BURLINGTON TO NANTICOKE REGION
SCOPING ASSESSMENT OUTCOME REPORT

SEPTEMBER 2017

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Burlington to Nanticoke Study Team

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Independent Electricity System Operator
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Burlington Hydro Inc.
Energy + Inc.
Oakville Hydro Inc.

1 Burlington to Nanticoke Scoping Assessment Outcome

Scoping Assessment Outcome Report Summary			
Region:	Burlington to Nanticoke		
Start Date	June 12, 2017	**End Date**	August 25, 2017

1. Introduction

This Scoping Assessment Outcome Report is part of the Ontario Energy Board's ("OEB" or "Board") Regional Planning process. The Board endorsed the Planning Process Working Group's Report to the Board in May 2013 and formalized the process and timelines through changes to the Transmission System Code and Distribution System Code in August 2013.

The Burlington to Nanticoke region has already undergone one regional planning cycle which was formally completed in February of 2017 with the publishing of Hydro One's regional infrastructure plan ("RIP"). However, in development of the RIP a number of end-of-life needs were identified for the region. This information was not available in 2014 when the original needs assessment ("NA") and scoping assessment ("SA") were completed. Projects to address a number of these end-of-life needs, as identified in the RIP, are currently underway. However, a number of the needs identified were in the mid- to long-term and, as such, the RIP recommended that the next regional planning cycle should be triggered and an expedited needs assessment report should be developed.

Following the recommendations of the RIP, a needs assessment was carried out by Hydro One Networks Inc. ("Hydro One") for the Burlington to Nanticoke region. The final needs assessment report[1] was issued on May 15, 2017 and concluded that some needs in the region may require regional coordination and more comprehensive planning, and should be reviewed further under the IESO-led scoping assessment process, which is the second stage in the Board's regional planning process.

The IESO, in collaboration with the Regional Participants, further reviewed the needs identified, along with information collected during the needs assessment, information on potential wires and non-wires alternatives, and the overall regional area impact to assess and determine the best planning approach for the whole or parts of the region. The available planning options considered in the scoping assessment include: an integrated regional resource plan ("IRRP"), a regional infrastructure plan ("RIP" or wires only plan), or a local plan.

[1] The Needs Assessment report for the Burlington to Nanticoke Region can be found at: http://www.hydroone.com/RegionalPlanning/Burlington/Pages/home.aspx

This Scoping Assessment report:

- Defines the sub-regions for needs requiring more comprehensive planning as identified in the needs assessment report;
- Determines the appropriate regional planning approach and scope for each sub-region where a need for regional coordination or more comprehensive planning is identified;
- Establishes a terms of reference when an IRRP is the recommended approach for the sub-region(s);
- Establishes a working group for each sub-region recommended for an IRRP or a RIP.

2. Team

The Scoping Assessment was carried out with the following Regional Participants:

- Independent Electricity System Operator ("IESO")
- Hydro One Networks Inc. ("Hydro One Transmission")
- Hydro One Networks Inc. ("Hydro One Distribution")
- Alectra Utilities Corporation
- Brantford Power Inc.
- Burlington Hydro Inc.
- Energy + Inc.
- Oakville Hydro Inc.

3. Categories of Needs, Analysis and Results

I. Overview of the Region

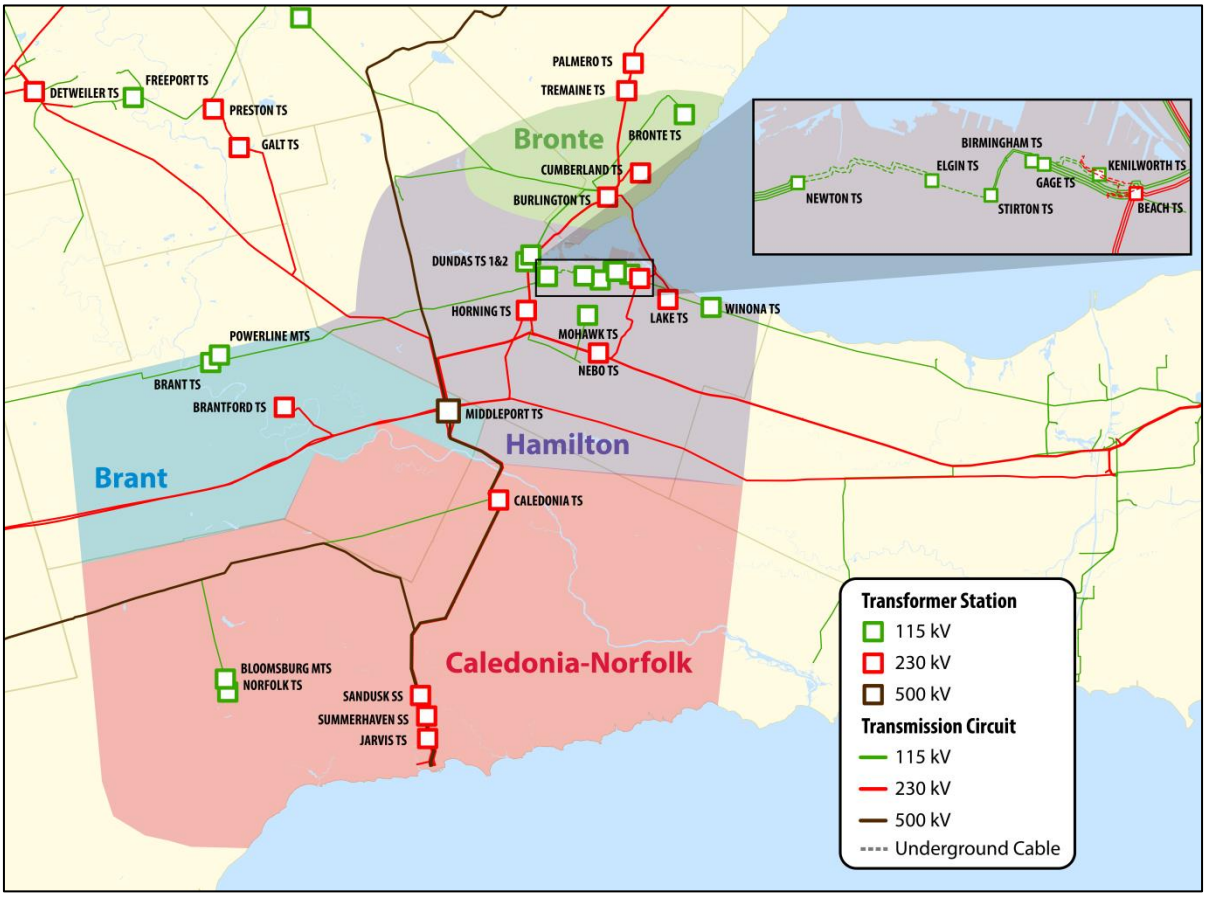
The Burlington to Nanticoke region is located in southwestern Ontario and includes all or part of the following Counties and Districts: the City of Hamilton, Brant County, the City of Brantford, Haldimand County, Norfolk County, and the Regional Municipality of Halton. For electricity planning purposes, the planning region is defined by electricity infrastructure boundaries, not municipal boundaries.

The region also includes the following First Nations:

- Mississaugas of the New Credit
- Six Nations of the Grand River

The electricity infrastructure supplying the Burlington to Nanticoke region is shown in Figure 1. For the purposes of regional planning, the Burlington to Nanticoke region has historically been sub-divided into four sub-regions: Bronte, Hamilton, Brant, and Caledonia-Norfolk.

Figure 1-1 Electricity Infrastructure in the Burlington to Nanticoke Region



NOTE: Region is defined by electricity infrastructure; geographical boundaries are approximate.

The Bronte sub-region includes Burlington TS and the 230 kV and 115 kV supply northeast of the station which services Cumberland TS and Bronte TS, respectively. The 115 kV supply southwest from Burlington TS and the 230 kV supply from Beach TS service the 115 kV network in the Hamilton sub-region, while 230 kV circuits between Burlington TS and Beach TS, Beach TS and Middleport TS, and Middleport TS and Burlington TS supply the Hamilton sub-region's 230 kV connected load supply stations. The Brant sub-region is supplied from the 230 kV supply west from Middleport TS and a 115 kV supply from Burlington TS. The 230 kV supply south from Middleport TS supplies the 230 kV connected stations in the Caledonia-Norfolk sub-region, including Caledonia TS. The 115 kV supply from Caledonia TS then supplies Bloomsburg MTS and Norfolk TS.

II. Background

This is the second cycle of regional planning for the Burlington to Nanticoke region. When the Board formalized the regional planning process in 2013 planning work was already ongoing in the Brant area, a sub-region of the Burlington to Nanticoke region. As such, Burlington to Nanticoke became one of the Group 1 planning regions, the first group to undergo the formalized regional planning process.

On May 23, 2014, Hydro One Transmission published the first needs assessment report for the region. Subsequently on September 25, 2014, the former OPA (now the IESO) published a scoping assessment report for the Burlington to Nanticoke region which specified the terms of reference for the Bronte IRRP, in addition to the already published terms of reference for the Brant IRRP which was already underway. The 2014 scoping assessment indicated that based on the available information, no IRRP was required for the Hamilton or Caledonia-Norfolk sub-regions and the needs identified for those regions would be addressed through local planning between the LDCs and the transmitter, as recommended in the needs assessment.

Regional plans were completed for the Brant and Bronte sub-regions in April 2015 and June 2016, respectively, and Hydro One completed a Local Planning Report for the broader region in October 2015. On the basis of these planning reports, Hydro One completed the Burlington to Nanticoke RIP on February 7, 2017. The RIP identified a number of regional sustainment investments above and beyond what was indicated in earlier planning products, many of which were already underway due to the transmitter's end-of-life considerations and had appeared in Hydro One's most recent rate filing with the Board.

Due to the timelines associated with the near-term investments in the RIP, the IESO worked with Hydro One to review the ongoing work in the context of existing plans for the region and the latest load forecast information, particularly for the Hamilton industrial area (Gage TS, Beach TS, Kenilworth TS, and Birmingham TS). Additionally, the RIP recommended that, in light of the new sustainment information available for the mid- to long-term, the next cycle of regional planning for the Burlington to Nanticoke region should begin and Hydro One should conduct a needs assessment.

Hydro One completed the needs assessment for the Burlington to Nanticoke region on May 15th, 2017. The needs identified form the basis of the analysis for the scoping assessment and are discussed in further detail in section III.

III. Needs Identified

Hydro One's needs assessment identified a number of needs in the Burlington to Nanticoke region based on their most up to date sustainment plans and a 20-year demand forecast.[2] Needs identified for the Burlington to Nanticoke region have been outlined below and include: end-of-life of lines and auto-transformers, end-of-life of transmission stations, needs from previous planning products (capacity and restoration), bulk system needs, and a summary of the current projects and plans underway to respond to existing needs.

End-of-life of 115 kV and 230 kV Lines and Auto-Transformers

- The 230/115 kV auto-transformers T7/T8 at Beach TS have been identified as being near their end-of-life with replacement planned for the 2023-2026 timeframe.
- The underground 115 kV supply cables in the Hamilton area, H5K/H6K, K1G/K2G, and HL3/HL4 (both segments), have been identified as being near their end-of-life with replacement planned for the 2027-2032 timeframe.

End-of-life of 115 kV and 230 kV Transmission Stations

Table 1-1 summarizes the transmission stations which were identified in the needs assessment[3] as having major facilities (i.e. power transformers, switchgear) reaching end-of-life within the study period.

Table 1-1 End-of-Life 115 kV and 230 kV Transmission Stations (LV switchgear & Transformers) from the needs assessment

Station	Assets Reaching EOL	Timing of Need
Birmingham TS	LV switchgear supplied by T1/T2	2021-2022
Dundas TS	LV switchgear supplied by T1/T2	2021-2022
Newton TS	T1/T2 DESN (transformers & switchgear)	2021-2022
Brantford TS	LV switchgear supplied by T3/T4	2022-2023
Caledonia TS	T1/T2 transformers	2022-2025
Jarvis TS	T3/T4 transformers	2022-2025
Beach TS	LV switchgear supplied by T5/T6	2024-2026
Norfolk TS	LV switchgear supplied by T1/T2	2025-2026
Burlington TS	LV switchgear supplied by T15/T16	2025-2026
Lake TS	T1/T2, 13.8 kV & 27.6 kV switchgear	2026

[2] Typically a 10 year demand forecast is used for a needs assessment. Since the Brant and Bronte areas had recently completed IRRPs a 20 year forecast was available for these sub-regions and 20 year forecasts were provided by the LDCs for the remaining sub-regions.

[3] The assets listed have end-of-life needs identified in the needs assessment. Additional facilities in the Burlington to Nanticoke region have been identified as being at end-of-life but already have work underway as described in the 2017 RIP.

Additional Needs from Previous Planning Products (Capacity & Restoration)

Potential capacity needs as well as needs related to restoring loads after a major outage were identified in previous planning products[4]. The existence of these needs continues to be supported by the latest load forecast from the needs assessment which was further analyzed during the scoping assessment process in the context of projects already underway in the region. Based on this re-assessment, the station capacity need in Table 1-2 was identified.

Table 1-2 Transformer Station Capacity Need

Station/Line	Demand	Timing	Treatment in Previous Products
Nebo TS (T3/T4)	Summer	2018	Alectra and Hydro One are monitoring load growth, with the Local Planning report indicating that transformer replacements planned for Nebo in 2022 would address the issue. Since this time, the transformer replacements have been removed from Hydro One's sustainment plans.

In accordance with ORTAC, following any designed for criteria contingencies on the transmission system affected loads need to be restored within 4 hours for any load loss in excess of 150 MW, and within 30 minutes for load lost in excess of 250 MW. Based on the previous planning products and a revised assessment using the needs assessment forecast, the restoration needs in Table 1-3 have been identified within the study period.

Table 1-3 Identified Restoration Needs

Circuits	Load Restoration Criterion to be Assessed
HL3+HL4[5] (Stirton to Beach)	4 hours
B3+B4	4 hours
Q24HM+Q29HM	4 hours
M32W+M33W	4 hours
Q23BM+Q25BM	4 hours
N21J+N22J	4 hours

[4] Link to 2014 Scoping Assessment:
http://www.ieso.ca/-/media/files/ieso/document-library/regional-planning/bronte/scoping-assessment-outcome-report.pdf?la=en
Link to the Local Planning Report:
http://www.hydroone.com/RegionalPlanning/Burlington/Documents/Local%20Planning%20Report%20-%20Burlington%20to%20Nanticoke%20Region.pdf

[5] Applies for the loss of the double circuit overhead segments.

Previously the local planning study had determined that based on the outage history of these circuits no action was required at that time. This position should be reconfirmed based on the latest data and in the context of the broader work ongoing in the region.

Bulk System Needs

Previous planning products have identified a capacity need on the Burlington 230 kV/ 115 kV autotransformers for the loss of a second auto while one is out of service, and for a specific breaker failure condition. This need is being evaluated further in the IESO's ongoing Middleport Area bulk study within the context of the recent changes in the transmission system, load, and generation in this broader area.

Projects & Plans Underway

The RIP published by Hydro One in February of this year identified the wires work required to meet existing system needs. This work is currently ongoing and is in either the execution ("committed") or detailed planning and design phase ("planning"). This work provides a basis for future assessments of the region and should be accounted for in planning. As such, it has been included here for completeness.

Table 1-4 Summary of needs and associated projects from the 2017 RIP

No.	Needs	Plans	Status	I/S Date
Projects Previously Developed in Local Planning or an IRRP				
1	115 kV B7/B8 Transmission Line Capacity	Bronte TS: Load Transfer	TBD	2018
2	115 kV B12/B13 Transmission Line Capacity	Install Brant Switching Station	Planning	2019
3	Two New Feeders at Dundas TS	Dundas TS: Load Transfer	Planning	2019
4	Cumberland TS – Power Factor Correction	LDC is developing distribution option	TBD	TBD
5	Kenilworth TS – Power Factor Correction	LDC is developing distribution option	TBD	TBD
Projects Previously Developed by HONI & the LDC(s), Reviewed by IESO				
6	115 kV B3/B4 – EOL Line Section from Horning Mountain Jct. to Glanford Jct.	Refurbish the EOL B3/B4 line section conductor	Planning	2018

7	Kenilworth TS EOL transformers & switchgear	Reconfigure from 2 DESNs to single DESN	Planning	2018
8	Beach TS – EOL T3/T4 DESN Transformers	Replace Beach TS T3/T4 DESN Transformers	Committed	2019
9	Gage TS – EOL transformers & switchgear	Gage TS: Reduce from 3 DESNs to 2 DESNs	Planning	2019
10	115 kV B7/B8 – EOL Line Section from Burlington TS to Nelson Jct.	Refurbish the EOL B7/B8 line section	Planning	2020
Projects Previously Developed by HONI & the LDC(s)				
11	Horning TS EOL transformers & switchgears	Replace EOL transformers & refurbish switchgears	Committed	2018
12	Bronte TS – EOL T5/T6 DESN	Replace EOL transformers & refurbish switchgear	Committed	2019
13	Elgin TS – EOL transformers & switchgears	Replace transformers and reduce 2 DESNs to 1 DESN	Committed	2019
14	Mohawk TS (T1/T2) – Station Capacity and EOL T1/T2 Transformers	Mohawk TS Transformers Replacement	Committed	2019

IV. Analysis of Needs and Identification of Sub-Regions

The Regional Participants have discussed the needs in the Burlington to Nanticoke area and have identified the planning approach for each sub-region. For this regional planning cycle, the Hamilton sub-region is the only sub-region identified for further study through the regional planning process. While additional needs were identified in the Bronte and Brant areas, these sub-regions have recently completed IRRPs and the Regional Planning Participants have agreed that the end-of-life needs identified for both these sub-regions could be addressed via local planning at this time. Likewise, for the Caledonia-Norfolk area, while no IRRP has been completed in the past, at this time there are no needs requiring more comprehensive planning.

Hamilton Sub-Region

The Hamilton sub-region encompasses the City of Hamilton, with a summer peak demand of just over 1,300 MW. The forecast demand for the Hamilton sub-region is relatively flat, while maintaining some small pockets of growth. However, a substantial number of end-of-life

station and underground cable needs have been identified, along with various sustainment projects already underway in the sub-region. The Hamilton sub-region includes the following infrastructure:

- 230 kV Connected Stations – Beach TS (T3/T4), Horning TS, Lake TS
- 115 kV Connected Stations – Newton TS, Dundas TS, Dundas #2 TS, Mohawk TS, Elgin TS, Stirton TS, Birmingham TS, Gage TS, Kenilworth TS, Beach TS (T5/T6), Winona TS
- Four customer owned transformer stations
- 230 kV Transmission Lines – B18H/B20H, H35D/H36D, Q24HM/Q29HM, M27B/M28B
- 115 kV Transmission Lines – B12/B13, Q2AH, B10/B11, B3/B4, HL3/HL4
- 115 kV Transmission Cables – H5K/H6K, K1G/K2G, HL3/HL4
- 230/115 kV auto-transformers at Beach TS

Customers in this sub-region are supplied by Alectra or Hydro One Distribution. However, the sub-region's transmission connected customers are supplied directly by Hydro One Transmission.

As discussed, due to the age of the assets in the Hamilton area, a number of station facilities and underground cables are reaching their end-of-life. Facilities reaching end-of-life provide an opportunity to re-examine their current use and configuration in the context of the latest load forecast and generation data, to ensure that any new assets installed in their place will continue to appropriately service both the impacted LDCs, and their customers, over the new assets' lifetime. In this instance, due to the number of facilities impacted and their proximity to one another, comprehensive planning should be done to optimize the transmission assets in the Hamilton area as they are renewed.

The following end-of-life needs will be included in the IRRP:

  - Lake TS T1/T2 and both the 13.8 kV and 27.6 kV switchgear
  - Newton TS transformers and low voltage switchgear
  - Beach TS low voltage switchgear supplied by T5/T6
  - Beach TS 230 kV/ 115 kV autotransformers
  - Underground cables: H5K/H6K, K1G/K2G, HL3/HL4

The remainder of the Hamilton sub-region needs identified in Table 1-1 are being reviewed via local planning between the LDC(s) and the transmitter:

While it is recognized that, with a need to replaced significant assets, a wires solution will necessarily be a part of the plan for this sub-region, there is an opportunity for a combination of wire and non-wires solutions. In addition, decisions made on these end-of-life replacements have implications for the provincial rate pool, representing over an estimated $160 M dollars of investment – while not even including costs for the end-of-life cable investments.

The end-of-life needs at Newton TS require a decision needs to be made as soon as possible due to the lead times required for design and implementation (such as ordering equipment) so that the identified need dates can be met. Therefore, rather than wait for the outcome of the IRRP (which typically takes 18 months), the terms of reference for the Hamilton IRRP specifies that a decision on the wires component of an integrated solution for these needs be made early in the IRRP process. At that time, wires planning would be initiated through a hand-off letter to the transmitter.

The IRRP will also confirm the potential load restoration needs identified for B3/B4, HL3/HL4 and Q24HM/Q29HM and identify Working Group recommendations for solutions if applicable.

The draft terms of reference for the Hamilton sub-region IRRP further outlining the scope and proposed timelines has been included in appendix A.

Brant Sub-Region

Based on the needs assessment, no IRRP for the Brant sub-region is required this cycle. Needs identified in the needs assessment will be addressed via local planning between the impacted LDCs and the transmitter, as recommended in the needs assessment. As well, work continues in order to implement projects identified in the Brant IRRP as outlined in Table 1-4.

Bronte Sub-Region

Based on the needs assessment, no IRRP for the Bronte sub-region is required this cycle. Needs identified in the needs assessment will be addressed via local planning between the impacted LDCs and the transmitter, as recommended in the needs assessment. As well, work continues in order to implement projects identified in the Brant IRRP as outlined in Table 1-4.

Caledonia-Norfolk Sub-Region

Based on the needs assessment, no IRRP for the Caledonia-Norfolk sub-region is required this cycle. Needs identified in the needs assessment will be addressed via local planning between the impacted LDCs and the transmitter, as recommended in the needs assessment.

Needs to be Addressed through Local Planning

The Regional Participants agreed on a number of investments in the region which can be addressed through local planning involving the transmitter and affected LDC. The determination to address these needs through local planning was made based on: the scale of the investments, the amount of sustainment work which had already been undertaken at the applicable stations, the current and forecast station load, and the relative age of the other major assets at the station. These investments, by sub-region, are outlined in Table 1-5.

Table 1-5 Needs to be assessed via local planning

Sub-Region	End of Life Need	Rationale for Local Planning
Hamilton	**Birmingham TS:** 2 LV Metalclad Switchgear (2021-2022)	• The T4 transformer was replaced in 2006 and the T2/T3 units were replaced in 2010, limiting the near-term opportunities for right-sizing the station • While the station is lightly loaded, industrial customer(s) supplied from the station have high short circuit requirements, which limited available options for the previous transformer replacements
	Dundas TS: T1/T2 DESN LV Switchgear (2021-2022)	• The T1/T2 transformers were replaced in 2015 • The T5/T6 DESN was built in 2003 • Both Dundas DESN stations are well utilized and the LDCs have been employing load transfers to better balance loads between the stations
Brant	**Brantford TS:** LV Switchgear (2022-2023)	• Transformers at Brantford TS were recently replaced in 2011 & 2013 • No capacity needs at Brantford TS within the study period and the station is well utilized
Bronte	**Burlington TS:** LV Switchgear (2025-2026)	• Transformers at Burlington TS were installed in 1991 and Hydro One currently has no plans in the next 10 years to replace the units • No capacity needs at Burlington TS within the study period and the station is well utilized
Caledonia-Norfolk	**Norfolk TS:** LV Switchgear (2025-2026)	• The transformers at Norfolk TS were recently replaced in 2009, limiting opportunities for right-sizing • Norfolk TS has over 40 MW of connected DG, displacing load at the station and contributing to its lower load level relative to its LTR – but with its own short circuit requirements
	Caledonia TS: T1/T2 Transformers (2022-2025)	• While the switchgear at Caledonia TS is the same vintage as the transformers, Hydro One has identified no current plans to replace it in the next 5-10 years • Caledonia TS has over 22 MW of connected DG, displacing load at the station and contributing to its lower load level relative to its LTR – but with its own short circuit requirements
	Jarvis TS: T3/T4 Transformers (2022-2025)	• While the switchgear at Jarvis TS is the same vintage as the transformers, Hydro One has identified no current plans to replace it in the next 5-10 years • Limited opportunities for downsizing • Distance from other stations limits opportunities for load transfers

In addition to the needs in Table 1-5 above, the following restoration needs will be investigated via local planning to confirm the 2015 local planning report's recommendation that no action is currently required based on circuit performance:

- Brant: M32W+M33W
- Bronte: Q23BM+Q25BM
- Caledonia-Norfolk: N21J+N22J

Ongoing Bulk System Planning

The IESO is currently completing a bulk study for the broader Middleport area. This study includes investigation of the loading of the Burlington TS 230 kV/ 115 kV autotransformers. This study will also look at any bulk implication on the loading on the Beach 230 kV/115 kV autos, two of which have been identified in the needs assessment as reaching their end-of-life.

4. Conclusion

The Scoping Assessment concludes that:

- Based on available information, no IRRP be undertaken this planning cycle for the Brant, Bronte and Caledonia-Norfolk sub-regions.
- An IRRP be undertaken to address the needs in the Hamilton sub-region.
- Additional needs identified in the needs assessment (outlined below) will be addressed through local planning between the transmitter and LDC:
  - Birmingham TS low voltage switchgear replacement
  - Dundas TS (T1/T2 DESN) low voltage switchgear
  - Brantford TS low voltage switchgear replacement
  - Burlington TS low voltage switchgear replacement
  - Norfolk TS low voltage switchgear replacement
  - Caledonia TS T1/T2 transformer replacement
  - Jarvis TS T3/T4 transformer replacement
  - Confirmation of restoration need for the following circuit outages: M23W+M33W, Q23BM+Q25BM, N21J+N22J
- The work to implement recommendations from previous IRRPs should continue.

The draft Terms of Reference for the Hamilton IRRP is attached in Appendix A.

List of Acronyms

CDM	Conservation and Demand Management
DG	Distributed Generation
FIT	Feed-in-Tariff
IESO	Independent Electricity System Operator
IRRP	Integrated Regional Resource Plan
kV	kilovolt
LAC	Local Advisory Committee
LDC	Local Distribution Company
MW	Megawatt
NA	Needs Assessment
NERC	North American Electric Reliability Corporation
NPCC	Northeast Power Coordinating Council
OEB	Ontario Energy Board
ORTAC	Ontario Resource and Transmission Assessment Criteria
RIP	Regional Infrastructure Plan
RPP	Regional Planning Process
SA	Scoping Assessment
TS	Transformer Station

Appendix A: Draft Terms of Reference

The Hamilton Sub-region IRRP Terms of Reference

1. Introduction and Background

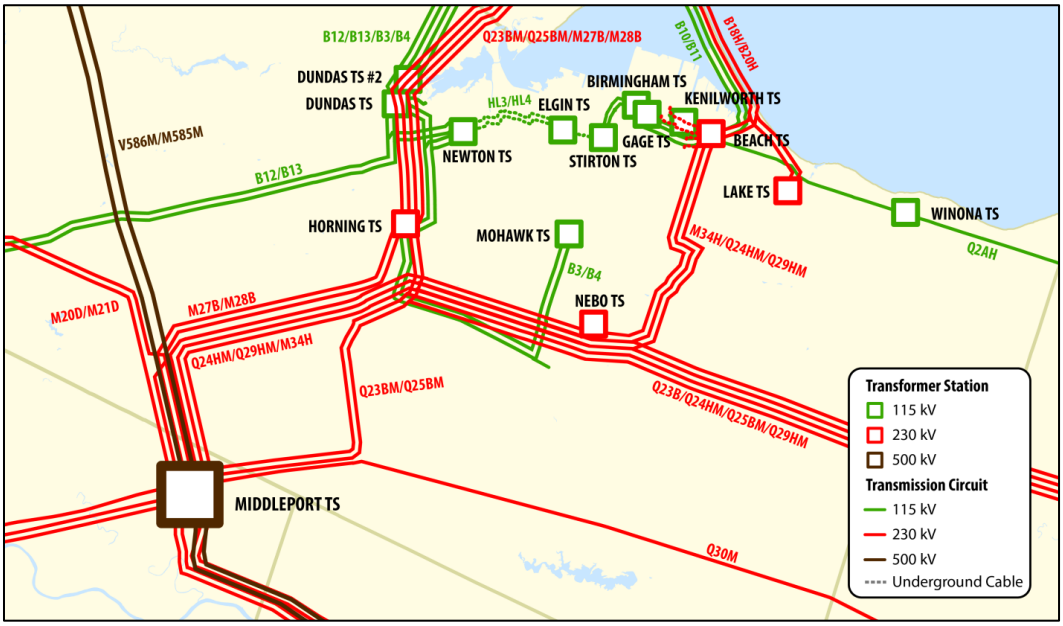
These Terms of Reference establish the objectives, scope, key assumptions, roles and responsibilities, activities, deliverables and timelines for an Integrated Regional Resource Plan ("IRRP") for the Hamilton sub-region.

Based on the significant asset sustainment needs identified throughout the area (including a number of end-of-life transmission cables in the mid- to long-term), changing economic conditions in the Hamilton area, and opportunities for coordinating demand and supply options, an integrated regional resource planning approach is recommended.

Hamilton Sub-region

The Hamilton sub-region is a summer-peaking region that includes the City of Hamilton and is supplied from the Beach, Birmingham, Dundas, Dundas #2, Elgin, Gage, Kenilworth, Mohawk, Newton, Lake, Nebo, Horning, Stirton, and Winona transformer stations (TS). The approximate geographical boundaries of the sub-region are shown in Figure A-1.

Figure A-1 Electricity Infrastructure in the Hamilton Sub-region[6]



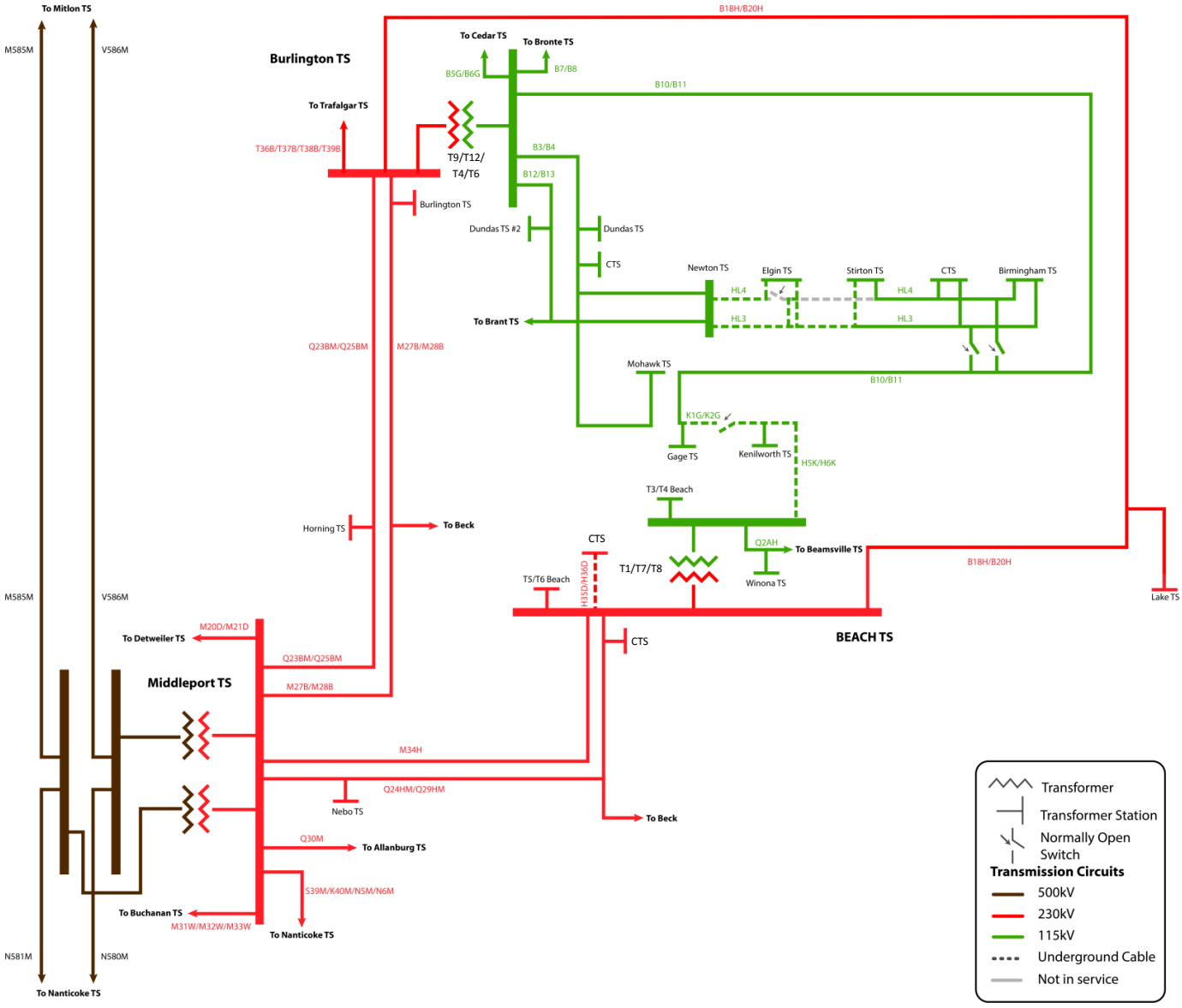
[6] The sub-region is defined by electricity infrastructure; geographical boundaries are approximate.

The City of Hamilton includes the communities of Hamilton, Flamborough, Dundas, Ancaster, Glanbrook, Binbrook, Waterdown, and Stoney Creek.

Hamilton Sub-region Electricity System

The electricity system supplying the Hamilton sub-region is shown in Figure A-2.[7]

Figure A-2 Single Line Diagram of Electricity System Supplying the Hamilton Sub-Region



Source: IESO

[7] Burlington TS (DESN) and the 500 kV system including the 500 kV to 230 kV autos, and 230 kV buses at Middleport TS and Burlington TS are not included in the study area.

Background

In May 2013 the OEB endorsed the Planning Process Working Group's report, formalizing the regional planning process. The Burlington to Nanticoke area was one of the first regions to undergo the new planning process, with a needs assessment published by Hydro One in May of 2014 and, subsequently, a scoping assessment published by the former OPA in September 2014. At that time, the OPA's scoping assessment indicated there was no need to complete an IRRP for the Hamilton sub-region and that the identified needs could be addressed through local planning between the LDCs and the transmitter.

In late 2016, the IESO was made aware of a number of significant sustainment investments in the Hamilton sub-region, for which there had been no information about at the time of the 2014 needs assessment. Accordingly, the IESO worked with Hydro One to undertake a review of these ongoing projects.

In the spring of 2017, the Burlington to Nanticoke RIP process identified additional end-of-life needs in the Hamilton sub-region, highlighting a need for coordinated planning. As a result, the RIP report (published February 2017) recommended that a needs assessment be undertaken for the Burlington to Nanticoke region, restarting the regional planning cycle ahead of schedule.

Hydro One completed the needs assessment for the Burlington to Nanticoke region in May of 2017, identifying a number of sustainment needs, particularly in the Hamilton area, which require regional coordination.

2. Objectives

1. To assess the adequacy of electricity supply to customers in the Hamilton sub-region over the next 20 years.
2. To integrate major transmission asset renewal needs with the sub-region's long-term capacity needs and demand forecast, and develop a flexible, comprehensive electricity plan for the Hamilton sub-region.
3. To develop an implementation plan that maintains flexibility in order to accommodate changes in key assumptions over time. The implementation plan should identify actions for near-term needs, preparation work for mid-term needs, and the planning direction for long-term needs.

3. Scope

This IRRP will develop and recommend an integrated plan to meet the needs of the Hamilton sub-region. The plan is a joint initiative involving Alectra, Hydro One Distribution, Hydro One Transmission, and the IESO, and will also incorporate input from community engagement

activities. The plan will focus on the identified mid- and long-term asset end-of-life needs in the sub-region, in particular opportunities for right-sizing or staging these investments. Like all IRRPs, in its analysis of options for addressing end-of-life needs, and identifying/confirming any capacity or restoration needs, the plan will integrate forecast electricity demand growth, conservation and demand management ("CDM") in the area with transmission and distribution system capability, relevant community plans, other bulk system developments, and distributed energy resources ("DER") uptake.

The scope of the Hamilton IRRP includes the following infrastructure:

- 230 kV Connected Stations – Beach TS (T3/T4), Horning TS, Lake TS
- 115 kV Connected Stations – Newton TS, Dundas TS, Dundas #2 TS, Mohawk TS, Elgin TS, Stirton TS, Birmingham TS, Gage TS, Kenilworth TS, Beach TS (T5/T6), Winona TS
- 4 customer owned transformer stations
- 230 kV Transmission Lines – B18H/B20H, H35D/H36D, Q24HM/Q29HM, M27B/M28B
- 115 kV Transmission Lines – B12/B13, Q2AH, B10/B11, B3/B4, HL3/HL4
- 115 kV Transmission Cables – H5K/H6K, K1G/K2G, HL3/HL4
- 230/115 kV auto-transformers at Beach TS and Burlington TS

The adequacy of the bulk system supplying the area is being assessed by the IESO in parallel with this study through a separate bulk system planning process. Results of that study will be shared with the Working Group and incorporated into applicable regional studies as they become available.

Based on the identified needs, the Hamilton IRRP process will consist of the following activities:

1) Creation of an updated 20-year demand forecast for the Hamilton sub-region.
2) Confirming the adequacy of transformer station ratings and the area's load meeting capability and reliability.
    a. Identify the transformer station capacity needs and sufficiency of the area's load meeting capability for the study period using the updated load forecast.
    b. Confirm identified restoration needs using the updated load forecast.
    c. Collect information on any know reliability issues and load transfer capabilities from the LDCs.
3) For confirmed needs, carry out an assessment of options. Options are evaluated using decision making criteria included, but not limited to, technical feasibility, economics, reliability performance, and environmental and social factors. The options analysis has been divided into groupings based on the priority/timing of the needs, any known lead time information, and the depth of analysis required.

a. Phase 1:
    i. Identify options for end-of-life transformers and low voltage switchgear at Newton TS
    ii. Determine if there is a restoration need on B3/B4 and Q24HM/Q29HM within the study period when load transfer capability is accounted for.
    iii. Initiate a local achievable potential study for any station with an identified capacity need within the study period (e.g., Nebo TS).
b. Phase 2:
    i. Issue a hand-off letter to Hydro One, recommending a preferred option for addressing end-of-life transformers at Newton TS. If a restoration need exists for B3/B4 or Q24HM/Q29HM, after accounting for load transfers, identify options for addressing the need, including outcomes of the local achievable potential study.
    ii. Identify the options for transformer station capacity needs (e.g., Nebo TS), accounting for the outcomes of the local achievable potential study.
    iii. Identify options for the end-of-life cables in the Hamilton sub-region (i.e., HL3/HL4, H5K/H6K, K1G/K2G) along with the end-of-life Beach TS 230 kV/115 kV autos (T7/T8). At this time, it should be confirmed if a restoration need exists on HL3/HL4 after accounting for load transfers.
    iv. Identify options for the end-of-life switchgear at Beach TS, currently supplied by T5/T6.
c. Phase 3:
    i. Develop the working group's long-term recommendations to address station capacity needs, confirmed restoration needs, end-of-life cables, end-of-life Beach TS 230 kV/115 kV autos (T7/T8), the end-of-life Beach TS switchgear supplied by T5/T6, and Lake TS (T1/T2 and the 13.8 kV and 27.6 kV switchgear).

4) Development of the long-term recommendations and the implementation plan.
5) Completion of the IRRP report documenting the near-, mid-, and long-term needs and recommendations.

In order to carry out this scope of work, the working group will consider the data and assumptions outlined in section 4 below.

4. Data and Assumptions

The plan will consider the following data and assumptions:

- Demand Data
    - Historical coincident & non-coincident peak demand information for the sub-region
    - Historical weather correction, for median and extreme conditions
    - Gross peak demand forecast scenarios by sub-region, TS, etc.
    - Coincident peak demand data including transmission-connected customers
    - Identified potential future load customers

- Conservation and Demand Management
    - LDC CDM plans
    - Incorporation of verified LDC results and progression towards OEB targets, and any other CDM programs/opportunities in the area
    - Long-term conservation forecast for LDC customers, based on sub-region's share of the 2013 Long-Term Energy Plan target
    - Conservation potential studies, if available
    - Potential for CDM at transmission-connected customers' facilities
    - Load segmentation data for each TS based on customer type (residential, commercial, industrial)

- Local resources
    - Existing local generation, including distributed generation ("DG"), district energy, customer-based generation, Non-Utility Generators and hydroelectric facilities as applicable
    - Existing or committed renewable generation from Feed-in-Tariff ("FIT") and non-FIT procurements
    - Future district energy plans, combined heat and power, energy storage, or other generation proposals

- Relevant local plans, as applicable
    - LDC Distribution System Plans
    - Community Energy Plans and Municipal Energy Plans
    - Municipal Growth Plans
    - Any transit plans impacting electricity use

- Criteria, codes and other requirements
    - Ontario Resource and Transmission Assessment Criteria ("ORTAC")
        - Supply capability
        - Load security
        - Load restoration requirements

- NERC and NPCC reliability criteria, as applicable
- OEB Transmission System Code
- OEB Distribution System Code
- Reliability considerations, such as the frequency and duration of interruptions to customers
- Other applicable requirements

- Existing system capability
  - Transmission line ratings as per transmitter records
  - System capability as per current IESO PSS/E base cases
  - Transformer station ratings (10-day LTR) as per asset owner
  - Load transfer capability for restoration during transmission system outages and/or as options for any transmission level capacity needs
  - Technical and operating characteristics of local generation

- End-of-life asset considerations/sustainment plans
  - Transmission assets
  - Distribution assets

- Other considerations, as applicable

5. Working Group

The core Working Group will consist of planning representatives from the following organizations:

- Independent Electricity System Operator *(Team Lead for IRRP)*
- Hydro One Transmission
- Alectra Utilities Inc.
- Hydro One Distribution

When discussing assets which are utilized by, or impact, only one LDC the discussions can be limited to the impacted LDC, Hydro One Transmission and the IESO – at the impacted LDC's request. However, any recommendations will be shared with the full Working Group prior to IRRP posting.

Authority and Funding

Each entity involved in the study will be responsible for complying with regulatory requirements as applicable to the actions/tasks assigned to that entity under the implementation plan resulting from this IRRP. For the duration of the study process, each participant is responsible for their own funding.

5. Engagement

Integrating early and sustained engagement with communities and stakeholders in the planning process was recommended to, and adopted by, the provincial government to enhance the regional planning and siting processes in 2013. These recommendations were subsequently referenced in the 2013 Long Term Energy Plan. As such, the Working Group is committed to conducting plan-level engagement throughout the development of the Hamilton IRRP.

The first step in engagement will consist of meetings with municipalities and Indigenous communities who may have an interest in the planning area to discuss regional planning, the development of the Hamilton plan, and integrated solutions.

Municipal engagement will continue throughout the development and completion of the plan.

6. Activities, Timeline and Primary Accountability

Table A-1 Summary of IRRP Timelines and Activities

	Activity	Lead Responsibility	Deliverable(s)	Timeframe
1	**Commence IRRP Process** - Prepare terms of reference considering stakeholder input - Kick-off meeting with working group members	*IESO*	- Finalized Terms of Reference	July – Early August 2017
2	**Develop the Planning Forecast for the sub-region**			
	- Establish historical coincident and non-coincident peak demand information	*IESO*	- Long-term planning forecast scenarios	August – October 2017
	- Establish historical weather correction, median and extreme conditions	*IESO*		
	- Establish gross peak demand forecast and high/low growth scenarios	*LDCs*		
	- Establish existing, committed and potential DG	*LDCs*		
	- Establish near- and long-term conservation forecasts based on LDC CDM plans and LTEP CDM targets	*IESO*		

	Activity	Lead Responsibility	Deliverable(s)	Timeframe
	- Develop planning forecast scenarios - including the impacts of CDM, DG and extreme weather conditions	*IESO*		
3	**Provide information on load transfer capabilities under normal and emergency conditions – for the purpose of analyzing transmission system needs and identifying options for addressing needs**	*LDCs*	- Load transfer capabilities under normal and emergency conditions	Q4 2017
4	**Provide and review relevant community plans, if applicable**	*LDCs and IESO*	- Relevant community plans	Q4 2017
5	**Complete system studies to identify needs over a twenty-year period** - Obtain PSS/E base case, include bulk system assumptions as identified in the key assumptions - Apply reliability criteria as defined in ORTAC to demand forecast scenarios - Confirm and refine the need(s) and timing/load levels	*IESO, Hydro One Transmission*	- Summary of needs based on demand forecast scenarios for the 20-year planning horizon	Q1 2018
6	**Develop Options and Alternatives**		- Develop flexible planning options for forecast scenarios - Deliverables staged according to the three phases outlined in section 3	Q2 2018
	Develop conservation options	*IESO and LDCs*		
	Develop local generation options	*IESO and LDCs*		
	Develop transmission (see Action 7 below) and distribution options	*Hydro One, and LDCs*		
	Develop options involving other electricity initiatives (e.g., smart grid, storage)	*IESO/ LDCs with support as needed*		
	Develop portfolios of integrated alternatives	*All*		
	Technical comparison and evaluation	*All*		
7	**Early Wires Planning**			
	Identify potential wires options to address end-of-life and local capacity needs	*Hydro One Transmission*	- Cost, feasibility and reliability performance of potential wires options - Detailed option	Q2 2018
	Provide information on cost, feasibility and reliability performance of			

	Activity	Lead Responsibility	Deliverable(s)	Timeframe
	identified wires options for the purpose of developing integrated solutions		development - Deliverables staged according to the three phases outlined in section 3	
8	**Plan and Undertake Community & Stakeholder Engagement**			
	- Early engagement with local municipalities and Indigenous communities within study area, First Nation communities who may have an interest in the study area, and the Métis Nation of Ontario	*All*	- Community and Stakeholder Engagement Plan - Input from local communities	Q3 2017
	- Develop communications materials	*All*		Q2 2018
	- Undertake community and stakeholder engagement	*All*		
	- Summarize input and incorporate feedback	*All*		
9	**Hand off Wires Component of Integrated Solution**			
	Newton TS End-of-Life Needs	*IESO*	- Hand-off letter to Hydro One	May 2018
10	**Develop long-term recommendations and implementation plan based on community and stakeholder input**	*IESO*	- Implementation plan - Monitoring activities and identification of decision triggers - Hand-off letters - Procedures for annual review	Q3 2018
11	**Prepare the IRRP report detailing the recommended near, medium and long-term plan for approval by all parties**	*IESO*	- IRRP report	Q4 2018