APPENDIX A CONNECTION ASSESSMENT

RESL McLaughlin Wind Aggregated Generating Facility Connection

Project Number: 1500

The attached engineering study report has been prepared by a third party as part of the AESOs connection process. The AESO has reviewed the report and the conclusions that it contains, and finds it acceptable for the purpose of assessing potential impacts of the proposed connection on the transmission system.

Information regarding the AESO's connection process can be found at: http://www.aeso.ca/8602.html

Date: December 8, 2015

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ALTALINK

Connection Engineering Study Report for AUC Application

RESL McLaughlin WAGF

AESO Project Number: P1500

AltaLink APEGA Permit Number P-7862

Version 1.0

December 3, 2015

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Executive Summary

Project Overview

Renewable Energy Services Ltd. (the Market Participant) has submitted a system access service request (SASR) to the Alberta Electric System Operator (AESO) for connection of the proposed McLaughlin Wind Aggregated Generating Facility (WAGF) in the AESO planning area of Fort Macleod (Area 53).

The SASR includes a Rate STS, *Supply Transmission Service*, contract capacity of 47 MW and a Rate DTS, *Demand Transmission Service*, contract capacity of 1 MW for new system access services in the Fort Macleod area, and a request to connect the McLaughlin WAGF to the Alberta interconnected electric system (AIES) (collectively, the Project).

The Maximum Authorized Real Power (MARP) for the McLaughlin WAGF is 47 MW. The requested connection would involve the development of a collector substation designated as McLaughlin 423S, which will be owned by the Market Participant. This collector substation will be located near the 138 kV transmission line 164L (between Goose Lake 103S and Drywood 415S substations).

The scheduled in-service date (ISD) for the Project is July 1, 2017.

This report details the system performance studies undertaken to assess the impact of the Project on the AIES.

Existing System

The Project is geographically located in the AESO planning area of Fort Macleod (Area 53), close to the boundary of the Glenwood planning area (Area 55). From a transmission system perspective, these two planning areas mainly consist of 69 kV, 138 kV and 240 kV transmission systems.

Several specific transmission constraints in Southern Alberta have been identified. Currently, the constraints are managed with remedial action schemes and in accordance with Section 302.1 of the ISO rules, *Real Time Transmission Constraint Management*.

Study Summary

<u>Study area for the Project</u>

The study area consists of the AESO planning areas of Fort Macleod, Lethbridge (Area 54), and Glenwood, and includes the tie lines connecting these planning areas to neighbouring planning areas. The study area was studied and monitored for violations of the *Transmission Planning Criteria – Basis and Assumptions* (Reliability Criteria).

<u>Studies performed for the Project</u>

Power flow studies were performed using 2017 summer peak (SP) and summer light (SL) scenarios, before and after the requested connection of the Project.

Transient stability studies were performed for 2017 SP and SL post-connection scenarios.

Short-circuit studies were also performed for 2017 SP pre-connection, post- connection and future 2024 winter peak (WP) scenarios.

Results of the pre-connection studies

No Reliability Criteria violations were observed for the pre-connection study scenarios.

Connection alternative examined for the Project

One connection alternative was identified for the Project, and was studied to evaluate the impact of the Project on the AIES.

The connection alternative involves connecting the proposed McLaughlin 423S substation to the existing 138 kV transmission line 164L (between the Goose Lake 103S and Drywood 415S substations) using a T-tap configuration, and includes adding a single circuit 138 kV transmission line with a minimum summer rating of 53 MVA.

Results of the post-connection studies

The following is a summary of the results of the post-connection studies.

Category A (N-0) conditions

Under Category A conditions, no Reliability Criteria violations were observed for any of the studied scenarios with the Project.

Category B (N-1) contingency conditions

Under Category B contingency conditions, no Reliability Criteria violations were observed for any of the studied scenarios with the Project.

Short-circuit analyses

The short-circuit analyses show that short-circuit current levels will not significantly increase with the Project.

Conclusions and Recommendations

The connection assessment indicates that the Project will not adversely impact the performance of the AIES. Therefore, it is recommended that the Project be connected using the identified connection alternative.

1. Introduction

This Engineering Study Report presents the results of the study conducted to assess the impact of the Project (as defined below) on the performance of the AIES.

1.1. Project

1.1.1. Project Overview

Renewable Energy Services Ltd. (the Market Participant) has submitted a system access service request (SASR) to the Alberta Electric System Operator (AESO) for connection of the proposed McLaughlin Wind Aggregated Generating Facility (WAGF) in the AESO planning area of Fort Macleod (Area 53).

The SASR includes a Rate STS, *Supply Transmission Service*, contract capacity of 47 MW and a Rate DTS, *Demand Transmission Service*, contract capacity of 1 MW for new system access services in the Fort Macleod area, and a request to connect the McLaughlin WAGF to the Alberta interconnected electric system (AIES) (collectively, the Project).

The MARP for the McLaughlin WAGF is 47 MW. The Project would involve the development of a collector substation designated as McLaughlin 423S, which will be owned by the Market Participant. This collector substation will be located near the existing 138 kV transmission line 164L (between Goose Lake 103S and Drywood 415S substations).

The scheduled in-service date (ISD) for the McLaughlin WAGF is July 1, 2017.

1.1.2. Load Component

- The requested Rate DTS contract capacity is 1 MW by July 1, 2017.

1.1.3. Generation Component

- MARP: 47 MW (also the maximum amount of McLaughlin WAGF generation studied).
- The McLaughlin WAGF consists of 20 Enercon E-92 2.35 MW wind turbine generators.
- Reactive power capability of each generator: +/- 1.5 MVAr.
- The requested Rate STS contract capacity is 47 MW by July 1, 2017.
- Future Expansion: no future expansion indicated in the SASR.

1.2. Study Scope

1.2.1. Study Objectives

The objectives of the study were the following:

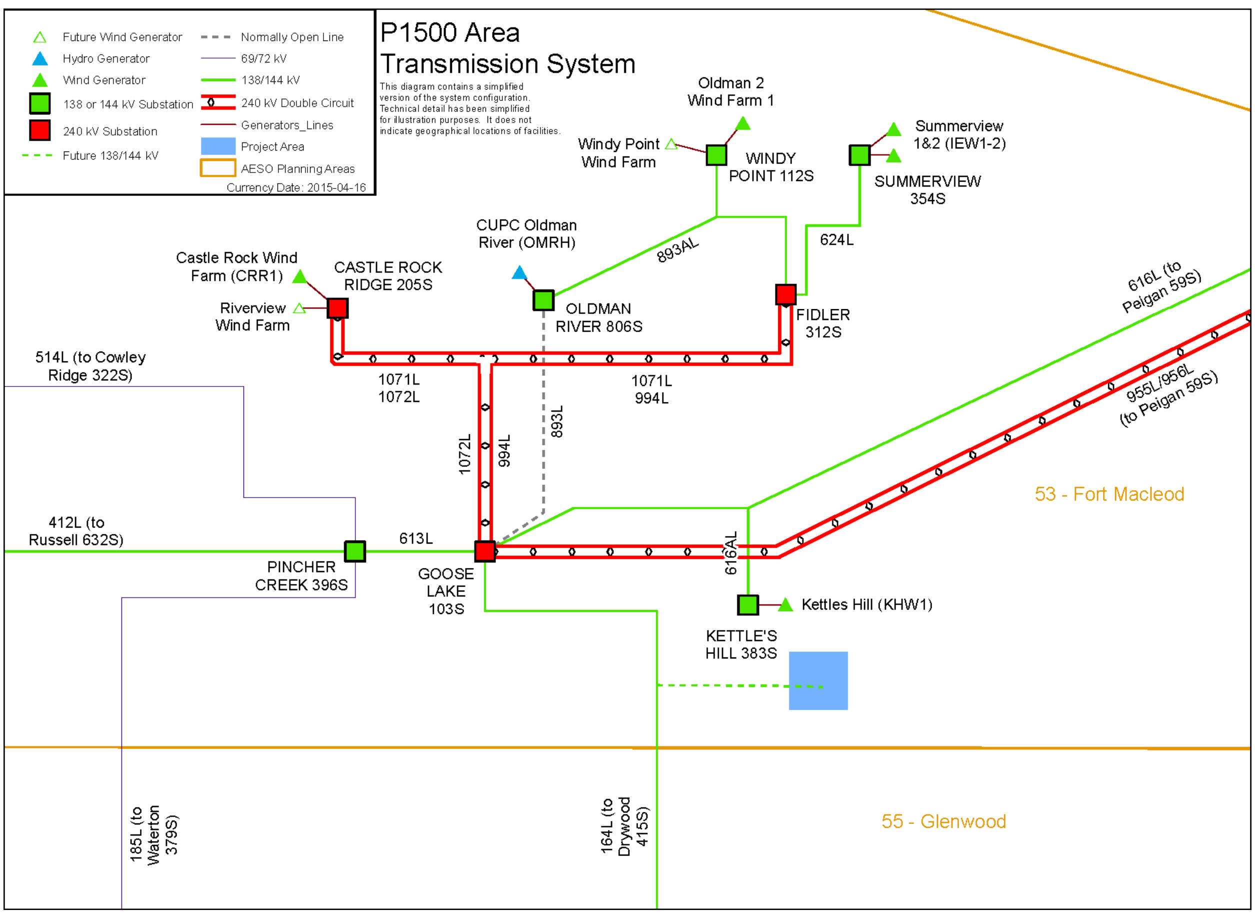
- To assess the impact of the Project on the AIES, using various analyses outlined in Section 1.2.3.
- To identify any violations of the relevant criteria, standards or requirements of the AESO, both pre- and post-connection.
- To recommend mitigation measures, if required, to enable the reliable integration of the Project into the AIES.

1.2.2. Study Area

1.2.2.1. Study Area Description

The Project is geographically located in the AESO planning area of Fort Macleod, close to the boundary of the Glenwood planning area (Area 55). From a transmission system perspective, these two planning areas mainly consist of 69 kV, 138 kV and 240 kV transmission systems. Figure 1 presents a simplified schematic of the anticipated transmission system near the Project in year 2017. The study area consists of the AESO planning areas of Fort Macleod, Lethbridge (Area 54) and Glenwood, and includes the tie lines connecting these planning areas to neighbouring planning areas.

Figure 1: 2017 Area Transmission System near the Project



1.2.2.2. Existing Constraints

Several specific transmission constraints in Southern Alberta have been identified. Currently, the constraints are managed with remedial action schemes and in accordance with Section 302.1 of the ISO rules, *Real Time Transmission Constraint Management* (TCM Rule), as required.

1.2.2.3. AESO Long-Term Plans

Major transmission developments are planned as part of the approved Southern Alberta Transmission Reinforcement (SATR) project to address the constraints in the Fort MacLeod area. The SATR developments in/around the study area include:

- Replacement of existing 911L line with a new high capacity double-circuit 240 kV line with series capacitor compensation (energized in Q4 2015).
- A 500/240 kV substation on the BC–AB 500 kV intertie near Chapel Rock, with a 240 kV line to Castle Rock.
- A new 240 kV transmission line between the Goose Lake and new Journault substations.

In addition to SATR, the *AESO 2015 Long-term Plan* (2015 LTP)[1] also includes the following system developments in the study area in the near term (by 2020):

- Upgrade existing 69 kV lines, from Stirling substation to Raymond substation and onto Magrath substation, to 138 kV.
- Convert Raymond substation from 69 kV to 138 kV.
- Add 138 kV breakers at North Lethbridge substation for better sectionalizing of Lethbridge 138 kV network.

1.2.3. Studies Performed

Power flow and transient stability studies were performed using 2017 summer peak (SP) and summer light (SL) scenarios. Short-circuit studies were performed using 2017 SP and 2024 winter peak (WP) scenarios.

The following studies were performed for the pre-connection analysis:

- Power flow analysis (Category A conditions and Category B contingencies)
- Short-circuit analysis (Category A conditions)

The following studies were performed for the post-connection analysis:

- Power flow analysis (Category A conditions and Category B contingencies)
- Transient stability analysis (Category B contingencies)
- Short-circuit analysis (Category A conditions)

1.3. Report Overview

The Executive Summary provides a high-level summary of the report and its conclusions. Section 1 provides an introduction. Section 2 describes the criteria, system data, and study

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

assumptions. Section 3 presents the study methodology used in this study. Section 4 discusses the pre-connection system assessment. Section 5 presents the connection alternative(s). Section 6 provides a technical analysis of the of the post-connection system assessment for the alternative(s) selected for further study. Section 7 provides a short-circuit analysis for the pre- and post-connection, as well as future post-connection information. Section 8 discusses project interdependencies. Section 9 presents conclusions and recommendations.

2. Criteria, System Data, and Study Assumptions

2.1. Criteria, Standards, and Requirements

2.1.1. Transmission Planning Standards and Criteria

The Transmission Planning (TPL) Standards, which are included in the Alberta Reliability Standards, and the AESO's *Transmission Planning Criteria – Basis and Assumptions* (Reliability Criteria)[2] 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 Rating when specifying the required system performance under Category A and Category B events. For the purpose of applying the TPL standards to the studies documented in this report Applicable Ratings are defined as follows:

- Seasonal continuous thermal rating of the line's loading limits.
- Highest specified loading limits for transformers.
- For Category A conditions: Voltage range under normal operating condition per AESO Information Document ID# 2010-007RS. For the busses not listed in ID#2010-007RS, Table 2-1 in the Reliability Criteria applies.
- For Category B conditions: The extreme voltage range values per Table 2-1 in the Reliability Criteria.
- Desired post-contingency voltage change limits for three defined post event timeframes as provided in Table 1, below.

[2] Filed under a separate cover.

Table 1: Post-Contingency Voltage Deviations Guidelines for Low Voltage Busses

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

2.1.2. Authoritative Documents (ADs)

The AESO ID #2010-007RS, *General Operating Practices - Voltage Control*, which relates to Section 304.4 of the ISO rules, *Maintaining Network Voltage* was applied to establish the pre-contingency voltage profile in the study area.

2.2. Load and Generation Assumptions

2.2.1. Load Assumptions

Table 2 presents the AESO's *2014 Long-term Outlook* (2014 LTO) corporate forecast for the South Region at Alberta Internal Load (AIL) peak with consideration to percentile metering point loading to ensure total AIL load levels remain consistent with the 2014 LTO.

Table 2: Forecast Load (2014 LTO)

AESO Planning Area Name and Season		Forecast Load (MW)
		2017
South Region (Areas 4, 6, 43, 44, 45, 46, 47, 48, 49, 52, 53 ,54, 55, 57)	Summer Peak	2,878
	Summer Light	1,890
AIL (w/o losses)	Summer Peak	11,440
	Summer Light	8,245

2.2.2. Generation Assumptions

The existing generators in the study area, proposed wind generators in Southern Alberta, and their respective dispatch levels are listed in Table 3 to Table 5 ("High Wind" scenario).

The High Wind scenario dispatch level will include all existing wind farm facilities and wind farm facilities currently under construction dispatched up to their contracted maximum capability (MC) level. The remaining forecast wind growth will be allocated to projects in the Southern Alberta region as identified in Table 5 to stress the local transmission network in the study area and will be distributed throughout Southern Alberta based on project information.

Table 3: Dispatch levels of Non-Wind Generators in the Study Area

Generator	Bus	Fuel Type	Total MC (MW)	2017 Dispatch (MW)
Area 55				
Taylor	4670	Hydro	14	13
Raymond	414	Hydro	21	17
Irrican	450	Hydro	7	5
Drywood	4226	Gas	6	0
Area 54				
Chin Chute	407	Hydro	15	12
Coaldale	4690	Gas	6.36	0
Area 53				
Old Man River	2230	Hydro	32	31

Table 4: Dispatch levels of the Existing and Under-construction Wind Generators

Plant Name	Asset ID	Planning area	Buses	MC (MW)	2017 Dispatch (MW)
Ardenville Wind (ARD1)*	ARD1	53	4735, 4740	68	68
Blue Trail Wind (BTR1)*	BTR1	53	66328, 67328	66	66
Castle River #1 (CR1)*	CR1	53	2234, 3234	39	39
Castle Rock Wind Farm (CRR1)*	CRR1	53	67221	77	77
Cowley Ridge (CRWD)*	CRWD	53	255, 265, 4264	38	38
Enmax Taber (TAB1)*	TAB1	52	15343, 16343	81	81
Kettles Hill (KHW1)*	KHW1	53	2402, 3402	63	63
McBride Lake Windfarm (AKE1)*	AKE1	53	2901, 3901, 4901	73	73
Soderglen Wind (GWW1)*	GWW1	53	12358, 13358	71	71
Summerview 1 (IEW1)*	IEW1	53	2338, 3338	66	66
Summerview 2 (IEW2)*	IEW2	53	4339, 5337	66	66
Suncor Chin Chute (SCR3)*	SCR3	54	2389	30	30
Suncor Magrath (SCR2)*	SCR2	55	11002	30	30
Suncor Wintering Hills (SCR4)*	SCR4	43	60789, 60791, 60793, 60846, 60848, 60850	88	88
Blackspring Ridge(BSR1)*	BSR1	49	61736, 61737	300	300
Oldman 2 Wind Farm 1 (OWF1)*	OWF1	53	61543	46	46
Total				**1202**	**1202**

Table 5: Dispatch levels of Future Southern Alberta Wind Projects

Southern Wind Projects (Past Gate 2)	Project Number	Planned ISD	Planning Area	Buses	MC (MW)	2017 Dispatch (MW)
Pteragen Peace Butte 116 MW Wind Farm	513	Dec, 2016	4	2294, 4294	116	0
Naturener Wild Rose Wind Farm	479	July 2017	4	4631, 5633, 5631, 6631, 7631, 4632, 5632, 6632, 7632, 4633	210	0
Benign Energy Heritage Wind Farm	515	Dec. 2018	53	66536,62536	350	0
Enel Alberta Riverview Wind Farm	524	Dec, 2016	53	69221	115	115
Windy Point Wind Farm	580	Dec, 2015	53	61546	63	63
Naturener Wild Rose Wind Farm Phase 2	693	Sept., 2016	4	3462, 7463, 4462, 5462, 6462, 7462, 3463, 4463, 5463, 6463	189	173
Old Elm & Pothole Creek Wind Farm	1080	Aug. 2017	55	1752, 1755, 1753, 1756	300	0
McLaughlin WAGF	1500	Aug. 2017	53	2781,2773,2775	47	47
Joss MPC WAGF	1533	May 2018	48	60798,61798	120	0
Subtotal						**398**

2.2.3. Intertie Flow Assumptions

Table 6 lists the intertie flow assumptions between the Alberta transmission system and adjacent systems.

Table 6: Alberta Intertie Exchange Assumptions

Year/Season Load	AIES Import (+) / Export (-) from/to BC (MW)	AIES Import (+) / Export (-) from/to SASK (MW)	AIES Import (+) / Export (-) from/to MATL (MW)	Scenario
2017 SL	0	0	0	"Zero Intertie Flow"
2017 SP	530	150	300	"High Import"

2.2.4. HVDC Assumptions

The Western Alberta Transmission HVDC Line (WATL) and the Eastern Alberta Transmission HVDC Line (EATL) assumptions were expected to have minimal impact for this connection studies, and they were dispatched to minimize total system loss in all study scenarios.

2.3. System Projects

Only the system projects in or near the study area that have an earlier ISD than the Project were modelled in the study cases. These future system projects are shown in Table 7.

Table 7: Summary of Future System Projects in or near the Study Area

Project	Project ID	Description	ISD
SATR (Southern Alberta Transmission Reinforcement)	787-11	Blackie Area 138 kV Upgrade	Apr. 2016
	787-1	911L Line Replacement (Windy Flats Substation to Foothills 237S, 240 kV double circuit (ckt))	Oct. 2015

2.4. Customer Connection Projects

Table 8 identifies customer connection projects in the study area.

Table 8: Customer Connection Projects in the Study Area

Planning Area	Queue Position*	ISD	Project Name	Project No.	Generation (MW)	Load (MW)	Included/Excluded from Studies
53	54	Jul. 2017	RESL McLaughlin WAG	1500	47.0	1.0	Included
54	19	Apr. 2016	Lethbridge Chinook NW POD	1260	0	30.0	Included
55	Energized	Oct. 2014	Fortis Spring Coulee Upgrade	1338	0	2.0	Included
55	57	Feb. 2017	BowArk Energy Drywood Power Gas Plant	1522	18.6	1.0	Excluded

* Per the AESO Connection Queue posted in December 2015.

Project No. 1522 (P1522) was not included in this study due to its position in the AESO Connection Queue, regardless of its ISD and the filing date of the needs identification document (NID) relating to P1522.[3] The connection assessment for the NID relating to P1522 will consider both P1522 and the Project, and any mitigation proposed for P1522 would be sufficient to address the impact of the generation and load associated with both P1522 and the Project on the transmission system.

2.5. Facility Ratings and Shunt Elements

Table 9 to Table 11 provide the ratings of the existing and future key transmission facilities in the Fort Macleod planning area.

[3] The NID relating to P1522 will be filed with the Alberta Utilities Commission in early 2016.

Table 9: Summary of Key Transmission Line Ratings

Line	From	To	Voltage Class (KV)	Summer Rating (MVA)	Winter Rating (MVA)
164L	Goose Lake 103S	Drywood 415S	138	85	90
413L	Russell 632S	Castle River 239S	138	120	148
616L	Goose Lake 103S	Peigan 59S	138	119	146
412L	Pincher Creek 396S	Russell 632S	138	121	148
170L	Russell 632S	Coleman 799S	138	121	148
786L	Natal	Coleman 799S	138	99	132
613L	Goose Lake 103S	Pincher Creek 396S	138	119	147
1037L&1038L	Windy Flats 138S	Foothills 237S	240	958	1213
955L & 956L	Goose Lake 103S	Peigan 59S	240	611	751
1071L&1072L	Goose Lake 103S	Castle Rock Ridge 205S	240	967	1203
967/968L	Windy Flat 138S	N Lethbridge 370S	240	499	499
1048L&1049L	Peigan 59S	Windy Flats 138S	240	611	751
185L	Pincher Creek 396S	Shell Canada Wateron 379S	69	41	53
185L	Shell Canada Wateron 379S	Drywood 415S	69	57	69
146L/162L	Drywood 415S	Glenwood 229S	69	29	36

Table 10: Summary of Key Transformer Ratings

Station Name and Number	Transformer	MVA Rating
Goose Lake 103S	T1-240/138kV	400
Peigan 59S	T1-240/138kV	179
Windy Flats 138S	T1 240/138 kV	400

Table 11: Summary of Key Shunt Elements

Substation Name and Number	Nominal Bus Voltage (kV)	Capacitors		Reactors	
		Number of Switched Shunt Blocks	Total at nominal voltage (MVAr)	Number of Switched Shunt Blocks	Total at nominal voltage (MVAr)
Pincher Creek 396S	138	1	24.46	-	-

2.6. Dynamic Data and Assumptions

Dynamic data used for the McLaughlin WAGF was provided by the wind turbine manufacturer, and is provided in Attachment D.

2.7. Protection Fault Clearing Times

Table 12 lists the typical fault clearing times for each voltage level. The study has been performed using either actual fault clearing times if available, or the estimated fault clearing times listed in Table 12. The fault clearing times used in this study are listed in Table 16.

Table 12: Typical Protection Fault Clearing Times

Voltage (kV)	Fault Clearing Times (Cycles)	
	Near-End	Far-End
240 kV	5	6
138 kV with telecom	6	8
138 kV without telecom	6	30

2.8. Voltage Profile Assumptions

The AESO ID #2010-007RS was used to establish normal system (i.e. pre-contingency) voltage profiles in the study area and its vicinity prior to commencing analysis. Table 13 lists the voltage profile, under normal operation conditions, for the key nodes in the study area. For steady state analysis, the operating range of the SVC at Langdon 102S was maintained in the range of -80MVAr to +40 MVAr.

Table 13: Summary of Voltage at Key Nodes in the Study Area

Substation	Nominal Voltage (kV)	Minimum Operating Limit (kV)	Desired Range (kV)	Maximum Operating Limit (kV)
Peigan 59S	240	235	235 - 258	260
	138	135	138 - 144	145
North Lethbridge 370S	240	235	240 - 260	264
	138	135	138 - 144	145
Pincher Creek 396S	138	138	138 - 144	145

3. Study Methodology

3.1. Study Objectives

The objectives of the study were the following:

- To assess the impact of the Project on the AIES.
- To identify any violations of the relevant criteria, standards or requirements of the AESO, both pre- and post-connection.
- To recommend mitigation measures, if required, to enable the reliable integration of the Project into the AIES.

3.2. Study Scenarios

Table 14 summarizes the study scenarios used for the connection studies.

Table 14: Summary of Study Scenario Assumptions

Scenario	Year/Season Load	Condition	System Generation Dispatch Conditions
1	2017 SP	Pre-connection	High Wind, High Import
2	2017 SL	Pre-connection	High Wind, Zero Intertie Flow
3	2017 SP	Post-connection	High Wind, High Import
4	2017 SL	Post-connection	High Wind, Zero Intertie Flow

3.3. Connection Studies Carried Out

Power flow and transient stability studies were performed using 2017 SP and SL scenarios. Short-circuit studies were performed using 2017 SP and 2024 WP scenarios.

The following studies were performed for the pre-connection analysis:

- Power flow analysis (Category A conditions and Category B contingencies)
- Short-circuit analysis (Category A conditions)

The following studies were performed for the post-connection analysis:

- Power flow analysis (Category A conditions and Category B contingencies)
- Transient stability analysis (Category B contingencies)
- Short-circuit analysis (Category A conditions)

3.4. Power Flow Analysis

Pre- and post-connection power flow studies were performed to assess system performance for Category A and Category B conditions. The system in the study area and its vicinity was monitored to identify any violations to the Reliability Criteria, including thermal overloads and voltage violations, and to identify any deviations from the desired limits in Table 1.

The elements that were monitored to record any violations of the Reliability Criteria include all the components at 69 kV and above in the study area and its vicinity.

PSS/E 33 contingency power flow analysis function was used as the study tool.

3.4.1. Contingencies Studied

The study includes all Category B contingencies (69 kV and above) within the study area and the lines from the study area to the surrounding areas.

3.5. Short-Circuit Analysis

Short-circuit analysis was performed for three-phase and single-phase to ground current levels. All 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 scope of the analysis included three-phase bolted faults and single-line to ground faults.

Short-circuit analysis was performed to evaluate the three-phase and single-phase to ground current levels at selected buses in the study area in the pre- and post-connection systems. PSS/E 33 automatic sequencing fault calculation function was used as the study tool.

3.6. Transient Stability Analysis

Post-connection transient stability studies were performed to assess the system performance for selected contingencies. Transient responses of selected bus voltage, machine angle and power output, and transmission line flow were recorded for system stability evaluation. PSS/E 33 transient stability analysis function was used as the study tool. Table 15 lists the monitored channels during transient stability study.

Table 15: Monitored Channels for Transient Stability Analysis

Channel Identifier	Channel Category	Bus 1	Bus 2	ID
WAGF-138-Vol	Bus-VOLTAGE	770		
GooseL-138-Vol	Bus-VOLTAGE	296		
Fidler-240-Vol	Bus-VOLTAGE	751		
GooseL-240-Vol	Bus-VOLTAGE	346		
Peigan-240-VOL	Bus-VOLTAGE	165		
Sheerness1	Machine-ANGLE	1482		1
Genesee-G3	Machine-ANGLE	490		3
WAGF_P	Machine-PELEC	2773		1
Sheerness1_P	Machine-PELEC	1482		1
Genesee-G3_P	Machine-PELEC	490		3
CRR_WF_P	Machine-PELEC	67221		G1
994L_P	Branch-P	751	346	94
1071L_P	Branch-P	751	221	71
1201L_P	Branch-P	1507	90000	01
956L_P	Branch-P	346	165	56

3.6.1. Contingencies Studied

The study includes selected critical Category B contingencies (138 kV and above) within the study area and the tie lines from the study area to the surrounding areas. Table 16 lists the contingencies studied.

Table 16: Selected Contingencies for Transient Stability Analysis

Contingency Description	Fault Clearing Time (Cycle)	
	Near End	Far End
3-phase fault on 164L (Goose lake 103S to Drywood 415S)	6	30
3-phase fault on 994L (Fidler 312S to Goose lake 103S)	5	6
3-phase fault on 1071L (Fidler 312S to Castle Rock Ridge 205S)	5	6
3-phase fault on 1072L (Castle Rock Ridge 205S to Goose Lake 103S)	5	6
3-phase fault on 955L (Goose Lake 103S to Peigan 59S)	5	6
3-phase fault on 1048L (Peigan 59S to Windy Flat 138S)	5	6
3-phase fault on 1038L (Windy Flat 138S to Foothills 237S)	5	6
3-phase fault on 967L (Windy Flat 138S to North Lethbridge 370S)	5	6
3-phase fault on 613L (Pincher Creek 396S to Goose Lake 103S)	11 (Pincher Creek)	6 (Goose Lake)
3-phase fault on 616L (Goose Lake 103S to Peigan 59S)	6	30
3-phase fault on Goose Lake 103S 240/138 kV Transformer	6	8

4. Pre-Connection System Assessment

4.1. Pre-Connection Power Flow Analysis

The pre-connection system is defined as the system configuration without the Project. The steady-state performance of the pre-connection system was assessed under the 2017 SP and 2017 SL study scenarios. The power flow analyses were based on the criteria, system data and study assumptions as described in Section 2.

4.1.1. Scenario #1 – 2017 SP Pre-Connection

No thermal overloads or voltage violations were observed with the 2017 SP pre-connection system configuration under N-0 and N-1 conditions.

The results of the power flow analysis for the studied contingencies are summarized in Table 17 and shown in the power flow diagrams in Attachment A.

Table 17: Summary of Pre-Connection System Performance – Pre-connection, Scenario #1

Contingency	Thermal Overloads	Voltage Performance
N-0: Normal Operation	None	Acceptable
N-1: All studied contingencies	None	Acceptable

4.1.2. Scenario #2 – 2017 SL Pre-Connection

No thermal overloads or voltage violations were observed with the 2017 SL pre-connection system configuration under N-0 and N-1 conditions.

The results of the power flow analysis for the studied contingencies are summarized in Table 18 and shown in the power flow diagrams in Attachment A.

Table 18: Summary of Pre-Connection System Performance – Pre-connection, Scenario #2

Contingency	Thermal Overloads	Voltage Performance
N-0: Normal Operation	None	Acceptable
N-1: All studied contingencies	None	Acceptable

5. Connection Alternative

5.1. Overview

One connection alternative was identified for the Project, and was studied to evaluate the impact of the Project on the AIES.

5.2. Connection Alternative Examined

Below is a description of the developments associated with the transmission alternative that was examined for the Project.

Connect the McLaughlin 423S substation using a T-tap configuration

This connection alternative involves connecting the proposed McLaughlin 423S substation to the existing 138 kV transmission line 164L (between the Goose Lake 103S and Drywood 415S substations) using a T-tap configuration.

This alternative includes the following:

- Add a single circuit 138 kV transmission line, with a minimum summer rating of 53 MVA, to connect the proposed McLaughlin 423S substation to transmission line 164L.

This connection alternative was studied to evaluate the impact of the Project on the AIES.

6. Technical Analysis of the Connection Alternative

6.1. Proposed Alternative

6.1.1. Power Flow Analysis

The power flow analyses were based on the criteria, system data and study assumptions as described in Section 2.

6.1.1.1. Scenario #3 – 2017 SP Post-Connection

No thermal overloads or voltage violations were observed with the 2017 SP post-connection system configuration under N-0 and N-1 conditions.

The results of the power flow analysis for the studied contingencies are summarized in Table 19 and shown in the power flow diagrams in Attachment B.

Table 19: Summary of Post-Connection System Performance – Scenario #3

Contingency	Thermal Overloads	Voltage Performance
N-0: Normal Operation	None	Acceptable
N-1: All studied contingencies	None	Acceptable

6.1.1.2. Scenario #4 – 2017 SL Post-Connection

No thermal overloads or voltage violations were observed with the 2017 SL post-connection system configuration under N-0 and N-1 conditions.

The results of the power flow analysis for the studied contingencies are summarized in Table 20 and shown in the power flow diagrams in Attachment B.

Table 20: Summary of Post-Connection System Performance – Scenario #4

Contingency	Thermal Overloads	Voltage Performance
N-0: Normal Operation	None	Acceptable
N-1: All studied contingencies	None	Acceptable

6.1.2. Transient Stability Analysis

The dynamic performance of the system was assessed using scenarios 3 to 4. The transient stability analyses were based on the criteria, system data and study assumptions as described in Section 2. Detailed transient stability results are documented in Attachment C.

Single Element Contingency (N-1) Results:

No stability issues were observed under N-1 contingencies (normal fault clearing) with three phase faults.

6.1.3. Mitigation Measures for Identified Issues

No mitigation measure is required since no system performance issue was identified by the analyses.

6.2. Conclusions and Recommendations

The power flow results showed that no system performance issues occur with the Project.

Transient stability results show that there is no transient stability concern with the Project.

Therefore, it is recommended that the Project be connected using the identified connection alternative.

7. Short-Circuit Analysis

Short-circuit studies were performed using the 2017 SP and 2024 WP scenarios to determine the fault levels[4] in the system before and after the Project. Single phase and three phase fault currents were calculated at nearby substations as shown in Table 21 to Table 23.

The short-circuit analysis shows that the short-circuit levels will not significantly increase with the Project.

Table 21: Short-Circuit Current Levels – Pre-Connection (Scenario 1, 2017 SP)

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage	Pre-Fault Voltage (pu)	3-Φ Fault (kA)	1-Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	Zero Sequence Thevenin Source Impedance (R0+jX0)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
Peigan 59S	240	244.4	1.018	12.57	8.21	1.776+ j11.238	0.003084+ j0.019510	7.540+ j28.507	0.013089+ j0.049491
Peigan 59S	138	139	1.007	7.74	6.32	1.563+ j10.393	0.008206+ j0.054572	2.987+ j17.273	0.015686+ j0.090699
Pincher Creek 396S	138	142.3	1.031	10.77	8.71	1.054+ j7.650	0.005535+ j0.040171	2.171+ j12.989	0.011401+ j0.068203
Drywood 415S	138	140.9	1.021	3.89	2.63	6.714+ j20.079	0.035257+ j0.105436	13.311+ j49.720	0.069896+ j0.261079
Goose Lake 103S	138	142.3	1.031	10.99	8.95	0.982+ j7.501	0.005156+ j0.039386	2.035+ j12.546	0.010686+ j0.065877
Goose Lake 103S	240	243.9	1.016	11.01	7.64	1.875+ j12.825	0.003255+ j0.022265	5.712+ j29.411	0.009917+ j0.051061

[4] 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.

Table 22: Short-Circuit Current Levels – Post-Connection (Scenario 3, 2017 SP)

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage	Pre-Fault Voltage (pu)	3-Φ Fault (kA)	1-Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	Zero Sequence Thevenin Source Impedance (R0+jX0)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
Peigan 59S	240	243.4	1.014	12.53	8.19	1.778+ j11.229	0.003088+ j0.019496	7.528+ j28.471	0.013069+ j0.049428
Peigan 59S	138	139.2	1.009	7.72	6.3	1.578+ j10.442	0.008285+ j0.054828	3.037+ j17.431	0.015946+ j0.091532
Pincher Creek 396S	138	141.7	1.027	10.71	8.67	1.057+ j7.659	0.005548+ j0.040218	2.173+ j12.999	0.011411+ j0.068256
Drywood 415S	138	140.2	1.016	3.88	2.63	6.691+ j20.020	0.035133+ j0.105124	13.248+ j49.469	0.069564+ j0.259764
Goose Lake 103S	138	141.7	1.027	10.94	8.91	0.984+ j7.510	0.005169+ j0.039433	2.037+ j12.556	0.010695+ j0.065930
Goose Lake 103S	240	243.1	1.013	10.97	7.62	1.878+ j12.827	0.003261+ j0.022269	5.716+ j29.416	0.009923+ j0.051070
McLaughlin 423S	138	141.4	1.025	6.03	4.16	3.602+ j13.234	0.018912+ j0.069492	7.545+ j31.305	0.039620+ j0.164380

Table 23: Short-Circuit Current Levels – Post-Connection (Long term, 2024 WP)

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage	Pre-Fault Voltage (pu)	3-Φ Fault (kA)	1-Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	Zero Sequence Thevenin Source Impedance (R0+jX0)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
Peigan 59S	240	247.2	1.03	13.96	9.38	1.755+ j10.072	0.003046+ j0.017486	6.839+ j24.403	0.011873+ j0.042366
Peigan 59S	138	142.4	1.032	8.05	6.69	1.555+ j10.089	0.008164+ j0.052976	2.868+ j16.232	0.015060+ j0.085233
Pincher Creek 396S	138	143.5	1.04	11.46	9.81	0.907+ j7.174	0.004761+ j0.037669	1.638+ j10.750	0.008599+ j0.056448
Drywood 415S	138	143.7	1.041	3.98	2.91	6.087+ j19.911	0.031964+ j0.104554	8.559+ j43.202	0.044944+ j0.226854
Goose Lake 103S	138	143.5	1.04	11.72	10.14	0.835+ j7.023	0.004382+ j0.036878	1.493+ j10.278	0.007838+ j0.053971
Goose Lake 103S	240	248.1	1.034	13.29	9.95	1.612+ j10.655	0.002799+ j0.018497	4.269+ j21.284	0.007411+ j0.036951
McLaughlin 423S	138	143.5	1.04	6.26	4.48	3.348+ j12.801	0.017583+ j0.067216	6.371+ j28.378	0.033453+ j0.149015

8. Project Interdependencies

No Project interdependencies were identified.

9. Conclusions and Recommendations

The Market Participant submitted a SASR to the AESO, including a request for the Project. The MARP for the proposed McLaughlin WAGF is 47 MW. The requested connection of the proposed McLaughlin WAGF would involve the development of a collector substation designated as McLaughlin 423S, which will be owned by the Market Participant. This collector substation will be located near the 138 kV transmission line 164L (between Goose Lake 103S and Drywood 415S substations).

The scheduled ISD for the Project is July 1, 2017.

This report detailed the system performance studies undertaken to assess the impact of the Project on the AIES.

Studies performed for the Project

Power flow studies were performed using 2017 SP and SL scenarios, before and after the requested connection of the Project.

Transient stability studies were performed for 2017 SP and SL post-connection scenarios.

Short-circuit studies were also performed for 2017 SP pre-connection, post- connection and future 2024 WP scenarios.

Results of the pre-connection studies

No Reliability Criteria violations were observed for the pre-connection study scenarios.

Connection alternative examined for the Project

One connection alternative was identified for the Project, and was studied to evaluate the impact of the Project on the AIES.

The connection alternative involves connecting the proposed McLaughlin 423S substation to the existing 138 kV transmission line 164L (between the Goose Lake 103S and Drywood 415S substations) using a T-tap configuration, and includes adding a single circuit 138 kV transmission line with a minimum summer rating of 53 MVA.

Results of the post-connection studies

The following is a summary of the results of the post-connection studies.

Category A (N-0) conditions

Under Category A conditions, no Reliability Criteria violations were observed for any of the studied scenarios with the Project.

Category B (N-1) contingency conditions

Under Category B contingency conditions, no Reliability Criteria violations were observed for any of the studied scenarios with the Project.

Short-circuit analyses

The short-circuit analyses show that short-circuit current levels will not significantly increase after the Project.

Conclusions and Recommendations

The connection assessment indicates that the Project will not adversely impact the performance of the AIES. Therefore, it is recommended that the Project be connected using the identified connection alternative.

ATTACHMENT A

Pre-Connection Power Flow Analysis Result

Scenarios 1 and 2

Table A-1

Figure #	Scenario	Cont. Category	Contingency Description	Thermal Overloads	Voltage Performance
Figure A-1	Scenario #1, 2017 SP	A	Normal Operation	None	Acceptable
Figure A-2	Scenario #1, 2017 SP	B	994L (Fidler 312S to Goose lake 103S)	None	Acceptable
Figure A-3	Scenario #1, 2017 SP	B	1071L (Fidler 312S to Castle Rock Ridge 205S)	None	Acceptable
Figure A-4	Scenario #1, 2017 SP	B	1072L (Castle Rock Ridge 205S to Goose Lake 103S)	None	Acceptable
Figure A-5	Scenario #1, 2017 SP	B	955L (Goose Lake 103S to Peigan 59S)	None	Acceptable
Figure A-6	Scenario #1, 2017 SP	B	1048L (Peigan 59S to Windy Flat 138S)	None	Acceptable
Figure A-7	Scenario #1, 2017 SP	B	1038L (Windy Flat 138S to Foothills 237S)	None	Acceptable
Figure A-8	Scenario #1, 2017 SP	B	967L (Windy Flat 138S to North Lethbridge 370S)	None	Acceptable
Figure A-9	Scenario #1, 2017 SP	B	613L (Goose Lake 103S to Pincher Creek 396S)	None	Acceptable
Figure A-10	Scenario #1, 2017 SP	B	616L (Goose Lake 103S to Peigan 59S)	None	Acceptable
Figure A-11	Scenario #1, 2017 SP	B	Goose Lake 103S 240/138 kV Transformer	None	Acceptable
Figure A-12	Scenario #2, 2017 SL	A	Normal Operation	None	Acceptable
Figure A-13	Scenario #2, 2017 SL	B	994L (Fidler 312S to Goose lake 103S)	None	Acceptable
Figure A-14	Scenario #2, 2017 SL	B	1071L (Fidler 312S to Castle Rock Ridge 205S)	None	Acceptable
Figure A-15	Scenario #2, 2017 SL	B	1072L (Castle Rock Ridge 205S to Goose Lake 103S)	None	Acceptable
Figure A-16	Scenario #2, 2017 SL	B	955L (Goose Lake 103S to Peigan 59S)	None	Acceptable

Figure A-17	Scenario #2, 2017 SL	B	1048L (Peigan 59S to Windy Flat 138S)	None	Acceptable
Figure A-18	Scenario #2, 2017 SL	B	1038L (Windy Flat 138S to Foothills 237S)	None	Acceptable
Figure A-19	Scenario #2, 2017 SL	B	967L (Windy Flat 138S to North Lethbridge 370S)	None	Acceptable
Figure A-20	Scenario #2, 2017 SL	B	613L (Goose Lake 103S to Pincher Creek 396S)	None	Acceptable
Figure A-21	Scenario #2, 2017 SL	B	616L (Goose Lake 103S to Peigan 59S)	None	Acceptable
Figure A-22	Scenario #2, 2017 SL	B	Goose Lake 103S 240/138 kV Transformer	None	Acceptable

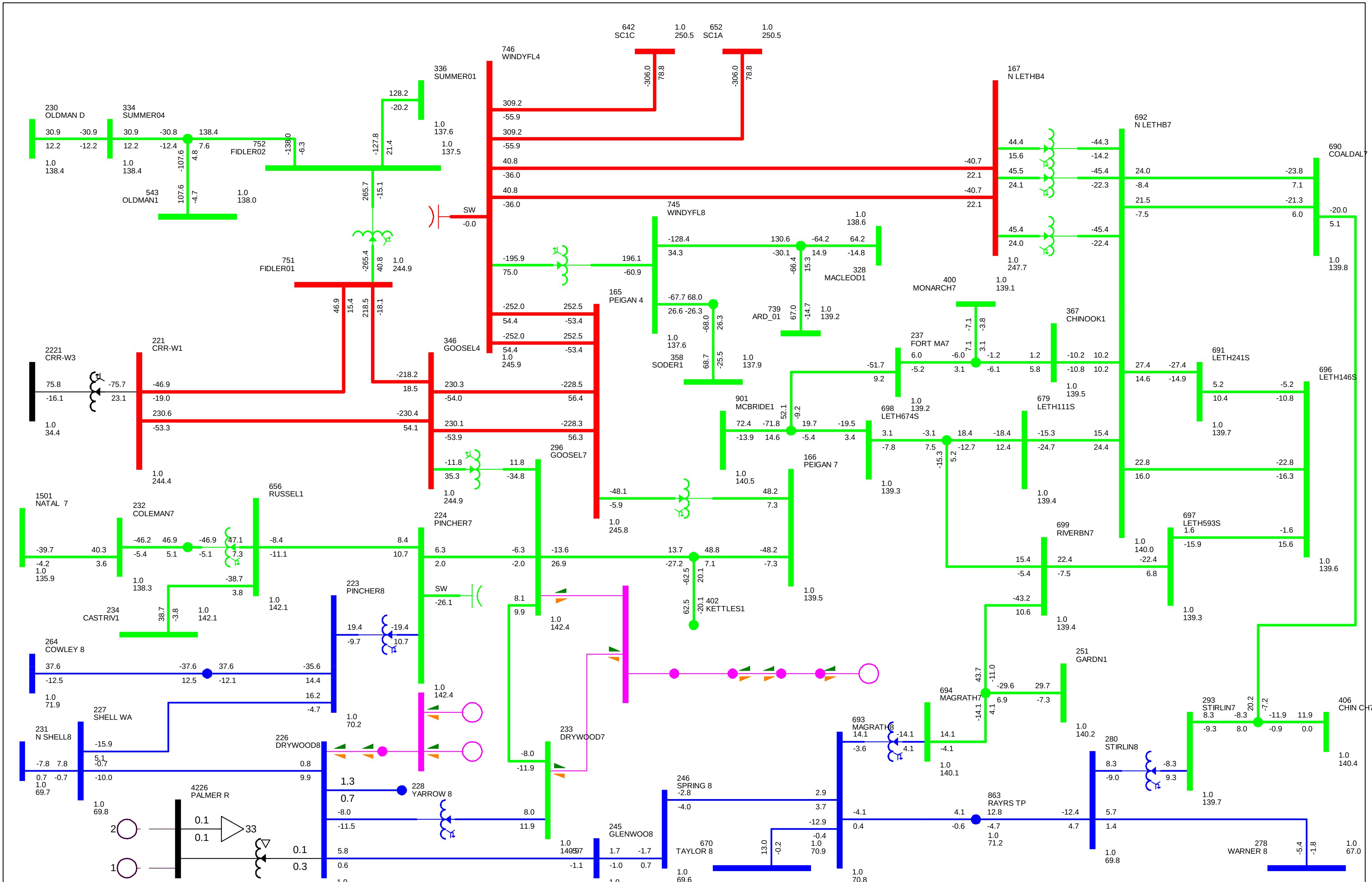


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FIGURE A-1 - SYSTEM NORMAL
PRE-CONNECTION, 2017SP, SCN #1
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kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000

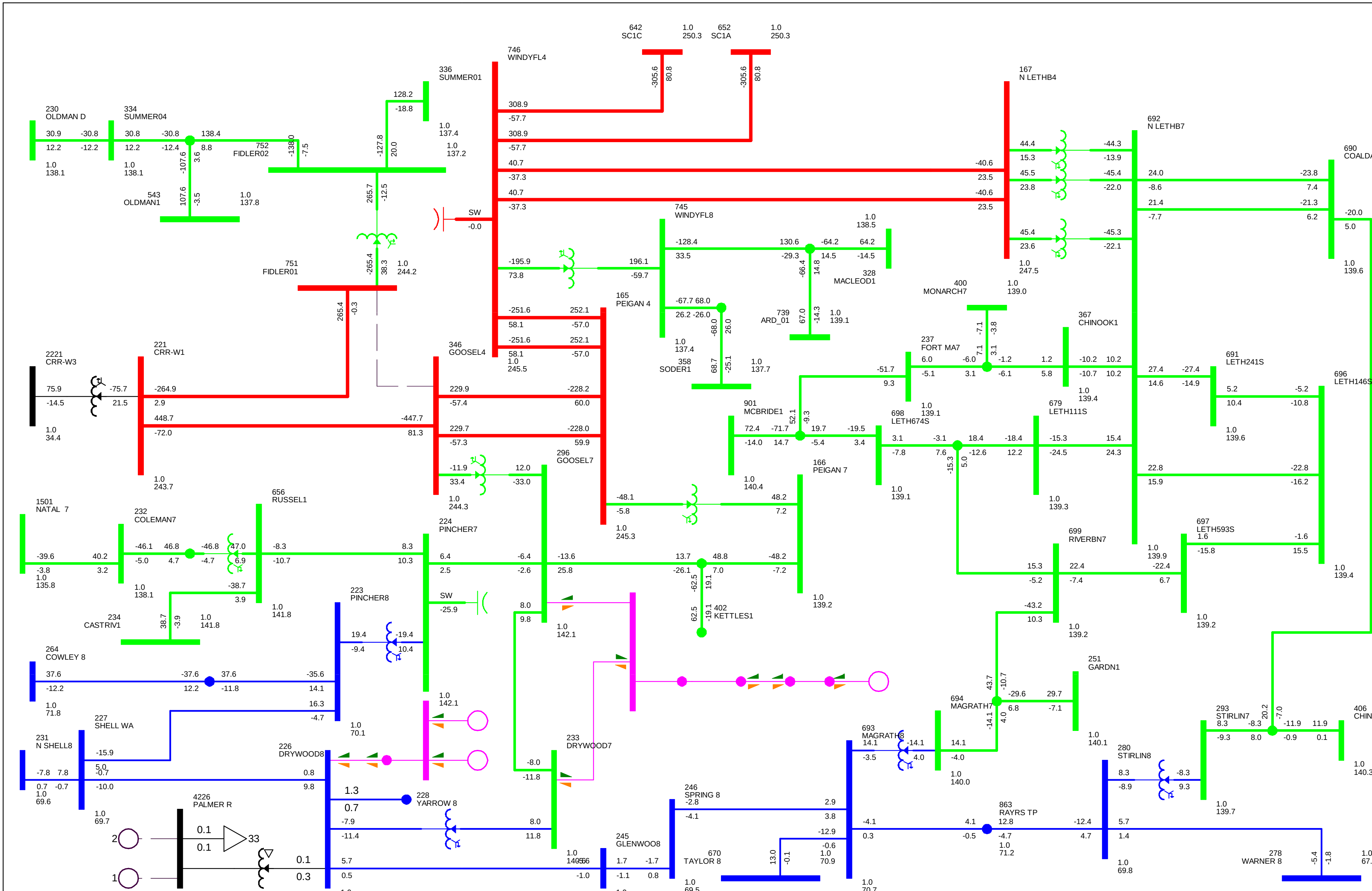

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FIGURE A-2 - CONTINGENCY 994L
PRE-CONNECTION, 2017SP, SCN #1
WED, MAY 13 2015 16:19

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000

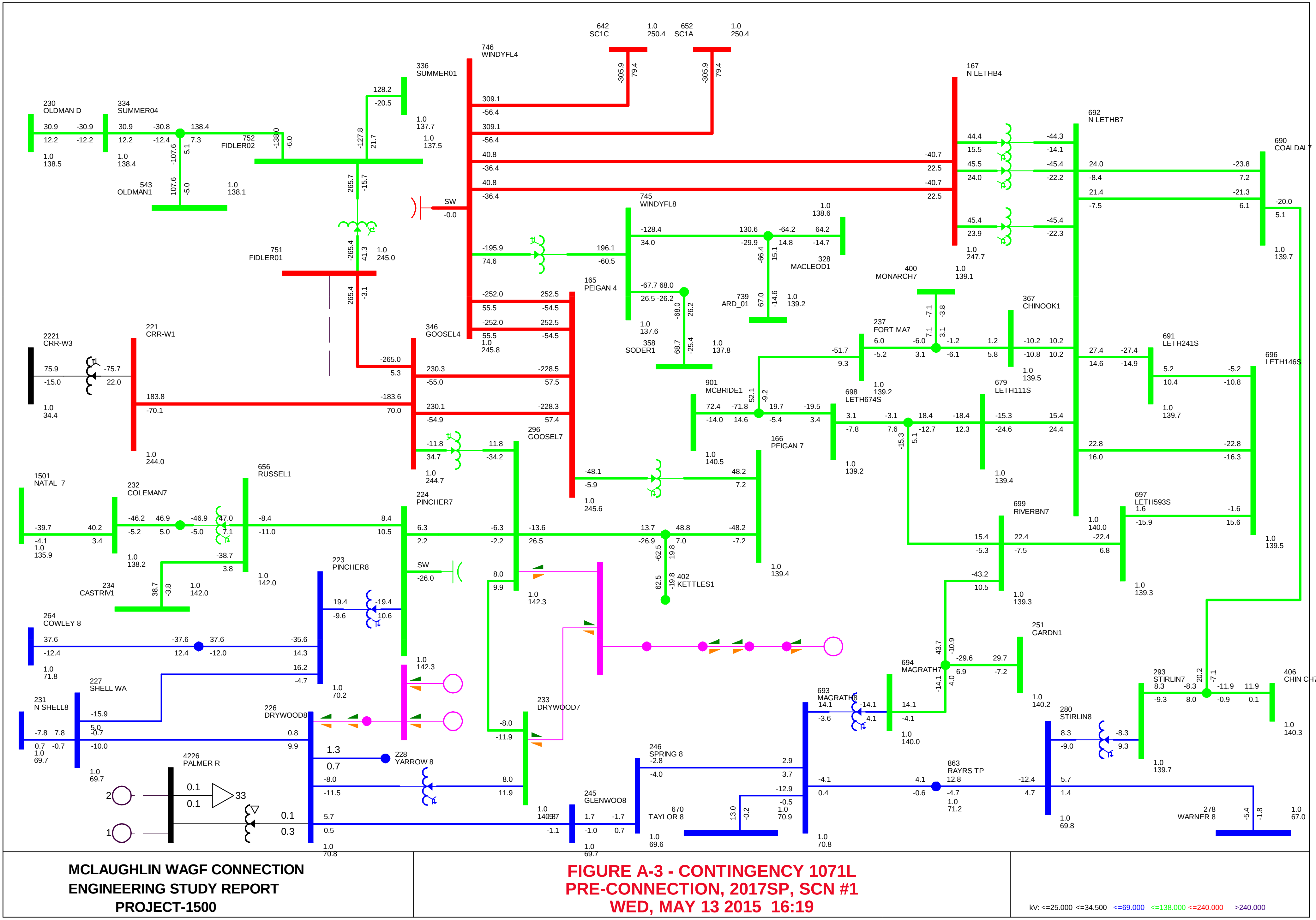

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FIGURE A-3 - CONTINGENCY 1071L
PRE-CONNECTION, 2017SP, SCN #1
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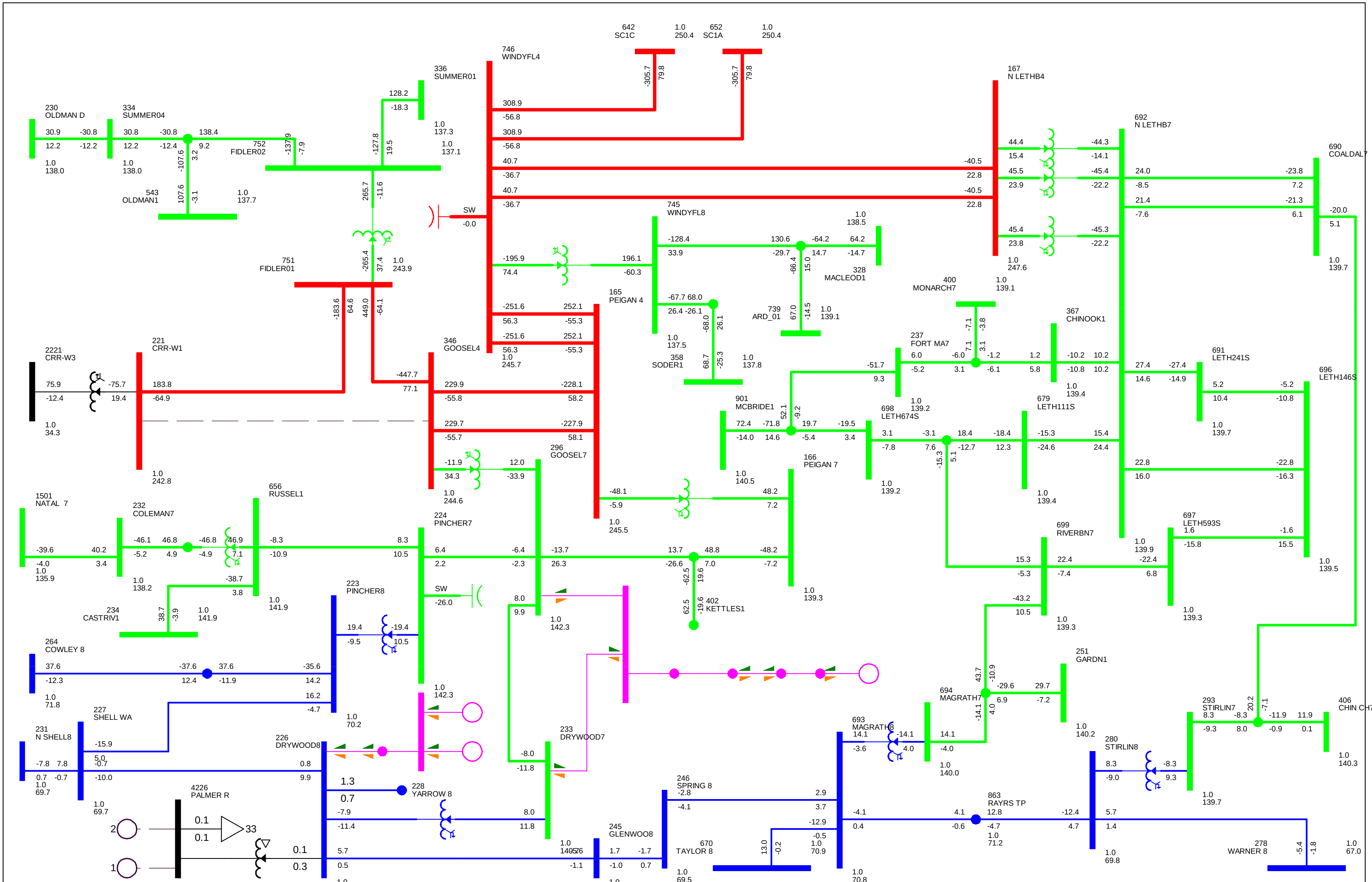

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FIGURE A-4 - CONTINGENCY 1072L
PRE-CONNECTION, 2017SP, SCN #1
WED, MAY 13 2015 16:19

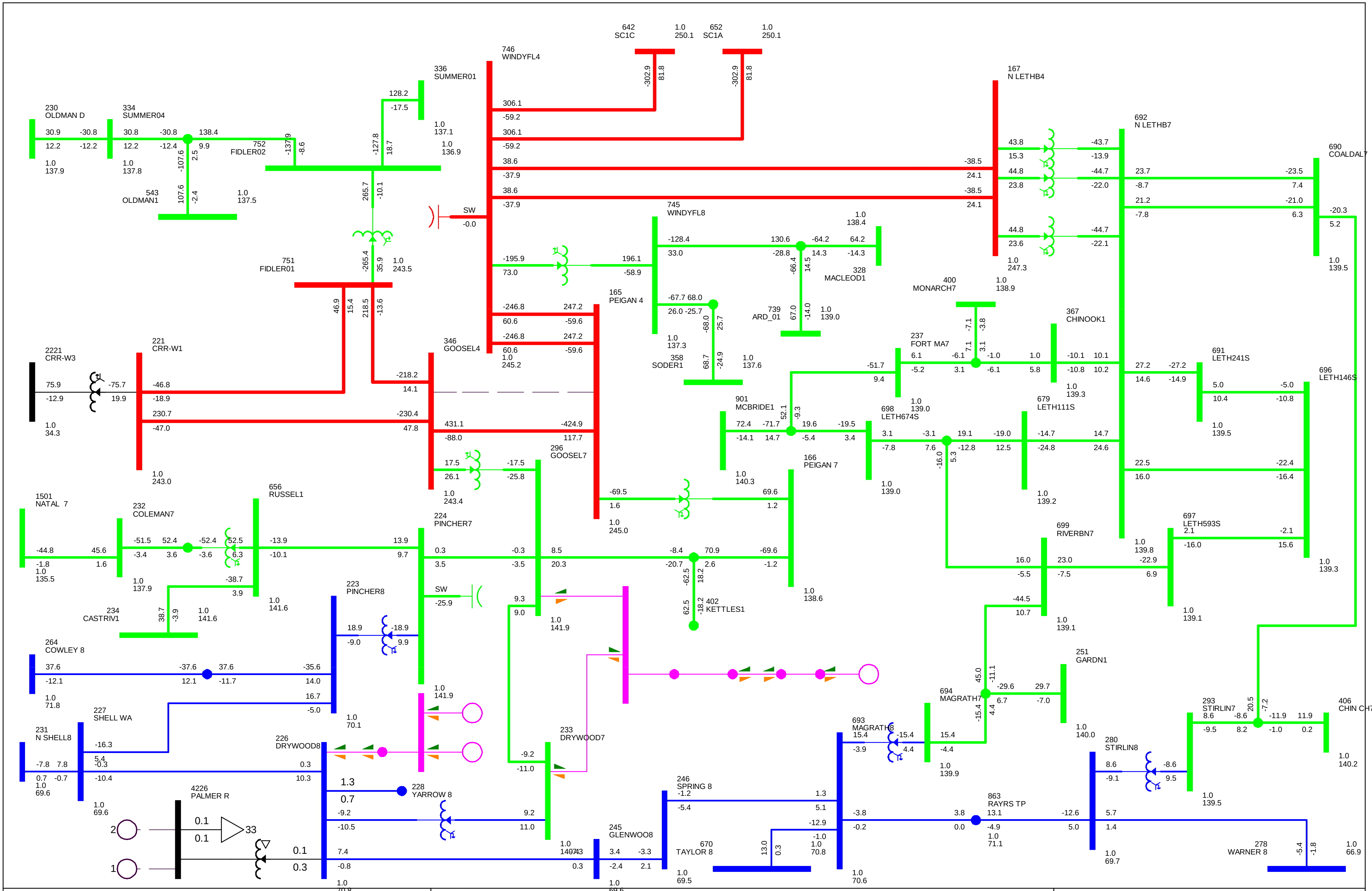

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FIGURE A-5 - CONTINGENCY 955L
PRE-CONNECTION, 2017SP, SCN #1
WED, MAY 13 2015 16:19

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000

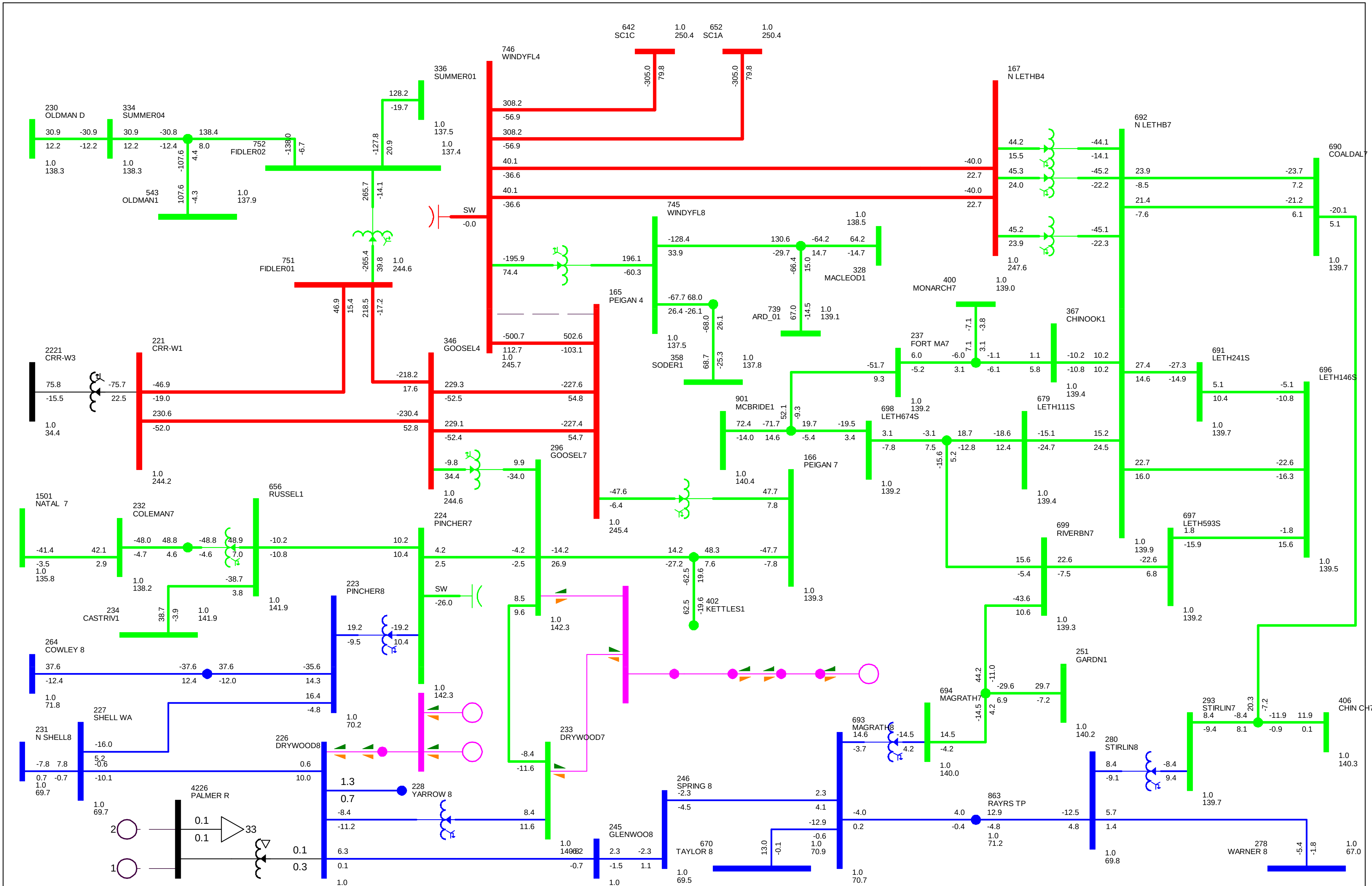

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FIGURE A-6 - CONTINGENCY 1048L
PRE-CONNECTION, 2017SP, SCN #1
WED, MAY 13 2015 16:19

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000

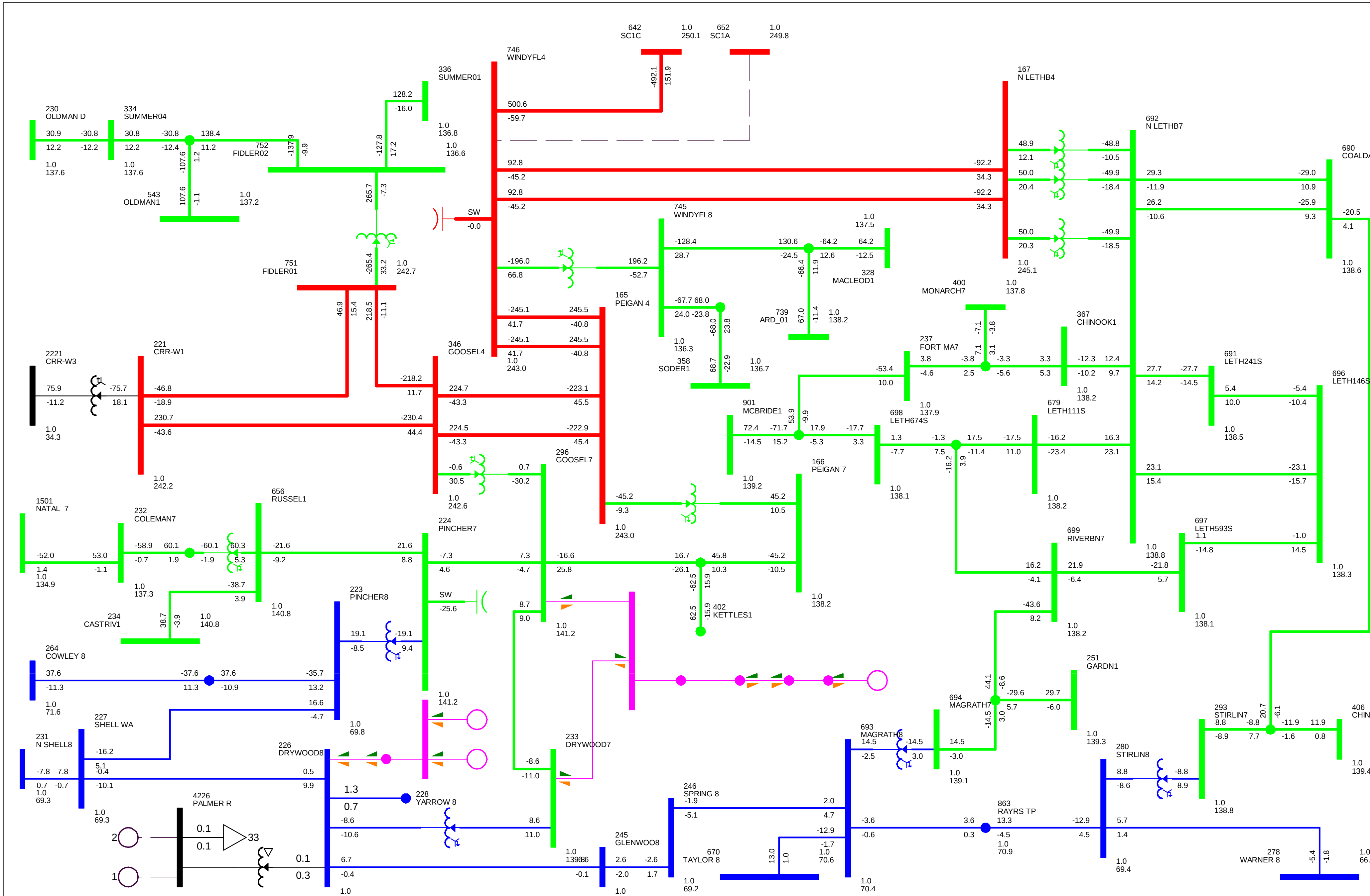

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FIGURE A-7 - CONTINGENCY 1038L
PRE-CONNECTION, 2017SP, SCN #1
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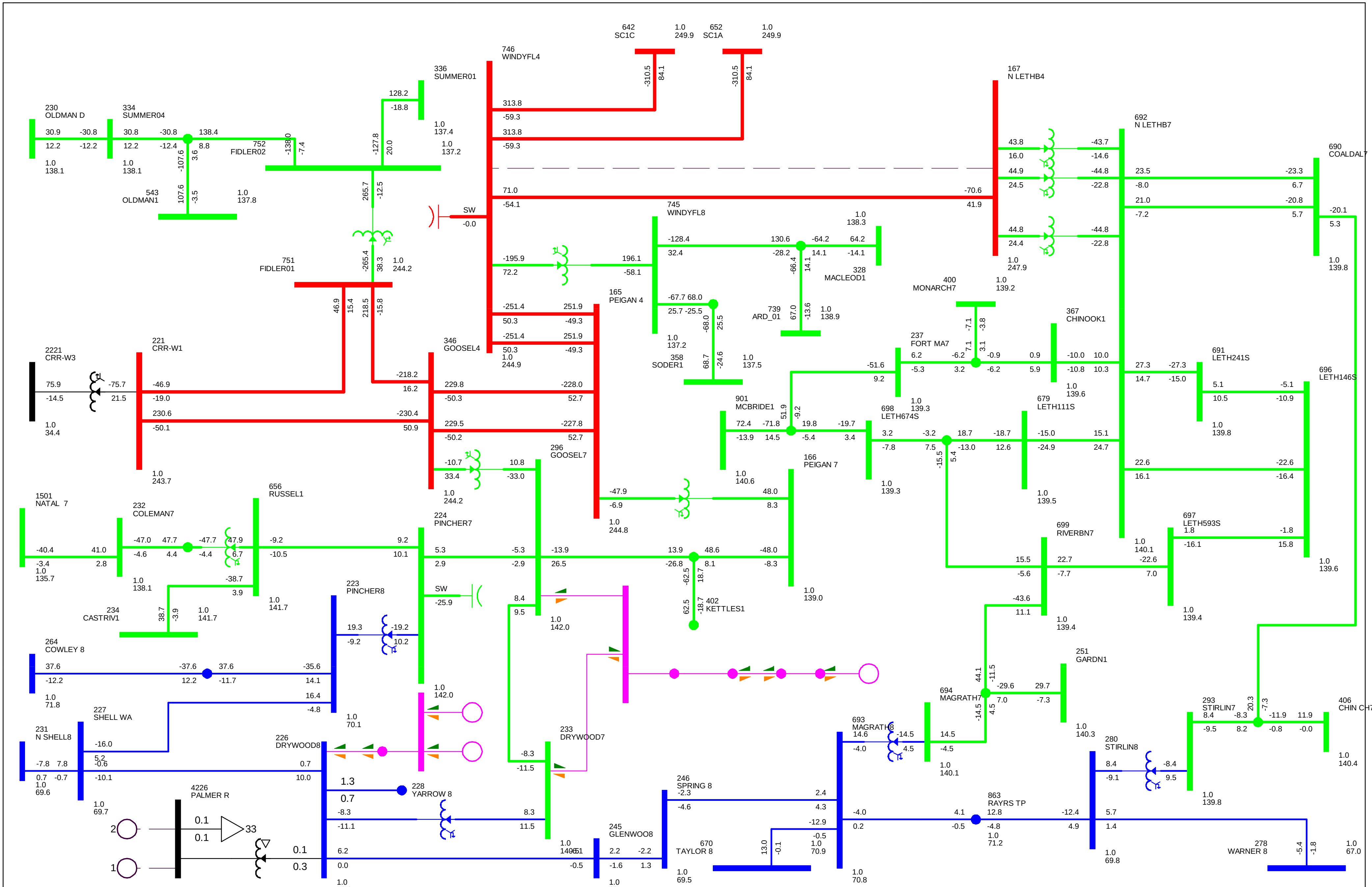

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FIGURE A-8 - CONTINGENCY 967L
PRE-CONNECTION, 2017SP, SCN #1
WED, MAY 13 2015 16:19

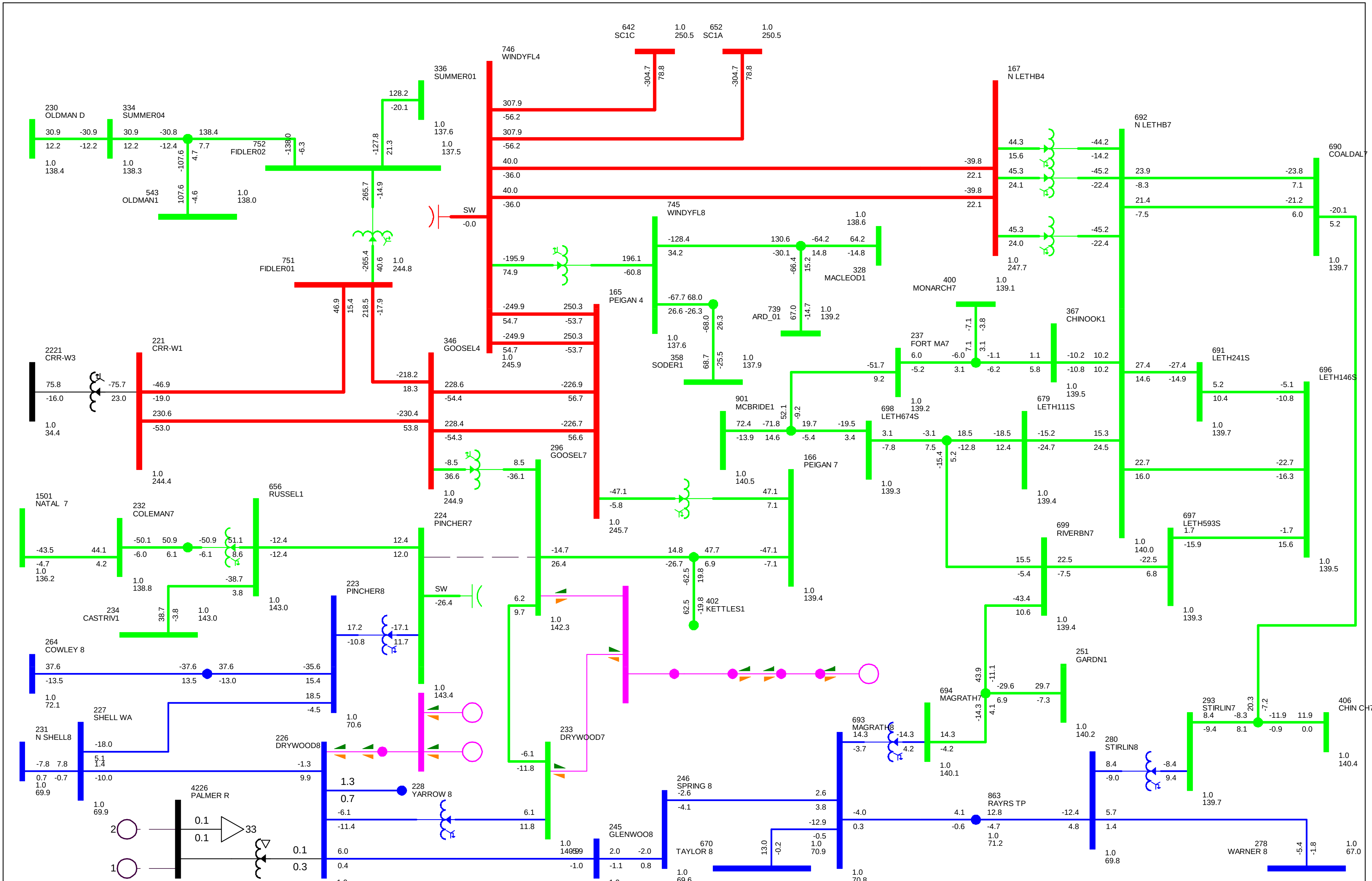

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FIGURE A-9 - CONTINGENCY 613L
PRE-CONNECTION, 2017SP, SCN #1
WED, MAY 13 2015 16:19

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000

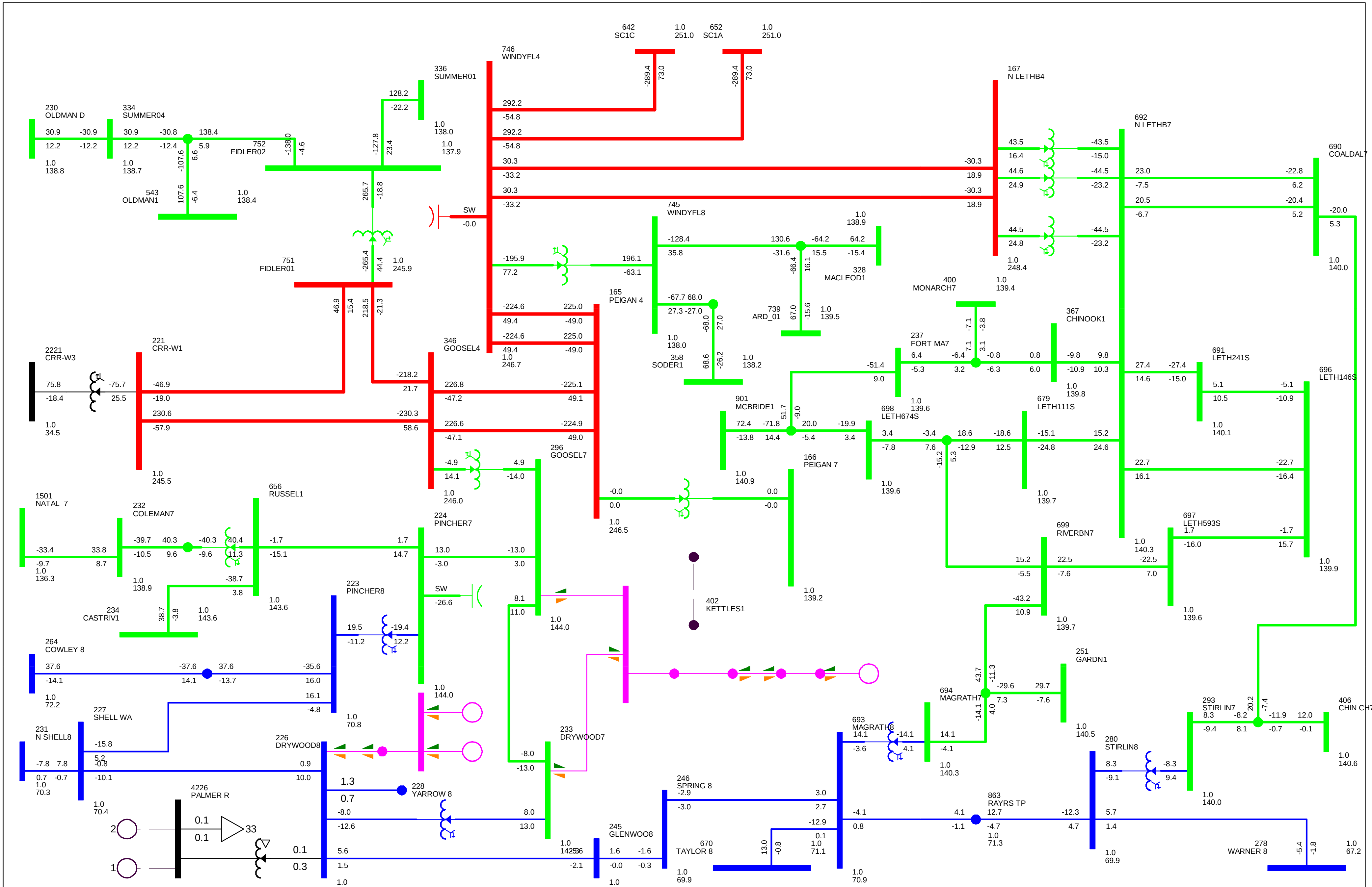

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FIGURE A-10 - CONTINGENCY 616L
PRE-CONNECTION, 2017SP, SCN #1
WED, MAY 13 2015 16:19

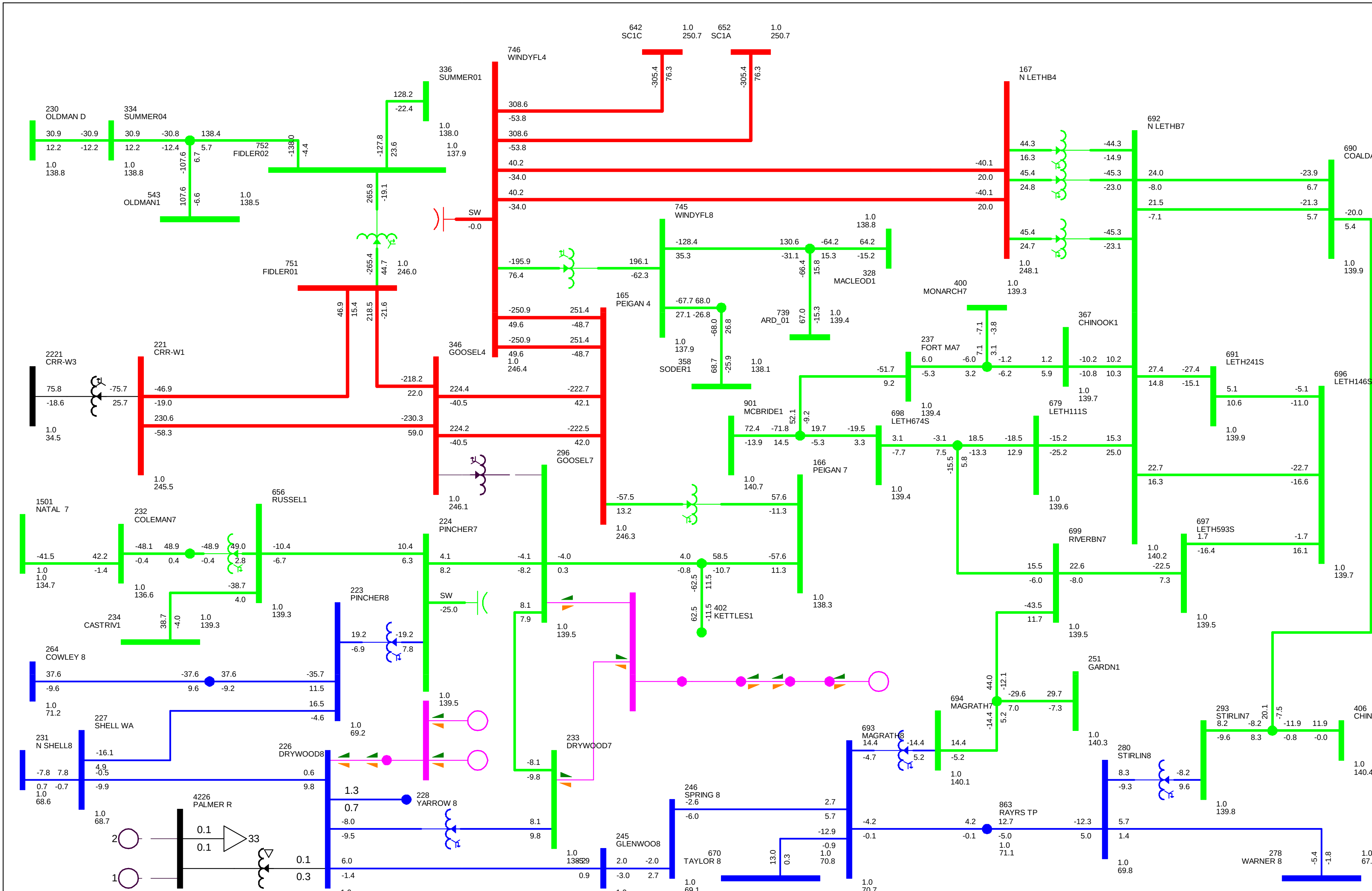

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FIGURE A-11 - CONTINGENCY GOOSEL-XFMR
PRE-CONNECTION, 2017SP, SCN #1
WED, MAY 13 2015 16:19

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000

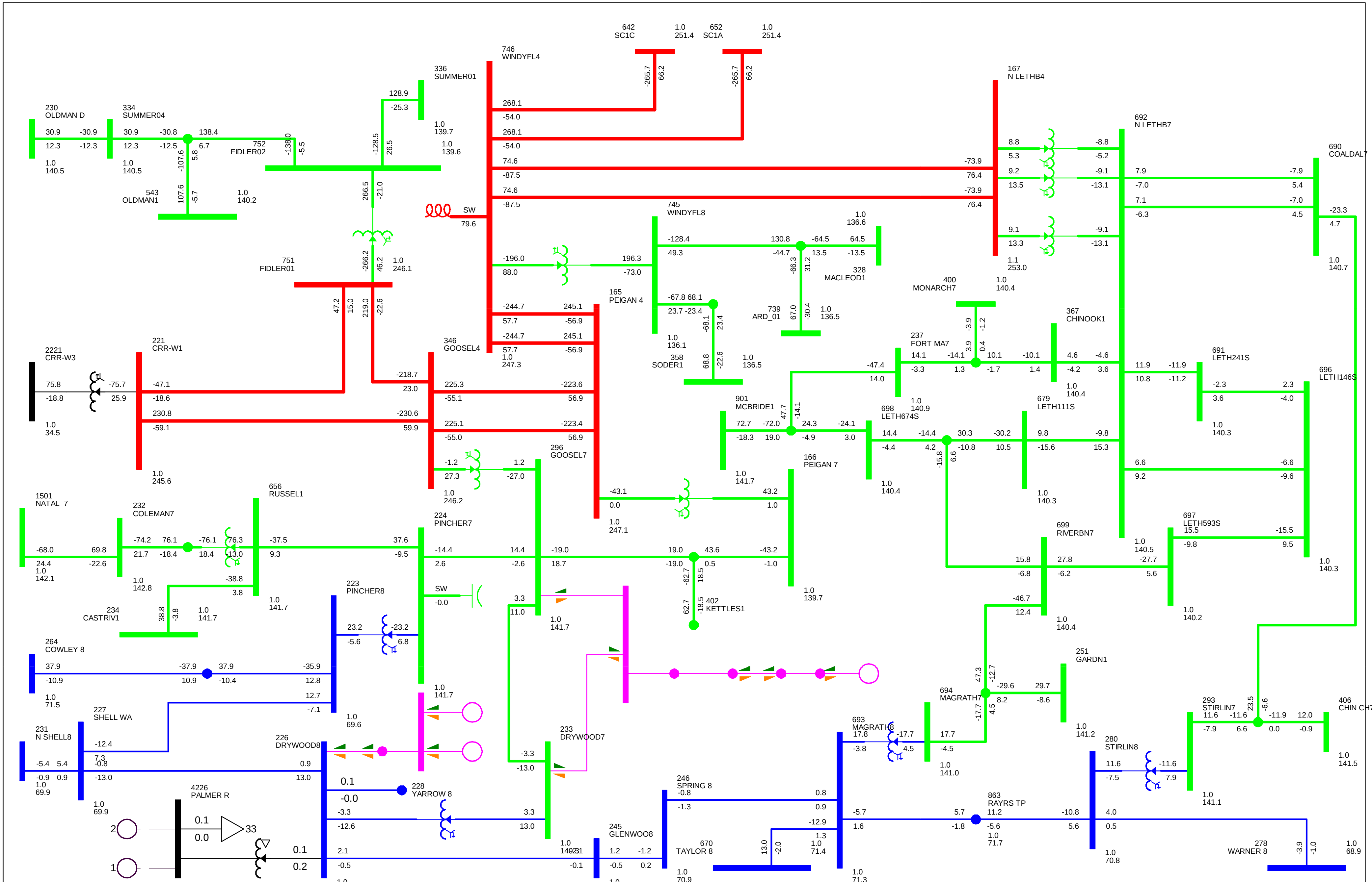

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FIGURE A-12 - SYSTEM NORMAL
PRE-CONNECTION, 2017SL, SCN #2
WED, MAY 13 2015 16:19

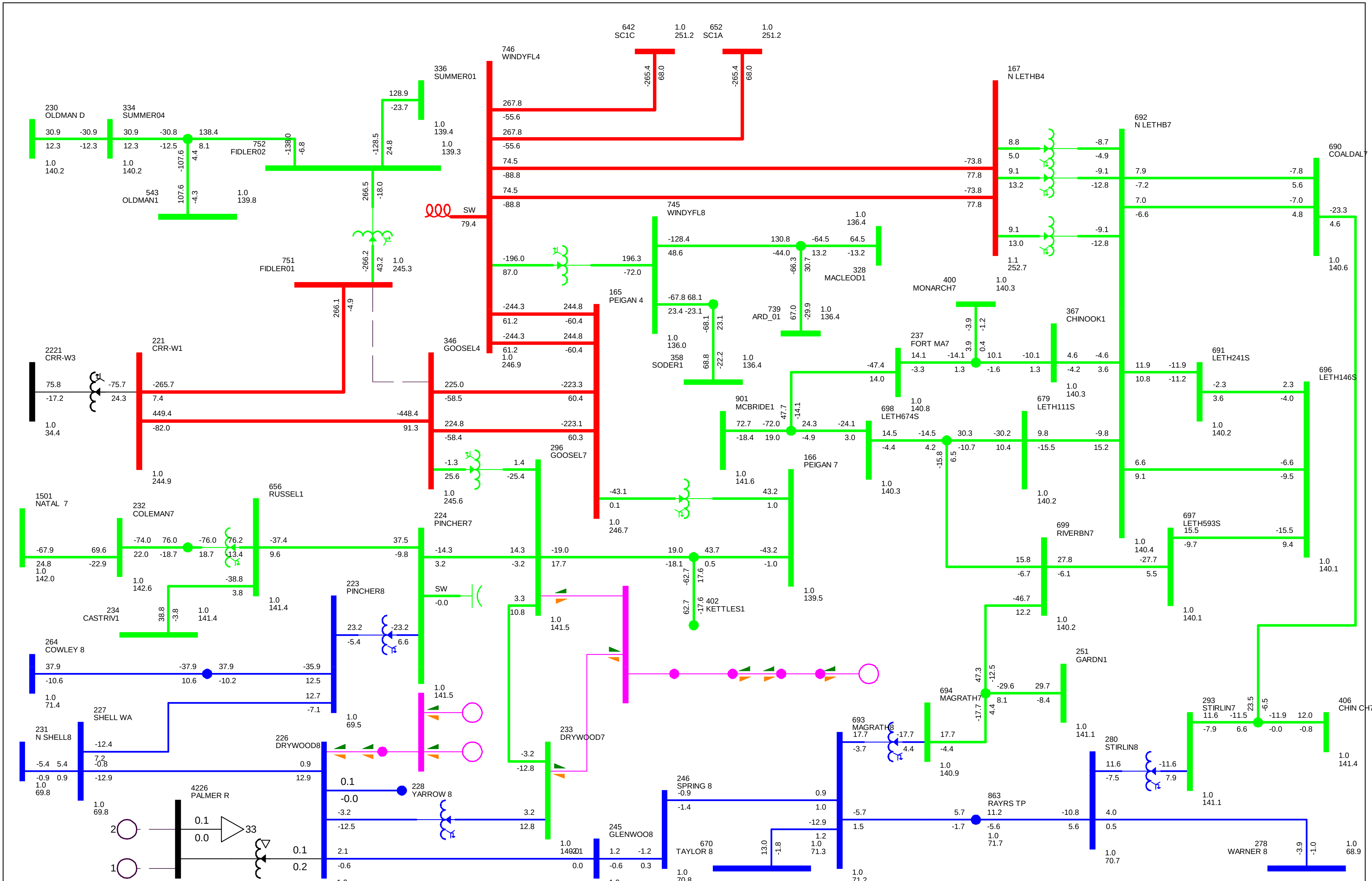

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FIGURE A-13 - CONTINGENCY 994L
PRE-CONNECTION, 2017SL, SCN #2
WED, MAY 13 2015 16:19

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000

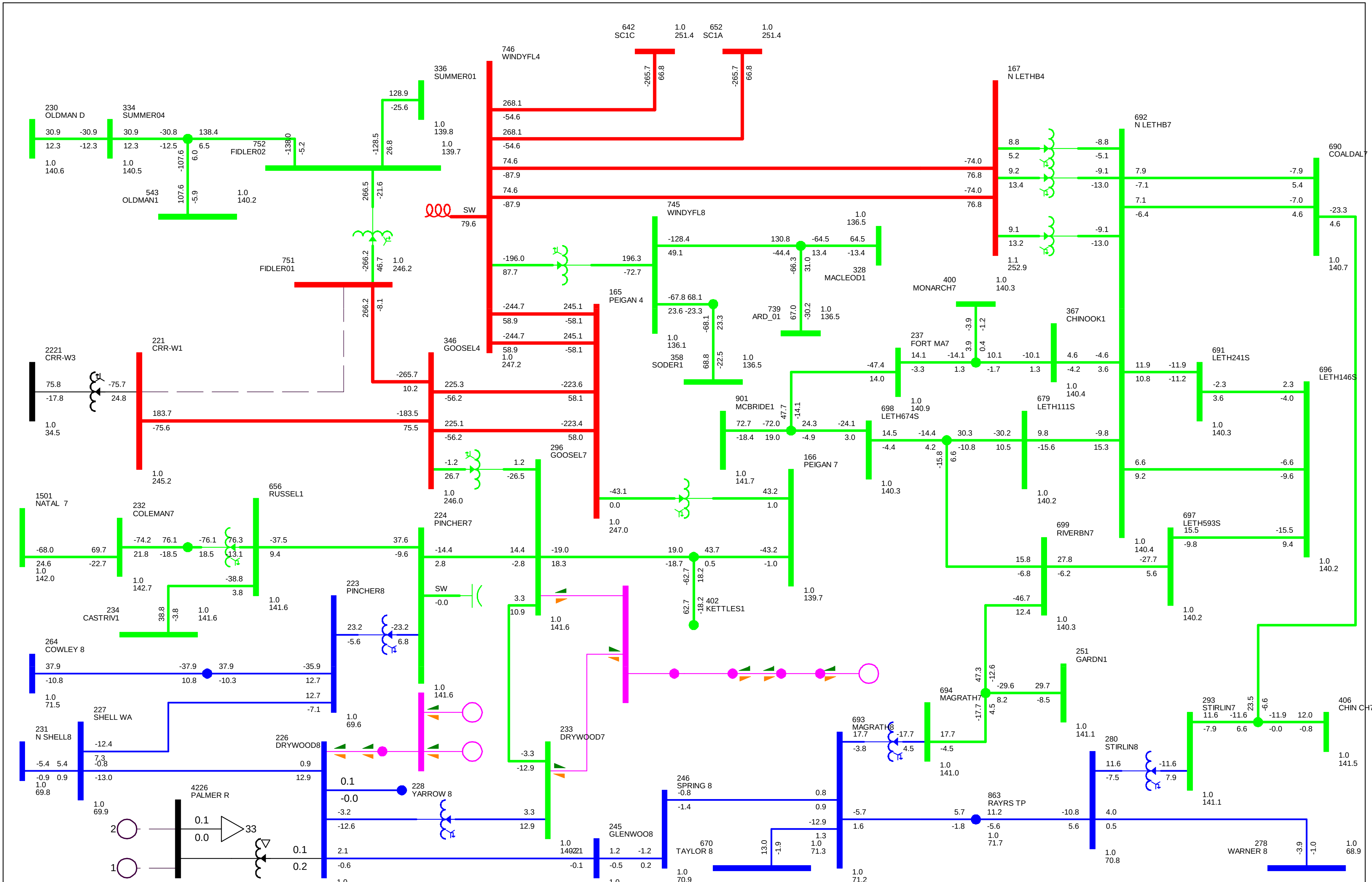

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FIGURE A-14 - CONTINGENCY 1071L
PRE-CONNECTION, 2017SL, SCN #2
WED, MAY 13 2015 16:19

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000

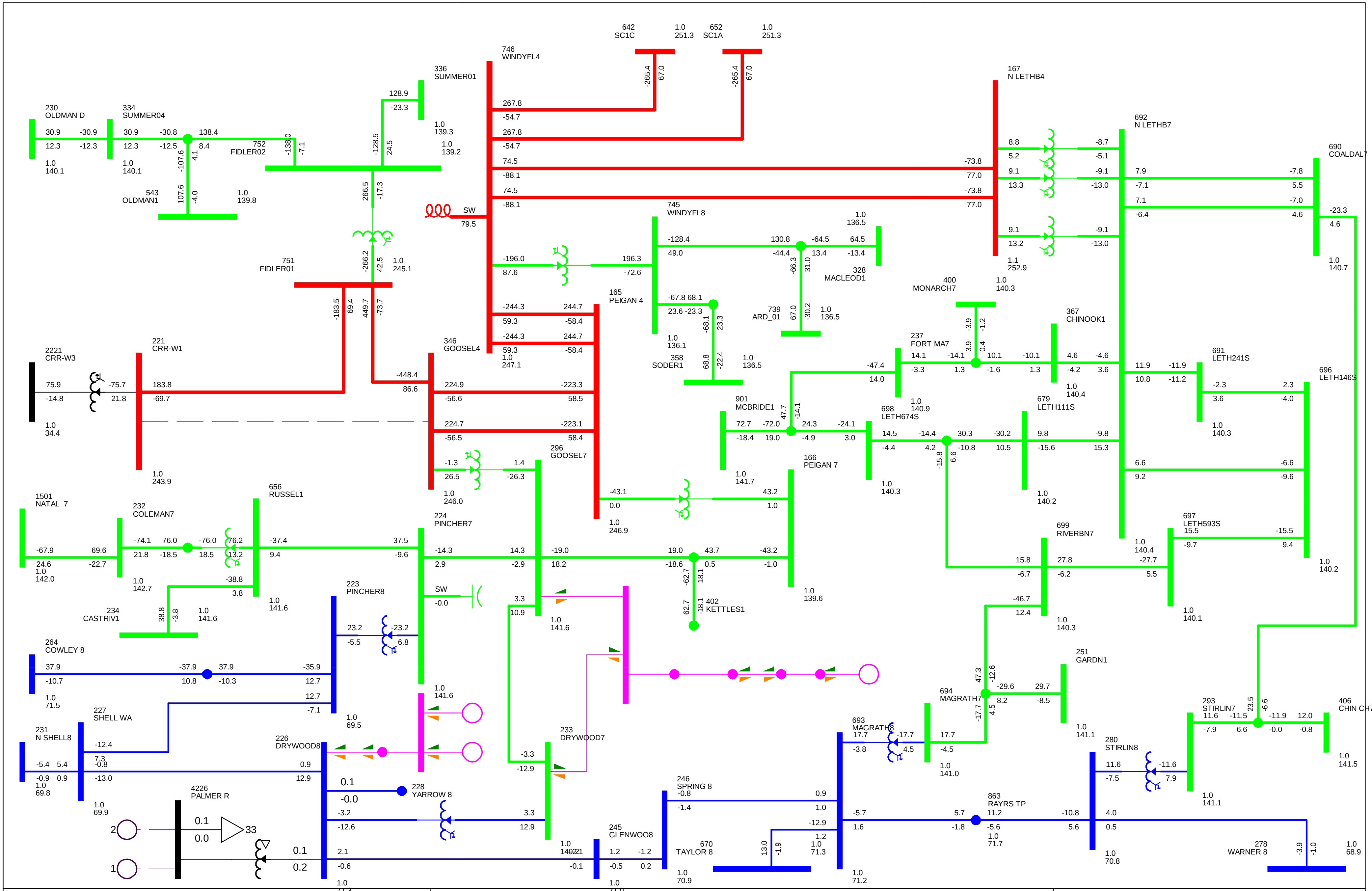

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FIGURE A-15 - CONTINGENCY 1072L
PRE-CONNECTION, 2017SL, SCN #2
WED, MAY 13 2015 16:19

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000

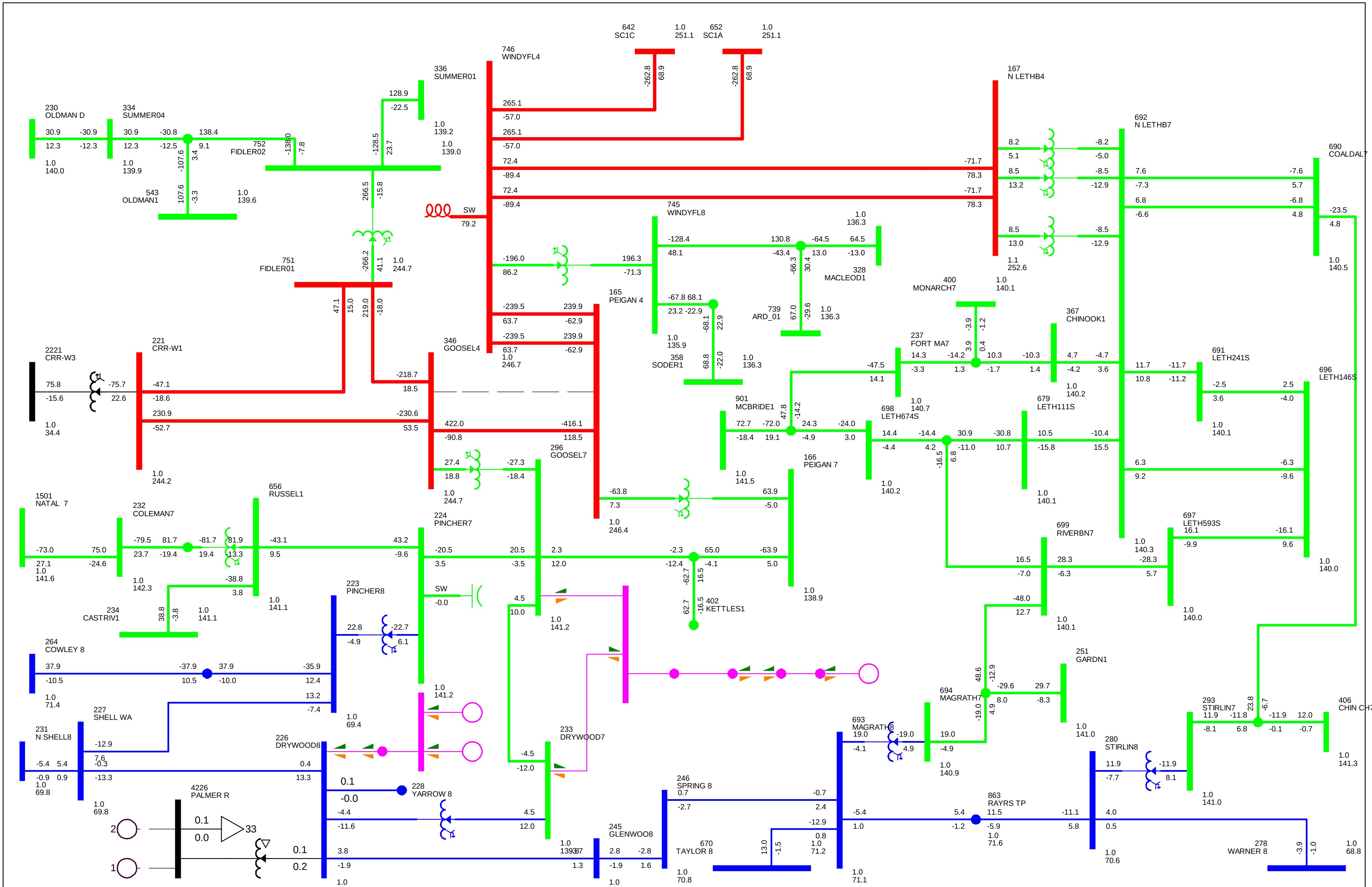

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FIGURE A-16 - CONTINGENCY 955L
PRE-CONNECTION, 2017SL, SCN #2
WED, MAY 13 2015 16:19

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000

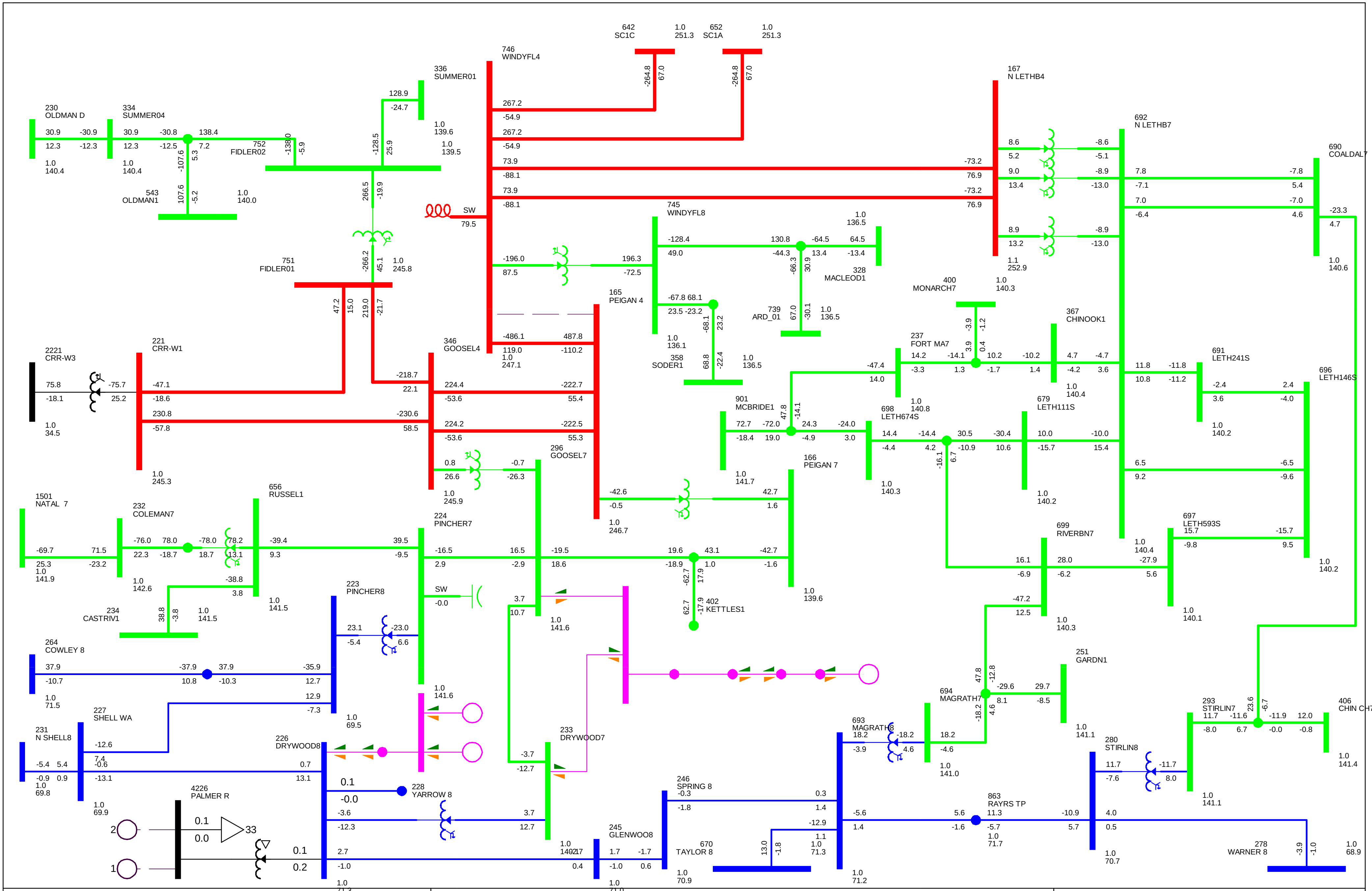

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FIGURE A-17 - CONTINGENCY 1048L
PRE-CONNECTION, 2017SL, SCN #2
WED, MAY 13 2015 16:19

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000

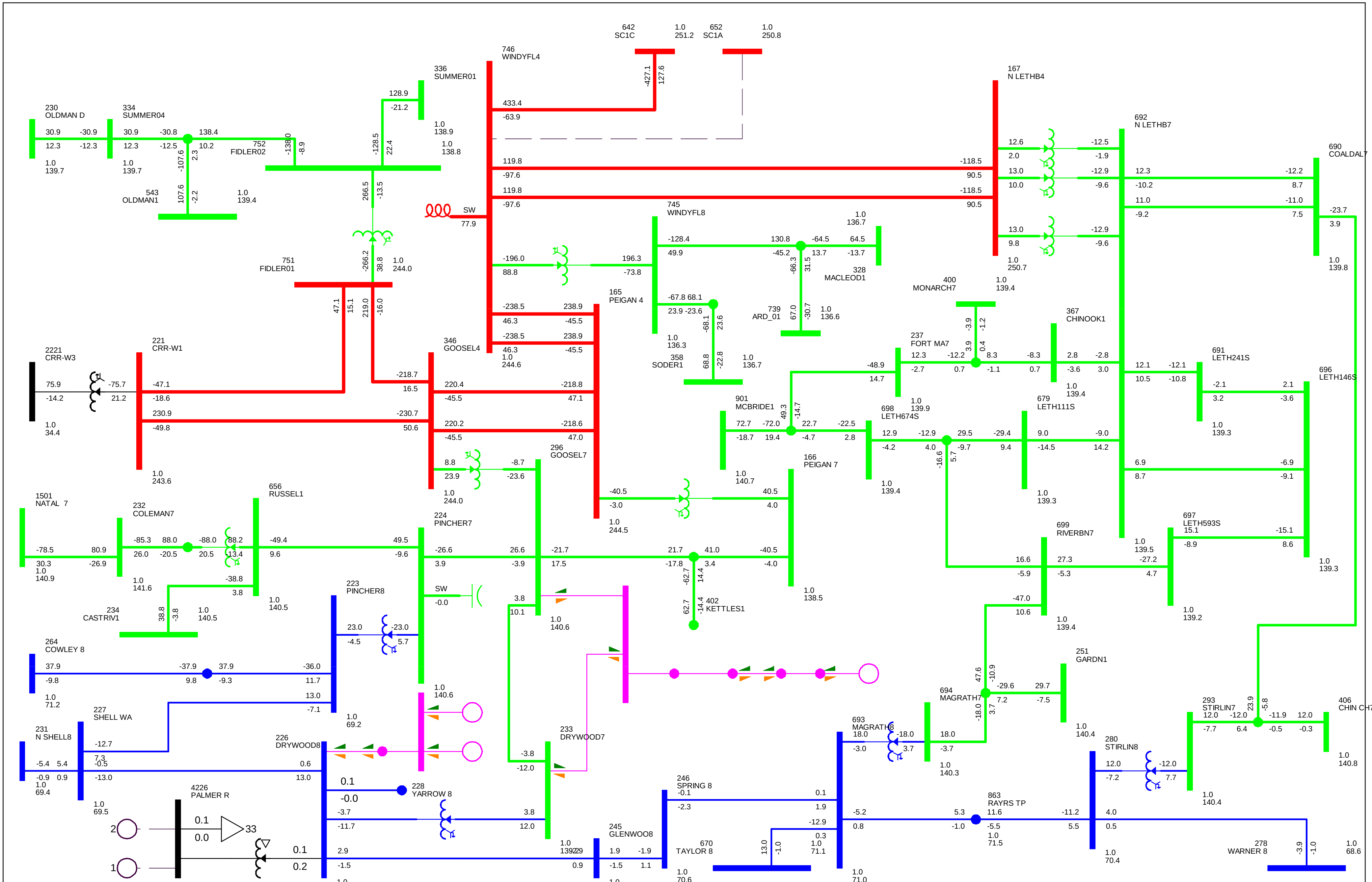

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FIGURE A-18 - CONTINGENCY 1038L
PRE-CONNECTION, 2017SL, SCN #2
WED, MAY 13 2015 16:19

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000

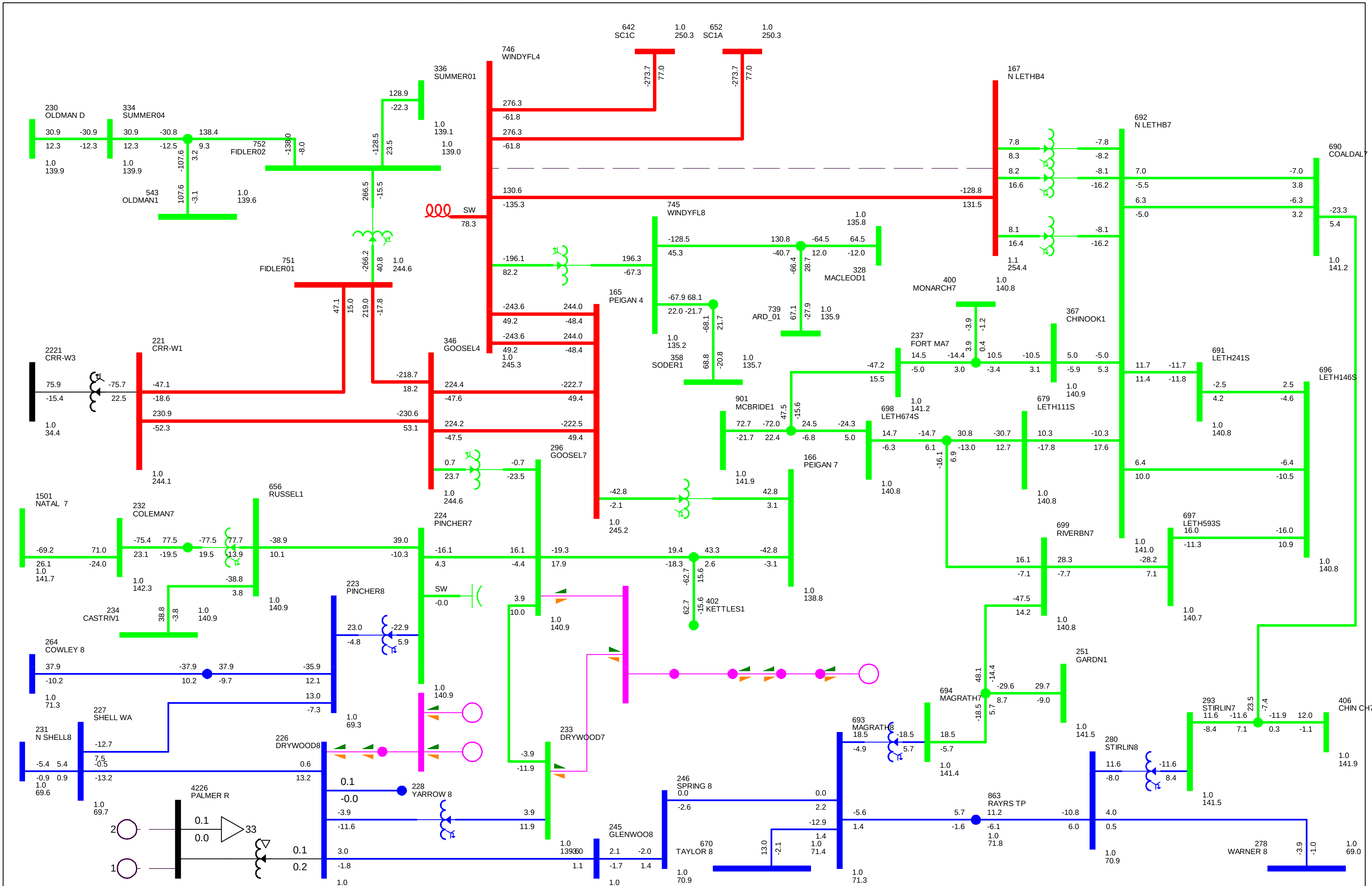

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FIGURE A-19 - CONTINGENCY 967L
PRE-CONNECTION, 2017SL, SCN #2
WED, MAY 13 2015 16:19

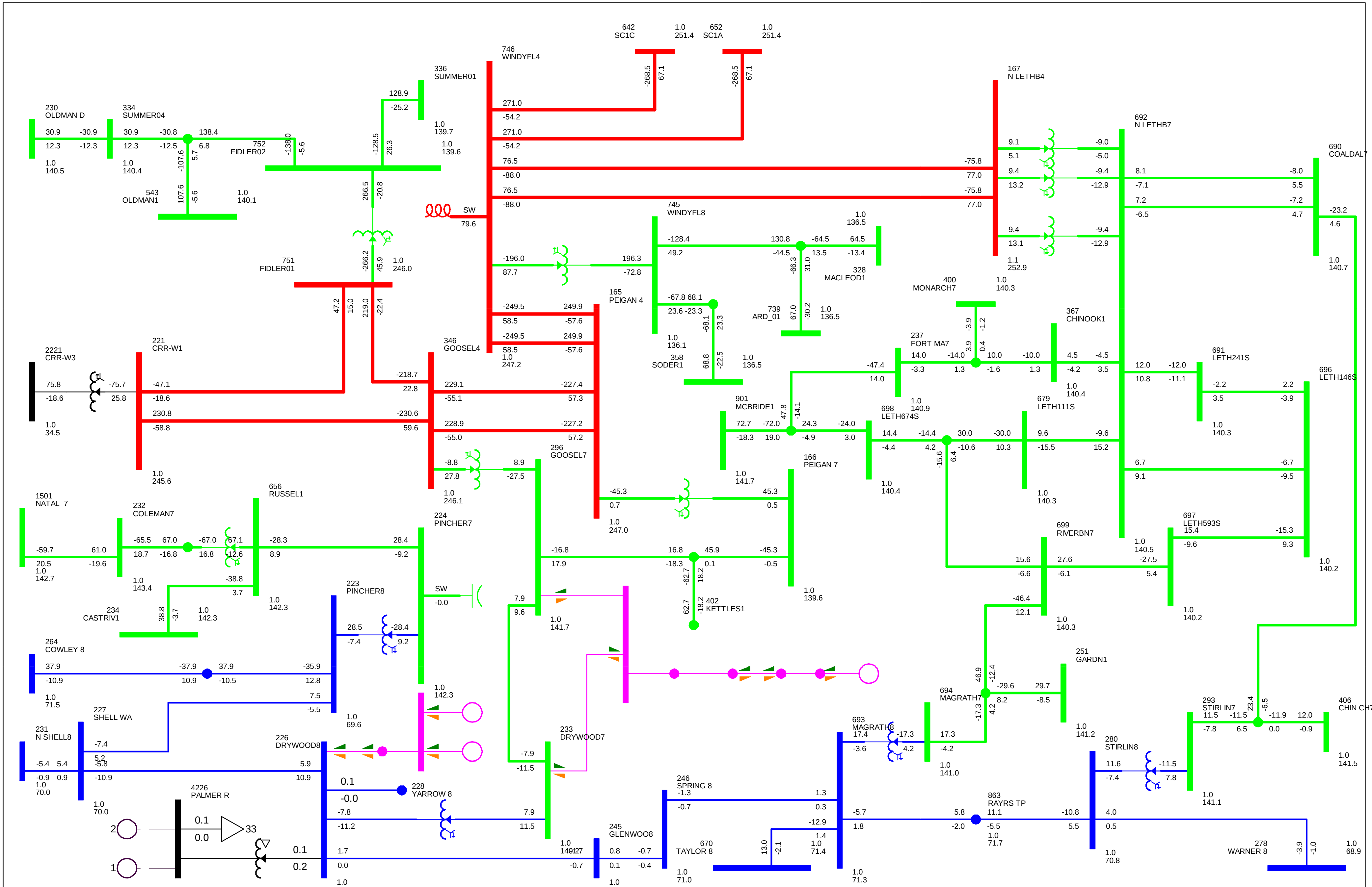

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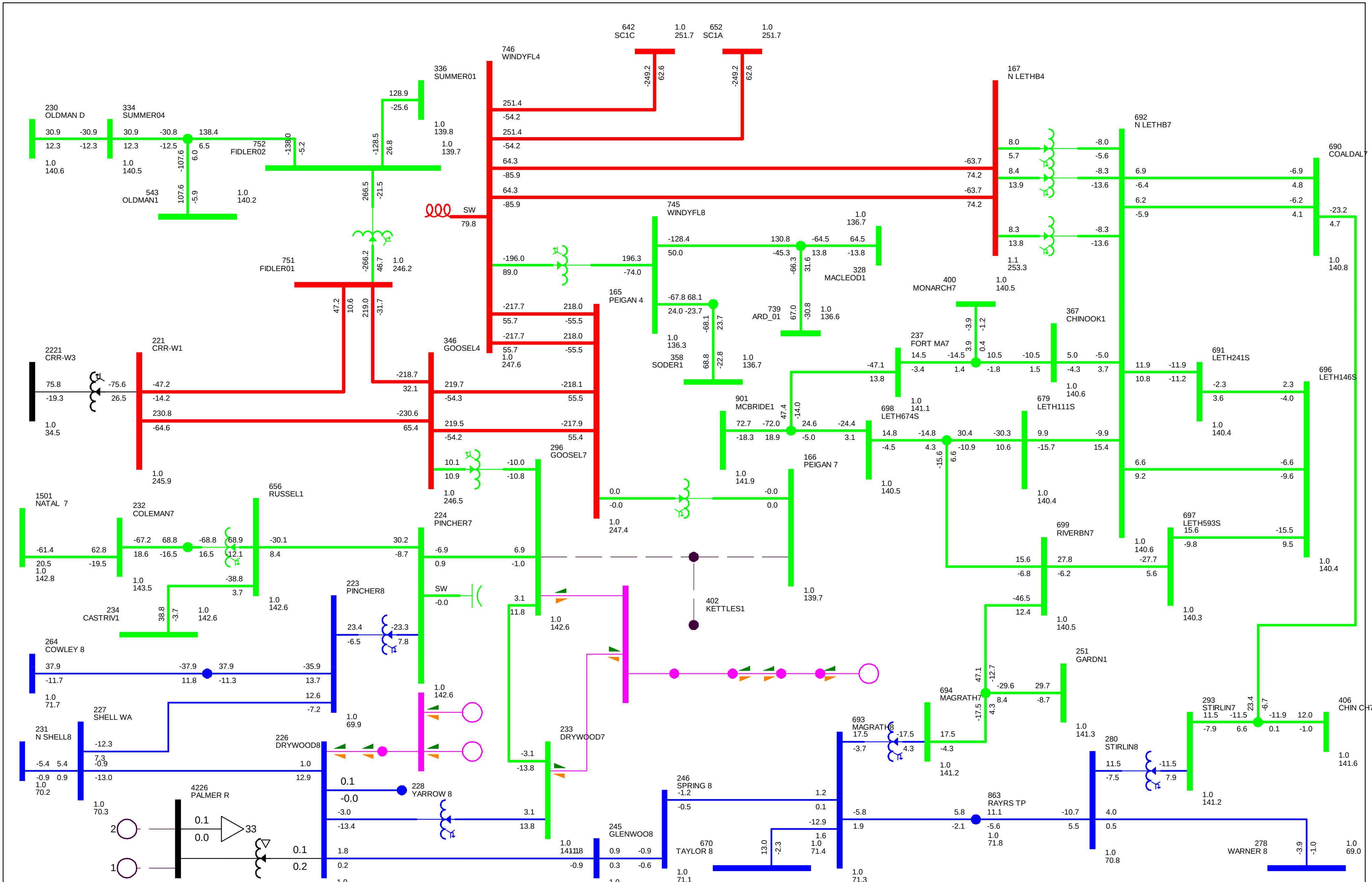
FIGURE A-20 - CONTINGENCY 613L
PRE-CONNECTION, 2017SL, SCN #2
WED, MAY 13 2015 16:19

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000



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ENGINEERING STUDY REPORT
PROJECT-1500

FIGURE A-21 - CONTINGENCY 616L
PRE-CONNECTION, 2017SL, SCN #2
WED, MAY 13 2015 16:19

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000

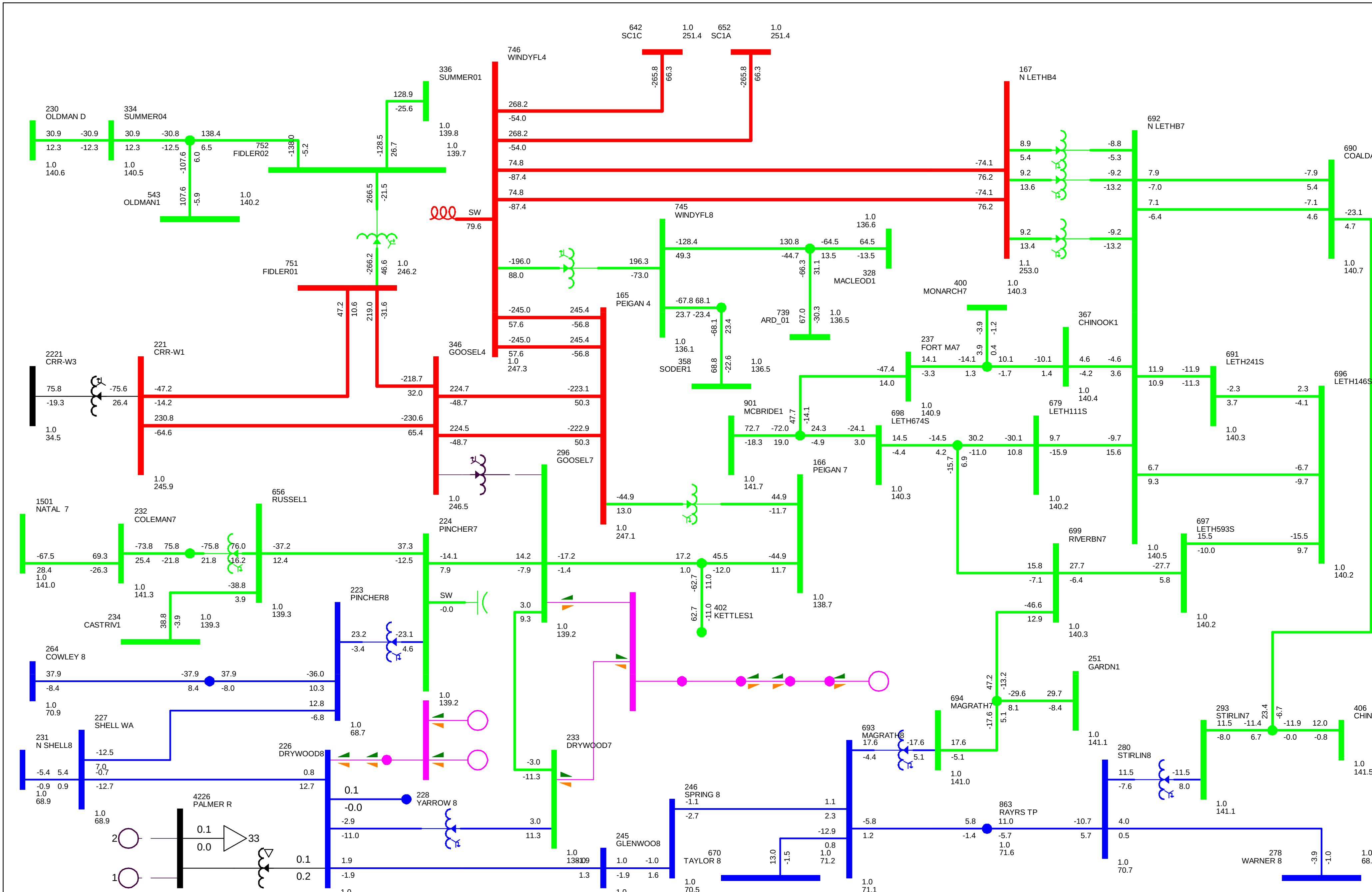

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FIGURE A-22 - CONTINGENCY GOOSEL-XFMR
PRE-CONNECTION, 2017SL, SCN #2
WED, MAY 13 2015 16:20

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000

ATTACHMENT B

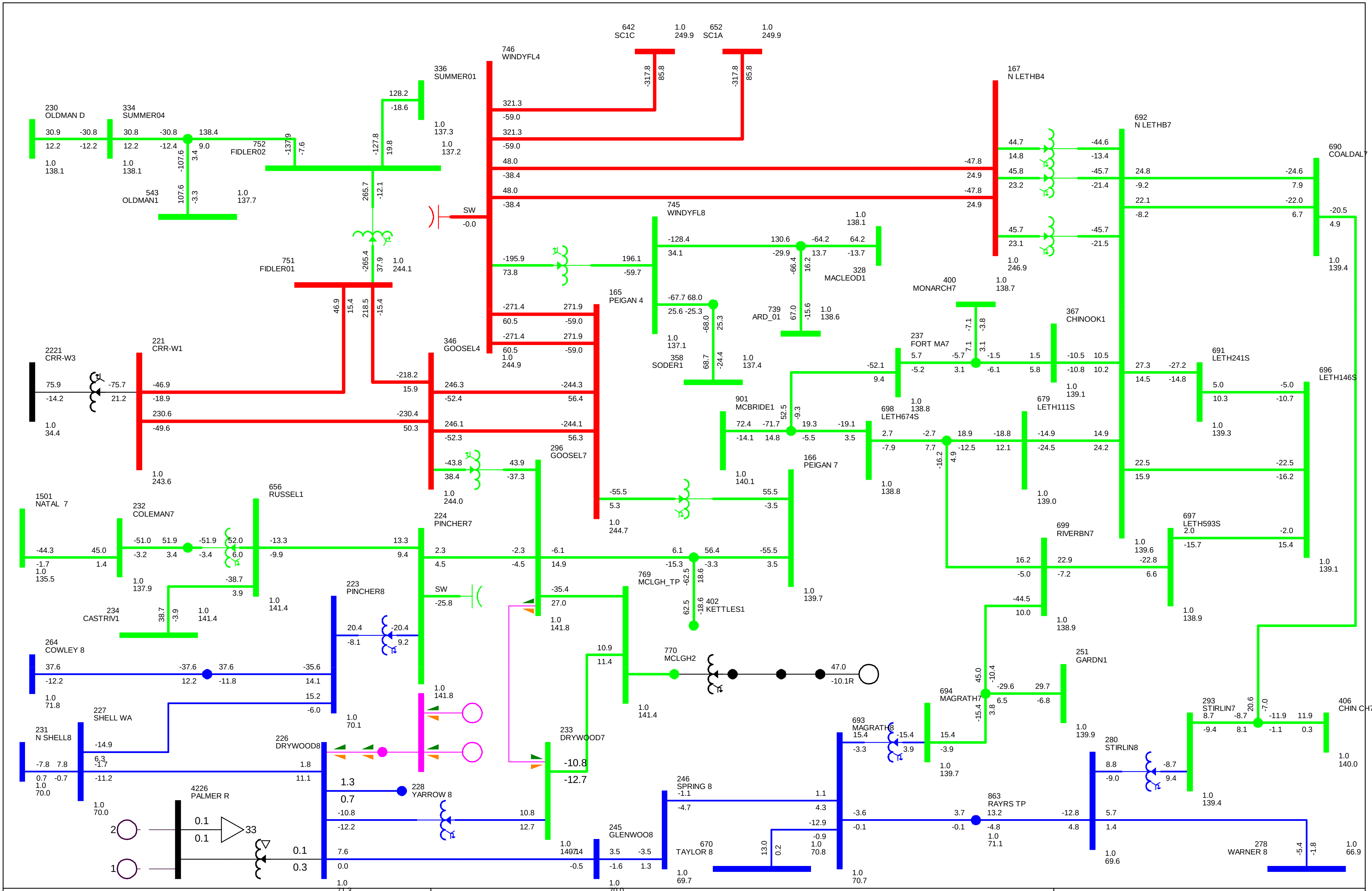
Post-Connection Power Flow Analysis Result

Scenarios 3 to 4

Table B-1

Figure #	Scenario	Cont. Category	Contingency Description	Thermal Overloads	Voltage Performance
Figure B-1	Scenario #3, 2017 SP	A	Normal Operation	None	Acceptable
Figure B-2	Scenario #3, 2017 SP	B	994L (Fidler 312S to Goose lake 103S)	None	Acceptable
Figure B-3	Scenario #3, 2017 SP	B	1071L (Fidler 312S to Castle Rock Ridge 205S)	None	Acceptable
Figure B-4	Scenario #3, 2017 SP	B	1072L (Castle Rock Ridge 205S to Goose Lake 103S)	None	Acceptable
Figure B-5	Scenario #3, 2017 SP	B	955L (Goose Lake 103S to Peigan 59S)	None	Acceptable
Figure B-6	Scenario #3, 2017 SP	B	1048L (Peigan 59S to Windy Flat 138S)	None	Acceptable
Figure B-7	Scenario #3, 2017 SP	B	1038L (Windy Flat 138S to Foothills 237S)	None	Acceptable
Figure B-8	Scenario #3, 2017 SP	B	967L (Windy Flat 138S to North Lethbridge 370S)	None	Acceptable
Figure B-9	Scenario #3, 2017 SP	B	613L (Goose Lake 103S to Pincher Creek 396S)	None	Acceptable
Figure B-10	Scenario #3, 2017 SP	B	616L (Goose Lake 103S to Peigan 59S)	None	Acceptable
Figure B-11	Scenario #3, 2017 SP	B	Goose Lake 103S 240/138 kV Transformer	None	Acceptable
Figure B-12	Scenario #4, 2017 SL	A	Normal Operation	None	Acceptable
Figure B-13	Scenario #4, 2017 SL	B	994L (Fidler 312S to Goose lake 103S)	None	Acceptable
Figure B-14	Scenario #4, 2017 SL	B	1071L (Fidler 312S to Castle Rock Ridge 205S)	None	Acceptable
Figure B-15	Scenario #4, 2017 SL	B	1072L (Castle Rock Ridge 205S to Goose Lake 103S)	None	Acceptable
Figure B-16	Scenario #4, 2017 SL	B	955L (Goose Lake 103S to Peigan 59S)	None	Acceptable

Figure B-17	Scenario #4, 2017 SL	B	1048L (Peigan 59S to Windy Flat 138S)	None	Acceptable
Figure B-18	Scenario #4, 2017 SL	B	1038L (Windy Flat 138S to Foothills 237S)	None	Acceptable
Figure B-19	Scenario #4, 2017 SL	B	967L (Windy Flat 138S to North Lethbridge 370S)	None	Acceptable
Figure B-20	Scenario #4, 2017 SL	B	613L (Goose Lake 103S to Pincher Creek 396S)	None	Acceptable
Figure B-21	Scenario #4, 2017 SL	B	616L (Goose Lake 103S to Peigan 59S)	None	Acceptable
Figure B-22	Scenario #4, 2017 SL	B	Goose Lake 103S 240/138 kV Transformer	None	Acceptable



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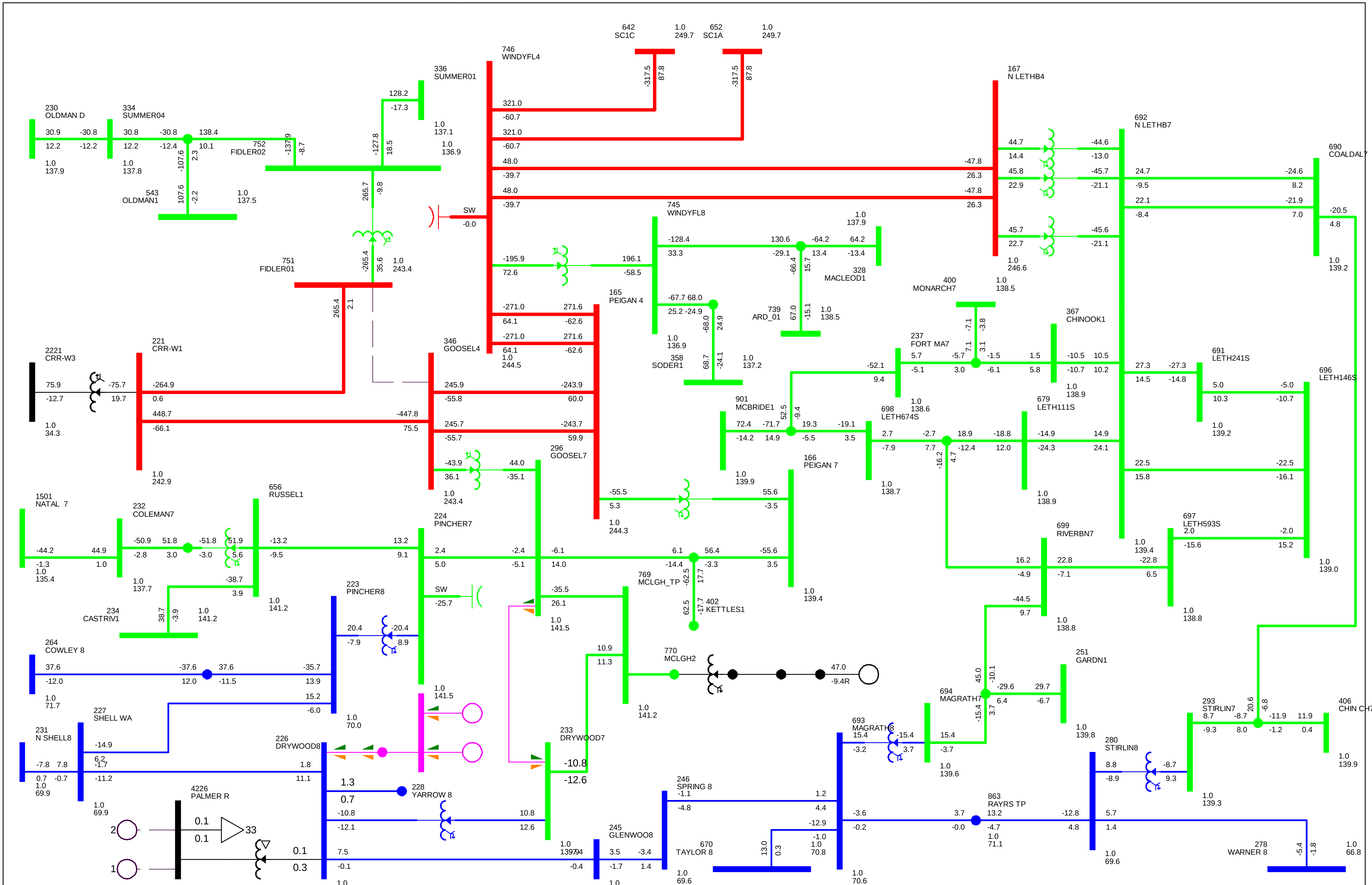
PROJECT-1500

FIGURE B-1 - SYSTEM NORMAL
POST-CONNECTION, 2017SP, SCN #3
WED, MAY 13 2015 16:20

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000



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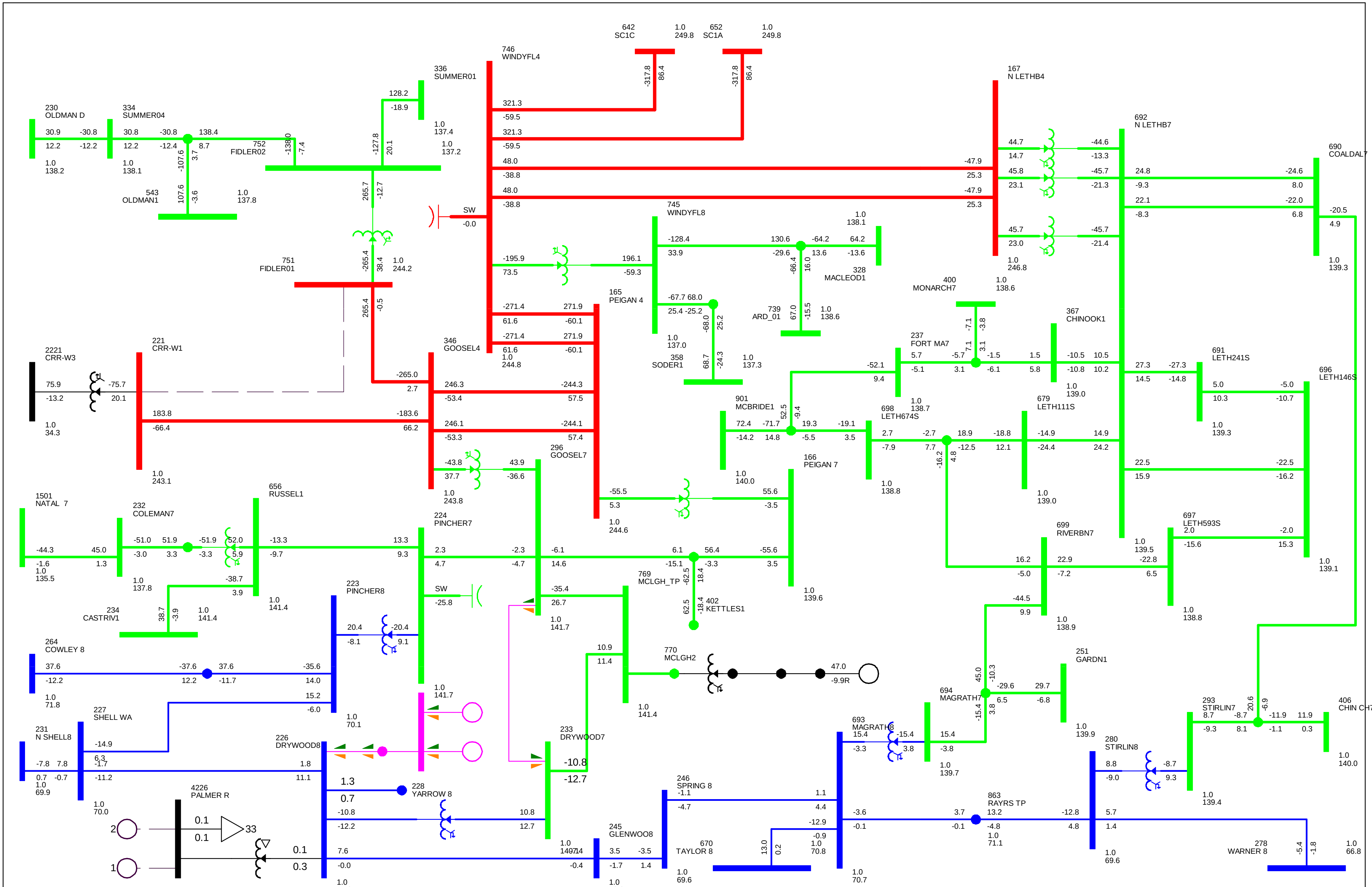
PROJECT-1500

FIGURE B-2 - CONTINGENCY 994L
POST-CONNECTION, 2017SP, SCN #3
WED, MAY 13 2015 16:20

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000



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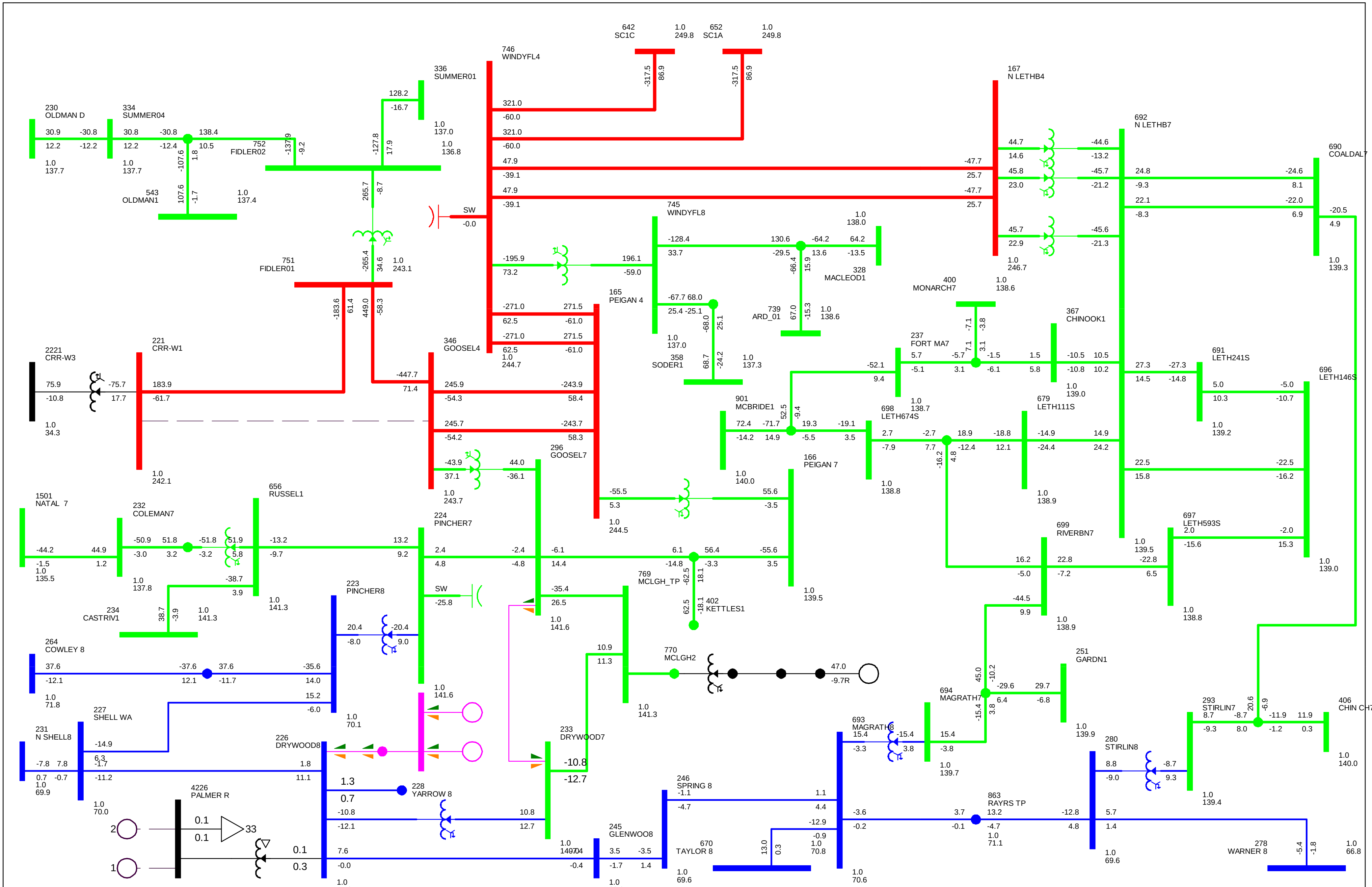
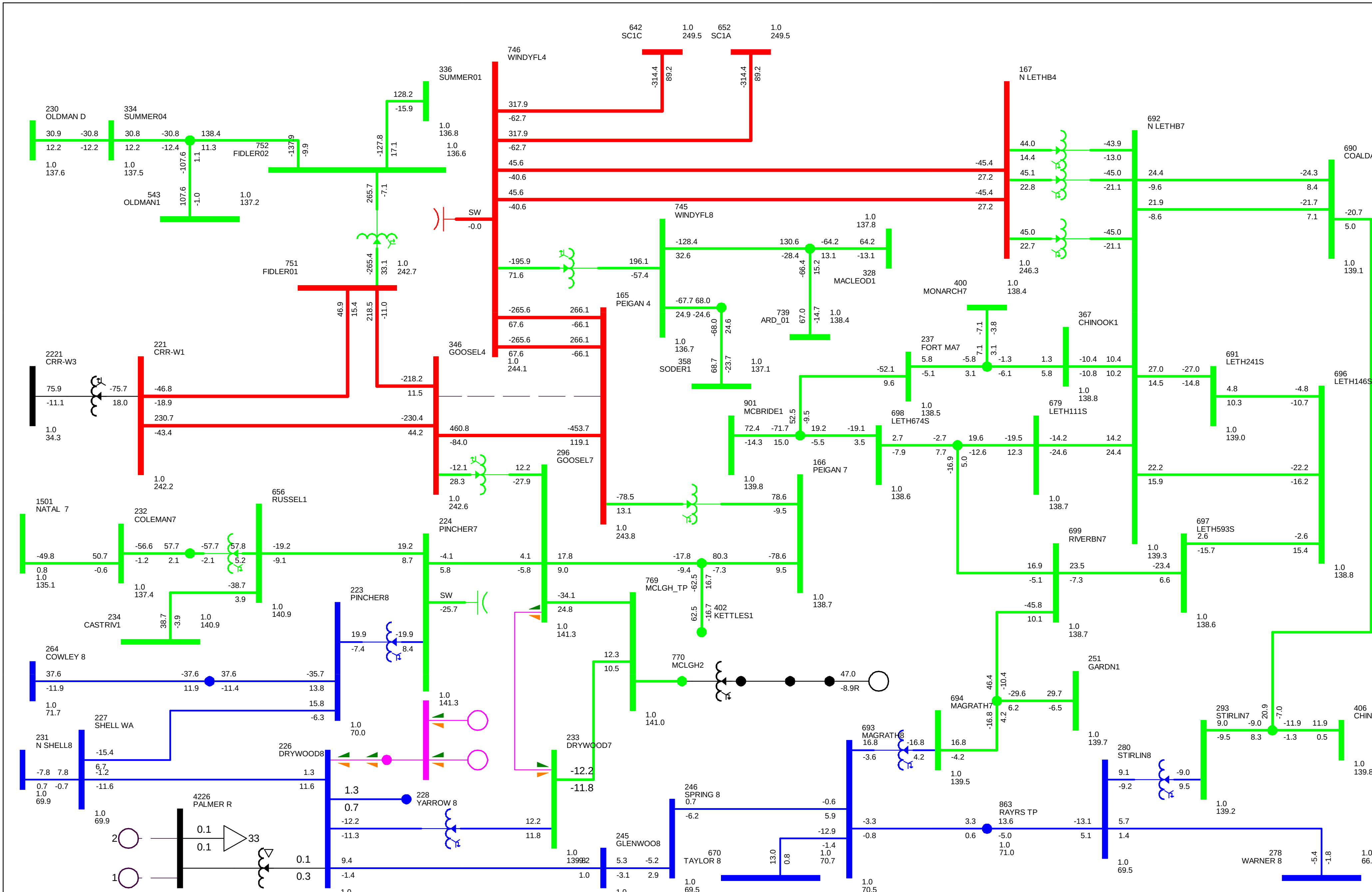
PROJECT-1500

FIGURE B-3 - CONTINGENCY 1071L
POST-CONNECTION, 2017SP, SCN #3
WED, MAY 13 2015 16:20



MCLAUGHLIN WAGF CONNECTION ENGINEERING STUDY REPORT PROJECT-1500	FIGURE B-4 - CONTINGENCY 1072L POST-CONNECTION, 2017SP, SCN #3 WED, MAY 13 2015 16:20	kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000



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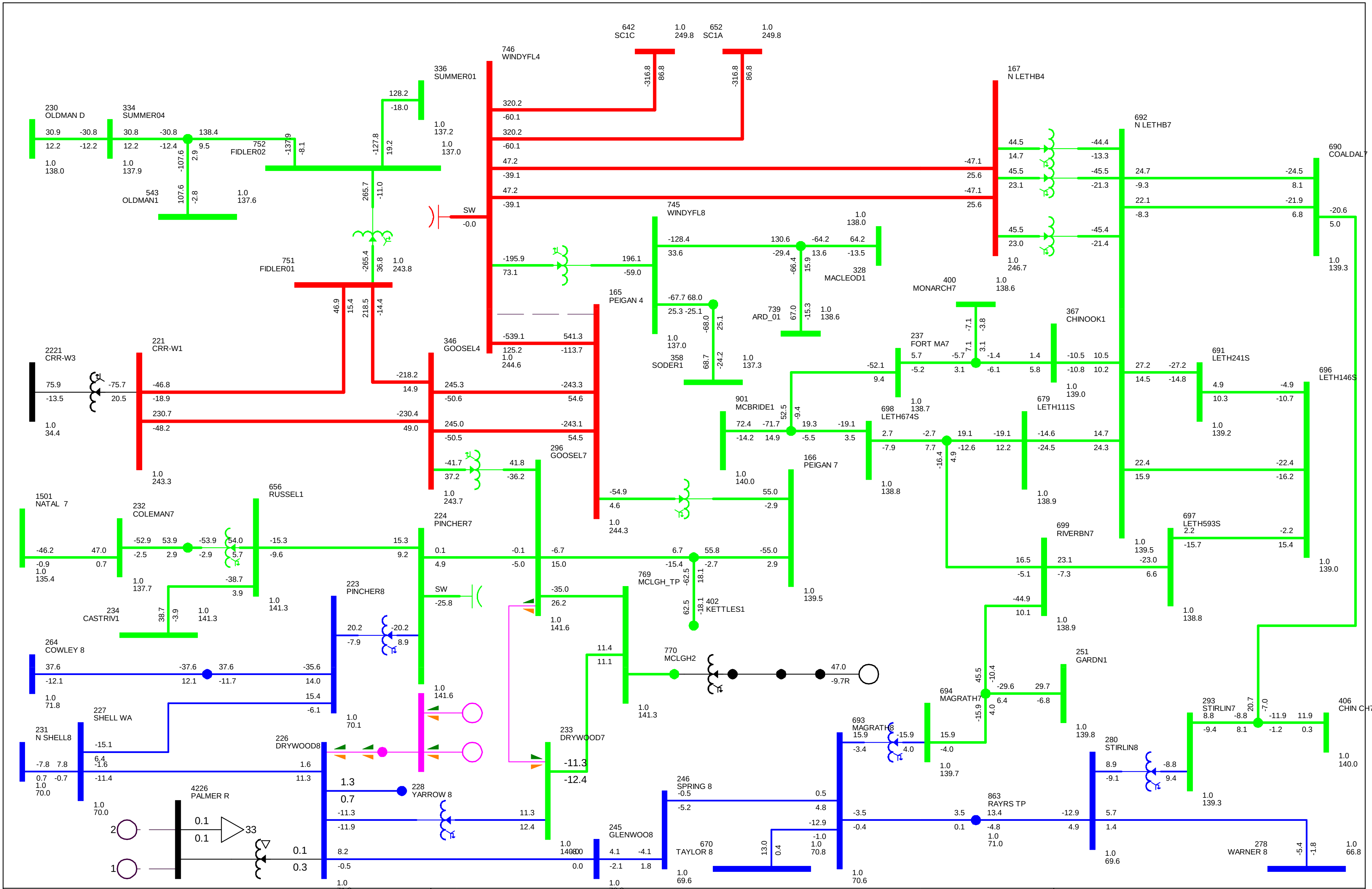
ENGINEERING STUDY REPORT
PROJECT-1500

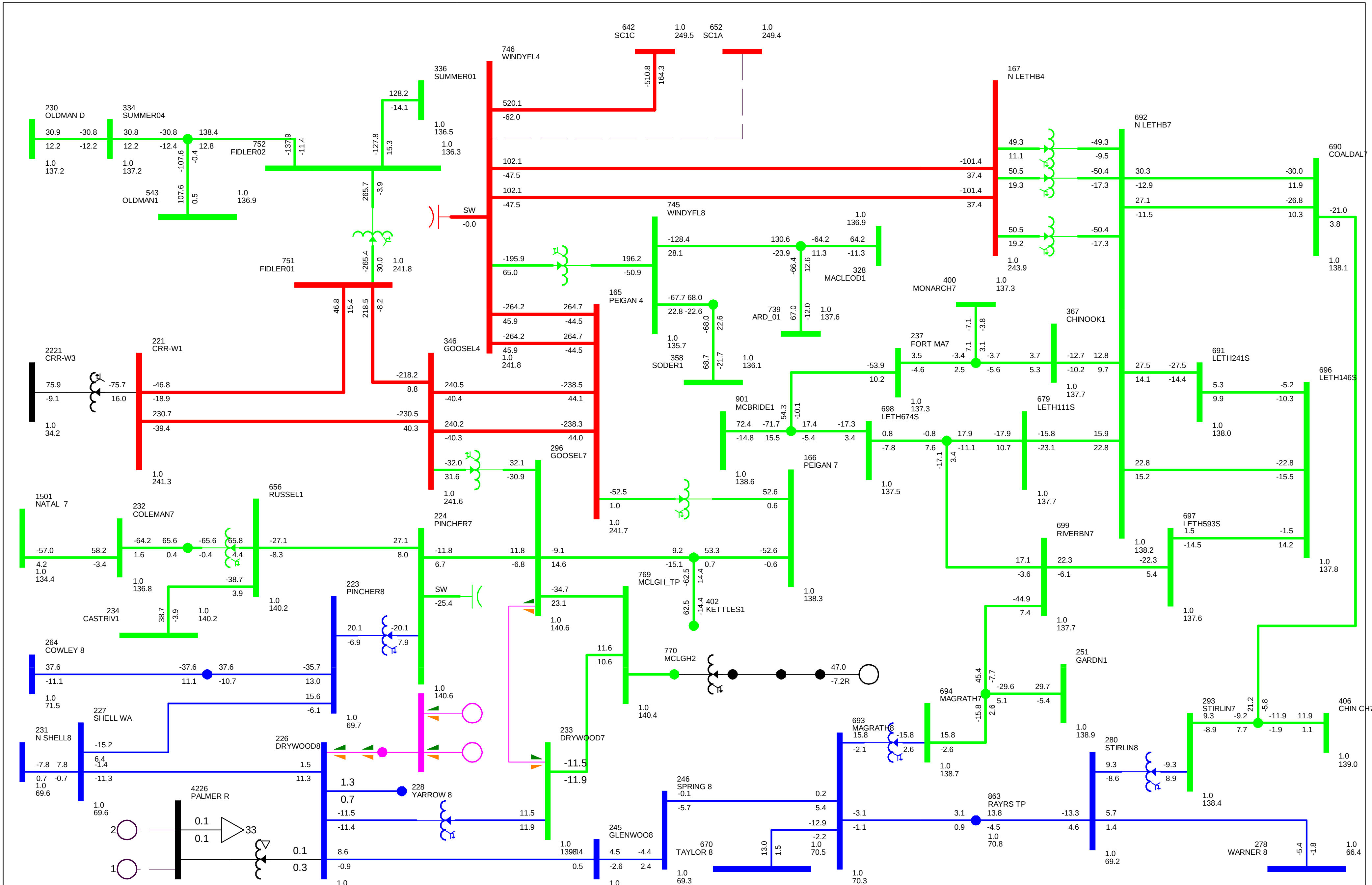
FIGURE B-5 - CONTINGENCY 955L
POST-CONNECTION, 2017SP, SCN #3
WED, MAY 13 2015 16:20

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000



MCLAUGHLIN WAGF CONNECTION
ENGINEERING STUDY REPORT
PROJECT-1500

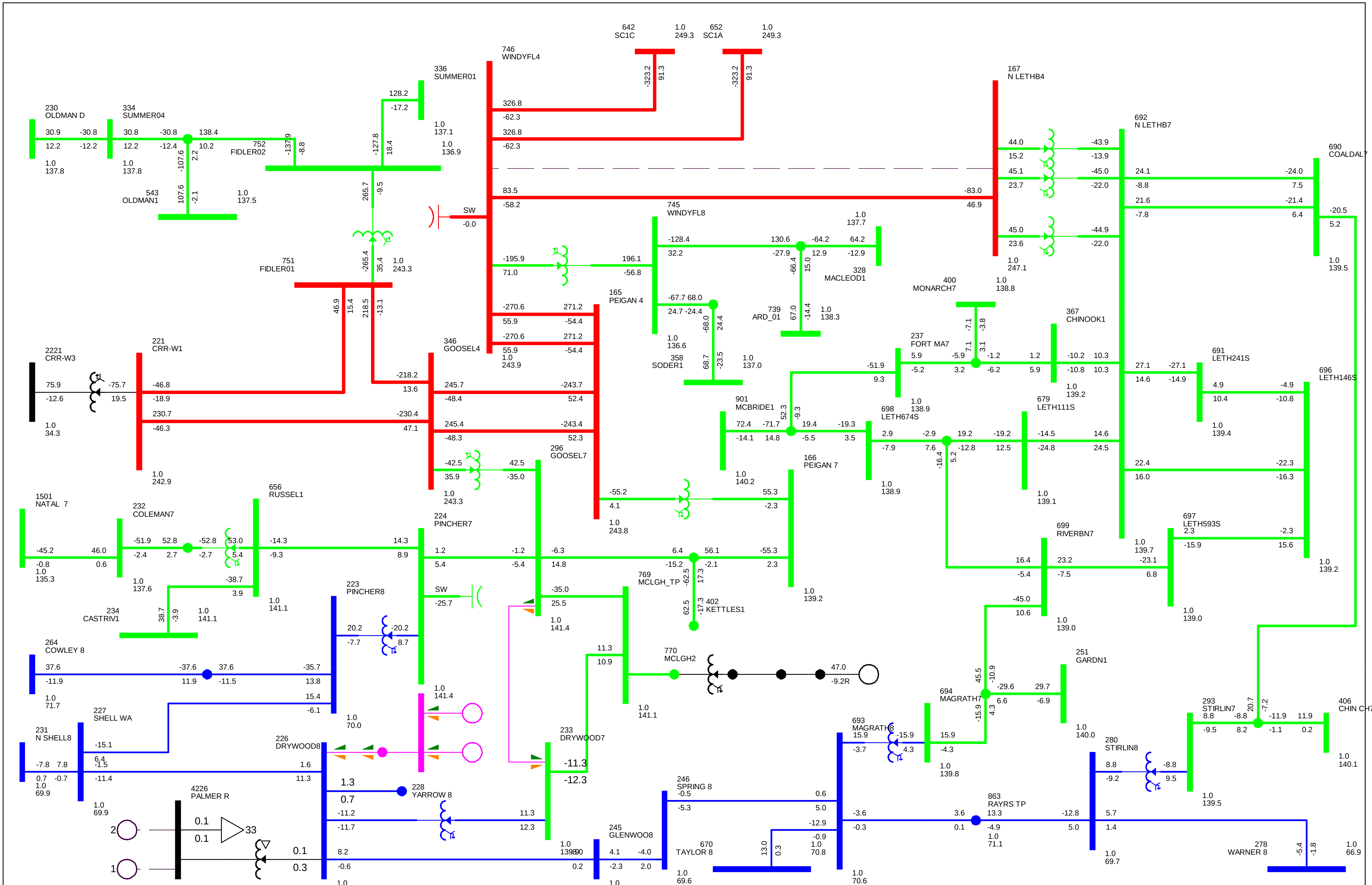
FIGURE B-6 - CONTINGENCY 1048L
POST-CONNECTION, 2017SP, SCN #3
WED, MAY 13 2015 16:20



MCLAUGHLIN WAGF CONNECTION
ENGINEERING STUDY REPORT
PROJECT-1500

FIGURE B-7 - CONTINGENCY 1038L
POST-CONNECTION, 2017SP, SCN #3
WED, MAY 13 2015 16:20

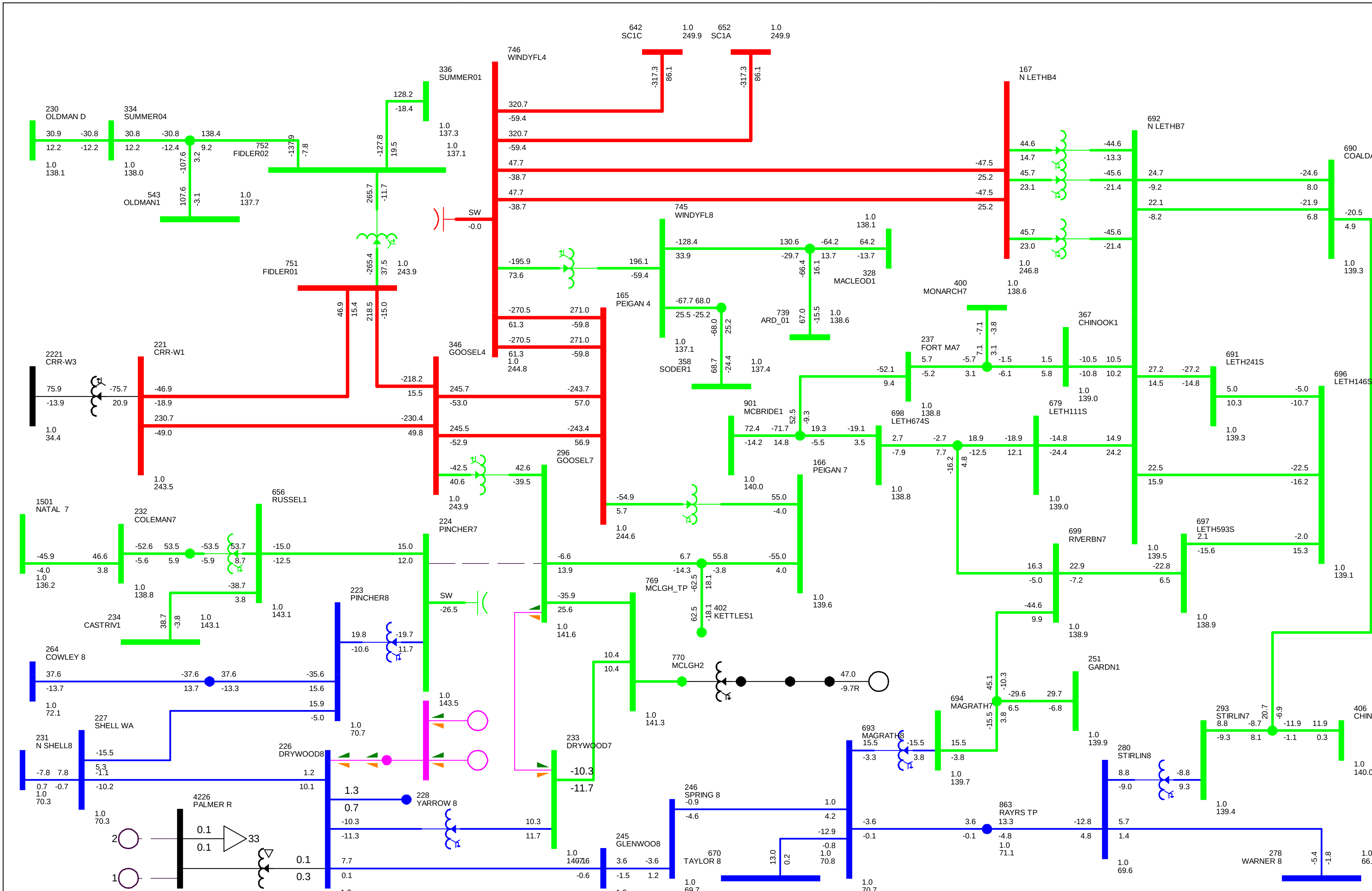
kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000



MCLAUGHLIN WAGF CONNECTION
ENGINEERING STUDY REPORT
PROJECT-1500

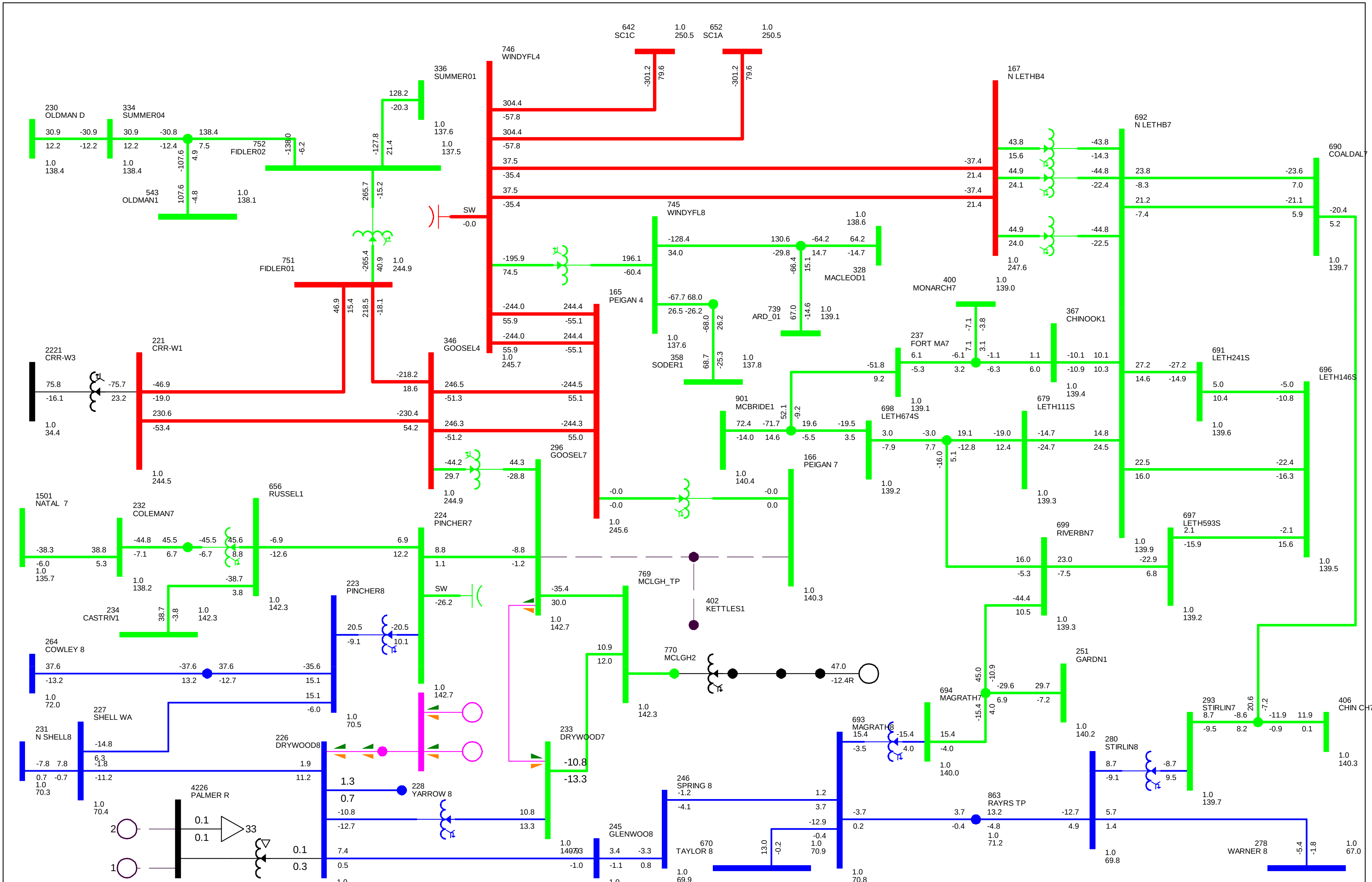
FIGURE B-8 - CONTINGENCY 967L
POST-CONNECTION, 2017SP, SCN #3
WED, MAY 13 2015 16:20

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000



MCLAUGHLIN WAGF CONNECTION
ENGINEERING STUDY REPORT
PROJECT-1500

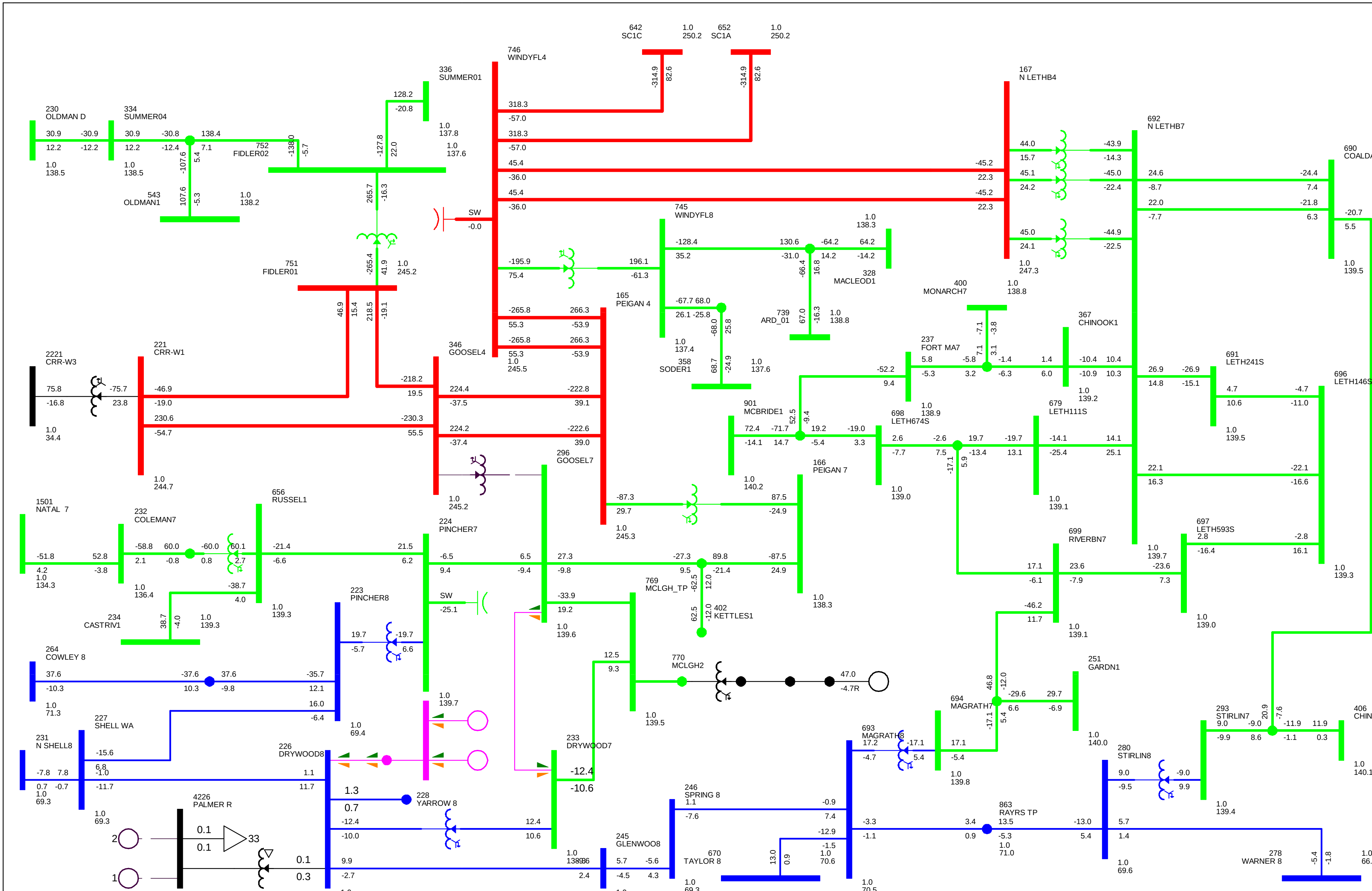
FIGURE B-9 - CONTINGENCY 613L
POST-CONNECTION, 2017SP, SCN #3
WED, MAY 13 2015 16:20



MCLAUGHLIN WAGF CONNECTION
ENGINEERING STUDY REPORT
PROJECT-1500

FIGURE B-10 - CONTINGENCY 616L
POST-CONNECTION, 2017SP, SCN #3
WED, MAY 13 2015 16:20

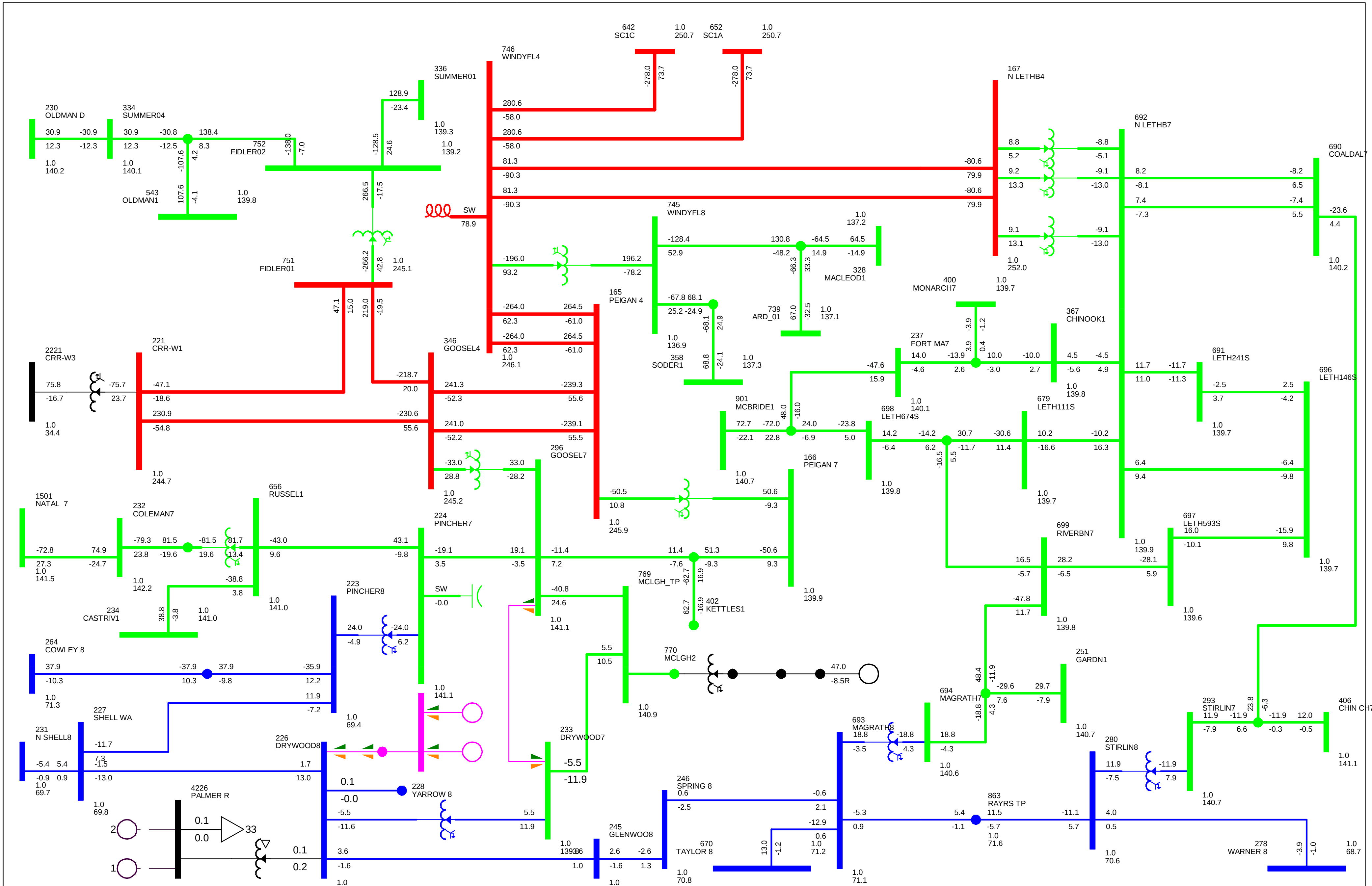
kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000



MCLAUGHLIN WAGF CONNECTION
ENGINEERING STUDY REPORT
PROJECT-1500

FIGURE B-11 - CONTINGENCY GOOSEL-XFMR
POST-CONNECTION, 2017SP, SCN #3
WED, MAY 13 2015 16:20

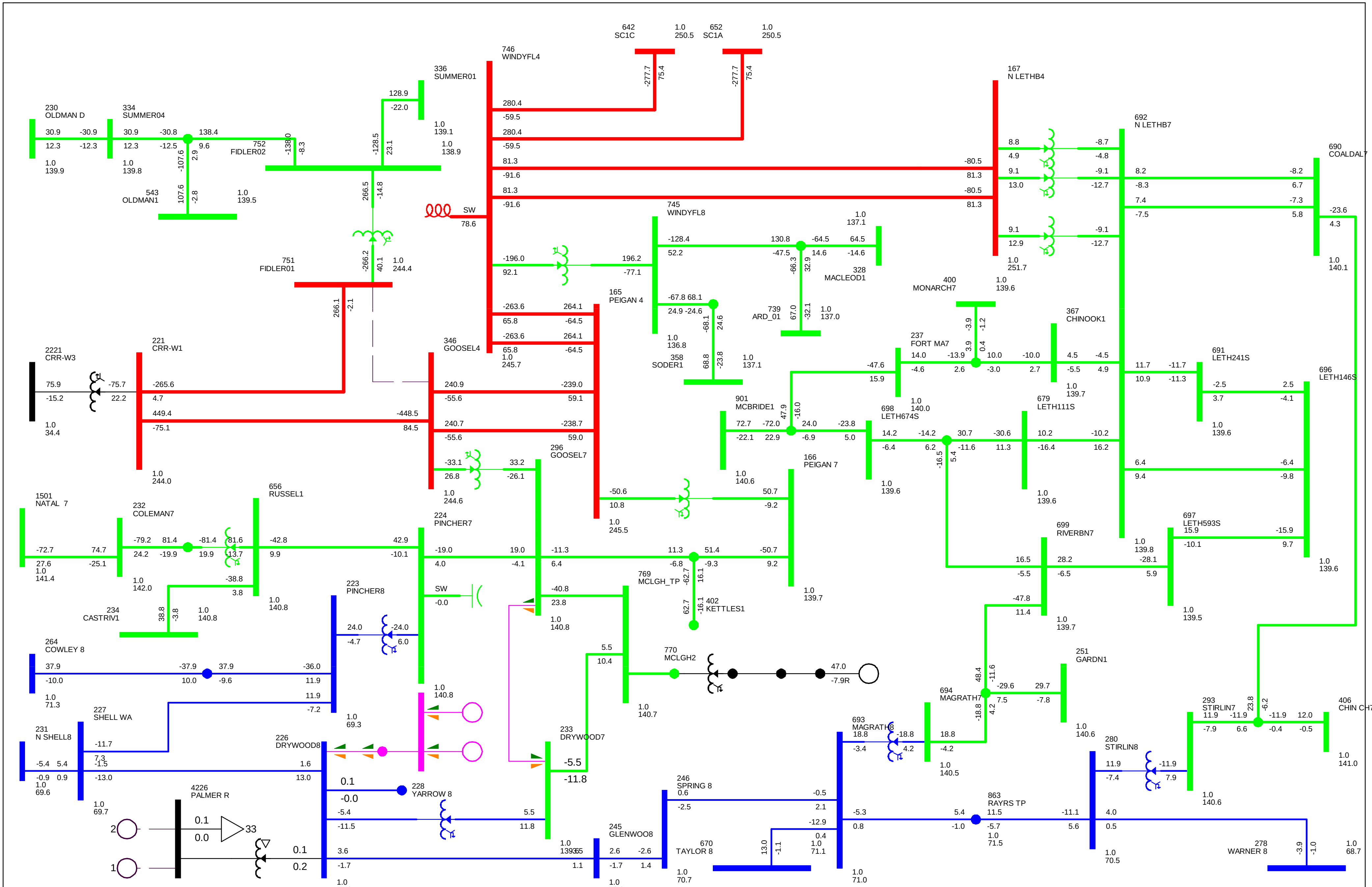
kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000



MCLAUGHLIN WAGF CONNECTION
ENGINEERING STUDY REPORT
PROJECT-1500

FIGURE B-12 - SYSTEM NORMAL
POST-CONNECTION, 2017SL, SCN#4
WED, MAY 13 2015 16:20

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000



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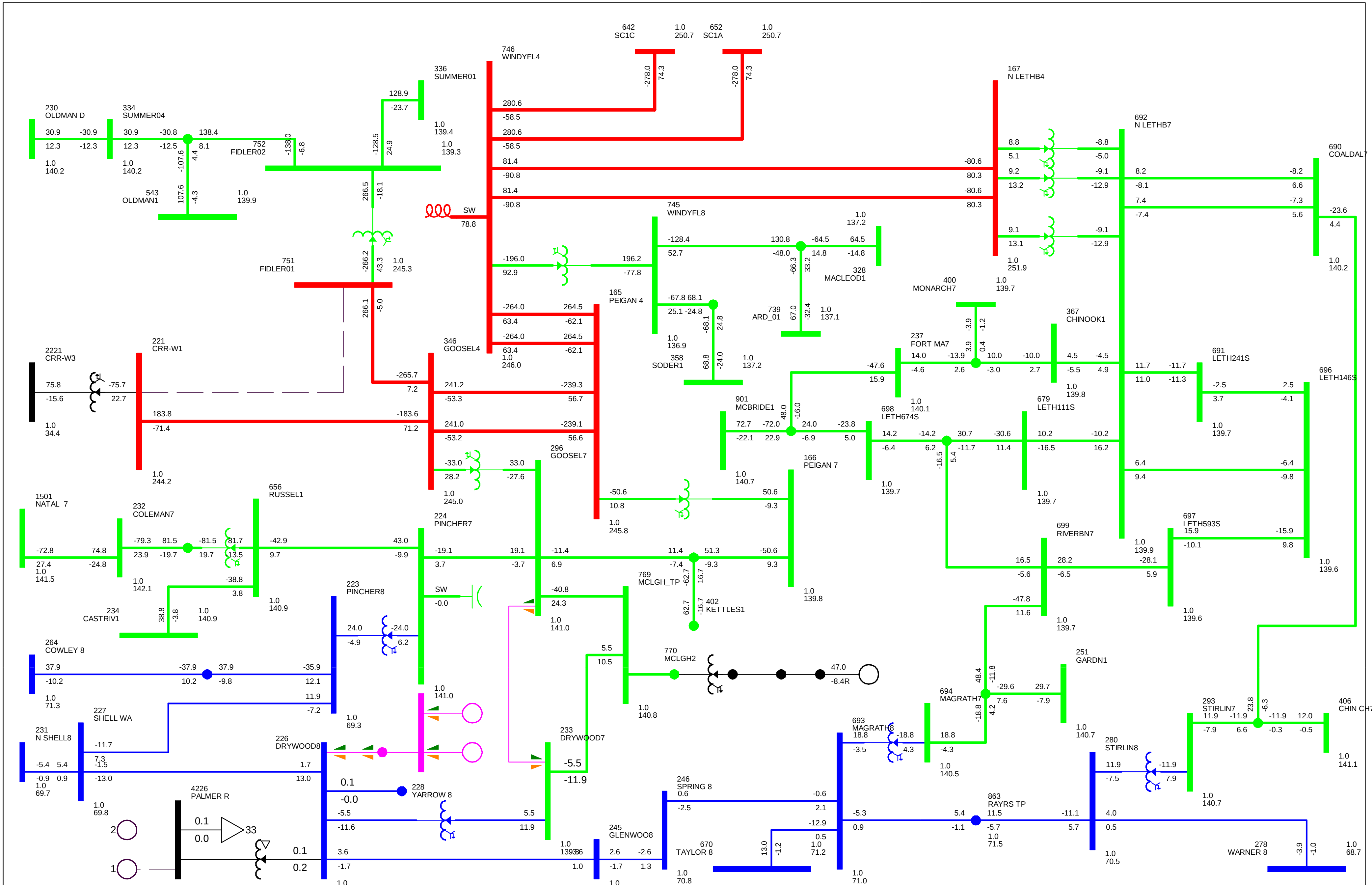
PROJECT-1500

FIGURE B-13 - CONTINGENCY 994L
POST-CONNECTION, 2017SL, SCN#4
WED, MAY 13 2015 16:20

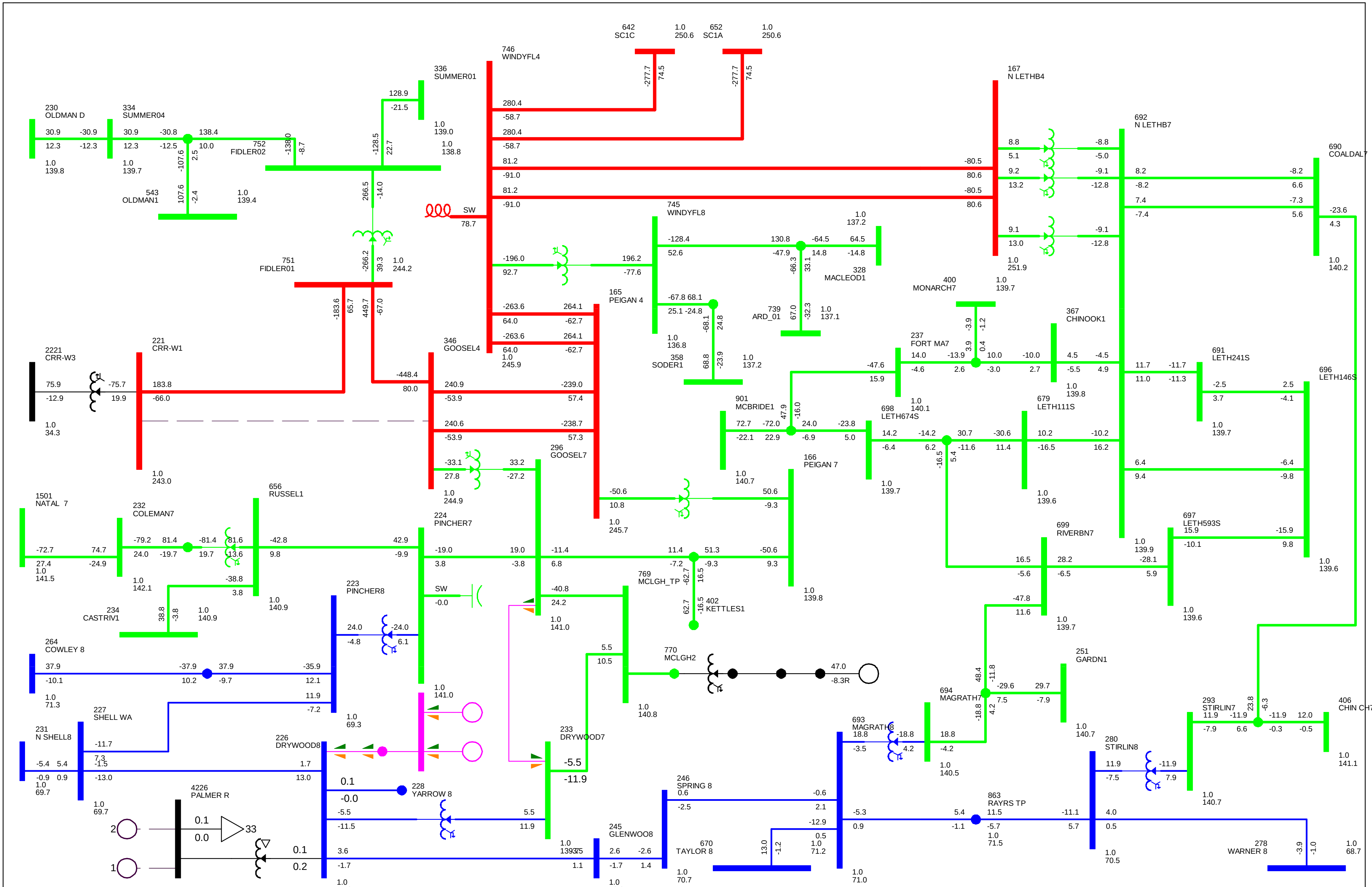
kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000



MCLAUGHLIN WAGF CONNECTION
ENGINEERING STUDY REPORT
PROJECT-1500

FIGURE B-14 - CONTINGENCY 1071L
POST-CONNECTION, 2017SL, SCN#4
WED, MAY 13 2015 16:20

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000



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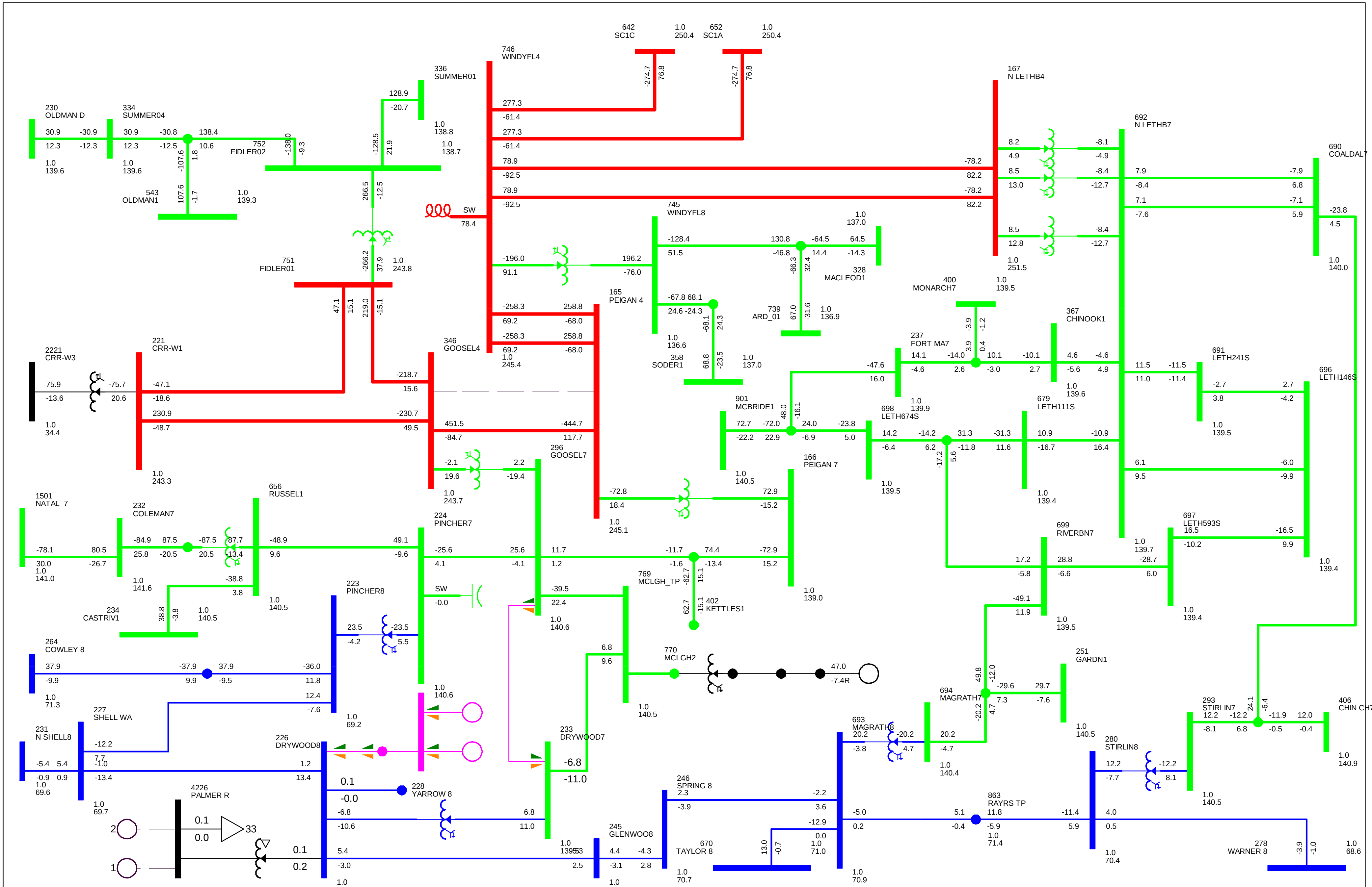
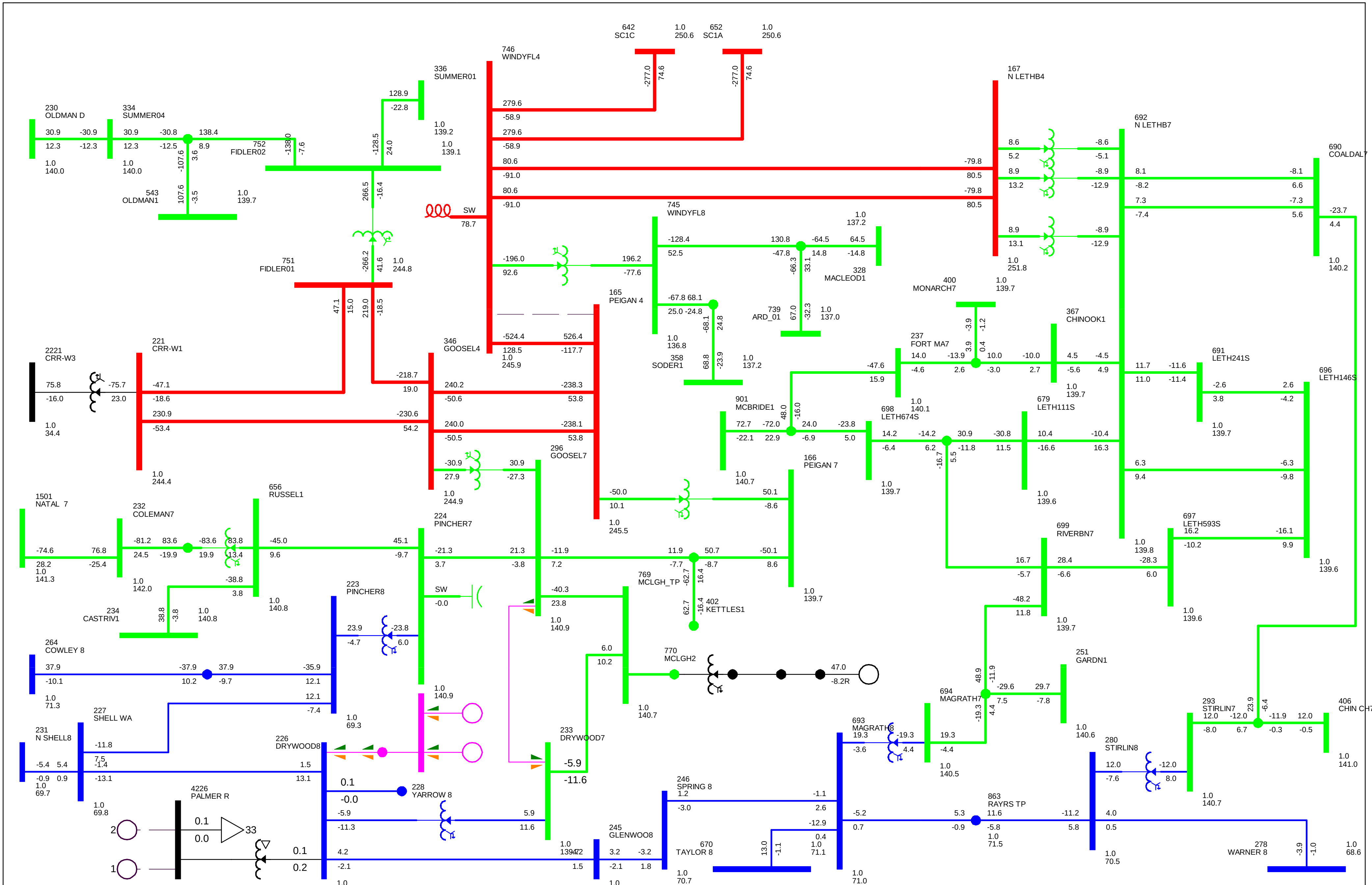
ENGINEERING STUDY REPORT
PROJECT-1500

FIGURE B-15 - CONTINGENCY 1072L
POST-CONNECTION, 2017SL, SCN#4
WED, MAY 13 2015 16:20

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000



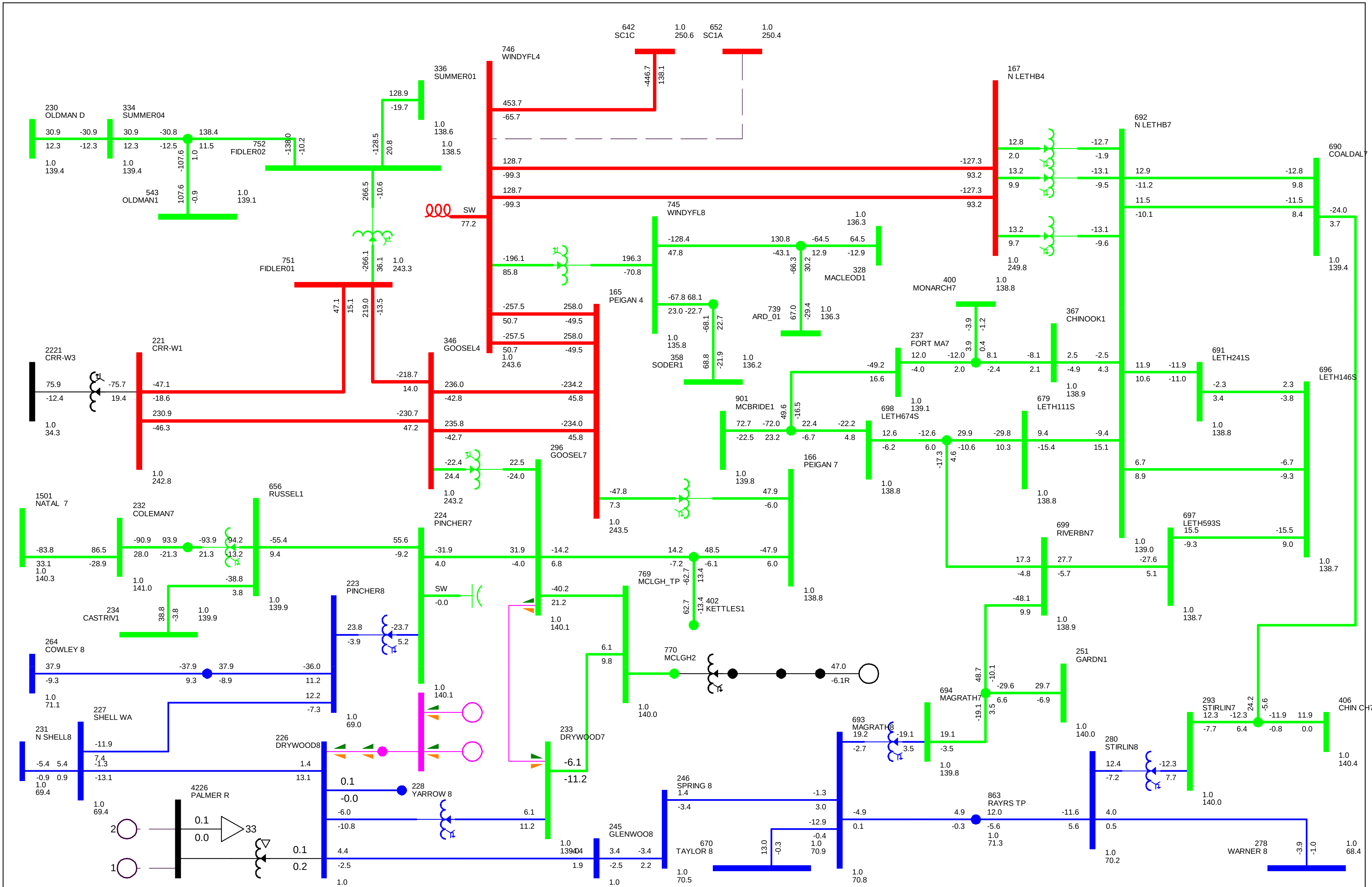
MCLAUGHLIN WAGF CONNECTION ENGINEERING STUDY REPORT PROJECT-1500	FIGURE B-16 - CONTINGENCY 955L POST-CONNECTION, 2017SL, SCN#4 WED, MAY 13 2015 16:21	kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000



MCLAUGHLIN WAGF CONNECTION
ENGINEERING STUDY REPORT
PROJECT-1500

FIGURE B-17 - CONTINGENCY 1048L
POST-CONNECTION, 2017SL, SCN#4
WED, MAY 13 2015 16:21

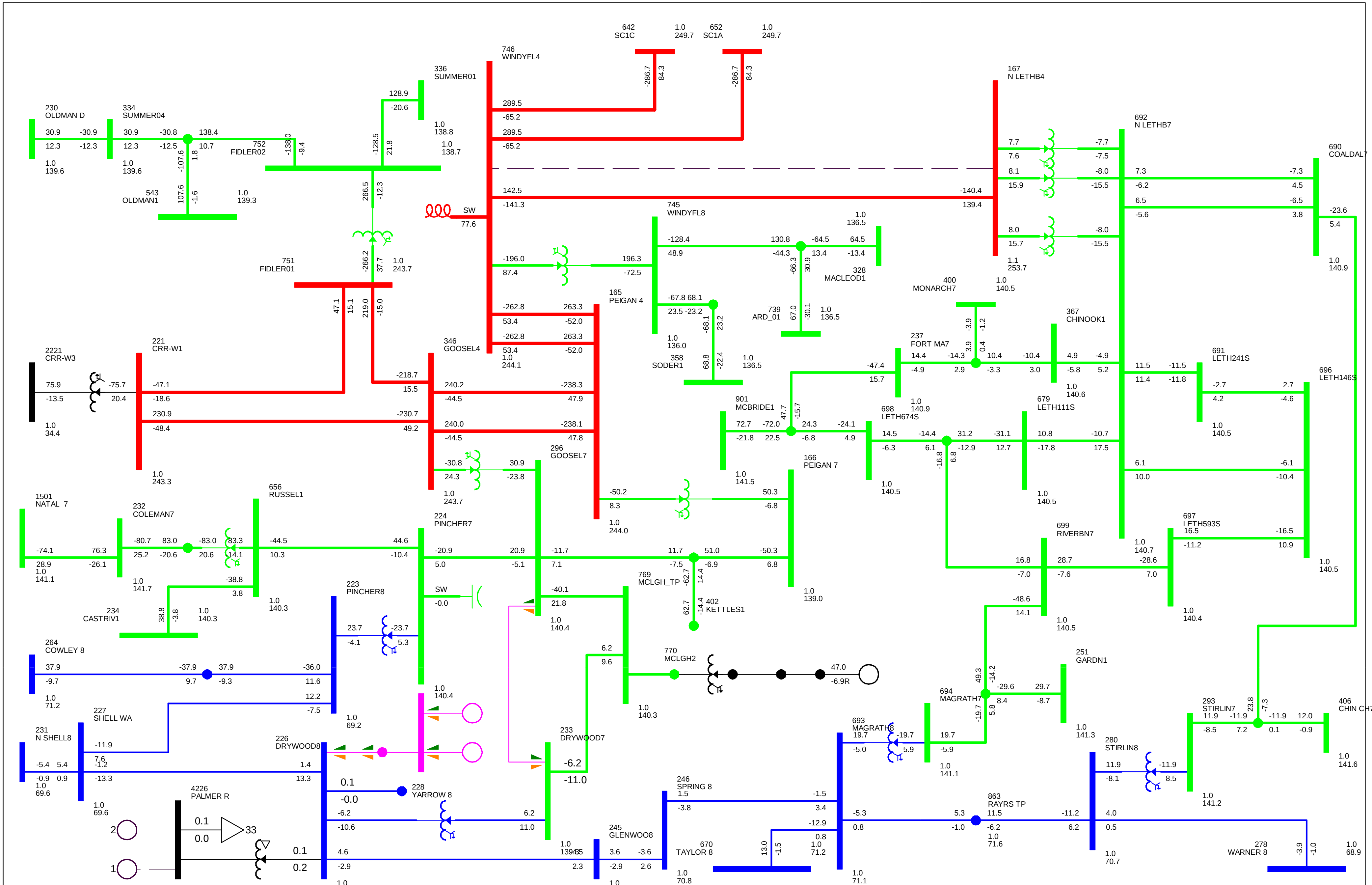
kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000



MCLAUGHLIN WAGF CONNECTION
ENGINEERING STUDY REPORT
PROJECT-1500

FIGURE B-18 - CONTINGENCY 1038L
POST-CONNECTION, 2017SL, SCN#4
WED, MAY 13 2015 16:21

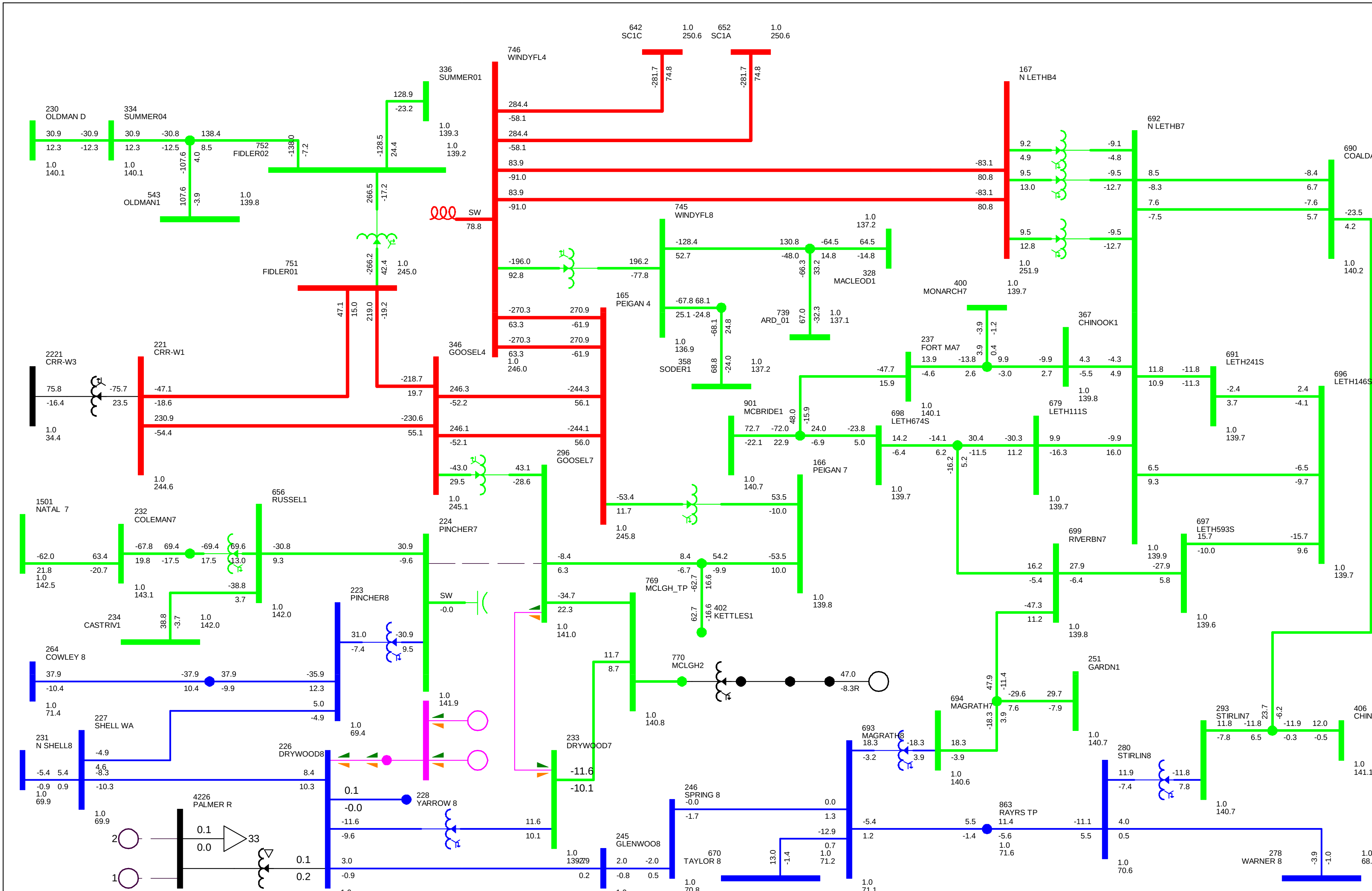
kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000



MCLAUGHLIN WAGF CONNECTION
ENGINEERING STUDY REPORT
PROJECT-1500

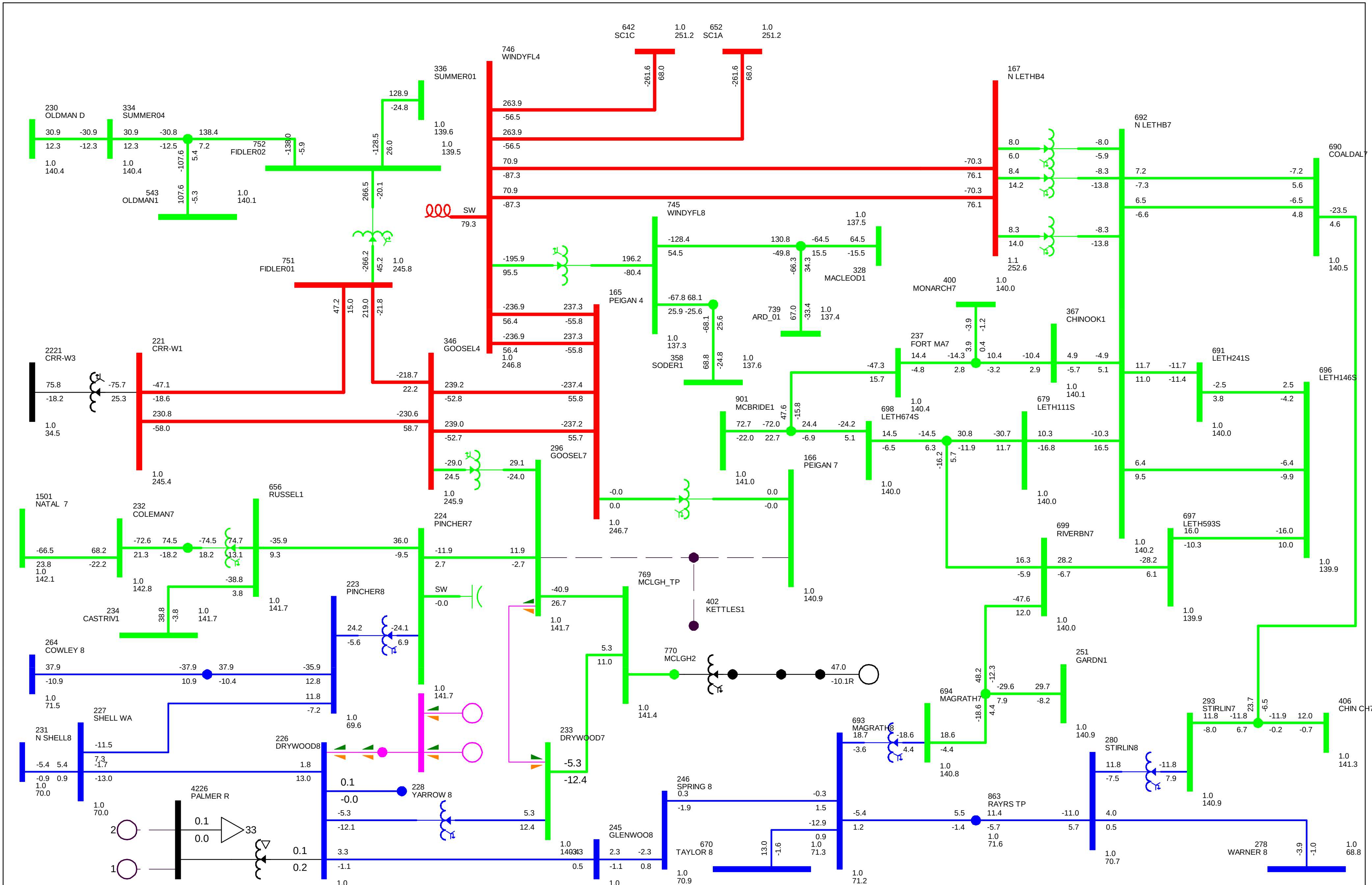
FIGURE B-19 - CONTINGENCY 967L
POST-CONNECTION, 2017SL, SCN#4
WED, MAY 13 2015 16:21

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000



MCLAUGHLIN WAGF CONNECTION
ENGINEERING STUDY REPORT
PROJECT-1500

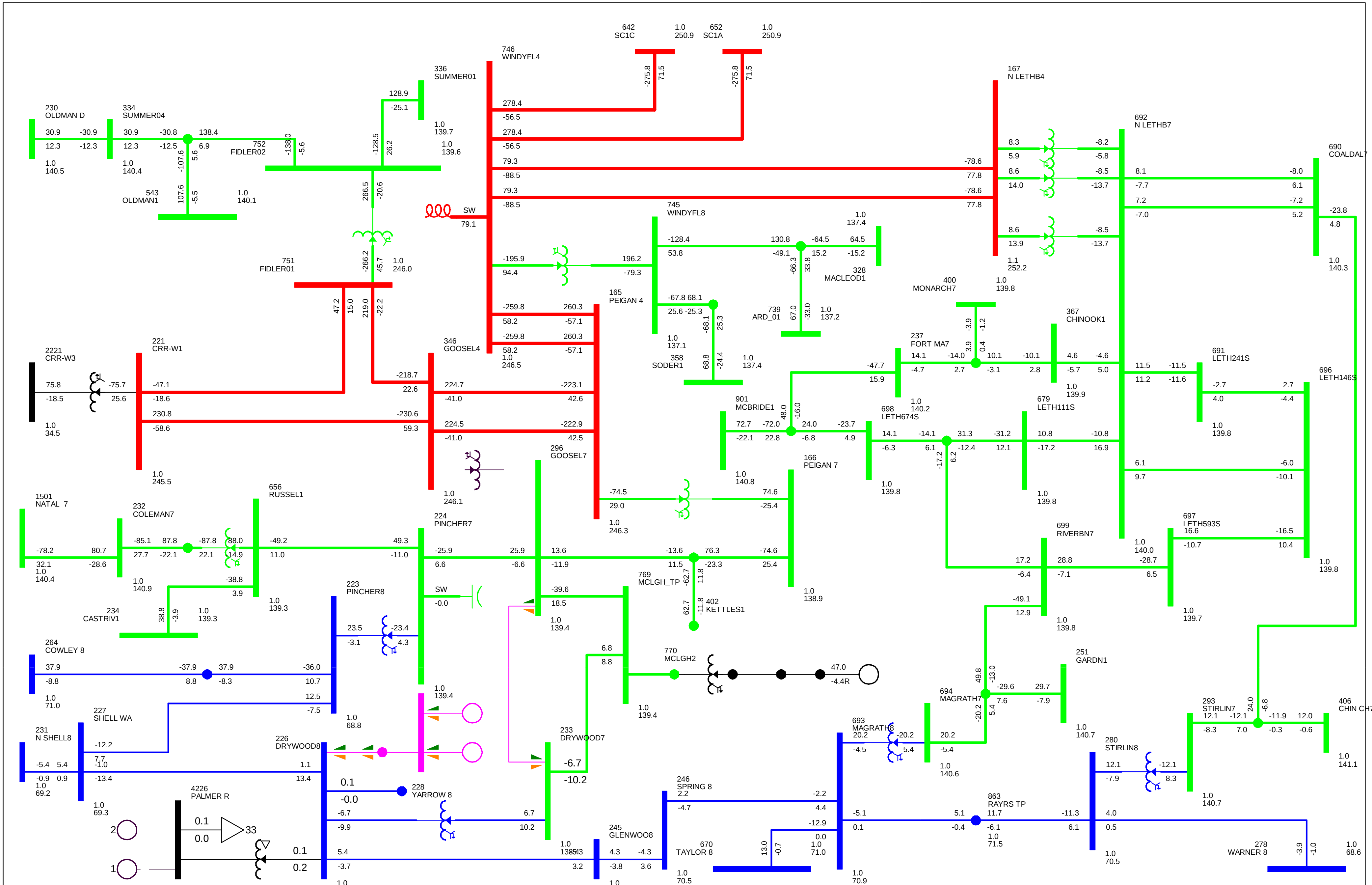
FIGURE B-20 - CONTINGENCY 613L
POST-CONNECTION, 2017SL, SCN#4
WED, MAY 13 2015 16:21



MCLAUGHLIN WAGF CONNECTION
ENGINEERING STUDY REPORT
PROJECT-1500

FIGURE B-21 - CONTINGENCY 616L
POST-CONNECTION, 2017SL, SCN#4
WED, MAY 13 2015 16:21

kV: <=25.000 <=34.500 <=69.000 <=138.000 <=240.000 >240.000



MCLAUGHLIN WAGF CONNECTION
ENGINEERING STUDY REPORT
PROJECT-1500

FIGURE B-22 - CONTINGENCY GOOSEL-XFMR
POST-CONNECTION, 2017SL, SCN#4
WED, MAY 13 2015 16:21

ATTACHMENT C

Post-Connection Transient Stability Analysis Results

Scenarios #3 to 4

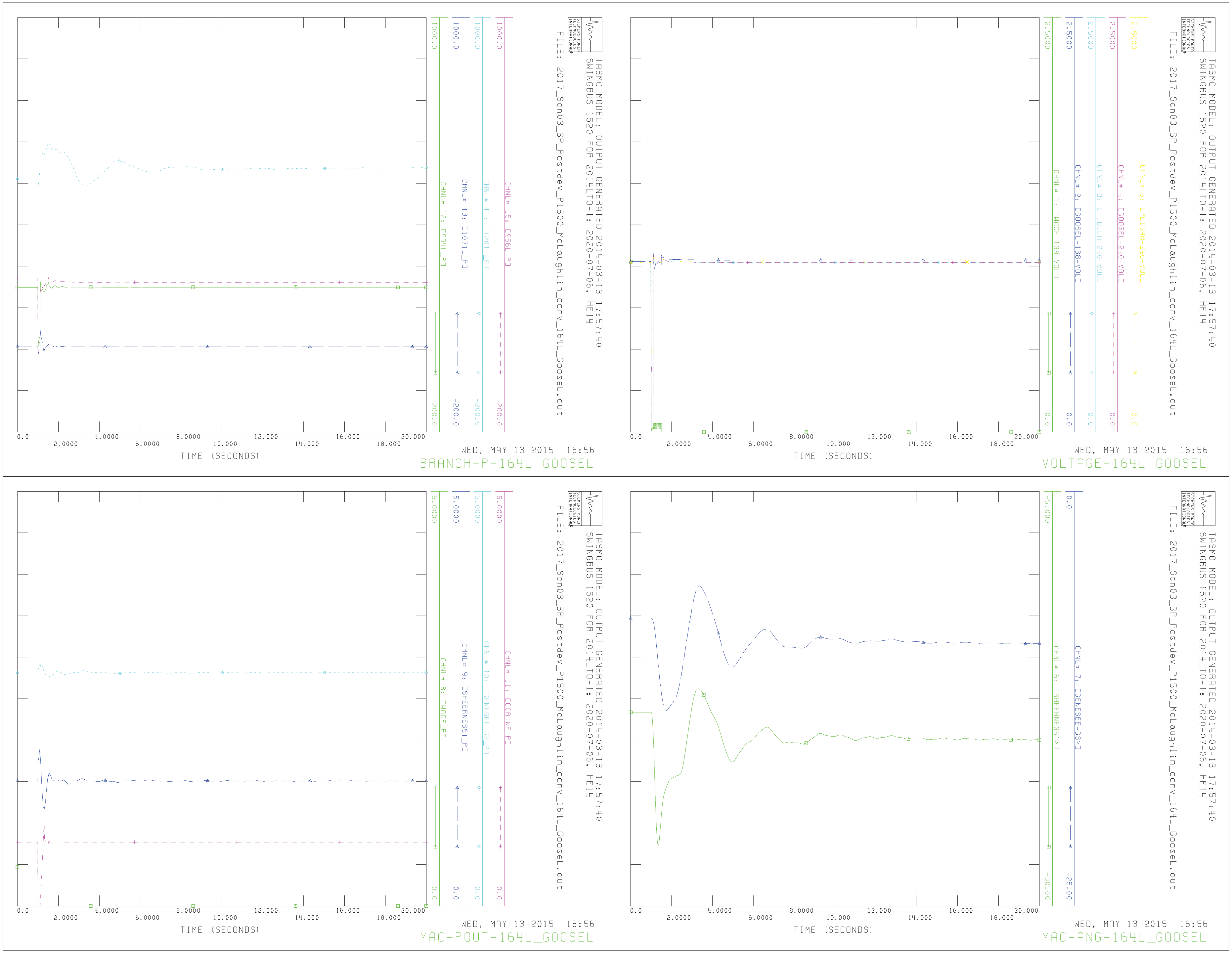
Table I C-1

Figure Name	Scenario	Cont. Category	Contingency Description	Fault Location	Stability Issue
Figure C-1	Scenario #3, 2017 SP	B	3-phase fault on 164L (Goose lake 103S to Drywood 415S)	Goose lake 103S	No
Figure C-2	Scenario #3, 2017 SP	B	3-phase fault on 164L (Goose lake 103S to Drywood 415S)	Drywood 415S	No
Figure C-3	Scenario #3, 2017 SP	B	3-phase fault on 994L (Fidler 312S to Goose lake 103S)	Fidler 312S	No
Figure C-4	Scenario #3, 2017 SP	B	3-phase fault on 994L (Fidler 312S to Goose lake 103S)	Goose lake 103S	No
Figure C-5	Scenario #3, 2017 SP	B	3-phase fault on 1071L (Fidler 312S to Castle Rock Ridge 205S)	Fidler 312S	No
Figure C-6	Scenario #3, 2017 SP	B	3-phase fault on 1071L (Fidler 312S to Castle Rock Ridge 205S)	Castle Rock Ridge 205S	No
Figure C-7	Scenario #3, 2017 SP	B	3-phase fault on 1072L (Castle Rock Ridge 205S to Goose Lake 103S)	Castle Rock Ridge 205S	No
Figure C-8	Scenario #3, 2017 SP	B	3-phase fault on 1072L (Castle Rock Ridge 205S to Goose Lake 103S)	Goose Lake 103S	No
Figure C-9	Scenario #3, 2017 SP	B	3-phase fault on 955L (Goose Lake 103S to Peigan 59S)	Goose Lake 103S	No
Figure C-10	Scenario #3, 2017 SP	B	3-phase fault on 955L (Goose Lake 103S to Peigan 59S)	Peigan 59S	No
Figure C-11	Scenario #3, 2017 SP	B	3-phase fault on 1048L (Peigan 59S to Windy Flat 138S)	Peigan 59S	No
Figure C-12	Scenario #3, 2017 SP	B	3-phase fault on 1048L (Peigan 59S to Windy Flat 138S)	Windy Flat 138S	No
Figure C-13	Scenario #3, 2017 SP	B	3-phase fault on 1038L (Windy Flat 138S to Foothills 237S)	Windy Flat 138S	No

Figure C-14	Scenario #3, 2017 SP	B	3-phase fault on 1038L (Windy Flat 138S to Foothills 237S)	Foothills 237S	No
Figure C-15	Scenario #3, 2017 SP	B	3-phase fault on 967L (Windy Flat 138S to North Lethbridge 370S)	Windy Flat 138S	No
Figure C-16	Scenario #3, 2017 SP	B	3-phase fault on 967L (Windy Flat 138S to North Lethbridge 370S)	North Lethbridge 370S	No
Figure C-17	Scenario #3, 2017 SP	B	3-phase fault on 613L (Goose Lake 103S to Pincher Creek 396S)	Pincher Creek 396S	No
Figure C-18	Scenario #3, 2017 SP	B	3-phase fault on 613L (Goose Lake 103S to Pincher Creek 396S)	Goose Lake 103S	No
Figure C-19	Scenario #3, 2017 SP	B	3-phase fault on 616L (Goose Lake 103S to Peigan 59S)	Goose Lake 103S	No
Figure C-20	Scenario #3, 2017 SP	B	3-phase fault on 616L (Goose Lake 103S to Peigan 59S)	Peigan 59S	No
Figure C-21	Scenario #3, 2017 SP	B	3-phase fault on Goose Lake 103S 240/138 kV Transformer	Goose lake 103S 240 kV	No
Figure C-22	Scenario #3, 2017 SP	B	3-phase fault on Goose Lake 103S 240/138 kV Transformer	Goose lake 103S 138 kV	No
Figure C-23	Scenario #4, 2017 SL	B	3-phase fault on 164L (Goose lake 103S to Drywood 415S)	Goose lake 103S	No
Figure C-24	Scenario #4, 2017 SL	B	3-phase fault on 164L (Goose lake 103S to Drywood 415S)	Drywood 415S	No
Figure C-25	Scenario #4, 2017 SL	B	3-phase fault on 994L (Fidler 312S to Goose lake 103S)	Fidler 312S	No
Figure C-26	Scenario #4, 2017 SL	B	3-phase fault on 994L (Fidler 312S to Goose lake 103S)	Goose lake 103S	No
Figure C-27	Scenario #4, 2017 SL	B	3-phase fault on 1071L (Fidler 312S to Castle Rock Ridge 205S)	Fidler 312S	No
Figure C-28	Scenario #4, 2017 SL	B	3-phase fault on 1071L (Fidler 312S to Castle Rock Ridge 205S)	Castle Rock Ridge 205S	No

Figure C-29	Scenario #4, 2017 SL	B	3-phase fault on 1072L (Castle Rock Ridge 205S to Goose Lake 103S)	Castle Rock Ridge 205S	No
Figure C-30	Scenario #4, 2017 SL	B	3-phase fault on 1072L (Castle Rock Ridge 205S to Goose Lake 103S)	Goose Lake 103S	No
Figure C-31	Scenario #4, 2017 SL	B	3-phase fault on 955L (Goose Lake 103S to Peigan 59S)	Goose Lake 103S	No
Figure C-32	Scenario #4, 2017 SL	B	3-phase fault on 955L (Goose Lake 103S to Peigan 59S)	Peigan 59S	No
Figure C-33	Scenario #4, 2017 SL	B	3-phase fault on 1048L (Peigan 59S to Windy Flat 138S)	Peigan 59S	No
Figure C-34	Scenario #4, 2017 SL	B	3-phase fault on 1048L (Peigan 59S to Windy Flat 138S)	Windy Flat 138S	No
Figure C-35	Scenario #4, 2017 SL	B	3-phase fault on 1038L (Windy Flat 138S to Foothills 237S)	Windy Flat 138S	No
Figure C-36	Scenario #4, 2017 SL	B	3-phase fault on 1038L (Windy Flat 138S to Foothills 237S)	Foothills 237S	No
Figure C-37	Scenario #4, 2017 SL	B	3-phase fault on 967L (Windy Flat 138S to North Lethbridge 370S)	Windy Flat 138S	No
Figure C-38	Scenario #4, 2017 SL	B	3-phase fault on 967L (Windy Flat 138S to North Lethbridge 370S)	North Lethbridge 370S	No
Figure C-39	Scenario #4, 2017 SL	B	3-phase fault on 613L (Goose Lake 103S to Pincher Creek 396S)	Pincher Creek 396S	No
Figure C-40	Scenario #4, 2017 SL	B	3-phase fault on 613L (Goose Lake 103S to Pincher Creek 396S)	Goose Lake 103S	No
Figure C-41	Scenario #4, 2017 SL	B	3-phase fault on 616L (Goose Lake 103S to Peigan 59S)	Goose Lake 103S	No
Figure C-42	Scenario #4, 2017 SL	B	3-phase fault on 616L (Goose Lake 103S to Peigan 59S)	Peigan 59S	No
Figure C-43	Scenario #4, 2017 SL	B	3-phase fault on Goose Lake 103S 240/138 kV Transformer	Goose lake 103S 240 kV	No

Figure C-44	Scenario #4, 2017 SL	B	3-phase fault on Goose Lake 103S 240/138 kV Transformer	Goose lake 103S 138 kV	No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SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_164L_Goosel.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:56
BRANCH-P-164L_GOOSEL
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
VOLTAGE-164L_GOOSEL
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCCR_WF_P]
MAC-POUT-164L_GOOSEL
CHNL# 6: [SHEERNESS1]
CHNL# 7: [GENESEE-G3]
MAC-ANG-164L_GOOSEL

Figure C-1

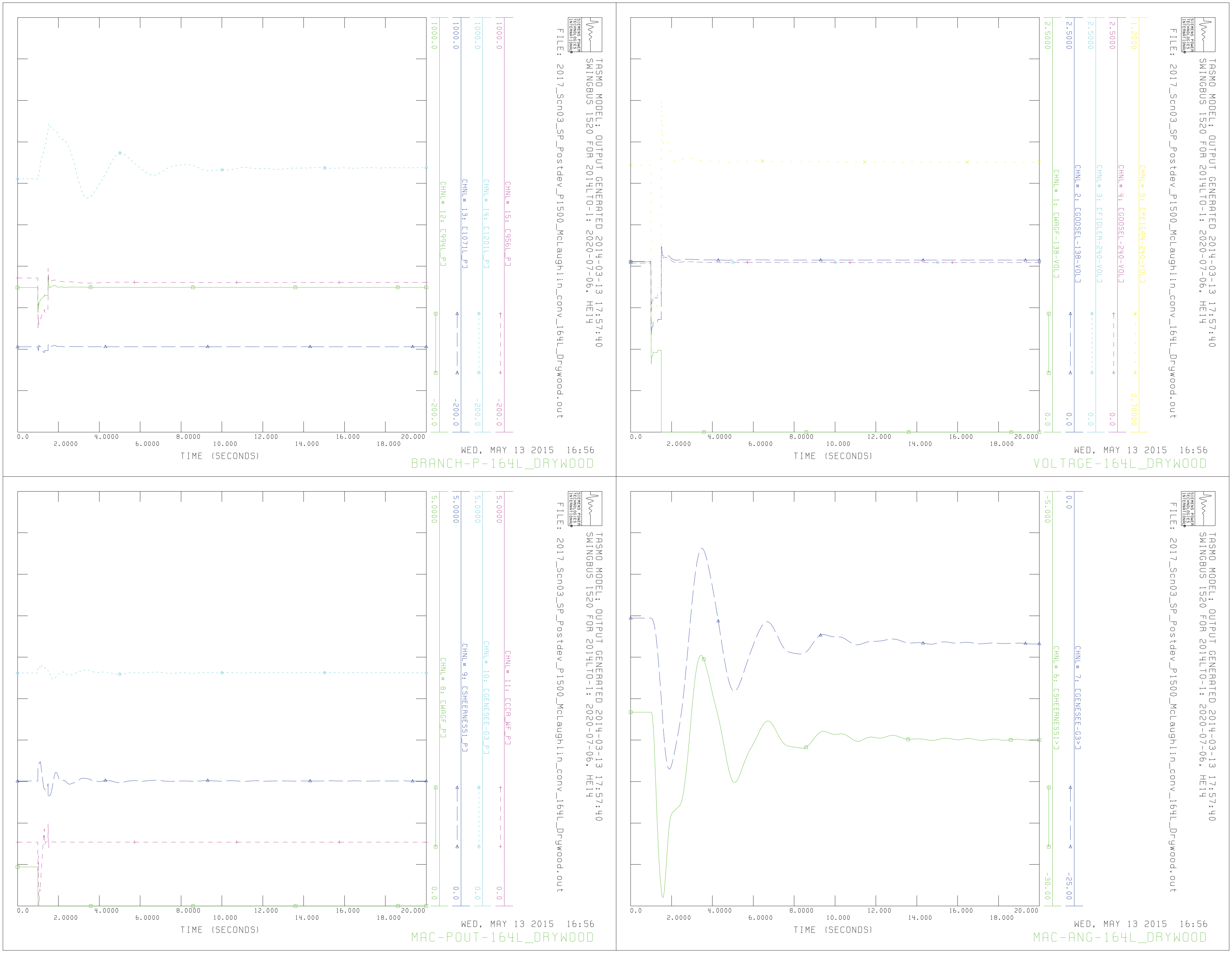

TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_164L_Drywood.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:56
BRANCH-P-164L_DRYWOOD
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
VOLTAGE-164L_DRYWOOD
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCCR_WF_P]
MAC-POUT-164L_DRYWOOD
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
MAC-ANG-164L_DRYWOOD

Figure C-2

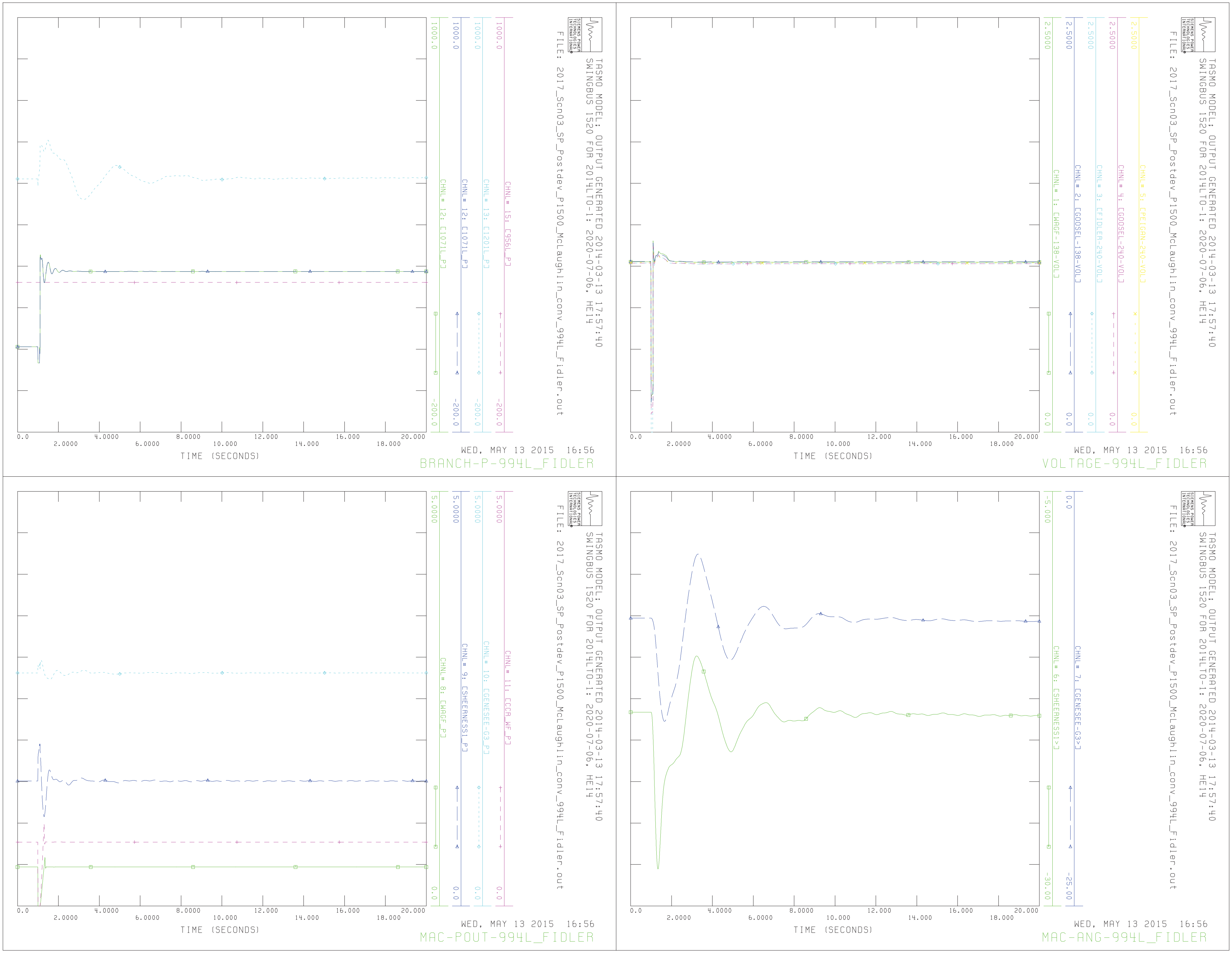

TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_994L_Fidler.out
TIME (SECONDS)
WED, MAY 13 2015 16:56
BRANCH-P-994L_FIDLER
VOLTAGE-994L_FIDLER
MAC-POUT-994L_FIDLER
MAC-ANG-994L_FIDLER

Figure C-3

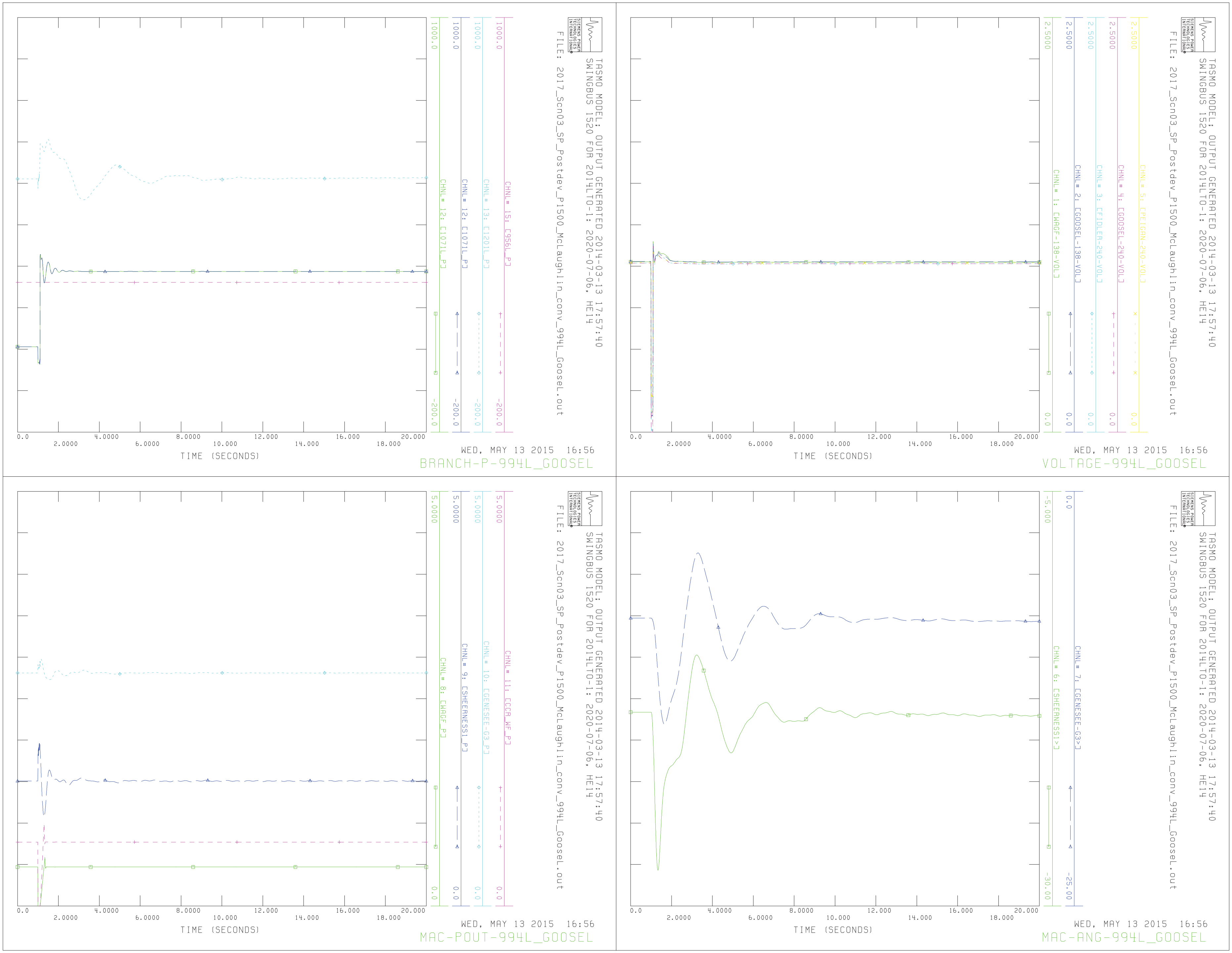

BRANCH-P-994L_GOOSEL
TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_994L_GooseL.out
CHNL# 12: [107L_P]
CHNL# 12: [107L_P]
CHNL# 13: [120L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:56
VOLTAGE-994L_GOOSEL
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
MAC-POUT-994L_GOOSEL
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
MAC-ANG-994L_GOOSEL
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]

Figure C-4

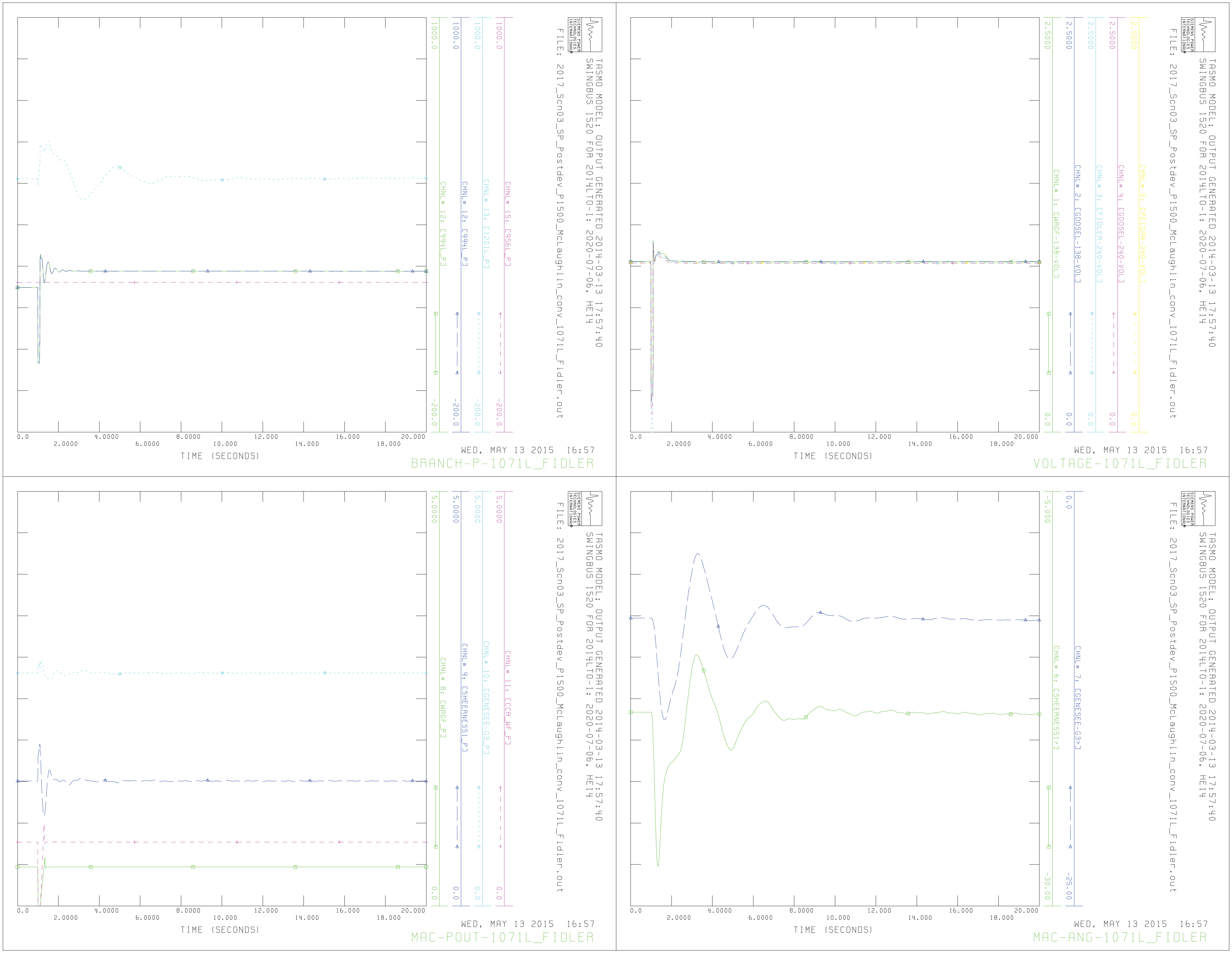
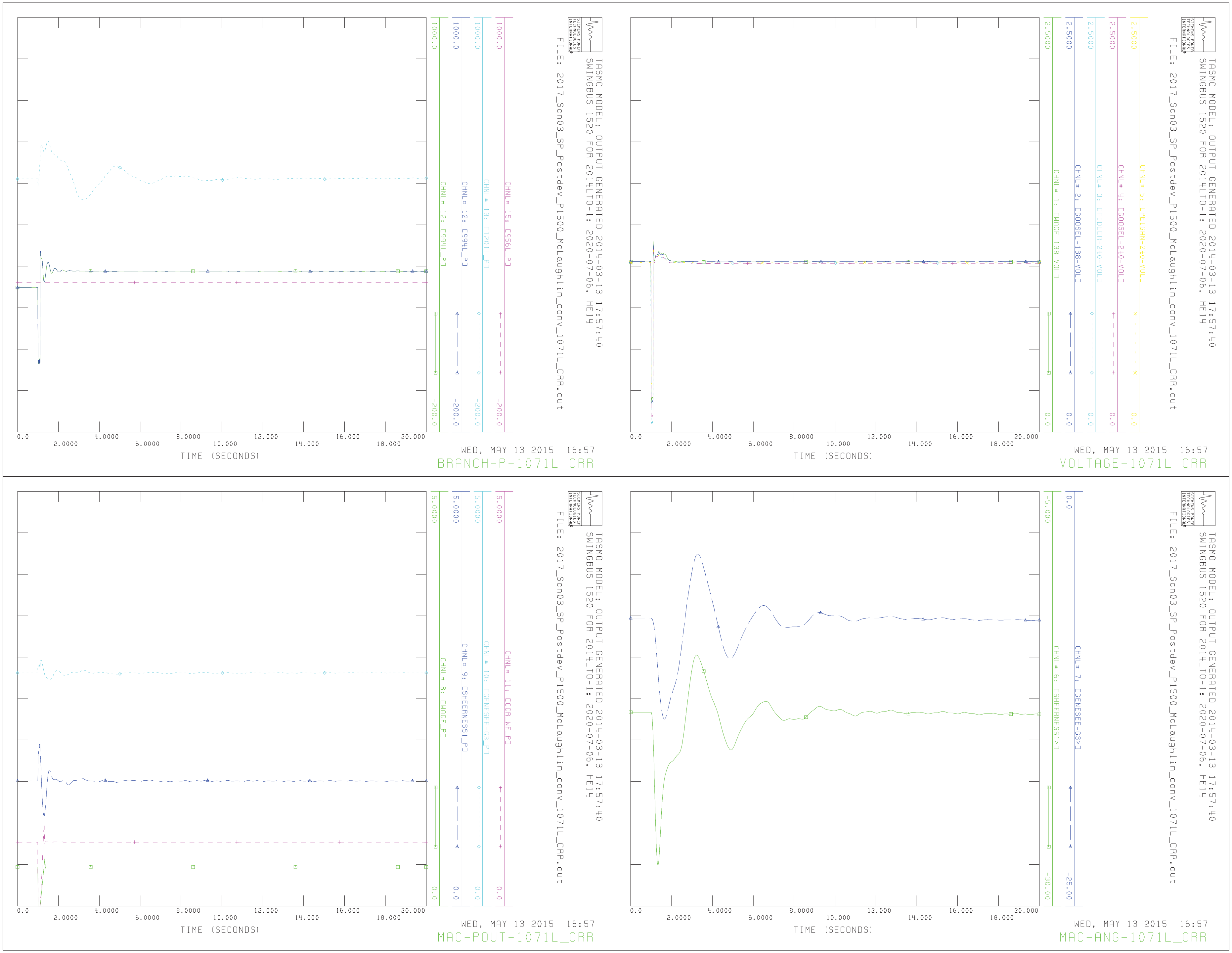
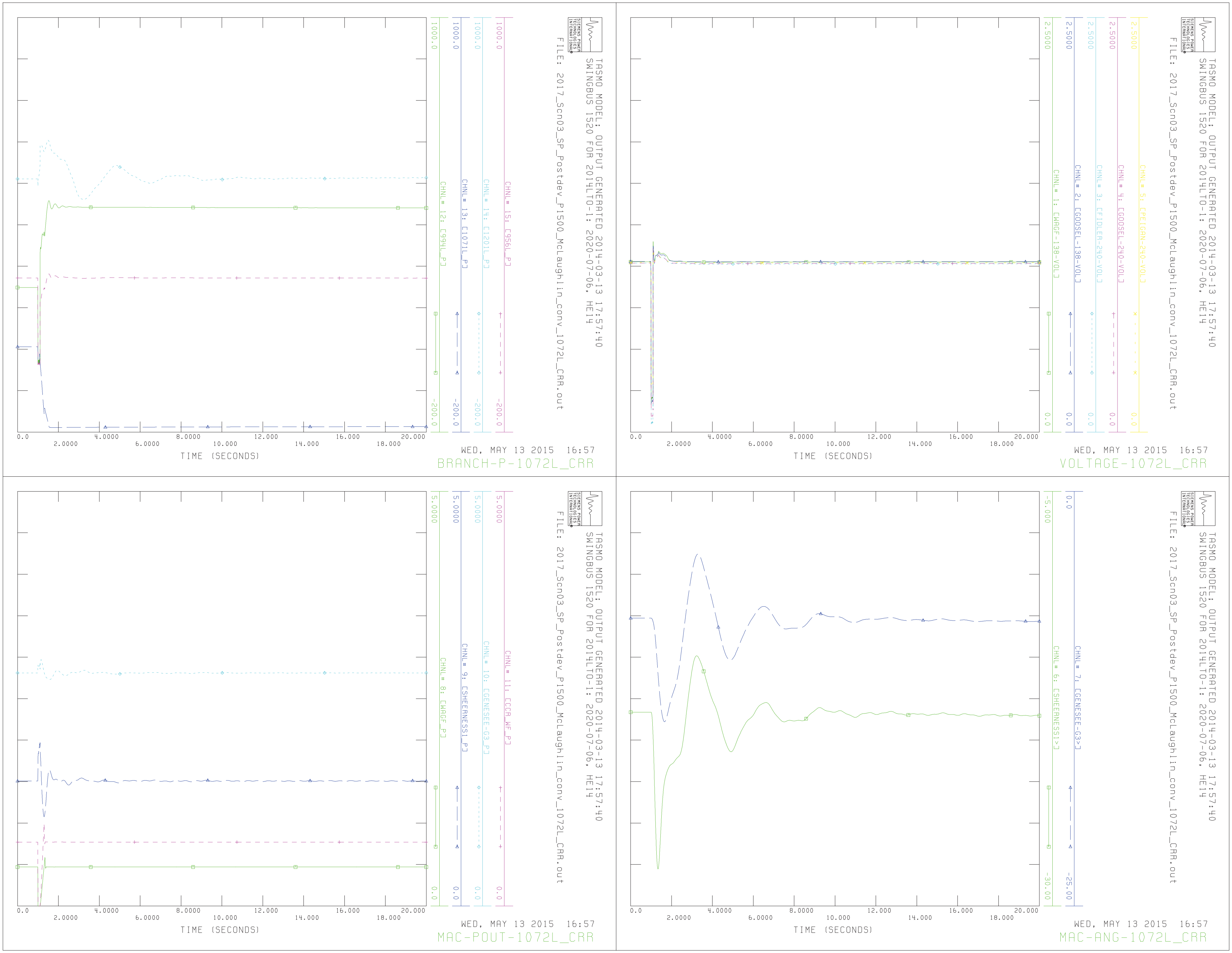

TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_1071L_Fidler.out
CHNL# 12: [994L_P]
CHNL# 12: [994L_P]
CHNL# 13: [1201L_P]
CHNL# 15: [956L_P]
1000.0
-200.0
TIME (SECONDS)
WED, MAY 13 2015 16:57
BRANCH-P-1071L_FIDLER
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
2.5000
0.0
VOLTAGE-1071L_FIDLER
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCCR_WF_P]
5.0000
0.0
MAC-POUT-1071L_FIDLER
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
-5.000
-30.00
0.0
-25.00
MAC-ANG-1071L_FIDLER

Figure C-5



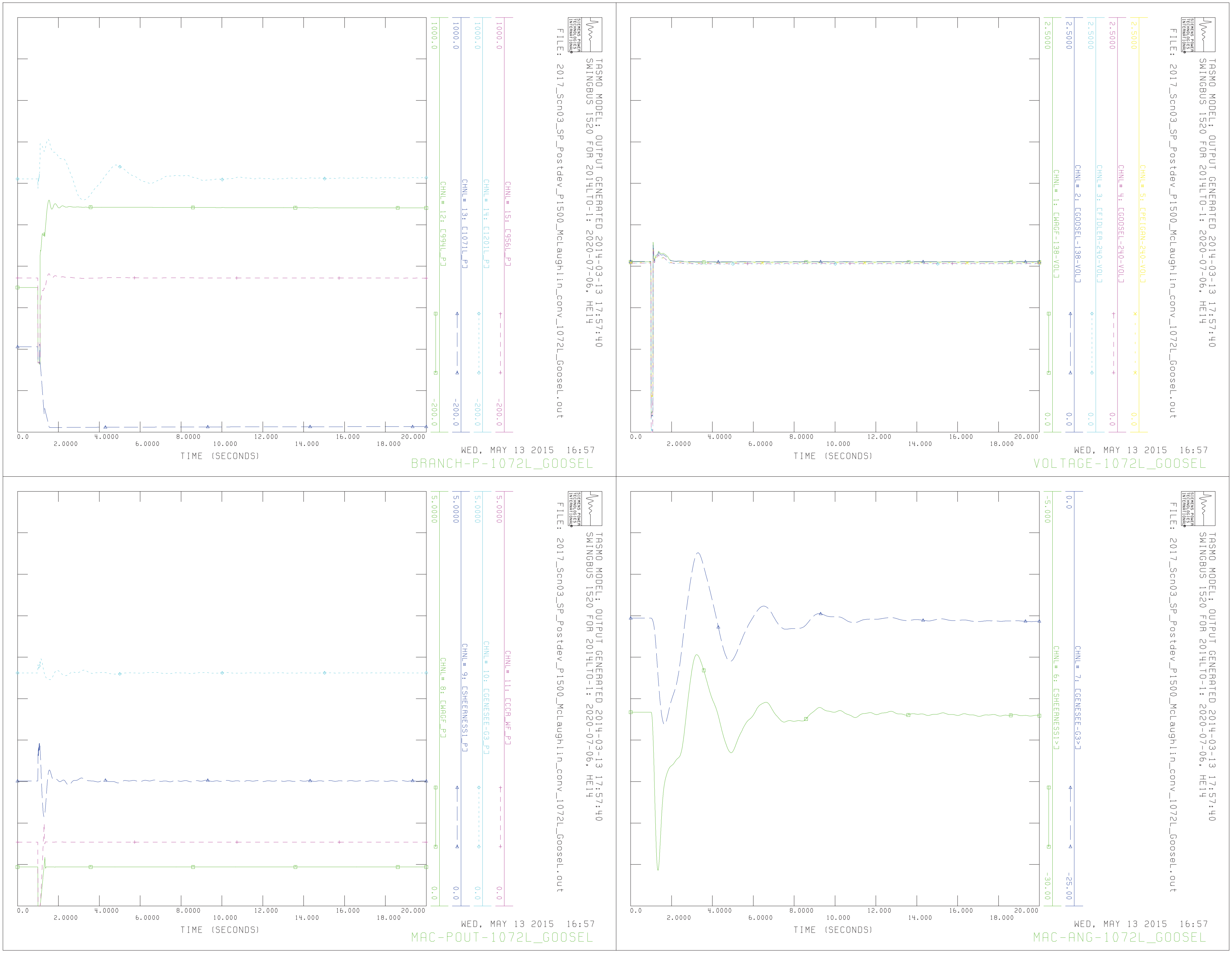
TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_1071L_CRR.out
TIME (SECONDS)
WED, MAY 13 2015 16:57
BRANCH-P-1071L_CRR
CHNL# 12: [994L_P]
CHNL# 13: [1201L_P]
CHNL# 15: [956L_P]
VOLTAGE-1071L_CRR
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
MAC-POUT-1071L_CRR
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
MAC-ANG-1071L_CRR
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]

Figure C-6



TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1; 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_1072L_CRR.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:57
BRANCH-P-1072L_CRR
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
VOLTAGE-1072L_CRR
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCCR_WF_P]
MAC-POUT-1072L_CRR
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
MAC-ANG-1072L_CRR

Figure C-7



TIME (SECONDS)
WED, MAY 13 2015 16:57
BRANCH-P-1072L_GOOSEL
VOLTAGE-1072L_GOOSEL
MAC-POUT-1072L_GOOSEL
MAC-ANG-1072L_GOOSEL
TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_1072L_GooseL.out

Figure C-8

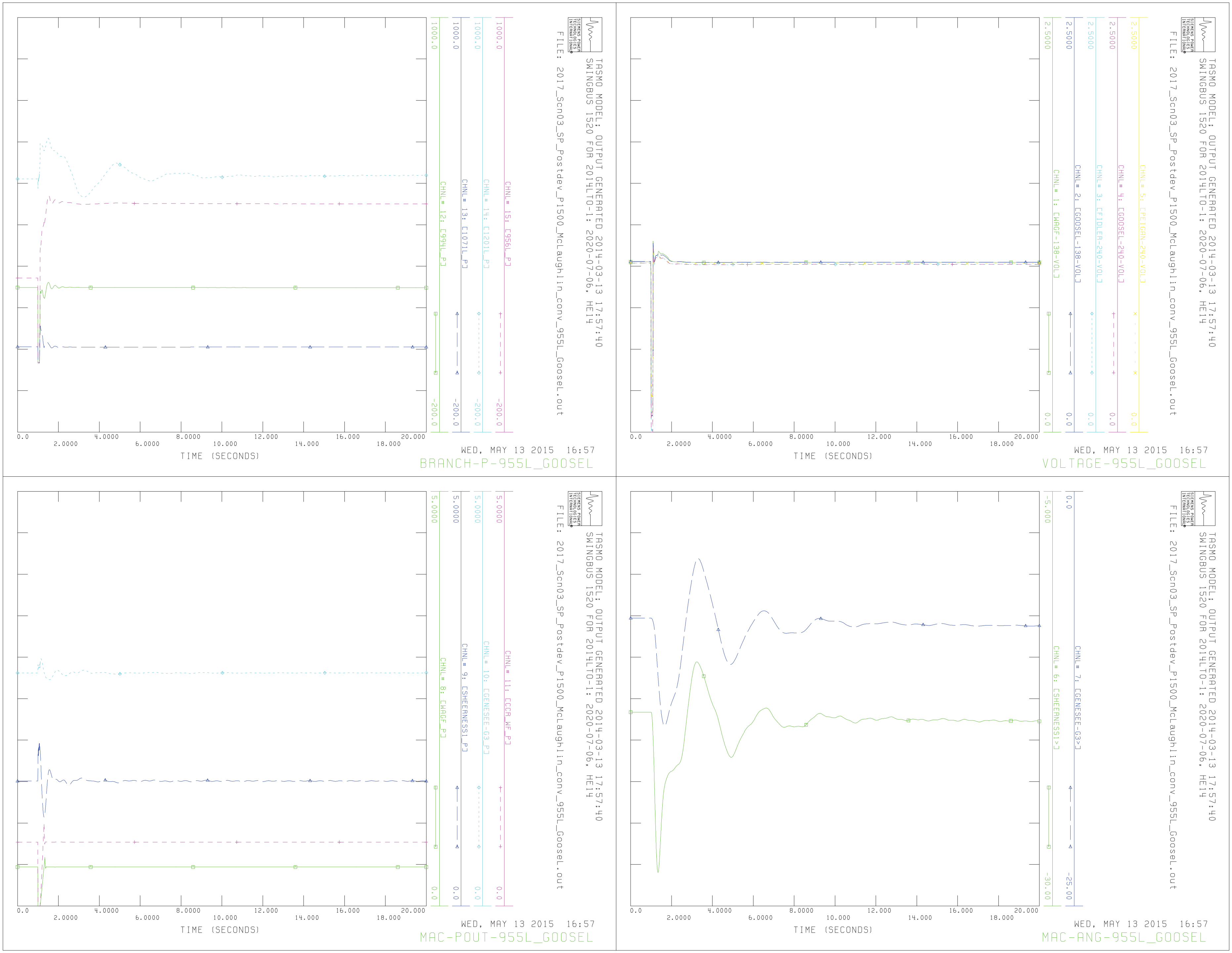

TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_955L_GooseL.out
TIME (SECONDS)
WED, MAY 13 2015 16:57
BRANCH-P-955L_GOOSEL
VOLTAGE-955L_GOOSEL
MAC-POUT-955L_GOOSEL
MAC-ANG-955L_GOOSEL

Figure C-9

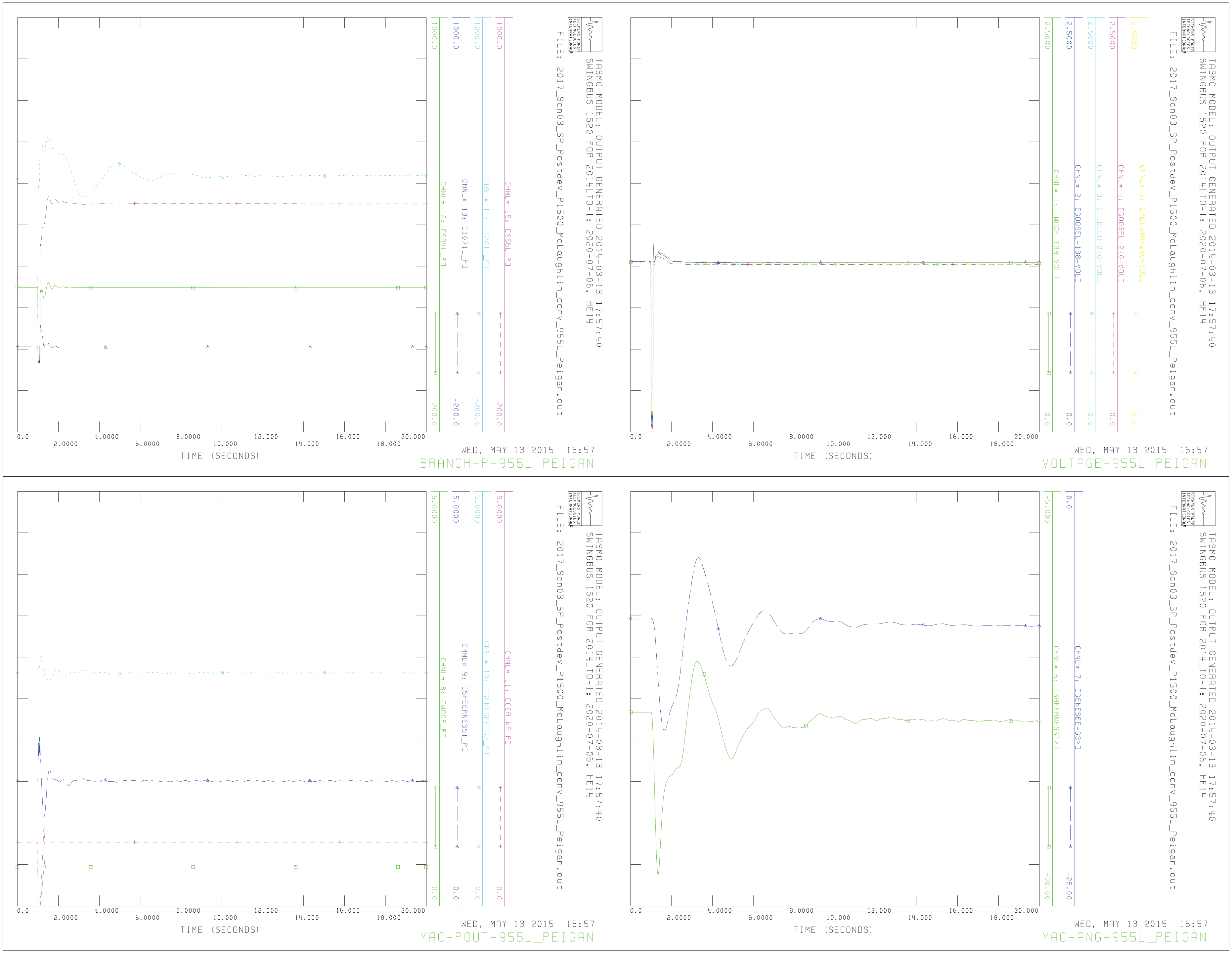
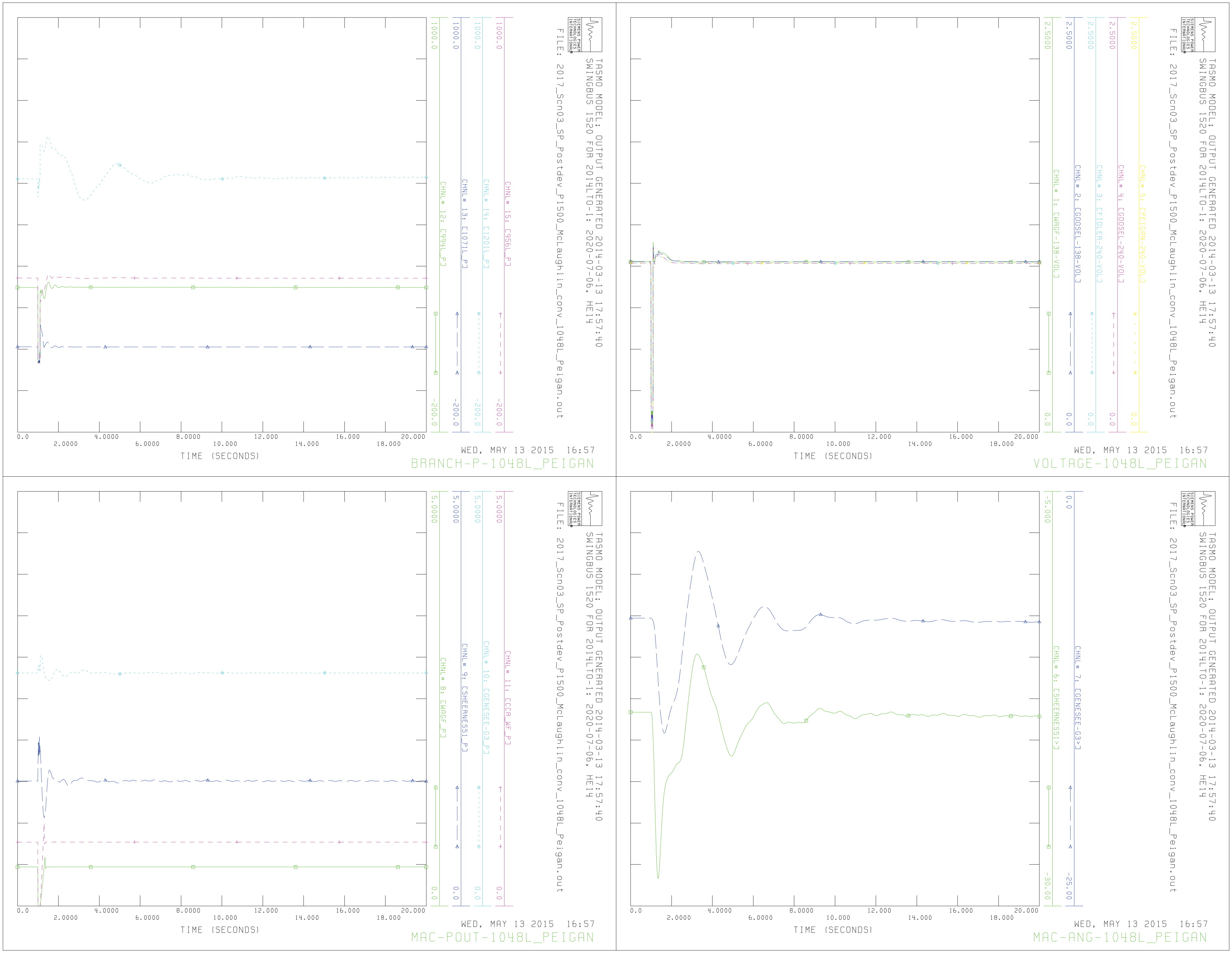

TASMO MODEL: OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_955L_Peigan.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:57
BRANCH-P-955L_PEIGAN
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GODSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GODSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
VOLTAGE-955L_PEIGAN
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
MAC-POUT-955L_PEIGAN
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
MAC-ANG-955L_PEIGAN

Figure C-10



BRANCH-P-1048L_PEIGAN
VOLTAGE-1048L_PEIGAN
MAC-POUT-1048L_PEIGAN
MAC-ANG-1048L_PEIGAN
TIME (SECONDS)
WED, MAY 13 2015 16:57
TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1; 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_1048L_Peigan.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]

Figure C-11

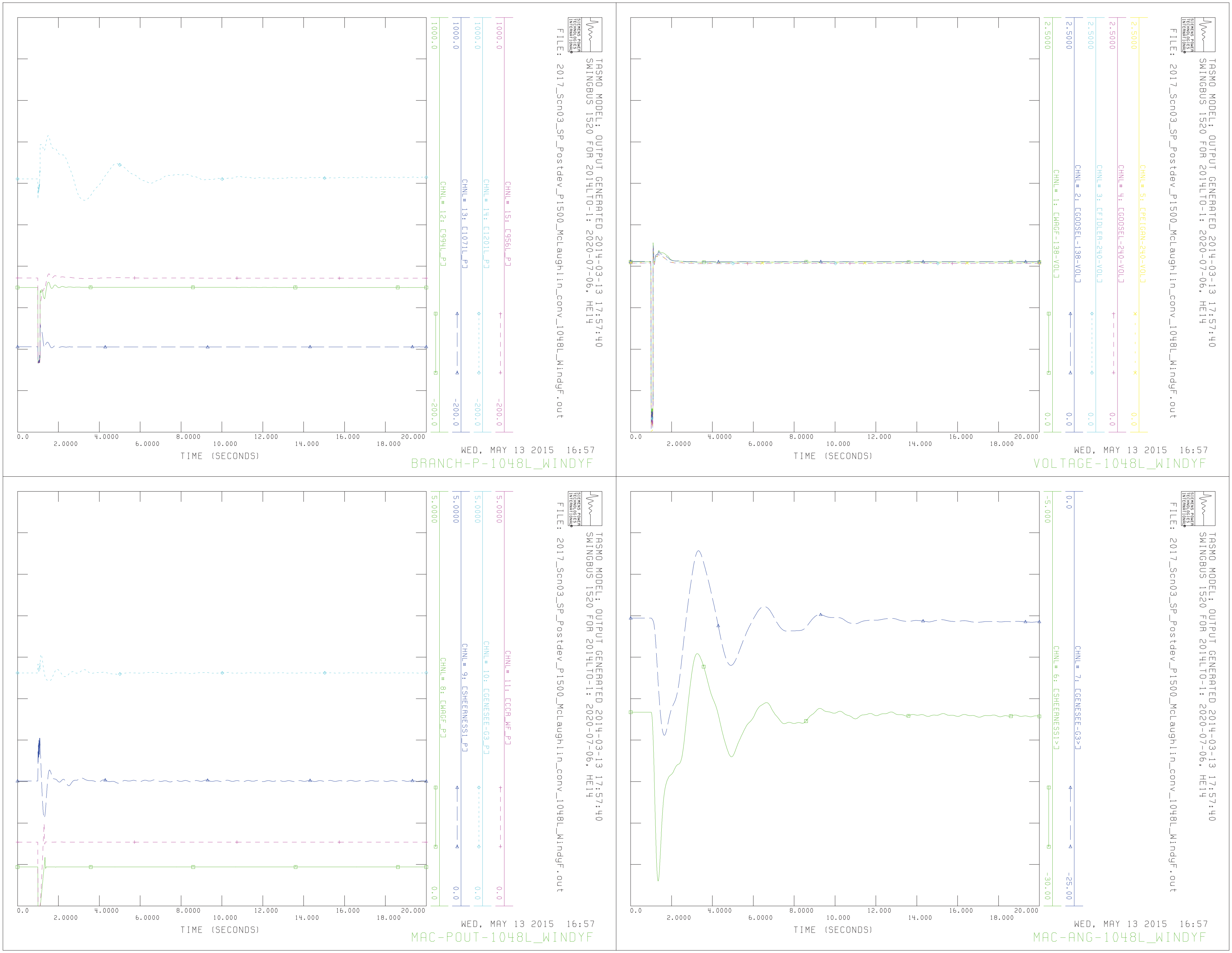
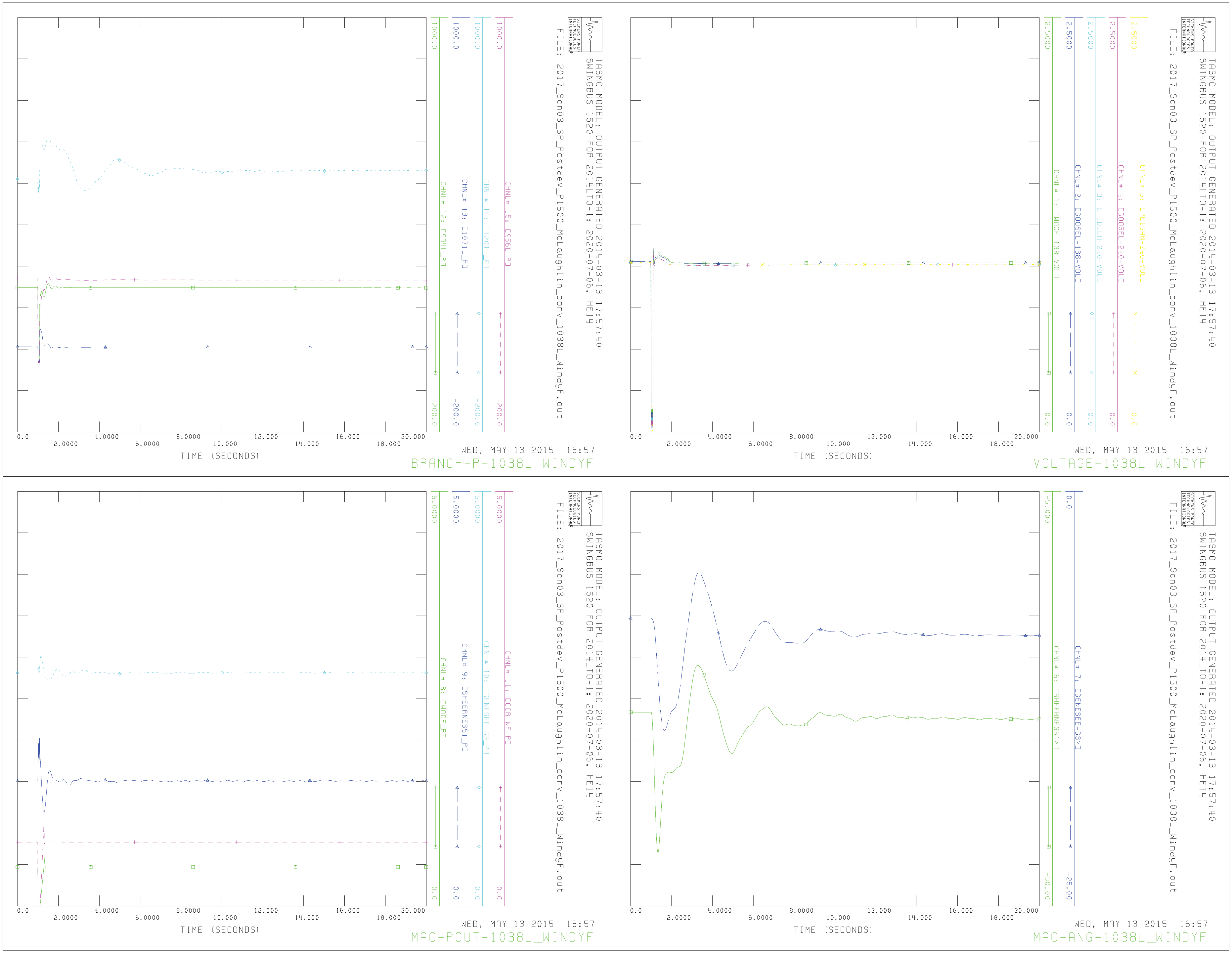

BRANCH-P-1048L_WINDYF
VOLTAGE-1048L_WINDYF
MAC-POUT-1048L_WINDYF
MAC-ANG-1048L_WINDYF
TIME (SECONDS)
WED, MAY 13 2015 16:57
TASMO MODEL: OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_1048L_WindyF.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]

Figure C-12



TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_1038L_WindyF.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:57
BRANCH-P-1038L_WINDYF
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
VOLTAGE-1038L_WINDYF
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
MAC-POUT-1038L_WINDYF
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
MAC-ANG-1038L_WINDYF

Figure C-13

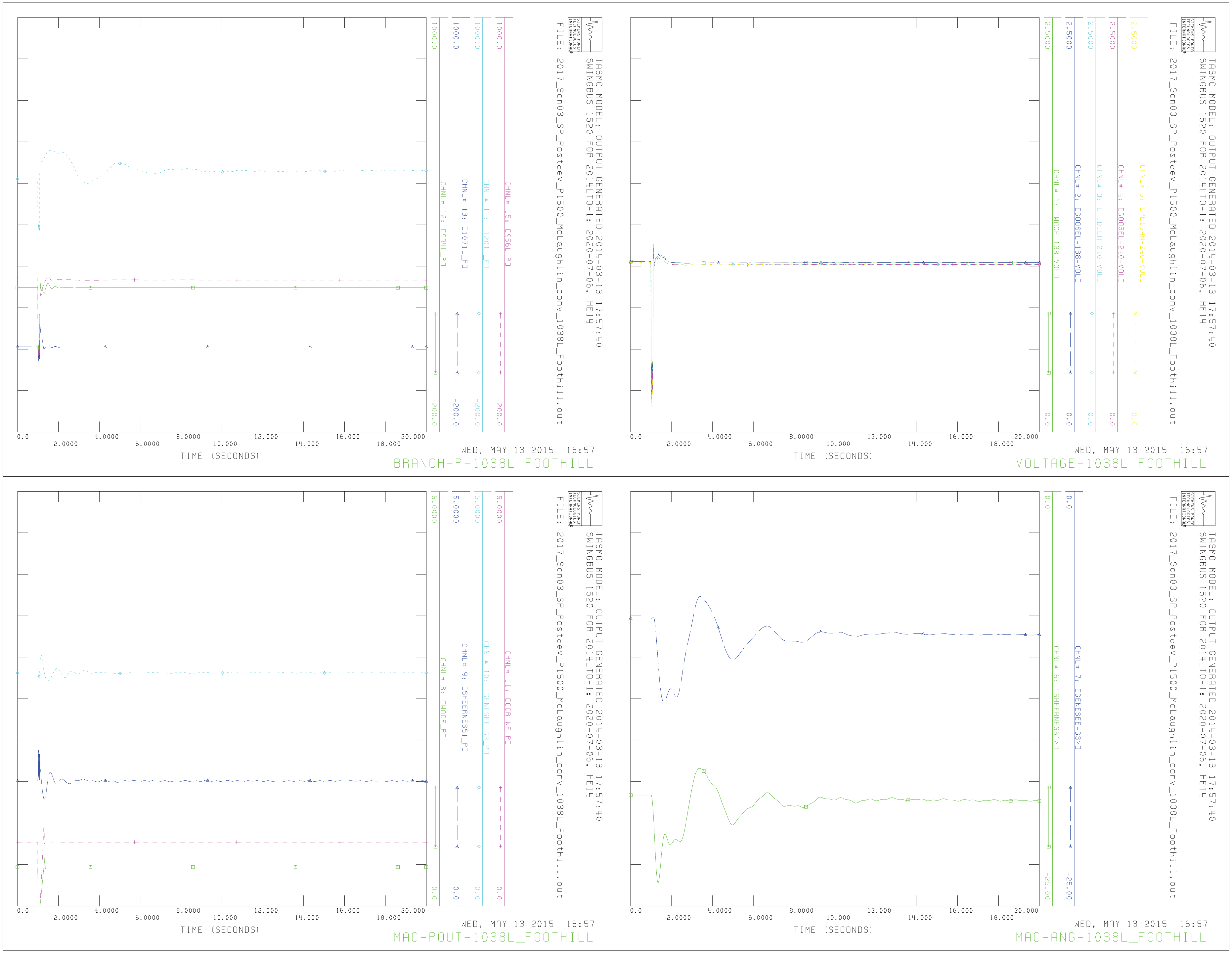

BRANCH-P-1038L_FOOTHILL
VOLTAGE-1038L_FOOTHILL
MAC-POUT-1038L_FOOTHILL
MAC-ANG-1038L_FOOTHILL
TIME (SECONDS)
WED, MAY 13 2015 16:57
TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1; 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_1038L_Foothill.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCCR_WF_P]
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]

Figure C-14

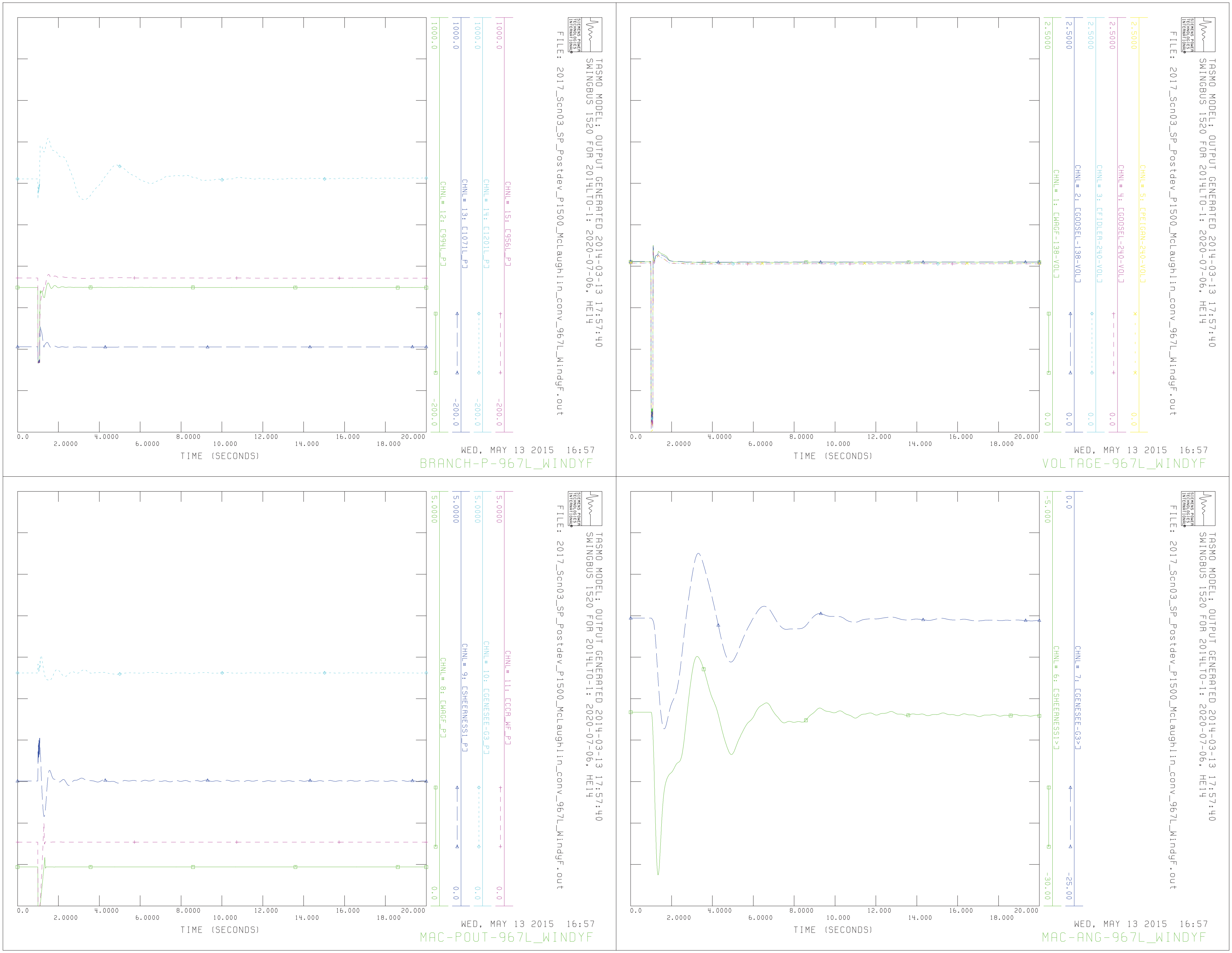
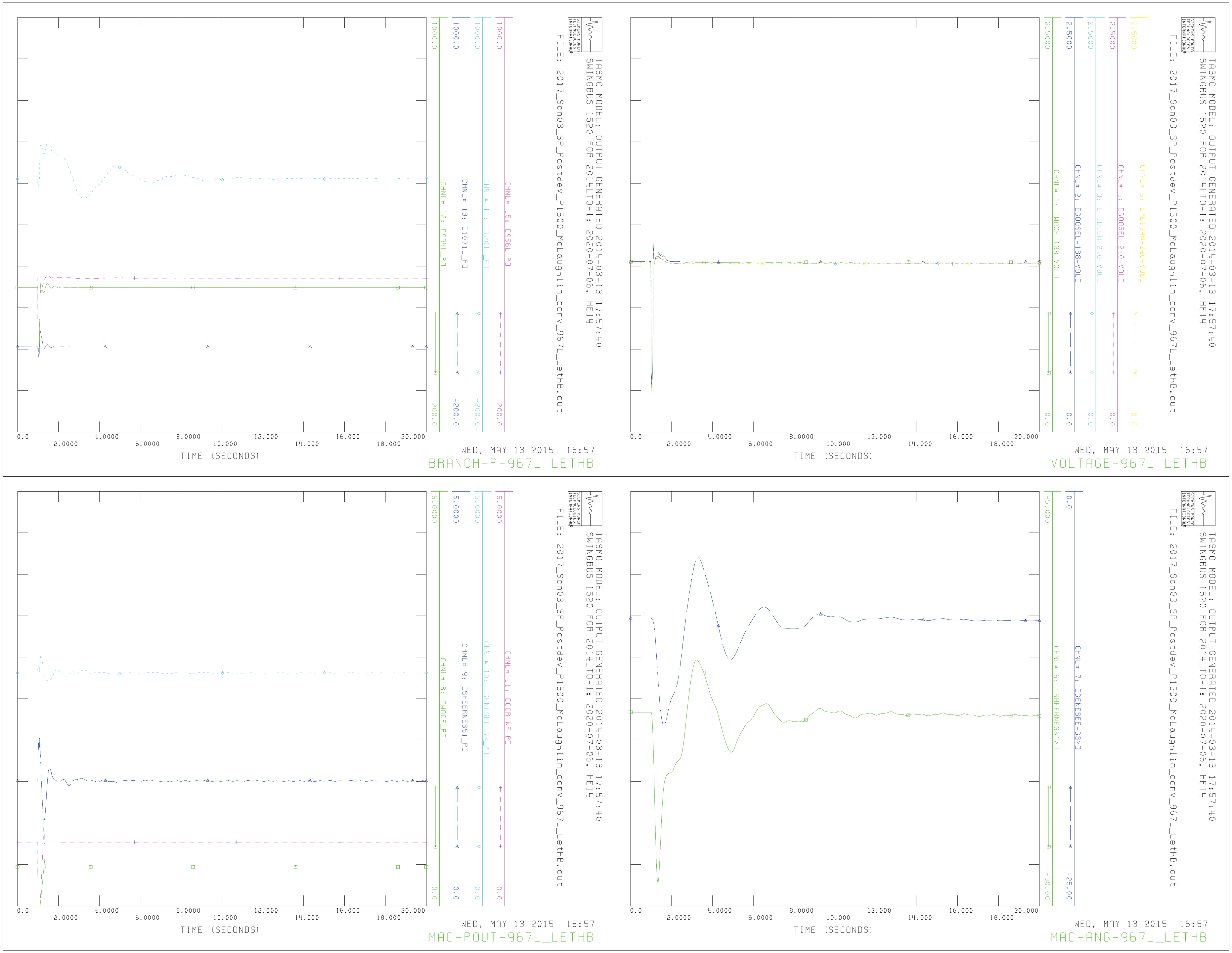

TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1; 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_967L_WindyF.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:57
BRANCH-P-967L_WINDYF
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
VOLTAGE-967L_WINDYF
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCCR_WF_P]
MAC-POUT-967L_WINDYF
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
MAC-ANG-967L_WINDYF

Figure C-15



TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_967L_LethB.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:57
BRANCH-P-967L_LETHB
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
VOLTAGE-967L_LETHB
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
MAC-POUT-967L_LETHB
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
MAC-ANG-967L_LETHB

Figure C-16

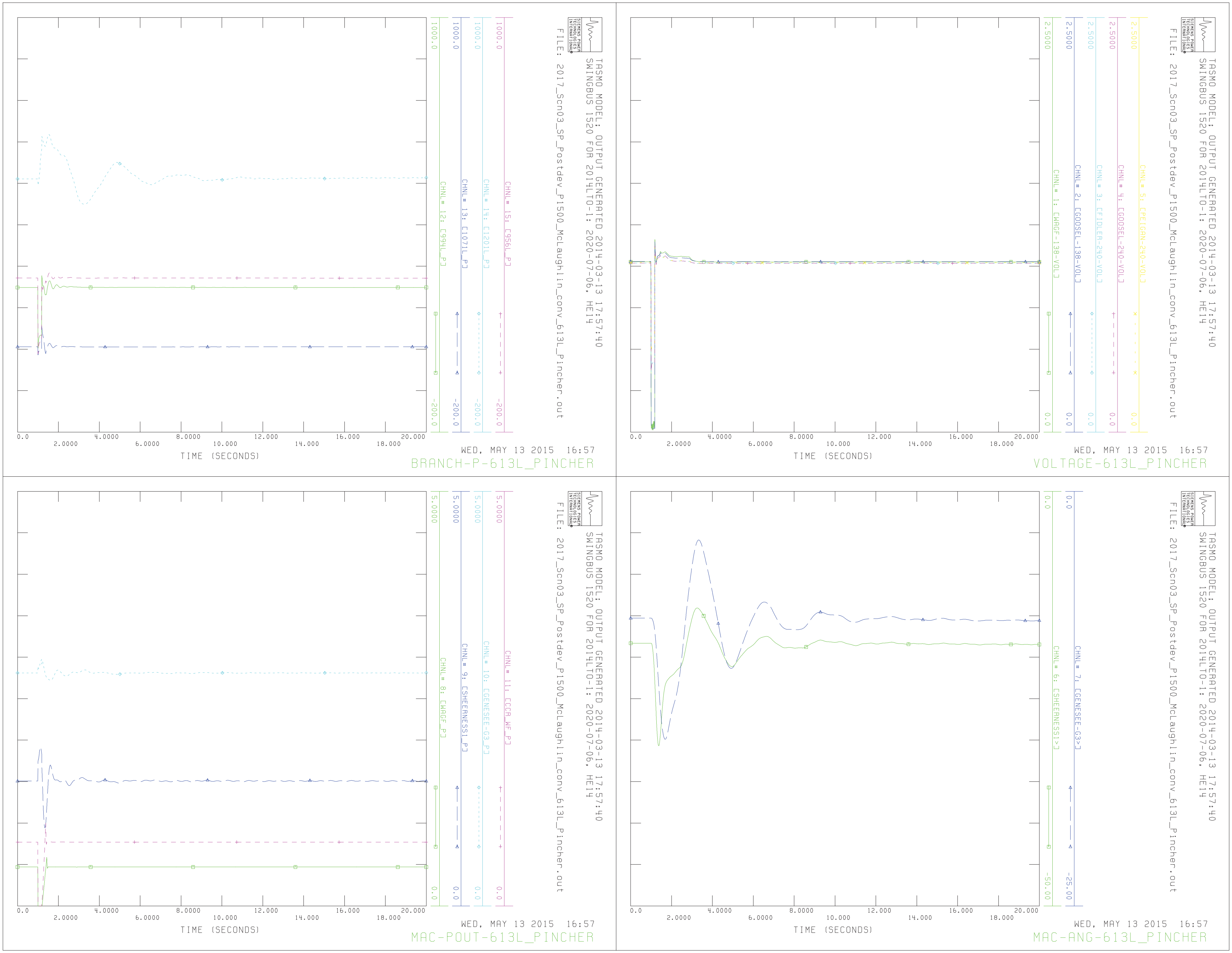
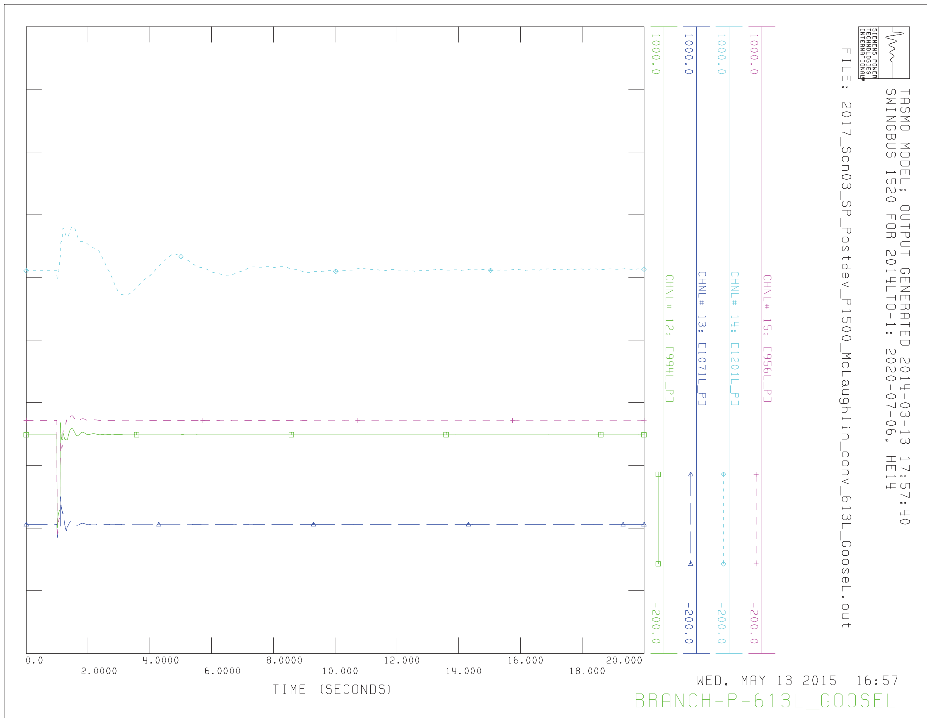
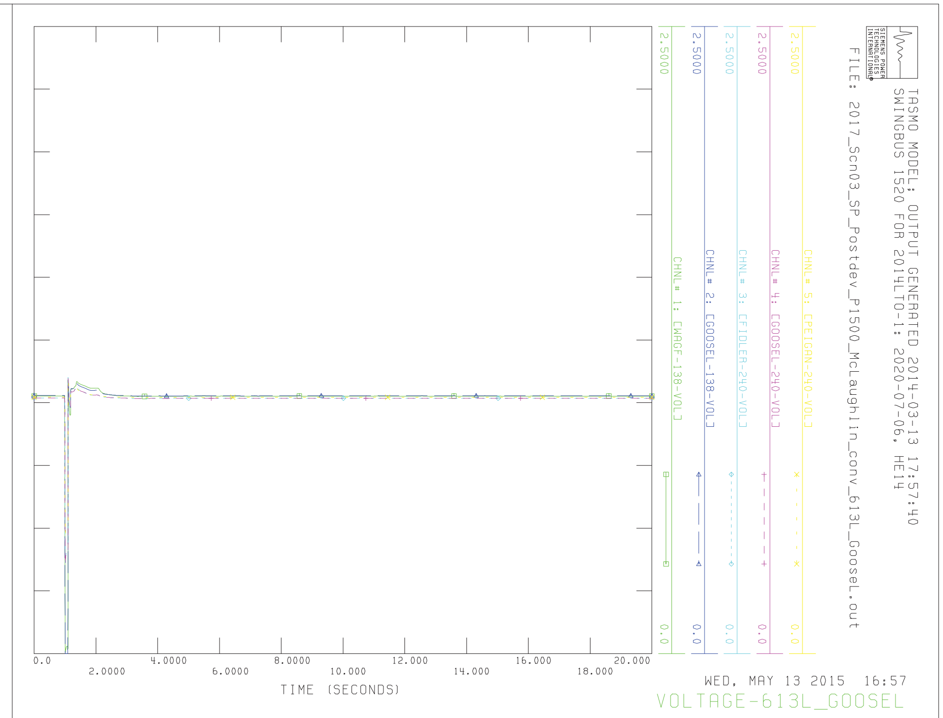
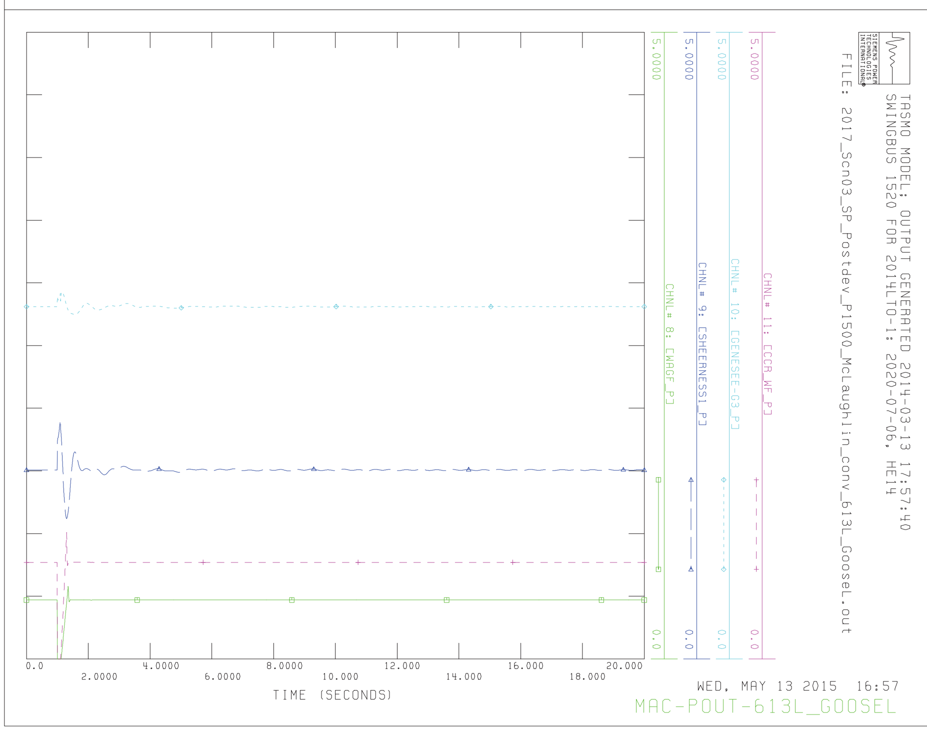

TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_613L_Pincher.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:57
BRANCH-P-613L_PINCHER
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
VOLTAGE-613L_PINCHER
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCCR_WF_P]
MAC-POUT-613L_PINCHER
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
MAC-ANG-613L_PINCHER

Figure C-17


TASMO MODEL: OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_613L_GooseL.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:57
BRANCH-P-613L_GOOSEL


TASMO MODEL: OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_613L_GooseL.out
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
TIME (SECONDS)
WED, MAY 13 2015 16:57
VOLTAGE-613L_GOOSEL


TASMO MODEL: OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_613L_GooseL.out
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
TIME (SECONDS)
WED, MAY 13 2015 16:57
MAC-POUT-613L_GOOSEL

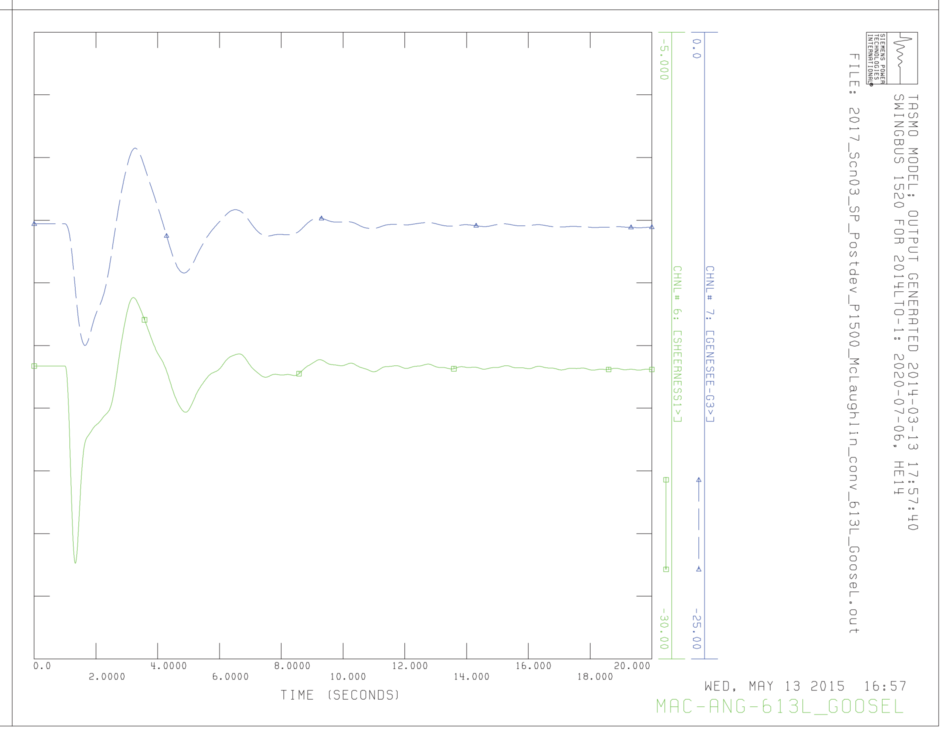

TASMO MODEL: OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_613L_GooseL.out
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
TIME (SECONDS)
WED, MAY 13 2015 16:57
MAC-ANG-613L_GOOSEL

Figure C-18

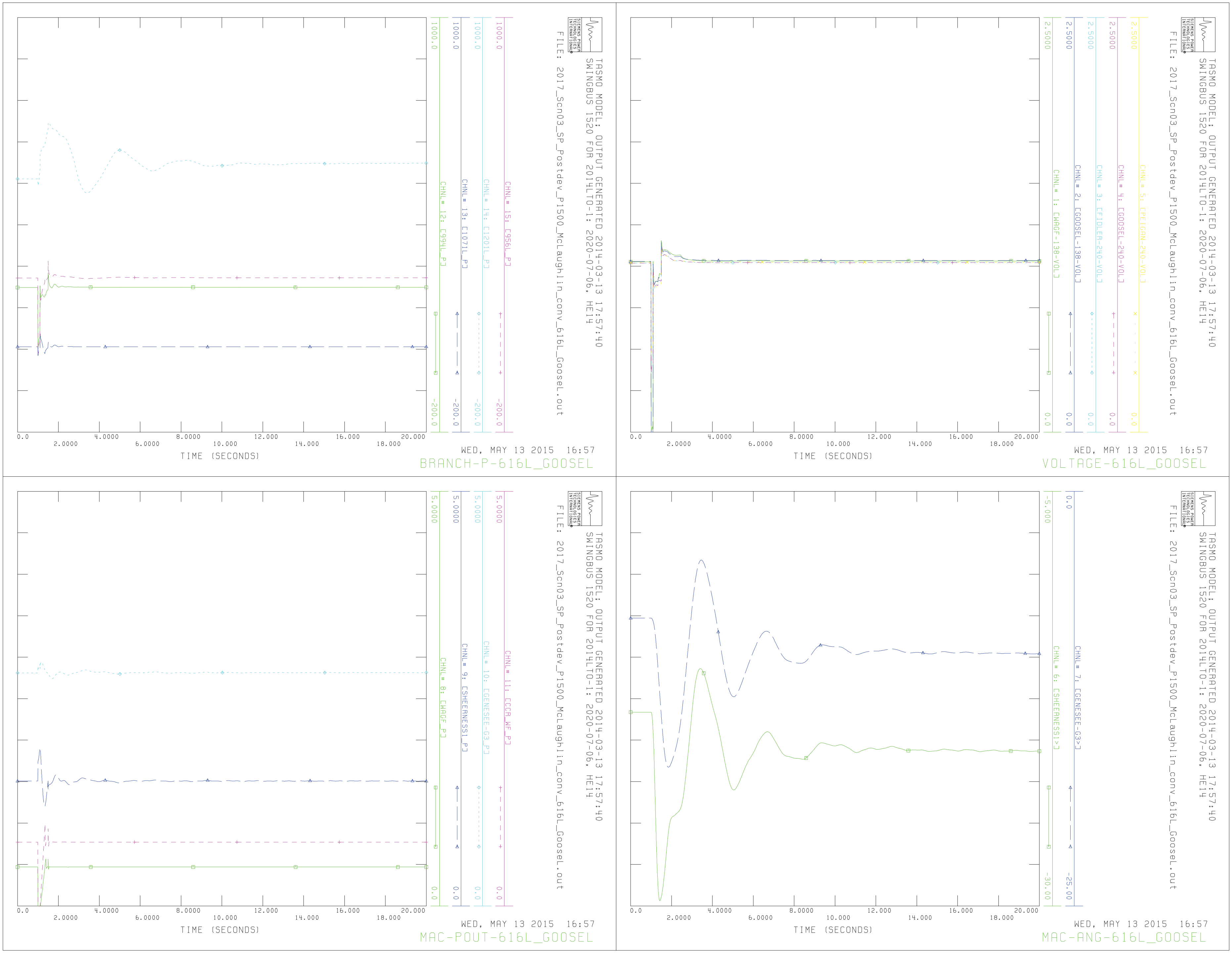

TASMO MODEL: OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_616L_GooseL.out
BRANCH-P-616L_GOOSEL
VOLTAGE-616L_GOOSEL
MAC-POUT-616L_GOOSEL
MAC-ANG-616L_GOOSEL
TIME (SECONDS)
WED, MAY 13 2015 16:57
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]

Figure C-19

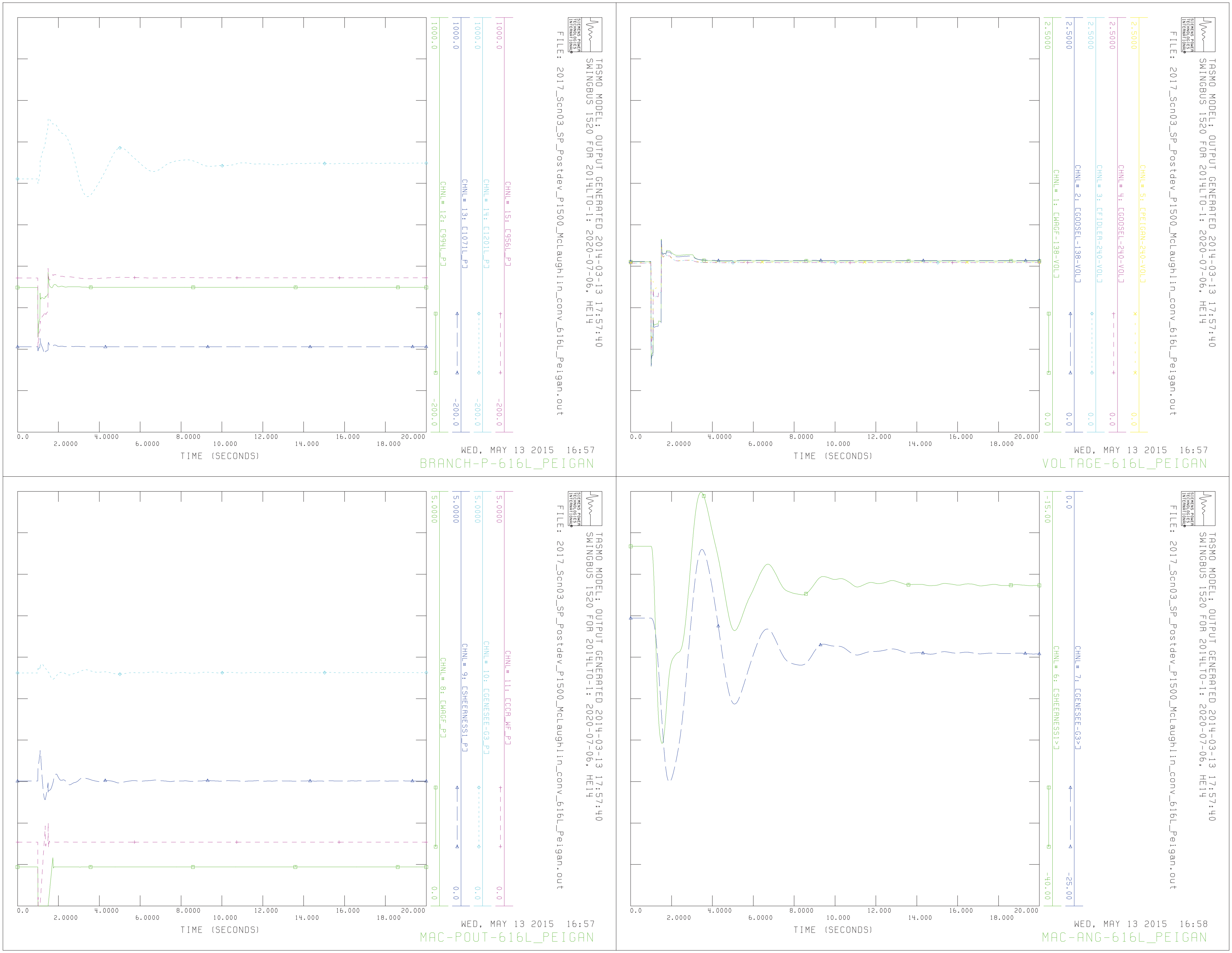

TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_616L_Peigan.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
1000.0
-200.0
0.0
2.0000
4.0000
6.0000
8.0000
10.000
12.000
14.000
16.000
18.000
20.000
TIME (SECONDS)
WED, MAY 13 2015 16:57
BRANCH-P-616L_PEIGAN
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
2.5000
VOLTAGE-616L_PEIGAN
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCCR_WF_P]
5.0000
MAC-POUT-616L_PEIGAN
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
-15.00
-40.00
-25.00
WED, MAY 13 2015 16:58
MAC-ANG-616L_PEIGAN

Figure C-20

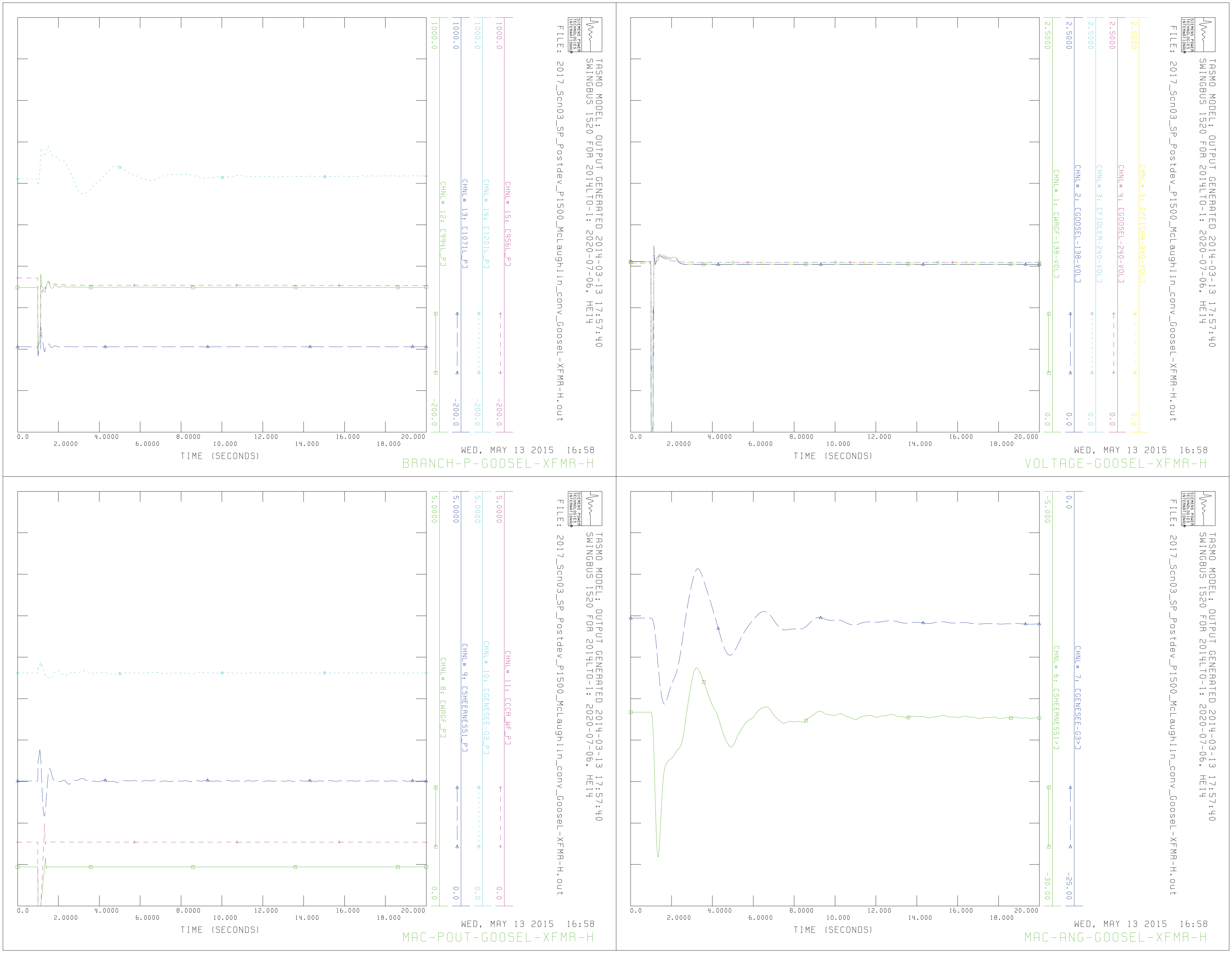

TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1; 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_Goosel-XFMR-H.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:58
BRANCH-P-GOOSEL-XFMR-H
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
VOLTAGE-GOOSEL-XFMR-H
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCCR_WF_P]
MAC-POUT-GOOSEL-XFMR-H
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
MAC-ANG-GOOSEL-XFMR-H

Figure C-21

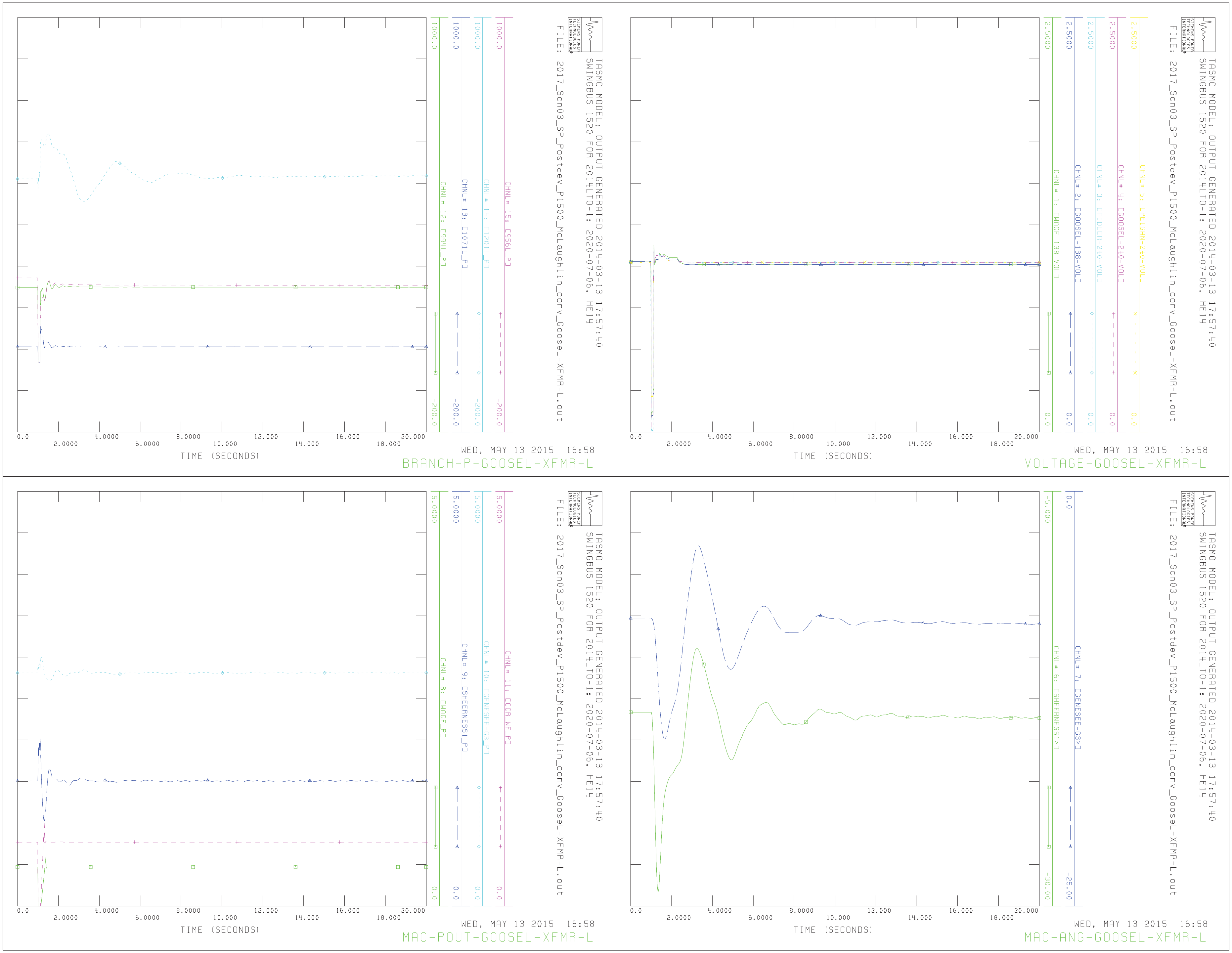

TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:57:40
SWINGBUS 1520 FOR 2014LTO-1: 2020-07-06, HE14
FILE: 2017_Scn03_SP_Postdev_P1500_McLaughlin_conv_Goosel-XFMR-L.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:58
BRANCH-P-GOOSEL-XFMR-L
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
VOLTAGE-GOOSEL-XFMR-L
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
MAC-POUT-GOOSEL-XFMR-L
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
MAC-ANG-GOOSEL-XFMR-L

Figure C-22

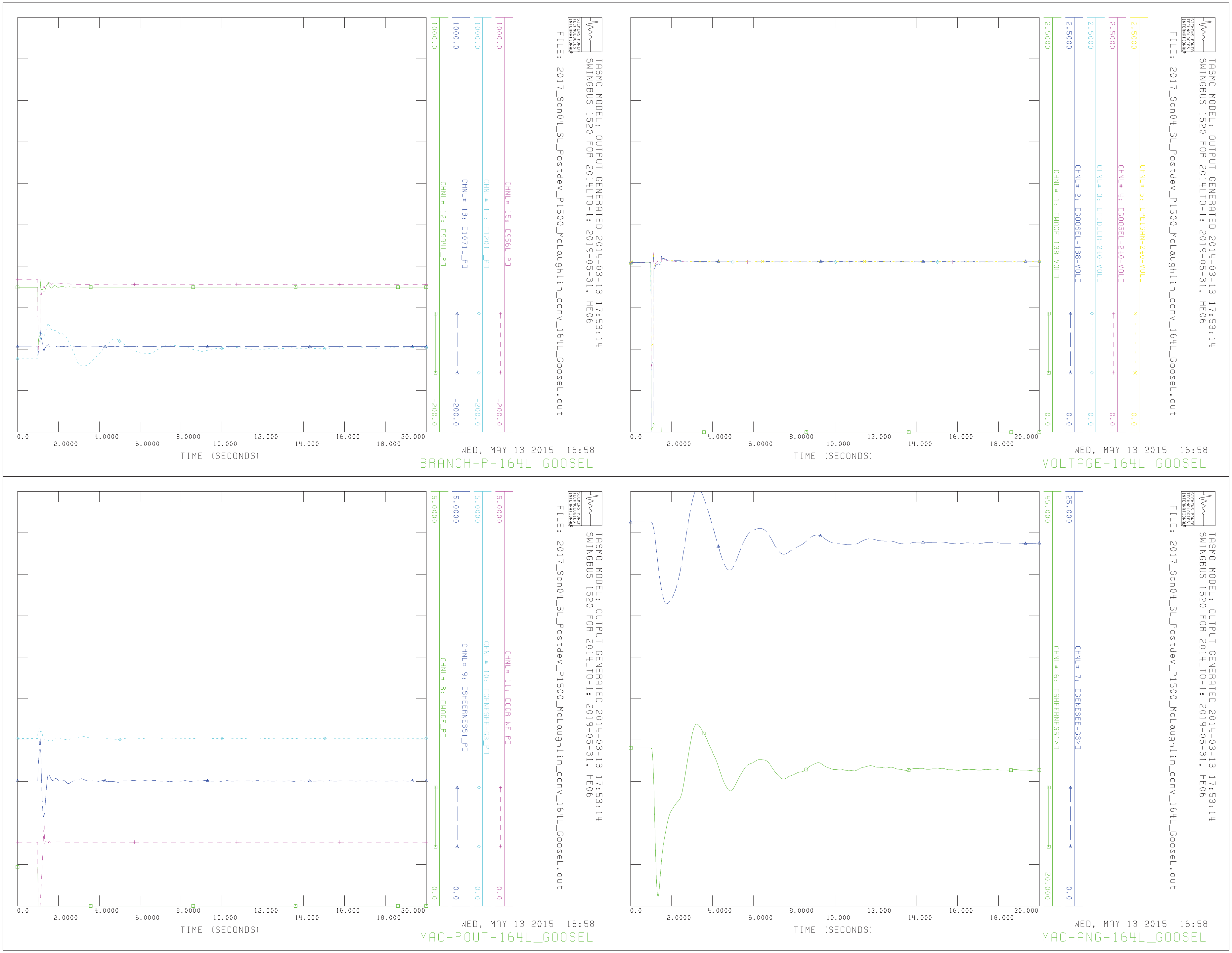

TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1; 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_164L_GooseL.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:58
BRANCH-P-164L_GOOSEL
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
VOLTAGE-164L_GOOSEL
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
MAC-POUT-164L_GOOSEL
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
MAC-ANG-164L_GOOSEL

Figure C-23

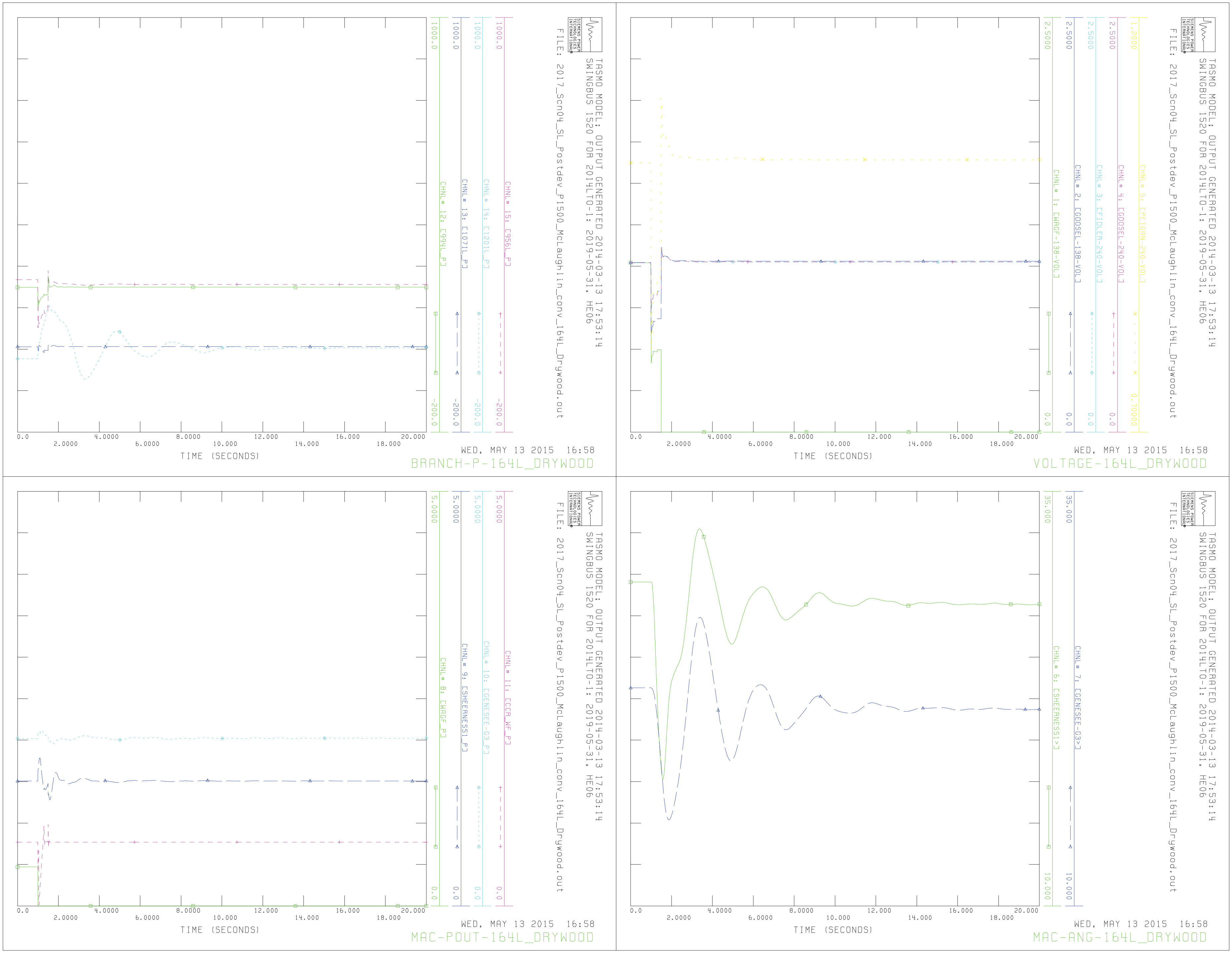

TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1; 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_164L_Drywood.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:58
BRANCH-P-164L_DRYWOOD
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
VOLTAGE-164L_DRYWOOD
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
MAC-POUT-164L_DRYWOOD
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
MAC-ANG-164L_DRYWOOD

Figure C-24

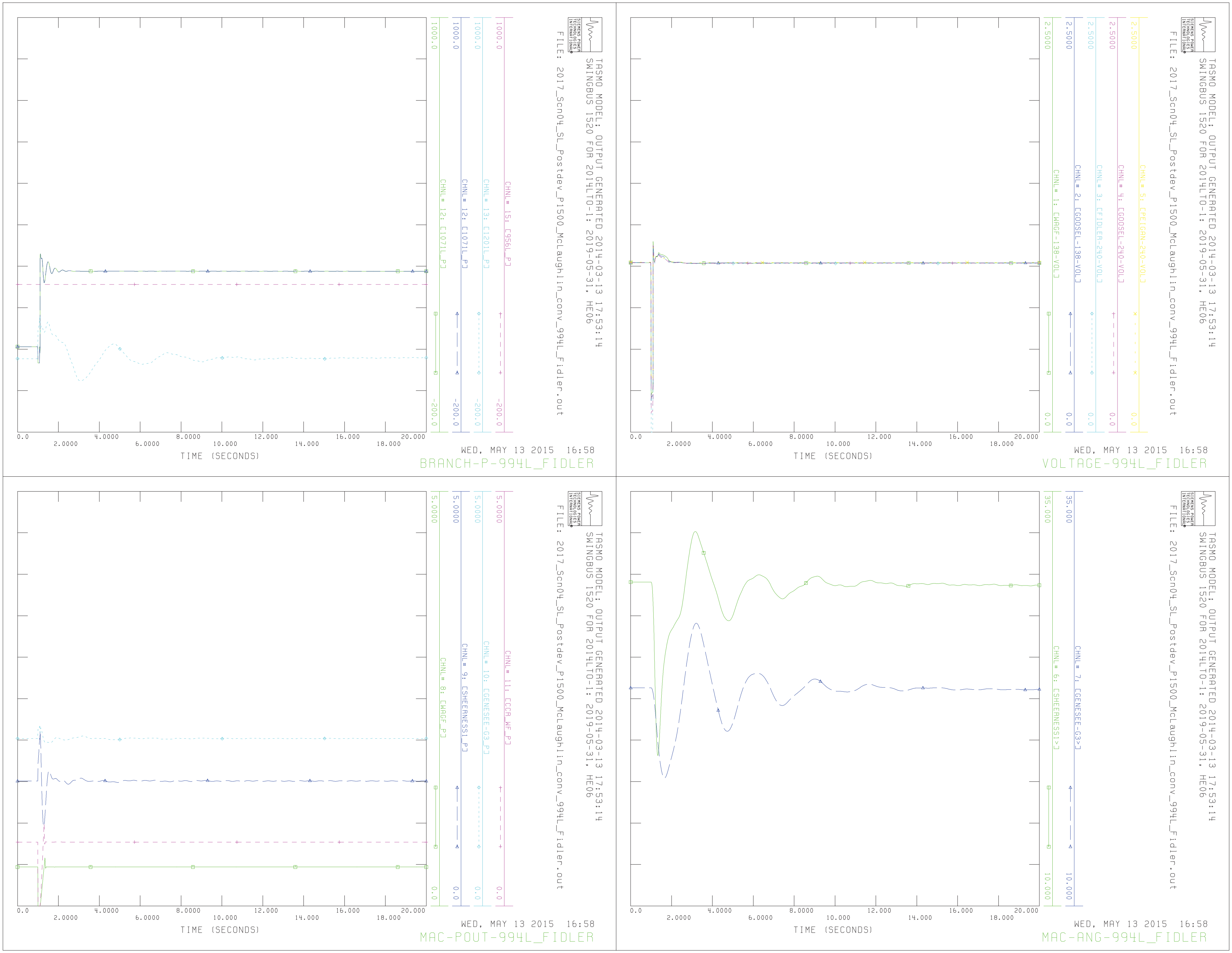

TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1: 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_994L_Fidler.out
TIME (SECONDS)
WED, MAY 13 2015 16:58
BRANCH-P-994L_FIDLER
VOLTAGE-994L_FIDLER
MAC-POUT-994L_FIDLER
MAC-ANG-994L_FIDLER

Figure C-25

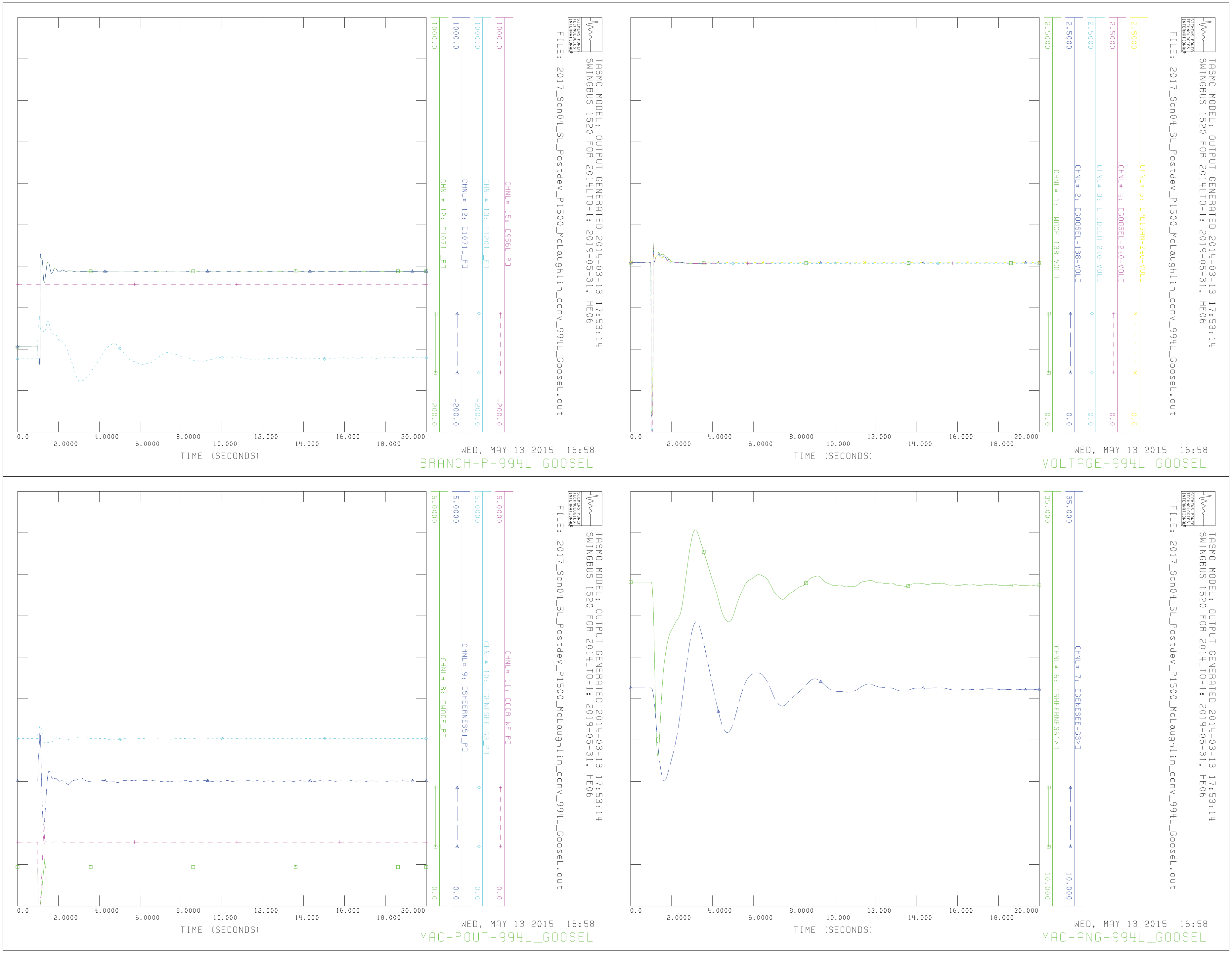

TASMO MODEL: OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1: 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_994L_GooseL.out
TIME (SECONDS)
WED, MAY 13 2015 16:58
BRANCH-P-994L_GOOSEL
VOLTAGE-994L_GOOSEL
MAC-POUT-994L_GOOSEL
MAC-ANG-994L_GOOSEL

Figure C-26

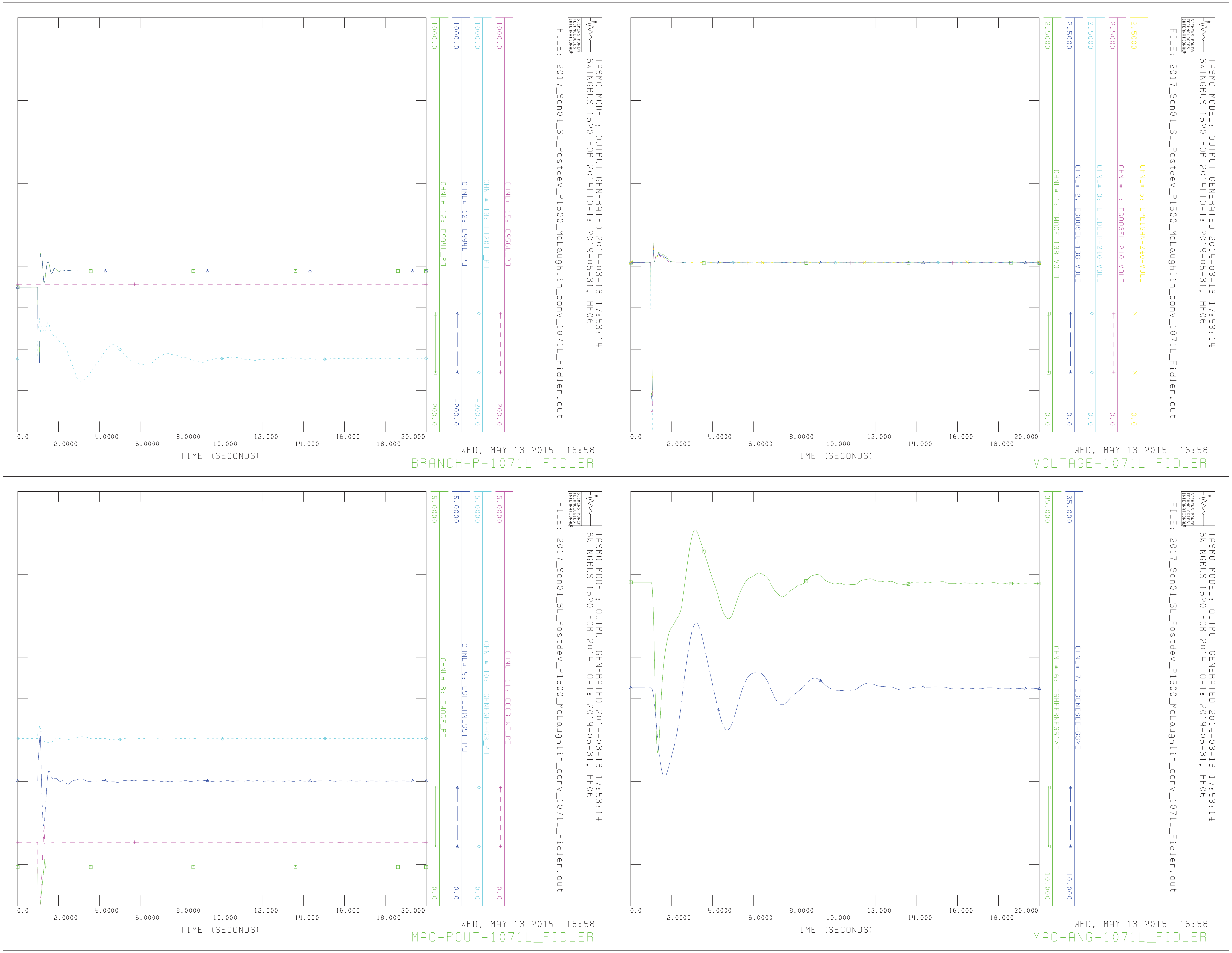

BRANCH-P-1071L_FIDLER
VOLTAGE-1071L_FIDLER
MAC-POUT-1071L_FIDLER
MAC-ANG-1071L_FIDLER
TIME (SECONDS)
WED, MAY 13 2015 16:58
TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1; 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_1071L_Fidler.out

Figure C-27

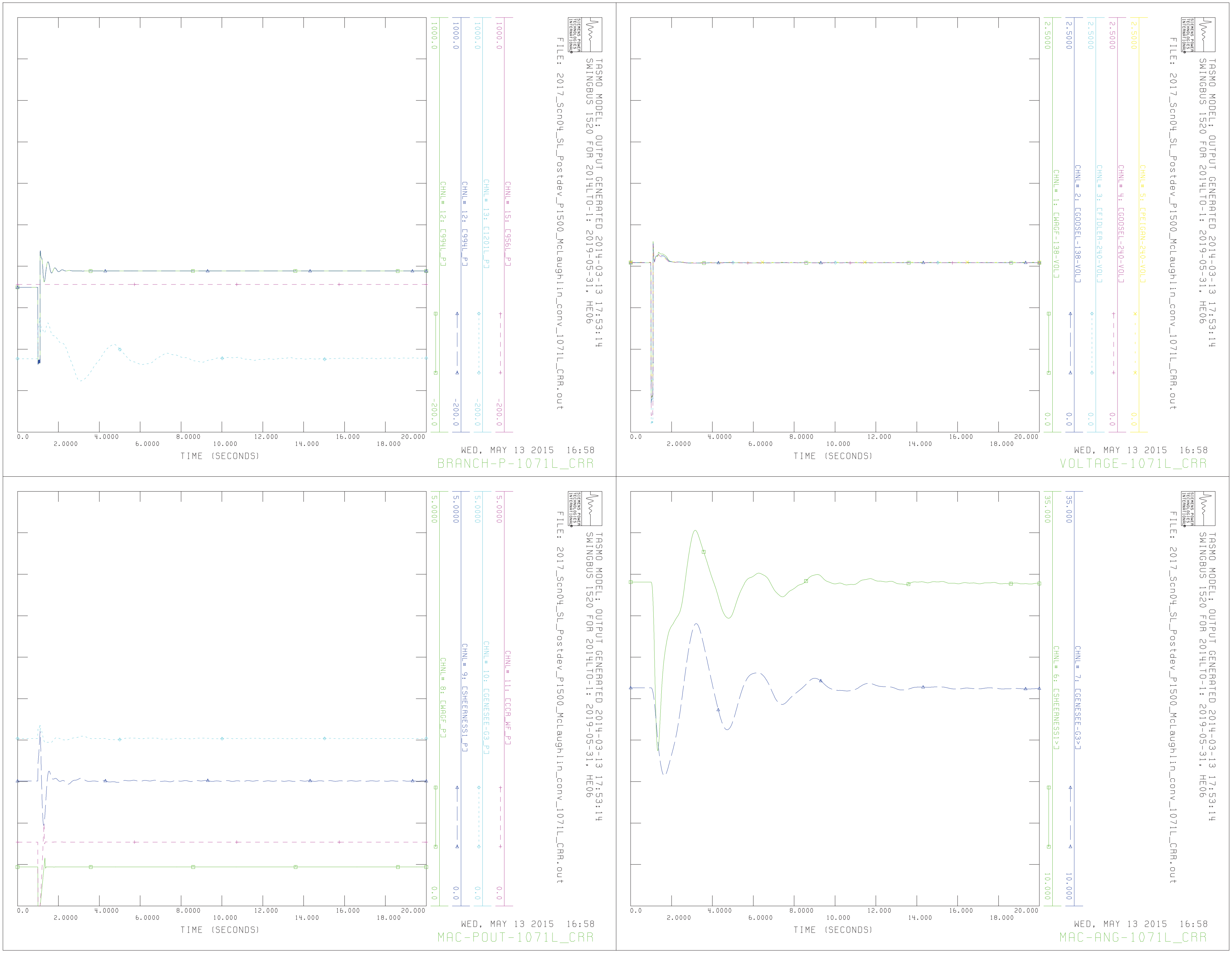

TASMO MODEL: OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1: 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_1071L_CRR.out
CHNL# 12: [994L_P]
CHNL# 12: [994L_P]
CHNL# 13: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:58
BRANCH-P-1071L_CRR
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
VOLTAGE-1071L_CRR
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
MAC-POUT-1071L_CRR
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
MAC-ANG-1071L_CRR

Figure C-28

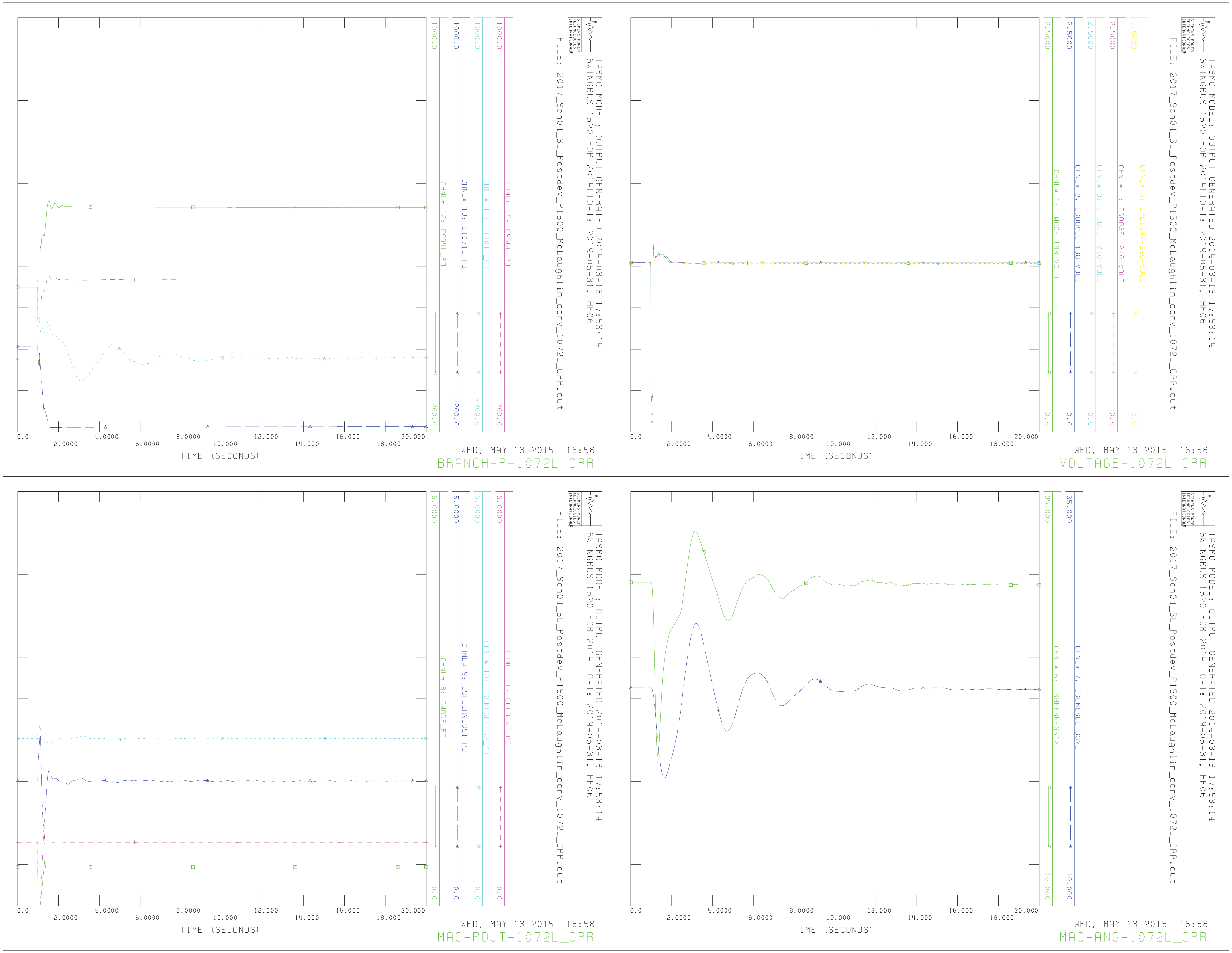
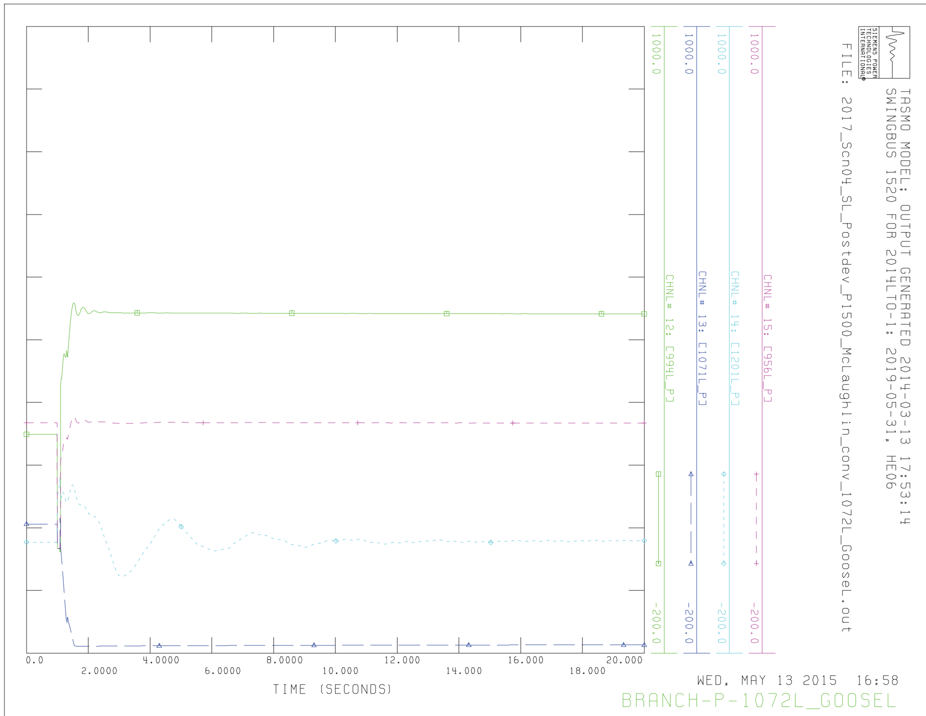
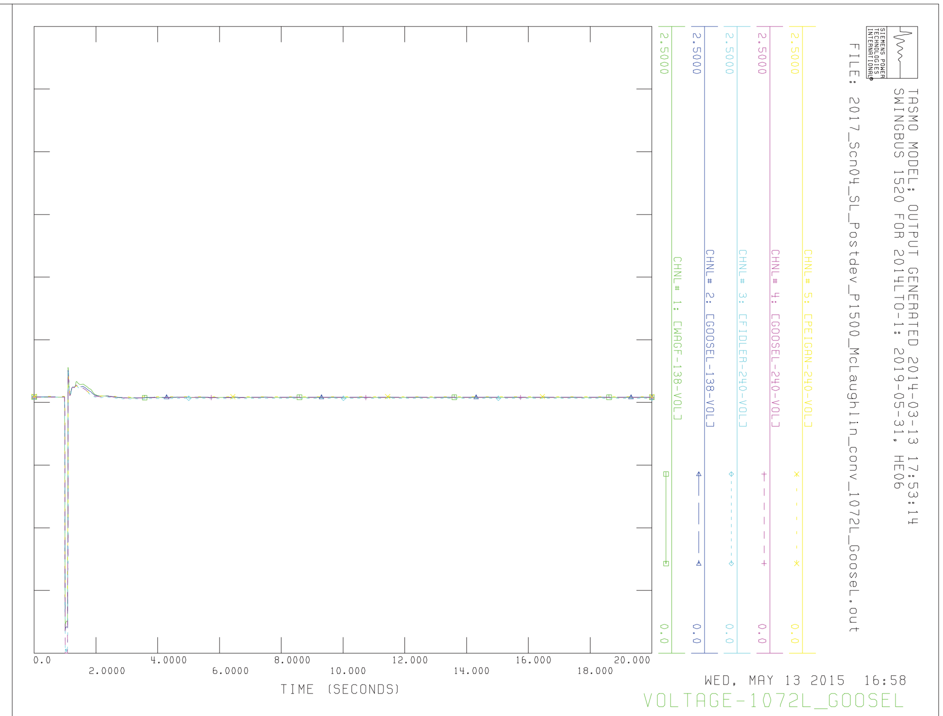

TASMO MODEL: OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1: 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_1072L_CRR.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:58
BRANCH-P-1072L_CRR
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
VOLTAGE-1072L_CRR
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
MAC-POUT-1072L_CRR
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
MAC-ANG-1072L_CRR

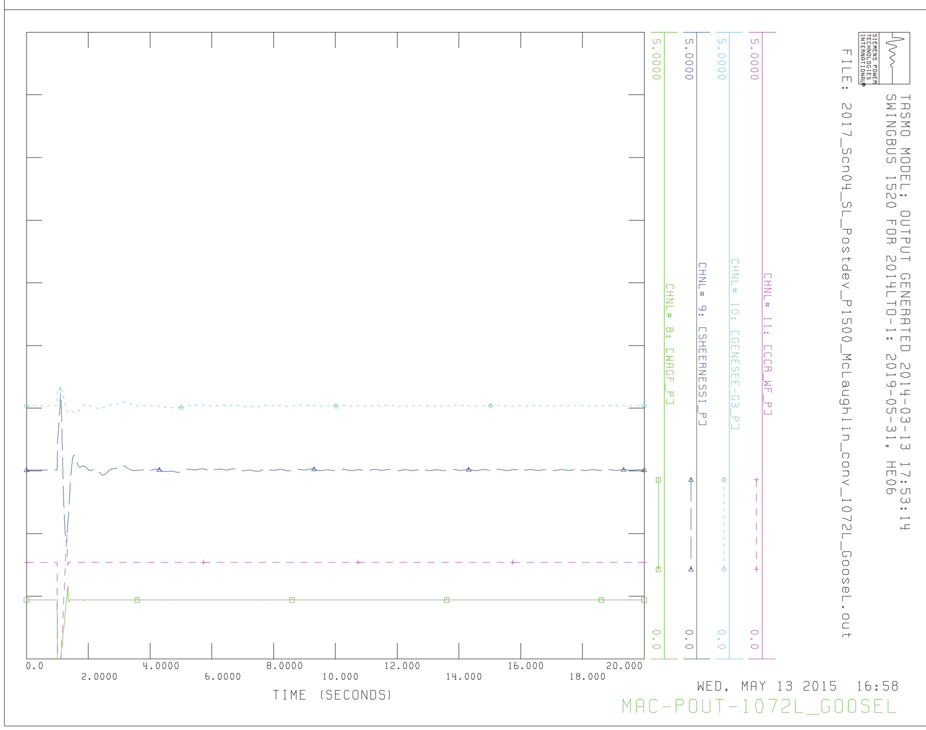
Figure C-29



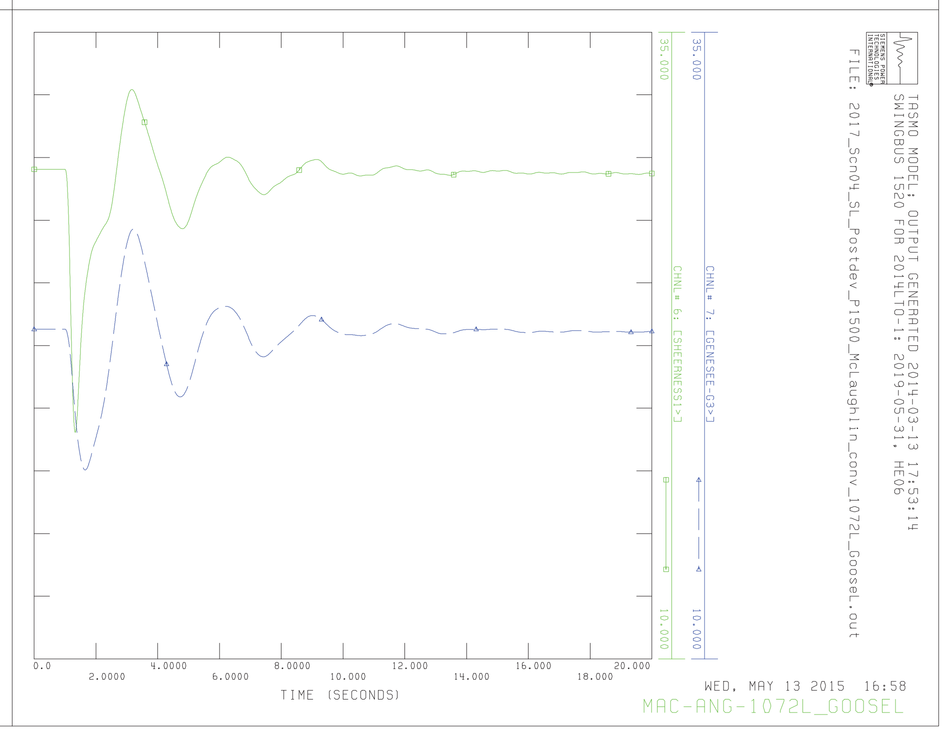
TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1; 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_1072L_Goosel.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
1000.0
-200.0
TIME (SECONDS)
WED, MAY 13 2015 16:58
BRANCH-P-1072L_GOOSEL



TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1; 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_1072L_Goosel.out
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PREIGRN-240-VOL]
2.5000
0.0
TIME (SECONDS)
WED, MAY 13 2015 16:58
VOLTAGE-1072L_GOOSEL



TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1; 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_1072L_Goosel.out
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
5.0000
0.0
TIME (SECONDS)
WED, MAY 13 2015 16:58
MAC-POUT-1072L_GOOSEL



TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1; 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_1072L_Goosel.out
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
35.000
10.000
TIME (SECONDS)
WED, MAY 13 2015 16:58
MAC-ANG-1072L_GOOSEL

Figure C-30

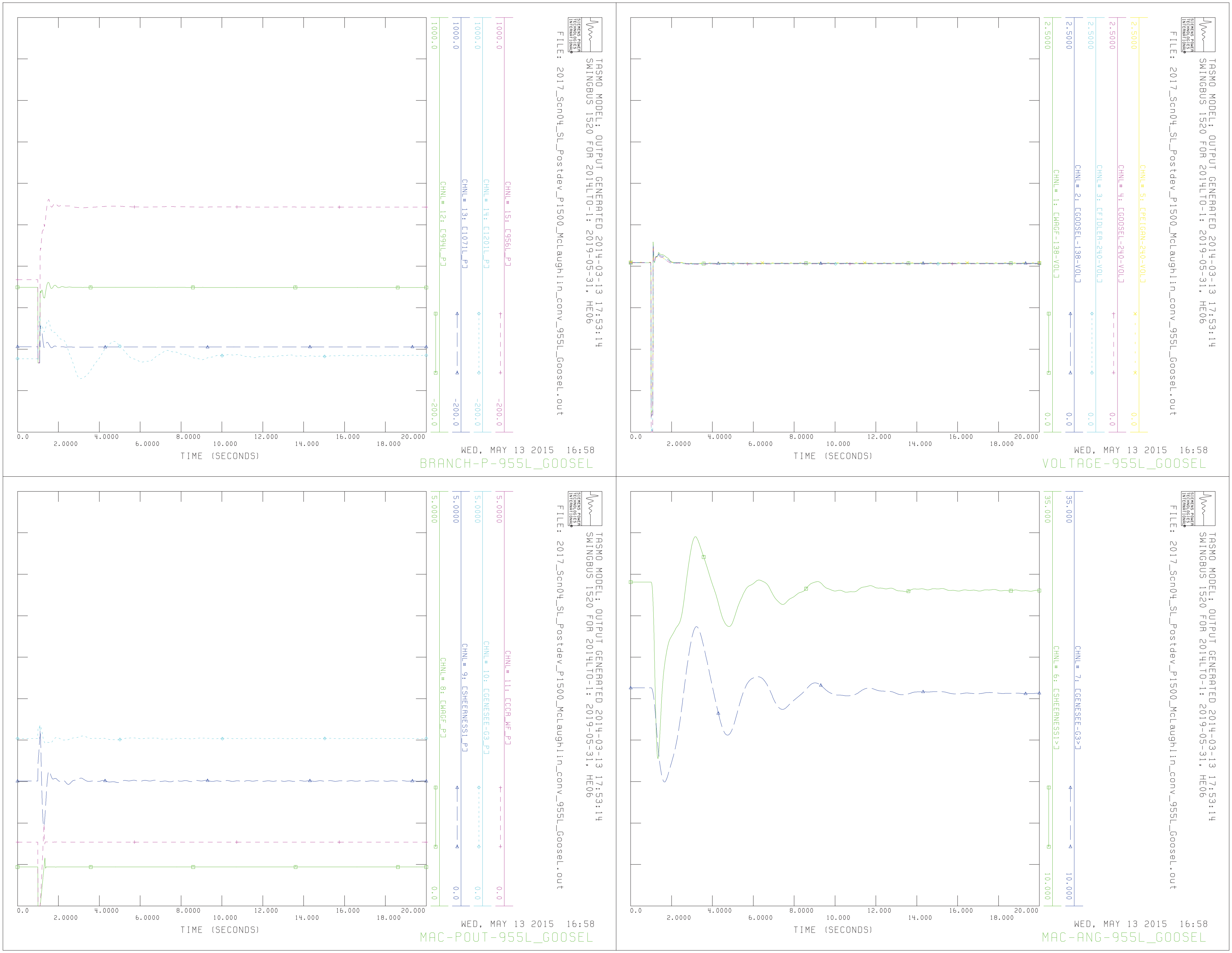

TIME (SECONDS)
WED, MAY 13 2015 16:58
BRANCH-P-955L_GOOSEL
VOLTAGE-955L_GOOSEL
MAC-POUT-955L_GOOSEL
MAC-ANG-955L_GOOSEL
TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1; 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_955L_GooseL.out

Figure C-31

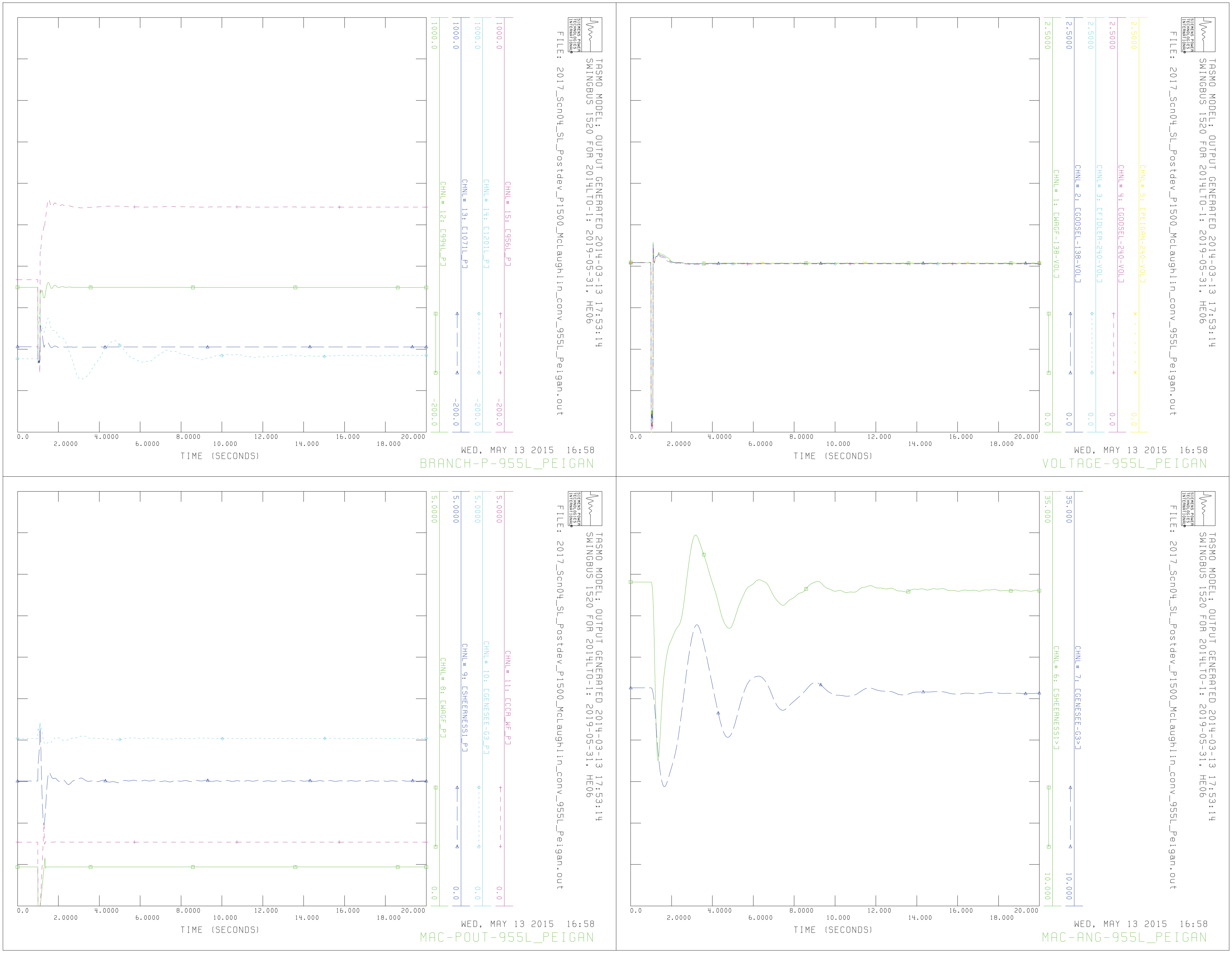

TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1; 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_955L_Peigan.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:58
BRANCH-P-955L_PEIGAN
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
VOLTAGE-955L_PEIGAN
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
MAC-POUT-955L_PEIGAN
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
MAC-ANG-955L_PEIGAN

Figure C-32

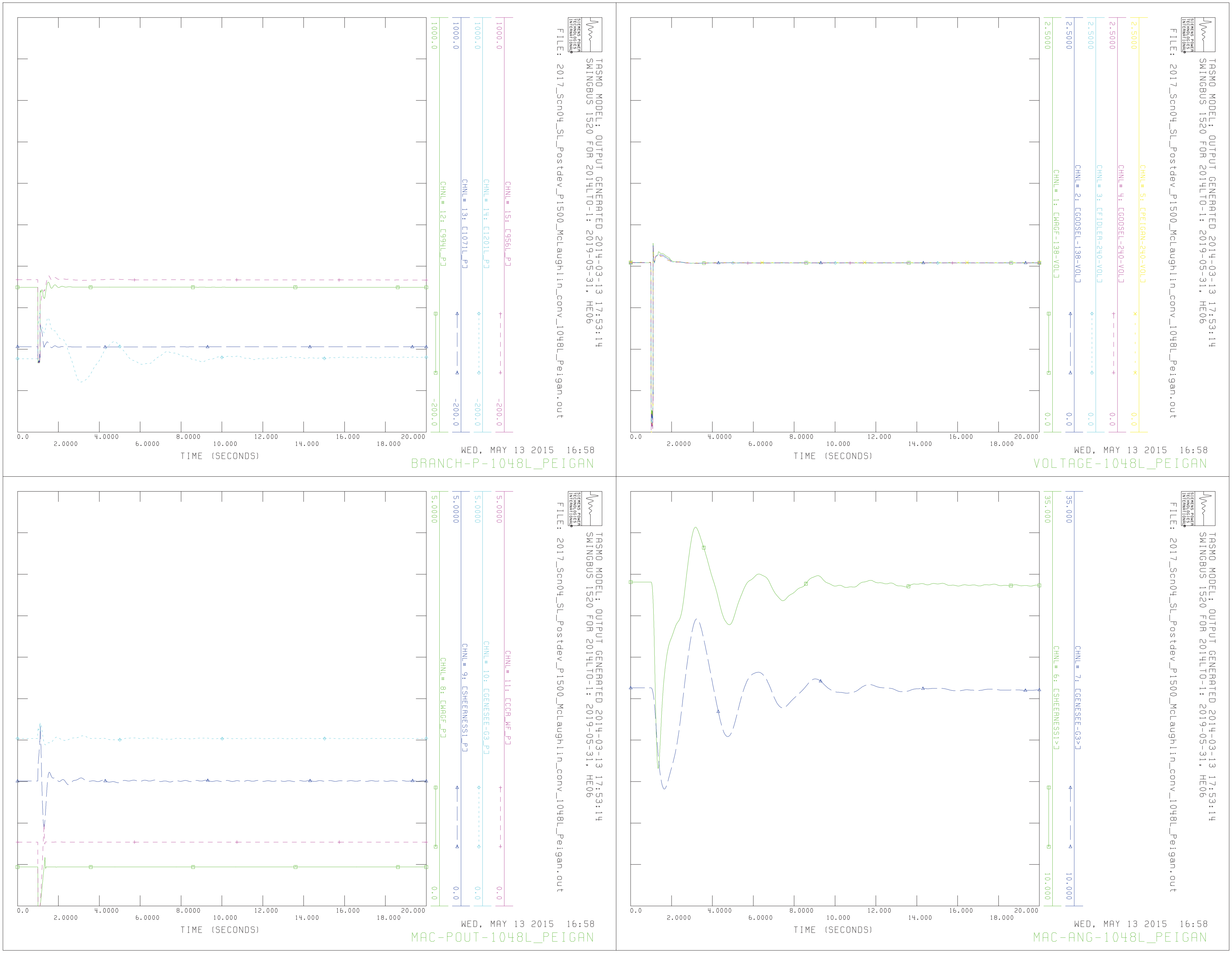

TASMO MODEL: OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1: 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_1048L_Peigan.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:58
BRANCH-P-1048L_PEIGAN
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
VOLTAGE-1048L_PEIGAN
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
MAC-POUT-1048L_PEIGAN
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
MAC-ANG-1048L_PEIGAN

Figure C-33

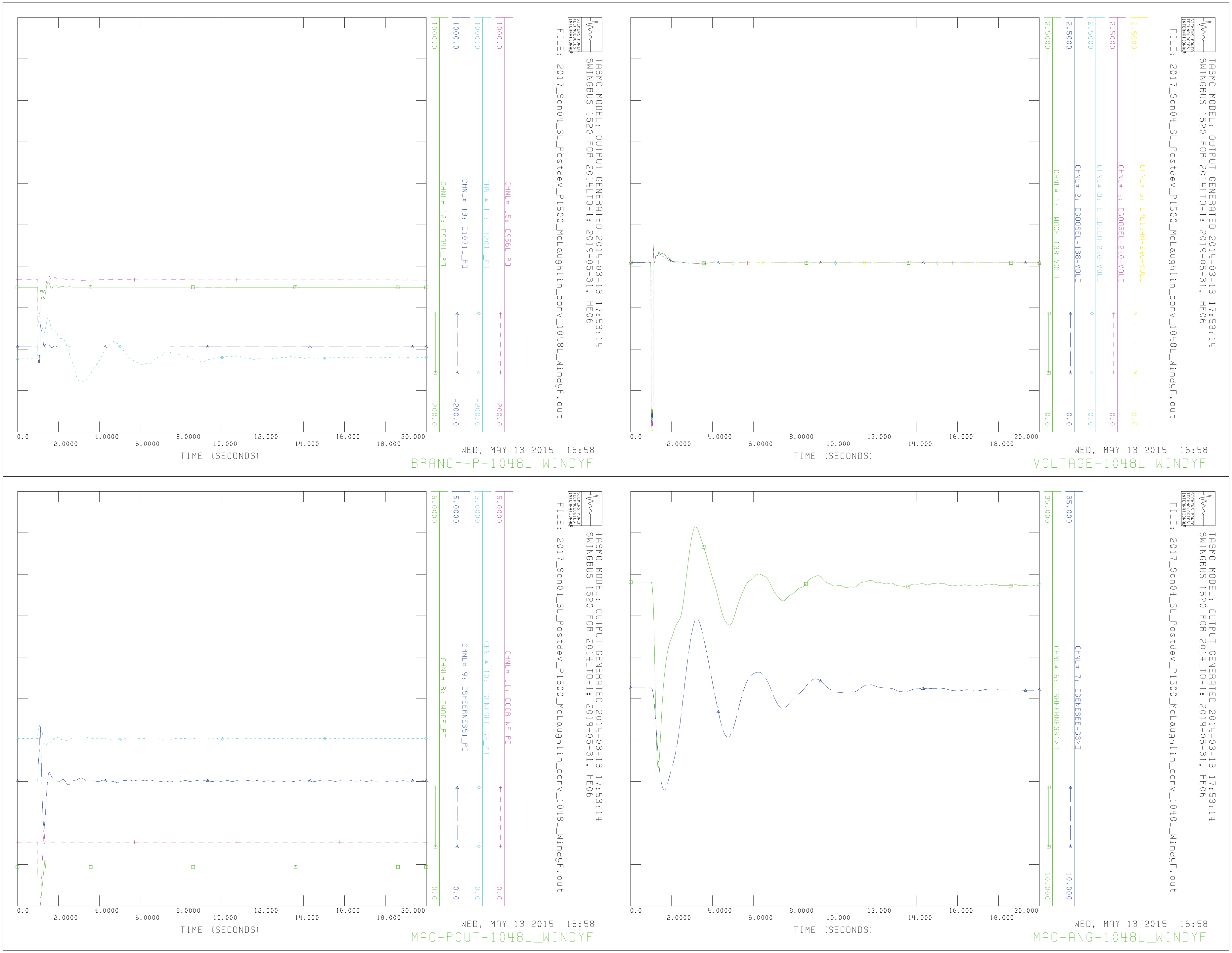

TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1; 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_1048L_WindyF.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:58
BRANCH-P-1048L_WINDYF
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
VOLTAGE-1048L_WINDYF
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
MAC-POUT-1048L_WINDYF
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
MAC-ANG-1048L_WINDYF

Figure C-34

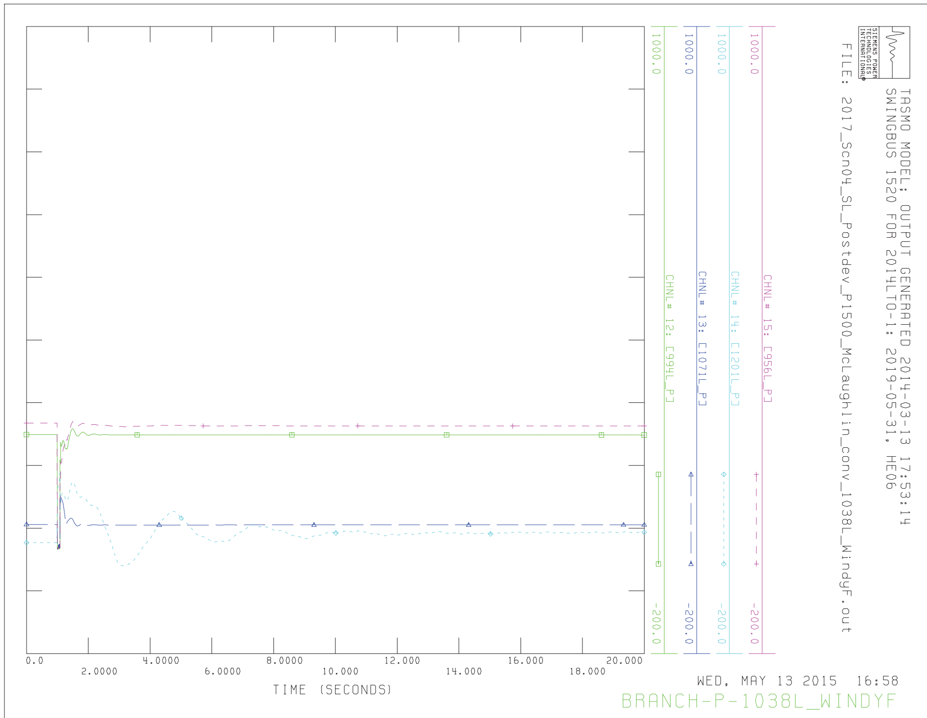
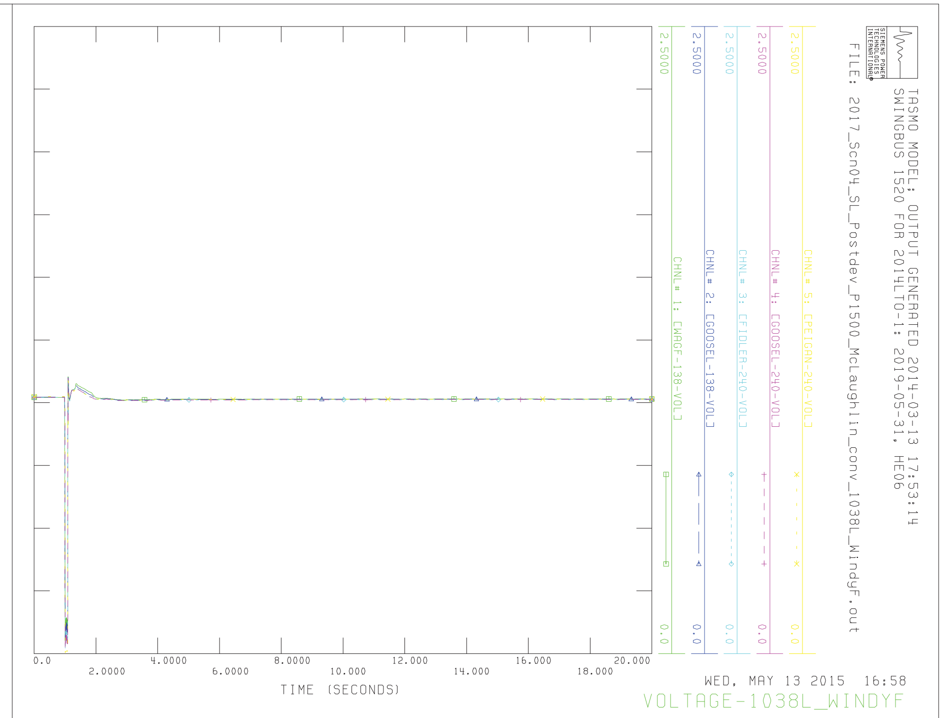
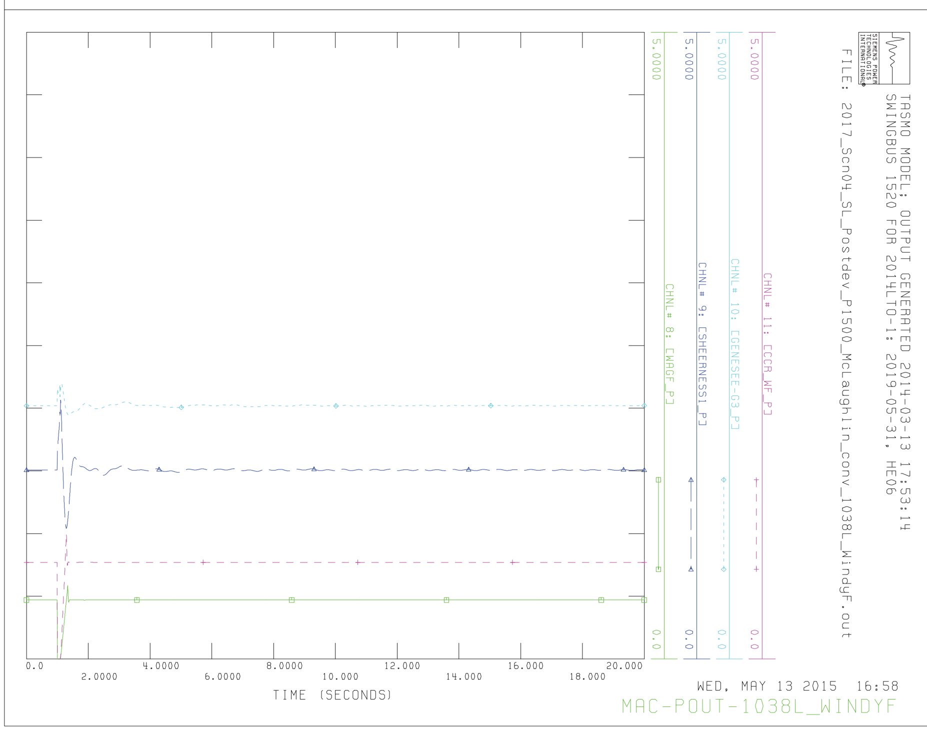
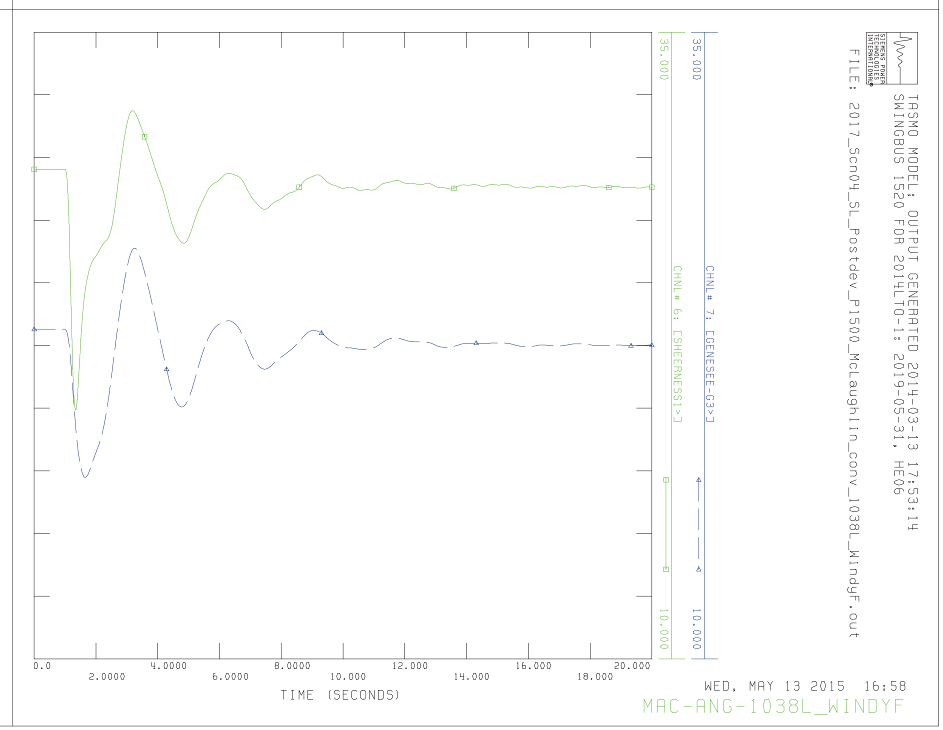
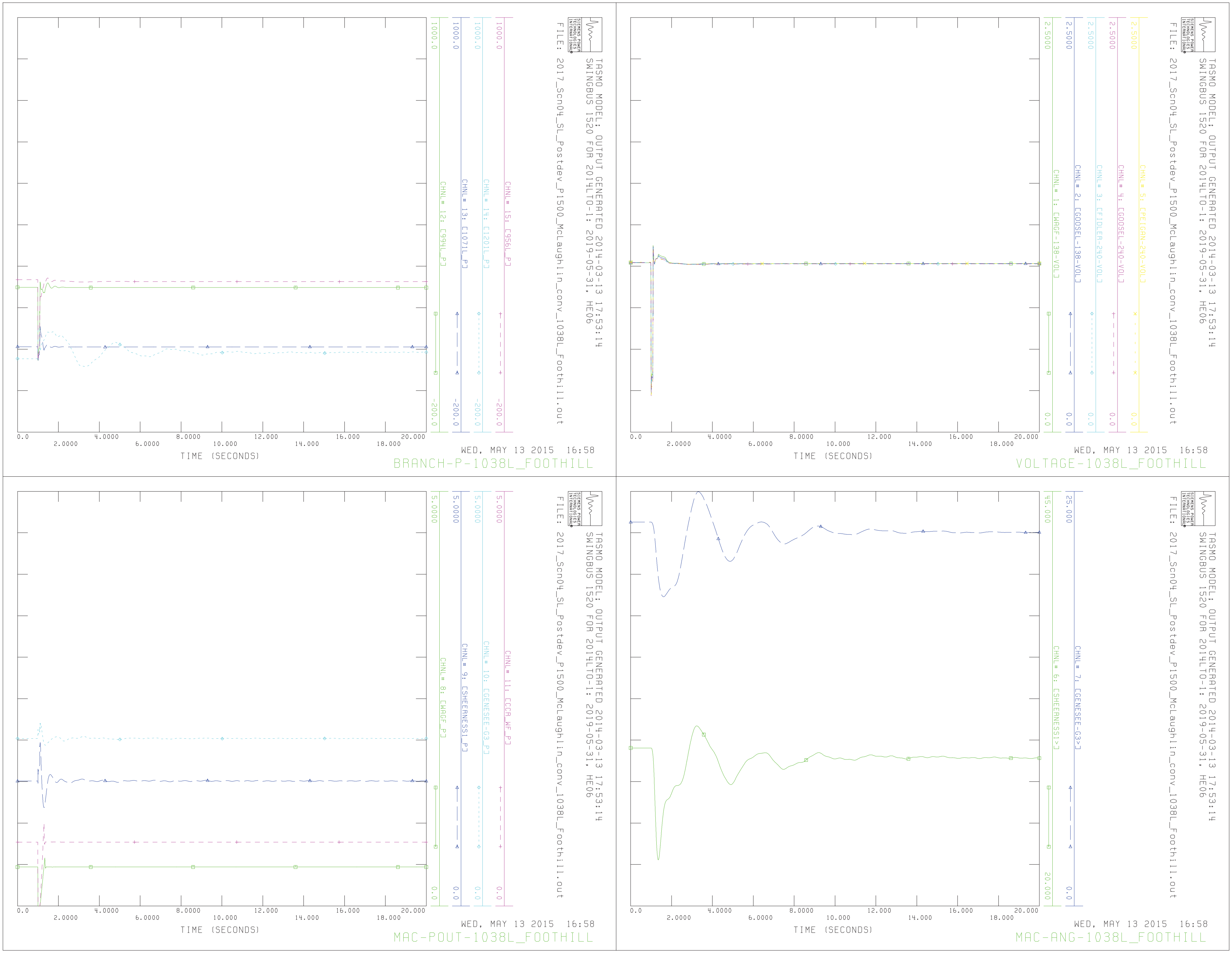

TASMO MODEL: OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1: 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_1038L_WindyF.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:58
BRANCH-P-1038L_WINDYF

TASMO MODEL: OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1: 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_1038L_WindyF.out
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
TIME (SECONDS)
WED, MAY 13 2015 16:58
VOLTAGE-1038L_WINDYF

TASMO MODEL: OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1: 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_1038L_WindyF.out
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
TIME (SECONDS)
WED, MAY 13 2015 16:58
MAC-POUT-1038L_WINDYF

TASMO MODEL: OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1: 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_1038L_WindyF.out
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
TIME (SECONDS)
WED, MAY 13 2015 16:58
MAC-ANG-1038L_WINDYF

Figure C-35



TASMO MODEL: OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1: 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_1038L_Foothill.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
1000.0
-200.0
TIME (SECONDS)
WED, MAY 13 2015 16:58
BRANCH-P-1038L_FOOTHILL
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
2.5000
0.0
VOLTAGE-1038L_FOOTHILL
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
5.0000
0.0
MAC-POUT-1038L_FOOTHILL
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
45.000
20.000
25.000
0.0
MAC-ANG-1038L_FOOTHILL
0.0
2.0000
4.0000
6.0000
8.0000
10.000
12.000
14.000
16.000
18.000
20.000

Figure C-36

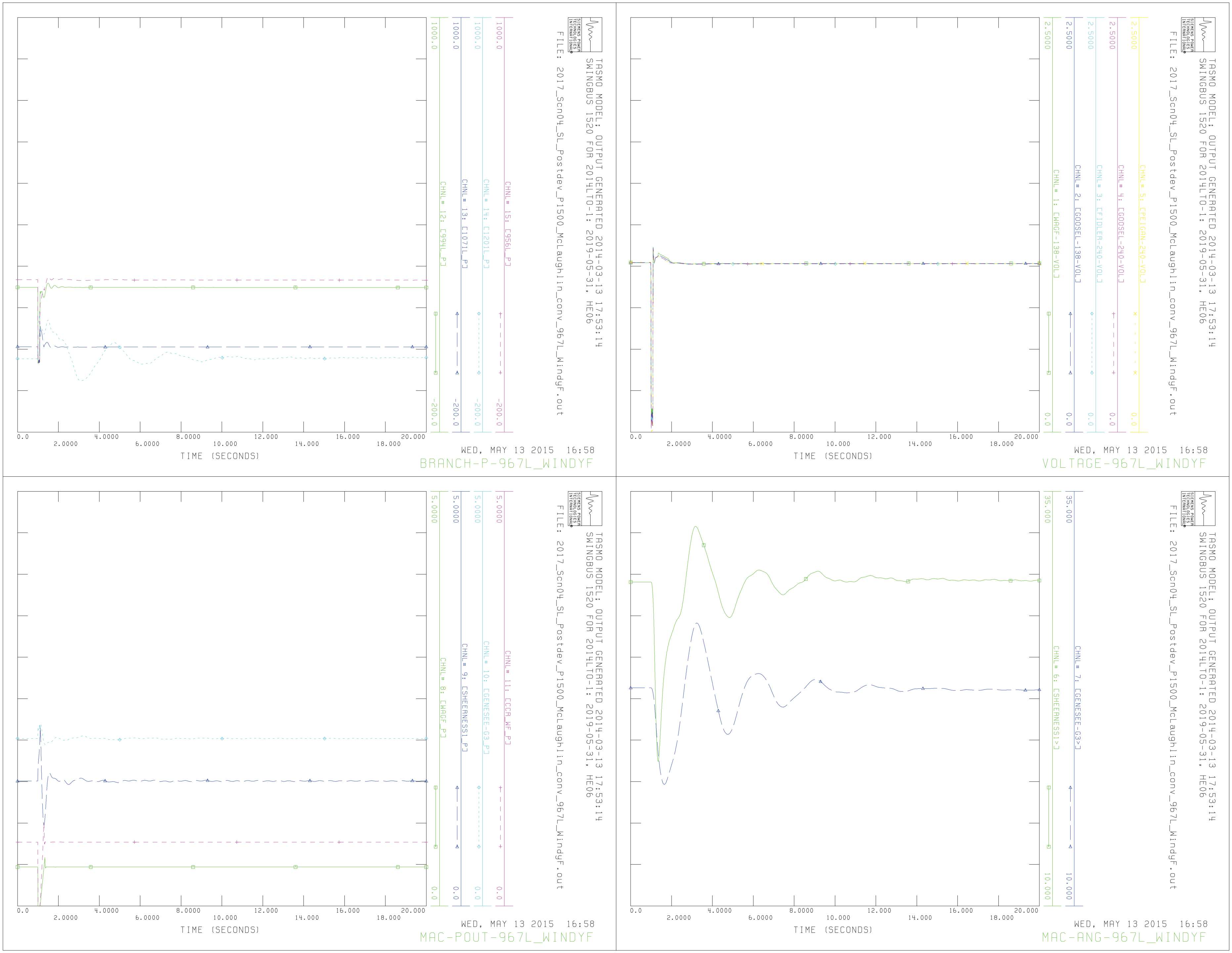

TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1; 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_967L_WindyF.out
TIME (SECONDS)
WED, MAY 13 2015 16:58
BRANCH-P-967L_WINDYF
VOLTAGE-967L_WINDYF
MAC-POUT-967L_WINDYF
MAC-ANG-967L_WINDYF

Figure C-37

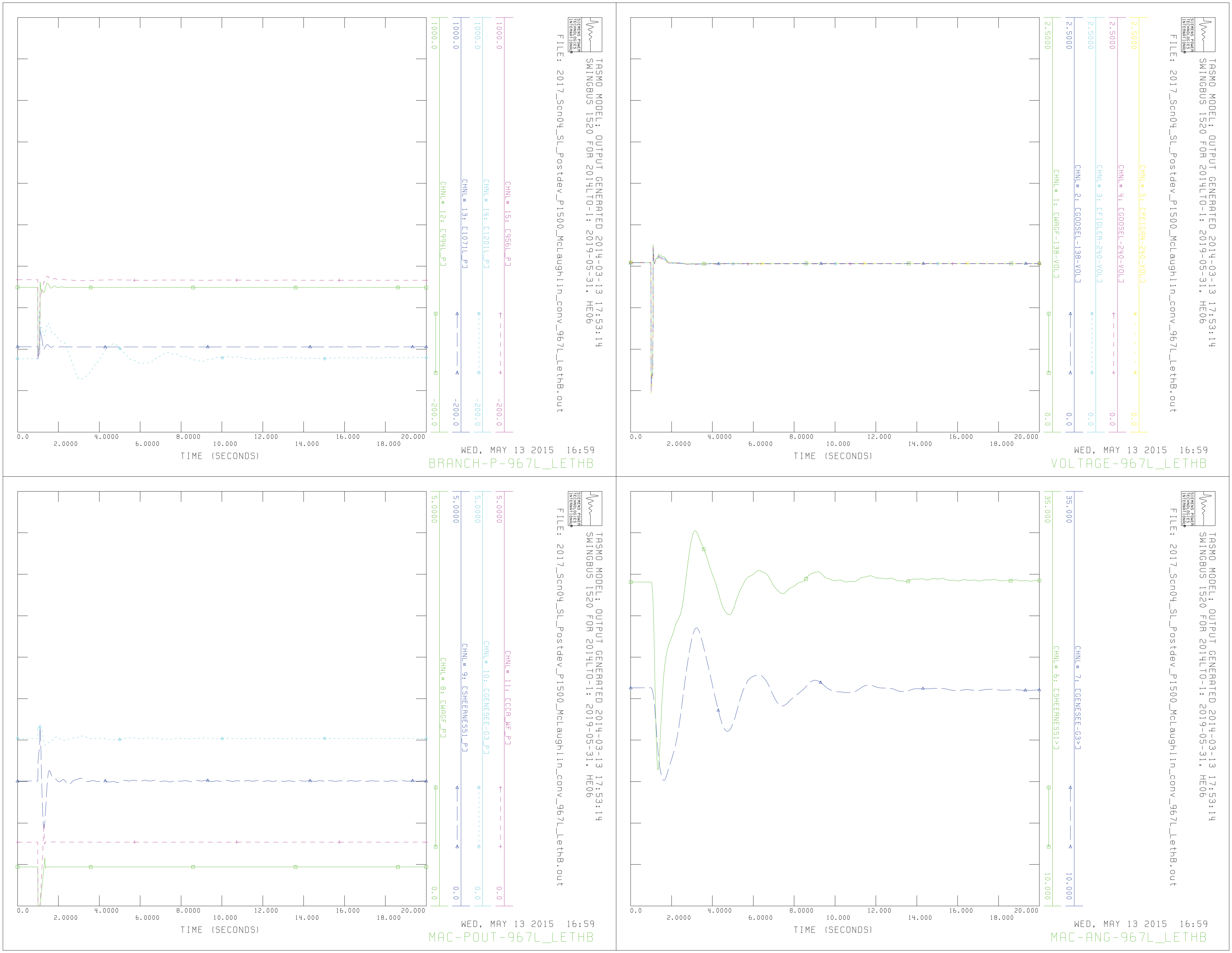
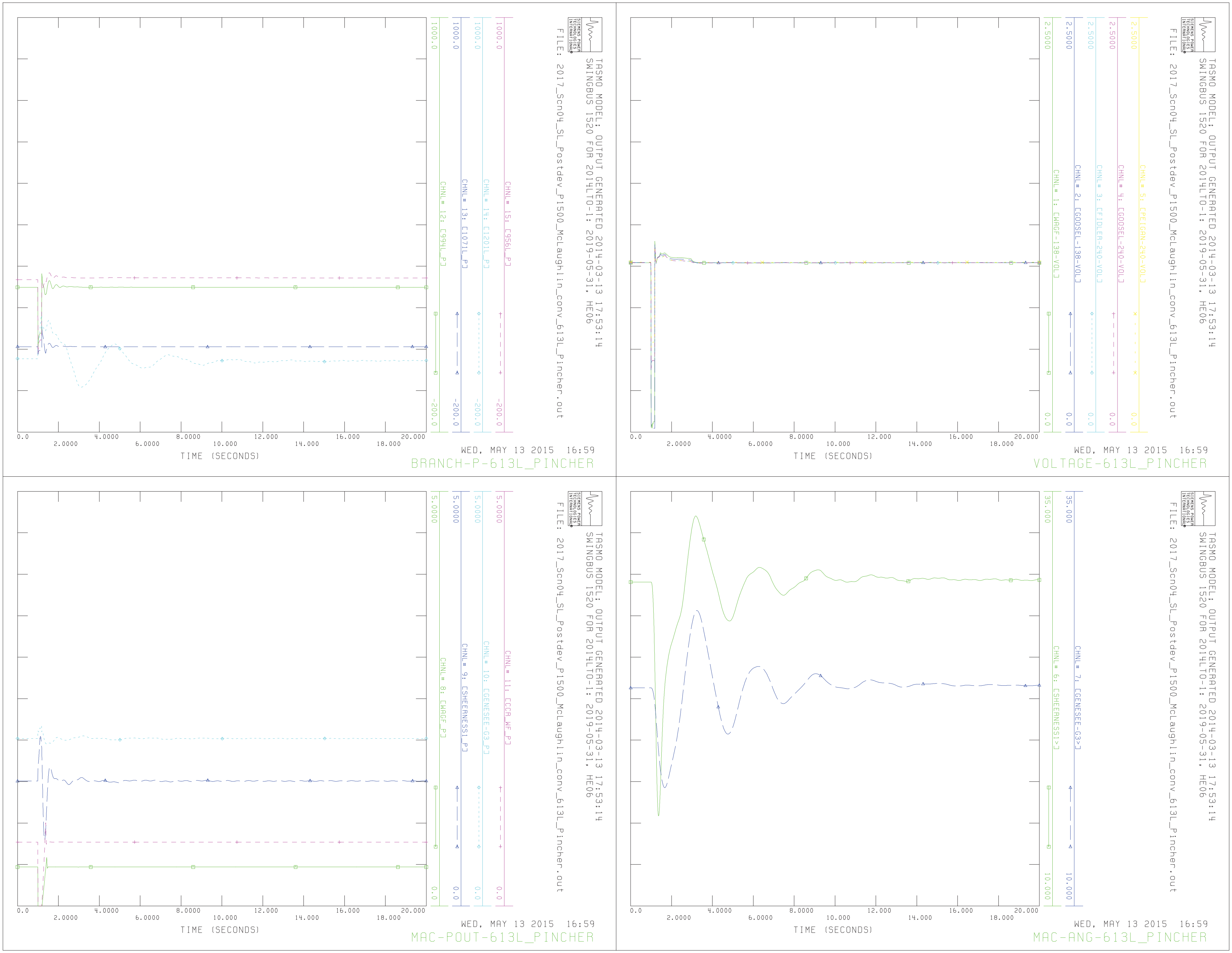

TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1; 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_967L_LethB.out
TIME (SECONDS)
WED, MAY 13 2015 16:59
BRANCH-P-967L_LETHB
VOLTAGE-967L_LETHB
MAC-POUT-967L_LETHB
MAC-ANG-967L_LETHB

Figure C-38



TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1; 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_613L_Pincher.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:59
BRANCH-P-613L_PINCHER
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
VOLTAGE-613L_PINCHER
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
MAC-POUT-613L_PINCHER
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
MAC-ANG-613L_PINCHER

Figure C-39

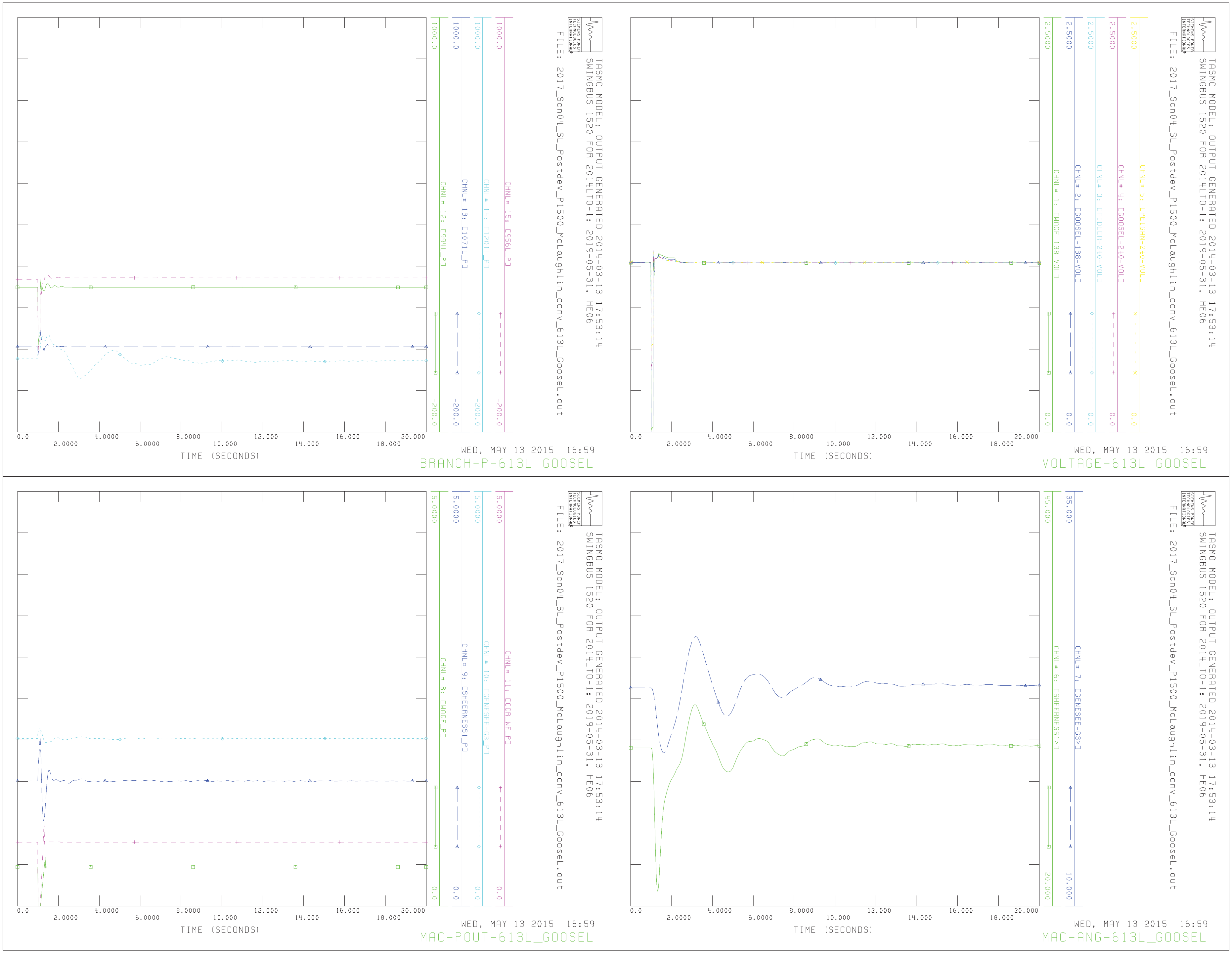
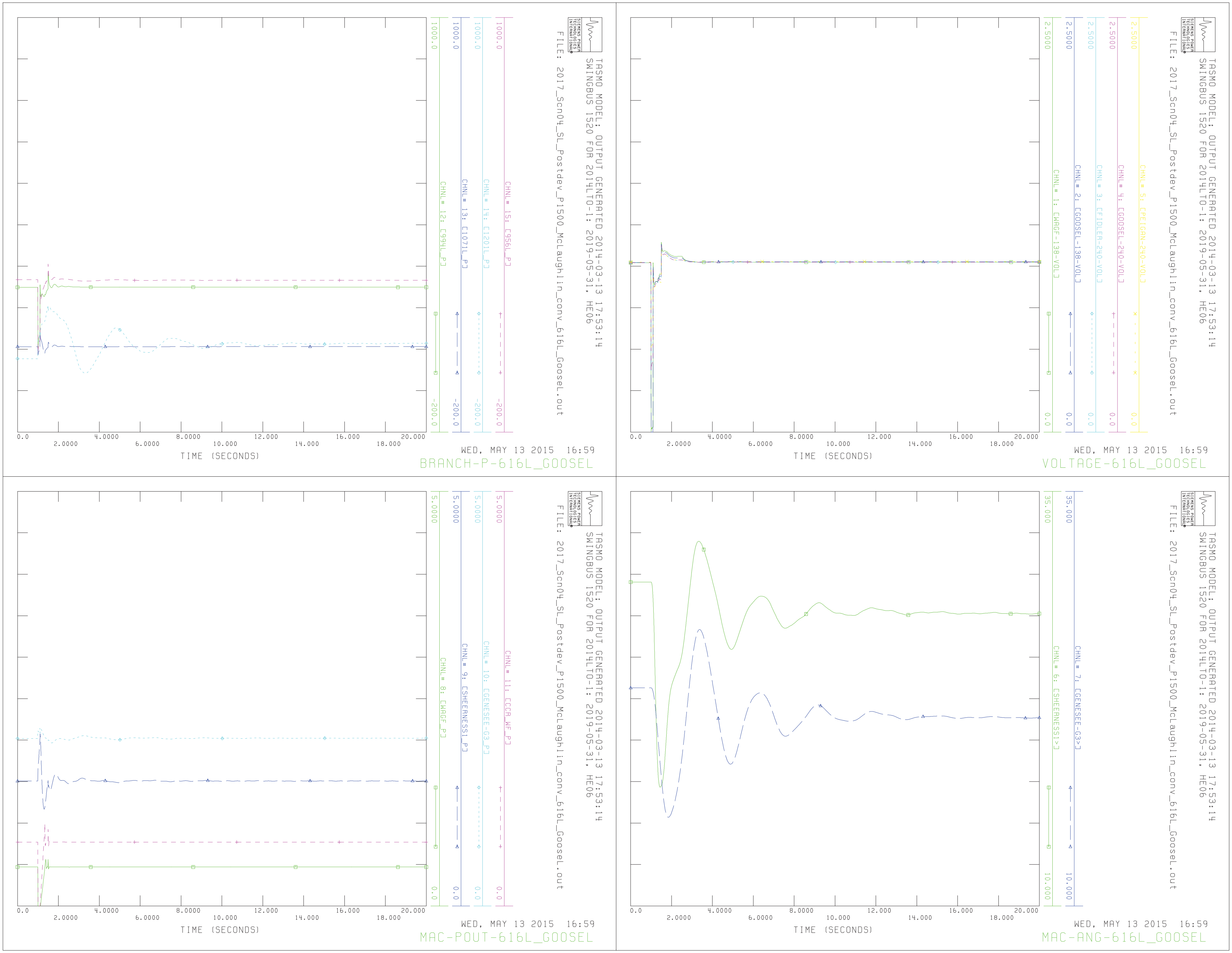
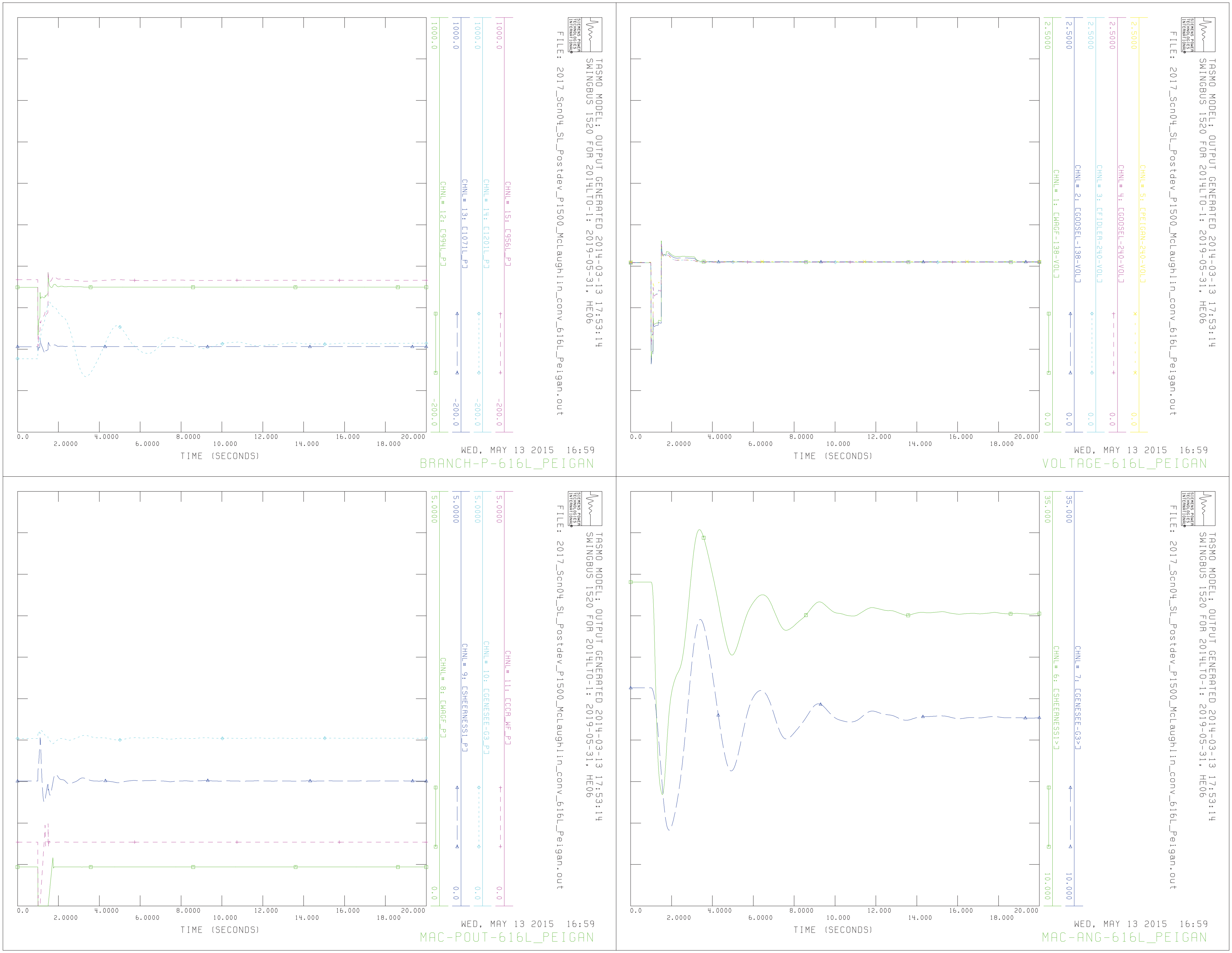

TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1; 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_613L_GooseL.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
TIME (SECONDS)
WED, MAY 13 2015 16:59
BRANCH-P-613L_GOOSEL
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
VOLTAGE-613L_GOOSEL
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
MAC-POUT-613L_GOOSEL
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
MAC-ANG-613L_GOOSEL

Figure C-40



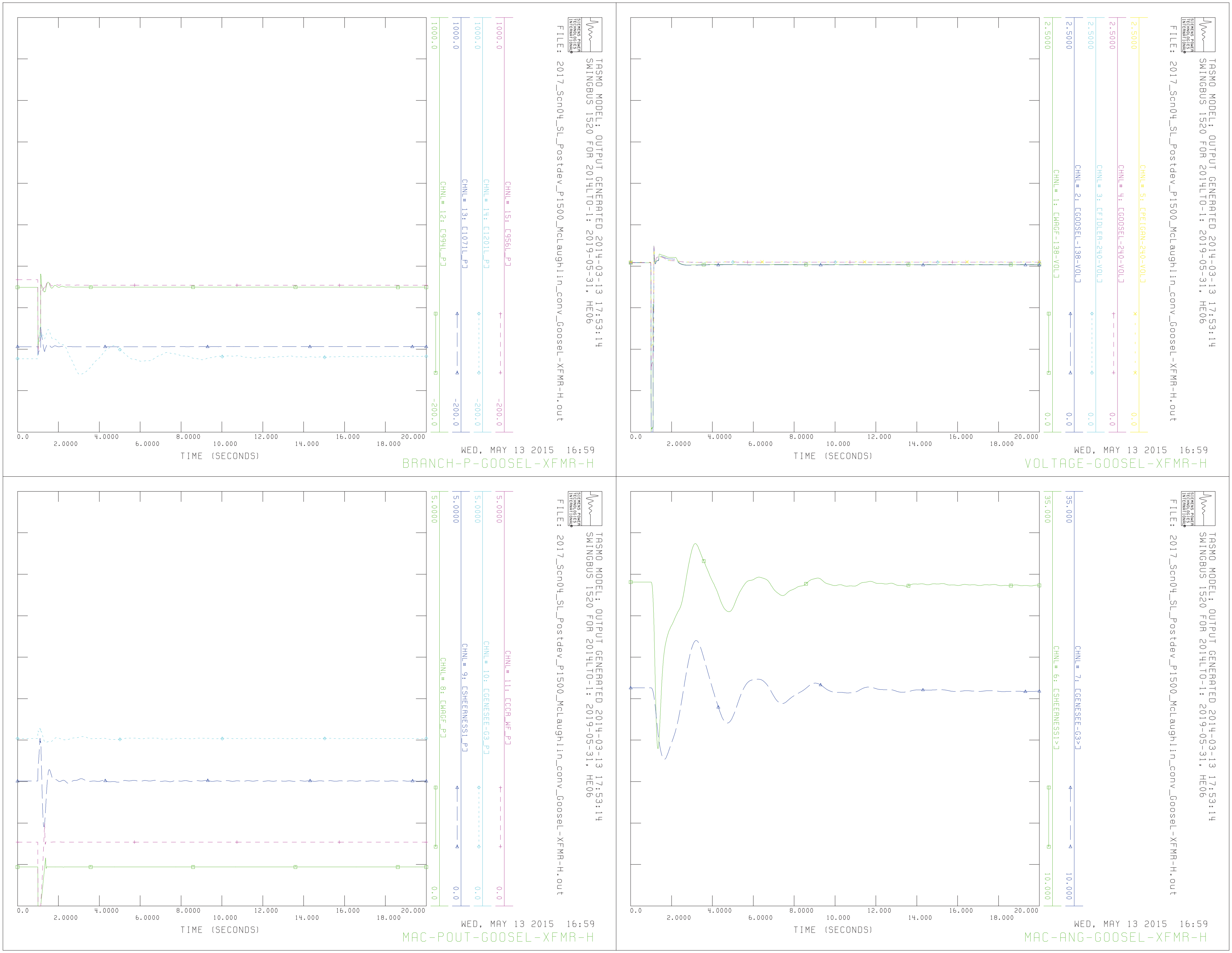
TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1: 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_616L_GooseL.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
1000.0
-200.0
TIME (SECONDS)
WED, MAY 13 2015 16:59
BRANCH-P-616L_GOOSEL
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
2.5000
0.0
VOLTAGE-616L_GOOSEL
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
5.0000
0.0
MAC-POUT-616L_GOOSEL
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
35.000
10.000
MAC-ANG-616L_GOOSEL
0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

Figure C-41



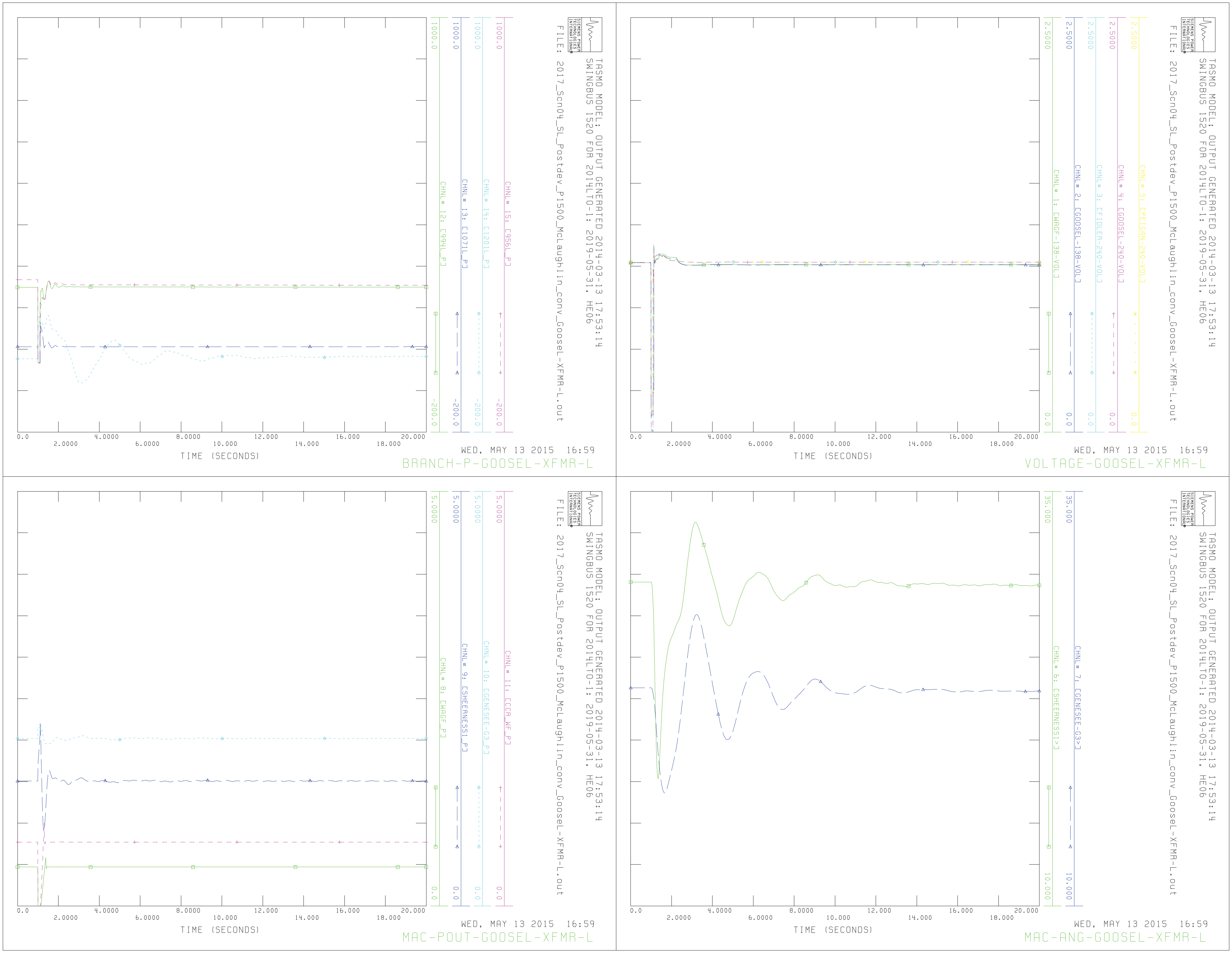
TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1; 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_616L_Peigan.out
CHNL# 12: [994L_P]
CHNL# 13: [1071L_P]
CHNL# 14: [1201L_P]
CHNL# 15: [956L_P]
1000.0
-200.0
TIME (SECONDS)
WED, MAY 13 2015 16:59
BRANCH-P-616L_PEIGAN
CHNL# 1: [WAGF-138-VOL]
CHNL# 2: [GOOSEL-138-VOL]
CHNL# 3: [FIDLER-240-VOL]
CHNL# 4: [GOOSEL-240-VOL]
CHNL# 5: [PEIGAN-240-VOL]
2.5000
0.0
VOLTAGE-616L_PEIGAN
CHNL# 8: [WAGF_P]
CHNL# 9: [SHEERNESS1_P]
CHNL# 10: [GENESEE-G3_P]
CHNL# 11: [CCR_WF_P]
5.0000
MAC-POUT-616L_PEIGAN
CHNL# 6: [SHEERNESS1>]
CHNL# 7: [GENESEE-G3>]
35.000
10.000
MAC-ANG-616L_PEIGAN
0.0
2.0000
4.0000
6.0000
8.0000
10.000
12.000
14.000
16.000
18.000
20.000

Figure C-42



TIME (SECONDS)
WED, MAY 13 2015 16:59
BRANCH-P-GOOSEL-XFMR-H
TIME (SECONDS)
WED, MAY 13 2015 16:59
VOLTAGE-GOOSEL-XFMR-H
TIME (SECONDS)
WED, MAY 13 2015 16:59
MAC-POUT-GOOSEL-XFMR-H
TIME (SECONDS)
WED, MAY 13 2015 16:59
MAC-ANG-GOOSEL-XFMR-H

Figure C-43



TASMO MODEL; OUTPUT GENERATED 2014-03-13 17:53:14
SWINGBUS 1520 FOR 2014LTO-1; 2019-05-31, HE06
FILE: 2017_Scn04_SL_Postdev_P1500_McLaughlin_conv_Goosel-XFMR-L.out
TIME (SECONDS)
WED, MAY 13 2015 16:59
BRANCH-P-GOOSEL-XFMR-L
VOLTAGE-GOOSEL-XFMR-L
MAC-POUT-GOOSEL-XFMR-L
MAC-ANG-GOOSEL-XFMR-L

Figure C-44

ATTACHMENT D

Dynamic Data for the Proposed WAGF

/ This data is based on the generic type 4 wind model ENERCON created for Project 1500 McLaughlin WAGF.

2773 'WT4G1' 1 0.01 0.01 0.8 0.81 1.35 1.35 1.35 5.0 0.02 /

2773 'WT4E1' 1 2770 0 1 1

0.01 840 0 5 15 0.0 0.08 0.64 -0.64 1.2

0.02 0.5 -0.5 0.05 2.0 0.8 1.2 200 40.0 0.05

1.35 1.35 1.35 /