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29 October 2015

Review of Muskrat Falls Project Cost and Schedule Management Processes and Controls

Ms. Mullaley,

EY has completed its engagement to review of Nalcor's cost and schedule management processes and controls as related to the Muskrat Falls Project (the "Project"). The engagement was performed in accordance with the statement of work dated 9 March 2015 between EY and Her Majesty in Right of Newfoundland and Labrador, and our procedures were limited to those described in that statement of work.

The field work for the engagement was completed in April and May 2015, and consisted of reviewing Project data and documentation, as well as structured interviews with Nalcor personnel. The Project reporting period under review spanned December 2014 to February 2015. The report resulting from our engagement is titled "Review of Muskrat Falls Cost and Schedule Management Processes and Controls" and is provided under this transmittal letter. As requested, our report is provided in two parts:

1. Summary Report
2. Detailed Supplementary Report

The services provided by EY as summarized in this report are advisory in nature. They are intended to provide insight into Nalcor's cost and schedule management processes and controls, and related reporting. EY is not rendering an audit, review, examination, or other form of attestation as those terms are defined by the American Institute of Certified Public Accountants or Chartered Professional Accountants Canada.

Restrictions on the use of our work product

This report is prepared solely for use of the Government of Newfoundland and Labrador for the purpose of assessing cost and schedule management processes and controls for the Muskrat Falls Project. Ernst & Young LLP specifically disclaims any responsibility to any other party, and disclaims any responsibility for loss incurred through use of the report for any other purpose.

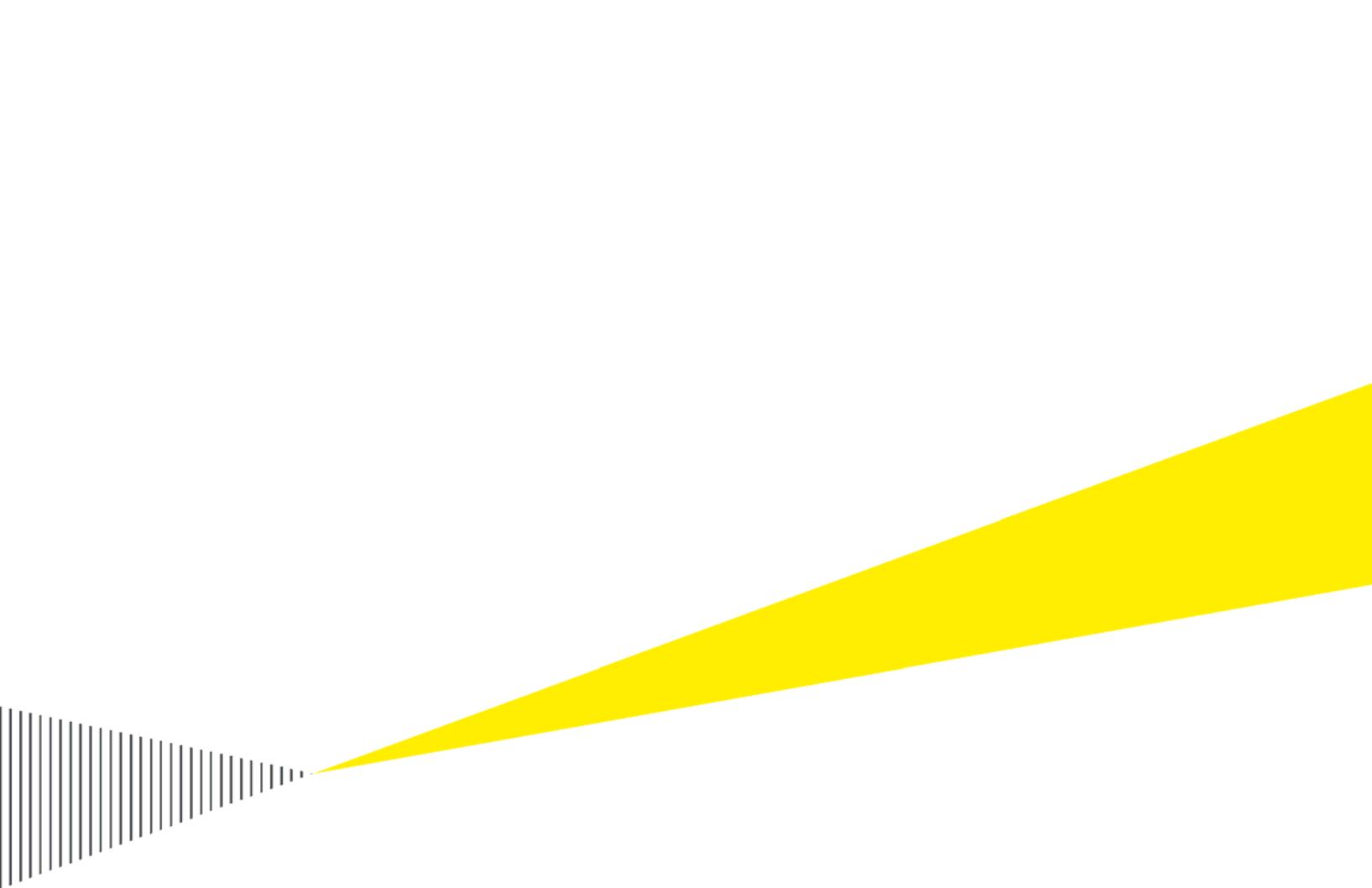
We appreciate the cooperation and assistance provided to us during the course of our work.

Yours very truly,

Ernst & Young LLP

Ernst & Young LLP

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Report on the Review of Muskrat Falls Project Cost and Schedule Management Processes and Controls

Detailed Supplementary Report

29 October 2015



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A. Executive summary

Background

The Government of Newfoundland and Labrador ("Government") has initiated oversight protocols for the Muskrat Falls Project ("Project"), a significant component of the Lower Churchill Project. This included establishing the Muskrat Falls Oversight Committee ("Oversight Committee"), which provides regular Project oversight reports to Cabinet.

The Oversight Committee is accountable to Cabinet for providing reliable and transparent oversight on the cost and schedule performance of the Project. The Oversight Committee is relying on the summary cost and schedule information produced by Nalcor as a key element in performing its mandate.

EY's Major Capital Projects practice was engaged to bring additional experience to assist the Oversight Committee in meeting its mandate. This report presents a summary of the results of EY's review of Nalcor's cost and schedule management processes and controls.

Review scope

The scope of the review included an assessment of the:

- Adequacy of Nalcor's cost and schedule management processes and controls as it manages and reports on the execution of the Project;
- Consistency of Nalcor's use of those processes and controls in key areas of the Project; and
- Extent of reliance the Oversight Committee could place on Nalcor's management reporting for cost and schedule forecasts.

The field work for the review was completed in April and May 2015, and consisted of reviewing Project data and documentation, as well as structured interviews with Nalcor personnel. The Project reporting period under review spanned December 2014 to February 2015.

A sample of five key contracts (the "Sample") was selected in conducting procedures for this review, whose aggregate value exceeds \$2.3 billion.

This report does not include a management response from Nalcor, as EY has not been engaged by Nalcor. This serves to preserve EY's independent reporting relationship to the Oversight Committee. The intention is that Nalcor will provide their management response directly to the Oversight Committee.

Review limitations

The following areas were excluded from the scope of the review:

- The estimating processes and cost baseline process were not assessed. The Oversight Committee indicated it intended to rely on the results of the DG approval processes (DG2 having been reviewed by MHI Consulting and DG3 having been reviewed by the Independent Engineer) and the approval of the narrow scope cost adjustments in the 30 June 2014 update.
- The accuracy of the forecasted costs or schedule dates for the contractors or Project as a whole.



- Change Management and Risk Management processes. The Oversight Committee indicated Nalcor's Internal Audit Department are assessing these areas and intends to assess Nalcor's Internal Audit reports for reliance purposes.

The services provided by EY as summarized in this report are advisory in nature. They are intended to provide insight into Nalcor's Cost and Schedule management processes and controls, and related reporting. EY is not rendering an audit, review, examination, or other form of attestation as those terms are defined by the American Institute of Certified Public Accountants or Chartered Professional Accountants Canada.

This report is prepared solely for use of the Government of Newfoundland and Labrador for the purpose of assessing cost and schedule management processes and controls for the Muskrat Falls Project. Ernst & Young LLP specifically disclaims any responsibility to any other party, and disclaims any responsibility for loss incurred through use of the report for any other purpose.

We understand that this Detailed Supplementary Report may include certain commercially sensitive information that might adversely impact the project if this information was released. Therefore, a Summary Report has also been provided to the Oversight Committee.

Summary of key findings

The following observations were noted during our review:

1. Key project control processes have been developed including an Integrated Project Schedule, Project Execution Plan and Coordination Procedures
2. Project reporting summarizes key information on construction cost and schedule
3. Nalcor continues efforts to work with contractors on maintaining a disciplined approach to project management, control and reporting
4. Proactive measures had been taken to manage potential claims
5. We saw evidence of active formalized management of cost and schedule issues and risks arising during the Project
6. A reasonable matrix organizational structure has been established staffed with resources experienced in cost and schedule management

However, issues and risks in cost and schedule management processes, controls, reporting and/or their deployment were also identified. The details are provided in Section C of this report.

We also recognize that Nalcor is using many conventional management processes and controls for the Project. However, while certain contractor Earned Value data is being collected, Nalcor is not reporting using a full Earned Value Management System across the whole of the project. Reporting on Earned Value performance would however, provide additional useful data and information to the Oversight Committee on individual contractor and overall Project performance where available.

Until such time as the management process and controls risks and issues identified in this report and the supplement are addressed, the completeness and accuracy of Project cost and schedule status reporting to the Oversight Committee cannot be fully verified.



Key recommendations

In response to the risks and issues identified in this report, we recommend that the Oversight Committee:

1. Work with Nalcor to obtain management response for each of the findings noted in this report with defined corrective action, responsibility and anticipated completion dates. Given the volume of Project activity (burn), timeliness of action is critical. Therefore, the Oversight Committee should actively monitor status and verify completion of management response to its expectations.
2. Consider conducting detailed assessments of the cost and schedule status of the Project on an ongoing basis until Nalcor's corrective action addressing key risks and issues noted in this report is complete to the Oversight Committee's satisfaction. This ongoing assessment should include the basis and accuracy of the forecasts for completion at the contractor level, as well as the quantification of cost and schedule risk.



B. Approach

The Oversight Committee requested that EY review Nalcor's cost and schedule processes and controls for the Project. This review included assessing the methods for calculating and reporting cost and schedule progress, as well as an assessment of:

- Schedule and cost management processes, controls and reporting against leading practices and standards (PMBOK); and
- Implementation of and compliance with schedule and cost processes and controls for a sample of contractors.

The review activities included:

- Interviewing key staff from Nalcor's project controls team and senior management;
- Reviewing Project controls cost and schedule processes and procedures, and comparison with leading practices and standards; and
- Reviewing cost and schedule data and reporting for a sample of contractors.

The field work for the review was completed in April and May 2015, and consisted of reviewing Project data and documentation, as well as structured interviews with Nalcor personnel. The Project reporting period under review spanned December 2014 to February 2015.

The Sample of five key contracts was selected in conducting procedures for this review, whose aggregate value exceeds \$2.3 billion.

The list of data obtained in conjunction with the review is contained in Appendix A of the report.

EY would like to thank the members of the Government and Nalcor who participated in this assessment process. The list of individuals interviewed is contained in Appendix B of the report.



C. Detailed findings

The 'Detailed findings' section of the report is organized as follows:

- Schedule management process design
- Schedule management process compliance
- Cost management process design
- Cost management process compliance

i) Schedule management process design

Effective schedule management, monitoring and control processes allow the user to maintain an effective baseline plan and compare with progress to identify variances from that plan and corrective actions taken.

A range of conventional schedule control plans, processes and procedures have been developed. These include:

- An Integrated Project Schedule (IPS) document, including a description of the IPS structure, schedule assumptions, baseline as well as IPS progress/updating/reporting and critical path determination and IPS bar charts;
- A Project Execution Plan (PEP), where the function and structure of Project controls are defined;
- A PEP, which includes a summary of forecast schedule and the basis of that schedule forecast, including key assumptions, driving logic and project milestones;
- A Project Control Management Plan with a detailed section dedicated to planning and scheduling, including:
 - General strategies for achieving Project planning and scheduling objectives;
 - Schedule reporting and alignment requirements; and
 - Integration of detailed schedules of various contractors and suppliers.
- Planning and schedule process work flows. While the process steps remain at a high level, the map demonstrates functional responsibilities and handoffs. These work flows include key steps for:
 - Controlling the schedule at component level (i.e., Muskrat Falls Generation, Labrador Transmission Asset, Labrador Island Transmission Link), from contract award up to contract close out;
 - Developing components schedule baseline;
 - Updating the IPS; and
 - Reporting.
- Coordination procedures for administration, execution control and management of contractors' schedules (and cost);
- Trend analysis and change management processes used for forecasting time (and cost);
- An IPS focused on completion of the physical construction of the plant. However, management also indicated that schedules had been prepared for operational readiness and commissioning; and
- Project monthly reporting capturing key information to manage work on schedule, including:
 - Planned/earned/forecast progress;



- Variance;
- Critical path(s);
- Float watch; and
- IPS summary and construction progress.

However, we observed that:

| Detailed observations |
|---|
| 1. The process used to update the status and recorded progress of the Project is not fully documented in the IPS. The process is complex and uses a number of manual inputs, tools (i.e., LCP database, IPS progress spreadsheet "Rosetta Stone") and monthly processing. |
| 2. Variance thresholds for monitoring schedule performance are not defined. Control thresholds are used to indicate predefined scale of variation permissible before a documented corrective action plan must be put in place and the issues escalated to key stakeholders. Use of these thresholds would better inform the Oversight Committee. |
| 3. The IPS Gantt charts do not show percent complete at the activity level, this limits the ability of the Oversight Committee to cross-check progress and forecasted end dates. |
| 4. The IPS focuses on three domains, namely construction, commissioning and operations start-up. The IPS does not include information on three other domains, namely engineering, procurement and fabrication. |
| <p>The logical relationships and the impact of delays in engineering, procurement or fabrication on construction schedule are not included in the IPS. Without these logical relationships between dependent activities and the construction schedule, it is not clear how such delays may impact construction and completion of the Project.</p> |

ii) Schedule management process compliance

Nalcor has established a conventional organizational structure to support Project management and execution of processes and controls. Key roles in this organizational structure have been staffed with resources experienced in schedule management, monitoring and control.

We noted that:

- Nalcor regularly updates and maintains the IPS as its core schedule management tool and basis of reporting. IPS updates are performed using the established tools (IPS progress spreadsheet "Rosetta Stone", LCP database);
- Nalcor is working towards systematically integrating contractor schedule updates as a basis for the IPS updates. Contractors' schedules are regularly reviewed (i.e., monthly) by the Project Controls team and comments are made;
- The Project Controls team is well aware of the established processes as well as the planning and schedule workflows;
- Nalcor is making an effort to work collaboratively with contractors to encourage them to comply with project requirements; and
- An onsite Nalcor quantity surveyor validates contractor quantity and supports progress reporting for the IPS.



However, we observed that:

| Detailed observations |
|--|
| <p>1. The process for integrated maintenance of the IPS and contractors' schedules is not fully deployed or consistently executed. Specifically:</p> <ul style="list-style-type: none">a. The Schedule Control Baseline Document (SCBD) and the Schedule Development and Control Plan (SDCP) are incomplete and/or fail criteria, as per Nalcor's coordination procedures. These key documents describe the approach to planning and schedule control, including schedule development, analysis, forecasting, reporting, progress measurement and corrective actions;b. Of the contractors from the Sample, only two had complete SCBDs and SDCPs. The status of control schedule baselines, as per contractors' monthly December 2014 and January 2015 progress have been reported independent of this report to the Oversight Committee (independent reporting of the status details to the Oversight Committee was required due to commercial sensitivity); andc. The updated schedule control baseline from the Sample of contractors is not rolled up in the IPS. A timeline had not been established for completing the plans and finalizing an integrated baseline of contractor and IPS schedules. |
| <p>2. From the Sample, one key contractor's most recent approved schedule (dated October 2014) does not fully comply with Nalcor's Coordination Procedure:</p> <ul style="list-style-type: none">a. More than 10% of the contractor's scheduled activities have negative float. A significant number have a negative float of more than 80 days. Negative float indicates the inability to meet schedule milestones/deadlines including the required project completion date. As of 21 May 2015, schedule non-compliances remained to be rectified; andb. The contractor's monthly progress report has not been approved since July 2014. |
| <p>Consequently, such matters may not be included in the IPS and reported to the Oversight Committee.</p> <p style="background-color: #cccccc; border: 1px solid black; padding: 2px;">S 5.4 of the Energy Corporation Act</p> |
| <p>3. Contractor's schedule corrective actions are not all implemented within the monthly reporting period following their identification by Nalcor. The result of a corrective action test performed on three contractors in the Sample has been reported independent of this report to the Oversight Committee. Independent reporting of the test details to the Oversight Committee was required due to commercial sensitivity.</p> |
| <p>4. Reasonability checks revealed instances where progress reported in the IPS differed from the progress reported from contractors in the Rosetta Stone. Although the differences are not in themselves material, the reported progress may be viewed as subject to interpretation and not wholly objective.</p> |
| <p>5. A target date for completion of corrective action on the schedule management and reporting challenges at the contractor level has not been established.</p> |



In EY's experience, challenges with contractor schedules and their management are not uncommon in the major construction industry. However, the corrective action required is important for the Project as well as its oversight.

iii) Cost management process design

Project cost management typically includes processes for planning, estimating, budgeting, financing, funding, managing and controlling costs so that the Project can be completed within the approved budget. Cost control processes are set to monitor and report project performance against the cost baseline and identify variance from plan, and forecast potential impacts.

A range of conventional cost management processes have been substantially developed.

We noted that:

- Nalcor's LCP cost management processes are detailed in the PEP, Project Controls Management Plan and Procedure for Cost Control. These plans and procedures include a description of the:
 - Function and structure of the Project Controls group for cost management; and
 - Structure of the cost baseline, which includes the Project coding structure and work breakdown structure, Project commitment packages and packages dictionaries, and the Project process to establish and maintain budgets.
- A Project Control Management Plan with a detailed section dedicated to cost management, including:
 - Commitments and incurred cost monitoring process and cost/cash flow methodology;
 - Trending and forecasting processes used to calculate Forecast Final Cost (FFC) and assess variances. FFC is adjusted through a formal Forecast Change Notices mechanism. Early identification of potential variance is necessary to allow for an effective cost control system, and ultimately improve the accuracy of cost forecast;
- Cost control workflows have been drafted by the Project Controls team. These workflows describe the key steps at a functional level for each interface involved in the cost control processes. Workflows cover the following areas:
 - Commitments;
 - Incurred and cost flow; and
 - Forecast cost.
- Coordination procedures for administration, execution control and management of the contractors' cost (and schedule);
- Nalcor's monthly cost report captures key cost information, both at program and component level, including:
 - Original control budget (OCB);
 - Approved project changes;
 - Current control baseline (CCB);
 - Incurred cost;
 - Committed cost;
 - FFC, which is the sum of original commitment, approved changes, changes in progress, trends and unallocated budget/unawarded scope;



- Variance from CCB and Trends; and
- Contingency with related drawdown curve.
- An estimated contingency drawdown curve has been developed to forecast the usage of estimate contingency over the Project life.

However, we observed that:

| Detailed Observations |
|---|
| 1. Cost variance thresholds are not defined. These thresholds are used to establish a permissible variation from budget before documented corrective action must be taken. Variance thresholds are also used to define what constitutes a variance requiring escalation for senior management's attention. |
| 2. The conditions and processes for rebaselining are not defined in the Project's control processes and procedures. Management indicated that rebaselining of the program was at their discretion and dependent on a variety of factors including forecast and rate of drawdown on contingency. |
| 3. Detailed checklists have not been developed for the use of Nalcor cost controllers to validate contractor costs and ensure review consistency. |
| 4. The shape of the contingency curve is conventionally defined by aggregation of the forecasted materialization of estimate uncertainties or tactical risks. The current basis of the forecast contingency drawdown curve did not include quantified material risks. This shortcoming significantly limits the ability to compare the rate of realized cost risks versus original forecast, and assess the need for additional contingency or the rebaselining of the Project's cost and schedule. |

iv) Cost management process compliance

Nalcor has established a conventional organizational structure to support the management of the Project and execution of the processes and controls. Key roles in this organizational structure have been staffed with resources experienced in management, monitoring and control of the Project cost.

We noted that:

- A Cost Control team has been established with the mandate to provide the Project Management Delivery team with timely updated information on the Project cost status for analysis and control to deliver the Project within budget;
- Major activities performed under this mandate include: budgeting, reporting commitments and actual status, trending and calculating FFC;
- The Project has been divided into manageable sub-projects with their own budget code for accounts, funding authority and funding release mechanism;
- A cost baseline has been established and maintained;
- The FFC is calculated using data from Nalcor's cost management systems (including PM+, LCP tracker and PRISM);
- Contractors' costs are regularly reviewed by Cost Control teams and comments made are reported back to the contractors;
- Reasonability checks and variance analysis are performed by cost controllers to validate



- contractors' cost figures;
- Processes for Deviation Alert Notices and Trends are implemented and reported; and
- The Project Cost Control team is well aware of the established processes and cost-related workflows (although some are still in draft version).

However, we observed that:

| Detailed observations |
|---|
| 1. A trend, quantified risk and/or early identification of potential material variance have not been raised for the challenges with one key contractor included in the Sample, particularly related to progress delays. It is not clear how the quantification of the related cost risk has been communicated in reporting, limiting the understanding of the scale of the risk or issue. |
| 2. Contractors' forecasts are not consistently used as a basis of the FFC. Alternative procedures are utilized including the use of a quantity surveyor who validates contractor quantity and supports progress reporting for the IPS. |
| 3. FFC does not include trends for another contractor included in the Sample, as a different system is used to track costs. |



Appendix A: Documentation reviewed

Documents reviewed as part of this engagement:

| | |
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| Monthly Progress Reports dated December 2014 and January 2015 for the following sample of contractors: <ul style="list-style-type: none">- Alstom CD0502- Andritz Hydro CH0032- Nexans LC-SB-003- Valard CT0327 | Coordination procedures for the following sample of contractors: <ul style="list-style-type: none">- Alstom CD0502- Andritz Hydro CH0032- Astaldi CH0007- Nexans LC-SB-003- Valard CT0327 |
| - C1 Progress to IPS rollup – Reporting MF Gen (C1) Progress to IPS; - IPS Progress Roll-up 2015 05 05; - IPS Progress weight factors 2015 05 05 | - LCP-LITL bar chart from IPS 2015 04 09; - LCP-LTA bar chart from IPS 2015 04 09; - LCP-MFG bar chart from 2015 04 09; - IPS LCP-PT-MD-0000-PC-SH-0001-01 |
| Cost reports dated December 2014 and January 2015 for the following sample of contractors: <ul style="list-style-type: none">- Alstom CD0502- Andritz Hydro CH0032- Astaldi CH0007- Nexans LC-SB-003- Valard CT0327 | Schedule .xer file for the following sample of contractors: <ul style="list-style-type: none">- Nexans LC-SB-003 with January and February 2015 data- Alstom CD0502 with August 2014 data- Valard CT0327 with August 2014 data |
| Control Schedule Baseline Document dated 27 January 2015 from Andritz Hydro CH0032 | Control Schedule Baseline Document dated 06 February 2015 from Nexans LC-SB-003 |
| Project Baseline Schedule dated 09 January 2015 from Andritz Hydro CH0032 | LCP Monthly Progress Report dated December 2014 and January 2015 |
| Integrated Project Schedule (IPS) - Monthly Schedule and Progress Analysis Project Based cut-off date 31 December 2014, 28 January 2015, 25 February 2015 | - Sample of Draw Confirmation Certificate - Sample of Draw Request and Funding Request - Sample of Construction Reports |
| IPS Progress Rosetta Stone for the months of December 2014, January 2015 and February 2015 | Material Contract Cost Summary dated December 2014 and January 2015 |
| McInnes Cooper Reports dated January, February and March 2015 | Contract Administration Plan_LCP-PT-MD-0000-CA-PL-0001-01 |
| LCP-PT-MD-0000-PM-ST-0002-01_B1_Contracting Strategy | Decision Gate 3 Basis of Estimate LCP-PT-ED-0000-EP-ES-0001-01 Rev B2 |
| Project Change Management Plan_LCP-PT-MD-0000-PM-PL-0002-01 | Integrated Project Schedule_LCP-PT-MD-0000-PC-SH-0001-01 |



| | |
|---|---|
| Project Control Management Plan_LCP-PT-MD-0000-PC-PL-0001-01[1] | LCP Assurance Framework May 2013 |
| Project Control Schedule Baseline Document_LCP-SN-CD-0000-PC-SH-0001-01 | LCP-PT-MD-0000-CS-PL-0001-01_B2 Construction Management Plan |
| Project Execution Plan (Scope and Approach)_LCP-PT-MD-0000-PM-PL-0001-01_B3 | Project Finance and Accounting Management Plan_LCP-PT-MD-0000-FI-PL-0001-01 |
| Project Risk Management Plan_LCP-PT-MD-0000-RI-PL-0001-01_B1 | Project Work Breakdown Structure and Code of Accounts_LCP-PT-MD-0000-PC-LS-0001-01 |
| Revised Project Work Breakdown Structure and Code of Accounts_LCP-PT-MD-0000-PC-LS-0001-01_Rev B5 | Work Planning Management Plan_LCP-PT-MD-0000-PM-PL-0003-01 |
| <ul style="list-style-type: none">- Astaldi CH0007 Monthly Progress Report dated 25-July-2014;- 2014 10 10 – ACI-MFC-0143 – Issue Of Revised Construction Schedule;- CH0007-Muskrat Falls – Execution Detailed Schedule v8.2 DD 28 SEP14 Official Submission 09.10.2014;- LTR-CH0007001-0283 – Baseline Control Schedule Conditional Acceptance;- Astaldi Execution Detailed Schedule – MFA-AT-SD-0000-PM-A02-0001-01 dated 10-October-2104 | <p>Project Controls Workflow/Procedure:</p> <ul style="list-style-type: none">- LCP_Cost Control_Mar2015_DRAFT;- LCP_Planning & Scheduling_Component Baseline_Mar2015_DRAFT;- LCP_Planning&Scheduling_IPS_Mar2015_DRAFT;- LCP_Planning&Scheduling_Mar2015_DRAFT;- LCP_Report Mar2015_DRAFT;- LCP-PT-MD-0000-PC-PR-0005-01_Cost Control Procedure_DRAFT |
| Organization Charts LCP-PT-MD-0000-PM-CR-0001-01 | Project Cost Update to MWH – 22-Jul-2014 |
| LCP Asset Schematic by Project | <ul style="list-style-type: none">- LCP_Monthly PC Meeting_25-Mar-2015;- LCP_PCMMeeting_Bi-Weekly_Agenda_Feb2015 |



Appendix B: Interviews conducted

Interviews with the following Nalcor personnel were conducted:

| # | Name | Title |
|----|------------------|---|
| 1 | Anthony Embury | Project Controls Manager |
| 2 | Carlos Fernandez | Deputy Project Controls Manager |
| 3 | Paul Harrington | Project Director |
| 4 | Jason Keane | Deputy General Project Manager |
| 5 | Ed Bush | Project Controls Lead – Muskrat Falls |
| 6 | Tanya Power | Project Controls Lead – HVdc Specialties |
| 7 | Nick Ternasky | Project Controls Lead – Overland Transmission |
| 8 | Georges Chehab | Lead Cost Controller |
| 9 | Brian Marsh | Sr. Cost Controller |
| 10 | Jill Hawkins | Cost Controller |
| 11 | Tara Dumaresque | Cost Controller |
| 12 | Tom Chudy | IPS Sr. Planner |
| 13 | Andrew Whitty | Planner |
| 14 | Craig Freake | Planner SOBI |
| 15 | Greg Fleming | Project Manager SOBI Crossing |
| 16 | Jennifer Grandy | Stewardship Reporting Coordinator |
| 17 | Scott Gillis | Change and Interface Management Lead |

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