
Nova Scotia Utility and Review Board

IN THE MATTER OF

*The Maritime Link Act, S.N.S 2012 c.9
and the
Maritime Link Cost Recovery Process Regulation, N.S. Reg. 189/2012*

NSPML Quarterly Report Q2 2018

June 15, 2018

Table of Contents

1.0 Introduction..... 3

2.0 Update of Project Schedule..... 4

 2.1 Gates and Milestones 4

 2.2 Safety..... 4

 2.3 Commercial Activities..... 5

 2.3.1 Land Access Agreements..... 9

 2.3.2 Funding 9

 2.3.3 Joint Development Agreements..... 9

 2.4 Engineering Activities..... 10

 2.5 Submarine Cables..... 11

 2.6 Converters and Substations 11

 2.7 Construction Contractors – Transmission Lines 12

 2.8 Independent Engineer..... 12

 2.9 Status of Nalcor Project and Muskrat Falls..... 12

 2.10 Status of Benefits to NS Power Customers..... 14

3.0 Updated Cost Summary 15

4.0 Cost Flow 17

5.0 Interim Assessment Financial Update 2018 18

1 **1.0 INTRODUCTION**

2

3 This is the Q2 2018 Quarterly Report for the Maritime Link as directed by the Utility
4 and Review Board (UARB) where the UARB ordered in its Supplemental Decision:

5

6 [115]....detailed reports must be filed by NSPML on a semi-
7 annual basis, on June 15 and December 15 each year. The reports
8 shall commence December 15, 2013. Updated status reports must
9 be filed quarterly.

10

11 As per the UARB's order in its Decision regarding the Maritime Link Interim Cost
12 Assessment (M07718), this Report now includes detail regarding the status of the
13 construction of Nalcor's assets.

14

15 This Decision also requested that the quarterly reports include an accounting of all
16 transactions related to this project, cash flow analysis, and a reporting of the financial
17 and other benefits realized for ratepayers from the Maritime Link prior to delivery of
18 the Nova Scotia Block and Nalcor market-priced energy. Given that the benefits to
19 ratepayers prior to the Nova Scotia Block and Nalcor market-priced energy are secured
20 by Nova Scotia Power through the Maritime Link, Nova Scotia Power will report on
21 these in its Quarterly Fuel Adjustment Mechanism Report.

1 **2.0 UPDATE OF PROJECT SCHEDULE**

2

3 The Maritime Link was placed in-service on January 15, 2018. The construction of
4 the Maritime Link is now complete, with final punchlist and remediation items in
5 progress.

6

7 Nalcor's schedule for the completion of construction of its transmission assets
8 remains mid-2018 and the completion of Muskrat Falls is forecast for Q3 2020. The
9 Nova Scotia Block continues to be forecast by Nalcor to be by Q2 2020. NSPML will
10 provide future updates as Nalcor advances towards completion of the Muskrat Falls
11 project.

12

13 **2.1 Gates and Milestones**

14

15 The Maritime Link was placed in-service January 15, 2018.

16

17 **2.2 Safety**

18

19 The project review of high-risk activities for any remaining field activities by
20 contractors continues to be followed, which include punchlist items and remediation.

21

22 Safety planning and preparations for the operations of the Maritime Link were
23 developed and implemented prior to the commissioning and continues to be a focus
24 during the early phase of the commercial operations.

25

26 The safety of the public and the workers continues to be the first priority, and
27 NSPML remains committed to a culture on the work sites that promotes world class
28 safety behaviours.

1 **2.3 Commercial Activities**

2

3 The key major procurement activities are presented in Table 1 with an update of the
 4 status for each initiative.

5

6 **Table 1 Key Major Procurement Activities**

7

Commercial Activity	Status in December 2017	Initiative Number	Status in June 2018
HVdc Submarine Cable Supply and Installation	<p>The Contract was awarded to Nexans in January 2014.</p> <p>Substantial Completion occurred in September, 2017.</p> <p>Final Completion expected before year end.</p>	E11-18	<p>Contract Final Completion Certificate signed February 5, 2018.</p> <p>Contract Closeout is in progress, with final as-built documents being verified.</p>
Converter stations, switchyards and related structures (“converters and structures”)	The Contract was awarded to ABB Inc. in June 2014.	E12-74	<p>Final System Test Completed January 15, 2018.</p> <p>Substantial Completion achieved on January 15, 2018.</p> <p>Final documentation and system studies are being verified.</p>

NSPML

Commercial Activity	Status in December 2017	Initiative Number	Status in June 2018
Right of Way Clearing along Transmission Lines	Contracts were awarded to Majors Logging Limited in NL and to R. MacLean Forestry in NS in February 2014. E13-88 is closed.	E13-88	Closed
Transmission Structures and Grillages	The Contract was awarded to Kalpataru Power Transmission Ltd. in September 2014 for design and delivery of Structures and Grillages.	E13-85	Contract closeout is in progress.
Site Preparation Services (Includes construction of access road upgrades)	The Contract was awarded to Joneljim Concrete Construction (1994) Ltd. for NS Site Preparation Services in September 2014. Contracts awarded to Marine Contractors Inc., MCI Limited Partnership for NL Site Preparation Services in September 2014.	E13-92	Closed Closed
Transmission Line Construction	E13-95 contract has been terminated. Contract replaced with E16-284 and E16-269 as reported in the previous report.	E13-95	No Change
Transmission Line Construction – NL AC	The contract with PowerTel was re-assigned to NSPML for the	E16-284	Final completion is in

Commercial Activity	Status in December 2017	Initiative Number	Status in June 2018
Line	<p>completion of the two Grounding Lines and the HVac Line.</p> <p>Substantial Completion achieved.</p>		progress.
Transmission Line Construction - NL and NS HVdc Lines	The contract for the construction of the HVdc Transmission Lines was awarded to a joint venture of Emera Utility Services and Rokstad Power Corporation (ERJV).	E16-269	<p>ERJV Contract is complete.</p> <p>Final remediation in progress by NSPML.</p>
Transmission Line Conductors	<p>The Contract for the supply of conductors was awarded to Midal Cables in March 2015. Contract close-out in progress.</p> <p>The contract for the supply of OPGW was awarded to Composite Power Group Inc. in June 2015. This is also within the scope of the E13-87 initiative. Contract close-out in progress.</p>	E13-87	<p>Contract close-out remains in progress.</p> <p>Closed</p>
Horizontal Directional Drill (HDD) Construction Program	<p>Contract awarded to Directional Horizontal Drilling (DHD) in January 2016.</p> <p>E13-157 was divided into two contracts.</p> <p>E13-157 A was awarded to Schlumberger in March 2016 for</p>	<p>E13-156</p> <p>E13-157</p>	<p>Closed</p> <p>Closed</p>

Commercial Activity	Status in December 2017	Initiative Number	Status in June 2018
	<p>the supply of HDD fluids. E13-157B was awarded to Baker Hughes in April 2016 for the Supply of directional drilling services, drill bits and other materials. Contract closed.</p> <p>E13-158 for marine intervention services was awarded in April 2016 to DOF Marine. Contract closed.</p> <p>The supply of the HDD casing (E15-238) was awarded to East Coast Tubulars Limited in October 2015. Contract closed.</p> <p>The closeout of all HDD construction contracts completed.</p>	<p>E13-158</p> <p>E15-238</p>	<p>Closed</p> <p>Closed</p>
<p>Accommodations Operations</p>	<p>The contract for the accommodations operations services was awarded to East Coast Catering in April 2015.</p> <p>The Contract was extended to the end of August 2017 with the completion of camp operations.</p> <p>The camp was dismantled and removed, followed by greenfielding of the site.</p>	<p>E13-89</p>	<p>Contract closed in February, 2018.</p>

1 **2.3.1 Land Access Agreements**

2

3 Title was acquired to the key Project sites by December 31, 2017, as required under
4 the Federal Loan Guarantee.

5

6 As final land surveys are completed, it is expected that there will be some new and
7 amended easements required, particularly along the Transmission and Grounding
8 lines, which is planned in 2018. These easements do not impact the ability of the
9 project to complete contract closeouts or to operate according to plan.

10

11 **2.3.2 Funding**

12

13 The IE Certificates allow for Project costs to be paid from the proceeds of the
14 Maritime Link Construction Loan under the payment terms of the Material Project
15 Documents and the Maritime Link Credit Agreement. There have been no further
16 draw certificates since February; the draw certificate was provided in the Quarterly
17 Report for April.

18

19 **2.3.3 Joint Development Agreements**

20

21 NSPML continues to work with Nalcor and NS Power to finalize the remaining
22 operational agreements arising from the Formal Agreements with Nalcor. Please refer
23 to Attachment 1 for details on the status of these Agreements.

1 **2.4 Engineering Activities**

2

3 Engineering is captured in three main categories across several Work Breakdown
4 Structures (“WBSs”):

5

6 • HVdc Submarine Cable Supply and Installation - Engineering activity on the
7 Submarine Cable as contemplated by the Contract is now complete. As-built
8 documentation and marine and navigation records are being assessed and finalized.

9

10 • HVdc Converters and Substations - Engineering is included in the contract
11 awarded to ABB for the supply and installation of these assets. The remaining
12 engineering priorities include the completion of punch list work and some studies,
13 the review and acceptance of the final engineering drawings, supporting the
14 operations of the Maritime Link, and closeout of punch list items.

15

16 • Overland Transmission - Currently, the remaining LIDAR (light detecting and
17 ranging) surveys are being scheduled. Final engineering drawings are under review
18 for as-builts, and are expected to be completed by Q3 in 2018.

1 **2.5 Submarine Cables**

2

3 Contract Final Completion Certificate was signed February 5, 2018 and the contract
4 closeout is in progress. Final punchlist items are being closed out.

5

6 **2.6 Converters and Substations**

7

8 The Construction of the Converters and Substations was completed with the
9 conclusion of system testing and the Maritime Link placed in-service on January 15,
10 2018.

11

12 Work continues on final punch list items with more than 90% of the items closed. The
13 preparation and transfer of final documentation is in progress and completion is
14 scheduled for Q2, 2018. One component in the AC switchyard, supplied by a third
15 party to ABB, requires an outage to repair and replace the item which is being
16 coordinated with planned outages by the utility.

1 **2.7 Construction Contractors – Transmission Lines**

2
3 The remaining work on the transmission lines includes minor punch list activities,
4 access trail rehabilitation, and final documentation, which are expected to be
5 completed in 2018.

6
7 NSPML has taken over the access rehabilitation scope of work as part of the NL
8 HVDC line completion work plan.

9
10 **2.8 Independent Engineer**

11
12 The Independent Engineer (IE) team has completed several site visits and project
13 inspections, at various stages in each province. As well, IE team members have
14 witnessed the progress at each major manufacturing facility for cables, converters and
15 transformers on multiple occasions at key stages of manufacturing. The IE reports to
16 Canada and provides a briefing to NSPML for each inspection.

17
18 The IE visited NSPML at site in November and December. Please refer to Attachment
19 2 for a copy of the November site visit report.

20
21 NSPML has entered into a contract with the IE related to the Operations phase of the
22 Maritime Link, as per the Federal Loan Guarantee requirements. Site visits will
23 continue to occur periodically and the IE will provide annual confirmation to Canada
24 and the Collateral Agent that the assets are being operated and maintained
25 appropriately. The IE visited NSPML at the end of May 2018 for discussions related
26 to operations and maintenance matters, and was provided with an update on project
27 close out activities.

28
29 **2.9 Status of Nalcor Project and Muskrat Falls**

30
31 Nalcor’s projected in-service date for the Labrador-Island Link (LIL) in monopole
32 mode continues to be Q2 2018. Nalcor’s projected date for first power for Muskrat

1 Falls Generation continues to be Q4 2019, with full power projected for Q3 2020. The
2 Nova Scotia Block of energy from Muskrat Falls is projected by Nalcor for Q2 2020,
3 when the third of four generation units is projected to be commissioned. This timing
4 was affirmed by Nalcor's Chief Executive Officer during its Annual General Meeting,
5 when he indicated that cost and schedule had not changed since June 2017.

6
7 The latest report from Nalcor, published on May 22, 2018 indicates the following
8 progress as of March 2018:

9
10 Overall construction progress of all components of the Muskrat Falls Project at
11 the end of March 2018 reached just over 90 percent complete. The Muskrat
12 Falls Generating Facility reached 80 percent complete, with the Labrador-
13 Island Transmission Link progress at just over 99 percent complete, and the
14 transmission line connecting Churchill Falls to Muskrat Falls remaining at just
15 over 99 percent complete.

1 For the Muskrat Falls Generating Facility, key recent activities include:

2

3 • Continuation of installation and construction activities on the turbine and generator
4 components.

5 • Continuation of concrete pour activities and other construction activities at the
6 Intake

7 • Continuation of guide installation for all draft tube units.

8 • Completion of draft tube crane installation.

9

10 **2.10 Status of Benefits to NS Power Customers**

11

12 Customer benefits received to date will be reported by NS Power with its Quarterly

13 Fuel Adjustment Mechanism Report.

3.0 UPDATED COST SUMMARY

As per Enerco U-31, section 6, the details below outline the DG3 forecasted costs.

Table 2 below provides an updated cost summary for the Maritime Link, which includes actual costs incurred as of March 31, 2018 and forecasted costs for the remainder of the Project's construction activities.

NSPML continues to track and report all costs, actual and forecast (2011-2018), consistent with the methodologies used in the cost forecast represented in the Maritime Link Project Application. Project costs include fully allocated costs for the entire Project Management Team, including contractors, employees, executives dedicated to the project, and NS Power seconded employees at affiliate mark-up rates according to the Affiliate Code of Conduct. All costs provided are in Canadian dollars.

Actual AFUDC has been tracked and recorded monthly up to December 31, 2017 and totals approximately \$209 million as of that date, which is below the \$230 million amount estimated at the time of filing of NSPML's Application.

Table 2 Updated Cost Summary for the Maritime Link Project

Description	Actual Costs									Total Project to Date	Estimate to Completion	Total Project Estimate at Completion (A)
	2011-2013	2014	2015	2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018			
Emera NL Project Management Costs	44,379	42,315	24,599	25,639	8,446	8,222	8,618	7,435	4,207	173,859	11,376	185,235
Nalcor Project Support Costs	-	15,232	425	438	15	128	70	44	(33)	16,319	183	16,502
Construction and Engineering Initiatives	14,975	167,980	259,750	403,871	128,726	150,318	75,123	124,049	(7,403)	1,317,389	18,424	1,335,813
Environmental Approval	2,651	4,378	1,082	1,623	450	3,335	3,093	212	58	16,881	1,671	18,552
Submarine and related	3,359	83,797	74,439	54,213	31,643	47,554	16,801	19,513	19	331,339	(1,764)	329,575
Converters, structures, and other ancillary equipment	1,517	48,747	106,195	227,643	49,566	31,725	34,839	41,484	(513)	541,203	8,787	549,990
AC and DC Transmission	7,448	31,057	78,035	120,392	47,067	67,704	20,390	62,840	(6,967)	427,966	9,730	437,696
Total	59,354	225,527	284,774	429,948	137,187	158,667	83,811	131,528	(3,229)	1,507,567	29,983	1,537,550
Escalation											32,454	32,454
Contingency											7,349	7,349
Grand Total	59,354	225,527	284,774	429,948	137,187	158,667	83,811	131,528	(3,229)	1,507,567	69,786	1,577,354

1 **Total Actual Project Costs at end of Q1 2018 Compared to Previous Forecast**

2

3

The costs incurred to the end of March 31, 2018 reflect a reduction in total project costs since December 31, 2017 due to adjustments required resulting from the closing out of certain major scopes of work. The total forecasted cost to complete the capital aspect of the project remains within the budget.

4

5

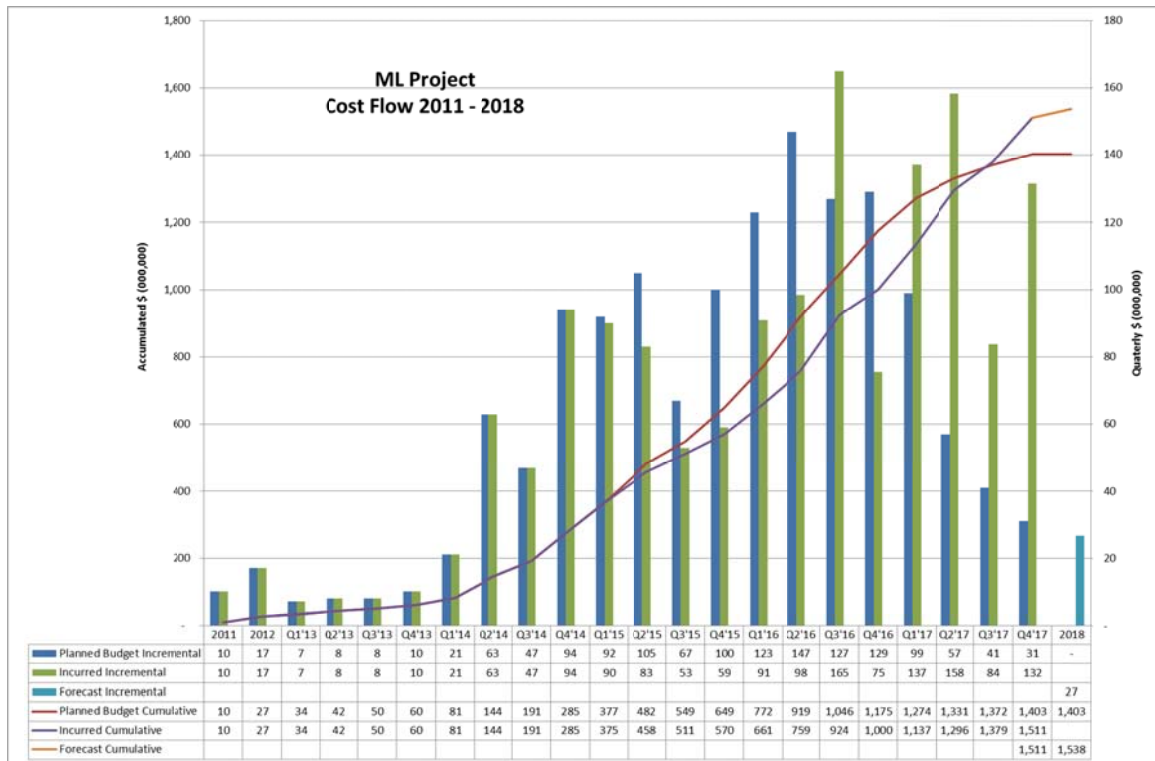
6

4.0 COST FLOW

As per Enerco U-31, section 2.2, please refer to Table 3 below for the cost flow of the Maritime Link. The total of the base capital spending, escalation, and contingency amounts remains at or below \$1.577 billion.

As the final as-builts are reviewed, punchlist and remediation continues in all work scopes in 2018 and remains within budget. Remaining budget also includes forecasted costs relating to completing documentation and close out payments to contractors as well as regulatory and environmental requirements relating to the construction aspect of the project.

Table 3 Maritime Link Cost Flow



15

1 **5.0 INTERIM ASSESSMENT FINANCIAL UPDATE 2018**

2

3

With the Maritime Link placed in-service on January 15, 2018, NSPML continues

4

begun to receive monthly revenues from NS Power pursuant to the Board's November

5

2, 2017 Order. NSPML continues to forecast its 2018 operating and maintenance,

6

debt and equity financing costs to be within the amounts budgeted for the year.

Operating Agreement Requirements Arising from the Formal Agreements

	Agreement	Parties	Description	Formal Agreement Source	Status
1.	Asset Interconnection Agreement (NL)	Emera, NLH	Interconnection of ML with the Island Interconnected System	ML-JDA, s. 2.1 (c)	Completed
2.	Multi-Party Pooling Agreement	Emera, NLH	NLH (SO) to have operational control of ML NLH AC Upgrades	ML-JDA, s. 2.1 (d)	Completed
3.	Transmission Operating Agreement (NL)	Emera, NLH	NLH (SO) to have operational control of ML NL HVdc Facilities	ML-JDA, s. 2.1 (e)	Completed
4.	Asset Interconnection Agreement (NS)	Emera, NSPI	Interconnection of ML with NS bulk electric transmission system	ML-JDA, s. 2.1 (f)(i)	Completed
5.	Transmission Operating Agreement (NS)	Emera, NSPI	NS SO to have general operational control of the ML	ML-JDA, s. 2.1 (f)(ii)	Completed
6.	ECA – Metering and Measuring Standards – Transmission Losses	NSPML, Nalcor	Metering and measuring standards used in the calculation of Transmission Losses	ECA, Schedule 3, s. 5	Completed
7.	Regulation Service Agreement	NS Power NLH	Nalcor’s provision of the Regulation Service with respect to the Nova Scotia Block for the Initial Term	ECA, Schedule 5	Expect completion in 2018
8.	Metering and Measuring Standards – NS NTQ transmission losses	NSPML, Nalcor	Metering and measuring standards used in calculation of NS –NTQ Path Peak and Off-Peak Hour transmission losses	NSTUA, Schedule 3, s. 6	Completed
9.	NB Back-up Capacity Agreement	Bayside Power L.P, Nalcor	Emera’s provision of backup Capacity to NB to Nalcor until March 31, 2021	NBTUA, s. 2.1(d)	Expect completion in 2018
10.	IOA – ML Transmission Procedures	NSPI, NLH	Rules and practices applicable to administration of transmission service over the ML	IOA, Schedule D	Completed
11.	IOA – Reserve Sharing	NSPI, NLH	Sharing of energy and reserves between the Parties to improve Reliability	IOA, Schedule A	Completed
12.	IOA – Description of Interconnection Facilities	NSPI, NLH	Description of Interconnection Facilities for which each Party is responsible	IOA, Schedule B	Completed
13.	IOA – Functional Operating Relationship	NSPI, NLH	Various matters relating to operating relationship	IOA, Schedule C	Completed

14.	IOA – Operating Procedures	NSPI, NLH	IOC to develop “operating procedures”	IOA s.7.2 and s. 7.4(a)	Completed
15.	IOA – Schedule A1.0	NSPI, NLH	Parties to prepare a plan for NLH participation in Reliability Assessment Program (“RAP”)	IOA Schedule A1.0	Completed
16.	ML TSA – ML Scheduling Process	Emera and Nalcor	Scheduling process applicable to the provision of Firm Point-to-Point Transmission Service	MLTSAs, Schedule 2	Completed
17.	Amendments to Formal Agreements	Emera, Nalcor	Amendments to Formal Agreements required by Sanction Agreement	Sanction Agreement	Completed
18.	Energy Access Agreement	Emera, Nalcor	Commitments regarding access to market priced energy	Compliance Filing, Appendix A	Completed
19.	Balancing Service Agreement	Emera, Nalcor	Nalcor commitment to provide balancing services from generation sources in NL for 25 years.	Energy Access Agreement Term Sheet, s. 7(g) and Appendix 1	Completed
20.	Assignment of Transmission Rights under ML(E)TSA	Emera, Nalcor	Assignment of Transmission Rights	ML(E)TSA, s. 3.3 (h)	Expect completion in 2018
21.	Assignment of Energy Access Agreement	Emera, Nalcor, NSPI and Nalcor Energy Marketing (NEM)	Assignment/assumption of Nalcor’s rights and obligations to/by NEM	EAA s. 15.1 (a)	Expect completion in 2019
22.	Assignment of Nalcor Master Agreement (EAA Schedule 2)	Nalcor, NSPI and NEM	Assignment/assumption of Nalcor’s rights and obligations to/by NEM	Nalcor Master Agreement s. 10.5 (a)	Expect completion in 2019
23.	JOA-Joint Operating Committee (“JOC”)	Nalcor and NSPML	Establish/Operationalize JOC	JOA s.s. 3.1, 3.5	Completed
24.	NS Transmission Utilization Agreement	Nalcor and Emera	Status of Emera firm Point to Point Transmission Service	NSTUA s.s.2.2 (a)-(c)	Completed

LCP - ML PROJECT

SITE VISIT REPORT NOVEMBER 6 TO 9, 2017

Prepared for: Natural Resources Canada and Emera

IE Point of Contact: Nik Argirov

Date: December 28, 2017

Quality Assurance Statement

Office Address	803-633 Kinghorne Mews, Vancouver BC, V6Z 3H3
Prepared by	Nik Argirov, Vlad Kahle, Hamdy Khalil and Tim Little
Reviewed by	Nik Argirov
Approved for Issue by	Nik Argirov

Disclaimer

This document contains information which may be confidential or proprietary. Any unauthorized use of the information contained herein is strictly prohibited and the writers shall not be liable for any use outside the intended and approved purpose.

This page left intentionally blank

TABLE OF CONTENTS

1. GENERAL	1
2. NEWFOUNDLAND PROJECT SITE – NOVEMBER 7, 2017	1
3. NOVA SCOTIA PROJECT SITES – NOVEMBER 8, 2017	2
4. STATION COMPLETION PLAN MEETINGS– NOVEMBER 8 AND 9, 2017	3
5. COMMENTS AND CONCLUSIONS	8

APPENDIX - Site Photographs

This page left intentionally blank

1. GENERAL

Independent Engineer (IE) team participated in the site visit for the Maritime Link (ML) project. The site visit took place in the provinces of Newfoundland and Nova Scotia on Nov 07- 08, 2017. EMERA senior management representatives Ken Meade, Assistant Project Manager, Anne-Marie Curtis, Completions and Integration Director, Phil Zinck, Converter and Stations Contract Lead and Rory McNeill, Sr. Engineer- HVDC Systems accompanied the IE team listed below. Joseph Krupski from Natural Resources Canada also attended the site visit.

IE team:

- Nik Argirov (IE Team Lead)
- Vlad Kahle (IE Electrical SME)
- Hamdy Khalil (IE Transmission Lines SME)
- Tim Little (IE Geotechnical SME)
- Paul Hewitt (IE Project Control & Estimating SME)

The trip itinerary was as follows:

Nov. 6:

- Arrive and overnight in Deer Lake NL

Nov. 7:

- Start from Deer Lake
- Inspect HVAC and HVDC Transmission Lines
- Bottom Brook Converter Station visit
- Travel to and overnight in Halifax

Nov. 8:

- Fly to Sydney, NS
- Point Aconi Transition Compound visit
- Woodbine Converter Station visit
- Commissioning Meeting at Woodbine (part of the IE team)
- Big Lorraine Grounding Site visit (part of the IE team)
- Depart Sydney for Halifax and overnight

Nov/ 9:

- Project Documentation and Commissioning Meeting in Halifax (part of the IE team)
- Depart for home bases

2. NEWFOUNDLAND PROJECT SITE – NOVEMBER 7, 2017

The Newfoundland portion of the project includes: (a) approximately 142 km of steel tower 200 kV HVDC transmission line from the existing Bottom Brook substation to Cape Ray, (b) approximately 20 km of grounding line from Bottom Brook to Indian Head

and (c) approximately 160 km of Wood H-Pole 230 kV HVAC transmission line from Bottom Brook to Nalcor's existing Granite Canal Hydroelectric Generating Station. The associated infrastructure includes: (i) a new HVDC converter station and AC substation expansion at Bottom Brook, (ii) a switchyard at Granite Canal, (iii) a transition compound, (iv) 2 km of underground cable and an onshore cable anchor at Cape Ray and (v) a marine ground at Indian Head.

Transportation to the sites was by road.

Newfoundland Transmission Lines

The HVAC line from Bottom Brook converter station to Granite Canal is completed and in service. The IE team drove the Burgeo Highway along several kilometers of the completed line near Bottom Brook (Appendix Photos 1 and 2).

Stringing of the HVDC line was in progress at the time of the site visit. Emera reported that 72 km of the 142 km total length were completed, and the target completion date is November 24. The IE team visited several locations along the line to observe ongoing work.

Along the HVDC line, there were about 10 towers still to be erected at the time of the site visit, including 2 previously-erected towers that had been laid down for anchor remediation. A failure of a grouted anchor had led to the collapse of a guyed tower (SB-114), and to the subsequent inspection and remediation of previously installed grouted anchors in Newfoundland. Emera reported that all tower anchor testing, repairs and replacements have been completed. Approximately 90 anchors were repaired and approximately 180 replaced. In some cases where the original grouted anchors were deep, they were replaced with steel grillages (Appendix Photos 3, 4, 5 and 6).

Bottom Brook AC Substation and Converter Station

The AC substation and switchyard are complete.

Focus of the site visit were the HVDC yard and Converter building where the IE inspected the valve hall, control room, P&C panels and battery room installations. All equipment has been installed, cabling and wire termination is in final stages of construction. No apparent impediments to meeting the Project schedules were identified at this time (Appendix Photos 7 to 12).

The HVDC switchyard appears largely complete with final grading and gravel placement in progress.

3. NOVA SCOTIA PROJECT SITES – NOVEMBER 8, 2017

In Nova Scotia the subsea cables come ashore just west of the existing Point Aconi thermal generating station. The Nova Scotia portion of the project includes approximately 46 km of 200 kV HVDC transmission line from Point Aconi to the Woodbine converter station site, and 41.4 km of grounding line from Woodbine to the Big Lorraine grounding site. Associated infrastructure includes an onshore cable anchor and cable transition compound at Point Aconi, a transition compound, converter station and substation expansion at Woodbine, a marine ground at Big Lorraine, and two sections of underground (land) cable each of about 1 km length at Point Aconi and Woodbine. Most of the Nova Scotia rights of way (ROW) for the new lines either parallel or are close to existing access roads or existing transmission rights of way.

The team started from Sydney in the morning, stopped at the local Maritime Link project office to pick up PPE and then proceeded in sequence to the following sites:

Point Aconi Landfall and Transition Compound Sites

Construction of the Point Aconi landfall site is complete and the transition compound works are nearing completion (Appendix Photos 13 to 17).

Woodbine Converter Station

The AC Substation installation is complete; no site visit was required or conducted at this time.

Focuses of the site visit were the HVDC yard and Converter building. The IE inspected the valve hall, control room, P&C panels, MCC room and control room installations. All equipment has been installed, cabling and wire terminations are in final stages of construction. No apparent impediments to meeting the Project schedules were identified at this time.

Completion level at Woodbine is similar to that at Bottom Brook. That allowed the IE to conduct an abbreviated site inspection and focus on meeting with the site staff instead.

Station Completion Meeting in Woodbine Construction Office

Meeting was conducted with the site and commissioning managers and specialists. The discussions focused on the status of communication links installation and testing. For meeting notes see Section 4. Other discussion topics were cyber security and determination of losses. See the detailed meeting notes in the 'meetings' section (Appendix Photos 18 to 23).

Big Lorraine Grounding Site

Construction of the Big Lorraine grounding site works is complete (Appendix Photos 24 to 26).

4. STATION COMPLETION PLAN MEETINGS– NOVEMBER 8 AND 9, 2017

Two meetings were held during the Nov. 6th to 9th, 2017 IE Site Visit, one at Woodbine and one in Halifax office. Meeting objectives have been to update the IE on the project completion plan, identify and fill in any information gaps and discuss technical issues pertaining to the integrated system testing.

Participants (full time or part time, in person and by teleconferencing):

EMERA: Joy Blake, Anne-Marie Curtis, Norm Dimmell, Rory McNeill, Chris Jin, Baron Young

Canada: Joe Krupski

IE: Nik Argirov, Vlad Kahle

A. REFERENCE DOCUMENTATION: Below is the listing of the key reference documents with discussion comments.

1. **Terminal Operation Testing** (1JNL481094, A): This ITR covers the initial terminal energization.

Comment: None. The document is comprehensive.

2. **Transmission Operation Tests** (1JNL481095, B): The ITR covers the initial energization of the HVDC cable.

Comment: None.

3. **Transmission Testing of HVDC Light** (1JNL100155-987): This doc prescribes the tests leading to initial energization of the cables, low power transmission, active power control, reactive and AC voltage controls.

Comment: None.

4. **Additional Operational Tests** (1JNL 549453): Either station can be the master. The tests consist of the Black Start at both ends, heat runs in one direction only with power ramp-up at 0.05 p.u. up to full load and then to 0MW at the same rate of 0.05 p.u. Staged DC line faults (multiple) will be applied at Bottom Brook and Woodbine. The faults will be applied at minimum power using the stored energy (i.e. AC circuit breakers will be open). The primary purpose of the DC faults is to validate and calibrate fault locating instrumentation.

Comment: This ITR satisfactorily answers the IE earlier enquiry on the staged DC faults tests.

5. **Bi-Pole Transmission Tests** (1JNL549454): These tests will take place once both stations have been energized and ready for transmission of power. Active power will be ramped up to +/-50MW @ 2MW per min and reactive power will be ramped to +/- 50MVARs @ 2MVARs per min. Verification of AC Voltage control in bi-pole mode will regulate the Woodbine voltage at 345kV @ 1kV/ min, BBR bus voltage will be regulated at 235kV @ 1kV/ min. Power absorption will be tested at 225kV. One pole will be tested in Ground return and in Metallic Return. Part of these tests will be High Power Transmission and Heat Run. Each pole will be tested at 250MW with the other pole at zero MW in bi-pole control mode (i.e. ready to take over if the first tested pole trips). Test MVAR order at both ends.

Comment: This ITR satisfactorily describes the first transfer of active and reactive power.

6. **Inherent Overload Capability Study** (1JNL533822, A): This document records the ML capability as 2*250MW and 2*125MVAR or 2*150MVAR @ -35 to + 30 deg C.

Comment: The study confirms the design maximum load values.

7. **Final Trip Test** (1JNL100041-604): This is a prescriptive and recording document for final testing of protective equipment.

Comment: None.

8. **Integrated Commissioning Plan** (1JNL526076, B): The Plan covers the entirety of the Maritime Link. Specific ITP's deal with the communication links, power equipment, P&C, CTs, CVTs, auxiliary equipment.

Comment: This is a complete description of the test structure and sequences of the HVDC subsystems tests.

9. **High Voltage Energization of HVDC Light Station** (1JNL100127-904;1): This is a description of procedural steps for accomplishing the final commissioning and handover of the DC station.

Comment: This document references Operating Instructions and Operating 1- line diagrams. These are being developed by EMERA's Integrated System Commissioning team and will be in place prior to the equipment being first energized by the grid voltages.

10. **Sequences and Interlocking** (1JNL324239, E): This is a key reference document describing the permissible equipment configurations, control sequences, operating modes and interlocks.

Comment: Permissible configurations and control sequences are fully covered by this document; those sequences will either be tested on line (grid conditions permitting) or proven by Real Time Digital Simulator (RTDS) tests and factory acceptance tests FAT). Completeness of the commissioning tests can be verified by referencing to this document.

11. **Terminal Operation of HVDC Light** (1JNL100154-692;1): These tests verify operations of redundant systems as well the high reactive power control:

- Seamless (bumpless) transfer between controls A & B
- Operation of Protection systems A & B
- Changeover from Auto control to Manual
- Operation during Auxiliary Power loss
- AC Voltage Control in both directions
- Reactive Power Control
- High Reactive Power Control as a STATCOM.

Comment: This is a description and record of critical operational tests.

12. **Communication Verification** (1JNL 2040070Rev 01-en): Describes the communication channel, LAN and server tests.

Comment: No comment.

13. **Determination of Losses** (1JNL 337462)

This report describes background and procedures for determining the power losses (full load and no load) for the Maritime Link converters. It is recognized that direct measurement is impractical. Therefore, for the specific converter station configurations, the losses are calculated by using the formulas presented in the report [13]. That said, it may be useful to confirm the calculations by comparing them to the results from the power equipment FAT's. Average measured values, rather than the lowest / highest ones, should be used for the purpose of losses study (this however is not stipulated in the IEC and therefore was not pursued).

Comment: This Report follows an established practice of determining the HVDC system losses that is based mainly on calculations and results of select FAT's.

Action item for Rory McNeill: Follow up on this issue with ABB.

B. SPECIAL PROTECTION SYSTEMS (SPS): Ref: E-mail from Mr. Gerry Brennan, June 21, 2017

IE understanding of the SPS systems is as follows:

- SPS signal receipt at the ML terminal will initiate Emergency Power Control (EPC).
- EPC power range is +/- 500MW at the allowable ramp rate of 1 to 100 000 MW/s.
- Operator may enable/disable the EPC, select delta or a setpoint, and permit manual trigger.

1. ML Runback Facility:

- ML is the 'slave' end that will receive six signals
- Arming, logic for SPS initiation and control mode selection reside in the NSPI equipment
- Alarms and checkback logic were implemented in the NSPI equipment.

2. Upon completion and commissioning of Muskrat Falls generating plant ML will send four signals to LIL upon:

Loss of ML bi-pole

Loss of ML mono-pole

Receipt of NS Block 1

Receipt of NS Block 2

(Implementation of the resulting action at LIL from the ML triggers resides with NALCOR)

Comment: NSPI SPS systems are currently in service and their signal will be rerouted to ML prior to the link operating at 250MW plus. NS SPS' are apparently described in several operating instructions; design documents were not available at the time of this meeting. It is noted that there is not yet ABB ITR or an in-house test procedure for the ML SPS. The SPS consists of both Protection and Telecom equipment. An integrated test procedure and single point of responsibility for the testing outcome are recommended. (Post meeting note 1: SPS instructions were provided to IE)

Requests for Anne-Marie Curtis and Rory McNeil: IE requested copies of the design notes and operating instructions for the NSPI SPS system. Mr. McNeill agreed to develop the requisite test procedure for ML SPS and forward a copy to the IE. (Post meeting note 2: SPS runback controls were satisfactorily tested. This item is closed until MFA generation goes on line.)

C. COMMUNICATION LINKS AND CYBER SECURITY DISCUSSION

Ref. 1. Fiber Network Overview, drawing # S000ML30500001, Rev. 9C.,

Ref. 2 [12] 1JNL2040070Rev 01- en above

To facilitate the HVDC stations operations, two paths will interconnect the NS and NL facilities. Both Path A (Northern Route) and Path B (Southern Route) use existing facilities; for the comm links between the stations there are new fiber connections between the converters, transition compounds and the HVAC stations. The comm links are an integral part of the teleprotection, SCADA and SPS functions as well as providing the voice communications. IE was advised of the following:

1. Communication Links

- Teleprotections were designed to NERC standards.
- All teleprotection channels have been tested already and their ITR's signed off.
- Woodbine to Cape Ray link is complete, Corporate network is not yet complete.
- DC transmission line completion is pacing the remaining work on the comm. links.
- SCADA has not been addressed during the meeting.

Request for Anne-Marie Curtis: *IE requested SCADA points list for reference. (Post meeting note: Item is complete)*

2. Cyber Security

- Firewalls have been installed and those will be managed by EMERA's IT. ABB will provide windows for access to the electronic devices.
- Engineering workstation will be authorized to 'view' only (i.e. there will be no functionality to control the equipment or modify settings).
- Four levels of password protections have been installed to prevent intrusions.
- ML installation will be in voluntarily compliance with the NERC reliability standards but will not be certified at this time. Cyber security manager will be appointed.

D. OPERATIONAL AND SUNDRY PROJECT ISSUES

- NSPI will have the primary operational control over ML.
- NB is the NERC reliability coordinator for Maritimes utilities. While NLH does not have NERC certified operators, NSP does. Regardless, there will be NERC certified operators at both ML stations during testing.
- Except for the maintenance activities, ML converter stations will be unattended. Operating instructions/procedures are therefore written for the Energy Control Centres's (ECC).
- Operating Committee 03 has the responsibility for developing the operating instructions. ECC managers participate in the development of the operating instructions that will determine safe operations for the NS and NL electric systems.
- Specifically, operating instructions for the testing will document all of the necessary steps and assignments of authority.
- Engineer and Operator training is in progress. Following the training in ABB factory EMERA took leading role in training their staff.
- AC staged tests on the 345kV systems are being planned for and discussed with NSPI.
- First verification/operating tests are scheduled for Nov. 22, 2017.
- Completion documentation is tracked by the list of the Commissioning Certificates.
- As-built drawings will be formally processed and signed/sealed by a P. Eng.

Requests for Anne-Marie Curtis:

1. Provide list of NSPI operating instructions relevant to the ML operation to IE *(Post meeting note: Item is complete)*.
2. Provide systems commissioning tests tracker to IE. *(Post meeting note: Item is complete)*

E. UTILIZATION & RELIABILITY

- CIGRE TB 590-2014 Protocol for Reporting the Operating Performance of HVDC Transmission Systems will be used for utilization and reliability tracking. This protocol tracks both the scheduled and forced outages.
- Converter station maintenance program and responsibilities were discussed only briefly to be followed up with more thorough information session at later date.

5. COMMENTS AND CONCLUSIONS

Recognizing the issues that are being resolved on the NL portion of the HVDC transmission line, it was evident that the work on site is proceeding with good quality and safety awareness, within the baseline schedule.

APPENDIX - Site Photographs



Photo 1: HVAC line at crossing of Southwest Brook along Burgeo Highway, with three-pole angle structures in foreground and two-pole structures in background.



Photo 2: Temporary construction access bridge across Southwest Brook, which is to be removed soon.



Photo 3: In-progress erection of an HVDC tower. Other completed HVDC towers are in the background at left, and the existing HVAC line is along the right side of the right-of-way.



Photo 4: Insulators with attached pulley systems ready for installation along HVDC line.



Photo 5: Line stringing in progress on guyed and freestanding HVDC towers.



Photo 6: Powerline Technician completing insulator installation on HVDC tower.



Photo 7: Bottom Brook converter building.



Photo 8: Pole 1 valve hall at Bottom Brook converter building.



Photo 9: Pole 1 reactor room at Bottom Brook converter building.



Photo 10: Station control room at Bottom Brook converter building.



Photo 11: Ventilation equipment at mezzanine floor at Bottom Brook converter building.



Photo 12: Fire suppression system chemical tanks at Bottom Brook converter building.



Photo 13: Point Aconi completed landfall site enclosed by security fence. HVDC cables are buried under low berm at left.



Photo 14: Point Aconi view from landfall site along road to transition compound. Low berm along right side of road covers the buried HVDC land cables, with riprap-lined drainage ditch to the right.



Photo 15: Point Aconi Transition Compound is nearly completed. Overhead connections to the two transition structures in centre of photo are not yet installed. Electrical works are being completed in the service building in background.



Photo16: Point Aconi transition compound - Control panel installation in progress inside service building.



Photo 17: Point Aconi transition compound - Communication battery inside service building is braced and anchored.



Photo 18: In-progress construction of transition structure where overhead HVDC line transitions to underground on north side of the Woodbine switchyard.



Photo 19: View from Woodbine along construction access road from Woodbine switchyard to HVDC transition structure. Underground HVDC land cables are buried by berm along left side of road.



Photo 20: Woodbine converter station.



Photo 21: Ventilation works located on mezzanine floor of Woodbine converter building.



Photo 22: Cable installation works nearing completion inside Woodbine converter building.



Photo 23: 125VDC battery inside Woodbine converter building are braced and anchored.



Photo 24: Panorama view inside protective rock berm at Big Lorraine grounding site. Grounding wells with precast concrete covers are located inside the fenced enclosure at left.

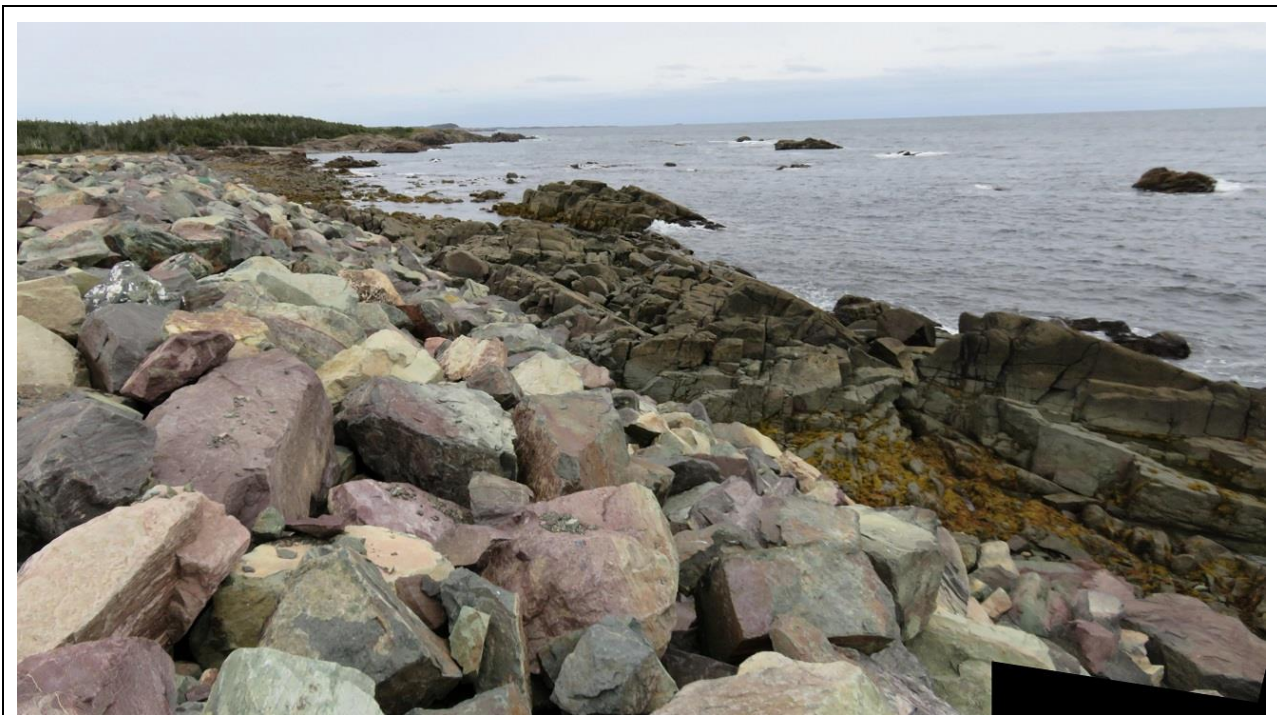


Photo 25: Big Lorraine grounding site riprap on outer side of protective rock berm is in good condition after first year of service.



Photo 26: Grounding site at Big Lorraine showing grounding lines transitions from overhead to underground.