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Joanne Richardson

Director – Major Projects and Partnerships
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BY EMAIL AND RESS

July 16, 2021

Ms. Christine E. Long
Registrar
Ontario Energy Board
Suite 2700, 2300 Yonge Street
P.O. Box 2319
Toronto, ON M4P 1E4

Dear Ms. Long:

EB-2021-0136 – Hydro One Networks Inc. Leave to Construct Application – Richview TS by Trafalgar TS Reconductoring Project – Application and Evidence

Pursuant to Section 92 of the *Ontario Energy Board Act, 1998*, Hydro One Networks Inc. seeks the Ontario Energy Board's ("OEB") approval for an Order or Orders granting leave to reconductor existing transmission line circuits along the route between Richview Transformer Station and Trafalgar Transformer Station (the "Richview TS by Trafalgar TS Reconductoring Project", or "RTR Project", or the "Project") located in the municipalities of Toronto and Mississauga.

Additionally, pursuant to s. 97 of the *Ontario Energy Board Act, 1998*, Hydro One Networks Inc. seeks for an Order granting approval of the forms of the agreement offered or to be offered to affected landowners.

An electronic copy of this Application has been filed through the OEB's Regulatory Electronic Submission System.

Sincerely,

A handwritten signature in dark ink, appearing to read "Joanne Richardson", written in a cursive style.

Joanne Richardson

EXHIBIT LIST

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- 1 interface¹ by approximately 2,000 MW. The IESO has identified a need for
2 additional capacity east of the FETT interface by 2026. Please refer to the Project
3 Area Map for an illustration of the existing transmission line routes and the
4 existing station locations filed at **Exhibit C, Tab 2, Schedule 1, Attachment 1**.
- 5 3. The RTR Project will involve the reconductoring of four existing 230 kV
6 transmission circuits, described as:
- 7 • Circuits known as R14T and R17T between Trafalgar TS and Richview TS,
8 a distance of approximately 21.7 km; and
 - 9 • Circuits known as R19TH and R21TH - between Trafalgar TS and
10 Tomken Junction ("JCT"), a distance of approximately 13.7 km.
- 11 4. A Single Line Diagram of the 230 kV Transmission Corridor between Richview TS
12 and Trafalgar TS, provided at **Exhibit B, Tab 2, Schedule 1, Figure 2**, provides a
13 visual representation of the individual sections of the four circuits that will be
14 reconducted as part of this Project.
- 15 5. A *Project Area Map* illustration of the existing transmission circuit routes and the
16 existing station locations is filed at **Exhibit C, Tab 2, Schedule 1, Attachment 1**
17 and is also provided for the OEB to use this as the *Notice Map*.
- 18 6. Each individual 230 kV circuit currently consists of three phases, with each phase
19 consisting of a single conductor. The RTR Project will reductor each circuit
20 with the same 'one conductor per phase' circuit configuration. Each
21 reconducted circuit will continue to operate at 230 kV line voltage. Each circuit
22 will continue to be carried on the same tower series between Richview TS and
23 Trafalgar TS, and these towers will continue to remain on the current
24 transmission right-of-way, with the same centre line. In addition to the

¹ The FETT interface is defined by four 500kV circuits into Claireville TS, two 230 kV circuits out of Orangeville TS (measured east of Everett TS) and four 230kV circuits out of Trafalgar TS. This transfer stresses the FETT interface of the power system by transferring power from the Southwest, Bruce, Niagara and West Zones to the Toronto Zone. A schematic diagram of the FETT interface can be found at Exhibit B, Tab 2, Schedule 1, Figure 1.

reconductoring, the following related work will be undertaken as part of the RTR Project:

- Replace insulators on the circuit sections that will be reconducted;
- Replace the existing skywire carried on one of the tower series, specifically the tower series that carries circuits R14T and R17T, with optical ground wire (“OPGW”) between Richview TS and Trafalgar TS;
- Reinforce existing tower structures, as appropriate, to meet Hydro One’s current standards for these reconducted circuits to withstand applicable wind and ice loads for the circuit’s design;
- Replace six existing towers to meet the standard required for the reconducted circuits; and
- Performing necessary protection and control work to facilitate the connection and effective operation of the reconducted circuits.

7. The need for the Project has been established by the Independent Electricity System Operator (“IESO”), via their hand-off letter (the “Letter”) dated December 10, 2020, and further substantiated in the IESO’s Need Report titled, *Trafalgar TS x Richview TS 230 kV Line Upgrade: Need and Selection of the Preferred Plan*, both provided at **Exhibit B, Tab 3, Schedule 1, Attachment 1 and Attachment 3** respectively, and together with both **Exhibit B, Tab 3, Schedule 1, and Attachment 2** (cost related evidence), are referred to as the “**Need Evidence**”.

8. The proposed in-service date for the Project is April 2026, assuming construction commencement in February 2022. The RTR Project’s Schedule is provided at **Exhibit B, Tab 11, Schedule 1**.

9. Hydro One will rely predominantly on the statutory easement rights it enjoys on Infrastructure Ontario Bill 58 lands and on other land rights it currently has for the existing RTR Project circuits (R14T, R17T, R19TH and R21TH) right-of-way to

1 construct, operate and maintain the proposed new transmission facilities. Further
2 information on land related matters is found at **Exhibit E, Tab 1, Schedule 1**.

3 10. This Application is also for approval of the forms of the agreement offered or to
4 be offered to affected landowners, pursuant to s. 97 of the Act. The agreements
5 are in the same form as previously approved in prior Hydro One leave to
6 construct proceedings. The agreements can be found as attachments to **Exhibit E,**
7 **Tab 1, Schedule 1**.

8 11. The IESO has provided a final System Impact Assessment (“**SIA**”) which concludes
9 that the RTR Project is expected to have no adverse impact on the reliability of
10 the integrated power system. The final SIA is provided as **Exhibit F, Tab 1,**
11 **Schedule 1, Attachment 1**.

12 12. Hydro One has completed the final Customer Impact Assessment (“**CIA**”) in
13 accordance with Hydro One’s connection procedures. The CIA results confirm that
14 the RTR Project will not have any adverse effects on the transmission-connected
15 customers of the area. A copy of the final CIA is provided as **Exhibit G, Tab 1,**
16 **Schedule 1, Attachment 1**.

17 13. The cost of the transmission line and related facilities for which Hydro One is
18 seeking approval is approximately \$60.9 million, of which \$56.3 million is capital
19 and will be added to rate base, and \$4.6 million is removals. The details pertaining
20 to these costs are provided at **Exhibit B, Tab 7, Schedule 1**.

21 14. Project economics, as filed in **Exhibit B, Tab 9, Schedule 1**, estimate there will be
22 a minimal increase in transmission rates to Ontario’s transmission ratepayers.
23 The line connection pool rate of Ontario’s Uniform Transmission Rates (“**UTRs**”)
24 will remain unchanged, whereas the network connection pool rate is forecast to
25 increase the 2020 OEB-approved rates by a 0.51%, or from the current rate of
26 \$3.92/kW/month to \$3.94/kW/month. For a typical residential customer who is
27 under the Regulated Price Plan, there will be minimal impact on rates.

1 15. The Application is supported by written evidence which includes details of Hydro
2 One's proposal for the transmission circuit work. The written evidence is prefiled
3 and may be amended from time to time prior to the Board's final decision on this
4 Application.

5 16. Given the information provided in the prefiled evidence, Hydro One submits that
6 the RTR Project is in the public interest. The Project will facilitate increased east-
7 directional transfers across the FETT via bulk transfers from western Ontario,
8 including supply from western Ontario generation, while improving the quality of
9 service and reliability.

10 17. Hydro One requests that a copy of all documents filed with the Board be served
11 on the Applicant and the Applicant's counsel, as follows:

12
13 a) The Applicant:

14
15 Eryn MacKinnon
16 Sr. Regulatory Coordinator
17 Hydro One Networks Inc.

18
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28 b) The Applicant's counsel:

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31 Assistant General Counsel
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PROJECT OVERVIEW DOCUMENTS

This Application is seeking OEB approval for Hydro One to construct transmission facilities between Richview TS and Trafalgar TS. The Project will reconductor Hydro One's existing 230 kV transmission circuits, whose nomenclatures are R14T, R17T, R19TH and R21TH, that connect two major stations, Richview TS and Trafalgar TS, in the Cities of Toronto and Mississauga, respectively.

These four circuits are paired as follows: circuits R14T and R17T are carried together on one set of towers (a configuration often referred to as 'double circuit'), and circuits R19TH and R21TH are carried together on a separate set of towers. Both tower spans are situated adjacent to each other and run parallel on the same right-of-way corridor between Richview TS and Trafalgar TS. The distance between Richview TS and Trafalgar TS is approximately 21.7km, and in total Hydro One is proposing to reconductor approximately 70km of circuits. Further detail on the specific lengths of each circuit that will be reconducted in the RTR Project is provided below, and a visual supporting schematic diagram is provided in **Figure 2** below.

The IESO has identified the need for an increased power transfer limit across the FETT transmission interface¹. The FETT interface delivers electricity from western Ontario towards the GTA. Supply capacity east of the GTA is expected to decline² over the next decade due to the retirement of Pickering Generating Station ("GS") and the ongoing nuclear refurbishment outages. The IESO³ has determined that the generation shortfall will be met by energy supplied from western Ontario and as such will require increased capacity flow on the FETT interface. The IESO has confirmed that the FETT interface capability will need to be increased by 2000 MW, which will be achieved by

¹ Exhibit B, Tab 3, Schedule 1, Attachment 1 and Attachment 3.

² Ibid

³ Ibid

reconductoring the four 230 kV transmission circuits, identified above, between Trafalgar TS and Richview TS.

The 230 kV circuits R14T, R17T, R19TH, and R21TH will be reconducted as follows:

- i) circuits R14T and R17T, which are carried on one tower span will be reconducted between Trafalgar TS and Richview TS, a length of approximately 21.7km; and
- ii) circuits R19TH and R21TH, which are carried on one tower span, will be reconducted between Trafalgar TS and Tomken Jct, a length of approximately 13.7km.

There is no requirement to reconductor two sections of 230 kV circuits, that of R19TH and R21TH between Richview TS and Tomken Jct. These two sections currently have a conductor installed with an adequate ampacity rating to meet the increased FETT flow required, once the two above-described sections have been reconducted.

Additionally, at the same time, Hydro One will replace the existing skywire atop the tower series that carries circuits R14T/R17T with an optical ground wire ("OPGW") between Richview TS and Trafalgar TS. The existing skywire was installed in 1985. The combination of new conductor characteristics, generation and transmission upgrades in the area, e.g. Hurontario SS, Halton Hills GS, Goreway GS, has resulted in short circuit fault levels reaching the current skywire's carrying capability. The new OPGW skywire will have higher short circuit capability and will provide path diversity for the existing protection and control signals that currently use the OPGW skywire installed on the tower line span carrying circuits R19TH and R21TH.

Bundling the OPGW skywire replacement with the RTR Project reconductoring work is economically more efficient than if Hydro One were to perform the scopes of work separately. The combined scope will also minimize outages to these critically important

Bulk Electric System (“BES”) classified transmission circuits, on which it has been historically difficult to obtain outages.

Figure 1, below, shows the geographic location of the RTR Project and the FETT Interface boundaries.



Figure 1: Map of the Richview TS by Trafalgar TS Reconductoring Project Area

- 1 **Figure 2**, below, schematically identifies the spans of circuit that will be reconductored.
- 2 Also identified are the locations of the connecting transmission stations and junctions
- 3 between Richview TS and Trafalgar TS. Circuit sections highlighted in red on **Figure 2**
- 4 indicate circuits that will be reconductored during the RTR Project.

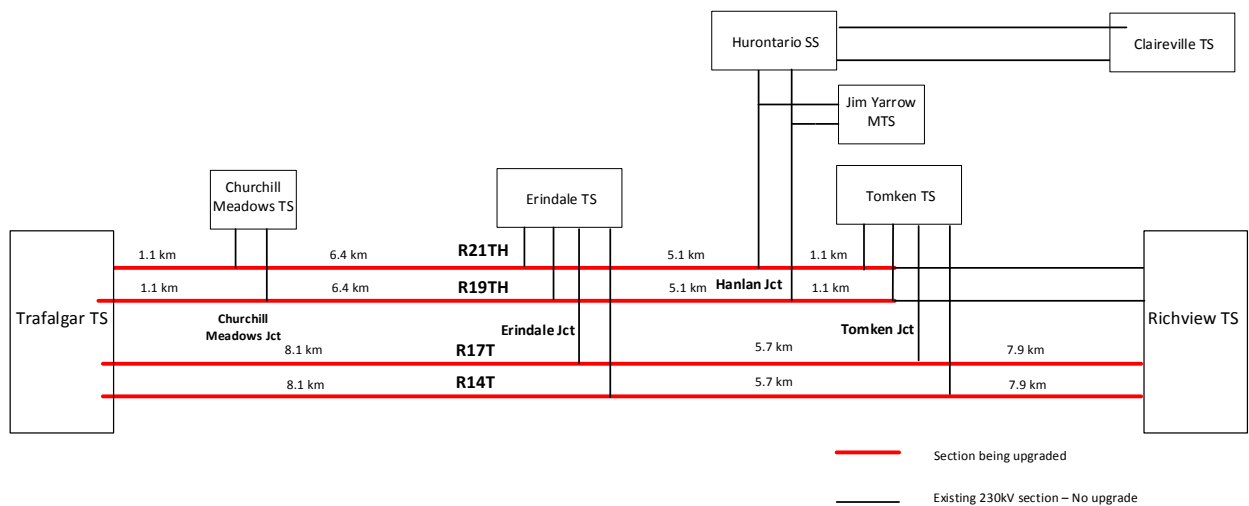


Figure 2: Single Line Diagram – 230 kV Transmission Corridor between Richview TS and Trafalgar TS.

EVIDENCE IN SUPPORT OF NEED

On December 10, 2020, the IESO provided a letter (the “**Letter**”) to Hydro One, requesting Hydro One to proceed with reconductoring the Richview TS by Trafalgar TS 230 kV transmission circuits R14T, R17T, R19TH and R21TH with 1433 kcmil aluminium conductor steel-supported (“ACSS”) conductor aimed to address an emerging supply capacity need from the decline in generation in eastern Ontario. The Letter confirms the need for the RTR Project, stating;

“Supply capacity in eastern Ontario is expected to decline over the next decade, which contributes to a provincial need for capacity and, because of limits on the transfer capability of the FETT interface, ~4,000 MW of that capacity will have to be sited east of the FETT interface by 2026. To reduce the amount of capacity that must be sited in eastern Ontario, the IESO is recommending this Project, which is expected to be completed by 2026 and will increase the transfer capability of the interface by ~2,000 MW. This Project would reduce the risk to reliability in having to acquire a large amount of capacity in eastern Ontario and would enable more resources to compete to meet provincial needs.”

The Letter confirms that the RTR Project will facilitate increased transfers from western Ontario supply resources thereby increasing the efficiency and effectivity of the Ontario grid. The IESO’s Letter provides specific direction regarding the RTR Project scope to Hydro One:

“The IESO is recommending Hydro One to proceed with conductor upgrades of the Richview TS x Trafalgar TS 230 kV transmission lines with 1433 kcmil ACSS conductor (the “Project”).”

and additionally,

“It was concluded that the use of 1433 kcmil ACSS would provide the required planning summer long term emergency (LTE) rating of 2000 A.”

1 Further information regarding the need for the Project is provided in the Letter, which is
2 filed at **Exhibit B, Tab 3, Schedule 1 Attachment 1.**

3
4 Filed at **Exhibit B, Tab 3, Schedule 1 Attachment 2** is a cost estimate that Hydro One
5 provided to the IESO in September 2020, regarding the reconductoring of specific
6 sections of four 230 kV circuits between Richview TS and Trafalgar TS, later to be known
7 as the RTR Project. This cost estimate informed the decision and direction that the IESO
8 provided to Hydro One in its Letter.

9
10 Additionally, the IESO have provided Hydro One with the Report, *'Trafalgar TS x*
11 *Richview TS 230 kV Line Upgrade: Need and Selection of the Preferred Plan'*, dated June
12 12, 2021, that further outlines the IESO's position regarding the need and subsequent
13 direction provided to Hydro One in its Letter. This report is also considered part of the
14 Need Evidence, all of which clearly identifies the Project's need, its scope, and the date
15 by which it should be completed and placed in-serviced. The IESO's report, as described
16 above, is filed at **Exhibit B, Tab 3, Schedule 1, Attachment 3.**

17
18 Accordingly, Hydro One is seeking approval from the OEB to undertake this
19 reconductoring project that will result in increased power flow requirements on R14T,
20 R17T, R19TH and R21TH 230 kV transmission circuits. The proposed RTR Project will
21 provide the necessary IESO-identified electricity capacity and reliability needs and will
22 facilitate additional system flows, including those from western Ontario generation.
23 Qualitative benefits of the recommended alternative are discussed in **Exhibit B, Tab 6,**
24 **Schedule 1.**



Independent Electricity System Operator
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t 416.967.7474
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December 10, 2020

Mr. Robert Reinmuller
Director, Transmission Planning
Hydro One Inc.
483 Bay St., 13th Floor, North Tower
Toronto, Ontario M5G 2P5

Dear Robert,

**Re: Flow East Towards Toronto (FETT) Interface:
Recommendation to Proceed with Conductor Upgrades on the Trafalgar TS x Richview TS 230
kV Lines**

With the letter dated June 18, 2019, the IESO requested Hydro One to carry out studies to confirm the feasibility of, and provide cost estimates for, various upgrade options for the Richview TS x Trafalgar TS 230 kV transmission lines (attached). Thank you for confirming the feasibility of upgrading the line and providing the high quality cost estimates and the project schedule in the memorandum dated September 9, 2020 (attached).

The IESO is recommending Hydro One to proceed with conductor upgrades of the Richview TS x Trafalgar TS 230 kV transmission lines with 1433 kcmil ACSS conductor (the "Project").

Need

FETT is a transmission interface that delivers electricity from western to eastern part of Ontario and it consists of three paths: (a) four 500 kV circuits into Claireville TS from the west, (b) four 230 kV circuits between Trafalgar TS and Richview TS, and (c) two 230 kV circuits between Orangeville TS and Essa TS. Typically, the power transfers on this interface are in the west to east direction and are limited by summer ampacity ratings of the transmission circuits.

Supply capacity in eastern Ontario is expected to decline over the next decade, which contributes to a provincial need for capacity and, because of limits on the transfer capability of the FETT interface, ~4,000 MW of that capacity will have to be sited east of the FETT interface by 2026. To reduce the amount of capacity that must be sited in eastern Ontario, the IESO is recommending this Project, which is expected to be completed by 2026 and will increase the transfer capability of the interface by ~2,000 MW. This Project would reduce the risk to reliability in having to acquire a large amount of capacity in eastern Ontario and would enable more resources to compete to meet provincial needs.

Increasing the FETT Transfer Capability

The FETT transfer capability can vary depending on how the power flows are distributed among the three paths that make up the interface. Under the typical flow distribution, the capacity of the Trafalgar TS x Richview TS path limits the amount of power that can be transferred across the FETT interface. Therefore, increasing the ampacity of the 230 kV circuits (R14/17T and R19/21TH) on the two double circuit lines between Trafalgar TS and Richview TS (please refer to Figure 1) path would increase the FETT transfer capability. IESO has considered a number of potential options to increase the FETT transfer capability and has concluded that the line upgrade is the preferred option as a first stage to increase the FETT transfer capability.

Figure 1: Trafalgar TS x Richview TS 230 kV Transmission Circuits R14/17T and R19/21TH



Upgrading Trafalgar x Richview 230 kV Transmission Line (R14/17T and R19/21TH)

Working with Hydro One, the scope of the line upgrade work has been optimized as follows:

Table 1: Required Ampacity

Circuit	From	To	Distance [km]	Required Planning Summer LTE [A]
R14/17T	Richview TS	Tomken JCT	7.9	2000
R14/17T	Tomken JCT	Erindale JCT	5.7	2000
R14/17T	Erindale JCT	Trafalgar TS	8.1	2000
R19/21TH	Richview TS	Tomken JCT	8.0	An upgrade is not required
R19/21TH	Tomken JCT	Hanlan JCT	1.1	2000
R19/21TH	Hanlan JCT	Erindale JCT	5.1	2000
R19/21TH	Erindale JCT	Churchill Meadows JCT	6.4	2000
R19/21TH	Churchill Meadows JCT	Trafalgar TS	1.1	2000

It was concluded that the use of 1433 kcmil ACSS would provide the required planning summer long term emergency (LTE) rating of 2000 A.

Next Steps

The IESO will support Hydro One in obtaining Ontario Energy Board and Environmental Assessment approvals for this project, as required.

Kind regards,

Ahmed Maria,
Director, Transmission Planning,
Independent Electricity System Operator (IESO)

c.c. Bruno Jesus, Hydro One
Leonard Kula, IESO
Terry Young, IESO
Chuck Farmer, IESO
Christopher Reali, IESO
Jim Lee, IESO



483 Bay Street, Toronto, M5G 2P5

MEMORANDUM

September 9th 2020

Richview x Trafalgar 230kV Circuits – R14T/R17T, R19TH/R21TH Conductor Upgrade

Cost Estimate Summary

A INTRODUCTION

A.1 Background

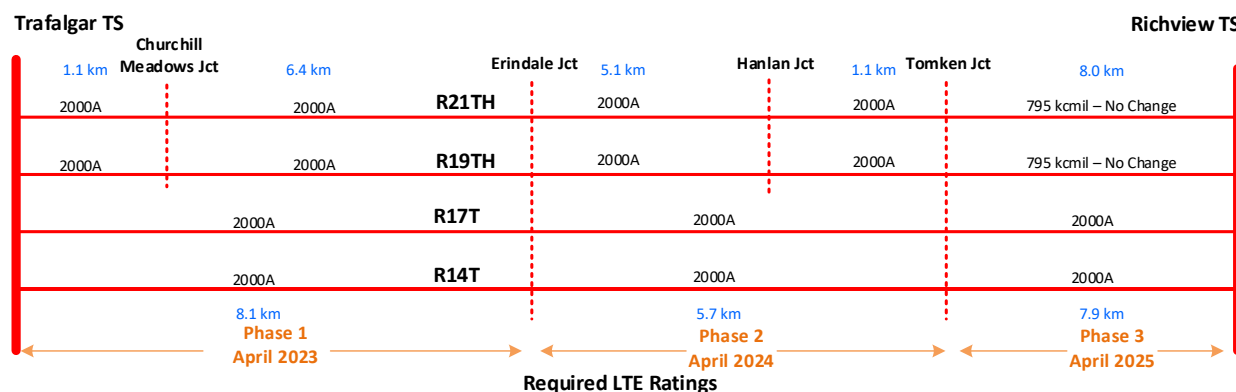
The IESO has indicated that there could be several changes to the generation availability in the area east of the FETT (Flow East Towards Toronto) interface. Two Pickering A units would be retired, Darlington units would be under refurbishment process and the current Lennox GS contract would have expired by then. Continuation of Lennox GS operation is a possibility, but it is uncertain. There will likely be a need to improve the FETT interface capability for 2023 summer.

The IESO requested Hydro One to provide a cost estimate for upgrading the R14T/R17T, and R19TH/R21TH circuits to a larger conductor.

A.2 Purpose

A.2.1 Conductor Upgrade

The scope of work is to upgrade the following sections of R14T/17T and R19TH/21TH circuits:



Phase	Circuits	From	To	Existing Conductor Size	Existing LTE Rating 127 ^{oc}	Required LTE Rating (min)	Length (km)	In Service Date
1	R19TH / R21TH R14T / R17T	Trafalgar TS	Erindale Jct	1307.4 kcmil	1460 A	2000 A	7.5 & 8.1	April 2023
2	R19TH / R21TH R14T / R17T	Erindale Jct	Tomken Jct	795 kcmil	1090 A	2000 A	6.2 & 5.7	April 2024
3	R14T / R17T	Tomken Jct	Richview TS	795 kcmil	1090 A	2000 A	7.9	April 2025

Upgrade line sections that currently have a 795 kcmil ACSR conductor or 1307 kcmil ACSR to a minimum 2000A conductor (1433kcmil ACSS).

B SCHEDULE

Decision (IESO/H1) to Proceed with Project	October 1st 2020
Partial Release of Funds – Kick off Project	October 21 st 2020
Detail Engineering to produce RFC all 3 phases	October 2020 – June 2021
Section 92	October 2020 – June 2021
Full Project Release – Business Case Approval	May 2021
Procurement	April 2021 – March 2022
Permits - NAV Canada, MTO, Train Tracks, Parks and City Approvals	June 2021 – December 2021
Lines Civil & Electrical - Phase 1	March 2022 – April 2023
Lines Civil & Electrical - Phase 2	October 2022 – April 2024
Lines Civil & Electrical - Phase 3	October 2023 – April 2025

C COST

The estimated cost to have all 3 phases completed by April 2025 is \$47.7M (30%/-20%).

Prepared by:

Gene Ng, P.Eng
Sr. Network Management Engineer
Transmission Planning
Transmission System Development Division

Farooq Qureshy, P.Eng
Manager - Transmission Planning
Transmission Planning
Transmission System Development Division

Trafalgar TS x Richview TS 230 kV line upgrade: Need and Selection of the Preferred Plan

July 12, 2021

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1. Flow East Towards Toronto (FETT) Interface

The Flow East Towards Toronto (FETT) interface is a transmission interface that delivers power from western Ontario to central and eastern Ontario. It consists of three paths:

- Four 500 kV circuits into Claireville TS from the west
- Four 230 kV circuits between Trafalgar TS and Richview TS
- Two 230 kV circuits between Orangeville TS and Essa TS

Over the next few years, supply capacity east of the FETT interface is expected to decline due to nuclear retirements and nuclear refurbishments, and could potentially decline towards the end of this decade due to contracts for generation facilities reaching the end of their terms.

This decline in supply contributes to an overall provincial need for capacity (see the 2020 Annual Planning Outlook), where due to limitations on the transfer capability of the FETT interface 1850 MW to 2250 MW of that capacity must be acquired east of the interface by 2026. More specifically, with the decline in supply capacity east of the FETT interface, studies show that the transfer capability of the FETT interface will not be sufficient to meet NERC and NPCC reliability requirements by 2026 requiring, approximately 2,000 MW of supply to be specifically acquired east of FETT.

This reliability concern occurs during the summer peak demand periods, when the transmission line ratings are low and demands are high, both as result of high ambient temperatures. At summer peak, the demand east of FETT is about 65% of the total Ontario demand. Under these conditions, the 230 kV Trafalgar TS x Richview TS path reaches its capacity before the other two paths of the FETT interface, thus setting the transfer capability for the whole FETT interface.

As will be described further in this submission, given information available to the IESO, relying on successfully acquiring approximately 2,000 MW of capacity east of FETT by 2026 represents an unacceptable risk in IESO's ability to meet reliability standard requirements. Given the level of certainty in the ability to deploy a transmission enhancement to address the reliability need, and given the lead-time associated with transmission upgrades, the IESO finds it prudent to recommend that transmission enhancements to increase the FETT transfer capability are pursued at this time.

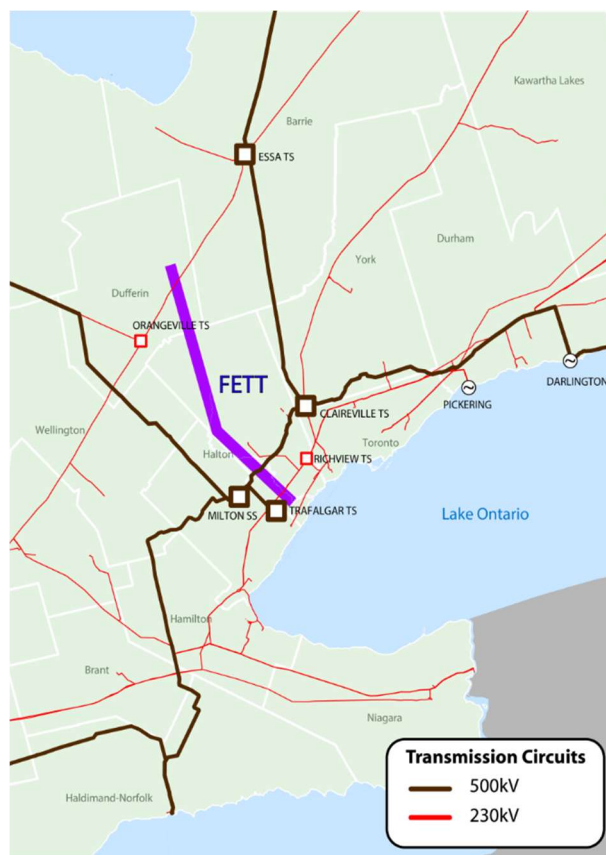


Figure 1: FETT Interface

In addition to addressing the reliability concern of acquiring that much generation east of the interface, an ancillary benefit (i.e. not the driving reason for enhancements) of increasing the transfer capability of the FETT interface is that it enables greater competition in meeting the provincial need for capacity by removing the restriction that 2,000 MW must be acquired east of FETT. Greater competition can lead to lower costs for Ontario rate payers.

2. Supply Reliability East of the FETT Interface

2.1 North American and Ontario Reliability Criteria

Reliability standards are specified continent-wide by the North American Electric Reliability Corporation (NERC), for the northeastern region of North America by the Northeast Power Coordination Council (NPCC), and for the IESO-controlled Grid (ICG) in Ontario by the IESO.

These standards encompass both resource adequacy and transmission security¹. Adequacy is the ability of the electric system to supply the aggregate electric power and energy requirements of the electricity consumers at all times, taking into account scheduled and reasonably expected unscheduled outages of system components. Security² is the ability of the electric system to withstand sudden disturbances such as electric short circuits or loss of system components.

The relevant reliability standard requirements for the planning timeframe are primarily outlined in NERC TPL-001 – Transmission System Planning Performance Requirements (“TPL-001”), NPCC Regional Reliability Directory #1 – Design and Operation of the Bulk Power System (“D1”), and IESO Ontario Resource and Transmission Assessment Criteria (“ORTAC”).

Resource Adequacy requirements are found in R4 of NPCC D1 and section 8 of ORTAC, and require the IESO to plan its resources such that there is not more than 1 day in 10 years of Loss of Load Expectation (“LOLE”). Assessments are probabilistic, modeling outage rates of generator and demand uncertainty. The transfer capabilities between zones are set at a fixed value that represents the level at which the system can withstand a single contingency with all transmission elements initially in-service.

Transmission security requirements are found in NERC TPL-001, R7-R10 of NPCC D1, and in all but section 8 of the ORTAC. Assessments are deterministic, based on the system’s ability to meet performance requirements for the specified disturbances, or “planning events”, defined in the standards, while considering scheduled outages and unscheduled outages of critical system elements.

2.2 Reliability East of the FETT Interface

Over the next few years, supply capacity east of the FETT interface is expected to decline due to nuclear retirements and nuclear refurbishments, and could potentially decline further towards the end of this decade due to contracts for generation facilities reaching the end of their terms.

¹ Definitions for adequacy and security can be found here, [North American Electric Reliability Corporation: Definition of “Adequacy Level of Reliability”](#)

² North American Electric Reliability Corporation (NERC) replaced the use of term “Security” in 2001 with “Operating Reliability”, but to not confuse the term with operational requirements, IESO continues to use the term security.

Given this reduction in supply east of the interface, studies indicate that starting in 2026 the transmission security and resource adequacy reliability criteria described in the previous section would not be met due to insufficient transfer capability across the FETT interface. The transmission security criteria was found to be more limiting and, hence, meeting those criteria, would also meet resource planning criteria. Therefore, the focus of this report will be on meeting transmission security criteria.

Table 1 shows the transfer capability of the FETT interface as determined in accordance with the transmissions security standards outlined previously. Table 2 shows by how much the forecasted demand east of FETT exceed the sum of the dependable resources east of FETT plus the transfer capability of the FETT interface. The two load forecast scenarios described in the 2020 Annual Planning Outlook were used in this need assessment.

The results of the assessment show an emerging need for supply capacity east of the FETT interface in the summer of 2023 when the Lennox GS contract expires in 2022 and further significant needs starting in 2026 after Pickering GS retires. Generating stations located east of FETT with expiring contracts around 2030 further adds to this need (Portland GS, Goreway GS, Halton Hills GS and York Energy Centre GS).

Table 1 | FETT Transfer Capability (2020 Annual Planning Outlook)

Scenario	Capability (MW)	Limiting Phenomenon	Limiting Contingency	Limiting Element	Note
All-In-Service	4,250 - 5,200	Thermal	Hurontario L21L30 (L19L29)	R19TH (R21H)	Summer capability; dependent on generation pattern
M570V initially Out-of-Service	2580 - 3350	Thermal	B560V + M571V	R21TH / R19TH	

Table 2 | Capacity needs east of FETT to meet transmission security

Demand Forecast	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Scenario 1	450	700	1550	4250	3550	3650	4400	5500	5200	5300	5350	5600
Scenario 2	0	0	950	3800	3000	3250	4000	5000	4650	4700	4750	4950

The IESO will be negotiating an extension of the Lennox GS contract as a transition measure to reduce this need. The capacity of Lennox GS is 2,000 MW and, as such, this need would be addressed until 2026 and the need for capacity east of FETT in 2026 would reduce to 2,250 MW under Scenario 1 and 1,800 MW under Scenario 2.

The next section describes the options available to meet this need.

3. Alternative Solution Options Considered

As mentioned in the previous section, to meet reliability criteria, 1850 MW to 2250 MW of supply is required to maintain security east of the FETT interface by 2026.

As indicated in the 2020 Annual Planning Outlook, in addition to this specific need for capacity east of the FETT interface, there is an overall need for capacity in Ontario due to increasing demand for electricity and the retirement of Pickering GS combined with nuclear unit outages for refurbishment. For the year 2026, that amount was determined to be about 5,200 MW after re-acquiring Lennox GS and 3,400 MW assuming all other resources with expiring contracts in the province are re-acquired.

To address the limitations of the FETT interface and the resulting supply concern east of the interface, some of the supply that is needed provincially, could be acquired east of the interface. This supply could be provided by:

1. Additional conservation programs targeted to areas east of FETT, beyond those already accounted for in IESO's demand forecasts
2. New domestic supply resources needed for the province in the areas east of FETT
3. Imports

After considering these supply options, as will be described in more detail below, relying on acquiring 1850 MW to 2250 MW of capacity east of the FETT interface by 2026 to meet reliability standards is an unacceptable reliability risk.

3.1 Additional Conservation Programs

The demand forecast used in the determination of the supply need in Table 2 contains the effect of codes and standards, previous conservation program savings, committed conservation programs under the 2021-2024 Conservation and Demand Management Framework and the continuation of such programs beyond 2024. There is potential for additional conservation programs, over and above those already considered, to help meet the supply need east of FETT.

A study carried out in 2019 looked at the achievable conservation potential for Ontario. Based on that study, it can be concluded that additional conservation programs alone would not meet the capacity needs east of FETT which is in the 2,000 MW range by 2026. The study indicates a possibility of obtaining about 200 MW of additional savings by 2026, which are cost effective based on their contributions to meeting the system's capacity and energy needs. Analysis of additional potential for conservation savings beyond that level has not been explored at this time.

3.2 New Supply Resources and/or Imports East of FETT

When acquiring new supply to meet the provincial need for capacity, it may be possible to run the capacity auction and resource procurements with a requirement to locate approximately 2,000 MW

east of the FETT interface by 2026. The IESO is aware of some interest in developing new supply east of the interface and imports from Quebec and New York could provide some of that supply; however, the amount we're aware of isn't enough to meet the approximately 2,000 MW need and/or it is unclear whether or not it can be developed/acquired by 2026. Hence, there is significant uncertainty and risk in being able to obtain a sufficient amount of new supply resources east of FETT by 2026. As IESO develops and executes its resource acquisition mechanisms, more information will become available on how to meet the need east of FETT beyond 2027. Depending on the outcomes of those future provincial resource acquisitions, additional incremental increase in FETT transfer capability may be recommended as a second stage.

3.3 Summary

Although a combination of the above options can be considered to meet the capacity need east of FETT there are significant risks and unknowns in being able to acquire 2,000 MW of supply capacity east of the interface by 2026:

- The conservation level assumed in the Scenario 1 and Scenario 2 in APO 2020 represents the committed or expected level of conservation savings. Additional conservation in the near term beyond what has been committed as part of the 2021-2024 CDM Framework is not significant compared to the magnitude of the need.
- There are uncertainties on the capacity level that can be obtained east of FETT through the targeted capacity auction process and other resource acquisition mechanisms under development.

Not being successful in acquiring the needed resources east of the interface would result in the IESO-controlled grid being non-compliant with NERC and NPCC reliability standard requirements.

Hence, the IESO is recommending enhancing the FETT transfer capability. Enhancing the transfer capability of the interface, would lessen the restriction that 2,000 MW of the new supply resources needed in Ontario be acquired specifically east of the FETT interface by 2026 and provide flexibility to acquire these resources west of the FETT interface. As an ancillary benefit, greater flexibility in where supply resources are located is expected to provide greater competition amongst those supply resources and ultimately lead to ratepayer savings.

As will be described in the next section, there are low cost options for enhancing the transfer capability on this interface that could be implemented by 2026.

4. Improving FETT Interface Transfer Capability

Several transmission alternatives were considered that can provide increases in the FETT capacity. Those options were narrowed down to two options that meet the following two criteria:

- Can be in-service before the summer 2026.
- Provide an increase in transfer capability of at least 2,250 MW in 2026 assuming all transmission elements in service.

4.1 Description of Transmission Alternatives

The following are the alternatives that meet the above screening criteria.

Alternative 1: Upgrade Trafalgar TS x Richview TS 230 kV lines

This will increase the ability of Trafalgar TS x Richview TS path (230 kV circuits: R14/17T and R19/21TH) to accommodate higher transfers thereby increasing the overall FETT transfer capability. This involves replacing conductors on the existing two double circuit 230 kV lines with compact high-temperature conductors.

At the development phase of the project, numerous conductors were considered for upgrading the Trafalgar TS x Richview TS lines. It was concluded that the use of 1433 kcmil ACSS would provide the required planning summer long term emergency (LTE) rating of 2000 A. It is a high-temperature compact conductor that allows the required rating without involving significant tower modifications. The existing line includes 795 kcmil ACSR and 1307 kcmil ACSR conductors. The reduction in the resistance, hence reduction in line losses, will be about 44% for the sections with 795 kcmil ACSR and about 8% for the sections with 1307 kcmil ACSR.

Further details of the project are included in the IESO letter to Hydro One dated December 18, 2020.

Alternative 2: Build a new double-circuit 230 kV line connecting Trafalgar TS and Oakville TS with new switching facilities at Trafalgar TS

This would provide another transmission path into the area east of FETT from the west and reduce the transfers on the critical Trafalgar TS x Richview TS circuits. There is an idle corridor with no transmission assets between Trafalgar TS and Oakville TS. The line involved would be about 8 km in distance, but there would be a significant cost associated with adding switching facilities at Trafalgar TS which is a gas-insulated station.

Development work for this option has not been carried out due to the high cost. Since the corridor designation is dated, a new approval under the Environmental Approval process is expected.

4.2 Comparison of Transmission Alternatives

4.2.1 Reliability Performance Comparison

The FETT transfer capability depends on generation dispatch and, so, two scenarios are considered that reflect different availability of generating units at Bruce GS. Table 3 below shows a comparison of the two alternatives during the period after Pickering GS retires and two Bruce units are unavailable due to refurbishment work (mid-term), and after Bruce refurbishment outages are completed (long-term). The table provides a comparison under two system considerations:

1. With all transmission elements in-service
2. With a critical transmission element out-of-service

Both options meet the needs under both situations.

Both alternatives provide similar FETT capacity improvements in the mid-term but Alternative 1 provides better performance than Alternative 2 in the long-term for both all in-service and one element out-of-service conditions. Alternative 1 has overall better performance than Alternative 2.

Table 3 | Performance Comparison of Alternatives

Description of Option	Time period	Bruce GS units in-service	Pickering GS units in-service	All in-service (MW)	One element out-of-service (MW)	Increase in all in-service (MW)	Increase in element out-of-service (MW)
Existing System	Mid-term	6	0	4250	2600	0	0
	Long-term	8	0	5200	3350	0	0
Alternative 1: Upgrade Trafalgar TS x Richview TS 230 kV line	Mid-term	6	0	6950	4600	2700	2000
	Long-term	8	0	7350	4900	2150	1550
Alternative 2: Connecting Trafalgar TS and Oakville TS with new 230 kV line (8 km) with new switching facilities at Trafalgar TS	Mid-term	6	0	6900	4700	2650	2100
	Long-term	8	0	6900	4600	1700	1250

4.2.1 Economic Performance Comparison

At the time the IESO recommended Hydro One to proceed with Alternative 1 in the IESO letter to Hydro One dated December 18, 2020, the cost estimate for Alternative 1 was \$48M. Subsequently, Hydro One has indicated the cost estimate now stands at \$61M after further reviews. The estimated cost for Alternative 2 is \$88 M, but it provides the added benefit of meeting the need for additional supply capacity to the Richview South area of Toronto (i.e., the area supplied by the Richview TS x Manby TS corridor). Thus, Alternative 2 would displace the need for transmission enhancements that increase the supply to Richview South area of Toronto, providing a benefit of about \$23M. Even with

this credit and now with the higher cost of Alternative 1, the cost of Alternative 2 is still expected to be higher than Alternative 1.

Therefore, overall Alternative 1 is preferred over Alternative 2 from a cost perspective.

4.2.2 Environmental Consideration

Upgrading the existing line between Trafalgar TS and Richview TS (Alternative 1) and rebuilding an idle 115 kV line to a new 230 KV Richview TS x Manby TS line (Toronto IRRP plan) is expected to have less environmental disturbance than building a new line on an idle corridor that currently has no assets (Alternative 2).

It also conforms with Provincial Policy Statement, 2020.

1.6.3 Before consideration is given to developing new infrastructure and public service facilities:

- a) the use of existing infrastructure and public service facilities should be optimized; and*
- b) opportunities for adaptive re-use should be considered, wherever feasible.*

4.3 Preferred Transmission Plan

In summary, Alternative 1 is the preferred plan for the following reasons compared to Alternative 2:

1. Cost advantage
2. Performance advantage
3. Lower environmental impact and conforms with Provincial Policy Statement, 2020
4. Lower implementation risk (i.e., if Alternative 2 is selected, there would be a higher risk of potential delay in obtaining EA approvals and not meeting the required summer 2026 in-service date)

5. Conclusion

The transmission project to upgrade the capacity of Trafalgar TS x Richview TS 230 kV lines is recommended as the preferred plan to meet the transmission security needs east of the FETT interface for the following reasons:

- It would provide the best path in meeting the capacity need east of the FETT interface where there is a significant risk of not being able to acquire sufficient new resources east of FETT to meet the need. The increase in FETT capability provided by the line upgrade would sufficiently increase the ability of resources west of FETT to contribute towards meeting the capacity need east of FETT.
- It can be implemented before summer 2026 when the need is expected to emerge.
- It is the most cost effective transmission alternative with least environmental impact and conforms with Provincial Policy Statement, 2020.
- It provides sufficient increase in FETT capability to meet both transmission security need and the resource adequacy need east of FETT.

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PROJECT CLASSIFICATION AND CATEGORIZATION

Project Classification

Per the Board's filing guidelines, rate regulated projects are classified into three groups based on their purpose.

- Development projects are those which:
 - (i) provide an adequate supply capacity and/or maintain an acceptable or prescribed level of customer or system reliability for load growth or for meeting increased stresses on the system; or
 - (ii) enhance system efficiency such as minimizing congestion on the transmission system and reducing system losses.
- Connection projects are those which provide connection of a load or generation customer or group of customers to the transmission system.
- Sustainment projects are those which maintain the performance of the transmission network at its current standard or replace end-of-life facilities on a "like for like" basis.

Based on the above criteria, the Project is a development project to help increase supply capacity from western Ontario towards the east, including towards the GTA.

Project Categorization

The Board's filing guidelines require that projects be categorized to distinguish between a project that is a "must-do", which is beyond the control of the applicant ("non-discretionary"), from a project that is at the discretion of the applicant ("discretionary").

Non-discretionary projects may be triggered or determined by such things as:

- a) mandatory requirement to satisfy obligations specified by regulatory organizations including NPCC/NERC or by the Independent Electricity System Operator (IESO);
- b) a need to connect new load (of a distributor or large user) or new generation connection;
- c) a need to address equipment loading or voltage/short circuit stresses when their rated capacities are exceeded;
- d) projects identified in a provincial government approved plan;
- e) projects that are required to achieve provincial government objectives that are prescribed in governmental directives or regulations; and
- f) a need to comply with direction from the Ontario Energy Board if it is determined that the transmission system's reliability is at risk.

Based upon the above criteria, the Project is considered non-discretionary. The Project is being undertaken at the request of the IESO. It will increase power transfer capability from western Ontario towards the east, including into the GTA, across the FETT interface, and it will support the transmission system during periods of high output from generation sources in western Ontario.

Categorization and Classification

		Project Need	
		Non-discretionary	Discretionary
Project Class	Development	X	

1 **COST BENEFIT ANALYSIS AND OPTIONS**

2
3 **TRANSMISSION ALTERNATIVES**

4 There are no practical alternatives to the scope of work for which Hydro One is seeking
5 the Board's approval. The Hand-off Letter provided to Hydro One by the IESO, included
6 in the Need Evidence per **Exhibit B, Tab 3, Schedule 1**, is very specific, and, as such, no
7 other alternatives were considered.

QUANTITATIVE BENEFITS OF THE PROJECT

The RTR Project encompasses the following quantitative benefit:

Increase Thermal Rating of ~36 km of double circuit line

This investment will increase the thermal limits of the 230 kV circuits R14T and R17T, between Trafalgar TS and Richview TS, and the 230 kV circuits R19TH and R21TH between Trafalgar TS and Tomken JCT, to provide a minimum summer continuous rating of 2000A. This is consistent with the IESO's request¹.

QUALITATIVE BENEFITS OF THE PROJECT

The RTR Project encompasses the following qualitative benefits that cannot be specifically quantified:

Avoiding Future Refurbishment and Maintenance Activities

Some transmission circuit refurbishment work such as protection coating on the tower lines between Richview TS and Trafalgar TS was planned for 2021. Hydro One will now use this opportunity to perform the work during the Project's construction schedule to maximize the use of the crews on site. Regular maintenance and brush clearing along the Richview to Trafalgar right-of-way route was also scheduled for 2024 but will now be scheduled to occur during the RTR Project's execution phase to take advantage of the circuit outage opportunities.

¹ Exhibit B, Tab 3, Schedule 1, Attachment 1 and Attachment 3.

APPORTIONING PROJECT COSTS & RISKS

The estimated capital cost of the RTR Project, including overheads and capitalized interest, is shown below:

Table 1 - Project Cost

	Estimated Cost (\$000's)
Materials	13,616
Labour	17,014
Equipment Rental & Contractor Costs	13,865
Sundry	1,921
Contingencies	2,710
OverHead ¹	4,617
Capitalized Interest ²	2,331
Real Estate ³	184
TOTAL PROJECT WORK	\$ 56,258

The cost of the work provided above allows for the schedule of approval, design and construction activities provided in **Exhibit B, Tab 11, Schedule 1**.

1.0 RISKS AND CONTINGENCIES

As with most projects, there are risks associated with estimating costs. Hydro One's cost estimate includes an allowance for contingencies, in recognition of these risks.

¹ Overhead Costs allocated to the project are for corporate services costs. These costs are charged to capital projects through a standard overhead capitalization rate. As such they are considered "Indirect Overheads".

² Capitalized Interest is calculated using the Board's approved interest rate methodology (EB-2016-0160) to the Project's forecast monthly cash flow and carrying forward closing balances from the preceding month.

³ Real Estate costs for the RTR Project is to acquire crossing permits to string conductors over railways, roads and waterways, as appropriate.

1 The top Project risks, outlined below, are the major contributors to the total
2 contingency suggested for this Project.

- 3 • **Outage constraints** – There circuits deliver electricity from western Ontario
4 towards the GTA. There is a risk of obtaining outages on these critical Bulk
5 Energy System circuits to complete the project work. This may result in schedule
6 delays and increase in project costs if timely outages cannot be obtained. Other
7 on-going work in 2022 at Trafalgar TS and Claireville TS that is not related to the
8 RTR Project scope may impact outage availability for the Project.
- 9 • **Permit and approval requirements** – the RTR Project requires a substantial
10 number of permits and approvals, including those from oil pipeline owners,
11 Navigation Canada, Ministry of Transportation, railway companies, the City of
12 Toronto. Environmental Screen Out/Class EA is also required from the Ministry
13 of Environment, Conservation and Parks. There is a risk that an approval may not
14 be granted in a timely manner, which may result in schedule delays and
15 additional costs.
- 16 • **Material delivery timelines** - The conductors and hardware required for the
17 project have lead times of up to one year. There is a risk that vendors may not
18 meet material requirement dates, which would result in schedule delays and
19 standby costs.
- 20 • **Subsurface conditions** – the geotechnical investigations have not yet been
21 completed for this Project. Poor soil conditions could increase the extent of the
22 foundation reinforcement required for the existing towers, as well as the
23 requirements for the foundation design of the six new towers, all of which would
24 result in additional costs to the Project.

25
26 Cost contingencies that have not been included, due to the unlikelihood or uncertainty
27 of occurrence, include:

- 28 • Labour disputes;
- 29 • Safety and environmental incidents;

- Significant changes in costs of materials since the estimate preparation; and
- Any other unforeseen and potentially significant event/occurrence.

2.0 COSTS OF COMPARABLE PROJECTS

The OEB Filing Requirements for Electricity Transmission and Distribution Applications, Chapter 4, requires the Applicant to provide information about a cost comparable project constructed by the Applicant.

The Project consists of reconductoring four circuits: two 230 kV circuits, known as R14T and R17T, from Trafalgar TS to Richview TS, and two circuits, known as R19TH and R21TH, from Trafalgar TS to Tomken JCT. Each replacement conductor on the four circuits will be 1433 kcmil ACSS/TW, with compact-type ACSS. The reconductoring will increase the conductor rating to a 2000 Ampacity Long Term Emergency (“LTE”) rating. Additionally, some structural tower modifications/reinforcement will be required to accommodate the increased loading conditions due to the larger conductor size. The existing skywire on the tower series that carry two circuits, R14T and R17T, will be replaced with OPGW from Trafalgar TS to Richview TS.

Project cost comparisons for the RTR Project line scope of work to other similar transmission line projects completed by Hydro One are provided below. Hydro One has provided three line comparison projects, one at 230 kV operating voltage, and two at 115 kV operating voltage. These are considered to be the most appropriate project scope comparators to the RTR Project proposed in this Application.

2.1 LINES PROJECTS

The three comparable line projects are: Circuits K1W, K3W, K11W and K12W of the West Toronto Transmission Enhancement (“WTTE”) Project; Circuits D6V and D7V Transmission Line Refurbishment (“D6V/D7V”) Project; and the Decew TS to Glendale TS Transmission Line Refurbishment (“DxS”) Project. The DxS Project involved the circuits

1 known as D9HS and D10HS. These three comparator projects involve reconductoring
2 existing 115 kV or 230 kV circuits. The WTTE and D6V/D7V Projects, both involved
3 capacity increases, whereas the DxS Project was a refurbishment project that involved
4 replacing existing end-of-life conductors with the same-sized conductor. As a result,
5 there was no increase in capacity on this DxS Project.

6
7 The RTR Project scope differs from the comparator reconductoring projects outlined in
8 this Application, as undertaken by Hydro One, due largely to the following two reasons:

- 9 • The scope of work on the RTR Project involves four 230 kV circuits carried on two
10 separate, and adjacent sets of towers, compared to the comparator projects
11 where reconductoring was carried out on only a single set of towers; and
- 12 • Tower reinforcement and some tower replacements are required for the RTR
13 Project such that the towers carrying the heavier conductors will meet Hydro
14 One's security class requirements, compared to the three comparator projects,
15 which did not require tower reinforcement.

16
17 The additional work scope for the RTR Project mentioned above, compared to the
18 comparative projects which did not contain those scope elements, contributes to a
19 comparatively higher complexity and higher cost per circuit km for the RTR Project.
20 These additional complexities require comparatively more planning, execution time and
21 resources to undertake. This is due primarily to the increased amount of 230 kV circuits
22 in proximity to each other and the dual sets of towers adjacent to each other, carrying
23 the four circuits. Additionally this requires comparatively more safety requirements
24 from the more complex scope of work, adding a level of cost above the comparator
25 projects that have a smaller, less complex scope of work. Apart from the dual tower
26 span with four circuits, these projects are nevertheless still an appropriate comparators,
27 due to the scopes similar to that of the RTR Project. As mentioned, a four-circuit
28 reconductoring project is unique, and as such the two-circuit project reconductoring
29 projects of the D6V/D7V and DxS projects are as similar in scope as Hydro One has

1 undertaken recently.

2

3 Hydro One has provided a side-by-side comparison of the projects described above to
4 the RTR Project in **Table 2**, below. Table 2 illustrates that the RTR Project cost per circuit
5 km is approximately \$0.8M per km, which is comparable, and slightly higher, to the
6 WTTE Project cost. Table 2 also indicates that the RTR Project's costs per km is expected
7 to be slightly higher compared to the D6V/D7V Project and the DxS Project on a per km
8 basis, however this is a result of the increased cost drivers on the RTR Project, as
9 outlined above.

Table 2 - Costs of Comparable Line Projects

Project	RTR Project	WTTE Project	D6V/D7V Project	DxS Project
Scope	Reconductor four 230 kV lines	Reconductor four 115 kV lines	Reconductor two 230 kV lines	Reconductor two 115 kV lines
Length (km)	21.7	10.0	9.4	9.0
Circuit Length (km) ⁴	70.8 ⁵	40.0	18.8	18.0
Project Surroundings	Urban	Urban	Mostly Rural	Mostly Urban
In-Service Date	Apr-2026	Nov-18	Dec-20	Dec-15
Years for escalation	-	7 yrs, 5 months	5 yrs, 4 months	10 yrs, 4 months
Total Project Cost (\$M)⁶	56.3	21.4	8.6	6.3
Less: By-Pass (\$M)	0.4	-	-	0.2
Less: OPGW Costs (\$M) ⁷	1.2	0.3	0.3	0.8
Total Project Costs Before Escalation (\$M)	54.7	21.1	8.3	5.3
Add: Escalation Adjustment (2%/year)	-	3.3	0.9	1.2
Total Comparable Project Costs (\$M)	54.7	24.5	9.2	6.6
Total Cost/Circuit km (\$M)	0.8	0.6	0.5	0.4

⁴ Circuit km length is the sum of the length of all circuits in the project.

⁵ The circuit length for the RTR Project is calculated by adding: the two circuits R14T and R17T of 21.7 km each, and, the two circuits R19TH and R21TH of 13.7 km each, for a total length of 70.8 km.

⁶ The RTR Project costs provided are forecasts. The D6V/D7V, WTTE and DxS project costs represent actual costs.

⁷ Installing OPGW costs are higher than the non-OPGW skywire alternative. The construction methodology and skywire material alternative has a cost impact. For the RTR Project, the replacement of strain plates on dead-end towers and reinforcement of tower peaks as well as splicing of the towers also impacts costs.

1 A description of each comparable project is provided below, with commentary
2 highlighting any applicable similarities and/or differences to the RTR Project which drive
3 costs for each.

4
5 a) The WTTE Project includes reconductoring of four 115 kV circuits (K1W, K3W,
6 K11W and K12W), approximately 10 km long, between Manby TS and Wiltshire
7 TS. K1W/k3W and K11W/K12W are each strung on a 2-Circuit 115 kV tower,
8 spanning from Manby TS to tower structure 'Structure 4'. From the "Structure 4"
9 tower to Wiltshire TS, the four circuits are then strung on a four-Circuit 115 kV
10 Kipling St. Clair Type towers, with the exception being a small line section
11 spanning between Runnymede TS and St. Clair JCT, (between Structures 34 and
12 35) which consists of two wood pole structures. The wood poles were replaced
13 as part of a prior project with two 'G4L' design type steel towers. The WTTE
14 Project went in-service in November 2018. Both the RTR Project and WTTE
15 Project are situated in almost identical urban locations west of Toronto. Both
16 projects involve multiple road crossings and involve increasing the rating of the
17 existing circuits. The total costs per circuit km are relatively similar for both
18 projects, with the RTR being slightly higher due to the differences between the
19 two projects. The similarities and differences between the two projects are
20 described below.

21
22 The WTTE line reconductor project was part of a larger overall project that
23 included an expansion to the 115/27.6 kV Runnymede TS work that consisted of
24 two new 50/83 MVA transformers. The scope of the RTR Project includes only
25 line upgrade, with no station upgrade work. Both projects include upgrades to
26 the existing shieldwire and replacement of existing insulators and associated
27 hardware. The projects were also very similar in scope and included structural
28 reinforcement and replacement of existing steel towers. The RTR Project
29 requires 230 kV hardware, e.g. larger structural reinforcements, insulators and

1 connectors, given the RTR Project is designed to be operated at a higher voltage
2 class than the 115 kV WTTE Project.

3
4 The WTTE Project also carries the four circuits for the majority of the distance
5 between the two terminal stations by the same tower span. The RTR Project
6 circuits R14T/R17T and R19TH/R21TH are instead carried on two separate spans
7 of towers for the entire route, adding to construction costs, as there is more
8 scope associated with tower reinforcement work, access roads and craning
9 requirements. By reconductoring only one circuit at a time, there are also
10 comparatively increased time and resources for the efforts of setup and
11 mobilization. Work teams complete one tower span and then return to the
12 starting point each time to begin the reconductoring of the next span. Thus the
13 mobilization and demobilization for each tower span adds more time and cost.

14
15 b) The D6V/D7V Project consists of refurbishing approximately 9.4km of double
16 circuit 230 kV line between Guelph North JCT and Fergus JCT. The D6V/D7V
17 Project is located mostly in a rural geographical area and was placed in service in
18 December 2020.

19
20 Scope differences between the two projects that drive cost differences are the
21 fact that the span length of the RTR Project is more than double the D6V/D7V
22 Project, and the scope of the RTR Project includes four circuits compared to the
23 D6V/D7V Project's two circuits. The RTR Project will undertake 70.8 km of circuit
24 reconductoring versus the D6V/D7V Project's shorter 18.8 km length. Although a
25 longer line enables the project fixed costs to be spread out on a cost per km
26 basis, the RTR Project's increased scope of work complexity requires a longer
27 overall construction schedule, which drives increased project cost, including
28 higher interest cost.

1 Additionally, the D6V/D7V Project is located primarily in a rural area with
2 minimal road crossings, compared to the highly urbanized RTR Project setting,
3 with multiple road, provincial highway, waterways, railways and pipeline
4 crossings which drive additional project cost. Both circuits D6V and D7V are
5 carried on a single set of towers with no other circuits on that tower, effectively
6 reducing the level of complexity of this undertaking when compared to the RTR
7 Project, which has two adjacent tower spans. No structural reinforcement of the
8 tower or tower replacements were required for the D6V/D7V Project, and all of
9 the foregoing result in comparatively lower project costs and a shorter
10 construction schedule.

- 11
- 12 c) The DxS Project was a like-for-like (end-of-life) conductor replacement for a
13 distance of approximately 9km for two 115 kV circuits, namely D9HS and D10S.
14 Both circuits are carried on the same tower span, and the project was completed
15 in December 2015. Both the RTR and DxS Projects are situated in urban
16 locations, but they vary in length, with the RTR Project measuring approximately
17 double the length of the DxS Project. A longer line enables the project fixed costs
18 to be spread out on a cost per km basis.

19

20 The DxS project involved reconductoring circuits on the same single span of
21 towers, resulting in a shorter overall construction schedule compared to that of
22 the RTR Project scope of work (the RTR Project consists of two adjacent, but
23 separate, tower spans). For the RTR Project, there are comparatively longer
24 construction time and higher cost resulting from the proximity of the
25 towers/circuits. Additionally, considering the criticality of these circuits to the
26 Bulk Energy System, no two circuits can be taken out of service at any one time;
27 and as such the sequential nature of the work results in a longer project
28 construction schedule (this is true for not only the DxS project but also the other
29 comparator projects selected in this exhibit). Furthermore, additional

1 precautions, safety measures and equipment are required to work on the RTR
2 Project, which consists of a 230 kV circuit instead of 115 kV for the DxS project.

3

4 In comparison to all the projects used for comparative purposes, the RTR Project
5 requires tower modifications to accommodate the new heavier conductor. This
6 is expected to include tower reinforcement, including localized steel member
7 replacement and foundational upgrades for increased loading conditions.
8 Additionally, six towers along the route have been identified as needing full
9 replacement. The tower reinforcement and replacement scope of work result in
10 an overall higher cost, on a per km basis, for the RTR Project, when compared to
11 the three comparative projects, on a per circuit km basis.

CONNECTION PROJECTS REQUIRING NETWORK REINFORCEMENT

This is not a connection project. Network facilities being upgraded as a result of this Project are limited to those discussed in the details of the work being undertaken. See **Exhibit C, Tab 1, Schedule 1.**

TRANSMISSION RATE IMPACT

1.0 ECONOMIC FEASIBILITY

The RTR Project costs will be included in the network connection pool for cost classification purposes and not allocated to any individual customer. See **Exhibit B, Tab 1, Schedule 1**, for information on the proposed work. No customer contribution is required for this project.

Once the Project is in service, there will be no incremental operating and maintenance costs since activities such as vegetation management and inspection would not be materially impacted by the change in the increased conductor size on the existing four 230 kV circuits. The RTR Project will also have no impact on provincial peak load, resulting in zero incremental network revenue over the 25-year evaluation period.

A 25-year discounted cash flow analysis of the network pool work was conducted. The results show that based on the estimated initial cost of \$60.9¹ million, plus the assumed impact on the future capital cost allowance and Hydro One corporate income tax, this capacity enhancement project will have a negative net present value of \$52.7 million as shown in Table 1. This amount will be fully recovered via the network pool rates.

2.0 COST RESPONSIBILITY

Network Pool

The RTR Project will address an emerging supply capacity need from the decline in generation in eastern Ontario². The Hydro One R14T, R17T, R19TH, and R21TH circuits

¹ Initial costs of \$60.9 million include \$56.3 million of up front capital costs plus \$4.6 million cost of removals.

² Exhibit B, Tab 3, Schedule 1

are 230 kV network transmission lines in the GTA; and at completion of the RTR Project, these lines will facilitate the above described IESO-identified need.

This network pooled Project is not tied to any specific load increase or customer load application but is intended to accommodate increased system flows on the four 230 kV circuits. As such, the proposed circuit upgrades are included in the network pool, and no customer capital contribution is required, consistent with the provisions of Section 6.3.5 of the Transmission System Code.

3.0 RATE IMPACT ASSESSMENT

The analysis of the network pool rate impacts has been carried out on the basis of Hydro One's transmission revenue requirement for the year 2020, and the 2020 approved Ontario Transmission Rate Schedules. The network pool revenue requirements would be affected by the line upgrade based on the project cost allocation.

The 2020 OEB-approved rates have been used to measure the Project's customer impacts on rates. 2020 rates were used because, unlike 2021 OEB-approved rates, they do not include any foregone revenue that Hydro One is currently recovering in the 2021 rates.

Network Pool

Based on the total Project's initial cost of \$60.9 million and the associated network pool incremental cash flows, there will be a change in the network pool revenue requirement once the project's impacts are reflected in the transmission rate base at the projected in-service date of April 1, 2026. Over a 25-year time horizon, this change in the network pool revenue requirement has a 0.51% incremental impact, increasing the 2020 OEB approved rate of \$3.92 kW/month to \$3.94 kW/month. If the 2021 OEB approved rates were used, there would be a 0.41% incremental impact, increasing the 2021 OEB approved rate of \$4.90 kW/month to \$4.92 kW/month. The maximum revenue shortfall

related to the proposed facilities will be \$4.2 million in the year 2034. The detailed analysis illustrating the calculation of the incremental network revenue shortfall and rate impact is provided in Table 3 and 4 below.

Impact on Typical Residential Customer

Based on the load forecast, initial capital costs and ongoing maintenance costs, adding the costs of the replacement of the required facilities to the network pool will cause a \$0.03 per month increase in a typical residential customer's rates under the Regulated Price Plan ("RPP"). The table below shows this result for a typical residential customer who is under the RPP, utilizing the maximum impact by rate pool, regardless of year.

A. Typical monthly bill (Residential R1 at 700 kWh consumption per month)	\$148.68 per month
B. Transmission component of monthly bill	\$11.65 per month
C. Line Connection Pool share of Transmission component	\$1.61 per month
D. Transformation Connection Pool share of Transmission component	\$3.86 per month
E. Network Connection Pool share of Transmission component	\$6.19 per month
F. Impact on Network Connection Pool Provincial Uniform Rates	0.51%
G. Net impact on typical residential bill (E x F)	\$0.03 per month or \$0.38 per year
H. Net increase on typical residential customer bill (G / A)	0.02%

Note: If 2021 OEB approved rates were used, the net impact on the typical residential customer bill would be the same with an increase of \$0.03 per month or \$0.38 per year, resulting in 0.02% net increase.

1

Table 1 - Net Present Value, page 1

		In-Service		Project year ended - annualized from In-Service Date											
		Date	<-----	----->											
Month		Apr-1	Apr-1	Apr-1	Apr-1	Apr-1	Apr-1	Apr-1	Apr-1	Apr-1	Apr-1	Apr-1	Apr-1	Apr-1	
Year		2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	
		0	1	2	3	4	5	6	7	8	9	10	11	12	
Revenue & Expense Forecast															
Load Forecast (MW)			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Load adjustments (MW)			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Tariff Applied (\$/kW/Month)			3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	
Incremental Revenue - \$M			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Removal Costs - \$M		(4.6)													
On-going OM&A Costs - \$M		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Municipal Tax - \$M			(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	
Net Revenue/(Costs) before taxes - \$M		(4.6)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	
Income Taxes		1.2	0.6	1.2	1.1	1.0	0.9	0.9	0.8	0.7	0.7	0.6	0.6	0.5	
Operating Cash Flow (after taxes) - \$M		(3.4)	0.5	1.0	0.9	0.8	0.7	0.7	0.6	0.6	0.5	0.4	0.4	0.4	
Cumulative PV @ 5.31%															
PV Operating Cash Flow (after taxes) - \$M	(A)	3.2	(3.4)	0.4	0.9	0.8	0.7	0.6	0.5	0.4	0.4	0.3	0.3	0.2	
Capital Expenditures - \$M															
Upfront - capital cost before overheads & AFUDC		(49.3)													
- Overheads		(4.6)													
- AFUDC		(2.3)													
Total upfront capital expenditures		(56.3)													
On-going capital expenditures			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PV On-going capital expenditures		0.0													
Total capital expenditures - \$M		(56.3)													
Capital Expenditures - \$M															
PV CCA Residual Tax Shield - \$M		0.3													
PV Working Capital - \$M		0.0													
PV Capital (after taxes) - \$M	(B)	(55.9)	(55.9)												
Cumulative PV Cash Flow (after taxes) - \$M	(A) + (B)	(52.7)	(59.4)	(58.0)	(57.2)	(56.5)	(55.9)	(55.4)	(55.0)	(54.6)	(54.3)	(54.0)	(53.8)	(53.6)	

Discounted Cash Flow Summary			Other Assumptions		
Economic Study Horizon - Years:	25		In-Service Date:	01-Apr-26	
Discount Rate - %	5.31%		Payback Year:	2051	
	Before Cont		No. of years required for payback:	25	
	\$M				
PV Incremental Revenue	0.0				
PV OM&A Costs	(4.6)				
PV Municipal Tax	(2.7)				
PV Income Taxes	1.9				
PV CCA Tax Shield	8.9				
PV Capital - Upfront	(56.3)				
Add: PV Capital Contribution	0.0	(56.3)			
PV Capital - On-going	0.0				
PV Working Capital	0.0				
PV Surplus / (Shortfall)		(52.7)			
Profitability Index*	0.1				
Notes:					
*PV of total cash flow, excluding net capital expenditure & on-going capital & proceeds on disposal / PV of net capital expenditure & on-going capital & proceeds on disposal					

2

1

Table 2 - Net Present Value, page 2

Month Year	Project year ended - annualized from In-Service Date ----->												
	Apr-1 2039	Apr-1 2040	Apr-1 2041	Apr-1 2042	Apr-1 2043	Apr-1 2044	Apr-1 2045	Apr-1 2046	Apr-1 2047	Apr-1 2048	Apr-1 2049	Apr-1 2050	Apr-1 2051
	13	14	15	16	17	18	19	20	21	22	23	24	25
Revenue & Expense Forecast													
Load Forecast (MW)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Load adjustments (MW)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tariff Applied (\$/kW/Month)	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
Incremental Revenue - \$M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Removal Costs - \$M													
On-going OM&A Costs - \$M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Municipal Tax - \$M	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)
Net Revenue/(Costs) before taxes - \$M	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)
Income Taxes	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2
Operating Cash Flow (after taxes) - \$M	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.0
PV Operating Cash Flow (after taxes) - \$M (A)	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Capital Expenditures - \$M													
Upfront - capital cost before overheads & AFUDC													
- Overheads													
- AFUDC													
Total upfront capital expenditures													
On-going capital expenditures	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PV On-going capital expenditures													
Total capital expenditures - \$M													
Capital Expenditures - \$M													
PV CCA Residual Tax Shield - \$M													
PV Working Capital - \$M													
PV Capital (after taxes) - \$M (B)													
Cumulative PV Cash Flow (after taxes) - \$M (A) + (B)	(53.4)	(53.3)	(53.1)	(53.0)	(53.0)	(52.9)	(52.8)	(52.8)	(52.8)	(52.7)	(52.7)	(52.7)	(52.7)

2

1

2

3

1 **Table 4 - Revenue Requirement and Network Pool Rate Impact, page 2**

Revenue Requirement and Network Pool Rate Impact

<i>Richview TS by Trafalgar TS Reconductoring Project</i>		01-Apr 2039	01-Apr 2040	01-Apr 2041	01-Apr 2042	01-Apr 2043	01-Apr 2044	01-Apr 2045	01-Apr 2046	01-Apr 2047	01-Apr 2048	01-Apr 2049	01-Apr 2050	01-Apr 2051
<i>Calculation of Incremental Revenue Requirement (\$000)</i>		13	14	15	16	17	18	19	20	21	22	23	24	25
In-service date	01-Apr-26													
Capital Cost	56,258													
Less: Capital Contribution Required	-													
Net Project Capital Cost	56,258													
Average Rate Base		42,240	41,118	39,997	38,875	37,754	36,632	35,511	34,389	33,268	32,146	31,025	29,903	28,782
Incremental OM&A Costs		0	0	0	0	0	0	0	0	0	0	0	0	0
Grants in Lieu of Municipal tax		191	191	191	191	191	191	191	191	191	191	191	191	191
Depreciation		1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121
Interest and Return on Rate Base		2,531	2,464	2,397	2,330	2,263	2,195	2,128	2,061	1,994	1,927	1,859	1,792	1,725
Income Tax Provision		303	339	371	399	424	445	464	481	495	506	516	524	530
REVENUE REQUIREMENT PRE-TAX		4,147	4,115	4,080	4,041	3,999	3,953	3,905	3,854	3,801	3,745	3,688	3,628	3,567
Incremental Revenue		0	0	0	0	0	0	0	0	0	0	0	0	0
SUFFICIENCY/(DEFICIENCY)		-4,147	-4,115	-4,080	-4,041	-3,999	-3,953	-3,905	-3,854	-3,801	-3,745	-3,688	-3,628	-3,567
Network Pool Revenue Requirement including sufficiency/(deficiency)	Base Year 977,674	981,820	981,789	981,754	981,715	981,672	981,627	981,579	981,528	981,474	981,419	981,361	981,302	981,241
Network MW	249,176	249,176	249,176	249,176	249,176	249,176	249,176	249,176	249,176	249,176	249,176	249,176	249,176	249,176
Network Pool Rate (\$/kw/month)	3.92	3.94	3.94	3.94	3.94	3.94	3.94	3.94	3.94	3.94	3.94	3.94	3.94	3.94
Increase/(Decrease) in Network Pool Rate (\$/kw/month), relative to base year		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
RATE IMPACT relative to base year		0.51%	0.51%	0.51%	0.51%	0.51%	0.51%	0.51%	0.51%	0.51%	0.51%	0.51%	0.51%	0.51%

2

1

Table 5 - DCF Assumptions

**Hydro One Networks -- Transmission Connection Economic Evaluation Model
2020 Parameters and Assumptions**

Transmission rates are based on 2020 OEB-approved uniform provincial transmission rates.

Monthly Rate (\$ per kW)	
Network	3.92
Transformation	2.33
Line	0.97

Grants in lieu of Municipal tax (% of up-front capital expenditure, a proxy for property value):

0.34%

Based on Transmission system average

Income taxes:

Basic Federal Tax Rate -
% of taxable income:

2020	15.00%
------	--------

Current rate

Ontario corporation income tax -
% of taxable income:

2020	11.50%
------	--------

Current rate

Capital Cost Allowance Rate:

Class 47 costs

2020	8%
------	----

Current rate

After-tax Discount rate:

5.31%

Based on OEB-approved ROE of 8.52% on common equity and 2.75% on short-term debt, 4.42% forecast cost of long-term debt and 40/60 equity/debt split, and current enacted income tax rate of 26.5%

2

DEFERRAL ACCOUNT REQUESTS

1

2

3 There are no new deferral account requests being made as part of this Application.

1

PROJECT SCHEDULE

2

TASK	START	FINISH
Submit Section 92		July 16, 2021
Projected Section 92 Approval		January , 2022
LINES		
Detailed Engineering	March 2021	December 2021
Procurement	April 2021	September 2022
Receive Material	January 2022	April 2025
Construction	February 2022	March 2026
IN SERVICE		April, 2026

PHYSICAL DESIGN

1.0 LINE FACILITIES

The current 230 kV circuits, known as R14T, R17T, R19TH and R21TH, located on the same right-of-way between Trafalgar TS and Richview TS, measure a distance of approximately 21.7 km, and each currently consist of three phases of single conductor. The RTR Project will replace the single 230 kV conductor on each phase of each circuit with a single 230 kV conductor on each phase of the three-phase circuits. Each circuit will continue to operate at 230 kV. The R14T, R17T, R19TH and R21TH reconducted circuits will remain in their current location, with their current tower centre-line and tower heights as situated on the current right-of-way corridor that is not expected to change. The planned scope of work includes replacing six current towers with new towers along the existing right-of-way. In addition, some structural steel tower member reinforcement/replacement is required to enable the current towers to adequately meet the design standards (in regards to wind and ice load) to carry the new 230 kV conductors to be strung on circuits R14T, R17T, R19TH and R21TH. In all, six existing towers on the right-of-way require replacement, 43 tower structures will require foundation refurbishment, and 116 towers will require some type of supporting steel arm reinforcement/modification.

Towers carrying both circuits require reinforcement due to increased tower loads from the proposed larger conductors and increased design loads using modern Hydro One structure load criteria. Additionally, some towers along the path have corrosion and the Project Plan is to address this. Examples of the structural reinforcement drawings for these structures are attached to this Exhibit in **Attachment 1** through **Attachment 4**.

1 Proposed reinforcement of the *1940 Type Semi Anchor Structure* on the R14T and R17T
2 circuits is illustrated in **Attachment 1**¹. There are two *1940 Type Semi Anchor Towers* on
3 the R14T and R17T circuits which require reinforcement. Reinforcement is generally
4 limited to the tower arms, where the arm hangers and cross-braces require larger steel
5 members due to the proposed larger conductor.

6
7 **Attachment 2**² illustrates the typical reinforcement and modification of the cross-arms
8 of the *1940 Type Suspension Structures* on the R14T and R17T circuits. Reinforcement
9 includes replacing the cross-arm hangers and addition of Z-brace to the top face of the
10 middle-arms. The cross-bracing at the shieldwire peak requires reinforcement due to
11 the larger OPGW cable. In addition, there are seven *1940 Type Suspension Towers* that
12 require new middle-arms to accommodate moving the bottom phase up in order to
13 increase electrical clearances. A total of 65 suspension structures for R14T and R17T
14 circuits are proposed to be reinforced.

15
16 **Attachment 3**³ provides the reinforcement strategy for the *1948 Canadian Bridge Type*
17 *Semi-Anchor Structures* of the R19TH and R19TH circuits. There are a total of three *1948*
18 *Canadian Bridge Type Semi Anchor Towers* that require reinforcement. The tower arm-
19 hangers and cross-braces require larger steel members due to the proposed larger
20 conductor. Some diagonal members on the tower body of these structures will also
21 require larger steel member reinforcement.

22
23 In **Attachment 4**⁴, reinforcement of the *Revised 1940 Type Suspension Towers* for the
24 R19TH and R21TH circuits is shown. These towers are similar to the *1940 Type*
25 *Suspension Structures* but were redesigned in the past with a double-shieldwire peak.
26 Reinforcement includes replacing the cross-arm hangers, addition of Z-brace to the top

¹ The structure members that will be replaced are marked in red on the attachment drawings.

² Ebit.

³ Ebit.

⁴ Ebit.

face of the middle-arms, and replacing the knee-brace of the shieldwire peak. There are a total of 33 *Revised 1940 Type Suspension Towers* for circuits R19TH and R17TH and two *Revised 1940 Type Suspension Towers* for circuits R14T/R17T which will be modified.

Other tower types on the R14T/R17T and R19TH/R21TH tower lines that require reinforcement include.

- *X10S Suspension Structure* (2 structures) – requires Z-brace added to middle arm hangers
- *1940 Type Transposition Structure* (6 structures) – similar reinforcement as the *1940 Type Suspension structure*.
- *1951 Type Semi-Anchor Structure* (1 structure) – similar reinforcement as the *1948 Canadian Bridge Type Semi Anchor Tower*
- *X1M Type Semi-Anchor Structure* (1 structure) – similar reinforcement as the *1948 Canadian Bridge Type Semi Anchor Tower*

Figure A below illustrates the existing steel suspension towers on the current Right-of-way carrying the four 230 kV circuits, R14T, R17T, R19TH, and R21TH.

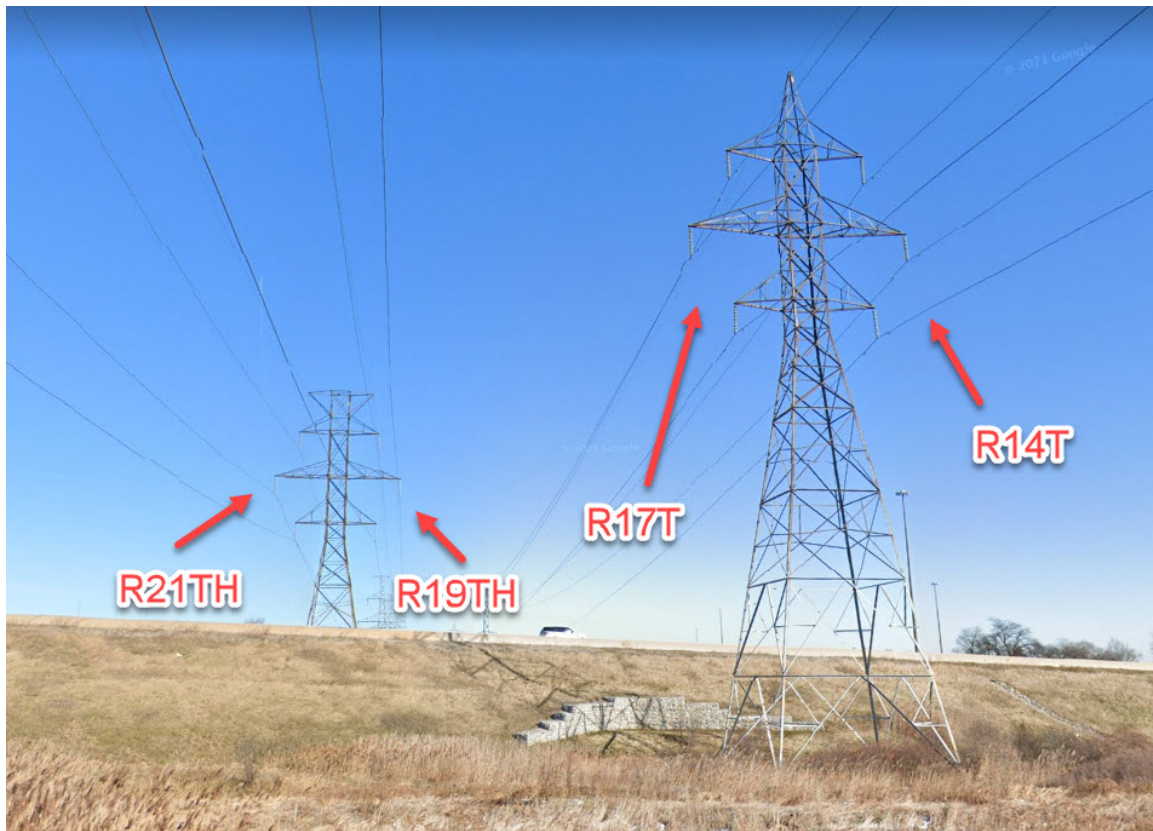


Figure A: Existing Tower and Circuit Facilities

(Photograph taken face east towards Toronto)

Figure A above illustrates the existing single-conductor circuits consisting of three phases (i.e. one conductor on each phase, and three conductors in total that constitute one 'circuit'). Additionally, Figure A shows two sets of adjacent parallel towers, with each tower carrying two circuits, situated on the same right-of-way. The RTR Project will replace conductor sections that currently have either 795 or 1307 kcmil ACSR conductor, with a 1433 kcmil ACSS conductor.

As mentioned, all four circuits' routes will continue to span along the current right-of-way, the width of which will not change. The locations of the currently situated towers carrying the four circuits will also not change as a result of this Project. Further details regarding land matters can be found at **Exhibit E, Tab 1, Schedule 1**.

Maps indicating the geographic location of both existing circuits' route are provided at **Exhibit C, Tab 2, Schedule 1, Attachment 1**. A schematic diagram of the proposed line facilities is provided in **Exhibit B, Tab 2, Schedule 1, Figure 1**.

2.0 STATION FACILITIES

In conjunction with the line facilities work described above, the RTR Project will also require the following minor station-related work:

- *Trafalgar TS*

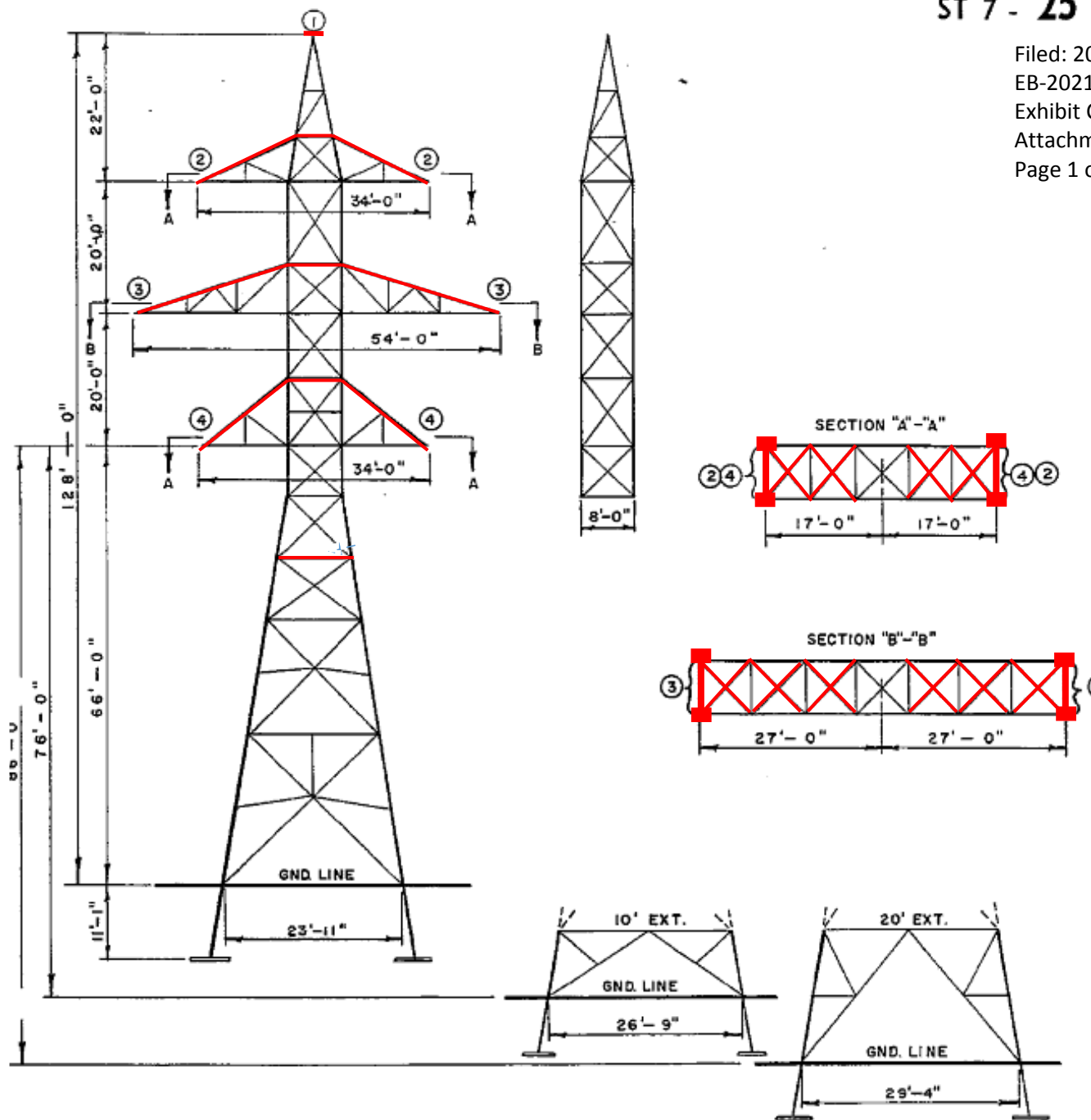
Project work at this station will consist of modifying the protection relays settings to accommodate for the circuit impedance. In addition, the OPGW skywire will be terminated at the station.

- *Richview TS*

Project work at this station will consist of modifying the protection relays settings to accommodate for the circuit impedance. In addition, the OPGW skywire will be terminated at the station.

ST 7 - 25

Filed: 2021-07-16
EB-2021-0136
Exhibit C-1-1
Attachment 1
Page 1 of 1



230 kv
DOUBLE CIRCUIT
1940 TYPE
SEMI-ANCHOR TOWER

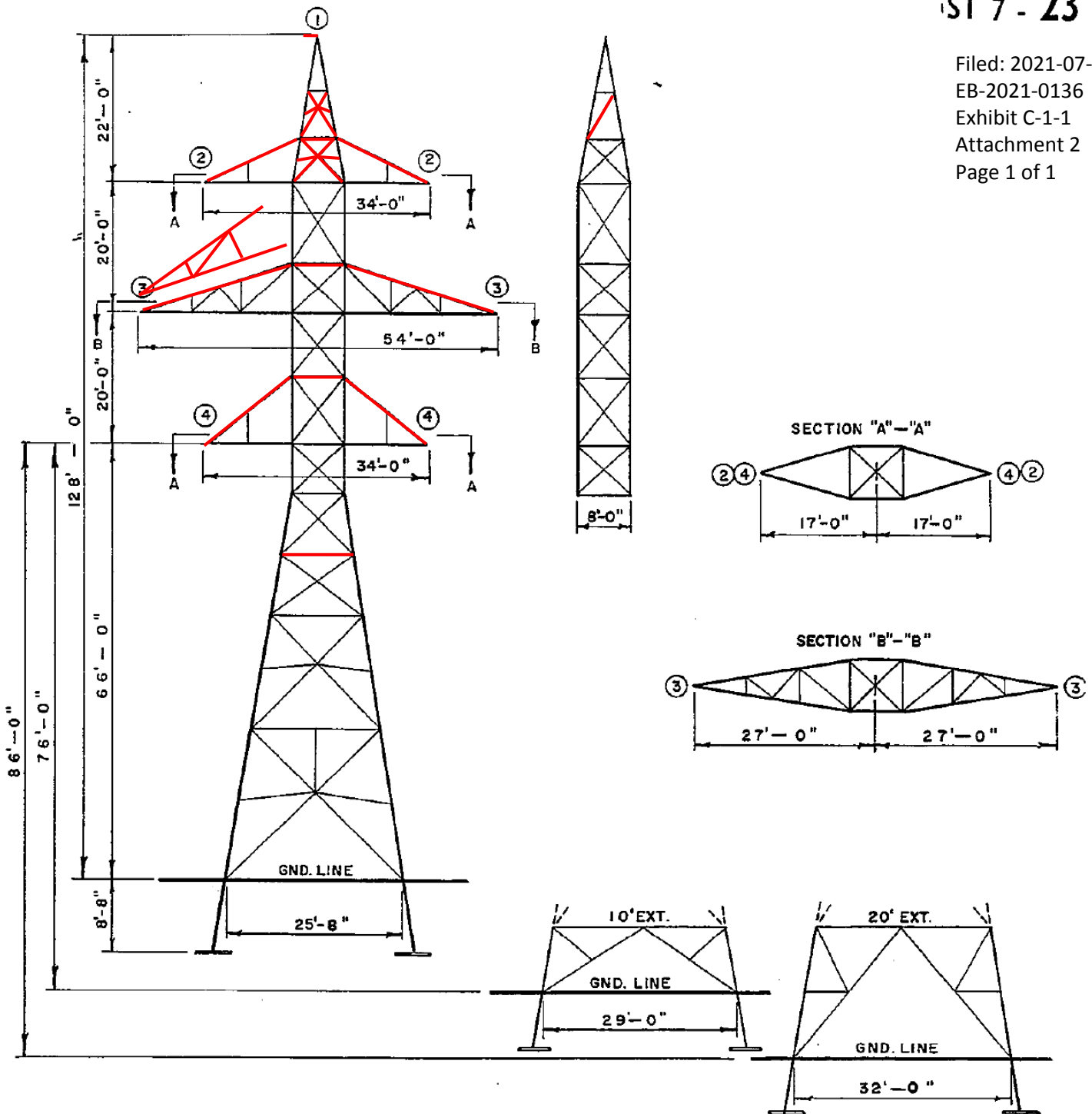
Attachment 1 - EXHIBIT C, TAB 1, SCHEDULE 1

Richview x Trafalgar Reconductoring Project

Structure Reinforcement
Circuit R14T/R17T

ST 7 - 23

Filed: 2021-07-16
EB-2021-0136
Exhibit C-1-1
Attachment 2
Page 1 of 1

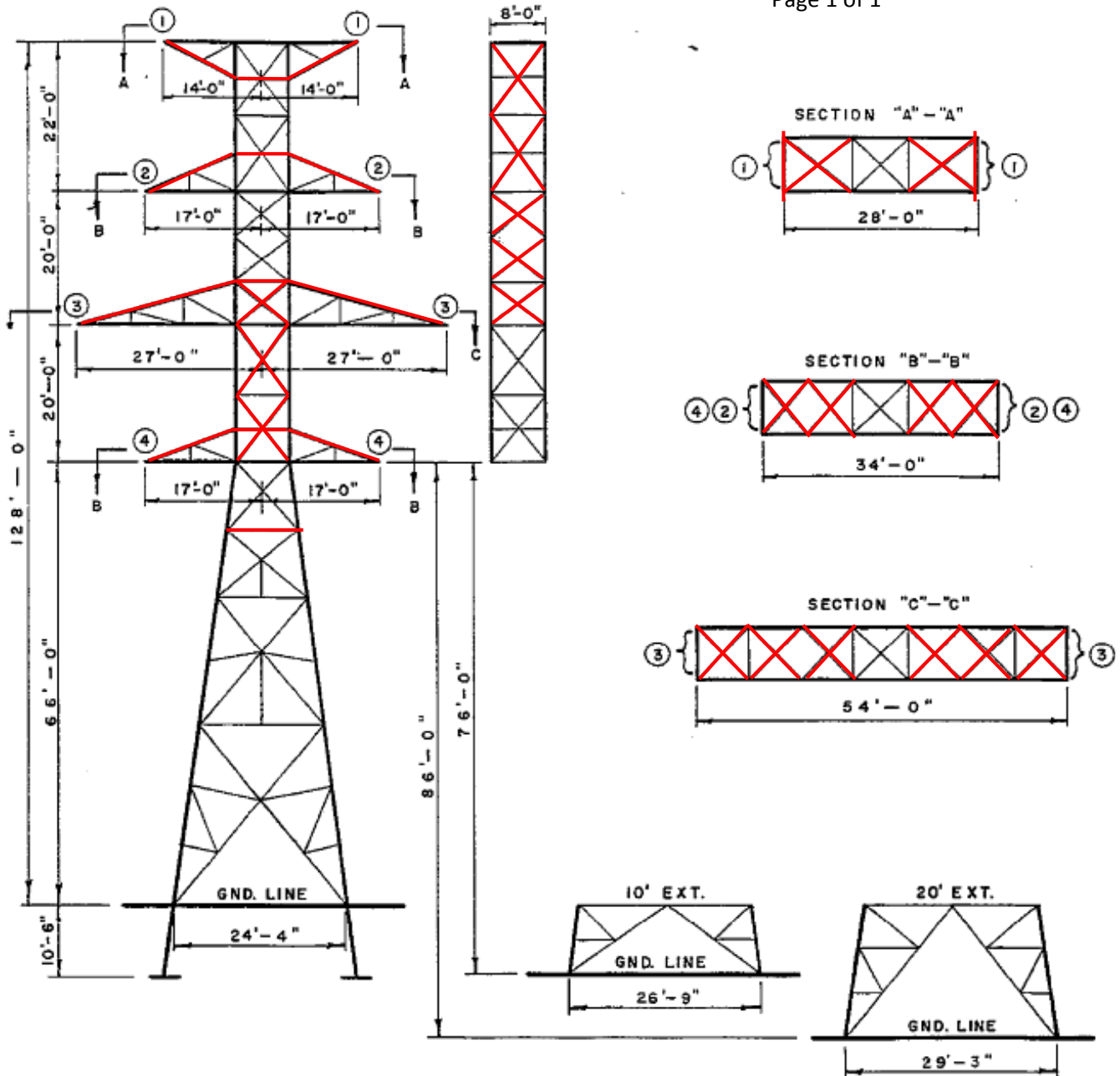


230 kv
DOUBLE CIRCUIT
1940 TYPE
SUSPENSION TOWER

Attachment 2 - EXHIBIT C, TAB 1, SCHEDULE 1

Richview x Trafalgar Reconductoring Project

Structure Reinforcement
Circuit R14T/R17T



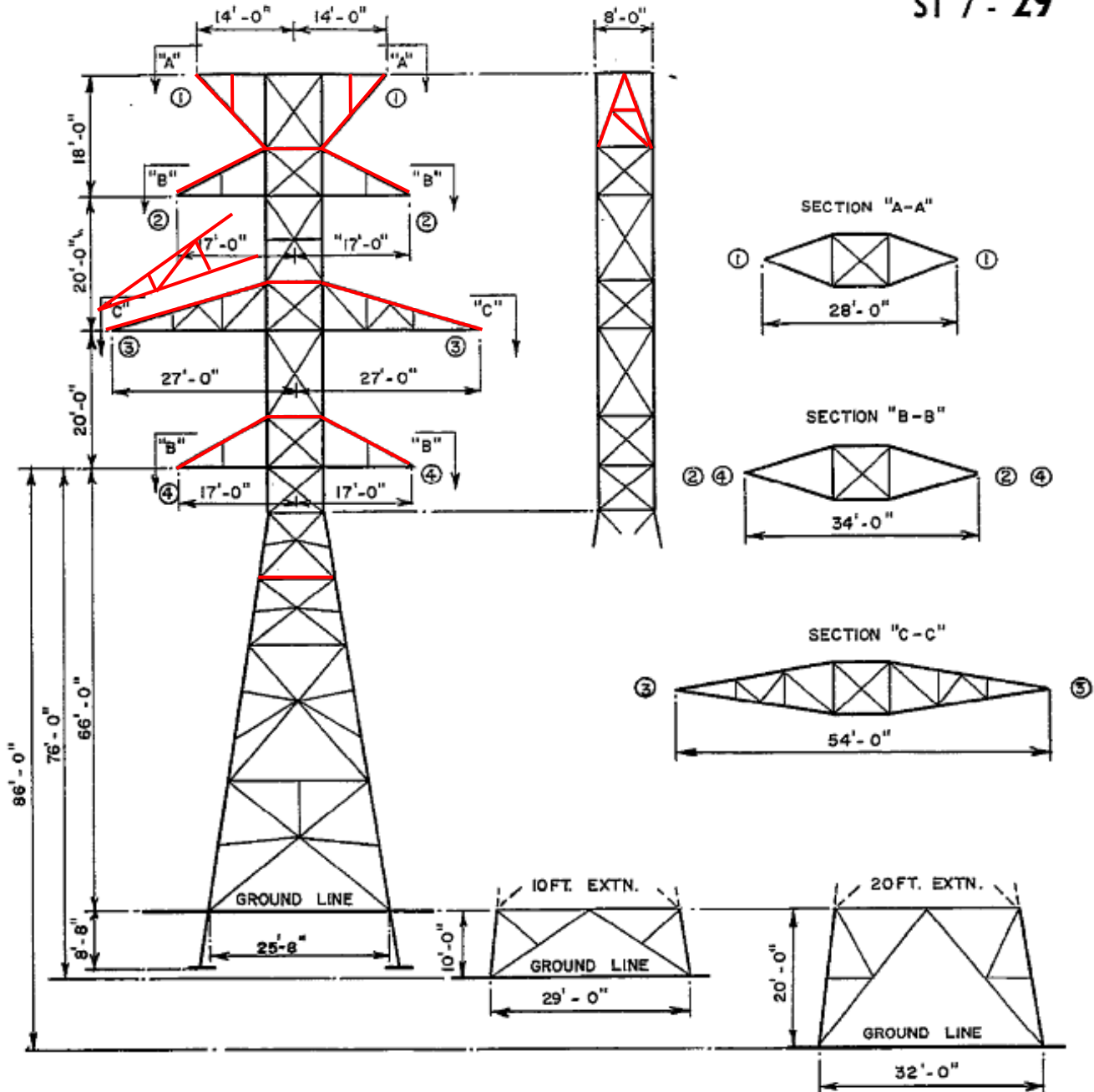
230 kv
DOUBLE CIRCUIT
1948 C.B. TYPE
SEMI-ANCHOR TOWER

Attachment 3 - EXHIBIT C, TAB 1, SCHEDULE 1

Richview x Trafalgar Reconductoring Project

Structure Reinforcement
 Circuit R19TH/R21TH

ST 7 - 29



230 kv
DOUBLE CIRCUIT
REVISED 1940 TYPE
SUSPENSION TOWER

Attachment 4 - EXHIBIT C, TAB 1, SCHEDULE 1

Richview x Trafalgar Reconductoring Project

Structure Reinforcement
Circuit R19TH/R21TH

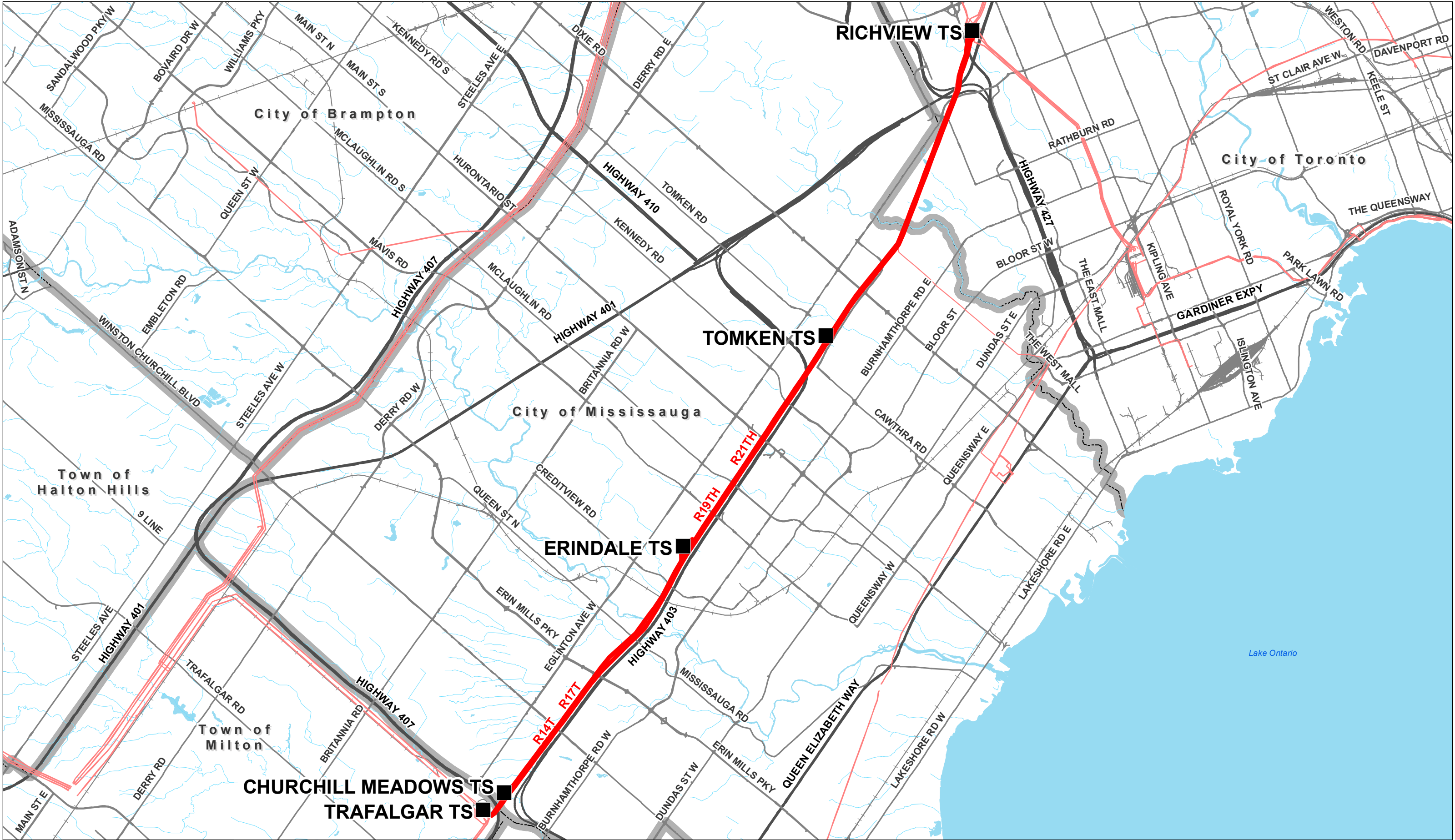
MAPS

A map showing the geographic location of the RTR Project is provided at **Exhibit C, Tab 2, Schedule 1, Attachment 1**. This map is for the OEB to use as the Project's Notice Map.

An illustrative aerial view map showing more detail of the footprint for the Project's line and station work is provided at **Exhibit E, Tab 1, Schedule 1, Attachment 1**.

Further details on land matters for this Project are available at **Exhibit E, Tab 1, Schedule 1**.

Map of Geographic Location – Notice Map



OPERATIONAL DETAILS

The RTR Project includes the replacement of the current conductors on circuits R14T, R17T, R19TH and R21TH. As discussed, each circuit currently consists of one conductor per phase (known as single phase), and each circuit has three phases, for a total of three conductors for each circuit. The RTR Project will replace all conductors on the four prior mentioned circuits along the Trafalgar TS to Richview TS route. Additionally, the RTR Project will replace the skywire atop the tower span carrying circuits R14T and R17T with OPGW between Trafalgar TS to Richview TS.

The four 230 kV circuits are located on towers situated on the same right-of-way, consisting of two adjacent sets of tower spans, each tower carrying two circuits. One tower span carries the R14T and R17T 230 kV circuits, and the second tower span carries the R19TH and R21TH 230 kV circuits.

No portion of any circuit on either of the two tower spans will be relocated or reconfigured, and as such, there will be no change to the operation of the circuits. The R14T, R17T, R19TH and R21TH circuits will continue to be operated at 230 kV. The existing stations in the Project vicinity, Churchill Meadows TS, Erindale TS and Tomken TS, will continue to be supplied by the same RTR Project circuits. The terminal stations connecting the circuits along the span of line being reconductored will also remain the same, those being Trafalgar TS and Richview TS.

After project completion, Hydro One Protection, Control and Telecom ("PC&T") facilities at Trafalgar TS and Richview TS will continue to protect the reconductored circuits by detecting faults and isolating faulted elements. Line protection for circuits R14T, R17T, R19TH and R21TH will be modified and coordinated for operation with the new conductor (for the reduction of the impedance of each circuit). Operation of the

1 proposed facilities will continue to be in accordance with the procedures administered
2 by Hydro One's Ontario Grid Control Centre ("OGCC") and the IESO.

3
4 Hydro One PC&T facilities will continue to protect all elements in those stations and
5 protect the 230 kV transmission lines by detecting faults and isolating faulted elements.
6 Operation of the proposed facilities will continue to be in accordance with the
7 procedures of the OGCC and the IESO.

8
9 This section of the transmission system is part of the eastern Ontario Bulk Electric
10 System and is a critical circuit section of the electrical system that allows management
11 of easterly flows towards the GTA.

LAND MATTERS

1.0 DESCRIPTION OF LAND RIGHTS

The proposed line upgrade of the R19TH and R21TH circuits from Richview TS x Trafalgar TS and R14T and R17T circuits from Tomken Jct x Trafalgar TS will be completed within the existing transmission right-of-way ("ROW"). The existing ROW can be broken into five sections:

1. Richview TS x Tomken Jct,
2. Tomken Jct x Hanlan Jct,
3. Hanlan Jct x Erindale Jct,
4. Erindale Jct x Churchill Meadows Jct, and
5. Churchill Meadows Jct x Trafalgar TS.

For each of the sections identified above, there is variation in width and there is also variation in the number of additional transmission lines that are also situated on each ROW section identified. All five ROW sections identified carry at least one additional circuit's towers on that ROW.

A detailed description of each of the individual five ROW sections, including the circuits and towers each ROW accommodates in addition to the RTR Project's circuits, is outlined below:

1. Richview TS x Tomken Jct – This ROW section accommodates the R19TH and R21TH circuits and the tower span carrying them, the R14T and the R17T circuits and the tower span carrying them. The ROW carries the R24C circuit and the tower span carrying that circuit. The corridor width is approximately 105m and comprises Bill 58 lands and an MTO crossing of the Highway 401/427 junction.
2. Tomken Jct x Hanlan Jct – This ROW section accommodates the R19TH and R21TH circuits and the tower span carrying them and also the R14T and the R17T

1 circuits and the tower span carrying them. The corridor width is approximately
2 81m and comprises Bill 58 lands and an MTO crossing of Highway 403.

3 3. Hanlan Jct x Erindale Jct - This ROW section accommodates the R19TH and
4 R21TH circuits and the tower span carrying them, and also the R14T and the
5 R17T circuits and the tower span carrying them. The corridor width varies from
6 approximately 81m up to a width of 100m wide east of Hurontario Street, and a
7 width of approximately 90m approaching Erindale Jct. This section of the ROW
8 comprises predominantly Bill 58 lands. In addition, there is an easement over the
9 City of Mississauga's property within this section measuring approximately 405m
10 long.

11 4. Erindale Jct x Churchill Meadows Jct – This ROW section accommodates the
12 R19TH and R21TH circuits and the tower span carrying them, and also the R14T
13 and the R17T circuits and the tower span carrying them. The corridor width
14 varies from approximately 81m to 125m and comprises Bill 58 lands.

15 5. Churchill Meadows Jct x Trafalgar TS – This ROW section accommodates the
16 R19TH and R21TH circuits and the tower span carrying them, and also the R14T
17 and the R17T circuits and the tower span carrying them. The corridor width is
18 approximately 81m and is comprises Bill 58 lands with a crossing of the MTO
19 Highway 403/407 junction.

20

21 The RTR Project will rely on the existing ROW's that are expected to accommodate the
22 occupation rights required for the Project. Renewal of MTO crossing permits may be
23 required for the 400 series Highway crossings, Highway 407/403 junction between
24 Trafalgar TS x Churchill Meadows Jct, Highway 403 at Tomken Jct x Hanlan Jct, and
25 Highway 427/401 junction outside Richview TS. Hydro One will coordinate all necessary
26 permits with the MTO.

27

28 Temporary land rights may be required for the Project at specific locations along the
29 circuits' existing ROW. It is expected that construction of the Project will not require

1 extensive temporary land rights, given the ability to utilize the already existing ROW and
2 Hydro One-owned land surrounding the stations along the route. Any temporary land
3 rights required have not yet been identified but will be determined in advance of the
4 Project's construction start date. Hydro One will undertake their acquisition at the
5 appropriate time. Temporary land rights required may include, but are not limited to,
6 temporary access roads, temporary laydown areas and material storage areas.

8 **2.0 DESCRIPTION OF NEW LAND RIGHTS REQUIRED**

9 Hydro One will rely predominantly on statutory easement rights it enjoys on
10 Infrastructure Ontario Bill 58 lands and one City of Mississauga property to construct,
11 operate and maintain the proposed reconducted circuit transmission facilities. It is
12 not expected that additional land rights will be required for this Project.

14 **3.0 EARLY ACCESS TO LAND**

15 Hydro One will be relying on existing land rights to conduct various activities and studies
16 associated with required environment approvals, engineering and design for this
17 Project. Hydro One does not expect to require any early access agreements and does
18 not anticipate the need to apply to the Board under section 98 of the *Ontario Energy*
19 *Board Act, 1998* for early access in advance of leave to construct approval.

21 **4.0 LAND ACQUISITION PROCESS**

22 No new land rights are expected to be required for this Project. In the event any
23 additional rights requirements are identified, Hydro One will follow its typical land
24 acquisition process in a manner similar to that which has been employed in the recent
25 past, which allowed Hydro One to acquire the necessary land rights from the property
26 owner in a mutually agreeable and timely manner.

Acquisition of Land Rights on Public Roads and Highways

As required, Hydro One intends to locate on public roads and highways. Given its legislated occupation rights under section 41 of the *Electricity Act, 1998*, Hydro One does not require consent of the owner or any other person having an interest in public streets or highways to locate its proposed project corridor ROW. Hydro One will, however, engage with representatives from the appropriate municipalities having jurisdiction over these public roads and highways to ensure compliance with section 41(9) of the *Electricity Act, 1998*. If necessary, Hydro One will obtain the requisite encroachment and occupancy permits within roadways under the jurisdiction of the MTO.

5.0 LAND-RELATED FORMS

Attachments 2 and 3 to this Exhibit contain the agreements that Hydro One intends to use to obtain land rights for the Project, should they be required. Listed below are the Hydro One form agreements included in the Application and a statement that indicates whether the individual form agreements have been previously approved by the Board in prior Hydro One leave to construct applications.

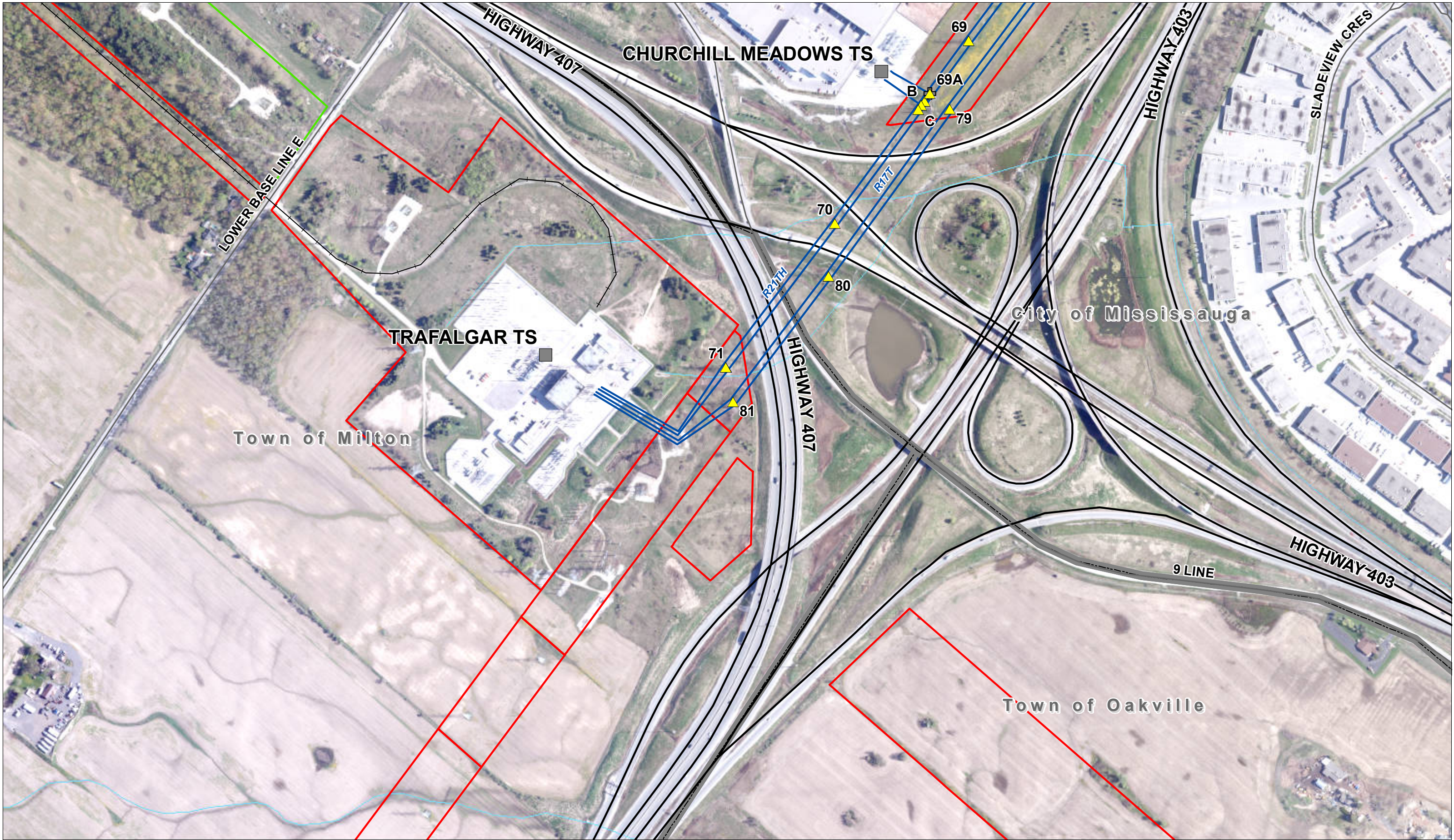
- Temporary Land Rights Agreement (**Attachment 2**). This form agreement was included and approved by the OEB in previous leave to construct applications.¹
- Damage Claim Agreement (**Attachment 3**). This form agreement was included and approved by the OEB in previous leave to construct applications.²

Where Hydro One requires encroachment or occupancy permits from MTO over 400-series highways, the form agreement will be provided by MTO as the landowner.

¹ This form agreement was included in and approved by the OEB in EB-2019-0077 Decision and Order dated October 17, 2019, and EB-2018-0117 Decision and Order dated April 23, 2020.

² Ibid.

Project Route Map



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Tile 1 of 19

	Existing Structure		Hydro One Land Ownership		Railway		Watercourse
	Junction		Hydro One Land Easement		Road		Waterbody
	Transformer Station				Highway		Municipal Boundary
	230 kV Transmission Line						

**Trafalgar TS to Richview TS -
Section 92 OEB Application**

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Key Map

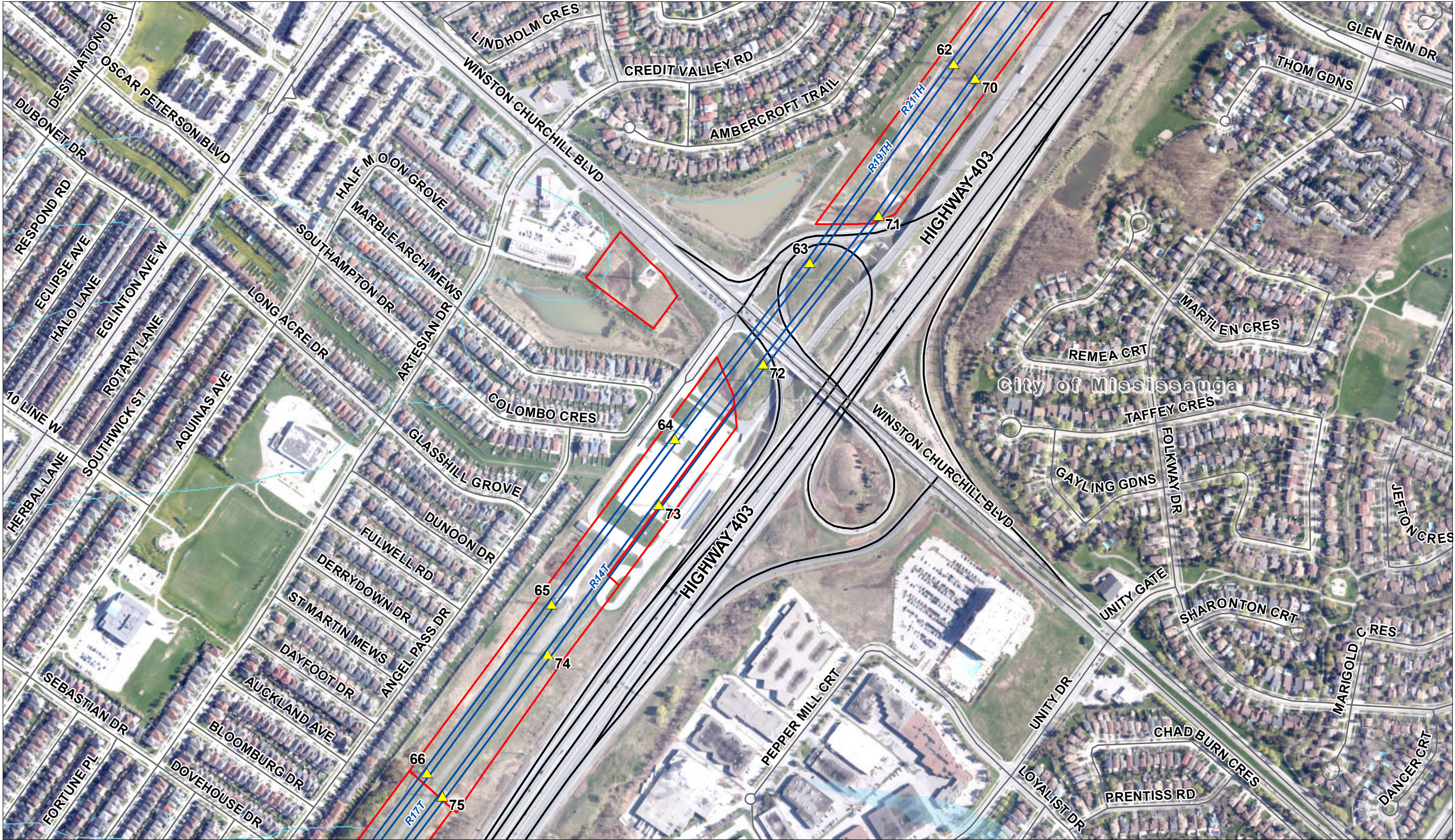
Tile 2 of 19

Existing Structure	Hydro One Land Ownership	Railway	Watercourse
Junction	Hydro One Land Easement	Road	Waterbody
Transformer Station		Highway	Municipal Boundary
230 kV Transmission Line			

**Trafalgar TS to Richview TS -
Section 92 OEB Application**

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Existing Structure

Junction

Transformer Station

230 kV Transmission Line

Hydro One Land Ownership

Hydro One Land Easement

Railway

Road

Highway

Watercourse

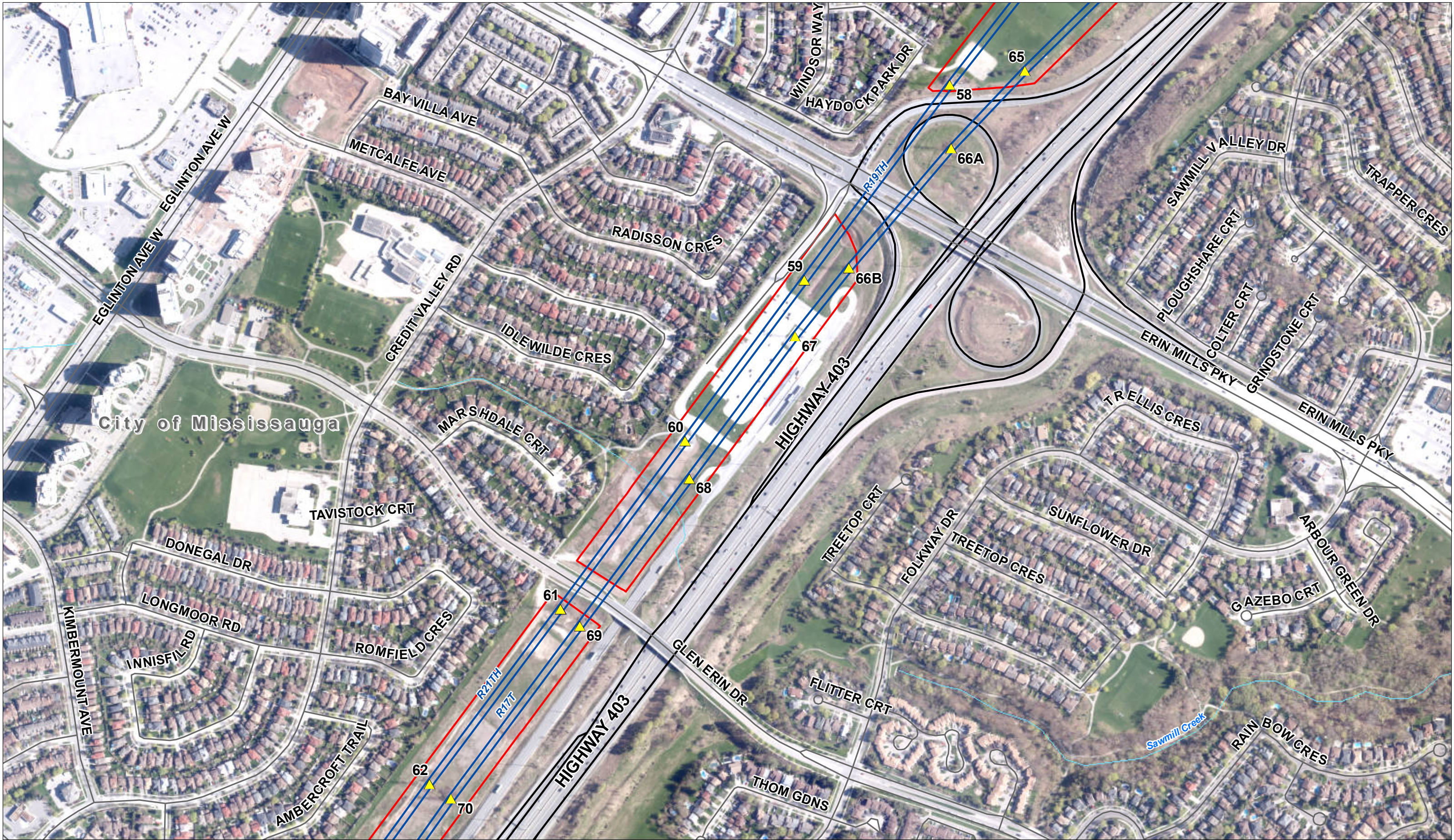
Waterbody

Municipal Boundary

**Trafalgar TS to Richview TS -
Section 92 OEB Application**

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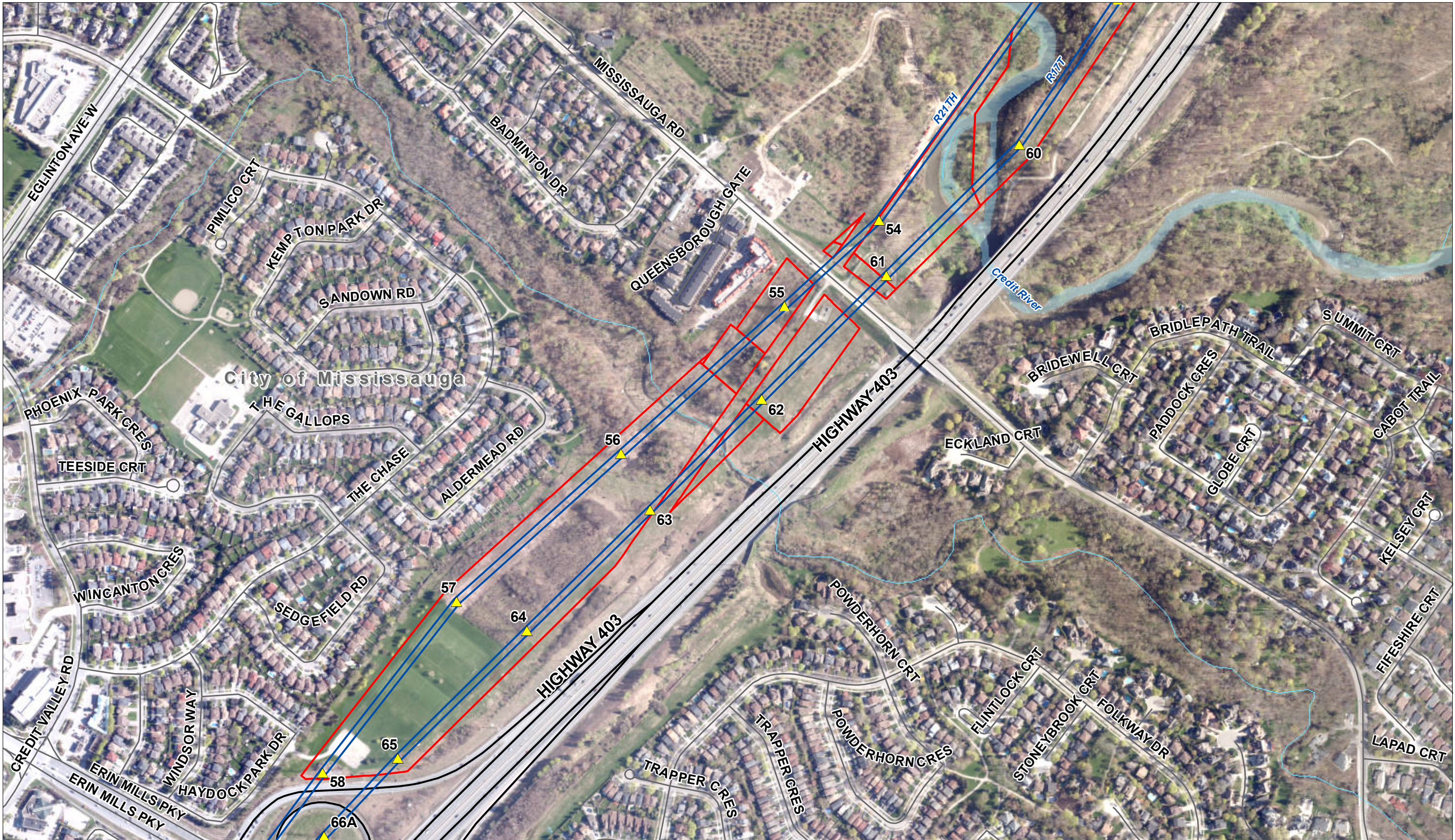
Key Map

Tile 4 of 19

Existing Structure	Hydro One Land Ownership	Railway	Watercourse
Junction	Hydro One Land Easement	Road	Waterbody
Transformer Station		Highway	Municipal Boundary
230 kV Transmission Line			

Trafalgar TS to Richview TS -
Section 92 OEB Application

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Key Map

▲ Existing Structure

⊕ Junction

■ Transformer Station

— 230 kV Transmission Line

▭ Hydro One Land Ownership

▭ Hydro One Land Easement

— Railway

— Road

— Highway

— Watercourse

— Waterbody

▭ Municipal Boundary

**Trafalgar TS to Richview TS -
Section 92 OEB Application**

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Key Map

▲ Existing Structure

⊕ Junction

■ Transformer Station

— 230 kV Transmission Line

▭ Hydro One Land Ownership

▭ Hydro One Land Easement

— Railway

— Road

— Highway

— Watercourse

— Waterbody

▭ Municipal Boundary

**Trafalgar TS to Richview TS -
Section 92 OEB Application**

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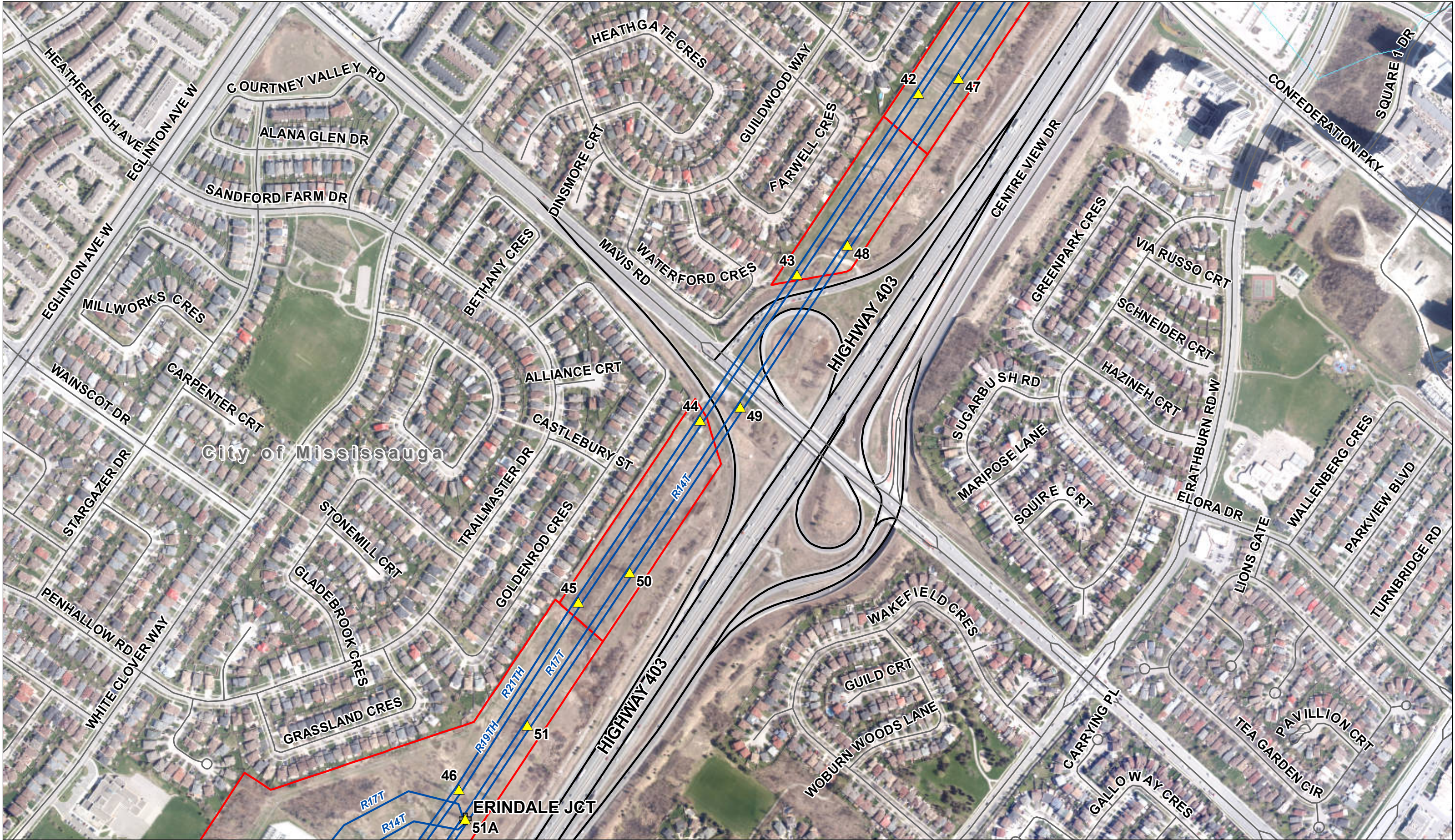
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Tile 7 of 19

Existing Structure	Hydro One Land Ownership	Railway	Watercourse
Junction	Hydro One Land Easement	Road	Waterbody
Transformer Station		Highway	Municipal Boundary
230 kV Transmission Line			

**Trafalgar TS to Richview TS -
Section 92 OEB Application**

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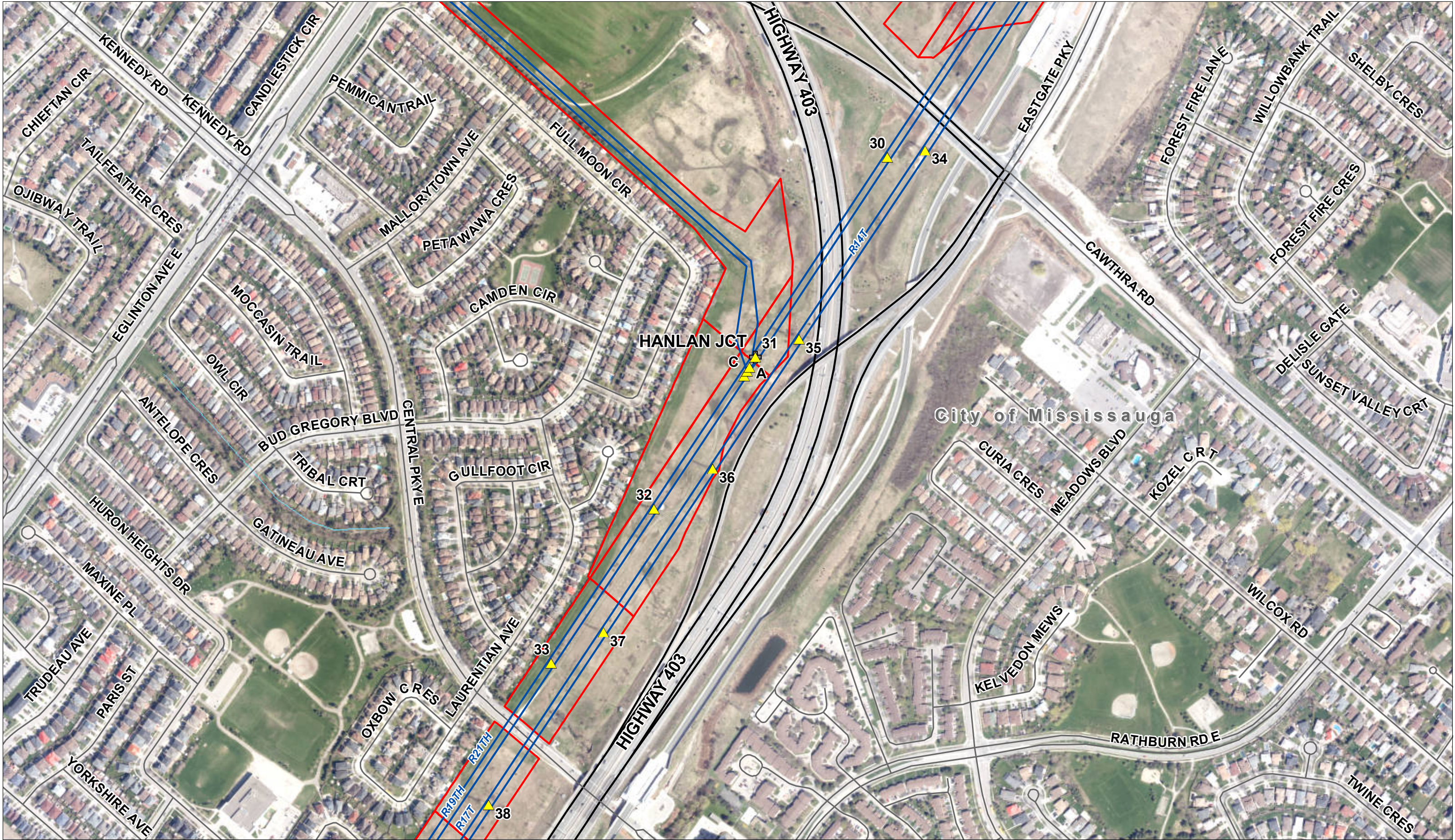


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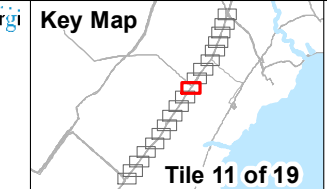
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	Junction		Hydro One Land Easement		Road		Waterbody
	Transformer Station				Highway		Municipal Boundary
	230 kV Transmission Line						

**Trafalgar TS to Richview TS -
Section 92 OEB Application**

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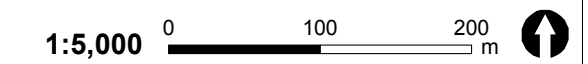


hydro one
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- | | | | |
|--------------------------|--------------------------|---------|--------------------|
| Existing Structure | Hydro One Land Ownership | Railway | Watercourse |
| Junction | Hydro One Land Easement | Road | Waterbody |
| Transformer Station | | Highway | Municipal Boundary |
| 230 kV Transmission Line | | | |

**Trafalgar TS to Richview TS -
Section 92 OEB Application**





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Key Map

Existing Structure

Junction

Transformer Station

230 kV Transmission Line

Hydro One Land Ownership

Hydro One Land Easement

Railway

Road

Highway

Watercourse

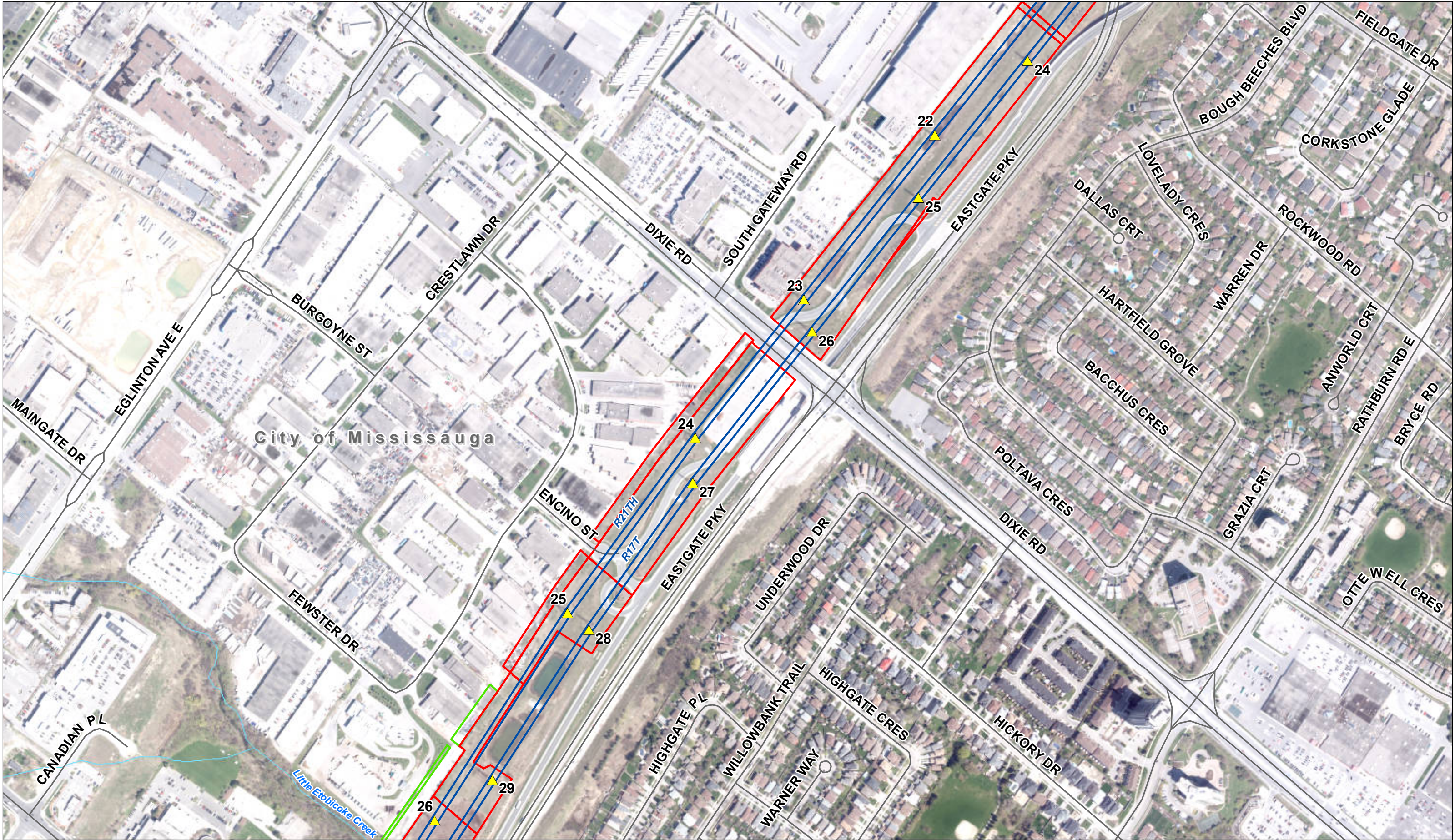
Waterbody

Municipal Boundary

**Trafalgar TS to Richview TS -
Section 92 OEB Application**

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Key Map

▲ Existing Structure

⊕ Junction

■ Transformer Station

— 230 kV Transmission Line

▭ Hydro One Land Ownership

▭ Hydro One Land Easement

— Railway

— Road

— Highway

— Watercourse

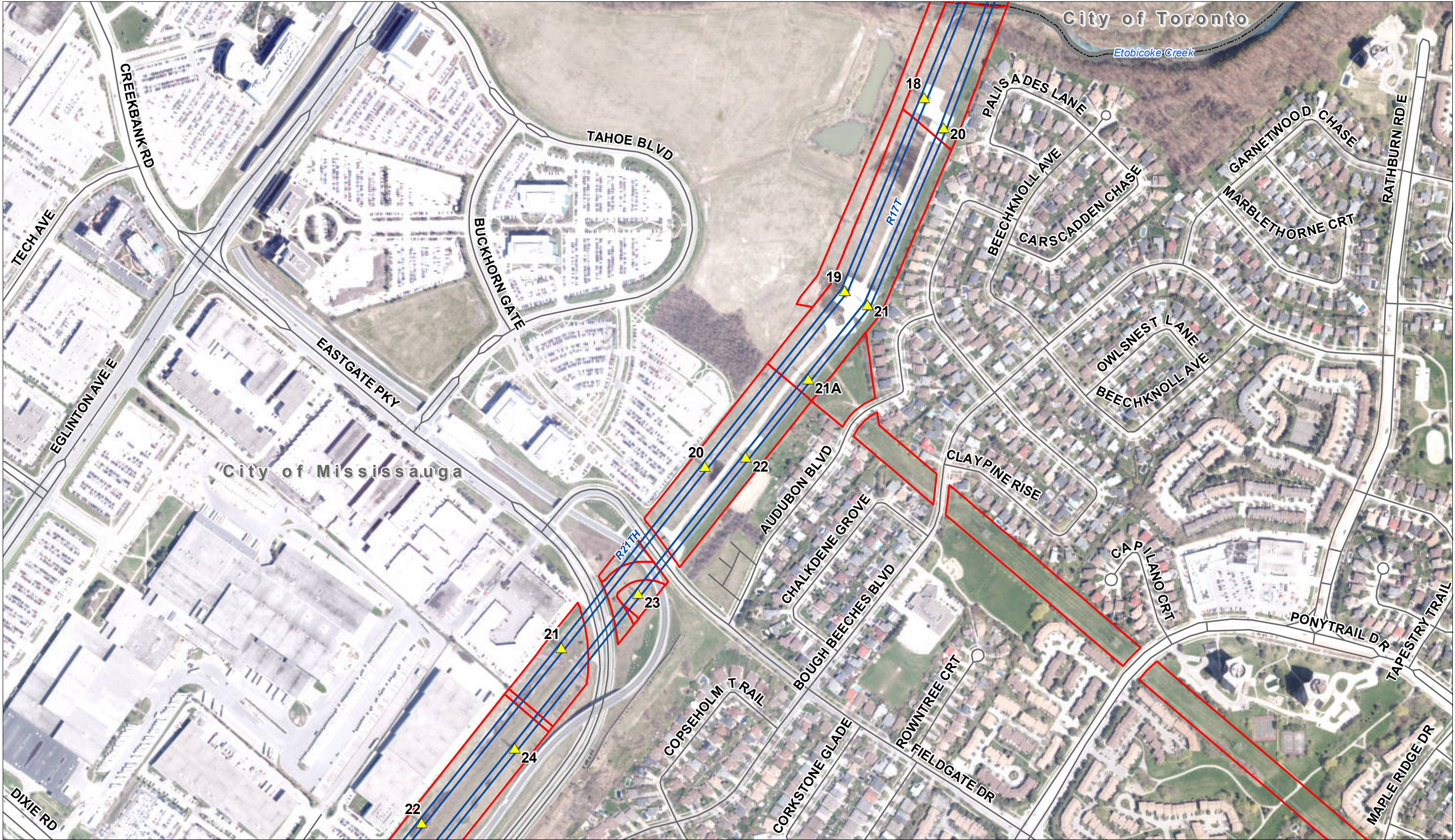
— Waterbody

▭ Municipal Boundary

**Trafalgar TS to Richview TS -
Section 92 OEB Application**

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Existing Structure

Junction

Transformer Station

230 kV Transmission Line

Hydro One Land Ownership

Hydro One Land Easement

Railway

Road

Highway

Watercourse

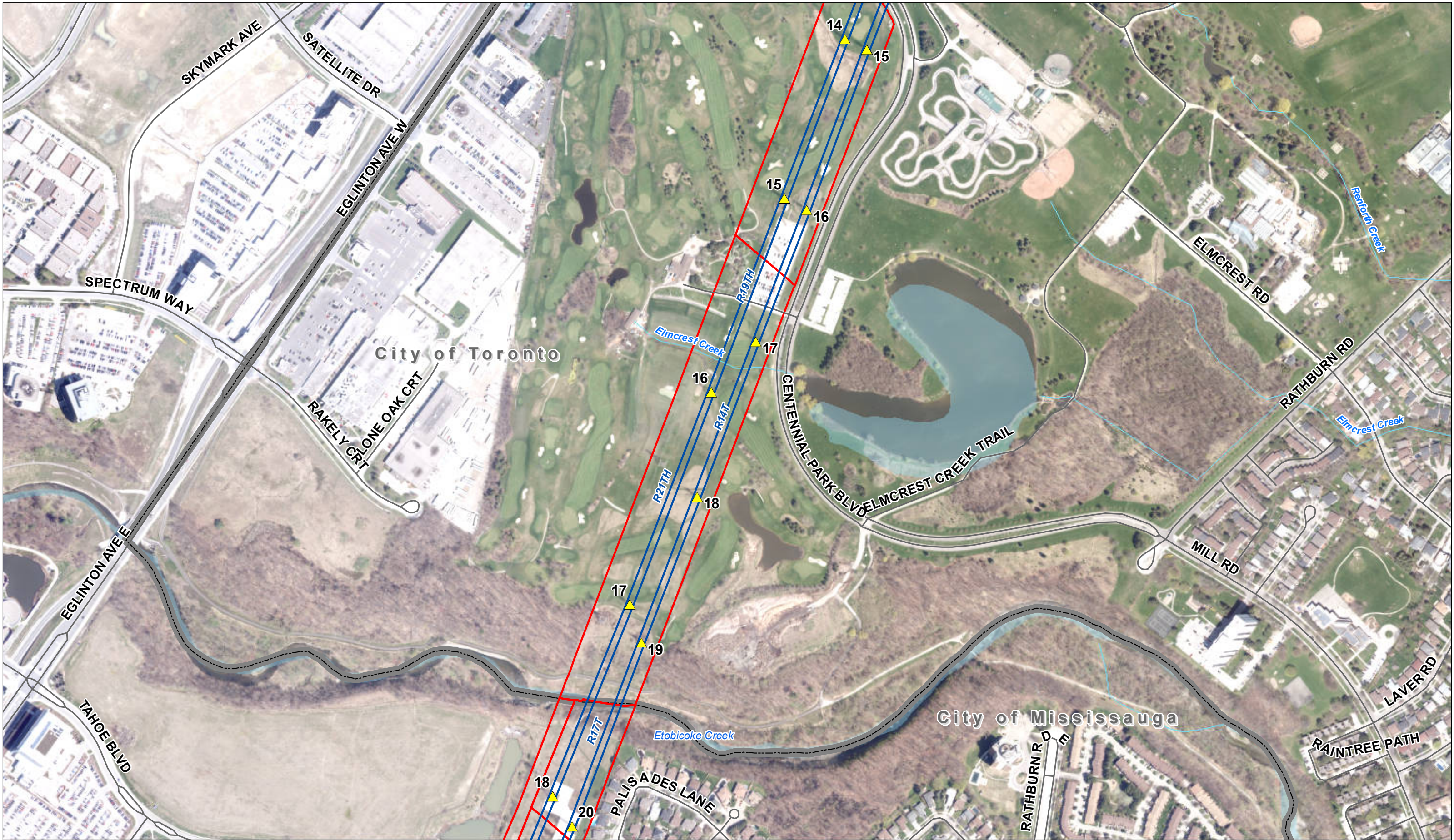
Waterbody

Municipal Boundary

**Trafalgar TS to Richview TS -
Section 92 OEB Application**

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Key Map

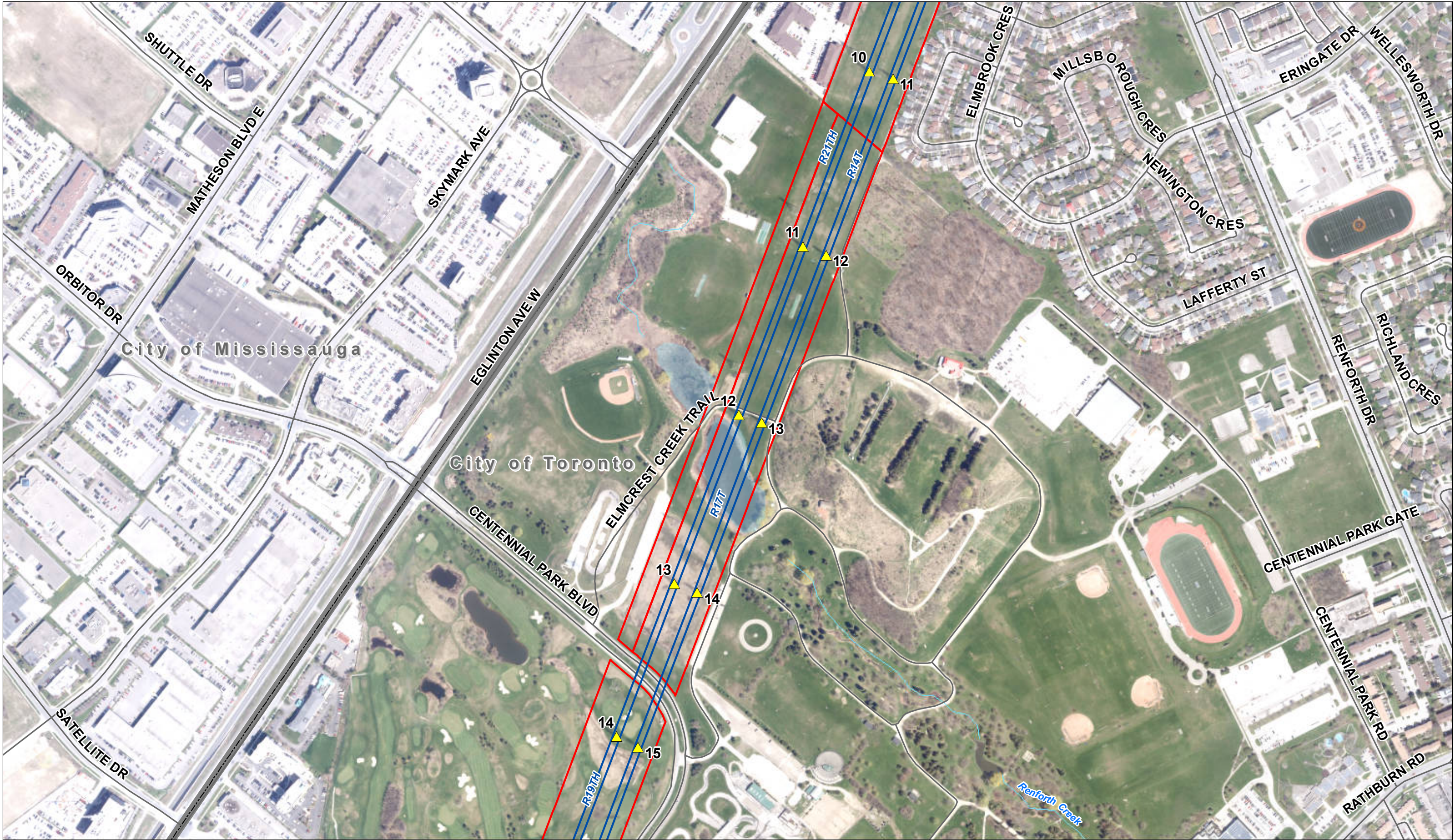
Tile 15 of 19

- | | | | |
|--------------------------|--------------------------|---------|--------------------|
| Existing Structure | Hydro One Land Ownership | Railway | Watercourse |
| Junction | Hydro One Land Easement | Road | Waterbody |
| Transformer Station | | Highway | Municipal Boundary |
| 230 kV Transmission Line | | | |

**Trafalgar TS to Richview TS -
Section 92 OEB Application**

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Key Map

Tile 16 of 19

	Existing Structure		Hydro One Land Ownership		Railway		Watercourse
	Junction		Hydro One Land Easement		Road		Waterbody
	Transformer Station				Highway		Municipal Boundary
	230 kV Transmission Line						

Trafalgar TS to Richview TS -
Section 92 OEB Application

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Key Map

Existing Structure

Junction

Transformer Station

230 kV Transmission Line

Hydro One Land Ownership

Hydro One Land Easement

Railway

Road

Highway

Watercourse

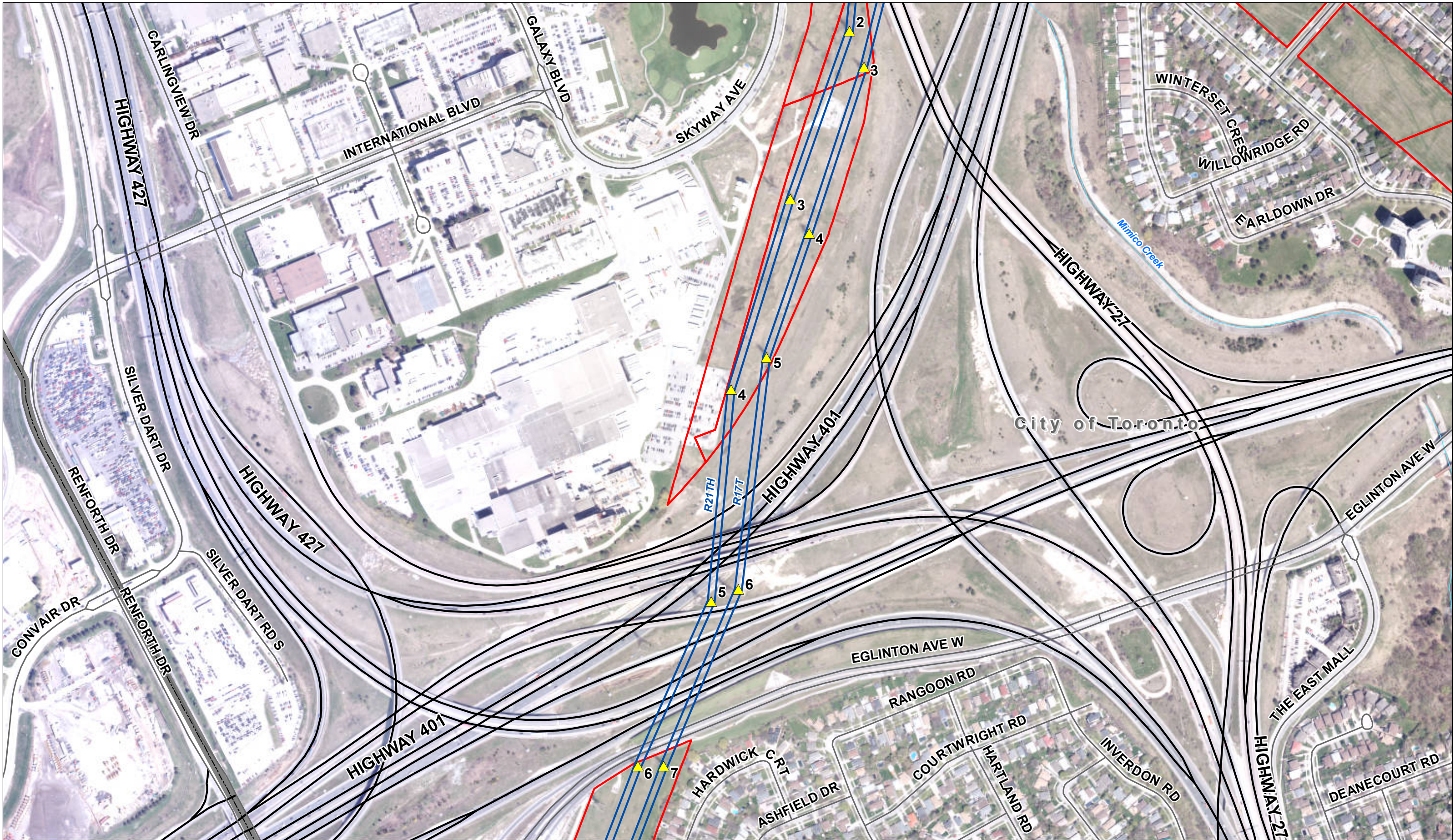
Waterbody

Municipal Boundary

**Trafalgar TS to Richview TS -
Section 92 OEB Application**

1:5,000

0 100 200 m



Produced By: Inerpi LP, GIS Services
Date: Apr 19, 2021
Map21-041_RichviewTS_TrafalgarTS_S92_OEB

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Key Map

Tile 18 of 19

	Existing Structure		Hydro One Land Ownership		Railway		Watercourse
	Junction		Hydro One Land Easement		Road		Waterbody
	Transformer Station				Highway		Municipal Boundary
	230 kV Transmission Line						

**Trafalgar TS to Richview TS -
Section 92 OEB Application**

1:5,000

0 100 200 m



Produced By: Inerpi LP, GIS Services
Date: Apr 19, 2021
Map21-041_RichviewTS_TrafalgarTS_S92_OEB

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Key Map

▲ Existing Structure

⊕ Junction

■ Transformer Station

— 230 kV Transmission Line

▭ Hydro One Land Ownership

▭ Hydro One Land Easement

— Railway

— Road

— Highway

— Watercourse

— Waterbody

▭ Municipal Boundary

**Trafalgar TS to Richview TS -
Section 92 OEB Application**

1:5,000

0 100 200 m

File: EB-2018-0117

THIS AGREEMENT made in duplicate the XXXXX day of XXXXXX 202X.

BETWEEN:

(INSERT NAME)

[NTD – ENSURE FULL LEGAL NAMES OF ALL OWNERS INSERTED]

[NTD – IF MORE THAN 1 OWNER THEN AMEND TO “(collectively the “**Owner**”)”]

(the “**Owner**”)
OF THE FIRST PART

AND:

HYDRO ONE NETWORKS INC.

(“**HONI**”)
OF THE SECOND PART

WHEREAS:

1. The Owner is the registered owner of lands legally described as **(INSERT LEGAL DESCRIPTION)** (the “Lands”)
2. The Owner is agreeable in allowing HONI to enter onto a portion of the Lands highlighted in yellow as shown on the sketch attached hereto as Schedule “A” (the “Strip”), for the purposes of certain construction activities in conjunction with the XXXXXX (the “Project”), which shall include but are not limited to a temporary material storage yard for the purposes of storage of materials and equipment, including but not limited to construction equipment and machinery, requisite to the construction on the Strip subject to the terms and conditions contained herein (collectively the “Activities”).

NOW THEREFORE THIS AGREEMENT WITNESSES THAT in consideration of Two Dollars (\$2.00) now paid by HONI to the Owner, and the respective covenants and agreements of the parties hereinafter contained and other valuable consideration, the receipt and sufficiency of which are hereby acknowledged by the parties hereto, the parties hereto agree as follows:

1. The Owner hereby grants to HONI and its respective officers, employees, workers, permittees, servants, agents, contractors and subcontractors, with or without vehicles, supplies, machinery, plant, material and equipment, as of the date this Agreement, (i) the right to commence the Activities on the Strip; and (ii) the right to enter upon and exit from, and to pass and repass at any and all times in, over, along, upon, across, and through the Strip and so much of the Lands as may be reasonably necessary.
2. The permission granted herein shall commence as of the date this Agreement (the “Commencement Date”) and shall terminate three (3) years from the Commencement Date (the “Initial Term”).
3. The Initial Term may be extended upon 60 days prior written notice from HONI to the Owner for an additional two (2) years on the same terms and conditions contained herein save for this right to extend (the “Extended Term”).
4. All agents, representatives, officers, directors, employees and contractors and property of HONI located at any time on the Lands shall be at the sole risk of HONI and the Owner shall not be liable for any loss or damage or injury (including loss of life) to them or it however occurring except and to the extent to which such loss, damage or injury is caused by the negligence or willful misconduct of the Owner.
5. Upon execution of this Agreement by all parties, HONI shall pay to the Owner the amount of XXXXX Dollars (\$XXXX), which is compensation for the permission granted herein.
6. HONI shall repair any physical damage to the Lands resulting from the Activities and, shall restore the Lands to its original condition so far as possible and practicable to the satisfaction of the Owner, acting reasonably.
7. HONI agrees that it shall indemnify and save harmless the Owner from and against all claims, demands, costs, damages, expenses and liabilities (collectively the “Costs”) whatsoever arising out of HONI’s presence on the Lands or of its activities on or in connection with the Lands arising out of the



permission granted herein except to the extent any of such Costs arise out of the negligence or willful misconduct of the Owner.

- 8. This Agreement does not commit the Owner to enter into any further agreements with HONI in conjunction with the Project.
- 9. This Agreement shall be governed by and construed in accordance with the laws of the Province of Ontario and the laws of Canada applicable herein. The parties hereto submit themselves to the exclusive jurisdiction of the Courts of the Province of Ontario.

IN WITNESS WHEREOF the Parties have hereunto set their respective hands and seals to this Agreement of Purchase and Sale.

SIGNED, SEALED AND DELIVERED

In the presence of)
)
)
)
)
)
)
_____) (seal)
Print Name of Witness (INSERT NAME)

)
)
)
)
)
)
)
_____) (seal)
Print Name of Witness (INSERT NAME)

IF OWNER IS CORPORATION – USE THE FOLLOWING

[INSERT FULL LEGAL NAME]

Per: _____
Print Name:
Print Title:

Per: _____
Print Name:
Print Title:

We/I have authority to bind the Corporation

HYDRO ONE NETWORKS INC.

Per: _____
Print Name:
Title:

I have authority to bind the Corporation

SCHEDULE “A”

SETTLEMENT AGREEMENT AND RELEASE

THIS AGEEMENT AND RELEASE IS made as of the _____ day of _____, 202X

Between:

[INSERT FULL LEGAL NAME OF INDIVIDUAL(S)]
(the “Claimant”)

- and-

HYDRO ONE NETWORKS INC.
(“Hydro One”)

WHEREAS the Claimant is the registered owner of the lands legally described as _____ being PIN • (LT) (the “**Claimant’s Lands**”).

AND WHEREAS the Claimant alleges that he/she/they suffered damages in the form of _____ as a result of construction, maintenance or other work carried out by Hydro One on the Claimant’s Lands in or around _____ (the “**Work**”).

AND WHEREAS Hydro One has agreed to pay to the Claimant the sum of • Dollars (\$0.00) in settlement of all claims related, in any manner whatsoever, to the Work (the “**Settlement Amount**”), which settlement precludes any litigation between the parties in respect of any cause of action, of any nature or kind whatsoever, whether known or unknown, in connection with the Work.

AND WHEREAS the calculation of the Settlement Amount is detailed on Schedule “A” attached hereto.

NOW THEREFORE, IN CONSIDERATION of payment by Hydro One to the Claimant of the Settlement Amount, and for other good and valuable consideration the receipt and sufficiency of which is hereby acknowledged, the parties hereto hereby agree as follows:

THE Claimant, for his/her heirs, administrators, successors, assigns, agents, servants, and on behalf of any parties who claim a right or interest through them, does hereby irrevocable release and forever discharge Hydro One and its administrators, successors, assigns, agents, servants, officers, directors, employees, shareholders, associates, including its parent, affiliates and subsidiary corporations, of, from and against any and all manner of actions, causes of action,

suits, proceedings, liabilities, debts, sums of money, claims, damages and demands which the Claimant ever had now has, can, shall or may hereafter have against Hydro One existing by any reason or by any act, cause, matter or thing whatsoever relating to, or connected with the Work.

AND FOR THE SAID CONSIDERATION, the Claimant further agrees not to make any claim or take any proceedings against any other person or corporation who might claim contribution or indemnity under the provisions of the *Negligence Act* and any amendments thereto from the persons or corporations discharged by this Agreement.

AND IT IS UNDERSTOOD AND AGREED that if any action is commenced in connection with any of the claims released herein and if Hydro One is added to such proceedings in any manner whatsoever, whether justified in law or not, the proceedings will immediately be discontinued and any legal costs incurred in any such proceedings shall be paid on a full indemnity basis to Hydro One.

AND IT IS FURTHER UNDERSTOOD AND AGREED that this Agreement is intended to cover and does cover not only all known injuries, losses and damages arising from the Work, but all future injuries, losses and damages arising from the Work, save and except any damages to drainage tiles, that are not now known or anticipated but which may later develop or be discovered, including all the effects and consequences thereof.

AND IT IS UNDERSTOOD AND AGREED that any claim for damages arising from the Work to drainage tiles on the Claimant's Land must be brought to Hydro One's attention within two (2) years from the date of this Agreement (the "Drainage Tile Damage"),

AND IT IS UNDERSTOOD AND AGREED the parties will negotiate a separate settlement agreement for any Drainage Tile Damage.

AND IT IS UNDERSTOOD AND AGREED that the fact and terms of this Agreement and the settlement underlying it will be held in confidence and will not be disclosed either orally or in writing, directly or indirectly, by any of the parties to this Agreement, unless in accordance with auditors' or accountants' written advice for financial statement or income tax purposes, or for the purpose of any judicial, legal or regulatory proceeding, process or requirement.

AND THE CLAIMANT hereby acknowledges, declares, and agrees that he/she understands the terms of this Agreement and voluntarily accepts the consideration referred to above, that he/she has had a full opportunity to obtain independent legal advice prior to execution of this Agreement, and that no party has been induced to enter into this Agreement by reason of any representation or warranty of any nature or kind whatsoever and that there is no condition, express or implied, or collateral agreement affecting this Agreement.

IT IS FURTHER UNDERSTOOD AND AGREED that the Settlement Amount shall be paid by Hydro One to the Claimant within 30 days from the date of this Agreement as written above.

IT IS UNDERSTOOD AND AGREED that the payment of the Settlement Amount is deemed to be no admission whatsoever of liability on the part of Hydro One.

IT IS FURTHER UNDERSTOOD AND AGREED that this Agreement may be transmitted by e-mail or facsimile, and that a copy so transmitted shall be valid and binding as if it were an original copy.

IT IS FURTHER UNDERSTOOD AND AGREED that this Agreement may be executed in any number of counterparts with the same effect as if the parties had signed the same Agreement. All counterparts shall constitute one and the same Agreement.

IN WITNESS WHEREOF, the parties have set their hands this _____ day of _____, 20____.

WITNESS:

CLAIMANT:

Name:

Name:

Address:

Name:

HYDRO ONE NETWORKS INC.

Per:_____

Name:

Title:

I have authority to bind the corporation

SCHEDULE “A”

Settlement Amount Calculation

SYSTEM IMPACT ASSESSMENT

Under the Market Rules, any party planning to construct a new or modified connection to the Independent Electricity System Operator (“IESO”)-controlled grid must request an IESO System Impact Assessment (“SIA”) of these facilities. The IESO has completed a SIA of the proposed facilities under the IESO Connections Assessment and Approval process. Please refer to **Attachment 1** for the IESO’s final SIA report.

The IESO assessment addresses the impact of the proposed facilities on system operating voltage, system operating flexibility, and on the ability of other connections to deliver or withdraw power supply from the IESO-controlled grid. The IESO’s SIA confirms that Hydro One’s proposed transmission facilities will not have a materially adverse impact on the reliability of the integrated power system. Furthermore, the Project will not cause any changes to the current classifications of North American Electric Reliability Corporation’s Bulk Electric System elements and Northeast Power Coordinating Council’s Bulk Power System elements in the Toronto to Mississauga transmission zone.

System Impact Assessment Report

Final Report - Confidential

CAA ID: 2020-679

Project: Richview x Trafalgar Conductor Upgrade
Connection Applicant: Hydro One Inc.

April 14, 2021



Acknowledgement

The IESO wishes to acknowledge the assistance of Hydro One in completing this assessment.

Disclaimers

IESO

This report has been prepared solely for the purpose of assessing whether the connection applicant's proposed connection with the IESO-controlled grid would have an adverse impact on the reliability of the integrated power system and whether the IESO should issue a notice of conditional approval or disapproval of the proposed connection under Chapter 4, section 6 of the Market Rules.

Conditional approval of the project is based on information provided to the IESO by the connection applicant and Hydro One at the time the assessment was carried out. The IESO assumes no responsibility for the accuracy or completeness of such information, including the results of studies carried out by Hydro One at the request of the IESO. Furthermore, the conditional approval is subject to further consideration due to changes to this information, or to additional information that may become available after the conditional approval has been granted.

If the connection applicant has engaged a consultant to perform connection assessment studies, the connection applicant acknowledges that the IESO will be relying on such studies in conducting its assessment and that the IESO assumes no responsibility for the accuracy or completeness of such studies including, without limitation, any changes to IESO base case models made by the consultant. The IESO reserves the right to repeat any or all connection studies performed by the consultant if necessary to meet IESO requirements.

Conditional approval of the proposed connection means that there are no significant reliability issues or concerns that would prevent connection of the proposed project to the IESO-controlled grid. However, the conditional approval does not ensure that a project will meet all connection requirements. In addition, further issues or concerns may be identified by the transmitter(s) during the detailed design phase that may require changes to equipment characteristics and/or configuration to ensure compliance with physical or equipment limitations, or with the Transmission System Code, before connection can be made.

This report has not been prepared for any other purpose and should not be used or relied upon by any person for another purpose. This report has been prepared solely for use by the connection applicant and the IESO in accordance with Chapter 4, section 6 of the Market Rules. This report does not in any way constitute an endorsement of the proposed connection for the purposes of obtaining a contract with the IESO for the procurement of supply, generation, demand response, demand management or ancillary services.

The IESO assumes no responsibility to any third party for any use, which it makes of this report. Any liability which the IESO may have to the connection applicant in respect of this report is governed by Chapter 1, section 13 of the Market Rules. In the event that the IESO provides a draft of this report to the connection applicant, the connection applicant must be aware that the IESO may revise drafts of this report at any time in its sole discretion without notice to the connection applicant. Although the IESO will use its best efforts to advise you of any such changes, it is the responsibility of the connection applicant to ensure that the most recent version of this report is being used.

Hydro One

The results reported in this report are based on the information available to Hydro One, at the time of the study, suitable for a System Impact Assessment of this connection proposal.

The short circuit and thermal loading levels have been computed based on the information available at the time of the study. These levels may be higher or lower if the connection information changes as a result of, but not limited to, subsequent design modifications or when more accurate test measurement data is available.

This study does not assess the short circuit or thermal loading impact of the proposed facilities on load and generation customers.

In this report, short circuit adequacy is assessed only for Hydro One circuit breakers. The short circuit results are only for the purpose of assessing the capabilities of existing Hydro One circuit breakers and identifying upgrades required to incorporate the proposed facilities. These results should not be used in the design and engineering of any new or existing facilities. The necessary data will be provided by Hydro One and discussed with any connection applicant upon request.

The ampacity ratings of Hydro One facilities are established based on assumptions used in Hydro One for power system planning studies. The actual ampacity ratings during operations may be determined in real-time and are based on actual system conditions, including ambient temperature, wind speed and facility loading, and may be higher or lower than those stated in this study.

The additional facilities or upgrades which are required to incorporate the proposed facilities have been identified to the extent permitted by a System Impact Assessment under the current IESO Connection Assessment and Approval process. Additional facility studies may be necessary to confirm constructability and the time required for construction. Further studies at more advanced stages of the project development may identify additional facilities that need to be provided or that require upgrading.



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Project Description

Hydro One Networks Inc. (the "connection applicant" and "transmitter") is proposing to replace the 230 kV conductors of most sections of circuits R14T, R17T, R19TH and R21TH that are connected between Richview Transformer Station (TS) and Trafalgar TS (the "project"). The IESO recommended, in a letter that was sent to the connection applicant on December 18, 2020, to proceed with this project, that is expected to address the need for improved capability across the Flow East Towards Toronto (FETT) interface. The specifications of the proposed conductors are presented in Appendix B of this report.

The connection applicant will adjust the settings of the existing line protections for transmission circuits R14T, R17T, R19TH and R21TH to maintain the same protection zones and operating times while accounting for the impedances of the proposed conductors.

The proposed in service date is in December 2024.

Notice of Conditional Approval

This assessment concludes that the proposed connection of the project is expected to have no material adverse impact on the reliability of the integrated power system, provided that all requirements in this report are implemented. Therefore, the assessment supports the release of the Notification of Conditional Approval for connection of the project.

Assessment Findings

The studies performed determined that there is no adverse impact to the surrounding system caused by the project. In addition, the impedances and thermal ratings of the replacement conductors are similar or better than those of the existing conductors. The studied scenarios, main assumptions and results are available in Appendix C of this report.

IESO Requirements for Connection

Specific Requirement:

The connection applicant shall submit the outage plan for incorporating the project to the IESO and obtain its approval at least twenty four months before the date of the first outage.

General Requirements:

The connection applicant shall satisfy all applicable requirements specified in the Market Rules, the Transmission System Code (TSC) and reliability standards. Some of the general requirements that are applicable to this project are presented in detail in Appendix A of this report.

Appendix A: General Requirements

The connection applicant shall satisfy all applicable requirements specified in the Market Rules, the Transmission System Code and reliability standards. This Section highlights some of the general requirements that are applicable to the project.

1. The connection applicant shall notify the IESO at connection.assessments@ieso.ca as soon as it becomes aware of any changes to the project scope or project data used in this assessment. The IESO will determine whether these changes require a re-assessment.
2. The connection applicant must initiate the IESO's Market Registration process prior to the commencement of any project related outages. Once the IESO's Market Registration process has been successfully completed, the IESO will provide the connection applicant with a Registration Approval Notification (RAN) document, confirming that the project is fully authorized to connect to the IESO-controlled grid. For more details about this process, the connection applicant is encouraged to contact IESO's Market Registration at market.registration@ieso.ca.

The connection applicant is required to provide "as-built" equipment data for the project during the IESO Market Registration process. If the "as-built" equipment data differs materially from the ones used in this assessment, then the IESO may decide that further analysis of the project is required.

3. The connection applicant shall ensure that the project's equipment meet the voltage requirements specified in section 4.2 and section 4.3 of the Ontario Resource and Transmission Assessment Criteria (ORTAC).
4. The connection applicant shall ensure that the connection equipment is designed to be fully operational in all reasonably foreseeable ambient conditions. Failures of the connection equipment must be contained within the project and have no adverse impact on the IESO-controlled grid.
5. As per Market Manual 1.4: Connection Assessment and Approval (formerly Market Manual 2.10), the connection applicant will be required to provide a status report of its proposed project with respect to its progress upon request of the IESO using the [project status report form](#) on the IESO website. Failure to comply with project status requirements listed in Market Manual 1.4: Connection Assessment and Approval (formerly Market Manual 2.10) will result in the project being withdrawn.



Disclaimer of Confidentiality

Appendices B to C, inclusive, contain confidential information of the IESO, the connection applicant, the transmitter and, potentially, other third parties, including information that, if disclosed, could reasonably be expected to pose a potential security threat to the integrated power system, the IESO-administered markets, or those of neighbouring jurisdictions.

Appendices B to C are intended only to be disclosed to, and may only be used on a confidential basis by the connection applicant and transmitter. The connection applicant and transmitter may not, except as permitted by Section 5.3 of Chapter 3 of the Market Rules, disclose or use such information, other than for the purpose of carrying out its responsibilities as described in Section 6 of Chapter 4 of the Market Rules, the Transmission System Code and Market Manual 1.4.

Appendix B: Data Verification (Confidential)

Equipment Data

The equipment specifications, shown in Table 1 to Table 6, were provided by the connection applicant.

Table 1: Line Parameters: Sections Lengths and Positive Sequence Data

Circuit	Sections	Length (km)	Existing R (pu)	Existing X (pu)	Existing B (pu)	New R (pu)	New X (pu)	New B (pu)
R14T	Richview TS to Tomken JCT	7.901	0.00131	0.00811	0.0128	0.000738	0.00786	0.0132
R14T	Tomken JCT to Erindale JCT	5.648	0.000935	0.0058	0.0091	0.000527	0.00562	0.00941
R14T	Erindale JCT to Trafalgar TS	8.111	0.000825	0.00805	0.01348	0.000757	0.00808	0.0135
R17T	Richview TS to Tomken JCT	7.901	0.00131	0.00811	0.01275	0.00074	0.00786	0.01316
R17T	Tomken JCT to Erindale JCT	5.648	0.00093	0.0058	0.00911	0.00053	0.00562	0.00941
R17T	Erindale JCT to Trafalgar TS	8.111	0.00082	0.00805	0.01349	0.00076	0.00808	0.01351
R19TH	Richview TS to Tomken JCT*	7.95	0.00131	0.00814	0.01289	-	-	-
R19TH	Tomken JCT to Hanlan JCT	1.094	0.00018	0.00112	0.00177	0.0001	0.00109	0.00182
R19TH	Hanlan JCT to Erindale TS	5.069	0.00081	0.00519	0.00821	0.00048	0.00506	0.00844
R19TH	Erindale TS to Churchill Meadows JCT	6.405	0.00066	0.00635	0.01065	0.0006	0.00638	0.01065
R19TH	Churchill Meadows JCT to Trafalgar TS	1.142	0.00011	0.00114	0.0019	0.00011	0.00115	0.00189
R21TH	Richview TS to Tomken JCT*	7.95	0.00131	0.00814	0.01289	-	-	-
R21TH	Tomken JCT to Hanlan JCT	1.094	0.00018	0.00112	0.00177	0.0001	0.00109	0.00182
R21TH	Hanlan JCT to Erindale TS	5.069	0.00081	0.00519	0.00821	0.00048	0.00506	0.00843
R21TH	Erindale TS to Churchill Meadows JCT	6.405	0.00066	0.00635	0.01065	0.0006	0.00638	0.01065
R21TH	Churchill Meadows JCT to Trafalgar TS	1.142	0.00011	0.00114	0.00189	0.00011	0.00115	0.00189

*The existing conductors on these section will remain unchanged

Table 2: Changes to Positive Sequence Data

Circuit	Sections	R Change*	X Change*	B Change*
R14T	Richview TS to Trafalgar TS	-34.14%	-1.82%	2.06%
R17T	Richview TS to Trafalgar TS	-33.66%	-1.82%	2.07%
R19TH	Richview TS to Trafalgar TS	-15.31%	-0.55%	0.76%
R21TH	Richview TS to Trafalgar TS	-15.31%	-0.55%	0.76%

* Changes are calculated using the formula: (new parameter – old parameter)/old parameter

Table 3: Line Parameters: Zero Sequence Data

Circuit	Sections	Existing R (pu)	Existing X (pu)	Existing B (pu)	New R (pu)	New X (pu)	New B (pu)
R14T	Richview TS to Tomken JCT	0.00409	0.02	0.00581	0.00297	0.0186	0.00606
R14T	Tomken JCT to Erindale JCT	0.00291	0.015	0.00391	0.00228	0.0132	0.00428
R14T	Erindale JCT to Trafalgar TS	0.00352	0.0232	0.00557	0.00334	0.02	0.00604
R17T	Richview TS to Tomken JCT	0.00415	0.0196	0.00554	0.00301	0.0183	0.00578
R17T	Tomken JCT to Erindale JCT	0.00303	0.0147	0.00355	0.00236	0.0129	0.00389
R17T	Erindale JCT to Trafalgar TS	0.00354	0.0231	0.00498	0.00335	0.02	0.00543
R19TH	Richview TS to Tomken JCT*	0.00443	0.01794	0.00583	0.00415	0.01761	0.00586
R19TH	Tomken JCT to Hanlan JCT	0.00068	0.00259	0.00076	0.00053	0.00245	0.00078
R19TH	Hanlan JCT to Erindale TS	0.00311	0.01199	0.00353	0.00244	0.01127	0.00364
R19TH	Erindale TS to Churchill Meadows JCT	0.00294	0.01817	0.00404	0.00263	0.01671	0.00416
R19TH	Churchill Meadows JCT to Trafalgar TS	0.00047	0.00316	0.00066	0.00044	0.00294	0.00068
R21TH	Richview TS to Tomken JCT*	0.00443	0.01771	0.00579	0.00418	0.01749	0.00581
R21TH	Tomken JCT to Hanlan JCT	0.00068	0.00259	0.00085	0.00053	0.00249	0.00086
R21TH	Hanlan JCT to Erindale TS	0.00311	0.01199	0.00393	0.00246	0.01145	0.00402
R21TH	Erindale TS to Churchill Meadows JCT	0.00294	0.01817	0.00449	0.00261	0.017	0.00456
R21TH	Churchill Meadows JCT to Trafalgar TS	0.00047	0.00318	0.00077	0.00043	0.003	0.00078

*The existing conductors on these section will remain unchanged

Table 4: Changes to Zero Sequence Data

Circuit	Sections	R Change*	X Change*	B Change*
R14T	Richview TS to Trafalgar TS	-18.35%	-11.00%	7.13%
R17T	Richview TS to Trafalgar TS	-18.66%	-10.80%	7.32%
R19TH	Richview TS to Trafalgar TS	-12.38%	-5.33%	2.02%
R21TH	Richview TS to Trafalgar TS	-12.21%	-4.12%	1.26%

* Changes are calculated using the formula: (new parameter – old parameter)/old parameter

Table 5: Summer Thermal Ratings

Circuit	Sections	Existing continuous (A)	Existing LTE (A)	Existing STE (A)	New Continuous (A)	New LTE (A)	New STE (A)
R14T	Richview TS to Tomken JCT	840	1090	1400	1770	2000	2180
R14T	Tomken JCT to Erindale JCT	840	1090	1400	1770	2000	2180
R14T	Erindale JCT to Trafalgar TS	1110	1460	2080	1770	2000	2180
R17T	Richview TS to Tomken JCT	840	1090	1400	1770	2000	2180
R17T	Tomken JCT to Erindale JCT	840	1090	1400	1770	2000	2180
R17T	Erindale JCT to Trafalgar TS	1110	1460	2080	1770	2000	2180
R19TH	Richview TS to Tomken JCT	840	1090	1400	840	1090	1400
R19TH	Tomken JCT to Hanlan JCT	840	1090	1400	1770	2000	2180
R19TH	Hanlan JCT to Erindale TS	840	1090	1400	1770	2000	2180
R19TH	Erindale TS to Churchill Meadows JCT	1110	1460	2080	1770	2000	2180
R19TH	Churchill Meadows JCT to Trafalgar TS	1110	1460	2080	1770	2000	2180
R21TH	Richview TS to Tomken JCT	840	1090	1400	840	1090	1400
R21TH	Tomken JCT to Hanlan JCT	840	1090	1400	1770	2000	2180
R21TH	Hanlan JCT to Erindale TS	840	1090	1400	1770	2000	2180
R21TH	Erindale TS to Churchill Meadows JCT	1110	1460	2080	1770	2000	2180
R21TH	Churchill Meadows JCT to Trafalgar TS	1110	1460	2080	1770	2000	2180

Table 6: Winter Thermal Ratings

Circuit	Sections	Existing continuous (A)	Existing LTE (A)	Existing STE (A)	New Continuous (A)	New LTE (A)	New STE (A)
R14T	Richview TS to Tomken JCT	1020	1230	1510	1930	2130	2310
R14T	Tomken JCT to Erindale JCT	1020	1230	1510	1930	2130	2310
R14T	Erindale JCT to Trafalgar TS	1360	1640	2210	1930	2130	2310
R17T	Richview TS to Tomken JCT	1020	1230	1510	1930	2130	2310
R17T	Tomken JCT to Erindale JCT	1020	1230	1510	1930	2130	2310
R17T	Erindale JCT to Trafalgar TS	1360	1640	2210	1930	2130	2310
R19TH	Richview TS to Tomken JCT	1020	1230	1510	1020	1230	1510
R19TH	Tomken JCT to Hanlan JCT	1020	1230	1510	1930	2130	2310
R19TH	Hanlan JCT to Erindale TS	1020	1230	1510	1930	2130	2310
R19TH	Erindale TS to Churchill Meadows JCT	1360	1640	2210	1930	2130	2310
R19TH	Churchill Meadows JCT to Trafalgar TS	1360	1640	2210	1930	2130	2310
R21TH	Richview TS to Tomken JCT	1020	1230	1510	1020	1230	1510
R21TH	Tomken JCT to Hanlan JCT	1020	1230	1510	1930	2130	2310
R21TH	Hanlan JCT to Erindale TS	1020	1230	1510	1930	2130	2310
R21TH	Erindale TS to Churchill Meadows JCT	1360	1640	2210	1930	2130	2310
R21TH	Churchill Meadows JCT to Trafalgar TS	1360	1640	2210	1930	2130	2310

Appendix C: Technical Assessment (Confidential)

Major Assumptions

The following assumptions were used in this assessment:

1. **Transmission facilities:** All existing transmission facilities and future proposed transmission system upgrades with 2031 in-service dates or earlier were assumed in-service.
2. **Generation facilities:** All existing and committed major generation facilities with 2031 in-service dates or earlier were assumed available. All units in Pickering NGS were assumed out of service. Existing natural gas fired generation in the West transmission zone was used to replace the Pickering NGS generation.
3. **Load facilities:** All major load facilities with the in-service dates in 2031 or earlier were assumed in-service.
4. **Load model:** As per section 2.4 in ORTAC, constant power load models were used for the assessment.
5. **Load power factor:** The power factor was assumed to be 0.9 at the high-voltage buses of the load facilities with low voltage capacitors out of service.
6. **Base Case:** A 2020-2021 case developed for the Winter peak was used as the starting point for simulations.

Study Scenarios

System impact studies were carried out to identify the effect of the project on the distribution of flows on the transmission facilities (lines and transformers) that form part of the project or are located in its immediate vicinity.

The following scenario listed in Table 7 was examined for this study.

Table 7: Study Scenario

Scenario	Description & Assumptions
S1: All element in service	<p>This scenario was used to simulate flows with the existing impedances and with proposed impedances for circuits R14T, R17T, R19TH and R21TH.</p> <ul style="list-style-type: none">• A flow of 5545 MW across the Flow East Towards Toronto (FETT) interface was obtained under the conditions presented in the assumptions section of this Appendix.

Monitored Elements

Table 8 and Table 9 list the the circuits and autotransformers monitored in this study.

Table 8: Monitored Circuits

Circuit	Section	Nominal Voltage (kV)
R14T	Richview TS to Tomken JCT	230
R14T	Tomken JCT to Erindale JCT	230
R14T	Erindale JCT to Trafalgar TS	230
R17T	Richview TS to Tomken JCT	230
R17T	Tomken JCT to Erindale JCT	230
R17T	Erindale JCT to Trafalgar TS	230
R19TH	Richview TS to Tomken JCT	230
R19TH	Tomken JCT to Hanlan JCT	230
R19TH	Hanlan JCT to Erindale TS	230
R19TH	Erindale TS to Churchill Meadows JCT	230
R19TH	Churchill Meadows JCT to Trafalgar TS	230
R21TH	Richview TS to Tomken JCT	230
R21TH	Tomken JCT to Hanlan JCT	230
R21TH	Hanlan JCT to Erindale TS	230
R21TH	Erindale TS to Churchill Meadows JCT	230
R21TH	Churchill Meadows JCT to Trafalgar TS	230
C18R	Bathurst JCT to Richview TS	230
C20R	Finch JCT to Richview TS	230
C4R	Finch JCT to Richview TS	230
C5R	Leslie TS to Richview TS	230
P21R	Finch JCT to Richview TS	230
P22R	Finch JCT to Richview TS	230
V76R	Westmore JCT to Richview TS	230
V74R	Westmore JCT to Richview TS	230
V72R	Claireville TS to Richview TS	230
V73R	Claireville TS to Richview TS	230
V77R	Claireville TS to Richview TS	230
V79R	Claireville TS to Richview TS	230
M570V	Milton TS to Claireville TS	500
M571	Milton TS to Claireville TS	500
B560V	Milton TS to Claireville TS	500
V586	Milton TS to Claireville TS	500
E8V	Everett Jct to Alliston Jct	500
E9V	Everett Jct to Alliston Jct	500

Table 9: Monitored Autotransformers

Autotransformer	Nominal Voltage (kV)
Trafalgar TS T14	500/230
Trafalgar TS T15	500/230
Claireville TS T13	500/230
Claireville TS T14	500/230
Claireville TS T15	500/230
Claireville TS T16	500/230

Study Results

The data submitted by the connection applicant, that is presented in Appendix B: Data Verification, shows that the impedances of the replacement conductors are not materially different from those of the exiting ones and, therefore, no significant changes in short circuit levels are expected following the incorporation of the project. Table 10 shows a comparison between the loading of the transmission circuits that form part of the FETT interface and are located in the immediate vicinity of the project, before and after the incorporation of the project.

Table 10: Changes in circuit loading

Section	From Bus	To Bus	Line loading with existing parameters (A)	Line loading with new parameters (A)	Difference of line loading from existing to new section (A)	% Difference of line loading from existing to new section*
R14T	Richview TS	Tomken JCT	472.24	476.38	4.14	0.88%
R14T	Tomken JCT	Erindale JCT	599.02	603.54	4.52	0.75%
R14T	Erindale JCT	Trafalgar TS	861.86	866.32	4.46	0.52%
R17T	Richview TS	Tomken JCT	471.35	475.51	4.16	0.88%
R17T	Tomken JCT	Erindale JCT	599.66	604.2	4.54	0.76%
R17T	Erindale JCT	Trafalgar TS	862.28	866.77	4.49	0.52%
R19TH	Richview TS	Tomken JCT	359.75	360.21	0.46	0.13%
R19TH	Tomken JCT	Hanlan JCT	478.91	479.33	0.42	0.09%
R19TH	Hanlan JCT	Erindale JCT	906.98	906.2	-0.78	-0.09%
R19TH	Erindale JCT	Churchill MeadowsJCT	1013.88	1013.14	-0.74	-0.07%
R19TH	Churchill MeadowsJCT	Trafalgar TS	1087.52	1086.88	-0.64	-0.06%
R21TH	Richview TS	Tomken JCT	351.18	351.05	-0.13	-0.04%
R21TH	Tomken JCT	Hanlan JCT	469.89	469.8	-0.09	-0.02%
R21TH	Hanlan JCT	Erindale JCT	912.44	911.47	-0.97	-0.11%
R21TH	Erindale JCT	Churchill MeadowsJCT	1019.78	1018.84	-0.94	-0.09%
R21TH	Churchill MeadowsJCT	Trafalgar TS	1094.2	1093.36	-0.84	-0.08%

Section	From Bus	To Bus	Line loading with existing parameters (A)	Line loading with new parameters (A)	Difference of line loading from existing to new section (A)	% Difference of line loading from existing to new section*
C18R	Bathurst JCT	Richview TS	133.51	134.24	0.73	0.55%
C20R	Finch JCT	Richview TS	209.24	209.24	0	0.00%
C4R	Finch JCT	Richview TS	39.52	40.49	0.97	2.45%**
C5R	Leslie TS	Richview TS	34.11	36.25	2.14	6.27%**
P21R	Finch JCT	Richview TS	72.39	69.79	-2.6	-3.59%**
P22R	Finch JCT	Richview TS	49.79	48.17	-1.62	-3.25%**
V76R	Westmore JCT	Richview TS	358.52	357.12	-1.4	-0.39%
V74R	Westmore JCT	Richview TS	274.85	271.91	-2.94	-1.07%**
V72R	Claireville TS	Richview TS	393.53	394.08	0.55	0.14%
V73R	Claireville TS	Richview TS	385.46	384.03	-1.43	-0.37%
V77R	Claireville TS	Richview TS	305.7	302.73	-2.97	-0.97%
V79R	Claireville TS	Richview TS	310.3	307.78	-2.52	-0.81%
M570V	Milton TS	Claireville TS	1244.2	1242.92	1.28	-0.10%
M571V	Milton TS	Claireville TS	1243.64	1242.36	1.28	-0.10%
B560V	Milton TS	Claireville TS	1225.88	1225.44	0.44	-0.04%
V586M	Milton TS	Claireville TS	332.82	331.22	1.6	-0.48%
E8V	Everett Jct	Alliston Jct	300.26	299.98	0.28	-0.09%
E9V	Everett Jct	Alliston Jct	288.47	288.21	0.26	-0.09%

* Changes are calculated using the formula: (new parameter – old parameter)/old parameter

** The % changes in loading of these circuits is higher than 1% but the change in the loading of these circuits is very low: less than 3 A

Table 11 shows a comparison between transformer loading before and after the incorporation of the project:

Table 11: Changes in autotransformer loading

Transformer	% Difference of transformer loading from existing to new section on the primary side*	% Difference of transformer loading from existing to new section on the secondary side*
Trafalgar TS T14	0.35%	0.30%
Trafalgar TS T15	0.35%	0.30%
Claireville TS T13	-0.19%	-0.15%
Claireville TS T14	-0.17%	-0.14%
Claireville TS T15	-0.13%	-0.10%
Claireville TS T16	-0.13%	0.56%

* Changes are calculated using the formula: (new parameter – old parameter)/old parameter

The changes to equipment loading, presented in Table 10 and Table 11 are not expected to result in any adverse impact on the reliability of the integrated power system.

The connection applicant indicated that the existing protection settings for transmission circuits R14T, R17T, R19TH and R21TH will be changed to maintain the same functionality, zone coverage and clearing time while taking into account for the slightly different impedances of the proposed conductors. As such, the proposed changes to protection settings are not expected to have any adverse impact on the reliability of the integrated power system.

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CUSTOMER IMPACT ASSESSMENT

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Hydro One has completed a Customer Impact Assessment (“CIA”) in accordance with its customer connection procedures, and the results confirm that there are no adverse impacts on transmission customers as a result of this Project. Please refer to **Attachment 1** for the final CIA report prepared by Hydro One.



Customer Impact Assessment
Richview TS x Trafalgar TS –Line Upgrade Project

CIA ID: 2021-03
Revision: Final
Date: May 31st 2021

Issued by: System Planning Division
Hydro One Networks Inc.

Prepared by:

Approved by:

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Disclaimer

This Customer Impact Assessment was prepared based on information available about the proposed transmission line reconductoring, spanning the cities of Mississauga and Toronto. It is intended to highlight significant impacts, if any, to affected transmission customers early in the project development process and thus 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 connection identified in this Customer Impact Assessment. The results of this Customer Impact Assessment and the estimate of the outage requirements are also 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. j

Hydro One Networks shall not be liable to any third party which uses the results of the Customer Impact Assessment under any circumstances whatsoever, for any indirect or consequential damages, loss of profit or revenues, business interruption losses, loss of contract or loss of goodwill, special damages, punitive or exemplary damages, whether any of the said liability, loss or damages, arises in contract, tort or otherwise.

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Customer Impact Assessment

Richview TS x Trafalgar TS Line Upgrade Project

1.0 INTRODUCTION

This Customer Impact Assessment (CIA) study assesses the potential impact of the line conductor upgrades of the Richview TS x Trafalgar TS 230kV transmission circuits on the transmission customers in the South West GTA area.

This study is intended to supplement the IESO System Impact Assessment (SIA) report CAA ID 2020-679 dated April 14, 2021 for the proposed Richview TS to Trafalgar TS Conductor Upgrade project.

In accordance with section 6 of the Ontario Energy Board's Transmission System Code ("TSC"), Hydro One Networks Inc. (Hydro One) is to carry out a Customer Impact Assessment ("CIA") study to assess the impact of the proposed line upgrade on existing transmission customers in the affected area. This assessment does not evaluate the overall impact of the project on the bulk electricity system.

This Customer Impact Assessment (CIA) study report is being issued to all area transmission customers being affected by the proposed work for review and comments.

2.0 BACKGROUND

The Independent Electricity System Operator ("IESO") has identified the need for increased power transfer capability across the "Flow East towards Toronto" ("FETT") transmission interface that delivers electricity from South West Ontario ("SWO") to the Greater Toronto Area ("GTA").

As supply capacity east of the GTA is expected to decline over the next decade due to the retirement of Pickering Generating Station ("GS") and the ongoing nuclear refurbishment outages, the generation short fall will be met with energy supply from SWO and will result in an increase in flow on the FETT interface.

The IESO has advised that the FETT interface capability will need to be increased by 2000 MW and to achieve this the two 230kV double circuit lines R14T/R17T and R19TH /R21TH, between Richview TS and Trafalgar TS, need to be upgraded.

Hydro One's proposed Richview Trafalgar Reconductoring (RTR) Project covers reconductoring of about 22km of 230 kV double circuit line R14T/R17T between Trafalgar TS and Richview TS and about 14km of 230kV double circuit line R19TH/R21TH between Trafalgar TS and Tomken Junction.

Figure 1 shows the sections of circuits R14T/R17T and R19TH/R21TH being replaced.

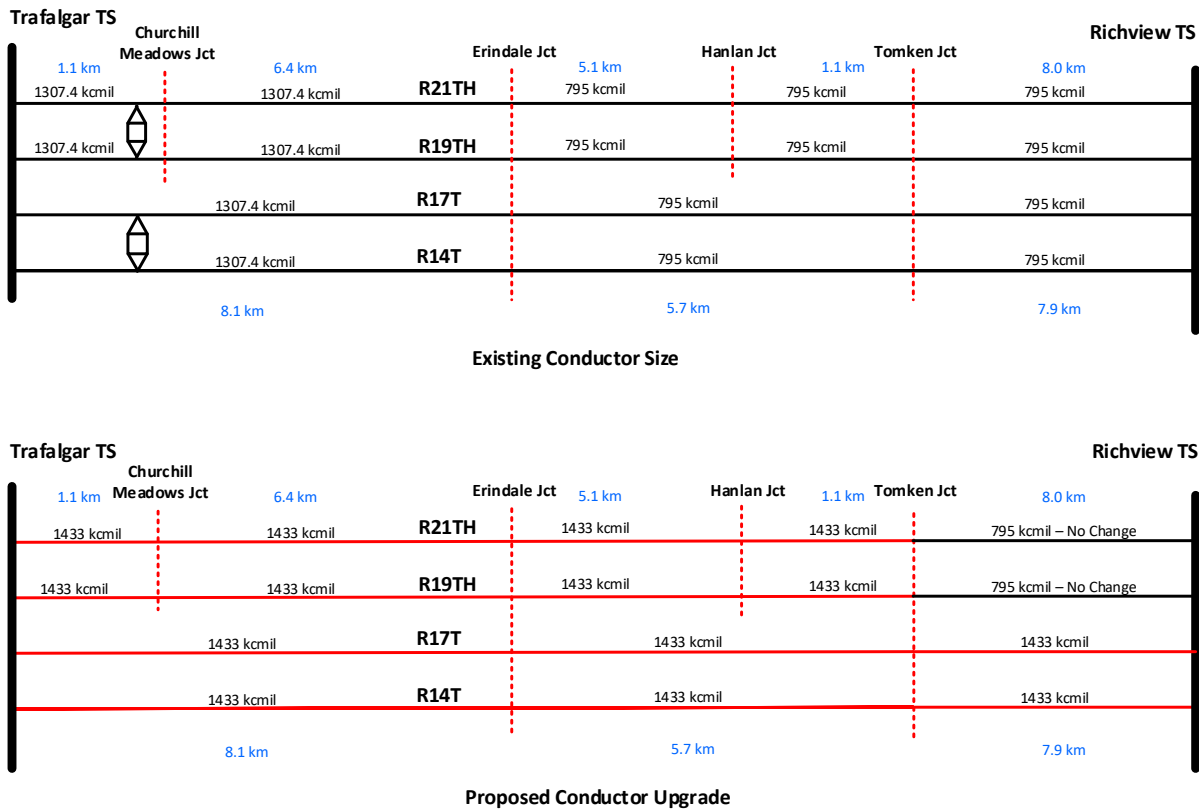


Figure 1 – Proposed Project

The conductor will be upgraded from either 795kcmil ACSR or 1307.4kcmil ACSR to 1433 kcmil ACSS. Table 1 shows the Long Term Emergency (LTE) ampacity ratings for each conductor. The LTE rating is applicable under contingency conditions.

Table 1: LTE Conductor Ratings

Conductor	LTE - Ampacity
795 kcmil ACSR	1090A
1307.4 kcmil ACSR	1460A
1433 kcmil ACSS	2000A

The proposed upgrade project is expected to be in-service by March 31, 2026.

3.0 CUSTOMER LIST

The purpose of the CIA is to assess the impact of the proposed line upgrade on existing transmission customers connected to Hydro One's transmission system on these circuits (R14T/R17T, R19TH/R21TH). The customers within the study scope are listed in Table 2.

Table 2: Connected Customers

Transformer Stations	Customer
Trafalgar TS	Oakville Hydro
Churchill Meadows TS	Alectra Utilities
Erindale TS	Alectra Utilities
Jim Yarrow MTS	Alectra Utilities
Tomken TS	Alectra Utilities
Richview TS	Toronto Hydro Alectra Utilities

4.0 CIA RESULTS

4.1 Load Flow and Short- Circuit Studies

There are no changes to the circuit configuration as a result of this reconductoring project.

The circuits' impedances with the replacement conductors are not materially different from the existing ones and, therefore, there are no significant changes to line flows and short circuit levels following the incorporation of the project.

The short circuit study results, with the new line conductors, are summarized in the Appendix A showing both symmetric and asymmetric (3-cycle) short circuit levels for the local busses. The study assumes maximum contribution from all the planned generation additions. Pre-fault voltage of 250.00 kV at 220 kV stations is assumed. There is minimal impact to the short circuit level in the area, and all HV breakers can withstand the change to the short circuit level.

All area customers are advised to review the short circuit results to ensure that their equipment ratings are adequate.

4.2 Customer Reliability

The proposed transmission reinforcement work will increase supply reliability and adequacy for all area customers connected as a result of the increased transmission capacity of the transmission circuits (R14T/R17T, R19TH/R21TH).

4.3 Preliminary Outage Impact Assessment

A preliminary outage plan associated with the project's construction work has been developed. The detailed outage plan will be identified when final engineering design is available and a detailed construction schedule is established. Whenever possible, the outage plan will include measures for maintaining local distribution load security in consultation with the area LDCs.

5.0 CONCLUSIONS AND RECOMMENDATIONS

This Customer Impact Assessment (CIA) study has reviewed the impact of the conductor upgrade project for the local customers connected to the 230kV circuits R14T/R17T and R19TH/R21TH.

The fault levels at all stations in the area experience no significant change as a result of the project. Customers are requested to review the fault levels provided in Appendix B to ensure to ensure that the capability of their equipment is not exceeded.

The study has confirmed that the proposed project can be incorporated without any adverse impact on Hydro One Transmission customers.

APPENDIX A: SHORT CIRCUIT LEVELS

Bus Name	BASE KV	MAX V (pu)	Breaker Clearing Time	3 Phase Fault		Single Phase Fault		Breaker Rating Sym kA	Breaker Rating Asym kA
				SYM I	ASYM I	SYM I	ASYM I		
TRAFALGAR TS	220	1.136	0.025	65.5	85.9	63.5	85.5	80	96
TRAF DSN T39	220	1.136	0.025	59.7	77.1	56.4	73.3	-	-
TRAF DSN T38	220	1.136	0.025	59.7	77.1	56.5	73.4	-	-
TRAF DSN BY	27.6	1.051	0.067	16.7	18.3	11.7	14.2	31.5	37.8
CHURCH MDR19	220	1.136	0.025	54.7	69.4	48.5	61.1	-	-
CHURCH MDR21	220	1.136	0.025	54.7	69.4	48.5	60.9	-	-
CHURCH MEAD	44	1.045	0.067	15.3	16.9	6.9	8.5	31.5	37.8
ERINDALE R14	220	1.136	0.025	33.3	40.8	25.6	29.2	-	-
ERINDALE R17	220	1.136	0.025	33.3	40.8	25.9	29.4	-	-
ERINDALE R19	220	1.136	0.025	36.8	44.4	30.6	35.9	-	-
ERINDALE R21	220	1.136	0.025	36.7	44.3	30.5	35.2	-	-
ERINDALE E	27.6	1.051	0.067	13.7	15.0	10.9	13.0	31.5	37.8
ERINDALE Q	27.6	1.051	0.067	14.2	15.7	10.6	12.9	31.5	37.8
ERINDALE BJ	44	1.045	0.067	15.2	17.0	14.0	16.6	18.8	20.7
ERINDALE YZ	44	1.045	0.067	14.8	16.6	6.9	8.3	18.8	20.7
J YARROW R19	220	1.136	0.025	27.4	33.5	23.4	26.3	-	-
J YARROW R21	220	1.136	0.025	27.2	33.3	23.2	26.1	-	-
JIM YARROW A	27.6	1.051	0.067	13.7	15.0	10.5	12.7	(1)	
JIM YARROW B	27.6	1.051	0.067	13.8	15.1	10.6	12.8	(1)	
TOMKEN R14T	220	1.136	0.025	34.2	41.6	26.3	29.8	-	-
TOMKEN R17T	220	1.136	0.025	34.4	41.9	26.8	30.3	-	-
TOMKEN R19T	220	1.136	0.025	39.5	46.9	33.8	38.7	-	-
TOMKEN R21T	220	1.136	0.025	39.3	46.7	33.7	38.5	-	-
TOMKEN TS BY	44	1.045	0.067	15.3	16.7	7.0	8.5	18.8	20.7
TOMKEN TS EZ	44	1.045	0.067	14.9	16.6	6.9	8.5	23.0	27.6
RICHVIEW AH2	220	1.136	0.025	63.1	81.4	57.5	73.7	80	104
RICHVIEW AH1	220	1.136	0.025	62.2	79.9	55.5	70.7	80	104
RICHVIEW BY	27.6	1.051	0.067	16.5	18.5	11.7	14.3	18.1	19.2
RICHVIEW E	27.6	1.051	0.067	14.8	15.7	10.8	12.9	29.9	32.8
RICHVIEW J	27.6	1.051	0.067	14.9	15.7	10.9	12.9	29.9	32.8
RICHVIEW Q	27.6	1.051	0.067	13.7	15.6	10.5	12.8	30	33
RICHVIEW Z	27.6	1.051	0.067	13.8	15.7	10.5	12.8	30	33
HURONTARIO19	220	1.136	0.025	32.1	39.4	26.3	29.6	63	81.9
HURONTARIO21	220	1.136	0.025	31.9	39.1	26.0	29.4	63	81.9

Note. 1) LV Breakers owned by Alectra