
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 Q3 2019

October 15, 2019

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1 **1.0 INTRODUCTION**

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3 This is the Q3 2019 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 complete, with final punch list, site and subsea cable burial
5 remediation activities all completed, and corrective activities underway.

6
7 With respect to Nalcor’s assets, construction of the Labrador Island Transmission
8 Link has been completed and the energization phase of the project began in June
9 2018. Consistent with Newfoundland and Labrador Hydro’s latest Winter Readiness
10 Planning Report, availability of the Labrador-Island Transmission Link is forecast for
11 June 2020 as Nalcor’s Contractor continues development of Protections & Controls
12 (P&C) Software needed for operations. Overall completion of the Muskrat Falls
13 Generating Station (MFGS) continues to be forecast for Q3 2020, with completion of
14 the third generating unit of the MFGS forecasted for completion in mid-2020.

15
16 **2.1 Gates and Milestones**

17
18 The Maritime Link was placed in-service January 15, 2018.

19
20 **2.2 Safety**

21
22 NSPML maintains its commitment to workplace health and safety through its
23 continuous assessment and adjustment of a robust health and safety management
24 system. A commitment to continuously improving health and safety performance
25 among all employees, promoted by leadership and backed by action, are the
26 foundations of its health and safety culture.

27
28 In Q3, NSPML sought opportunities for improvement to the health and safety
29 program through the continued monitoring of contractor activities related to
30 inspection, maintenance and remediation.

1 NSPML continues to focus on the analysis of leading indicators through continued
 2 monitoring and improvement of the proactive reporting program. Continuous
 3 improvement across internal processes remained a focus in Q3. There have been no
 4 recordable injuries to date in 2019.

5
 6 **2.3 Commercial Activities**

7
 8 The key major procurement activities are presented in Table 1 with an update of the
 9 status for each initiative.

10
 11 **Table 1 Key Major Procurement Activities**

12

Commercial Activity	Background	Initiative Number	Status in October 2019
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>Contract Final Completion Certificate signed February 5, 2018.</p>	E11-18	Closed
Converter stations, switchyards and related structures (“converters and structures”)	<p>The Contract was awarded to ABB Inc. in June 2014.</p> <p>Final System Test Completed January 15, 2018.</p> <p>Substantial Completion achieved on January 15, 2018.</p>	E12-74	System studies are being completed as well as delivery of final spare parts, expected in Q4 2019.

Commercial Activity	Background	Initiative Number	Status in October 2019
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	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	Closed
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 terminated as of late 2016. Contract replaced with E16-284 and E16-269 previously reported.	E13-95	Contract Closeout is in progress.
Transmission Line Construction – NL AC Line	The contract with PowerTel was re-assigned to NSPML for the completion of the two Grounding Lines and the HVAC Line. Final Completion was achieved January 31, 2019.	E16-284	Contract Closeout is in progress.

Commercial Activity	Background	Initiative Number	Status in October 2019
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	Contract Closeout is in progress.
Transmission Line Conductors	<p>The Contract for the supply of conductors was awarded to Midal Cables in March 2015.</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.</p>	E13-87	<p>Closed</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 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.</p> <p>E13-158 for marine intervention</p>	<p>E13-156</p> <p>E13-157</p> <p>E13-158</p>	<p>Closed</p> <p>Closed</p> <p>Closed</p>

Commercial Activity	Background	Initiative Number	Status in October 2019
	services was awarded in April 2016 to DOF Marine. The supply of the HDD casing (E15-238) was awarded to East Coast Tubulars Limited in October 2015.	E15-238	Closed
Accommodations Operations	The contract for the accommodations operations services was awarded to East Coast Catering in April 2015.	E13-89	Closed

1 **2.3.1 Land Access Agreements**

2

3 Final as-built land surveys revealed that some new and amended easements were
4 required, particularly along the transmission and grounding lines. The vast majority of
5 these are now in place, and NSPML is in the final stages of securing these rights.
6 These easements do not impact the ability of the project to complete contract closeouts
7 or to operate according to plan.

8

9 **2.3.2 Funding**

10

11 The IE Certificates allow for Project costs to be paid from the proceeds of the
12 Maritime Link Construction Loan under the payment terms of the Material Project
13 Documents and the Maritime Link Credit Agreement. There have been no further
14 draw certificates since February 2018.

15

16 **2.3.3 Joint Development Agreements**

17

18 NSPML continues to work with Nalcor and NS Power to finalize the remaining
19 operational agreements arising from the Formal Agreements with Nalcor. Please refer
20 to Attachment 1 for details on the status of these Agreements, which indicate four
21 Agreements remain to be concluded.

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 - Completed.

7

8 • HVDC Converters and Substations - The remaining engineering drawings are
9 complete and have been accepted. The first draft of the short circuit protection
10 study (and the associated system models) has been received and is under
11 review.

12

13 • Overland Transmission – All project as-builts completed.

14

15

16 **2.5 Submarine Cables**

17

18 In meetings between February and May of 2019, the Department of Fisheries and
19 Oceans (DFO) informed NSPML that they intended to re-establish a commercial
20 fishery for redfish starting in 2020, given that redfish stocks in the Gulf of St.
21 Lawrence had unexpectedly recovered. The abundance of redfish targeted by
22 commercial fisheries is now found between 350m and 500m water depths. NSPML
23 learned from DFO and the Atlantic Groundfish Council that the fishing industry is
24 shifting to bottom trawling to optimize redfish harvesting at these depths. The
25 submarine cables are surfaced laid over a 59km section and therefore not physically
26 protected against this emerging risk.

27

28 To mitigate this risk, NSPML retained Nexans to trench the cables below 400m water
29 depth. Nexans chartered the M/V Polar King and employed its proprietary Capjet
30 systems, the same vessel and technology used in the 2017 campaign. The trenching
31 work commenced in late August, targeting a 1.0 meter burial depth consistent with the
32 design criteria used during the Project for fishing related risks. Trenching and

1 associated survey activities concluded in late September. NSPML’s annual cable
2 survey was recently completed. The results of these surveys will be used to facilitate
3 planning for 2020.

4
5 Routine preventative maintenance of the termination and transition sites and related
6 land-based protection continues as part of routine maintenance activities. Visual
7 inspections include site inspections, access road conditions, fencing, land cable berms
8 and any related items.

9
10 **2.6 Converters and Substations**

11
12 The Construction of the Converters and Substations was completed with the
13 conclusion of system testing and the Maritime Link placed in-service on January 15,
14 2018. All punch list items have now been completed.

15
16 **2.7 Transmission Lines**

17
18 NSPML initiated a planned inspection program for the Maritime Link overhead
19 transmission lines, with a 100% ground survey completed during the spring and
20 summer of 2018. Further inspections continued into 2019.

21
22 Through the inspections, NSPML identified certain deficiencies, the most notable of
23 which were damaged OPGW suspension clamps, a number of broken OPGW/OHSW
24 jumpers (with various failure mechanisms), and damaged conductors resulting from
25 loose vibration dampers. Work is underway to identify the root causes of these issues
26 and to carry out repairs. NSPML has also initiated warranty claims with the relevant
27 parties.

28
29 Additionally, NSPML is finalizing the review of proposals for the rerouting of a short
30 section of the NL HVAC line near Southwest Brook. It is anticipated that the contract
31 for this work will be awarded to allow for work completion in Q4 2019. This is
32 required due to soil erosion on the hillside near the base of three structures.

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The overhead transmission system continues to perform well through the second year of operations with no significant reliability or downtime impacts experienced.

2.8 Independent Engineer

NSPML has entered into a contract with the IE related to the Operations phase of the Maritime Link, as per the Federal Loan Guarantee requirements. Site visits will continue to occur routinely, and the IE will provide annual confirmation to Canada and the Collateral Agent that the assets are being operated and maintained appropriately. Please see Attachments 2-6 for recent reports from the IE, including site visit reports and the 2018 Annual O&M Report.

2.9 Status of Nalcor Project and Muskrat Falls

Nalcor’s latest project update indicates that overall construction of the Muskrat Falls Project is 98% completed¹ with the anticipated MFGS and Labrador-Island Transmission Link completion schedules forecasting commencement of the NS Block in mid-2020.

Nalcor’s monthly report indicates the following progress:

- The Muskrat Falls Generating Facility reached 96% complete.
- The Labrador-Island Transmission Link (LIL) remains at over 99% complete, as Nalcor’s Contractor GE continues development of the P&C Software needed for operations.
- The transmission line connecting Churchill Falls to Muskrat Falls is now 100% complete.

¹ Muskrat Falls Project Monthly Report, July 2019, dated September 19, 2019, page 4, section 2.0.

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For the Muskrat Falls Generating Facility:

- Civil work continued on the Intake and Powerhouse, with a focus on completion of punch lists in preparation for powering up to enable Unit 1 to be turned.
- Rotor installation was completed in Unit 1; preparation continued for rotor flip in Unit 2; and pit assembly continued for Unit 3.
- Commissioning was completed on the trash rack cleaning machine.

Nalcor has been experiencing challenges with the Protections & Controls (P&C) Software required to operate the LIL. The latest version of Muskrat Falls Oversight Committee, dated June 27, 2019, noted that the final version of bipole software is expected to be delivered by GE in early 2020, followed by an additional testing and trial operations period to be coordinated with Newfoundland and Labrador Hydro. Meetings between GE and Nalcor are ongoing to discuss progress of bipole software development and Independent Third-Party reviewers are validating progress, functionality and completion deliverables under the GE amending agreement(s).

NSPML is supportive of a mid-2020 planning date being used by NS Power for the start of the NS Block. NSPML’s site visit at the last Board of Director’s meeting, as well as ongoing updates from the Joint Operating Committee support the schedule for the NS Block starting in mid-2020. Nalcor remains on-track for the first Muskrat Falls generating unit to be commissioned in December of 2019, an encouraging milestone when achieved.

1 **2.10 Status of Benefits to NS Power Customers**

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3 Customer benefits received to date are being reported by NS Power with its Quarterly

4 Fuel Adjustment Mechanism Report.

1 **3.0 UPDATED COST SUMMARY**

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

Table 2 provides an updated cost summary for the Maritime Link, which includes actual costs incurred as of June 30, 2019 and forecasted costs for the remainder of the Project's construction activities.

Costs associated with trenching the submarine cables as noted in section 2.5 of this report (and associated with transmission line corrective work noted in section 2.7 of this report) were included in the project forecast after June 30, 2019 and as such will be reflected in a future report.

NSPML continues to track and report all costs, actual and forecast, consistent with the methodologies used in the cost forecast represented in the Maritime Link Project Application. Capitalized 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.

1
2 **Table 2 Updated Cost Summary for the Maritime Link Project**
3

Description	Actual Costs									Estimate to Completion	Total Project Estimate at Completion (A)
	2011-2013	2014	2015	2016	2017	2018	Q1 2019	Q2 2019	Total Project to Date		
Emera NL Project Management Costs	44,379	42,315	24,599	25,639	32,721	15,789	2,741	1,140	189,323	1,405	190,728
Nalcor Project Support Costs	-	15,232	425	438	257	(136)	15	12	16,242	259	16,501
Construction and Engineering Initiatives	14,975	167,980	259,750	403,871	478,216	(630)	943	1,211	1,326,317	4,005	1,330,322
Environmental Approval	2,651	4,378	1,082	1,623	7,090	1,415	33	54	18,326	110	18,436
Submarine and related	3,359	83,797	74,439	54,213	115,511	(5,897)	-	-	325,422	(0)	325,422
Converters, structures, and other ancillary equipment	1,517	48,747	106,195	227,643	157,614	5,397	275	422	547,810	3,246	551,055
AC and DC Transmission	7,448	31,057	78,035	120,392	198,001	(1,545)	636	736	434,759	649	435,409
Total	59,354	225,527	284,774	429,948	511,194	15,023	3,699	2,363	1,531,882	5,669	1,537,551
Escalation									-	32,454	32,454
Contingency									-	7,349	7,349
Grand Total	59,354	225,527	284,774	429,948	511,194	15,023	3,699	2,363	1,531,882	45,472	1,577,354

1 **Total Actual Project Costs at end of Q2 2019 Compared to Previous Forecast**

2
3 The total actual project capital costs incurred during Q2 2019 of \$2,363,000 are
4 detailed below:

- 5
- 6 • Emera NL Project Management Costs of \$1,140,000: Project management
7 costs continue to be incurred as work advances relating to closing out of
8 contracts, procuring and managing punch list, remediation and corrective
9 activities, and ensuring appropriate documentation is in place for project
10 closeout and regulatory purposes. NSPML has segregated these capital costs
11 from costs relating to operating and maintenance activities and have expensed
12 such operating and maintenance costs accordingly.
 - 13
 - 14 • Nalcor Project Support of \$12,000: This reflects Nalcor services relating to
15 construction activities.
 - 16
 - 17 • Environmental Approval (EA) of \$54,000: This reflects the cost of EA
18 monitoring and finalization of EA related compensation.
 - 19
 - 20 • Converters, structures, and other ancillary equipment of \$422,000: This
21 reflects the cost of NL Hydro and NS Power system upgrades and
22 modifications, as well as the construction of material spares buildings in both
23 provinces.
 - 24
 - 25 • AC and DC Transmission of \$736,000: This reflects the costs of punch list,
26 remediation and transmission line inspection activities.
 - 27

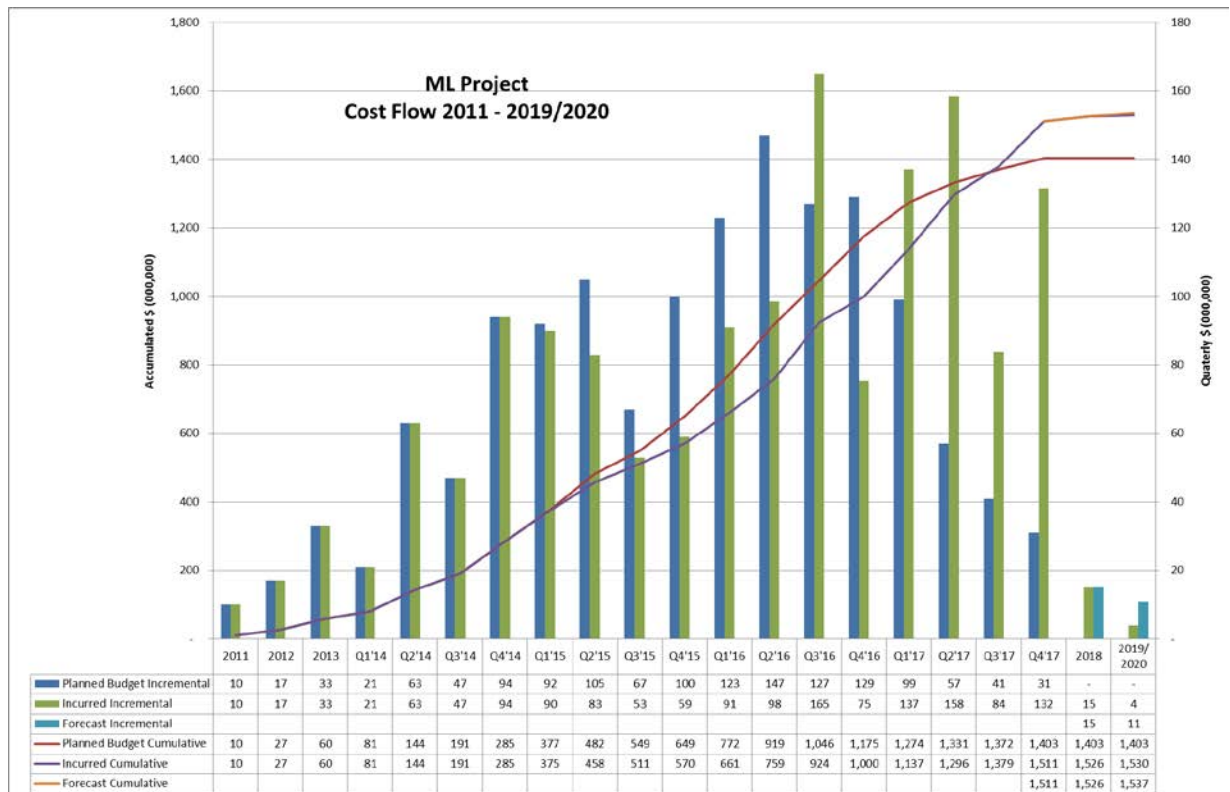
28 The Project capital cost remains within budget.

1 **4.0 COST FLOW**

2
3 As per Enerco U-31, section 2.2, please refer to Table 3 below for the cost flow of the
4 Maritime Link.

5
6 The remaining budget includes forecasted costs relating to trenching the submarine
7 cables, remediation and corrective activities as well as completion of documentation
8 and close out of payments to contractors, as well as regulatory and environmental
9 requirements relating to the construction aspect of the project. Certain of these costs
10 are expected to take place in 2019/2020 and are expected to require further draws on
11 remaining budgeted contingency and escalation balances. The total forecast of base
12 capital spending, escalation, and contingency amounts for the project remains at or
13 below \$1.577 billion.

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15
16 **Table 3 Maritime Link Cost Flow**



1 **5.0 INTERIM ASSESSMENT FINANCIAL UPDATE 2018**

2

3 With the Maritime Link placed in-service on January 15, 2018, NSPML continues to
4 receive monthly cost recovery revenues from NS Power pursuant to the Board's
5 November 2, 2017 Order. NSPML forecasts its 2019 operating and maintenance, debt
6 and equity financing costs to approximate the amounts budgeted for the year. The
7 actual costs in 2018 were as reported in NSPML's audited financial statements filed
8 with the UARB.

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 2020
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)	No longer required given sale of Bayside to NB Power.
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 2019
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 2020
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 2020
23.	JOA-Joint Operating Committee (“JOC”)	Nalcor and NSPML	Establish/Operationalize JOC	JOA 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

REPORT ON MEETING IN HALIFAX ON

FEBRUARY 1, 2018

Prepared for: Natural Resources Canada and NSP Maritime Link Inc. (NSPML)

IE Point of Contact: Nik Argirov

Date: May 30, 2019

Quality Assurance Statement

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1. GENERAL

Independent Engineer (IE) team participated in meeting with NSP Maritime Link Inc. (NSPML) management on February 1st, 2018. Meeting topics covered ML Operations update and review of outstanding commissioning items.

IE team:	Nik Argirov (IE Team Lead)
	Vlad Kahle (IE Electrical SME)
NSPML Attendees:	Anne- Marie Curtis
	Norm Dimmell
	Rory MacNeill
	Craig Snelgrove
	Phil Zinck (part of meeting)
	Ken Meade (part of meeting)
	Rick Janega (part of meeting)

2. AGENDA

2.1 ML Operations update (discussion led by Mr. Dimmell)

- Personnel and operational safety remain the priority.
- Operations team is now managing the ML with the emphasis on familiarization of HVDC link performance characteristics and maximization of benefits.
- Reliability and performance measurements are in place.
- Long Term Asset Management Plan (LTAMP) has been organized. Although it is essentially a budgeting tool for allocating resources, the maintenance strategy is contained within LTAMP.
- Planned resource allocation is as follows:
 - (i) NSPML is working with ABB on development of a 3- 5 years Service Level Agreement (SLA) for maintenance of the system. After that period NSPML will self-perform the equipment maintenance.
 - (ii) NSPI and NSPML are drafting scope of work for the maintenance of AC equipment and the Control systems at the Woodbine Substation.
 - (iii) NLH and NSPML are drafting scope of work for the maintenance of AC equipment and the Control systems at Bottom Brook Terminal Station 2 and Granite Canal.
 - (iv) Discussions for contingency support agreement for the submarine cable work are in progress with NEXANS. This will include handling of the intellectual property and splicing technology.
- North American Electric Reliability Corporation (NERC) compliance is through NSPI. ML may become subject to full compliance in the future. Therefore, the maintenance and reliability procedures are being set up to accommodate the future compliance requirements.

- Time based maintenance criteria in accordance with the OEM instructions will drive the maintenance schedules during the first period of ML operation. Once reliability and performance data are available, the scheduling may shift to risk and reliability assessment-based maintenance.

2.2 Review of the Outstanding Commissioning Items (discussion led by Mr. MacNeill)

2.2.1 Deficiencies identified during the commissioning have been largely addressed with the following exceptions:

- (i) Auto restart sequence did not work properly during the test on 2018- 01- 08. This requires further analysis and the auto restart sequence will remain blocked until the auto restart sequence has been analyzed and corrected.
IE Comment: This is a satisfactory interim measure. It is recommended the Control Centers be formally advised.
- (ii) Number of changes to software code have been made during the commissioning program leading to recommendation for software regression testing. IE were advised that all changes were approved by the ABB engineering team and the only affected software blocks were those of sequencing and interlocking. That is, the valve firing control and voltage control blocks were not impacted. ABB and NSPML apparently concluded that, due to the segregation of the software blocks, full scale regression testing is not required nor is it planned. It is noted that the revised program portions were retested or will be tested again during the Company Operational Testing.
IE Comment: Regression testing is an accepted practice that verifies the existing code after new lines of code have been added to it. It is typically necessary to retest the existing and previously tested parts every time new lines of code are added. If the full regression testing is not to be carried out, IE recommend that ABB issues statement of guarantee that the revised code will not interact with the previously tested software blocks. In absence of such a guarantee, full regression testing should be performed.
- (iii) Concern was raised about the different power apparatus basic insulation levels (BIL), i.e. equipment in the AC Substations being rated at 1050kV and the AC equipment in the AC Yard of the DC converter stations rated at 950kV.
IE Comment: Insulation coordination study indicates that equipment rated 950kV will withstand voltages imposed on the equipment by switching surges and lightning.
- (iv) Bottom Brook and Cape Ray HVDC Punch List has nine outstanding items.
IE Comment: None of the listed deficiencies appear to have significant impact on the operation of the ML.
- (v) Woodbine and Pt Aconi HVDC Punch List has forty-seven outstanding items.
IE Comment: Most of the listed deficiencies are being addressed by ABB or are to be completed during the Company Operational Testing. In the meantime, majority of the items do not appear to have significant impact on the operation of the ML as long as the Control Centers are made formally aware of any SCADA, metering and HMI display anomalies. IE would like to highlight the following items for early attention:
936: Confirm completion.
973: Complete trip testing of 345kV node breakers. Any future modifications to the breaker trip circuit such as blocking of the trip for an 'open' AC disconnect switch, should include fail safe trip circuit monitoring.

2.2.2 Performance testing has been satisfactorily completed with the exception of:

- (i) Audible tests could not be done at this time due to wind generated ambient noise level.
- (ii) DC Harmonics verification that requires insertion of the test ground rods. Weather permitting this test will be performed in the Spring 2018.
- (iii) Verification of the equipment performance during abnormal grid conditions. NSPML and IE accepted the factory acceptance testing and equipment specifications.
- (iv) No-load and full-load losses calculations as documented in ABB's 'Determination of Losses, 1JNL337462, dated 2017-05-11' were accepted by NSPML and IE.

3. CONCLUSION

IE did not identify any outstanding items that would put significant restrictions on operability of the Maritime Link. The anomalies identified in the 'Punch Lists' have not precluded the ML entering into an operational status. It is expected that the Control Centers will be duly notified of any operating restrictions and all of the items will be resolved early during the Company Operational Testing.

Post meeting note: Software regression testing scope will be prepared by NSPML and submitted to ABB.

LCP - ML PROJECT

REPORT ON MEETING IN HALIFAX ON MAY 30 AND 31, 2018

Prepared for: Natural Resources Canada and NSP Maritime Link Inc. (NSPML)

IE Point of Contact: Nik Argirov

Date: May 30, 2019

Quality Assurance Statement

Office Address	740-1185 W Georgia Street, Vancouver BC, V6E 4E6
Prepared by	Nik Argirov, Vlad Kahle and Hamdy Khalil
Reviewed by	Nik Argirov
Approved for Issue by	Nik Argirov

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1. GENERAL

Independent Engineer (IE) team participated in meeting with NSPML management on May 30th and 31st, 2018. Meeting topics covered ML Operations update and review of outstanding commissioning items.

IE team:	Nik Argirov (IE Team Lead)
	Vlad Kahle (IE Electrical SME)
NSPML Attendees:	Anne- Marie Curtis
	Gerry Brennan
	Norm Dimmell
	Rory MacNeill (by video conference)
	Craig Snelgrove (by video conference)

2. AGENDA

2.1 Project update (discussion led by Mr. Brennan)

- Most of the punch list items were completed following the Project close-out.
- Any outstanding items at Woodbine and Bottom Brook are being addressed; structural reinforcement of the motor operated disconnect switches (MODS) are planned for the following week. Seventy disconnects are affected, no outages are required to implement the upgrades.
- Arc-flash study has not been discussed; an item for discussion in the next conference call.
- DC Harmonic and radio interference measurements were taken at bi-pole and monopole load of 150MW.
- ABB filed the bulk of the Project documentation. As-builds are to be delivered to NSPML by Q3, 2018. Revisions are reported to be duly signed and tracked by their revision number.
- Frequency control has been tested and the charts show satisfactory damping over 10 sec intervals. Frequency, load and voltage controls have been purposely dampened and delayed allowing the NL facilities to act first during the system excursions. ML is intended to be the back-up to NL plant controllers. *Item closed.*
- Logic for the special protection system (SPS) and the rules for application of the remedial action steps reside in the NSPI equipment; SPS confirmation signal reflects NSPI application philosophy. ML signals receipt and confirmations have been commissioned. *Item is closed until the LIL is integrated into the NSPI electric system.*
- Software regression testing has been satisfactorily completed. *Item closed.*

2.2 ML Operations Update (discussion led by Mr. Dimmell)

- Personnel and operational safety remain the priority. ML Safety Management Plan (SMS) consists of ten principles. Safety committees are in place; injuries and incidents are formally investigated and reported to the highest level.
- Reliability and performance measurements are in place.

- Utilization reporting is not necessarily a good indicator of the ML reliability. The link is operated by NSPI and NSPML has no control over the ML utilization – Availability is the primary performance indicator and is calculated in accordance with CIGRE protocol TB590.
- Long Term Asset Management Plan (LTAMP) has been organized. It includes Asset Integrity Plan, Asset and Finance Management Plan, Environmental Plan and Regulatory Compliance.
- Service Level Agreements (SLA):
 - (i) NSPML and ABB executed a 5-year service level agreement (SLA) for maintenance of the system. It includes 3 years on-site technical support. ABB will assist NSPML in preparing the maintenance procedures. Those will initially be based on the OEM Manuals.
 - (ii) NSP and NSPML as well as NLH and NSPML agreements and scope of work for the maintenance of AC equipment are being finalized.
 - (iii) Communication channels maintenance are mixed responsibility (no further details were provided at this time).
 - (iv) Discussions for contingency support agreement for the cable work are in progress with NEXANS. Splicing procedure is in safety deposit box to be used in case NEXANS is unable to carry out the repairs within 2 months of the repair request. NSPML is preparing cable repair plans that include seagoing equipment marshalling options.
- HVDC equipment data base is largely in place with the exception of transmission line and grounding sites inventories.
- Preparation and maintenance of AC assets list is part of the Utilities' SLA. Utilities will report to NSPML on the maintenance work completed against the plan.
- Transmission maintenance goal for 2018 is to inspect 100% of the structures and guy wires. Infrared imaging will be carried out when Muskrat Falls generating plan is in service. IE recommend checking conductor ground clearance against the design criteria.
- Wall bushing issues account for the majority of reportable 'forced outage time'.
- Fisheries timeframe will permit subsea cable inspections to start in July.

3. CONCLUSION

Key operational items such as the staff training, technical support for the HVDC systems and ABB SLA are in place. Pending the wall bushing repair, MODS structure upgrades and completion of the remaining punch list items, IE have no concern at this time.

IE next site inspection should focus on the review of preventive maintenance instructions and progress against the maintenance plans.

LCP - ML PROJECT

SITE VISIT REPORT OCTOBER 10 TO 13, 2018

Prepared for: Natural Resources Canada and NSP Maritime Link Inc. (NSPML)

IE Point of Contact: Nik Argirov

Date: May 30, 2019

Quality Assurance Statement

Office Address	740-1185 W Georgia Street, Vancouver BC, V6E 4E6
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1. GENERAL

Independent Engineer (IE) team participated in the site visit for the Maritime Link (ML) project. The site visit took place in the province of Newfoundland on October 11th and 12th 2018. NSPML management representatives Gerry Brennan, Anne-Marie Curtis, Craig Snelgrove, Rory MacNeill and Roger Burton led the site meetings and accompanied the IE team listed below.

IE team:

- Nik Argirov (IE Team Lead)
- Vlad Kahle (IE Electrical SME)
- Hamdy Khalil (IE Transmission Lines SME)

The trip itinerary was as follows:

October 10:

- Arrive and overnight in Deer Lake NL

October 11:

- Site visit and meeting at Bottom Brook
- Indian Head grounding site visit
- Transmission inspection
- Overnight in Stephenville NL

October 12:

- Cape Ray Cable Transition site and cable site visit
- Return to and overnight in Halifax NS

October 13:

- Travel from Halifax NS to home bases

2. NEWFOUNDLAND PROJECT SITES – OCTOBER 11 AND 12, 2018

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 kilometers 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 converter station and 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 site at Indian Head.

Transportation to all sites was by road.

Indian Head Grounding Site

IE visit was facilitated by Craig Snelgrove. The facility has been fully commissioned and the site was rehabilitated.



Photo 1. Indian Head grounding site and grounding line

HVDC Transmission Line

IE visit was facilitated by Roger Burton.

The HVDC line is equipped with both the conventional shielding wire and OPGW (optical ground wire). DC line protection between the converter station and the transition compound will communicate via the optical fibers within the OPGW. The OPGW has to be periodically grounded to dissipate unwanted electric charge. Transmission tower termination/ grounding box is shown below.



Photos 2 and 3. OPGW Splice Box and transmission tower detail

Cape Ray Landfall and Transition Compound Site

Gerry Brennan, Anne-Marie Curtis and Roger Burton conducted the IE visits. The facilities have been fully commissioned and the sites have been rehabilitated.

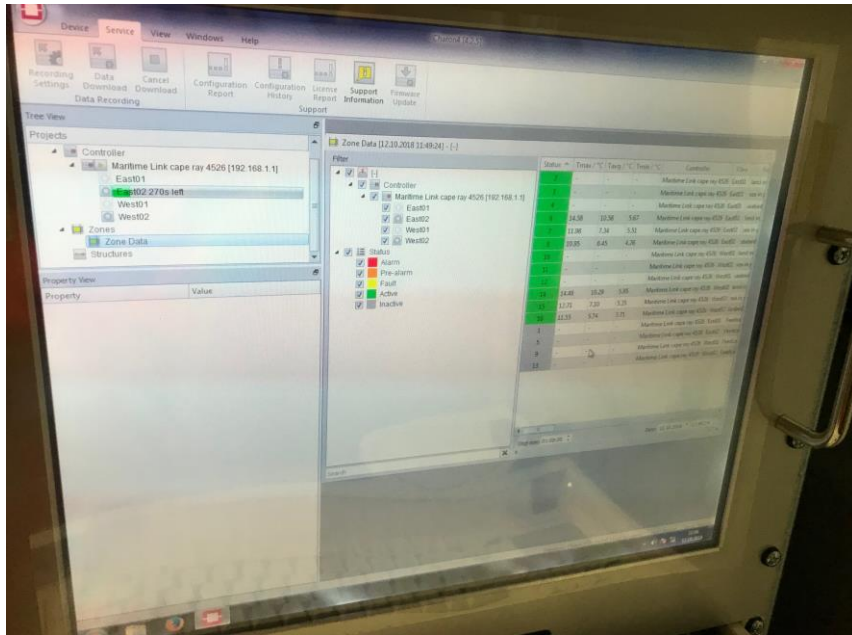


Photo 4. Cable temperature monitoring display

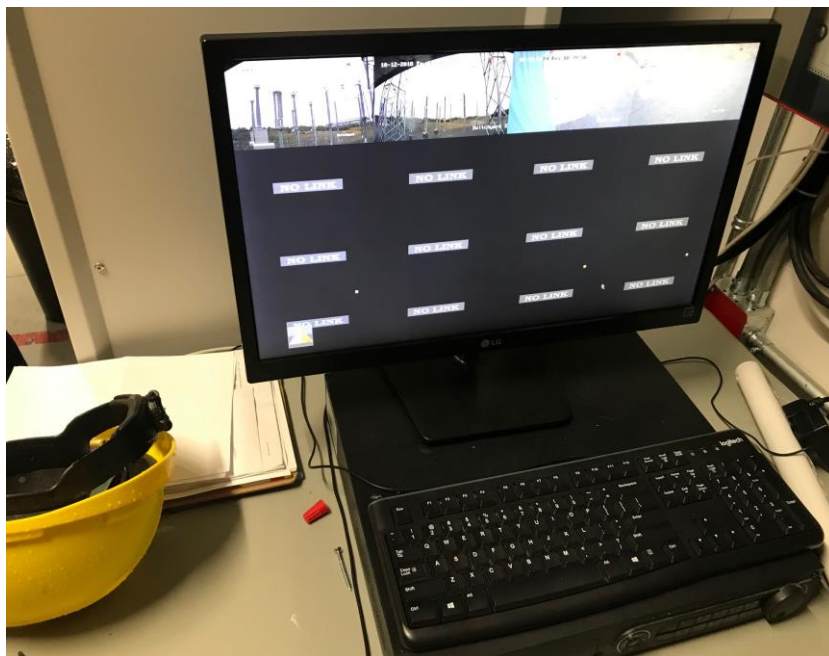


Photo 5. Site security monitoring display

Bottom Brook AC Substation and Converter Station

Site walkthrough and technical discussions were led by Rory MacNeill. The AC Substation and Converter station installations are complete and in service.

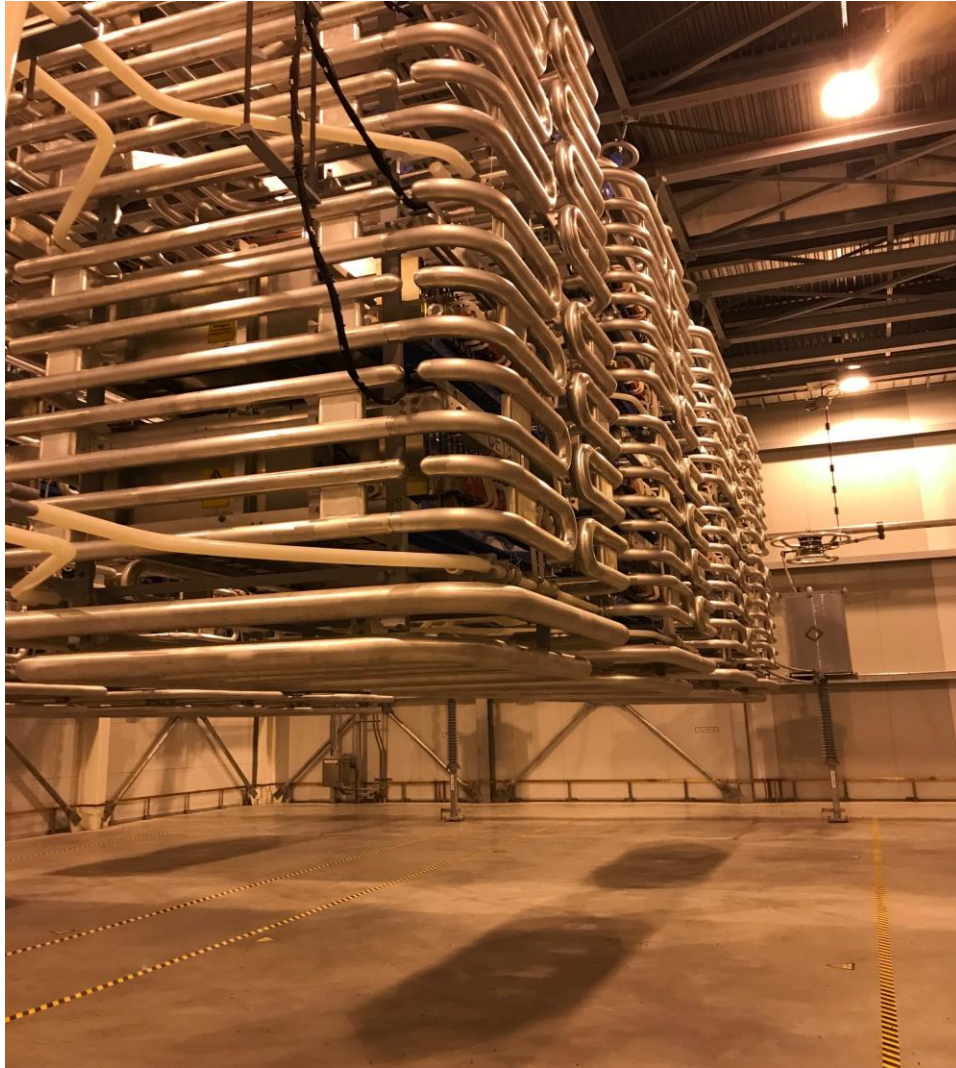


Photo 6: Converter Station – HVdc valves

Technical Meeting in Bottom Brook

- a) Transmission Line discussion
- Line inspection was conducted by Roger Burton and Hamdy Khalil
 - Remediation of problem areas A40 to A47 is in progress. Options are to re-route the line or install longer span.
 - There have been OPGW tab failures. NSPML is exploring several alternative engineering solutions.
 - Several minor problems such as missing signage, missing pole caps, etc. have been identified with NL grounding line.
 - The NL HVAC line does not have many problems with the OPGW wire jumpers.

b) HVDC Performance Report

- HMI's for Pole 1, Pole 2 and Bi-pole are working well.
- There are some issues with the NS ECC HMI data base for the Woodbine AC Substation related to time delays on equipment position and HMI system switchover.
- IE were advised that Joy Brake is now a manager of the ECC.
- HVDC availability is tracked by NSPML. ECC is responsible for the HVDC dispatch so the ML utilization is not a very useful performance indicator.
- Majority of outage time was the result of bushing failures and neutral capacitor failures.
- There were minor problems with a loose snubber circuit electrical connection causing partial discharge and eventual arcing, causing damage to a heat sink. Replacement planned for late Q4, 2019.
- Converter DC saturation transformer protection mis operated due to winding turns ratio error when transformer tap changer went to extreme position while the link was operating at reduced DC voltage. Correction factor was implemented to prevent reoccurrence.

c) Project Closeout by Gerry Brennan

- HVDC Converters, HVAC: ABB substantial completion and trial operations
- Submarine cable: NEXANS final completion
- HVAC transmission in NL and grounding sites at NL and NS: Power Tel final completion
- HVDC transmission in NS: ERJV (EUS) substantial completion
- HVDC transmission in NL: ERJV (Rockstad) mechanical completion

d) Wrap-up Activities

- Final documentation handover is in progress
- Spares sign-off has been done
- AC Fault tests are pending
- Radio interference tests are pending. NSPML will follow the CIGRE guidelines.
- Enhanced (i.e. fuller scope than the ABB commissioning tests) black-start tests are pending
- Short Circuit Studies are ongoing
- Site security and video monitoring RFP process is in progress
- Cyber security requirements for NS Power are apparently not as stringent as for the other Eastern seaboard electric utilities.
- IE Role in Operation and Maintenance reviews was discussed. IE reiterated that this is a broad guide (white paper) on good utility practices in North America. NSPML is welcome to provide comments and initiate further discussions.

3. COMMENTS

Transmission line issues are being addressed by engineering and management.

ECC HMI database and minor technical issues are being resolved with regards to the Woodbine AC Substation. IE will follow on the resolution of HMI commissioning and verify punch list closeout.

Documentation management and turnover of as-build drawings is in hand and near completion.

LCP - ML PROJECT

SITE VISIT REPORT MAY 6 TO 10, 2019

Prepared for: Natural Resources Canada and NSP Maritime Link Inc. (NSPML)

IE Point of Contact: Nik Argirov

Date: June 13, 2019

Quality Assurance Statement

Office Address	803-633 Kinghorne Mews, Vancouver BC, V6Z 3H3
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1. GENERAL

Independent Engineer (IE) team participated in the site visit for the Maritime Link (ML) project. The site visit took place in the province of Nova Scotia between May 6th and 10th 2019. NSPML management representatives Norm Dimmell, Anne-Marie Curtis, Craig Snelgrove and Rory MacNeill led the site meetings and accompanied the IE team listed below. Roger Burton participated by phone.

IE team:

- Nik Argirov (IE Team Lead)
- Vlad Kahle (IE Electrical SME)
- Hamdy Khalil (IE Transmission Lines SME)

The trip itinerary was as follows:

May 6:

- Arrive and overnight in Halifax, NS

May 7:

- Meeting at EMERA office
- Travel to Sydney, NS

May 8:

- Big Lorraine Grounding Site and Point Aconi Transition Site visit
- Meeting at Sydney

May 9:

- Woodbine Converter Station site visit and meeting
- Travel from Sydney to Halifax, NS

May 10:

- Travel from Halifax NS to home base

2. NOVA SCOTIA PROJECT SITES – MAY 8 AND 9, 2019

Transportation to all sites was by road.

2.1. Big Lorraine Grounding Site

IE visit was facilitated by Craig Snelgrove. The facility has been fully commissioned and the site was reclaimed. The electrode line fault locating service is fully in service and calibration is ongoing.

Emera has established survey control points through a LiDAR survey and will complete yearly LiDAR surveys to track any future site movements.

2.2. Point Aconi Transition Compound

IE visit was facilitated by Craig Snelgrove. The facility, cable trench and cable site have been fully commissioned and the site was reclaimed.

2.3. HVDC Transmission Line

All work is completed. Inspection of all structures was completed in 2018. Torqueing of all bolts and climbing inspection are targeted for completion by the end of 2019.

2.4. Woodbine AC Substation and Converter Station Site Visit

Site walkthrough and technical discussions were led by Rory MacNeill. The AC Substation and Converter station installations are complete and in service. Spare parts storage shed has been completed and inventory is stored in permanent bins. Outdoor parts storage containers' water proofing will be completed when the weather improves.

2.5. Technical Meeting in Woodbine

Meeting was moderated by Anne-Marie Curtis.

- a) Asset Management Review Session (Anne-Marie Curtis)
 - 2018 Annual Budget was discussed. \$11.1 mil was spent; the numbers will be detailed in the IE 2018 Annual O&M Report.
 - 2019 Annual O&M Budget is \$18.3 mil.
 - ABB has been contracted for technical support for at least 2 more years.
 - 6-year warranty is in place for HVDC equipment.

- b) Operations
 - Current Operations team consists of 18 staff; 2 utility technicians are being recruited, targeting Q3.
 - Continued Safety and Technical competency training is ongoing.
 - Safety Committee is in place and 2019 safety meetings and inspections have been scheduled.
 - 27 targets and commitments remain on track.
 - In Q1 there was one high potential incident observed by the staff, remedial action took place and there was no injury.
 - RFP has been issued for Vegetation Management Program.
 - Environmental targets for 2019 include; increased liaison with DFO and local fisheries as well as training for spill containment.

- c) Asset Management Reviews
 - (i) Transmission Maintenance (Craig Snelgrove).
 - In 2018 ground level inspections were performed on all structures (2611 structures in total).
 - 2019 work plan is based on findings.
 - Several different hardware problems were resolved. 'Salvi' damper issues were identified.
 - OPGW braided wire replacement is in progress (140 in NL, 5 to be replaced in NS).
 - HVac towers relocation between STR 841 and STR 845 is planned for 2019.

- Danger trees removal has taken place and is also planned for 2019.
 - Long term inspection plan has been developed.
 - (ii) Transmission - Project closeout (Roger Burton).
 - HVDC Transmission lines contract is concluded per 2018 agreement.
 - (iii) HVDC (Rory MacNeill)
 - Developed and executed preventive and corrective maintenance activities in the system. Total 1919 PM work orders were issued.
 - Annual shutdown took place in October 1 to 7, 2018. 2019 shutdown is planned for August 18 to 25.
 - HVDC performance numbers will be detailed in the IE 2018 Annual O&M Report. 2018 Equipment Availability was 82.71%.
 - P1 OR P2 Availability target for 2019 is 99.8%.
 - 2018 Statcom availability (P1 and P2) was 92.7% in NL and 95.1% in NS.
 - ML continues to comply with NERC reliability and cyber security requirements as defined by Nova Scotia Power.
 - (iv) Marine (Norm Dimmell; Anne-Marie Curtis).
 - Submarine cable survey and inspection was completed by DOF Subsea.
 - For cable protection design, 'Fishing risk' zones were identified as well as the 'Low risk' zone (cables not buried). It was noted there is an emerging risk zone associated with increased abundance of red fish that NSPML is assessing.
- d) Discussion & Questions
- IE Role in HVDC Links Operation and Maintenance document was discussed. It was agreed that this should be a broad guide (white paper) on good utility practices for maintaining HVDC facilities. NSPML provided comments and IE will reissue the document.
 - Documentation management framework is in place. As-builds have been handed over by ABB.
 - Long Term Asset Management Plan (LTAMP) will continue to evolve during 2019-2020 period.

3. COMMENTS

Sites have been completed and reclaimed.

Asset management program has been developed.

It is anticipated that the link will meet the expected performance criteria in 2019.

Transmission line issues are being addressed by engineering and management.

Documentation management and turnover of as-build drawings are in hand and near completion.

MARITIME LINK: 2018 IE ANNUAL O&M REPORT

Prepared for: Natural Resources Canada and NSPML

IE Team Lead: Nik Argirov

Date: June 14, 2019

Quality Assurance Statement

Office Address	803-633 Kinghorne Mews, Vancouver, BC V6Z 3H3
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1. GENERAL

Contractor: Argirov Engineering Inc.

Company: NSP Maritime Link (NSPML)

Annual Report Purpose:

Contractor is tasked to confirm that the budgeting and maintenance of the Maritime Link Project is being conducted in accordance with Good Utility Practice.

Limitations and Exclusions:

For purposes of this Report the Contractor relied solely on the information provided by the Company. Equipment inspections and the maintenance activities were not witnessed in person.

2. SCOPE OF THE REPORT

- (a) A summary of any material routine and unscheduled maintenance which has been carried out since the last report as well as an updated review of expected major maintenance requirements, timing and milestones;
- (b) A breakdown of costs incurred during the year covered by the applicable annual report with respect to operations and maintenance (O&M) including any variance from annual O&M budgets and a summary of any updates of O&M budgets;
- (c) A summary of any staffing, training or labour management issues;
- (d) A list of changes to key personnel and the qualifications of new key personnel, if any;
- (e) Commentary on parts inventory and redundancy;
- (f) A review of construction contractors' support and the ongoing management of post-completion technical risks;
- (g) Ongoing compliance with major permits; and
- (h) A review of the state of repair of key equipment and facilities.

3. DATA SOURCES

- [1] Maritime Link Q4 2018 Operations and Maintenance Report, EMERA Doc. No. D-000ED-0-950-05-041 dated 02/04/2019
- [2] Maritime Link Operations Annual Maintenance Plan – 2018, EMERA Doc. No. D-000OP-0-950-03-016 dated 01/09/2017
- [3] Maritime Link Operations Asset Integrity Management Plan, EMERA Doc. No. D-000OP-0-950-02-001 dated 01/09/2017
- [4] IE Report on Site Visit to NL site titled 'LCP-ML Project Site visit Report October 11 to 13, 2018' dated October 25, 2018
- [5] IE Reports on Meetings in Halifax, NS on 2018- 02-01 and 2018-05-30 & 31
- [6] O&M Update Teleconferences on 2018-01-09, 2018-02-6, 2018-02-12, 2018-03-19, 2018-03-25, 2018-05-02, 2018-12-11

- [7] Schedule “J” 2018 Operating Report to TD Bank dated April 30, 2019
- [8] 190510 BBK_CR Master Punch List Tracker (Bottom Brook and Cape Ray)
- [9] 190510 WB_POA Master Punch List Tracker (Woodbine and Point Aconi)
- [10] IE Site Visit May 8 & 9, 2019 Maritime Link Operations presentation
- [11] Maritime Link Operations HVDC Maintenance Plan, Doc. No: D-000OP-0-950-03-020

4. O&M DOCUMENTS AND INITIATIVES

4.1 EMERA 2018 O&M REPORT (ref. [1])

4.1.1 Introduction

The Maritime Link is owned and operated by NSP Maritime Link Inc. (NSPML), a wholly owned subsidiary of EMERA Newfoundland & Labrador Holdings Incorporated.

Commercial operation of the Maritime Link commenced on January 15, 2018. Project closeout activities, resource development and competency training for Operations staff also took place in 2018.

4.1.2 Safety

There were no reportable injuries during the Maritime Link’s first year of operations, including no lost time injuries for the contractors. Two first aids occurred during 2018 in Q4. NSPML met or exceeded the 2018 targets in 23 of 24 2018 Safety Commitment, Compliance and Audit Plan metrics, and All Balanced Score Card (BSC). With the 2018 transition from Construction to Operations, the safety of every person working at NSPML sites has remained the absolute priority.

Ongoing safety activities are:

- Focus on diligent risk assessment including management risk reviews for high risk activities as well as a monthly Field Level Risk Review (FLRA) component of the safety meeting agendas.
- Supervisor and Peer-to-peer observations with the HVDC Electrical Technologists to maintain an appropriate focus on safety.

4.1.3 Environment

No major environmental events occurred in 2018 Operations. NSPML experienced one single moderate environmental incident which occurred when approximately 150L of mineral oil was released at the Woodbine converter station when a forklift accidentally punctured a storage barrel. The site was remediated, and any remaining non-critical oil storage was removed from all sites.

Phase Two of the crab and lobster Environmental Effects Monitoring program, a requirement of the Project’s Environmental Assessment (EA), was initiated in 2018; Crab and Lobster monitoring arrays were put in place for the winter season.

An environmental monitoring program to characterize sea ice in the nearshore region of Point Aconi was launched in 2018, including the deployment of Upward Looking Sonar/Acoustic Doppler Current Profiler (ULS/ADCP) for the 2018/19 winter season.

4.1.4 Performance

Availability and Reliability (ref. [10])

NSPML monitors and reports on Maritime Link availability/reliability metrics in accordance with CIGRE TB 590-2014. The Maritime Link's 2018 Availability as of the end of Q4 2018 was 82.21% including planned and unplanned outages that occurred throughout the year. The Maritime Link is a new asset and has thus experienced outage levels typical for a post-commissioning period during the first year of operation. The largest of these outages included wall bushing installation issues, neutral RI capacitor thermal design and some control and protection issues that were corrected after being identified. These items are no longer a reliability concern. Maritime Link availability performance guarantee period included in NSPML's contract with ABB commences in 2019.

CIGRE TB590 Dashboard:

	Q1	Q2	Q3	Q4
%EU	6.97	9.63	15.25	15.79
%FEU	6.72	6.9	12.51	13.65
%SEU	0.25	2.74	2.74	4.14
%EA	93.03	90.36	84.75	82.21
BFO	0	0	2	2

Legend:

- EU Equipment Unavailability
- FEU Forced Equipment Unavailability
- SEU Scheduled Equipment Unavailability
- EA Equipment Availability
- BFO Bipole Forced Outage

Event Reporting

Root Cause Analysis (RCA) is generally required to determine unique forced outages causes and types. For example, RCA of the capacitor failures which occurred in Q3 2018 indicated that the thermal losses of the installed capacitors were higher than that of the design due to the methods and materials used in the manufacturing of these capacitor units. Replacement capacitors are expected to be shipped to the converter stations in Q2, 2019.

Losses

Maritime Link Loss Factor calculation is based on revenue meter data analysis. For 2018 the average posted Maritime Link Loss Factor is 4.72%; recognizing that the ML was operated below its 500MW rating, this is consistent with the guaranteed losses.

4.1.5 Maintenance Highlights

In order to ensure that warranty protections are maintained the maintenance activities in the current period will comply with the Original Equipment Manufacturer (OEM) recommendations. During 2018, a total of 1,919 Preventative Maintenance Work Orders (PM) were scheduled (excluding Transmission and Marine work scopes). During this period all preventative work orders that were scheduled were completed as planned; it is noted that 2 items were re-scheduled as their timing was not critical and the work has since been completed.

HVDC Converter Stations

The “trial operation” period as defined by the Maritime Link Project agreement with ABB was completed mid-year, following which ABB’s Long-Term Service Agreement (LTSA) went fully into effect. The 2018 Annual Maintenance Plan was successfully completed by on-site and ABB support resources throughout the year. Project punch list items were also completed during this period, mainly at the Woodbine Converter Station as well as in the Woodbine AC Substation. Cyber security patching of the pole and bipole control and protection computers mandated by North American Electric Reliability Corporation ‘critical infrastructure protection’ (NERC CIP) was also completed.

HVAC Substations

NSPML liaised with both utilities, NSPI and NLH, to complete the required AC substation maintenance.

Transmission

NSPML initiated a planned inspection program for the Maritime Link overhead transmission lines with a 100% ground survey completed during the spring and summer of 2018. Inspections uncovered no significant reliability issues. Corrective maintenance items identified in the 2018 inspection program were related to failed grounding bond jumpers on the Optical Ground Wire and Overhead Shield Wire as well as in a few instances to a vibration damper related conductor damage. Corrective work was either completed in 2018 or scheduled for completion in early 2019.

Submarine and Land Cables

Both cables were fully surveyed between September and November 2018. Key outcomes included:

- Minor remediation activity consisted of removing an out of service telegraph cable and partially buried crab trap.
- Two findings required further investigation following the survey. Occurrences of seabed scouring/ mobility was observed over 2km section of each cable near Cape Ray, NL and the survey uncovered one occurrence of cable contact from dragged object. The cable manufacturer, Nexans, has assessed that damage as superficial in nature with only minor abrasion evident on the outer polyester yarn.
- Other marine related activities initiated in 2018 include:
 - Initiation of a real time vessel monitoring system using Automatic Identification System (AIS) tracking.
 - A fisheries assessment was initiated to update operational understanding of any emerging or changing fishing related risks.
 - Ice monitoring equipment was deployed near the Point Aconi shore for purpose of collecting data required to assist with long term operational understanding of local ice conditions.

Warranty and Corrective Work

Other than as previously described, there were no major insurance claims or non-warranty equipment replacements during the quarter associated with Maritime Link Operations activities or costs. Software punch list items were completed. Retrofits were carried out on 67 disconnect switches to improve mechanical bracing. No outages were re-

quired. Bulk of the ABB documentation has been completed with as-build drawing delivery scheduled for Q3.

Spare Parts

Materials have been moved from offsite temporary locations to the new Spares Buildings. The reconciliation of ABB spares with contractual and operational requirements is ongoing as part of contract closeout.

4.2 EMERA ANNUAL MAINTENANCE PLAN (REF. [2])

The plan appears to contain all the necessary elements required to carry out annual equipment maintenance in accordance with good utility practice. O&M Manuals will be used, with ABB's assistance, to build EMERA's maintenance procedures. CAMS, EMERA's scheduling and tracking computerized system, was under development. To date, the IE has not assessed in detail the maintenance scheduling methods or the equipment inventory data base.

AC substation maintenance programs will be carried out in accordance with the OEM warranty and good utility practice. This work will be carried out by each utility (NLH and NSPI) on a contract basis; agreements are being finalized at this time.

4.3 EMERA ASSET INTEGRITY PLAN (REF. [3])

The plan appears to contain all the necessary elements required to carry out annual equipment maintenance in accordance with good utility practice.

Synopsis of the Plan:

LTAMP - Maritime Link Long Term Asset Management Plan is an umbrella structure for guidance and governance. It is not a maintenance management tool that defines the procedures and periodicity of preventive maintenance (see work orders). Key components are:

- (i) Asset Integrity Plan [3].
- (ii) Environmental Management Plan (not reviewed by IE).
- (iii) Safety Management Plan (not reviewed by IE).
- (iv) Operations Manual (not reviewed by IE).

Other supporting documents under review and development as part of the LTAMP address corporate services and financial management, quality management, regulatory, compliance, human resources and other management matters.

CAMS - Computerized Asset Management System is a scheduling and tracking tool for planned and unplanned maintenance. It is also ML asset register, i.e. equipment inventory data base.

Work Orders - Contain detailed description of the work to be carried out. W.O.s will also collect data on work performed.

ABB/EMERA SLA – 5 year Service Level Agreement has been executed. It includes 3 years on-site technical support with the option for annual extensions.

Routine Inspection Data - Directly inputted to CAMS.

HVDC - Subcontracted to ABB; work is to be done according to OEM recommendations during warranty period.

Grounding Stations - Inspections only.

AC Substations - NLH and NSPI Utilities will maintain and ML will obtain records as necessary.

Submarine and Land Cable - Maintenance is defined in NEXANS document (M-20000-1-100-09-001). Surveys and inspections were planned and carried out.

OH Transmission and Grounding Lines - Line inspections, vegetation control and ROW maintenance were carried out as planned. All structures were inspected in 2018 as planned. Torqueing all bolts on the lattice towers and climbing inspections are planned for 2019. 10 year inspection plan is also developed based on the location of each segment of the transmission lines. A vegetation Management Program including cutting and herbicide spray treatment is also developed.

5. SITE INSPECTIONS AND MEETINGS (REF'S [4], [5] & [6])

IE visited NL sites and published formal site visit reports. In addition, IE and Emera held two Project and O&M update meetings in Halifax, NS. Seven teleconferences took place to discuss equipment reliability, availability and resolution of any deficiencies.

5.1 KEY FINDINGS

- NL site inspection confirmed that; Indian Head Grounding, Cape Ray Landfall and Transition Compound sites, Bottom Brook AC Substation and Converter Station have been fully commissioned.
- Transmission line remediation is being monitored – a small area near SW brook is planned to be rerouted.
- Several Optical Ground Wire (OPGW) tabs experienced failures. EMERA is exploring several alternative engineering solutions and root cause analysis.
- Several minor problems including missing signage, pole caps, etc. have been identified with NL grounding line.

5.2 WRAP - UP ACTIVITIES

- Final documentation handover is in progress.
- Spares sign-off is close to completion, with a few items still to be delivered by ABB. All spares received have been catalogued in Emera spares warehousing.
- Final radio frequency interference (RFI) testing is planned at full load of 500MW.
- Black- start capability has been verified per contract.
- Short Circuit Studies are ongoing.
- Staged short circuit tests were cancelled following evaluation by ABB and EMERA of satisfactory response to 3 phase AC faults.
- Site security and video monitoring contractual process is in progress.
- Cyber security requirements for NS Power are being assessed on an ongoing basis. NS Power requirements are as directed by the UARB.
- IE provided EMERA with a broad Operation and Maintenance guide (white paper on good utility practices in North America). EMERA has provided comments for the IE's consideration.
- All punch list items for Bottom Brook, Cape Ray, Woodbine and Point Aconi have been closed (ref's [8] and [9]).

6. CONCLUDING REMARKS

6.1 MAINTENANCE PLANS

Suitable maintenance plans are in place or under development (ref. [11]). When completed, those plans will consist of an umbrella long term asset management plan as well as the equipment inventory, maintenance procedure documentation and work order systems. Such an approach is consistent with good utility practice.

6.2 ROUTINE MAINTENANCE ACTIVITIES

For the time being the scheduled maintenance is carried out according to Original Equipment Manufacturer (O&M) manuals. Service Level Agreements are in place or are being finalized. This approach is deemed to be the most appropriate during the warranty period and it is consistent with good utility practice.

6.3 UNSCHEDULED MAINTENANCE AND RESPONSE TO FORCED OUTAGES

Response to deficiencies and equipment failures has been timely and appropriate. Engineering solutions have/are being explored to find optimal solutions to hardware problems. Majority of the forced outages have been attributed to bushing failures that are being addressed by ABB. Failed capacitors caused two bi-pole outages.

6.4 MAINTENANCE BUDGET (ref. [7]):

Breakdown in \$M	Operating Budget Oct. 2017	Cost incurred to Dec.31, 2018	Commentary
Labor, Admin. and Other	2.6	3.7	Some items ended up costing less than forecasted.
Converters and Stn's Operations	4	2.4	Reduced ABB costs due to extension of Trial operations to Q3.
Marine Surveillance	2	2.5	More detailed survey was required due to remediation work
Vegetation Management	0.1	0	No activities.
Insurance	4.5	1.8	Costs were apportioned between capital and Operations.
Independent Engineer	0.1	0.2	Costs reflect new contract negotiated mid-year.
Environmental Assessment	0.8	0.4	Costs were re-forecasted in Q1. Objectives were completed.
Subtotal	13.8	11.1	
Contingency	0.4	n/a	
Total O&M Budget	14.2	11.1	

Budget and maintenance activities objects appear to have been achieved in 2018.

6.5 SUMMARY OF STAFFING, TRAINING OR LABOUR MANAGEMENT ISSUES

There are 18 full time employees with 2 additional staff being recruited. No management or labor issues were reported in 2018. Training has been completed by Q3.

6.6 PARTS INVENTORY:

Spare parts have now been stored in permanent facility. Contractual reconciliation with ABB is taking place as a part of Project close-out activities.

6.7 CONSTRUCTION CONTRACTORS' SUPPORT AND MANAGEMENT OF POST-COMPLETION TECHNICAL RISKS

AC Substations - NLH and NSPI Utilities will jointly maintain the power apparatus and Protections and Control equipment.

HVDC - Maintenance is subcontracted to ABB and will be carried out within the framework of 5 year SLA. ABB staff will provide on-site technical assistance for at least three (3) years.

Submarine Cables - EMERA is preparing cable repair plans. In the event of a repair, NEXANS would be contracted to participate in submarine cable repairs. In case NEXANS is unable to participate in any cable repair within two (2) months, the splicing instructions are held in escrow and will be available to 3rd party contractor.

Communications Channels - Since those were provided by different vendors there are overlapping responsibilities for the maintenance and technical support.

Transmission Inspections and Repairs - There were multiple inspection findings last year such as shield wire jumper damage, clamp damage and dampers issues/damage. The following repairs were completed in 2018:

- 96 OPGW (Optical Ground Wire) Braided wire bonds were installed
- 218 OHSW (Overhead Shield Wire) bonds were replaced

This summer 2019 inspection would most likely identify more related damages that will be addressed in 2019/2020.

6.8 PROJECT CLOSE-OUT ACTIVITIES

HVDC Converter Stations and HVAC systems (ABB) - Trial operation is complete. Substantial Completion Certificate was issued by ABB on January 15, 2018 and fully contractually accepted by NSPML on Feb 7, 2018. There are clean up items for ABB's Final Completion and also some remaining tests at full power. Those are not expected to impact on the link reliability or performance. Punch lists items have been closed (ref.'s [8] and [9]).

Submarine Cable (Nexans) - Final Completion certificate was issued on Oct 30, 2017.

HVDC Transmission NS (ERJV-EUS) – Scheduled Completion Certificate was issued. Punch lists items have been closed.

HVDC Transmission NL (Rokstad) – Mechanical Completion Certificate was issued. Punch lists items have been closed.

HVAC Transmission in NL and Grounding Lines at NL and NS (POWERTEL) - Final Completion Certificate was issued in April 2019.

6.9 ML PERFORMANCE

The Maritime Link's 2018 Availability as of the end of Q4 2018 was 82.21% including planned and unplanned outages that occurred throughout the year. Maritime Link availability performance guarantee period included in NSPML's contract with ABB commences in 2019.

For 2018 the average posted Maritime Link Loss Factor is 4.72%. This is consistent with the losses guaranteed recognizing that power flows in 2018 were lower than the Maritime Link's 500MW rating.