

CONNECTION ASSESSMENT & APPROVAL PROCESS

Preliminary Assessment Report Port Albert Gas-fired Generation

CAA ID 2002-082

Final Report

Long Term Forecasts & Assessments Department
&
Consistent Information Department

November 10, 2003

Preliminary Assessment Report

Port Albert Gas-fired Generation

Acknowledgement

The IMO wished to acknowledge the assistance of Hydro One Networks Inc. (HONI) in completing this assessment.

Disclaimers

IMO

This report has been prepared solely for the purpose of assessing whether the connection applicant's proposed connection with the IMO-controlled grid would have an adverse impact on the reliability of the integrated power system and whether the IMO should issue a notice of approval or disapproval of the proposed connection under Chapter 4, section 6 of the Market Rules.

Approval of the proposed connection is based on information provided to the IMO by the connection applicant and the transmitter(s) at the time the assessment was carried out. The IMO assumes no responsibility for the accuracy or completeness of such information, including the results of studies carried out by the transmitter(s) at the request of the IMO. Furthermore, the connection approval is subject to further consideration due to changes to this information, or to additional information that may become available after the approval has been granted. Approval of the proposed connection means that there are no significant reliability issues or concerns that would prevent connection of the proposed facility to the IMO-controlled grid. However, connection approval does not ensure that a project will meet all connection requirements. In addition, further issues or concerns may be identified by the transmitter(s) during the detailed design phase that may require changes to equipment characteristics and/or configuration to ensure compliance with physical or equipment limitations, or with the Transmission System Code, before connection can be made.

This report has not been prepared for any other purpose and should not be used or relied upon by any person for another purpose. This report has been prepared solely for use by the connection applicant and the IMO in accordance with Chapter 4, section 6 of the Market Rules. The IMO assumes no responsibility to any third party for any use, which it makes of this report. Any liability which the IMO may have to the connection applicant in respect of this report is governed by Chapter 1, section 13 of the Market Rules. In the event that the IMO provides a draft of this report to the connection applicant, you must be aware that the IMO may revise drafts of this report at any time in its sole discretion without notice to you. Although the IMO will use its best efforts to advise you of any such changes, it is the responsibility of the connection applicant to ensure that it is using the most recent version of this report.

Hydro One Networks Inc.

The results reported in this preliminary feasibility study are based on the information available to HONI, at the time of the study, suitable for a preliminary assessment of a new generation or load connection proposal.

The short circuit and thermal loading levels have been computed based on the information provided by the connection proponent at the time of the study. These levels may be higher or lower if the connection information changes as a result of, but not limited to, subsequent design modifications or when more accurate test measurement data is available.

This study does not assess the short circuit or thermal loading impact of the proposed connection on facilities owned by other load and generation (including OPGI) customers.

In this preliminary feasibility study, short circuit adequacy is assessed only for HONI breakers and does not include other HONI facilities. The short circuit results are only for the purpose of assessing the capabilities of the existing HONI breakers and identifying upgrades required to incorporate the proposed connection. These results should not be used in the design and engineering of new facilities for the proposed connection. The necessary data will be provided by HONI and discussed with the connection proponent(s) upon request.

The ampacity rating of HONI facilities are established based on assumptions used in HONI for power system planning studies. The actual ampacity ratings during operations may be determined in real-time and are based on actual system conditions, including ambient temperature, wind speed and facility loading, and may be higher or lower than those stated in this study.

The additional facilities or upgrades, which are required to incorporate the proposed connection, have been identified to the extent permitted by a preliminary assessment. Additional facility studies may be necessary to confirm constructability and the time required for construction. System impact or further studies at more advanced stages of the project development may identify additional facilities that need to be provided or that require upgrading.

Connection Assessment Report

Executive Summary

Project Description

This preliminary assessment has been conducted to examine the proposed 50 MW Port Albert Gas-fired Generation project in the Goderich area and its impact on the reliability of the IMO-Controlled Grid.

Northern Cross Energy Ltd., the proponent of the 50 MW gas-fired generation project, is considering two incorporation alternatives:

Alternative 1:

- 50 MW of generation is to be incorporated via two or more dedicated 27.6 kV feeders, each 15 km in length, terminated on to the existing 27.6 kV bus at Goderich TS.

Alternative 2:

- 50 MW of generation is to be incorporated via two or more dedicated 34.5 kV feeders, each 15 km in length, terminated on to the 34.5 kV bus at a new 115/34.5 kV substation and connected to 115 kV circuit M18 near Goderich TS.

A related project involving incorporation of 57.2 MW of wind turbine generation at the same location is proposed by Port Albert Wind Farms Ltd. with identical incorporation alternatives. Northern Cross Energy Ltd. and Port Albert Wind Farms Ltd., two associated proponents, requested that the IMO review the two projects together to determine whether a common LV connection arrangement would be feasible for a combined development of 100 MW of generation. The remaining 7.2 MW of wind turbine generation is to be incorporated via the existing 27.6 kV feeder M2 at Goderich TS.

Commissioning of the 50 MW gas-fired generation project is scheduled to commence in Q1-2004, with full commercial operation starting in Q2-2004.

Conclusions

Based on the results of this assessment, it is concluded that:

1. The proposed 50 MW Port Albert Gas-fired Generation project, incorporated as a standalone project or in addition to the 57.2 MW Port Albert Wind Farm project, will not have an adverse impact on the performance of the IMO-Controlled Grid and transfer capabilities of major 500/230 kV transmission interfaces.
2. A standalone incorporation of the proposed 50 MW generation via two 27.6 kV feeders with adequate capacity would be within the existing transformer capacity at Goderich TS. Loss of one 27.6 kV feeder will require generation rejection.
3. The proposed 50 MW generation, if incorporated with the 57.2 MW Port Albert Wind Farm both at 27.6 kV as per Alternative 1, would result in overloading the existing 3 x 15 MVA

115/27.6 kV transformers at Goderich TS. Increase in 115/27.6 kV transformer capacity to accommodate the combined output of the two generation projects during minimum load periods is required at Goderich TS. In addition, the 27.6 kV buses for the two generation projects must be separated at the generation site.

4. A standalone incorporation of 50 MW via two 34.5 kV feeders with adequate capacity is acceptable. Loss of one feeder will require generation rejection.
5. The proposed 50 MW generation, if incorporated with the 57.2 MW Port Albert Wind Farm, both at 34.5 kV as per Alternative 2 is acceptable with four 34.5 kV feeders. A common 34.5 kV bus for connection of the two 50 MW generation projects and four feeders to the new 115/34.5 kV substation is acceptable.
6. The increases in fault level, due to the proposed 50 MW gas-fired generation, will not exceed the interrupting capabilities of the existing breakers. However, if both projects are to be incorporated at the 27.6 kV as per Alternative 1, the increases in fault levels will exceed the interrupting capabilities of the four feeder breakers M1, M2, M3 and M4 at Goderich TS. Incorporation of the two projects at 34.5 kV as per Alternative 2 will not exceed the interrupting capabilities of the existing breakers.

IMO Requirements

1. To incorporate 50 MW of gas-fired generation, Northern Cross Energy Ltd. is required to:
 - Provide and install the gas-fired generator(s) with excitation system(s), power system stabilizer(s) and speed governor(s) that meet the generation facility requirements as per Chapter 4 Appendix 4.2.
 - Provide and install the unit transformer(s) with an equivalent impedance of less than 12.5% on the generator(s) base rating to satisfy the generator's reactive power capabilities required by the market rules.
 - Provide and install two dedicated 27.6 kV feeders with adequate capacity as per Alternative 1 (if selected) with the following alternative connection arrangements:
 - Two 27.6 kV feeders, with each feeder connecting one 25 MW gas-fired unit radially
 - Two 27.6 kV feeders connecting one 50 MW gas-fired unit via a 27.6 kV common bus. Generation rejection of the 50 MW unit is required for loss of one feeder.
 - Provide and install two dedicated 34.5 kV feeders and 34.5/115 kV transformer(s) with adequate capacity as per Alternative 2 (if selected) with the following alternative connection arrangements:
 - Two 34.5 kV feeders, with each feeder connecting one 25 MW gas-fired unit radially
 - Two 34.5 kV feeders connecting one 50 MW gas-fired unit via a 34.5 kV common bus. Generation rejection of the 50 MW unit is required for loss of one feeder.

- Provide and install switched shunt capacitors to compensate for the reactive power consumption on the dedicated 27.6 kV or the dedicated 34.5 kV feeders and the 34.5/115 kV transformer(s) as per Alternatives 1 or 2 respectively.
2. Northern Cross Energy Inc. must complete the IMO facility registration process including meter registration before placing the proposed 50 MW Port Albert gas-fired generation facility in service.
 3. A Customer Impact Assessment (CIA) is required to determine the impact of new generation connection on Transmission Customers and a detailed CIA study will be carried out by Hydro One.
 4. A separate System Impact Assessment is not required since this Preliminary Assessment has included transient stability analysis of the IMO-Controlled Grid.

Budgetary Cost Estimates

There is only minor work associated with review and verification of protection schemes and final equipment data, and witness verification during commissioning. No budgetary cost estimate is provided for that purpose.

If required to make its investment decision, Northern Cross Energy Ltd. is to obtain the cost estimates from Hydro One for uprating the three 15 MVA 115/27.6 kV transformers and associated facilities at Goderich TS.

Identification of "Sole Beneficiary"

The facilities that are triggered by this project and deemed to be for the sole benefit of this project have been identified to enable incorporation of the proposed generation:

- Uprating of the three 15 MVA 115/27.6 kV transformers and associated facilities at Goderich TS to accommodate 100 MW of generation during minimum load periods, if the 50 MW gas-fired generation is to be incorporated at 27.6 kV in addition to the 57.2 MW Port Albert Wind Farm project.

Notification of Approval

This Preliminary Assessment has investigated the impact of the proposed 50 MW Port Albert Gas-fired Generation on the reliability of the IMO-Controlled Grid and has identified IMO's requirements for connection to ensure that the project has no adverse impact on the reliability of the IMO-Controlled Grid.

It is recommended that a Notification of Approval be granted, subject to the implementation of the requirements stipulated in this report.

1.0 Proposal Description

This preliminary assessment has been conducted to examine the proposed 50 MW gas-fired generation facility in the Goderich area and its impact on the reliability of the IMO-Controlled Grid.

Northern Cross Energy Ltd., the proponent of the 50 MW gas-fired generation project, is considering two incorporation alternatives:

Alternative 1:

- 50 MW of generation is to be incorporated via two or more dedicated 27.6 kV feeders, each 15 km in length, terminated on to the existing 27.6 kV bus at Goderich TS.

Alternative 2:

- 50 MW of generation is to be incorporated via two or more dedicated 34.5 kV feeders, each 15 km in length, terminated on to the 34.5 kV bus at a new 115/34.5 kV substation and connected to 115 kV circuit M18 near Goderich TS.

Commissioning of the project is scheduled to commence in Q1-2004, with full commercial operation starting in Q2-2004.

2.0 Data Verification

At the time of application, Northern Cross Energy Ltd. did not have the data for the specific gas-fired generator(s) and the associated excitation system(s), power system stabilizer(s), governor(s), unit transformer(s) and 115/34.5 kV transformer(s).

Northern Cross Energy Inc. requested that the IMO would use typical data in the assessment. Northern Cross Energy Ltd. would provide the final data that it is equivalent to or better than that assumed, to the IMO for verification before connection can be made. Data provision and verification are required to be completed at least one month prior to the connection date.

The data for the wind turbine generators, gas-fired generator(s), transformers and 27.6/34.5 kV feeders assumed in this assessment is shown in Appendix A.

2.1 Connection Arrangement

The proposed 50 MW gas-fired generation facility is to be incorporated onto the 115 kV transmission system in the Goderich area.

The 500/230 kV transmission system in southwestern Ontario and the 115 kV transmission system in the Goderich area are shown in Figure 1. Goderich TS is an existing 115/27.6 kV station consisting of three 15 MVA transformers connected to the 115 kV radial circuit M18 from Seaforth TS. Seaforth TS is connected to the 230 kV double circuit line B22D and B23D between Bruce GS and Detweiler TS via two 230/115 kV 250 MVA autotransformers.

Two incorporation alternatives are being considered.

Alternative 1: 27.6 kV Incorporation

- 50 MW of generation is to be incorporated via two or more dedicated 27.6 kV feeders, each 15 km in length, terminated on to the existing 27.6 kV bus at Goderich TS.

Alternative 2: 115 kV Incorporation

- 50 MW of generation is to be incorporated via two or more dedicated 34.5 kV feeders, each 15 km in length, terminated on to the 34.5 kV bus at a new 115/34.5 kV substation and connected to 115 kV circuit M18 near Goderich TS.

A related project involving incorporation of 57.2 MW of wind turbine generation at the same location is proposed by Port Albert Wind Farms Ltd. with identical incorporation alternatives. Northern Cross Energy Ltd. and Port Albert Wind Farms Ltd., two associated proponents, request the IMO to review the two projects together to determine whether a common LV connection arrangement would be feasible for a combined development of 100 MW of generation. The remaining 7.2 MW of wind turbine generation is to be incorporated via the existing 27.6 kV feeder M2 at Goderich TS.

The Transmission System Code specifies that the standard transformer winding connection is LV delta and HV wye and that any other configuration has to be approved by the transmitter. Northern Cross Energy Ltd. is advised to seek approval from Hydro One with respect to winding configuration and grounding requirements if different from the standard.

2.2 Generating Facility Requirements

Market Rule Chapter 4 Appendix 4.2 contains the generating facility requirements for generator connection to the IMO-Controlled Grid.

3.0 Impact on the IMO-Controlled Grid

Power system studies have been conducted to assess the incorporation of the proposed facility and its impact on the IMO-Controlled Grid.

3.1 Power System Study Assumptions

The forecast 2004 summer peak load conditions form the basis of the assessment. Consistent with the queue principles of the Connection Assessment and Approval process, all of the relevant projects, that have been registered prior to December 11, 2002, the CAA registration date of this proposal, have been included in the power system studies.

The base case load flow assumes all 6 units at the Bruce Complex at their respective maximum output. The proposed 57.2 MW of wind turbine generation and 50 MW of gas-turbine generation at the Port Albert generation site and the available resources in southwestern Ontario were dispatched to effect an eastbound power transfer of 1670 MW (1500 MW + 10% margin) on the Bruce Longwood Input interface. This represents a critical system condition in which the IMO-Controlled Grid is stressed. It is selected to assess whether the two proposed generation projects at the Port Albert site would have an adverse impact on the stability performance of the ICG.

3.2 Ampacity Considerations

The 115 kV circuit M18 has a summer continuous rating of 480 A under the ambient conditions of 30° C and 4 km/hr wind. The proposed 107.2 MW of generation, after supplying the load at Goderich TS (say 15 MW during light load periods), would result in a net injection of about 88 MW of power into the 115 kV network via circuit M18. This is within the summer continuous rating of the 115 kV circuit M18 that is connected radial from Seaforth TS. Therefore both Alternatives 1 and 2 will not result in overloading the 115 kV circuit.

Goderich TS presently consists of three 15 MVA, 115/27.6 kV transformers. Incorporation of 57.2 MW of wind turbine generation as a standalone project as per Alternative 1 would be within the transformer capacity. However, if it is to be incorporated with the 50 MW gas-fired generation at 27.6 kV, the transformer capacity at Goderich TS needs to be uprated to accommodate the combined generation of 107.2 MW during light load periods.

3.3 Voltage Change Considerations

For Alternative 1, the loss of the 50 MW gas-fired generator(s) at unity power factor due to a fault on the 27.6 kV bus at the generation site would result in a voltage decline of 2.7 % at Goderich 115 kV. The voltage decline would increase to 4.4% if the unit(s) were operating at a power factor of 0.9 lagging. These voltage declines are acceptable from the performance of the IMO-Controlled Grid viewpoint. However, the voltage changes at Goderich 27.6 kV due to the loss of up to 50 MW of generation would impact on the customer supply voltages. These are subject to Hydro One's approval.

For Alternative 2, the loss of 100 MW of generation due to a fault on the common 34.5 kV bus would result in a voltage decline of 2 % at Goderich 115 kV. This voltage change is within the market rule requirements. Therefore Alternative 2 is acceptable.

3.4 Post Contingency Load Flow Considerations

Load flow studies have been carried out to assess the impact of the proposed facility on the performance of the IMO-Controlled Grid.

LF1 is the base case created to assess the impact on the transfer capability of the BLIP interface loaded at its test level of -1,670 MW (-1,500 MW + 10% margin). This base case assumes all 6 units at the Bruce Complex at their respective maximum output, the proposed 107.2 MW of Port Albert generation and the available resources in southwestern Ontario dispatched to effect the desired eastbound power transfer on the BLIP interface.

LF2 is the post-fault load flow following the loss of the 500 kV double-circuit line (B560V/B561M) between Bruce GS and Claireville TS and Milton TS. The results show a satisfactory post-fault voltage profile on the ICG.

LF3 is the post-fault load flow following the loss of the 500 kV double-circuit line (B561L/B562L) between Bruce GS and Longwood TS. The results show a satisfactory post-fault voltage profile on the ICG.

LF4 is the post-fault load flow following the loss of the 230 kV circuit B22D and the 230/115 kV auto-transformer T1 at Seaforth TS. The results show a satisfactory post-fault voltage profile on the ICG.

LF5 is the post fault load flow following the loss of the proposed 100 MW generation consisting of 50 MW of gas-fired generation and 50 MW of wind turbine generation incorporated at the 115 kV level. The voltage declines at the 115 kV buses in the vicinity are all within 3%.

LF6 is the post fault load flow following the loss of the proposed 50 MW of gas-fired generation (assuming a common 27.6 kV bus connection). The voltage changes at the 115 kV buses in the vicinity are all within 3 %.

The salient parameters of the load flow results are summarized below:

2004 Summer Peak, BLIP = -1,670 MW, Bruce = 6 units, Port Albert generation = 107.2 MW

Case	Voltage Profile (kV)						Remarks
	Bruce 500	Longwood 500	Lambton 230	Richview 230	Seaforth 115	Goderich 115	
LF1	547	546	242	238	121	120.7	Base Case
LF2	542	526	242	224	115	115	Loss of 500 kV Bruce-Milton/Claireville 2-cct line.
LF3	548	533	242	238	120	120	Loss of 500 kV Bruce-Longwood 2-cct line
LF4	547	545	242	238	116	116	Loss of B22D and 1 autotransformer at Seaforth
LF5	547	546	242	238	121	117.8	Loss of 100 MW Port Albert generation.
LF6	547	546	242	238	121	118.2	Loss of 50 MW of Port Albert generation.

3.5 Transient Stability Study Results

Transient stability simulations have been carried out using the following recognized critical contingencies to assess the impact of the proposed 50 MW gas-fired generation and 57.2 MW wind turbine generation and the on the ICG. The initial system conditions prior to the simulated disturbances were based on LF1. The gas-fired generation and the wind turbine generation and their transmission connections were adjusted as per Alternatives 1 and 2 and to represent a stand-alone incorporation and a combined incorporation. Common to all cases is the 7.2 MW of wind turbine generation connected to the existing 27.6 kV feeder M3 at Goderich TS.

- Contingency 1: 3-phase fault at Seaforth 115 kV, loss of 230/115 kV auto and 230 kV cct B22D
- Contingency 2: 2-cct llg fault at Willow Creek Junction, loss of two 500 kV ccts B562L/B563L
- Contingency 3: 2-cct llg fault at Willow Creek Junction, loss of two 500 kV ccts B560V/B561M
- Contingency 4: 3-phase fault at Port Albert 27.6/34.5 kV, loss of one 27.6/34.5 kV feeder.

(A) Stand-alone Incorporation of 50 MW at 27.6 kV

Two 27.6 kV Feeders

With two 27.6 kV feeders to incorporate 50 MW of gas-fired generation, loss of one feeder (Contingency 4) would result in instability of the gas-fired generator(s) as shown in Figure 2.

The transient stability test was re-run assuming two 27.6 kV feeders, each connecting radially to one 25 MW gas-fired unit. As shown in Figure 3, for the same feeder contingency the remaining 25 MW gas-fired unit results in stable and positively-damped responses.

Therefore, it can be concluded that, for local contingencies two 27.6 kV feeders would be adequate to incorporate 50 MW of gas-fired generation with the following connection arrangements:

- Two 27.6 kV feeders, with each feeder connecting one 25 MW gas-fired unit radially
- Two 27.6 kV feeders connecting one 50 MW gas-fired unit via a 27.6 kV common bus. Generation rejection of the 50 MW unit is required for loss of one feeder.

Three critical system contingencies were simulated to show that two 27.6 kV feeders would be adequate for the incorporation of 50 MW of gas-fired generation.

Results of the transient stability cases show stable and positively damped system responses and the terminal voltages at the gas-fired generator(s) decline by less than 10% as summarized in the table below. It is noted that the most onerous system contingency is the loss of the 230 kV circuit between Bruce and Detweiler and the autotransformer at Seaforth TS (contingency 1).

2004 Summer Peak, BLIP = -1,670 MW, Bruce = 6 units, Port Albert wind generation = 57.2 MW

Transient Stability Case	Contingency	Voltage Plots	System Responses	Acceptable Voltage Declines (less than 10%)	
				500/230/115 kV	Gas-fired Generator Terminal
TS1	1 (B22D + auto)	Figure 4	Stable, positive damping	Yes	Yes
TS2	2 (BxL)	Figure 5	"	Yes	Yes
TS3	3 (BxM/C)	Figure 6	"	Yes	Yes

Therefore two 27.6 kV feeders would be adequate for the incorporation of 50 MW of gas-fired generation for system contingencies.

(B) Standalone Incorporation of 50 MW at 34.5 kV

Since the equivalent impedance of the 34.5 kV alternative (2 feeders and 115/34.5 kV transformer) is slightly smaller than that of the 27.6 kV alternative (2 feeders and 115/27.6 kV transformers), it can be concluded that two 34.5 kV feeders are adequate to incorporate the proposed 50 MW of wind turbine generation with the following connection arrangements:

- Two 34.5 kV feeders, with each feeder connecting one 25 MW gas-fired unit radially
- Two 34.5 kV feeders connecting one 50 MW gas-fired unit via a 34.5 kV common bus. Generation rejection of the 50 MW unit is required for loss of one feeder.

(C) Combined Incorporation of 107.2 MW at 27.6 kV

A companion report entitled “Preliminary Assessment on Port Albert Wind Farm” has concluded that three 27.6 kV feeders would be required to incorporate 50 MW of wind turbine generation.

Separate 27.6 kV Buses for Gas-fired and Wind Turbine Generation

Three system contingencies (1, 2 and 3) were simulated to assess the performance of the IMO-Controlled Grid with a group of three 27.6 kV feeders connecting 50 MW of wind turbine generation and a group of two 27.6 kV feeders connecting 50 MW of gas-fired generation. The two generation groups were assumed to have separate 27.6 kV buses.

Transient stability test results show stable and positively damped responses and the terminal voltages of the proposed generators decline by less than 10%, as shown in the table below.

2004 Summer Peak, BLIP = -1,670 MW, Bruce = 6 units, Port Albert gas-fired generation = 50 MW

Transient Stability Case	Contingency	Voltage Plots	System Responses	Acceptable Voltage Declines (less than 10%)	
				500/230/115 kV	Gas-fired Generator Terminal
TS4	1 (B22D + auto)	Figure 7	Stable, positive damping	Yes	Yes
TS5	2 (BxL)	Figure 8	"	Yes	Yes
TS6	3 (BxM/C)	Figure 9	"	Yes	Yes

Common 27.6 kV Bus for Gas-fired and Wind Turbine Generation

Contingency 1 was re-tested assuming the two generation facilities were connected to a common 27.6 kV bus at the generation site. Figure 10 shows an unstable response of the gas-fired generator(s) at about 0.3 second. Therefore, it is not acceptable to have a common 27.6 kV bus for the combined incorporation of both projects.

Therefore Alternative 1, consisting of two 27.6 kV feeders connected to the 50 MW gas-fired generation facility with the connection arrangement as discussed in Section (A) above, and three 27.6 kV feeders connected to the 50 MW wind turbine generation facility with a separate 27.6 kV bus, is acceptable.

(D) Combined Incorporation of 100 MW at 34.5 kV

Four contingencies (1, 2, 3 and 4) were simulated to assess the performance of the IMO-Controlled Grid with four 34.5 kV feeders for the combined incorporation of 100 MW. A common 34.5 kV bus was assumed for both generation facilities.

Transient stability test results show stable and positively damped responses and the terminal voltages of the proposed generators decline by less than 10%, as shown in the table below.

2004 Summer Peak, BLIP = -1,670 MW, Bruce = 6 units, Port Albert generation = 107.2 MW

Transient Stability Case	Contingency	Voltage Plots	System Responses	Acceptable Voltage Declines (less than 10%)	
				500/230/115 kV	Generator Terminal Voltages
TS7	1 (B22D + auto)	Figure 11	Stable, positive damping	Yes	Yes
TS8	2 (BxL)	Figure 12	"	Yes	Yes
TS9	3 (BxM/C)	Figure 13	"	Yes	Yes
TS10	4 (l/o feeder)	Figure 14	"	Yes	Yes

Therefore Alternative 2, consisting of a 115/34.5 kV transformer, four 34.5 kV feeders with a common 34.5 kV bus or separate 34.5 kV buses, is acceptable.

3.6 Reactive Power Compensation

Reactive compensation is also required on the 27.6 kV feeders as per Alternative 1 or the 34.5 kV feeders and the 115/34.5 kV transformer(s) which are owned and used exclusively by the gas-fired generators.

3.7 Fault Level Analysis

Fault level analysis was conducted to determine the impact of the proposed 50 MW gas-fired generation project on the existing transmission facilities. The base condition for the study assumes all projects including the Port Albert Wind Farm project that are ahead of the Port Albert Gas-fired Generation project in the CAA Queue.

The increases in fault level, due to the proposed 50 MW gas-fired generation, will not exceed the interrupting capabilities of the existing breakers. However, if both projects are to be incorporated at the 27.6 kV as per Alternative 1, the increases in fault levels will exceed the interrupting capabilities of the four feeder breakers M1, M2, M3 and M4 at Goderich TS. Incorporation of the two projects at 34.5 kV as per Alternative 2 will not exceed the interrupting capabilities of the existing breakers.

4.0 Conclusions

Based on the results of this assessment, it is concluded that:

1. The proposed 50 MW Port Albert Gas-fired Generation project, incorporated as a standalone project or in addition to the 57.2 MW Port Albert Wind Farm project, will not have an adverse impact on the performance of the IMO-Controlled Grid and transfer capabilities of major 500/230 kV transmission interfaces.
2. A standalone incorporation of the proposed 50 MW generation via two 27.6 kV feeders with adequate capacity would be within the existing transformer capacity at Goderich TS. Loss of one 27.6 kV feeder will require generation rejection.
3. The proposed 50 MW generation, if incorporated with the 57.2 MW Port Albert Wind Farm both at 27.6 kV as per Alternative 1, would result in overloading the existing 3 x 15 MVA 115/27.6 kV transformers at Goderich TS. Increase in 115/27.6 kV transformer capacity to

accommodate the combined output of the two generation projects during minimum load periods is required at Goderich TS. In addition, the 27.6 kV buses for the two generation projects must be separated at the generation site.

4. A standalone incorporation of 50 MW via two 34.5 kV feeders with adequate capacity is acceptable. Loss of one feeder will require generation rejection.
5. The proposed 50 MW generation, if incorporated with the 57.2 MW Port Albert Wind Farm, both at 34.5 kV as per Alternative 2 is acceptable with four 34.5 kV feeders. A common 34.5 kV bus for connection of the two 50 MW generation projects and four feeders to the new 115/34.5 kV substation is acceptable.
6. The increases in fault level, due to the proposed 50 MW gas-fired generation, will not exceed the interrupting capabilities of the existing breakers. However, if both projects are to be incorporated at the 27.6 kV as per Alternative 1, the increases in fault levels will exceed the interrupting capabilities of the four feeder breakers M1, M2, M3 and M4 at Goderich TS. Incorporation of the two projects at 34.5 kV as per Alternative 2 will not exceed the interrupting capabilities of the existing breakers.

5.0 IMO Requirements

1. To incorporate 50 MW of gas-fired generation, Northern Cross Energy Ltd. is required to:
 - Provide and install the gas-fired generator(s) with excitation system(s), power system stabilizer(s) and speed governor(s) that meet the generation facility requirements as per Chapter 4 Appendix 4.2.
 - Provide and install the unit transformer(s) with an equivalent impedance of less than 12.5% on the generator(s) base rating to satisfy the generator's reactive power capabilities required by the market rules.
 - Provide and install two dedicated 27.6 kV feeders with adequate capacity as per Alternative 1 (if selected) with the following alternative connection arrangements:
 - Two 27.6 kV feeders, with each feeder connecting one 25 MW gas-fired unit radially
 - Two 27.6 kV feeders connecting one 50 MW gas-fired unit via a 27.6 kV common bus. Generation rejection of the 50 MW unit is required for loss of one feeder.
 - Provide and install two dedicated 34.5 kV feeders and 34.5/115 kV transformer(s) with adequate capacity as per Alternative 2 (if selected) with the following alternative connection arrangements:
 - Two 34.5 kV feeders, with each feeder connecting one 25 MW gas-fired unit radially
 - Two 34.5 kV feeders connecting one 50 MW gas-fired unit via a 34.5 kV common bus. Generation rejection of the 50 MW unit is required for loss of one feeder.

- Provide and install switched shunt capacitors to compensate for the reactive power consumption on the dedicated 27.6 kV or the dedicated 34.5 kV feeders and the 34.5/115 kV transformer(s) as per Alternatives 1 or 2 respectively.
2. Northern Cross Energy Inc. must complete the IMO facility registration process including meter registration before placing the proposed 50 MW Port Albert gas-fired generation facility in service.
 3. A Customer Impact Assessment (CIA) is required to determine the impact of new generation connection on Transmission Customers and a detailed CIA study will be carried out by Hydro One.
 4. A separate System Impact Assessment is not required since this Preliminary Assessment has included transient stability analysis of the IMO-Controlled Grid.

6.0 Budgetary Cost Estimates

There is only minor work associated with review and verification of protection schemes and final equipment data, and witness verification during commissioning. No budgetary cost estimate is provided for that purpose.

If required to make its investment decision, Northern Cross Energy Ltd. is to obtain the cost estimates from Hydro One for uprating the three 15 MVA 115/27.6 kV transformers and associated facilities at Goderich TS

7.0 Identification of "Sole Beneficiary"

The facilities that are triggered by this project and deemed to be for the sole benefit of this project have been identified to enable incorporation of the proposed generation:

- Uprating of the three 15 MVA 115/27.6 kV transformers and associated facilities at Goderich TS to accommodate 100 MW of generation during minimum load periods, if the 50 MW gas-fired generation is to be incorporated at 27.6 kV in addition to the 57.2 MW Port Albert Wind Farm project.

8.0 Notification of Approval

This Preliminary Assessment has investigated the impact of the proposed 50 Port Albert Gas-fired Generation project on the reliability of the IMO-Controlled Grid. It has also identified IMO's requirements for connection to ensure that the project has no adverse impact on the reliability of the IMO-Controlled Grid.

It is recommended that a Notification of Approval be granted, subject to the implementation of the requirements stipulated in this report.

Appendix A

Assumed Data for Generators, 118/34.5 kV Transformer and 27.6/34.5 kV Feeders

Wind Turbine Generators:

PTI induction generator model type CIMTR3 data on 2 MVA base

T'	T''	H	X	X'	X''	Xl
0.087	0.0	3.0	6.96	0.307	0.0	0.126
E1	S(E1)	E2	S(E2)	Switch	Syn-Power	
1	0.1	1.2	0.5	0	0.1	

Unit Transformers:

690V: 27.6 kV Reactance X = 6.8% on 1.85 MVA base

690V: 34.5 kV Reactance X = 6.8% on 1.85 MVA base

118/34.5 kV transformer:

118 kV: 34.5 kV Reactance X = 10% on 120 MVA base

One, 27.6 kV feeder impedance on 100 MVA (15 km):

R	X	B
0.16	0.80	0.0

One, 34.5 kV feeder impedance on 100 MVA (15 km):

R	X	B
0.124	0.50	0.0

Fault Clearing Times for Feeders and Generator Protection

Breakers: 50 ms (3 cycles)

Protection Relaying: 35 ms

50 MW Gas-Fired Generation:

```

** GENROU ** 7673 P_ALBEGT13.8
      MBASE      Z S O R C E      X T R A N      GENTAP
      60.0      0.00000+J 0.17200      0.00000+J 0.00000      1.00000

T'D0 T''D0 T'Q0 T''Q0      H      DAMP      XD      XQ      X'D      X'Q      X''D      XL
7.60 0.050 2.33 0.050      1.00      0.00 2.5700 2.3500 0.2480 0.4100 0.1720 0.1610

      S(1.0) S(1.2)
      0.2000 0.6000

** PSS2A **
      IC1 REMBUS1      IC2 REMBUS2      M      N
      1      0      3      0      5      1

      TW1      TW2      T6      TW3      TW4      T7      KS2      KS3
      5.000      5.000      0.000      5.000      5.000      3.000      0.990      1.000

      T8      T9      KS1      T1      T2      T3      T4      VSTMAX      VSTMIN
      0.200      0.100      2.000      0.150      0.030      0.150      0.030      0.100      -0.100
    
```

```
** ESST1A **
UEL VOS      TR    VIMAX  VIMIN    TC      TB      TC1     TB1     KA
  1   1      0.020  1.000  -1.000  1.000  1.000  1.000  1.000  200.0

  TA    VAMAX  VAMIN  VRMAX  VRMIN  KC      KF      TF      KLR     ILR
0.030  10.000 -10.000  10.000 -10.000  0.000  0.000  0.100  0.000  0.000

** GAST **
  R      T1      T2      T3    LOAD LIM  KT      VMAX  VMIN  DT
0.050  0.400  0.100  3.000  1.000  2.000  1.000 -0.050  0.000
```

Unit transformers:

13.8 kV: 27.6 kV reactance X=12.5% on 60 MVA base

13.8 kV: 34.5 kV reactance X=12.5% on 60 MVA base

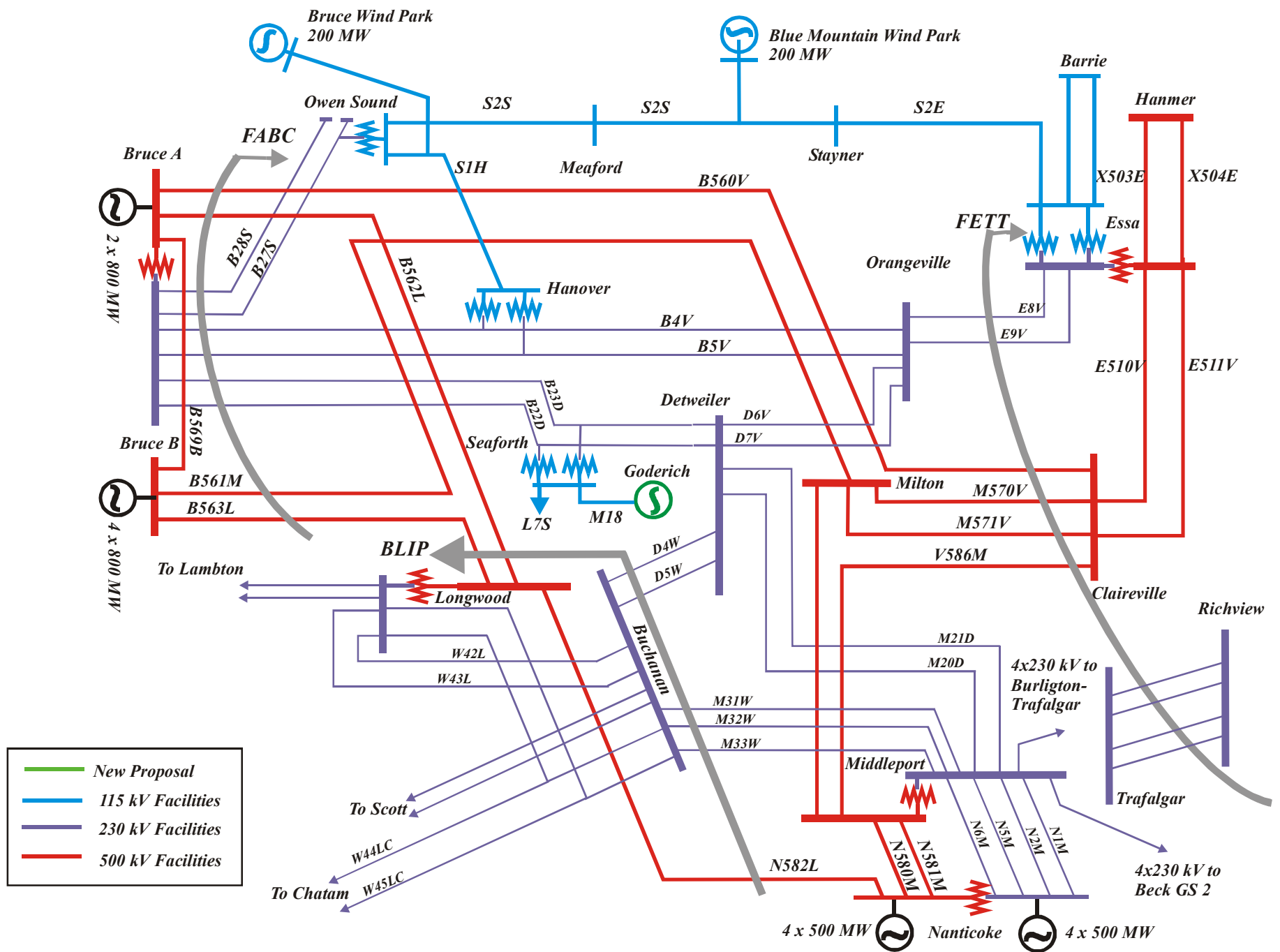


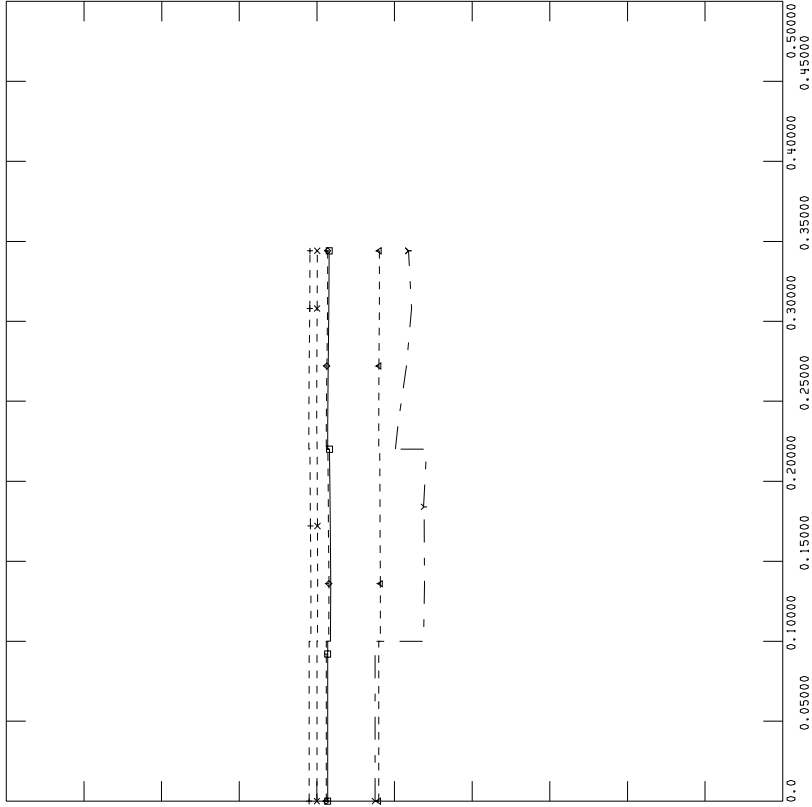
Figure 1. Southwestern Ontario Transmission System- Northern Cross Generation Project



BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-1671ON>NY-162QFW1269FETT4881FABC5123
 3-PHASE FAULT AT PORT ALBERT 27.6 KV
 LOSS OF ONE 27.6KV FEEDER

FILE: 3p_feeder_paGpa_GasP27p6-G.bin
 CHNL = 57: [VOLT 7306 [SEAFORTH118.00]]

1.5000		0.50000
1.5000	CHNL = 34: [VOLT 7105 [CLAMTON 220.00]]	0.50000
1.5000	CHNL = 33: [VOLT 5105 [NANTICOK220.00]]	0.50000
1.5000	CHNL = 20: [VOLT 7000 [LONGWOOD500.00]]	0.50000
1.5000	CHNL = 26: [VOLT 4003 [MILTON 500.00]]	0.50000
1.5000	CHNL = 21: [VOLT 6400 [BRUCE A 500.00]]	0.50000



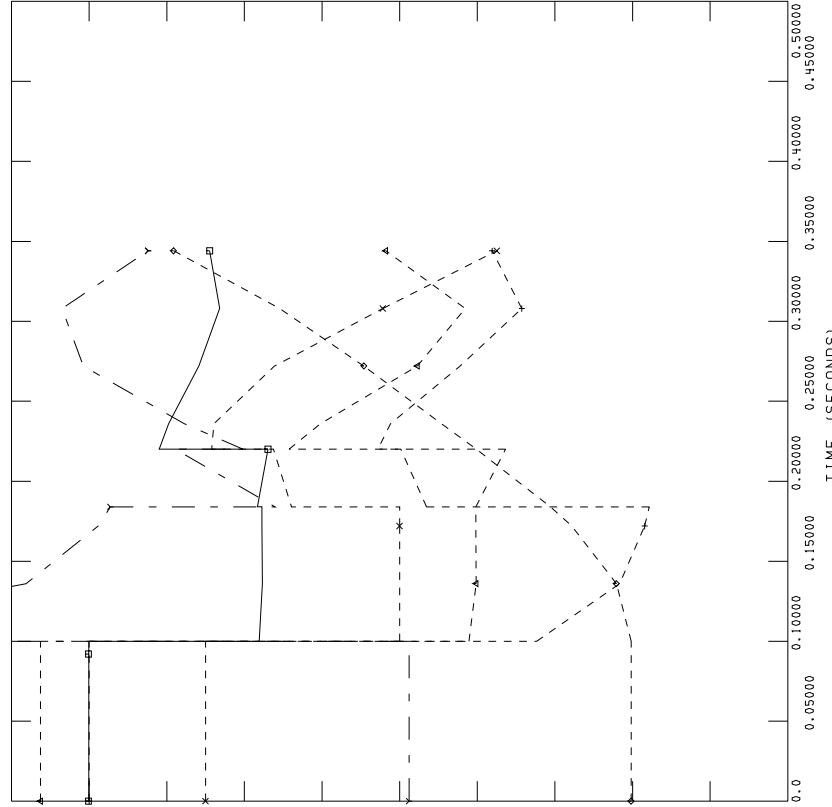
MON, JUN 30 2003 9:14
 FIG_2A: VOLTAGE PROFILE



BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-1671ON>NY-162QFW1269FETT4881FABC5123
 3-PHASE FAULT AT PORT ALBERT 27.6 KV
 LOSS OF ONE 27.6KV FEEDER

FILE: 3p_feeder_paGpa_GasP27p6-G.bin
 CHNL = 125: [VARS 7665 [P_ALBEGT13.800] [I]]

0.50000		-0.50000
1.0000	CHNL = 121: [PWR 7665 [P_ALBEGT13.800] [I]]	-1.0000
1.1000	CHNL = 129: [ETRM 7665 [P_ALBEGT13.800] [I]]	0.10000
300.00	CHNL = 116: [ANGL 7665 [P_ALBEGT13.800] [I]]	0.0
1.1000	CHNL = 54: [VOLT 7652 [GODERICH27.600]]	0.10000
1.1000	CHNL = 55: [VOLT 7350 [GODERICH118.00]]	0.10000



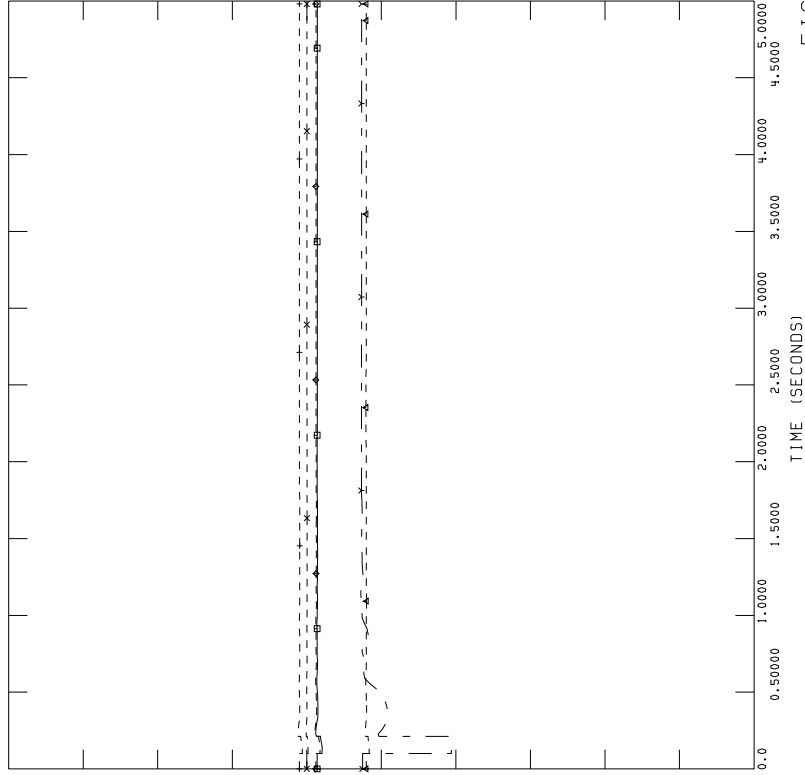
MON, JUN 30 2003 9:14
 FIG_2B: LOCAL CONDITIONS



BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
ONT>MI-332BLIP-1671ON>NY-1620FW1269FETT4881FABC5123
3-PHASE FAULT AT PORT ALBERT 27.6 KV
LOSS OF ONE 27.6KV FEEDER

FILE: 3p_feeder_grGpa_GasP27p6.bin
CHNL = 57: CVOLT 7306 [SEAFORTH118.00]]

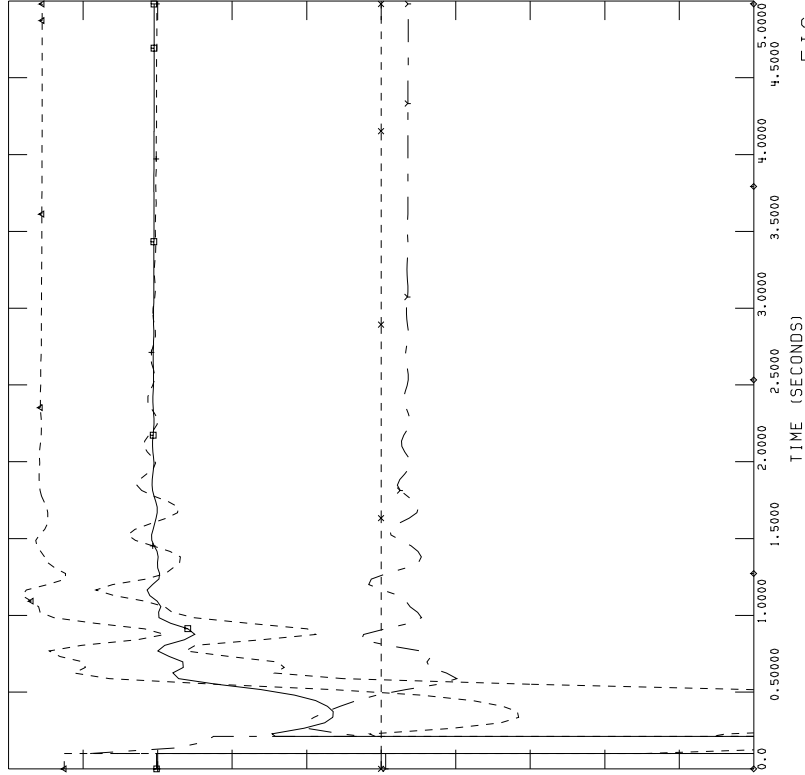
1.5000	CHNL = 34: CVOLT 7105 [LAMBTON 220.00]]	0.50000
1.5000	CHNL = 33: CVOLT 5105 [NANTICOK220.00]]	0.50000
1.5000	CHNL = 20: CVOLT 7000 [LONGWOOD500.00]]	0.50000
1.5000	CHNL = 26: CVOLT 4003 [MILTON 500.00]]	0.50000
1.5000	CHNL = 21: CVOLT 6400 [BRUCE A 500.00]]	0.50000



BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
ONT>MI-332BLIP-1671ON>NY-1620FW1269FETT4881FABC5123
3-PHASE FAULT AT PORT ALBERT 27.6 KV
LOSS OF ONE 27.6KV FEEDER

FILE: 3p_feeder_grGpa_GasP27p6.bin
CHNL = 125: CVARS 7665 [P_ALBEGT13.800] [1]]

0.50000	CHNL = 123: CVARS 7655 [P_ALBEP0.6900] [1]]	-0.5000
0.50000	CHNL = 129: [ETRM 7665 [P_ALBEGT13.800] [1]]	-0.5000
1.1000	CHNL = 127: [ETRM 7655 [P_ALBEP0.6900] [1]]	0.60000
1.1000	CHNL = 54: CVOLT 7652 [CODERICH27.600]]	0.60000
1.1000	CHNL = 55: CVOLT 7350 [CODERICH118.00]]	0.60000

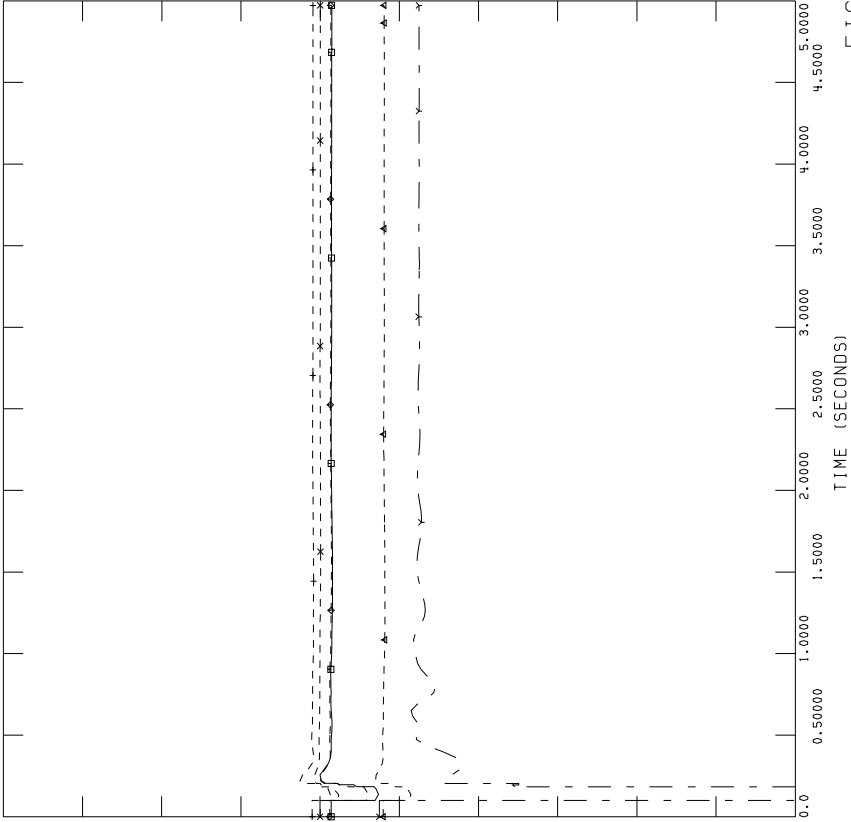




BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-16710N>NY-1620FW1269FETT4881FABC5123
 3-PHASE FAULT AT SEAFORTH 115KV
 LOSS OF 230/115KV AUTO&230KV CCT B22D

FILE: 3p_b22d_slpa_GasP27p6-G.bin
 CHNL = 57: CVOLT 7306 [SEAFORTH118.00]]

1.5000	CHNL = 34: [CVOLT 7105 [LAMBTON 220.00]]	0.50000
1.5000	CHNL = 33: [CVOLT 5105 [NANTICOK220.00]]	0.50000
1.5000	CHNL = 20: [CVOLT 7000 [LONGWOODS500.00]]	0.50000
1.5000	CHNL = 26: [CVOLT 4003 [MILTON 500.00]]	0.50000
1.5000	CHNL = 21: [CVOLT 6400 [BRUCE A 500.00]]	0.50000



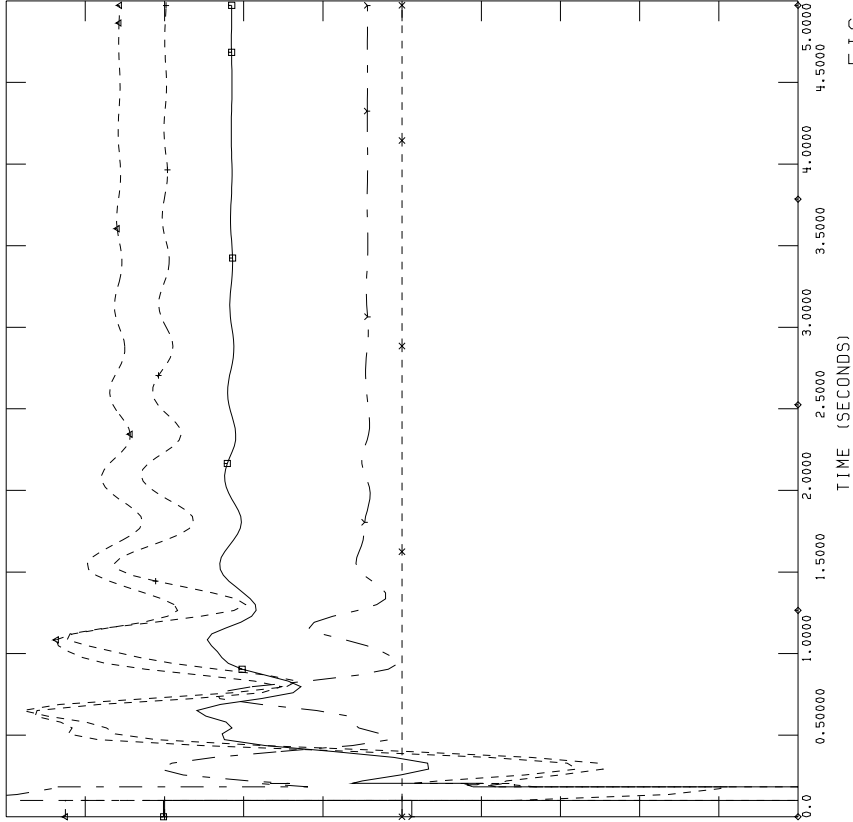
MON, JUN 30 2003 9:28
 FIG_4A: VOLTAGE PROFILE



BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-16710N>NY-1620FW1269FETT4881FABC5123
 3-PHASE FAULT AT SEAFORTH 115KV
 LOSS OF 230/115KV AUTO&230KV CCT B22D

FILE: 3p_b22d_slpa_GasP27p6-G.bin
 CHNL = 125: [CVARS 7655 [P_ALBENP0.6900] [I]]

0.50000	CHNL = 123: [CVARS 7655 [P_ALBENP0.6900] [I]]	-0.5000
0.50000	CHNL = 129: [CETRM 7665 [P_ALBEGT13.800] [I]]	-0.5000
1.1000	CHNL = 127: [CETRM 7655 [P_ALBENP0.6900] [I]]	0.60000
1.1000	CHNL = 54: [CVOLT 7652 [GODERICH27.600]]	0.60000
1.1000	CHNL = 55: [CVOLT 7350 [GODERICH118.00]]	0.60000



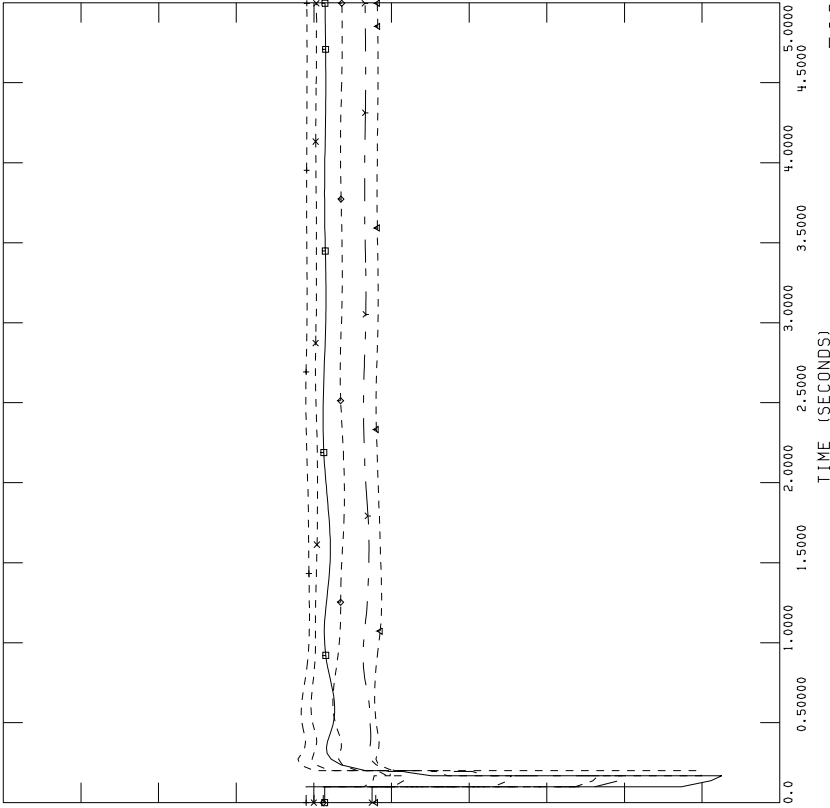
MON, JUN 30 2003 9:28
 FIG_4B: LOCAL CONDITIONS



BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-1671ON>NY-162QFW1269FETT4881FABC5123
 TWO CCT LINE-LINE-TO-GROUND FAULT AT WILLOW CREEK JUNCTION
 LOSS OF TWO 500KV CCT B562L&B563L

FILE: 1lg_b-l_wcj_rej0pa_GasP27p6-G.bin
 CHNL = 57: [VOLT 7306 [ESEAFORTH118.00]]

1.5000	CHNL = 34: [VOLT 7105 [CLAMTON 220.00]]	0.50000
1.5000	CHNL = 33: [VOLT 5105 [NANTICOK220.00]]	0.50000
1.5000	CHNL = 20: [VOLT 7000 [LONGWOOD500.00]]	0.50000
1.5000	CHNL = 26: [VOLT 4003 [MILTON 500.00]]	0.50000
1.5000	CHNL = 21: [VOLT 6400 [BRUCE A 500.00]]	0.50000



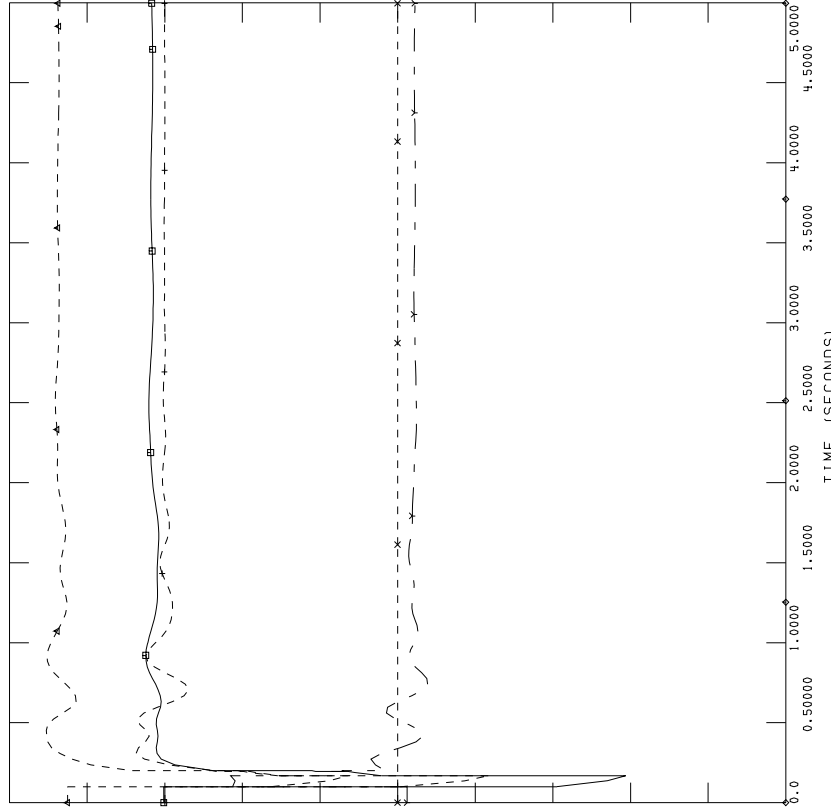
MON, JUN 30 2003 9:28
 FIG_5A: VOLTAGE PROFILE



BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-1671ON>NY-162QFW1269FETT4881FABC5123
 TWO CCT LINE-LINE-TO-GROUND FAULT AT WILLOW CREEK JUNCTION
 LOSS OF TWO 500KV CCT B562L&B563L

FILE: 1lg_b-l_wcj_rej0pa_GasP27p6-G.bin
 CHNL = 125: [VARS 7665 [CP_ALBENP0.6900] [I]]

0.50000	CHNL = 123: [VARS 7655 [CP_ALBENP0.6900] [I]]	-0.50000
0.50000	CHNL = 129: [ETRM 7665 [CP_ALBEGT13.800] [I]]	-0.50000
1.1000	CHNL = 127: [ETRM 7655 [CP_ALBENP0.6900] [I]]	0.60000
1.1000	CHNL = 54: [VOLT 7652 [GODERICH27.600]]	0.60000
1.1000	CHNL = 55: [VOLT 7350 [GODERICH118.00]]	0.60000



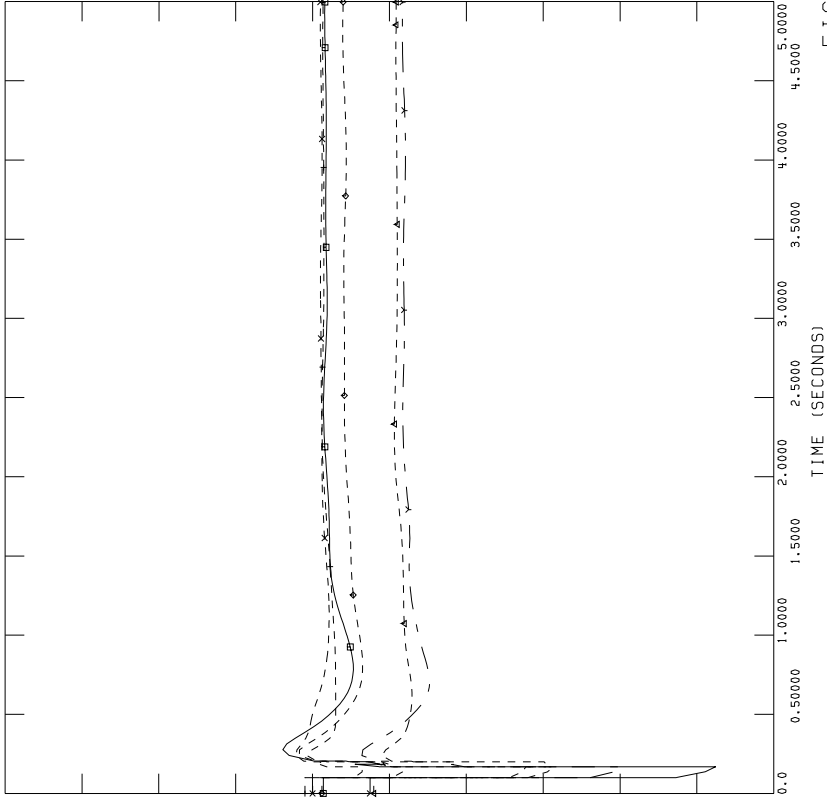
MON, JUN 30 2003 9:28
 FIG_5B: LOCAL CONDITIONS



BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-16710N>NY-162QFW1269FETT4881FABC5123
 TWO CCT LINE-LINE-TO-GROUND FAULT AT WILLOW CREEK JUNCTION
 LOSS OF TWO 500KV CCT B566V&B561M

FILE: 1lg_b-m_wcj_rej2pa_GasP27p6-G.bin
 CHNL = 57: [VOLT 7306 [SEAFORTH118.00]]

1.5000	CHNL = 34: [VOLT 7105 [LAMBTON 220.00]]	0.50000
1.5000	CHNL = 33: [VOLT 5105 [NANTICOK220.00]]	0.50000
1.5000	CHNL = 20: [VOLT 7000 [LONGWOOD500.00]]	0.50000
1.5000	CHNL = 26: [VOLT 4003 [MILTON 500.00]]	0.50000
1.5000	CHNL = 21: [VOLT 6400 [BRUCE A 500.00]]	0.50000



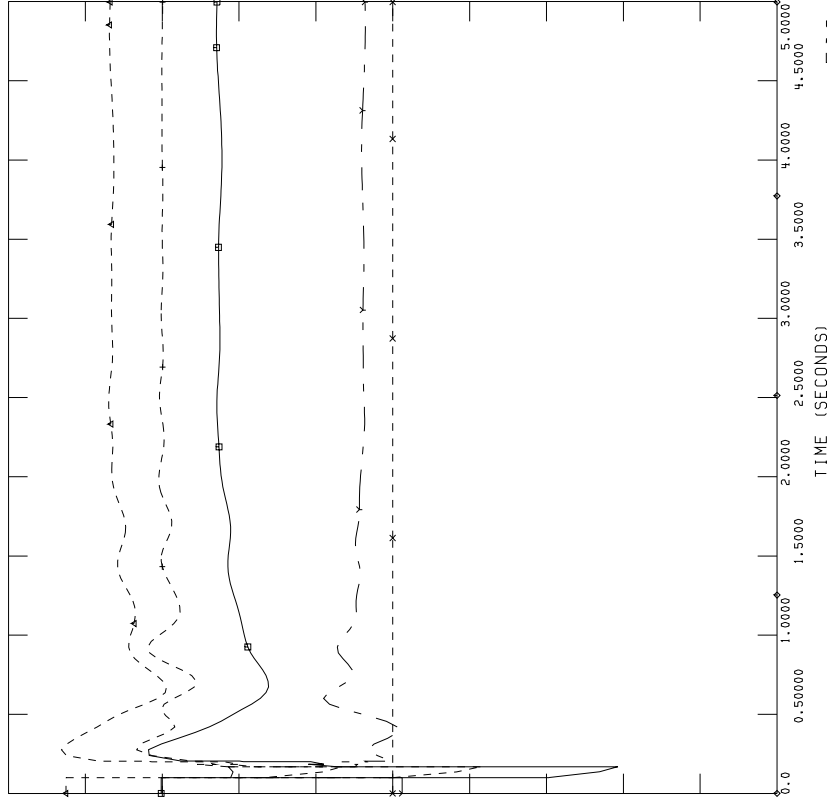
MON, JUN 30 2003 9:28
 FIG_6A: VOLTAGE PROFILE



BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-16710N>NY-162QFW1269FETT4881FABC5123
 TWO CCT LINE-LINE-TO-GROUND FAULT AT WILLOW CREEK JUNCTION
 LOSS OF TWO 500KV CCT B566V&B561M

FILE: 1lg_b-m_wcj_rej2pa_GasP27p6-G.bin
 CHNL = 125: [VARS 7665 [ALBEGT13.800]] [1]]

0.50000	CHNL = 123: [VARS 7655 [CP_ALBENP0.6900]] [1]]	-0.50000
0.50000	CHNL = 129: [ETRM 7665 [CP_ALBEGT13.800]] [1]]	-0.50000
1.1000	CHNL = 127: [ETRM 7655 [CP_ALBENP0.6900]] [1]]	0.60000
1.1000	CHNL = 54: [VOLT 7652 [GODERICH27.600]]	0.60000
1.1000	CHNL = 55: [VOLT 7350 [GODERICH118.00]]	0.60000

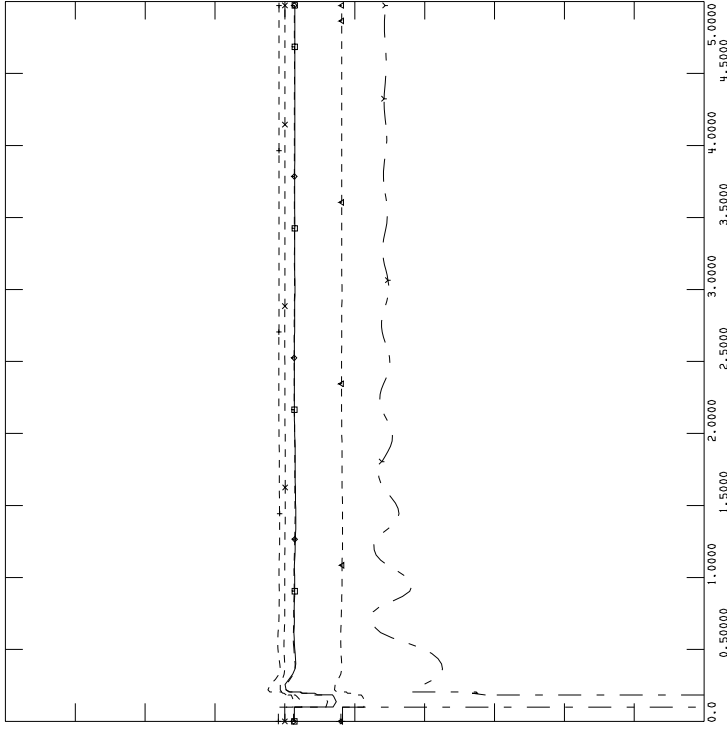


MON, JUN 30 2003 9:28
 FIG_6B: LOCAL CONDITIONS



BLUMNT_BASE-----4LB7N4LK306B6P1LX
 ONT>MI-332BLIP-16710N>NY-1620FW1269FETT4881FABC5123
 3-PHASE FAULT AT SEAFORTH 115KV
 LOSS OF 230/115KV AUTO&230KV CCT B22D
 FILE: 3p_b22d_s1pa_GasWP27p6-GW.bin
 CHNL = 57: EVOLT 7306 [SEAFORTH118.00]]

1.5000	CHNL = 34: EVOLT 7105 [LAMBTON 220.00]]	0.50000
1.5000	CHNL = 33: EVOLT 5105 [NANTICOK220.00]]	0.50000
1.5000	CHNL = 20: EVOLT 7000 [LONGWOODS00.00]]	0.50000
1.5000	CHNL = 26: EVOLT 4003 [MILTON 500.00]]	0.50000
1.5000	CHNL = 21: EVOLT 6400 [BRUCE A 500.00]]	0.50000

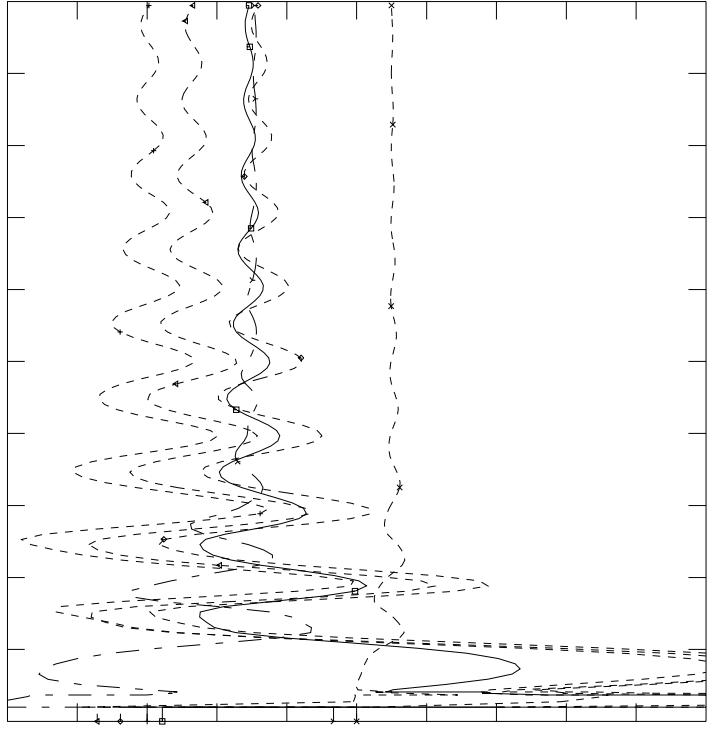


FRI, JUN 27 2003 11:21
 FIG_7A: VOLTAGE PROFILE



BLUMNT_BASE-----4LB7N4LK306B6P1LX
 ONT>MI-332BLIP-16710N>NY-1620FW1269FETT4881FABC5123
 3-PHASE FAULT AT SEAFORTH 115KV
 LOSS OF 230/115KV AUTO&230KV CCT B22D
 FILE: 3p_b22d_s1pa_GasWP27p6-GW.bin
 CHNL = 125: CVARS 7665 [P_ALBEGT13.800]] [I]]

0.50000	CHNL = 123: CVARS 7655 [P_ALBENP0.6900]] [I]]	-0.50000
0.50000	CHNL = 129: CETRM 7665 [P_ALBEGT13.800]] [I]]	-0.50000
1.1000	CHNL = 127: CETRM 7655 [P_ALBENP0.6900]] [I]]	0.60000
1.1000	CHNL = 54: EVOLT 7652 [GODERICH27.600]]	0.60000
1.1000	CHNL = 55: EVOLT 7350 [GODERICH118.00]]	0.60000



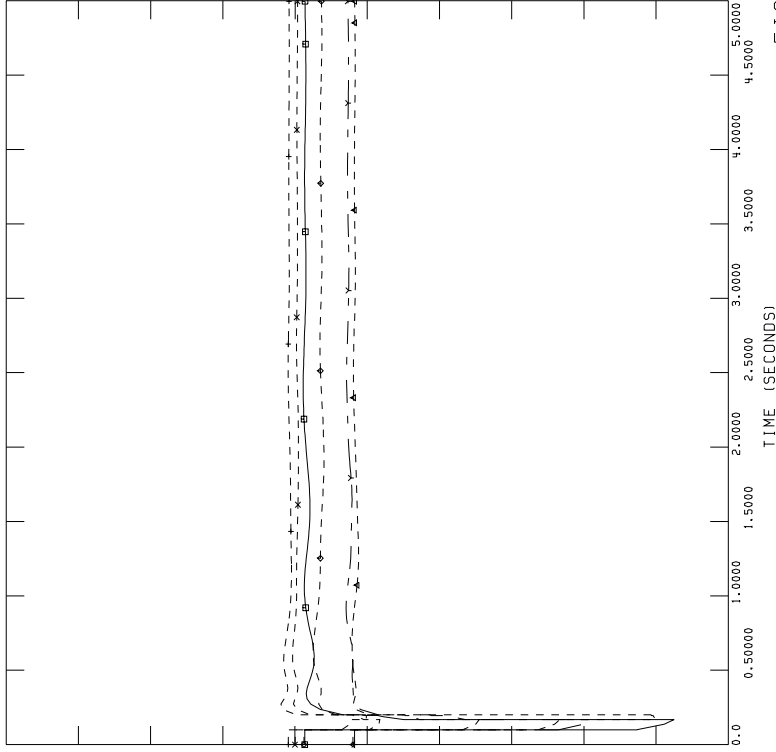
FRI, JUN 27 2003 11:21
 FIG_7B: LOCAL CONDITIONS



BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-16710N>NY-162QFW1269FETT4881FABC5123
 TWO CCT LINE-LINE-TO-GROUND FAULT AT WILLOW CREEK JUNCTION
 LOSS OF TWO 500KV CCT B562L4B563L

FILE: 1lg_b-1_wcj_rej0pa_GasWP27p6-GW.bin
 CHNL = 57: CVOLT 7306 CSEAFORTH118.00J

1.5000	CHNL = 34: CVOLT 7105 CLAMPTON 220.00J	0.50000
1.5000	CHNL = 33: CVOLT 5105 CNANTICOK220.00J	0.50000
1.5000	CHNL = 20: CVOLT 7000 CLONGWOOD00500.00J	0.50000
1.5000	CHNL = 26: CVOLT 4003 EMILTON 500.00J	0.50000
1.5000	CHNL = 21: CVOLT 6400 CBRUCE A 500.00J	0.50000



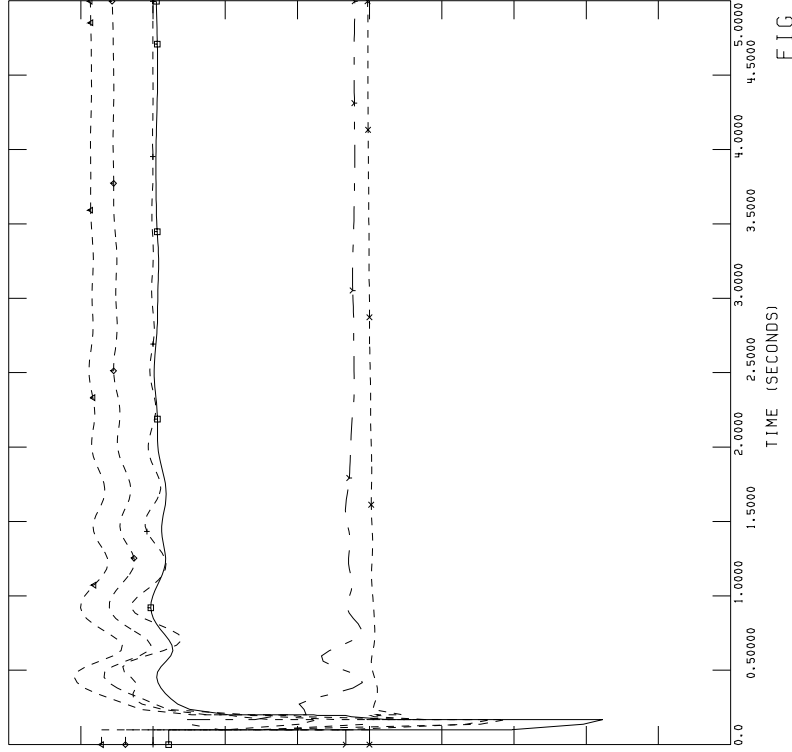
FRI, JUN 27 2003 11:21
 FIG_8A: VOLTAGE PROFILE



BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-16710N>NY-162QFW1269FETT4881FABC5123
 TWO CCT LINE-LINE-TO-GROUND FAULT AT WILLOW CREEK JUNCTION
 LOSS OF TWO 500KV CCT B562L4B563L

FILE: 1lg_b-1_wcj_rej0pa_GasWP27p6-GW.bin
 CHNL = 125: CVARS 7665 CP_ALBEGT13.800J C1 JJ

0.50000	CHNL = 123: CVARS 7655 CP_ALBEWP0.6900J C1 JJ	-0.5000
0.50000	CHNL = 129: CETRM 7665 CP_ALBEGT13.800J C1 JJ	-0.5000
1.1000	CHNL = 127: CETRM 7655 CP_ALBEWP0.6900J C1 JJ	0.60000
1.1000	CHNL = 54: CVOLT 7652 EGODERICH27.600J	0.60000
1.1000	CHNL = 55: CVOLT 7350 EGODERICH118.00J	0.60000



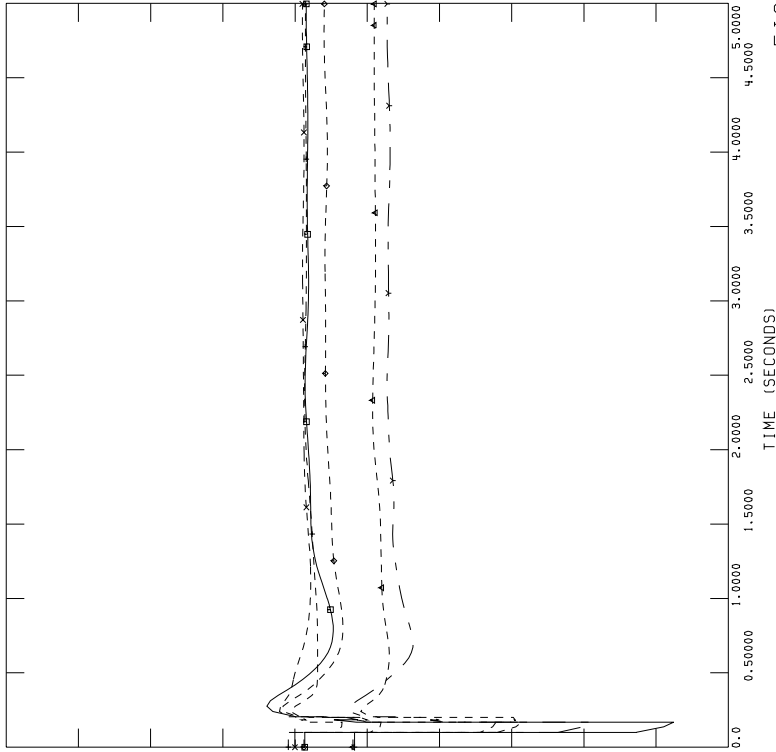
FRI, JUN 27 2003 11:21
 FIG_8B: LOCAL CONDITIONS



BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-16710N>NY-162QFW1269FETT4881FABC5123
 TWO CCT LINE-LINE-TO-GROUND FAULT AT WILLOW CREEK JUNCTION
 LOSS OF TWO 500KV CCT B566V4B561M

FILE: 1lg_b-m_wcj_rej2pa_GasWP27p6-GW.bin

1.5000	CHNL# 57: [VOLT 7306 CSEAFORTH118.00]]	0.50000
1.5000	CHNL# 34: [VOLT 7105 CLAMBTON 220.00]]	0.50000
1.5000	CHNL# 33: [VOLT 5105 CNANTICOK220.00]]	0.50000
1.5000	CHNL# 20: [VOLT 7000 CLONGWOOD0500.00]]	0.50000
1.5000	CHNL# 26: [VOLT 4003 CMILTON 500.00]]	0.50000
1.5000	CHNL# 21: [VOLT 6400 CBRUCE A 500.00]]	0.50000



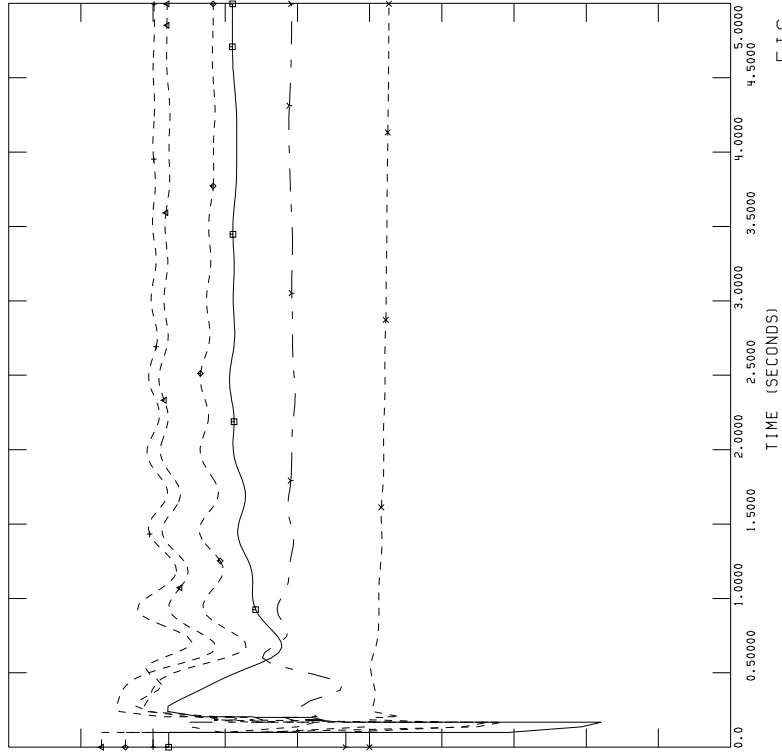
FRI, JUN 27 2003 11:21
 FIG_9A: VOLTAGE PROFILE



BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-16710N>NY-162QFW1269FETT4881FABC5123
 TWO CCT LINE-LINE-TO-GROUND FAULT AT WILLOW CREEK JUNCTION
 LOSS OF TWO 500KV CCT B566V4B561M

FILE: 1lg_b-m_wcj_rej2pa_GasWP27p6-GW.bin

0.50000	CHNL# 125: [VARS 7665 CP_ALBENP0.6900] [I JJ]	-0.5000
0.50000	CHNL# 123: [VARS 7655 CP_ALBENP0.6900] [I JJ]	-0.5000
1.1000	CHNL# 129: [ETRM 7665 CP_ALBEGT13.800] [I JJ]	0.60000
1.1000	CHNL# 127: [ETRM 7655 CP_ALBENP0.6900] [I JJ]	0.60000
1.1000	CHNL# 54: [VOLT 7652 CGODERICH27.600]]	0.60000
1.1000	CHNL# 55: [VOLT 7350 CGODERICH118.00]]	0.60000



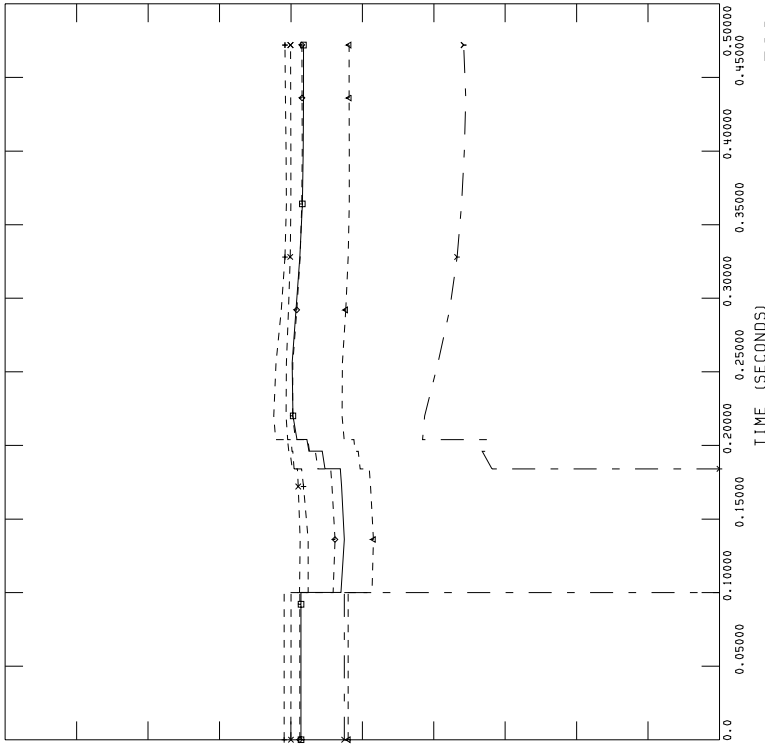
FRI, JUN 27 2003 11:21
 FIG_9B: LOCAL CONDITIONS



BLUMNT_BASE-----4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-16710N>NY-1620FW1269FETT4881FABC5123
 3-PHASE FAULT AT SEAFORTH 115KV
 LOSS OF 230/115KV AUTO&230KV CCT B22D

FILE: 3p_b22d_s1pa_GasWP27p6-5f1b.bin
 CHNL = 57: [VOLT 7306 [SEAFORTH118.00]]

1.5000	CHNL = 34: [VOLT 7105 [LAMBTON 220.00]]	0.50000
1.5000	CHNL = 33: [VOLT 5105 [NANTICOK220.00]]	0.50000
1.5000	CHNL = 20: [VOLT 7000 [LONGWOOD500.00]]	0.50000
1.5000	CHNL = 26: [VOLT 4003 [MILTON 500.00]]	0.50000
1.5000	CHNL = 21: [VOLT 6400 [BRAUCE A 500.00]]	0.50000



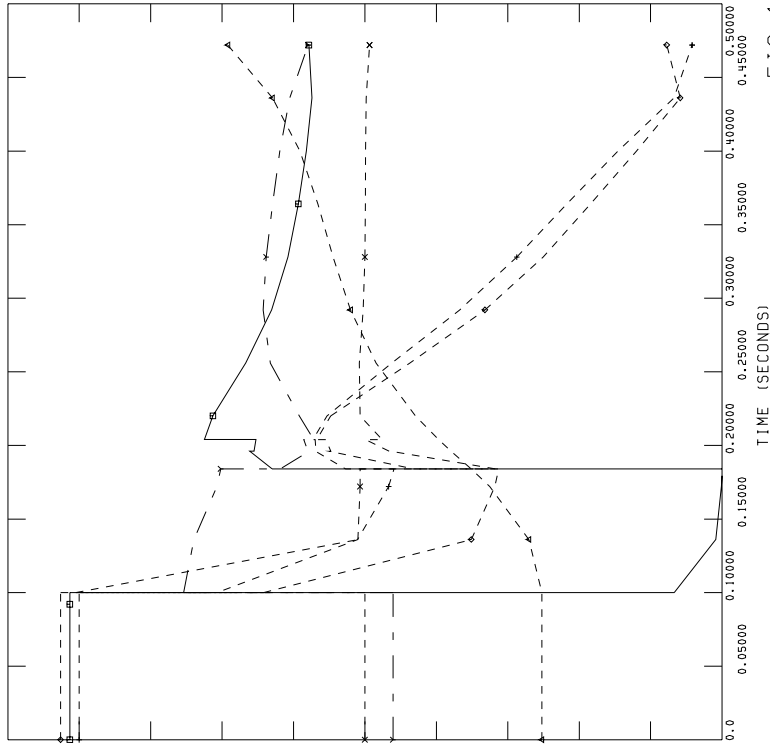
FRI, JUN 27 2003 11:21
 FIG_10A: VOLTAGE PROFILE



BLUMNT_BASE-----4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-16710N>NY-1620FW1269FETT4881FABC5123
 3-PHASE FAULT AT SEAFORTH 115KV
 LOSS OF 230/115KV AUTO&230KV CCT B22D

FILE: 3p_b22d_s1pa_GasWP27p6-5f1b.bin
 CHNL = 125: [VARS 7665 [ALBEGT13.800] [I]]

0.50000	CHNL = 123: [VARS 7655 [ALBENP0.6900] [I]]	-0.5000
0.50000	CHNL = 129: [ETRM 7665 [ALBEGT13.800] [I]]	-0.50000
1.1000	CHNL = 127: [ETRM 7655 [ALBENP0.6900] [I]]	0.10000
1.1000	CHNL = 116: [ANGL 7665 [ALBEGT13.800] [I]]	0.10000
300.00	CHNL = 55: [VOLT 7350 [GODERICH118.00]]	0.0
1.1000		0.10000



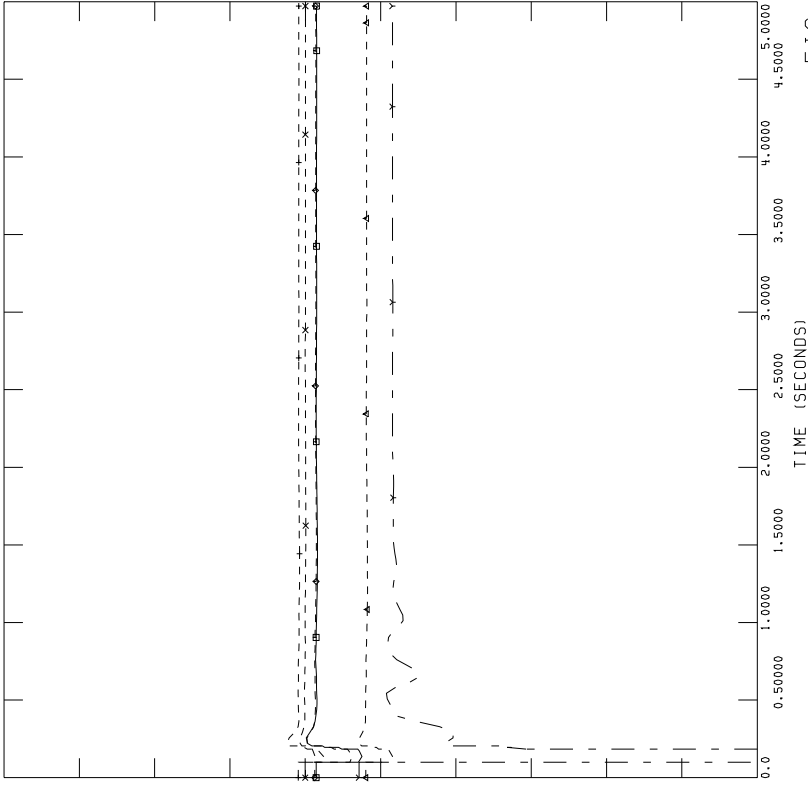
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 FIG_10B: LOCAL CONDITIONS



BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-16710N>NY-162QFW1269FETT4881FABC5123
 3-PHASE FAULT AT SEAFORTH 115KV
 LOSS OF 230/115KV AUTO&230KV CCT B22D

FILE: 3p_b22d_s1pa_wp34p5-34kv.bin
 CHNL = 55: CVOLT 7306 [SEAFORTH118.00]]

1.5000	CHNL = 34: CVOLT 7105 [LAMBTON 220.00]]	0.50000
1.5000	CHNL = 33: CVOLT 5105 [ENANTICOK220.00]]	0.50000
1.5000	CHNL = 20: CVOLT 7000 [LONGWOOD500.00]]	0.50000
1.5000	CHNL = 26: CVOLT 4003 [MILTON 500.00]]	0.50000
1.5000	CHNL = 21: CVOLT 6400 [BRUCE A 500.00]]	0.50000



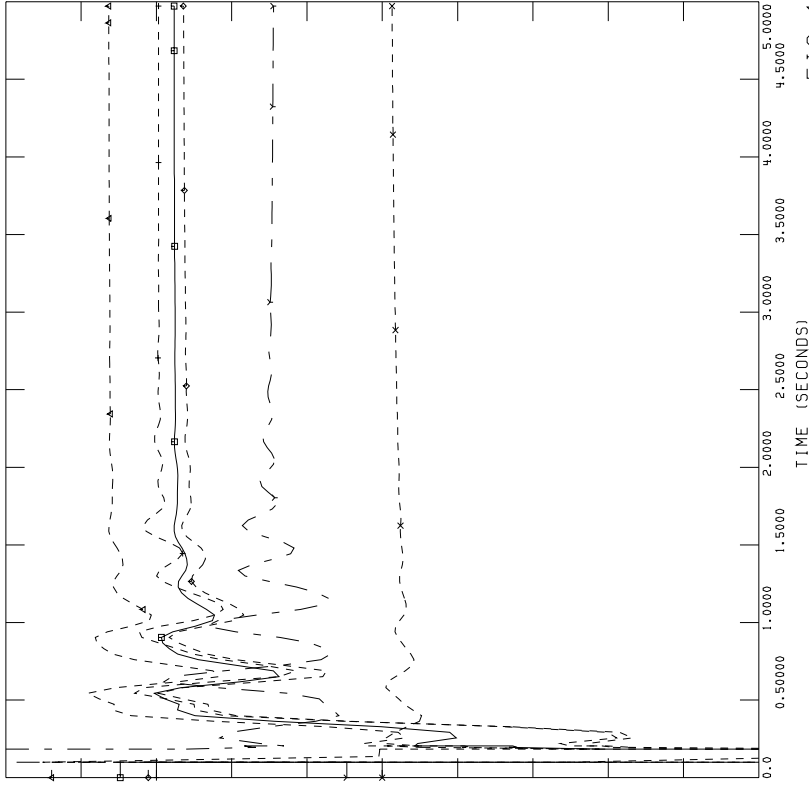
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 FIG_11A: VOLTAGE PROFILE



BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-16710N>NY-162QFW1269FETT4881FABC5123
 3-PHASE FAULT AT SEAFORTH 115KV
 LOSS OF 230/115KV AUTO&230KV CCT B22D

FILE: 3p_b22d_s1pa_wp34p5-34kv.bin
 CHNL = 113: CVARS 7673 [ALBEGT13.800] [I]]

0.50000	CHNL = 112: CVARS 7672 [P_ALBEP0.6900] [I]]	-0.5000
0.50000	CHNL = 117: [ETRM 7673 [P_ALBEGT13.800] [I]]	-0.5000
1.1000	CHNL = 116: [ETRM 7672 [P_ALBEP0.6900] [I]]	0.60000
1.1000	CHNL = 52: CVOLT 7652 [G00ERICH27.600]]	0.60000
1.1000	CHNL = 53: CVOLT 7350 [G00ERICH118.00]]	0.60000



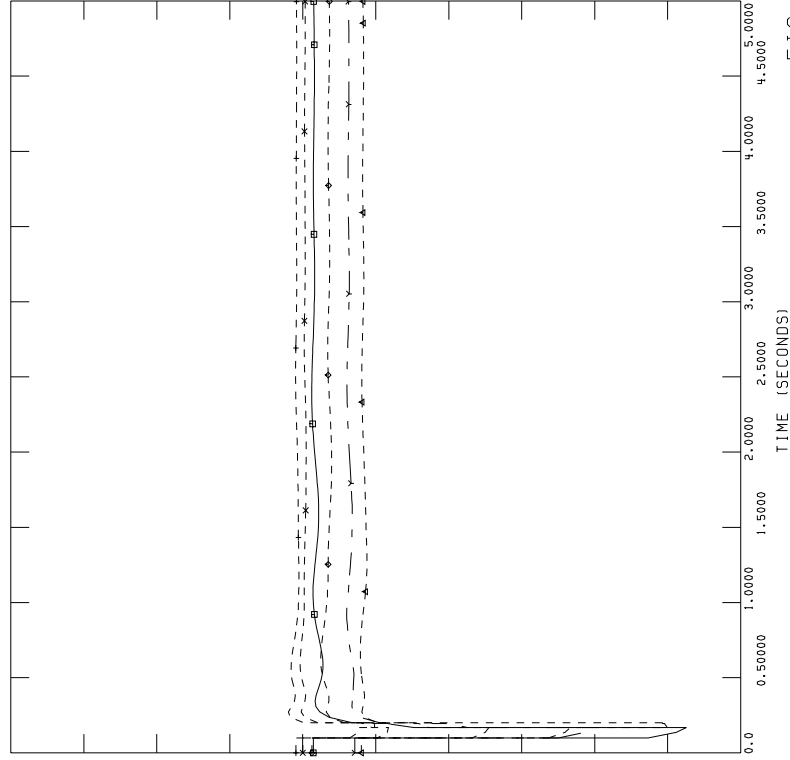
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 FIG_11B: LOCAL CONDITIONS



BLUMNT_BASE-----4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-16710N>NY-162QFW1269FETT4881FABC5123
 TWO CCT LINE-LINE-TO-GROUND FAULT AT WILLOW CREEK JUNCTION
 LOSS OF TWO 500KV CCT B562L&B563L

FILE: 11g_b-1_wcj_rej0pa_wp34p5-34kv.bin

1.5000	CHNL# 55: [VOLT 7306 [SEAFORTH118.00]]	0.50000
1.5000	CHNL# 34: [VOLT 7105 [LAMBTON 220.00]]	0.50000
1.5000	CHNL# 33: [VOLT 5105 [NANTICOK220.00]]	0.50000
1.5000	CHNL# 20: [VOLT 7000 [LONGWOOD500.00]]	0.50000
1.5000	CHNL# 26: [VOLT 4003 [MILTON 500.00]]	0.50000
1.5000	CHNL# 21: [VOLT 6400 [BRUCE A 500.00]]	0.50000



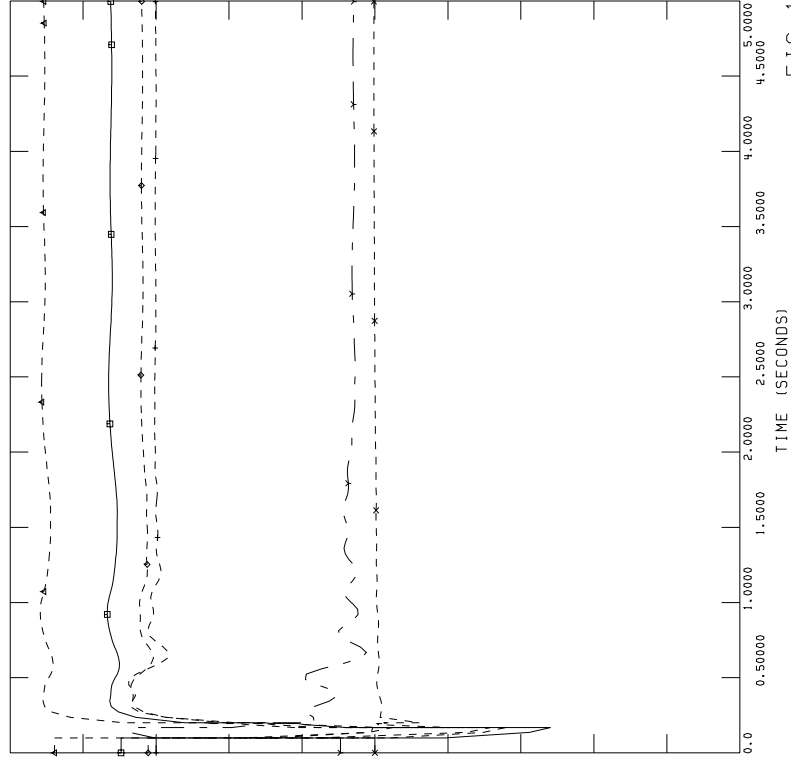
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 FIG_12A: VOLTAGE PROFILE



BLUMNT_BASE-----4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-16710N>NY-162QFW1269FETT4881FABC5123
 TWO CCT LINE-LINE-TO-GROUND FAULT AT WILLOW CREEK JUNCTION
 LOSS OF TWO 500KV CCT B562L&B563L

FILE: 11g_b-1_wcj_rej0pa_wp34p5-34kv.bin

0.50000	CHNL# 113: [VARS 7673 [P_ALBEGT13.800] [I]]	-0.50000
0.50000	CHNL# 112: [VARS 7672 [P_ALBEWP0.6900] [I]]	-0.50000
1.1000	CHNL# 117: [ETRM 7673 [P_ALBEGT13.800] [I]]	0.60000
1.1000	CHNL# 116: [ETRM 7672 [P_ALBEWP0.6900] [I]]	0.60000
1.1000	CHNL# 52: [VOLT 7652 [GODERICH27.600]]	0.60000
1.1000	CHNL# 53: [VOLT 7350 [GODERICH118.00]]	0.60000



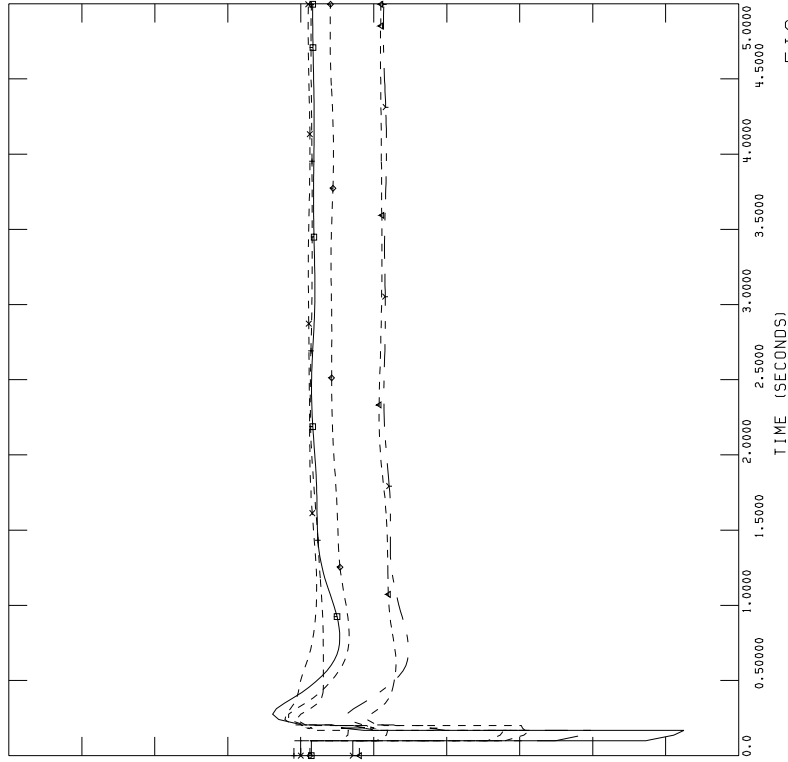
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 FIG_12B: LOCAL CONDITIONS



BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
 QNT>MI-332BLIP-1671ON>NY-1620FW1269FETT4881FABC5123
 TWO CCT LINE-LINE-TO-GROUND FAULT AT WILLOW CREEK JUNCTION
 LOSS OF TWO 500KV CCT B566V&B561M

FILE: 11g_b-m_wcj_rej2pa_wp34p5-34kv.bin
 CHNL = 55: [VOLT 7306 [SEAFORTH118.00]]

1.5000	CHNL = 34: [VOLT 7105 [LAMBTON 220.00]]	0.50000
1.5000	CHNL = 33: [VOLT 5105 [NANTICOK220.00]]	0.50000
1.5000	CHNL = 20: [VOLT 7000 [LONGWOOD500.00]]	0.50000
1.5000	CHNL = 26: [VOLT 4003 [MILTON 500.00]]	0.50000
1.5000	CHNL = 21: [VOLT 6400 [BRUCE A 500.00]]	0.50000



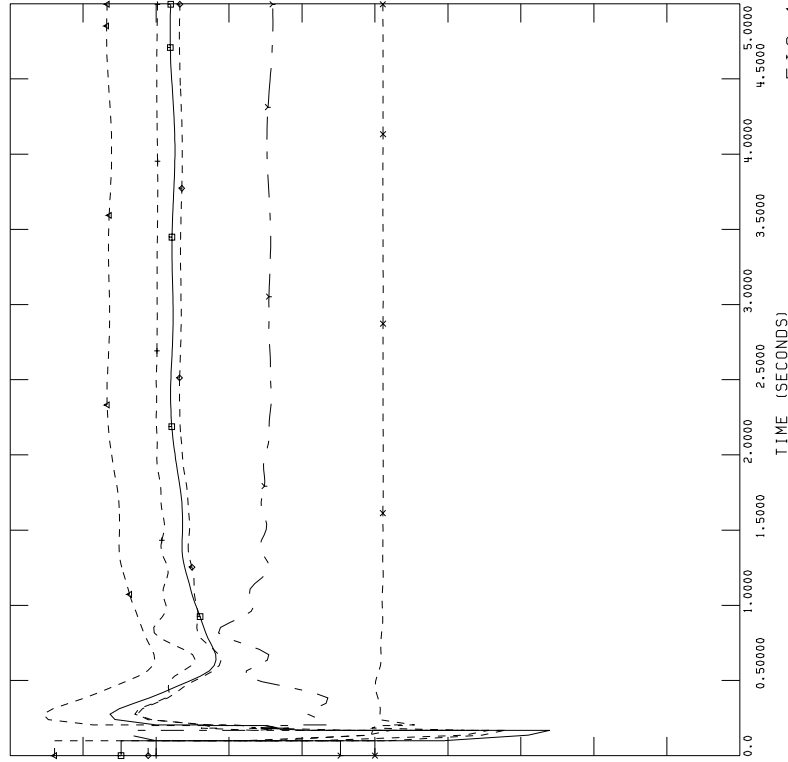
FRI, JUN 27 2003 11:21
 FIG_13A: VOLTAGE PROFILE



BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
 QNT>MI-332BLIP-1671ON>NY-1620FW1269FETT4881FABC5123
 TWO CCT LINE-LINE-TO-GROUND FAULT AT WILLOW CREEK JUNCTION
 LOSS OF TWO 500KV CCT B566V&B561M

FILE: 11g_b-m_wcj_rej2pa_wp34p5-34kv.bin
 CHNL = 113: [VARS 7673 [P_ALBEGT13.800] [I]]

0.50000	CHNL = 112: [VARS 7672 [P_ALBEP0.6900] [I]]	-0.5000
0.50000	CHNL = 117: [ETRM 7673 [P_ALBEGT13.800] [I]]	-0.50000
1.1000	CHNL = 116: [ETRM 7672 [P_ALBEP0.6900] [I]]	0.60000
1.1000	CHNL = 52: [VOLT 7652 [GODERICH27.600]]	0.60000
1.1000	CHNL = 53: [VOLT 7350 [GODERICH118.00]]	0.60000



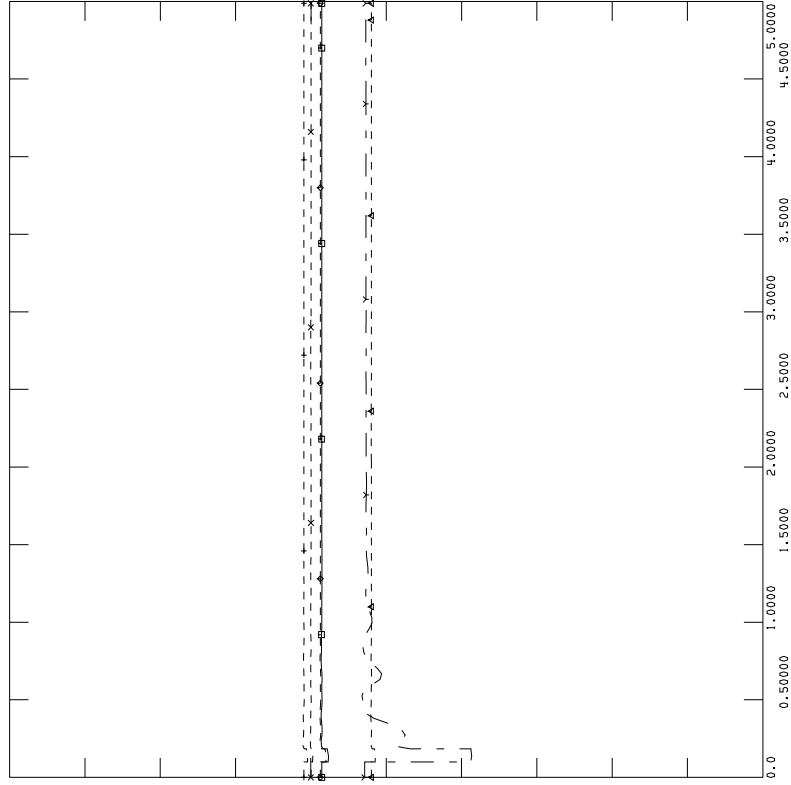
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 FIG_13B: LOCAL CONDITIONS



BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-16710N>NY-162QFW1269FETT4881FABC5123
 3-PHASE FAULT AT PORT ALBERT 34.5 KV
 LOSS OF ONE 34.5 KV FEEDER

FILE: 3p_feeder_pa34p5pa_wp34p5-34kv.bin

1.5000	CHNL = 55: CVOLT 7306 [SEAFORTH118.00]]	0.50000
1.5000	CHNL = 34: CVOLT 7105 [CLAMBTON 220.00]]	0.50000
1.5000	CHNL = 33: CVOLT 5105 [NANTICOK220.00]]	0.50000
1.5000	CHNL = 20: CVOLT 7000 [LONGWOOD500.00]]	0.50000
1.5000	CHNL = 26: CVOLT 4003 [MILTON 500.00]]	0.50000
1.5000	CHNL = 21: CVOLT 6400 [BRAUCE A 500.00]]	0.50000



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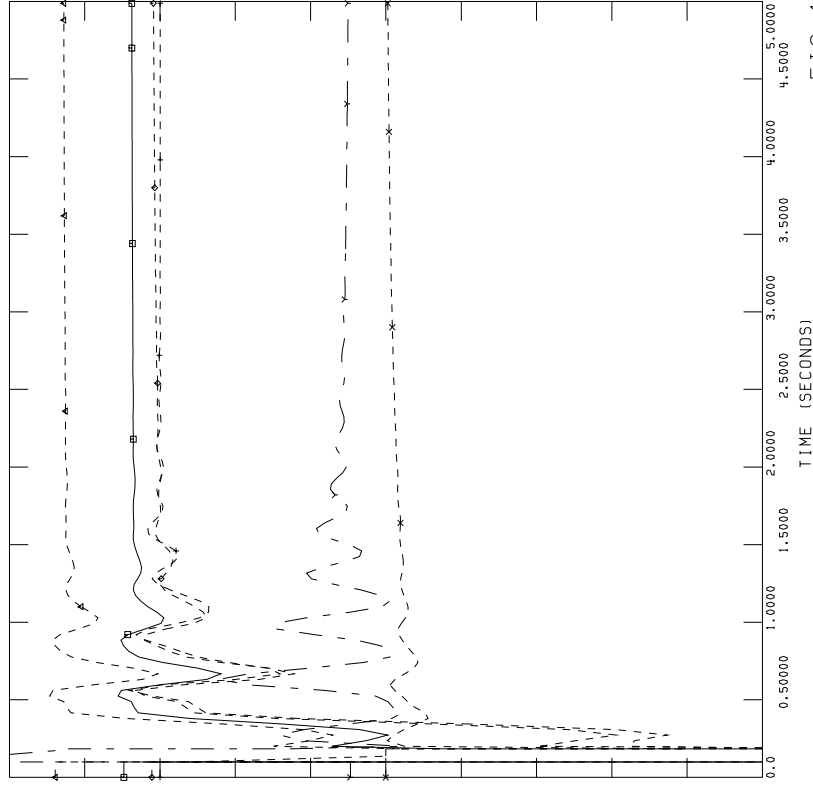
FIG_14A: VOLTAGE PROFILE



BLUMNT_BASE----- 4LB7N4LK3D6B6P1LX
 ONT>MI-332BLIP-16710N>NY-162QFW1269FETT4881FABC5123
 3-PHASE FAULT AT PORT ALBERT 34.5 KV
 LOSS OF ONE 34.5 KV FEEDER

FILE: 3p_feeder_pa34p5pa_wp34p5-34kv.bin

0.50000	CHNL = 112: CVARS 7672 [P_ALBEWP0.6900] [1]]	-0.5000
0.50000	CHNL = 117: [ETRM 7673 [P_ALBEGT13.800] [1]]	-0.5000
1.1000	CHNL = 116: [ETRM 7672 [P_ALBEWP0.6900] [1]]	0.60000
1.1000	CHNL = 52: CVOLT 7652 [GODERICH27.600]]	0.60000
1.1000	CHNL = 53: CVOLT 7350 [GODERICH118.00]]	0.60000



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FIG_14B: LOCAL CONDITIONS