

# MEETINGS IN ST. JOHN'S AND VISITS TO LOWER CHURCHILL PROJECT SITES, OCTOBER 29 TO NOVEMBER 2, 2018

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## Quality Assurance Statement

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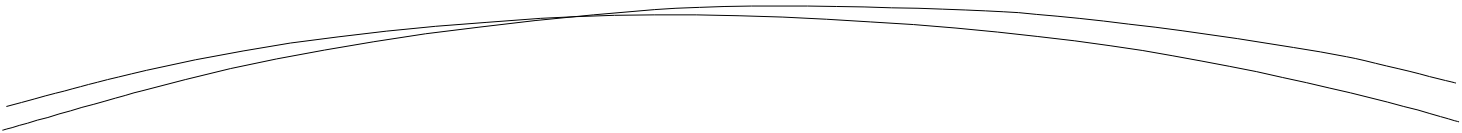


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## APPENDIX 1 - Site Photographs



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## 1. GENERAL

The Independent Engineer (IE) team attended project briefings at the Lower Churchill Project (LCP) Delivery Office in St. John's on Oct. 30<sup>th</sup> and Nov. 2<sup>nd</sup>, 2018 and visited Soldiers Pond and Muskrat Falls construction and HVDC sites between October 30<sup>th</sup> and Nov. 1<sup>st</sup>, 2018. NALCOR management and project team representatives as well as Messrs. Joe Krupski (Natural Resources Canada) and Paul Carter (Government of Newfoundland & Labrador) accompanied the IE.

IE team:

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

The trip itinerary was as follows:

October 29: Arrive in St John's NL

October 30:

- Orientation meeting and project updates in Nalcor's LCP Delivery office
- Visit to Soldiers Pond converter building, DC yard and Synchronous Condenser (SC) building

October 31:

- Commercial flight from St. John's to Goose Bay
- Site visit to Muskrat Falls Generating Plant, Gas Insulated Switchgear (GIS) building

November 1:

- Site visit to Muskrat Falls Generating Plant
- Commercial flight from Goose Bay to St John's

November 2:

- Recap meetings in LCP office
- Depart St John's for home bases

## 2. NEWFOUNDLAND AND LABRADOR PROJECT SITES – OCTOBER 30 TO NOVEMBER 1, 2018

Transportation to and from all sites was by commercial flights and by road.

Photographs taken during site visits are presented in Appendix 1.

### 2.1 MUSKRAT FALLS RESERVOIR

- The reservoir was at about El. 23 m at the time of the IE site visit.
- The buoy clamps of the debris/ice/safety boom have been replaced and the buoys repositioned on the boom.
- Removal of the temporary steel truss bridge across the spillway intake channel was in progress.
- See Appendix 1, Section A for photos.

### 2.2 MUSKRAT FALLS INTAKES AND POWERHOUSE


- Final stage concrete for power intake trash rack and gate guides is completed in Unit 1 and 2 and in progress in Units 3 and 4.
- Powerhouse building is 100% complete.
- First Stage Concrete is 100% complete.
- Unit 1 pit free was achieved and turbine / generator installation and assembly have begun. Unit 1 stator frame is in place and ready for alignment.
- Balance of Plant installations are well underway and reported to be 36% complete.
- Approximately 2000 m<sup>3</sup> of Final Stage Concrete to be completed.
- Alternative options for completing the Final Stage Concrete Work are on hold pending resolution of situation with Astaldi.
- Drilling & blasting of tailrace rock plug was underway. Downstream marine blast planned for later that week.
- See Appendix 1, Section B for photos.

### 2.3 MUSKRAT FALLS SPILLWAY

- Spillway concrete is complete except for rollways 2, 3 and 4 and minor local repairs.
- Spillway gate guides are 100% complete.
- Final commissioning of gates is underway.
- See Appendix 1, Section C for photos.

### 2.4 MUSKRAT FALLS NORTH RCC DAM AND UPSTREAM COFFERDAM

- North RCC Dam is complete.
- Foundation curtain grouting is in progress. Grout takes have been higher than estimated.
- Nalcor advised that once grouting is completed, the upstream cofferdam pumps will be turned off to allow the area between the cofferdam and the RCC dam to slowly fill to current reservoir level.

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- Cofferdam will remain in place during and after final reservoir filling. A question was raised regarding if additional loading would build up on North Dam as area between cofferdam and dam fills with silt and debris over time. The answer was that such a load case is already part of the original design.
  - See Appendix 1, Section D for photos.

## **2.5 MUSKRAT FALLS NORTH SPUR**

- The IE team did not inspect the North Spur.
- It was reported that the dewatering well pumps were rehabilitated to remain reliable for several years. The North Spur design does not rely on the wells and an evaluation will be made after reservoir filling to decide if they can be shut down.

## **2.6 MUSKRAT FALLS GIS BUILDING**

- GIS installation is complete and ready for power transfer.
- See Appendix 1, Section E for photos.

## **2.7 MUSKRAT FALLS DC SWITCHYARD**

- DC switchyard is complete and ready for power transfer

## **2.8 MUSKRAT FALLS CONVERTER BUILDING**

- The Converter building is complete and ready for power transfer.
- Main outstanding item is the installation and commissioning of the P&C and HMI software.
- See Appendix 1, Section E for photos.

## **2.9 SOLDIERS POND CONVERTER BUILDING**

- The Converter building is complete and ready for power transfer.
- Main outstanding item is the installation and commissioning of the P&C and HMI software.

## **2.10 SOLDIERS POND DC YARD**

- DC switchyard is complete and ready for power transfer.

## **2.11 SOLDIERS POND SYNCHRONOUS CONDENSER BUILDING**

- Units 1, 2 and 3 are on their pads.

- Lubricating oil contamination was discovered in all three units during precommissioning checks. Source of the contamination is not known at this time. External consultants are assisting in the investigation and will conduct root cause analysis of the problem.
- Unit 1 rotor was jacked up, bellhousing removed and bearing shells were removed for inspection.
- See Appendix 1, Section F for photos.

### 3 LCP PROJECT OFFICE MEETINGS ON OCTOBER 30 AND NOVEMBER 02, 2018

Discussions on Project issues and updates were carried out during the two sessions in the LCP Project office:

#### MFA Project briefing based on progress reporting to the end of September 2018:

- Safety update indicates that the LCP Project site staff worked 13.5 million hours since the last lost time accident.
- Powerhouse and spillway are 85% and 90% complete, respectively.
- Spillway rollways #1 and 5 are completed, and #2, 3 and 4 will be completed next year.
- North Dam is 94% complete.
- Overall, the project is only 1% behind schedule and it is essentially on track for 1st power from Unit 1 in 2019.
- Unit 1 turbine / generator assembly commenced in Q3'18.
- Final installation of Unit 1 GSU transformer is scheduled for Q4'18.
- Overall Project scope is 89% complete.
- Engineering is substantially complete.
- Removal of the tailrace rock plug is in progress and scheduled to be completed by January 2019.
- Cleaning of the intake channel and removal of intake cofferdam are scheduled for February-March 2019.
- Dynamic commissioning and start up plan document is to be completed in Q4'18.

#### Astaldi:

- Work stop order was issued to the Contractor on 18 October 2018' and Contractor's personnel have been demobilized from site. It became increasingly apparent challenges facing Astaldi would impair their ability to complete their scope of work including, allegedly, not having sufficient funds to meet payroll or finish the job.
- Critical work is moving forward, and the legal/commercial issues are being attended to including, for example, meetings with Astaldi's bonding company that was scheduled to take place the week of the IE visit.

#### RCC North Dam:

- Roller Compacted Concrete (RCC) is 100 % complete.
- Final mass concrete pour was done on October 15 before shutting the concrete plant for the winter.
- Foundation curtain grouting is underway. Grout take is more than estimated and some additional split spacing of grout holes has been required.
- Thermal analyses indicate that no winter insulation is required if RCC compressive strength is >15MPa. Some lower strengths are reported in local areas and additional information will be provided to the IE.



- Shrinkage cracks in the flip bucket concrete were grouted; the IE recommends that the grouting be inspected as the concrete may still experience additional shrinkage.

#### C3 / C4 Update:

- LTA is 98% complete, LIL TL is 100% complete.
- Pole 1 Mechanical Completion (MC) is 100% complete and Static Commissioning is 99% complete.
- Pole 2 MC is 78% complete with 424 items in the Punch List.
- SC oil contamination was discovered in all three units. The units are not required for the Winter 2018/19 transfer. Unit 1 was disassembled for investigation.
- All three SCs are expected to be in service for 2019 power transfers.
- DCCT problem has been resolved. Ongoing monitoring continues.
- Electrode Line Fault Locators (ELFL's) have not yet been installed at MF or SP. This is scheduled for January 2019.

#### P&C Software:

- Version 16.1 release has been delayed.
- Commercial discussions with GE are in progress, IE were not advised why and how those discussions impact on the software development activities.
- Power transfer of 45MW for 10h / day is scheduled with plan to go to 24h transfer this winter.
- Due to uncertainties with the design and some system failures ECC may be reluctant to accept the Release 1.
- Key point is the lack of redundancy. That is, at present only Lane 1 system is in service and any control failure in that system will result in the HVDC link shutdown.
- Release 1 was renamed 'version V1.0.17' and FAT is expected to be completed shortly. Lane changeover works fine with this version. Regression testing of V 1.17 will be carried out prior to release to the site. This will be subject to further discussions.
- Pole 2 and Bi - pole software is expected by end of 2019.
- Operational studies are under way. The focus is on delivery of software version that will permit higher power transfer.
- GE's progress reports are not consolidated enough to clearly indicate the project risks.

## 4 CONCLUSIONS AND COMMENTS

- With respect to the Operational Studies, IE recommend repeat of simulation studies for N-1 and N-2 grid contingencies prior to increasing the LIL power transfer.
- IE were provided with the Operational Study dated March 15, 2018. IE requested the latest, July 2018, study for reference.
- Software design progress and reporting of the work done/ work remaining are the main C3/C4 outstanding items.
- The Generation site (MFA) work is progressing well and it is on schedule. Potential delays (due to the situation with Astaldi) to pit free milestones for Unit 2, 3 and 4 are not expected to negatively impact the schedule for First Power. Risk of impact to the overall project schedule is being evaluated.



# **Appendix 1**

## **Site Photographs**



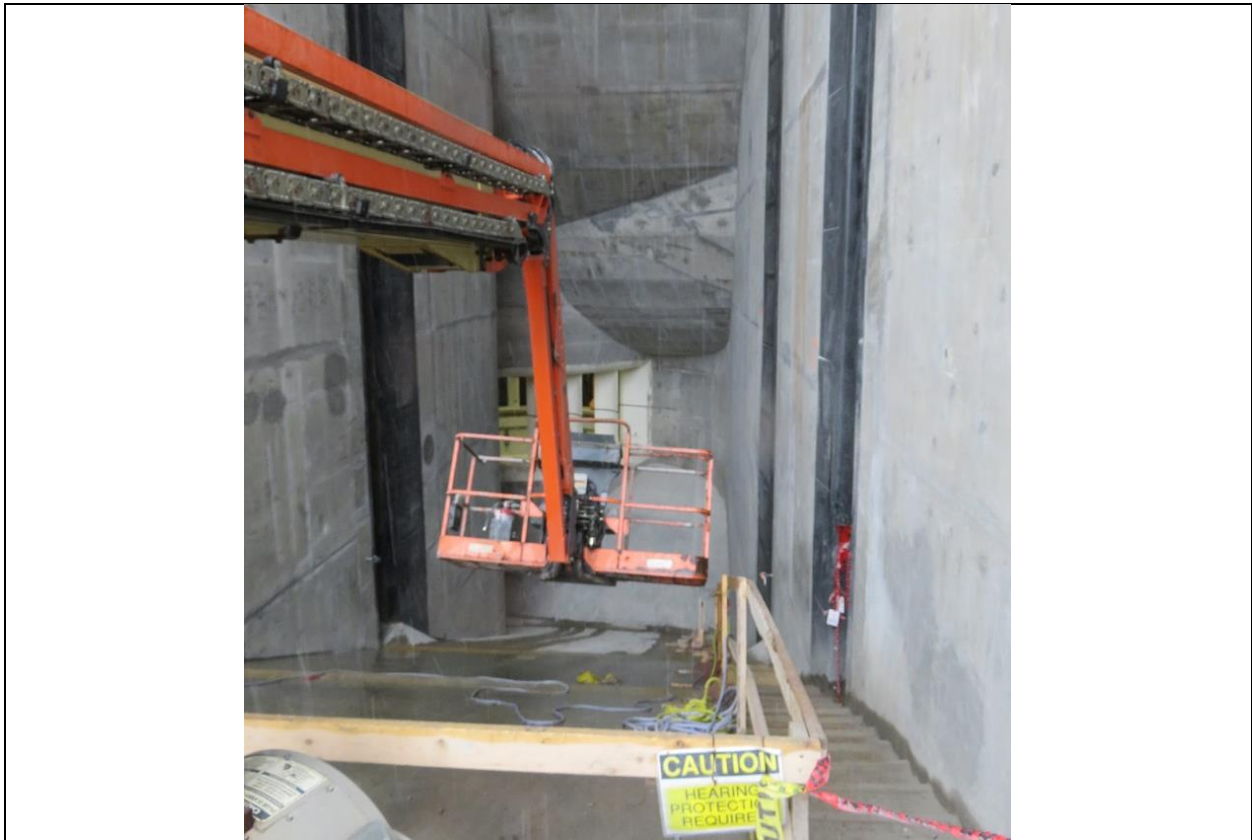
Photo A.1: Upstream view of debris/ice/safety boom. Buoy clamps were replaced, and buoys repositioned along main cable.



Photo A.2: Removal of temporary construction bridge in progress with completed North RCC dam in background.



**Photo B.1:** Power intakes with temporary hoarding and heating in place for completion of second stage concrete for gate guides.



**Photo B.2:** View down one intake of Unit 1 looking along flow passage into guide vanes.



**Photo B.3:** Interior view of powerhouse from main service bay.



Photo B.4: Panorama view of Unit 1.



**Photo B.5:** Interior view of powerhouse from north service bay with Unit 4 in foreground.



Photo B.6: Unpacking lamination plates for generator stator core.



Photo B.7: Cable trays installed below generator floor.





**Photo B.8:** Installation of isolated phase bus in progress.



Photo B.9: Generator transformer installed on tailrace deck.



Photo B.10: Removal of rock plug at downstream end of tailrace channel is in progress.



Photo C.1: Local concrete repair between gate guides in spillway bay 1.



Photo C.2: Spillway gate in raised position in Bay 5.



**Photo D.1:** View from north transition dam looking northerly along top of completed north RCC dam.



Photo D.2: Non-overflow section of north RCC dam.



Photo D.3: Downstream side of north RCC dam.



Photo D.4: Drainage gallery inside north RCC dam.



Photo D.5: Upstream cofferdam.





Photo E.1: GIS building and yard.



Photo E.2: GIS equipment



Photo E.3: HVDC valves.



Photo F.1: SOP Unit 1, bellhousing removed.



Photo F.2: . SOP Unit 1 bearing shell.