

MEETING IN ST. JOHN'S AND VISITS TO LOWER CHURCHILL PROJECT SITES, SEPTEMBER 15 TO 18, 2019

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Quality Assurance Statement

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GENERAL

The Independent Engineer (IE) team attended project briefings and meeting at the Lower Churchill Project Delivery Office in St. John's and visited the Soldiers Pond as well as Muskrat Falls generating plant and converter station sites between September 16 and 17, 2019. Meetings and site visits were attended by NALCOR senior staff and representatives from the Government of Newfoundland & Labrador and Natural Resources Canada.

IE team: Nik Argirov (IE Team Lead)
Vlad Kahle (IE Electrical SME)
Tim Little (IE Geotechnical SME)

NALCOR Meeting and Site Visit Coordinators: Rosanne Williams and Stephen Pellerin

Trip itinerary:

Sept. 15:

- Arrive and overnight in St John's

Sept. 16:

- Project update meetings at LCP office
- SOP Converter Station and Synchronous Condenser building visit
- Return to and overnight in St John's

Sept. 17:

- Travel to Goose Bay
- Muskrat Falls powerhouse visit
- Muskrat GIS (gas insulated switch gear) building visit
- North Spur site visit
- Travel to St John's and to Toronto

Sept. 18:

- Depart for home bases

1. TECHNICAL UPDATE AT LCP OFFICE – SEPTEMBER 16, 2019

1.1 MFA Project Progress Update

- Safety remains #1 priority. Total of 16 million person hours were worked since the last lost time incident.
- Project progress and schedule:
 - The seasonal debris boom has been deployed; a decision on whether to install the permanent boom for winter is expected later this year. *Post meeting note: The decision was not to re-install the permanent boom but preserve and store it for future use should operations see the need for such an installation at some later date.*

- Powerhouse is 96% complete as of end of August 2019. It will be back- fed via unit #1 generator transformer within the next 2 weeks.
- Rollways 2, 3, and 4 are to be completed in Q4/ 19.
- Energization and commissioning of the Plant's auxiliary systems (e.g. Station Service, HVAC, unit cooling, air and fire protection and suppression systems) will be staged and coordinated with the commissioning of generating units.
- Spillway is 95% complete as of end of August 2019.
- Intake gate and spill gate controls are complete.
- Impoundment commenced on August 7th, and full supply level was reached on September 4th. Full Supply Level (FSL) is 39.0 meters and the normal reservoir operating range will be 38.5 meters up to FSL.
- Removal of tailrace rock plug was about 30% complete at the time of this meeting and site visit.

1.2 Turbine and Generator Update

- Unit 1
 - First power is expected around in early November 2019. Date to be firmed up by Andritz.
 - Commercial power should be available in December 2019.
 - P&C installation is complete. Commissioning of the Protection systems and unit control board is in progress, see Photo 1. and 2. Exciter and governor installation has been completed.
 - NALCOR's response to earlier IE comments on generator Protection changes is expected in 2 weeks.
- Unit 2 is 48% complete as of August 24. Commercial operation is expected by February 2020.
- Unit 3 is 25% complete. Commercial operation is expected by May 2020.
- Unit 4 is 18% complete. Commercial operation is expected by July 2020.

1.3 Transmission Update

- Strait of Belle Isle is 100% complete. Site has been turned over to Operations.
- LTA (Labrador Transmission Assets) is 100% complete. It has been turned over to Operations.
- LITL (Labrador-Island Transmission Link) is 99.94% complete as of end of July 2019.
 - Overhead line is 100% complete.
 - Final version of monopole was successfully tested in May 2019 thus completing the monopole S/W work. The S/W version was removed from service in June 2019.
 - HVDC Bi-pole software is not yet completed. Static, non-operational, version was installed for testing.
 - FAT (Factory Acceptance Testing) on interim bi-pole software version completion is scheduled for November 4, 2019.

2. SOLDIERS POND PROJECT SITE – SEPTEMBER 16, 2019

2.1 Converter building

- Hardware installation has been completed.
- Control room and HMI's have been installed awaiting implementation of the GE S/W.

2.2 Synchronous Condensers

- Previous issues related to lubrication oil contamination, rotor lift and hydrogen piping have been fully remediated.
- Units 1 and 2 could not be rotated for dynamic commissioning in August. Bearing binding has been detected and it is interpreted that the bearing housing is deflecting and pinching the rotor shaft. Installation of 18 stiffener brackets on the collector end and 21 on the flywheel end of each unit is expected to stiffen the deflecting bearing housing and provide a permanent solution to the problem and is in progress.
- Dynamic commissioning commenced for Unit 3, but it experiences vibration at operational speeds. Vibration source has not yet been determined although foundation interaction is considered a possible cause. Several potential remedies are being considered.

3. MUSKRAT FALLS PROJECT SITE – SEPTEMBER 17, 2019

3.1 Reservoir

- Reservoir was at full pool level just below the overflow crest of the north RCC dam (El. 39.0 m) with water level being controlled through spillway bays 1 and 5.
- The seasonal debris boom was in place. There was no floating debris against the boom and minimal small size woody debris along the new reservoir shoreline near the dam. Several boats were being used to collect larger floating logs and trees to tow them to the North Spur where they are to be removed and hauled away.

3.2 Dams and Power Intakes

- All water retaining structures had full reservoir head on their upstream sides. No significant leakage from construction joints or lift joints was observed on the downstream sides. All structures are performing well.
- The IE continues to receive copies of weekly dam safety monitoring reports. Foundation piezometric levels and weir flows in dam galleries showed modest increases due to reservoir filling (as would be expected). There have been no anomalous responses or behaviour recorded, and no dam safety concerns have been identified.

3.3 North Spur

- The upstream and downstream slopes on the North Spur were stable and in good condition. There are some local areas of surficial erosion of sand by wind and surface runoff on the upper slopes which are not of concern. Nalcor has been hydroseeding and planting alders in these areas which should eventually stop such erosion.

- Dam safety instrumentation indicates that there have been no movements in the North Spur due to reservoir filling. The wall is performing well as Piezometric levels in the North Spur downstream of the seepage cut-off wall show little to no response to reservoir filling. There have been no anomalous responses or behaviour recorded and no dam safety concerns have been identified.

3.4 Powerhouse

- Unit 1 is in final stages of construction.
- The lessons learned on Unit 1 benefit the work processes on other units and Units 2, 3, and 4 are generally progressing well.
- Emergency Diesel and Station Service equipment are installed and undergoing final tests.

3.5 Spillway

- Spillway bays 1 and 5 were in operation at the time of the site visit.
- Rollway construction was in progress in bays 3, 4 and 5 with bay 3 nearing completion.

4. MUSKRAT FALLS GIS – SEPTEMBER 17, 2019

4.1 Gas Insulated Switchyard (GIS) building

- Power equipment installation has been completed.
- Equipment is ready to back feed power to the Powerhouse.

Appendix 1

Site Photographs



Photo A.1: Northerly view along upstream side of concrete structures with reservoir at full pool level.



Photo A.2: Southerly view along upstream side of power intakes with south embankment dam in background.



Photo A.3: Northerly view along north RCC dam.



Photo A.4: Downstream side of north RCC dam. Local areas of minor leakage along base appear to be from water ponded in the flip bucket that is draining through construction joints.



Photo A.5: Downstream view of temporary boom, with no accumulated debris.

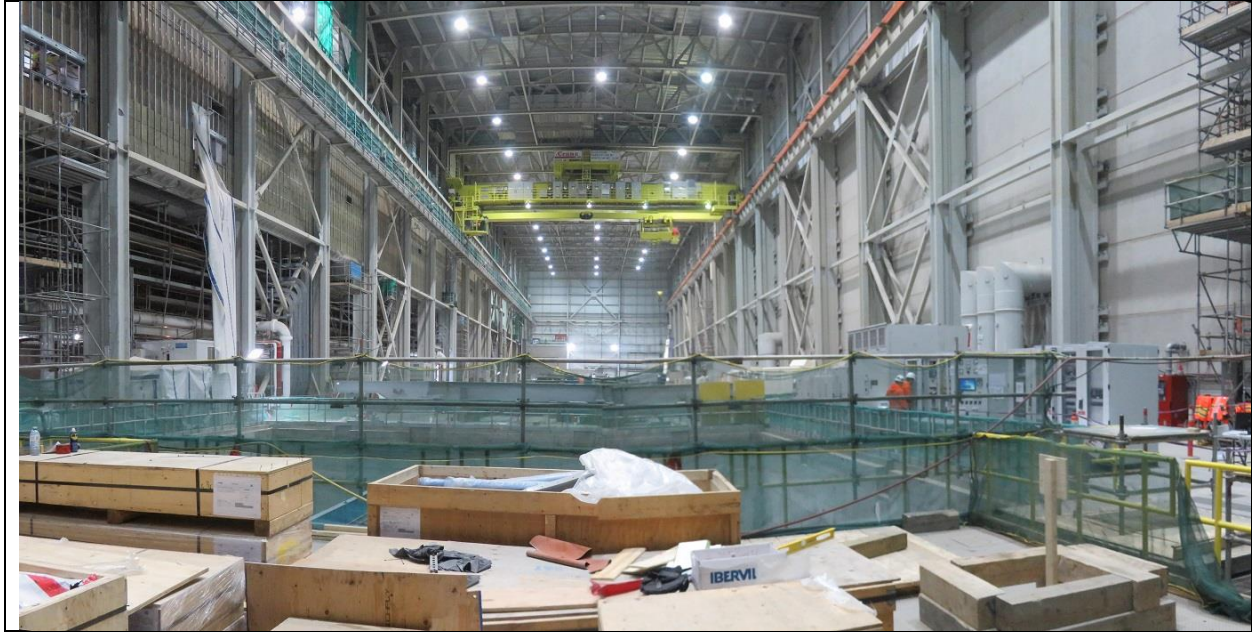


Photo B.1: Powerhouse interior, looking north from service bay. Unit controls and switchboard cabinets are being installed along right side of turbine pits.

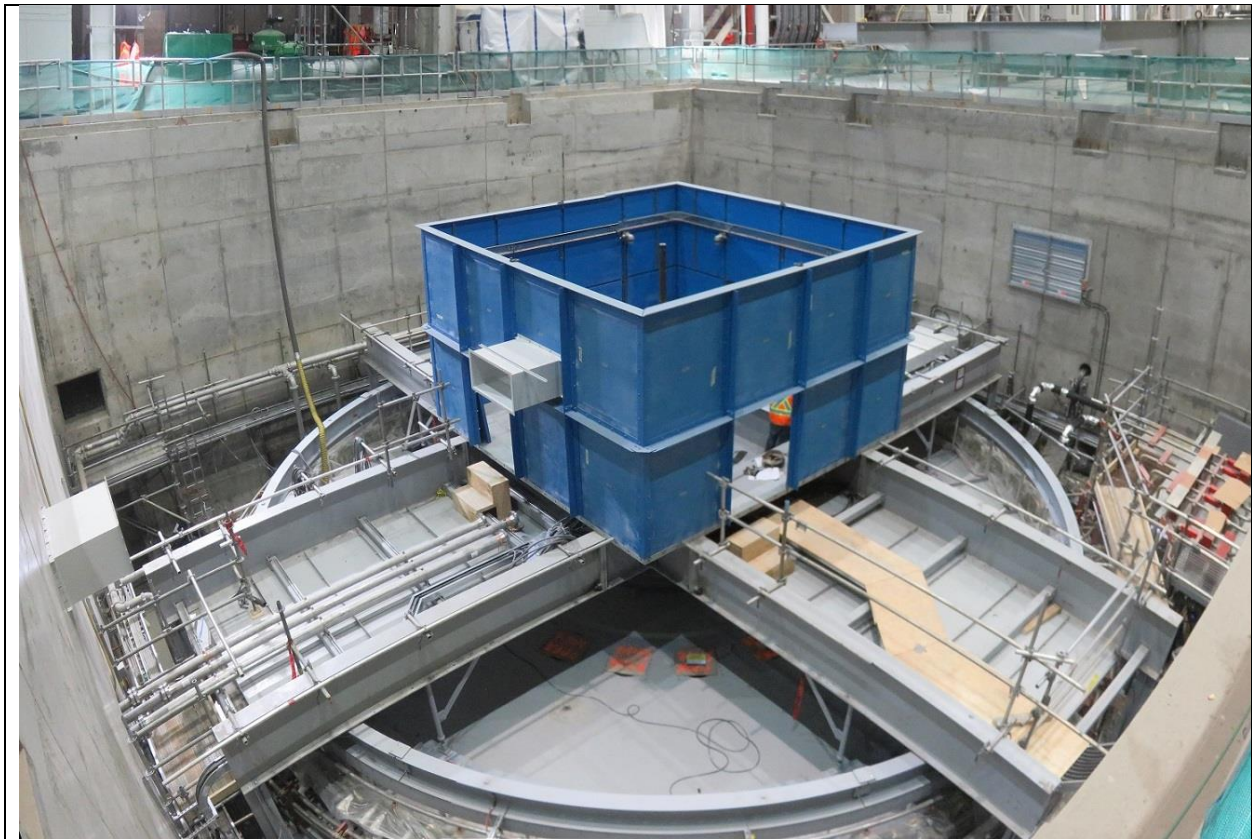


Photo B.2: Unit 1 with upper generator bracket installed.



Photo B.3: Unit 2 with stator winding installation in progress.



Photo B.4: Unit 3, with stator core stacking in progress.



Photo B.5: Unit 4, with partially installed stator frame.



Photo B.6: Protection switchboards.



Photo B.7: Unit control board.

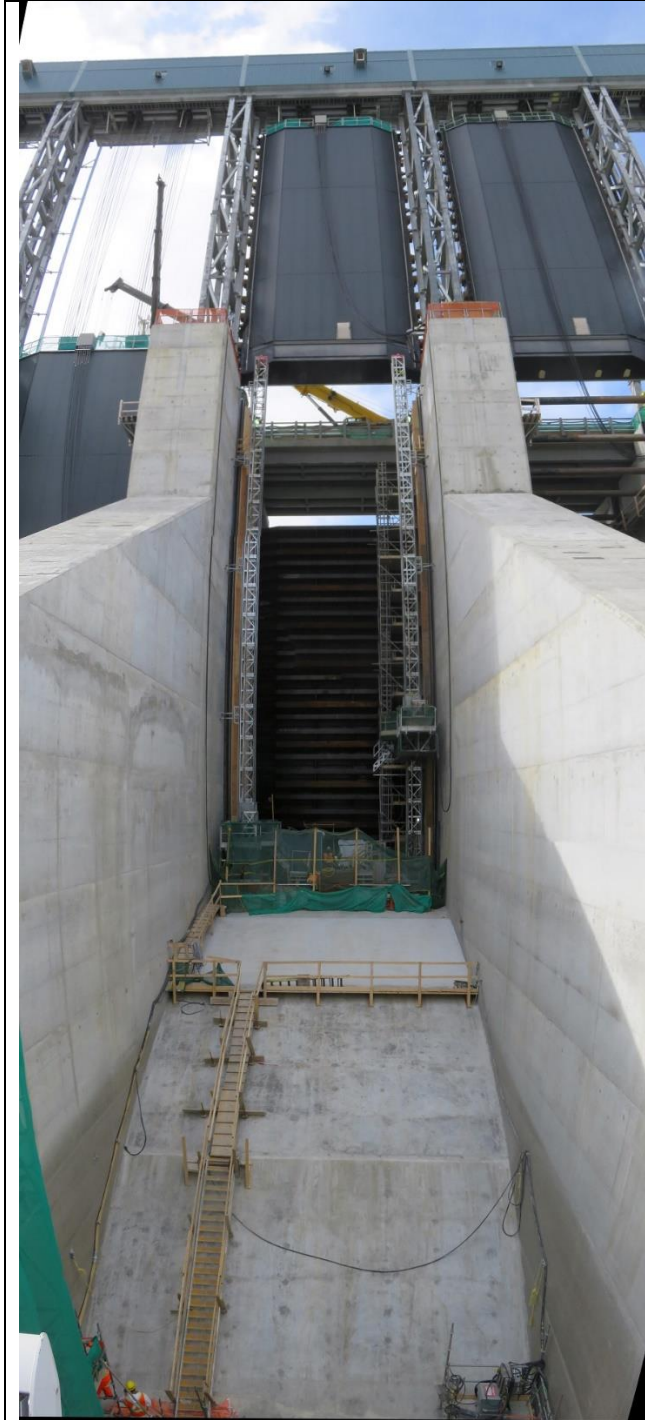


Photo C.1: Upstream view of rollway nearing completion in spillway bay 3.

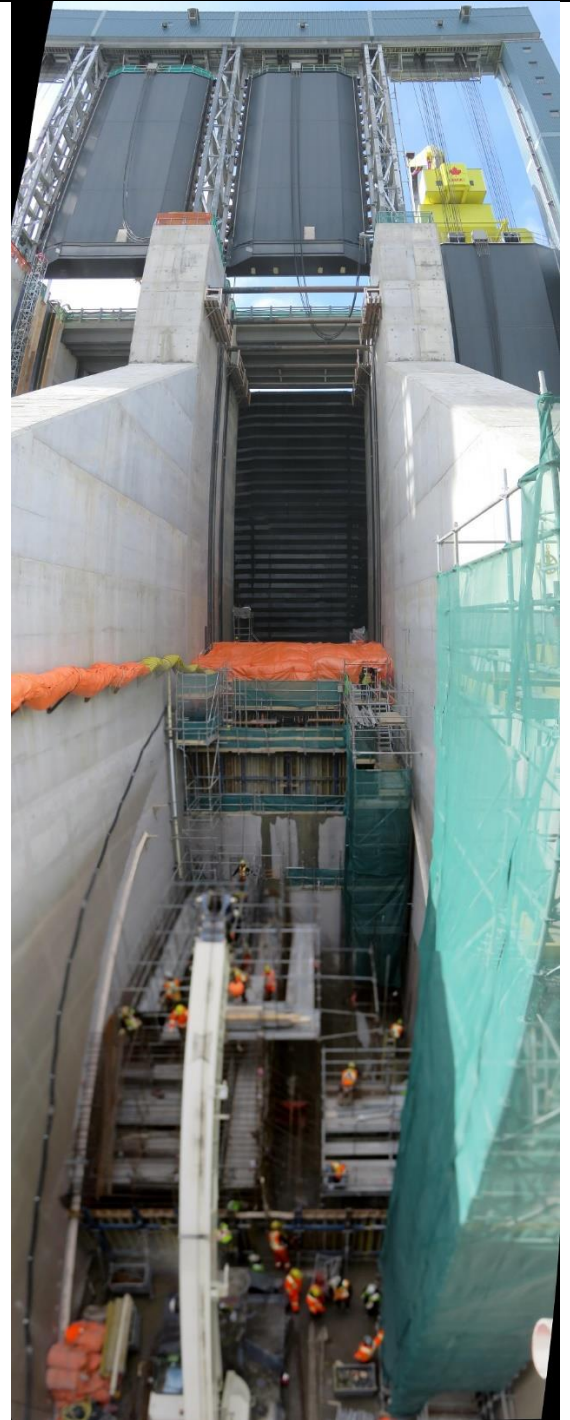


Photo C.2: Upstream view of rollway construction in spillway bay 4.



Photo C.3: Removal of tailrace rock plug in progress.



Photo D.1: Upstream side of North Spur. Collected floating debris is removed from reservoir via the ramp near centre of photo.



Photo D.2: Downstream side of North Spur.