Nalcor Energy – Lower Churchill Project

2019 Annual Report for the Navigable Waters Protection Act Authorization 8200-2013-700011-001

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1 INTRODUCTION

This 2019 Annual Report includes information requested by Transport Canada as part of the Navigable Waters Protection Act Authorization No. 8200-2013-700011-001, and as outlined in Section 11 of the Navigation Mitigation & Monitoring Plan (NMMP). This report will be prepared annually and will include a description of environmental effects monitoring and follow up monitoring and associated reporting conducted during impoundment and the first five years of operations on various aspects related to navigation on the lower Churchill River.

2 ABBREVIATIONS AND ACRONYMS

EA – Environmental Assessment

EIS –Environmental Impact Statement

EEMP – Environmental Effects Monitoring Plan

FSL – Full Supply Level (Reservoir; in metres of elevation)

JRP – Joint Review Panel

LCP – Lower Churchill Project

LSL – Low Supply Level (Reservoir; in metres of elevation)

NMMP – Navigation Mitigation and Monitoring Plan

NWPP – Navigable Waters Protection Program

NWPA – *Navigable Waters Protection Act*

TC – Transport Canada

TSS – Total Suspended Solids

3 BACKGROUND

The creation of the reservoir will have significant impacts to the current river system of the lower Churchill River. The changes are described below.

3.1 ICE FORMATION

The change from a river-based system to a reservoir will have an impact on the thermal regime of the lower Churchill River as it is changed to a deeper, low-velocity reservoir system. The reservoir system will store heat and release warmer water, which results in a time lag and reduction in the variability of water temperatures..

The two primary environmental effects of the Project on the thermal regime will be the introduction of a time lag and a reduction in the variability of water temperatures. The reservoir will form a stable ice cover; however, it is predicted that there will be a 2-week lag delay in the cool down period for ice formation on the reservoirs. It is also predicted that the freeze-up period will also be delayed by two weeks while the ice-break update would occur one week later downstream of the Muskrat Falls facility. This will result in a 1-week increase in the open water season downstream of Muskrat Falls.

Downstream of the reservoir, the start of ice progression from Goose Bay to Muskrat Falls is anticipated to be delayed in the post-impoundment scenario by approximately two weeks.

3.2 CHANGE FROM RIVER TO RESERVOIR SYSTEM

The construction and operation of the dam at Muskrat Falls will change the existing river system into a reservoir system that will be less variable in velocity such as steadies and rapids. Within the reservoir, water velocity will be reduced, and a laminar flow will occur over most of the created reservoir. None of the existing rapids will exist once the dam is operational. The Muskrat Falls reservoir will be relatively slow moving as compared to its current state.

3.3 DOWNSTREAM CHANGES

The Muskrat Falls facility is predicted to intercept Total Suspended Solids (TSS) coming from upstream areas causing the downstream areas to have reduced TSS. The reduction in TSS downstream of Muskrat Falls could lead to increased scour and may induce a shift from the present mildly braided river to a deeper, more consolidated meandering river channel.

The creation of a deeper, more consolidated channel may have navigational impacts on the residents of Mud Lake. There will be reduction of TSS migrating downstream as the reservoir system stabilizes, however, this will likely lead to a new equilibrium of erosion and deposition downstream of the Muskrat Falls facility. A deeper, more consolidated channel will remain navigable but may potentially result in a change in the current navigational patterns.

4 EFFECTS MONITORING

To confirm predictions and ensure successful mitigation of the impacts to navigation, monitoring will be conducted. Monitoring will occur through several programs as outlined below.

4.1 ICE SURVEY PROGRAM

An Ice Survey Program monitoring the formation and break up periods of the lower Churchill River has been occurring since 2013 and will continue for five years into operations. Information from this survey program will be useful to inform residents and river users of potential hazards and navigational impacts. The Ice Formation Environmental Effects Monitoring Plan contains the details regarding this program and is available on the Project website. Table 4-1 provides a list of ice survey program reports and a link to their location on muskratfalls.nalcorenergy.com

Table 4-1: Ice Formation Environmental Effects Monitoring Plan and Reports

Report Title	Website Link to Report
LCP Ice Formation Environmental Effects Monitoring Plan	https://muskratfalls.nalcorenergy.com/wp-content/uploads/2018/03/LCP-Ice-Formation-Environmental-Effects-Monitoring-Plan.pdf
2013/2014 Ice Observation Survey Mud Lake Crossing, Lower Churchill River	https://muskratfalls.nalcorenergy.com/wp-content/uploads/2015/02/2013-14-Ice-Observation-Survey_Mud-Lake-Crossing_REPORT.pdf https://muskratfalls.nalcorenergy.com/wp-content/uploads/2015/02/2013-14-Ice-Observation-Survey_Mud-Lake-Crossing_APPENDIX-A-C.pdf https://muskratfalls.nalcorenergy.com/wp-content/uploads/2015/02/2013-14-Ice-Observation-Survey_Mud-Lake-Crossing_APPENDIX-D.pdf https://muskratfalls.nalcorenergy.com/wp-content/uploads/2015/02/2013-14-Ice-Observation-Survey_Mud-Lake-Crossing_APPENDIX-E-G.pdf
2014/2015 Ice Observation Survey Mud Lake Crossing, Lower Churchill River	https://muskratfalls.nalcorenergy.com/wp-content/uploads/2014/08/ice-2014-15_Web_Report.pdf https://muskratfalls.nalcorenergy.com/wp-content/uploads/2014/08/Ice-

Report Title	Website Link to Report
	2014-15_Web_Report-Appendices-Reduced.pdf
2015/2016 Ice Observation Survey Mud Lake Crossing, Lower Churchill River	https://muskratfalls.nalcorenergy.com/wp-content/uploads/2014/08/2015-2016-Ice-Observation-Survey-V2.pdf
2016/2017 Ice Observation Survey Mud Lake Crossing, Lower Churchill River	https://muskratfalls.nalcorenergy.com/wp-content/uploads/2018/10/2016-2017-Ice-Observation-Survey-1.pdf https://muskratfalls.nalcorenergy.com/wp-content/uploads/2017/10/Appendix-A.pdf https://muskratfalls.nalcorenergy.com/wp-content/uploads/2017/10/Appendix-B.pdf
Lower Churchill River Ice Thickness Survey from Helicopter-mounted Ground Penetration Radar – Interim Report	https://muskratfalls.nalcorenergy.com/wp-content/uploads/2018/03/Lower-Churchill-River-ice-thickness-survey-from-helicopter-mounted-GPR-Interim-Report_.pdf
Lower Churchill River Ice Thickness Survey from Helicopter-mounted Ground Penetration Radar – Final Report	https://muskratfalls.nalcorenergy.com/wp-content/uploads/2018/11/Lower-Churchill-River-Ice-Thickness-Survey-from-Helicopter-mounted-Ground-Penetrating-Radar.pdf
2017/2018 Ice Observation Survey Mud Lake Crossing, Lower Churchill River	https://muskratfalls.nalcorenergy.com/wp-content/uploads/2018/11/2017-2018-Ice-Observation-Survey-Mud-Lake-Crossing-Lower-Churchill-River.pdf https://muskratfalls.nalcorenergy.com/wp-content/uploads/2018/11/2017-2018-Ice-Observation-Survey-Mud-Lake-Crossing-Lower-Churchill-River-Appendix-A.pdf https://muskratfalls.nalcorenergy.com/wp-content/uploads/2018/11/2017-2018-Ice-Observation-Survey-Mud-Lake-Crossing-Lower-Churchill-River-Appendix-B.pdf

4.2 AQUATIC ENVIRONMENTAL EFFECTS MONITORING PROGRAM

Following completion of the Muskrat Falls facility, sedimentation and erosion in the reach downstream of Muskrat Falls will be altered. The Aquatic Environmental Effects Monitoring (EEM) Program focusses on the effects downstream of Muskrat Falls, including bottom scour and shoreline erosion. Bathymetric mapping will also be used to monitor bottom scour, as well as indicate areas of slumping below Muskrat Falls. Table 4-2 provides a list of annual aquatic EEM reports that can be found at muskratfalls.nalcorenergy.com

Table 4-2: Aquatic Environmental Effects Monitoring Program Plan and Reports

Report Title	Website Link to Report
LCP Aquatic Environmental Effects Monitoring Plan	https://muskratfalls.nalcorenergy.com/wp-content/uploads/2014/08/Aquatic-Environmental-Effects-Monitoring-Plan_Jul2014.pdf https://muskratfalls.nalcorenergy.com/wp-content/uploads/2014/08/Aquatic-EEMP_Addendum-to-Figure-2.20.pdf https://muskratfalls.nalcorenergy.com/wp-content/uploads/2014/08/2016-Addendum-Aquatic-EEMP.pdf
Aquatic Environmental Effects Monitoring Program, 1998 to 2017 Baseline Conditions, Muskrat Falls	https://muskratfalls.nalcorenergy.com/wp-content/uploads/2019/03/003-Part-A.pdf https://muskratfalls.nalcorenergy.com/wp-content/uploads/2019/03/003-Part-B.pdf https://muskratfalls.nalcorenergy.com/wp-content/uploads/2019/03/003-Part-C.pdf
Muskrat Falls Aquatic Environmental Effects Monitoring Program, 2018 Annual Data Report	https://muskratfalls.nalcorenergy.com/wp-content/uploads/2019/04/TF13104119.1000-2018-EEM-Annual-Report-March-29-2019-Final.pdf

4.3 STICK-UP ZONES

Stick-up zone locations will be identified and quantified to determine the potential effects on navigation. An analysis will also be completed to determine the effects of ice on stick-up zones during ice formation. The analysis will be completed during the first ice out (2020) and will be reported on in the 2020 Annual Report.

4.4 DEBRIS MANAGEMENT

During the inundation of the reservoir, debris such as branches, may be disturbed and float to the surface, causing obstructions for boaters. Debris will be estimated, and an analysis conducted to determine overall navigational effects. Also, an evaluation of debris management activities and methods, such as specialized marine and land equipment to collect debris, will be conducted.

During 2019, 3,989 m^3 of debris were removed from the reservoir.

4.5 NAVIGATION AROUND FACILITY

Monitoring will be conducted at the Muskrat Falls facility to confirm that the replaced infrastructure is sufficient for river users to allow navigation around the facility. The effectiveness of the portage trail will be reported on in the 2020 Annual Report.

4.6 DOWNSTREAM CHANGES

The Aquatic EEMP, as described in Section 9.2.2, monitors parameters such as flow, velocity, sedimentation and erosion to determine if the downstream effects of the Muskrat Falls facility will significantly affect navigation. Table 4-2 provides a list of the relevant reports and a link to the muskratfalls.nalcorenergy.com website where the plan and reports are available.

5 REFERENCES

Minaskuat. 2009. *Land and Resource Use Baseline Report*.

Nalcor. 2009a *Lower Churchill Hydroelectric Generation Project Environmental Impact Statement – Volume 2A*

Nalcor. 2009b *Reservoir Preparation*. Information request No.148, JRP.

Nalcor. 2009c *Navigation*. Information request No.34, JRP.

Nalcor. 2009d *Navigation (Operation)*. Information request No.36 JRP.

Nalcor. 2009e *Land and Resource Use – Access*. Information request No.72, JRP.

Nalcor. 2014 *Navigation Mitigation and Monitoring Plan.*

Transport Canada, *Technical Analysis of the EIS and Additional Information Documents.* February 21, 2011.