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System Impact Assessment Report (Addendum)

Essa x Stayner 230 kV Transmission

CONNECTION ASSESSMENT & APPROVAL PROCESS

Final Draft Report

CAA ID 2005-190

Applicant: Hydro One Networks

**Transmission Assessments & Performance
Department**

2008 February 12

REPORT

System Impact Assessment Report – Disclaimer

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Reason for Issue	Change of Configuration and Addition of In-line Breaker
Effective Date	February 12, 2008

System Impact Assessment Report

Hydro One Networks Inc.

Acknowledgement

The IESO wishes to acknowledge the assistance of Hydro One in completing this assessment.

Disclaimers

IESO

This report has been prepared solely for the purpose of assessing whether the connection applicant's proposed connection with the IESO-controlled grid would have an adverse impact on the reliability of the integrated power system and whether the IESO 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 IESO by the connection applicant and the transmitter(s) at the time the assessment was carried out. The IESO 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 IESO. 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 IESO-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 IESO in accordance with Chapter 4, section 6 of the Market Rules. The IESO assumes no responsibility to any third party for any use, which it makes of this report. Any liability which the IESO 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 IESO provides a draft of this report to the connection applicant, you must be aware that the IESO may revise drafts of this report at any time in its sole discretion without notice to you. Although the IESO 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.

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Special Notes and Limitations of Study Results

The results reported in this study are based on the information available to Hydro One, 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 available 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 study, short circuit adequacy is assessed only for Hydro One breakers and does not include other Hydro One facilities. The short circuit results are only for the purpose of assessing the capabilities of existing Hydro One 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 Hydro One and discussed with the connection proponent upon request.

The ampacity ratings of Hydro One facilities are established based on assumptions used in Hydro One 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 under the current IESO Connection Assessment and Approval process. Additional facility studies may be necessary to confirm constructability and the time required for construction. Further studies at more advanced stages of the project development may identify additional facilities that need to be provided or that require upgrading.

Final Draft Report

Assessment Summary

Hydro One Networks Inc.



**Essa x Stayner 230 kV Transmission
(Addendum)**

CAA ID Number: 2005-190

1.0 General Description

Hydro One is proposing to establish a new 230 kV transmission corridor between Essa TS and Stayner TS to be in-service by April 2009. Under this proposal, the existing Essa TS 230 kV station arrangement shown in **Figure 1** will need to be reconfigured.

The Essa x Stayner 230 kV Transmission System Impact Assessment was completed (CAA ID 2005 -190) on October 18, 2006. **Figure 2** shows the Essa TS 230 kV station arrangement that was assessed at the time. In addition, an expedited SIA (CAA ID 2007 – EX339) was completed on September 30, 2007 to address the retirement of the Stayner TS SC2B capacitor when the reinforcement is to come into service.

Recently, Hydro One has submitted a modified design of the Essa TS 230 kV station to the IESO. The modifications include:

- Reconfiguration of E9V, Essa T1, Essa T3 and Essa x Stayner 230 kV circuit
- Addition of an in-line breaker to one of the new Essa x Stayner 230 kV circuits

Figure 3 shows the proposed modified Essa TS 230 kV station configuration with the affected elements highlighted. **Figure 4** illustrates the new equipment associated with the additional in-line breaker.

These modifications will come into effect April 2009. The purpose of this Addendum is to evaluate whether the new contingencies introduced by the changes will have an adverse impact on the IESO grid.

System Impact Assessment Report for Essa x Stayner 230 kV Transmission (Addendum)

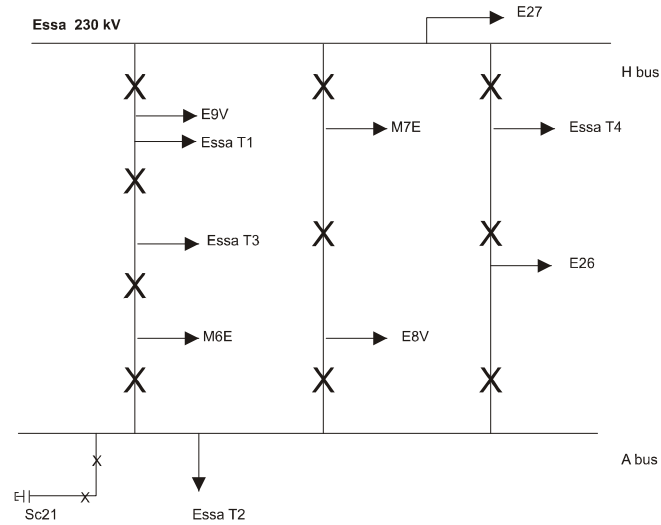


Figure 1 - Existing Configuration

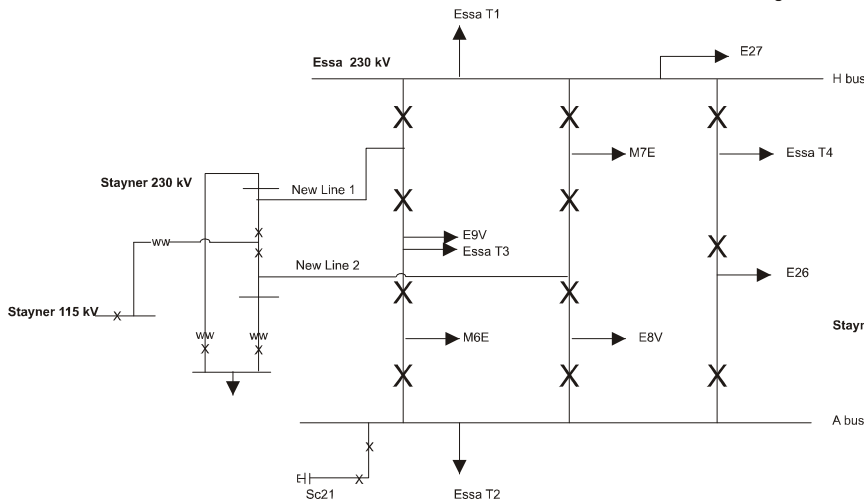


Figure 2- Proposed Change - Original SIA Specifications

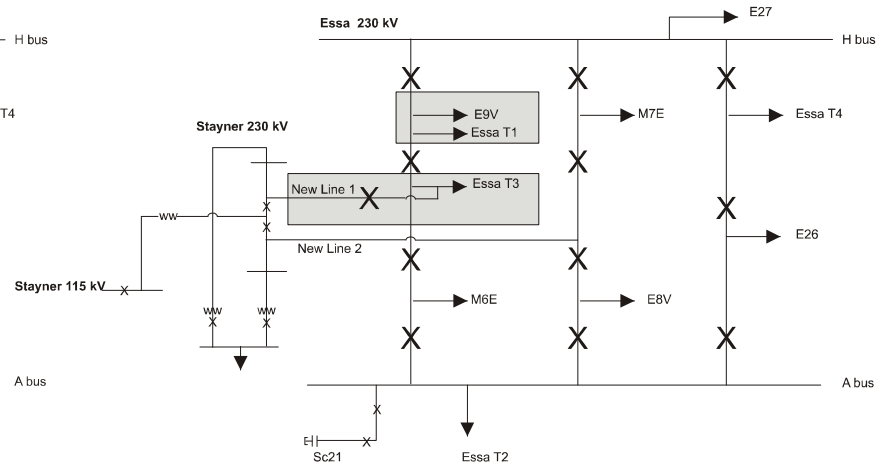


Figure 3 -Proposed Change - New

 Denotes changes/new equipment

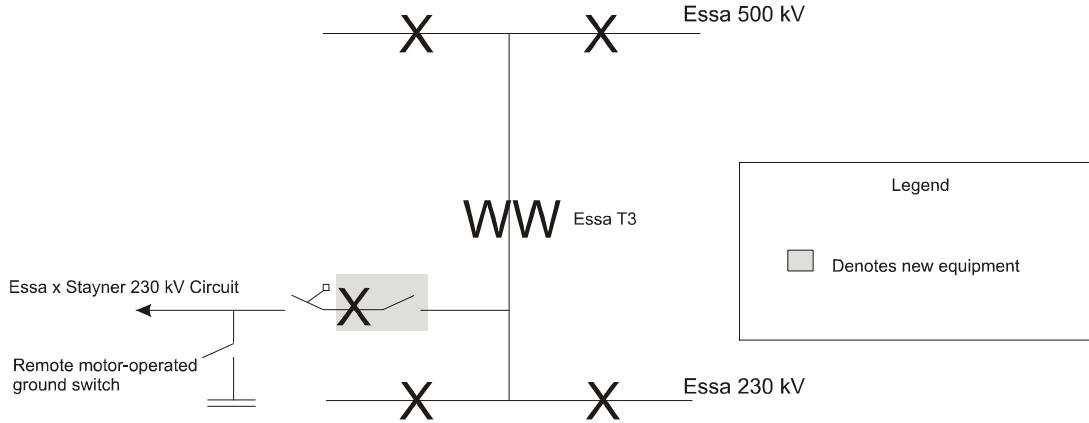


Figure 4 Addition of In-line Breaker at Essa x Stayner 230 kV Circuit

2.0 Data Verification

Specifications associated with the new in-line breaker and manual breaker switch provided by Hydro One are listed below. The in-line breaker is adequately rated, meeting the Transmission Code Requirement.

230 kV In-line Breaker	Values
Rated voltage (kV)	250 kV
Rated continuous current (A)	≥ 2000 A
Interrupting Time (cycles)	3 cycles
Rated symmetrical interrupting capability (kA)	63 kA
230 kV Disconnection Switch	Values
Rated line-to-line voltage (kV)	250 kV
Rated summer continuous current (A)	≥ 2000 A

3.0 New Contingencies and Assumptions

With the Essa 230 kV station configuration specified in the original SIA as reference, the following table lists the new contingencies as a result of the proposed reconfiguration:

List of New Contingencies Due to Proposed Reconfiguration	
Contingency	Singles
C1	Loss of E9V + Essa T1 ¹
C2	Loss of Essa x Stayner Circuit + Essa T3
Contingency	Doubles
C3	Loss of E8V + E9V + Essa T1 + Orangeville T4 ¹
C4	Loss of E9V + Essa T1 + E27 ¹
C5	Loss of E9V + Essa T1 + Loss of Essa T3 + Essa x Stayner 230 kV Circuit
C6	Loss of Essa x Stayner 230 kV Circuit + Essa T3 + M6E
C7	Loss of Essa x Stayner 230 kV Circuit + Stayner 230/44 kV transformer + Essa T3

Notes: (1) This is a recognized contingency under the existing Essa 230 kV configuration (Figure 1).

A post-contingency voltage and thermal analysis were performed for contingencies C1 to C7. The analysis assumed the same summer “High Negative BLP” study conditions as presented in the Essa x Stayner 230 kV Transmission System Impact Assessment (CAA ID 2005 -190). Under post-contingency analysis the active power loads were converted into constant current and constant admittance loads equally. The reactive power loads were converted only into constant admittance loads. The analysis also assumed Essa 230 kV shunt capacitor SC21 to be in-service.

4.0 Thermal Analysis

The following table lists the elements that were monitored for the thermal analysis and their respective post-contingency ratings:

	Monitored Element	Post-Contingency Rating
E1	E8V (from Essa to Alliston JCT) ¹	1414 A
E2	E8V (from Everett JCT to Orangeville TS) ¹	1200 A
E3	Essa T4 ²	1454 MVA
E4	Essa x Stayner 230 kV Circuit ^{1,4}	1220 A
E5	M7E (from Midhurst TS to Essa TS) ¹	1017 A
E6	Essa T2 ³	187 MVA
E7	S2S ¹ (from Meaford TS to Stayner TS) ¹	861A

Notes:

1. Value represents the Limited Time Rating based on 35°C and 5 km/h wind speed with a pre-flow of 75% of the continuous rating.
2. Value represents the 15 minute Limited Time Rating.
3. Value represents the 10 day Limited Time Rating. The 10 day LTR is used in this case as the transformer supplies radial load.
4. For contingencies in which both Essa x Stayner 230 kV circuits are not lost, this refers to the remaining Essa x Stayner 230 kV circuit.

4.1 Post-contingency Thermal Analysis

The following table shows the projected post-flow as a percentage of the post-contingency rating for the monitored elements under contingencies C1 to C7. All post contingency flows are within post-contingency ratings.

Contingency	Projected Post-Flow/Post-Contingency Rating (%)						
	E1	E2	E3	E4	E5	E6	E7
C1	15.97	31.84	21.22	2.41	25.75	58.69	38.41
C2	9.43	26.27	32.67	4.34	23.84	25.13	39.86
C3	-	-	20.86	2.52	27.16	58.70	40.42
C4	14.80	32.04	21.48	2.32	25.25	59.33	38.25
C5	16.43	39.51	36.55	3.84	22.68	58.82	41.71
C6	9.01	23.95	29.37	4.73	51.87	25.35	38.73
C7	9.17	26.27	32.68	6.06	23.68	25.08	39.51

5.0 Voltage Decline

The ΔV given in the following voltage analysis represents the worst of the pre-ULTC and post-ULTC values. All voltage declines were found to be within IESO criteria.

Monitored Busses	Projected voltage decline percentages (%)						
	C1	C2	C3	C4	C5	C6	C7
Bruce A 230 kV	0.17	0.22	0.04	0.19	0.22	0.18	0.23
Detweiler 230 kV	0.96	1.04	0.61	1.01	1.06	0.89	1.07
Essa 115 kV	2.81	1.10	1.56	3.33	3.91	0.59	1.25
Essa 230 kV	0.65	1.08	-0.53	1.09	1.69	0.57	1.22
Hanover 115 kV	0.25	0.53	-0.32	0.32	0.48	0.38	0.57
Hanover 230 kV	0.23	0.51*	-0.82	0.29	0.43	0.36	0.53
Meaford 115 kV	0.51	0.94	-0.06	0.71	1.32	0.60	1.13
Orangeville 230 kV	0.53	0.84	1.83*	0.65	0.85	0.58	0.90
Owen Sound 115 kV	0.32	0.56	-0.06	0.41	0.69	0.38	0.64
Owen Sound 230 kV	0.26	0.44	-0.02	0.32	0.52	0.31	0.49
Stayner 115 kV	0.66	1.27	-0.20	1.00	1.86	0.78	1.58
Stayner 230 kV	0.65	1.27	-0.49	1.08	1.87	0.77	1.68
Palmerston 115 kV	0.29	0.57	-0.29	0.35	0.52	0.42	0.61

* indicates a post contingency pre-ULTC voltage decline value. Voltage declines are otherwise given as a post contingency post-ULTC value.

6.0 Conclusions

The assessment of the Essa 230 kV switchyard re-configuration and new 230 kV in-line breaker concluded that:

- (1) The proposed changes will not have a material adverse effect on the IESO-controlled grid.
- (2) The new contingencies do not result in thermal overloading of the remaining lines.
- (3) The post-contingency voltages for the new contingencies were found to be within IESO criteria.

7.0 Requirements for Connection

With respect to the addition of the in-line breaker, the IESO requires that:

- (1) The status of all isolating disconnect switches and breaker be monitored on a continual basis
- (2) The proponent must notify the IESO as soon as it becomes aware of any changes to the assumptions made in the connection assessment. The IESO will determine whether these changes require a reassessment.

8.0 Notification of Approval

This expedited System Impact Assessment concludes that the Essa 230 kV switchyard reconfiguration and additional 230 kV in-line breaker to one of the new Essa TS x Stayner 230 kV circuits is not expected to have a material adverse effect on the IESO-controlled grid. The Notification of Approval to Connect, issued on October 19, 2006, remains valid.