

Hydro One Networks Inc. 483 Bay Street Toronto, Ontario M5G 2P5

NEEDS ASSESSMENT REPORT

Toronto Region

Date: December 19, 2022

Prepared by: Toronto Region Technical Working Group









Disclaimer

This Needs Assessment Report was prepared for the purpose of identifying potential needs in the Toronto Region and to recommend which need: a) does not require further regional coordination and b) identify needs requiring further assessment and/or regional coordination. The results reported in this Needs Assessment are based on the input and information provided by the Technical Working Group ("TWG") for this region.

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Executive Summary

REGION	Toronto Region (the "Region")			
LEAD	Hydro One Networks Inc. ("Hydro One")			
START DATE	August 23, 2022 END DATE December 19, 2022			

1. INTRODUCTION

The second Regional Planning ("RP") cycle for the Toronto Region was completed in March 2020 with the publication of the Regional Infrastructure Plan ("RIP") report. This is the third RP cycle for this Region, which begins with the Needs Assessment ("NA") phase. The purpose of this NA is to:

- a) Identify any new needs and reaffirm needs identified in the previous RP cycle; and
- b) Recommend which needs:
 - i. require further assessment and regional coordination (and hence, proceed to the next phases of RP); and
 - ii. do not require further regional coordination (i.e., can be addressed directly between Hydro One and the impacted Local Distribution Companies ("LDC") to develop a preferred plan, or no regional investment is required at this time and the need may be reviewed during the next RP cycle.

2. REGIONAL ISSUE/TRIGGER

In accordance with the RP process, the RP cycle should be triggered at least once every five years. Considering these timelines, the third Regional Planning cycle was triggered in August 2022 for the Toronto Region.

3. SCOPE OF NEEDS ASSESSMENT

The scope of the Toronto Region NA includes:

- a) Reaffirm and update needs/plans identified in the previous RP cycle;
- b) Identify any new needs resulting from this assessment;
- c) Recommend which need(s) require further assessment and regional coordination in the next phases of the RP cycle; and
- d) Recommend which needs do not require further regional coordination (i.e., can be addressed directly between Hydro One and the impacted LDC(s) to develop a preferred plan, or no regional investment is required at this time and the need may be reviewed during the next RP cycle).

The Technical Working Group ("TWG") may also identify additional needs during the next phases of the planning process, namely Scoping Assessment ("SA"), Integrated Regional Resource Plan ("IRRP") and RIP, based on updated information available at that time.

The planning horizon for this NA is 10 years.

4. INPUTS/DATA

The TWG representatives from LDCs, the Independent Electricity System Operator ("IESO"), and Hydro One provided input and relevant information for the Toronto Region regarding capacity needs, system reliability needs, operational issues, and major high-voltage ("HV") transmission assets requiring replacement over the planning horizon. The information was based on what was available and provided at the time of the NA, which does not include the impact from the IESO's "Pathways to Decarbonization" report published on December 15, 2022. The electricity demand and new infrastructure need in the longer term could be substantially higher than anticipated and discussed in this report. This will be further assessed in the next phase of this RP cycle.

5. ASSESSMENT METHODOLOGY

The assessment's primary objective is to identify the electrical infrastructure needs in the Region over the study period. The assessment methodology includes a review of planning information such as load forecast, conservation and demand management ("CDM") forecast, available distributed generation ("DG") information, system reliability and operation issues, and major HV transmission assets requiring replacement.

A technical assessment of needs was undertaken based on:

- a) Station capacity and transmission adequacy;
- b) System reliability and any operational concerns;
- c) Major HV transmission equipment requiring replacement with consideration to "right-sizing"; and
- d) Sensitivity analysis to capture uncertainty in the load forecast as well as variability of demand drivers such as electrification. (which does not consider the impact from the "Pathways to Decarbonization" report published by the IESO on December 15, 2022, but will be assessed in the next phase of this RP cycle)

6. NEEDS

Needs that were identified in the last RP cycle with associated projects recently done or currently underway are:

- Second DESN at Horner TS and refurbishment projects at Runnymede TS (T3/T4), Sheppard TS (T3/T4), and Strachan TS (T12) were completed in 2021-2022.
- Copeland MTS phase 2 is expected to be in-service in 2024 to address the station capacity need.
- Bridgman TS transformer replacement (T11/T12/T13/T14) is expected to be done in 2024.
- Fairbank TS transformer replacement (T1/T2/T3/T4) is expected to be completed in 2024.
- Main TS transformer replacement (T3/T4) is expected to be completed in 2024.
- John TS transformer replacement (T5/T6) is expected to be complete in 2025. Transformer T1, T2 and T4 have been replaced in 2019-2021. The condition of transformer T3 and the 115 kV breakers are reviewed and considered in fair condition; no replacement in the near/medium term is needed.
- Circuits C5E/C7E underground cable replacement between Esplanade TS and Terauley TS is underway and expected to be completed in 2026.

Other near/medium-term needs identified in the previous RP cycle and the new near/medium-term needs identified in this NA are:

Identified in the previous RP cycle	Identified in this NA
Identified in the previous RP cycle Line Capacity (Refer to section 7.2 for more details) • Richview to Manby 230 kV Corridor [2026] • Manby to Riverside Jct 115 kV Corridor [2026, with a line upgrade expected by 2028] Transformers / Autotransformers Requiring Replacement (Refer to section 7.1 for more details) • Charles TS: T3/T4 [2026] • Duplex TS: T1/T2 [2026] • Scarboro TS: T23 [2027] • Fairchild TS: T1 [2028] • Bermondsey TS: T3/T4 [2029] • Manby TS: autotransformers T7, T9, and T12, and step-down transformer T13 [2029-2030] • Leslie TS: T1 [2030] Transmission Lines Requiring Replacement (Refer to section 7.1 for more details) • H1L/H3L/H6LC/H8LC: Leaside Jct. to Bloor St. Jct. 115 kV overhead section [2025] • L9C/L12C: Leaside TS to Balfour Jct. 115 kV	 Scarboro TS: T23 [2027] Fairchild TS: T3/T4 [2028] Malvern TS: T3 [2029] Manby TS: T14 [2029] Duplex TS: T3/T4 [2031] Load Restoration (Refer to section 7.4) Loss of C14L/C17L Loss of C18R/P22R

The long-term needs that were identified in the previous RP cycle and this NA are [beyond 2031]:

Identified in the previous RP cycle	Identified in this NA (Potential)
Station Capacity	Station Capacity
• Fairbank TS	Glengrove TS
• Sheppard TS	• Finch TS / Bathurst TS
• Strachan TS	• Warden TS
Basin TS	Line Capacity
Transformation Capacity	• Parkway TS to Richview TS 230 kV Corridor
• Manby W TS	
• Leaside TS	
Line Capacity	
• Leaside TS to Wiltshire TS 115 kV Corridor	

7. **RECOMMENDATIONS**

The TWG's recommendations are as follows:

- a) No further regional coordination is required for the following need:
 - Asset renewal needs for replacing the major HV equipment as listed in the table below. These needs will be addressed directly by Hydro One and THESL to develop a preferred replacement plan giving consideration to "right-sizing";
- b) Further assessment and regional coordination is required in the next phases of the RP cycle to review and/or develop a preferred plan for the follow needs:
 - The line capacity need for the 115 kV corridor between Manby TS and Riverside Jct. Hydro One will initiate the development work for reconductoring the overhead line section; and
 - The load restoration and long-term needs as listed in the following table.

Further Regional Coordination Not Required	Further Regional Coordination Required
 Asset Renewal Needs (Stations): Strachan T14 & T13/T15 Charles TS: T3/T4 Duplex TS: T1/T2 & T3/T4 Basin TS: T3/T5 Scarboro TS: T23 Fairchild TS: T1 & T3/T4 Bermondsey TS: T3/T4 Malvern TS: T3 Manby TS: T7, T9, T12 autotransformers, T13/T14 	 Line Capacity Need: 115 kV Manby TS to Riverside Jct. Corridor Load Restoration: Loss of C14L/C17L Loss of C18R/P22R
 step-down transformer Leslie TS: T1 Asset Renewal Needs (Lines): 115 kV H1L/H3L/H6LC/H8LC: Leaside Jct. to Bloor St. Jct. overhead section 115 kV L9C/L12C: Leaside TS to Balfour Jct. overhead section Line Capacity Need: 230 kV Richview TS to Manby TS Corridor 	 Long-Term Needs: Sheppard TS – Station Capacity Basin TS – Station Capacity Glengrove TS – Station Capacity Finch TS / Bathurst TS – Station Capacity Warden TS – Station Capacity 230/115kV Manby W Autotransformers – Transformation Capacity 230/115kV Leaside TS Autotransformers – Transformation Capacity
Station Capacity Need:Fairbank TSStrachan TS	 230 kV Parkway TS to Richview TS Corridor – Line Capacity 115kV Leaside TS to Wiltshire TS Corridor – Line Capacity

This NA assessment does not include or consider the impact from the IESO's "Pathways to Decarbonization" report published on December 15, 2022. The electricity demand and new infrastructure need in the longer term could be substantially higher than anticipated and discussed in this report. The TWG recommends that this be assessed in the next phase of this RP cycle.

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1 INTRODUCTION

The second cycle of the Regional Planning ("RP") process for the Toronto Region was completed in March 2020 with the publication of the Regional Infrastructure Plan ("RIP") report.

The purpose of this Needs Assessment ("NA") is to identify new needs in the region, reaffirm and update needs identified in the previous Toronto RP cycle, and recommend which needs require further assessment and regional coordination and which do not.

This report was prepared by the Toronto Region Technical Working Group ("TWG"), led by Hydro One Networks Inc. Participants of the TWG are listed below in Table 1. The report presents the results of the assessment based on information provided by the Hydro One, the Local Distribution Companies ("LDC") and the Independent Electricity System Operator ("IESO").

Table 1: Toronto Region TWG Participants

Company	
Alectra Utilities Corporation	
Elexicon Energy Inc.	
Hydro One Networks Inc. (Distribution)	
Independent Electricity System Operator ("IESO")	
Toronto Hydro-Electric System Limited ("THESL")	
Hydro One Networks Inc. (Lead Transmitter)	

2 **REGIONAL ISSUE/TRIGGER**

In accordance with the RP process, the RP cycle should be triggered at least once every five years. Considering these timelines, the third RP cycle was triggered for the Toronto Region.

3 SCOPE OF NEEDS ASSESSMENT

The scope of this NA covers the Toronto Region and includes:

- Reaffirm and update needs/plans identified in the previous RP cycle;
- Identify any new needs resulting from this assessment;
- Recommend which need(s) require further assessment and regional coordination in the next phases of the RP cycle; and

• Recommend which need(s) that do not require further regional coordination (i.e. can be addressed directly between Hydro One and the impacted LDC(s) to develop a preferred plan, or no regional investment is required at this time and the need may be reviewed during the next RP cycle).

The TWG may identify additional needs during the next phases of the RP process, namely Scoping Assessment ("SA"), Integrated Regional Resource Plan ("IRRP"), and/or RIP based on updated information available at that time.

4 **REGIONAL DESCRIPTION AND CONNECTION CONFIGURATION**

The Toronto Region covers the area roughly bordered geographically by Lake Ontario on the south, Steeles Avenue on the north, Highway 427 on the west and Regional Road 30 on the east. It includes the City of Toronto, which is the largest City in Canada and the fourth largest in North America. Please see Figure 1 for the Toronto Region map. Electrical supply to this Region is provided by thirty-five 230kV and 115kV transmission and step-down stations as shown in Figure 2. The eastern, northern, and western parts of the Region are supplied by seventeen 230/27.6kV step-down transformer stations. The central area is supplied by two 230/115kV autotransformer stations (Leaside TS and Manby TS) and sixteen 115/13.8kV and two 115/27.6kV step-down transformer stations. The region is also supplied locally by Portlands Energy Centre, a 550 MW combined-cycle power generating station. The sum of 2021 non-coincident summer station peak load of the Region was about 4,850 MW.

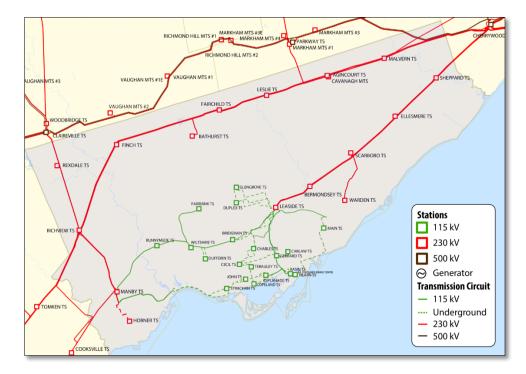


Figure 1: Toronto Region Map

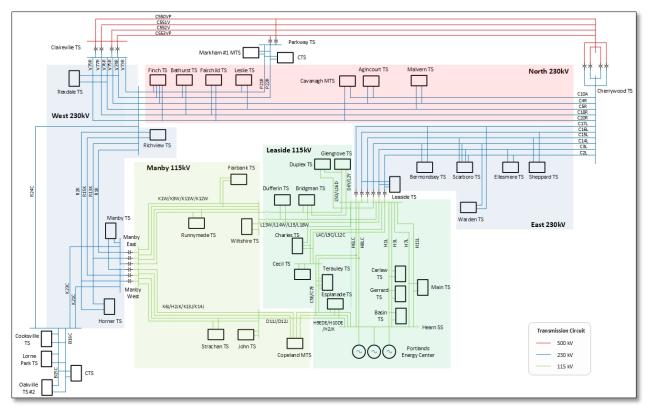


Figure 2: Toronto Region – Single Line Diagram

5 INPUTS AND DATA

TWG participants, including representatives from LDCs, IESO, and Hydro One provided information and input for the Toronto Region NA. The information provided includes the following:

- Load Forecast for all supply stations in the Toronto Region;
- Known capacity and system reliability needs, operational issues, and/or major HV transmission equipment requiring replacement over the study period; and
- Planned/foreseen transmission and distribution investments that are relevant to the Toronto RP process.

The information provided was the most recent information available and provided at the time of the NA phase. With respect to the load forecast information, the OEB Regional Planning Process Advisory Group (RPPAG) recently published a document called "Load Forecast Guideline for Ontario" in October 2022. The objective of this document is to provide guidance to the TWG in the development of the load forecasts used in the various phases of the RP process with a focus on the NA and the IRRP. One of the inputs into the LDC's load forecast that is called for in this guideline is information from Municipal Energy Plans (MEP) and/or Community Energy Plans (CEP) (in cases where it has been produced by the municipality and the information can be translated by the LDC into the impact on peak demand). Accordingly, the OEB

RPPAG also recently developed a guideline called "Improving the Electricity Planning Process in Ontario: Enhanced Coordination between Municipalities and Entities in the Electricity Sector", which lists the key MEP/CEP outputs to improve LDC load forecasts going forward. THESL has been closely coordinating with developers, provincial agencies and the City of Toronto on energy plans impacting various sections of the grid across the Toronto region. This NA report is recommending that further engagement be undertaken during the next phase of the RP cycle.

Also, it is important to be noted that, the IESO has just published the "Pathways to Decarbonization" on December 15, 2022, which evaluates a moratorium on the procurement of new natural gas generating stations in Ontario and develops an achievable pathway to decarbonization in the electricity system. It recommends that development work for priority transmission investments be identified to support decarbonization in the RP process. With this increasing focus on decarbonization and electrification, the electricity demand and new infrastructure need in the longer term could be substantially higher than anticipated and discussed in this NA report. The TWG recommends that the "Pathways to Decarbonization" report and its subsequent impact on the need and/or the timing for additional electrical supply facilities in the Toronto Region be considered and assessed in the next phase of this RP cycle.

6 ASSESSMENT METHODOLOGY

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

Information gathering included:

- Load forecast: The LDCs provided their load forecast for all the stations supplying their loads in the Toronto Region for the 10-year study period. The IESO provided a Conservation and Demand Management ("CDM") forecast and Distributed Generation ("DG") contract information for the Toronto Region. The region's extreme summer non-coincident peak gross load forecast for each station were prepared by applying the growth rates from the LDC load forecast to the actual 2021 summer peak extreme weather corrected loads. The extreme summer weather correction factor was provided by Hydro One. The net extreme weather summer load forecast was produced by reducing the gross load forecast for each station by the percentage CDM from the IESO for that station. It is to be noted that even though the IESO did not have information on new and contracted DG coming into service within the planning horizon, THESL has assumed the existing DGs are to remain inservice in the base year when developing their load forecasts for the individual stations in the Toronto region are given in Appendices A-1 and A-2;
- Relevant information regarding system reliability and operational issues in the region;
- List of major HV transmission equipment planned and/or identified to be replaced based on asset condition assessment, and relevant for RP purposes. The scope of equipment considered is given in Section 7.1.

A technical assessment of needs was undertaken based on:

- Station capacity and transmission adequacy assessment;
- System reliability and operational considerations;
- Asset renewal for major HV transmission equipment requiring replacement with consideration to "right-sizing"; and
- Sensitivity analysis to capture uncertainty in the load forecast (which does not consider the impact from the "Pathways to Decarbonization" report published by the IESO on December 15, 2022, but will be assessed in the next phase of this RP cycle).

The following other assumptions are made in this report.

- The study period for this NA is 2022-2031.
- Transmission system adequacy is assessed by using coincident peak loads in the area.
- Station capacity adequacy is assessed by comparing the non-coincident peak load with the station's normal planning supply capacity, assuming a 90% lagging power factor for stations having no low-voltage (LV) capacitor banks and 95% lagging power factor for stations having LV capacitor banks.
- Normal planning supply capacity for transformer stations is determined by the Hydro One summer 10-Day Limited Time Rating (LTR) of a single transformer at that station.
- Adequacy assessment is conducted as per Ontario Resource Transmission Assessment Criteria (ORTAC).

7 **NEEDS**

This section identifies any new needs in the Toronto Region, and reaffirms and provides an update on the near, medium, and long-term needs already identified in the previous RIP.

Needs that were identified in the previous RP cycle with associated projects recently completed or currently underway were reaffirmed and are briefly described below with relevant updates. These are not further discussed in later sections of this report.

- Second DESN at Horner TS and refurbishment projects at Runnymede TS (T3/T4), Sheppard TS (T3/T4), and Strachan TS (T12) were completed in 2021-2022.
- Copeland MTS phase 2 is expected to be in-service in 2024 to address the station capacity need.
- Bridgman TS transformer replacement (T11/T12/T13/T14) is expected to be completed in 2024.
- Fairbank TS transformer replacement (T1/T2/T3/T4) is expected to be completed in 2024.
- Main TS transformer replacement (T3/T4) is expected to be completed in 2024.
- John TS transformer replacement (T5/T6) is expected to be completed in 2025. Transformer T1, T2 and T4 were replaced in 2019-2021. Based on asset condition assessment, transformer T3 and the 115 kV breakers are not recommended for replacement in the near/medium term.
- Circuits C5E/C7E underground cable replacement between Esplanade TS and Terauley TS is underway and expected to be completed in 2026. A 2.5 km tunnel between Esplanade TS and Terauley TS is to be built.

The planned in-service year for the above underway projects is tentative and is subject to change.

All the other near/medium-term needs and long-term needs are summarized in Table 2 and Table 3 respectively. The load restoration need was also reviewed and is discussed in Section 7.4.

Type of Needs	Near/Medium-Term Needs	NA Section	Timing	Recommended Plan / Status	RIP Report Section
Line Capacity	Richview TS to Manby TS 230 kV Corridor	7.2.1	2026	Project in estimate phase.	7.5
Liı Capa	Manby TS to Riverside Jct 115 kV Corridor	7.2.2	2028 (3)	Timing is advanced to 2026.	7.9.5
	Strachan TS: Transformers T14 & T13/T15	7.1.1	2025 2031	 T14 requires replacement with higher rated unit. T13/T15 need replacement with higher rated unit in medium term. 	NEW
	Charles TS: Transformer T3/T4	7.1.2	2026	T3/T4 require replacement with higher rated units.	2 nd cycle NA
	Duplex TS: Transformers T1/T2 & T3/T4	7.1.3	2026 2031	• T1/T2 require replacement with higher rated units.	2 nd cycle NA
(5)	13/14		2031	• T3/T4 need replacement with higher rated unit in medium term.	NEW
tions)	Basin TS: Transformers T3/T5	7.1.4	2027	T3/T5 require replacement with higher rated units.	NEW / 7.9.4
Asset Renewal Needs (Stations) ⁽²⁾	Scarboro TS: Transformer T23	7.1.5	2027	T23 requires replacement with like- for-like unit.	NEW
	Fairchild TS: Transformer T1 & T3/T4	7.1.6	2028	T1 and T3/T4 require replacement with like-for-like units.	2 nd cycle NA (T1), NEW (T3/T4)
t Ren	Bermondsey TS: Transformers T3/T4	7.1.7	2029	T3/T4 require replacement with like- for-like units.	7.7
Asse	Malvern TS: Transformer T3	7.1.8	2029	T3 requires replacement with like- for-like unit.	NEW
	Manby TS: Autotransformers (T7, T9, T12), Step-down transformer (T13/T14)	7.1.9	2029 2030	 T13/T14 need replacement with similar unit per current standard. T7/T9/T12 need replacement with similar unit per current standard. 230 kV breakers are in fair condition; will not be replaced in the near term. 	7.6, NEW (T14)
	Leslie TS: Transformer T1	7.1.10	2030	T1 requires replacement with similar unit per current standard.	2 nd cycle NA
Asset Renewal Needs (Lines) ⁽²⁾	H1L/H3L/H6LC/H8LC: Leaside Jct. to Bloor St. Jct. overhead section	7.1.11	2025	Development and estimate work to initiate in 2023.	7.2
	L9C/L12C: Leaside TS to Balfour Jct. overhead section	7.1.12	2027	Development and estimate work to initiate in 2023.	7.3
			1		L

 Table 2: Near/Medium Term Needs Identified in Previous RIP ⁽¹⁾ and/or this NA

(1) Includes needs identified in the previous RIP that do not have projects in execution yet.

(2) The replacement/refurbishment scope, timing, and prioritization are based on the best available information at the time, and are subject to change.

(3) Earliest in-service of reconductoring the overhead line K13J/K14J is expected to be around 2028 if the development and estimate work is to be initiated in 2023.

Type of Needs	Long-Term Needs	NA Section	Timing (2 nd Cycle RIP)	Description / Update	RIP Report Section
apacity	Fairbank TS	7.3.1	2030-2035	New Runnymede DESN and the underway transformers replacement at Fairbank TS will provide relief.	7.9.1
	Sheppard TS	7.3.2	2030-2035	Consideration may be given to utilizing the idle winding on transformers T1/T2.	7.9.2
	Strachan TS	7.3.3	2030-2035	Transformer T12 has been replaced with a 60/100 MVA unit. Station capacity will increase after T14 is replaced by 2025 and T13/T15 are replaced in the medium term.	7.9.3
	Basin TS	7.3.4	2030-2035	Station capacity will increase when transformers T3/T5 will be replaced with 60/100 MVA units by 2027.	7.9.4
Station Capacity	Glengrove TS	7.3.5	Beyond 2031	Glengrove TS is almost at capacity in 2031. The transformer replacement with higher rated units at Duplex TS will provide relief.	NEW
	Finch TS / Bathurst TS	7.3.6	Beyond 2031	Total load at Finch TS and Bathurst TS is almost reaching the combined station capacity in 2031. To be managed by load transfer between DESNs and nearby stations at distribution level in the near/medium term.	NEW
	Warden TS	7.3.7	Beyond 2031	Load demand near Warden TS exceeds its capacity from 2024. To be managed by load transfer to Scarboro TS at distribution level in the near/medium term.	NEW
Transformation Capacity	Manby W TS Autotransformers (T12)	7.3.8	2030-2035	Restricted by the lowest rated autotransformer unit T12. This unit is planned to be replaced by 2030 and will provide relief to this constraint.	7.9.6
	Leaside TS Autotransformers (T16)	7.3.9	2035-2040	Autotransformer T16 is potentially overloaded following circuit C14L, C15L, or C17L contingency, assuming that two of the three units at Portlands Energy Centre GS are out-of- service, and total plant generation is 160 MW. Post-contingency control action is currently available to resolve this issue by transferring Dufferin TS to Manby supply if needed.	7.9.8
Line Capacity	230 kV Parkway TS to Richview TS Corridor	7.3.10	Beyond 2031	Some sections of the 230 kV circuits P21R and P22R near the Parkway TS end are approaching limit by 2031. The baseline forecast does not reflect several customers that show interest in connecting new load near the Steeles / Hwy 404 area. This need may arise sooner.	NEW
	115 kV Leaside TS to Wiltshire TS Corridor		2035-2040	The Bayview Jct. x Balfour Jct. underground section of the 115 kV circuit L15 is potentially overloaded in the long term.	7.9.7

Table 3: Long-Term Needs Identified in Previous RIP and/or this NA

7.1 Asset Renewal Needs for Major HV Transmission Equipment

In addition to the previously identified asset renewal needs from the second RP cycle, Hydro One and the TWG have identified some new major HV equipment replacement needs over the next 10 years in the Toronto Region, as shown in Table 4 below. These needs are determined by asset condition assessment, which is based on a range of considerations such as equipment deterioration; technical obsolescence due to outdated design; lack of spare parts availability or manufacturer support; and/or potential health and safety hazards, etc. The scope, timing, and prioritization of these replacement needs are based on the current available information and are subject to change.

The major HV transmission equipment considered in this assessment includes the following:

- 230 / 115 kV autotransformers;
- 230 kV and 115 kV load serving step-down transformers;
- 230 kV and 115 kV breakers where:
 - Replacement of six breakers or more than 50% of station breakers, the lesser of the two; and
- 230 kV and 115 kV transmission lines requiring refurbishment where:
 - Leave to Construct (i.e., Section 92) approval is required for any alternatives to like-for-like.

The asset renewal assessment considers options for "right-sizing" the equipment such as:

- 1. Maintaining the status quo;
- 2. Replacing equipment with similar equipment with lower ratings and built to current standards;
- 3. Replacing equipment with similar equipment with lower ratings and built to current standards by transferring some load to other existing facilities;
- 4. Eliminating equipment by transferring all the load to other existing facilities;
- 5. Replacing equipment with similar equipment and built to current standards (i.e., "like-for-like" replacement); and
- 6. Replacing equipment with higher ratings and built to current standards.

Table 4: New Major HV	Transmission Equipment Replacement Needs Identified in this NA
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Station	Timing	Need Description
Strachan TS: Transformers T14 &	2025*	T14 requires replacement in the medium term with higher rated unit.
T13/T15	2031	T13/T15 need replacement in the medium term with higher rated units.
Basin TS: Transformers T3/T5	2027	T3/T5 require replacement in the near term with higher rated units.
Scarboro TS: Transformer T23	2027	T23 requires replacement in the near term with like-for-like unit.
Fairchild TS: Transformer T3/T4	2028	T3 requires replacement in the medium term with like-for-like unit.
Malvern TS: Transformer T3	2029	T3 requires replacement in the medium term with like-for-like unit.
Manby TS: Transformer T14	2029	T14 need replacement in the medium term with similar unit per current
		standard.
Duplex TS: Transformers T3/T4	2031	T_3/T_4 require replacement in the medium term with higher rated units

Duplex TS: Transformers T3/T4 | 2031 | T3/T4 require replacement in the medium term with higher rated units. * Need date is advanced to support planned work at the other DESN in Strachan TS. The newly identified major HV transmission equipment replacement need in this NA will be discussed in detail in the following subsections. The previously identified asset renewal needs from the last RP cycle, for which project execution has not yet been initiated, will also be reviewed and discussed in the following. The TWG recommends continuation of addressing all the identified needs for the Toronto Region as per the recommended plan described in each subsection. THESL has also confirmed that there is no plan to replace any major HV transmission equipment under its under ownership over the study period.

For the 115-13.8 kV 45/75 MVA step-down transformers where replacement is required, and upsizing is recommended, the largest standard size (60/100MVA) units for this voltage class will be used. The 115-13.8 kV 60/100 MVA transformer has two secondary windings and each winding has an LTR of 72 MVA which matches the 3000 A or 72 MVA metal clad switchgear that THESL has standardized on and used at 13.8 kV. Even if a larger custom size transformer is procured, no additional station capacity will be provided as it is limited by the metal clad switchgear. The estimated incremental cost of upsizing a 45/75 MVA unit to a 60/100 MVA unit is approximately \$300k based on current dollars.

7.1.1 Strachan TS

Strachan TS comprises two DESN units, T12/T14 (T12 replaced in 2022: 60/100 MVA; T14: 45/75 MVA) and T13/T15 (45/75 MVA), having a summer 10-Day LTR of 171 MW. The station's 2021 actual non-coincident summer peak load was about 135 MW and is forecasted to be approximately 140 MW (net adjusted for extreme weather) in 2031.

Transformer T14 is currently about 47 years old and requires replacement in the medium term based on asset condition assessment. It is planned to replace it with a 60/100MVA unit as the companion transformer T12 was recently replaced with a 60/100 MVA unit thereby increasing the station capacity. Transformers T13 and T15 are currently about 40 years old and will also require replacement in the medium term based on their condition. The station capacity will be further increased after they are replaced with 60/100 MVA units. This will provide the additional capacity required to support the transformers and switchgear replacement work planned for Strachan TS in the medium term and accommodate the long-term growth and development need anticipated in the area subsequent to the Ontario Line subway project. Replacing the transformers with similar size equipment is not recommended since upgrading later within the lifetime of the transformer due to eventual load growth will be significantly more costly. It should also be noted that increasing capacity, as opposed to maintaining it, is a more resilient option as it provides additional flexibility during emergency conditions or any planned outages through load transfers. With new T12 installed this year, replacing the remaining three transformers with 60/100 MVA units will provide an additional station capacity of approximately 98 MVA at Strachan TS.

Based on the above, the TWG recommends that transformers T14, T13 and T15 be replaced with 60/100MVA units. Hydro One and THESL will coordinate the replacement plan for these transformers. The planned in-service date is 2025 for T14 and 2031 for T13 and T15.

7.1.2 Charles TS

Charles TS comprises two DESN units, T1/T2 (60/100 MVA) and T3/T4 (45/75 MVA), having a summer 10-Day LTR of 211 MW. The station's 2021 actual non-coincident summer peak load was about 127 MW and is forecasted to be approximately 165 MW (net adjusted for extreme weather) in 2031. Transformers T3 and T4 are currently about 55 years old and require replacement based on asset condition assessment.

The load at Charles TS is forecasted to be almost 80% of its LTR in the medium term. The load at three of the closest stations, Bridgman TS, Cecil TS and Terauley TS, is also forecasted to be about 80%, 65%, and 80% in the medium term.

As discussed in the 2nd cycle NA, the TWG recommends that transformer T3 and T4 be replaced with 60/100MVA units because this is the most cost-effective option that addresses the replacement need and maintains reliable long-term supply to the existing and potential customers in the area. Hydro One and THESL are coordinating this replacement work and the planned in-service date is 2026.

7.1.3 Duplex TS

Duplex TS comprises two DESN units, T1/T2 (45/75 MVA) and T3/T4 (45/75 MVA), having a summer 10-Day LTR of 128 MW. The station's 2021 actual non-coincident summer peak load was about 88 MW and is forecasted to be approximately 112 MW (net adjusted for extreme weather) in 2031.

Transformers T1 and T2 are currently about 54 years old and require replacement in the near term based on asset condition assessment. As discussed in the second cycle NA, replacing T1/T2 with 60/100 MVA units is recommended to allow for effective planning for long-term electricity needs, reliability and system resiliency. The forecast developed in this NA reaffirms this recommendation as the load at Duplex TS and its nearby stations Bridgman TS and Glengrove TS are to be over 85%, 80% and 95% of their station LTR respectively in 2031.

Transformer T3 and T4 are currently about 46-48 years old and require replacement in the medium term based on asset condition assessment. With the same reasons discussed above and the growing demand in the area, the TWG recommends that these transformers be replaced with 60/100 MVA units.

Hydro One and THESL will coordinate the replacement plan for transformers T1/T2 and T3/T4. The current planned in-service dates are 2026 and 2031 respectively.

7.1.4 Basin TS

Basin TS comprises one DESN unit, T3/T5 (45/75 MVA), having a summer 10-Day LTR of 88 MW. The station's 2021 actual non-coincident summer peak load was about 57 MW and is forecasted to be approximately 85 MW (net adjusted for extreme weather) in 2031.

Transformers T3 and T5 are currently about 39 years old and require replacement in the near term based on asset condition assessment. The load at Basin TS is forecasted to be over 95% of its station LTR in 2031.

The load at its nearby stations Carlaw TS, Gerrard TS and Esplanade TS is also forecasted to be over 70-85% of their station LTR by 2031.

The City of Toronto is planning to re-develop the East Harbour land which is located in the Lakeshore and Don Roadway area in the near and medium term, as well as the Port Lands area in the longer term. These areas may see additional load in the longer term, beyond what is currently forecast in this NA. The scale and timing of additional load will depend upon the City's plan. However, the City's current re-development plans may impact the continued operation of Basin TS and several high voltage lines in their current locations in the Port Lands area. If implemented, this would significantly impact both Hydro One infrastructure and THESL infrastructure within and outside of Basin TS. No potential sites for a replacement transformer station or high voltage line routes have been identified by the City at this time. Hydro One and THESL have requested the City to revise its plans to avoid the conflicts with Basin TS and high voltage lines, and joined others in a legal appeal of the City's land plans. In December 2020, the appeal was settled provided that all parties will continue to reassess different options with and without the relocation or reconfiguration of the electricity infrastructure in the Port Lands area. There is no update or change in status at this time, but Hydro One and THESL will provide updates to the TWG as information becomes available.

Based on asset condition assessment of the existing transformers at Basin TS, the TWG recommends that transformers T3/T5 be replaced with 60/100 MVA units to address the replacement need and avoid any extended forced outages due to potential failure of these existing transformers. This will also provide an additional station capacity of approximately 46 MVA at Basin TS to help accommodate expected load growth in this area. Hydro One and THESL coordinate the replacement work.

The TWG also recommends that the long-term supply need in the Basin / Port Lands area be reviewed as part of the next phase in the RP process because of the uncertainty associated with the long-term growth plans as well as the potential impacts on the electricity infrastructure in this area resulting from the City's redevelopment plans. This is consistent with the finding and the recommendation from the previous RP cycle and as discussed in Section 7.3.4 of this report.

7.1.5 Scarboro TS

Scarboro TS comprises two DESN units, T21/T22 (75/125 MVA) and T23/T24 (75/125 MVA), having a summer 10-Day LTR of 340 MW. The station's 2021 actual non-coincident summer peak load was about 217 MW and is forecasted to be approximately 257 MW (net adjusted for extreme weather) in 2031.

Transformer T23 is currently about 48 years old and require replacement in the near term based on asset condition assessment. The load at Scarboro TS is forecasted to be over 75% of its station LTR in 2031. Its nearby stations Warden TS is forecasted to exceed its station capacity in the near term and need relief by transferring load to Scarboro TS. The load at other closest stations Bermondsey TS and Ellesmere TS is also forecasted to be about 80% and 85% of their station LTR by 2031.

Downsizing capacity today and then later upgrading within the lifetime of the transformer due to eventual load growth will be significantly costlier. It should also be noted that maintaining capacity, as opposed to

downsizing, is a more resilient option as it provides additional flexibility during emergency conditions or any planned outages through load transfers. Therefore, downsizing T23 is not a viable option. Upgrading the transformer is also not an option since it is already at the maximum standard size.

The TWG has recommended that transformer T23 be replaced with the same type and size unit (75/125 MVA). Hydro One and THESL will coordinate the replacement plan for the transformer and the planned in-service date is 2027.

7.1.6 Fairchild TS

Fairchild TS comprises two DESN units, T1/T2 (75/125 MVA) and T3/T4 (75/125 MVA), having a summer 10-Day LTR of 346 MW. The station's 2021 actual non-coincident summer peak load was about 216 MW and is forecasted to be approximately 243 MW (net adjusted for extreme weather) in 2031. Transformers T1 is 52 years old but was rebuilt 36 years ago. The companion DESN transformer T2 failed and was replaced under emergency in 2017 with a similar 75/125 MVA unit. Transformers T3 and T4 in the other DESN are 39 years old. Transformers T1, T3 and T4 require replacement in the medium term based on asset condition assessment.

The load at Fairchild TS is forecasted to be over 70% of its LTR in the medium term. The load at the two closest stations, Bathurst TS and Leslie TS, is also forecasted to be about 95% and 90% of their respective LTR's in the medium term. Downsizing capacity today and then later upgrading within the lifetime of the transformer due to eventual load growth will be significantly costlier. It should also be noted that maintaining capacity, as opposed to downsizing, is a more resilient option as it provides additional flexibility during emergency conditions or any planned outages through load transfers. Therefore, downsizing the transformers at Fairchild TS and consolidating load within the station and/or with area stations is not a viable option given medium term load growth at these stations. Upgrading the transformers is also not an option since they are already at the maximum standard size.

Based on the above, the TWG recommends that transformers T1, T3 and T4 be replaced like-for-like. Hydro One and THESL will coordinate the replacement plan for these transformers. The planned in-service date is 2028.

7.1.7 Bermondsey TS

Bermondsey TS comprises two DESN units, T1/T2 (75/125MVA) and T3/T4 (75/125 MVA), having a summer 10-Day LTR of 348 MW. The station's 2021 actual non-coincident summer peak load was about 153 MW and is forecasted to increase significantly in the near term due to new load customers in the area. The load is forecasted to be approximately 275 MW (net adjusted for extreme weather) in 2031. Transformers T3 and T4 are currently about 57 years old and require replacement in the near term based on asset condition assessment.

The load at Bermondsey TS is forecasted to be almost 80% of its LTR in the medium term. The load at the three closest stations, Scarboro TS, Warden TS, and Leaside TS is forecasted to be over 75%, 100%¹, and 67% respectively of their LTR's in the medium term.

As evaluated in the 2nd cycle RIP and reaffirmed in this NA, transformer T3 and T4 are to be replaced with similar type and size equipment as per current standard because this is the most cost effective option that addresses the replacement need and maintains reliable long-term supply to the customers in the area. The planned in-service date of this refurbishment work is 2029.

7.1.8 Malvern TS

Malvern TS comprises one DESN unit, T3/T4 (75/125 MVA), having a summer 10-Day LTR of 176 MW. The station's 2021 actual non-coincident summer peak load was about 110 MW and is forecasted to be approximately 119 MW (net adjusted for extreme weather) in 2031. Transformers T3 is currently 36 years old and requires replacement in the medium term based on asset condition assessment.

The load at Malvern TS is forecasted to be almost 70% of its LTR in the medium term. The load at the three closest stations, Agincourt TS, Cavanagh MTS, and Sheppard TS is forecasted to be over 60%, 90%, and 90% respectively of their LTR's in the medium term. Downsizing capacity today and then later upgrading within the lifetime of the transformer due to eventual load growth will be significantly costlier. It should also be noted that maintaining capacity, as opposed to downsizing, is a more resilient option as it provides additional flexibility during emergency conditions or any planned outages through load transfers. Therefore, downsizing the transformer at Malvern TS and consolidating load within the station and/or with area stations is not a viable option given medium term load growth at these stations.

Based on the above, the TWG recommends that transformer T3 be replaced with the same type and size unit (75/125 MVA). Hydro One and THESL will coordinate the replacement plan for this transformer. The planned in-service date is 2029.

7.1.9 Manby TS

Manby TS is a major bulk electric switching and autotransformer station in the Toronto region. Station facilities include the Manby West and Manby East 230 kV and 115 kV switchyards, six 230/115 kV autotransformers (T1, T2, T7, T8, T9, T12), and six 230/27.6 kV step-down transformers supplying three DESNs (T3/T4, T5/T6, T13/T14).

Three of the autotransformers, T7, T9, and T12, and two of the step-down transformers, T13 and T14, are close to 55 years old and require replacement in the medium term based on asset condition assessment. It is to be noted that T14 was not identified as a candidate for replacement in the previous RP cycle. The autotransformers continue to be critical to the load supply to the downtown and west Toronto area and will

¹ The net demand at Warden TS exceeds its station LTR by 2024. THESL will manage the station overload by transferring some load to Scarboro TS in the near/medium term.

be replaced with similar 250 MVA units, consistent with recommendations from previous RP cycle. The expected in-service date for the autotransformer replacement is 2030.

The total summer 10-Day LTR of the six step-down transformers is 226 MW. The station's 2021 actual non-coincident summer peak load was about 237 MW which exceeds the station capacity and will be relieved in the near and medium term by transferring load to the second DESN at Horner TS recently built. The total DESN load at Manby TS, after the load transfer, is forecasted to be approximately 204 MW (net adjusted for extreme weather) in 2031, i.e. over 90% of its LTR in the medium term. Therefore, the TWG recommends transformers T13 and T14 (56/93 MVA units, non-standard size) be replaced with the current standard size units (75/125 MVA units) to address the replacement need and maintain reliable long-term supply to the customers in the area. This will potentially increase the station LTR by approximately 60 MVA. Hydro One and THESL will coordinate the replacement plan for these transformers. The planned in-service date of this refurbishment work is 2029.

Previously, the 230 kV oil breakers were considered as candidates for replacement. Since then, the condition of these breakers has been reviewed and based on this assessment, they are not required for replacement in the near or medium term. Hydro One will continue to monitor the condition of these breakers and coordinate the future replacement plan with the phase 2 work of the Richview TS x Manby TS 230 kV Corridor Upgrade project as described in Section 7.2.1 of this report. Updates will be provided to the TWG in the next RP cycle as required.

7.1.10 Leslie TS

Leslie TS comprises two DESN units, T1/T2 (75/125 MVA) and T3/T4 (75/125 MVA), having a summer 10-Day LTR of 323 MW. The station's 2021 actual non-coincident summer peak load was about 221 MW and is forecasted to be approximately 249 MW (net adjusted for extreme weather) in 2031. Transformer T1 is currently about 59 years old and require replacement based on asset condition assessment. The companion DESN transformer T2 is currently 25 years old and does not require replacement in the near or medium term.

It should be noted that transformers T1 and T2 are non-standard units with dual LV voltages (230-27.6-13.8 kV 75/125 MVA units). The 13.8 kV load that are currently supplied from Leslie TS will be diminished and the 13.8 kV supply will not be needed from Leslie TS. Excluding the capacity for the 13.8kV winding, the total station LTR for the 27.6kV load is about 280 MW. The 27.6kV load at Leslie TS will be at almost 90% of its LTR in the medium term. The load at the three closest stations, Fairchild TS, Cavanagh MTS, and Agincourt TS, is also forecasted to be over 70%, 90%, and 60% respectively of their LTR's in the medium term. THESL is also anticipating additional new load connection in the longer term at Leslie TS and Agincourt TS.

Based on the above and consistent with the recommendation from the last NA, the TWG recommends that transformer T1 be replaced with a standard unit of same size without dual LV voltages (i.e. a 230-27.6-27.6 kV 75/125 MVA unit). Hydro One and THESL will coordinate the replacement plan for this transformer. When more capacity is required at Leslie TS, the companion transformer T2 can be replaced with the same

230-27.6-27.6 kV 75/125 MVA unit to provide an increase of approximately 70 MVA for the 27.6 kV supply capacity. The planned in-service date for transformer T1 is 2030.

7.1.11 Overhead Transmission Line H1L/H3L/H6LC/H8LC

The 115 kV circuits H1L/H3L/H6LC/H8LC provide connections between Leaside TS, Hearn SS, and Cecil TS, and supply transformer stations in the eastern part of central Toronto including Gerrard TS, Carlaw TS, and Basin TS. Based on their asset condition, conductors along the overhead section between Leaside 34 Jct. and Bloor St. Jct. (about 2 route km) are required to be replaced in the near term.

As recommended by the TWG from the previous RIP, the conductor in this overhead section will be replaced with largest size possible conductor while retaining existing tower structures. The expected in-service date for this line replacement work is around 2025.

7.1.12 Overhead Transmission Line L9C/L12C

The 115 kV circuits L9C/L12C provide connections between Leaside TS and Cecil TS, and supply to central downtown area including Charles TS and Cecil TS. The overhead section of this 115 kV double-circuit line between Leaside TS and Balfour Jct. (about 3.6 route km) is over 90 years old and require replacement in the near term.

As recommended by the TWG from the previous RIP, the conductor in this overhead section will be replaced with largest size possible conductor while retaining existing tower structures. The expected in-service date for this line replacement work is around 2027.

7.2 Station and Transmission Capacity Needs in the Near / Medium Term

The Station and Transmission supply capacities have been reviewed. No near or medium-term station capacity need has been identified in the Toronto region. However, two transmission line capacity needs are identified below during the study period of 2022 to 2031.

7.2.1 Richview TS x Manby TS 230 kV Corridor – Line Capacity

The 230 kV transmission corridor between Richview TS and Manby TS is the main supply path for the Western Sector of Central Toronto. Along this corridor there are two double-circuit 230 kV lines R1K/R2K and R13K/R15K. Together with circuit R24C between Richview TS and Cooksville TS, this corridor also supplies the load in the southern Mississauga and Oakville areas via Manby TS. The need and options to increase transfer capability of this transmission corridor to support the continuous load growth in these areas has been identified and discussed in the past RP cycles. This need was also reaffirmed in an IRRP addendum done in 2021.²

² The IRRP addendum for the Richview TS x Manby TS Circuit Upgrade need has not been published or shared outside of the TWG yet. However, since it was just reviewed last year, this need is not to be re-evaluated in this NA.

As previously documented, the recommendation is to proceed with:

Phase 1: Rebuilding the existing idle 115 kV overhead line on the transmission corridor between Richview TS and Manby TS to 230 kV standards. The new line will operate in parallel with the existing four 230 kV circuits from Richview TS to Manby TS, which will initially be reconfigured to create two "supercircuits" R2K and R15K. This configuration avoids the need to build new terminations and new breakers at Manby TS. This project is currently in estimate and public consultation phase. The planned in-service date is 2026.

Phase 2: Unbundling the "supercircuits" with one new circuit connected to Manby West and one to Manby East with new termination installed at Manby TS. At Richview TS, the new circuits will be tapped to existing 230 kV circuits V73R and V79R from Claireville TS. This configuration allows Richview TS to be bypassed and permits continued supply to Manby TS should there be an emergency at Richview TS. The timing of Phase 2 will be planned to coincide with Manby TS 230kV breakers replacement work when the time comes. As discussed in Section 7.1.9 of this report, the 230 kV breakers at Manby TS are currently in good condition and not planned to be in replaced in the coming 10 years. Their condition will be monitored and this phase 2 work will be coordinated with the replacement work. Updates will be provided to the TWG in the next RP cycle as required.

7.2.2 Manby TS x Riverside Junction 115 kV Corridor – Line Capacity

The 115 kV transmission corridor between Manby TS and John TS comprises four circuits K13J, K14J, K6J and H2JK, and provides supply to Downtown Toronto via three transformer stations John TS, Strachan TS and Copeland MTS. The 2021 actual total coincident summer peak load of these stations was about 370 MW and is forecasted to be approximately 513 MW and 500 MW (net adjusted for extreme weather) in 2026 and 2031 respectively. This corridor also provides backup supply to other stations that are normally connected to the Leaside / Hearn subsystem, such as Esplanade TS and Terauley TS.

The 7 km overhead section of the circuits K13J/K14J between Manby TS and Riverside Jct., as shown in Figure 3, is potentially overloaded under the contingency of the loss of the other circuits on this corridor. This need was identified as a long-term need (2030-2035) in the previous RIP. However, the new forecast in this NA has reflected the load demand increase from the Ontario Line subway and other residential and commercial development projects expected in the near term at Copeland MTS and John TS, and therefore this need is advanced to 2026.

The companion overhead line K6J/H2JK was upgraded in 2000 and currently has a higher ampacity rating than the K13J/K14J line. The capacity of this corridor could potentially be increased by approximately 100 MVA if the overhead section of the circuits K13J/K14J between Manby TS and Riverside Jct. is upgraded. A line upgrade project of this scope may take over 5-6 years to carry out the required work before it is inservice which includes, but not limited to, the development and estimate work, public consultation, environmental assessment, internal and external approvals, construction, outage planning and commissioning work. The earliest in-service date of the reconductoring work could be in 2028 if the development and estimate work is to begin in 2023. It is also to be noted that extended outages may be required to reconductor the line. As a result of limited load transfer capability between the Manby West

and Leaside / Hearn subsystems, obtaining the said outages to complete this work could be very challenging, and worsen further as the load increases in these areas.

Considering the long timeline of the corridor upgrade and that more load could potentially be affected during construction, the TWG recommends Hydro One proceed on the development work for reconductoring the circuits K13J/K14J to higher ampacity conductors without replacing the existing towers. This need will continue to be reviewed as part of the next phase of this RP cycle.

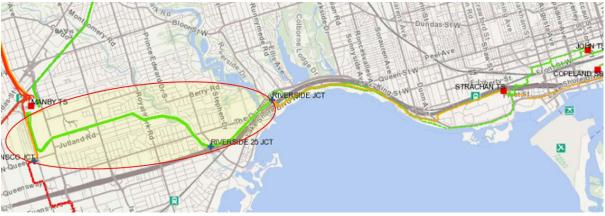


Figure 3: 115 kV Corridor between Manby TS and John TS (overhead section is circled)

7.3 Long-Term Capacity Needs

This section describes the long-term capacity needs identified from the previous RIP as well as the potential ones that are observed from this NA review.

This NA focuses on assessing and identifying the needs in the Toronto Region within the 10-year timeframe (up to 2031). It is observed that there are some transformer stations and 230 kV circuits that are approaching their limits by 2031 as listed in Table 5 below. This finding is consistent with the information shared by the TWG that the Toronto Region is about to embark on a period of growth over the short and medium term driven by electrification, and that the large-scale development and customer connection projects are expected in several areas within the Toronto Region in the coming years.

Station / Circuit	Need Description	
Glengrove TS	Total net demand is forecasted to be about 98% of station LTR by 2031.	
Finch TS / Bathurst TS	Total net demand at Finch TS and Bathurst TS is forecasted to be about	
Warden TS	100% and 97% of station LTR respectively by 2031.	
warden 15	The net demand at Warden TS exceeds its station LTR by 2024. THESL will manage the station overload by load transfer to Scarboro TS in	
	the near/medium term.	
Parkway TS to Richview TS	Markham #1 Jct. x Leaside Jct. section of the overhead 230 kV circuits	
230 kV Corridor (P21R/P22R)	P21R and P22R, connecting Parkway TS and Richview TS, is approaching	
	limit by 2031.	

 Table 5: Potential Long-Term Capacity Needs to be Further Assessed

These potential long-term capacity needs will be further reviewed in the next phases of this RP cycle.

7.3.1 Fairbank TS – Station Capacity

The long-term capacity need at Fairbank TS was identified in the previous RIP. The load at Fairbank TS was expected to exceed LTR within the 2030-2035 time period.

Fairbank TS comprises two DESN units, T1/T3 and T2/T4 (all 115/27.6 kV 50/83 MVA units), having a summer 10-Day LTR of 182 MW. The station's 2021 actual non-coincident summer peak load was about 197 MW. The excess load is planned to be transferred to Runnymede TS where a new DESN was built in 2019 and the old DESN was rebuilt in 2021. The Fairbank TS load is forecasted to be approximately 170 MW (net adjusted for extreme weather) or 93% of its station LTR in 2031. The transformer replacement work at Fairbank TS (T1/T2/T3/T4) is also underway with planned in-service date of 2024. The station LTR at Fairbank TS is expected to increase after the transformer replacement and provide some additional capacity. Together with the new and refurbished DESNs recently built at Runnymede TS, it is expected that the existing facilities will be adequate to supply the long-term growth in the area. The TWG recommends the loading be monitored and reviewed in the next RP cycle.

7.3.2 Sheppard TS – Station Capacity

The long-term capacity need at Sheppard TS was identified in the previous RIP. The load at Sheppard TS was expected to exceed LTR within the 2030-2035 time period.

Sheppard TS comprises two DESN units, T1/T2 (75/125 MVA units with idle winding) and T5/T6 (50/83 MVA units), having a summer 10-Day LTR of 204 MW. The station's 2021 actual non-coincident summer peak load was about 167 MW, and is forecasted to be approximately 187 MW (net adjusted for extreme weather) or 92% of its station LTR in 2031. Consideration may be given to utilizing the idle winding on transformers T1/T2. The TWG recommends the Sheppard TS loading be monitored and reviewed in the next phases of this RP cycle.

7.3.3 Strachan TS – Station Capacity

The long-term capacity need at Strachan TS was identified in the previous RIP. The load at Strachan TS was expected to exceed LTR within the 2030-2035 time period.

As discussed in Section 7.1.1, the transformer T12 at Strachan TS has been replaced recently with a 60/100 MVA unit. The station capacity at Strachan TS will increase after the transformer T14, and T13/T15 are also replaced with 60/100MVA units. This will provide adequate capacity to accommodate the long-term growth. The TWG recommends the loading be monitored and reviewed in the next RP cycle.

7.3.4 Basin TS – Station Capacity

The long-term capacity need at Basin TS was identified in the previous RIP. The load at Basin TS was expected to exceed LTR within the 2030-2035 time period.

As discussed in Section 7.1.4, the load at Basin TS is forecasted to be over 95% in 2031 and expected to increase further in the longer term due to the development plan in the Port Lands area as well as the East Harbor area. The transformers T13/T15 (45/75 MVA units) require replacement in the near term based on asset condition assessment. The TWG recommends that Hydro One and THESL coordinate and initiate the development work for replacing the transformers T3/T5 with 60/100 MVA units, and that the long-term supply need in the Basin / Port Lands area be reviewed as part of the next phase in the RP process. This will include consideration of the uncertainty associated with the long-term growth plans as well as the potential impacts on the electricity infrastructure in this area resulting from the City's redevelopment plans. This is consistent with the finding and the recommendation from the previous RP cycle.

7.3.5 Glengrove TS – Station Capacity

Glengrove TS comprises two DESN units, T1/T3 and T2/T4 (all 25/42 MVA units), having a summer 10-Day LTR of 88 MW. The station's 2021 actual non-coincident summer peak load was about 47 MW and is forecasted to be approximately 86 MW (net adjusted for extreme weather) or 98% of its LTR in 2031.

As discussed in Section 7.1.3, its closet station Duplex TS also has two DESN units, T1/T2 (45/75 MVA) and T3/T4 (45/75 MVA), having a summer 10-Day LTR of 128 MW. The load at Duplex TS is forecasted to be approximately 112 MW (net adjusted for extreme weather) or 88% of its LTR in 2031. The transformers T1/T2 and T3/T4 require replacement in the near and medium term. The TWG has recommended that these transformers be replaced with 60/100 MVA units to provide additional capacity in this area, and that the Glengrove TS and Duplex TS loading be monitored and reviewed in the next phases of this RP cycle.

7.3.6 Finch TS / Bathurst TS – Station Capacity

THESL has identified an emerging load growth in the Northwest Toronto area near Finch TS and Bathurst TS due to re-development plan in the Downsview area located in the Keele and Sheppard area.

Finch TS comprises two DESN units, T1/T2 and T3/T4 (all 75/125 MVA units), having a summer 10-Day LTR of 366 MW. The station's 2021 actual non-coincident summer peak load was about 253 MW and is forecasted to be approximately 367 MW (net adjusted for extreme weather) in 2031.

Bathurst TS also comprises two DESN units, T1/T2 and T3/T4 (all 75/125 MVA units), having a summer 10-Day LTR of 361 MW. The station's 2021 actual non-coincident summer peak load was about 241 MW and is forecasted to be approximately 350 MW (net adjusted for extreme weather) or 97% of its LTR in 2031. The TWG recommends this need be reviewed in the next phases of this RP cycle.

7.3.7 Warden TS – Station Capacity

Warden TS comprises one DESN unit, T3/T4 (75/125 MVA), having a summer 10-Day LTR of 182 MW. The station's 2021 actual non-coincident summer peak load was about 150 MW and is forecasted to be approximately 195 MW and 185 MW (net adjusted for extreme weather) in 2024 and 2031.

The demand at Warden TS exceeds its station LTR in 2024 due to new large customer connection request in the south Toronto. THESL will manage it in the near/medium term by transferring load to its closest station Scarboro TS as discussed in Section 7.1.5. The TWG recommends this need be reviewed in the next phases of this RP cycle.

7.3.8 Manby W TS Autotransformers – Transformation Capacity

The long-term transformation capacity need at Manby West TS was identified in the previous RIP. Manby West TS 230/115 kV autotransformers were found to be restricted by the lowest rated unit T12 in the fleet, and is potentially overloaded within the 2030-2035 time period, following T1 or T2 contingency. This NA also affirms this transformation capacity need and the autotransformer replacement plan for T12 that is expected to provide relief to this constraint as discussed in Section 7.1.9. The current planned in-service date of the T12 autotransformer replacement is around 2030. The TWG recommends that the long-term supply need in this area be reviewed as part of the next phase of this RP cycle.

7.3.9 Leaside TS Autotransformers – Transformation Capacity

The long-term transformation capacity need at Leaside TS was identified in the previous RIP. Leaside TS 230/115 kV autotransformers were found to be restricted by the lowest rated unit T16 in the fleet, and is potentially overloaded within the 2035-2040 time period, following T15 or T17 contingency, assuming that two of the three units at Portlands Energy Centre GS are out-of-service, and total plant generation is 160 MW. Post-contingency control action is currently available to resolve this issue by transferring Dufferin TS to Manby supply. The TWG recommends this need be monitored and reviewed in the next phases of this RP cycle.

7.3.10 Parkway TS to Richview TS 230 kV Corridor – Line Capacity

The 230 kV circuits P21R/P22R provide the transmission network connection between Parkway TS and Richview TS. These circuits also supply two transformer stations in the City of Markham as well as three transformer stations in the Northwest Toronto area (Leslie TS, Bathurst TS, and Finch TS) together with the other 230 kV circuits on the "Finch Corridor" between Cherrywood TS and Richview TS.

With the increasing demand forecasted on this corridor, some sections of the circuits P21R/P22R³ are over 90% of their ratings under certain contingencies in the medium term and are potentially overloaded in the long term. Consideration may be given to reconductoring part of the circuits close to the Parkway TS end. It is to be noted that the baseline NA forecast does not reflect a number of customers that show interest in connecting new load near the Steeles / Hwy 404 area. The need for this corridor upgrade may become sooner. The TWG recommends this need be monitored and reviewed in the next phase of this RP cycle.

³ The line section between Markham #1 Jct. and CTS Jct. of the circuits P21R/P22R is found to be the most restrictive in this NA review; however, the scope and timing of the preferred plan for this need will be reviewed and determined in the next phases of this RP cycle when a more certain and longer term load forecast will become available and considered.

7.3.11 Leaside TS to Wiltshire TS 115 kV Corridor – Line Capacity

The 115 kV transmission corridor between Leaside TS and Wiltshire TS comprises four circuits L13W, L14W, L18W and L15. It provides supply to Midtown Toronto area via two transformer stations Bridgman TS and Dufferin TS. The 2021 actual total coincident summer peak load of these stations was about 257 MW and is forecasted to be approximately 280 MW (net adjusted for extreme weather) in 2031. This corridor also provides backup supply to other stations that are normally connected to the Manby East subsystem such as Wiltshire TS, Fairbank TS and/or Runnymede TS.

The line capacity need on this corridor was identified as a long-term need (2035-2040) in the previous RIP, that the 1.8 km underground section of the circuit L15 between Bayview Jct. and Balfour Jct. is potentially overloaded in the long term. In this NA review, the contingency flow on this line section is about 80% of its limited time emergency rating in 2031. The TWG recommends the loading and the line capacity need on this Leaside TS x Wiltshire TS corridor be monitored and reviewed in the next phase of this RP cycle.

7.4 Load Restoration Analysis

The contingencies from the previous load restoration analysis in the 2^{nd} cycle IRRP are reviewed along with this new NA forecast. The potential load interrupted by configuration for the following contingencies is significantly higher than the amount from the 2^{nd} cycle IRRP.

For the loss of 230kV circuits C14L and C17L⁴ (stations connected are Warden TS and Bermondsey TS), a total load of 379 MW in 2031 will be interrupted by configuration and 129 MW of it will need to be restored within 30 minutes based on the load restoration criteria in the ORTAC.

For the loss of 230kV circuits C18R and P22R⁵ (Bathurst TS), a total load of 350 MW in 2031 will be interrupted by configuration and 100 MW of it will need to be restored within 30 minutes based on the load restoration criteria in the ORTAC.

THESL has indicated that the current distribution feeder configuration and spare capacity from the nearby stations will not be adequate to resupply all of the aforementioned amount of load in excess of 250 MW within 30 minutes and recommends that these load restoration scenarios and options be reviewed in the next phase of this RP cycle.

8 SENSITIVITY ANALYSIS

The objective of a sensitivity analysis is to capture uncertainty in the load forecast as well as variability of electric demand drivers to identify any emerging needs and/or advancement or deferment of recommended

⁴ The circuits C14L and C17L only share the same towers along a 4 km overhead line tap supplying Warden TS.

⁵ The circuits C18R and P22R only share the same towers along a 2 km overhead line tap supplying Bathurst TS.

investments. The TWG has determined that the key electric demand driver in the Toronto Region to be considered in this sensitivity analysis is electric vehicle (EV) penetration and electrified heating.⁶

A high demand growth forecast was developed by applying +5% on the extreme summer corrected Normal Growth net load forecast. The TWG has also considered a slower EV and electrified heating change and developed a low demand growth forecast by applying -2.5% on the extreme summer corrected Normal Growth net load forecast.

The impact of sensitivity analysis for the high and low growth scenarios on the capacity needs identified in Section 7 is summarized in Table 6.

Need	Normal Growth	High Growth	Low Growth
	Scenario	Scenario	Scenario ⁽¹⁾
Manby TS to Riverside Jct 115 kV Corridor	2026	2026	2026
Fairbank TS	Beyond 2031	Beyond 2031	-
Sheppard TS	Beyond 2031	Beyond 2031	-
Strachan TS	Beyond 2031	Beyond 2031	-
Basin TS	Beyond 2031	2031	-
Glengrove TS	Beyond 2031	2031	-
Finch TS / Bathurst TS	Beyond 2031	2028	-
Warden TS	Beyond 2031	TBD ⁽²⁾	-
Manby W TS Autotransformers (T12)	Beyond 2031	Beyond 2031	-
Leaside TS Autotransformers (T16)	Beyond 2031	2031	-
230 kV Parkway TS to Richview TS Corridor	Beyond 2031	Beyond 2031 (3)	-
115 kV Leaside TS to Wiltshire TS Corridor	Beyond 2031	Beyond 2031	-

 Table 6: Impact of Sensitivity Analysis on the Identified Capacity Needs

(1) The objective of a low growth scenario analysis is to identify any deferment in the timing of needs identified in this NA. Therefore, the long-term needs will not be looked at in the low growth scenario analysis.

(2) Forecasted load demand at Warden TS exceeds its capacity from 2024 but THESL plans to manage it by transferring the excess load to Scarboro TS. A higher load growth scenario will certainly advance the need to relieve Warden TS and further assessment will be carried out during the next phases of this Regional Planning cycle.

(3) Like the normal growth scenario, the high growth scenario does not reflect several customers that show interest in connecting new load near the Steeles / Hwy 404 area. The need for this corridor upgrade may be advanced to the medium term. The TWG recommends this need be monitored and reviewed in the next phases of this RP cycle.

In the high growth scenario, the timing of some of the long-term station capacity needs (Basin TS, Glengrove TS, Finch TS / Bathurst TS, and potentially Warden TS as well) is advanced to the medium-term timeframe. The timing of the long-term transformation capacity needs at Leaside TS is also advanced to 2031. The TWG recommends these needs be assessed during the next phases of this RP cycle.

The timing of the near-term capacity need on the 115 kV corridor between Manby TS and Riverside Jct. does not change in the sensitivity analysis. As discussed in Section 7.2.2, the TWG recommends Hydro One proceed on the development work for reconductoring the circuits K13J/K14J to higher ampacity conductors without replacing the existing towers and this need be reviewed as part of the next phase of this RP cycle.

⁶ The sensitivity analysis does not consider the impact from the IESO's "Pathways to Decarbonization" report published on December 15, 2022. The electricity demand and new infrastructure need in the longer term could be substantially higher than anticipated in this report, and will be assessed in the next phase of this RP cycle.

9 **RECOMMENDATIONS**

The TWG's recommendations to address the needs identified are as follows:

- a) No further regional coordination is required for the following need:
 - Asset renewal needs for replacing the major HV equipment as listed in Table 7 below. These needs will be addressed directly by Hydro One and THESL to develop a preferred replacement plan giving consideration to "right-sizing";
- b) Further assessment and regional coordination is required in the next phases of the RP cycle to review and/or develop a preferred plan for the follow needs:
 - The line capacity need for the 115 kV corridor between Manby TS and Riverside Jct. Hydro One will initiate the development work for reconductoring the overhead line section; and
 - The load restoration and long-term needs as listed in the following table.

Table 7 summarizes the above recommendations.

Further Regional Coordination Not Required	Further Regional Coordination Required
 Asset Renewal Needs (Stations): Strachan T14 & T13/T15 Charles TS: T3/T4 Duplex TS: T1/T2 & T3/T4 Basin TS: T3/T5 Scarboro TS: T23 Fairchild TS: T1 & T3/T4 Bermondsey TS: T3/T4 Malvern TS: T3 Manby TS: T7, T9, T12 autotransformers, T13/T14 	 Line Capacity Need: 115 kV Manby TS to Riverside Jct. Corridor Load Restoration: Loss of C14L/C17L Loss of C18R/P22R
 Manby TS: 17, 19, 112 autotransformers, 113/114 step-down transformer Leslie TS: T1 Asset Renewal Needs (Lines): 115 kV H1L/H3L/H6LC/H8LC: Leaside Jct. to Bloor St. Jct. overhead section 115 kV L9C/L12C: Leaside TS to Balfour Jct. overhead section 	 Long-Term Needs: Sheppard TS – Station Capacity Basin TS – Station Capacity Glengrove TS – Station Capacity Finch TS / Bathurst TS – Station Capacity Warden TS – Station Capacity 230/115kV Manby W Autotransformers – Transformation Capacity
 Line Capacity Need: 230 kV Richview TS to Manby TS Corridor Station Capacity Need: Fairbank TS Strachan TS 	 230/115kV Leaside TS Autotransformers – Transformation Capacity 230 kV Parkway TS to Richview TS Corridor – Line Capacity 115kV Leaside TS to Wiltshire TS Corridor – Line Capacity

Table 7: Summary of Recommendations

This NA assessment was performed before the publication of the IESO's "Pathways to Decarbonization" report on December 15, 2022, and does not include its impact on the need and/or the timing for additional electrical supply facilities in the Toronto Region. The TWG recommends that the "Pathways to Decarbonization" and its subsequent impact be considered and assessed in the next phase of this RP cycle.

10 **References**

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- [2]. Hydro One, "Needs Assessment Report, Toronto Region", October 18, 2017. <u>https://www.hydroone.com/abouthydroone/CorporateInformation/regionalplans/metrotoronto/Do</u> <u>cuments/Needs%20Assessment%20-%20Toronto%20Region%20-%20Final.pdf</u>
- [3]. IESO, "Toronto Region: Integrated Regional Resource Plan", August 9, 2019. <u>https://www.hydroone.com/abouthydroone/CorporateInformation/regionalplans/toronto/Documen</u> <u>ts/Toronto-IRRP-20190809-Report.pdf</u>
- [4]. Planning Process Working Group Report to the Board, 17 May 2013. <u>http://www.ontarioenergyboard.ca/OEB/_Documents/EB-2011-0043/PPTECHNICAL_STUDY</u> <u>TEAM_Regional_Planning_Report_to_the_Board_App.pdf</u>
- [5]. IESO, Ontario Resource and Transmission Assessment Criteria (ORTAC) Issue 5.0, August 22, 2007
 <u>https://www.ieso.ca/-/media/Files/IESO/Document-Library/Market-Rules-and-Manuals-Library/market-manuals/connecting/IMO-REQ-0041-TransmissionAssessmentCriteria.ashx</u>

Appendix A-1: Non-Coincident Summer Peak Net Load Forecast (2022 to 2031)

STATIONS	DESN ID	Summer LTR (MW)	2021 (Actuals)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
NORTH 230kV		1902	1249	1317	1388	1459	1483	1513	1525	1553	1573	1575	1577
Agincourt TS	Т5/Т6	174	88	89	91	98	102	105	106	106	108	108	108
Bathurst TS	T1/T2	183	131	120	123	125	142	160	178	176	175	174	172
	T3/T4	178	110	135	131	146	148	146	146	163	181	179	178
Cavanagh MTS	T1/T2	157	120	117	118	121	121	127	130	141	141	141	142
Fairchild TS	T1/T2	174	108	119	131	134	134	134	134	133	132	132	132
	T3/T4	172	108	118	117	116	114	114	113	112	112	112	112
Finch TS	T1/T2	180	129	144	167	176	178	181	182	182	183	184	185
	T3/T4	186	124	132	156	179	178	178	178	177	179	181	182
Leslie TS	T1/T2 13.8	43	9	13	14	13	10	11	0	0	0	0	0
	T1/T2 27.6	96	85	86	92	100	102	88	91	91	92	93	93
	T3/T4 27.6	184	127	139	141	141	143	157	157	158	157	157	156
Malvern TS	T3/T4	176	110	106	108	108	109	112	112	113	114	115	119
EAST 230kV	T4 (T0	1475	962	1018	1059	1154	1156	1158	1186	1207	1209	1212	1213
Bermondsey TS	T1/T2	186	60	75	103	109	109	127	143	142	142	141	140
511 T C	T3/T4	162	93	120	124	129	132	113	131	130	129	132	135
Ellesmere TS	T3/T4	189 100	124	123 70	131	152	157	157	156 71	165 71	165	164	163 71
Leaside TS	T19/T20/T21 13.8 T19/T20/T21 27.6	100	67 83	70	70 80	69 78	70 78	71 77	71	71	71 75	71 74	71
	T21/T22	110	109	113	111	137	139	138	136	150	150	151	150
Scarboro TS	T23/T24	189	109	113	111	137	139	138	136	150	150	151	150
Sheppard TS	T1/T2	95	76	69	70	70	70	108	70	70	108	81	82
Sheppara 15	T5/T6 (was T3/T4)	109	91	98	100	103	105	106	108	109	103	104	105
Warden TS	T3/T4	105	150	156	160	105	105	100	188	186	186	186	105
WEST 230kV		1239	768	752	796	837	810	828	864	862	870	879	889
Horner TS	T1/T2	184	0	30	31	39	40	96	95	95	95	95	95
	T3/T4	182	147	126	147	145	145	117	115	115	114	114	113
Manby TS	T13/T14	106	85	81	82	98	98	83	83	84	84	86	86
	T3/T4	60	73	58	58	59	60	53	53	53	55	56	58
	T5/T6	60	79	64	66	65	53	55	56	57	59	59	61
Rexdale TS	T1/T2	187	102	104	108	108	93	93	140	144	148	154	160
Richview TS	T1/T2	159	111	114	112	111	109	108	106	105	104	103	102
NULLIVIEW 13	11/12	155		114		111	105					100	102
NUMBER 15	T5/T6	135	103	104	121	142	105	150	140	132	132	132	133
										132 77			
LEASIDE 115kV	T5/T6	188	103	104	121	142	141	150	140		132	132	133
	T5/T6	188 113 1779 88	103 68	104 70 1265 74	121 71	142 71 1339 67	141 72	150 74	140 76 1369 77	77 1382 81	132 79 1389 82	132 80	133 81 1416 85
LEASIDE 115kV	T5/T6 T7/T8	188 113 1779	103 68 1141	104 70 1265	121 71 1318 59 146	142 71 1339 67 148	141 72 1365	150 74 1365	140 76 1369	77 1382 81 147	132 79 1389	132 80 1403	133 81 1416 85 150
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2	188 113 1779 88 189 73	103 68 1141 57 133 63	104 70 1265 74 145 43	121 71 1318 59 146 43	142 71 1339 67 148 42	141 72 1365 69 147 47	150 74 1365 72 147 49	140 76 1369 77 147 50	77 1382 81 147 51	132 79 1389 82 147 52	132 80 1403 82 148 53	133 81 1416 85 150 53
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T1/T2	188 113 1779 88 189 73 85	103 68 1141 57 133 63 55	104 70 1265 74 145 43 61	121 71 1318 59 146 43 60	142 71 1339 67 148 42 59	141 72 1365 69 147 47 58	150 74 1365 72 147 49 57	140 76 1369 77 147 50 55	77 1382 81 147 51 54	132 79 1389 82 147 52 55	132 80 1403 82 148 53 57	133 81 1416 85 150 53 57
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T1/T2 T3/T4	188 113 1779 88 189 73 85 130	103 68 1141 57 133 63 55 92	104 70 1265 74 145 43 61 91	121 71 1318 59 146 43 60 89	142 71 1339 67 148 42 59 89	141 72 1365 69 147 47 58 87	150 74 1365 72 147 49 57 86	140 76 1369 77 147 50 55 84	77 1382 81 147 51 54 82	132 79 1389 82 147 52 55 81	132 80 1403 82 148 53 57 81	133 81 1416 85 150 53 57 82
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T1/T2 T3/T4 T1/T2	188 113 1779 88 189 73 85 130 130	103 68 1141 57 133 63 55 92 70	104 70 1265 74 145 43 61 91 86	121 71 1318 59 146 43 60 89 91	142 71 1339 67 148 42 59 89 95	141 72 1365 69 147 47 58 87 93	150 74 1365 72 147 49 57 86 98	140 76 1369 77 147 50 55 84 97	77 1382 81 147 51 54 82 98	132 79 1389 82 147 52 55 81 97	132 80 1403 82 148 53 57 81 96	133 81 1416 85 150 53 57 82 95
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Charles TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T3/T4	188 113 1779 88 189 73 85 130 130 130	103 68 1141 57 133 63 55 92 70 57	104 70 1265 74 145 43 61 91 86 62	121 71 1318 59 146 43 60 89 91 64	142 71 1339 67 148 42 59 89 95 60	141 72 1365 69 147 47 58 87 93 71	150 74 1365 72 147 49 57 86 98 71	140 76 1369 77 147 50 55 84 97 72	77 1382 81 147 51 54 82 98 71	132 79 1389 82 147 52 55 81 97 70	132 80 1403 82 148 53 57 81 96 70	133 81 1416 85 150 53 57 82 95 70
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3	188 113 1779 88 189 73 85 130 130 130 81 94	103 68 1141 57 133 63 55 92 70 57 57 46	104 70 1265 74 145 43 61 91 86 62 53	121 71 1318 59 146 43 60 89 91 64 64	142 71 1339 67 148 42 59 89 95 60 59	141 72 1365 69 147 47 58 87 93 71 63	150 74 1365 72 147 49 57 86 98 71 65	140 76 1369 77 147 50 55 84 97 72 66	77 1382 81 147 51 54 82 98 71 66	132 79 1389 82 147 52 55 81 97 70 67	132 80 1403 82 148 53 57 81 96 70 67	133 81 1416 85 150 53 57 82 95 70 67
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Charles TS Dufferin TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T3/T4 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4	188 113 1779 88 189 73 85 130 130 130 81 94 86	103 68 1141 57 133 63 55 92 70 57 57 46 80	104 70 1265 74 145 43 61 91 86 62 53 53 71	121 71 1318 59 146 43 60 89 91 64 64 64	142 71 1339 67 148 42 59 89 95 60 59 60 59 68	141 72 1365 69 147 47 58 87 93 71 63 63	150 74 1365 72 147 49 57 86 98 71 65 65 68	140 76 1369 77 147 50 55 84 97 72 66 66	777 1382 81 147 51 54 82 98 71 66 66 66	132 79 1389 82 147 52 55 81 97 70 67 65	132 80 1403 82 148 53 57 81 96 70 67 65	133 81 1416 85 150 53 57 82 95 70 67 65
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Charles TS Dufferin TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T1/T2	188 113 1779 88 189 73 85 130 130 81 130 81 94 86 81	103 68 1141 57 133 63 55 92 70 57 46 80 55	104 70 1265 74 145 43 61 91 86 62 53 71 66	121 71 1318 59 146 43 60 89 91 64 64 64 64 64	142 71 1339 67 148 42 59 89 95 60 59 60 59 68 70	141 72 1365 69 147 47 58 87 93 71 63 63 69 70	150 74 1365 72 147 49 57 86 98 71 65 65 68 72	140 76 1369 77 147 50 55 84 97 72 66 66 66	77 1382 81 147 51 54 82 98 71 66 66 66 73	132 79 1389 82 147 52 55 81 97 70 67 65 75	132 80 1403 82 148 53 57 81 96 70 67 65 76	133 81 1416 85 150 53 57 82 95 70 67 65 78
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Charles TS Dufferin TS Dufferin TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T2 T3/T4	188 113 1779 88 189 73 85 130 130 130 81 94 86 81 47	103 68 1141 57 133 63 55 92 70 70 57 46 80 55 35	104 70 1265 74 145 43 61 91 86 62 53 71 66 66 36	121 71 1318 59 146 43 60 89 91 64 64 64 64 70 68 33	142 71 1339 67 148 42 59 89 95 60 0 59 60 59 68 70 32	141 72 1365 69 147 47 58 87 93 71 63 63 69 70 32	150 74 1365 72 147 49 57 86 98 71 65 68 72 33	140 76 1369 77 147 50 55 84 97 72 2 66 66 66 66 73 33	77 1382 81 147 51 54 82 98 71 66 66 66 73 33	132 79 1389 82 147 52 55 81 97 70 65 75 33	132 80 1403 82 148 53 57 81 96 70 67 65 76 33	133 81 1416 85 150 53 57 82 95 70 67 65 78 34
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Charles TS Dufferin TS Dupfex TS Esplanade TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T3/T4 T11/T12/T13	188 113 1779 88 189 73 85 130 130 130 81 94 86 81 47 187	103 68 1141 57 133 63 55 92 70 70 57 46 80 55 35 35 125	104 70 1265 74 145 43 61 91 86 62 53 71 66 36 36 145	121 71 1318 59 146 43 60 89 91 64 64 64 64 64 64 33 50	142 71 1339 67 148 42 59 89 95 60 0 59 60 59 68 70 32 32 155	141 72 1365 69 147 47 58 87 93 71 63 69 70 32 32 157	150 74 1365 72 147 49 57 86 98 71 65 68 72 33 156	140 76 1369 77 147 50 55 84 97 72 66 66 66 66 66 73 33 33	77 1382 81 147 51 54 82 98 71 66 66 66 66 73 33 157	132 79 1389 82 147 52 55 81 97 70 0 67 65 75 33 33	132 80 1403 82 148 53 57 81 96 70 70 67 65 76 33 33 158	133 81 1416 85 150 53 57 82 95 70 67 65 78 34 34
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Charles TS Dufferin TS Dupfex TS Esplanade TS Gerrard TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T1/T2 T1/T2	188 113 1779 88 189 73 85 130 130 130 81 94 86 81 47 187 128	103 68 1141 57 133 63 555 92 70 557 46 80 555 355 355 355 335 335	104 70 1265 74 145 43 61 91 86 62 53 71 66 36 36 145 55	121 71 1318 59 146 43 60 89 91 64 64 64 70 68 83 33 150 78	142 71 1339 67 148 42 59 89 95 60 59 60 59 60 59 60 59 60 70 0 32 59 80 80	141 72 1365 69 147 47 58 87 93 71 63 69 70 32 70 32 157 79	150 74 1365 72 147 49 57 86 98 71 65 68 72 33 3156 80	140 76 1369 77 147 55 55 84 97 72 66 66 66 73 333 33 33 55 80	77 1382 81 147 51 54 82 98 71 66 66 66 66 66 73 33 157 84	132 79 1389 82 147 555 81 97 70 67 65 75 75 333 158 88	132 80 1403 82 148 53 57 81 96 70 67 65 76 33 3 158 91	133 81 1416 85 150 53 57 82 95 70 67 65 78 34 34 158 91
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Charles TS Dufferin TS Dufferin TS Duplex TS Esplanade TS Gerrard TS Glengrove TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T11/T12/T13 T11/T2 T1/T3	188 113 1779 88 189 73 85 130 130 130 81 94 86 81 47 187 128 44	103 68 1141 57 133 63 55 59 22 70 57 46 80 55 35 35 35 35 35 325 30 125 30	104 70 1265 74 145 61 91 86 62 53 71 66 366 366 345 55 31	121 71 1318 59 146 43 60 89 91 64 64 64 64 64 70 68 333 150 78 33	142 71 1339 67 148 42 59 89 95 60 59 60 59 60 59 68 70 32 155 80 35	141 72 1365 69 147 47 58 87 93 71 63 63 69 70 32 157 79 35	150 74 1365 72 147 49 57 86 98 71 65 65 68 72 333 156 80 80 35	140 76 1369 77 147 50 55 84 97 72 66 66 66 73 33 3 3 33 155 80 35	77 1382 81 147 51 54 82 98 71 666 666 666 666 73 333 157 84 36	132 79 1389 82 147 55 811 97 70 67 65 75 333 158 88 88 36	132 80 1403 82 148 53 57 81 96 70 67 65 76 333 158 91 37	133 81 1416 85 150 53 57 82 95 70 67 65 78 34 158 34 158 91 37
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Charles TS Charles TS Dufferin TS Duplex TS Esplanade TS Gerrard TS Glengrove TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T1/T13 T1/T2 T1/T3 T2/T4	188 113 1779 88 189 73 85 130 130 130 81 94 86 81 47 7187 128 44 44	103 68 1141 57 133 63 55 922 70 57 46 80 55 35 35 125 30 0 17 30	104 70 1265 74 145 61 91 86 62 53 71 66 36 36 36 36 31 55 31 32	121 71 1318 59 146 43 60 89 91 64 64 64 64 70 668 333 150 78 33 35	142 71 1339 67 148 42 59 89 995 60 59 60 59 68 70 32 155 80 32 35 39	141 72 1365 69 147 47 58 87 93 71 63 63 69 70 32 157 79 35 39	150 74 1365 72 147 49 57 866 98 71 65 68 71 65 68 72 33 156 80 35 41	140 76 1369 77 147 50 55 84 97 72 66 66 66 66 66 73 33 155 80 33 580 35	77 1382 81 147 51 54 82 98 71 66 66 66 73 33 157 87 44 36 44	132 79 1389 82 147 55 55 811 97 70 67 65 75 333 158 88 88 8 88 836 46	132 80 1403 82 148 53 57 81 96 70 67 65 76 33 158 91 37 37 47	133 81 1416 85 150 53 57 82 95 70 67 65 78 34 158 91 37 37
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Charles TS Charles TS Dufferin TS Duplex TS Esplanade TS Gerrard TS Glengrove TS Main TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T12 T3/T4 T1/T12 T3/T4 T1/T12 T1/T13 T1/T2 T1/T13 T1/T2 T1/T3 T2/T4 T3/T4	188 113 1779 88 189 73 85 130 130 130 81 94 86 81 47 7187 128 44 44 44	103 68 1141 57 133 63 55 922 70 57 46 80 55 35 125 30 30 17 30 56	104 70 1265 74 145 61 91 86 62 53 71 66 36 36 145 531 32 60	121 71 1318 59 146 43 60 89 91 64 64 64 64 70 68 33 150 750 33 36 62	142 71 1339 67 148 42 59 89 95 60 59 60 59 68 70 32 155 55 39 62	141 72 1365 69 147 47 58 87 93 71 63 63 69 70 32 157 70 35 39 35 39	150 74 1365 72 147 49 57 866 98 71 65 68 71 65 68 72 33 156 86 35 41 63	140 76 1369 77 147 50 55 58 84 97 72 66 66 66 66 73 33 155 55 85 0 35 42 42 64	77 1382 81 147 51 54 82 98 71 66 66 66 73 33 157 83 157 84 36 44 64 64	132 79 1389 82 147 55 811 97 70 67 65 75 33 158 8 36 46 65	132 80 1403 82 148 53 57 81 96 70 67 65 76 65 76 333 158 91 37 47 66	133 81 1416 85 150 53 57 82 95 70 67 65 78 34 158 34 158 37 49 67
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Charles TS Charles TS Dufferin TS Duplex TS Esplanade TS Gerrard TS Glengrove TS	T5/T6 T7/T8 T3/T5 T1/T12/T13/T14/T15 T1/T2 T3/T4 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T1/T2 T1/T3 T1/T2 T3/T4 T1/T2 T3/T4 T3/T4 T3/T4 T3/T4 T1/T4	188 113 1779 88 189 73 85 130 130 130 81 94 86 81 47 187 128 44 77 108	103 68 1141 57 133 63 55 922 70 57 46 80 55 35 125 30 177 30 56 53	104 70 1265 74 145 43 61 91 91 91 91 86 62 53 71 66 63 66 145 55 31 32 60 60 61	121 71 1318 59 146 43 60 89 91 64 64 64 64 64 70 68 33 150 78 333 36 62 91	142 71 1339 67 148 42 59 89 99 59 60 59 60 59 68 70 32 155 80 32 39 62 95	141 72 1365 69 147 47 58 87 79 33 71 63 69 70 32 157 70 32 157 79 35 39 35 39	150 74 1365 72 147 49 57 866 98 71 65 68 72 33 156 80 355 41 63 85	140 76 1369 77 147 50 55 84 97 72 66 66 66 66 73 33 155 80 35 42 64 85	77 1382 81 147 51 54 82 98 71 66 66 66 73 33 157 84 84 64 84 84 87	132 79 1389 82 147 55 811 97 70 67 65 75 33 158 88 366 466 65 87	132 80 1403 82 148 53 57 81 96 70 67 65 76 33 158 91 37 47 47 66 88	133 81 1416 85 150 53 57 82 95 70 67 65 78 34 158 91 377 49 67 89
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Duplex TS Gerrard TS Glengrove TS Main TS Terauley TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T12 T3/T4 T1/T12 T3/T4 T1/T12 T1/T13 T1/T2 T1/T13 T1/T2 T1/T3 T2/T4 T3/T4	188 113 1779 88 189 73 85 130 130 130 81 94 86 81 147 187 128 44 77 108 108	103 68 1141 57 133 63 55 92 70 57 46 80 0 55 335 125 330 17 30 556 53 88	104 70 1265 74 145 43 61 91 91 86 62 53 71 66 36 145 55 311 32 60 61 92	121 71 1318 59 146 43 60 89 91 64 64 64 64 70 70 68 33 150 78 33 36 662 91 81	142 71 1339 67 148 42 59 89 95 60 59 68 68 68 70 32 155 80 339 62 39 62 80 35 39 62 80 85 80 85 80 85 80 85 80 85 80 85 80 85 80 85 80 85 80 85 80 80 80 80 80 80 80 80 80 80 80 80 80	141 72 1365 69 147 58 87 93 71 63 69 70 32 157 79 35 39 63 39 63 39 63	150 74 1365 72 147 9 57 86 98 71 65 68 68 8 68 8 72 33 156 80 35 41 63 85 88	140 76 1369 77 147 55 84 97 72 66 66 66 66 66 66 63 33 33 155 80 335 42 42 64 485 88	77 1382 81 147 51 54 82 98 71 66 66 66 66 73 33 157 84 36 44 44 64 87 88	132 79 1389 82 147 55 81 97 70 65 5 5 5 33 158 88 33 158 88 36 46 65 5 87 88	132 80 1403 82 148 53 57 81 96 70 67 65 76 63 33 158 91 37 47 66 88 88	133 81 1416 85 150 53 57 82 95 78 2 95 70 67 65 578 34 158 91 37 49 67 89 89
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Charles TS Charles TS Dufferin TS Duplex TS Esplanade TS Gerrard TS Glengrove TS Main TS	T5/T6 T7/T8 T3/T5 T1/T12/T13/T14/T15 T1/T2 T3/T4 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T1/T2 T1/T3 T1/T2 T3/T4 T1/T2 T3/T4 T3/T4 T3/T4 T3/T4 T1/T4	188 113 1779 88 189 73 85 130 130 130 81 94 86 81 47 187 128 44 44 77 108	103 68 1141 57 133 63 55 922 70 57 46 80 55 35 125 30 177 30 56 53	104 70 1265 74 145 43 61 91 91 91 86 62 53 71 66 63 66 145 55 31 32 60 60 61	121 71 1318 59 146 43 60 89 91 64 64 64 64 64 70 68 33 150 78 333 36 62 91	142 71 1339 67 148 42 59 89 99 55 60 59 68 70 32 155 80 32 155 80 35 39 62 95	141 72 1365 69 147 47 58 87 79 33 71 63 69 70 32 157 70 32 157 79 35 39 35 39	150 74 1365 72 147 49 57 866 98 71 65 68 72 33 156 80 355 41 63 85	140 76 1369 77 147 50 55 84 97 72 66 66 66 66 73 33 155 80 35 42 64 85	77 1382 81 147 51 54 82 98 71 66 66 66 73 33 157 84 84 64 84 84 87	132 79 1389 82 147 55 811 97 70 67 65 75 33 158 88 366 466 65 87	132 80 1403 82 148 53 57 81 96 70 67 65 76 33 158 91 37 47 47 66 88	133 81 1416 85 150 53 57 82 95 70 67 65 78 34 158 91 377 49 67 89
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Duplex TS Esplanade TS Gerrard TS Glengrove TS Main TS Terauley TS MANBY E 115kV	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T1/T2 T1/T2 T1/T3 T1/T2 T1/T3 T2/T4 T1/T4 T1/T4 T1/T4 T1/T4 T1/T4 T1/T4 T2/T3 T2/T4	188 113 1779 88 189 73 85 130 130 130 81 94 86 81 47 128 44 44 44 44 44 44 44 579	103 68 1141 57 133 63 55 59 2 70 57 46 80 55 53 55 335 125 30 117 30 55 30 55 33 53 30 117 30 55 33 30 125 33 30 30 30 30 30 30 30 30 30 30 30 30	104 70 1265 74 145 43 61 91 86 62 53 71 66 63 66 36 36 36 32 60 60 61 92 92 374	121 71 1318 59 146 43 60 89 91 64 64 64 64 70 68 33 150 78 33 35 62 91 1 81 81 81 81	142 71 1339 67 148 42 59 89 95 60 59 60 59 60 59 60 59 60 32 155 80 33 39 62 95 86 421	141 72 1365 69 147 58 87 93 71 63 69 70 32 157 79 35 39 63 99 86 428	150 74 1365 72 147 49 57 86 98 72 68 68 72 33 156 68 72 33 3156 80 35 41 63 85 88 88 88 88	140 76 1369 77 147 55 84 97 72 66 66 66 66 67 3 33 33 155 80 335 42 64 88 88 88 88 88 88	77 1382 81 147 51 54 82 98 71 66 66 66 63 33 157 84 36 44 64 87 88 429	132 79 1389 82 147 55 58 81 97 70 65 75 33 3 158 88 33 6 46 65 587 88 88 34 30	132 80 1403 82 148 53 57 81 96 70 67 65 76 65 76 65 76 333 158 91 37 47 66 88 88 88 88	133 81 1416 85 150 53 57 82 95 70 67 65 78 34 158 91 37 49 67 89 89 89 89 89
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Charles TS Dufferin TS Dufferin TS Duplex TS Esplanade TS Gerrard TS Glengrove TS Main TS Terauley TS MANBY E 115kV Fairbank TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T1/T2 T1/T3 T2/T4 T1/T3 T2/T4 T1/T3 T2/T4 T3/T4 T1/T4 T2/T3 T2/T3	188 113 1779 88 189 187 3 55 130 130 130 130 130 130 130 130 130 130 130 130 130 130 130 141 44 44 44 44 108 108 579 90	103 68 1141 57 133 63 55 59 2 70 55 55 55 55 55 55 55 55 355 125 30 117 30 55 30 55 53 88 8 88 8 8 8 8 8 8 8 8 90	104 70 1265 74 145 43 61 91 86 62 53 71 66 66 36 36 36 31 31 32 60 61 92 92 374	121 71 1318 59 146 43 60 89 91 64 64 64 64 70 68 33 3 150 78 33 36 62 91 81 399	142 71 1339 67 148 42 59 89 95 60 59 60 59 60 70 70 32 155 80 33 35 33 9 62 95 86 62 95 886 62 95 886 62 95 889	141 72 1365 69 147 58 87 93 71 63 69 70 70 32 157 79 35 39 63 99 99 98 66 428 90	150 74 1365 72 147 49 57 86 98 72 65 68 72 72 33 3156 88 80 35 41 63 85 88 88 85 88 88 85	140 76 1369 77 147 50 55 84 97 72 66 66 66 73 33 3 33 33 55 80 35 42 64 85 88 88 88 88 88	77 1382 81 147 51 54 82 98 71 66 66 67 33 33 157 84 36 44 64 87 88 429 89 89	132 79 1389 82 147 555 811 97 70 65 75 333 158 88 36 46 65 87 87 88 88 98 989	132 80 1403 82 148 53 57 76 65 76 65 76 65 76 65 76 65 76 63 33 158 91 37 47 66 88 88 88 88 88 88	133 81 1416 85 150 53 57 82 95 70 67 65 78 34 158 91 37 49 67 89 89 89 89 89 89
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Charles TS Dufferin TS Dufferin TS Duplex TS Esplanade TS Gerrard TS Glengrove TS Main TS Terauley TS MANBY E 115kV Fairbank TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T1/T12/T13 T1/T2 T1/T12/T13 T1/T2 T1/T3 T2/T4 T2/T4 T2/T4 T2/T4 T2/T4 T2/T4 T2/T4 T1/T3 (to be T5/T6)	188 113 1779 88 189 73 85 130 130 130 81 94 86 81 47 187 128 44 77 108 579 90 92	103 68 1141 57 133 63 55 92 70 57 46 80 55 35 35 35 35 30 125 30 17 30 56 53 88 8 88 88 88 8 88 8 8 8 8 8 8 8 8 8	104 70 1265 74 145 43 61 91 86 62 53 71 66 36 36 36 36 36 31 31 32 60 61 92 374 96 89	121 71 1318 59 146 43 60 89 91 64 64 64 64 64 64 64 70 68 33 31 50 078 33 35 6 62 91 81 399 86 81	142 71 1339 67 148 42 59 89 95 60 59 60 59 60 59 60 59 60 70 322 155 80 35 35 39 62 95 86 62 95 86 62 95 89 74	141 72 1365 69 147 47 58 8 87 93 71 63 69 70 32 157 79 35 39 63 99 63 99 866 428 90 74	150 74 1365 72 147 49 57 86 98 71 65 68 72 333 156 88 80 35 41 63 85 88 80 91 75	140 76 1369 77 147 50 55 58 4 97 72 66 66 66 73 33 3 33 155 80 35 42 64 88 88 88 88 428 88 88 88 88	77 1382 81 147 51 54 82 98 71 66 66 73 33 157 84 36 44 64 87 88 88 429 89 76	132 79 1389 82 147 55 55 81 97 70 67 65 75 333 158 88 36 46 65 87 88 88 430 889 77	132 80 1403 82 148 53 57 70 66 70 67 65 76 33 31 58 91 37 47 66 88 88 88 88 88 88 90 78	133 81 1416 85 150 53 57 70 67 65 78 34 158 91 37 49 67 89 89 436 91 37 77 79
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Charles TS Dufferin TS Dufferin TS Duplex TS Esplanade TS Gerrard TS Glengrove TS Main TS Terauley TS MANBY E 115kV Fairbank TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T1/T12 T1/T2 T1/T3 T2/T4 T3/T4 T1/T4 T2/T2 T2/T4 T2/T4 T2/T2/T2/T2 T2/T2/T2/T2/T2/T2/T2/T2/T2/T2/T2/T2/T2/T	188 113 1779 88 189 73 85 130 130 130 130 130 130 130 130 131 94 86 81 47 187 128 44 47 108 108 90 90 92 108	103 68 1141 57 133 63 55 92 70 57 46 80 55 35 35 35 35 30 125 30 177 30 56 53 88 362 900 107 78	104 70 1265 74 145 43 61 91 86 62 53 71 66 366 366 366 366 345 55 31 32 60 61 92 374 92 374 89 80	121 71 1318 59 146 43 60 89 91 64 64 64 64 70 68 33 31 50 78 33 350 78 33 350 78 33 350 78 33 36 62 91 81 399 866 82 95	142 71 1339 67 148 42 59 89 95 60 59 60 59 68 70 32 155 80 35 39 62 95 86 421 89 74	141 72 1365 69 147 47 58 87 93 71 63 69 70 32 157 79 35 39 63 99 86 428 90 0 74	150 74 1365 72 147 49 57 86 98 71 65 68 72 333 156 80 333 156 80 335 41 63 85 88 430 91 75 5106	140 76 1369 77 147 50 55 84 97 72 66 66 66 73 33 3 155 80 33 5 80 35 42 64 88 88 428 88 88 88 88 75 105	77 1382 81 147 51 54 82 98 71 66 66 66 66 66 73 33 157 87 44 36 44 88 44 87 88 429 89 76 104	132 79 1389 82 147 55 811 97 70 67 65 75 333 158 88 336 46 65 88 36 46 65 88 36 46 65 87 88 39 77 71 03	132 80 1403 82 148 53 57 81 96 70 67 65 76 33 31 58 99 13 37 47 66 88 88 88 432 90 90 78 103	133 81 1416 85 150 53 57 82 95 70 67 65 78 34 158 91 37 49 67 89 89 436 91 79 79
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Charles TS Charles TS Dufferin TS Duplex TS Duplex TS Esplanade TS Gerrard TS Glengrove TS Glengrove TS Main TS Terauley TS MANBY E 115kV Fairbank TS Runnymede TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T1/T2 T1/T2 T1/T2 T1/T2 T1/T2 T1/T3 T2/T4 T2/T4 T2/T4 T2/T4 T2/T4 T2/T3 T2/T4 T2/T4 T2/T3 T2/T4 T2/T4 T2/T3 T2/T4 T2/T4 T2/T4 T2/T4 T2/T4 T2/T4 T2/T4 T2/T4 T2/T4 T2/T4 T2/T3 T2/T4 T2/T4 T2/T4 T2/T4 T2/T4 T2/T3 T2/T4 T2/T4 T2/T4 T2/T4 T2/T4 T2/T3 T2/T4 T2/T4 T2/T4 T2/T4 T2/T4 T2/T4 T2/T4 T2/T4 T2/T2 T2/T4 T2/T2 T2/T4 T2/T	188 113 1779 88 189 73 85 130 130 130 131 94 86 81 44 47 108 108 90 90 92 108 111	103 68 1141 57 133 63 55 922 70 57 46 80 55 35 125 30 0 117 30 56 53 88 362 900 900 107 78	104 70 1265 74 145 61 91 86 62 53 71 66 36 36 36 36 36 36 36 36 36 36 36 36	121 71 1318 59 146 43 60 89 91 64 64 64 70 668 333 150 78 333 35 6 62 91 81 81 399 399 6 81 95	142 71 1339 67 148 42 59 89 995 60 59 60 59 68 70 32 155 80 335 39 62 95 86 421 974 408	141 72 1365 69 147 47 58 87 93 71 63 63 69 70 32 157 79 35 39 63 99 86 428 90 0 74 110 53	150 74 1365 72 147 49 57 866 98 71 65 68 72 33 156 80 33 156 80 335 41 63 85 88 430 975 106 57	140 76 1369 77 147 50 55 84 97 72 66 66 66 66 66 66 63 33 33 155 80 0 335 42 64 88 88 428 88 428 88 75 59	77 1382 81 147 51 54 82 98 71 66 66 66 66 73 33 157 87 88 44 64 87 88 429 89 76 104 60 60 60 60 60 60 60 60 60 60	132 79 1389 82 147 55 55 811 97 70 67 65 75 333 158 88 88 88 836 46 65 87 88 430 889 77 7103	132 80 1403 82 148 53 57 81 96 70 67 65 76 33 31 58 91 33 158 91 37 47 66 88 88 83 432 90 0 78 103 62	133 81 1416 85 150 53 57 82 95 70 67 65 78 34 158 91 337 49 67 89 89 89 67 89 89 89 436 91 79 91 02 65
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Charles TS Charles TS Dufferin TS Duplex TS Duplex TS Esplanade TS Gerrard TS Glengrove TS Glengrove TS Main TS Terauley TS MANBY E 115kV Fairbank TS Runnymede TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T12 T3/T4 T1/T13 T1/T13 T1/T2 T2/T4 T1/T3 T2/T4 T1/T2 T1/T3 T2/T4 T1/T2 T1/T3 T2/T4 T1/T2 T1/T3 T2/T4 T1/T2 T1/T3 T2/T4 T1/T2 T1/T3 T2/T4 T1/T2 T	188 113 1779 88 189 73 85 130 130 130 130 130 130 85 130 130 130 130 130 130 130 130 130 130 130 130 130 130 130 130 130 131 108 108 108 101 108 111 48	103 68 1141 57 133 63 55 922 70 57 46 80 55 35 125 35 125 35 35 125 30 30 30 56 53 88 362 90 107 78 32 25	104 70 1265 74 145 43 61 91 86 62 53 71 66 36 36 145 55 31 32 60 61 92 92 374 96 89 89 80 28	121 71 1318 59 146 43 60 89 91 64 64 64 70 64 64 70 68 33 150 70 68 33 35 62 91 81 399 86 81 95 44 34	142 71 1339 67 148 42 59 89 99 60 59 60 59 68 70 32 155 85 39 62 95 86 421 89 70 35 74 421 89 89 74 40 89 74 34	141 72 1365 69 147 47 58 87 93 71 63 63 69 70 32 157 70 35 39 63 99 86 428 99 86 428 99 70 35 39 71 57 75 79 35 39 63 99 90 70 71 53 39 63 99 86 71 70 70 70 70 70 70 70 70 70 70 70 70 70	150 74 1365 72 147 49 57 866 98 71 65 68 71 65 68 71 65 68 72 33 1560 35 41 63 85 88 430 91 75 50 106 57 35	140 76 1369 77 147 50 55 84 97 72 66 66 66 66 66 73 33 155 80 33 55 80 33 55 80 88 88 428 88 428 88 75 59 59 35	77 1382 81 147 51 54 82 98 71 66 66 66 73 33 157 83 157 88 429 89 89 70 70 71 73 73 73 73 73 73 73 75 73 73 75 73 75 75 75 75 75 75 75 75 75 75	132 79 1389 82 147 55 55 811 97 70 67 65 75 33 158 836 46 65 87 88 836 46 65 87 88 430 89 77 77 103 61	132 80 1403 82 148 53 57 81 96 70 67 65 76 65 76 65 76 333 158 91 37 47 66 88 88 88 88 432 90 78 103 78 103 62 36	133 81 1416 85 150 53 57 82 95 70 67 65 78 34 158 34 158 95 70 67 89 89 89 89 436 91 79 91 02 65 36
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Cecil TS Charles TS Dufferin TS Duplex TS Duplex TS Gerrard TS Glengrove TS Gerrard TS Glengrove TS Main TS Terauley TS MANBY E 115kV Fairbank TS Runnymede TS Willshire TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T12 T3/T4 T1/T13 T1/T13 T1/T2 T2/T4 T1/T3 T2/T4 T1/T2 T1/T3 T2/T4 T1/T2 T1/T3 T2/T4 T1/T2 T1/T3 T2/T4 T1/T2 T1/T3 T2/T4 T1/T2 T1/T3 T2/T4 T1/T2 T	188 113 1779 88 189 73 85 130 130 130 130 130 130 81 94 86 81 47 187 128 44 77 108 108 990 92 111 48 129	103 68 1141 57 133 55 92 70 57 46 80 80 55 35 125 335 125 330 17 30 56 53 30 107 730 56 533 88 362 90 107 732 30	104 70 1265 74 145 43 61 91 86 62 53 71 66 63 60 36 145 55 31 32 60 60 61 92 374 96 89 80 80 82 83 4	121 71 1318 59 146 43 60 89 91 64 64 64 70 68 33 150 62 91 83 36 62 91 81 81 81 89 986 81 95 44 434 59	142 71 1339 67 148 259 89 95 60 59 68 70 32 155 80 32 155 80 339 62 95 86 421 89 74 108 89 74	141 72 1365 69 147 58 87 93 71 63 69 70 32 157 79 35 39 63 99 86 428 90 74 110 53 34 67	150 74 1365 72 147 86 98 98 71 65 68 80 33 156 80 35 41 63 85 88 430 91 75 106 57 35 66	140 76 1369 77 147 55 84 97 72 66 66 66 66 66 63 33 33 33 55 80 33 55 80 335 422 64 88 88 428 88 428 88 75 59 335	77 1382 81 147 51 54 82 98 71 66 66 66 73 33 157 84 44 64 87 88 429 89 76 104 60 35 65	132 79 1389 82 147 55 58 81 97 70 65 75 33 31 58 88 36 46 65 587 88 88 36 46 65 587 88 88 36 40 65 577 77 00 77 00 77 00 70 70 70 70 70 70 7	132 80 1403 82 148 53 57 81 96 76 65 76 65 76 63 33 158 91 37 47 666 888 88 88 432 90 78 103 62 236 64	133 81 1416 85 150 53 57 82 95 78 2 95 78 2 95 78 34 158 91 37 49 67 89 89 89 67 89 89 89 67 89 91 79 102 65 53 64
LEASIDE 115kV Basin TS Carlaw TS Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Duplex TS Duplex TS Gerrard TS Glengrove TS Gerrard TS Glengrove TS Main TS Terauley TS MANBY E 115kV Fairbank TS Runnymede TS Wiltshire TS Wiltshire TS MANBY W 115kV Copeland MTS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T1/T2 T1/T3 T1/T2 T1/T3 T2/T4 T1/T3 T2/T4 T3/T4 T1/T3 T2/T4 T3/T4 T1/T3 T2/T4 T3/T4 T1/T3 T2/T4 T3/T4 T1/T3 T2/T4 T3/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T3 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T1/T2 T1/T3 T1/T2 T1/T2 T1/T2 T1/T2 T1/T2 T1/T2 T1/T2 T1/T2 T1/T2 T1/T2 T1/T2 T1/T2 T1/T2 T1/T2 T1/T2 T1/T2 T1/T2 T1/T2 T1/T2 T1/T3 T1/T2 T1/T2 T1/T2 T1/T2 T1/T2 T1/T3 T1/T2 T1/T3 T1/T2 T1/T	188 113 1779 88 189 189 130 130 130 130 130 130 130 130 130 130 130 130 130 130 130 130 130 130 141 108 108 108 579 90 92 108 111 48 129 611	103 68 1141 57 133 63 55 92 70 57 46 80 55 35 35 35 35 35 35 30 177 30 55 30 177 30 55 30 107 78 388 362 90 107 78 32 30 30 374	104 70 1265 74 145 43 61 91 86 62 53 71 66 66 63 66 36 36 145 55 31 32 60 60 61 92 374 96 89 80 80 237 4 96 89 80 237 4 96 89 80 237 4	121 71 1318 59 146 43 60 89 91 64 64 64 70 68 33 150 68 33 35 62 91 83 33 662 91 81 81 399 866 81 95 44 434 59 380	142 71 1339 67 148 42 59 89 95 60 59 60 59 60 59 60 59 60 59 60 32 155 80 339 62 95 86 421 89 74 108 89 74 108 89 74	141 72 1365 69 147 58 87 93 71 63 69 70 32 157 79 35 39 63 99 86 428 90 74 110 334 67 425	150 74 1365 72 147 49 57 86 98 72 68 98 72 33 156 68 80 35 41 65 88 80 35 41 65 88 80 35 41 65 85 88 80 35 41 65 65 88 80 35 57 57 57 57 57 57 57 57 57 57 57 57 57	140 76 1369 77 147 55 84 97 72 66 66 66 73 33 33 155 80 33 33 55 80 335 42 64 88 88 428 88 428 88 428 88 428 55 59 335 55 516	77 1382 81 147 51 54 82 98 71 66 66 66 63 33 157 84 33 157 84 33 157 84 36 44 64 87 88 429 89 76 104 60 355 51 51 51 51 51 51 51 51 51	132 79 1389 82 147 55 58 81 97 70 65 75 75 33 3158 88 33 67 65 75 75 88 88 33 67 65 75 75 75 88 88 33 67 65 75 75 75 75 75 75 75 70 67 65 75 70 67 65 75 70 67 65 75 70 67 65 75 70 70 67 65 75 70 70 67 67 65 75 75 70 70 67 67 65 75 75 70 70 70 67 65 75 75 70 70 67 67 65 75 75 75 70 70 70 67 67 65 75 75 75 70 70 70 70 70 67 75 75 75 75 75 75 75 75 75 75 75 75 75	132 80 1403 82 148 53 57 81 96 70 67 65 76 65 76 65 76 63 33 158 91 337 47 66 88 88 88 88 88 83 91 37 47 66 66 88 83 83 91 37 70 67 65 70 67 65 70 67 65 70 67 65 70 67 65 70 67 65 70 67 65 70 67 65 70 67 65 70 67 70 67 70 67 70 67 70 67 70 67 70 67 70 67 70 67 70 67 70 67 70 67 70 67 70 70 67 70 70 67 70 70 67 70 70 67 70 70 67 70 70 67 70 70 67 70 70 70 70 70 70 70 70 70 70 70 70 70	133 81 1416 85 150 53 57 82 95 78 2 95 78 2 78 34 158 91 37 49 67 89 89 89 89 89 89 89 89 89 91 79 102 5 36 6 4 5 5 5 7 91
LEASIDE 115kV Basin TS Carlaw TS Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Duplex TS Duplex TS Gerrard TS Glengrove TS Gerrard TS Glengrove TS Main TS Terauley TS MANBY E 115kV Fairbank TS Runnymede TS Wiltshire TS Wiltshire TS MANBY W 115kV Copeland MTS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T1/T2 T1/T3 T2/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T5/T6 (was T3/T4) T1/T6 T7X/T2X	188 113 1779 88 189 187 385 130 130 130 130 130 130 81 94 86 81 47 187 128 44 44 707 108 090 92 108 111 48 129 611 130	103 68 1141 57 133 63 55 92 70 55 55 55 35 55 35 55 35 55 35 55 35 55 35 55 35 55 35 55 30 0 107 78 30 90 107 78 32 25 30 0 374	104 70 1265 74 145 43 61 91 86 62 53 71 66 66 63 66 36 36 35 31 31 32 60 61 92 374 96 89 89 80 28 89 80 28 34 47 7 375	121 71 71 1318 59 146 43 60 89 91 64 64 64 64 70 68 83 33 150 78 33 35 662 91 81 91 81 91 81 95 95 44 334 95 95 95 95 95 95 95 95 95 95 95 95 95	142 71 1339 67 148 42 59 89 95 60 59 60 59 60 70 70 32 155 80 335 339 62 95 866 421 89 74 108 49 34 67 7 423	141 72 1365 69 147 47 58 8 87 93 71 63 69 70 70 32 157 79 35 39 63 99 99 98 6 428 90 74 110 53 34 67 7	150 74 1365 72 147 49 57 86 98 72 65 68 72 72 33 156 88 80 35 41 63 85 88 88 430 91 75 106 57 35 666 518	140 76 1369 77 147 50 55 84 97 72 66 66 66 73 33 33 33 55 80 33 5 80 35 88 88 88 88 88 88 88 88 88 85 88 88 85 88 88	77 1382 81 147 51 54 82 98 71 66 66 67 73 33 157 84 36 44 64 87 88 429 89 76 104 60 35 65 511 177	132 79 1389 82 147 55 55 81 97 70 65 75 75 33 3 158 88 36 46 65 87 87 88 88 36 46 65 87 87 88 89 77 103 61 35 64 4 5	132 80 1403 82 148 53 57 76 65 76 65 76 65 76 65 76 63 33 158 91 337 47 66 88 88 88 88 88 88 88 90 778 103 62 36 64 4 506 64 174	133 81 1416 85 150 53 57 82 95 70 67 65 78 34 4 95 78 34 4 95 78 34 4 91 37 49 67 89 89 89 89 89 67 89 89 67 67 67 67 67 67 67 67 67 67 65 78 70 67 65 78 70 67 65 70 67 65 70 67 65 70 70 65 70 70 65 70 70 65 70 82 70 70 65 70 70 65 70 70 70 65 70 70 70 65 70 70 65 70 70 65 70 70 65 70 82 70 91 70 82 70 91 70 65 70 82 70 89 89 89 89 89 89 89 89 89 80 80 80 80 80 80 80 80 80 80 80 80 80
LEASIDE 115kV Basin TS Carlaw TS Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Duplex TS Duplex TS Gerrard TS Glengrove TS Gerrard TS Glengrove TS Main TS Terauley TS MANBY E 115kV Fairbank TS Runnymede TS Wiltshire TS Wiltshire TS MANBY W 115kV Copeland MTS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T3/T4 T1/T2 T1/T1/T13 T1/T2 T2/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T3 T1/T2 T1/T2 T1/T2 T1/T6 T2/T4 T1/T3 T1/T3 T1/T6 T3/T3 T1/T3 T1/T3	188 113 1779 88 189 73 85 130 130 130 81 94 86 81 94 86 81 47 187 128 44 44 77 108 579 90 92 108 111 48 129 611 130 187	103 68 1141 57 133 63 55 92 70 57 46 80 55 35 35 35 35 35 30 30 30 56 53 30 56 53 30 30 77 8 88 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	104 70 1265 74 145 43 61 91 86 62 53 71 66 36 36 36 36 36 36 36 36 36 36 36 36	121 71 71 1318 59 146 43 60 89 91 64 64 64 64 64 64 64 70 68 33 3 150 78 33 3 59 91 81 3 95 86 81 95 44 34 599 380	142 71 1339 67 148 42 59 9 89 95 60 59 60 59 60 70 32 155 80 39 62 95 86 6 421 889 74 108 49 34 67 7 423	141 72 1365 69 147 47 58 87 93 71 63 69 70 32 157 79 35 39 63 99 63 99 866 428 90 74 110 53 34 67 7 425	150 74 1365 72 147 49 57 86 98 71 65 68 72 333 156 88 80 35 41 63 85 88 88 83 85 85 41 63 57 57 106 57 35 666 518	140 76 1369 77 147 50 55 58 4 97 72 66 66 73 33 3 33 155 80 73 33 3155 80 33 35 42 64 88 88 88 88 88 88 88 88 88 88 85 51 65 55 50 59 33 55 59 35 55 59 35 55 59 35 55 55 55 59 35 55 59 35 55 59 35 55 55 55 55 55 55 55 55 55 55 55 55	77 1382 81 147 51 54 82 98 71 66 66 73 33 157 84 44 66 44 87 88 429 89 76 104 60 35 511 177 143	132 79 1389 82 147 55 55 81 97 70 67 65 75 333 158 88 88 36 46 65 87 88 88 430 89 77 103 61 35 64 4 55 55 55 55 55 55 55 55 55 55 55 55 55	132 80 1403 82 148 53 57 70 67 65 65 76 33 31 58 91 33 77 47 66 88 88 88 88 88 88 88 88 91 37 37 47 66 66 88 88 91 33 77 81 103 66 66 88 90 78 103 66 103 103 66 103 103 103 103 103 103 103 103 103 103	133 81 1416 85 150 53 57 70 65 78 295 70 67 65 78 34 49 67 89 91 37 49 67 89 91 02 65 36 64 4 505 36 64 40
LEASIDE 115kV Basin TS Bridgman TS Carlaw TS Cecil TS Cecil TS Charles TS Dufferin TS Duplex TS Duplex TS Gerrard TS Gerrard TS Glengrove TS Gerrard TS Glengrove TS Main TS Terauley TS Main TS Terauley TS MANBY E 115kV Fairbank TS Wiltshire TS Wiltshire TS MANBY W 115kV Copeland MTS John TS	T5/T6 T7/T8 T3/T5 T11/T12/T13/T14/T15 T1/T2 T3/T4 T1/T2 T1/T1/T1/T13 T1/T2 T1/T4 T2/T4 T3/T4 T1/T2 T1/T3 T2/T4 T1/T3 T1/T2 T5/T6 (was T3/T4) T1/T2 T3/T4 T1/T2 T5/T6 (was T3/T4) T1/T3 T1/T4 T3/T4	188 113 1779 88 189 73 85 130 130 130 130 130 130 130 130 131 94 86 81 47 187 128 44 47 108 579 90 92 108 111 48 129 130 187 130 187 123	103 68 1141 57 133 63 55 92 70 57 46 80 55 35 35 35 35 35 35 35 35 35 35 35 35	104 70 1265 74 145 43 61 91 86 62 53 71 66 366 366 366 366 366 366 365 55 31 32 60 60 61 92 374 96 89 80 80 28 89 80 28 34 47 375 104 47 92	121 71 71 1318 59 146 43 60 89 91 64 64 64 64 70 68 33 3 150 78 33 350 78 33 350 78 33 350 78 33 36 62 91 81 81 95 84 44 34 59 95 95 444 37 95 92	142 71 1339 67 148 42 59 89 95 60 59 60 59 68 70 32 155 80 35 39 62 95 86 421 89 74 108 49 34 67 423 120 61	141 72 1365 69 147 47 58 87 93 71 63 69 70 32 157 79 35 39 63 99 866 428 90 74 110 53 34 67 425 121 159 99	150 74 1365 72 147 49 57 86 98 98 71 65 68 72 33 3 156 88 80 35 41 63 88 80 35 41 63 85 88 430 91 75 106 57 35 666 518 8182 98 8101	140 76 1369 77 147 55 84 97 72 66 66 73 33 3 33 155 80 73 33 35 80 35 42 64 88 88 88 88 88 88 88 88 88 88 88 55 105 59 33 55 516 79 99 99	77 1382 81 147 54 82 98 71 66 66 66 73 33 157 84 43 64 44 84 84 98 99 76 104 60 35 65 511 177 143 54	132 79 1389 82 147 55 811 97 70 67 65 75 333 158 88 33 58 88 36 46 65 87 88 33 3158 88 36 46 65 87 333 158 88 36 46 65 87 333 55 64 45 64 55 55 55 55 55 55 55 55 55 55 55 55 55	132 80 1403 82 148 53 57 81 96 70 65 76 65 76 33 31 58 91 33 158 88 91 37 47 66 88 88 88 432 90 78 103 62 36 64 506 78	133 81 1416 85 150 53 57 82 95 70 67 65 78 34 158 91 37 49 67 89 34 67 89 436 91 37 79 102 65 36 64 505 173 140 52

Appendix A-2: Coincident Summer Peak Net Load Forecast (2022 to 2031)

STATIONS	DESN ID	Summer LTR (MW)	2021 (Actuals)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
NORTH 230kV		1902	1173	1240	1309	1376	1401	1430	1444	1470	1490	1492	1493
Agincourt TS	T5/T6	174	72	73	74	80	83	86	86	87	88	89	88
Bathurst TS	T1/T2	183	127	116	119	121	138	156	173	171	170	169	168
Courses h MTC	T3/T4	178	110	135	131	146	148	146	145	163	180	179	178
Cavanagh MTS Fairchild TS	T1/T2 T1/T2	157 174	96 106	93 117	94 129	97 132	97 132	101 132	104 131	113 131	113 130	113 130	113 129
Faircillu 13	T3/T4	174	108	117	129	132	152	152	131	131	130	130	129
Finch TS	T1/T2	172	100	143	166	110	114	114	113	112	112	182	183
	T3/T4	186	124	133	156	179	178	178	178	177	179	181	182
Leslie TS	T1/T2 13.8	43	5	7	8	7	6	6	0	0	0	0	0
	T1/T2 27.6	96	74	75	80	87	89	76	79	80	80	81	81
	T3/T4 27.6	184	127	139	141	141	143	157	157	158	157	157	156
Malvern TS	T3/T4	176	96	92	94	94	95	97	98	98	99	100	104
EAST 230kV		1475	865	915	950	1029	1033	1031	1056	1075	1076	1079	1080
Bermondsey TS	T1/T2	186	48	60	82	87	87	101	114	113	113	113	112
	T3/T4	162	88	114	117	122	125	107	124	123	122	125	128
Ellesmere TS	T3/T4	189	116	115	122	141	147	146	145	154	154	153	152
Leaside TS	T19/T20/T21 13.8	100	66	69	69	68	69	70	70	70	70	70	70
Coord or TC	T19/T20/T21 27.6	110	79	77	76	74	74	73	72	72	71	71	70
Scarboro TS	T21/T22 T23/T24	189 151	94 107	97 111	96 110	118 111	119 109	118 108	117 107	129 108	129 107	129 107	129 107
Sheppard TS	T1/T2	95	65	60	60	60	60	108	60	108	107	107	107
Shepparu 15	T5/T6 (was T3/T4)	109	89	96	97	100	102	104	105	106	101	102	103
Warden TS	T3/T4	103	113	118	120	100	102	104	105	100	101	102	105
WEST 230kV	13/14	1239	648	640	680	711	685	710	745	743	749	756	764
Horner TS	T1/T2	184	0	30	31	39	40	96	95	95	95	95	95
	T3/T4	182	144	123	144	142	142	115	112	112	112	111	111
Manby TS	T13/T14	106	58	55	56	67	67	57	57	57	57	59	58
	T3/T4	60	36	29	29	29	30	26	26	26	27	28	29
	T5/T6	60	75	60	62	62	50	52	53	54	56	55	57
Rexdale TS	T1/T2	187	97	99	103	102	89	88	133	137	141	147	152
Richview TS	T1/T2	159	109	112	110	108	107	106	104	103	102	101	100
	T5/T6	188	83	84	98	114	114	121	113	106	106	107	107
	Т7/Т8	113	46	47	48	48	49	50	51	53	54	54	55
LEASIDE 115kV		1779	1131	1253	1305	1326	1352	1351	1355	1368	1375	1389	1401
Basin TS	T3/T5	88	57	74	59	67	69	72	77	81	82	82	
Database and TC	T44 / T42 / T42 / T44 / T45		400	4 45	4.40	4.40	4.40	4 47	4 47	4 47			85
Bridgman TS	T11/T12/T13/T14/T15	189	133	145	146	148	148	147	147	147	147	149	151
Carlaw TS	T1/T2	73	62	43	42	41	46	49	49	50	147 51	149 52	151 52
	T1/T2 T1/T2	73 85	62 55	43 61	42 61	41 59	46 58	49 57	49 56	50 54	147 51 55	149 52 57	151 52 57
Carlaw TS Cecil TS	T1/T2 T1/T2 T3/T4	73 85 130	62 55 92	43 61 91	42 61 89	41 59 89	46 58 87	49 57 86	49 56 84	50 54 82	147 51 55 80	149 52 57 81	151 52 57 82
Carlaw TS	T1/T2 T1/T2 T3/T4 T1/T2	73 85 130 130	62 55 92 70	43 61 91 86	42 61 89 91	41 59 89 94	46 58 87 93	49 57 86 97	49 56 84 97	50 54 82 97	147 51 55 80 96	149 52 57 81 95	151 52 57 82 94
Carlaw TS Cecil TS	T1/T2 T1/T2 T3/T4	73 85 130	62 55 92	43 61 91	42 61 89	41 59 89	46 58 87	49 57 86	49 56 84	50 54 82	147 51 55 80	149 52 57 81	151 52 57 82
Carlaw TS Cecil TS Charles TS	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4	73 85 130 130 81	62 55 92 70 57	43 61 91 86 61	42 61 89 91 64	41 59 89 94 60	46 58 87 93 70	49 57 86 97 71	49 56 84 97 71	50 54 82 97 70	147 51 55 80 96 70	149 52 57 81 95 70	151 52 57 82 94 70
Carlaw TS Cecil TS Charles TS	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T3/T4 T1/T3	73 85 130 130 81 94	62 55 92 70 57 46	43 61 91 86 61 53	42 61 89 91 64 63	41 59 89 94 60 58	46 58 87 93 70 63	49 57 86 97 71 64	49 56 84 97 71 65	50 54 82 97 70 66	147 51 55 80 96 70 66	149 52 57 81 95 70 66	151 52 57 82 94 70 66
Carlaw TS Cecil TS Charles TS Dufferin TS	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4	73 85 130 130 81 94 86	62 55 92 70 57 46 78	43 61 91 86 61 53 69	42 61 89 91 64 63 68	41 59 89 94 60 58 66	46 58 87 93 70 63 67	49 57 86 97 71 64 66	49 56 84 97 71 65 65	50 54 82 97 70 66 64	147 51 55 80 96 70 66 64	149 52 57 81 95 70 66 63	151 52 57 82 94 70 66 63
Carlaw TS Cecil TS Charles TS Dufferin TS	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T3/T4 T11/T12/T13	73 85 130 130 81 94 86 81 47 187	62 55 92 70 57 46 78 55 34 125	43 61 91 86 61 53 69 67 35 145	42 61 89 91 64 63 68 68 68 33 150	41 59 89 94 60 58 66 70 31 155	46 58 87 93 70 63 67 71 31 156	49 57 86 97 71 64 66 72 32 32 156	49 56 84 97 71 65 65 73 32 32 155	50 54 82 97 70 66 64 74 32 157	147 51 55 80 96 70 66 64 75 32 32 157	149 52 57 81 95 70 66 63 76 33 157	151 52 57 82 94 70 66 63 78 33 158
Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Esplanade TS Gerrard TS	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T3 T1/T2 T3/T4 T11/T12/T13 T1/T2	73 85 130 130 81 94 86 81 47 187 128	62 55 92 70 57 46 78 55 34 125 29	43 61 91 63 69 67 35 145 53	42 61 89 91 64 63 68 68 33 150 76	41 59 89 94 60 58 66 70 31 155 77	46 58 87 93 70 63 67 71 31 156 77	49 57 86 97 71 64 66 72 32 32 156 77	49 56 84 97 71 65 65 73 32 155 77	50 54 82 97 70 66 64 74 32 157 81	147 51 55 80 96 70 66 64 75 32 32 157 85	149 52 57 81 95 70 66 63 76 33 157 88	151 52 57 82 94 70 66 63 78 33 158 88
Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Esplanade TS	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T3/T4 T11/T12/T13 T1/T2 T1/T3	73 85 130 130 81 94 86 81 47 187 128 44	62 55 92 70 57 46 78 55 34 125 29 16	43 61 91 86 61 53 69 67 35 145 53 30	42 61 89 91 64 63 68 68 68 33 150 76 32	41 59 89 94 60 58 66 70 31 155 77 34	46 58 87 93 70 63 67 71 31 156 77 34	49 57 86 97 71 64 66 72 32 32 156 77 34	49 56 84 97 71 65 65 73 32 155 77 34	50 54 82 97 70 66 64 74 32 157 81 34	147 51 55 80 96 66 64 75 32 157 85 35	149 52 57 81 95 70 66 63 76 33 157 88 35	151 52 57 82 94 70 66 63 78 33 158 88 33
Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Esplanade TS Gerrard TS Glengrove TS	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T11/T12/T13 T1/T2 T1/T3 T2/T4	73 85 130 130 81 94 86 81 47 187 187 128 44 44	62 55 92 70 57 46 78 55 34 125 29 16 29	43 61 91 86 61 53 69 67 35 145 53 30 30	42 61 89 91 64 63 68 68 68 33 150 76 32 35	41 59 89 94 60 58 66 70 31 155 77 77 34 37	46 58 87 93 70 63 67 71 31 156 77 34 38	49 57 86 97 71 64 66 72 32 32 156 77 77 34	49 56 84 97 71 65 65 73 32 155 77 34 41	50 54 82 97 70 66 64 74 32 157 81 81 34 34	147 51 55 80 96 66 64 75 32 157 85 35 35	149 52 57 81 95 70 66 63 76 63 33 157 88 83 35 45	151 52 57 82 94 70 66 63 78 33 158 88 88 36 36
Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Esplanade TS Gerrard TS Glengrove TS Main TS	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T12/T13 T1/T12 T1/T2 T1/T3 T2/T4 T1/T3 T2/T4 T3/T4	73 85 130 130 81 94 86 81 47 187 128 44 44 44 77	62 55 92 70 57 46 78 55 34 125 29 16 29 16 29	43 61 91 86 61 53 69 67 35 145 53 30 30 31	42 61 89 91 64 63 68 68 33 150 76 32 35 60	41 59 89 94 60 58 66 70 31 155 77 77 34 37 61	46 58 87 93 70 63 67 71 31 156 77 34 38 61	49 57 86 97 71 64 66 72 32 156 77 77 34 40 62	49 56 84 97 71 65 65 73 32 155 77 34 41 62	50 54 82 97 70 66 64 74 32 157 81 34 34 34	147 51 55 80 96 66 64 70 66 64 75 32 157 85 35 35 44 63	149 52 57 81 95 70 66 63 33 157 88 33 35 45 64	151 52 57 82 94 70 66 63 78 33 158 88 33 55 88 47 65
Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Esplanade TS Gerrard TS Glengrove TS	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T1/T3 T1/T3 T1/T3 T1/T3 T1/T3 T1/T4 T1/T4	73 85 130 130 81 94 86 81 47 187 128 44 44 77 7108	62 55 92 70 57 46 78 55 34 125 29 16 29 16 29 54 52	43 61 91 86 61 53 69 67 35 145 5 145 5 30 30 31 58 60	42 61 89 91 64 63 68 68 33 150 76 32 35 60 89	41 59 89 94 60 58 66 70 31 155 155 77 34 34 37 61 94	46 58 87 93 70 63 67 71 31 56 57 77 34 38 61 97	49 57 86 97 71 64 66 72 32 156 156 77 34 40 62 83	49 56 84 97 71 65 65 73 32 155 77 34 41 62 84	50 54 82 97 70 66 64 74 32 157 81 34 34 43 62 85	147 51 55 80 96 70 66 64 75 32 157 85 35 44 463 86	149 52 57 81 95 70 66 63 33 157 88 335 45 64 87	151 52 57 82 94 70 66 63 78 33 158 88 36 47 7 65 88
Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Esplanade TS Gerrard TS Glengrove TS Main TS Terauley TS	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T12/T13 T1/T12 T1/T2 T1/T3 T2/T4 T1/T3 T2/T4 T3/T4	73 85 130 130 81 94 86 81 47 187 128 44 44 77 71 108 108	62 55 92 70 57 46 78 55 34 125 29 16 29 54 52 87	43 61 91 86 61 53 69 67 35 145 30 30 31 58 60 91	42 61 89 91 63 68 68 68 33 150 76 32 35 60 0 89 80	41 59 89 94 60 58 66 70 31 155 77 34 37 61 94 85	46 58 87 93 70 63 67 71 31 156 57 34 38 61 97 85	49 57 86 97 71 64 66 72 32 156 77 34 40 60 62 83 87	49 56 84 97 71 65 65 73 32 155 77 34 41 62 84 87	50 54 82 97 70 66 64 74 32 157 157 34 43 62 85 87	147 51 55 80 96 66 64 75 32 157 85 35 44 63 85 85 86 87	149 52 57 81 95 70 66 63 33 157 88 33 35 45 64 88 88	151 52 57 82 94 70 66 63 78 33 158 88 33 33 158 88 33 56 47 65 88 88 88
Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Esplanade TS Gerrard TS Glengrove TS Main TS Terauley TS MANBY E 115kV	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T1/T2 T1/T2 T1/T3 T2/T4 T3/T4 T3/T4 T3/T4 T3/T4 T3/T4 T3/T4	73 85 130 81 94 86 86 81 47 187 128 44 44 44 44 108 579	62 55 92 70 57 46 78 55 34 125 29 16 29 54 52 87 52 87 293	43 61 91 53 69 67 35 145 53 30 31 58 60 0 91 336	42 61 89 91 63 68 68 68 33 150 76 32 35 60 89 80 80 80 362	41 59 89 94 60 58 66 70 31 155 77 34 37 61 94 85 384	46 58 87 93 63 67 71 31 156 77 34 38 61 97 97 85 390	49 57 86 97 71 64 66 66 72 32 156 77 34 40 62 83 83 87 392	49 56 84 97 71 65 65 73 32 155 77 34 41 62 84 84 87 390	50 54 82 97 70 666 64 74 32 157 81 34 34 43 62 85 87 391	147 51 55 80 96 666 64 75 32 157 85 32 157 85 35 44 63 86 83 86 87 392	149 52 57 81 95 70 66 63 33 157 88 33 45 64 87 88 394	151 52 57 82 94 70 66 6 3 33 158 88 33 47 65 88 88 88 88 88 88 88 88
Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Esplanade TS Gerrard TS Glengrove TS Main TS Terauley TS	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T1/T2 T1/T2 T1/T3 T1/T2 T1/T3 T2/T4 T3/T4 T1/T4 T1/T4 T2/T3 T2/T4	73 85 130 130 81 94 86 81 47 187 128 44 44 44 44 44 44 579 108 108	62 55 92 70 57 46 78 55 34 125 29 16 29 54 52 87 293	43 61 91 69 69 67 35 145 53 30 31 31 58 60 91 336 84	42 61 89 91 64 63 68 68 68 33 150 76 32 35 60 89 80 89 80 362 75	41 59 89 94 60 58 66 60 70 31 155 77 34 37 61 94 85 384 78	46 58 87 93 67 70 63 67 71 31 156 77 34 38 61 97 97 85 390 79	49 57 86 97 71 64 66 66 72 32 156 77 34 40 62 83 87 392 80	49 56 84 97 71 65 65 73 32 155 77 34 41 62 84 84 87 390 77	50 54 82 97 70 66 64 74 32 157 81 34 34 43 62 85 87 391 78	147 51 55 80 96 66 64 75 32 157 85 32 157 85 35 44 63 86 83 86 83 78	149 52 57 81 95 70 66 63 37 6 63 33 157 88 33 45 64 87 88 83 94 79	151 52 57 82 94 70 666 63 378 33 158 88 33 6 47 65 888 88 88 88 88 88 88 88 88 88 88 88 8
Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Duplex TS Esplanade TS Gerrard TS Glengrove TS Main TS Terauley TS MANBY E 115kV Fairbank TS	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T1/T3 T1/T2 T1/T3 T2/T4 T3/T4 T1/T4 T1/T4 T2/T3 T2/T4 T1/T3 (to be T5/T6)	73 85 130 130 81 94 86 81 47 187 128 44 44 77 108 108 108 579 90 92	62 55 92 70 57 46 78 55 34 125 29 16 29 54 52 87 7 293 79 91	43 61 91 69 69 67 35 145 53 30 31 58 69 91 336 84 84 75	42 61 89 91 64 68 68 68 33 150 76 32 35 60 89 80 80 362 75 69	41 59 89 94 60 58 66 670 31 155 77 34 37 61 94 85 384 78 62	46 58 87 93 70 67 71 31 156 77 34 38 61 97 85 390 79 63	49 57 86 97 71 64 66 66 72 32 156 77 34 40 62 83 87 392 80 63	49 56 84 97 71 65 65 73 32 155 77 34 41 62 84 87 390 77 64	50 54 82 97 70 66 64 74 32 157 81 34 43 62 85 85 87 391 78 64	147 51 55 80 96 66 64 64 75 32 157 85 32 157 85 35 44 63 86 87 392 78	149 52 57 81 95 70 66 33 76 33 157 88 35 45 64 87 88 394 79 66	151 52 57 82 94 70 66 63 378 33 158 88 33 158 88 36 47 65 88 88 88 88 88 88 88 88 88 88 88 88 88
Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Duplex TS Esplanade TS Gerrard TS Glengrove TS Main TS Terauley TS MANBY E 115kV Fairbank TS	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T1/T3 T2/T4 T1/T3 T2/T4 T1/T4 T2/T3 T2/T4 T2/T4 T2/T3 T2/T4 T1/T3 (to be T5/T6) T1/T2	73 85 130 81 94 86 81 47 187 128 44 44 44 77 108 579 90 90 92	62 55 92 70 57 46 78 55 34 125 29 16 29 54 52 87 293	43 61 91 86 61 53 67 35 145 53 30 31 31 58 60 91 336 4 75 71	42 61 89 91 64 63 68 68 68 33 150 76 32 35 60 89 80 89 80 362 75	41 59 89 94 60 58 66 70 31 155 77 34 34 37 61 94 85 384 78 62 95	46 58 87 93 70 63 67 71 31 31 56 77 34 38 61 97 85 390 79 63 97	49 57 86 97 71 64 66 67 2 32 32 156 77 34 40 62 83 87 392 80 63 87	49 56 84 97 71 65 65 73 32 155 77 34 41 62 84 87 390 77 64 93	50 54 82 97 70 66 64 74 32 157 81 34 43 62 85 87 391 78 64 92	147 51 55 80 96 64 64 64 75 32 157 85 32 157 85 35 44 63 86 87 392 78 65 91	149 52 57 81 95 70 66 33 35 35 45 64 88 35 45 64 87 88 394 79 66 90	151 52 57 82 94 70 66 63 378 33 158 88 333 158 88 336 47 65 88 88 88 88 88 88 90 67 90
Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Duplex TS Esplanade TS Gerrard TS Glengrove TS Main TS Terauley TS MANBY E 115kV Fairbank TS	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T1/T3 T1/T2 T1/T3 T2/T4 T3/T4 T1/T4 T1/T4 T2/T3 T2/T4 T1/T3 (to be T5/T6)	73 85 130 130 81 94 86 81 47 187 128 44 44 77 108 108 108 579 90 92	62 55 92 70 57 46 78 55 34 125 29 16 29 54 52 87 7 9 9 54 52 87 79 991	43 61 91 69 69 67 35 145 53 30 31 58 69 91 336 84 84 75	42 61 89 91 64 68 68 33 150 76 32 35 60 89 80 80 362 75 69 83	41 59 89 94 60 58 66 670 31 155 77 34 37 61 94 85 384 78 62	46 58 87 93 70 67 71 31 156 77 34 38 61 97 85 390 79 63	49 57 86 97 71 64 66 66 72 32 156 77 34 40 62 83 87 392 80 63	49 56 84 97 71 65 65 73 32 155 77 34 41 62 84 87 390 77 64	50 54 82 97 70 66 64 74 32 157 81 34 43 62 85 85 87 391 78 64	147 51 55 80 96 66 64 64 75 32 157 85 32 157 85 35 44 63 86 87 392 78	149 52 57 81 95 70 66 33 76 33 157 88 35 45 64 87 88 394 79 66	151 52 57 82 94 70 66 63 378 33 158 88 33 158 88 36 47 65 88 88 88 88 88 88 88 88 88 88 88 88 88
Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Duplex TS Gerrard TS Glengrove TS Main TS Terauley TS MANBY E 115kV Fairbank TS Runnymede TS	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T1/T3 T2/T4 T3/T4 T1/T3 T2/T4 T3/T4 T1/T4 T2/T3 T2/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T3 (to be T5/T6) T1/T2 T5/T6 (was T3/T4)	73 85 130 81 94 86 81 47 128 44 44 77 128 44 44 77 108 579 90 90 92 108	62 55 92 70 57 46 78 55 34 125 29 16 29 16 29 54 52 87 293 79 9 91 69 91	43 61 91 86 67 67 35 145 53 30 31 58 60 91 336 4 75 71	42 61 89 91 64 68 68 68 68 68 33 150 76 32 35 60 89 80 362 569 83 44	41 59 89 94 60 58 66 70 31 155 77 34 34 37 61 94 85 384 85 384 62 95 94 9	46 58 87 93 67 71 31 31 56 77 34 38 61 97 85 390 63 97 63 97 53	49 57 86 97 71 64 66 72 32 156 77 34 40 62 83 87 392 392 80 63 94 57	49 56 84 97 71 65 65 73 32 155 77 34 41 62 84 84 87 390 777 64 93 59	50 54 82 97 70 66 64 74 32 157 81 34 34 43 62 85 87 391 64 92 60	147 51 55 80 96 70 66 64 75 32 157 85 35 35 35 44 463 86 87 392 78 65 91 61	149 52 57 81 95 70 66 63 33 157 88 35 64 88 83 5 64 87 88 394 79 66 6 90 62	151 52 57 82 94 70 66 63 78 33 158 88 36 47 65 88 88 398 88 398 80 67 90 65
Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Duplex TS Gerrard TS Glengrove TS Main TS Terauley TS MANBY E 115kV Fairbank TS Runnymede TS	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T1/T3 T1/T3 T1/T3 T1/T3 T1/T3 T2/T4 T1/T4 T2/T3 T2/T4 T1/T4 T2/T4 T1/T3 (to be T5/T6) T1/T2 T5/T6 (was T3/T4) T1/T6	73 85 130 81 94 86 81 47 187 128 44 44 77 108 108 579 90 90 92 108 111	62 55 92 70 57 46 6 78 55 34 125 29 16 29 54 52 87 293 79 91 91 69 9 1 1 23	43 61 91 53 69 67 35 145 53 30 31 58 60 91 336 84 75 71 28 28	42 61 89 91 63 68 68 68 33 150 76 32 35 60 89 80 362 75 683 83 44	41 59 89 94 60 58 66 70 31 155 77 34 37 61 94 85 384 78 62 95 94 9	46 58 87 93 63 67 71 31 156 77 31 156 77 34 38 61 97 85 390 79 63 97 53 32	49 57 86 97 71 64 66 72 32 156 77 32 156 77 34 0 63 83 87 392 80 63 94 57 33	49 56 84 97 71 65 65 73 32 155 77 33 4 41 6 6 84 87 390 77 64 93 59 33	50 54 82 97 70 66 66 64 74 32 157 81 34 362 85 87 391 78 64 92 60 33	147 51 55 80 96 66 64 75 32 157 85 35 44 63 86 86 87 392 78 65 911 61	149 52 57 81 95 70 66 63 33 157 88 33 35 64 88 35 64 87 88 394 79 66 69 00 62 34	151 52 57 82 94 70 66 63 78 33 158 88 36 47 65 88 88 88 88 88 88 67 67 90 90 65 34
Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Esplanade TS Gerrard TS Glengrove TS Main TS Terauley TS MANBY E 115kV Fairbank TS Runnymede TS Wiltshire TS WANBY W 115kV	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T1/T3 T1/T3 T1/T3 T1/T3 T1/T3 T2/T4 T1/T4 T2/T3 T2/T4 T1/T4 T2/T4 T1/T3 (to be T5/T6) T1/T2 T5/T6 (was T3/T4) T1/T6	73 85 130 81 94 86 86 81 47 187 128 44 44 77 108 108 579 90 92 90 92 108 111 48 129	62 55 92 70 57 46 78 55 34 125 29 16 29 54 4 52 87 293 79 9 91 69 11 23 30	43 61 91 53 69 67 35 145 53 30 31 58 60 91 336 84 4 75 71 288 32 46	42 61 89 91 63 68 68 68 33 150 76 32 35 60 0 89 80 362 75 69 83 83 44 4 32 59	41 59 89 94 60 58 66 70 31 155 77 34 37 61 94 85 384 78 62 95 95 95 92 932	46 58 87 93 63 67 71 31 56 77 34 38 61 97 85 390 79 63 97 53 32 66	49 57 86 97 71 64 66 72 32 156 77 34 40 60 62 83 87 392 80 63 94 57 333 65	49 56 84 97 71 65 65 73 32 155 77 34 41 62 84 87 390 77 64 93 599 333 65	50 54 82 97 70 66 66 64 74 32 157 81 34 43 62 85 87 391 78 64 92 60 33 64	147 51 55 80 96 66 64 75 32 157 85 35 44 46 33 86 87 392 78 65 91 61 1 33 64	149 52 57 81 95 70 66 63 33 157 88 33 45 64 88 394 79 66 394 90 66 90 62 34	151 52 57 82 94 70 66 63 78 33 158 88 33 47 65 88 88 398 88 88 90 67 90 65 34 63
Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Esplanade TS Gerrard TS Glengrove TS Main TS Terauley TS MANBY E 115kV Fairbank TS Runnymede TS Wiltshire TS WANBY W 115kV	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T1/T3 T2/T4 T1/T2 T1/T3 T2/T4 T3/T4 T2/T4 T1/T4 T2/T3 T2/T4 T1/T3 (to be T5/T6) T1/T2 T5/T6 (was T3/T4) T1/T2	73 85 130 130 81 94 86 81 47 187 128 44 44 77 187 128 90 90 90 90 92 108 108 108 108 108 108 108 108 108 108	62 55 92 70 46 78 55 34 125 29 16 29 54 52 87 293 79 91 69 11 69 11 233 30 370	43 61 91 53 69 67 35 145 53 30 31 58 60 91 336 84 75 71 28 322 46 371	42 61 89 91 63 68 68 68 33 150 76 32 35 60 89 80 362 75 69 83 44 432 59 376	41 59 89 94 66 70 31 155 77 34 37 61 94 85 384 78 62 95 384 78 62 95 94 9 932 266 66 418	46 58 87 93 63 67 71 31 55 77 34 38 61 97 85 390 79 63 97 53 322 66 420	49 57 86 97 71 64 66 72 32 156 77 34 40 62 83 87 392 80 63 94 57 33 365 5 512	49 56 84 97 71 65 73 32 155 77 34 41 62 84 84 87 390 777 64 93 59 333 65 510	50 54 82 97 70 666 64 74 32 157 81 34 43 62 85 87 391 78 64 92 600 33 64 506	147 51 55 80 96 66 66 4 75 32 157 85 35 35 44 4 4 63 86 87 392 78 865 91 61 33 64 503	149 52 57 81 95 70 66 63 76 33 157 88 33 45 64 88 394 79 66 90 62 34 64 64 501	151 52 57 82 94 70 66 63 78 33 158 88 33 47 65 88 88 398 88 88 67 90 65 5 34 63 500
Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Duplex TS Gerrard TS Glengrove TS Glengrove TS Main TS Terauley TS MANBY E 115kV Fairbank TS Runnymede TS Willshire TS MANBY W 115kV Copeland MTS	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T1/T3 T1/T2 T1/T3 T2/T4 T3/T4 T2/T4 T3/T4 T2/T4 T2/T3 T2/T4 T1/T3 (to be T5/T6) T1/T2 T2/T4 T1/T2 T5/T6 (was T3/T4) T1/T6 T7X/T2X	73 85 130 81 94 86 86 81 47 187 128 44 44 44 44 44 90 90 90 90 92 108 579 90 92 108 111 130	62 55 92 70 57 46 78 55 34 125 29 16 29 54 54 52 87 293 79 91 69 11 69 11 23 300 370	43 61 91 86 61 53 69 69 67 35 145 53 30 31 58 60 0 91 336 84 75 71 28 322 46 371 102	42 61 89 91 63 68 68 33 150 76 32 35 60 89 80 362 75 69 83 44 322 59 376 112	41 59 89 94 60 58 66 67 70 31 155 77 34 37 61 94 85 384 78 62 95 49 95 49 32 66 6 6 6 418	46 58 87 93 70 63 67 71 31 156 77 34 38 61 97 85 390 79 63 97 53 322 66 420 119	49 57 86 97 71 64 66 67 2 32 156 77 34 40 62 83 87 392 80 63 94 57 333 65 512 180	49 56 84 97 71 65 65 73 32 155 77 34 41 62 84 84 87 390 77 64 93 59 333 65 510	50 54 82 97 70 666 64 74 32 157 81 34 43 62 85 87 391 78 64 92 60 333 64 506	147 51 55 80 96 666 64 75 32 157 85 32 157 85 33 44 63 86 86 87 392 78 65 91 61 33 3 64 4 503	149 52 57 81 95 70 66 63 33 157 88 33 45 64 87 88 394 79 66 90 62 34 62 34 64 501	151 52 57 82 94 70 66 6 33 78 33 158 88 33 6 58 88 336 47 65 88 88 88 88 88 398 65 65 34 65 500 170
Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Duplex TS Gerrard TS Glengrove TS Glengrove TS Main TS Terauley TS MANBY E 115kV Fairbank TS Runnymede TS Willshire TS MANBY W 115kV Copeland MTS	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T1/T3 T1/T2 T1/T3 T2/T4 T3/T4 T1/T4 T2/T3 T2/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T3 T5/T6 (was T3/T4) T1/T2 T3/T4 T1/T3 T3/T4	73 85 130 81 94 86 81 47 187 128 44 44 77 108 108 579 90 90 92 108 111 48 129 611 130 187 123 74	62 55 92 70 57 46 78 55 34 125 29 16 29 54 52 87 293 79 91 69 11 69 11 23 300 370 79 83	43 61 91 86 69 69 67 35 145 53 30 31 330 30 31 53 8 60 0 91 336 84 75 71 28 82 24 6 6 91 336 6 91 336 6 91 336 6 91 336 6 9 1 336 6 9 1 35 33 30 30 31 31 31 31 32 33 30 30 31 31 31 31 31 32 33 30 30 31 31 31 31 31 32 33 30 30 31 31 31 31 31 31 31 31 32 33 30 30 31 31 31 31 31 31 31 31 31 31 31 31 31	42 61 89 91 64 63 68 68 33 150 76 32 35 60 89 80 362 75 69 83 44 42 32 59 376 112	41 59 89 94 60 58 66 67 70 31 155 77 34 37 61 94 85 384 78 62 95 49 95 49 95 49 32 66 6 6 6 1 19 5 384 78 61 95 95 19 95 95 95 95 95 95 95 95 95 95 95 95 95	46 58 87 93 70 63 67 71 31 156 77 34 38 61 97 85 390 79 63 97 53 32 66 6 420 119 59	49 57 86 97 71 64 66 67 2 32 156 77 34 40 65 83 87 392 80 63 94 57 392 80 63 94 57 333 65 5 512 180 98	49 56 84 97 71 65 65 73 32 155 77 34 41 62 84 84 84 87 390 77 64 93 359 33 65 510 177 99	50 54 82 97 70 666 64 74 32 157 81 34 43 62 85 87 391 78 64 92 60 333 64 506 175 143	147 51 55 80 96 666 64 75 32 157 85 32 157 85 33 44 63 86 86 87 392 78 65 91 61 33 36 44 503 91	149 52 57 81 95 70 66 63 33 157 88 33 45 64 88 394 79 66 90 62 34 64 4 501 171	151 52 57 82 94 70 66 63 78 33 158 88 36 47 65 88 88 36 67 90 65 34 65 34 65 34 65 34 65 34 65 34 88 83 88 398 83 90 65 34 500 170 90 65 34 52 23 52 52 52 53 53 50 53 50 53 50 53 50 53 50 53 50 50 50 50 50 50 50 50 50 50 50 50 50
Carlaw TS Cecil TS Charles TS Dufferin TS Duplex TS Duplex TS Gerrard TS Glengrove TS Main TS Terauley TS MANBY E 115kV Fairbank TS Runnymede TS Wiltshire TS MANBY W 115kV Copeland MTS John TS	T1/T2 T1/T2 T3/T4 T1/T2 T3/T4 T1/T3 T2/T4 T1/T3 T2/T4 T1/T2 T3/T4 T1/T2 T3/T4 T1/T2 T1/T3 T1/T3 T2/T4 T1/T4 T2/T3 T2/T4 T1/T4 T2/T3 T2/T4 T1/T3 T2/T4 T1/T2 T5/T6 (was T3/T4) T1/T6 T7X/T2X T1/T3 T1/T2/T3/T4 T5/T6 T1/T3/T15	73 85 130 130 81 94 86 81 47 187 128 44 44 44 47 7 108 108 108 108 108 108 108 108 108 108	62 55 92 70 57 46 78 55 34 125 29 16 29 52 87 293 79 91 69 11 23 300 370 79 83	43 61 91 86 69 69 67 35 145 53 30 30 31 58 60 91 336 84 75 71 28 32 46 371 28 32 32 46 371	42 61 89 91 64 63 68 68 33 150 76 32 35 60 89 89 80 362 75 69 83 44 432 59 376 112 37	41 59 89 94 60 58 66 670 31 155 77 34 34 37 61 94 85 384 78 62 95 49 95 49 32 66 61 81 98	46 58 87 93 70 63 67 71 31 156 77 34 38 61 97 97 85 390 79 63 97 53 32 66 66 420 119 59 98	49 57 86 97 71 66 66 67 2 32 156 77 34 40 62 83 83 87 392 80 65 5 512 180 98 100	49 56 84 97 71 65 65 73 32 155 77 34 41 62 84 84 84 84 87 390 77 64 93 59 33 65 510 177 99	50 54 82 97 70 66 64 74 32 157 81 34 43 62 85 85 87 391 78 64 92 60 33 64 506 175 143	147 51 55 80 96 66 64 75 32 157 85 32 157 85 35 44 63 86 86 88 63 86 65 91 61 33 64 4503 173 31 42 53	149 52 57 81 95 70 66 63 33 76 33 157 88 33 45 64 87 88 83 94 79 66 90 66 90 62 34 64 50 171 171 140 52	151 52 57 82 94 70 66 63 37 8 83 33 158 88 33 6 47 65 88 88 88 88 88 88 88 88 88 88 67 90 65 34 63 500 170 140

Appendix B: Lists of Step-Down Transformer Stations (Current)

Station (DESN)	Voltage (kV)	Supply Circuits
Agincourt TS T5/T6	230/27.6	C4R/C10A
Basin TS T3/T5	115/13.8	H3L/H1L
Bathurst TS T1/T2	230/27.6	P22R/C18R
Bathurst TS T3/T4	230/27.6	P22R/C18R
Bermondsey TS T1/T2	230/27.6	C17L/C14L
Bermondsey TS T3/T4	230/27.6	C17L/C14L
Bridgman TS T11/T12/T13/T14/T15	115/13.8	L14W/L15/L18W
Carlaw TS T1/T2	115/13.8	H1L/H3L
Cavanagh MTS T1/T2	230/27.6	C20R/C10A
Cecil TS T1/T2	115/13.8	Cecil Buses H & P
Cecil TS T3/T4	115/13.8	Cecil Buses P & H
Charles TS T1/T2	115/13.8	L4C/L9C
Charles TS T3/T4	115/13.8	L12C/L4C
Copeland MTS T1/T3	115/13.8	D11J/D12J
Dufferin TS T1/T3	115/13.8	L13W/L18W
Dufferin TS T2/T4	115/13.8	L13W/L18W
Duplex TS T1/T2	115/13.8	L16D/L5D
Duplex TS T3/T4	115/13.8	L5D/L16D
Ellesmere TS T3/T4	230/27.6	C2L/C3L
Esplanade TS T11/T12/T13	115/13.8	H2JK/H10DE(C5E)/H9DE(C7E)
Fairbank TS T1/T3 (to be T5/T6)	115/27.6	K3W/K1W
Fairbank TS T2/T4	115/27.6	K3W/K1W

Station (DESN)	Voltage (kV)	Supply Circuits
Fairchild TS T1/T2	230/27.6	C18R/C20R
Fairchild TS T3/T4	230/27.6	C18R/C20R
Finch TS T1/T2	230/27.6	C20R/P22R
Finch TS T3/T4	230/27.6	P21R/C4R
Gerrard TS T1/T2	115/13.8	H3L/H1L
Glengrove TS T1/T3	115/13.8	D6Y/L2Y
Glengrove TS T2/T4	115/13.8	D6Y/L2Y
Horner TS T3/T4	230/27.6	R13K/R2K
Horner TS T1/T2	230/27.6	R13K/R2K
John TS T1/T2/T3/T4	115/13.8	John Buses K1 & K2 & K3 & K4
John TS T5/T6	115/13.8	John Buses K1 & K4
Leaside TS T19/T20/T21 13.8	230/13.8	Leaside Buses HL2, HL3, HL16
Leaside TS T19/T20/T21 27.6	230/27.6	Leaside Buses HL2, HL3, HL16
Leslie TS T1/T2 13.8	230/13.8	P21R/C5R
Leslie TS T1/T2 27.6	230/27.6	P21R/C5R
Leslie TS T3/T4 27.6	230/27.6	P21R/C5R
Main TS T3/T4	115/13.8	H7L/H11L
Malvern TS T3/T4	230/27.6	C4R/C5R
Manby TS T13/T14	230/27.6	Manby W Buses A1 & H1
Manby TS T3/T4	230/27.6	Manby W Buses A1 & H1
Manby TS T5/T6	230/27.6	Manby E Buses H2 & A2
Rexdale TS T1/T2	230/27.6	V74R/V76R
Richview TS T1/T2	230/27.6	Richview Buses H1 & A1

Station (DESN)	Voltage (kV)	Supply Circuits
Richview TS T5/T6	230/27.6	V74R/V72R
Richview TS T7/T8	230/27.6	Richview Buses H2 & A2
Runnymede TS T1/T2	115/27.6	K12W/K11W
Runnymede TS T5/T6 (was T3/T4)	115/27.6	K12W/K11W
Scarboro TS T21/T22	230/27.6	C14L/C2L
Scarboro TS T23/T24	230/27.6	C15L/C3L
Sheppard TS T1/T2	230/27.6	C16L/C15L
Sheppard TS T5/T6 (was T3/T4)	230/27.6	C15L/C16L
Strachan TS T12/T14	115/13.8	H2JK/K6J
Strachan TS T13/T15	115/13.8	K6J/H2JK
Terauley TS T1/T4	115/13.8	C7E/C5E
Terauley TS T2/T3	115/13.8	C7E/C5E
Warden TS T3/T4	230/27.6	C14L/C17L
Wiltshire TS T1/T6	115/13.8	K1W/K3W (Wiltshire Buses H1 & H3)
Wiltshire TS T7X/T2X	115/13.8	K1W/K3W (Wiltshire Buses H1 & H3)

Appendix C: Lists of Transmission Circuits

Location	Circuit Designations	Voltage (kV)
Richview x Manby	R1K, R2K, R13K, R15K	230
Richview x Cooksville	R24C	230
Manby x Cooksville	K21C, K23C	230
Cherrywood x Leaside	C2L, C3L, C14L, C15L, C16L, C17L	230
Cherrywood x Richview	C4R, C5R, C18R, C20R	230
Cherrywood x Agincourt	C10A	230
Parkway x Richview	P21R, P22R	230
Claireville x Richview	V72R, V73R, V74R, V76R, V77R, V79R	230
Manby East x Wiltshire	K1W, K3W, K11W, K12W	115
Manby West x John	K6J, K13J, K14J	115
Manby West x John x Hearn	Н2ЈК	115
John x Esplanade x Hearn	D11J, D12J, H9DE, H10DE	115
Esplanade x Cecil	С5Е, С7Е	115
Hearn x Cecil x Leaside	H6LC, H8LC	115
Hearn x Leaside	H1L, H3L, H7L, H11L	115
Leaside x Bridgman x Wiltshire	L13W, L14W, L15, L18W	115
Leaside x Charles	L4C	115
Leaside x Cecil	L9C, L12C	115
Leaside x Duplex	L5D, L16D	115
Leaside x Glengrove	L2Y	115
Duplex x Glengrove	D6Y	115

Appendix D: Acronyms

Acronym	Description
A	Ampere
BES	Bulk Electric System
BPS	Bulk Power System
CDM	Conservation and Demand Management
CEP	Community Energy Plan
CIA	Customer Impact Assessment
CGS	Customer Generating Station
CSS	Customer Switching Station
CTS	Customer Transformer Station
DCF	Discounted Cash Flow
DESN	Dual Element Spot Network
DG	Distributed Generation
DSC	Distribution System Code
GS	Generating Station
GTA	Greater Toronto Area
HV	High Voltage
IESO	Independent Electricity System Operator
IRRP	Integrated Regional Resource Plan
kV	Kilovolt
LDC	Local Distribution Company
LP	Local Plan
LTE	Long Term Emergency
LTR	Limited Time Rating
LV	Low Voltage
MEP	Municipal Energy Plan
MTS	Municipal Transformer Station
MW	Megawatt
MVA	Mega Volt-Ampere
MVAR	Mega Volt-Ampere Reactive
NA	Needs Assessment
NERC	North American Electric Reliability Corporation
NGS	Nuclear Generating Station
NPCC	Northeast Power Coordinating Council Inc.
NUG	Non-Utility Generator
OEB	Ontario Energy Board
OPA	Ontario Power Authority
ORTAC	Ontario Resource and Transmission Assessment Criteria
PEC	Portland Energy Centre
PF	Power Factor
PPWG	Planning Process Working Group
RIP	Regional Infrastructure Plan
RP	Regional Planning
ROW	Right-of-Way
SA	Scoping Assessment
SIA	System Impact Assessment
SPS	Special Protection Scheme
SS	Switching Station
STG	Steam Turbine Generator
TPS	Traction Power Station
TS	Transformer Station
TSC	Transmission System Code
UFLS	Under Frequency Load Shedding
ULTC	Under Load Tap Changer
UVLS	Under Voltage Load Rejection Scheme