ADDENDUM

Power to Ontario.
On Demand.

System Impact Assessment Addendum

Connection Assessment & Approval Process

Project: **Leaside to Bridgman Reinforcement**
CAA ID 2006-238

Applicant: **Hydro One Networks Inc.**

Market Facilitation Department

Date: January 25th, 2010

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System Impact Assessment Addendum

Acknowledgement

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

Disclaimers

IESO

This addendum 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 conditional approval or disapproval of the proposed connection under Chapter 4, section 6 of the Market Rules.

Conditional approval of the proposed connection is based on information provided to the IESO by the connection applicant and Hydro One 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 Hydro One at the request of the IESO. Furthermore, the conditional approval is subject to further consideration due to changes to this information, or to additional information that may become available after the conditional approval has been granted.

If the connection applicant has engaged a consultant to perform connection assessment studies, the connection applicant acknowledges that the IESO will be relying on such studies in conducting its assessment and that the IESO assumes no responsibility for the accuracy or completeness of such studies including, without limitation, any changes to IESO base case models made by the consultant. The IESO reserves the right to repeat any or all connection studies performed by the consultant if necessary to meet IESO requirements.

Conditional 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, the conditional 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 addendum has not been prepared for any other purpose and should not be used or relied upon by any person for another purpose. This addendum 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 addendum. Any liability which the IESO may have to the connection applicant in respect of this addendum is governed by Chapter 1, section 13 of the Market Rules. In the event that the IESO provides a draft of this addendum to the connection applicant, the connection applicant must be aware that the IESO may revise drafts of this addendum at any time in its sole discretion without notice to the connection applicant. 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 the most recent version of this addendum is being used.

Hydro One

The results reported in this addendum are based on the information available to Hydro One, at the time of the study, suitable for a preliminary assessment of this transmission system reinforcement 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 facilities on load and generation customers.

In this addendum, short circuit adequacy is assessed only for Hydro One circuit breakers. The short circuit results are only for the purpose of assessing the capabilities of existing Hydro One circuit breakers and identifying upgrades required to incorporate the proposed facilities. These results should not be used in the design and engineering of any new or existing facilities. The necessary data will be provided by Hydro One and discussed with any 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 facilities 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.

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Summary

Hydro One is proposing to install a new 115 kV circuit from Leaside TS to Bridgman Junction and to upgrade various sections of the existing L14W and L15W circuits. The new 115 kV circuit would be configured to supply Bridgman T13, and will be connected to the existing L15W Bridgman Junction x Wiltshire section; the L15W circuit would end at Bridgman TS; Bridgman T11 and T12 transformers would be transferred from L13W to L15W Leaside x Bridgman section. A new 115 kV motorized disconnect switch is also proposed to be installed on the new circuit at Bridgman Junction. The project has an expected in-service date of April, 2013.

The purpose of this addendum is to analyze the effects of the proposed connection arrangement on the reliability of the IESO controlled grid using revised/updated load forecasts from the original forecasts provided by Hydro One and used in the original SIA. The new proposal also contains two more motorized disconnect switches to be installed at Bridgman Junction: a normally open disconnect switch between L13W and Bridgman T11+T12, and a normally closed disconnect switch between L15W and Bridgman T11+T12.

Conclusions, Requirements and Recommendations

The study results concluded the following:

1. Using extreme weather peak load forecasts provided for years 2010 - 2025, the loadings with all elements in service on the Leaside to Wiltshire circuits remain well below their continuous ratings.

2. When one element is on outage, the loadings remain below the long term emergency thermal ratings, for load forecasts up to and including the year 2025.

3. Using extreme weather peak load forecasts provided for years 2010 - 2025, configurations with two Leaside to Wiltshire circuits out of service, resulting from single-element contingencies when one circuit is out-of-service pre-contingency, can result in the loading of the remaining two circuits above the long term emergency (LTE) ratings and short term emergency ratings (STE). A possible mitigating measure to the overloading of the circuits is to open LV breakers behind the Bridgman transformers during outages, so that load is lost by configuration following a contingency.

   Further planned load curtailment at Dufferin TS and Bridgman TS, which must occur within 15 minutes after the contingency, will return the post-contingency loading of the remaining circuits to below their LTE values. Planned load curtailment or load rejection of up to 150 MW is an acceptable control action as a response to N-2 conditions (i.e. two elements out of service), to help obey the Load Security Criteria, as per the *IESO Transmission Assessment Criteria.*

Recommendations

The revised recommendations are given below. These recommendations replace the recommendations in the original SIA.

1. The original SIA recommended the new circuit to have its own terminal at Leaside TS for operation flexibility and to prevent operating challenges during switching, and potential feed-back during certain element outages and system configurations. Hydro One decided to create a terminal for the new circuit by installing one additional 115 kV breaker at Leaside TS on the same diameter with the

circuits L4C and H8LC, resulting in the three circuits connecting to a one-and-a-third breaker diameter configuration, as shown in Figure 2.

2. Even though the 230 kV Richview x Manby circuits were not part of the scope of the original SIA study, it was identified that the flow on the R15K circuit was approaching or was above its long term emergency rating for various contingencies. Future assessments are recommended to be carried out for Richview-Manby-Cooksville area and reinforcements to be identified for the region.

3. Under certain system conditions, in order to maintain the reliability of the bulk system, the IESO may have to transfer load from Leaside to Manby East supply. The process of transferring Dufferin TS from normal Leaside supply to Manby East supply would not change under the proposed configuration.

   The original SIA identified that when Bridgman TS is on Manby East supply, Bridgman T11 and T12 transformers would have to be offloaded or removed from service. In this configuration, a next single contingency would result in load loss at Bridgman TS. To ensure a greater load supply security when Bridgman TS is connected to Manby East, Hydro One decided to install two more motorized disconnect switches at Bridgman Junction, which will allow Bridgman T11 and T12 to be transferred back to the L13W circuit.

Notification of Approval for Connection Proposal

It is recommended that a Notification of Conditional Approval be issued for the new 115 kV circuit and the refurbishing of the L14W and L15W circuits. Final approval will be subject to the requirements described below under the heading "IESO Requirements".

IESO Requirements

General Requirements:

1. Appendix 4.1, reference 2 of the Market Rules states that under normal conditions voltages in the south are maintained within the range of 113 kV to 127 kV. Thus, the IESO requires that the 115 kV equipment in southern Ontario must have a maximum continuous voltage rating of at least 127 kV.

   Fault interrupting devices must be able to interrupt fault current at the maximum continuous voltage of 127 kV.

2. The Transmission System Code (TSC), Appendix 2 establishes maximum fault levels for the transmission system. For the 115 kV system, the maximum 3 phase symmetrical fault level is 50 kA and the single line to ground (SLG) symmetrical fault level is 50 kA.

   The TSC requires that new equipment be designed to sustain the fault levels in the area where the equipment is installed. If any future system enhancement results in an increased fault level higher than the equipment's capability, the connection applicant is required to replace the equipment at their own expense with higher rated equipment capable of sustaining the increased fault level, up to the TSC's maximum fault level of 50 kA for the 115 kV system.

3. In accordance with the telemetry requirements for transmitters (see Appendices 4.16, 4.20 and 4.21 of the Market Rules) the connection applicant must install equipment at this project with specific performance standards to provide telemetry data to the IESO. The data is to consist of certain equipment status and operating quantities which will be identified during the IESO Market Entry Process.

As part of the IESO Facility Registration/Market Entry process, the connection applicant must also complete end to end testing of all necessary telemetry points with the IESO to ensure that standards are met and that sign conventions are understood. All found anomalies must be corrected before IESO final approval to connect any phase of the project is granted.

4. Prior to connecting to the IESO controlled grid, the proposed facility must be compliant with the applicable reliability standards set by the North American Electric Reliability Corporation (NERC) and the North East Power Coordinating Council (NPCC). A list of applicable standards, based on the proponent's/connection applicant's market role/OEB licence can be found here:

   http://www.ieso.ca/imoweb/ircp/reliabilityStandards.asp

   In support of the NERC standard EOP-005, the proponent/ connection applicant may meet the restoration participant criteria. Please refer to section 3 of Market Manual 7.8 (Ontario Power System Restoration Plan) to determine its applicability to the proposed facility.

   The IESO monitors and assesses market participant compliance with these standards as part of the IESO Reliability Compliance Program. To find out more about this program, visit the webpage referenced above or write to ircp@ieso.ca.

   Also, to obtain a better understanding of the applicable reliability obligations and find out how to engage in the standards development process, we recommend that the proponent/ connection applicant join the IESO's Reliability Standards Standing Committee (RSSC) or at least subscribe to their mailing list at rssc@ieso.ca. The RSSC webpage is located at: http://www.ieso.ca/imoweb/consult/consult_rssc.asp.

5. The connection applicant must complete the IESO Facility Registration/Market Entry process in a timely manner before IESO final approval for connection is granted. Models and data, including any controls that would be operational, must be provided to the IESO. This information should be submitted at least seven months before energization to the IESO-controlled grid, to allow the IESO to incorporate this project into IESO work systems and to perform any additional reliability studies.

   As part of the IESO Facility Registration/Market Entry process, the connection applicant must provide evidence to the IESO confirming that the equipment installed meets the Market Rules requirements and matches or exceeds the performance predicted in this assessment. This evidence shall be either type tests done in a controlled environment or commissioning tests done on-site. In either case, the testing must be done not only in accordance with widely recognized standards, but also to the satisfaction of the IESO. Until this evidence is provided and found acceptable to the IESO, the Facility Registration/Market Entry process will not be considered complete and the connection applicant must accept any restrictions the IESO may impose upon this project's participation in the IESO administered market or connection to the IESO-controlled grid.

   The evidence must be supplied to the IESO within 30 days after completion of commissioning tests. Failure to provide evidence may result in disconnection from the IESO-controlled grid.

   If the submitted models and data differ materially from the ones used in this assessment, then further analysis of the project will need to be done by the IESO.

Protection Requirements:

1. Protection systems must be designed to satisfy all the requirements of the Transmission System Code as specified in Schedules E and G of Appendix 1 and any additional requirements identified by the transmitter. New protection systems must be coordinated with existing protection systems.

2. The new facilities must be protected by two redundant protection systems according to section 8.2.1a of the TSC. These redundant protections systems must satisfy all requirements of the TSC but in particular they may not use common components, common battery banks or common secondary CT or PT windings.

3. Protective relaying must be set to ensure that transmission equipment remains in-service for voltages between 94% of the minimum continuous and 105% of the maximum continuous values in the Market Rules, Appendix 4.1.

4. The transmitter shall identify any protection relay modifications (e.g. equipment and settings) required to incorporate the new facility into the integrated power system. To allow sufficient time to assess the impact on power system reliability, the transmitter must submit any proposed protection relay modifications to the IESO as soon as the protection assessment for the new facility is finished or at least six (6) months before any actual modifications are to be implemented on the existing protection systems.

   The IESO will evaluate the impact on system reliability due to any protection relay modifications and any modifications to functionality, timing or reach. The IESO will not assess aspects of protection systems which are solely the accountability of the transmitter (e.g. coordination of protection relays).

   Send documentation for protection modifications triggered by new or modified primary equipment (i.e. new or replacement relays) to connection.assessments@ieso.ca.

   For protection modifications that are not associated with new or modified equipment (i.e. protection setting modifications) please send documentation to protection.settings@ieso.ca.

– End of Section –

1. Project Description

In 2006 Hydro One and Toronto Hydro commissioned the *City of Toronto Electric Supply Study – Adequacy of Transmission Facilities and Transmission Supply Plan for the Central Toronto Area 2006-2021*. The study identified a series of reinforcements in the power system required to ensure an adequate transmission system to meet the electricity demand over the next 15 years. Part of the study focused on the Leaside to Manby 115 kV system.

To eliminate thermal overload issues in the Leaside to Manby 115 kV area resulting from the local load growth, Hydro One proposed the following changes:

- Construct a new 115kV circuit from Leaside TS to Bridgman Junction
- Upgrade various sections of the existing L14W and L15W circuits
- Reconfigure the new 115kV circuit from Leaside TS to Bridgman Junction so that it would supply Bridgman T13, and be connected to the existing L15W Bridgman Junction x Wiltshire section
- Reconfigure the existing L15W circuit such that it would end at Bridgman TS and supply T11 and T12, transferred from L13W.
- Install a new 115 kV motorized disconnect switch on the new circuit at Bridgman Junction.
- Install two more motorized disconnect switches at Bridgman Junction: a normally open disconnect switch between L13W and Bridgman T11+T12, and a normally closed disconnect switch between L15W and Bridgman T11+T12.

The SIA assessing the impact of these proposed changes was completed in 2006 and noted that under the proposed system configuration and with Hydro One forecasted load growth estimates, post-contingency thermal overloading of the L13W circuit was a possibility by the year 2014.

Due to changes in load growth and load patterns since that time, Hydro One and Toronto Hydro have submitted revised forecasts for the load supplied by Dufferin TS and Bridgman TS.

The purpose of this Addendum is to identify the impact these new load forecasts on system reliability.

The new facilities have a scheduled initial in-service of April 2013.

– End of Section –

2. Review of Connection Proposal

2.1 Connection Arrangement

The proposed connection arrangement with the proposed changes highlighted is presented in Figure 1 below:

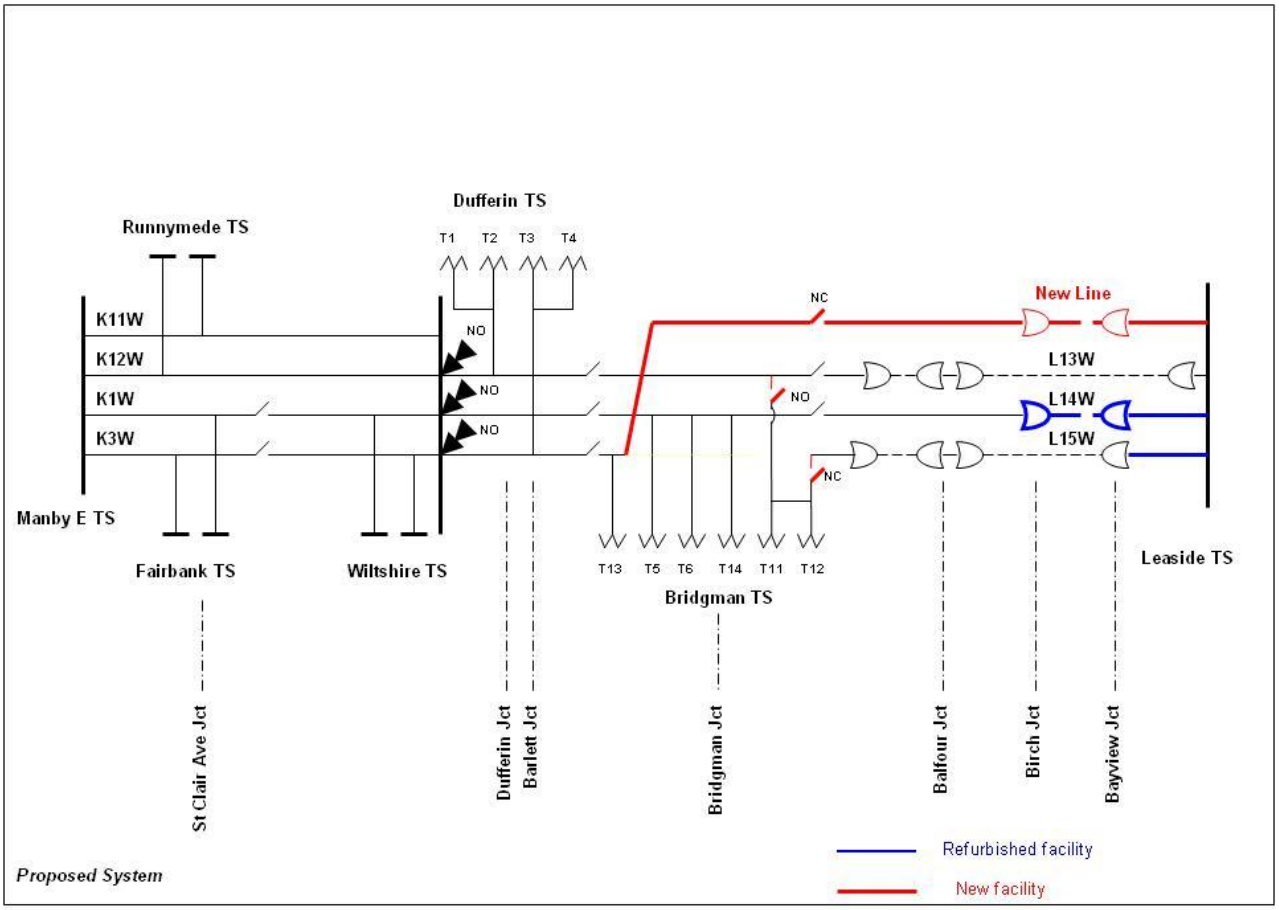

Figure 1: Proposed Connection

(a) L14W/L15W will be rebuilt as a three circuit 115 kV line between Leaside TS and Bayview Jct. (about 1.7km). All three circuits will have an ampacity rating of 1200A at 35°C ambient temperature.

(b) Two underground 115kV cable circuits will be built between Bayview Jct. and Birch Jct. (about 2.2km). Both U/G cable circuits will have an ampacity rating of 1200A. One cable will replace the old L14W cable in that section. The other cable will be for the new circuit.

(c) Birch Jct. x Bridgman TS overhead section of line L14W carries an idle 115kV circuit. The idle section on this line will be used for the new circuit. It will have an ampacity rating of 1200A at 35°C ambient temperature.

(d) The new circuit will be incorporated at Leaside on the same diameter with L4C and H8LC, by adding a new 3000 A breaker – see Figure 3.

(e) A new motorized disconnect switch will be installed on the new circuit at Bridgman Junction, on Leaside side.

(f) The L15W circuit will be open at Bridgman TS. The new circuit will be connected to the Bridgman TS to Wiltshire TS section of the L15W circuit, and will supply Bridgman T13, and Dufferin T3 and T4.

(g) Bridgman T11 and T12 will be disconnected from L13W and connected to L15W, on Leaside side. Two motorized disconnect switches at Bridgman Junction, a normally open disconnect switch between L13W and Bridgman T11+T12, and a normally closed disconnect switch between L15W and Bridgman T11+T12, will allow this transfer.

As a result of the proposed changes, Bridgman TS will be supplied by L14W, L15W and the new circuit, and Dufferin TS will be supplied by the new circuit and L13W.

The original SIA recommended the new circuit to have its own terminal at Leaside TS for operation flexibility and to prevent operating challenges during switching, and potential feed-back during certain element outages and system configurations. Hydro One decided to create a terminal for the new circuit by installing one additional 115 kV breaker at Leaside TS on the same diameter with the circuits L4C and H8LC, resulting in three circuits connecting to a one-and-a-third breaker diameter configuration, as shown in Figure 2.

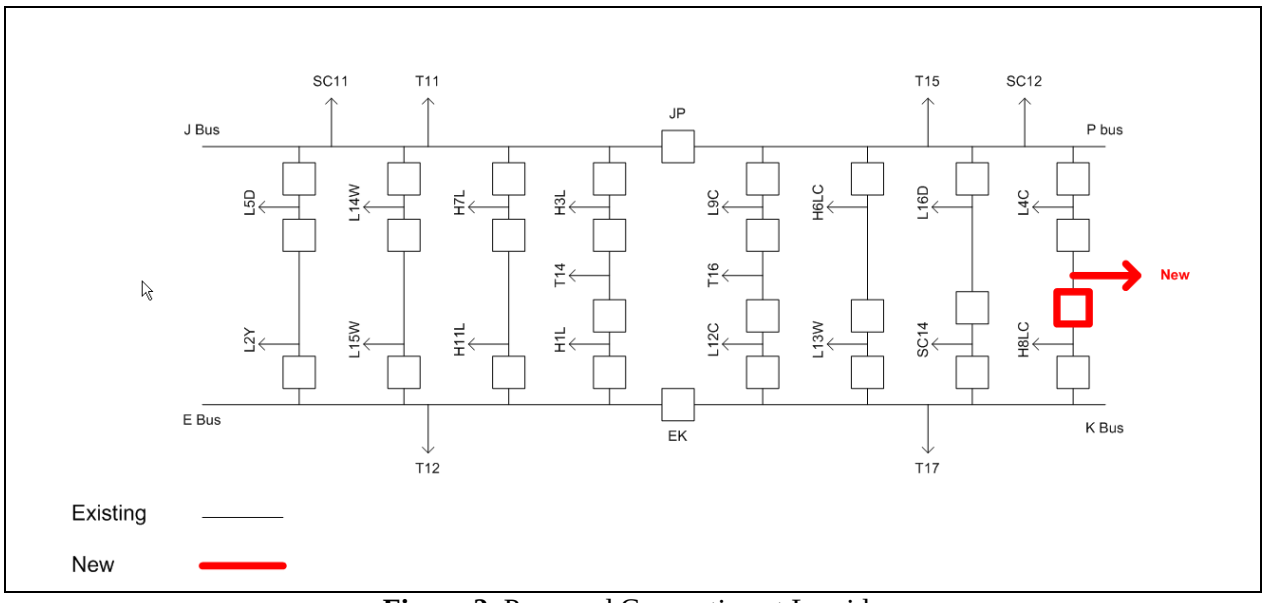

Figure 2: Proposed Connection at Leaside

– End of Section –

3. Load Forecasts

Table 1 below, shows the revised Hydro One extreme weather forecasts from 2010 – 2025. They are based on summer 2009 loads and Toronto Hydro load forecasts for Dufferin and Bridgman TS load.

	Actual	Forecast MW													
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2023	2025
Bridgman	163	164	165	167	168	170	171	173	174	176	178	179	181	184	187
Dufferin	123	127	128	129	130	131	132	134	135	136	137	138	140	142	145
Total	288	290	293	296	298	301	304	306	309	312	315	317	320	326	332

Table 1: Hydro One Revised Load Forecasts

Table 2 shows the original Hydro One forecasts provided in 2006 which were used in the original SIA studies and report. A comparison of the old forecast with the actual peak load condition in 2009 shows a 27 MW total lower than expected actual demand than what was forecasted in 2006. The revised forecast for subsequent years shows a slower average expected growth in demand than the original forecast (1.0089% vs. 1.25%).

	Forecast MW												
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Bridgman	172	174	176	177	179	181	183	184	186	188	190	192	194
Dufferin	143	144	146	147	149	150	152	153	155	156	158	159	161
Total	315	318	322	324	328	331	335	337	341	344	348	351	355

Table 2: Original Hydro One 2006 Load Forecast

Table 3 shows the IESO forecasted extreme weather demand for all of Ontario and the Toronto area.

	Ontario Demand (MW)	Toronto Demand (MW)
2010	26,863	10,273
2011	26,658	10,964
2012	26,300	10,860
2013	25,881	10,644
2014	25,655	10,692
2015	25,428	10,597
2016	25,482	10,620
2017	25,346	10,563
2018	25,298	10,543

Table 3: IESO Ontario and Toronto Area Demand Forecast

– End of Section –

4. System Impact Studies

This connection assessment study focused on pre and post contingency thermal analysis on all main sections of the 115 kV circuits between Leaside TS and Manby East TS and the 230/115 kV Leaside TS autotransformers supplying the area.

No steady state voltage decline studies have been completed as the original SIA identified no voltage issues, using more conservative system conditions than system conditions used in the studies for this addendum.

4.1 Study Assumptions

The PSS/E software was used to carry out the thermal analyses.

Based on the information provided by Hydro One, the following elements have been added to the load flow model. Hydro One has provided the following equipment specifications for new components:

(a) Transmission Line Data

The equivalent R, X, B parameters for the Leaside x Bridgman portion of L13W, L14W, L15W and the new circuit remain unchanged from the SIA report and are shown below.

Circuit	**R**	**X**	**B**	**km**
L13W:	0.00134	0.00633	0.17903	5.9
L14W:	0.00296	0.01226	0.05083	5.2
L15W:	0.00261	0.00829	0.09966	5.6
New:	0.00296	0.01226	0.05083	5.2

The following thermal ratings were used for the studies:

Circuit	**Section**		**Continuous**		**LTE**		**STE (15 Minute LTR)**	
			Amp	**MVA**	**Amp**	**MVA**	**Amp**	**MVA**
L13W	Leaside TS	Bridgman Jct	985	205	1138	237	2249	467
	Bridgman Jct	Dufferin Jct	680	141	890	185	970	202
	Dufferin Jct	Wiltshire TS	680	141	890	185	970	202
L14W	Leaside TS	Birch Jct	1200	249	1200	249	1308	272
	Birch Jct	Bridgman TS	810	168	1070	222	1350	281
	Bridgman Jct	Wiltshire TS	690	143	890	185	1090	227
New Circuit	Leaside TS	Bridgman Jct	1200	249	1200	249	1308	272
(former L15W)	Bridgman Jct	Barlett Jct	750	156	980	204	1100	229
(former L15W)	Barlett Jct	Wiltshire TS	750	156	980	204	1100	229
L15W	Leaside TS	Bayview Jct	1200	249	1200	249	1308	272
	Bayview Jct	Bridgman TS	670	139	790	164	2990	621

The continuous ratings for the overhead conductors were calculated at the lowest of the sag temperature or 93°C operating temperature, with a 35°C ambient temperature and 4 km/h wind speed.

The long term emergency ratings for the overhead conductors were calculated at the lowest of the sag temperature or 127°C operating temperature, with a 35°C ambient temperature and 4 km/h wind speed.

For the underground lines, the continuous rating was calculated at the normal operating temperatures, with the cables from vicinity assumed to be in service. The long term emergency rating used was the 10 day LTR rating.

The short term emergency ratings (15 Minute LTR) for all conductors were calculated at the sag temperature, with a 35°C ambient temperature, 4 km/h wind speed and 75% continuous preload.

The continuous rating and long term emergency rating, the 10-Day LTR, used for autotransformers were obtained from the Hydro One secure website.

The continuous, long term emergency and short term emergency MVA ratings for 115 kV lines were calculated assuming 120 kV.

If any of the above data is inaccurate, the applicant should provide the correct data to the IESO prior to the completion of IESO Facility Registration process.

(b) Configuration Changes

The existing L15W Bridgman TS x Wiltshire TS section, including Bridgman T13, has been disconnected from L15W and connected to the new circuit. Bridgman T11 and T12 have been disconnected from L13W and connected to L15W.

As a result, L13W will supply only Dufferin T1 and T2 transformers. The L14W circuit will continue to supply Bridgman T5, T6 and T14 transformers. The L15W circuit will supply Bridgman T11 and T12 transformers, with the new circuit supplying Bridgman T13, and Dufferin T3 and T4.

(c) Power System Modeling

To conduct the computer analysis, the IESO summer 2010 base case model was used with the following adjustments.

The Toronto zone load was scaled to match the IESO 2014 extreme weather monthly peak load forecast as shown in Section 3 of this addendum. The 2014 demand was used as it provides the largest load estimate of the Toronto area after the proposed in-service date of the project.

Dufferin TS and Bridgman TS loads were adjusted to the revised 2025 extreme peak values provided by Hydro One and shown in Section 3 of this report

Leaside 115 kV and Hearn 115 kV buses were split to respect the maximum short-circuit levels.

The new Leaside x Bridgman circuit was added and the Leaside x Wiltshire lines configurations were changed to reflect the proposed arrangement.

Dufferin TS and Bridgman TS are being supplied from Leaside TS.

Summary of Study conditions:

Total Ontario Demand	27,162 MW	Total Dufferin TS Load	145 MW
Total Ontario Generation	26,693 MW	Total Bridgman TS Load	187 MW
Total Ontario Losses	711 MW	Portlands Center GS	550 MW
Toronto Zone Load	10,690 MW		

4.2 Thermal Loading Assessment

During the thermal loading assessment, the pre and post contingency flows were monitored on all main sections of the 115 kV circuits between Leaside TS and Manby East TS and all 230/115 kV Leaside TS autotransformers supplying the area.

All contingencies were simulated with loads modeled as constant power, post ULTC action. Only contingencies on the Leaside x Wiltshire area were simulated, since the proposed changes do not impact the Manby x Wiltshire part of the system.

The pre-contingency flows were compared to the continuous ratings of the equipment.
The *IESO Transmission Assessment Criteria* requires that all line and equipment loadings to be within their continuous rating with all elements in service.

The single element post-contingency line flows were compared to the long term emergency ratings. The *IESO Transmission Assessment Criteria* requires the post-contingency loading on local transmission lines and local transformers to be within their long term emergency ratings.

The single element post-contingency line flows with outage conditions to lines pre-contingency were compared to the short term emergency rating (15 minute Limited Time Ratings). The *IESO Transmission Assessment Criteria* requires that with any two elements out of service, either through double-element contingencies or single-element contingencies with one element out-of-service pre-contingency, the post-contingency loading on local transmission lines and local transformers to be within their short term emergency ratings.

The results of the pre-contingency and single element post-contingency simulations are presented in Table 4.

The results of the single element post-contingency simulations with one L x W circuit out of circuit pre-contingency are presented in Table 5.

The following observations resulted from the analysis of the new configuration:

1. The pre-contingency loadings of the Leaside to Wiltshire circuits are well below their continuous ratings.

2. All simulated single element contingencies result in post-contingency loadings below the long term emergency thermal ratings, for load forecasts up to and including the year 2025.

3. Using extreme weather peak load forecasts provided for years 2010 - 2025, contingencies resulting in two of the new proposed CCT, L14W or L15W circuits out of service, through a single-element contingency with one other L x W circuit out-of-service pre-contingency will result

in the loading of the remaining circuits above their STE. This is a result of one remaining circuit supplying the entire Bridgman TS load on its own. A possible mitigating measure to the overloading of the STE ratings is to open LV breakers behind the Bridgman transformers during outages, so that load is lost by configuration following a contingency. A simulation of one of these scenarios is shown in Table 6.

Further planned load curtailment at Dufferin TS and Bridgman TS, which must occur within 15 minutes after the contingency, will return the post-contingency loading of the remaining circuits to below their LTE values. Planned load curtailment or load rejection of up to 150 MW is an acceptable control action as a response to N-2 conditions (i.e. two elements out of service), to help obey the Load Security Criteria, as per the *IESO Transmission Assessment Criteria.*

			Continuous Rating	Long Term Emergency Rating	Pre-Contingency System – Duff + Bridg on Leaside Supply		Loss of L13W		Loss of L14W		Loss of L15W		Loss of new CCT	
Monitored Element			AMPS	AMPS	AMPS	Cont	AMPS	LTE	AMPS	LTE	AMPS	LTE	AMPS	LTE
Cct	**From**	**To**				%		%		%		%		%
115 kV Circuits														
L13W	Leaside TS	Bridgman Jct	985	1138	423.7	43.0	0.0	0.0	434.1	38.1	431.9	37.9	864.4	76.0
L13W	Bridgman Jct	Dufferin Jct	680	890	424.1	62.4	0.0	0.0	434.4	48.8	432.2	48.6	864.8	**97.2**
L13W	Dufferin Jct	Wiltshire TS	680	890	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
L14W	Leaside TS	Birch Jct	1200	1200	408.4	34.0	417.7	34.8	0.0	0.0	788.9	65.7	524.8	43.7
	Birch Jct	Bridgman Jct	810	1070	408.6	50.4	417.9	39.1	0.0	0.0	789.2	73.8	525.0	49.1
	Bridgman Jct	Wiltshire TS	690	890	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
L15W	Leaside TS	Bayview Jct	1200	1200	427.3	35.6	436.7	36.4	756.3	63.0	0.0	0.0	535.7	44.6
	Bayview Jct	Bridgman Jct	670	790	451.5	67.4	461.4	58.4	783.4	**99.2**	0.0	0.0	561.9	71.1
NEW	Leaside TS	Bridgman Jct	1200	1200	572.1	47.7	1045.8	87.1	705.4	58.8	709.4	59.1	0.0	0.0
Former L15W	Bridgman Jct	Barlett Jct	750	980	383.4	51.1	868.2	88.6	378.6	38.6	375.7	38.3	0.0	0.0
Former L15W	Barlett Jct	Wiltshire TS	750	980	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Autotransformers			MVA	MVA	MVA	LTE %	MVA	LTE %	MVA	LTE %	MVA	LTE %	MVA	LTE %
	Leaside	T11	281	347	105.4	37.5	105.5	30.3	99.5	28.7	98.5	28.4	112.7	32.5
	Leaside	T12	317	419	91.4	28.8	91.5	21.8	85.5	20.4	84.6	20.2	99.2	23.7
	Leaside	T14	281	332	94.6	33.7	94.9	28.6	88.8	26.8	87.9	26.5	102.8	30.9
	Leaside	T15	287	369	195.7	68.2	199.0	53.9	203.3	55.1	203.8	55.2	187.9	50.9
	Leaside	T16	281	347	190.2	67.7	193.9	55.9	198.0	57.1	198.5	57.2	182.4	52.6
	Leaside	T17	317	347	185.8	58.2	188.1	54.2	192.2	55.4	192.7	55.5	176.7	50.9

Table 4: Pre-Contingency and Single Element Contingency Thermal Study Results for 2025 Load Forecast

Monitored Element			Long Term Emergency Rating	Short Term Emergency Rating	L13W + L15W Out of Service			L13W + L14W Out of Service			L13W + New CCT Out of Service			L14W + New CCT Out of Service			L14W + L15W Out of Service			L15W + New CCT Out of Service		
Cct	From	To	AMPS	AMPS	AMPS	LTE %	STE %	AMPS	LTE %	STE %	AMPS	LTE %	STE %	AMPS	LTE %	STE %	AMPS	LTE %	STE %	AMPS	LTE %	STE %
115 kV Circuits																						
L13W	Leaside TS	Bridgman Jct	1138	2249	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	875.0	76.9	38.9	482.9	42.4	21.5	872.8	76.7	38.8
	Bridgman Jct	Dufferin Jct	890	970	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	875.4	98.4	90.2	483.3	54.3	49.8	873.2	98.1	90.0
	Dufferin Jct	Wiltshire TS	890	970	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
L14W	Leaside TS	Birch Jct	1200	1308	800.3	66.7	61.2	0.0	0.0	0.0	513.2	42.8	39.2	0.0	0.0	0.0	0.0	0.0	0.0	1427.6	**119.0**	**109.1**
	Birch Jct	Bridgman Jct	1070	1350	800.5	74.8	59.3	0.0	0.0	0.0	513.4	48.0	38.0	0.0	0.0	0.0	0.0	0.0	0.0	1427.8	**133.4**	**105.8**
	Bridgman Jct	Wiltshire TS	890	1090	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
L15W	Leaside TS	Bayview Jct	1200	1308	0.0	0.0	0.0	771.5	64.3	59.0	533.8	44.5	40.8	1482.9	**123.6**	**113.4**	0.0	0.0	0.0	0.0	0.0	0.0
	Bayview Jct	Bridgman Jct	790	2290	0.0	0.0	0.0	798.7	**101.1**	26.7	560.7	71.0	18.8	1520.8	**192.5**	50.9	0.0	0.0	0.0	0.0	0.0	0.0
NEW	Leaside TS	Bridgman Jct	1200	1308	1219.6	101.6	93.2	1206.2	**100.5**	92.2	0.0	0.0	0.0	0.0	0.0	0.0	1402.1	**116.8**	**107.2**	0.0	0.0	0.0
Former L15W	Bridgman Jct	Barlett Jct	980	1100	883.8	90.2	80.3	882.3	90.0	80.2	0.0	0.0	0.0	0.0	0.0	0.0	361.1	36.8	32.8	0.0	0.0	0.0
Former L15W	Barlett Jct	Wiltshire TS	980	1100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 5: Double Element Contingency Thermal Study Result for 2025 Load Forecasts

– End of Report –

			Long Term Emergency Rating	Short Term Emergency Rating	L14W + New CCT Out of Service with T12XH breaker open pre-contingency		
Monitored Element			AMPS	AMPS	AMPS	LTE	STE
Cct	**From**	**To**				%	%
115 kV Circuits							
L13W	Leaside TS	Bridgman Jct	1138	2249	864.4	76.0	38.4
L13W	Bridgman Jct	Dufferin Jct	890	970	864.8	97.2	89.2
L13W	Dufferin Jct	Wiltshire TS	890	970	0.0	0.0	0.0
L14W	Leaside TS	Birch Jct	1200	1308	0.0	0.0	0.0
	Birch Jct	Bridgman Jct	1070	1350	0.0	0.0	0.0
	Bridgman Jct	Wiltshire TS	890	1090	0.0	0.0	0.0
L15W	Leaside TS	Bayview Jct	1200	1308	814.4	67.9	62.3
	Bayview Jct	Bridgman Jct	790	2290	847.5	**103.1**	28.3
NEW	Leaside TS	Bridgman Jct	1200	1308	0.0	0.0	0.0
Former L15W	Bridgman Jct	Barlett Jct	980	1100	0.0	0.0	0.0
Former L15W	Barlett Jct	Wiltshire TS	980	1100	0.0	0.0	0.0

Table 6: Double Element Contingency Study Results with Preventative Pre-Contingency Control Actions

Notes: 59 MW of load are lost by configuration

– End of Report –