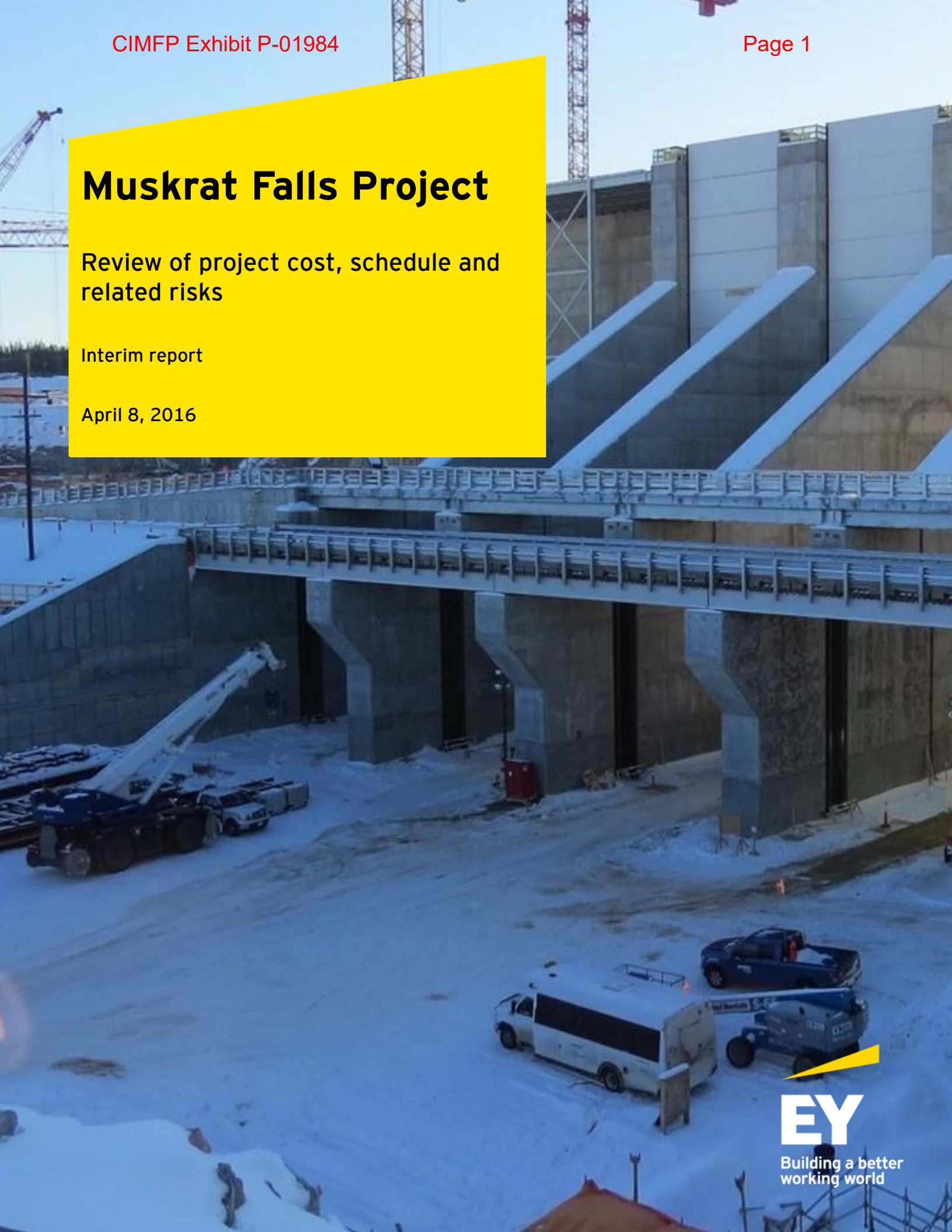
Muskrat Falls Project

Review of project cost, schedule and related risks

Interim report

April 8, 2016



EY
Building a better working world

Building a better working world

Dieppe
11 Englehart Street
Dieppe, NB E1A 7Y7
Tel: +1 506 853 3097
Fax: +1 506 859 7190

Fredericton
527 Queen Street
Suite 110
Fredericton, NB E3B 3T2
Tel: +1 506 455 8181
Fax: +1 506 455 8141

Halifax
RBC Waterside Centre
1871 Hollis Street
Suite 500
Halifax, NS B3J 0C3
Tel: +1 902 420 1080
Fax: +1 902 420 0503

Saint John
Red Rose Tea Building
5th floor
12 Smythe Street
Saint John, NB E2L 5G5
Tel: +1 506 634 7000
Fax: +1 506 634 2129

St. John's
Fortis Place
5 Springdale Street
Suite 800
St. John's, NL A1E 0E4
Tel: +1 709 726 2840
Fax: +1 709 726 0345

Ernst & Young LLP
Atlantic Canada
ey.com

Julia Mullaley
Clerk of the Executive Council & Secretary to Cabinet
Government of Newfoundland and Labrador
P.O. Box 8700
St. John's NL A1B 4J6

April 8, 2016

Muskrat Falls Project review of project cost, schedule and related risks

Ms. Mullaley,

EY has completed an interim report as part of the review of the Muskrat Falls Project's cost, schedule and related risks (the "Engagement"). Our Engagement is being performed in accordance with the statement of work dated 14 January 2016 between EY and Her Majesty in Right of Newfoundland and Labrador.

The objective of the Engagement is to assess the reasonableness of the Muskrat Falls Project's cost and schedule forecast and to identify opportunities to address any material/critical risks. As requested, this interim report will assess the reasonableness of the Project's most recent approved cost and schedule forecast, with a final report to be provided after Nalcor Energy Ltd. ("Nalcor") completes its ongoing reforecasting process. This interim report:

- informs the Provincial Government on current material risks and issues not reflected in the September 2015 forecast;
- provides recommendations that Nalcor should consider as it completes its risk assessment and re-baselining activities; and
- informs the EY final review, enabling it to be completed in a timely fashion.

The field work for this interim report was completed in January and February 2016 and consisted of reviewing project data and documentation, as well as enquiries and discussions with senior management and representatives of Nalcor, the Independent Engineer and the Provincial Government. The services provided by EY in this report are advisory in nature.

EY has not developed its own cost, schedule and risk forecast but instead assessed the reasonableness of that prepared by Nalcor.

We would like to express our appreciation for the cooperation and assistance provided to us by Nalcor, the Independent Engineer and the Provincial Government.

Yours sincerely,

Ernst & Young LLP

Ernst & Young LLP

Building a better working world

Disclaimer

This report is intended solely for the information and use of Her Majesty in Right of Newfoundland and Labrador as represented by the Executive Council and is not intended to be and should not be used by any other parties. In preparing this report, EY relied on information provided by its client and by Nalcor. EY has not audited, reviewed or otherwise attempted to verify the accuracy or completeness of such information. This report has not considered issues relevant to third parties and is subject to certain limitations. We shall have no responsibility whatsoever to any third party that obtains a copy of this report. Any use such a third party may choose to make of this report is entirely at its own risk. We disclaim all responsibility for loss or damage, if any, suffered by any third party as a result of reliance on, decisions made or actions taken based on this report.

Table of contents

1 Executive summary

1.1 The Government of Newfoundland and Labrador ("the Provincial Government") engaged EY to assess the reasonableness of the Muskrat Falls Project's ("the Project") cost and schedule forecast and to identify opportunities to address any material/critical risks.

1.2 The most recent cost forecast for the Project was set in September 2015. At this time the Project schedule was not updated but was described as "under review". This cost and schedule position ("the September 2015 Forecast") forms the basis for the EY review to date ("the Review") and is summarized in the table below:

Total forecast cost, including contingency	$7.653b
Ready for sustainable power transfer Labrador to Newfoundland	November 2017
First power from Muskrat Falls	December 2017[1]

1.3 The overall conclusion of the Review is that the September 2015 Forecast is not reasonable. The principal reasons for this conclusion are as follows:

- the Muskrat Falls Generation ("MFG") contract for civil construction is significantly behind schedule in the Powerhouse and Intake areas. The direct and indirect consequences of this delay are expected to have material impacts on cost and schedule that are not reflected in the September 2015 Forecast;
- the current contingency level representing 4.7% of the cost to complete[2], or 2.3% of total cost, is low for the current stage of completion of the Project. More than 50% of work on the Project has now been completed, and just over 40% of the construction work has been finished. The majority of design, engineering and procurement work is complete; however, there is a significant amount of physical construction work remaining that will be followed by commissioning and integration. This construction work is challenging in terms of its scale, time and geography and as such is exposed to a wide range of execution risks; and
- there is a risk of multiple-month delay to completion of the HVdc transmission line contract as a result of a number of delivery challenges that have been experienced to

[1] At the time of the September 2015 Forecast, Nalcor communicated that first power in 2017 was not achievable
[2] As at the 31 December 2015 reporting period compared to the September 2015 Forecast

date and the risks associated with the remaining scope, where full mitigation may not be possible.

1.4 Nalcor Energy Ltd. ("Nalcor") has identified and documented contract risks including those above. However, the potential impacts of these risks on cost and schedule are not adequately reflected in the September 2015 Forecast. Nalcor is currently undertaking a risk assessment to evaluate the impacts of all Project risks, including the above, and will use the results of this process to prepare a revised forecast.

1.5 We have the following observations relevant to the conclusion in 1.3 above:

- risks defined by Nalcor as strategic are not allowed for in the financial forecast;
- the potential cost and schedule impacts of all individual risks are recorded in the Project's risk register but are not systematically reflected in the overall reported forecasts for cost and schedule; and
- some anticipated material cost variances have only been reflected in the forecast cost when they are contractually committed.

1.6 From the above conclusion and observations, EY recommends that:

- the Project should revise its planning and forecasting processes to explicitly include the regular reporting of a fully risk-adjusted final forecast of cost and schedule;
- the Project contingency should make appropriate allowances for all risks, including strategic, at a confidence level reflecting stakeholders' required cost certainty. EY recommends that consideration be given to the use of a more conservative confidence level for setting Project contingency, based on a thorough risk assessment;
- the sufficiency of the Project contingency should be reviewed quarterly to assess whether it appropriately covers all risks, taking account of the effectiveness of mitigation plans and the likelihood of risks crystallizing; and
- there should be separation of the Project contingency into an amount to be managed by the Project team and an amount to be managed at a higher level of governance.

1.7 The scope of EY's review did not include a formal review of the Project governance[3] arrangements and we have not met with the members of the Board of Directors of Nalcor or its subsidiaries in this regard. However, in the course of conducting the Review, EY has observed that certain elements of governance and reporting arrangements have not been effective in respect of the Project's cost and schedule forecasts to date. There is a need to

[3] Project governance refers to the overall framework within which decisions are made. This covers four elements: structure, people, information and assurance, which combine to provide the necessary experience, diversity, independence, challenge and oversight to project reporting, decision making, planning and forecasting.

strengthen Project governance and reporting to provide more effective oversight and constructive challenge to Project performance and execution, key decisions and forecasting.

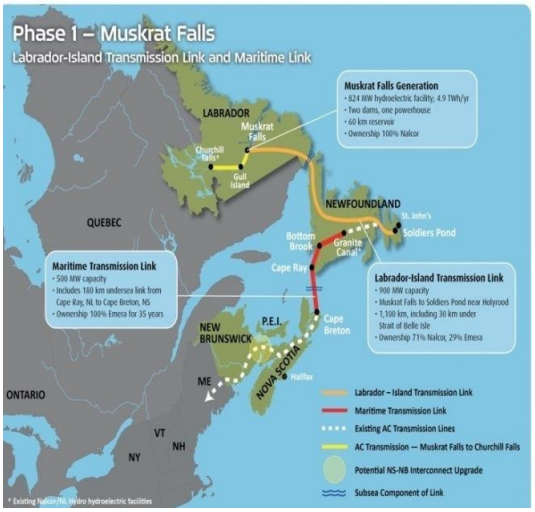
1.8 From these further observations, EY recommends that:

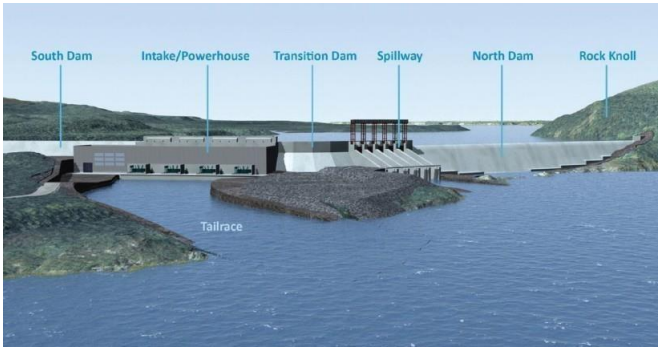
- Project governance and independent oversight should be re-evaluated by the Provincial Government and strengthened at the Project, Nalcor Board and Provincial Government levels; and
- Project reporting should be enhanced to support senior management focus on key risks and issues, to communicate more clearly how key risks are reflected in the forecast and to enable more effective Provincial Government oversight.

2 Introduction

2.1 The Project is a multi-billion dollar program involving design, procurement, manufacture and construction over a period of more than five years, across multiple continents and with construction across multiple remote sites in Newfoundland and Labrador. There are three main sub-projects:

- Labrador Transmission Assets: includes a 315-kV HVac transmission interconnection from Muskrat Falls to Churchill Falls and HVac switchyards;
- Labrador Island Transmission Link: includes a ±350-kV HVdc transmission connection from Muskrat Falls to Soldiers Pond (over 1,050 km of transmission line), HVac to HVdc converter stations, shore electrodes, and 30 km of 350-kV HVdc cable crossing at the Strait of Belle Isle; and
- Muskrat Falls Generation Facility: includes 4 x 206-MW (totalling 824-MW) turbine/generators, dams/spillways, river diversion, North Spur stabilization, reservoir, access road and buildings.

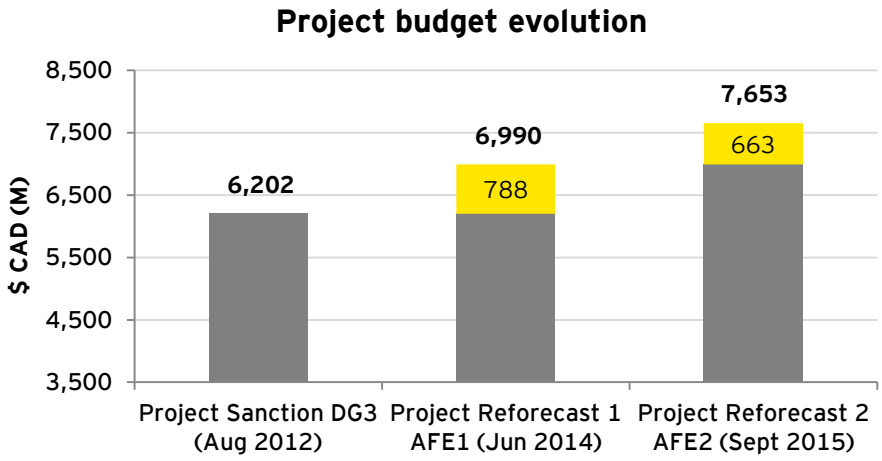




2.2 The Project is being delivered through multiple separate contracts. Nalcor performs its role through an integrated project team of approximately 400 people. SNC Lavalin was originally engaged as the Engineering, Procurement & Construction Management contractor. From November 2013, Nalcor moved to an integrated management model utilizing Nalcor staff, SNC Lavalin resources and other third-party consultants.

2.3 The Project deploys proven technology, but the delivery is of a significant scale and subject to challenging terrain and weather conditions. For example, the HVdc transmission line, whilst using standard technology, is one of the longest such constructions in North America, with a route that includes hundreds of kilometres of remote terrain with no existing access and will be exposed to extreme weather conditions during construction and operation.

2.4 More than 50% of work on the Project has now been completed, and just over 40% of the construction work has been finished. The Project has been through two major cost reforecasting processes since sanction, shown in the chart below:



2.5 The main drivers reported by Nalcor for these cost movements were:

- market conditions and market pressures;
- reliability improvements and design enhancements; and
- contractor performance and project management execution.

2.6 The key target milestone dates in the September 2015 Forecast have not changed since the Project was sanctioned. However, Nalcor also stated as part of the September 2015 reforecast that the target dates related to the Muskrat Falls Power Generation facility will not be met and are under review.

3 Objective and scope

3.1 The objective of the Review, as described in the statement of work, is to assess the reasonableness of the Project's[4] cost and schedule forecast and to identify opportunities to address any material/critical risks.

3.2 At the start of the Review, Nalcor informed EY that it was engaged in commercial discussions with the MFG civil works contractor and that EY would not receive forecast information related to this contract during January 2016.

3.3 During the Review, Nalcor advised EY that the commercial discussions in relation to the MFG civil works contract would not be completed within the time frame of the Review and that Nalcor would be engaging in risk assessment and re-baselining activities subsequent to the completion of those discussions.

3.4 As a result, this interim report will assess the reasonableness of the Project's most recent approved cost and schedule forecast – namely the September 2015 Forecast shown below:

Total forecast cost, including contingency	$7.653b
Ready for sustainable power transfer Labrador to Newfoundland	November 2017
First power from Muskrat Falls	December 2017

3.5 Many key risks and issues referenced in this interim report have already been identified and documented by Nalcor. Nalcor is currently undertaking a risk assessment to evaluate the impacts of all Project risks, including the above, and will use the results of this process to prepare a revised forecast. This interim report gives Nalcor the opportunity to reflect EY's conclusions and recommendations in its upcoming forecast process.

3.6 EY will assess the reasonableness of Nalcor's reforecast cost and schedule once it is completed and will update this report accordingly, drawing on the work already completed in preparing this interim report.

[4] Does not include the Maritime Link

4 Approach

4.1 The Review has been based on data and information provided by Nalcor. EY has not sought to independently verify this data. EY has had access to the Nalcor team; we have not had direct access to contractors. EY has not conducted any engineering review, physical inspection or validation of construction process. Primary sources of data have been:

- Nalcor and contractor monthly reports;
- management presentations and follow-up discussions;
- meeting with the Independent Engineer;
- specific data requests; and
- interviews with members of the Nalcor project team.

4.2 Due to the scale of the Project and the timeline and scope of this review, EY has focused on areas likely to be material to the overall cost and schedule of the Project. We have selected 10 major contracts based on the following criteria:

- total monetary value;
- spend to complete;
- potential to impact other contracts; and
- potential to impact critical path.

4.3 For each of these contracts, cost and schedule risk has first been considered at the individual contract level. Individual contract risks may be partially or wholly mitigated at the Project level through cost or schedule contingency. EY has assessed whether the contract risks are appropriately reflected in the Project's September 2015 Forecast.

5 Material cost and schedule risks

Context for risk assessment

5.1 Large projects such as the Muskrat Falls Project involve diverse and complex risks, which change through the phases of design, procurement and construction. Part of the role of the Nalcor project team is to identify, evaluate and, where possible, mitigate risks.

5.2 Nalcor invested heavily in upfront design and engineering to proactively manage risk in the early phases of the Project. This approach has resulted in a low degree of engineering change through the Project to date.

5.3 The scale, complexity and time frame of the remaining Project scope mean that significant risk still exists. Nalcor has processes in place to identify, evaluate and mitigate project risks.

Risks to cost and schedule

5.4 The Review has highlighted risks in each of the following areas that are relevant to the reasonableness of the September 2015 Forecast:

- MFG civil works contract;
- HVdc transmission line contract;
- HVdc converter stations contract; and
- contingency level.

These are explained in more detail below.

MFG civil works contract

5.5 The MFG civil works contract is the highest dollar value contract. This contract involves construction of a number of areas: Intake and Powerhouse, Spillway and Transition Dams. The deliverables on this contract are required to allow progress on other contracts, e.g. installation and commissioning of the turbines and generators, installation of spillway and intake gates and the balance of plant contract.

5.6 Contractor performance fell significantly behind plan at the start of the contract and the rate of concrete placement volume, whilst now much improved, has continued to be below original plan levels. As a result, the volume of concrete placed is below plan in all areas, most notably in the powerhouse and powerhouse intake areas. There have been a number of contributory factors identified by Nalcor, including but not limited to:

- slower than required contractor's mobilization and ramp up;
- inadequate planning and establishment of required infrastructure;
- lower than planned concrete placement rates;
- number of contractor's project manager replacements and contractor's project management personnel changes;
- quality of contractor's management resources for the first 15 months of the contract;
- overall contractor performance, management and supervision for the first 15 months of the contract; and
- a key feature of the contractor's execution plan was the contractor's Integrated Cover System (ICS), designed to enable winter working on the powerhouse. The ICS was not successfully delivered, which significantly impacted the ability to place concrete during the winter months. The ICS has now been removed.

5.7 Concrete placement rates improved significantly after Q1 2015, in part due to intensive contractor performance management by Nalcor. Progress on this contract is significantly behind the original contract schedule.

5.8 The contract structure was designed to realize possible savings in construction labour productivity and also to protect Nalcor from any labour cost overruns that might be experienced by the contractor. It was intended that this would be achieved by including in the contract a maximum value for labour that Nalcor would have to pay to the contractor. However, the payment mechanism is based on person-hours expended rather than m^3 of concrete poured. This mechanism did not capture the potential for poor contract management of labour and the consequent decoupling of labour paid for from work completed (measured by m^3 of concrete poured). As at December 2015, the proportion of contract value paid to the contractor is significantly greater than the proportion of the concrete that has been placed.

5.9 The impacts of these risks and issues to both cost and schedule were identified by Nalcor, but not fully reflected in the September 2015 Forecast. Nalcor indicated this was due to the ongoing discussions between Nalcor and the contractor.

5.10 The work to be performed under this contract is on the Project's critical path, so the known schedule delay will directly impact overall Project milestones. This delay will also have a

knock-on impact to Nalcor's Project costs and to costs of other impacted contracts. The scale of this aggregate cost impact is in excess of the Project contingency level.

HVdc transmission line contract

5.11 The HVdc transmission line contract is the second largest contract by dollar value and involves the construction of a 1,050 km HVdc transmission line from Muskrat Falls to Soldiers Pond near St. John's. This route crosses remote and challenging terrain, for example the Long Range Mountains. The same contractor is also nearing completion on the construction of the HVac transmission line connecting Muskrat Falls to Churchill Falls under a separate contract.

5.12 In the first nine months of the 32-month contract duration, actual progress has been only 50% of plan.

5.13 Recent contractor performance has improved, and potential mitigation for some of the schedule risk may be available by mobilizing additional skilled crews from the successful execution of the HVac contract. The physical distribution of the work also means that it is possible, at the contractor's own cost, to work on multiple work fronts to improve progress. The contractor is incentivized through the terms of the contract to minimize delay.

5.14 However, risks exist to future schedule performance, including continued below plan performance from the contractor, weather conditions and areas requiring a higher proportion of more complex foundation installations.

5.15 Performance to date and the ongoing risks described above create potential for a multiple-month delay to the contract schedule. This potential delay could be greater than the time contingency included in Nalcor's Project schedule and so presents a risk to overall Project milestones.

HVdc convertor stations contract

5.16 The HVdc convertors are situated at either end of the HVdc line and convert the AC current used in the existing distribution grid to the DC current used to transport power from Muskrat Falls to Soldiers Pond and back again to AC current. Nalcor and the contractor are currently forecasting delays to the mechanical completion of the convertor stations, with the Muskrat Falls delay being approximately two months. Mitigation plans are being implemented to maintain the forecast and recover this delay; however, the contractor would be required to more than double its rate of progress to date to maintain the forecast schedule.

5.17 Nalcor expects improved progress and the contractor is incentivized through the terms of the contract to minimize delay. Nevertheless, based on past performance and the proposed work

forecast for this contract, there is a risk of additional schedule delay, which would directly impact the Project milestones for the power transfer from Labrador to Newfoundland.

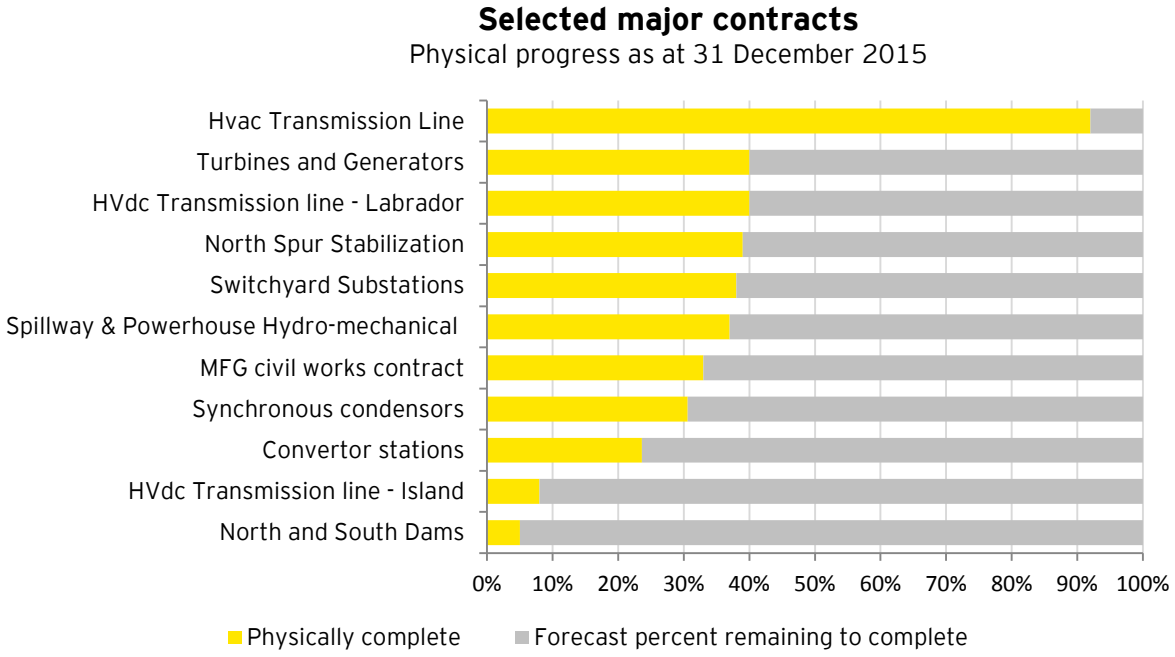
Contingency

5.18 The amount of the contingency remaining at 31 December 2015 was $173m, which represented 4.7% of the cost to complete, or 2.3% of total cost.

5.19 This contingency amount must cover any cost increases resulting from budget overruns or schedule delays. The extent of Project completion and the complexity of the remaining Project scope are relevant to the calculation of the appropriate level of contingency the Project should hold.

5.20 The Project is more than 50% complete overall, with just over 40% of construction now completed. Design and engineering are almost complete and procurement is over 90% complete.

5.21 Nevertheless, the scale, complexity and time frame of the remaining execution mean that there is potential for significant risk. This is illustrated by the scope of work to be completed on major contracts, as shown in the chart below[5]:



[5] HVdc transmission line contract has been separated into two scopes for the purposes of the chart

5.22 Commissioning and integration activities have not yet started. These are a frequent source of risk in major power projects. However, planning for these activities is underway.

5.23 Nalcor has identified and documented risks associated with all remaining scope, including commissioning and integration, and there is opportunity to mitigate some of these risks. In addition, the contract structures in place provide some protection for cost and schedule risk.

5.24 Nevertheless, EY has concluded that the current contingency level is low based on the remaining scope of work to complete and the degree of execution risk. Nalcor is currently undertaking a risk assessment that should be used to inform the amount of contingency required.

6 Other observations

Planning for strategic risks

6.1 The Project defines risks to be either tactical or strategic – the latter are those considered by Nalcor to be outside of the controllable scope of the Project team. A quantitative assessment of strategic risks was made at the time of the sanction process, but no explicit allowance was made in the form of a quantified reserve in the sanction budget.

6.2 The contingency in the September 2015 Forecast was only deemed to include the tactical risks, and there is no quantified reserve held elsewhere to allow for the strategic risks.

6.3 The following risks are classified by Nalcor as strategic:

- Schedule risks - relating to bad weather, to the volume of work required to deliver the powerhouse (particularly given the challenging performance assumptions for powerhouse concrete) and schedule challenges for certain sections of the transmission line;
- Performance risks – the risks of not being able to achieve the performance rates and productivity assumed in the schedule estimate and the challenges associated with being able to attract the quality of experienced front-line supervision required to manage performance; and
- Skilled labour risks – risks of budgeted labour rates being exceeded.

6.4 The crystallization of risks classified as strategic was the main driver for the cost increases seen to date on the Project. Risks that would be classified as strategic are expected to continue to impact the remaining scope of the Project.

Inclusion of risk quantification in the forecast

6.5 Nalcor estimates the potential cost and schedule impact of individual risks and records them in the Project risk register. The Project team develops and monitors risk mitigation plans.

6.6 Nalcor regularly evaluates potential cost and schedule impacts of these risks, but does not develop an aggregate position, compare it to contingency levels or integrate it into the Project forecast to provide a risk-adjusted forecast.

6.7 Nalcor also seeks to identify and manage specific material cost variances, but some potential variances are only reflected in the forecast when they are contractually committed or near to certain.

Project governance and reporting

6.8 The scope of EY's review did not include a formal review of the Project governance arrangements and we have not met with the members of the Board of Directors of Nalcor or its subsidiaries in this regard. However, in the course of conducting the Review, EY has observed that certain elements of governance and reporting arrangements have not been effective in respect of the Project's cost and schedule forecasts. There is a need to strengthen Project governance and reporting to provide more effective oversight and constructive challenge to Project performance and execution, key decisions and forecasting.

7 Recommendations

7.1 The recommendations arising from the Review are as follows:

- the Project should revise its planning and forecasting processes to explicitly include the regular reporting of a fully risk-adjusted final forecast of cost and schedule;
- the Project contingency should make appropriate allowances for all risks, including strategic, at a confidence level reflecting stakeholders' required cost certainty. EY recommends that consideration be given to the use of a more conservative confidence level for setting Project contingency, based on a thorough risk assessment;
- the sufficiency of the Project contingency should be reviewed quarterly to assess whether it appropriately covers all risks, taking account of the effectiveness of mitigation plans and the likelihood of risks crystallizing;
- there should be separation of the Project contingency into an amount to be managed by the Project team and an amount to be managed at a higher level of governance;
- Project governance and independent oversight should be re-evaluated by the Provincial Government and strengthened at the Project, Nalcor Board and Provincial Government levels; and
- Project reporting should be enhanced to support senior management focus on key risks and issues, to communicate more clearly how key risks are reflected in the forecast and to enable more effective Provincial Government oversight.

EY | Assurance | Tax | Transactions | Advisory

About EY

EY is a global leader in assurance, tax, transaction and advisory services. The insights and quality services we deliver help build trust and confidence in the capital markets and in economies the world over. We develop outstanding leaders who team to deliver on our promises to all of our stakeholders. In so doing, we play a critical role in building a better working world for our people, for our clients and for our communities.

EY refers to the global organization and may refer to one or more of the member firms of Ernst & Young Global Limited, each of which is a separate legal entity. Ernst & Young Global Limited, a UK company limited by guarantee, does not provide services to clients. For more information about our organization, please visit ey.com.

For more information, please visit ey.com/ca.

ey.com/ca