



East Lake Superior

REGIONAL INFRASTRUCTURE PLAN

October 1st, 2021



(This page is intentionally left blank)

Prepared and supported by:

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



DISCLAIMER

This Regional Infrastructure Plan (“RIP”) report was prepared for the purpose of developing an electricity infrastructure plan to address all near and mid-term needs identified in previous planning phases and any additional needs identified based on new and/or updated information provided by the RIP Study Team.

The preferred solution(s) that have been identified in this report may be reevaluated based on the findings of further analysis. The load forecast and results reported in this RIP report are based on the information provided and assumptions made by the participants of the RIP Study Team.

Study Team participants, their respective affiliated organizations, and Hydro One Networks Inc. (collectively, “the Authors”) make no representations or warranties (express, implied, statutory or otherwise) as to the RIP report or its contents, including, without limitation, the accuracy or completeness of the information therein and shall not, under any circumstances whatsoever, be liable to each other, or to any third party for whom the RIP report was prepared (“the Intended Third Parties”), or to any other third party reading or receiving the RIP report (“the Other Third Parties”), for any direct, indirect or consequential loss or damages or for any punitive, incidental or special damages or any loss of profit, loss of contract, loss of opportunity or loss of goodwill resulting from or in any way related to the reliance on, acceptance or use of the RIP report or its contents by any person or entity, including, but not limited to, the aforementioned persons and entities.

EXECUTIVE SUMMARY

THIS REGIONAL INFRASTRUCTURE PLAN (“RIP”) WAS PREPARED BY HYDRO ONE SAULT STE. MARIE LP WITH SUPPORT FROM THE RIP STUDY TEAM IN ACCORDANCE TO THE ONTARIO TRANSMISSION SYSTEM CODE REQUIREMENTS. IT IDENTIFIES INVESTMENTS IN TRANSMISSION FACILITIES, DISTRIBUTION FACILITIES, OR BOTH, THAT SHOULD BE DEVELOPED AND IMPLEMENTED TO MEET THE ELECTRICITY INFRASTRUCTURE NEEDS WITHIN THE EAST LAKE SUPERIOR REGION.

The participants of the Regional Infrastructure Plan (“RIP”) Study Team included members from the following organizations:

- Algoma Power Inc. (“API”)
- Chapleau Public Utilities Corporation (“Chapleau PUC”)
- Hydro One Networks Inc. (Transmission)
- Hydro One Sault Ste. Marie LP. (“HOSSM”)
- Hydro One Networks Inc. (Distribution)
- Independent Electricity System Operator (“IESO”)
- PUC Distribution Inc. (“PUC”)

This RIP is the final phase of the second cycle of East Lake Superior (ELS) regional planning process, which follows the completion of the East Lake Superior Integrated Regional Resource Plan (“IRRP”) in April 2021 and the East Lake Superior Region Needs Assessment (“NA”) in June 2019. This RIP provides a consolidated summary of the needs and recommended plans for East Lake Superior Region over the planning horizon (1 – 20 years) based on available information.

This RIP discusses needs identified in the previous regional planning cycle, the Needs Assessment and IRRP reports for this cycle, and wires solutions recommended to address these needs. Implementation plans to address some of these needs are already completed or are underway. Since the previous regional planning cycle, the following projects are underway or completed

- **End of life Wood Pole Replacements:** Multiple wood pole replacement projects were completed on a number of 115kV and 230kV circuits. These circuits consisted of wood pole structures that were assessed at being at their end of life and in need of replacements. The following circuits have their end of life wood pole structures replacement completed between 2014 to 2019:
 - No.2 and No.3 Algoma (completed in 2014)
 - Northern Ave 115kV circuit (completed in 2014)
 - No.1 Garshore (completed in 2015)
 - Hogg (completed in 2015)
 - P21G (completed in 2019)

- **Hwy 101 TS:** Installed a new control building completed with new protection relays, batteries, chargers, automatic transfer schemes and RTU to replace end of life components such as electro-mechanical relays and batteries. This project was completed and in-serviced in 2015.
- **Anjigami TS:** Performed electrical and civil upgrade, including the installation of a new 44kV breaker, redundant battery and chargers, and replacement of protection equipment and other end of life AC/DC system. It also includes ground grid improvements. This project was completed in 2017.
- **Echo River TS:** Improve transmission reliability with the installation of an additional 230/34.5kV 25MVA Transformer (T2) as an on-site spare. This project is underway with a targeted in-service date of 2023 Q2.

The major infrastructure investments recommended by the Study Team in the near and mid-term planning horizon are provided in the Table 1 below, along with their planned in-service date and budgetary estimates for planning purpose.

Table 1. Recommended Plans in East Lake Superior Region over the Next 10 Years

No.	Need	Recommended Action Plan	Planned I/S Date	Budgetary Estimate ⁽¹⁾
1	Eliminate/Minimize manual communication between IESO and OGCC when arming Third Line Instantaneous Load Rejection Scheme	Enable remote arming of Third Line Instantaneous Load Rejection Scheme via ICCP line between IESO's EMS and HONI's NMS	2021	\$10K
2	Third line TS: End of life protection	Replace end of life protection per current standard	2022	\$0.8M
3	Echo River TS : Transmission Supply Reliability and end of life breaker	Install 'hot' spare transformer and replace end of life breaker	2023/2024	\$11.5M
4	115kV Sault No.3: end of life structures and conductor	Replace end of life structure and conductor per current standard ¹	2024	\$54.4M
5	Batchawana TS: End of life components	Refurbish Batchawana TS with MUS provision	2024	\$6.2M
6	Goulais TS: End of life components	Refurbish Goulais TS with MUS provision	2024	\$13.4M
7	Patrick St. TS, Algoma No.1 overload	Implement Automatic Load Rejection Scheme at Patrick St. TS	2023	\$1.2M

¹ To coordinated with IESO's 2021 Bulk Planning Study regarding Sault No.3 Circuit Overloading

8	Patrick St. TS: End of life 115kV breaker	Replace end of life 115kV breakers 'like for like' per current standard	2024	\$3.3M
9	Third Line TS : T2 end of life	Replace end of life T2 'like for like' per current standard	2025	\$16.4M
10	Northern Ave TS: end of life component replacement	Replace end of life T1 with smaller MVA unit and protection relays per current standard	2025	\$2.5M
11	Anjigami/Hollingsworth TS : Transformer overload	Build new 115/44kV Station - HOSSM to work with API to continue to develop solutions	2024/2025	\$30M
12	Clergue TS: End of life metal clad switch gear	Replace end of life switch gear 'like for like' per current standard	2026	\$5.2M
13	Hollingsworth TS: End of life Protection relay	Replace end of life protection per current standard	2025	\$1.1M
14	D.A. Watson TS: End of life metal clad switch gear	Replace end of life switch gear 'like for like' per current standard	2026	\$9.2M

The Study Team recommends that:

- Hydro One to continue with the implementation of infrastructure investments listed in Table 1 while keeping the Study Team apprised of project status;
- All the other identified needs/options in the long-term will be further reviewed by the Study Team in the next regional planning cycle.

TABLE OF CONTENTS

Disclaimer 4

Executive Summary 5

Table of Contents 8

1 Introduction..... 10

 1.1 Objectives and Scope 11

 1.2 Structure 12

2 Regional Planning Process..... 13

 2.1 Overview 13

 2.2 Regional Planning Process 13

 2.3 RIP Methodology 15

3 Regional Characteristics 17

4 Transmission Facilities/Projects Completed and/or Underway since last Regional planning 20

5 Load Forecast and Study Assumptions 21

 5.1 Load Forecast 21

 5.2 Study Assumptions 21

6 Adequacy of Existing Facilities 23

 6.1 230 kV Transmission Facilities..... 23

 6.2 230/115 kV Autotransformers Facilities..... 24

 6.3 115 kV Transmission Facilities..... 24

 6.4 Step-Down Transformer Station Facilities..... 25

 6.5 Bulk Areas Need 26

7 Regional Needs and Plans..... 27

 7.1 Third Line TS – Enable remote arming of Third Line TS Load Rejection Scheme 28

 7.2 Third Line TS – End of life Protection Replacment 29

 7.3 Patrick St TS – Automatic Load Rejection Scheme 30

 7.4 Echo River TS – Install Spare 230kV Transformer (2023) and end of life 230kV breaker replacement (2024) 30

 7.5 115kV Sault No.3 Structure and Conductor Replacement..... 31

 7.6 Batchawana TS and Goulais – End of life Component Replacement..... 32

 7.7 Patrick St TS – End of life 115kV breaker replacement 34

 7.8 Third Line TS – T2 End of Life Replacement 35

 7.9 Northern Ave TS – T1 End of Life Replacement 35

 7.10 Anjigami/Hollingsworth TS – Transformer overload..... 36

 7.11 Clergue TS - End of life metal clad switch gear replacement..... 37

 7.12 Hollingsworth TS – End of life Protection Replacment 37

 7.13 Watson TS - End of life Metal Clad switch gear replacement..... 38

8 Conclusions and Next Steps 39

9 References..... 41

Appendix A. Stations in the East Lake Superior Region 42

Appendix B. Transmission Lines in the East Lake Superior Region..... 44

Appendix C. Distributors in the East Lake Superior Region 45

Appendix D. East Lake Superior Region Load Forecast 46

List of Figures

Figure 1-1: East Lake Superior Region Map	11
Figure 2-1: Regional Planning Process Flowchart.....	15
Figure 2-2: RIP Methodology	16
Figure 3-1: East Lake Superior Regional Map.....	18
Figure 3-2: Single Line Diagram of East Lake Superior Region Transmission Network.....	19
Figure 5-1: East Lake Superior Region Load Forecast.....	21
Figure 7-1: ICCP Link between IESO and Hydro One.....	30
Figure 7-2: Batchawana TS and Goulais Bay TS on 115kV circuit map	31

List of Tables

Table 6-1: New Facilities Assumed In-Service	23
Table 6-2: East Lake Superior Step-Down Transformer Stations.....	25
Table 7-1: Identified Near and Mid-Term Needs in East Lake Superior Region	27
Table 8-1: Recommended Plans in East Lake Superior Region over the Next 10 Years	39
Table D-1: East Lake Superior Non-coincident peak Load Forecast, with the Impacts of Energy-Efficiency Savings per station	46
Table D-2: East Lake Superior Forecasted Impacts of Energy-Efficiency Savings due to Codes , Standards and Funded CDM Program.....	47
Table D-3: East Lake Superior IRRP Forecasted DER by station.....	48

1 INTRODUCTION

THIS REPORT PRESENTS THE REGIONAL INFRASTRUCTURE PLAN (“RIP”) TO ADDRESS THE ELECTRICITY NEEDS OF THE EAST LAKE SUPERIOR REGION BETWEEN 2019 AND 2039.

The report was prepared by Hydro One Sault Ste. Marie LP (HOSSM) on behalf of the Study Team that consists of Hydro One Networks Inc. (Transmission), Hydro One (Distribution), Algoma Power Inc. (API), PUC Distribution Inc., Chapleau Public Utilities Corporation and the Independent Electricity System Operator (“IESO”), in accordance with the new Regional Planning process established by the Ontario Energy Board in 2013.

The East Lake Superior Region is the region extends from the town of Dubreuilville in the north to the town of Bruce Mines in the south and includes the city of Sault Ste. Marie and the township of Chapleau. The region is roughly bordered geographically by Highway 129 to the east, Highway 101 to the north, Lake Superior to the west and St. Mary’s River and St. Joseph Channel to the south as shown in Figure 1.1 below. The region is supplied from a combination of local generation and connection to the Ontario electricity grid via 230 kV transmission lines to Mississagi Transformer Station in the East, 230kV and 115 kV transmission lines to Wawa Transformer Station in the North.

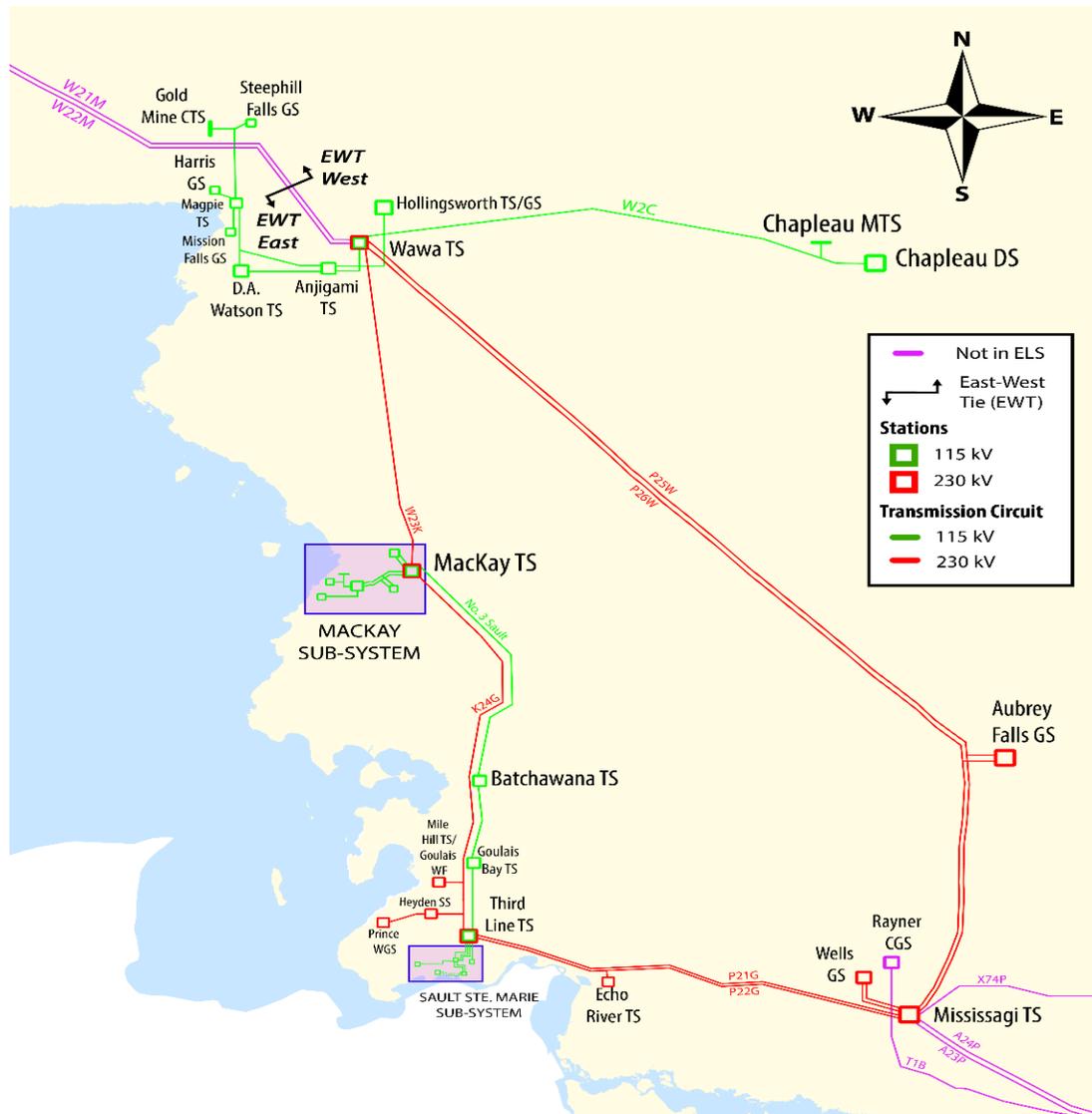


Figure 1-1: East Lake Superior Region Map

1.1 Objectives and Scope

The RIP report examines the needs in the East Lake Superior Region. Its objectives are to:

- Provide a comprehensive summary of needs and wires plans to address the needs;
- Identify any new needs that may have emerged since previous planning phases e.g., Needs Assessment (“NA”), Scoping Assessment (“SA”), and/or Integrated Regional Resource Plan (“IRR”);
- Assess and develop a wires plan to address these needs; and
- Identify investments in transmission and distribution facilities or both that should be developed and implemented on a coordinated basis to meet the electricity infrastructure needs within the region.

The RIP reviewed factors such as the load forecast, major high voltage sustainment issues emerging over the near, mid- and long-term horizon, transmission and distribution system capability along with any updates to local plans, conservation and demand management (“CDM”) forecasts, renewable and non-renewable generation development, and other electricity system and local drivers that may impact the need and alternatives under consideration.

The scope of this RIP is as follows:

- A consolidated report of the relevant wires plans to address near and medium-term needs identified in previous planning phases (Needs Assessment, Scoping Assessment, and/or Integrated Regional Resource Plan);
- Discussion of any other major transmission infrastructure investment plans over the planning horizon;
- Identification of any new needs and a wires plan to address these needs based on new and/or updated information;
- Develop a plan to address any longer term needs identified by the Study Team.

1.2 Structure

The rest of the report is organized as follows:

- Section 2 provides an overview of the regional planning process.
- Section 3 describes the regional characteristics.
- Section 4 describes the transmission work completed over the last ten years.
- Section 5 describes the load forecast and study assumptions used in this assessment.
- Section 6 describes the adequacy of the transmission facilities in the region over the study period.
- Section 7 discusses the needs and provides the alternatives and preferred solutions.
- Section 8 provides the conclusion and next steps.

2 REGIONAL PLANNING PROCESS

2.1 Overview

Planning for the electricity system in Ontario is done at three levels: bulk system planning, regional system planning, and distribution system planning. These levels differ in the facilities that are considered and the scope of impact on the electricity system. Planning at the bulk system level typically looks at issues that impact the system on a provincial level, while planning at the regional and distribution levels looks at issues on a more regional or localized level.

Regional planning looks at supply and reliability issues at a regional or local area level. Therefore, it largely considers the 115 kV and 230 kV portions of the power system that supply various parts of the province.

2.2 Regional Planning Process

A structured regional planning process was established by the Ontario Energy Board (“OEB”) in 2013 through amendments to the Transmission System Code (“TSC”) and Distribution System Code (“DSC”). The process consists of four phases: the Needs Assessment² (“NA”), the Scoping Assessment (“SA”), the Integrated Regional Resource Plan (“IRRP”), and the Regional Infrastructure Plan (“RIP”).

The regional planning process begins with the NA phase, which is led by the transmitter to determine if there are regional needs. The NA phase identifies the needs and the Study Team determines whether further regional coordination is necessary to address them. If no further regional coordination is required, further planning is undertaken by the transmitter and the impacted local distribution company(s) (“LDC”) or customer(s) and develops a Local Plan (“LP”) to address them.

In situations where identified needs require coordination at the regional or sub-regional levels, the IESO initiates the SA phase. During this phase, the IESO, in collaboration with the transmitter and impacted LDCs, reviews the information collected as part of the NA phase, along with additional information on potential non-wires alternatives, and makes a decision on the most appropriate regional planning approach. The approach is either a RIP, which is led by the transmitter, or an IRRP, which is led by the IESO. If more than one sub-region was identified in the NA phase, it is possible that a different approach could be taken for different sub-regions.

The IRRP phase will generally assess infrastructure (wires) versus resource (CDM and Distributed Generation and energy efficiency) options at a higher or more macro level, but sufficient to permit a comparison of options. If the IRRP phase identifies that infrastructure options may be most appropriate to meet a need, the RIP phase will conduct detailed planning to identify and assess the specific wires alternatives and recommend a preferred wires solution. Similarly, resource options that the IRRP identifies as best suited to meet a need are then further planned in greater detail by the IESO. The IRRP phase also includes IESO led stakeholder engagement with municipalities, Indigenous communities, business sectors and other interested stakeholders in the region.

² Also referred to as Needs Screening

The RIP phase is the fourth and final phase of the regional planning process and involves: discussion of previously identified needs and plans; identification of any new needs that may have emerged since the start of the planning cycle; and development of a wires plan to address the needs where a wires solution would be the best overall approach. This phase is led and coordinated by the transmitter and the deliverable is a comprehensive report of a wires plan for the region. Once completed, this report is also referenced in transmitter's rate filing submissions and as part of LDC rate applications with a planning status letter provided by the transmitter.

To efficiently manage the regional planning process, Hydro One has been undertaking wires planning activities in collaboration with the IESO and/or LDCs for the region as part of and/or in parallel with:

- Planning activities that were already underway in the region prior to the new regional planning process taking effect;
- The NA, SA, and LP phases of regional planning;
- Participating in and conducting wires planning as part of the IRRP for the region or sub-region;
- Working and planning for connection capacity requirements with the LDCs and transmission connected customers.

Figure 2-1 illustrates the various phases of the regional planning process (NA, SA, IRRP, and RIP) and their respective phase trigger, lead, and outcome.

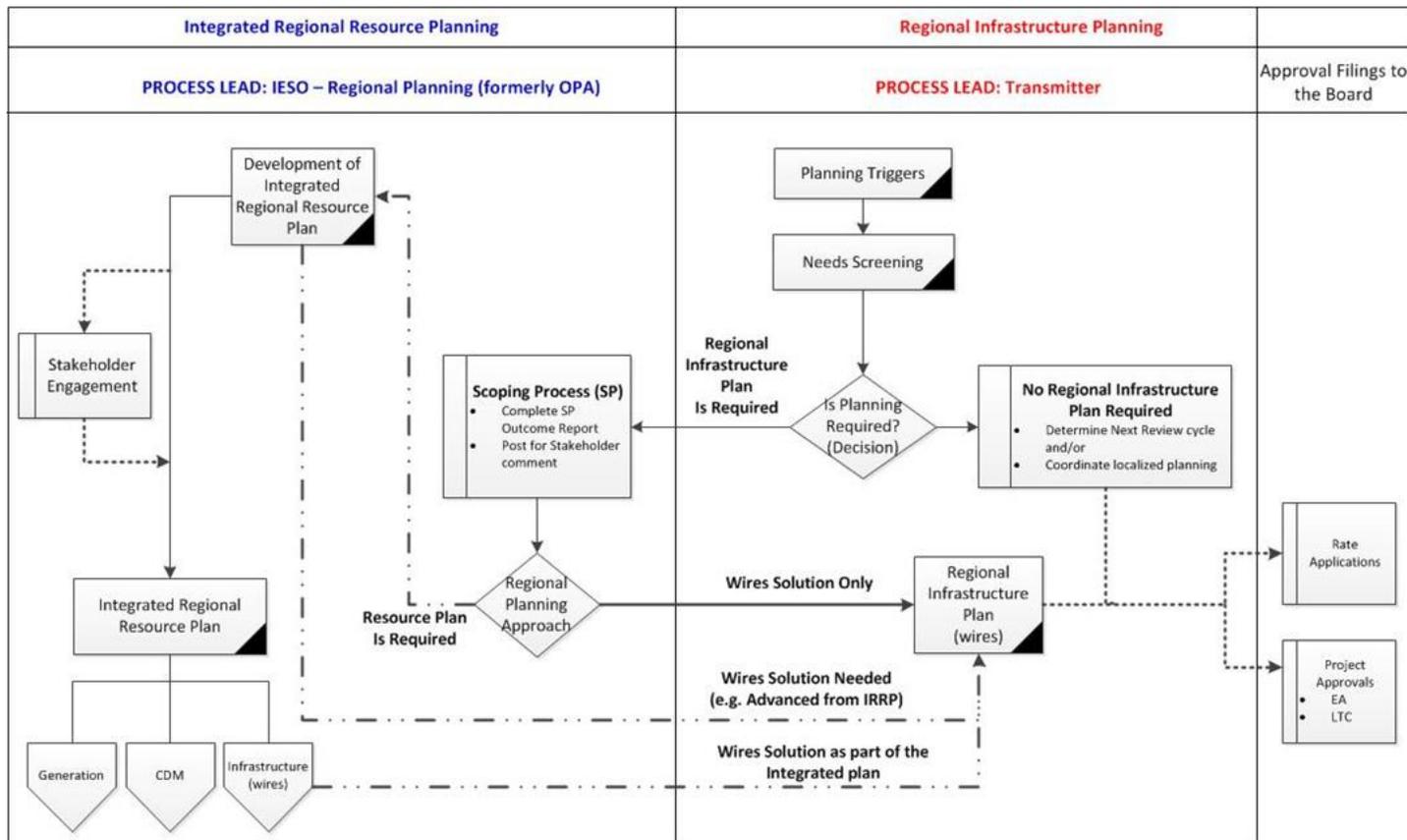


Figure 2-1: Regional Planning Process Flowchart

2.3 RIP Methodology

The RIP phase consists of a four step process (see Figure 2-2) as follows:

- 1) **Data Gathering:** The first step of the process is the review of planning assessment data collected in the previous phase of the regional planning process. Hydro One collects this information and reviews it with the Study Team to reconfirm or update the information as required. The data collected includes:
 - Net peak demand forecast at the transformer station level. This includes the effect of any distributed generation or conservation and demand management programs.
 - Existing area network and capabilities including any bulk system power flow assumptions.
 - Other data and assumptions as applicable such as asset conditions; load transfer capabilities, and previously committed transmission and distribution system plans.
- 2) **Technical Assessment:** The second step is a technical assessment to review the adequacy of the regional system including any previously identified needs. Depending upon the changes to load forecast or other relevant information, regional technical assessment may or may not be required

or be limited to specific issue only. Additional near and mid-term needs may be identified in this phase.

- 3) **Alternative Development:** The third step is the development of wires options to address the needs and to come up with a preferred alternative based on an assessment of technical considerations, feasibility, environmental impact and costs.
- 4) **Implementation Plan:** The fourth and last step is the development of the implementation plan for the preferred alternative.

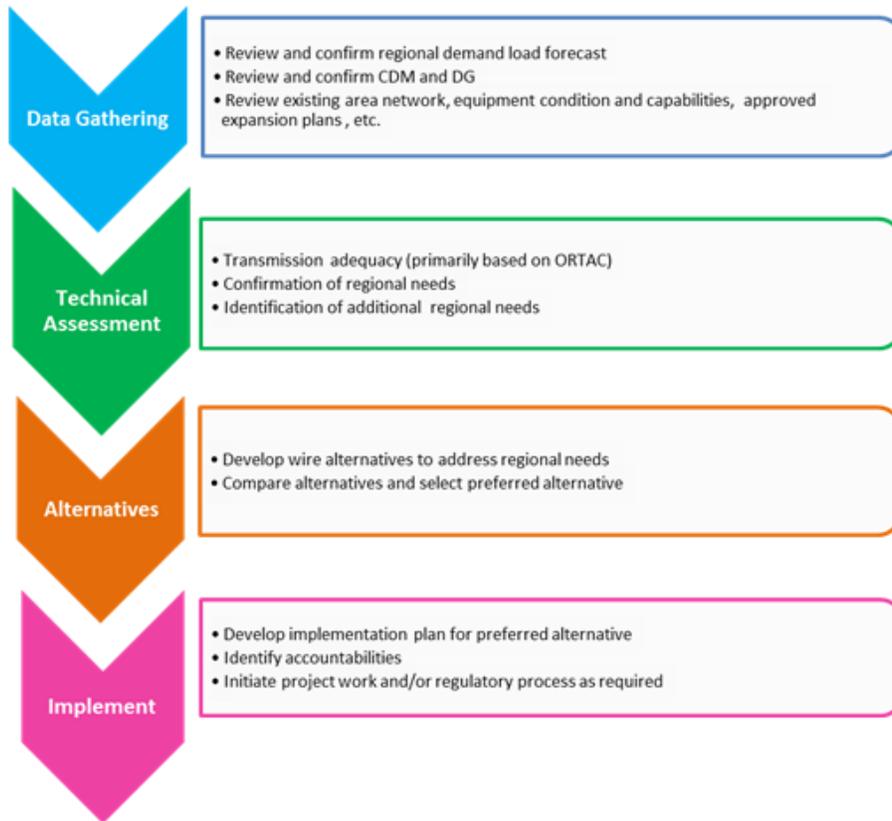


Figure 2-2: RIP Methodology

3 REGIONAL CHARACTERISTICS

THE EAST LAKE SUPERIOR REGION INCLUDES THE AREA ROUGHLY BORDERED GEOGRAPHICALLY BY TOWN OF DUBERUILVILLE AND HIGHWAY 101 TO THE NORTH AND THE TOWNSHIP OF CHAPLEAU, BRUCE MINES TO THE SOUTH AND INCLUDES THE CITY OF SAULT STE. MARIE, HIGHWAY 129 TO THE EAST, AND LAKE SUPERIOR TO THE WEST. IT CONSISTS OF THE CITY OF SAULT STE. MARIE.

The region is supplied from a combination of local generation and connections to the Ontario electricity grid via 230 kV transmission lines to Mississagi Transformer Station in the East, 230kV and 115 kV transmission lines to Wawa Transformer Station in the North. Majority of the region's electrical need is supplied through a 230/115 kV transformer station at Third Line TS. Local generation in the area consists of mainly hydroelectric and wind generation with a total installed capacity of 1039 MW in the 115 kV and 230kV networks. The East Lake Superior Region is a winter peaking region, with 2020 winter peak demand at 361MW.

PUC Distribution Inc. ("PUC") is the Local Distribution Company ("LDC") which serves the electricity demand in the City of Sault Ste. Marie. The LDC that supplies primarily rural customers – industrial, commercial, and residential customers in the aregion are API, Chapleau PUC and Hydro One Networks Inc. Distribution

Below is a description of major Transmission asset in the region:

- Third line TS is the major transmission station that connects the 115kV system within the City of Sault Ste. Marie via two 230/115kV autotransformer to the 230kV bulk electricity network.
- Mackay TS is a 230/115kV station with one 230/115kV autotransformer that connects the local 115kV network in the vicinity of Montreal River to the 230kV bulk electricity network.
- Wawa TS is a 230/115kV station with two 230/115kV autotransformer that connects the local 115kV network in the vicinity of Michipicoten River.
- 12 other Transmission stations supply the area, with 10 of them operating at 115kV, 1 operating at 230kV , 1 operating at 44kV ³
- A total of 319 km of 230kV circuits, 232 km of 115kV circuits and 10 km of 44kV circuits interconnect transmission stations, generation customer(s), distribution customer(s) and Transmission connected load customer(s) within the region.

Table in Appendix A and B summarize Transmission station and circuits at different operating voltages and in the area. A geographical map showing the electrical facilities of the East Lake Superior Region is provided in Figure 3-1. A single line diagram showing the electrical facilities of the East Lake Superior Region is provided in Figure 3-2.

³ The 44kV station and line is included in HOSSM's transmitter license and are deemed transmission asset by the OEB.

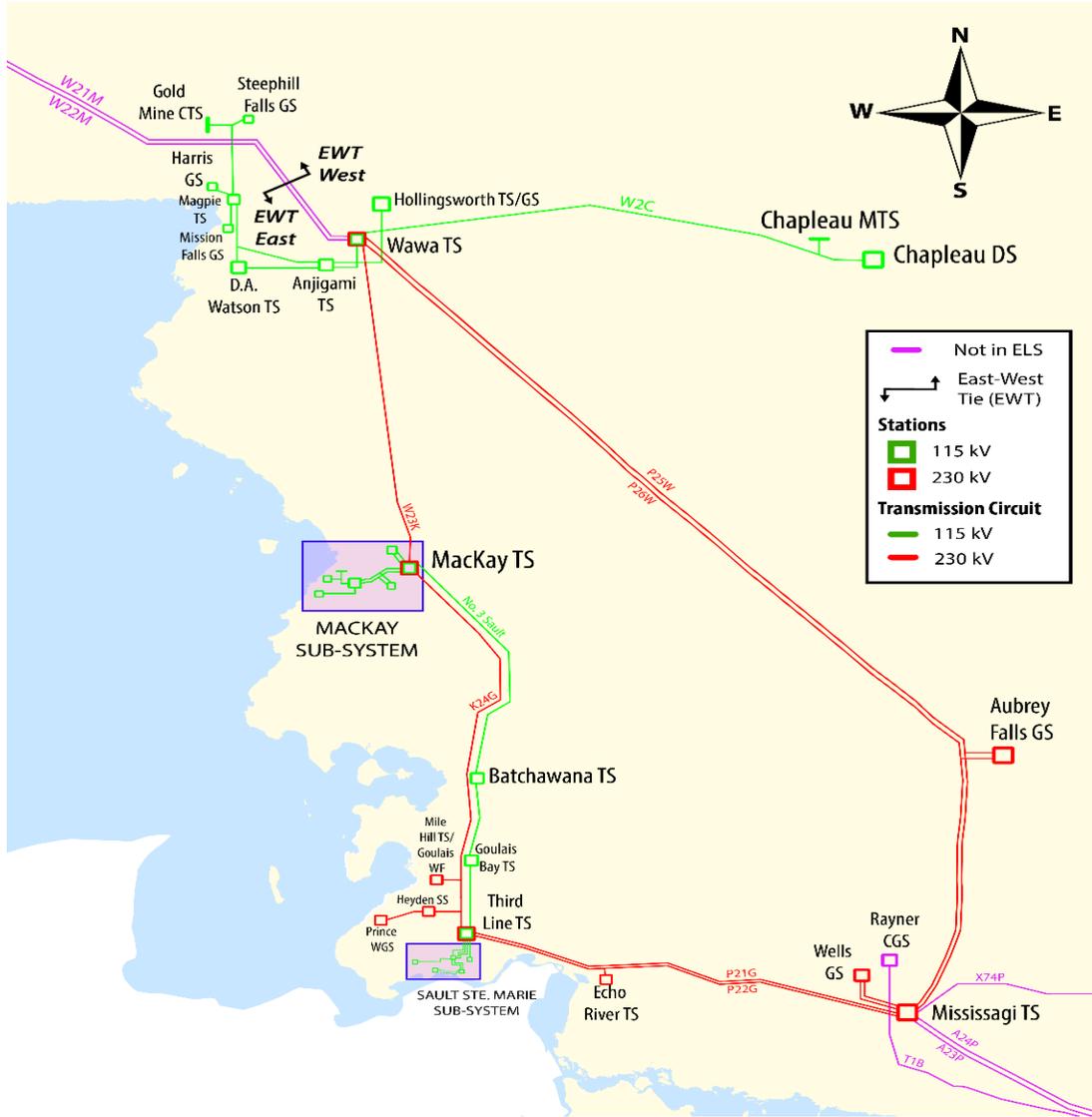


Figure 3-1: East Lake Superior Region’s Transmission Network

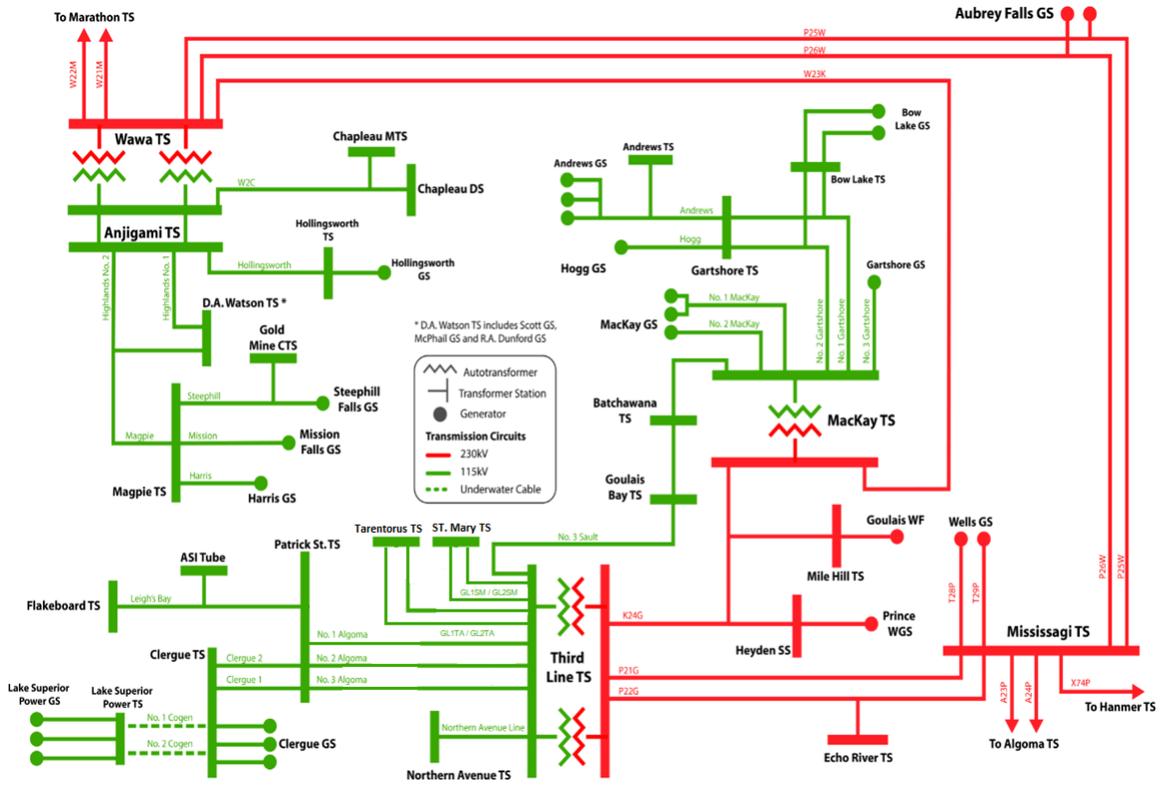


Figure 3-2: Single Line Diagram of East Lake Superior Region's Transmission Network

4 TRANSMISSION FACILITIES/PROJECTS COMPLETED AND/OR UNDERWAY SINCE LAST REGIONAL PLANNING

THE ESL REGIONS COMPLETED IT 1ST CYCLE REGIONAL PLANNING IN 2014. SINCE THAT TIME, SEVERAL TRANSMISSION PROJECTS HAVE BEEN PLANNED AND/OR UNDERTAKEN BY HYDRO ONE SAULT STE. MARIE AIMED TO MAINTAIN THE RELIABILITY AND ADEQUACY OF ELECTRICITY SUPPLY TO THE EAST LAKE SUPERIOR REGION.

A summary and description of the major projects completed and/or currently underway since the completion of last cycle regional planning is provided below.

- **End of life Wood Pole Replacements:** Multiple wood pole replacement projects were completed on a number of 115kV and 230kV circuits. These circuits consisted of wood pole structures that were assessed at being at their end of life and in need of replacements. The following circuits have their end of life wood pole structures replacement completed between 2013 to 2019:
 - No.2 and No.3 Algoma (completed in 2014)
 - Northern Ave (completed in 2014)
 - No.1 Garshore (completed in 2015)
 - Hogg (completed in 2015)
 - P21G (completed in 2019)
- **Hwy 101 TS:** Installed a new control building completed with new protection relays, batteries, chargers, automatic transfer schemes and RTU to replace end of life components such as electro-mechanical relays and batteries. This project was completed and in-serviced in 2015.
- **Anjigami TS:** Performed electrical and civil upgrade, including the installation of a new 44kV breaker, redundant battery and chargers, and replacement of protection equipment and other end of life AC/DC system. It also includes ground grid improvements. This is completed in 2017.
- **Echo River TS:** Improve transmission reliability with the installation of an additional 230/34.5kV 25MVA Transformer (T2) as an on-site spare. This project is underway and have a targeted in-service date of 2023 Q2.

5 LOAD FORECAST AND STUDY ASSUMPTIONS

5.1 Load Forecast

The LDCs provided load forecasts for all the stations supplying their loads in the East Lake Superior region for the 20-year study period during the IESO led IRRP phase of regional planning. The net extreme weather corrected winter load forecast was produced by modifying the LDC forecast provided for each station to reflect extreme weather conditions and subtracted the estimated peak demand impacts of provincial conservation policy and committed Distributed Energy Resource (DER) that may have been contracted through previous provincial programs such as the Feed-in Tariff (FIT) and micro FIT program.

The electricity demand in the East Lake Superior Region is anticipated to stay flat over the next 20 years, with a peak of 348W in 2031. Figure 5-1 shows the East Lake Superior Region’s Winter peak net load forecast developed during the East Lake Superior IRRP process. This IRRP forecast was used to determine the loading that would be seen by transmission lines and autotransformer stations and to identify the need for additional line and auto-transformation capacity. The IRRP non-coincident load forecasts for the individual stations in the East Lake Superior Region is given in Appendix D, Table D-1 and Table D-2. This forecast does not included a high industrial growth or expansion scenario, which will be studied as part of the IESO’s bulk planning study in 2021 given the impact to the bulk transmission network in the broader region

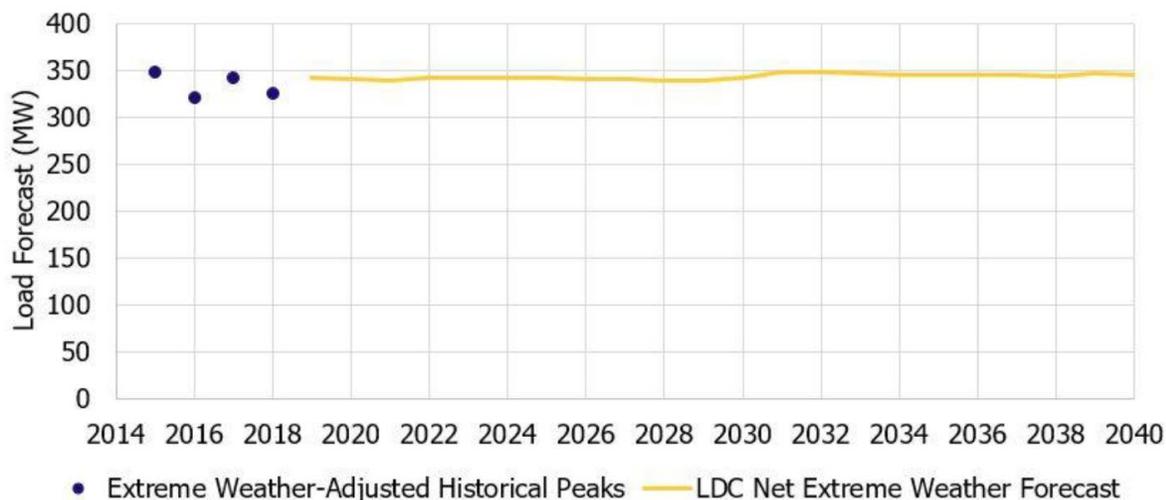


Figure 5-1: East Lake Superior Region Load Forecast

5.2 Study Assumptions

The following other assumptions are made in this report.

- The study period for the RIP assessments is 2019-2038.
- All facilities that are identified in Section 4 and that are planned to be placed in-service within the study period are assumed to be in-service.

- Winter is the critical period with respect to line and transformer loadings. The assessment is therefore based on winter peak loads.
- Station capacity adequacy is assessed by comparing the non-coincident peak load with the station's normal planning supply capacity, assuming a 90% lagging power factor for stations having no low-voltage capacitor banks. Normal planning supply capacity for transformer stations is determined by the winter 10-day Limited Time Rating (LTR).
- Autotransformers and line capacity adequacy is assessed by using coincident peak loads in the area or supplied station(s). Where a circuit is feeding radial load, the capacity adequacy is assessed by using the connected station's non-coincident peak.
- Adequacy assessment is conducted as per Ontario Resource Transmission Assessment Criteria (ORTAC).
- The East-West Tie Transmission Reinforcement is included in the assessment.
- Hydro-electric generation assumption is taken as the output that is coincident with the region's overall 98% dependable output. Wind generation assumption were modelled by IESO based on their summer and winter capacity contribution factors per IESO Reliability Outlook, multiplied by their peak capacity.
- Sault No.3 circuit will be refurbished and return to network configuration at 115kV.

6 ADEQUACY OF EXISTING FACILITIES

THIS SECTION REVIEWS THE ADEQUACY OF THE EXISTING TRANSMISSION LINE AND TRANSFORMER STATION FACILITIES SUPPLYING THE EAST LAKE SUPERIOR REGION OVER THE PLANNING PERIOD (2019-2038). ALL PROJECTS CURRENTLY UNDERWAY ARE ASSUMED IN-SERVICE.

Within the current regional planning cycle two regional assessments have been conducted for the East Lake Superior Region. The findings of these studies are input to this Regional Infrastructure Plan. The studies are:

- 2019 East Lake Superior Region Needs Assessment (“NA”) Report
- 2019 East Lake Superior Region Scoping Assessment (“SA”) Report
- 2021 East Lake Superior Integrated Regional Resource Plan (“IRRP”) and Appendices

This section provides a review of the adequacy of the transmission lines and stations in the East Lake Superior Region. The adequacy is assessed from a loading perspective using the latest regional load forecast provided in Appendix D. Sustainment aspects were identified in the NA report and are addressed in Section 7 of this report. The review assumes that the following projects shown in Table 6-1 will be in-service. Sections 6.1 to 6.4 present the results of this review.

Table 6-1: New Facilities Assumed In-Service

Facility	In-Service Date
‘hot’ spare transformer at Echo River TS	2023
115kV Sault No.3 circuit re-conductoring	2024

6.1 230 kV Transmission Facilities

The East Lake Superior 230 kV transmission facilities consist of the following 230 kV transmission circuits (please refer to Figure 3-1 and 3-2):

- a) Mississagi TS to Third Line TS 230 kV circuits: P21G and P22G
- b) Mississagi TS to Wawa TS 230 kV circuit: P25W and P26W
- c) Wawa TS to Mackay TS 230 kV circuits: W23K
- d) Mackay TS to Third Line 230 kV circuits: K24G

230kV circuits supplying the region are within their thermal limits as per ORTAC over the study period for the loss of a single 230kV circuit in the region. Voltage concerns is observed when applying multiple contingencies on Bulk Electric System (BES) elements as per performance requirements set out in NERC TLP-001-4.

6.1.1 Voltage Concerns on following the loss of P21G and P22G

P21G and P22G are critical 230kV supply circuits that connects Third Line TS with Mississagi TS. A double circuit loss of P21G and P22G due to them being adjacent circuits on common towers, or the loss of either one circuit, followed by a contingency on the companion circuit would cause voltage decline in violation with ORTAC voltage change limits (i.e., in excess of 10%) at Third Line TS and other 115kV facilities supplied from Third Line TS throughout the planning horizon. Loss of both P21G and P22G will also result in the loss of Third Line autotransformer T1 by configuration. IESO's IRRP has determined that the voltage instability threshold for the region is reached when the GLP inflow interface exceed 230MW and both P21G and P22G are out of service.

Third line TS is equipped with Instantaneous Load Rejection Scheme with six load blocks to be armed for the loss of P21G and P22G, or the loss of T1 and T2. Currently, the IESO will direct HOSSM to arm this scheme via Hydro One's Ontario Grid Control Centre (OGCC) using manual phone call, where IESO will request arming of certain amount of load for rejection depending on prevailing system conditions. HOSSM will prioritize selection of available load blocks. IESO has expressed the need to enable remote arming of this scheme directly from IESO control room to make the arming procedure more efficient. Section 7 will discuss in more detail.

6.2 230/115 kV Autotransformers Facilities

The 230/115 kV autotransformers facilities in the region consist of the following elements:

- a. Third Line TS 230/115 kV, 150/200/250MVA autotransformers: T1, T2
- b. Mackay TS 230/115 kV, 150/200/250MVA autotransformers: T2

Loading of Third Line TS autotransformers has been identified to approach their 10-day LTR when the companion autotransformer is lost. Loading on companion autotransformer during single event contingency (N-1) would be reduced modestly beyond 2024 when the Sault No.3 circuit returns to a network at 115kV (non-radial configuration).

This is not a firm need as there is no existing violations but this is flagged because loading on Third Line autotransformers is approaching its LTR limit and should continue to be monitored. Despite the fact that one of the autotransformer (T2) has been identified for end-of-life replacement by 2025, such replacement would only marginally improve supply capacity by 10MVA for Third Line's autotransformers due to LTR rating of the existing autotransformer (T1), which was put into service since 2007 and is not near End-of-Life.

6.3 115 kV Transmission Facilities

115kV circuits supplying the region are within their thermal limits as per ORTAC over the study period for the loss of a single transmission element in the region. A list of circuits can be found in Appendix B. Capacity overload is observed on 115kV circuit Algoma No.1 and Sault No.3 following multiple contingencies as per performance requirements set out in NERC TLP-001-4.

6.3.1 Capacity overload on 115kV circuit Algoma No.1

A failure of breaker 214 to operate at Patrick St TS will remove Algoma No.2 and Algoma No. 3 circuits from Third Line TS to Patrick St TS by configuration. This results in thermal overload of the remaining Algoma No. 1 circuit beyond its short-term emergency (STE) rating during peak loads at Patrick St TS, of which Algoma No. 1 is the lowest rated circuit out of the three. This thermal overload on Algoma No. 1 can also occur with one of the Algoma circuits initially out of service, followed by the loss of another Algoma circuit.

This is an existing issue which was also identified in the NA and SA report. This is currently mitigated by the Patrick St TS manual load shedding scheme under which load is curtailed manually at Patrick St TS following the loss of one of the Algoma line circuits. This is done to prevent overloading of the Algoma No. 1 circuit in case the second circuit is also lost. Since this scheme is manual, load has to be shed before the actual contingency of the second circuit has taken place. This scheme was designed as an interim solution until a more permanent solution was implemented. The IRRP has recommended a need for a more permanent solution.

6.3.2 Capacity overload of 115kV circuit Sault No.3

During an outage to either P25W or P26W circuit between Wawa TS to Mississagi TS, a contingency on the K24G circuit between Third Line TS and Mackay TS results in the thermal overload of the Sault No.3 circuit beyond its STE ratings starting in 2023 when No.3 Sault circuit is connected in a network configuration⁴. This phenomenon is a result of high East West Transfer (EWT) flows and losing two circuits that carry that flow.⁵

In addition, when one of the Third Line TS autotransformers is out of service, a Sault No.3 circuit operated as network configuration (after its proposed upgrades) helps to alleviate overloading of the companion Third Line TS autotransformer. However, if the second autotransformer is also lost, Sault No.3 circuit will be overloaded beyond its STE rating and causes a significant voltage decline in the 115kV area served by Third Line TS. The risk of capacity overload on Sault No.3 circuit and area voltage decline as a result of losing both autotransformer is presently mitigated by Third line’s Instantaneous Load Rejection scheme. Subjected to the outcome of IESO’s 2021 Bulk Planning Study with regards to Sault No.3 overloading, the overloading may continue to be a need.

6.4 Step-Down Transformer Station Facilities

There are a total of 11 step-down transformers stations in the East Lake Superior Region, connected to the 230 kV and 115 kV transmission network as listed below. The stations winter peak load forecast is given in Appendix D.

Table 6-2: East Lake Superior Step-Down Transformer Stations

230 kV Connected	115 kV Connected	
Echo River TS	Andrew TS	Chapleau MTS

⁴ Sault No.3 circuit is currently operated radial to Mackay GS (G3) and is being refurbished as part of a sustainment project

⁵ EWT is defined as the MW flow at Wawa TS on circuits W21M and W22M. By 2023, EWT tie flow will also include the flow of the new NextBridge circuits.

	Anjigami TS	Goulais TS
	Batchawana TS	Hollingsworth TS
	Clergue TS	Northern Ave TS
	Chapleau DS	St Mary CTS
	Tarentorus CTS	

Capacity of Anjigami T1 / Hollingsworth T1 & T2 are exceeded by end of 2024 based on the load forecast provided by LDC, where Hollingsworth T1 & T2 will be overload when Anjigami T1 is out of service, and vice versa. The overload is caused by loading increases on the 44kV circuit that Anjigami TS and Hollingsworth TS supply in parallel. HOSSM is working with the impacted LDC and have proposed to build a new 115/44kV station, with a proposed name Limer TS (subject to change) that will tap off Hollingsworth 115kV circuit to handle the load increase.

6.5 Bulk Areas Need

There is a potential for significant growth in industrial load in the ELS region over the planning period which would have a material impact on the bulk transmission system outside the region. Hence, the IESO has initiated a bulk planning study for this scenario outside of the regional planning process.

Based on the reference load forecast included in the IRRP, the following bulk system need was identified and will be further coordinated with the bulk planning study described above:

- Following the loss of one of the 230 KV circuits, P25W or P26W circuits from Mississagi TS to Wawa TS, the companion circuit becomes loaded beyond its LTR rating under high westward power flow on the EWT.

Results and recommendations from the bulk planning study would be published separately. HOSSM and HONI will work with IESO to address recommendations as appropriate.

7 REGIONAL NEEDS AND PLANS

THIS SECTION DISCUSSES ELECTRICAL INFRASTRUCTURE NEEDS IN THE EAST LAKE SUPERIOR REGION AND SUMMARIZES THE PLANS DEVELOPED TO ADDRESS THESE NEEDS.

This section outlines and discusses electrical infrastructure needs in the East Lake Superior Region and plans to address these needs. The electrical infrastructure needs encompass both end of life replacement needs identified in the Need Assessment phase, and needs identified in section 6. A list of needs are summarized below in Table 7.1.

Table 7-1: Identified Near and Mid-Term Needs in East Lake Superior Region

Section	Facilities/Circuit	Need	Timing
7.1	Third Line TS/OGCC	Enable remote arming of Third Line TS Instantaneous Load Rejection Scheme	Immediate
7.2	Third Line TS	End of life Protection replacement	2022
7.3	Patrick St TS, Algoma No.1 overload	Automate existing manual load curtailment scheme to meet NERC standards	Immediate
7.4	Echo River TS	Transmission Supply Reliability / End of Life 230kV Breaker replacement	2023/2024
7.5	115kV Sault No.3	Sault No.3 Structure and End of Life Conductor Replacement ⁶	2024
7.6	Batchawana TS and Goulais TS	End of Life component replacement	2024
7.7	Patrick St TS	End of Life 115kV breaker replacement	2024
7.8	Third Line TS	T2 End of Life Replacement	2025
7.9	Northern Ave TS	T1 End of Life replacement	2025

⁶ To coordinated with IESO's 2021 Bulk Planning Study Regarding Sault No.3 Circuit Overloading

7.10	Anjigami/Hollingsworth TS	Anjigami/Hollingsworth Transformers Overload	2024
7.11	Clergue TS	End of life metal clad switch gear replacement	2026
7.12	Hollingsworth TS	End of life Protection replacement	2026
7.13	Watson TS	End of life metal clad switch gear replacement	2026

7.1 Third Line TS – Enable remote arming of Third Line TS Instantaneous Load Rejection Scheme.

7.1.1 Description

Instantaneous Load Rejection Scheme at Third line TS are designed to respond to the loss of both P21G and P22G, or the loss of both T1 and T2. This scheme is currently armed under the direction of IESO. Upon IESO request, OGCC will manually arm the scheme and prioritized available load blocks for rejection. OGCC has established communication channels to perform arming function via Hydro One Network Management System (NMS).

7.1.2 Alternatives and Recommendation

The following alternatives were considered to address Main TS end-of-life assets need:

- 1. Alternative 1 - Maintain Status Quo:** This alternative was considered and rejected as it will not address the manual process involved in arming of the load rejection scheme, as well as the selection of load blocks to be armed. The risk of communication delays between IESO and OGCC is not mitigated.
- 2. Alternative 2 – Enable remote arming of Third Line TS Instantaneous Load rejection scheme:** Under this alternative, Hydro One will work with IESO to make necessary control points available on IESO’s Energy Management System (EMS) interface such that IESO’s control command can be relayed to OGCC’s NMS via existing Inter-Control Centre Communication Protocol (ICCP) link, which will subsequently be relayed to Third Line’s Instantaneous Load Rejection Scheme.

The Study Team recommends Alternative 2 as the technically preferred and most cost-effective alternative because this will facilitate the automation of dispatch arming from IESO in a real-time setting, and eliminate manual communications delays between IESO and Hydro One. Further, given the ICCP infrastructure already exists, the cost to perform alternative 2 is expect to be limited to control points and status points set up in NMS and EMS respectively, as well as testing activities that can be done in both ends to ensure

functionality. The estimated cost for this upgrade is about \$10,000 and is expected to in-service by end of 2021.

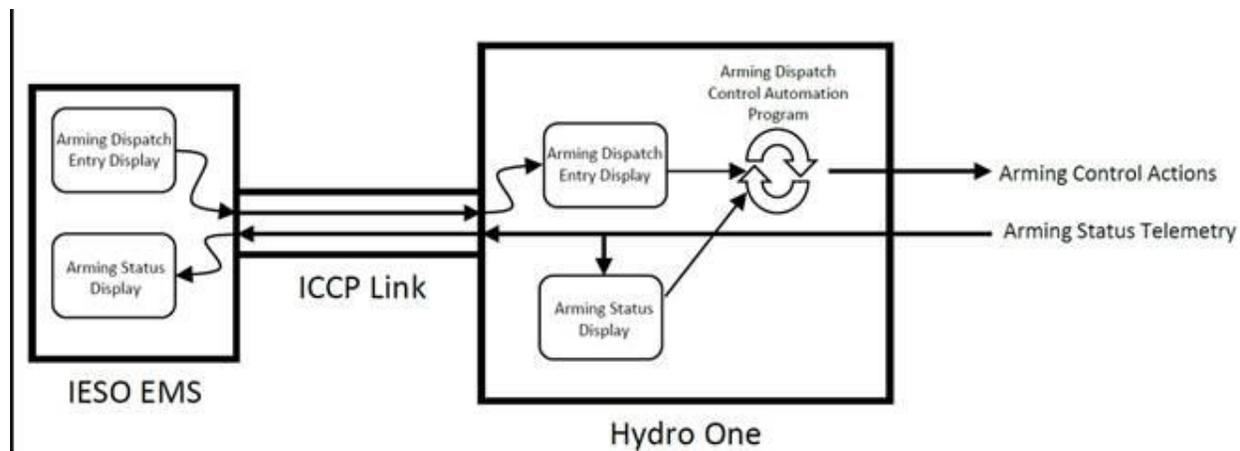


Figure 7-1: ICCP link between IESO and Hydro One.

7.2 Third Line TS – End of life Protection Replacement

7.2.1 Description

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 supplies two (2) LDC HV load supply stations via 115kV circuits GL1SM GL2SM, GL1TA, and GL2TA. Based on an asset condition assessment, P21G’s and P22G’s line protections are approaching end of life. Further, due to legacy reasons, P21G’s and P22G’s line protection do not meet standard physical separation requirement .

7.2.2 Alternatives and Recommendation

The following alternatives were considered to address the end-of-life assets need:

1. **Alternative 1 - Maintain Status Quo:** This alternative is rejected as it does not address the risk of failure due to end-of-life asset condition and would result in increased maintenance expenses and reduce supply reliability to the ELS region.
2. **Alternative 2 – Replace end-of-life protection as per current standard:** Under this alternative the existing end-of-life protection will be replaced with new protection relay consistent with Hydro One standard. This alternative will also implement ‘A’ and ‘B’ protection separation, which will

bring these protection be in compliance with reliability standards, addresses the end-of-life assets need, minimizes losses and maintains reliable supply to the customers in the area.

The Study Team recommends Alternative 2 – replace end-of-life protection relay. The protection replacement work is expected to be complete by 2022.

7.3 Patrick St TS – Automatic Load Rejection Scheme

7.3.1 Description

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 IESO IRRP findings, upon a breaker failure of breaker 214, or a contingency on either Algoma No.2 or Algoma No.3 circuit, followed by another contingency on the remaining circuit, Algoma No.1 will be overloaded beyond its STE rating during peak load. At present, a manual load shedding scheme is implemented as an interim solution until a more permanent solution is available.

7.3.2 Alternatives and Recommendation

The following alternatives were considered to address the interim manual load shedding scheme need:

- 1. Alternative 1 - Maintain Status Quo:** This alternative is rejected as it does not address the risk of circuit overload during contingency and could result in equipment (overhead conductor) damage, increase public safety risk and reduce supply reliability to connected customers.
- 2. Alternative 2 – Implement Automatic Load Rejection Scheme at Patrick St TS:** This alternative would implement an automatic load rejection upon the loss of Algoma No.2 and Algoma No.3 to reject load blocks and respect the existing LTE rating of Algoma No.1 circuit.

Considering above options, the Study Team recommends that Hydro One proceed with Alternative 2, consistent with recommendation from the ELS's IRRP.

7.4 Echo River TS – Install Spare 230kV Transformer (2023) and end of life 230kV breaker replacement (2024)

7.4.1 Description

Echo River TS is a 230kV load supply station. The station consists of a single 230/115/34.5kV autotransformer and a single 230kV circuit breaker (556) to supply two (2) 34.5 kV customer feeders. Historically, load at Echo River TS can be transferred to Northern Ave TS 34.5 kV feeders via the API's distribution system in case of outages at Echo River TS, such as transformer maintenance or failure.

As per the 2nd cycle of Need Assessment completed in Q2 2019 for the ELS region, it has been identified that the existing back up from Northern Ave TS can no longer provide adequate voltage support at peak load during a transformer outage at Echo River TS.

Echo River 230kV breaker 556 is a live tank minimum oil breaker, which has also been identified to be end of life and obsoleted based on asset condition assessment.

7.4.2 Alternatives and Recommendation

The following alternatives were considered to address the end-of-life assets need:

1. **Alternative 1 - Maintain Status Quo:** This alternative is rejected as it does not address system reliability needs and HOSSM asset needs due to asset condition. This alternative would result in increased maintenance expenses and reduce supply reliability to the customers.
2. **Alternative 2 – “Cold” spare 230kV Transformer and replace end of life 230kV breaker :** install a “cold” spare in Echo River TS that is completed with new spill containment only, without 230kV and 34.5kV connection facilities and dedicated protection equipment. The spare will not normally put on potential. This alternative is not recommended as the load restoration time associated with connecting the unit and making it ready to serve load would exceed ORTAC load restoration requirement.
3. **Alternative 3 – “Hot” spare 230kV Transformer and replace end of life 230kV breaker:** install a “hot” spare in Echo River TS that is completed with new 230kV and 34.5kV connection facilities, dedicated protection equipment and new spill containment systems. The spare transformer is usually on potential and ready to serve load upon switching. This alternative can significantly shorten load restoration time to respect ORTAC load restoration timeline in the event of a transformer outage due to maintenance or failure, which improves local transmission supply reliability.

The Study Team recommends Alternative 3 – “Hot” spare 230kV Transformer and replace end of life 230kV breaker. The spare transformer is planned to be completed by 2023, while the breaker replacement work is planned to be completed in 2024. In lieu of replacing the breaker HOSSM will install a 230 kV circuit switcher and enable transfer trip functionality between Echo River TS and it’s terminal stations.

7.5 115kV Sault No.3 Structure and Conductor Replacement

7.5.1 Description

Built in 1929, Sault No.3 is a 90 km long 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 asset condition assessment, approximately 70km of the circuit’s conductor from Goulais TS (str # 129) to MacKay TS is the original conductor, and has been rated between “Poor” and “Very Poor” as it has multiple component (sleeves) failures. This circuit also accounts for 39% of all line equipment related outages experienced over the 2013 – 2017 period within HOSSM’s system. The circuit is currently de-rated as a pre-cautionary action to minimize further stress. Due to the de-rating, Sault No.3 circuit is also forced to operate in a radial

configuration to Mackay G3 to limit loading on the line. The end of life replacement work would include 'like for standard' conductor replacement and replacement of selected wood poles along the corridor as condition warrants.

HOSSM has completed the detail project definition work for this project. It is noted that the on-going IESO bulk system studies have considered upgrading Sault 3 to 230kV⁷ as a potential solution. IESO bulk system studies is expected to be available Q4 2021. Provided that IESO's recommendation is to refurbish the line as per current plan, the project is expected to be completed by 2024.

7.5.2 Alternatives and Recommendation

The following alternatives were considered to address the end-of-life assets need:

1. **Alternative 1 - Maintain Status Quo:** This alternative is rejected as it does not address the risk of failure due to asset condition. Failure of this circuit can impact the power supply to load centres close to the city of Sault Ste. Marie.
2. **Alternative 2 - Replace conductor, structures and associated End-of-Life components with Hydr One standard 115kV equipment:** Under this alternative, the existing conductor and wood pole that are assessed to be end of life will be replaced with new 115 kV rated line and structures. This alternative will also allow Sault No.3 to return to its network configuration.

The Study Team recommends Alternative 2 – the replacement of the end-of-life conductor and wood pole structures between Mackay TS and Goulais TS (str # 129) as it addresses the end-of-life assets need and maintains reliable supply to the customers in the area.

7.6 Batchawana TS and Goulais – End of life Component Replacement

7.6.1 Description

Batchawana TS and Goulais Bay TS are load supply stations with single transformer to supply to the Batchawana Bay and Goulais Bay areas. Goulais Bay TS is about 30 km North of Sault Ste. Marie, while Batchawana TS is about 47 km North of Sault Ste. Marie along Hwy 17. Both are connected to 115kV No.3 Sault circuit. Figure 7-2 below shows geographical location of both station. Based on asset condition assessment, both stations are at End-of-life stage with obsoleted equipment including power transformers, protections (fuse), batteries, chargers, steel structure foundations and remote terminal units. Both stations are also built with legacy design standards and do not provide adequate clearance to today's standard. Their single transformer configuration has also made it difficult to schedule and perform maintenance.

⁷ Possibly upgrading to 230kV standard and operate at 115kV until 230kV operation is needed for the bulk system.

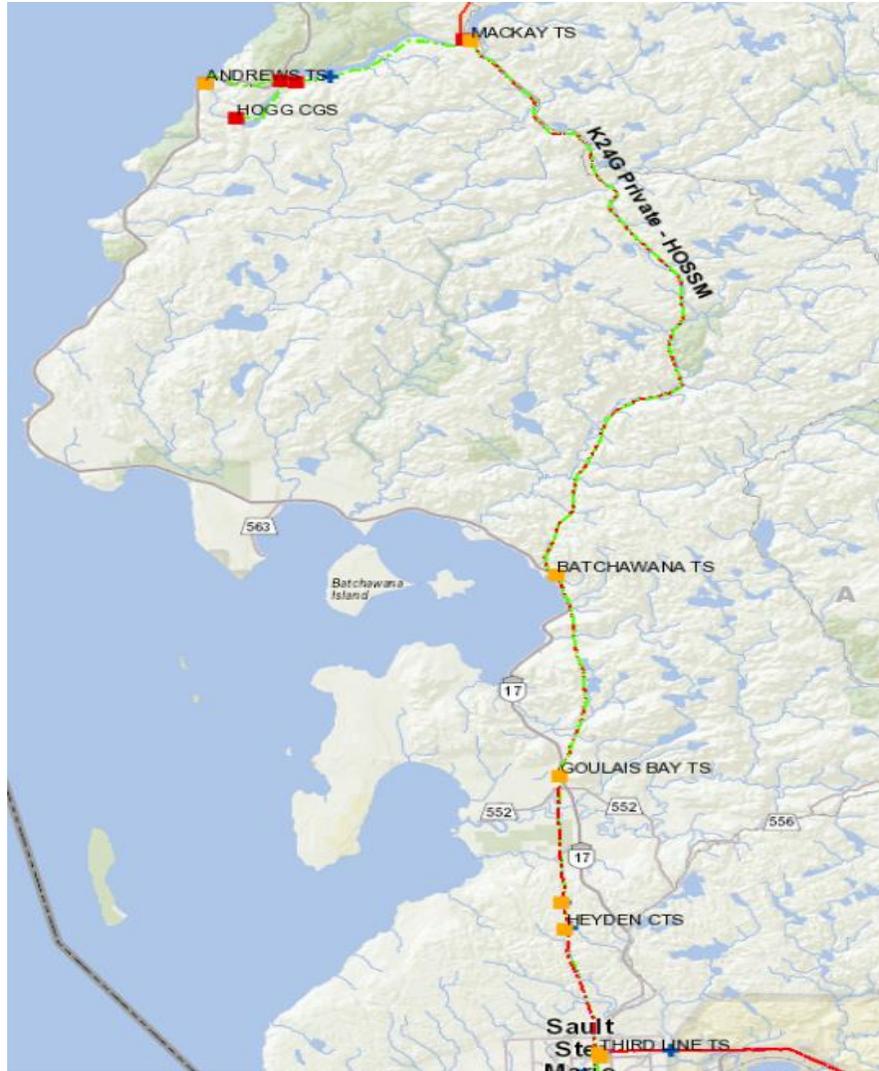


Figure 7-2: Batchawana TS and Goulais Bay TS on 115kV circuit

7.6.2 Alternatives and Recommendation

A detailed assessment that analyzed supply options for Batchawana TS and Goulais Bay TS was carried out between HOSSM and API from 2019 -2020 to compare and evaluate supply options based on Transmission and Distribution supply reliability and performances. The assessment compared three (3) different options, they are:

- Option 1: Refurbish both Goulais Bay TS and Batchawana TS using a new 115kV, 3 –phase power transformer, with provision for a 115kV Mobile Unit substation (MUS) connection facility in each station. Transformer capacity to be sized to handle the long term peak forecast of the individual stations.
- Option 2: Consolidate Goulais Bay TS and Batchawana TS into a ‘New’ TS that is equipped with two 20MVA, 3-phase transformer to supply both distribution sub-system at either 12.5kV or 25kV. The location of this ‘New’ TS would be in the vicinity of Goulais bay.

- Option 3: Consolidate Goulais Bay TS and Batchawana TS into a ‘New’ TS with dedicated 25kV “express feeder” between Goulais and Batchawana. This ‘New’ TS would be located in the vicinity of Goulais bay, and be equipped with two 20MVA, 3-phase transformer to supply both distribution sub-system at either 12.5kV or 25kV. An additional 25/12.5kV unit is required on the distribution system in the vicinity of Batchawana bay to convert voltage from the incoming 25kV dedicated “express feeder” to 12.5kV in order to supply distribution sub-system in the vicinity of Batchawana bay.

Depending on the choice of distribution voltage, there are two (2) different scenarios (12.5kV vs 25kV) for each option above. Evaluation of alternatives was completed by HOSSM and API as documented in the 2021 East Lake Superior Regional Local Planning Report. As per the report’s recommendation, HOSSM is proceeding with option 1 - Refurbish both Goulais Bay TS and Batchawana TS. More details related to the supply option analysis can be found in the Local Planning Report – Supply Option Analysis for Goulais and Batchawana (2020), available on Hydro One public website. Refurbishment for both stations are expected to be completed in 2024.

7.7 Patrick St TS – End of life 115kV breaker replacement

7.7.1 Description

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 asset condition assessment, breaker 208, 211, 214 and 217 are minimum oil live tank breakers that are considered End of Life and obsolete.

7.7.2 Alternatives and Recommendation

The following alternatives were considered to address the end-of-life assets need:

1. **Alternative 1 - Maintain Status Quo:** This alternative is rejected as it does not address the risk of failure due to asset condition and would result in increased maintenance expenses and reduce supply reliability for customers.
2. **Alternative 2 - Replace the end-of-life breakers with new standard breakers:** This alternative involves the replacement of breaker 208, 211, 214 and 217 with new SF6 breakers in similar ratings.. This alternative is recommended as it addresses the end-of-life asset needs and maintains reliable supply to customers connected at Patrick St TS by reducing the risk of breaker failure; and reducing on-going maintenance cost associated with obsolete breaker technology.

Alternative 2 is recommended. The project is expected to be completed by 2024.

7.8 Third Line TS – T2 End of Life Replacement

7.8.1 Description

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 supplies two (2) PUC HV load supply stations via 115kV circuits GL1SM, GL2SM, GL1TA, and GL2TA. Among the 2 autotransformers, T2 is at end of life based on asset condition assessment. Based on long term load forecast, units with similar ratings are required for the end of life autotransformer T2 replacement.

7.8.2 Alternatives and Recommendation

The following alternatives were considered to address the end-of-life assets need:

1. **Alternative 1 - Maintain Status Quo:** This alternative is rejected as it does not address the risk of failure due to asset condition and would result in increased maintenance expenses and reduce supply reliability to the region.
2. **Alternative 2 – Replace T2 with equivalent size unit as per current standard:** This alternative would replace old T2 with a unit that has equivalent rating. This is recommended alternative as it will mitigate risk of autotransformer failure due to its deteriorating conditions and maintain supply reliability of the region.
3. **Alternative 3 – Replace T2 with larger size unit:** This alternative would replace old T2 with a unit that has higher rating. This alternative is rejected as a 230/115kV autotransformer at 150/200/250MVA is currently the highest rating available based on HOSSM and Hydro One standards.

Alternative 2 is recommended. The project is expected to be completed by 2025.

7.9 Northern Ave TS – T1 End of Life 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 is at end of life. Historically, Northern Ave TS has been used as a backup supply to Echo River TS to facilitate outages. Reliance on Northern Ave TS is expected to reduce starting 2023 as the spare unit at Echo River TS comes into service in 2023. The longer term forecast for Northern Ave TS peaks at 2.7MW.

7.9.1 Alternatives and Recommendation

The following alternatives were considered to address the end-of-life assets need:

1. **Alternative 1 - Maintain Status Quo:** This alternative is rejected as it does not address the risk of failure due to asset condition and would result in increased maintenance expenses and reduce supply reliability to connected customers.
2. **Alternative 2 – Replace T1 with a smaller MVA size unit as per current standard:** This alternative would replace T1 with a ‘like for similar’ unit that has a smaller MVA rating compared to existing T1, and would be adequate for Northern Ave’s long term load forecast. This is recommended alternative as it will mitigate risk of transformer failure due to its deteriorating conditions and maintain supply reliability of the station.

Alternative 2 is recommended. The project is expected to be completed by 2025.

7.10 Anjigami/Hollingsworth TS – Transformer overload.

Anjigami TS is a 115kV/44kV load supply station with a single transformer. Hollingsworth TS is a 115kV/12.5kV/44kV station that supplies load on 44kV, and connected to Hollingsworth CGS on the 12.5kV. Anjigami’s and Hollingsworth’s 44kV feeders are connected to each other with a 10km long 44kV line to supply LDC load on No.4 circuit. Base on LDC load forecast, load increase on 44kV system by end of 2024 would exceed transformer capacity in both Anjigami TS and Hollingsworth TS when the companion station is out of service. HOSSM is working with API and have proposed to build a new 115/44kV station, with a proposed name Limer TS (subject to change) that will tap off Hollingsworth 115kV circuit to handle the load increase.

7.10.1 Alternatives and Recommendation

The following alternatives were considered to address the end-of-life assets need:

1. **Alternative 1 - Maintain Status Quo:** This alternative is rejected as it does not address the transformer capacity needs based on load forecast.
2. **Alternative 2 – Replace Anjigami T1, Hollingsworth T1 and T2 with a larger MVA size units as per current standard to handle load increases:** This alternative is considered but not recommended as both Anjigami TS and Hollingsworth TS have a limited footprint, and site expansion would be required for both sites for such upgrade. Further, due to Hollingsworth TS existing configuration, upgrades are also required on all existing 12.5kV facilities, including disconnect switches, breakers, and overhead bus work to accommodate the load increase.
3. **Alternative 3 – Build new 115/44kV ‘Limer TS’ that will be supplied from Hollingsworth 115kV circuit, transfer existing LDC load from existing 44kV system to ‘Limer TS’ :** This alternative would build a new 115/44kV station in the vicinity of Hollingsworth TS and tap off from 115kV Hollingsworth circuit to supply new loads as well as existing load that are presently supplied by Anjigami/Hollingsworth 44kV system. The new station would be similar to a DESN station with two (2) 115/44kV, 50/67/83MVA transformers as per current HONI standard, HV

and LV connection facilities such as circuit switchers and feeder breakers, modern protections and telecommunication systems to service the new load. API will re-route their 44kV feeder(s) and connect to 'Limer TS'.

Given the alternatives above, Alternative 3 is recommended because it is expected to be the most cost efficient alternatives. Compared to Alternative 2, where it will require the coordination of 2 environmental approvals at different sites for site expansion, replacement of three (3) transformer (Anjigami T1, Hollingsworth T1 and T2), and upgrade on existing 12.5kV equipment at Hollingsworth TS, Alternative 3 has a more concise scope. Building new station will also have less outage constraints when compared to upgrading existing facilities. HOSSM will continue to work with API to develop a local solution. The project is expected to be completed by end of 2024/early 2025.

7.11 Clergue TS - End of life metal clad switch gear 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 at End-of-Life and obsoleted

Based on the load forecast and expected system conditions, similar equipment ratings are required for end of life replacement.

7.11.1 Alternatives and Recommendation

The following alternatives were considered to address the end-of-life assets need:

- 1. Alternative 1 - Maintain Status Quo:** This alternative is rejected as it does not address the risk of failure due to asset condition and would result in increased maintenance expenses and reduce supply reliability to connected customers.
- 2. Alternative 2 – Replace existing metal clad switch gear with SF6 metal clad switch gear as per current standard:** This alternative would replace existing minimal oil metal clad switch gear with SF6 metal clad switch gear. This is recommended alternative as it will mitigate risk of switch gear failure due to its deteriorating conditions and maintain supply reliability of the station.

Alternative 2 is recommended. The project is expected to be completed by 2026.

7.12 Hollingsworth TS – End of life Protection Replacement

Hollingsworth TS is a 115kV station that connects Hollingsworth Generating Station and is supplied by Hollingsworth 115kV circuit. Majority of protection relay equipment in Hollingsworth TS were in-serviced 2005. Based on asset condition assessment, the existing protection relay would approach end of life by 2025.

7.12.1 Alternatives and Recommendation

The following alternatives were considered to address the end-of-life assets need:

1. **Alternative 1 - Maintain Status Quo:** This alternative is rejected as it does not address the risk of failure due to asset condition and would result in increased maintenance expenses and reduce supply reliability to connected customers.
2. **Alternative 2 – Replace end of life protection with “like for like” protection relay as per current standard:** This alternative would replace identified end of life protection relays with as per current standard. This is recommended alternative as it will mitigate risk of protection relay failure due to their deteriorating conditions and maintain supply reliability to connected customers.

Alternative 2 is recommended. The project is expected to be completed by 2025

7.13 Watson TS - End of life Metal Clad switch gear 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 using metal clad switch gear. Based on an asset condition assessment, the existing minimal oil metalclad switch gear are at End of life and obsolete

7.13.1 Alternatives and Recommendation

The following alternatives were considered to address the end-of-life assets need:

1. **Alternative 1 - Maintain Status Quo:** This alternative is rejected as it does not address the risk of failure due to asset condition and would result in increased maintenance expenses and reduce supply reliability to connected customers.
2. **Alternative 2 – Replace existing metal clad switch gear with SF6 metal clad switch gear as per current standard:** This alternative would replace existing minimal oil metal clad switch gear with SF6 metal clad switch gear. This is recommended alternative as it will mitigate risk of equipment failure due to its deteriorating conditions and maintain supply reliability of the station.

Alternative 2 is recommended. The project is expected to be completed by 2026.

8 CONCLUSIONS AND NEXT STEPS

THIS REGIONAL INFRASTRUCTURE PLAN CONCLUDES THE REGIONAL PLANNING PROCESS FOR THE EAST LAKE SUPERIOR REGION.

The major infrastructure investments recommended by the Study Team in the near and mid-term planning horizon are provided in Table 8-1 below, along with their planned in-service date and budgetary estimates for planning purpose.

Table 8-1: Recommended Plans in East Lake Superior Region over the Next 10 Years

No.	Need	Recommended Action Plan	Planned I/S Date	Budgetary Estimate
1	Eliminate/Minimize manual communication between IESO and OGCC when arming Third Line Instantaneous Load Rejection Scheme	Enable remote arming of Third Line Instantaneous Load Rejection Scheme via ICCP line between IESO’s EMS and HONI’s NMS	2021	\$10K
2	Third line TS: End of life Protection	Replace end of life protection per current standard	2022	\$0.8M
3	Echo River TS : Transmission Supply Reliability and end of life breaker	Install ‘hot’ spare transformer and replace end of life breaker	2023/2024	\$11.5M
4	115kV Sault No.3: end of life structures and conductor	Replace end of life structure and conductor per current standard ⁸	2024	\$54.4M
5	Batchawana TS: End of life components	Refurbish Batchawana TS with MUS provision	2024	\$6.2M
6	Goulais TS: End of life components	Refurbish Goulais TS with MUS provision	2024	\$13.4M
7	Patrick St. TS, Algoma No.1 overload	Implement Automatic Load Rejection Scheme at Patrick St. TS	2023	\$1.2M
8	Patrick St. TS: End of life 115kV breaker	Replace end of life 115kV breakers	2024	\$3.3M
9	Third Line TS : T2 end of life	Replace end of life T2	2025	\$16.4M
10	Northern Ave TS: end of life component replacement	Replace end of life T1 with smaller MVA unit and protection relays per current standard	2025	\$2.5M
11	Anjigami/Hollingsworth TS : Transformer overload	Build new 115/44kV Station - HOSSM to work with API to continue to develop solutions	2024/2025	\$30M

⁸ To coordinated with IESO's 2021 Bulk Planning Study Regarding Sault No.3 Circuit Overloading

12	Clergue TS: End of life metal clad switch gear	Replace end of life switch	2026	\$5.2M
13	Hollingsworth TS: End of life Protection relay	Replace end of life protections	2025	\$1.1M
14	D.A. Watson TS: End of life metal clad switch gear	Replace end of life switch gear	2026	\$9.2M

The Study Team recommends that:

- Hydro One to continue with the implementation of infrastructure investments listed in Table 8-1 while keeping the Study Team apprised of project status;
- Any other identified needs/options in the long-term will be further reviewed by the Study Team in the next regional planning cycle.

9 REFERENCES

- [1] **East Lake Superior Region Needs Assessment (2019)**
- [2] **East Lake Superior Region Scoping Assessment (2019)**
- [3] **Local Planning Report – Supply Option Analysis for Goulais and Batchawana (2020)**
- [4] **East Lake Superior Integrated Regional Resource Plan (2021)**
- [5] **East Lake Superior Integrated Regional Resource Plan - Appendices (2021)**

APPENDIX A. STATIONS IN THE EAST LAKE SUPERIOR REGION

Station	Voltage (kV)	Supply Circuits
Andrews TS	115/25	Andrew 115kV
Anjigami TS	115/44	High falls No.1 /Highfalls No.2
Batchawana TS	115/12.5	Sault No.3
Chapleau DS	115/25	W2C
Chapleau MTS	115kV	W2C
Clergue TS	115/12.5	Clergue No.1 / Clergue No.2
D.A. Watson TS	115/34.5	Magpie 115kV/High falls No.1 /Highfalls No.2
Echo River TS	230/34.5	P22G
Flakeboard CTS	115	Leigh's Bay 115kV
Gartshore SS	115	Gartshore No.1 / Gartshore No.2/ Gartshore No.3 / Hogg 115kV / Andrews 115kV
Gold Mine CTS (Magnacon Mine)	115	Steephill 115kV
Goulais Bay TS	115/12.5	Sault No.3
Heyden CSS	230	K24G
Hollingsworth TS	115/12.5/44	Hollingsworth 115kV
Hwy 101 SS	44	Anjigami 44kV/Limer 44kV
Mackay TS	230	K24G/W23K
Mackay TS	115	Gartshore No.1 / Gartshore No.2/ Mackay No.1/Mackay No.2/Sault No.3
Magpie SS	115	Harris 115kV/Steephill 115kV /Mission Falls 115kV/Magpie 115kV
Mile Hill CTS	230	K24G
Northern Ave. TS	115/34.5/12.5	Northern Ave 115kV
Patrick St. TS	115/34.5	Algoma No.1/No.2/No.3 , Clergue No.1 /No.2
St Mary CTS	115/34.5	GL1SM / GL2SM
Tarentorus CTS	115/34.5	GL1TA / GL2TA
Third Line TS	230	K24G/P21G/P22G
Third Line TS	115	Sault No.3, Algoma No.1/No.2/No.3, Northern Ave 115kV
Wallace Terrace CTS	115/34.5	Leigh's Bay 115kV

Wawa TS	230	P25W/P26W/W21M/W22M/W35M*/W36M*
Wawa TS	115	W2C/ Hollingsworth 115kV

*after the completion of East West Tie

APPENDIX B. TRANSMISSION LINES IN THE EAST LAKE SUPERIOR REGION

Location	Circuit Designations	Voltage (kV)
Mississagi x Third line	P21G , P22G	230
Mississagi x Wawa	P25W, P26W	230
Third line x Mackay	K24G	230
Mackay x Wawa	W23K	230
Third line x Mackay	Sault No.3	115
Third line x Patrick St.	Algoma No.1 / No.2 / No.3	115
Third line x Norther Ave	Northern Ave 115kV	115
Third line x St Mary CTS	GL1SM, GL2SM	115
Third line x Tarentorus CTS	GL1TA , GL1TA	115
Patrick st x Flakeboard CTS	Leigh's Bay 115kV	115
Patrick St. x Clergue TS	Clergue No.1 / No.2	115
Mackay GS x Mackay TS	Mackay No.1 / No.2	115
Gartshore SS x Mackay TS	Gartshore No.1 / No.2	115
Gartshore SS x Hogg CGS	Hogg 115kV	115
Gartshore SS x Andrew CGS	Andrew 115kV	115
Magpie SS x Mission Falls CGS	Mission falls 115kV	115
Magpie SS x Steephill CGS	Steephill 115kV	115
Magpie SS x Harris CGS	Harris 115kV	115
Magpie SS x DA Watson TS	Magpie 115kV	115
DA Watson TS x Wawa TS	High Falls No.1/No.2	115
Hollingsworth TS x Wawa TS	Hollingsworth 115kV	115

Anjigami TS x Hwy 101 SS	Anjigami 44kV	44
Hollingsworth TS x Hwy 101 SS	Limer 44kV	44

APPENDIX C. DISTRIBUTORS IN THE EAST LAKE SUPERIOR REGION

Distributor Name	Station Name	Connection Type
Algoma Power Inc.	Andrew TS	Tx
	Anjigami TS	Tx
	Batchawana TS	Tx
	D.A. Watson TS	Tx
	Echo River TS	Tx
	Goulais TS	Tx
	Mackay TS (115kV)	Tx
	Northern Ave TS	Tx
	Hollingsworth TS	Tx
Distributor Name	Station Name	Connection Type
Chapleau PUC	Chapleau MTS	Tx
Hydro One Networks Inc. (Dx)	Chapleau DS	Dx
PUC Distribution	St Mary CTS	Tx
	Tarentorus CTS	Tx

APPENDIX D. EAST LAKE SUPERIOR REGION LOAD FORECAST

Table D-1: East Lake Superior Non-coincident peak Load Forecast, with the Impacts of Energy-Efficiency Savings per station

Transformer Station	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Batchawana TS	1.56	1.85	1.86	1.88	1.90	1.91	1.93	1.95	1.97	1.98	2.00	2.02	2.04	2.05	2.06	2.08	2.10	2.12	2.14	2.15
DA Watson TS	8.53	8.57	8.55	8.56	8.57	8.58	8.60	8.63	8.67	8.71	8.75	8.80	8.87	8.93	8.99	9.06	9.13	9.20	9.26	9.32
Echo River TS	14.18	14.23	14.19	14.19	14.17	14.18	14.20	14.23	14.28	14.33	14.38	14.45	14.57	14.67	14.80	14.95	15.06	15.17	15.25	15.33
Goulais Bay TS	8.00	8.00	9.49	9.81	10.40	10.70	10.76	10.83	10.90	10.96	11.01	11.07	11.13	11.18	11.23	11.29	11.36	11.43	11.50	11.57
Limer TS	13.18	13.74	13.81	13.88	13.99	54.00	54.00	28.62	28.65	28.68	28.70	28.76	56.00	56.00	56.00	56.00	56.00	56.00	56.00	56.00
Andrews TS	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
Mackay TS	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Northern Av TS	2.50	2.51	2.50	2.51	2.51	2.51	2.52	2.53	2.54	2.55	2.57	2.58	2.60	2.62	2.63	2.65	2.67	2.70	2.71	2.73
Chapleau DS	6.31	6.47	6.51	9.24	9.32	9.38	9.44	9.51	9.59	9.68	9.76	9.84	9.94	10.03	10.13	10.23	10.33	10.44	10.53	10.63
Chapleau MTS	4.47	4.36	4.44	4.19	4.69	4.58	4.59	4.59	4.21	4.15	4.14	4.27	4.27	4.27	4.27	4.28	4.29	4.29	4.29	4.30
PUC Distribution Inc.	120.7	119.5	117.5	115.9	114.2	112.7	111.4	110.0	108.9	107.9	106.8	109.7	116.5	115.7	114.9	114.2	113.6	112.9	112.3	111.5

Table D-2: East Lake Superior Forecasted Impacts of Energy-Efficiency Savings due to Codes , Standards and Funded CDM Program

Transformer Station	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Batchawana TS	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04
DA Watson TS	0.07	0.12	0.12	0.12	0.09	0.09	0.09	0.09	0.09	0.09	0.11	0.12	0.14	0.16	0.18	0.19	0.20	0.20	0.20	0.20
Echo River TS	0.11	0.20	0.20	0.20	0.16	0.16	0.16	0.16	0.16	0.16	0.18	0.20	0.24	0.27	0.30	0.32	0.33	0.34	0.34	0.34
Goulais Bay TS	0.07	0.12	0.12	0.12	0.09	0.09	0.09	0.09	0.09	0.09	0.11	0.12	0.14	0.16	0.18	0.19	0.20	0.20	0.20	0.20
Limer TS	0.11	0.19	0.19	0.19	0.15	0.15	0.15	0.15	0.15	0.15	0.17	0.19	0.23	0.25	0.28	0.30	0.32	0.32	0.32	0.32
Andrews TS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mackay TS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Northern Av TS	0.02	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.06	0.06
Chapleau DS	0.07	0.12	0.12	0.12	0.10	0.10	0.10	0.10	0.10	0.10	0.12	0.13	0.16	0.18	0.20	0.22	0.23	0.23	0.23	0.23
Chapleau MTS	0.03	0.06	0.06	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.05	0.06	0.07	0.07	0.08	0.09	0.09	0.09	0.09	0.09
St. Mary's TS	0.91	1.58	1.54	1.54	1.16	1.16	1.13	1.12	1.12	1.08	1.17	1.29	1.46	1.60	1.76	1.87	1.93	1.91	1.88	1.86
Tarentorus TS	1.16	2.02	1.97	1.98	1.49	1.48	1.45	1.43	1.43	1.39	1.50	1.66	1.88	2.05	2.25	2.40	2.47	2.44	2.41	2.38
Total	2.56	4.45	4.36	4.39	3.33	3.32	3.27	3.23	3.23	3.15	3.45	3.84	4.39	4.82	5.32	5.69	5.87	5.84	5.79	5.74

Table D-3: East Lake Superior IRRP Forecasted DER by station

Transformer Station	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Batchawana TS	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DA Watson TS	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Echo River TS	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.16	0.12	0.08	0.02	0.01	0.00	0.00	0.00
Goulais Bay TS	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00
Limer TS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Andrews TS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mackay TS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Northern Av TS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chapleau DS	2.65	2.65	2.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chapleau MTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
St. Mary's TS	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	0.23	0.18	0.16	0.16	0.16	0.14	0.00	0.00
Tarentorus TS	3.93	3.93	3.93	3.93	3.93	3.93	3.93	3.93	3.93	3.93	3.93	0.14	0.10	0.06	0.03	0.03	0.02	0.00	0.00	0.00