



CONNECTION ASSESSMENT & APPROVAL PROCESS

Connection Assessment Report

Connection Applicant: Enbridge Pipeline Inc.

Project: North Westover Substation – Modifications of 155
kV Substation

CAA ID 2003-EX142

Final Report

Prepared by
Long Term Forecasts & Assessments Department &
Consistent Information Set Department

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1.0 Project Description

The Enbridge North Westover substation is supplied from the Hydro One 115 kV circuit B5G emanating from Burlington TS via one motorized disconnect switch as shown in Figure 1. The peak load at the substation is about 3.4 MW.

The 115 kV substation presently consists of:

- One 3 phase 7.5/10 MVA, 115-4.16 kV transformer with delta configured primary and wye configured secondary which is grounded via a resistor;
- One 138 kV 600 A disconnect switch in series with a 138 kV fused disconnect with a 75E fuse;
- The 4.16 kV facilities including switchgear and two 300 kvar shunt capacitor banks and
- Auxiliary facilities including station service and protection and control.

Enbridge Pipeline Inc. is proposing to replace the aging equipment, modify the 115 kV connection to the IMO-controlled grid also replace the transformer protection system. The plan includes:

- Replacement of the existing 75E fuse with a 100E unit,
- Installation of a new 115 kV 1200 A SF6 circuit switcher associated disconnect,
- Installation of a new transformer protection scheme including associated current transformer and battery bank and
- Replacement of the existing 4.16 kV switchgear.

Upon completion of the proposed modifications the connection to the IMO-controlled grid will be provided via the new circuit switcher, the new fused disconnect switch and the existing 138 kV disconnect switch as shown in Figure 2.

The new and modified equipment is rated as follows:

115 kV Disconnect Switch

Voltage Rating	138 kV
Continuous Current Rating	600 A

115 kV Fused Disconnect

Voltage Rating	138 kV
Fuse Cutout Rating	100E
Short Time Interrupting Current	

115 kV Circuit Switcher

Nominal Voltage Rating	115 kV
Maximum Voltage Rating	145 kV
Continuous Current Rating	1200 A
Short Circuit Rating	40 kA

The scheduled in service date for the proposed station modifications is January 5, 2004.

2.0 Assessment

The IMO assessment of the impact of the proposed work on the reliability of the IMO-controlled grid was based involves the 115 kV facilities only.

All the protection system requirements for the substation are covered and verified by Hydro One in accordance with the Transmission System Code. This assessment assumes that the Enbridge Pipeline Inc. will be complying with all the Transmission System Code requirements.

This proposal does not involve any changes to the station load and it is expected that the substation will continue to operate at the same load power factor range as before.

Equipment Rating Verification

The Market Rules requires that all the equipment connected to the IMO-controlled grid be capable for normal operating voltages between 113 kV to 127 kV.

All new equipment proposed for installation at North Westover substations has adequate voltage ratings.

The primary substation fault-isolating device is the 115 kV circuit switcher, with the fused disconnect providing back-up protection in case the circuit switcher fails to operate. Based on information provided by Hydro One the three phase short circuit currents for maximum system conditions at North Westover T1 is about 5 kA for a pre-fault voltage of 118 kV. The new 115 kV circuit switcher rated for 40 kA is adequate by a large margin for present fault levels. The Transmission System Code specifies that the short circuit levels for the 115 kV system should not exceed 50 kA. Implicitly any new 115 kV equipment should be capable to withstand this short circuit levels and fault interrupting devices should be rated accordingly.

Any future development in the area that would result in short circuit levels that are above the interrupting capability of the new circuit switcher is considered to be unlikely. However, if such development occurs then the subsequent replacement of the circuit switcher at North Westover substation might be the responsibility of Enbridge Pipeline Inc.

Underfrequency Load Shedding Requirements

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 up to 35% of its peak demand.

With a peak load of 3.4 MW North Westover substation is not required to install UFLS facilities at this time.

Voltage Reduction Facilities Requirements

The Market Rules (Chapter 4 Appendix 4.3) requires that the distributors and wholesale customers install facilities to reduce, when instructed by the IMO, the distribution voltage by 3% to 5%.

North Westover station is exempt from this requirement because its current maximum capability is only 7.5 MVA.

On-line Monitoring

The Market Rules (Chapter 4 section 7.5) require that each non-dispatchable load rated at 20 MVA or higher shall provide the IMO on a continual basis with on-line monitored quantities as specified in Appendix 4.17.

North Westover station is exempt from this requirement because its current maximum capability is only 7.5 MVA.

Power Factor

Appendix 4.3 reference 1 of the *Market Rules* require that wholesale customers and distributors connected to the IMO-controlled grid shall operate at a power factor within the range 90% lagging to 90% leading as measured at the *defined meter point*.

The peak load at this station was 3.4 MW and the station is equipped with 2 x 300 kvar power factor correction shunt capacitors. Historic data indicate that the substation has been operated close to a 0.9 lagging power factor.

It is expected that the substation will continue to operate within acceptable the power factor range, and that additional power correction shunt capacitors will be installed if the Market Rules power factor requirements are violated.

3.0 Conclusions and Recommendations

The proposed replacement of aging equipment and the modification of the 115 kV connection to the IMO-controlled were deemed to have no adverse impact on the IMO-controlled grid with respect to line loading, voltage profile or fault levels.

Currently the clearing of any fault associated with the substation transformer involves the transfer tripping of B5G and the interruption of supply to other loads connected to this circuit. With the new circuit switcher any fault involving the transformer will be cleared locally while the 115 kV circuit B5G would remain in service. Consequently, the proposed plan will result in improved reliability of load supply in the area.

4.0 Notification of Approval

It is thus recommended that notification of approval be granted for the proposed modifications to North Westover substation.

