50.00
	= \$0.00
	= \$0.00

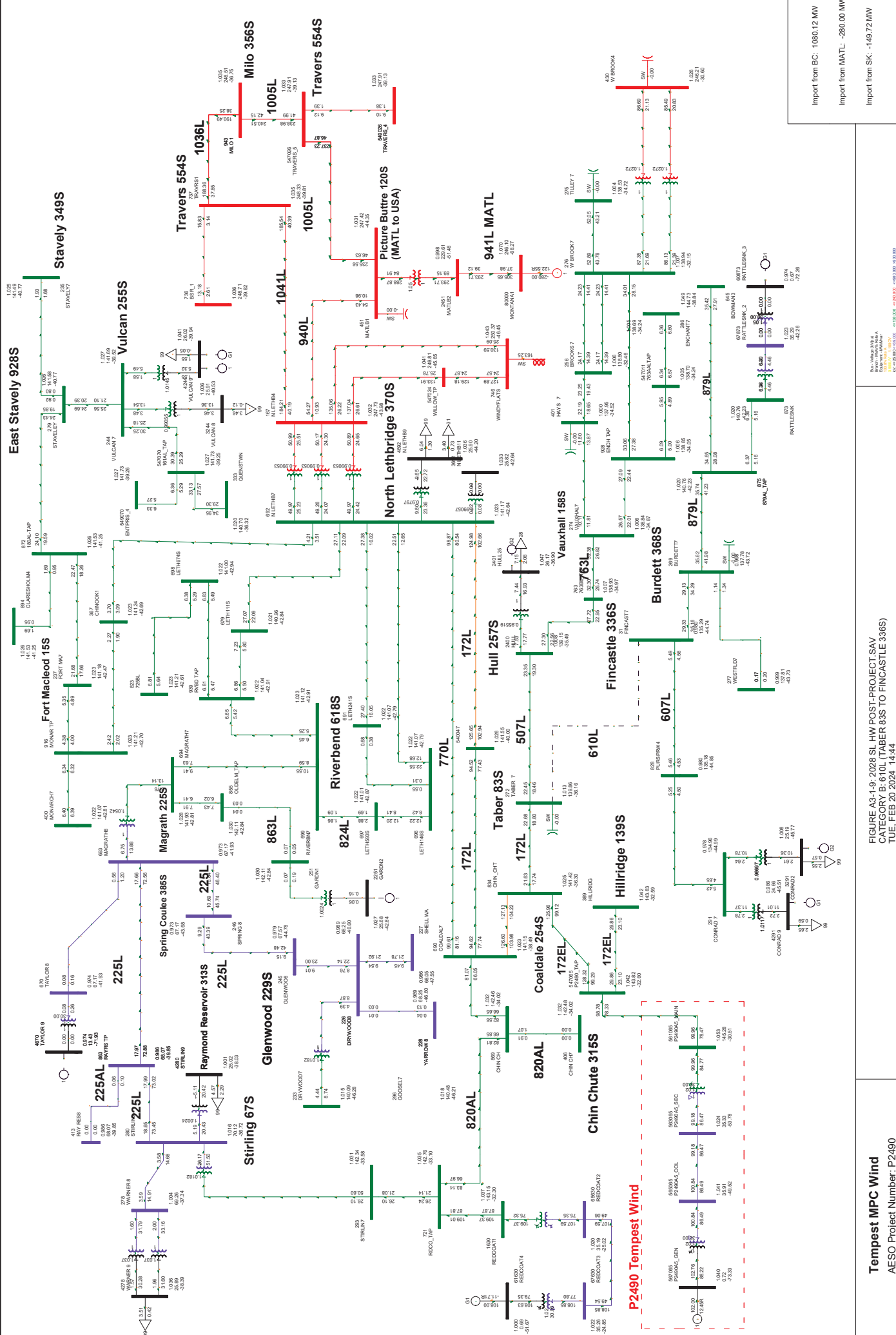


FIGURE A3-1-9: 2028 SL HW POST-PROJECT.SAV
CATEGORY B: 610L (TABER 83S TO FINCASTLE 336S)
TUE, FEB 20 2024 14:44

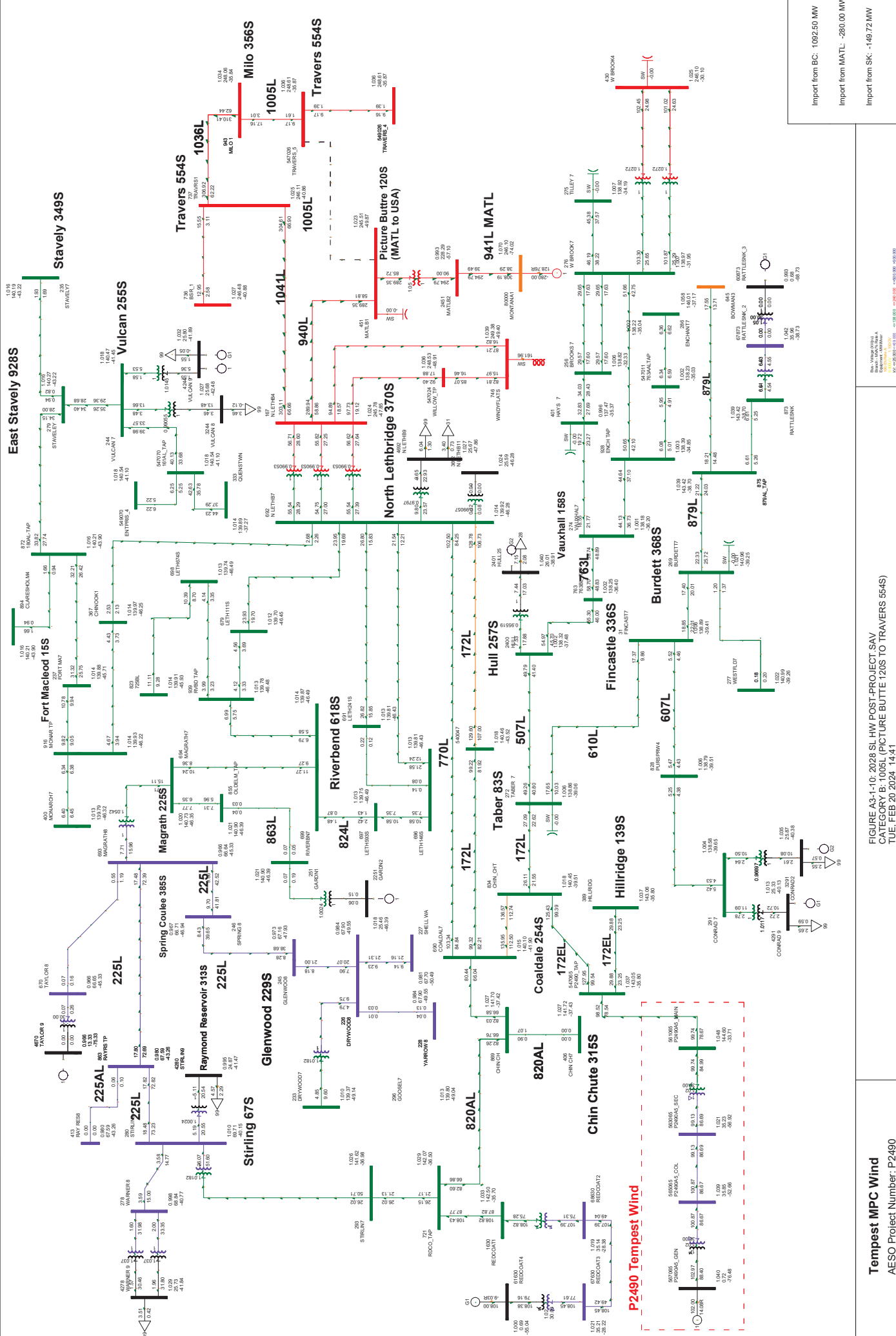


FIGURE A3-1-10: 2028 SL HW POST-PROJECT.SAV
CATEGORY B: 1005L (PICTURE BUTTE 120S TO TRAVERS 554S)
TUE, FEB 20 2024 14:41

East Stavelly 928S

Stavelly 349S

Fort Macleod 15S

Vulcan 255S

Travers 554S

1036L

Milo 356S

1005L

Travers 554S

1005L

Picture Butte 120S

(MATL to USA)

941L MATL

North Lethbridge 370S

Vauxhall 158S

Burdett 368S

Fincastle 336S

610L

Hillridge 139S

Chin Chute 315S

Coaldale 254S

820AL

Stirling 67S

Glenwood 229S

Raymond Reservoir 313S

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East Stavely 928S

Stavely 349S

Fort Macleod 15S

Magrath 225S

Spring Coulee 38S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

863L

824L

770L

172L

507L

610L

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1036L

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1041L

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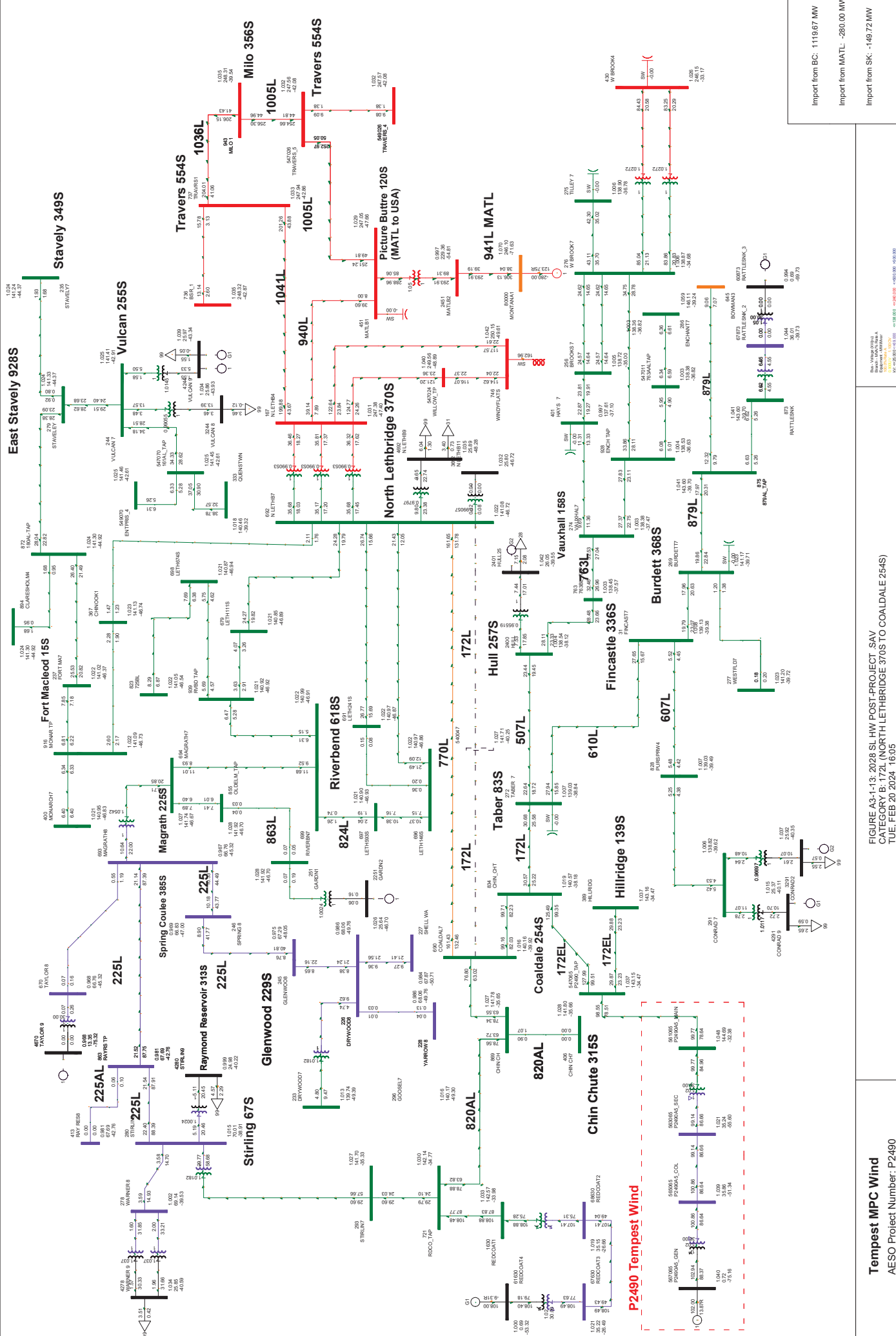


FIGURE A3-1-13: 2028 SL HW POST-PROJECT .SAV
CATEGORY B: 172L (NORTH LETHBRIDGE 370S TO COALDALE 254S)
TUE, FEB 20 2024 16:05

Import from BC: 1119.67 MW

Import from MATL: -280.00 MW

Import from SK: -149.72 MW

Bus - Voltage (V/vpu)
Branch - Amps/% Rate A
Equipment - MW/Mvar
100.0% Rate A
0.0000 V 1.0000 W
MW: -425.0000 -40.0000

ADDITIONAL INFORMATION

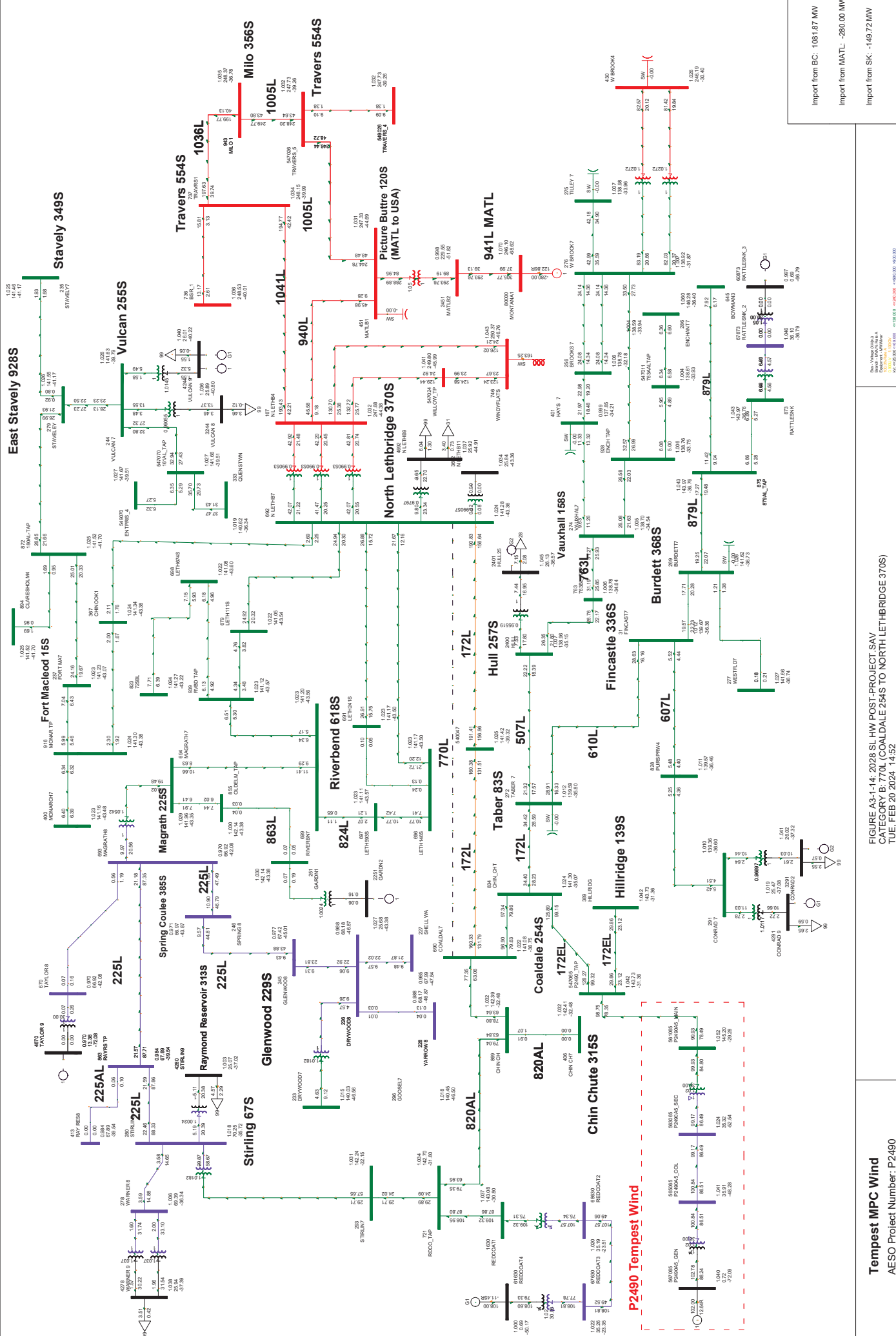


FIGURE A3-1-14: 2028 SL HW POST-PROJECT.SAV
CATEGORY B: 770L (COALDALE 254S TO NORTH LETHBRIDGE 370S)
TUE, FEB 20 2024 14:52

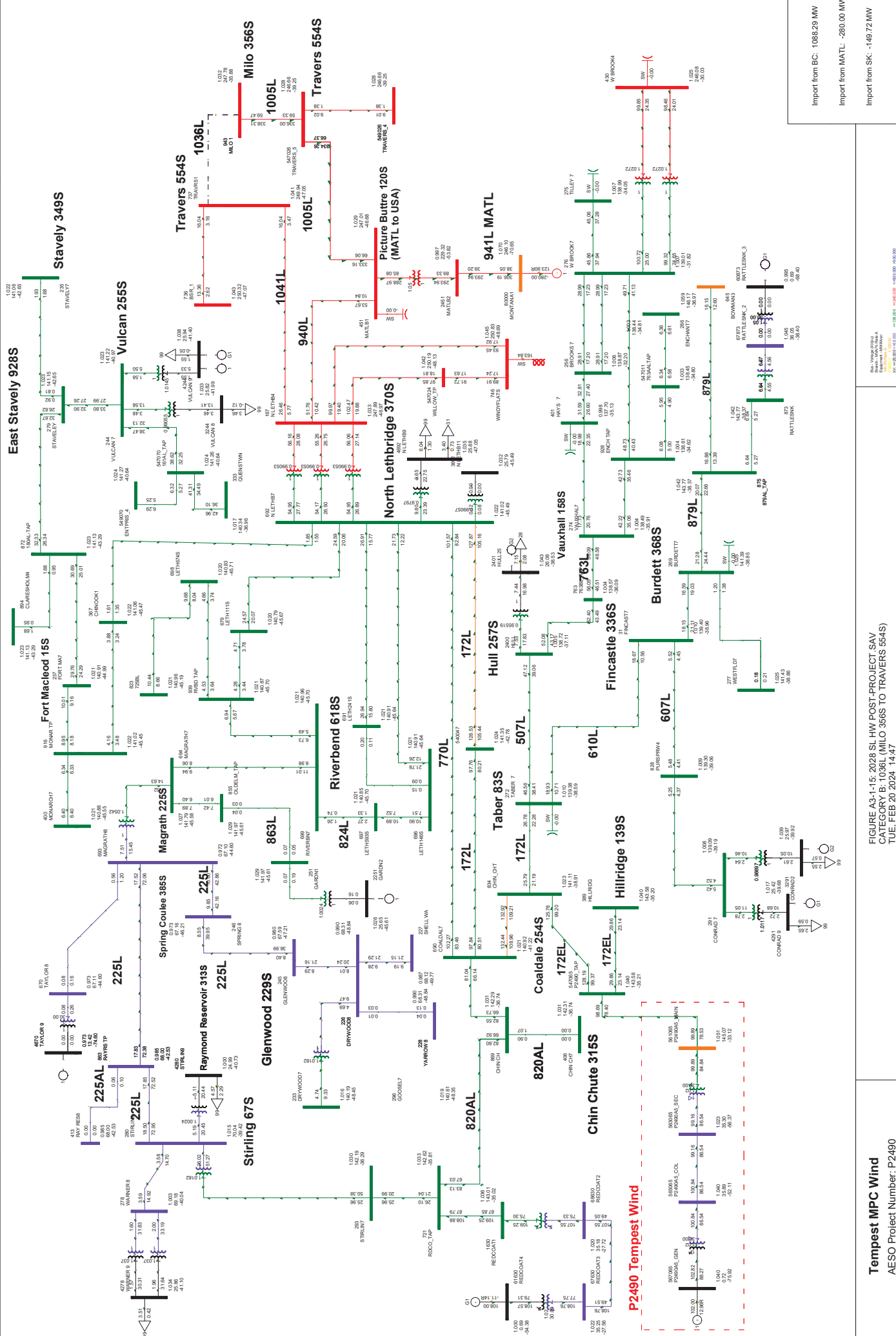


FIGURE A3-1-15: 2028 SL HW POST-PROJECT.SAV
CATEGORY B: 1036L (MILO 356S TO TRAVERS 554S)
TUE, FEB 20 2024 14:47

East Stavely 928S

Stavely 349S

STAVELY7

Fort Macleod 15S

STAVELY7

Vulcan 255S

STAVELY7

Travers 554S

STAVELY7

1005L

STAVELY7

Travers 554S

STAVELY7

1005L

STAVELY7

Picture Butte 120S

STAVELY7

941L MATL

STAVELY7

North Lethbridge 370S

STAVELY7

Vauxhall 158S

STAVELY7

Burdett 368S

STAVELY7

607L

STAVELY7

Hillridge 139S

STAVELY7

Chin Chute 315S

STAVELY7

820AL

STAVELY7

Coaldale 254S

STAVELY7

172L

STAVELY7

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Stavely 349S

Fort Macleod 15S

Vulcan 255S

Magrath 225S

Spring Coulee 385S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

Travers 554S

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North Lethbridge 370S

Riverbend 618S

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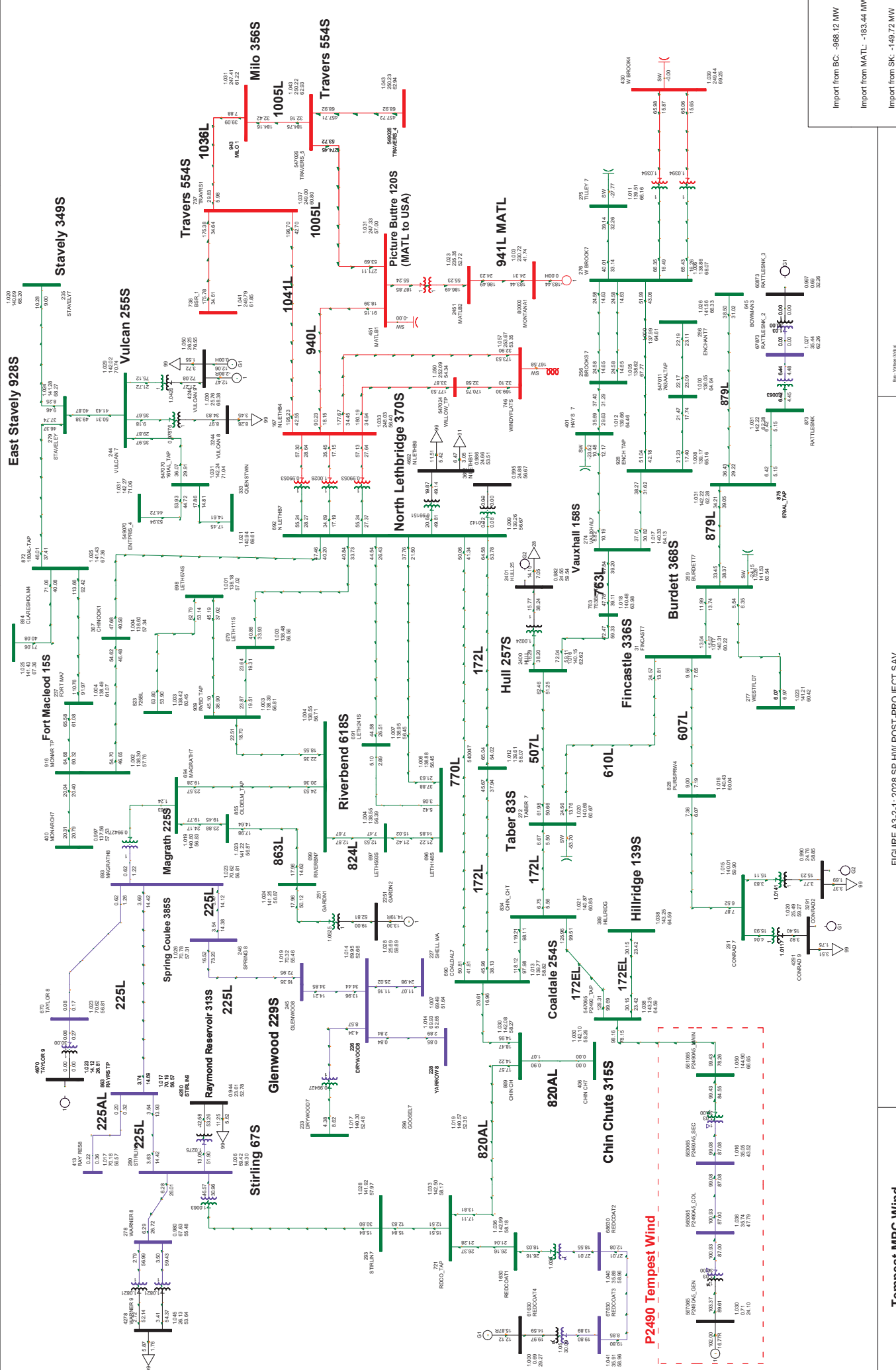


FIGURE A3-2-1: 2028 SP HW POST-PROJECT.SAV
CATEGORY A - NO CONTINGENCY
TUE, FEB 20 2024 16:30

Tempest MPC Wind
AESO Project Number: P2490

Import from BC: -968.12 MW
Import from MATL: -183.44 MW
Import from SK: -149.72 MW

Bus - Voltage (V/Vp.u)			
Branch - MinV, % Rate A			
Equipment - MW/Mvar			
100.0% Rate A			
0.000 V	5.000 GV		
MW = 25.000	Mvar = 40.000		
		400.000	400.000
		100.000	100.000
		240.000	240.000
		400.000	400.000

East Stavelly 928S

Stavelly 349S

Fort Macleod 15S

225L

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Magrath 225S

Spring Coulee 38S

Raymond Reservoir 313S

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FIGURE A3-2-2: 2028 SP HW POST-PROJECT.SAV
CATEGORY B: 940L (NORTH LETHBRIDGE 370S TO PICTURE BUTTE 120
TUE, FEB 20 2024 16:42

Tempest MPC Wind
AESO Project Number: P2490

Import from BC: -964.16 MW
Import from MATL: -183.44 MW
Import from SK: -149.72 MW

See: Vantage Wind
Category: B
Date: 2024-02-20 16:42
AESO Project Number: P2490

P2490 Tempest Wind

East Stavelly 928S

Stavelly 349S

Fort Macleod 15S

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Spring Coulee 38S

Raymond Reservoir 313S

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Glenwood 229S

Stirling 67S

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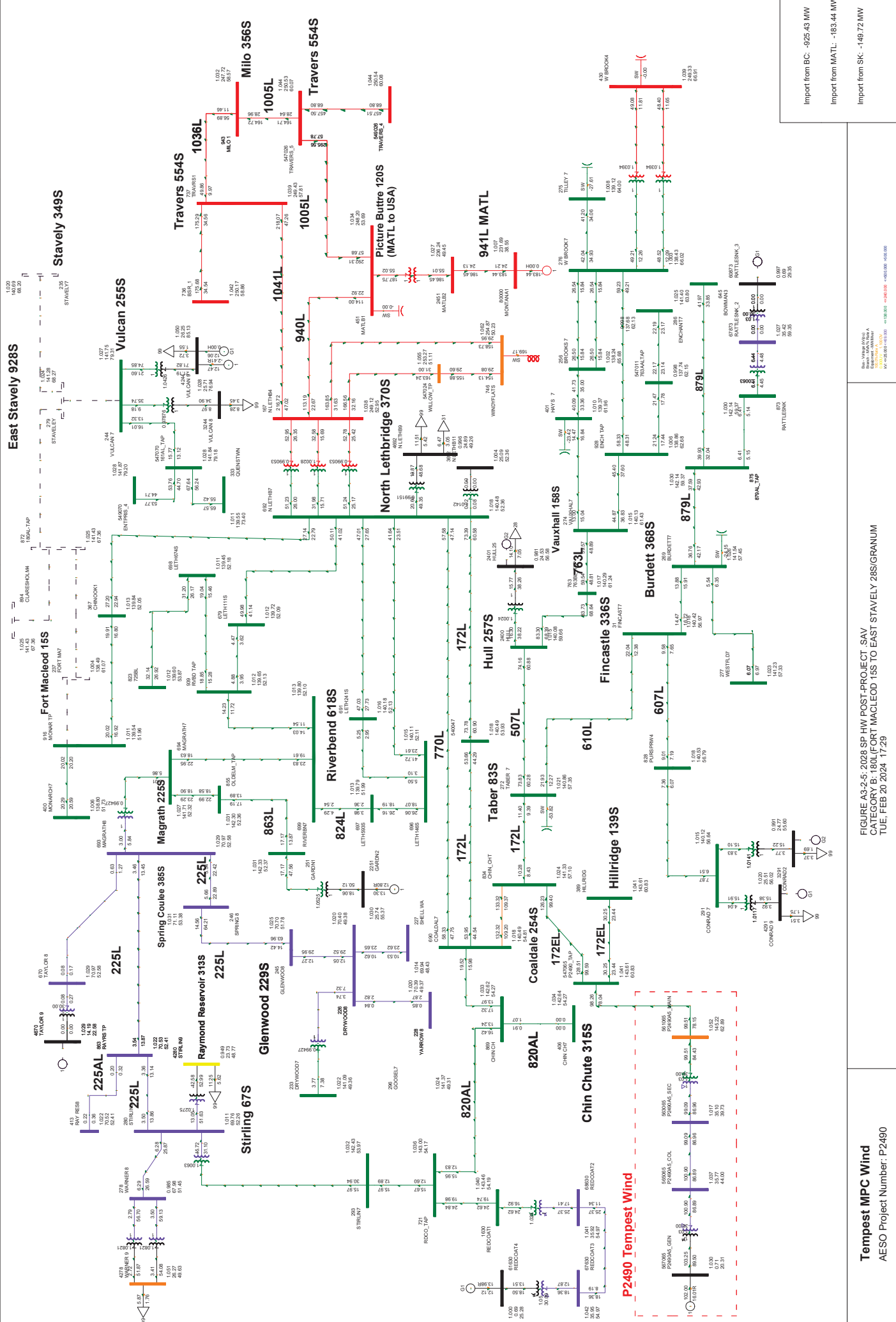
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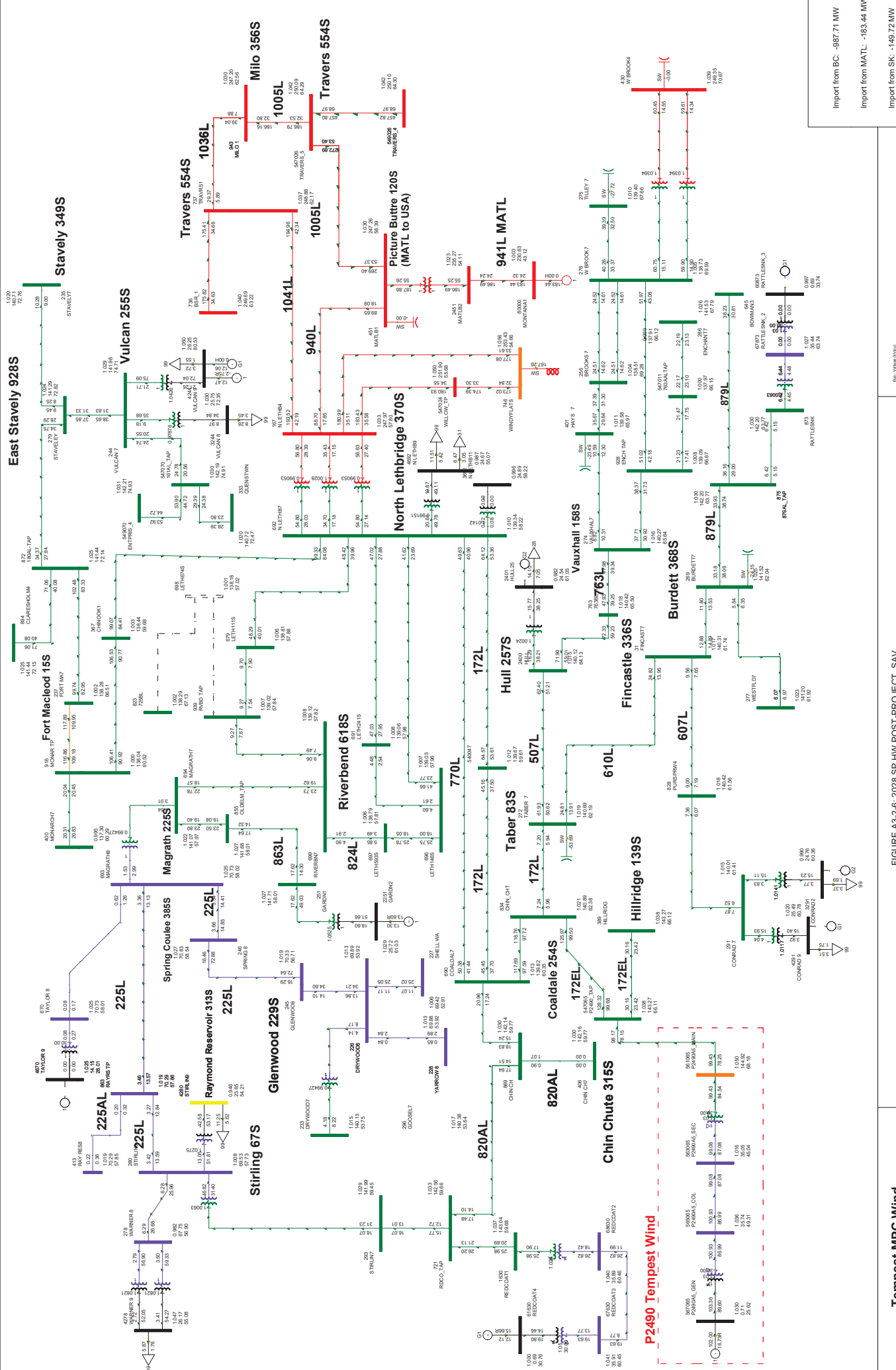


FIGURE A3-2-6: 2028 SP HW POST-PROJECT .SAV
CATEGORY B: BOWRON 674S 13.8/138 KV T1/T2
TUE, FEB 20 2024 17:42

Tempest MPC Wind
AESO Project Number: P2490

Import from BC: -987.71 MW

Import from MATL: -183.44 MW

Import from SK: -149.72 MW

Bus - Voltage (kV@u)	
Branch - MVA% Rate A	
Equipment - MW/MVar	
100.0% Rate A	
0.0000 V	1.1000 V
kV	→ 25.0000 V (1.0000 kV)
	→ 139.0000 → 240.000 → 450.000 → 500.000

East Stavelly 928S

Stavelly 349S

Vulcan 255S

Travers 554S

Stirling 67S

Glenwood 229S

Riverbend 618S

Hull 257S

Vauxhall 158S

Burdett 368S

941L MATL

Milo 356S

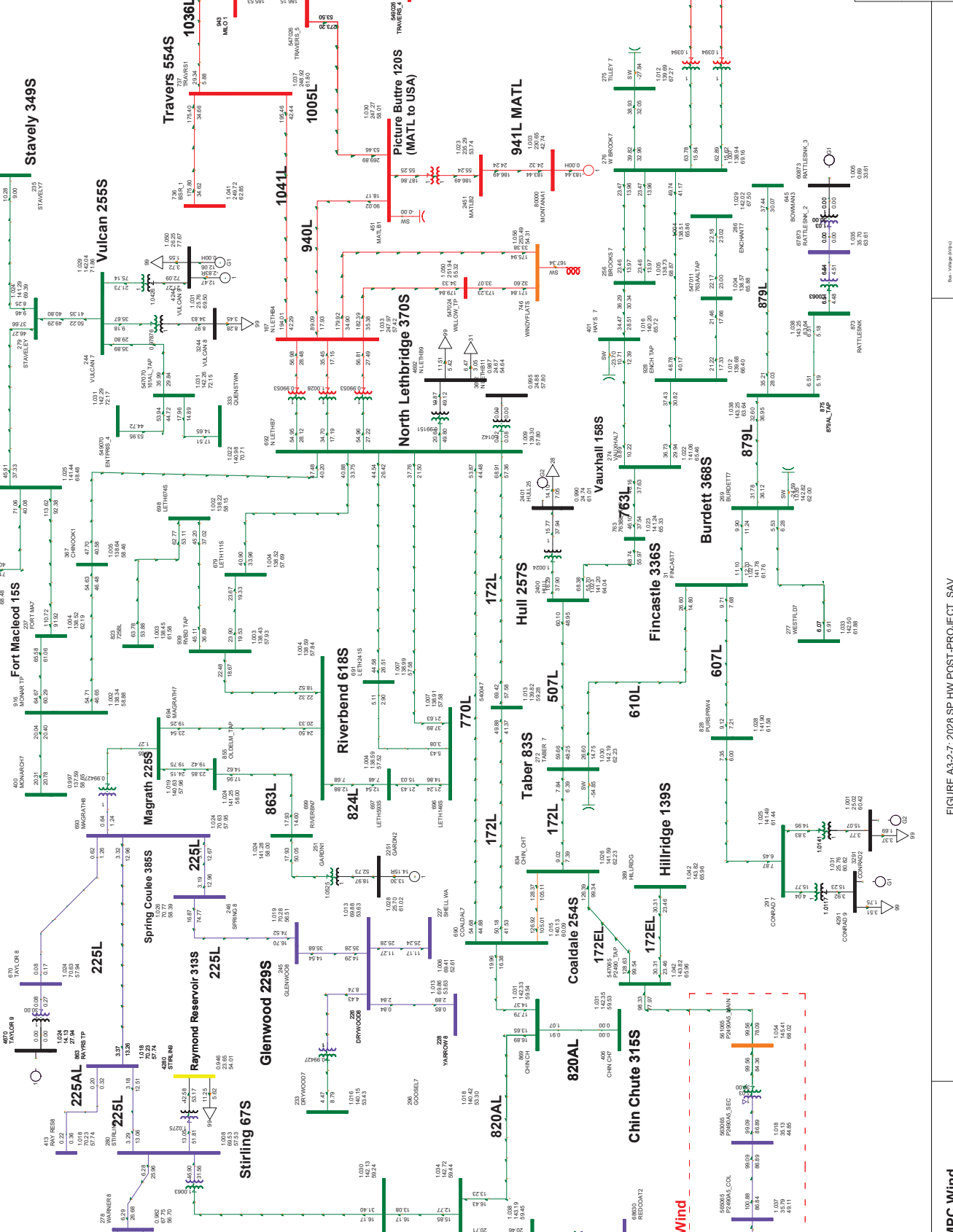
Travers 554S

1005L

Travers 554S

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Travers 554S



Tempest MPC Wind
AESO Project Number: P2490

FIGURE A3-2-7: 2028 SP HW POST-PROJECT SAV
CATEGORY B: TABER 83S 25/138 KV T1
WED, FEB 21 2024 9:09

Rev: Veng Veng
Category: B
Date: 2024-02-21
By: Veng Veng

Import from BC: -982.50 MW
Import from MATL: -183.44 MW
Import from SK: -149.72 MW

East Stavely 928S

Stavely 349S

Fort Macleod 15S

Vulcan 255S

Magrath 225S

Spring Coulee 385S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

Riverbend 618S

North Lethbridge 370S

Hull 257S

Taber 83S

Coaldale 254S

Chin Chute 315S

Hillridge 139S

Burdett 368S

Vauxhall 158S

941L MATL

Picture Butte 120S

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Travers 554S

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FIGURE A3-2-10: 2028 SP HW POST-PROJECT SAV
CATEGORY B: FINCASTLE 336S 25/138 KV T1/T2
WED, FEB 21 2024 9:22

Tempest MPC Wind
AESO Project Number: P2490

Import from BC: -996.23 MW
Import from MATL: -183.44 MW
Import from SK: -149.72 MW

See: Vauxhall Wind
Export: -100.00 MW
Import: -100.00 MW
Net: -200.00 MW

East Stavely 928S

Stavely 349S

Fort Macleod 15S

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Vulcan 255S

Travers 554S

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Magrath 225S

Spring Coulee 388S

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Raymond Reservoir 313S

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East Stavelly 928S

Stavelly 349S

Fort Macleod 15S

Stirling 67S

Spring Coulee 38S

Raymond Reservoir 313S

Glenwood 229S

Magrath 225S

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863L

824L

Riverbend 618S

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Travers 554S

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Glenwood 229S

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Riverbend 618S

North Lethbridge 370S

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Attachment A4

Post-Project Transient Stability Diagram

Scenario 3 2028 SL HR Post-Project Plots

Scenario 4 2028 SP HR Post-Project Plots

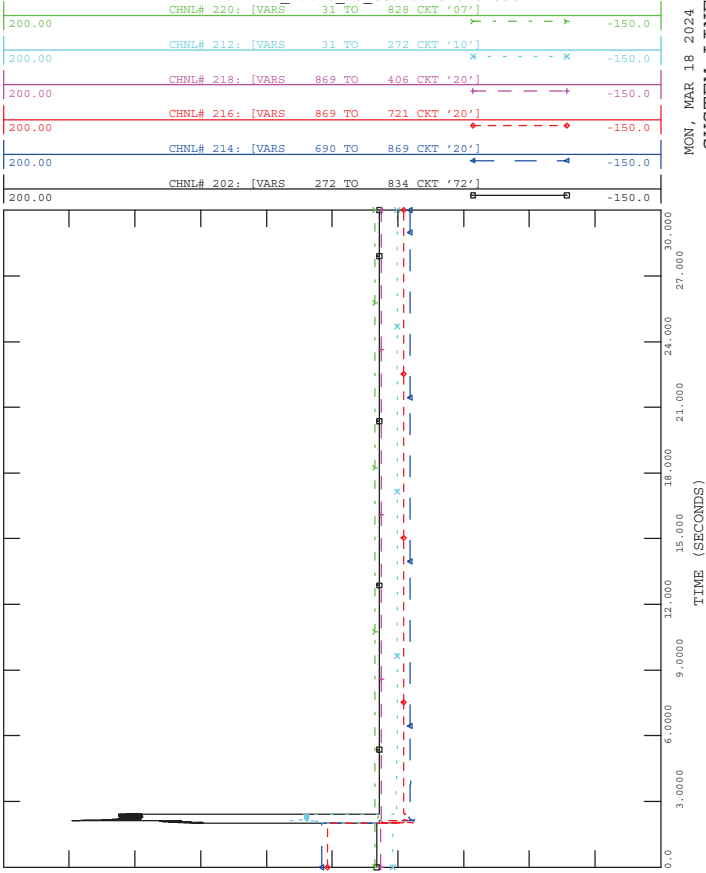
Table A4-1: Transient Stability Study Results under Category B Conditions for Scenario 3

Studied Contingency	Fault Description and Location	Results
172L/172EL (Coaldale 254S to Taber 83S)	Coaldale 254S	Stable
	Taber 83S	Stable
	Hillridge 139S	Stable
820L/820AL (Coaldale 254S to Stirling 67S)	Coaldale 254S	Stable
	Stirling 67S	Stable
	Chin Chute 315S	Stable
610L (Taber 83S to Fincastle 336S)	Taber 83S	Stable
	Fincastle 336S	Stable
607L/607AL (Fincastle 336S to Conrad 135S)	Conrad 135S	Stable
	Fincastle 336S	Stable
	Taber Wind Farm 134S	Stable



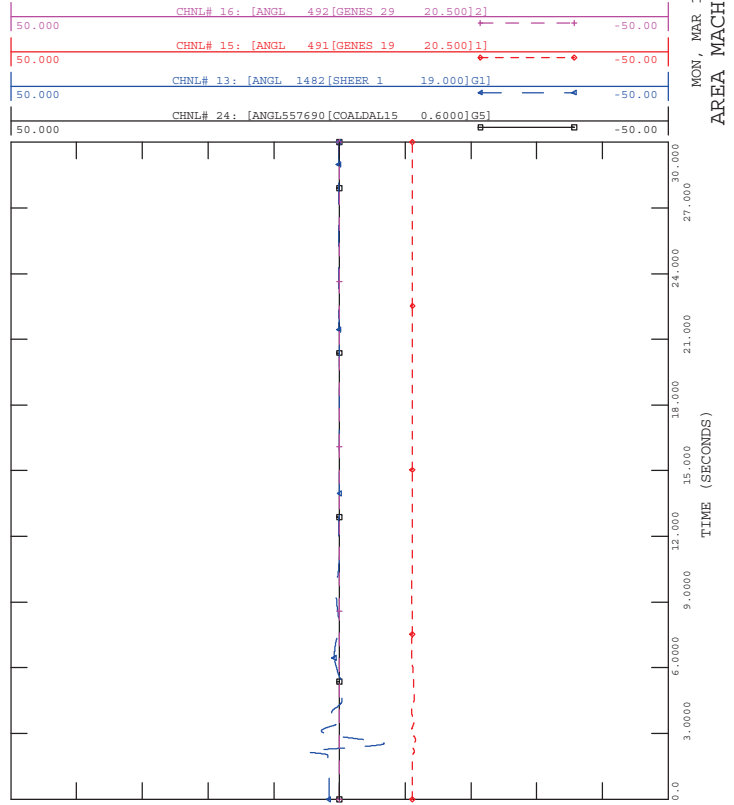
SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_COALDALE254S

FILE: 172L&172EL_Fault_at_Coaldale254S.out
CHNL# 220: [VARS 31 TO 828 CKT '07']



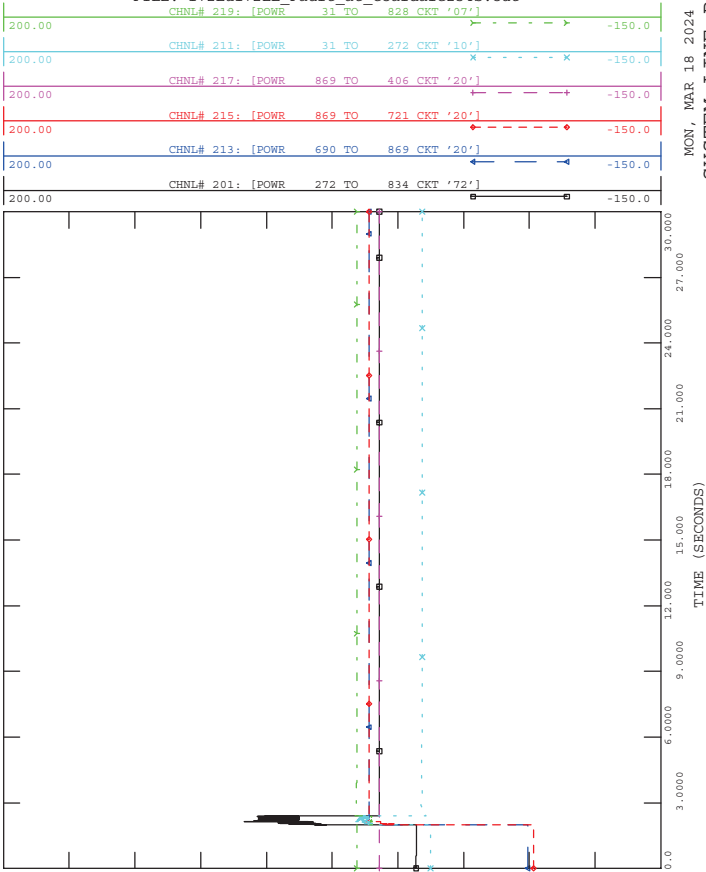
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FILE: 172L&172EL_Fault_at_Coaldale254S.out



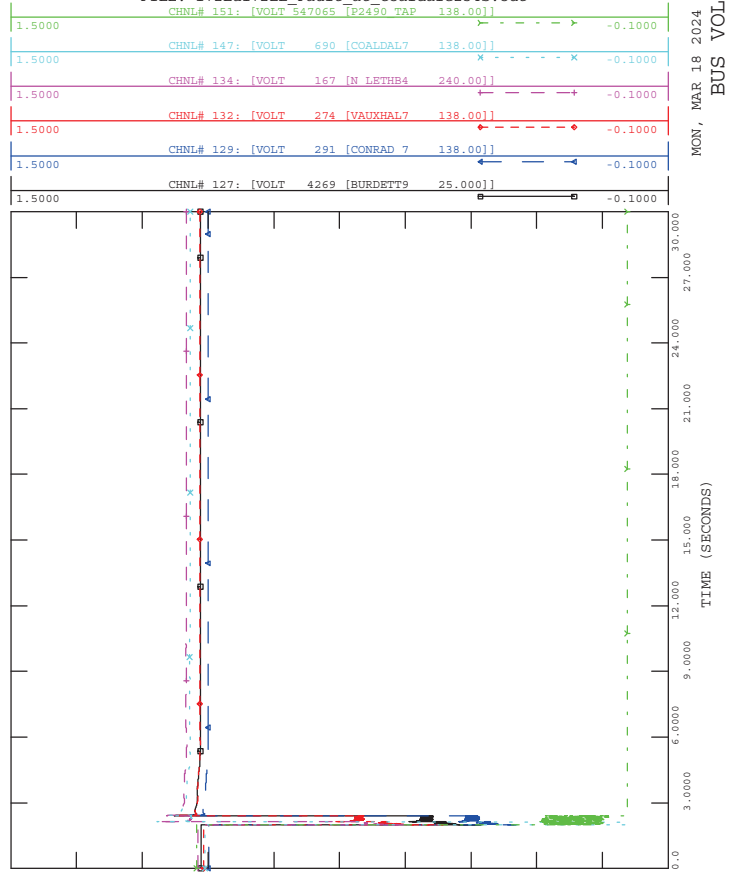
SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_COALDALE254S

FILE: 172L&172EL_Fault_at_Coaldale254S.out
CHNL# 219: [POWR 31 TO 828 CKT '07']



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_COALDALE254S

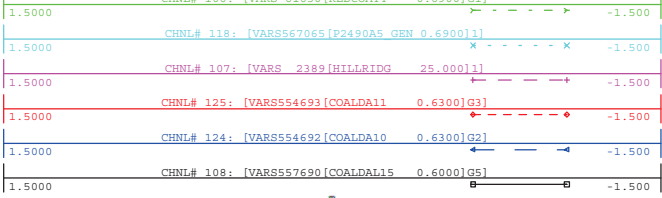
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SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_COALDALE254S

FILE: 172L&172EL Fault_at Coaldale254S.out
CHNL# 106: [VARS 61630[REDCOAT4 0.6900]G1]

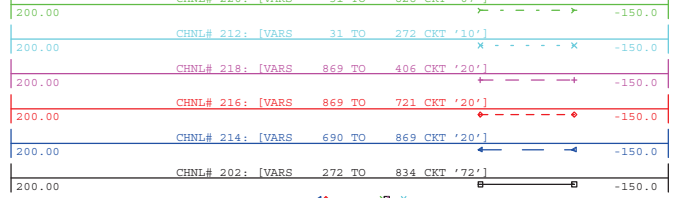


MON, MAR 18 2024 15:36
MACHINE VAR



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_HILLRIDGE139S

FILE: 172L&172EL Fault_at Hillridge139S.out
CHNL# 220: [VARS 31 TO 272 CKT '10']

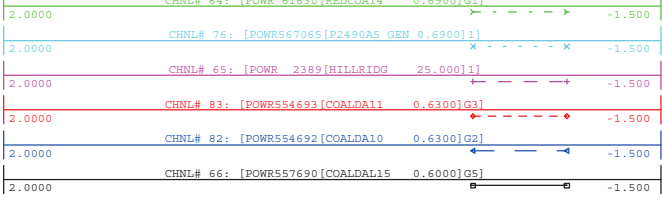


MON, MAR 18 2024 15:36
SYSTEM LINE VAR



SCENARIO #3: 2028 SL POST PROJECT
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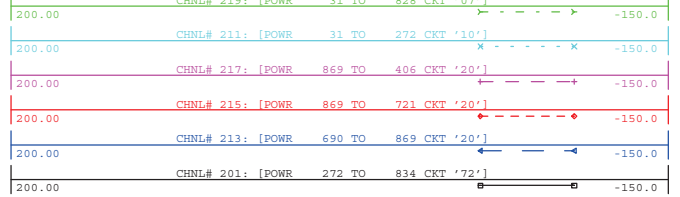


MON, MAR 18 2024 15:36
MACHINE POWER



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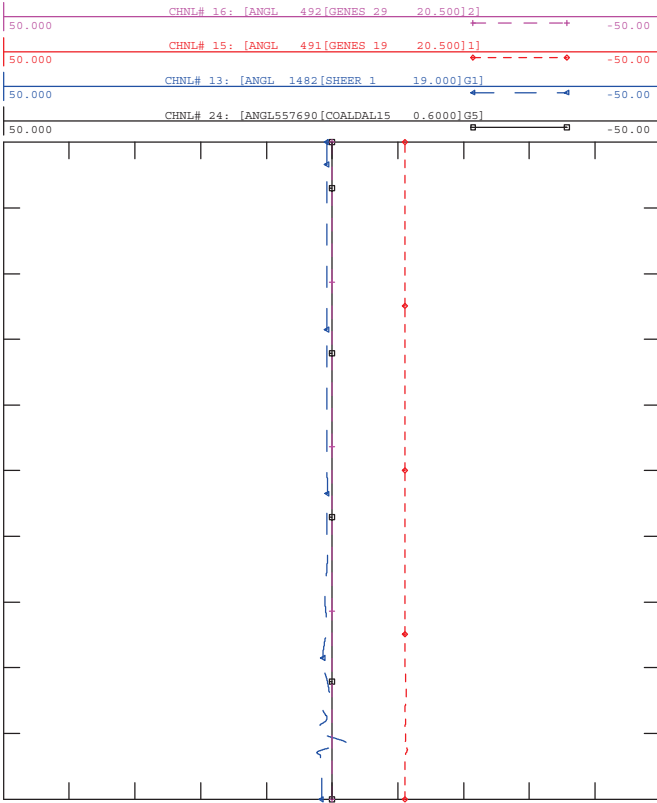


MON, MAR 18 2024 15:36
SYSTEM LINE POWER



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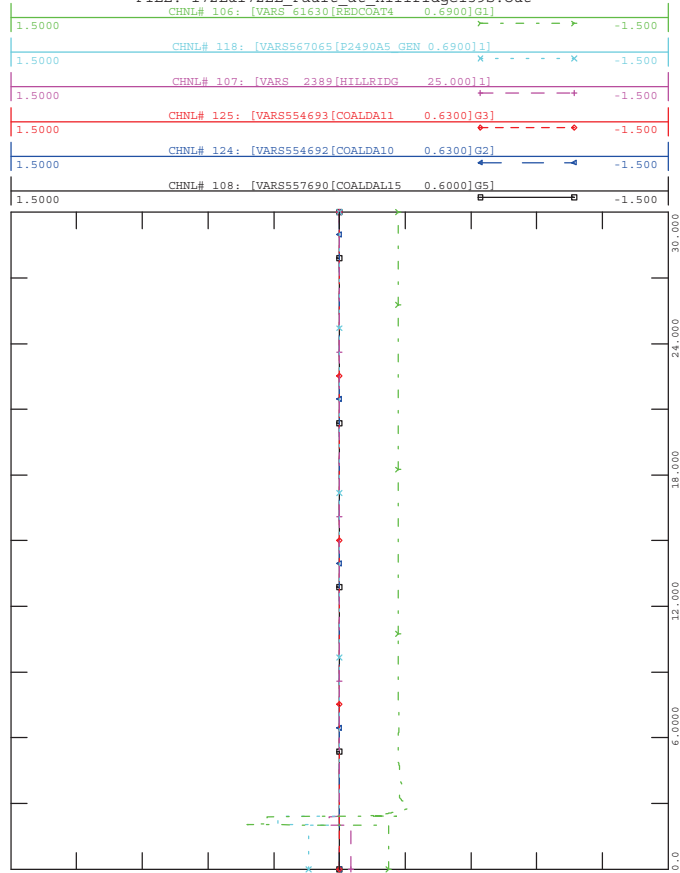


MON, MAR 18 2024 15:36
AREA MACHINE ANGLE



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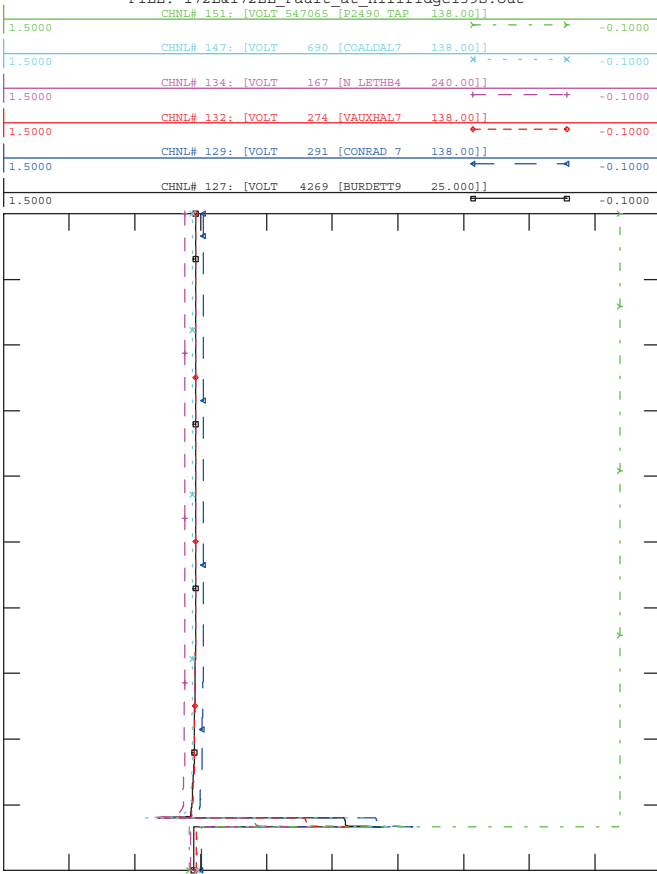


MON, MAR 18 2024 15:36
MACHINE VAR



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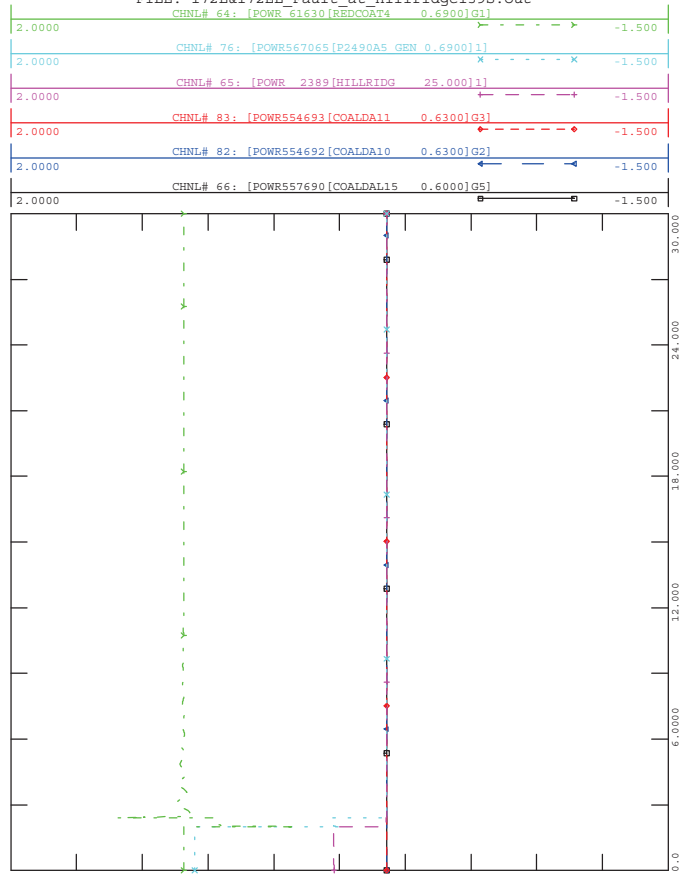


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BUS VOLTAGE



SCENARIO #3: 2028 SL POST PROJECT
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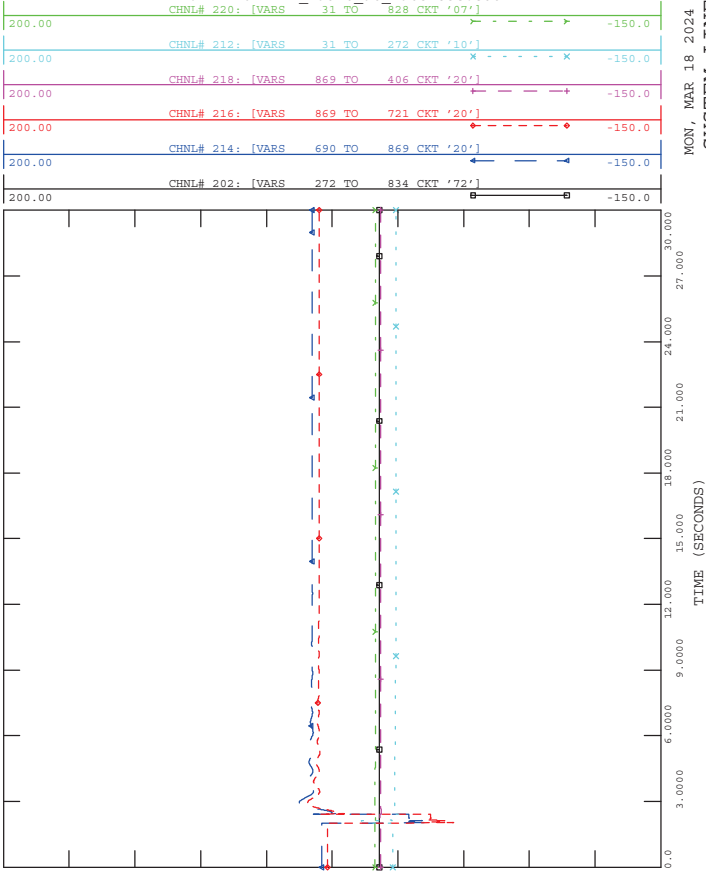


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MACHINE POWER



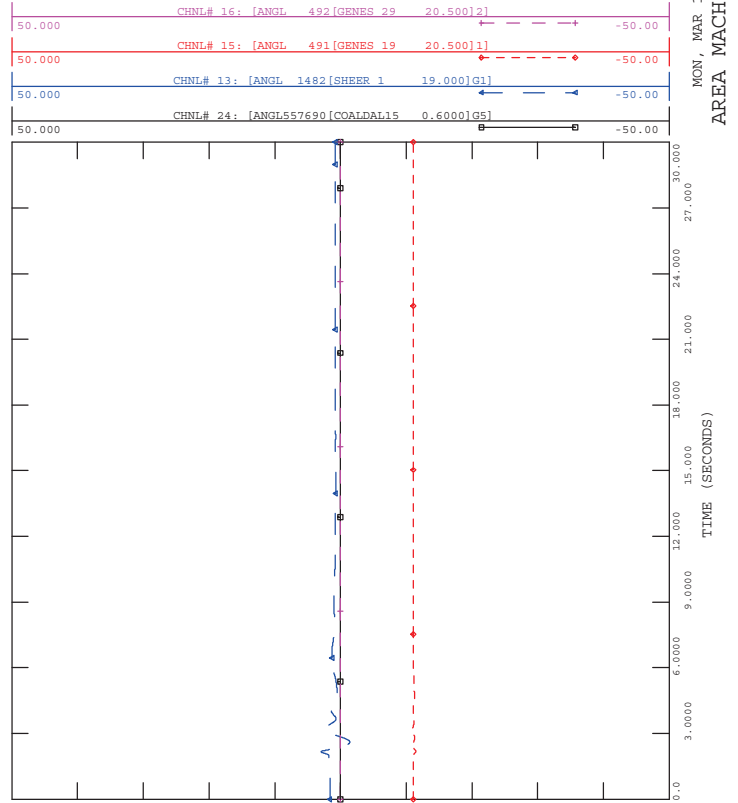
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CONTINGENCY -172L&172EL_FAULT_AT_TABER83S

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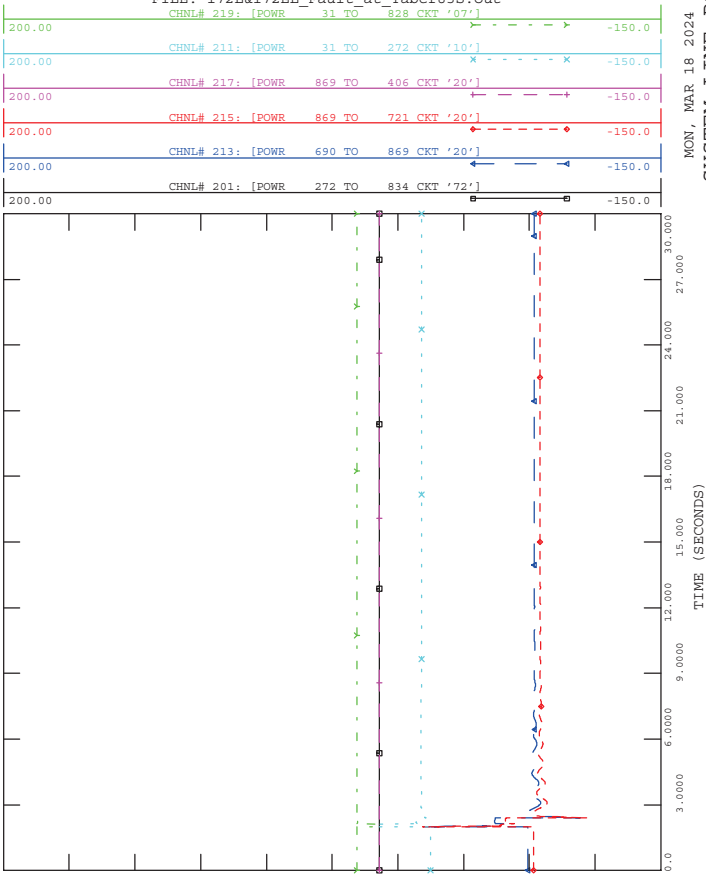
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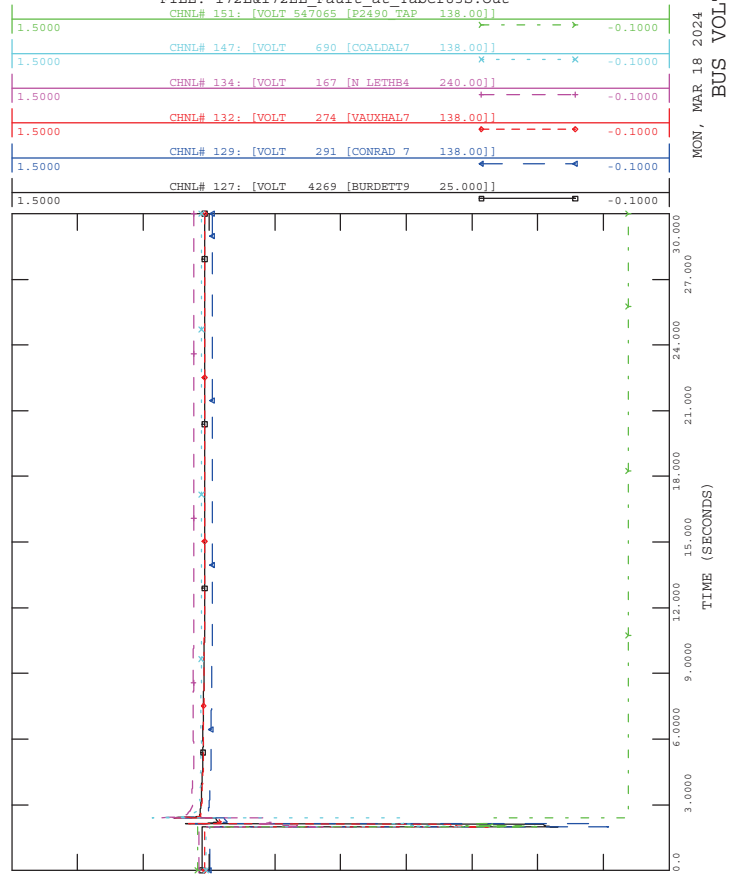
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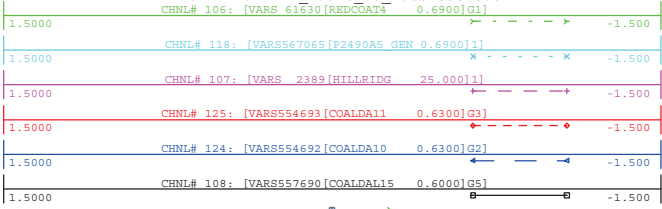
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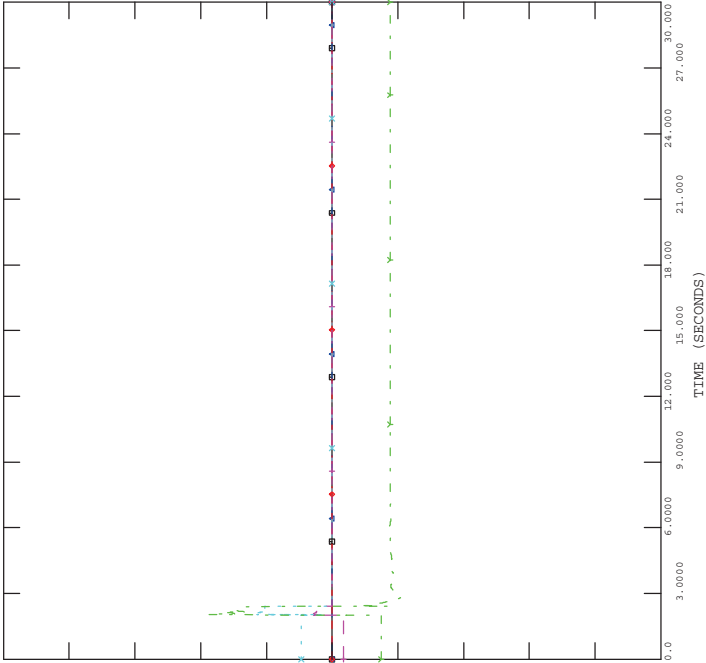


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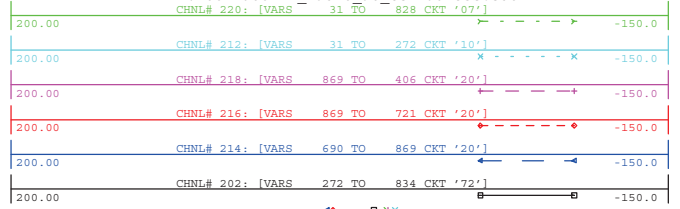


MON, MAR 18 2024 15:36
MACHINE VAR

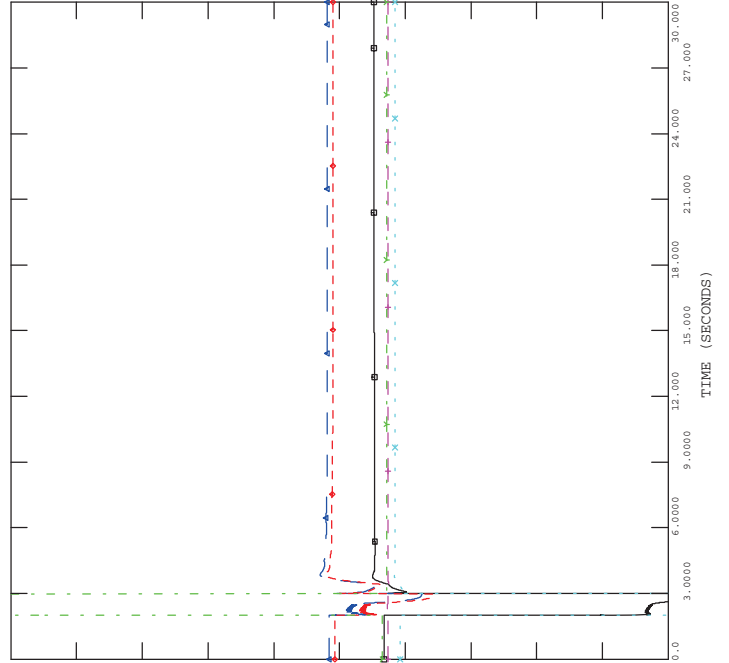


SCENARIO #3: 2028 SL POST PROJECT
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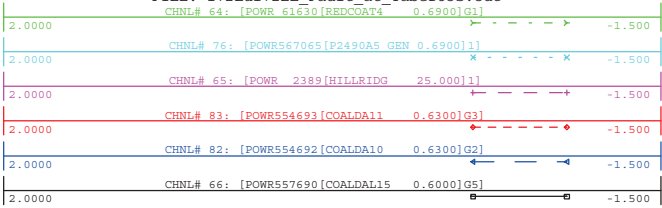


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SYSTEM LINE VAR

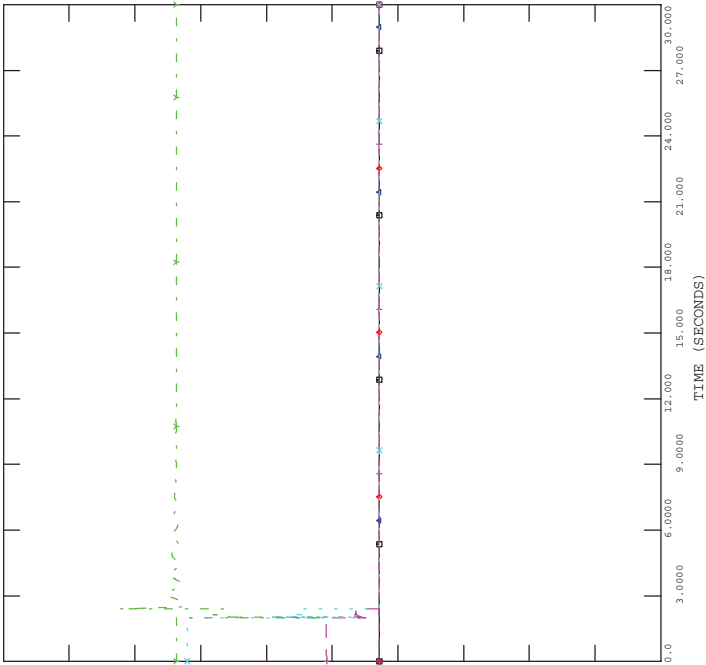


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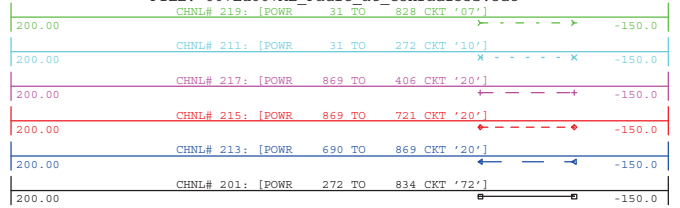


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MACHINE POWER

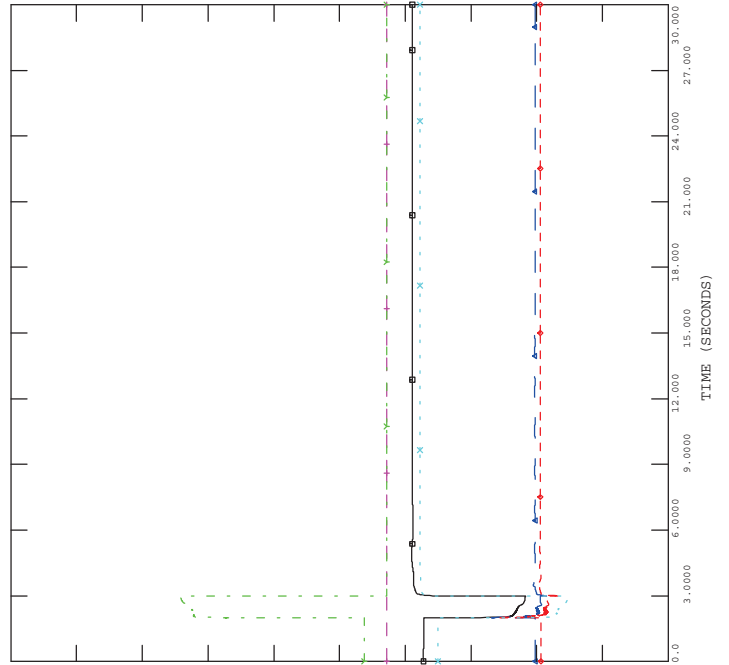


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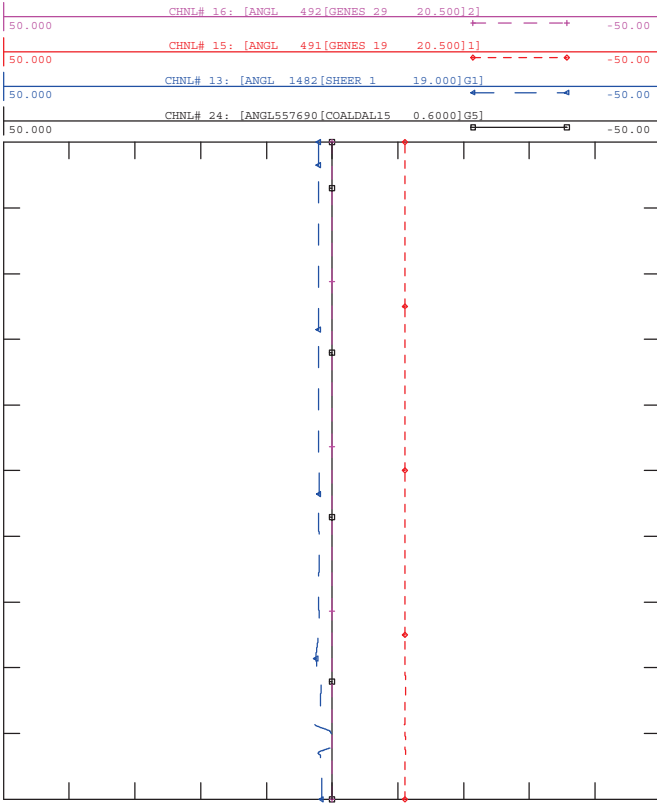
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SYSTEM LINE POWER





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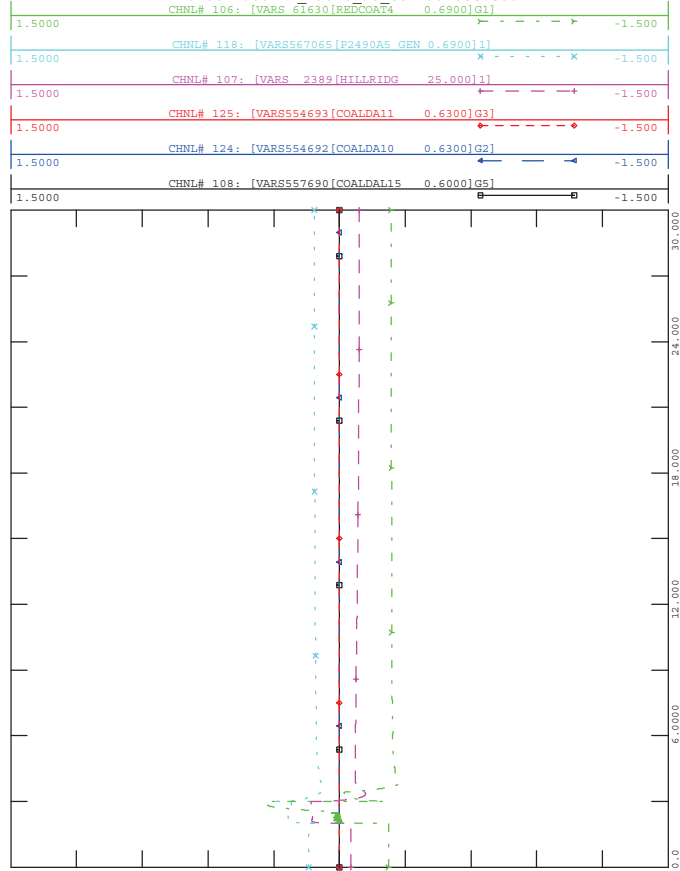


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AREA MACHINE ANGLE



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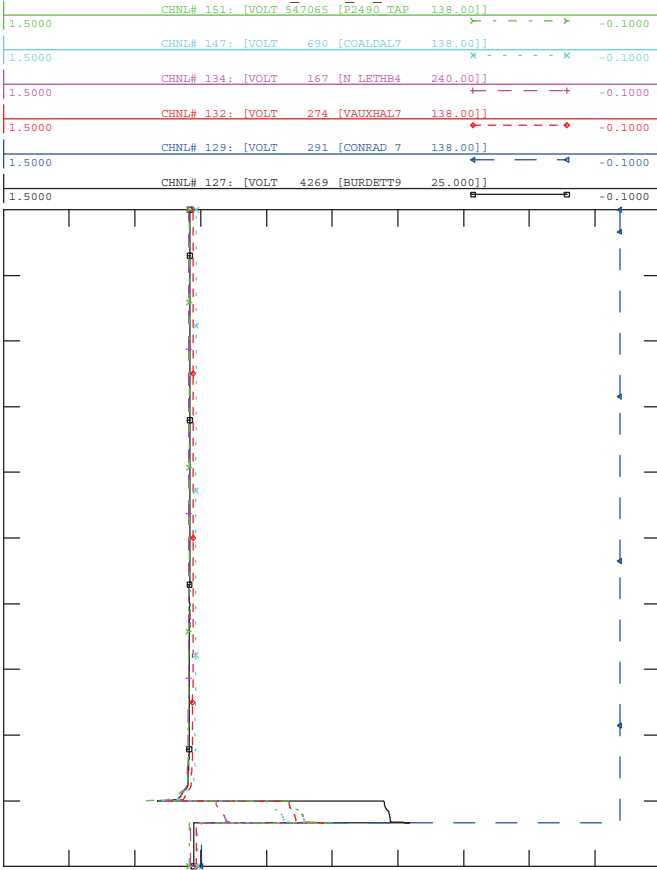


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MACHINE VAR



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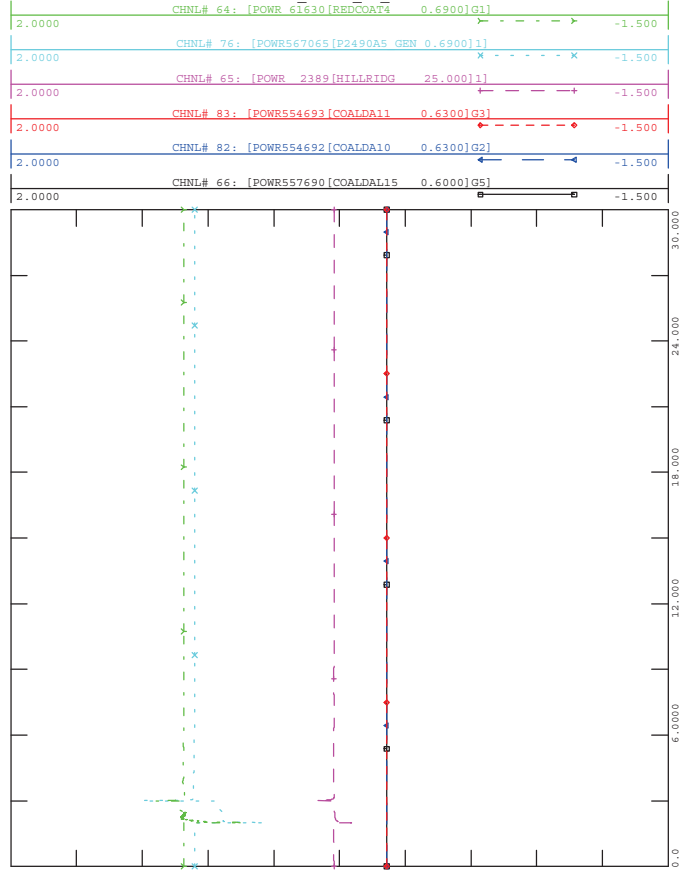


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BUS VOLTAGE



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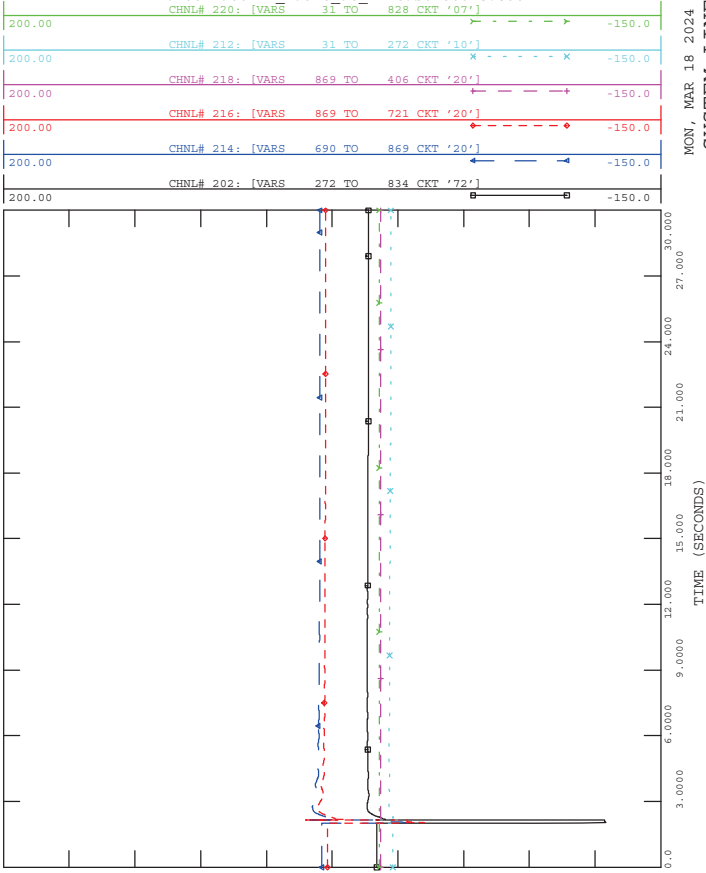


MON, MAR 18 2024 15:36
MACHINE POWER



SCENARIO #3: 2028 SL POST PROJECT
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FILE: 607L&607AL_Fault_at_Fincastle607S.out

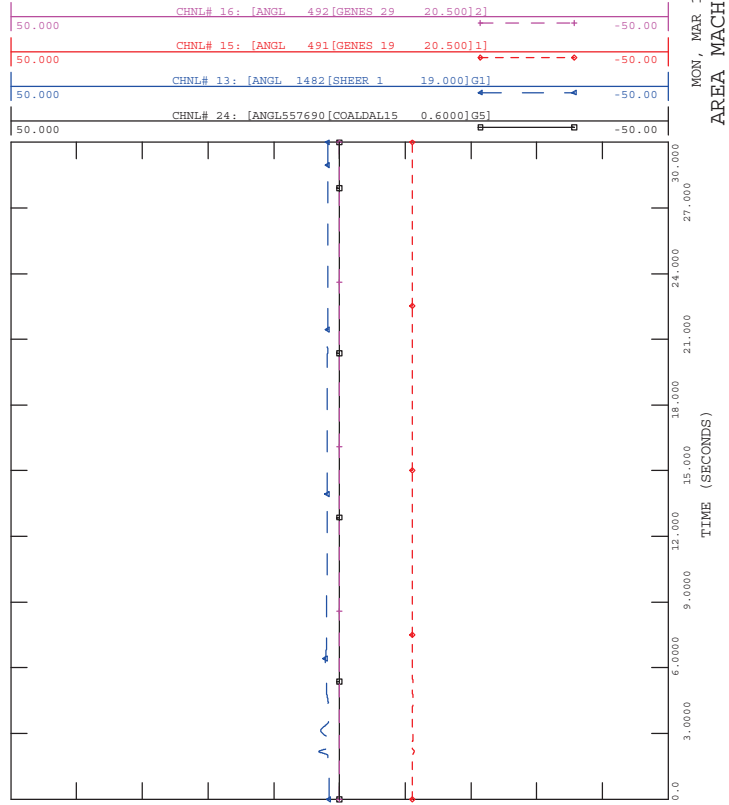


MON, MAR 18 2024 15:36
SYSTEM LINE VAR



SCENARIO #3: 2028 SL POST PROJECT
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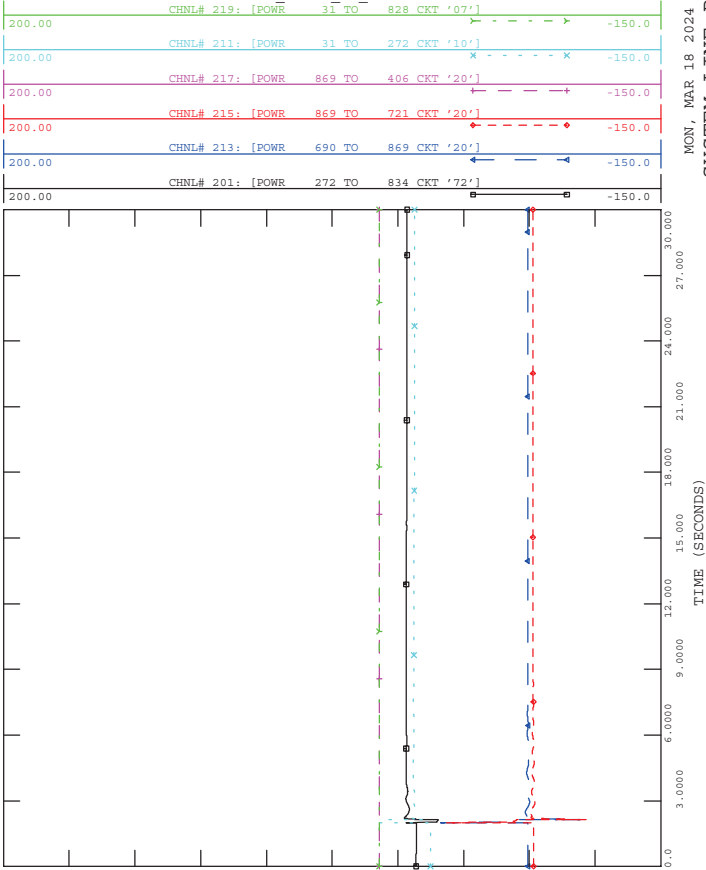


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AREA MACHINE ANGLE



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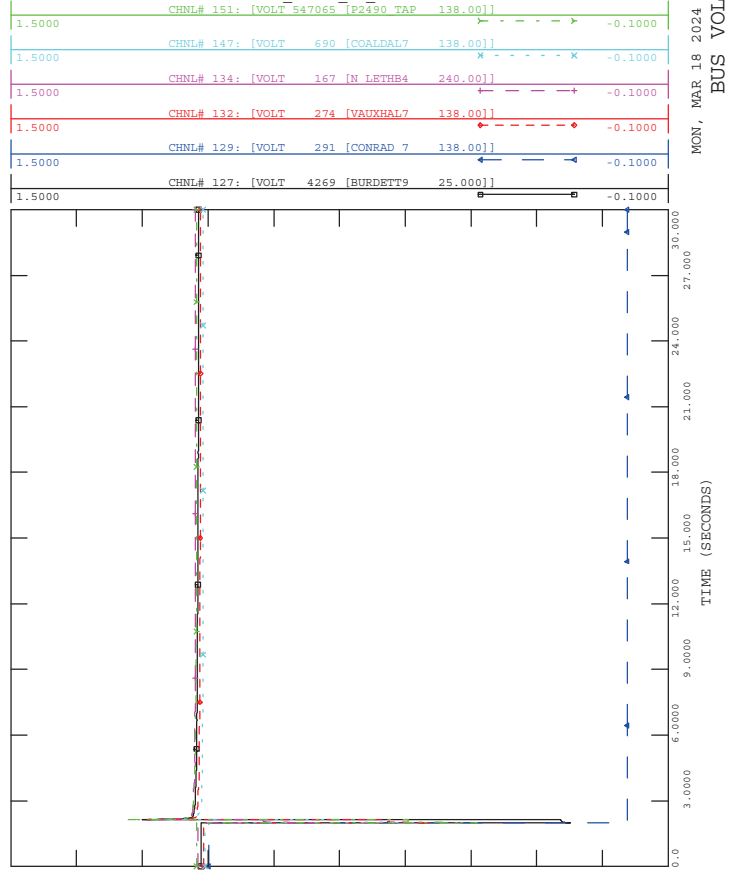


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SYSTEM LINE POWER



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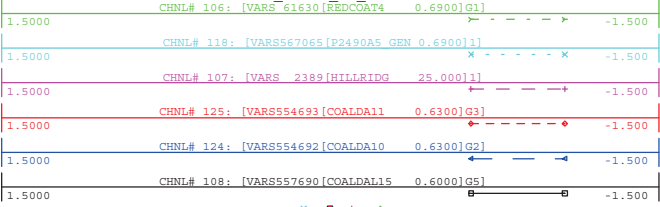


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BUS VOLTAGE



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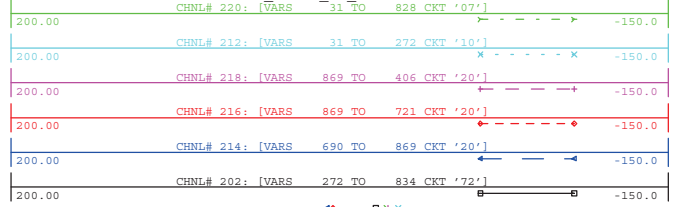


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MACHINE VAR



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_TABERWINDFARM134S

FILE: 607L&607AL Fault at TaberWindFarm134S.out

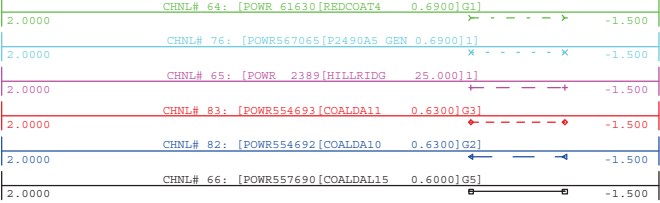


MON, MAR 18 2024 15:36
SYSTEM LINE VAR



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_FINCASTLE607S

FILE: 607L&607AL Fault at Fincastle607S.out

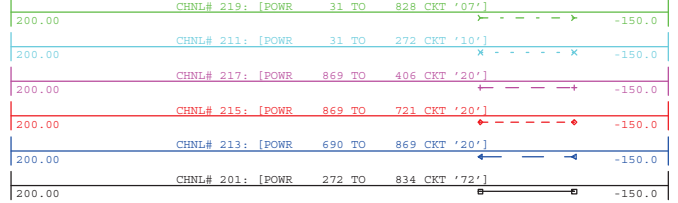


MON, MAR 18 2024 15:36
MACHINE POWER



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_TABERWINDFARM134S

FILE: 607L&607AL Fault at TaberWindFarm134S.out

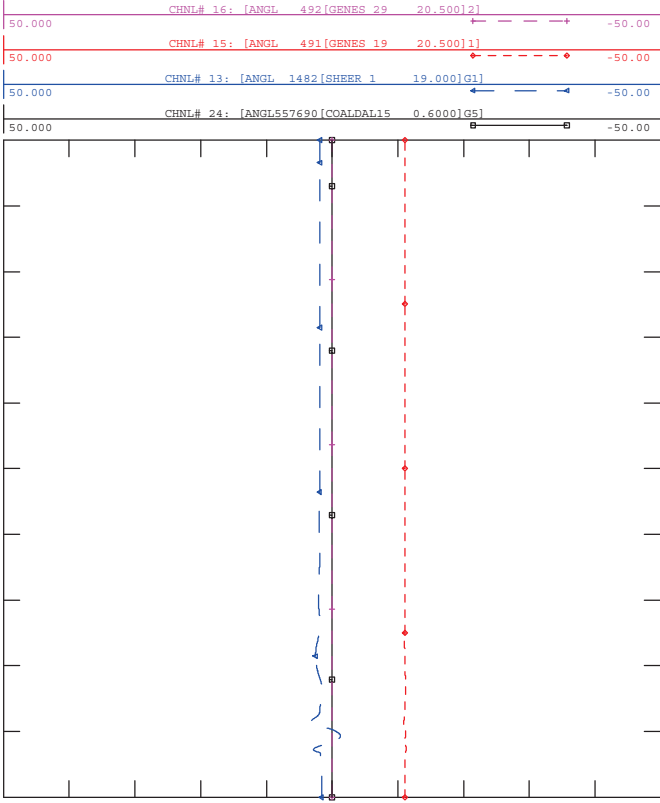


MON, MAR 18 2024 15:36
SYSTEM LINE POWER



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_TABERWINDFARM134S

FILE: 607L&607AL_Fault_at_TaberWindFarm134S.out

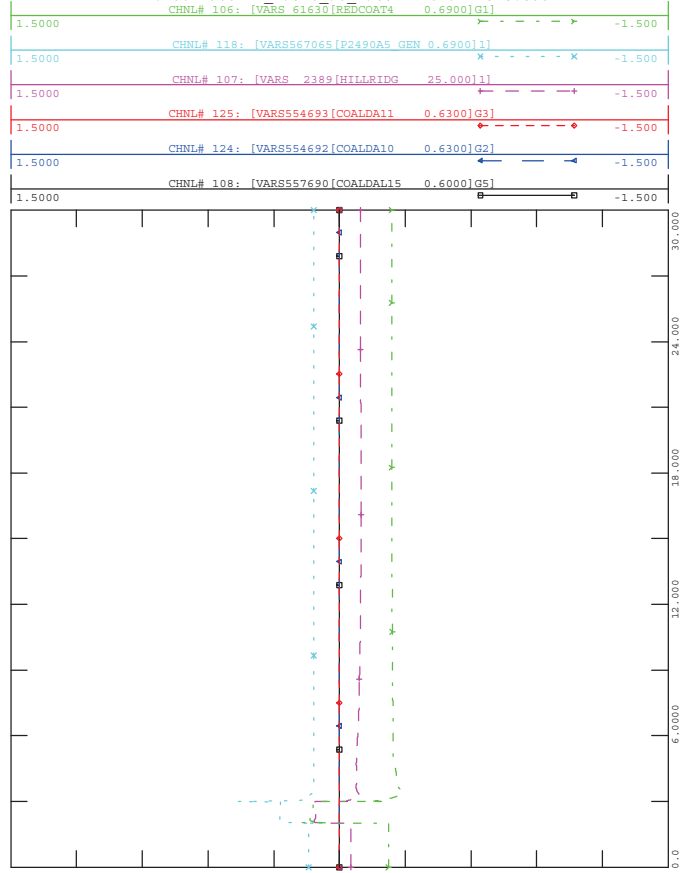


MON, MAR 18 2024 15:36
AREA MACHINE ANGLE



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_TABERWINDFARM134S

FILE: 607L&607AL_Fault_at_TaberWindFarm134S.out

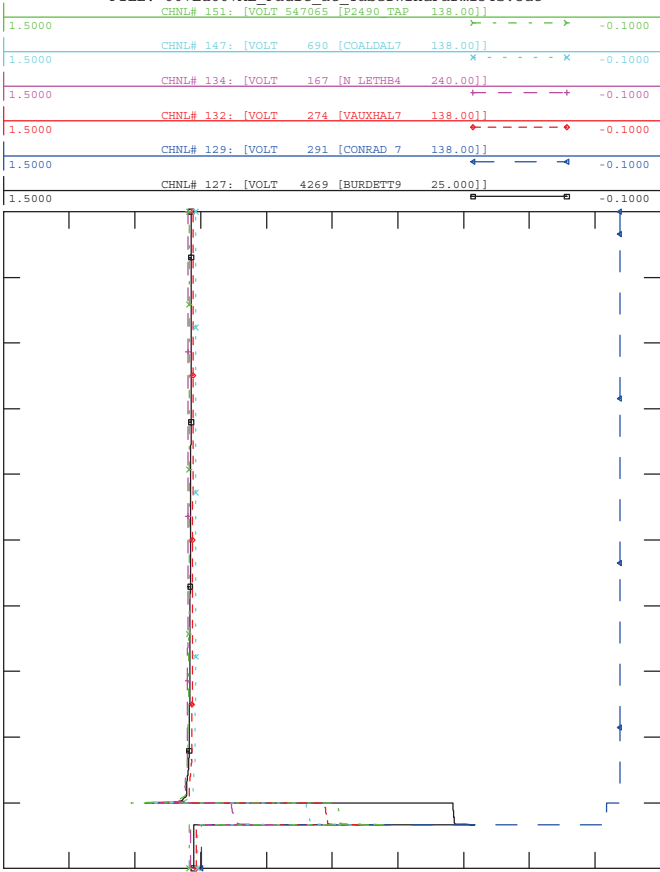


MON, MAR 18 2024 15:36
MACHINE VAR



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_TABERWINDFARM134S

FILE: 607L&607AL_Fault_at_TaberWindFarm134S.out

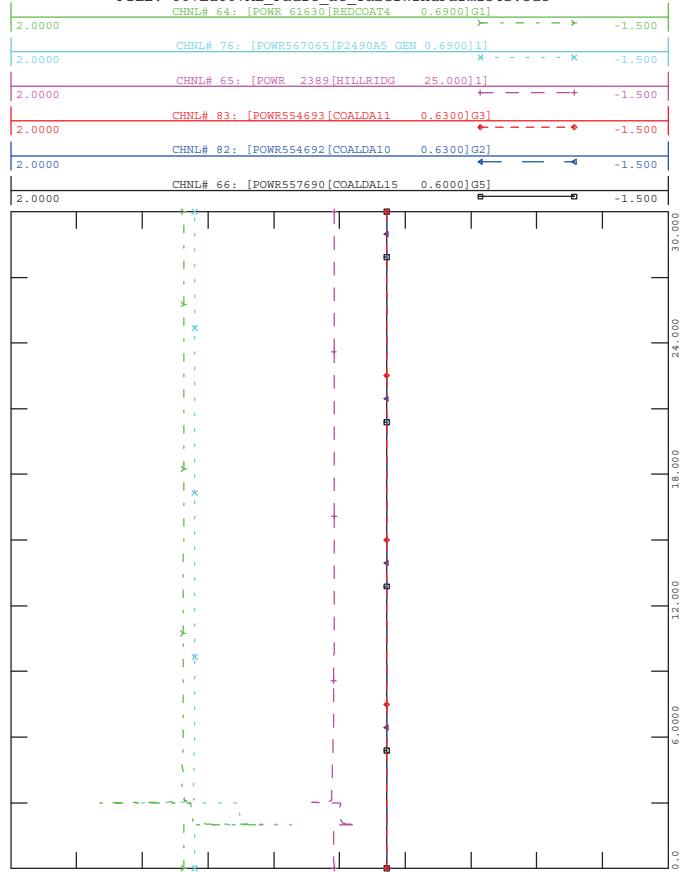


MON, MAR 18 2024 15:36
BUS VOLTAGE



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_TABERWINDFARM134S

FILE: 607L&607AL_Fault_at_TaberWindFarm134S.out

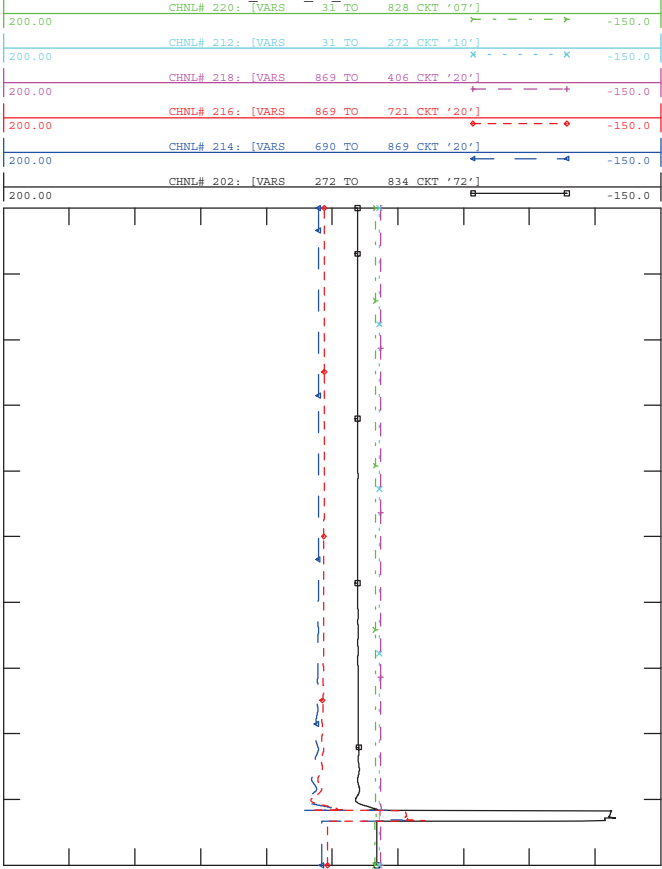


MON, MAR 18 2024 15:36
MACHINE POWER



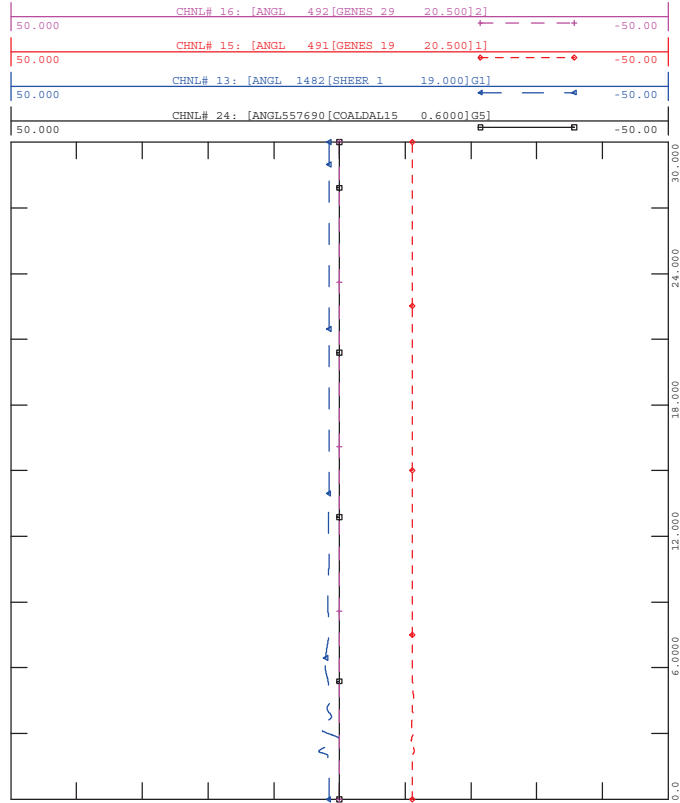
SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -610L_FAULT_AT_FINCASTLE336S

FILE: 610L_Fault_at_Fincastle336S.out
CHNL# 220: [VARS 31 TO 828 CKT '07']



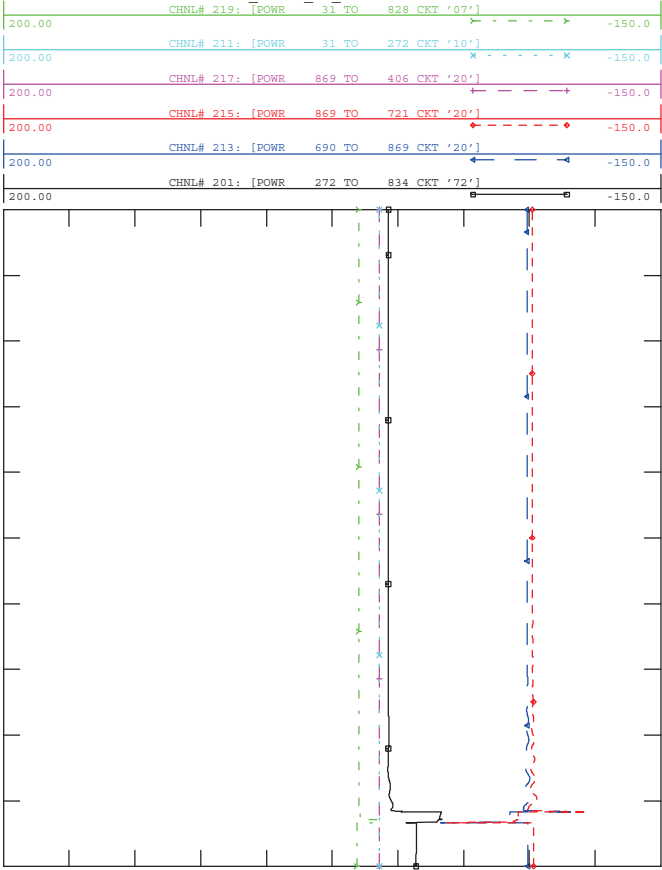
SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -610L_FAULT_AT_FINCASTLE336S

FILE: 610L_Fault_at_Fincastle336S.out



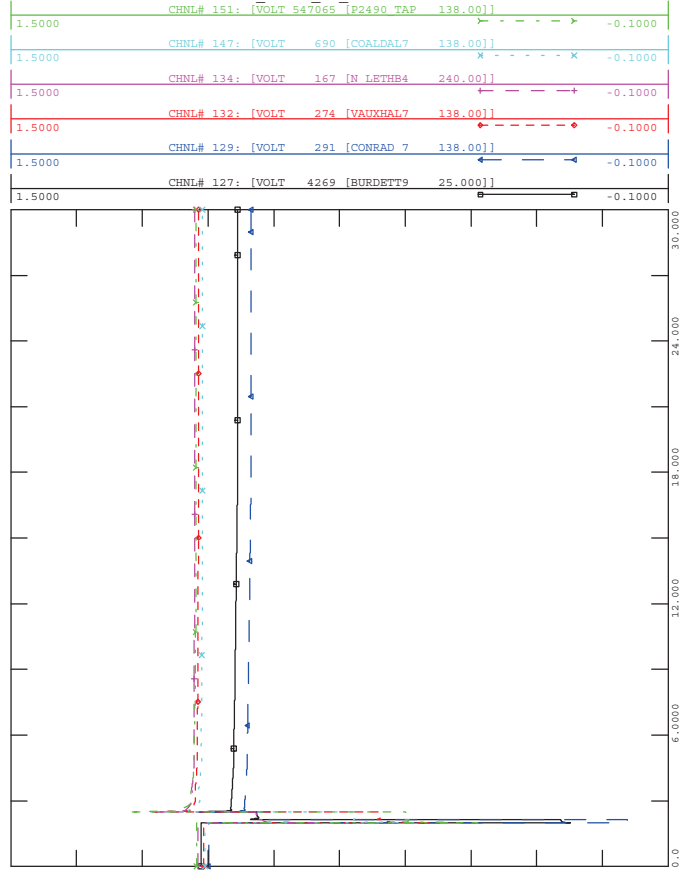
SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -610L_FAULT_AT_FINCASTLE336S

FILE: 610L_Fault_at_Fincastle336S.out
CHNL# 219: [POWR 31 TO 828 CKT '07']



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -610L_FAULT_AT_FINCASTLE336S

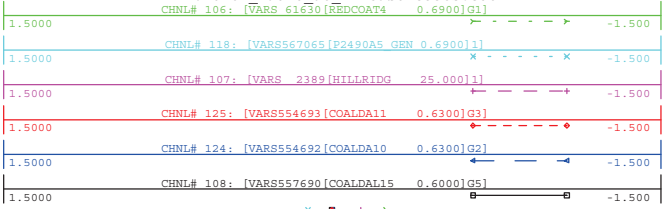
FILE: 610L_Fault_at_Fincastle336S.out





SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -610L_FAULT_AT_FINCATTLE336S

FILE: 610L Fault at Fincastle336S.out
CHNL# 106: [VARS 61630[REDCOAT4 0.6900]G1]

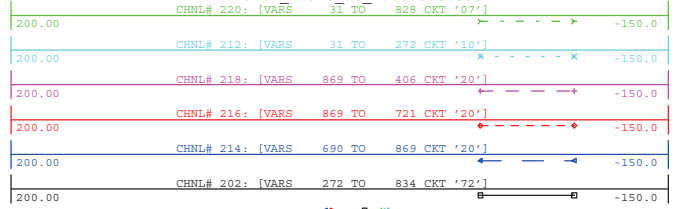


MON, MAR 18 2024 15:36
MACHINE VAR



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -610L_FAULT_AT_TABER83S

FILE: 610L Fault at Taber83S.out
CHNL# 220: [VARS 31 TO 272 CKT '10']

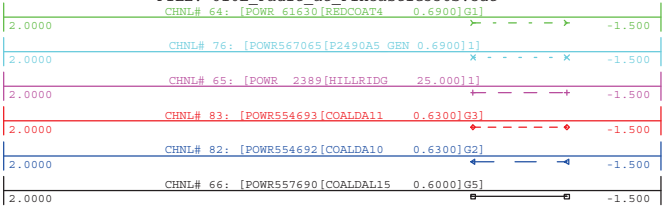


MON, MAR 18 2024 15:36
SYSTEM LINE VAR



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -610L_FAULT_AT_FINCATTLE336S

FILE: 610L Fault at Fincastle336S.out
CHNL# 64: [POWR 61630[REDCOAT4 0.6900]G1]

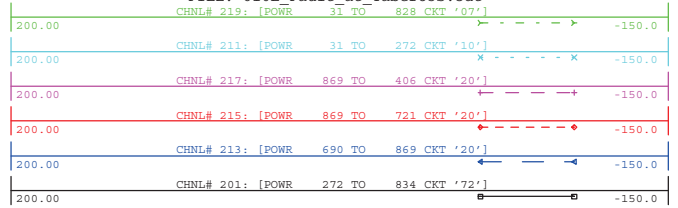


MON, MAR 18 2024 15:36
MACHINE POWER



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -610L_FAULT_AT_TABER83S

FILE: 610L Fault at Taber83S.out
CHNL# 219: [POWR 31 TO 828 CKT '07']

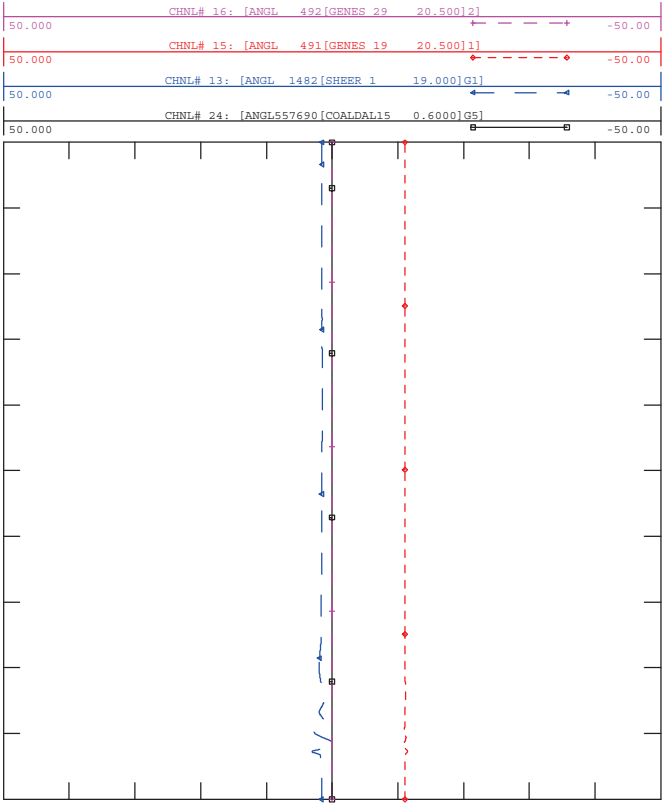


MON, MAR 18 2024 15:36
SYSTEM LINE POWER



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -610L_FAULT_AT_TABER83S

FILE: 610L_Fault_at_Taber83S.out

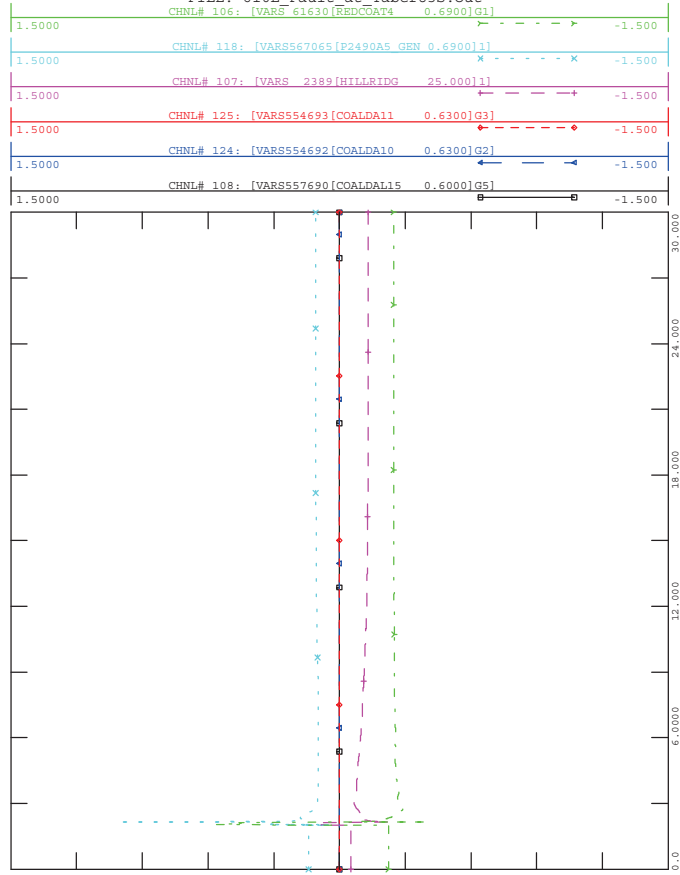


MON, MAR 18 2024 15:36
AREA MACHINE ANGLE



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -610L_FAULT_AT_TABER83S

FILE: 610L_Fault_at_Taber83S.out

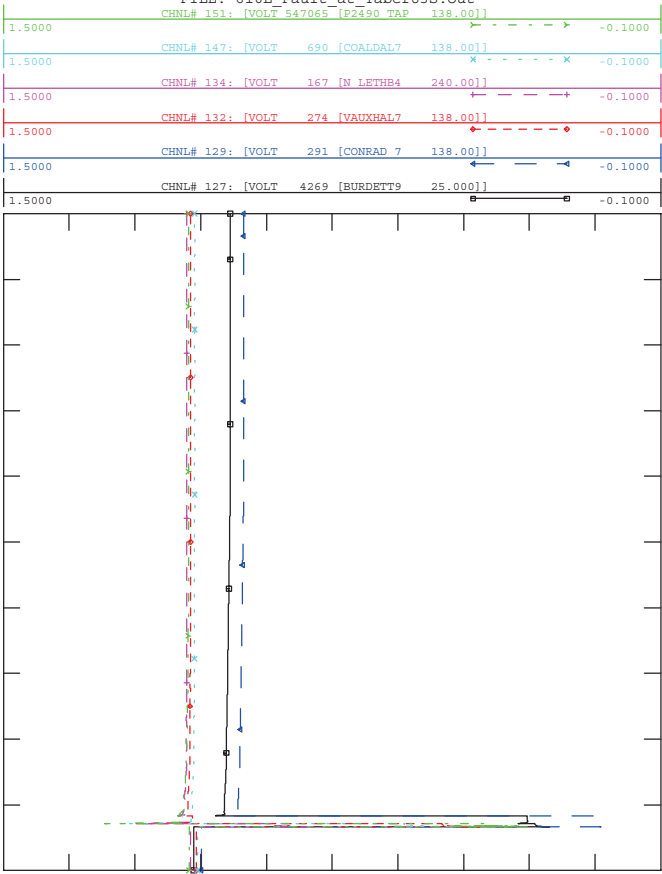


MON, MAR 18 2024 15:36
MACHINE VAR



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -610L_FAULT_AT_TABER83S

FILE: 610L_Fault_at_Taber83S.out

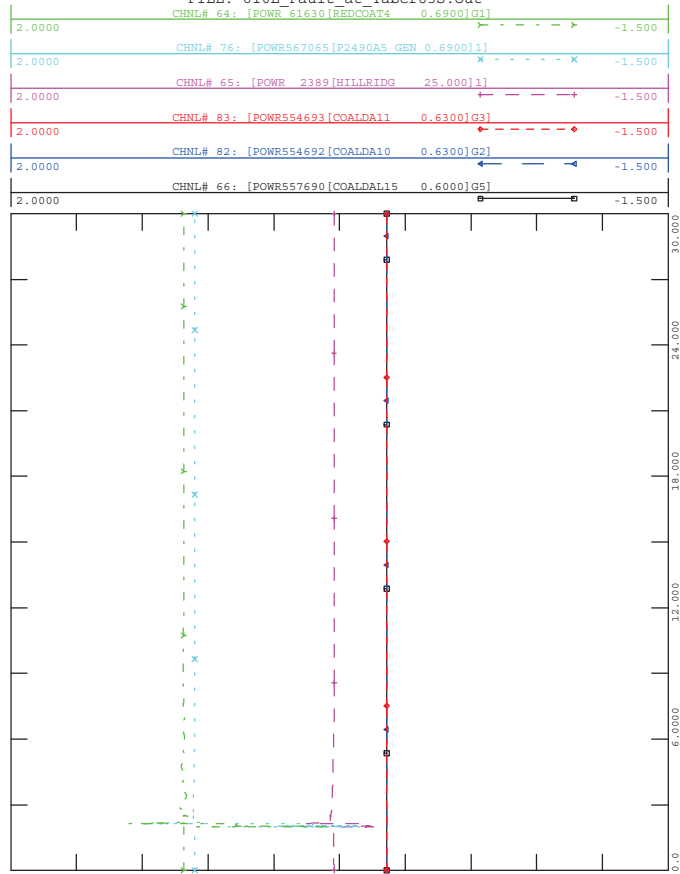


MON, MAR 18 2024 15:36
BUS VOLTAGE



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -610L_FAULT_AT_TABER83S

FILE: 610L_Fault_at_Taber83S.out

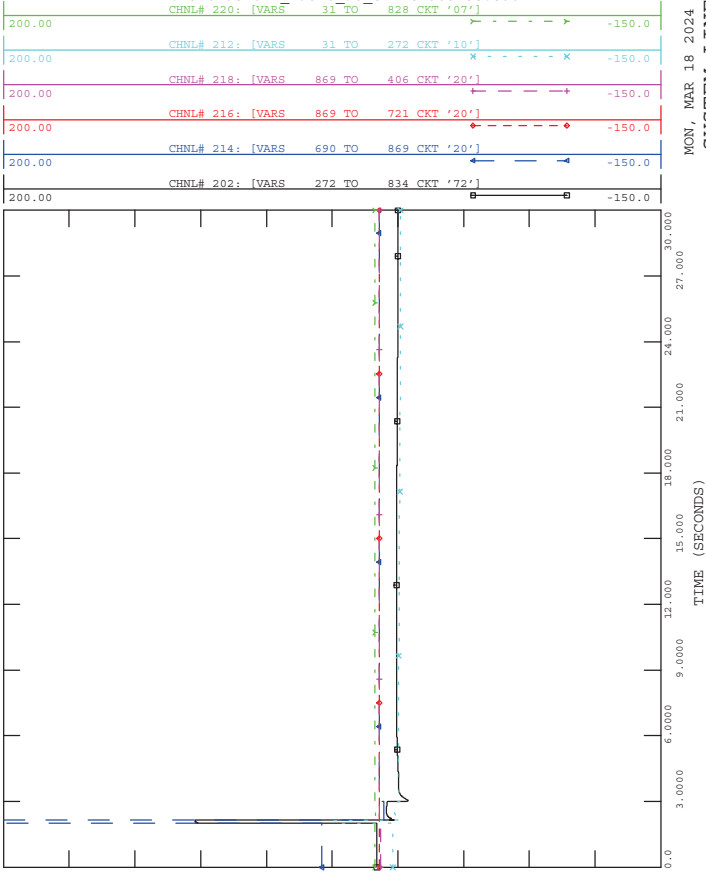


MON, MAR 18 2024 15:36
MACHINE POWER



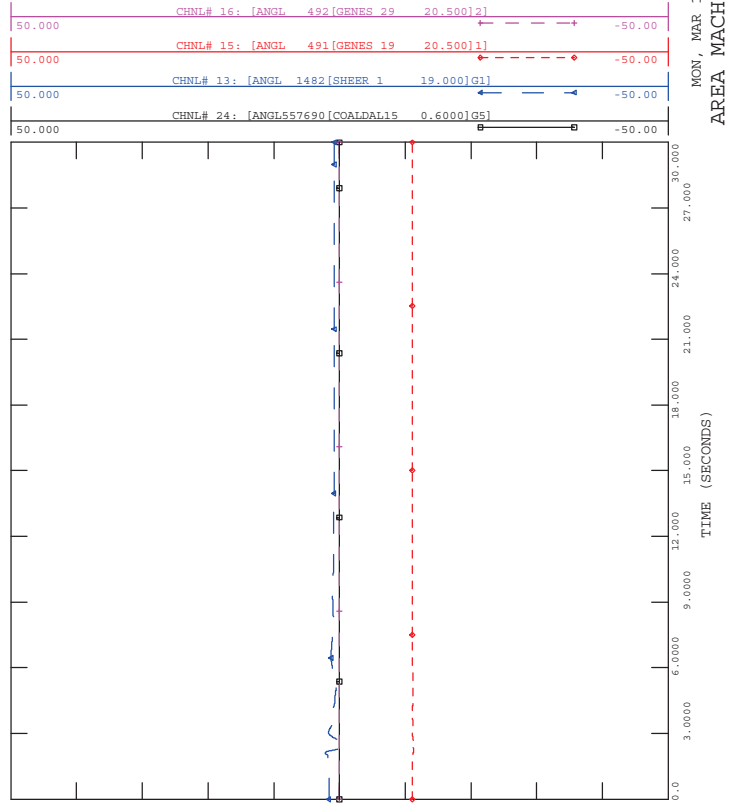
SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_CHINCHUT315S

FILE: 820L&820AL_Fault_at_ChinChut315S.out



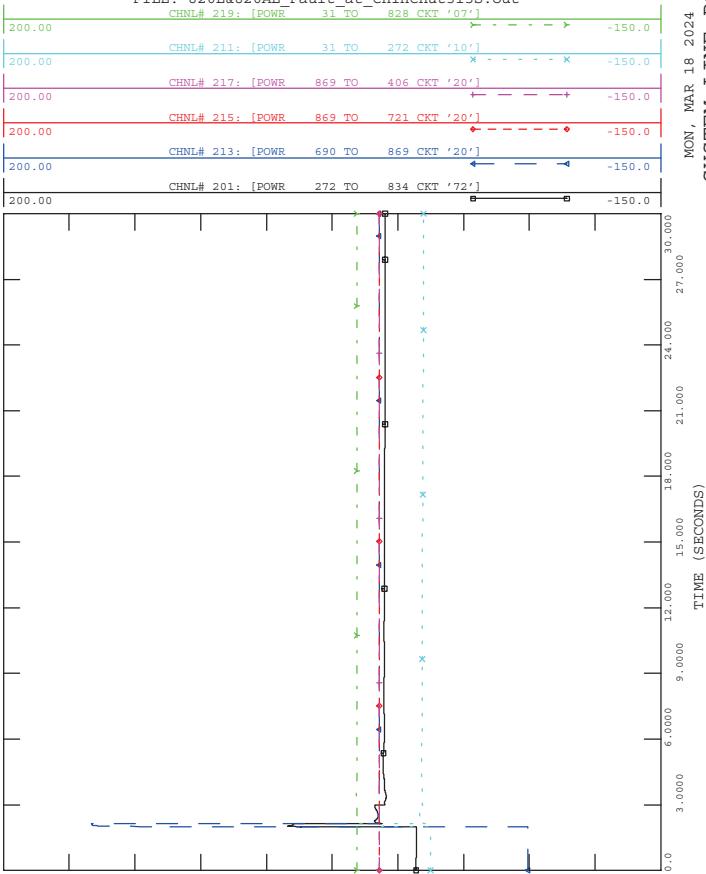
SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_CHINCHUT315S

FILE: 820L&820AL_Fault_at_ChinChut315S.out



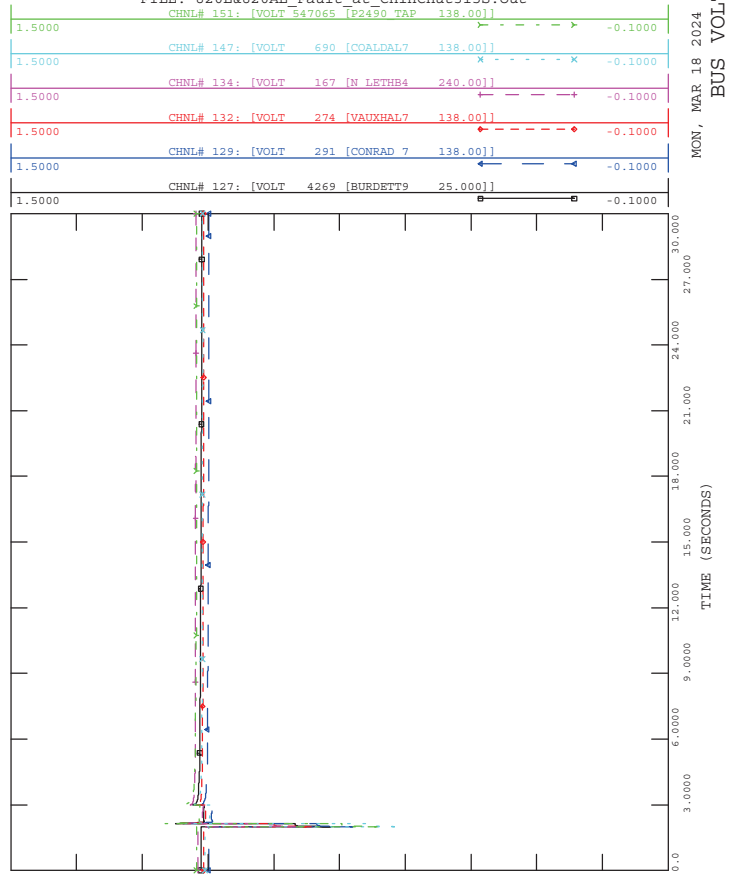
SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_CHINCHUT315S

FILE: 820L&820AL_Fault_at_ChinChut315S.out



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_CHINCHUT315S

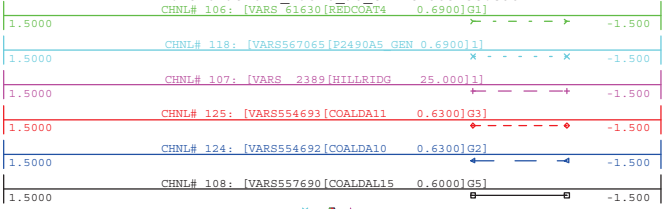
FILE: 820L&820AL_Fault_at_ChinChut315S.out



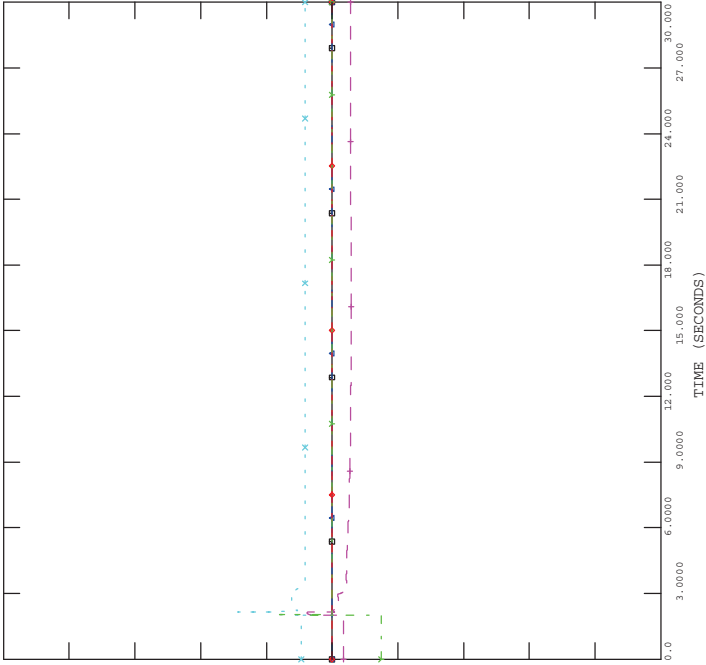


SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_CHINCHUT315S

FILE: 820L&820AL Fault_at_ChinChut315S.out

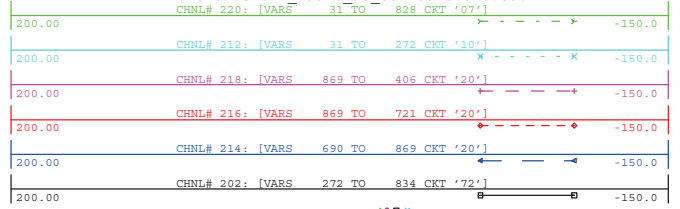


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MACHINE VAR

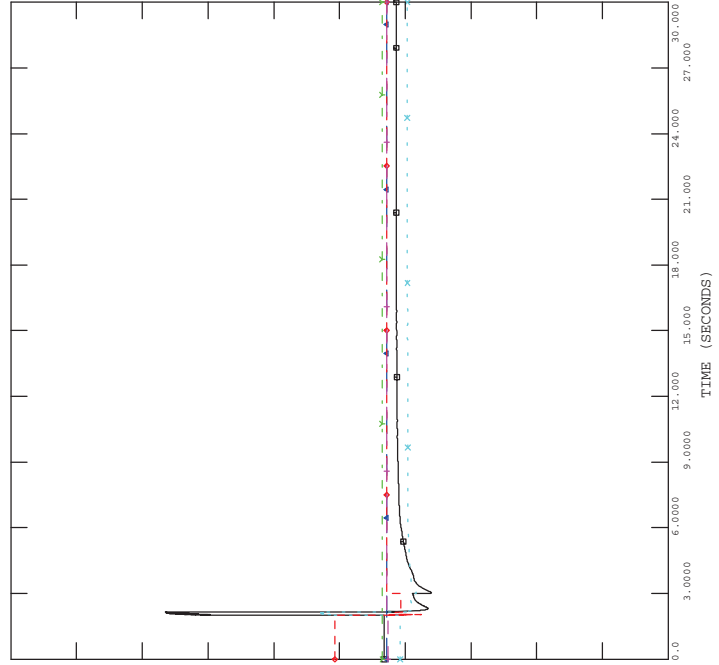


SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_COALDALE254S

FILE: 820L&820AL Fault_at_Coaldale254S.out

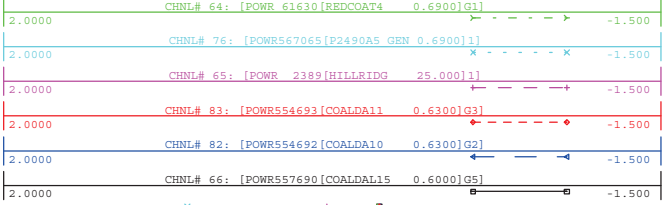


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SYSTEM LINE VAR

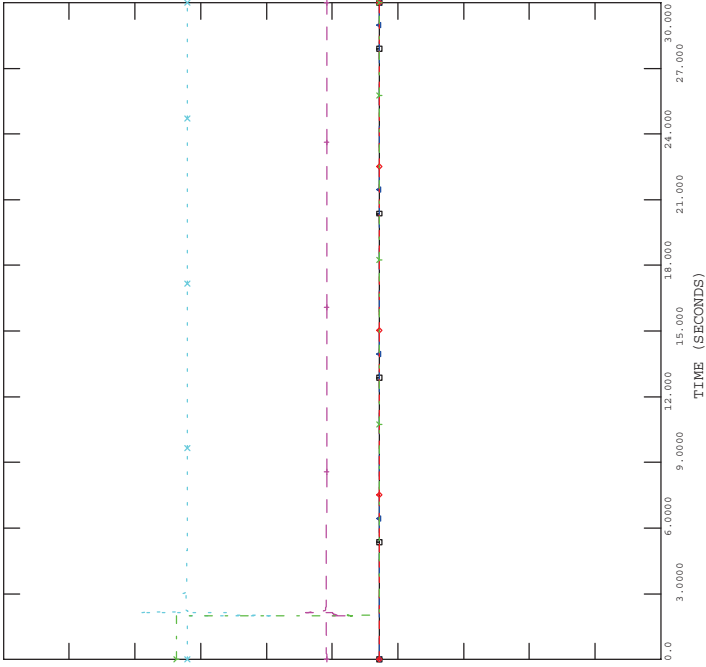


SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_CHINCHUT315S

FILE: 820L&820AL Fault_at_ChinChut315S.out

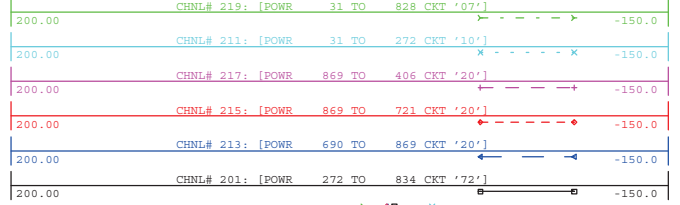


MON, MAR 18 2024 15:36
MACHINE POWER

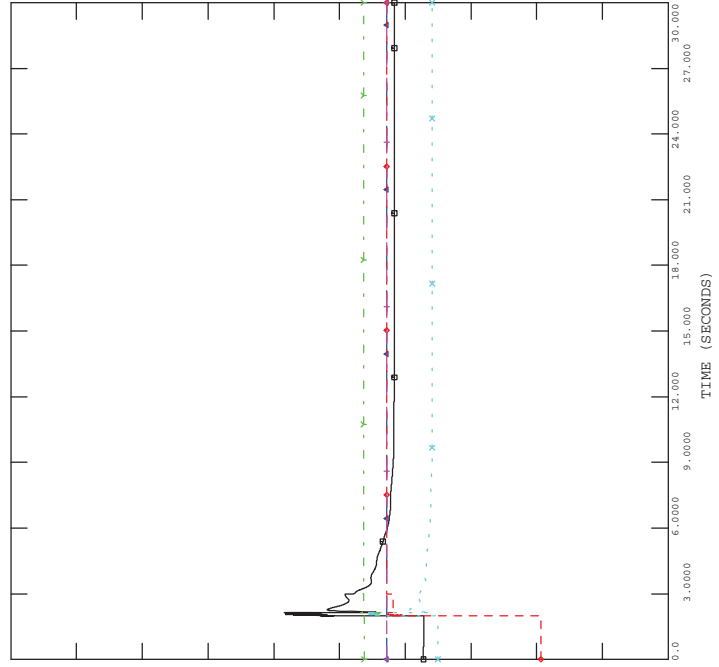


SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_COALDALE254S

FILE: 820L&820AL Fault_at_Coaldale254S.out



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SYSTEM LINE POWER

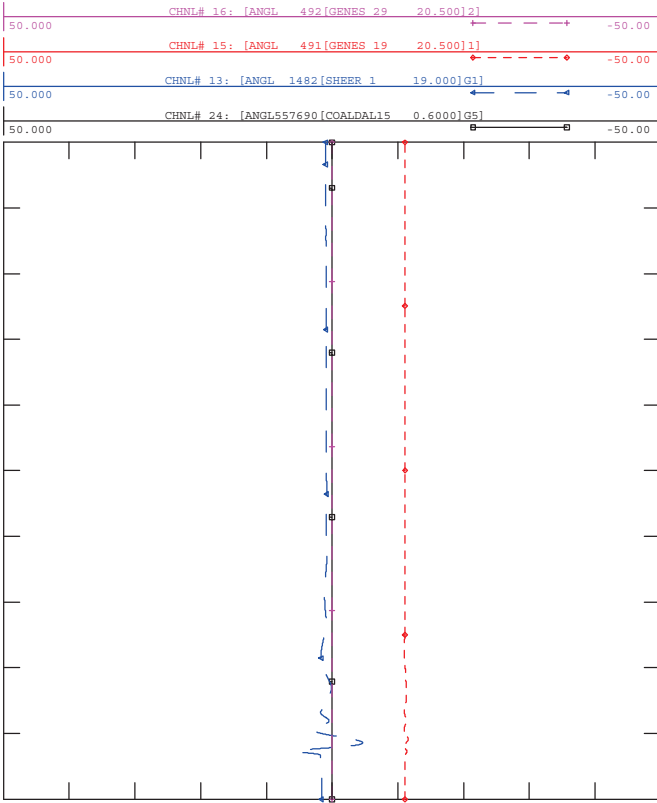




SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_COALDALE254S

FILE: 820L&820AL_Fault_at_Coaldale254S.out

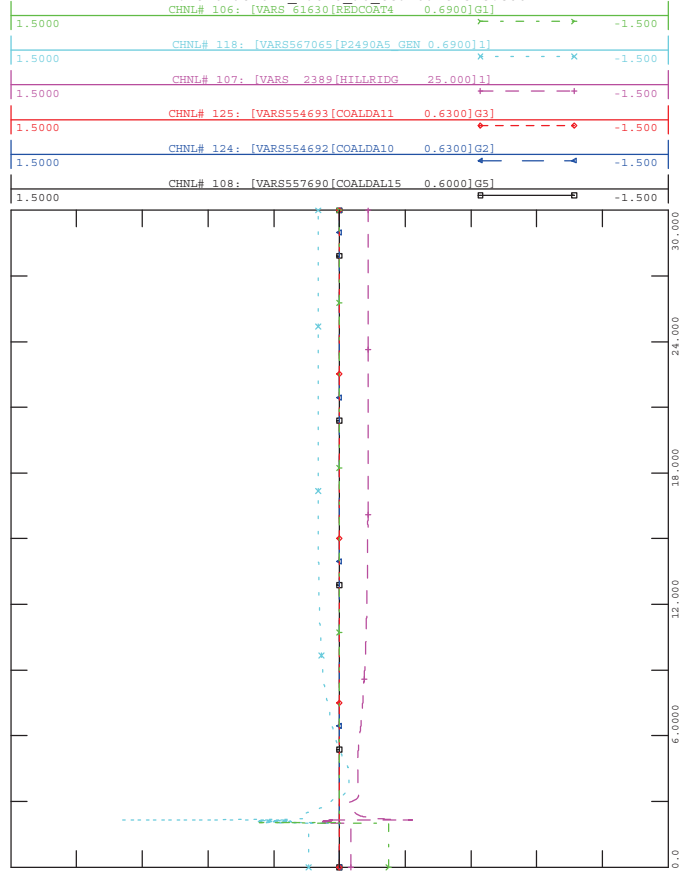
MON, MAR 18 2024 15:36
AREA MACHINE ANGLE



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_COALDALE254S

FILE: 820L&820AL_Fault_at_Coaldale254S.out

MON, MAR 18 2024 15:36
MACHINE VAR



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_COALDALE254S

FILE: 820L&820AL_Fault_at_Coaldale254S.out

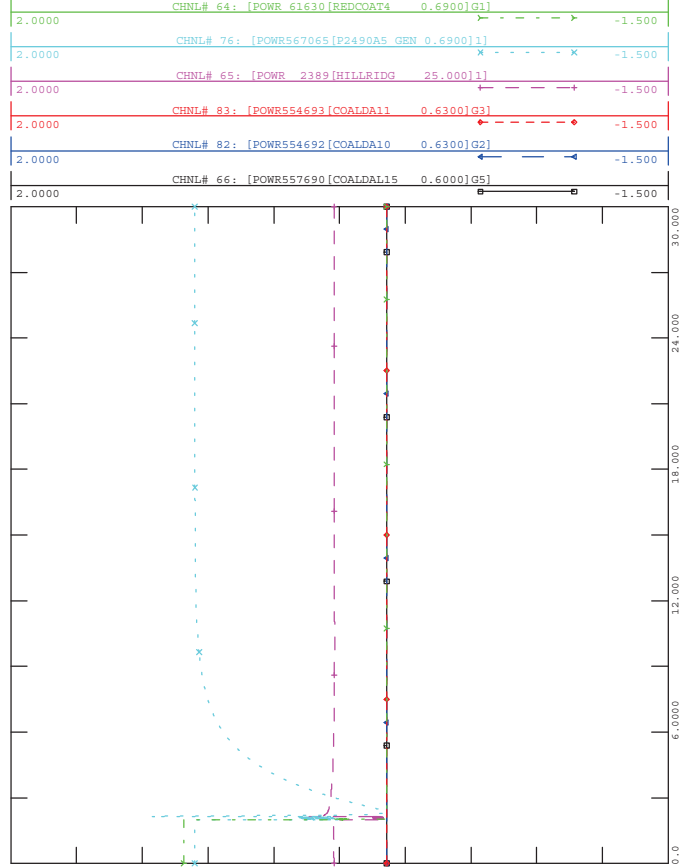
MON, MAR 18 2024 15:36
BUS VOLTAGE



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_COALDALE254S

FILE: 820L&820AL_Fault_at_Coaldale254S.out

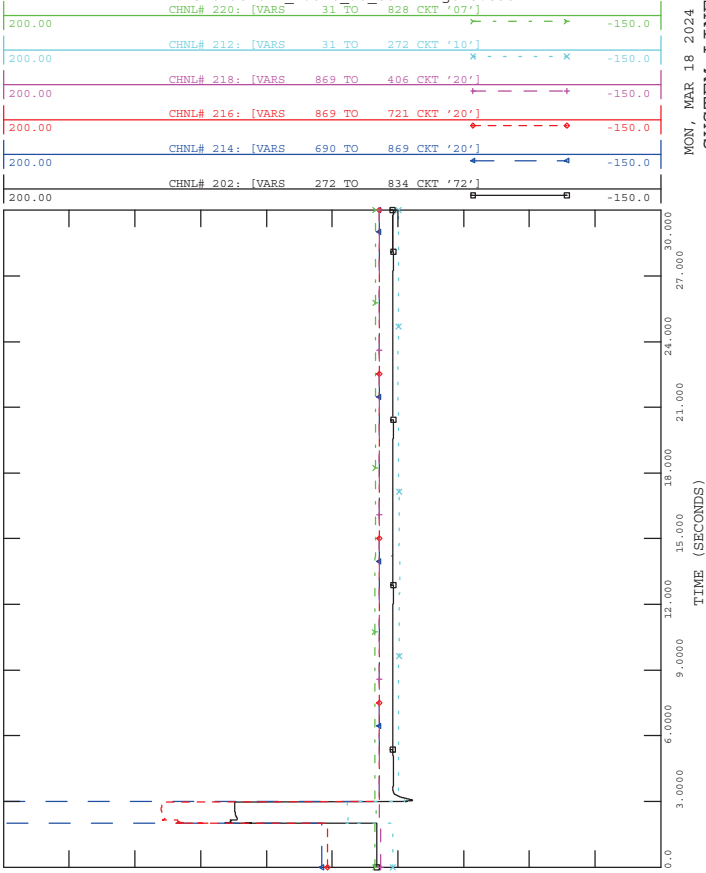
MON, MAR 18 2024 15:36
MACHINE POWER





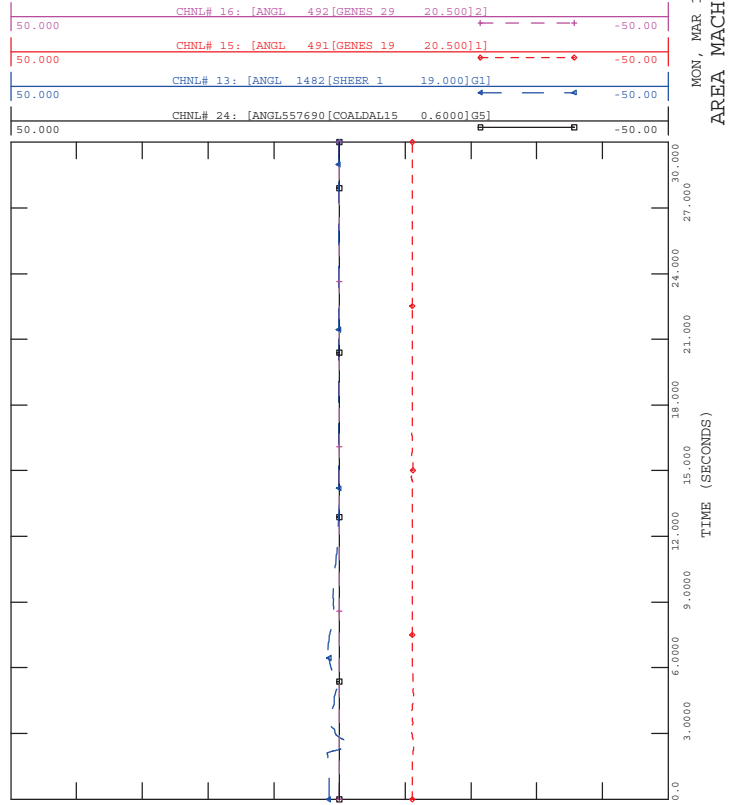
SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_STIRLING67S

FILE: 820L&820AL_Fault_at_Stirling67S.out



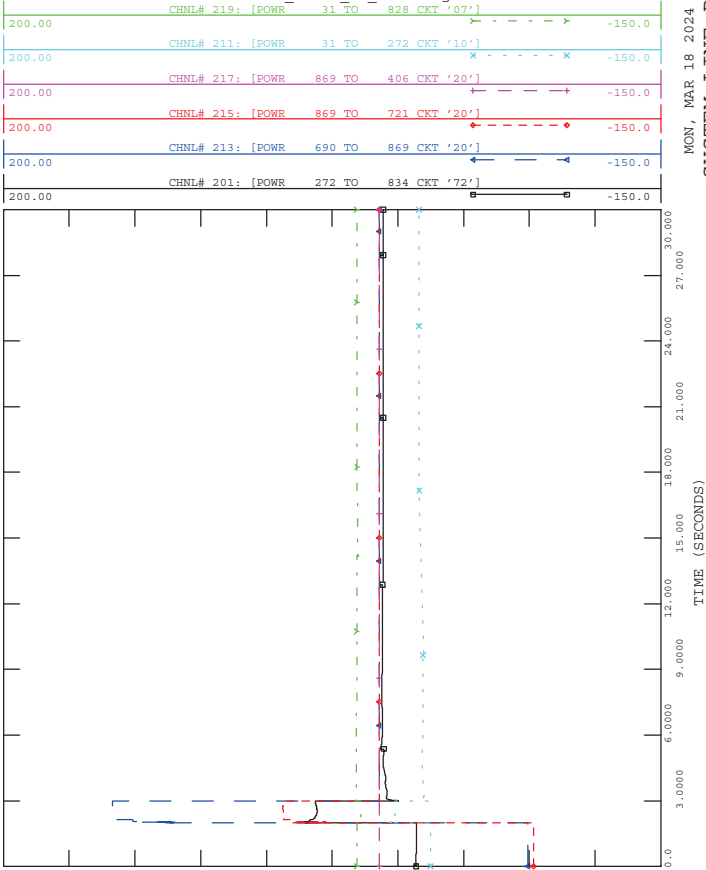
SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_STIRLING67S

FILE: 820L&820AL_Fault_at_Stirling67S.out



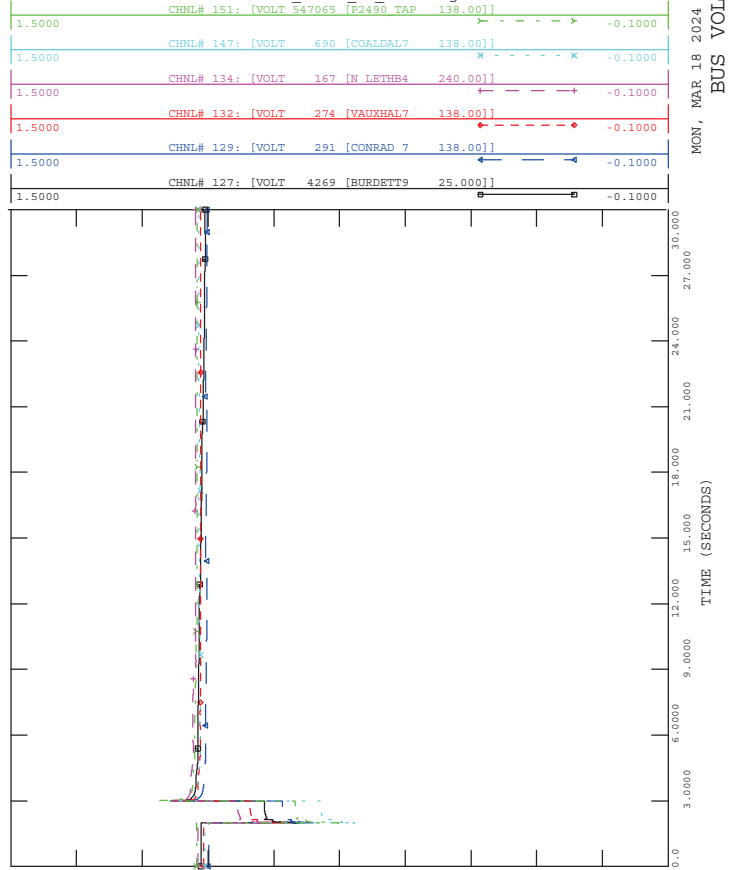
SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_STIRLING67S

FILE: 820L&820AL_Fault_at_Stirling67S.out



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_STIRLING67S

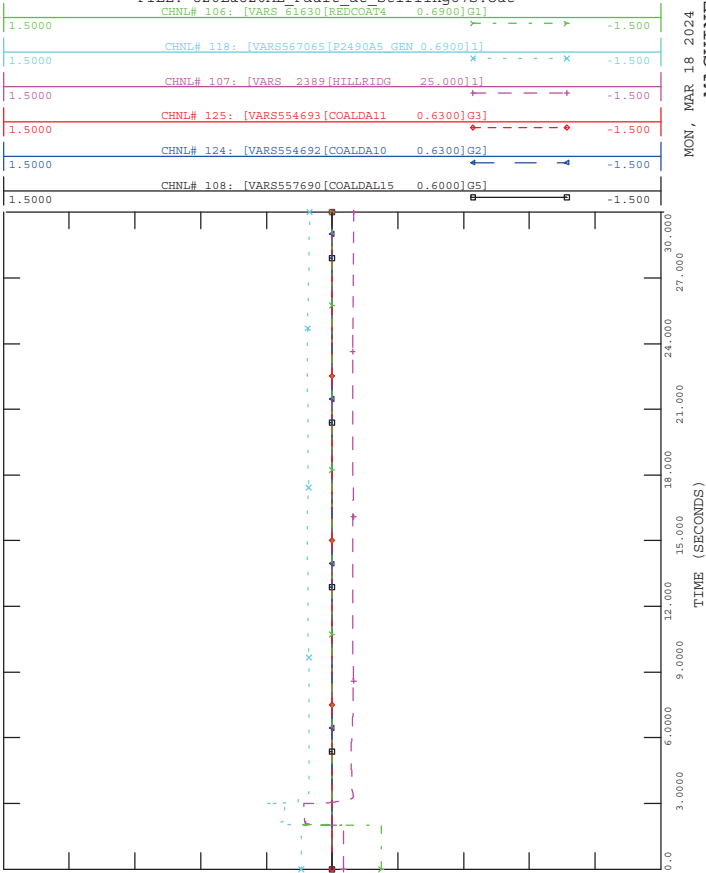
FILE: 820L&820AL_Fault_at_Stirling67S.out





SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_STIRLING67S

FILE: 820L&820AL_Fault_at_Stirling67S.out



SCENARIO #3: 2028 SL POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_STIRLING67S

FILE: 820L&820AL_Fault_at_Stirling67S.out

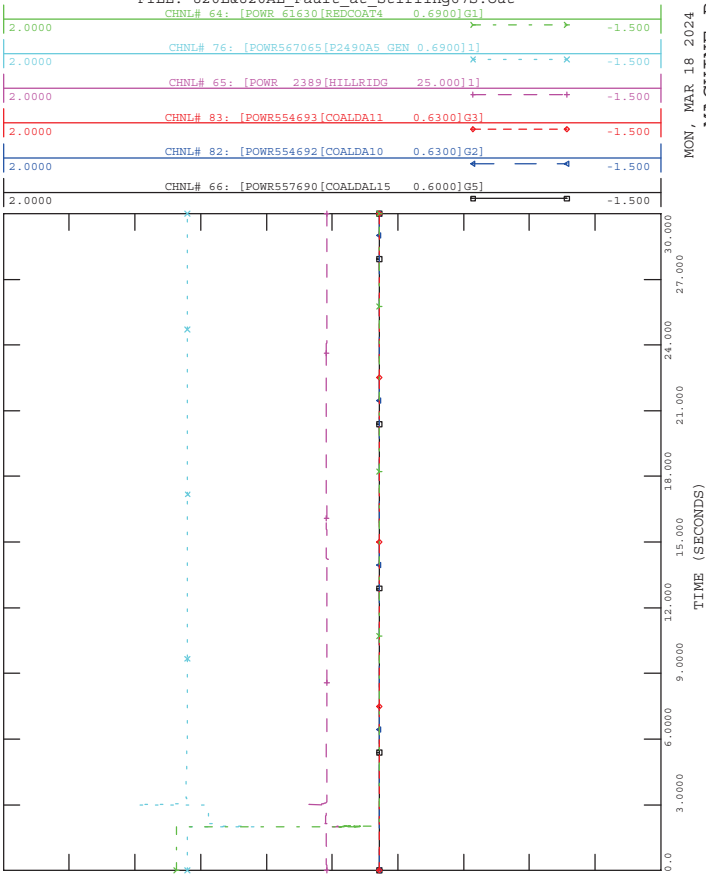


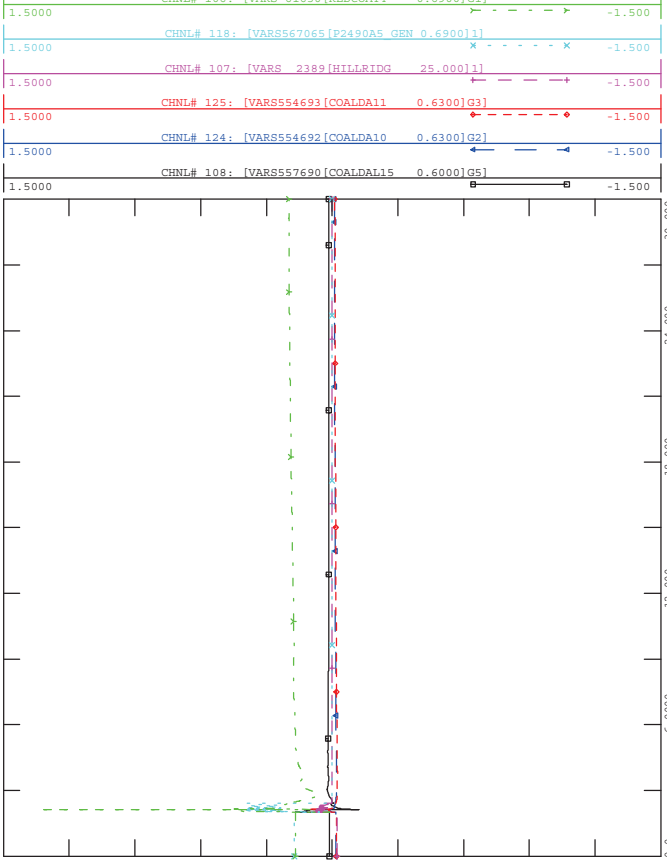
Table A4-2: Transient Stability Study Results under Category B Conditions for Scenario 4

Studied Contingency	Fault Description and Location	Results
172L/172EL (Coaldale 254S to Taber 83S)	Coaldale 254S	Stable
	Taber 83S	Stable
	Hillridge 139S	Stable
820L/820AL (Coaldale 254S to Stirling 67S)	Coaldale 254S	Stable
	Stirling 67S	Stable
	Chin Chute 315S	Stable
610L (Taber 83S to Fincastle 336S)	Taber 83S	Stable
	Fincastle 336S	Stable
607L/607AL (Fincastle 336S to Conrad 135S)	Conrad 135S	Stable
	Fincastle 336S	Stable
	Taber Wind Farm 134S	Stable



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_COALDALE254S

FILE: 172L&172EL Fault_at_Coaldale254S.out
CHNL# 106: [VARS 61630[REDCOAT4 0.6900]G1]

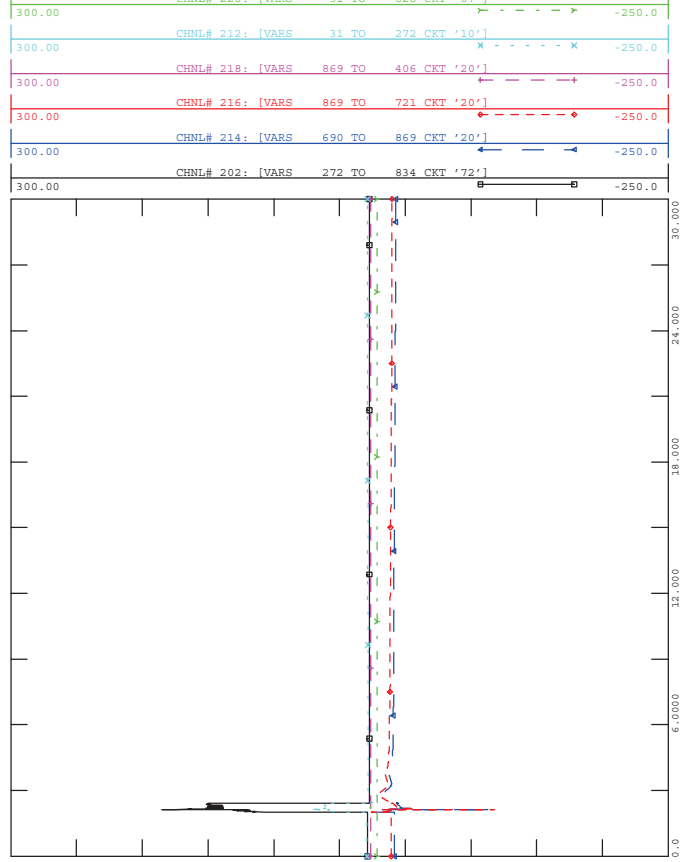


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MACHINE VAR



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_COALDALE254S

FILE: 172L&172EL Fault_at_Coaldale254S.out
CHNL# 220: [VARS 31 TO 828 CKT '07']

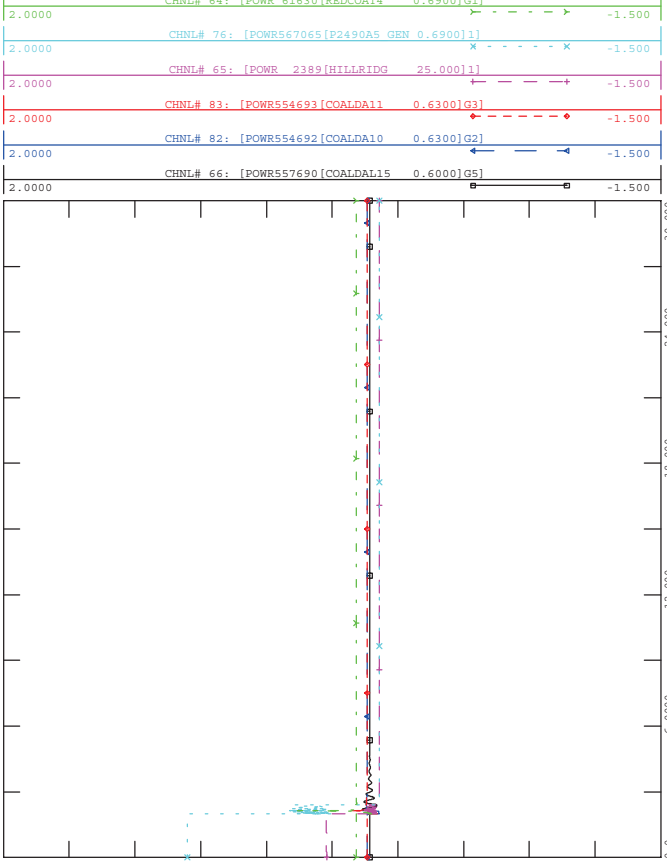


MON, MAR 18 2024 15:22
SYSTEM LINE VAR



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_COALDALE254S

FILE: 172L&172EL Fault_at_Coaldale254S.out
CHNL# 64: [POWR 61630[REDCOAT4 0.6900]G1]

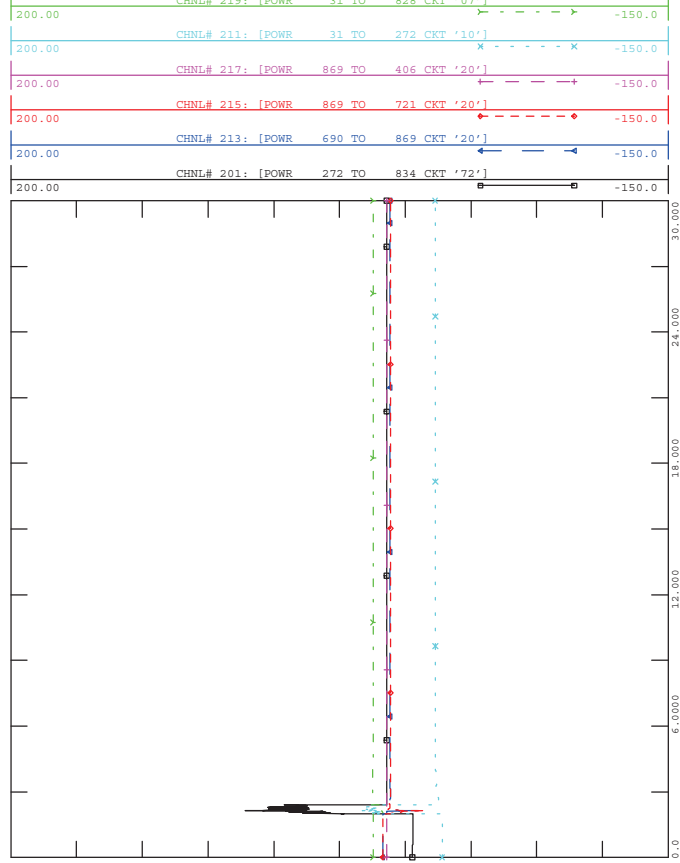


MON, MAR 18 2024 15:22
MACHINE POWER



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_COALDALE254S

FILE: 172L&172EL Fault_at_Coaldale254S.out
CHNL# 219: [POWR 31 TO 828 CKT '07']

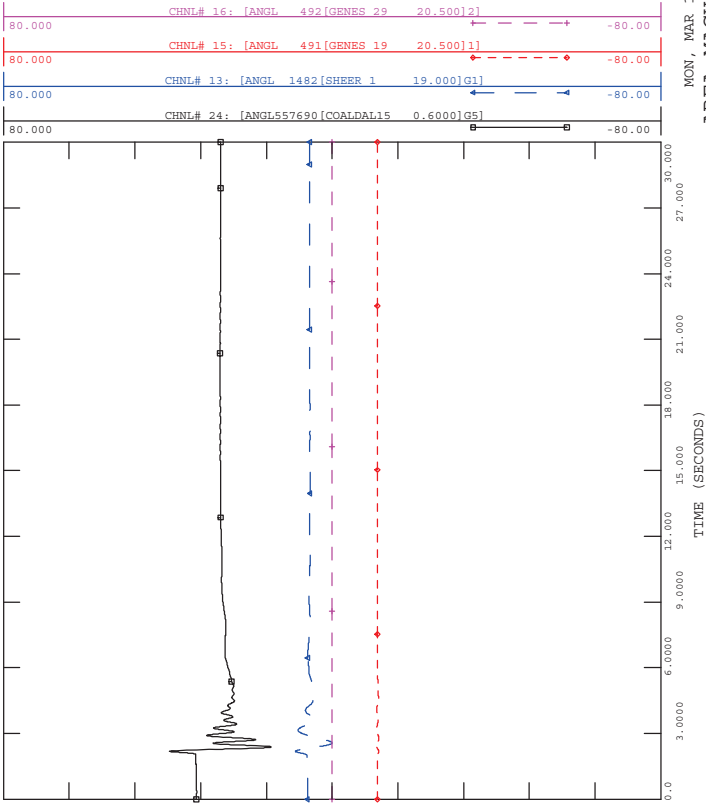


MON, MAR 18 2024 15:22
SYSTEM LINE POWER



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_COALDALE254S

FILE: 172L&172EL_Fault_at_Coaldale254S.out

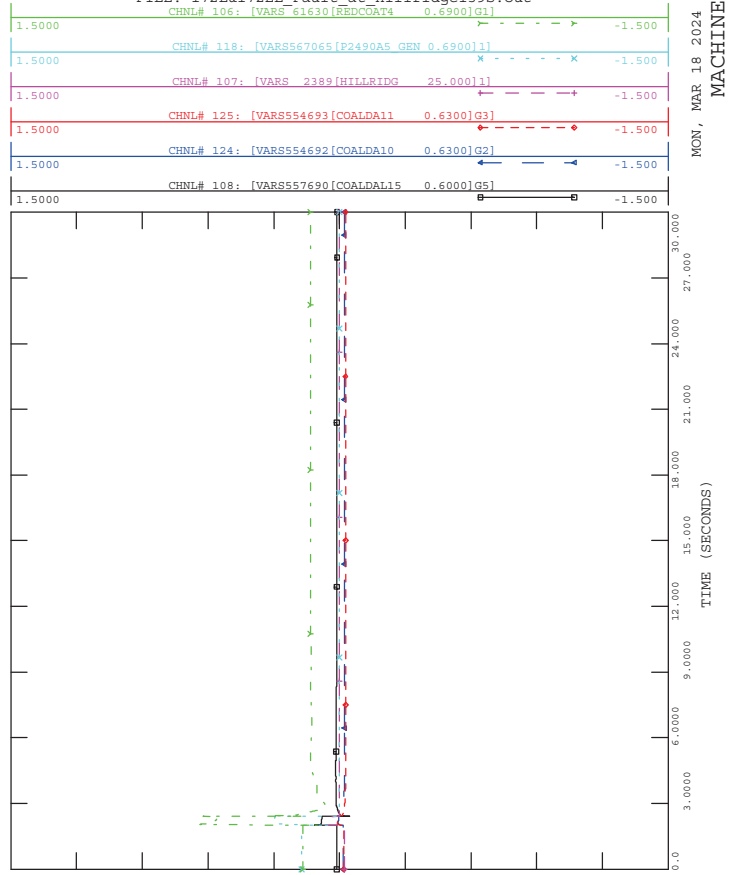


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AREA MACHINE ANGLE



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_HILLRIDGE139S

FILE: 172L&172EL_Fault_at_Hillridge139S.out

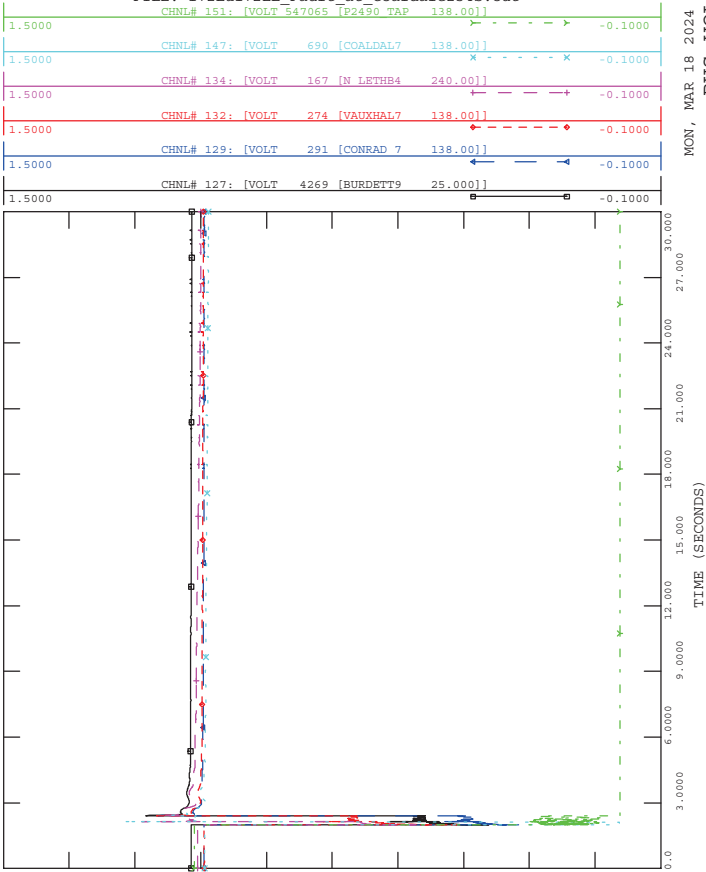


MON, MAR 18 2024 15:22
MACHINE VAR



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_COALDALE254S

FILE: 172L&172EL_Fault_at_Coaldale254S.out

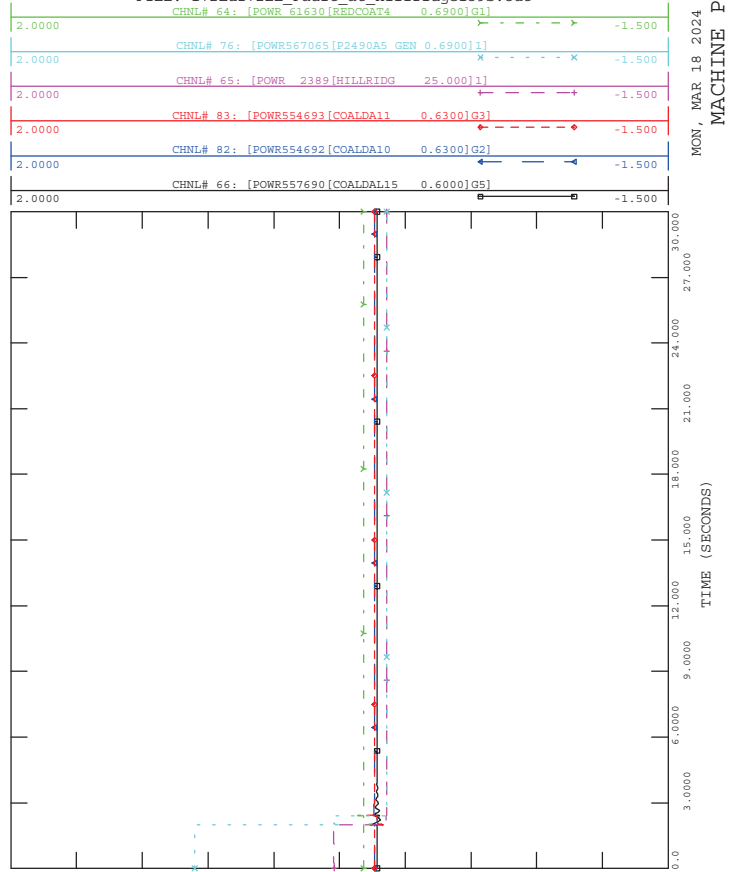


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BUS VOLTAGE



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_HILLRIDGE139S

FILE: 172L&172EL_Fault_at_Hillridge139S.out

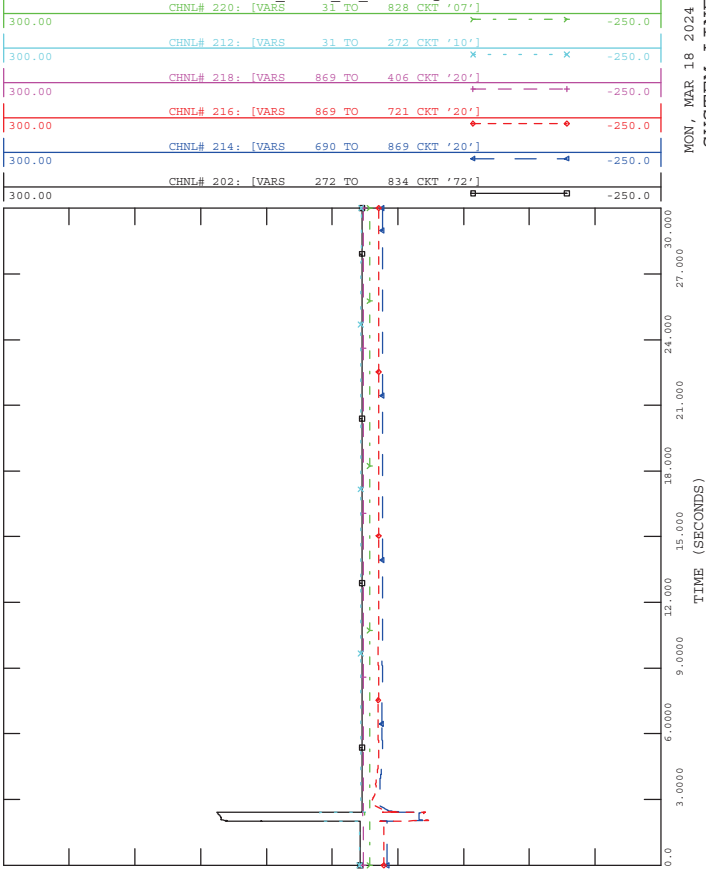


MON, MAR 18 2024 15:22
MACHINE POWER



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_HILLRIDGE139S

FILE: 172L&172EL_Fault_at_Hillridge139S.out
CHNL# 220: [VARS 31 TO 828 CKT '07']

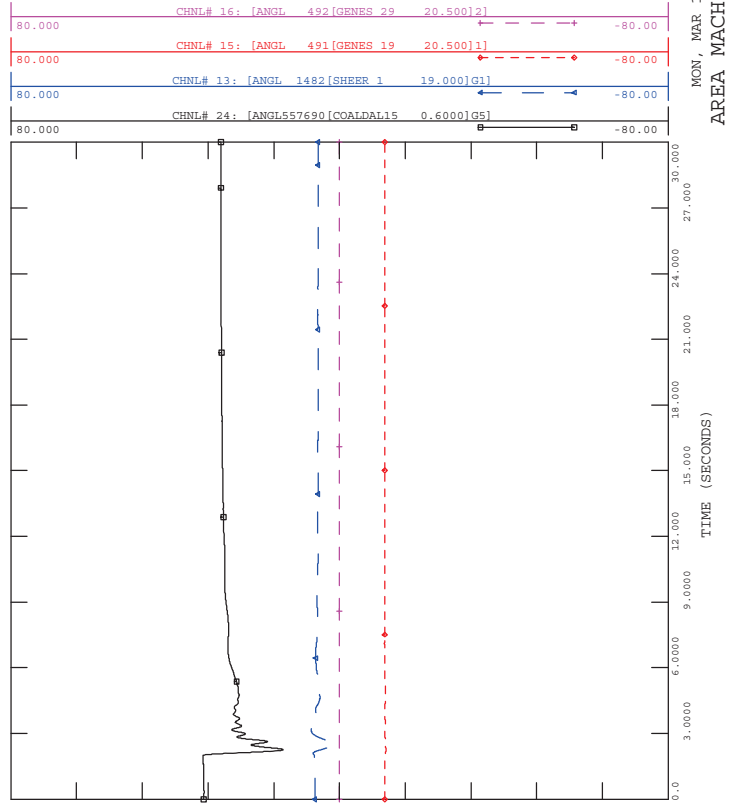


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SYSTEM LINE VAR



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_HILLRIDGE139S

FILE: 172L&172EL_Fault_at_Hillridge139S.out

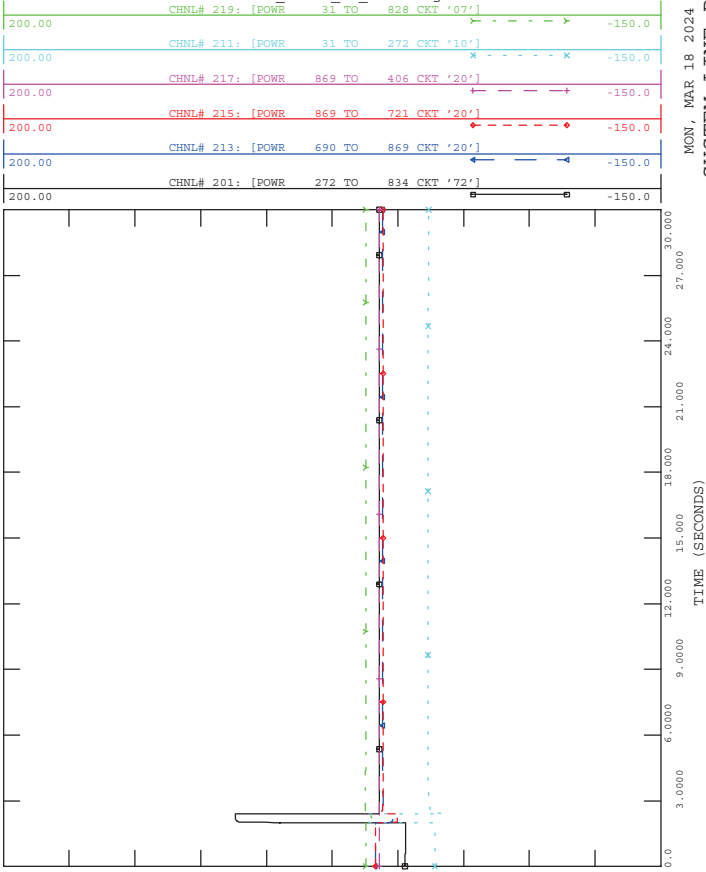


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AREA MACHINE ANGLE



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_HILLRIDGE139S

FILE: 172L&172EL_Fault_at_Hillridge139S.out
CHNL# 219: [POWR 31 TO 828 CKT '07']

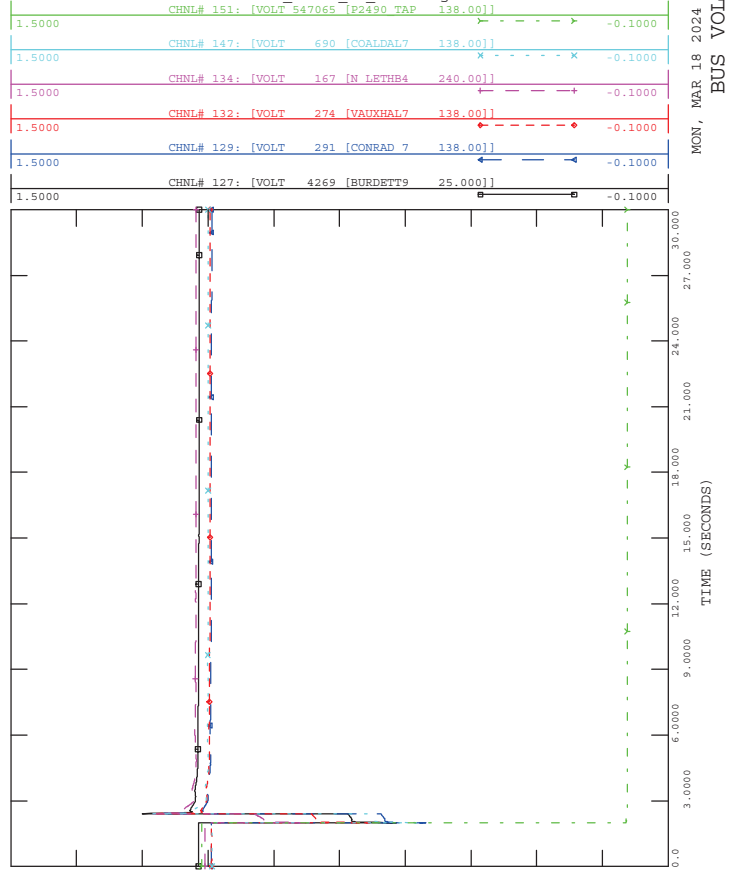


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SYSTEM LINE POWER



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_HILLRIDGE139S

FILE: 172L&172EL_Fault_at_Hillridge139S.out

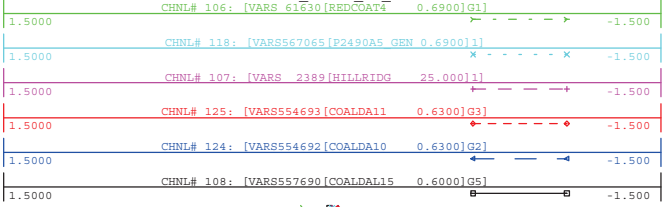


MON, MAR 18 2024 15:22
BUS VOLTAGE

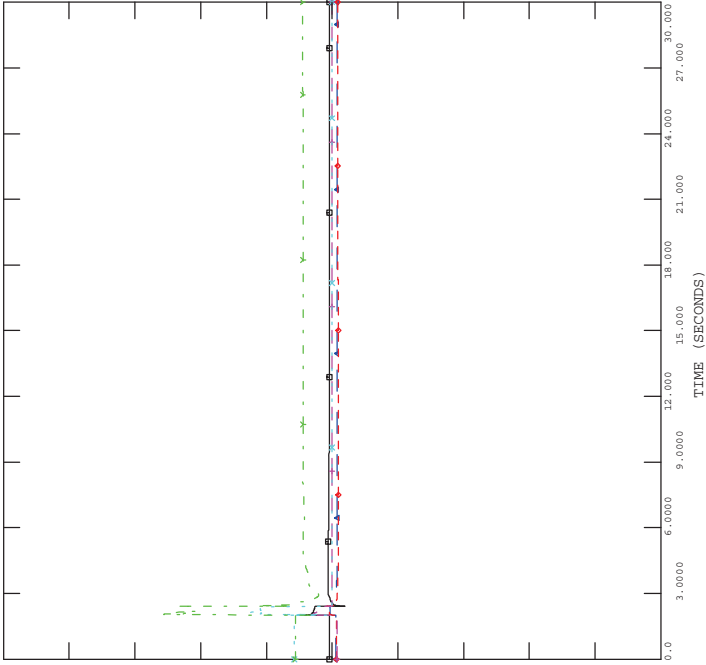


SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_TABER83S

FILE: 172L&172EL_Fault_at_Taber83S.out

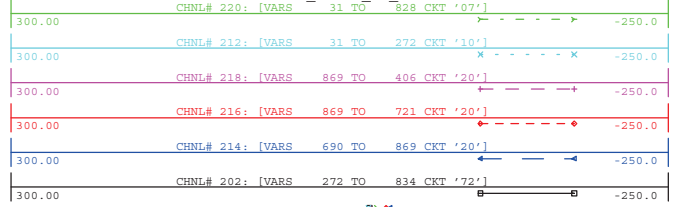


MON, MAR 18 2024 15:22
MACHINE VAR

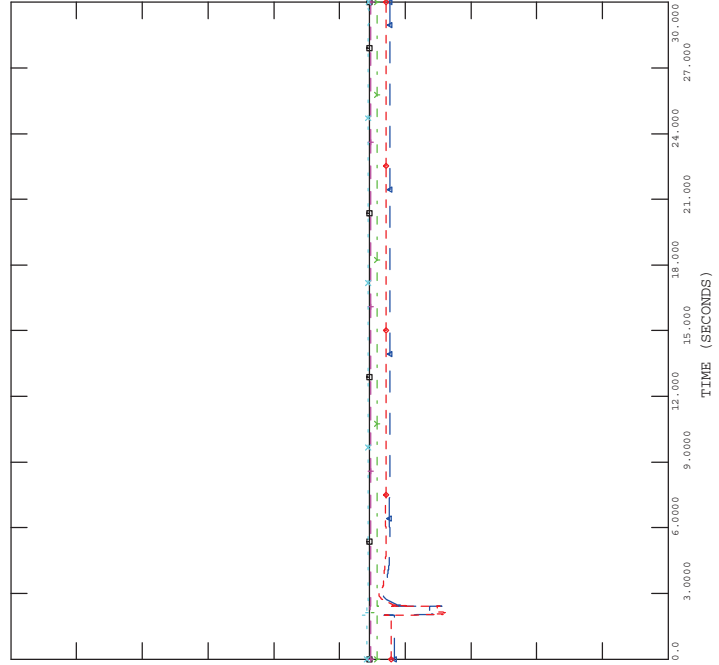


SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_TABER83S

FILE: 172L&172EL_Fault_at_Taber83S.out

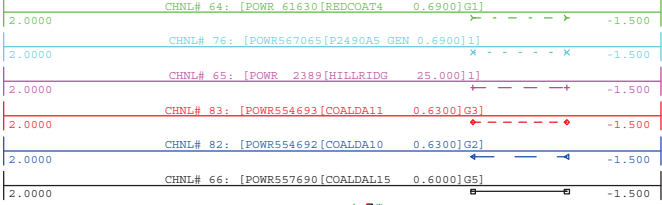


MON, MAR 18 2024 15:22
SYSTEM LINE VAR

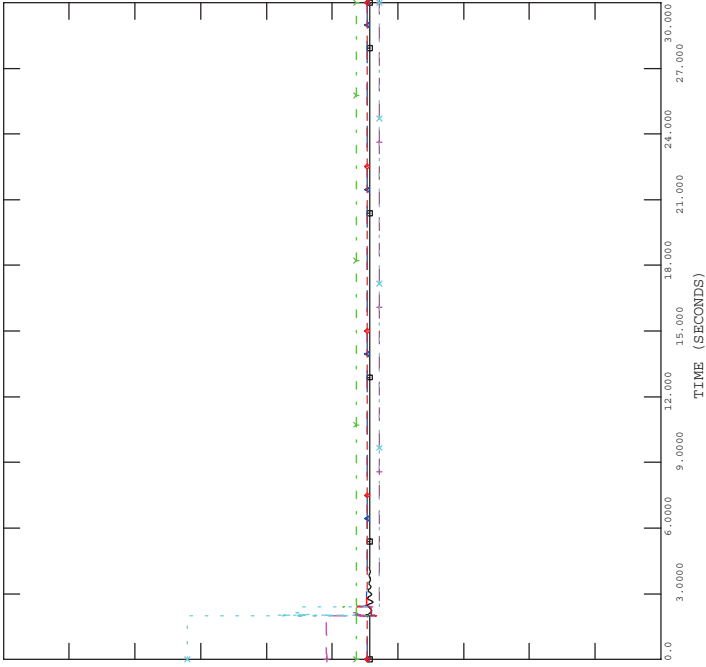


SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_TABER83S

FILE: 172L&172EL_Fault_at_Taber83S.out

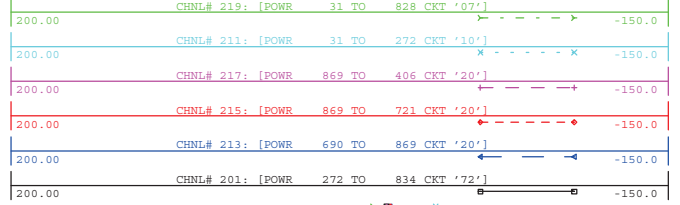


MON, MAR 18 2024 15:22
MACHINE POWER

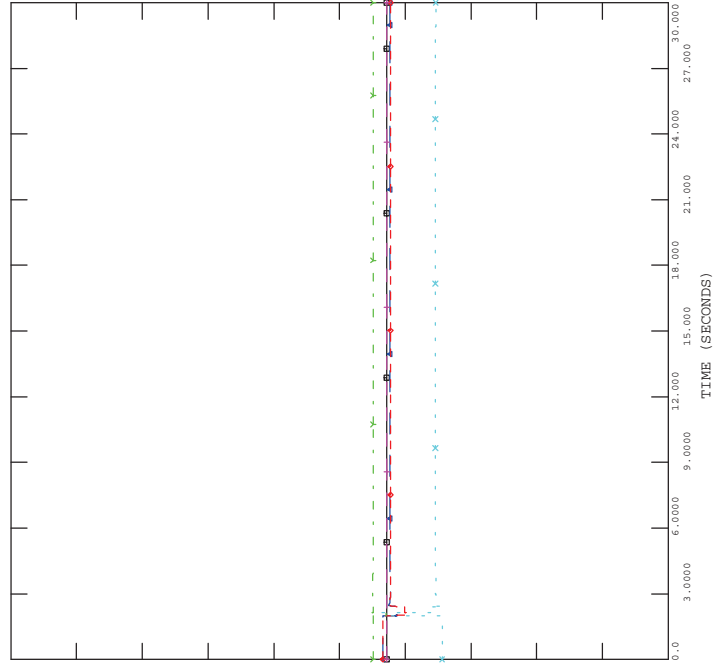


SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_TABER83S

FILE: 172L&172EL_Fault_at_Taber83S.out



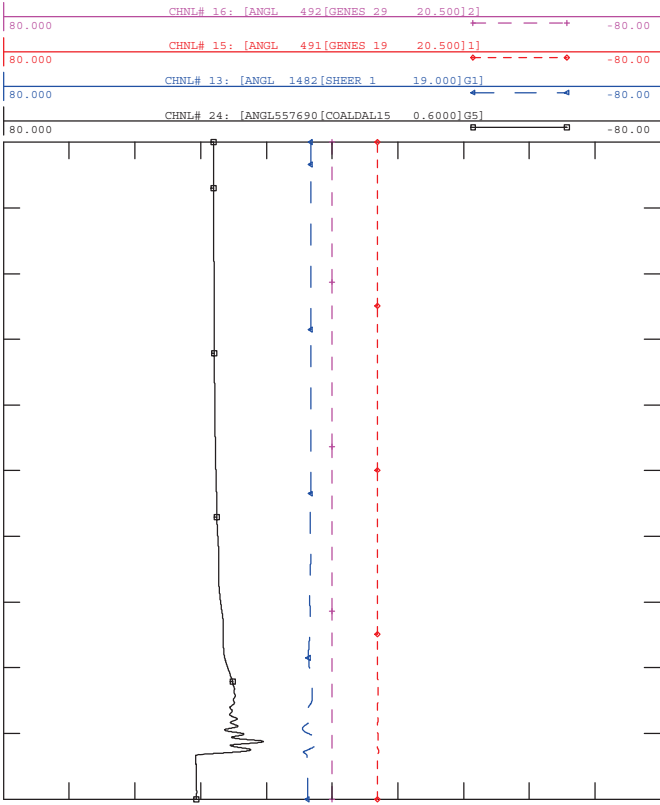
MON, MAR 18 2024 15:22
SYSTEM LINE POWER





SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_TABER83S

FILE: 172L&172EL_Fault_at_Taber83S.out

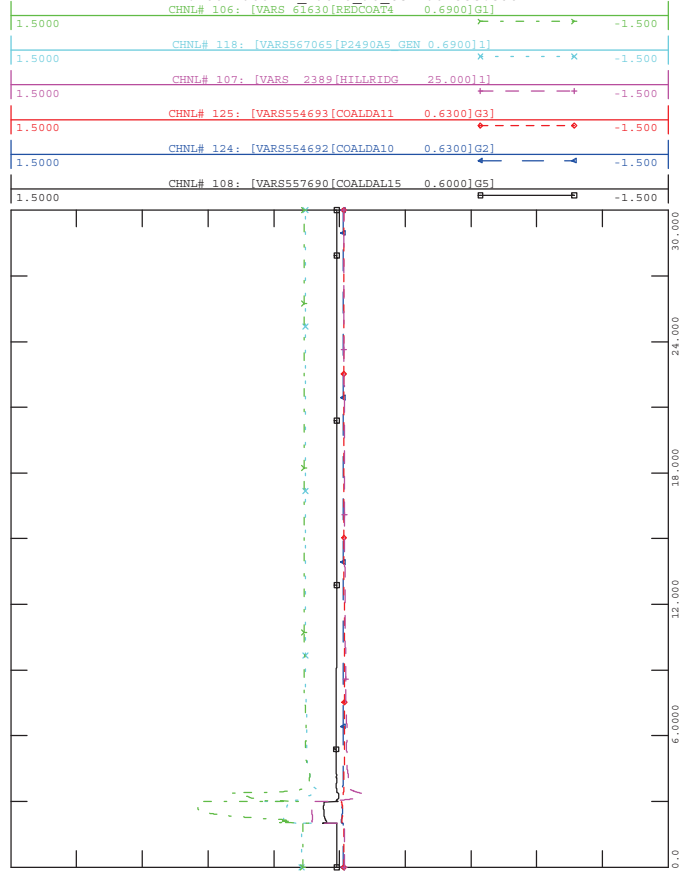


MON, MAR 18 2024 15:22
AREA MACHINE ANGLE



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_CONRAD135S

FILE: 607L&607AL_Fault_at_Conrad135S.out

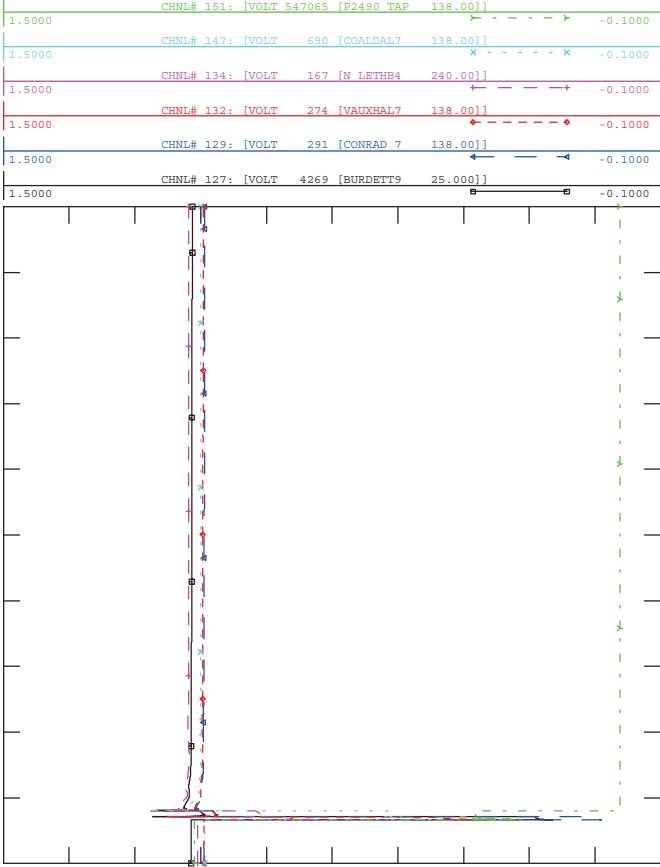


MON, MAR 18 2024 15:22
MACHINE VAR



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -172L&172EL_FAULT_AT_TABER83S

FILE: 172L&172EL_Fault_at_Taber83S.out

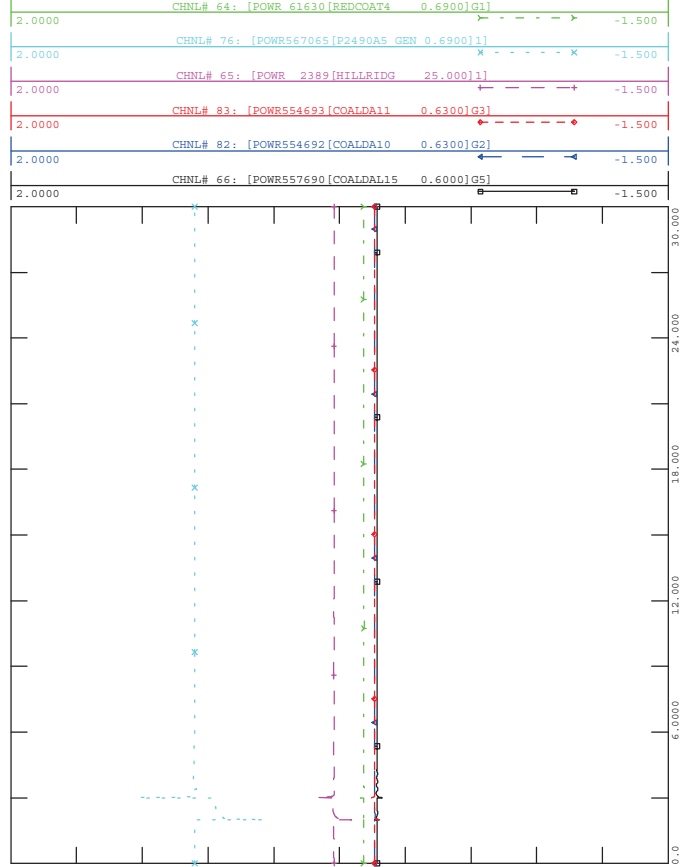


MON, MAR 18 2024 15:22
BUS VOLTAGE



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_CONRAD135S

FILE: 607L&607AL_Fault_at_Conrad135S.out

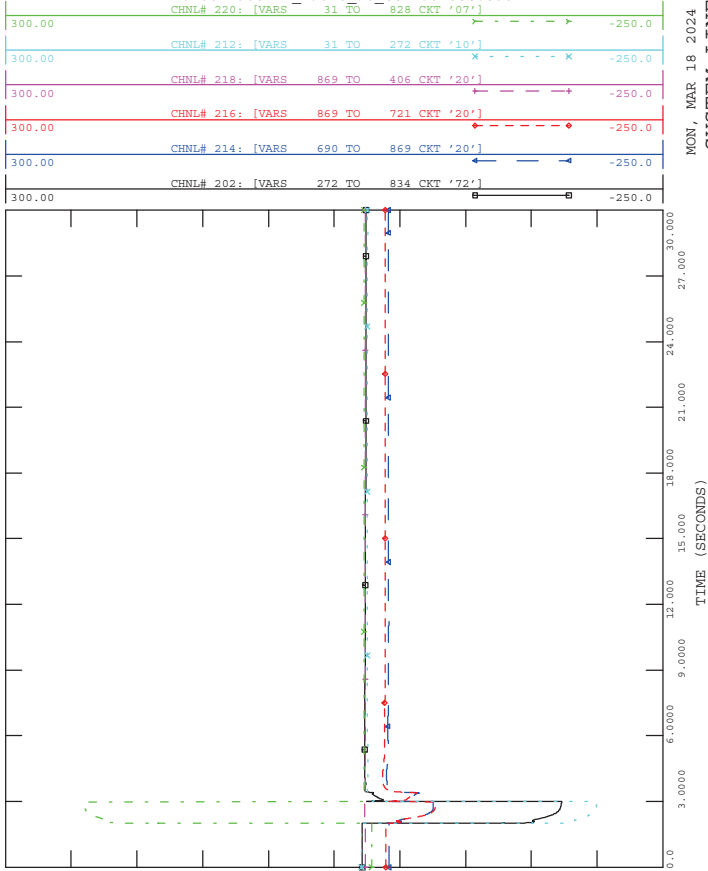


MON, MAR 18 2024 15:22
MACHINE POWER



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_CONRAD135S

FILE: 607L&607AL_Fault_at_Conrad135S.out
CHNL# 220: [VARS 31 TO 828 CKT '07']

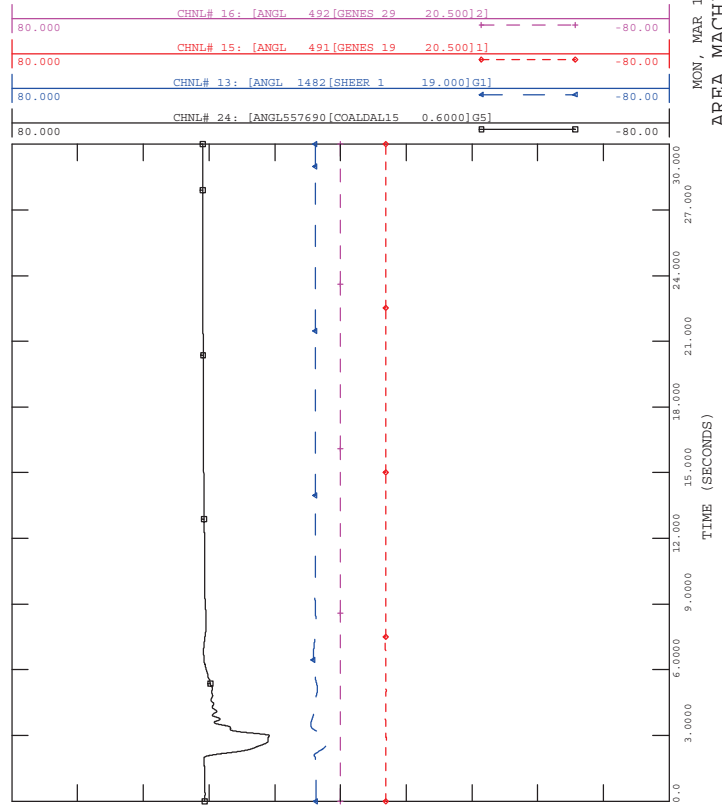


MON, MAR 18 2024 15:22
SYSTEM LINE VAR



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_CONRAD135S

FILE: 607L&607AL_Fault_at_Conrad135S.out

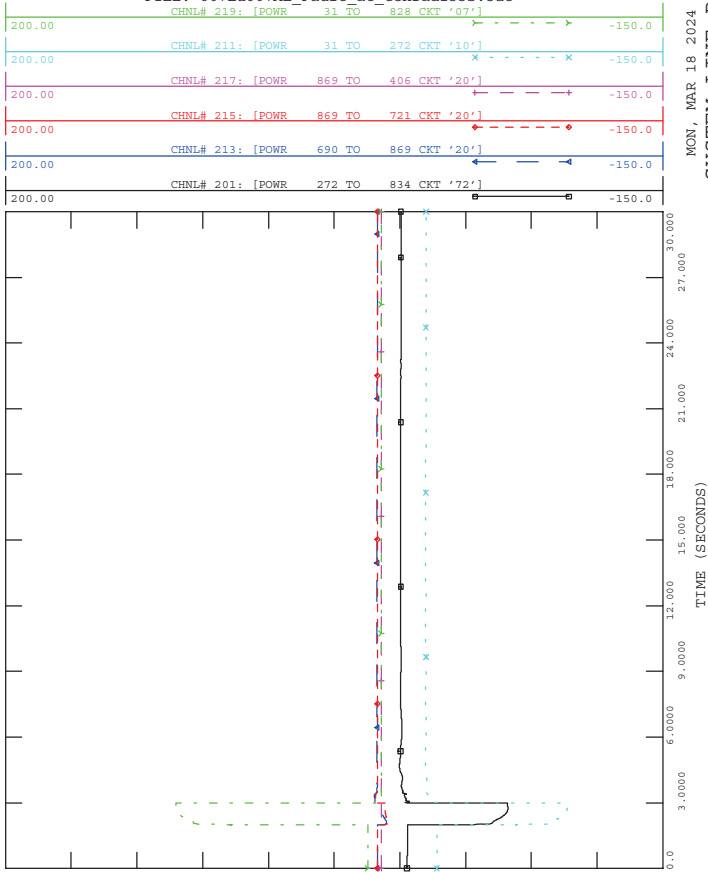


MON, MAR 18 2024 15:22
AREA MACHINE ANGLE



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_CONRAD135S

FILE: 607L&607AL_Fault_at_Conrad135S.out
CHNL# 219: [POWR 31 TO 828 CKT '07']

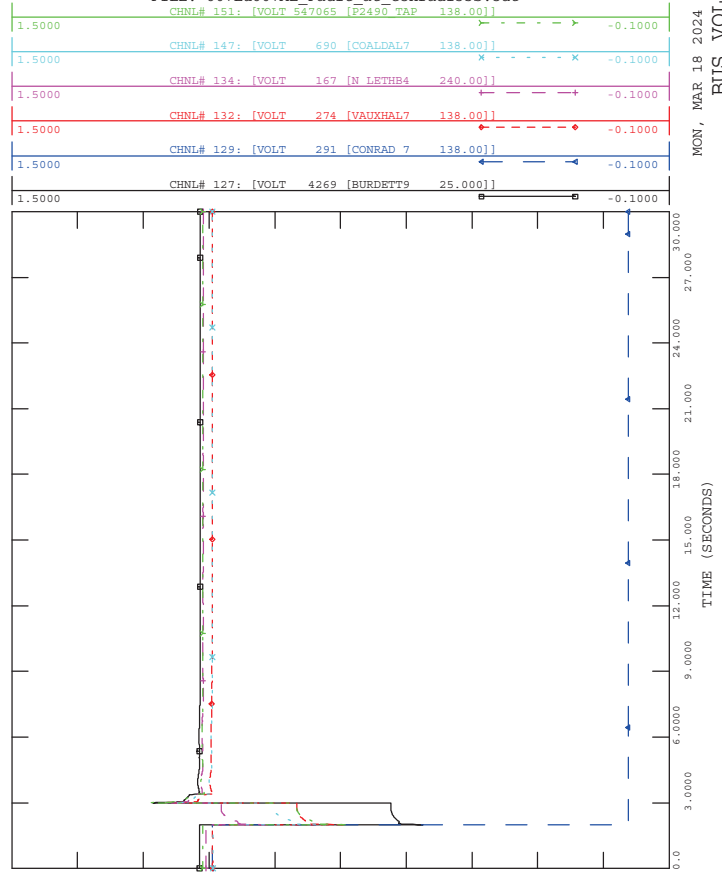


MON, MAR 18 2024 15:22
SYSTEM LINE POWER



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_CONRAD135S

FILE: 607L&607AL_Fault_at_Conrad135S.out

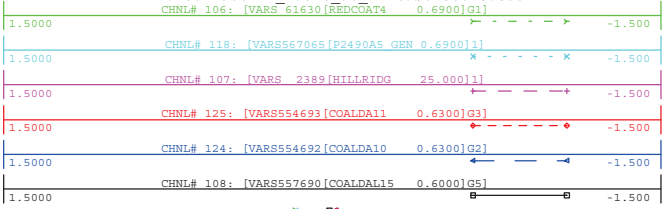


MON, MAR 18 2024 15:22
BUS VOLTAGE

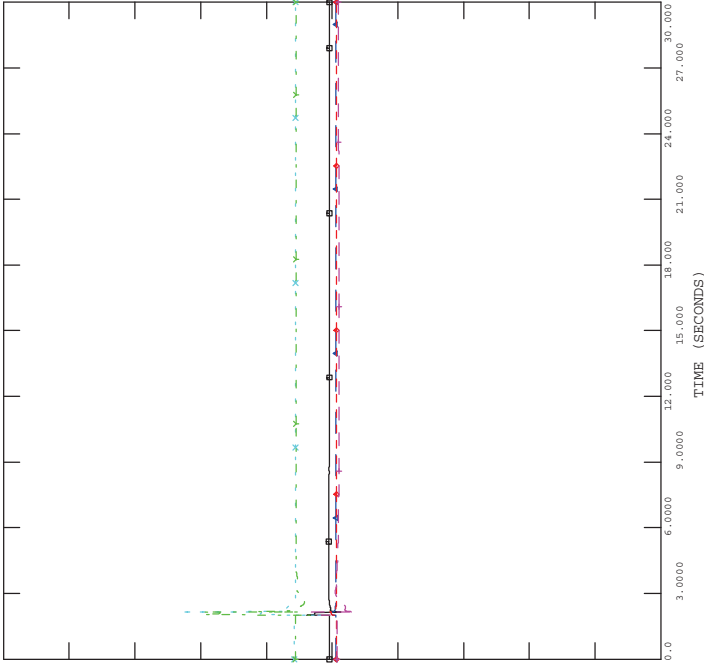


SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_FINCATTLE607S

FILE: 607L&607AL Fault_at Fincastle607S.out

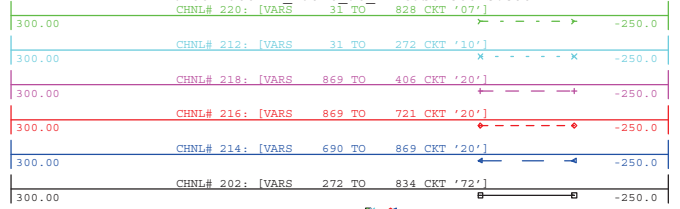


MON, MAR 18 2024 15:22
MACHINE VAR

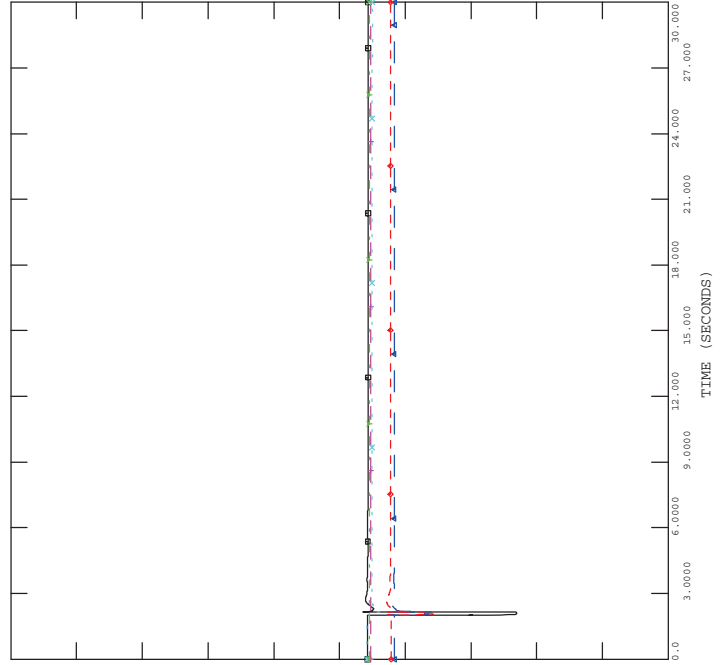


SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_FINCATTLE607S

FILE: 607L&607AL Fault_at Fincastle607S.out

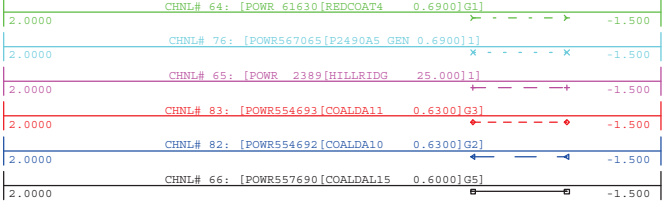


MON, MAR 18 2024 15:22
SYSTEM LINE VAR

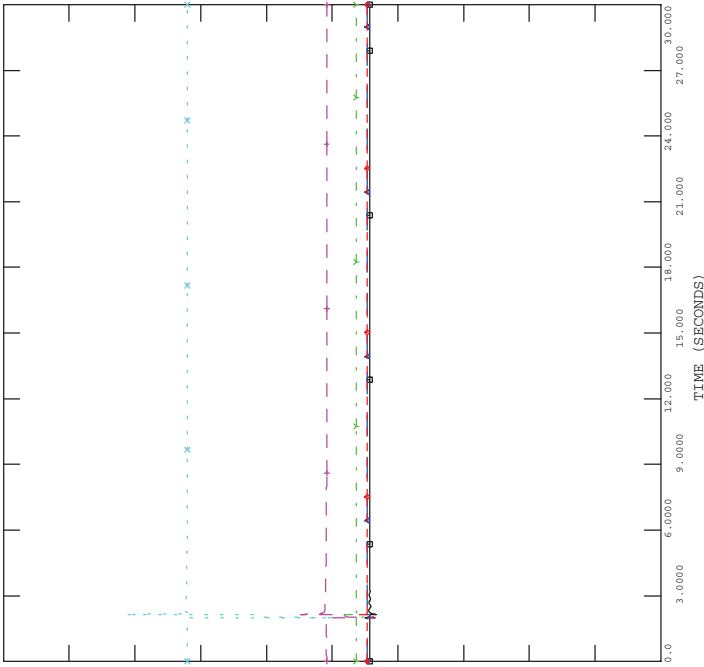


SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_FINCATTLE607S

FILE: 607L&607AL Fault_at Fincastle607S.out

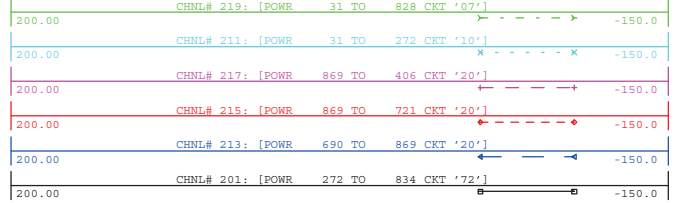


MON, MAR 18 2024 15:22
MACHINE POWER

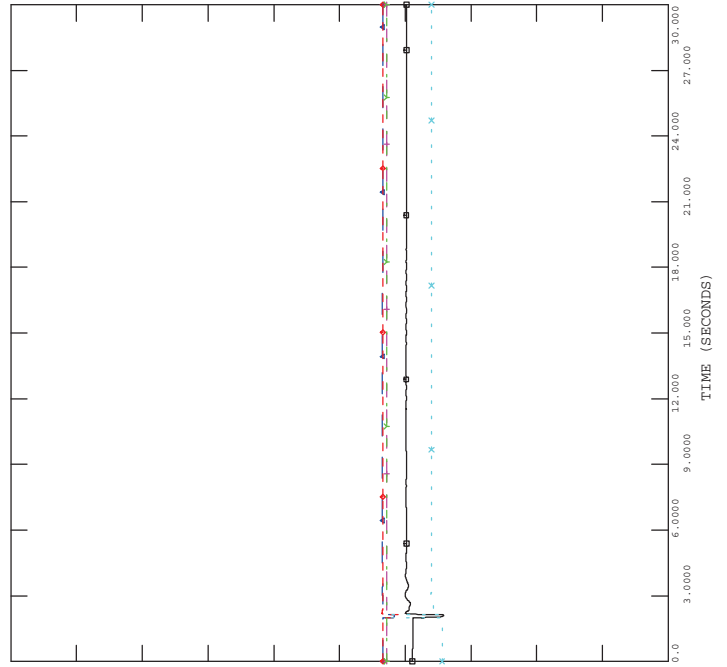


SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_FINCATTLE607S

FILE: 607L&607AL Fault_at Fincastle607S.out



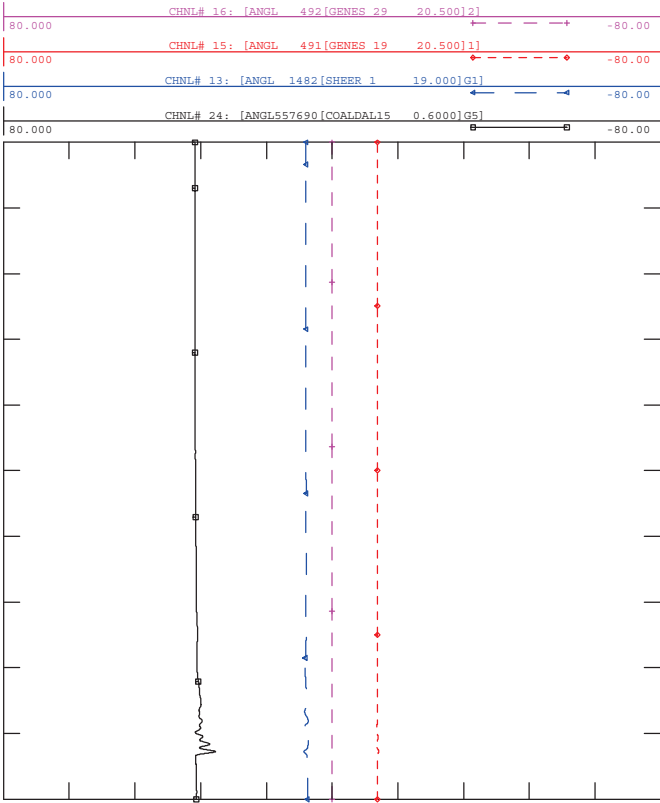
MON, MAR 18 2024 15:22
SYSTEM LINE POWER





SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_FINCATTLE607S

FILE: 607L&607AL_Fault_at_Fincastle607S.out

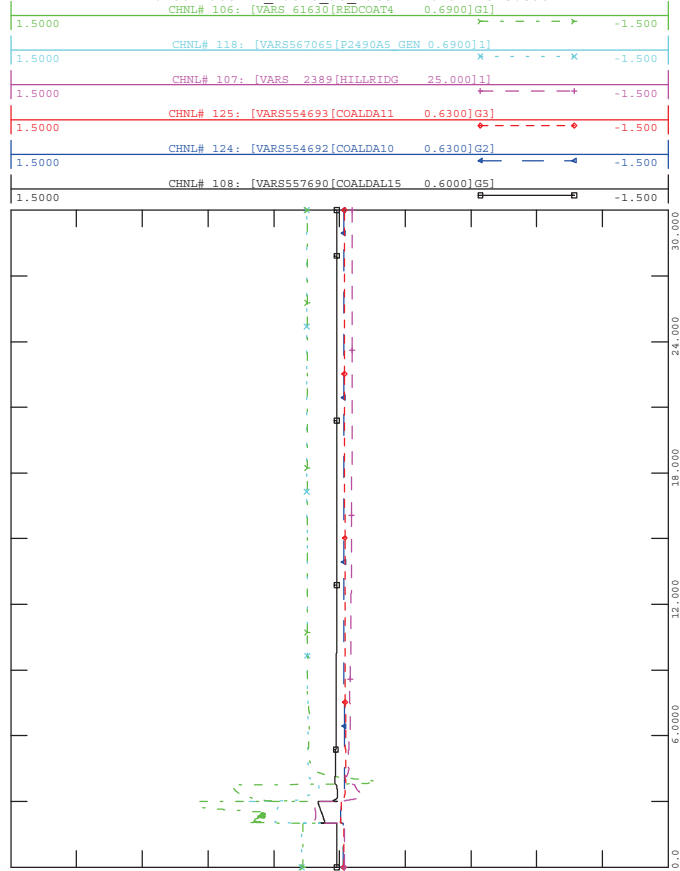


MON, MAR 18 2024 15:22
AREA MACHINE ANGLE



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_TABERWINDFARM134S

FILE: 607L&607AL_Fault_at_TaberWindFarm134S.out

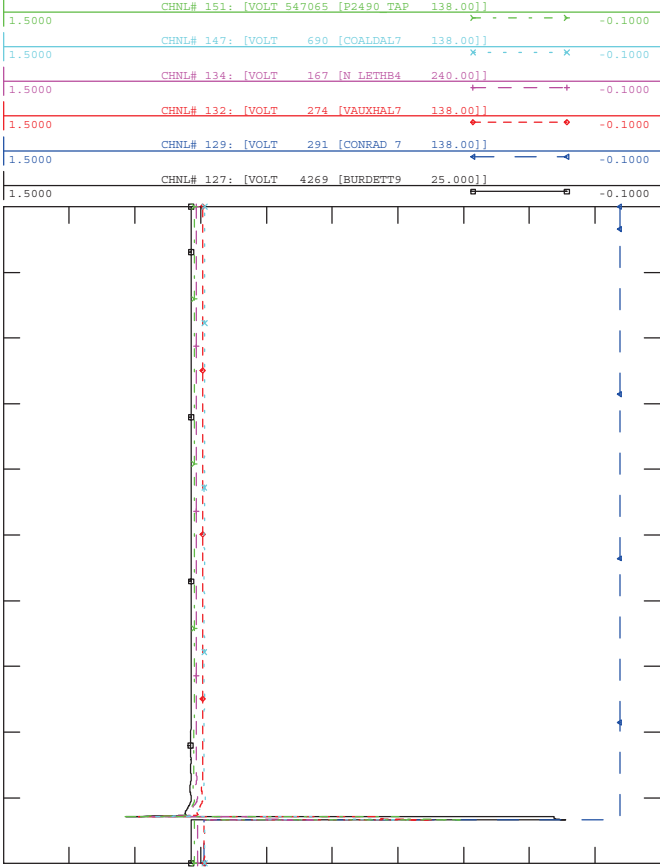


MON, MAR 18 2024 15:22
MACHINE VAR



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_FINCATTLE607S

FILE: 607L&607AL_Fault_at_Fincastle607S.out

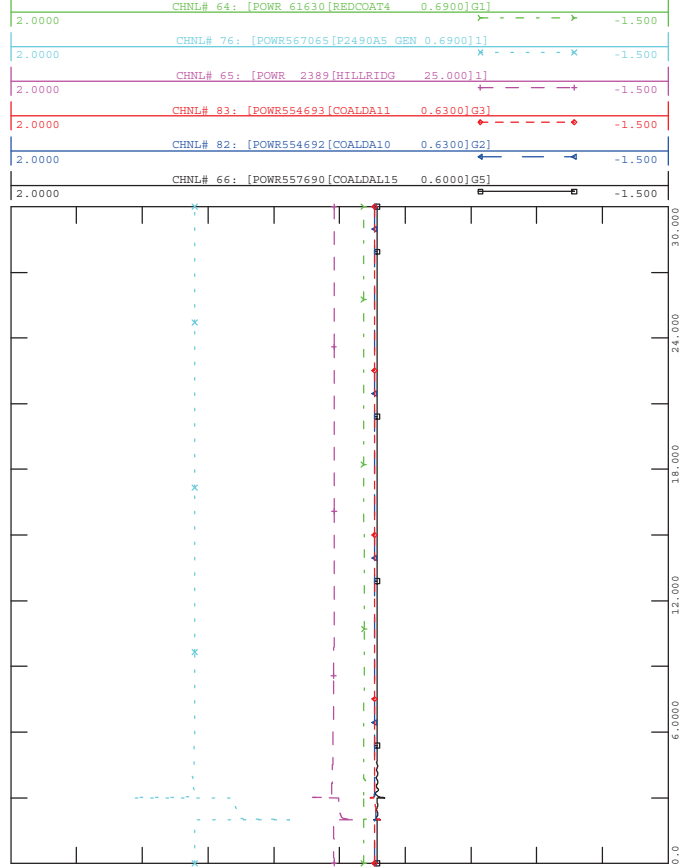


MON, MAR 18 2024 15:22
BUS VOLTAGE



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_TABERWINDFARM134S

FILE: 607L&607AL_Fault_at_TaberWindFarm134S.out

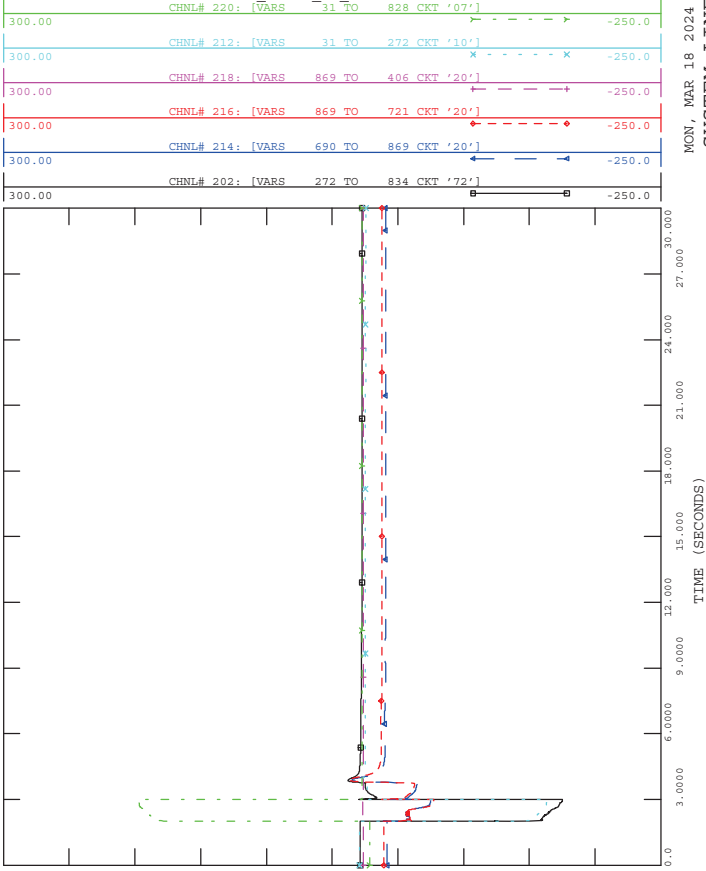


MON, MAR 18 2024 15:22
MACHINE POWER



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_TABERWINDFARM134S

FILE: 607L&607AL_Fault_at TaberWindFarm134S.out
CHNL# 220: [VARS 31 TO 828 CKT '07']

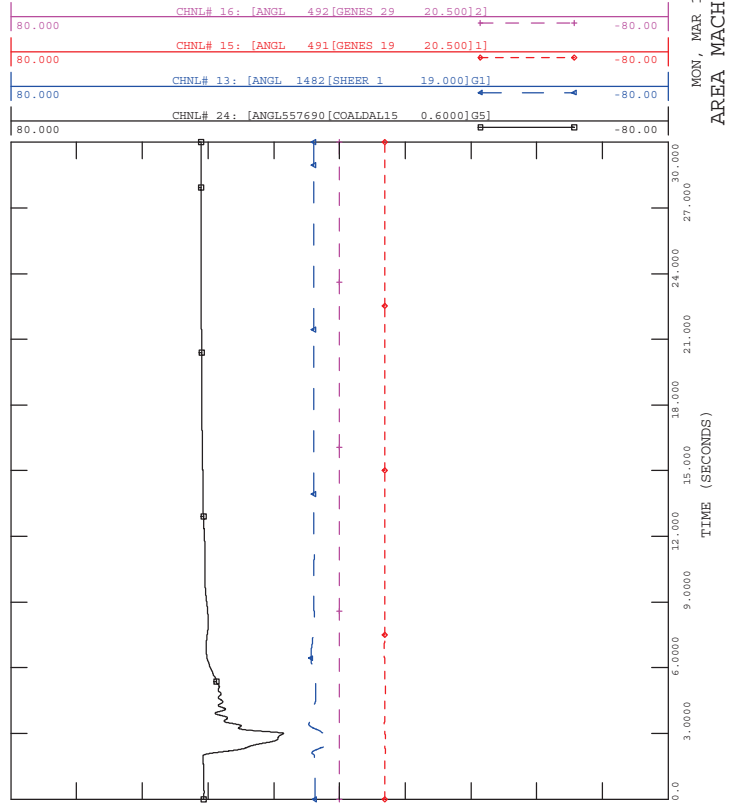


MON, MAR 18 2024 15:22
SYSTEM LINE VAR



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_TABERWINDFARM134S

FILE: 607L&607AL_Fault_at TaberWindFarm134S.out

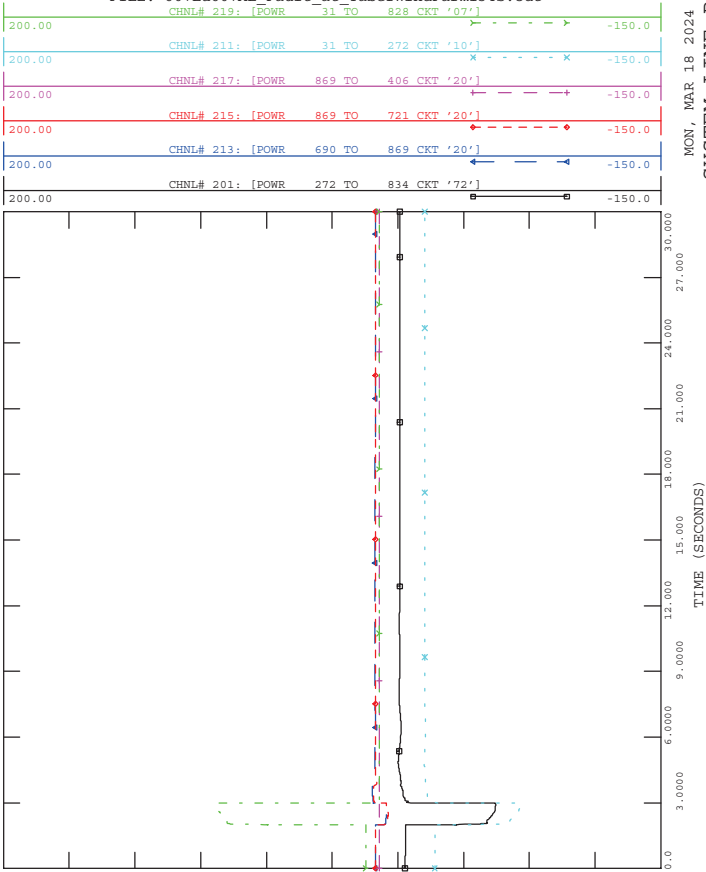


MON, MAR 18 2024 15:22
AREA MACHINE ANGLE



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_TABERWINDFARM134S

FILE: 607L&607AL_Fault_at TaberWindFarm134S.out
CHNL# 219: [POWR 31 TO 828 CKT '07']

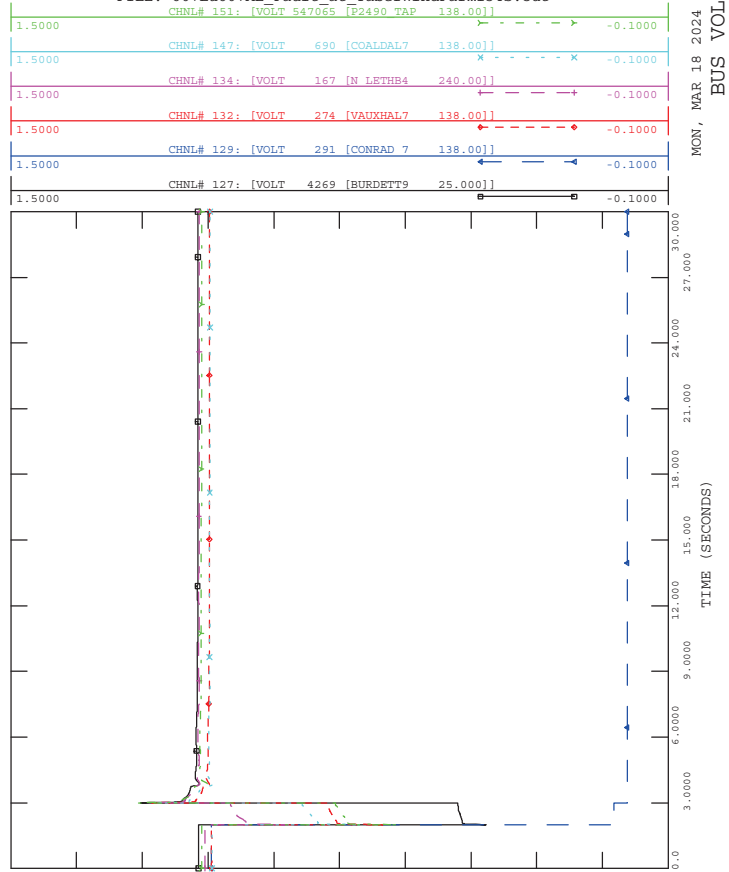


MON, MAR 18 2024 15:22
SYSTEM LINE POWER



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -607L&607AL_FAULT_AT_TABERWINDFARM134S

FILE: 607L&607AL_Fault_at TaberWindFarm134S.out
CHNL# 151: [VOLT 5470E5 [P2490 TAP 138.00]]

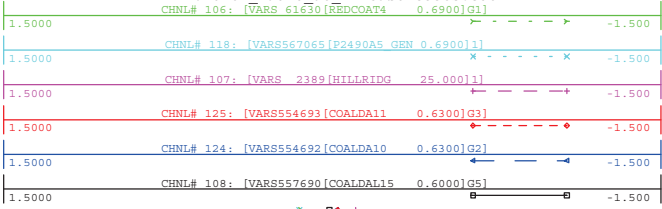


MON, MAR 18 2024 15:22
BUS VOLTAGE



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -610L_FAULT_AT_FINCATTLE336S

FILE: 610L Fault_at Fincastle336S.out
CHNL# 106: [VARS 61630[REDCOAT4 0.6900]G1]

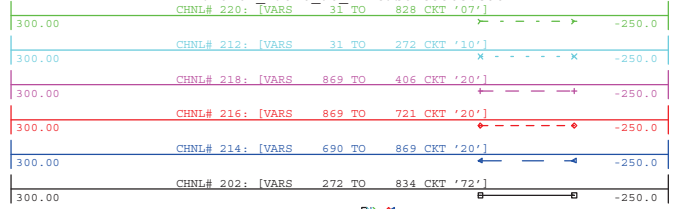


MON, MAR 18 2024 15:22
MACHINE VAR



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -610L_FAULT_AT_FINCATTLE336S

FILE: 610L Fault_at Fincastle336S.out
CHNL# 220: [VARS 31 TO 272 CKT '10']

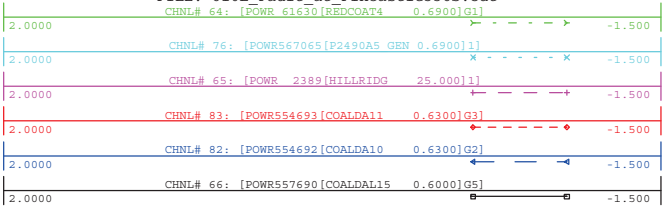


MON, MAR 18 2024 15:22
SYSTEM LINE VAR



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -610L_FAULT_AT_FINCATTLE336S

FILE: 610L Fault_at Fincastle336S.out
CHNL# 64: [POWR 61630[REDCOAT4 0.6900]G1]

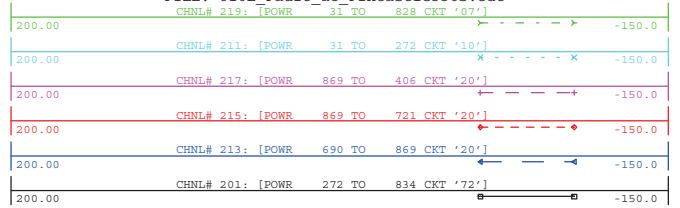


MON, MAR 18 2024 15:22
MACHINE POWER



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -610L_FAULT_AT_FINCATTLE336S

FILE: 610L Fault_at Fincastle336S.out
CHNL# 219: [POWR 31 TO 272 CKT '10']

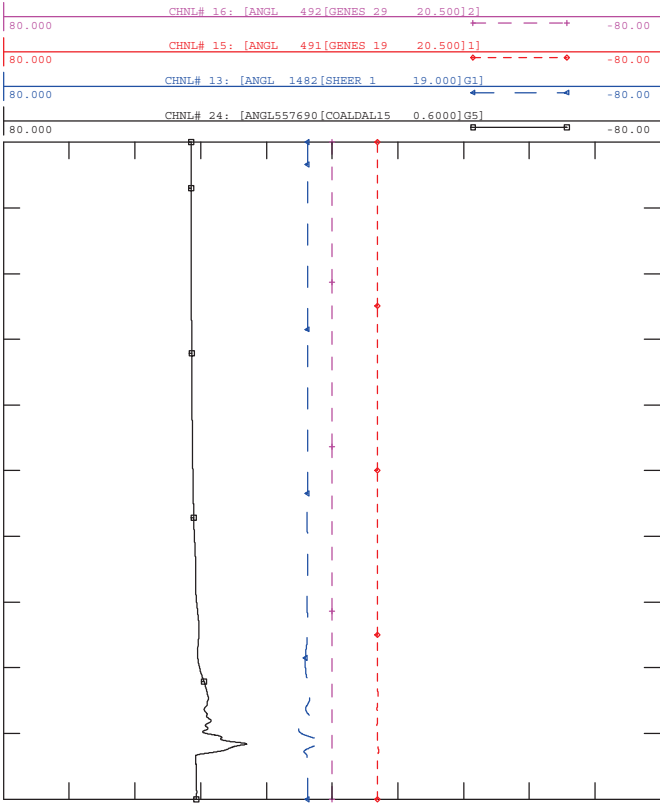


MON, MAR 18 2024 15:22
SYSTEM LINE POWER



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -610L_FAULT_AT_FINCATTLE336S

FILE: 610L_Fault_at_Fincastle336S.out

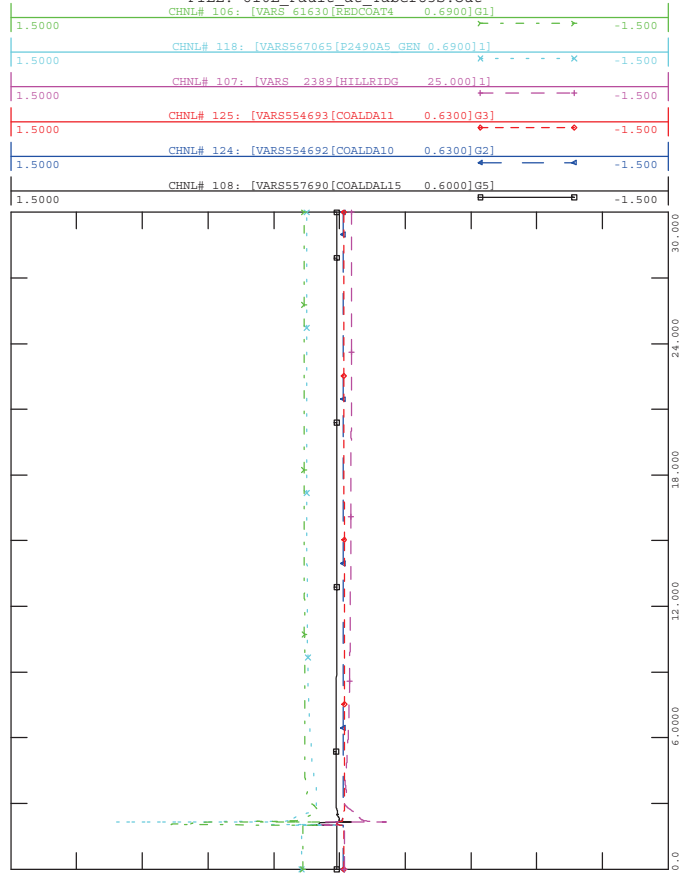


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AREA MACHINE ANGLE



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -610L_FAULT_AT_TABER83S

FILE: 610L_Fault_at_Taber83S.out

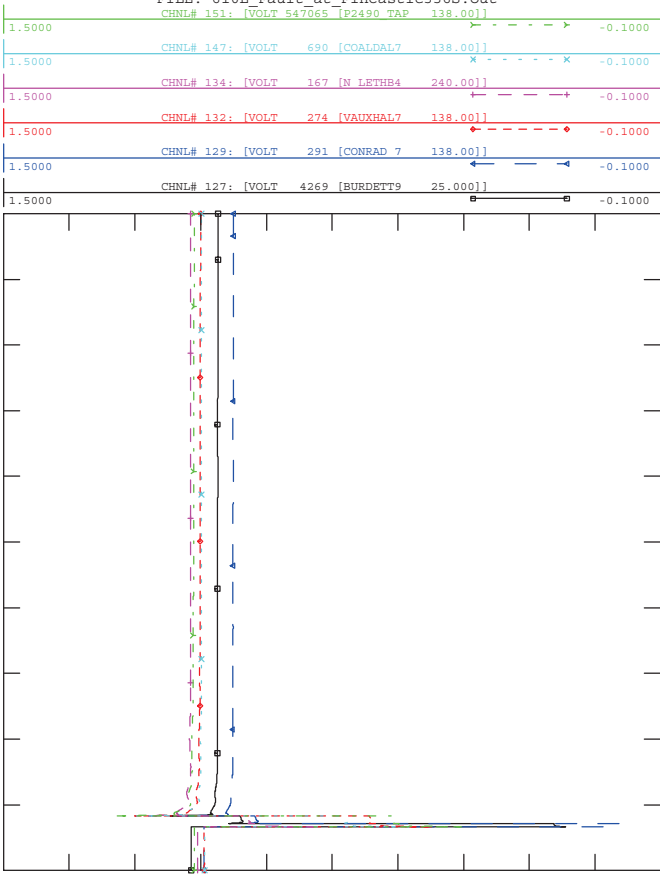


MON, MAR 18 2024 15:22
MACHINE VAR



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -610L_FAULT_AT_FINCATTLE336S

FILE: 610L_Fault_at_Fincastle336S.out

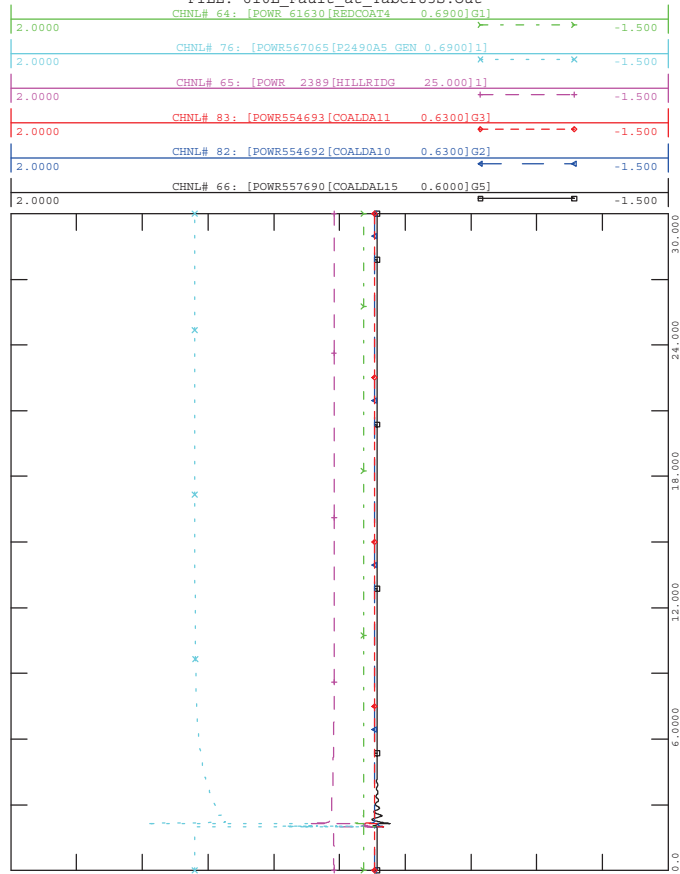


MON, MAR 18 2024 15:22
BUS VOLTAGE



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -610L_FAULT_AT_TABER83S

FILE: 610L_Fault_at_Taber83S.out

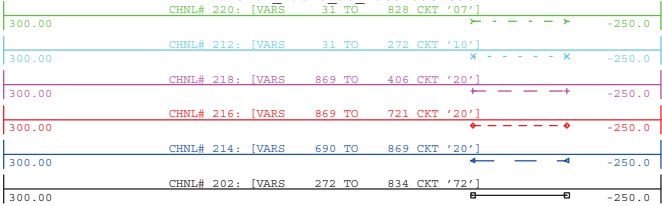


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MACHINE POWER



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -610L_FAULT_AT_TABER83S

FILE: 610L_Fault_at_Taber83S.out
CHNL# 220: [VARS 31 TO 828 CKT '07']

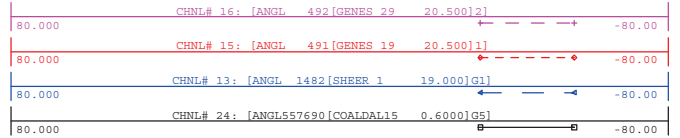


MON, MAR 18 2024 15:22
SYSTEM LINE VAR



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -610L_FAULT_AT_TABER83S

FILE: 610L_Fault_at_Taber83S.out

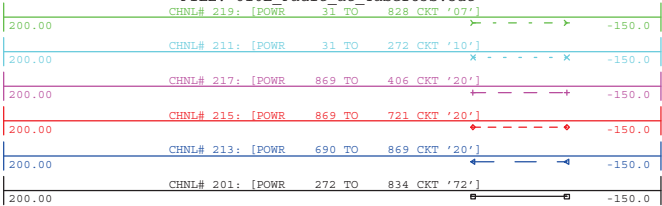


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AREA MACHINE ANGLE



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -610L_FAULT_AT_TABER83S

FILE: 610L_Fault_at_Taber83S.out
CHNL# 219: [POWR 31 TO 828 CKT '07']

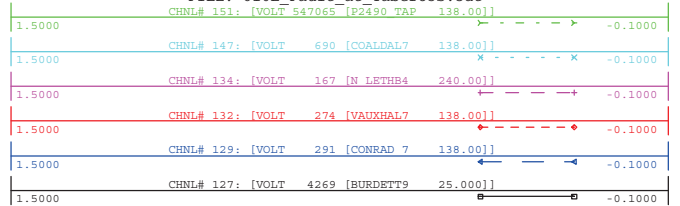


MON, MAR 18 2024 15:22
SYSTEM LINE POWER



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -610L_FAULT_AT_TABER83S

FILE: 610L_Fault_at_Taber83S.out

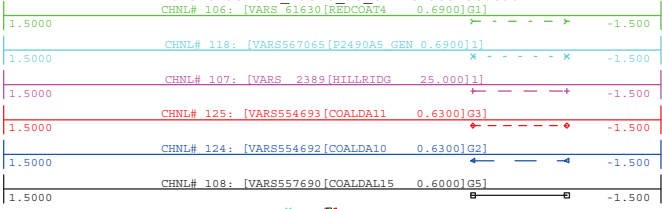


MON, MAR 18 2024 15:22
BUS VOLTAGE

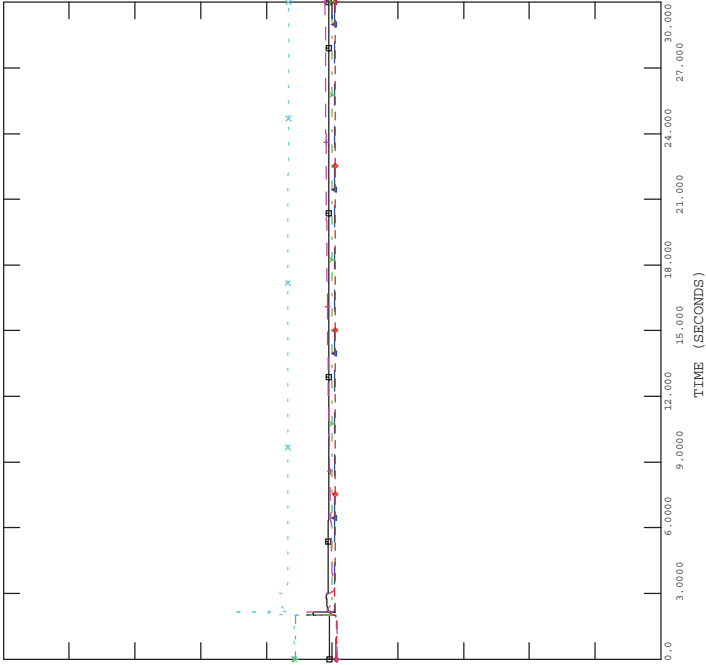


SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_CHINCHUT315S

FILE: 820L&820AL_Fault_at_ChinChut315S.out

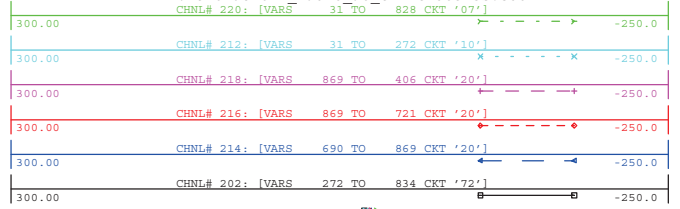


MON, MAR 18 2024 15:22
MACHINE VAR

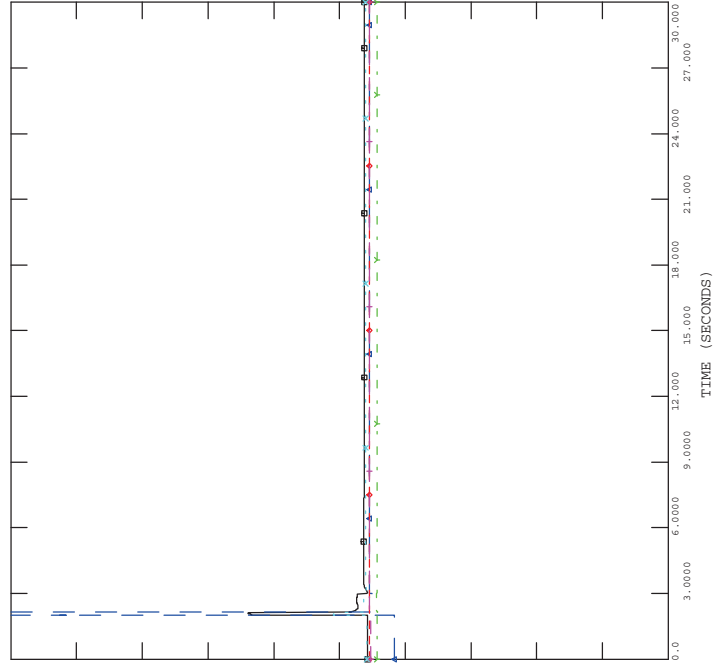


SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_CHINCHUT315S

FILE: 820L&820AL_Fault_at_ChinChut315S.out

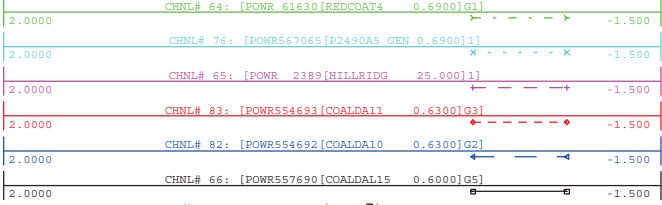


MON, MAR 18 2024 15:22
SYSTEM LINE VAR

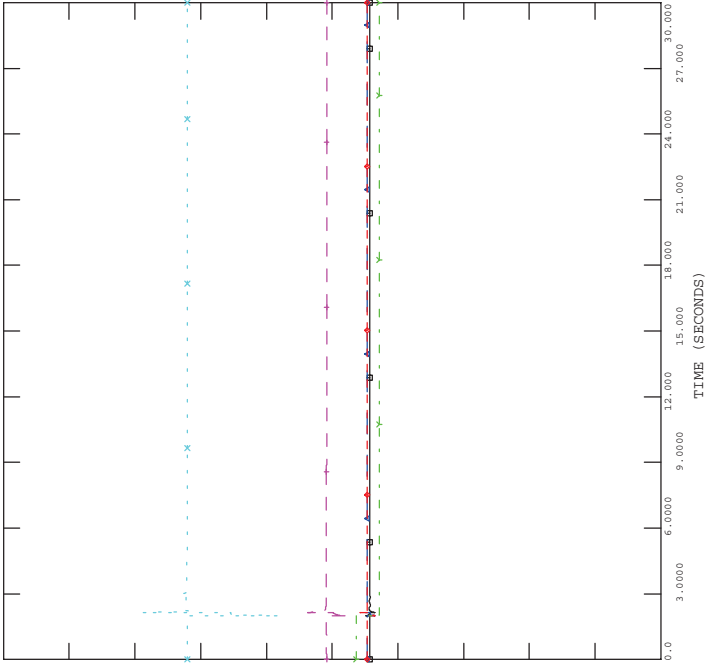


SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_CHINCHUT315S

FILE: 820L&820AL_Fault_at_ChinChut315S.out

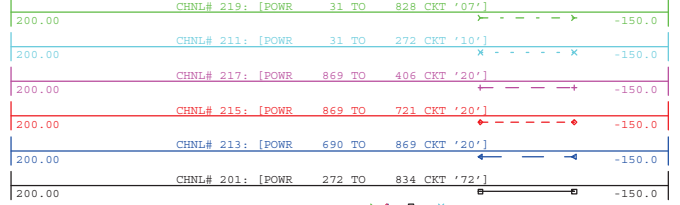


MON, MAR 18 2024 15:22
MACHINE POWER

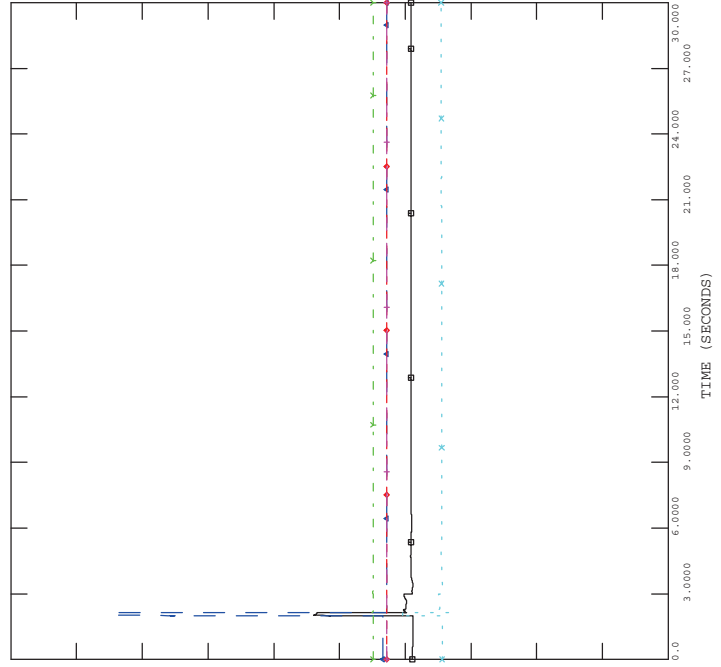


SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_CHINCHUT315S

FILE: 820L&820AL_Fault_at_ChinChut315S.out



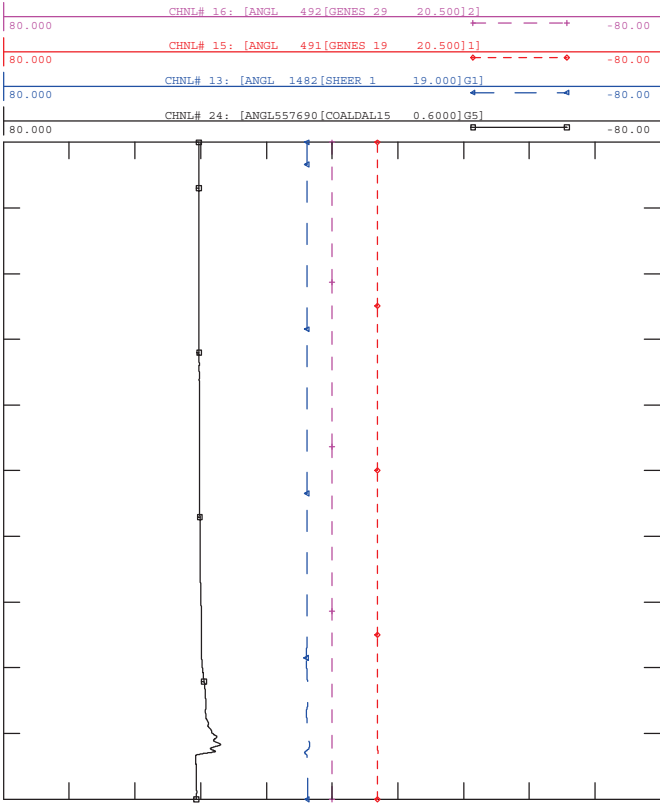
MON, MAR 18 2024 15:22
SYSTEM LINE POWER





SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_CHINCHUT315S

FILE: 820L&820AL_Fault_at_ChinChut315S.out

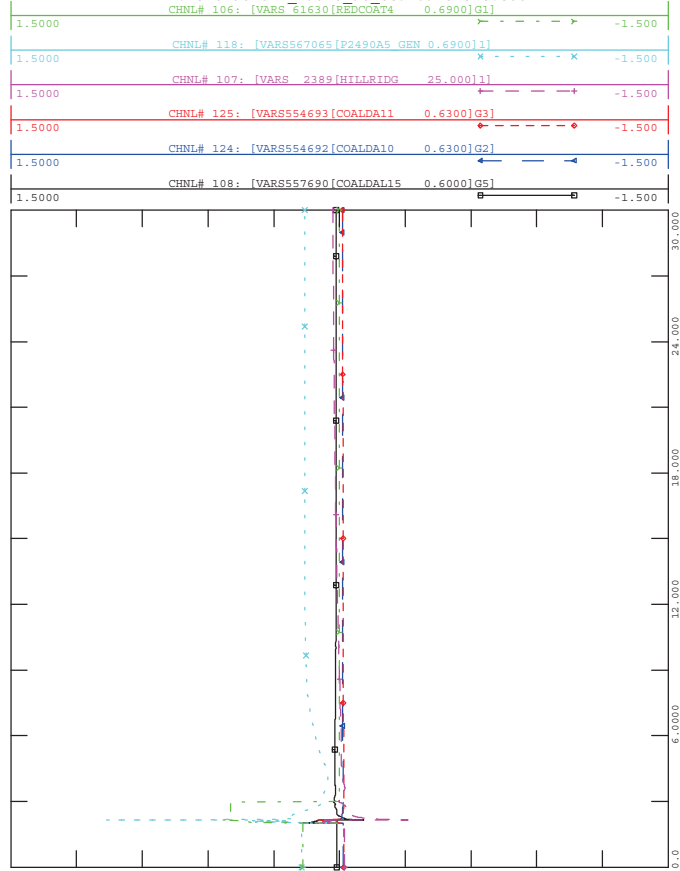


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AREA MACHINE ANGLE



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_COALDALE254S

FILE: 820L&820AL_Fault_at_Coaldale254S.out

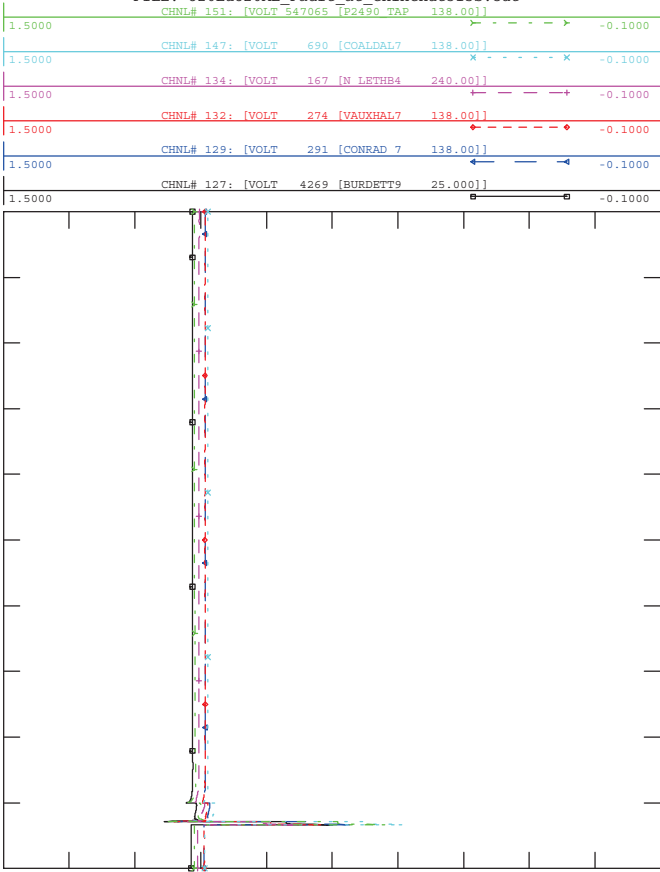


MON, MAR 18 2024 15:22
MACHINE VAR



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_CHINCHUT315S

FILE: 820L&820AL_Fault_at_ChinChut315S.out

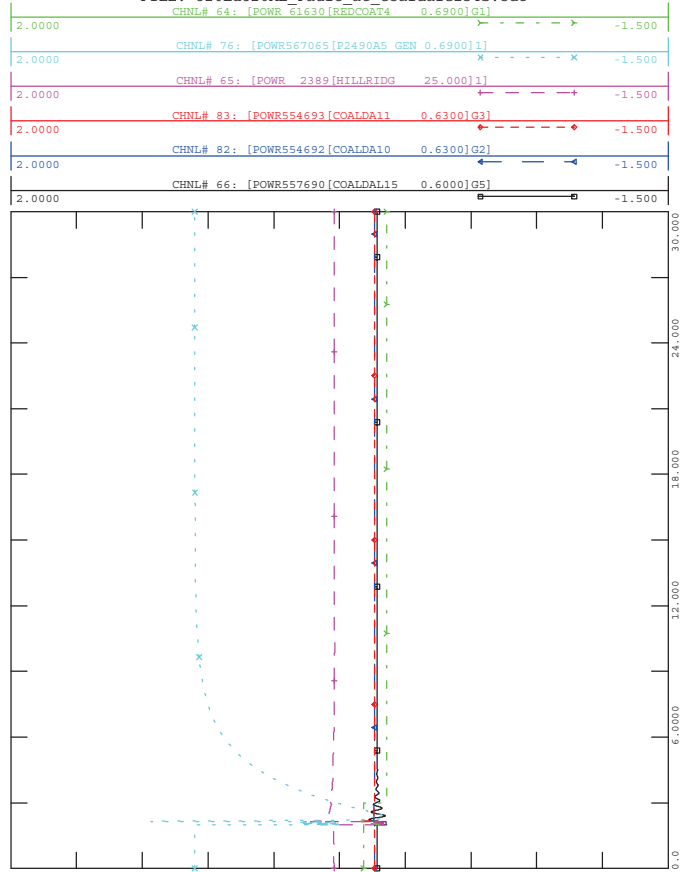


MON, MAR 18 2024 15:22
BUS VOLTAGE



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_COALDALE254S

FILE: 820L&820AL_Fault_at_Coaldale254S.out

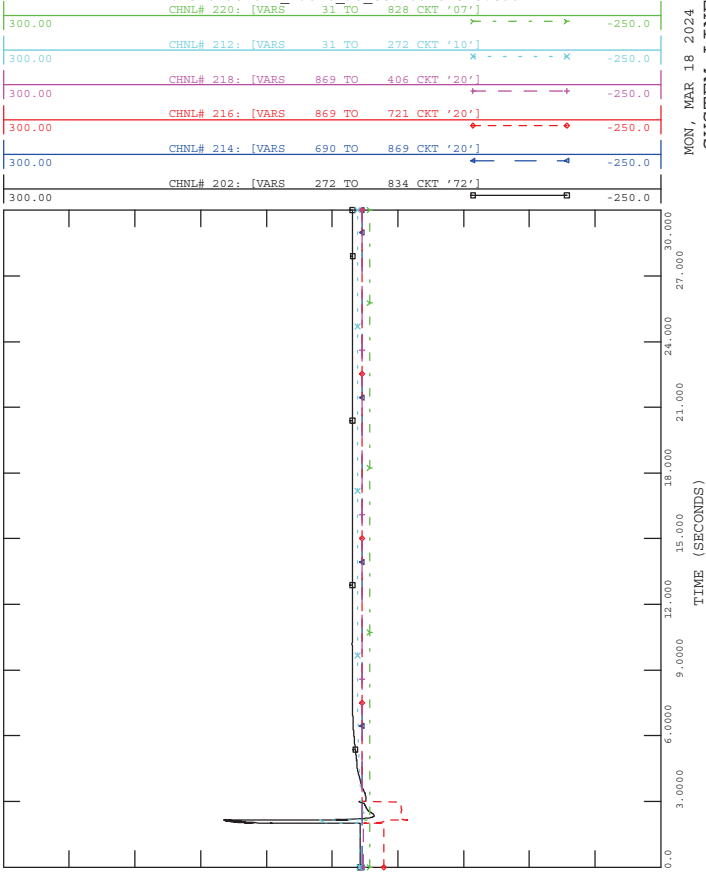


MON, MAR 18 2024 15:22
MACHINE POWER



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_COALDALE254S

FILE: 820L&820AL_Fault_at_Coaldale254S.out

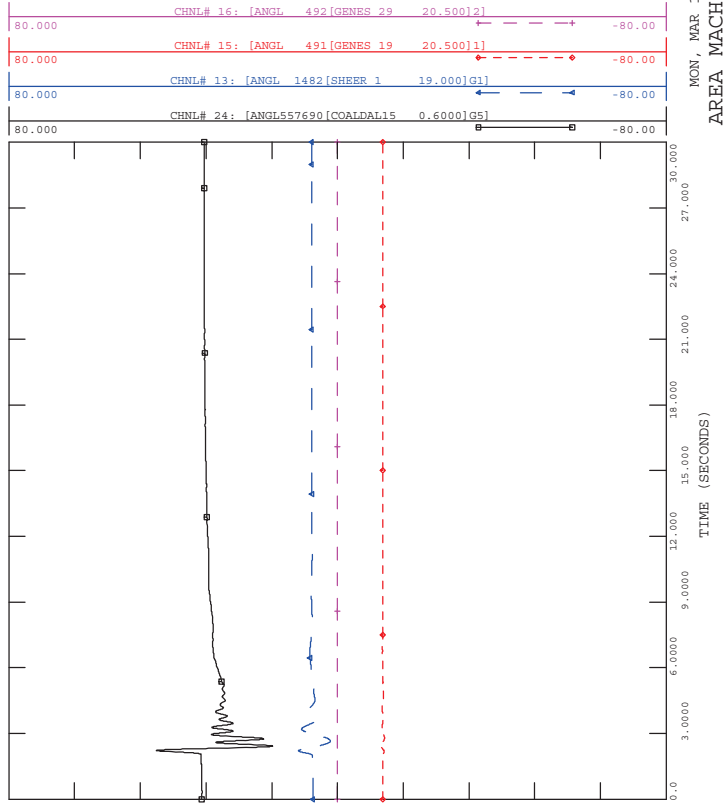


MON, MAR 18 2024 15:22
SYSTEM LINE VAR



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_COALDALE254S

FILE: 820L&820AL_Fault_at_Coaldale254S.out

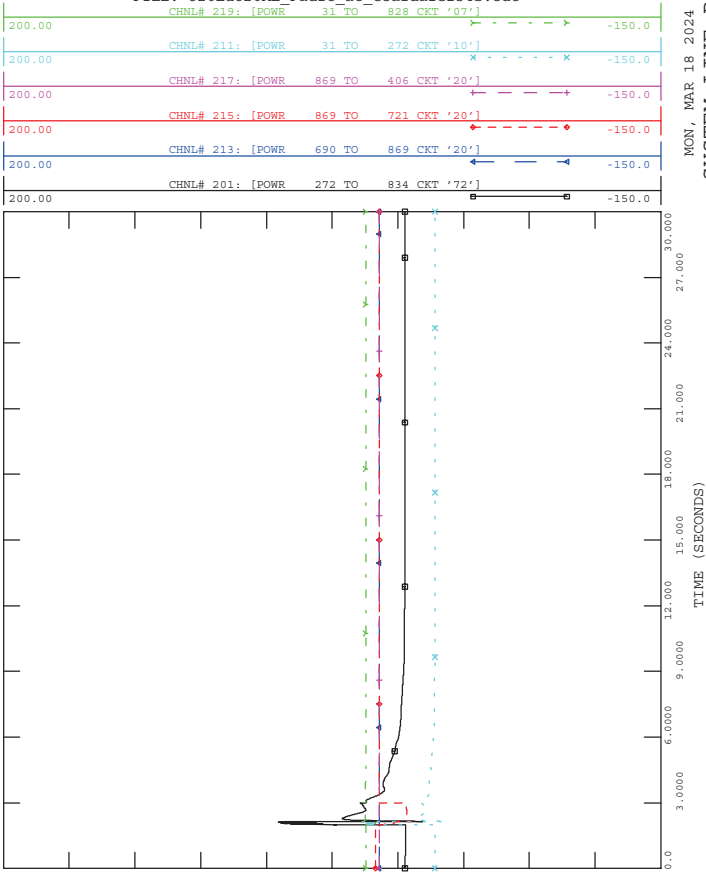


MON, MAR 18 2024 15:22
AREA MACHINE ANGLE



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_COALDALE254S

FILE: 820L&820AL_Fault_at_Coaldale254S.out

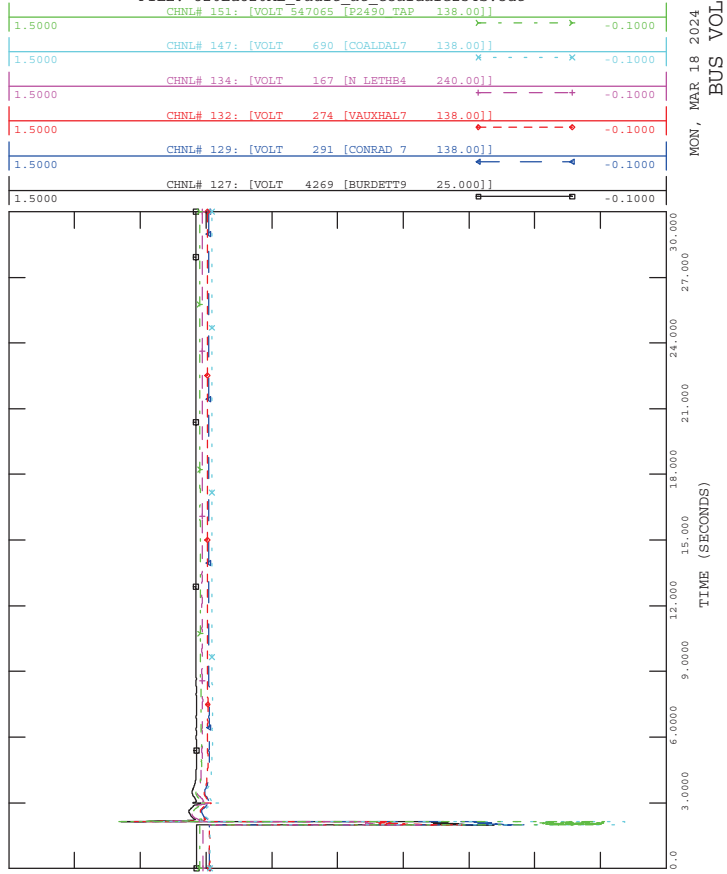


MON, MAR 18 2024 15:22
SYSTEM LINE POWER



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_COALDALE254S

FILE: 820L&820AL_Fault_at_Coaldale254S.out

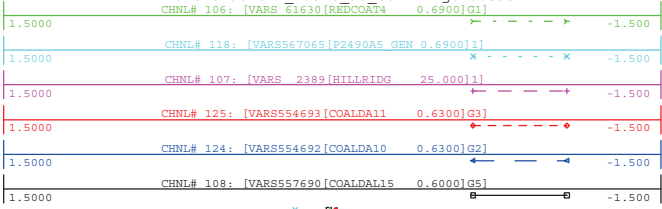


MON, MAR 18 2024 15:22
BUS VOLTAGE



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_STIRLING67S

FILE: 820L&820AL Fault_at Stirling67S.out
CHNL# 106: [VARS 61630[REDCOAT4 0.6900]G1]

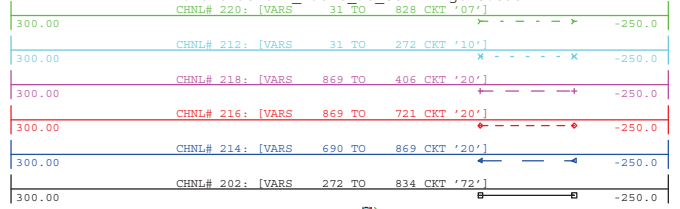


MON, MAR 18 2024 15:22
MACHINE VAR



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_STIRLING67S

FILE: 820L&820AL Fault_at Stirling67S.out
CHNL# 220: [VARS 31 TO 272 CKT '10']

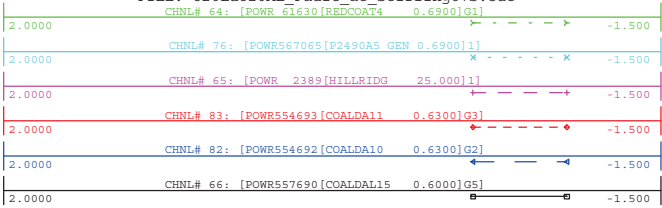


MON, MAR 18 2024 15:22
SYSTEM LINE VAR



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_STIRLING67S

FILE: 820L&820AL Fault_at Stirling67S.out
CHNL# 64: [POWR 61630[REDCOAT4 0.6900]G1]

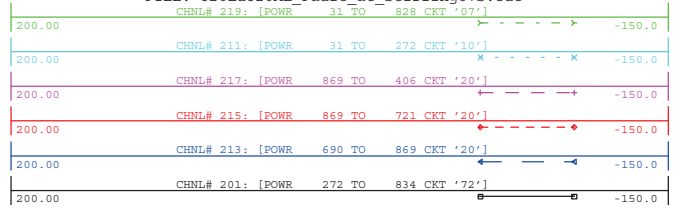


MON, MAR 18 2024 15:22
MACHINE POWER



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_STIRLING67S

FILE: 820L&820AL Fault_at Stirling67S.out
CHNL# 219: [POWR 31 TO 272 CKT '10']



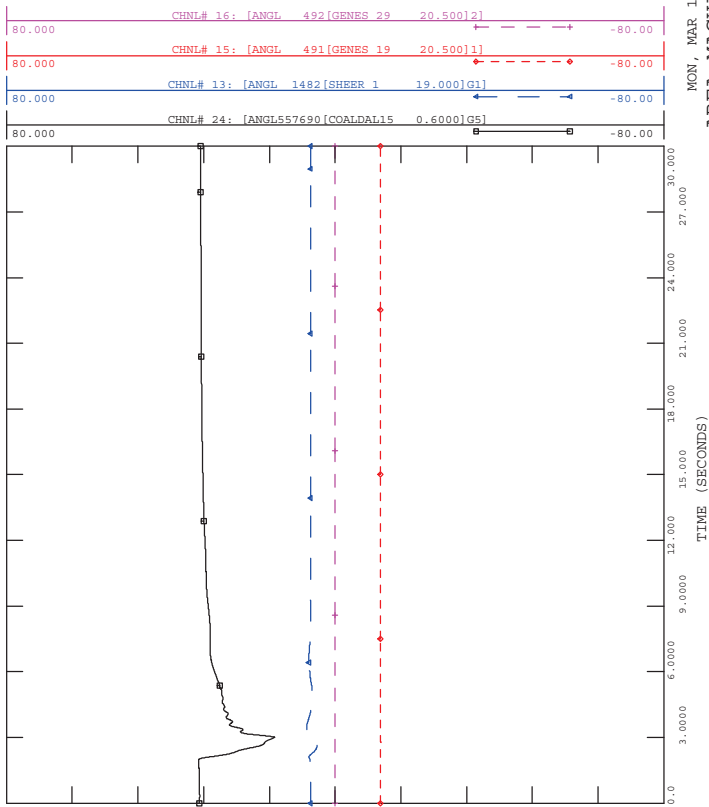
MON, MAR 18 2024 15:22
SYSTEM LINE POWER



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_STIRLING67S

FILE: 820L&820AL_Fault_at_Stirling67S.out

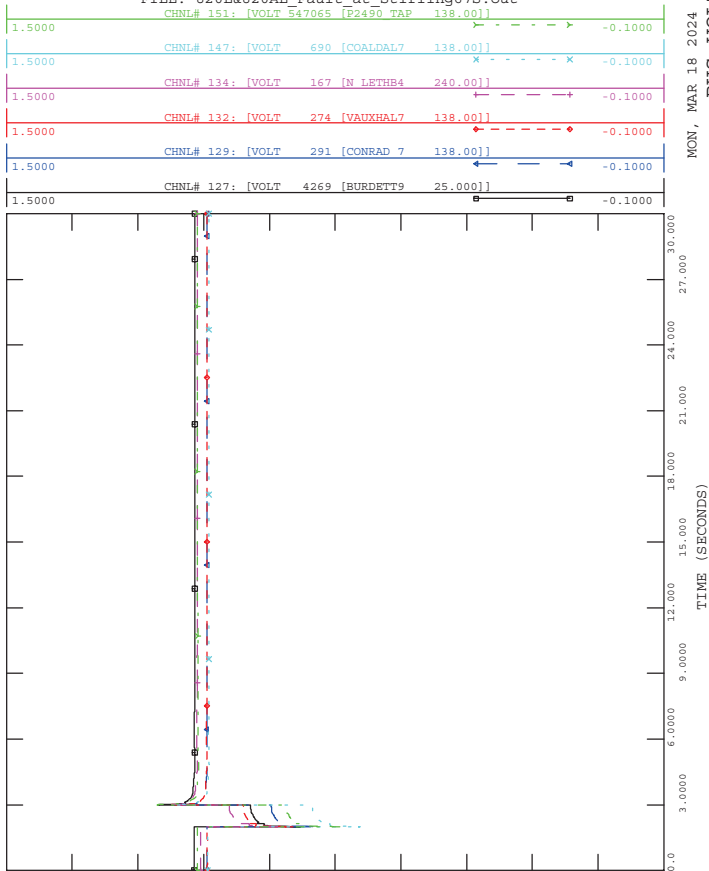
MON, MAR 18 2024 15:22
AREA MACHINE ANGLE



SCENARIO #4: 2028 SP POST PROJECT
CONTINGENCY -820L&820AL_FAULT_AT_STIRLING67S

FILE: 820L&820AL_Fault_at_Stirling67S.out

MON, MAR 18 2024 15:22
BUS VOLTAGE



Attachment A5

Dynamic Data and Assumptions

Table A5-1: Converter Model (REGCAU1)

Renewable Energy Generator/Converter Model (REGCAU1)									
Tg	Rrpwr	Brkpt	Zerox	Lvp11	Volim	Lvpnt1	Lvpnt0	Iolim	Tfltr
0.02	10.0	0.9	0.5	1.0	1.2	0.01	0.00	-1	0.0
Khv	Iqrmax	Iqrmin	Accel	Lvplsw					
0.0	20	-20	0.7	0					

Table A5-2: Electrical Control Model (REECAU1)

Generic Renewable Electrical Control Model (REECAU1)											
Vdip	Vup	Trv	dbd1	dbd2	Kqv	Iqhl	Iqll	Vref0	Iqfrz	Thld	Thld2
0.9	1.2	0.01	-0.1	0.1	1	2	-2	0	1	0	0
Tp	QMax	QMin	VMAX	VMIN	Kqp	Kqi	Kvp	Kvi	Vbias	Tiq	dPmax
0.05	0.6	-0.6	1.2	0.8	0	1	0	1	0	0.01	1
dPmin	PMax	PMIN	Imax	Tpord	Vq1	Iq1	Vq2	Iq2	Vq3	Iq3	Vq4
-1	1	0	1	0.01	0	1	0.33	1	0.66	1	1
Iq4	Vp1	Ip1	Vp2	Ip2	Vp3	Ip3	Vp4	Ip4	Bus	PFFLAG	VFLAG
1	0	1	0.33	1	0.66	1	1	1	0	0	1
QFLAG	PFLAG	PQFLAG									
0	0	0									

Table A5-3: Power Plant Control Model (REPCAUI)

Renewable Energy Generator/Converter Model (REPCTAU1)											
Tfltr	Kp	Ki	Tft	Tfv	Vfrz	Rc	Xc	Kc	emax	emin	dbd1
0.04	0.06	8.5	0	0.04	0.9	0	0	0.04	0.05	-0.05	-0.005
dbd2	Qmax	Qmin	Kpg	Kig	Tp	fdbd1	Fdbd2	femax	femin	Pmax	Pmin
0.005	0.2957	-0.2957	0	0.5	0.04	-0.006	0.006	999	-999	0.9	0
Tg	Ddn	Dup	Bus	FromBus	ToBus	ID	VCFlag	RefFlag	Fflag		
0.04	20	20	563065	0	0	-	0	1	1		

/*****

*** P2490 Tempest MPC Wind MFO: 100 MW

*** Alternative 5: POI between Hillridge 138 kV (Bus#389) and 172EL 138 kV Tap Point (Bus#834)

*** Stage 2 Project Data Update Package created by CF Power LTD.

/*****

567065, 'USRMDL', 1, 'REGCAU1', 101, 1, 1, 14, 3, 4

0				
0.0200	10	0.9000	0.5000	1.0000
1.2000	0.01	0.0000	-1.0000	0.0000
0.0000	20.000	-20.000	0.7000/	

567065, 'USRMDL', 1, 'REECAU1', 102, 0, 6, 45, 6, 9

0	0	1	0	0	0
0.9000	1.2000	0.0100	-0.1000	0.1000	
1.0000	2.0000	-2.0000	0.0000	1.0000	
0.0000	0.0000	0.0500	0.6000	-0.6000	
1.2000	0.8000	0.0000	1.0000	0.0000	
1.0000	0.0000	0.0100	1.0000	-1.0000	
1.0000	0.0000	1.0000	0.0100	0.0000	
1.0000	0.3300	1.0000	0.6600	1.0000	
1.0000	1.0000	0.0000	1.0000	0.3300	
1.0000	0.6600	1.0000	1.0000	1.0000/	

567065, 'USRMDL', 1, 'REPCAU1', 107, 0, 7, 27, 7, 9,

563065	0	0	''	0	1	1
0.0400	0.0600	8.5000	0.0000	0.0400	0.0500	
0.9000	0.0000	0.0000	0.0400	0.0500		
-0.0500	-0.0050	0.0050	0.2957	-0.2957		
0.0000	0.5000	0.0400	-0.0006	0.0006		
999.00	-999.00	0.9000	0.0000	0.0400		
20.000	20.000/					

/*****

*** Project: 2490 ends

/*****

/*****

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Attachment A6

Post-Mitigation Power Flow Diagrams

Thermal Violations

- 1- FIGURE A6-1-1: 2028 SL HW POST PROJECT POST RAS168 [CATEGORY B: Red Coat 967S T1]
- 2- FIGURE A6-1-2: 2028 SL HW POST PROJECT POST RAS168 [CATEGORY B: 1041L (North Lethbridge 370S to Travers 554S)]
- 3- FIGURE A6-1-3: 2028 SL HW POST PROJECT POST RAS168 [CATEGORY B: RDCO_TAP(Stirling 67S to Chin Chute 315S/ Coaldale 254S)]
- 4- FIGURE A6-1-4: 2028 SL HW POST PROJECT POST RAS168 [CATEGORY B Fincastle 336S 25/138 kV T1/T2]
- 5- FIGURE A6-1-5: 2028 SL HW POST PROJECT POST RAS168 [CATEGORY B: 610L (Taber 83S to Fincastle 336S)]
- 6- FIGURE A6-1-6: 2028 SL HW POST PROJECT POST RAS168 [CATEGORY B: 1005L (Picture Butte 120S to Travers 554S)]
- 7- FIGURE A6-1-7: 2028 SL HW POST PROJECT POST RAS168 [CATEGORY B: 1005L (Travers 554S to Milo 356S)]
- 8- FIGURE A6-1-8: 2028 SL HW POST PROJECT POST RAS219 [CATEGORY B: 172L (North Lethbridge 370S to Coaldale 254S)]
- 9- FIGURE A6-1-9: 2028 SL HW POST PROJECT POST RAS219 [CATEGORY B: 770L (Coaldale 254S to North Lethbridge 370S)]
- 10- FIGURE A6-1-10: 2028 SL HW POST PROJECT POST RAS168 [CATEGORY B: 1036L (Milo 356S to Travers 554S)]

Thermal Violations

- 11- FIGURE A6-2-1: 2028 SP HW POST PROJECT POST RAS168 [CATEGORY B: 940L (North Lethbridge 370S to Picture Butte 120S)]
- 12- FIGURE A6-2-2: 2028 SP HW POST PROJECT POST RAS168 [CATEGORY B: 1041L (North Lethbridge 370S to Travers 554S)]
- 13- FIGURE A6-2-3: 2028 SP HW POST PROJECT POST RAS168 [CATEGORY B: 180L (Fort Macleod 15S to East Stavely 28S/Granum 604S)]
- 14- FIGURE A6-2-4: 2028 SP HW POST PROJECT POST RAS168 [CATEGORY B: Taber 83S 25/138 kV T1]
- 15- FIGURE A6-2-5: 2028 SP HW POST PROJECT POST RAS168 [CATEGORY B: Taber 83S 25/138 kV T3]
- 16- FIGURE A6-2-6: 2028 SP HW POST PROJECT POST RAS168 [CATEGORY B: 610L (Taber 83S to Fincastle 336S)]
- 17- FIGURE A6-2-7: 2028 SP HW POST PROJECT POST RAS168 [CATEGORY B: Fincastle 336S 25/138 kV T1/T2]
- 18- FIGURE A6-2-8: 2028 SP HW POST PROJECT POST RAS168 [CATEGORY B: 607L/607AL (Fincastle 336S to Conard 135S/ Taber Wind Farm 134S)]
- 19- FIGURE A6-2-9: 2028 SP HW POST PROJECT POST RAS168 [CATEGORY B: 1005L (Picture Butte 120S to Travers 554S)]
- 20- FIGURE A6-2-10: 2028 SP HW POST PROJECT POST RAS168 [CATEGORY B: 725BL (MacBride Lake 640S to Fort Macleod/ Bowron 674S)]
- 21- FIGURE A6-2-11: 2028 SP HW POST PROJECT POST RAS168 [CATEGORY B: Claresholm 34.5/138 kV T2]

Voltage Violations

- 22- FIGURE A6-2-12: 2028 SP HW POST PROJECT POST RAS168 [CATEGORY B: 820/820AL (Stirling 67S to Chin Chute 315S/ Coaldale 254S)]
- 23- FIGURE A6-2-13: 2028 SP HW POST PROJECT POST RAS168 [CATEGORY B: Stirling 67S 69/138 kV T2]

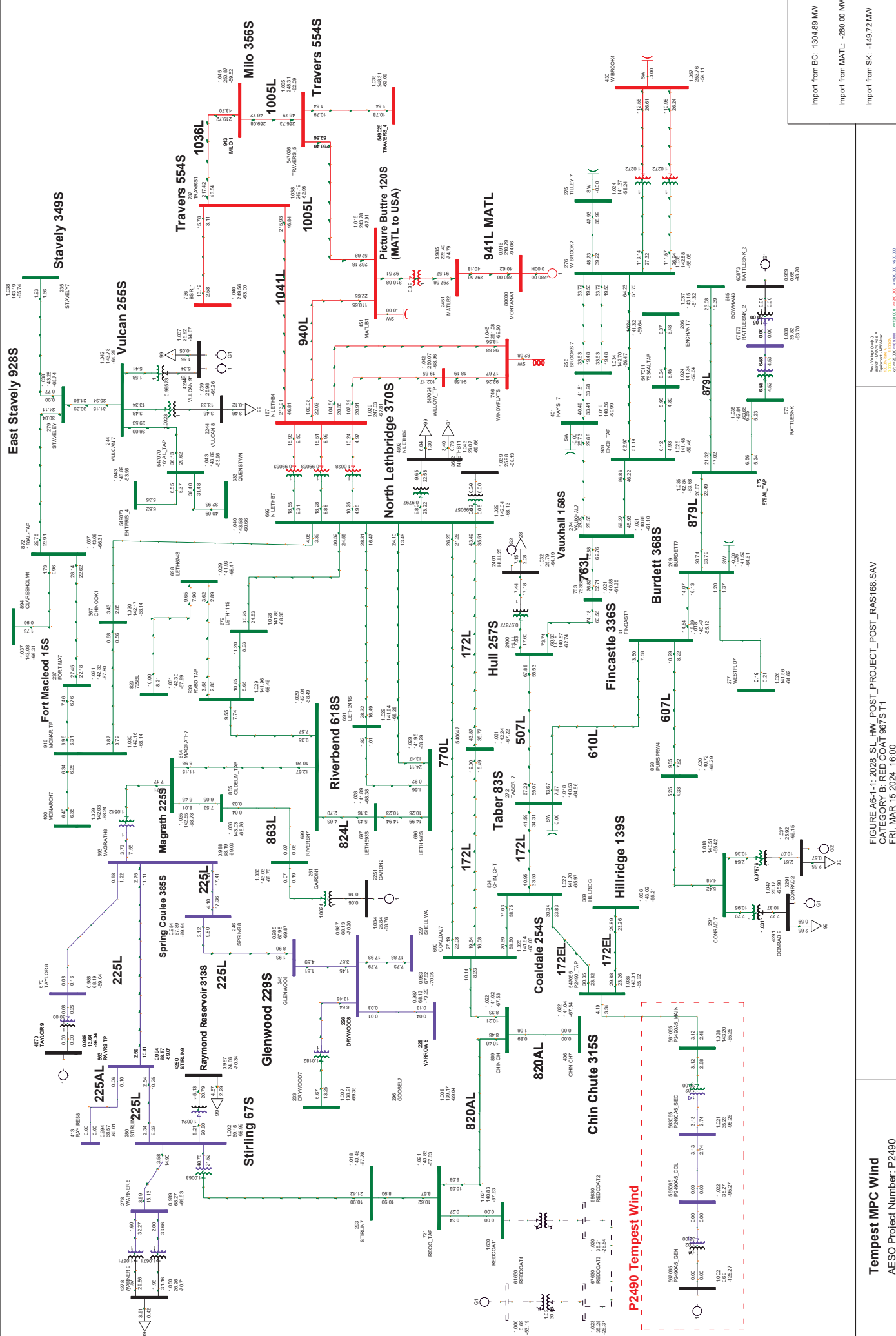


FIGURE A6-1-1: 2028_SL_HW_POST_PROJECT_POST_RAS168.SAV
CATEGORY B: RED COAT 967S T1
FRI, MAR 15 2024 16:00

Tempest MPC Wind
AESO Project Number: P2490

Import from BC: 1304.89 MW

Import from MATL: -280.00 MW

Import from SK: -149.72 MW

Bus - Voltage (kV/bv)	1.0000	1.0000	1.0000
Branch - Max % Ratio A	25.000	25.000	25.000
Equipment - MW/Mvar	240.000	240.000	240.000
100.0% Ratio A	138.000	138.000	138.000

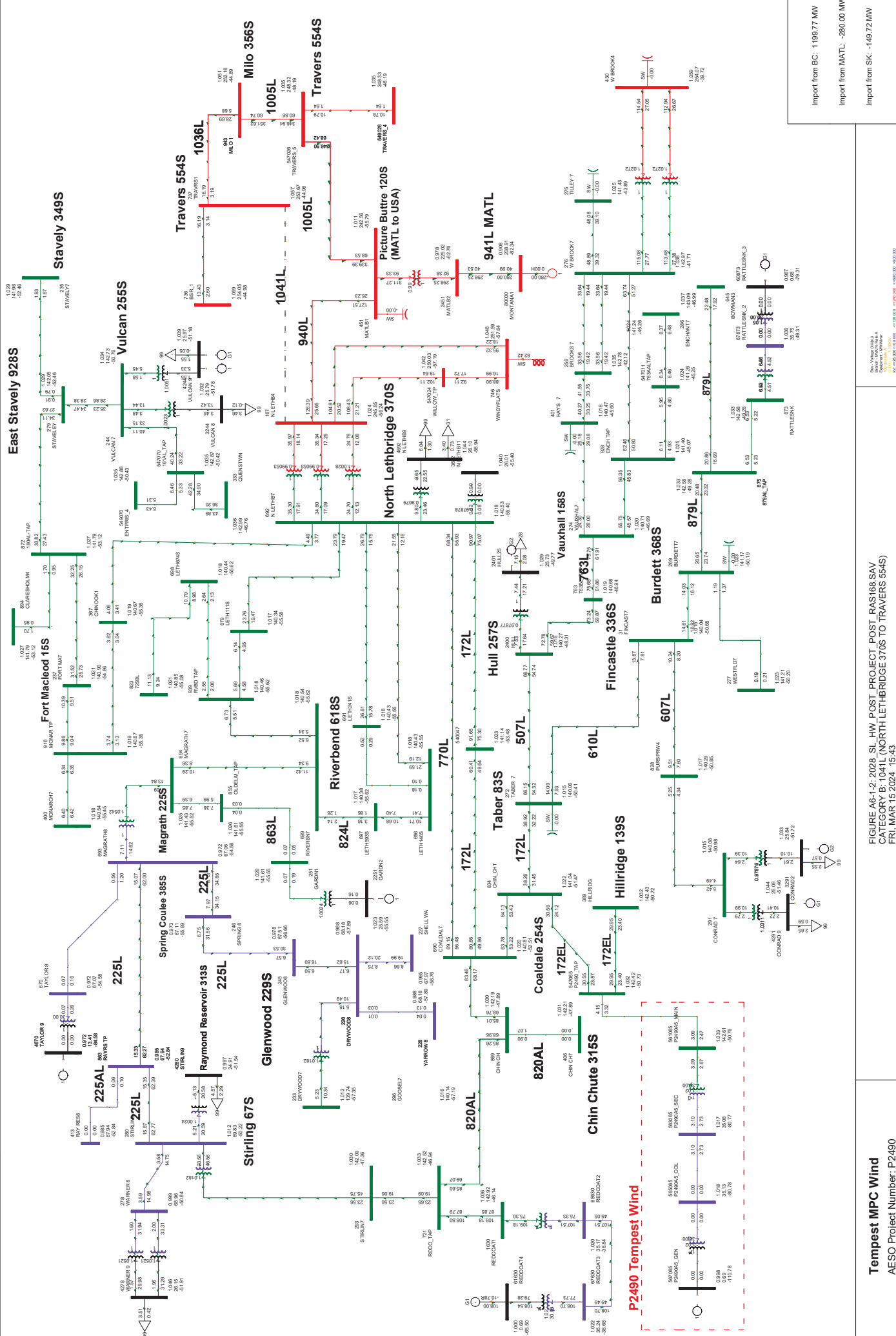


FIGURE A6-1-2: 2028 SL HW POST_PROJECT_POST_RAS168.SAV
CATEGORY B: 1041L (NORTH LETHBRIDGE 370S TO TRAVERS 554S)
FRI MAR 15 2024 15:43

Tempest MPC Wind
AESO Project Number: P2490

Import from BC: 1199.77 MW

Import from MATL: -280.00 MW

Import from SK: -149.72 MW

Buss - Voltage (KVbu)	
Synch - MWh% Rate A	
Equipment - MW/MWyr	
100.0% Rate A	
0.9990/V	1.1010V
KV = 25.000 0.000 0.000	
	-260.000
	+128.000
	+505.000
	+5.000

East Stavelly 928S

Stavelly 349S

Fort Macleod 15S

Magrath 225S

Spring Coulee 388S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

Riverbend 618S

North Lethbridge 370S

770L

172L

507L

610L

Fincastle 336S

Burdett 368S

879L

879L

879L

879L

879L

879L

879L

Travers 554S

1036L

1005L

1005L

1041L

940L

Picture Butte 120S

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

Travers 554S

1036L

1005L

1005L

1041L

940L

Picture Butte 120S

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

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941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

Travers 554S

1036L

1005L

1005L

1041L

940L

Picture Butte 120S

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

Travers 554S

1036L

1005L

1005L

1041L

940L

Picture Butte 120S

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

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941L MATL

941L MATL

941L MATL

941L MATL

941L MATL

Travers 554S

1036L

1005L

1005L

1041L

940L

Picture Butte 120S

941L MATL

941L MATL

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941L MATL

941L MATL

Travers 554S

1036L

1005L

1005L

1041L

940L

Picture Butte 120S

941L MATL

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941L MATL

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941L MATL

Travers 554S

1036L

1005L

1005L

1041L

940L

Picture Butte 120S

941L MATL

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Travers 554S

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1005L

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Picture Butte 120S

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Travers 554S

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Picture Butte 120S

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Travers 554S

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Picture Butte 120S

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Travers 554S

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Picture Butte 120S

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Picture Butte 120S

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Travers 554S

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Picture Butte 120S

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Travers 554S

1036L

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940L

Picture Butte 120S

East Stavelly 928S

Stavelly 349S

Fort Macleod 15S

Vulcan 255S

Travers 554S

Magrath 225S

Spring Coulee 38S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

Riverbend 618S

North Lethbridge 370S

770L

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941L MATL

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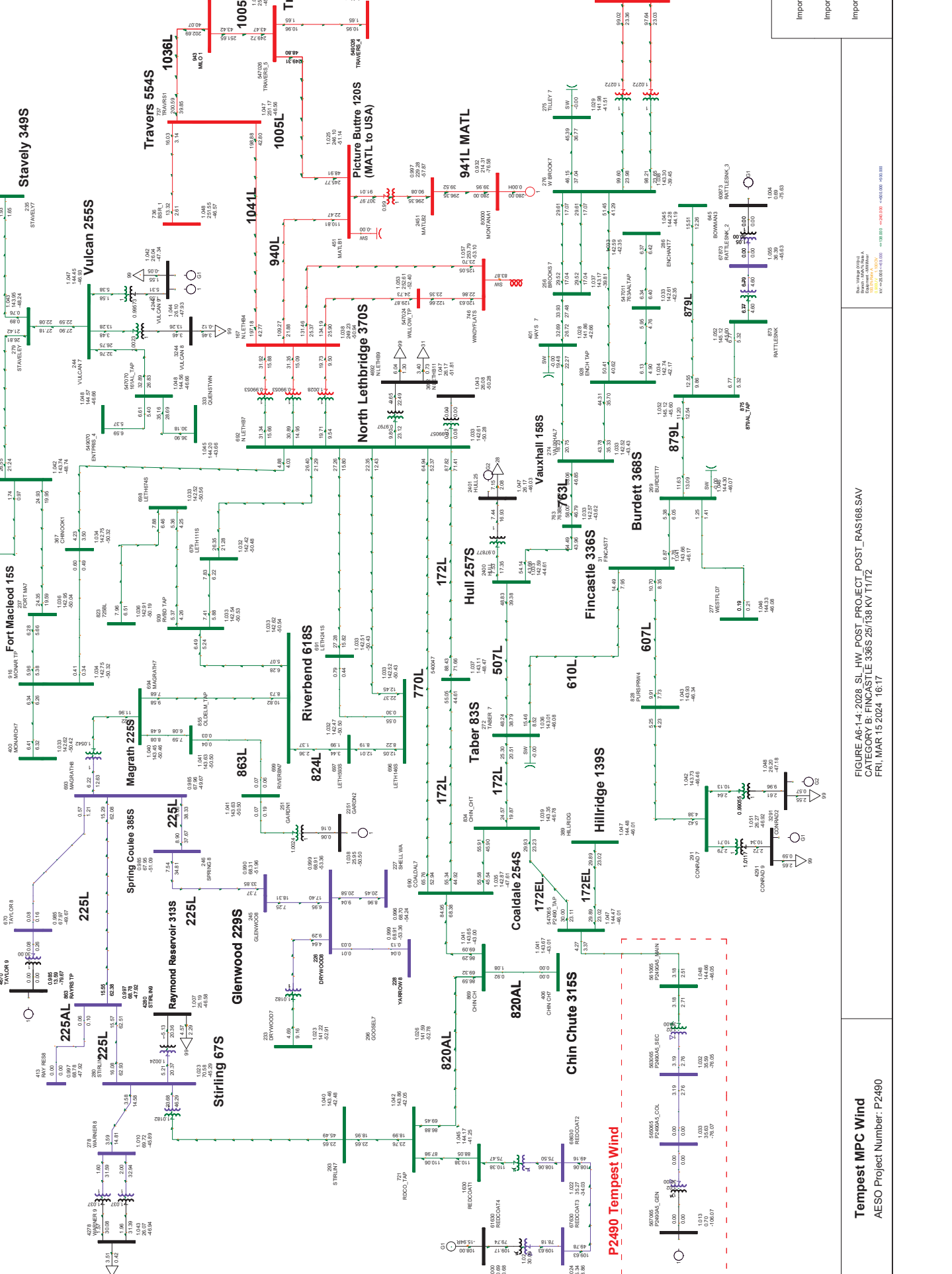
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Import from BC: -1155.42 MW

Import from MATL: -280.00 MW

Import from SK: -149.72 MW

FIGURE A6-1.4: 2028 SL HW POST PROJECT_POST_RAS168.SAV
CATEGORY B: FINCASTLE 336S 25/138 KV T1/T2
FRI, MAR 15 2024 16:17

East Stavely 928S

Stavely 349S

Fort Macleod 15S

Magrath 225S

Spring Coulee 385S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

Travers 554S

1036L

Vulcan 255S

863L

Riverbend 618S

824L

770L

172L

172L

507L

610L

Hillridge 139S

607L

172EL

172EL

172EL

172EL

172EL

172EL

172EL

1005L

1041L

940L

1005L

1005L

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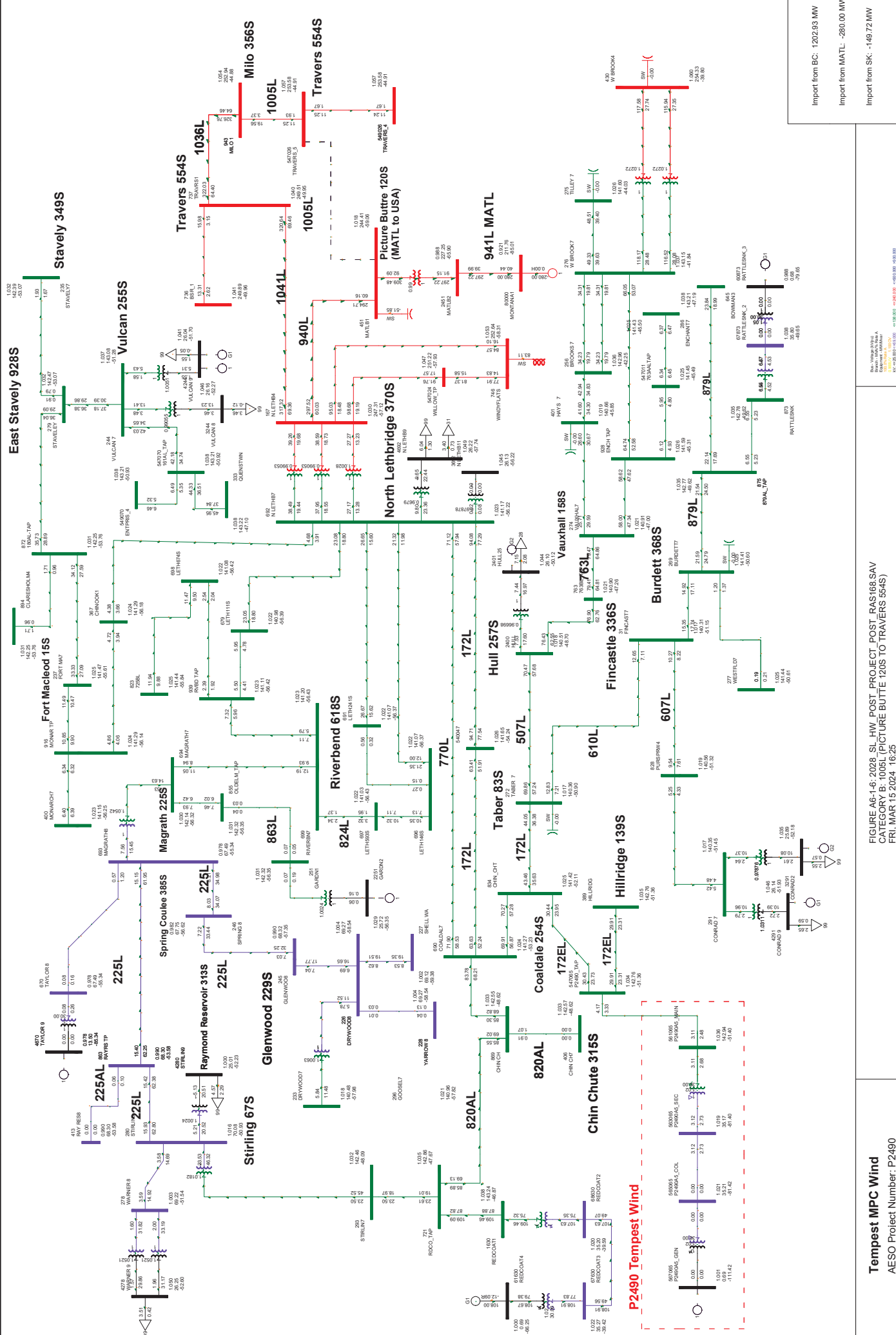


FIGURE A6-1-6: 2028_SL_HW_POST_PROJECT_POST_RAS168.SAV
CATEGORY B: 1005L (PICTURE BUTTE 120S TO TRAVERS 554S)

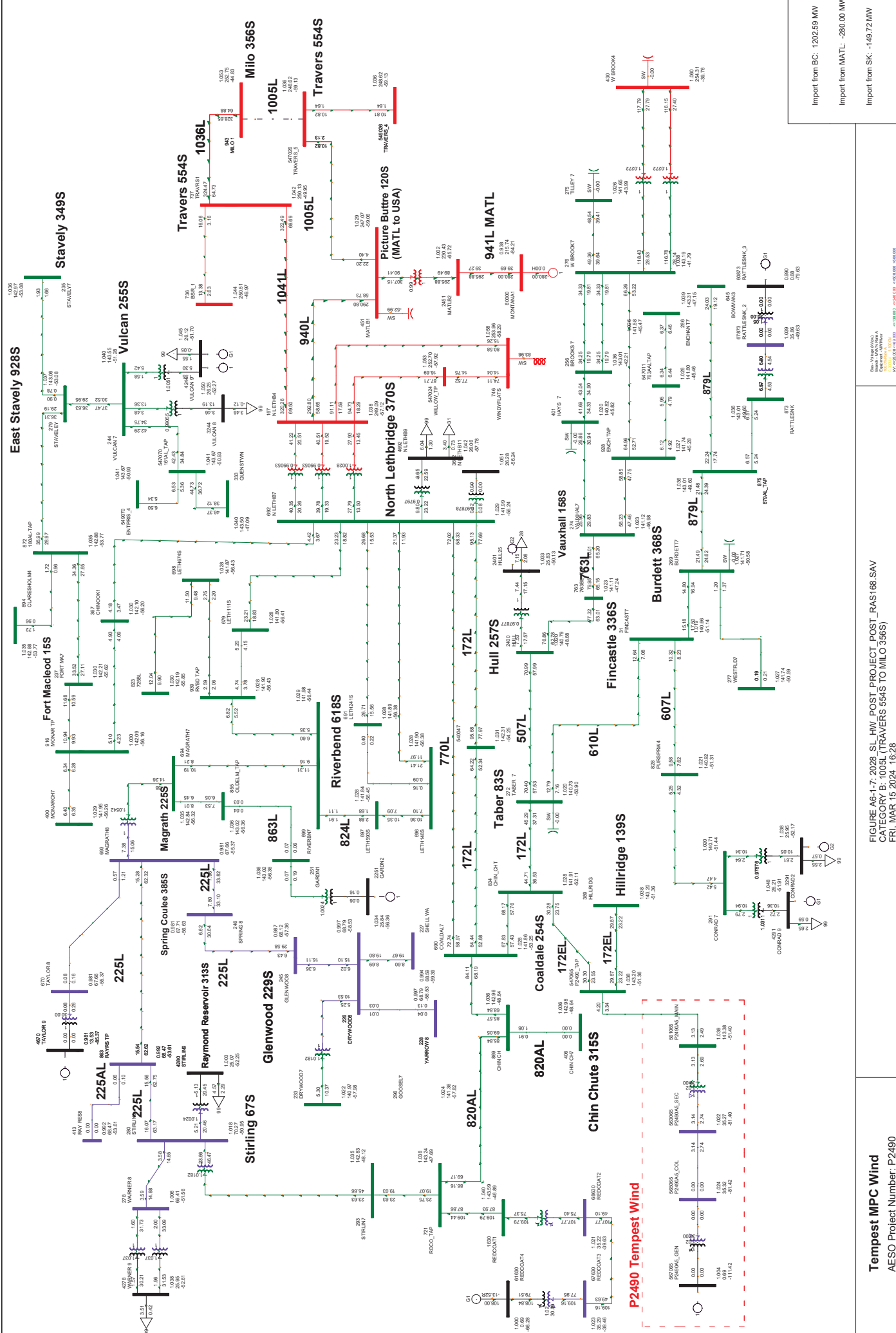


FIGURE A6-1-7: 2028_SL_HW_POST_PROJECT_POST_RAS168.SAV
CATEGORY B: 1005L (TRAVERS 554S TO MILO 356S)
FRI, MAR 15 2024 16:28

Import from BC: 1202.59 MW

Import from MATL: -280.00 MW

Import from SK: -149.72 MW

Bus - Voltage (kVpu)
Branch - MVA% Rate A
Equipment - MW/Mvar
100.0% Rate A
0.000 JV 1.000 CV
MVA - 25.000 - 16.0.000

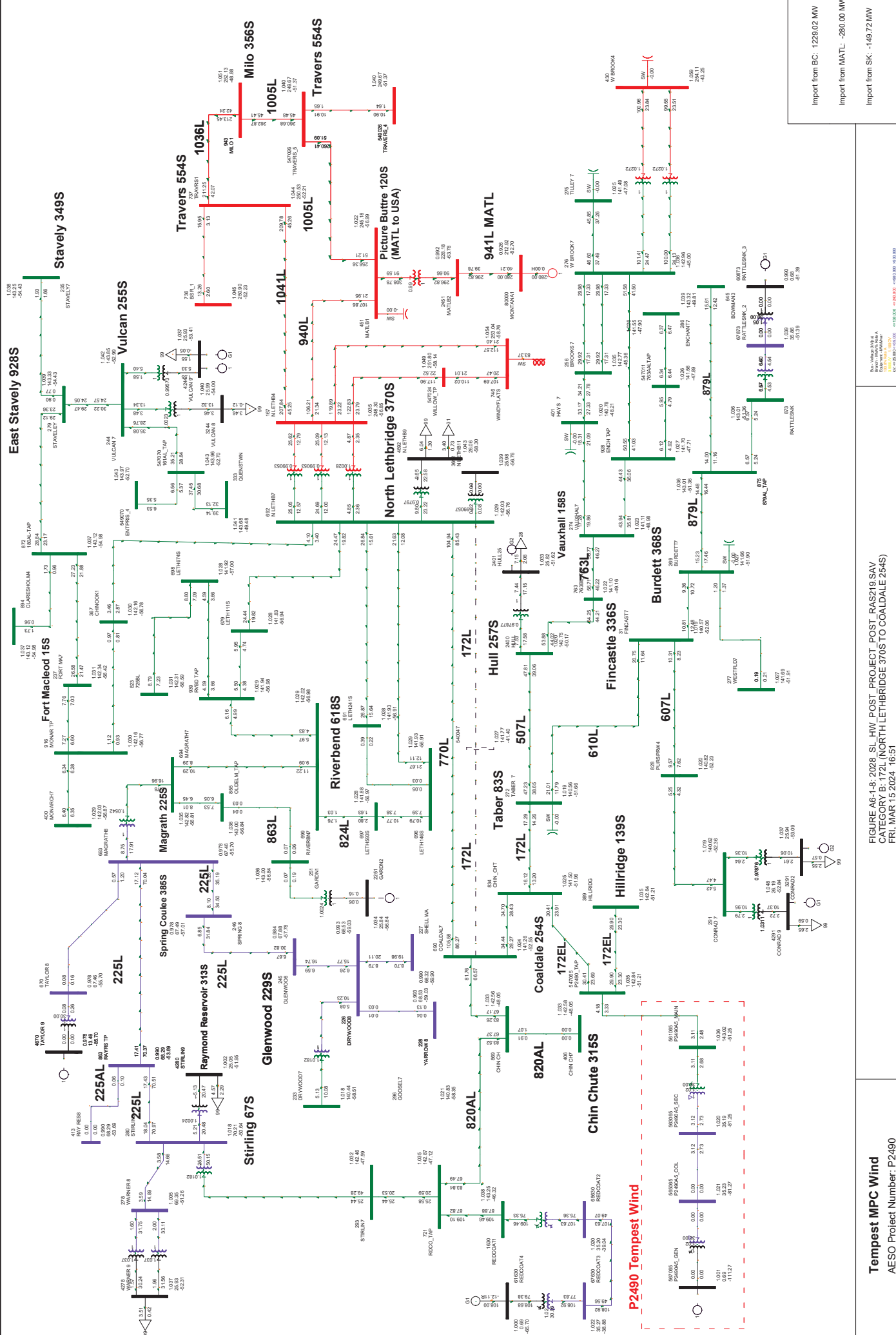


FIGURE A6-1-8: 2028 SL_HW_POST_PROJECT_POST_RAS219.SAV
CATEGORY B: 172L (NORTH LETHBRIDGE 370S TO COALDALE 254S)

Import from BC: 1229.02 MW

Import from MATL: -280.00 MW

Import from SK: -149.72 MW

Bus - Voltage (kV/bv)
Branch - Make % Rate A
Equipment - MW/Mvar
100 % Rate A
0.0001V 1.100 GV
MVA: 0.000 0.010 0.010 0.000

East Stavely 928S

Stavely 349S

Vulcan 255S

Travers 554S

1005L

Travers 554S

1005L

Picture Butte 120S

941L MATL

North Lethbridge 370S

Vauxhall 158S

Burdett 368S

879L

607L

172L

507L

Fort Macleod 15S

Magrath 225S

Spring Coulee 388S

Raymond Reservoir 313S

225L

225L

863L

824L

820AL

Chin Chute 315S

172EL

172EL

172EL

172EL

172EL

225AL

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FIGURE A6-1-9: 2028 SL HW POST PROJECT POST_RAS219 SAV
CATEGORY B: 770L (COALDALE 254S TO NORTH LETHBRIDGE 370S)

Tempest MPC Wind
AESO Project Number: P2490

Import from BC: -1304.68 MW

Import from MATL: -280.00 MW

Import from SK: -149.72 MW

See: Vauxhall 158S
See: Burdett 368S
See: 879L
See: 607L
See: 172L
See: 507L
See: 820AL
See: Chin Chute 315S
See: 172EL
See: 172EL
See: 172EL
See: 172EL
See: 172EL

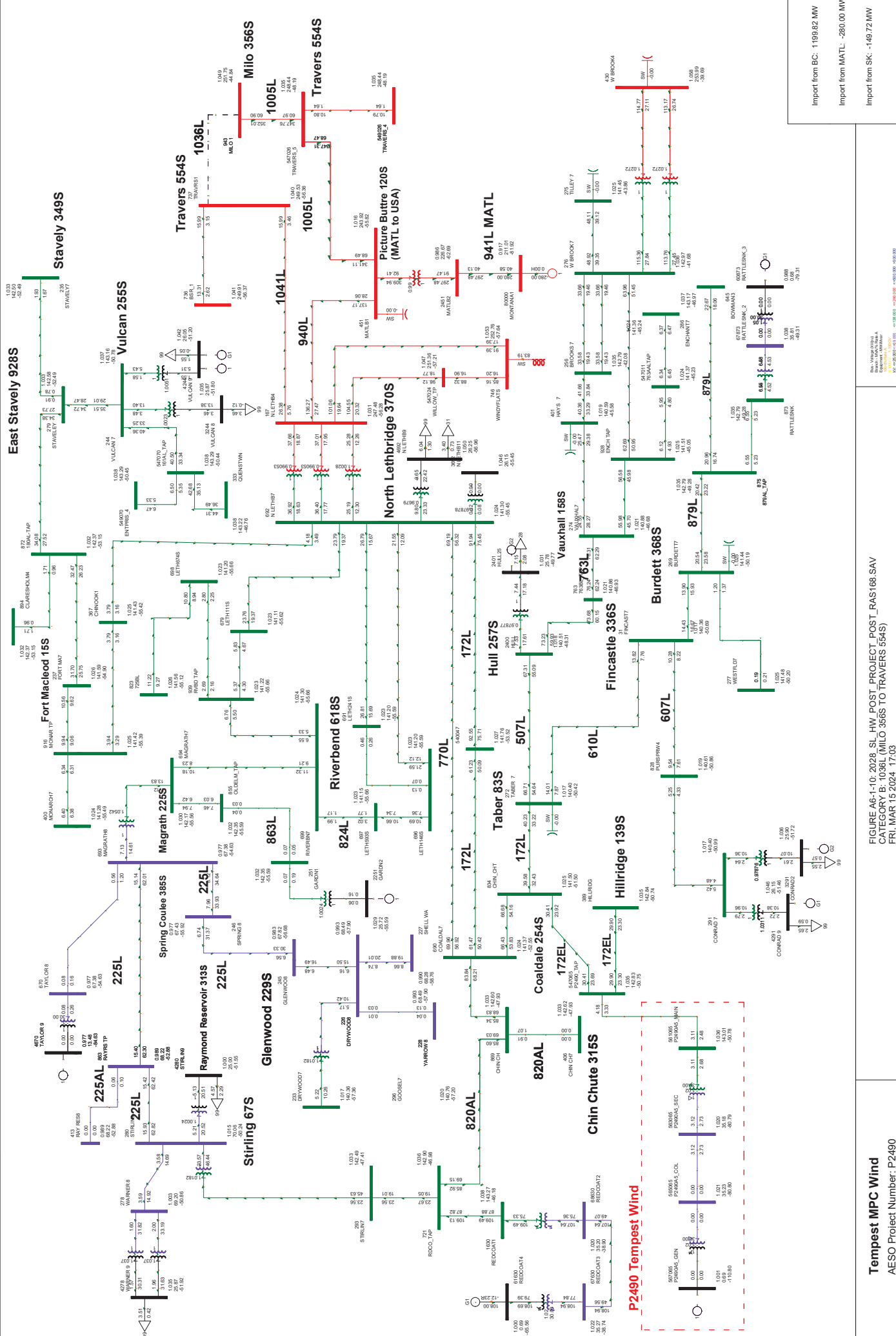


FIGURE A6-1-10: 2028_SL_HW_POST_PROJECT_POST_RAS168.SAV
CATEGORY B: 1036L (MILO 356S TO TRAVERS 554S)
FRI, MAR 15 2024 17:03

Tempest MPC Wind
AESO Project Number: P2490

Import from BC: 1199.82 MW

Import from MATL: -280.00 MW

Import from SK: -149.72 MW

[illegible]

East Stavelly 928S

Stavelly 349S

Fort Macleod 15S

Vulcan 255S

Magrath 225S

Spring Coulee 388S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

Riverbend 618S

863L

824L

820AL

Chin Chute 315S

Picture Butte 120S (MATL to USA)

North Lethbridge 370S

770L

172L

172L

172L

172EL

172EL

820AL

941L MATL

Winnipeg 7

Vauxhall 158S

763L

610L

Hillridge 139S

607L

Burdett 368S

879L

1005L

1005L

1041L

940L

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FIGURE A6-2-1: 2028 SP-HW POST PROJECT POST-RAS168 SAV
CATEGORY B: 940L (NORTH LETHBRIDGE 370S TO PICTURE BUTTE 120
MON, MAR 18 2024 10:06

Tempest MPC Wind
AESO Project Number: P2490

Import from BC: -884.48 MW
Import from MATL: -183.44 MW
Import from SK: -149.72 MW

Run: Vauxhall Wind
Export: P2490
Import: P2490
Net: -183.44 MW

P2490 Tempest Wind

East Stavely 928S

Stavely 349S

Stavely 349S

Fort Macleod 16S

Magrath 225S

Spring Coulee 38S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

North Lethbridge 370S

Picture Butte 120S

941L MATL

Vauxhall 158S

Burdett 368S

Fincastle 336S

Hillridge 139S

Coaldale 254S

Chin Chute 315S

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Vulcan 255S

Fort Macleod 16S

Magrath 225S

Spring Coulee 38S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

North Lethbridge 370S

Picture Butte 120S

941L MATL

Vauxhall 158S

Burdett 368S

Fincastle 336S

Hillridge 139S

Coaldale 254S

Chin Chute 315S

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Vulcan 255S

Fort Macleod 16S

Magrath 225S

Spring Coulee 38S

Raymond Reservoir 313S

Glenwood 229S

Stirling 67S

North Lethbridge 370S

Picture Butte 120S

941L MATL

Vauxhall 158S

Burdett 368S

Fincastle 336S

Hillridge 139S

Coaldale 254S

Chin Chute 315S

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East Stavely 928S

Stavely 349S

Fort Macleod 15S

Vulcan 255S

Travers 554S

1036L

Glenwood 229S

Stirling 67S

Spring Coulee 38S

Raymond Reservoir 313S

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Fort Macleod 15S

Vulcan 255S

Travers 554S

1036L

Glenwood 229S

Stirling 67S

Spring Coulee 38S

Raymond Reservoir 313S

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Fort Macleod 15S

Vulcan 255S

Travers 554S

1036L

Glenwood 229S

Stirling 67S

Spring Coulee 38S

Raymond Reservoir 313S

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Fort Macleod 15S

Vulcan 255S

Travers 554S

1036L

Glenwood 229S

Stirling 67S

Spring Coulee 38S

Raymond Reservoir 313S

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Fort Macleod 15S

Vulcan 255S

Travers 554S

1036L

Glenwood 229S

Stirling 67S

Spring Coulee 38S

Raymond Reservoir 313S

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Fort Macleod 15S

Vulcan 255S

Travers 554S

1036L

Glenwood 229S

Stirling 67S

Spring Coulee 38S

Raymond Reservoir 313S

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Fort Macleod 15S

Vulcan 255S

Travers 554S

1036L

Glenwood 229S

Stirling 67S

Spring Coulee 38S

Raymond Reservoir 313S

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Fort Macleod 15S

Vulcan 255S

Travers 554S

1036L

Glenwood 229S

Stirling 67S

Spring Coulee 38S

Raymond Reservoir 313S

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East Stavely 928S

Stavely 349S

Fort Macleod 15S

Vulcan 255S

Travers 554S

1036L

Milo 356S

1005L

Travers 554S

Picture Butte 120S (MATL to USA)

941L MATL

North Lethbridge 370S

940L

1041L

1005L

940L

941L MATL

Magrath 225S

Spring Coulee 38S

Raymond Reservoir 313S

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FIGURE A6-2-6: 2028 SP HW POST PROJECT POST_RAS168 SAV
CATEGORY B: 610L (TABER 83S TO FINCASTLE 336S)
MON, MAR 18 2024 10:09

Tempest MPC Wind
AESO Project Number: P2490

Import from BC: -887.27 MW

Import from MATL: -183.44 MW

Import from SK: -149.72 MW

East Stavelly 928S

Stavelly 349S

Fort Macleod 15S

Vulcan 255S

Travers 554S

1036L

Milo 356S

1005L

Travers 554S

1005L

Picture Butte 120S

(MATL to USA)

941L MATL

Vauxhall 158S

Fincastle 336S

Burdett 368S

879L

879L

879L

879L

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879L

Import from BC: -832.47 MW

Import from MATL: -183.44 MW

Import from SK: -149.72 MW

FIGURE A6-2-11: 2028 SP HW POST PROJECT_POST_RAS168.SAV
CATEGORY B: CLARESHOLM 34.5/138 KV T2
MON, MAR 18 2024 10:34

Tempest MPC Wind
AESO Project Number: P2490

P2490 Tempest Wind

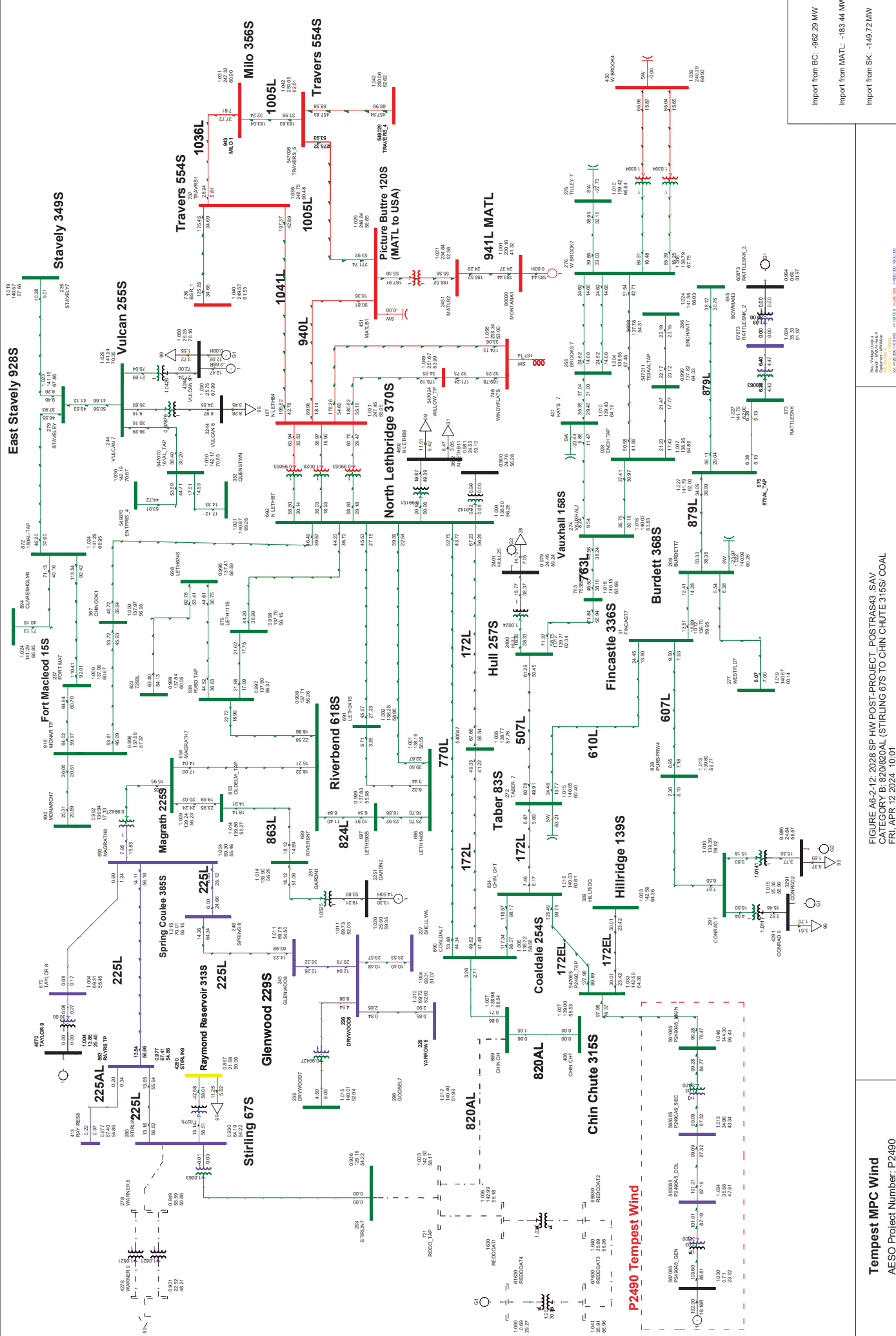


FIGURE A6-2-12: 2028 SP HW POST-PROJECT_POSTRAS43 .SAV
CATEGORY B: 820/820AL (STIRLING 67S TO CHIN CHUTE 315S/ COAL
FRI, APR 12 2024 10:01

Tempest MPC Wind
AESO Project Number: P2490

Import from BC: -962.29 MW
Import from MATL: -183.44 MW
Import from SK: -149.72 MW

Import from SK: -149.72 MW

Import from SK: -149.72 MW

Bus - Voltage (KVbu)	
Branch - MVA Rate A	
Equipment - MW/Mvar	
100.0% Rate A	
0.930 JV 1.00 OV	
MV -> 20.000 <-+0.000	
KV -> 130.000 <-+0.000	
MW -> 240.000 <-+0.000	
MVar -> 60.000 <-+0.000	

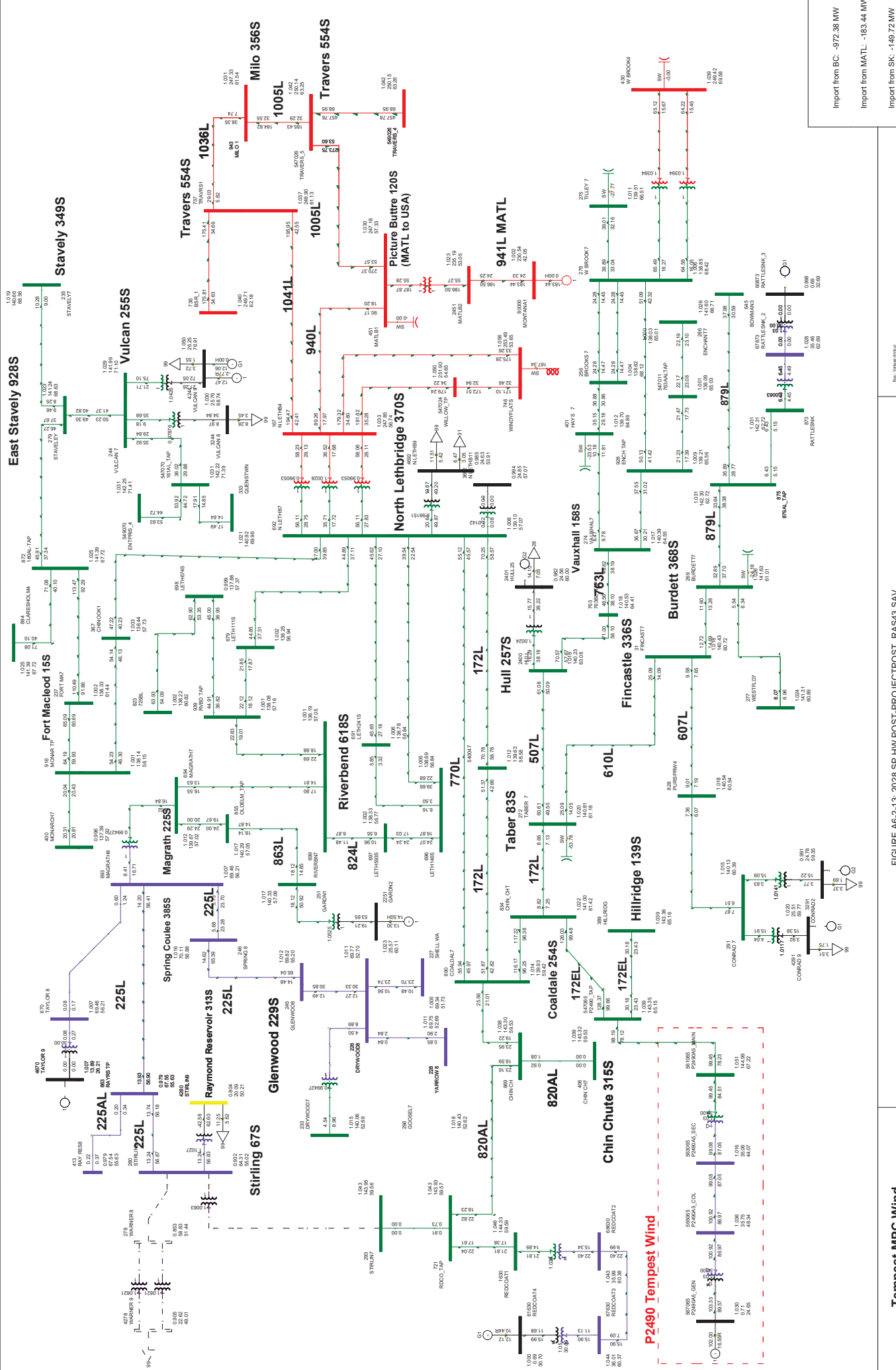


FIGURE A6-2-13: 2028 SP HW POST-PROJECTPOST_RAS43.SAV
CATEGORY B: 820/820AL (STIRLING 67S TO CHIN CHUTE 315S/ COAL
FRI, APR 12 2024 10:05

Tempest MPC Wind
AESO Project Number: P2490

Import from BC: -972.38 MW
Import from MATL: -183.44 MW
Import from SK: -149.72 MW

Bus - Voltage (V/Vu)			
Search - Min/Max Rate A			
Equipment - MMWear			
100.0% Rate A			
0.000 JV	1.100 JV		
M2 -	25.000	49.000	
	130.000	240.000	450.000

Attachment A7

Constraint Effective Factors Table

