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NEEDS ASSESSMENT REPORT

East Lake Superior Region

Date: June 14th, 2019

Prepared by: East Lake Superior Region Study Team



Disclaimer

This Needs Assessment Report was prepared for the purpose of identifying potential needs in the East Lake Superior Region and to recommend which need may require further assessment and/or regional coordination to develop a preferred plan. The results reported in this Needs Assessment are based on the input and information provided by the Study Team.

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Executive Summary

REGION	East Lake Superior Region		
LEAD	Hydro One Sault Ste. Marie LP.		
START DATE	April 16 th , 2019	END DATE	Jun 14 th , 2019

1. INTRODUCTION

The first cycle of the Regional Planning process for the East Lake Superior (“ELS”) Region was initiated by the former Great Lakes Power Transmission (“GLPT”) in October 2014 and completed in December 2014 with the publication of the Needs Assessment (“NA”) Report. The NA Report provided a description of needs and recommendations of preferred wires plans to address near- and mid-term needs at the time.

The purpose of the second cycle NA Report is to review the status of needs identified in the previous regional planning cycle and to identify any new needs based on the new load forecast.

2. REGIONAL ISSUE/TRIGGER

In accordance with the Regional Planning process, the regional planning cycle should be triggered at least every five years for each region. The first cycle of Regional Planning for the ELS Region was triggered in October 2014, and this second cycle Regional Planning was triggered in April 2019.

3. SCOPE OF NEEDS ASSESSMENT

The scope of this NA includes:

- Review and reaffirm needs/plans identified in the previous Regional Planning process; and
- Identification and assessment of system capacity, reliability, operation, and aging infrastructure needs.

The Study Team may also identify additional needs during the next phases of the planning process, namely SA, IRRP and RIP, based on updated information available at that time.

4. INPUTS/DATA

The Study Team representatives from LDCs, the IESO, Hydro One Sault Ste. Marie and Hydro One provided input and relevant information for the East Lake Superior Region regarding capacity needs, reliability needs, operational issues, and major assets/facilities approaching end-of-life (“EOL”).

5. ASSESSMENT METHODOLOGY

The assessment’s primary objective is to identify electrical infrastructure needs and to determine whether further regional coordination or broader studies would be beneficial for addressing these needs.

The scope of the assessment includes reviewing previously identified needs and identifying new needs based on available information including load forecasts, conservation and demand management (“CDM”), distributed generation (“DG”) forecasts, reliability concerns, operational issues, and major high

voltage equipment identified to be at or near the end of their useful life.

A technical assessment of needs was undertaken based on:

- Planning criteria outlined in IESO-ORTAC (section 2.7.2) for analysis of current and future station capacity and transmission adequacy;
- Planning criteria outlined in IESO-ORTAC (section 7) for system reliability; Analysis of major high voltage equipment reaching the end of its useful life, in conjunction with emerging system needs; and
- Analysis of operational concerns relevant to Regional Planning

6. NEEDS

I. Station & Transmission Supply Capacity

- Based on planning criteria, Third Line TS 230/115kV Autotransformers T1 and T2 are expected to approach their 10-Day Limited Time Rating over the near/mid-term planning horizon.

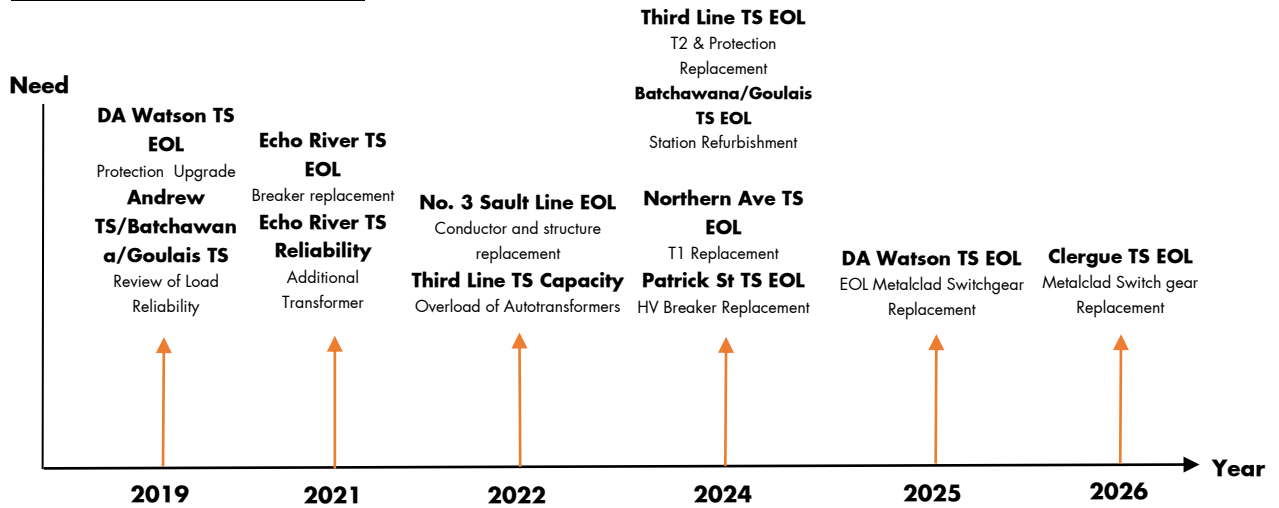
II. System Reliability & Operation

- Based on forecasted winter gross load, load security criteria can be met over the study period.
- Load restoration at transformer stations listed below requires further review with affected LDC:
 - i. Andrew TS
 - ii. Batchawana TS
 - iii. Goulais TS

III. Aging Infrastructure – Transformer Replacements and Circuit Refurbishments

- Projects in execution:
 - i. DA Watson TS – Protection Upgrade
- Future projects:
 - i. Echo River TS – EOL Breaker Replacement
 - ii. No.3 Sault Circuit – EOL Conductor and Structure Replacement
 - iii. Third Line TS – Transformer T2 EOL and Protection Replacement
 - iv. Patrick St TS – HV Breaker Replacement
 - v. Batchawana TS / Goulais Bay TS – Station Refurbishment
 - vi. Northern Ave TS – Transformer T1 Replacement
 - vii. DA Watson TS – Metalclad Switchgear Replacement
 - viii. Clergue TS – Switchgear Replacement

Needs Timeline Summary



7. RECOMMENDATIONS

The Study Team’s recommendations for the above identified needs are as follows:

1. Overloading of 230/115 kV Autotransformers at Third Line TS – Further analysis in the Scoping Assessment phase of Regional Planning is required to address supply capacity to the 115 kV systems. IESO will lead the Scoping Assessment phase to determine and to recommend the best planning approach to address the need.
2. Reliability to Load - Load restoration after loss of a single element may lead to longer restoration time than ORTAC guidelines. A review by the transmitter and impacted distributor is required to evaluate the local reliability for the following stations:
 - i. Andrew TS
 - ii. Batchawana TS
 - iii. Goulais TS
3. The implementation and execution for the replacement of the following EOL transmission assets will be coordinated between Hydro One Sault Ste. Marie and the affected LDCs and/or customers, where required. These projects will be coordinated with IESO where required and where feasible within the timelines afforded by each project.
 - i. Echo River TS – Breaker Replacement
 - ii. No. 3 Sault Conductor and Structure Replacement
 - iii. Third Line TS – Autotransformer T2 & Protection Replacement
 - iv. Patrick St TS – HV Breaker Replacement
 - v. Batchawana TS / Goulais Bay TS – Station Refurbishment
 - vi. DA Watson TS – Metalclad Switchgear Replacement

vii. Clergue TS – Switchgear Replacement

4. Overload of No. 1 Algoma circuit due to breaker failure at Patrick St TS and/or other multiple element contingencies requires additional study. Further analysis in the Scoping Assessment phase of Regional Planning is required to determine the best planning approach while taking into account the outcome of an ongoing SIA for new load connection at Patrick St TS.

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1 INTRODUCTION

This Needs Assessment (“NA”) report identifies needs in the East Lake Superior (“ELS”) Region. For needs that require coordinated regional planning, the Independent Electricity System Operator (“IESO”) will initiate the Scoping Assessment process to determine the appropriate regional planning approach. The approach can either be the IESO-led Integrated Regional Resource Planning (“IRRP”) process or the transmitter-led Regional Infrastructure Plan (“RIP”), which focuses on the development of “wires” solutions. It may also be determined that the needs can be addressed more directly through localized planning between the transmitter and the specific distributor(s) or transmission connected customer(s). The development of the Needs Assessment report is in accordance with the regional planning process as set out in the Ontario Energy Board’s (“OEB”) Transmission System Code (“TSC”) and Distribution System Code (“DSC”) requirements.

The purpose of the second cycle NA is to review the status of needs identified in the previous Regional Planning cycle and to identify any new needs based on the new load forecast.

This report was prepared by the ELS Region Needs Assessment Study Team listed in Table 1, and led by the lead transmitter in the region, Hydro One Sault Ste. Marie (“HOSSM”). The report captures the results of the assessment based on information provided by the LDCs, Hydro One Network Inc. and the IESO.

Table 1: East Lake Superior Region Study Team Participants

Company
Hydro One Sault Ste. Marie LP. (Lead Transmitter)
Hydro One Networks Inc.
Algoma Power Inc.
Chapleau PUC
Hydro One Distribution
Independent Electricity System Operator (“IESO”)
Sault Ste. Marie PUC

2 REGIONAL ISSUE/TRIGGER

In accordance with the Regional Planning process, the regional planning cycle should be triggered at least every five years. The first cycle of Regional Planning for ELS Region was triggered in October 2014, and as such, the second cycle Regional Planning was triggered in April 2019.

3 SCOPE OF NEEDS ASSESSMENT

The scope of this NA covers the entire ELS Region and includes:

- Review of existing needs and/or plans identified in the previous planning cycle; and
- Identification and assessment of any new system capacity, reliability, operation, and aging infrastructure needs.

The Study Team may identify additional needs during the next phases of the regional planning process, namely Scoping Assessment (“SA”), Local Planning (“LP”), IRRP, and/or RIP.

4 REGIONAL DESCRIPTION AND CONNECTION CONFIGURATION

The ELS Region includes all of Hydro One Sault Ste. Marie’s (formerly Great Lakes Power Transmission’s) 560 km of HV transmission lines as well as ties to the provincial grid at Wawa TS in the Northwest and Mississagi TS in the Northeast. Hydro One Network’s 115 kV W2C circuit also supplies the Town of Chapleau from Wawa TS. The boundary of the ELS Region is shown in Figure 1. Figures 2-5 show Single Line Diagram (“SLD”) depictions of various parts of the ELS Region.

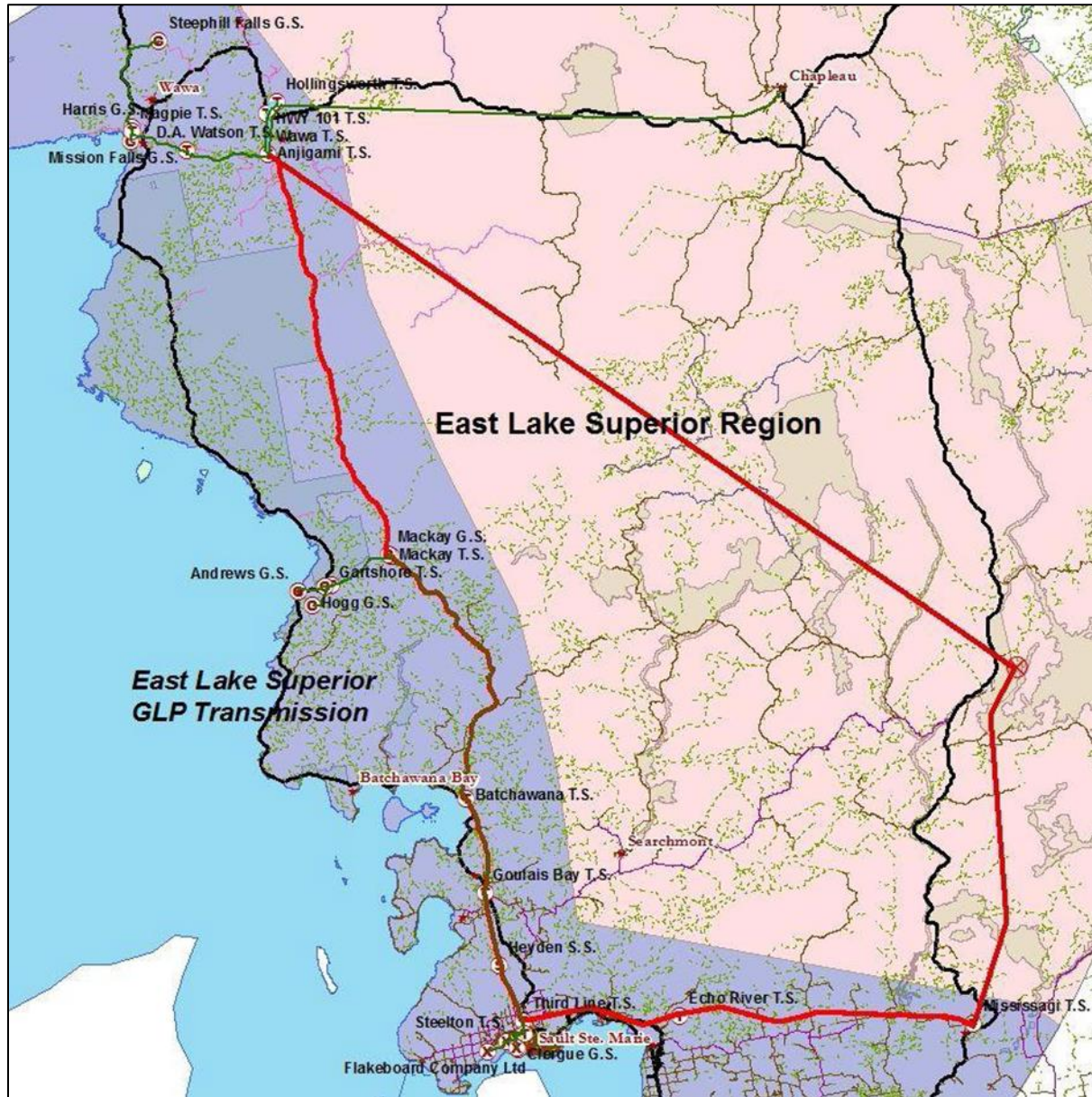


Figure 1: Geographic Area of the East Lake Superior (ELS) Region

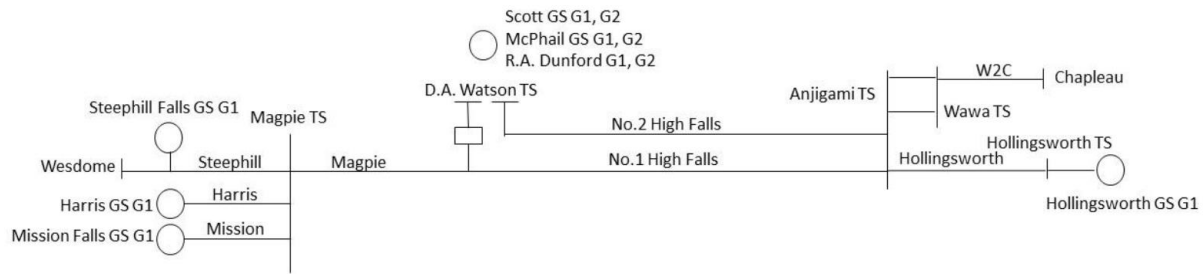


Figure 2: ELS Region – Northern Area Single Line Diagram

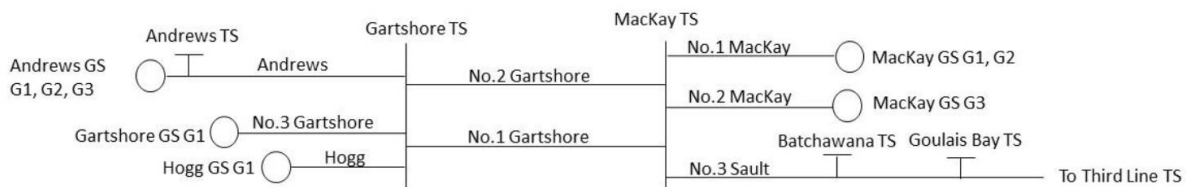


Figure 3: ELS Region – Southern Central Area Single Line Diagram

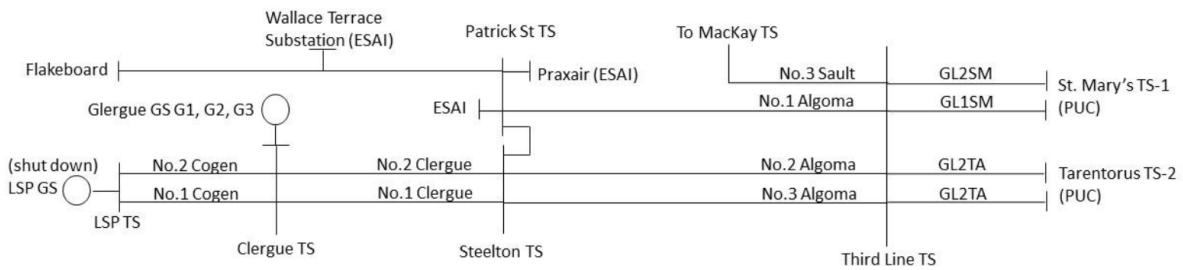


Figure 4: ELS Region – Southern Area Single Line Diagram

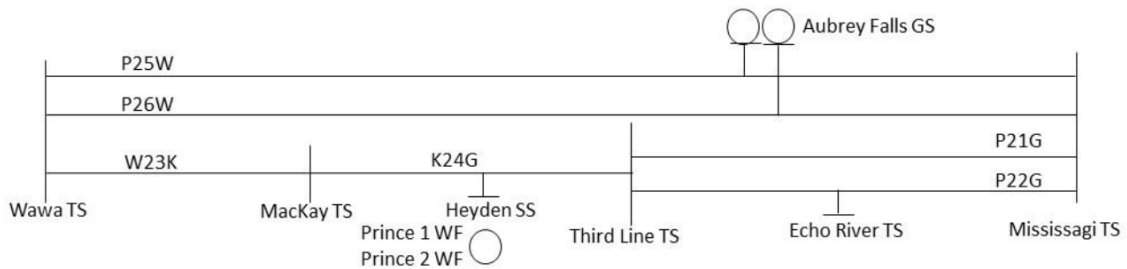


Figure 5: ELS Region – Eastern Area Single Line Diagram

5 INPUTS AND DATA

Study Team participants, including representatives from LDCs, IESO, Hydro One and HOSSM provided information and input for producing the ELS Region NA Report. The information provided includes the following:

- ELS Region Summer and Winter Non-Coincident Load Forecast for all supply stations
- ELS Region Summer and Winter Coincident Load Forecast for all supply stations
- Known capacity and reliability needs, operating issues, and/or major assets approaching the end of their useful life (“EOL”); and
- Planned/foreseen transmission and distribution investments that are in scope for the ELS Region.

6 ASSESSMENT METHODOLOGY

The following methodology and assumptions are made in this Needs Assessment:

- Load forecast: The relevant LDCs provided load forecasts for their respective load supply stations in the ELS Region for the ten (10) year study period. The IESO provided a Conservation and Demand Management (“CDM”) and Distributed Generation (“DG”) forecast for the ELS region. The region’s extreme summer and winter non-coincident peak gross load forecasts for each station were prepared by applying the LDC load forecast load growth rates to the actual 2018 summer and 2017/2018 winter peak extreme weather corrected loads, with Hydro One providing extreme weather correction factors. The net extreme weather summer and winter load forecasts were then produced by subtracting the percentage CDM reduction, and the amount of effective DG capacity from each station’s gross load forecast. These extreme weather summer and winter load forecasts for the individual stations in the East Lake Superior region are given in Appendix A;
- Relevant information regarding system reliability and operational issues in the region; and
- List of major high voltage transmission equipment planned and/or identified to be refurbished and/or replaced due to the end of their useful life which is relevant for regional planning purposes. This includes transformers, autotransformers, Breakers, and overhead lines.

A technical assessment of needs was undertaken based on:

- i. Planning criteria outlined in IESO-ORTAC (section 2.7.2) for analysis of current and future station capacity and transmission adequacy;
- ii. Planning criteria outlined in IESO-ORTAC (section 7) for system reliability and operational concerns;
- iii. Analysis of major high voltage equipment reaching the end of their life, in conjunction with emerging system needs; and
- iv. Analysis of operational concerns relevant to Regional Planning.

In addition, the following assumptions were made in this Needs Assessment:

- The new East-West Tie Transmission Reinforcement is included in the assessment model.
- The region is winter peaking, but the study includes both winter and summer peak loads with interface transfer at normal limits to investigate effects of equipment limit changes relative to different seasonal peaks.
- Adequacy of transformation capacity at load stations was assessed assuming a 0.9 lagging power factor and non-coincident station loads.
- Adequacy of the following transmission lines capacity was assessed assuming a 0.9 lagging power factor and non-coincident station peak load due to the radial nature of the connections:
 - 115kV GL1SM (Third Line TS x St. Mary’s MTS)
 - 115kV GL2SM (Third Line TS x St. Mary’s MTS)
 - 115kV GL1TA (Third Line TS x Tarentorus MTS)
 - 115kV GL2TA (Third Line TS x Tarentorus MTS)
- Adequacy of transformation capacity for 230/115kV autotransformers T1 and T2 at Third Line TS, as well as transmission lines adequacy (excluding the above) were assessed using coincident system peak load in different seasons. Furthermore, this assessment investigated network capacity based on two (2) different configurations of the No.3 Sault circuit:
 - No.3 Sault circuit is connected radially to MacKay CGS G3 until 2022 with limited capacity;
 - No.3 Sault circuit is not radially connected to MacKay CGS G3 from 2022 onwards to 2028, with current capacity restrictions removed (restore to original capacity).

Subsequently, four (4) major scenarios were investigated per season:

East – West Tie (Flow West)		East – West Tie (Flow East)	
No.3 Sault Radial	No.3 Sault Not Radial	No.3 Sault Radial	No.3 Sault Not Radial

- For the Sault Ste. Marie area, hydro generation is assumed to be at 98% dependable when all elements are in service, as well as during N-1 contingency analysis as per IESO-ORTAC. Hydro generation stations with water storage capacity (ie: Aubery Falls GS and Wells GS) typically generates at peak. Half of its respective generation capacity (equivalent to 1 unit) is assumed available when assessing autotransformer and transmission line adequacies.
- One of the industrial customers in the Sault Ste. Marie area has acquired Lake Superior Power (“LSP”) Generating Station. There is currently a project to re-route two (2) of LSP’s generators as

embedded generation, with the remaining generator to be re-connected to Clergue TS via 115kV No. 1 and No. 2 CoGen circuits. In developing the worst case base case scenario, the study assumed generation from LSP to be unavailable.

7 NEEDS

This section assess the adequacy of regional infrastructure to met the forecasted load in the East Lake Superior Region and identify needs. The section also reviews and/or reaffirms needs previously identified in the last cycle of regional planning.

7.1 Review of Needs Identified in the Previous Cycle of Regional Planning

This section review the status of the needs identified in the previous cycle of Region Planning as summarized in Table 2 below.

Table 2: Needs Identified in the First Cycle Regional Planning Cycle

Type of Needs identified in the first RP cycle	Needs Details	Current Status
Transmission Supply Capacity of Hollingsworth TS / Anjigami TS Transformers	Overloading at Anjigami T1/ Hollingsworth T2	Pending confirmation for new customer connection
Transmission Supply Capacity of No. 1 Algoma Circuit	Thermal overloading on No. 1 Algoma circuit upon Breaker 214 Fail Contingency, where No. 2 and No. 3 Algoma lines will be removed from service	Continue to work with impacted customers to arrive at mutually agreeable solution.
Transmission Supply Reliability	Echo River TS – Single Transformer Supply	Transmitter and affected LDC have developed project scope for the installation of an additional transformer

a. Transmission Supply Capacity of Hollingsworth TS and Anjigami TS

Based on the previous NA, Hollingsworth TS – Transformer T2 / Anjigami TS – Transformer T1 will become overloaded due to a large customer connecting to the 44kV system. The customer has since put the connection application on hold. This need will be studied within the load connection process when the customer decides to proceed.

b. Transmission Supply Capacity of No. 1 Algoma Circuit

Based on the previous NA, No.1 Algoma Circuit may become overloaded after a breaker fail contingency at Patrick St. TS that removes No.2 Algoma and No.3 Algoma circuits by configuration. This overload is observed depending on the amount of load supplied from Patrick St. TS. This overload continues to be observed; refer to section 7.3 of this report for details.

c. Transmission Supply Reliability

Based on the previous NA, load restoration criteria cannot always be met at Echo River TS upon a transformer failure. HOSSM has been working with the impacted LDC, where HOSSM has developed and discussed different options that varies in levels of reliability and cost. HOSSM and the impacted LDS have come to an agreement to install a second transformer to improve reliability to load. The decision is reflected in HOSSM's and LDC's recent rate application.

7.2 Assessment of Transmission Capacity Needs in the Region**230kV Connection Facilities**

Based on the demand forecast, there is sufficient step-down transformation capacity throughout the study period at Echo River TS.

Voltage performance for the 230kV system is within the ORTAC guidelines upon observing N-1 contingencies, and after taking control actions such as switching in and out shunt capacitor banks at Wawa TS or Third Line TS.

230/115kV Auto-transformation Facilities

Third Line TS

No capacity concerns when both Third Line autotransformers are in-service.

Upon N-1 contingency, autotransformers at Third Line TS will approach their 10-Day Limited Time Ratings (LTRs) by Winter 2022. The loading on the companion bank, subjected to different circuit configurations, is as follows:

No.3 Sault 3 Radial		No.3 Sault 3 Not Radial	
All elements in service	N-1 (Third Line TS Autotransformer Contingency)	All elements in service	N-1 (Third Line TS Autotransformer Contingency)
Third Line Autotransformer within its Continuous Rating	290.45MVA (100% of 10 day LTR)	Third Line Autotransformer within its Continuous Rating	273.57MVA (94.3% of 10-Day LTR)

The overload of Third Line TS auto-transformers is a capacity need.

MacKay TS

Prior to year 2022, no overloading on 115 kV circuit No.3 Sault is observed for loss of MacKay Transformer T2 due to No.3 Sault’s radial configuration. Post year 2022, after No. 3 Sault line is no longer radially connected to Mackay G3, overloading of No. 3 Sault upon loss of T2 or upon loss of 230 kV circuit K24G will be mitigated by arming the existing MacKay TS Generation Rejection (G/R) Scheme.

115kV Connection Facilities

Based on the demand forecast, there is sufficient transformation and circuit capacity throughout the study period for 115kV connected load stations.

Voltage performance for the 115kV system is within the ORTAC guidelines upon N-1 contingencies

Load Security

As per IESO ORTAC criteria:

Criteria 1: With all transmission facilities in-service and coincident with an outage of the largest local generation unit, equipment within continuous rating, voltages must be within normal ranges, and transfers must be within applicable normal condition.

Assessment

- in the 230 kV system the largest unit is a Wells GS G1 or G2 unit;
- in the 115 kV system the largest unit is Clergue GS G2;

Under both outage scenarios, all equipment are within their continuous ratings, voltages are within normal ranges, and transfers are within applicable normal conditions. Hence it is concluded that Criteria 1 is satisfied.

Criteria 2: With any one element out of service, all equipment and circuits within applicable limits and load curtailment/Load Rejection only for local generation outages. No more than 150MW of load may be interrupted by configurations and by planned load curtailment or load rejections.

Assessment

- No more than 150MW is loss by configuration or load rejection. Therefore Criteria 2 is satisfied.

Criteria 3: With any two elements out of service, all equipment and circuits within applicable limits by time afforded by short-term ratings. Planned load curtailment or L/R exceeding 150 MW permissible for only local generation outages, and not more than 600 MW of load interrupted by configuration, by planned load curtailment or Load Rejection.

Assessment

- The projected regional gross load at coincident peak is forecasted at 377MW in 2028.
- Approximately 70MW of load will be rejected for a breaker fail contingency at Patrick St TS. If breaker 214 fails to open, both No.2 and No.3 Algoma circuits will be loss by configuration. This results in overload of No.1 Algoma circuit. This load rejection is required to decrease area loading in order to respect No. 1 Algoma circuit's long-term emergency rating of 128MVA. The impact is currently being assessed in a pending System Impact Assessment (SIA) from the IESO.
- Loss of 230kV P21G and P22G due a common tower contingency, or loss of both T1 and T2 Autotransformer at Third Line TS, will trigger instantaneous load rejections schemes at Third Line TS. At 98% dependable hydro generation, approximately 103MW of planned load curtailment or load rejection is required to bring the system to within applicable rating. It is expected that continued reliance on this load rejection scheme is necessary.
- Therefore, no more than 600MW of load will be interrupted by configuration, and no more than 150MW will be rejected by planned load curtailment or L/R scheme. It is concluded that Criteria 3 is satisfied.

Load Restoration

The ELS region has multiple radial single circuit and/or single transformer load connection stations where load loss is anticipated after a single transformer and/or single circuit contingency. At these locations ORTAC restoration criteria of 8 hours may not always be met. Stations that are impacted include:

- Andrew TS
- Batchawana TS
- Goulais TS

There is a need to review load restoration reliability at these stations.

The loss of 230kV P21G and P22G due a common tower contingency, or loss of both T1 and T2 Autotransformer at Third line TS, will trigger instantaneous load rejections schemes at Third Line TS. Loss of P21G and P22G will only take T1 out by configuration. Load restoration after operation of planned load curtailment / L/R scheme can proceed gradually via remaining 230kV connection (K24G and T2). Load restoration upon loss of both T1 and T2 will proceed gradually on HOSSM 115kV system via No.3 Sault circuit and Clergue GS. Therefore, ORTAC load restoration requirements are met.

7.3 Sensitivity Analysis

This Needs Assessment is subject to local area contingency criteria. To bridge the gap between regional and bulk system planning, the following bulk power system contingencies were assessed:

- Loss of No.2 and No.3 Algoma Lines due to Breaker 214 failure

Observations are as follows:

Based on the load forecast, a breaker failure contingency of circuit breaker 214 at Patrick St TS will remove No. 2 and No. 3 Algoma lines simultaneously by configuration, causing an overload on No. 1 Algoma circuit. The impact is also being investigated in a pending IESO's System Impact Assessment (SIA).

7.4 Assessment of End-Of-Life (EOL) Equipment Needs in the Region

HOSSM and LDCs have provided high voltage asset information under the following categories that have been identified at this time and are likely to be replaced over the next ten (10) years:

- Autotransformers
- Power Transformers

- HV and LV Breakers
- Transmission Circuits
- Protection System

Accordingly, following major high voltage equipment has been identified as approaching its EOL over the next 10 years.

Table 3: End-of-Life Equipment – East Lake Superior Region

EOL Asset Replacement/ Refurbishment	Replacement / Refurbishment Timing	Notes
Projects in Execution		
DA Watson TS – Protection Upgrade	End of 2019	This project is discussed further in Section 7.4.1
Future Projects		
Echo River TS – Breaker Replacement	2021	These Project are discussed further in Section 7.4.2
No.3 Sault Conductor and Structure Replacement	2022	
Third Line TS – Autotransformer T2 & Protection Replacement	2024	
Patrick St TS – HV Breaker Replacement	2024	
Batchawana TS / Goulais Bay TS – Station Refurbishment	2024	
Northern Ave TS – Transformer T1 Replacement	2024	
DA Watson TS – Metalclad Switchgear Replacement	2025	
Clergue TS – Switchgear Replacement	2026	

The EOL assessment for the above high voltage equipment included consideration of the following options:

1. Maintaining the status quo;
2. Replacing equipment with similar equipment of lower ratings (right-sizing) due to forecasted decrease in demand and built to current standards;

3. Replacing equipment with lower ratings (right-sizing) and built to current standards by transferring portions of load to other existing facilities;
4. Eliminating equipment by transferring all of the load to other existing facilities;
5. Replacing equipment with similar equipment and built to current standards (i.e. “like-for-like” replacement);
6. Replacing equipment with higher ratings (right-sizing) due to forecasted increase in demand or due to load transfer and built to current standards; and
7. Station reconfiguration

From HOSSM’s perspective as a facility owner and operator of its transmission equipment, status quo is generally not an option for major high voltage equipment due to safety and reliability risk of equipment failure.

7.4.1 Projects in Execution

The following EOL refurbishment project is currently under execution. Since the completion of the last RP, the need for proceeding with this project arose before the initiation of the second RP cycle. Hence, the following project was not listed or discussed during the first cycle of regional planning and are currently in execution:

DA Watson TS – Protection Upgrade

DA Watson TS is an 115kV station that connects multiple local hydraulic generating stations to HOSSM transmission system. Protection relays at DA Watson TS are at increased risk of failure and have been deemed obsolete by their manufacturer with limited spares parts and technical support available. In addition, the high arc flash hazard rating of the existing DA Watson TS metalclad switchgear compromises equipment integrity, system stability and worker safety.

The scope of work includes installing modern protection relays with arc flash detection mounted in racks located away from the metalclad switchgear. These new relays will also directly communicate with Hydro One’s Network Management System (NMS) utilizing the OC3 SCADA network.

7.4.2 New Needs

The following EOL refurbishment needs have been identified in the current regional planning cycle:

1. Echo River TS – Breaker Replacement

Echo River TS is a 230kV load supply station. The station consists of a single step-down transformer and a single 230kV circuit breaker to supply two (2) 34.5 kV customer feeders. Based on results of an asset condition assessment, the 230 kV circuit breaker is currently in deteriorating condition. This breaker is a live tank minimum oil breaker, which is considered obsolete and is due for replacement.

In consultation with the affected LDC, the breaker replacement will be coordinated with the other need at Echo River TS. The planned in-service year is 2021.

2. No.3 Sault Conductor and Structure Replacement

No.3 Sault is a 115kV transmission circuit that runs from MacKay TS 115kV station yard to Third Line TS 115kV station yard. This circuit provides an alternative path for local generation to reach load centres close to the Sault Ste. Marie area. Based on an asset condition assessment, No.3 Sault circuit is currently rated between “Poor” and “Very Poor” as it has multiple component (sleeves) failures and aging conductors. This circuit also accounts for 39% of all line equipment related outages experienced over the 2013 – 2017 period. The circuit is currently de-rated as a pre-cautionary action to minimize further stress.

The EOL replacement work of approximately 70km of conductor from Batchawana TS to MacKay TS includes replacing selected wood poles along the corridor as condition warrants. The planned in-service date is 2022. Based on load forecast, similar conductor ratings are expected. Due to the urgency the replacement, line rating will be reviewed within timeline afforded by the project.

3. Third Line TS – Autotransformer T2 & Protection Replacement

Third Line TS is a major transformer station in the region and it consists of two (2) 230/115kV, 150/200/250MVA autotransformers supplied by 230kV circuits K24G, P21G and P22G. Third line TS 115kV station yard supplies multiple load stations via Algoma No. 1, No. 2, No. 3 circuits, No.3 Sault circuit and Northern Ave circuit. It also supplied two (2) LDC HV load supply stations via 115kV circuits GL1SM GL2SM, GL1TA, and GL2TA. Based on an asset condition assessment, autotransformer T2 is approaching its EOL.

Based on the load forecast, similar ratings are required for the EOL autotransformer T2 replacement. While it is recognized that there is a capacity related need at the station as per Section 7.2 (to be considered in the Scoping Assessment Phase), the replacement of T2 will not alleviate the capacity need, as the replacement transformer (with similar ratings) is the largest standard size autotransformer available. To maintain supply reliability in the ELS Region, the planned in-service date for replacing T2 autotransformer and associated EOL protections is year 2024.

4. Patrick St TS – HV Breaker Replacement

Patrick St TS is an 115kV switching station that consists of thirteen (13) 115kV breakers. It connects to Third Line TS – 115kV station yard via 115kV Algoma No. 1, No. 2 and No. 3 circuits. It also connects to Clergue TS via 115kV Clergue No. 1 and No. 2 circuits. The station supplies major industrial customers in the Sault Ste. Marie area. Based on an asset condition assessment, four (4) out of thirteen (13) 115kV breakers are minimum oil live tank breakers and they are considered obsolete.

Based on the load forecast and expected system conditions, similar equipment ratings are required for EOL replacement. The current plan is to replace these four (4) obsolete breakers with new SF6 breakers, complete with new breaker disconnect switches. The planned in-service date for this project is 2024.

5. Batchawana TS / Goulais Bay TS – Station Refurbishment

Batchawana TS and Goulais Bay TS are load supply stations that are in proximity of each other, and both are connected to 115kV No.3 Sault circuit. Each station is currently configured with a single transformer supply. Based on an asset condition assessment, both stations are in a deteriorated state with obsolete equipment including power transformers, protections (fuse), batteries, chargers, and remote terminal units.

The scope of refurbishment is still under development, with different options under evaluation. HOSSM is actively engaging the local LDC to arrive at a mutually agreeable solution. The planned completion date for this refurbishment is anticipated to be 2024.

6. Northern Ave TS – Transformer T1 Replacement

Northern Ave TS is a 115kV load supply station that is connected to Third Line TS via 115kV Northern Ave circuit. Northern Ave Transformer T1 is a 115/34.5kV, 20/26.7MVA step down transformer that supplies Algoma Power Inc. via one (1) 34.5kV feeder. Transformer T1 has been in-service since the 1970's, and it is now approaching its EOL.

Based on the load forecast, similar equipment ratings are required for EOL replacement. The current plan of replacing T1 and associated equipment has an in-service date of year 2024.

7. DA Watson TS – Metalclad Switchgear Replacement

DA Watson TS is a 115kV load supply station that also has connectivity with three (3) local hydro generating stations. The station has two 45/60/75 MVA transformers and nine 34.5kV feeders. Based on an asset condition assessment, the existing metalclad feeder breakers are obsolete and near EOL.

Based on the load forecast and expected system conditions, similar ratings are required for EOL feeder breaker replacements. The planned in-service date to replace existing metalclad breakers and associated equipment at DA Watson TS is year 2025.

8. Clergue TS – Switchgear Replacement

Clergue TS is a 115kV station that connects Clergue Generating Station and LSP co-generation station to the HOSSM system via two (2) 115kV circuits emanating from Patrick St TS. Based on an asset condition assessment, the existing 12 kV minimum-oil metal-clad switchgear is obsolete and approaching EOL.

Based on the load forecast and expected system conditions, similar equipment ratings are required for EOL replacement. The planned in-service date to replace the metalclad switchgear and associated equipment is year 2026.

8 CONCLUSION AND RECOMMENDATIONS

Based on the findings of the Needs Assessment, the study team recommends the following:

1. The overload of the 230/115 kV auto-transformers at Third Line TS requires further regional coordination in the Scoping Assessment phase of Regional Planning to determine the best study approach to address the need. IESO will lead the Scoping Assessment phase.
2. Reliability to load at Andrew TS, Batchawana TS and Goulais TS to be reviewed. The review to be conducted by the transmitter and impacted distributor to evaluate the local reliability needs on a case by case basis.
3. The implementation and execution for the replacement of the following EOL transmission assets will be coordinated between Hydro One Sault Ste. Marie and the affected LDCs and/or customers, where required. These projects will be coordinated with IESO where required and where feasible within the timelines afforded by each project.
 - ii. Echo River TS – Breaker Replacement
 - iii. No.3 Sault Conductor and Structure Replacement
 - iv. Third Line TS – Autotransformer T2 & Protection Replacement
 - v. Patrick St TS – HV Breaker Replacement
 - vi. Batchawana TS / Goulais Bay TS – Station Refurbishment
 - vii. Northern Ave TS – Transformer T1 Replacement
 - viii. DA Watson TS – Metalclad Switchgear Replacement
 - ix. Clergue TS – Switchgear Replacement

4. The overload of Algoma No. 1 Circuit due to breaker failure at Patrick St TS and/or other multiple elements contingencies required additional study. Further analysis in the Scoping Assessment phase of Regional Planning is required to determine the best planning approach while taking into account the outcome of an ongoing SIA for new load connection at Patrick St TS.

9 REFERENCES

[1] East Lake Superior Region Need Assessment Report – December 2014

<https://www.hydroone.com/about/corporate-information/regional-plans/east-lake-superior>

[2] Planning Process Working Group Report to the OEB - [https://www.oeb.ca/oeb/ Documents/EB-2011-0043/PPWG_Regional_Planning_Report_to_the_Board_App.pdf](https://www.oeb.ca/oeb/Documents/EB-2011-0043/PPWG_Regional_Planning_Report_to_the_Board_App.pdf)

[3] Ontario Resource and Transmission Assessment Criteria (ORTAC) – Issue 5.0 – August 2007

[IESO ORTAC Issue 5.0 August 2007](#)

Appendix A: East Lake Superior Region Winter & Summer Non-Coincident Load Forecast

Winter Non-Coincident Load Forecast [MW]

Transformer Station		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
St. Mary's MTS (T1/T2)	Gross	52.16	51.78	51.39	51.01	50.63	50.25	49.88	49.51	49.14	48.78	48.41
	CDM	19.49	19.49	19.49	19.49	19.49	19.49	19.49	19.49	19.49	19.49	19.49
	DG	0.61	1.10	1.11	1.12	1.18	1.21	1.25	1.30	1.35	1.37	1.30
	Net	33.60	32.68	32.27	31.85	31.40	30.97	30.54	30.10	29.66	29.26	28.95
St. Mary's MTS (T3/T4)	Gross	51.97	51.58	51.20	50.82	50.44	50.06	49.69	49.32	48.96	48.59	48.23
	CDM	19.57	19.57	19.57	19.57	19.57	19.57	19.57	19.57	19.57	19.57	19.57
	DG	0.61	1.10	1.10	1.12	1.17	1.20	1.25	1.29	1.35	1.36	1.29
	Net	31.79	30.92	30.53	30.13	29.70	29.29	28.88	28.47	28.04	27.66	27.37
Tarentorus MTS (T1/T2)	Gross	64.35	63.87	63.40	62.93	62.46	61.99	61.53	61.08	60.62	60.17	59.72
	CDM	19.56	19.56	19.56	19.56	19.56	19.56	19.56	19.56	19.56	19.56	19.56
	DG	0.76	1.36	1.37	1.39	1.45	1.49	1.55	1.60	1.67	1.69	1.60
	Net	43.08	42.03	41.55	41.07	40.55	40.06	39.55	39.06	38.54	38.08	37.73
Tarentorus MTS (T3/T4)	Gross	69.04	68.52	68.02	67.51	67.01	66.51	66.01	65.52	65.04	64.55	64.07
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.81	1.46	1.47	1.49	1.56	1.60	1.66	1.71	1.79	1.81	1.72
	Net	68.23	67.07	66.55	66.02	65.45	64.91	64.36	63.81	63.25	62.74	62.35
Andrews TS (T4)	Gross	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Net	0.22	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
Batchawana TS	Gross	1.50	2.01	2.02	2.03	2.04	2.05	2.06	2.07	2.08	2.09	2.10
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.02	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.06	0.06	0.06
	Net	1.48	1.96	1.97	1.98	1.99	2.00	2.01	2.01	2.02	2.03	2.04
DA Watson CTS (T1/T2)	Gross	7.85	7.93	8.01	8.09	8.17	8.25	8.33	8.41	8.50	8.58	8.67
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.09	0.17	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24	0.23
	Net	7.76	7.76	7.84	7.91	7.98	8.05	8.12	8.19	8.27	8.34	8.44
Echo River TS (T1)	Gross	12.61	12.74	12.87	13.00	13.13	13.26	13.39	13.52	13.66	13.80	13.93
	CDM	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	DG	0.15	0.27	0.28	0.29	0.31	0.32	0.34	0.35	0.38	0.39	0.37
	Net	12.36	12.37	12.49	12.61	12.72	12.84	12.95	13.07	13.18	13.31	13.46
Goulais Bay TS (T1)	Gross	9.01	9.10	9.19	9.28	9.38	9.47	9.56	9.66	9.76	9.85	9.95
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.11	0.19	0.20	0.20	0.22	0.23	0.24	0.25	0.27	0.28	0.27
	Net	8.90	8.91	8.99	9.08	9.16	9.24	9.32	9.41	9.49	9.57	9.68
Hollingsworth TS (T2) Anjigami TS (T1)	Gross	12.50	12.69	12.88	13.07	13.27	13.47	13.67	13.87	14.08	14.29	14.51
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.15	0.27	0.28	0.29	0.31	0.32	0.34	0.36	0.39	0.40	0.39
	Net	12.35	12.42	12.60	12.78	12.96	13.14	13.32	13.51	13.69	13.89	14.12
MacKay TS (T1)	Gross	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Net	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Northern Ave TS (T1)	Gross	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	Net	0.20	0.20	0.20	0.20	0.20	0.20	0.19	0.19	0.19	0.19	0.19
Northern Ave TS (T2)	Gross	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.03	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.06
	Net	2.38	2.36	2.36	2.36	2.35	2.35	2.35	2.35	2.34	2.34	2.35
Chapleau MTS	Gross	4.12	4.03	4.13	3.92	4.41	4.33	4.36	3.70	4.01	3.96	3.96
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.05	0.09	0.09	0.09	0.10	0.10	0.11	0.10	0.11	0.11	0.11
	Net	4.07	3.94	4.04	3.83	4.31	4.23	4.25	3.61	3.89	3.84	3.85
Chapleau DS	Gross	9.9	10.5	12.1	12.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.12	0.22	0.26	0.27	0.33	0.35	0.37	0.39	0.41	0.42	0.40
	Net	9.76	10.31	11.88	11.99	14.07	14.16	14.25	14.33	14.41	14.50	14.62
Patrick St TS	Gross	149.7	159.9	167.2	164.6	165.6	165.8	165.3	165.6	165.6	165.5	165.5
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Net	149.70	159.90	167.20	164.60	165.60	165.80	165.30	165.60	165.60	165.50	165.50
Wallace Terrace CTS	Gross	15.60	15.80	15.70	15.70	15.70	15.70	15.70	15.70	15.70	15.70	15.70
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Net	15.60	15.80	15.70	15.70	15.70	15.70	15.70	15.70	15.70	15.70	15.70

Summer Non-Coincident Load Forecast [MW]

Transformer Station		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
St. Mary's MTS (T1/T2)	Gross	42.87	42.55	42.23	41.92	41.61	41.30	40.99	40.69	40.39	40.08	39.79
	CDM	19.61	19.61	19.61	19.61	19.61	19.61	19.61	19.61	19.61	19.61	19.61
	DG	0.50	0.91	0.91	0.92	0.97	0.99	1.03	1.06	1.11	1.12	1.07
	Net	22.76	22.04	21.72	21.39	21.04	20.70	20.36	20.02	19.67	19.36	19.11
St. Mary's MTS (T3/T4)	Gross	38.54	38.26	37.97	37.69	37.41	37.13	36.85	36.58	36.31	36.04	35.77
	CDM	19.66	19.66	19.66	19.66	19.66	19.66	19.66	19.66	19.66	19.66	19.66
	DG	0.45	0.81	0.82	0.83	0.87	0.89	0.93	0.96	1.00	1.01	0.96
	Net	18.43	17.78	17.49	17.19	16.88	16.57	16.27	15.96	15.65	15.37	15.15
Tarentorus MTS (T1/T2)	Gross	52.00	51.62	51.23	50.85	50.47	50.10	49.73	49.36	48.99	48.63	48.26
	CDM	19.75	19.75	19.75	19.75	19.75	19.75	19.75	19.75	19.75	19.75	19.75
	DG	0.61	1.10	1.10	1.12	1.17	1.21	1.25	1.29	1.35	1.36	1.30
	Net	31.64	30.77	30.38	29.98	29.55	29.14	28.72	28.31	27.89	27.51	27.22
Tarentorus MTS (T3/T4)	Gross	52.32	51.94	51.55	51.17	50.79	50.41	50.03	49.66	49.29	48.93	48.56
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.62	1.11	1.11	1.13	1.18	1.21	1.26	1.30	1.36	1.37	1.30
	Net	51.71	50.83	50.44	50.04	49.61	49.20	48.78	48.36	47.94	47.55	47.26
Andrews TS (T4)	Gross	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Net	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Batchawana TS	Gross	1.56	1.57	1.59	1.61	1.62	1.64	1.65	1.67	1.69	1.70	1.72
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.02	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05
	Net	1.54	1.54	1.56	1.57	1.58	1.60	1.61	1.63	1.64	1.65	1.67
DA Watson CTS (T1/T2)	Gross	5.11	5.16	5.22	5.27	5.32	5.37	5.43	5.48	5.54	5.59	5.65
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.06	0.11	0.11	0.12	0.12	0.13	0.14	0.14	0.15	0.16	0.15
	Net	5.05	5.05	5.11	5.15	5.20	5.24	5.29	5.34	5.39	5.43	5.50
Echo River TS (T1)	Gross	13.50	13.63	13.77	13.91	14.05	14.19	14.33	14.47	14.62	14.76	14.91
	CDM	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	DG	0.16	0.29	0.30	0.31	0.33	0.34	0.36	0.38	0.40	0.41	0.40
	Net	13.24	13.24	13.37	13.50	13.62	13.75	13.87	13.99	14.12	14.25	14.41
Goulais Bay TS (T1)	Gross	4.74	4.78	4.83	4.88	4.93	4.98	5.03	5.08	5.13	5.18	5.23
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.06	0.10	0.10	0.11	0.11	0.12	0.13	0.13	0.14	0.15	0.14
	Net	4.68	4.68	4.73	4.77	4.82	4.86	4.90	4.95	4.99	5.03	5.09
Hollingsworth TS (T2) Anjigami TS (T1)	Gross	12.15	12.28	12.40	12.52	12.65	12.77	12.90	13.03	13.16	13.29	13.43
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.14	0.26	0.27	0.28	0.29	0.31	0.32	0.34	0.36	0.37	0.36
	Net	12.01	12.02	12.13	12.24	12.36	12.46	12.58	12.69	12.80	12.92	13.07
MacKay TS (T1)	Gross	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Net	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Northern Ave TS (T1)	Gross	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	Net	0.20	0.20	0.20	0.20	0.20	0.20	0.19	0.19	0.19	0.19	0.19
Northern Ave TS (T2)	Gross	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45

	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.03	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07
	Net	2.42	2.40	2.40	2.40	2.39	2.39	2.39	2.39	2.38	2.38	2.38
Chapleau MTS	Gross	2.36	2.19	2.02	2.06	2.51	1.90	1.62	2.06	2.05	2.02	2.02
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.03	0.05	0.04	0.05	0.06	0.05	0.04	0.05	0.06	0.06	0.05
	Net	2.33	2.14	1.98	2.02	2.45	1.85	1.58	2.01	2.00	1.96	1.96
Chapleau DS	Gross	7.4	8.0	9.6	9.7	11.8	11.9	12.0	12.1	12.1	12.2	12.3
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.09	0.17	0.21	0.21	0.27	0.29	0.30	0.32	0.33	0.34	0.33
	Net	7.31	7.83	9.39	9.49	11.53	11.61	11.70	11.78	11.77	11.86	11.97
Patrick St TS	Gross	147.8	156.4	160.5	160.6	160.8	160.6	160.7	160.7	160.7	160.7	160.7
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Net	147.83	156.41	160.52	160.59	160.84	160.65	160.69	160.73	160.69	160.70	160.70
Wallace Terrace CTS	Gross	15.33	15.43	15.70	15.49	15.54	15.50	15.53	15.55	15.52	15.53	15.53
	CDM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Net	15.33	15.43	15.70	15.49	15.54	15.50	15.53	15.55	15.52	15.53	15.53

Appendix B: Lists of Step-Down Transformer Stations

Sr. No.	Transformer Stations
1.	Andrew TS
2.	Anjigami TS
3.	Batchawana TS
4.	Chapleau DS
5.	Chapleau MTS
6.	Clergue TS
7.	DA Watson TS
8.	Echo River TS
9.	Flakeboard CTS
10.	Gold Mines CTS
11.	Goulais Bay TS
12.	Hollingsworth TS
13.	MacKay TS
14.	Northern Ave TS
15.	Patrick St TS
16.	Rentech CTS
17.	St. Mary's MTS
18.	Tarentorus MTS
19.	Third Line TS
20.	Wallace Terrace CTS
21.	Wawa TS

Appendix C: Lists of Transmission Circuits

Sr. No.	Circuit ID	From Station	To Station	Voltage (kV)
1.	K24G	Third Line TS	MacKay TS	230
2.	P21G	Third Line TS	Mississagi TS	230
3.	P22G	Third Line TS	Mississagi TS	230
4.	P25W	Mississagi TS	Wawa TS	230
5.	P26W	Mississagi TS	Wawa TS	230
6.	T27P	Mississagi TS	Wells CGS	230
7.	T28P	Mississagi TS	Wells CGS	230
8.	W21M	Marathon TS	Wawa TS	230
9.	W22M	Marathon TS	Wawa TS	230
10.	W23K	MacKay TS	Wawa TS	230
11.	No.1 ALGOMA	Third Line TS	Patrick St TS	115
12.	No.2 ALGOMA	Third Line TS	Patrick St TS	115
13.	No.3 ALGOMA	Third Line TS	Patrick St TS	115
14.	ANDREWS1	Andrews TS	Andrews CGS	115
15.	CLERGUE1	Patrick St TS	Clergue TS	115
16.	CLERGUE2	Patrick St TS	Clergue TS	115
17.	No.1 COGEN	Clergue TS	Lake Superior CGS	115
18.	No.2 COGEN	Clergue TS	Lake Superior CGS	115
19.	GARTSHO1	MacKay TS	Gartshore SS	115
20.	GARTSHO2	MacKay TS	Gartshore SS	115

21.	GARTSHO3	Gartshore SS	Gartshore GS	115
22.	GL1SM	Third Line TS	St. Mary's MTS	115
23.	GL1TA	Third Line TS	Tarentorus MTS	115
24.	GL2SM	Third Line TS	St. Mary's MTS	115
25.	GL2TA	Third Line TS	Tarentorus MTS	115
26.	HARRIS1	Magpie SS	Harris CGS	115
27.	HIGHFAL1	Anjigami TS	DA Watson TS	115
28.	HIGHFAL2	Anjigami TS	DA Watson TS	115
29.	HLNGWTH1	Hollingsworth TS	Wawa TS	115
30.	HOGG1	Gartshore SS	Hogg CGS	115
31.	LEIGHBY1	Patrick St TS	Flakeboard CTS	115
32.	MAGPIE1	DA Watson TS	Magpie SS	115
33.	MISSION1	Magpie SS	Misson Falls CGS	115
34.	No.3 SAULT	MacKay TS	Third Line TS	115
35.	STEEPHL1	Magpie SS	Steephill Falls CGS	115
36.	W2C	Wawa TS	Chapleau DS	115

Appendix D: Lists of LDCs in the East Lake Superior Region

SR. NO.	COMPANY	CONNECTION TYPE (TX / DX)
1.	ALGOMA POWER INC.	TX
2.	CHAPLEAU PUC	TX
3.	HYDRO ONE NETWORKS INC. (DISTRIBUTION)	TX
4.	SAULT STE. MARIE PUC	TX

Appendix E: Acronyms

Acronym	Description
A	Ampere
BES	Bulk Electric System
BPS	Bulk Power System
CDM	Conservation and Demand Management
CIA	Customer Impact Assessment
CGS	Customer Generating Station
CSS	Customer Switching Station
CTS	Customer Transformer Station
DESN	Dual Element Spot Network
DG	Distributed Generation
DS	Distribution Station
GS	Generating Station
HV	High Voltage
IESO	Independent Electricity System Operator
IRRP	Integrated Regional Resource Plan
kV	Kilovolt
LDC	Local Distribution Company
LP	Local Plan
LTE	Long Term Emergency
LTR	Limited Time Rating
LV	Low Voltage
MTS	Municipal Transformer Station
MW	Megawatt
MVA	Mega Volt-Ampere
MVAR	Mega Volt-Ampere Reactive
NA	Needs Assessment
NERC	North American Electric Reliability Corporation
NGS	Nuclear Generating Station
NPCC	Northeast Power Coordinating Council Inc.
NUG	Non-Utility Generator
OEB	Ontario Energy Board
OPA	Ontario Power Authority
ORTAC	Ontario Resource and Transmission Assessment Criteria
PF	Power Factor
PPWG	Planning Process Working Group
RIP	Regional Infrastructure Plan
SA	Scoping Assessment
SIA	System Impact Assessment
SPS	Special Protection Scheme
SS	Switching Station
STG	Steam Turbine Generator
TS	Transformer Station