



IMO_REP_0018

CONNECTION ASSESSMENT & APPROVAL PROCESS

**Preliminary Assessment Report
For Hydro Vaughan MTS #3**

CAA ID 2000-025

Long Term Forecasts & Assessments Department

January 12, 2001

Preliminary Assessment Report

Hydro Vaughan MTS #3

Acknowledgement

The IMO wished to acknowledge the assistance of Hydro One in completing this assessment.

Disclaimers

IMO

This report has been prepared solely for the purpose of assessing, on a preliminary basis, 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 a System Impact Assessment of the proposed connection should be conducted under Chapter 4, section 6 of the Market Rules. 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, Hydro One 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

The results reported in this preliminary feasibility 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 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 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 rating 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. 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.

1.0 Project Description

Vaughan Hydro Distribution Inc. has started construction of Municipal Transformer Station #3 located at a site on Rutherford Road, adjacent to the existing 230 kV transmission right-of-way between Claireville TS and Kleinburg TS. The new station will be connected to the 230 kV lines V74R and V75R between Woodbridge Junction and Kleinburg TS, approximately 3 km away from Claireville.

It is projected that initially, in the summer of 2001, the station will supply about 40 MW of load and ultimately, by 2005, the load will grow to about 165 MW.

A schematic representation of the electrical connectivity for the proposed Vaughan MTS #3 is shown in Figure 1.

2.0 Review of Connection Arrangement

The proposed municipal transformer station is equipped with two 230/28 kV transformers rated at 75/100/125 MVA each, which are supplied from two separate transmission lines (V74R and V75R) that share the same right of way.

The transformer station arrangement was designed in agreement with Hydro One. Based on the single line diagram VH3-100 provided by Vaughan Hydro, each transformer is separated from the transmission system via a motorized disconnection switch. For this particular arrangement the Transmission System Code requires that transfer trip of the Transmitter's breakers at the terminal stations be provided for transformer faults and for a failure to operate condition of the LT breakers (T1X-B, T1Y-B, T2X-B and T2Y-B). It is also required that the protection system initiate simultaneously both the transfer trip and the opening of the disconnect switch, signals. Full opening of the disconnect switch shall block the sending of the transfer trip signal.

Voltage control is to be provided via on-load tap changers located on the high voltage winding of the transformer. The tap changer range for the step-down transformer is +34.3 kV to -34.3 kV and it is to be achieved in 33 steps.

The Market Rules (Chapter 5 section 10.4) require that each distributor and connected wholesale customer, in conjunction with the relevant transmitter, make arrangements to enable the automatic disconnection of under-frequency demand of at least 30% of its peak demand. To meet this requirement a frequency trend relay must be installed at the station on the low voltage bus. The single line diagram does not show the presence of the frequency trend relay.

The Market Rules (Chapter 4 section 7.5) require that each distributor and connected wholesale customer shall provide the IMO on a continual basis with on-line monitored quantities as specified in Appendix 4.17. It is required that Vaughan Hydro install all the equipment required to monitor the information required by the IMO on a continuous basis.

3.0 Data Verification

The information provided by the proponent as part of the application for preliminary assessment was incomplete in some areas and certain assumptions were made in this assessment.

The current rating of the transformer low voltage neutral 1.5 ohms grounding reactor was not specified. The industry standards require that the grounding reactor have a continuous rating of 1000A and 15 s current rating of 6000A.

With the PA application, Hydro Vaughan did not provide limited time ratings (LTR) for the transformer. The load capability of a DESN station is defined as the maximum load that one transformer can carry for a period of 10 days (10-day LTR). This value is usually computed using specific transformer data and daily load curves and temperature data specific to the transformer location. As a guideline, the calculated 10-day LTR value ranges from 1.36 (summer) to 1.6 (winter) times the forced cooled rating of one transformer. Based on this rule of thumb, the load capability of the new Vaughan MTS#3 is 170 MVA. Assuming a 0.9 load power factor, the maximum MW load that can be supplied from this station is 153 MW.

It is worth noting that in the PA application the proponent indicated an ultimate station load of 165 MW by year 2005 which exceeds the Vaughan MTS#3 calculated maximum capability. If the proponent chooses to connect to the new station loads in excess of the maximum station capability (153 MW) they may risk damaging their own equipment for situations when one transformer is out of service.

It is expected that the proponent will provide when available, complete and accurate transformer information.

The rating of the remaining station equipment was found to meet all applicable standards.

4.0 Fault Level Assessment

In general, radial loads do not have a large impact on the system fault levels, however a small contribution can be observed due to the grounding of the step-down transformers.

Hydro One has carried out a study to identify the impact of the Vaughan MTS#3 on short circuit currents in the area. The results indicated that the contribution of the proposed Vaughan MTS#3 to the single-line-to-ground fault and double-line-to-ground fault currents is very small, and that the short circuit levels that result from the addition of the new supply point are well within the fault interrupting capability of the station breakers.

5.0 Impact on Load Meeting Capability

5.1 Description of Transmission Facilities

The new Vaughan MTS#3 will have a dual supply from the 230 kV single circuit lines V74R and V75R. Figure 1 shows a schematic representation of the IMO-controlled Grid in the area surrounding Claireville TS. The line designated as V75R is a radial line out of Claireville TS which branches into two sections, one going to Kleinburg and the other one going to Richmond Hill TS. The line designated as V74R also branches into two sections one terminating at Richview TS and the other one at Kleinburg. After the incorporation of the proposed development, three municipal transformer stations will be supplied via the two circuits, namely Woodbridge, Vaughan MTS#3 and Kleinburg.

5.2 Area Load Forecast

The impact of the proposed MTS on the local area transmission was studied for the summer of 2005 under conditions of peak demand. A moderate average load growth of 2% per year was assumed between year 2000 and 2005 for the existing Kleinburg and Woodbridge stations, which resulted in a total of 10% load growth per station by year 2005. In addition, 165 MW of new load which has been forecast by Vaughan Hydro was considered to be connected to the new Vaughan MTS#3.

As a start, the actual peak loads at the existing stations were obtained from the available historical information. We decided to choose the 1999 summer peak load because the peak demand was higher in 1999 than in year 2000. The 1999 actual station loads in MVA are as shown in Table 1. The values represent the July 5, 1999 peak MW consumption at each station at an assumed power factor of 0.9 (the Market Rules require that load connected at 50 kV or lower have a power factor between 0.9 lagging to 0.9 leading). The projected load to be supplied via V74R and V75R by year 2005 is calculated below in Table 1.

Table 1: 2005 Projected Loads

Station Name	Actual 1999 Summer Load (coincident with system peak) (MVA)	2005 Summer Peak Load (MVA)	Station summer capacity-10day LTR (MVA)
Woodbridge TS	144	158	179.6
Vaughan MTS#3	N/A	183.3 ¹	175
Kleinburg TS	113	124.3	217.6
Total Load		465.6	

The impact on the new Vaughan MTS#3 on the area transmission capability was studied for year 2005 for station loading conditions shown above.

5.3 Assessment of Transmission Thermal Loading

For the purpose of this study a load of about 184 MVA was assumed to be supplied by Vaughan MTS#3 in year 2005.

Table 2: Pre-contingency and Post-contingency Line Loading-Year 2005

Circuit	Rating (MVA)		Pre-contingency flow		Post-contingency Flow	
	Summer Continuous	Summer LTR(15 min)	(MVA)	% of rating	Loss of V74R MVA / % of c. rating	Loss of V75R MVA / % of c. rating
V74R	579 ² (750)	628 (811)	225.8	39%	-	452 / 73%
V75R	579 (750)	628 (811)	226	39%	452 / 73%	-

¹ MVA load was calculated based on 165 MW at 0.9 power factor.

² The circuit rating quoted is based on 93⁰C operating temperature and 235.4 kV.

The studies concluded that in 2005 with all elements in service under peak load conditions the 230 kV circuits V74R and V75R which supply the three municipal station will be equally loaded to about 39% of their summer continuous capability. The summer continuous rating quoted in the table was calculated based on a continuous operating temperature of 93⁰C. However our operating practice has been to use 127⁰C rating for both continuous and limited time rating. Recently, in agreement with Hydro One, it was decided to continue with this operating practice on an interim basis. Consequently, based on present operating practices, V74R and V75R continuous and limited time ratings are 750 MVA and 811 MVA, respectively (as indicated in the brackets). However in the calculation of the lines thermal loading we used the more conservative rating based on 93⁰C.

Under contingency situation, for the loss of V74R or V75R the three loads will be supplied via the remaining 230 kV line. The flow on the remaining transmission line will be at about 73% of the continuous rating of the line and well under the 15-minute LTR.

A preliminary analysis of the IMO-controlled grid voltage at the point of connection of Vaughan MTS#3 indicated that the system voltage will be similar in magnitude to the voltages observed at the other two Vaughan station.

5.4 Richview Capacitor Switching Impact

The preliminary assessment also examined the effect of Richview capacitor switching on the voltage at the new Vaughan station. A 420 MVAR capacitor bank is connected at Richview 230 kV bus. The studies showed that a voltage increase of 1.33% and a decrease of 1.31% is recorded at Vaughan MTS#3 when the Richview capacitor is switched on and off, respectively.

The effect of the Richview capacitor switching on the Vaughan MTS#3 voltage is within the 4% margin allowed by the Market Rules.

6.0 Conclusions and Recommendations

This Preliminary Assessment has examined the impact of connecting Vaughan MTS#3 to the 230 kV line V74R and V75R, on the local transmission system. The studies concluded:

1. The addition of the new supply point increases slightly the short circuit current at Claireville TS but the resulting fault levels are well within the breakers' fault interrupting capability.
2. The power transfers over the 230 kV lines V74R and V75R, to which the new Vaughan MTS#3 is connected, with all elements in service and under post contingency situations are well within the continuous and limited time line ratings of the lines.

It is recommended that Vaughan Hydro Distribution Inc. apply for a System Impact Assesment within thirty days from the issuance of this report. The following information must be provided with the SIA application:

1. The transformer limited time ratings as requested in the preliminary assessment forms.
2. A confirmation that the neutral grounding reactors will be rated as specified in section 3 above.
3. A confirmation that a frequency trend relay which will have the capability of tripping up to 30% of the station load is to be installed.

4. A confirmation that transfer trip circuits will be provided as required by the Transmission System Code.

It is required that Vaughan Hydro install all the equipment needed to monitor the information required by the IMO on a continuous basis as described in Chapter 4 section 7.5 and Appendix 4.17 of the Market Rules.

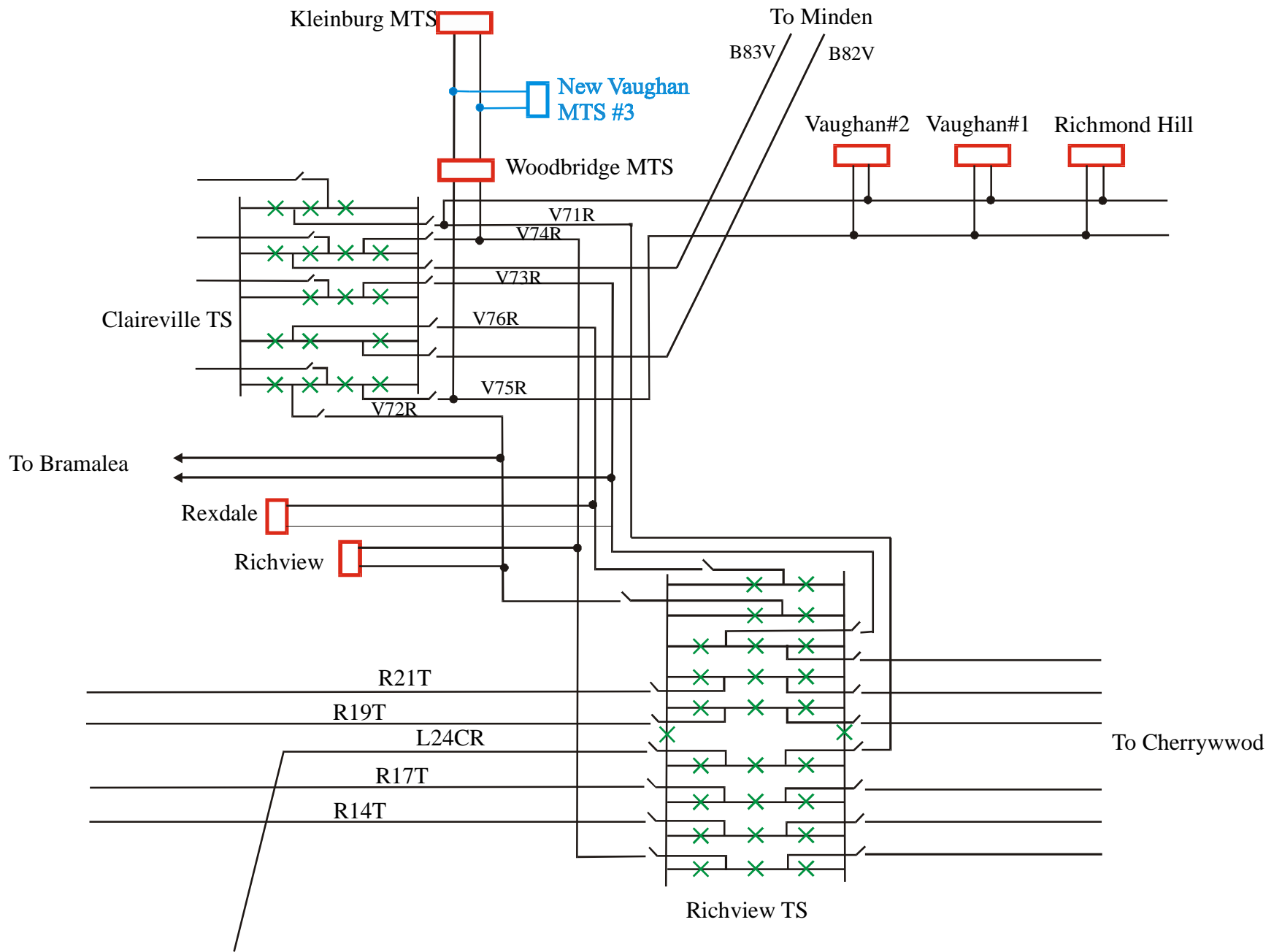


Figure 1. Claireville Area Transmission Layout

CONNECTION ASSESSMENT & APPROVAL PROCESS

Amendment To

**Preliminary Assessment Report
For Hydro Vaughan MTS #3**

CAA ID 2000-025

Long Term Forecasts & Assessments Department

March 7, 2001

Rationale for Amendment

The IMO has carried out a preliminary assessment and issued a Preliminary Assessment Report on the new Vaughan Municipal Transformer Station #3. This project was initiated and has been studied with Hydro One for the past two to three years, well before the coming into force of the Connection Assessment and Approval process. Consequently, the new station is already under construction and is scheduled for in service for June 2001.

Originally, the preliminary assessment looked at the proposed development in isolation of any other proposed projects in the area. The preliminary assessment identified that the new development will not affect the reliability or the load meeting capability of the local transmission system. The PA report required that Hydro Vaughan Distribution Inc. apply for a System Impact Assessment which would study the combined impact of Vaughan MTS#3 and Richmond Hill MTS#2 on the reliability of the IMO-controlled Grid.

Lately, the IMO has reconsidered the need for a System Impact Assessment for Hydro Vaughan Distribution Inc. and Richmond Hill Hydro Inc. projects and contemplates using the expedited CAA process instead. The expedited CAA process is a process which includes an expanded Preliminary Assessment in situations when the IMO identifies that all outstanding issues could be resolved during the Preliminary Assessment stage. In the case of Vaughan MTS#3 project it was realized that all the issues related to the proposed connection have been addressed in the PA and that any issues related to Richmond Hill project will also be covered in the preliminary assessment with an expanded scope of work.

Consequently, the IMO has decided to proceed with the Hydro Vaughan Distribution Inc. approval for connection of MTS#3 based on the findings of the preliminary assessment and perform the PA for Richmond Hill MTS#2 on a baseline assumption that includes Vaughan MTS#3 and all the other neighbouring projects that have been approved so far.

The purpose of this amendment is to modify section 6.0 of the Preliminary Assessment Report titled Conclusion and Recommendation to reflect this decision.

Amendment

6.0 Conclusions and Recommendation

This Preliminary Assessment has examined the impact of connecting Vaughan MTS#3 to the 230 kV line V74R and V75R, on the local transmission system. The studies concluded:

1. The addition of the new supply point increases slightly the short circuit current at Claireville TS but the resulting fault levels are well within the breakers' fault interrupting capability.
2. The power transfers over the 230 kV lines V74R and V75R, to which the new Vaughan MTS#3 is connected, with all elements in service and under post contingency situations are well within the continuous and limited time line ratings of the lines.

It is recommended that Vaughan Hydro Distribution Inc. provide the following information as soon as it becomes available:

3. The transformer limited time ratings as requested in the preliminary assessment forms.
4. A confirmation that the neutral grounding reactors will be rated as specified in section 3 above.
5. A confirmation that a frequency trend relay which will have the capability of tripping up to 30% of the station load is to be installed.
6. A confirmation that transfer trip circuits will be provided as required by the Transmission System Code.

It is required that Vaughan Hydro install all the equipment needed to monitor the information required by the IMO on a continuous basis as described in Chapter 4 section 7.5 and Appendix 4.17 of the Market Rules.

7.0 Notification of Approval

Section 6.0 of the preliminary assessment lists all the requirements identified by the IMO for the incorporation of the proposed Vaughan Municipal Transformer Station #3. It is recommended that approval be granted and Notification of Approval be issued subject to the acceptance by the proponent of the IMO requirements.