APPENDIX A CONNECTION ASSESSMENT

Connection Engineering Study Report for AUC Application

ATCO Heartland Generating Station

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Executive Summary

Project Overview

ATCO Power Canada Ltd. (the market participant) has submitted a system access service request to the Alberta Electric System Operator (AESO) to connect its approved ATCO Heartland Generating Station[1] (the Facility) to the AIES. The Facility consists of a 510 MW gas-fired, combined-cycle, generating facility and includes the market participant's Lamont 400S substation. The Facility will be located in Strathcona County, near the City of Fort Saskatchewan.

The request for system access service includes a request for a Rate STS, *Supply Transmission Service,* contract capacity of 510 MW and a Rate DTS, *Demand Transmission Service,* contract capacity of 15 MW for new system access service in the area, and a request for transmission development (collectively, the Project).

The scheduled in-service date (ISD) for this Project is November 1, 2019.

This report presents the results of the engineering studies conducted to assess the impact of the Project on the performance of the AIES.

Existing System

Geographically, the Project is located in the AESO planning area of Fort Saskatchewan (Area 33), which is part of the AESO Northeast Planning Region. Fort Saskatchewan (Area 33) is adjacent to AESO planning areas Edmonton (Area 60), Athabasca (Area 27), Fort Saskatchewan (Area 33) and Wabamun (Area 40).

From a transmission system perspective, Fort Saskatchewan (Area 33) consists of 500 kV, 240 kV and 138 kV transmission systems. Fort Saskatchewan (Area 33) is connected to adjacent planning areas by the double-circuit, 240 kV transmission lines 920L/921L and 9L960/9L961. In addition, Fort Saskatchewan (Area 33) is connected to Edmonton (Area 60) via the double-circuit 500 kV transmission lines 1206L/1212L. Moreover, the 500 kV HVDC Eastern Alberta Transmission Line (EATL, 13L50) connects Fort Saskatchewan (Area 33) to the AESO South planning region. Fort Saskatchewan (Area 33) also has 138 kV transmission lines that connect generation and load facilities throughout the Fort Saskatchewan area.

Existing constraints in Fort Saskatchewan (Area 33) are managed in accordance with the procedures set out in Section 302.1 of the ISO rules, *Real Time Constraint Management* (TCM Rule).

Study Summary

Study Area for the Project

The Study Area for this project is defined as the AESO planning areas of Fort Saskatchewan (Area 33), Edmonton (Area 60) and Wabamun (Area 40), including the tie lines connecting

[1] The Facility was originally approved by the Alberta Utilities Commission on September 3, 2014 in Decision 2014-253 and issued Power Plant Approval No. U2014-380.

these planning areas to the rest of the AIES. All transmission facilities rated at 138kV and above within the Study Area were studied and monitored to assess the impact of the Project on the performance of the AIES, including for any violations of the Reliability Criteria (as defined in Section 2.1.1).

Studies Performed for the Project

Technical studies were performed for 2020 winter peak (WP), 2020 summer peak (SP) and 2020 summer light (SL) scenarios. The AESO also studied multiple scenarios focusing on two primary cut-planes: Northwest Region and, South of Keephills-Ellerslie-Genesee (SOK) cut-plane[2]. In addition, the studies considered the Fort McMurray area exchange as one of the assumptions[3]. The different scenarios used in this report are listed below.

Table E-1: Study scenario definitions

Scenario Name (Year/ Season Load)	Area Exchange Assumptions		
	SOK (N→S)	NW Region	FMM Area
2020 SL High SOK	High Flow	High Import	High Import
2020 WP High SOK	High Flow	High Import	Low Import
2020 SP High SOK	High Flow	High Import	Low Import
2020 WP Low SOK	Low Flow	High Import	Low Import
2020 SP Low SOK	Low Flow	High Import	Low Import

Each scenario was studied prior to the connection of the Project (pre-Project), after connection of the Project (post-Project baseline), and after connection of the Project and completion of the 2015 AESO LTP components required to mitigate Reliability Criteria violations observed in the post-Project baseline scenarios (post-Project with LTP).

Power flow studies were performed for all pre-Project, post-Project baseline, and post-Project with LTP scenarios. Transient stability studies were performed for all post-Project baseline scenarios. Short-circuit studies were performed for the 2020 WP High SOK pre-Project and post-Project baseline scenarios and for a 2026 WP post-Project scenario.

Results of the Pre-Project Studies

Under the Category A condition, no Reliability Criteria violations were observed for any of the pre-Project scenarios.

[2] The South of Keephills-Ellerslie-Genesee (SOK) cut-plane is defined in AESO ID#2013-004R Keephills Ellerslie-Genesee Area Transmission Constraint Management

[3] The Fort McMurray (FMM) area exchange is the net of load and generation in the Fort McMurray Planning Area (Area 25). The AESO's current FMM cut-plane definition does not include the 500 kV Fort McMurray West line.

Thermal criteria violations were observed for all pre-Project scenarios under certain Category B conditions, as shown in Table E-2. No voltage criteria violations were observed under Category B conditions.

Connection Alternatives Examined for the Project

The AESO, in consultation with the TFO and the market participant, examined three transmission alternatives to meet the market participant's request for system access service.

Alternative 1: In-and-out connection to the 240 kV transmission line 1120L near Amelia 108S

Alternative 1 includes connecting the approved Lamont 400S substation to the 240 kV transmission line 1120L (between the Amelia 108S substation and the Josephburg 410S substation) using an in-and-out configuration. Compared to the approved Lamont 400S configuration, this would require the addition of two 240 kV breakers and associated equipment at the Lamont 400S substation to form a ring bus. Alternative 1 would also require two new 240 kV circuits, each approximately 4 km in length.

Alternative 2: In-and-out connection to the 240 kV transmission line 1120L near Josephburg 410S

Alternative 2 includes connecting the approved Lamont 400S substation to the 240 KV transmission line 1120L (between the Amelia 108S substation and the Josephburg 410S substation) using an in-and-out configuration. Compared to the approved Lamont 400S configuration, this would require the addition of two 240 kV breakers and associated equipment at the Lamont 400S substation to form a ring bus. Alternative 2 would also require two new 240 kV circuits, each approximately 4 km in length.

Alternative 3: Radial connection to the Josephburg 410S substation

Alternative 3 involves connecting the approved Lamont 400S substation to the existing Josephburg 410S substation in a radial configuration. This would require modifying the Josephburg 410S substation by adding one 240 kV circuit breaker and associated equipment, and , adding one new 240 kV circuit approximately 5.5 km in length.

Alternatives Selected for Further Examination

Alternative 3 is considered technically feasible and was selected for further study. Alternative 1 and Alternative 2 would involve increased transmission development and hence, increased cost, compared to Alternative 3. Therefore, Alternative 1 and Alternative 2 were not selected for further study.

Results of the Post-Project Studies

Post-Project Baseline Scenarios

Under the Category A condition, no Reliability Criteria violations were observed for any of the post-Project baseline scenarios.

Table E-2 summarizes thermal criteria violations observed under certain Category B conditions along with the proposed mitigation measures to address these thermal criteria violations. No voltage criteria violations were observed under Category B conditions.

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

The 2020 WP High SOK post-Project baseline scenario short-circuit fault levels are not significantly higher than pre-Project levels. The long term (2026 WP Post-Project scenario) short circuit levels were found to be within the designed capabilities of the nearby facilities.

Post-Project with LTP Scenarios

Under the Category A condition, no Reliability Criteria violations were observed for any of the post-Project with LTP scenarios.

Under Category B conditions, all of the thermal criteria violations that were observed in the pre-Project scenarios were resolved in the post-Project with LTP scenarios. Table E-2 summarizes thermal criteria violations observed under certain Category B conditions along with the proposed mitigation measures to address these thermal criteria violations. No voltage criteria violations were observed under Category B conditions.

Mitigation Measures

Thermal loading above the short-term emergency rating of the 138 kV transmission lines 898L and 792L can be mitigated by reconfiguring the 138 kV system to open the path between the North Calder 37S and Clyde 150S substations until the capacity of 898L and 792L is increased as part of the 2015 LTP. Prior to the planned system reinforcements, temporary mitigation measures, operating procedures and/or Remedial Action Schemes (RAS) may be required. The AESO will continue to monitor the flows in the region and, if necessary, modify these mitigation measures as system and customer connection projects proceed through the AESO connection process.

All other observed thermal loadings that exceed the seasonal continuous transmission line rating, but that are less than the short-term emergency rating of the transmission line, can be managed by real-time operational practices.

Project Dependencies

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

Conclusions and Recommendations

The connection assessment identified a number of pre-Project and post-Project system performance issues under certain Category B conditions. These are summarized in Table E-1 along with the associated mitigation measures. The identified thermal criteria violations will be resolved by planned system reinforcements identified in 2015 LTP. Until such time as those reinforcements are in place, the AESO will establish the mitigation measures identified in Table E-2, as required.

Based on the study results, Alternative 3 is technically acceptable. The new 1181L 240 kV transmission line which connects Lamont 400S to Josephburg 410S should be capable of accommodating the generation of 600 MVA (365 MVA Gas Unit and 235 MVA Steam Unit).

It is recommended to proceed with the Project using Alternative 3 as the preferred option to respond to the market participant's request for system access service.

Table E-2: Thermal Criteria Violations and Mitigation Measures for Pre-Project, Post-Project Baseline and Post-Project with LTP Scenarios under Certain Category B Conditions

Reliability Criteria Violations		Scenario	Pre-Project		Post-Project Baseline		Post-Project with LTP	
Violation	Contingency		Thermal Violation Type	Mitigation Measures	Violation Type	Mitigation Measures	Violation Type	Mitigation Measures
898L (North Calder 37S - Viscount 92S)	1046L (Sundance Plant 310P - Cherhill 338S)	2020 SL High SOK 2020 WP High SOK	Above emergency	Reconfigure 138kV system to open the path between North Calder 37S and Clyde 150S until 898L and 792L capacity is increased as part of the near-term LTP.	Above emergency	Reconfigure 138kV system to open the path between North Calder 37S and Clyde 150S until 898L and 792L capacity is increased as part of the near-term LTP.	Not applicable	None required
		2020 WP Low SOK	Above seasonal continuous	Real-time operational practices	Above emergency			
		2020 SP High SOK 2020 SP Low SOK	Above seasonal continuous		Above seasonal continuous	Real-time operational practices		
	913L (North Barrhead 69S - Cherhill 338S)	2020 SL High SOK 2020 WP High SOK	Above seasonal continuous		Above emergency	Reconfigure 138kV system to open the path between North Calder 37S and Clyde 150S until 898L and 792L capacity is increased as part of the near-term LTP.		
		2020 WP Low SOK 2020 SP Low SOK			Above seasonal continuous	Real-time operational practices		
		2020 SP High SOK	Not applicable	None required	Above seasonal continuous			
	69ST4 (North Barrhead 69S Transformer)	2020 WP High SOK	Above seasonal continuous	Real-time operational practices	Above seasonal continuous			
792L (N.W. Cardiff191S - Viscount 92S)	1046L (Sundance Plant 310P - Cherhill 338S)	2020 SL High SOK	Above seasonal continuous		Above seasonal continuous			
	913L (North Barrhead 69S - Cherhill 338S)		Not applicable	None required	Above seasonal continuous			
677L (Acheson 305S - Spruce Grove 595S)	37ST6 (North Calder 37S Transformer)	2020 SP Low SOK	Above seasonal continuous	Real-time operational practices	Above seasonal continuous			
		2020 WP Low SOK			Not applicable	None required		
		2020 SP High SOK						
	1139L (Harry Smith 367S - Petrolia)	2020 SP Low SOK						
706L (Josephburg 410S - 706AL Tap)	997L (Lamoureux 71S - Josephburg 410S)	2020 WP Low SOK	Not applicable	None required	Above seasonal continuous	Real-time operational practices		
		2020 SP Low SOK					Above seasonal continuous	Real-time operational practices
706L (Fort Saskatchewan 54S - 706AL Tap)		2020 SP Low SOK						

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1. Introduction

This report presents the results of the engineering studies conducted to assess the impact of the Project (as defined below) on the performance of the Alberta Interconnected Electrical System (AIES).

1.1. Project

1.1.1. Project Overview

ATCO Power Canada Ltd. (the market participant) has submitted a system access service request to the Alberta Electric System Operator (AESO) to connect its approved ATCO Heartland Generating Station[4] (the Facility) to the AIES. The Facility consists of a 510 MW gas-fired, combined-cycle, generating facility and includes the market participant's Lamont 400S substation. The Facility will be located in Strathcona County, near the City of Fort Saskatchewan.

The request for system access service includes a request for a Rate STS, *Supply Transmission Service,* contract capacity of 510 MW and a Rate DTS, *Demand Transmission Service,* contract capacity of 15 MW for new system access service in the area, and a request for transmission development (collectively, the Project).

The scheduled in-service date (ISD) for the Project is November 1, 2019.

1.1.2. Load Component

- Requested Rate DTS, *Demand Transmission Service*, contract capacity: 15 MW
- Load Type: Station service.

1.1.3. Generation Component

- One natural gas turbine and one steam turbine will be installed at the Facility.
- Requested Rate STS, *Supply Transmission Service*, contract capacity: 510 MW
- Maximum Authorized Real Power (MARP): 510 MW.
- Total Reactive Power Capability: +249/-175 MVAR at MARP.
- The market participant advised that there is no future expansion planned.

Table 1.1-1 provides a summary of generating unit capability.

[4] The Facility was originally approved by the Alberta Utilities Commission on September 3, 2014 in Decision 2014-253 and issued Power Plant Approval No. U2014-380.

Table 1.1-1: Summary of Generating Unit Capability

Designation	Type	MVAbase	Pmax (MW)	Qmax (MVAr)	Qmin (MVAr)
G1	Gas Turbine	365	310	160	-110
G2	Steam Turbine	235	200	89	-65

1.2. Study Scope

1.2.1. Study Objectives

The objectives of the study are as follows:

- Assess the impact of the Project on the performance of the AIES.
- Identify any violations of the relevant criteria, standards, or requirements of the AESO, both pre-Project and post-Project.
- Recommend mitigation measures, if required, to enable the reliable connection of the Project to the AIES.

1.1.1. Study Area

1.1.1.1. Study Area Description

Geographically, the Project is located in the AESO planning area of Fort Saskatchewan (Area 33), which is part of the AESO Northeast Planning Region. Fort Saskatchewan (Area 33) is adjacent to the AESO planning areas of Edmonton (Area 60), Athabasca (Area 27), Fort Saskatchewan (Area 33) and Wabamun (Area 40).

From a transmission system perspective, Fort Saskatchewan (Area 33) consists of 500 kV, 240 kV and 138 kV transmission systems, as shown in Figure 1.2-1. Fort Saskatchewan (Area 33) is connected to adjacent planning areas by the double-circuit 240 kV transmission lines 920L/921L and 9L960/9L961. In addition, Fort Saskatchewan (Area 33) is connected to Edmonton (Area 60) by the double-circuit 500 kV transmission line 1206L/1212L. Moreover, the 500 kV DC Eastern Alberta Transmission Line (EATL, 13L50) connects Fort Saskatchewan (Area 33) to the AESO South planning region. Fort Saskatchewan (Area 33) also has 138 kV transmission lines that connect generation and load facilities throughout the Fort Saskatchewan area.

The Study Area for this project is defined as the AESO planning areas of Fort Saskatchewan (Area 33), Edmonton (Area 60), and Wabamun (Area 40), including the tie lines connecting these planning areas to the rest of the AIES. All transmission facilities rated at 138kV and above within the Study Area were studied and monitored to assess the impact of the Project on the performance of the AIES, including for any violations of the Reliability Criteria (as defined in Section 2.1.1). Figure **1.2-2** shows the existing transmission system in the Study Area.

Figure 1.2-1: Existing Transmission System in Fort Saskatchewan (Area 33)

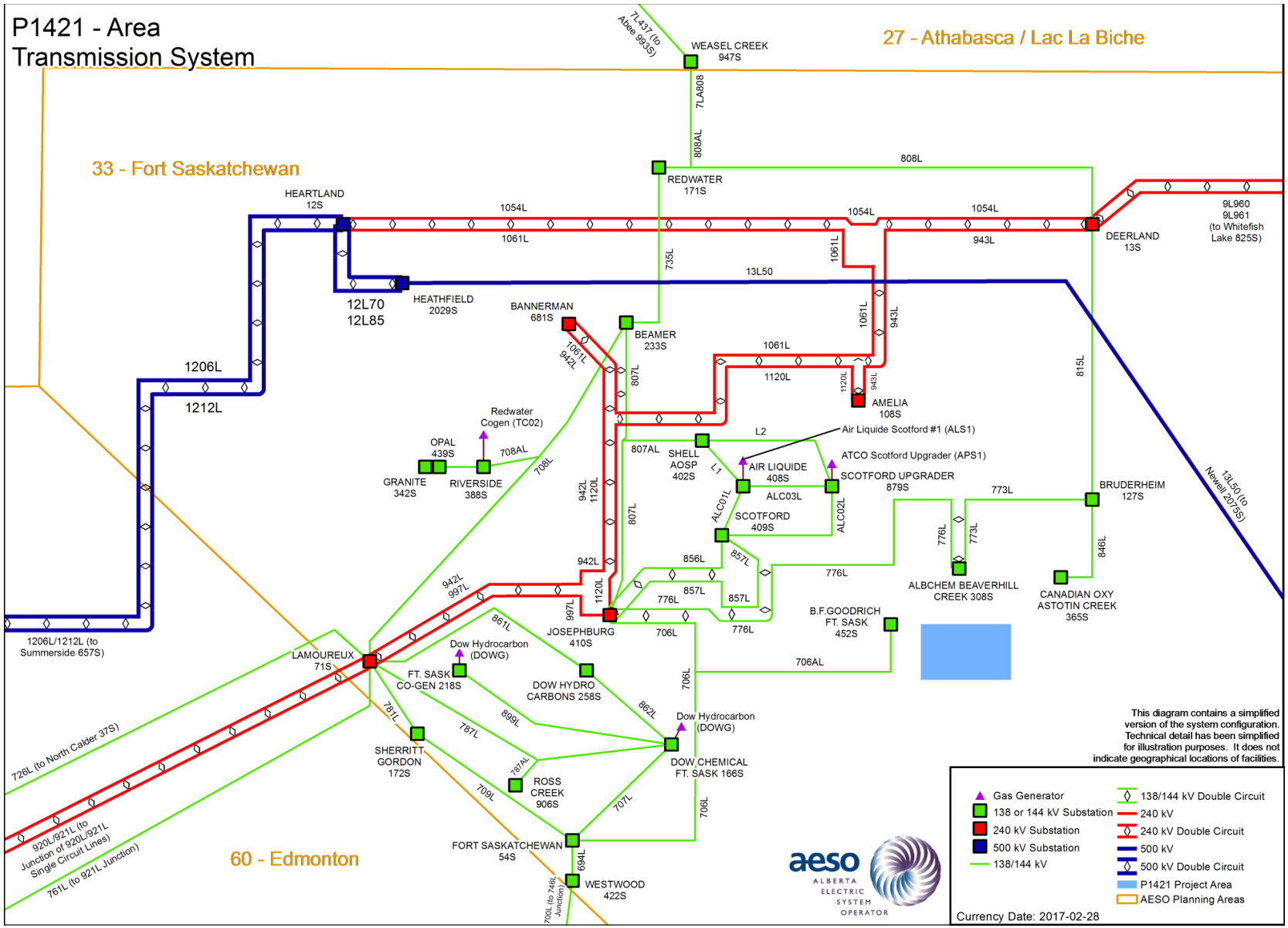
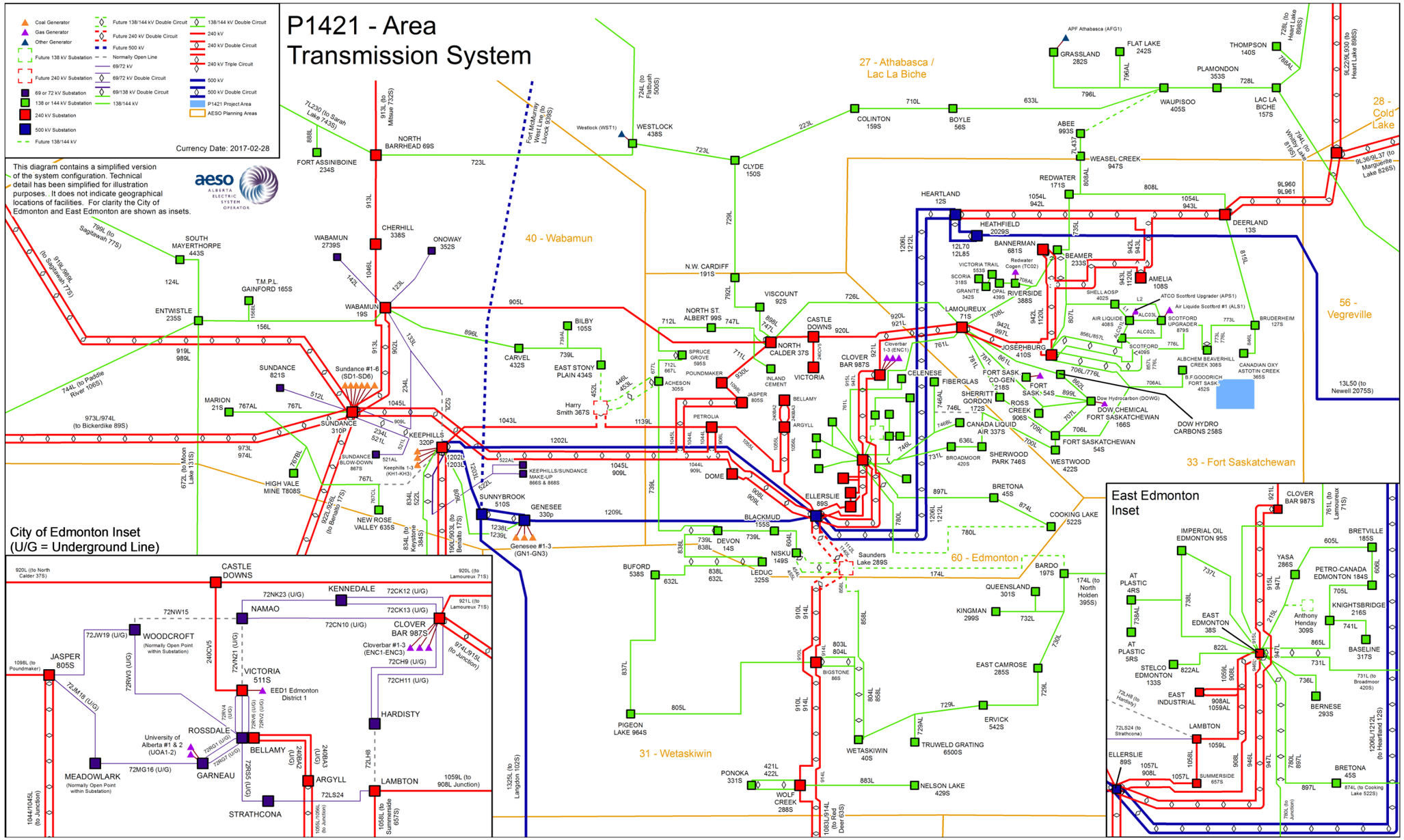


Figure 1.2-2**: Transmission System in the Study Area**



1.1.1.2. Existing Constraints

Existing constraints in Fort Saskatchewan (Area 33) are managed in accordance with the procedures set out in Section 302.1 of the ISO rules, *Real Time Constraint Management* (TCM Rule).

1.1.1.3. AESO Long-Term Transmission Plans (LTP)

The *AESO 2015 Long-term Transmission Plan* (2015 LTP)[5] includes the following system transmission developments in the Study Area in the near term (to 2020):[6]

Athabasca-Lac La Biche Subregion

- Add new 138 kV line between Abee and Waupisoo substations
- Rebuild 138 kV line between North Calder and Viscount substations in north Edmonton and onto Cardiff substation near Morinville to higher capacity

Fort Saskatchewan Subregion

- Connect second circuit of 240 kV double-circuit line from Lamoureux to Deerland using an in/out at Josephburg substation
- Open 138 kV paths parallel to 240 kV path connecting to east of Edmonton
- Rebuild 138 kV line between Beamer and Shell substations

Fox Creek-Valleyview Subregion

- Increase 240/144 kV transformer capacity at Little Smoky substation
- Add new 240 kV lines from Little Smoky substation to Fox Creek substation (ATCO) Expand Fox Creek substation to include 240/144 kV facilities
- Add new 240 kV lines from Fox Creek substation to Bickerdike substation near Edson
- Open 144 kV line between Fox Creek and Little Smoky substations
- Add voltage support at Fox Creek substation

City of Edmonton Subregion

- Convert Hardisty substation in east Edmonton to 240/15 kV from 72/15 kV
- Add new 240 kV loop from Lambton substation in southeast Edmonton to Hardisty substation and onto Bellamy substation at Rossdale
- Discontinue use of 72 kV lines from Rossdale substation (Bellamy) to Strathcona substation to Lambton substation
- Replace existing 240/72 kV transformers at Clover Bar substation in northeast Edmonton with larger units

[5] The 2015 LTP document is available on the AESO website.

[6] The 2015 LTP identifies the transmission developments in the Northeast planning region starting on page 55 and the Edmonton planning region starting on page 61.

- Add new 240/72 kV substation near Namao in northeast, cut into 240 kV line between Castle Downs substation and Victoria substation on north edge of downtown Edmonton
- Add new 72 kV line from new substation to existing Namao substation
- Add new 240/72 kV transformer at Castle Downs substation in northeast
- Add new 72 kV transmission lines from Castle Downs substation to Kennedale substation, and onto Namao substation
- Discontinue use of 72 kV lines between Clover Bar and Hardisty substations, and Hardisty and Lambton substations
- Discontinue use of existing 72 kV lines that connect Clover Bar, Victoria, Namao, Kennedale, and Woodcroft substations
- Convert Victoria substation from 240/72/15 kV to 240/15 kV
- Add new 240 kV line from Victoria substation to Bellamy substation
- Discontinue use of 72 kV lines between Rossdale and Victoria substations

East of Edmonton Subregion

- Add new 240/138 kV substation near north edge of Edmonton/Strathcona refinery area
- Add new 138 kV transmission line from new substation to nearby Bretville substation
- Reconfigure 138 kV network in East Edmonton–Sherwood Park area
- Open 138 kV network between Edmonton and Fort Saskatchewan areas

West of Edmonton Subregion

- Add new 138 kV transmission line from Acheson substation west of Edmonton to North St. Albert substation
- Open 138 kV line between Inland Cement tap in north Edmonton to North St. Albert substation

1.1.1. Studies Performed

The following studies were performed for the pre-Project scenarios:

- Power flow studies
- Short circuit studies

The following studies were performed for the post-Project scenarios:

- Power flow studies
- Transient stability studies
- Short circuit studies

1.2. Report Overview

The Executive Summary provides a high-level summary of the assessment and its conclusions. Section 1 provides an introduction of the Project. Section 2 describes the criteria, system data, and study assumptions used in this study. Section 3 presents the methodology used for this study. Section 4 presents the pre-Project study results. Section 5 presents the connection alternatives examined. Section 6 provides a technical analysis of the post-Project system assessment for the alternatives that were selected for further study. Section 7 contains the short circuit study results. Section 8 discusses the mitigation measures, if any, required to enable the reliable connection of the Project to the AIES. Section 9 presents any dependencies the Project may have on other projects or other AESO plans to expand or enhance the transmission system. Section 10 presents the conclusions and recommendations of this assessment.

2. Criteria, System Data, and Study Assumptions

2.1. Criteria, Standards, and Requirements

2.1.1. Transmission Planning Standards and Reliability Criteria

The Transmission Planning (TPL) Standards, which are included in the Alberta Reliability Standards, and the AESO's *Transmission Planning Criteria – Basis and Assumptions*[7] (collectively, the Reliability Criteria) were 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-AB-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 in this report, Applicable Ratings are defined as follows:

- Seasonal continuous thermal rating of the transmission line's loading limits.
- Highest specified loading limits for transformers.
- For Category A conditions: Voltage range under normal operating condition per the AESO Information Document ID# 2010-007RS, *General Operating Practices – Voltage Control* (ID# 2010-007RS). ID #2010-007RS relates to Section 304.4 of the ISO rules, *Maintaining Network Voltage*. 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* applies.
- Desired post-contingency voltage change limits for three defined post event timeframes as provided in Table 2.1-1.

[7] Filed under a separate cover.

Table 2.1-1: Post Contingency Voltage Deviation Guidelines for Low Voltage POD 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 POD low voltage bus	±10%	±7%	±5%

2.1.2. ISO Rules and Information Documents

ID #2010-007RS was applied to establish system normal (i.e., pre-contingency) voltage profiles in the Study Area.

The TCM Rule was followed to set up the study scenarios and assess the study results. In addition, due regard was given to the AESO's Connection Study Requirements and the AESO's Generation and Load Interconnection Standard.

2.2. Study Scenarios

The scheduled ISD for the Project is November 1, 2019; as a result, the engineering studies were conducted using the 2020 winter peak (WP), 2020 summer light (SL) and 2020 summer peak (SP) scenarios. The AESO also studied multiple scenarios focusing on two primary cut-planes: Northwest Region and, South of Keephills-Ellerslie-Genesee (SOK) cut-plane. In addition, the studies considered the Fort McMurray area exchange as one of the assumptions. The different scenarios used in this report are listed below.

Table 2.2-1: Study scenario definitions

Scenario Name (Year/ Season Load)	Area Exchange Assumptions		
	SOK (N→S)	NW Region	FMM Area
2020 SL High SOK	High Flow	High Import	High Import
2020 WP High SOK	High Flow	High Import	Low Import
2020 SP High SOK	High Flow	High Import	Low Import
2020 WP Low SOK	Low Flow	High Import	Low Import
2020 SP Low SOK	Low Flow	High Import	Low Import

Each scenario was studied prior to the connection of the Project (pre-Project), after connection of the Project (post-Project baseline) and after connection of the Project and completion of the 2015 AESO LTP components required to mitigate Reliability Criteria violations observed in the post-Project baseline scenarios (post-Project with LTP).

The study scenarios are outlined in Table 2.2-2, which shows the SOK flow level, the northwest region (NW) cut-planes import level [8] and the Fort McMurray area (FMM) cut-plane [9] import/export level. This table also provides power order levels for the HVDC facilities: Eastern Alberta Transmission Line (EATL) and Western Alberta Transmission Line (WATL).

Table 2.2-2: Connection Study Scenario Descriptions

Condition	Scenario	Year/ Season Load	Project Generation (MW)	Area Exchange Assumptions (MW)			HVDC Power Order (N→S)	
				SOK Flow (N ->S)	NW Region Import	FMM Area Import	EATL	WATL
Pre-Project	1	2020 SL High SOK	0	930.5	747.3	617.5	275.0	325.0
	2	2020 WP High SOK	0	1015.4	743.9	116.6	250.0	475.0
	3	2020 SP High SOK	0	962.8	770.1	147.7	275.0	500.0
	4	2020 WP Low SOK	0	339.2	723.7	59.2	0.0	0.0
	5	2020 SP Low SOK	0	417.1	759.1	147.7	0.0	0.0
Post-Project Baseline	6	2020 SL High SOK	510	1053.1	747.3	617.5	375.0	600.0
	7	2020 WP High SOK	510	1160.8	743.8	116.6	325.0	750.0
	8	2020 SP High SOK	510	1107.6	769.9	147.7	375.0	750.0
	9	2020 WP Low SOK	510	457.7	723.6	59.2	0.0	225.0
	10	2020 SP Low SOK	510	479.4	759.7	147.7	0.0	275.0
Post-Project with LTP	11	2020 SL High SOK	510	1062.8	757.2	617.5	375.0	600.0
	12	2020 WP High SOK	510	1144.4	749.1	116.6	325.0	775.0
	13	2020 SP High SOK	510	1089.9	778.4	147.7	400.0	750.0
	14	2020 WP Low SOK	510	440.4	729.8	59.2	0.0	250.0
	15	2020 SP Low SOK	510	487.1	767.8	147.7	0.0	275.0
Post-Project 2026 for Short Circuit studies	16	2026 WP	510	N/A				

[8] The northwest region (NW) cut-planes are defined in AESO ID#2011-004R Northwest Area Transmission Constraint Management

[9] The Fort McMurray area (FMM) cut-planes are defined in AESO ID#2011-008R Northeast Area Transmission Constraint Management

2.3. Load and Generation Assumptions

2.3.1. Load Assumptions

The relevant AESO forecasts used for this connection assessment are shown in Table 2.3-1. The forecasts are based on the *AESO 2016 Long-Term Outlook* (2016 LTO) at Alberta Internal Load (AIL) peak. For all studies performed, when POD loads for the AIL were modified to align with the load forecast in the 2016 LTO, the active power to reactive power ratio in the base case scenarios was maintained.

Table 2.3-1: Forecast Area Load (2016 LTO at AIL Peak)

Area or Region Name	Year/ Season Load	Forecast Peak Load (MW)
Edmonton (Area 60)	2020 SP	1860
	2020 WP	1935
	2020 SL	1192
Wabamun (Area 40)	2020 SP	158
	2020 WP	180
	2020 SL	102
Fort Saskatchewan (Area 33)	2020 SP	722
	2020 WP	743
	2020 SL	557
AIL w/o Losses	2020 SP	11844
	2020 WP	12791
	2020 SL	8258

2.3.2. Generation Assumptions

The generation assumptions used for each study scenario are shown in Table 2.3-2. It was assumed that the Sundance units 1 and 2 retired.[10]

[10] In accordance with the AESO Market Update available at: https://www.aeso.ca/market/market-updates/status-of-sundance-unit-1-sd1-and-sundance-unit-2-sd2-effective-january-1-2018/.

Table 2.3-2: Local Generation (MW) in the Study Scenarios

Name	Unit	Pmax (MW)	Generation Dispatch by Study Scenario (MW)														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Approved ATCO Heartland	G1(Gas)	310	Not Applicable					310	310	310	310	310	310	310	310	310	310
	G2(Steam)	200						200	200	200	200	200	200	200	200	200	200
Genesee (Approved AESO P1440)*	4	530	530	530	530	530	530	530	530	530	530	530	530	530	530	530	530
	5	530	530	530	530	530	530	530	530	530	530	530	530	530	530	530	530
Air Liquide 408S	G1	96	19.1	65.3	61	66.7	61	19.1	65.3	61	57.4	45.9	19.1	65.3	61	57.4	45.9
Alpac	1	43.8	12.4	20.1	22	22	22	12.4	20.1	22	22	22	12.4	20.1	22	22	22
	2	43.8	12.4	20.1	22	22	22	12.4	20.1	22	22	22	12.4	20.1	22	22	22
	3	19.9	5.6	9.1	9.9	9.9	9.9	5.6	9.1	9.9	9.9	9.9	5.6	9.1	9.9	9.9	9.9
	4	32.1	9.6	15.6	17	17	17	9.6	15.6	17	17	17	9.6	15.6	17	17	17
Battle River	4	165	60	152	115	155	147	60	152	115	155	147	60	152	115	155	147
	5	413.7	141	381	290	385	368	141	381	290	385	368	141	381	290	385	368
Cloverbar	G1	43.9	0	46	35	0	0	0	46	35	0	0	0	46	35	0	0
	G2	100	0	100	91	0	0	0	100	91	0	0	0	100	91	0	0
	G3	100.8	0	98	93	0	0	0	98	93	0	0	0	98	93	0	0
Dow Chemical Fort Saskatchewan 166S	G1	99.5	5.5	35	35	39	35	5.5	35	35	51.5	40	5.5	35	35	51.5	40
	G2	99.5	5.5	35	35	39	35	5.5	35	35	51.5	40	5.5	35	35	51.5	40
Fort Saskatchewan Cogen 218S	GT	95	21.8	81.6	66.6	80.2	66.6	21.8	81.6	66.6	21.5	16.8	21.8	81.6	66.6	21.5	16.8
	ST	45.5	10.2	38.4	31.4	37.8	31.4	10.2	38.4	31.4	10.5	8.25	10.2	38.4	31.4	10.5	8.25
Garneau	1	16	3.2	16.4	9.6	5.6	0.8	3.2	16.4	9.6	5.6	0.8	3.2	16.4	9.6	5.6	0.8
	2	26	4.8	24.6	14.4	8.4	1.2	4.8	24.6	14.4	8.4	1.2	4.8	24.6	14.4	8.4	1.2
Genesee	1	430	391	398	401	350	378	391	398	401	350	378	391	398	401	350	378
	2A	430	392	399	400	373	381	392	399	400	373	381	392	399	400	373	381

Name	Unit	Pmax (MW)	Generation Dispatch by Study Scenario (MW)														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	3	527.4	463	464	465	340	386	463	464	465	340	386	463	464	465	340	386
Keephills	1A	415	393	395	393	324	294	393	395	393	324	294	393	395	393	324	294
	2A	415	392	397	393	329	316	392	397	393	329	316	392	397	393	329	316
	3	512	450	451	454	239	221	450	451	454	239	221	450	451	454	239	221
Scotford Upgrader 879S	GT	99.4	19.7	67.3	62.9	68.7	62.9	19.7	67.3	62.9	59.2	47.2	19.7	67.3	62.9	59.2	47.2
	ST	95.7	19.1	65.3	61	66.7	61	19.1	65.3	61	57.4	45.9	19.1	65.3	61	57.4	45.9
Sheerness	G1	418.5	143	327	262	392	332	143	327	262	392	332	143	327	262	392	332
	2	408	143	329	247	388	314	143	329	247	388	314	143	329	247	388	314
Shell AOSP1 402S	1	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Project 1289 (Maxim Power Deerland Peaking Station) **	G1	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G2	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G3	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G4	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sundance	1	303	Retired														
	2	303															
	3A	380	355	356	356	202	198	355	356	356	202	198	355	356	356	202	198
	4A	435	365	405	395	212	202	365	405	395	212	202	365	405	395	212	202
	5A	435	397	410	405	204	285	397	410	405	204	285	397	410	405	204	285
	6A	435	380	397	395	172	244	380	397	395	172	244	380	397	395	172	244

Note: All the generation dispatch shown as “0” means the generating unit is not in-merit based on forecasted economic merit order. For the sake of the studies, these units are assumed off-line.

* Genesee Generating Station Units 4 and 5 were originally approved by the Alberta Utilities Commission on August 12, 2014 in Decision 2014-226 and issued Power Plant Approval No. U2014-287.

** The 190-MW Deerland Gas Peaking Station was originally approved by the Commission on June 10, 2008 in Power Plant Approval No. U2008-140.

2.3.3. Intertie Flow Assumptions

The intertie points are deemed to be too far away from the Study Area to have any material effect on the results of the studies. As a result, the AESO planning base case intertie assumptions were used for all study scenarios.

2.3.4. HVDC Power Order

The power orders of the HVDC transmission lines (EATL and WATL) assumed in the study scenarios were set based on the minimum loss. The power orders used in the study scenarios are shown in Table 2.2-1.

WATL MVAr exchange with the AC system will be controlled between +35 MVAr and -35 MVAr at its south terminal, and between +75 MVAr and -75 MVAr at its north terminal.

EATL MVAr exchange with the AC system will be controlled between +35 MVAr and -35 MVAr at its south terminal, and between +75 MVAr and -85 MVAr at its north terminal.

2.4. System Projects

All of the system projects that occur in the Study Area were included in the study for all studied scenarios, as shown in Table 2.4-1.

Table 2.4-1: System Projects Included in the Studies

AESO Project No.	Project Name	Project Area	Scheduled ISD	AUC Decision No.	AUC NID Approval No.	Date of original AUC approval
850	South and West Edmonton Area Transmission System Reinforcement	60	Q1 2018	2014-126	U2014-183	May 5, 2014
1381	807L Capacity Increase	33	Q4 2019	22040-D01-2017	22040-D02-2017	January 23, 2017
1186	Thickwood Hills 240 kV Transmission Development and Reactive Power Reinforcement	25	Q4-2018	3588-D01-2015	3588-D02-2015	March 12, 2015
1590	Fort McMurray West 500 kV Transmission Project	25	Q2 2019	21030-D02-2017*	n/a	February 10, 2017
1655	Sunnybrook and Livock Interconnection with Fort McMurray West 500kV Transmission Facilities	25	Q4 2018	20736-D01-2015	20736-D02-2015	November 19, 2015

*Decision 21030-D02-2017 issued on February 10, 2017 provides approval for the facilities application submitted by Alberta PowerLine General Partner Ltd. A Needs Identification Document (NID) application was not required because the Project is considered Critical Transmission Infrastructure.

2.5. Customer Connection Projects

Customer connection projects that have passed Gate 2 of the AESO Connection Process as of February 2017 were modelled in the study scenarios based on their respective positions in the AESO Connection Queue. Table 2.5-1 summarizes the customer connection project

assumptions that were used in the studies. It should be noted that the information in this table is subject to change as projects progress.

Table 2.5-1: Customer Connection Projects Included in the Studies

Queue Position*	AESO Project No.	AESO Project Name	AESO Planning Area	Generation (MW)	Load (MW)	Scheduled ISD
27	1289	Maxim Power Deerland Peaking Station	33	185.8	0.0	Dec 1, 2017
31	1412	Trans Mountain Pipeline Gainford Substation 16501S	40	0.0	11.0	Feb 1, 2019
33	1442	Fortis New Anthony Henday Substation	60	0.0	21.0	Feb 1, 2019
39	1440	CP Genesee Generating Units 4 and 5	60	1010.0	50.0	Jan 19, 2019

* Per the AESO Connection Project List posted in February 2017. With the exception of Project 1440, customer connection projects that have queue positions after the Project are not listed in this table and were not included in the study cases.

2.6. Facility Ratings and Shunt Elements

The legal owners of transmission facilities (TFO) in the area provided the seasonal continuous thermal ratings and the short-term emergency ratings for the transmission lines in the Study Area, as shown in Table 2.6-1.

Table 2.6-1: Key Transmission Line Ratings in the Study Area

Line ID	Line Description	Voltage Class (kV)	Seasonal Continuous Rating (MVA)		Short-term Emergency* Rating (MVA)	
			Summer	Winter	Summer	Winter
1202L	Keephills 320P - Ellerslie 89S	500	2598	2598	3380	3464
1209L	Genesee - Ellerslie 89S	500	2500	2500	3250	3250
1238L	Genesee - Sunnybrook 510S	500	3464	3464	3464	3464
1239L	Genesee - Sunnybrook 510S	500	3464	3464	3464	3464
1203L	Keephills 320P - Sunnybrook 510S	500	2500	2500	3250	3250
1206L	Heartland 12S - Ellerslie 89S	500	2598	2598	3464	3464
1212L	Heartland 12S - Ellerslie 89S	500	2598	2598	3464	3464
1046L	Cherhill 338S - Sundance 310P	240	337	404	407	488
913L	North Barrhead 69S – Cherhill 338S	240	449	608	449	736
9L960	Whitefish 825S – Deerland 13S	240	498	498	498	498
9L961	Whitefish 825S - Deerland 13S	240	498	498	498	498
997L	Lamoureux 71S - Josephburg 410S	240	499	499	628	706

Line ID	Line Description	Voltage Class (kV)	Seasonal Continuous Rating (MVA)		Short-term Emergency* Rating (MVA)	
			Summer	Winter	Summer	Winter
943L	Amelia 108S – Deerland 13S	240	457	654	457	686
905L	Wabamun Generation Station 19S - North Calder 37S	240	299	437	359	524
921L	Lamoureux 71S - Cloverbar	240	417	499	500	620
712L	North St. Albert 99S - Spruce GroveSpruce Grove 595S	138	108	114	119	125
694L	Fort Saskatchewan 54S - Westwood 422S	138	119	146	131	161
677L	Acheson 305S - Spruce GroveSpruce Grove 595S	138	108	114	119	125
792L	N.W. Cardiff 191S - Viscount 92S	138	85	90	94	99
807L	Beamer 233S - 807AL Tap	138	85	90	94	99
898L	North Calder 37S - Viscount 92S	138	85	90	94	99
728L	Waupisoo 405S – Plamondon 353S	72	72	95	72	100
706L	Josephburg 410S – 706AL Tap	138	119	131	146	161
706L	706AL Tap – Fort Saskatchewan 54S	138	119	131	146	161
739L	Acheson 305S – Devon 14S	138	143	162	162	162
707L	Fort Saskatchewan 54S - Dow Chemical Fort Saskatchewan 166S	138	119	146	131	161
706L	Josephburg 410S to B.F. Goodrich Fort Saskatchewan 452S	138	119	146	131	161
706L	B.F. Goodrich Fort Saskatchewan 452S to Fort Saskatchewan 54S	138	119	146	131	161
781L	Sherritt Gordon 172S - Lamoureux 71S	138	143	172	172	186
761L	Lamoureux 71S - East Edmonton 38S	138	98	132	108	145
700L	Sherwood Park 746S - 700L Tap	138	119	146	131	161
604L	Nisku 149S - Blackmud 155S	138	120	148	132	163
708L	Lamoureux 71S - 708AL Tap	138	121	148	133	163
708L	Beamer 233S - 708AL Tap	138	121	148	133	163

*When line loading following a Category B contingency is observed to exceed the seasonal continuous rating and is less than the short-term emergency rating, it is assumed that AESO and TFO real-time operational practices can be used to manage the constraint within the time requirements of the TFO short-term emergency rating.

The TFO also provided the facility ratings for the existing transformers in the Study Area. The ratings of the key transformers are shown in Table 2.6-2.

Table 2.6-2: Key Transformer Ratings in the Study Area

Substation Name and Number	Transformer ID	Transformer Voltages (kV)	Rating (MVA)
Heartland 12S	T1	500/240	1200
Ellerslie 89S	T1	500/240	1200
Ellerslie 89S	T2	500/240	1200
Keephills 320P	T6	500/240	1200
North Calder 37S	T6	240/138	448
Harry Smith 367S	T1	240/138	400
Harry Smith 367S	T2	240/138	400
Lamoureux 71S	T2	240/138	448
East Edmonton 38S	T1	240/138	337
East Edmonton 38S	T4	240/138	337
Josephburg 410S	T1	240/138	336
Josephburg 410S	T1	240/138	336
Deerland 13S	T2	240/138	300
Fort Saskatchewan 54S	T1	240/138	300
Fort Saskatchewan 54S	T2	240/138	300
Wabamun 19S	T5	240/138	200
North Barrhead 69S	T4	240/138	179
Sundance 310P	36	240/138	168

The details of shunt elements in the Study Area are given in Table 2.6-3.

Table 2.6-3: Shunt Elements in the Study Area

Substation Name and Number	Voltage Class (kV)	Capacitors		Reactors	
		Number of Switched Shunt Blocks	Total at Nominal Voltage (MVAr)	Number of Switched Shunt Blocks	Total at Nominal Voltage (MVAr)
Boyle 56S	138	1 x 14.95 MVAr	14.95	-	-
Fort Saskatchewan 54S	138	1 x 48.91 MVAr	48.91	-	-
Lamoureux 71S	138	2 x 48.91 MVAr	97.82	-	-
Bruderheim 127S	138	1 x 45 MVAr	45	-	-

Substation Name and Number	Voltage Class (kV)	Capacitors		Reactors	
		Number of Switched Shunt Blocks	Total at Nominal Voltage (MVAr)	Number of Switched Shunt Blocks	Total at Nominal Voltage (MVAr)
East Edmonton 38S	138	2 x 48.91 MVAr	97.82	-	-
Nisku 149S	138	1 x 30 MVAr	30	-	-
Heart Lake 898S	240	4 x 50 MVAr	200	-	-
Lac La Biche 157S	138	1 x 10.8 MVAr	10.8	-	-
Winefred 818S	138	1 x 10 MVAr 1 x 14 MVAr 1 x 18 MVAr	42	-	-
Leduc 325S	138	1 x 27 MVAr	27	-	-
Acheson 305S	138	1 x 24.46 MVAr	24.46	-	-
Waupisoo 405S	138	1 x 16.20 MVAr 1 x 19.93 MVAr	36.13	-	-
Jasper	240	1 x 105.31 MVAr	105.31	-	-
Rossdale	69	1 x 47.76	47.76	-	-
Cloverbar	69	1 x 31.57 MVAr	31.57	-	-
Sunnybrook 510S	500	3 x 150 MVAr 2 x 130 MVAr	710	1 x -110 MVAr	-110
Heathfield 2029S	500	4 x 110 MVAr 2 x 103 MVAr 4 x 110 MVAr	1086	1 x -90 MVAr	-90
Stelco Edmonton 133S	34.5	1 x 16.8 MVAr 1 x 30 MVAr	46.8	-	-
Heart Lake 898S	25	-	-	1 x -20 MVAr	-20

2.7. Voltage Profile Assumptions

The AESO ID# 2010-007RS was used to establish normal system (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 all the busses not included in the ID# 2010-007RS. These voltages were utilized to set the voltage profile for the study base cases prior to power flow analysis. The key bus voltages in the Study Area are shown in Table 2.7-1.

Table 2.7-1: Voltage Operating Ranges at Key Nodes in the Study Area

Substation	Nominal Voltage (kV)	Minimum Operating Limit (kV)	Desired Range (kV)	Maximum Operating Limit (kV)
Ellerslie 89S	500	505	520-540	550
	240	243	246 - 254	255
Lamoureux 69S	240	240	240 – 254	255
	138	140	140 - 144	145
Sundance 310P	240	252	255 - 262	264
	138	138	138 - 144	145
Genesee	500	518	525 – 540	550
	138	124	124 – 152	152

2.8. Protection Fault Clearing Times

The fault clearing times used in the transient stability studies are provided in Table 2.8-1.

Table 2.8-1: Protection Fault Clearing Times During Category B conditions

	Contingency Description	Fault Clearing Times (Cycles)	
		Near end	Far End
	997L (Josephburg 410S - Lamoureux 71S)	4.5	6
	997L (Lamoureux 71S - Josephburg 410S)	5	6
	1120L (Josephburg 410S - Amelia 108S)	5	6
	1120L (Amelia 108S - Josephburg 410S)	5	6
	706L (Josephburg 410S - Ft. Saskatchewan 54S)	5	6
	706L (Ft. Saskatchewan 54S - Josephburg 410S)	5	6
	856L (Josephburg 410S - Shell Scotford 409S)	5	6
	856L (Shell Scotford 409S - Josephburg 410S)	5	6
	857L (Josephburg 410S - Shell Scotford 409S)	5	6
	857L (Shell Scotford 409S - Josephburg 410S)	5	6
	807L (Josephburg 410S - AOSP1 402S - Beamer 233S)	5	6/6
	807L (Beamer 233S - AOSP1 402S - Josephburg 410S)	5	6/6

2.9. Dynamic Data and Assumptions

Dynamic data for the Facility are provided by the Market Participant, and are provided in Attachment E.

3. Study Methodology

All of the studies were performed using PSS/E software Version 33.

3.1. Connection Studies Carried Out

The studies that were carried out are identified in Table 3.1-1.

Table 3.1-1: Summary of Studies Performed

Scenario and Condition		Power flow	Transient Stability	Short-circuit
1	2020 SL High SOK Pre-project	X		
2	2020 WP High SOK Pre-Project	X		X
3	2020 SP High SOK Pre-Project	X		
4	2020 WP Low SOK Pre-Project	X		
5	2020 SP Low SOK Pre-Project	X		
6	2020 SL High SOK Post-Project Baseline	X	X	
7	2020 WP High SOK Post-Project Baseline	X	X	X
8	2020 SP High SOK Post-Project Baseline	X	X	
9	2020 WP Low SOK Post-Project Baseline	X	X	
10	2020 SP Low SOK Post-Project Baseline	X	X	
11	2020 SL High SOK Post-Project with LTP	X		
12	2020 WP High SOK Post-Project with LTP	X		
13	2020 SP High SOK Post-Project with LTP	X		
14	2020 WP Low SOK Post-Project with LTP	X		
15	2020 SP Low SOK Post-Project with LTP	X		
16	2026 WP Post-Project			X

3.2. Power Flow Analysis

Pre-Project and post-Project power flow studies were performed on the scenarios as described in Table 3.1-1 to assess the system performance for the Category A condition and all Category B. Power flow studies were performed to identify thermal and voltage criteria violations as per the Reliability Criteria, and any deviations from the desired limits in Table 2.1-1. The purpose of the power flow analysis is to quantify any incremental violations in the Study Area after the Project is connected. For the Category B power flow studies, transformer tap and switched

shunt reactive compensation devices such as shunt capacitors and reactors were locked and continuous shunt devices were enabled.

3.2.1. Contingencies Studied

Power flow analysis was completed for all Category B contingencies (138 kV facilities and above) within the Study Area.

All transmission facilities in the Study Area were monitored for voltage criteria violations and thermal criteria violations under Category A conditions and under Category B conditions.

3.3. Transient Stability Analysis

Transient stability analysis was performed for the Post-Project Baseline scenarios (Scenarios 6, 7, 8, 9 and 10). Transient stability analysis was performed for all Category B contingencies (138 kV facilities and above) in the Study Area. Near and far end three-phase–to-ground faults were applied to transmission lines to assess the stability of the system in the post-Project scenarios. The applied faults were cleared by opening the respective near-end and far-end line breakers using the fault clearing times as stated in Section 2.8.

A system dynamic response was considered acceptable if the following conditions were met after a disturbance:

- All the generators exhibited stable and damped response and remained connected to the AIES,
- The BC intertie did not trip,
- The post-transient voltage did not differ from the pre-fault voltage by more than 10%, and
- All oscillations in the system were damped successfully as per Western Electricity Coordinating Council (WECC) and AESO Transmission Planning Criteria and Guidelines.

3.4. Short-Circuit Analysis

Short-circuit analysis was performed for 2020 WP High SOK pre–Project scenario, and the 2020 WP High SOK post-Project scenarios, as well as for the long-term assessment using the 2026 WP post-Project scenario. For short-circuit analysis, all transmission elements were in service and all the generators in and around the study area were switched on to evaluate the maximum fault current under three-phase-to-ground faults and single-line-to-ground faults.

The maximum three-phase-to-ground and single-line-to-ground fault levels were simulated and the results reported using polar co-ordinates and physical values for the substations stated in Table 3.4-1.

Table 3.4-1: Applicable Substations for Short-circuit Level Analysis

Substation Name and Number	Base Voltage (kV)
North Calder 37S	138
Scotford 409S	138
Riverside 388S	138
Lamoureux 71S	240
Fort Saskatchewan 54S	138
Beamer 233S	138
Sherritt 172S	138
Lamoureux 71S	138
Deerland 13S	138
Deerland 13S	240
Josephburg 410S	240
Josephburg 410S	138
Albchem 308S	138
Dow Hydro 258S	138
Shell 402S	138
Amelia 108S	240

4. Pre-Project System Assessment

4.1. Power Flow Analysis

This section describes the results of the pre-Project power flow studies. Power flow diagrams illustrating the pre-Project power flow studies results for Category A and selected Category B conditions in the Study Area are included in Attachment A.

4.1.1. Scenario 1 – 2020 SL High SOK Pre-Project

Category A Condition

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

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions, as shown in Table 4.1-1.

Table 4.1-1: Thermal Criteria Violations for the 2020 SL High SOK Pre-Project Scenario Under Category B

Contingency	Limiting Branch	Seasonal Continuous Line Rating (MVA)	Short-term Emergency Rating (MVA)	Pre-Project	
				Power flow[11] (MVA)	% Loading[12]
1046L Sundance (Plant) 310P -- Cherhill 338S)	898L (North Calder 37S - Viscount 92S)	85	94	97.51	111
913L (North Barrhead 69S - Cherhill 338S)		85	94	94.79	108
1046L (Sundance (Plant) 310P - Cherhill 338S)	792L (N.W. Cardiff191S - Viscount 92S)	85	94	89.13	102

No voltage criteria violations were observed under Category B conditions.

4.1.2. Scenario 2 – 2020 WP High SOK Pre-Project

Category A Condition

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

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions, as shown in Table 4.1-2.

Table 4.1-2: Thermal Criteria Violations for the 2020 WP High SOK Pre-Project Scenario Under Category B

Contingency	Limiting Branch	Seasonal Continuous Line Rating (MVA)	Short-term Emergency Rating (MVA)	Pre-Project	
				Power flow (MVA)	% Loading
1046L (Sundance Plant 310P - Cherhill 338S)	898L (North Calder 37S - Viscount 92S)	90	99	104.52	112
913L (North Barrhead 69S - Cherhill 338S)		90	99	101.02	108
69ST4 (North Barrhead Transformer)		90	99	95.51	103

No voltage criteria violations were observed under Category B conditions.

4.1.3. Scenario 3 – 2020 SP High SOK Pre-Project

Category A Condition

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

[11] Power flow (MVA) is current expressed as MVA (ie. $S = \sqrt{3} \times V_{base} \times I_{actual}$)

[12] % loading is current expressed as MVA (ie. $S = \sqrt{3} \times V_{base} \times I_{actual}$)

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions, as shown in Table 4.1-3.

Table 4.1-3: Thermal Criteria Violations for the 2020 SP High SOK Pre-Project Scenario Under Category B

Contingency	Limiting Branch	Seasonal Continuous Line Rating (MVA)	Short-term Emergency Rating (MVA)	Pre-Project	
				Power flow (MVA)	% Loading
37ST6 (North Calder 37S Transformer)	677L (Acheson 305S - Spruce Grove 595S)	108	119	120.29	109
1046L Sundance (Plant) 310P - Cherhill 338S)	898L (North Calder 37S - Viscount 92S)	85	94	90.28	103

No voltage criteria violations were observed under Category B conditions.

4.1.4. Scenario 4 – 2020 WP Low SOK Pre-Project

Category A Condition

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

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions, as shown in Table 4.1-4.

Table 4.1-4: Thermal Criteria Violations for the 2020 WP Low SOK Pre-Project Scenario Under Category B

Contingency	Limiting Branch	Seasonal Continuous Line Rating (MVA)	Short-term Emergency Rating (MVA)	Pre-Project	
				Power flow (MVA)	% Loading
1046L (Sundance (Plant) 310P - Cherhill 338S)	898L (North Calder 37S - Viscount 92S)	90	99	100.40	108
913L (North Barrhead 69S - Cherhill 338S)		90	99	97.07	104
37ST6 (North Calder Transformer)	677L (Acheson 305S - Spruce Grove 595S)	114	125	117.03	100

No voltage criteria violations were observed under Category B conditions.

4.1.5. Scenario 5 – 2020 SP Low SOK Pre-Project

Category A Condition

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

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions, as shown in Table 4.1-8.

Table 4.1-5: Thermal Criteria Violations for the 2020 SP Low SOK Pre-Project Scenario Under Category B

Contingency	Limiting Branch	Seasonal Continuous Line Rating (MVA)	Short-term Emergency Rating (MVA)	Pre-Project	
				Power flow (MVA)	% Loading
37ST6 (North Calder Transformer)	677L (Acheson 305S - Spruce Grove 595S)	108	119	120.20	109
1139L (Harry Smith 367S - Petrolia)		108	119	114.81	102
1046L (Sundance (Plant) 310P - Cherhill 338S)	898L (North Calder 37S - Viscount 92S)	85	94	91.79	105
913L (North Barrhead 69S - Cherhill 338S)		85	94	88.66	101

No voltage criteria violations were observed under Category B conditions.

5. Connection Alternatives

5.1. Overview

The AESO, in consultation with the TFO and the market participant, examined three transmission alternatives to meet the market participant's request for system access service.

5.1.1. Connection Alternatives Identified

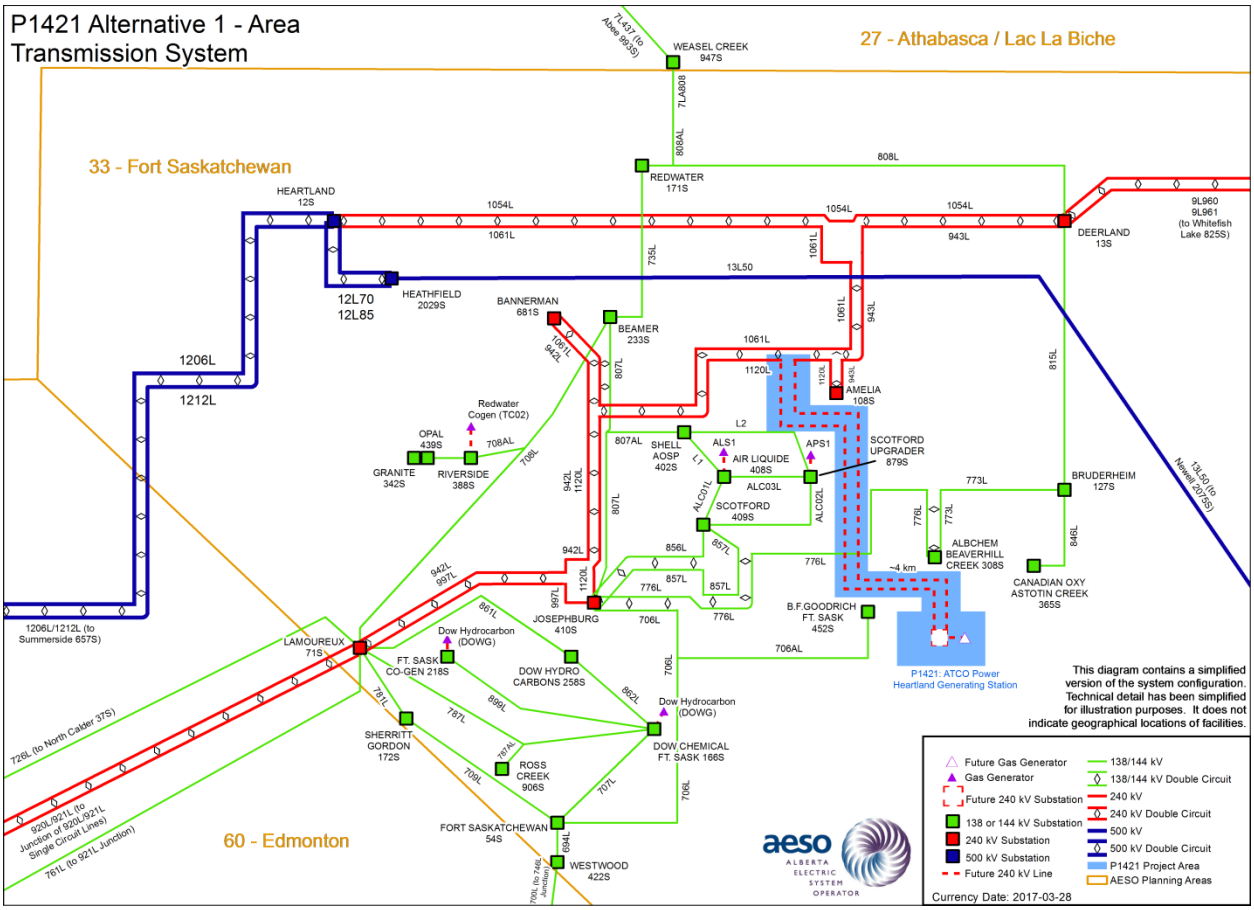
The developments associated with each connection alternative are described below.

Alternative 1: In-and-out connection to the 240 kV transmission line 1120L near Amelia 108S

Alternative 1 includes connecting the approved Lamont 400S substation to the 240 kV transmission line 1120L (between the Amelia 108S substation and the Josephburg 410S substation) using and in-and-out configuration. Compared to the approved Lamont 400S configuration, this would require the addition of two 240 kV breakers and associated equipment at the Lamont 400S substation to form a ring bus. Alternative 1 would also require two new 240 kV circuits, each approximately 4 km in length.

Figure 5.1-1 shows the configuration of Alternative 1.

Figure 5.1-1: Connection Alternative 1 Single Line Diagram

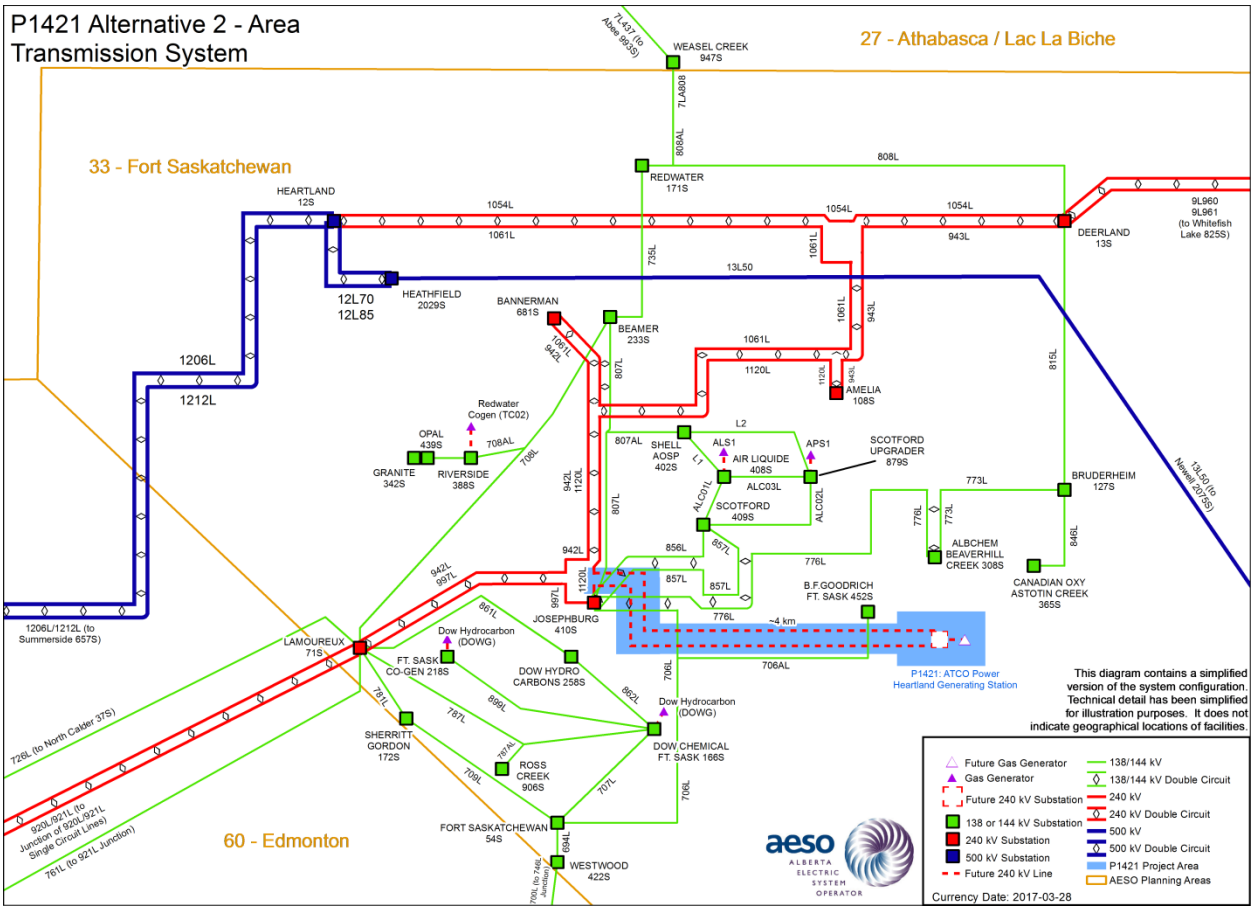


Alternative 2: In-and-out connection to the 240 kV transmission line 1120L near Josephburg 410S

Alternative 2 includes connecting the approved Lamont 400S substation to the 240 kV transmission line 1120L (between the Amelia 108S substation and the Josephburg 410S substation) using and in-and-out configuration. Compared to the approved Lamont 400S configuration, this would require the addition of two 240 kV breakers and associated equipment at the Lamont 400S substation to form a ring bus. Alternative 2 would also require two new 240 kV circuits, each approximately 4 km in length

Figure 5.1-2 shows the configuration of Alternative 2.

Figure 5.1-2: Connection Alternative 2 Single Line Diagram

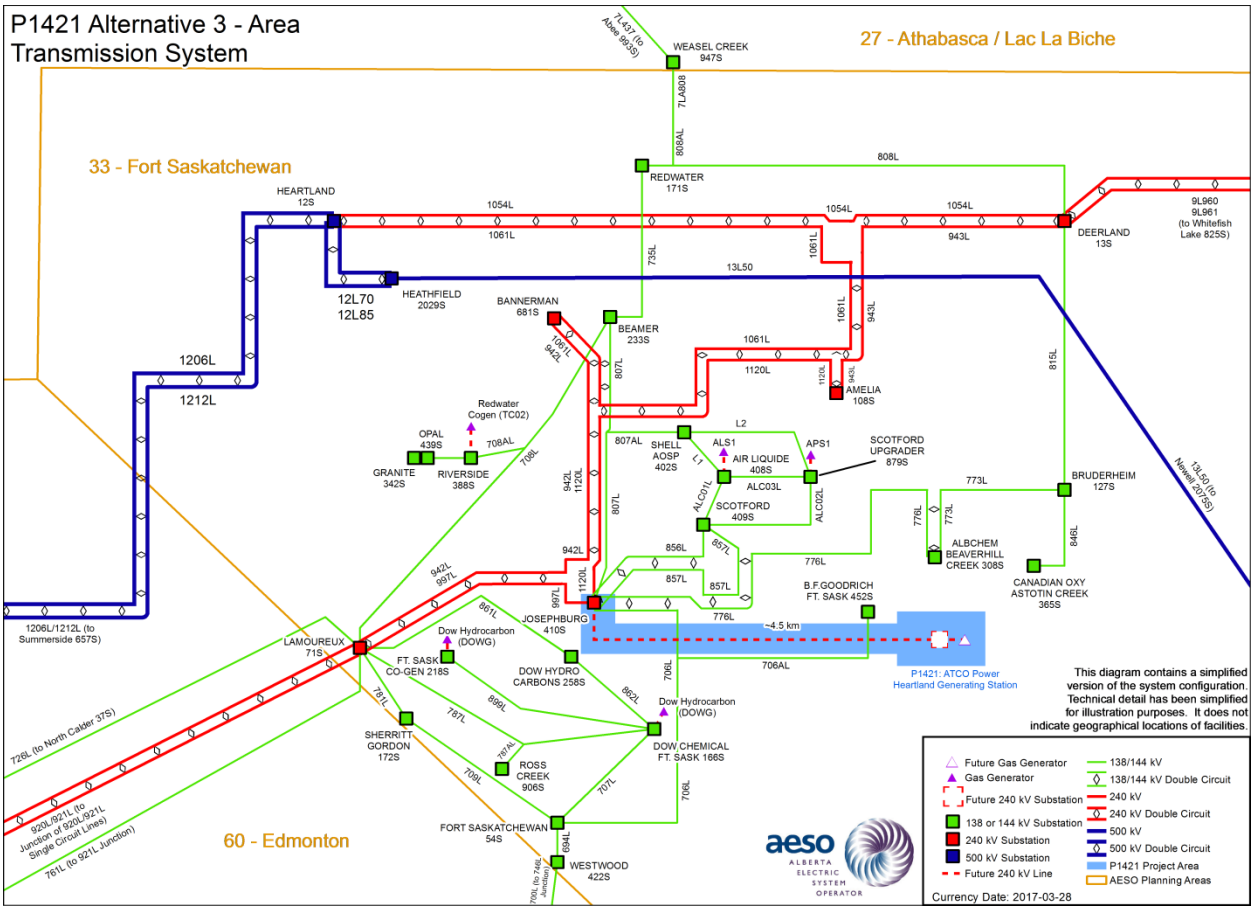


Alternative 3: Radial connection to the Josephburg 410S substation

Alternative 3 involves connecting the approved Lamont 400S substation to the existing Josephburg 410S substation in a radial configuration. This would require modifying the Josephburg 410S substation by adding one 240 kV circuit breaker and associated equipment, and , adding one new 240 kV circuit approximately 5.5 km in length.

Figure 5.1-3 shows the configuration of Alternative 3.

Figure 5.1-3: Connection Alternative 3 Single Line Diagram



5.1.2. Connection Alternatives Selected for Further Studies

Alternative 3 is considered technically feasible and was selected for further study.

5.1.3. Connection Alternatives Not Selected for Further Studies

Alternative 1 and Alternative 2 would involve increased transmission development and hence, increased cost, compared to Alternative 3. Therefore, Alternative 1 and Alternative 2 were not selected for further study.

6. Technical Analysis of the Preferred Connection Alternative

This section provides the results of the post-Project study results for Alternative 3, which is described in Section 5.

6.1. Power Flow Analysis

6.1.1. Post-Project Baseline Scenarios

The results of power flow studies following connection of the Facility, but prior to the energization of the relevant 2015 LTP components, are presented in this section. Post-Project baseline scenario power flow diagrams are provided in Attachment B.

6.1.1.1. Scenario 6 – 2020 SL High SOK Post-Project Baseline

Category A Condition

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

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions, as shown in Table 6.1-1.

Table 6.1-1: Thermal Criteria Violations for the 2020 SL High SOK Post-Project Scenario Under Category B

Contingency	Limiting Branch	Seasonal Continuous Line Rating (MVA)	Short-term Emergency Rating (MVA)	Pre- Project		Post- Project Baseline	
				Power flow (MVA)	% Loading	Power flow (MVA)	% Loading
1046L Sundance (Plant) 310P - Cherhill 338S)	898L (North Calder 37S - Viscount 92S)	85	94	97.51	111	100.93	115
913L (North Barrhead 69S - Cherhill 338S)		85	94	94.79	108	98.19	112
1046L Sundance (Plant) 310P - Cherhill 338S)	792L (N.W. Cardiff191S - Viscount 92S)	85	94	89.13	102	92.51	106
913L (North Barrhead 69S - Cherhill 338S)		85	94	86.7	93	89.84	103

No voltage criteria violations were observed under Category B conditions.

6.1.1.2. Scenario 7 – 2020 WP High SOK Post-Project Baseline

Category A Condition

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

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions, as shown in Table 6.1-2.

Table 6.1-2: Thermal Criteria Violations for the 2020 WP High SOK Post-Project Scenario Under Category B

Contingency	Limiting Branch	Seasonal Continuous Line Rating (MVA)	Short-term Emergency Rating (MVA)	Pre- Project		Post- Project Baseline	
				Power flow (MVA)	% Loading	Power flow (MVA)	% Loading
1046L (Sundance Plant 310P - Cherhill 338S)	898L (North Calder 37S - Viscount 92S)	90	99	104.52	112	107.79	115
913L (North Barrhead 69S - Cherhill 338S)		90	99	101.02	108	104.28	112
69ST4 (North Barrhead Transformer)		90	99	95.51	103	98.04	105

No voltage criteria violations were observed under Category B conditions.

6.1.1.3. Scenario 8 – 2020 SP High SOK Post-Project Baseline

Category A Condition

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

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions, as shown in Table 6.1-3.

Table 6.1-3: Thermal Criteria Violations for the 2020 SP High SOK Post-Project Scenario Under Category B

Contingency	Limiting Branch	Seasonal Continuous Line Rating (MVA)	Short-term Emergency Rating (MVA)	Pre- Project		Post- Project Baseline	
				Power flow (MVA)	% Loading	Power flow (MVA)	% Loading
1046L (Sundance Plant 310P - Cherhill 338S)	898L (North Calder 37S - Viscount 92S)	85	94	90.28	103	93.62	106
913L (North Barrhead 69S - Cherhill 338S)		85	94	85.8	99	90.59	103

No voltage criteria violations were observed under Category B conditions.

6.1.1.4. Scenario 9 – 2020 WP Low SOK Post-Project Baseline

Category A Condition

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

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions, as shown in Table 6.1-4.

Table 6.1-4: Thermal Criteria Violations for the 2020 WP Low SOK Post-Project Scenario Under Category B

Contingency	Limiting Branch	Seasonal Continuous Line Rating (MVA)	Short-term Emergency Rating (MVA)	Pre- Project		Post- Project Baseline	
				Power flow (MVA)	% Loading	Power flow (MVA)	% Loading
1046L Sundance (Plant) 310P - Cherhill 338S)	898L (North Calder 37S - Viscount 92S)	90	99	100.40	108	102.61	110
913L (North Barrhead 69S - Cherhill 338S)		90	99	97.07	104	99.27	106
997L (Lamoureux 71S - Josephburg 410S)	706L (Josephburg 410S - 706AL Tap)	146	161	32.1	25	149.64	100

No voltage criteria violations were observed under Category B conditions.

6.1.1.5. Scenario 10 – 2020 SP Low SOK Post-Project Baseline

Category A Condition

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

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions, as shown in Table 6.1-5.

Table 6.1-5: Thermal Criteria Violations for the 2020 SP Low SOK Post-Project Scenario Under Category B

Contingency	Limiting Branch	Seasonal Continuous Line Rating (MVA)	Short-term Emergency Rating (MVA)	Pre- Project		Post- Project Baseline	
				Power flow (MVA)	% Loading	Power flow (MVA)	% Loading
997L (Lamoureux 71S - Josephburg 410S)	706L (Josephburg 410S - 706AL Tap)	119	131	22.3	18	131.24	108
	706L (Fort Saskatchewan 54S - 706AL Tap)	119	131	22.1	18	130.92	108
1046L Sundance (Plant) 310P - Cherhill 338S)	898L (North Calder 37S - Viscount 92S)	85	94	91.79	105	93.81	107
913L (North Barrhead 69S - Cherhill 338S)		85	94	88.66	101	90.67	104
37ST6 (North Calder Transformer)	677L (Acheson 305S - Spruce Grove 595S)	108	119	120.20	109	113.24	103

No voltage criteria violations were observed under Category B conditions.

6.1.2. Post-Project with LTP Scenarios

This section gives a summary of the power flow study results, following connection of the Facility and after energization of the 2015 LTP components, which are listed below:

- Rebuild 138 kV line between North Calder and Viscount substations in north Edmonton and onto Cardiff substation near Morinville to higher capacity
- Add new 240 kV lines from Little Smoky substation to Fox Creek substation (ATCO)
- Add new 240 kV lines from Fox Creek substation to Bickerdike substation near Edson
- Add new 240/138 kV substation near north edge of Edmonton/Strathcona refinery area
- Add new 138 kV transmission line from new substation to nearby Bretville substation
- Reconfigure 138 kV network in East Edmonton–Sherwood Park area
- Open 138 kV network between Edmonton and Fort Saskatchewan areas
- Add new 138 kV transmission line from Acheson substation west of Edmonton to North St. Albert substation
- Open 138 kV line between Inland Cement tap in north Edmonton to North St. Albert substation

Post-Project with LTP scenario power flow diagrams are provided in Attachment C.

6.1.2.1. Scenario 11 – 2020 SL High SOK Post-Project with LTP

<u>Category A Condition</u>

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

<u>Category B Conditions</u>

No thermal criteria violations or voltage criteria violations were observed under Category B conditions.

6.1.2.2. Scenario 12 – 2020 WP High SOK Post-Project with LTP

<u>Category A Condition</u>

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

<u>Category B Conditions</u>

No thermal or voltage criteria violations were observed under Category B conditions.

6.1.2.3. Scenario 13 – 2020 SP High SOK Post-Project with LTP

<u>Category A Condition</u>

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

<u>Category B Conditions</u>

No thermal or voltage criteria violations were observed under Category B conditions.

6.1.2.4. Scenario 14 – 2020 WP Low SOK Post-Project with LTP

Category A Condition

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

Category B Conditions

No thermal or voltage criteria violations were observed under Category B conditions.

6.1.2.5. Scenario 15 – 2020 SP Low SOK Post-Project with LTP

Category A Condition

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

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions, as shown in Table 6.1-6.

Table 6.1-6: Thermal Criteria Violations for the 2020 SP Low SOK Post-Project with LTP Scenario Under Category B

Contingency	Limiting Branch	Seasonal Continuous Line Rating (MVA)	Short-term Emergency Rating (MVA)	Pre- Project		Post- Project with LTP	
				Power flow (MVA)	% Loading	Power flow (MVA)	% Loading
997L (Lamoureux 71S - Josephburg 410S)	706L (Josephburg 410S - 706AL Tap)	119	131	22.3	18	125.65	103
	706L (Fort Saskatchewan 54S - 706AL Tap)	119	131	22.1	18	125.36	103

No voltage criteria violations were observed under Category B conditions.

6.2. Transient Stability

Transient stability studies were completed for the Post-Project Baseline scenarios (Scenarios 6, 7, 8, 9 and 10). The results did not indicate any transient stability concerns, and the system showed acceptable dynamic response to all Category B conditions studied. Transient stability plots are provided in Attachment D.

Table 6.2-1: Summary of Transient Stability Results Under Category B Conditions

Contingency	Fault Description (fault location)	Results
997L (Josephburg 410S - Lamoureux 71S)	3-phase fault at Josephburg 410S	Stable
997L (Josephburg 410S - Lamoureux 71S)	3-phase fault at Lamoureux 71S	Stable
1120L (Josephburg 410S - Amelia 108S)	3-phase fault at Josephburg 410S	Stable
1120L (Josephburg 410S - Amelia 108S)	3-phase fault at Amelia 108S	Stable
856L (Josephburg 410S - Shell Scotford 409S)	3-phase fault at Josephburg 410S	Stable

Contingency	Fault Description (fault location)	Results
856L (Josephburg 410S - Shell Scotford 409S)	3-phase fault at Shell Scotford 409S	Stable
857L (Josephburg 410S - Shell Scotford 409S)	3-phase fault at Josephburg 410S	Stable
857L (Josephburg 410S - Shell Scotford 409S)	3-phase fault at Shell Scotford 409S	Stable
706L (Josephburg 410S - Fort Saskatchewan 54S)	3-phase fault at Josephburg 410S	Stable
706L (Josephburg 410S - Fort Saskatchewan 54S)	3-phase fault at Fort Saskatchewan 54S	Stable
776L (Josephburg - Beaverhill Creek 308S)	3-phase fault at Josephburg 410S	Stable
776L (Josephburg - Beaverhill Creek 308S)	3-phase fault at Beaverhill Creek 308S	Stable

7. Short-Circuit Analysis

Short circuit analysis was performed using the 2020 WP pre-Project and post-Project High SOK scenarios and the 2026 WP scenario to determine the expected system short circuit levels[13] in the vicinity of the Project. Single phase and three phase fault currents were calculated at the approved Lamont 400S substation and other substations in electric proximity to the Project.

7.1. Pre-Project

Short-circuit studies were performed to determine fault levels under the 2020 WP High SOK Pre-Project scenario. 2020 WP High SOK Pre-Project short-circuit levels are provided in Table 7.1-1.

Table 7.1-1: Short-Circuit Current Levels for the 2020 WP High SOK Pre-Project Scenario

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage	Pre-Fault Voltage (pu)	3-Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	1-Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
North Calder 37S	138	143.56	1.04	15.7	1.18+5.20j	0.006+0.027j	13.1	1.09+8.45j	0.006+0.044j
Scotford 409S	138	141.72	1.03	25.2	0.63+3.22j	0.003+0.017j	23	0.57+4.21j	0.003+0.022j
Riverside 388S	138	141.38	1.02	17.6	1.05+4.56j	0.006+0.024j	14.1	1.49+8.13j	0.008+0.043j
Lamoureux 71S	240	250.55	1.04	20.6	1.32+6.98j	0.002+0.012j	17.8	1.64+10.50j	0.003+0.018j
Fort Saskatchewan 54S	138	142.06	1.03	24.5	0.85+3.28j	0.004+0.017j	20.7	1.01+5.17j	0.005+0.027j
Beamer 233S	138	141.14	1.02	20.3	0.94+3.95j	0.005+0.021j	16.1	1.40+7.13j	0.007+0.037j
Sherritt 172S	138	142.18	1.03	24.1	0.83+3.34j	0.004+0.018j	20.2	1.02+5.40j	0.005+0.028j
Lamoureux 71S	138	142.6	1.03	28.4	0.59+2.88j	0.003+0.015j	26.2	0.51+3.65j	0.003+0.019j
Deerland 13S	138	143.3	1.04	13	1.21+6.35j	0.006+0.033j	14.5	0.29+4.41j	0.002+0.023j
Deerland 13S	240	252.95	1.05	14.6	1.56+10.02j	0.003+0.017j	12.9	1.68+14.12j	0.003+0.025j
Josephburg 410S	240	249.93	1.04	17.5	1.42+8.25j	0.002+0.014j	15	1.90+12.35j	0.003+0.021j
Josephburg 410S	138	141.99	1.03	26.4	0.60+3.09j	0.003+0.016j	24.1	0.58+4.03j	0.003+0.021j
Albchem 308S	138	142.66	1.03	11.3	1.60+7.18j	0.008+0.038j	8.9	2.68+13.06j	0.014+0.069j
Dow Hydro 258S	138	142.37	1.03	21.6	0.83+3.75j	0.004+0.020j	18.3	1.10+5.85j	0.006+0.031j
Shell 402S	138	141.55	1.03	24.3	0.67+3.34j	0.003+0.018j	21.6	0.70+4.62j	0.004+0.024j

[13] 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.

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage	Pre-Fault Voltage (pu)	3-Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	1-Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
Amelia 108S	240	251.02	1.05	14.5	1.54+10.00j	0.003+0.017j	11.6	2.82+17.68j	0.005+0.031j

7.2. Post-Project

The 2020 WP High SOK Post-Project and 2026 WP Post-Project scenario short-circuit levels are provided in Table 7.2-1 and Table 7.2-2.

Post-Project short-circuit fault levels are not significantly higher than pre-Project levels. The long term (2026 WP Post-Project scenario) short circuit levels were found to be within the designed capabilities of the nearby facilities.

Table 7.2-1: Short-Circuit Current Levels for the 2020 WP High SOK Post-Project Scenario

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage	Pre-Fault Voltage (pu)	3-Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	1-Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
North Calder 37S	138	143.47	1.04	16	1.14+5.14j	0.006+0.027j	13.3	1.09+8.41j	0.006+0.044j
Scotford 409S	138	141.68	1.03	27.1	0.54+3.02j	0.003+0.016j	25.4	0.44+3.69j	0.002+0.019j
Riverside 388S	138	141.31	1.02	18.4	0.98+4.40j	0.005+0.023j	14.6	1.45+7.89j	0.008+0.041j
Lamoureux 71S	240	250.07	1.04	22.8	1.10+6.38j	0.002+0.011j	19.8	1.47+9.29j	0.003+0.016j
Fort Saskatchewan 54S	138	141.87	1.03	25.7	0.79+3.15j	0.004+0.017j	21.7	0.97+4.96j	0.005+0.026j
Beamer 233S	138	141.12	1.02	21.4	0.86+3.78j	0.005+0.020j	16.9	1.34+6.82j	0.007+0.036j
Sherritt 172S	138	141.97	1.03	25.3	0.77+3.20j	0.004+0.017j	21.1	0.98+5.18j	0.005+0.027j
Lamoureux 71S	138	142.39	1.03	30	0.53+2.74j	0.003+0.014j	27.9	0.47+3.41j	0.002+0.018j
Deerland 13S	138	143.88	1.04	13.5	1.14+6.19j	0.006+0.032j	15	0.28+4.33j	0.001+0.023j
Deerland 13S	240	252.22	1.05	15.6	1.35+9.42j	0.002+0.016j	13.8	1.55+13.18j	0.003+0.023j
Josephburg 410S	240	249	1.04	20.4	1.07+7.10j	0.002+0.012j	18.9	1.11+8.81j	0.002+0.015j
Josephburg 410S	138	141.94	1.03	28.6	0.51+2.87j	0.003+0.015j	27.1	0.40+3.38j	0.002+0.018j
Albchem 308S	138	143.03	1.04	11.7	1.53+7.00j	0.008+0.037j	9.2	2.64+12.85j	0.014+0.067j
Dow Hydro 258S	138	142.17	1.03	22.6	0.78+3.62j	0.004+0.019j	19.1	1.08+5.67j	0.006+0.030j
Shell 402S	138	141.53	1.03	26	0.58+3.15j	0.003+0.017j	23.5	0.60+4.18j	0.003+0.022j
Amelia 108S	240	250.17	1.04	16.1	1.24+9.07j	0.002+0.016j	13.1	2.35+15.26j	0.004+0.027j
Lamont 400S	240	248.64	1.04	17.2	1.10+8.42j	0.002+0.015j	15.9	1.14+10.51j	0.002+0.018j

Table 7.2-2: Short-Circuit Current Levels for the 2026 WP Post-Project Scenario

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage	Pre-Fault Voltage (pu)	3-Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	1-Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
North Calder 37S	138	142.4	1.03	16.1	1.11+5.01j	0.006+0.026j	13.3	1.09+8.35j	0.006+0.044j
Scotford 409S	138	140.94	1.02	30.5	0.44+2.65j	0.002+0.014j	28.3	0.37+3.29j	0.002+0.017j
Riverside 388S	138	140.53	1.02	19.4	0.91+4.10j	0.005+0.022j	15	1.43+7.74j	0.008+0.041j
Lamoureux 71S	240	248.78	1.04	26.2	0.84+5.45j	0.001+0.009j	22.9	1.18+7.80j	0.002+0.014j
Fort Saskatchewan 54S	138	141.22	1.02	27.1	0.74+2.93j	0.004+0.015j	22.5	0.94+4.79j	0.005+0.025j
Beamer 233S	138	140.28	1.02	23.1	0.78+3.43j	0.004+0.018j	17.7	1.31+6.60j	0.007+0.035j
Sherritt 172S	138	141.34	1.02	26.7	0.71+2.99j	0.004+0.016j	21.9	0.94+5.00j	0.005+0.026j
Lamoureux 71S	138	141.76	1.03	32.1	0.47+2.52j	0.002+0.013j	29.6	0.41+3.19j	0.002+0.017j
Deerland 13S	138	142.46	1.03	17.8	0.66+4.60j	0.003+0.024j	18.3	0.28+4.27j	0.001+0.022j
Deerland 13S	240	250.3	1.04	17.3	1.02+8.32j	0.002+0.014j	14.8	1.48+12.59j	0.003+0.022j
Josephburg 410S	240	248.01	1.03	27.3	0.74+5.23j	0.001+0.009j	26.3	0.62+5.83j	0.001+0.010j
Josephburg 410S	138	141.19	1.02	32.5	0.41+2.48j	0.002+0.013j	31	0.28+2.88j	0.001+0.015j
Albchem 308S	138	141.8	1.03	13.5	1.23+5.96j	0.006+0.031j	9.8	2.62+12.70j	0.014+0.067j
Dow Hydro 258S	138	141.56	1.03	23.6	0.72+3.41j	0.004+0.018j	19.6	1.05+5.50j	0.005+0.029j
Shell 402S	138	140.77	1.02	28.9	0.49+2.78j	0.003+0.015j	25.7	0.54+3.84j	0.003+0.020j
Amelia 108S	240	248.83	1.04	18.9	0.92+7.60j	0.002+0.013j	14.9	2.11+13.61j	0.004+0.024j
Lamont 400S	240	247.95	1.03	21.3	0.80+6.69j	0.001+0.012j	19.5	0.94+8.53j	0.002+0.015j

8. Mitigation Measures

The Reliability Criteria violations observed during the connection assessment studies are summarized in Table 8.1-1.

Under certain Category B conditions, Reliability Criteria violations were observed in the pre-Project, post-Project baseline, and post-Project with LTP scenarios. The observed Reliability Criteria violations consist of thermal criteria violations above the seasonal continuous ratings and/or the short-term emergency ratings of the 138 kV transmission lines in the Study Area.

Thermal loading above the short-term emergency rating of the 138 kV transmission lines 898L and 792L can be mitigated by reconfiguring the 138 kV system to open the path between the North Calder 37S and Clyde 150S substations until the capacity of 898L and 792L is increased as part of the 2015 LTP. Prior to the planned system reinforcements, temporary mitigation measures, operating procedures and/or Remedial Action Schemes (RAS) may be required. The AESO will continue to monitor the flows in the region and, if necessary, modify these mitigation measures as system and customer connection projects proceed through the AESO connection process.

All other observed thermal loadings that exceed the seasonal continuous transmission line rating, but that are less than the short-term emergency rating of the transmission line, can be managed by real-time operational practices.

Table 8.1-1: Thermal Criteria Violations and Mitigation Measures for Pre-Project, Post-Project Baseline and Post-Project with LTP Scenarios under Certain Category B Conditions

Reliability Criteria Violations		Scenario	Pre-Project		Post-Project Baseline		Post-Project with LTP	
Violation	Contingency		Thermal Violation Type	Mitigation Measures	Violation Type	Mitigation Measures	Violation Type	Mitigation Measures
898L (North Calder 37S - Viscount 92S)	1046L (Sundance Plant 310P - Cherhill 338S)	2020 SL High SOK 2020 WP High SOK	Above emergency	Reconfigure 138kV system to open the path between North Calder 37S and Clyde 150S until 898L and 792L capacity is increased as part of the near-term LTP.	Above emergency	Reconfigure 138kV system to open the path between North Calder 37S and Clyde 150S until 898L and 792L capacity is increased as part of the near-term LTP.	Not applicable	None required
		2020 WP Low SOK	Above seasonal continuous	Real-time operational practices	Above emergency			
		2020 SP High SOK 2020 SP Low SOK	Above seasonal continuous		Above seasonal continuous	Real-time operational practices		
	913L (North Barrhead 69S - Cherhill 338S)	2020 SL High SOK 2020 WP High SOK	Above seasonal continuous		Above emergency	Reconfigure 138kV system to open the path between North Calder 37S and Clyde 150S until 898L and 792L capacity is increased as part of the near-term LTP.		
		2020 WP Low SOK 2020 SP Low SOK			Above seasonal continuous	Real-time operational practices		
		2020 SP High SOK	Not applicable	None required	Above seasonal continuous			
	69ST4 (North Barrhead 69S Transformer)	2020 WP High SOK	Above seasonal continuous	Real-time operational practices	Above seasonal continuous			
792L (N.W. Cardiff191S - Viscount 92S)	1046L (Sundance Plant 310P - Cherhill 338S)	2020 SL High SOK	Above seasonal continuous		Above seasonal continuous			
	913L (North Barrhead 69S - Cherhill 338S)		Not applicable	None required	Above seasonal continuous			
677L (Acheson 305S - Spruce Grove 595S)	37ST6 (North Calder 37S Transformer)	2020 SP Low SOK	Above seasonal continuous	Real-time operational practices	Above seasonal continuous			
		2020 WP Low SOK			Not applicable	None required		
		2020 SP High SOK						
	1139L (Harry Smith 367S - Petrolia)	2020 SP Low SOK						
706L (Josephburg 410S - 706AL Tap)	997L (Lamoureux 71S - Josephburg 410S)	2020 WP Low SOK	Not applicable	None required	Above seasonal continuous	Real-time operational practices		
		2020 SP Low SOK					Above seasonal continuous	Real-time operational practices
706L (Fort Saskatchewan 54S - 706AL Tap)		2020 SP Low SOK						

9. Project Dependencies

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

10. Conclusion and Recommendations

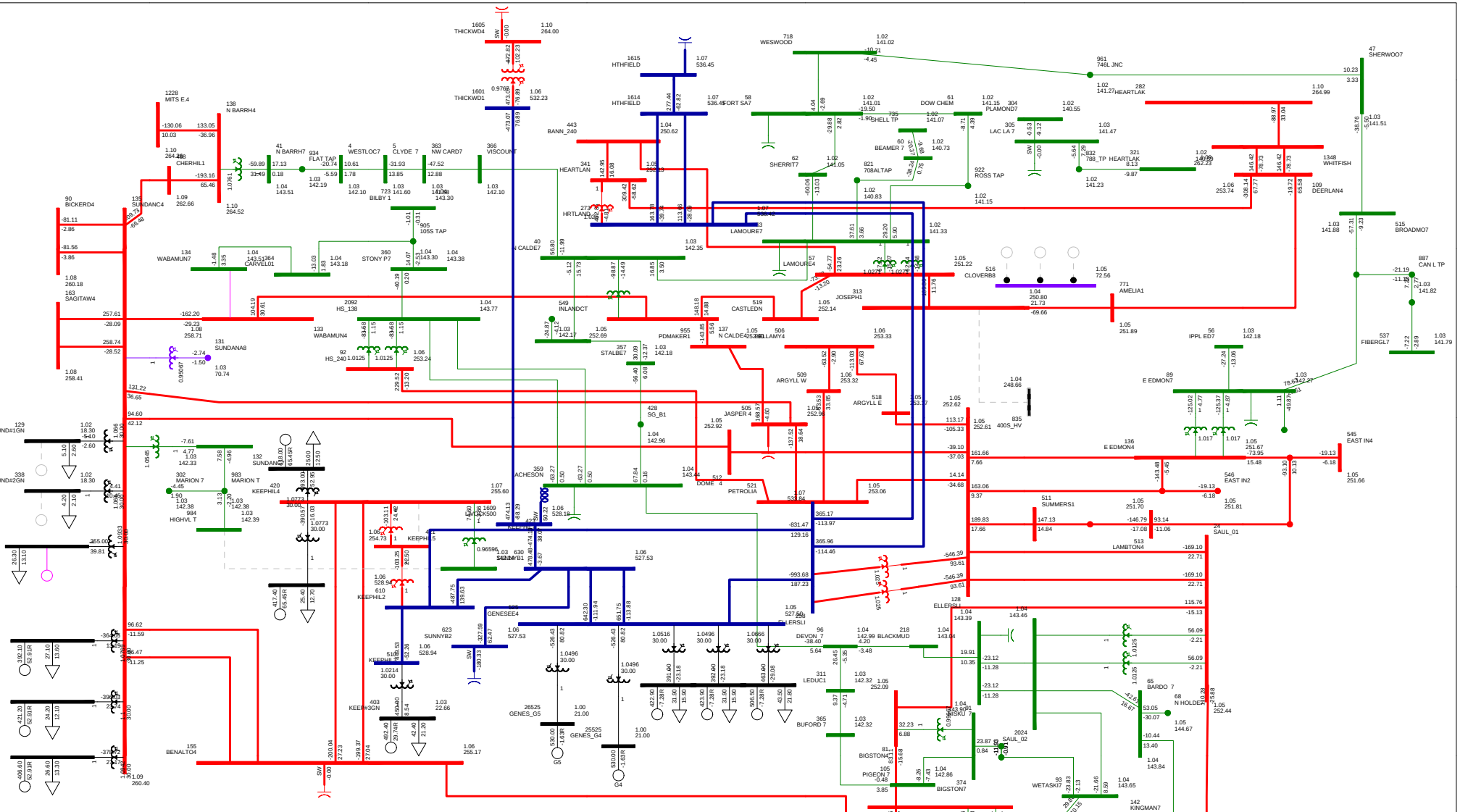
The connection assessment identified a number of pre-Project and post-Project system performance issues under certain Category B conditions. These are summarized in Table E-2 along with the associated mitigation measures. The identified thermal criteria violations will be resolved by planned system reinforcements identified in 2015 LTP. Until such time as those reinforcements are in place, the AESO will establish the mitigation measures identified in Table E-2, as required.

Based on the study results, Alternative 3 is technically acceptable. The new 1181L 240 kV transmission line which connects Lamont 400S to Josephburg 410S should be capable of accommodating the generation of 600 MVA (365 MVA Gas Unit and 235 MVA Steam Unit).

It is recommended to proceed with the Project using Alternative 3 as the preferred option to respond to the market participant's request for system access service.

Attachment A

Pre-Project Power Flow Diagrams (Scenarios 1 to 5)



SCENARIO 1 2019SL HIGH SOK (PRE CONNECTION)
BASE CASE
FIG A-1
THU, APR 20 2017 8:58

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(MW/Mvar/MVA)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 536.26 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

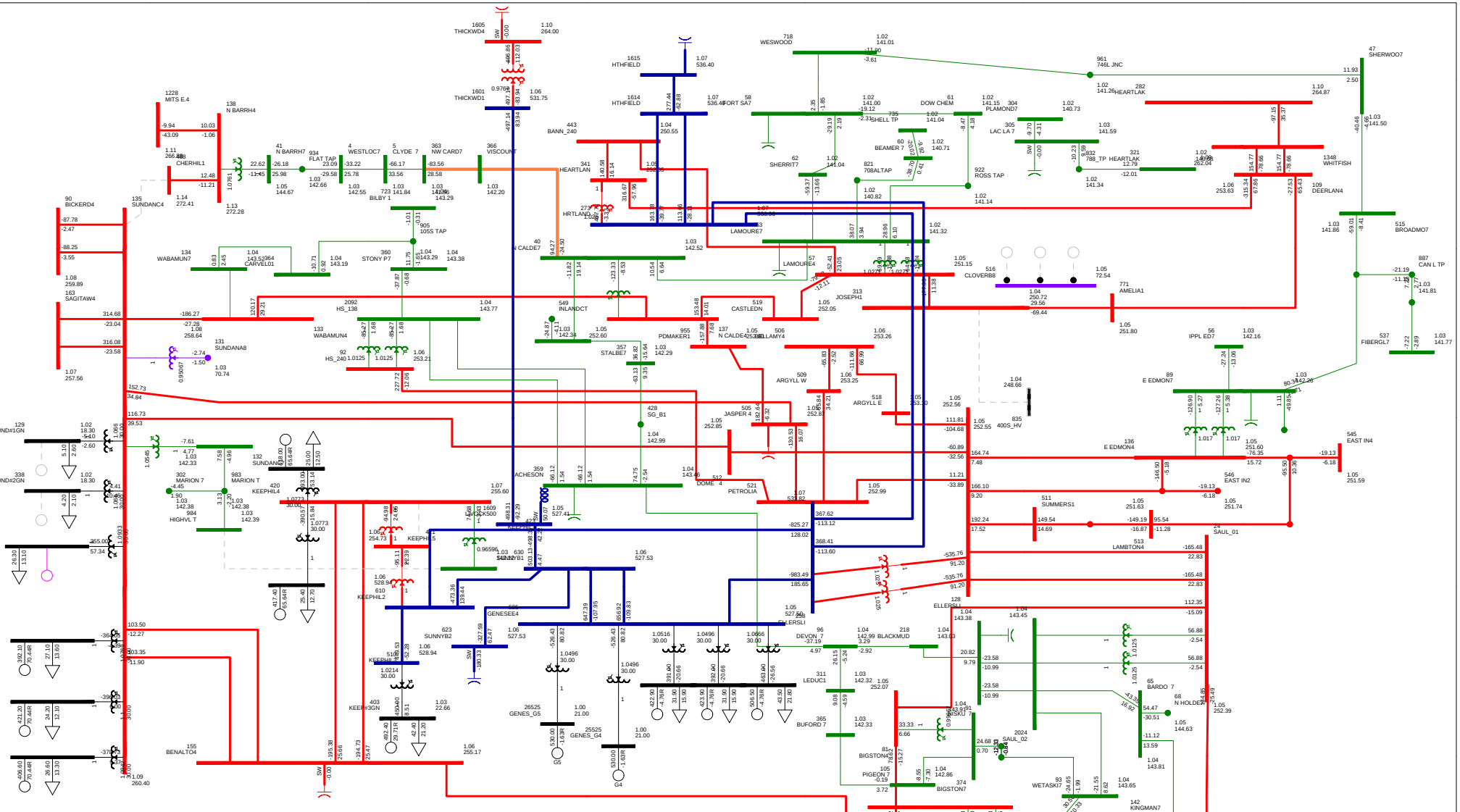
WATL: 320.14 MW
EATL: 270.32 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2413.30 MW

SOK Cutplane	906.95 MW	+ (0.35) x67.43 MW
KEG Cutplane	2315.55 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 1 2019SL HIGH SOK (PRE CONNECTION)
1046L
FIG A-2
THU, APR 20 2017 8:58

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(MW,Mvar,pu)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 548.42 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

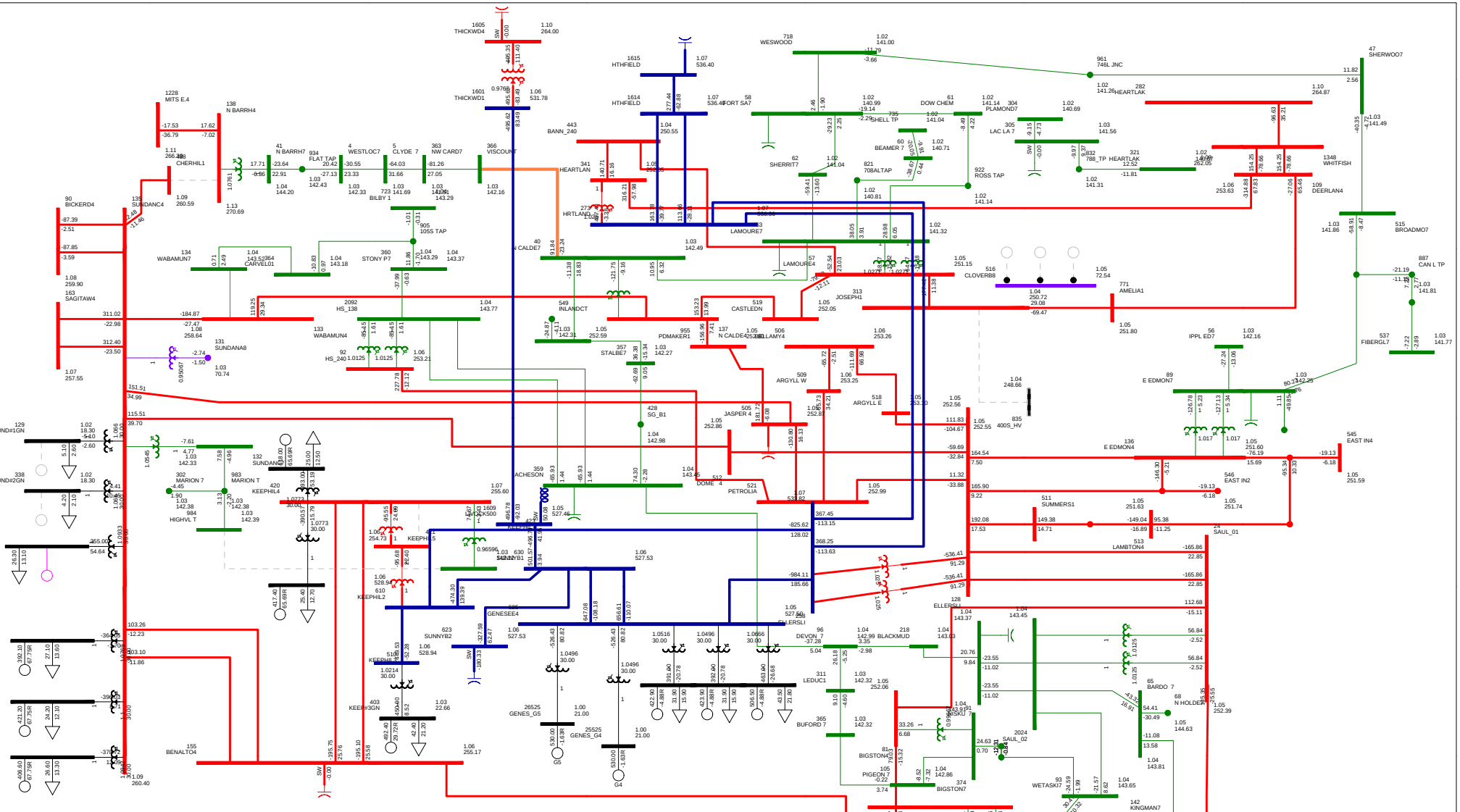
WATL: 320.14 MW
EATL: 270.32 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2413.30 MW

SOK Cutplane	901.99 MW	+ (0.35) x68.65 MW
KEG Cutplane	2289.32 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 1 2019SL HIGH SOK (PRE CONNECTION)
913L
FIG A-3
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(MW/Mvar/MVA)
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 546.75 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

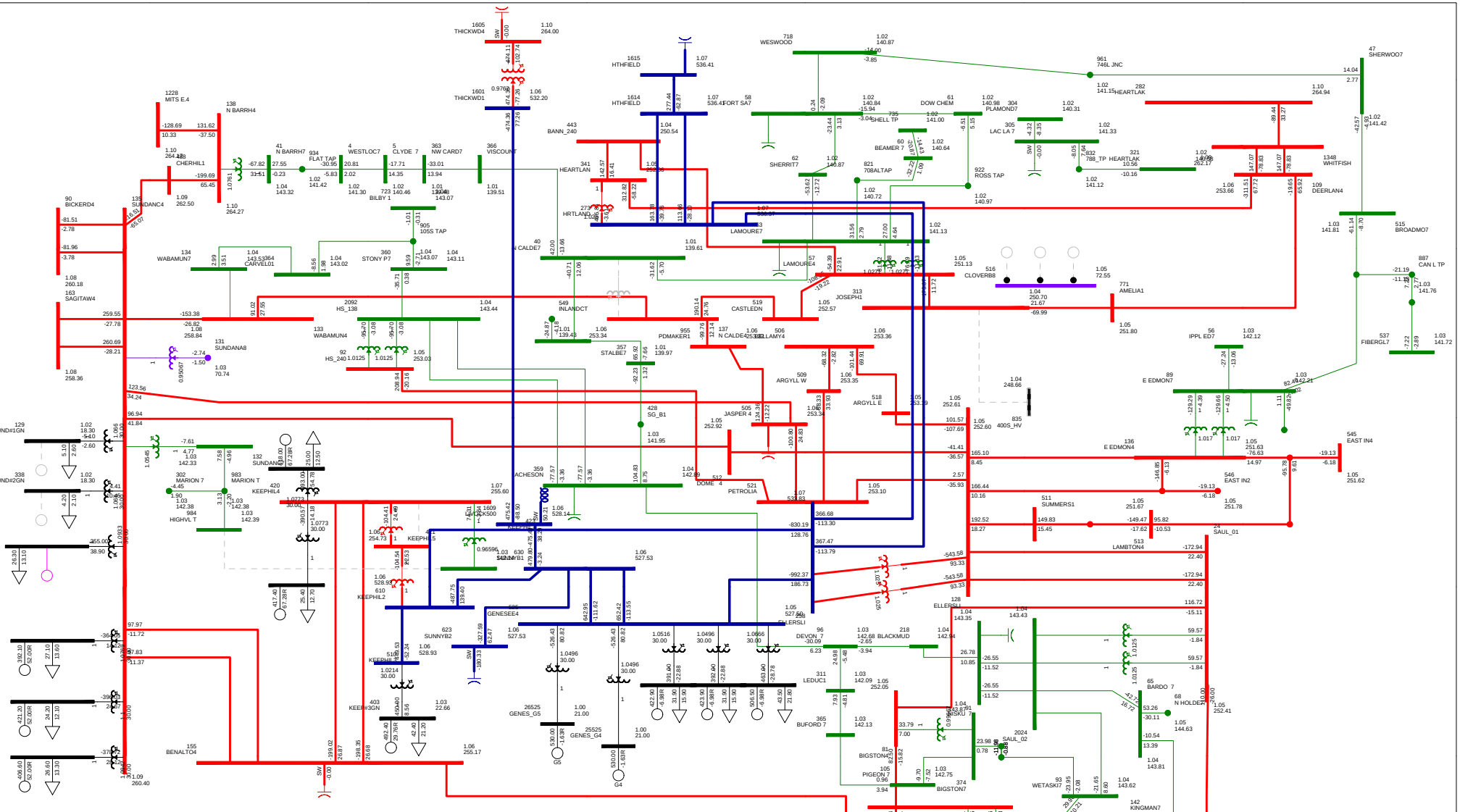
WATL: 320.14 MW
EATL: 270.32 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2413.30 MW

SOK Cutplane	903.19 MW	+ (0.35) x68.63 MW
KEG Cutplane	2291.06 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 1 2019SL HIGH SOK (PRE CONNECTION)
37ST6
FIG A-4
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(MW/Mvar/%)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 537.58 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

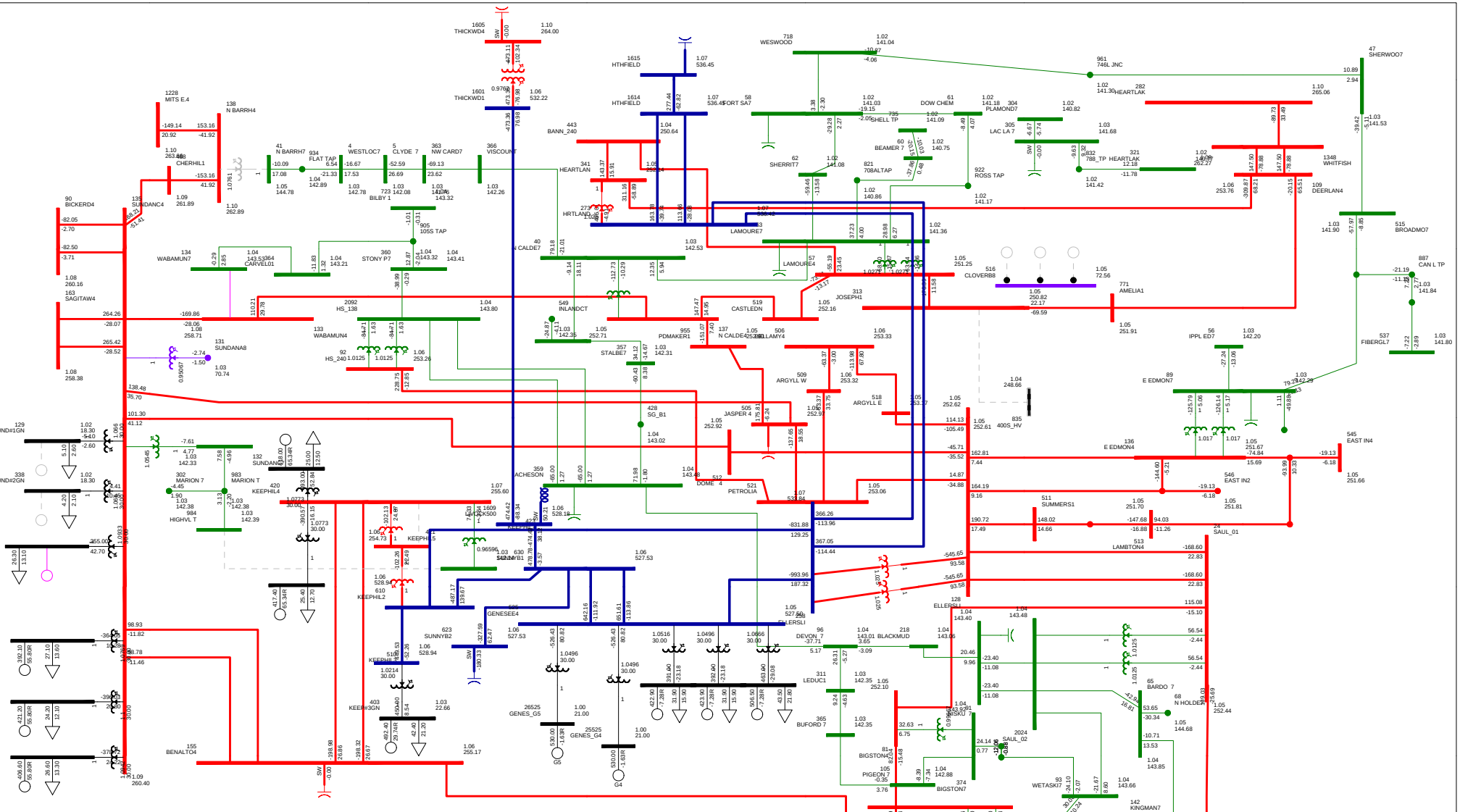
WATL: 320.14 MW

EATL: 270.32 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2413.30 MW

SOK Cutplane	915.25 MW	+ (0.35) x67.88 MW	Max: 2,050MW
KEG Cutplane	2310.49 MW		2,520MW (SOK <= 1,805MW) 2,450MW (SOK > 1,805MW)



SCENARIO 1 2019SL HIGH SOK (PRE CONNECTION)
69ST4
FIG A-5
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(MW,Mvar,Amp)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 537.44 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

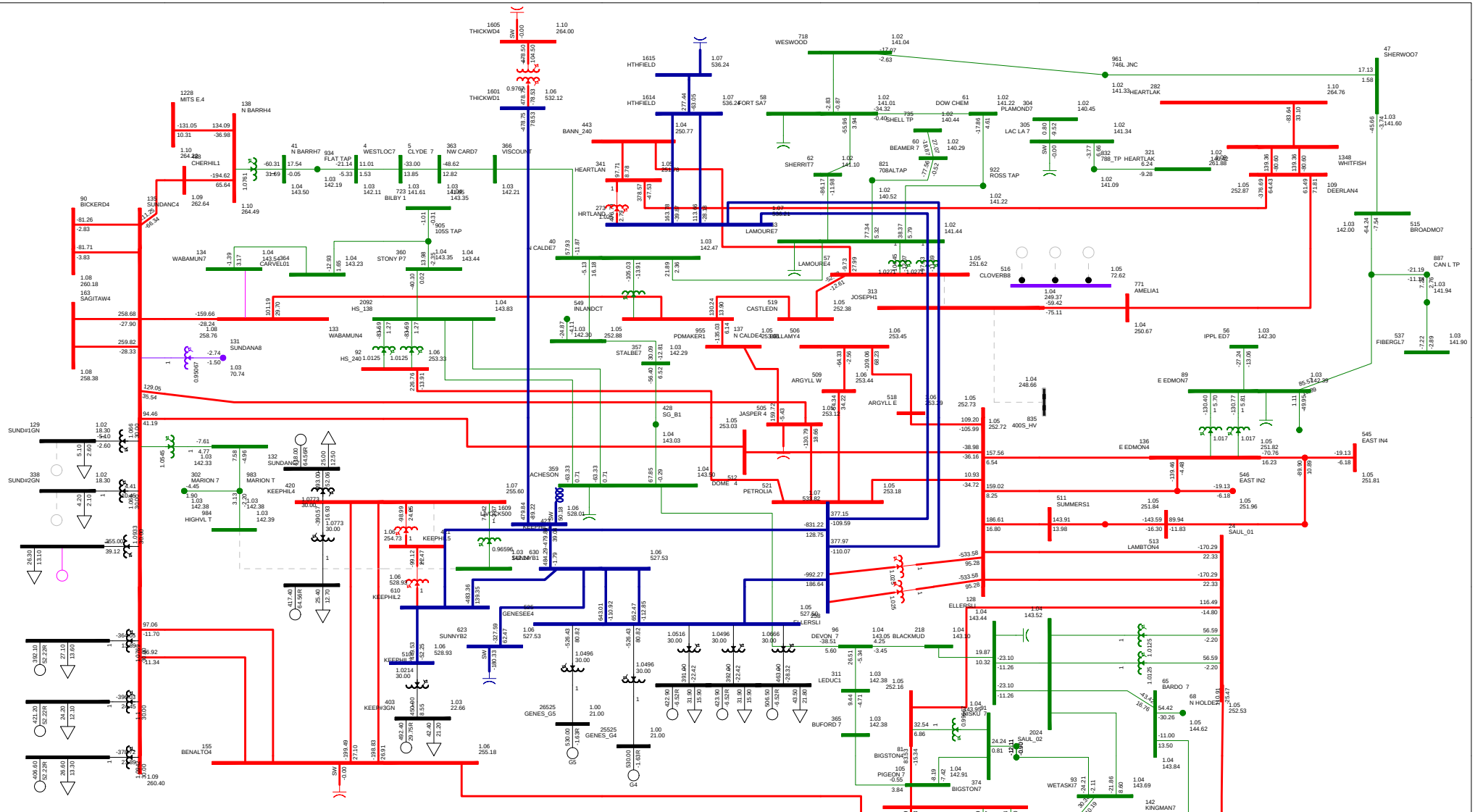
WATL: 320.14 MW
EATL: 270.32 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2413.30 MW

SOK Cutplane	908.36 MW	+ (0.35) x67.98 MW
KEG Cutplane	2313.74 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 1 2019SL HIGH SOK (PRE CONNECTION)
997L
FIG A-6
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(MW/Mvar)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 537.76 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

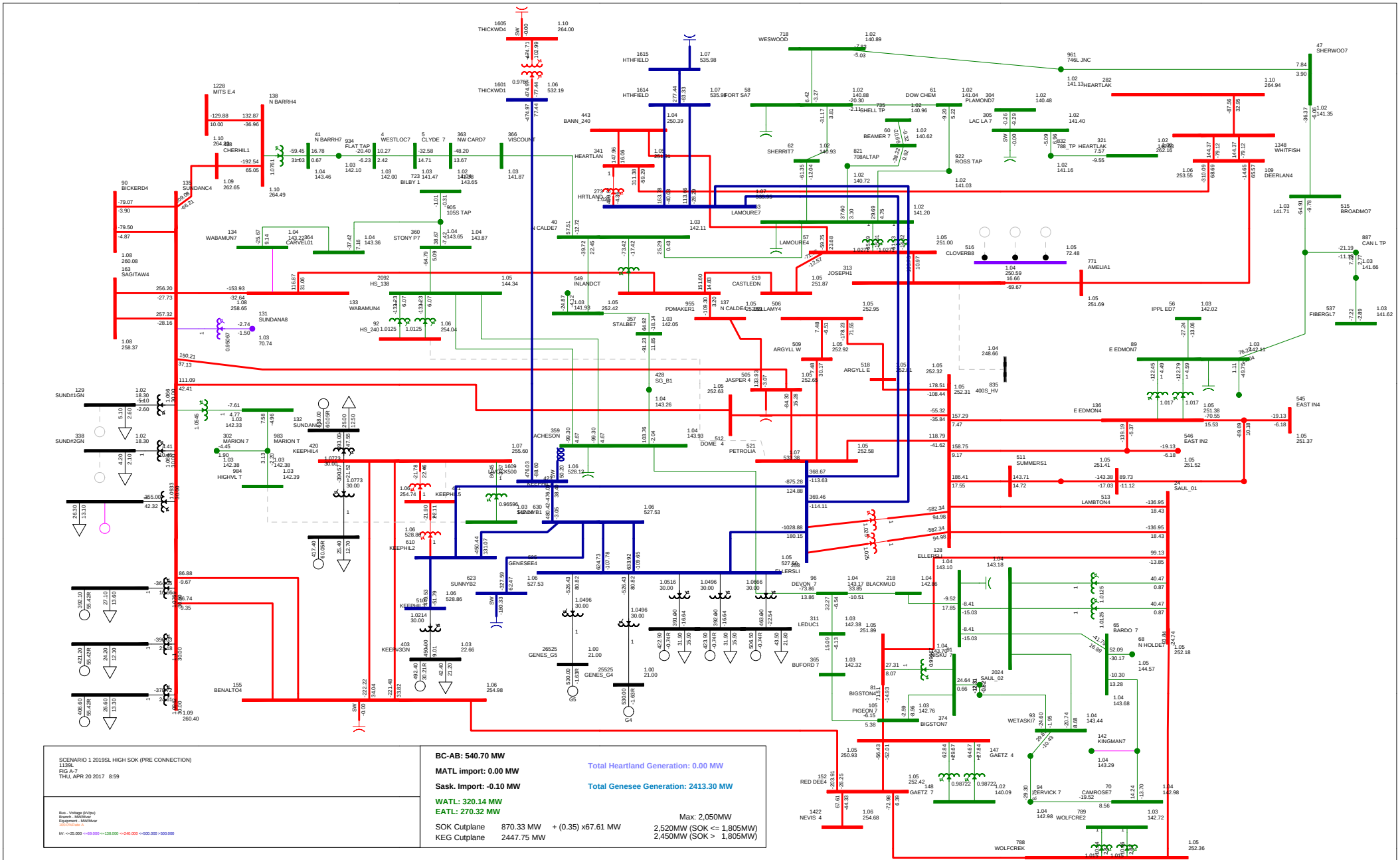
WATL: 320.14 MW
EATL: 270.32 MW

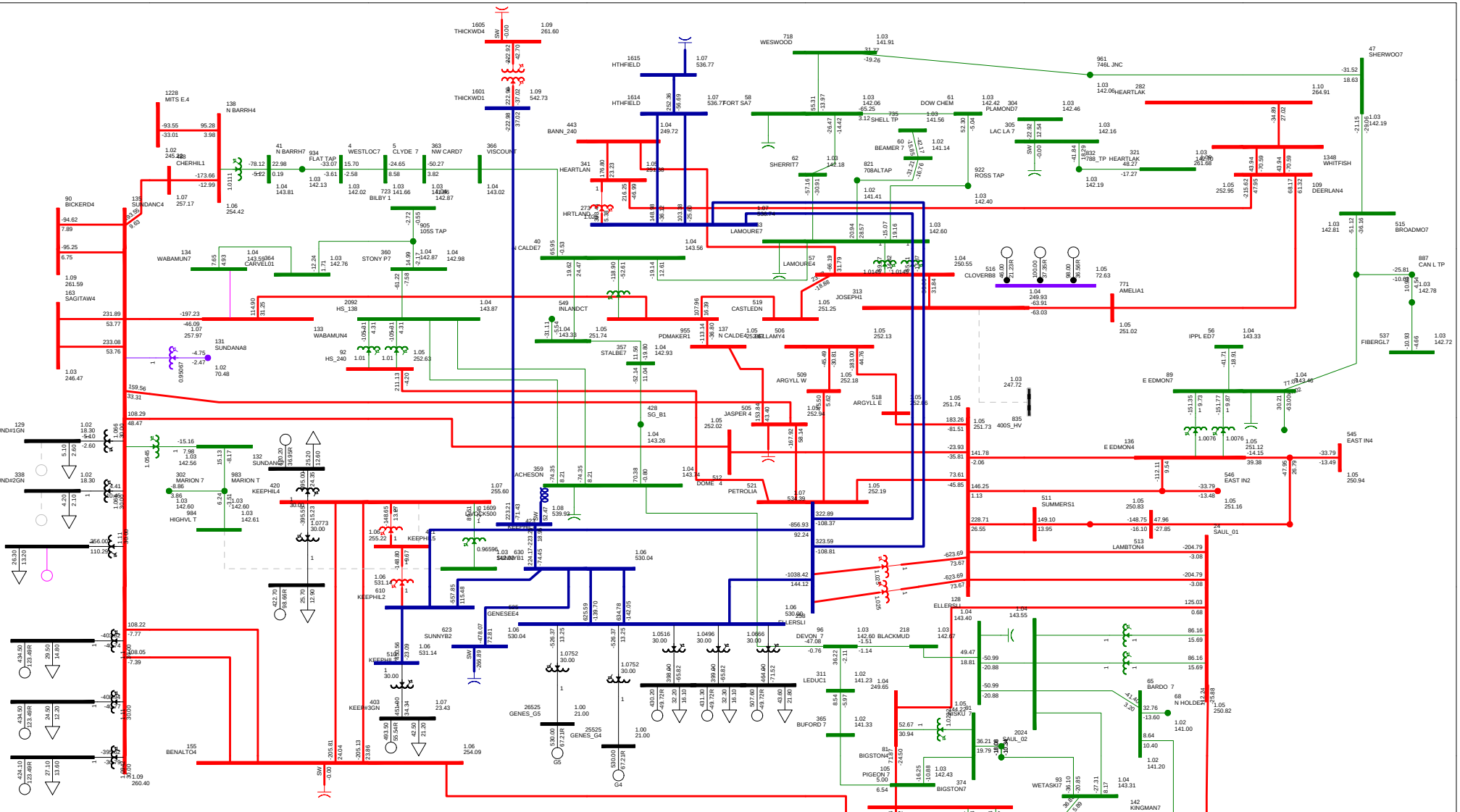
Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2413.30 MW

SOK Cutplane	909.11 MW	+ (0.35) x68.64 MW
KEG Cutplane	2312.53 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)


SCENARIO 1 2019SL HIGH SOK (PRE CONNECTION)
1139L
FIG A-7
THU, APR 20 2017 8:59
BC-AB: 540.70 MW
MATL import: 0.00 MW
Sask. Import: -0.10 MW
WATL: 320.14 MW
EATL: 270.32 MW
Total Heartland Generation: 0.00 MW
Total Genesee Generation: 2413.30 MW
SOK Cutplane 870.33 MW + (0.35) x67.61 MW
KEG Cutplane 2447.75 MW
Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



SCENARIO 2 2021 WP HIGH SOK (PRE CONNECTION)
BASE CASE
FIG A-8
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0 Base (MVA)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 348.72 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 467.19 MW

EATL: 245.69 MW

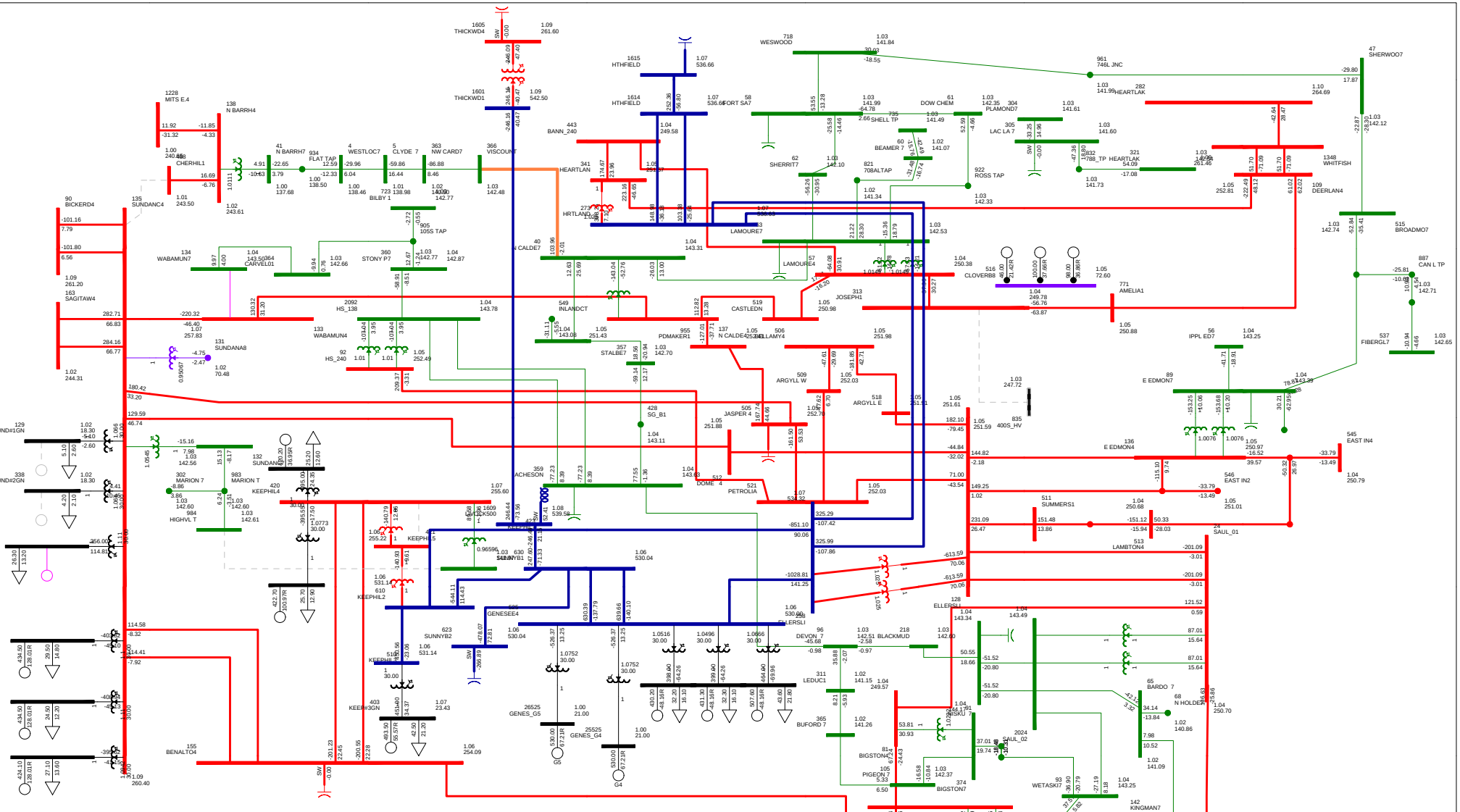
Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2429.10 MW

SOK Cutplane 1029.34 MW + (0.35) x-39.82 MW

KEG Cutplane 2413.11 MW

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 2 2021 WP HIGH SOK (PRE CONNECTION)
1046L
FIG A-9
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(100,100 base)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 361.91 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

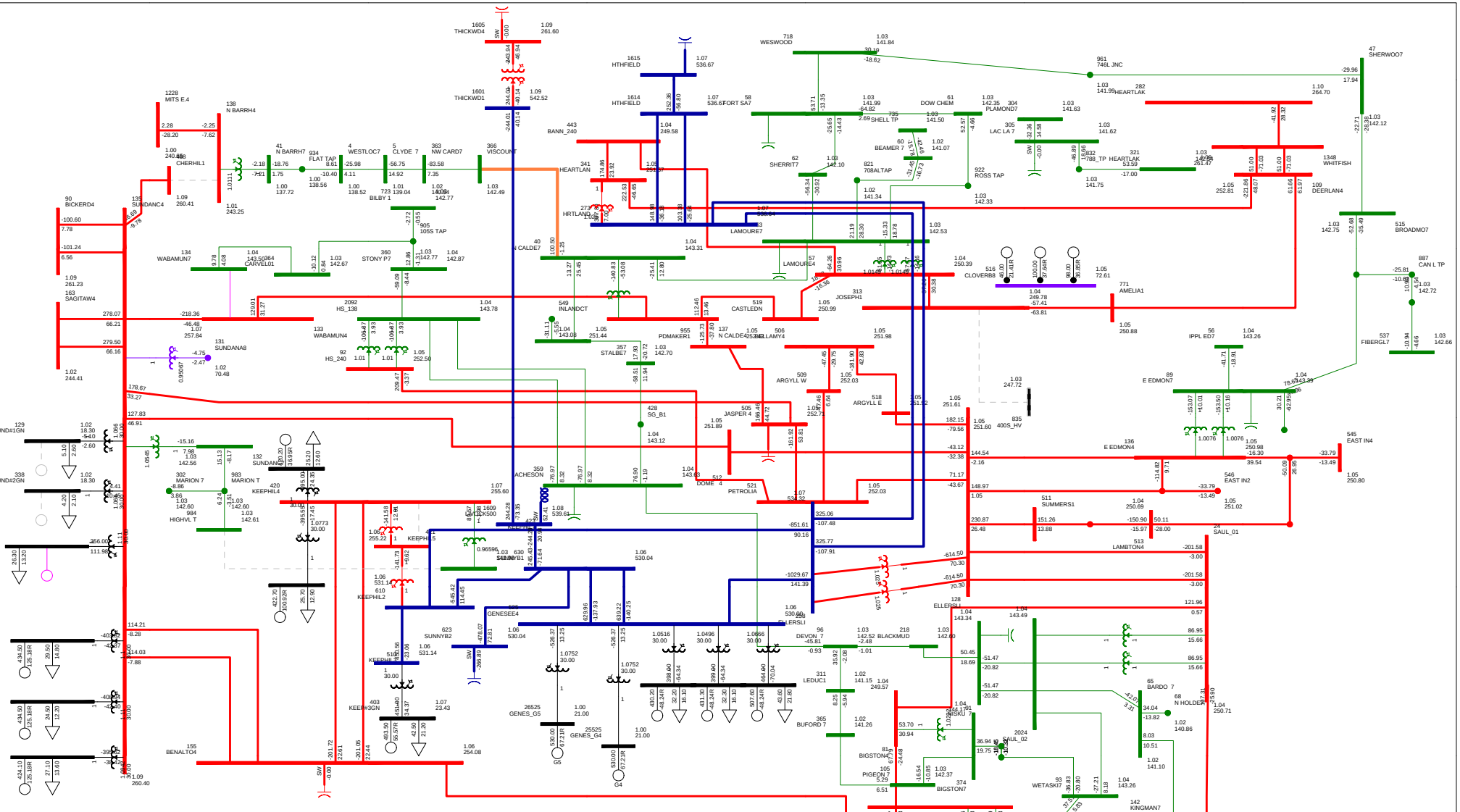
WATL: 467.19 MW
EATL: 245.69 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2429.10 MW

SOK Cutplane 1023.26 MW + (0.35) x-38.72 MW
KEG Cutplane 2387.96 MW

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 2 2021 WP HIGH SOK (PRE CONNECTION)
913L
FIG A-10
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(xx.xx) base kV

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 359.78 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

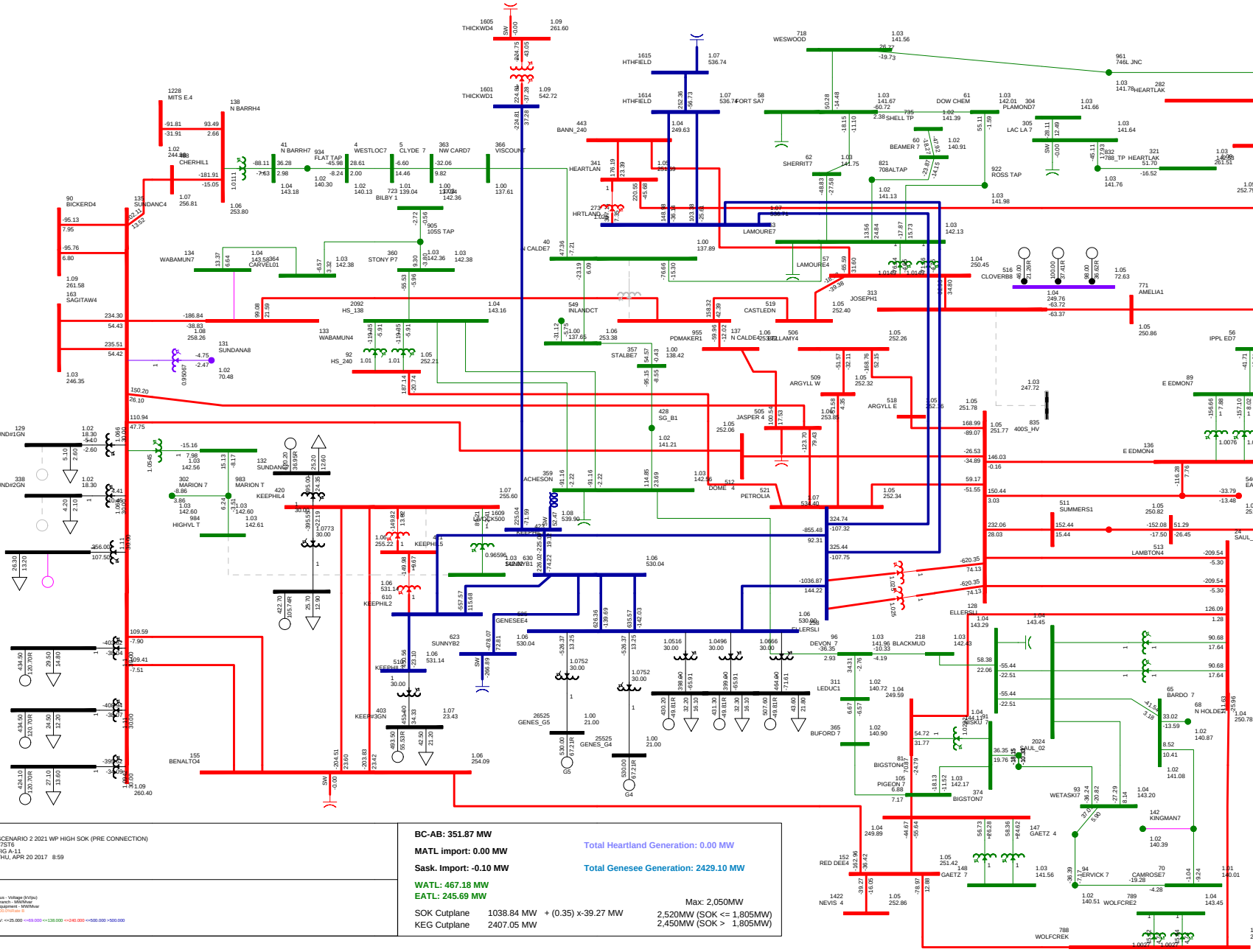
WATL: 467.19 MW
EATL: 245.69 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2429.10 MW

SOK Cutplane	1024.75 MW	+ (0.35) x-38.75 MW
KEG Cutplane	2390.38 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 2 2021 WP HIGH SOK (PRE CONNECTION)
37ST6
FIG A-11
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(xx.xx) Area #

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 351.87 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 467.18 MW

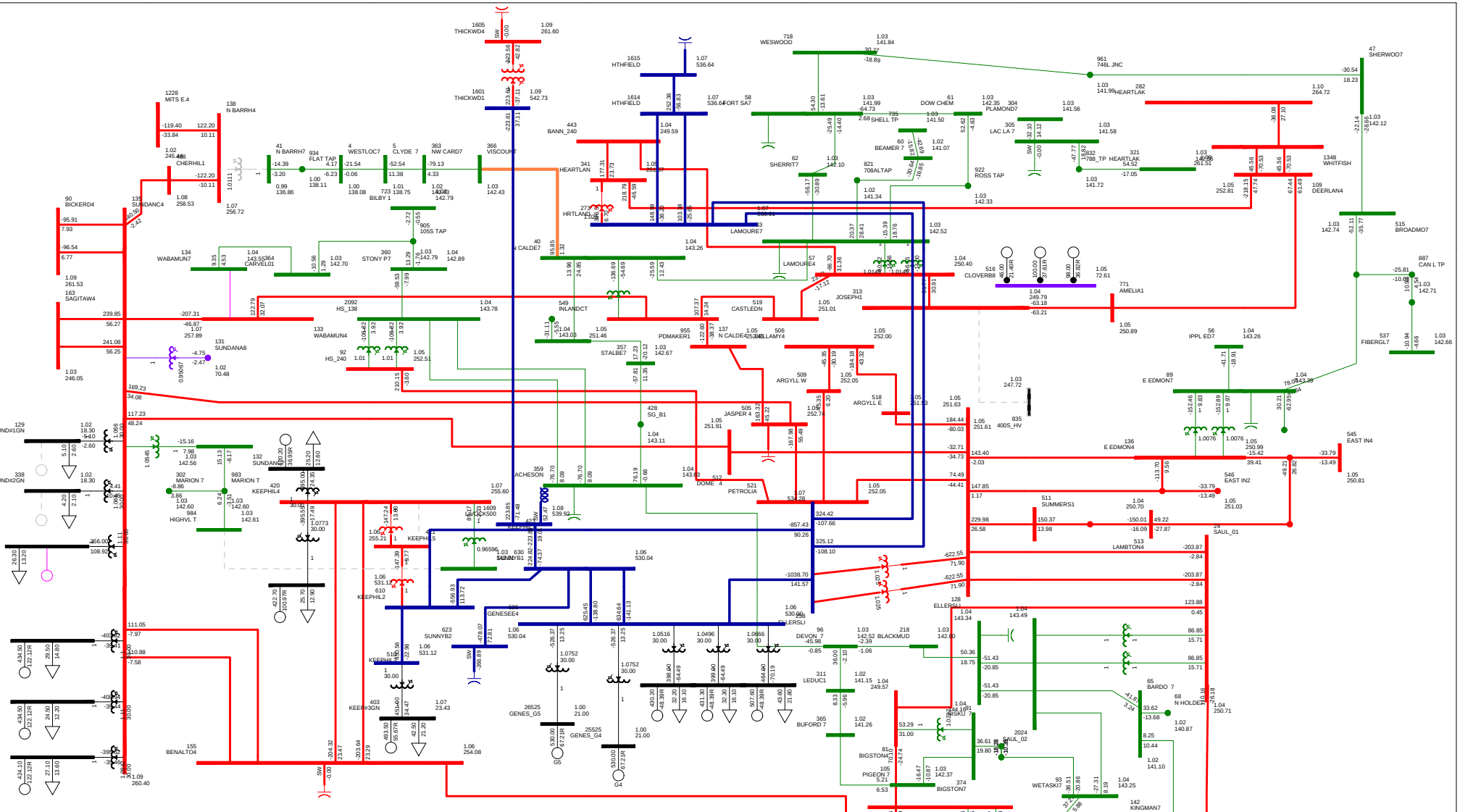
EATL: 245.69 MW

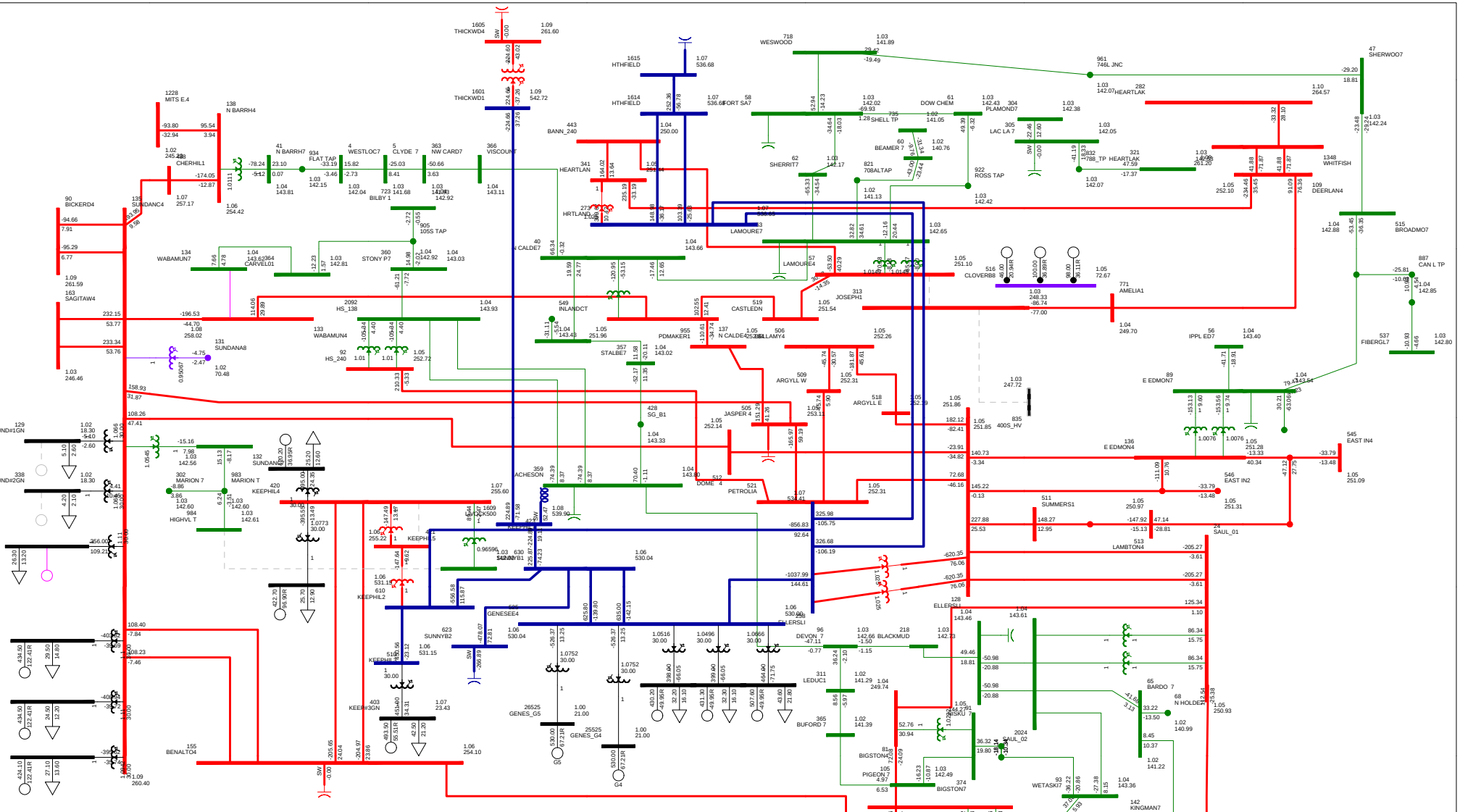
Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2429.10 MW

SOK Cutplane	1038.84 MW	+ (0.35) x-39.27 MW
KEG Cutplane	2407.05 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)


1605 THICKWD4
1601 THICKWD1
1615 HTHFIELD
1614 HTHFIELD
718 WESWOOD
961 746L JNC
47 SHERWOO7
282 HEARTLAK
1348 WHITFISH
109 DEERLAN4
515 BROADMO7
887 CAN L TP
537 FIBERGL7
1228 MITS E.4
138 N BARRH4
488 CHERHIL1
90 BICKERD4
135 SUNDANC4
163 SAGITAW4
134 WABAMUN7
905 105S TAP
360 STONY P7
2092 HS_138
133 WABAMUN4
131 SUNDANA8
92 HS_240
443 BANN_240
341 HEARTLAN
HRTLND
40 N CALDET
549 INLANDCT
955 PDMAKER1
357 STALBE7
428 SG_B1
359 LACHESON
1609 BLACK500
630 SUNNYB1
610 KEEPHIL2
623 SUNNYB2
510 KEEPHIL3
403 KEEP#3GN
155 BENALTO4
129 SUND#1GN
338 SUND#2GN
302 MARION 7
984 HIGHVT T
983 MARION T
420 KEEPHIL4
132 SUNDANA
41 N BARRH7
934 FLAT TAP
4 WESTLOC7
5 CLYDE 7
363 NW CARD7
366 VISCOUNT
BILBY 1
58 FORT SA7
62 SHERRIT7
821 708ALTAP
922 ROSS TAP
61 DOW CHEM
304 PLAMOND7
735 SHELL TP
60 BEAMER 7
305 LAC LA 7
832 788_TP
321 HEARTLAK
LAMOURE7
LAMOURE4
516 CLOVERB8
313 JOSEPH1
771 AMELIA1
519 CASTLEDN
137 N CALDER
506 BILLAMY4
509 ARGYLL W
518 ARGYLL E
505 JASPER 4
512 DOME 4
521 PETROLIA
835 400S_HV
56 IPPL ED7
89 E EDMON7
136 E EDMON4
545 EAST IN4
546 EAST IN2
511 SUMMERS1
513 LAMBTON4
24 SAUL_01
128 ELLERSL1
96 DEVON 7
218 BLACKMUD
311 LEDUC1
365 BUFORD 7
2024 SAUL_02
81 BIGSTON7
105 PIGEON 7
374 BIGSTON7
65 BARDO 7
68 N HOLDER
93 WETASKI7
142 KINGMAN7
147 GAETZ 4
148 GAETZ 7
94 VERVICK 7
70 CAMROSE7
789 WOLFCRE2
788 WOLFCREK
152 RED DEE4
1422 NEVIS 4
526 GENESEE4
26525 GENES_G5
25525 GENES_G4
G4
SCENARIO 2 2021 WP HIGH SOK (PRE CONNECTION)
69ST4
FIG A-12
THU, APR 20 2017 8:59
BC-AB: 352.16 MW
MATL import: 0.00 MW
Sask. Import: -0.10 MW
WATL: 467.19 MW
EATL: 245.69 MW
Total Heartland Generation: 0.00 MW
Total Genesee Generation: 2429.10 MW
SOK Cutplane 1029.94 MW + (0.35) x-39.06 MW
KEG Cutplane 2410.39 MW
Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



SCENARIO 2 2021 WP HIGH SOK (PRE CONNECTION)
997L
FIG A-13
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(MW/Mvar/Amp)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 348.81 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 467.18 MW

EATL: 245.69 MW

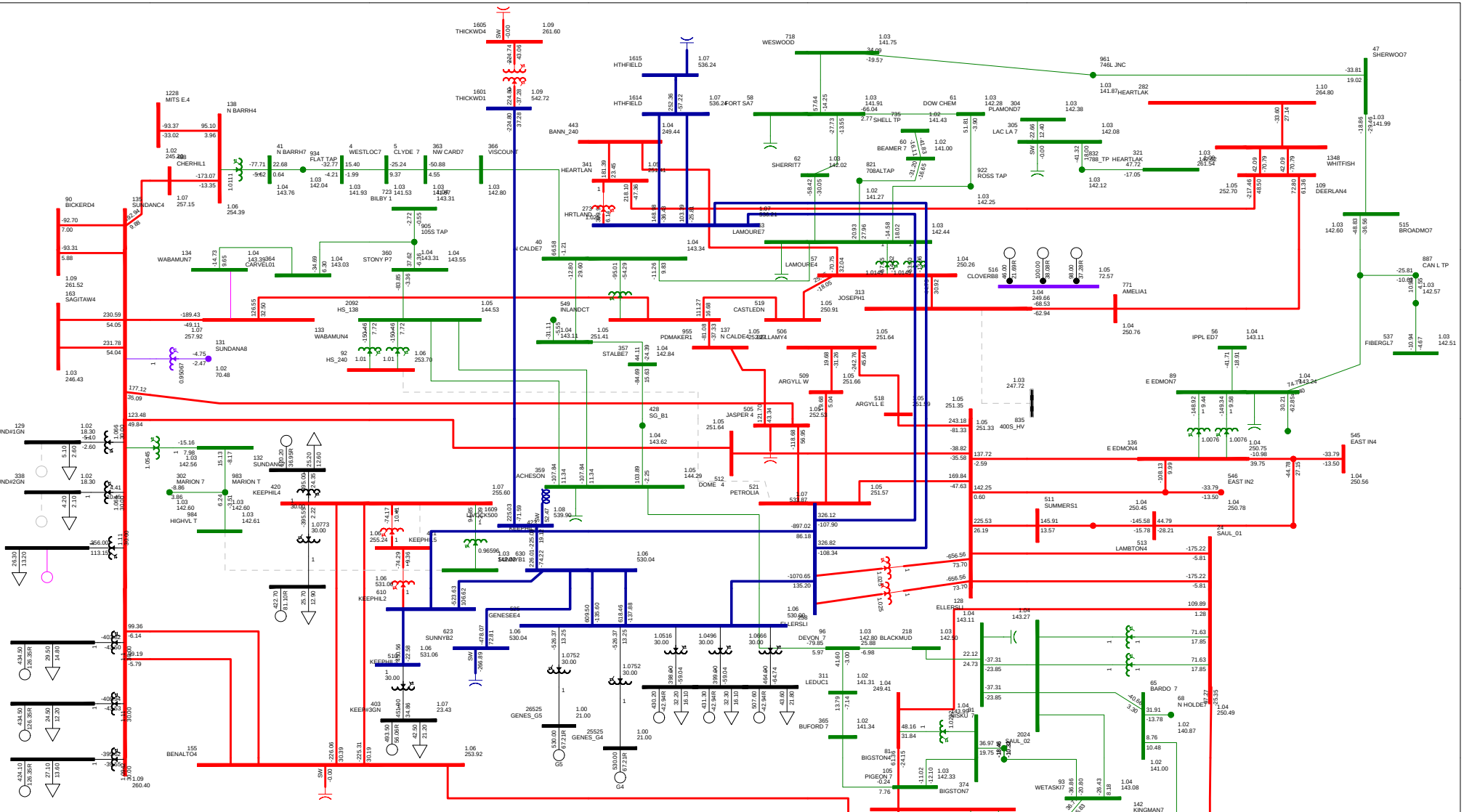
Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2429.10 MW

SOK Cutplane 1030.37 MW + (0.35) x-39.44 MW

KEG Cutplane 2412.17 MW

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 2 2021 WP HIGH SOK (PRE CONNECTION)
1139L
FIG A-14
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0/100.0/0.0

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 352.39 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

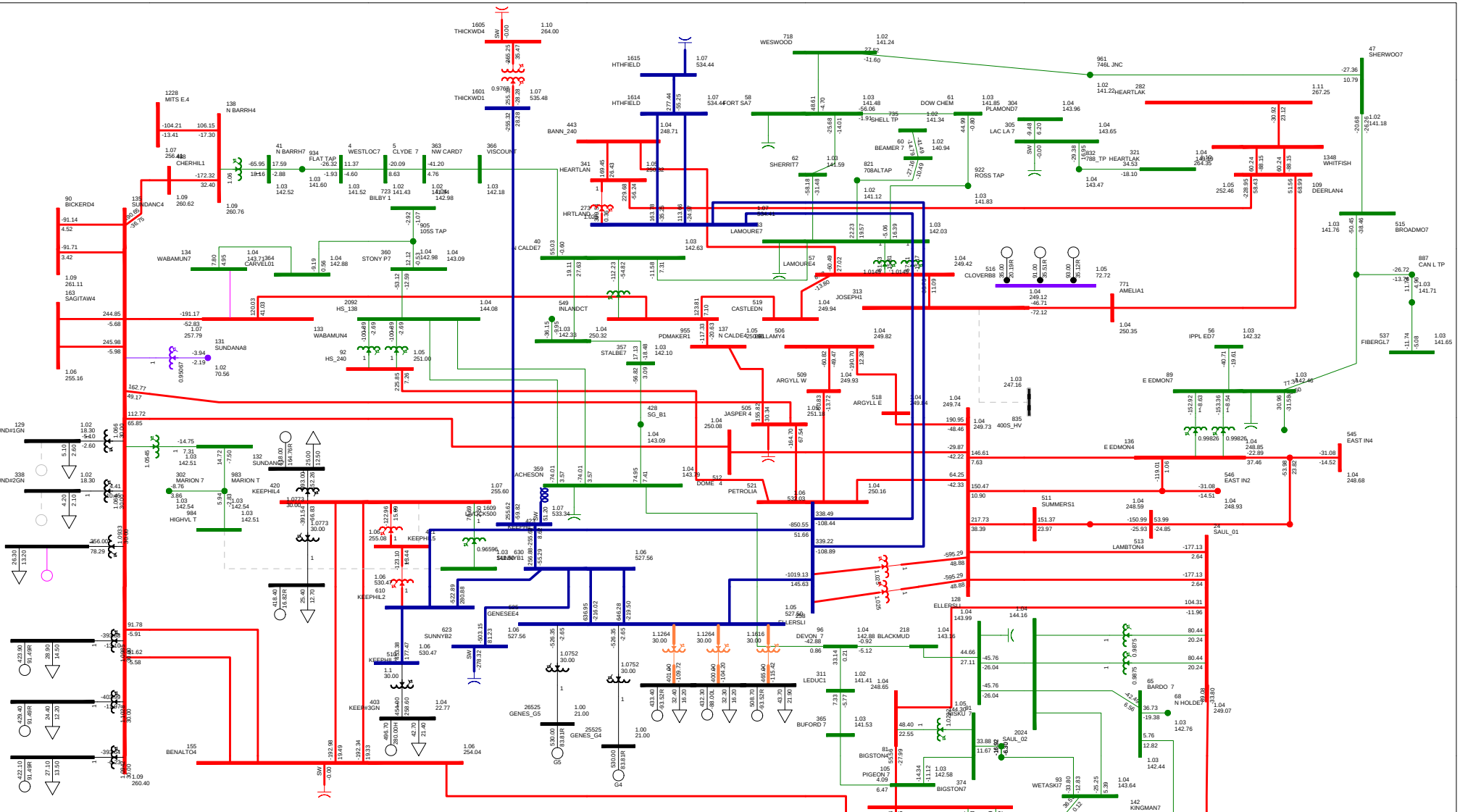
WATL: 467.19 MW
EATL: 245.69 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2429.10 MW

SOK Cutplane	995.51 MW	+ (0.35) x-39.64 MW
KEG Cutplane	2534.06 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 3 2021 SP HIGH SOK (PRE CONNECTION)
BASE CASE
FIG A-15
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(MW/Mvar/MVA)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 706.71 MW

MATL import: 0.00 MW

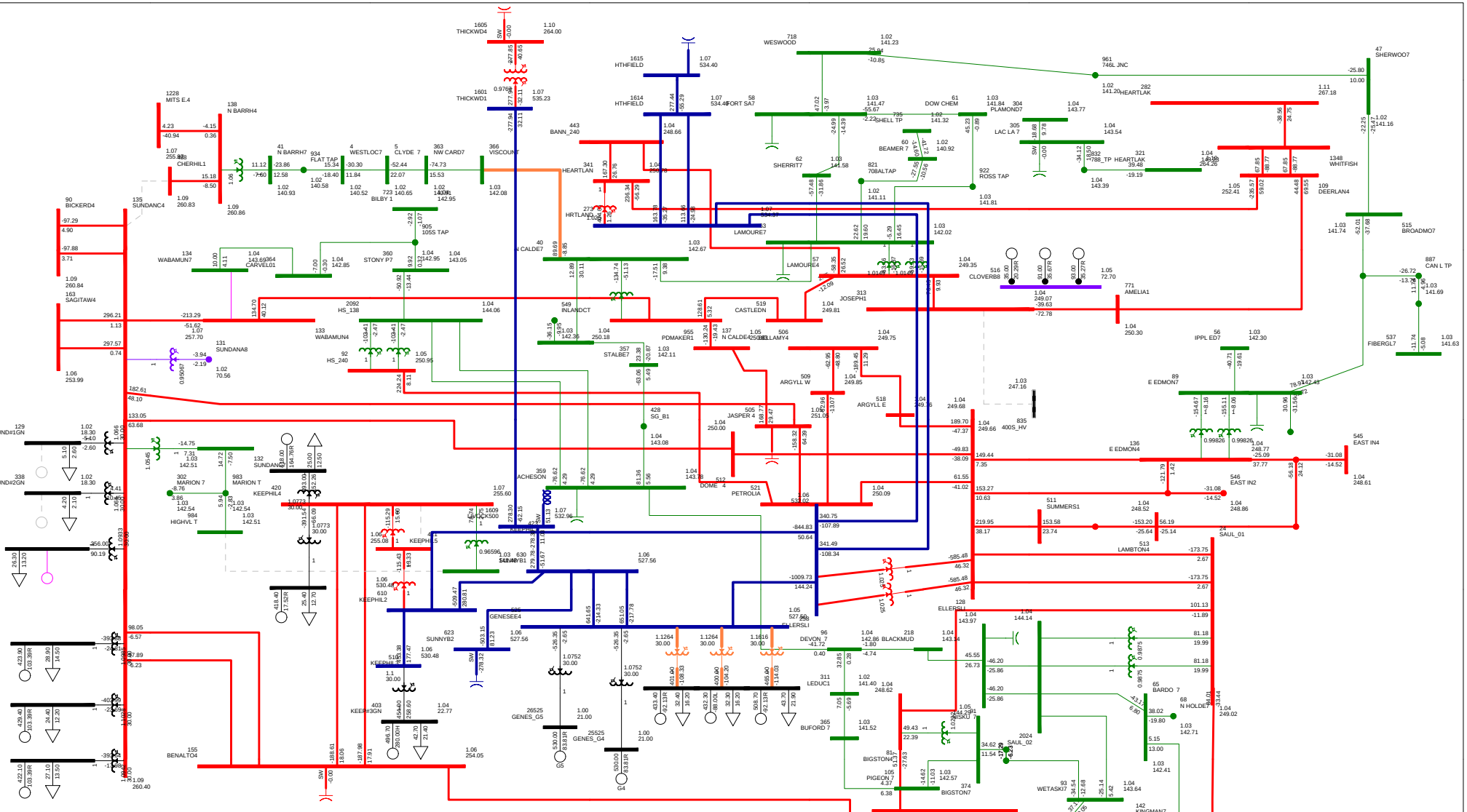
Sask. Import: -0.10 MW

WATL: 491.60 MW
EATL: 270.36 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2434.40 MW

SOK Cutplane	959.75 MW	+ (0.35) x8.68 MW	Max: 2,050MW
KEG Cutplane	2349.45 MW		2,520MW (SOK <= 1,805MW) 2,450MW (SOK > 1,805MW)



SCENARIO 3 2021 SP HIGH SOK (PRE CONNECTION)
1046L
FIG A-16
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(xx.xx/xx.xx)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 718.34 MW

MATL import: 0.00 MW

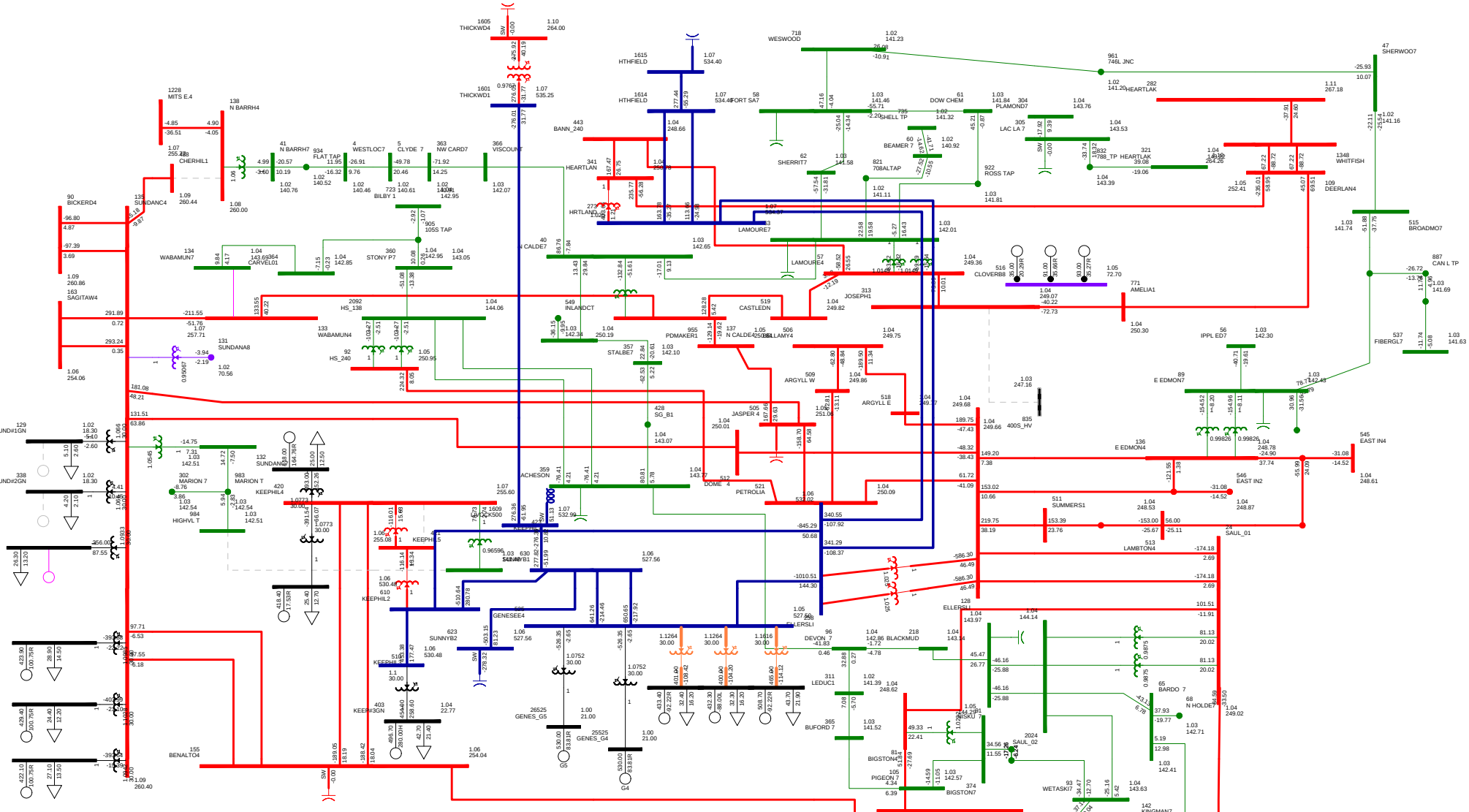
Sask. Import: -0.10 MW

WATL: 491.60 MW
EATL: 270.36 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2434.40 MW

SOK Cutplane	954.83 MW	+ (0.35) x9.78 MW	Max: 2,050MW
KEG Cutplane	2325.09 MW		2,520MW (SOK <= 1,805MW) 2,450MW (SOK > 1,805MW)



SCENARIO 3 2021 SP HIGH SOK (PRE CONNECTION)
913L
FIG A-17
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(xx.xx/xx.xx)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 716.46 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

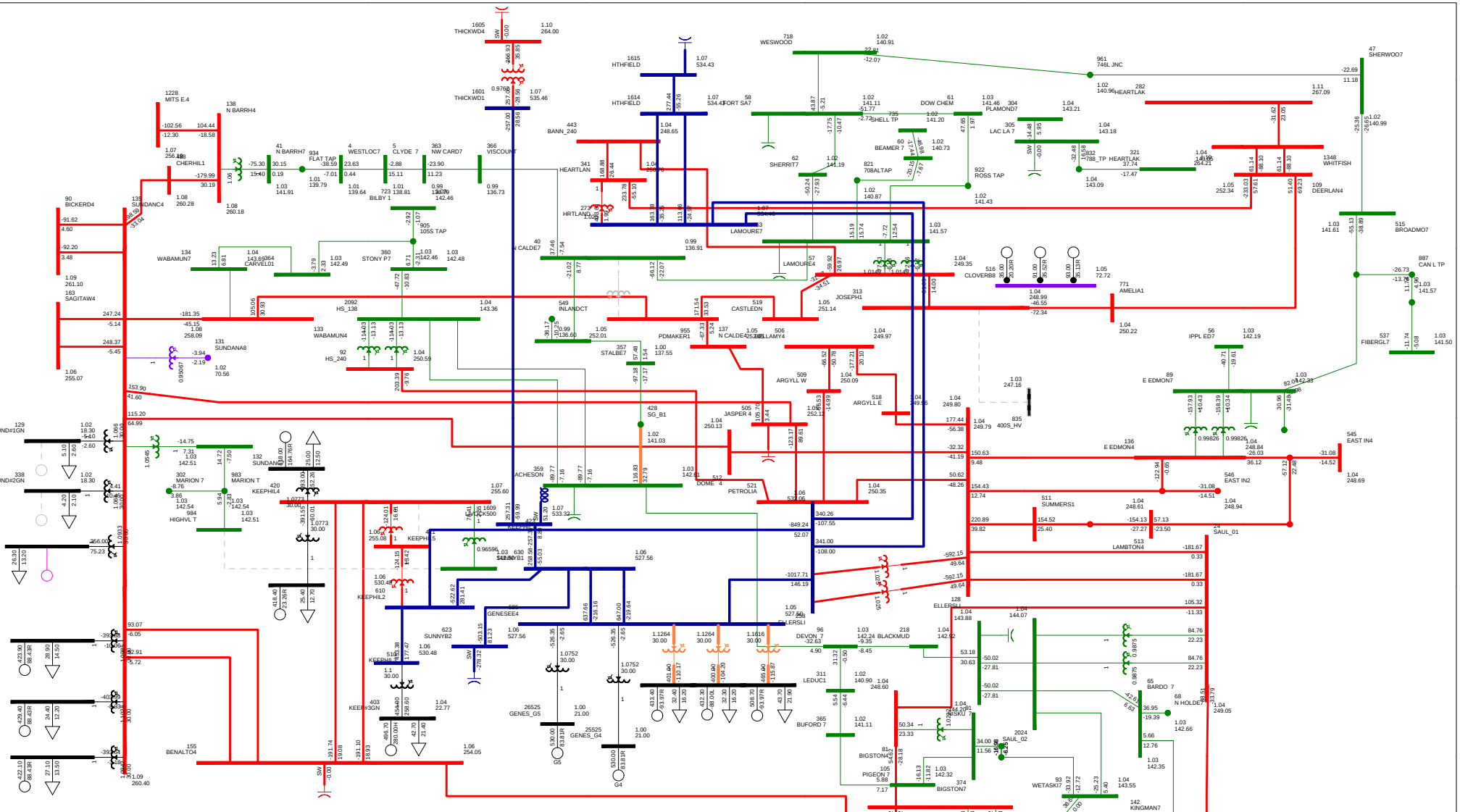
WATL: 491.60 MW
EATL: 270.36 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2434.40 MW

SOK Cutplane	956.11 MW	+ (0.35) x9.75 MW
KEG Cutplane	2327.26 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 3 2021 SP HIGH SOK (PRE CONNECTION)
37ST6
FIG A-18
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(MW,Mvar,pu)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 709.75 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

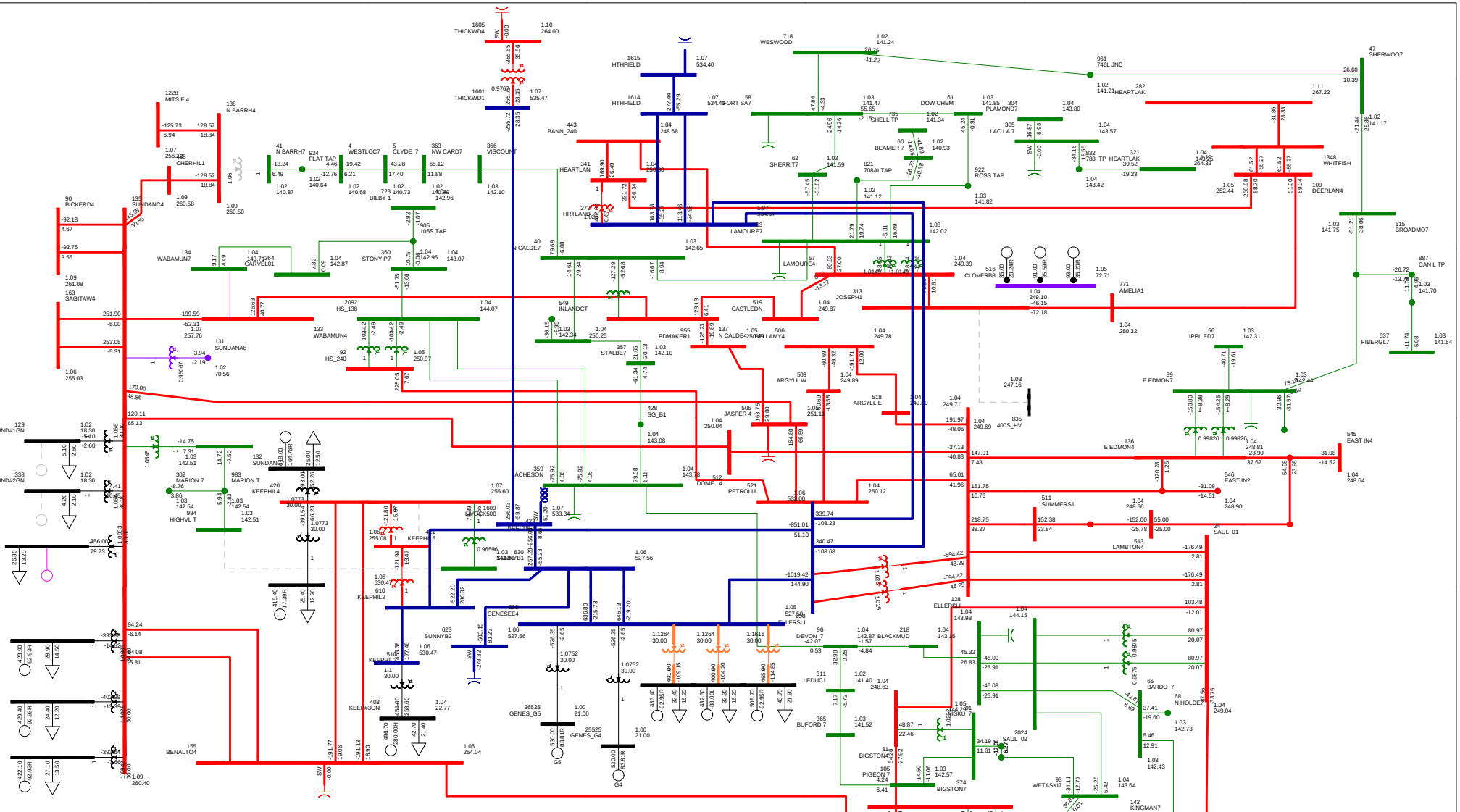
WATL: 491.60 MW
EATL: 270.36 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2434.40 MW

SOK Cutplane	968.80 MW	+ (0.35) x9.21 MW
KEG Cutplane	2343.81 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 3 2021 SP HIGH SOK (PRE CONNECTION)
69ST4
FIG A-19
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(MW,Mvar,pu)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 708.71 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

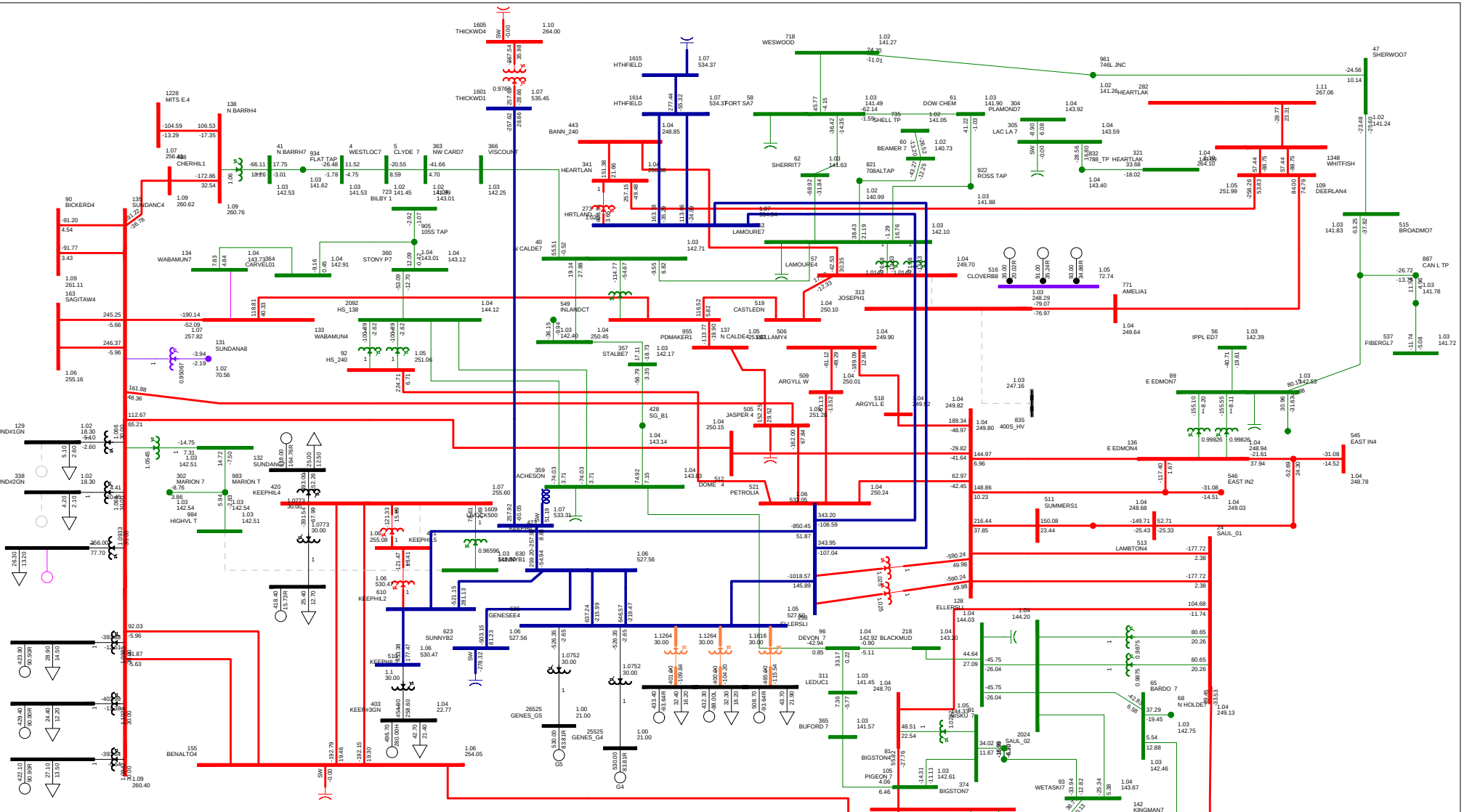
WATL: 491.60 MW
EATL: 270.36 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2434.40 MW

SOK Cutplane	960.85 MW	+ (0.35) x9.31 MW
KEG Cutplane	2347.35 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 3 2021 SP HIGH SOK (PRE CONNECTION)
997L
FIG A-20
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(MW/Mvar)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 706.77 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

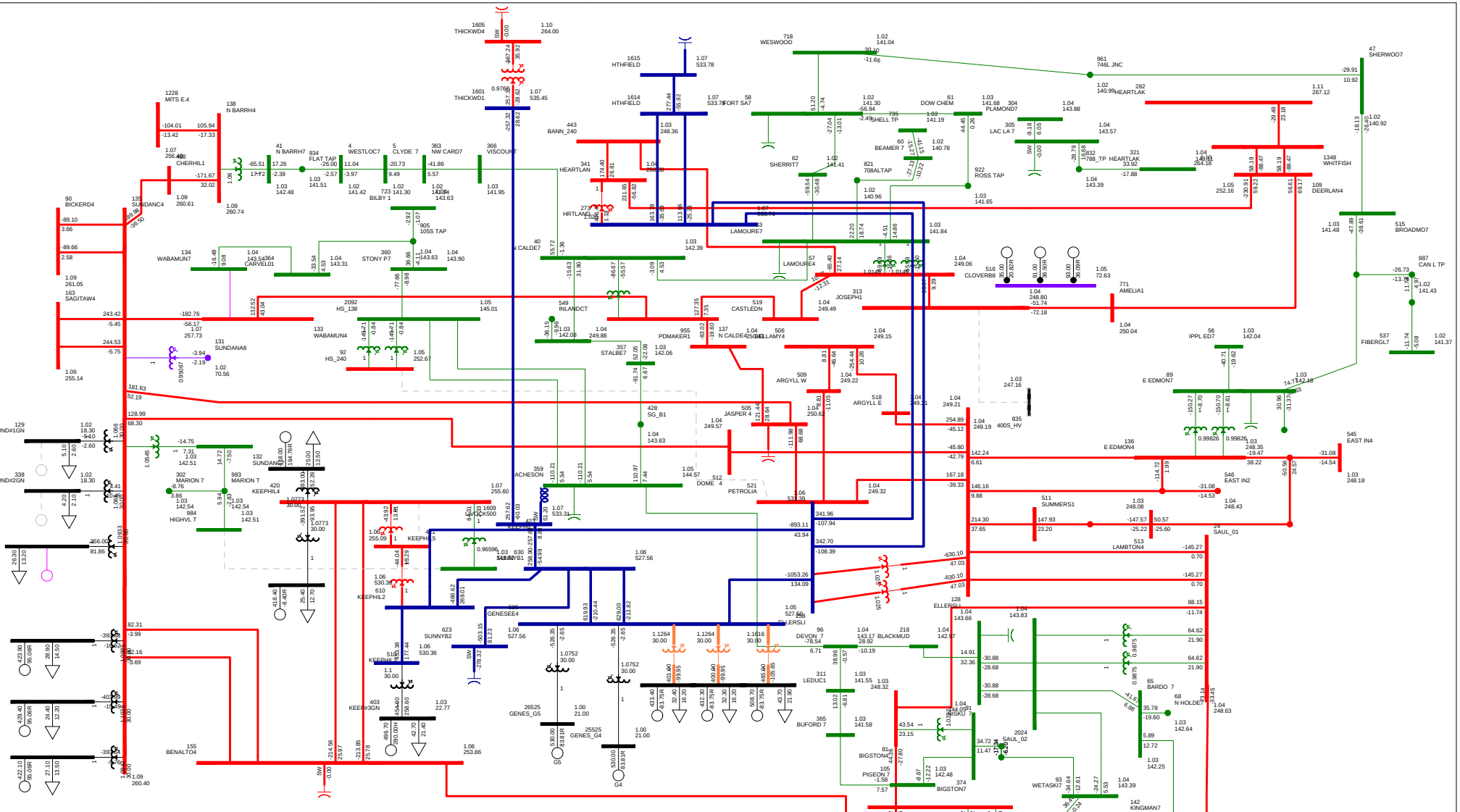
WATL: 491.60 MW
EATL: 270.36 MW

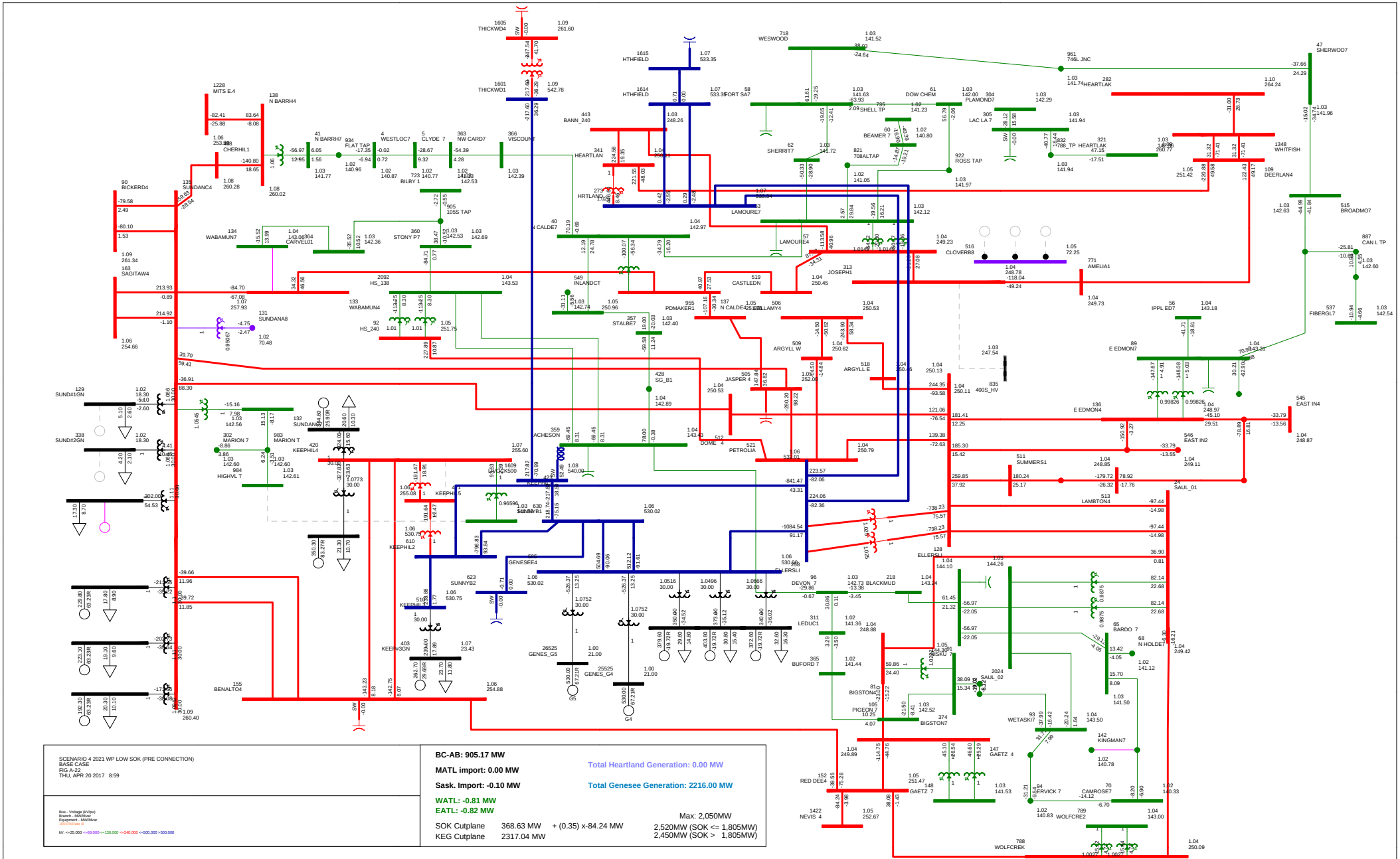
Total Heartland Generation: 0.00 MW

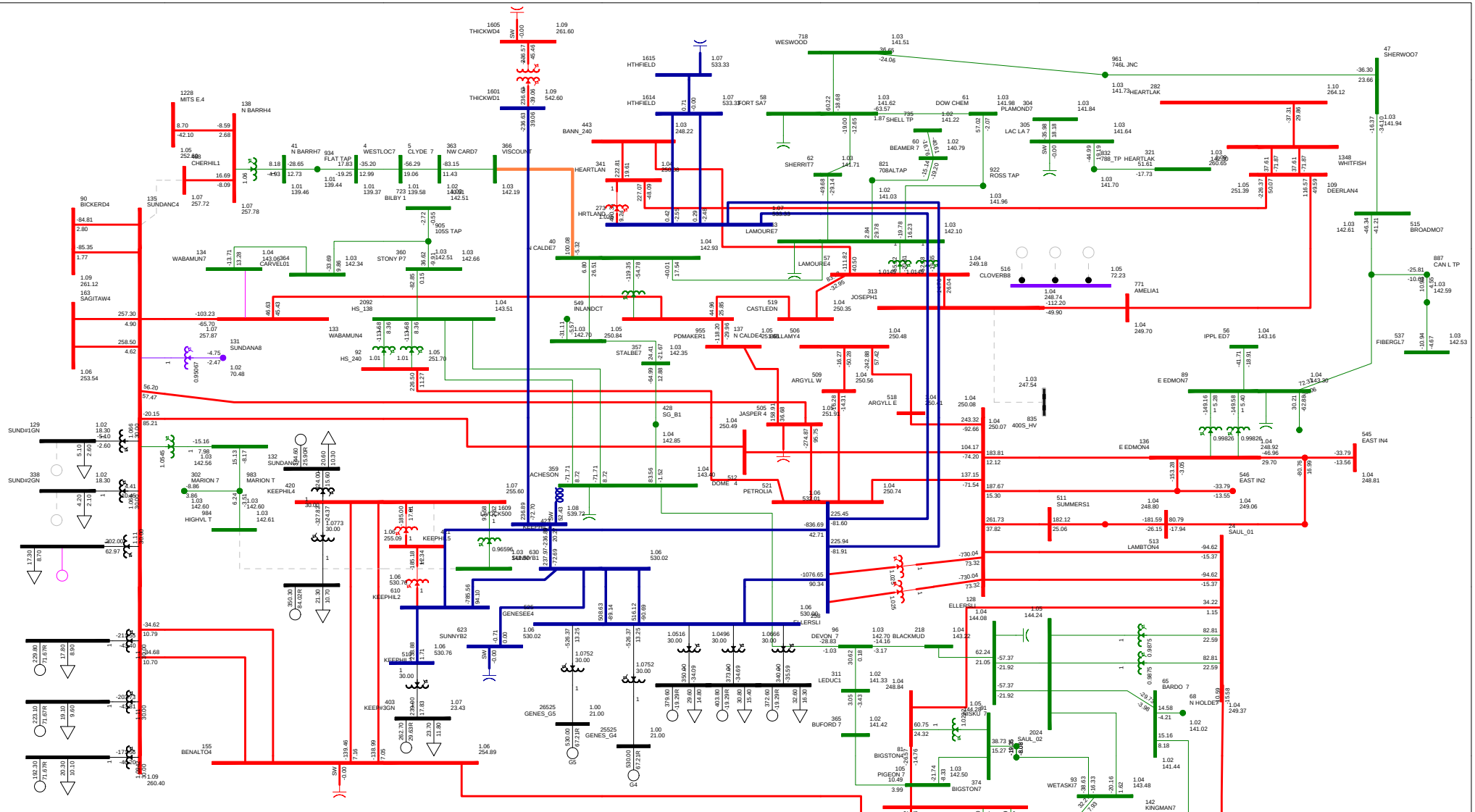
Total Genesee Generation: 2434.40 MW

SOK Cutplane	961.08 MW	+ (0.35) x9.18 MW
KEG Cutplane	2348.30 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)


1605 THICKWD4
1601 THICKWD1
1615 HTHFIELD
1614 HTHFIELD
718 WESWOOD
961 746L JNC
47 SHERWOO7
282 HEARTLAK
1348 WHITFISH
109 DEERLAN4
515 BROADMO7
887 CAN L TP
537 FIBERGL7
771 AMELIA1
1228 MITS E.4
138 N BARRH4
90 BICKERD4
135 SUNDANC4
163 SAGITAW4
129 SUND#1GN
338 SUND#2GN
155 BENALTO4
443 BANN_240
341 HEARTLAN
273 HRTLND_1
40 N CALDET
549 INLANDCT
519 CASTLEDN
313 JOSEPH1
516 CLOVERB8
955 PDMAKER1
137 N CALDER25
506 HILLAMY4
509 ARGYLL W
518 ARGYLL E
835 400S_HV
89 E EDMON7
136 E EDMON4
545 EAST IN4
546 EAST IN2
24 SAUL_01
2024 SAUL_02
56 IPPL ED7
511 SUMMERS1
513 LAMBTON4
128 ELLERSL1
96 DEVON_7
218 BLACKMUD
65 BARDO 7
68 N HOLDE7
374 BIGSTON7
93 WETASKI7
142 KINGMAN7
147 GAETZ 4
148 GAETZ 7
94 VERVICK 7
70 CAMROSE7
789 WOLFCRE2
788 WOLFCREK
152 RED DEE4
1422 NEVIS 4
365 BUFORD 7
311 LEDUC1
105 PIGEON_7
81 BIGSTA7
623 SUNNYB2
630 SUNNYB1
359 PACHESON
512 DOME 4
521 PETROLIA
428 SG_B1
505 JASPER 4
357 STALBE7
2092 HS_138
92 HS_240
133 WABAMUN4
134 WABAMUN7
360 STONY P7
905 105S TAP
131 SUNDANA8
302 MARION 7
984 HIGHVL T
983 MARION T
420 KEEPHL4
132 SUNDANA7
610 KEEPHIL2
403 KEEP#3GN
526 GENESEE4
26525 GENES_G5
25525 GENES_G4
G5
G4
SCENARIO 3 2021 SP HIGH SOK (PRE CONNECTION)
1139L
FIG A-21
THU, APR 20 2017 8:59
BC-AB: 711.03 MW
MATL import: 0.00 MW
Sask. Import: -0.10 MW
WATL: 491.60 MW
EATL: 270.36 MW
Total Heartland Generation: 0.00 MW
Total Genesee Generation: 2434.40 MW
SOK Cutplane 922.87 MW + (0.35) x8.88 MW
KEG Cutplane 2477.74 MW
Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000


SCENARIO 4 2021 WP LOW SOK (PRE CONNECTION)
BASE CASE
FIG A-22
THU, APR 20 2017 8:59
BC-AB: 905.17 MW
MATL import: 0.00 MW
Sask. Import: -0.10 MW
WATL: -0.81 MW
EATL: -0.82 MW
Total Heartland Generation: 0.00 MW
Total Genesee Generation: 2216.00 MW
SOK Cutplane 368.63 MW + (0.35) x-84.24 MW
KEG Cutplane 2317.04 MW
Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000



SCENARIO 4 2021 WP LOW SOK (PRE CONNECTION)
1046L
FIG A-23
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(100.0/100.0)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 915.76 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

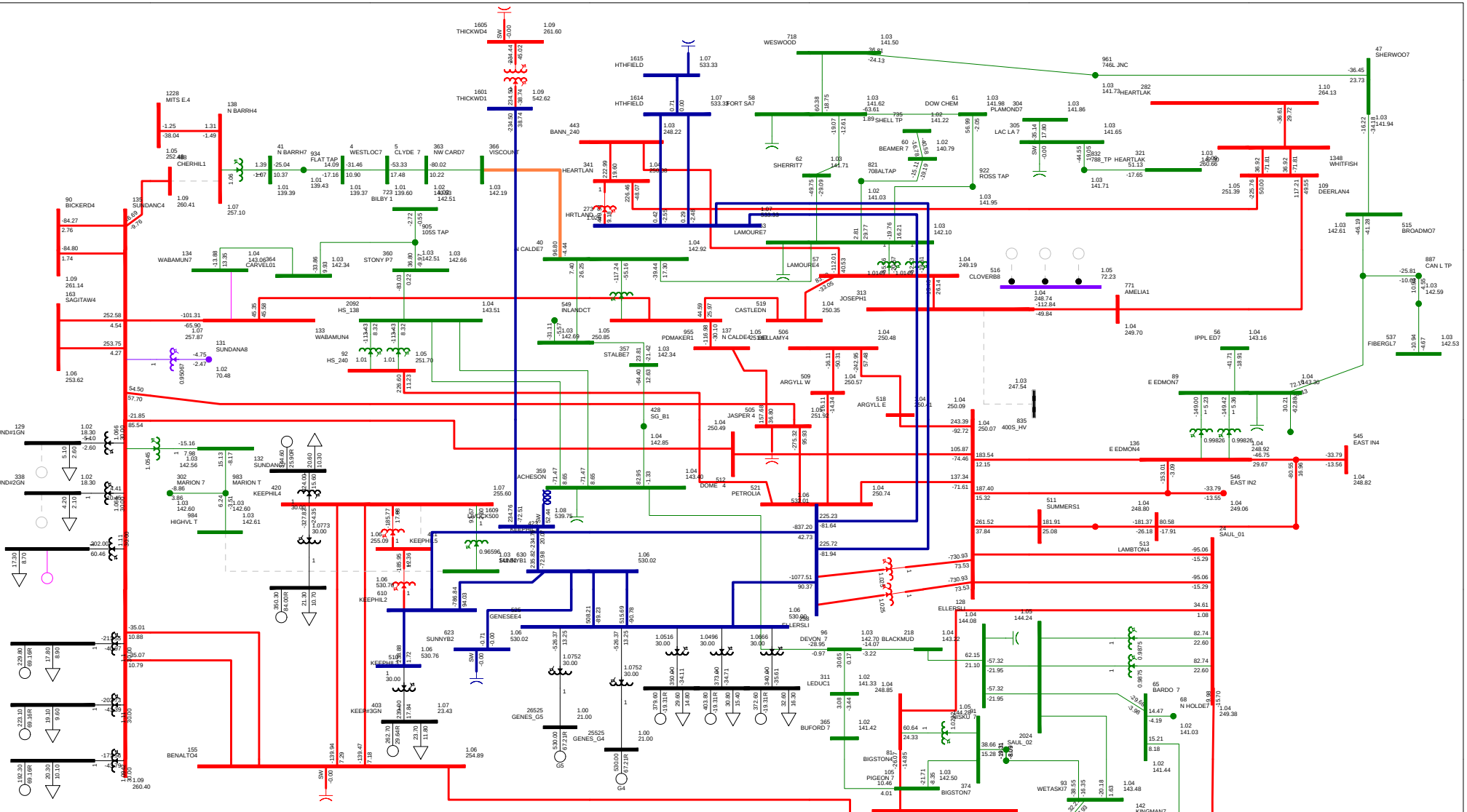
WATL: -0.81 MW
EATL: -0.82 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2216.00 MW

SOK Cutplane	363.95 MW	+ (0.35) x-83.33 MW
KEG Cutplane	2296.51 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 4 2021 WP LOW SOK (PRE CONNECTION)
913L
FIG A-24
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(MW/Mvar/%)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 913.75 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: -0.81 MW

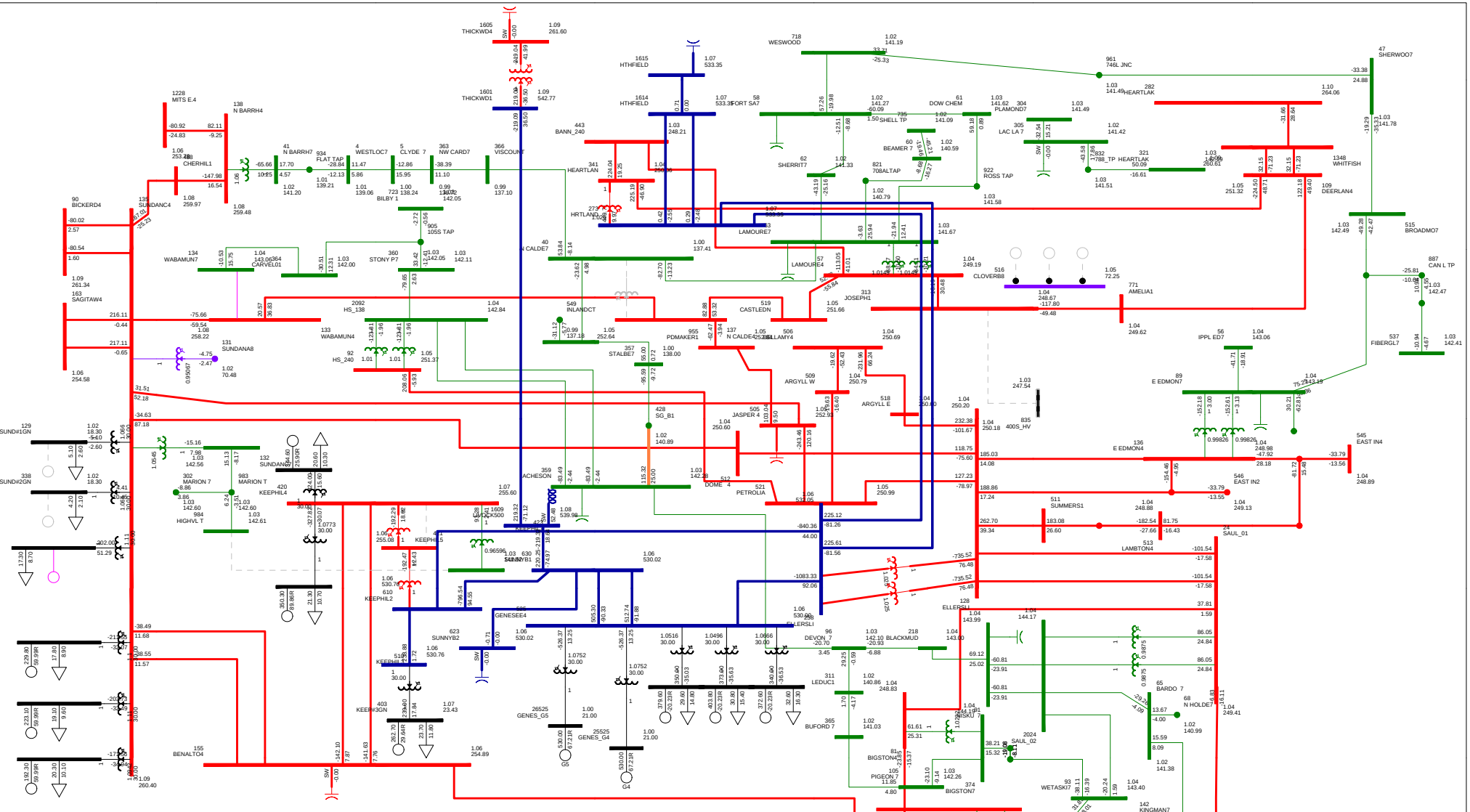
EATL: -0.82 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2216.00 MW

SOK Cutplane	365.23 MW	+ (0.35) x-83.38 MW
KEG Cutplane	2298.88 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 4 2021 WP LOW SOK (PRE CONNECTION)
37ST6
FIG A-25
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(MW/Mvar/pu)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 907.92 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: -0.81 MW

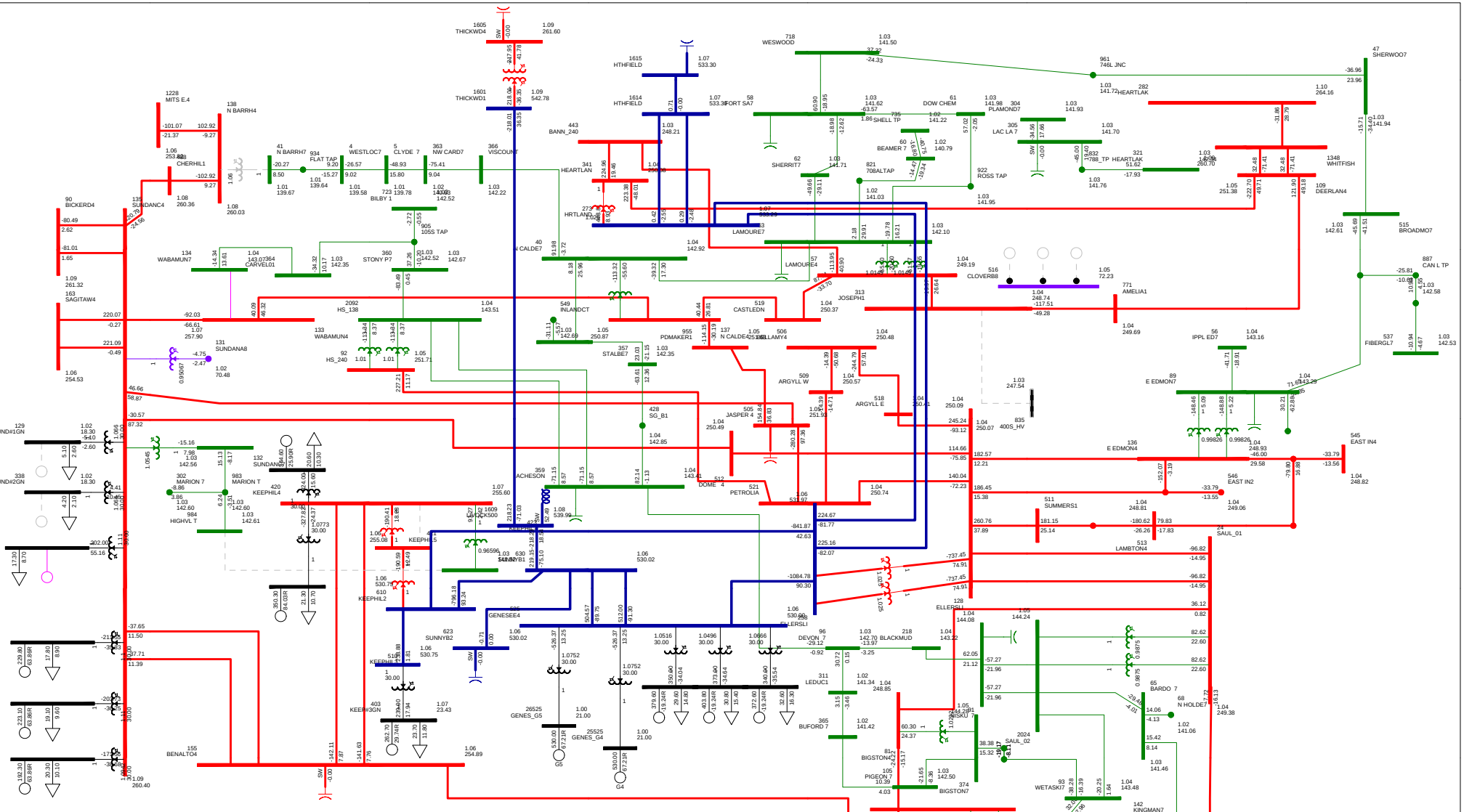
EATL: -0.82 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2216.00 MW

SOK Cutplane	376.82 MW	+ (0.35) x-83.76 MW
KEG Cutplane	2312.11 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 4 2021 WP LOW SOK (PRE CONNECTION)
69ST4
FIG A-26
THU, APR 20 2017 8:59

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
LOC (Fixed size 1)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 907.55 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

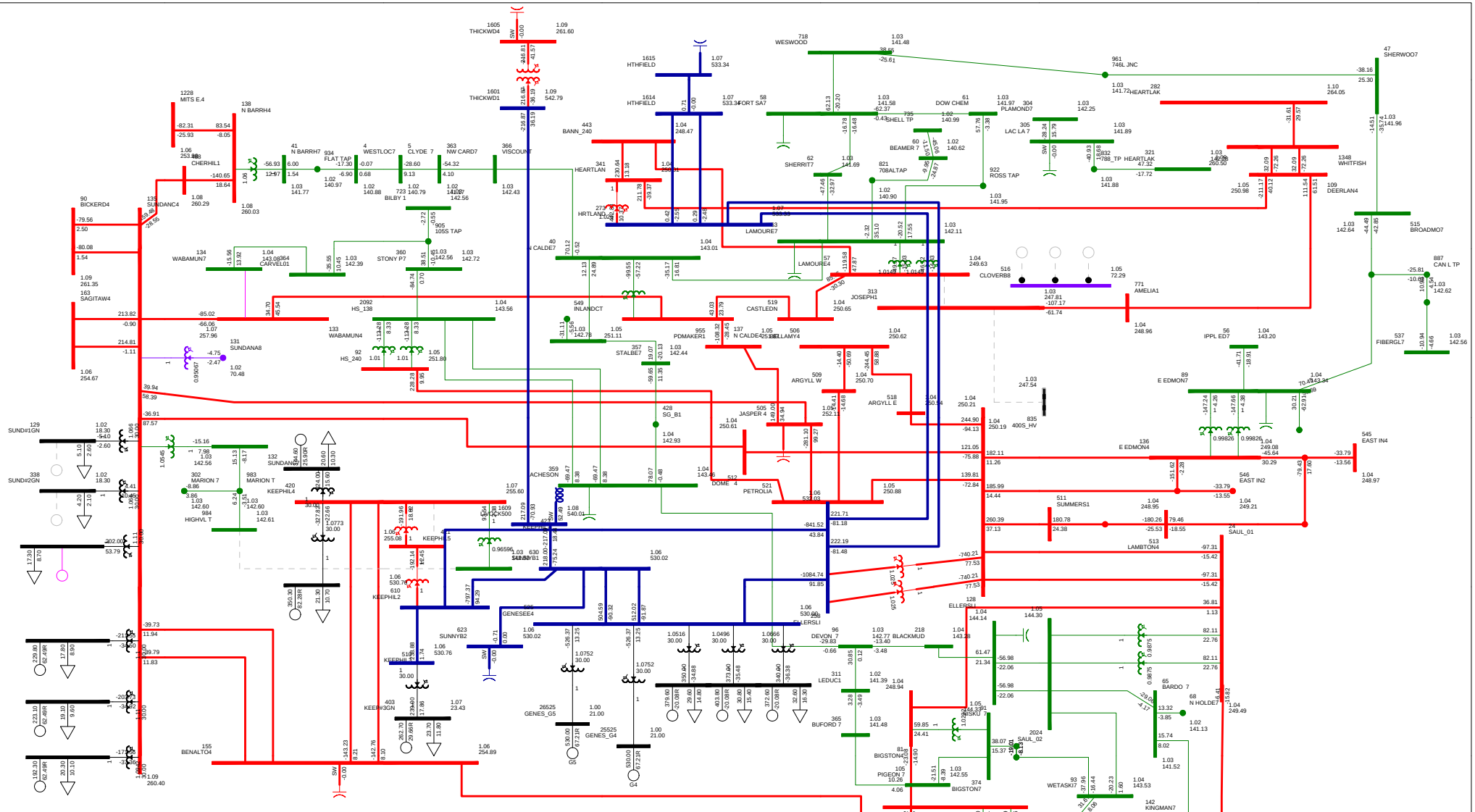
WATL: -0.81 MW
EATL: -0.82 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2216.00 MW

SOK Cutplane	369.07 MW	+ (0.35) x-83.70 MW
KEG Cutplane	2315.09 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 4 2021 WP LOW SOK (PRE CONNECTION)
997L
FIG A-27
THU, APR 20 2017 9:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(MW,Mvar,Mva)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 905.31 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: -0.81 MW

EATL: -0.82 MW

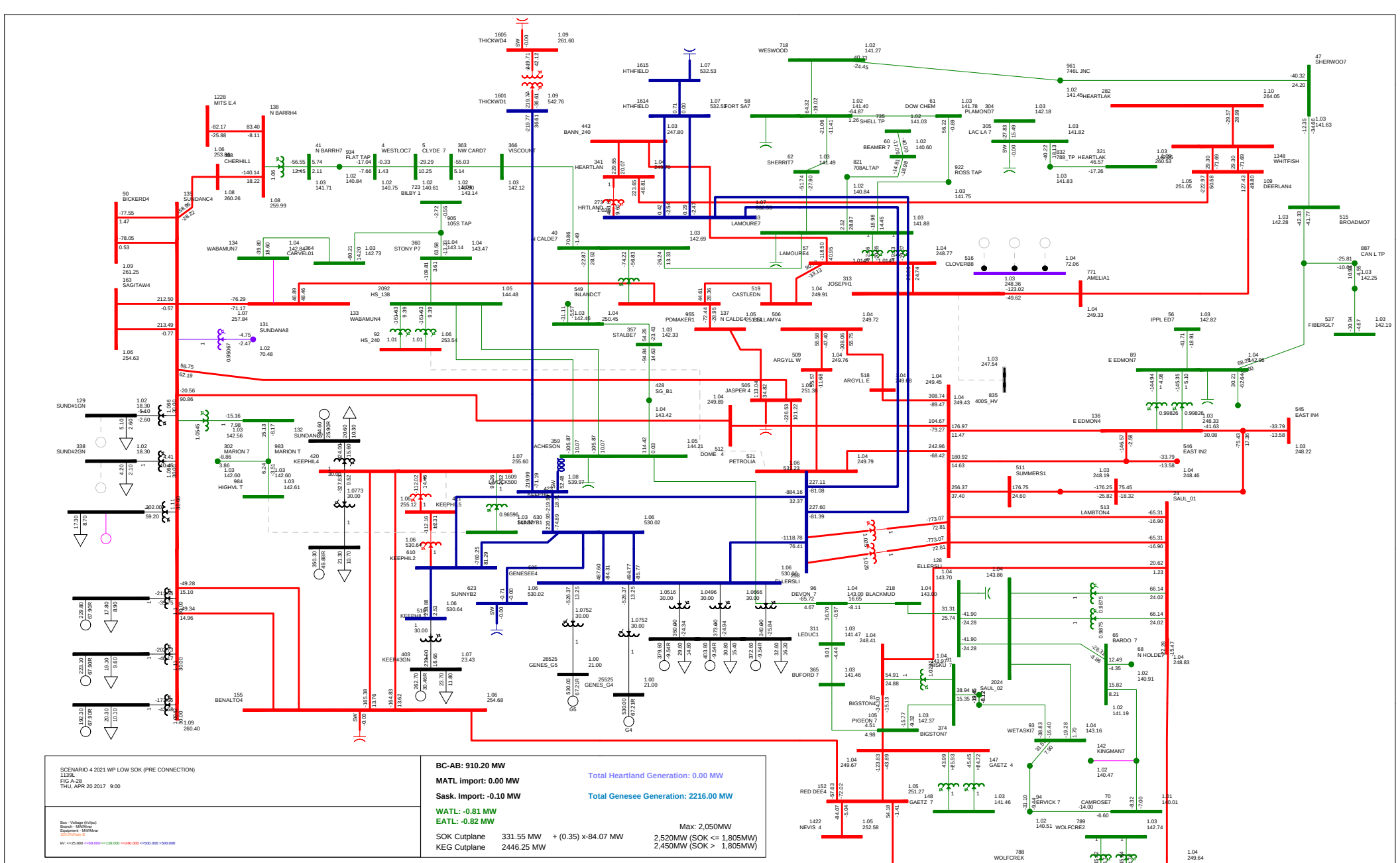
Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2216.00 MW

SOK Cutplane 368.22 MW + (0.35) x-84.37 MW

KEG Cutplane 2317.30 MW

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 4 2021 WP LOW SOK (PRE CONNECTION)
1139L
FIG A-28
THU, APR 20 2017 9:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(xx.xx/xx.xx)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 910.20 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

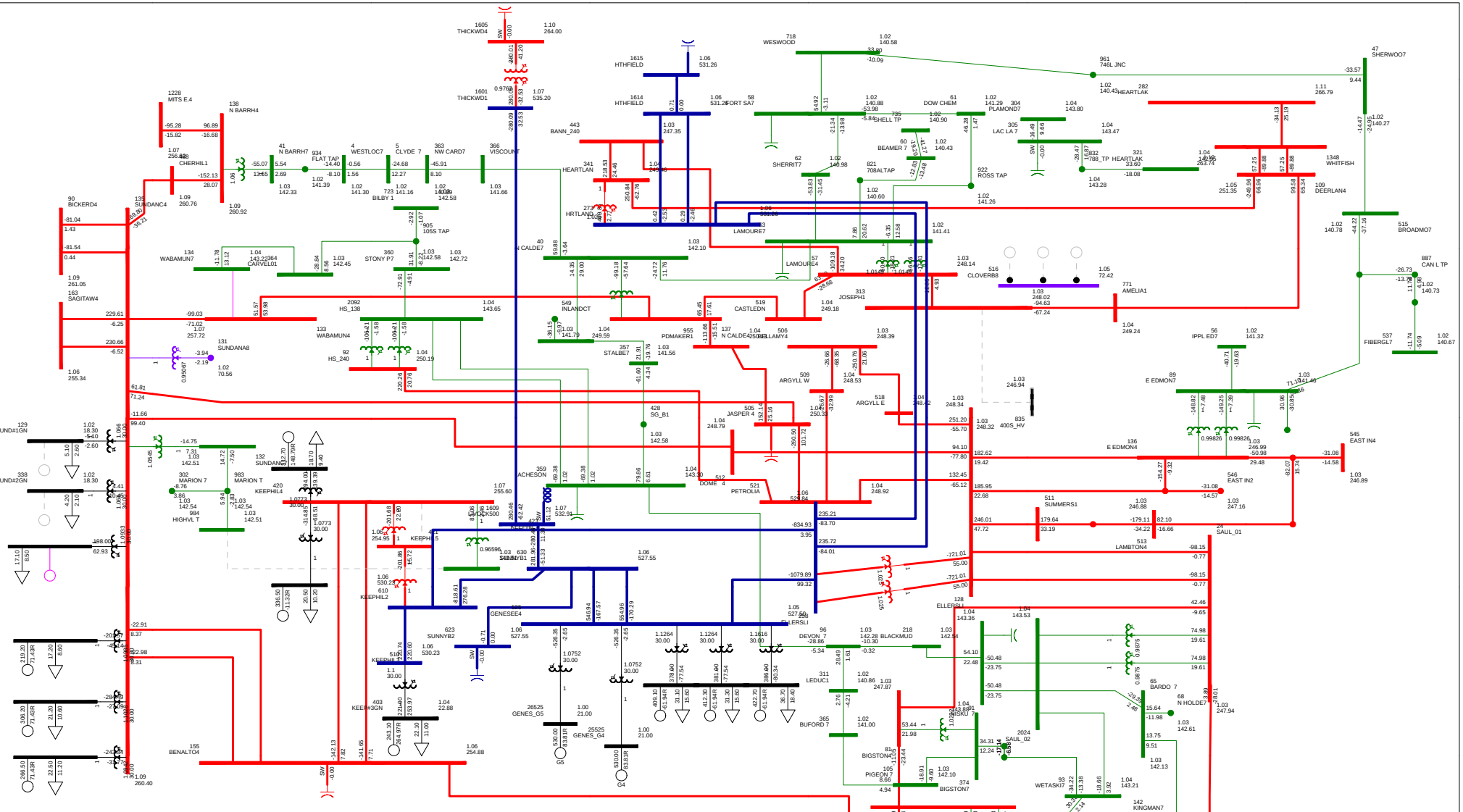
WATL: -0.81 MW
EATL: -0.82 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2216.00 MW

SOK Cutplane 331.55 MW + (0.35) x-84.07 MW
KEG Cutplane 2446.25 MW

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 5 2021 SP LOW SOK (PRE CONNECTION)
BASE CASE
FIG A-29
THU, APR 20 2017 9:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(MW,Mvar,Mva)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 883.86 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

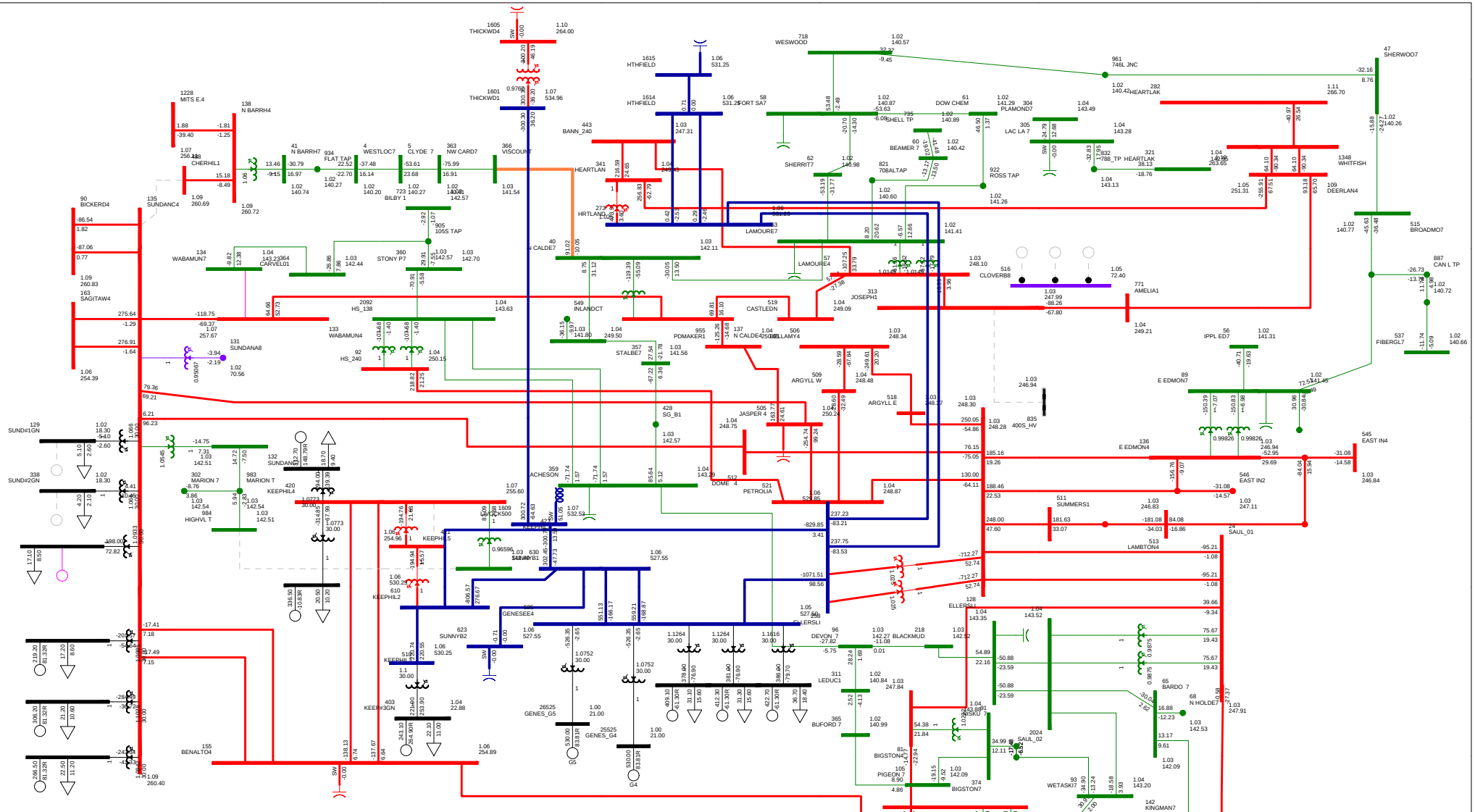
WATL: -0.81 MW
EATL: -0.73 MW

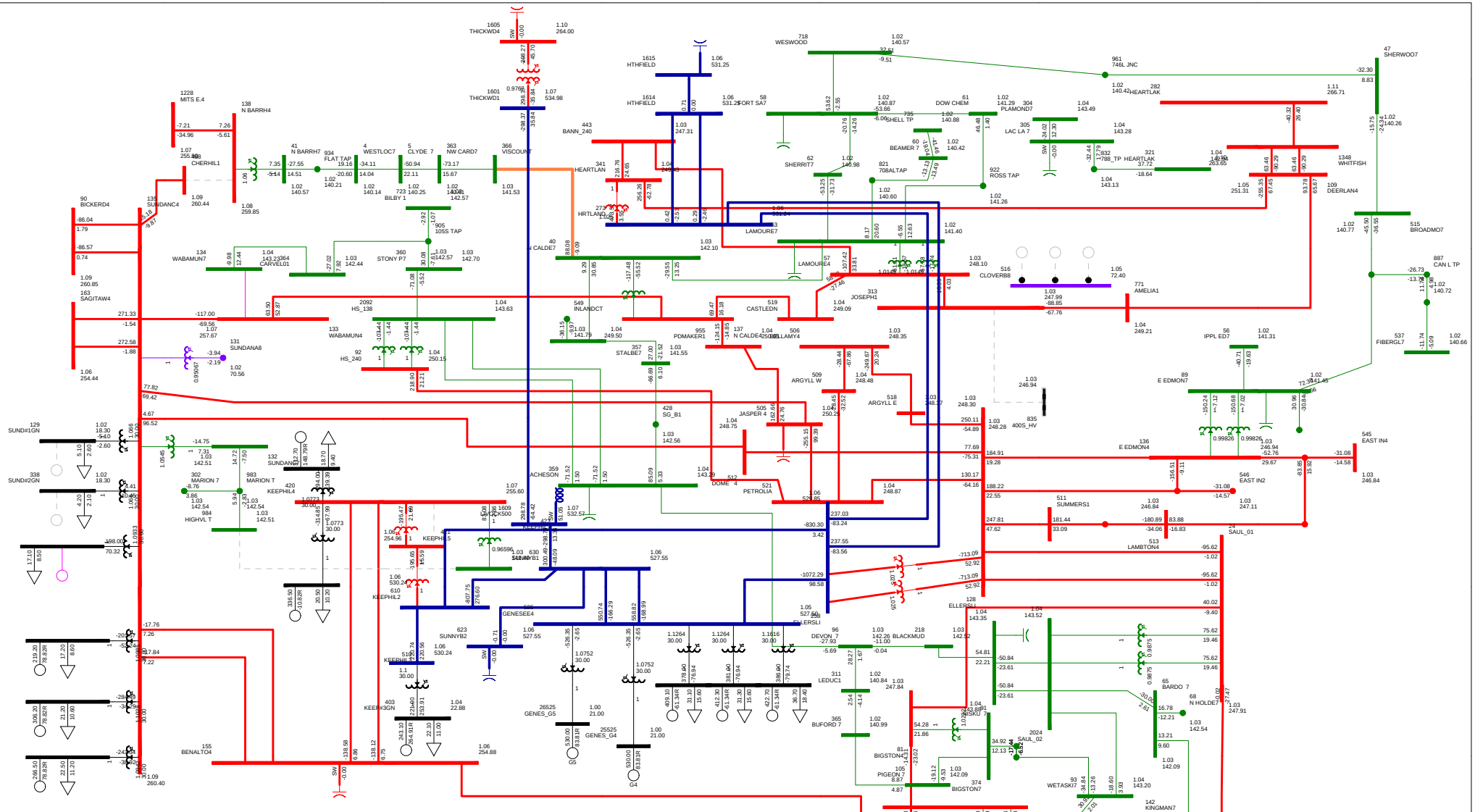
Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2304.10 MW

SOK Cutplane 438.13 MW + (0.35) x-60.18 MW
KEG Cutplane 2293.05 MW

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)


1605 THICKWD4
1601 THICKWD1
1615 HTHFIELD
1614 HTHFIELD
718 WESWOOD
961 746L JNC
47 SHERWOO7
282 HEARTLAK
1348 WHITFISH
109 DEERLAN4
515 BROADMO7
887 CAN L TP
537 FIBERGL7
1228 MITS E.4
138 N BARRH4
41 N BARRH7
934 FLAT TAP
4 WESTLOC7
5 CLYDE 7
363 NW CARD7
366 VISCOUNT
1488 CHERHIL1
90 BICKERD4
135 SUNDANC4
905 105S TAP
360 STONY P7
134 WABAMUN7
364 CARVEL01
163 SAGITAW4
131 SUNDANA8
133 WABAMUN4
2092 HS_138
92 HS_240
443 BANN_240
341 HEARTLAN
273 HRTLND
40 N CALDET
549 INLANDCT
357 STALBE7
428 SG_B1
955 PDMAKER1
137 N CALDE4
506 BELLAMY4
519 CASTLEDN
313 JOSEPH1
516 CLOVERB8
771 AMELIA1
56 IPPL ED7
89 E EDMON7
136 E EDMON4
545 EAST IN4
546 EAST IN2
24 SAUL_01
513 LAMBTON4
511 SUMMERS1
835 400S_HV
509 ARGYLL W
518 ARGYLL E
505 JASPER 4
512 DOME 4
521 PETROLIA
359 JACHESON
129 SUND#1GN
338 SUND#2GN
132 SUNDANG
420 KEEPHL4
302 MARION 7
983 MARION T
984 HIGHVL T
1609 BLACK500
421 KEEPHL5
610 KEEPHL2
511 KEEPHL1
403 KEEP#3GN
155 BENALTO4
623 SUNNYB2
630 SUNNYB1
595 GENESEE4
26525 GENES_G5
25525 GENES_G4
G4
128 ELLERSL1
96 DEVON 7
218 BLACKMUD
311 LEDUC1
365 BUFORD 7
2024 SAUL_02
65 BARDO 7
68 N HOLDE7
374 BIGSTON7
93 WETASKI7
142 KINGMAN7
147 GAETZ 4
148 GAETZ 7
152 RED DEE4
1422 NEVIS 4
94 VERVICR 7
70 CAMROSE7
789 WOLFCRE2
788 WOLFCREK
1 SCENARIO 5 2021 SP LOW SOK (PRE CONNECTION)
1046L
FIG A-30
THU, APR 20 2017 9:00
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000
BC-AB: 894.60 MW
MATL import: 0.00 MW
Sask. Import: -0.10 MW
WATL: -0.81 MW
EATL: -0.73 MW
Total Heartland Generation: 0.00 MW
Total Genesee Generation: 2304.10 MW
SOK Cutplane 433.62 MW + (0.35) x-59.16 MW
KEG Cutplane 2271.26 MW
Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 5 2021 SP LOW SOK (PRE CONNECTION)
913L
FIG A-31
THU, APR 20 2017 9:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(xx.xx/xx.xx)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 892.74 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

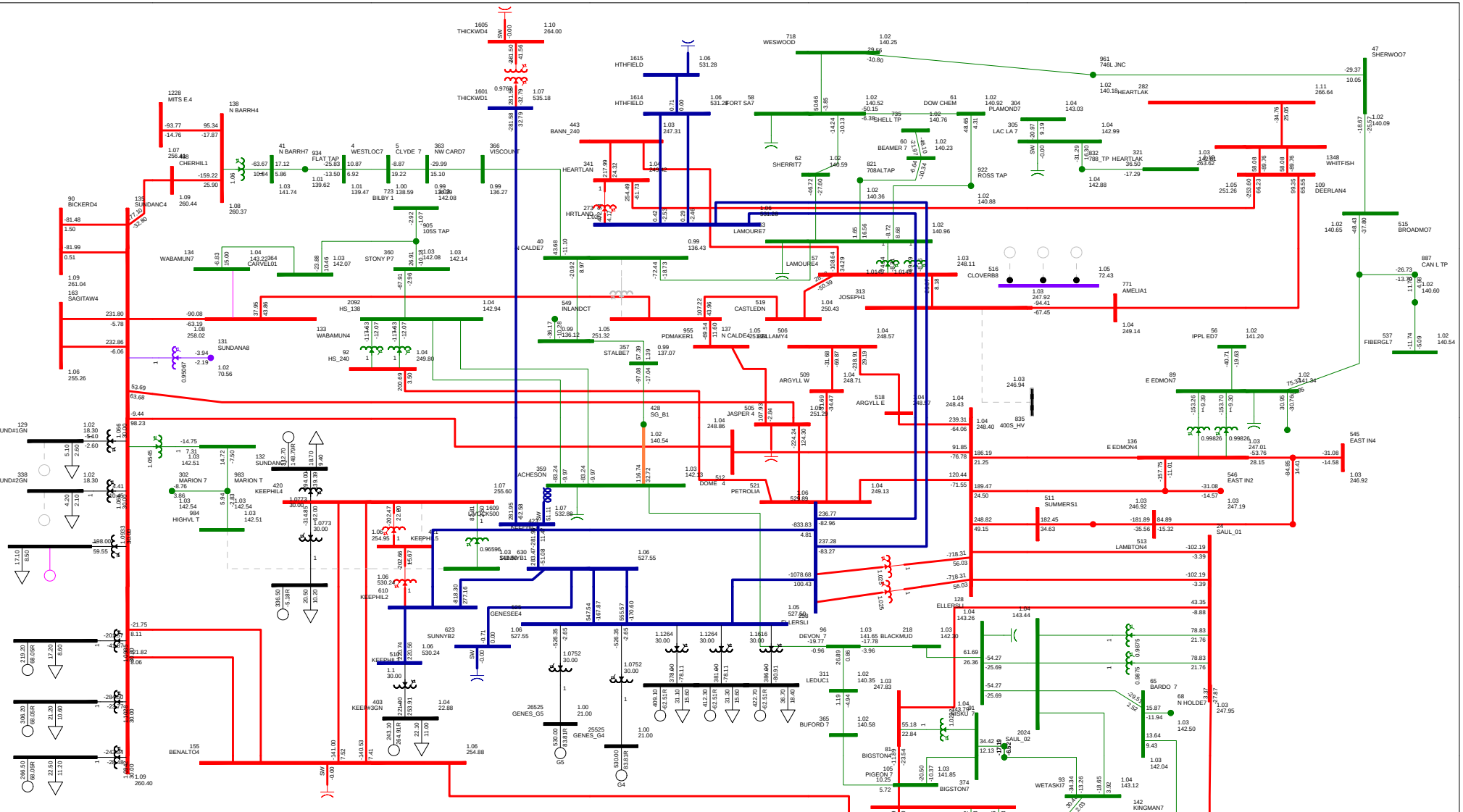
WATL: -0.81 MW
EATL: -0.73 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2304.10 MW

SOK Cutplane	434.83 MW	+ (0.35) x-59.20 MW
KEG Cutplane	2273.42 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)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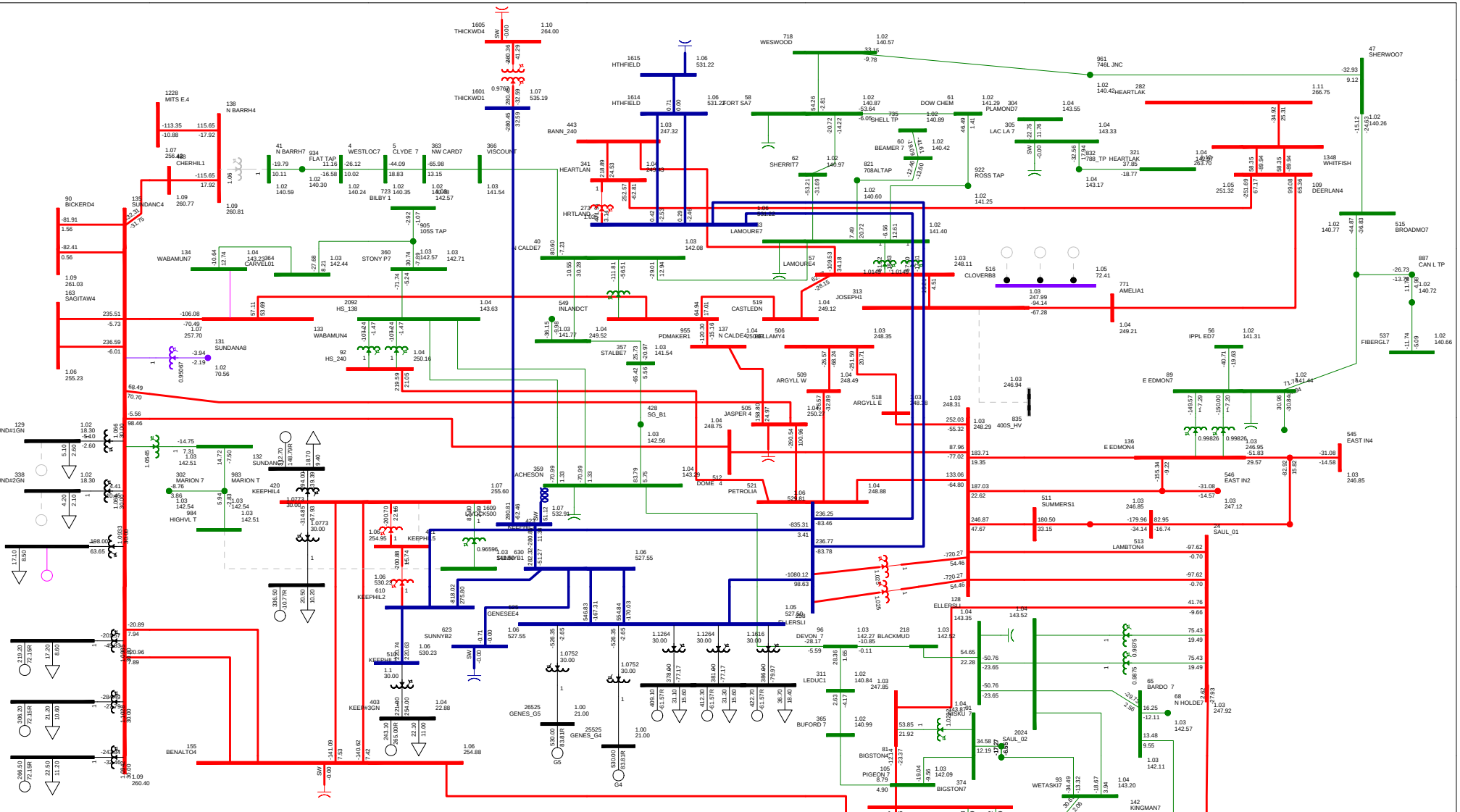
1614 HTHFIELD
718 WESWOOD
961 746L JNC
47 SHERWOO7
282 HEARTLAK
1348 WHITFISH
109 DEERLAN4
515 BROADMO7
887 CAN L TP
537 FIBERGL7
1228 MITS E.4
138 N BARRH4
1488 CHERHIL1
90 BICKERD4
135 SUNDANC4
163 SAGITAW4
134 WABAMUN7
360 STONY P7
905 105S TAP
443 BANN_240
341 HEARTLAN
273 HRTLAND
40 N CALDET
549 INLANDCT
2092 HS_138
133 WABAMUN4
92 HS_240
357 STALBE7
955 PDMAKER1
137 N CALDE4
506 BELLAMY4
519 CASTLEDN
313 JOSEPH1
516 CLOVERB8
771 AMELIA1
509 ARGYLL W
518 ARGYLL E
505 JASPER 4
512 DOME 4
521 PETROLIA
428 SG_B1
56 IPPL ED7
89 E EDMON7
136 E EDMON4
545 EAST IN4
546 EAST IN2
24 SAUL_01
513 LAMBTON4
511 SUMMERS1
835 400S_HV
129 SUND#1GN
338 SUND#2GN
131 SUNDANA8
302 MARION 7
983 MARION T
984 HIGHVL T
420 KEEPHL4
132 SUNDANA7
359 JACHESON
1609 BLACK500
421 KEEPHL5
610 KEEPHL2
511 KEEPHL1
403 KEEP#3GN
155 BENALTO4
623 SUNNYB2
630 SUNNYB1
526 GENESEE4
26525 GENES_G5
25525 GENES_G4
G5
G4
128 ELLERSL1
96 DEVON_7
218 BLACKMUD
311 LEDUC1
365 BUFORD 7
2024 SAUL_02
65 BARDO 7
68 N HOLDE7
93 WETASKI7
94 VERVICK 7
70 CAMROSE7
142 KINGMAN7
147 GAETZ 4
148 GAETZ 7
152 RED DEE4
1422 NEVIS 4
788 WOLFCREK
789 WOLFCRE2
374 BIGSTON7
81 BIGSTON
105 PIGEON_7
41 N BARRH7
934 FLAT TAP
4 WESTLOC7
5 CLYDE 7
363 NW CARD7
366 VISCOUNT
BILBY 1
CARVEL01
HS_138
HS_240
HIGHVL T
KEEPHL4
KEEPHL5
KEEPHL2
KEEP#3GN
BENALTO4
SUNNYB2
SUNNYB1
GENES_G5
GENES_G4
ELLERSL1
BLACKMUD
LEDUC1
BUFORD 7
BIGSTON7
PIGEON_7
WETASKI7
VERVICK 7
CAMROSE7
KINGMAN7
GAETZ 4
GAETZ 7
RED DEE4
NEVIS 4
WOLFCREK
WOLFCRE2
BARDO 7
N HOLDE7
SAUL_02
SAUL_01
EAST IN4
EAST IN2
LAMBTON4
SUMMERS1
400S_HV
E EDMON7
E EDMON4
IPPL ED7
AMELIA1
CLOVERB8
JOSEPH1
ARGYLL W
ARGYLL E
JASPER 4
DOME 4
PETROLIA
SG_B1
PDMAKER1
N CALDE4
BELLAMY4
CASTLEDN
STALBE7
INLANDCT
N CALDET
HRTLAND
HEARTLAN
BANN_240
HTHFIELD
THICKWD4
THICKWD1
WESWOOD
SHERWOO7
HEARTLAK
WHITFISH
DEERLAN4
BROADMO7
CAN L TP
FIBERGL7
MITS E.4
N BARRH4
CHERHIL1
BICKERD4
SUNDANC4
SAGITAW4
WABAMUN7
STONY P7
105S TAP
WABAMUN4
SUND#1GN
SUND#2GN
SUNDANA8
MARION 7
MARION T
HIGHVL T
KEEPHL4
SUNDANA7
JACHESON
BLACK500
KEEPHL5
KEEPHL2
KEEP#3GN
BENALTO4
SUNNYB2
SUNNYB1
GENESEE4
GENES_G5
GENES_G4
ELLERSL1
DEVON_7



SCENARIO 5 2021 SP LOW SOK (PRE CONNECTION)
69ST4
FIG A-33
THU, APR 20 2017 9:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(MW/Mvar)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 885.66 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

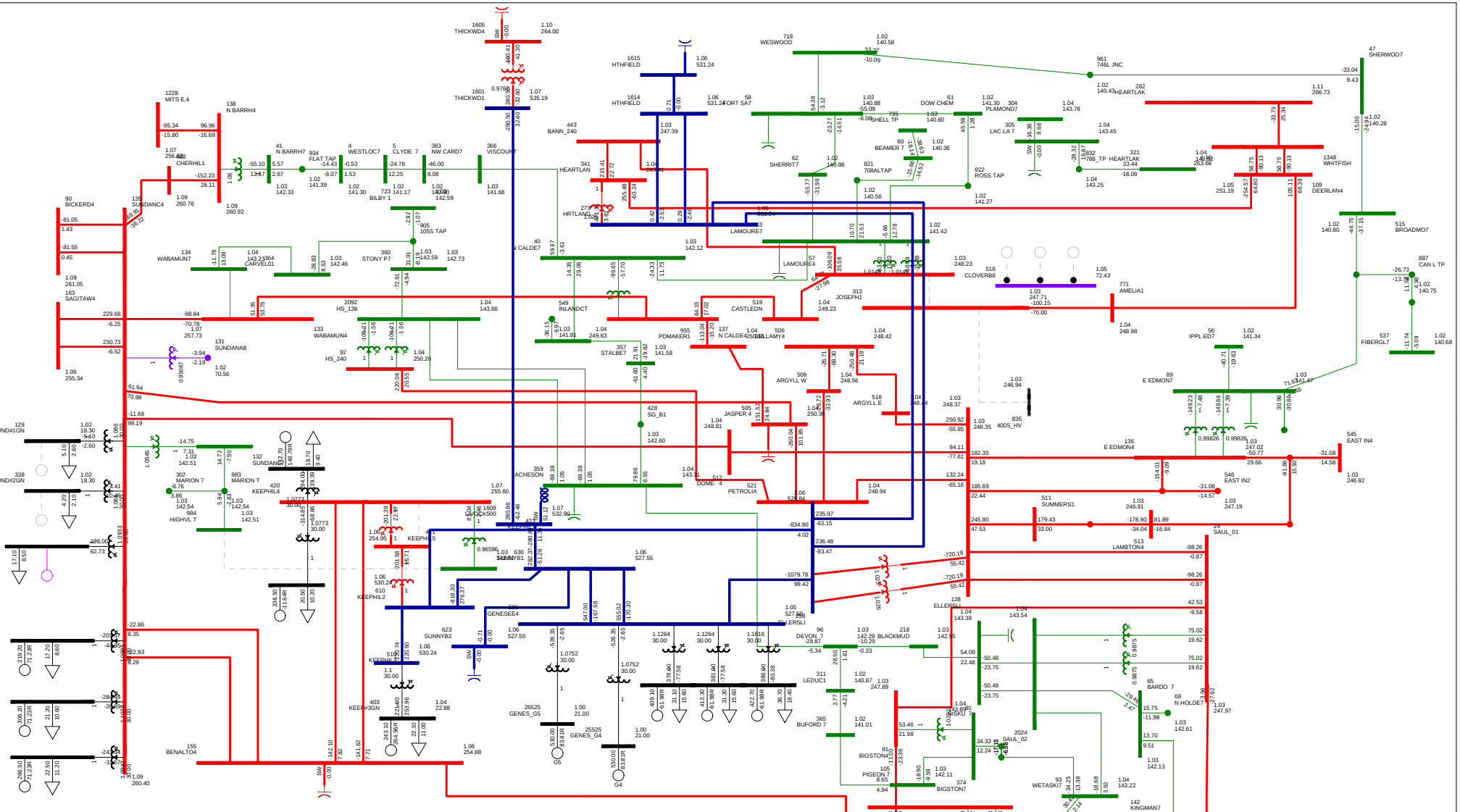
WATL: -0.81 MW
EATL: -0.73 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2304.10 MW

SOK Cutplane	438.96 MW	+ (0.35) x-59.63 MW
KEG Cutplane	2291.26 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 5 2021 SP LOW SOK (PRE CONNECTION)
997L
FIG A-34
THU, APR 20 2017 9:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
(MW/Mvar)

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 883.83 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

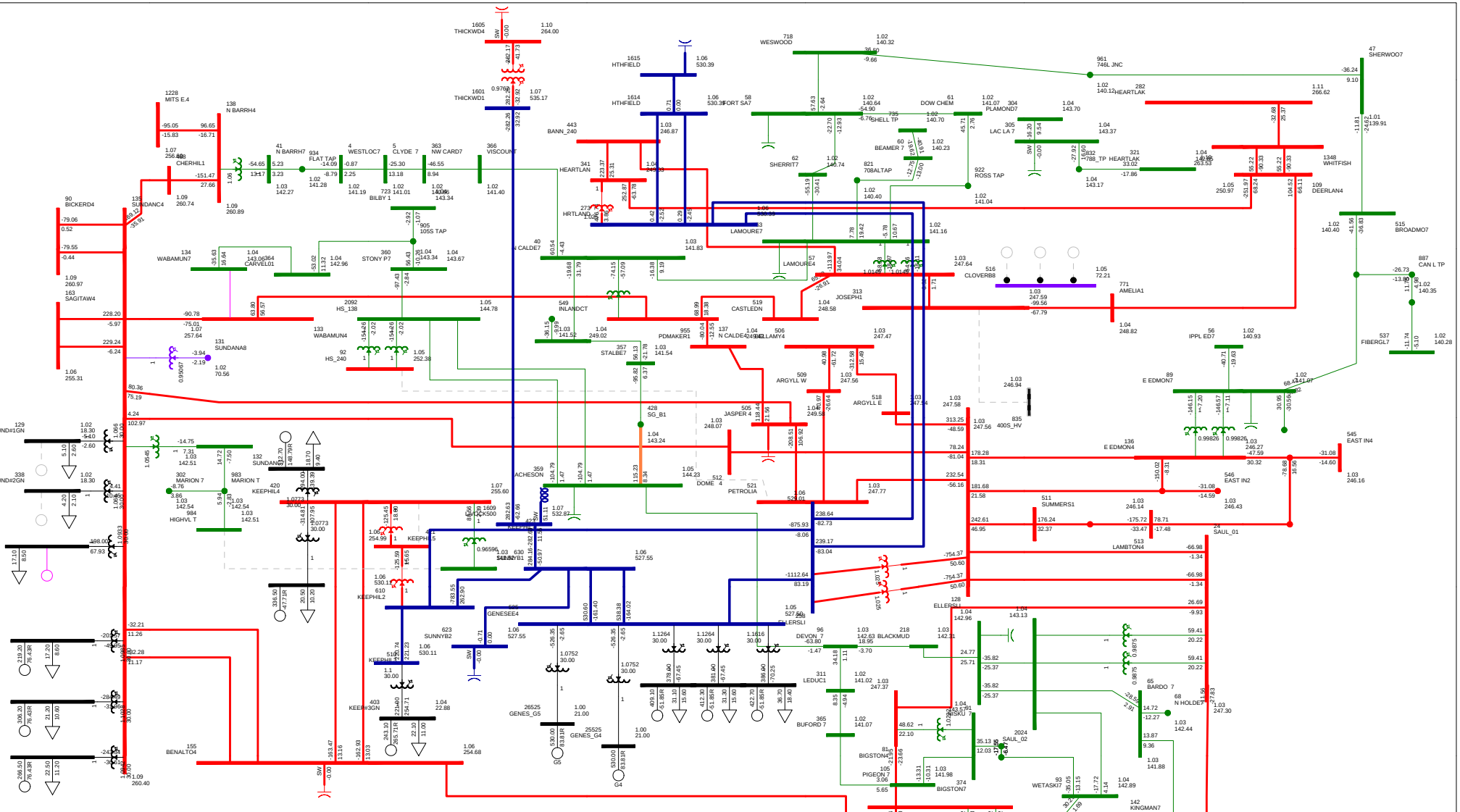
WATL: -0.81 MW
EATL: -0.73 MW

Total Heartland Generation: 0.00 MW

Total Genesee Generation: 2304.10 MW

SOK Cutplane	438.41 MW	+ (0.35) x-60.09 MW
KEG Cutplane	2292.84 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)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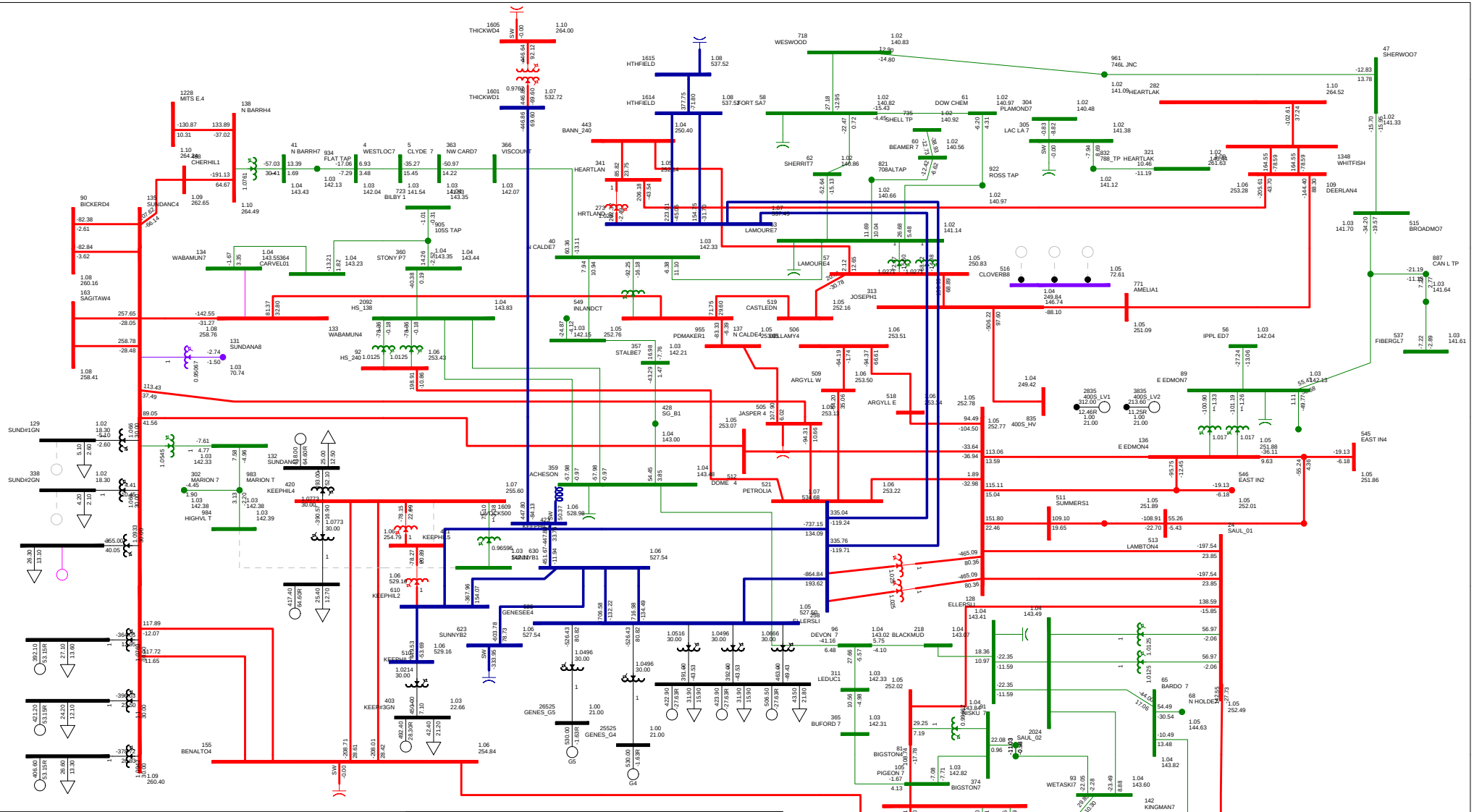
1601 THICKWD1
1615 HTHFIELD
1614 HTHFIELD
718 WESWOOD
961 746L JNC
47 SHERWOO7
282 HEARTLAK
1348 WHITFISH
109 DEERLAN4
515 BROADMO7
887 CAN L TP
537 FIBERGL7
1228 MITS E.4
138 N BARRH4
488 CHERHIL1
90 BICKERD4
135 SUNDANC4
163 SAGITAW4
905 105S TAP
134 WABAMUN7
360 STONY P7
2092 HS_138
133 WABAMUN4
92 HS_240
131 SUNDANA8
129 SUND#1GN
338 SUND#2GN
302 MARION 7
984 HIGHVL T
983 MARION T
420 KEEPIHL4
132 SUNDANG
155 BENALTO4
610 KEEPIHL2
403 KEEP#3GN
623 SUNNYB2
630 SUNNYB1
359 JACHESON
549 INLANDCT
40 N CALDET
443 BANN_240
341 HEARTLAN
273 HRTLAND
955 PDMAKER1
357 STALBE7
428 SG_B1
505 JASPER 4
512 DOME 4
521 PETROLIA
519 CASTLEDN
506 N CALDE4
509 ARGYLL W
518 ARGYLL E
313 JOSEPH1
516 CLOVERB8
771 AMELIA1
56 IPPL ED7
89 E EDMON7
136 E EDMON4
545 EAST IN4
546 EAST IN2
835 400S_HV
511 SUMMERS1
24 SAUL_01
513 LAMBTON4
128 ELLERS1
96 DEVON_7
218 BLACKMUD
311 LEDUC1
365 BUFORD 7
2024 SAUL_02
65 BARDO 7
68 N HOLDE7
374 BIGSTON7
93 WETASKI7
142 KINGMAN7
147 GAETZ 4
148 GAETZ 7
152 RED DEE4
1422 NEVIS 4
94 VERVICK 7
70 CAMROSE7
789 WOLFCRE2
788 WOLFCREK
1609 BLACK500
26525 GENES_G5
25525 GENES_G4
G4
SCENARIO 5 2021 SP LOW SOK (PRE CONNECTION)
1139L
FIG A-35
THU, APR 20 2017 9:00
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000
BC-AB: 888.72 MW
MATL import: 0.00 MW
Sask. Import: -0.10 MW
WATL: -0.81 MW
EATL: -0.73 MW
Total Heartland Generation: 0.00 MW
Total Genesee Generation: 2304.10 MW
SOK Cutplane 401.91 MW + (0.35) x-59.99 MW
KEG Cutplane 2417.16 MW
Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)

Attachment B

Post-Project Power Flow Diagrams (Scenarios 6 to 10)



SCENARIO 6 2019SL HIGH SOK (POST CONNECTION)
BASE CASE
FIG B-1
THU, APR 20 2017 9:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0 Kilotaw A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 36.62 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 588.83 MW

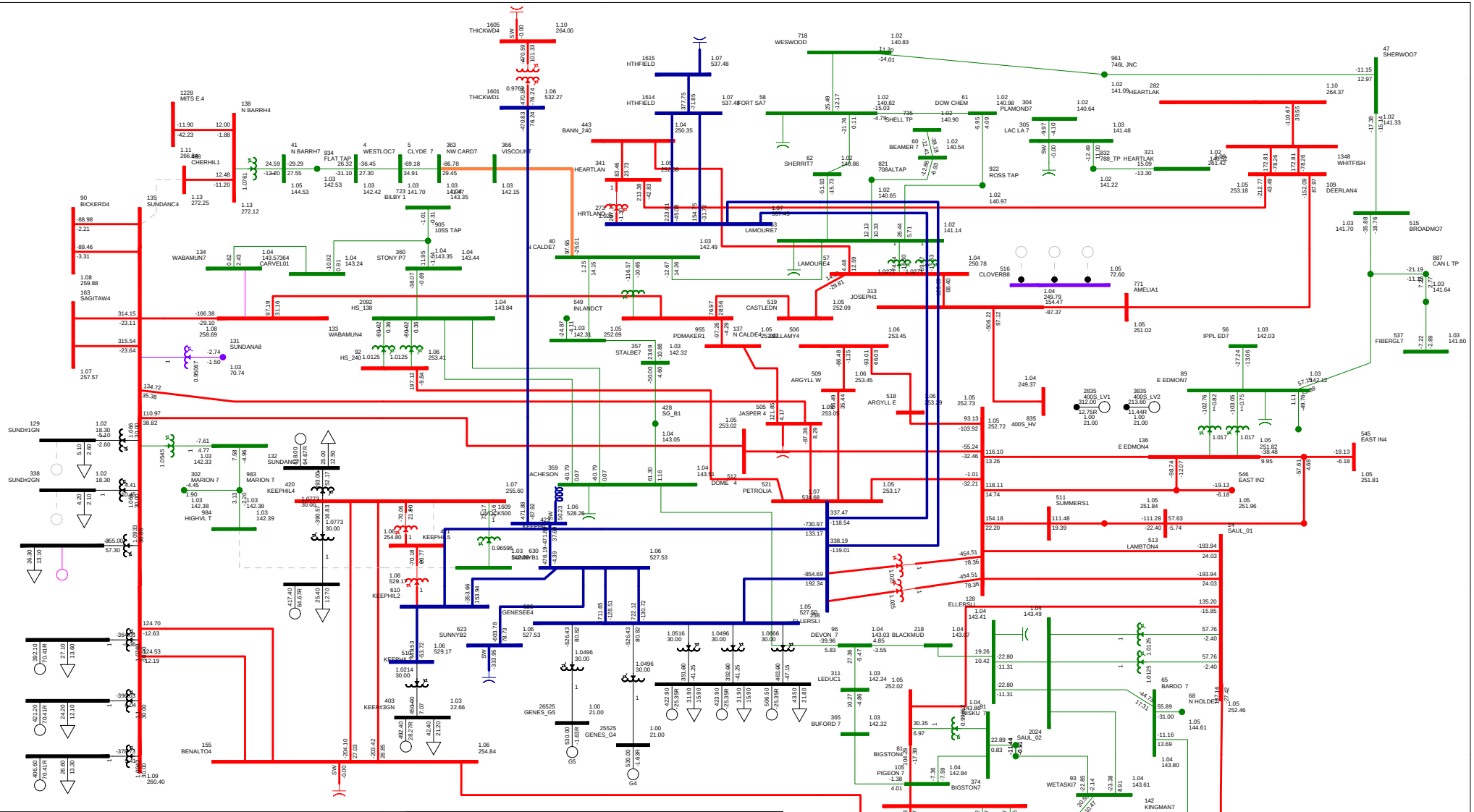
EATL: 368.06 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2413.30 MW

Max: 2,050MW

SOK Cutplane	1030.61 MW	+ (0.35) x64.18 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2107.95 MW		2,450MW (SOK > 1,805MW)



SCENARIO 6 2019SL HIGH SOK (POST CONNECTION)
1046L
FIG B-2
THU, APR 20 2017 9:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Ohm/sec X

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 48.38 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 588.83 MW

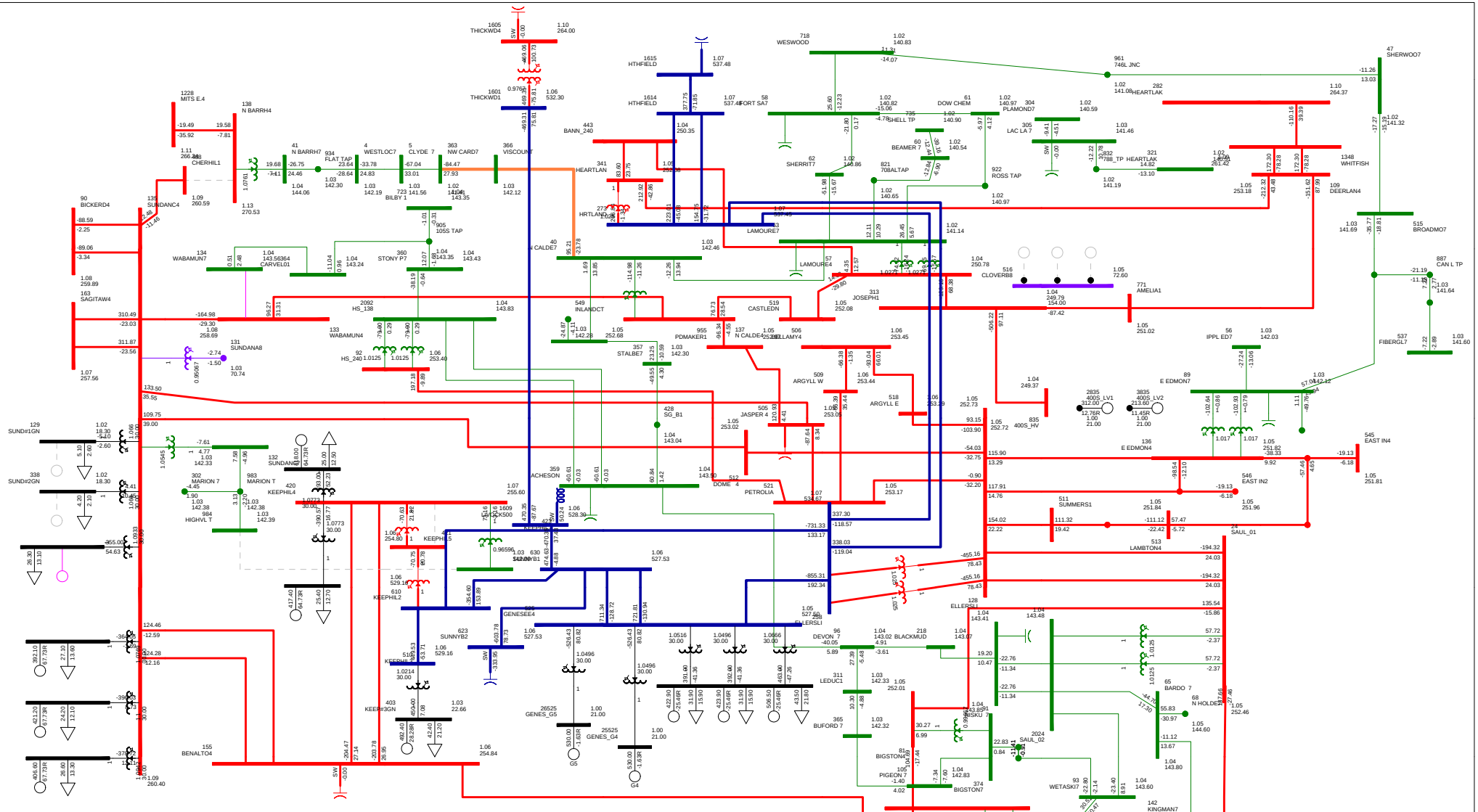
EATL: 368.06 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2413.30 MW

Max: 2,050MW

SOK Cutplane	1025.65 MW	+ (0.35) x65.37 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2081.87 MW		2,450MW (SOK > 1,805MW)



SCENARIO 6 2019SL HIGH SOK (POST CONNECTION)
913L
FIG B-3
THU, APR 20 2017 9:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Ontario A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 46.76 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 588.83 MW

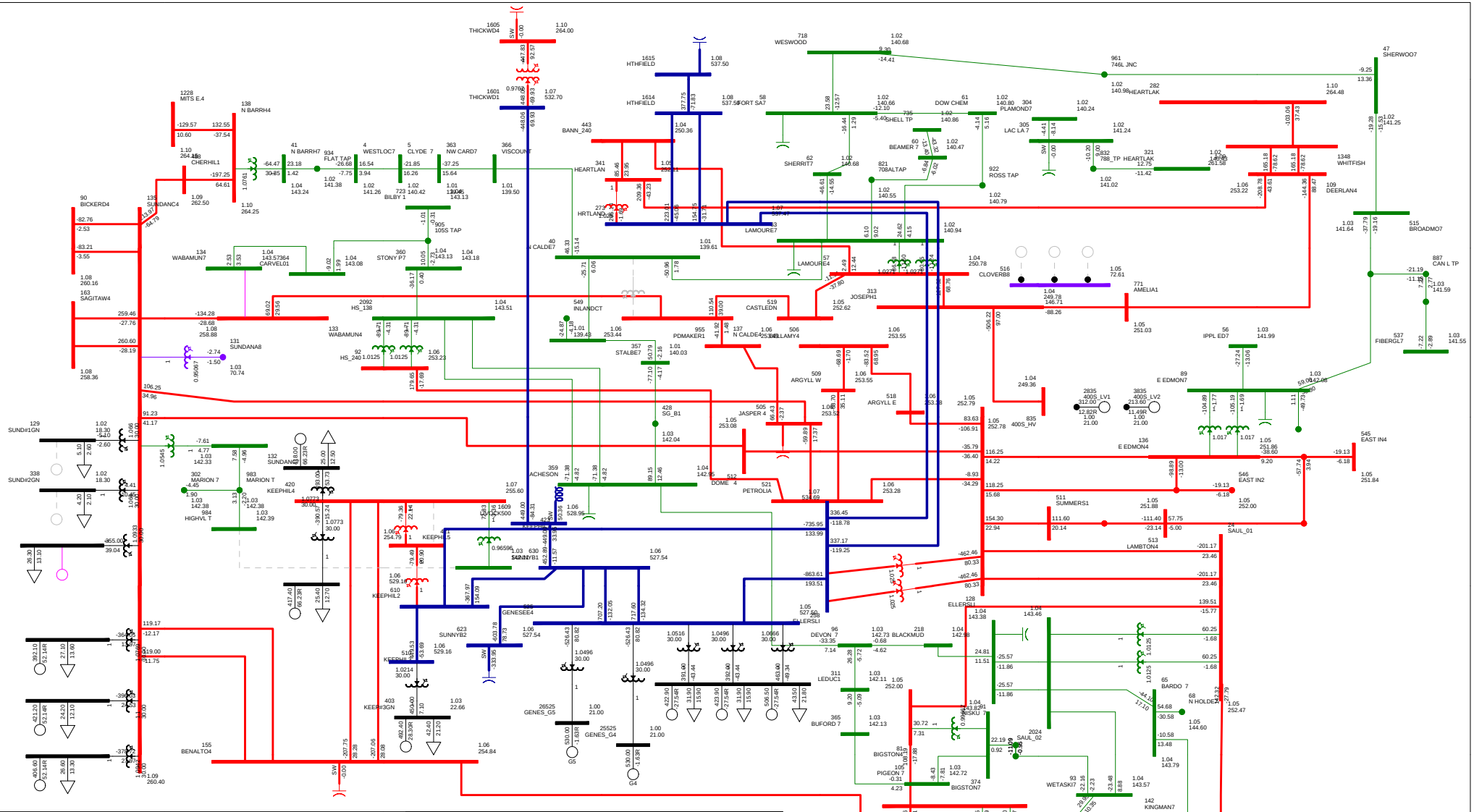
EATL: 368.06 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2413.30 MW

Max: 2,050MW

SOK Cutplane	1026.84 MW	+ (0.35) x65.36 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2083.62 MW		2,450MW (SOK > 1,805MW)


1605 THICKWD4
1601 THICKWD1
1615 HTHFIELD
1614 HTHFIELD
718 WESWOOD
961 746L JNC
47 SHERWOO7
282 HEARTLAK
1348 WHITFISH
109 DEERLAN4
515 BROADMO7
887 CAN L TP
537 FIBERGL7
1228 MITS E.4
138 N BARRH4
90 BICKERD4
135 SUNDANC4
163 SAGITAW4
129 SUND#1GN
338 SUND#2GN
134 WABAMUN7
360 STONY P7
905 105S TAP
133 WABAMUN4
131 SUNDANA8
302 MARION 7
984 HIGHVL T
983 MARION T
420 KEEPHL4
610 KEEPHL2
615 KEEPHL5
403 KEEP#3GN
155 BENALTO4
443 BANN_240
341 HEARTLAN
549 INLANDCT
40 N CALDE7
359 JACHESON
630 SUNNYB1
623 SUNNYB2
609 WOLCK500
524 GENESEE4
26525 GENES_G5
25525 GENES_G4
G5
G4
62 SHERRIT7
821 708ALTAP
922 ROSS TAP
63 LAMOURE7
57 LAMOURE4
506 BELLAMY4
519 CASTLEDN
313 JOSEPH1
516 CLOVERB8
771 AMELIA1
509 ARGYLL W
518 ARGYLL E
428 SG_B1
505 JASPER 4
512 DOME 4
521 PETROLIA
128 ELLERSL1
96 DEVON 7
311 LEDUC1
365 BUFORD 7
2024 SAUL_02
374 BIGSTON7
147 GAETZ 4
148 GAETZ 7
152 RED DEE4
1422 NEVIS 4
93 WETASKI7
94 SERVICK 7
70 CAMROSE7
789 WOLFCRE2
798 WOLFCREK
1605 THICKWD4
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1.07 532.70
1.08 537.50
1.08 537.55
1.02 140.68
1.02 140.66
1.02 140.86
1.02 140.80
1.02 140.24
1.02 141.24
1.02 141.02
1.02 140.79
1.02 140.94
1.02 140.47
1.02 140.68
1.02 140.55
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1.04 249.36
1.05 252.79
1.05 252.78
1.05 252.62
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1.06 253.28
1.05 252.82
1.05 252.30
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1.04 143.46
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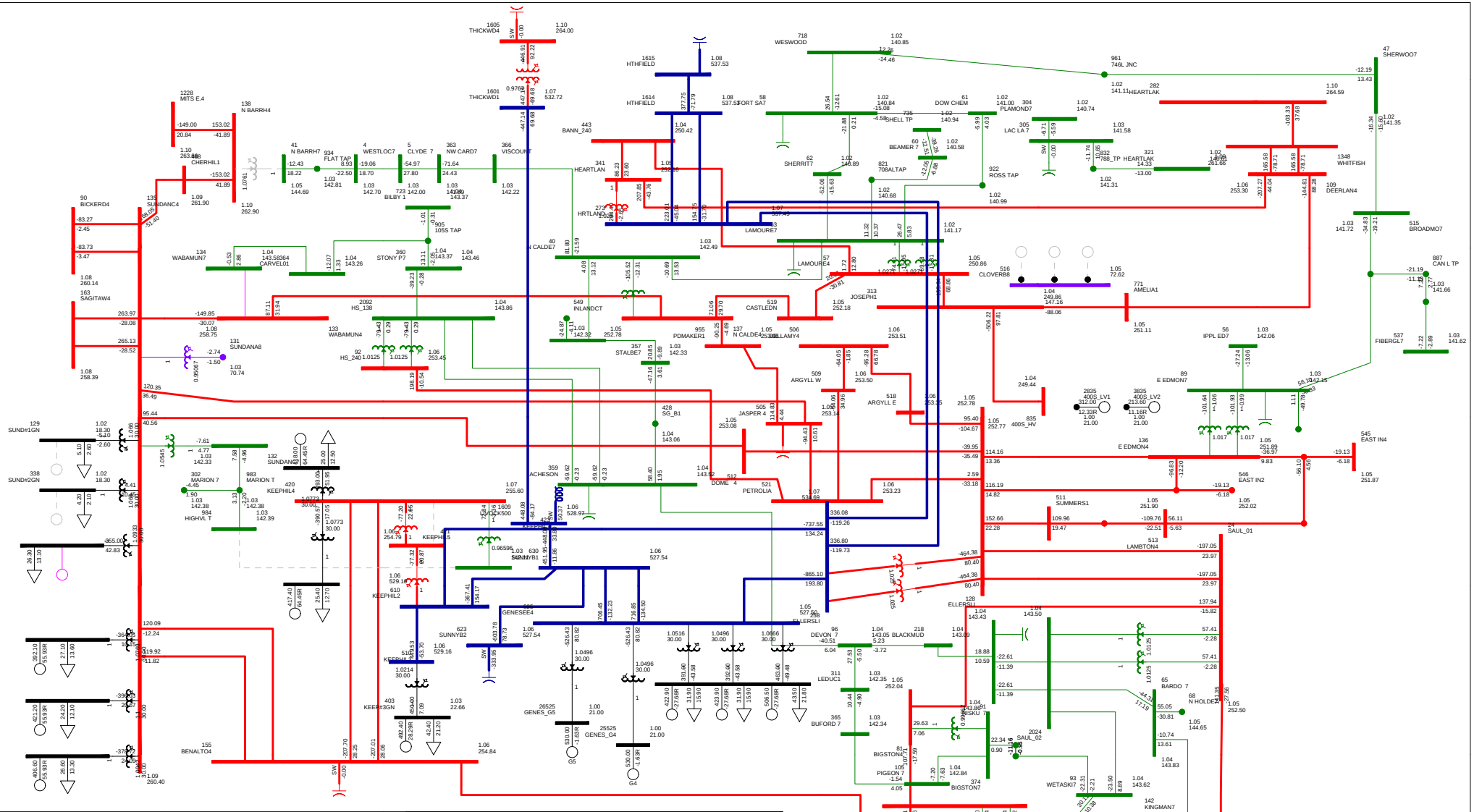
1.04 143.79
1.04 143.40
1.05 252.47
1.05 144.60
1.05 252.39
1.04 143.09
1.03 142.74
1.04 143.08
1.05 250.82
1.06 254.60
1.06 254.84
1.09 260.40
1.09 262.50
1.10 264.25
1.10 264.48
1.10 264.18
1.08 260.16
1.08 258.36
1.03 141.64
1.03 141.59
1.03 141.55
1.03 141.99
1.05 251.84
1.05 252.00
1.05 251.88
1.05 251.86
1.05 252.47
1.05 252.39
1.04 143.40
1.04 143.57
1.04 143.79
1.04 143.09
1.03 142.74
1.04 143.08
1.05 252.30
1.05 250.82
1.06 254.60
1.06 254.84
1.09 260.40
1.05 251.84
1.05 252.00
1.05 251.88
1.05 251.86
1.05 252.47
1.05 252.39
1.04 143.40
1.04 143.57
1.04 143.79
1.04 143.09
1.03 142.74
1.04 143.08
1.05 252.30
1.05 250.82
1.06 254.60
1.06 254.84
1.09 260.40
1.09 262.50
1.10 264.25
1.10 264.48
1.10 264.18
1.08 260.16
1.08 258.36
1.03 141.64
1.03 141.59
1.03 141.55
1.03 141.99



SCENARIO 6 2019SL HIGH SOK (POST CONNECTION)
69ST4
FIG B-5
THU, APR 20 2017 9:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Brightness X

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 37.73 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 588.83 MW

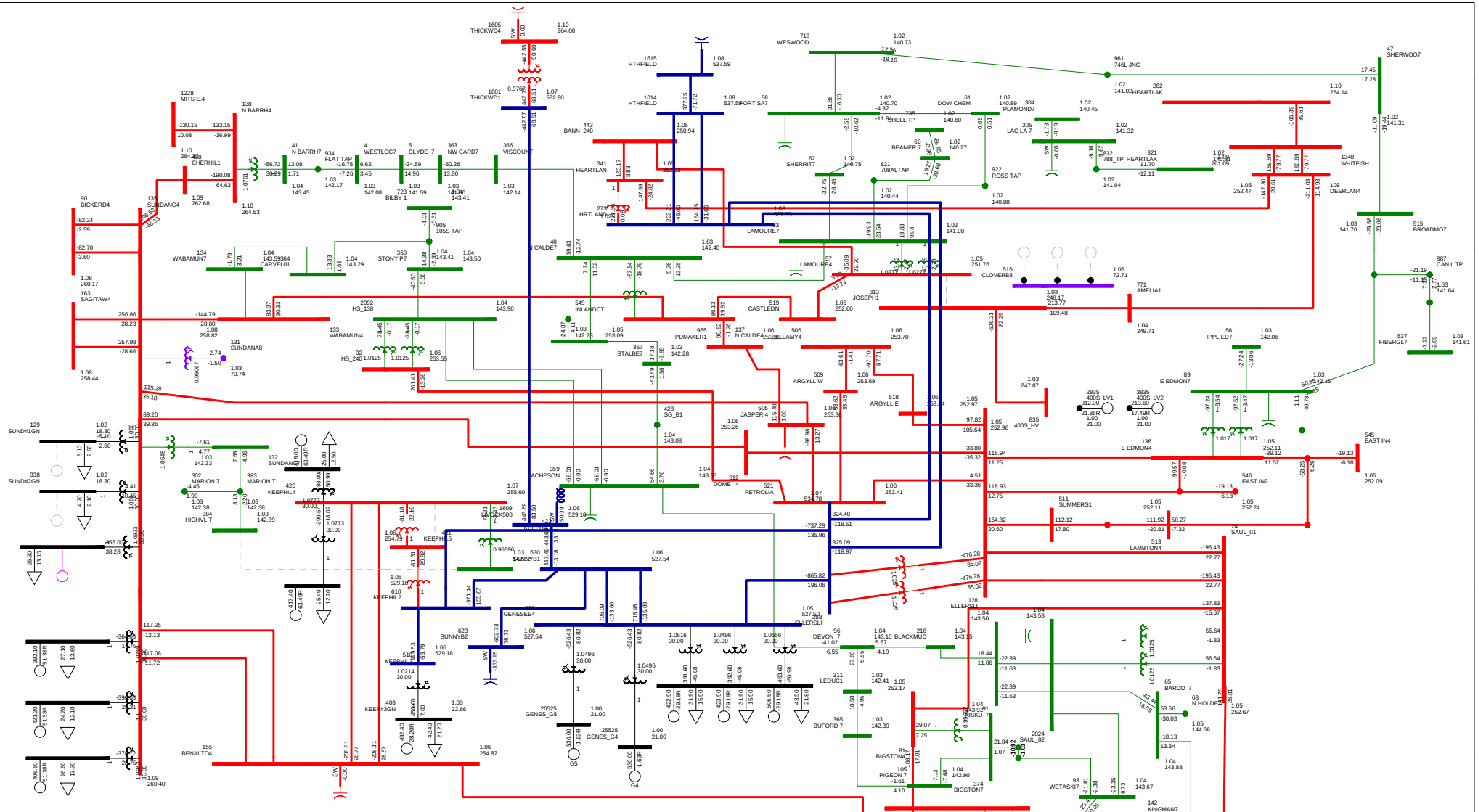
EATL: 368.06 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2413.30 MW

Max: 2,050MW

SOK Cutplane	1031.93 MW	+ (0.35) x64.70 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2106.22 MW		2,450MW (SOK > 1,805MW)



SCENARIO 6 2019SL HIGH SOK (POST CONNECTION)
997L
FIG B-6
THU, APR 20 2017 9:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Ohm/sec A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 37.61 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 588.83 MW

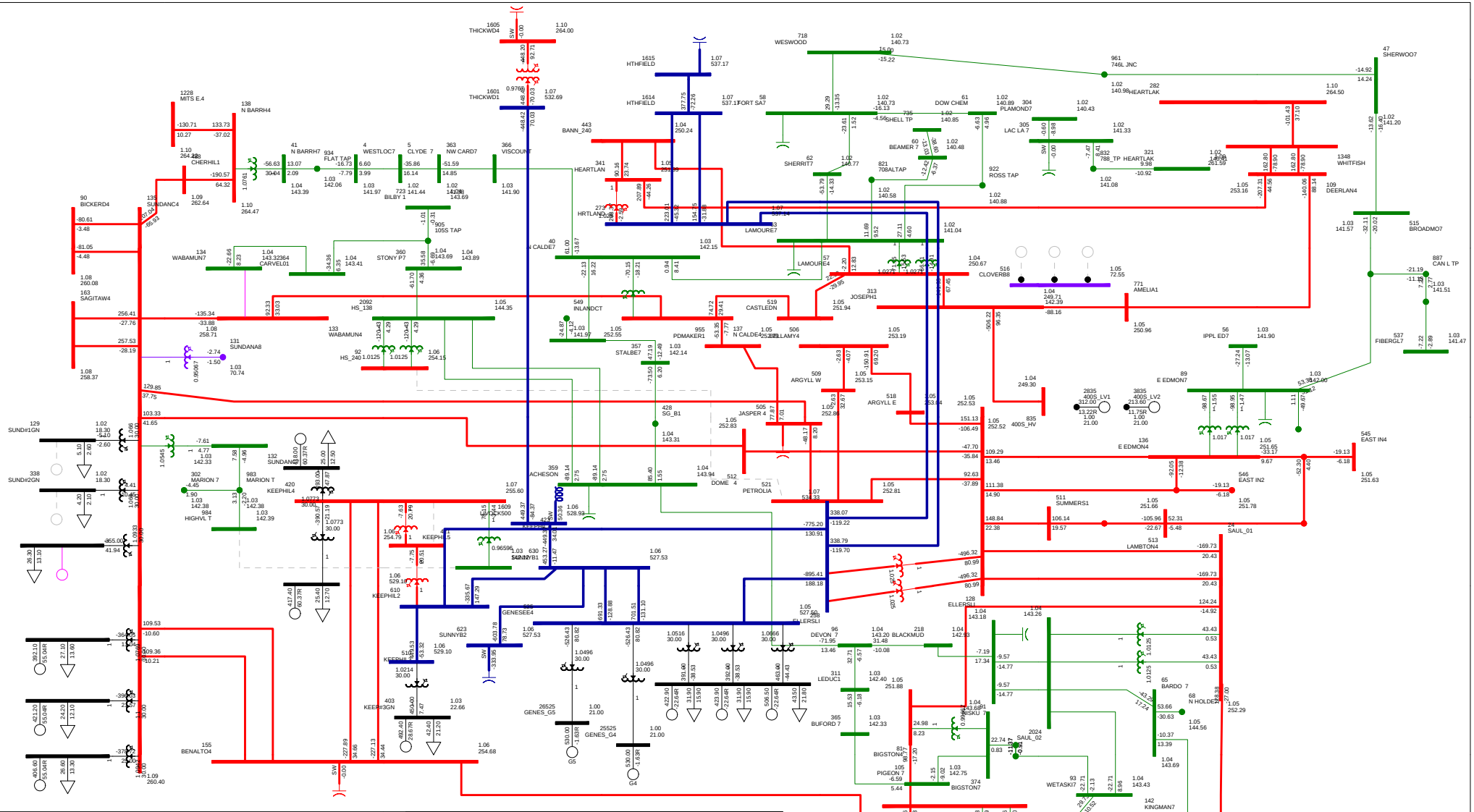
EATL: 368.06 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2413.30 MW

Max: 2,050MW

SOK Cutplane	1027.19 MW	+ (0.35) x63.21 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2109.40 MW		2,450MW (SOK > 1,805MW)



SCENARIO 6 2019SL HIGH SOK (POST CONNECTION)
1139L
FIG B-7
THU, APR 20 2017 9:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Ontario A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 39.81 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 588.83 MW

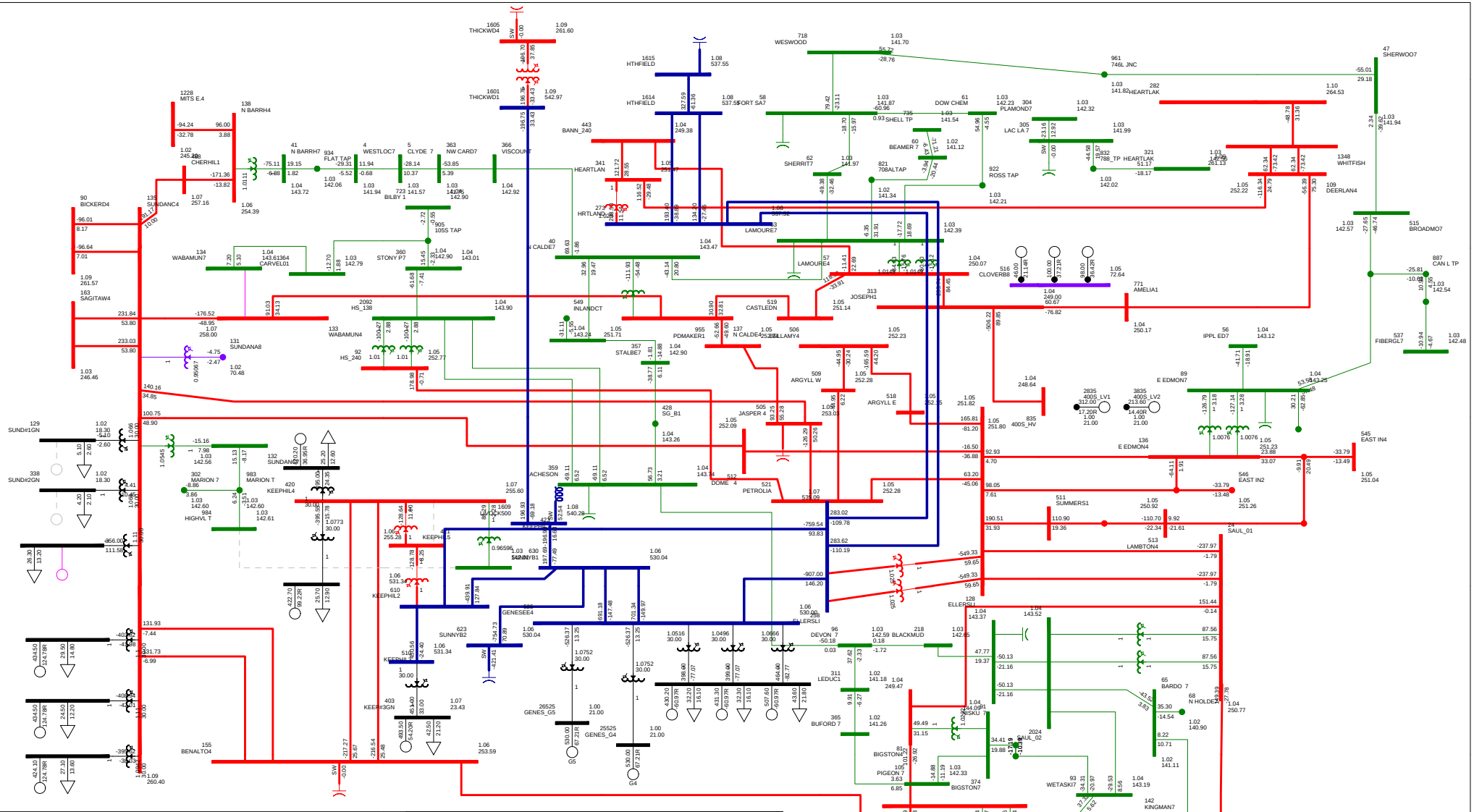
EATL: 368.06 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2413.30 MW

Max: 2,050MW

SOK Cutplane	999.08 MW	+ (0.35) x64.36 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2222.60 MW		2,450MW (SOK > 1,805MW)



SCENARIO 7 2021 WP HIGH SOK (POST CONNECTION)
BASE CASE
FIG B-8
THU, APR 20 2017 9:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 BASEkva B

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: -139.59 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 733.94 MW

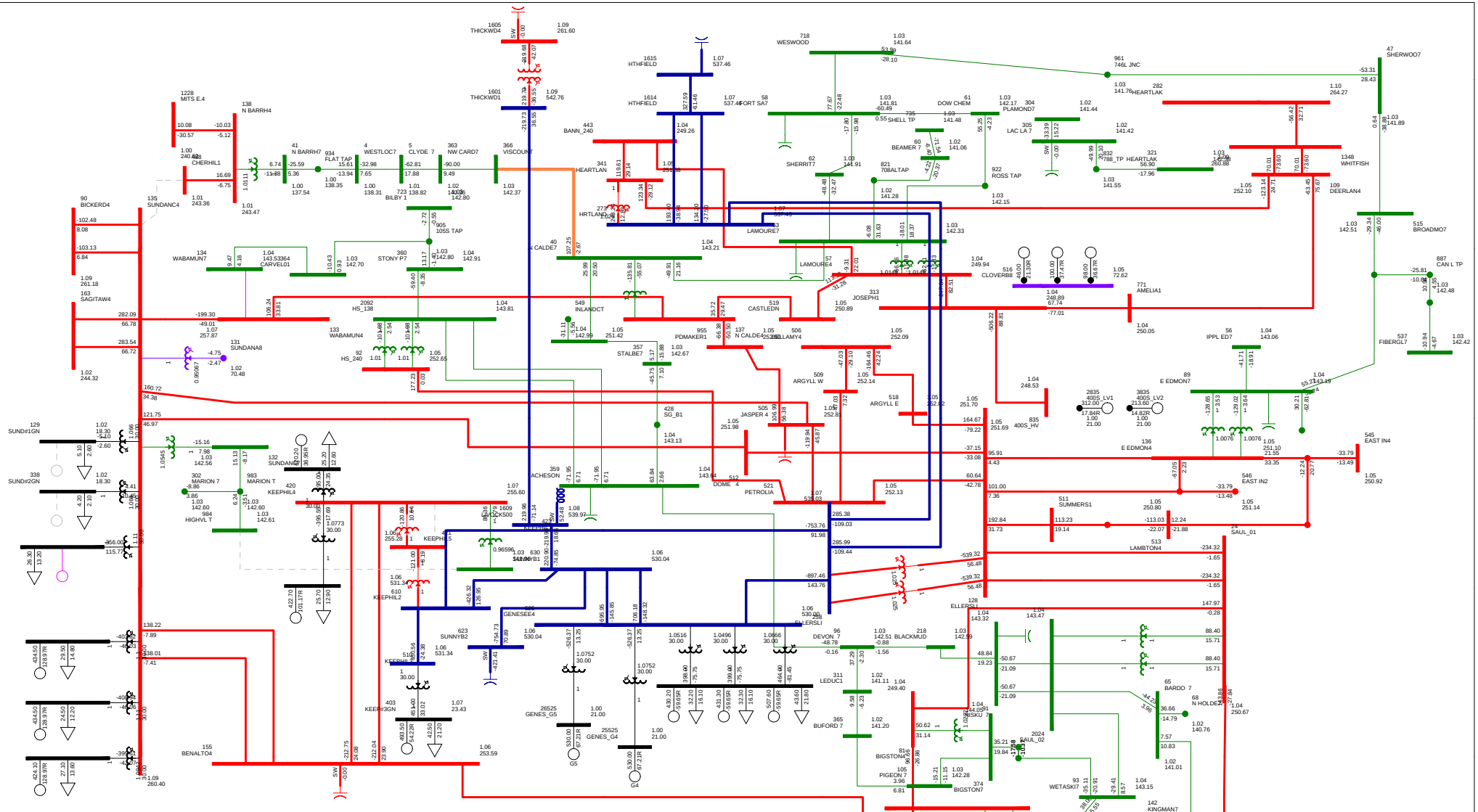
EATL: 319.20 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2429.10 MW

Max: 2,050MW

SOK Cutplane	1174.24 MW	+ (0.35) x-38.28 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2205.99 MW		2,450MW (SOK > 1,805MW)



SCENARIO 7 2021 WP HIGH SOK (POST CONNECTION)
1046L
FIG B-9
THU, APR 20 2017 9:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0 kVbase B

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: -126.92 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 733.94 MW

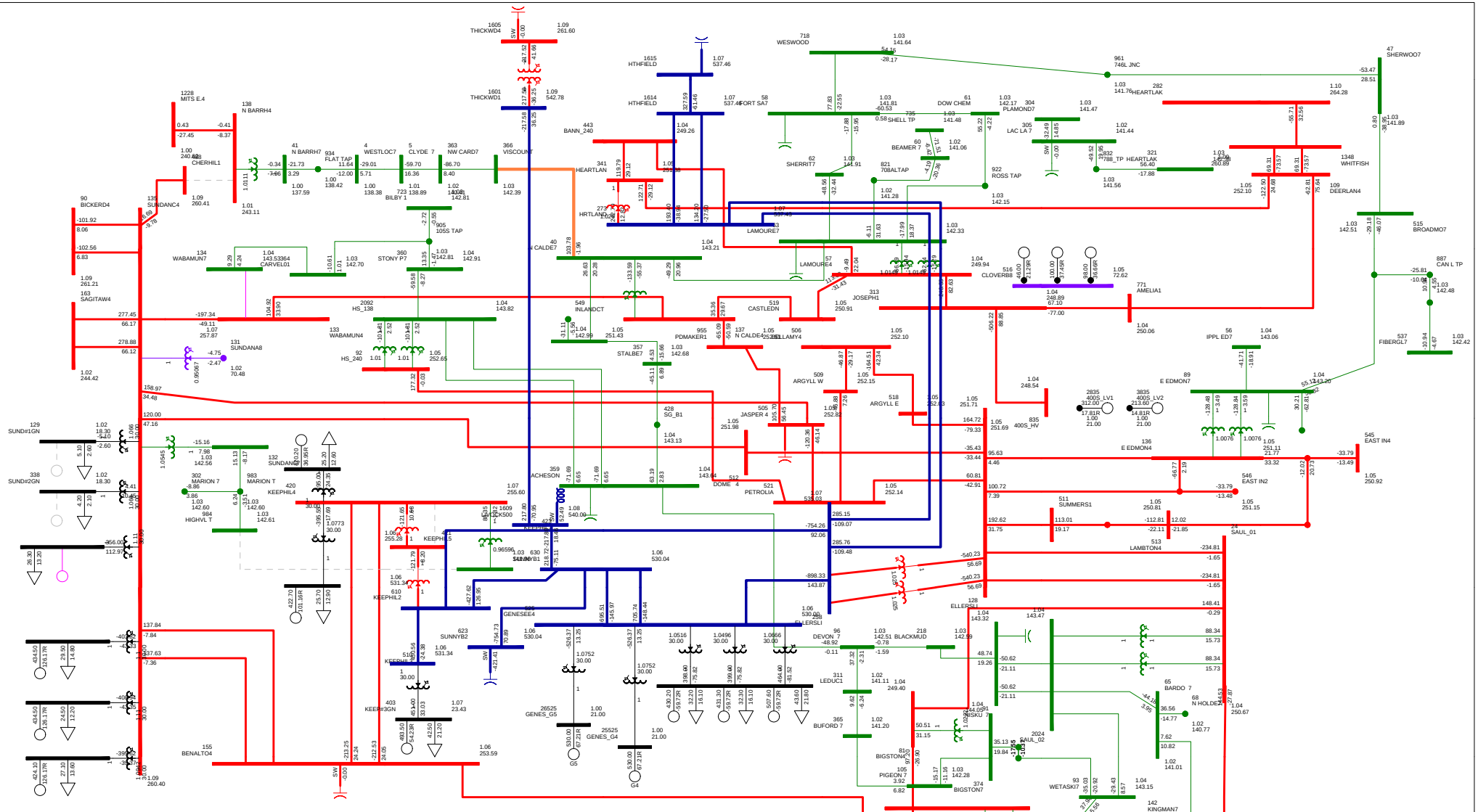
EATL: 319.20 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2429.10 MW

Max: 2,050MW

SOK Cutplane	1168.21 MW	+ (0.35) x-37.20 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2181.09 MW		2,450MW (SOK > 1,805MW)



SCENARIO 7 2021 WP HIGH SOK (POST CONNECTION)
913L
FIG B-10
THU, APR 20 2017 9:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Brightness

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: -128.97 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 733.94 MW

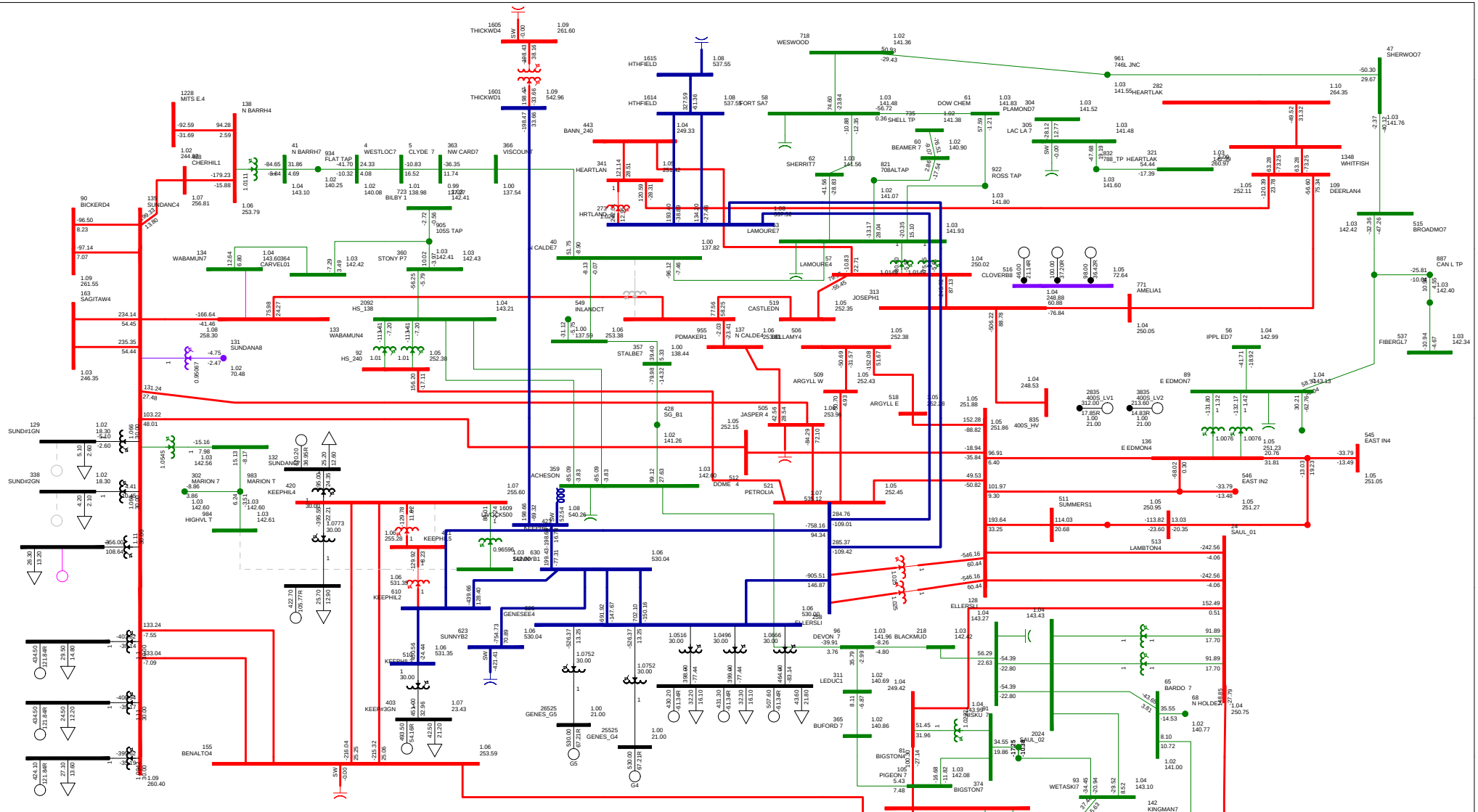
EATL: 319.20 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2429.10 MW

Max: 2,050MW

SOK Cutplane	1169.69 MW	+ (0.35) x-37.24 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2183.51 MW		2,450MW (SOK > 1,805MW)



SCENARIO 7 2021 WP HIGH SOK (POST CONNECTION)
37ST6
FIG B-11
THU, APR 20 2017 9:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 BASEmva B

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: -136.77 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

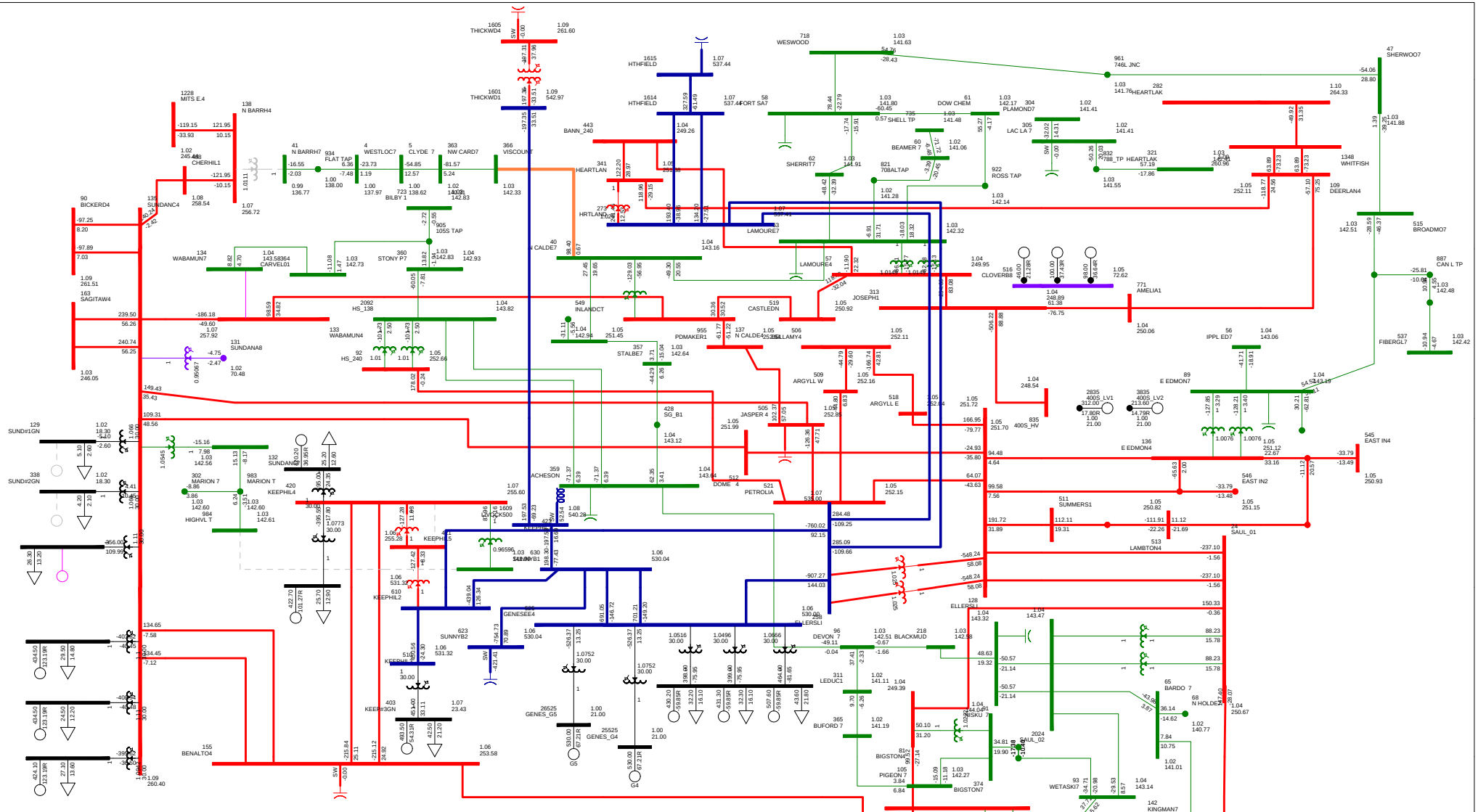
WATL: 733.94 MW

EATL: 319.20 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2429.10 MW

			Max: 2,050MW
SOK Cutplane	1183.45 MW	+ (0.35) x-37.75 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2200.23 MW		2,450MW (SOK > 1,805MW)



SCENARIO 7 2021 WP HIGH SOK (POST CONNECTION)
69ST4
FIG B-12
THU, APR 20 2017 9:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Brightness

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: -136.35 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

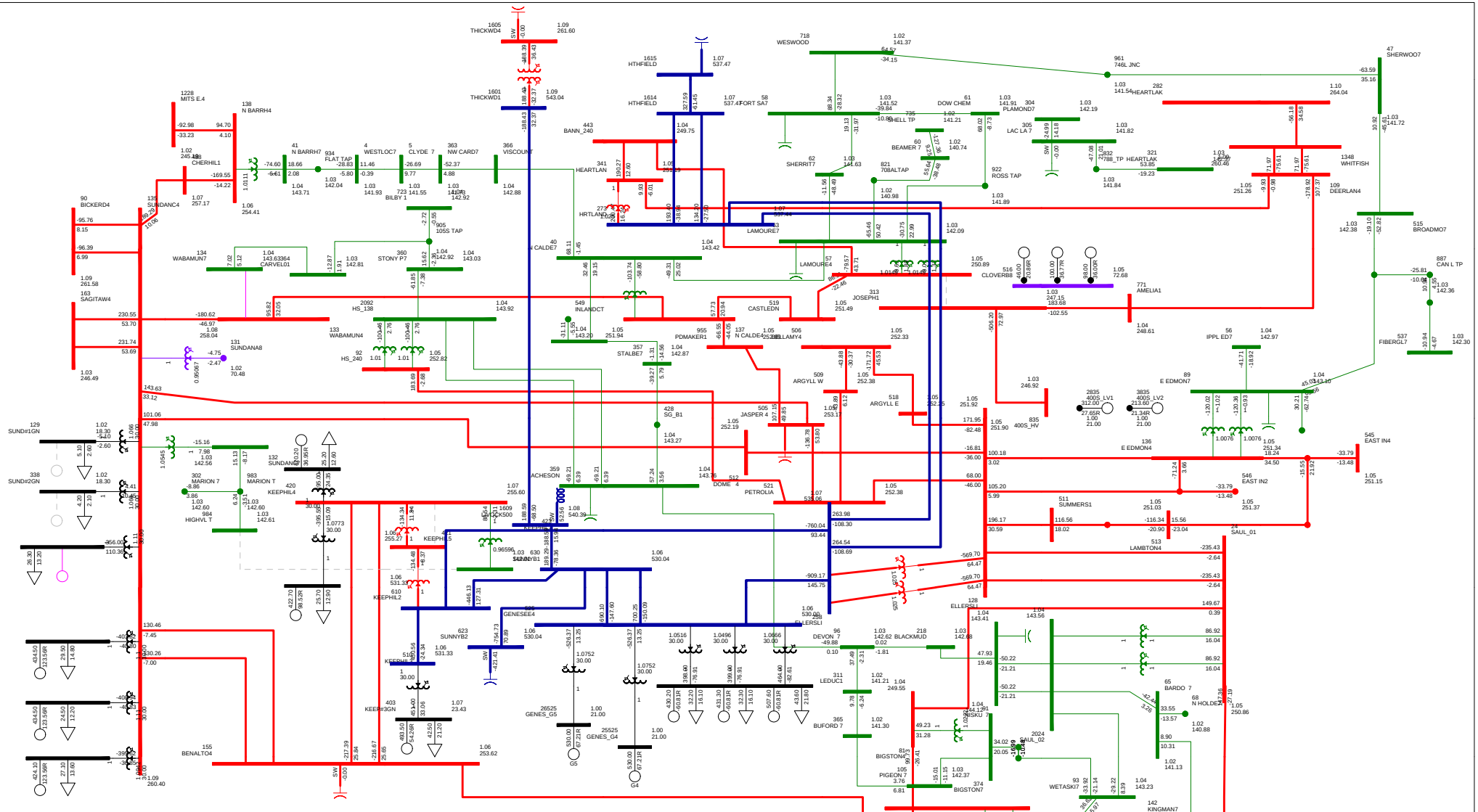
WATL: 733.94 MW

EATL: 319.20 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2429.10 MW

			Max: 2,050MW
SOK Cutplane	1174.83 MW	+ (0.35) x-37.55 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2203.39 MW		2,450MW (SOK > 1,805MW)



SCENARIO 7 2021 WP HIGH SOK (POST CONNECTION)
99/L
FIG B-13
THU, APR 20 2017 9:00

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Brightness

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: -135.79 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 733.94 MW

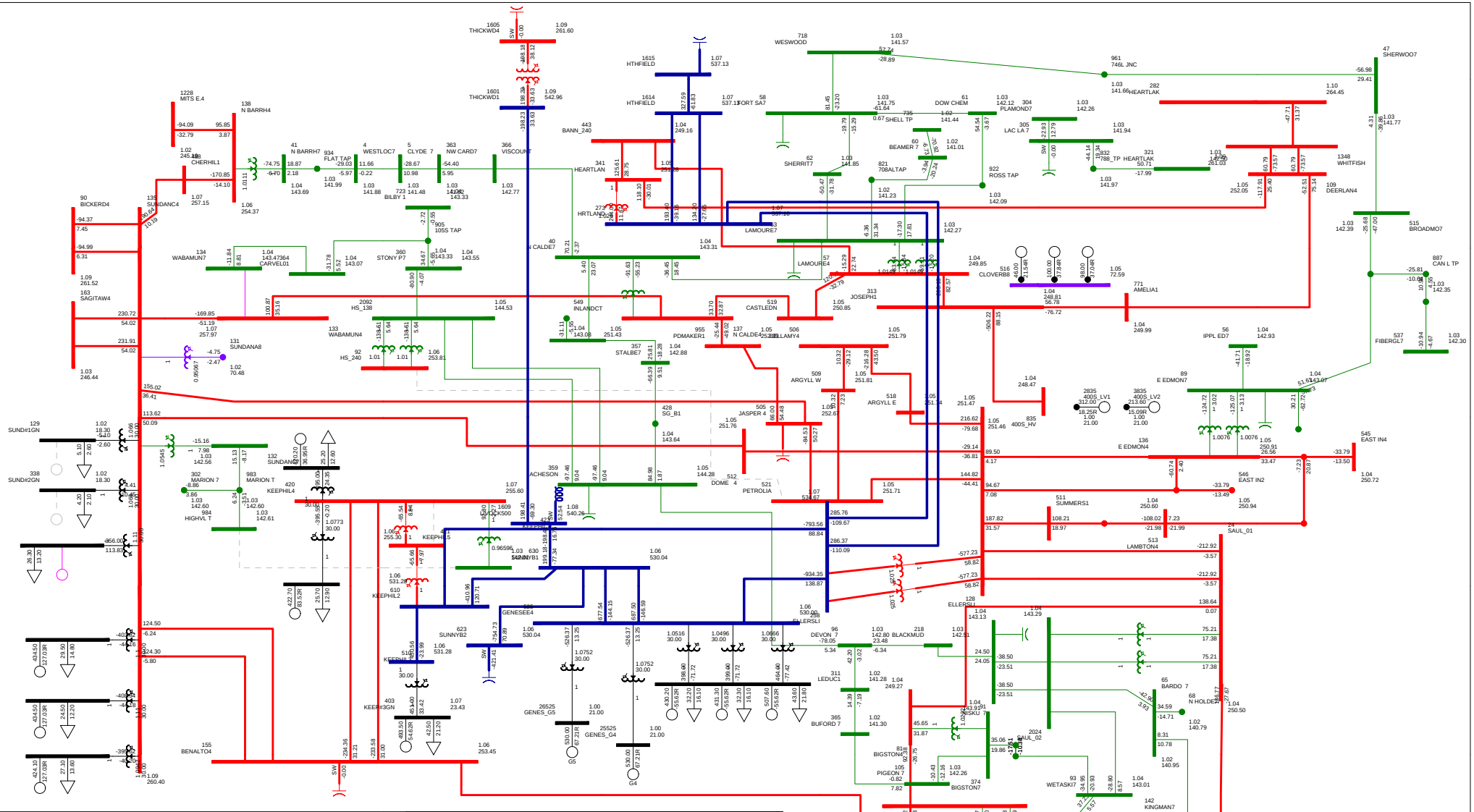
EATL: 319.20 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2429.10 MW

Max: 2,050MW

SOK Cutplane	1166.14 MW	+ (0.35) x-40.10 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2209.20 MW		2,450MW (SOK > 1,805MW)



SCENARIO 7 2021 WP HIGH SOK (POST CONNECTION)
1139L
FIG B-14
THU, APR 20 2017 9:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 BASEmva

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: -137.07 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

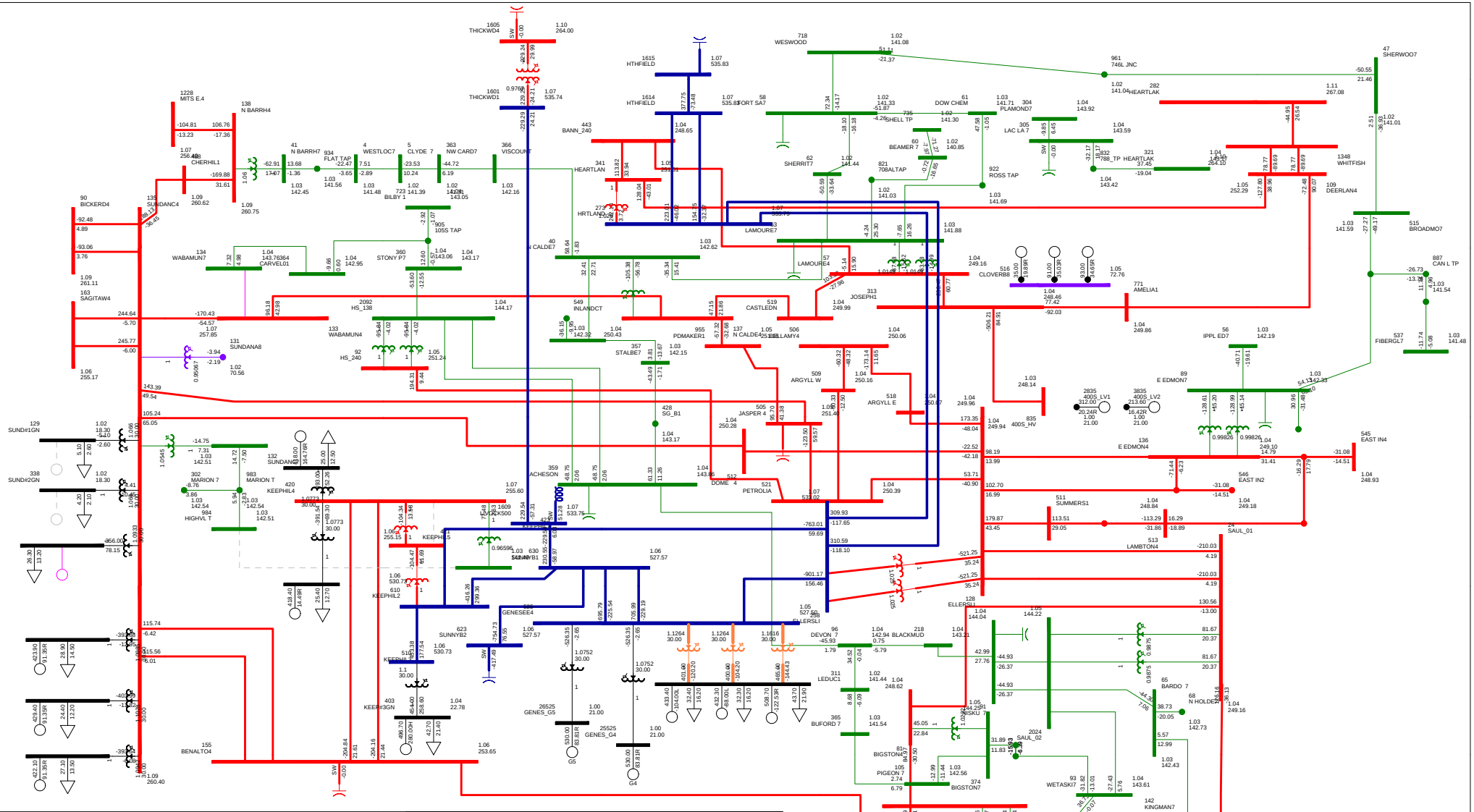
WATL: 733.94 MW

EATL: 319.20 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2429.10 MW

			Max: 2,050MW
SOK Cutplane	1145.69 MW	+ (0.35) x-38.11 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2308.48 MW		2,450MW (SOK > 1,805MW)



SCENARIO 8 2021 SP HIGH SOK (POST CONNECTION)
BASE CASE
FIG B-15
THU, APR 20 2017 9:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Brightness A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 209.58 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 733.94 MW

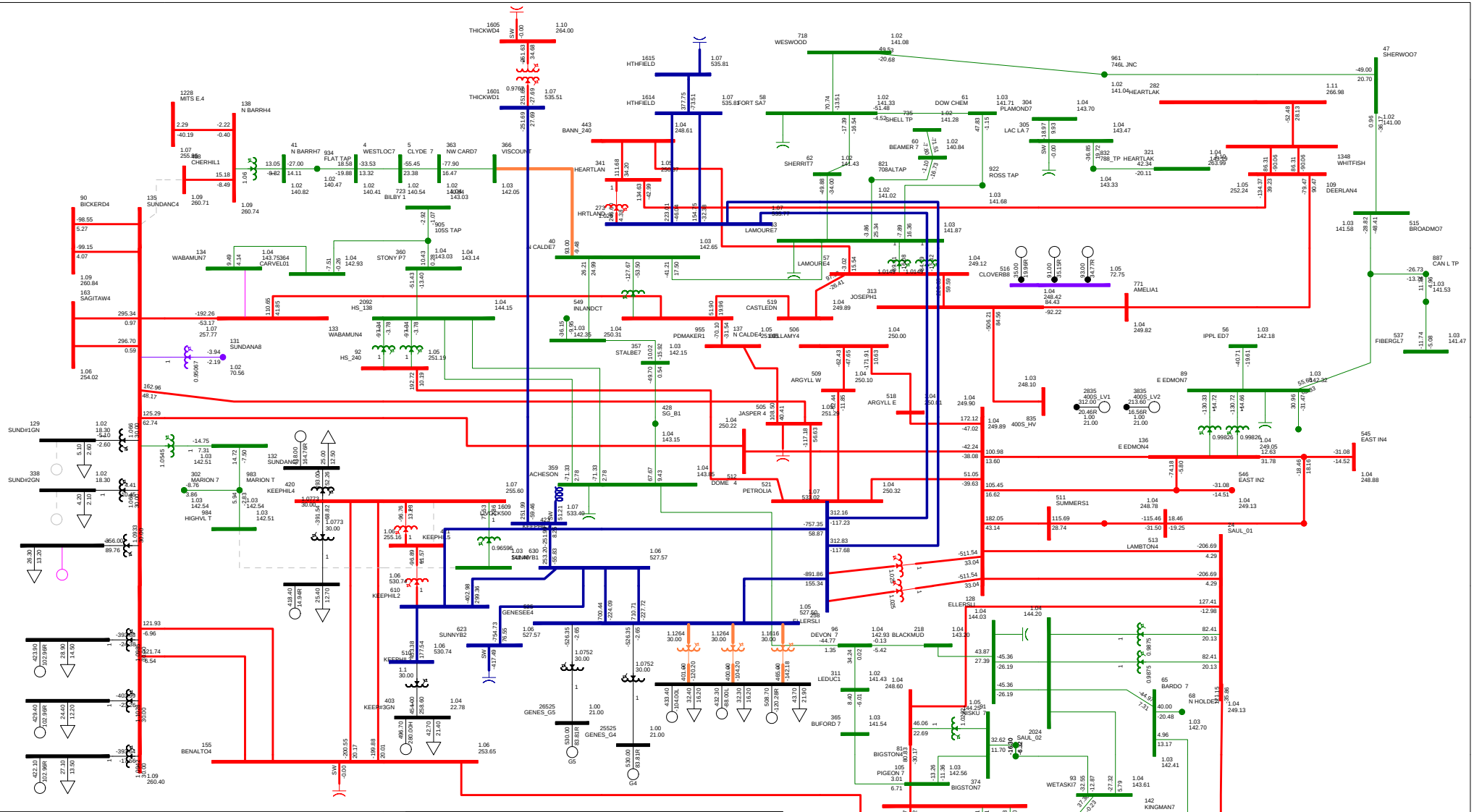
EATL: 368.11 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2434.40 MW

Max: 2,050MW

SOK Cutplane	1105.39 MW	+ (0.35) x6.22 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2166.57 MW		2,450MW (SOK > 1,805MW)



SCENARIO 8 2021 SP HIGH SOK (POST CONNECTION)
1046L
FIG B-16
THU, APR 20 2017 9:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Brightness A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 220.74 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 733.94 MW

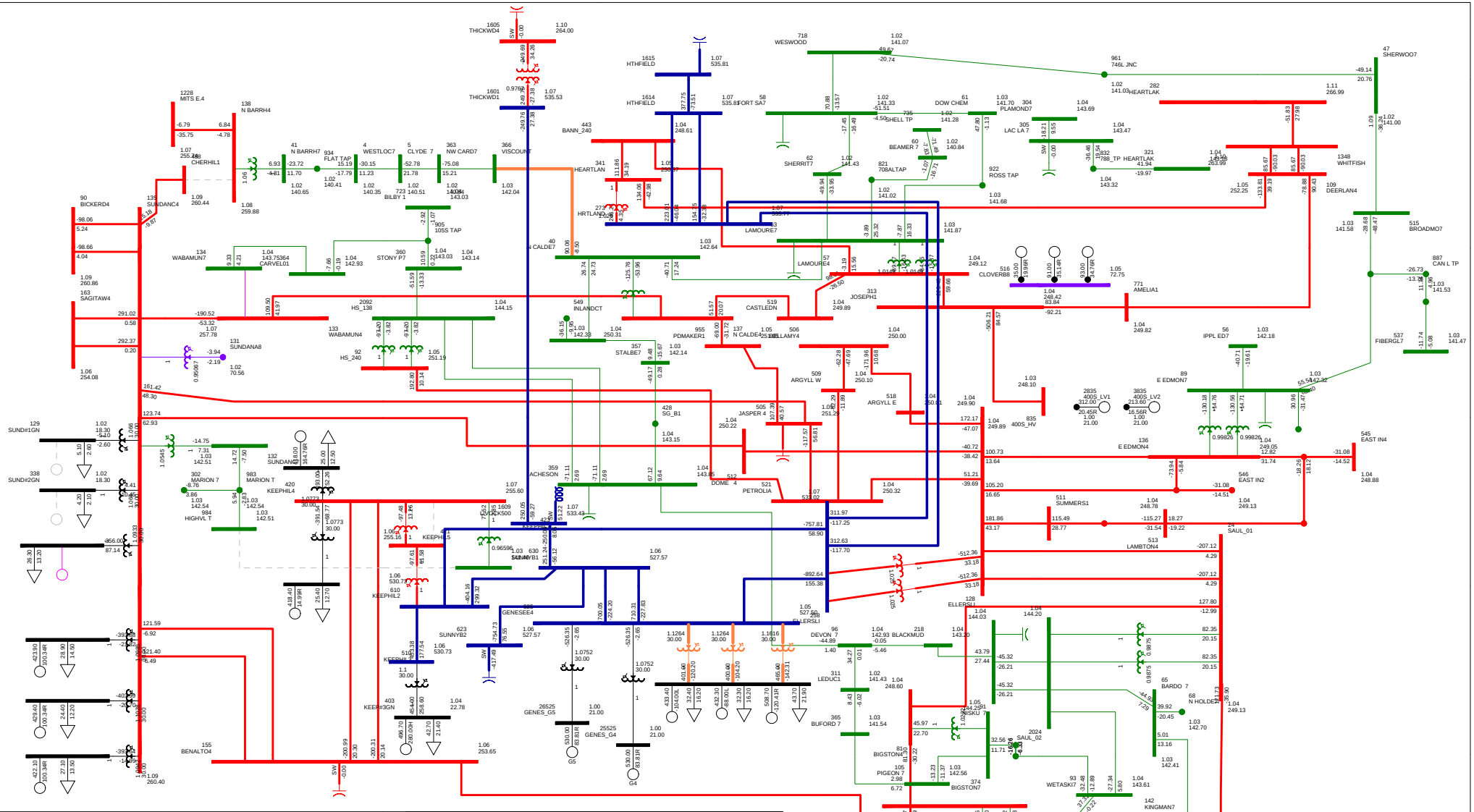
EATL: 368.11 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2434.40 MW

Max: 2,050MW

SOK Cutplane	1100.50 MW	+ (0.35) x7.29 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2142.49 MW		2,450MW (SOK > 1,805MW)



SCENARIO 8 2021 SP HIGH SOK (POST CONNECTION)
913L
FIG B-17
THU, APR 20 2017 9:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Ohm/sec A
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 218.93 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 733.94 MW

EATL: 368.11 MW

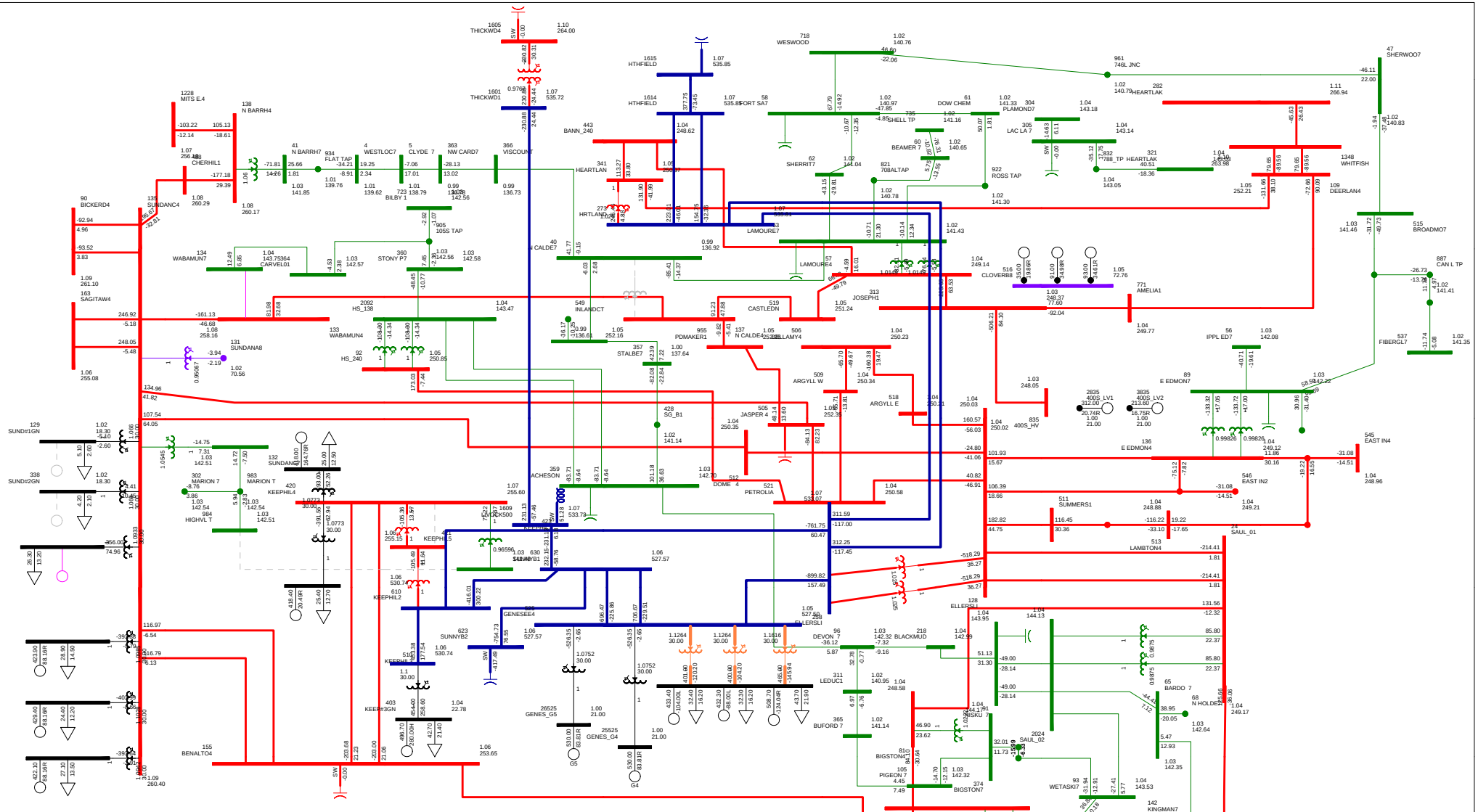
Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2434.40 MW

Max: 2,050MW

SOK Cutplane 1101.78 MW + (0.35) x7.25 MW 2,520MW (SOK <= 1,805MW)

KEG Cutplane 2144.65 MW 2,450MW (SOK > 1,805MW)



SCENARIO 8 2021 SP HIGH SOK (POST CONNECTION)
37ST6
FIG B-18
THU, APR 20 2017 9:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Brightness A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 212.30 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 733.94 MW

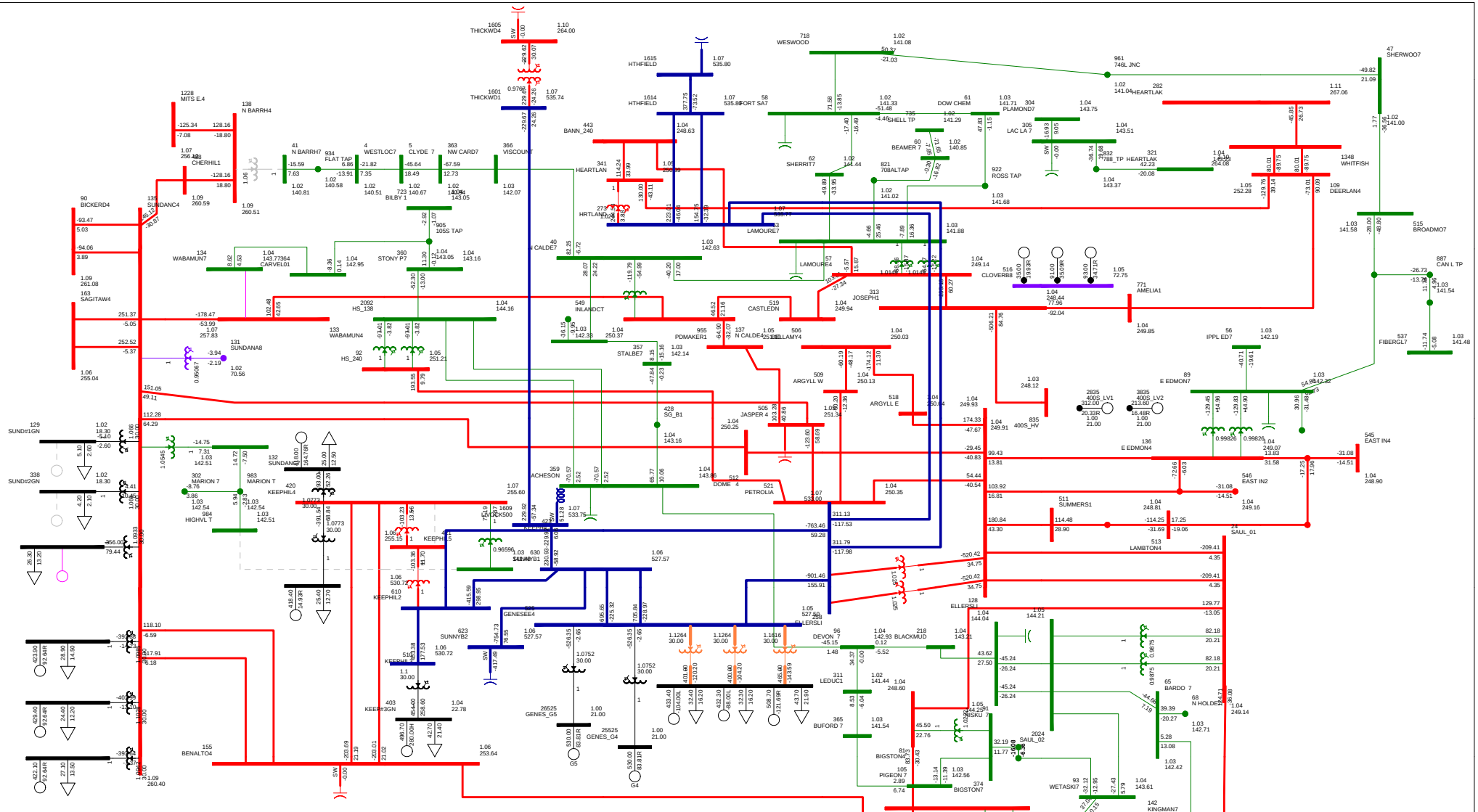
EATL: 368.11 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2434.40 MW

Max: 2,050MW

SOK Cutplane	1114.15 MW	+ (0.35) x6.72 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2161.22 MW		2,450MW (SOK > 1,805MW)



SCENARIO 8 2021 SP HIGH SOK (POST CONNECTION)
69ST4
FIG B-19
THU, APR 20 2017 9:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 BAMPS/ar A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 211.45 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 733.94 MW

EATL: 368.11 MW

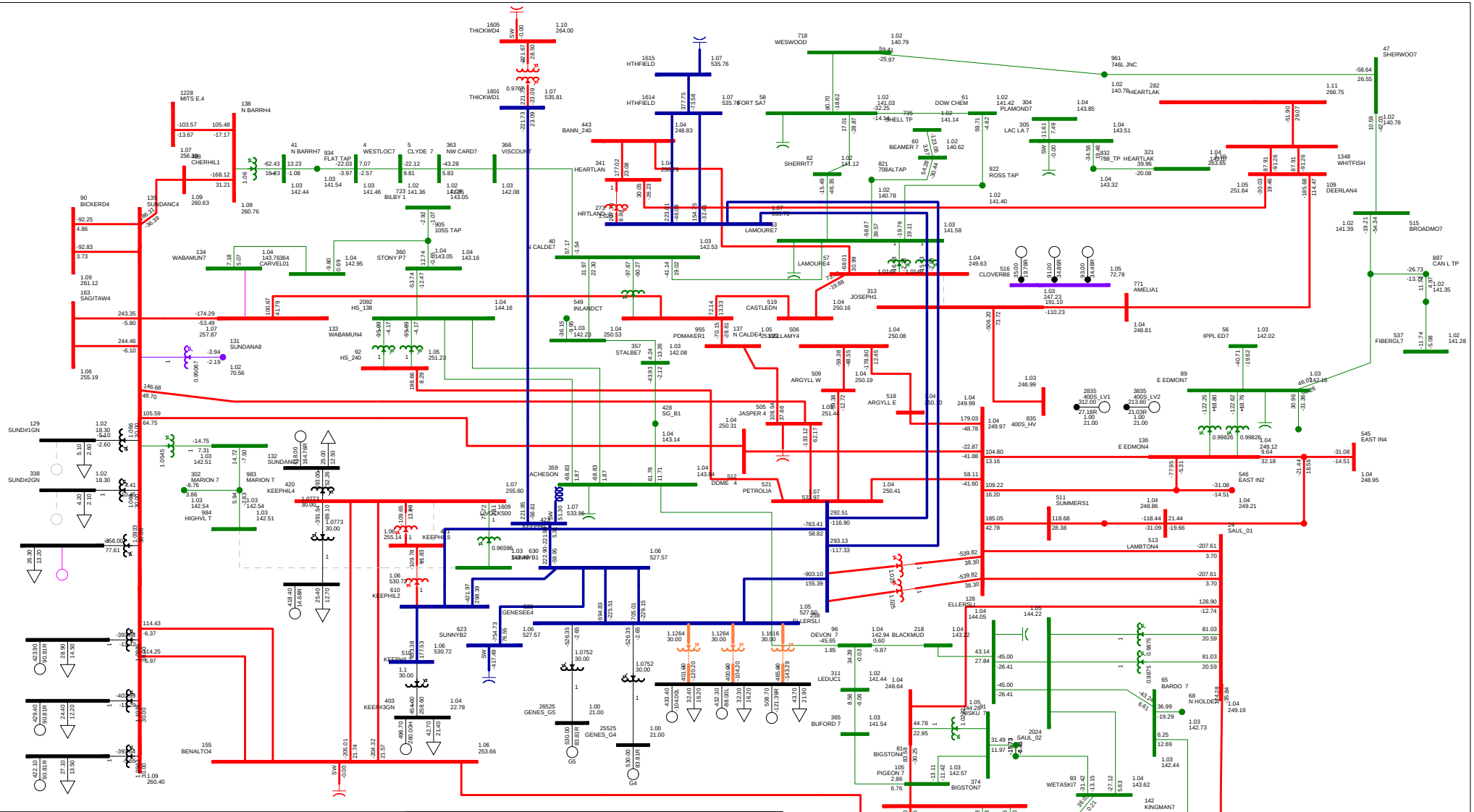
Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2434.40 MW

Max: 2,050MW

SOK Cutplane 1106.42 MW + (0.35) x6.81 MW 2,520MW (SOK <= 1,805MW)

KEG Cutplane 2164.57 MW 2,450MW (SOK > 1,805MW)



SCENARIO 8 2021 SP HIGH SOK (POST CONNECTION)
99/L
FIG B-20
THU, APR 20 2017 9:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Brightness X

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 212.82 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 733.9 MW

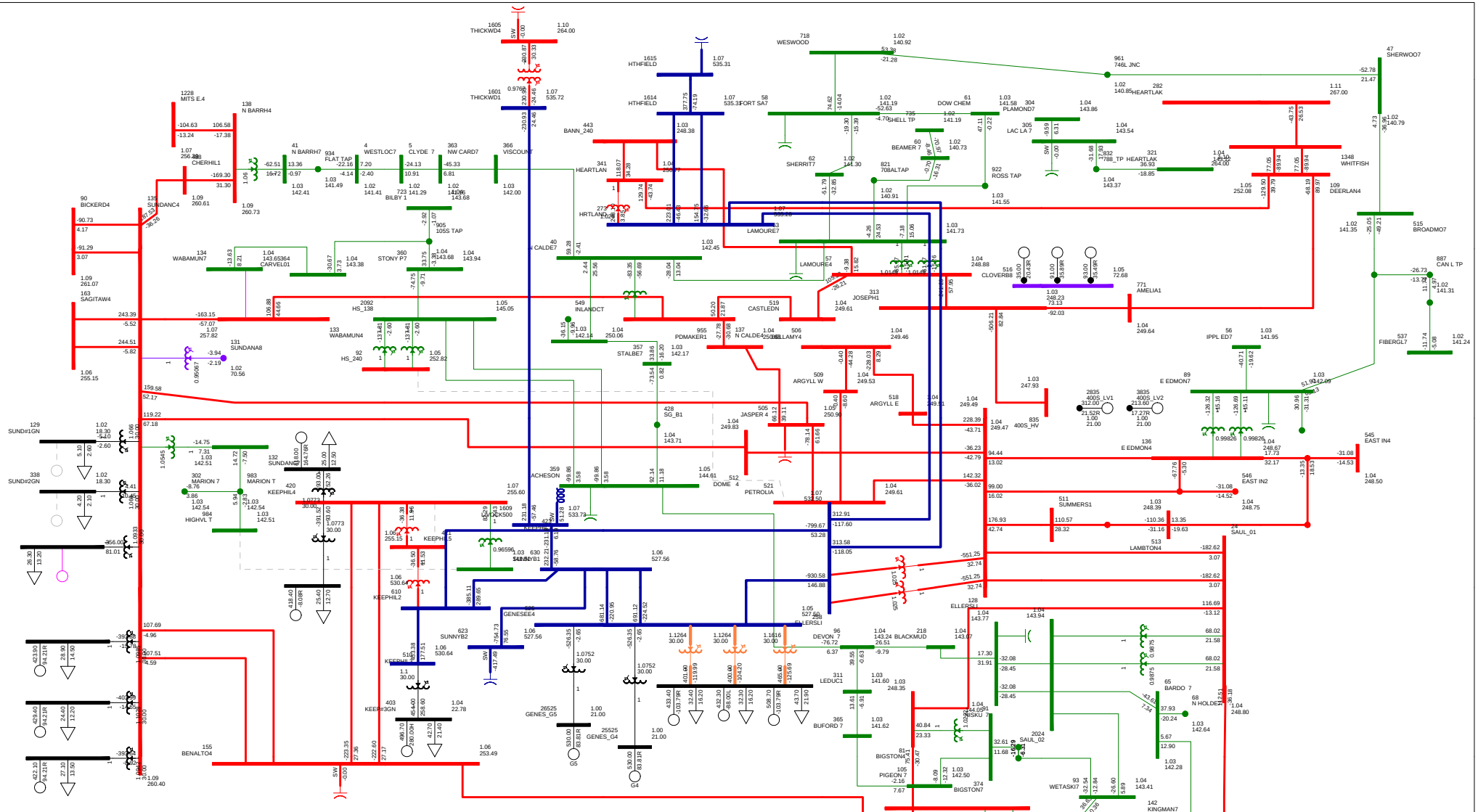
EATL: 368.11 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2434.40 MW

Max: 2,050MW

SOK Cutplane	1097.97 MW	+ (0.35) x4.46 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2169.48 MW		2,450MW (SOK > 1,805MW)



SCENARIO 8 2021 SP HIGH SOK (POST CONNECTION)
1139L
FIG B-21
THU, APR 20 2017 9:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 BASMVA X

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 212.64 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 733.94 MW

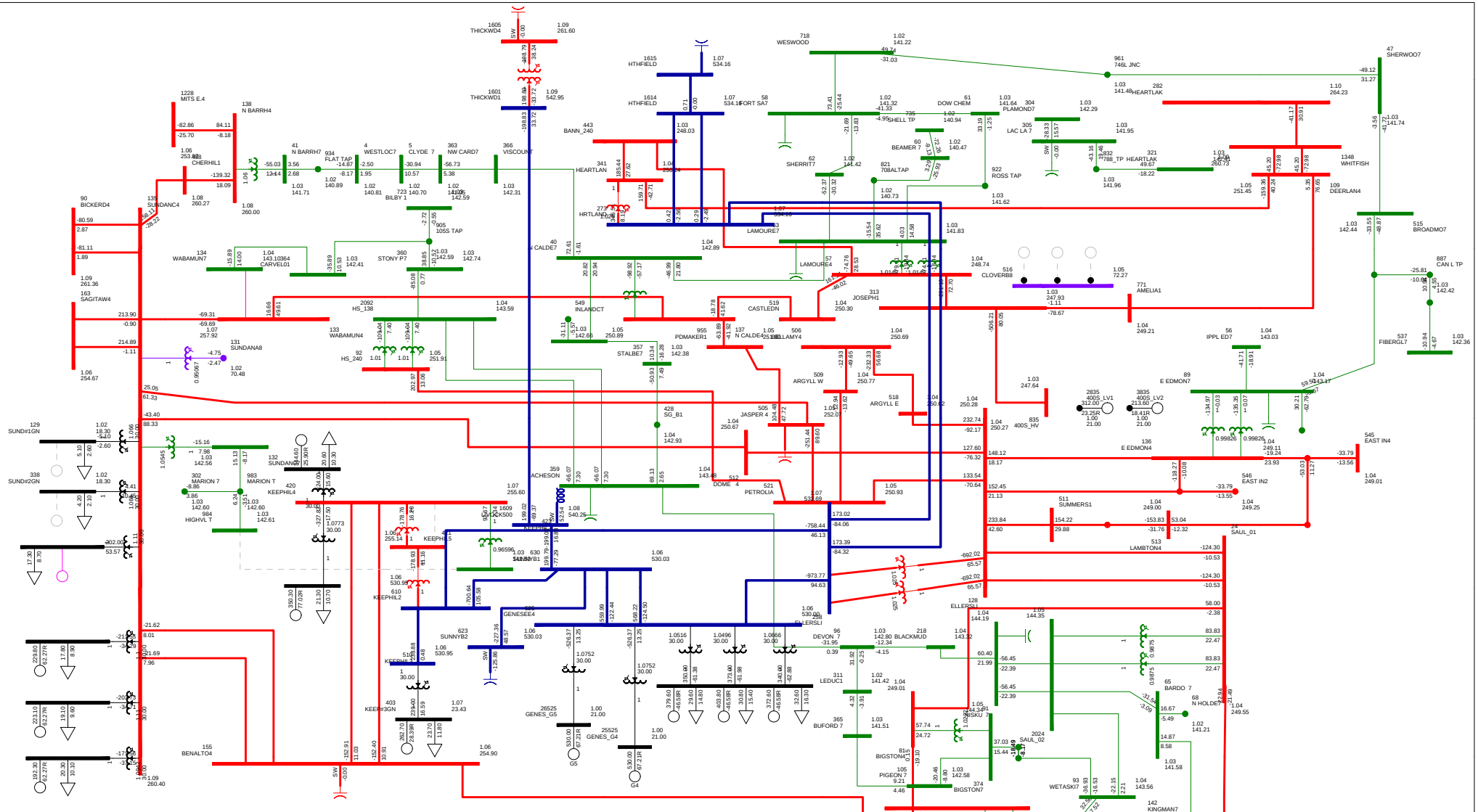
EATL: 368.11 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2434.40 MW

Max: 2,050MW

SOK Cutplane	1073.78 MW	+ (0.35) x6.41 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2276.92 MW		2,450MW (SOK > 1,805MW)



SCENARIO 9 2021 WP LOW SOK (POST CONNECTION)
BASE CASE
FIG B-22
THU, APR 20 2017 9:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0 Mvbase S

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 548.50 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 221.41 MW

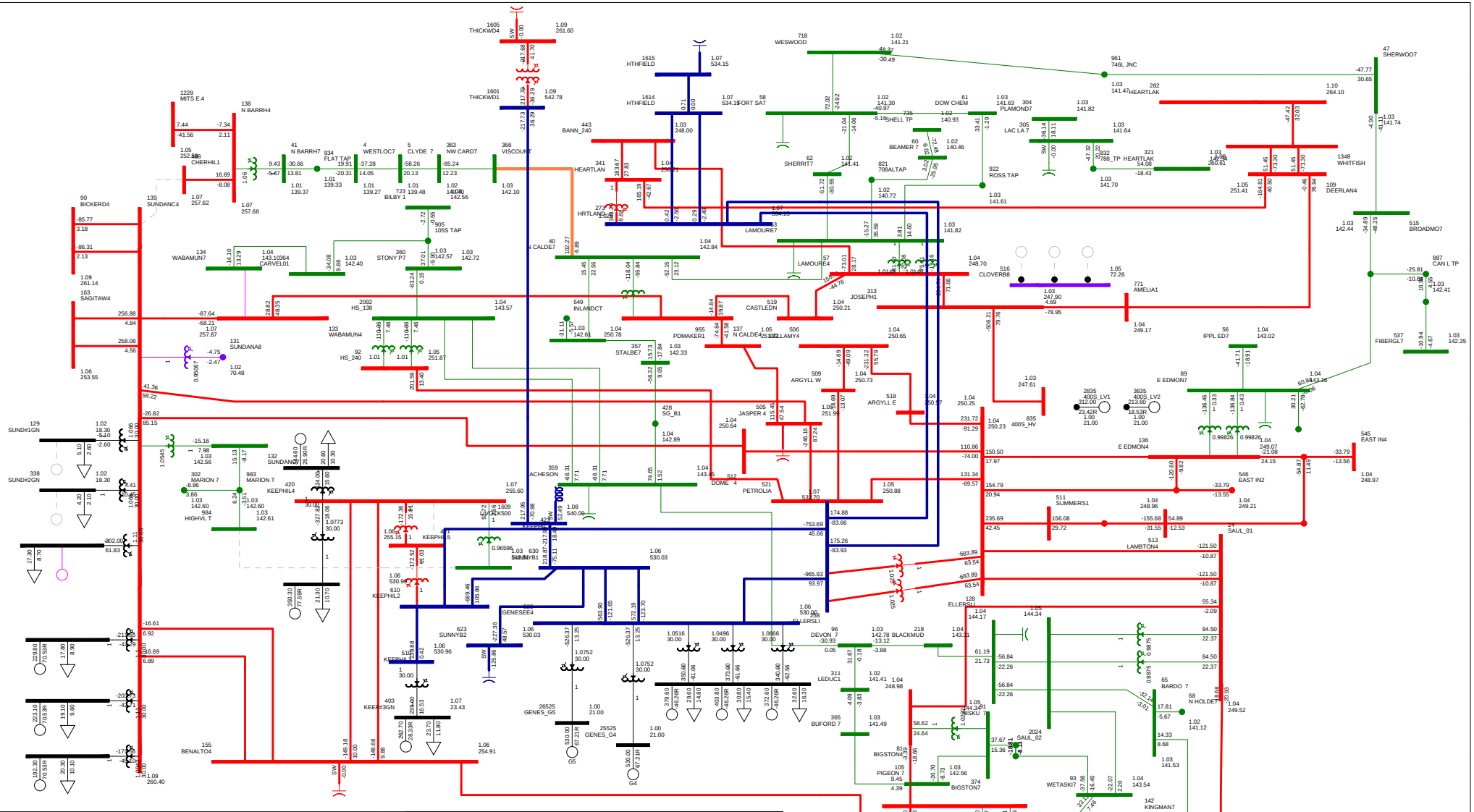
EATL: -0.82 MW

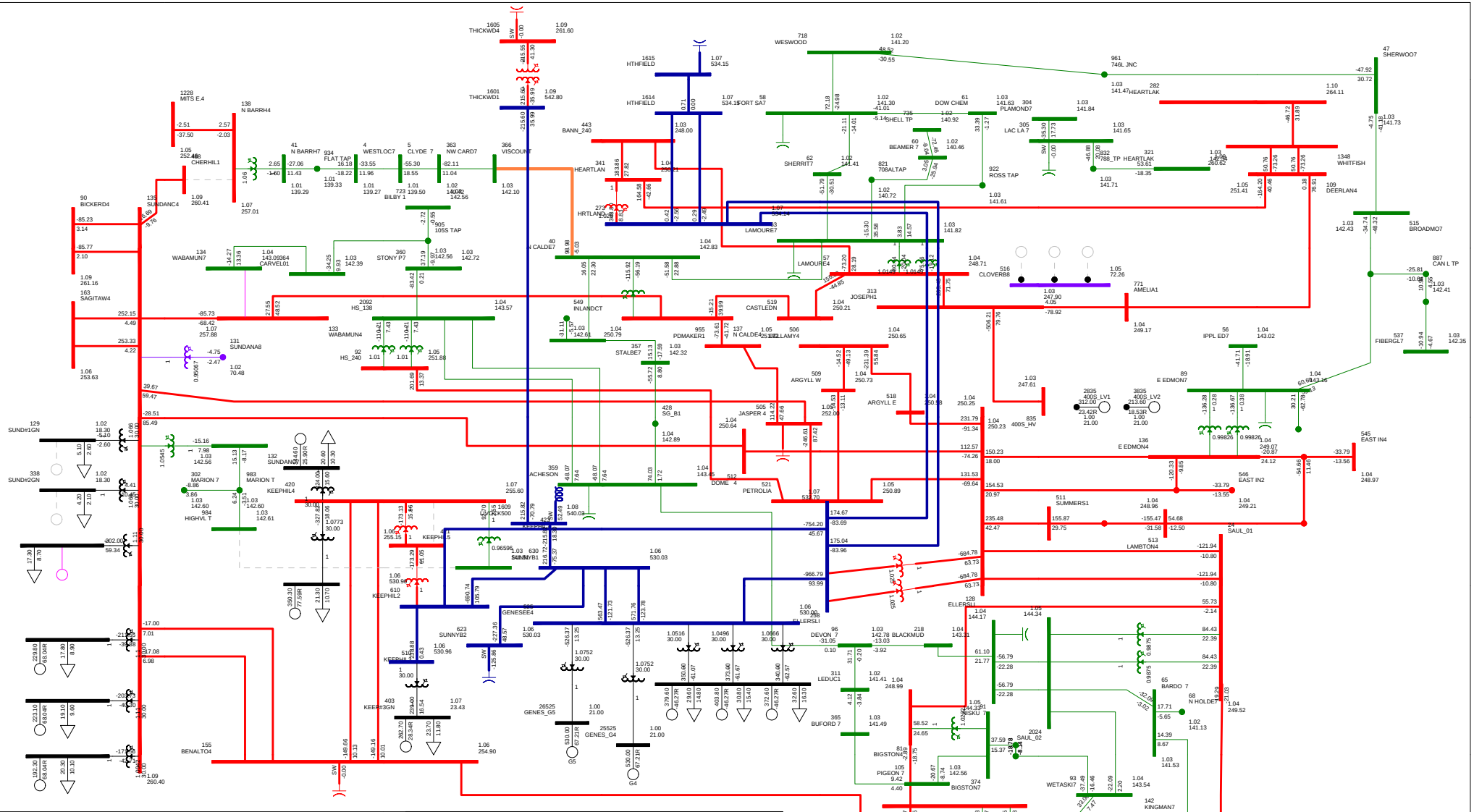
Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2216.00 MW

Max: 2,050MW

SOK Cutplane	483.72 MW	+ (0.35) x-74.42 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2141.32 MW		2,450MW (SOK > 1,805MW)


1605 THICKWD4
1601 THICKWD1
1615 HTHFIELD
1614 HTHFIELD
718 WESWOOD
961 746L JNC
47 SHERWOO7
282 HEARTLAK
1348 WHITFISH
109 DEERLAN4
515 BROADMO7
887 CAN L TP
537 FIBERGL7
1228 MITS E.4
138 N BARRH4
90 BICKERD4
135 SUNDANC4
163 SAGITAW4
134 WABAMUN7
905 105S TAP
360 STONY P7
133 WABAMUN4
131 SUNDANA8
129 SUND#1GN
338 SUND#2GN
302 MARION 7
983 MARION T
984 HIGHVL T
420 KEEPHIL4
610 KEEPHIL2
403 KEEP#3GN
155 BENALTO4
443 BANN_240
341 HEARTLAN
366 VISCOUNT
359 MACHESON
623 SUNNYB2
630 SUNNYB1
549 INLANDCT
40 N CALDE7
2092 HS_138
92 HS_240
357 STALBE7
955 PDMAKER1
428 SG_B1
505 JASPER 4
512 DOME 4
521 PETROLIA
519 CASTLEDN
506 N CALDE4
509 ARGYLL W
518 ARGYLL E
313 JOSEPH1
516 CLOVERB8
771 AMELIA1
56 IPPL ED7
89 E EDMON7
136 E EDMON4
545 EAST IN4
546 EAST IN2
24 SAUL_01
511 SUMMERS1
513 LAMBTON4
128 ELLERSL1
96 DEVON 7
218 BLACKMUD
311 LEDUC1
365 BUFORD 7
2024 SAUL_02
65 BARDO 7
68 N HOLDET
374 BIGSTON7
93 WETASKI7
142 KINGMAN7
147 GAETZ 4
148 GAETZ 7
152 RED DEE4
1422 NEVIS 4
70 CAMROSE7
789 WOLFCRE2
798 WOLFCREK
1 GENESEE4
26525 GENES_G5
25525 GENES_G4
G5
G4
1 LAMOURE7
1 LAMOURE4
1 HRTLAND7
1 HTHFIELD
1 FORT SA7
1 DOW CHEM
1 PLAMOND7
1 SHELL TP
1 BEAMER 7
1 LAC LA 7
1 SHERRIT7
1 708ALTAP
1 ROSS TAP
1 788_TP
1 BEVERLY7
1 BISKU 7
1 BIGSTON7
1 PIGEON7
1 BIGSTON7
1 WETASKI7
1 GAETZ 7
1 CAMROSE7
1 WOLFCRE2
1 WOLFCREK
1 NEVIS 4
1 RED DEE4
1 BUFORD 7
1 LEDUC1
1 DEVON 7
1 BARDO 7
1 N HOLDET
1 SAUL_02
1 SAUL_01
1 EAST IN4
1 EAST IN2
1 E EDMON4
1 E EDMON7
1 IPPL ED7
1 CAN L TP
1 FIBERGL7
1 BROADMO7
1 DEERLAN4
1 WHITFISH
1 HEARTLAK
1 746L JNC
1 SHERWOO7
1 WESWOOD
1 THICKWD4
1 THICKWD1
1 HTHFIELD
1 HTHFIELD
1 MITS E.4
1 N BARRH4
1 CHERHIL1
1 BICKERD4
1 SUNDANC4
1 SAGITAW4
1 WABAMUN7
1 CARVEL01
1 STONY P7
1 105S TAP
1 WABAMUN4
1 SUNDANA8
1 SUND#1GN
1 SUND#2GN
1 MARION 7
1 MARION T
1 HIGHVL T
1 KEEPHIL4
1 KEEPHIL2
1 KEEP#3GN
1 BENALTO4
1 BANN_240
1 HEARTLAN
1 VISCOUNT
1 MACHESON
1 SUNNYB2
1 SUNNYB1
1 INLANDCT
1 N CALDE7
1 HS_138
1 HS_240
1 STALBE7
1 PDMAKER1
1 SG_B1
1 JASPER 4
1 DOME 4
1 PETROLIA
1 CASTLEDN
1 N CALDE4
1 ARGYLL W
1 ARGYLL E
1 JOSEPH1
1 CLOVERB8
1 AMELIA1
1 IPPL ED7
1 E EDMON7
1 E EDMON4
1 EAST IN4
1 EAST IN2
1 SAUL_01
1 SUMMERS1
1 LAMBTON4
1 ELLERSL1
1 DEVON 7
1 BLACKMUD
1 LEDUC1
1 BUFORD 7
1 SAUL_02
1 BARDO 7
1 N HOLDET
1 BIGSTON7
1 WETASKI7
1 KINGMAN7
1 GAETZ 4
1 GAETZ 7
1 RED DEE4
1 NEVIS 4
1 CAMROSE7
1 WOLFCRE2
1 WOLFCREK
1 GENESEE4
1 GENES_G5
1 GENES_G4
1 G5
1 G4
1 LV1
1 LV2
1 400S_HV
1 400S_LV1
1 400S_LV2
1 SW
1 SW
1 SW



SCENARIO 9 2021 WP LOW SOK (POST CONNECTION)
913L
FIG B-24
THU, APR 20 2017 9:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0 kVbase B

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 556.80 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

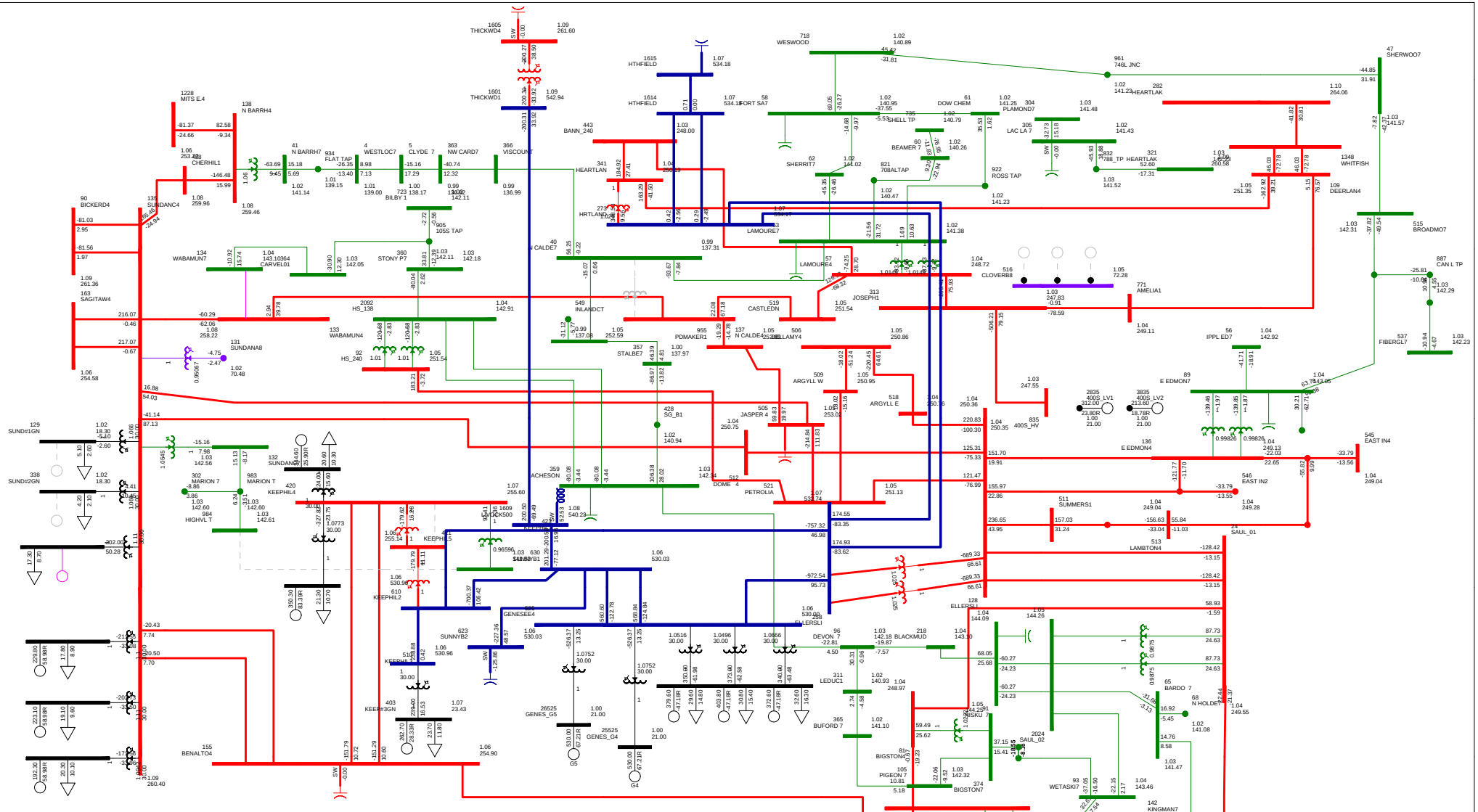
WATL: 221.41 MW

EATL: -0.82 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2216.00 MW

			Max: 2,050MW
SOK Cutplane	480.36 MW	+ (0.35) x-73.57 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2123.33 MW		2,450MW (SOK > 1,805MW)



SCENARIO 9 2021 WP LOW SOK (POST CONNECTION)
37ST6
FIG B-25
THU, APR 20 2017 9:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 BASEmva: B

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 551.08 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

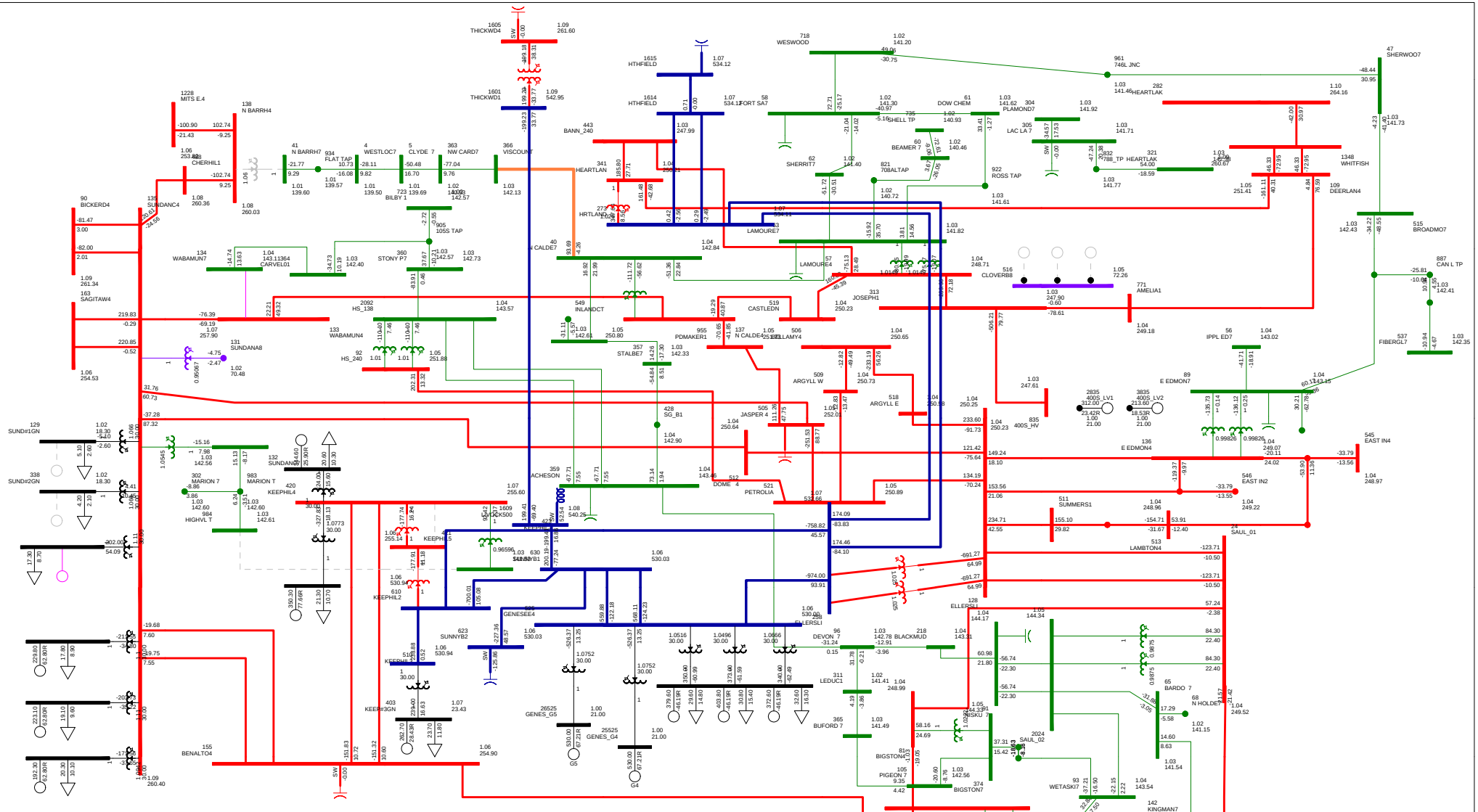
WATL: 221.41 MW

EATL: -0.82 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2216.00 MW

			Max: 2,050MW
SOK Cutplane	492.00 MW	+ (0.35) x-73.93 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2136.40 MW		2,450MW (SOK > 1,805MW)



SCENARIO 9 2021 WP LOW SOK (POST CONNECTION)
69ST4
FIG B-26
THU, APR 20 2017 9:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0 Kilotiae B

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 550.75 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 221.41 MW

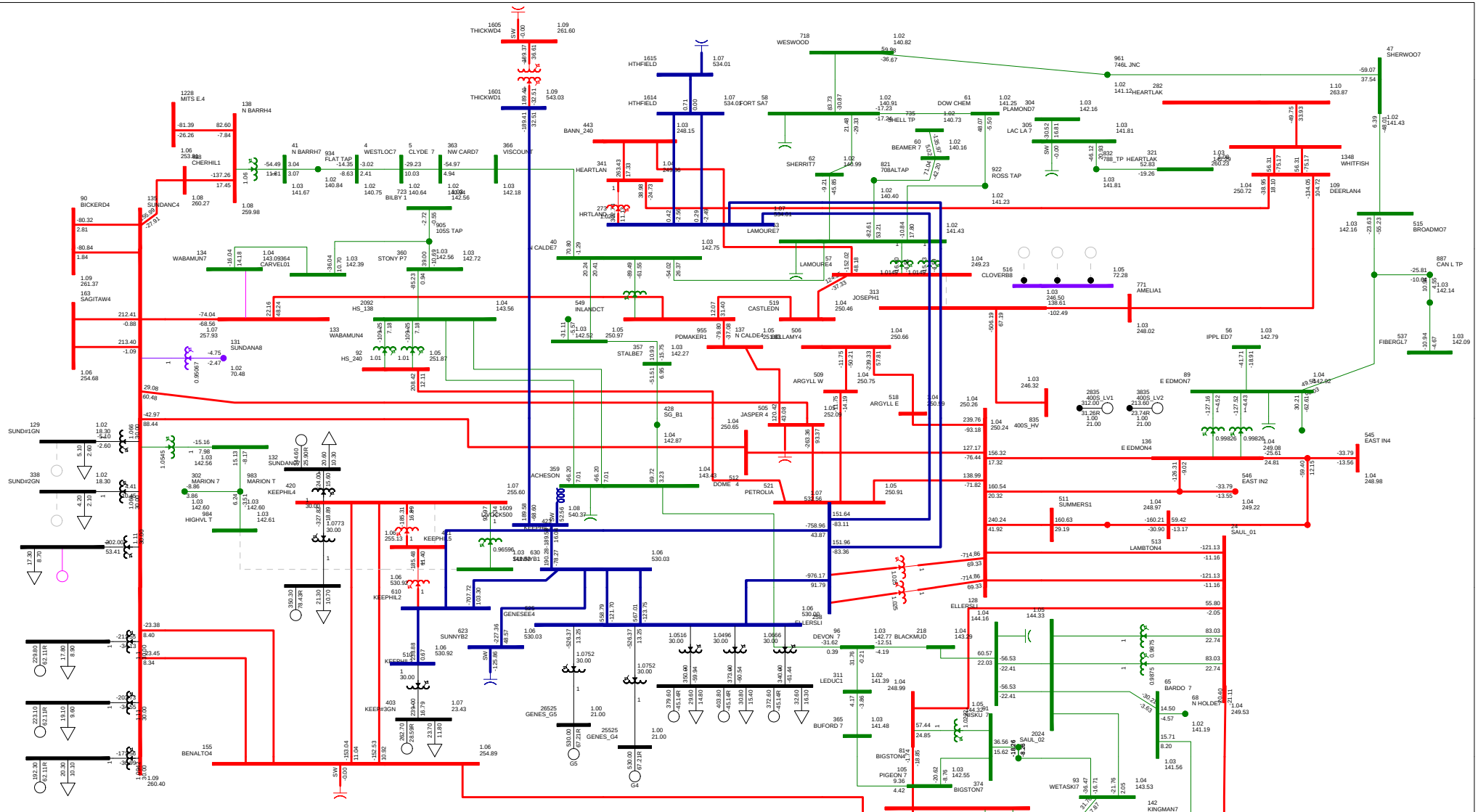
EATL: -0.82 MW

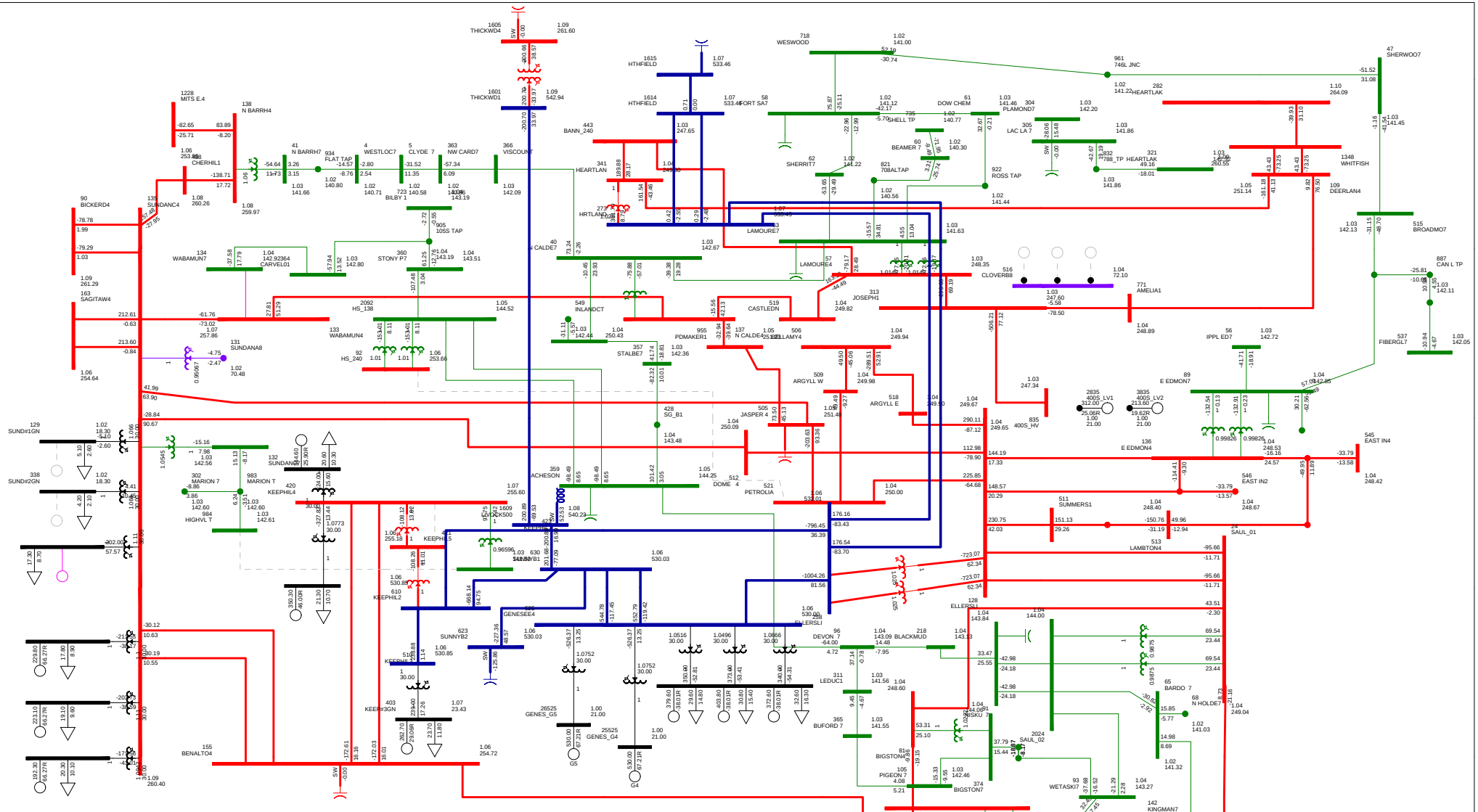
Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2216.00 MW

Max: 2,050MW

SOK Cutplane	484.14 MW	+ (0.35) x-73.90 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2139.44 MW		2,450MW (SOK > 1,805MW)


1605 THICKWD4
1601 THICKWD1
1615 HTHFIELD
1614 HTHFIELD
718 WESWOOD
961 746L JNC
47 SHERWOO7
282 HEARTLAK
1228 MITS E.4
138 N BARRH4
1348 WHITFISH
109 DEERLAN4
515 BROADMO7
887 CAN L TP
537 FIBERGL7
771 AMELIA1
516 CLOVERB8
313 JOSEPH1
519 CASTLEDN
506 BELLAMY4
509 ARGYLL W
518 ARGYLL E
56 IPPL ED7
89 E EDMON7
136 E EDMON4
545 EAST IN4
546 EAST IN2
24 SAUL_01
2024 SAUL_02
511 SUMMERS1
513 LAMBTON4
128 ELLERSL1
65 BARDO 7
68 N HOLDE7
142 KINGMAN7
70 CAMROSE7
789 WOLFCRE2
798 WOLFCREK
1422 NEVIS 4
152 RED DEE4
147 GAETZ 4
148 GAETZ 7
93 WETASKI7
94 ERVICK 7
374 BIGSTON7
105 PIGEON 7
81 BIGSTON1
365 BUFORD 7
311 LEDUC1
96 DEVON 7
218 BLACKMUD
128 ELLERSL1
359 JACHESON
521 PETROLIA
512 DOME 4
505 JASPER 4
428 SG_B1
357 STALBE7
955 PDMAKER1
137 N CALDE2
549 INLANDCT
40 N CALDE7
133 WABAMUN4
92 HS_240
2092 HS_138
163 SAGITAW4
131 SUNDANA8
134 WABAMUN7
360 STONY P7
905 105S TAP
135 SUNDANC4
90 BICKERD4
1228 MITS E.4
1066 CHERHIL1
41 N BARRH7
934 FLAT TAP
4 WESTLOC7
5 CLYDE 7
363 NW CARD7
366 VISCOUNT
341 HEARTLAN
272 HRTLAND2
443 BANN_240
53 LAMOURE7
57 LAMOURE4
1615 HTHFIELD
1614 HTHFIELD
58 FORT SA7
62 SHERRIT7
821 708ALTAP
922 ROSS TAP
60 BEAMER 7
735 SHELL TP
61 DOW CHEM
304 PLAMOND7
305 LAC LA 7
832 788_TP
321 HEARTLAK
129 SUND#1GN
338 SUND#2GN
302 MARION 7
983 MARION T
984 HIGHVL T
420 KEEPHL4
132 SUNDANG4
610 KEEPHIL2
623 SUNNYB2
403 KEEP#3GN
155 BENALTO4
26525 GENES_G5
25525 GENES_G4
G5
G4
1609 WOCK500
630 SUNNYB1
424 GENESEE4
1.06 530.03
1.06 530.00
1.06 530.92
1.06 530.92
1.06 530.92



SCENARIO 9 2021 WP LOW SOK (POST CONNECTION)
1139L
FIG B-28
THU, APR 20 2017 9:01

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0 Base kV

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 552.39 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 221.41 MW

EATL: -0.82 MW

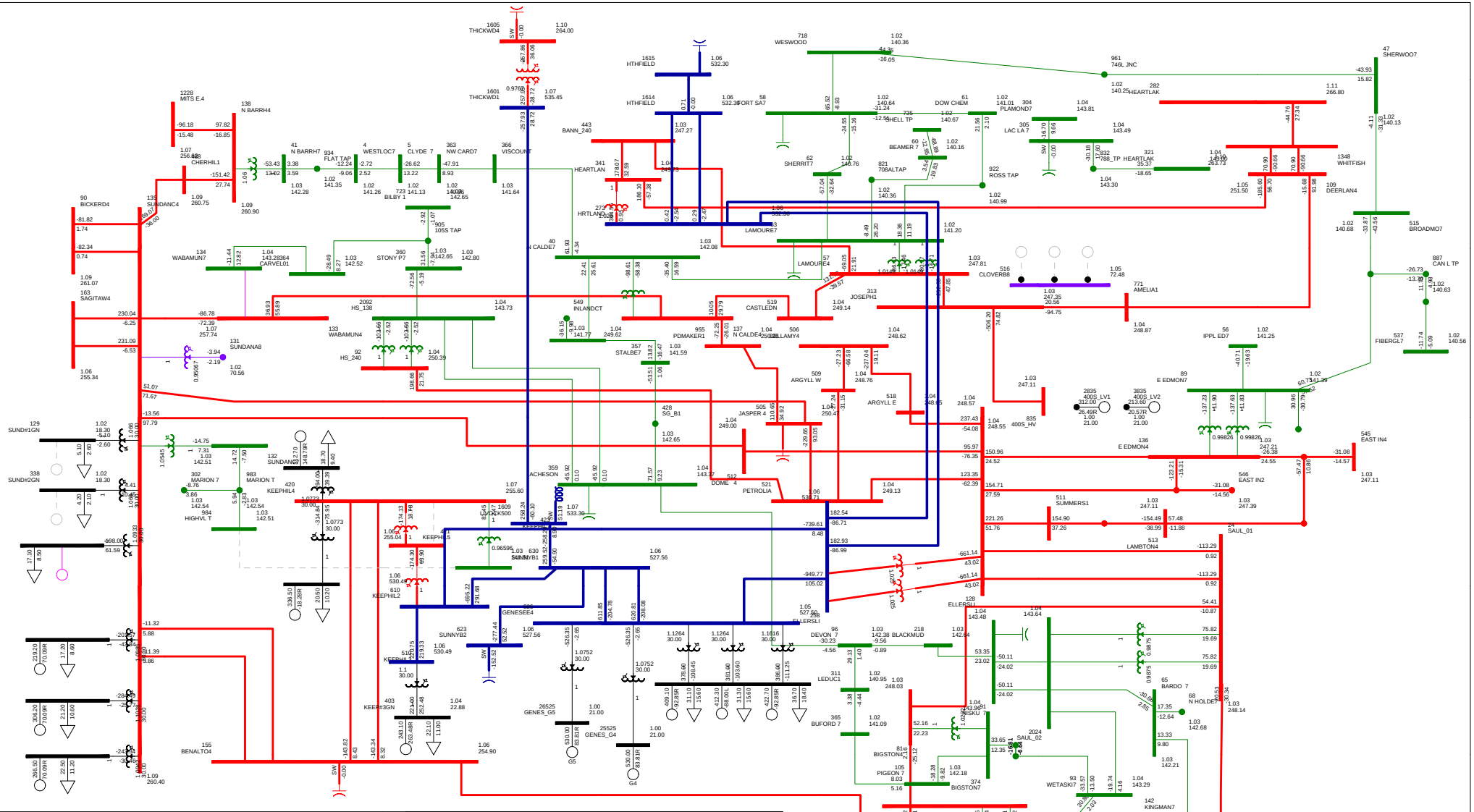
Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2216.00 MW

Max: 2,050MW

SOK Cutplane	450.78 MW	+ (0.35) x-74.25 MW
KEG Cutplane	2256.36 MW	

2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 10 2021 SP LOW SOK (POST CONNECTION)
BASE CASE
FIG B-29
THU, APR 20 2017 9:02

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100.0 Kilotaw A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 536.39 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

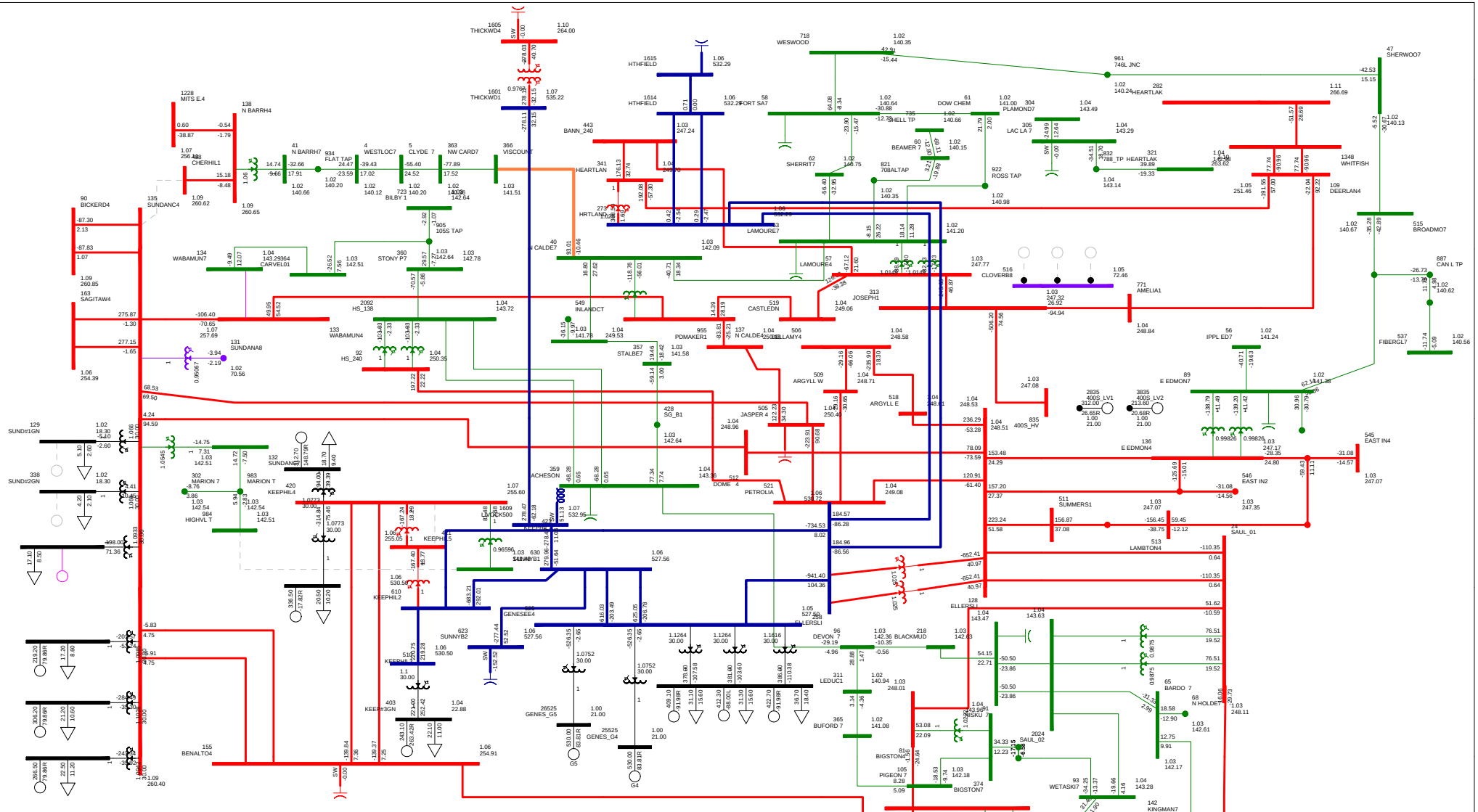
WATL: 270.94 MW

EATL: -0.73 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2304.10 MW

			Max: 2,050MW
SOK Cutplane	498.07 MW	+ (0.35) x-53.34 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2068.20 MW		2,450MW (SOK > 1,805MW)



SCENARIO 10 2021 SP LOW SOK (POST CONNECTION)
1046L
FIG B-30
THU, APR 20 2017 9:02

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Ohm/Line X

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 546.93 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

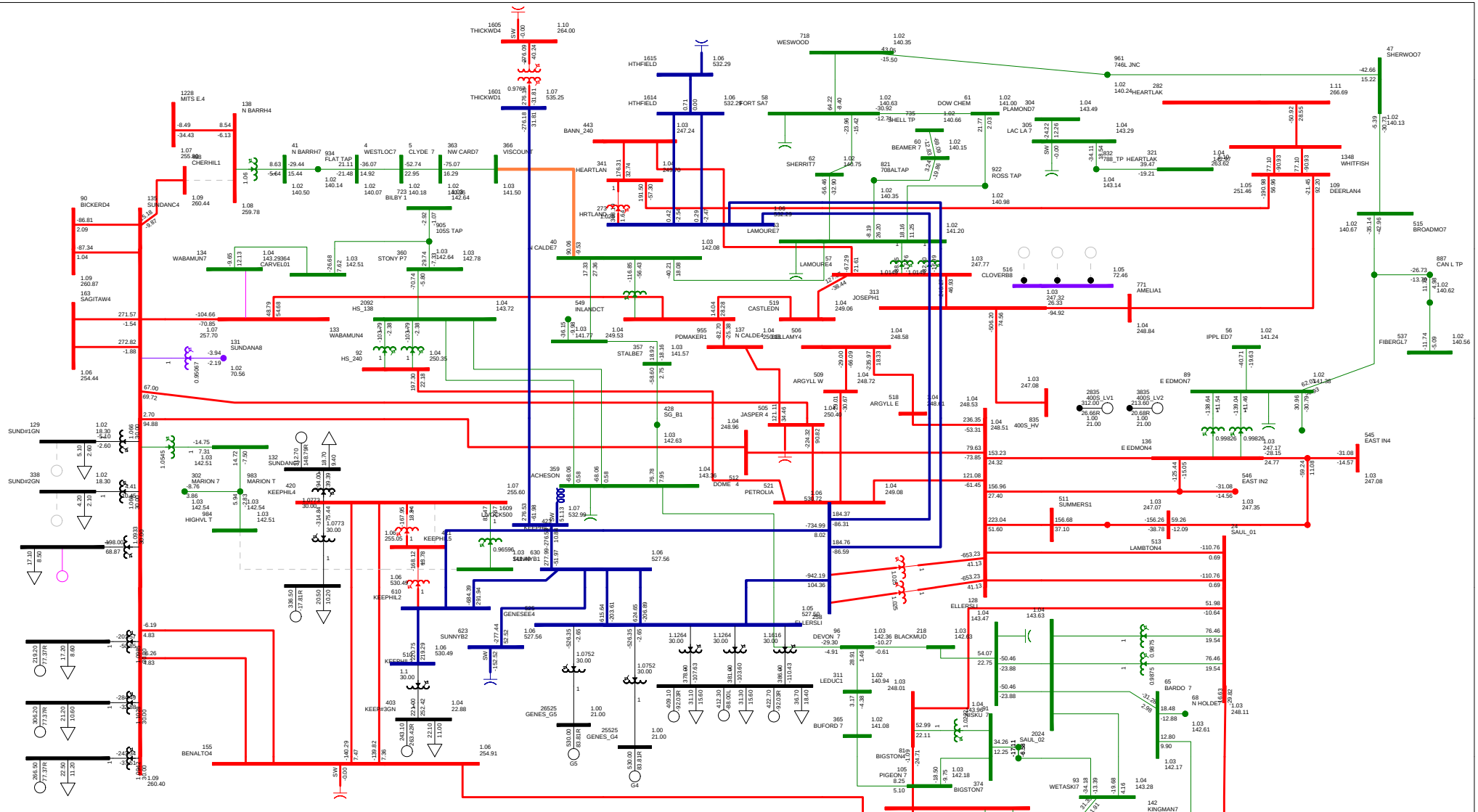
WATL: 270.94 MW

EATL: -0.73 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2304.10 MW

			Max: 2,050MW
SOK Cutplane	493.57 MW	+ (0.35) x-52.33 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2046.45 MW		2,450MW (SOK > 1,805MW)



SCENARIO 10 2021 SP LOW SOK (POST CONNECTION)
913L
FIG B-31
THU, APR 20 2017 9:02

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Brightness X

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 545.11 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

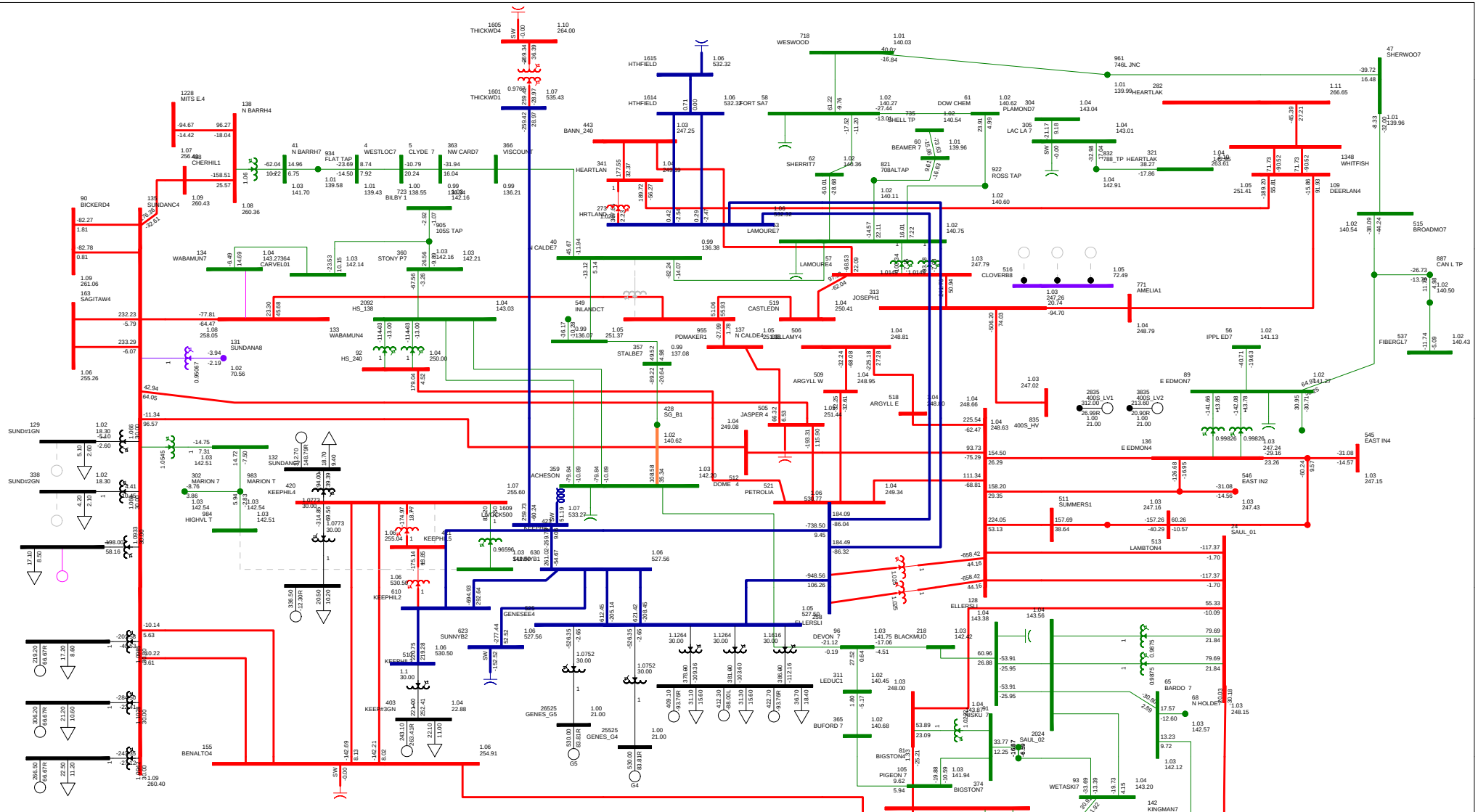
WATL: 270.94 MW

EATL: -0.73 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2304.10 MW

			Max: 2,050MW
SOK Cutplane	494.77 MW	+ (0.35) x-52.37 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2048.61 MW		2,450MW (SOK > 1,805MW)



SCENARIO 10 2021 SP LOW SOK (POST CONNECTION)
37ST6
FIG B-32
THU, APR 20 2017 9:02

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Brightness A

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 539.04 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

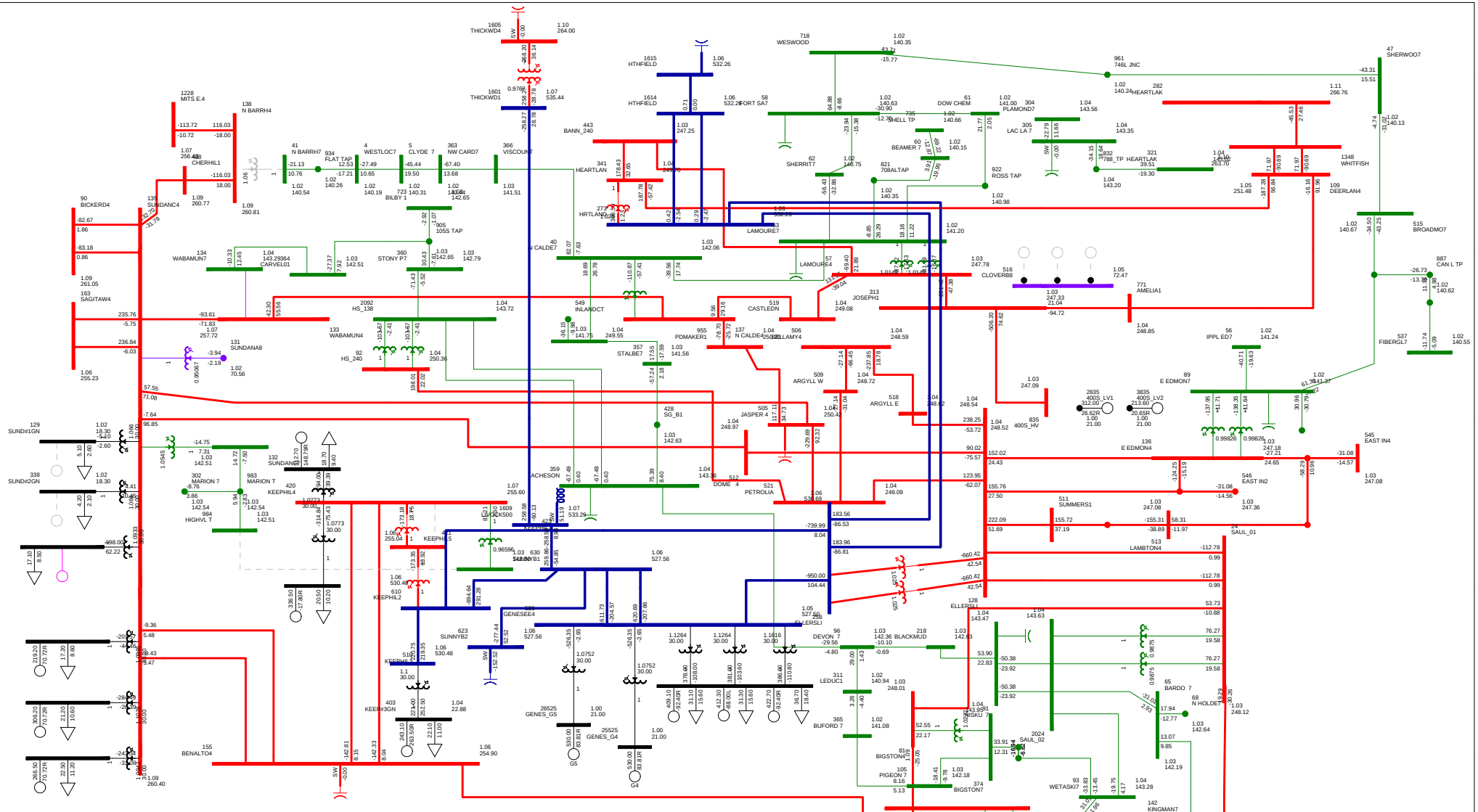
WATL: 270.94 MW

EATL: -0.73 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2304.10 MW

			Max: 2,050MW
SOK Cutplane	506.21 MW	+ (0.35) x-52.86 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2063.26 MW		2,450MW (SOK > 1,805MW)



SCENARIO 10 2021 SP LOW SOK (POST CONNECTION)
69ST4
FIG B-33
THU, APR 20 2017 9:02

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Brightness X

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 538.12 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

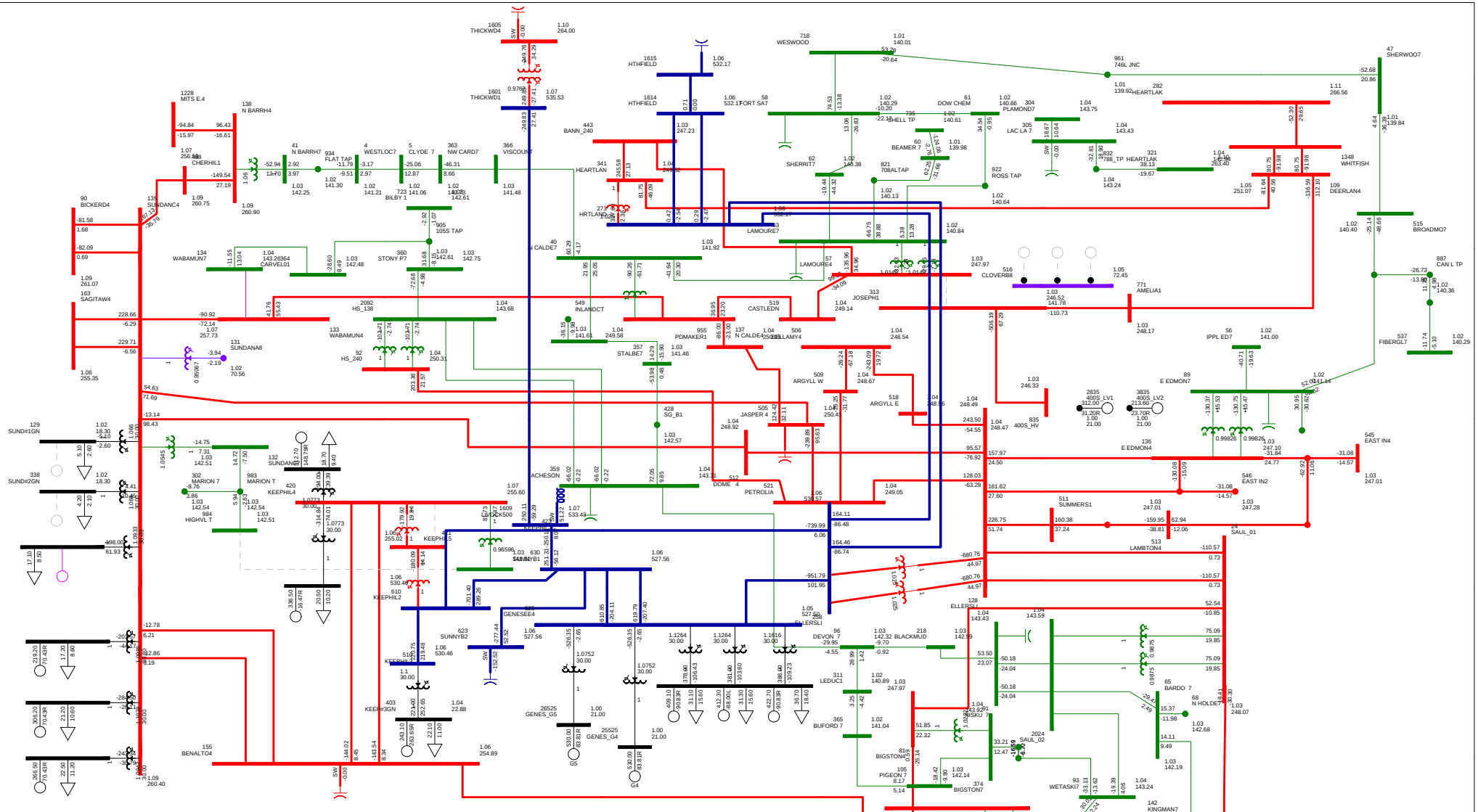
WATL: 270.94 MW

EATL: -0.73 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2304.10 MW

			Max: 2,050MW
SOK Cutplane	498.88 MW	+ (0.35) x-52.81 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2066.46 MW		2,450MW (SOK > 1,805MW)



SCENARIO 10 2021 SP LOW SOK (POST CONNECTION)
99/L
FIG B-34
THU, APR 20 2017 9:02

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Brightness X

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 540.39 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

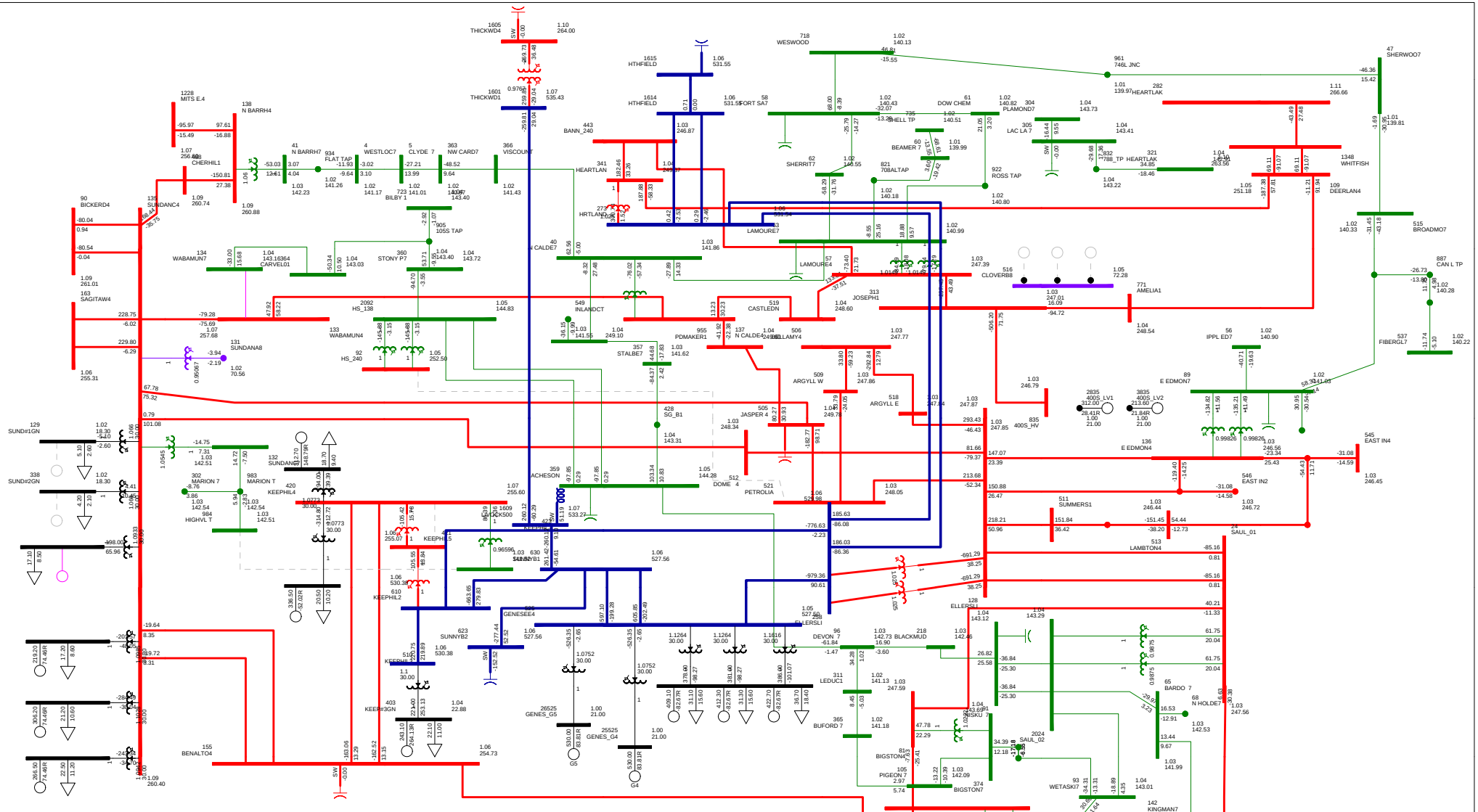
WATL: 270.94 MW

EATL: -0.73 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2304.10 MW

			Max: 2,050MW
SOK Cutplane	489.79 MW	+ (0.35) x-55.31 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2071.30 MW		2,450MW (SOK > 1,805MW)



SCENARIO 10 2021 SP LOW SOK (POST CONNECTION)
1139L
FIG B-35
THU, APR 20 2017 9:02

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Brightness X

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 540.26 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 270.94 MW

EATL: -0.73 MW

Total Heartland Generation: 525.60 MW

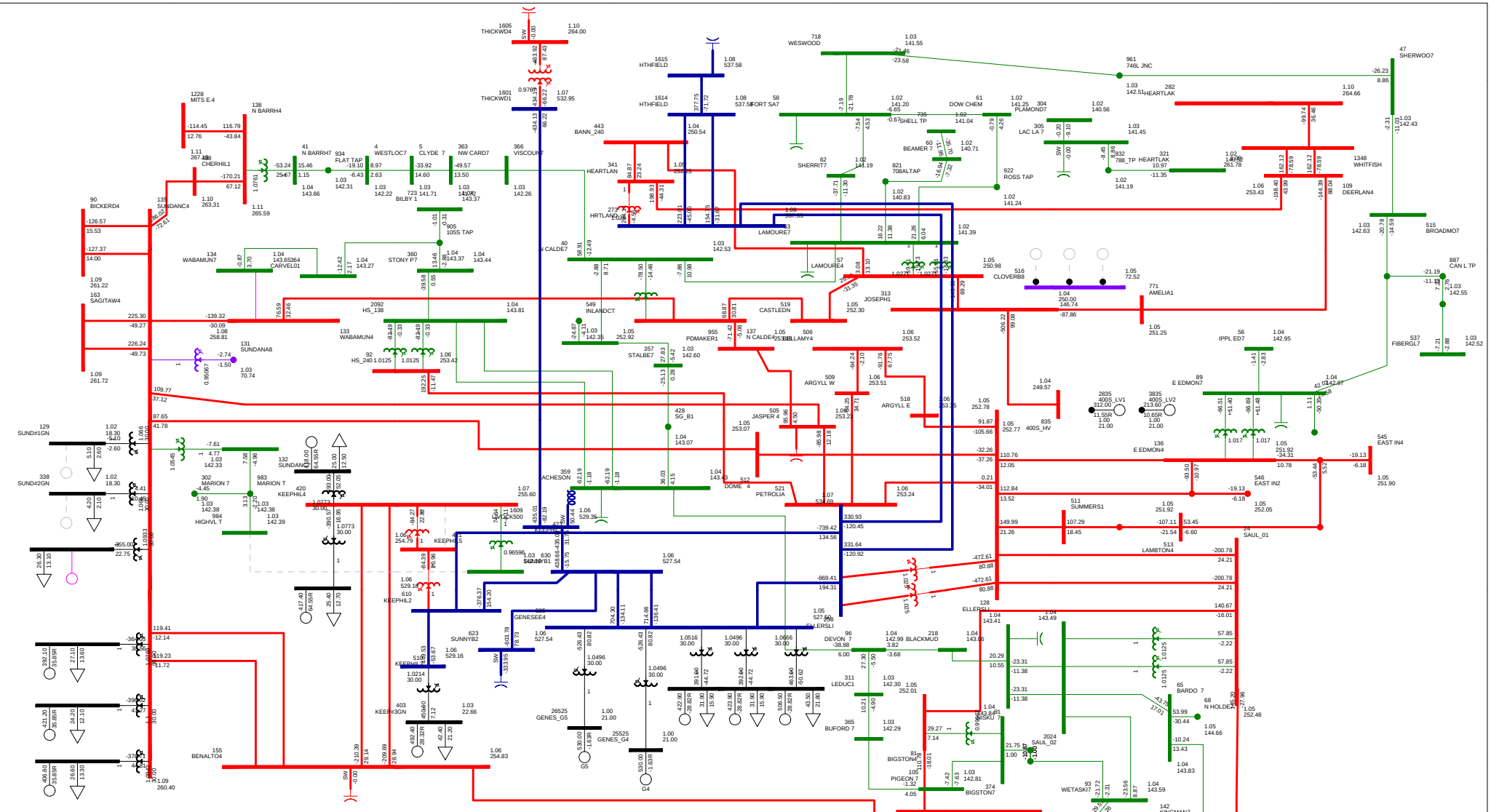
Total Genesee Generation: 2304.10 MW

Max: 2,050MW

SOK Cutplane	465.50 MW	+ (0.35) x-53.16 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2180.12 MW		2,450MW (SOK > 1,805MW)

Attachment C

Post-Project with LTP Power Flow Diagrams (Scenarios 11 to 15)



SCENARIO 11 2019SL HIGH SOK (POST CONNECTION W/ LTP)
BASE CASE
FIG C-1
THU, APR 20 2017 9:02

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Bus/Area 8

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 27.13 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 588.83 MW

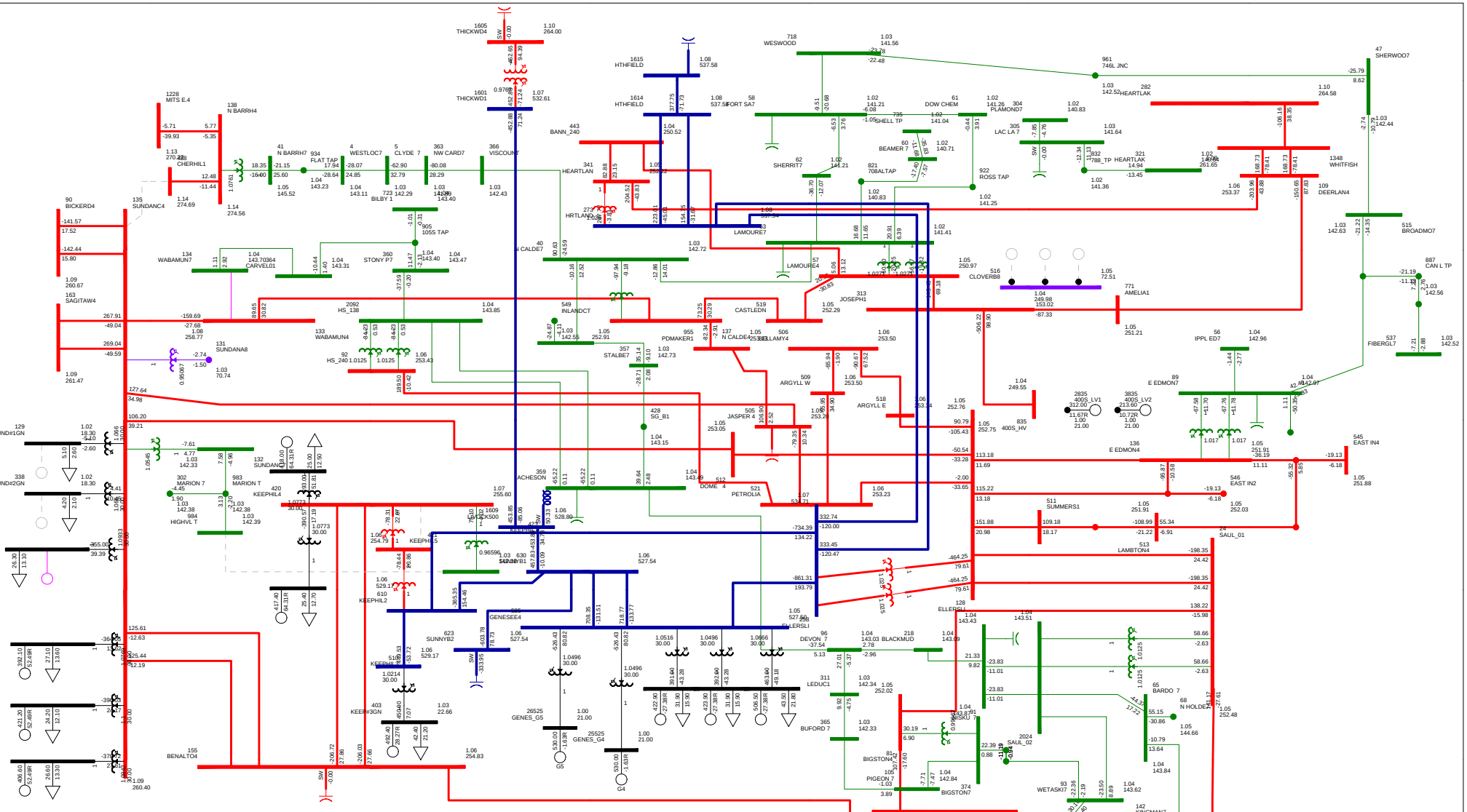
EATL: 368.06 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2413.30 MW

Max: 2,050MW

SOK Cutplane	1040.41 MW	+ (0.35) x64.05 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2119.93 MW		2,450MW (SOK > 1,805MW)



SCENARIO 11 2019SL HIGH SOK (POST CONNECTION W/ LTP)
1046L
FIG C-2
THU, APR 20 2017 9:02

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Breaker 4

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 35.45 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 588.83 MW

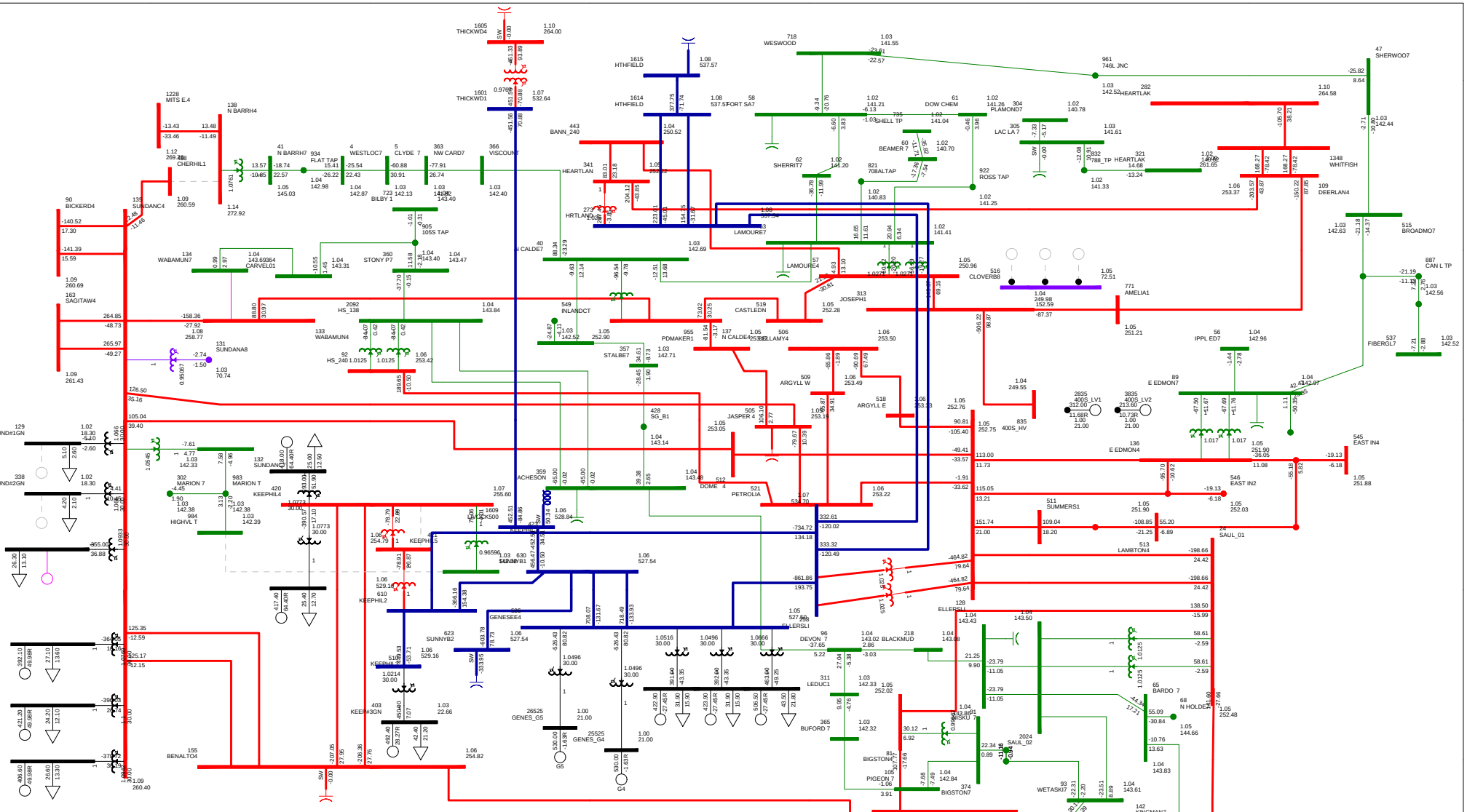
EATL: 368.06 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2413.30 MW

Max: 2,050MW

SOK Cutplane	1037.92 MW	+ (0.35) x65.06 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2099.42 MW		2,450MW (SOK > 1,805MW)



SCENARIO 11 2019SL HIGH SOK (POST CONNECTION W/ LTP)
913L
FIG C-3
THU, APR 20 2017 9:02

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Bus/Area 2

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 34.06 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 588.83 MW

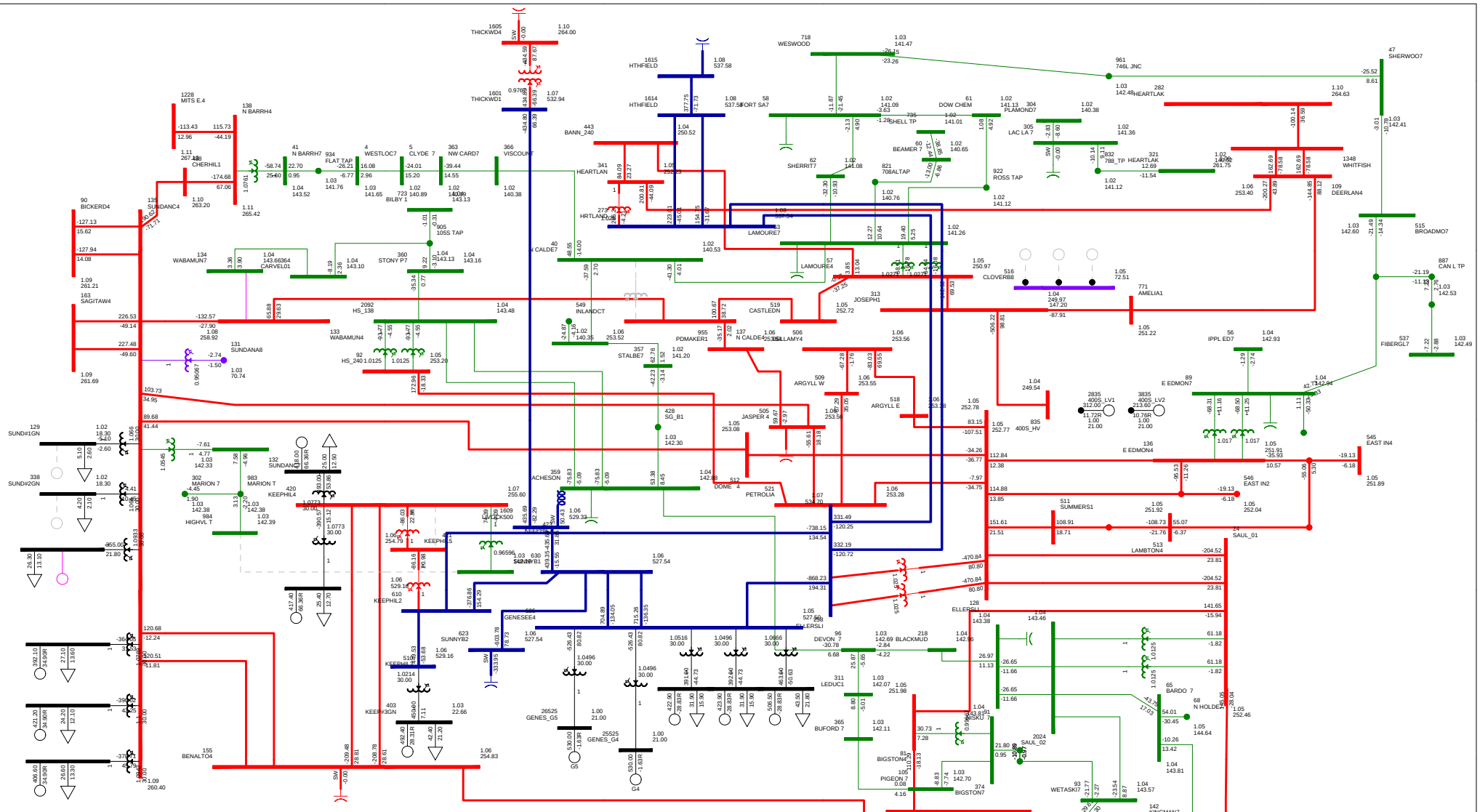
EATL: 368.06 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2413.30 MW

Max: 2,050MW

SOK Cutplane	1038.91 MW	+ (0.35) x65.05 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2100.95 MW		2,450MW (SOK > 1,805MW)



SCENARIO 11 2019SL HIGH SOK (POST CONNECTION W/ LTP)
37ST6
FIG C-4
THU, APR 20 2017 9:02

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Bus/Area 4

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 27.80 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 588.83 MW

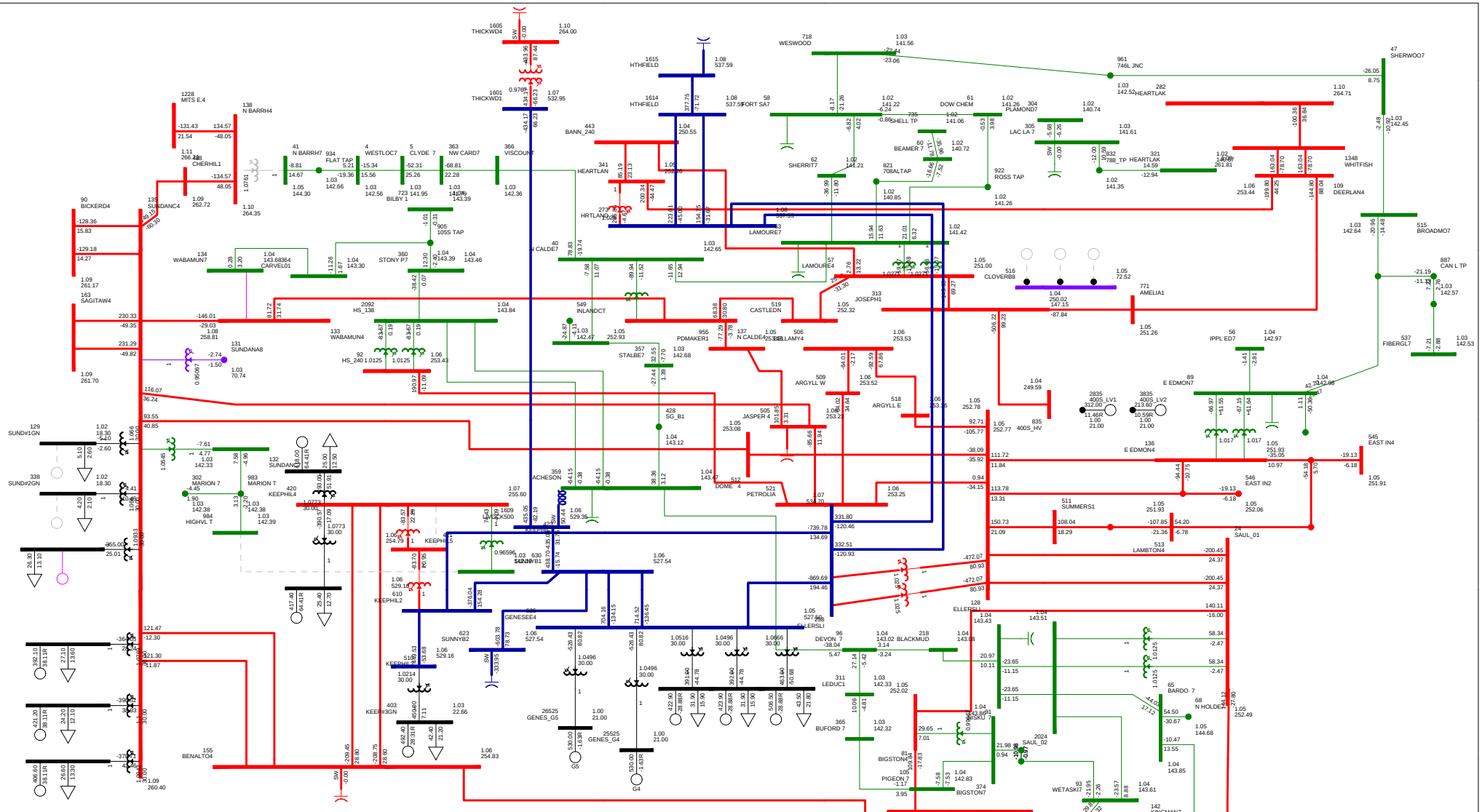
EATL: 368.06 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2413.30 MW

Max: 2,050MW

SOK Cutplane	1048.60 MW + (0.35) x64.37 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2115.28 MW	2,450MW (SOK > 1,805MW)



SCENARIO 11 2019SL HIGH SOK (POST CONNECTION W/ LTP)
69ST4
FIG C-5
THU, APR 20 2017 9:02

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Bus/Area 4

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 28.16 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 588.83 MW

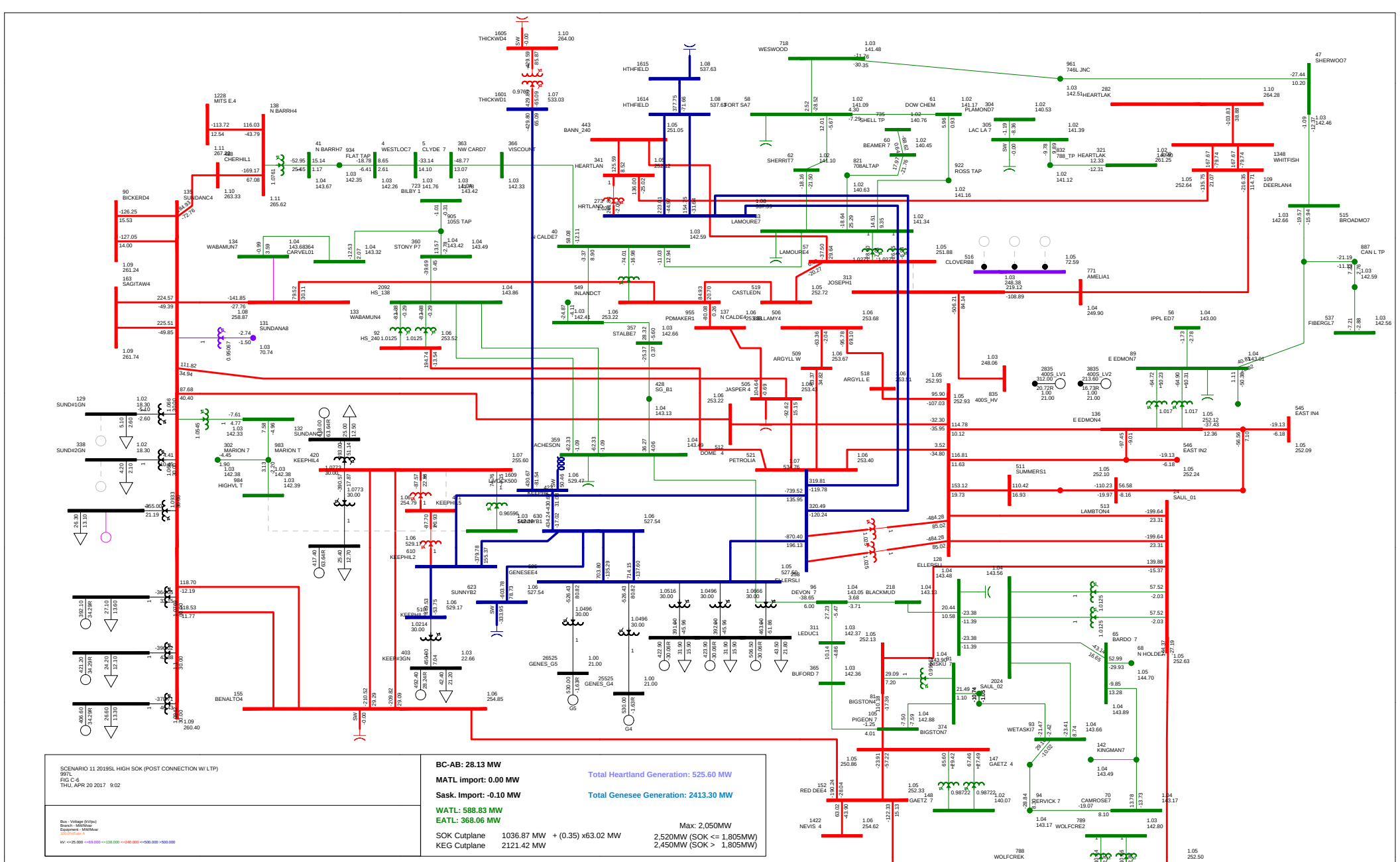
EATL: 368.06 MW

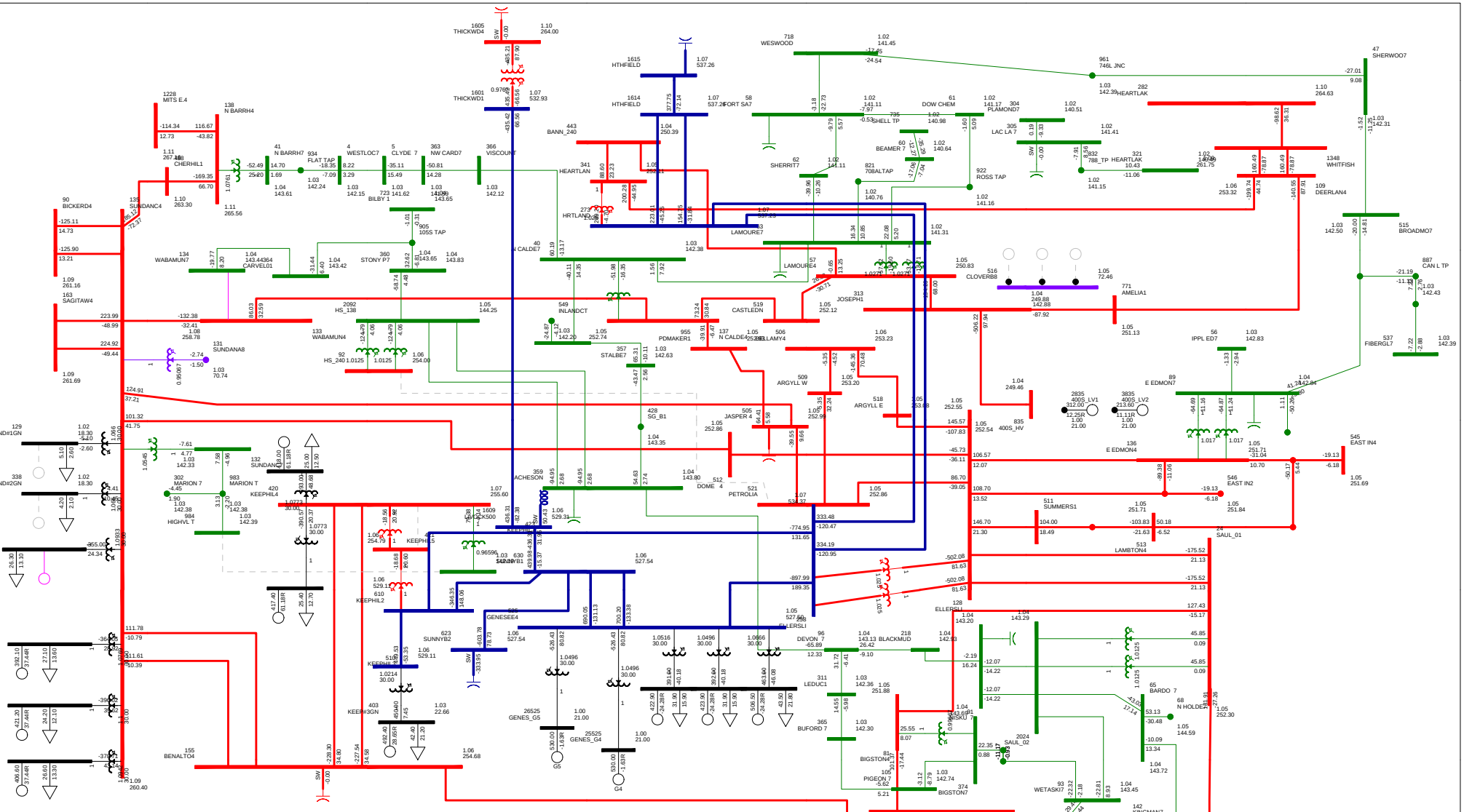
Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2413.30 MW

Max: 2,050MW

SOK Cutplane	1041.84 MW	+ (0.35) x64.52 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2118.37 MW		2,450MW (SOK > 1,805MW)


SCENARIO 11 2019SL HIGH SOK (POST CONNECTION W/ LTP)
997L
FIG C-6
THU, APR 20 2017 9:02
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Bus/Area 8
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000
BC-AB: 28.13 MW
MATL import: 0.00 MW
Sask. Import: -0.10 MW
WATL: 588.83 MW
EATL: 368.06 MW
Total Heartland Generation: 525.60 MW
Total Genesee Generation: 2413.30 MW
Max: 2,050MW
SOK Cutplane 1036.87 MW + (0.35) x63.02 MW
KEG Cutplane 2121.42 MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 11 2019SL HIGH SOK (POST CONNECTION W/ LTP)
1139L
FIG C-7
THU, APR 20 2017 9:02

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Bus/Area 4

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 29.87 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 588.83 MW

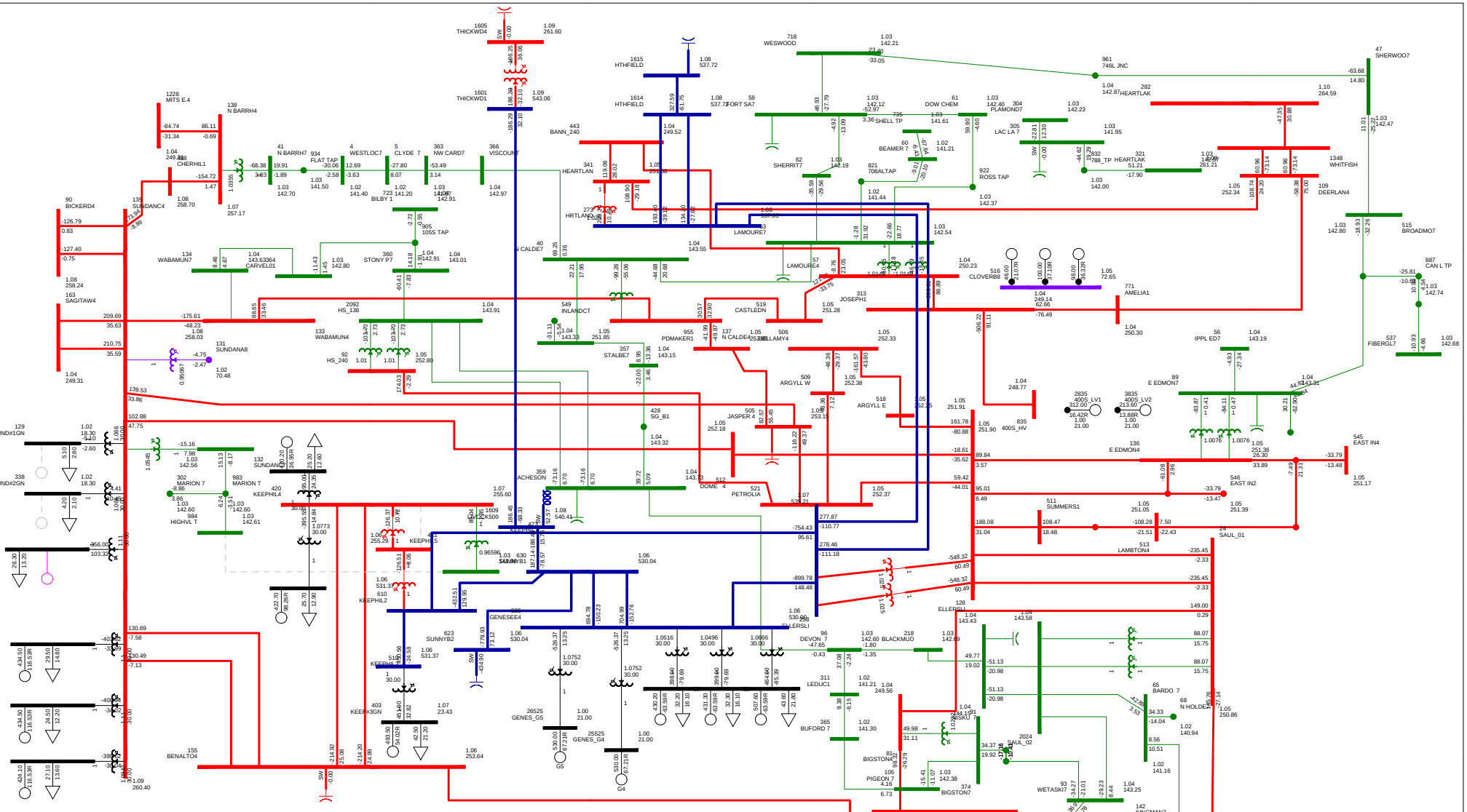
EATL: 368.06 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2413.30 MW

Max: 2,050MW

SOK Cutplane	1012.75 MW	+ (0.35) x64.22 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2227.04 MW		2,450MW (SOK > 1,805MW)



SCENARIO 12 2021 WP HIGH SOK (POST CONNECTION W/ LTP)
BASE CASE
FIG C-8
THU, APR 20 2017 9:02

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Contour 0

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: -146.70 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 758.02 MW

EATL: 319.20 MW

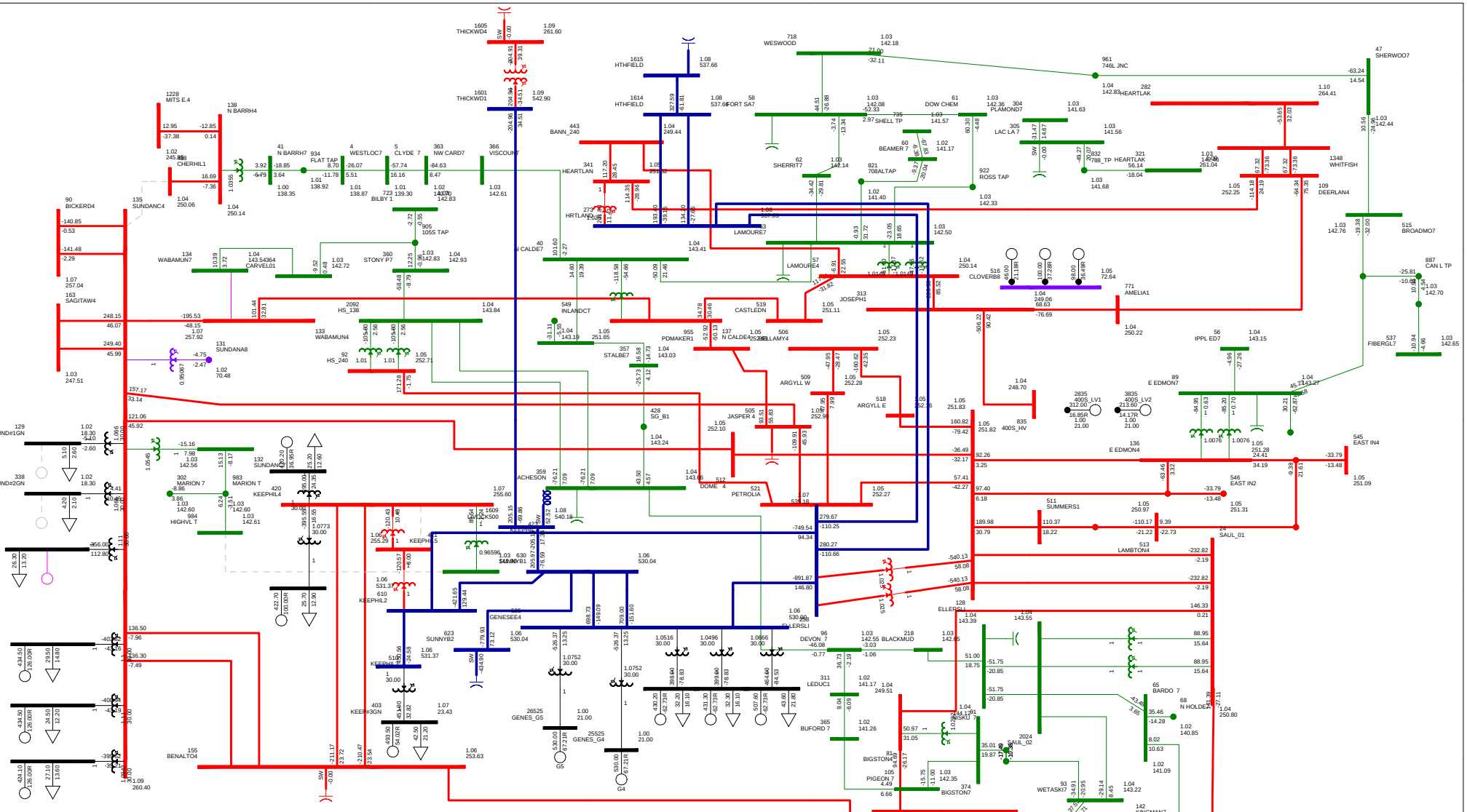
Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2429.10 MW

Max: 2,050MW

SOK Cutplane	1158.18 MW	+ (0.35) x-39.51 MW
KEG Cutplane	2189.38 MW	

2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 12 2021 WP HIGH SOK (POST CONNECTION W/ LTP)
1046L
FIG C-9
THU, APR 20 2017 9:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Bus/Line 0

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: -136.73 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 758.02 MW

EATL: 319.20 MW

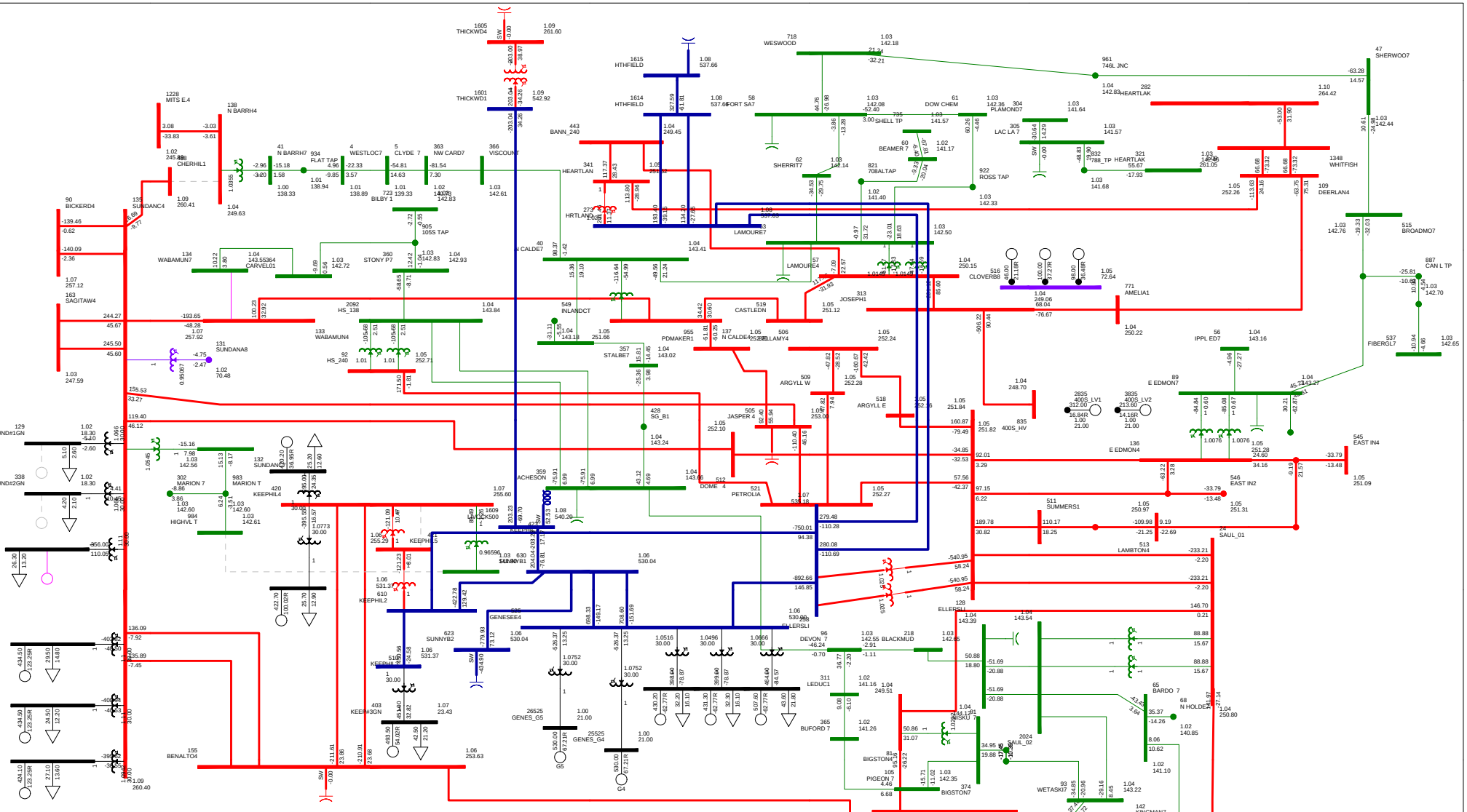
Total Heartland Generation: 525.60 MW

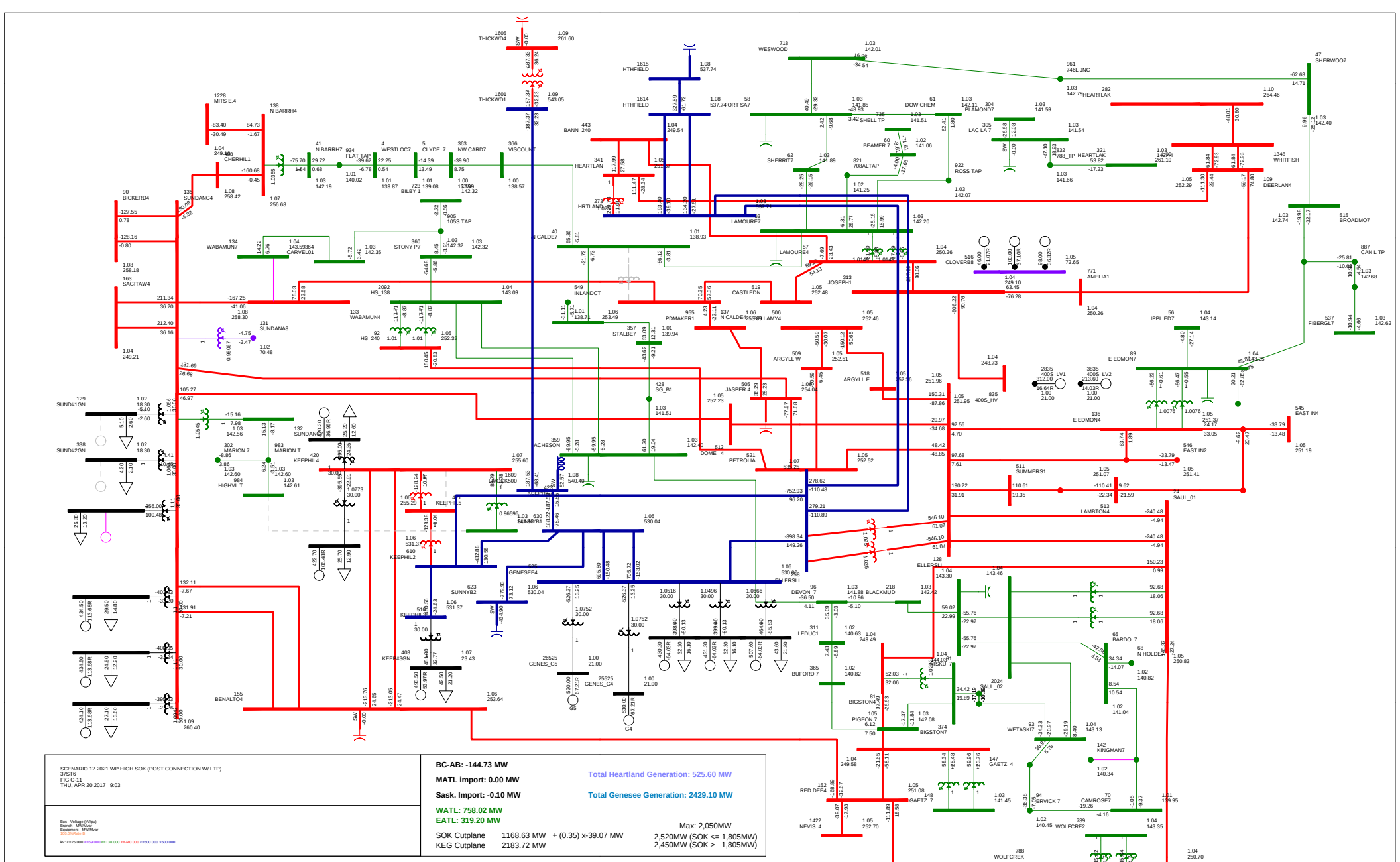
Total Genesee Generation: 2429.10 MW

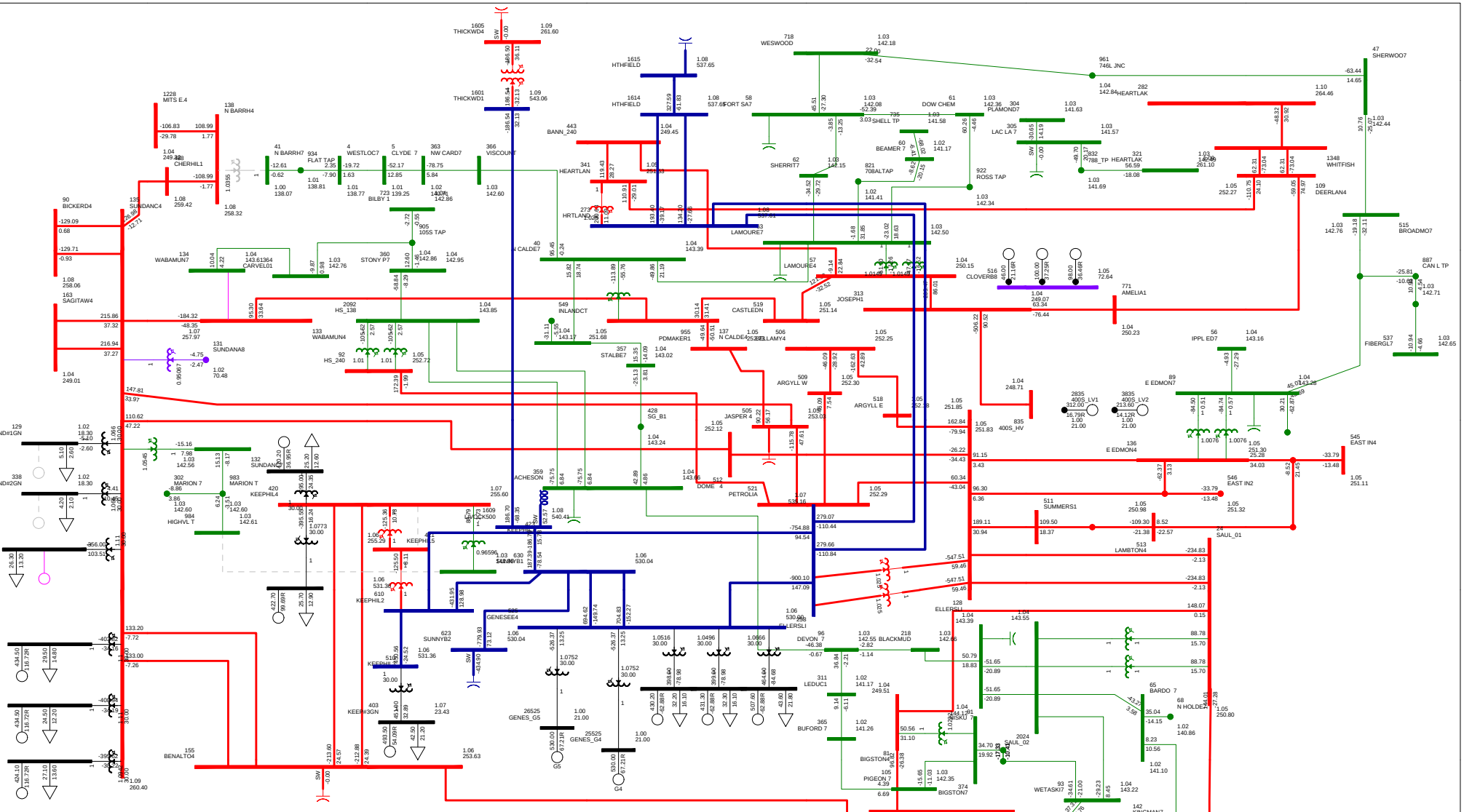
Max: 2,050MW

SOK Cutplane	1154.16 MW	+ (0.35) x-38.60 MW
KEG Cutplane	2169.07 MW	

2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)


1605 THICKWD4
1601 THICKWD1
1615 HTHFIELD
1614 HTHFIELD
718 WESWOOD
961 746L JNC
47 SHERWOO7
282 HEARTLAK
1348 WHITFISH
109 DEERLAN4
515 BROADMO7
887 CAN L TP
537 FIBERL7
1228 MITS E.4
138 N BARRH4
41 N BARRH7
934 FLAT TAP
4 WESTLOC7
5 CLYDE 7
363 NW CARD7
366 VISCOUNT
443 BANN_240
341 HEARTLAN
58 FORT SA7
735 SHELL TP
61 DOW CHEM
304 PLAMOND7
305 LAC LA 7
60 BEAMER 7
62 SHERRIT7
821 708ALTAP
922 ROSS TAP
832 788_TP
321 HEARTLAK
90 BICKERD4
135 SUNDANC4
905 105S TAP
134 WABAMUN7
360 STONY P7
40 N CALDE7
53 LAMOURE7
57 LAMOURE4
516 CLOVERB8
771 AMELIA1
163 SAGITAW4
2092 HS_138
549 INLANDCT
519 CASTLEDN
313 JOSEPH1
133 WABAMUN4
92 HS_240
357 STALBE7
955 PDMAKER1
137 N CALDE2
506 WILLAMY4
509 ARGYLL W
518 ARGYLL E
505 JASPER 4
428 SG_B1
512 DOME 4
521 PETROLIA
835 400S_HV
2835 400S_LV1
3835 400S_LV2
89 E EDMON7
136 E EDMON4
56 IPPL ED7
545 EAST IN4
546 EAST IN2
511 SUMMERS1
513 LAMBTON4
24 SAUL_01
128 ELLERSL1
218 BLACKMUD
96 DEVON 7
311 LEDUC1
365 BUFORD 7
2024 SAUL_02
65 BARDO 7
68 N HOLDE7
374 BIGSTON7
105 PIGEON 7
81 BIGSTON1
93 WETASKI7
142 KINGMAN7
147 GAETZ 4
148 GAETZ 7
94 ERVICK 7
70 CAMROSE7
789 WOLFCRE2
788 WOLFCREK
152 RED DEE4
1422 NEVIS 4
129 SUND#1GN
338 SUND#2GN
132 SUNDANG
302 MARION 7
983 MARION T
984 HIGHVL T
420 KEEPHIL4
359 ACHESON
1609 LAMCOK00
630 SUNNYB1
623 SUNNYB2
595 GENESEE4
610 KEEPHIL2
403 KEEP#3GN
155 BENALTO4
26525 GENES_G5
26525 GENES_G4
G5
G4
SCENARIO 12 2021 WP HIGH SOK (POST CONNECTION W/ LTP)
913L
FIG C-10
THU, APR 20 2017 9:03
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Footnote 9
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000
BC-AB: -138.48 MW
MATL import: 0.00 MW
Sask. Import: -0.10 MW
WATL: 758.02 MW
EATL: 319.20 MW
Total Heartland Generation: 525.60 MW
Total Genesee Generation: 2429.10 MW
Max: 2,050MW
SOK Cutplane 1155.35 MW + (0.35) x-38.63 MW
KEG Cutplane 2171.23 MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)


SCENARIO 12 2021 WP HIGH SOK (POST CONNECTION W/ LTP)
37ST6
FIG C-11
THU, APR 20 2017 9:03
BC-AB: -144.73 MW
MATL import: 0.00 MW
Sask. Import: -0.10 MW
WATL: 758.02 MW
EATL: 319.20 MW
Total Heartland Generation: 525.60 MW
Total Genesee Generation: 2429.10 MW
Max: 2,050MW
SOK Cutplane 1168.63 MW + (0.35) x-39.07 MW
KEG Cutplane 2183.72 MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 12 2021 WP HIGH SOK (POST CONNECTION W/ LTP)
69ST4
FIG C-12
THU, APR 20 2017 9:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Contour 0

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: -143.86 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 758.02 MW

EATL: 319.20 MW

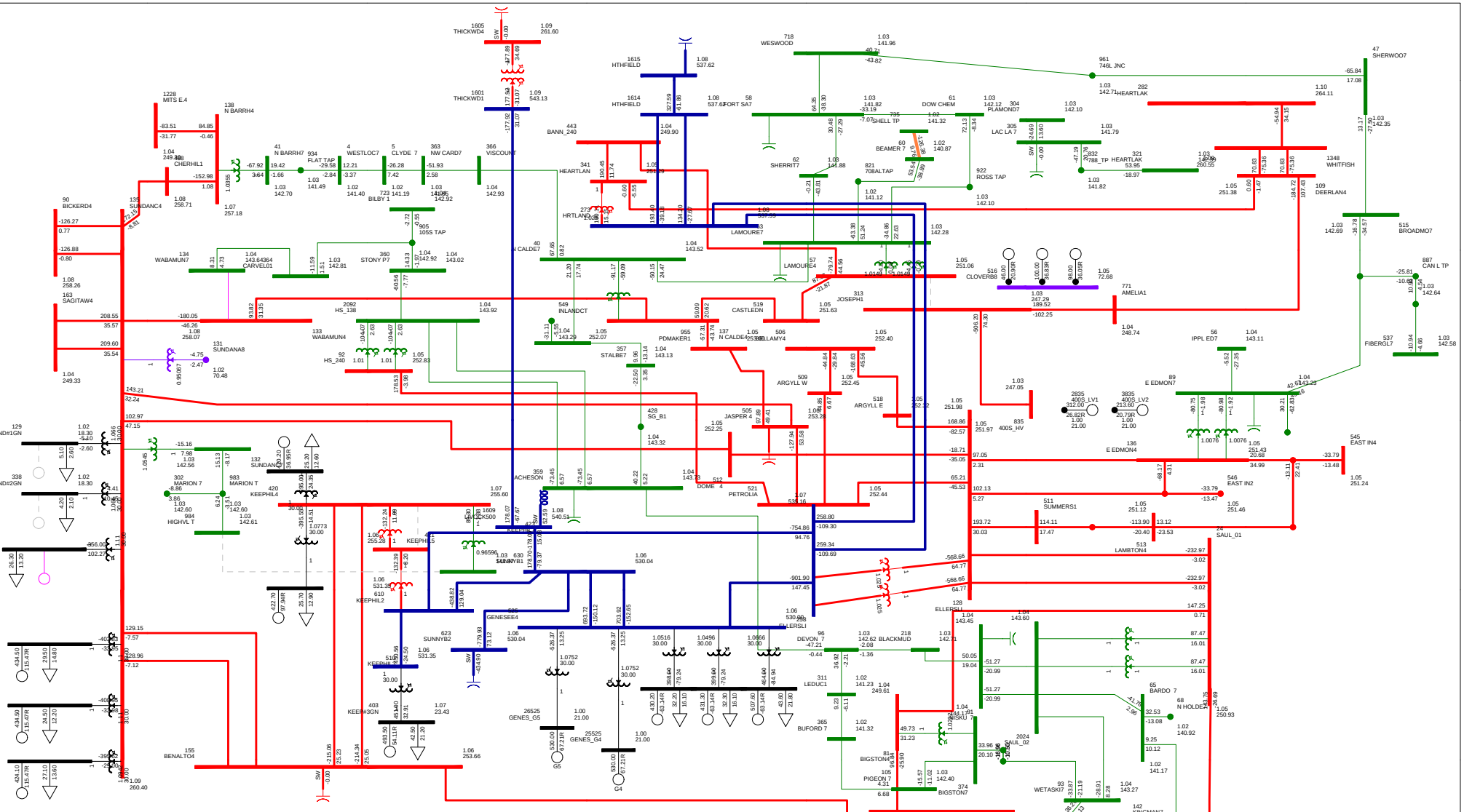
Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2429.10 MW

Max: 2,050MW

SOK Cutplane	1158.96 MW	+ (0.35) x-38.88 MW
KEG Cutplane	2187.10 MW	

2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 12 2021 WP HIGH SOK (POST CONNECTION W/ LTP)
997L
FIG C-13
THU, APR 20 2017 9:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Breaker 8

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: -142.87 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 758.02 MW

EATL: 319.20 MW

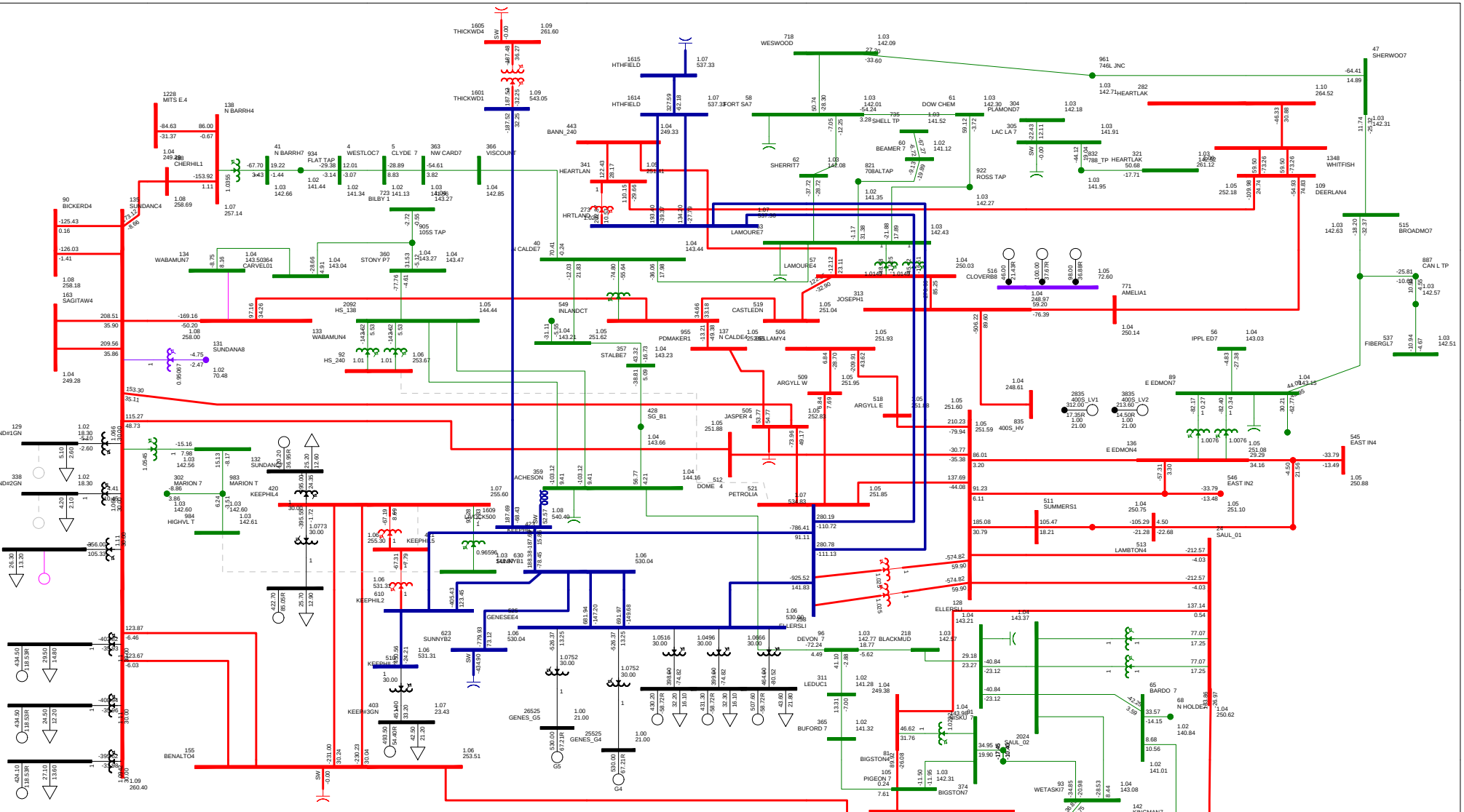
Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2429.10 MW

Max: 2,050MW

SOK Cutplane	1150.13 MW	+ (0.35) x-41.35 MW
KEG Cutplane	2192.48 MW	

2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 12 2021 WP HIGH SOK (POST CONNECTION W/ LTP)
1139L
FIG C-14
THU, APR 20 2017 9:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Fontrae 9

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: -144.54 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 758.02 MW

EATL: 319.20 MW

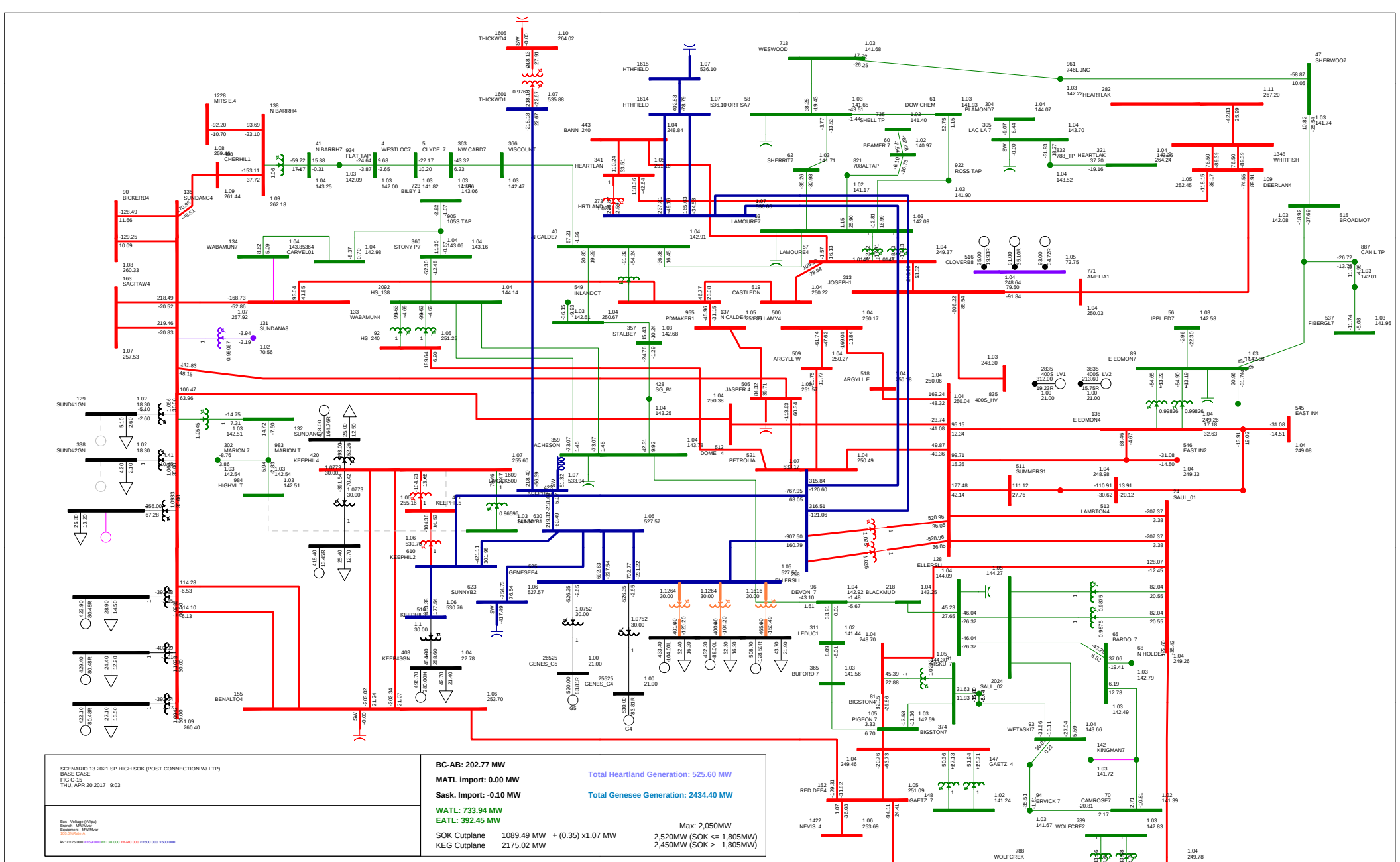
Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2429.10 MW

Max: 2,050MW

SOK Cutplane	1133.02 MW	+ (0.35) x-39.34 MW
KEG Cutplane	2285.74 MW	

2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 13 2021 SP HIGH SOK (POST CONNECTION W/ LTP)
BASE CASE
FIG C-15
THU, APR 20 2017 9:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Bus/Area 4

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 202.77 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 733.94 MW

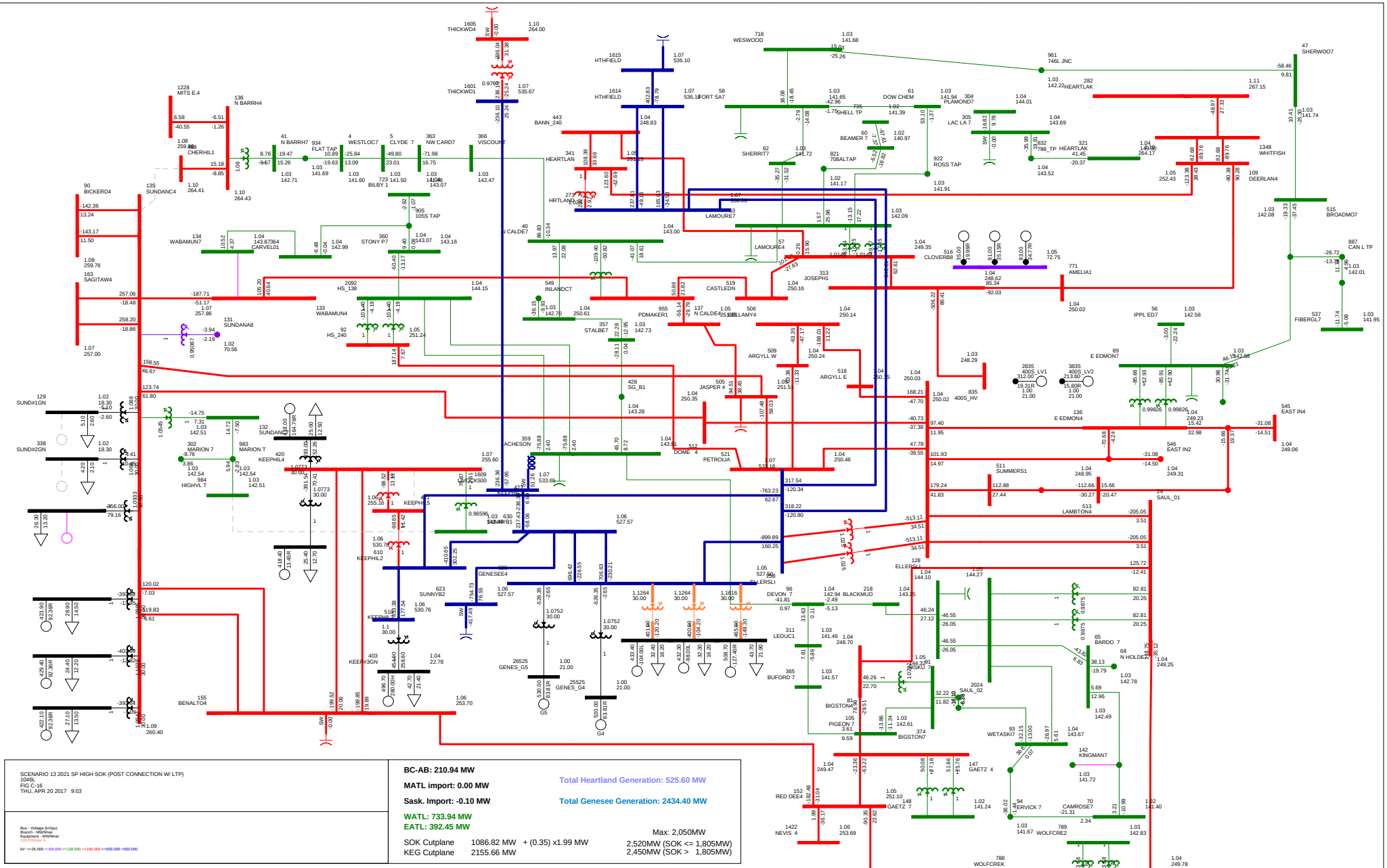
EATL: 392.45 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2434.40 MW

Max: 2,050MW

SOK Cutplane	1089.49 MW	+ (0.35) x1.07 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2175.02 MW		2,450MW (SOK > 1,805MW)



SCENARIO 13 2021 SP HIGH SOK (POST CONNECTION W/ LTP)
1046L
FIG C-16
THU, APR 20 2017 9:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Bus/Area 2

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 210.94 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 733.94 MW

EATL: 392.45 MW

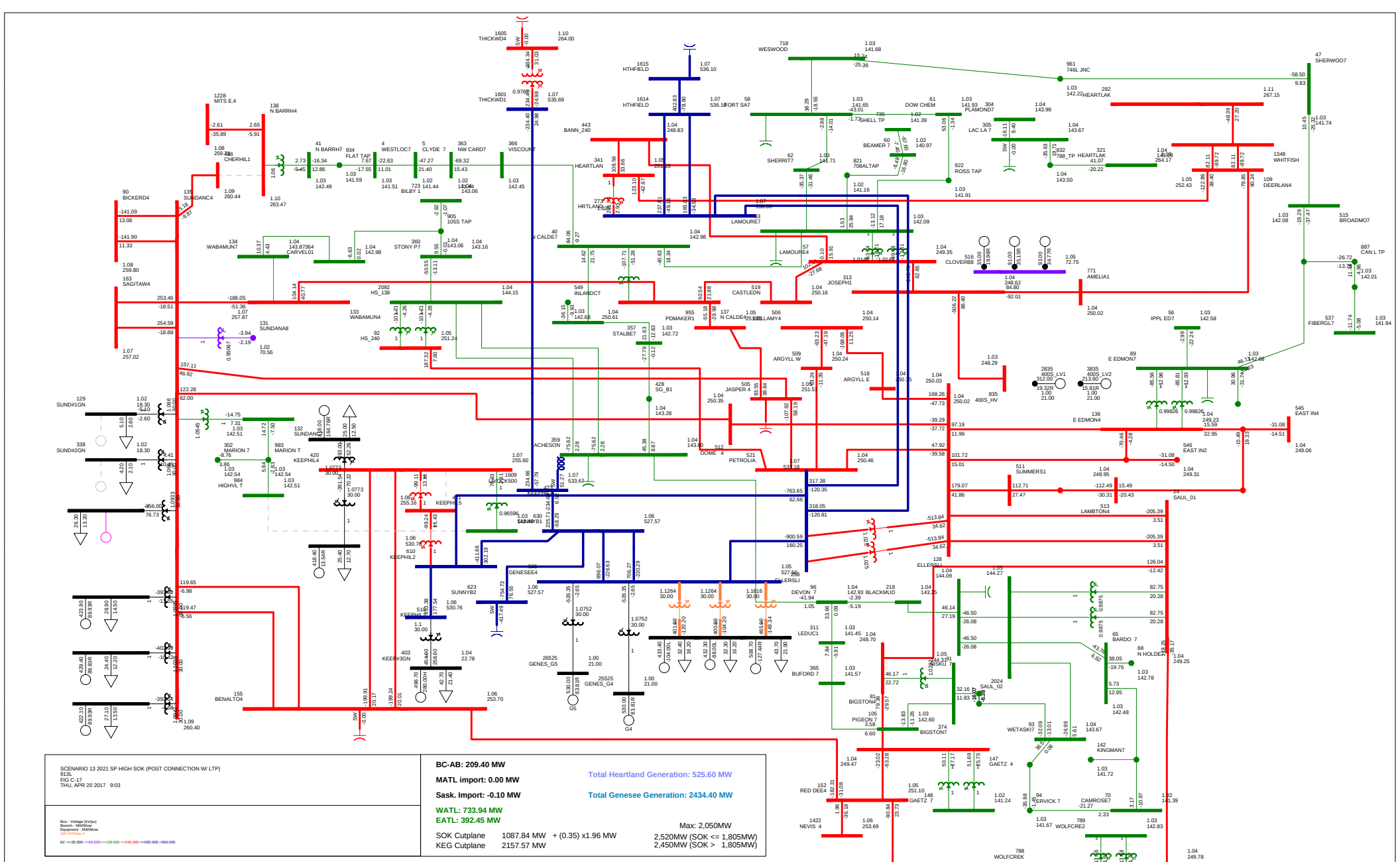
Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2434.40 MW

Max: 2,050MW

SOK Cutplane	1086.82 MW	+ (0.35) x1.99 MW
KEG Cutplane	2155.66 MW	

2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 13 2021 SP HIGH SOK (POST CONNECTION W/ LTP)
913L
FIG C-17
THU, APR 20 2017 9:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Bus/Area 2

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 209.40 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 733.94 MW

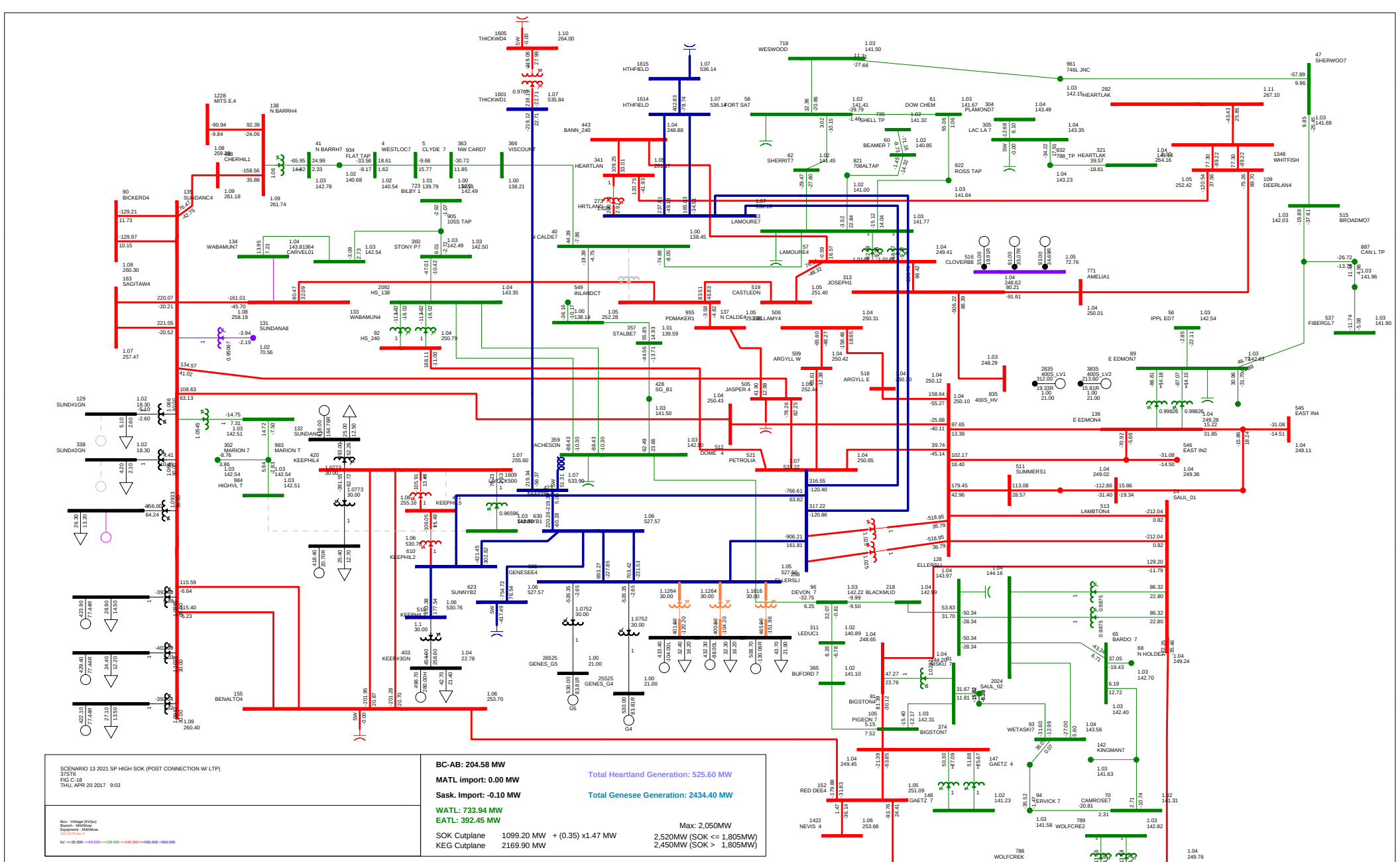
EATL: 392.45 MW

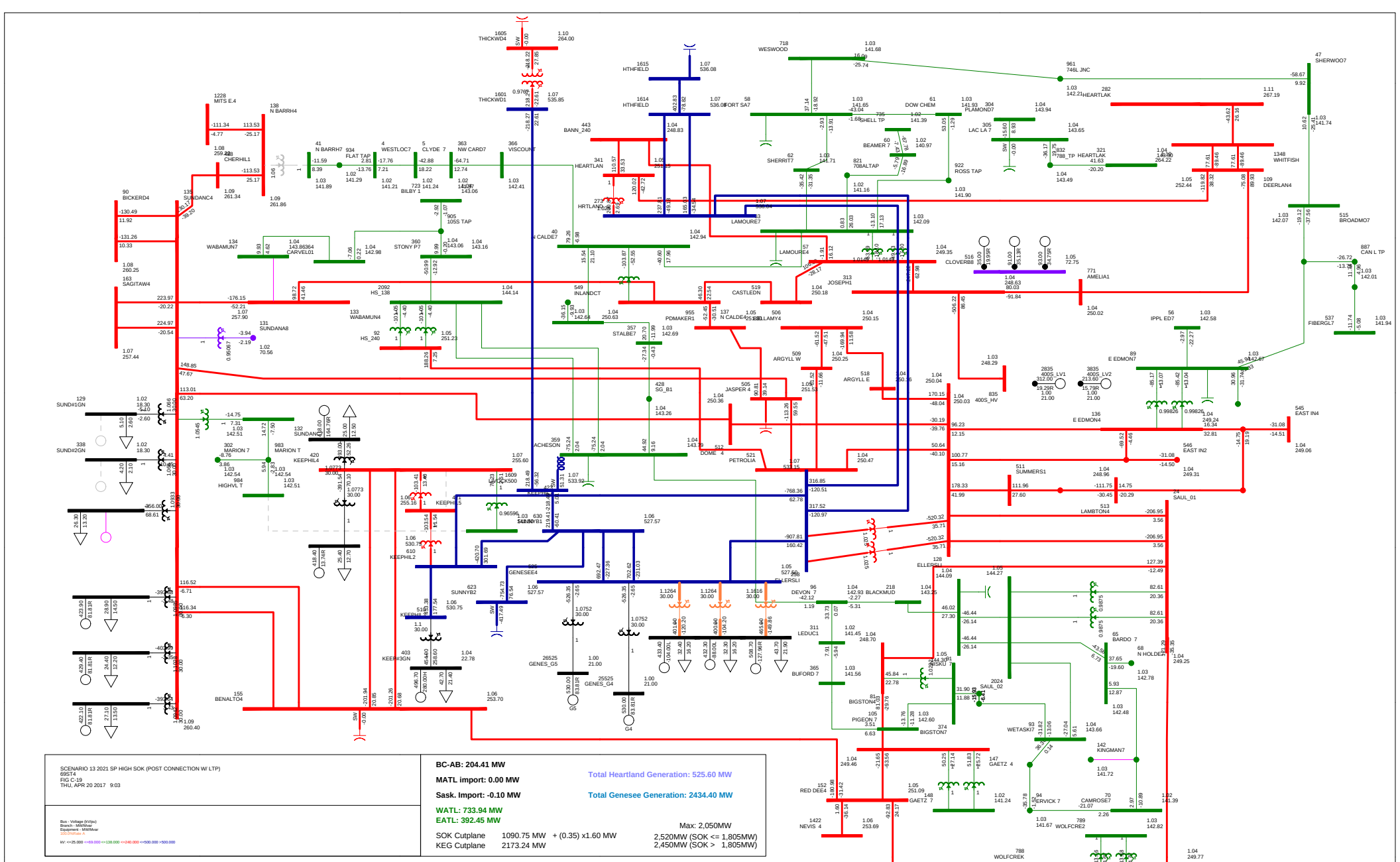
Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2434.40 MW

Max: 2,050MW

SOK Cutplane	1087.84 MW	+ (0.35) x1.96 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2157.57 MW		2,450MW (SOK > 1,805MW)


SCENARIO 13 2021 SP HIGH SOK (POST CONNECTION W/ LTP)
37ST6
FIG C-18
THU, APR 20 2017 9:03
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Bus/Area 4
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000
BC-AB: 204.58 MW
MATL import: 0.00 MW
Sask. Import: -0.10 MW
WATL: 733.94 MW
EATL: 392.45 MW
Total Heartland Generation: 525.60 MW
Total Genesee Generation: 2434.40 MW
Max: 2,050MW
SOK Cutplane 1099.20 MW + (0.35) x1.47 MW
KEG Cutplane 2169.90 MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 13 2021 SP HIGH SOK (POST CONNECTION W/ LTP)
69ST4
FIG C-19
THU, APR 20 2017 9:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Fault# 0

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 204.41 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 733.94 MW

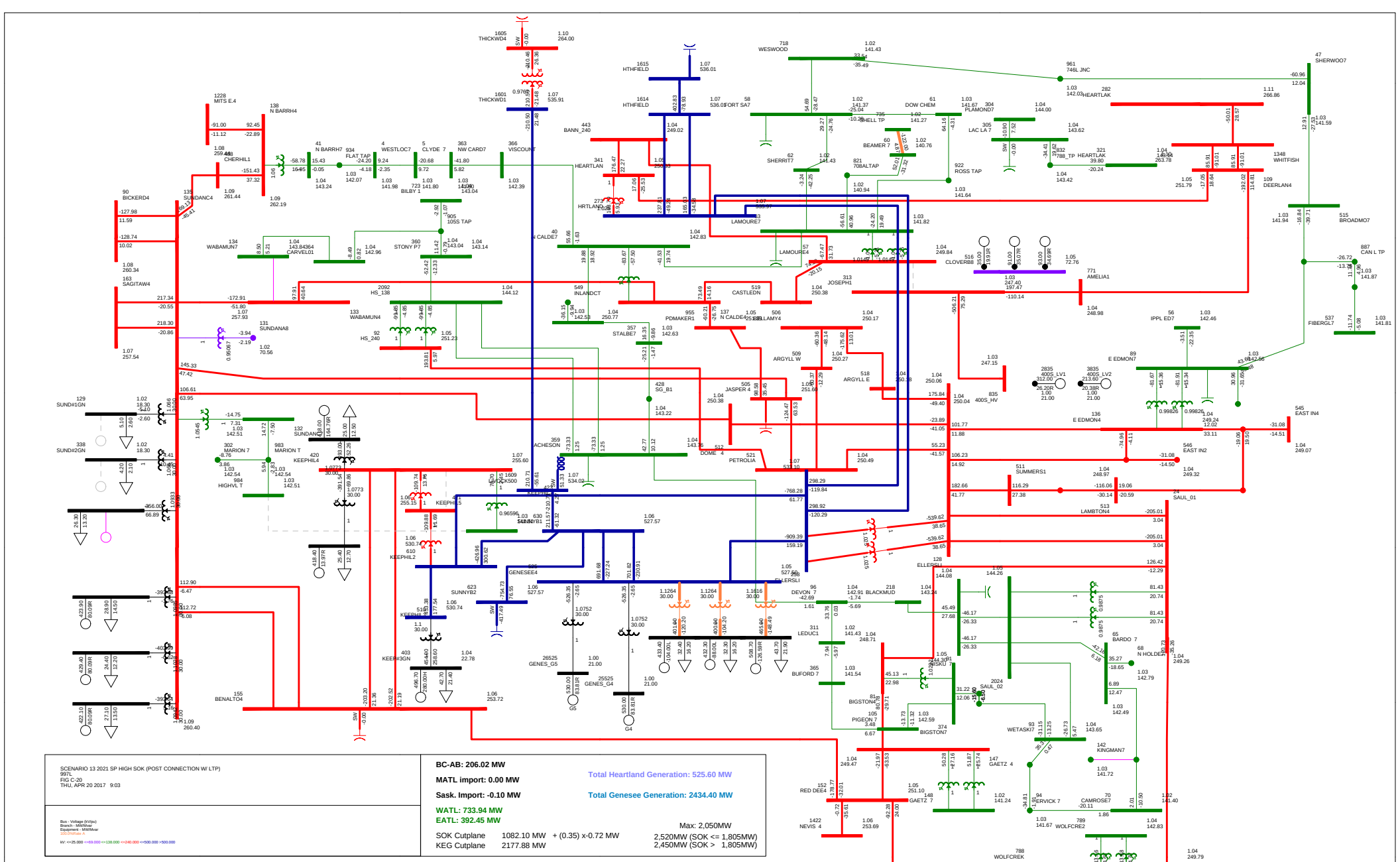
EATL: 392.45 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2434.40 MW

Max: 2,050MW

SOK Cutplane	1090.75 MW	+ (0.35) x1.60 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2173.24 MW		2,450MW (SOK > 1,805MW)



SCENARIO 13 2021 SP HIGH SOK (POST CONNECTION W/ LTP)
997L
FIG C-20
THU, APR 20 2017 9:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Bus/Line -1

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 206.02 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 733.94 MW

EATL: 392.45 MW

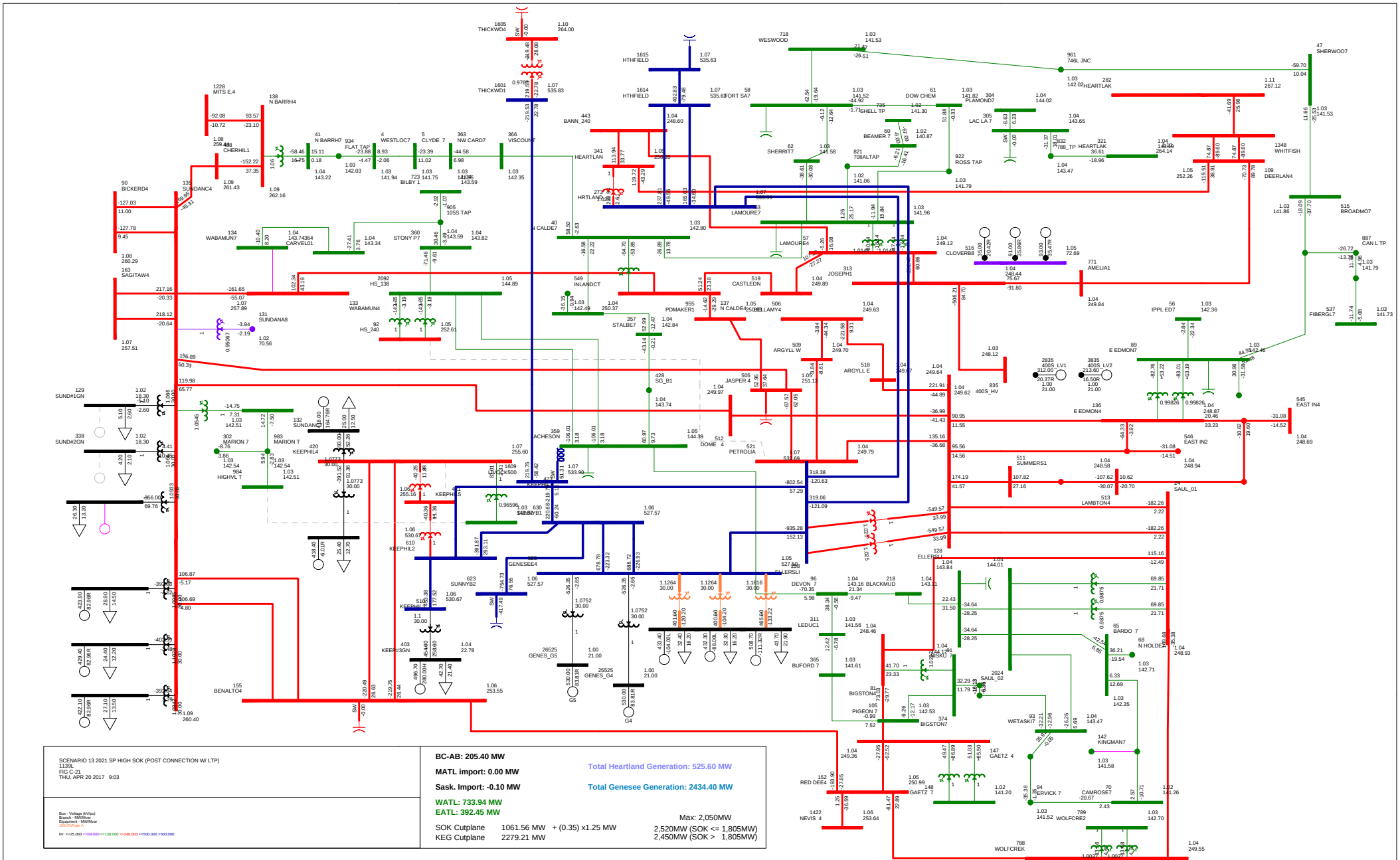
Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2434.40 MW

Max: 2,050MW

SOK Cutplane	1082.10 MW	+ (0.35) x-0.72 MW
KEG Cutplane	2177.88 MW	

2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 13 2021 SP HIGH SOK (POST CONNECTION W/ LTP)
1139L
FIG C-21
THU, APR 20 2017 9:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Fontrae 4

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 205.40 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

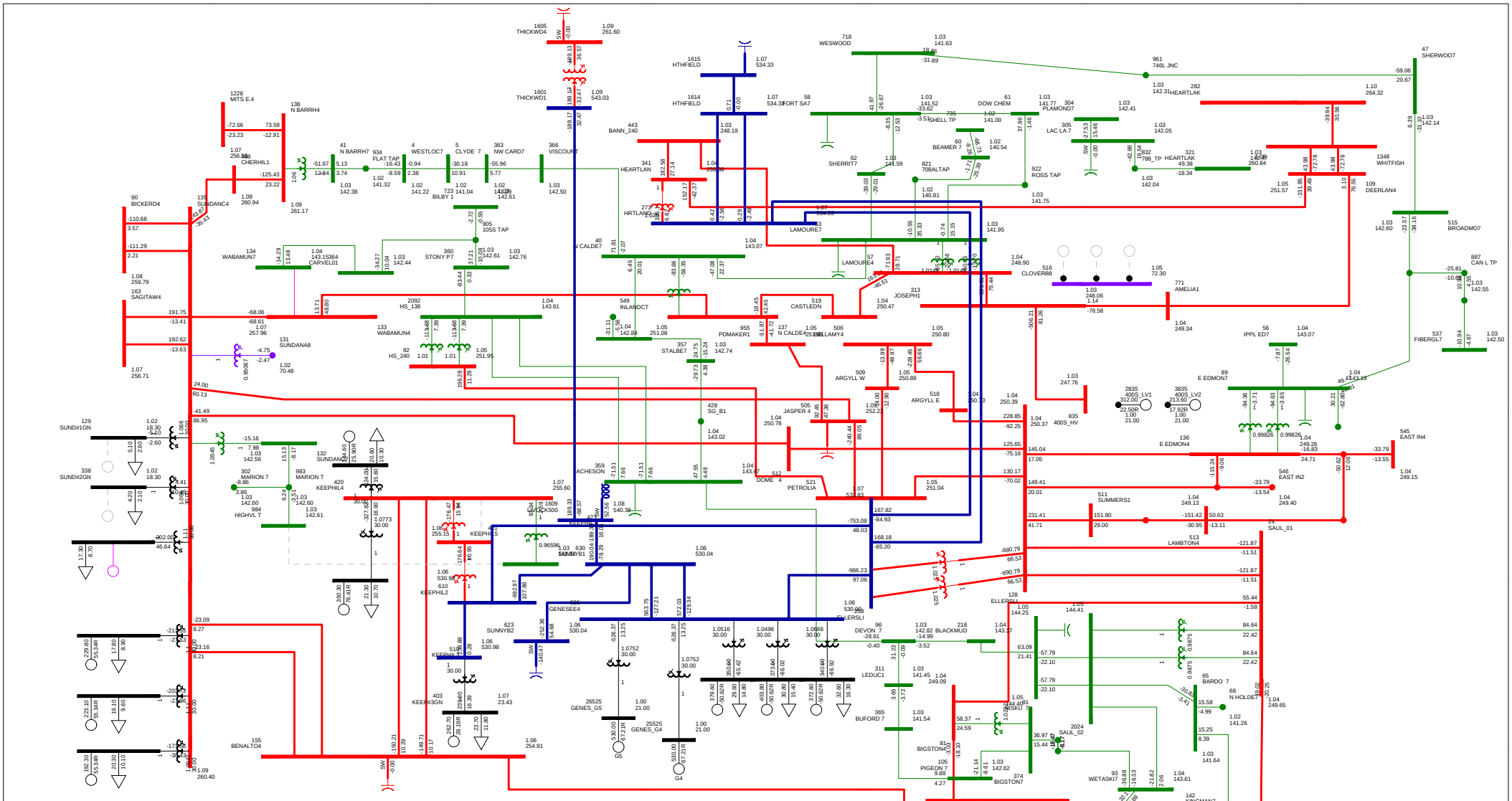
WATL: 733.94 MW

EATL: 392.45 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2434.40 MW

			Max: 2,050MW
SOK Cutplane	1061.56 MW	+ (0.35) x1.25 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2279.21 MW		2,450MW (SOK > 1,805MW)



SCENARIO 14 2021 WP LOW SOK (POST CONNECTION W/ LTP)
BASE CASE
FIG C-22
THU, APR 20 2017 9:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Bus/Area 9

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 542.98 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

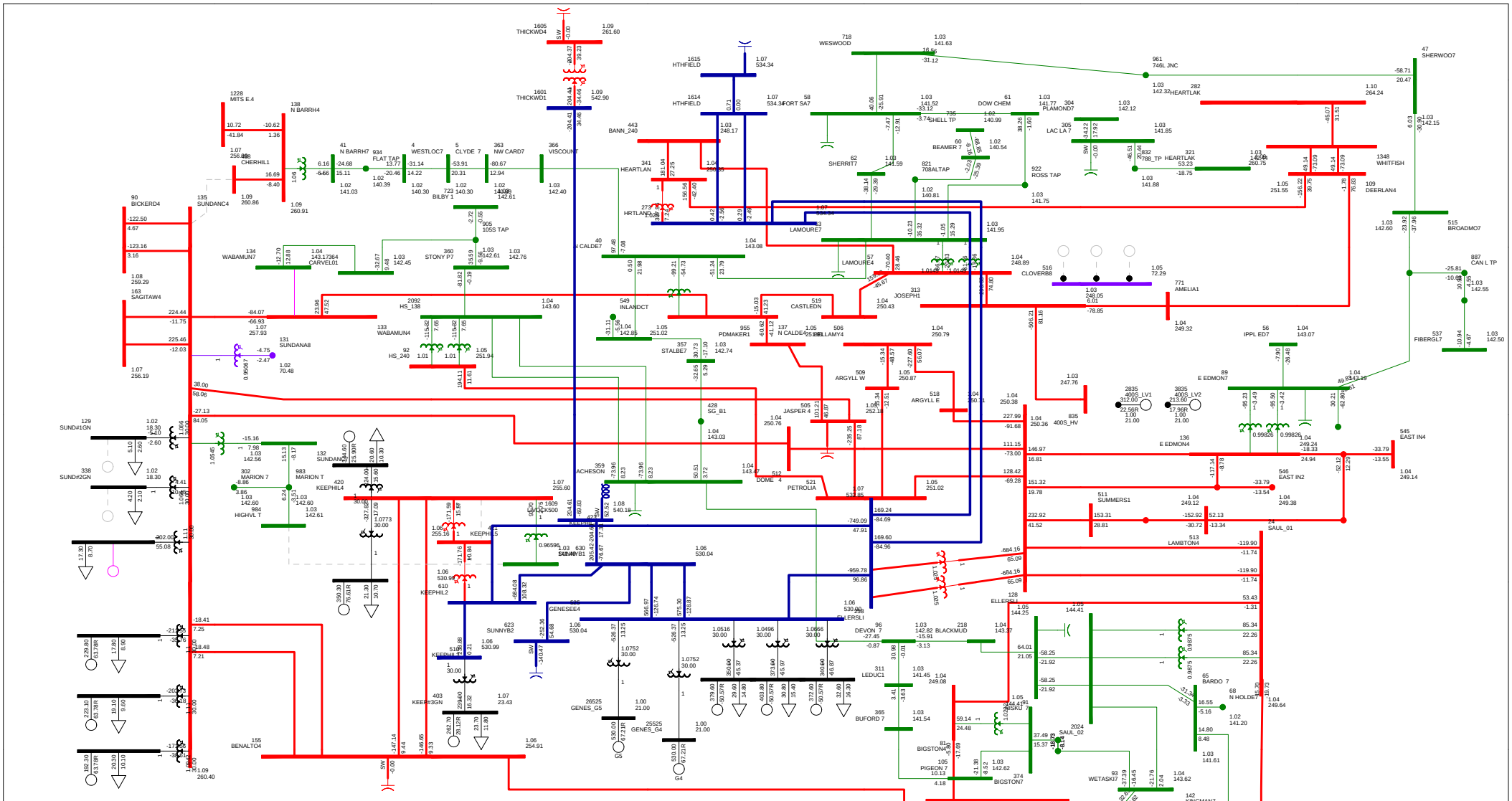
WATL: 246.28 MW

EATL: -0.82 MW

Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2216.00 MW

SOK Cutplane	466.90 MW	+ (0.35) x-75.79 MW	Max: 2,050MW 2,520MW (SOK <= 1,805MW) 2,450MW (SOK > 1,805MW)
KEG Cutplane	2123.42 MW		



SCENARIO 14 2021 WP LOW SOK (POST CONNECTION W/ LTP)
1046L
FIG C-23
THU, APR 20 2017 9:03

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Drafaxe 9

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 550.66 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

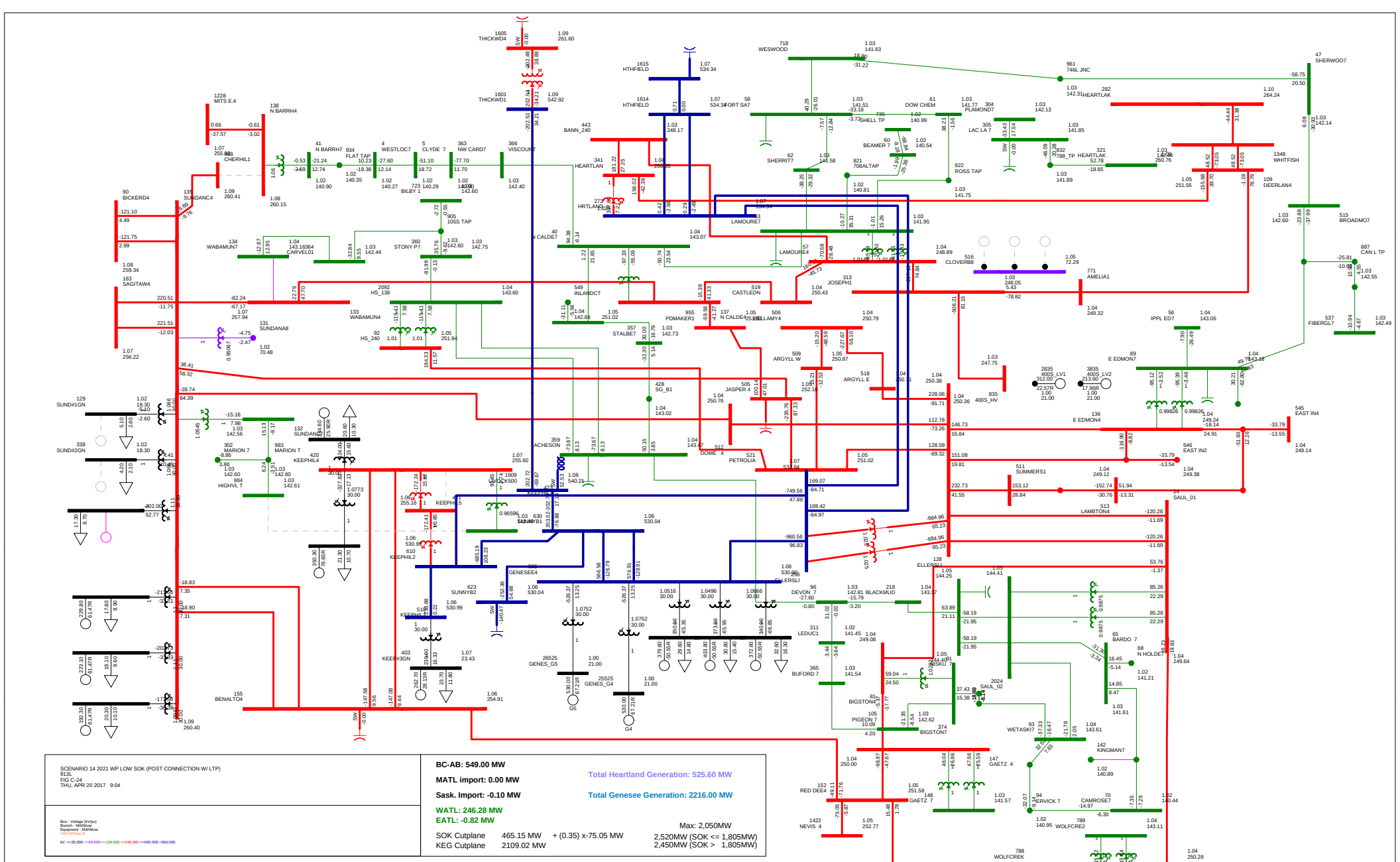
WATL: 246.28 MW

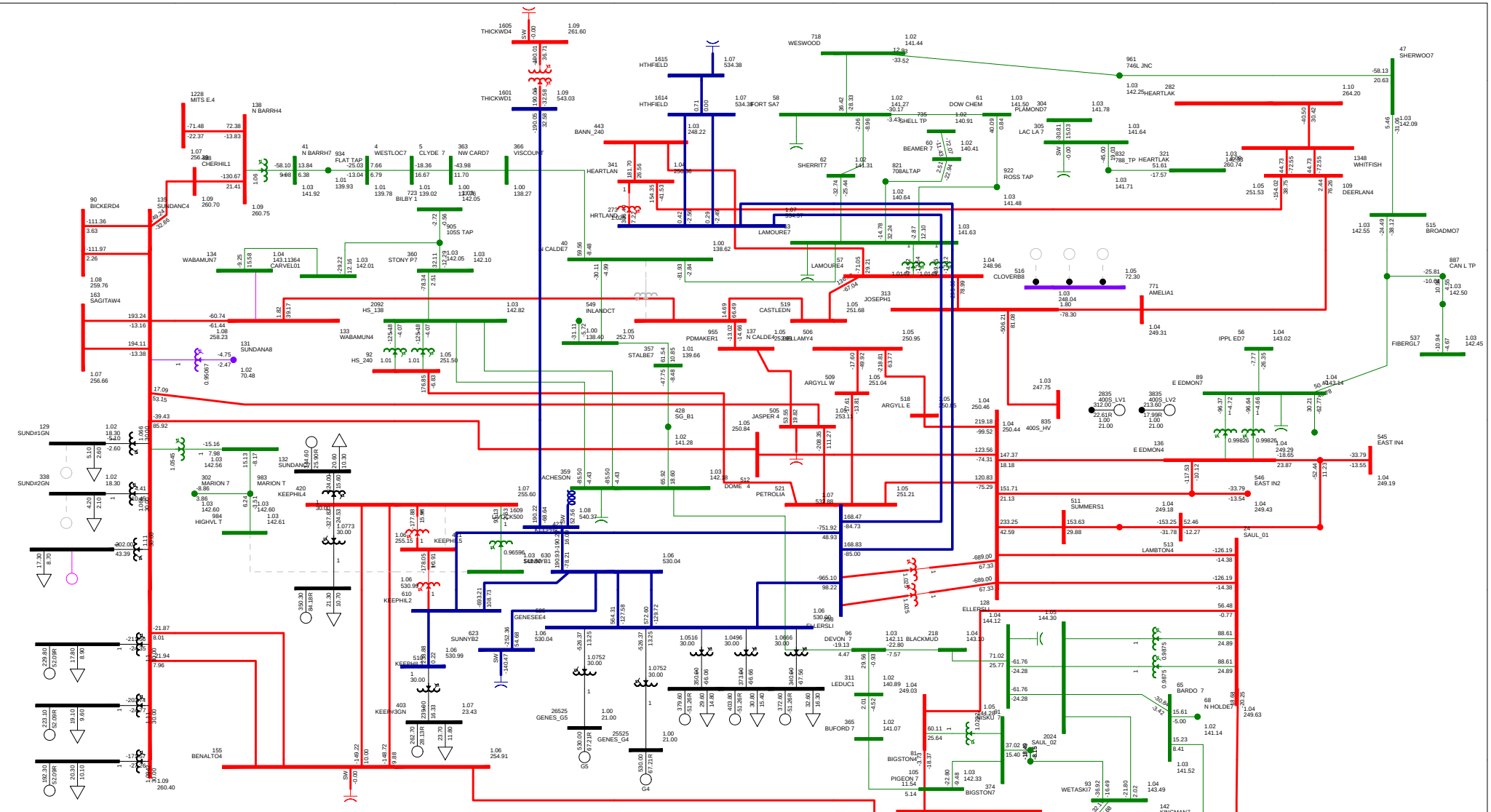
EATL: -0.82 MW

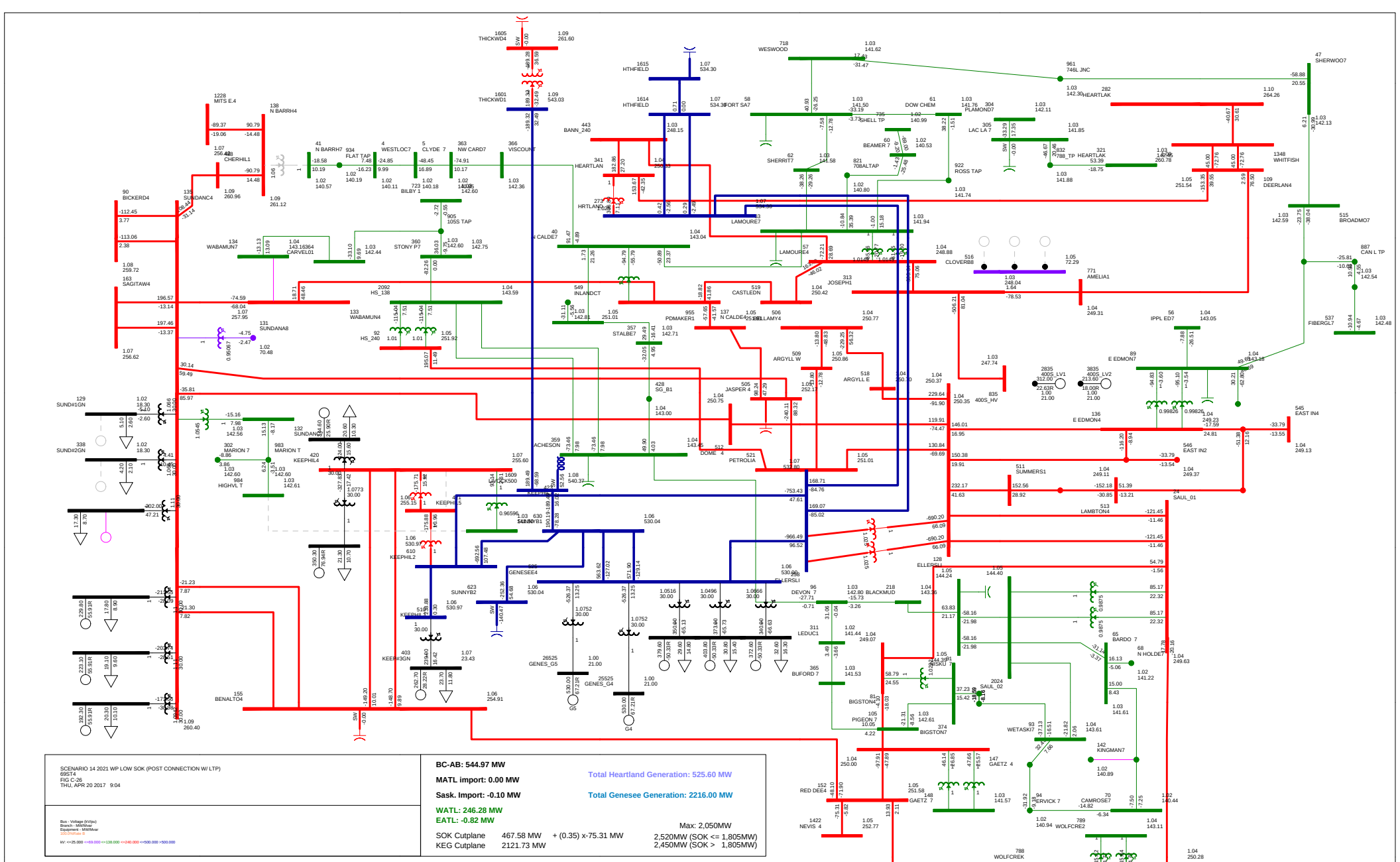
Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2216.00 MW

			Max: 2,050MW
SOK Cutplane	464.13 MW	+ (0.35) x-75.01 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2106.92 MW		2,450MW (SOK > 1,805MW)


SCENARIO 14 2021 WP LOW SOK (POST CONNECTION W/ LTP)
913L
FIG C-24
THU, APR 20 2017 9:04
BC-AB: 549.00 MW
MATL import: 0.00 MW
Sask. Import: -0.10 MW
WATL: 246.28 MW
EATL: -0.82 MW
Total Heartland Generation: 525.60 MW
Total Genesee Generation: 2216.00 MW
Max: 2,050MW
SOK Cutplane 465.15 MW + (0.35) x-75.05 MW
KEG Cutplane 2109.02 MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Kv/Kaw 0
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000


1605 THICKWD4
1601 THICKWD1
1615 HTHFIELD
1614 HTHFIELD
718 WESWOOD
961 746L JNC
47 SHERWOO7
282 HEARTLAK
1348 WHITFISH
109 DEERLAN4
515 BROADMO7
887 CAN L TP
537 FIBERGL7
1228 MITS E.4
138 N BARRH4
CHERHIL1
90 BICKERD4
135 SUNDANC4
163 SAGITAW4
129 SUND#1GN
338 SUND#2GN
155 BENALTO4
366 VISCOUNT
443 BANN_240
341 HEARTLAN
HRTLAND
40 N CALDE7
549 INLANDCT
519 CASTLEDN
313 JOSEPH1
516 CLOVERB8
771 AMELIA1
56 IPPL ED7
89 E EDMON7
136 E EDMON4
545 EAST IN4
546 EAST IN2
24 SAUL_01
2024 SAUL_02
513 LAMBTON4
128 ELLERSLI
218 BLACKMUD
96 DEVON 7
311 LEDUC1
365 BUFORD 7
65 BARDO 7
68 N HOLDE7
81 BIGSTON7
105 PIGEON 7
374 BIGSTON7
93 WETASKI7
142 KINGMAN7
147 GAETZ 4
148 GAETZ 7
94 VERVICK 7
70 CAMROSE7
789 WOLFCRE2
788 WOLFCREK
152 RED DEE4
1422 NEVIS 4
359 JACHESON
1609 KEEPHIL5
420 KEEPHIL4
610 KEEPHIL2
403 KEEP#3GN
983 MARION T
984 HIGHVL T
302 MARION 7
132 SUNDANC4
131 SUNDANA8
134 WABAMUN7
CARVEL01
360 STONY P7
905 10SS TAP
133 WABAMUN4
2092 HS_138
92 HS_240
357 STALBE7
955 PDMAKER1
137 N CALDE7
506 WILLAMY4
509 ARGYLL W
518 ARGYLL E
505 JASPER 4
521 PETROLIA
512 DOME 4
428 SG_B1
630 SUNNYB1
623 SUNNYB2
595 GENESEE4
26525 GENES_G5
26525 GENES_G4
G5
G4
2835 400S_LV1
3835 400S_LV2
835 400S_HV
511 SUMMERS1
SAGITAW4
SUNDANA8
SUNDANC4
SUNDANC4
SUNDANC4



SCENARIO 14 2021 WP LOW SOK (POST CONNECTION W/ LTP)
69ST4
FIG C-26
THU, APR 20 2017 9:04

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Bus/Area 9

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 544.97 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

WATL: 246.28 MW

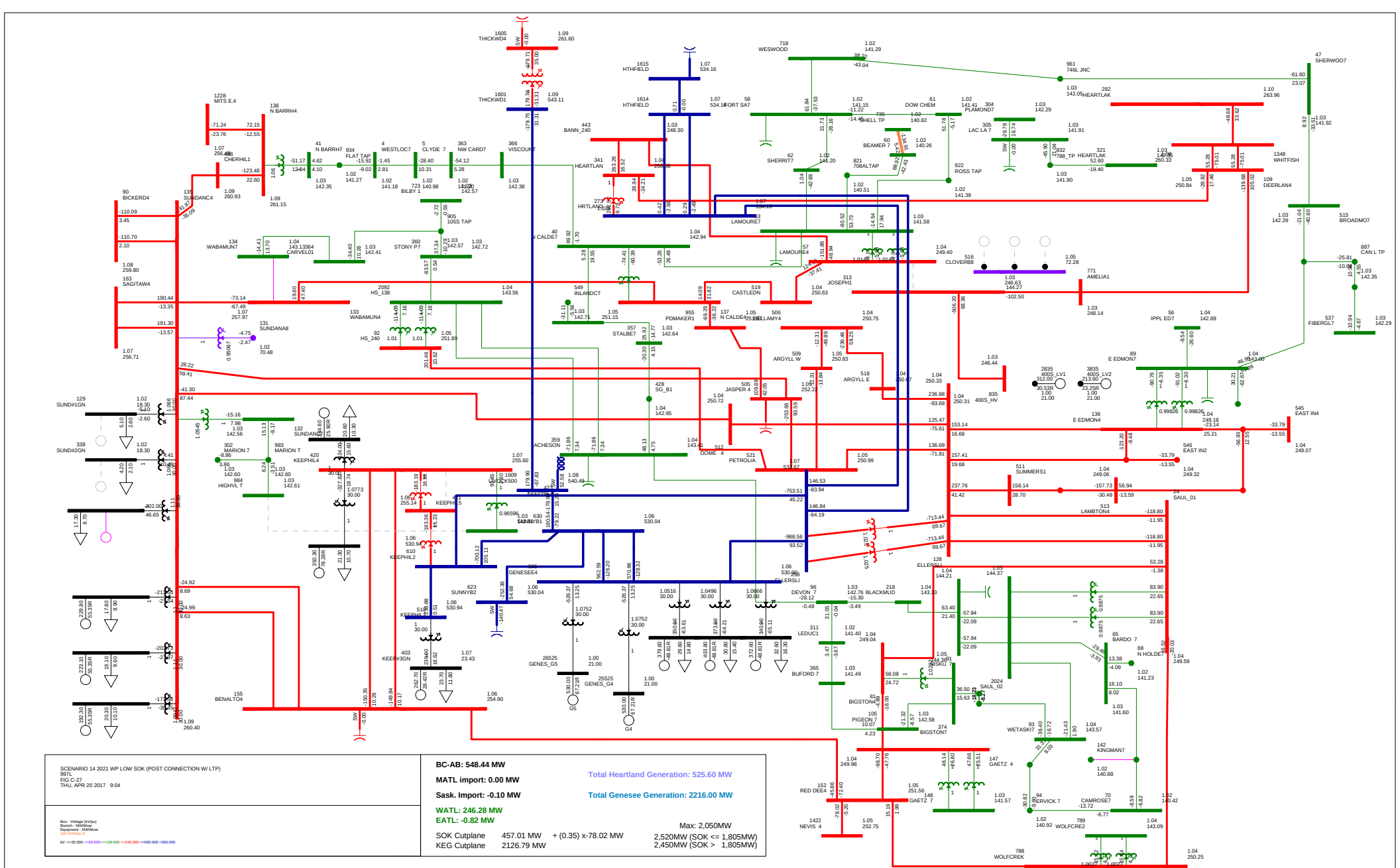
EATL: -0.82 MW

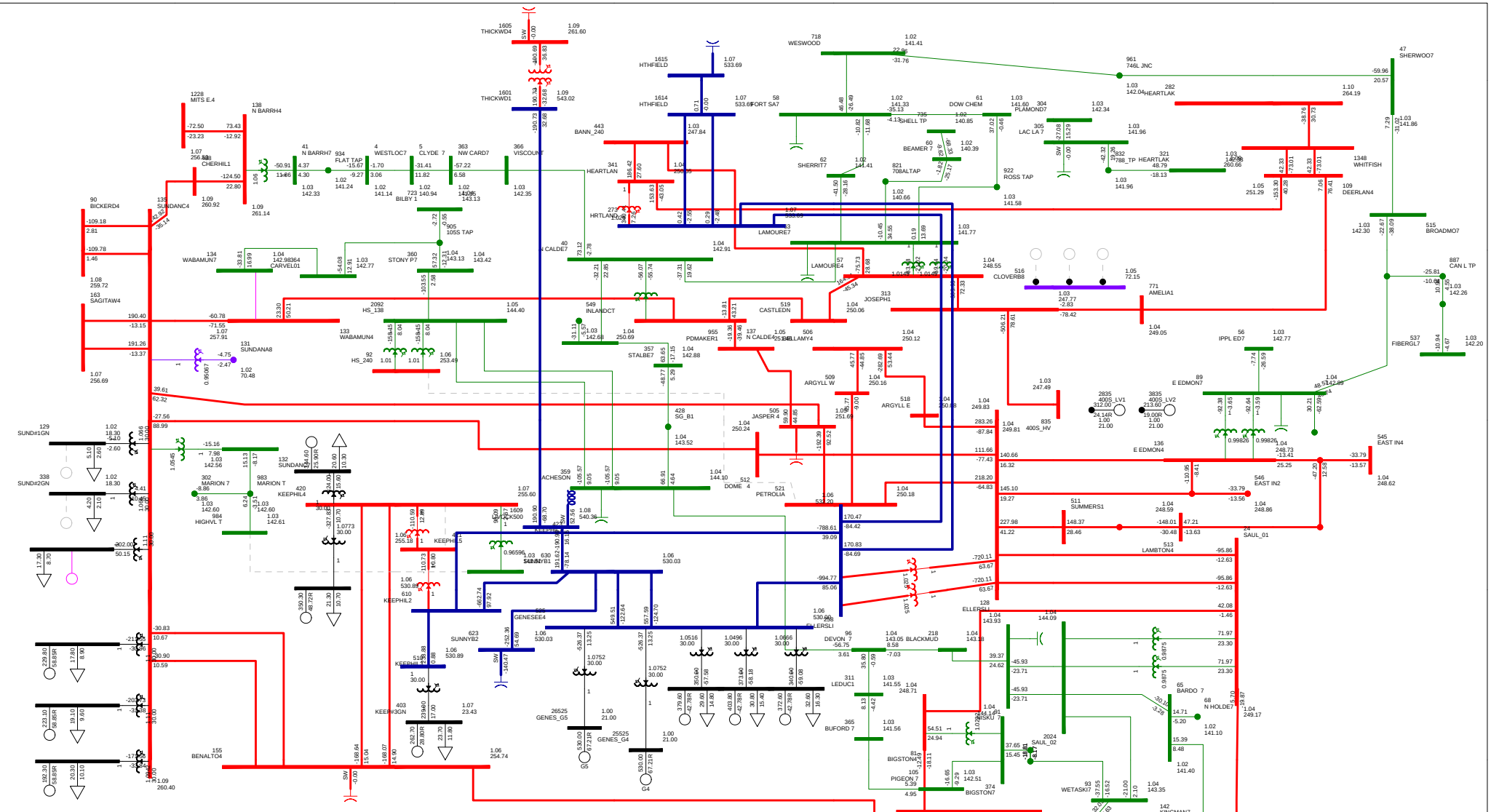
Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2216.00 MW

SOK Cutplane	467.58 MW	+ (0.35) x-75.31 MW
KEG Cutplane	2121.73 MW	

Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)


1605 THICKWD4
1601 THICKWD1
1615 HTHFIELD
1614 HTHFIELD
718 WESWOOD
961 746L JNC
47 SHERWOO7
282 HEARTLAK
1348 WHITFISH
109 DEERLAN4
515 BROADMO7
887 CAN L TP
537 FIBERL7
228 MITS E.4
138 N BARRH4
41 N BARRH7
934 FLAT TAP
4 WESTLOC7
5 CLYDE 7
363 NW CARD7
366 VISCOUNT
905 105S TAP
360 STONY P7
134 WABAMUN7
CARVEL01
90 BICKERD4
135 SUNDANC4
163 SAGITAW4
131 SUNDANA8
2092 HS_138
133 WABAMUN4
92 HS_240
443 BANN_240
341 HEARTLAN
273 HRTLAND
40 N CALDE7
549 INLANDCT
357 STALBE7
955 PDMAKER1
137 N CALDE4
519 CASTLEDN
506 BELLAMY4
53 LAMOURE7
57 LAMOURE4
516 CLOVERB8
313 JOSEPH1
771 AMELIA1
509 ARGYLL W
518 ARGYLL E
505 JASPER 4
428 SG_B1
512 DOME 4
521 PETROLIA
56 IPPL ED7
89 E EDMON7
136 E EDMON4
2835 400S_LV1
3835 400S_LV2
835 400S_HV
545 EAST IN4
546 EAST IN2
511 SUMMERS1
24 SAUL_01
513 LAMBTON4
128 ELLERSL1
96 DEVON 7
218 BLACKMUD
311 LEDUC1
365 BUFORD 7
65 BARDO 7
68 N HOLDE7
2024 SAUL_02
81 BIGSTON4
105 PIGEON 7
374 BIGSTON7
93 WETASKI7
142 KINGMAN7
147 GAETZ 4
148 GAETZ 7
94 FERVICK 7
70 CAMROSE7
789 WOLFCRE2
788 WOLFCREK
152 RED DEE4
1422 NEVIS 4
129 SUND#1GN
338 SUND#2GN
302 MARION 7
983 MARION T
984 HIGHVL T
420 KEEPHIL4
132 SUNDANA4
359 PACHESON
610 KEEPHIL2
403 KEEP#3GN
155 BENALTO4
623 SUNNYB2
630 SUNNYB1
525 GENESEE4
26525 GENES_G5
26525 GENES_G4
G5
G4
SCENARIO 14 2021 WP LOW SOK (POST CONNECTION W/ LTP)
997L
FIG C -27
THU, APR 20 2017 9:04
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Footnote 9
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000
BC-AB: 548.44 MW
MATL import: 0.00 MW
Sask. Import: -0.10 MW
WATL: 246.28 MW
EATL: -0.82 MW
Total Heartland Generation: 525.60 MW
Total Genesee Generation: 2216.00 MW
Max: 2,050MW
SOK Cutplane 457.01 MW + (0.35) x-78.02 MW
KEG Cutplane 2126.79 MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 14 2021 WP LOW SOK (POST CONNECTION W/ LTP)
1139L
FIG C-28
THU, APR 20 2017 9:04

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Bus/Line 0

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 546.28 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

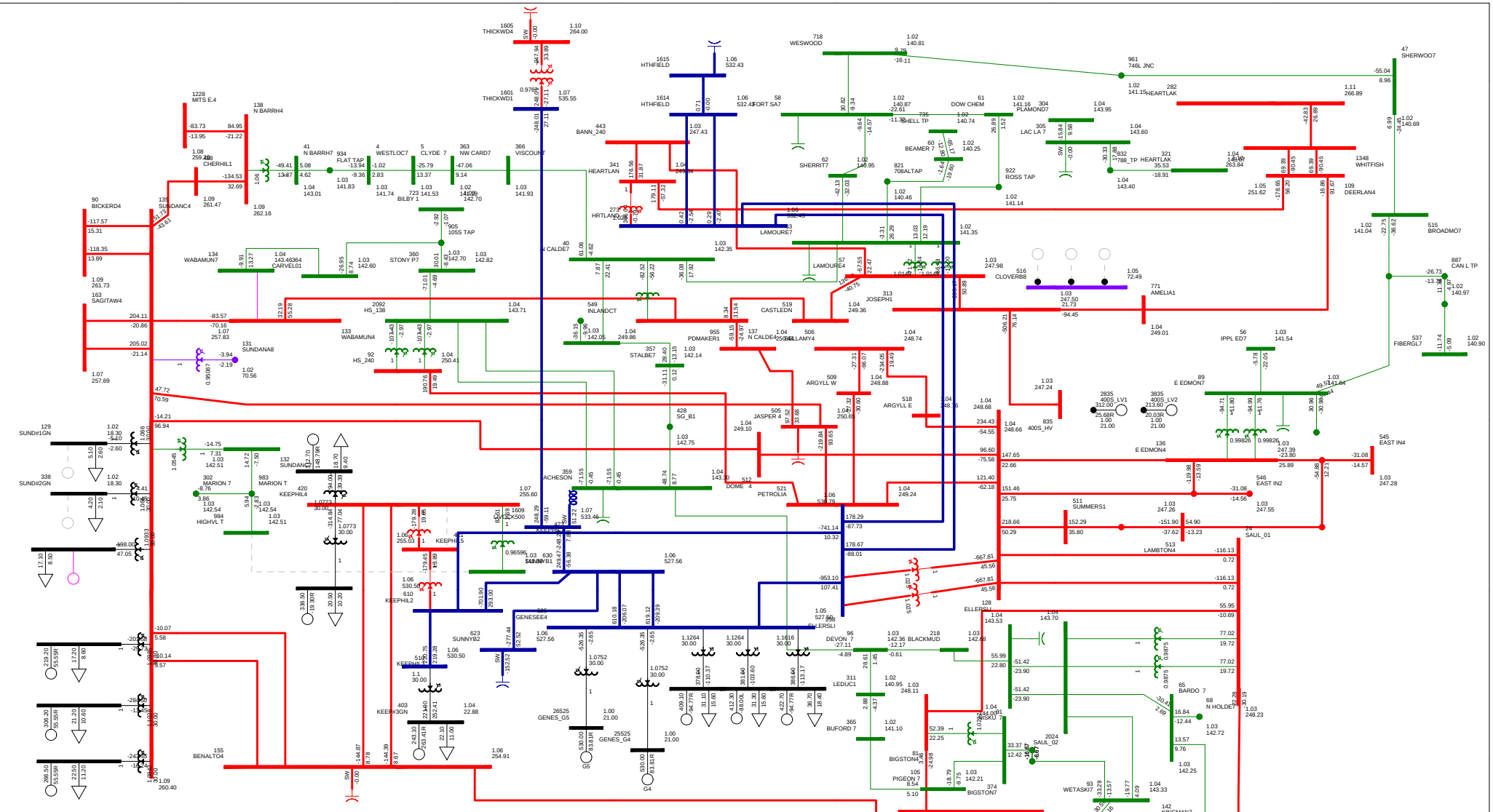
WATL: 246.28 MW

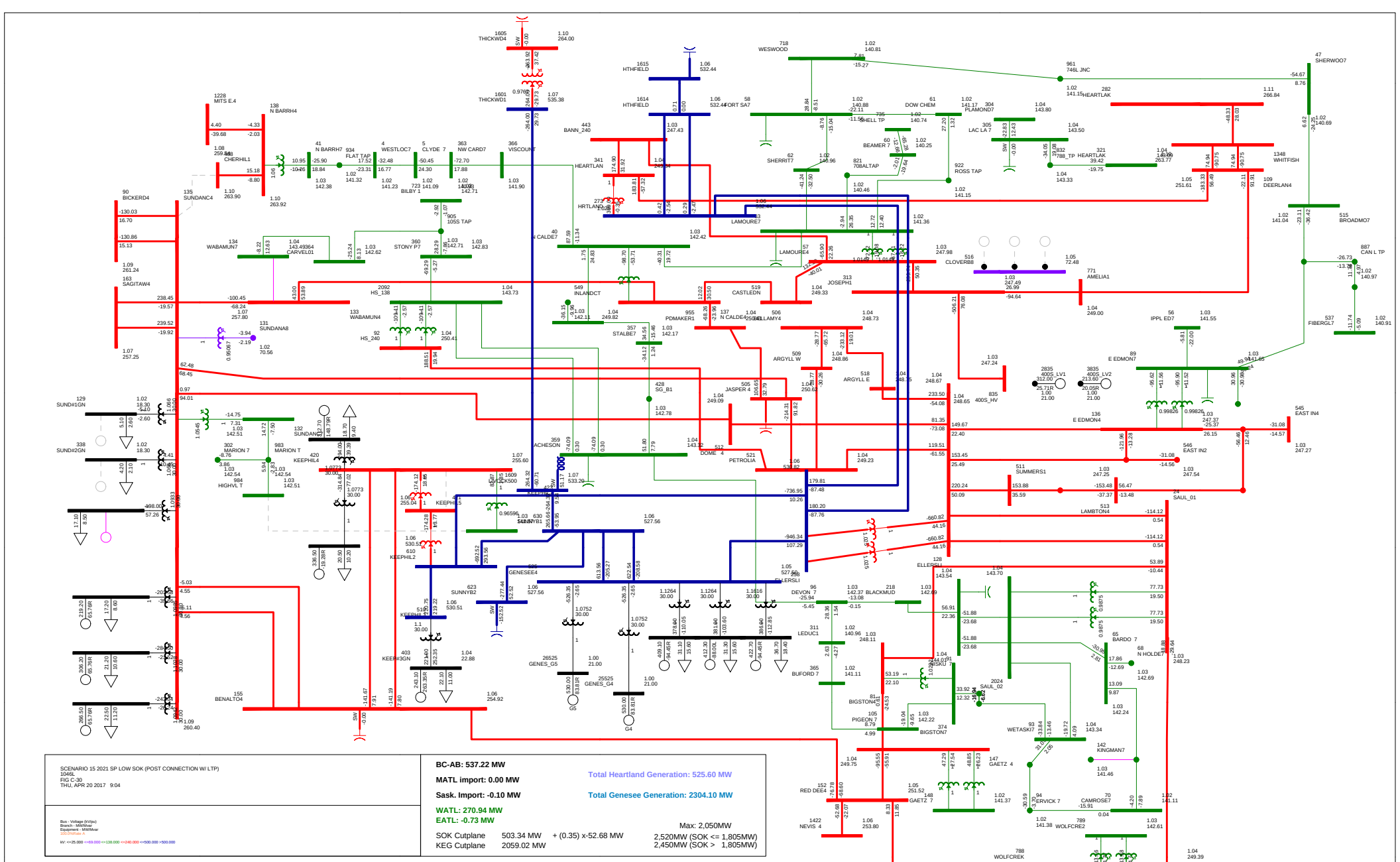
EATL: -0.82 MW

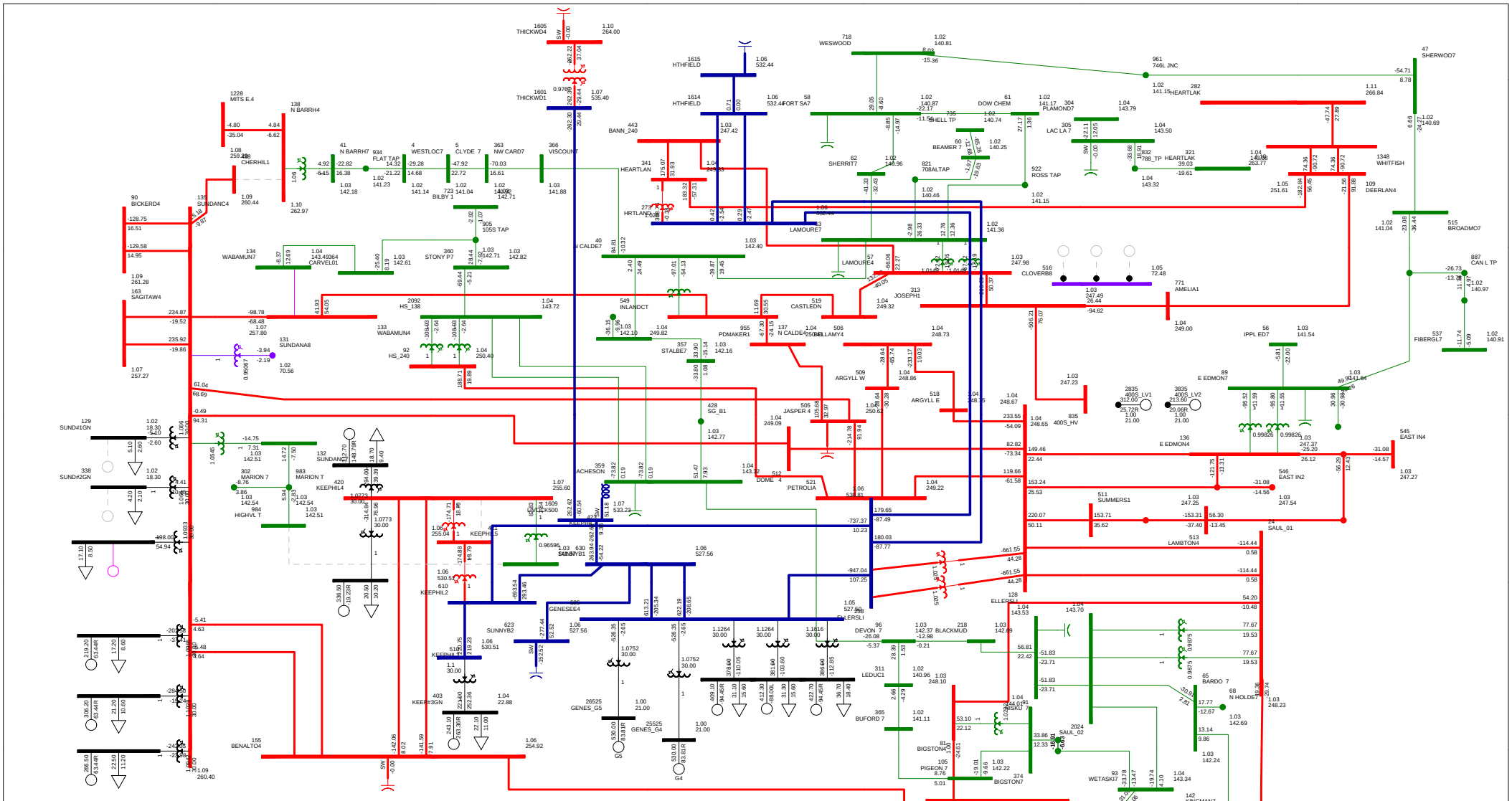
Total Heartland Generation: 525.60 MW

Total Genesee Generation: 2216.00 MW

			Max: 2,050MW
SOK Cutplane	438.06 MW	+ (0.35) x-75.63 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2230.99 MW		2,450MW (SOK > 1,805MW)


1605 THICKWD4
1601 THICKWD1
1615 HTHFIELD
1614 HTHFIELD
718 WESWOOD
961 746L JNC
47 SHERWOO7
282 HEARTLAK
1348 WHITFISH
109 DEERLAN4
515 BROADMO7
887 CAN L TP
537 FIBERL7
1228 MITS E.4
138 N BARRH4
90 BICKERD4
163 SAGITAW4
129 SUND#1GN
338 SUND#2GN
155 BENALTO4
443 BANN_240
341 HEARTLAN
366 VISCOUNT
905 105S TAP
134 WABAMUN7
360 STONY P7
133 WABAMUN4
92 HS_240
2092 HS_138
549 INLANDCT
40 N CALDE7
955 PDMAKER1
137 N CALDE4
506 BALLAMY4
519 CASTLEDN
313 JOSEPH1
516 CLOVERB8
771 AMELIA1
509 ARGYLL W
518 ARGYLL E
505 JASPER 4
428 SG_B1
512 DOME 4
521 PETROLIA
359 JACHESON
630 SUNNYB1
623 SUNNYB2
595 GENESEE4
610 KEEPHIL2
403 KEEP#3GN
420 KEEPHIL4
132 SUNDANC
984 HIGHVT T
983 MARION T
302 MARION 7
131 SUNDANA8
56 IPPL ED7
89 E EDMON7
136 E EDMON4
545 EAST IN4
546 EAST IN2
24 SAUL_01
2024 SAUL_02
513 LAMBTON4
511 SUMMERS1
128 ELLERSLI
96 DEVON 7
218 BLACKMUD
311 LEDUC1
365 BUFORD 7
81 BIGSTON4
105 PIGEON 7
374 BIGSTON7
65 BARDO 7
68 N HOLDE7
93 WETASKI7
142 KINGMAN7
147 GAETZ 4
148 GAETZ 7
94 VERVICK 7
70 CAMROSE7
789 WOLFCRE2
788 WOLFCREK
152 RED DEE4
1422 NEVIS 4
526525 GENES_G5
526525 GENES_G4
G5
G4
2835 400S_LV1
3835 400S_LV2
835 400S_HV
SCENARIO 15 2021 SP LOW SOK (POST CONNECTION W/ LTP)
BASE CASE
FIG C-29
THU, APR 20 2017 9:04
BC-AB: 529.58 MW
MATL import: 0.00 MW
Sask. Import: -0.10 MW
WATL: 270.94 MW
EATL: -0.73 MW
Total Heartland Generation: 525.60 MW
Total Genesee Generation: 2304.10 MW
Max: 2,050MW
SOK Cutplane 505.83 MW + (0.35) x-53.55 MW
KEG Cutplane 2076.33 MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Footage 4
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000


1605 THICKWD4
1601 THICKWD1
1615 HTHFIELD
1614 HTHFIELD
718 WESWOOD
961 746L JNC
47 SHERWOO7
282 HEARTLAK
1348 WHITFISH
109 DEERLAN4
515 BROADMO7
887 CAN L TP
537 FIBERGL7
1228 MITS E.4
138 N BARRH4
90 BICKERD4
135 SUNDANC4
163 SAGITAW4
129 SUND#1GN
338 SUND#2GN
155 BENALTO4
984 HIGHVL T
983 MARION T
302 MARION 7
132 SUNDANC
420 KEEPHIL4
610 KEEPHIL2
403 KEEP#3GN
623 SUNNYB2
630 SUNNYB1
359 ACHESON
443 BANN_240
341 HEARTLAN
273 HRTLAND
40 N CALDE7
549 INLANDCT
519 CASTLEDN
955 PDMAKER1
137 N CALDE4
506 BELLAMY4
313 JOSEPH1
516 CLOVERB8
771 AMELIA1
56 IPPL ED7
89 E EDMON7
136 E EDMON4
545 EAST IN4
546 EAST IN2
24 SAUL_01
513 LAMBTON4
128 ELLERSLI
96 DEVON 7
218 BLACKMUD
311 LEDUC1
365 BUFORD 7
2024 SAUL_02
81 BIGSTON4
105 PIGEON 7
374 BIGSTON7
65 BARDO 7
68 N HOLDE7
93 WETASKI7
142 KINGMAN7
147 GAETZ 4
148 GAETZ 7
94 FERVICK 7
70 CAMROSE7
789 WOLFCRE2
788 WOLFCREK
152 RED DEE4
1422 NEVIS 4
526 GENESEE4
26525 GENES_G5
26525 GENES_G4
G5
G4
1609 KEEPHIL5
1610 KEEPHIL2
1611 KEEPHIL3
1612 KEEPHIL4
1613 KEEPHIL5
2835 400S_LV1
3835 400S_LV2
835 400S_HV
511 SUMMERS1
SCENARIO 15 2021 SP LOW SOK (POST CONNECTION W/ LTP)
1046L
FIG C-30
THU, APR 20 2017 9:04
BC-AB: 537.22 MW
MATL import: 0.00 MW
Sask. Import: -0.10 MW
WATL: 270.94 MW
EATL: -0.73 MW
Total Heartland Generation: 525.60 MW
Total Genesee Generation: 2304.10 MW
Max: 2,050MW
SOK Cutplane 503.34 MW + (0.35) x-52.68 MW
KEG Cutplane 2059.02 MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)



SCENARIO 15 2021 SP LOW SOK (POST CONNECTION W/ LTP)
913L
FIG C-31
THU, APR 20 2017 9:04

Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Breaker #

kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

BC-AB: 535.68 MW

MATL import: 0.00 MW

Sask. Import: -0.10 MW

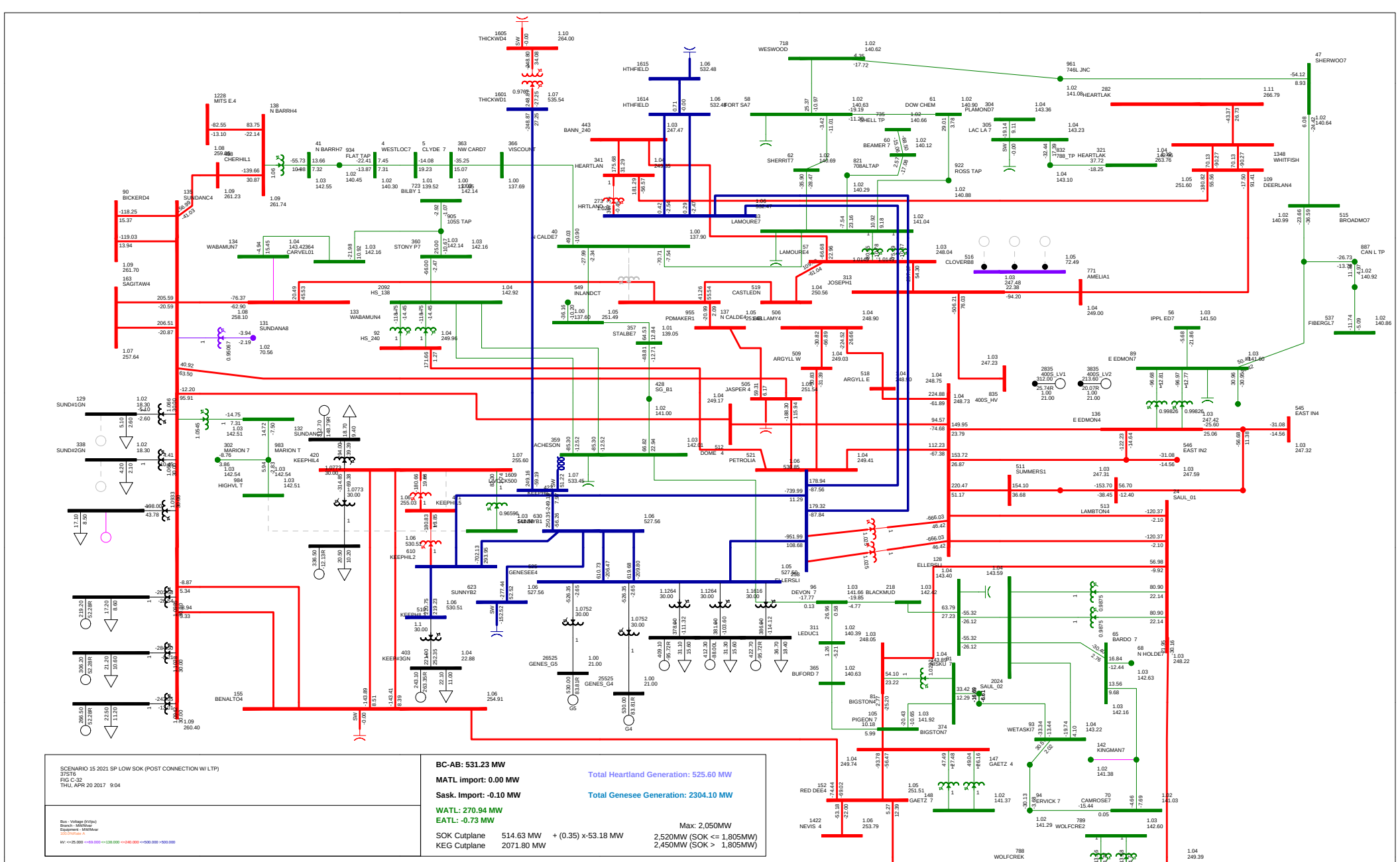
WATL: 270.94 MW

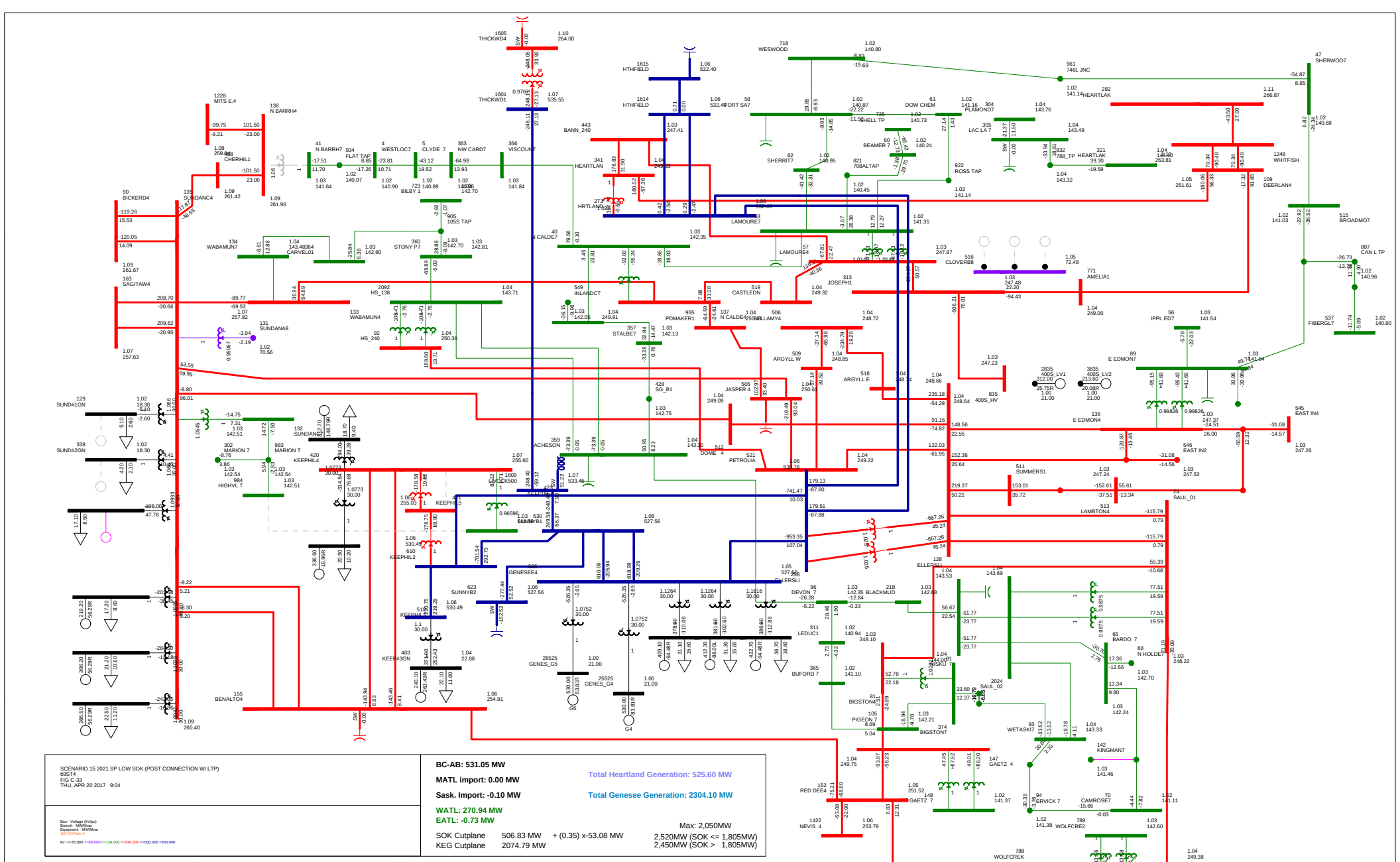
EATL: -0.73 MW

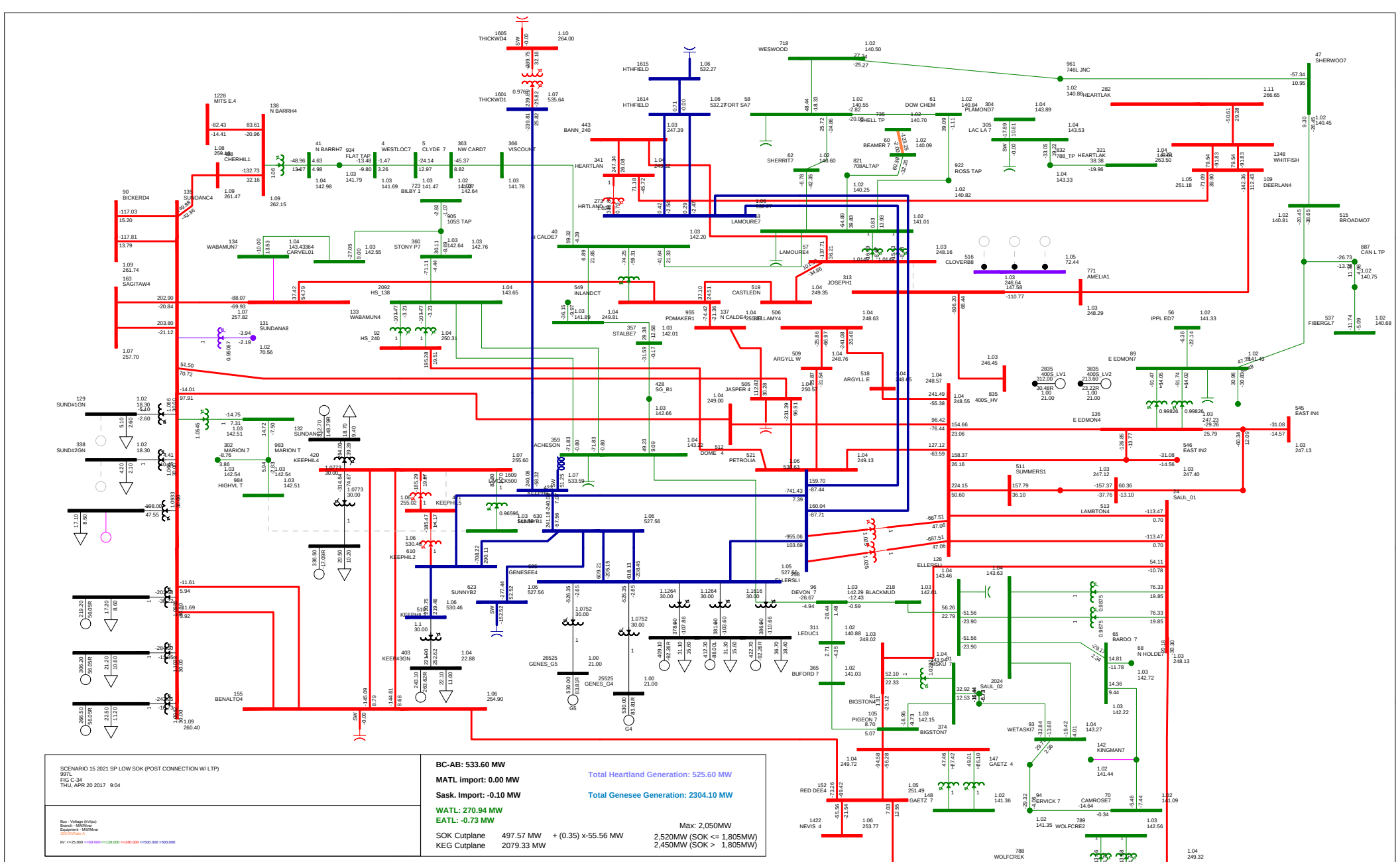
Total Heartland Generation: 525.60 MW

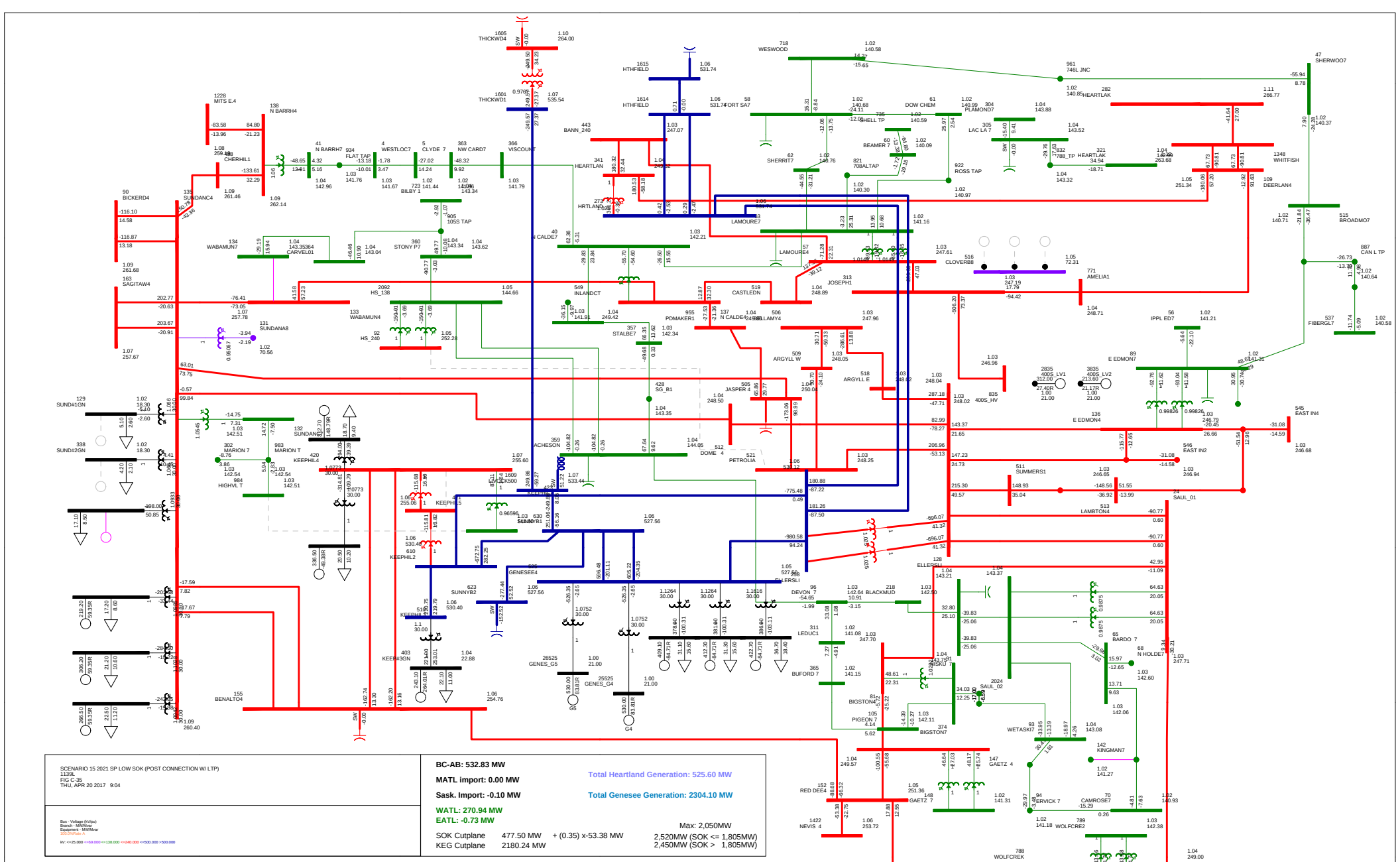
Total Genesee Generation: 2304.10 MW

			Max: 2,050MW
SOK Cutplane	504.29 MW	+ (0.35) x-52.72 MW	2,520MW (SOK <= 1,805MW)
KEG Cutplane	2060.92 MW		2,450MW (SOK > 1,805MW)


SCENARIO 15 2021 SP LOW SOK (POST CONNECTION W/ LTP)
37ST6
FIG C-32
THU, APR 20 2017 9:04
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Fontrae 4
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000
BC-AB: 531.23 MW
MATL import: 0.00 MW
Sask. Import: -0.10 MW
WATL: 270.94 MW
EATL: -0.73 MW
Total Heartland Generation: 525.60 MW
Total Genesee Generation: 2304.10 MW
SOK Cutplane 514.63 MW + (0.35) x-53.18 MW
KEG Cutplane 2071.80 MW
Max: 2,050MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)


SCENARIO 15 2021 SP LOW SOK (POST CONNECTION W/ LTP)
69ST4
FIG C-33
THU, APR 20 2017 9:04
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Kilofeet 0
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000
BC-AB: 531.05 MW
MATL import: 0.00 MW
Sask. Import: -0.10 MW
WATL: 270.94 MW
EATL: -0.73 MW
Total Heartland Generation: 525.60 MW
Total Genesee Generation: 2304.10 MW
Max: 2,050MW
SOK Cutplane 506.83 MW + (0.35) x-53.08 MW
KEG Cutplane 2074.79 MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)


SCENARIO 15 2021 SP LOW SOK (POST CONNECTION W/ LTP)
997L
FIG C-34
THU, APR 20 2017 9:04
Bus - Voltage (kV/pu)
Branch - MW/Mvar
Equipment - MW/Mvar
100 Bus/Line -9
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000
BC-AB: 533.60 MW
MATL import: 0.00 MW
Sask. Import: -0.10 MW
WATL: 270.94 MW
EATL: -0.73 MW
Total Heartland Generation: 525.60 MW
Total Genesee Generation: 2304.10 MW
Max: 2,050MW
SOK Cutplane 497.57 MW + (0.35) x-55.56 MW
KEG Cutplane 2079.33 MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)


SCENARIO 15 2021 SP LOW SOK (POST CONNECTION W/ LTP)
1139L
FIG C-35
THU, APR 20 2017 9:04
BC-AB: 532.83 MW
MATL import: 0.00 MW
Sask. Import: -0.10 MW
WATL: 270.94 MW
EATL: -0.73 MW
Total Heartland Generation: 525.60 MW
Total Genesee Generation: 2304.10 MW
Max: 2,050MW
SOK Cutplane 477.50 MW + (0.35) x-53.38 MW
KEG Cutplane 2180.24 MW
2,520MW (SOK <= 1,805MW)
2,450MW (SOK > 1,805MW)

Attachment D

Transient Stability Results

FIGURE D-1B
2020WP, POST-PROJECT
3 PHASE FAULT ON 997L AT JOSEPHBURG
CLEARED IN 4.5 CYCLES, FAR END IN 6 CYCLES
FILE: D-1_997L_NE_Josephburg.out

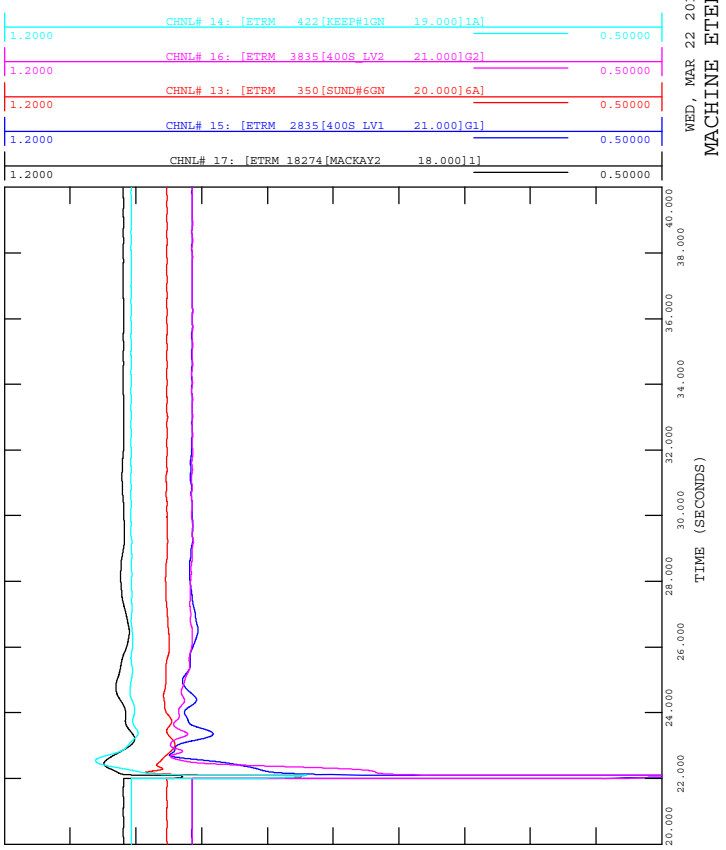


FIGURE D-1D
2020WP, POST-PROJECT
3 PHASE FAULT ON 997L AT JOSEPHBURG
CLEARED IN 4.5 CYCLES, FAR END IN 6 CYCLES
FILE: D-1_997L_NE_Josephburg.out

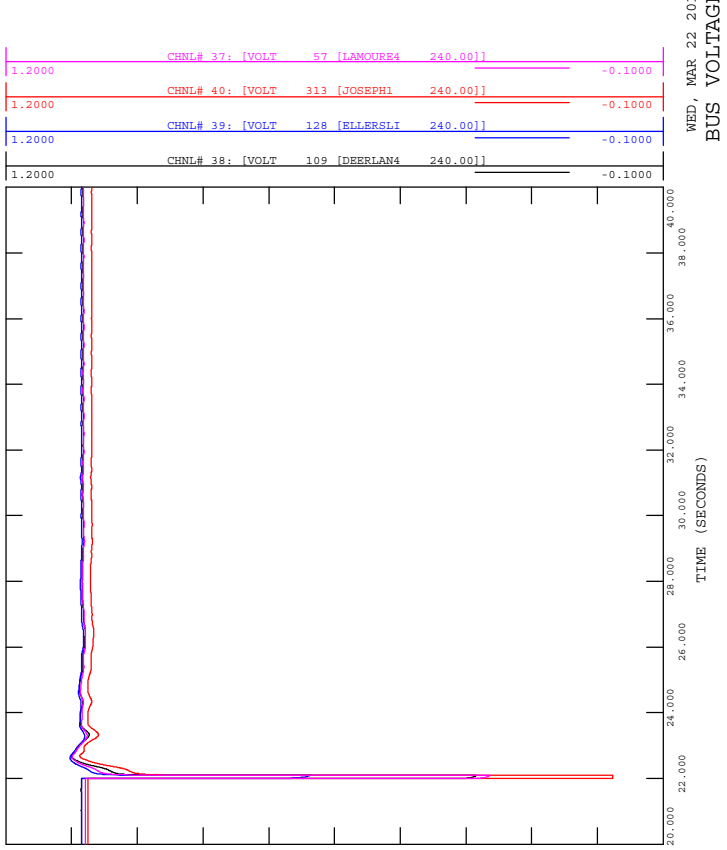


FIGURE D-1A
2020WP, POST-PROJECT
3 PHASE FAULT ON 997L AT JOSEPHBURG
CLEARED IN 4.5 CYCLES, FAR END IN 6 CYCLES
FILE: D-1_997L_NE_Josephburg.out

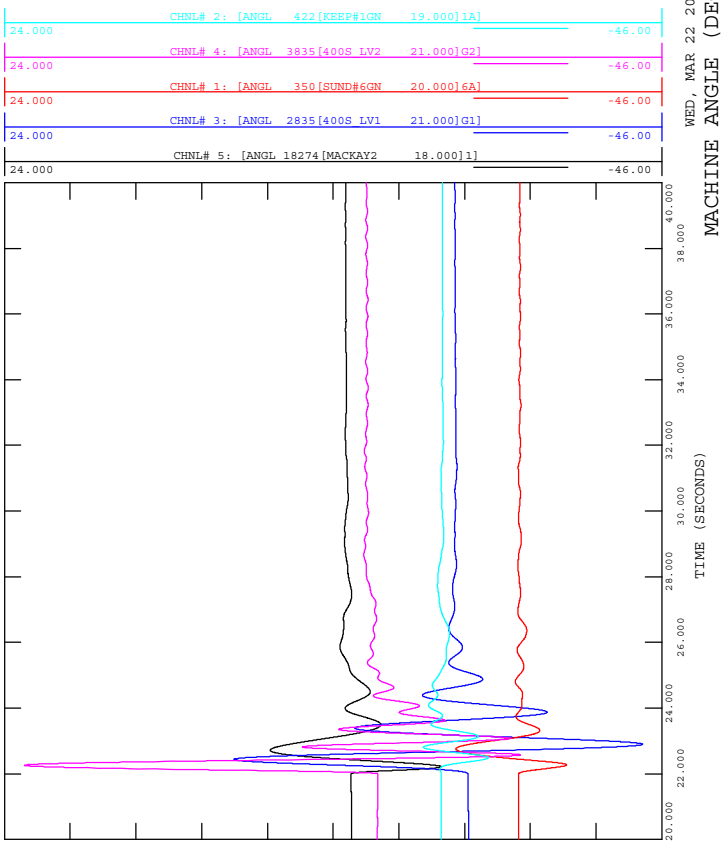


FIGURE D-1C
2020WP, POST-PROJECT
3 PHASE FAULT ON 997L AT JOSEPHBURG
CLEARED IN 4.5 CYCLES, FAR END IN 6 CYCLES
FILE: D-1_997L_NE_Josephburg.out

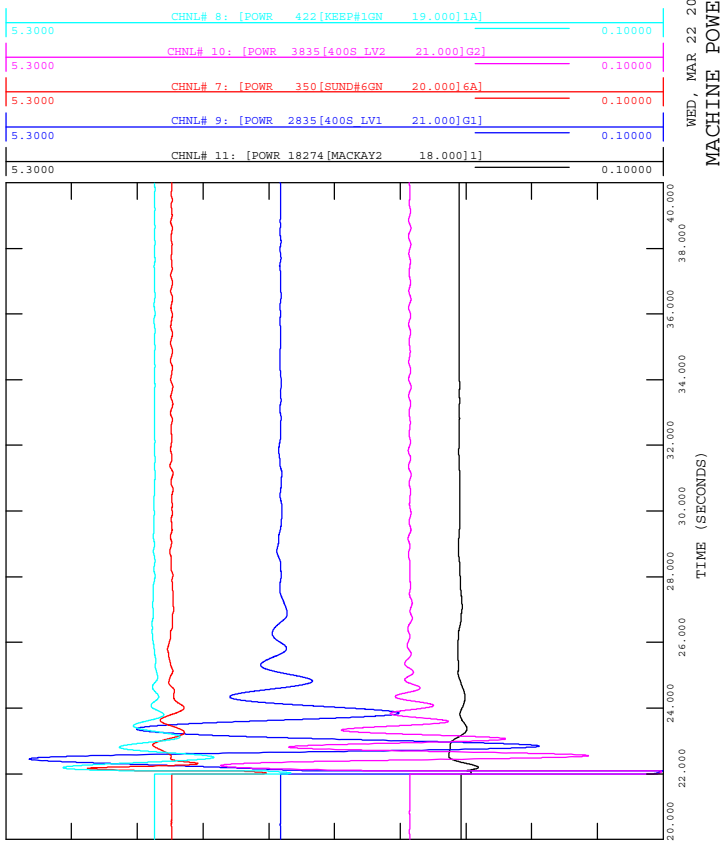


FIGURE D-1F
2020WP, POST-PROJECT
3 PHASE FAULT ON 997L AT JOSEPHBURG
CLEARED IN 4.5 CYCLES, FAR END IN 6 CYCLES
FILE: D-1_997L_NE_Josephburg.out

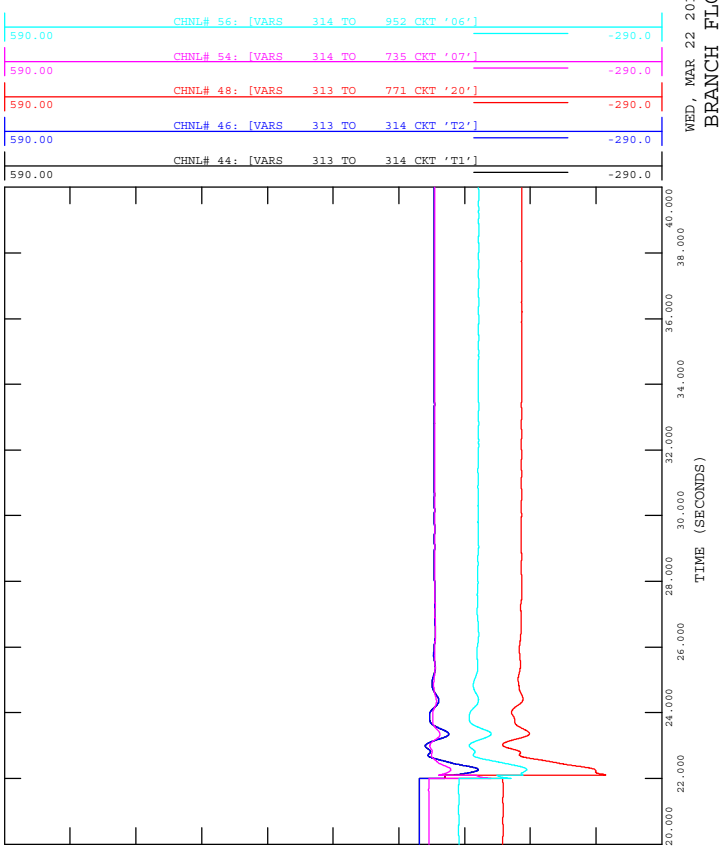


FIGURE D-1E
2020WP, POST-PROJECT
3 PHASE FAULT ON 997L AT JOSEPHBURG
CLEARED IN 4.5 CYCLES, FAR END IN 6 CYCLES
FILE: D-1_997L_NE_Josephburg.out

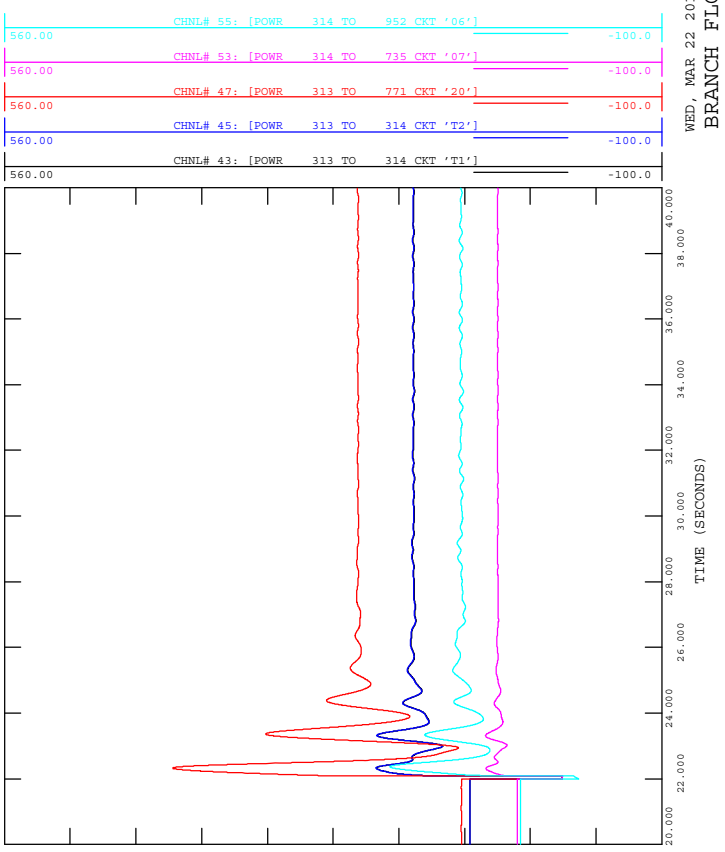


FIGURE D-2B
2020WP, POST-PROJECT
3 PHASE FAULT ON 997L AT LAMOUREUX
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-2_997L_NE_Lamoureux.out

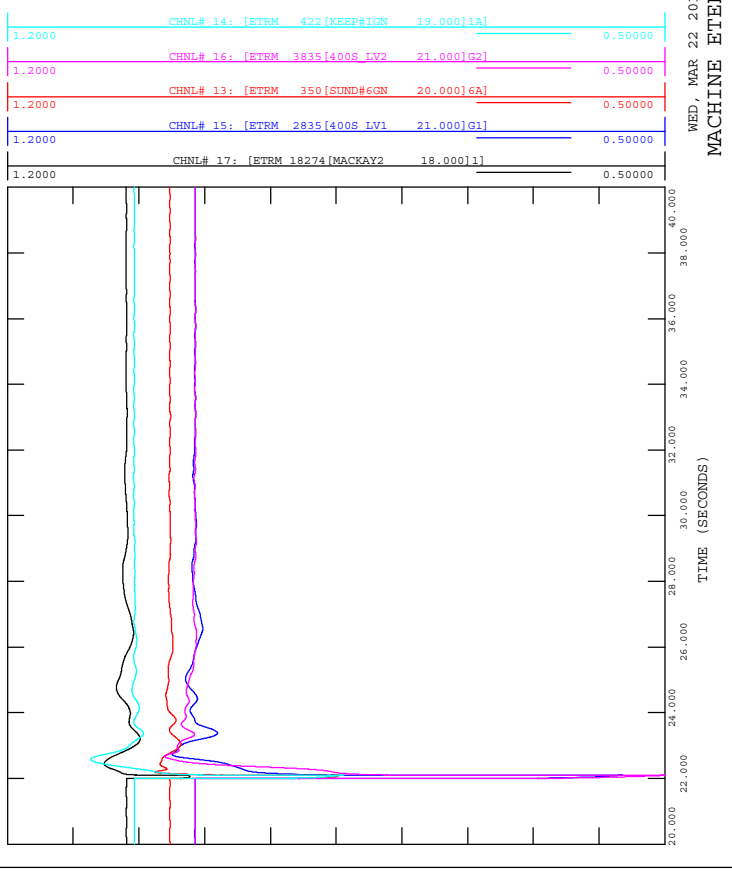


FIGURE D-2D
2020WP, POST-PROJECT
3 PHASE FAULT ON 997L AT LAMOUREUX
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-2_997L_NE_Lamoureux.out

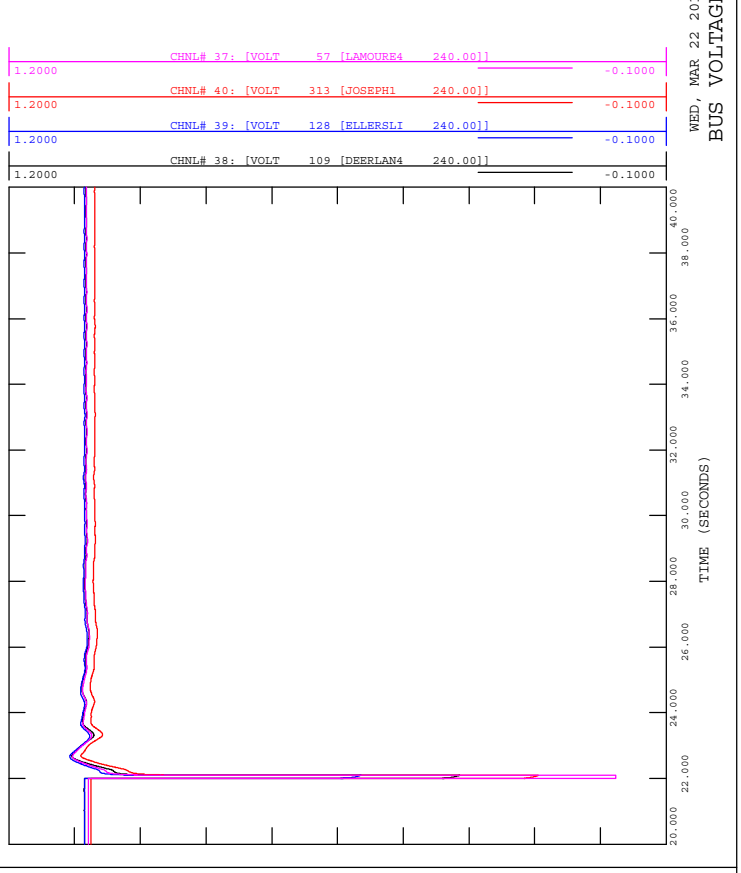


FIGURE D-2A
2020WP, POST-PROJECT
3 PHASE FAULT ON 997L AT LAMOUREUX
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-2_997L_NE_Lamoureux.out

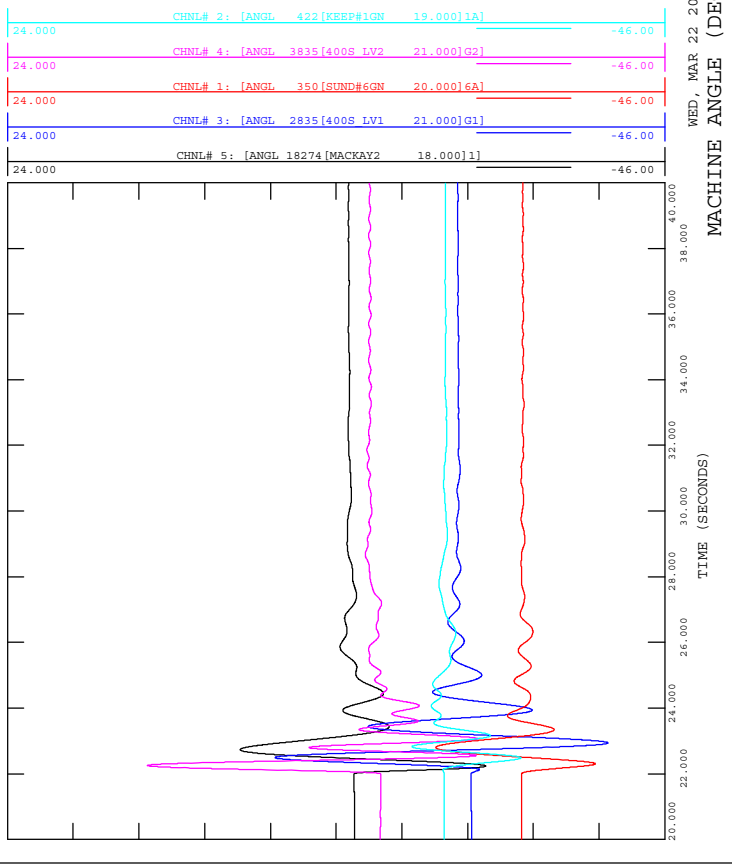


FIGURE D-2C
2020WP, POST-PROJECT
3 PHASE FAULT ON 997L AT LAMOUREUX
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-2_997L_NE_Lamoureux.out

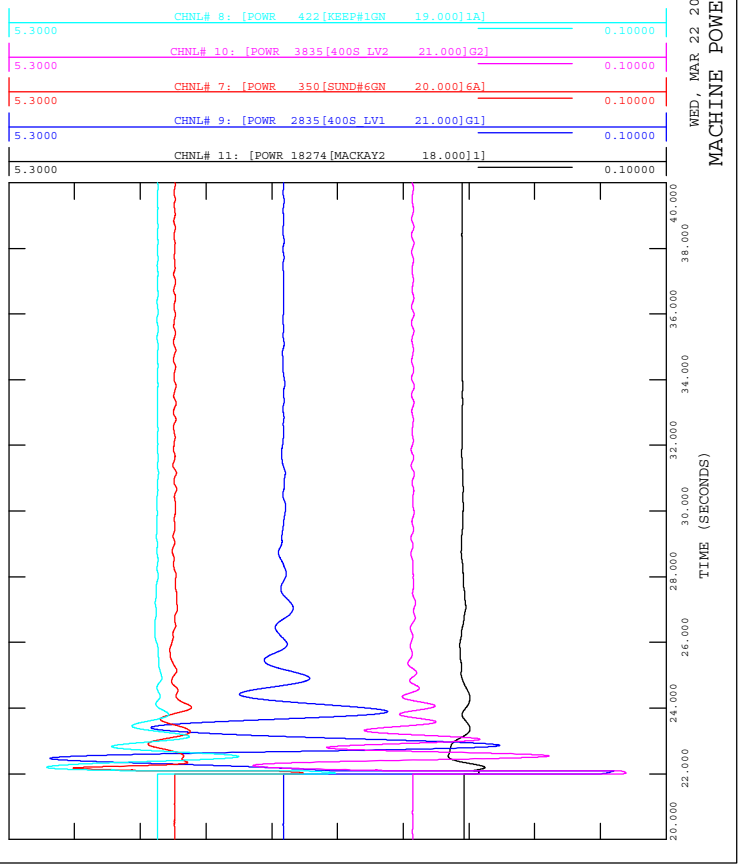


FIGURE D-2F
2020WP, POST-PROJECT
3 PHASE FAULT ON 997L AT LAMOUREUX
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-2_997L_NE_Lamoureux.out

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BRANCH FLOW (Q)

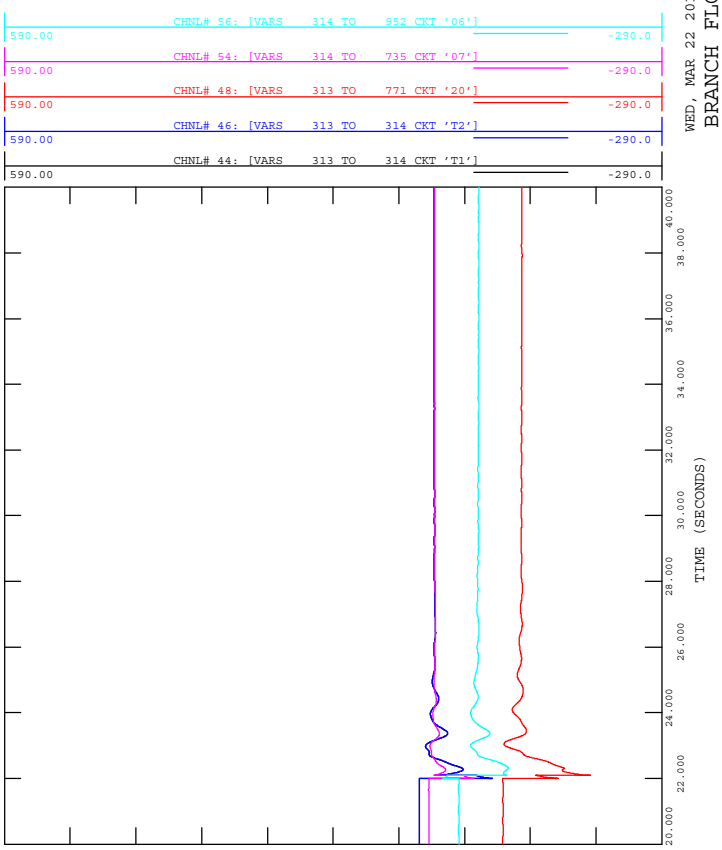


FIGURE D-2E
2020WP, POST-PROJECT
3 PHASE FAULT ON 997L AT LAMOUREUX
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-2_997L_NE_Lamoureux.out

WED, MAR 22 2017 9:33
BRANCH FLOW (P)

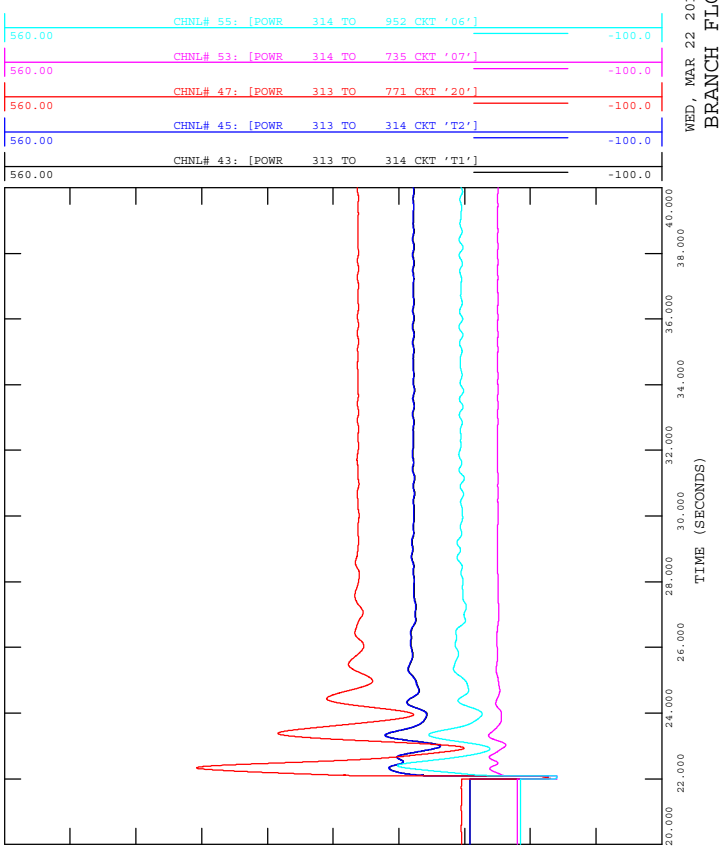


FIGURE D-3B
2020WP, POST-PROJECT
3 PHASE FAULT ON 1120L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-3_1120L_NE_Josephburg.out

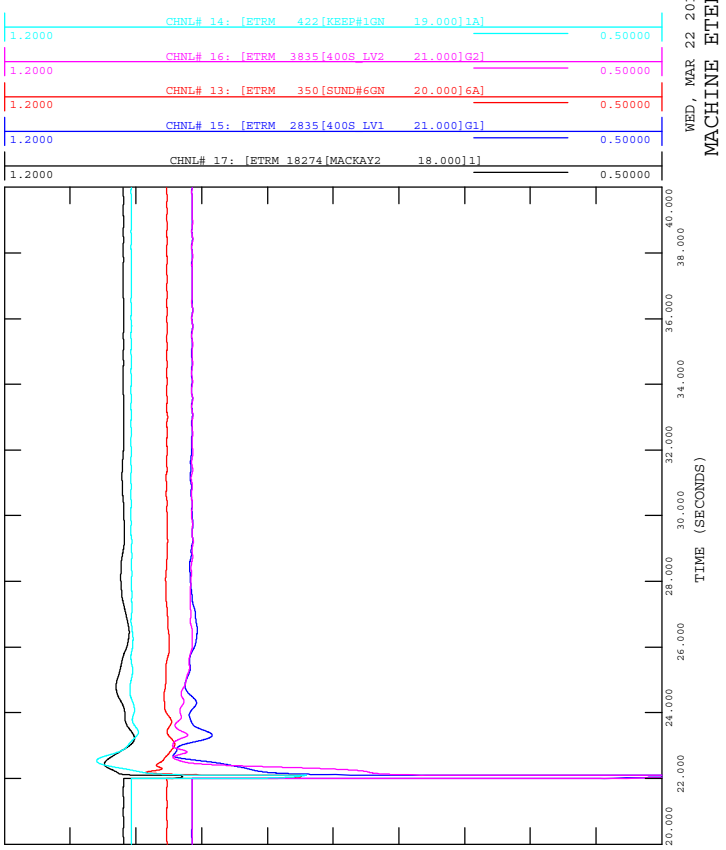


FIGURE D-3D
2020WP, POST-PROJECT
3 PHASE FAULT ON 1120L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-3_1120L_NE_Josephburg.out

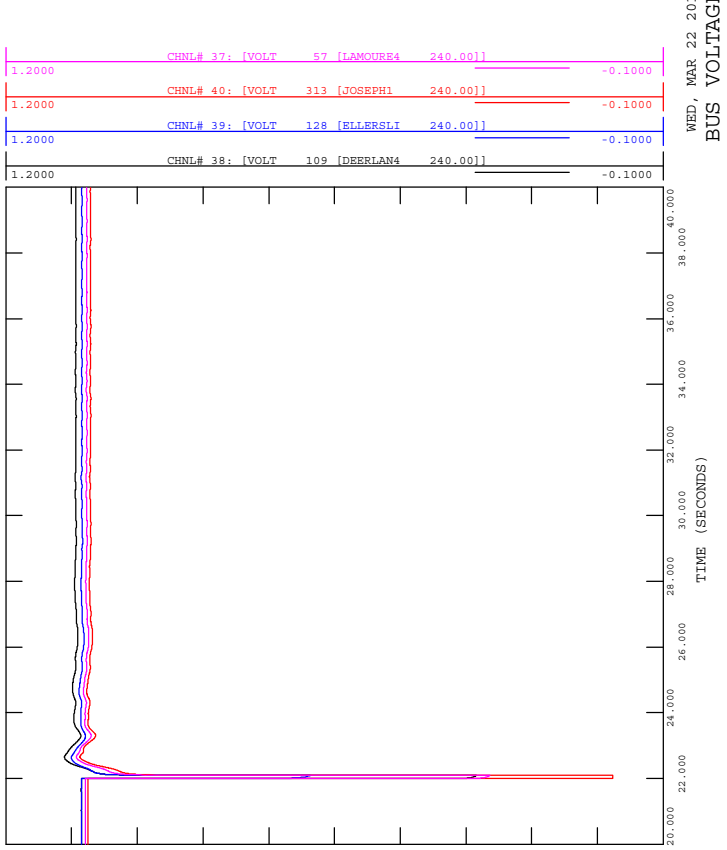


FIGURE D-3A
2020WP, POST-PROJECT
3 PHASE FAULT ON 1120L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-3_1120L_NE_Josephburg.out

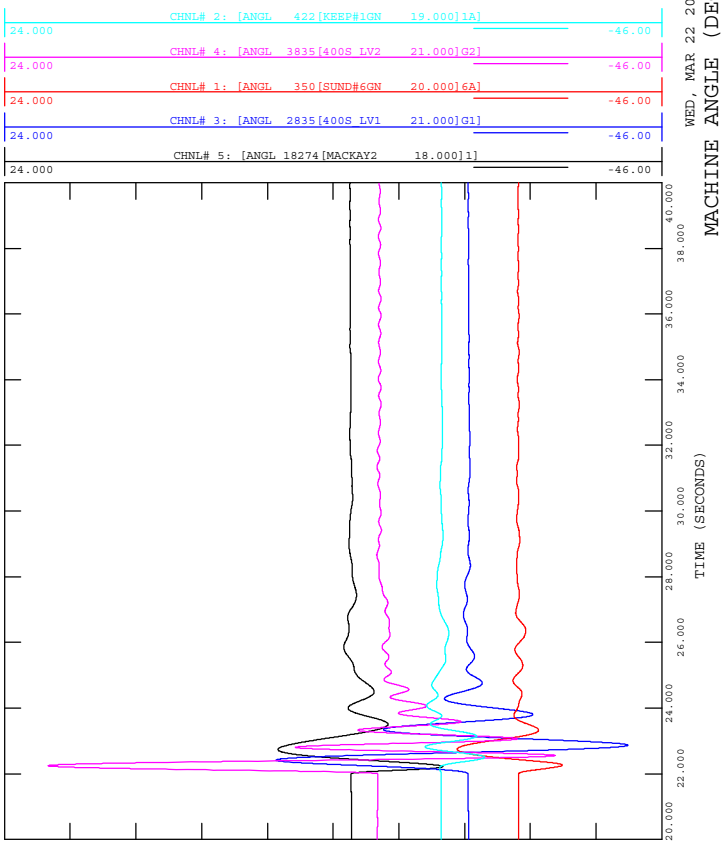


FIGURE D-3C
2020WP, POST-PROJECT
3 PHASE FAULT ON 1120L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-3_1120L_NE_Josephburg.out

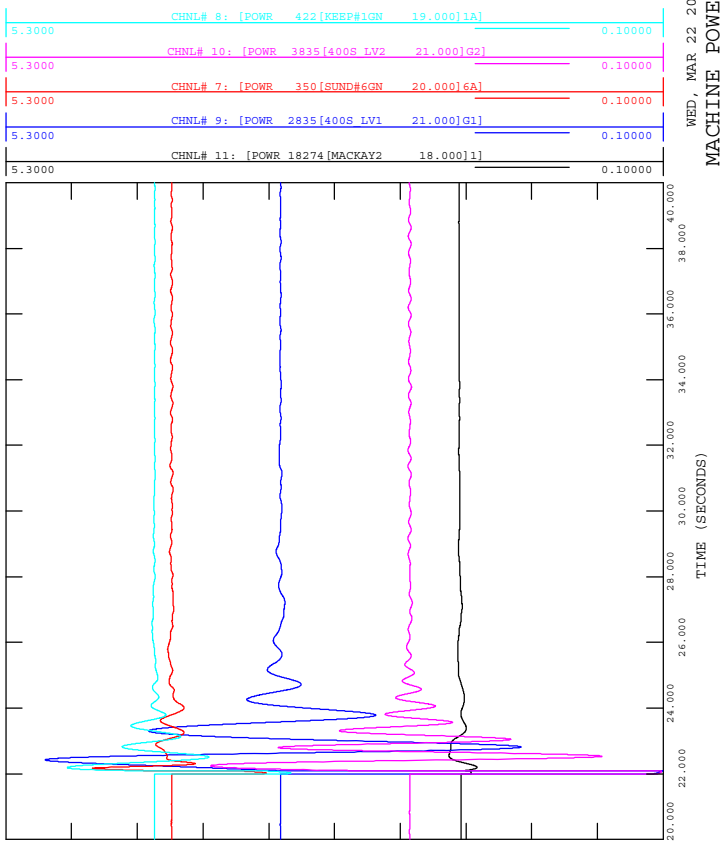
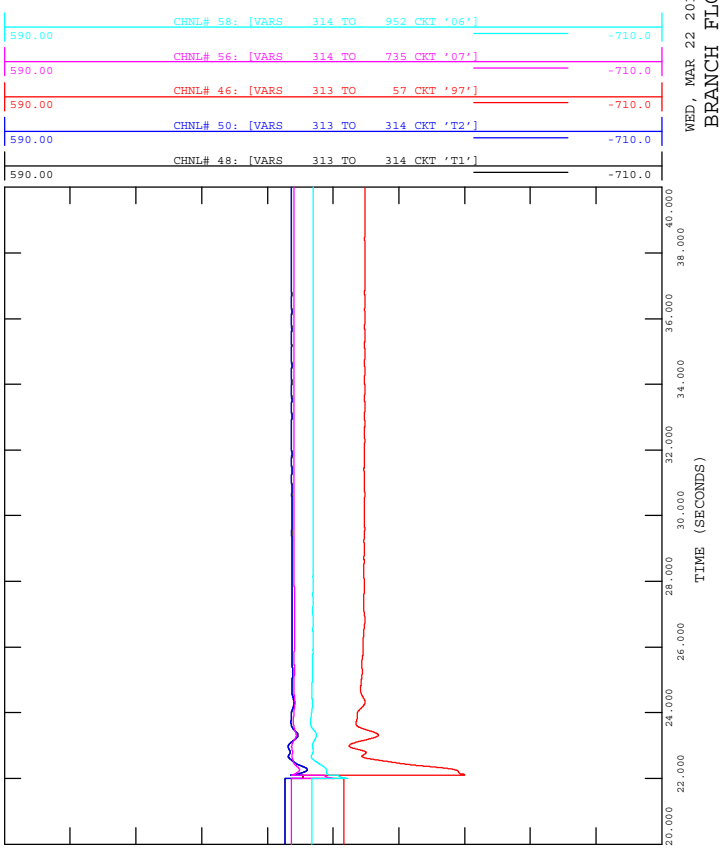


FIGURE D-3F
2020WP, POST-PROJECT
3 PHASE FAULT ON 1120L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-3_1120L_NE_Josephburg.out



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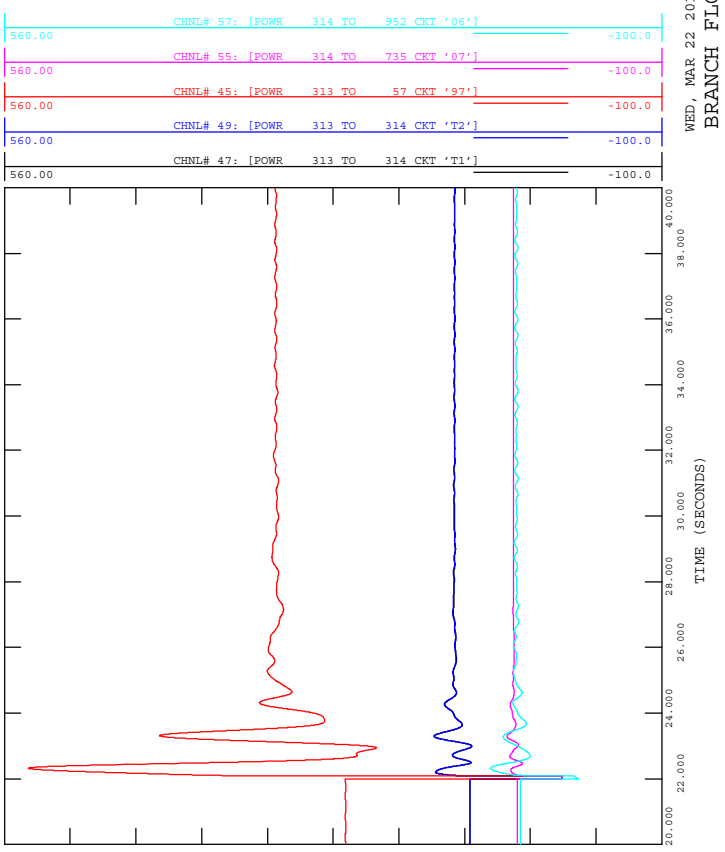
BRANCH FLOW (Q)

FIGURE D-3E
2020WP, POST-PROJECT
3 PHASE FAULT ON 1120L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-3_1120L_NE_Josephburg.out



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BRANCH FLOW (P)

FIGURE D-4B
2020WP, POST-PROJECT
3 PHASE FAULT ON 1120L AT AMELIA
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-4_1120L_NE_Amelia.out

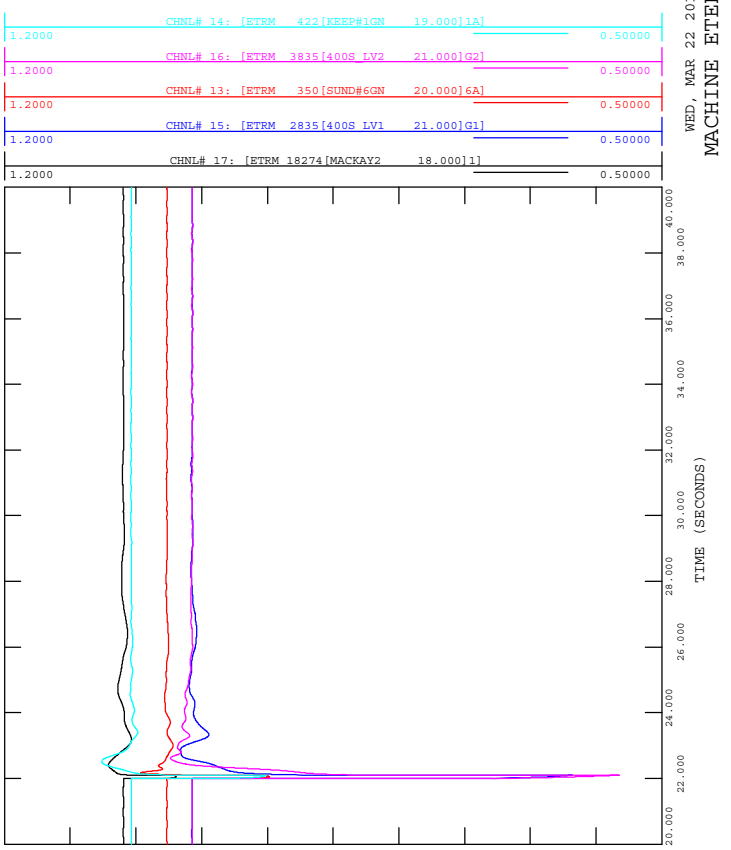


FIGURE D-4D
2020WP, POST-PROJECT
3 PHASE FAULT ON 1120L AT AMELIA
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-4_1120L_NE_Amelia.out

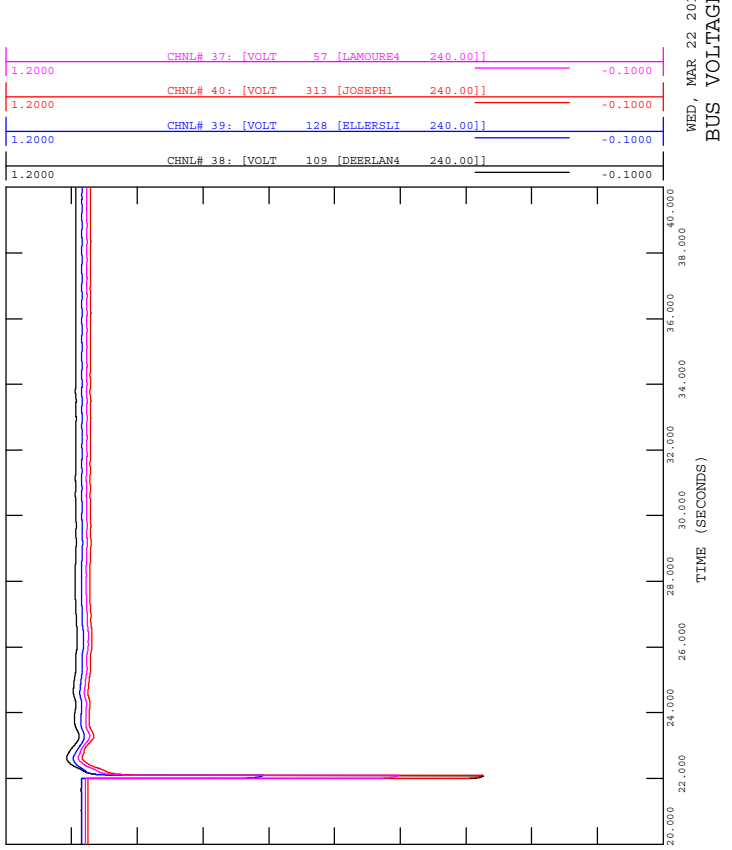


FIGURE D-4A
2020WP, POST-PROJECT
3 PHASE FAULT ON 1120L AT AMELIA
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-4_1120L_NE_Amelia.out

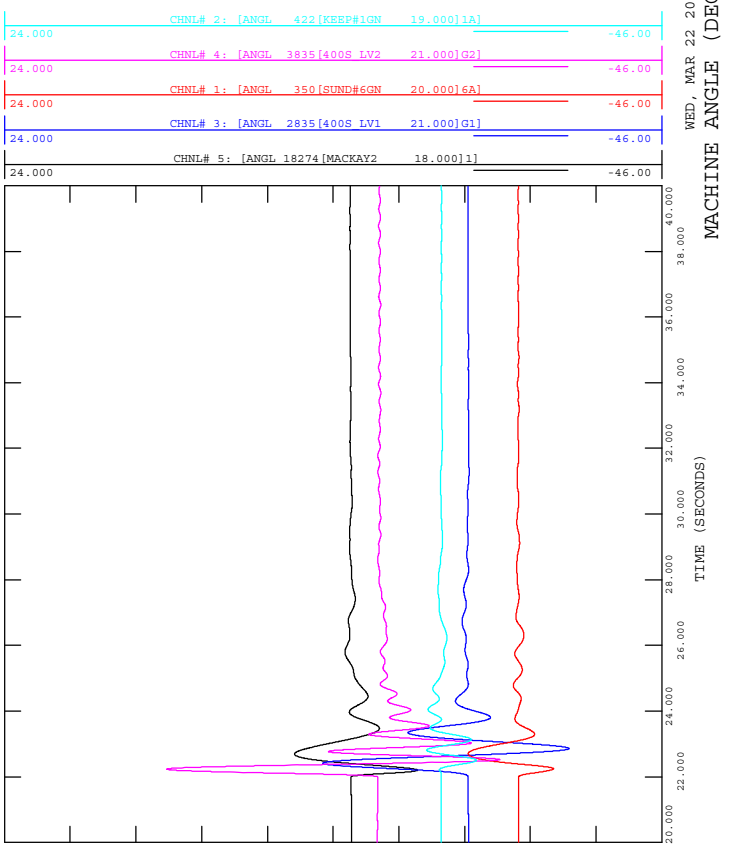


FIGURE D-4C
2020WP, POST-PROJECT
3 PHASE FAULT ON 1120L AT AMELIA
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-4_1120L_NE_Amelia.out

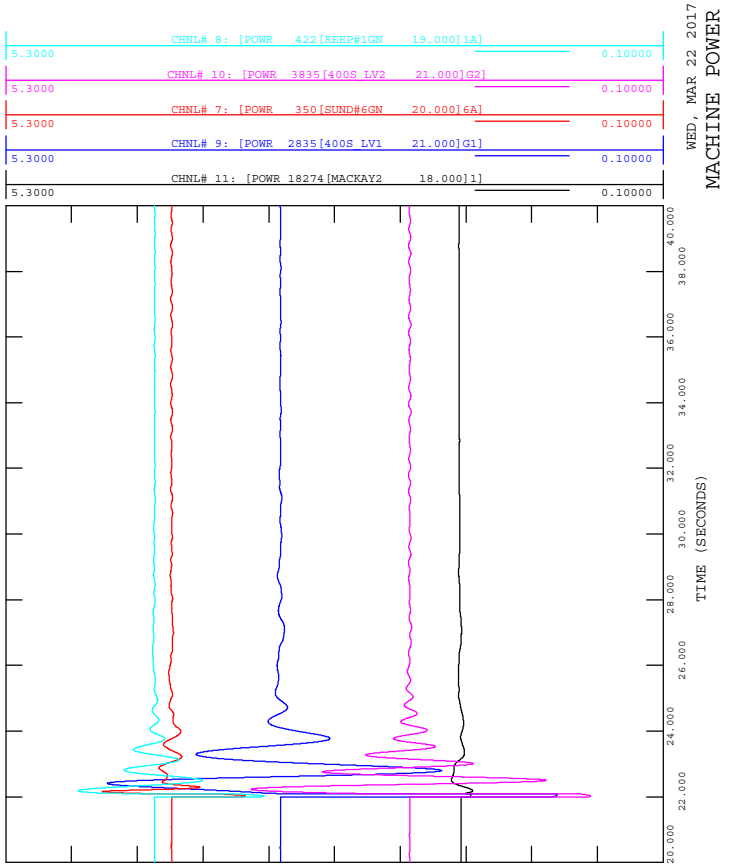


FIGURE D-4F
2020WP, POST-PROJECT
3 PHASE FAULT ON 1120L AT AMELIA
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-4_1120L_NE_Amelia.out

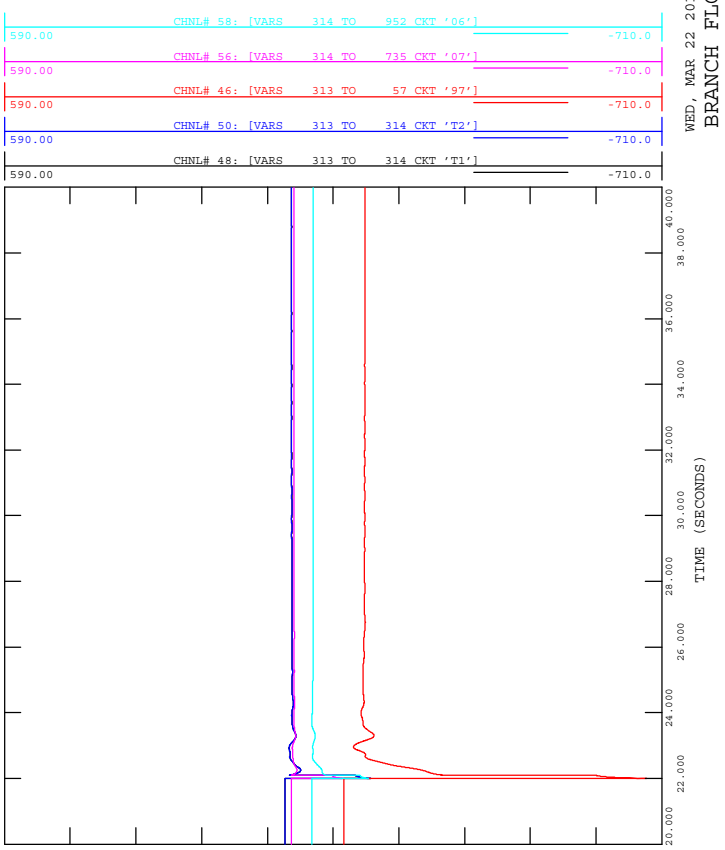


FIGURE D-4E
2020WP, POST-PROJECT
3 PHASE FAULT ON 1120L AT AMELIA
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-4_1120L_NE_Amelia.out

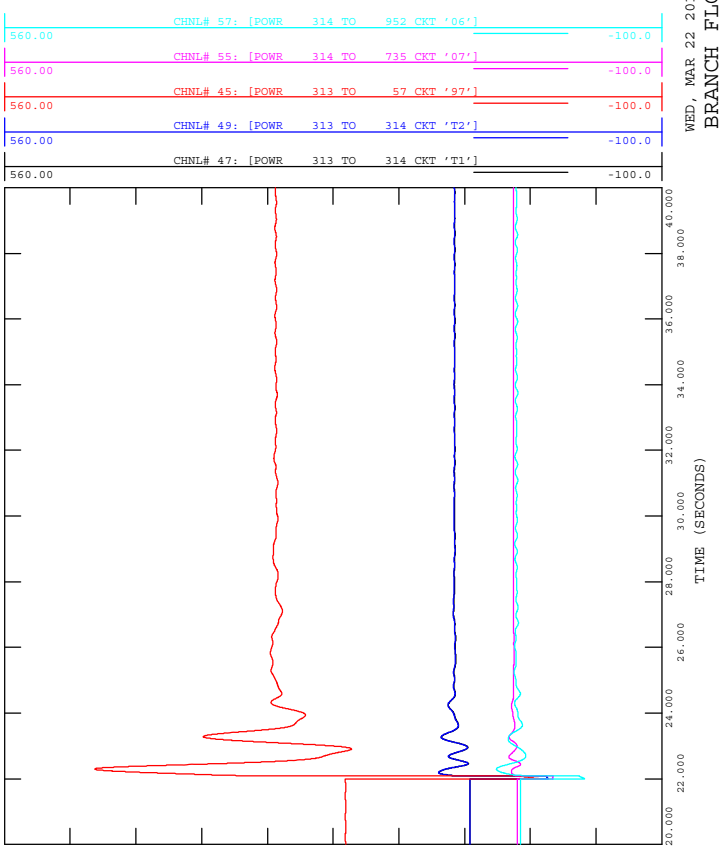


FIGURE D-5B
2020WP, POST-PROJECT
3 PHASE FAULT ON 856L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-5_856L_NE_Josephburg.out

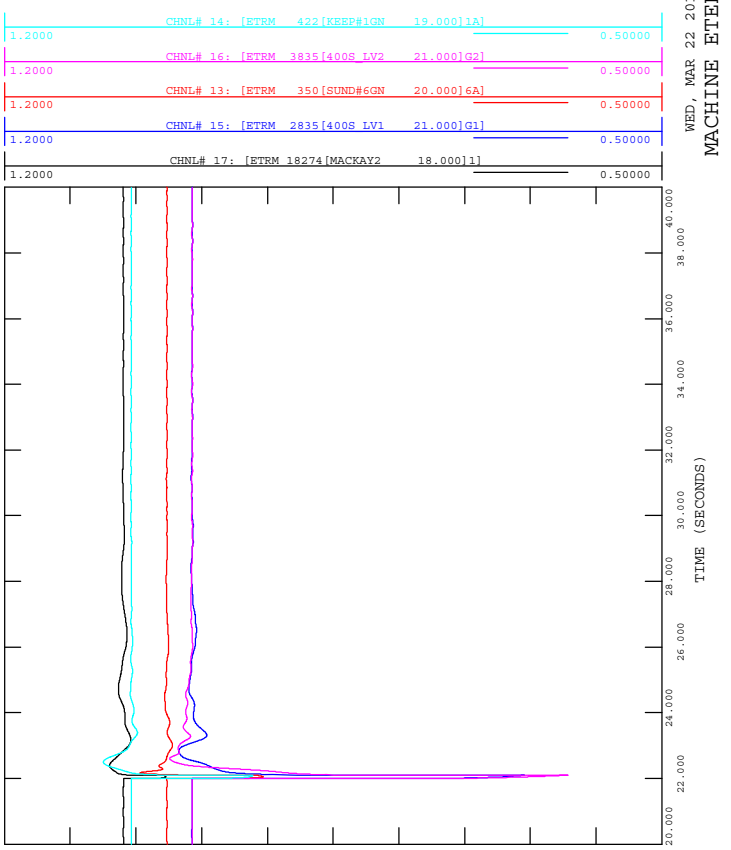


FIGURE D-5D
2020WP, POST-PROJECT
3 PHASE FAULT ON 856L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-5_856L_NE_Josephburg.out

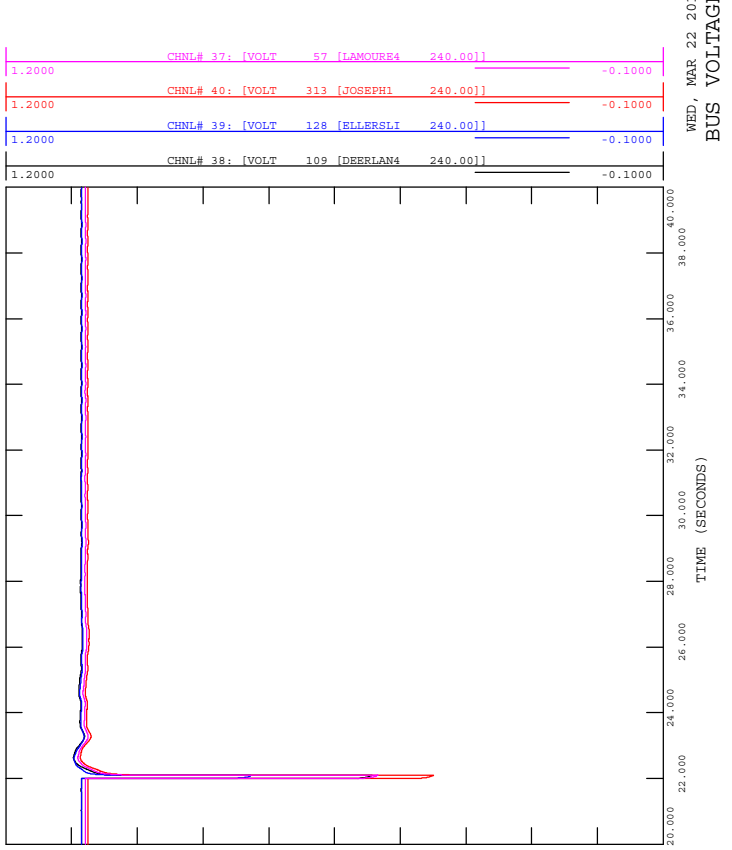


FIGURE D-5A
2020WP, POST-PROJECT
3 PHASE FAULT ON 856L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-5_856L_NE_Josephburg.out

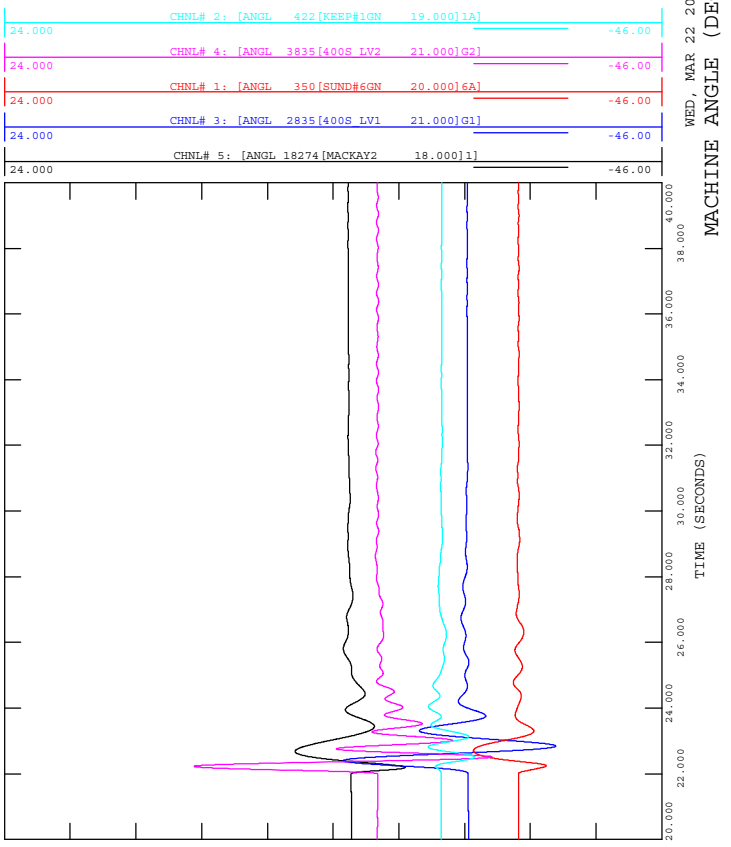


FIGURE D-5C
2020WP, POST-PROJECT
3 PHASE FAULT ON 856L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-5_856L_NE_Josephburg.out

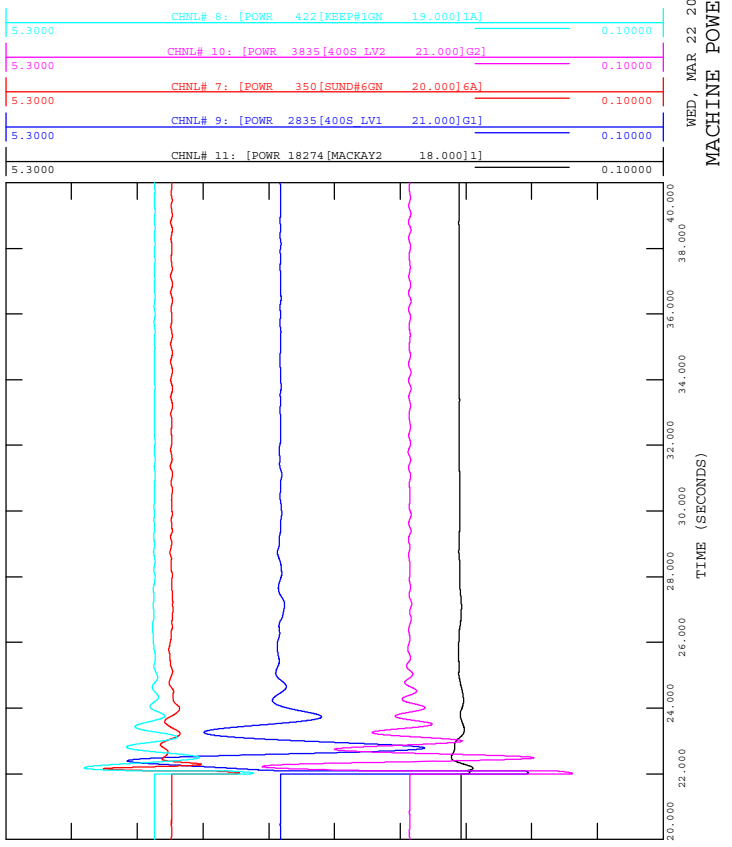
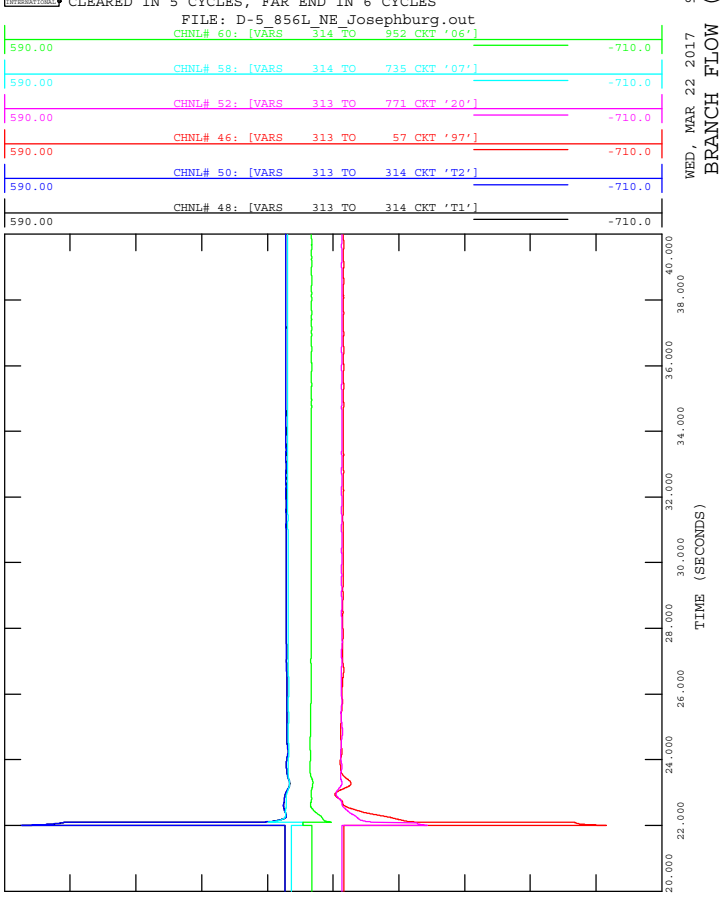


FIGURE D-5F
2020WP, POST-PROJECT
3 PHASE FAULT ON 856L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES



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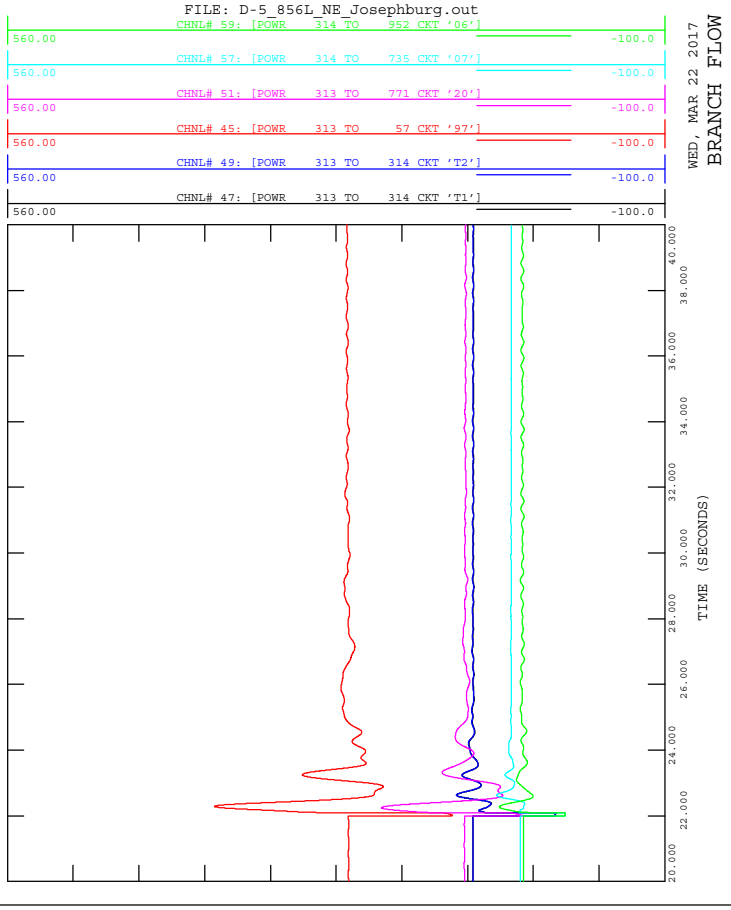
BRANCH FLOW (Q)

FIGURE D-5E
2020WP, POST-PROJECT
3 PHASE FAULT ON 856L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES



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BRANCH FLOW (P)

FIGURE D-6B
2020WP, POST-PROJECT
3 PHASE FAULT ON 856L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-6_856L_NE_Shell_Scotford.out

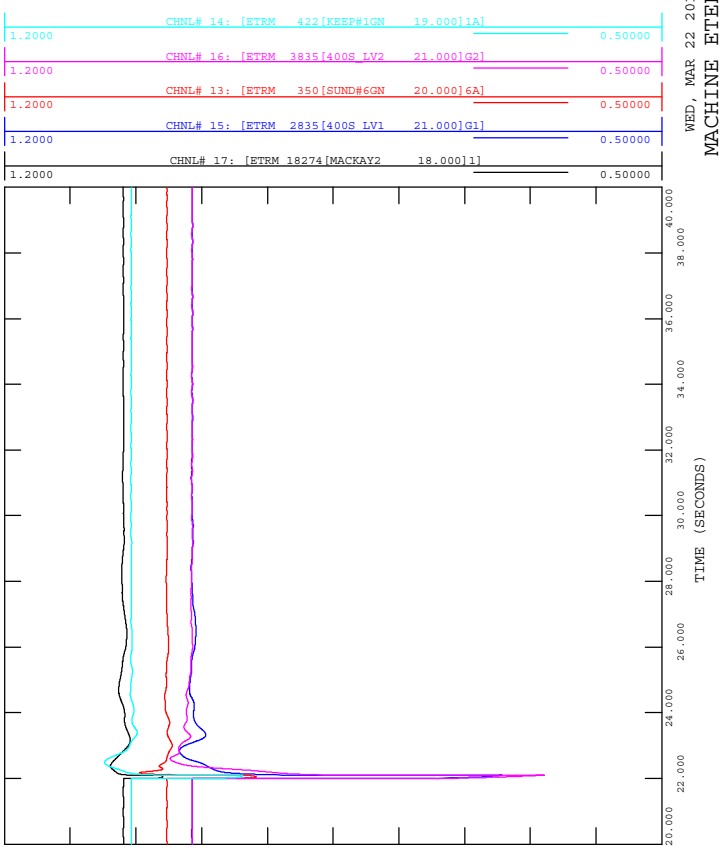


FIGURE D-6D
2020WP, POST-PROJECT
3 PHASE FAULT ON 856L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-6_856L_NE_Shell_Scotford.out

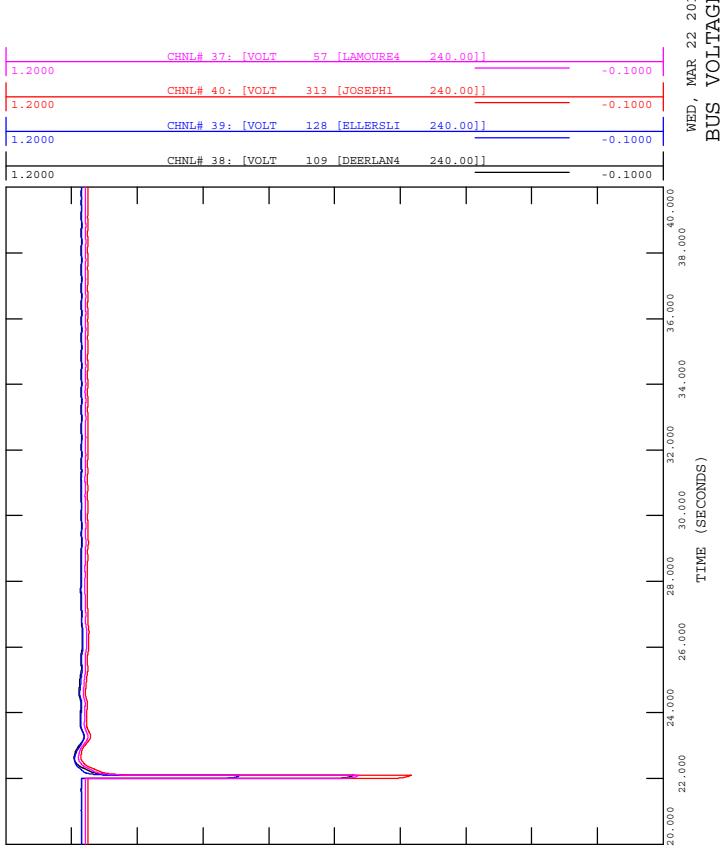


FIGURE D-6A
2020WP, POST-PROJECT
3 PHASE FAULT ON 856L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-6_856L_NE_Shell_Scotford.out

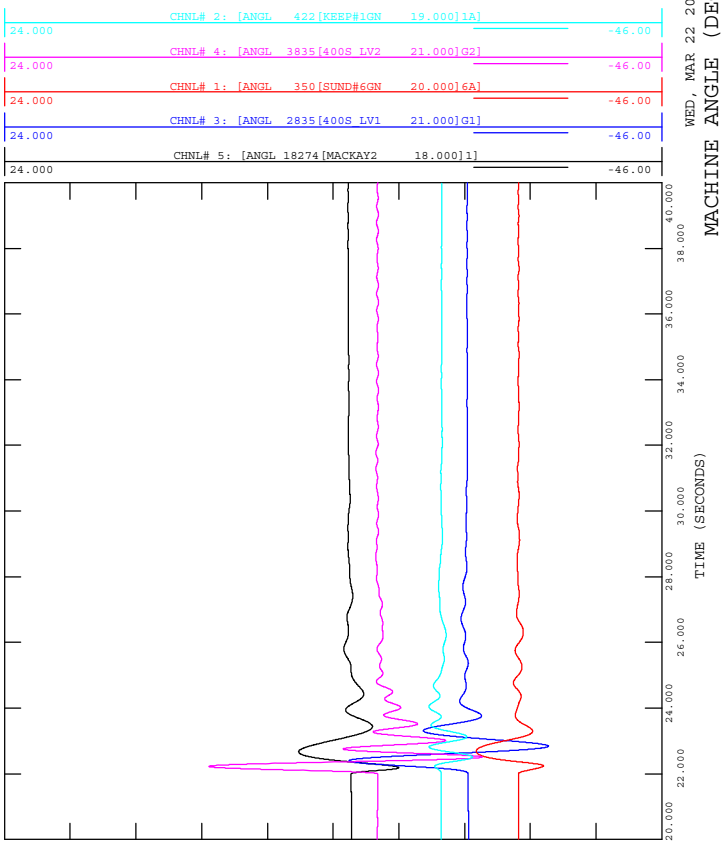


FIGURE D-6C
2020WP, POST-PROJECT
3 PHASE FAULT ON 856L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-6_856L_NE_Shell_Scotford.out

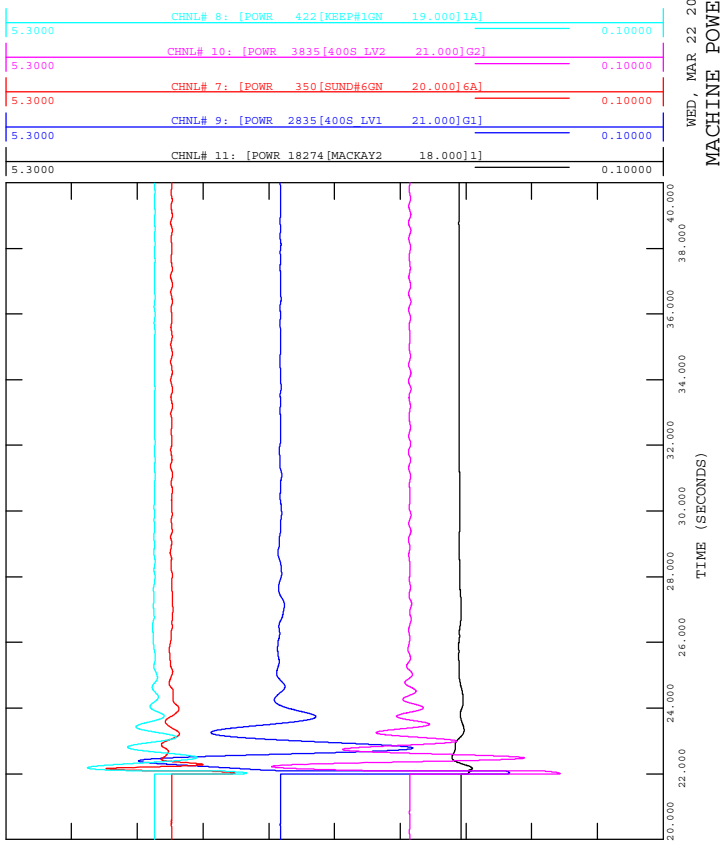
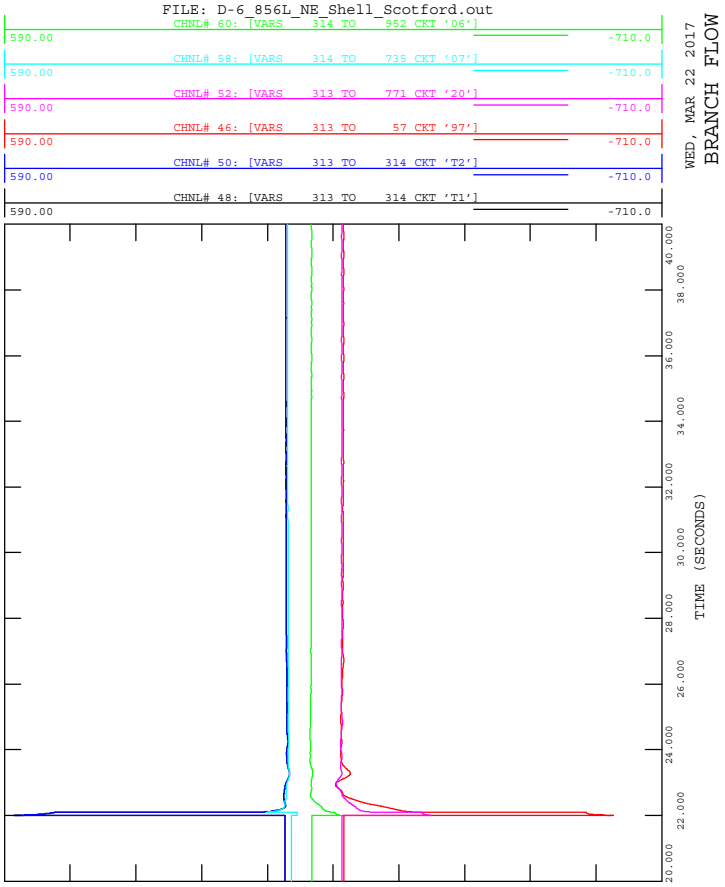


FIGURE D-6F
2020WP, POST-PROJECT
3 PHASE FAULT ON 856L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-6_856L_NE_Shell_Scotford.out



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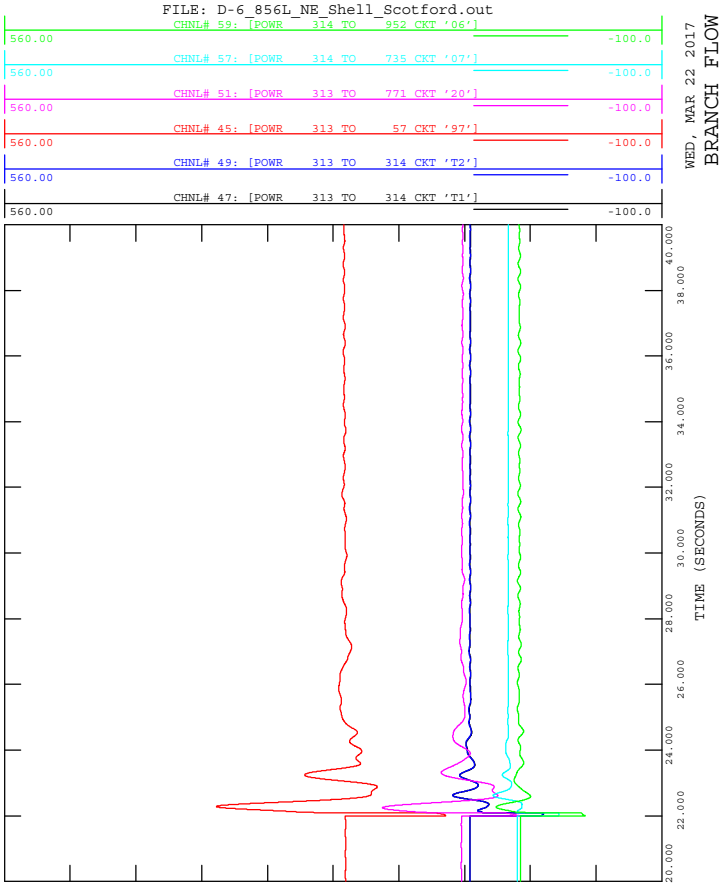
BRANCH FLOW (Q)

FIGURE D-6E
2020WP, POST-PROJECT
3 PHASE FAULT ON 856L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-6_856L_NE_Shell_Scotford.out



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BRANCH FLOW (P)

FIGURE D-7B
2020WP, POST-PROJECT
3 PHASE FAULT ON 857L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-7_857L_NE_Josephburg.out

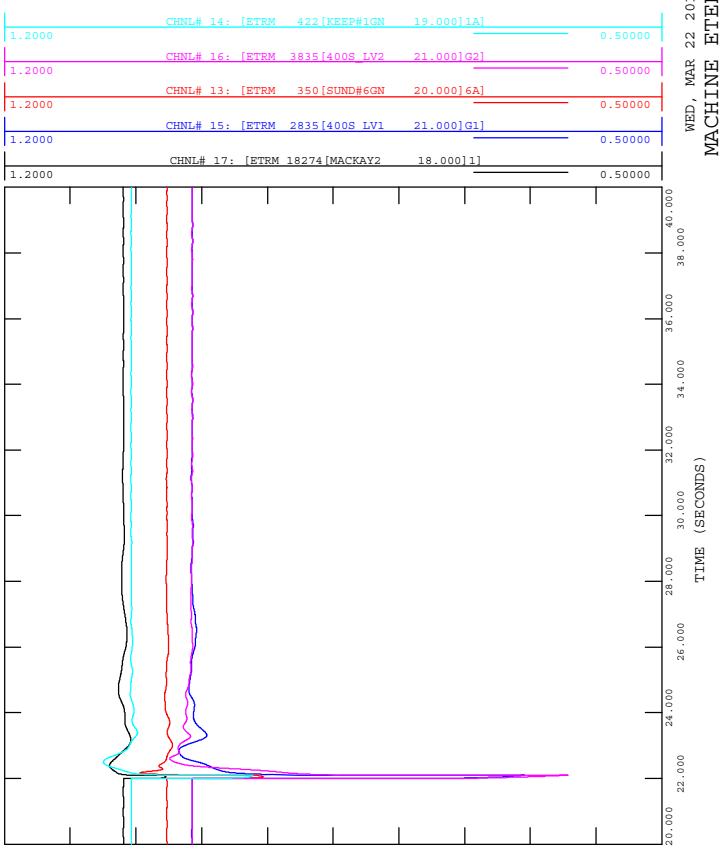


FIGURE D-7D
2020WP, POST-PROJECT
3 PHASE FAULT ON 857L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-7_857L_NE_Josephburg.out

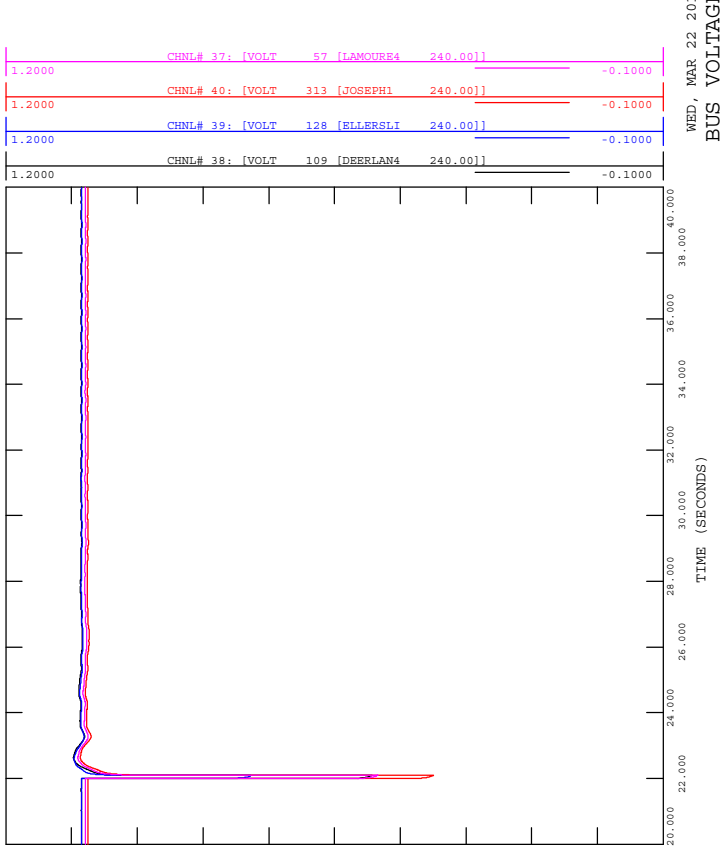


FIGURE D-7A
2020WP, POST-PROJECT
3 PHASE FAULT ON 857L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-7_857L_NE_Josephburg.out

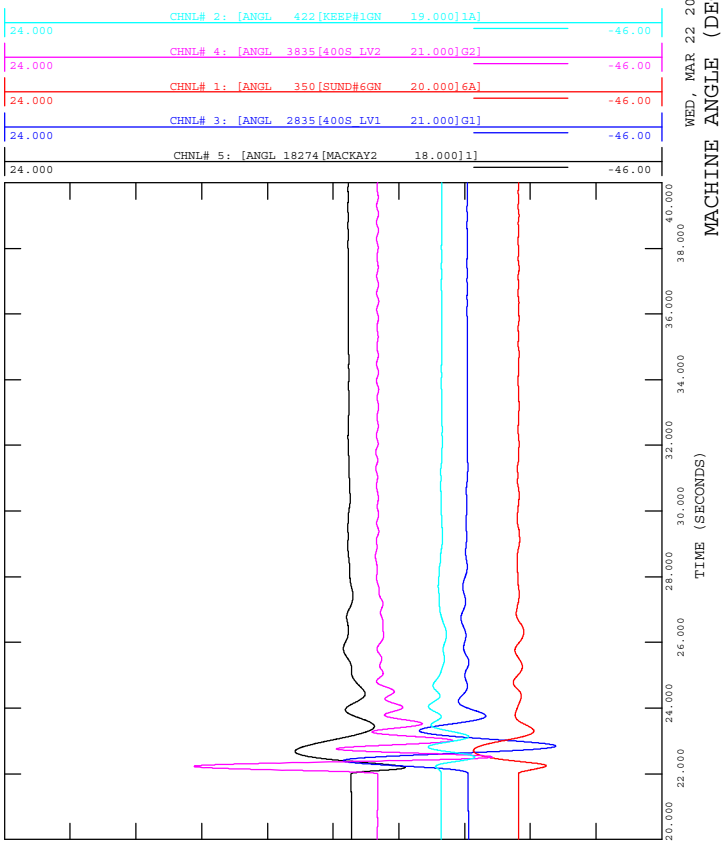


FIGURE D-7C
2020WP, POST-PROJECT
3 PHASE FAULT ON 857L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-7_857L_NE_Josephburg.out

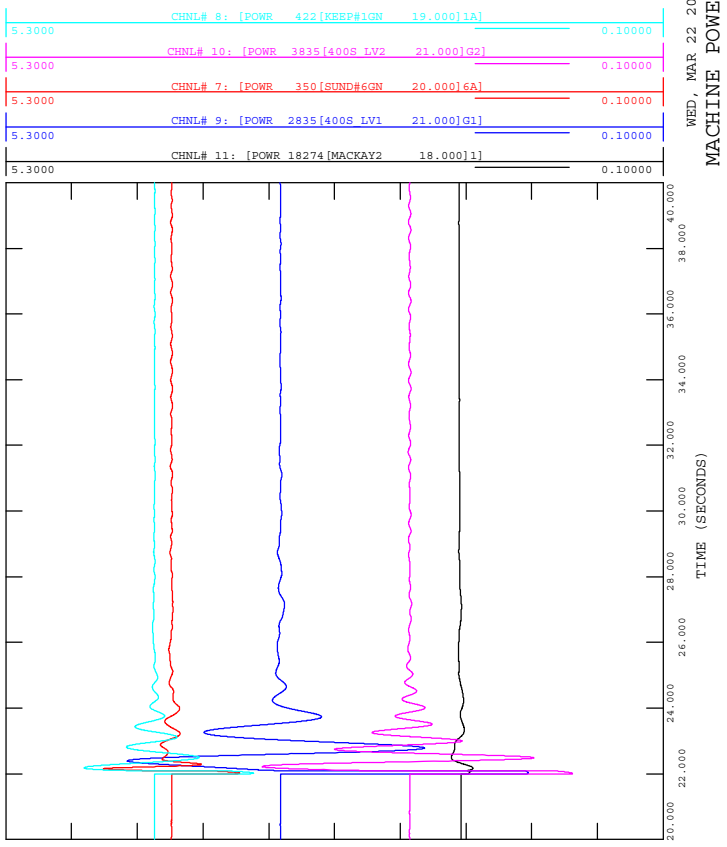
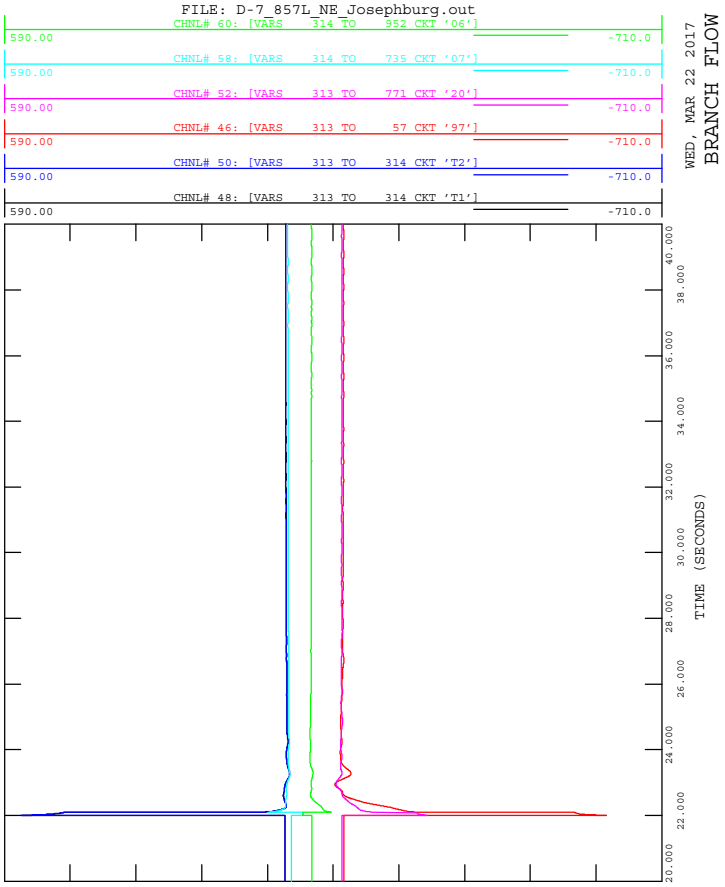


FIGURE D-7F
2020WP, POST-PROJECT
3 PHASE FAULT ON 857L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-7_857L_NE_Josephburg.out



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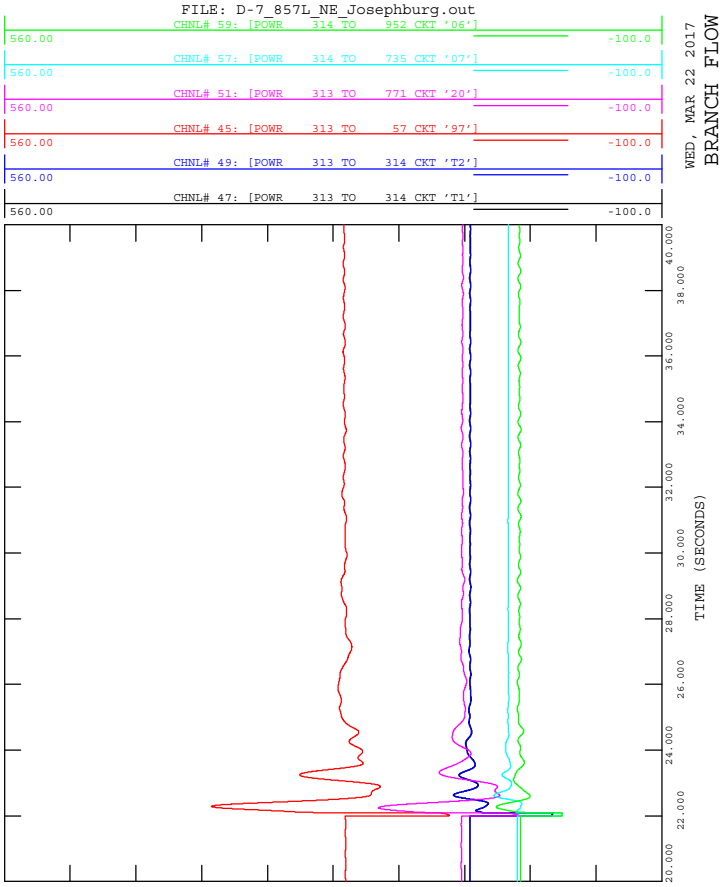
BRANCH FLOW (Q)

FIGURE D-7E
2020WP, POST-PROJECT
3 PHASE FAULT ON 857L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-7_857L_NE_Josephburg.out



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BRANCH FLOW (P)

FIGURE D-8B
2020WP, POST-PROJECT
3 PHASE FAULT ON 857L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-8_857L_NE_Shell_Scotford.out

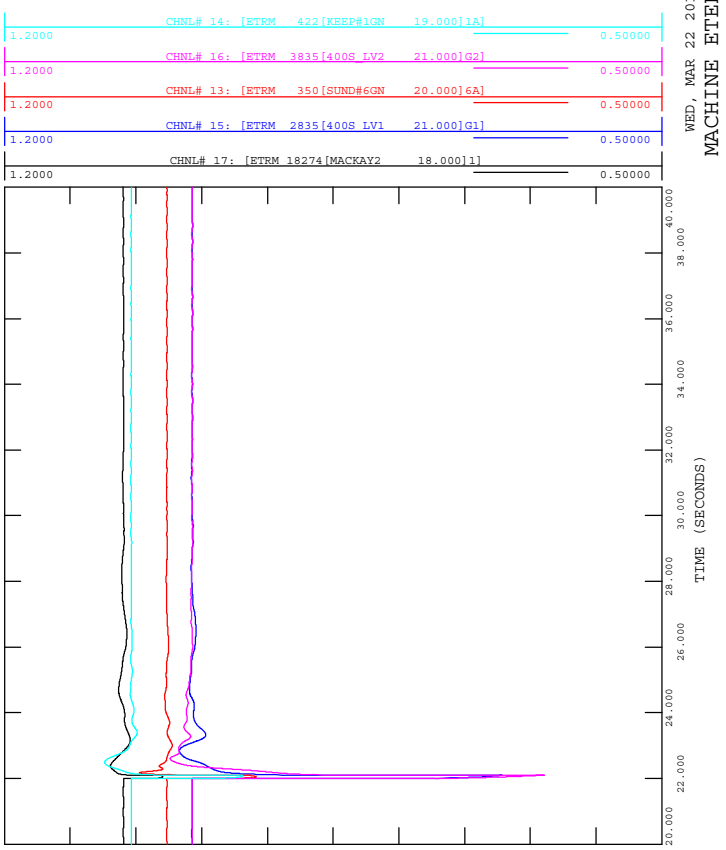


FIGURE D-8D
2020WP, POST-PROJECT
3 PHASE FAULT ON 857L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-8_857L_NE_Shell_Scotford.out

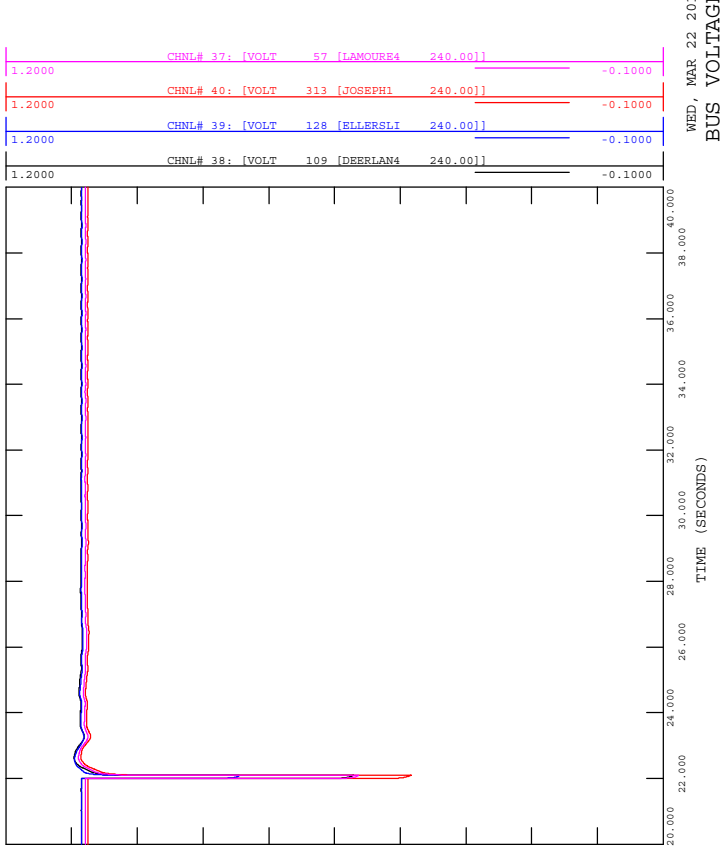


FIGURE D-8A
2020WP, POST-PROJECT
3 PHASE FAULT ON 857L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-8_857L_NE_Shell_Scotford.out

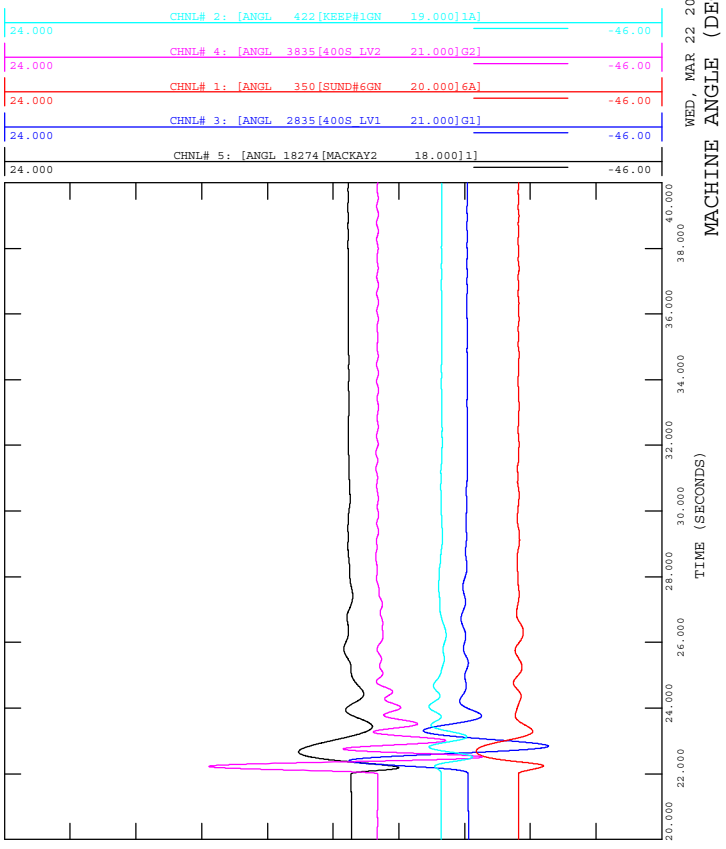


FIGURE D-8C
2020WP, POST-PROJECT
3 PHASE FAULT ON 857L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-8_857L_NE_Shell_Scotford.out

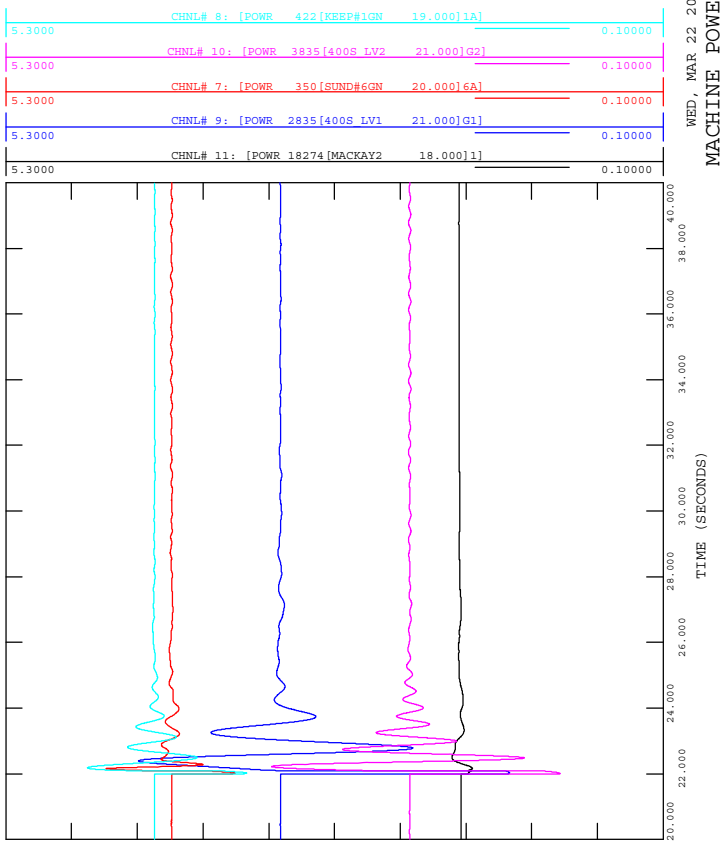
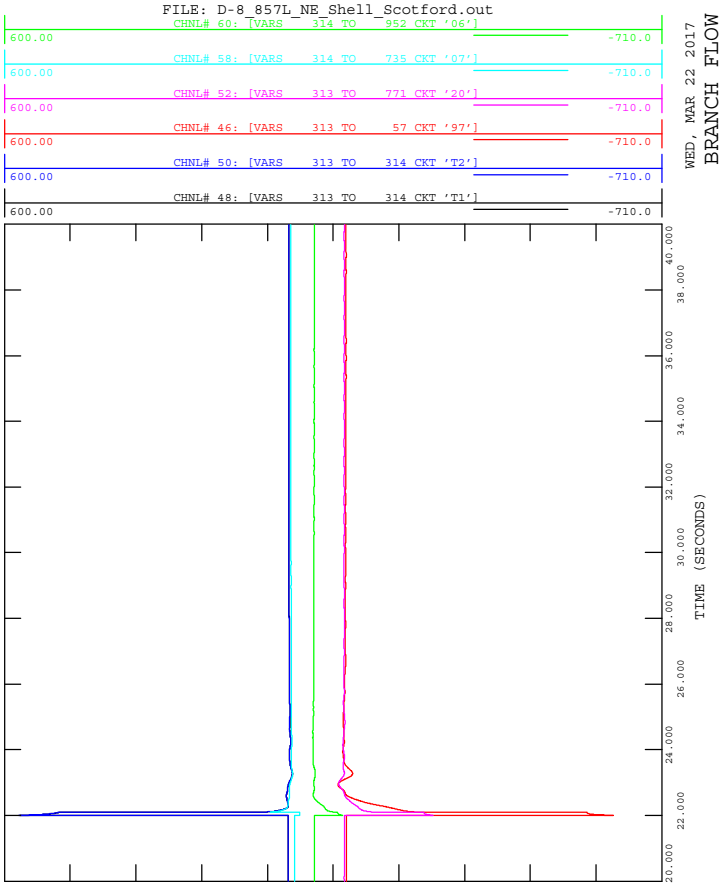


FIGURE D-8F
2020WP, POST-PROJECT
3 PHASE FAULT ON 857L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-8_857L_NE_Shell_Scotford.out



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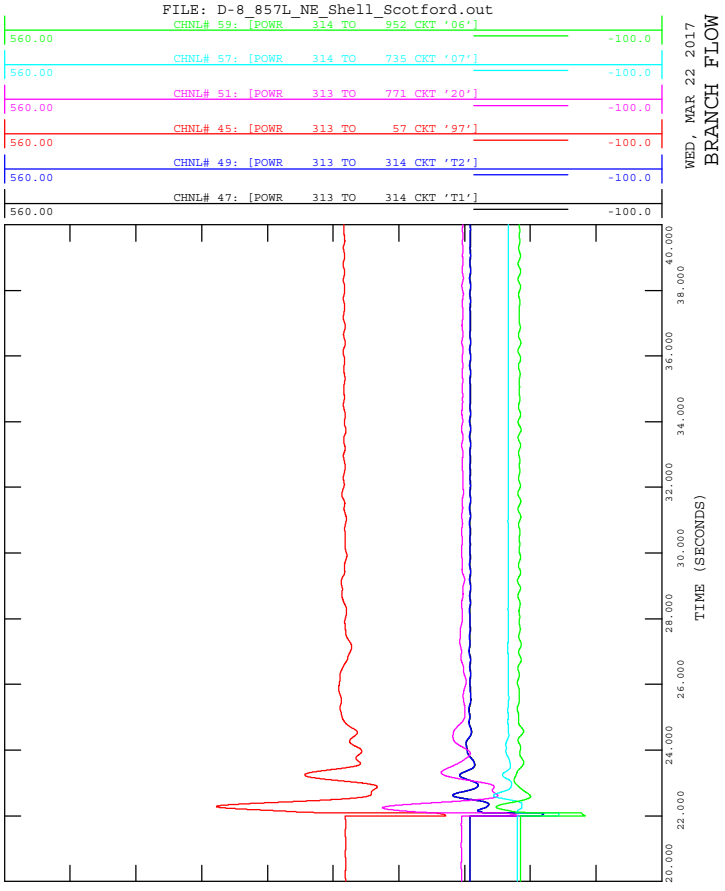
BRANCH FLOW (Q)

FIGURE D-8E
2020WP, POST-PROJECT
3 PHASE FAULT ON 857L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-8_857L_NE_Shell_Scotford.out



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BRANCH FLOW (P)

FIGURE D-9B
2020WP, POST-PROJECT
3 PHASE FAULT ON 706L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-9_706L_NE_Josephburg.out

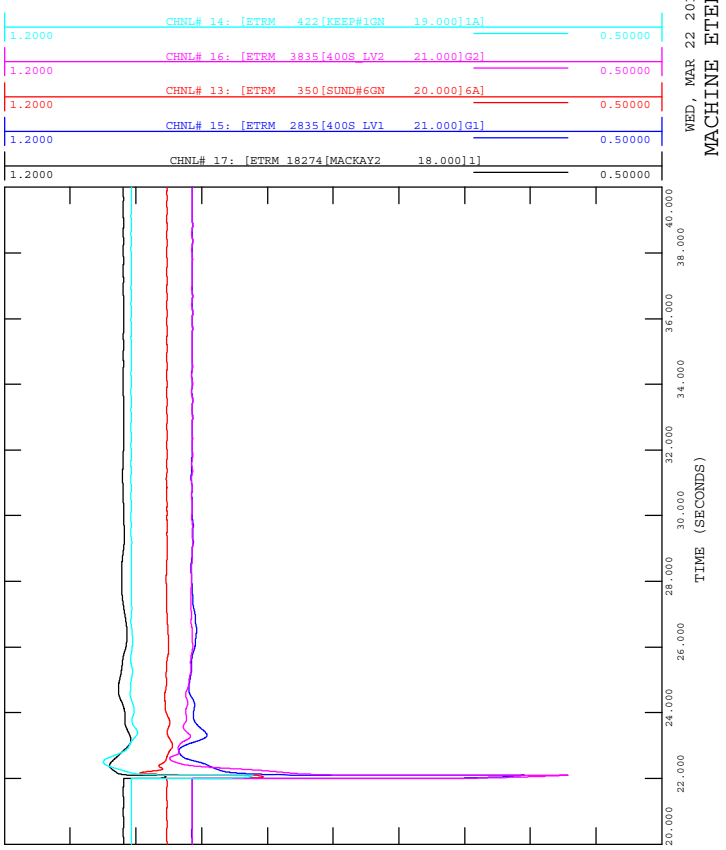

FIGURE D-9D
2020WP, POST-PROJECT
3 PHASE FAULT ON 706L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-9_706L_NE_Josephburg.out

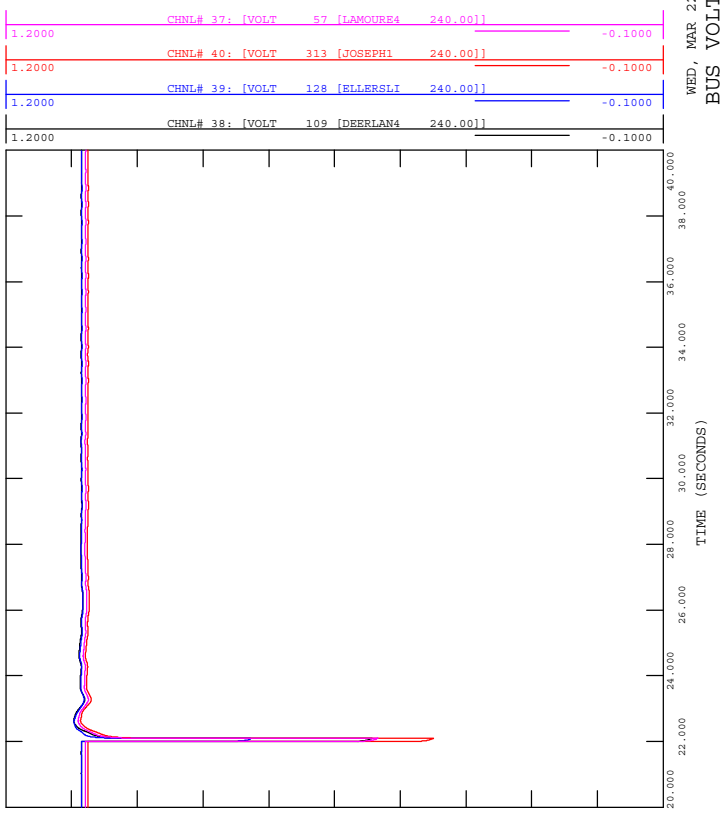

FIGURE D-9A
2020WP, POST-PROJECT
3 PHASE FAULT ON 706L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-9_706L_NE_Josephburg.out

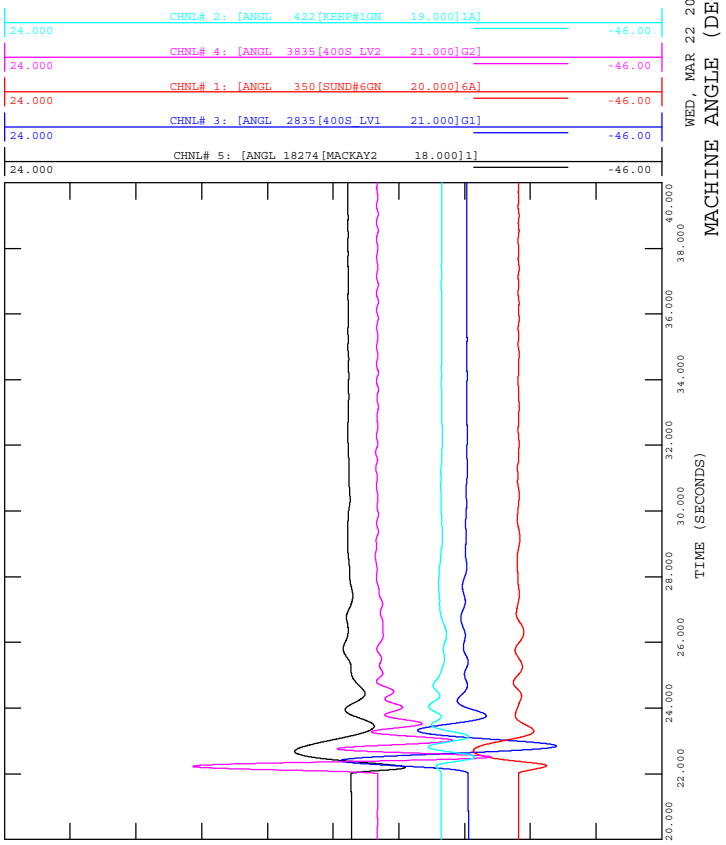

FIGURE D-9C
2020WP, POST-PROJECT
3 PHASE FAULT ON 706L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-9_706L_NE_Josephburg.out

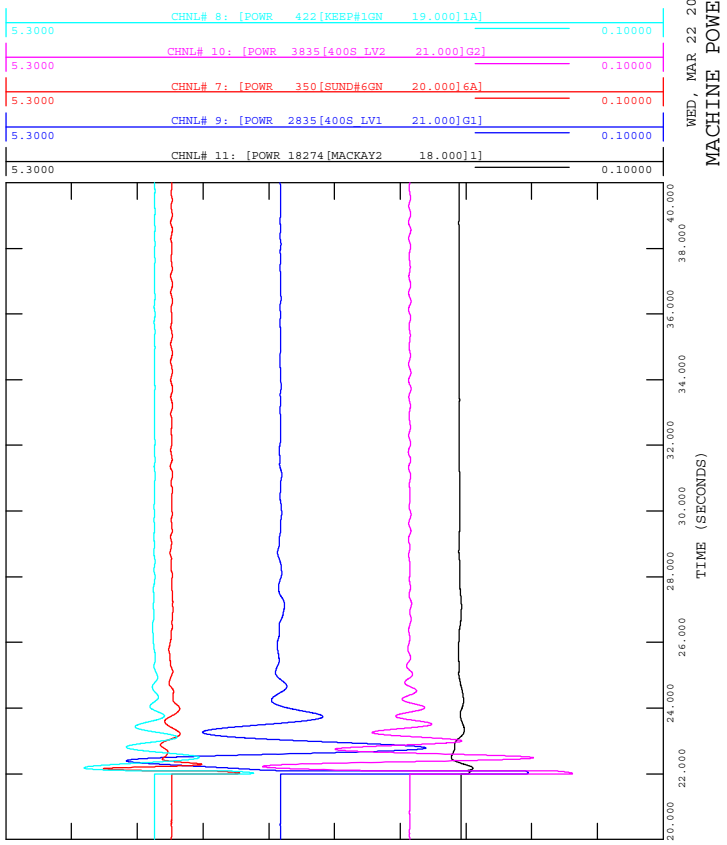

FIGURE D-9F
2020WP, POST-PROJECT
3 PHASE FAULT ON 706L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-9_706L_NE_Josephburg.out

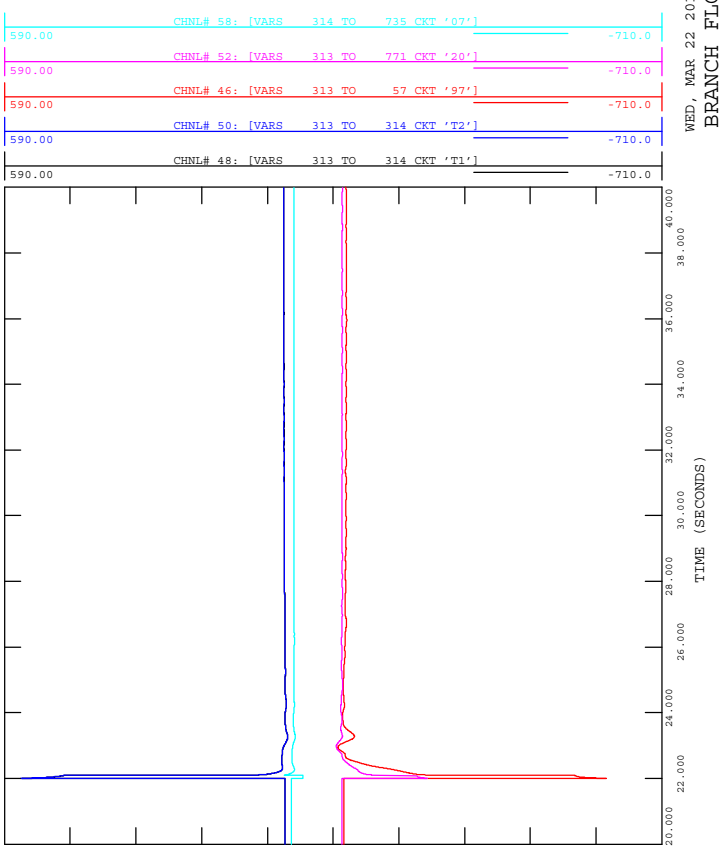

FIGURE D-9E
2020WP, POST-PROJECT
3 PHASE FAULT ON 706L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-9_706L_NE_Josephburg.out

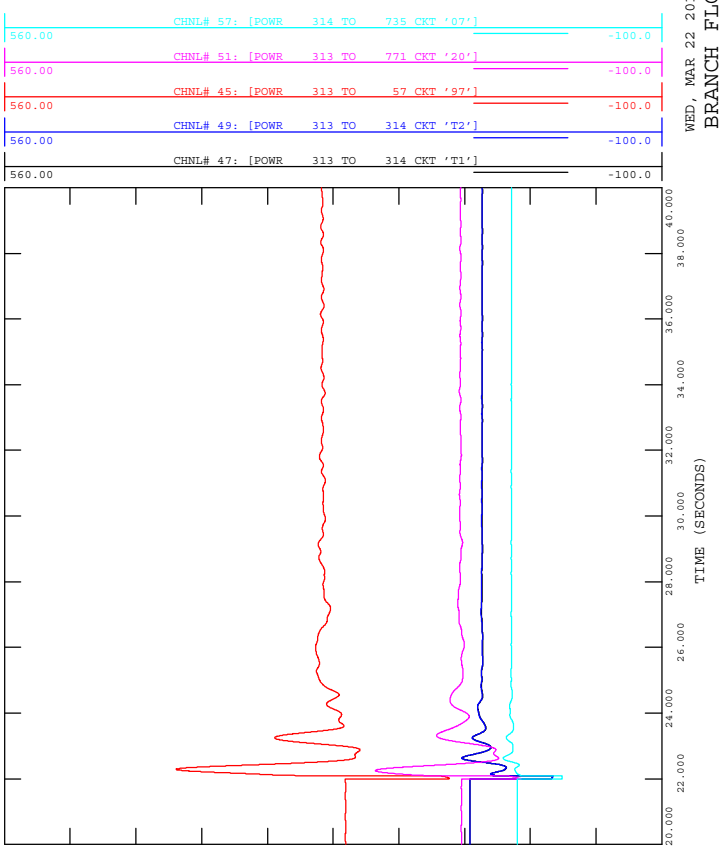

FIGURE D-10B
2020WP, POST-PROJECT
3 PHASE FAULT ON 706L AT FT. SASK
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-10_706L_NE_Ft_Sask.out

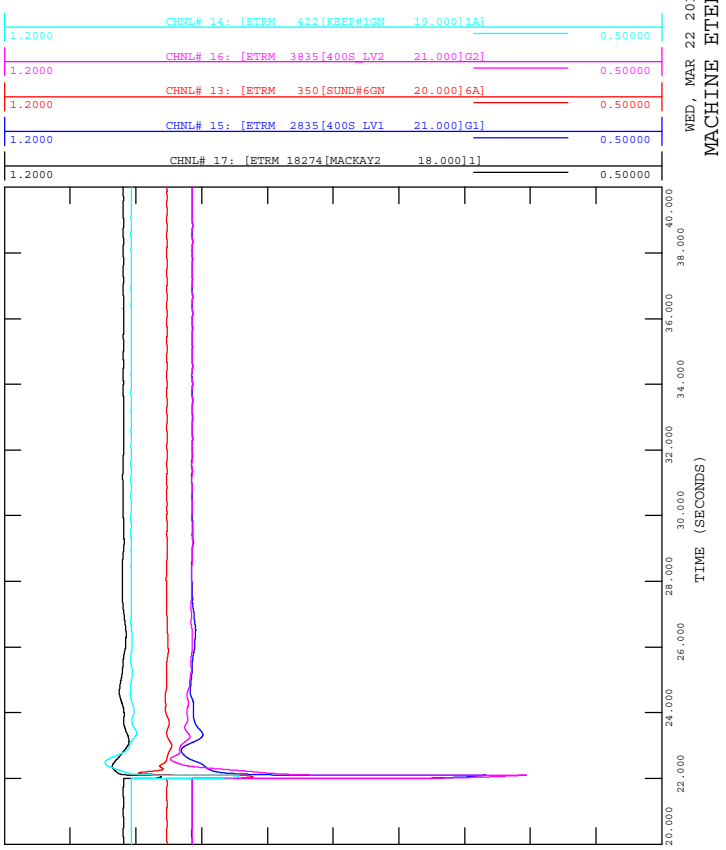

FIGURE D-10D
2020WP, POST-PROJECT
3 PHASE FAULT ON 706L AT FT. SASK
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-10_706L_NE_Ft_Sask.out

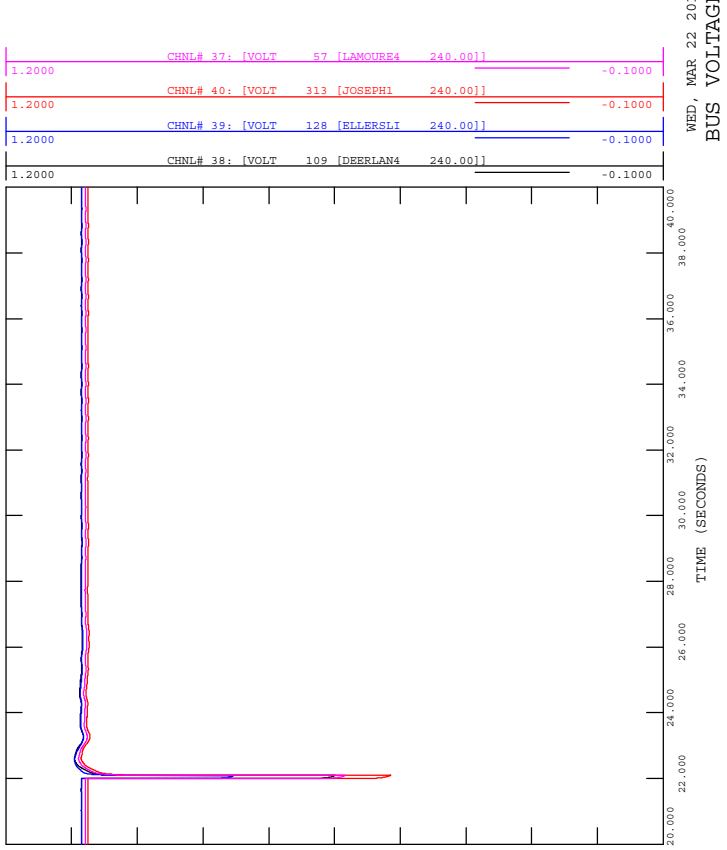

FIGURE D-10A
2020WP, POST-PROJECT
3 PHASE FAULT ON 706L AT FT. SASK
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-10_706L_NE_Ft_Sask.out

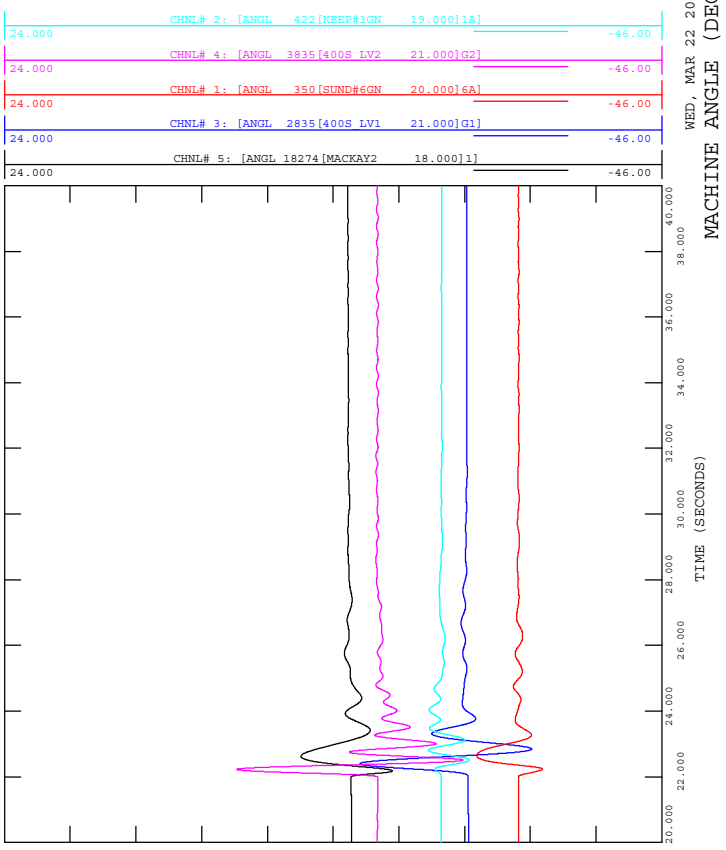

FIGURE D-10C
2020WP, POST-PROJECT
3 PHASE FAULT ON 706L AT FT. SASK
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-10_706L_NE_Ft_Sask.out

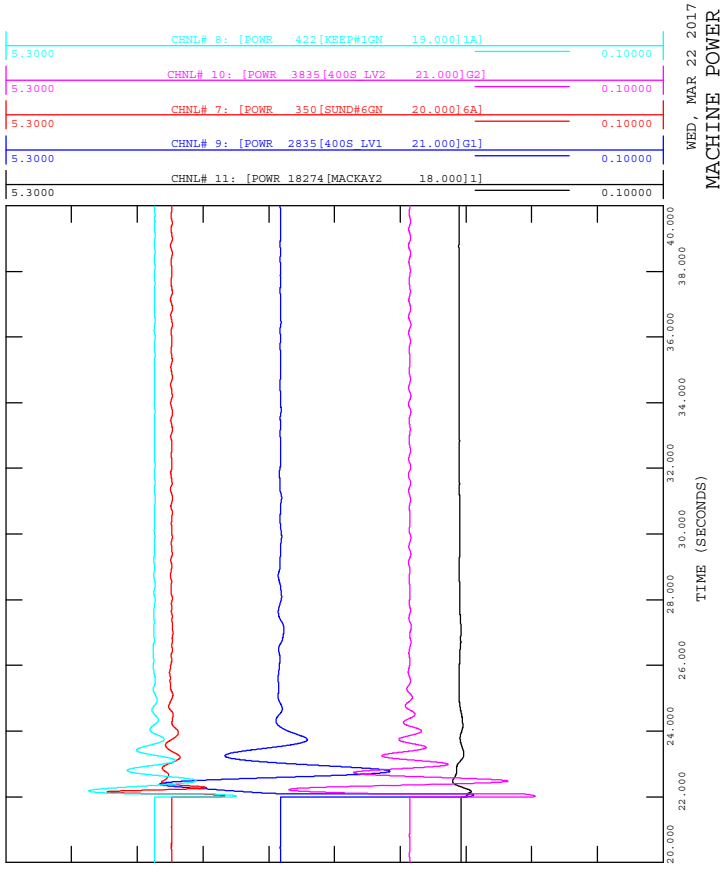

FIGURE D-10F
2020WP, POST-PROJECT
3 PHASE FAULT ON 706L AT FT. SASK
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-10_706L_NE_Ft_Sask.out

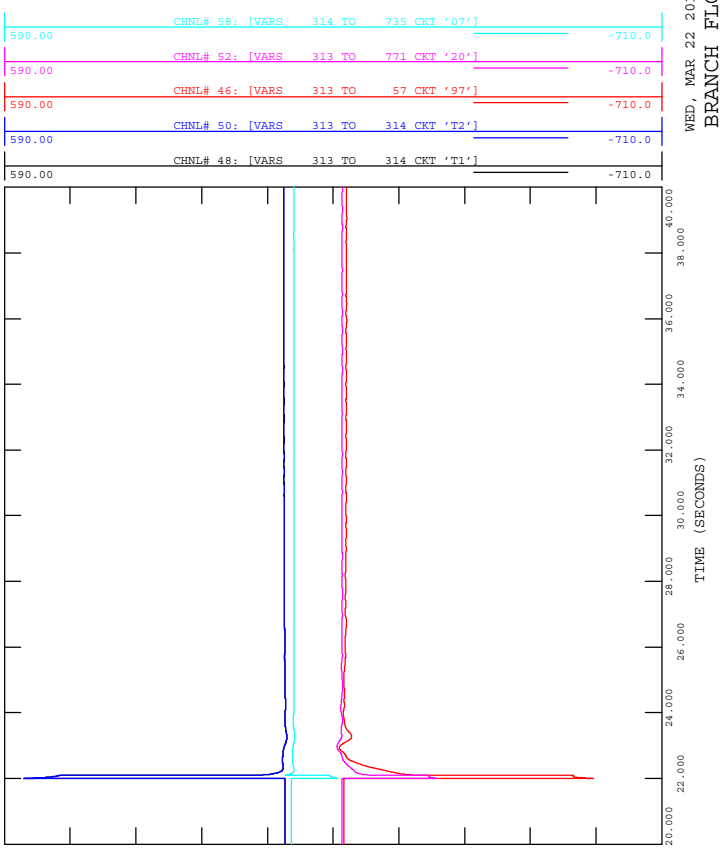

FIGURE D-10E
2020WP, POST-PROJECT
3 PHASE FAULT ON 706L AT FT. SASK
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-10_706L_NE_Ft_Sask.out

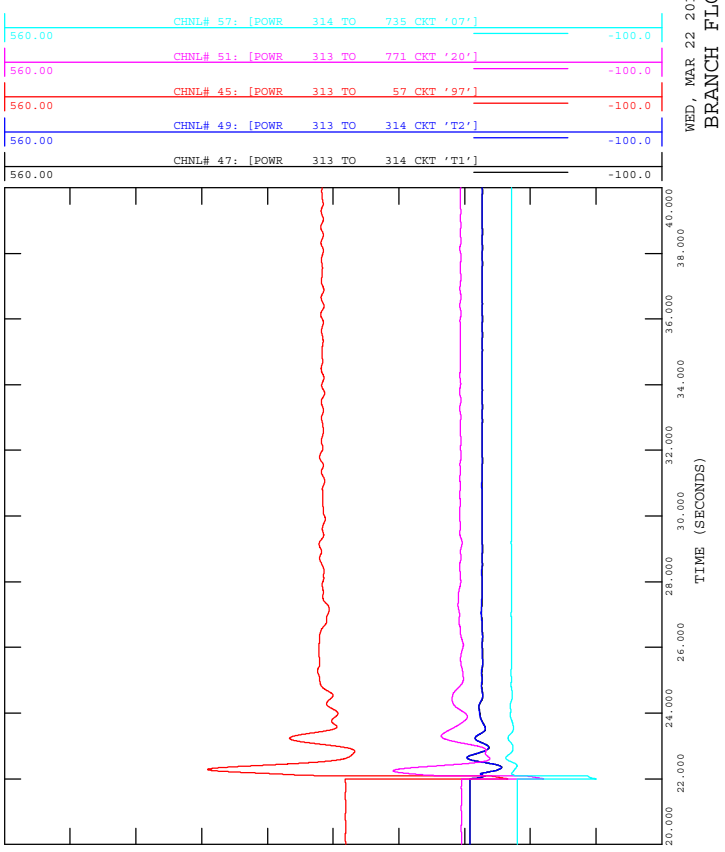

FIGURE D-11B
2020WP, POST-PROJECT
3 PHASE FAULT ON 776L AT JOSEPHBURG
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-11_776L_NE_Josephburg.out

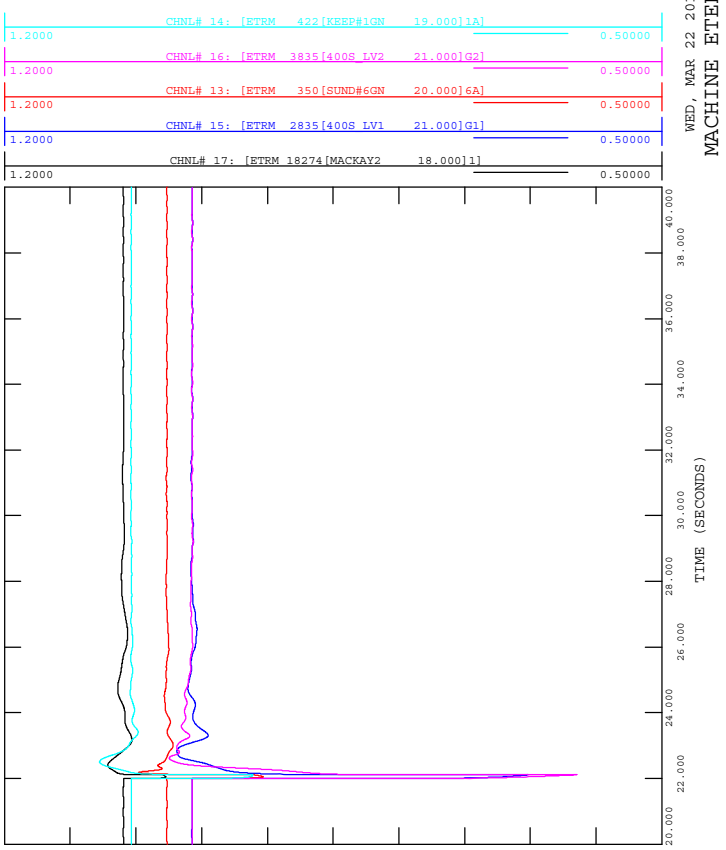

FIGURE D-11D
2020WP, POST-PROJECT
3 PHASE FAULT ON 776L AT JOSEPHBURG
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-11_776L_NE_Josephburg.out

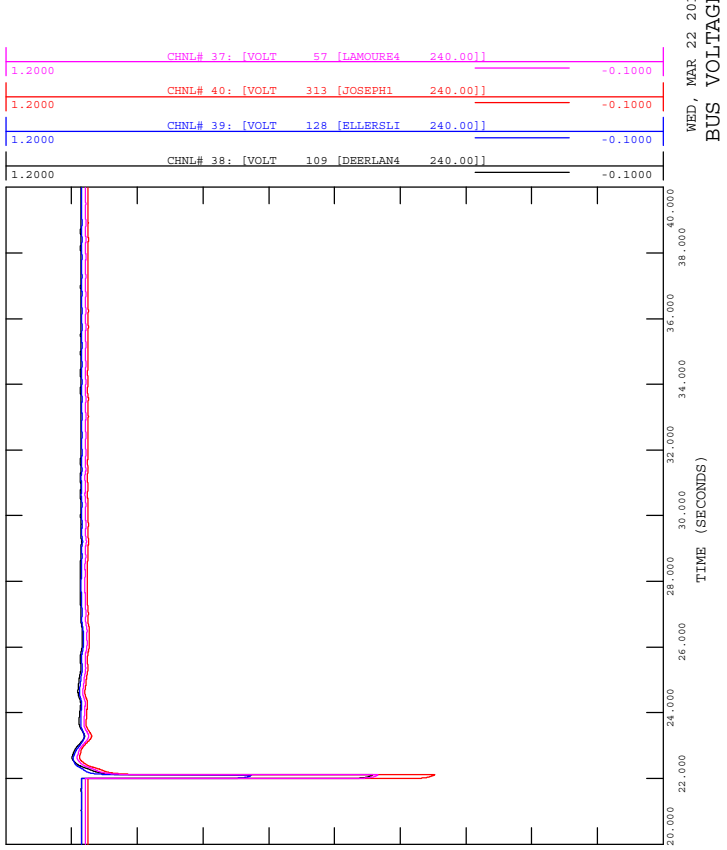

FIGURE D-11A
2020WP, POST-PROJECT
3 PHASE FAULT ON 776L AT JOSEPHBURG
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-11_776L_NE_Josephburg.out

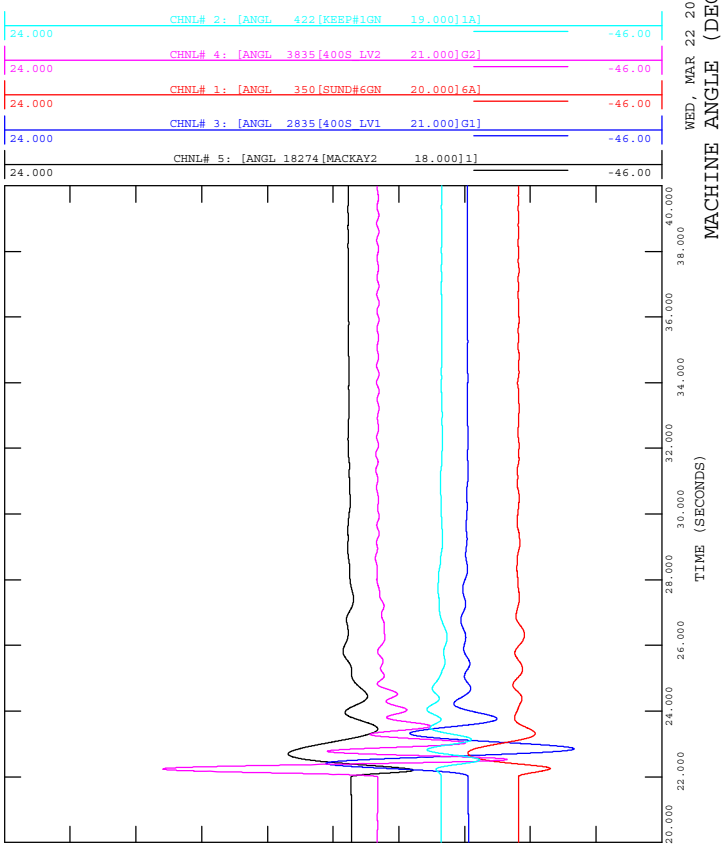

FIGURE D-11C
2020WP, POST-PROJECT
3 PHASE FAULT ON 776L AT JOSEPHBURG
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-11_776L_NE_Josephburg.out

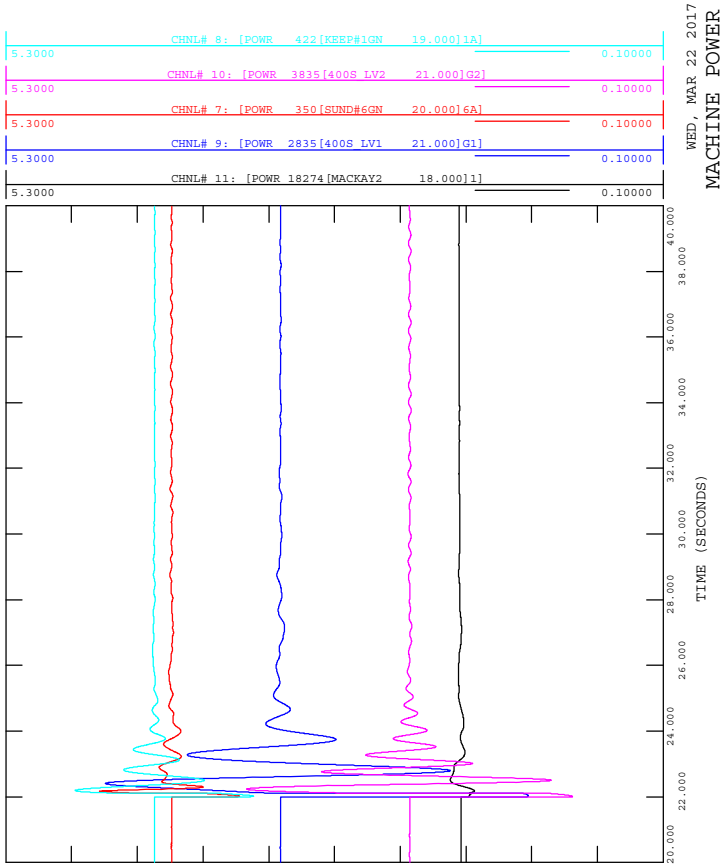

FIGURE D-11F
2020WP, POST-PROJECT
3 PHASE FAULT ON 776L AT JOSEPHBURG
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-11_776L_NE_Josephburg.out

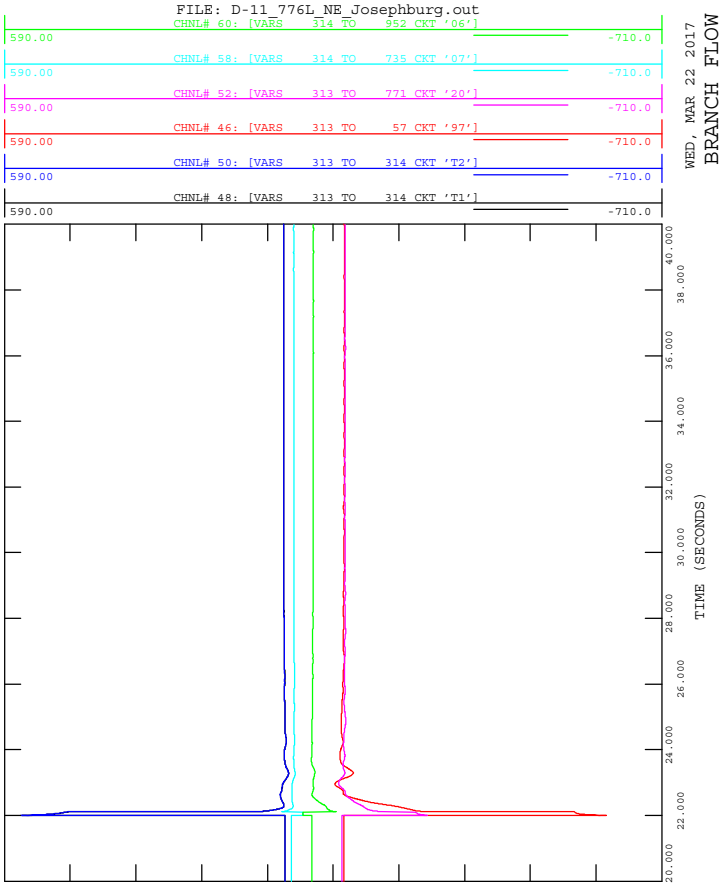

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FIGURE D-11E
2020WP, POST-PROJECT
3 PHASE FAULT ON 776L AT JOSEPHBURG
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-11_776L_NE_Josephburg.out

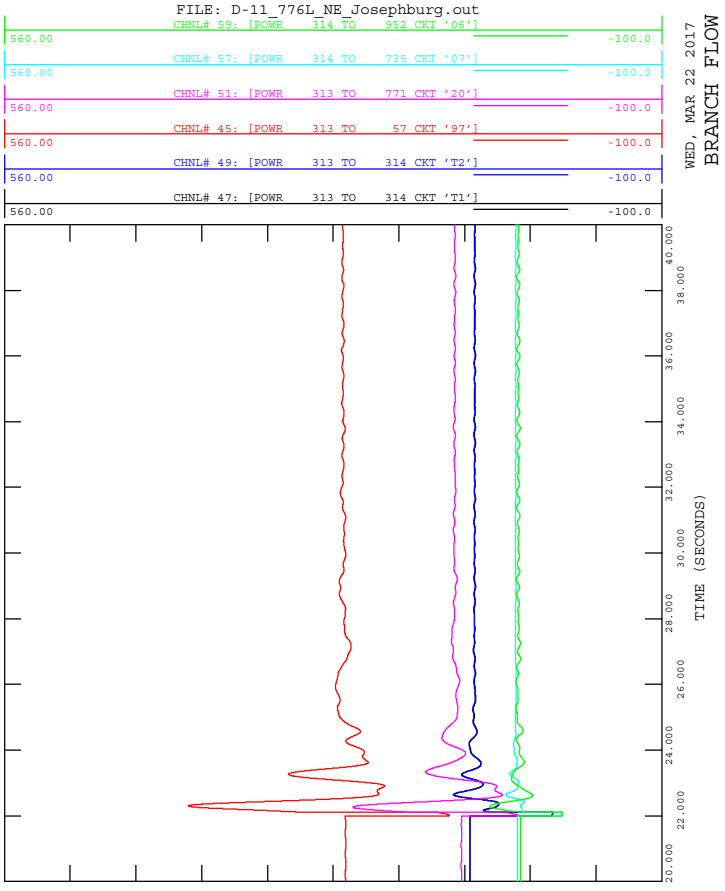

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FIGURE D-12B
2020WP, POST-PROJECT
3 PHASE FAULT ON 776L AT BEAVERHILL CREEK
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-12_776L_NE_Beaverhill_Ck.out

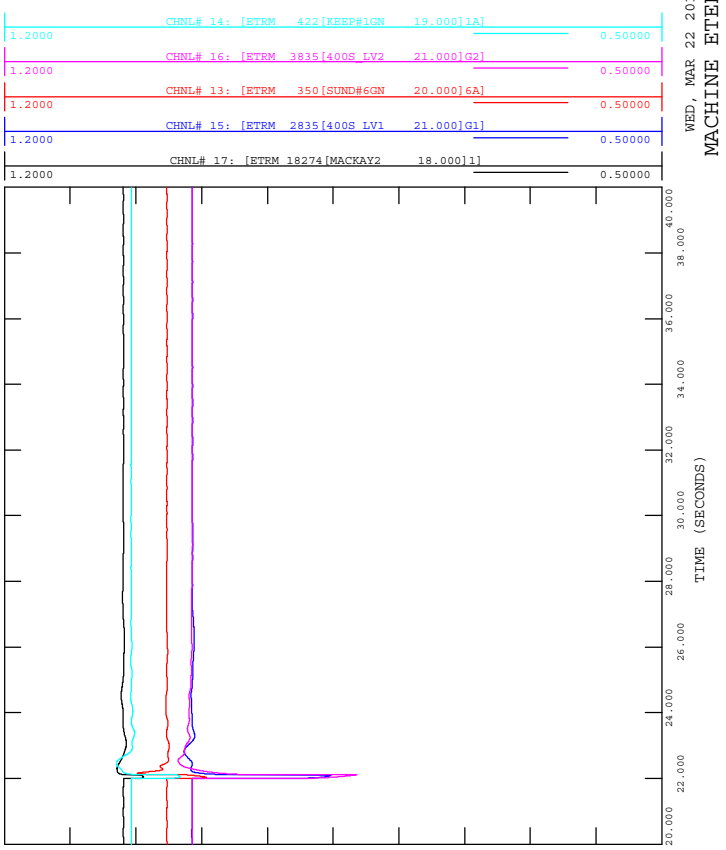


FIGURE D-12D
2020WP, POST-PROJECT
3 PHASE FAULT ON 776L AT BEAVERHILL CREEK
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-12_776L_NE_Beaverhill_Ck.out

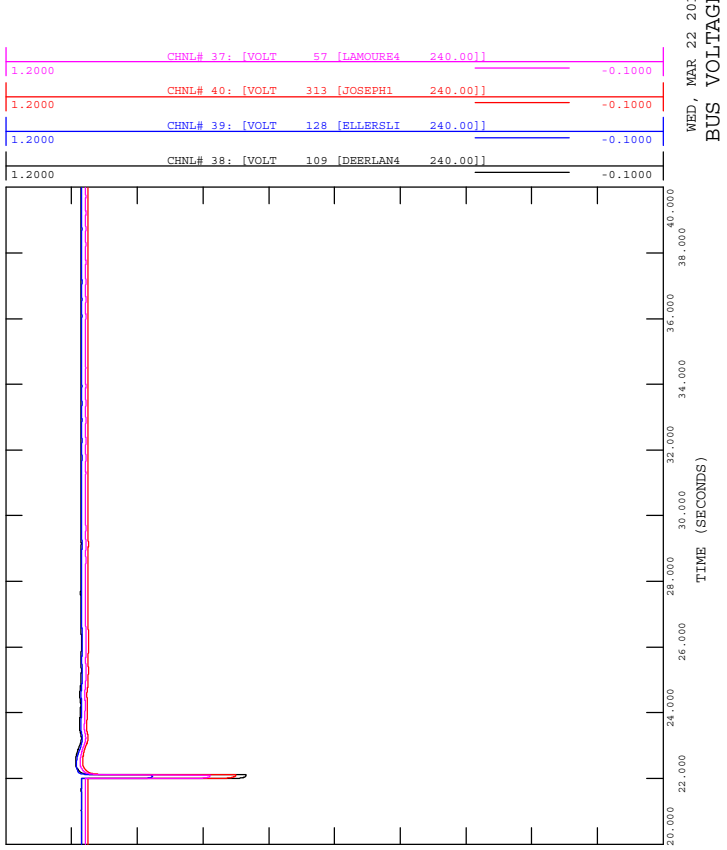


FIGURE D-12A
2020WP, POST-PROJECT
3 PHASE FAULT ON 776L AT BEAVERHILL CREEK
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-12_776L_NE_Beaverhill_Ck.out

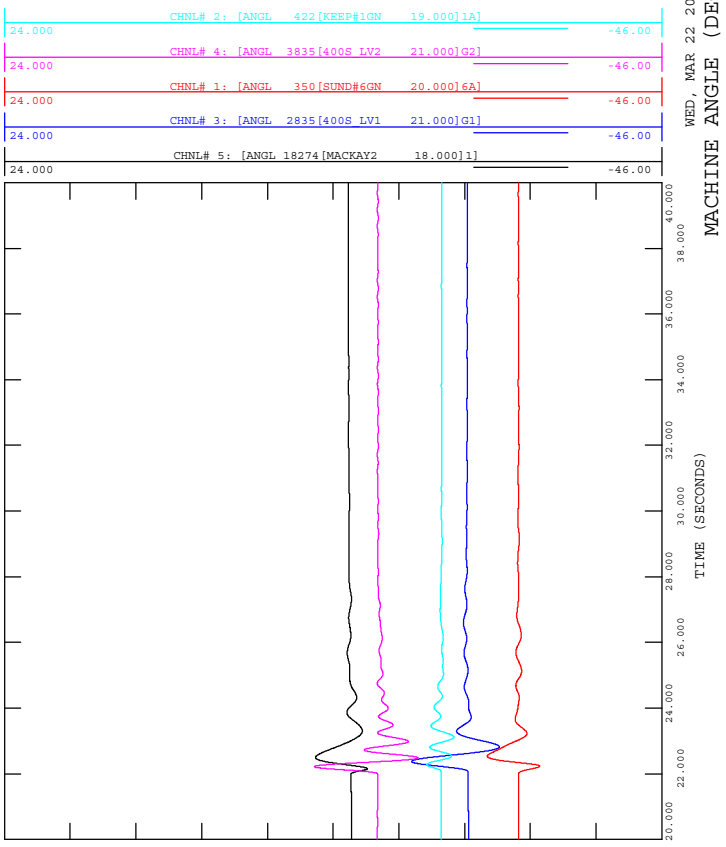


FIGURE D-12C
2020WP, POST-PROJECT
3 PHASE FAULT ON 776L AT BEAVERHILL CREEK
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-12_776L_NE_Beaverhill_Ck.out

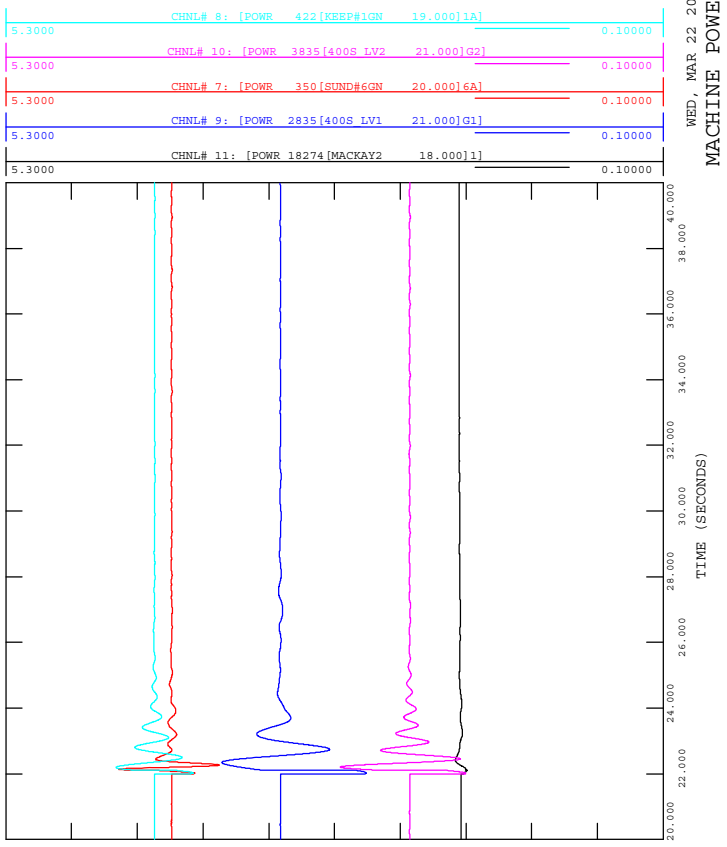
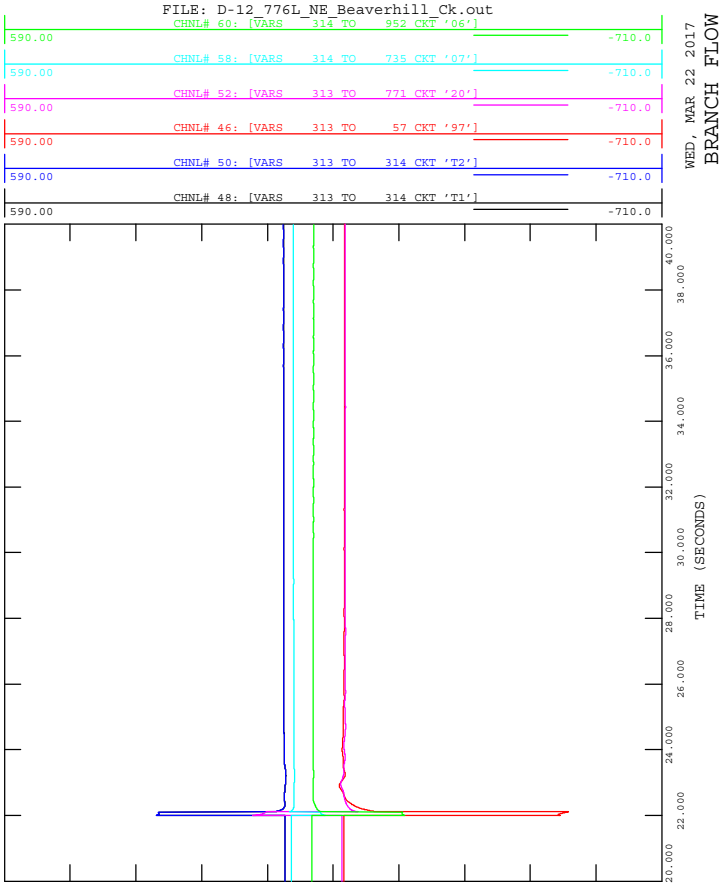


FIGURE D-12F
2020WP, POST-PROJECT
3 PHASE FAULT ON 776L AT BEAVERHILL CREEK
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-12_776L_NE_Beaverhill_Ck.out



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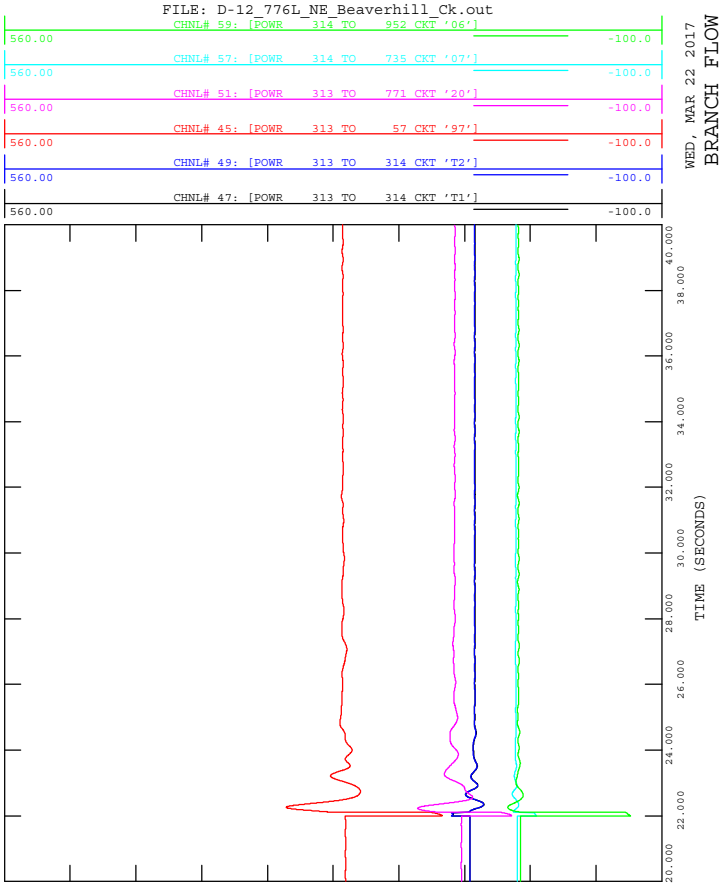
BRANCH FLOW (Q)

FIGURE D-12E
2020WP, POST-PROJECT
3 PHASE FAULT ON 776L AT BEAVERHILL CREEK
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-12_776L_NE_Beaverhill_Ck.out



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BRANCH FLOW (P)

FIGURE D-13B
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 997L AT JOSEPHBURG
CLEARED IN 4.5 CYCLES, FAR END IN 6 CYCLES
FILE: D-13_997L_NE_Josephburg.out

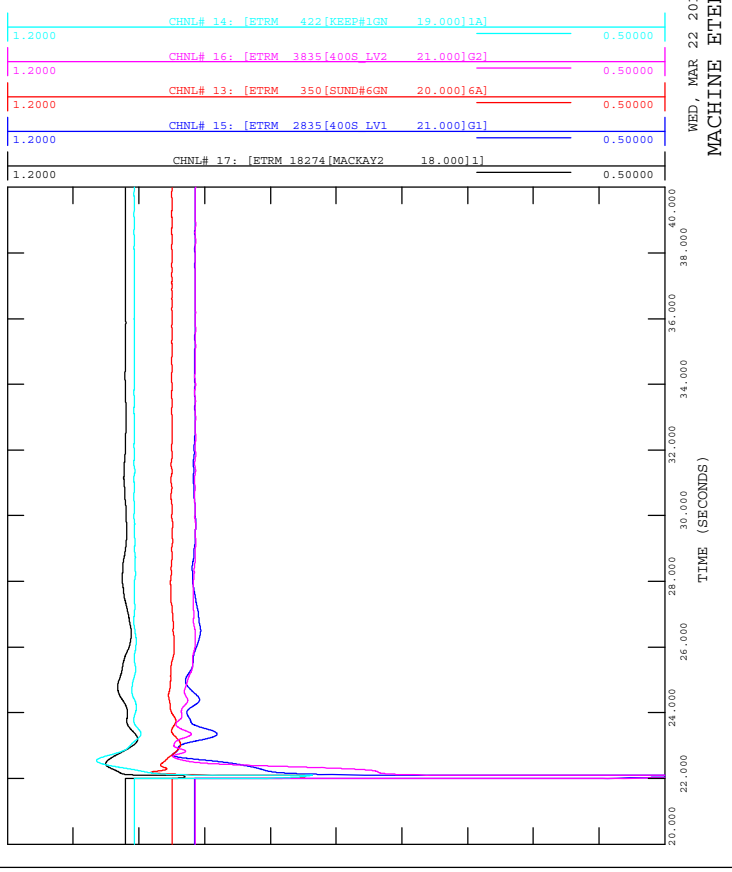


FIGURE D-13D
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 997L AT JOSEPHBURG
CLEARED IN 4.5 CYCLES, FAR END IN 6 CYCLES
FILE: D-13_997L_NE_Josephburg.out

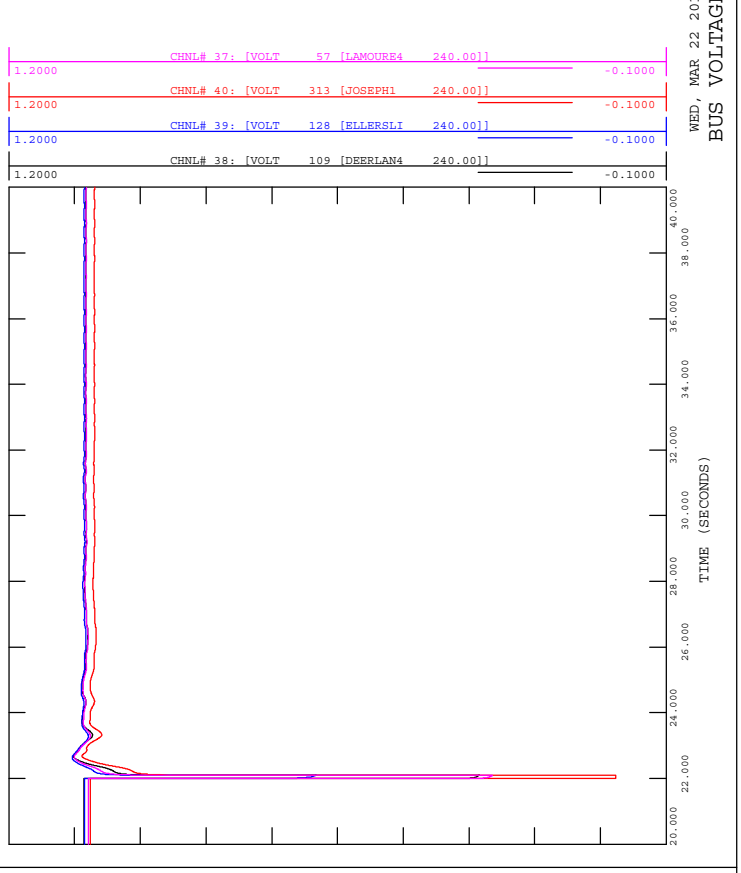


FIGURE D-13A
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 997L AT JOSEPHBURG
CLEARED IN 4.5 CYCLES, FAR END IN 6 CYCLES
FILE: D-13_997L_NE_Josephburg.out

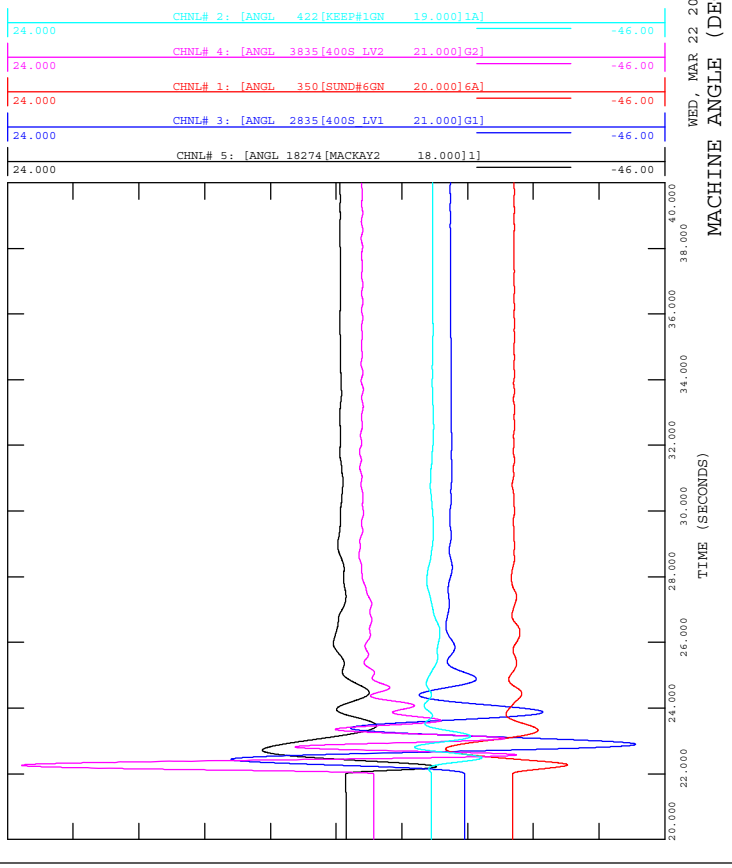


FIGURE D-13C
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 997L AT JOSEPHBURG
CLEARED IN 4.5 CYCLES, FAR END IN 6 CYCLES
FILE: D-13_997L_NE_Josephburg.out

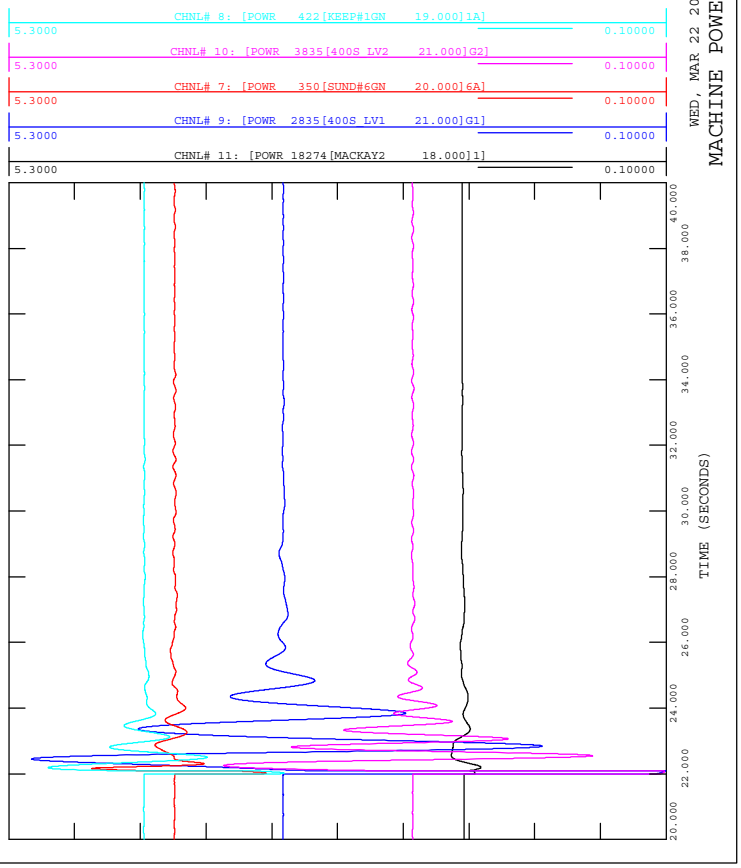


FIGURE D-13F
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 997L AT JOSEPHBURG
CLEARED IN 4.5 CYCLES, FAR END IN 6 CYCLES
FILE: D-13_997L_NE_Josephburg.out

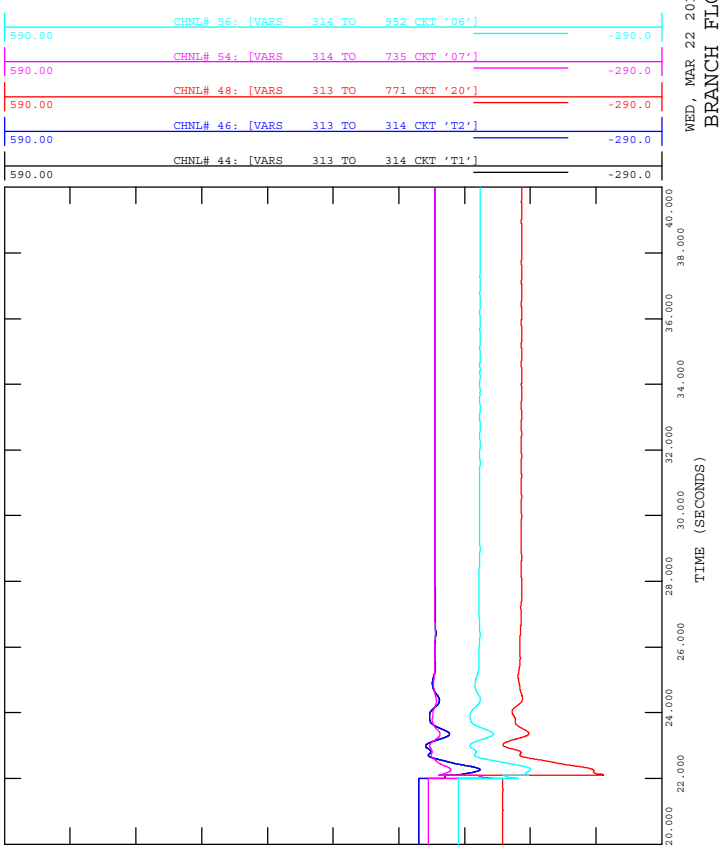


FIGURE D-13E
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 997L AT JOSEPHBURG
CLEARED IN 4.5 CYCLES, FAR END IN 6 CYCLES
FILE: D-13_997L_NE_Josephburg.out

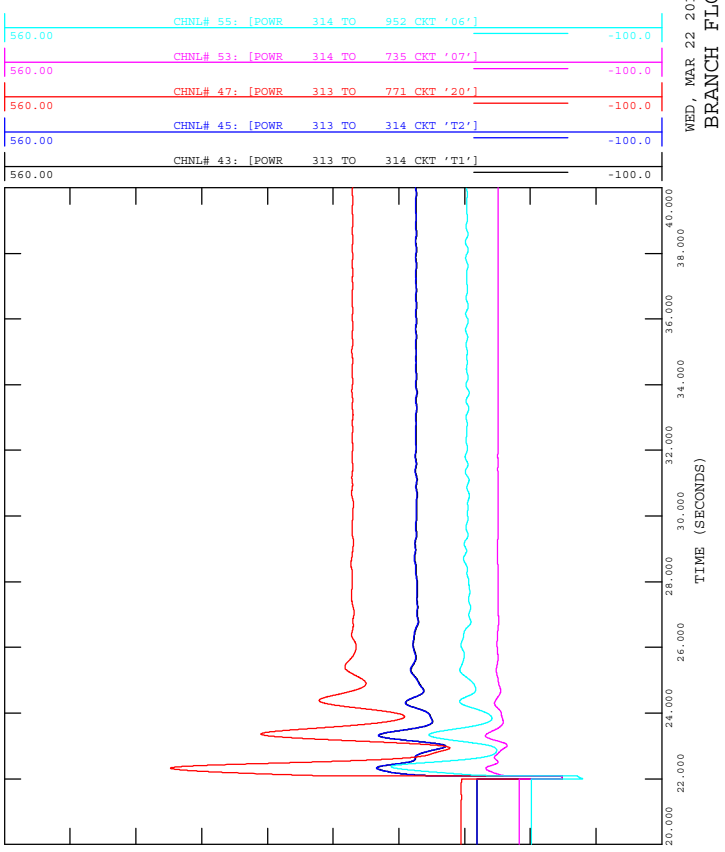


FIGURE D-14B
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 997L AT LAMOUREUX
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-14_997L_NE_Lamoureux.out

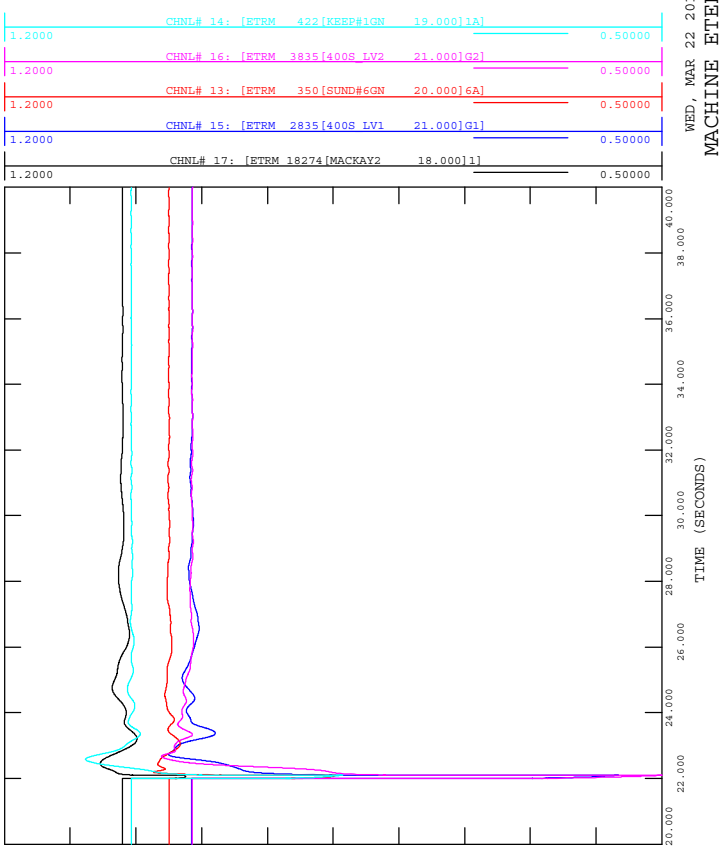


FIGURE D-14D
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 997L AT LAMOUREUX
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-14_997L_NE_Lamoureux.out

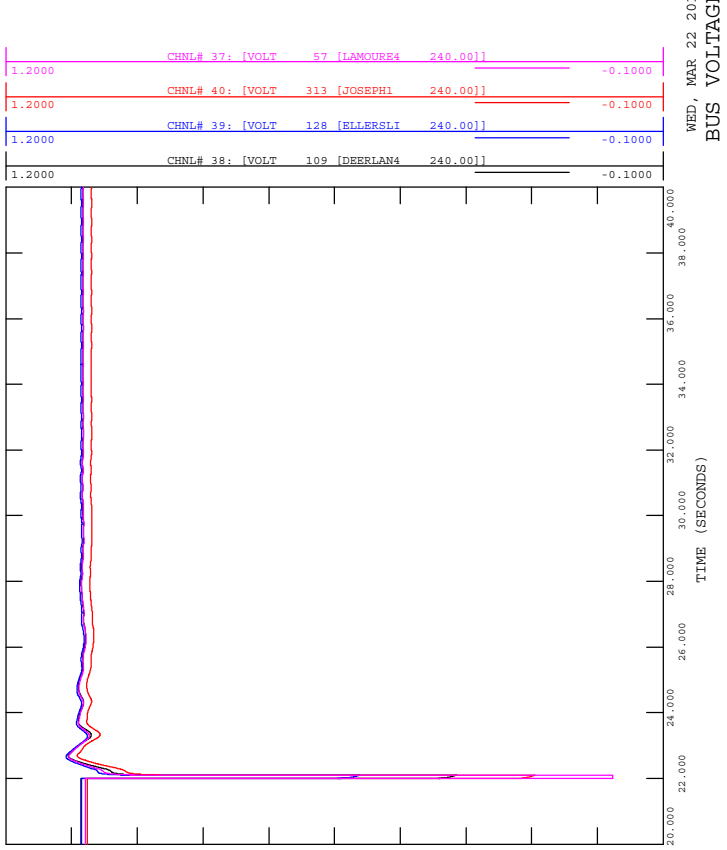


FIGURE D-14A
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 997L AT LAMOUREUX
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-14_997L_NE_Lamoureux.out

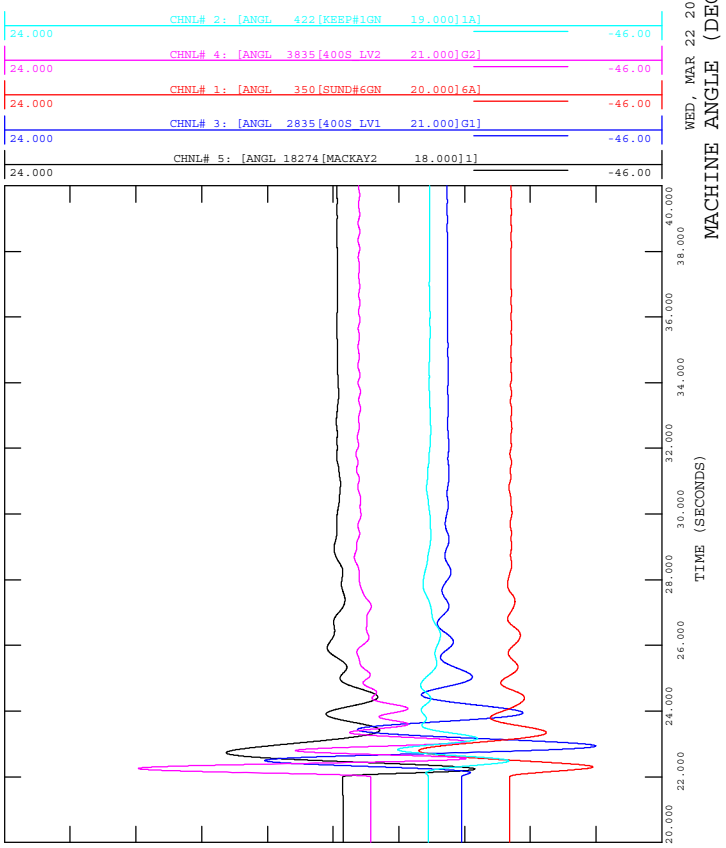


FIGURE D-14C
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 997L AT LAMOUREUX
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-14_997L_NE_Lamoureux.out

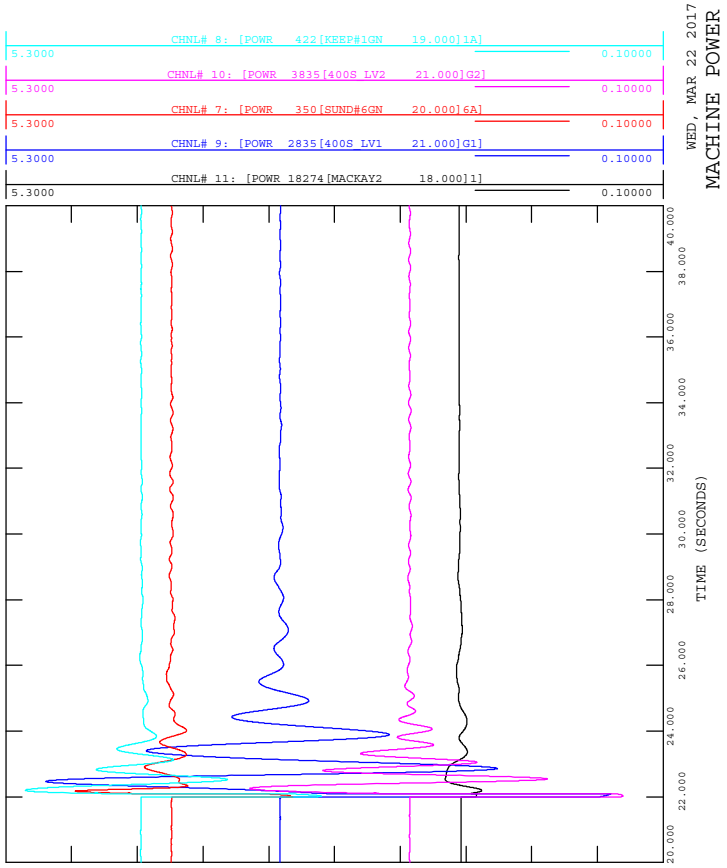


FIGURE D-14F
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 997L AT LAMOUREUX
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-14_997L_NE_Lamoureux.out

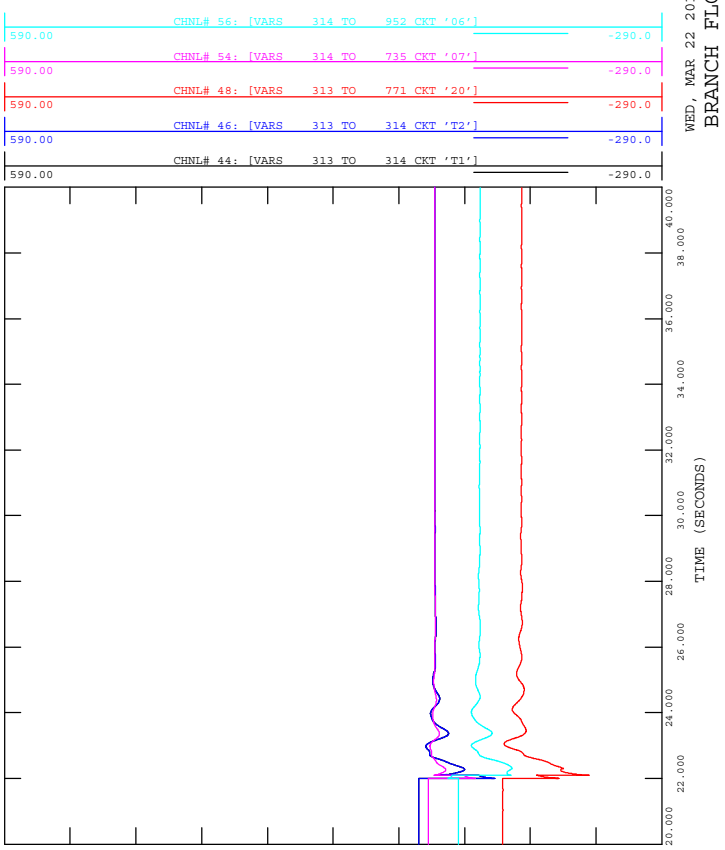


FIGURE D-14E
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 997L AT LAMOUREUX
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-14_997L_NE_Lamoureux.out

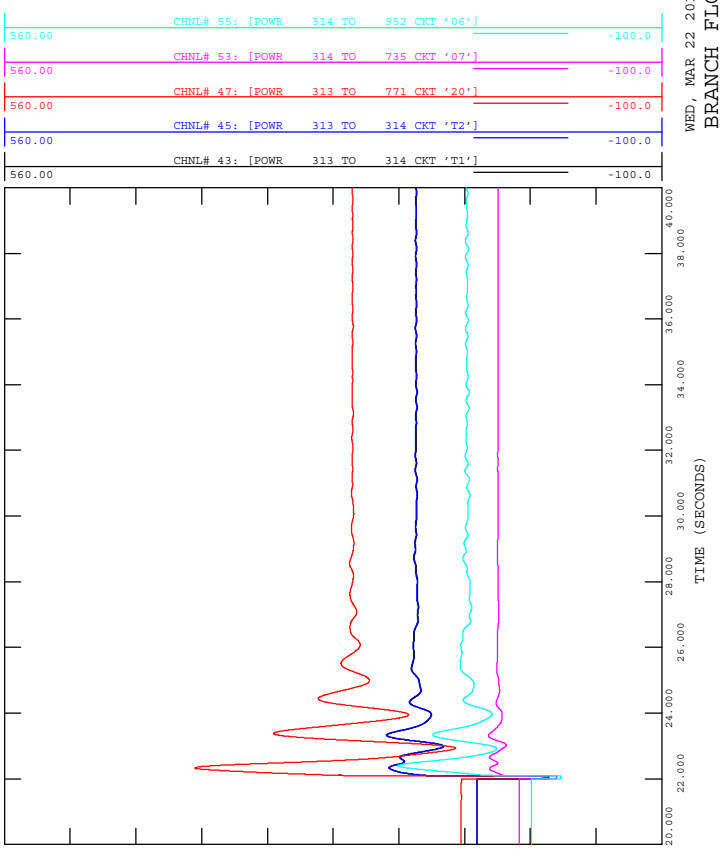


FIGURE D-15B
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 1120L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-15_1120L_NE_Josephburg.out

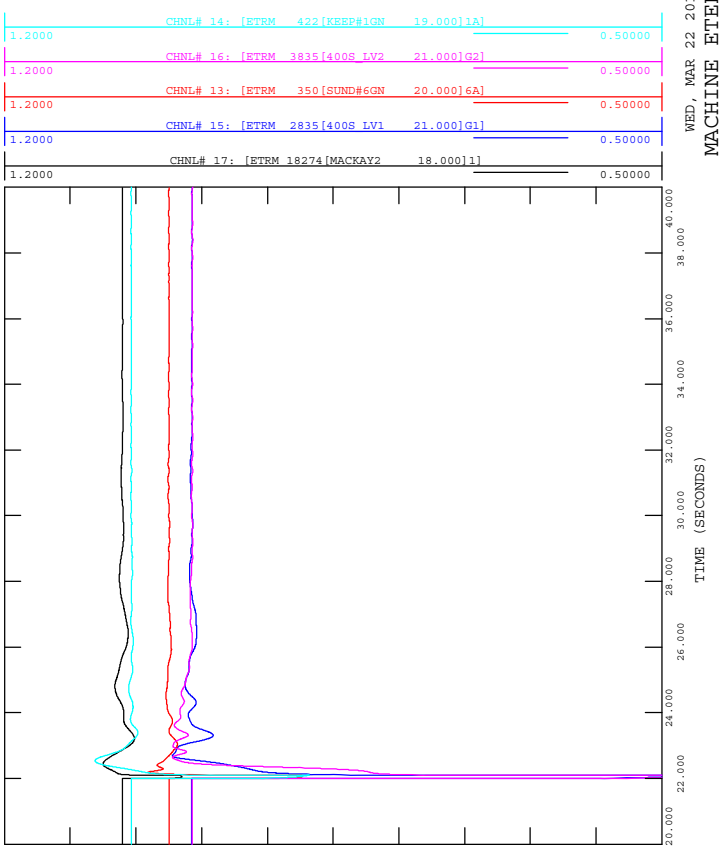


FIGURE D-15D
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 1120L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-15_1120L_NE_Josephburg.out

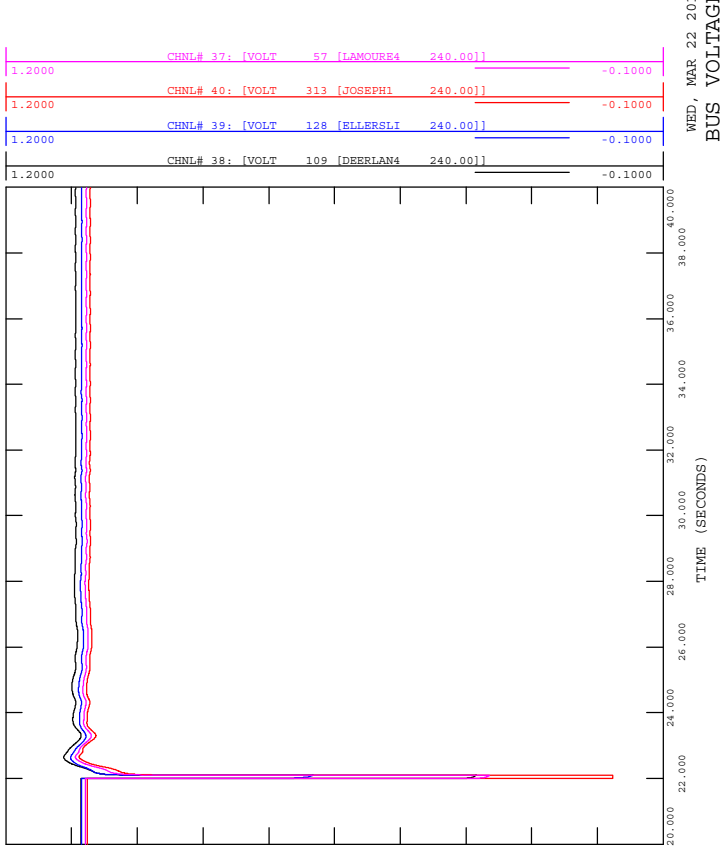


FIGURE D-15A
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 1120L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-15_1120L_NE_Josephburg.out

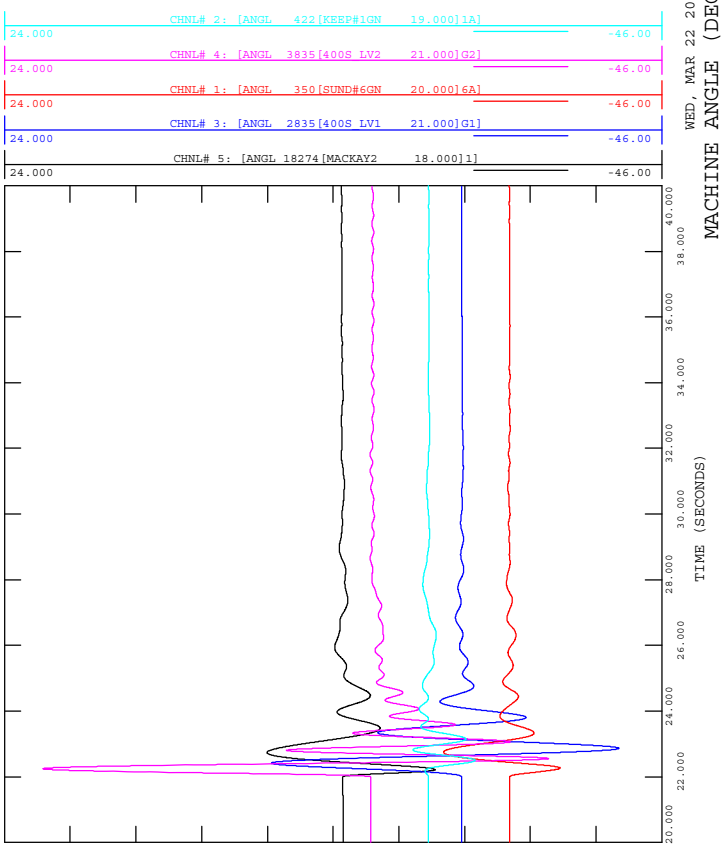


FIGURE D-15C
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 1120L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-15_1120L_NE_Josephburg.out

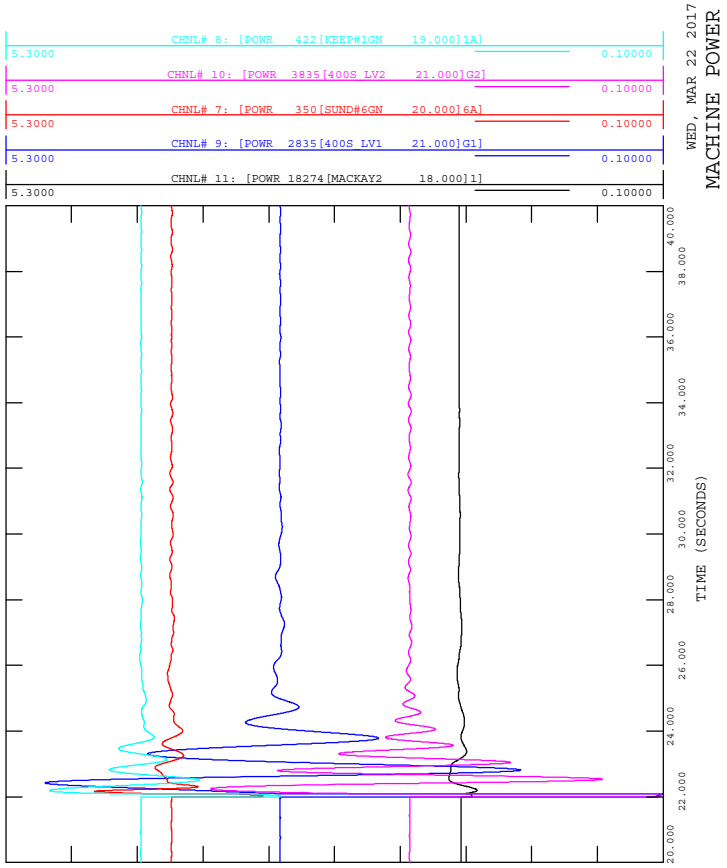
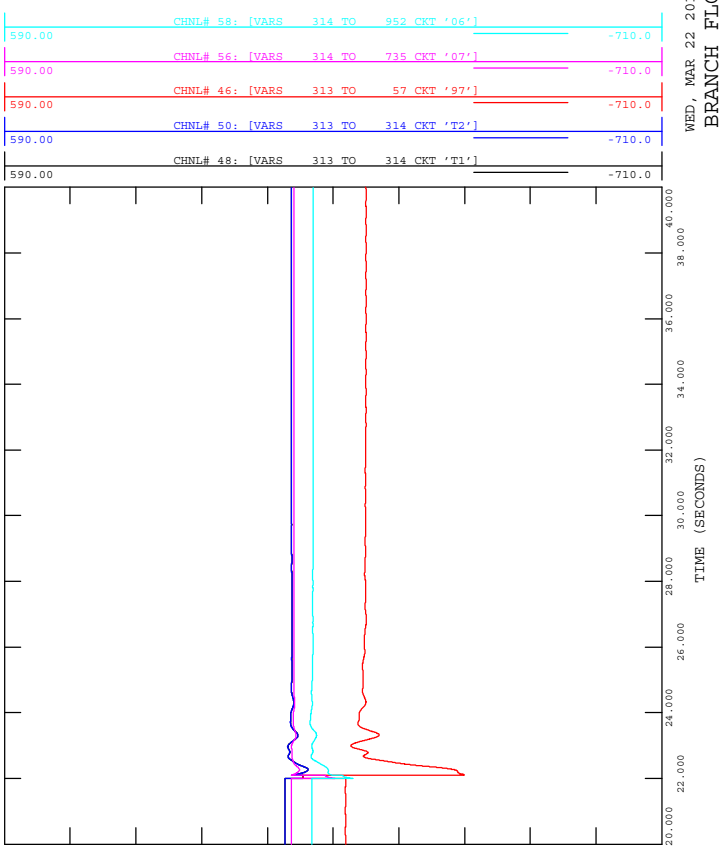


FIGURE D-15F
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 1120L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-15_1120L_NE_Josephburg.out



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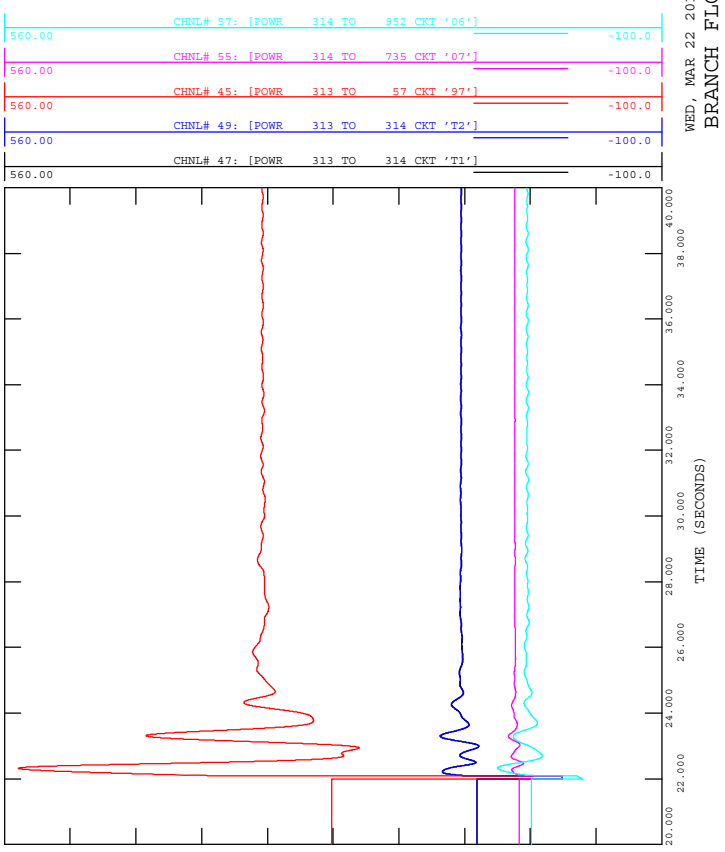
BRANCH FLOW (Q)

FIGURE D-15E
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 1120L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-15_1120L_NE_Josephburg.out



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BRANCH FLOW (P)

FIGURE D-16B
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 1120L AT AMELIA
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-16_1120L_NE_Amelia.out

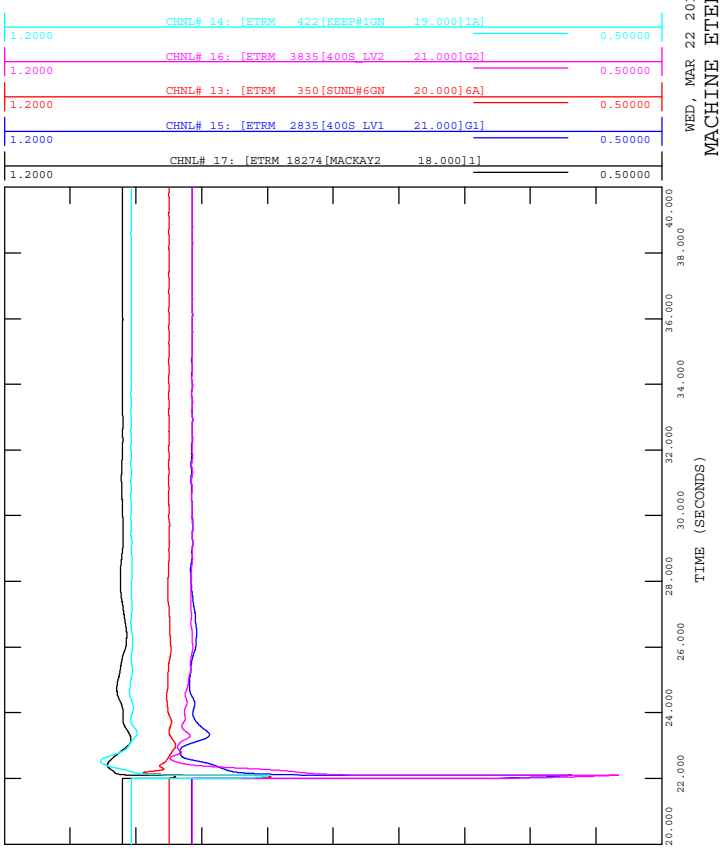

FIGURE D-16D
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 1120L AT AMELIA
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-16_1120L_NE_Amelia.out

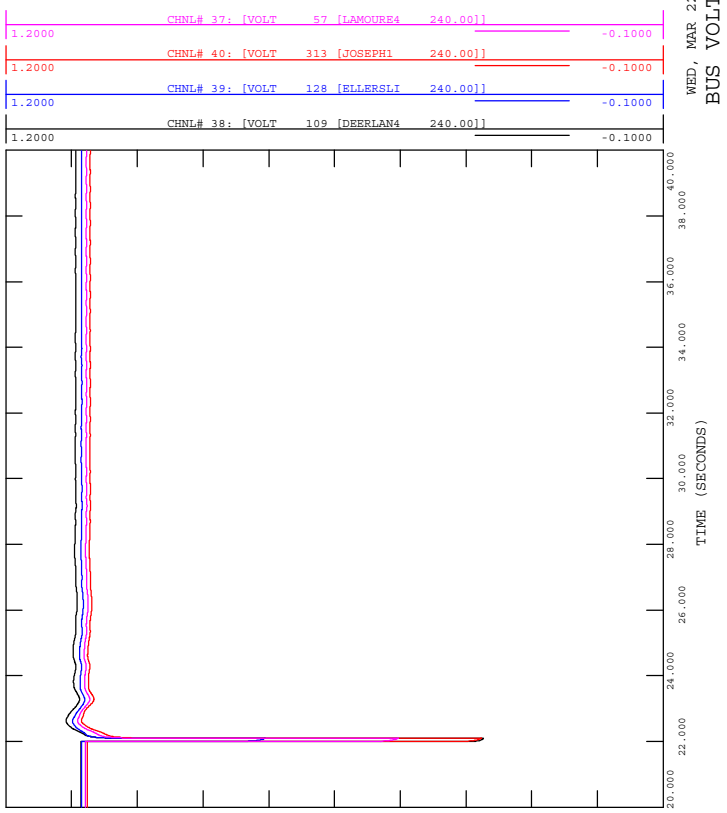

FIGURE D-16A
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 1120L AT AMELIA
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-16_1120L_NE_Amelia.out

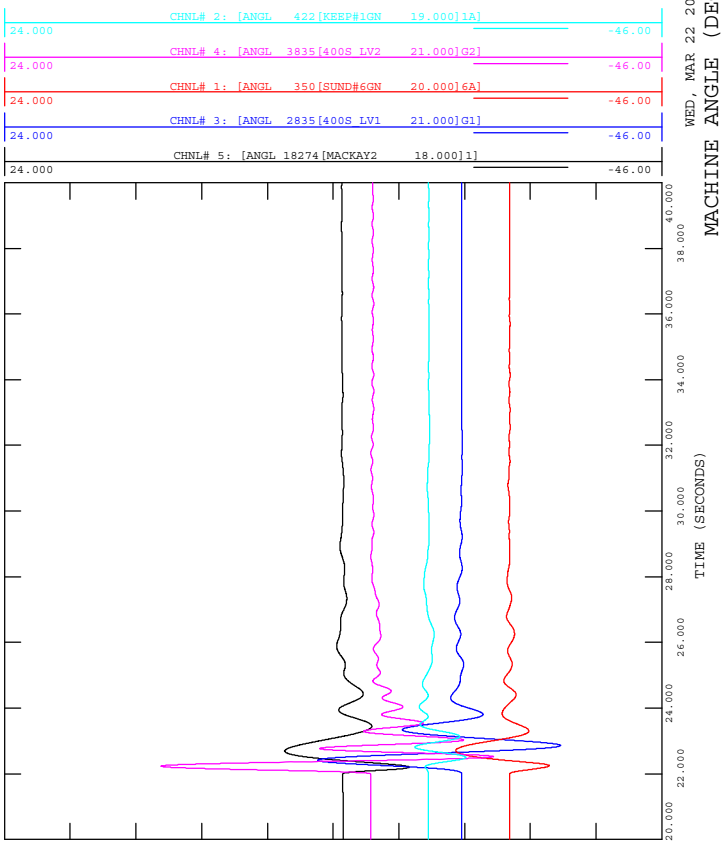

FIGURE D-16C
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 1120L AT AMELIA
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-16_1120L_NE_Amelia.out

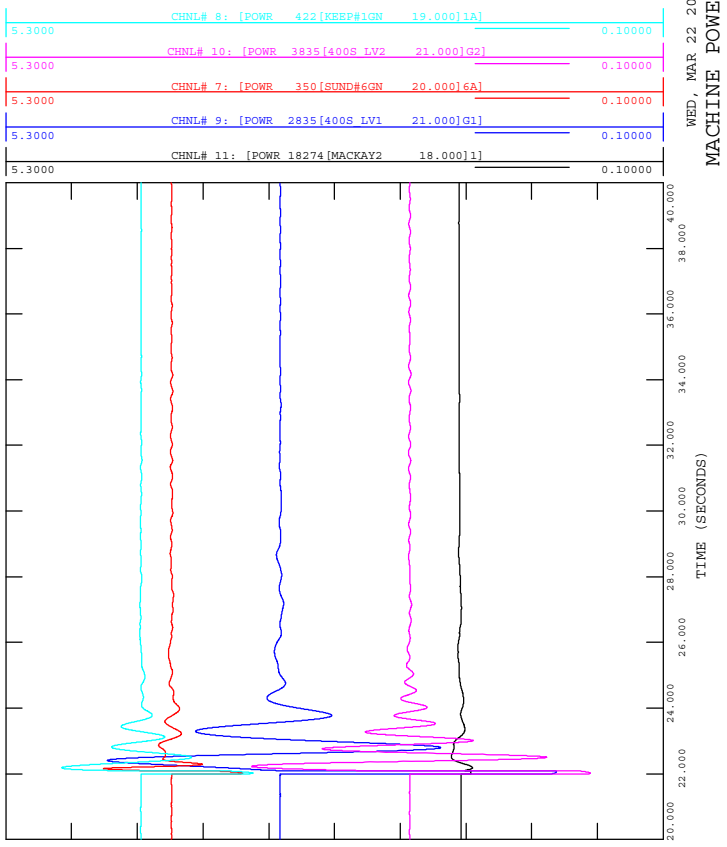

FIGURE D-16F
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 1120L AT AMELIA
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-16_1120L_NE_Amelia.out

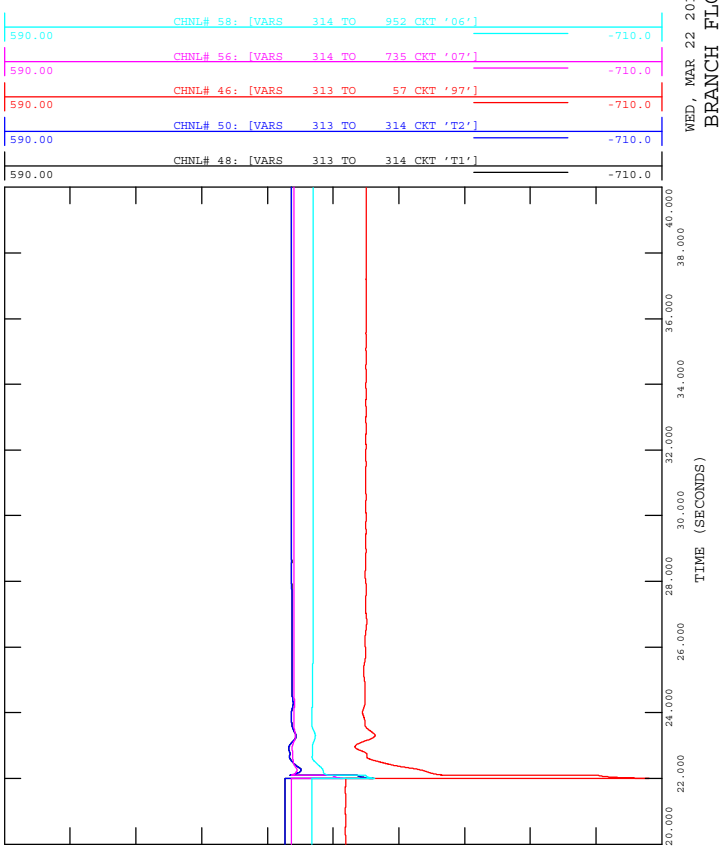

FIGURE D-16E
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 1120L AT AMELIA
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-16_1120L_NE_Amelia.out

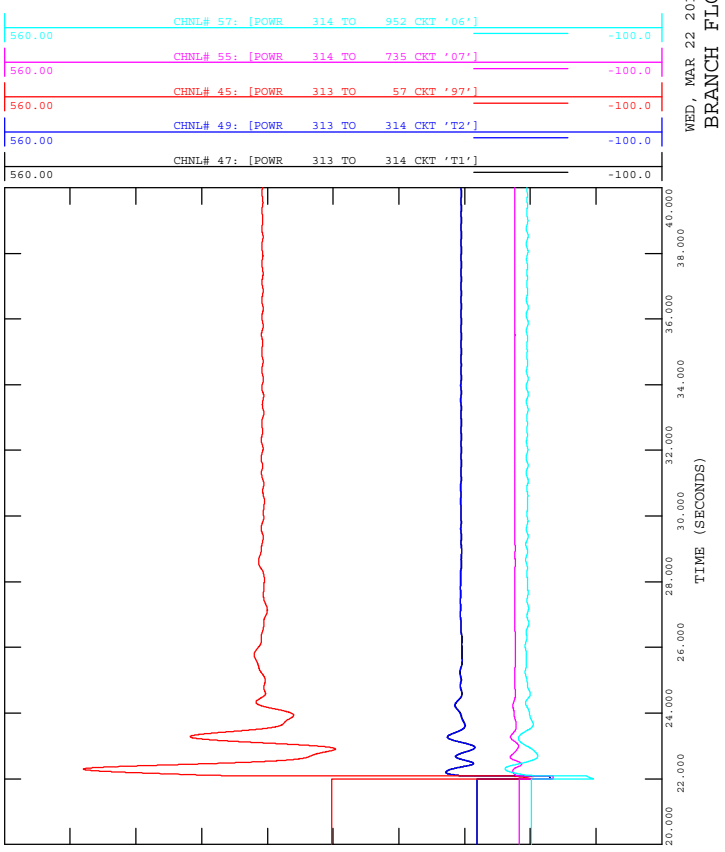

FIGURE D-17B
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 856L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-17_856L_NE_Josephburg.out

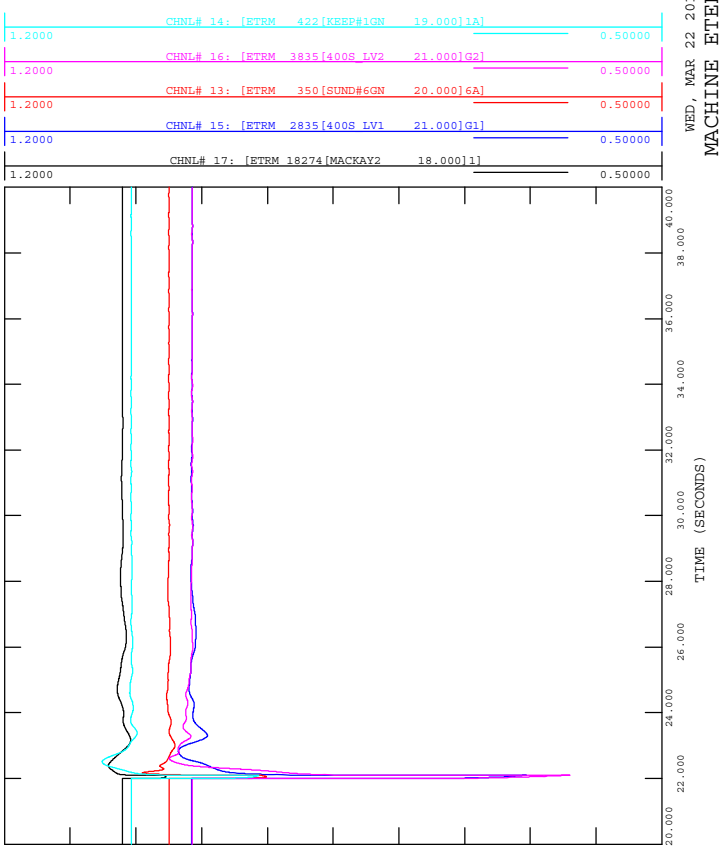

FIGURE D-17D
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 856L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-17_856L_NE_Josephburg.out

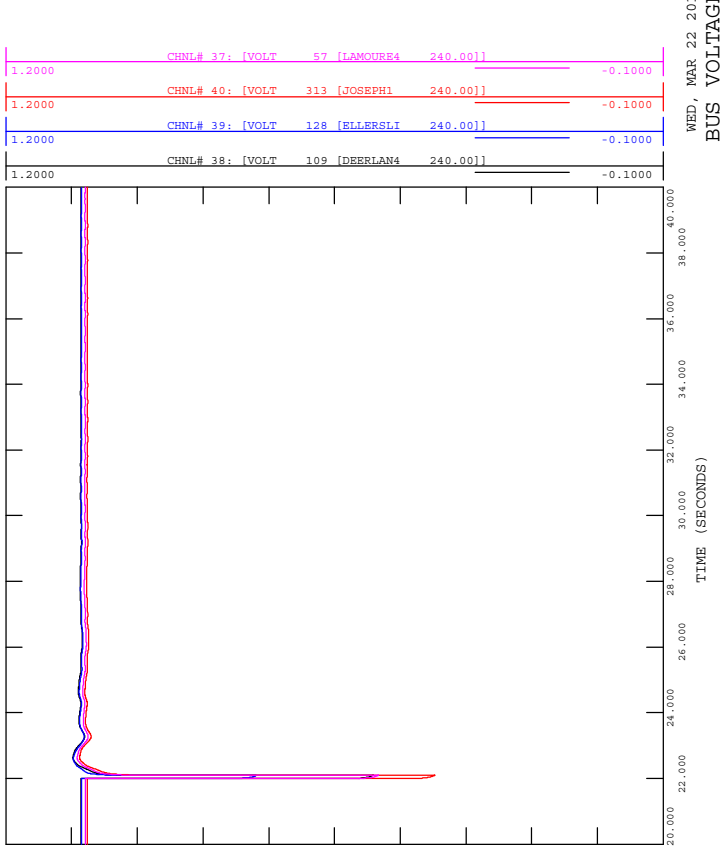

FIGURE D-17A
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 856L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-17_856L_NE_Josephburg.out

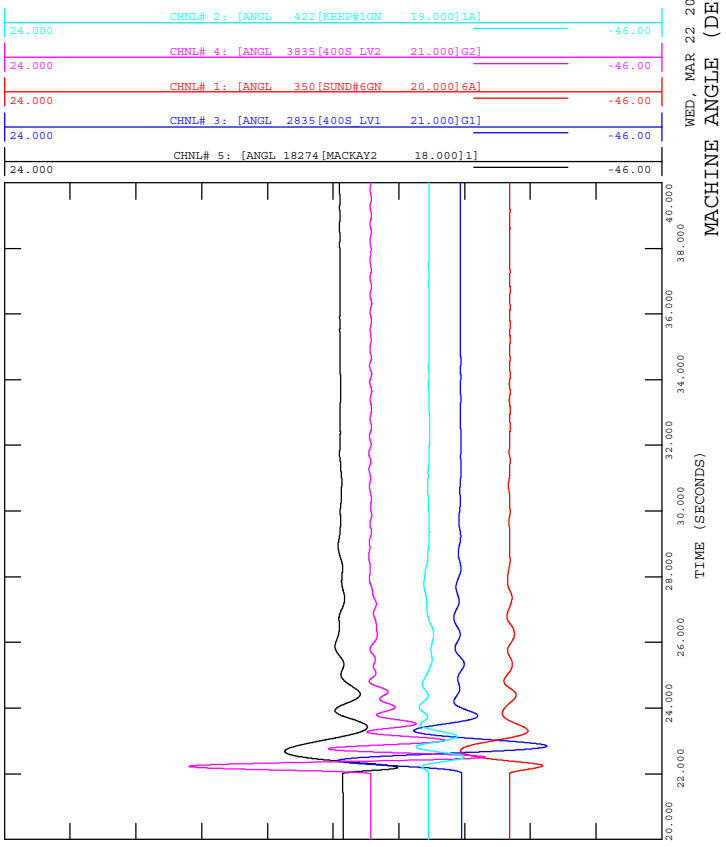

FIGURE D-17C
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 856L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-17_856L_NE_Josephburg.out

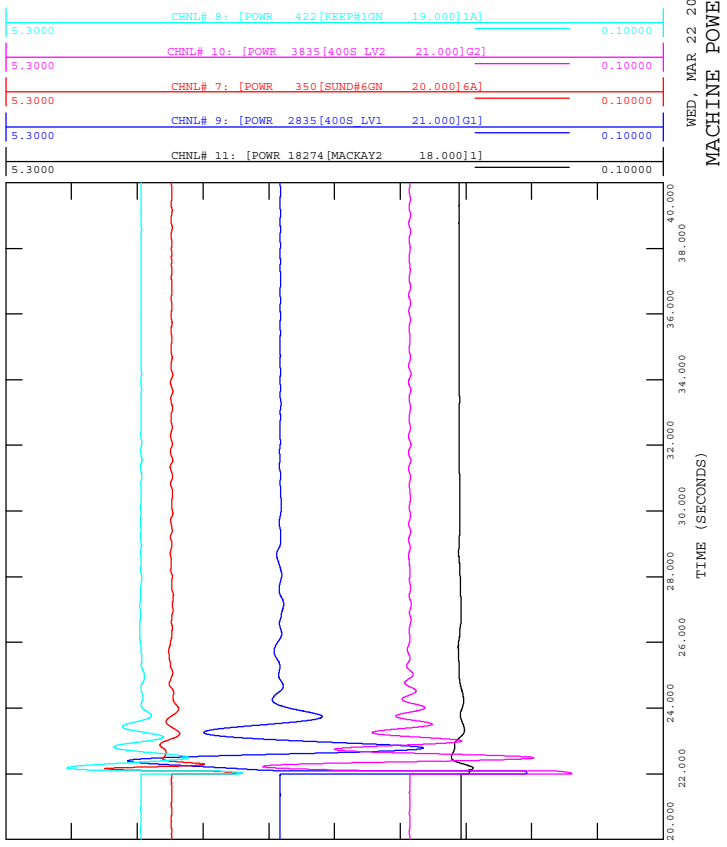

FIGURE D-17F
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 856L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES

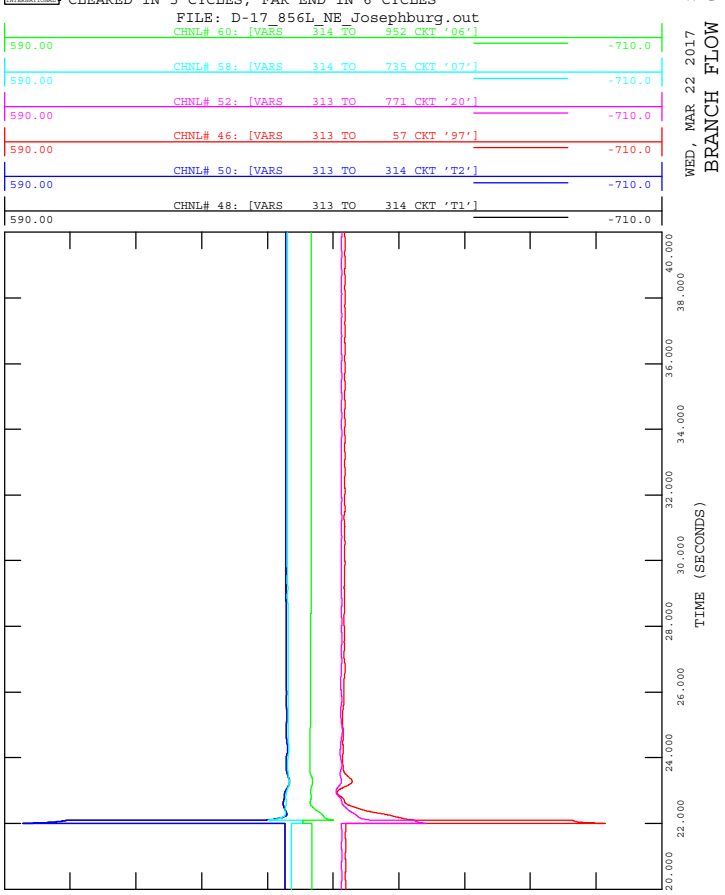

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FIGURE D-17E
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 856L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES

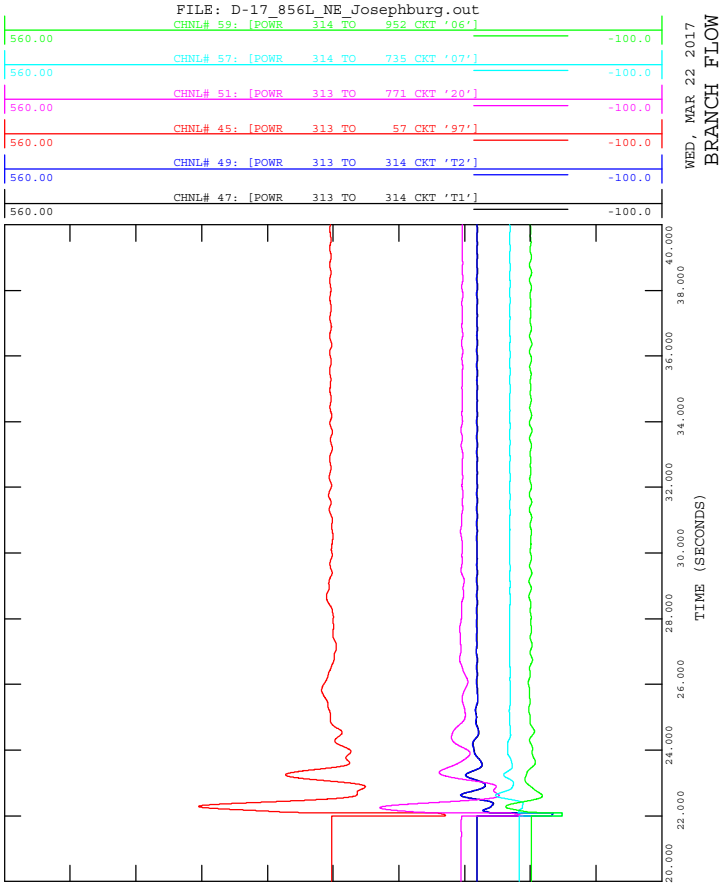

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FIGURE D-18B
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 856L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-18_856L_NE_Shell_Scotford.out

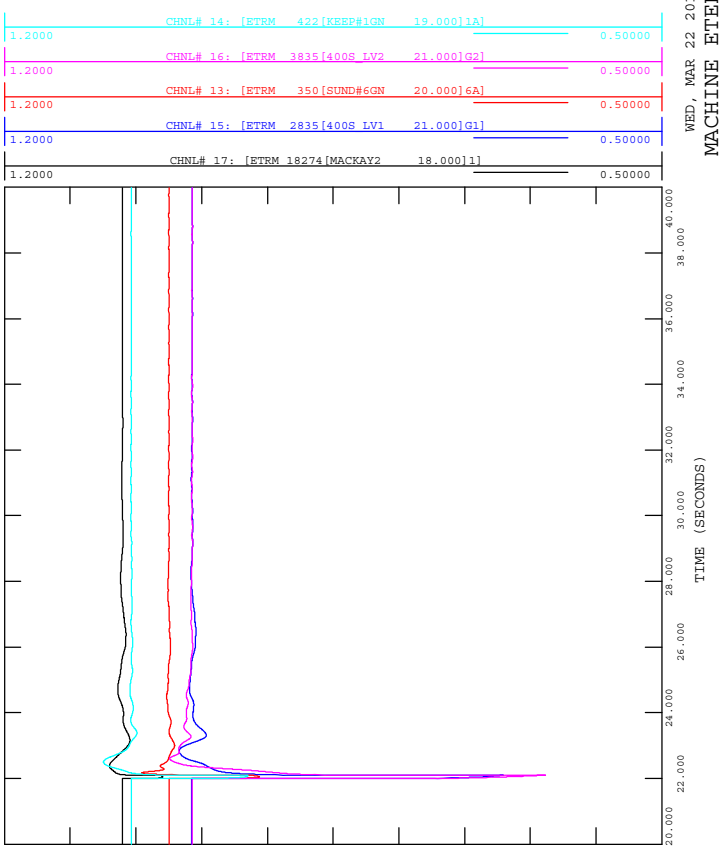


FIGURE D-18D
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 856L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-18_856L_NE_Shell_Scotford.out

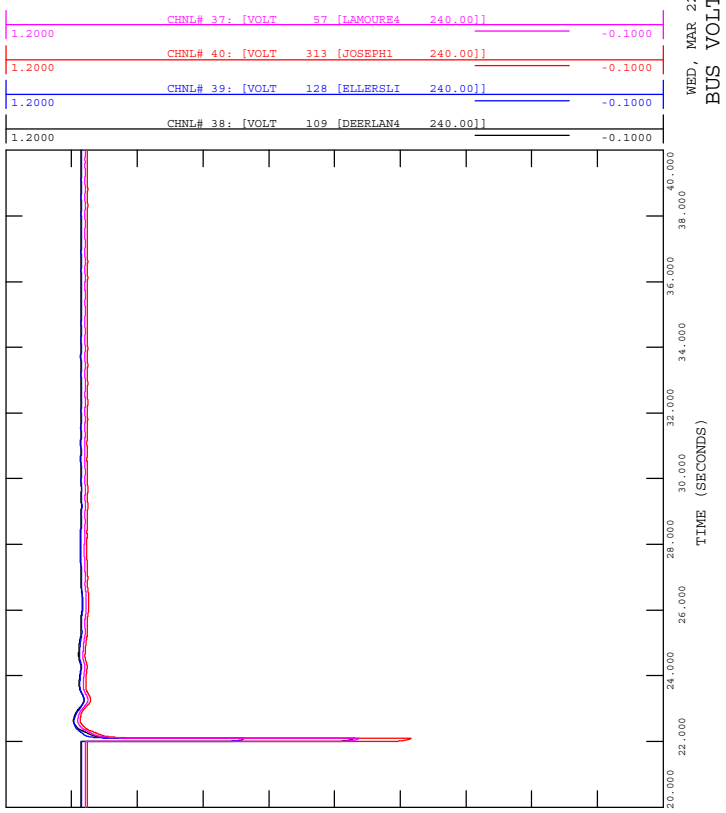


FIGURE D-18A
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 856L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-18_856L_NE_Shell_Scotford.out

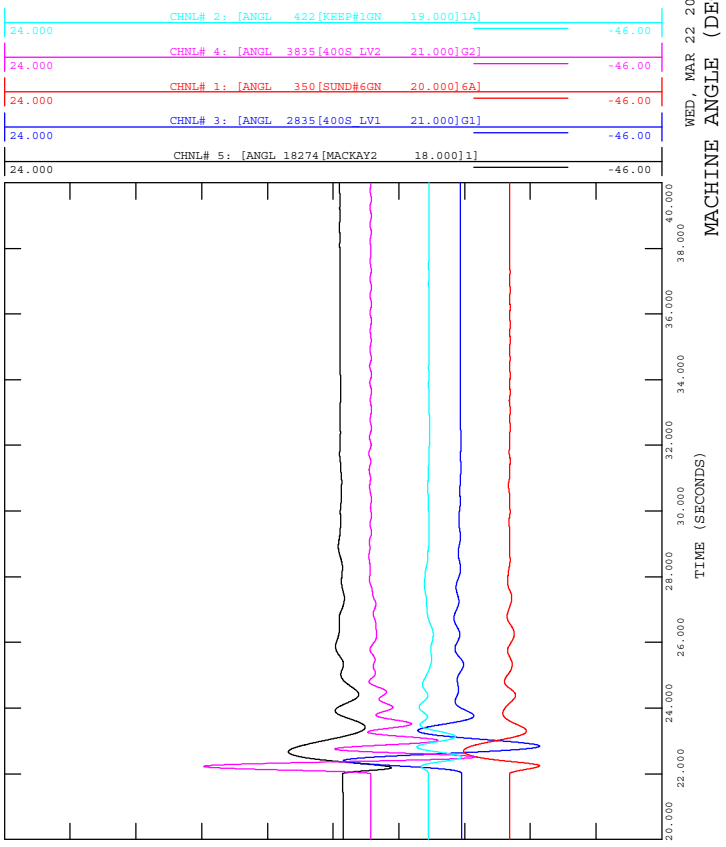


FIGURE D-18C
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 856L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-18_856L_NE_Shell_Scotford.out

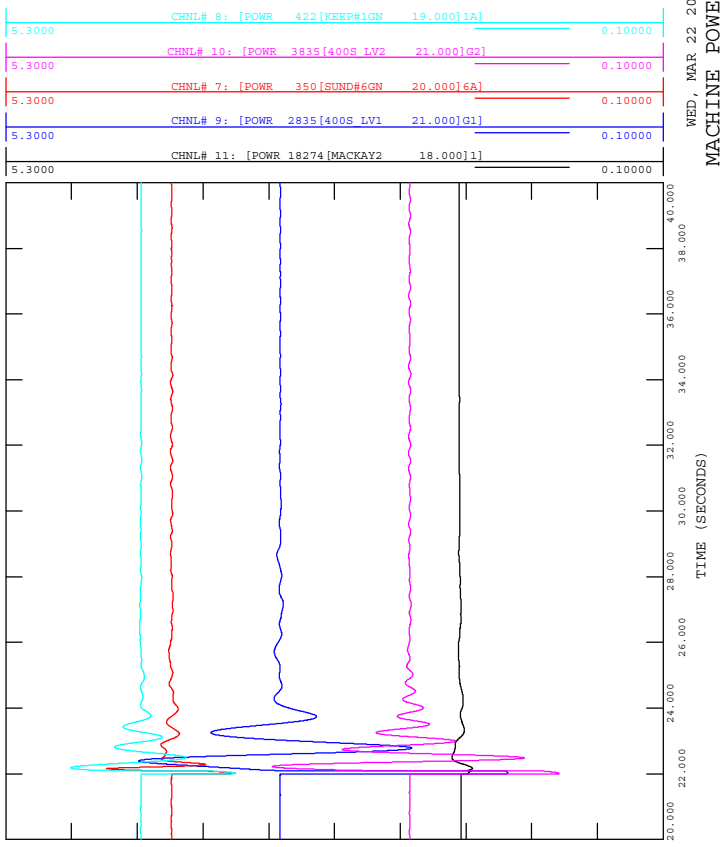
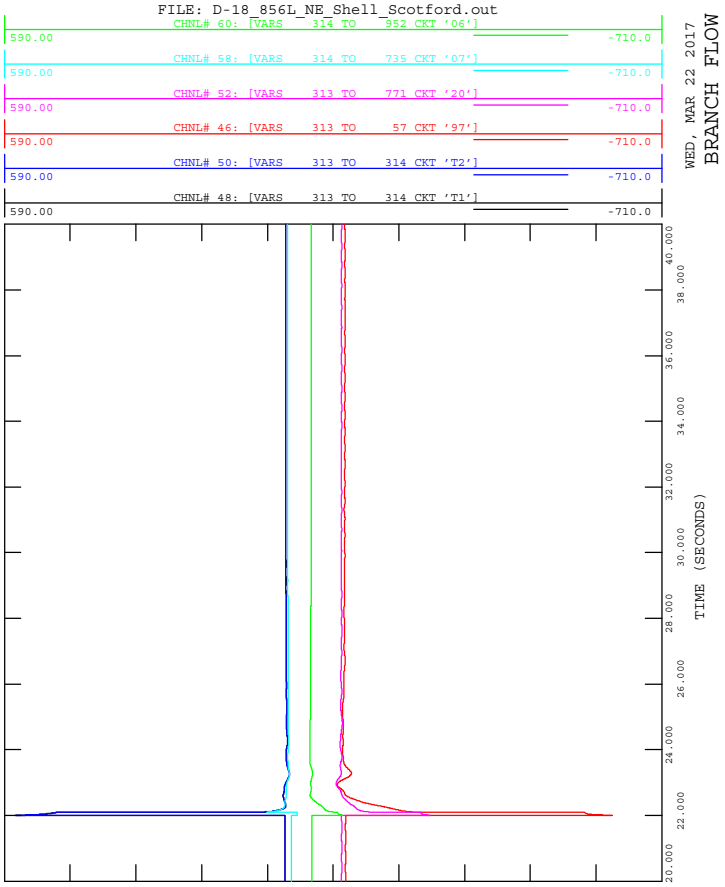


FIGURE D-18F
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 856L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-18_856L_NE_Shell_Scotford.out



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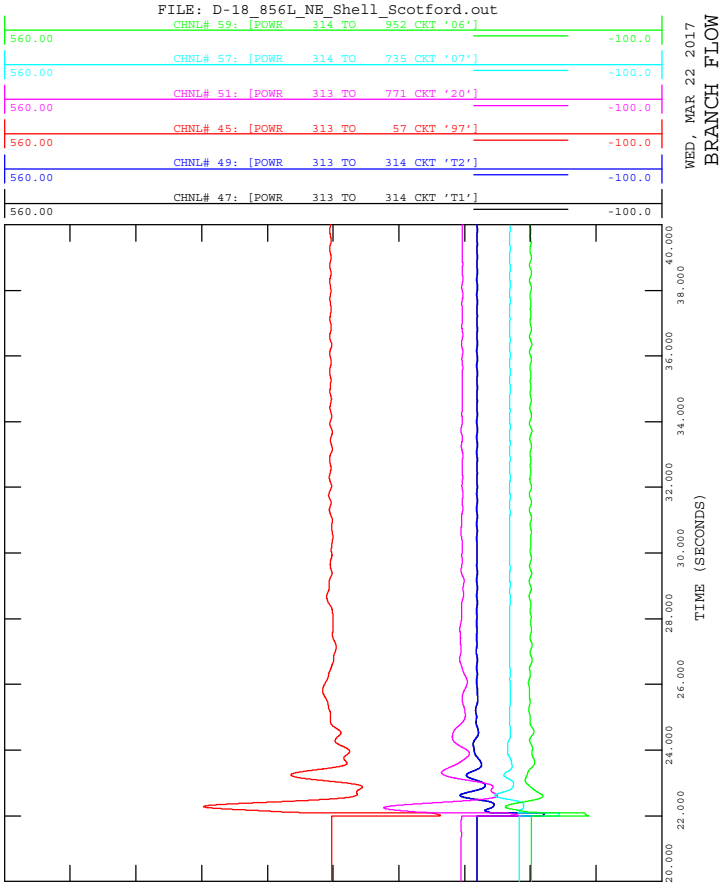
BRANCH FLOW (Q)

FIGURE D-18E
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 856L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-18_856L_NE_Shell_Scotford.out



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BRANCH FLOW (P)

FIGURE D-19B
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 857L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-19_857L_NE_Josephburg.out

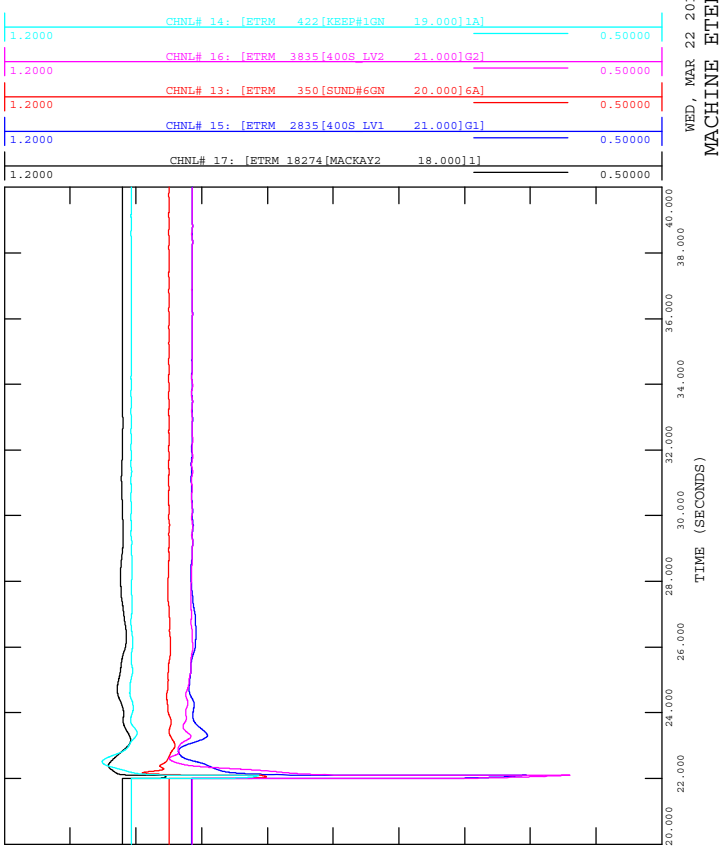

FIGURE D-19D
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 857L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-19_857L_NE_Josephburg.out

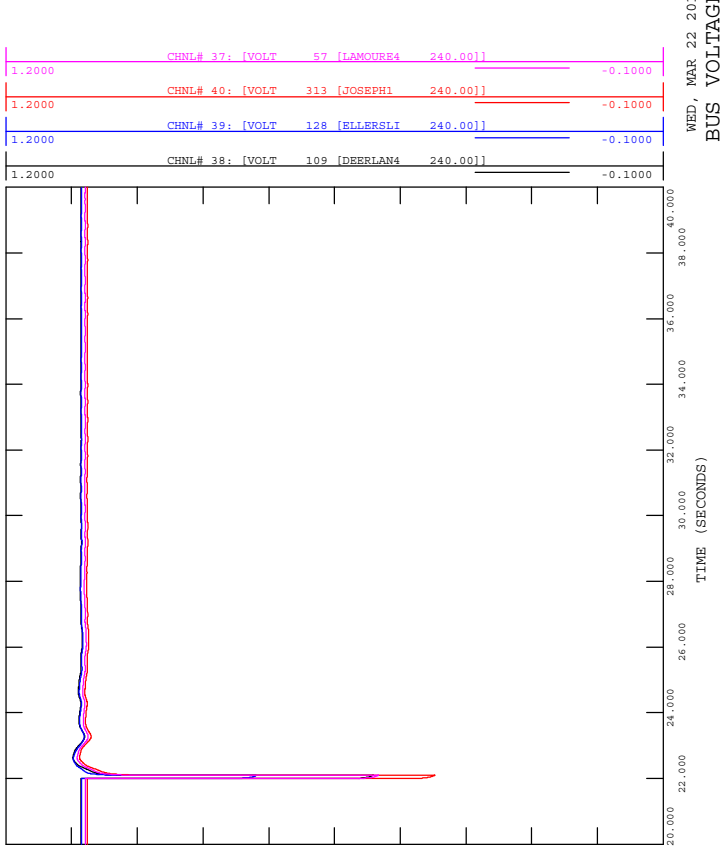

FIGURE D-19A
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 857L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-19_857L_NE_Josephburg.out

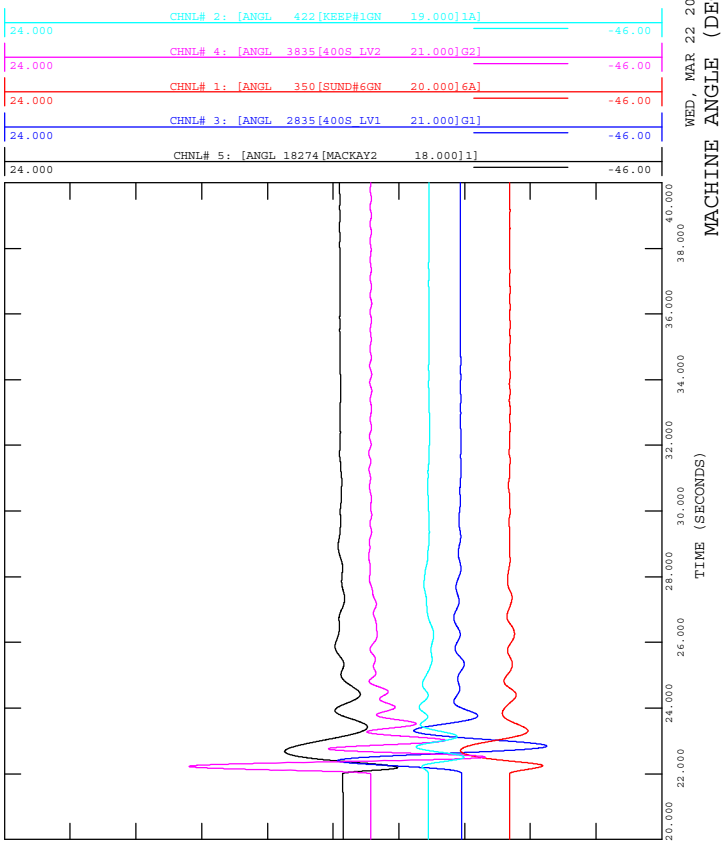

FIGURE D-19C
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 857L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-19_857L_NE_Josephburg.out

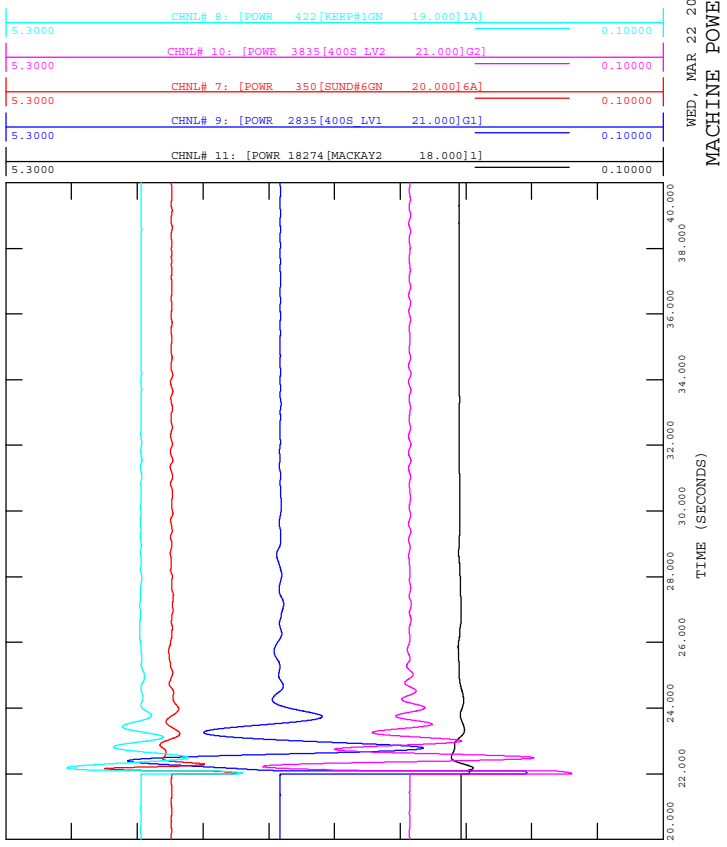

FIGURE D-19F
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 857L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES

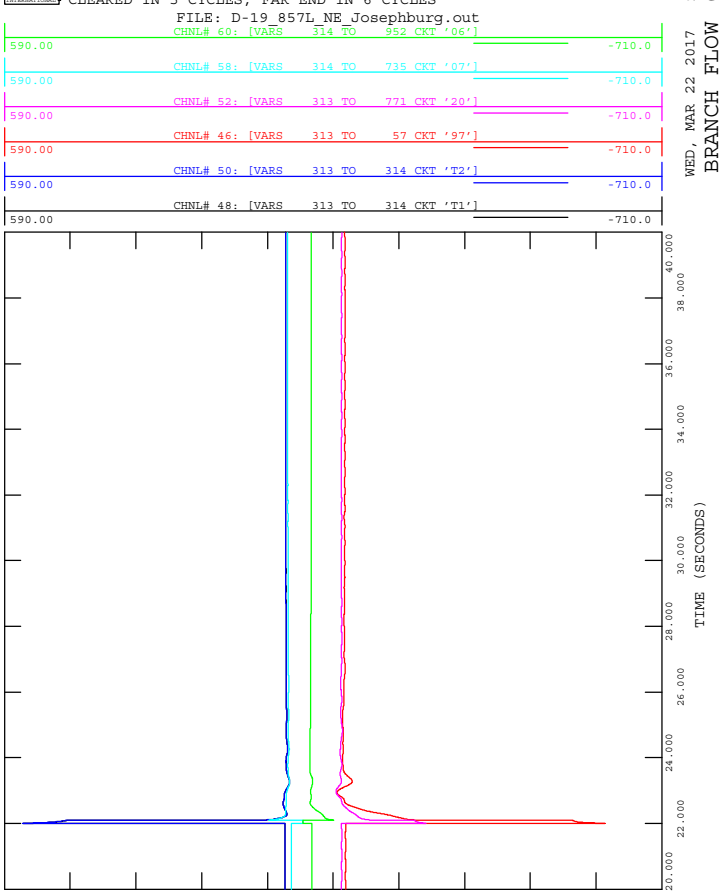

FIGURE D-19E
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 857L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES

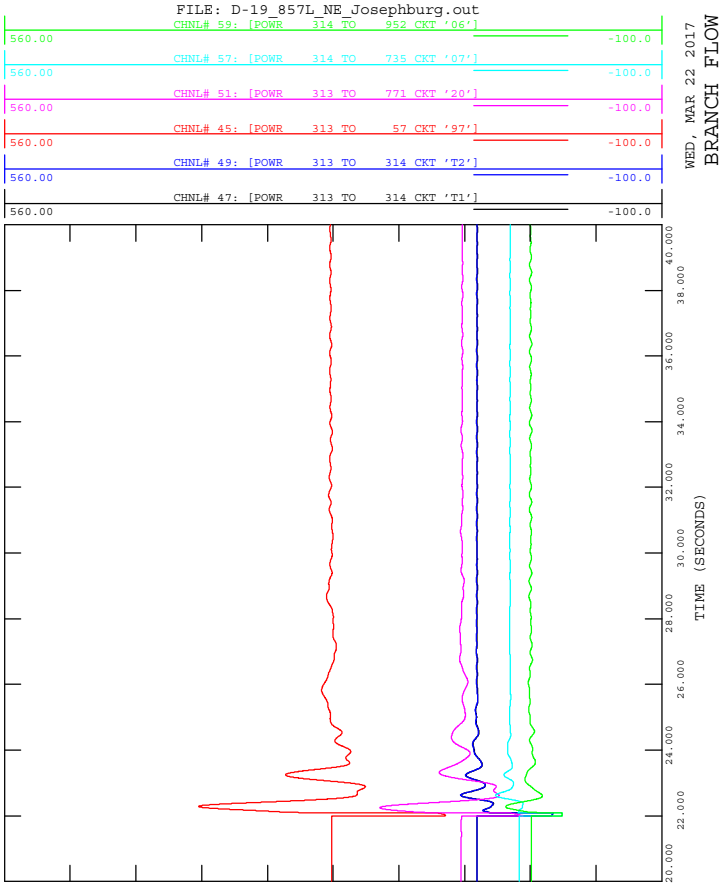

FIGURE D-20B
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 857L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-20_857L_NE_Shell_Scotford.out

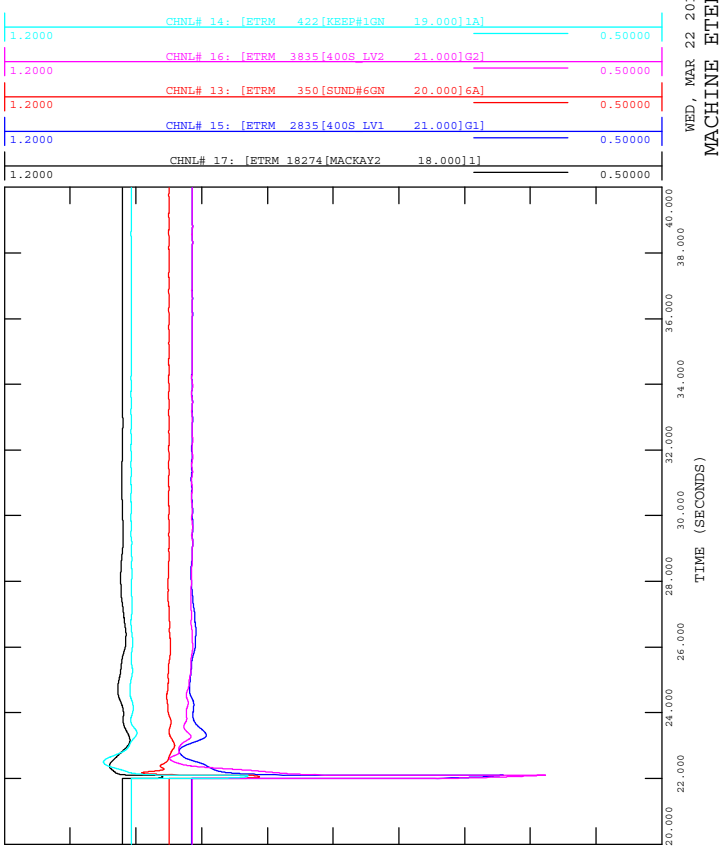

FIGURE D-20D
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 857L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-20_857L_NE_Shell_Scotford.out

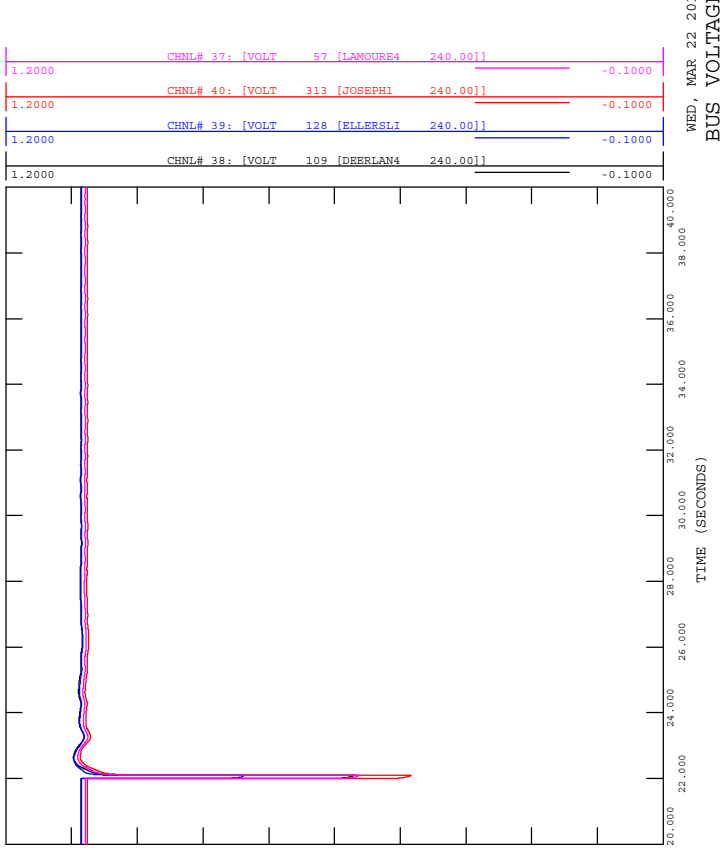

FIGURE D-20A
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 857L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-20_857L_NE_Shell_Scotford.out

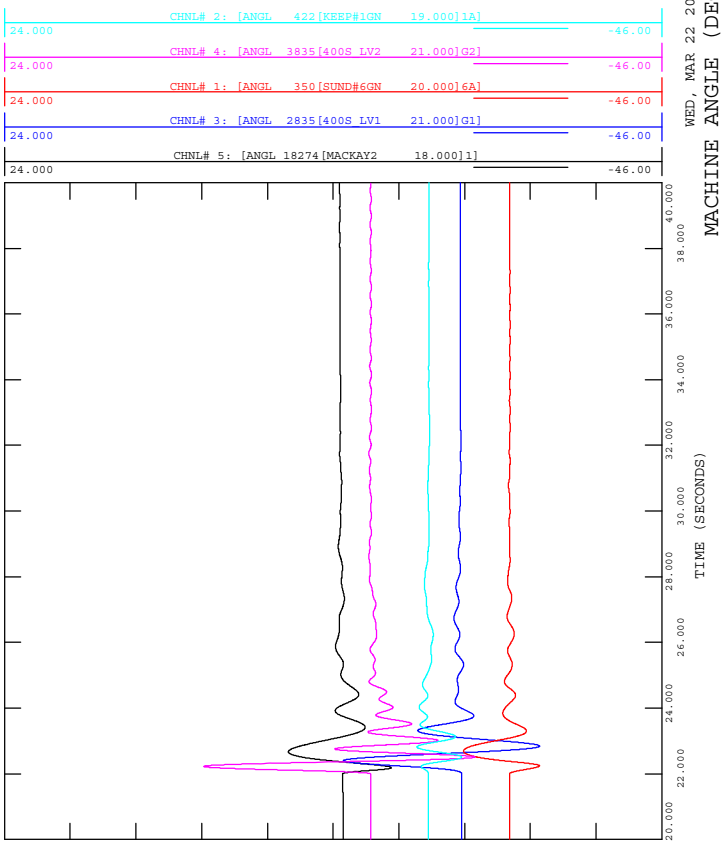

FIGURE D-20C
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 857L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-20_857L_NE_Shell_Scotford.out

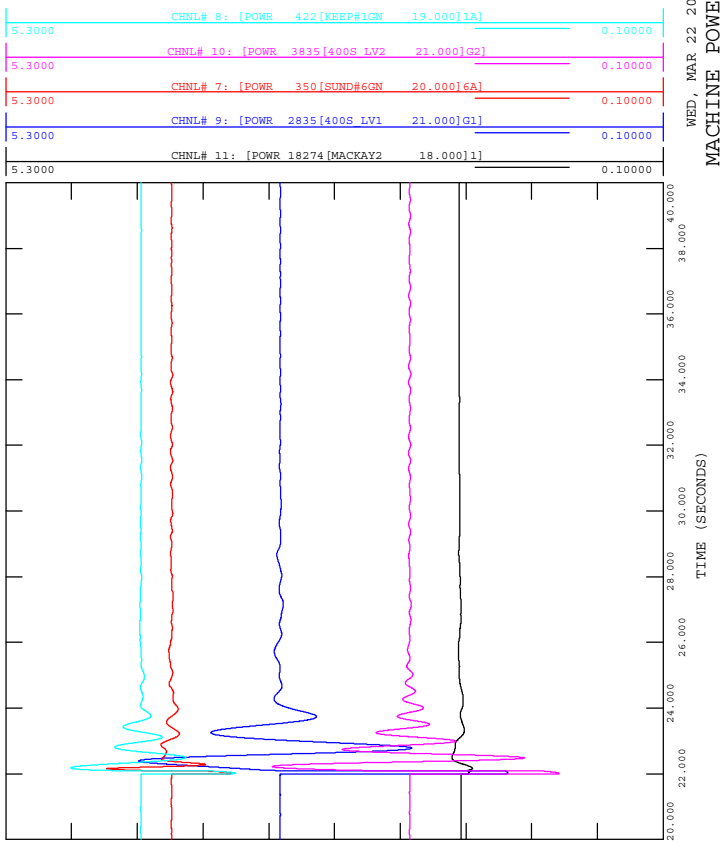

FIGURE D-20F
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 857L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-20_857L_NE_Shell_Scotford.out

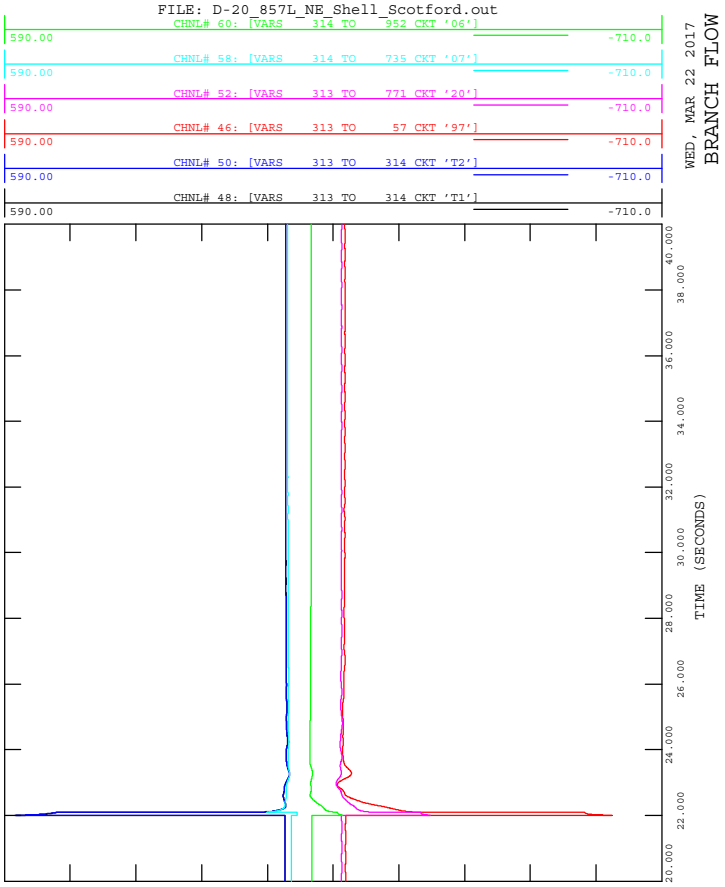

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FIGURE D-20E
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 857L AT SHELL SCOTFORD
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-20_857L_NE_Shell_Scotford.out

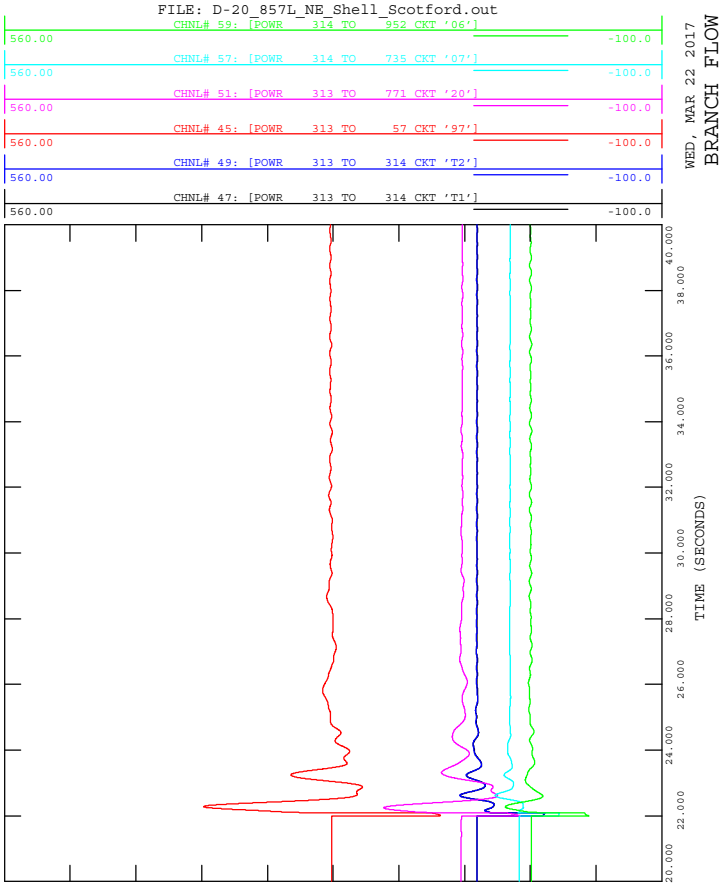

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FIGURE D-21B
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 706L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-21_706L_NE_Josephburg.out

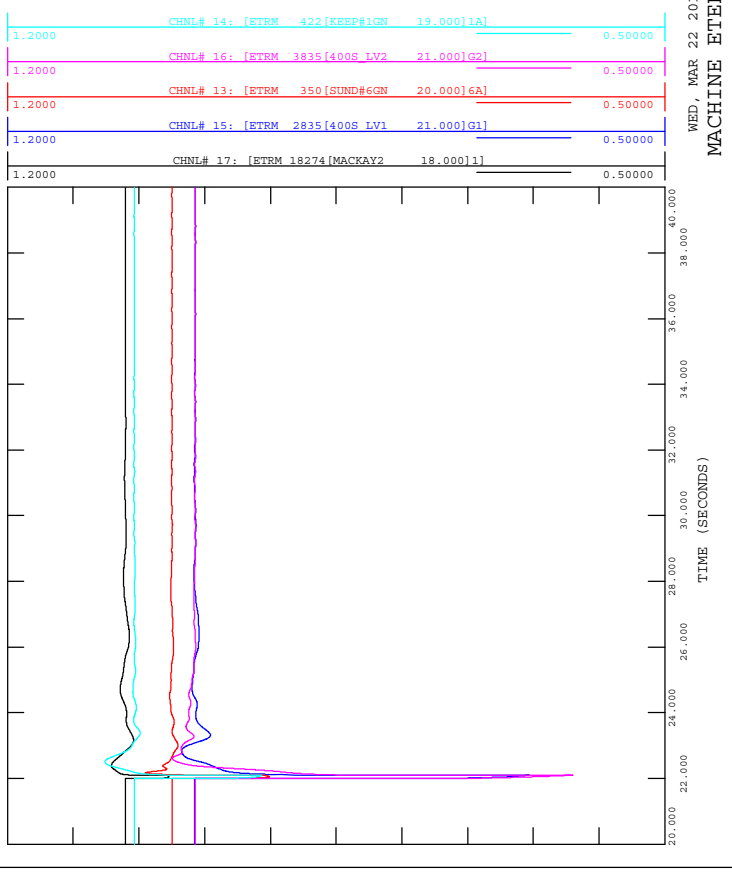

FIGURE D-21D
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 706L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-21_706L_NE_Josephburg.out

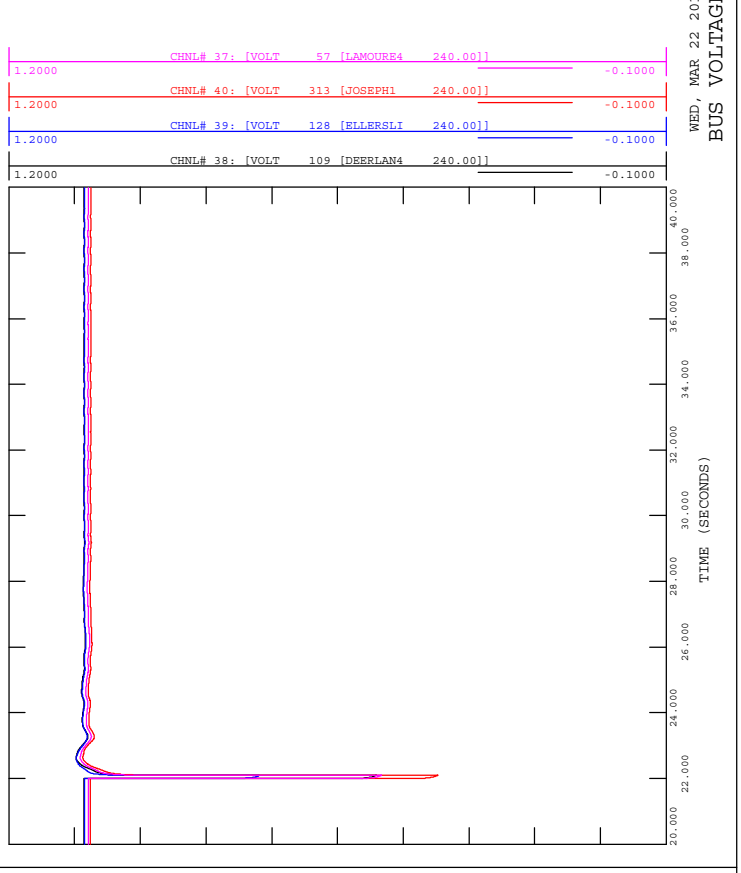

FIGURE D-21A
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 706L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-21_706L_NE_Josephburg.out

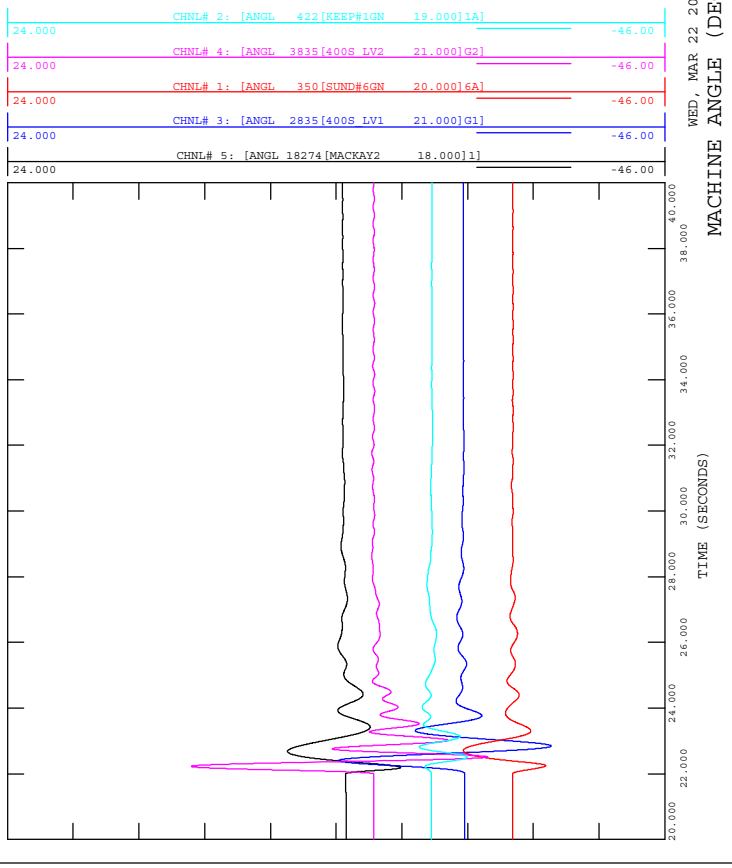

FIGURE D-21C
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 706L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-21_706L_NE_Josephburg.out

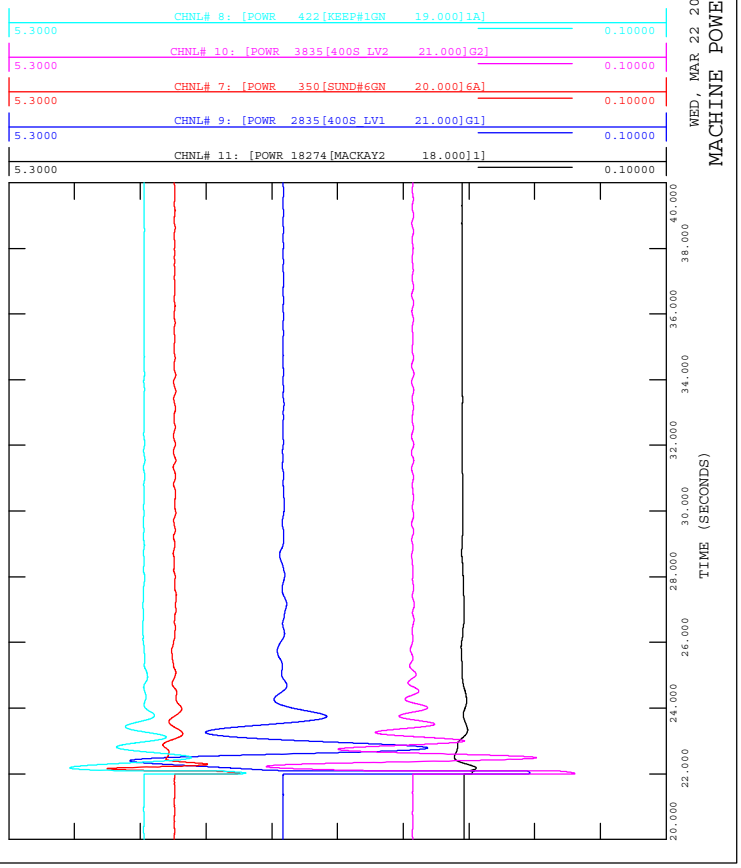

FIGURE D-21F
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 706L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-21_706L_NE_Josephburg.out

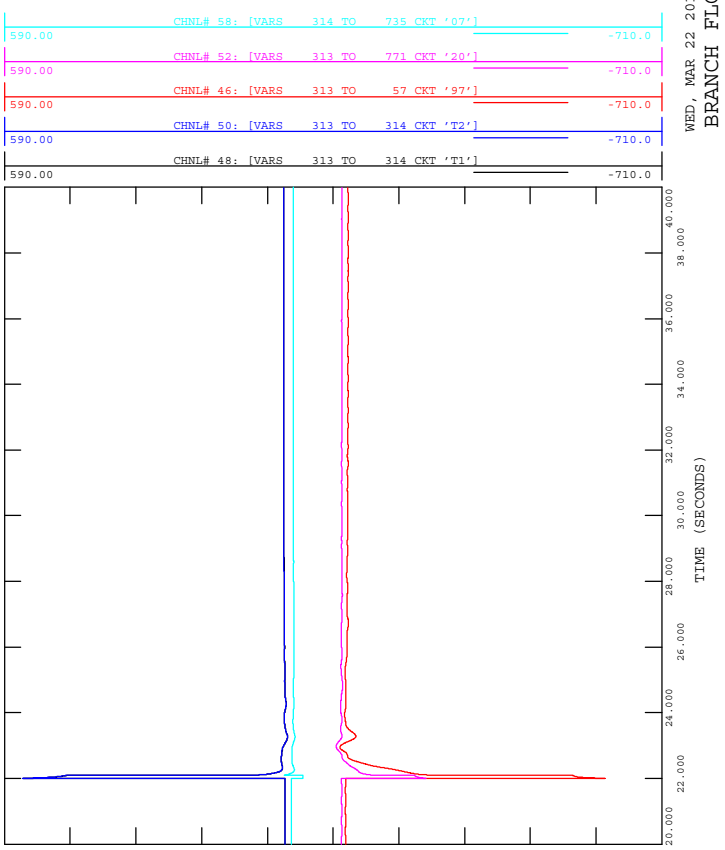

FIGURE D-21E
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 706L AT JOSEPHBURG
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-21_706L_NE_Josephburg.out

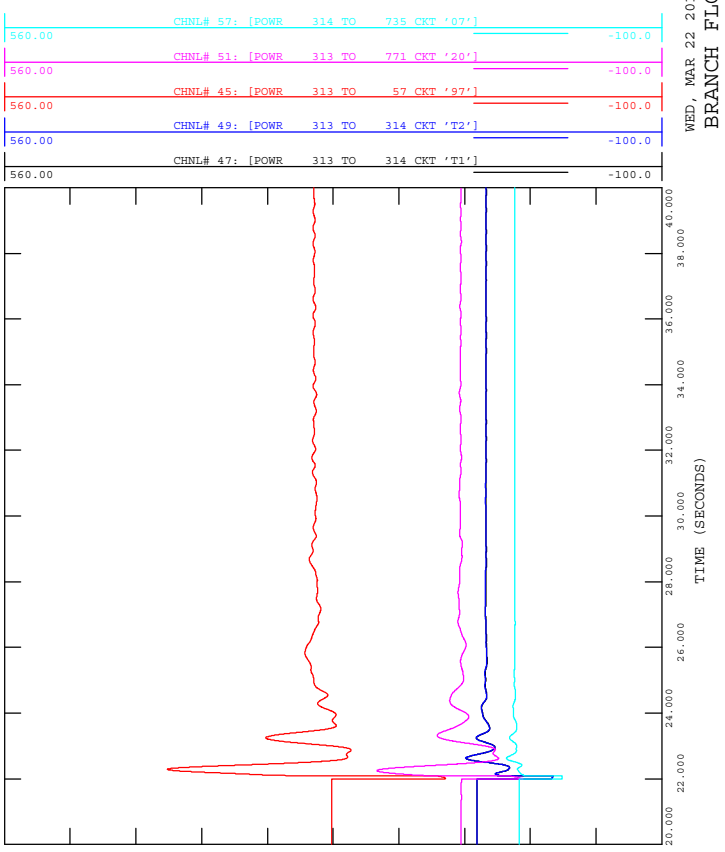

FIGURE D-22B
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 706L AT FT. SASK
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-22_706L_NE_Ft_Sask.out

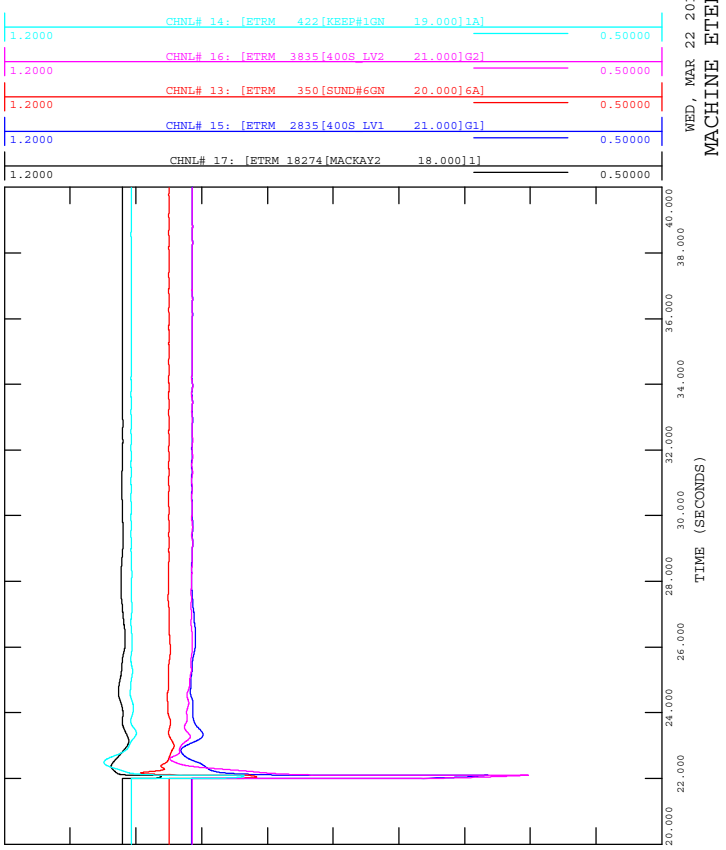

FIGURE D-22D
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 706L AT FT. SASK
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-22_706L_NE_Ft_Sask.out

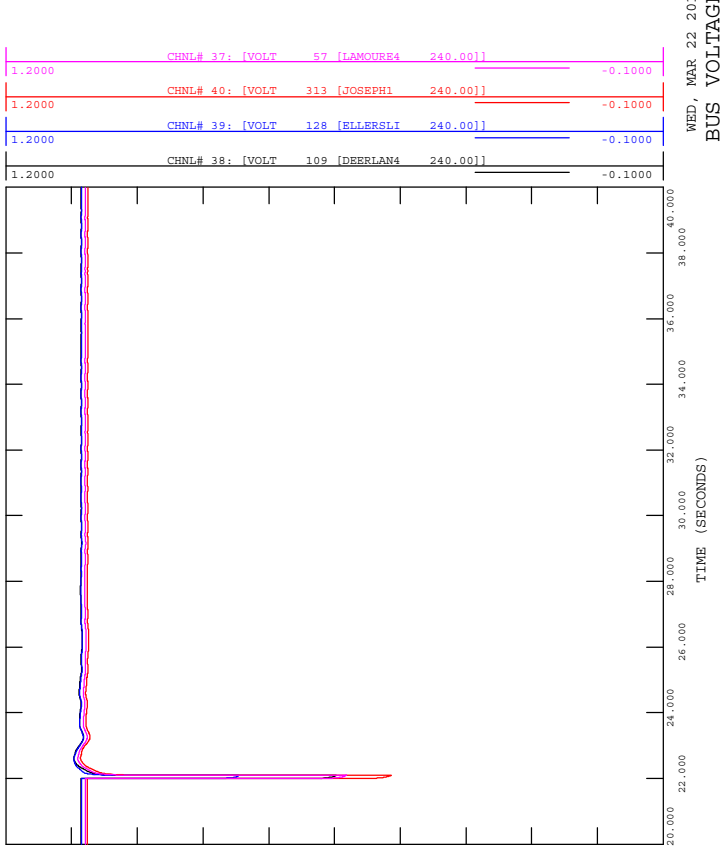

FIGURE D-22A
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 706L AT FT. SASK
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-22_706L_NE_Ft_Sask.out

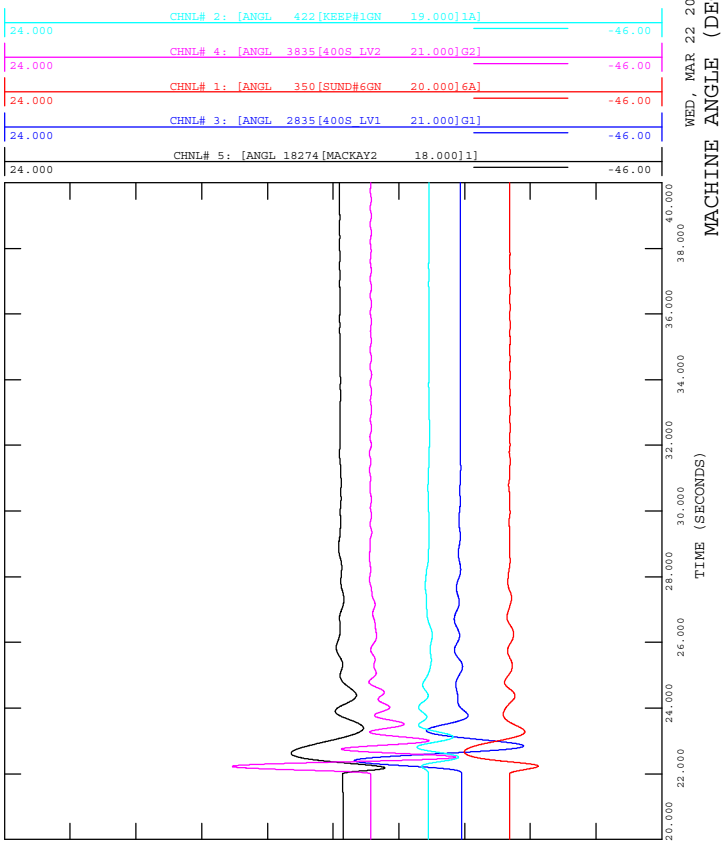

FIGURE D-22C
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 706L AT FT. SASK
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-22_706L_NE_Ft_Sask.out

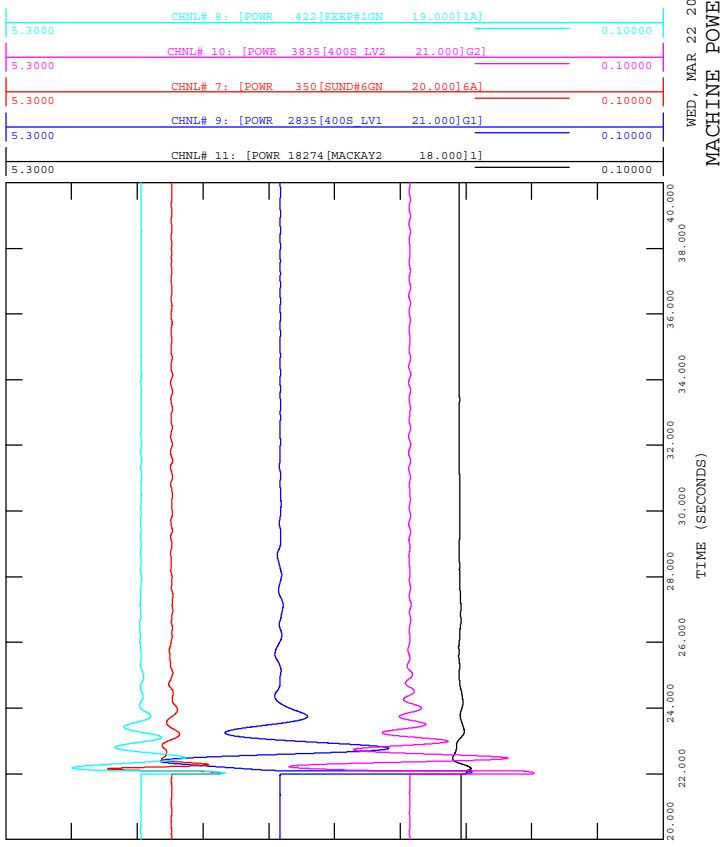

FIGURE D-22F
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 706L AT FT. SASK
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-22_706L_NE_Ft_Sask.out

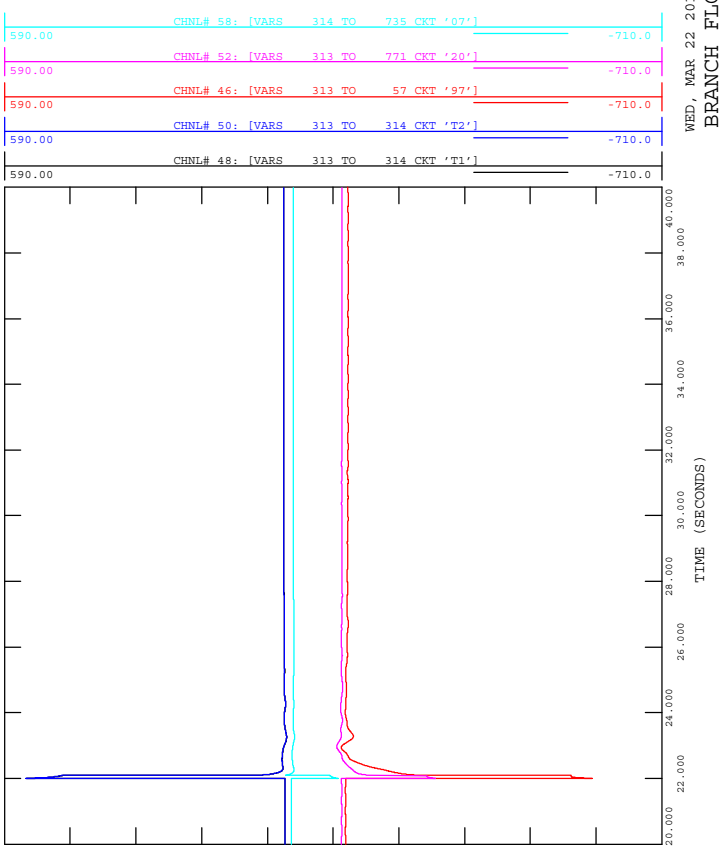

FIGURE D-22E
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 706L AT FT. SASK
CLEARED IN 5 CYCLES, FAR END IN 6 CYCLES
FILE: D-22_706L_NE_Ft_Sask.out

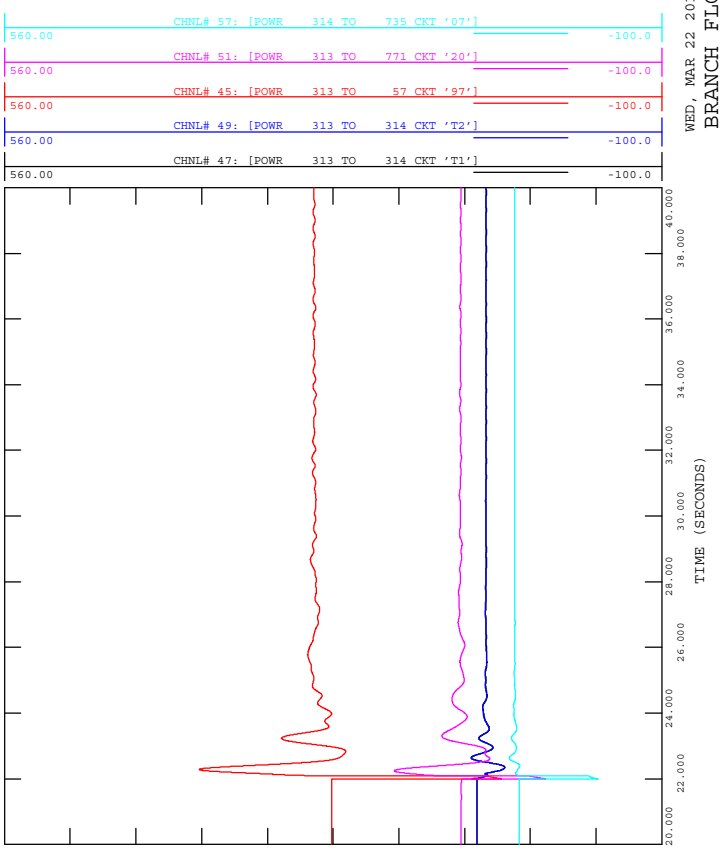

FIGURE D-23B
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 776L AT JOSEPHBURG
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-23_776L_NE_Josephburg.out

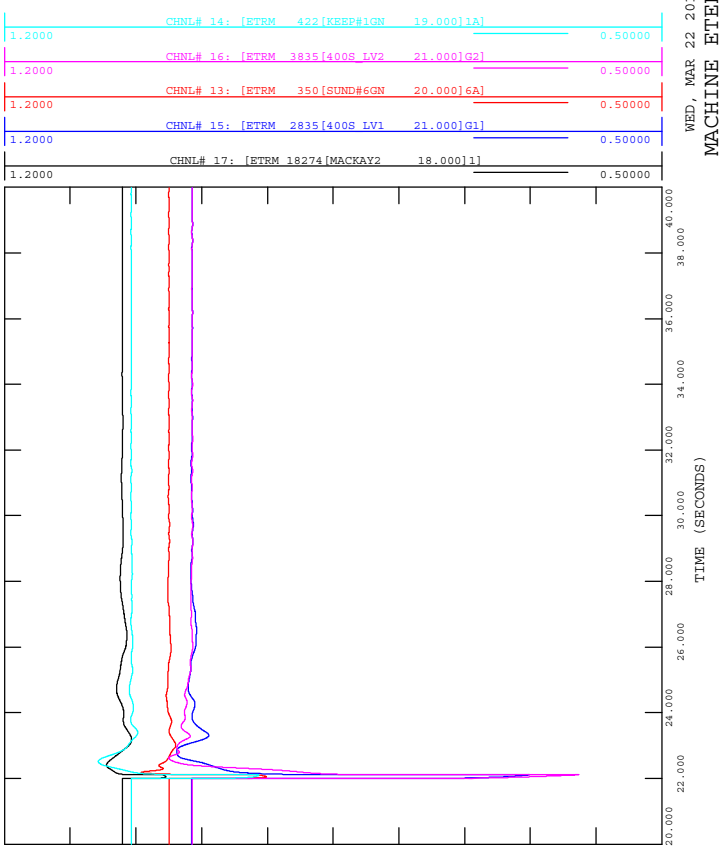

FIGURE D-23D
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 776L AT JOSEPHBURG
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-23_776L_NE_Josephburg.out

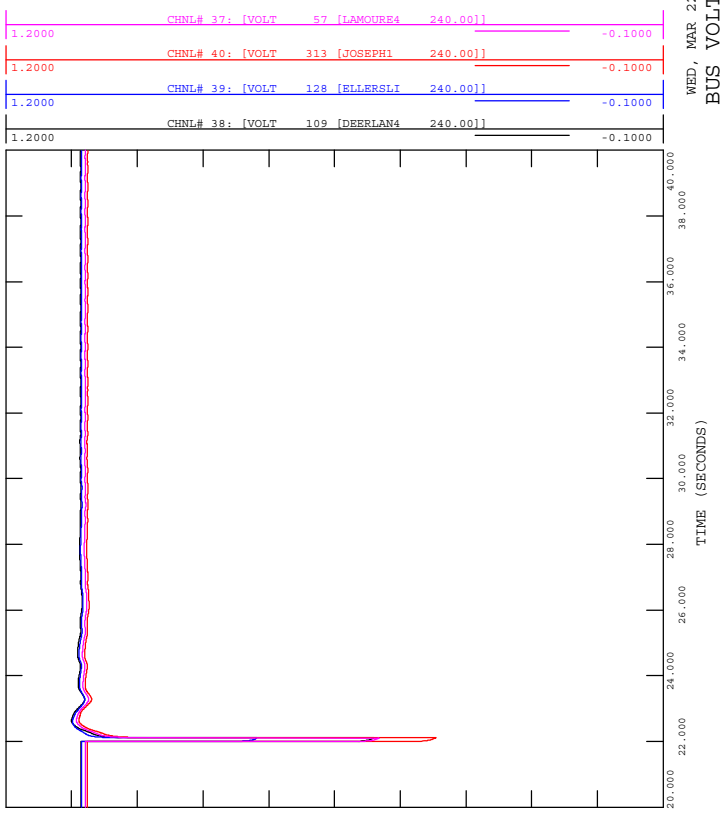

FIGURE D-23A
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 776L AT JOSEPHBURG
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-23_776L_NE_Josephburg.out

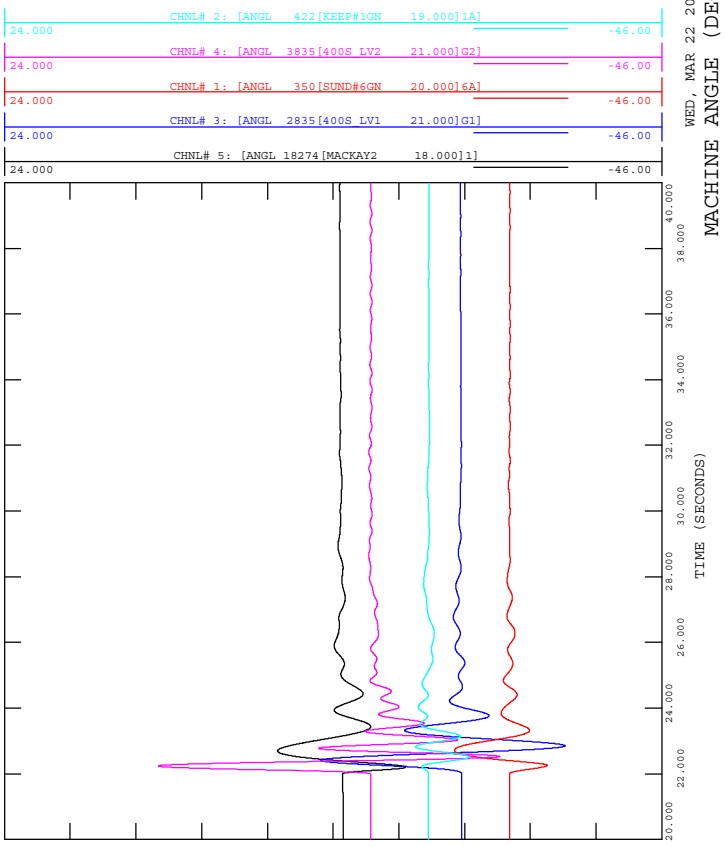

FIGURE D-23C
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 776L AT JOSEPHBURG
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-23_776L_NE_Josephburg.out

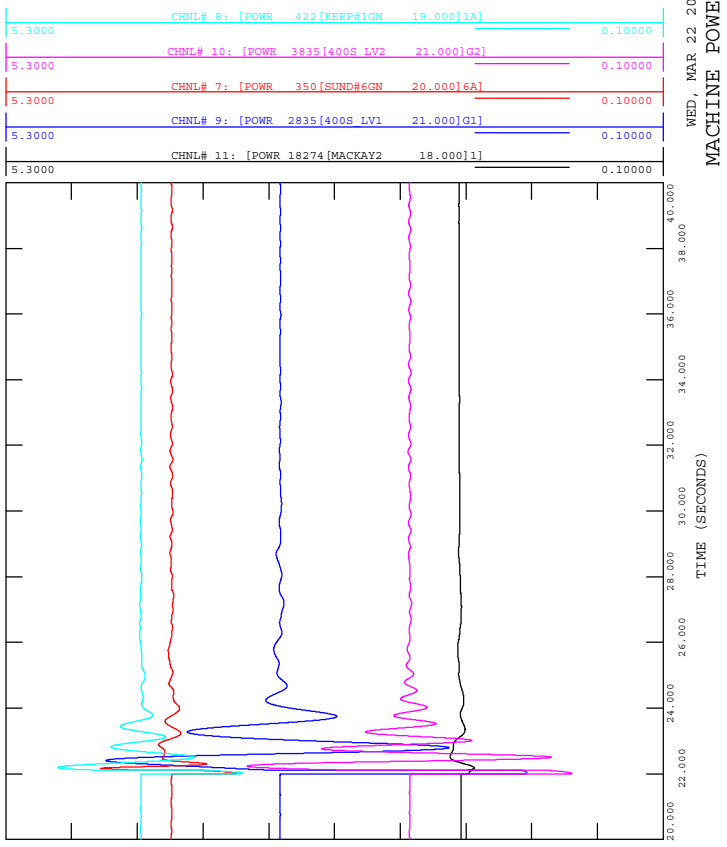

FIGURE D-23F
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 776L AT JOSEPHBURG
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES

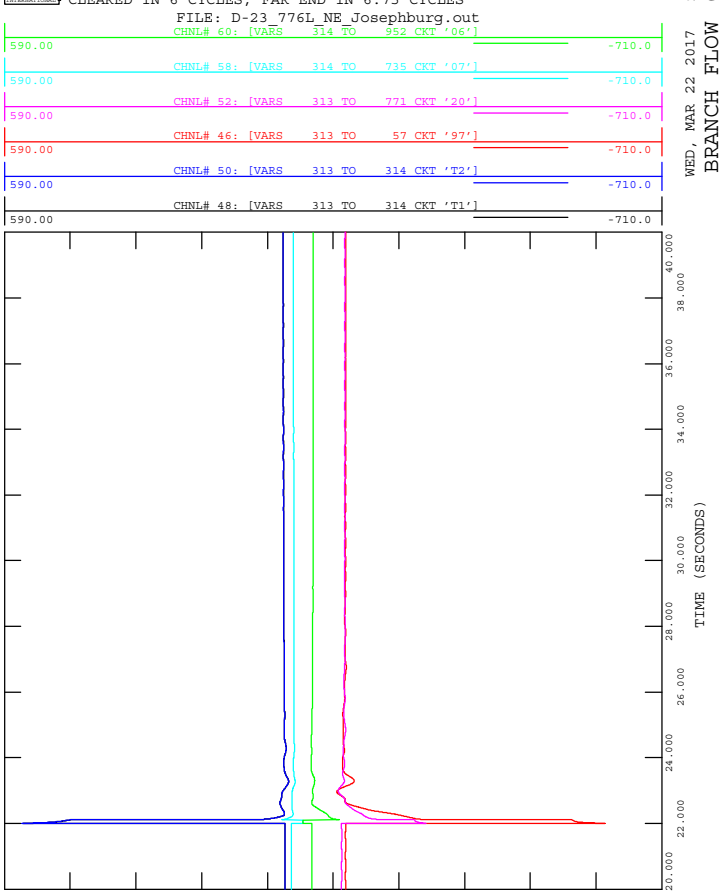

FIGURE D-23E
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 776L AT JOSEPHBURG
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES

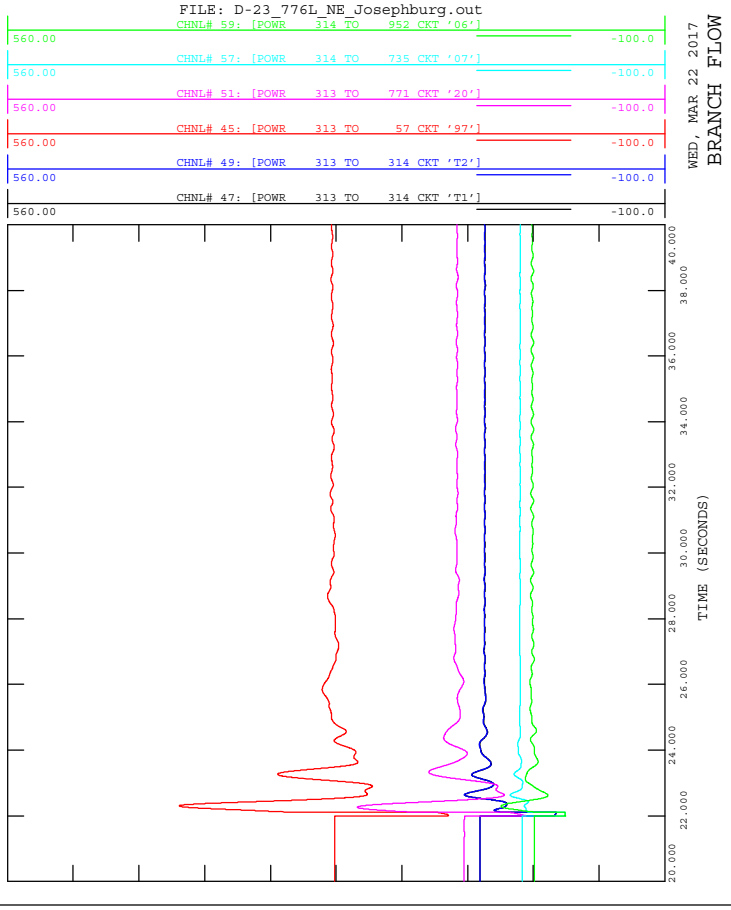

FIGURE D-24B
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 776L AT BEAVERHILL CREEK
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-24_776L_NE_Beaverhill_Ck.out

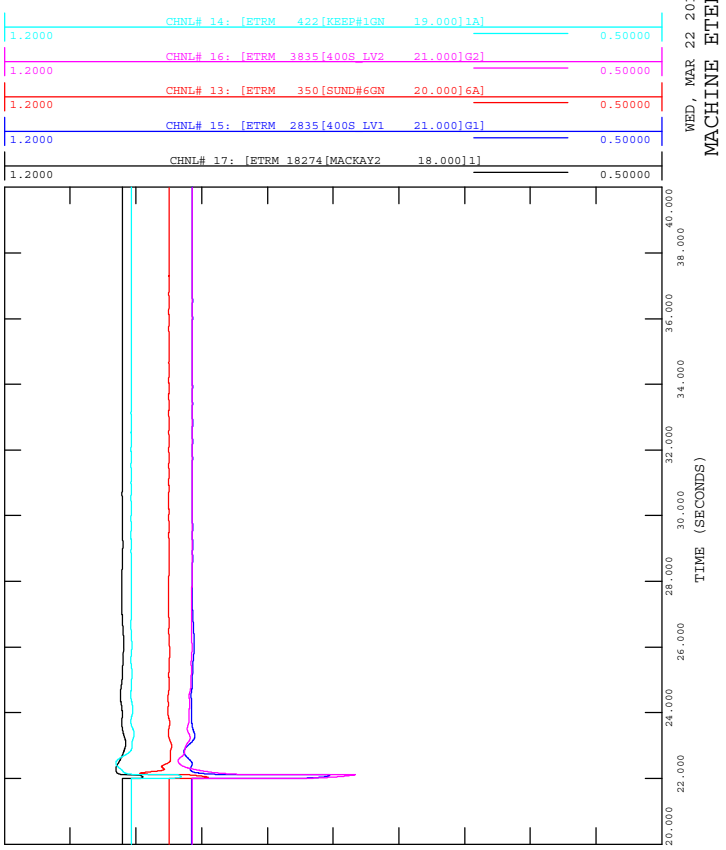

FIGURE D-24D
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 776L AT BEAVERHILL CREEK
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-24_776L_NE_Beaverhill_Ck.out

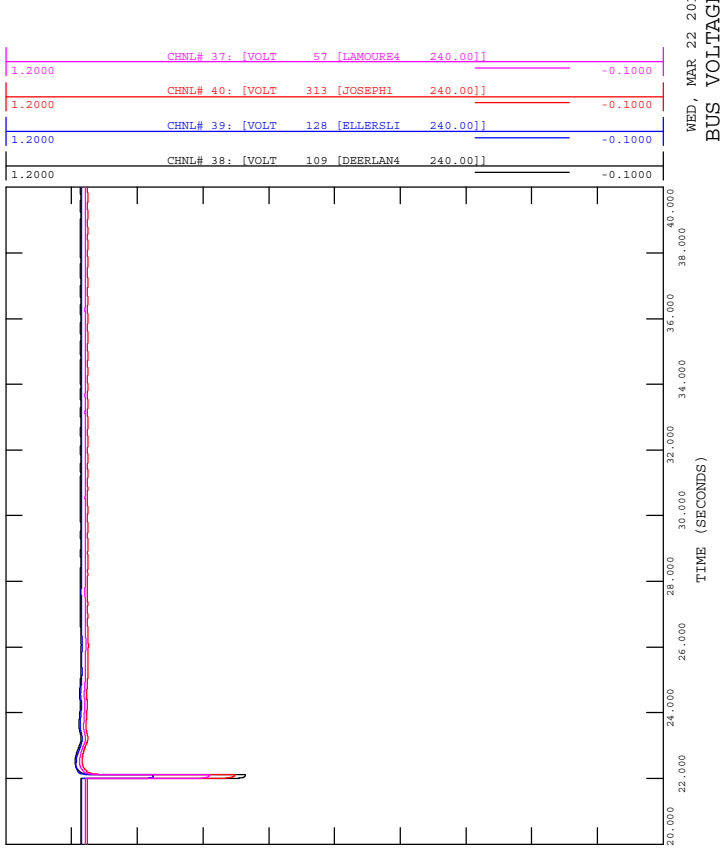

FIGURE D-24A
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 776L AT BEAVERHILL CREEK
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-24_776L_NE_Beaverhill_Ck.out

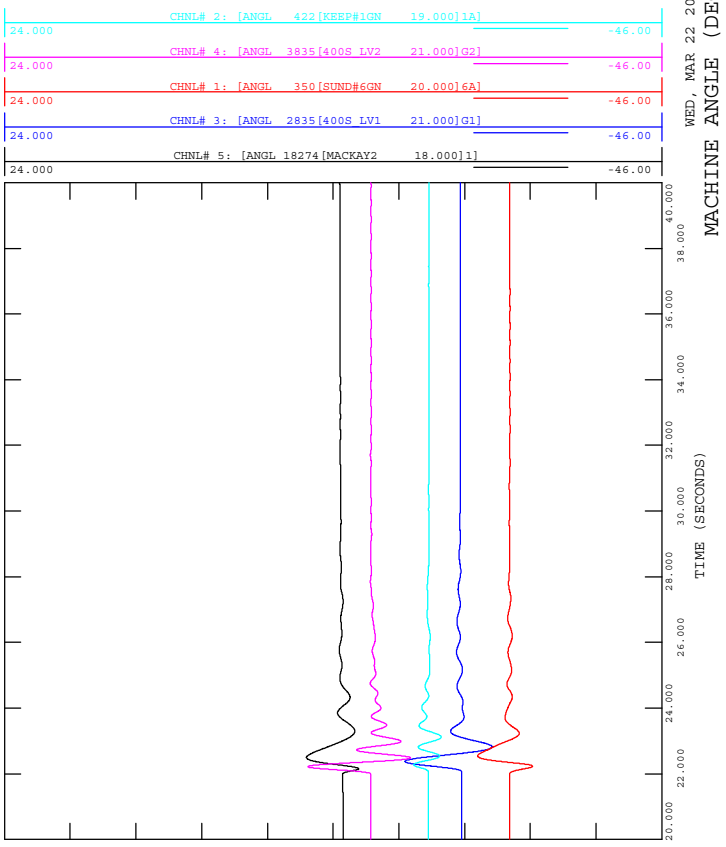

FIGURE D-24C
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 776L AT BEAVERHILL CREEK
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-24_776L_NE_Beaverhill_Ck.out

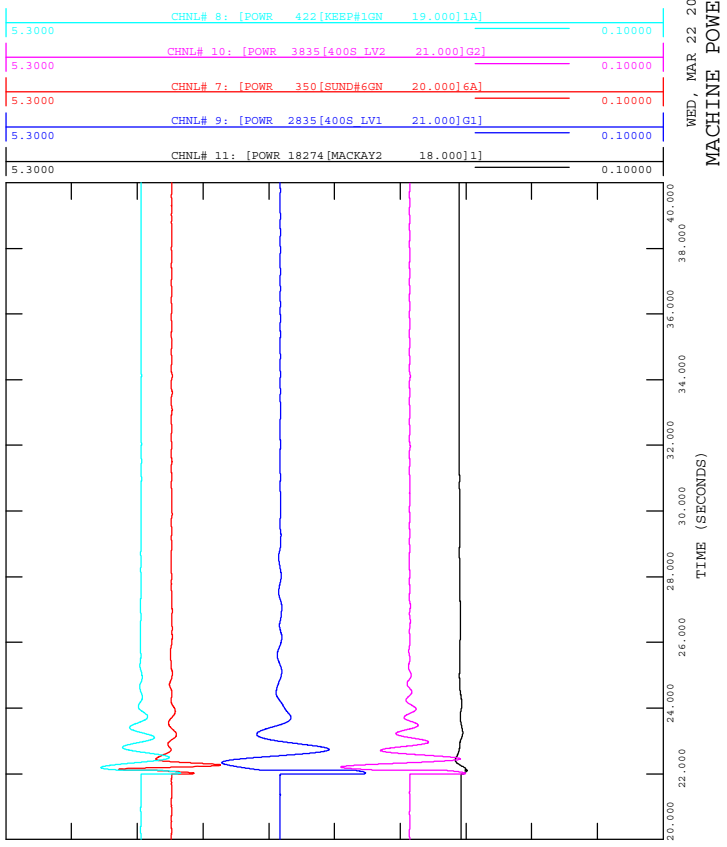

FIGURE D-24F
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 776L AT BEAVERHILL CREEK
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-24_776L_NE_Beaverhill_Ck.out

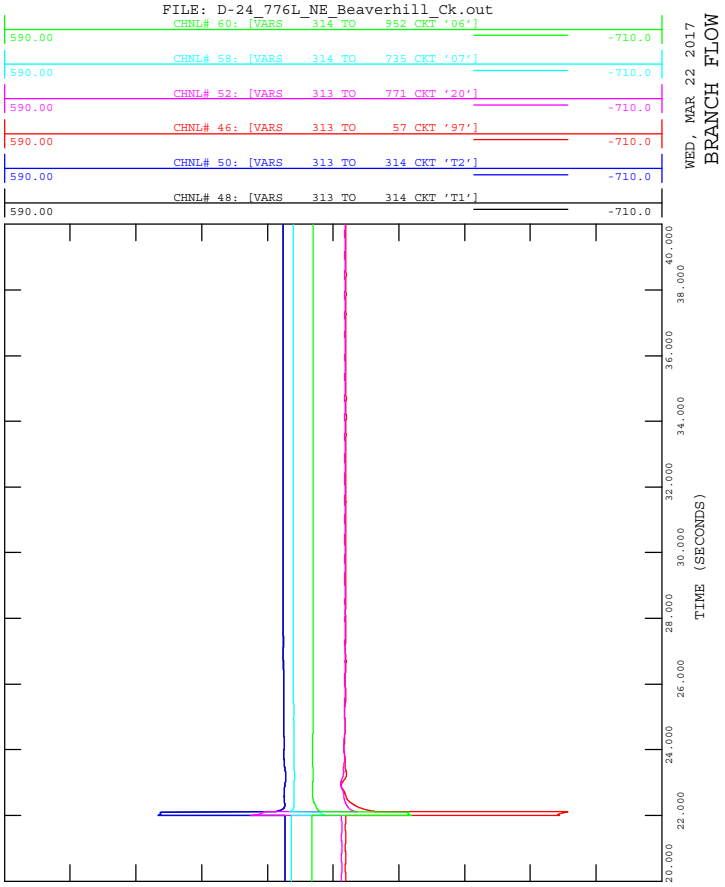

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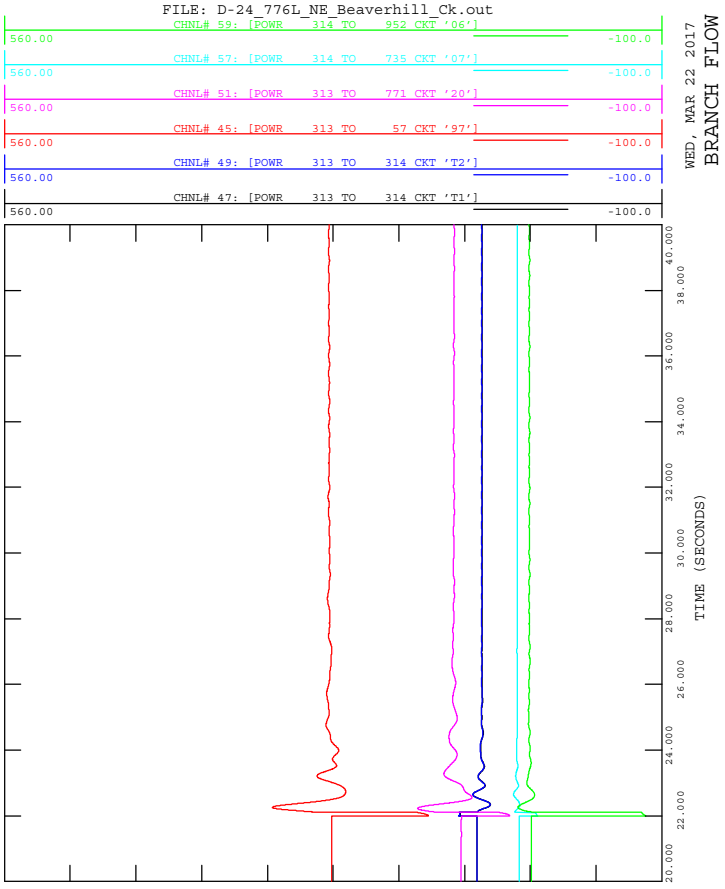
FIGURE D-24E
2020WP, POST-PROJECT WITH LTP
3 PHASE FAULT ON 776L AT BEAVERHILL CREEK
CLEARED IN 6 CYCLES, FAR END IN 6.75 CYCLES
FILE: D-24_776L_NE_Beaverhill_Ck.out



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BRANCH FLOW (P)

Attachment E

Dynamic data for ATCO Heartland Generating Station

Table B-2: Generator Dynamic for 400SG1 (GENROU)

Generator Dynamic Data (GENROU model)											
T'do	**T"do**	**T'qo**	**T"qo**	**H**	**D**	**Xd**	**Xq**	**X'd**	**X'q**	**X"d**	**Xl**
7.2030	*0.0470*	*0.8000*	*0.0740*	*6.7500*	*0.0000*	*1.3930*	*1.3745*	*0.2862*	*0.4435*	*0.2163*	*0.1788*
S(1.0)	**S(1.2)**										
0.0690	*0.4000*										

Table B-3: Exciter Dynamic Data for 400SG1 (ST6B)

Exciter Dynamic Data (ST6B model)											
TR	**KPA**	**KIA**	**KDA**	**TDA**	**VAMAX**	**VAMIN**	**KFF**	**KM**	**KCI**	**KLR**	**ILR**
0.0120	*20.30000*	*4.10000*	*0.0000*	*1.0000*	*5.4100*	*-4.3300*	*1.0000*	*1.0000*	*1.0000*	*30.0000*	*3.7400*
VRMAX	**VRMIN**	**KG**	**TG**								
5.4100	*-4.3300*	*1.0000*	*0.0200*								

Table B-4: Stabilizer Dynamic Data for 400SG1 (PSS2B)

Stabilizer Dynamic Data (PSS2B model)											
Tw1	**Tw2**	**T6**	**Tw3**	**Tw4**	**T7**	**KS2**	**KS3**	**T8**	**T9**	**KS1**	**T1**
10.0000	*10.0000*	*0.0000*	*10.0000*	*0.0000*	*10.0000*	*0.7400*	*1.0000*	*0.60000*	*0.1200*	*20.0000*	*0.1400*
T2	**T3**	**T4**	**T10**	**T11**	**VSI1MAX**	**VSI2MIN**	**VSI1MAX**	**VSI2MIN**	**VSTMAX**	**VSTMIN**	**ICS1**
0.0140	*0.1400*	*0.0140*	*1.0000*	*1.0000*	*1.0000*	*-1.0000*	*1.0000*	*-1.0000*	*0.0500*	*-0.0500*	*1*
REMBUS1	**ICS2**	**REMBUS2**	**M**	**N**							
0	*3*	*0*	*5*	*1*							

Table B-5: Governor Dynamic Data for 400SG1 (GGOV1)

Governor Dynamic Data (GGOV1 model)											
R	**Tpelec**	**Maxerr**	**Minerr**	**Kpgov**	**Kigov**	**Kdgov**	**Tdgov**	**Vmax**	**Vmin**	**Tact**	**Kturb**
0.0422	*5.000*	*0.0500*	*-0.0500*	*10.0000*	*2.0000*	*0.0000*	*1.000*	*1.000*	*0.1000*	*0.5000*	*1.5000*
Wfnl	**Tb**	**Tc**	**Teng**	**Tfload**	**Kpload**	**Kiload**	**Ldref**	**Dm**	**Ropen**	**Rclose**	**Kimw**
0.2000	*0.5000*	*0.0000*	*0.0000*	*3.0000*	*1.0000*	*0.3500*	*1.1200*	*0.0000*	*0.1000*	*-0.1000*	*0.0000*
Aset	**Ka**	**Ta**	**Trate**	**db**	**Tsa**	**Tsb**	**Rup**	**Rdown**	**Rselect**	**Flag**	
0.0100	*0.0000*	*0.1000*	*295.0000*	*0.0000*	*5.0000*	*4.0000*	*99.0000*	*-99.0000*	*1*	*0*	

Table B-2: Generator Dynamic for 400SG2 (GENROU)

Generator Dynamic Data (GENROU model)											
T'do	**T"do**	**T'qo**	**T"qo**	**H**	**D**	**Xd**	**Xq**	**X'd**	**X'q**	**X"d**	**Xl**
6.8730	*0.0430*	*0.5170*	*0.0790*	*2.5300*	*0.0000*	*2.0680*	*1.9310*	*0.2790*	*0.4970*	*0.2290*	*1.1610*
S(1.0)	**S(1.2)**										
0.0800	*0.1590*										

Table B-3: Exciter Dynamic Data for 400SG2 (EXST1)

Exciter Dynamic Data (ST6B model)											
TR	**VIMAX**	**VIMIN**	**TC**	**TB**	**KA**	**TA**	**VRMAX**	**VRMIN**	**KC**	**KF**	**TF (>0)**
0.0100	*0.2000*	*-0.2000*	*1.6700*	*6.9600*	*400.0000*	*0.0030*	*4.5000*	*-4.5000*	*0.0000*	*0.0000*	*1.0000*

Table B-4: Stabilizer Dynamic Data for 400SG2 (PSS2A)

Stabilizer Dynamic Data (PSS2B model)											
Tw1	**Tw2**	**T6**	**Tw3**	**Tw4**	**T7**	**KS2**	**KS3**	**T8**	**T9**	**KS1**	**T1**
5.0000	*5.0000*	*0.0000*	*5.0000*	*5.0000*	*5.0000*	*1.1000*	*1.0000*	*0.0000*	*0.1000*	*2.5000*	*0.2000*
T2	**T3**	**T4**	**VSTMAX**	**VSTMIN**	**IC1**	**REMBUS1**	**IC2**	**REMBUS2**	**M**	**N**	
0.0200	*0.2000*	*0.2000*	*0.1000*	*-0.1000*	*2*	*0*	*3*	*0*	*5*	*1*	

Table B-5: Governor Dynamic Data for 400SG2 (IEEEG1)

Governor Dynamic Data (GGOV1 model)											
K	**T1**	**T2**	**T3**	**Uo**	**Uc**	**PMAX**	**PMIN**	**T4**	**K1**	**K2**	**T5**
22.0000	*0.1800*	*0.0000*	*0.3000*	*0.1000*	*-0.1000*	*0.9000*	*0.2300*	*0.1900*	*0.2500*	*0.0000*	*6.0000*
K3	**K4**	**T6**	**K5**	**K6**	**T7**	**K7**	**K8**				
0.4000	*0.0000*	*0.3650*	*0.3500*	*0.0000*	*0.0000*	*0.0000*	*0.0000*				