

**From:** pharrington@lowerchurchillproject.ca  
**To:** [emartin@nalcoreenergy.com](mailto:emartin@nalcoreenergy.com)  
**Subject:** Fw: Feedback  
**Date:** Monday, February 29, 2016 4:19:27 PM  
**Attachments:** [...png](#)  
[...png](#)  
[EY draft Report Comments\\_29\\_feb.docx](#)  
[Draft\\_ey\\_report\\_feedback.pdf](#)

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FYI

**Paul Harrington**

**Project Director**

**PROJECT DELIVERY TEAM**

**Lower Churchill Project**

t. 709 737-1907 c. 709 682-1460 f. 709 737-1985

e. [PHarrington@lowerchurchillproject.ca](mailto:PHarrington@lowerchurchillproject.ca)

w. [muskratfalls.nalcoreenergy.com](http://muskratfalls.nalcoreenergy.com)

You owe it to yourself, and your family, to make it home safely every day. What have you done today so that nobody gets hurt?

----- Forwarded by Paul Harrington/NLHydro on 02/29/2016 04:19 PM -----

From: Paul Harrington/NLHydro

To: Tim Calver <[tcalver@uk.ey.com](mailto:tcalver@uk.ey.com)>

Cc: Michael Kennedy <[Michael.Kennedy@ca.ey.com](mailto:Michael.Kennedy@ca.ey.com)>, "StevePellerin@lowerchurchillproject.ca" <[StevePellerin@lowerchurchillproject.ca](mailto:StevePellerin@lowerchurchillproject.ca)>

Date: 02/29/2016 04:16 PM

Subject: Feedback

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Tim

Please find attached a scanned copy of hand written comments to the PDF document plus a word document that consolidates our feedback to you/ I trust you find this helpful

Regards Paul



EY draft Report Comments\_29\_feb.docx



Draft ey report feedback.pdf

**Paul Harrington**

Project Director

**PROJECT DELIVERY TEAM**

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Tim Calver ---02/29/2016 01:49:51 PM---Paul, Can we make this a bit later please, say 10.30 as I won't get the chance the go though your co

From: Tim Calver <[tcalver@uk.ey.com](mailto:tcalver@uk.ey.com)>

To: "PHarrington@lowerchurchillproject.ca" <[PHarrington@lowerchurchillproject.ca](mailto:PHarrington@lowerchurchillproject.ca)>

Cc: Michael Kennedy <[Michael.Kennedy@ca.ey.com](mailto:Michael.Kennedy@ca.ey.com)>, "StevePellerin@lowerchurchillproject.ca" <[StevePellerin@lowerchurchillproject.ca](mailto:StevePellerin@lowerchurchillproject.ca)>

Date: 02/29/2016 01:49 PM

Subject: RE: Draft Interim report

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Paul,

Can we make this a bit later please, say 10.30 as I won't get the chance the go though your comments with Mike until the morning, as he flies in late tonight.

Thanks

Tim

---

**From:** Tim Calver  
**Sent:** Monday, February 29, 2016 2:22:40 PM  
**To:** PHarrington@lowerchurchillproject.ca  
**Cc:** Michael Kennedy; StevePellerin@lowerchurchillproject.ca  
**Subject:** RE: Draft Interim report

Paul,

This would work fine thanks.

We look forward to your written comments today and will meet tomorrow at 9.

We are just on our way now to your offices now to meet with Lance.

Kind regards

Tim

---

**From:** PHarrington@lowerchurchillproject.ca  
**Sent:** Monday, February 29, 2016 2:14:19 PM  
**To:** Tim Calver  
**Cc:** Michael Kennedy; StevePellerin@lowerchurchillproject.ca  
**Subject:** Re: Draft Interim report

Tim

How would you like to handle this - we could send you our feedback as requested today, which may make tomorrows meeting more efficient - pls let me know.

Shall we agree on a meeting time Tuesday of 0900 hrs at Torbay Rd?

Regards Paul

**Paul Harrington**

**Project Director**

**PROJECT DELIVERY TEAM**

**Lower Churchill Project**

t. 709 737-1907 c. 709 682-1460 f. 709 737-1985

e. [PHarrington@lowerchurchillproject.ca](mailto:PHarrington@lowerchurchillproject.ca)

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---

From: Tim Calver <tcalver@uk.ey.com>  
To: "PHarrington@lowerchurchillproject.ca" <PHarrington@lowerchurchillproject.ca>  
Cc: Michael Kennedy <Michael.Kennedy@ca.ey.com>  
Date: 02/28/2016 06:36 PM  
Subject: Draft Interim report

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Dear Paul,

Please find attached a draft copy of the EY interim report.

I can be at the Nalcor offices tomorrow, so am available to discuss this and receive your comments on any factual

errors or misstatements. As a reminder on timeline, we will issue the interim report as a draft to GNL and to Nalcor on Tuesday, in advance of our meeting with the Oversight Committee on Wednesday.

Kind regards

Tim

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## General Comments

As discussed previously, we had understood that there would be a paragraph or two to provide context regarding EY's observations regarding Safety Performance, Project Management organization, comprehensive processes and procedures etc. Basically, include a preamble that addresses all the good words that Michael Kennedy provided to the Oversight Committee (OC) and to our CEO.

We have an obligation to notify our contractors who are publically traded of any negative commentary that would be contained in publically released reports - so we would be greatly appreciative of seeing the report you send to OC that would become public so we can honour that commitment

We would also request an acknowledgement (if you agree with the sentiment) that Nalcor have been cooperative, collaborative and have provided data, reports, information as requested by EY.

## Specific Comments

Attached is a scanned version with handwritten notes. The following provides further explanation for these comments.

- Page 4 Executive Summary point 1.2 – In September 2015, there was a Project Cost Update – not a full schedule re-baseline. As you know, we cannot do that until we have a commercial settlement with the CH0007 contractor. Ed Martin said that a project schedule re-baseline would be when we have that settled.
- The table in point 1.2 – The Milestone 14 Nov 2017 should be "Ready for Power Transport Labrador to Newfoundland" and the 30th Dec 2017 (not 10<sup>th</sup> December 2017) Milestone "First Power from Muskrat Falls". This also applies to the table on Page 8.
- Page 4 Executive Summary point 1.3 – The statement that the September 2015 Forecast "is not reasonable", is not quite accurate. It was reasonable at the time it was prepared with the information available to Nalcor. Please consider the following.... "The overall conclusion of the Review is that the September 2015 Forecast is no longer considered reasonable because of events that have occurred since that date." Also, it would be helpful to further provide context to point 1.3 by including point 1.4 text into 1.3 as follows:
  - "The overall conclusion of the Review is that the September 2015 Forecast is no longer considered reasonable because of events that have occurred since that date. Nalcor has identified and documented cost and schedule risks since September 2015, including those noted below. Nalcor is currently undertaking a quantitative cost and schedule risk analysis to quantify the impact of these potential risks, the completion date of this full project cost and schedule risk analysis is contingent on the conclusion of the commercial discussions with a major project contractor".
- Page 4 Executive Summary point 1.3 bullet #1 – The responsibility to provide project schedule updates resides with Nalcor and GNL - to date Nalcor has stated publically that the First Power date of late 2017 is delayed and is under review- whilst internally we have a view we have not released any specific

number of months publically and therefore we respectfully request that EY revise the first sentence as follows:

- "The Muskrat Falls Generation ("MFG") civil construction of Powerhouse is currently estimated to be behind schedule and is under review."
- Page 4/5 Executive Summary point 1.3 bullets #3 and 4 – For context and greater clarity please consider the following:
  - It is mentioned in the body of the report that Nalcor has Liquidated damages in place for both the HVDC and Converter Contracts also that there is no apparent cost risk to these contracts- including those key points would help to balance the two bullet points.
- Page 5 Executive Summary point 1.5 bullet #1,2 and 3 – Since these bullets refer to the QRA we wish to clarify the following:
  - Bullet #1 – We will be including strategic risks in the QRA and subsequent cost and schedule forecast;
  - Bullet #2 – We will be including the potential impacts into the forecasted project cost and schedule; and
  - Bullet #3 – We only have one contract to award so the statement is no longer relevant.
- Page 6 Point 2.2 – Please consider removing the last sentence regarding SNC. In fact, the CM part of the original contract was an option so it is not strictly true to say we changed and this point is not relevant to the scope or the report at this time.
- Page 7 point 2.3 – Please be aware that the statement made is not correct. Hydro Quebec Phase 2 is longer than LIL as is Bipole 3. And Bipole 1 and 2 are approximately 900 and 950 kms in length respectively – similar in scope.
- Page 7 Point 2.4 – The Graph should not be labelled Project Baseline 1 and 2. More correctly, it should be labelled AFE Rev1 (June 2014) and AFE Rev2 (Sept 2015).
- Page 7 Point 2.5 – The official Nalcor categories are as follows- this wording was carefully chosen:
  - Market Conditions and Market Pressures
  - Reliability improvements and design enhancements
  - Contractor performance and Project Management execution
- Page 7 point 2.6 – We suggest wording to be "the key target milestone dates in the September 2015 cost update have not changed since the Project was sanctioned. However, Nalcor has also stated in the September 2015 cost update that the target dates related to the Muskrat Falls First Power will not be met and are under review.
- Page 8 Point 3.1 – Regarding the final sentence ....As you are aware, the CH0007 commercial discussions were interrupted and are now scheduled to restart in the coming days subject to GNL approval of a mandate. We understand the need for EY to make this point however perhaps it could be worded better.
- Page 8 point 3.2 – We do not understand the meaning of this point perhaps you can clarify?
- Page 8 point 3.3 – The baseline was not approved in September. The AFE Rev2 was approved and a cost update provided publically – the schedule was not updated other than to say there was a delay in 2018 for First Power and that Power from Labrador was still considered achievable in 2017.

- Page 8 Point 3.4 – It should be noted that the end March 2016 date is subject to conclusion of ongoing commercial discussions.
- Page 9 Point 4.1 – Please consider adding the following:
  - “The Independent Engineer” and “Westney Consulting” to the primary sources of data.
- Page 10 MFG Civil Works Contract – This whole section is a concern because of the impact these statements may have to the Astaldi financial situation and share price - considering this Report will be made public just before the Contractors year end results. However if this section has to stand we have the following feedback:
  - Point 5.5 – Please consider removing the \$1.1Bn contract value we try and avoid contract values publically;
  - Point 5.5 – Please consider wording of the last sentence “Delays to the Powerhouse and Intake scopes of work for this contract will impact other contractors, i.e. the intake gates, the turbine & generators and the Balance of plant Contractors”;
  - Point 5.6 – Please consider wording as follows “Contractor performance at the start of the contract was poor and the volume of concrete placed is behind plan, specifically in the powerhouse and powerhouse intakes. A number of contributory factors have been identified by Nalcor, including but not limited to:
    - Slower than required Contractors mobilization and ramp up;
    - Inadequate planning and establishment of required infrastructure;
    - Lower than planned concrete placement rates;
    - Number of Contractor Project Manager replacements and Contractor Project Management personnel changes;
    - Quality of Contractor Management resources;
    - Overall Contractor performance, management and supervision; and
    - A key feature of the Contractor Execution plan was the Contractor designed Integrated Cover System (ICS) which was intended to provide cover during winter with climate control, internal crane cover and concrete distribution systems. The ICS failed to be provided which significantly impacted the ability to place concrete during the winter months which in turn resulted in a requirement for increased labour during the summer months. The ICS has since been removed.
- Point 5.7 – Please consider the following wording:
  - “Concrete placement performance was improved significantly in 2015, primarily due to intensive contractor performance management by Nalcor. Progress on the Intake and Powerhouse is behind the original schedule and is under review by Nalcor.
- Point 5.8 – Given the political and commercial sensitivity of this, we respectfully request you consider if this adds anything to the report. It is not factually accurate as written and we can explain when we meet. Would the report be less insightful if this was removed?
- Point 5.9 – Please consider wording as follows:
  - “The impact of these issues and impact to both cost and schedule were not quantified at the September 2015 Cost Update as commercial discussions with the contractor were underway and commercial sensitivity dictated that these discussions needed to reach a conclusion first”.



- Point 5.10 – Please consider removing the word "known" and replace with "any".

## HVDC Transmission Line Contract

- Point 5.11 – Please consider removing the actual contract value. Also replace the word "inaccessible" with "challenging" and remove the wording "including the Long Range Mountains" because it is just one of the challenging areas.
- Point 5.12 – The last sentence is not correct...we suggest considering the following wording:
  - "Nalcor has advised this is largely due to Contractor Performance." We do not consider geotechnical conditions have caused progress issues to this contract and the quality problems are associated with the HVac line, not in any significant way on the HVdc line.
- Point 5.13 – Please consider the following wording of the second sentence:
  - "The physical distribution of the work also means that it is possible, at the Contractors own cost, to work on multiple work fronts to improve progress. The Contractor is incentivized to do so by the Contract provisions to achieve the contract completion date."
- Point 5.14 – The statements regarding the Long Range Mountains and the higher proportion of more complex foundations and rework are not correct and we suggest that they be removed.
- Point 5.15 - Please consider replacing the word "contingency" with "schedule float".

## Power Converter Stations Contract

- The correct wording should be "HVdc Converters Contract".
- Point 5.16 – We suggest replacing the word "power" with "HVdc" and replace the wording "more than triple their" with "significantly increase their".
- Point 5.17 – We suggest replacing the word "would" with "could" and replace "for the transmission line" with "for the LIL/LTA energization and power transfer".
- Point 5.20 – We suggest replacing the word "approximately" with "over" to be consistent with previous text.
- Point 5.22 – Consider adding the words "However planning for this activity is well advanced".

## Other Considerations

- Point 6.1 and 6.2 – Consider adding the word "Management" in front of "reserve" for clarity.
- Point 6.3 – The wording should be in the past tense as follows:
  - "At Sanction the following risks were classified as strategic". As mentioned earlier, our current QRA includes all risks be they strategic or tactical.
- Point 6.5 – We request you consider removing "where they deem necessary".
- Point 6.6 – We do not understand how you have drawn this conclusion - we should discuss when we meet.



CONSIDER ADDING A PARAGRAPH OR TWO REGARDING EY'S OBSERVATIONS WRT SAFETY PERFORMANCE, PROJECT MANAGEMENT ORGANIZATION, COMPREHENSIVE PROCESS & PROCEDURES ETC.

Muskrat Falls Project Page 4

ALSO AN ACKNOWLEDGEMENT BY EY THAT NALCOR HAVE BEEN COOPERATIVE, COLLABORATIVE & HAVE PROVIDED DATA, REPORTS, ACCESS TO THE SITE TO MTL CONSULTANTS.

## 1 Executive Summary

1.1 The Government of Newfoundland and Labrador ("the Client") engaged EY on 14th January 2016 to assess the reasonableness of the Muskrat Falls Project's<sup>1</sup> ("the Project") cost and schedule forecast, and identify opportunities to address any material/critical risks.

THE SEPTEMBER 2015 WAS A COST UPDATE NOT A REBASING

1.2 The current cost and schedule forecast for the Project was set by the September 2015 rebaseline process ("the September 2015 Forecast"), which forms the basis for the EY review ("the Review") and is summarized in the table below:

READY FOR POWER TRANSFER LABRADOR TO NEWFOUNDLAND

FIRST POWER FROM MUSKRAT FALLS.

Total forecast cost, including contingency	\$7.653bn
Transmission lines ready for sustainable power transfer	14 <sup>th</sup> November 2017
First power generation from Muskrat Falls hydroelectric power plant	30 <sup>th</sup> Dec 10 <sup>th</sup> December 2017

1.3 The overall conclusion of the Review is that the September 2015 Forecast is ~~not~~ <sup>no longer</sup> considered reasonable. The principal reasons for this conclusion are as follows;

~~because of events that have occurred since that date.~~

Nalcor has identified and documented cost & schedule risks since September 2015 including those noted below. Nalcor is currently undertaking a quantitative cost and schedule risk analysis to quantify the impact of these potential risks. The completion date of this full project cost & schedule risk analysis is contingent on the conclusion of commercial discussions with a major project contractor.

- ▶ The Muskrat Falls Generation ("MFG") contract for civil construction of the Intake and Powerhouse, Spillway and Transition Dams is currently estimated to be 12-18 months behind schedule. 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<sup>2</sup>, 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;
- ▶ there is a risk of delay to completion of the HVdc transmission line contract as a result of a number of delivery challenges that have been experienced to date and the risks associated with the remaining scope, where full mitigation may not be possible; and

<sup>1</sup> Does not include the Emera Maritime Link scope

<sup>2</sup> As at the 31<sup>st</sup> December Reporting period compared to the September 2015 forecast



- ▶ there are delays relating to the engineering and procurement of the electrical power convertor contract that have not been successfully mitigated. These delays have the potential to delay the overall delivery schedule.

*Both these contracts have contract provisions which incentivize the contractor to avoid contract delay or minimize.*

1.4 *→* Nalcor has identified and documented contract risks including those above. However, the impact 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 impact of these risks, and will be preparing a revised forecast by the end of March 2016.

1.5 We have the following observations relevant to the conclusion above;

*Nalcor is including all risks in the latest Q&A - so these bullets are no longer accurate.*

- ▶ risks defined by Nalcor as strategic and outside of the controllable scope of the project team 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. *→ ON 07, 1 CONTRACT REMAINS.*

1.6 In addition to the above, we observed a need to strengthen project governance to provide more effective oversight and constructive challenge to key decisions and planning.

1.7 The recommendations arising from the Review are as follows;

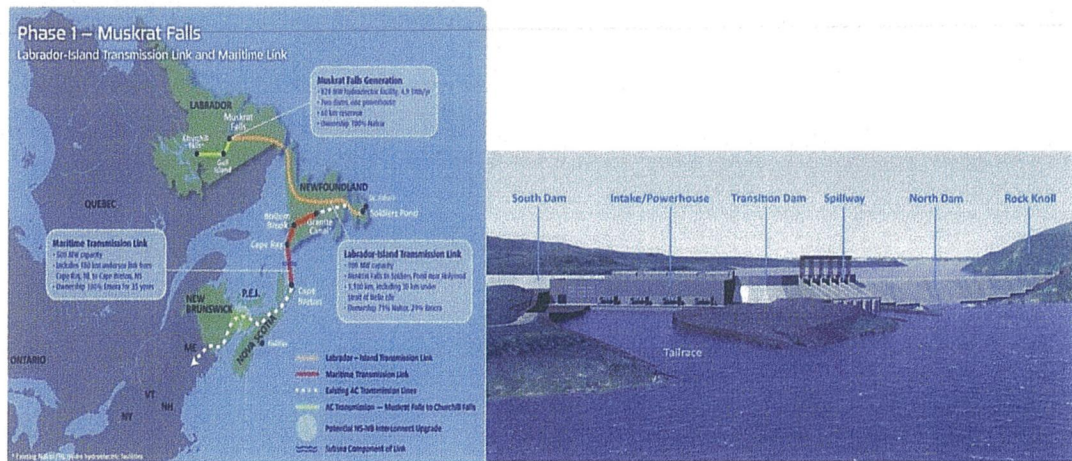
- ▶ the Project should revise its planning and forecasting processes to explicitly include the regular reporting of a fully risk adjusted final forecast of cost and schedule;
- ▶ the Project Contingency should make appropriate allowances for all risks (including strategic);
- ▶ the sufficiency of the 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 crystalizing;
- ▶ 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, financial control and independent oversight should be re-evaluated and strengthened at the Project, Nalcor Board and Oversight Committee levels; and
- ▶ Project reporting should be enhanced to enable more effective management and 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 315-kV HVac transmission interconnection from Muskrat Falls to Churchill Falls and HVac switchyards;
- ▶ Labrador Island Transmission Link: includes ±350-kV HVdc transmission connection from Muskrat Falls to Soldier’s 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 Strait of Belle Isle (SOBI); 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 consisting of Nalcor staff, SNC-Lavalin resources and other third party consultants. This is a change from the original approach where ~~SNC Lavalin were engaged as the Engineering, Procurement & Construction Management ("EPCM") contractor.~~

*See national doc in word document →*

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,

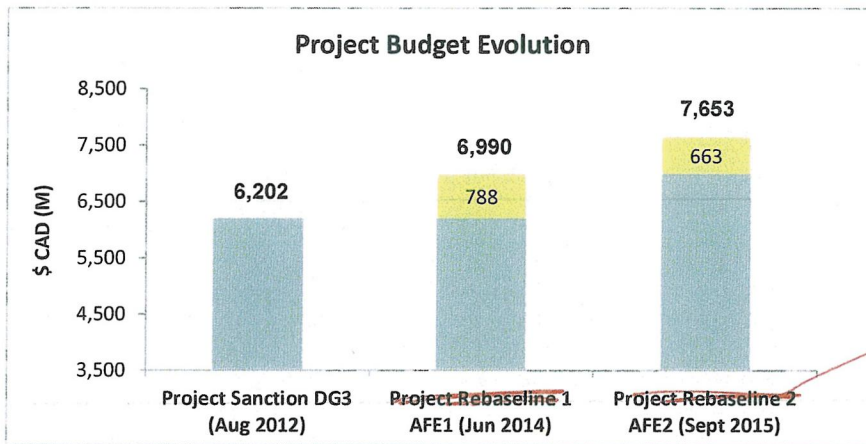


*The HQ Phase 2, Bipole 3 are longer - Bipole 1 & 2 are ~ 900 to 950 kms respectively*

Muskrat Falls Project  
Page 7

whilst using standard technology, is the longest such construction in North America, with a route that includes hundreds of kilometers of remote terrain with no existing access and will be exposed to extreme weather conditions in 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 pressures which were crystallized in contractor pricing;
- ▶ contractor performance, local labour productivity and the associated additional project management execution; and
- ▶ construction design change.

*Nalcor has also stated in the Sept 2015 cost update that...*

2.6 The key target milestone dates in the September 2015 Forecast have not changed since the Project was sanctioned. However the target dates related to the Muskrat Falls Power Generation facility will not be met and are under review.

*OFFICIAL NALCOR CATEGORIES ARE:*

- MARKET CONDITIONS & MARKET PRESSURES
- RELIABILITY IMPROVEMENTS & DESIGN ENHANCEMENTS
- CONTRACTOR PERFORMANCE & PROJECT MANAGEMENT EXECUTION.



### 3 Objective and Scope

*Better wording?*

3.1 The objective of the Review, as described in the Statement of Work ("SOW") dated January 14<sup>th</sup> 2016, is to assess the reasonableness of the Muskrat Falls Project's cost and schedule forecast, and identify opportunities to address any material/critical risks. At the start of the Review, it was understood that important elements of reforecasting for the Project were ongoing, notably in relation to the MFG civil works contract. It was expected that the reforecasting would be completed by early February 2016, allowing EY to assess the new baseline cost and schedule to be reported at the end of February/early March.

*Please clarify this*

3.2 During the Review, it became apparent that an additional set of reforecasting activities was ongoing within Nalcor (specifically in relation to the Labrador Island Transmission Link ("LITL")) and that the MFG civil work contract position would not be resolved within the originally intended timeframe. *?*

3.3 Therefore, this report will assess the reasonableness of the Project's current approved cost and schedule forecast - namely the ~~baseline~~ *cost update* approved in the September 2015 Forecast shown below:

*See earlier comment*

Total forecast cost, including contingency	\$7.653bn
Transmission lines ready for sustainable power transfer	14 <sup>th</sup> November 2017
First power generation from Muskrat Falls hydroelectric power plant	<del>10<sup>th</sup></del> <i>30<sup>th</sup></i> December 2017

3.4 It is acknowledged that many key risks and issues to the September 2015 Forecast have already been identified and documented by Nalcor. In response to these risks and issues Nalcor expects to complete their reforecasting process for the Project by the end of March 2016, *subject to conclusion of commercial discussions.*

3.5 EY will assess the reasonableness of Nalcor's reforecast cost and schedule once it is completed and update this report accordingly.



## 4 Approach

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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. Primary sources of data have been:

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

*Add*  
*• Independent Engineer*  
*• Westlake Consulting*

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 contract, project schedule and final forecast.



## 5 Material Cost & 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 delivered benefit, as the degree of engineering change observed through the Project to date has been low.
- 5.3 The scale, complexity and timeframe 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;
  - ▶ power converter stations contract; and
  - ▶ contingency level.

These are explained in more detailed below.

#### MFG civil works contract

- 5.5 The MFG civil works contract is the highest value contract at ~~\$1.1bn~~. 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.~~ *Delays to the Intakes and powerhouse will impact other contractors i.e. the intake gates, TG sets & Balance of Plant contract*
- 5.6 Contractor performance has been poor from the start of the contract and volume of assets constructed is behind plan. There have been a number of contributory factors;
  - ▶ slow contract mobilisation and ramp up;
  - ▶ lower than planned productivity (cubic metre of concrete placed per man-hour expended);
  - ▶ changes in contractor key personnel;

*Part A section Commercial contract*

*See suggested wording on next page*





5.6. Contractor performance at the start of the contract was poor and the volume of concrete placed is behind plan specified for the powerhouse and powerhouse intakes. A number of contributory factors have been identified by Nalcor, including but not limited to:

- Slower than planned contractor mobilization ramp up
- Inadequate planning and establishing reqd infrastructure
- Lower than planned concrete placement rates
- PM replaced several times and contractor PM personnel change
- Quality of contractor resources
- Overall contractor performance, management & supervision
- ICS ~~and~~ failure & impact on year round work.

Muskrat Falls Project Page 11

- ▶ the capacity of the initial site batch plant was insufficient to meet the requirements of the planned production; and
- ▶ the execution plan for the contract included construction of an Integrated Cover Solution, designed to enable winter working on the powerhouse. This was not completed, has now been dismantled without enabling winter work and all associated work has been unproductive.

5.7 Monthly performance improved significantly in the second half of 2015, in part due to intensive contractor performance management by Nalcor. Progress on this contract is 12-18 months behind the original contract schedule.

5.8 The contract structure was designed to protect Nalcor from any cost overruns that might be experienced by the contractor. This was achieved by including in the contract a maximum value for labour which Nalcor would have to pay to the contractor. However, the payment mechanism is based on man-hours expended rather than m<sup>3</sup> of concrete poured. This mechanism failed to capture the potential for poor labour productivity. Approximately one third of the concrete has been placed compared to the contractor receiving two thirds of the committed contract value as at December 2015.

Request removal for commercial reasons - does it add any value?

5.9 The impact of these issues to both cost and schedule have not been reflected in the September 2015 Forecast, pending the outcome of ongoing discussions between Nalcor and the contractor.

2-3 commercial discussions with the contractor were underway and commercial sensitivity considerations dictated these discussions needed to be concluded first.

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

expected to be. has the potential to exceed the Project contingency level.

5.11 The HVdc Transmission Line Contract is the second largest contract with a value of \$890M and involves the construction of a 1,050 km HVdc transmission line from Muskrat Falls to Soldier's Pond near St. John's. This route crosses remote and inaccessible terrain including 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.

challenging.

5.12 In the first nine months of the 32 month contract duration, actual progress has been only 50% of plan. Nalcor has advised that this is due to geotechnical conditions, contractor performance and quality problems.

5.13 Recent contractor performance is 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 extra ~~cost~~ <sup>own cost</sup> to the contractor to work on multiple work fronts to improve progress. ~~The contractor is incentivized to do so by the contract provisions to achieve the contract completion date.~~

5.14 However, risks exist to future schedule performance, including continued poor performance from the contractor, weather constraints of ~~Long Range Mountain construction (compounded by a higher proportion of more complex foundation installations in this area)~~ and ~~rework needed to rectify quality issues on tower foundations~~. There is also a dependency on weather conditions to enable access to particular areas of construction.

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 ~~contingency~~ <sup>schedule float</sup> included in Nalcor's Project schedule and so presents a risk to overall Project milestones.

<sup>HVdc</sup>  
Power Convertor Stations contract

5.16 The ~~power~~ <sup>HVdc</sup> 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 Soldier's 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 triple their~~ <sup>significantly increase their</sup> rate of progress to date to maintain the forecast schedule.

5.17 Nalcor expects improved progress and the contractor is incentivized through 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 ~~transmission line~~.

<sup>LTA/LIL energization and power transfer</sup>

Contingency Level

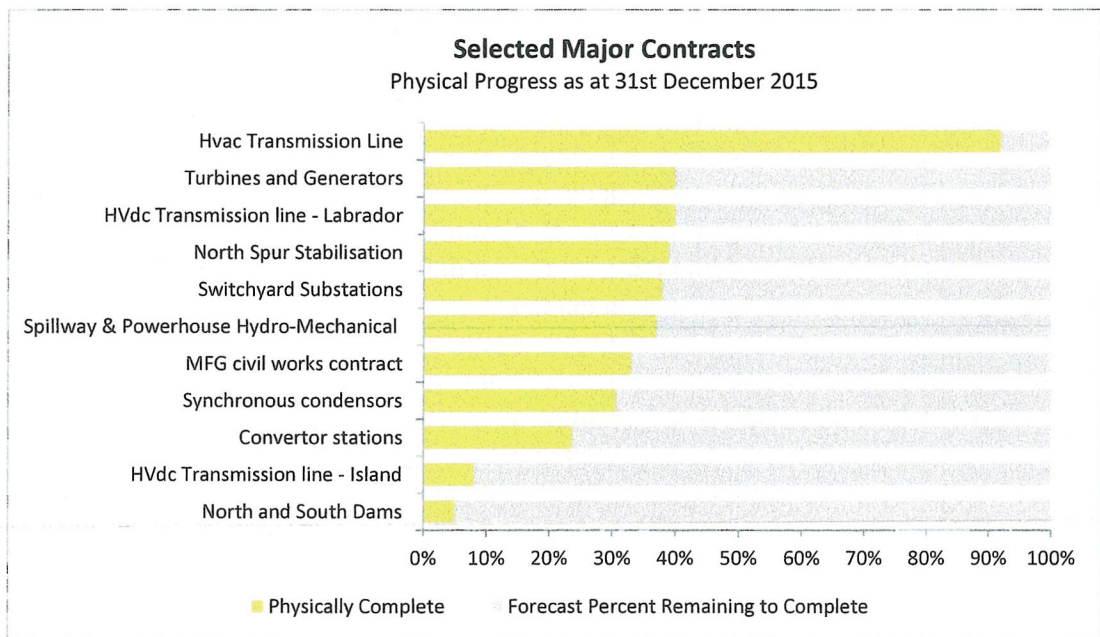
5.18 The amount of the contingency remaining at 31st December 2015 was \$173M, which represented 4.7% of the cost to complete, or 2.3% of total cost.

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 <sup>over</sup> approximately 50% complete overall, with 40% of construction now completed. Design and Engineering is almost complete and procurement is over 90% complete.



5.21 Nevertheless, the scale, complexity and timeframe of the remaining execution mean that the potential for significant risk remains. Important scope items remaining to be completed are shown in the chart below<sup>3</sup>:



- 5.22 All commissioning and integration activities have not yet started. These are a frequent source of risks in major power projects. *However planning for this activity is well advanced.*
- 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 Quantitative Risk Assessment (QRA) that should inform the amount of contingency required.

<sup>3</sup> HVdc transmission line contract has been separated into two scopes for the purposes of the chart



## 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 have been 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 which would be classified as strategic are expected to continue to impact the remaining scope of the Project.

*At Project Sanction*

*Management*

*Management*

*work*

### 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 where they deem appropriate.
- 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.

*Please clarify - we don't understand this point.*



## 7 Recommendations

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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);
- ▶ 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 crystalizing;
- ▶ 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, financial control and independent oversight should be re-evaluated and strengthened at the Project, Nalcor Board and Oversight Committee levels; and
- ▶ Project reporting should be enhanced to enable more effective management and oversight.