

July 16, 2018

RESS, EMAIL & COURIER

Ontario Energy Board
P.O. Box 2319
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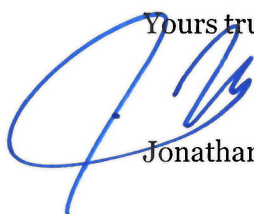
Attention: Ms. K. Walli, Board Secretary

Dear Ms. Walli:

**Re: Wataynikaneyap Power LP - Application for Leave to Construct
Transmission Facilities (EB-2018-0190) – Final CIAs**

We are legal counsel to Wataynikaneyap Power GP Inc. and Wataynikaneyap Power LP (together, "WPLP"). WPLP filed the above-referenced application on June 8, 2018. The application included final System Impact Assessments from the IESO in Exhibit G, and draft Customer Impact Assessments (CIAs) from Hydro One Networks Inc. (Hydro One) in Exhibit H. WPLP indicated in the application that the final Pickle Lake CIA and the final Red Lake CIA were expected by early Q3 2018. WPLP received these final reports from Hydro One on July 9, 2018 and is hereby providing the Board with copies as an update to the application. The final Pickle Lake CIA is an update to the draft report in Exhibit H, Tab 2, Schedule 1. The final Red Lake CIA is an update to the draft report in Exhibit H, Tab 3, Schedule 1. The final reports do not include any material changes relative to the drafts previously filed.

Yours truly,



Jonathan Myers

Enclosure

cc: Ms. Margaret Kenequanash, WPLP
Mr. Duane Fecteau, WPLP
Mr. Charles Keizer, Torys LLP

CUSTOMER IMPACT ASSESSMENT

**Wataynikaneyap Power L.P.'s
230 kV TRANSMISSION LINE TO PICKLE LAKE
AND NORTH OF PICKLE LAKE 115 kV SYSTEM
PROJECT**

Plan/Project #: **AR 24552**

Revision: **Final**

Date: **July 9, 2018**

Issued by: **Transmission Planning Department
System Planning Division
Hydro One Networks Inc.**

Prepared by:



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DISCLAIMER

This Customer Impact Assessment was prepared based on preliminary information available about Wataynikaneyap Power L.P.'s proposed 230 kV Transmission Line to Pickle Lake and North of Pickle Lake 115 kV System project, consisting of a new switching station (SS) located in the vicinity of exiting 230 kV transmission circuit D26A, a new transformer station (TS) located in the vicinity of existing 115 kV transmission circuit E1C, a new 303 km 230 kV single-circuit transmission line from the new Wataynikaneyap SS to the new Wataynikaneyap TS, a new 148 km 115 kV single-circuit radial transmission line from the new Wataynikaneyap TS 115 kV to Ebane Junction (Jct.) and two new single-circuit radial transmission lines from Ebane Junction (Jct.) to connect ten First Nation communities. This report is intended to highlight significant impacts, if any, on transmission customers early in the project development process and thus to allow an opportunity for these parties to bring forward any concerns that they may have, including those needed for the review of the connection and for any possible application for Leave to Construct. Subsequent changes to the required modifications or the implementation plan may affect the impacts of the proposed facility connection identified in this Customer Impact Assessment. The results of this Customer Impact Assessment and the estimate of the outage requirements are subject to change to accommodate the requirements of the IESO and other regulatory or municipal authority requirements. The fault levels computed as part of this Customer Impact Assessment are meant to assess current conditions in the study horizon and are not intended to be for the purposes of sizing equipment or making other project design decisions. Many other factors beyond the existing fault levels go into project design decisions.

Hydro One Networks Inc. shall not be liable, whether in contract, tort or any other theory of liability, to any person who uses the results of the Customer Impact Assessment under any circumstances whatsoever for any damages arising out of such use unless such liability is created under some other contractual obligation between Hydro One Networks Inc. and such person.

Executive Summary

Wataynikaneyap Power L.P. (WPLP, the “connection applicant”) is proposing to build a new 303 km 230 kV single-circuit transmission line from Dinorwic (approximately 40 km southeast of the Dryden) to Pickle Lake, a new 230 kV switching station at Dinorwic, a new 230/115 kV transformer station at Pickle Lake, and a new network of 115 kV and lower voltage lines to connect ten remote First Nation communities to Pickle Lake. Hydro One Networks Inc. (Hydro One) will build a new 230 kV junction on the existing D26A transmission line at Dinorwic to connect the new WPLP’s switching station to D26A and a new 115 kV switching station near the existing Crow River DS to connect the new WPLP’s transformer station to circuit E1C, Crow River DS and circuit M1M. The new 230 kV transmission line and stations and associated connection facilities are scheduled to be in service by October 31, 2020, with connection of the remote communities beginning in 2021.

The project has been identified as a priority project in the Order-in-Council issued by the Lieutenant Governor in Council on July 20, 2016, and in the government’s 2017 and earlier Long-Term Energy Plans.

The IESO has conducted the System Impact Assessment (SIA) for the project and identified the connection requirements.

Hydro One has conducted this Customer Impact Assessment (CIA) to assess the potential impacts of the project on existing customers in the area, including:

- Short circuit impact
- Impact on voltage at customer supply points
- Impact on customer power supply capacity and reliability

The findings of this CIA are as follows:

- The proposed 230 kV line and switching station, which will connect D26A at Dinorwic to E1C at Pickle Lake, will slightly increase the short circuit levels for the 115 kV E1C connected customers. However, the short-circuit level still remains relatively low compared to the TSC prescribed limits. There will be no significant impact on short-circuit levels for the customers connected to circuit E2R.
- The project will not have material adverse impact on voltage at customer supply points. Minor violation of voltage criteria observed on circuit E1C, when it is operated open at Ear Falls TS, is deemed acceptable since it will be corrected by the transformer tap changer.
- The project will increase the supply capacity for load customers north of Dryden and it will also improve their supply reliability by introducing a second supply source. Today, in case of a sustained fault on circuit E4D or a planned outage, the supply to the E1C and E2R connected customers is interrupted. After, the incorporation of the new WPLP’s 230 kV transmission line to Pickle Lake, the customers connected to E1C will remain connected and, depending on the amount of load and generation in the Red Lake and Ear Falls area, the customers connected to circuit E2R and Ear Falls TS could also remain connected to the grid if E1C is operated closed. Some operating conditions might result in voltage stability or transient stability issues for the loss of circuit E4D if circuit E1C is

kept closed at Ear Falls in pre-contingency. In these cases, circuit E1C could be opened at Ear Falls TS in pre-contingency and, if circuit E4D outage occurs, E1C could be closed and some or all of the load and available generation will be restored until circuit E4D is brought back in-service.

Contents

Page

| | |
|--|----|
| Executive Summary | 3 |
| 1. Introduction | 6 |
| 1.1. Customer List | 8 |
| 2. Customer Impact Assessment Scope..... | 9 |
| 3. Short-Circuit Assessment | 9 |
| 4. Voltage Assessment..... | 11 |
| 5. Supply Capacity and Reliability | 17 |
| 6. Conclusions and Recommendations..... | 17 |

Customer Impact Assessment

230 kV Transmission Line to Pickle Lake and North of Pickle Lake 115 kV System Project

1. Introduction

The government's 2010, 2013 and 2017 Long-Term Energy Plans and the IESO's "North of Dryden Integrated Regional Resource Plan", dated January 27, 2015, have recommended a new single-circuit 230 kV line from Dryden/Dinorwic area to Pickle Lake to address near- and medium- term needs for the Pickle Lake and Red Lake areas. This line will provide capacity for connection of remote communities and development of mines north of Pickle Lake and improve reliability and increase supply capacity for the customers north of Dryden. The project, along with the connection of the remote communities, has been identified as a priority project in an Order-in-Council dated July 20, 2016.

The new 230 kV transmission line and stations and associated connection facilities are scheduled to be in service by October 31, 2020, with connection of the remote communities beginning in 2021.

Wataynikaneyap Power L.P. (the "connection applicant"; WPLP) is proposing to build a new 303 km 230 kilovolt (kV) single-circuit transmission line from Dinorwic to Pickle Lake along with a network of new 115 kV and lower voltage transmission lines extending from Pickle Lake to the ten remote communities north of Pickle Lake. In addition to the new transmission lines, the project includes:

- A new 230/115 kV transformer station at Pickle Lake named Wataynikaneyap TS (or, as referred to in this CIA, Watay Pickle Lake CTS)
- A short 115 kV line to connect the new Wataynikaneyap TS to Hydro One's facilities at Pickle Lake
- A 230 kV switching station at Dinorwic named Wataynikaneyap SS (or, as referred to in this CIA, Watay Dinorwic CSS)
- A short 230 kV transmission line to connect the new Wataynikaneyap SS to Hydro One's facilities at Dinorwic
- Transformer and switching stations, including breakers and shunt reactors, at the remote communities served by the new transmission lines

For this project, Hydro One is proposing to,

- Build a new 230 kV junction on the existing transmission line D26A at Dinorwic, called Dinorwic JCT, adjacent to WPLP's new Wataynikaneyap SS (Watay Dinorwic CSS) at this location, with two motor-operated disconnect switches
- Connect D26A and the short tap from the new Wataynikaneyap SS to Dinorwic JCT
- Build a new 115 kV switching station near the end of the existing transmission line E1C at Pickle Lake, called Pickle Lake SS, adjacent to WPLP's new Wataynikaneyap TS (Watay Pickle Lake CTS), with two new 115 kV circuit breakers and associated switches and protection and control facilities

- Sectionalize the existing 115 kV transmission line E1C near its end, close to the existing Crow River DS, and extend and connect the two sections to the new Pickle Lake SS and also connect the short tap from the new Wataynikaneyap TS to Pickle Lake SS

The short section of the existing E1C from Crow River DS to Musselwhite CSS and its extension to the new Pickle Lake SS becomes a new 115 kV transmission line, called C2M. A schematic diagram of the proposed 230 kV and 115 kV facilities and their connection to the existing transmission lines at Dinorwic and at Pickle Lake is shown in Figure 1.

As part of the Connection Assessment and Approval (CAA) process, the IESO has carried out System Impact Assessment (SIA) of the proposed project and has documented the findings in the SIA report CAA ID 2016-567, “Wataynikaneyap 230 kV Transmission Line to Pickle Lake and North of Pickle Lake 115 kV System”, dated June 1, 2018. The SIA has indicated that:

- There is a requirement for addition of shunt reactors to maintain acceptable voltages during energization and normal operation conditions. These include
 - One 30 MVar (@245 kV operating voltage) reactor at Wataynikaneyap SS
 - Two 20 MVar (@245 kV operating voltage) reactors at Wataynikaneyap TS
 - Two 10 MVar (@115 kV operating voltage) reactors at Wataynikaneyap TS
 - Other reactors at the remote stations
- To prevent voltage or transient instability in the Red Lake and Ear Falls area in case of the loss of circuit E4D, depending on the level of load and available generation in this pocket, circuit E1C could be opened at Ear Falls TS.

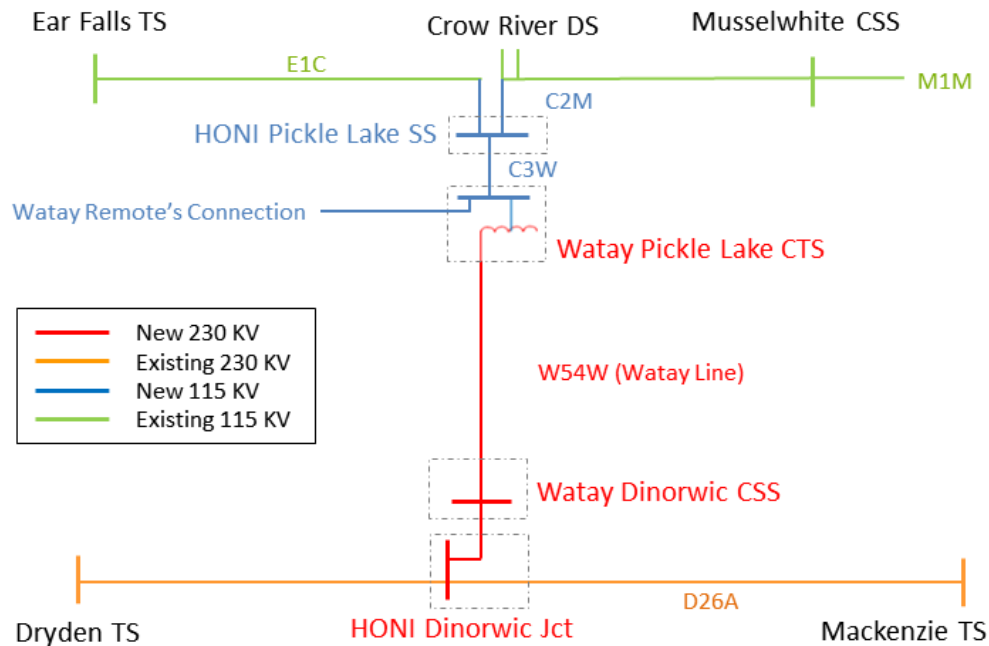


Figure 1: Proposed new facilities and connections

Hydro One has carried out this CIA to assess the impact that the proposed transmission facility connections may have on load and generation customer facilities in the area from Mackenzie in the south to Red Lake and Pickle Lake in the north. This assessment is in accordance with the requirements of the Ontario Energy Board Transmission System Code.

WPLP is also proposing to connect six remote communities north of Red Lake, by a network of 115 kV and lower voltage lines, to circuit E2R near Red Lake TS. This project, scheduled to be in-service by Q4-2020 (with the connection of remote communities beginning in Q1-2021 and complete by Q4-2023), is the subject of separate SIA (CAA ID 2017-601) and a companion CIA.

The short-circuit and voltage assessments presented in this CIA are the result of both WPLP's Pickle Lake and Red Lake projects.

1.1. Customer List

Table 1 lists transmission customers in the study area of the project.

Table 1: Transmission Customers in Study Area

| Customer | Station / Supply Circuit |
|--|---------------------------------|
| Atikokan Hydro Inc. | Moose Lake TS |
| Domtar Inc. | Domtar Dryden CTS / D5D |
| Glencore Canada Corporation [Mattabi Division] | Mattabi CTS / M2D |
| Goldcorp Canada Ltd. [Musselwhite Mine] | Musselwhite CSS / E1C |
| Goldcorp Inc. [Red Lake Gold Mines] | Balmer CTS / E2R |
| H2O Power LP [Calm Lake] | H2O Pwr Calm Lk CGS / M1S |
| H2O Power LP [Sturgeon Falls] | H2O Pwr SturgFls CGS / M1S |
| Hydro One Distribution | Agimak DS / M2D |
| | Cat Lake MTS / E1C |
| | Crow River DS / E1C |
| | Ear Falls TS |
| | Eton DS / K3D |
| | Perrault Falls DS / E4D |
| | Sam Lake DS / K3D |
| | Slate Falls DS / E1C |
| | Valora DS / M2D |
| | Vermilion Bay DS / K3D |
| Ontario Power Generation Inc. [Manitou Falls GS] | Manitou Falls GS / M3E |
| Ontario Power Generation Inc. [Atikokan TGS] | Moose Lake TS |
| Ontario Power Generation Inc. [Ear Falls GS & Lac Seul GS] | Ear Falls TS |
| TransCanada PipeLines Limited [Vermilion Bay] | TCPL Vermillion Bay CTS / K23D |
| Valerie Falls Limited | Valerie Falls CGS / M1S |

2. Customer Impact Assessment Scope

A review of the following potential impacts on existing customers is conducted in this CIA:

- Short circuit impact
- Impact on voltage at customer supply points
- Impact on customer power supply capacity and reliability

3. Short-Circuit Assessment

Short circuit studies were carried out to determine the fault current levels before the incorporation of the project, and the short circuit currents following the incorporation of the new transmission facilities. Table 2 below shows the short-circuit level before and after the connection of the new facilities.

Table 2: Short Circuit Level

| | Before project incorporated | | | | After project incorporated and E1C operated closed | | | |
|---------------------------|-----------------------------|---------|---------------|---------|--|---------|---------------|---------|
| | 3-phase fault (kA) | | LG fault (kA) | | 3-phase fault (kA) | | LG fault (kA) | |
| | SYMM I | ASYMM I | SYMM I | ASYMM I | SYMM I | ASYMM I | SYMM I | ASYMM I |
| Red Lake TS (HV) | 1.354 | 1.380 | 1.624 | 1.676 | 1.381 | 1.405 | 1.649 | 1.700 |
| Red Lake TS (LV) | 2.41 | 2.41 | 3.271 | 3.271 | 2.444 | 2.444 | 3.313 | 3.313 |
| Mussle White CSS (HV) | 0.701 | 0.885 | 0.198 | 0.199 | 0.996 | 1.189 | 0.441 | 0.452 |
| Placer JCT | 0.694 | 0.695 | 0.285 | 0.285 | 2.107 | 2.172 | 2.849 | 2.984 |
| Crow River DS (HV) | 0.694 | 0.695 | 0.285 | 0.285 | 2.106 | 2.170 | 2.845 | 2.978 |
| Crow River DS (LV) | 1.489 | 1.489 | 1.869 | 1.869 | 2.470 | 2.470 | 2.794 | 2.794 |
| Golden Patricia JCT | 0.765 | 0.766 | 0.369 | 0.369 | 1.289 | 1.290 | 0.956 | 0.957 |
| Cat Lake MTS (HV) | 0.677 | 0.677 | 0.334 | 0.334 | 1.053 | 1.054 | 0.751 | 0.751 |
| Cat Lake MTS (LV) | 0.643 | 0.643 | 0.716 | 0.716 | 0.703 | 0.703 | 0.764 | 0.764 |
| Slate Falls DS (HV) | 0.913 | 0.914 | 0.496 | 0.496 | 1.231 | 1.232 | 0.844 | 0.845 |
| Slate Falls DS (LV) | 0.614 | 0.614 | 0.643 | 0.643 | 0.637 | 0.637 | 0.659 | 0.659 |
| Ear Falls TS (LV) | 3.485 | 3.485 | 3.679 | 3.766 | 3.507 | 3.507 | 3.696 | 3.781 |
| Lac Seul GS | 8.738 | 8.738 | 6.924 | 6.964 | 8.829 | 8.829 | 6.962 | 6.998 |
| Balmer J | 1.407 | 1.434 | 1.615 | 1.666 | 1.435 | 1.462 | 1.640 | 1.690 |
| Balmer CTS (HV) | 1.290 | 1.316 | 1.343 | 1.376 | 1.314 | 1.338 | 1.360 | 1.392 |
| Balmer CTS (LV) | 2.378 | 2.378 | 3.101 | 3.101 | 2.408 | 2.408 | 3.135 | 3.135 |
| Manitou Falls GS (HV) | 2.751 | 3.156 | 3.125 | 3.743 | 2.839 | 3.241 | 3.203 | 3.818 |
| Perraults Falls DS (HV) | 2.901 | 2.975 | 2.199 | 2.25 | 2.949 | 3.021 | 2.222 | 2.272 |
| Perraults Falls DS (LV) | 3.147 | 3.147 | 3.328 | 3.336 | 3.155 | 3.155 | 3.333 | 3.342 |
| Red Lake TS (LV) | 2.410 | 2.410 | 3.271 | 3.27 | 2.444 | 2.444 | 3.313 | 3.313 |
| Moose Lake TS (HV) | 5.515 | 5.912 | 5.306 | 5.691 | 5.257 | 5.923 | 5.313 | 5.698 |
| Moose Lake TS (LV) T2 | 1.145 | 1.145 | 1.461 | 1.461 | 1.145 | 1.145 | 1.461 | 1.461 |
| Moose Lake TS (LV) T3 | 1.972 | 1.972 | 2.522 | 2.522 | 1.972 | 1.972 | 2.523 | 2.523 |
| Vermilion Bay TS (230 kV) | 3.68 | 4.169 | 3.032 | 3.264 | 3.714 | 4.203 | 3.054 | 3.286 |
| Vermilion Bay TS (115 kV) | 3.702 | 3.773 | 2.439 | 2.450 | 3.709 | 3.780 | 2.443 | 2.453 |
| Vermilion Bay TS (27 kV) | 2.924 | 2.924 | 2.846 | 2.891 | 2.924 | 2.924 | 2.846 | 2.891 |
| Dryden TS (230 kV) | 4.150 | 4.960 | 4.367 | 5.383 | 4.228 | 5.046 | 4.470 | 5.494 |
| Dryden TS (115 kV) | 7.003 | 7.825 | 8.340 | 9.591 | 7.037 | 7.868 | 8.401 | 9.664 |
| Dryden TS (44 kV) | 3.799 | 3.799 | 4.905 | 4.905 | 3.803 | 3.803 | 4.910 | 4.910 |
| Mackenzie TS (230 kV) | 6.413 | 8.108 | 6.582 | 8.529 | 6.462 | 8.161 | 6.620 | 8.573 |
| Mackenzie TS (115 kV) | 6.157 | 7.509 | 7.392 | 9.431 | 6.173 | 7.526 | 7.409 | 9.449 |

The new connection at Pickle Lake slightly reduces the equivalent impedance, resulting in a moderate increase in short-circuit level at some locations, the short circuit level still remains relatively low. As shown in Table 2, the change in short-circuit level is within 0.001 kA to 2.7 kA range for locations along circuit E1C and at other locations. The highest short circuit increase resulting from the connection of the new line is observed at Placer Jct and Crow River DS, however it remains relatively low at these locations. Fault levels at 230 kV and 115 kV buses at Hydro One stations as well as customer connection points are below the maximum symmetrical three-phase and single line-to-ground fault limits set out in Appendix 2 of the TSC. The fault levels at Hydro One's 230 kV and 115 kV buses are within Hydro One's asymmetrical breaker ratings and are acceptable to Hydro One.

4. Voltage Assessment

The impact of the proposed transmission facilities on the pre- and post-contingency voltages is studied in this CIA for the peak-load and minimum generation condition, where as indicated in the SIA, circuit E1C would be opened at Ear Falls TS to prevent voltage instability in case of the loss of circuit E4D. Table 3, Table 4 and Table 5 show 2030 peak load forecast for the existing and new load stations used in this study.

Table 2: 2030 Peak Load Forecast for Existing Load Stations

| Remote communities | Load forecast (MW) |
|-------------------------------|--------------------|
| Red Lake TS | 32.5 |
| Balmer CTS | 33.8 |
| Ear Falls TS | 4.64 |
| Crow River DS | 3.07 |
| Slate Falls DS | 0.73 |
| Perrault Falls DS | 0.93 |
| Cat Lake DS | 1.01 |
| Musselwhite CTS and Esker CTS | 19.5 |

Table 3: 2030 Peak load of Pickle Lake new remote communities load

| Remote communities | Load forecast (MW) |
|---------------------|--------------------|
| Weagamow TS | 1.92 |
| Muskrat Dam TS | 1.18 |
| Bearskin Lake TS | 1.113 |
| Sachigo Lake TS | 1.259 |
| Wunnumin Lake TS | 1.595 |
| Kingfisher Lake TS | 1.216 |
| Wawakapewin Lake TS | 0.248 |
| Kasabonika Lake TS | 1.823 |
| Wapekeka TS | 1.176 |
| KI-Wepekeka TS | 2.613 |

Table 4: 2030 Peak load of Red Lake new remote communities load

| Remote communities | Load forecast (MW) |
|----------------------|--------------------|
| Pikangikum TS | 3.46 |
| Poplar Hill TS | 1.31 |
| Deer Lake TS | 2.3 |
| Sandy Lake TS | 4.71 |
| North Spirit Lake TS | 1.01 |
| Keewaywin TS | 1.14 |

Table 6 shows the pre-contingency voltages in the study area, as well as the post-contingency voltages for the following contingencies before the ULTC action:

- Circuit W54W (the new WPLP's 230 kV line)
- Circuit D26A
- Circuit E1C
- Circuit M1M
- Circuit E2R
- Circuit E4D

In the peak-load case, with circuit E1C open at Ear Falls TS, the minimum and maximum pre- and post-contingency voltages (before ULTC action) are in the following range:

Pre-Contingency:

| | |
|--------------------|-----------------|
| 220.57 : 243.27 kV | at 230 kV buses |
| 121.29 : 130.64 kV | at 115 kV buses |
| 44.53 : 45.78 kV | at 44 kV buses |
| 27.50 : 27.50 kV | at 28 kV buses |

Post-Contingency:

| | |
|--------------------|-----------------|
| 209.55 : 245.06 kV | at 230 kV buses |
| 118.14 : 132.43 kV | at 115 kV buses |
| 43.84 : 46.40 kV | at 44 kV buses |
| 25.98 : 27.88 kV | at 28 kV buses |

The change in voltages from pre-contingency to post-contingency range between -5.53% to 2.09%. The pre- and post-contingency voltages are within or close to the limits specified in the Ontario Resource and Transmission Assessment Criteria (ORTAC) and deemed acceptable since:

- For 115 kV buses, pre-contingency voltage of up to 130.64 kV (higher than the 127 kV limit) and post-contingency voltage of up to 132.43 kV (slightly higher than the 132 kV limit) are at the end of open-ended E1C circuit and are acceptable. The tap setting of the new 230/115 kV transformer at WPLP's Pickle Lake TS and the new shunt reactors at this station and at the remote stations will be used to keep the voltage on E1C and the remote stations at acceptable levels pre- and post-contingency.

- Voltage change of up to -5.53% at the 28 kV bus at Crow River DS (following the E1C contingency) is below the 10% limit before the ULTC action. ULTC action will bring the voltage change below the post-ULTC 5% limit.

Table 5: Pre- and Post-Contingency Voltages before ULTC Action

| | Pre-Contg | W54W Contg | | D26A Contg | | E1C Contg | | M1M Contg | | E2R Contg | | E4D Contg | |
|--------------|-----------|------------|-----------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Bus Name | kV | kV | Delta-V % | kV | Delta-V % | kV | Delta-V % | kV | Delta-V % | kV | Delta-V % | kV | Delta-V % |
| DINORWIC_TAP | 242.02 | 244.09 | 0.86 | 0.00 | | 239.12 | -1.20 | 242.27 | 0.10 | 244.57 | 1.05 | 244.61 | 1.07 |
| DRYDEN_TS | 242.49 | 244.18 | 0.70 | 239.12 | -1.39 | 240.16 | -0.96 | 242.71 | 0.09 | 244.97 | 1.02 | 245.06 | 1.06 |
| MACKENZIE_TS | 239.56 | 240.72 | 0.48 | 235.45 | -1.72 | 238.40 | -0.48 | 239.84 | 0.12 | 241.18 | 0.68 | 241.15 | 0.66 |
| PKLLAKE_230 | 220.57 | 0.00 | | 0.00 | | 209.55 | -5.00 | 219.53 | -0.47 | 223.45 | 1.31 | 223.49 | 1.32 |
| TCPL_VERM_J | 243.27 | 244.44 | 0.48 | 240.21 | -1.26 | 241.55 | -0.71 | 243.40 | 0.05 | 244.82 | 0.64 | 244.94 | 0.69 |
| AGIMAK_DS_T1 | 123.70 | 124.48 | 0.63 | 120.82 | -2.33 | 122.88 | -0.66 | 123.87 | 0.14 | 124.84 | 0.92 | 124.88 | 0.95 |
| AGIMAK_DS_T2 | 123.70 | 124.48 | 0.63 | 120.82 | -2.33 | 122.88 | -0.66 | 123.87 | 0.14 | 124.84 | 0.92 | 124.88 | 0.95 |
| BALMER_CTS | 123.58 | 125.22 | 1.33 | 121.27 | -1.87 | 122.30 | -1.04 | 124.07 | 0.40 | 0.00 | | 0.00 | |
| CROW_RIV_T2 | 125.02 | 0.00 | | 0.00 | | 118.14 | -5.50 | 124.11 | -0.73 | 126.68 | 1.33 | 126.70 | 1.34 |
| CROW_RIV_T2 | 125.02 | 0.00 | | 0.00 | | 118.14 | -5.50 | 124.11 | -0.73 | 126.68 | 1.33 | 126.70 | 1.34 |
| DOMTAR_DRYDN | 123.27 | 124.17 | 0.73 | 121.10 | -1.76 | 122.20 | -0.87 | 123.43 | 0.13 | 124.32 | 0.85 | 124.45 | 0.96 |
| DRYDEN_TS | 123.13 | 124.03 | 0.73 | 120.96 | -1.76 | 122.06 | -0.87 | 123.29 | 0.13 | 124.19 | 0.86 | 124.32 | 0.97 |
| EAR_FALLS_TS | 121.29 | 122.47 | 0.97 | 119.52 | -1.46 | 120.28 | -0.83 | 121.61 | 0.26 | 123.46 | 1.79 | 0.00 | |
| EAR_FALLS_TS | 121.29 | 122.47 | 0.97 | 119.52 | -1.46 | 120.28 | -0.83 | 121.61 | 0.26 | 123.46 | 1.79 | 0.00 | |
| ETON_DS | 123.24 | 124.08 | 0.68 | 121.16 | -1.69 | 122.23 | -0.82 | 123.39 | 0.12 | 124.23 | 0.80 | 124.35 | 0.90 |
| GOLD_PAT_2_J | 128.02 | 0.00 | | 0.00 | | 0.00 | | 127.09 | -0.73 | 129.75 | 1.35 | 129.77 | 1.37 |
| GOLDEN_PATRJ | 128.02 | 0.00 | | 0.00 | | 0.00 | | 127.09 | -0.73 | 129.75 | 1.35 | 129.77 | 1.37 |
| IGNACE_J | 123.65 | 124.43 | 0.63 | 120.79 | -2.31 | 122.84 | -0.66 | 123.82 | 0.14 | 124.78 | 0.91 | 124.83 | 0.95 |
| MACKENZIE_A3 | 122.68 | 123.23 | 0.45 | 120.89 | -1.46 | 122.13 | -0.45 | 122.81 | 0.11 | 123.38 | 0.57 | 123.39 | 0.58 |
| MANITOU_FLS | 121.71 | 122.78 | 0.88 | 120.13 | -1.30 | 120.81 | -0.74 | 122.00 | 0.24 | 123.67 | 1.61 | 0.00 | |
| MATTABI_CTS | 123.97 | 124.75 | 0.63 | 121.08 | -2.33 | 123.15 | -0.66 | 124.14 | 0.14 | 125.12 | 0.93 | 125.16 | 0.96 |
| MILL_CREEK_J | 123.35 | 123.86 | 0.41 | 121.54 | -1.47 | 122.83 | -0.42 | 123.47 | 0.10 | 124.04 | 0.56 | 124.05 | 0.57 |
| MOOSE_LK_TS | 122.99 | 123.52 | 0.43 | 121.11 | -1.53 | 122.46 | -0.43 | 123.12 | 0.11 | 123.72 | 0.59 | 123.72 | 0.59 |
| MUSSELWH_CSS | 125.02 | 0.00 | | 0.00 | | 118.14 | -5.50 | 0.00 | | 126.68 | 1.33 | 126.70 | 1.34 |

| | Pre-Contg | W54W Contg | | D26A Contg | | E1C Contg | | M1M Contg | | E2R Contg | | E4D Contg | |
|--------------|-----------|------------|-----------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Bus Name | kV | kV | Delta-V % | kV | Delta-V % | kV | Delta-V % | kV | Delta-V % | kV | Delta-V % | kV | Delta-V % |
| PLACER_2276J | 125.02 | 0.00 | | 0.00 | | 118.14 | -5.50 | 124.11 | -0.73 | 126.68 | 1.33 | 126.70 | 1.34 |
| RED_LAKE_TS | 123.91 | 125.55 | 1.32 | 121.62 | -1.85 | 122.64 | -1.02 | 124.41 | 0.40 | 0.00 | | 0.00 | |
| SAM_LAKE_DS | 122.67 | 123.58 | 0.74 | 120.47 | -1.79 | 121.58 | -0.89 | 122.83 | 0.13 | 123.74 | 0.87 | 123.87 | 0.98 |
| SAPAWE_J_B6M | 123.38 | 123.83 | 0.36 | 121.71 | -1.35 | 122.91 | -0.38 | 123.48 | 0.08 | 124.00 | 0.50 | 124.00 | 0.50 |
| SCOUT_LAKE_J | 121.29 | 122.40 | 0.92 | 119.35 | -1.60 | 120.24 | -0.87 | 121.56 | 0.22 | 123.82 | 2.09 | 0.00 | |
| SLATE_FALS_J | 129.56 | 0.00 | | 0.00 | | 0.00 | | 128.61 | -0.73 | 131.31 | 1.35 | 131.34 | 1.37 |
| STURGEON_FLS | 123.34 | 123.85 | 0.41 | 121.53 | -1.47 | 122.83 | -0.41 | 123.46 | 0.10 | 124.04 | 0.57 | 124.04 | 0.57 |
| TROUT_LAKE | 130.64 | 0.00 | | 0.00 | | 0.00 | | 129.68 | -0.73 | 132.40 | 1.35 | 132.43 | 1.37 |
| VALERIE_FL_J | 123.18 | 123.69 | 0.41 | 121.38 | -1.46 | 122.67 | -0.41 | 123.30 | 0.10 | 123.87 | 0.56 | 123.88 | 0.57 |
| VALORA_DS | 123.99 | 124.77 | 0.63 | 121.10 | -2.33 | 123.17 | -0.66 | 124.16 | 0.14 | 125.14 | 0.93 | 125.18 | 0.96 |
| VERM_BAY_DSJ | 123.57 | 124.28 | 0.57 | 121.72 | -1.50 | 122.71 | -0.70 | 123.69 | 0.10 | 124.39 | 0.66 | 124.50 | 0.75 |
| DRYDEN_TS_Y | 44.79 | 45.13 | 0.76 | 43.96 | -1.85 | 44.38 | -0.92 | 44.85 | 0.13 | 45.19 | 0.89 | 45.24 | 1.00 |
| MOOSE_LK_B2 | 44.53 | 44.73 | 0.45 | 43.84 | -1.55 | 44.34 | -0.43 | 44.58 | 0.11 | 44.81 | 0.63 | 44.81 | 0.63 |
| MOOSE_LK_B3 | 44.81 | 45.01 | 0.45 | 44.12 | -1.54 | 44.62 | -0.42 | 44.86 | 0.11 | 45.08 | 0.60 | 45.08 | 0.60 |
| RED_LAKE_TS | 45.78 | 46.40 | 1.35 | 44.92 | -1.88 | 45.30 | -1.05 | 45.97 | 0.42 | 0.00 | | 0.00 | |
| CROW_RIV_T13 | 27.50 | 0.00 | | 0.00 | | 25.98 | -5.53 | 27.30 | -0.73 | 27.87 | 1.35 | 27.87 | 1.35 |
| CROW_RIVER_Y | 27.50 | 0.00 | | 0.00 | | 25.98 | -5.53 | 27.30 | -0.73 | 27.87 | 1.35 | 27.88 | 1.38 |

Contingency Study Recommendations/Conditions

- Loss of W54W, D26A or Pickle Lake CTS Transformer

In case of the loss of the new WPLP's 230 kV line W54W, existing 230 kV line D26A or the 230/115 kV transformer at Watay Pickle Lake CTS, the connection to the remote communities north of Pickle Lake (circuits WBC from Pickle Lake TS to Ebane JCT) will be cross-tripped. If E1C is open at Ear Falls TS pre-contingency, or if E1C cannot remain connected to Ear Falls post-contingency, the remote communities north of Red Lake must also be disconnected so that E1C and the new C2M and their customers will be restored from Ear Falls TS.

- Loss of E1C

When operating E4D-W54W-E1C loop closed pre-contingency, upon the loss of E1C, for certain operating conditions, voltages at Ear Falls TS and Balmer Junction needs to be improved by switching in capacitor banks and switching out shunt reactors.

- Loss of E4D

According to the SIA, when operating E4D-W54W-E1C loop closed pre-contingency, upon the loss of E4D, the post-contingency flow on E1C should be limited to 25MW to prevent voltage or transient instability. At high load or low generation conditions, where post-contingency flow on E1C would exceed 25MW, E1C will be opened at Ear Falls TS in pre-contingency to respect post-contingency limits.

5. Supply Capacity and Reliability

The proposed facilities will not only increase the supply capacity at Pickle Lake, they will also increase the capacity at Ear Falls and Red Lake by eliminating the need to supply Pickle Lake from Ear Falls. The proposed facilities will also significantly improve the reliability of supply for customers north of Dryden. The Pickle Lake Customers that are interrupted today with circuit E1C outages, will remain uninterrupted with the new connection. Today, outages of circuit E4D often results in the outage of E1C and E2R and all their connected customers. With the new facilities, E1C will remain in-service for any E4D outage and, with rejection of some of the load, the remaining customers on circuit E2R will also remain in-service.

Some operating conditions might result in voltage stability or transient stability issues for the loss of circuit E4D if circuit E1C is kept closed at Ear Falls in pre-contingency. In these cases, circuit E1C could be opened at Ear Falls TS and, if circuit E4D outage occurs, E1C could be closed and some or all of the load and available generation will be restored until circuit E4D is brought back in-service.

The proposed connection of the remote community to Pickle Lake will not have an adverse impact on the reliability of supply for E1C existing connected customers. The new 115 kV line to remote communities will be connected to WPLP's new 230/115 kV TS at Pickle Lake via terminal breakers which will clear faults on the new system north of Pickle Lake without interrupting circuit E1C and WPLP's new 230 kV transmission line.

In case of a sustained fault on a section of circuit D26A, or during planned outages, the Mackenzie-Dinorwic or Dinorwic-Dryden section of D26A can be isolated to keep WPLP's new 230 kV line and the Pickle Lake customers supplied from Mackenzie TS or Dryden TS.

6. Conclusions and Recommendations

This CIA report describes the impact of WPLP's proposed 230 kV Dinorwic to Pickle Lake Transmission and 115 kV Remote Connections project on the customers in the area.

The short-circuit levels at customer transmission connection points will not be significantly increased as a result of this project.

The project will not have material adverse impact on voltage at customer supply points. Minor violation of voltage criteria observed on circuit E1C, when it is operated open at Ear Falls TS, is deemed acceptable since it will be corrected by the transformer tap changer.

The project significantly increases the supply capability in the area north of Dryden and also improves the reliability of supply for the existing customers.

The SIA and CIA have not assessed the impact of potential load increase or connection of new load or generation that will be made possible by this project (except those that were assessed in recent SIAs). New requests for load increase or connection of new facilities will be the subject of separate SIA/CIA.

CUSTOMER IMPACT ASSESSMENT

Wataynikaneyap Power L.P.'s
RED LAKE REMOTE CONNECTION PROJECT

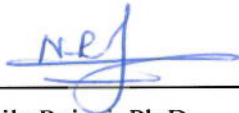
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DISCLAIMER

This Customer Impact Assessment was prepared based on preliminary information available about Wataynikaneyap Power L.P.'s proposed Red Lake Remote Connection project, consisting of a new 115 kV transmission line from Red Lake to Pikangikum and a network of 115 kV and lower voltage lines from Pikangikum to five more First Nation communities. This report is intended to highlight significant impacts, if any, on transmission customers early in the project development process and thus to allow an opportunity for these parties to bring forward any concerns that they may have, including those needed for the review of the connection and for any possible application for Leave to Construct. Subsequent changes to the required modifications or the implementation plan may affect the impacts of the proposed facility connection identified in this Customer Impact Assessment. The results of this Customer Impact Assessment and the estimate of the outage requirements are subject to change to accommodate the requirements of the IESO and other regulatory or municipal authority requirements. The fault levels computed as part of this Customer Impact Assessment are meant to assess current conditions in the study horizon and are not intended to be for the purposes of sizing equipment or making other project design decisions. Many other factors beyond the existing fault levels go into project design decisions.

Hydro One Networks Inc. shall not be liable, whether in contract, tort or any other theory of liability, to any person who uses the results of the Customer Impact Assessment under any circumstances whatsoever for any damages arising out of such use unless such liability is created under some other contractual obligation between Hydro One Networks Inc. and such person.

Executive Summary

Wataynikaneyap Power L.P. (WPLP, the “connection applicant”) is proposing to build a new 511 km 115 kV single-circuit radial transmission lines extending north from a new 115 kV switching station near Red Lake (WPLP’s Red Lake SS) to supply Pikangikum TS, Polar Hill TS, Deer Lake TS, North Spirit Lake TS, Sandy Lake TS and Keewaywin TS. The new Red Lake SS will connect this new 115 kV system to the existing E2R transmission line approximately 4 km from Red Lake TS. The new station and initial sections of the new transmission lines and associated connection facilities are scheduled to be in service by Q4-2020, with the connection of remote communities beginning in Q1-2021 and complete by Q4-2023.

The project, along with WPLP’s proposed new 230 kV transmission line to Pickle Lake and connection of the remote communities north of Pickle Lake, has been identified as a priority project in the Order-in-Council issued by the Lieutenant Governor in Council on July 20, 2016, and in the government’s 2017 and earlier Long-Term Energy Plans.

The IESO has conducted the System Impact Assessment (SIA) for the project and identified the connection requirements.

Hydro One has conducted this Customer Impact Assessment (CIA) to assess the potential impacts of the project on existing customers in the area, including:

- Short circuit impact
- Impact on voltage at customer supply points
- Impact on customer power supply capacity and reliability

The findings of this CIA are as follows:

- The project will have no significant impact on short-circuit levels in the area since it does not introduce additional sources of short circuit current.
- The project will not have material adverse impact on voltage at customer supply points. Minor violation of voltage criteria observed on circuit E1C, when it is operated open at Ear Falls TS, is deemed acceptable since it will be corrected by the transformer tap changer.
- The project will not adversely impact the reliability of supply for the existing connected customers at Ear Falls and Red Lake as the new line will be connected to E2R via a terminal breaker which will clear faults on the new system north of Red Lake without interrupting circuit E2R. Today, in case of a sustained fault on circuit E4D or a planned outage, the supply to the E1C and E2R connected customers is interrupted. After the incorporation of the new WPLP’s 230 kV transmission line to Pickle Lake, depending on the amount of load and generation in the Red Lake and Ear Falls area, the customers connected to circuit E2R and Ear Falls TS could remain connected to the grid if circuit E1C is operated closed. Some operating conditions might result in voltage stability or transient stability issues for the loss of circuit E4D if circuit E1C is kept closed at Ear Falls in pre-contingency. In these cases, circuit E1C could be opened at Ear Falls TS and, if circuit E4D outage occurs, E1C could be closed and some or all of the load and available generation will be restored until circuit E4D is brought back in-service.

Contents

Page

| | |
|--|----|
| Executive Summary | 3 |
| 1. Introduction | 5 |
| 1.1. Customer List | 6 |
| 2. Customer Impact Assessment Scope..... | 7 |
| 3. Short-Circuit Assessment | 7 |
| 4. Voltage Assessment..... | 9 |
| 5. Supply Capacity and Reliability | 14 |
| 6. Conclusions and Recommendations..... | 14 |

Customer Impact Assessment

Wataynikaneyap Power L.P.'s Red Lake Remote Connection Project

1. Introduction

The government's 2010, 2013 and 2017 Long-Term Energy Plans and the IESO's "North of Dryden Integrated Regional Resource Plan", dated January 27, 2015, have recommended a new single-circuit 230 kV line from Dryden/Dinorwic area to Pickle Lake to address near- and medium- term needs for the Pickle Lake and Red Lake areas. This line will provide capacity for connection of remote communities and development of mines in the Red Lake and Pickle Lake areas and improve reliability and increase supply capacity for the customers north of Dryden. The project, along with the connection of the remote communities, has been identified as a priority project in an Order-in-Council dated July 20, 2016.

Wataynikaneyap Power L.P. (the "connection applicant"; WPLP) is proposing to build 511 km of new 115 kV single-circuit transmission lines, extending north from Red Lake, to supply Pikangikum TS, Polar Hill TS, Deer Lake TS, North Spirit Lake TS, Sandy Lake TS and Keewaywin TS. In addition to the new transmission lines, the project includes:

- A new 115 kV switching station at Red Lake named Red Lake SS (or, as referred to in this CIA, Watay Red Lake CSS), approximately 4 km from the existing Red Lake TS, with one in-line breaker and a 6 MVar variable shunt reactor.
- A short 115 kV transmission line to connect the new Red Lake SS to Hydro One's existing transmission line E2R.
- Transformer and switching stations, including breakers and shunt reactors at the remote communities served by the new transmission lines.

For this project, Hydro One is proposing to,

- Add a new junction on the existing 115 kV transmission line E2R, called E2R-WPLP JCT, adjacent to WPLP's new Red Lake SS (Watay Red Lake CSS)
- Connect the short tap from the new Red Lake SS to E2R-WPLP JCT

A schematic diagram of the proposed 115 kV facilities and their connection to the existing transmission lines at Red Lake is shown in Figure 1.

The new Red Lake switching station, with associated connection facilities, and the initial sections of the new transmission lines are scheduled to be in service by Q4-2020, with the connection of remote communities beginning in Q1-2021 and complete by Q4-2023

As part of the Connection Assessment and Approval (CAA) process, the IESO has carried out System Impact Assessment (SIA) of the proposed project and has documented the findings in the SIA report CAA ID 2017-601 "Red Lake Remote Connection Lines", dated June 7, 2018.

The SIA has indicated that during periods of high load and low local hydroelectric generation, or low load and high generation, to prevent voltage or transient instability or thermal overload in case of the loss of circuit E4D, E1C, W54W (the new WPLP's 230 kV line to Pickle Lake) or D26A (which connects circuit W54W to the grid), circuit E1C would be opened at Ear Falls TS. In this case, Ear Falls and Red Lake areas will be outaged following the loss of circuit E4D.

Some of these customers could be reconnected by closing circuit E1C following the E4D contingency.

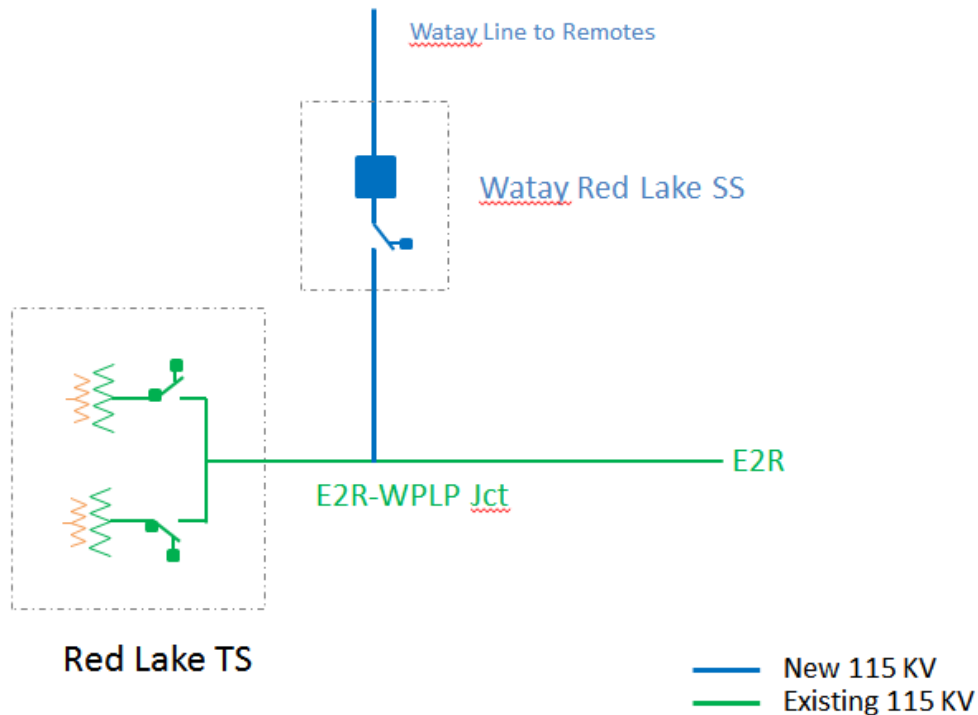


Figure 1: Proposed new facilities and connections

Hydro One has carried out this CIA to assess the impact that the proposed transmission facility connections may have on load and generation customer facilities in the area from Mackenzie in the south to Red Lake and Pickle Lake in the north. This assessment is in accordance with the requirements of the Ontario Energy Board Transmission System Code.

WPLP has also proposed a new 303 km 230 kilovolt (kV) single-circuit transmission line from Dinorwic to Pickle Lake along with a network of 115 kV and lower voltage transmission lines extending from Pickle Lake to the remote communities north of Pickle Lake. This project, scheduled to be in service by October 31, 2020 (with connection of the remote communities beginning in 2021) is the subject of separate SIA (CAA ID 2016-567) and a companion CIA.

The short-circuit and voltage assessments presented in this CIA are the result of both WPLP's Pickle Lake and Red Lake projects.

1.1. Customer List

Table 1 lists transmission customers in the study area of the project.

Table 1: Transmission Customers in Study Area

| Customer | Station / Supply Circuit |
|--|---------------------------------|
| Atikokan Hydro Inc. | Moose Lake TS |
| Domtar Inc. | Domtar Dryden CTS / D5D |
| Glencore Canada Corporation [Mattabi Division] | Mattabi CTS / M2D |
| Goldcorp Canada Ltd. [Musselwhite Mine] | Musselwhite CSS / E1C |
| Goldcorp Inc. [Red Lake Gold Mines] | Balmer CTS / E2R |
| H2O Power LP [Calm Lake] | H2O Pwr Calm Lk CGS / M1S |
| H2O Power LP [Sturgeon Falls] | H2O Pwr SturgFls CGS / M1S |
| Hydro One Distribution | Agimak DS / M2D |
| | Cat Lake MTS / E1C |
| | Crow River DS / E1C |
| | Ear Falls TS |
| | Eton DS / K3D |
| | Perrault Falls DS / E4D |
| | Sam Lake DS / K3D |
| | Slate Falls DS / E1C |
| | Valora DS / M2D |
| | Vermilion Bay DS / K3D |
| Ontario Power Generation Inc. [Manitou Falls GS] | Manitou Falls GS / M3E |
| Ontario Power Generation Inc. [Atikokan TGS] | Moose Lake TS |
| Ontario Power Generation Inc. [Ear Falls GS & Lac Seul GS] | Ear Falls TS |
| TransCanada PipeLines Limited [Vermilion Bay] | TCPL Vermillion Bay CTS / K23D |
| Valerie Falls Limited | Valerie Falls CGS / M1S |

2. Customer Impact Assessment Scope

A review of the following potential impacts on existing customers is conducted in this CIA:

- Short circuit impact
- Impact on voltage at customer supply points
- Impact on customer power supply capacity and reliability

3. Short-Circuit Assessment

The proposed transmission facilities have no significant impact on short-circuit levels in the area since they do not add new sources of short circuit current. Table 2 below shows the short-circuit level before and after the connection of WPLP's new Red Lake project as well as WPLP's new 230 kV transmission line to Pickle Lake and associated station facilities.

Table 2: Short Circuit Level

| | Before WPLP's Red Lake and Pickle Lake projects incorporated | | | | After WPLP's Red Lake and Pickle Lake projects incorporated, E1C operated closed | | | |
|----------------------------|--|---------|---------------|---------|--|---------|---------------|---------|
| | 3-phase fault (kA) | | LG fault (kA) | | 3-phase fault (kA) | | LG fault (kA) | |
| | SYMM I | ASYMM I | SYMM I | ASYMM I | SYMM I | ASYMM I | SYMM I | ASYMM I |
| Red Lake TS (HV) | 1.354 | 1.380 | 1.624 | 1.676 | 1.381 | 1.405 | 1.649 | 1.700 |
| Red Lake TS (LV) | 2.41 | 2.41 | 3.271 | 3.271 | 2.444 | 2.444 | 3.313 | 3.313 |
| Mussle White CSS (HV) | 0.701 | 0.885 | 0.198 | 0.199 | 0.996 | 1.189 | 0.441 | 0.452 |
| Placer JCT | 0.694 | 0.695 | 0.285 | 0.285 | 2.107 | 2.172 | 2.849 | 2.984 |
| Crow River DS (HV) | 0.694 | 0.695 | 0.285 | 0.285 | 2.106 | 2.170 | 2.845 | 2.978 |
| Crow River DS (LV) | 1.489 | 1.489 | 1.869 | 1.869 | 2.470 | 2.470 | 2.794 | 2.794 |
| Golden Patricia JCT | 0.765 | 0.766 | 0.369 | 0.369 | 1.289 | 1.290 | 0.956 | 0.957 |
| Cat Lake MTS (HV) | 0.677 | 0.677 | 0.334 | 0.334 | 1.053 | 1.054 | 0.751 | 0.751 |
| Cat Lake MTS (LV) | 0.643 | 0.643 | 0.716 | 0.716 | 0.703 | 0.703 | 0.764 | 0.764 |
| Slate Falls DS (HV) | 0.913 | 0.914 | 0.496 | 0.496 | 1.231 | 1.232 | 0.844 | 0.845 |
| Slate Falls DS (LV) | 0.614 | 0.614 | 0.643 | 0.643 | 0.637 | 0.637 | 0.659 | 0.659 |
| Ear Falls TS (LV) | 3.485 | 3.485 | 3.679 | 3.766 | 3.507 | 3.507 | 3.696 | 3.781 |
| Lac Seul GS | 8.738 | 8.738 | 6.924 | 6.964 | 8.829 | 8.829 | 6.962 | 6.998 |
| Balmer J | 1.407 | 1.434 | 1.615 | 1.666 | 1.435 | 1.462 | 1.640 | 1.690 |
| Balmer CTS (HV) | 1.290 | 1.316 | 1.343 | 1.376 | 1.314 | 1.338 | 1.360 | 1.392 |
| Balmer CTS (LV) | 2.378 | 2.378 | 3.101 | 3.101 | 2.408 | 2.408 | 3.135 | 3.135 |
| Manitou Falls GS (HV) | 2.751 | 3.156 | 3.125 | 3.743 | 2.839 | 3.241 | 3.203 | 3.818 |
| Perraults Falls DS (HV) | 2.901 | 2.975 | 2.199 | 2.25 | 2.949 | 3.021 | 2.222 | 2.272 |
| Perraults Falls DS (LV) | 3.147 | 3.147 | 3.328 | 3.336 | 3.155 | 3.155 | 3.333 | 3.342 |
| Red Lake TS (LV) | 2.410 | 2.410 | 3.271 | 3.27 | 2.444 | 2.444 | 3.313 | 3.313 |
| Moose Lake TS (HV) | 5.515 | 5.912 | 5.306 | 5.691 | 5.257 | 5.923 | 5.313 | 5.698 |
| Moose Lake TS (LV) T2 | 1.145 | 1.145 | 1.461 | 1.461 | 1.145 | 1.145 | 1.461 | 1.461 |
| Moose Lake TS (LV) T3 | 1.972 | 1.972 | 2.522 | 2.522 | 1.972 | 1.972 | 2.523 | 2.523 |
| Vermilion Bay TS (230 kV) | 3.68 | 4.169 | 3.032 | 3.264 | 3.714 | 4.203 | 3.054 | 3.286 |
| Vermilion Bay TS (115 kV) | 3.702 | 3.773 | 2.439 | 2.450 | 3.709 | 3.780 | 2.443 | 2.453 |
| Vermilion Bay TS (26.7 kV) | 2.924 | 2.924 | 2.846 | 2.891 | 2.924 | 2.924 | 2.846 | 2.891 |
| Dryden TS (230 kV) | 4.150 | 4.960 | 4.367 | 5.383 | 4.228 | 5.046 | 4.470 | 5.494 |
| Dryden TS (115 kV) | 7.003 | 7.825 | 8.340 | 9.591 | 7.037 | 7.868 | 8.401 | 9.664 |
| Dryden TS (44 kV) | 3.799 | 3.799 | 4.905 | 4.905 | 3.803 | 3.803 | 4.910 | 4.910 |
| Mackenzie TS (230 kV) | 6.413 | 8.108 | 6.582 | 8.529 | 6.462 | 8.161 | 6.620 | 8.573 |
| Mackenzie TS (115 kV) | 6.157 | 7.509 | 7.392 | 9.431 | 6.173 | 7.526 | 7.409 | 9.449 |

The results show a slight increase in short-circuit level at Red Lake of up to 0.03 kA and an increase of up to 2.7 kA for locations along circuit E1C. The slight increase in short circuit level is a result of incorporation of WPLP's new 230 kV transmission line to Pickle Lake.

4. Voltage Assessment

The impact of the proposed transmission facilities on the pre- and post-contingency voltages is studied in this CIA for the peak-load and minimum generation condition, where as indicated in the SIA, circuit E1C would be opened at Ear Falls TS to prevent voltage instability in case of the loss of circuit E4D. Table 3, Table 4 and Table 5 show 2030 peak load forecast for the existing and new load stations used in this study.

Table 1: 2030 Peak Load Forecast for Existing Load Stations

| Remote communities | Load forecast (MW) |
|-------------------------------|---------------------------|
| Red Lake TS | 32.5 |
| Balmer CTS | 33.8 |
| Ear Falls TS | 4.64 |
| Crow River DS | 3.07 |
| Slate Falls DS | 0.73 |
| Perrault Falls DS | 0.93 |
| Cat Lake DS | 1.01 |
| Musselwhite CTS and Esker CTS | 19.5 |

Table 2: 2030 Peak load of Pickle Lake new remote communities load

| Remote communities | Load forecast (MW) |
|---------------------------|---------------------------|
| Weagamow TS | 1.92 |
| Muskrat Dam TS | 1.18 |
| Bearskin Lake TS | 1.113 |
| Sachigo Lake TS | 1.259 |
| Wunnumin Lake TS | 1.595 |
| Kingfisher Lake TS | 1.216 |
| Wawakapewin Lake TS | 0.248 |
| Kasabonika Lake TS | 1.823 |
| Wapekeka TS | 1.176 |
| KI-Wepekeka TS | 2.613 |

Table 3: 2030 Peak load of Red Lake new remote communities load

| Remote communities | Load forecast (MW) |
|---------------------------|---------------------------|
| Pikangikum TS | 3.46 |
| Poplar Hill TS | 1.31 |
| Deer Lake TS | 2.3 |
| Sandy Lake TS | 4.71 |
| North Spirit Lake TS | 1.01 |
| Keewaywin TS | 1.14 |

Table 6 shows the pre-contingency voltages in the study area, as well as the post-contingency voltages for the following contingencies before the ULTC action:

- Circuit W54W (the new WPLP's 230 kV line to Pickle Lake)
- Circuit D26A
- Circuit E1C
- Circuit M1M
- Circuit E2R
- Circuit E4D

In the peak-load case, with circuit E1C open at Ear Falls TS, the minimum and maximum pre- and post-contingency voltages (before ULTC action) are in the following range:

Pre-Contingency:

| | |
|--------------------|-----------------|
| 220.57 : 243.27 kV | at 230 kV buses |
| 121.29 : 130.64 kV | at 115 kV buses |
| 44.53 : 45.78 kV | at 44 kV buses |
| 27.50 : 27.50 kV | at 28 kV buses |

Post-Contingency:

| | |
|--------------------|-----------------|
| 209.55 : 245.06 kV | at 230 kV buses |
| 118.14 : 132.43 kV | at 115 kV buses |
| 43.84 : 46.40 kV | at 44 kV buses |
| 25.98 : 27.88 kV | at 28 kV buses |

The change in voltages from pre-contingency to post-contingency range between -5.53% to 2.09%. The pre- and post-contingency voltages are within or close to the limits specified in the Ontario Resource and Transmission Assessment Criteria (ORTAC) and deemed acceptable since:

- For 115 kV buses, pre-contingency voltage of up to 130.64 kV (higher than the 127 kV limit) and post-contingency voltage of up to 132.43 kV (slightly higher than the 132 kV limit) are at the end of open-ended E1C circuit and are acceptable. The tap setting of the new 230/115 kV transformer at WPLP's Pickle Lake TS and the new shunt reactors at this station and at the remote stations will be used to keep the voltage on E1C and the remote stations at acceptable levels pre- and post-contingency.
- Voltage change of up to -5.53% at the 28 kV bus at Crow River DS (following the E1C contingency) is below the 10% limit before the ULTC action. ULTC action will bring the voltage change below the post-ULTC 5% limit.

Table 6: Pre- and Post-Contingency Voltages before ULTC Action

| | Pre-Contg | W54W Contg | | D26A Contg | | E1C Contg | | M1M Contg | | E2R Contg | | E4D Contg | |
|--------------|-----------|------------|-----------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Bus Name | kV | kV | Delta-V % | kV | Delta-V % | kV | Delta-V % | kV | Delta-V % | kV | Delta-V % | kV | Delta-V % |
| DINORWIC_TAP | 242.02 | 244.09 | 0.86 | 0.00 | | 239.12 | -1.20 | 242.27 | 0.10 | 244.57 | 1.05 | 244.61 | 1.07 |
| DRYDEN_TS | 242.49 | 244.18 | 0.70 | 239.12 | -1.39 | 240.16 | -0.96 | 242.71 | 0.09 | 244.97 | 1.02 | 245.06 | 1.06 |
| MACKENZIE_TS | 239.56 | 240.72 | 0.48 | 235.45 | -1.72 | 238.40 | -0.48 | 239.84 | 0.12 | 241.18 | 0.68 | 241.15 | 0.66 |
| PKLLAKE_230 | 220.57 | 0.00 | | 0.00 | | 209.55 | -5.00 | 219.53 | -0.47 | 223.45 | 1.31 | 223.49 | 1.32 |
| TCPL_VERM_J | 243.27 | 244.44 | 0.48 | 240.21 | -1.26 | 241.55 | -0.71 | 243.40 | 0.05 | 244.82 | 0.64 | 244.94 | 0.69 |
| AGIMAK_DS_T1 | 123.70 | 124.48 | 0.63 | 120.82 | -2.33 | 122.88 | -0.66 | 123.87 | 0.14 | 124.84 | 0.92 | 124.88 | 0.95 |
| AGIMAK_DS_T2 | 123.70 | 124.48 | 0.63 | 120.82 | -2.33 | 122.88 | -0.66 | 123.87 | 0.14 | 124.84 | 0.92 | 124.88 | 0.95 |
| BALMER_CTS | 123.58 | 125.22 | 1.33 | 121.27 | -1.87 | 122.30 | -1.04 | 124.07 | 0.40 | 0.00 | | 0.00 | |
| CROW_RIV_T2 | 125.02 | 0.00 | | 0.00 | | 118.14 | -5.50 | 124.11 | -0.73 | 126.68 | 1.33 | 126.70 | 1.34 |
| CROW_RIV_T2 | 125.02 | 0.00 | | 0.00 | | 118.14 | -5.50 | 124.11 | -0.73 | 126.68 | 1.33 | 126.70 | 1.34 |
| DOMTAR_DRYDN | 123.27 | 124.17 | 0.73 | 121.10 | -1.76 | 122.20 | -0.87 | 123.43 | 0.13 | 124.32 | 0.85 | 124.45 | 0.96 |
| DRYDEN_TS | 123.13 | 124.03 | 0.73 | 120.96 | -1.76 | 122.06 | -0.87 | 123.29 | 0.13 | 124.19 | 0.86 | 124.32 | 0.97 |
| EAR_FALLS_TS | 121.29 | 122.47 | 0.97 | 119.52 | -1.46 | 120.28 | -0.83 | 121.61 | 0.26 | 123.46 | 1.79 | 0.00 | |
| EAR_FALLS_TS | 121.29 | 122.47 | 0.97 | 119.52 | -1.46 | 120.28 | -0.83 | 121.61 | 0.26 | 123.46 | 1.79 | 0.00 | |
| ETON_DS | 123.24 | 124.08 | 0.68 | 121.16 | -1.69 | 122.23 | -0.82 | 123.39 | 0.12 | 124.23 | 0.80 | 124.35 | 0.90 |
| GOLD_PAT_2_J | 128.02 | 0.00 | | 0.00 | | 0.00 | | 127.09 | -0.73 | 129.75 | 1.35 | 129.77 | 1.37 |
| GOLDEN_PATRJ | 128.02 | 0.00 | | 0.00 | | 0.00 | | 127.09 | -0.73 | 129.75 | 1.35 | 129.77 | 1.37 |
| IGNACE_J | 123.65 | 124.43 | 0.63 | 120.79 | -2.31 | 122.84 | -0.66 | 123.82 | 0.14 | 124.78 | 0.91 | 124.83 | 0.95 |
| MACKENZIE_A3 | 122.68 | 123.23 | 0.45 | 120.89 | -1.46 | 122.13 | -0.45 | 122.81 | 0.11 | 123.38 | 0.57 | 123.39 | 0.58 |
| MANITOU_FLS | 121.71 | 122.78 | 0.88 | 120.13 | -1.30 | 120.81 | -0.74 | 122.00 | 0.24 | 123.67 | 1.61 | 0.00 | |
| MATTABI_CTS | 123.97 | 124.75 | 0.63 | 121.08 | -2.33 | 123.15 | -0.66 | 124.14 | 0.14 | 125.12 | 0.93 | 125.16 | 0.96 |
| MILL_CREEK_J | 123.35 | 123.86 | 0.41 | 121.54 | -1.47 | 122.83 | -0.42 | 123.47 | 0.10 | 124.04 | 0.56 | 124.05 | 0.57 |
| MOOSE_LK_TS | 122.99 | 123.52 | 0.43 | 121.11 | -1.53 | 122.46 | -0.43 | 123.12 | 0.11 | 123.72 | 0.59 | 123.72 | 0.59 |
| MUSSELWH_CSS | 125.02 | 0.00 | | 0.00 | | 118.14 | -5.50 | 0.00 | | 126.68 | 1.33 | 126.70 | 1.34 |
| PLACER_2276J | 125.02 | 0.00 | | 0.00 | | 118.14 | -5.50 | 124.11 | -0.73 | 126.68 | 1.33 | 126.70 | 1.34 |
| RED_LAKE_TS | 123.91 | 125.55 | 1.32 | 121.62 | -1.85 | 122.64 | -1.02 | 124.41 | 0.40 | 0.00 | | 0.00 | |

| | Pre-Contg | W54W Contg | | D26A Contg | | E1C Contg | | M1M Contg | | E2R Contg | | E4D Contg | |
|--------------|-----------|------------|-----------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Bus Name | kV | kV | Delta-V % | kV | Delta-V % | kV | Delta-V % | kV | Delta-V % | kV | Delta-V % | kV | Delta-V % |
| SAM_LAKE_DS | 122.67 | 123.58 | 0.74 | 120.47 | -1.79 | 121.58 | -0.89 | 122.83 | 0.13 | 123.74 | 0.87 | 123.87 | 0.98 |
| SAPAWA_J_B6M | 123.38 | 123.83 | 0.36 | 121.71 | -1.35 | 122.91 | -0.38 | 123.48 | 0.08 | 124.00 | 0.50 | 124.00 | 0.50 |
| SCOUT_LAKE_J | 121.29 | 122.40 | 0.92 | 119.35 | -1.60 | 120.24 | -0.87 | 121.56 | 0.22 | 123.82 | 2.09 | 0.00 | |
| SLATE_FALS_J | 129.56 | 0.00 | | 0.00 | | 0.00 | | 128.61 | -0.73 | 131.31 | 1.35 | 131.34 | 1.37 |
| STURGEON_FLS | 123.34 | 123.85 | 0.41 | 121.53 | -1.47 | 122.83 | -0.41 | 123.46 | 0.10 | 124.04 | 0.57 | 124.04 | 0.57 |
| TROUT_LAKE | 130.64 | 0.00 | | 0.00 | | 0.00 | | 129.68 | -0.73 | 132.40 | 1.35 | 132.43 | 1.37 |
| VALERIE_FL_J | 123.18 | 123.69 | 0.41 | 121.38 | -1.46 | 122.67 | -0.41 | 123.30 | 0.10 | 123.87 | 0.56 | 123.88 | 0.57 |
| VALORA_DS | 123.99 | 124.77 | 0.63 | 121.10 | -2.33 | 123.17 | -0.66 | 124.16 | 0.14 | 125.14 | 0.93 | 125.18 | 0.96 |
| VERM_BAY_DSJ | 123.57 | 124.28 | 0.57 | 121.72 | -1.50 | 122.71 | -0.70 | 123.69 | 0.10 | 124.39 | 0.66 | 124.50 | 0.75 |
| DRYDEN_TS_Y | 44.79 | 45.13 | 0.76 | 43.96 | -1.85 | 44.38 | -0.92 | 44.85 | 0.13 | 45.19 | 0.89 | 45.24 | 1.00 |
| MOOSE_LK_B2 | 44.53 | 44.73 | 0.45 | 43.84 | -1.55 | 44.34 | -0.43 | 44.58 | 0.11 | 44.81 | 0.63 | 44.81 | 0.63 |
| MOOSE_LK_B3 | 44.81 | 45.01 | 0.45 | 44.12 | -1.54 | 44.62 | -0.42 | 44.86 | 0.11 | 45.08 | 0.60 | 45.08 | 0.60 |
| RED_LAKE_TS | 45.78 | 46.40 | 1.35 | 44.92 | -1.88 | 45.30 | -1.05 | 45.97 | 0.42 | 0.00 | | 0.00 | |
| CROW_RIV_T13 | 27.50 | 0.00 | | 0.00 | | 25.98 | -5.53 | 27.30 | -0.73 | 27.87 | 1.35 | 27.87 | 1.35 |
| CROW_RIVER_Y | 27.50 | 0.00 | | 0.00 | | 25.98 | -5.53 | 27.30 | -0.73 | 27.87 | 1.35 | 27.88 | 1.38 |

Contingency Study Recommendations/Conditions

- Loss of W54W, D26A or Pickle Lake CTS Transformer

In case of the loss of the new WPLP's 230 kV line W54W, existing 230 kV line D26A or the 230/115 kV transformer at Watay Pickle Lake CTS, the connection to the remote communities north of Pickle Lake (circuits WBC from Pickle Lake TS to Eban JCT) will be cross-tripped. If E1C is open at Ear Falls TS pre-contingency, or if E1C cannot remain connected to Ear Falls post-contingency, the remote communities north of Red Lake must also be disconnected so that E2R, E1C and the new C2M and their customers will stay connected or, if outaged by this contingency, will be restored from Ear Falls TS.

- Loss of E1C

When operating E4D-W54W-E1C loop closed pre-contingency, upon the loss of E1C, for certain operating conditions, voltages at Ear Falls TS and Balmer Junction needs to be improved by switching in capacitor banks and switching out shunt reactors.

- Loss of E4D

According to the SIA, when operating E4D-W54W-E1C loop closed pre-contingency, upon the loss of E4D, the post-contingency flow on E1C should be limited to 25MW to prevent voltage or transient instability. At high load or low generation conditions, where post-contingency flow on E1C would exceed 25MW, E1C will be opened at Ear Falls TS in pre-contingency to respect post-contingency limits. In this condition, Ear Falls and Red Lake customers will be outaged with E4D contingency. Some of these customers could be reconnected by closing circuit E1C following this contingency.

5. Supply Capacity and Reliability

The project will not adversely impact the reliability of supply for the existing connected customers at Ear Falls and Red Lake as the new line is connected to E2R via a terminal breaker which will clear faults on the new system north of Red Lake without interrupting circuit E2R.

The connection applicant's companion plan for a 230 kV transmission line to Pickle Lake will supply the load in Pickle Lake area and as a result offload circuit E4D. This will provide capacity at Ear Falls to serve the existing and new customers at Ear Falls and Red Lake.

Today, in case of a sustained fault on circuit E4D or a planned outage, the supply to the E1C and E2R connected customers is interrupted. After the incorporation of WPLP's new 230 kV transmission line to Pickle Lake, depending on the amount of load and generation in the Red Lake and Ear Falls area, these customers could remain connected to the grid in case of circuit E4D outage.

Some operating conditions might result in voltage stability or transient stability issues for the loss of circuit E4D if circuit E1C is kept closed at Ear Falls in pre-contingency. In these cases, circuit E1C could be opened at Ear Falls TS and, if circuit E4D outage occurs, E1C could be closed and some or all of the load and available generation will be restored until circuit E4D is brought back in-service.

6. Conclusions and Recommendations

This CIA report describes the impact of WPLP's proposed Red Lake 115 kV remote connection project, as well as the proposed Dinorwic to Pickle Lake 230 kV Transmission and 115 kV remote connection at Pickle Lake, on the customers in the area.

The short-circuit levels at customer transmission connection points will not be significantly increased as a result of this project.

The project will not have material adverse impact on voltage at customer supply points. Minor violation of voltage criteria observed on circuit E1C, when it is operated open at Ear Falls TS, is deemed acceptable since it will be corrected by the transformer tap changer.

The project significantly increases the supply capability in the area north of Dryden and also improves the reliability of supply for the existing customers.

The SIA and CIA have not assessed the impact of potential load increase or connection of new load or generation that will be made possible by this project (except those that were assessed in recent SIAs). New requests for load increase or connection of new facilities will be the subject of separate SIA/CIA.