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nalcor energy
LOWER CHURCHILL PROJECT

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INDEPENDENT ENGINEER'S REPORT

LOWER CHURCHILL PROJECT

PHASE I
MUSKRAT FALLS GENERATION
LABRADOR TRANSMISSION ASSETS
LABRADOR-ISLAND TRANSMISSION LINK

DECEMBER 30, 2013

Prepared for:

Government of Canada

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LIST OF ACRONYMS AND ABBREVIATIONS

A	amperes
AACEI	Association for Advancement of Cost Engineering International
AAE	Average Annual Energy
AAQM	ambient air quality monitoring
AC	alternating current
ADSS	all-dielectric self-supporting
AFUDC	allowance for funds used during construction
BC	British Columbia
CEA	Canadian Electricity Association
CEAA	Canadian Environmental Assessment Act
CEPA	Canadian Environmental Protection Act
CF	Churchill Falls
CF(L) Cos	Churchill Falls (Labrador) Companies
CIGRE	International Council on Large Electric Systems
CPI	Consumer Price Index
CPM	Critical Path Method
CWIP	construction work in progress
cms	cubic meters per second
DAFOR	derate adjusted forced outage rate
DAUFOP	derate adjusted utilization forced outage probability
DC	direct current
DFO	Department of Fisheries and Oceans - Canada
DG3	Decision Gate 3
DSCR	debt service coverage ratio
EA	Environmental Assessment
ECC	Energy Control Centre
EEM	environmental effects monitoring
EIS	Environmental Impact Statement
El.	elevation
EPA	Environmental Protection Act
EPC	Engineering, Procurement, and Construction
EPCM	Engineering, Procurement, and Construction Management
FLG	Federal Loan Guarantee
FSL	full surface level
GADS	Generating Availability Data System
Government	Federal government of Canada
GPS	global positioning system
GSU	generator step-up
HADD	harmful alteration, disruption, or destruction
HHRA	human health risk assessment
HVac	High Voltage Alternating Current
HVdc	High Voltage Direct Current
IBA	Impacts and Benefits Agreement
ICBF	incapability factor
IDC	interest during construction
IE	Independent Engineer
IER	Independent Engineer's Report
IFIM	instream flow incremental methodology
IPS	Integrated Project Schedule

LIST OF ACRONYMS AND ABBREVIATIONS (cont'd)

IR	information request
KA	kiloamps
Km	kilometer
kV	kilovolt
LC	letter of credit
LCC	Land Cover Classification
LCP	Lower Churchill Project
LD	liquidated damage
Lease	Water Lease Agreement
LIL	Labrador Island Transmission Link
LNTP	Limited Notice to Proceed
LOA	leave of absence
LRA	liquidity reserve
LTA	Labrador Transmission Assets
LTAP	Labrador Transmission Assets Project
MAF	Mean Annual Flow
MF	Muskrat Falls Generation
MFGS	Muskrat Falls Generating Station
MI	mass-impregnated
ML	Maritime Link
MOF	maintenance outage factor
msl	mean sea level
MVA	megavolt amperes
MVAR	megavolt ampere reactive
MW	megawatt(s)
MWc	megawatts continuous
MWH	MWH Canada, Inc.
MWhour	megawatt hour
NAERC	North American Electric Reliability Corporation
Nalcor	Nalcor Energy
Nalcor/MWH Agreement	agreement between Nalcor and MWH to prepare the IER
NEHRP	National Earthquake Hazards Reduction Program
NLH	Newfoundland and Labrador Hydro
NSPI	Nova Scotia Power, Inc. (owned by Emera)
NWPA	Navigable Water Protection Act
O&M	operations and maintenance
OHGW	overhead ground wire
ONAF	oil filled unit that has natural convection flow in the tank and utilizes has fans added for forced air external cooling
ONAN	oil filled unit that has natural convection flow in the tank and utilizes natural air convection cooling externally
OPGW	optical ground wire
P&C	Protection & Control
P50	50 percent
PGA	peak ground acceleration
PM	project manager
PMF	Probable Maximum Flood
PMI	Project Management Institute

LIST OF ACRONYMS AND ABBREVIATIONS (cont'd)

PMP	Probable Maximum Precipitation
POF	planned outage factor
PSSE	Power System Simulator for Engineering
PSU	practical salinity units
pu	per unit
P-WEPP	Project-Wide Environmental Protection Plan
RCC	roller compacted concrete
RFP	Request for Proposal
SARA	Species at Risk Act
SNC-L	SNC-Lavalin
SOBI	Strait of Belle Isle
SOW	scope of work
TRO	Transmission and Rural Operations
TWH	terra-watt hours
var	volt amperes reactive
VEC	valued environment component
VHF	very high frequency
Vista DSS	Vista Decision Support System
WA	Washington
WBS	work breakdown structure
WMA	Water Management Agreement

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SECTION 1

OVERVIEW OF LOWER CHURCHILL PROJECT

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SECTION 1

OVERVIEW OF LOWER CHURCHILL PROJECT

1.1 INTRODUCTION

The Lower Churchill Project (LCP) is a large, important energy generating and transmission facility of regional and national significance to Newfoundland and Labrador, Nova Scotia, and the federal government of Canada (Government). When completed, the LCP will have a capacity to generate and transmit more than 824 megawatts (MW) of electricity at an initial capital cost of approximately $6.2B.

Figure 1-1 shows the general layout of the individual projects comprising the Lower Churchill Project, which include the following to be developed during Phase 1: Muskrat Falls (MF); Labrador Transmission Assets (LTA); Labrador-Island Link (LIL); and Maritime Link (ML). Phase 2 will include the final LCP to be developed by Nalcor Energy (Nalcor), the Gull Island project. Only the Nalcor projects, MF, LTA, and LIL are discussed in this report.

In November 2012 the Government of Canada, through Her Majesty the Queen in Right of Canada entered into a Federal Loan Guarantee (FLG) with Nalcor, Emera, the Province of Newfoundland and Labrador, and the Province of Nova Scotia to guarantee the Guaranteed Debt of each project (i.e., the MF Generation Facility, LTA, and LIL for Nalcor as the Borrower; and the ML for Emera as the Borrower) to enhance the credit quality of project financing. This FLG Agreement constitutes an absolute, continuing, unconditional and irrevocable guarantee of payment when due of the Guaranteed Debt of each Borrower to the Lenders. Under the terms of the FLG Agreement an Independent Engineer (IE) is to be appointed to assist each Lender and the Guarantor to complete its due diligence and to ensure compliance with the FLG Agreement and other documentation required in order to effect financial closing. Section 9.3 of this IER provides information regarding some of the significant terms of the FLG Agreement related to its applicability to the projects' financial pro forma. A full copy of the FLG Agreement is included herein in Appendix L.

Nalcor selected MWH Canada, Inc. (MWH) as their IE in fulfillment of the above requirement, and also to perform additional review and reporting services pertaining to both construction monitoring and long-term operation monitoring after the LCP has been placed into commercial operation. A Reliance Agreement was entered into by Nalcor, MWH, and Government which allows Government to be a party to the Nalcor/MWH Agreement under the same terms and conditions. MWH has no financial ties to Nalcor or Government aside from the agreement to prepare this report (Nalcor/MWH Agreement). MWH has no fiduciary relationship with other firms involved with the LCP or interest in the sale of bonds to finance the LCP.

The purpose of this report (referred to herein as the IER, or Independent Engineer's Report) is to provide IE's opinions to support the financing of Nalcor's portion of the LCP using long-term bonds that will be guaranteed by Canada's best-in-the-world credit worthiness, rated AAA. To that end, this report presents professional opinions based on information supplied by Nalcor and studies performed by them and their consultants, which was reviewed by the IE that the design is satisfactory, estimated construction and operations costs are reasonable, that the estimated construction schedule is reasonable, and that projected financial results of operations will generate sufficient net revenues to repay the debt, including revenues to meet debt service coverage requirements as well as to properly operate and maintain the LCP facilities.

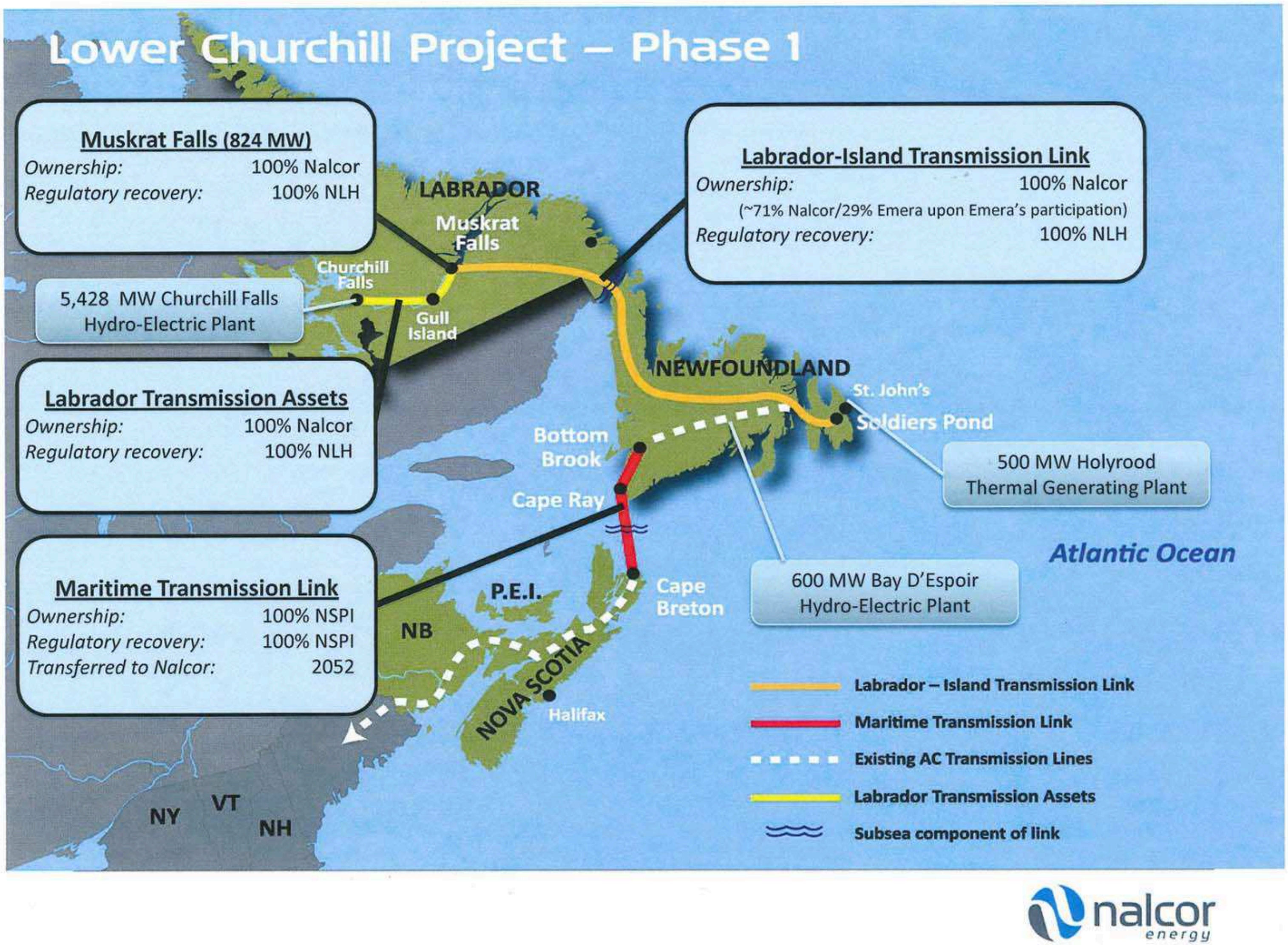

Figure 1-1 Lower Churchill Project – Phase 1 Development

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1.2 PROJECT DATA AND COMMUNICATIONS PROTOCOLS

1.2.1 Contacts

The Nalcor/MWH Agreement was signed on August 27, 2012. A kickoff meeting was held on September 13 and 14, 2012 in St. John's, Newfoundland. Nalcor selected Mr. Lance Clarke, Project Commercial Manager, LCP to be MWH's principal contact during the duration of the IE's review and preparation of the IER. Mr. James Meaney, CFA, General Manager Finance, was also designated as another principal contact. Additionally, Mr. Ross Beckwith, Nalcor's Commercial Coordinator, was also designated as a contact for discussions. Mr. Peter Madden has been the day-to-day contact for MWH. For the Government of Canada, Ms. Alison Manzer, Cassels, Brock & Blackwell, LLP, is the principal contact for day-to-day matters. For all issues pertaining to the Nalcor/MWH Agreement, Mr. Nikolay Argirov, MWH Vice President, has been the principal Nalcor contact. Rey Hokenson is MWH's day-to-day contact and is the project manager (PM) for this assignment.

1.2.2 Project Schedule

The Project Target Milestone Schedule for the preparation and award of the numerous contracts that has been prepared by Nalcor and the Engineering, Procurement, and Construction Management (EPCM) Consultant is given in Appendix A. The IE's Execution Plan has been tailored to accommodate the Project Target Milestone Schedule.

1.3 PROJECT DESCRIPTION

The history of the LCP dates to the early 20th century when it was envisioned that a series of hydroelectric projects would be developed on the Hamilton River (now the Churchill River). During the mid-1960s an earnest effort was made to plan for the development of this valuable resource when Labrador and Newfoundland were in need of power. At that time electricity demand was growing by more than 10 percent per year. The plan was to construct the first project, Churchill Falls, on the Churchill River upstream of the LCP for supplying power to Newfoundland Island in 1972, and then to construct the LCP following completion of the 5,428 MW Churchill Falls Generating Station. The Churchill Falls Project commissioned its first unit in 1971 to supply power to Newfoundland. The Churchill Falls Project provides about 65 percent of the power available from the Churchill River, with the remaining 35 percent coming from two proposed power stations, Gull Island and MF. Muskrat Falls has been sized to provide 824 MW, while Gull Island has been sized to provide 2250 MW.

The first phase of the LCP is to construct a new dam and power station in Labrador at Muskrat Falls; four new 315 kilovolt (kV) high voltage alternating current (HVac) transmission lines between the MF switchyard and Soldiers Pond converter station located West of St. John's, Newfoundland, which includes a subsea crossing of the Strait of Belle Isle (SOBI) (Appendices B, C, and D). Additionally, the MF switchyard will be connected to the Churchill Falls substation and HVdc converter station through an extension of the Churchill Falls yard. A 315 kV high voltage alternating current (HVac) line will be used. The subsections following this general description more fully describe the LCP features and the full description of components of the project is found in Appendix E.

Phase I development also provides for construction by Emera Newfoundland and Labrador (Emera), a large energy and service company based in the northeastern United States and Canada, of a new maritime transmission link between Newfoundland and Nova Scotia employing a 180 kilometer (km)-long subsea cable system that allows LCP power to be used in Nova Scotia. The Emera project is not intended to be included in this review by the IE; it is covered in a separate IER. The second phase of the LCP is construction of Gull Island.

1.3.1 Muskrat Falls Generating Station

The Muskrat Falls Generating Station (MFGS) consists of several primary components: a powerhouse with an integral intake structure; a vertical-gated auxiliary spillway; an overflow service spillway fitted to the north roller compacted concrete (RCC) dam; a south rock-fill embankment dam; a project switchyard; and protective works located in the left abutment (North Spur) to control seepage. The MFGS will be serviced by a new 21-km access road that connects the project to Highway 510, south of the Churchill River bridge crossing and by a road that connects the north abutment area to Highway 500, Trans-Labrador Highway to Churchill Falls. The powerhouse substructure is reinforced concrete with a structural steel superstructure. The reinforced concrete intake structure, integral with the powerhouse, will be fitted with three service gates and three bulkhead gates, located upstream of the service gates, for each of the four intake bays. The installed capacity of the powerhouse will be 824 MW with each of the four generating units rated at 229 megavolt amperes (MVA) with a 0.9 Power Factor at 39 meters net head.

The spillway consists of two components: (1) a reinforced concrete five-bay structure, fitted with 10.5-meter-wide by 22-meter-high vertical lift gates, and (2) a 425-meter-long, ogee-shaped overflow RCC spillway. The spillway sections acting in combination can pass the Probable Maximum Flood (PMF) of 25,060 cubic meters per second (cms) at El. 45.1. The overflow spillway is normally used to pass flows that exceed the powerhouse hydraulic capacity of 2,660 cms.

The protective works located in the left abutment (North Spur) include a slurry wall constructed to bedrock to control seepage from the reservoir and local groundwater, and include shoreline bank protection to prevent erosion from ice heave and abrasion, and wind-induced waves.

The MF powerhouse and switchyard will be connected to the Trans-Labrador Highway by an access road located on the south side of the Churchill River.

1.3.2 Labrador Transmission Assets Project

Near the powerhouse, the MF switchyard will be constructed to transmit power via two 315 kV HVac overhead transmission lines to the 350 kV HVdc converter station. Four feeder lines will be used; two feeders will be connected to the converter transformers and two feeders will connect to the filters. These lines are part of the Labrador Transmission Assets Project (LTAP). Each of these lines is to have a capacity of 900 MW (Appendix F).

The MF switchyard will also connect to the Churchill Falls switchyard that will be extended to accommodate the interconnection from Muskrat Falls to Gull Island. Twin 350 kV HVdc lines between MF and the SOBI will be used. Again, each line will have the capacity of 900 MW that will allow the Muskrat Falls power station entire plant load to be transmitted on one line. The lines will be carried on lattice steel towers with self-supported angles and dead-ends and with guyed suspension towers. Each of the lines will have overhead lightning protection with one being an OPGW for the operations telecommunication system. Two electrode lines between MF and the electrode station will be employed and will also be mounted on the transmission towers. The MF powerhouse step-up transformers will be connected to the switchyard using overhead lines supported on steel lattice towers.

1.3.3 Labrador-Island Link Project (LIL)

The LIL (by Emera) will consist of a converter station located at Muskrat Falls, a transmission link from MF switchyard to the SOBI, a transition station at the Labrador side of the SOBI from the transmission line to a submarine cable, a submarine cable under the SOBI, a transition station on the Newfoundland side of the SOBI from the submarine cable to an overhead transmission line, a transmission line from the SOBI to Soldiers Pond, and a converter terminal station located at Soldiers Pond, west of St. John’s. The transition station (compound) at Shoal Cove will include an enclosed building and provision for the submarine cable termination system and associated switching equipment. Also included will be control, protection, and monitoring and communication equipment within the building (Appendix F).

The converter stations at Muskrat Falls and Soldiers Pond will be designed as automated, remotely controlled facilities. The direct current (DC) system will be a point-to-point +/- 350 kV Land Cover Classification (LCC) bi-pole from Muskrat Falls to Soldiers Pond. During a converter pole outage, the HVdc system will immediately and automatically reconfigure to operate as a monopole, with a metallic return without interruption to the service using sea electrodes installed at Conception Bay.

This project also includes a 350 kV HVdc, 900 MW submarine cable system that will extend from Forteau Point, Labrador to Shoal Cove, Newfoundland across the SOBI. The offshore component will consist of three submarine HVdc mass-impregnated (MI) cables; one of the cables will be used as a spare. Each of the cables will be installed on the seafloor with approximately 150 meters of separation and all within a 500 meter wide by 34 km long corridor. Each of the cables will carry 450 MW with a rated capacity of 100 percent overload for 10 minutes and 50 percent overload for continuous operation. The water depth along the subsea transmission corridor varies between 60 meters to 120 meters. The cables will be protected along the length by a rock berm and the route was selected to avoid iceberg contact. The undersea cables will extend through steel pipe encasements in bored holes to protect the cables in the heavy ice and surf zones. The cables will be trenched underground to a depth of about 2 meters to two transition compounds that will be located approximately 1 km from the land entry locations. The transition compounds contain the cable terminations, switch gear and transition to the overhead line transmission system.

A shoreline pond electrode system will be located on the Labrador side of the SOBI. An electrode system pond will be located on the east side of Conception Bay near Soldiers Pond; the electrode line is 10 km long from Soldiers Pond to Conception Bay. The electrode ponds allow the transmission system to operate as a monopole system if one of the conductors is not functioning.

The switchyard at Soldiers Pond will interconnect eight 230 kV HVac transmission lines (four existing transmission lines looped in), and the synchronous condensers and the Soldiers Pond Converter Station. The upgrade at Soldiers Pond will include three new 175 megavolt ampere reactive (MVAR) high-inertia synchronous condensers, 230 kV and 138 kV circuit breaker replacements, and replacement of conductors and reconstruction of eight transmission lines entering and leaving the switchyard.

Information pertaining to the Maritime Link Transmission Project to be constructed and financed by Emera will be found in a separate report prepared for the Government responsible for its financing.

1.4 REVIEW OF CONSTRUCTION PROGRESS

Presently, there are three construction contracts, which have been under way. The contract dealing with the southerly access road is considered completed. Of the about 21 km of access road to be built, MWH understands that has been completed. Additionally, the Bulk Excavation Contract has also been substantially completed, with demobilization in process. The first scheduled excavation blast occurred during early February 2013. Finally, the main powerhouse contract (CH0007) has been awarded and the selected contractor is currently mobilizing to the project site.

SECTION 2

SITE VISIT

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SECTION 2

SITE VISIT

2.1 SITE VISIT

A site visit was undertaken by MWH. The North Spur and the main MF excavation area were seen.

The representatives of MWH visited and performed general field observations of only the MF project site. The general field observations were visual, above-ground examinations of selected areas which we deemed adequate to comment on the condition of the planned facilities and were not in the detail which would be necessary to reveal conditions with respect to safety; the internal physical conditions of any facilities; or the conformance with agreements, codes, permits, rules, or regulations of any party having jurisdiction with respect to the construction, operation, and maintenance of the properties.

MWH was not made aware if the Environmental Assessment of the lands and rights-of-way associated with the projects has been performed to assess the potential for finding hazardous materials on the MF site or other project sites.

2.2 GENERAL

Two members of MWH, as part of the IE's team, attended a project briefing and participated in a site visit to the MF project during September 24-26, 2013. The project briefing was carried out by project designers and supervisory staff in the SNC-Lavalin (SNC-L)/Nalcor project offices in St. John's on September 24, 2013. SNC-L has an EPCM Agreement with Nalcor and currently is providing the design services for MF. The date of the EPCM Agreement is February 2011. SNC-L works with Nalcor in an Integrated Project Team to manage this project. (Refer to Section 4.) The briefing presentations covered the main aspects of the safety programs, geotechnical and civil design, field conditions, and site facilities and construction progress of the powerhouse and spillway excavations, as well as cofferdam construction.

Site visits to the MF project were made on September 25 and 26, 2013. The site visit included tours of the North Spur, cofferdams, spillway, and powerhouse/tailrace channels and the project infrastructure sites. Most of the project construction work viewed was being completed as part of ongoing work associated with Contract CH0006 (Bulk Excavation). These visits were guided by Nalcor and SNC-L. Separate discussions were held about blasting, geology, and rock slope stability with the project geology/geotechnical engineering team.

Principal observations and comments on the active geotechnical and civil construction and design works are presented in the following subsections. Photographs taken during the site visit are included in Appendix G[1].

2.3 NORTH SPUR

2.3.1 General

The North Spur is a 1000 m long, 500 m wide and 45 m to 60 m high ridge that connects the MF rock knoll to the north bank of the river (Photograph 3). When the reservoir is impounded this feature will form a natural dam and become a major part of the river impoundment. At the Spur location, the soil stratigraphy can be summarized as follows:

- 10-15 m of fine-to-medium sand deposit
- 30-40 m of stratified intermediate sandy-silt and upper sensitive clay deposit
- 50-60 m of lower non-sensitive clay deposit
- Up to 200 m sandy-gravely-silty lower aquifer deposit

The upstream and downstream slopes of this feature are subject to ongoing river erosion and mass wasting. This has contributed to local slope over-steepening of the slope, which triggers rotational sliding on both the downstream and upstream sides of the spur. Past studies indicate multiple small to large slide events have occurred during the recent centuries. A significant landslide took place on downstream slope of the North Spur in 1978 (Photographs 4 and 5). During 1980 it was determined that the natural mass wasting processes, could be arrested by controlling the water table with a pumped well system. A line of pumped wells was installed in the center of the spur in 1981 and continues to operate to present times.

2.3.2 Site Visit Observations

A brief site visit was made on September 25 to the plateau on top (Photograph 4) and the scarp of the 1978 slide (Photograph 5). The drilled wells were viewed and found to be in good condition. These wells are currently in operation. The slide is covered with vegetation, which indicates no significant activity for at least the past 25 years. As can be seen in photos, fine to medium sand is exposed in the crest of the slide scar. Large tilted and eroded blocks of cohesive soil could be seen at the toe (Photograph 6), adjacent to the river shoreline.

2.3.3 Stabilization Works

After reservoir impoundment, long term seepage and slope stability characteristics of the spur should be similar to a modern dam. Measures are needed to (a) control piezometric levels, (b) control seepage across the weir, and (c) stabilize the upstream and downstream slopes. The following measures are planned:

[1] All photographs referenced in the following sections are contained in Appendix G.

- Flatten both the upstream and downstream slopes to increase the overall safety factor against sliding failures.

- Rockfill and riprap slope erosion protection will be placed on all areas of the upstream and downstream slopes. Stabilizing fill will be placed in selected areas of the downstream slope to improve local toe stability and reduce potential for retrogressive failures in sensitive marine clays of the Upper Clay unit.

- Construct an impervious fill blanket at the upstream slope and install a cut-off wall at the base of the blanket. This combined barrier will block water seepage into the spur from the reservoir. The cut-off wall (plastic cement slurry wall) will be connected to the impervious lower clay formation that extends beneath the river level.

- Construct a second cut-off wall across the north end of the spur to cut off seepage from the high ground north of the river. The upstream end of this wall will be connected to the cutoff wall of the upstream slope

- Construct toe relief drains and a major drainage trench for further lowering of the water table.

- Carry out long term monitoring of the piezometric conditions within the spur during operation of the reservoir. It is planned to augment the existing network of 29 piezometers with 15 additional ones. All piezometers will be instrumented with electronic sensors. Data will be recorded on a continuous basis and transmitted to Nalcor's headquarters in St John's.

Current plans are to continue operation of the dewatering wells for about two years after the reservoir is impounded. The situation will be studied during that time and, if warranted by piezometric conditions, the dewatering system may eventually be discontinued.

2.3.4 Comments

The stabilization works have been designed in accordance with currently accepted geotechnical design practices and will effectively stabilize the north spur when the reservoir is impounded. The upstream impervious blanket and the plastic cement slurry cut-off walls will control seepage and piezometric levels in the spur. Slope flattening excavations and the placement of lower slope weighting berms will enhance slope stability. Erosion control blankets of rockfill and rip rap will be placed on the upstream and downstream slopes to prevent natural erosion that would contribute to slope degradation and instability over time. The planned long term monitoring program is an important component of the works which will ensure safe operation of the reservoir and detect on a timely basis any anomalous behavior that may affect safe operations.

The IE has reviewed various aspects of the geotechnical designs and planned works. Detailed and rigorous investigations and laboratory testing of samples have provides accurate geotechnical and hydrogeological data. Limit Equilibrium stability analyses have been carried out for the final slopes by the design team. Various materials assessments have been performed to determine gradations of the various fill materials that will be used. These works have been augmented by a seismicity study, 2D seepage analysis and reservoir landslide generated wave height studies. All of this work has been carried out to a high standard.

Geotechnical design work is currently being performed and the final design report has not yet been issued. The recently issued "Cold Eye Review of Design and Technical Specifications, North Spur Stabilization Works" (Cold Eye) by Hatch has indicated that, among other things, additional investigations and analyses are recommended to further enhance the design parameters for the sensitive clays and the overall seepage analysis assessment of the spur. The recommended work includes further investigations of the properties of the sensitive clays with respect to cyclic softening, more detailed stability analyses to assess the impact of earthquake ground motions and further seepage analyses. The IE was advised that Nalcor is following the recommendations provided by the Cold Eye reviewers. The IE has not yet been advised of details of the planned work.

The IE agrees with the Cold Eye recommendations and understands that work is proceeding on them. This supplementary work will further enhance confidence in the current design and should not result in any significant modifications to the planned work.

2.4 COFFERDAMS

2.4.1 General

Construction work was in progress on the RCC cofferdam (Photographs 7, 8, and 9) and on fill cofferdams No. 1 and No. 2 (Photographs 10 and 11). At the time of the site visit, the RCC cofferdam was approximately 40 to 50 percent complete and the fill cofferdams were about 20 percent complete. These structures were scheduled for completion by the first week of November, 2013. The RCC structure has reportedly now been completed as of October 31, 2013. A discussion of these structures is given in the following sections.

2.4.2 RCC Cofferdam

The RCC cofferdam was well advanced at the time of the site visit as can be seen in the photographs. As decided by the contractor, this structure was constructed in three separate sections, which have been joined together into one continuous structure. Photographs 7 and 8 show the upper levels being formed in layers with wooden formworks.

The RCC properties are judged to be satisfactory and detailing of the structures is satisfactory. It is understood that the RCC mixture currently being used has a 28-day strength of 12 MPa. The tops of the two higher sections are still a few meters below the planned crest level of El. 21 m for this phase of the work.

Photographs 9a, 9b, and 9c show details of the pre-formed vertical joints (contraction joints). These joints were constructed by inserting plastic sheeting into the RCC at every other lift that will perform as joint initiators. As can be seen in Photograph 9c, water-stops were installed at the upstream end of each joint to reduce leakage, which is typical for this type of construction.

2.4.2.1 Aggregate Production and Concrete Production

The crushers and screeners are located in the west end of Laydown Area A. The batch plant is located in the west end of Laydown Area B. Haul trucks transported aggregates from the crusher to Laydown Area B for stockpiling west of the batch plant. The three required aggregate sizes produced as per RCC mix design requirements were: group 1 (0-10 mm), group 2 (10-20 mm), and group 3 (20-40 mm). The aggregates were separated into stockpiles based on their respective group.

Aggregates were produced by crushing rock provided from the powerhouse and spillway excavation. The crusher set-up includes a Primary Jaw crusher, a Cone crusher, an Oval Stroke Screen deck, and a Vibrating Grizzly Feeder. A diesel generator CAT C15 ATAAC of 725 kW provided power to the crusher. Dust suppression operations for the crusher required the use of a water tank that provided up to 2000L of water over 24 hours of operation. One CAT 980H loader was used to take aggregates from the belts and load trucks. One CAT 988H loader was used to feed the crusher jaw. Three types of aggregates were produced simultaneously at an average rate of 3000t per shift. Average daily production time was 20 hours (2 x 10 hour shifts).

The concrete batch plant produced RCC as well as conventional ready-mix type concrete for Dental, Bedding, Dry pack and Grout for GERCC. The concrete batch plant consists of: an RCC batch plant, a mobile silo, an aggregates and cement feeder, and four horizontal silos (cement pigs) for a total of 650t. A diesel generator CAT C15 ATAAC of 500 kW provided power to the batch plant. One CAT 950G loader was used to feed the batch plant with aggregates. Two ready-mix trucks were used to transport the Conventional Concrete. A water tank with enough capacity to ensure a 20 hour production was set up near the batch plant. The batch plant has the necessary set-up for discharging into ready-mix trucks as well as into rock trucks. RCC was transported from the batch plant to the point of placement in CAT 740 articulated haul trucks and 769 CAT rigid frame trucks.

2.4.3 Embankment Cofferdams

Fill was being placed for Cofferdam No. 2, near the downstream end of the RCC cofferdam and at Cofferdam No. 1 at the upstream end. The impervious core consists of compacted grey, silty-sand till. Pit-run sandy gravel is being placed in the upstream transition zone and blasted rockfill is used in the upstream and downstream shell. The rock fill consists of equal-dimensional, sound gneiss particles. As can be seen in the photographs, the zoning of the dam is well-controlled laterally and vertically. Visually, the fill properties are satisfactory and appropriate compaction methods are being employed in MWH's opinion.

2.5 POWERHOUSE/TAILRACE AND SPILLWAY EXCAVATIONS

2.5.1 General

Excavation of the power intake/powerhouse/tailrace channel is more than 85 percent complete, according to Nalcor. Blasting of the spillway channel is completed, although the downstream end has not yet been mucked. These works are generally on schedule and the powerhouse/tailrace channel was planned to be substantially completed by the end of October 2013. Photographs 2 to 19 show various aspects of the powerhouse/tailrace excavation and some details of the spillway excavation are shown in Photographs 20 to 23. Groundwater inflow into the two major excavations is very low and easily handled by part time pumping.

2.5.2 Rock Conditions – General Description

The excavations are in granitic gneiss bedrock. The rock is very strong, competent, and generally fresh and has a gneissic foliation that is inclined towards the south. There is a distinct color layering parallel to the foliation (Photographs 13, 14, and 15). In slightly weathered rock (right abutment) near the ground surface (approximately 3 to 5 m depth below the top of rock), these layers are relatively loose and give the rock a slabby appearance. At depth, the effect of this fabric is less distinct and the rock mass has a more homogeneous, massive character. The gneiss is intruded by a number of very strong, crystalline granite dykes and veins (Photograph 19). A number of thin (10 to 30 cm wide) schistose to homogeneous amphibolite layers can be seen in the south wall of the spillway (Photographs 20 and 21) and in other locations of the excavations. Some of these layers form distinct weakness planes of soft, fissile material that extend for 50 m or more along the excavation walls.

The rock mass is broken by a few sets of discontinuities. Site geologists have identified three prevalent joint sets that are developed throughout both excavations:

Set No.	Dip/Dip Dir. (deg)
S1	32/184
S3	51/077
S4	80/303

Discontinuity set S1 is generally parallel to foliation. Individual S1 joint planes can run for 50 m or more in some cases. Sets S3 and S4 cut across the foliation and persist for lengths of up to 10 or 15 m in many areas. Other secondary joint sets are developed at a number of locations. Joint spacing generally varies from 10 cm to more than 100 cm. Joint surfaces are generally planar to slightly wavy and slightly rough. Some altered surfaces were noted but silt/clay infillings appear to be rare.

2.5.3 Powerhouse and Spillway Channels Blasting

Blasting for rock excavations is being carried out in a competent fashion in MWH's opinion. Careful, controlled blasting techniques (no explosives in the control line holes) are used in the concrete structures areas (Photographs 13, 15, and 18a). Presplit blasting is employed to form final walls in the open channels of the tailrace, intake, and spillway (Photographs 13, 16, and 18a). General characteristics are as follows:

- All holes and faces are vertical
- In open channel areas there is a 0.75 m wide bench every 10 m vertical distance
- In the line drilled concrete structures areas there is a 0.75 m bench every 20 m vertical distance
- Powder factor ranges from about 0.8 to about 1.1 kg/m^3
- Vibration monitoring is carried out for all blasts

Blast hole spacing and loading vary depending upon location. However, the site staff personnel indicate these typical patterns apply, as given in Table 2-1:

Table 2-1

TYPICAL BLAST PATTERNS (varies from location to location)

Blast Hole Type		**Line Drilled Areas (Concrete Structure Areas)**	**Presplit Blasted Faces (Open Channel Areas)**
Control Line Holes		Unloaded 6.5 in. holes, spaced 240 mm co; 20 m deep	Lightly loaded 3.5 in. holes spaced 750 mm cc; 10 m deep
Buffer Holes	First row	Lightly loaded 3.5 in. holes, burden of 0.75 m from presplit line, spacing 1.5 m cc	Lightly loaded 3.5 in. holes, burden of 0.75 to 1.0 m from presplit line, spacing 1.5 m cc
	Second row	Not applicable	Lightly loaded 4.5 in. holes, burden of 1.5 m to 2.5 m from presplit holes, spacing 2.5 m
Production Holes		6.5 in. holes, located 1.5 m from buffer row Blast hole spacing varies from 4.50 x 4.50 m to 4.75 x 4.75 m	6.5 in. holes, spaced 3.00 m burden from buffer row Blast hole spacing varies from 4.50 x 4.50 m to 4.75 to 4.75 m

During the site visit, MWH observed that:

- Most of the line-drilled walls have about 85 percent to 95 percent half-barrel traces and overbreak is minimal (Photographs 15, 16, and 18b).
- The presplit walls are also very good with an estimated 75 percent to 90 percent half-barrel traces (Photographs 16, 17, 18b, and 20). Photograph 16 shows a good comparison between line-drilled and presplit blasted faces at the same location.

- No significant rock mass blast damage (i.e., cracking, block loosening, etc.) could be seen in any of the walls.

- A few areas of localized overbreak were noted in the walls of the spillway and powerhouse/tailrace excavations. For example, a few of the areas of shallow overbreak can be seen in the line-drilled lower north slope of the powerhouse excavation in Photograph 15. Photograph 16 shows detail of an overbreak feature in the presplit wall on the north side of the tailrace excavation. Photograph 19 shows localized overbreak on an outside corner on the south side of the powerhouse excavation. In almost all cases, the overbreak is triggered by shallow block sliding or toppling along natural discontinuities adjacent the face. None of these features are serious concerns but they serve to show the influence of natural discontinuities on the blasting results.

- Observations made during the site visit indicate that the blasting program is well executed and the amount of overbreak is well within the normal standard for this type of work. It is noted that the use of line drilling for the final face control in the concrete structure areas, is very conservative for a rock mass of this quality.

2.5.4 Slope Stability and Rock Support

The rock mass contains numerous natural discontinuities that can trigger block sliding and rock falls in the vertical rock faces. These failures are preventable if the hazardous features are identified on a timely basis and supported with appropriate rock support, usually rock bolts.

The SNC-L site geologists have prepared detailed geology maps of all permanent rock faces on a blast-by-blast basis. The mapping is used in the slope stability analyses and as input for rock support design of permanent rock faces. Based on records observed on September 26 in the site office, the site geological and geotechnical work is being performed to a high standard, in MWH's opinion.

The intent of slope and rock support designs is to ensure permanent slope stability in the areas of the concrete structures and the open channels. In the area of the concrete structures, all rock loads are to be taken up by the rock support and none will act on the various concrete structures. Numerous rock bolts have been installed to stabilize the rock faces. It is understood that pattern rock bolts, have been installed throughout the concrete structure areas as well as in some areas of the open cut spillway and tailrace channels. Spot bolting has been installed in other areas to stabilize individual geological features. Rock bolts are fully grouted, tensioned hollow core assemblages. Bolt lengths of 4m, 6m and 9m have been used and pattern rock bolts spacing varies from 2m x 2m to 3m x 3m.

Wire mesh has been draped over all vertical rock faces as a safety measure. This will be removed at the completion of the project. The rock bolts are visible in some areas but the wire mesh makes it difficult see all of the areas which have been rock bolted.

A review of the excavations and the geology indicates the following as given in Table 2-2:

Table 2-2

GEOLOGY SUMMARY

Location	Description
North Walls	The North Walls of the Spillway and Powerhouse/Tailrace excavations, which are undercut by the south dipping S1 foliation joints, are susceptible to block sliding (see shallow block sliding along S1 joint planes in Photographs 15 and 16). There is potential for relatively deep seated sliding along north wall S1 planes. The project designers and on-site geotechnical staff have evaluated this slope on a blast by blast basis. Rock bolts, both pattern support and spot bolting, have been installed as required and no deep seated or shallow instability was obvious.
South Walls	The jointing in the South Walls is generally favorable for overall South Wall stability. However there have been some very shallow rock fallouts along steeply inclined to vertical joints in this wall (see Photographs 18b and 19). Despite this, however, there appears to be very low potential for deep seated sliding along the south walls. Pattern and spot rock bolts have been installed to stabilize the face in many areas.
East Facing Faces	The S3 joint set, which is inclined 51 degrees towards the east, undercuts and destabilizes east facing rock faces. To date no permanent east facing slopes have been cut but this joint set is prominently displayed in temporary excavations. There is concern for the upcoming excavation of the bull noses between the generator units. Sliding along J3 joints could cause significant overbreak in this area if it is not controlled. Temporary pre-support, in the form of vertical dowels will be installed before excavation is carried out to preserve the integrity of these features. Permanent support, consisting of tensioned, grouted rock bolts will be installed sub-horizontally once the rock faces have been exposed. This is a sound plan, provided it is combined with very carefully executed blasting in MWH's opinion.
Foundation Base of Concrete Structures	Foundation conditions for water retaining concrete structures in the powerhouse intake and spillway channel are good. The rock mass is strong and the shear strength of concrete/rock interface will be high. The geological mapping indicates that no systematic sets of sub-horizontal discontinuities are present. This was verified by observations made during the September 25-26 site visits. This observation indicates that there is very little likelihood for the presence of rock mass sliding planes below the foundations of the structures. In our opinion, this should be verified by geological inspections of the final foundations.

The slope control program appears to be satisfactory. However details of rock support design could not be reviewed during the September 25-26 site visit because of limited time. Additionally, the exact extent of rock bolting in the excavation walls was not clear to MWH. The site staff do not have a single plan showing areas of pattern bolting and spot bolting, nor is there a single document summarizing rock bolt patterns and support loads for various areas, as is normal for a project of this scope. All of this information is available on individual blast faces maps and data sheets, but no compilation has been done. Thus it is not possible to comment on whether sufficient rock support has been installed. In MWH's opinion, this compilation should be performed.

Visual inspections of the rock faces during the September 25-26 site visit were impeded by the ubiquitous wire mesh on the rock faces. This mesh obscures the face and makes it difficult to determine where pattern rock support was installed. It appears that the entire areas of the concrete structures are supported by pattern rock bolts (yellow and red painted bolt heads as seen in Photographs 18 and 19). However, MWH was unable to visually determine the extent of rock bolting in much of the tailrace channel. In particular, the extent of pattern bolting in the high north face of the tailrace could not be assessed visually. Theoretically, the North Face should require more support because of the prevalent J1 joints. This could not be confirmed during the site visit and there was insufficient time to go through the rock support and face mapping records present on site.

2.5.5 Erosion of Unlined Spillway Channel

It is understood that flow velocities in the final Spillway channel will be over 20 m/s. This level of flow can cause serious erosion in the rock mass of an unlined spillway if the rock mass has insufficient resistance to erosion. Erosion hazard is more influenced by the properties of the discontinuities than by the strength of the rock material.

The project designers plan to install a concrete lining in the upstream end of the channel, downstream of the gate structures. Most of the downstream end of the spillway channel has not yet been excavated and rock mass conditions have not yet been determined in this area. To date, no decision has been made to line the downstream area pending exposure and evaluation of the rock mass in this area. Geological site staff intend to carry out an engineering geology rock mass evaluation of the excavation once the lower benches have been excavated to allow completion of the geologic mapping. This work will include an assessment of the Annandale Erodibility Index and computations of scour potential. Appropriate concrete lining will be designed and constructed if required. The IE endorses this approach.

2.6 RIVER DIVERSION

River closure is scheduled to take place in 2016. During the construction of the RCC overflow spillway, the Churchill River will be diverted through the gated spillway. For this purpose, the five bays of the gated spillway will initially be constructed without rollways and the gates will be closing on an invert set at El. 5.0 m. The river will be closed by groins built with rock from the excavation and selected material designed to withstand the river flow velocities. The optimum river closure sequence should correspond, to the extent practicable, to the size of the rock that is available on the site.

A closure scheme of two parallel groins has been selected. The scheme has been studied with a physical model at the NHC laboratory in Edmonton, Alberta (Patarroyo et al, 2013). The results of this study have been used to calibrate a numerical model which could then be used to understand the implications of any changes to the location and alignment of the cofferdam as the design is finalized.

The closure will use rock from the Bulk Excavation. The studies have identified the sizes and quantities of rock that would be required so that the contractor could be directed to stockpile this rock for use later in the Project.

MWH requested further information from Nalcor on the sizes of rock required for river closure and was supplied the following information:

- Dump Rockfill corresponds to an average size block (D50) of 200 mm;
- Class 1 material corresponds to D50 of 500mm with gradation of 300-1,000 mm;
- Class 2 material corresponds to D50 of 1,100 mm with gradation 1,000-1,200 mm; and
- Class 3 material corresponds to Dmin of 1,300 mm.

The river closure will take place following the passage of the spring freshet when the flow in the river falls to1800 m^3/s or lower. This means that most likely closure cannot begin until July. As soon as closure is complete, the upstream groin will be raised by 2 m to provide protection against the 1/20 summer/fall flood which could occur during the completion of the construction. The cofferdam must be completely finished by the end of October 2016, to allow for impoundment of the diversion head pond to El 25 m prior to the start of freeze up in order to facilitate the creation of a stable thermal ice cover, and therefore, reduce the risk of frazil ice accumulation and downstream ice damming.

2.7 CIVIL DESIGN ASPECTS

As noted previously, the MWH team that visited the Project site did not have the opportunity to visit many of the other sites of the three projects, other than at MF. MWH requested photographs of areas of the projects that depict some of the work that has been ongoing since construction started at the Project.

Of particular interest was the two marshaling yards where materials will be received by Nalcor and stored for contractors until the material are released to the contractors. MWH was advised that Nalcor has re-assessed the size of the yards and has increased both yards to better accommodate the materials that are expected to be stored in the yard prior to award of the construction contracts and the loading and unloading activities. Photographs of both marshaling yards have been included in Appendix G to give the reader a clear impression of the size of the yards and the preparation efforts to prepare a level, well-drained surface that have been ongoing for several months.

Photographs were also received of the site preparation that has started on preparing the Soldiers Pond Station area for project structures. Additionally, the Shoal Cove Station area photos showing ongoing work were reviewed. These photos were not included with this report since they are general in nature and lack descriptive titles and a photo location map. Photographs were also received of right-of-way clearing for portions of the transmission lines. Clear-cutting of all vegetation is observable for the line that parallels the existing line. These photographs were also not included with this report, but are available from Nalcor.

Nalcor advised the MWH team that work is progressing well for site preparation and they did not report any issues of a general nature or a specific nature that have occurred to date.

2.8 INFRASTRUCTURE SUMMARY OBSERVATIONS

The following observations pertaining to the project's infrastructure are furnished based on MWH's observations:

- Site camps and infrastructure are adequate to handle the planned construction works.
- The camp conditions, with only 300 beds, were very tight at the time of the site visit. However new camp facilities are being constructed and there will be accommodations for almost 1,000 persons by November 2013. We have subsequently been advised by Nalcor that this work will be completed by January 1, 2014.
- Roads are generally good, and are up the normal standard for a hydroelectric construction site.

The following observations pertaining to the project schedule are as follows:

- Schedule achievements to-date are considered satisfactory.
- Construction work will continue throughout the winter periods.
- MFGS major works (CH0007) will be covered by large weatherproof shelters to enhance civil works construction during winter conditions.

2.9 INFRASTRUCTURE GENERAL OBSERVATIONS

Observations made during the September 2013 site visit by the MWH Team members are summarized below:

- The planned North Spur remediation measures, as presented by design staff in St. John's during the site visit, are appropriate to stabilize the slopes, arrest natural mass wasting and to control seepage and piezometric pressures after impoundment of the reservoir.

- Cofferdam construction is proceeding satisfactorily. Work on the RCC and Fill cofferdams, as viewed during the site visit, show satisfactory work by the contractor and supervisory staff that appears to exceed usual practice.

- The large rock excavations for the Powerhouse/Tailrace and the Spillway channels are more than 90 percent complete. The blasting quality exceeds normal practice, in MWH's opinion. The line drilled and pre-spit permanent faces have very little overbreak and blasting damage is minimal.

- The final rock slopes have been supported by rock bolts in many areas. The design intends that all permanent rock slopes have long term stability against rock falls and sliding failures. In particular, no rock loads will be carried by concrete structures. In general, pattern rock bolts have been installed in the areas of the concrete structures and in much of the open channels.

- Foundation conditions for water-retaining concrete structures in the Powerhouse, Intake, and Spillway channel appear to be satisfactory. The rock mass is strong and the shear strength of concrete/rock interface is expected to be high, in MWH's opinion. The geological mapping to date indicates that no systematic sets of sub-horizontal discontinuities are present.

- Due to high flow velocities that are projected to occur during the operation of the spillway channel, the potential for rock erosion is high and will require mitigation. Nalcor has decided to install a concrete lining in the upstream end of the channel, but the decision for the downstream channel will be decided when the rock, which is presently covered by blasted muck, can be inspected. It is intended to classify the rock with the Annandale erodibility index. This procedure is a useful tool for assisting in the decision to line the channel.

- Site camps and infrastructure appear to be adequate to handle the planned construction works. The camp conditions, with only 300 beds, were very tight at the time of the site visit. However, additional camp facilities are being constructed and there will be accommodations for almost 1,000 persons by November 2013 (January 1, 2014, the camp work will be completed to accommodate the planned 1,000 persons). Roads are generally satisfactory, and are generally up the normal standard for a hydroelectric construction site.

- Schedule achievements are satisfactory. Construction work will continue throughout the winter. The major works will be covered by large weatherproof shelters to civil works construction during winter conditions.

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SECTION 3

PROJECT DESIGN AND PROJECTED PERFORMANCE

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SECTION 3

PROJECT DESIGN AND PROJECTED PERFORMANCE

3.1 PROJECTED PROJECT PERFORMANCE

In the following paragraphs of this section we have included our comments based on the review of the information furnished to MWH that summarizes our observations to date (December 2013). Additional information has been requested of Nalcor to allow us to complete our review and to allow us to form our final opinions pertaining to some of the subjects included herein. Award of some major contracts was still pending at the time this IER was published. However, in our opinion, the expected project performance can be achieved assuming the Integrated Project Team (IPT) continues to closely manage the projects and proactively mitigates presented constraints and risks.

3.2 PROJECT HYDROLOGY

3.2.1 Spillway Design Flood

For high hazard potential critical structures where loss of life and substantial damage would occur if a dam breach occurred during a flood event or a sunny day event[2], international standards and those of Canada required that the spillway be designed to pass the Probable Maximum Flood (PMF). This flood is derived using stochastic methods that estimate the Probable Maximum Precipitation (PMP) in the watershed and then apply this precipitation to the watershed to derive the runoff associated with the PMF. Consultants involved in this effort found that for the MF Project site, the PMF is 25,060 cms. This flood was used to size the capacity of the gated spillway (16,750 cms) and the RCC dam (13,300 cms). Reservoir flood routing studies using the reservoir volume curve and the hydrograph for the PMF determined the resulting maximum flood elevation of the reservoir during a PMF event to be El. 45.1 mean sea level (msl). From this elevation, the deck elevation of the power station was established, considering freeboard requirements.

3.2.2 Ice Effect on Tailwater Elevation

Ice affects water elevation since water is forced to flow beneath it which results in higher frictional resistance than that generated by an open water surface. A higher water surface elevation for a given flow occurs to overcome the additional resistance. Nalcor performed studies that indicate that ice can expect to form at the site during the months from November to May. The studies indicate, for example, that for a plant discharge of 2,500 cms, the tailwater is 2.0 meters higher when ice cover is present than during the ice free period. This ice-cover condition affects the rated head on the generating units by about 5 percent, and therefore, it

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[2] A sunny day event is assumed to be a day when average flow is occurring under the normal reservoir El. 39.0 and normal tailwater with no rainfall.

must be taken into consideration when computing the power output of the hydroelectric plant. Two tailwater curves were derived for open water and for ice cover which were used in the energy generation model (Vista Decision Support System™ [Vista DSS™]) where the model employs an adjustment factor to shift the curves to accommodate the conditions that are being modeled.

3.2.3 Power Generation

Two models have been used during the derivation studies associated with determining the power generation from the MF power plant. Both models used a monthly time resolution (time-step). The Vista DSS™ model employs different software and is the preferred model to use for the LCP. It uses a more detailed time resolution and a much more detailed representation of the system. The Water Management Agreement (WMA) for the Churchill River prescribes that the operation of the Churchill Falls project and the LCP must be coordinated as prescribed by the Independent River Operator and includes provisions for banking energy in the seasonal reservoirs at Churchill Falls. The Vista DSS™ is reported to accommodate these requirements since it is able to route the release Churchill Falls flows that arrive at MF about three days later. MWH has not independently verified these results, but other commercially available software, such as the suite of programs available from the U.S. Army Corps of Engineers would allow comparisons to be made if there is a requirement to do so.

The firm energy capability for the Project is defined as "the maximum annual energy that can be supported by MF during the critical (dry) hydrologic sequence, assuming coordinated operations between the MF and the Churchill Falls (Labrador) Companies (CF[L] Cos) facilities, as specified in the WMA and while meeting all of CF(L) Cos obligations from prior agreements." We note that for each system, the definition of firm energy is specifically defined for it. International standards sometimes require an assessment that looks at the energy that is available for 95 percent of the time or 98 percent of the time, for example. In the analysis, the critical period was determined, and for this period detailed chronologic simulation was performed to determine the firm energy capability of MF. The load demand on the Churchill Falls plant was determined based on contractual obligations and by considering the full range of hydrologic variability according to the reports furnished to MWH. Excess sales opportunities were also determined, as according to information furnished us, and both load and excess sales were inputted to the firm energy and Average Annual Energy (AAE) analyses.

The AAE for the Project is defined as

> the increase in the average annual generation that can be expected from the Churchill River with the addition of Muskrat Falls, again reflecting the benefits of coordinated operations with the CF(L) Co facilities. The average annual energy is estimated by simulating operations over long periods (of time, sic) and the range of hydrologic conditions, as defined by the available hydrology.

The AAE was determined by performing a series of long-term analyses, using a range of MF load demands which were higher and lower than the firm energy demands. The simulations used 30-years of record; the simulations were reported to be repeated "54 times with a different hydrological sequence each time". The period of hydrologic record was from 1957 to 2010 where data was used (a period of 53 years). Normally, we advise that the period of record must be at least 30 to 35 years of record before these studies are meaningful, and normally like to use 50 years of record if it is available in determining AAE.

The energy runs also made use of computed headloss equations, relating the losses to the flow squared, and to the guaranteed efficiency of the turbines and generators as it relates to rated head and discharge. This information is presented in one of the documents furnished to the IE that was prepared by Nalcor's consultant, Hatch Energy. Nalcor's support data is also included in the hydraulic design criteria that specifically identify the equations used to compute the headloss. A loss that is typically omitted, or incorrectly derived, is the loss at the exit of the draft tube; MWH verified that this was included. The IE has not independently confirmed the values used, nor has it separately confirmed the calculated power and energy from the project, however, the procedures followed are typically used in the power generation model.

We were advised that at full head and flow, 0.47 meters of head loss was derived by the design team and included in power estimates. An equation was developed for headloss and a coefficient determined based on these parameters for other flows and heads.

Based on the plots that relate the guaranteed efficiency of the turbine and generator, as noted above, these guaranteed values were used in the model to compute the power. We believe that the guarantee value is that value prescribed in the turbine and generator generating equipment Request for Proposal (RFP), and not the actual value that Andritz committed to furnish in the contract as their guarantee value. Nalcor advised the model values are a "little higher" than the guarantee values. Normally, the final energy computations are performed using the equipment manufacturer's guaranteed values to determine the values of power that are used in the financial pro forma.

When the generating units are shut down, Nalcor indicated flow will be released at the gated spillway structure. This release, depending on river flows, may remove water from storage. The reservoir will be maintained between El. 39.0 and El. 38.5 msl.

The results of the power generation runs performed by a consultant (Hatch) are given in Table 3-1.

[redacted]

[redacted]

3.2.4 Diversion Flood Assumed for Construction and Ice Affects

To enable cofferdam heights to be determined, Nalcor selected a return period flood of 20-years recurrence interval. Normally for larger projects where excavations are open for about one year while concrete is being placed, a 20-year to 25-year recurrence interval is selected as the minimum value for which the contractor must provide protection. Risks associated with floods with recurrence levels higher than this value are then either assigned to the Owner as their responsibility or to the contractor depending on contract language. For embankment structures, usually a longer period than 20-year return period for important structures is prescribed. For construction that takes longer than one year of cofferdam use, recurrence intervals of longer period are prescribed and costs of increased cofferdam sizes are paid for by the Owner. Determination of the value to use should be based on economics, balancing the cost of higher and larger cofferdams with the loss or damage of the structures being constructed and the cofferdam, cofferdam rebuilding, clean-up costs, environmental mitigation costs and fines, and lengthening of the contract schedule which delays power production, and higher interest during construction payments on construction loans. Once the recurrence interval is selected, the water surface elevation is determined from hydraulic studies associated with the construction flood discharge, and the freeboard (elevation distance between the flood level and cofferdam crest) is determined to establish the crest elevation of the cofferdam.

In the case of MF, another important consideration was required since ice jams are known to occur almost every year downstream of the dam and power station complex site. Historically data is available that allows a determination of water level flood elevation that occurs during an ice jam. Selecting the elevation that corresponds to a recurrence interval of 40-years for an ice jam event was then determined and compared to the elevation established from a 20-year return period flood; in this case, the ice jam elevation controlled the design of the RCC cofferdam (No.3) and establishes its height.

3.3 EXPECTED PERFORMANCE OF MAJOR SYSTEMS

Based on our current understanding of the LCP and Nalcor's contracting philosophy, which we have observed in reviewing the RFPs and the Contracts reviewed to date (November 2013), only tier-one fabricators, suppliers and installers of equipment and systems, along with tier-one contractors are being solicited to propose on the work. Tier one companies are assumed to be top-level and among the largest and most well-known companies of their type and are among the most important members of a supply chain to supply to an original equipment manufacturer. This philosophy in turn generates competitive responses from these firms who supply the utility-grade equipment required of the specifications. This equipment and systems meet, in our opinion, the intent of the contract's quality requirements and the technical conditions. We, therefore, are currently of the opinion, and with our monitoring of the work during Phase II and thereafter, expect that the performance of major systems and sub-systems will be satisfactory.

3.4 MAJOR SYSTEMS COMPATIBILITY AND COMPLETENESS

We currently (December 2013) have only three contracts available to form a preliminary opinion pertaining to the compatibility of major systems and completeness. These contracts are as follows: CH0030, LC-SB-003, and CH0007.

Contract CH0030 involving the turbines, generators, and associated controls for this equipment is being provided by Andritz Hydro, a tier-one company. Andritz has provided numerous equipment packages for major hydro projects like this, and several recent ones that MWH has direct knowledge of, being the Owner's Engineer. Based on what has been reviewed to date, without viewing the fabrication, assembly, installation, and start-up and testing, we expect that the hydro-generating package will perform as designed and expected. Since the responsibility of the system compatibility and completeness lies with Andritz, following the technical provisions of the contract documents, we expect this package will be performed satisfactorily.

Contract LC-SB-003 involving the Engineering, Procurement, and Construction (EPC) form of contract delivery for the submarine cable(s), which is directly managed by Nalcor is being provided by one of the three leading designers, fabricators, and installers of submarine cables, Nexans Cable. Based on information known to MWH about other projects Nexans has completed, which are judged to be more difficult than the SOBI cable crossing, we are of the current opinion that their system will be compatible with the land-based transmission systems and their system, and in itself will perform satisfactorily and will be completed, as specified.

Contract CH0007, involving the construction of Intake and Powerhouse, Spillway and Transition Dams, will be performed by Astaldi Canada Inc., based in St. John's. Astaldi's parent company is based in Italy and they have offices in the United States, Latin America, and the Middle East. MWH has direct working experience with Astaldi's Latin America company as Owner's Engineer on much smaller hydroelectric projects with less severe weather conditions than prevailing conditions at Muskrat Falls. All contractors will require Nalcor management oversight.

3.5 OPERATING HISTORY OF MAJOR EQUIPMENT

The following Table 3-2 lists major equipment that the IE has reviewed or will review during the Phase I work and comments germane to its operating history.

Table 3-2

OPERATING HISTORY OF MAJOR EQUIPMENT

ITEM NO.	CONTRACT	EQUIPMENT	REMARKS PERTAINING TO HISTORY	COMMENTS
1	CH0030	TURBINES	ANDRITZ WILL MANUFACTURE THE TURBINES; ANDRITZ HAS MANUFACTURED OVER 2000 KAPLAN TURBINES WITH OVER 39 BEING IN THE 8-9.5 METER SIZE RANGE	SATISFACTORY
2	CH0030	GENERATORS	ANDRITZ WILL MANUFACTURE THE GENERATORS USING COMPONENTS FROM THEIR WORLDWIDE FACTORIES. ANDRITZ HAS MANUFACTURED OVER 200 GENERATORS IN THE SAME SIZE RANGE (204 MW).	SATISFACTORY

Table 3-2 (cont'd)

OPERATING HISTORY OF MAJOR EQUIPMENT

ITEM NO.	CONTRACT	EQUIPMENT	REMARKS PERTAINING TO HISTORY	COMMENTS
3	CH0030	GOVERNORS	HEMI CONTROLS WILL MANUFACTURE THE GOVERNOR CONTROL SYSTEM. HEMI HAS NOT MANUFACTURED GOVERNORS FOR HYDRAULIC TURBINES FOR KAPLAN-TYPE TURBINES IN THIS SIZE RANGE.	IN MWH'S OPINION, CAREFULLY MONITORING OF THIS EQUIPMENT WILL BE REQUIRED, INCLUDING THE DESIGN AND WITH TRIAL SHOP TESTING OF THE UNITS BEFORE SHIPMENT AND WHEN INSTALLED IN THE FIELD.
4	CH0030	STATIC EXCITATION	ABB WILL MANUFACTURE THE STATIC EXCITATION SYSTEM. ABB HAS MANUFACTURED OVER 25 EXCITATION SYSTEMS FOR HYDRO GENERATORS OF THE SAME SIZE OR LARGER RANGE AS THE LOWER CHURCHILL UNITS	SATISFACTORY

Table 3-2 (cont'd)

OPERATING HISTORY OF MAJOR EQUIPMENT

ITEM NO.	CONTRACT	EQUIPMENT	REMARKS PERTAINING TO HISTORY	COMMENTS
5	LC-SB-003	SUBMARINE CABLE	NEXANS HAS MANUFACTURED 2,500-3,000 KM OF MASS IMPREGNATED INSULATED CABLE FOR HVdc SUBMARINE CABLE. NEXANS HAS EXISTED AS A COMPANY FOR 35-YEARS	SATISFACTORY
6	PH0014	GENERATOR STEP-UP TRANSFORMER		CONTRACT NOT YET AWARDED
7	CD0502	CIRCUIT BREAKERS		CONTRACT NOT YET AWARDED
8	PH0016	GENERATOR CIRCUIT BREAKERS		CONTRACT NOT YET AWARDED
9	CDO501	CONVERTER TRANSFORMERS		CONTRACT NOT YET AWARDED
10	CD0501	THYRISTOR VALVES		CONTRACT NOT YET AWARDED

3.6 ELECTRICAL INTERCONNECTIONS BETWEEN PROJECTS

3.6.1 General

MWH reviewed the following studies to ascertain if the electrical interconnections between the projects provided security as required by the basis of design and Good Utility Practice (GUP): stability studies; load flow and short-circuit studies; and the Churchill Falls-Muskrat Falls transmission link study. In addition, MWH reviewed a set of one-line diagrams to determine that the electrical transmission network is complete.

3.6.2 Load Flow and Short-circuit Studies

The studies were carried out by Nalcor to access the steady-state performance of the Newfoundland and Labrador power system with the HVdc interconnections between Muskrat Falls and Soldiers Pond (Island Link) and between Bottom Brook and the Nova Scotia (Maritime Link) power system. The design provided for a DC voltage level of +/- 350 kV and a nominal bipole rating of 900 MW, and for the Maritime Link a DC voltage level of +/- 200 kV and a nominal bipole rating of 500 MW. In addition to the nominal ratings given, the design requires a 10-minute overload capability of 200 percent and a continuous overload capability of 150 percent, both in the mono-polar mode on the Island Link. This will enable the Island system to sustain a permanent pole outage on the Island Link without having to shed load. The Maritime Link is required to have a 500 MW continuous capability in bipolar mode in both directions.

The studies were designed to provide the following information:

- Quantify the operating modes in both the normal and outage conditions;
- Define the overload requirement for the Island Link;
- Define the limits for the Maritime Link export levels;
- Assess the reactive compensation requirements in the Island system under various load conditions;
- Determine the maximum and minimum short circuit levels that would occur at the converter station AC busses at Muskrat Falls, Soldiers Pond and Bottom Brook; and
- Identify system conditions that will result in overloads or under-voltages that will require mitigating measures on the AC systems in Labrador and the Island.

Based on the review of the studies, the design appears to be satisfactory to achieve the objectives of the study and to define the limits on the particular study goals.

3.6.3 Stability Studies

The report reviewed by MWH outlined the results of the stability studies carried out to examine the dynamic performance of the AC and DC systems including the HVdc interconnections between Muskrat Falls and Soldiers Pond (Island Link) and between Bottom Brook and the Nova Scotia power system (Maritime Link). In addition to the voltage levels discussed in 3.6.2, the Island Link will normally be a uni-directional from Labrador to Newfoundland, but the system can operate in the reverse direction. The Maritime Link is required to have a 500 MW continuous capability in the bipolar mode in both directions. The studies were designed to determine the dynamic performance of the AC/DC systems following major faults on either the AC or DC systems.

The objectives of the studies were as follows:

- Verify that the interconnected systems of Newfoundland and Labrador with interconnections into Quebec and Nova Scotia can operate satisfactorily through a wide range of faults resulting in outages on the transmission network;

- Determine the requirements of the control functions that will be required on the Island and Maritime DC links;

- Determine the requirements for additional equipment in the form of static volt amperes reactive (var) compensators and synchronous condensers that would be required at or near the converter stations to ensure satisfactory dynamic performance;

- Verify that load shedding on the Island will not occur for the range of fault cases examined; and

- Determine any operating requirements that must be applied to the Island and Maritime DC links to ensure stable operation.

The criteria selected for the study were taken from the Newfoundland and Labrador Hydro (NLH) Transmission Planning Manual and are given below to demonstrate that the project systems will function satisfactorily within the existing system:

- The system will be able to sustain a single contingency loss of any transmission element without loss of system stability;

- The system is able to sustain a successful single pole reclose for a line to ground fault;

- Multi-phase 230 kV faults will be cleared in a maximum clearing time of six cycles;

- Load shedding should not occur for the loss of the largest generator in Newfoundland;

- Load shedding will not occur for the temporary loss of a pole or bipole of an HVdc link;

- The system response should be stable and well damped;

- Post-fault recovery voltages on the AC system shall be:

    - Transient under-voltages following fault clearing should not drop below 0.7 per unit (pu); and

    - The duration of voltage below 0.8 pu following fault clearance should not exceed 20-cycles;

- Post-fault frequencies should not drop below 59 Hz; and

- Under-frequency load shedding should be minimized.

The report discusses the slight modifications that were necessary to accommodate the models used in the Power System Simulator for Engineering (PSSE) program following International Council on Large Electric Systems (CIGRE) documents and discussions with Nalcor pertaining to load shedding. In general, the studies showed that they satisfactorily achieved the objectives and could be considered to be satisfactory in meeting the design.

3.6.4 Dynamic Performance of the Churchill Falls/Muskrat Falls System

MWH reviewed the results of the studies carried out to determine the relative capabilities and performance of the transmission link between Churchill Falls and Muskrat Falls for two considered transmission voltages: 315 kV and 345 kV; this link would replace the existing 138 kV line from Churchill Falls that supplies Happy Valley. The study demonstrated that a cost savings of between $10M to $14M could be expected by using the 315 kV systems without sacrificing dependability and thus it was adopted.

3.6.5 One-Line Diagrams

MWH reviewed the one-line diagrams furnished by Nalcor to assess the general arrangements of the electrical systems associated with the projects and to determine if the entire network would be able to function as required by the design criteria.

The following one-line diagrams were reviewed:

- 230 kV Soldiers Pond Terminal Station (AC Substation)
- Muskrat Falls HVdc Transmission System, Overall Single Line Diagram, 315 kVac and 350 kVdc Transmission System (seven single line diagrams)
- 735-315 CF Switchyard Extension, Single-Line Diagram, 735-315 kV Substation
- 315-138 kV Muskrat Falls Switchyard, single-Line diagram, 315-138 kV Switchyard

These one-line diagrams are included in Appendix H.

Based on our general review, the single line diagrams indicate the electrical configuration and the intended protective elements in a clear fashion, and are believed to be satisfactory to meet the design requirements.

3.7 TECHNICAL CRITERIA CONSISTENCY

We currently reviewed a limited number of contract documents and the RFPs that are available to opine on the technical criteria consistency. An example is Contract CH0030 for the turbines and generators and comparing certain provisions of this contract pertaining to the water conveyance passageways with the finishes required of the concrete surfaces required in CH0007 to cite a technical consistency example. We find that the criteria are consistent and have been accepted by the equipment supplier as being adequate, assuming that the passageway surfaces will actually be constructed, as required.

We also note that provisions have already been made by Nalcor to ensure that the turbine and generator components will fit within the pit dimensions used in the RFP/bid documents for CH0007 since Nalcor obtained early-on, dimensional requirements from each of the three bidders for CH0030 to help them plan the layout of the power station for Muskrat Falls and included in the drawing package in the CH0007 RFP.

We further note that for Contract CH0006, Bulk Excavation, the provisions for excavation have been carefully coordinated with the drawings and contract language found within RFP CH0007, in our opinion, to accommodate a smooth transition between the contract work when it is accepted by Nalcor and transferred to the contractor for CH0007.

We also noted in Contract CH0006 that dewatering of the excavation would be occurring after the contractor was granted substantial completion. Nalcor was questioned about this matter and they indicated that they would be responsible for this system that would be furnished to the contractor for CH0007 to allow it to construct the substructure of the power station, intakes and transition structure within its contract. The IE was pleased with Nalcor’s response and finds it should allow the smooth transition between contracts to be promulgated.

3.8 EXPERIENCE AND CAPABILITY OF MAJOR PROJECT PARTICIPANTS

Nalcor has advised the IE that for all of the major contracts that are currently under design or that have been awarded, a careful screening process was conducted to allow only tier-one contracting groups and suppliers the opportunity to propose on the work. Of the contracts that we have reviewed wherein we have been apprised of the bidders who proposed on the work, we are of the opinion that due diligence to screen prospective bidders has been conducted and that supports Nalcor’s philosophy and statements made to the IE.

Nalcor also selected a Canadian Engineering firm that has not only prepared numerous designs for hydroelectric projects and other projects in Canada, but worldwide. Following Nalcor’s philosophy of project development and management, Nalcor shortlisted only tier-one engineering firms to propose on the EPCM services that were awarded to SNC-Lavalin (SNC-L). Work is currently ongoing with SNC-L transferring key hydroelectric specialists to St. John’s but also performing work in several of their other offices in Canada.

Nalcor has also engaged very experienced consultants who have been employed on mega projects in Canada and internationally to assist permanent staff, but who work solely on the LCP and hold key positions of management on this project. The guidance the Nalcor team provides to its EPCM contractor, and to the contractors it has engaged, should allow early detection and resolution of any issues that may or will occur during the construction of the LCP.

Additionally, Nalcor has engaged an Advisory Board (Board) of senior engineers to review project aspects and independently opine on their findings directly to Nalcor. The Board meets as often as required by project needs and will be active throughout the construction period. MWH personally knows the board members and considers them qualified to provide peer review to the Integrated Project Team.

SECTION 4

CONSTRUCTION PLAN AND SCHEDULE

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SECTION 4

CONSTRUCTION PLAN AND SCHEDULE

4.1 EPCM (ENGINEERING, PROCUREMENT, AND CONSTRUCTION MANAGEMENT) CONTRACT REVIEW

We note that Nalcor advised MWH that they have revised a pure EPCM Model to an Integrated Project Team Model. The following subsections discuss this Agreement.

4.1.1 Responsibilities of Parties

The EPCM Services Agreement (EPCM Agreement) for the Muskrat Falls Hydroelectric Development between Nalcor and SNC-L is a well prepared and comprehensive contract that places the responsibility for design of a successful project on SNC-L, in MWH's opinion. The effective date of the Agreement is February 1, 2011.

Late in 2012, Nalcor made a strategic decision to adjust its organizational model as it moved through Decision Gate 3 (DG3). At this decision point, the bulk of strategic front-end deliverables that were the focus of Nalcor (i.e., environmental approvals) had been achieved, while the LCP was transitioning from the engineering and procurement phase into the construction phase. A change in the working organizational model was also considered by Nalcor to be key to ensure clarity on roles and responsibilities, while fully leveraging the collective organization resources to achieve priority activities.

Leveraging the strength of Nalcor's Owner's Team, combined with the significant resources of SNC-L as EPCM Consultant, the execution model has transitioned from a pure EPCM model to an Integrated Project Team Model, or Option 2 to Option 1 in Figure 4-1. The mantra, according to Nalcor, is "One Team. One Vision." The organizational model shift is viewed as a key enabler of team effectiveness, which is considered imperative for delivery of this megaproject.

Project Delivery Methods

<table>
<tr><th>Activity</th><th>Option 1</th><th>Option 2</th><th>Option 3</th></tr>
<tr><td>Oversight / Project Controls / Audit</td><td rowspan="4">Integrated Project Team
Engineering Consultant</td><td>Nalcor</td><td>Nalcor</td></tr>
<tr><td>Detailed Engineering & Design</td><td rowspan="3">EPCM Consultant</td><td rowspan="4">EPC Contractor</td></tr>
<tr><td>Project Management, Engineering, Procurement, Project Services</td></tr>
<tr><td>Overall Site and Contractor Management</td></tr>
<tr><td>Construction of the Physical Works</td><td>Construction Contractors</td><td>Construction Contractors</td></tr>
</table>

Figure 4-1 Project Delivery Methods[3]

This Integrated Project Team, or Project Delivery Organization, consists of Nalcor and SNC-L resources as well as various third party consultants, including Hatch, AMEC, Stantec, and independent consultants. Broadening the potential sourcing base for resources has facilitated the ability to secure scarce PM and Construction Management resources within Labrador/Newfoundland's "heated" resource-based economy. Nalcor advised MWH that within this Integrated Project Delivery Organization a Nalcor person can report to a SNC-L person, and vice versa. The objective is to avoid duplication, fully leverage available resources, right-size the project team, and ensure an organizational structure that supports empowerment, accountability, and delegation of authority, according to Nalcor.

[3] Figure 4-1 Project Delivery Methods was furnished to MWH by Nalcor for use in the IER.

Nalcor contends that strong project governance and leadership is achieved by the establishment of an Integrated Management Team that is led by a Project Director. The Nalcor Project Director reports to the LCP VP and Executive Committee. Figure 4-2 gives the high-level organization and governance structure for the LCP.

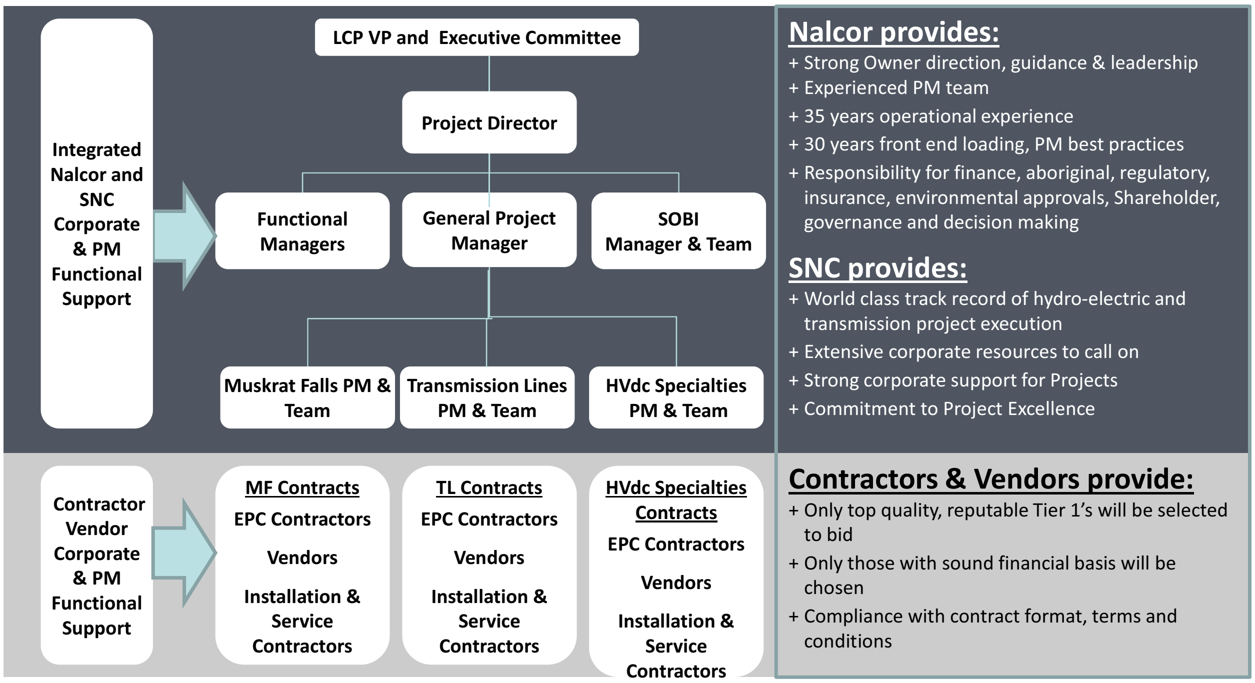

Figure 4-2 LCP Organization and Governance[4]

Consistent with the premises stated within the Overarching Contracting Strategy, this Project Delivery Organization is the Integrator of all contractor works. The Project Delivery Organization must fulfill all obligations that were previously defined for each of Nalcor and for SNC-L as EPCM Consultant.

Within the model, SNC-L remains solely responsible for the completion of all engineering and design, and for assurance of the quality of all engineering with standard engineering practice as stated in Section 4.1.2. The SNC-L Senior Manager has accountability to ensure SNC-L's engineering and design practices are upheld.

Nalcor has advised MWH that the Project Delivery Organization relies heavily on the processes and systems offered by SNC-L, in particular as it relates to project control. SNC-L's project management enterprise system, PM+, has been implemented on the LCP. To that effect, SNC-L provides a substantive resource base to support the Project Delivery Organization.

[4] Figure 4-2 LCP Organization and Governance was furnished to MWH by Nalcor for use in the IER.

As can be seen in the organization figure, the organizational design consists of three PMs reporting to a General PM. A deputy PM supports each PM, while overall delivery, including scope, cost, and schedule management, of a particular project component or physical area, is the responsibility of the Area Managers. Reporting to each Area Manager are Package Leaders (i.e., sub-Area Managers), package engineers, and contract administrators. This Area-based management approach has remained consistent since the engagement of SNC-L in early 2011, and underpins the overall delivery strategy.

The Marine Crossings Team, responsible for the SOBI work, is led by a designated PM who reports directly to the Project Director, but maintains day-to-day working relationships with the three Component PMs and all functional managers.

Figure 4-3[5] presents the organizational chart for the Integrated Management Team reporting to the Project Director.

[5] Figure 4-3 Integrated Management Team Organization Chart was furnished to MWH by Nalcor for use in the IER.

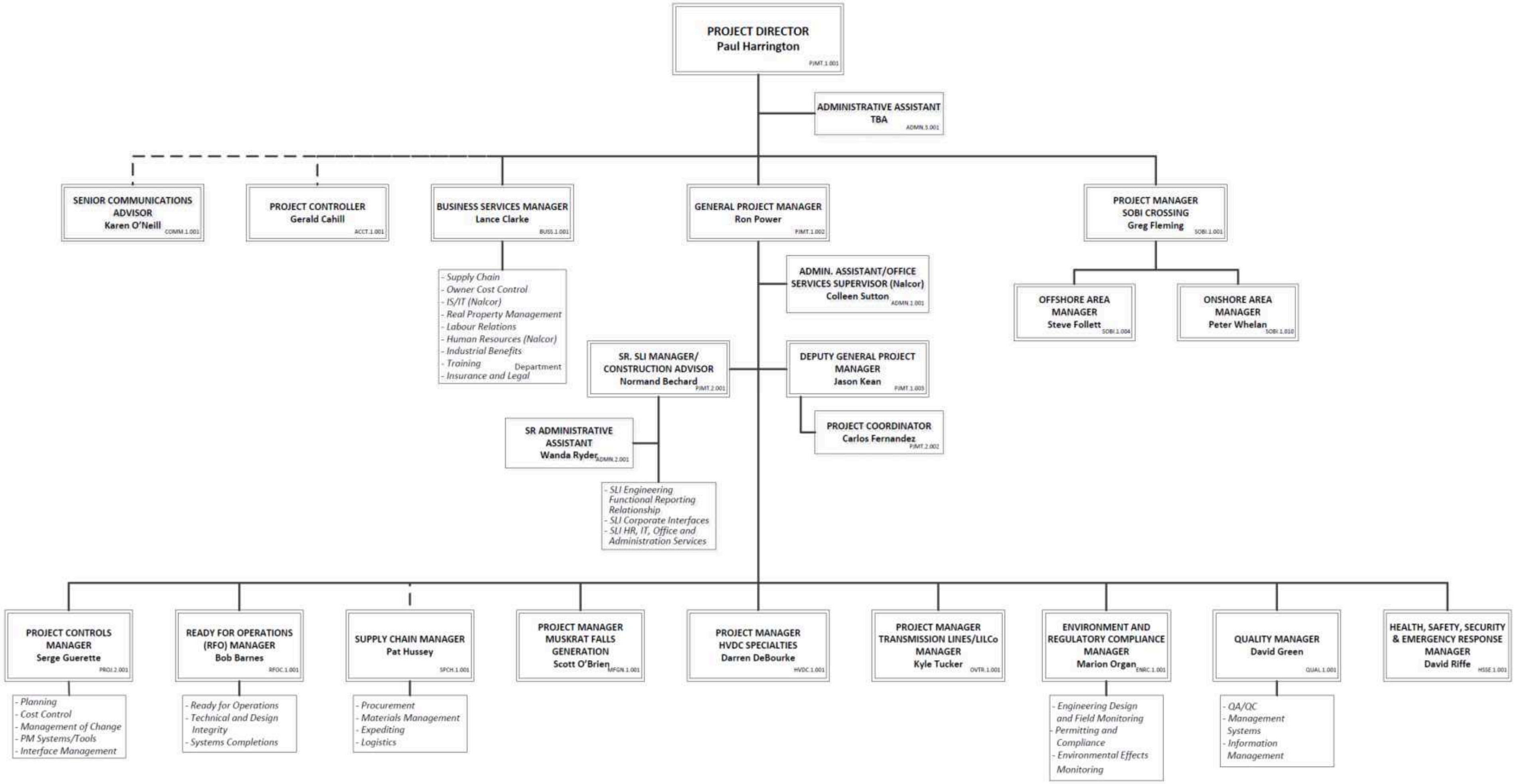

Figure 4-3 Integrated Management Team Organization Chart

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4.1.2 Scope of Work Requirements

Nalcor has included in Exhibit 6 of the Agreement with SNC-L, a listing of documents that define the previous work performed for the LCP and details the studies conducted for the LCP that are available and set out to guide SNC-L in their work. SNC-L is responsible for all of the work for the design, and for the assurance of the quality of all engineering with standard engineering practice, provides some of the personnel and tools (software) for project control (PM+), and resources for the construction management services for the power station and transmission system except the work associated with the high voltage DC cable procurement and installation for the SOBI crossing, which Nalcor is administrating (Contract LC-SB-003).

SNC-L will provide the design and specification development for the over 116 contracts that are the responsibility of the Integrated Project Delivery Organization to issue and administer for the work. Key contracts include:

CH0006 – Bulk Excavation

CH0007 – Muskrat Falls Complex [Intake & Powerhouse, Spillway & Transition Dams]

CH0030 – Turbines and Generators Design, Supply and Install Agreement

PH0014 (RFP) – Generator Step-Up Transformers

CD0501 (RFP) – Converters and Cable Transition Compounds

CT0327 – 350 kV HVdc Transmission Line---Section 1

CT0346 – 350 kV HVdc Transmission Line—Section 2

PH0016 (RFP) – Generator Circuit Breakers

CD0502 – Construction of AC Substations

A list of the other contracts is provided in Appendix I of this report for ease of reference by the reader.

Nalcor, through the Integrated Project Delivery Organization, is responsible for obtaining any necessary license, permits, or approvals for the work, while SNC-L provides relevant technical input to obtain these permits.

4.1.3 Liability

SNC-L is responsible and assumes weather risk up to and including 20-year return period storm events.

The EPCM Agreement provides for the following protection of Nalcor:

1. A Parent Company Guarantee
2. A Letter of Credit equal to 5 percent of the Agreement Price ($15 Million)
3. Professional Errors and Omissions Liability Insurance ($5 Million)
4. Commercial Liability Insurance (limit of $10 Million)
5. Project-specific Commercial General Liability Insurance ($20 Million)
6. Automobile Liability Insurance ($2 Million)
7. Any Reconstruction Costs incurred by Nalcor ($2 Million)

SNC-L's Limit of Liability was fixed at 16 percent of the Agreement Price (Section 27.2), or $48 Million.

When a change is required, as ordered by Nalcor, SNC-L has 14 days to respond to the request and is required to furnish a budget and schedule.

The compensation for changes entitles SNC-L to obtain additional compensation for reimbursable costs and additional fixed fees incurred in relation to the Change Order or Change Request. Changed conditions are clearly detailed in Section 23 of the EPCM Agreement, in MWH's opinion.

4.1.4 Communication and Interface Requirements

The EPCM Agreement provides throughout the text in different sections, information pertaining to how the parties will be communicating. Several of these sections are discussed hereafter.

Section 11 allows for Nalcor to conduct performance reviews of SNC-L's work periodically. Nalcor decides if a Performance Report is required and is delivered after the review has been completed. The Performance Report would describe any actions that Nalcor directs to remedy any failure in the performance of the Services that is apparent from the review. SNC-L is required to comply and remedy the issues found.

Section 31 discusses Public Communications and the constraints placed on SNC-L regarding communicating project information to the public without the written consent of Nalcor. SNC-L is restricted from addressing any media questions, and must revert to Nalcor for any communications that would take place.

Section 32 clearly spells out, in MWH's opinion, the requirement of the parties regarding how they communicate with each other as to the following when giving a notice (communication): it must be written; it must be addressed to Representative for the Party to whom the notice is addressed; when issued by Nalcor, it must be signed or authorized by a company representative, a director or company secretary, or duly authorized representative; where given by SNC-L, it must be signed or authorized by SNC-L's Representative, a director or company secretary, or duly authorized representative, and be delivered by post, by hand or facsimile to Party; it must be sent or delivered to the specified numbers and addresses in the EPCM Agreement. This section also requires that electronic mail can be used for day-to-day communication, but shall not be used to give notice for Claims, Application for Payments, and termination. It further notes that verbal communication will not constitute formal communications or notice under the EPCM Agreement.

Exhibit 5, Coordination Procedures, spells out numerous details regarding how the parties must coordinate their respective work through different management practices: Technical Interface; Health and Safety; Quality; Procurement; Contracting and Materials; Cost; Project Change; Risk; Construction; Project Completions; Invoicing and Payment; Province Benefits Obligations and Reporting; Information; Regulatory and Environment; and Schedule Management. MWH's opinion is that Exhibit 5 clearly outlines the responsibilities of both parties regarding how they must communicate as required by the EPCM Agreement. With the transition to an Integrated Project Delivery Organization, the formal coordination methods described in Exhibit 5 have become practically superseded since the team is working under a model that reflects a combined Nalcor/SNC-L management system.

Under the Integrated Project Team Model, we anticipate that the communication and interface requirements will work more effectively.

4.1.5 Dispute Resolution Provision

Defects in the Services are required to be rectified by SNC-L as given in Section 26 of the EPCM Agreement. When an issue arises, Section 28 of the EPCM Agreement would be implemented (Section 28 Dispute Resolution).

Disputes, claims, differences of opinion are handled by the following procedures as given in the EPCM Agreement: Party notifies other Party in writing within 30 days of the dispute; within 30 days, Parties shall attempt to resolve differences through the Project Change Management Process as given in Exhibit 5, Sections 8 and 9 of the EPCM Agreement; if not resolved through the process, Parties shall meet at the following levels: Senior Project Managers within 15 days of receipt of dispute; if not resolved by Senior Project Managers, then Project Sponsor level would be required to be involved within 15 days of the Senior Project Managers' meeting to discuss; if the dispute is not resolved by the Project Sponsor-level individuals, then the issue is addressed by the Chief Executive Officers of Nalcor and SNC-L with 30 days of the meeting of the Project Sponsors; if the dispute is still not resolved within 120 days from the delivery of the dispute to the other Party, the Party filing the dispute may take whatever action is deemed appropriate pursuant to the EPCM Agreement.

Based on MWH's review of the resolution process, as described above, it is our opinion that the dispute resolution procedure is satisfactory and appropriate. Furthermore, under the Integrated Project Team Model, issues will probably be identified earlier and resolved more quickly in MWH's opinion.

4.1.6 Ability to Integrate Each Project with Other Projects

Because Nalcor, through the Integrated Project Delivery Organization, has overall responsibility for all of the projects including the SOBI cable procurement and installation, and has the organizational structure and authority to monitor the different contracts, and with the aid of their critical path schedule will be able to observe where interface issues may arise during the work, MWH is of the opinion that the EPCM Agreement provides the safeguards necessary to achieve successful integration of the meshing contracts.

The relevant Area Construction Manager, who reports to both the Construction Manager and the Area Manager, would be the individual who would identify delays or issues. The Area Construction Manager, in collaboration with the Site Controls Manager, would develop an appropriate specific strategy to address the issue(s) and develop the implementation plan to facilitate the corrections.

The Integrated Planning and Scheduling Team track and monitor the critical and subcritical paths within the three projects, including the SOBI work. The Planning and Scheduling Team also monitors and tracks the critical and subcritical paths for the combination of the projects--interfacing and completions (Ready for Operations) activities. This team also monitors, tracks, and analyzes the contractor-supplied schedules, which include the critical and subcritical paths including key interfaces between each of the contract packages. This activity, according to Nalcor helps ensure the visibility of all internal and external interfaces under the responsibility of the team.

The integration of the SOBI crossing work and the HVdc Specialties-work, for which SNC-L is performing the design, is led by Nalcor's Project Engineer (Drover) with the Marine Crossings Team. Nalcor utilizes the interface management system that is guided by Nalcor's Change and Technical Interface Coordinator (Gillis) for all three components of the LCP for which SNC-L is responsible for the design, but mostly with the Nalcor Project Manager HVdc Specialties and the Nalcor Project Manager Overland Transmission. Regular bi-weekly interface meetings between these parties occur to address open interfaces. There are a defined number of interfaces that are well understood, and as a result personnel from both the Onshore and Offshore functions of the Marine Crossing Team are deeply involved with the interfaces as well. MWH concurs that the system to promulgate a successful interface of the work should be able to address the rather limited number of instances where an interface issue would occur and is suitable for its intended purpose of expediting solutions to any issues that may occur during design and construction.

The Procurement Team is responsible for establishing contracts and facilitating the delivery of the system. The quality assurance function provides the necessary level of shop surveillance to minimize the likelihood of an unforeseen event occurring. The LCP's overall quality assurance program combined with logistics functions is expected to work to minimize losses during shipment or damage to components being shipped.

4.2 BULK EXCAVATION CONTRACT REVIEW – CH0006

The Bulk Excavation Contract was started on November 9, 2012, shortly before Nalcor received notification that the LCP received Government Sanction on December 17, 2012, since a further delay due to waiting for the full Sanction would have severely delayed the start of the contract and the entire project. Contract CH0006 was awarded to a group of four contractors including the following firms, each of which is well known in Canada: HT O'Connell, EBJ, Nielson, and Kiewit. The reader is advised that within this report pertaining to contracts, all dollars given are Year-2012 and Year-2013 Canadian Dollars, depending on the award date. The Contract Substantial Completion Date is December 31, 2013.

Since the IE, by Agreement, is only required to review certain contracts out of the 116 total contracts identified (Appendix I) that Nalcor and MWH believe are the main contracts that need to be reviewed as part of the IE's technical and environmental evaluations, MWH has developed a standard format that addresses the questions contained in the Agreement task descriptions to standardize its responses. Since additional information is also specifically requested in other sections of the IER, some information may be repeated or expanded, as required by the Agreement.

Since Contract CH0006 reached substantial completion on November 30, 2013, a brief review summary will be provided. MWH considers all of the CH0006 work to have been completed satisfactorily and conforms to industry standards. The terms of the contract made it possible to achieve a successful job since penalties and performance guarantees (bonds, LDs) were adjusted to accommodate a reasonable price. Nalcor has advised that there is a pending acceleration claim, which may have an effect on the final contract price. MWH's site visit has verified that the work was satisfactory.

4.3 CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS CONTRACT REVIEW – CH0007

To date, MWH has only been furnished with the RFP to solicit bids for Contract CH0007 and a portion of the contract. Based on our review of these documents, we find that many of the subjects that we are required to comment on are not sufficiently addressed, requiring more information that has not yet been provided by the contractor, such as the contractor's CPM execution schedule and the Transportation Plan. As such, Nalcor initially requested MWH to review the RFP in lieu of the actual contract since the contract signing and subsequent award was expected to be on or before June 4, 2013. The actual award date of the Limited Notice to Proceed (LNTP) is now reported as of September 24, 2013.

This is the largest single contract to be awarded for the Project, and as such, it will have a significant bearing on overall success of the Project. The IE has evaluated the qualifications of Astaldi in terms of their capability to perform according to the terms of their contract with respect to quality, schedule, and budget, and finds that they have the corporate capacity to perform adequately. Astaldi's parent company is based in Rome, Italy, whereas Astaldi Canada, Inc. is based in St. John's, Newfoundland. They reportedly have a current construction backlog of approximately $10B. Because of the large scope of Astaldi's role on the Project, and considering other ongoing global work commitments, close monitoring and supervision by Nalcor is advised to ensure their timely performance. In addition to the work they will self-perform, Astaldi has 28 different subcontractors and material suppliers supporting them on this contract. Successful performance will require significant attention to detail throughout construction as well as exemplary project management oversight. Nalcor has indicated that they are aware of the importance of this contract and they have a monitoring and control program in place to ensure all contract requirements are met.

Based on MWH's review of Contract CH0007, Construction of Intake & Powerhouse, Spillway & Transition Dams; Contract CH0030, Turbines & Generators Design, Supply and Install Agreement; and Contract LC-SB-003, Strait of Belle Isle Submarine Cable Design, Supply, and Install Contract we have prepared summary tables that list items that were requested to be specifically reviewed and commented on by the IE. The summary tables, for the most part are nearly complete, lacking only those items that are either waiting contract completion or require a contractor to submit an appropriate plan to Nalcor. The IE finds good consistency in the contract documents for all of the contracts we have reviewed and the RFPs that we have also reviewed (Contract PH0014, Generator Step-up Transformers; Contract CD0501, Converters & Cable Transition Compounds; Contract PH0016, Supply of Generator Circuit breakers; and Contract CD0502, Construction of AC Substations). This is expected to allow the contracts to be managed more easily and effectively and should allow smooth interfacing among the contracts, where required. MWH is pleased to see that this process has been followed in the documents we have reviewed and is in accordance with Nalcor's Contract Strategy Plan.

Based on the review of Contract CH0007, we have prepared the following table to aid the reader in its assessment of what the IE has been able to conclude to date (November 2013).

Table 4-1

CONTRACT CH0007

CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
1	QUALIFICATIONS OF CONTRACTOR		NALCOR REQUIRED TO FURNISH THE COMPLETE CONTRACT FOR CH0007; ALSO CONTRACTOR EVALUATION FOR MWH REVIEW	SATISFACTORY

TABLE 4-1 (cont'd)

CONTRACT CH0007

CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
2	QUALIFICATIONS OF SUBCONTRACTORS	SUBCONTRACTORS ARE COVERED UNDER ARTICLE 6	SUBCONTRACTOR'S NAMES HAVE BEEN SUBMITTED OR FURNISHED TO MWH. NALCOR REQUIRED TO FURNISH SUBCONTRACTOR EVALUATIONS FOR REVIEW.	NOT ALL SUB-CONTRACTORS ARE KNOWN TO MWH. ONLY 11 OUT OF 28 FIRMS (SOLUTION 1) KNOWN TO MWH; THESE FIRMS ARE SATISFACTORY. OTHER CONTRACTORS AWAITING CONTRACT COMPLETION.
3	COMPLETENESS	CONTRACT APPEARS TO BE COMPLETE		SATISFACTORY
4	CONTRACTS PERFORMED INDEPENDENTLY	WE REQUIRED A CRITICAL PATH METHOD (CPM) SCHEDULE TO OPINE	P6 CPM REQUIRED. NALCOR BELIEVES THAT CONTRACTOR CAN ACHIEVE ALL CONTRACT WORK IN 5.25 YEARS.	AWAITING CONTRACT COMPLETION.
5	CONTRACTOR'S AND OWNER'S RESPONSIBILITIES	ARTICLE 2 LISTS THE GENERAL REQUIREMENTS OF THE CONTRACTOR; ARTICLE 3 LISTS THE CONTRACTOR'S WORK OBLIGATIONS; OWNER'S RESPONSIBILITIES COVERED UNDER ARTICLE 10; ENGINEER'S RESPONSIBILITIES UNDER ARTICLE 11	EXHIBIT 9 MILESTONE SCHEDULE IS MISSING FROM THE CONTRACT. NALCOR REQUIRED TO FURNISH EXHIBITS TO MWH.	ROLES OF CONTRACTOR AND OWNER ARE CLEARLY DEFINED. SATISFACTORY

Table 4-1 (cont'd)

CONTRACT CH0007

CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
6	GUARANTEES, WARRANTIES	ARTICLE 7 COVERS PERFORMANCE SECURITY; UNDER PART 1, APPENDIX A2, 7. PERFORMANCE SECURITY, PERFORMANCE BONDS AND LABOR AND MATERIAL PAYMENT BONDS ARE NOT REQUIRED. A PARENTAL GUARANTEE IS REQUIRED BY 7.4 AND A LETTER OF CREDIT (LC) OF 10% OF CONTRACT PRICE IS REQUIRED AS GIVEN IN ARTICLE 7 AT 7.6. UNDER ARTICLE 17, CONTRACTOR WARRANTIES WORK FOR 3 YEARS	LC OR PAYMENT BOND AMOUNT IS JUDGED TO BE TOO SMALL FOR THIS CONTRACT. NOTED OUR OPINION TO NALCOR FOR FURTHER CONSIDERATION. A MINIMUM AMOUNT OF ABOUT 20 TO 30% WOULD BE REASONABLE WE BELIEVE AFTER HOLDING DISCUSSIONS WITH GOVERNMENT TO SOLICIT THEIR OPINIONS. PAYMENT FOR THE LETTER OF CREDIT AND PARENT GUARANTEE IS ON A PRO-RATED MONTHLY INSTALLMENT OVER THE PERIOD OF THE AGREEMENT, NORMAL FOR SUCH LARGE CONTRACTS. NALCOR HAS EXPLAINED THE REASONING BEHIND THEIR DECISION – ENSURE THEY HAVE SEVERAL BIDDERS IN FOLLOW-UP	SATISFACTORY

Table 4-1 (cont'd)

CONTRACT CH0007

CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
			RESPONSES FROM TIER ONE CONTRACTORS BY REMOVING PROVISION OF PERFORMANCE BONDS AND LIMIT LC TO 10%. THE FINAL LC/BOND IS $250M; ABOUT 25% OF CONTRACT VALUE. NALCOR HAS FOLLOWED A DETAILED RISK ASSESSMENT INVOLVING FINANCIAL ADVISORS, INSURANCE SPECIALISTS, AND LEGAL COUNSEL TO ARRIVE AT A BEST VALUE FOR PROJECT SECURITY. THEY ARE CONFIDENT THEY HAVE PROVIDED SUB-STANTIATION OF THEIR WORK. BASED ON NALCOR'S ASSESSMENT, MWH BELIEVES THIS TO BE A REASONABLE DECISION AS TO THE VALUES THAT ARE USED IN THE CONTRACT. MWH HAS RECOMMENDED THAT NALCOR	

Table 4-1 (cont'd)

CONTRACT CH0007

CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
			REASSESS THE NEED TO ALSO HAVE THE CONTRACTOR PROVIDE A LABOUR AND MATERIALS BOND.	
7	CHANGE ORDERS	ARTICLE 14 PROVIDES FOR CHANGES IN WORK; ONLY OWNER CAN MAKE A CHANGE. NO OVERHEAD AND PROFIT PERCENTAGES ARE GIVEN IN THE CONTRACT ON PAGE 41. ARTICLE 31 COVERS DISPUTE RESOLUTION.	REQUIRE A COMPLETE, FILLED-IN CONTRACT. AWAITING CONTRACT COMPLETION.	CONTRACT RECEIVED DECEMBER 18, 2013; NOT REVIEWED.
8	TRANSPORTATION PLAN	ARTICLE 22 LISTS SITE AND TRANSPORTATION CONDITIONS; AT 22.7, CONTRACTOR ASSUMES ALL RISK ASSOCIATED WITH RIVER AND WEATHER CONDITIONS AT THE SITE; IT NEGLECTS TO NOTE THAT THE OWNER PROVIDES THE REQUIREMENT FOR A 1:40 YEAR RETURN PERIOD FLOOD FOR DESIGN OF COFFERDAMS FOR ICE JAM EVENTS AND 1:20 FOR FLOODS AND A	WE REQUIRE THE TRANSPORTATION PLAN TO BE FURNISHED BEFORE WE CAN OPINE.	AWAITING CONTRACT COMPLETION.

Table 4-1 (cont'd)

CONTRACT CH0007

CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
		MINIMUM HEIGHT FOR THE ICE JAM DISCHARGE EFFECTS ELEVATION.		
9	LOGISTICS/STORAGE OF MATERIALS	TRANSPORTATION IS COVERED UNDER ARTICLE 22; STORAGE IS ACTUALLY COVERED UNDER PAY ITEM FOR SITE INSTALLATION; THE CONTRACT IS SILENT ON THE AMOUNT OF STORAGE REQUIRED WHICH MAY BE SHOWN ON THE DRAWINGS WHICH WE DO NOT HAVE.	CURRENTLY, INFORMATION IS LACKING TO FORM AN OPINION; WE NEED THE TRANSPORTATION PLAN; THE WAREHOUSING AND STORAGE PLAN; THE TRACKING PLAN FOR ITEMS IN WAREHOUSES.	AWAITING CONTRACT COMPLETION.
10	CONFORMS TO INDUSTRY STANDARDS	WE REQUIRED THE CONTRACT DOCUMENTS BEFORE AN OPINION CAN BE GIVEN.	NALCOR TO SUPPLY THE CONTRACT. COMPLETE CONTRACT EXPECTED OCTOBER 31, 2013. THE FULL AGREEMENT WILL BE REVIEWED BY NALCOR TO ENSURE THE FULL CONTRACT AGREES WITH INDUSTRY STANDARDS.	SATISFACTORY

Table 4-1 (cont'd)

CONTRACT CH0007

CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
11	COMPENSATION TERMS	PART 2, EXHIBIT 2—ATTACHMENT 1 CONTAINS MEASUREMENT AND PAYMENT PROVISIONS. IT ALSO INCLUDED PROVISIONS FOR FIXED LUMP SUMS AND UNIT PRICES WORK AND INCLUDES PROVISIONS FOR INFLATION. A MONTHLY FORECAST SCHEDULE IS REQUIRED.		SATISFACTORY
12	GUARANTEES & LIQUIDATED DAMAGES	LDS ARE GIVEN IN PART 2, EXHIBIT 2, OPTION 2, SECTION 13, LIQUIDATED DAMAGES FOR DELAY AND PERFORMANCE INCENTIVES. ALSO GIVEN IN ARTICLE 26 WHICH LIMITS THE TOTAL AMOUNT OF LDS TO 5% OF THE CONTRACT PRICE. SECTION 13 GIVES LDS FOR KEY PERSONNEL REMOVAL WITHOUT PROPER NOTIFICATION.	WE HAVE INCLUDED SAMPLE COMPUTATIONS IN APPENDIX J.	SATISFACTORY

Table 4-1 (cont'd)

CONTRACT CH0007

CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
13	PERFORMANCE BOND, LDS, BONUS, BUYDOWN/OUT	PERFORMANCE SECURITY EXHIBIT 14, IS $50,000,000 UNTIL FINAL COMPLETION CERTIFICATE HAS BEEN ISSUED; AND $10,000,000 DURING THE WARRANTY PERIOD DISCUSSED IN ARTICLE 17.	SOME OF THE INFORMATION HAS BEEN FURNISHED..	SATISFACTORY
14	COMPLIANCE CONTRACTS, PERMITS, PERFORMANCE	A SITE-SPECIFIC ENVIRONMENTAL PLAN IS REQUIRED; NALCOR WILL FURNISH ALL PERMITS REQUIRED BY OWNER TO BE OBTAINED; CONTRACTOR RESPONSIBLE FOR OTHERS. CONTRACTOR MUST FOLLOW THE OWNER-FURNISHED PERMITS.	A LISTING OF CONTRACTOR-FURNISHED PERMITS NEEDS TO BE REVIEWED BEFORE AN OPINION CAN BE GIVEN. MWH IS NOT REQUIRED BY GOVERNMENT TO GIVE OPINION.	NO OPINION WILL BE FURNISHED BY IE.
15	GUARANTEE OF EQUIPMENT	NOT APPLICABLE		NO OPINION REQUIRED
16	CONSTRUCTION SCHEDULE	CRITICAL PATH SCHEDULE AND EXECUTION PLAN ARE REQUIRED TO BE FURNISHED	55 MONTHS TO COMMISSION FIRST UNIT PLUS 8 MONTHS TO COMMISSION REMAINING 3 UNITS IS WITHIN RANGE OF 5 TO 7 YEARS FOR LARGE HYDRO PROJECT.	SATISFACTORY AWAITING CONTRACT COMPLETION.
17	AGREED TO SCHEDULE REVIEW; ADEQUATE PROVISIONS	CRITICAL PATH SCHEDULE IS REQUIRED FOR REVIEW		AWAITING CONTRACT COMPLETION

Table 4-1 (cont'd)

CONTRACT CH0007

CONSTRUCTION OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
18	CRITICAL PATHS	MILESTONE DATES REQUIRED; CPM SCHEDULE REQUIRED; SUBSTANTIAL COMPLETION DATE REQUIRED	MORE INFORMATION IS REQUIRED TO ALLOW AN ASSESSMENT TO BE PERFORMED BY THE IE	AWAITING CONTRACT COMPLETION.
19	LIKELIHOOD OF ACHIEVING MILESTONES	MILESTONE DATES REQUIRED; CPM SCHEDULE REQUIRED; SUBSTANTIAL COMPLETION DATE REQUIRED	SEE 18, ABOVE.	AWAITING CONTRACT COMPLETION.
20	SUBSURFACE CONDITIONS	ARTICLE 23 PROVIDES PROTECTION TO THE CONTRACTOR IF IT ENCOUNTERS UNFORESEEN GEOLOGICAL OR GEOTECHNICAL CONDITIONS, INCLUDING GROUND WATER WHICH IT BELIEVES WILL IMPACT THE PROJECT SCHEDULE. ARTICLE 14, IF ACCEPTABLE TO THE OWNER WILL ALLOW A CHANGE TO BE MADE TO THE CONTRACT		SATISFACTORY

The reader should be aware of the fact that the IE can only give opinions once it has sufficient information to review to be reasonably certain that there will be no changed conditions that would negate its opinion or observation. Opinions can be expressed in a manner that will qualify the IE's knowledge at the time of making an opinion that is a 'forecast' of what the IE believed to be reasonably expected. Because many of the contracts that the IE will be reviewing will be released after Financial Close unless waived by Government, there are "gaps" in this document that will be required to be addressed after Financial Close.

4.4 TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT – CH0030

Contract CH0030 was awarded on December 31, 2012, and is scheduled to be substantially complete by March 23, 2017, when commissioning the Muskrat Falls Powerhouse is planned to occur. The contract was awarded to Andritz Hydro Canada Inc. whose parent company, Andritz Hydro is an internationally known, tier-one company that supplies hydrogenerating equipment. Most of the components for the turbine will be fabricated and assembled in China at companies that Andritz Hydro has an interest in and which are able to use the technologies developed by Andritz in their design, manufacturing, and assembly processes.

Table 4-2

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
1	QUALIFICATIONS OF CONTRACTOR	ANDRITZ HYDRO CANADA INC., REGISTERED IN NEW BRUNSWICK, AND ITS PARENT COMPANY, ANDRITZ, IS A TIER-ONE SUPPLIER OF TURBINES AND ASSOCIATED EQUIPMENT		SATISFACTORY
2	QUALIFICATIONS OF SUBCONTRACTORS	ALMOST ALL OF THE SUB-CONTRACTORS AND SUB-SUPPLIERS ARE UNKNOWN TO MWH AND FOR THE TURBINES WHICH WILL BE MANUFACTURED IN TIANBAO, CHINA. ABB WILL	IT IS NOT CLEAR WHERE THE GENERATORS WILL FIRST BE ASSEMBLED AND TESTED TO ENSURE THAT ALL COMPONENTS WILL BE READY FOR ASSEMBLY IN THE FIELD; WE	ANDRITZ IS A SATISFACTORY CONTRACTOR. HOWEVER, MWH IS UNABLE TO OPINE ON THE SUB-CONTRACTORS BEING USED TO SUPPLY THE MAJOR COMPONENTS OF

Table 4-2 (cont'd)

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
		SUPPLY THE STATIC EXCITATION SYSTEM; THE DIGITAL GOVERNOR WILL BE SUPPLIED BY AH HEMI CONTROLS; THE ROTOR POLES WILL BE FROM AH BHOPAL, INDIA; THE STATOR BARS & CONNECTIONS WILL BE FURNISHED BY AH LACHINE, CANADA; THE STATOR PUNCHINGS FROM AH WEIZ, AUSTRIA (AH=ANDRITZ HYDRO)	MUST SURMISE THAT THIS WILL NOT BE DONE AND THAT ANY MODIFICATIONS WILL REQUIRE FIELD MACHINING TO ALLOW PARTS TO FIT PROPERLY IF THERE ARE ANY ISSUES ENCOUNTERED. SINCE THE TURBINE IS AT A SIZE LIMIT FOR THE LARGEST DIAMETER BEING SUPPLIED, AND IN THE 9 METER CLASS, VERY CAREFUL MONITORING OF ALL WORK SHOULD BE REQUIRED.	THE TURBINES AND OF CERTAIN COMPONENTS OF THE GENERATORS SINCE WE HAVE NO EXPERIENCE IN DEALING WITH THEM. WE REQUIRE THE FOLLOWING: EXPERIENCE RECORD OF SIMILAR PROJECTS; COMPANY BROCHURES; LIST OF MAJOR EQUIPMENT USED IN THE MANUFACTURING PROCESS; COMPANY ORGANIZATION CHART; ISO CERTIFICATION PROOF; ANDRITZ PAST EXPERIENCE WITH THE SUPPLIER. NALCOR ADVISED THAT AH OWNS OR IS A PRINCIPAL SHAREHOLDER IN MANY OF THE COMPANIES AND INTENDS TO MONITOR THEM CLOSELY.

Table 4-2 (cont'd)

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
				NO OPINION ON THE SUBCONTRACTORS WILL BE FURNISHED BY MWH.
3	CONTRACTS PERFORMED INDEPENDENTLY	WE DO NOT HAVE A CPM SCHEDULE (P6) TO FULLY UNDERSTAND THE IMPACT OF DELAYS ON OTHER CONTRACTORS, BUT BELIEVE THAT FOR THE EMBEDDED ITEMS FOR THE TURBINE, A SUBSTANTIAL IMPACT TO THE POWERHOUSE CONTRACTOR COULD OCCUR. SINCE MOST OF THE MANUFACTURING WILL OCCUR IN CHINA, NECESSITATING OCEAN SHIPMENTS AS WELL AS LAND TRANSPORT, MONITORING VERY CLOSELY WILL BE VERY IMPORTANT. FIT-UP IN THE FIELD WILL DEPEND ON THE WORK PLAN THAT WE CURRENTLY DO		MWH WILL NOT BE ABLE TO OFFER AN OPINION UNTIL WE BETTER UNDERSTAND HOW THE EQUIPMENT WILL BE HANDLED AND REQUIRE SUPPORT DATA INCLUDING THE P6 CPM NALCOR ADVISES THE INTEGRATED PROJECT SCHEDULE WILL BE AVAILABLE END OF 2013. THUS, IT WILL PROBABLY NOT BE AVAILABLE BEFORE FINANCIAL CLOSE. NO OPINION WILL BE GIVEN BY MWH.

Table 4-2 (cont'd)

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
		NOT HAVE FOR REVIEW		
4	CONTRACTOR'S AND OWNER'S RESPONSIBILITIES	IN SCOPE OF WORK, 2.7 DEALS WITH OWNER'S RESPONSIBILITY OF SUPPLY; EXHIBIT 11 ALSO IS A NALCOR SUPPLY REQUIREMENTS; EXHIBIT 9 IS ANDRITZ WORK AND MILESTONE SCHEDULE		SATISFACTORY
5	GUARANTEES, WARRANTIES	EXHIBIT 1, APPENDIX B DISCUSSES GUARANTEES; IN THE TECHNICAL SPECIFICATIONS, SECTION 2.3 GUARANTEES ARE DISCUSSED; ALSO IN THE TS UNDER 2.4 DISCUSS THE WARRANTIES	THE GUARANTEES AND WARRANTIES ARE TYPICAL FOR UNITS EXCEPT FOR THE DIMENSIONABLE STABILITY AND CRACKING ONES; IN OUR OPINION THESE ARE AN APPROPRIATE ADDITION TO THOSE WE NORMALLY REVIEW	SATISFACTORY

Table 4-2 (cont'd)

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
6	CHANGE ORDERS	CHANGE ORDERS ARE DISCUSSED IN SEVERAL LOCATIONS OF THE CONTRACT DOCUMENTS. IN EXHIBIT 2, SECTION 4 CHANGE IS DISCUSSED; IN SCOPE OF WORK, ARTICLE 3, AT 3.19 CHANGE ORDER IS DISCUSSED; AND IN EXHIBIT 3, SECTION 7, CHANGE ORDERS ARE DISCUSSED,	WE BELIEVE THAT IN THE DEFINITIONS, THE AREAS IN THE CONTRACT DOCUMENTS WHERE CHANGE ORDER IS DISCUSSED SHOULD BE LISTED FOR THE PARTIES' QUICK REFERENCE.	SATISFACTORY
7	TRANSPORTATION PLAN	ARTICLE 2.2.6 DISCUSSES LOGISTICS, ARTICLE 7.7.3 AND 7.7.4 DISCUSS THE TRANSPORTATION REQUIREMENTS; AND APPENDIX A15, LOGISTICS AND TRANSPORTATION STRATEGY	WE REQUESTED CLARIFICATION ON ANY LOAD RESTRICTIONS TO THE BRIDGE DOWNSTREAM OF THE PROJECT AND RECEIVED IT. APPENDIX A15 INDICATES THAT THIS BRIDGE IS ADEQUATE. WHAT IS ITS LOAD RESTRICTION AND WHAT IS THE WEIGHT AND HEAVIEST PIECE OF EQUIPMENT THAT WILL BE TRANSPORTED OVER IT? NALCOR	NO FORMAL PLAN WAS GIVEN, BUT APPENDIX A15 SUFFICES FROM OUR PERSPECTIVE AT THIS TIME TO ALLOW US TO OPINE. SATISFACTORY

Table 4-2 (cont'd)

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
			FURNISH ANSWER ON EQUIPMENT WEIGHTS.	
8	LOGISTICS/STORAGE OF MATERIALS	THE TS IN 1.6.3 DISCUSSES SHIPPING; IN EXHIBIT 1, SECTION 7, COVERS STORAGE, PRESERVATION AND PREPARATION OF MATERIALS; ARTICLE 22, SITE & TRANSPORTA-TION ROUTE CONDITIONS	IT WOULD BE DESIRABLE TO HAVE REQUIRED A SYSTEM TO INVENTORY VIA ELECTRONIC MEANS ALL EQUIPMENT AND NOTE LOCATION WITHIN STORAGE BUILDING FOR EASE IN LOCATING DURING THE WORK.	SATISFACTORY
9	CONFORMS TO INDUSTRY STANDARDS	CONTRACT APPEARS TO CONFORM TO INDUSTRY STANDARDS AND IN SOME AREAS, IN OUR OPINION, EXCEEDS INDUSTRY STANDARDS		SATISFACTORY
10	COMPENSATION TERMS	EXHIBIT 2, SECTION 2 LISTS MILESTONE PAYMENTS; APPENDIX B TO EXHIBIT 2 IS THE MILESTONE PAYMENT SCHEDULE; EXHIBIT 2, SECTION 8 IS	TERMS APPEAR TO BE WELL EXPLAINED AS GIVEN IN APPENDIX B. PRICE IS COMPETITIVE BUT IS EXPECTED FROM PRODUCTS	SATISFACTORY

Table 4-2 (cont'd)

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
		THE CONTRACT PRICE,	CURRENTLY BEING PRODUCED IN CHINA.	
11	GUARANTEES & LIQUIDATED DAMAGES	EXHIBIT 2, SECTION 7 DISCUSSES LDS; EXHIBIT 1, APPENDIX B, DISCUSSES PERFORMANCE GUARANTEES; TD, SECTION 2.3 GUARANTEES	A SAMPLE COMPUTATION WOULD BE HELPFUL IN EXPLAINING HOW THE GUARANTEE PENALTIES AND LDS WILL BE APPLIED AND SHOWING HOW THE LIMITATIONS ON PENALTIES WILL BE USED TOO. WE PLAN TO INCLUDE SAMPLE COMPUTATIONS IN APPENDIX J. NALCOR ADVISED THAT SAMPLE COMPUTATIONS WILL BE FURNISHED; THE COMPUTATIONS ARE INCLUDED IN APPENDIX J. REQUIRES FURTHER REVIEW.	SATISFACTORY

Table 4-2 (cont'd)

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
12	PERFORMANCE BOND, LDS, BONUS, BUYDOWN/OUT	ARTICLE 35 DISCUSSES THE PERFORMANCE GUARANTEES; ARTICLE 36 DISCUSSES LIQUIDATED DAMAGES; ARTICLE 37 DISCUSSES PERFORMANCE TESTING. NOTE THAT SOME OF THE FORMULAS RELATE TO KILOWATT HOURS AND THAT THE FORMULAS FOR THE LDS ARE IN MEGAWATT HOURS — THEY SHOULD BE CONSISTENT	PERFORMANCE BOND REQUIRED FOR 50% OF CONTRACT PRICE; A BUYOUT PROVISION IS PROVIDED FOR A SITUATION WHERE PITTING OCCURS AGAIN AFTER THE FIRST 40,000 HOUR PERIOD- TERMS ARE NOT DESCRIBED THAT REQUIRE ATTENTION. NO BONUS PROVISIONS ARE PROVIDED WITHIN THE CONTRACT WHICH IN SOME COURT SYSTEMS LEADS TO DIFFICULTIES WHEN LDS ARE BEING ASSESSED. NALCOR ADVISED THAT THIS WOULD APPLY TO CANADA EXPERIENCE. LC OF 15% OF CONTRACT PRICE IS REQUIRED.	WE FIND THAT THESE CONDITIONS WOULD NOT NORMALLY ALIGN WITH NORMAL INDUSTRY STANDARDS. HOWEVER, SINCE ANDRITZ ACCEPTED THEM, THEY WILL APPLY TO THIS CONTRACT SINCE THEY WERE CONSIDERED WHEN THE CONTRACT TERMS WERE NEGOTIATED. SATISFACTORY

Table 4-2 (cont'd)

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
13	COMPLIANCE CONTRACTS, PERMITS, PERFORMANCE	EXHIBIT 1, ITEM 13; EXHIBIT 6, ENVIRONMENTAL AND REGULATORY COMPLIANCE REQUIREMENTS; ARTICLE 15, HEALTH, SAFETY AND ENVIRONMENTAL PROTECTION	IT WOULD BE BEST TO PROVIDE A COMPLETE LIST TO THE CONTRACTOR FOR EASE OF REFERENCE, IN OUR OPINION; ON THE LIST THOSE PERMITS AND ITEMS REQUIRED FOR THE CONTRACTORS ATTENTION SHOULD BE HIGHLIGHTED	SATISFACTORY
14	GUARANTEE OF EQUIPMENT	AS DISCUSSED IN 11 ABOVE, GUARANTEES ARE GIVEN	DURING OUR DISCUSSIONS IN ST. JOHN'S, THE LDS WERE NOT DESCRIBED TO SUFFICIENTLY ADDRESS MWH'S REMARKS HEREIN. WE WOULD LIKE TO REVIEW SAMPLE COMPUTATIONS FOR EACH OF THE GUARANTEES AS TO THE AMOUNTS BEING REASONABLE. NO OPINION CAN BE GIVEN AT THIS TIME. REQUIRES	SATISFACTORY

Table 4-2 (cont'd)

CONTRACT CH0030

TURBINES & GENERATORS DESIGN, SUPPLY AND INSTALL AGREEMENT

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
			FURTHER REVIEW.	
15	CONSTRUCTION SCHEDULE	MILESTONES ARE GIVEN IN EXHIBIT; WE REQUIRE A P6 CPM	WE REQUIRE A P6 CPM BEFORE WE CAN OPINE. NALCOR ADVISES SCHEDULE WILL BE INPUT INTO THE EXISTING SCHEDULE FRAMEWORK AT AN APPROPRIATE TIME.	NO OPINION CAN BE GIVEN AT THIS TIME. NALCOR ADVISES AN IPS WILL BE AVAILABLE END 2013.
16	SCHEDULE REVIEW; ADEQUATE PROVISIONS		WE REQUIRE A P6 CPM BEFORE WE CAN OPINE. NALCOR ADVISES SCHEDULE WILL BE INPUT INTO THE EXISTING SCHEDULE FRAMEWORK AT AN APPROPRIATE TIME.	NO OPINION CAN BE GIVEN AT THIS TIME.
17	CRITICAL PATHS	WE REQUIRE A P6 CPM SCHEDULE	NALCOR ADVISES SCHEDULE WILL BE INPUT INTO THE EXISTING SCHEDULE FRAMEWORK AT AN APPROPRIATE TIME.	NO OPINION CAN BE GIVEN AT THIS TIME.

As noted previously in the discussion following Table 4-1, we have included a discussion of how we believe we can accommodate any items that remain "blank" or are as yet undesignated, that leave gaps in the table because we either do not have a contract to review, or that have not been addressed by Nalcor to allow the IE to inform the reader as to our current position regarding the review of CH0030 documents.

4.5 STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY, AND INSTALL CONTRACT – LC-SB-003

Contract LC-SB-003 was awarded with a start date of December 12, 2012, and with a given substantial completion date of November 28, 2016. The early start of this contract was necessitated by the advantage Nalcor realized in favorable market conditions for the subsea cable as well as being able to schedule the manufacture of the cable early by reserving the manufacturing facilities in Japan to fabricate the cable and appurtenances associated with it. Nexans Cable is one of the three cable companies in the world that has the required experience in manufacturing and installing subsea cables, and coupled with Nippon High Voltage Cable Corp.'s experience in manufacturing subsea cables, has been critical to assuring a successful project in the opinion of Nalcor.

Listed below in Table 4-3 are the current findings and opinions of MWH pertaining to contract LC-SB-003.

Table 4-3

CONTRACT LC-SB-003

STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY AND INSTALL

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
1	QUALIFICATIONS OF CONTRACTOR	NEXANS CABLE IS A TIER ONE SUPPLIER AND INSTALLER OF SUBSEA CABLES		SATISFACTORY
2	QUALIFICATIONS OF SUBCONTRACTORS	ARTICLE 6 DISCUSSES SUB-CONTRACTORS; EXHIBIT 3 LISTS NIPPON HIGH VOLTAGE CABLE CORP AS THE MANUFACTURER OF THE CABLE.	DISCUSSION ON JAN.4, 2013, NOTED NIPPON AND NEXANS IN JV TO MANUFACTURE CABLE. AUDIT CONDUCTED APRIL-MAY, 2012 AND WAS SATISFACTORY	SATISFACTORY

Table 4-3 (cont'd)

CONTRACT LC-SB-003

STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY AND INSTALL

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
3	COMPLETENESS	NO CONSTRUCTION DRAWINGS WERE INCLUDED WITH CONTRACT; EXHIBIT 5 REFERS TO LOCATION PLAN DRAWINGS INCLUDED IN EXHIBIT 6—COMPANY SUPPLIED DATA	NALCOR REPORTED THEY ISSUED PERFORMANCE SPECIFICATIONS. MWH REQUIRES DRAWING REVIEW TO VERIFY DESIGN; CORRIDOR SELECTED BY MAY 2013. RECEIVED AUGUST 19, 2013.	SATISFACTORY
4	CONTRACTS PERFORMED INDEPENDENTLY	NEXANS IS EXPECTED TO WORK CLOSELY WITH NALCOR ON THIS PROJECT THAT IS MANAGED BY NALCOR. THEY ALSO INDICATE THEY WILL BE WORKING CLOSELY WITH NIPPON.	INTERFACE AT SHORE NEEDS TO BE DISCUSSED AND SHOWN ON CPM SCHEDULE	TENTATIVE: SATISFACTORY MWH WAITING TO RECEIVE CPM TO ALLOW OPINION TO BE EXPRESSED.
5	CONTRACTOR'S AND OWNER'S RESPONSIBILITIES	CONTRACTOR'S RESPONSIBILITIES ARE GIVEN IN ARTICLES 2, 3, AND 4 OF THE CONTRACT; NALCOR'S ARE COVERED UNDER ARTICLE 10		SATISFACTORY

Table 4-3 (cont'd)

CONTRACT LC-SB-003

STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY AND INSTALL

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
6	GUARANTEES, WARRANTIES	ARTICLE 17, WARRANTIES, PROVIDES FOR 36 MONTHS; CAN BE EXTENDED 36 MONTHS IF FAILURE OR REPAIR REQUIRED OF PART OR SYSTEM.	GUARANTEES ARE NOT MENTIONED. NALCOR ADVISED THAT ONLY THE WARRANTY OF 36 MONTHS APPLIES WHICH EXCEEDS INDUSTRY STANDARDS BY AT LEAST 12 MONTHS	SATISFACTORY
7	CHANGE ORDERS	ARTICLE 26 PROVIDES FOR CHANGES ORDERED BY NALCOR; ARTICLE 39 COVERS DISPUTE RESOLUTION	EXHIBIT 4, SECTION 11 DISCUSSES CHANGE ORDERS	SATISFACTORY
8	LOGISTICS/STORAGE OF MATERIALS	EXHIBIT 1A SCOPE OF WORK, SECTION 7 CONTAINS REQUIREMENTS FOR STORAGE, PRESERVATION AND PREPARATION. IT WOULD ALSO BE EXPECTED TO BE FURNISHED UNDER 0.5.2 EXECUTION PLAN AND EXHIBIT 4, SECTION 14	MWH REQUIRES ADDITIONAL INFORMATION SINCE NO PARTICULAR INFORMATION IS FURNISHED. NALCOR ADVISED MWH THAT STORAGE WILL BE LOCATED AT THE PORTS. 10.1.9 LOGISTIC PRECEDENT'S LIST OF KEY ITEMS TO BE SHIPPED.	TENTATIVE: SATISFACTORY. WAITING TO RECEIVE THE EXECUTION PLAN. FURTHER DETAILS STORAGE – NOT INCLUDED.

Table 4-3 (cont'd)

CONTRACT LC-SB-003

STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY AND INSTALL

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
9	CONFORMS TO INDUSTRY STANDARDS	CONTRACT APPEARS TO BE GENERALLY COMPLETE		SATISFACTORY
10	COMPENSATION TERMS	PART 2, EXHIBIT 2 COVERS COMPENSATION	THE BREAKDOWN OF ITEMS AND THE UNITS OF MEASURE APPEAR TO BE ADEQUATE FOR THIS CONTRACT	SATISFACTORY
11	GUARANTEES & LIQUIDATED DAMAGES	LDS ARE GIVEN IN EXHIBIT 2, SECTION 7; REQUIRE \$200,000/DAY FOR MISSING MILESTONE GIVEN IN SECTION 4 AND EXHIBIT 11- MILESTONE SCHEDULE	NALCOR ADVISED THE BARGE STANDBY RATE OF \$200 K/DAY WAS USED FOR DELAYS. THE RATE WILL BE ASSESSED AS A PORTION OF A DAY TO THE NEAREST HOUR.	SATISFACTORY
12	PERFORMANCE BOND, LDS, BONUS, BUYDOWN/OUT	PERFORMANCE BOND COVERED IN ARTICLE 7 AMOUNTING TO 50% OF THE CONTRACT PRICE; LC OF 15% OF CONTRACT PRICE	NO COMPANY GUARANTEE WAS REQUIRED	SATISFACTORY

Table 4-3 (cont'd)

CONTRACT LC-SB-003

STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY AND INSTALL

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
13	COMPLIANCE CONTRACTS, PERMITS, PERFORMANCE	IN PART 1, SECTION 0.7, 10. ENVIRONMENTAL, THERE ARE REQUIREMENTS FOR A PROGRAM. IT IS NOT SPECIFIC WITH RESPECT TO PERMITS; PERMITS ARE TO BE OBTAINED BY NALCOR; OTHER PERMITS FOR THE WORK VESSEL WOULD NORMALLY BE THE RESPONSIBILITY OF NEXANS. EXHIBIT 1A, SCOPE OF WORK, SECTION 2.2, TABLE 2.2 LISTS THE CONSENTS, AUTHORIZATION AND PERMITS. THE TEXT FURTHER STATES THAT THE CONTRACTOR	SINCE NEXANS IS A FOREIGN CONTRACTOR, SOME OF THE RESPONSIBILITIES PLACED ON THEM MAY BE UNFAMILIAR TO THEM, LEAVING ROOM FOR AN INCOMPLETE RESPONSE AND DELAY OR OMISSION CAUSING A DELAY. NALCOR ADVISED ON AUGUST 19, NO ADDITIONAL PERMITS HAVE BEEN IDENTIFIED BY NEXANS.	GOVERNMENT ADVISES MWH DOES NOT HAVE TO OPINE ON PERMITS.

Table 4-3 (cont'd)

CONTRACT LC-SB-003

STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY AND INSTALL

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
		SHALL OBTAIN AND MAINTAIN ALL OTHER AUTHORIZATIONS, PERMITS, DISPENSATIONS, CONSENTS AND LICENSES, REQUIRED BY APPLICABLE LAWS TO ENABLE IT TO PERFORM THE WORK THAT CAN BE OBTAINED IN THE CONTRACTOR'S NAME.		
14	GUARANTEE OF EQUIPMENT	GUARANTEES ARE NOT FURNISHED; WARRANTY OF WORK AND MATERIAL FOR 36 MONTHS, AND AFTER REPAIR, ANOTHER 36 MONTHS OF SERVICE	WARRANTY PERIOD REVISED DOWN TO 36 MONTHS FROM ORIGINAL PROPOSED 60 MONTHS. NO GUARANTEES ARE PROVIDED. TYPICALLY, INDUSTRY REQUIRES ONLY ONE OR TWO YEARS. TESTING WILL OCCUR BEFORE AND AFTER PLACING THE ROCK FILL PROTECTION.	SATISFACTORY

Table 4-3 (cont'd)

CONTRACT LC-SB-003

STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY AND INSTALL

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
15	CONSTRUCTION SCHEDULE	MILESTONES FURNISHED IN PART 2, EXHIBIT 11, MILESTONE SCHEDULE; P6 CPM SCHEDULE IS REQUIRED TO BE FURNISHED	MWH REQUIRES A P6 CPM SCHEDULE MWH AWAITING TO REVIEW THE P6 CPM. NALCOR ADVISED THAT THE SCHEDULE IS A DELIVERABLE OF THE PROJECT CONTRACTOR AND WILL INPUT INTO THE EXISTING SCHEDULE FRAMEWORK AT AN APPROPRIATE TIME.	NO OPINION WILL BE GIVEN BY MWH AT THIS TIME.
16	SCHEDULE REVIEW; ADEQUATE PROVISIONS	MWH REQUIRES P6 CPM SCHEDULE TO REVIEW	MWH AWAITING TO REVIEW THE P6 CPM. NALCOR ADVISED THAT THE SCHEDULE IS A DELIVERABLE OF THE PROJECT CONTRACTOR AND WILL INPUT INTO THE EXISTING SCHEDULE FRAMEWORK AT AN APPROPRIATE TIME.	NO OPINION WILL BE GIVEN BY MWH AT THIS TIME.

Table 4-3 (cont'd)

CONTRACT LC-SB-003

STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY AND INSTALL

ITEM NO.	DESCRIPTION	OBSERVATIONS; SOURCE IN CONTRACT	REMARKS; QUESTIONS?	OPINION OF INDEPENDENT ENGINEER
17	CRITICAL PATHS	MWH REQUIRES P6 CPM SCHEDULE	MWH AWAITING TO REVIEW THE P6 CPM. NALCOR ADVISED THAT THE SCHEDULE IS A DELIVERABLE OF THE PROJECT CONTRACTOR AND WILL INPUT INTO THE EXISTING SCHEDULE FRAMEWORK AT AN APPROPRIATE TIME.	NO OPINION WILL BE GIVEN BY MWH AT THIS TIME.

4.6 GENERATOR STEP-UP TRANSFORMERS – PH0014

The work for Contract PH0014 consists of the design, fabrication, shop testing, packaging, delivery, and warranty for 175/230 MVA ONAN/ONAF generator step-up transformers complete with 315 kV lightning arresters and accessories and one spare generator step-up transformer. The IE is awaiting contract issuance and award.

4.7 CONVERTERS & CABLE TRANSITION COMPOUNDS – CD0501 (RFP)

The work under this RFP consists of the study, design, factory testing, supply, construction, installation, site testing, and commissioning of the HVdc link stations at Muskrat Falls and Soldiers Pond Converter Stations, and Forteau Point and Shoal Cove Cable Transition compounds. This work further includes the following components:

- Completely operational ±350 kV, 900 MW bipolar HVdc system, including the necessary communications interface equipment and the associated HVac equipment;
- Overall project management; studies; design; engineering; training; manufacture; factory testing; supply; delivery to site, loading and unloading; storing; preserving; handling and moving into final position; installation; testing; commissioning; and placing into successful commercial operation and warranty;
- Civil works, including buildings and foundations;

- Two HVdc converter stations based on Line Commutated Conversion technology; one at Muskrat Falls next to the power station and the other at Soldiers Pond interconnecting with the Newfoundland power network; and
- Two Cable transition compounds; one at Forteau Point and the other at Shoal Cove.

The IE is awaiting contract issuance and award.

4.8 GENERATOR CIRCUIT BREAKERS – PH0016 (RFP)

The work under this RFP consists of the design, fabrication, shop testing, packaging, and supply of four 24 kV, 12,000 A, 80 KA interrupting capacity generator circuit breakers complete with the control panels for each of the Lower Churchill turbine/generator units. At this time, MWH has only had the opportunity to review the RFP that was issued for this work. The IE is awaiting contract award.

4.9 CONSTRUCTION OF AC SUBSTATIONS – CD0502

The RFP for Contract CD0502 was issued on July 16, 2013, and was scheduled to be closed on October 10, 2013. Contract award was expected on December 15, 2013, and the contract forecasted completion date is November 30, 2016. The value of the contract has not been furnished to MWH, since it combines contracts and it is now an EPC contract. The IE is awaiting contract award.

4.10 GUARANTEES AND LIQUIDATED DAMAGES (LDs)

Included with the contract summaries as provided in Section 4 of this report are provisions established by the IE's Agreement with Nalcor Energy for the respective contracts. For the contracts that the IE is expected to review, we have tabulated the results found during our reviews into Table 4-4, below, for easy reference (see also Appendix J).

Table 4-4

SUMMARY OF GUARANTEES AND LIQUIDATED DAMAGES (LDs)

ITEM NO.	CONTRACT OR RFP NO.	ITEM NOs. IN TABLES	OBSERVATIONS	REMARKS; QUESTIONS	OPINION OF INDEPENDENT ENGINEER
1	CH0006 (MF) CONTRACT	6	NO GUARANTEES 3 YEAR WARRANTY	IE REQUIRES TIME TO OBSERVE PERFORMANCE	SATISFACTORY
		12	NO GUARANTEES NO LDS	IE REQUIRES TIME TO OBSERVE PERFORMANCE	SATISFACTORY

Table 4-4 (cont'd)

SUMMARY OF GUARANTEES AND LIQUIDATED DAMAGES (LDs)

ITEM NO.	CONTRACT OR RFP NO.	ITEM NOs. IN TABLES	OBSERVATIONS	REMARKS; QUESTIONS	OPINION OF INDEPENDENT ENGINEER
		13	NO PERFORMANCE BOND OR PAYMENT BOND REQUIRED	IE REQUIRES CLARIFICATION FROM NALCOR AS TO WHAT PERFORMANCE SECURITY EXISTS OTHER THAN HOLDBACK PERCENTAGE OF PAYMENTS. NO IE OPINION UNTIL MWH RECEIVES NOTICE FROM NALCOR THAT NO BONDS WILL BE NECESSARY AT PROJECT CLOSING. WE CURRENTLY UNDERSTAND NO BONDS WILL BE REQUIRED BY NALCOR. NALCOR ADVISED IE THAT A POTENTIAL CLAIM IS PENDING.	SATISFACTORY
		15	NOT APPLICABLE		NOT APPLICABLE
2	CH0007 (MF) RFP	6	LC AND PAYMENT BOND JUDGED TO BE TOO SMALL; WARRANTY OF WORK FOR THREE YEARS PARENTAL GUARANTEE IS REQUIRED	NALCOR IS REVIEWING ALL PROVISIONS FOR LCS, GUARANTEES, WARRANTIES, PAYMENT AND PERFORMANCE BONDS.	SATISFACTORY

Table 4-4 (cont'd)

SUMMARY OF GUARANTEES AND LIQUIDATED DAMAGES (LDs)

ITEM NO.	CONTRACT OR RFP NO.	ITEM NOs. IN TABLES	OBSERVATIONS	REMARKS; QUESTIONS	OPINION OF INDEPENDENT ENGINEER
		12	LDS RANGING FROM $15K TO $20K FOR MISSED MILESTONES ARE GIVEN IN PART 2, EXHIBIT 2, SECTION 13 LDS PERSONNEL PERFORMANCE INCENTIVES ARE ALSO GIVEN IN SECTION 12.2 WITH A POSSIBLE TOTAL BONUS OF $16.5M	EXAMPLES OF HOW LDS ARE COMPUTED ARE REQUIRED BY THE IE; THESE WERE FURNISHED BY NALCOR. IE REQUIRES FINAL LDS AS GIVEN IN CONTRACT. NALCOR PROVIDED INFORMATION.	SATISFACTORY
		13	SEE 12 DIRECTLY ABOVE FOR BONUS PROVISIONS, DECISIONS ON PERFORMANCE BONDS AND LDS DISCUSSED IN 6 ABOVE	NALCOR REQUIRED TO MAKE DECISIONS REGARDING THESE ISSUES. NALCOR PROVIDED INFORMATION.	SATISFACTORY
		15	NOT APPLICABLE		NO OPINION REQUIRED
3	CH0030 (MF) CONTRACT	6	GUARANTEES ARE DISCUSSED IN EXHIBIT 1, APPENDIX B AND IN THE TECHNICAL SPECIFICATIONS IN SECTION 2.3 WARRANTIES ARE DISCUSSED IN THE TECHNICAL SPECIFICATIONS UNDER 2.4	TYPICAL GUARANTEES AND WARRANTEES ARE PROVIDED. DIMENSIONABLE STABILITY AND CRACKING ARE ALSO COVERED.	SATISFACTORY

Table 4-4 (cont'd)

SUMMARY OF GUARANTEES AND LIQUIDATED DAMAGES (LDs)

ITEM NO.	CONTRACT OR RFP NO.	ITEM NOs. IN TABLES	OBSERVATIONS	REMARKS; QUESTIONS	OPINION OF INDEPENDENT ENGINEER
		12	LDS DISCUSSED IN EXHIBIT 2, SECTION 7. EXHIBIT 1, APPENDIX B DISCUSSES PERFORMANCE GUARANTEES. SECTION 2.3 OF THE TECHNICAL SPECIFICATIONS DISCUSSES GUARANTEES	SAMPLE COMPUTATIONS TO SHOW HOW LDS ARE DERIVED HAVE BEEN REQUESTED; NALCOR FURNISHED TO MWH. ALSO, HOW THE LIMIT ON PENALTIES WILL BE USED. FURNISHED.	REQUIRES FURTHER REVIEW. SAMPLE COMPUTATIONS NOW INCLUDED IN APPENDIX J.
		13	ARTICLE 35 DISCUSSES PERFORMANCE GUARANTEES; ARTICLE 36 DISCUSSES LDS; ARTICLE 37 DISCUSSES PERFORMANCE TESTING. BUYOUT PROVISIONS ARE ALSO GIVEN. NO BONUS PROVISIONS HAVE BEEN PROVIDED	THE IE NOTES REVISIONS TO FORMULAS SHOULD BE CONSIDERED.	SATISFACTORY
		15	APPENDIX B, EXHIBIT 1 DISCUSSES PERFORMANCE GUARANTEES	WE WOULD LIKE TO VIEW SAMPLE COMPUTATIONS TO ILLUSTRATE HOW THESE PROVISIONS WOULD BE APPLIED. PROVIDED IN APPENDIX J.	SATISFACTORY

Table 4-4 (cont'd)

SUMMARY OF GUARANTEES AND LIQUIDATED DAMAGES (LDs)

ITEM NO.	CONTRACT OR RFP NO.	ITEM NOs. IN TABLES	OBSERVATIONS	REMARKS; QUESTIONS	OPINION OF INDEPENDENT ENGINEER
1	LC-SB-003 (LIL)	6	NO GUARANTEES 36 MONTH WARRANTY		SATISFACTORY
		12	LD OF $200K/DAY		SATISFACTORY
		13	50% CONTRACT PRICE PERFORMANCE BOND; LC OF 15% CONTRACT PRICE	NO COMPANY GUARANTEE WAS REQUIRED	SATISFACTORY
		15	NO GUARANTEES 36 MONTH WARRANTY		SATISFACTORY

4.11 CONSTRUCTION SCHEDULE

The IE has reviewed the Integrated Project Schedule (IPS) (Rev B3, dated 27 July 2013) that provides the timeline for completion of the MFGS, LTA and LIL projects' components. A copy of the Rev B3 version of the IPS is attached in Appendix K.

4.11.1 Schedule Achievability

To account for uncertainty in the project's schedule opinion, stakeholders should be aware that a range of probable outcomes is possible. The IE has extensive global experience with hydro-power projects of this scale. Similar large-scale hydro projects have taken approximately five to seven (5-7) years to complete. Nalcor's estimated 5.25-year build-out and commissioning period is observed to be within that range. While there is probability that the projects' schedule objectives, as defined by Nalcor, can be achieved there is also reportable probability that the target in-service dates for initial and full power generation (late 2017) will remain under pressure for protraction as known and unknown field execution challenges are encountered, and as craft labor peaking is managed to benefit the overall project budget. Relative to criteria 27R-03 established by the Association for the Advancement of Cost Engineering International (AACEI), the Class 3 schedule is assumed to have an accuracy range of -20% to +30% for listed dates. The IE confirms that project schedule does not incorporate buffer-type activities as contingency and the listed activity durations represent the expected durations as envisioned by the project team to complete each listed task.

4.11.2 Schedule Risk Discussion

Nalcor carried out a Schedule Risk Analysis at DG3 and identified weather risk, the volume of work to be carried out in the powerhouse, the rate of concrete placement in the powerhouse and certain challenging sections of the transmission lines as being the main schedule protraction risks. Subsequent to the DG3 risk analysis Nalcor developed mitigation measures to reduce the the impact of the identified schedule risks.

Specifically, Contract CH0007 weather related and accelerated concrete placement risks have been reduced by a “mega dome” shelter that the contractor will erect to temporarily enclose the powerhouse structure which will provide a controlled climate for year round concrete placement. This mitigation directly addresses a significant component of the weather risk identified at DG3 and enhances the volume of concrete that can be placed year round. This shelter mitigation measure also helps to level the craft labor workforce year round off-setting issues related to summer craft peaking and winter layoffs which are viewed as undesirable.

It can also be pointed out that Nalcor has endeavored to transfer schedule risk and provide incentives to the contractor teams to meet or exceed the project’s stated schedule objectives through the assignment of onerous liquidated damages that would be incurred if certain milestone dates are not achieved. Time will tell if the liquidated damages strategy will prevail as a means to motivate contractors to accelerate tasks to ensure timely completion.

4.11.3 Critical Path Discussion

At a high level, the project is defined by three concurrent critical paths running through the MF project element. The IPS indicates simultaneous completion of the following: turbine/generator supply and install work, spillway construction, and the powerhouse/intake work in late 2017. Correspondingly, the project maintains two sub-critical paths associated with the LTA and LIL transmission components. While the schedule indicates some float for the transmission assets relative to MFGS, at a high level with respect to reporting accuracy, the transmission facilities come on line just ahead of the MFGS first power milestone and the indicated float component is not considered significant to offset critical path implications. Nalcor has provided the opinion that the LTA and LIL transmission line assets should finish off the final critical path.

Schedules that are characterized by multiple major concurrent critical paths are generally considered risky by industry standards. That is, statistically there is a greater potential for overall schedule protraction by slippage in any one of three concurrent critical paths and two sub-critical concurrent paths versus a schedule that entailed a singular linear critical path. The mega-project status and remote nature of the project emphasizes the need to maintain vigorous scheduling controls to mitigate schedule protraction.

4.11.4 General Schedule Comments/Observations

While the project is basically just getting underway, a review of the high level IPS Gantt chart documenting planned versus actual for the LTA, LIL and the MFGS sub-projects provides the following observations:

- Generally, the LCP milestones indicate an as-planned execution to date.

- Contract CH0006 (Bulk Excavation) is substantially complete and on-time access has been provided to the CH0007 contractor.

- Nalcor has provided assurances that Contract CH0007 (Construction of Intake & Powerhouse) has been awarded with a LNTP (September 2013) versus the originally-planned June award timeframe. MWH understands that the contractor had started his mobilization and pre-construction planning activities during final contract negotiations under the LNTP.

- The explicit schedule impacts associated with the six-month award delay to CH0007, installation of all-weather structures to facilitate powerhouse construction, and the one-year delay in the river diversion are not expressed in the B3 version of the IPS.

Despite general slippage in the early tasks for all three sub-projects, generally the as-planned completion milestones remain relatively unaffected by the early delays. This outcome suggests that Nalcor is implementing mitigation measures or mid-course schedule corrections to maintain schedule.

4.12 PERFORMANCE TEST CRITERIA

4.12.1 Turbines and Generators

The performance test criteria for the turbines and generators (Contract: CH0030) are the only ones that are currently available for review (December 2013). As noted in the Summary Table 4-2, Items 11 and 14, we find that they are Satisfactory and would meet GUP. We have noted that two of the test criteria and the penalties for not meeting the criteria are usually not found in specifications and contracts for other projects that we have reviewed; we find these extra provisions that are given in the Contract Documents very appropriate for the large size equipment. For our readers' benefit, we repeat what the LCP has accepted as its definition of "Good Utility Practice" as given in Schedule A of the WMA and quote this definition as follows since it is succinctly stated:

> Good Utility Practice means those practices, methods or acts, including but not limited to the practices, methods or acts engaged in or approved by a significant portion of the electric utility industry in Canada, that at a particular time, in the exercise of reasonable judgment, and in light of the facts known at the time a decision is made, would be expected to accomplish the desired result in a manner which is consistent with laws and regulations and with due consideration for safety, reliability, environmental protection, and economic and efficient operations.

4.12.2 Other Equipment

Currently there is no other equipment where performance test criteria are available for comment by the IE.

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SECTION 5

CAPITAL BUDGET

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SECTION 5

CAPITAL BUDGET

5.1 CAPITAL COST ESTIMATE

The IE has reviewed the DG3 Basis-of-Estimate document (LCP-PT-ED-0000-EP-ES-0001-01, rev B1 dated 03 Dec 2012) and the DG3 Capital Cost and Schedule Estimate Summary Report (LCP-PT-MD-0000-IM-PR-0003-01, rev B1 dated 09 Nov 2012) as input materials describing the capital budget for LCP's MFGS, LTA, and LIL project elements. Table 5-1 provides a summary of Nalcor's most recent (DG3) Capital Cost Estimate.

Table 5-1

DG3 CAPITAL COST ESTIMATE SUMMARY

MF		
Description	**Code**	**Budget (DG3)**
Owner, admin and EPCM	100	369,386,000
Feasibility engineering	200	5,784,000
Environmental and regulatory compliance	300	28,883,000
Aboriginal Affairs	400	13,314,000
Procurement and Construction	500	2,236,921,066
Commercial and Legal	900	20,021,000
Contingency	990	226,849,222
	Total	**2,901,158,288**
LIL		
Description	**Code**	**Budget (DG3)**
Owner, admin and EPCM	100	254,581,000
Feasibility engineering	200	38,824,000
Environmental and regulatory compliance	300	25,751,000
Aboriginal Affairs	400	2,244,000
Procurement and Construction	500	2,181,118,031
Commercial and Legal	900	20,603,000
Contingency	990	86,627,861
	Total	**2,609,748,892**

TABLE 5-1 (cont'd)

DG3 CAPITAL COST ESTIMATE SUMMARY

LTA		
Description	**Code**	**Budget (DG3)**
Owner, Administration, and EPCM	100	89,306,000
Feasibility Engineering	200	2,240,000
Environmental and Regulatory Compliance	300	705,000
Aboriginal Affairs	400	188,000
Procurement and Construction	500	542,289,172
Commercial and Legal	900	2,479,000
Contingency	990	54,375,314
	Total	**691,582,486**
TOTAL CAPITAL COST – LCP*		
Description	**Code**	**Budget (DG3)**
Owner, Administration, and EPCM	100	713,273,000
Feasibility Engineering	200	46,848,000
Environmental and Regulatory Compliance	300	55,339,000
Aboriginal Affairs	400	15,746,000
Procurement and Construction	500	4,960,328,269
Commercial and Legal	900	43,103,000
Contingency	990	367,852,397
	Grand Total	**6,202,489,666**

*Includes cost of MF, LIL, and LTA projects.

5.1.1 DG3 Capital Cost Estimating Methodology

The cost estimating methodology employed by Nalcor utilizes a deterministic approach to calculate the project's direct and indirect costs and a risk-adjusted analytical technique to develop a contingency allocation for defined tactile risks. Finally, a separate escalation analysis has been developed to calculate and fund anticipated changes in forward price levels. The IE notes that Nalcor follows standard estimating practices as put forward by the Association for the Advancement of Cost Engineering International (AACEI), including 69R-12, 58R-10, 18R-97, and 17R-97.

The IE's review of the above-noted cost estimating documentation indicates that GUP was followed by Nalcor to develop the DG3 capital cost budget. Generally, the cost estimate methodology can be described as a "bottom-up" approach relative to the level of detail, supporting documentation, and implied level of effort. A "top-down" approach was utilized for certain allowances and undefined scope elements to ensure budget inclusion.

The methodology applied to the risk analysis is also considered to meet GUP expectations for quantifying pricing uncertainties utilizing range modeling against group subtotals with standard statistical techniques. As noted, the project's extensive risk register is not mapped specifically to the cost estimate or schedule to quantify cost or schedule uncertainties, but remains as a separate document that can be referenced during the project execution phase for constraint and opportunity awareness.

5.1.2 Defined DG3 Cost Escalation Allowance

Estimated capital costs included in the DG3 estimate are costs based on 2012 values. These values were escalated in the Nalcor financial models to reflect expected future fluctuations in pricing levels occurring during the years of construction. It should be pointed out that an escalation allowance is not considered a contingency by either the Project Management Institute (PMI) or the AACEI as escalation is a known, but not priced item as opposed to an unknown item or project constraint that requires a contingency offset.

The long durations associated with project development, field construction, and the commissioning phases of the LCP subject project costs to escalation caused by inflation and various other factors, including changes in market conditions, labor rates, productivity, etc. As shown in Table 5-1, above, the DG3 capital cost estimates for each of the Nalcor projects have been adjusted to reflect cost escalation and contingency allowances. The Nalcor financial models also incorporate cost escalation and contingencies as separate line items.

With the assistance of external consultants who specialize in preparing construction cost estimates following AACEI principles, Nalcor has projected cost escalation through project completion taking into account how each sector of the economy, e.g. commodity, labor market or global economic factors, will impact the project budget differently. In our opinion, the escalation strategy adopted by Nalcor permits a realistic estimate of forward price risk and is considered to meet GUP criteria.

Escalation assumptions input into the MF, LTA, and LIL spreadsheets in the financial models reflect the detailed estimates prepared, and appear consistent with the trends projected for the provinces. Table 5-2 summarizes the annual escalation rates as put forward by Nalcor through 2018.

Table 5-2

ANNUAL COST ESCALATION

ESCALATION	2012	2013	2014	2015	2016	2017	2018
MUSKRAT FALLS							
CUMULATIVE	1.1%	2.8%	5.8%	8.3%	10.1%	10.6%	10.2%
ANNUAL	1.1%	1.7%	2.9%	2.3%	1.7%	0.5%	-0.3%
LABRADOR TRANSMISSION ASSETS							
CUMULATIVE	0.6%	2.5%	5.4%	10.3%	13.0%	14.8%	
ANNUAL	0.6%	1.9%	2.8%	4.7%	2.5%	1.5%	
LABRADOR ISLAND TRANSMISSION LINK							
CUMULATIVE	0.2%	2.5%	5.0%	7.8%	9.5%	14.2%	21%
ANNUAL	0.2%	2.3%	2.4%	2.7%	1.6%	4.4%	5.9%
TOTAL LCP ESCALATION							
CUMULATIVE	0.9%	2.7%	5.3%	8.2%	9.8%	12.0%	11.9%
ANNUAL	0.9%	1.8%	2.6%	2.7%	1.5%	1.9%	

As noted in Table 5-2, the developed escalation analysis utilizing the defined annual rates allocates a total of $361M to the project budget allocated against the MFGS, LIL and LTA projects as noted. As a function of the total project budget ($6.2B) for Nalcor's projects, the escalation allowance represents approximately 6.0 percent.

5.1.3 Defined DG3 Contingency Analysis

The contingency allowance figures for the three sub-projects are identified in Table 5-1. As defined by the PMI and the AACEI, a scope or tactile contingency is used to offset known project risks and/or market conditions. While Nalcor adopted a theoretical P50 contingency for “tactile” type risks based on analytical statistical modeling (i.e., range uncertainty) of the project’s sub-element summary budgets, the IE is of the opinion that the calculated overall 6 percent scope contingency representing an adder of $368M to the project budget is not conservative relative to our legacy experience with similar remote heavy-civil construction endeavors, and is, therefore, judged to be somewhat optimistic. The IE typically sees scope or tactile contingency allowances in the range of 8 percent to 12 percent at comparable DG3 stage gates, A mitigating circumstance for the current LCP budget is the fact that cost certainty has been achieved for the awarded-to-date work (See Section 5.1.4) that provides a rationale to carry a reduced contingency allowance.

As the IE, we understand that the Province of Newfoundland and Labrador (Province) will provide necessary contingent equity or completion guarantee for any budget shortfalls past the $5.0B Federal Loan Guarantee (FLG). Consequently, the total contingent equity or completion guarantee required from the Province is currently undefined and is predicated on final project reconciliation; currently, this amount is $1,202,489,666 (Grand Total $6,202,489,666 less FLG $5.0B).

Typically, a separate allowance for unknown project risks, known as the management reserve is provided as an additional backstop to mitigate untheorized risks, changed field conditions, or strategic risks that the conventional scope contingency doesn't cover. The management reserve is usually controlled by the owner or entity sanctioning the project which represents the Province of Newfoundland and Labrador. As per AACEI standard practice, the scope contingency is assumed to be spent during project execution while the management reserve is considered to be unspent in entirety during project execution.

5.1.4 Reconciliation of the DG3 Capital Cost Estimate to Actual

To account for uncertainty in the project's cost opinion, stakeholders should be aware that a range of probable outcomes is possible. Reconciliation of the project's DG3 capital cost estimate to actual tendered amounts up to mid-November 2013 provides a means for interested parties to trend the current budget and understand variance relative to DG3 metrics. Table 5-3 provides a comparison of the DG3 capital budget to actual expenditures made by Nalcor to date.

Table 5-3

EXPENDITURES TO NOVEMBER 2013 VERSUS THE DG3 CAPITAL COST ESTIMATE

Description	Amount ($CDN)	Metric
Awarded Work to November 2013	$2,401,387,000	44% of total original budget less Program costs ($5.52B)
Net Variance on Awarded Work to November 2013 Relative to DG3	$388,175,000	16% of awarded work to November 2013 ($2.4B)
Soon to be Awarded Work (within +2 Quarters)	$1,797,221,000	33% of total original budget less Program costs ($5.52B)
Estimated Net Variance on Soon to be Awarded Work	$125,825,000	7% of soon to be awarded work ($1.8B)
Overall Net Variance on Awarded and Soon to be Awarded Work Relative to DG3	$514,000,000	12.0% of awarded and soon to be Awarded costs ($4.3B)

Table 5-3 (cont'd)

EXPENDITURES TO NOVEMBER 2013 VERSUS THE DG3 CAPITAL COST ESTIMATE

Description	Amount ($CDN)	Metric
Overall Positive to Negative Variance on Awarded and Soon to be Awarded Work Relative to DG3	$571.8M / ($57.6M)	Ratio of 10 times positive to negative variance
Unreconciled (Un-awarded) Work	$2,044,746,000	32% of total budget less contingency
Contingency Reduction Post DG3	($184,907,000)	50% reduction
Remainder Contingency	$182,000,000	2.8% of project total
Escalation Allowance Reduction Post DG3	$330,000,000	90% reduction
Remainder Escalation Allowance	$31,000,000	½% of project total
Contingent Equity Provision Required for Overruns	Undefined	n/a

These metrics indicate that the awarded work through November 2013 has experienced a 16 percent positive (over budget) variance from the DG3 cost estimate. The soon-to-be-awarded work (By Q2 2014) is expected to deviate positively 7 percent (over budget) from established DG3 budgets. Overall, the analysis indicates a combined 12 percent positive estimating variance for the awarded and soon-to-be awarded work based on cost information recently provided by Nalcor. The IE is of the opinion that the estimating variance will continue to trend on par or slightly downwards for the remainder of the un-awarded work and for the project's support and project management costs. Since the revised budget projection put forward by Nalcor does not factor in an allowance for estimating variance relative to DG3, the IE suggests that Nalcor apply an appropriate management reserve from contingent equity to accommodate future changes in project scope and cost growth related to scope, estimating and escalation variance.

As the project moves into full-scale field execution with the award of CH0007 (Muskrat Falls Powerhouse), the IE would advocate for adjustment of the project contingency fund. Due to overruns recently recognized with the award of CH0007, the project contingency fund is considered to be spent at this time and unavailable for future unknowns and risks associated with the field construction phase for all sub-project elements of the multi-year project. The IE believes the drivers on contingency will be varied and not entirely predictable as the project unfolds over the next several years. Issues associated with budget estimate accuracy, baseline schedule accuracy, uncompetitive market conditions, directed scope changes, changed field conditions, claims, weather impacts, resource shortages, directed schedule acceleration, potential contractor defaults, incremental owner project support costs, and other unknown risks are some of the typical factors that our experience indicates will consume contingency on a remote, large-scale, heavy-civil endeavor.

5.1.5 Capital Cost Estimate Classification

AACEI Standard Practice 69R-12 (Cost Estimate Classification for the Hydropower Industry) provides the criteria or guidelines to classify the DG3 capital cost estimate and communicate an appropriate accuracy range to stakeholders. The estimate accuracy range is driven by many other variables and risks, so the maturity and quality of the scope inputs available at the time of the estimate is not the sole determinate of estimate accuracy; risk analysis is required to determine an appropriate contingency. The AACEI's criteria is noted as a general guideline and serves as a starting point for cost estimate accuracy discussion. Some important aspects of the AACEI criteria are:

- The guidelines apply to EPC type project delivery
- An appropriate contingency (i.e., 50% confidence level) is assumed to be established
- Range limits are applied to point value of the estimate inclusive of contingency
- The range limits assume a triangular vs. a uniform probability distribution

Table 5-4 provides a comparison of the DG3 cost estimate by estimate characteristic as established by the AACEI for a Class 3 cost estimate:

Table 5-4

DG3 CAPITAL COST ESTIMATE CLASSIFICATION

Characteristic	AACEI Class 3 Criteria	DG3 Classification by IE
Maturity Level of Project Definition Deliverables (Expressed as % of complete definition)	10%-40%	30-40% (October 2012)
End Usage (Typical purpose of estimate)	Budget authorization or control	Sanction Budget
Methodology (Typical estimating method)	Semi-detailed unit cost with assembly level line items	Bottom-up with allowance factoring
Expected Accuracy Range (Typical variation in low and high ranges)	L: -10% to -20% H: +10% to+30%	-5% to +20%

While the AACEI considers the maturity level of the engineering inputs as the primary classification characteristic for determining estimate class, secondary classification criteria and identified contingency drivers (Section 5.1.4) determine the accuracy range of the Class 3 cost estimate. While we agree that the engineering definition is advanced and enhances cost certainty for the DG3 cost estimate, the IE's opinion is that expansion of the high range limit for positive variance from the estimated DG3 budget is warranted due to low remainder contingencies and identified known project constraints and theorized unknown project risks.

5.2 EPCM AND CONSTRUCTION CONTRACTOR'S EXPERIENCE

At the present time, we only have knowledge of the EPCM contractor and three other contracting groups of the contracts the IE is required to review and report on. These entities are included in the following Table 5-5 with our remarks.

Table 5-5

CONTRACTOR'S EXPERIENCE

CONTRACT NO.	CONTRACT DESCRIPTION AND CONTRACTOR	REMARKS	OPINION OF INDEPENDENT ENGINEER
CH0006	BULK EXCAVATION HT O'CONNELL, EBJ, NIELSON, AND KIEWIT	EACH OF THE CONTRACTORS IS WELL-KNOWN IN CANADA AND HAS THE FULL CAPABILITIES TO PERFORM THE ENTIRE CONTRACT BY THEMSELVES. THE CONTRACTORS HAVE WORKED TOGETHER ON OTHER HEAVY CIVIL PROJECTS AND ALL HAVE WORKED ON HYDROELECTRIC PROJECTS	SATISFACTORY
LC-SB-003	STRAIT OF BELLE ISLE SUBMARINE CABLE DESIGN, SUPPLY AND INSTALL NEXANS CABLE	NEXANS CABLE IS A TIER ONE DESIGNER, SUPPLIER, AND INSTALLER OF SUBMARINE CABLES WORLDWIDE.	SATISFACTORY

Table 5-5 (cont'd)

CONTRACTOR'S EXPERIENCE

CONTRACT NO.	CONTRACT DESCRIPTION AND CONTRACTOR	REMARKS	OPINION OF INDEPENDENT ENGINEER
EPCM	ENGINEERING, PROCUREMENT, AND CONSTRUCTION MANAGEMENT SNC-L.	SNC-L IS A TIER ONE ENGINEERING AND CONSULTING COMPANY WHICH HAS DESIGNED AND MANAGED MANY LARGE HYDROELECTRIC PROJECTS, THERMAL GENERATING STATIONS, AND NUCLEAR POWER PLANTS	SATISFACTORY
CH0007	CONSTRUCTION COST OF INTAKE & POWERHOUSE, SPILLWAY & TRANSITION DAMS	ASTALDI HAS BEEN SELECTED AND GIVEN LIMITED NOTICE TO PROCEED.	SATISFACTORY. CLOSE MONITORING DURING CONSTRUCTION BY THE INTEGRATED PROJECT TEAM IS ADVISED TO ACHIEVE PROJECT GOALS AND CONTRACT REQUIREMENTS.

Note: No additional contracts were available for review prior to Financial Close.

5.3 MAJOR SCHEDULE MILESTONES

5.3.1 Major Equipment Delivery Dates

MWH has included in Table 5-6 below, the major equipment delivery dates used by Nalcor in developing the DG3 schedule and cost estimate. Nalcor has advised MWH that these dates will be given in the contracts as milestone requirements that will ensure project schedule adherence. They will also be used by suppliers and contractors to develop their costs.

Table 5-6

DELIVERY DATES

MAJOR EQUIPMENT AND SYSTEMS

Muskrat Falls Generation		
	Spillway	
CH0032	Gate Anchors	2014 Jan
CH0032	Gate Guides 1	2015 Mar
CH0032	Gate 1	2015 Jun
CH0032	Stoplog Anchors	2014 Jan
CH0032	Stoplog Guides	2015 Mar
CH0032	Stoplog 1	2015 Oct
CH0033	**Powerhouse Crane**	
	Powerhouse Unit 1	
CH0032	Draft Tube Gate Anchors	2014 Mar
CH0032	Draft Tube Gate Guide	2015 Sep
CH0032	Draft Tube Gate	2016 May
CH0032	Intake Gate Anchors	2014 Apr
CH0032	Intake Gate Guide	2016 Mar
CH0032	Intake Gate	2016 Jun
CH0030	T/G Anchors (embedded)	2014 Mar
CH0030	Stay Ring (embedded) non-embedded parts not included in this list	2016 May
PH0014	Power Transformer	2015 Jul
PH0015	Isophase System	2017 Jul
Labrador Transmission Asset		
PD0537	**Transformers 735kV – Churchill Falls Switch Yard**	2015 Jun
PD0537	**Transformers 315kV – Muskrat Falls Switch Yard**	2015 Jun
	Labrador Marshalling Yard for Transmission Line	
PD0335	Anchors – 50% to Marshalling Yard	2013 Aug
PD0307	Steel Tower Foundations – 40% to Marshalling Yard	2013 Sep
PD0302	Steel Towers – 1000 Tons to Marshalling Yard	2013 Oct
PD0300	Conductor – 50% to Marshalling Yard	2013 Nov

Table 5-6 (cont'd)

DELIVERY DATES

MAJOR EQUIPMENT AND SYSTEMS

Labrador Island Transmission Link		
	Synchronous Condensers – Soldiers Pond	
CD0534	1st unit at site	2014 Dec
	Converter Station Equipment – Muskrat Falls	
CD501	DC Equipment	2015 Jan
CD501	AC Equipment	2015 Mar
	Converter Station Equipment – Soldiers Pond	
CD501	DC Equipment	2015 Apr
CD501	AC Equipment	2016 Feb
	Labrador Marshalling Yard for Transmission Line	
PT0352	Anchors – 50% to Marshalling Yard in Lab	2014 Apr
PT0308	Steel Tower Foundations – 50% to Marshalling Yard in Lab	2014 Jun
PT0330	Steel Towers – 50% Tons to Marshalling Yard in Lab	2014 Aug
PT0328	Conductor – 50% to Marshalling Yard in Lab	2014 May
	Newfoundland Marshalling Yard for Transmission Line	
PT0352	Anchors – 50% to Marshalling Yard in Newfoundland	2014 Apr
PT0308	Steel Tower Foundations – 50% to Marshalling Yard in Newfoundland	2014 Jun
PT0330	Steel Towers – 50% to Marshalling Yard in Newfoundland	2014 Aug
PT0328	Conductor – 50% to Marshalling Yard in Newfoundland	2014 May
SOBI Crossing		
	Subsea Cable fabricated and available for pick-up	2015 Nov

5.3.2 Schedule of Values

The structure of key operating cash flows is shown in Appendix M. The schedule showing the estimated base cost (DG3 Cost) by component for MF, LTA and LIL projects cash expenditure schedule and accumulated cash flow is given in Figure 5-1 at the bottom of the table, which has been enlarged following the figure. This exhibit was copied directly from Decision Gate 3 Capital Cost Estimate, LCP-PT-ED-00000-EP-ES-0002-01, and clearly illustrates what Nalcor predicts is the cash flow for the three different projects comprising their portion of the LCP. In the opinion of the IE, we find this schedule to be reasonable and supported by Nalcor's evaluation and analysis.

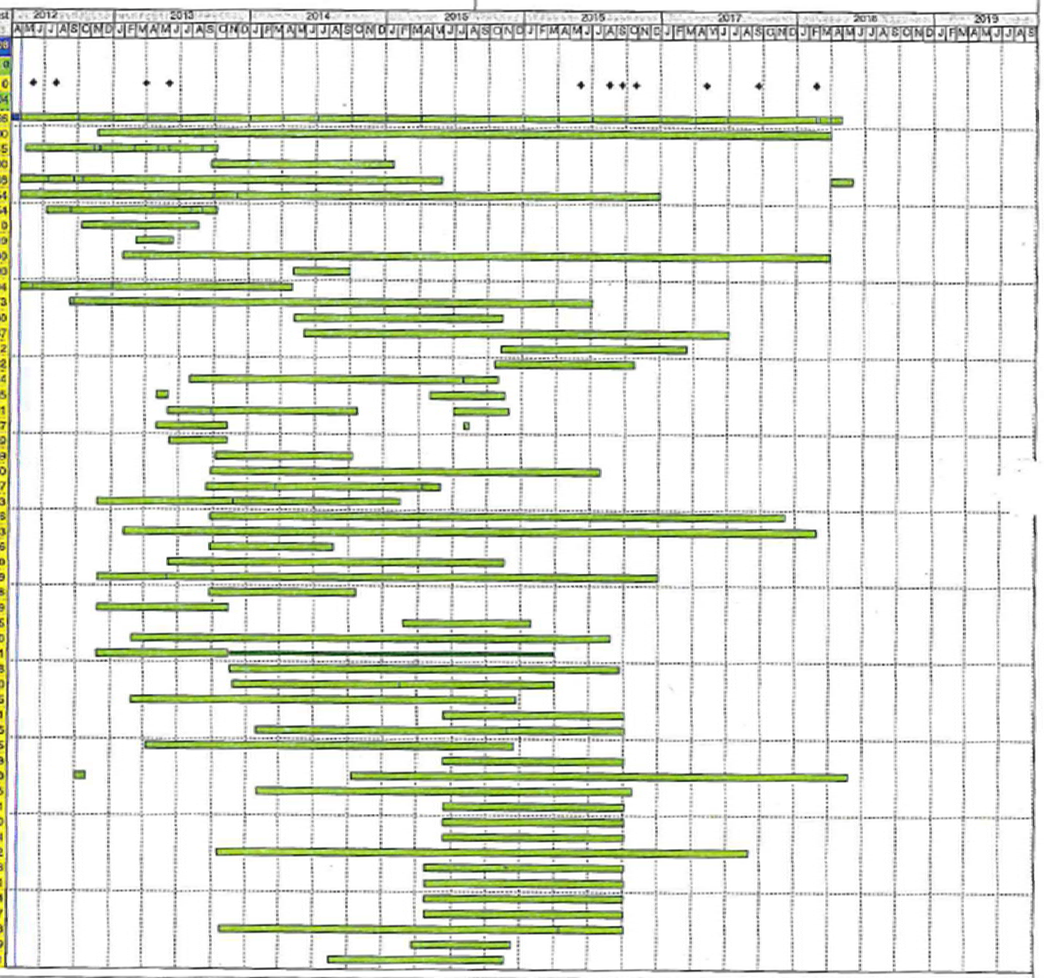
Project: LCP Ph1 DG3 Financial Model (MF+LITL+LTA+GENERAL)

Filter: TASK filter: All Activities

DG3 Financial Model

12-Jun-12 12:20

Activity ID	Activity Name	Start	Finish	Budgeted Total Cost
Total		01-Apr-12 A	29-Jun-18	5,492,783,808
General		01-Jun-12	22-Feb-18	0
No 4WBS_PHYS COMP		01-Jun-12	22-Feb-18	0
Muskrat Falls		01-Apr-12 A	29-Jun-18	2,511,923,904
0000	NO SPECIFIC COMPONENT	01-Apr-12 A	29-Jun-18	650,239,166
1030	Office Facilities - Other	23-Nov-12	31-Mar-18	480,000
1110	Access Roads	15-May-12	08-Oct-13	45,811,615
1150	Construction Bridges (Inc Spillway & MF SSAR)	23-Sep-13	23-Jan-15	8,100,000
1320	Construction Power - Muskrat Falls	01-May-12	30-May-18	19,142,968
1420	Construction Telecoms - Muskrat Falls	01-May-12	31-Dec-16	15,389,554
1500	ACCOMODATIONS COMPLEX/TEMPORARY BUILDINGS	11-Jul-12	08-Oct-13	83,384,754
1530	Buildings - Dormitories	12-Oct-12	19-Aug-13	0
1540	Buildings - Administration Building and Workshops	07-Mar-13	12-Jun-13	8,209,000
1570	Site Services	12-Nov-12	29-Jun-18	34,650,000
1830	Offsite Roads & Bridges	01-May-14	30-Sep-14	10,000,000
2000	RESERVOIR, DIVERSION, DAM & SPILLWAY - GENERAL	01-May-12	30-Apr-14	1,115,004
2110	Reservoir	11-Sep-12	06-Jul-16	144,079,173
2130	Trash Management System (incl. log booms)	06-May-14	07-Nov-15	7,500,000
2300	DAMS & COFFERDAMS	30-May-14	05-Jul-17	4,028,087
2320	North Dam	05-Nov-15	15-Mar-17	1,137,512
2321	North Dam Prep/Foundation	20-Oct-15	25-Oct-16	75,941,122
2322	North Dam Abutment	29-Jul-13	28-Oct-15	2,821,664
2330	South Dam	01-May-13	14-Nov-15	4,971,005
2341	Upstream Cofferdams	01-Jun-13	27-Nov-15	67,373,841
2342	Downstream Cofferdams	01-May-13	10-Aug-15	3,104,737
2343	Riverside Cofferdam	06-Jun-13	06-Nov-13	10,918,440
2351	North Transition Structure	09-Oct-13	11-Oct-14	7,185,589
2362	Centre Transition Structure	25-Sep-13	27-Jul-16	20,072,290
2363	South Transition Structure	13-Sep-13	28-May-15	21,511,387
2400	SPILLWAY	28-Nov-12	14-Feb-15	17,606,053
2410	Spillway Structure	25-Sep-13	04-Dec-17	76,755,865
2420	Gates, Guides Stoplogs and Hoist	04-Feb-13	26-Feb-18	53,514,793
2430	Spillway Channels	25-Sep-13	20-Aug-14	597,946
2800	NORTH SPUR	05-Jun-13	18-Nov-15	57,709,810
3000	POWER FACILITIES	26-Nov-12	31-Dec-16	40,736,119
3120	Tailrace	23-Sep-13	21-Oct-14	5,138,608
3200	INTAKE AND PENSTOCKS	26-Nov-12	13-Nov-13	51,083,599
3220	Intake Structure	25-Feb-15	27-Jan-16	178,716,306
3240	Intake Gates,Trashracks & Stoplogs	28-Feb-13	29-Aug-16	13,485,490
3300	POWERHOUSE	26-Nov-12	31-Mar-16	6,067,551
3310	Substructure	19-Nov-13	20-Sep-16	289,079,738
3320	Superstructure	25-Nov-13	31-Mar-16	45,373,310
3330	Draft Tube Gates & Hoists	28-Feb-13	18-Dec-15	94,841,165
3340	Building Electrical Services	09-Jun-15	04-Oct-16	15,782,541
3350	Building Mechanical Services	28-Jan-14	04-Oct-16	13,306,025
3360	Powerhouse Crane	06-Apr-13	15-Dec-15	8,872,175
3400	POWER GENERATION	08-Jun-15	04-Oct-16	8,985,349
3410	Turbine	01-Oct-12	29-May-18	200,000,000
3420	Generator	30-Jan-14	24-Oct-18	7,394,645
3430	Electrical Ancillary/Auxillary Systems	08-Jun-15	04-Oct-16	2,999,701
3431	DC Power/UPS System	08-Jun-15	04-Oct-16	1,517,500
3435	Station Service Transformers	08-Jun-15	04-Oct-16	1,914,704
3436	Bus Ducts	17-Oct-13	31-Aug-17	1,850,952
3440	Mechanical Ancillary/Auxillary Systems	22-Apr-15	04-Oct-16	17,554,583
3441	Service Air System	22-Apr-15	04-Oct-16	1,162,641
3448	Colling Water System	22-Apr-15	04-Oct-16	2,438,534
3449	Service Water System	22-Apr-15	04-Oct-16	1,589,297
3460	Generator Transformers	24-Oct-13	04-Oct-16	19,731,483
3470	Spare Parts & Special Tools	24-Mar-15	07-Dec-15	277,079
6160	CL to Switchyard	14-Aug-14	20-Nov-15	3,770,591



Remaining Level of Effort — Remaining Work — Actual Work — ◆ Milestone

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TASK filter: All Activities
Resource Profile Filter:ESC_AirTravel.Air Travel (ESCALATION CUSETG01NS), ESC_Marine.Cable Laying Vessels, ESC_CementProd.Cement Products (ESCALATION V1675704), ESC_Concrete.Concrete

Figure 5-1 Schedule of Expenditures for Major Components of the Projects and Accumulated Cash Flow Projection

Project: LCP Ph1 DG3 Financial Model (MF+LITL+LTA+GENERAL)

Filter: TASK filter: All Activities

DG3 Financial Model

12-Jun-12 12:20

Activity ID	Activity Name	Start	Finish	Budgeted Total Cost
9112	Aquatic Habitat Compensation Muskrat Falls	27-Feb-14	07-Jun-17	10,100,000
9200	OPERATIONS TELECOMS SYSTEMS	05-Dec-13	31-Jan-15	250,000
9220	Operations Telecoms - MF	04-Jun-14	07-Oct-16	1,658,906
3442	Govenor Air System	22-Apr-15	04-Oct-16	1,172,654
3443	Fire Protection System	22-Apr-15	04-Oct-16	3,732,122
3444	Pump Drainage System	22-Apr-15	04-Oct-16	2,695,481
3445	Pump Dewatering System	22-Apr-15	04-Oct-16	2,448,322
3446	Hydraulic Oil Handling & Filtration System	22-Apr-15	04-Oct-16	862,322
3447	Oily Water Interception System	22-Apr-15	04-Oct-16	591,758
Island Link & Upgrades		01-Apr-12 A	31-Mar-18	2,359,610,971
0000	NO SPECIFIC COMPONENT	01-Apr-12 A	31-Dec-17	323,388,755
1110	Access Roads	01-Mar-14	29-Apr-14	3,500,000
1430	Construction Telecoms - Island Link	01-May-12	15-Jan-15	3,745,517
4500	SOLDIERS POND SWITCHYARD	04-Apr-13	22-Apr-17	102,144,142
6200	DC TRANSMISSION	01-May-12	02-May-17	26,996,922
6221	Island Section 1 West	13-Jul-13	29-Jun-17	534,087,951
6224	Labrador Section1 @ MF	04-Jun-13	18-Sep-16	356,800,163
6310	Electrode Line - Labrador	06-Sep-13	06-Jul-16	5,038,517
6320	Electrode Line - Newfoundland East	05-Sep-13	10-Feb-16	4,527,398
7110	Unit Conversion @ Holyrood	01-Apr-17	31-Mar-18	30,000,000
7120	New Synchronous Condensers	13-Mar-13	24-Feb-17	110,776,909
7130	Breakers	01-Apr-16	31-Mar-17	6,700,000
7140	AC Line Rebuilds	26-Jul-13	15-Aug-14	7,526,772
8110	SOBI	01-May-12	27-Dec-13	110,000
8111	Subsea Cables (SOBI) Supply	15-Jul-12	30-Sep-16	173,368,767
8113	SOBI Landfall	01-May-13	31-Dec-15	85,344,240
8114	SOBI Protection	01-Jul-13	31-Dec-16	78,619,255
[illegible]00	CONVERTER STATIONS	04-Apr-13	22-Apr-17	11,788,175
[illegible]0	Labrador Converter Station	01-Jun-13	17-Nov-16	179,430,514
[illegible]0	Soldiers Pond Converter Station	04-Apr-13	22-Apr-17	187,199,083
[illegible]00	DC SPECIALITIES - TRANSITION COMPOUNDS	13-May-14	22-Apr-17	10,499,800
8510	Transition Compound - Labrador	04-Apr-13	17-Nov-16	19,313,420
8520	Transition Compound - Northern Peninsula	04-Apr-13	22-Apr-17	16,105,312
8600	DC SPECIALITIES - ELECTRODES	27-Mar-15	24-Mar-17	420,745
8610	Electrode - Labrador	27-Mar-15	01-Oct-16	14,895,752
8620	Electrode - Newfoundland East	27-Mar-15	21-May-16	12,050,384
9200	OPERATIONS TELECOMS SYSTEMS	01-May-15	31-Mar-17	6,675,000
9230	Operations Telecoms - LITL	11-Feb-15	23-Mar-17	15,688,478
Labrador Transmission Assets		01-Apr-12 A	31-Dec-17	624,311,780
0000	NO SPECIFIC COMPONENT	01-Apr-12 A	31-Dec-17	92,799,673
1450	Construction Telecoms - Labrador Transmisison Assets	01-May-12	21-May-13	2,115,329
1500	ACCOMODATIONS COMPLEX/TEMPORARY BUILDINGS	09-Jul-13	04-Nov-13	7,520,650
1570	Site Services	09-Jul-13	04-Nov-13	9,822,840
4000	SWITCHYARDS - GENERAL	04-Sep-13	30-Nov-16	6,898,868
4100	CHURCHILL FALLS EXTENSION	09-Jan-13	07-Jul-16	117,753,190
4300	MUSKRAT FALLS SWITCHYARD	01-Mar-13	29-Feb-16	53,444,572
6140	Muskrat Falls to Churchill Falls	01-May-12	06-Feb-16	286,716,962
6180	735kV AC line at Churchill Falls	01-May-12	16-Jan-16	2,117,495
7520	315kV/138kV Switchyard @ Muskrat Falls	01-Jun-13	29-Feb-16	6,019,999
9200	OPERATIONS TELECOMS SYSTEMS	01-May-15	21-Oct-16	750,000
9250	Operations Telecoms - LTA	01-Jul-12	11-Apr-16	13,352,178
HVGB Tranmission Connection		01-Jun-13	12-Feb-16	19,937,554
7520	315kV/138kV Switchyard @ Muskrat Falls	01-Jun-13	12-Feb-16	19,937,554

Budgeted Cost
Actual Cost
Remaining Early Cost

Remaining Level of Effort — Remaining Work
Actual Work — ◆ Milestone

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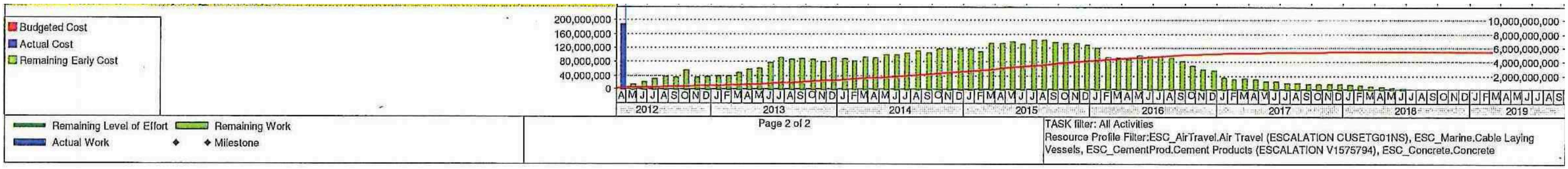
TASK filter: All Activities
Resource Profile Filter: ESC_AirTravel.Air Travel (ESCALATION CUSETG01NS), ESC_Marine.Cable Laying Vessels, ESC_CementProd.Cement Products (ESCALATION V1575794), ESC_Concrete.Concrete

Figure 5-1 Schedule of Expenditures for Major Components of the Projects and Accumulated Cash Flow Projection (continued)

Enlargement of bottom section of Figure 5-1.



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5.3.3 Allowance for Contractor Bonus

Bonuses or performance incentives are only provided under the following contract: CH0007.

For Contract CH0007, the bonus provisions provide a reasonable incentive to the contractor to complete the milestones early. MWH believes that with the Integrated Project Team and close project monitoring and control, these bonus incentives will be beneficial to the Project.

Nalcor advised MWH that no other contracts will provide for a bonus provision.

5.3.4 Highlight Sensitive and Critical Areas

At DG3, and as part of the Risk Analysis performed at that time, Nalcor had identified several areas that they initially believed to be the critical risk areas for the projects, namely the following: Performance Risk and Schedule Risk. A brief discussion of each, from Nalcor's perspective at DG3, follows.

Performance risk was assumed to exist since Nalcor had used historical norms from legacy hydroelectric projects that were predicated on achieving an envisioned labor strategy and were even assumed to be more efficient in realizing productivity compared to a contemporary project where restrictive work practices exist. Nalcor was concerned that "…contractor mark-ups for unit price agreements could be excessive if there is a perception risk that the labor strategy will not materialize." The experienced front-line supervision, which is key to performance execution for the LCP had been correctly identified by Nalcor in MWH's opinion. The LCP now competes with other projects, world-wide. Nalcor also considered that there was a potential for a time or schedule risk exposure for the MF powerhouse beyond the plan they developed at DG3 due to weather and the sheer magnitude of the volume of work for the powerhouse. The main concern was that the placement and curing of the 460,000 CM of powerhouse reinforced concrete over several winters would present a significant challenge for the contractor for CH0007. Additionally, the Bulk Excavation contractor (CH0006) needed to keep to schedule to complete its work by the Fall of 2013 to enable the contractor for CH0007 to start its work on time, which was achieved.

MWH agrees with Nalcor's assessment that these are certainly risks that must be considered and accounted for in the schedule and cost estimate. MWH notes that the perceived schedule risk exposure pertaining to the Bulk Excavation contractor completing on time appears to be a non-issue, as viewed during the field trip in late September 2013, assuming that the contractor's performance continues to be satisfactory. Additionally, MWH believes that with Nalcor's acceptance of the contractor's proposal to use an all-weather enclosure for powerhouse construction as proposed by the contractor for CH0007 can work to mitigate the risk of extensive delays in the powerhouse concrete construction during the winter seasons.

With the concern that Nalcor has expressed in the past regarding uncertainties surrounding the potential cost increase due to the competition for labor and key personnel, MWH believes that this concern could have been addressed in the DG3 cost estimate and reflected in the Project Schedule by including less aggressive contingencies and a lengthened project schedule. MWH, for preparation of similar cost estimates, would generally follow AACEI's guidelines for projects with respect to contingencies since AACEI has a broad data base to support the contingency values and accuracy statement used for each level of the cost estimate. Additionally, we have found that the schedule opinion will gain accuracy if the project's risk register is mapped to the individual line item activities and supported with an analytical uncertainty analysis using Monte Carlo simulation to discern finish date accuracy relative to desired confidence intervals.

Nalcor advises that the current final forecast cost estimate (December 2013) shows that there has been a net increase in DG3 capital cost by 5 percent with two-thirds of the Project at an AACEI Class I estimate level. Based on performance to-date, they believe they have managed and mitigated the project cost risks successfully and will complete their projects within their current forecast cost estimate.

5.3.5 Price Risks

Nalcor has discussed in the contracting philosophy their methods to quantity and manage price risks due to changing market conditions, inflation, labor issues, weather and hydrology issues, manufacturing space and equipment availability, delays in meeting milestones, and competition with other projects in Canadian Provinces. The risk assessments they conducted following a multi-faceted Project Risk Management Plan using AACEI's recommended practice for price changes for major equipment they will purchase, as well as the construction and installation contracts they and SNC-L will administer, appear to be carefully performed and were taken into consideration in their economic analysis. The CPM schedule was also integrated into the analysis to arrive at appropriate unit cost pricing.

Where appropriate, liquidated damages, letters of credit, and performance protection have also been used to protect Nalcor as well as bonus provisions for at least one major contract (CH0007) to help Nalcor achieve their development schedule.

5.4 DRAWDOWN SCHEDULES

In order to opine on the reasonableness of the drawdown schedules for each of the contracts that MWH is required to review and comment on, we have prepared Table 5-7 wherein we have summarized our findings for each of the contracts. We note that even where we believe we have observed some payments in favor of the contractor or vendor, since the payment schedule was considered among many items in the consideration and award of the contract, other issues may override any unbalance we may observe.

Table 5-7

PAYMENT SCHEDULES FOR CONTRACTS REVIEWED BY THE INDEPENDENT ENGINEER

PROJECT	CONTRACT NUMBER	PAYMENT SCHEDULE		REMARKS/COMMENTS
		NORMAL EXPECTED	UNUSUAL	
MF	CH0030	Normal		Satisfactory
	CH0006	Normal		Satisfactory
	CH0007			Awaiting contract award and payment schedule
SOBI	LC-SB-003	Unknown		Satisfactory

To allow a more easy comparison to determine if the drawdown payment schedule is normal or unusual, we have plotted each of the schedules we have been asked to review where information is available. A composite plot is given in Figure 5-2 below for Contract CH0006, Contract LC-SB-003, and Contract CH0030, which has three currencies to consider. The plots indicate no unusual issues with drawdown payments.

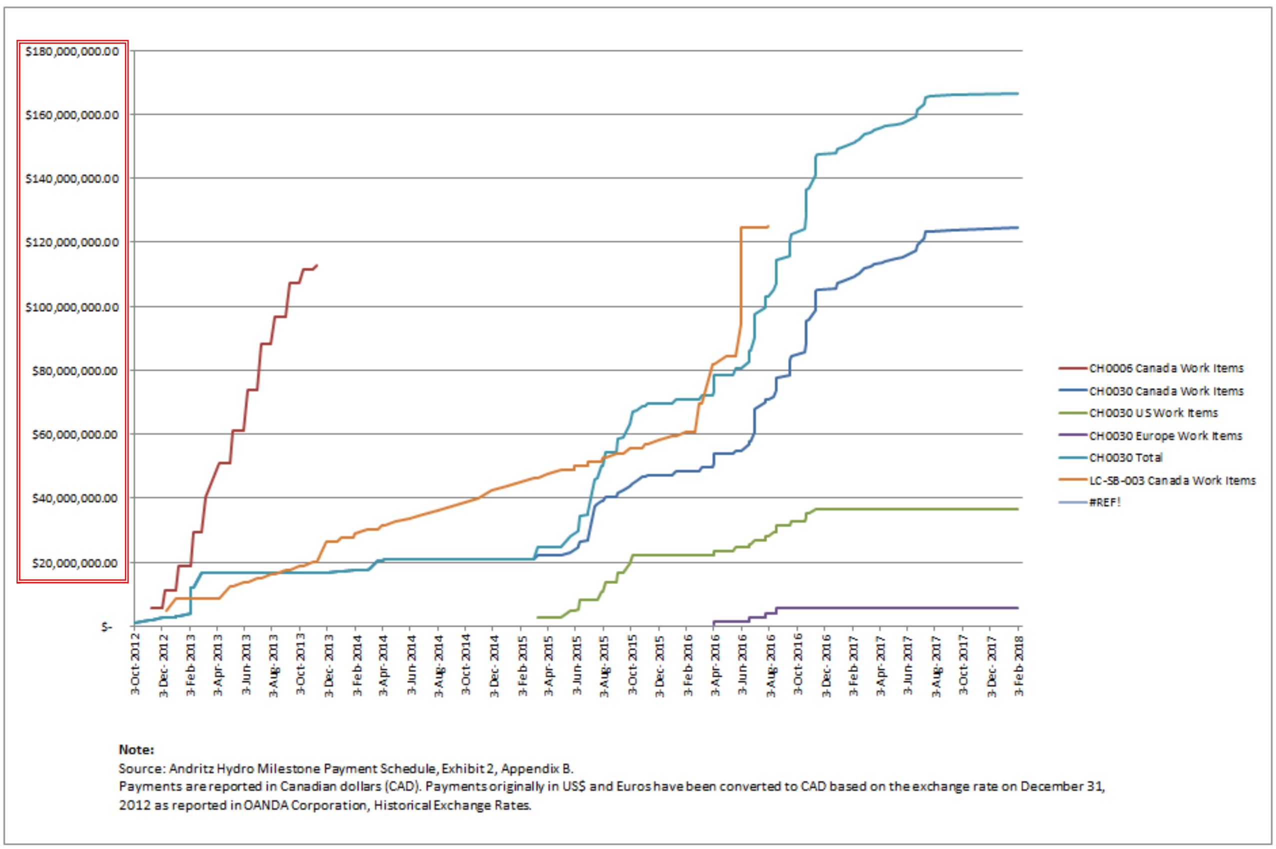

Figure 5-2 Composite Plot of Drawdown Payment Schedule – Contract CH0006, Contract LC-SB-003, and Contract CH0030

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SECTION 6

COMMERCIAL OPERATION AND MAINTENANCE SERVICES

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SECTION 6

COMMERCIAL OPERATION AND MAINTENANCE SERVICES

6.1 OPERATIONS AND MAINTENANCE PLAN

6.1.1 Commercial Operation Services

Nalcor plans to use outside services to assist it in operating and maintaining the terminal station extension at CF according to Nalcor's Operations and Maintenance (O&M) Philosophy document. The Churchill Falls Labrador Corporation will be responsible for the operation and maintenance of this facility.

Nalcor plans to operate the other components of the LCP they are constructing and financing by themselves, or through subsidiary companies established for taxing and legal reasons.

6.1.2 Adequacy of Start-Up and Long-Term Procedures

No comments will be furnished by MWH prior to Financial Close. The program for the operation services is currently under development and will not be available for review until later next year.

6.1.3 Reasonableness of Annual Operations and Maintenance Budget

MWH requested computation spreadsheets to support Nalcor's values of O&M Annual Charges contained in Table 6-1. This information was not available for review (December 2013).

6.1.4 Proposed Training Budget

No information is yet available for MWH's review. Nalcor advises that this information will not be available until late 2014.

6.2 OPERATIONS AND MAINTENANCE COST ESTIMATE

6.2.1 Completeness

The following table presents the estimated annual O&M costs provided for our review by Nalcor. They are figures that have been developed by the Integrated Project Team, which have been used in Nalcor's financial pro forma.

Table 6-1

ANNUAL OPERATIONS AND MAINTENANCE COSTS

Year:	1	2	3	4	5	10	20	30	40	50
Muskrat Falls Generation	$ 6,345,025	$ 6,345,025	$ 6,345,025	$ 6,345,025	$ 6,345,025	$ 6,345,025	$ 6,345,025	$ 6,345,025	$ 6,345,025	$ 6,345,025
Labrador Transmisson Assets	$ 2,148,360	$ 2,148,360	$ 2,148,360	$ 2,148,360	$ 2,148,360	$ 2,148,360	$ 2,148,360	$ 2,148,360	$ 2,148,360	$ 2,148,360
Labrador - Island Transmisson Link	$15,970,624	$15,970,624	$14,623,124	$15,870,624	$14,623,124	$16,070,624	$14,823,124	$14,823,124	$14,823,124	$14,823,124
Total:	**$24,464,009**	**$24,464,009**	**$23,116,509**	**$24,364,009**	**$23,116,509**	**$24,564,009**	**$23,316,509**	**$23,316,509**	**$23,316,509**	**$23,316,509**

The data shown in Table 6-1 are based on January 2012 costs and include 15 percent contingency allowances. Each of the first five years, starting from the first date of commercial operation of the project, the tenth year, and then each subsequent tenth year are indicated.

MWH has independently tried to verify that the annual operating and maintenance costs for MF are reasonable for the project using information from the following sources: data published in U.S. Energy Information Administration publication for power plants owned by major U.S. investor-owned utilities; historical information gathered by Canadian investigators from plants in the Canada and the United States and published in 1987 by “Water Power and Dam Construction” (WPDC) and updated by MWH via appropriate indices experienced by the USBR tracking system, one of the largest owners of hydroelectric power plants in the USA (the largest being the U.S. Army Corps of Engineers); and a recent study completed by MWH for the Susitna-Watana hydroelectric project in Alaska (600 MW). We find that the closest comparison to the value derived by Nalcor was the WPDC cost information that clearly separates out annual Operation and Maintenance costs and Renewals and Replacements costs. The information does not include the General and Administrative costs which typically run in the range of 35 percent to 40 percent of the O&M costs. G&A needs to be added to the O&M, R&R, as well as insurance costs to arrive at the Annual Cost for a project. Annual costs from this compilation do not include insurance. We find that annual O&M costs are nearly $8,445,000, approximately 33 percent more than those derived by Nalcor. Since the MF plant will be operated remotely, this would account for some of the disparity we have found in trying to compare the values. However, we believe that the O&M costs are below the normal annual costs experienced for other large hydroelectric plants that MWH is aware of.

Corporate costs (general and overhead) are allocated among the three projects based on the direct O&M cost estimates. They are:

- MF 23.95 percent;
- LTA 19.28 percent; and
- LIL 56.77 percent.

Energy Control Centre (ECC) costs are allocated among two projects based on expected use. They are:

- LTA 25 percent; and
- LIL 75 percent.

6.2.2 Assumptions

6.2.2.1 Nalcor's O&M strategy is to operate MF, terminal and converter stations at Soldiers Pond and MF, terminal station extension at CF, AC transmission lines in Labrador, DC transmission lines in Labrador and Newfoundland, and the SOBI crossing and transition stations remotely from Nalcor's ECC in St. John's and by local staff as required.

6.2.2.2 Routine maintenance, condition and performance monitoring, inspection, adjustment and minor repairs will be performed by Nalcor staff working at the facilities, or located nearby in other Nalcor facilities.

6.2.2.3 Major maintenance and repair, specialized inspections, tests, and adjustments will be performed by contractors through various arrangements depending on the service to be provided.

6.2.2.4 Support services including technical, environmental, accounting, budgeting, financial reporting, procurement, human resources, legal, etc. will be provided from Nalcor headquarters in St. John's.

6.2.2.5 Staffing requirements are discussed in Tables 6-2 through 6-9 in Subsection 6.2.4, and were provided by Nalcor.

6.2.2.6 Nalcor has advised MWH that, as the design is refined and more specific details are finalized, the staffing requirements will be reviewed and adjusted, if needed.

6.2.3 Reasonableness of Assumptions

The assumptions regarding the number of required personnel listed in tables contained in Subsection 6.2.4 Staffing are reasonable and many are generally assumed by utilities for large projects like LCP.

6.2.4 Staffing

Contained within Nalcor's O&M Philosophy document, LCP-PT-0000-PM-00010-01, are summary tables that designate the positions, number of personnel, and classification/expertise that are required for each of its major facilities found in the document for the LCP. For the principal facilities, we have included several of these tables below as reported by Nalcor.

Table 6-2

STAFFING REQUIREMENTS PROPOSED FOR MUSKRAT FALLS FACILITY

POSITION	NO. REQUIRED	CLASSIFICATION/EXPERTISE
PLANT MANAGER	1	ELECTRICAL/MECHANICAL ENGINEER
PLANT ENGINEER, ASSET SPECIALIST	1	ELECTRICAL/MECHANICAL ENGINEER
TECHNICAL SUPERVISOR	1	P&C/OPERATIONS/MECHANICAL/ ELECTRICAL TRADES & TECHNOLOGY
TECHNICAL OPERATOR	4	P&C/COMMUNICATIONS/OPERATIONS/MECHANICAL/ELECTRICAL TRADES & TECHNOLOGY
UTILITY WORKER	2	GENERAL MAINTENANCE
PLANNER	1	MECHANICAL/ELECTRICAL—TRADES & TECHNOLOGY
ENVIRONMENTAL COORDINATOR	1	BIOLOGY, SCIENCE
AREA OFFICE CLERK	1	ADMINISTRATION, ACCOUNTING
CLERK	1	CLERICAL/DOCUMENT CONTROL/STORES/TOOL CRIB
TOTAL STAFF MF	**13**	

Table 6-3

STAFFING REQUIREMENTS PROPOSED FOR

MUSKRAT FALLS, ISLAND LINK AND MARITIME LINK TRANSMISSION (SIC) FACILITIES

POSITION	NO. REQUIRED	CLASSIFICATION/EXPERTISE
SYSTEM OPERATOR	5	ELECTRICAL TECHNOLOGY
SYSTEM PERFORMANCE	1	ELECTRICAL ENGINEERING
OPERATIONS PLANNING	1	ELECTRICAL ENGINEERING
GENERATION COORDINATOR	1	ELECTRICAL OR HYDROTECHNICAL ENGINEER
TOTAL MF; LIL; ML	**8**	

The IE notes that the staffing includes provisions for the Maritime Link facilities that are believed to be just those that deal with Nalcor assets.

According to Nalcor's O&M Philosophy document, the Churchill Falls Labrador Corporation will be responsible for the operation and maintenance of the terminal station extension at CF.

Table 6-4

STAFFING REQUIREMENTS PROPOSED FOR MAINTENANCE OF TRANSMISSION LINES, ELECTRODE LINE, SHORE LINE POND ELECTRODE, DISTRIBUTION LINES AT MUSKRAT FALLS AND ASSOCIATED FACILITIES IN LABRADOR WILL BE THE RESPONSIBILITY OF TRANSMISSION AND RURAL OPERATIONS (TRO) LABRADOR. THIS INCLUDED THE SWITCHYARD AND CONVERTER STATION AT MUSKRAT FALLS, THE TRANSITION STATION AT FORTEAU BAY

POSITION	NO. REQUIRED	CLASSIFICATIONS/EXPERTISE	REMARKS
LINE WORKER	6	TRADES	
PROTECTION & CONTROL (P&C) TECHNOLOGIST	2	ELECTRICAL TECHNOLOGY	
ELECTRICIAN	4	TRADES	
TERMINAL MAINTENANCE A	2	TRADES	
SUPERVISOR	2	TRADES	
CLERICAL	1	TRADES	
PLANNER	1	TRADES	THE IE QUESTIONS THE EXPERTISE REQUIRED FOR THE PLANNER BELIEVING IT SHOULD BE AN ENGINEER OR TECHNOLOGIST
EQUIPMENT ENGINEER	1	PROFESSIONAL ENGINEER	
MECHANIC	1	TRADES	
TOTAL TRO LABRADOR	**20**		SATISFACTORY

Table 6-5

PROPOSED STAFFING LEVELS FOR TRO NORTHERN/CENTRAL INCLUDING MAINTENANCE OF TRANSMISSION LINES AND ASSOCIATED FACILITIES ON NEWFOUNDLAND INCLUDING SWITCHYARD AT SOLDIER'S POND, THE ELECTRODE LINE, SHORELINE POND ELECTRODE AT CONCEPTION BAY, THE SOBI CABLE CROSSING AND TRANSITION STATION NEAR SHOAL COVE

POSITION	NO. REQUIRED	CLASSIFICATION/EXPERTISE	REMARKS
LINE WORKER	8	TRADES	
P&C TECHNOLOGIST[1]	4	ELECTRICAL TECHNOLOGY	
NETWORK SERVICES TECHNICIAN	3	COMMUNICATION TECHNOLOGY	
EQUIPMENT ENGINEER	1	ELECTRICAL ENGINEERING	
ELECTRICIAN	6	TRADES	
TERMINAL MAINTENANCE A	2	TRADES	
GENERAL MAINTENANCE B	1	TRADES	
SUPERVISOR	2	TRADES	
VEGETATION INSPECTOR	1	TRADES	
PLANNER[2]	1	TRADES	THE IE QUESTIONS THE EXPERTISE REQUIRED FOR THE PLANNER. IT IS OUR OPINION THAT THIS IS AN ENGINEERING TASK.
MECHANIC	2	TRADES	
TOTAL TRO[3] NORTHERN & CENTRAL	**31**		SATISFACTORY

Notes:

1. A P&C Technologist is a person who will installs, tests, and performs maintenance and modifications to protective relaying, metering, instrumentation, and control equipment.
2. A Planner is defined as a person who co-ordinates the development and implementation of a computerized maintenance program, develops schedules, and assists in the implementation of maintenance.
3. Transmission and Rural Operations (TRO)

Table 6-6

PROPOSED STAFFING LEVELS FOR SOLDIERS POND CONVERTER STATION

POSITION	NO. REQUIRED	CLASSIFICATION/EXPERTISE	REMARKS
TECHNICAL SUPERVISOR	1	TECHNICAL SUPERVISOR P&C/ELECTRICAL TECHNOLOGY/ENGINEERING	
TECHNICAL OPERATOR	4	P&C/ELECTRICAL/MECHANICAL/OPERATIONS-TRADES AND TECHNOLOGY	
UTILITY WORKER	2	GENERAL MAINTENANCE	
ASSET SPECIALIST	1	ELECTRICAL/MECHANICAL ENGINEER TECHNOLOGIST	
TOTAL SOLDIERS POND	**8**		SATISFACTORY

Table 6-7

PROPOSED STAFFING LEVELS FOR ST. JOHN'S CORPORATE HEAD OFFICE

(ADDITIONAL STAFF REQUIRED FOR THE PROJECT)

POSITION	NO. REQUIRED	CLASSIFICATION/EXPERTISE	REMARKS
ENGINEERING	3	**MECHANICAL, P&C, ELECTRICAL**	
FINANCE-BUDGETS	1	ACCOUNTING GRADUATE	
FINANCE—GENERAL ACCOUNTING, FINANCIAL STATEMENT PREPARATION AND REPORTING	2	ACCOUNTING GRADUATE	
FINANCE—TRANSACTIONAL PROCESSING	3	ACCOUNTING GRADUATE	
FINANCE—CASH MANAGEMENT	1.5	ACCOUNTING GRADUATE	

Table 6-7 (cont'd)

PROPOSED STAFFING LEVELS FOR ST. JOHN’S CORPORATE HEAD OFFICE

(ADDITIONAL STAFF REQUIRED FOR THE PROJECT)

POSITION	NO. REQUIRED	CLASSIFICATION/EXPERTISE	REMARKS
ENVIRONMENTAL SPECIALIST, ECOLOGIST	3	BIOLOGY, SCIENCE	IN THE IE’S OPINION, THERE DO NOT SEEM TO BE SUFFICIENT BIOLOGISTS AND ENVIRONMENTAL ENGINEERS TO MONITOR THE PROJECT AND ITS GREAT GEOGRAPHIC SPREAD, ESPECIALLY IN THE EARLY YEARS WHEN THERE WILL BE NUMEROUS REPORTS TO DEVELOP AND FACILITIES TO MONITOR AND REPORT ON. THERE IS NO MENTION OF ANY CONTRACTORS AND CONSULTANTS PLANNED TO AID THE PROPOSED STAFF AS PRESENTLY PLANNED.[1]
INFRASTRUCTURE SUPPORT & CLIENT SUPPORT SPECIALIST (IS)	3	DEGREE OR DIPLOMA WITH APPROPRIATE TRAINING	
TOTAL CORPORATE HEAD OFFICE	**16.5**		SATISFACTORY

[1]Nalcor advised there are other staff to assist, thus a reasonable number of biologists will be available to accommodate project needs.

The total number of personnel that Nalcor proposes to use to operate and maintain the LCP facilities under their domain is 96.5 people.

In addition to those technical personnel and specialists who will be assigned to the LCP, Nalcor plans to engage the following services from others as given in Table 6-8.

Table 6-8

CONTRACTORS AND CONSULTANTS

SERVICE
SNOW CLEARING
ROAD MAINTENANCE
SUPPLY OF CONSUMABLES
PEST CONTROL
VEGETATION MANAGEMENT
VEHICLE MAINTENANCE
HELICOPTER SERVICES
TRUCKING AND OTHER TRANSPORTATION
DIVING
ELEVATOR MAINTENANCE
FIRE ALARM AND SUPPRESSION SYSTEMS MAINTENANCE
CRANE AND HOIST MAINTENANCE
PRESSURE VESSEL INSPECTIONS
HVAC MAINTENANCE
DAM SAFETY INSPECTIONS(1)

NOTES:
(1) IE suggests this consultant be included.

In addition to the outside services to be provided by others to Nalcor for the LCP, Nalcor has identified specialized technical support for the following equipment and systems as given in Table 6-9.

Table 6-9

OUTSIDE TECHNICAL SUPPORT

SERVICE, EQUIPMENT OR SYSTEM
TURBINES
GOVERNORS
GENERATORS
EXCITERS
CONVERTER STATION EQUIPMENT
CONTROL SYSTEMS
SWITCHGEAR
TRANSFORMERS
SUBMARINE CABLE
DYKE BOARD OF CONSULTANTS(1)
ENVIRONMENTAL CONSULTANTS(2)

NOTES:
(1) IE recommends that the Dyke Board of Consultants be moved to table 6 8.
(2) IE recommends that it be considered that environmental consultants be added to this list.

6.2.5 Maintenance Provisions

No information is currently available to review; descriptive material will not be available until 2014.

6.2.6 Administrative Costs

Corporate costs (general and overhead) are allocated among the three projects based on the direct O&M cost estimates. They are:

- MF 23.95 percent;
- LTA 19.28 percent; and
- LIL 56.77 percent.

ECC costs are allocated among two projects based on expected use. They are:

- LTA 25 percent; and
- LIL 75 percent.

MWH has found that General and Administrative costs are about 40 percent of O&M. Those being used by Nalcor are within this general parameter and appear to have been developed to support the listed values. MWH has not seen the actual derivation of these numbers.

6.2.7 Management Fees

No information is currently available for MWH's review. Nalcor advised information will be available next year.

6.2.8 Consumables

No information is currently available for MWH's review. Nalcor advised information will be available next year.

6.3 NALCOR ENERGY'S RELIABILITY STATISTICS

In the review of information furnished to MWH by Nalcor, MWH found information that is germane to consider for this review in document: LCP-PT-MD-0000-AM-PH-0001-01, REV.B1, Appendix XIV: Reliability Statistics. Nalcor's regulated utility, NLH, has been a member of the Canadian Electricity Association (CEA) for many years, and the 2006 to 2010 reporting period, which is tabulated below for reference, is a good source of data pertaining to the reliability of their projects compared to other utilities in their classification.

Table 6-10

NLH HISTORICAL RELIABILITY STATISTICS

YEARS 2006-2010

PARAMETER	CEA AVERAGE	NLH AVERAGE	NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION *Generating Availability Data System* (2007-2011) AVERAGE VALUE IS:[8]
FOR (FORCED OUTAGE RATE)[1]	2.60%	0.79%	5.79
DAFOR (DERATE ADJUSTED FORCED OUTAGE RATE)[2]	2.74	0.96	5.30

Table 6-10 (cont'd)

NLH HISTORICAL RELIABILITY STATISTICS

YEARS 2006-2010

PARAMETER	CEA AVERAGE	NLH AVERAGE	NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION *Generating Availability Data System* (2007-2011) AVERAGE VALUE IS:[8]
DAUFOP (DERATE ADJUSTED UTILIZATION FORCED OUTAGE PROBABILITY)[3]	2.40	0.84	NO DATA AVAILABLE
ICBF (INCAPABILITY FACTOR)[4]	8.4	8.04	11.92
FAIL RATE[5]	2.15	2.79	3.10
MOF (MAINTENANCE OUTAGE FACTOR)[6]	0.85	0.70	1.92
POF (PLANNED OUTAGE FACTOR)[7]	5.41	6.59	8.46

NOTES:
1. A measure of the time a unit is unable to operate because of a problem.
2. A measure of the time a unit is unable to operate, or is able to operate but not at rated capacity, because of a problem.
3. The probability that a unit will not be available, or is available but not at rated capacity, when required.
4. A measure of the total outage time for a unit.
5. The rate at which a unit encounters a forced outage.
6. A measure of the total maintenance outage hours for a unit.
7. A measure of the planned maintenance outage hours for a unit.
8 Values in table were computed by MWH using North American Electric Reliability Corporation's (NAERC) Generating Availability Data System (GADS) data.

Nalcor draws the following conclusion: “The table indicates that the generating equipment operated by Newfoundland and Labrador Hydro performs very well compared to the other Canadian utilities.” Based on the numbers presented in Table 6-10, the IE concurs with this observation.

The IE has also added values taken from NAERC’s GADS for about the same period of time for comparison purposes. Based on these values, which have a much broader base but include plants in the southern and western portion of the United States, we find Nalcor’s overall performance exceeds the NAERC averages for the period compared.

Based on the above data, the IE is of the opinion that the expected performance of Nalcor, and the companies it has established to operate and maintain the LCP assets, is expected to be at least as reliable as the CEA average and is satisfactory.

SECTION 7

PROJECT AGREEMENTS

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SECTION 7

PROJECT AGREEMENTS

As required by the Professional Services Agreement between Nalcor and MWH, and the Reliance Agreement among Nalcor, MWH, and Government, requirements were set forth for MWH to review the following Project Agreements: Power Purchase Agreement; Interconnection Facilities Agreement; Water Management Agreement; Water Lease Agreement; and O&M Agreements. Subsequent to completion of MWH's review following the terms of this agreement, Government directed MWH to only review the technical portions of the Water Management Agreement; the Water Lease Agreement; and the O&M Agreements. The other agreements to be reviewed by MWH that were initially included in MWH's Scope of Work, at Government's request, are currently being reviewed by other independent consultants under their agreement with Government.

7.1 WATER MANAGEMENT AGREEMENT (WMA)

The WMA, between Nalcor and the Churchill Falls Labrador Corporation Limited was ordered by the Board of Commissioners of Public Utilities, Newfoundland and Labrador, No. P.U. 8(2010) on March 9, 2010. The intent of the WMA is to manage and operate facilities within the Province in the most efficient way for the production, transmission, and distribution of power and energy, and be assessed and allocated and re-allocated in the manner necessary to effect such a policy. As such, the objective of the WMA

> shall be the coordination of the Power generation and Energy production in the aggregate for all Production Facilities on the Churchill River to satisfy the Delivery Requirements for all Suppliers, in a manner that provides for the maximization of the long term Energy-generating potential of the Churchill River, while ensuring that the provisions of any Prior Power Contracts are not adversely affected.

The WMA requires the establishment of a Water Management Committee consisting of four members selected by the parties, and the Committee is required to appoint an Independent Coordinator which may be one or more persons.

The duties of the Independent Coordinator shall

> establish short and long term Production Schedules for all Production Facilities on the Churchill River, through the coordination of production scheduling of the Suppliers based upon the use of the aggregate generating Capability, storage and transmission facilities of any supplier on the Churchill River.

The Independent Coordinator is required to determine the total power to be produced and is required to determine and prepare the production schedules, which shall specify the amount of power to be produced by each supplier's production facilities in accordance with the provisions of the WMA. The Independent Coordinator is required to determine the energy storage and energy losses assignments for each of the suppliers in accordance with the terms of the WMA. The procedure under which this is accomplished and the calculations necessary to do so are described in Annex "A" to the WMA to appropriately assign energy storage amounts and energy losses to each supplier. Energy benefits for each of the suppliers are also described therein.

The term of the WMA is discussed in Article 12 of the agreement and will continue in full force until the earliest of the

> (i) the permanent cessation of all operations at either of the CF(L) Co Production Facilities or the Nalcor Production Facilities, and (ii) any earlier date agreed to by the Suppliers, subject to the execution of a new water management agreement agreed to by the Suppliers and approved by the Board pursuant to Subsection 5.4(3)(a) of the Act.

In the opinion of the IE, the WMA is similar to other agreements where compensation must be allocated to generation facilities that share the resources of a river basin and is found to be satisfactory.

7.2 WATER LEASE AGREEMENT (LEASE)

The Water Lease Agreement (Lease) between Nalcor and Newfoundland and Labrador was made March 17, 2009. It gives Nalcor the exclusive use of all of that part of the Churchill River below the 425-foot-contour line and that part of the Churchill River below El. 425, downstream to the intersection of the Churchill River with the meridian of 60 degrees-45 minutes west of Greenwich, and includes all waters that originate within the Churchill River catchment area and all rivers that naturally flow within the catchment area. It also gives Nalcor the right to flood those areas held by the Lease. The period of the Lease is 50 years.

Government has reserved rights of the public to use the Lower Churchill River for the purpose of fishing, shooting, hunting, trapping, logging, and travelling. It places restrictions on the public that would constitute a hazard to Nalcor where it would create an operation concern.

The Lease gives Nalcor the exclusive right to store and regulate so much of the Lower Churchill River as is economic or beneficial for the purpose of developing the Lower Churchill River.

Nalcor may be required to install, operate, and maintain stream flow, water level monitoring stations, and other instrumentation and means to measure and record level of quality at designated locations. Copies of records can be provided, as requested, at least once per year.

Nalcor is required to pay to Government $2.50 per MWhour of power generated each year from their facilities. This rate can be adjusted every year based on the Consumer Price Index (CPI, Canada, All-items) as established under the Statistics Act of Canada.

Records must show the rates and amounts of water used on a daily basis for the generation of hydroelectric power, rates and amounts of water spilled or released downstream, operating water levels, extent of the flooded area, and additional related information requested by Government. Submittals are to be made at the end of March each year to the Water Rights Section of the Department of Environment and Conservation.

7.3 O&M AGREEMENTS

O&M Agreements are currently being discussed and planned by Nalcor and will not be available for review until later next year. The IE, therefore, cannot comment on the following: Term and Termination Provisions; Budget Review and Control; Owner and Operator Responsibilities; Operations and Maintenance Plans; Environmental Compliance Plans; Reporting Procedures; Compensation and Incentive Bonus; and Consistency.

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SECTION 8

REVIEW PERMITS AND LICENSES

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SECTION 8

REVIEW PERMITS AND LICENSES

We have included in Section 8.2 our review of only those typical permits prepared for the Muskrat Falls project since there are currently over 300 permits which do not include those being prepared for the LIL project. We have also reviewed the EIS, Executive Summary, for the LIL project during the early phase of our studies.

8.1 PROJECT-WIDE ENVIRONMENTAL PROTECTION PLAN (P-WEPP)

As part of MWH's review of permits and licenses, we reviewed the Project-Wide Environmental Protection Plan (P-WEPP)-Component 1 and 4b (Plan) provided by Nalcor. Our copy notes a date of January 24, 2013, which is believed to be the most current edition of the Plan. The Plan succinctly provides the basis for all work practices required to mitigate negative environmental effects associated with construction and commissioning of the LCP. These requirements can be found in the following sections of the Plan:

- INTRODUCTION
- PROJECT DESCRIPTION
- ROLES AND RESPONSIBILITIES
- RELEVANT LEGISLATION
- GENERAL ENVIRONMENTAL PROTECTION PROCEDURES
- ENVIRONMENTAL MONITORING AND FOLLOW UP
- CONTINGENCY PLANS
- FORMS
- REFERENCE DOCUMENTS
- REGULATORY CONTACT LIST.

The Plan includes an extensive number of figures and several tables that illustrate typically acceptable or unacceptable practice, and presents examples of recommended mitigation methods. The Plan lists in considerable detail the General Environmental Protection Procedures recommendations that are to be followed for the LCP. The Plan provides to those monitoring the progress of the work the guidelines and information necessary to successfully inform others as to the acceptability of the work being performed in a satisfactory manner in compliance with the Plan. Sample forms are provided in Section 8 of the Plan, as noted above, to track the activities for which environmental monitoring is prescribed. The forms provide a historic record for regulatory review, as may be required in the permits issued to Nalcor, as well as its contractors. In the opinion of the IE, the Plan, itself, is comprehensive and suitable, and is judged to be satisfactory for the LCP.

8.2 REVIEW OF PERMITS AND LICENSES AND APPROVALS

Based on our initial review of the documents furnished and those that are available on the Nalcor website for the LCP, we have summarized our findings of representative permits that currently are available for review. This summary is contained in Table 8-1, below. We realize that additional documents will be made available as they are prepared and issued for the LIL that will require further sampling to ascertain the information to form the IE's opinions.

Table 8-1

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
SLI-00006	DFO Project Review C7 (5+800) Caroline's Brook	Approved	Complete	Permit should reference P-WEPP relative to potential equipment oil leaks, operation of equipment in and near water, fueling and overnight storage of equipment, and working within 15 m of a water body. Nalcor comments: 1. The P-WEPP has been referenced in all applications; 2. The requirements P-WEPP requirements are applicable for all construction activities regardless of the approval documentation. 3. Requirements are made aware to all contractors during the procurement process and during construction by the LCP Environment Team

Table 8-1 (cont'd)

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
SLI-00008	Alter a Body of Water - Temporary Bridge C7 (5+800) Caroline's Brook	Approved	Complete	Permit should reference P-WEPP relative to potential equipment oil leaks, operation of equipment in and near water, fueling and overnight storage of equipment, and working within 15 m of a water body. Nalcor comments: See SLI-00006
SLI-00082	DOEC Blanket Permit - Construction Power- Work within 15m	Approved	Complete	
SLI-00115	Department of Fisheries and Oceans (DFO) Project Review - Water Use - C7 - C22	Approved	Complete	
SLI-00094	DFO Project Review Culvert 1 - Access Road to GD11	To Be Reviewed	Complete	Permit should reference P-WEPP relative to potential equipment oil leaks, operation of equipment in and near water, fueling and overnight storage of equipment, and working within 15 m of a water body. Nalcor Comment: See SLI-0006 Is there a need for water control/pumping contingency

Table 8-1 (cont'd)

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
				if higher stream discharges are encountered? Nalcor Comment: The contingency not required for this temporary structure; design is 1:5 year peak flow; if the flow exceeded, the road will be temporarily closed.
SLI-00079	Navigable Waters Protection Act (Muskrat Falls) p-WC-1e	To Be Reviewed	Complete	
SLI-00158	DOEC Alter a body of water - Dams	To Be Reviewed	Complete	
LCP-AM-CD-0000-EA-RP-0014-01	Fish Habitat Compensation Strategy	DRAFT		pg. 58-60: Would be helpful to have a map showing the various reaches referred to in the Total Phosphorous graphs. Reaches appear to be different from those shown in Figure 3.2. Nalcor Comment: Nalcor advised by DFO to keep additional figures to minimum; the reaches, as MWH notes are slightly different, however, they are known to the regulators.

Table 8-1 (cont'd)

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
				pg. 95: Figure 3.24 shows general cut and fill associated with Delta Compensation Works. Biological function of the delta habitat would likely improve if the placed excavated material elevations paralleled the original ground profile rather than being uniformly horizontal. Nalcor comment: Agree with the comment, however, based on constructability and past experience, they selected least-cost solution recognizing that ice and high flows will modify the sections during post-construction. Fine sediments (i.e., silts and fine sands) would need to comprise <15-18% of the substrate composition if the proposed deltas are to be effective as spawning habitat for most fish (i.e., redd builders and broadcast spawners). It's mentioned that wave action will act to 'clean' the sediments in the new near shore terraces (pg. 96) that will be constructed for habitat compensation. Are all proposed terrace sites subject to sufficient wave action to ensure substrates remain functional for successful fish spawning /

Table 8-1 (cont'd)

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
				incubation? Will the benefits of wave action be outweighed by the effect of waves on shoreline stability/erosion and consequent sediment inputs to those habitats? The Edward's Brook (pg. 100) delta is located in a relatively protected bay. Will tributary discharges be sufficient to scour fine sediments and maintain the spawning function proposed for all the proposed new delta Compensation areas? For example, it appears unlikely that the Metchin River area (pg. 105), Minipi River (pg. 106), Elizabeth River (pg. 107), and West Mechin River (pg. 108) discharges will maintain spawning function within the entire area of the constructed deltas. pg.102: Does the Gull Island Plateau have groundwater upwelling? If it doesn't, then brook trout spawning would be unlikely due to the importance of groundwater upwelling for selection of their spawning locations.

Table 8-1 (cont'd)

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
				Nalcor Comment: This is potential physical habitat construction option and is not included in the Fish Habitat Compensation Plan. It is being considered relevant for ongoing compensation considerations. Nalcor also includes a lengthy additional paragraph regarding this matter that is not included herein, for brevity.
TF8110486-LCD-DRAFT Compensation Plan, Dec 2020, 12 Rev 4[1]	Draft Fish Habitat Compensation Plan, Muskrat Falls Rev 4 Dec 2012	DRAFT		pg. 43: Predicted use of shoals for brook trout spawning will be unlikely due to the importance of groundwater upwelling for selection of their spawning locations. Also, what is the predicted functional life (i.e., number of years) of these shoals as viable spawning / incubation areas given the relatively low velocities and high water depths (see Table 5.5, pg. 40) and the predicted increase in TSS for the initial 10-15 years? pg. 49-50: Predicted use of deltas for brook trout spawning will be unlikely due to the importance of groundwater upwelling for selection of their spawning locations.

Table 8-1 (cont'd)

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
				Nalcor comment: Comment similar to above comment on upwelling RP-0014 pg. 51: Figure 5.14 shows general cut and fill associated with Delta Compensation Works. Biological function of the delta habitat would likely improve if the placed excavated material elevations paralleled the original ground profile rather than being uniformly horizontal. Nalcor Comment: Comment similar to above comment in RP-0014 pg. 53-54: Will high frequency flood discharges in Pinus River be sufficient to scour fine sediments and maintain the spawning function of proposed new delta compensation area? What proportion of the delta is expected to be 'flushed' of fine sediments during a higher frequency event such as 2-yr. event? Nalcor Comment: Yes. Mean annual spring flows are pro-rated at 90 cms. Table 5.8 shows that at a discharge of 55 cms has the potential to flush up to 1 cm diameter

Table 8-1 (cont'd)

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
				material. A 2-yr event would be assumed to be of this magnitude. "...therefore, most of the delta is anticipated to flush, although there will be areas of deposition. Exact extent of substrate redistribution will not be known until monitoring begins after inundation." pg. 58: Have any habitat compensation options for improving / creating spawning and rearing habitat been explored within the cross section of the existing tributaries upstream of the full surface level (FSL)? Nalcor Comment: Yes. As part of the stakeholder consultation process (both Framework and strategy stages) all potential options were presented, and on the table, including compensation outside the entire watershed as well as areas of existing tributaries upstream of the FSL. It was indicated by some stakeholders, similar to other projects in Labrador, that any extension of physical works outside the proposed project area would be an extension of the project footprint.

Table 8-1 (cont'd)

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
				Therefore, compensation options were directed at fish species within the reservoir with physical construction constrained within the reservoir boundary. pg. 63: If slope in Tables 5.7 and 5.8 is in percent (as stated), then Incipient Particle Diameters (cm) should be divided by 100. Similarly, potential calculation error in Table 5.09 and 5.10. For the tractive force equation in Newbury and Gaboury (1993), slope is measured as m/m. Nalcor Comment: Correction required. The values of slope are in m/m however the column headings for slope in Tables 5.7 and 5.9l indicate %. The headings have been revised. pg. 83+88: Grain size analysis should also be done at some spawning redd sites to determine percent fines, and therefore, the suitability of the substrate for incubation.

Table 8-1 (cont'd)

PRELIMINARY FINDINGS OF REPRESENTATIVE PERMITS

REVIEWED BY THE INDEPENDENT ENGINEER

Document Reviewed			Reviewer's Assessment and Nalcor Comments	
Document No.	**Title**	**Status**	**Complete / Incomplete**	**Questions / Comments**
				Nalcor Comment: As stated on page 87, grain size distributions will be determined for material placed in each delta so that they can be used to determine the degree of substrate shifting and movement. The geotechnical programs have provided data related to existing material as well and will be used for comparisons. Baseline samples of existing instream material can be collected in 2013 and added to the material baseline.
TF1010486-LCHGEEM-Rev3-Dec2012[1]	Aquatic Environmental Effects Monitoring Program Dec 2012	DRAFT		Generally, the proposed EEM program appears to be quite comprehensive and appropriate in breadth for monitoring effects downstream of Muskrat Falls dam. pg. 27: The frequency and intensity / duration of field sampling events of, for example, turbine entrainment, fish habitat utilization, and fish population assessments, in the mainstem and tributaries should be clearly stated or shown in a table. pg. 43: Why is the trigger for injury/survival rate not provided? Will it be established prior to conducting the monitoring?

Responses to our questions and comments on Permits, Fish Compensation Strategy, Draft Fish Habitat Compensation Plan, and Aquatic Environmental Effects Monitoring Program were provided by Nalcor. We acknowledge that our questions pertaining to these four subjects were satisfactorily answered by Nalcor and, in our opinion, conclude that the adopted approach is satisfactory.

8.3 FUNDING OF ENVIRONMENTAL STUDIES AND ADEQUACY OF BUDGET AMOUNT

8.3.1 Current Studies Funding

Table 8-2 contains the information available from Nalcor that lists budget funding for current environmental studies.

Table 8-2

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
Environmental Affairs - General Consultation	5.1.300.0000.0303.02.00	NE-LCP General	$44,787
		Consultation Database	$25,000
		Environmental Affairs - General Consultation	$19,787
	5.1.300.0000.0303.02.00 Total		**$44,787**
Environmental Effects Monitoring	5.1.360.0000.0310.02.00	Both Gull Island and Muskrat Falls Generation	$1,442,500
		Aerial surveys of the river and surrounding locations for waterfowl and analyze temporal use of traditional ashkui sites.	$25,000
		Ambient air quality monitoring (AAQM) program	$50,000
		Caribou Program	$75,000
		Environmental Effects Monitoring	$900,000
		Mercury levels monitoring program	$100,000
		Nalcor will monitor and assess greenhouse gas fluxes as a result of LCP activities.	$75,000
		Nalcor will monitor ice conditions and issue public advisories on the condition of ice.	$75,000

Table 8-2 (cont'd)

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS

AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
		Nalcor will monitor methylmercury levels in river otter feces.	$25,000
		Baseline methylmercury exposure program (HHRA)	$105,000
		Regionally uncommon terrestrial vegetation survey	$12,500
		Muskrat Falls – Generation	$255,000
		Comprehensive monitoring and follow-up program upon LCP start-up, employing an adaptive management process	$80,000
		Nalcor will access marten data for post-project trapping for analysis and comparison with pre-project trapping data.	$75,000
		Nalcor will re-deploy GPS/VHF collars on bears in the river valley.	$50,000
		Winter aerial and ground or GPS telemetry surveys of moose	$50,000
		Mud Lake Drinking Water Baseline Study	$0
		Labrador - Island Transmission Link	$435,000
		Access Impacts Monitoring Program	$0
		Environmental Effects Monitoring Program	$210,000
		Furbearer Baseline Study	$75,000
		Harlequin Duck Baseline	$75,000
		Rare Plant Survey & Planning	$75,000
	5.1.360.0000.0310.02.00 Total		**$2,132,500**
Environmental Management Expert Legal Advice	5.1.300.0000.0103.02.10	E&AA Management	$132,782
		Environmental Management Expert Legal Advice	$132,782
	5.1.300.0000.0103.02.10 Total		**$132,782**
General (Response to Project Modifications)	5.4.330.0000.0000.02.00	Labrador - Island Transmission Link	$29,000

Table 8-2 (cont'd)

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS

AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
		General (Response to Project Modifications)	$24,000
		Labrador Woodland Caribou Recovery Team	$5,000
	5.4.330.0000.0000.02.00 Total		**$29,000**
LCP Aboriginal Agreements Consultation (Interpretation & Translation)	5.1.420.0000.0000.02.01	Aboriginal Affairs	$75,000
		LCP Aboriginal Agreements Consultation (Interpretation & Translation)	$25,000
		Continually engage Aboriginal groups throughout the construction and operation of the LCP.	$25,000
		Aboriginal Affairs consultation - Linked to Item #1	$25,000
	5.1.420.0000.0000.02.01 Total		**$75,000**
LCP Aboriginal Agreements General Planning & Strategic Support	5.1.420.0000.0000.02.12	IBA	$210,148
		EMC	$55,000
		LCP Aboriginal Agreements General Planning & Strategic Support	$125,148
		IBA Implementation Committee shared costs with Innu Nation	$30,000
	5.1.420.0000.0000.02.12 Total		**$210,148**
LCP Aboriginal Planning Expert Advice	5.1.420.0000.0000.02.11	Aboriginal Affairs	$60,000
		LCP Aboriginal Planning Expert Advice	$60,000
	5.1.420.0000.0000.02.11 Total		**$60,000**
LCP E&AA - Agreements with Other Aboriginal Groups	5.1.430.0000.0403.52.00	Aboriginal Affairs	$168,101
		LCP E&AA - Agreements with Other Aboriginal Groups	$168,101
	5.1.430.0000.0403.52.00 Total		**$168,101**

Table 8-2 (cont'd)

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS

AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
LCP E&AA - Island Link Environmental Impact Statement (EIS) Response to Information Requests (IRs)	5.4.330.0000.0306.02.00	Labrador - Island Transmission Link	$1,880,000
		LCP E&AA - Island Link EIS Response to IR's	$1,880,000
	5.4.330.0000.0306.02.00 Total		**$1,880,000**
LCP E&AA - OAG Document Production	5.1.430.0000.0403.02.00	Aboriginal Affairs	$9,600
		LCP E&AA - OAG Document Production	$9,600
	5.1.430.0000.0403.02.00 Total		**$9,600**
LCP E&AA - OAG translation	5.1.430.0000.0403.02.01	Aboriginal Affairs	$15,596
		LCP E&AA - OAG translation	$15,596
	5.1.430.0000.0403.02.01 Total		**$15,596**
LCP E&AA - Project Commitments - Island Link Transmission	5.4.330.0000.0350.02.01	Labrador - Island Transmission Link	$250,000
		Caribou Considerations in Design	$0
		Environmental Effects Monitoring Program	$50,000
		LCP E&AA - Project Commitments - Island Link Transmission	$200,000
		Marine Fisheries Compensation Planning/Support	$0
		Rare Plant Mitigation Efforts	$0
		Socioeconomic Effects Monitoring Program	$0
	5.4.330.0000.0350.02.01 Total		**$250,000**
LCP E&AA Aboriginal Agreements Legal Support	5.1.400.0000.0103.02.00	IBA	$228,508
		EMC	$25,000
		LCP E&AA Aboriginal Agreements Legal Support	$203,508
	5.1.400.0000.0103.02.00 Total		**$228,508**

Table 8-2 (cont'd)

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS

AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
LCP E&AA Generation Project Commitments (WQM, Research, EMS, etc.)	5.2.320.0000.0350.02.00	Both Gull Island and Muskrat Falls Generation	$518,870
		Caribou Program	$100,000
		Compensation program for flooded trap lines	$0
		LCP E&AA Generation Project Commitments (WQM, Research, EMS etc.)	$168,870
		RTWQM	$250,000
		Muskrat Falls – Generation	$80,000
		Nalcor will conduct an amphibian relocation program prior to reservoir filling.	$0
		Nalcor will re-deploy GPS/VHF collars on bears in the river valley.	$40,000
		Winter aerial and ground or GPS telemetry surveys of moose	$40,000
	5.2.320.0000.0350.02.00 Total		**$598,870**
LCP E&AA Generation Updates and Supplements to Studies	5.2.320.0000.0304.02.10	Both Gull Island and Muskrat Falls Generation	$506,013
		LCP E&AA Generation Updates and Supplements to Studies	$506,013
		Muskrat Falls – Generation	$0
		Update to EcoRisk Assessment - Re-Baseline for Monitoring Program	$0
	5.2.320.0000.0304.02.10 Total		**$506,013**
LCP E&AA Island Transmission Aboriginal & Stakeholder Consultation	5.4.330.0000.0304.02.04	Labrador - Island Transmission Link	$147,801
		LCP E&AA Island Transmission Aboriginal & Stakeholder Consultation	$87,801
		Stakeholder Relations	$60,000
	5.4.330.0000.0304.02.04 Total		**$147,801**

Table 8-2 (cont'd)

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS

AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
LCP E&AA Management General Consultant Services	5.1.310.0000.0000.02.00	E&AA Management	$6,080
		LCP E&AA Management General Consultant Services	$6,080
	5.1.310.0000.0000.02.00 Total		**$6,080**
LCP E&AA Transmission Island Link DFO Compensation Strategy	5.4.330.0000.0320.02.00	Labrador - Island Transmission Link	$710,000
		LCP E&AA Transmission Island Link DFO Compensation Strategy	$360,000
		Labrador - Island Transmission Link DFO Compensation Strategy	$350,000
	5.4.330.0000.0320.02.00 Total		**$710,000**
LCP E&AA Transmission Island Link Document Production	5.4.330.0000.0305.02.02	Labrador - Island Transmission Link	$154,806
		LCP E&AA Transmission Island Link Document Production	$154,806
	5.4.330.0000.0305.02.02 Total		**$154,806**
LCP E&AA Transmission Island Link Legal Support	5.4.330.0000.0103.02.00	Labrador - Island Transmission Link	$579,661
		LCP E&AA Transmission Island Link Legal Support	$454,661
		LIL Environmental Management Plans	$50,000
		Marine Fisheries Compensation Planning/Support	$50,000
		Socioeconomic Effects Monitoring Program	$25,000
	5.4.330.0000.0103.02.00 Total		**$579,661**
LCP EA GENERATION - PERMIT fees & Studies	5.2.350.0000.0320.02.00	Both Gull and Muskrat Falls Generation	$850,000
		LCP EA GENERATION - PERMIT fees & studies	$750,000
		Gull Island and MF Stream Surveys	$100,000
	5.2.350.0000.0320.02.00 Total		**$850,000**

Table 8-2 (cont'd)

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS

AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
LCP EA Generation (Aboriginal and Stakeholder Consultation)	5.2.320.0000.0303.02.00	Both Gull Island and Muskrat Falls Generation	$42,000
		LCP EA Generation (Aboriginal and Stakeholder Consultation)	$42,000
	5.2.320.0000.0303.02.00 Total		**$42,000**
LCP EA Generation DFO Compensation Strategy	5.2.320.0000.0320.02.00	Both Gull Island and Muskrat Falls Generation	$281,099
		LCP EA Generation DFO Compensation Strategy	$281,099
		Muskrat Falls – Generation	$350,000
		FHCP	$350,000
	5.2.320.0000.0320.02.00 Total		**$631,099**
LCP EA Generation Legal Support	5.2.300.0000.0103.02.00	Both Gull Island and Muskrat Falls Generation	$1,427,372
		Compensation program for flooded trap lines	$0
		LCP EA Generation Legal Support	$1,427,372
		Baseline methylmercury exposure program (HHRA)	$0
		Generation EA Court Injunction Legal Support	$0
		Muskrat Falls – Generation	$25,000
		FHCP	$25,000
		Aboriginal Affairs	$100,000
		Continually engage Aboriginal groups throughout the construction and operation of the Project.	$50,000
		Aboriginal Affairs consultation - Linked to Item #1	$50,000
	5.2.300.0000.0103.02.00 Total		**$1,552,372**

Table 8-2 (cont'd)

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS

AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
LCP EA Island Link Process Costs (Panel, Harmful Alteration, Disruption or Destruction [HADD], etc.)	5.4.330.0000.0310.02.00	Labrador - Island Transmission Link	$600,000
		LCP EA Island Link Process Costs (Panel, HADD, etc.)	$450,000
		LCP EA Island Link Process Costs	$150,000
	5.4.330.0000.0310.02.00 Total		**$600,000**
LCP IBA Third Party Service (Document Preparation IBA, IMA)	5.1.420.0000.0000.02.00	IBA	$20,000
		LCP IBA Third Party Service (Document Preparation IBA, IMA)	$20,000
	5.1.420.0000.0000.02.00 Total		**$20,000**
Regulatory Compliance	5.1.360.0000.0000.00.00	Both Gull Island and Muskrat Falls Generation	$187,500
		Canada Yew relocation program	$0
		Historic and Archaeological Resources Contingency and Response Plan	$25,000
		Historic and Archaeological Resources Recovery	$100,000
		Historic Resources Overview Assessment pre-construction Stage 1	$50,000
		Regionally uncommon aquatic vegetation survey	$12,500
		Muskrat Falls – Generation	$75,000
		Active osprey nest survey and relocation program	$0
		Nalcor will conduct an amphibian relocation program prior to reservoir filling.	$25,000
		Nalcor will conduct surveys of forest avifauna (ruffed grouse and wetland songbird habitat) at key intervals during construction, and operation and maintenance.	$50,000

Table 8-2 (cont'd)

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS

AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
		Reservoir Beaver survey program	$0
		Fish Recovery/Relocation	$0
		Labrador - Island Transmission Link	$200,000
		Historic Resources Overview Assessment	$200,000
		Rare Plant Mitigation Efforts	$0
	5.1.360.0000.0000.00.00 Total		**$462,500**
LCP EA LIL - PERMIT fees & studies	5.4.350.0000.0320.02.00	Labrador - Island Transmission Link	$500,000
		Stream Surveys	$500,000
	5.4.350.0000.0320.02.00 Total		**$500,000**
Generation Environmental Policy and Plan Development	5.2.360.0000.0000.00.00	Both Gull Island and Muskrat Falls Generation	$50,000
		Compensation program for flooded trap lines	$25,000
		Nalcor will develop mitigation measures for any species of plant to be in danger of extirpation in Labrador to the LCP.	$25,000
	5.2.360.0000.0000.00.00 Total		**$50,000**
LIL Environmental Policy and Plan Development	5.4.360.0000.0000.00.00	Labrador - Island Transmission Link	$325,000
		Adaptive Management	$0
		Avifauna Considerations in Design	$75,000
		Caribou Considerations during Operations	$0
		Caribou Considerations in Design	$75,000
		LIL Environmental Management Plans	$50,000
		Marine Fisheries Compensation Planning/Support	$50,000
		Marten Baseline Study & Considerations in Design	$50,000

Table 8-2 (cont'd)

CURRENT ENVIRONMENTAL STUDIES FUNDING MUSKRAT FALLS

AND LABRADOR-ISLAND TRANSMISSION LINK

Control Account Description	Control Account	Budget Items	2013 Budget
		Socioeconomic Effects Monitoring Program	$25,000
	5.4.360.0000.0000.00.00 Total		**$325,000**
	GRAND TOTAL		**$12,972,224**

Because the project was the subject of a full environmental assessment process, the IE's review was not requested by Nalcor.

8.3.2 Studies to be Performed During Construction

Nalcor has prepared a budget for the period 2012 through 2018 to cover the required environmental activities that will be occurring during the construction period and leading up to it. As a basis for the studies, Nalcor considered the following items and commitments:

- Requirements of the Environmental Assessment (EA) for MF and the LTA;
- Commitments and anticipated requirements of the LIL EA;
- Environmental requirements of the Impacts and Benefits Agreement (IBA) with the Innu Nation;
- Mitigation measures designed to maintain compliance with applicable legislation, EA commitments and requirements, and minimize effects; and
- Baseline data needed to inform the environmental effects monitoring programs required post-construction.

Nalcor has advised MWH that they have completed extensive field programs in support of the EA process. The estimates provided herein have been derived with consideration of these costs. Nalcor advised MWH that many of the projected costs should be considered conservative with sampling frequencies at the upper limit of those expected for all programs.

Table 8-3

STUDIES AND SURVEYS TO BE PERFORMED DURING CONSTRUCTION

PROJECT/TOPIC	2012	2013	2014	2015	2016	2017	2018	Total
Muskrat Falls								
Historic Resources--Stage 1		$50,000	$50,000					$100,000
Historic Resources--Stage 3	$800,000	$100,000	$100,000					$1,000,000
Stream Surveys	$35,000	$25,000	$25,000	$25,000	$25,000			$135,000
Avifauna Management (Including Osprey nest relocation)	$70,000	$125,000	$125,000	$75,000				$395,000
Terrestrial Relocation (Beaver/Amphibian)			$100,000		$100,000			$200,000
Fish Recovery and Fish Relocation			$125,000		$125,000			$250,000
Subtotal	**$905,000**	**$300,000**	**$525,000**	**$100,000**	**$250,000**			**$2,080,000**
Labrador TL Asset								
Historic Resources—Stage 1		$12,500	$12,500					$25,000
Historic Resources—Stage 3		$75,000	$75,000					$150,000
Stream Surveys		$10,000	$10,000	$10,000				$30,000
Avifauna Management (Including Osprey nest relocation)		$50,000	$50,000	$50,000				$150,000
Rare Plant Survey (Aquatic)		$5,000	$5,000					$10,000
Subtotal		**$152,500**	**$152,500**	**$60,000**				**$365,000**
Island Link								
Historic Resources		$200,000	$150,000	$150,000	$75,000			$575,000
Stream Surveys		$50,000	$50,000	$50,000	$50,000			$200,000
Rare Plant Surveys		$50,000	$50,000	$50,000	$50,000			$200,000
Avifauna Management (Including Osprey nest relocation)		$100,000	$100,000	$100,000	$92,500			$392,500
Subtotal		$400,000	$350,000	$350,000	$267,500			$1,367,500
Total	**$90,500**	**$852,500**	**$1,027,500**	**$510,000**	**$517,500**			**$3,812,500**

8.3.3 Studies to be Performed During Project Operation and Environmental Monitoring

Nalcor has furnished budget estimates for funding programs/studies associated with environmental issues that will be conducted during the operating period of the project (current dollars). A summary of this information is contained in Table 8-4.

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Table 8-4

ENVIRONMENTAL PROGRAMS/STUDIES AND MONITORING COSTS

OPERATIONS PERIOD

Program	Year 1-5	Year 6-10	Year 11-15	Year 16-20	Year 21-25	Component	Comments
Bank Recession Rates Downstream	$375,000	$375,000				MF	$75,000 per year up to year 10 and then assumed no longer required. Could be modified based on monitoring results
Bank Erosion with the Reservoir	$625,000	$625,000				MF	$125,000 per year up to year 10 and then assumed no longer required. Could be modified based on monitoring results
Sediment Transport	$375,000	$375,000				MF	$75,000 per year up to year 10 and then assumed no longer required. Could be modified based on monitoring results
Ice Formation - Reservoirs, Downstream Including Mud Lake	$100,000	$50,000				MF	2x year first 5 years (10,000 per trip including helicopters). Frequency after TBD based on results of monitoring. Assume 1 x per year for year 5 through 10 and then no further monitoring required.

Table 8-4 (cont'd)

ENVIRONMENTAL PROGRAMS/STUDIES AND MONITORING COSTS

OPERATIONS PERIOD

Program	Year 1-5	Year 6-10	Year 11-15	Year 16-20	Year 21-25	Component	Comments
Water Quality Monitoring	$1,250,000	$625,000	$200,000	$200,000	$200,000	MF	For first 5 years use current then scale back based on monitoring results to gradually phase out system. Some level of monitoring to at least 25 years (nutrient levels predicted to return to background)
Green House Gas Flux	$30,000					MF	Cost of equipment - $20,000. High degree of confidence in prediction. Can be measured via plant staff so limited additional cost after installation.
Fish Habitat Utilization Upstream and Downstream	$750,000	$300,000				MF	Seven years required for Granite Canal authorization. Depends of monitoring results. Based on baseline monitoring

Table 8-4 (cont'd)

ENVIRONMENTAL PROGRAMS/STUDIES AND MONITORING COSTS

OPERATIONS PERIOD

Program	Year 1-5	Year 6-10	Year 11-15	Year 16-20	Year 21-25	Component	Comments
Nutrient Levels Upstream and Downstream	$500,000	$200,000				MF	Seven years required for Granite Canal authorization. Depends of monitoring results. Based on baseline monitoring
Fish Growth, Condition, Fecundity, Trophic Feedings and Age Structure Upstream and Downstream	$750,000	$300,000				MF	Seven years required for Granite Canal authorization. Depends of monitoring results. Based on baseline monitoring
Entrainment	$75,000					MF	One time study. Assume results are acceptable.
Compensation Works for Substrate Placement, Habitat Stability	$500,000	$200,000				MF	Seven years required for Granite Canal authorization. Depends of monitoring results. Based on baseline monitoring

Table 8-4 (cont'd)

ENVIRONMENTAL PROGRAMS/STUDIES AND MONITORING COSTS

OPERATIONS PERIOD

Program	Year 1-5	Year 6-10	Year 11-15	Year 16-20	Year 21-25	Component	Comments
Benthic Macro-invertebrates, Primary and Secondary Productivity, and Fish Health and Habitat Utilization in Reservoir	$500,000	$200,000				MF	Seven years required for Granite Canal authorization. Depends of monitoring results. Based on baseline monitoring. Based on 3 trips per year.
Monitoring Wetland Habitat Creation and Development Success	$500,000	$500,000				MF	Assume similar requirements as FHCP. 10 year monitoring program.
Methylmercury Levels in River Otter	$125,000					MF	Based on baseline monitoring costs. Not predicted to be an effect so monitoring will only be required for first 5 years to confirm predictions. May be revised based on monitoring results.

Table 8-4 (cont'd)

ENVIRONMENTAL PROGRAMS/STUDIES AND MONITORING COSTS

OPERATIONS PERIOD

Program	Year 1-5	Year 6-10	Year 11-15	Year 16-20	Year 21-25	Component	Comments
Monitoring of Osprey Methylmercury Levels through Feather Collection	$125,000					MF	Based on baseline monitoring costs. Not predicted to be an effect so monitoring will only be required for first 5 years to confirm predictions. May be revised based on monitoring results.
Telemetry Monitoring of Black Bears (included Relocated Bears)	$100,000					MF	Based on baseline monitoring costs. Not predicted to be an effect so monitoring will only be required for first few years to confirm predictions. May be revised based on monitoring results.

Table 8-4 (cont'd)

ENVIRONMENTAL PROGRAMS/STUDIES AND MONITORING COSTS

OPERATIONS PERIOD

Program	Year 1-5	Year 6-10	Year 11-15	Year 16-20	Year 21-25	Component	Comments
Aerial Surveys to Monitor the Effectiveness of the Beaver Relocation Program	$100,000					MF	Based on baseline monitoring costs. Not predicted to be an effect so monitoring will only be required for first few years to confirm predictions. May be revised based on monitoring results.
Monitor Relocated Osprey Nests	$100,000					MF	Based on baseline monitoring cost. Should determine success within first 2-3 years. High degree of confidence that no significant effect. Extensive experience with technique.

Table 8-4 (cont'd)

ENVIRONMENTAL PROGRAMS/STUDIES AND MONITORING COSTS

OPERATIONS PERIOD

Program	Year 1-5	Year 6-10	Year 11-15	Year 16-20	Year 21-25	Component	Comments
Winter and Summer Ground Surveys of Wildlife Habitat Association Transects Established as Part of Baseline to Examine Changes to Distribution and Abundance, Will Be Conducted for Furbearers and Other Wildlife	$200,000	$200,000				MF	Based on baseline monitoring costs. Not predicted to be an effect but may be longer term in terms of seeing effects. Monitoring may be required for first 10 years to confirm predictions. May be revised based on monitoring results.
Forest Avifauna Will Be Monitored for Changes in Distribution and Abundance by Resurveying along Transects Established in 2006 and 2007	$200,000	$100,000				MF	Based on baseline monitoring costs. Not predicted to be an effect but may be longer term in terms of seeing effects. Monitoring may be required for first 10 years to confirm predictions. May be revised based on monitoring results.

Table 8-4 (cont'd)

ENVIRONMENTAL PROGRAMS/STUDIES AND MONITORING COSTS

OPERATIONS PERIOD

Program	Year 1-5	Year 6-10	Year 11-15	Year 16-20	Year 21-25	Component	Comments
Moose Will Be Monitored Using Winter Aerial Surveys and/or GPS Telemetry of Moose in Key Wintering Areas and Areas Where Habitat Is Altered	$200,000					MF	Based on baseline monitoring costs. Not predicted to be an effect so monitoring will only be required for first 5 years to confirm predictions. May be revised based on monitoring results.
Assessment of Trapping Data Post Project Will Be Conducted	$50,000					MF	Desk top review to confirm effects prediction. $10,000/year for first 5 years.
Methylmercury Levels in the Reservoirs Will Be Monitored. Monitoring Will Include Fish in the Lower Churchill River, Goose Bay, and Lake Melville. Monitoring Will Also Include Seals Downstream of Muskrat Falls.	$400,000	$400,000	$400,000	$400,000	$400,000	MF	$75,000/year based on baseline program costs (upstream and downstream). Maybe scaled backed based on results but predicted to take 25 years to return to baseline levels.
Total MF	$7,930,000	$4,450,000	$600,000	$600,000	$600,000		

Table 8-4 (cont'd)

ENVIRONMENTAL PROGRAMS/STUDIES AND MONITORING COSTS

OPERATIONS PERIOD

Program	Year 1-5	Year 6-10	Year 11-15	Year 16-20	Year 21-25	Component	Comments
Monitor the Effects on Listed Plants or Induced Effects Resulting from Improved Access.	$50,000					LIL	Limited area to be monitored
Monitoring of Any Compensation Works as a Result of HADD of Marine Fish Habitat Will Be Conducted According to a Protocol Acceptable to DFO. Initial Monitoring (as-built monitoring) Will Be conducted to Provide Information on the Structure of the Compensation Works, and Subsequent Effectiveness Monitoring Will Also Include a Biological Component to Provide Some Measure of Productivity Occurring at the Compensation Works.	$600,000	$200,000				SOBI	Monitoring of the rock berms will be done using a remotely operated method such as ROV. $200 000 for data collection, data analysis and report preparation x 4 years (Year 2, 3, 5, &7) = $800,000

Assumptions

- Based on review of Generation EIS limited monitoring for Labrador Transmission Assets
- Based on review of LIL EIS there are limited commitments for the overland transmission. Subject to conditions of EA release (i.e., assume no freshwater habitat monitoring for DFO)

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8.3.4 Mitigation During Construction

Nalcor furnished to MWH a list of studies and mitigation measures that they intend to conduct during construction of the LCP. As noted previously, the mitigation measures were designed to maintain compliance with the applicable legislation, EA commitments and requirements, and to minimize effects on the habitat. We have repeated the items that contain mitigation measures in Table 8-5 that were taken from Table 8-3 without knowledge of any study work that was included with the mitigation since there was no breakout of the mitigation costs from study costs. The IE has confirmed with Nalcor that the bulk of the cost is for mitigation of the items listed in Table 8-5. Nalcor has informed MWH that if additional funds are necessary for mitigation, Nalcor will provide the funds to ensure that habitat is fully protected.

Table 8-5

MITIGATION COSTS DURING CONSTRUCTION

PROJECT/TOPIC	2012	2013	2014	2015	2016	2017	2018	TOTAL
Muskrat Falls								
Historic Resources—Stage 3	$800,000	$100,000	$100,000					$1,000,000
Avifauna Management (Including Osprey nest relocation)	$70,000	$125,000	$125,000	$75,000				$395,000
Terrestrial Relocation (Beaver/Amphibian)			$100,000		$100,000			$200,000
Fish Recovery and Fish Relocation			$125,000		$125,000			$250,000
SUBTOTAL	**$870,000**	**$225,000**	**$450,000**	**$75,000**	**$225,000**			**$1,845,000**
Labrador TL Asset								
Historic Resources—Stage 3		$75,000	$75,000					$150,000
Avifauna Management (including Osprey nest relocation)		$50,000	$50,000	$50,000				$150,000
SUBTOTAL		**$125,000**	**$125,000**	**$50,000**				**$300,000**
Island Link								
Historic Resources		$200,000	$150,000	$150,000	$75,000			$575,000
Avifauna Management (including Osprey nest relocation)		$100,000	$100,000	$100,000	$92,500			$392,500
SUBTOTAL		**$300,000**	**$250,000**	**$250,000**	**$167,500**			**$967,500**
TOTAL	**$870,000**	**$650,000**	**$825,000**	**$375,000**	**$392,500**			**$3,112,500**

8.4 ENVIRONMENTAL FLOW

To maintain and provide environmental habitat downstream of the LCP, studies were performed to establish the minimum flow release required from the MF facilities when the power station was shut down. Usually these studies employ instream flow incremental methodology (IFIM) techniques requiring habitat assessment at numerous cross sections along the river and for different depths of water that relate to flow releases. These assessments in turn are related to the requirements of different fish species to arrive at the most desired range of depth, associated with the amount of habitat in which the fish can be sustained. Information provided to MWH indicates that the minimum release flow established for the LCP (the environmental flow) is 552 cms for impoundment of the MF reservoir. No environmental flow condition during operations exists in the DFO Section 35 Fisheries Authorization or the Authorization to Alter a Body of Water provided by the Government of Newfoundland and Labrador. Churchill Falls' minimum flow is 475 cms and Nalcor advises that for practically all times, to maintain the reservoir at 39.0 FSL, flow through the power plant will be at least 475 cms. We have not independently reviewed the data to support this determination of no minimum flow being prescribed.

During the period while the reservoir is filling, estimated to be about 10 to 12 days, releases will be made that amount to 30 percent of the normal flow for the period. Once the reservoir is filled to El 39.0 FSL, flows will be released equal to the inflow. The reservoir will be maintained between El 38.5 and 39.0 msl.

8.5 TECHNICAL REQUIREMENTS AND CONSTRAINTS

From an environmental perspective, Nalcor identified a number of constraints during the planning process that were considered in the design and execution of the LCP. Constraints and methods and means of mitigation to address the issues are summarized in Table 8-6.

Table 8-6

CONSTRAINTS AND PROVIDED MITIGATION

Constraint	Mitigation
Harmful Alteration, Disruption or Destruction of Fish and Fish Habitat, including fish mortality	- Obtain authorization from Dept. of Fisheries and Oceans based on a comprehensive habitat compensation program, environmental effects monitoring program and an approved environmental protection plan. - Used a unique approach to leverage the incidental habitat gained with the reservoir to obtain habitat units. - Committed to compensation flow during impoundment to reduce fish mortality caused by dewatering.

Table 8-6 (cont'd)

CONSTRAINTS AND PROVIDED MITIGATION

Constraint	Mitigation
Stream Crossings	Addressed through a blanket approval process with the Dept. of Environment and Conservation and standard mitigation approach accepted by DFO. Navigable water crossings identified and approval provided for navigable waters.
Historic Resources	Historic Resources potential mapping created and an investigation approach agreed with the provincial archeology office. Recovery plan approved for known sites and a contingency plan in place for inadvertent discoveries.
Wetlands	- Environmental protection plan approved which includes mitigation measures for wetlands. - A wetland compensation strategy has been proposed and a plan will be developed to address wetland losses within the reservoir. - Potential partnerships with wetland conservation agencies are to be explored.
Downstream Effects (including mercury)	Extensive analysis and modeling as part of the environmental assessment process indicates no significant downstream effects beyond Goose Bay. An environmental effects monitoring program has been developed to confirm effects predictions and an adaptive management approach will be employed.
Avifauna and Migratory Birds Convention Act	An avifauna management plan based on comprehensive surveys has been developed to allow project activities to continue during the migratory bird nesting season and to avoid raptor nesting.
Red Wine Mountain Caribou and Endangered Species (including rare plants)	The approved environmental protection plan includes measures to protect caribou and other endangered species. An environmental effects management plan has also been developed for caribou and species at risk.
Transmission Line Routing	Constraint mapping developed for all transmission lines and environmental constraints considered in conjunction with technical and economic constraints to optimize routing.

Table 8-6 (cont'd)

CONSTRAINTS AND PROVIDED MITIGATION

Constraint	Mitigation
Reservoir Clearing	Reservoir clearing methodology selected to optimize technical and economic constraints as well as ensure wildlife access, navigation and aesthetics during operations.

The IE has reviewed the EA requirements and Fisheries Act Authorization and is of the opinion that the prescribed conditions will not restrict the LCP given the design will accommodate the prescribed conditions to mitigate the issues. Nalcor has advised MWH that during the LCP's execution, if issues that are being mitigated are not as effective as proposed, they will modify the mitigation methods and means to achieve the intended results.

8.6 TECHNICAL AND COMMERCIAL ISSUES

Nalcor advised MWH that only a very limited number of issues were identified during the study and design phase of the project that were of technical and commercial importance. Table 8-7 lists the two potential commercial issues related to constraints to the LCP and includes the adopted mitigation for resolution of the issue.

Table 8-7

TECHNICAL AND COMMERCIAL ISSUES AND PROVIDED MITIGATION

Issue	Mitigation
Requirement for a letter of credit for the fisheries authorization.	This requirement was waived by the Department of Fisheries and Oceans based on the public ownership of the LCP.
Requirement for the provision of minimum downstream flow during impoundment and operations.	Flow values required align with available inflows and the WMA with the Upper Churchill plant.

Based on information made available to MWH and correspondence with Nalcor, there are no known issues with respect to technical or commercial aspects of the project or with permits or licenses. Because the majority of the LCP is on Crown Land, with the exception of small lengths of HVdc transmission line, land acquisition or expropriation will mitigate any perceived issues.

8.7 REVIEW SOCIO-ECONOMIC ENVIRONMENT ASSESSMENT REPORT

The Executive Summary presents a comprehensive review of the topics that were studied and included in Table 16-3 of the EIS, starting on page 85 of this document, the *Cumulative Environmental Effects Summary: Socio-economic Environment* for the findings to date.

Table 8-8 is a simplified version of the EIS Summary and is presented below to be a readily available resource for further assessment by the IE.

Table 8-8

ABBREVIATED SUMMARY OF ENVIRONMENTAL EFFECTS FINDINGS OF EIS

SOCIOECONOMIC ENVIRONMENT

LABRADOR-ISLAND TRANSMISSION LINK

TOPIC	FINDING	FINDING
VALUED ENVIRONMENTAL COMPONENT (VEC)	LIKELY CUMULATIVE ENVIRONMENTAL EFFECTS OF OTHER FUTURE PROJECTS AND ACTIVITIES	CUMULATIVE ENVIRONMENTAL EFFECTS SUMMARY
HISTORIC AND HERITAGE RESOURCES	GROUND DISTURBANCE LCH; GENERAL INFRASTRUCTURE; INCREASED OHV ACCESS WITH FORESTRY ROADS; COULD CONTRIBUTE TO CUMULATIVE EFFECTS NEAR COMMUNITIES	NOT SIGNIFICANT
COMMUNITIES	MAY BE DEMAND ON HEALTH-RELATED INFRASTRUCTURE DURING CONSTRUCTION; HEALTH CONCERNS WITH PROJECT OPERATION; UNIQUE TO THIS TYPE OF PROJECT	NOT SIGNIFICANT
ECONOMY, EMPLOYMENT AND BUSINESS	MAY HAVE EFFECTS THAT OVERLAP WITH PROJECT EFFECTS; MAY RESULT IN LABOR SHORTAGES AND HIGH LABOR COSTS; CAPACITY OF PROVINCIAL COMPANIES TO SUPPLY MATERIALS AND SERVICES TO THE LCP AND OTHER PROJECTS MAY BE COMPROMISED; PROVINCIAL REVENUE BENEFIT FROM the LCP AND OTHER PROJECTS	NOT SIGNIFICANT

Table 8-8 (cont'd)

ABBREVIATED SUMMARY OF ENVIRONMENTAL EFFECTS FINDINGS OF EIS

SOCIO-ECONOMIC ENVIRONMENT

LABRADOR-ISLAND TRANSMISSION LINK

LAND AND RESOURCE USE	LIMITED PROPOSED DEVELOPMENT ACTIVITY OR LIKELY CHANGES IN NATURE AND INTENSITY OF EXISTING ACTIVITIES	NOT SIGNIFICANT
MARINE FISHERIES	NO KNOWN OR LIKELY CHANGES TO THE NATURE AND INTENSITY OF VESSEL TRAFFIC, OR ANY OTHER PROPOSED DEVELOPMENT PROJECTS IN THE AREA	NOT SIGNIFICANT
TOURISM	INSUFFICIENT SUPPLY OF SHORT-TERM ACCOMMODATIONS AND INCREASED DEMAND FOR RESTAURANTS AND RETAIL SERVICES; INCREASED TRAFFIC ON ROUTE 510 AND ROUTE 430; INCREASED NUMBER OF WORKERS AS RESULT OF GENERAL ECONOMIC DEVELOPMENT COULD AFFECT THE ABILITY OF TOURISTS TO FIND AVAILABLE ACCOMMODATION DURING THE PEAK TOURISM SEASON	NOT SIGNIFICANT
VISUAL AESTHETICS	ALTERATIONS TO THE EXISTING VIEWSCAPES DUE TO VEGETATION CLEARING TO ACCOMMODATE ACTIVITIES, OR INFRASTRUCTURE CONSTRUCTION RELATED TO OTHER PROJECTS	NOT SIGNIFICANT

8.8 SALT WATER INTRUSION

In an early study performed by Hatch for Nalcor, a salt water intrusion 3D Model Study was performed to determine the effects of the reservoirs and new schedule of releases that would be necessary for the MF generating complex and the effects in the Churchill River and the estuary from Goose Bay. Salinity and temperature modeling was conducted using a software program DHI MIKE 3 using data from bathymetric surveys of the Churchill River and Canadian Hydrographic Service nautical chart data, and temperature and salinity measurements taken during the 1998-1999 oceanography field program.

The salinity program concluded that there is a stable and slightly brackish surface layer of 2-4 practical salinity units (PSU) in Goose Bay and Lake Melville. There is also a stable saline bottom layer (15-25 PSU) that extends throughout Goose Bay and Lake Melville. Lower Churchill River salinity was between 2-3 PSU with no variation in depth or location between Muskrat Falls and the river mouth.

With the MF plant in operation and the compensation flow being followed, the salt water penetrations would be pushed back to almost their original location at the river mouth as was modeled when Gull Island was modeled (MF was not solely modeled at this time and we believe that it was not modeled alone). The report concludes that saline intrusion is limited to the last few kilometers of the river nearest the mouth" and "that the progress of the intrusion would be halted at this maximum extent even without the release of any compensation flow." Based on this early study, in the IE's opinion, there should be no issues with saline penetrations with the LCP in operation.

8.9 RESERVOIR FILLING AND MANAGEMENT STRATEGIES

The IE reviewed the Information Request, IR#JPR.28 (Information Request-Joint Review Panel) associated with the proposed reservoir filling and management strategies under which both Gull Island and the MF projects were reviewed. The criteria that was adopted for flow release was 30 percent of the Mean Annual Flow (MAF) which equates to about 500 cms for the minimum fixed flow during reservoir impounding. The actual minimum flow release for impoundment is 552 cms. The current normal minimum flow release is 350 cms. The 500 cms has been found to be a flow that "both the fish populations within the river and the habitat would have experienced previously." Nalcor has advised the IE that once the spillway is constructed, the compensation flow (minimum flow of 350 cms) will be modified, if necessary based on monitoring results. This will allow flexibility to allow proper adjustments in the flow based on what the monitoring results reveal. It is uncertain whether the permits provide for this adjustment and it must be verified that they do allow for revisions to the prescribed and agreed to value by the regulatory agencies and concerned parties. The report determines the filling time for MF and the environmental effects for fish and fish habitat. The report does not lead directly to a recommendation, but lists the findings of the study, both pro and con. Based on the data presented, Alternative 4: Fall appears to be the desirable choice with a filling time of 15-19 days. Elsewhere in the documents that MWH reviewed, we found a citing of filling time of 9-11 days which equates to the spring alternative, Alternative 2, which lists 9-11 days; this alternative was apparently selected. This alternative notes that it has the least amount of adult mortality, but the young-of-year would be lost in de-watered habitat perimeters. Table 8, page 11, where this information is found does not mention the adults issues under the fish issues. We note there was apparently a trade-off made in which more data was presented to support this decision. We requested support backup data but it has not been furnished. (See 8.10; this work is no longer in MWH's scope of work.)

8.10 DOCUMENTATION AND SUPPORT CONCLUSIONS

As noted in Section 8.2, the IE has reviewed a sample of the permits that have been prepared to date and requested additional information as well as providing comments on what has been performed. This information was received from Nalcor and noted in Table 8-1.

Based on the exchange of comments to date, in the opinion of the IE, the documentation presented supports the conclusions. No further information has yet been presented on permits and studies performed for the LIL project; no opinion by the IE is necessary since Government has advised MWH that it is no longer a part of their scope of work.

For other studies (e.g., the saline study as discussed in Section 8.8), the documentation presented by Nalcor supports the conclusion that there will be no adverse effect from LCP operations.

8.11 UNUSUAL CIRCUMSTANCES

Unusual circumstances identified by Nalcor that are related to the Muskrat Falls/LTA and LIL include the following items summarized in Table 8-9:

Table 8-9

UNUSUAL CIRCUMSTANCES AND PROVIDED MITIGATION

Circumstance	Mitigation
Cultural significance of the rock knoll at Muskrat Falls.	This effect was mitigated through consultation with the Innu Nation and project design which avoided diversion tunnels through the rock knoll and minimized the disturbance in this area.
Presence of culturally significant sites such as the last shaking tent ceremony.	This effect was mitigated through consultation with the Innu Nation and funding of an Innu Elder Site visit and documentation of this event.
Presence of cultural significant plant in the river valley (Canada Yew).	This was mitigated by commitment to relocate the plants prior to impoundment.

In addition, MWH was not made aware by Nalcor if the Environmental Assessment of the lands and rights-of-way associated with the projects has been performed to assess the potential for finding hazardous waste materials on the MF site or the LTA or LIL sites. In particular, hazardous materials, such as PCBs and asbestos, that are associated with older electrical equipment that may be present at existing switchyard facilities is unknown where project(s) interfacing will occur.

The IE is not aware of any other significant unusual circumstances that should be identified and discussed herein.

8.12 STATUS OF REMEDIAL ACTIVITIES

Information provided by Nalcor pertaining to remedial activities associated with the environmental surveys, studies, monitoring, and mitigation that are currently ongoing and will be performed during and after construction is summarized in Table 8-10.

Table 8-10

SUMMARY AND STATUS OF REMEDIAL ACTIVITIES ASSOCIATED WITH ENVIRONMENTAL WORK

IER Table No.	Title	Cost to Date	Status	Remarks
8—3	Current Studies Funding MF and LIL	Unknown	Unknown	No information pertaining to the ML is included in this Table or IER
8—4	Studies and Surveys to be Performed During Construction	Unknown	Unknown	
8—5	Environmental Programs/Studied and Monitoring Costs, Operating Period	Period has not started	Not Applicable	
8—6	Mitigation Costs During Construction	Unknown	Unknown	These costs are only for mitigation and do not include studies which are included in Table No. 8-4

8.13 CURRENT STATUS OF PERMITS

Table 8-11 presents a general summary of the permit process to date and the status of the permits, including the authorizing entities responsible for issuing the permits. Table 8-12 lists a breakout of permits for each of the principal contracts furnished to MWH, the agency responsible for review, and the current status. As can be noted in this table, there are still 63 pending permits yet to be approved by Government (as of October 2, 2013). We note that Nalcor advises that the approved permits by Government are all current (December 2013). MWH has not independently checked to verify that this represents the current conditions and has not directly talked to Government Agencies about any of the permits, relying solely on the input we receive from Nalcor.

Table 8-11

PERMIT STATUS

Description	Permit For	Date Issued	Status
EA Release Federal and Provincial	MF and LTA	March 2012	Issued
EA Release Provincial	LIL	June 2013	Issued; Federal Release imminent
Authorizations	DFO (Generation) DFO (Transmission)		Issued Habitat Quantification Accepted. Determining Compensation requirements.
Authorizations	Transport Canada Dam and Reservoir		Minor Works approved Authorization in progress
Provincial Permits	Crown Lands Dam and Powerhouse Reservoir and Transmission Line Clearing Quarries (blanket), stream crossings (blanket), and buildings		Approved for Generation Site and Labrador Transmission Assets Permit issued Permit issued Numerous permits (See representative permits in Table 8-1.)

Table 8-12

PERMIT STATUS BY CONSTRUCTION PACKAGE

Construction Package	Permits Required	Permits Developed	Submitted to Nalcor	Reviewed by EMC	Submitted to Government	Approved	Pending
South Side Access Road – CH0004	51	51	51	51	51	51	0
Bypass Road – SSAR	8	8	8	8	8	3	5
Clearing – CH0048	54	54	54	54	54	54	0
Site Utilities – CH0005 (temp camp)	22	22	22	22	22	22	0
Construction Power – CD0512	34	34	34	34	34	34	0
Reservoir Clearing	11	11	11	11	11	8	3
Bulk Excavation – CH0006	42	40	40	40	40	35	7
Construction of Intake and Powerhouse, Spillway and Transition Dams – CH0007	2	2	2	2	2	1	1
North Spur Stabilization Works – CH0008	20	12	12	12	12	11	9
HVac Line Clearing – CT0341	15	15	15	15	15	10	5
HVac Line Construction – CT0319	23	23	23	23	23	15	8
Geotechnical SM0713	4	4	4	4	4	3	1
Churchill Falls Camp – CD0538	8	8	8	8	8	7	1
Electrode Geotechnical – SD0565	3	3	3	0	0	0	3
Component 3 Earth Works – CD0503	17	5	5	5	5	0	17
SOBI Civil Works – LC-SB-021	3	1	1	1	1	0	3
TOTAL	**317**	**293**	**293**	**290**	**290**	**254**	**63**

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SECTION 9

NALCOR ENERGY'S PROJECT FINANCIAL PRO FORMA

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SECTION 9

NALCOR ENERGY'S PROJECT FINANCIAL PRO FORMA

The purpose of this section is to review Nalcor's[6] financial planning for the LCP as represented in Nalcor financial models/pro forma and other resources, and to review projected results of operations as represented in Nalcor financial models.

9.1 INTRODUCTION

This section includes the following topics:

- Capital costs
- Financial planning
- Annual costs
- Revenue requirements and projections
- Implementation issues

Reviews of Nalcor's financial planning and projected results of operations are preliminary, conditioned by development of the LCP. The LCP is progressing rapidly, but at this juncture the financial information includes a number of unknown features, including the accuracy and degree of precision of estimated costs and cost contingencies.

The review of overall LCP economics has been narrowed by this constraint, and focus is placed on technical content and analysis of the Nalcor financial models.

The scope of the review covers three projects being developed by Nalcor, namely MF, LTA, and LIL, collectively comprising three of the four LCP projects. The review does not include the Maritime Link (ML) project being developed by Emera.

9.2 CAPITAL COSTS

A principal feature of the development of the LCP is preparation of estimates of construction and ancillary costs, collectively known as Capital Costs. Section 5 of this IER addresses in detail the LCP construction cost estimate; Section 4 addresses the construction schedule. This section addresses ancillary costs, including indirect costs, historical capital outlay, interest during construction, and renewals/replacements.

9.2.1 Indirect Costs

An important component capitalized into the LCP funding mechanisms is the cost of financing. This cost category includes bond counsel, financial advisory, underwriter discount, official

[6] Nalcor is a body corporate existing pursuant to the Energy Corporation Act being Chapter E-11.01 of the *Statutes of Newfoundland and Labrador*, 2007.

statement printing and distribution, and other costs. Because of the very high credit worthiness of the financing securities, we are advised that there will be no cost of bond insurance premiums or surety costs.

Financing costs for the three projects included in the models total $16.90M, as follows:

MF	$ 7.10M
LTA	$ 1.54M
LIL	$ 8.25M
Sum (Total LCP-Nalcor)	$ 16.90M

Other indirect costs included in the DG3 estimate include:

- project management;
- integrated commissioning;
- project vehicles / helicopter support;
- insurance / commercial;
- land acquisition and permits;
- quality surveillance and inspection;
- freight forwarding services; and
- environmental and aboriginal affairs.

In our opinion, the approach and the comprehensiveness of the technical estimates is consistent, and even better than those normally seen in projects of this type.

Financing fees, namely those for arrangement and commitment (LIL at 1.8 percent of amount financed, for example), are in the range typically seen in other similar projects.

9.2.2 Historical Capital Outlay

Capital costs that have occurred or shall have occurred prior to project financing are included in the DG3 estimate. Some utilities capitalize such costs in their main financing packages where some form of short-term "bridge financing" may have been used to pay for the initial construction activities. Such bridge financing securities are refinanced into the main financing structures. Other utilities fund the initial construction outlay using equity funds on-hand and do not re-capitalize those expenditures into the main financing vehicles.

Nalcor's DG3 cost estimate and financial planning models include more than $186M in pre-government sanction development costs.

Table 9-1 summarizes these costs, provided by Nalcor, by project.

Table 9-1

HISTORICAL COSTS

PROJECT	HISTORICAL COST (note 1; note 2)
Muskrat Falls	$97,303,164
Labrador Transmission Assets	4,196,093
Labrador-Island Transmission Link	85,307,165
Total (LCP-Nalcor)	**$186,806,422**

Notes:

Note 1: Cost data in Table 9-1 are reported at original cost.

Note 2: Historical costs are those costs associated with the projects that have occurred before Project Sanction, December 17, 2012.

9.2.3 Interest During Construction

The DG3 construction cost estimate does not include costs of interest during construction (IDC), also called "advanced funds used during construction" (AFUDC). However, IDC is an important feature to capitalize in the financings and it is included in the Nalcor financial models. Table 9-2 summarizes the IDC values included for the three projects.

Table 9-2

FINANCING COST AND INTEREST DURING CONSTRUCTION COST

PROJECT	IDC
MF	$403,270,000
LTA	$95,700,000
LIL	$462,976,000
Total LCP-Nalcor	**$961,946,000**

9.2.4 Renewals and Replacements

Nalcor advised the IE that the financial planning for the projects did not specifically include costs for major equipment renewals and replacements in the capital or annual cost estimates. Their opinion is that with proper design and installation and with regular and prudent maintenance following manufacturers' recommended scheduled maintenance there should be no need to replace the equipment since its useful life will exceed the bond repayment period.

The IE is of the opinion, based on experience that funds should be provided for major replacements in the 25-30 year period with minor replacement after 10-15 years of service.

If major repairs/replacements become necessary, Nalcor will have access to Provincial equity funding to be repaid subsequently. This program is consistent with the manner of utilities that use the “Cash Needs” method of revenue requirements. The three step solution: (1) problem happens or will happen; (2) problem solution is funded; and (3) the funding is repaid, is optimized if the utility has a capital reserve or other liquidity feature to minimize the time taken in the funding step.

Although Renewals and Replacements are not included in either DG3 or the Nalcor financial models, Nalcor has included in its Asset Management Philosophy report the Renewals and Replacements data included here in Table 9-3.

Table 9-3

MAJOR MAINTENANCE ACTIVITIES PLANNING

Hydro Power Plant Major Maintenance Activity	Interval (years)	Activity Duration	Activity Cost
Replace bearings	Turbine 25-35 Generator 40-50 Thrust 40-50	4 days	$75,000/bearing
Replace wicket gate bushing	25-50	1 month	$400,000
Replace shaft seal	15-30	2 days	$40,000
Clean rotor and stator	50-75	1 month	$350,000
Repair cavitation	25-50	2 weeks	$60,000
Replace generator cooler	35-50	1 week	$90,000/cooler
Rewind generator	60-80	1.5 months	$9,000,000
Replace exciter	15-20	5 weeks	$1,300,000
Replace governor	15-20	5 weeks	$650,000
Replace voltage regulator	15-20	5 weeks	$300,000

9.3 FINANCIAL PLANNING

The Nalcor financial planning/pro forma models are comprehensive and evaluate nearly every variable of project cost, financing and debt repayment. The models address the three basic project elements, MF, LTA and LIL, each in two separate Excel workbooks. Nalcor is currently intending to finance each of MF/LTA and LIL with a series of bonds

Nalcor financial planning incorporates provisions of the FLG. The FLG guarantees that up to $5.0 billion may be borrowed (Guaranteed Debt) for the MF, LTA, and LIL projects, allocated as follows: up to $2.6 billion for the MF/LTA projects and up to $2.4 billion for the LIL project. The Guaranteed Debt will be encumbered at rates of interest reflecting AAA credit ratings. Costs that exceed these amounts will be funded using equity sources (which may entail incurrence of debt at interest rates greater than those of the Guaranteed Debt).

9.3.1 Sources and Uses of Capital Funds

Tables 9-4 and 9-5 show the sources and uses of funds for the MF and LTA projects, as configured in the Nalcor financial models. The MF and LTA projects have combined debt amounts about $2.6B ($2.136B + $0.464B). Thus, the FLG stipulated maximum Guaranteed Debt of $2.6B is met. The total amounts to be debt and equity funded are shown at the bottom of the Uses columns of the two tables: $3.804B for MF and $0.826B for LTA.

The FLG also limits the amount of debt as a percentage of total capital cost to 65 percent for the MF and LTA projects. The debt funding figure shown in Table 9-4 for the MF project is 56.2 percent of total capital costs. The debt funding figure shown in Table 9-5 for the LTA project also is 56.2 percent of total capital costs. Thus the ratio of debt for the MF and LTA projects, separately or combined, are within the FLG Guaranteed Debt constraints.

Table 9-4

MF SOURCES AND USES OF CAPITAL FUNDS

MF Sources & Uses of Funds During Funding Period					
Sources	**$ Million**	**%**	**Uses**	**$ Million**	**%**
Pre-FC Equity Funding	565.40	15	Pre-FC Capex & Innu	565.40	15
Post-FC Equity Funding	1,039.04	27	Post-FC Capex	2,724.35	72
Debt Funding	2,136.10	56	Post-FC Innu Payments	25.16	1
Interest on BSF	2.84	0	Financing Upfront Fees	7.10	0
Interest on SDN & BHA	60.63	2	Capitalized Interest	364.52	10
			DSRA Pre-Funding	65.38	2
			LRA Funding	52.08	1
Total (rounded)	**$3,804**	**100**	**Total (rounded)**	**$3,804**	**100**

Table 9-5

LTA SOURCES AND USES OF CAPITAL FUNDS

LTA Sources & Uses of Funds During Funding Period					
Sources	**$ Million**	**%**	**Uses**	**$ Million**	**%**
Pre-FC Equity Funding	73.02	9	Pre-FC Capex & Innu	73.02	9
Post-FC Equity Funding	275.42	33	Post-FC Capex	646.89	78
Debt Funding	463.90	56	Financing Upfront Fees	1.54	0
Interest on BSF	0.62	0	Capitalized Interest	79.16	10
Interest on SDN & BHA	13.17	2	DSRA Pre-Funding	14.20	2
			LRA Funding	11.31	1
Total (rounded)	**$826**	**100**	**Total (rounded)**	**$826**	**100**

Analysis of the LTA information, paralleling the above discussion for the MF project, confirms the "Debt Funding" labeled debt financing amount of $0.464B for the LTA project.

Table 9-6 shows the sources and uses of funds for LIL as per the Nalcor financial models. The amount of debt funding for the LIL project is shown to be $2,369.9 million. As indicated above, the LIL project has a maximum Guaranteed Debt amount of $2.4B, so the prospective LIL funding is about $30 million less than the stipulated Guaranteed Debt figure.

Table 9-6

LIL SOURCES AND USES OF CAPITAL FUNDS

LILSources & Uses of Funds During Funding Period					
Sources	**$ Million**	**%**	**Uses**	**$ Million**	**%**
Debt Funding	2,369.93	75	Pre-FC Capex	106.71	3
Equity Funding	575.54	18	Post-FC Capex	2,420.38	77
AFUDC on Equity	215.57	7	Financing Costs	8.25	0
			IDC / AFUDC	558.4	18
			DSRA	67.3	2
Total (rounded)	**$3,161**	**100**	**Total**	**$3,161**	**100**

The maximum Guaranteed Debt to total capital ratio for the LIL project stipulated in the FLG is 75 percent. The figures shown in Table 9-6 indicate that the estimated debt-to-total-capital ratio is 75.0 percent, so the FLG criterion is satisfied.

9.4 ANNUAL COSTS

Annual costs may seem immaterially small in comparison with the capital costs of the LCP, but it will be important to forecast annual costs for the purposes of bond documents. Operations and maintenance, debt service, depreciation expense, and pay-as-you-go annual capital requirements will be the largest annual costs.

9.4.1 Annual O&M Expenses

Annual O&M cost data have been estimated by Nalcor. The costs for each of the three projects include the following cost categories:

- Staff
- Vehicles
- Service contracts
- Miscellaneous costs.

The LIL cost estimate also includes O&M costs associated with Submarine Cable and Sea Electrodes.

Nalcor has provided projected annual O&M expenses from the time of commissioning, Year 2018, out fifty years.

9.4.2 Debt Service

The financial models compute annual debt service, debt service coverage requirements, and debt service reserve account. Annual debt service becomes an expense that must be paid to bond holders by Nalcor or the Province under the terms of the FLG. Nalcor will plan that rate revenue will be sufficient to meet (with the Liquidity Reserves) the DSCR stipulated in the FLG.

From a business perspective, the IE infers from the FLG that the project has full equity backing from the Province, including all costs to completion, including cost overruns, and that revenue agreements then cover all ongoing costs including any resulting debt.

9.5 REVENUE PROJECTIONS

Nalcor provided projections of revenue based on the assumed terms of the power PPA and the average annual power forecast of 4.93 TWH in their model. Plant usage and internal usage of the other project facilities may or may not be included in the computations. Confirmation of these power deductions has not been independently made by the IE.

9.6 IMPLEMENTATION ISSUES

9.6.1 Dispatch Constraints

The dispatch of the project's power is controlled by the WMA under which the Water Management Committee selects the Independent Coordinator whose responsibility is to

> determine the total power to be produced and is required to determine and prepare the production schedules which shall specify the amount of power to be produced by each supplier's production facilities in accordance with the provisions of the Agreement. Nalcor and Churchill Falls (Labrador) Corporation Limited are the "Suppliers of power."

MWH currently does not see where a dispatch constraint could occur, in our opinion, with the WMA in place and dutifully promulgated, and with the information the IE has been provided.

We requested further information from Nalcor pertaining to any dispatch constraints and where and why they may occur, since this issue was studied and risk assessments conducted. Nalcor reports that no constraints were identified.

9.6.2 Project Performance and Reliability

Based on the number of contracts and the RFP for CH0007 that we have been able to review to date, it is still too early to forecast directly from actual results of LCP testing and commissioning of systems, and how each of the turbine-generating units and the systems actually will perform over time. However, based on other projects of similar complexity and size and their performance and reliability history which we are aware of, we have no reason to question at this time that the LCP, as presently configured and provided with the proposed adequate O&M and renewals and replacement budgets, will produce satisfactory performance and will be a reliable and dependable resource.

SECTION 10

CONCLUSIONS AND INDEPENDENT ENGINEER'S OPINIONS

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SECTION 10

CONCLUSIONS AND INDEPENDENT ENGINEER'S OPINIONS AND RECOMMENDATIONS

The following section lists our principal conclusions and recommendations as of December 30, 2013, which are based on a site visit conducted during the week of September 23, 2013 and data, RFPs, and contracts furnished by Nalcor, the Borrower for the following three of the four projects of the LCP: MFGS; LTAP; and LIL.

10.1 CONCLUSIONS AND INDEPENDENT ENGINEER OPINIONS

10.1.1 General Assumptions

MWH's review was performed within our scope of services and in accordance with generally accepted engineering practices. Our review includes such observations and analyses as we, in our professional capacity, deemed necessary for this review.

As an IE, we have made no determination as to the validity and enforceability of any contract, agreement, rule or regulation applicable to the LCP. For the purposes of this IER, we have assumed that all contracts, agreements, rules and regulations will be fully enforceable in accordance with the contractual terms. Moreover, it is assumed that all parties will comply with and fulfill the provisions of the contracts and agreements.

In the preparation of this IER and the opinions presented in this IER, MWH has made certain assumptions with respect to conditions which may exist or events which may occur in the future. While we believe these assumptions to be reasonable for the purpose of this IER, they are dependent upon future events, and actual conditions may differ from those assumed. In addition, for projections and studies, we have used and relied upon certain information provided to us by others. While we believe the use of such information and assumptions to be reasonable for the purposes of this IER, we offer no other assurances with respect thereto, and some assumptions may vary significantly due to unanticipated events and circumstances. To the extent that the actual future conditions differ from those assumed herein or provided to us by others, the actual results will vary from those projected herein. This IER summarizes our work up to the date of the IER. Thus, changed conditions occurring or becoming known after such date could affect the material presented to the extent of such changes.

Evaluation by MWH of the actual security of the components of the projects, as well as other entities with whom Nalcor has business or operational relations, relative to security issues, is not in MWH's scope of work. We have not been engaged to conduct, and in fact have not conducted, any independent evaluations or on-site review in any way to ascertain the effectiveness of the measures Nalcor has undertaken to address security issues. In the event that currently unknown shortcomings in security should arise which lead to significant construction or operational problems, such problems could have an adverse impact on the projects.

10.1.2 Qualifications of Participants

In our opinion, and based on past experience, the Integrated Project Team consisting of SNC-L (the borrower's Engineer) and Nalcor (the borrower) are qualified to design, contract, manage, commission, operate and maintain the three projects currently under design and construction for the LCP.

10.1.3 Project Design and Performance

The MF generating site is a relatively easy site to develop from a technical and logistical point of view. The terrain is relatively flat with nearby access to a principal road in Labrador. For both the temporary structures and the permanent facilities, sufficient space is available for the project development.

The North Spur area has been geologically explored and studied in the past by several engineering organizations as well as during the most recent studies conducted by the Integrated Project Team to develop a satisfactory solution to reduce seepage and provide stabilization remediation procedures that should provide a useful life beyond the design life of 50-years, in our opinion. The planned North Spur remediation measures are appropriate to stabilize the slopes, arrest natural mass wasting and to control seepage and piezometric pressures after impoundment of the reservoir. Recommended additional studies on the sensitive clays will be useful to confirm current design assumptions, but should not significantly affect the current design solution.

Hydrological risk in terms of generation capability is well understood as documented in the studies conducted for the project. With average annual energy of 4.93 TWH/year established by using long-term flow records, the power purchase agreement with Emera allowed Emera to claim 20 percent of the power for 35-years with the commitment to build the transmission system to Nova Scotia, and Nalcor and their special purpose companies using the rest of the power in the Newfoundland and Labrador system. Long-term generation is assured by the WMA that provides storage at Churchill Falls and a means of operating the Churchill River to near-optimize the power production.

Hydrological risk in terms of construction diversion flows at Muskrat Falls have been satisfactorily studied and cofferdam heights and means of diversion have been designed to account for ice jams as well as flood flows with a return period of 20-years; 40-years for the ice jam events. Mitigation of flooding event risks during construction beyond these normally assumed return-period events will be the responsibility of Nalcor Energy.

10.1.4 Construction Plan and Schedule

Construction safety requires contractors to supply their Health, Safety and Security Plans as part of their required submittals. They must follow the generally-high standards established by Nalcor Energy which follows a 'safety first' philosophy. We understand that Nalcor intends to strictly monitor these plans to ensure these requirements are met.

The risk of problems associated with transportation are mitigated to some extent by Nalcor providing storage facilities at two locations as well as providing transportation to the sites of the projects. Risk associated with transportation of materials, equipment, and supplies to these facilities is the responsibility of the contractors. Risk still exists using overseas suppliers, however, these shipments will be closely monitored as required by Nalcor's overarching transportation plan by the Integrated Project Team.

RFPs and Contracts reviewed to date are generally satisfactorily written and similar with respect to terms and conditions imposed on the suppliers and contractors. The contracts convey to the parties the clear responsibilities of the contractor as well as Nalcor, with no ambiguities detectable by the IE in the documents we have reviewed to date. Nalcor has established a system wherein they weigh the bid amount with the security provided (performance bond amount, letters of credit, and parent-company guarantees) to arrive at a satisfactory level of risk and to keep the price as low as practical. We normally do not see this level of balancing all factors considering risk to reduce cost on other projects we are aware of, but find the methodology employed by Nalcor to be satisfactory for the projects.

We have reviewed the Integrated Project Schedule prepared by Nalcor and find that it is generally complete as far as listing contracts, but it is a Gantt chart without activity linking, critical path(s), float time, etc., and is not suitable to the level of detail we require and had expected to view to allow us to form opinions. Until we view more large contracts under construction and obtain the P6 classic CPM view of the project schedule, we cannot express an opinion as to the likelihood of the contracts being completed as scheduled.

10.1.5 Capital Budget

Based on the limited number of large contracts we have reviewed, it is our opinion that the DG3 cost estimate was robustly prepared, following the general procedures outlined in the AACEI for a Class 3 estimate. We differ from Nalcor's opinion as to the level of accuracy of the estimate in that we generally follow the recommendations of AACEI for this level of estimate wherein they allow a -20% to a + 30% allowance for estimating accuracy.

Construction to date pertaining to the contracts that MWH was required to review is limited to the Bulk Excavation contract, CH0006, that currently achieved substantial completion on November 30, 2013. Based on the results of MWH's field trip observations, we found the work to be satisfactory. MWH was earlier made aware by Nalcor that an Acceleration Claim is pending and is under discussion between the parties.

10.2 RECOMMENDATIONS

1. Nalcor is requested to furnish to the IE the Contractor schedules to enable the IE to fulfill its obligations under the Project Financing Agreements.

2. When available, Nalcor is requested to furnish to the IE for review the complete analysis of the North Spur including the laboratory test reports that determine the strength of the soils under the loadings that it will sustain during the life of the project.

3. In accordance with the Project Financing Agreements, updated cost estimates will be provided as stipulated in said Agreements.

INDEPENDENT ENGINEER'S REPORT

LOWER CHURCHILL PROJECT

PHASE I
MUSKRAT FALLS GENERATION
LABRADOR TRANSMISSION ASSETS
LABRADOR-ISLAND TRANSMISSION LINK

APPENDICES

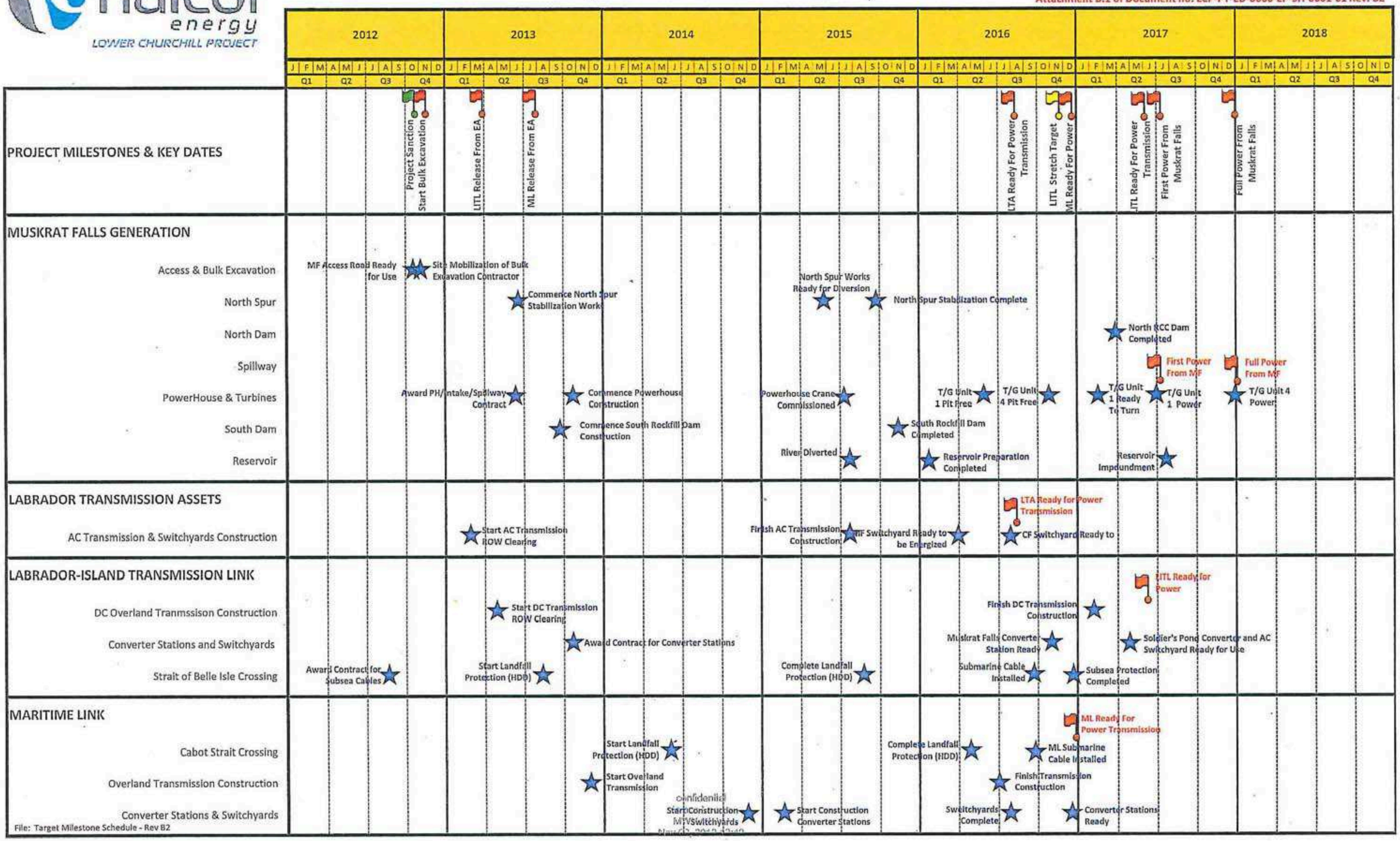
APPENDIX A

Milestone Schedule and Major Contract Packages

nalcor energy
LOWER CHURCHILL PROJECT

Lower Churchill Project - Phase I
Target Milestone Schedule

Attachment B.1 of Document no. LCP-PT-ED-0000-EP-SH-0001-01 Rev. B2

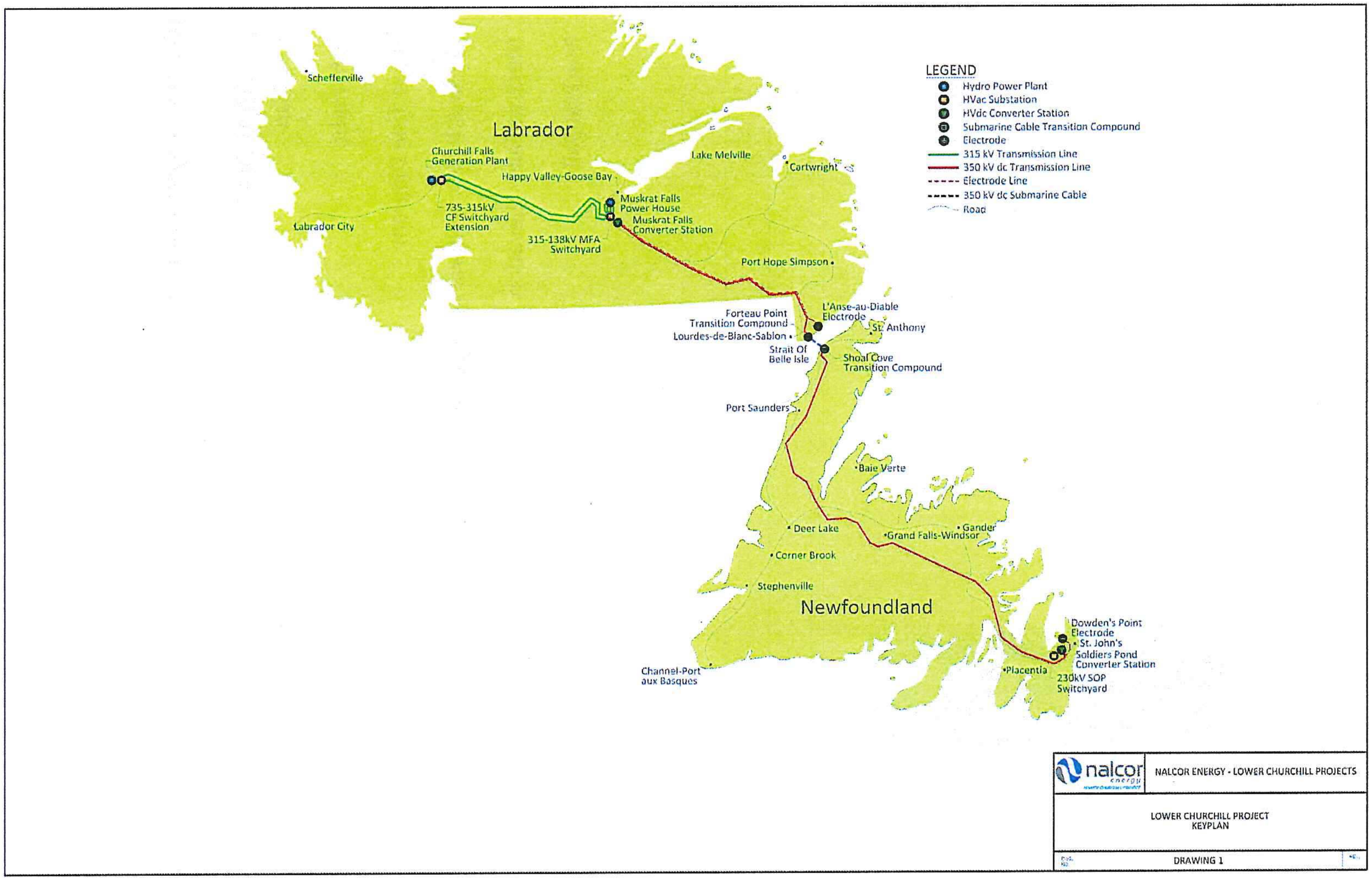


Estimated Award and Completion Date
Major Contract Packages - Lower Churchill Project

Major Packages required for Final Disclosure				
				Updated Award Date - IE Key Contracts (01-Mar-2013)
		PO/Contract Award Dates		
Muskrat Falls (MF)				
Pkg Ref. No.	Contract Pkg. Title	Baseline Finish	Forecast Finish	
CH0002	Supply and Install Accommodations Complex Buildings			Contract Awarded on Oct. 22, 2012
CH0003	Supply and Install Administrative Buildings.	22-Apr-13	2-Aug-13	
CH0004	Construction of Southside Access Road			Contract Awarded on May 25, 2012
CH0005	Supply and Install Accommodation Complex Site Utilities.	7-May-13	16-Aug-13	
CH0006	Construction of Bulk Excavation Works			Contract Awarded on Nov. 06, 2012
CH0007	Construction of Intake and Powerhouse, Spillway and Transition Dams	31-Jul-13	31-Jul-13	
CH0008	Construction of North Spur Stabilization Works	1-Oct-13	26-Jan-14	
CH0009	Construction of North and South Dams	30-May-14	9-Jul-14	
CH0023	Construction of Reservoir Clearing - South Bank	16-Aug-13	16-Aug-13	Could be awarded earlier (based on CH0024 award expected in May 2013)
CH0030	Supply and Install Turbine and Generators			Contract Awarded on Jan. 02, 2013
CH0031	Supply and Install Mechanical and Electrical Auxiliaries (MF)	7-Mar-14	20-Mar-14	
CH0048	Construction of Site Clearing Access Road & Ancillary Areas			Contract Awarded on Apr. 20, 2012
CH0050	Supply Concrete Including Batch Plant (MF) **Deleted Scope now in CH0007 Package**			
PH0014	Generator Step-Up Transformer	29-Jul-13	29-Jul-13	
PH0016	Generator Circuit Breakers	31-Jul-13	31-Jul-13	
Labrador Transmission Assets (LTA)				
CT0319	Construction of 315 kV Hvac Transmission Line (MF to CF)	9-Apr-13	21-May-13	
CT0341	Clearing of Right of Way for 315 kV Hvac Transmission Line (MF to CF)	16-Apr-13	16-Apr-13	Bids In - Award Pending
CD0502	Construction of AC Substations & Synchronous Condenser Facilities	10-Jul-13	10-Jul-13	
CD0503	Construction of Earth Works at Power Distribution Sites	3-Apr-13	18-Apr-13	
PD0505	Switchyard Equipment AC Substations CF, MF, and SP **Deleted Scope now in CD0502 Package**			
Labrador Island Transmission Link (LITL)				
CD0501	Supply & Install Converters, Harmonic Filters and Transition Compounds	15-Dec-13	22-Oct-13	
CD0502	Construction of AC Substations and Synchronous Condensers Facilities	24-Mar-14	15-Dec-13	
CD0503	Construction of Earth Works at Power Distribution Sites	10-Jul-13	10-Jul-13	
CD0508	Construction of Electrode Sites	30-Apr-14	30-Apr-14	
CD0534	Supply and Install Soldiers Pond Synchronous Condensers	31-Jan-14	31-Jan-14	
CT0327	Construction of 350 kV HVdc Transmission Line - Section 1	23-Oct-13	23-Oct-13	
CT0343	Clearing of Right of Way for HVdc Transmission Line - Section 1 **Deleted Scope now in CT0327**			
CT0345	Clearing of Right of Way for HVdc Transmission Line - Section 2	7-Mar-14	7-Mar-14	
CT0346	Construction of 350 kV HVdc Transmission Line - Section 2	23-Sep-14	23-Sep-14	
LC-SB-003	Strait of Belle Isle Submarine Cable			Contract Awarded on Nov. 29, 2012
	After August 2013			

APPENDIX B

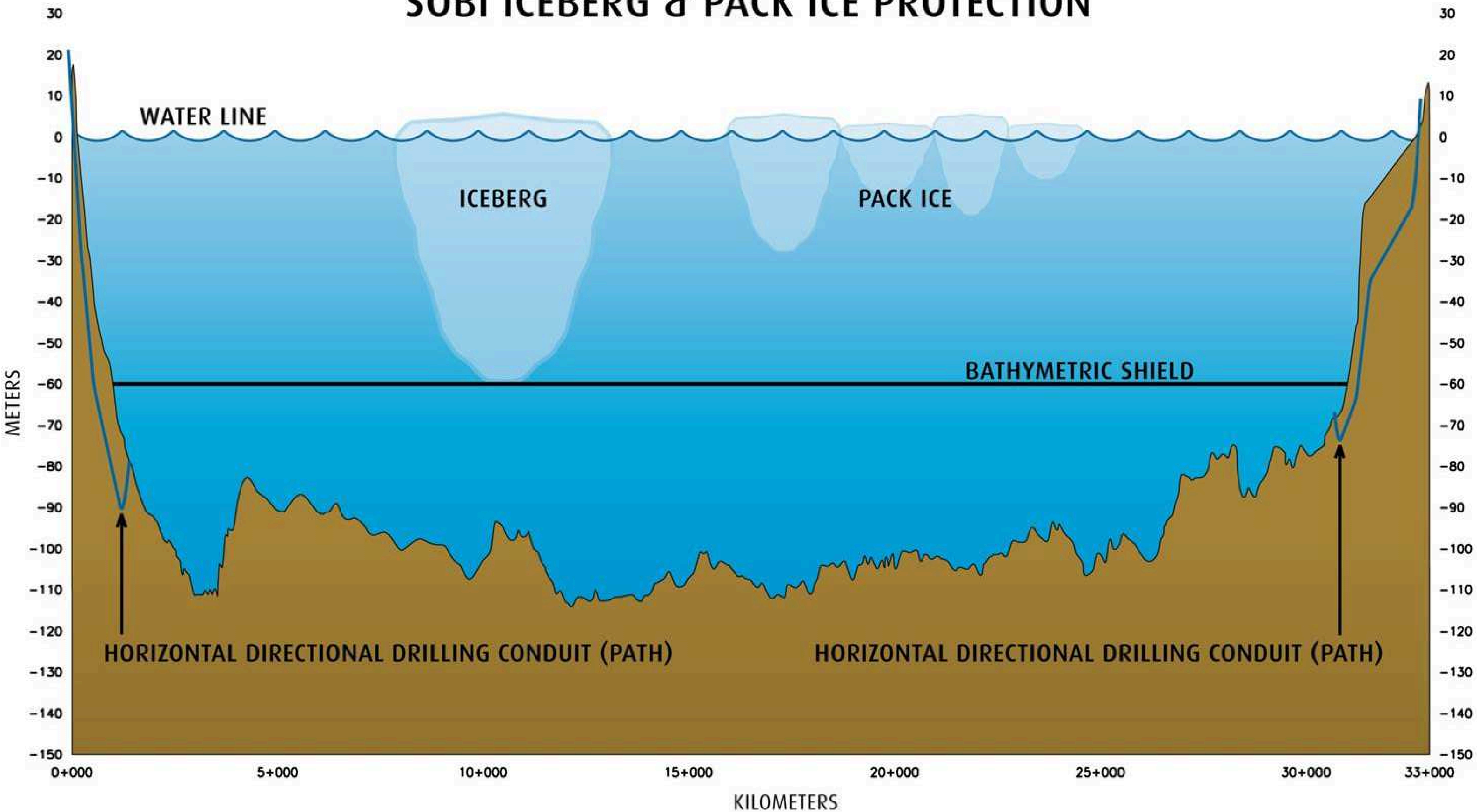
Location Map


LEGEND
Hydro Power Plant
HVac Substation
HVdc Converter Station
Submarine Cable Transition Compound
Electrode
315 kV Transmission Line
350 kV dc Transmission Line
Electrode Line
350 kV dc Submarine Cable
Road
Schefferville
Labrador
Churchill Falls Generation Plant
Happy Valley-Goose Bay
Lake Melville
Cartwright
735-315kV CF Switchyard Extension
Labrador City
Muskrat Falls Power House
Muskrat Falls Converter Station
315-138kV MFA Switchyard
Port Hope Simpson
L'Anse-au-Diable Electrode
Forteau Point Transition Compound
Lourdes-de-Blanc-Sablon
St. Anthony
Strait Of Belle Isle
Shoal Cove Transition Compound
Port Saunders
Baie Verte
Deer Lake
Gander
Grand Falls-Windsor
Corner Brook
Stephenville
Newfoundland
Dowden's Point Electrode
St. John's
Soldiers Pond Converter Station
Placentia
230kV SOP Switchyard
Channel-Port aux Basques
nalcor energy
NALCOR ENERGY - LOWER CHURCHILL PROJECTS
LOWER CHURCHILL PROJECT KEYPLAN
DRAWING 1

APPENDIX C

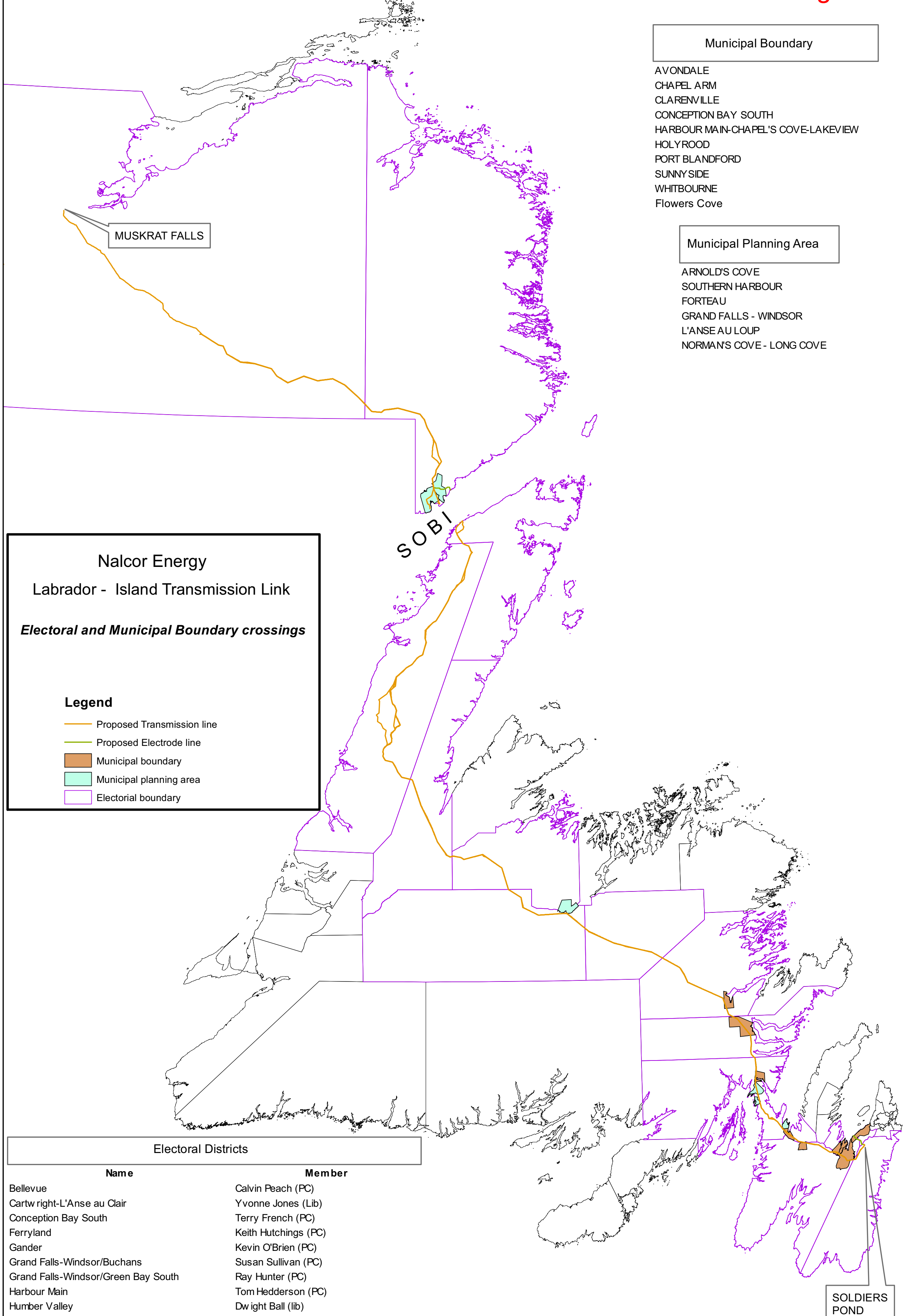
Bathymetry Profile of Submarine Cables for Labrador- Island Transmission Link

SOBI ICEBERG & PACK ICE PROTECTION



APPENDIX D

Electoral and Municipal Boundary Crossings



Electoral Districts

Name	Member
Bellevue	Calvin Peach (PC)
Cartwright-L'Anse au Clair	Yvonne Jones (Lib)
Conception Bay South	Terry French (PC)
Ferryland	Keith Hutchings (PC)
Gander	Kevin O'Brien (PC)
Grand Falls-Windsor/Buchans	Susan Sullivan (PC)
Grand Falls-Windsor/Green Bay South	Ray Hunter (PC)
Harbour Main	Tom Hedderson (PC)
Humber Valley	Dwight Ball (lib)
Lake Melville	Keith Russell (PC)
Placentia - St. Mary's	Felix Collins (PC)
St. Barbe	Jim Bennett (Lib)
Terra Nova	Sandy Collins (PC)
The Straits - White Bay North	Christopher Mitchelmore (NDP)
Trinity North	Ross Wiseman (PC)

APPENDIX E

Project Descriptions Based Upon Basis of Design

7.0 Descriptions

7.1 General

This BOD includes Muskrat Falls Generation, Labrador Transmission Asset and the Labrador-Island Transmission Link.

The primary reason for developing Muskrat Falls Generation, the Labrador Transmission Asset and the Labrador - Island Transmission Link is to meet increased capacity and energy requirements on the Island of Newfoundland. The electrical system on the Island of Newfoundland will experience a capacity deficit in 2015 and an energy short fall in 2021. Extensive analysis of the alternative supply options for the Island has demonstrated that Muskrat Falls and the associated transmission interconnection is the least cost technically acceptable supply alternative for the Island. Muskrat Falls and the interconnection not only provide for future load growth but also facilitate the retirement of the Holyrood Thermal Generating Station virtually eliminating the Island's dependence on fossil fuel fired generation.

All design assumptions used to establish the BOD respect the following overarching principles:

- Only proven technologies will be considered, unless it can be clearly demonstrated to the satisfaction of the Engineering Manager, Project Managers, Project Director and VP of the LCP that emerging technologies can be as reliable and provide significant cost and/or schedule savings.
- Local climatic/service conditions such as ambient temperature, elevation, humidity, sea temperature, sea currents and wind will be respected throughout the Project.
- All generating plants and transmission systems will be remotely operated and monitored from NE-NLH's Energy Control Centre.
- All designs shall assume a 50 year design life for the purposes of evaluation.
- Environmental *mitigation* and *rehabilitation* will be designed by LCP prior to issuing requests for proposals leading to construction contracts.
- The designs will assume the use of existing transportation infrastructure to the maximum extent possible. In particular, existing roads, bridges, railways and wharfs.
- *Good Utility Practice* will be observed.
- *Fail Safe Design* principles will be employed.
- Principles of *Life Cycle Cost Analysis* will be employed.
- The designs will be consistent with the NE Safety and Health Program.
- The designs will be consistent with NE Environmental Policy and Guiding Principles.
- The designs will be consistent with NE Asset Management Policy and Guiding Principles.
- The designs will be consistent with all applicable governing Standards, Codes, Acts and Regulations.
- All assets and systems will be designed to ensure safety, reliability, efficiency and minimal impact to the environment.

7.2 Muskrat Falls Generation

1100 Access - General

- Site roads to be gravel surfaced unless conditions dictate otherwise e.g. to limit dust and flying stones in areas such as accommodations complex and other site facilities.
- Permanent site access from south, along south side of river via TLH.
- Temporary site access to north side from TLH.

1200 Permanent Accommodations

- No permanent accommodations required.

1320 Construction Power

- Construction power will be supplied from the existing 138 kV transmission line between CF and HVGB by means of a temporary tap station at MF, to be located on the north side of the Churchill River. It will comprise of a 50 MVA, 138 – 25 kV transformer with an on-load tap changer (OLTC), 138 kV circuit breakers for the transformer and the line feeder to HVGB and capacitor banks to provide voltage regulation. The installation will be capable of providing 12 MW peak load and will be remotely controlled and supervised from the Nalcor ECC in St. John's.
- Construction power will be supplied to the south side of the Churchill River with a 25 kV distribution feeder that will take off from this tap station and cross the river to provide power to the construction sites and the campsite located approximately 10.5 km east of Muskrat Falls.
- A new 125 MVA, 230 – 138 kV transformer with OLTC will be installed in CF as a replacement for the two existing 42 MVA transformers without OLTC to accommodate the increase of power transfer to provide 12 MW of power at MF.
- Once the 315 kV HVac network is energized during construction, power will be supplied from the 315 – 138 kV substation transformer tertiary winding until all construction facilities are demobilized.

1420 Construction Telecommunications – Muskrat Falls

- Communications during early works of access road, camp start-up and start of site excavations will be by land mobile radio system and cellular phones.
- Communications during the main construction phase will be linked to a new high-speed fibre-optic network being constructed in Labrador and will include:
  - Data (business and personal)
  - Telephone (business and personal)
  - Video Conferencing
  - Television
  - Land Mobile Radio System (LMRS)
  - Cellular Telephone System (CTS)
  - Mobile Internet System (MIS)
  - Building Management Systems (BMS)
  - Network Management Systems (NMS)
  - Closed Circuit Television (CCTV)

- Security and Access Control System (SACS)
- Supervisory Control and Data Acquisition (SCADA) and Protection

1500 Accommodations Complex

- Staged, modular construction to accommodate up to 1,500 persons with appropriate offices, cooking, dining, sleeping, washing, medical, firefighting, entertainment, recreational, power, water, sewage, and administrative and other life support facilities within the project area.
- Main site facilities to be located on south side of river approximately 10.5 km southeast of Muskrat Falls.
- Includes substation and distribution system for construction power supplied from the 25 kV feeder and backup diesel generation at the site.
- Designed for removal following construction.

1800 Offsite Logistics, Infrastructure and Support – General

- Approximately 15 ha of marshalling yards, potentially in multiple locations. Yards to include grading, fencing, storage racks and equipment for loading/offloading.
- Upgrading and/or replacement of the Paradise River and Kenamu River bridges, or some acceptable alternate solution, on the Cartwright access road to accommodate a design load of 250 t.

2100 Reservoir

- FSL = 39 m; LSL = 38.5 m; MFL = 45.1 m without GI and 44.3 m with GI.
- Remove all trees that grow in, or extend into the area between 3 m above FSL and 3 m below LSL, except where determined otherwise by the reservoir preparation strategy.
- Trash management system to include an automated hydraulically operated trash removal system explained in detail under "3200 Intake and Penstocks – General". Trash management also includes a series of trash booms, one located approximately 2.3 km upstream of the intake and a second located approximately 5 km downstream of the plant. Both trash booms will be designed to restrict the movement of floating trash and debris, and guide it to shoreline design and access roads to enable removal and disposal. Both trash booms are to be designed with either mid-channel or shoreline gaps to allow boat travel.
- A series of safety booms, one located approximately 1.4 km upstream of the intake and a second one located downstream of the plant. The design is to include suitable anchorage and shoreline design. The downstream boom is to have a mid-channel gap with several safety buoys.

2200 Diversion

- Through spillway structure.
- Capacity = 5, 990 m^3/s based on a 1:20 year return period.
- *Fish Compensation Flow* will be approximately 550 m^3/s equivalent to 30% of mean annual flow.
- *Fish Compensation Flow* will be through spillway structure.

2300 Dams & Cofferdams - General

- Development flood capacity is based on the PMF, equal to 25,060 m^3/s at 45.1 m without GI and 44.3 m with GI.
- South Dam to be an earth/rockfill dam with a central core crest elevation to be El. 45.5 m.
- North Dam to be a RCC overflow dam, acting as a secondary spillway with a crest elevation of El. 39.3 m over a 430 m long overflow section. The north end of the dam will be rotated slightly downstream in order to improve the north abutment against the rock knoll and eliminate potential erosion during spilling.
- Transition dams to be conventional concrete.
- All concrete dams to be designed with necessary drainage galleries and monitoring equipment.
- All dams are to be founded directly on bedrock.
- *Cofferdams* are to be of the most economical and proven material and technology.

2400 Spillway - General

- Primary spillway structure.
- Concrete structure in rock excavation.
- Capacity = PMF in conjunction with North RCC Dam.
- Five surface vertical lift gates on parabolic rollways, 10.5 m wide with top of gate at El. 40.0 m and sill at El. 18.0 m.
- Gates with heating and hoisting mechanisms designed for severe cold climate operation.
- Structure designed to accommodate an automated, hydraulically operated trash removal system explained in detail under "3200 Intake and Penstocks – General". The system includes a permanent hoist capable of lifting the upstream *stoplogs*.
- One set of upstream steel *stoplogs* with a permanent hoist system.
- One set of downstream steel *stoplogs* operated by a mobile crane.
- *Stoplog* storage on site.
- One emergency diesel *generator* set, complete with fuel storage system, for emergency load requirements sufficient for heating and operation of two surface gates only.

2800 North Spur - General

- The deep well system installed in 1981 is to be placed in standby mode.
- Measures are required to prevent water infiltration and to physically stabilize the upstream and downstream slopes. Pressure relief wells are to be installed in the downstream section of the North Spur to lower the groundwater pressure.
- Measures are required to prevent groundwater infiltration into the North Spur from the Kettle Lakes region.
- Piezometers are to be outfitted with data loggers to monitor the water table levels in the North Spur.

3100 Powerhouse Channels

- Approach channels excavated in bedrock with minimum rock reinforcement required.
- Draft tubes discharge directly into river in rock excavation.
- *Tailrace* channel excavated in bedrock with minimum rock reinforcement required.

3200 Intake & Penstocks - General

- Approach channel in open cut earth/rock excavation and designed to eliminate frazil ice.
- Concrete structure in rock excavation.
- Four intakes (one per unit).
- Four sets of vertical lift operating gates with individual wire rope hoists in heated enclosures.
- One set of steel bulkhead *stoplogs* able to close only one single intake passage opening (1 of 12) at any one time.
- Four sets of removable steel *trash racks*.
- An automated, hydraulically operated trash removal system capable of cleaning both the upstream side of the intake and the gated spillway. System is to include interchangeable heads that will enable cleaning of floating debris, submerged debris, debris lodged in *trash racks*, and debris in rock traps. The system will include a permanent hoist capable for removing the intake bulkhead *stoplogs*.
- No *penstocks*; four individual water passages in concrete (close-coupled intake/powerhouse).

3300 Powerhouse

- Concrete structure in rock excavation.
- Structural steel super-structure with metal cladding.
- Designed, constructed and operated in accordance with applicable requirements of the Provincial Government's Build Better Buildings policy.
- Four-unit powerhouse with two maintenance bays.
  - The south maintenance bay shall be large enough to assemble one complete turbine/*generator* unit, plus assembly and transfer of one extra *rotor*, and include provision of an unloading area. After completion of turbine/*generator* installation, the south maintenance bay will be reduced in size to accommodate permanent offices and warehousing while leaving space for the dismantling of one entire turbine/*generator* unit.
  - The north maintenance bay shall be used to stage civil works construction and shall become a space for mechanical and electrical auxiliary equipment at the completion of the Project.
- Area for offices, maintenance shops and warehouse. Offices, maintenance shops, and warehouse will occupy the south of the maintenance bay.
- All systems are to be designed using *good utility practice*.
- Two sets of steel draft tube *stoplogs* with a permanent hoist system in a heated enclosure.

3410/3420 Turbines and Generators

- Four 206 MW units, approximately, @ 0.90 pf vertical axis *Generators*.
- Inertia constant H not less than 4.1 kWs/kVA.
- Four *Kaplan turbines* with *Cavitation Resistant Design*.
- Unitized approach from intake to *generator* step-up transformer.
- Failure of any equipment/system of one unit not to affect the operation of the remaining units.

3430 Electrical Ancillary Equipment

- Dual 125 Vdc battery systems with dual chargers per battery system for control and protection.
- Independent 125 Vdc battery system with dual chargers for field flashing and other dc power.
- Dual 48 Vdc battery systems with dual chargers per battery system for telecommunication system.
- A minimum of two independent sources of station service.
- Arc flash category two for all electrical panels of 600 Vac or greater.
- Dual digital protection systems.
- One standby emergency diesel *generator* for the powerhouse essential load auxiliaries, complete with fuel storage systems.

3440 Mechanical Ancillary Equipment

- Water systems, for supply of turbine and *generator* cooling water, fire protection water, domestic water and auxiliary water.
- Separate high and low pressure compressed air systems.
- Domestic waste water to septic tank and disposal field.
- HVAC systems using the *generators'* cooling systems as a source of powerhouse heating.
- Two overhead powerhouse cranes, with the capability to operate in tandem having a combined design capacity to lift a fully assembled *rotor*.
- Elevator access to all levels of powerhouse.
- Dewatering and drainage systems complete with oil interception system.
- Permanent waste hydraulic and lubricating oil storage and handling system complete with a permanent centrifuge filtration system.
- Oil water separator for drainage from *generator* transformer basins, powerhouse diesel room and tank room.
- Permanent hoist system in each turbine pit.

3450 Protection, Control & Monitoring

- Redundant protection systems for each element from two different manufacturers.
- Main and backup systems to be installed in two separate panels.
- Protection shall be stable during system transients and operate correctly during system faults.
- A distributed digital control and monitoring system.
- Dual CPU for control system functions.

3460 Generator Transformers

- Four step-up transformers (unit voltage to 315 kV), plus one spare step-up transformer, located on powerhouse draft tube deck.
- Each unit will have a *generator* circuit breaker.
- Each transformer will include drainage to a common oil water separator.
- Transformers will be separated from each other by a concrete firewall.

6160 Collector Lines – Powerhouse to Switchyard

- Four 315 kV HVac overhead transmission lines to connect the high side of the step up transformers to the switchyard.

9112 Fish Habitat Compensation

- *Fish habitat compensation* will include delta enhancements at the Pinus River and Edward's Brook and enhancements of spawning areas located in Gull Lake.

9122 Terrestrial Habitat Compensation

- *Terrestrial habitat compensation* will be based on conditions of EA release and *terrestrial habitat compensation* plans to be agreed to with applicable regulatory bodies.

9220 Operations Telecommunications System – Muskrat Falls

- Telecommunication System shall be comprised of three separate layers: Optical Transport Network (OTN), Convergence, and Access Layers.

- OTN Layer shall be the telecommunications backbone and utilize the single OPGW, All Dielectric Self Supporting (ADSS) or equivalent fibre optic infrastructure. The OTN Layer equipment nodes shall be designed based upon the least total cost of ownership alternative.

- Convergence layer shall be based on the Synchronous Optical Network (SONET) international standard. It shall be used to create logical point-to-point telecommunication links between all MF locations. It will multiplex and de-multiplex the access layer subsystems for transmission on the OTN.

- Access Layer shall be based on the Ethernet (IEEE 802.3) standard. It shall be comprised of a minimum of three separate telecommunication systems: Protection and Control, SCADA, and Administrative systems. The Administrative system may include the following subsystems: telephony, corporate data, security access control system, and video surveillance.

- The Muskrat Falls telecommunication assets specifically include the following:

  - Convergence and access layers telecommunication systems at the MF generating plant, *converter station* and switchyards.
  - NLH ECC and BCC SCADA system upgrades.
  - Network Management System to monitor, notify, and provision the OTN, convergence and access layers telecommunication systems.

7.3 Labrador Transmission Asset

4300 Muskrat Falls Switchyard

- Situated on the south side of the river on a level, fenced site.
- Concrete foundations and galvanized steel structures to support the electrical equipment and switchgear.
- Electrical layout of the switchyard is to be in accordance with the SLD. (See Drawing 3).
- Substation to interconnect the plant to the 315 kV HVac transmission lines to CF and the HVdc *Converter Station*.
- Substation includes two 125 MVA transformers, 315-138 kV with tertiary windings rated at 25 kV to supply station services for switchyard and convertor station.

6130 Muskrat Falls Switchyard to HVdc Converter Station

- Four 315 kV HVac feeders connecting the switchyard to the *converter station* as per the attached single line diagram. Two feeders connecting to the converter transformers and two feeders connecting to the filters.

6140 HVac Overland Transmission - Muskrat Falls to Churchill Falls

- Two 315 kV HVac overhead transmission lines to connect the Muskrat Falls switchyard to the Churchill Falls switchyard extension.
- Provision for Gull Island interconnection to be included through selected placement of dead end towers.
- Transmission lines are to be carried on galvanized lattice steel towers, with self-supported angles and dead ends, and guyed suspension towers.
- Transmission line power capacity is to be 900 MW for each transmission line, allowing for all load to be carried on a single circuit.
- Transmission line corridor as per Key Plan. (See Drawing 1).
- 50 year *Reliability Level Return Period* of loads, with respect to Nalcor Energy operating experience and LCP specific modeling and test programs.
- One transmission line shall have one OHGW and one OPGW and the second line shall have two OHGW.
- *Counterpoise* installed from station-to-station.

4100 Churchill Falls Switchyard Extension

- Extension of the existing 735 kV main bus with bus coupling circuit breakers.
- Two 833 MVA, 735-315 kV auto-transformers, with tertiary windings rated at 13.8 kV to supply the substation service loads.
- Accommodation of two 315 kV HVac transmission lines from MF.
- Provision for space for future 735 kV and 315 kV transmission line feeders in accordance with the SLD. (See Drawing 3).
- CF switchyard extension is to be located approximately 500 m east of the existing CF switchyard on a level, fenced site and includes developed space for future 735 kV and 315 kV line feeders.

- Two 735 kV transmission lines, each approximately 500 m in length, to join the existing CF switchyard to the CF switchyard extension.
- Construction and operation not to adversely impact the existing CF operation.
- Concrete foundations and galvanized steel structures to support the electrical equipment and switchgear.

9250 Operations Telecommunications System – Labrador Transmission

- Telecommunication System shall be comprised of three separate layers: Optical Transport Network (OTN), Convergence, and Access Layers.
- OTN Layer shall be the telecommunications backbone and utilize the OPGW, All Dielectric Self Supporting (ADSS) or equivalent fibre optic infrastructure. The OTN layer equipment nodes shall be designed based upon the least total cost of ownership alternative.
- Convergence layer shall be based on the Synchronous Optical Network (SONET) international standard. It shall be used to create logical point-to-point telecommunication links between all MF locations. It will multiplex and de-multiplex the Access Layer subsystems for transmission on the OTN.
- Access Layer shall be based on the Ethernet (IEEE 802.3) standard. It shall be comprised of a minimum of three separate telecommunication systems: Protection and Control, SCADA, and Administrative systems. The Administrative system may include the following subsystems: telephony, corporate data, security access control system, and video surveillance.
- The Labrador Transmission Link Telecommunication Assets specifically include the following:
  - One OPGW mounted on one 315 kV HVac TL connecting
    - MF 315 kV Switchyard to CF 735-315 kV Switchyard
  - TLH ADSS fibre optics connecting
    - Labrador West to CF to MF to HVGB.
  - OTN Layer optical-electronics associated with the above referenced fibre optic interconnections.
  - Convergence and Access Layer telecommunication systems associated with the above referenced OTN Layer optical-electronics, except these telecommunication layers at MF.
  - NLH ECC and BCC SCADA system upgrades and upgrades to CF SCADA system as required.

7.4 Labrador – Island Transmission Link (LITL)

Overall HVdc system consists of a 900 MW HVdc Island Link between Labrador and Newfoundland.

1330 Construction Power

The following power supply sources will be used for construction power:

- Muskrat Falls: A 25 kV tap from the construction power system for the Muskrat Falls Generating Facility (see 1320 Construction Power)
- Forteau Point: A 25 kV tap from an existing distribution system located approximately 2.5 km away.
- Shoal Cove: A 25 kV tap from an existing distribution system located approximately 700 m away.
- L'Anse Au Diable: A 14.4 kV tap from an existing distribution system located approximately 400 m away.
- Dowden's Point: A 14.4 kV tap from an existing distribution system located approximately 1.5 km away.
- Soldiers Pond: A 25 kV tap from an existing distribution system located approximately 4 km away.

1430 Construction Telecommunication Systems – Labrador-Island Link

- Provision of telecommunications services and infrastructure during the construction phase to the end of the Project along the 315 kV HVac and the ±350 kV HVdc transmission lines and associated construction camps, including the CF Extension Switchyard construction camp.
  - Services along the transmission line rights-of-way
    - Land Mobile Radio System (LMRS)
    - Services available at the various remote campsites
    - Data (corporate and personal)
    - Telephony (corporate and personal)
    - Network Management System (NMS)
    - Closed Circuit Television (CCTV) and
    - Security and Access Control System (SACS)

8210 Labrador Converter Station

- 900 MW, ±350 kV bi-pole, LCC *converter station* capable of operating in mono-polar mode.
- Each pole rated at 450 MW with 100% overload capacity for ten minutes and 50% overload capacity for continuous operation.
- Situated on the south side of the Churchill River on a level fenced site.
- Concrete foundations and galvanized steel structures to support the electrical equipment and switchgear.
- Mono-polar operation shall be supported by an *electrode*.

6310 Electrode Line - Labrador

- An *electrode line* carrying two conductors with the first 370 km to be supported on the HVdc lattice steel towers from Muskrat Falls to Forteau Point and the remaining section from Forteau Point to L'Anse au Diable to be supported on a wood pole line.
- 50-year *Reliability Level Return Period* of loads.
- *Electrode line* will have provision for arcing horns.

8610 Electrode Labrador

- A shoreline pond *electrode* to be located at L'Anse au Diable on the Labrador side of the SOBI.
- Nominal rating of 450 MW with 100% overload capacity for ten minutes and 50% overload capacity for continuous operation.

6220 Labrador – Island Overland HVdc Transmission

- An HVdc overhead transmission line, ±350 kV bi-pole, to connect the Muskrat Falls *Converter Station* to the Labrador Transition Compound at the Strait of Belle Isle and then to connect the Northern Peninsula Transition Compound at the Strait of Belle Isle to the Soldiers Pond *Converter Station*.
- Transmission line to carry both poles (single conductor per pole) and one OPGW. The Labrador section is to carry two *electrode* conductors from the Muskrat Falls *Converter Station* to Forteau Point (see 6310 Electrode Line – Labrador).
- Transmission line corridor as per Key Plan. (See Drawings).
- The HVdc transmission line is to have a designed nominal power capacity of 900 MW; however, given the mono-polar operation criteria, each pole is to have a nominal rating of 450 MW with 100% overload capacity for ten minutes and 50% overload capacity for continuous operation.
- *Counterpoise* installed from station-to-station.
- Towers are to be galvanized lattice steel, with self-supported angles and dead ends, and guyed suspension towers.
- 50 year *Reliability Level Return Period* of loads, with respect to Nalcor Energy operating experience and LCP specific modeling and test programs.

8510 Transition Compound - Labrador

- Situated on a level fenced site at Forteau Point.
- Enclosed building and provision for submarine cable termination system and associated switching requirements.
- Concrete pads and steel structures to support the electrical equipment and switchgear.
- Overhead line to cable transition equipment.
- High-speed switching, control, protection, monitoring and communication equipment.

8110 Marine Crossing – SOBI - General

- 350 kV, 900 MW submarine cable system to transmit power across the SOBI in bi-polar mode for 50-year design life, with capabilities to allow configuration in mono-polar mode.
- Each cable to have a nominal rating of 1286 A (one pu per pole) and a transient rating of 2572 A (two pu per pole) for five minutes in mono-pole mode.
- Consists of three *mass impregnated* submarine cables and associated components, inclusive of one spare submarine cable.
- Land cables shall connect submarine cables to cable termination system within the transition compound.
- The route for the submarine cable(s) crossing shall be designed to meet the transmission, protection, reliability, and design life requirements, and give consideration to technical and economic optimization.
- Cable corridor as per Key Plan. (See Drawing 1).
- Cables shall be adequately protected along the entire length of the crossing as required. Cable protection methodology will employ proven technologies only, and may include rock placement, trenching, horizontal directional drilling (HDD) and concrete mattresses.
- Where discrete protection application is required, protection measures shall be designed to meet the transmission and reliability requirements.

8520 Transition Compound – Northern Peninsula

- Situated on a level fenced site at Shoal Cove.
- Enclosed building and provision for submarine cable termination system and associated switching requirements.
- Concrete pads and steel structures to support the electrical equipment and switchgear.
- Cable to overhead line transition equipment.
- High-speed switching, control, protection, monitoring and communication equipment.

8220 Soldiers Pond Converter Station

- 900 MW, ±350 kV bi-pole, LCC *converter station* capable of operating in mono-polar mode.
- Each pole rated at 450 MW with 100% overload protection for ten minutes and 50% overload protection for continuous operation.
- Situated next to the Soldiers Pond switchyard on the Avalon Peninsula on a level fenced site.
- Concrete foundations and galvanized steel structures to support the electrical equipment and switchgear.
- Mono-polar operation shall be supported by an *electrode*.

6320 Electrode Line – Newfoundland East

- An *electrode line* carrying two conductors generally follows the existing transmission ROW from Soldiers Pond to Conception Bay.
- Wood pole construction.
- 50-year *Reliability Level Return Period* of loads.
- *Electrode line* will have provision for arcing horns.

8620 Electrode Newfoundland East

- A shoreline pond *electrode* to be located at Dowden's Point on the east side of Conception Bay.
- Nominal rating of 450 MW with 100% overload protection for ten minutes and 50% overload protection for continuous operation.

4500 Soldiers Pond Switchyard

- Situated on the north-east side of Soldiers Pond on a level, fenced site.
- Concrete foundations and galvanized steel structures to support the electrical equipment and switchgear.
- Electrical layout of the switchyard is to be in accordance with the proposed SLD. (See Drawing 2).
- Switchyard to interconnect eight 230 kV HVac transmission lines (four existing transmission lines looped in), the synchronous condensers and the Soldiers Pond *Converter Station*.

7100 Island System Upgrades East

- Three 175 MVAR high-inertia synchronous condensers at Soldiers Pond.
- 230 kV and 138 kV circuit breaker replacements.
- Replacement of conductors, 230 kV transmission line – Bay d'Espoir to Sunnyside.
- Looping in-out of the four existing 230 kV transmission lines into the new Soldier's Pond Switchyard. This requires reconstruction of the resulting eight transmission lines entering and leaving the switchyard to account for lightening protection.
- Upgrade of the protection and control systems at Hardwoods, Oxen Pond, Holyrood and Western Avalon Switchyards.

9230 Operations Telecommunications System – Island Link

- Telecommunication System shall be comprised of three separate layers: Optical Transport Network (OTN), Convergence, and Access Layers.

- OTN Layer shall be the telecommunications backbone and utilize the OPGW, All Dielectric Self Supporting (ADSS) or equivalent fibre optic infrastructure. The OTN Layer equipment nodes shall be designed based upon the least total cost of ownership alternative.

- Convergence Layer shall be based on the Synchronous Optical Network (SONET) international standard. It shall be used to create logical point-to-point telecommunication links between all MF locations. It will multiplex and de-multiplex the Access Layer subsystems for transmission on the OTN.

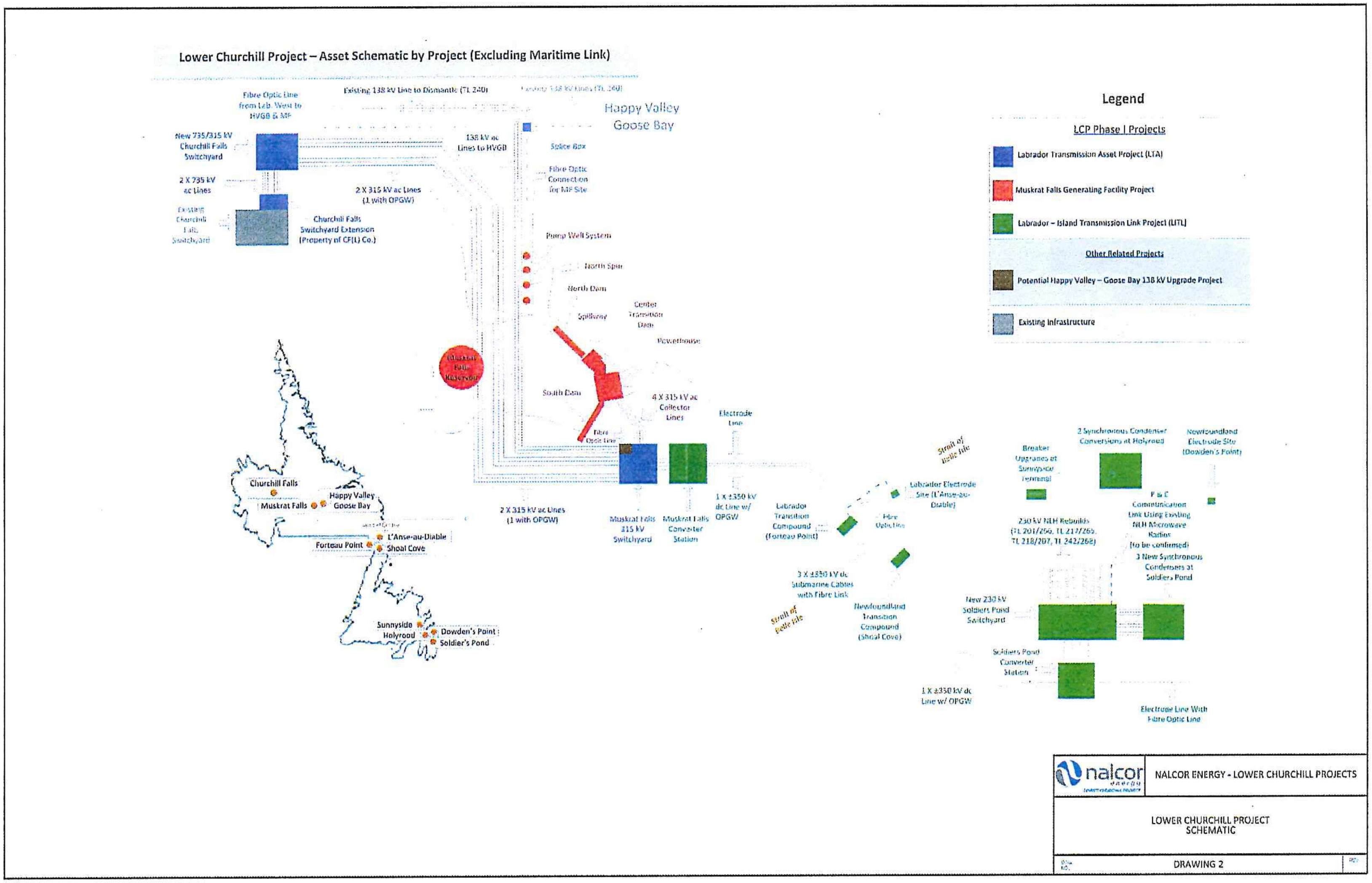
- Access Layer shall be based on the Ethernet (IEEE 802.3) standard. It shall be comprised of a minimum of three separate telecommunication systems: Protection and Control, SCADA, and Administrative systems. The Administrative system may include the following subsystems: telephony, corporate data, security access control system, and video surveillance.

- The Island Transmission Link Telecommunication Assets specifically includes the following.

  - HVdc OPGW fibre optics connecting
    - Muskrat Falls *Converter Station* to Forteau Point Transition Compound
    - Shoal Cove Transition Compound to Soldiers Pond *Converter Station*
  - ADSS fibre optics connecting
    - Forteau Point Transition Compound to the L'Anse au Diable *Electrode*
    - Soldiers Pond *Converter Station* to Dowden's Point *Electrode*
  - Fibre optic infrastructure shall also be used to connect
    - Forteau Point Transition Compound to Shoal Cove Transition Compound by optic fibres embedded in each power cable being installed across the SOBI
    - Soldiers Pond *Converter Station* to the NLH Energy Control Centre (ECC) in St. John's
    - Soldiers Pond *Converter Station* to the NLH Backup Control Centre (BCC) in Holyrood
  - OTN Layer optical-electronics associated with the above referenced HVdc OPGW fibre optic interconnections.
  - Convergence and Access Layers telecommunication systems associated with all of the above referenced fibre optic interconnections, except these telecommunication layers at MF.
  - NLH ECC and BCC SCADA system upgrades.

APPENDIX F

Transmission Line Routes


Lower Churchill Project – Asset Schematic by Project (Excluding Maritime Link)
Happy Valley
Goose Bay
Legend
LCP Phase I Projects
Labrador Transmission Asset Project (LTA)
Muskrat Falls Generating Facility Project
Labrador – Island Transmission Link Project (LITL)
Other Related Projects
Potential Happy Valley – Goose Bay 138 kV Upgrade Project
Existing Infrastructure
Churchill Falls
Muskrat Falls
Happy Valley
Goose Bay
L'Anse-au-Diable
Forteau Point
Shoal Cove
Sunnyside
Holyrood
Dowden's Point
Soldier's Pond
Churchill Falls Switchyard Extension (Property of CF(L) Co.)
2 X 315 kV ac Lines (1 with OPGW)
4 X 315 kV ac Collector Lines
Electrode Line
Muskrat Falls 315 kV Switchyard
Muskrat Falls Converter Station
Labrador Transition Compound (Forteau Point)
Newfoundland Transition Compound (Shoal Cove)
2 Synchronous Condenser Conversions at Holyrood
Newfoundland Electrode Site (Dowden's Point)
3 New Synchronous Condensers at Soldiers Pond
New 230 kV Soldiers Pond Switchyard
Soldiers Pond Converter Station
1 X ±350 kV dc Line w/ OPGW
Electrode Line With Fibre Optic Line
NALCOR ENERGY - LOWER CHURCHILL PROJECTS
LOWER CHURCHILL PROJECT SCHEMATIC
DRAWING 2

01 - HVac Lines Overview Map - MFA-SN-CD-6140-TL-MP-0004-01.pdf

Overview of the Routing for 315 kV HVac Transmission Lines

02 - HVac Lines at Churchill Falls - MFA-SN-CD-6140-TL-MP-0007-01.pdf

Overview of the 735 kV and 315 kV transmission lines at Churchill Falls Switchyard and LCP 315/735 kV switchyard

03 - HVac Line at Muskrat Falls - MFA-SN-CD-6140-TL-MP-0006-01.pdf

Overview of the 315 kV transmission lines at Muskrat Falls

04 - HVdc Line Overview Map - ILK-SN-CD-6000-TL-MP-0001-01.pdf

Overview of the entire HVdc line routing including particular areas covered in this document list. Also includes some line reroutes required in Newfoundland and Labrador Hydro system

05 - HVdc Line at Muskrat Falls - ILK-SN-CD-6200-TL-MP-0006-01.pdf

Overview of the 350 kV transmission line at Muskrat Falls Converter Station

06 - HVdc Line at Forteau - ILK-SN-CD-6200-TL-MP-0003-01.pdf

Overview of the 350 kV transmission line at Forteau Point Transition Compound

07 - HVdc Line at Shoal Cove - ILK-SN-CD-6200-TL-MP-0004-01.pdf

Overview of the 350 kV transmission line at Forteau Point Transition Compound

08 - HVdc Line at Soldiers Pond - under revision due to Converter Station modification - ILK-SN-CD-4500-TL-MP-0001-01.pdf

The Converter Station / Switchyard location has been revised; however, this map does not reflect the revision. In the revised map, the switchyard does not interfere with the existing transmission line routing. Revision in progress.

09 - Electrode Line at L'Anse Au Diable - ILK-SN-CD-6310-TL-MP-0001-01.pdf

Overview of the electrode line at the L'Anse Au Diable Electrode Site.

10 - Electrode Line at Dowden's Point - line route being revised - ILK-SN-CD-6320-TL-MP-0001-01.pdf

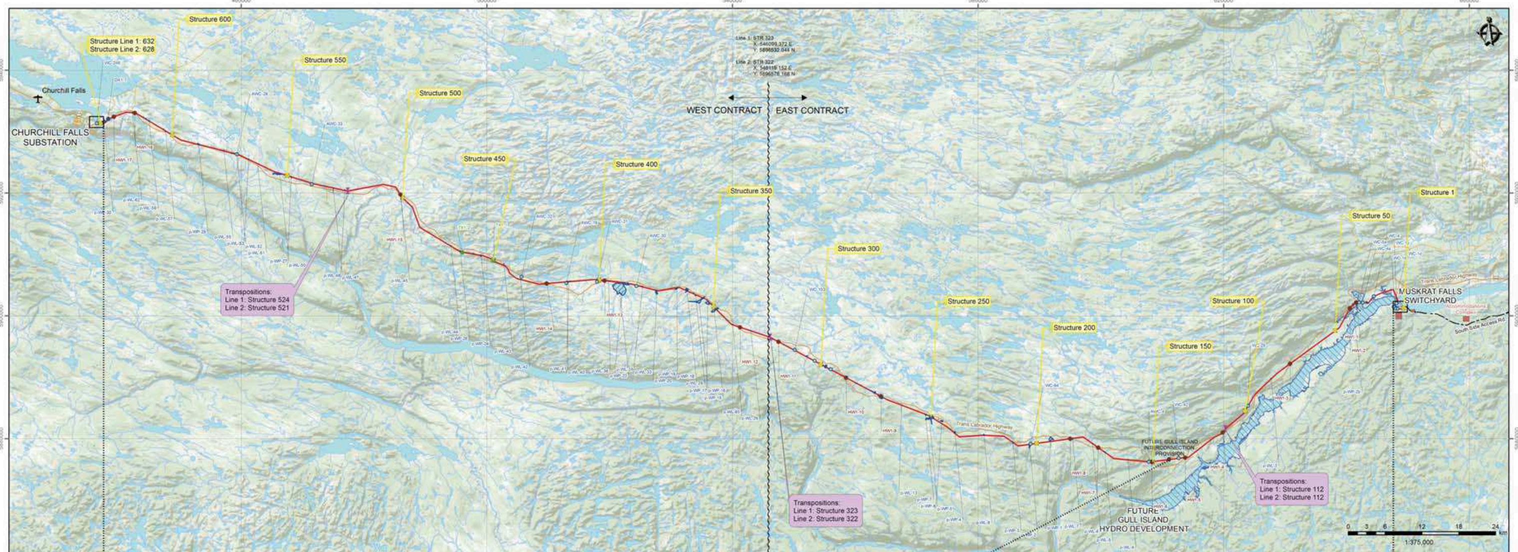
Overview of the electrode line at the Dowden's Point Electrode Site. The revised line routing is along the coast and does not go through the community as shown. Revision in progress.

11 – HVac Overview

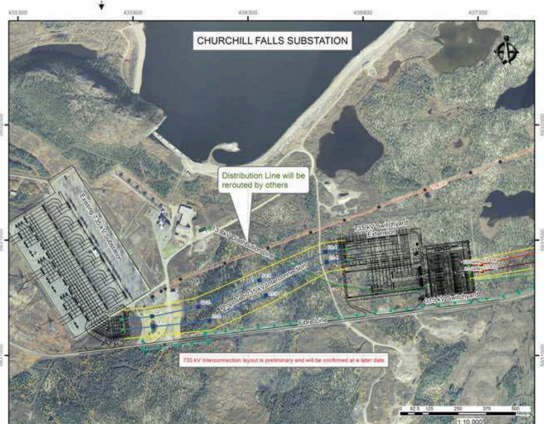
Simple Line route overview for the 315 kV HVac lines

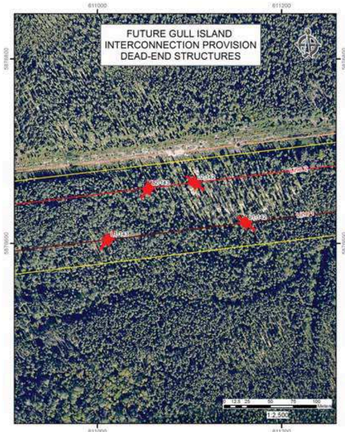
12 – HVdc Overview

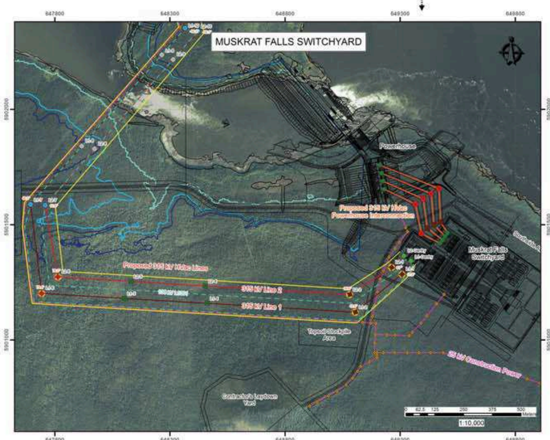
Simple Line route overview for the 350 kV HVdc line



Legend
- HVac Line 1 Structure Marker (Every 50th)
- Transposition Structure
- Proposed HVac Line 1 (South)
- Highway Crossing (HW#-#)
- Transmission Line Crossing (TX#-#)
- Distribution Line Crossing (DX#-#)
- Major Stream/River Crossing (p-WC-X)
- Major Pond/Lake Crossing (p-WP-XX)
- Proposed Southside Access Road to Muskrat Falls
- Airports
- Roads and Highways
- Rivers
- Lakes
- MF Infrastructure Sites
- Reservoir 39m Flood Level







- RT-45 Structure
- 735 kV Line 1 and 2
- 735 kV ROW
- Bell Aliant Poles
- Bell Aliant Fibre Line
- 138 kV Structures (TL 240)
- Existing Transmission Line (TL240)
- Existing 13.8 kV Distribution Line
- HVac Interconnection Lines
- Line Angle (PI)
- Anti-Cascade Tower
- Structure Type A
- Structure Type B
- Structure Type C
- Structure Type D
- Structure Type E
- Double Circuit AA
- Double Circuit EE
- Gantry
- Proposed Future 138 kV Line
- Proposed Combined HVac ROW
- Proposed HVac Line 1 (South)
- Proposed HVac Line 2 (North)
- 25 kV Structure Locations
- Proposed 25 kV Construction Power
- Muskrat Falls Proposed Infrastructure
- Reservoir 45m Flood Contour
- Reservoir 39m Flood Contour
- Reservoir 25m Flood Contour

PROVINCE OF NEWFOUNDLAND PERMIT HOLDER CLASS "A" This Permit Allows SNC-LAVALIN Inc. To practice Professional Engineering in Newfoundland and Labrador. Permit No. as issued by PEGNL N0436 which is valid for the year 2013

ISSUE	REV.	DATE	DISTRIBUTION & STATUS	No.	REFERENCE DRAWING
3	C1	27-MAR-2013	ISSUED FOR CONSTRUCTION (CT0319)	MFA-SN-CD-6140-TL-MP-0003-01	315 kV HVac LINES ROUTE MAP
2	B2	13-JUL-2012	ISSUED FOR BID PURPOSES	MFA-SN-CD-4100-EL-LT-0011-01	735-315 kV CF SWITCHYARD EXTENSION
1	B1	19-APR-2012	ISSUED FOR BID PURPOSES	MFA-SN-CD-4300-EL-LT-0010-01	MUSKRAT FALLS SUBSTATION 315-138 kV SWITCHYARD AND HVdc CONVERTER STATION LAYOUT
				MFA-SN-CD-3000-GT-GA-0001-01	MUSKRAT FALLS INTAKE AND POWERHOUSE, SPILLWAY AND TRANSITION DAMS GENERAL LAYOUT PLAN

ISSUE REGISTER

No.	DATE	REVISION	MOD.	VER.	APP.

REVIEW CLASS: | EQUIPMENT TAG NUMBER:

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- ☐ 4. INFORMATION ONLY
- ☐ 5. NOT REVIEWED

LEAD REVIEWER: Date (dd-mmm-yyyy)
NE-LCP MANAGEMENT: Date (dd-mmm-yyyy)
AREA MANAGER: Date (dd-mmm-yyyy)

PROFESSIONAL STAMP: REGISTERED PROFESSIONAL ENGINEER — PEG Newfoundland and Labrador — SHIVA SHENOY — SIGNATURE — DATE — NEWFOUNDLAND & LABRADOR

SNC·LAVALIN

DESIGNED:	S. SHENOY	APPROVED Discipline Lead Engineer	H. BAKHSHI
DRAWN:	S. ROBERTS		
VERIFIED:	M. MEZIANE	APPROVED Engineering Manager	G. SALTAN
DATE:	27-MAR-2013 SCALE: VARIOUS		

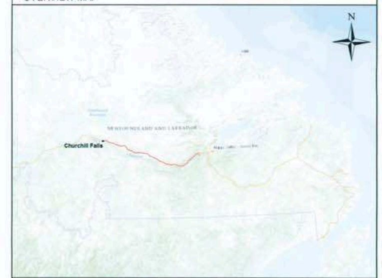
CLIENT: nalcor energy

PROJECT: LOWER CHURCHILL PROJECT

TITLE: 315 kV HVac TRANSMISSION LINES OVERVIEW MAP
MUSKRAT FALLS TO CHURCHILL FALLS

FILE NO.: 505573-3611-4ZDD-0001_02 | MFA-SN-CD-6140-TL-MP-0004-01 | REV. C1

OVERVIEW MAP



NOTES:

1) The constraints illustrated on the drawing do not represent the exact location in the field and shall only be used to assist with contractor planning. The contractor will be required to ground truth the listed constraints prior to the start of construction. This ground truthing exercice will be conducted by the contractor's designated environmental representative, along with the engineer's environmental representative.
2) All construction activities shall comply with the Project-Wide Environmental Protection Plan and the Contract-Specific Environmental Protection Plan.
3) 735 kV ROW extents provided by Nalcor.
4) For 735-315 kV Switchyard and 735 kV ROW, wood is to be piled in the designated wood piling area as indicated.

LEGEND

- Gantry
- A
- B
- C
- D
- E
- PI
- Bell Aliant Poles
- Bell Aliant Fibre Line
- Contours (5m)
- Roads and Highways
- Snowmobile Trails
- Streams/Rivers
- Ponds/Lakes
- Public Water Supply
- Issued Titles
- Structure Box
- Wood Pile Locations for 735-315 kV Switchyard and 735 kV ROW
- Proposed 315 kV / 735 kV Right of Way and 735kV/315kV Switchyard to be cleared
- Proposed 315 kV HVac Line 1 South
- Proposed 315 kV HVac Line 2 North
- Existing 138 kV Transmission Line (TL240)
- 138 kV Structures (TL 240)
- Existing 13.8 kV Distribution Line (Will be rerouted by others)

PROVINCE OF NEWFOUNDLAND PERMIT HOLDER CLASS "A" This Permit Allows SNC-LAVALIN Inc. To practice Professional Engineering in Newfoundland and Labrador. Permit No. as issued by PEGNL N0458 which is valid for the year 2013

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS

0 62.5 125 250 375 500 m

ISSUE	REV.	DATE	DISTRIBUTION & STATUS	No.	REFERENCE DRAWING	No.	DATE	REVISION	MOD.	VER.	APP.
3	C2	24-JUL-2013	ISSUED FOR CONSTRUCTION (CT0319)								
2	C1	27-MAR-2013	ISSUED FOR CONSTRUCTION (CT0319)	MFA-SN-CD-6140-TL-MP-0003-01	315 kV HVac LINES ROUTE MAP						
1	B1	21-NOV-2012	ISSUED FOR BID PURPOSES	MFA-SN-CD-4100-CV-PL-0001-01	CHURCHILL FALLS LOCATION DRAWING EXTENSION OF 735 kV NEW 315 kV SUBSTATION (Rev. C1)						
				ILK-SN-CD-4100-CV-PL-0036-01	735-315 kV CF SWITCHYARD EXTENSION SITE CLEARING OUTLINE (Rev. C1)						
ISSUE REGISTER											

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- ☐ 3. REVIEWED - NOT ACCEPTED
- ☐ 4. INFORMATION ONLY
- ☐ 5. NOT REVIEWED

LEAD REVIEWER: Date (dd-mmm-yyyy):
NE-LCP MANAGEMENT: Date (dd-mmm-yyyy):
AREA MANAGER: Date (dd-mmm-yyyy):

PROFESSIONAL STAMP:
REGISTERED PROFESSIONAL ENGINEER PEG Newfoundland and Labrador SHIVA SHENOY 24-JUL-2013 DATE NEWFOUNDLAND & LABRADOR

SNC·LAVALIN

DESIGN:	S. SHENOY	APPROVED Discipline Lead Engineer:	H. BAKHSHI
DRAWN:	S. ROBERTS	APPROVED Engineering Manager:	G. SALTAN
VERIFIED:	M. MEZIANE		
DATE:	24-JUL-2013	SCALE:	1:5,000
SLI DOC NO.:	505573-3613-4ZDD-0024_02		

nalcor energy

PROJECT: LOWER CHURCHILL PROJECT

TITLE: 315 kV HVac LINES CHURCHILL FALLS SITE PLAN

NE DOC NO.: MFA-SN-CD-6140-TL-MP-0007-01 REV.: C2

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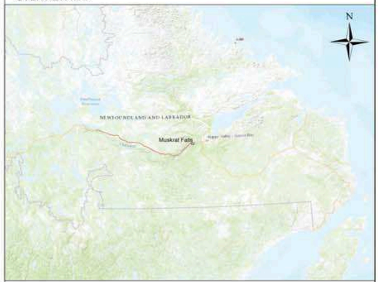
Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS

0 125 250 500 750 1,000 m

OVERVIEW MAP



NOTES:

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2) All construction activities shall comply with the Project-Wide Environmental Protection Plan and the Contract-Specific Environmental Protection Plan.

LEGEND

Proposed Infrastructure
- Line Angle (PI)
- Structure Type A
- Structure Type B
- Structure Type C
- C Suspension
- Structure Type D
- Structure Type E
- Double Circuit AA
- Double Circuit EE
- GANTRY_315kV
- Proposed Combined HVac ROW
- Proposed HVac Line 1 (South)
- Proposed HVac Line 2 (North)
- 315 kV HVac Interconnection Lines
- Proposed Future 138 kV Line
- 138 kV/ 25 kV Substation
- Proposed 350 kV HVdc Centreline
- Proposed 350 kV HVdc RoW
- Muskrat Falls Proposed Infrastructure

Existing Constraints
- 25 kV Structure Locations
- 25 kV Construction Power Centreline
- 138 kV Structures (TL 240)
- Existing Transmission Line (TL240)
- Bell Aliant Poles
- Bell Aliant Fibre Line
- 25 kV Distribution Line
- Telecom Towers HVGB
- Snowmobile Trails
- Roads and Highways
- Streams/Rivers
- Ponds/Lakes
- 5m Contours
- Regionally Uncommon Plants
- Portage Trail
- Historic Resource
- Wetlands
- Cottage Planning Development Area
- Issued Titles
- Map Staked Claims

ISSUE	REV.	DATE	DISTRIBUTION & STATUS	No.	REFERENCE DRAWING	No.	DATE	REVISION	MOD.	VER.	APP.
2	C1	27-MAR-2013	ISSUED FOR CONSTRUCTION (CT0319)	MFA-SN-CD-6140-TL-MP-0003-01	315 kV HVac LINES ROUTE MAP						
1	B1	22-JUN-2012	ISSUED FOR BID PURPOSES	MFA-SN-CD-4300-EL-LT-0010-01	Muskrat Falls Substation 315-138kV Switchyard and HVdc Converter Station Layout						
				MFA-SN-CD-3000-GT-GA-0001-01	Muskrat Falls Intake and Powerhouse, Spillway and Transition Dams General Layout Plan						

ISSUE REGISTER

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EQUIPMENT TAG NUMBER:

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NE-LCP MANAGEMENT: Date (dd-mmm-yyyy):
AREA MANAGER: Date (dd-mmm-yyyy):

PROFESSIONAL STAMP:
REGISTERED PROFESSIONAL ENGINEER
PEG Newfoundland and Labrador
SHIVA SHENOY
SIGNATURE
DATE
NEWFOUNDLAND & LABRADOR

SNC·LAVALIN

DESIGN:	S. SHENOY	APPROVED Discipline Lead Engineer:	H. BAKHSHI
DRAWN:	S. ROBERTS	APPROVED Engineering Manager:	G. SALTAN
VERIFIED:	M. MEZIANE		
DATE:	27-MAR-2013	SCALE:	1:10,000
SLI DOC NO.:	505573-3613-4ZDD-0025_01		

nalcor energy

PROJECT: LOWER CHURCHILL PROJECT

TITLE: 315 kV HVac LINES MUSKRAT FALLS SITE PLAN

NE DOC NO.: MFA-SN-CD-6140-TL-MP-0006-01 REV: C1

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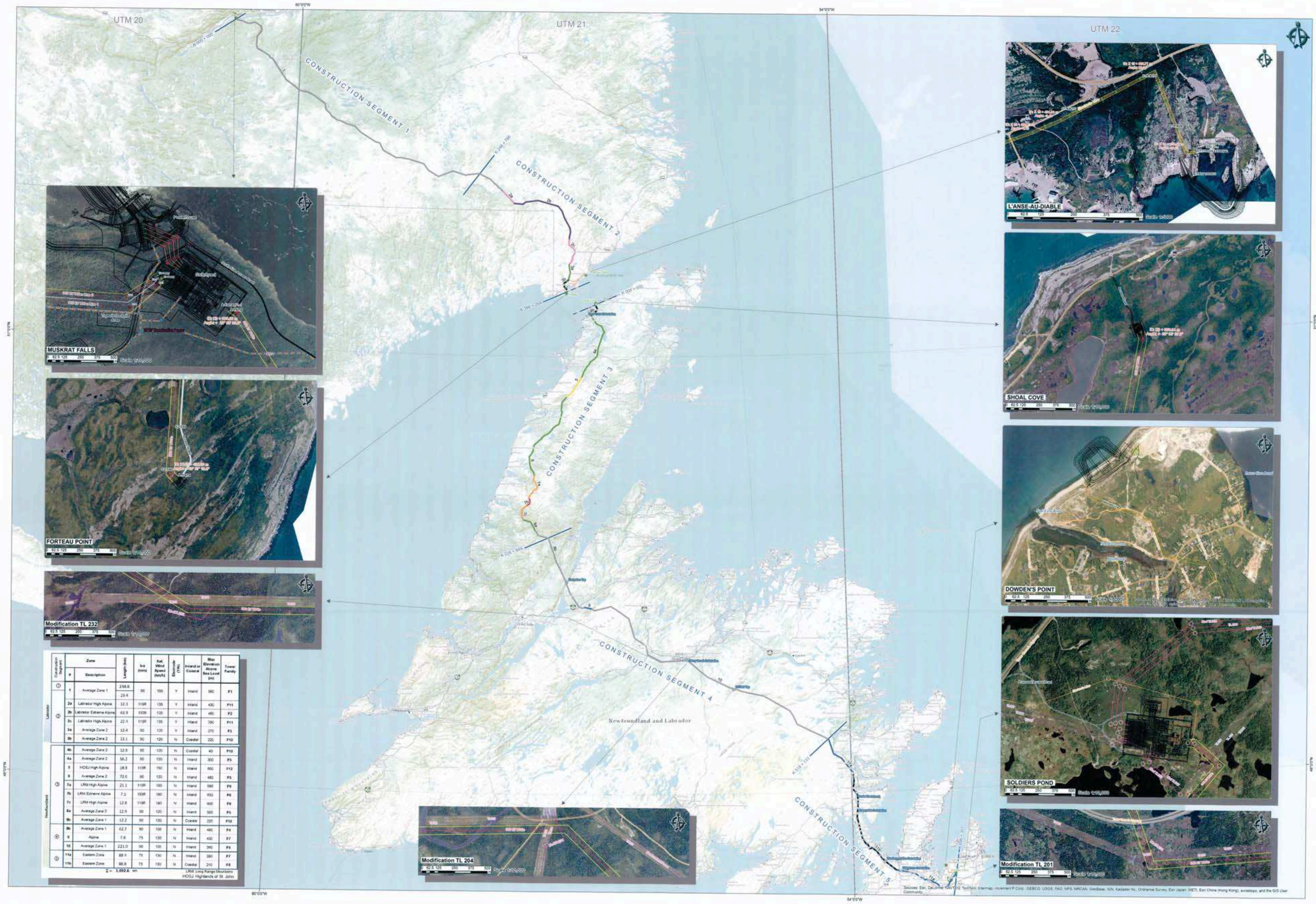

Construction Segment	Zone #	Zone Description	Length (km)	Ice (mm)	Ref. Wind Speed (km/h)	Electrode (Y/N)	Inland or Coastal	Max Elevation Above Sea Level (m)	Tower Family
Labrador ①	1	Average Zone 1	248.8	50	105	Y	Inland	560	F1
Labrador ②			23.4						
	2a	Labrador High Alpine	12.3	115R	135	Y	Inland	430	F11
	2b	Labrador Extreme Alpine	63.9	135R	135	Y	Inland	480	F2
	2c	Labrador High Alpine	22.4	115R	135	Y	Inland	750	F11
	3a	Average Zone 2	12.4	50	120	Y	Inland	270	F3
	3b	Average Zone 2	13.1	50	120	N	Coastal	220	F10
Newfoundland ③	4b	Average Zone 2	12.5	50	120	N	Coastal	40	F10
	4a	Average Zone 2	56.2	50	120	N	Inland	300	F5
	5	HOSJ High Alpine	28.9	115R	150	N	Inland	600	F12
	6	Average Zone 2	72.6	50	120	N	Inland	480	F5
	7a	LRM High Alpine	21.1	115R	180	N	Inland	590	F9
	7b	LRM Extreme Alpine	7.1	135R	180	N	Inland	650	F6
	7c	LRM High Alpine	12.8	115R	180	N	Inland	600	F9
	8a	Average Zone 2	12.9	50	120	N	Inland	560	F5
	8b	Average Zone 1	12.2	50	120	N	Coastal	220	F10
Newfoundland ④	8b	Average Zone 1	62.7	50	105	N	Inland	490	F4
	9	Alpine	7.8	75	130	N	Inland	430	F7
	10	Average Zone 1	221.0	50	105	N	Inland	390	F4
Newfoundland ⑤	11a	Eastern Zone	89.4	75	130	N	Inland	390	F7
	11b	Eastern Zone	88.8	75	130	N	Coastal	210	F8

Σ = 1,092.6 km

LRM: Long Range Mountains
HOSJ: Highlands of St. John

LEGEND

- 350 kV HVdc Centreline
- 350 kV HVdc Right of Way
- Structure Type A
- Structure Type B
- Structure Type C
- Structure Type D
- Structure Type E
- GANTRY_315kV
- Line Angle (PI)
- 25 kV Structure Locations
- 25 kV Construction Power
- Proposed Combined HVac ROW
- Proposed HVac Line 1 (South)
- Proposed HVac Line 2 (North)
- Future 138 kV Line (L130X)
- 138 kV M.F. switchyard to H.V. substation (L1301)
- A-FRAME
- Electrode Line
- Proposed Modified Existing Transmission Lines

HVdc Meteorological and Coastal Zones

1, 2a, 2b, 2c, 3a, 3b, 4a, 4b, 5, 6, 7a, 7b, 7c, 8a, 8b, 9, 10, 11a, 11b

UTM Zones

Coordinate System: Geographic

0 12.5 25 50 75 100 km

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ISSU.	REV.	DATE	DISTRIBUTION & STATUS	NO.	REFERENCE DRAWING	NO.	REFERENCE DRAWING
				ILK-SN-CD-8620-CV-GA-0001-01	Dowden's Point Shoreline Pond Electrode General Arrangement		
				ILK-SN-CD-8610-CV-PL-0006-01	Electrode L'Anse au Diable - Access Road Plan View	ILK-SN-CD-6223-TL-DD-0191-01	350 kV HVdc Line Route Map Construction Segment 5
				ILK-SN-CD-8520-CV-PL-0006-01	Shoal Cove Transition Compound Location Plan	ILK-SN-CD-6222-TL-DD-0001-01	350 kV HVdc Line Route Map Construction Segment 4
2	B2	12-JUN-2013	ISSUED FOR BID PURPOSES	ILK-SN-CD-8510-CV-PL-0007-01	Forteau Point Transition Compound Location Plan	ILK-SN-CD-6200-TL-DD-0190-01	350 kV HVdc Line Route Map Construction Segment 3
1	B1	16-JUL-2012	ISSUED FOR BID PURPOSES	ILK-SN-CD-4500-CV-PL-0001-01	Soldiers Pond Converter Station Location Plan	ILK-SN-CD-6200-TL-DD-0191-01	350 kV HVdc Line Route Map Construction Segment 2
				MFA-SN-CD-4300-CV-PL-0001-01	Muskrat Falls Station Location Plan	ILK-SN-CD-6200-TL-MP-0008-01	350 kV HVdc Line Route Map Construction Segment 1
ISSUE REGISTER							

NO.	DATE	REVISION	MOD.	VER.	APP.

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NE-LCP MANAGEMENT: | DATE (dd-mmm-yyyy):
AREA MANAGER: | DATE (dd-mmm-yyyy):

SNC·LAVALIN

DESIGNED BY: S. SHENOY
DRAWN BY: S. ROBERTS
VERIFIED BY: M. MEZIANE, J. YANG
APPROVED DISCIPLINE LEAD ENGINEER: H. BAKHSHI
APPROVED ENGINEERING MANAGER: G. SALTAN
DATE: 12-JUN-2013
SCALE: 1:1,000,000

CLIENT: nalcor energy

PROJECT: LOWER CHURCHILL PROJECT

TITLE: 350 kV HVdc LINE OVERVIEW MAP

SLI DOC NO.: 505573-462A-4ZDD-0018_01
NE DOC NO.: ILK-SN-CD-6000-TL-MP-0001-01
REV.: B2

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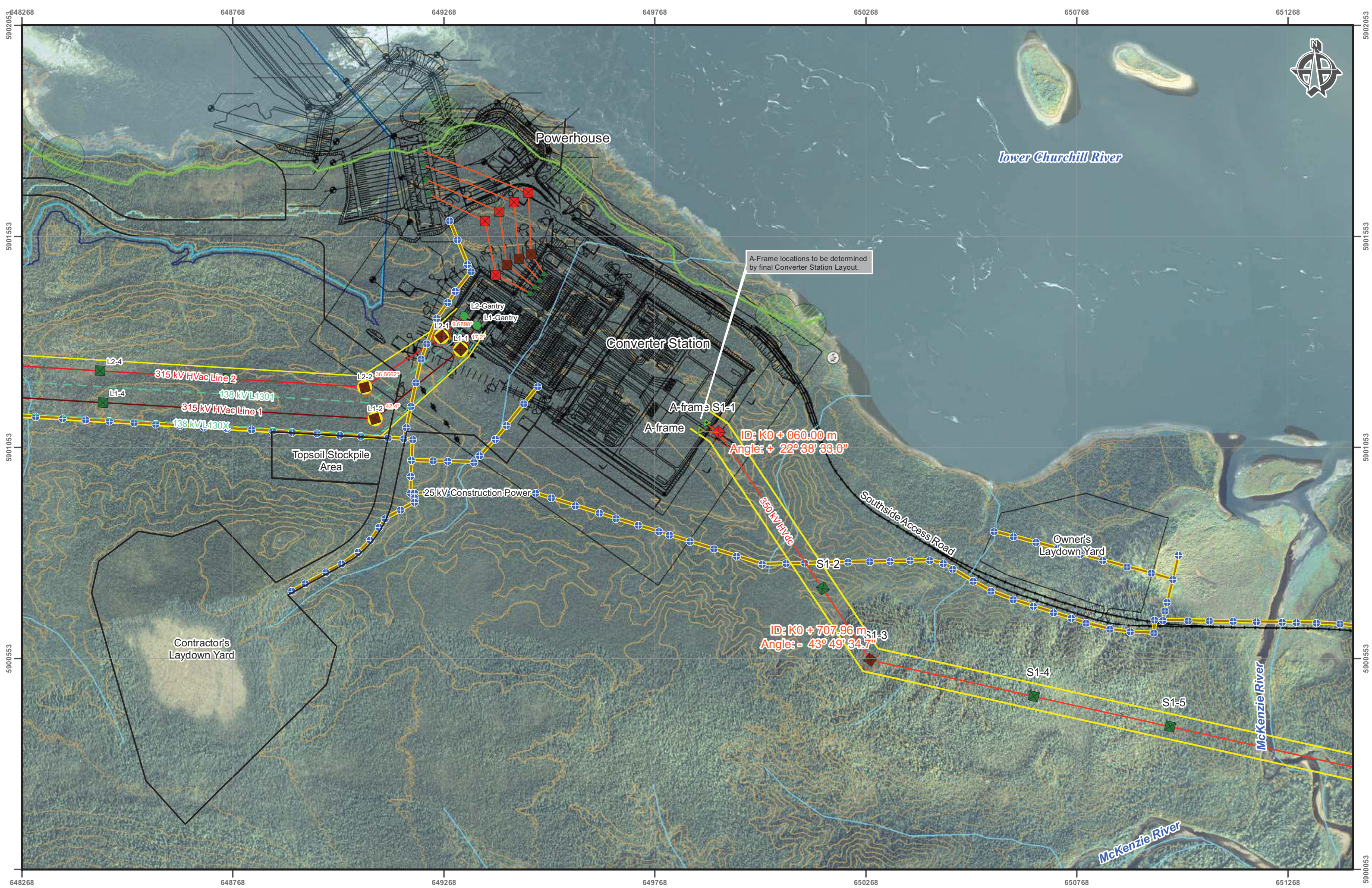
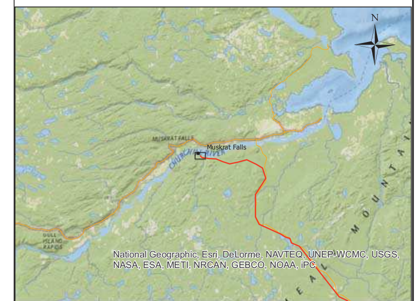


Projection: UTM 20, Meters
Datum: NAD83 (CSRS)

0 62.5 125 250 375 500 m

OVERVIEW MAP



LEGEND

- PI
- 350 kV HVdc Centreline
- Right of Way
- A-frame
- Structure Type A
- Structure Type B
- Structure Type C
- Structure Type D
- Structure Type E
- Anti-Cascade
- Proposed 315 kV HVac Line 1 South
- Proposed 315 kV HVac Line 2 North
- 315 kV HVac Interconnection
- Proposed Future 138 kV Line
- 25 kV Pole location
- 25 kV Construction Power
- Contours (5m)
- Streams/Rivers
- Ponds/Lakes
- Reservoir 45m Flood Contour
- Reservoir 39m Flood Contour
- Reservoir 25m Flood Contour
- Portage Trail
- Historic Resource
- Regionally Uncommon Plants

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ISSUE	REV.	DATE	DISTRIBUTION & STATUS
2	B2	14-MAY-2013	ISSUED FOR BID PURPOSES
1	B1	25-SEP-2012	ISSUED FOR BID PURPOSES

ISSUE REGISTER

No.	REFERENCE DRAWING
MFA-SN-CD-4300-CV-PL-0007-01	Muskrat Falls Bulk Excavation Switchyard and Converter Station

No.	DATE	REVISION	MOD.	VER.	APP.

REVIEW CLASS:

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NE-LCP MANAGEMENT: Date (dd-mmm-yyyy):

AREA MANAGER: Date (dd-mmm-yyyy):

PROFESSIONAL STAMP:

SNC·LAVALIN

DESIGN:	S. SHENOY	APPROVED Discipline Lead Engineer:	H. BAKHSHI
DRAWN:	S. ROBERTS	APPROVED Engineering Manager:	G. SALTAN
VERIFIED:	J. YANG		
DATE:	14-MAY-2013	SCALE:	1:10,000

SLI DOC NO.: 505573-4623-4ZDD-0169_01

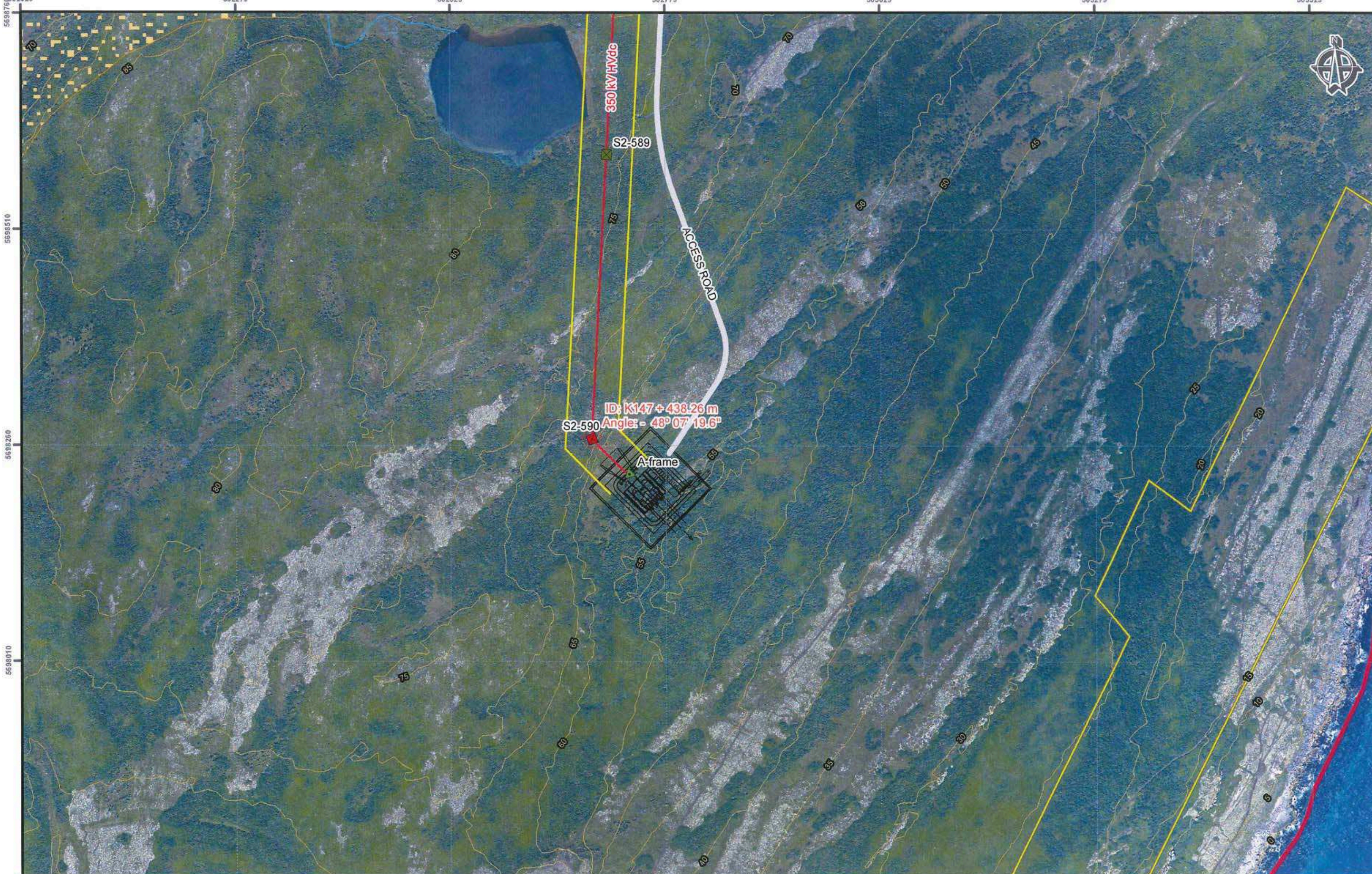
nalcor energy

PROJECT: LOWER CHURCHILL PROJECT

TITLE: 350 kV HVdc Line Muskrat Falls Site Plan

NE DOC NO.: ILK-SN-CD-6200-TL-MP-0006-01 REV.: B2

G:\505573\Comp4-Trans\40-ENG\40-GENENG\Geomatics\Project\HVdc\Infrastructure\siteplans\Muskrat Falls HVdc\mxd\MF_HVdc_Site_Plan_11x17_R05-13-2013_01.mxd



OVERVIEW MAP

LEGEND

- A-frame
- A Type Structure
- E Type Structure
- Line Angle (PI)
- 350 kV HVdc Centreline
- 350 kV HVdc Right of Way
- Transition Compound Access Road
- Proposed Transition Compound
- Rivers
- Ponds/Lakes
- Bakeapple Bog
- Issued Titles
- Municipal Planning Area Boundary
- Contours (5m)

NOT FOR CONSTRUCTION

Projection: UTM 21, Meters
Datum: NAD83 (CSRS)

0 30 60 120 180 240 m

ISSUE	REV.	DATE	DISTRIBUTION & STATUS
2	B2	13-MAY-2013	ISSUED FOR BID PURPOSES
1	B1	17-JUL-2012	ISSUED FOR BID PURPOSES

ISSUE REGISTER

No.	REFERENCE DRAWING
ILK-SN-CD-8510-CV-PL-0007-01	FORTEAU POINT TRANSITION COMPOUND LOCATION PLAN

No.	DATE	REVISION	MOD.	VER.	APP.

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- ☐ 3. REVIEWED - NOT ACCEPTED
- ☐ 4. INFORMATION ONLY
- ☐ 5. NOT REVIEWED

LEAD REVIEWER: Date (dd-mmm-yyyy):
NE-LCP MANAGEMENT: Date (dd-mmm-yyyy):
AREA MANAGER: Date (dd-mmm-yyyy):

PROFESSIONAL STAMP:

SNC·LAVALIN

DESIGN:	S. SHENOY	APPROVED Discipline Lead Engineer:	H. BAKHSHI
DRAWN:	S. ROBERTS	APPROVED Engineering Manager:	G. SALTAN
VERIFIED:	J. YANG		
DATE:	13-JUN-2012	SCALE:	1:5,000

SLI DOC NO.: 505573-4623-4ZDD-0170_01

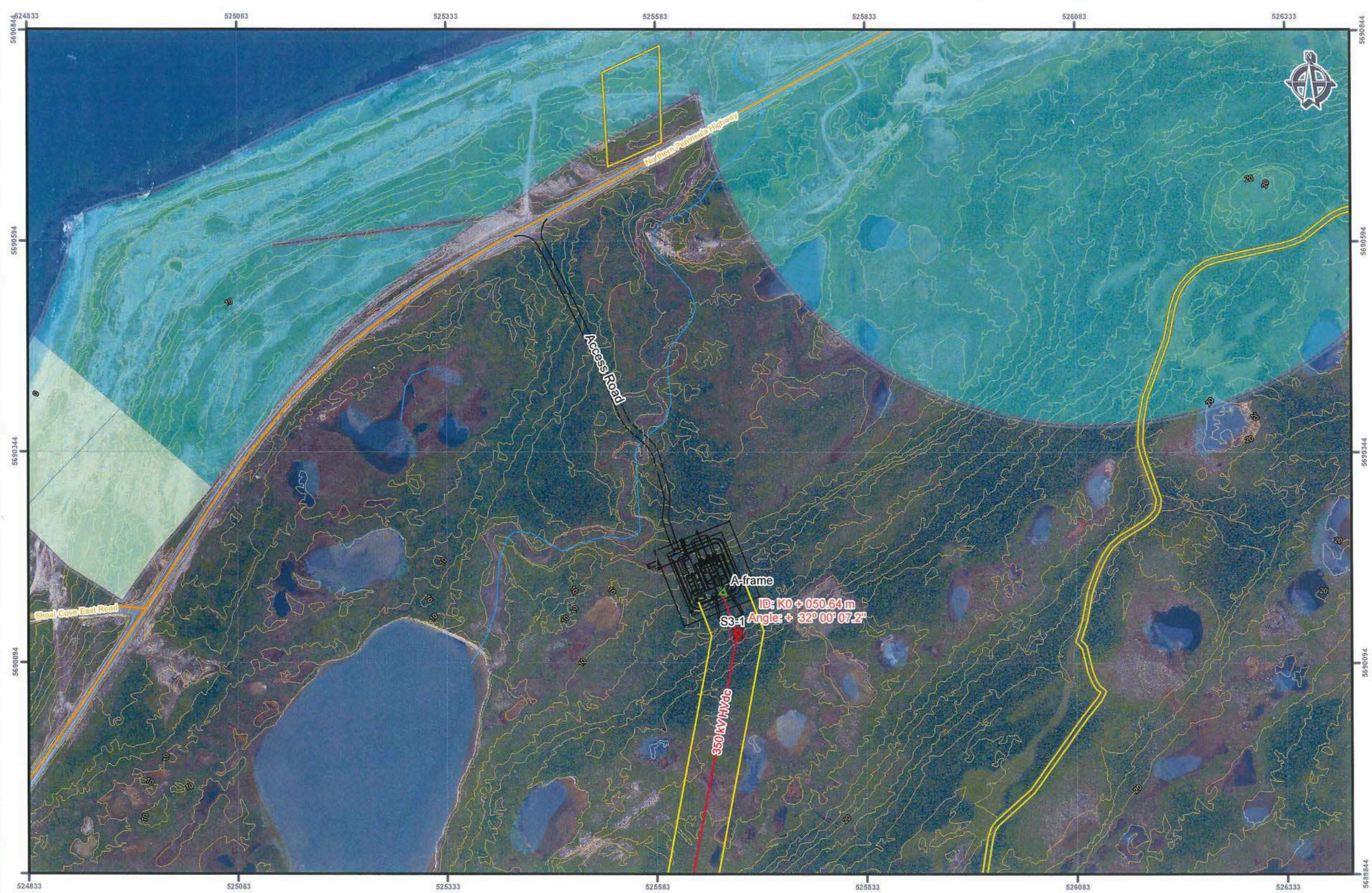
nalcor energy

PROJECT: LOWER CHURCHILL PROJECT

TITLE: 350 kV HVdc Line Forteau Site Plan

NE DOC NO.: ILK-SN-CD-6200-TL-MP-0003-01 REV: B2

G:\505573\Comp4-Trans\40-ENG\40-GENENG\Geomatics\Project\HVdc\Infrastructure\siteplans\Forteau\mxd\Forteau_Site_Plan_R05-13-2013_01.mxd



Projection: UTM 21, Meters
Datum: NAD83 (CSRS)

0 30 60 120 180 240 m

OVERVIEW MAP

LEGEND

- A-frame
- E Type Structure
- Line Angle (PI)
- 350 kV HVdc Centreline
- 350 kV HVdc Right of Way
- Transition Compound
- Highways\Roads
- Contours (5m)
- Rivers
- Ponds\Lakes
- Issued Titles
- Fernald's Braya and Long's Braya Habitat
- Sensitive Wildlife and Plant Areas

NOT FOR CONSTRUCTION

ISSUE	REV.	DATE	DISTRIBUTION & STATUS	No.	REFERENCE DRAWING	No.	DATE	REVISION	MOD.	VER.	APP.
2	B2	13-MAY-2013	ISSUED FOR BID PURPOSES								
1	B1	17-JUL-2012	ISSUED FOR BID PURPOSES								
				ILK-SN-CD-8520-CV-PL-0006-01	SHOAL COVE TRANSITION COMPOUND AND LOCATION PLAN						

ISSUE REGISTER

REVIEW CLASS:

EQUIPMENT TAG NUMBER:

REVIEW DOES NOT CONSTITUTE APPROVAL OF DESIGN DETAILS, CALCULATIONS, TEST METHOD OR MATERIAL DEVELOPMENT AND/OR SELECTED BY CONTRACTOR, NOR DOES IT RELIEVE THE CONTRACTOR FROM FULL COMPLIANCE WITH CONTRACTUAL OR OTHER OBLIGATIONS.

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LEAD REVIEWER:	Date (dd-mmm-yyyy):
NE-LCP MANAGEMENT:	Date (dd-mmm-yyyy):
AREA MANAGER:	Date (dd-mmm-yyyy):

PROFESSIONAL STAMP:

SNC·LAVALIN

DESIGN:	S. SHENOY	APPROVED Discipline Lead Engineer:	H. BAKHSHI
DRAWN:	S. ROBERTS	APPROVED Engineering Manager:	G. SALTAN
VERIFIED:	J. YANG		
DATE:	13-MAY-2013	SCALE:	1:5,000
SLI DOC NO.:	505573-4623-4ZDD-0171_01		

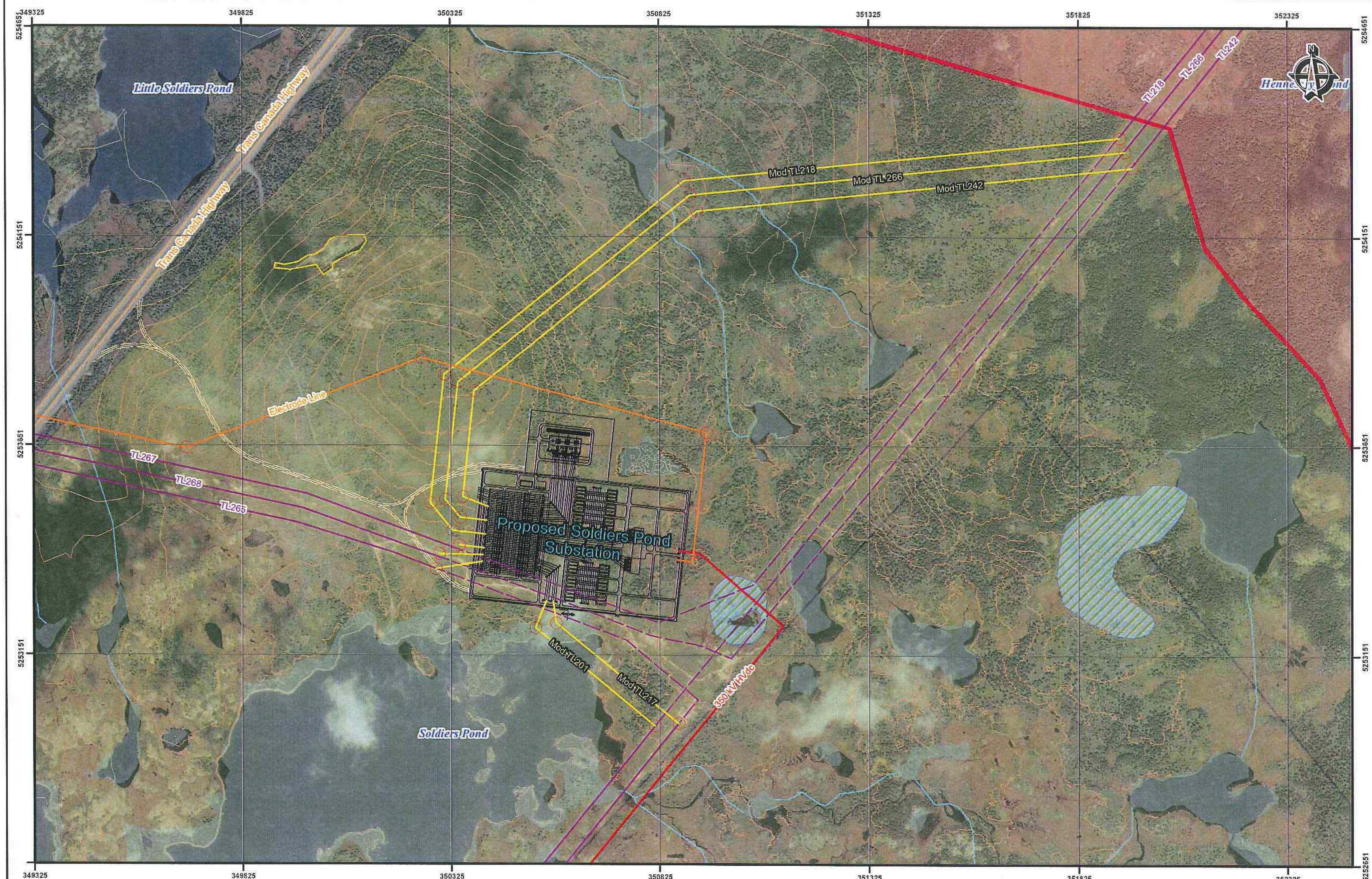
nalcor energy

PROJECT: LOWER CHURCHILL PROJECT

TITLE: 350 kV HVdc Line Shoal Cove Site Plan

NE DOC NO.: ILK-SN-CD-6200-TL-MP-0004-01 REV. B2

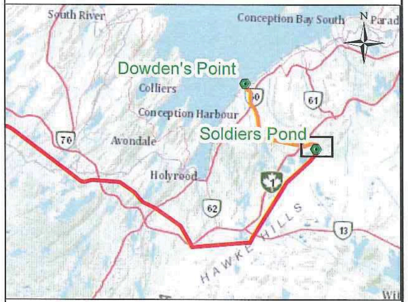
G:\505573\Comp4-Trans\40-ENG\40-GENENG\Geomatics\Project\HVdc\Infrastructure\siteplans\Shoal Cove\mxd\SC_Site_Plan_R05-13-2013_01.mxd



Projection: UTM 22, Meters
Datum: NAD83 (CSRS)

0 62.5 125 250 375 500 m

OVERVIEW MAP



LEGEND

- PI
- Proposed Electrode Line
- Proposed HVdc Alignment
- Proposed Modified Transmission Lines
- 230 kV TL to be salvaged
- 230 kV Existing Transmission Lines
- Soldiers Pond Substation
- Proposed Access Road (To be defined during detailed design)
- Rivers
- Ponds/Lakes
- Contours (5m)
- Wetland
- Municipal Boundary
- Municipal Planning Area
- Cabin Application
- Crown Reserves - Lands

NOT FOR CONSTRUCTION

ISSUE	REV.	DATE	DISTRIBUTION & STATUS
1	B1	7-JUN-2012	ISSUED FOR BID/PURCHASE

ISSUE REGISTER

No.	REFERENCE DRAWING
ILK-SN-CD-4500-CV-PL-0001-01	SOLDIERS POND CONVERTER STATION LOCATION PLAN

No.	DATE	REVISION	MOD.	VER.	APP.

REVIEW CLASS:

EQUIPMENT TAG NUMBER:

REVIEW DOES NOT CONSTITUTE APPROVAL OF DESIGN DETAILS, CALCULATIONS, TEST METHOD OR MATERIAL DEVELOPMENT AND/OR SELECTED BY CONTRACTOR, NOR DOES IT RELIEVE THE CONTRACTOR FROM FULL COMPLIANCE WITH CONTRACTURAL OR OTHER OBLIGATIONS.

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- ☐ 3. REVIEWED - NOT ACCEPTED
- ☐ 4. INFORMATION ONLY
- ☐ 5. NOT REVIEWED

LEAD REVIEWER: Date (dd-mmm-yyyy):

NE-LCP MANAGEMENT: Date (dd-mmm-yyyy):

AREA MANAGER: Date (dd-mmm-yyyy):

PROFESSIONAL STAMP:

SNC·LAVALIN

DESIGN: SR 6r S. SHENOY

DRAWN: S. ROBERTS SR

VERIFIED: D. ALMANZA

DATE: 20-APR-2012

APPROVED Discipline Lead Engineer: H. BAKHSHI

APPROVED Engineering Manager: G. SALTAN

SCALE: 1:10,000

SLI DOC NO.: 505573-4623-4ZDD-0172_00

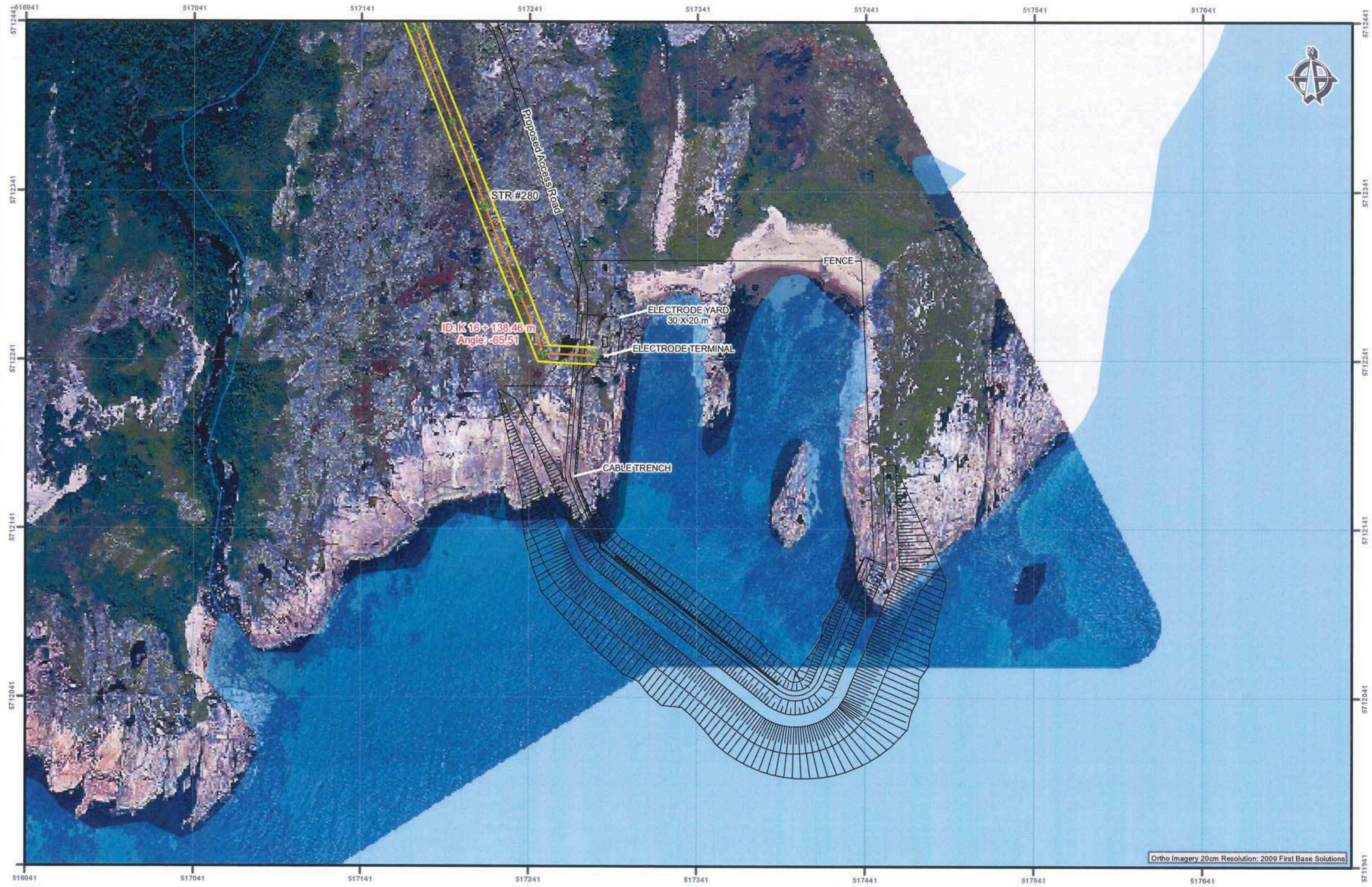
nalcor energy

PROJECT: LOWER CHURCHILL PROJECT

TITLE: 350 kV HVdc Line Soldiers Pond Site Map

NE DOC NO.: MFA-SN-CD-4500-TL-MP-0001-01 REV.: B1

G:\505573\Comp4-Trans\40-ENG\40-GENENG\Geomatics\Project\HVdc\Infrastructure\siteplans\mxd\SP_Site_Plan_11x17_R06-05-2012_00.mxd



Projection: UTM 21, Meters
Datum: NAD83 (CSRS)

0 15 30 60 90 120 m

OVERVIEW MAP

Notes
1. The constraints illustrated on the drawing do not represent the exact location in the field and shall only be used to assist with contractor planning. The contractor will be required to ground truth the listed constriants prior to the start of construction. This ground truthing exercise will be conducted bu the contractor's designated environmental representative, along with the engineer's environmental representative.
2. All construction activities shall comply with the Project-Wide Environmental Protection Plan and the Contract-Specific Environmental Protection Plan.

LEGEND

- Angle Point
- Gantry
- Electrode Structures
- Electrode Line
- Right of Way
- Roads
- Rivers
- Ponds/Lakes
- 350 kV HVdc Centreline
- L'Anse au Diable Shoreline Pond Electrode Site

NOT FOR CONSTRUCTION

ISSUE	REV.	DATE	DISTRIBUTION & STATUS
1	B1	04-APR-2013	ISSUED FOR BID PURPOSES (CT0327)

ISSUE REGISTER

No.	REFERENCE DRAWING
ILK-SN-CD-8610-CV-PL-0006-01	Electrode L'Anse au Diable Access road plan view

No.	DATE	REVISION	MOD.	VER.	APP.

REVIEW CLASS:

EQUIPMENT TAG NUMBER:

REVIEW DOES NOT CONSTITUTE APPROVAL OF DESIGN DETAILS, CALCULATIONS, TEST METHOD OR MATERIAL DEVELOPMENT AND/OR SELECTED BY CONTRACTOR, NOR DOES IT RELIEVE THE CONTRACTOR FROM FULL COMPLIANCE WITH CONTRACTURAL OR OTHER OBLIGATIONS.

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LEAD REVIEWER:	Date (dd-mmm-yyyy):
NE-LCP MANAGEMENT:	Date (dd-mmm-yyyy):
AREA MANAGER:	Date (dd-mmm-yyyy):

PROFESSIONAL STAMP:

SNC·LAVALIN

DESIGN:	S. SHENOY	APPROVED Discipline Lead Engineer:	H. BAKHSHI
DRAWN:	S. ROBERTS	APPROVED Engineering Manager:	G. SALTAN
VERIFIED:	J. YANG		
DATE:	04-APR-2013	SCALE:	1:2,500
SLI DOC NO.:	505573-4633-4ZDD-0018_00		

nalcor energy

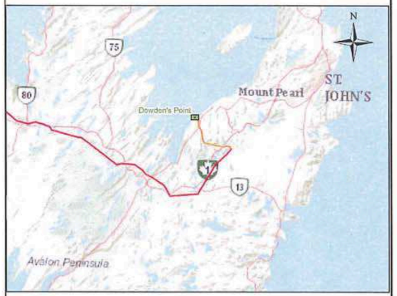
PROJECT: LOWER CHURCHILL PROJECT

TITLE: Electrode Lines Labrador L'Anse Au Diable Site Plan

NE DOC NO.: ILK-SN-CD-6310-TL-MP-0001-01 REV.: B1

G:\505573\Comp4-Trans\40-ENG\40-GENENG\Geomatics\Project\Lab_Electrode\Infrastructure\siteplans\Lanse au Diable\mxd\L'Anse-Au-Diable_Site_Plan_R04-02-2013_00_.mxd

OVERVIEW MAP



LEGEND

- Proposed Electrode Site
- Angle Point
- A-Frame Structure
- Electrode Line
- Right of Way
- Roads
- 350 kV HVdc Centreline
- Dowden's Point Shoreline Pond Electrode Site

PRELIMINARY

Projection: UTM 22, Meters
Datum: NAD83 (CSRS)

0 30 60 120 180 240 m

ISSUE	REV.	DATE	DISTRIBUTION & STATUS
1	A1	27-NOV-2012	ISSUED FOR CLIENT REVIEW

ISSUE REGISTER

No.	REFERENCE DRAWING	No.	DATE	REVISION	MOD.	VER.	APP.

REVIEW CLASS: | EQUIPMENT TAG NUMBER:

REVIEW DOES NOT CONSTITUTE APPROVAL OF DESIGN DETAILS, CALCULATIONS, TEST METHOD OR MATERIAL DEVELOPMENT AND/OR SELECTED BY CONTRACTOR, NOR DOES IT RELIEVE THE CONTRACTOR FROM FULL COMPLIANCE WITH CONTRACTUAL OR OTHER OBLIGATIONS.

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- ☐ 5. NOT REVIEWED

LEAD REVIEWER: Date (dd-mmm-yyyy):
NE-LCP MANAGEMENT: Date (dd-mmm-yyyy):
AREA MANAGER: Date (dd-mmm-yyyy):

PROFESSIONAL STAMP:

SNC·LAVALIN

DESIGN:	S. SHENOY	APPROVED Discipline Lead Engineer:	H. BAKHSHI
DRAWN:	S. ROBERTS	APPROVED Engineering Manager:	G. SALTAN
VERIFIED:	J. YANG		
DATE:	27-NOV-2012	SCALE:	1:5,000
SLI DOC NO.:	505573-4633-4ZDD-0019_PB		

nalcor energy

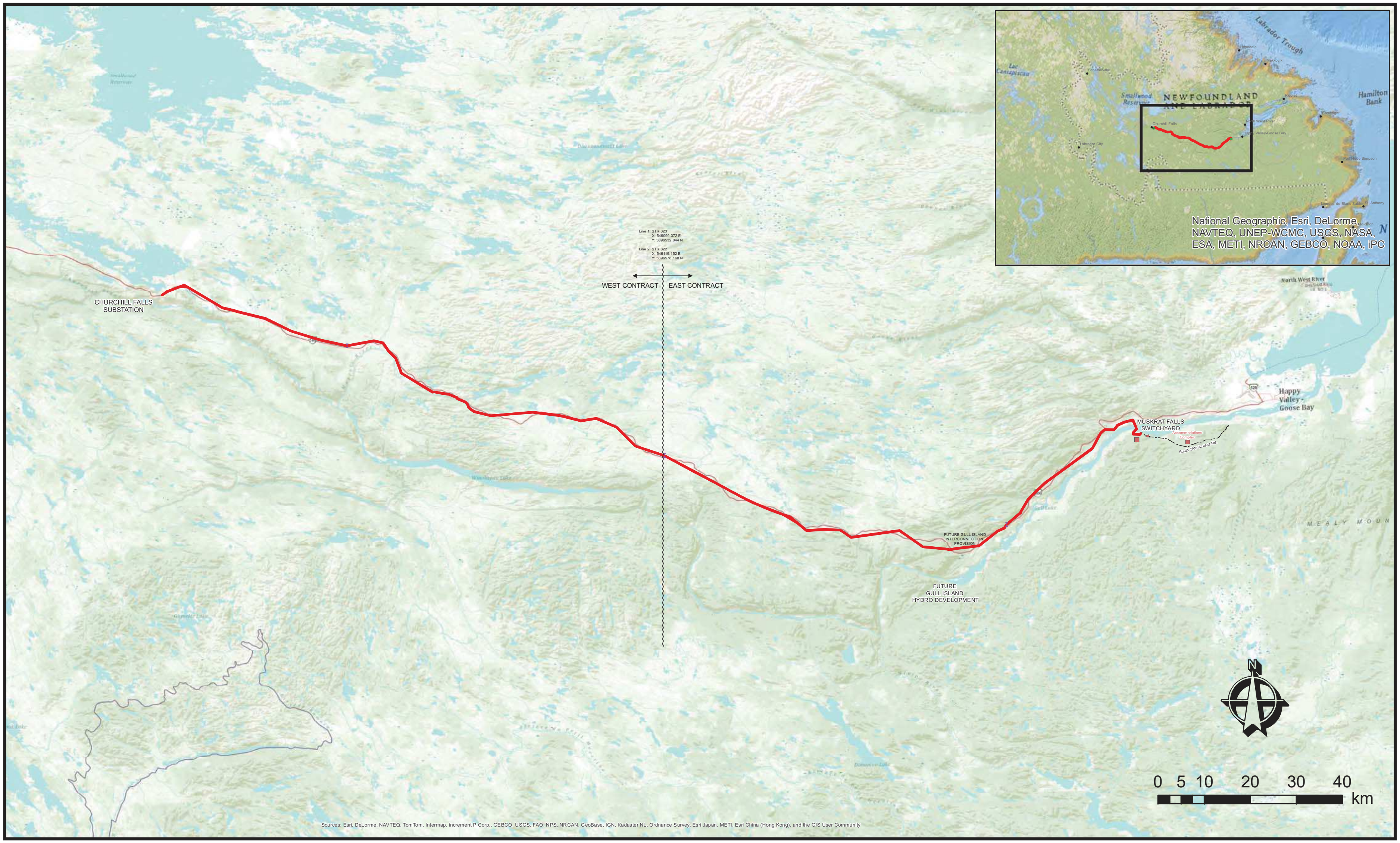
PROJECT: LOWER CHURCHILL PROJECT

TITLE: Electrode Lines Newfoundland Dowden's Point Site Plan

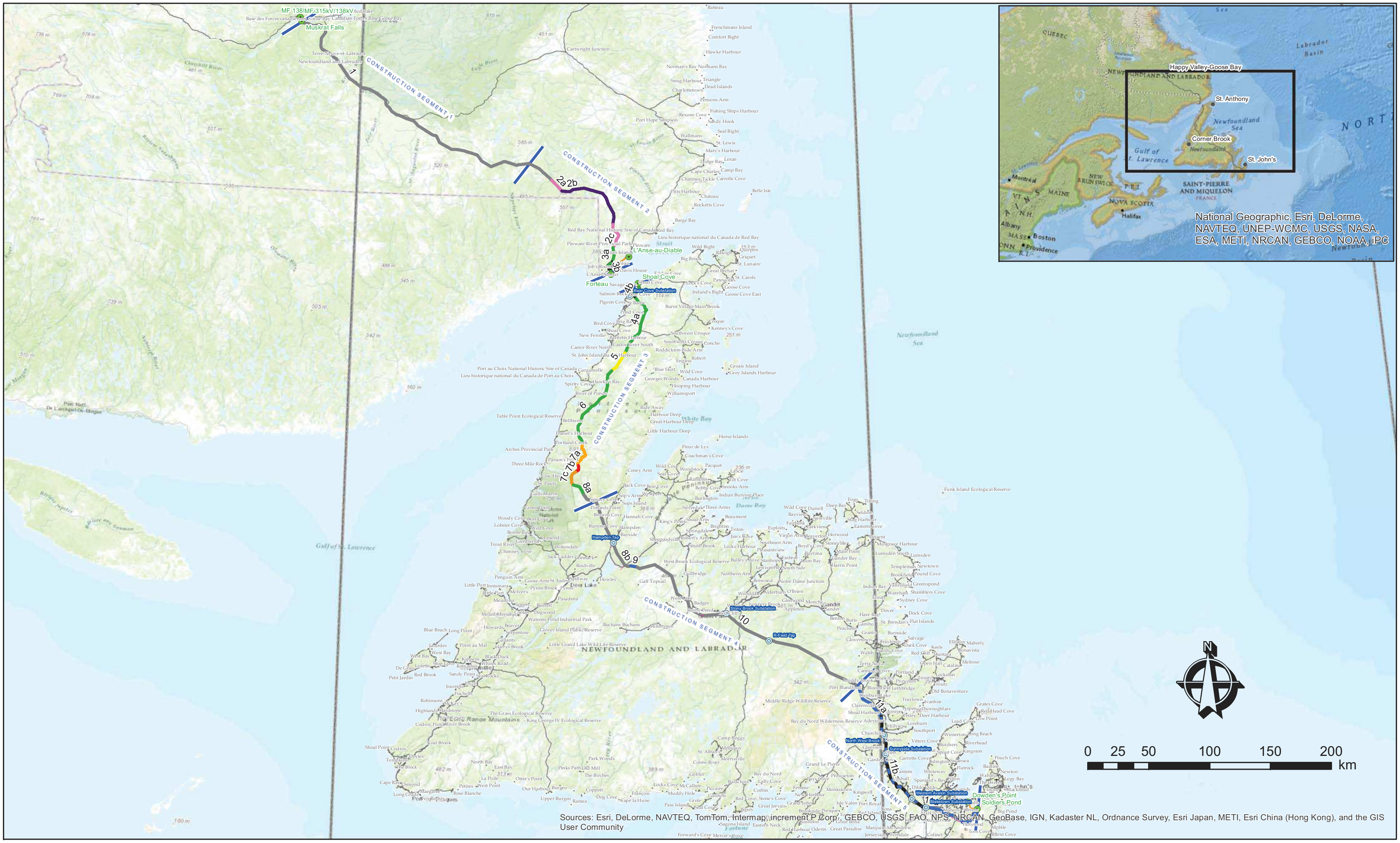
NE DOC NO.: ILK-SN-CD-6320-TL-MP-0001-01 REV.: A1

G:\505573\Comp4-Trans\40-ENG\40-GENENG\Geomatics\Project\Nfl_Electrode\Infrastructure\siteplans\Dowden's Point\mxd\Dowden's Point_Site_Plan_11x17_R11-01-2012_PB

315 kV HVac Transmission Lines Route

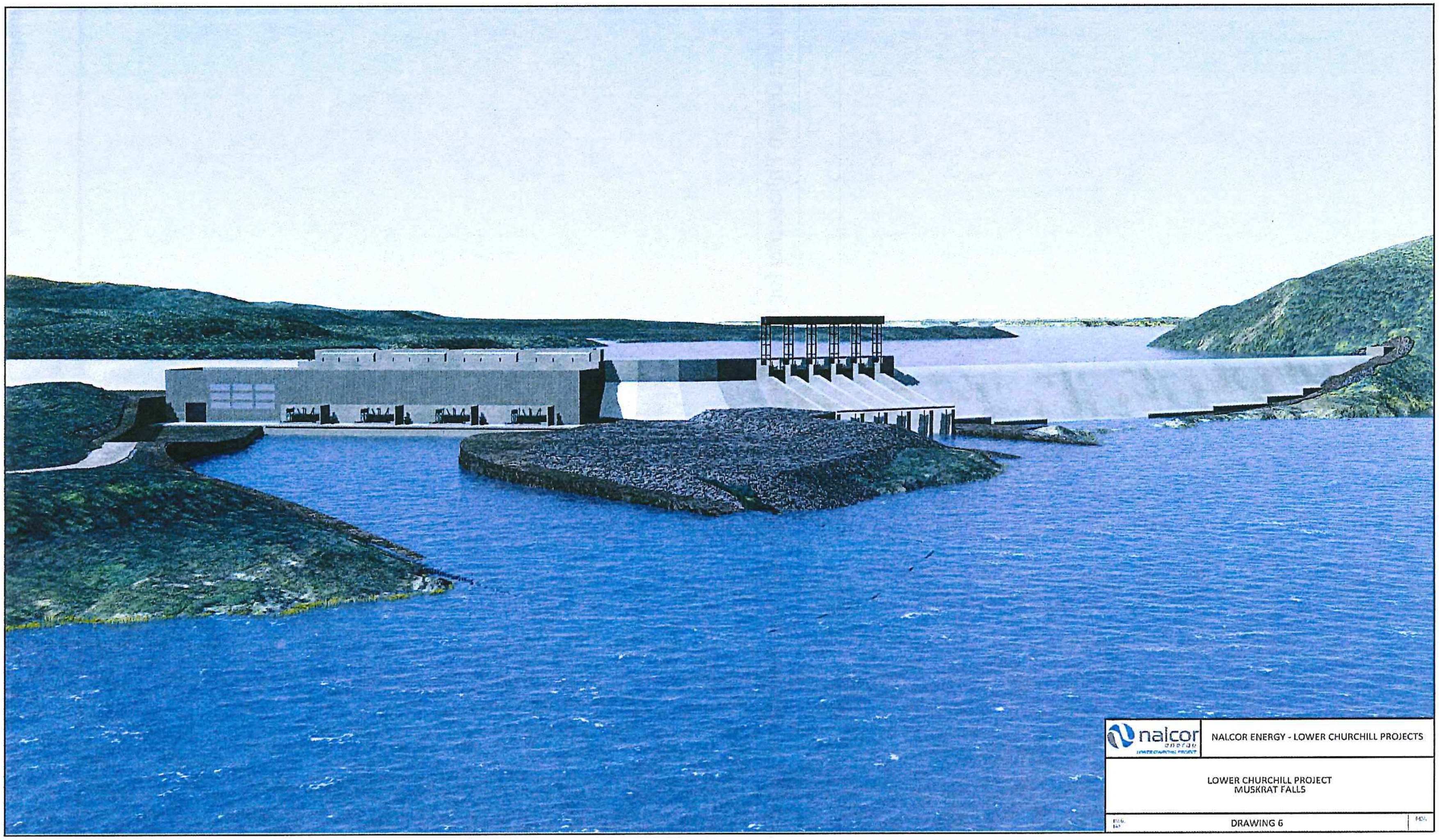


350 kV HVdc Transmission Line Route



APPENDIX G

Photographs and Artist Rendering


nalcor energy
NALCOR ENERGY - LOWER CHURCHILL PROJECTS
LOWER CHURCHILL PROJECT
MUSKRAT FALLS
DRAWING 6

Muskrat Falls Site Photographs – September 25, 26 and 28, 2013

Photo 1: Muskrat Falls rapids. View looking north along the planned dam axis.(09/25/2013)

Photo 2: 2009 aerial view of Muskrat Falls, looking north

Photo 3: Aerial view of North Spur (2009 photograph)

Photo 4: North Spur. Plateau on top of the North Spur. Line of pumped wells runs adjacent to the utility pole. (09/25/2013)

Muskrat Falls Site Photographs – September 25, 26 and 28, 2013

Photo 5: North Spur, 1978 landslide scar, looking northeast. Note exposures of upper sand at crest of slope. (09/25/2013)

Photo 6: North Spur, 1978 landslide toe adjacent t to the river. A pinnacle of tilted cohesive overburden adjacent to shoreline is visible on the right side of the photograph. (09/25/2013)

Photo 7: Aerial view of the RCC cofferdam (Aerial photograph taken by Nalcor on September 28, 2013)

Photo 8: Formwork for downstream end of the RCC cofferdam. Note sloped RCC material in the section immediacy upstream of the formwork. (09/25/2013)

		
9a: RCC cofferdam, showing the line of the expansion crack release plane	**9b**: Installing crack release plane liner. Note plastic sheeting on ground and the water-stop at the left side of photo.	**9c**: Plastic crack release plane in RCC

Photo 9: Details of the tension crack release plane liner. (09/25/2013)

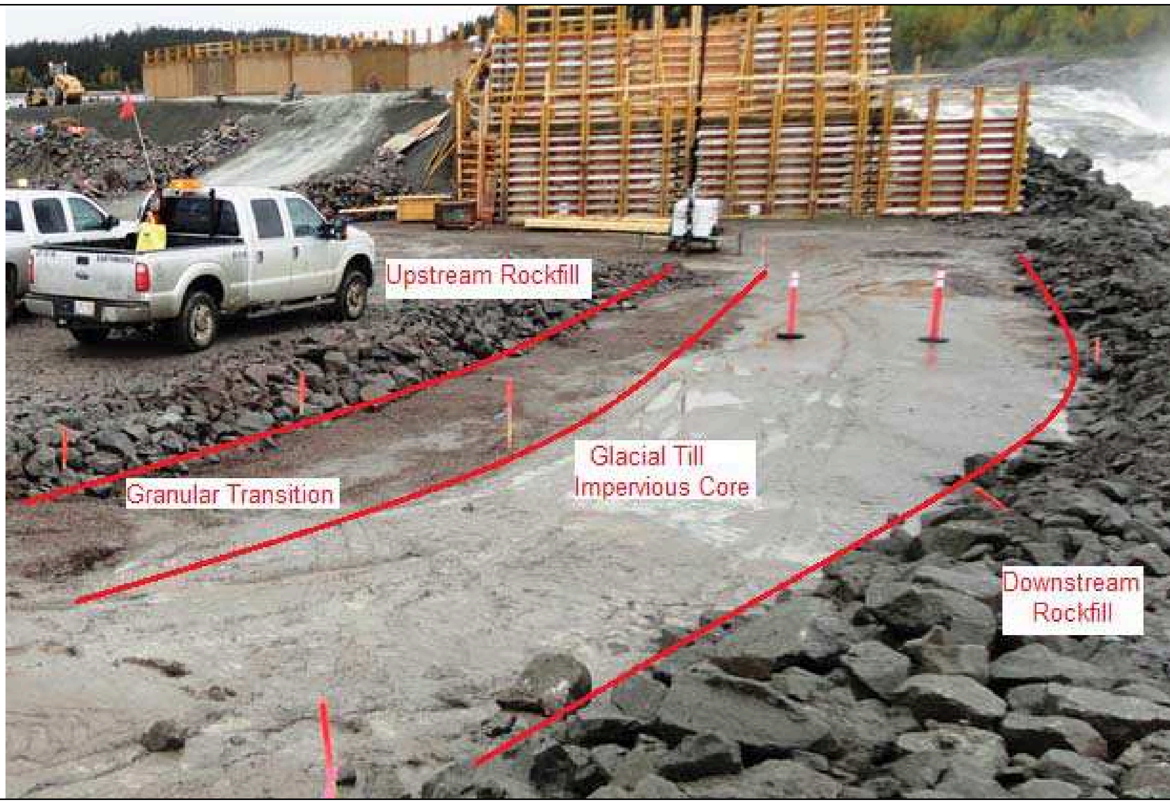


Photo 10: Zoning of cofferdam No. 3 (09/25/2013)

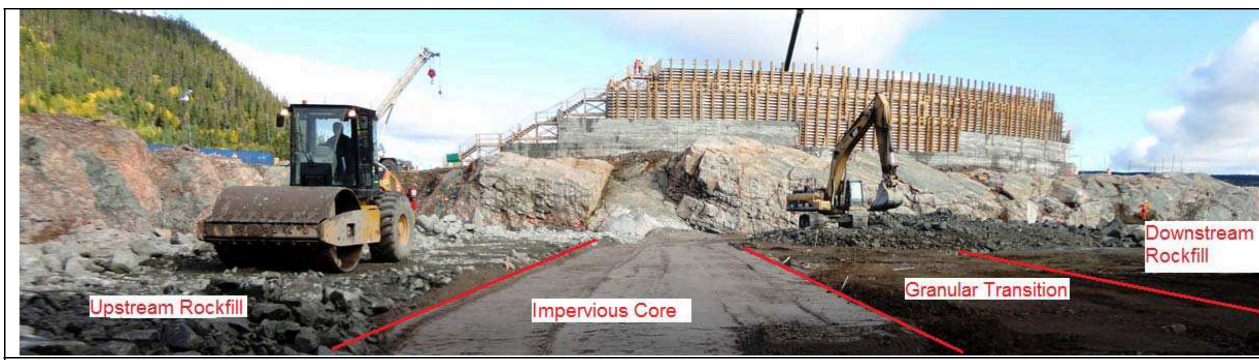


Photo 11: Zoning of upstream cofferdam No. 1. View looking north towards the river. Note upstream end of the RCC cofferdam in the background. (09/26/2013)

Muskrat Falls Site Photographs – September 25, 26 and 28, 2013

Photo 12: Powerhouse/tailrace excavation looking downstream (09/26/2013)

Photo 13: Powerhouse and tailrace excavation north wall. Areas of line drilling and pre-spit wall control are shown. Note the 0.75m die berms at 10 m vertical spacing in the presplit area. On the right side of the photograph. (09/26/2013)

Photo 14: Powerhouse excavation. View looking upstream showing ongoing excavation and the north wall (Aerial photograph taken by Nalcor on September 28, 2013)

Muskrat Falls Site Photographs – September 25, 26 and 28, 2013

Photo 15: Powerhouse north wall. Line drilling half barrel traces are visible on the whole face. Note the small over-breaks in the face caused by localized block sliding along foliation and joint planes. Dark grey and medium grey layering, inclined towards the left of the picture parallel to foliation, are also visible in this photograph. (09/26/2013)

Photo 16: Powerhouse north wall. Line drilled face on left half and presplit face on right half of photo. Note the block sliding overbreak above the crane on the right. This sliding occurred along a moderately inclined S1 foliation plane. . Also note the wire mesh cover draped over the rock face to ensure safety against rock falls. (09/26/2013)

Photo 17: Powerhouse/tailrace south wall. Half-barrel traces can be seen in the face. Note the 0.75m wide benches at 10 m vertical spacing. (09/25/2013)

18a: Line drilling results in powerhouse wall

18b: Presplit blasted surface in tailrace wall immediately downstream of powerhouse

Photo 18: Powerhouse and tailrace south wall. Comparison of line drilling and presplit wall control. (09/26/2013)

Photo 19: Powerhouse south wall. Contact between pink granitic intrusion and grey gneiss. Note excellent wall contours and the localized fallouts at the outside corner in the centre of the picture. Rock bolts are visible. Note the temporary wire mesh cover to ensure safety against rock falls. (09/26/2013)

Photo 20: Spillway. South wall in in background showing the control drill half barrels and gently curved foliation and amphibolite layers. Foreground shows ongoing fill placement work for the upstream cofferdam. (09/25/2013)

Photo 21: Spillway south wall. Dark grey amphibolite layers visible in the face. The upper amphibolite is fissile and soft and has triggered minor overbreak raveling. The amphibolite layers dip into the wall, are inclined approximately 30 degrees, and do not pose and sliding stability issues for this face. (09/26/2013)

Photo 22: Spillway, downstream area (09/25/2013)

Muskrat Falls Site Photographs – September 25, 26 and 28, 2013

Photo 23: Spillway. Upstream end of north wall (09/25/2013)

Photo 24: Armor-stone stockpile. (09/26/2013)

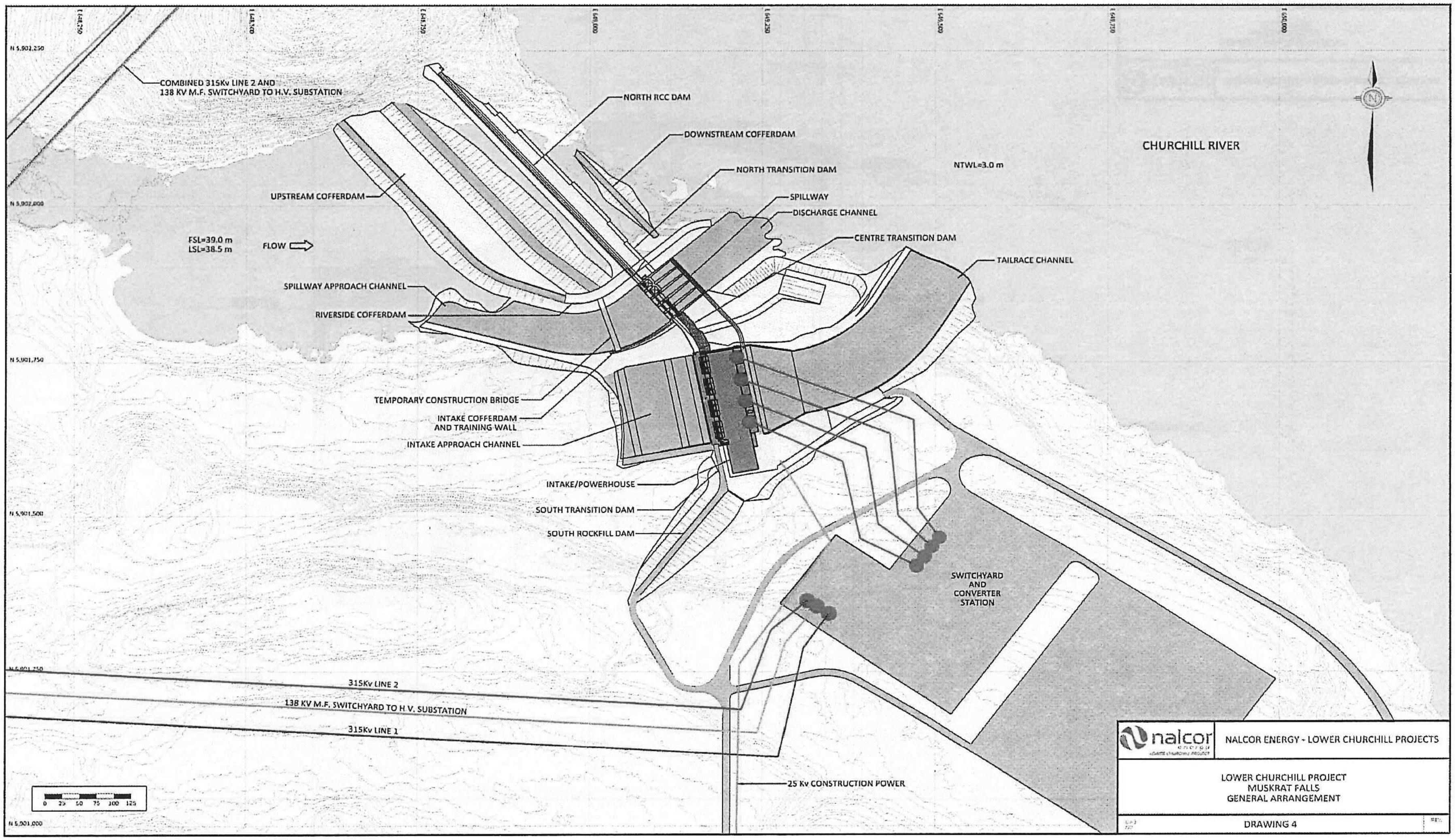
Muskrat Falls Site Photographs – September 26 and 27, 2013

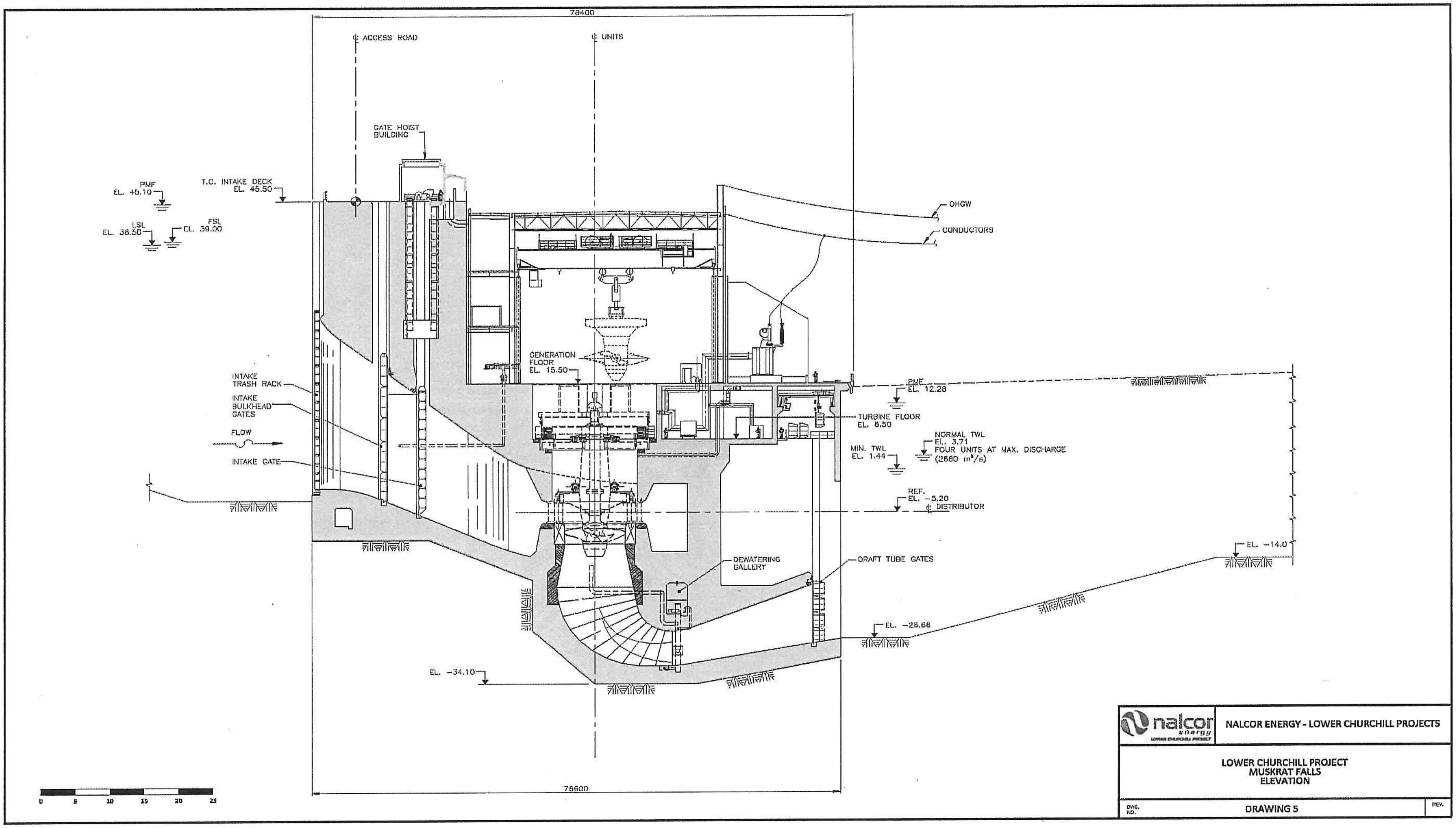
Photo 1: Marshaling Yard.

Photo 2: Marshaling Yard

APPENDIX H

Site Plans, One-Line Diagrams, Powerhouse Control System


COMBINED 315Kv LINE 2 AND
138 KV M.F. SWITCHYARD TO H.V. SUBSTATION
NORTH RCC DAM
DOWNSTREAM COFFERDAM
NORTH TRANSITION DAM
NTWL=3.0 m
CHURCHILL RIVER
UPSTREAM COFFERDAM
SPILLWAY
DISCHARGE CHANNEL
FSL=39.0 m
LSL=38.5 m
FLOW
CENTRE TRANSITION DAM
TAILRACE CHANNEL
SPILLWAY APPROACH CHANNEL
RIVERSIDE COFFERDAM
TEMPORARY CONSTRUCTION BRIDGE
INTAKE COFFERDAM
AND TRAINING WALL
INTAKE APPROACH CHANNEL
INTAKE/POWERHOUSE
SOUTH TRANSITION DAM
SOUTH ROCKFILL DAM
SWITCHYARD
AND
CONVERTER
STATION
315Kv LINE 2
138 KV M.F. SWITCHYARD TO H.V. SUBSTATION
315Kv LINE 1
25 Kv CONSTRUCTION POWER
0 25 50 75 100 125
nalcor
NALCOR ENERGY - LOWER CHURCHILL PROJECTS
LOWER CHURCHILL PROJECT
MUSKRAT FALLS
GENERAL ARRANGEMENT
DRAWING 4


78400
℄ ACCESS ROAD
℄ UNITS
GATE HOIST BUILDING
PMF EL. 45.10
T.O. INTAKE DECK EL. 45.50
LSL EL. 38.50
FSL EL. 39.00
OHGW
CONDUCTORS
GENERATION FLOOR EL. 15.50
INTAKE TRASH RACK
INTAKE BULKHEAD GATES
FLOW
INTAKE GATE
PMF EL. 12.28
TURBINE FLOOR EL. 6.50
NORMAL TWL EL. 3.71 FOUR UNITS AT MAX. DISCHARGE (2680 m³/s)
MIN. TWL EL. 1.44
REF. EL. -5.20 ℄ DISTRIBUTOR
EL. -14.0
DEWATERING GALLERY
DRAFT TUBE GATES
EL. -26.66
EL. -34.10
78600
0 5 10 15 20 25
nalcor energy
NALCOR ENERGY - LOWER CHURCHILL PROJECTS
LOWER CHURCHILL PROJECT
MUSKRAT FALLS
ELEVATION
DRAWING 5

s.31(1)(l)

REDACTED

s.31(1)(l)

REDACTED

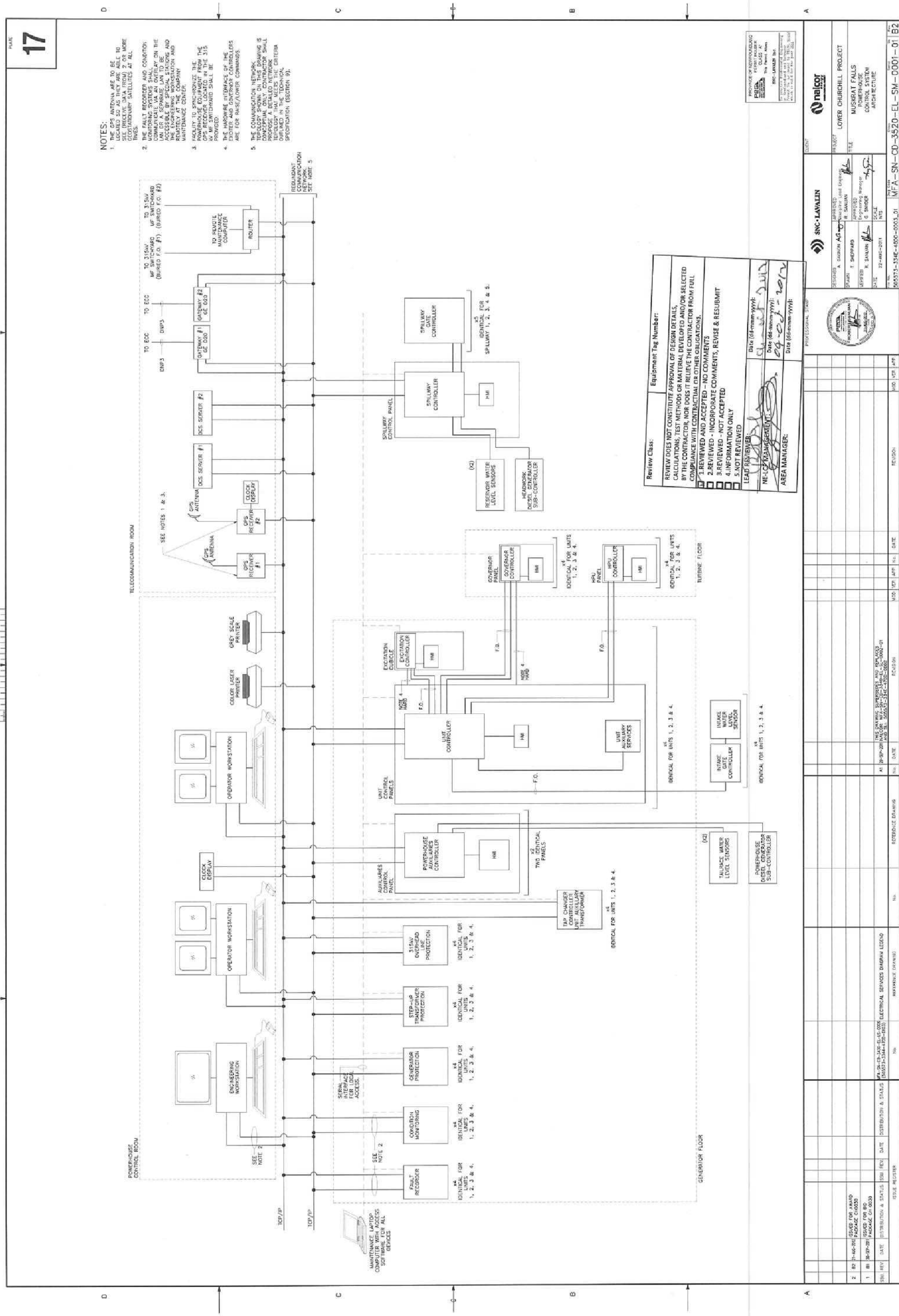
[redacted] 6

s.31(1)(l)

REDACTED

s.31(1)(l)

REDACTED


LOWER CHURCHILL PROJECT
MUSKRAT FALLS POWERHOUSE CONTROL SYSTEM ARCHITECTURE
MFA-SN-CD-3520-EL-SM-0001-01 B2

APPENDIX I

List of Contracts Planned to be Issued by Nalcor Energy

Focus Contracts for this Group

Package Title	Package #	Project	Type	Status (1)	Contract Basis	Award Date (2)	Selection Criteria: Contract Value >$100m	Selection Criteria: Part of IE Review
Construction of Intakes & Powerhouse, Spillway and Transition Dams	CH0007	MF	Civil	Started	Unit Rates	09/15/13	X	X
Supply and Install of Converters and Cable Transition Compounds	CD0501	LIL	S & I	Started	Lump Sum	12/20/13	X	X
Construction of 350 kV HVdc Transmission Line - Section 1 (MF to SOBI to Deer Lake 610 km)	CT0327	LIL	Civil	Started	Combination Lump Sum-Unit Rates	Q2 2014	X	X
Construction of 315 kV Hvac Transmission Line (MF to CF)	CT0319	LTA	Civil	Started	Combination Lump Sum-Unit Rates	09/30/13	X	
Construction of 350 kV HVdc Transmission Line - Section 2 (Central & Eastern NL 470 km)	CT0346	LIL	Civil	Not Started	Combination Lump Sum-Unit Rates	Q3 2014	X	X
Supply and Install Turbines and Generators	CH0030	MF	S & I	Awarded	Lump Sum	01/02/13	X	X
Construction of AC Substation and Synchronous Condensers Facilities	CD0502	LIL/LTA	Civil	Started	Unit Rates	03/17/14	X	X

Key Contracts

Package Title	Package #	Project	Type	Status (1)	Contract Basis	Award Date (2)	Selection Criteria: Contract Value >$100m	Selection Criteria: Part of IE Review
Construction of Reservoir Clearing - North and South Banks (was formally CH0023 & CH0024)	CH0024-001	MF	Civil	Awarded	Combination Lump Sum-Unit Rates	04/25/13	X	
Construction of North and South Dams	CH0009	MF	Civil	Not Started	Lump Sum	Q2 2014	X	
Provision of Catering, Housekeeping & Janitorial Services (MF)	SH0018	MF	Services	Started	Unit Rate	09/19/13	X	
Construction of Bulk Excavation Works	CH0006-001	MF	Civil	Awarded	Unit Rates	11/06/12	X	X
Supply and Install Accommodations Complex Buildings	CH0002-001	MF	S & I	Awarded	Lump Sum	10/22/12	X	
Supply and Install of Powerhouse Hydro-Mechanical Equipment	CH0032	MF	S & I	Started	Lump Sum	09/30/13	X	
Submarine Cable Design, Supply and Install	LC-SB-003	LIL	S & I	Awarded		11/29/12	X	X
Engineering, Procurement and Construction Management (EPCM) Services	N/A	MF/LTA/LIL	Services	Awarded		02/01/11	X	X
Supply of Generator Step-up Transformers	PH0014	MF	Supply	Started	Lump Sum	09/18/13		X
Supply of Generator Circuit Breakers	PH0016	MF	Supply	Started	Lump Sum	12/02/13		X

Attachment B.1 to LCP-PT-MD-0000-PM-ST-0002-01 Rev. B1

Contract Package List
Excluding SOBI Crossing (as of 3-Feb-2012)

EPCM Component Reference	Type	Code	Package Name	SPV Reference			Package Count
				MF	LTA	LITL	
C1	C - Contract	CH0002	Supply and Install Accommodations Complex Buildings	X			
C1	C - Contract	CH0003	Supply and Install Administrative Buildings	x			
C1	C - Contract	CH0004	Construction of Southside Access Road	x			
C1	C - Contract	CH0005	Supply nad Install Accommodations Complex Site Utilities	x			
C1	C - Contract	CH0006	Construction of Bulk Excavation Works and Associated Civil Works	x			
C1	C - Contract	CH0007	Construction of Intake and Powerhouse, Spillway and Transition Dams	x			
C1	C - Contract	CH0008	Construction of North Spur Stabilization Works	x			
C1	C - Contract	CH0009	Construction of North and South Dams	x			
C1	C - Contract	CH0023	Construction of Reservoir Clearing South Bank	x			
C1	C - Contract	CH0024	Construction of Reservoir Clearing North Bank	x			
C1	C - Contract	CH0029	Construction of Site Restoration at Muskrat Falls	x			
C1	C - Contract	CH0030	Supply and Install Turbines and Generators	x			
C1	C - Contract	CH0031	Supply and Install Mechanical and Electrical Auxiliaries (MF)	x			
C1	C - Contract	CH0032	Supply and Install Powerhouse Hydro-Mechanical Equipment	x			
C1	C - Contract	CH0033	Supply and Install Powerhouse Cranes	x			
C1	C - Contract	CH0034	Supply and Install Powerhouse Elevator	x			
C1	C - Contract	CH0039	Supply and Install McKenzies River Permanent Bridge	x			
C1	C - Contract	CH0046	Supply and Install Spillway Hydro-Mechanical Equipment	x			
C1	C - Contract	CH0048	Construction of Site Clearing Access Road & Ancillary Areas	x			
C1	C - Contract	CH0049	Supply and Install Log Booms	x			
C1	C - Contract	CH0050	Supply of Concrete including Batch Plant (MF)	x			
C1	C - Contract	CH0052	Construction of Habitat Compensation Works	x			
C1	P - Purchase Order	PH0014	Supply of Generator Step-up Transformer	x			
C1	P - Purchase Order	PH0015	Supply of Isolated Phase Bus	x			
C1	P - Purchase Order	PH0016	Supply of Generator Circuit Breakers	x			
C1	P - Purchase Order	PH0035	Supply of 15kV Switchgear and Station Service Breakers	x			
C1	P - Purchase Order	PH0036	Supply of Auxiliary Transformers	x			
C1	P - Purchase Order	PH0037	Supply of 25kV Switchgear	x			
C1	P - Purchase Order	PH0038	Supply of Emergency Diesel Generators	x			
C1	S - Service Contract	SH0001	Physical Hydraulic Model	x			
C1	S - Service Contract	SH0018	Provision of Catering, Housekeeping and Janitorial Services (MF)	x			
C1	S - Service Contract	SH0019	Provision of Security Services	x			
C1	S - Service Contract	SH0020	Provision of Medical Services	x			
C1	S - Service Contract	SH0021	Provision of Road Maintenance and Snow Clearing Services (MF)	x			
C1	S - Service Contract	SH0022	Provision of Fuel Supply and Dispensing Services (MF)	x			
C1	S - Service Contract	SH0040	Provision of Garbage Removal and Disposal Services (MF)	x			
C1	S - Service Contract	SH0041	Provision of Ground Transportation Services (HVGB to MF)	x			
C1	S - Service Contract	SH0051	Provision of Buildings Maintenance Services (MF)	x			
							38

Contract Package List
Excluding SOBI Crossing (as of 3-Feb-2012)

EPCM Component Reference	Type	Code	Package Name	SPV Reference			Package Count
				MF	LTA	LITL	
C3	C - Contract	CD0501	Supply and Install Converters and Cable Transition Compounds			X	
C3	C - Contract	CD0502	Construction of AC Substations and Synchronous Condensers Facilities		X		
C3	C - Contract	CD0503	Construction of Earthworks at Various Power Distribution Sites		X	X	
C3	C - Contract	CD0508	Supply and Install of Electrode Sites			X	
C3	C - Contract	CD0509	Construction Telecommunication Services - Phase 2	X			
C3	C - Contract	CD0510	Supply and Install Permanent Communication Systems	X	X	X	
C3	C - Contract	CD0512	Construction of Construction Power Facilities	X			
C3	C - Contract	CD0534	Supply and Install Soldiers Pond Synchronous Condensers			X	
C3	C - Contract	CD0535	Construction Telecommunication Services - Phase 2 Remote Camps		X	X	
C3	C - Contract	CD0538	Supply and Install Accommodations Camp (CF)		X		
C3	C - Contract	CD0564	Construction of Land Mobile Radio System - Labrador	X	X	X	
C3	P - Purchase Order	PD0505	Supply of Switchyard Equipment, AC Substations at CF, MF and SP		X	X	
C3	P - Purchase Order	PD0513	Supply of 138/25 kV Transformers	X			
C3	P - Purchase Order	PD0514	Supply of 138 kV & 25 kV Circuit Breakers	X			
C3	P - Purchase Order	PD0515	Supply of 138 kV & 25 kV Disconnect Switches	X			
C3	P - Purchase Order	PD0518	Supply of 138 kV Capacitor Voltage Transformers	X			
C3	P - Purchase Order	PD0519	Supply of 25 kV Vacuum Interrupters	X			
C3	P - Purchase Order	PD0520	Supply of 25 kV 6 x 3.6 MVAR Capacitor Banks	X			
C3	P - Purchase Order	PD0522	Supply of Pre-fabricated Control Room Building	X			
C3	P - Purchase Order	PD0523	Supply of Substation Service Transformer	X			
C3	P - Purchase Order	PD0529	Supply of 25 kV Reclosers, MV Switches & Fuse Cut-outs	X			
C3	P - Purchase Order	PD0530	Supply of 138 kV & 25 kV Surge Arrestors	X			
C3	P - Purchase Order	PD0531	Supply of MV Instrument Transformer	X			
C3	P - Purchase Order	PD0533	Supply and Install Early Works Telecom Devices	X			
C3	P - Purchase Order	PD0537	Supply of Power Transformers, AC Substations at CF, MF and SP		X	X	
C3	P - Purchase Order	PD0561	Supply of D20 RTU and Cabinet (CF) - Construction Power	X			
C3	P - Purchase Order	PD0562	Supply of Specific Relays and Test Switches (CF) - Construction Power	X			
C3	P - Purchase Order	PD0563	Supply of 138 kV Circuit Switcher (CF) - Construction Power	X			
C3	S - Service Contract	SD0536	Provision of Integrated Commissioning Support Services	X	X	X	
C3	S - Service Contract	SD0560	Provision of Early Works Construction Telecommunication Services (MF)	X			
C3	S - Service Contract	SD0565	Provision of Land Mobile Radio System - Newfounland			X	
							31

Attachment B.1 to LCP-PT-MD-0000-PM-ST-0002-01 Rev. B1

Contract Package List
Excluding SOBI Crossing (as of 3-Feb-2012)

EPCM Component Reference	Type	Code	Package Name	SPV Reference			Package Count
				MF	LTA	LITL	
C4	C - Contract	CT0319	Construction of 315 kV HVac Transmission Line (MF to CF)		X		
C4	C - Contract	CT0327	Construction of 350 kV HVdc Transmission Line - Section 1			X	
C4	C - Contract	CT03141	Clearing of Right of Way for 315 kV KVac Transmission Line (MF to CF)		X		
C4	C - Contract	CT0342	Construction of AC Transmission Lines - Island			X	
C4	C - Contract	CT0343	Clearing of Right of Way for HVdc Transmission Line - Section 1			X	
C4	C - Contract	CT0345	Clearing of Right of Way for HVdc Transmission Line - Section 2			X	
C4	C - Contract	CT0346	Construction of 350 kV HVdc Transmission Line - Section 2			X	
C4	P - Purchase Order	PT0300	Supply of Transmission Line Conductors - 315 kV HVac		X		
C4	P - Purchase Order	PT0301	Supply of HVac Insulators - 315 kV HVac		X		
C4	P - Purchase Order	PT0302	Supply of Steel Towers - 315 kV HVac		X		
C4	P - Purchase Order	PT0303	Supply of Tower Hardware - 315 kV HVac		X		
C4	P - Purchase Order	PT0304	Supply of Optical Ground Wire (OPGW) - 315 kV HVac		X		
C4	P - Purchase Order	PT0307	Supply of Steel Tower Foundations - 315 kV HVac		X		
C4	P - Purchase Order	PT0308	Supply of Steel Tower Foundations - 350 kV HVdc			X	
C4	P - Purchase Order	PT0313	Purchase of Electrode Line Wood Poles			X	
C4	P - Purchase Order	PT0326	Supply of Steel Wires - 315 kV HVac		X		
C4	P - Purchase Order	PT0328	Supply of Transmission Line Conductors - 350 kV HVdc			X	
C4	P - Purchase Order	PT0329	Supply of HVdc Insulators - 350 kV HVdc			X	
C4	P - Purchase Order	PT0330	Supply of Steel Towers - 350 kV HVdc			X	
C4	P - Purchase Order	PT0331	Supply of Tower Hardware - 350 kV HVdc			X	
C4	P - Purchase Order	PT0334	Supply of Steel Wires - 350 kV HVdc			X	
C4	P - Purchase Order	PT0335	Supply of Anchor Materials - 315 kV HVac			X	
C4	P - Purchase Order	PT0336	Supply of 25 kV Distribution Line Hardware	X			
C4	P - Purchase Order	PT0337	Supply of 25 kV Distribution Line ADSS Fibre Optic Cable	X			
C4	P - Purchase Order	PT0338	Supply of 25 kV Distribution Line Conductors	X			
C4	P - Purchase Order	PT0339	Supply of 25 kV Distribution Line Insulators	X			
C4	P - Purchase Order	PT0340	Supply of Wood Poles for 138/25 kV Distribution Line	X			
C4	P - Purchase Order	PT0347	Supply of Re-terminations Materials			X	
C4	P - Purchase Order	PT0351	Supply of Wood Poles			X	
C4	P - Purchase Order	PT0352	Supply of Anchor Materials - 350 kV HVdc			X	
C4	P - Purchase Order	PT0353	Supply of Optical Ground Wire (OPGW) - 350 kV HVdc			X	
C4	S - Service Contract	ST0309	Provisions of Geotechnical Investigation Services - 315 kV HVac		X		
C4	S - Service Contract	ST0310	Provisions of Geotechnical Investigation Services - 350 kV HVdc			X	
C4	S - Service Contract	ST0311	Provision of Survey Services - 315 kV HVac		X		
C4	S - Service Contract	ST0312	Provision of Survey Services - 350 kV HVdc			X	
							35

Contract Package List
Excluding SOBI Crossing (as of 3-Feb-2012)

EPCM Component Reference	Type	Code	Package Name	SPV Reference			Package Count
				MF	LTA	LITL	
SM	S - Service Contract	SM0700	Provision of General Freight Forwarding Services	X	X	X	
SM	S - Service Contract	SM0701	Provision of Third Party Quality Surveillance & Inspection Services	X	X	X	
SM	S - Service Contract	SM0703	Provision of Happy Valley-Goose Bay Project Office Space	X	X	X	
SM	S - Service Contract	SM0704	Provision of Surveying Services	X	X	X	
SM	S - Service Contract	SM0705	Provision of Laboratory Services	X	X	X	
SM	S - Service Contract	SM0706	Supply and Maintenance of Project Vehicles	X	X	X	
SM	S - Service Contract	SM0707	Provision of Helicopter Services	X	X	X	
SM	S - Service Contract	SM0709	Provision of Air Transportation Services	X	X	X	
SM	S - Service Contract	SM0710	Supply and Maintenance of various IT Equipment	X	X	X	
SM	S - Service Contract	SM0713	Provision of Geotechnical Investigation Services		X	X	
SM	S - Service Contract	SM0714	Provision of EPCM Services - SNC Lavalin Inc.	X	X	X	
SM	S - Service Contract	SM0715	Provision of Expediting Services	X	X	X	
							12
						Grand Total	**116**

APPENDIX J

Liquidated Damages Calculations

The following table provides four illustrations of how the Performance Liquidated Damages will be calculated for the Muskrat Falls turbine generators.

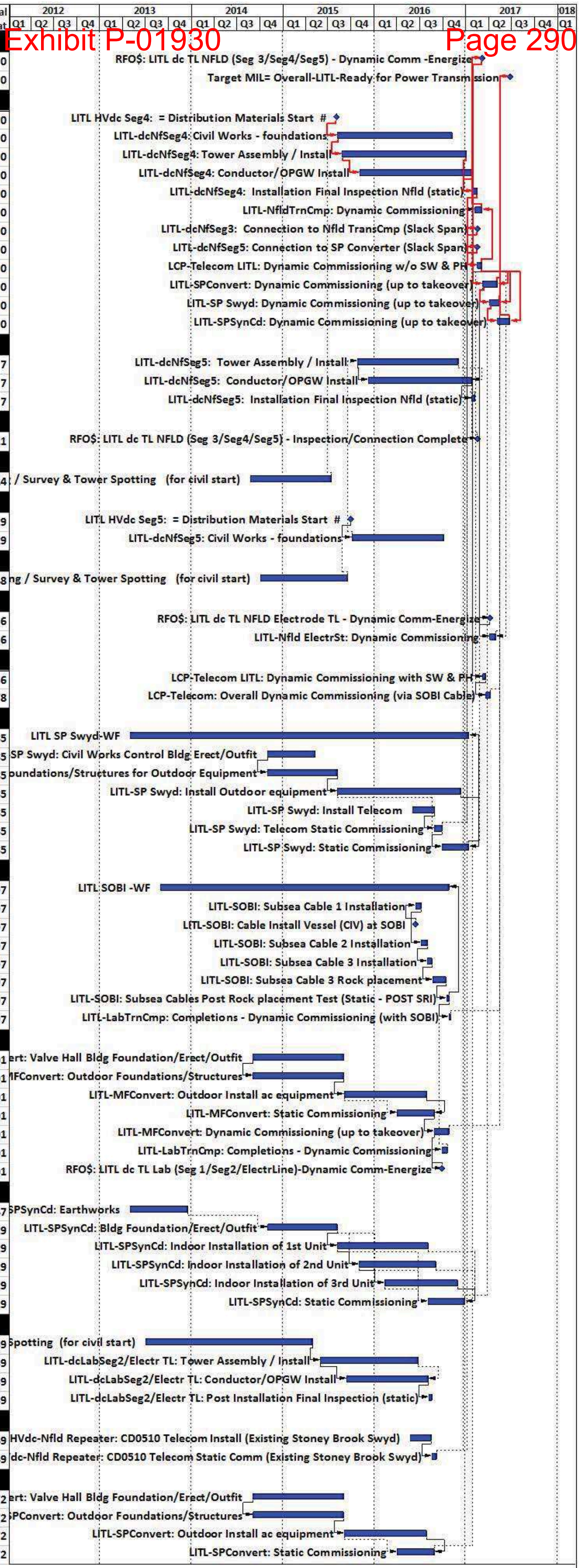
		Example A	Example B	Example C	Example D
1	Contractor's Guaranteed kW Unit Output (Exhibit 1-Appendix B, 1.3.2)(229MVA*.9=206,100kW)	206,100 kW	206,100 kW	206,100 kW	206,100 kW
2	Actual Power Output as tested in accordance with Specifications (from Performance Tests)	204,500 kW	206,100 kW	206,900 kW	205,900 kW
3	Difference in Unit Output = [(2)-(1)*4units]	-1,600 kW	0 kW	+800 kW	-200 kW
4	Evaluation of Guaranteed kW Unit Output payment (Contract Price = $160M*.05=**$8M** LD cap, Article 36.3 b (i)	6,000*1,600= **$9,600,000** **Exceeds cap must fix**	0	0	6,000*500= **$3,000,000**
5	Guaranteed Weighted Average Unit Efficiency (Exhibit 1-Appendix B , 1.4.3)	94.40%	94.40%	94.40%	94.40%
6	Actual Weighted Average Unit Efficiency (from Performance Tests)	93.40%	94.00%	92.40%	94.40
7	Test Uncertainty for example purposes is (1.2%) Max allowed per spec is 1%	1	1	1	1
7	Difference in Weighted Average Unit Efficiency = [(5) – (6+7)]	0 %	0 %	1%	0%
8	Evaluation of Guaranteed Weighted Unit Efficiency per	$0	$0	+$5,000,000*1*4units=	$0

	Unit = $5,000,000*(item 7)			**$20,000,000**	
	(Contract Price = $160M*.05=$8M LD cap, Article 36.3 b (i))	No LDs	No LDs	Exceeds cap must fix	No LDs
9	Guaranteed Mean Wicket gate Leakage per Unit per Exhibit 1-Appendix B section 1.5.1.1	6.0 m3/s	6.0 m3/s	6.0 m3/s	6.0 m3/s
10	Actual Mean Wicket Gate Leakage per test	5.8 m3/s	6.0m3/s	5.6 m3/s	5.0 m3/s
11	Difference = [(9) - (10)]	.2 m3/s	0	.4 m3/s	1 m3/s
12	Evaluation of Losses = $400,000* (11)*4units	**$400,000**	**0**	**$800,000**	**$1,600,000**
13	Combined evaluation of Unit Output, Efficiency, and leakage =[(4)+(8)+(12)]	**$10,000,000**	**$0**	**$20,800,000**	**$4,600,000**
14	Overall LDs Payable for Performance cannot exceed 10% Contract Price per Article 36.3 (b) = $16M	**Must Fix until LDs cover shortfall**	**$0**	**Must Fix until LDs cover shortfall**	**Pay LDs**

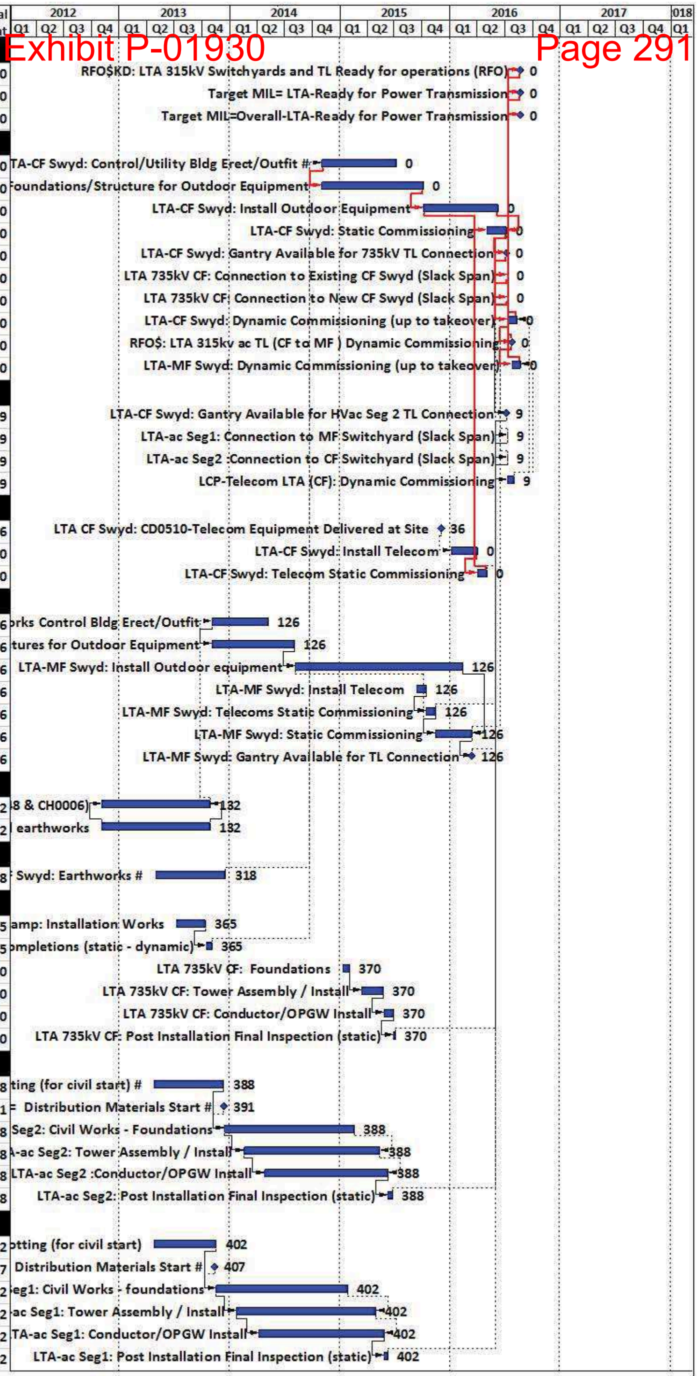
APPENDIX K

Integrated Project Schedule

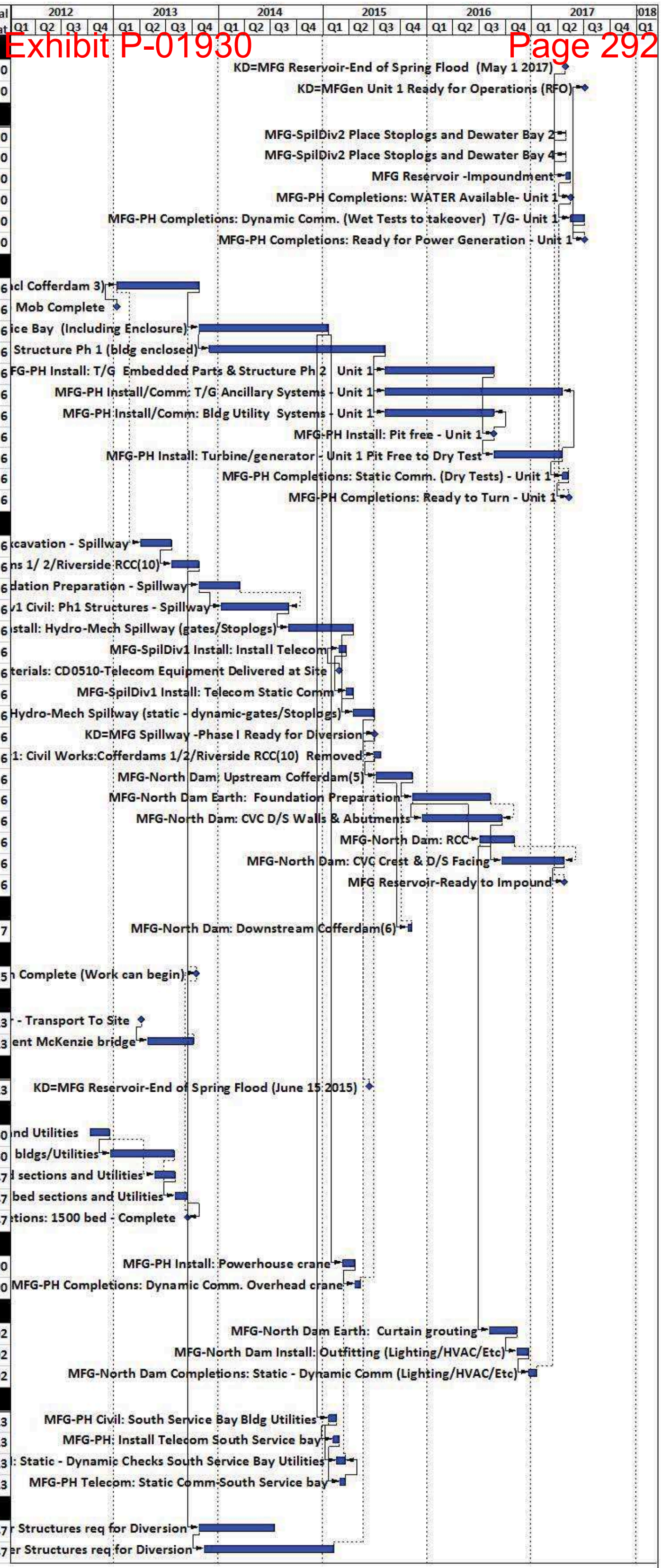
Activity Name	Total Float
LITL Critical Path - Key Dates	
RFO$: LITL dc TL NFLD (Seg 3/Seg4/Seg5) - Dynamic Comm -Energize	0
Target MIL= Overall-LITL-Ready for Power Transmission	0
LITL Critical Path	
LITL HVdc Seg4: = Distribution Materials Start #	0
LITL-dcNfSeg4: Civil Works - foundations	0
LITL-dcNfSeg4: Tower Assembly / Install	0
LITL-dcNfSeg4: Conductor/OPGW Install	0
LITL-dcNfSeg4: Installation Final Inspection Nfld (static)	0
LITL-NfldTrnCmp: Dynamic Commissioning	0
LITL-dcNfSeg3: Connection to Nfld TransCmp (Slack Span)	0
LITL-dcNfSeg5: Connection to SP Converter (Slack Span)	0
LCP-Telecom LITL: Dynamic Commissioning w/o SW & PH	0
LITL-SPConvert: Dynamic Commissioning (up to takeover)	0
LITL-SP Swyd: Dynamic Commissioning (up to takeover)	0
LITL-SPSynCd: Dynamic Commissioning (up to takeover)	0
LITL Sub-Critical Path 1	
LITL-dcNfSeg5: Tower Assembly / Install	7
LITL-dcNfSeg5: Conductor/OPGW Install	7
LITL-dcNfSeg5: Installation Final Inspection Nfld (static)	7
LITL Sub-Critical Path 2	
RFO$: LITL dc TL NFLD (Seg 3/Seg4/Seg5) - Inspection/Connection Comple	21
LITL Sub-Critical Path 3	
LITL-dcNfSeg4: ROW Clearing / Survey & Tower Spotting (for civil start)	24
LITL Sub-Critical Path 4	
LITL HVdc Seg5: = Distribution Materials Start #	29
LITL-dcNfSeg5: Civil Works - foundations	29
LITL Sub-Critical Path 5	
LITL-dcNfSeg5: ROW Clearing / Survey & Tower Spotting (for civil start)	48
LITL Sub-Critical Path 6	
RFO$: LITL dc TL NFLD Electrode TL - Dynamic Comm-Energize	56
LITL-Nfld ElectrSt: Dynamic Commissioning	56
LITL Sub-Critical Path 7	
LCP-Telecom LITL: Dynamic Commissioning with SW & PH	56
LCP-Telecom: Overall Dynamic Commissioning (via SOBI Cable)	78
LITL Sub-Critical Path 8	
LITL SP Swyd-WF	85
LITL-SP Swyd: Civil Works Control Bldg Erect/Outfit	85
LITL-SPSwyd: Civil Works Foundations/Structures for Outdoor Equipmen	85
LITL-SP Swyd: Install Outdoor equipment	85
LITL-SP Swyd: Install Telecom	85
LITL-SP Swyd: Telecom Static Commissioning	85
LITL-SP Swyd: Static Commissioning	85
LITL Sub-Critical Path 9	
LITL SOBI -WF	97
LITL-SOBI: Subsea Cable 1 Installation	97
LITL-SOBI: Cable Install Vessel (CIV) at SOBI	97
LITL-SOBI: Subsea Cable 2 Installation	97
LITL-SOBI: Subsea Cable 3 Installation	97
LITL-SOBI: Subsea Cable 3 Rock placement	97
LITL-SOBI: Subsea Cables Post Rock placement Test (Static - POST SRI)	97
LITL-LabTrnCmp: Completions - Dynamic Commissioning (with SOBI)	97
LITL Sub-Critical Path 10	
LITL-MFConvert: Valve Hall Bldg Foundation/Erect/Outfit	101
LITL-MFConvert: Outdoor Foundations/Structures	101
LITL-MFConvert: Outdoor Install ac equipment	101
LITL-MFConvert: Static Commissioning	101
LITL-MFConvert: Dynamic Commissioning (up to takeover)	101
LITL-LabTrnCmp: Completions - Dynamic Commissioning	101
RFO$: LITL dc TL Lab (Seg 1/Seg2/ElectrLine)-Dynamic Comm-Energize	101
LITL Sub-Critical Path 11	
LITL-SPSynCd: Earthworks	447
LITL-SPSynCd: Bldg Foundation/Erect/Outfit	129
LITL-SPSynCd: Indoor Installation of 1st Unit	129
LITL-SPSynCd: Indoor Installation of 2nd Unit	129
LITL-SPSynCd: Indoor Installation of 3rd Unit	129
LITL-SPSynCd: Static Commissioning	129
LITL Sub-Critical Path 12	
LITL-dcLabSeg2/Electr TL: ROW Clearing / Survey & Tower Spotting (for	139
LITL-dcLabSeg2/Electr TL: Tower Assembly / Install	139
LITL-dcLabSeg2/Electr TL: Conductor/OPGW Install	139
LITL-dcLabSeg2/Electr TL: Post Installation Final Inspection (static)	139
LITL Sub-Critical Path 13	
LITL HVdc-Nfld Repeater: CD0510 Telecom Install (Existing Stoney Brook S	149
LITL HVdc-Nfld Repeater: CD0510 Telecom Static Comm (Existing Stoney E	149
LITL Sub-Critical Path 14	
LITL-SPConvert: Valve Hall Bldg Foundation/Erect/Outfit	172
LITL-SPConvert: Outdoor Foundations/Structures	172
LITL-SPConvert: Outdoor Install ac equipment	172
LITL-SPConvert: Static Commissioning	172



Activity Name	Total Float
LTA Critical Path - Key Dates	
RFO$KD: LTA 315kV Switchyards and TL Ready for operations (RFO)	0
Target MIL= LTA-Ready for Power Transmission	0
Target MIL=Overall-LTA-Ready for Power Transmission	0
LTA Critical Path	
LTA-CF Swyd: Control/Utility Bldg Erect/Outfit #	0
LTA-CF Swyd: Foundations/Structure for Outdoor Equipment	0
LTA-CF Swyd: Install Outdoor Equipment	0
LTA-CF Swyd: Static Commissioning	0
LTA-CF Swyd: Gantry Available for 735kV TL Connection	0
LTA 735kV CF: Connection to Existing CF Swyd (Slack Span)	0
LTA 735kV CF: Connection to New CF Swyd (Slack Span)	0
LTA-CF Swyd: Dynamic Commissioning (up to takeover)	0
RFO$: LTA 315kv ac TL (CF to MF) Dynamic Commissioning	0
LTA-MF Swyd: Dynamic Commissioning (up to takeover)	0
LTA Sub- Critical Path 1	
LTA-CF Swyd: Gantry Available for HVac Seg 2 TL Connection	9
LTA-ac Seg1: Connection to MF Switchyard (Slack Span)	9
LTA-ac Seg2 :Connection to CF Switchyard (Slack Span)	9
LCP-Telecom LTA (CF): Dynamic Commissioning	9
LTA Sub- Critical Path 2	
LTA CF Swyd: CD0510-Telecom Equipment Delivered at Site	36
LTA-CF Swyd: Install Telecom	0
LTA-CF Swyd: Telecom Static Commissioning	0
LTA Sub- Critical Path 3	
LTA-MF Swyd: Civil Works Control Bldg Erect/Outfit	126
LTA-MF Swyd: Civil Works Foundations/Structures for Outdoor Equipme	126
LTA-MF Swyd: Install Outdoor equipment	126
LTA-MF Swyd: Install Telecom	126
LTA-MF Swyd: Telecoms Static Commissioning	126
LTA-MF Swyd: Static Commissioning	126
LTA-MF Swyd: Gantry Available for TL Connection	126
LTA Sub- Critical Path 4	
LTA-MF Swyd: Earthworks (CH0048 & CH0006)	132
MFG-PH Earth: MF Switchyard earthworks	132
LTA Sub- Critical Path 6	
LTA-CF Swyd: Earthworks #	318
LTA Sub- Critical Path 7	
LTA-CF Camp: Installation Works	365
LTA-CF Camp: Completions (static - dynamic)	365
LTA 735kV CF: Foundations	370
LTA 735kV CF: Tower Assembly / Install	370
LTA 735kV CF: Conductor/OPGW Install	370
LTA 735kV CF: Post Installation Final Inspection (static)	370
LTA Sub- Critical Path 8	
LTA-ac Seg2: ROW Clearing / Survey & Tower Spotting (for civil start) #	388
LTA HVac Seg2: CT0319 = Distribution Materials Start #	391
LTA-ac Seg2: Civil Works - Foundations	388
LTA-ac Seg2: Tower Assembly / Install	388
LTA-ac Seg2 :Conductor/OPGW Install	388
LTA-ac Seg2: Post Installation Final Inspection (static)	388
LTA Sub- Critical Path 9	
LTA-ac Seg1: ROW Clearing / Survey & Tower Spotting (for civil start)	402
LTA HVac Seg1: CT0319 = Distribution Materials Start #	407
LTA-ac Seg1: Civil Works - foundations	402
LTA-ac Seg1: Tower Assembly / Install	402
LTA-ac Seg1: Conductor/OPGW Install	402
LTA-ac Seg1: Post Installation Final Inspection (static)	402



Activity Name	Total Float
MFG Critical Path - Key Dates	
KD=MFG Reservoir-End of Spring Flood (May 1 2017)	0
KD=MFGen Unit 1 Ready for Operations (RFO)	0
MFG Critical Path	
MFG-SpilDiv2 Place Stoplogs and Dewater Bay 2	0
MFG-SpilDiv2 Place Stoplogs and Dewater Bay 4	0
MFG Reservoir -Impoundment	0
MFG-PH Completions: WATER Available- Unit 1	0
MFG-PH Completions: Dynamic Comm. (Wet Tests to takeover) T/G- Unit	0
MFG-PH Completions: Ready for Power Generation - Unit 1	0
MFG Sub-Critical Path 1	
MFG-PH Excavation: Powerhouse (incl Cofferdam 3)	6
KD=MFG-PH: CH0006 Bulk Exca Equip Mob Complete	6
MFG-PH Civil: South Service Bay (Including Enclosure)	6
MFG-PH Civil: Unit 1 Structure Ph 1 (bldg enclosed)	6
MFG-PH Install: T/G Embedded Parts & Structure Ph 2 Unit 1	6
MFG-PH Install/Comm: T/G Ancillary Systems - Unit 1	6
MFG-PH Install/Comm: Bldg Utility Systems - Unit 1	6
MFG-PH Install: Pit free - Unit 1	6
MFG-PH Install: Turbine/generator - Unit 1 Pit Free to Dry Test	6
MFG-PH Completions: Static Comm. (Dry Tests) - Unit 1	6
MFG-PH Completions: Ready to Turn - Unit 1	6
MFG Sub-Critical Path 2	
MFG-SpilDiv1: Excavation - Spillway	6
MFG-SpilDiv1: Civil Works: Cofferdams 1/ 2/Riverside RCC(10)	6
MFG-SpilDiv1 Civil:: Ph1 Foundation Preparation - Spillway	6
MFG-SpilDiv1 Civil: Ph1 Structures - Spillway	6
MFG-SpilDiv1 Install: Hydro-Mech Spillway (gates/Stoplogs)	6
MFG-SpilDiv1 Install: Install Telecom	6
MFG-SpilDiv1 Materials: CD0510-Telecom Equipment Delivered at Site	6
MFG-SpilDiv1 Install: Telecom Static Comm	6
MFG-SpilDiv1 Completions: Hydro-Mech Spillway (static - dynamic-gates/	6
KD=MFG Spillway -Phase I Ready for Diversion	6
MFG-SpilDiv1: Civil Works:Cofferdams 1/2/Riverside RCC(10) Removed	6
MFG-North Dam: Upstream Cofferdam(5)	6
MFG-North Dam Earth: Foundation Preparation	6
MFG-North Dam: CVC D/S Walls & Abutments	6
MFG-North Dam: RCC	6
MFG-North Dam: CVC Crest & D/S Facing	6
MFG Reservoir-Ready to Impound	6
MFG Sub-Critical Path 3	
MFG-North Dam: Downstream Cofferdam(6)	7
MFG Sub-Critical Path 4	
MFG-SW CH0007 Mobilization Complete (Work can begin)	15
MFG Sub-Critical Path 5	
MFG-South Side Site Access Bridge Rebar - Transport To Site	23
MFG-South Side Site Access permanent McKenzie bridge	23
MFG Sub-Critical Path 6	
KD=MFG Reservoir-End of Spring Flood (June 15 2015)	23
MFG Sub-Critical Path 7	
MFG-Camp Installation: Starter Camp (150 bed) and Utilities	50
MFG-Camp Installation: 500 bed sections/Admin bldgs/Utilities	50
MFG-Camp Installation: 1000 bed sections and Utilities	47
MFG-Camp Installation: 1500 bed sections and Utilities	47
MFG-Camp Completions: 1500 bed - Complete	47
MFG Sub-Critical Path 8	
MFG-PH Install: Powerhouse crane	90
MFG-PH Completions: Dynamic Comm. Overhead crane	90
MFG Sub-Critical Path 9	
MFG-North Dam Earth: Curtain grouting	102
MFG-North Dam Install: Outfitting (Lighting/HVAC/Etc)	102
MFG-North Dam Completions: Static - Dynamic Comm (Lighting/HVAC/Et	102
MFG Sub-Critical Path 10	
MFG-PH Civil: South Service Bay Bldg Utilities	123
MFG-PH: Install Telecom South Service bay	123
MFG-PH: Static - Dynamic Checks South Service Bay Utilities	123
MFG-PH Telecom: Static Comm-South Service bay	123
MFG Sub-Critical Path 11	
MFG-SpilDiv1 Civil: Ph1 Foundation Preparation - other Structures req fo	147
MFG-SpilDiv1 Civil: Ph1 Structures - other Structures req for Diversion	147



APPENDIX L

Federal Loan Guarantee Agreement (FLG)

Agreement Providing Key Terms and Conditions For the

FEDERAL LOAN GUARANTEE BY HER MAJESTY THE QUEEN IN RIGHT OF CANADA

FOR THE DEBT FINANCING OF THE LOWER CHURCHILL RIVER PROJECTS

PREAMBLE

Nalcor Energy ("Nalcor"), Emera Inc. ("Emera"), the Province of Newfoundland and Labrador ("NL"), and the Province of Nova Scotia ("NS") have informed Her Majesty the Queen in Right of Canada ("Canada") (all collectively called the "Parties") that Nalcor and Emera or their affiliates intend to develop, construct and operate, with the support of NL and NS, the Muskrat Falls Generation Facility, Labrador Transmission Assets, Labrador Island Link, and Maritime Link Projects (the "Projects"). Canada, NL, and NS subsequently signed a Memorandum of Agreement to support the Projects on August 19, 2011 (the "MOA").

It is essential to Canada that the Projects have national and regional significance, economic and financial merit, and significantly reduce greenhouse gas emissions. Canada's Guarantee of the Guaranteed Debt of each Project will significantly enhance the credit quality of the Financing of each Project. Canada hereby agrees to guarantee the Guaranteed Debt of each Project and will provide the Guarantees for the Projects as more fully described, and subject to the terms and conditions described herein.

The agreements of Canada hereunder are made solely for the benefit of Nalcor, Emera, and their affiliates including the Borrowers, and for the benefit of the Lenders ultimately selected by them to make the Financing available for the Projects and may be relied upon by all such persons but may only be enforced by Nalcor and Emera and affiliates including the Borrowers.

Once it has been accepted by all the Parties, this agreement may be disclosed publicly by or on behalf of any of Canada, Nalcor, Emera, their affiliates, NL and NS.

As regards the MF, LTA and LIL Projects, MFCo, LTACo, LILCo, LIL Opco,Nalcor, NL and Canada, this agreement shall be governed by, and construed in accordance with, the laws of the Province of Newfoundland and Labrador and the federal laws of Canada applicable therein and all actions, suits and proceedings arising will be brought in the courts of competent jurisdiction of NL. subject to any right of appeal to the Federal Court of Appeal or to the Supreme Court of Canada. As regards the ML, MLCo, Emera, NS and Canada, this agreement shall be governed by and construed in accordance with the laws of the Province of Nova Scotia and the federal laws of Canada applicable therein and all actions, suits and proceedings arising will be brought in the courts of competent jurisdiction of NS, subject to any right of appeal to the Federal Court of Appeal or the Supreme Court of Canada. This agreement sets forth the entire agreement among the Parties with respect to the matters addressed herein as regards the Projects and supersedes all prior communications, written or oral, with respect thereto including MOA. This agreement may be executed in any number of counterparts, each of which, when so executed, shall be deemed to be an original and all of which, taken together, shall constitute one and the same agreement. Delivery of an executed counterpart of this agreement by telecopier or electronically shall be as effective as delivery of a manually executed counterpart of this agreement.

Canada understands that Nalcor and Emera, or their affiliates, will be soliciting offers for the Financings from a range of Lenders. Given the importance of a Federal Loan Guarantee to the Financing for each Project, Canada hereby acknowledges and agrees that upon request by Nalcor or Emera within a reasonable period of time prior to any proposed meeting, it shall make available senior representatives of Canada, and its legal advisors and financial consultants as appropriate, responsible for the provision and oversight of the Federal Loan Guarantee, for participation in meetings with credit rating agencies and potential Lenders to respond to queries concerning the Federal Loan Guarantee.

TERMS AND CONDITIONS

1. THE PROJECTS AND THE TRANSACTION PARTIES	
1.1 Projects:	The Muskrat Falls Generation Facility ("MF"), the Labrador Transmission Assets ("LTA"), the Labrador-Island Link ("LIL") and the Maritime Link ("ML"), each as more fully described as follows: MF: an 824-MW hydro-electric generation facility in the vicinity of Muskrat Falls, Labrador, which Nalcor will develop. LTA: a 345-kV HVac transmission interconnection between Muskrat Falls and Churchill Falls, which Nalcor will develop. LIL: a HVDC transmission line connecting the Island of Newfoundland to generation facilities in Labrador which Nalcor will develop but in which Emera Inc., via a Newfoundland and Labrador corporate entity, will have an opportunity to invest. ML: a transmission line connecting the Island of Newfoundland to the Province of Nova Scotia, which will be developed by Emera. Each of (i) MF and LTA together; (ii) LIL; and (iii) ML is referred to herein as a "Project" and together as the "Projects".
1.2 Guarantor:	Her Majesty the Queen in Right of Canada ("Canada" or "Guarantor").
1.3 Proponents:	Nalcor Energy ("Nalcor"), acting on its own behalf and not as agent of the Province of Newfoundland and Labrador ("NL Crown"), and Emera Inc. ("Emera.
1.4 Borrowers:	MFCo: a special purpose wholly-owned subsidiary of Nalcor.

	LTACo: a special purpose wholly-owned subsidiary of Nalcor. LILCo: a special purpose limited partnership controlled by Nalcor and held by it alone or together with Emera ("LILCo"). The obligations of LILCo will be guaranteed by LIL OpCo, a special purpose wholly-owned subsidiary of Nalcor ("LIL OpCo"). MLCo: a special purpose wholly-owned subsidiary of Emera. Each a "Borrower" and collectively, the "Borrowers".
1.5 Lenders:	Subject to the form of Financing Structure selected by the Borrower, with respect to each Borrower, a financial institution or a group of financial institutions or financiers that will purchase debt securities to be issued by such Borrower or make credit facilities available to such Borrower, which will be guaranteed by Canada pursuant to the Federal Loan Guarantee, defined herein (the "Lender" or "Lenders"). Lenders shall include a Guarantee Agent and Collateral Trustee for the benefit of the Lender, where applicable.
2. TRANSACTIONS	
2.1 Federal Loan Guarantee:	The Federal Loan Guarantee ("FLG") shall, in respect of each Project, be an absolute, continuing, unconditional and irrevocable guarantee of payment (not collection) when due of the Guaranteed Debt of the relevant Borrower to the Lenders. The Lenders shall not be bound to pursue or exhaust their recourses against the relevant Borrower or any security held by them before demanding payment from the Guarantor. Subrogation - Canada shall be subrogated in the rights of the Lenders for any Project in respect of and at the time of each and every particular payment made by the Guarantor. Acceleration - It shall be a term of any Financing Document for any Project that in the event of default by a Borrower thereunder, the Lenders shall not accelerate the loan. With respect to MF, LTA and LIL, "FLG Agreement" means the agreement among the Guarantor, MFCo, LTACo, LILCo and Nalcor containing their respective rights and obligations as contained in this Term Sheet. With respect to ML, "FLG Agreement" means the agreement among the Guarantor, ML and Emera containing their respective rights and obligations as contained in this Term Sheet.
2.2 Transaction Structure:	Canada, the Borrowers and the Proponents will work to agree on a Transaction Structure that in conjunction with the FLG Agreement will result in the Project debt achieving Canada's AAA credit rating. The parties agree that the credit rating agencies will be asked to confirm that the FLG Agreement and Transaction Structure would achieve this objective. The Parties agree that they will work together to finalize the Transaction Structure and form of

	Guarantee, including obtaining confirmation from the credit rating agencies, by January 31, 2013 in order to facilitate the start of the financing process.
2.3 Financing Structure:	Following the execution and delivery of all Financing Documents (defined in Section 3.5), ("Financial Close"), the Borrowers intend to pay for Project costs which would include construction costs, interest, fees and other related costs, using a combination of equity to be provided by the Proponents and debt to be made available by the relevant Lenders. The Parties agree that Financial Close for ML must occur by the later of 90 days after the Nalcor Projects, or December 31, 2013. The Financing Structure will be flexible enough to allow each Borrower to raise debt , by way of: (i) bank credit facilities; (ii) a commercial paper program; (iii) a single bond or a series of bonds with staggered short-term maturity dates or a single maturity date issued and maturing within the Construction Period (the period between Financial Close and Commercial Operations Date (defined herein)); (iv) a single long-term bond or a series of long-term bonds issued during the Construction Period; or (v) a combination of one or more of the foregoing options, together with any related hedging instruments. The Guaranteed Debt incurred during the Construction Period for each Project may be refinanced by way of loans, bonds or a combination thereof, provided that: (a) the principal amount of such refinancing does not exceed the then outstanding principal amount of the Guaranteed Debt; and (b) the term thereof does not extend beyond the end of the FLG Term, it being expressly agreed that any loan or bond that matures on or after the earlier of: (i) 2 years after COD; or (ii) 7 years after Financial Close, may not be further refinanced. All of the foregoing is hereinafter collectively referred to as the "Financing". As may be required by the nature of the Financing, a hedging program shall be put in place for each Borrower at Financial Close. In order to ensure certainty in the cost of the Financing for each of the Projects, any interest expense risk will be hedged. The Project hedging principles will be agreed to with the Guarantor prior to Financial Close. Canada, the Borrowers and the Proponents will work to agree on a Financing Structure for the Projects, it being acknowledged that a range of financing structures may be considered. "Commercial Operations Date" ("COD"), in respect of each Project, shall be the date upon which construction is certified by the Borrowers' Engineer to be complete and confirmed by the Independent Engineer, which is currently expected to be July, 2017.
3. FLG TERMS	

3.1 Guaranteed Debt:	A. The total maximum amount of borrowing and hedging obligations (including principal, interest, fees, and costs) under the Financing to be guaranteed by Canada ("Guaranteed Debt") shall be the lesser of the following for each of the Projects: i. A fixed dollar-based cap of $6.3 billion, allocated among the Projects as follows: a. MF/LTA: up to $2.6 billion, b. LIL: up to $2.4 billion; and c. ML: up to $1.3 billion; herein called "Individual Project Debt Caps". ii. The amount of debt implied by the maximum Debt to Equity Ratios ("DER") for each Project as follows: a. MF/LTA: 65:35 b. LIL: 75:25 c. ML: lower of Nova Scotia Utility and Review Board (UARB) approval or 70: higher of UARB approval or 30; or iii. The amount of debt that provides a minimum Debt Service Coverage Ratio ("DSCR") of 1.40x for each Project throughout the Term of the FLG. B. The terms and conditions of the Guaranteed Debt shall be those commonly used in similar commercial transactions, shall be subject to Canada's approval, acting reasonably, and shall include the following: (i) Rate of Interest that is no greater than that which would be offered by Lenders to an entity with a "AAA" credit rating; (ii) The proceeds from the Guaranteed Debt and the Additional Debt shall be used for the sole purpose of the Project; and (iii) Any long-term bond issued in connection with the Guaranteed Debt may carry a call feature.
3.2 Term of the FLG:	The FLG Term shall begin on Financial Close and shall terminate on the earlier of: (a) payment in full of the Guaranteed Debt; or (b) the Maximum Term for each Project, as follows: (i) MF/LTA: 35 years after Financial Close; (ii) LIL: 40 years after Financial Close; and (iii) ML: 40 years after Financial Close.
3.3 FLG Amortization Profile:	The Guaranteed Debt shall be repaid in accordance with the following amortization profile: MF/ LTA : simple mortgage-style amortization, ending no later than 35 years after Financial Close; LIL : level amortization, ending no later than 55 Years after Financial Close; and

COD	ML : level amortization, ending no later than 40 years after Financial Close. The Amortization period is to begin on the earlier of: (i) Commercial Operations Date, and (ii) seven (7) years after Financial Close. The Amortization Profile shall be such that there is no principal outstanding at the end of each amortization period for each Project. In each case, save if bullet maturity bonds are used, there shall be at least one payment a year. Bullet maturity bonds may be used instead of amortizing bonds. Bullet maturities will be matched as closely as possible to the relevant FLG Amortization Profile.
3.4 FLG Maximum Exposure:	The maximum exposure to the Guarantor under the FLG at any given time shall be the actual amount outstanding on the Guaranteed Debt at such time based on the FLG Amortization Profile.
3.5 FLG Conditions Precedent:	A. The following conditions precedent (the "FLG Conditions Precedent") must be satisfied in form and substance acceptable to the Guarantor prior to the execution and delivery of the FLG for all Projects: (i) Confirmation by Credit Rating Agencies of indicative credit ratings for each of MF, LTA, and LIL (prepared on a non-guaranteed basis) equal to or higher than investment grade; (ii) Provision by Credit Rating Agencies of indicative credit ratings for the ML (prepared on a non-guaranteed basis and based on information provided in the application to the UARB) equal to or higher than investment grade; (iii) Enactment of legislation, and execution of formal agreements between the NL Crown and Nalcor (or related entities), which put into legally binding effect the commitments made by the NL Crown as outlined in Schedule "A", both the legislation and the agreements being to the Guarantor's satisfaction.; (iv) The formalization of a regulatory framework by the Province of Nova Scotia ("NS") in legislation and/or regulations; (v) Execution of an inter-governmental agreement (the "IGA") between Canada and the NL Crown in which NL Crown: (a) makes the commitments outlined in Schedule "A" to Canada; (b) indemnifies Canada for any costs that it may incur under the FLG as a result of a regulatory decision or regulatory change (including through legislation or policy) that prevents a Borrower from recovering Project costs and fully servicing the Guaranteed Debt; and (c) guarantees completion of the MF, LTA and LIL Projects to COD such that, where non-completion is due to NL Crown's failure to comply with the commitments outlined in Schedule "A", NL Crown shall indemnify Canada for any costs Canada may incur as a result of those Projects not achieving COD. (vi) Execution of an agreement between Canada and NS in which NS

	(viii) Execution and delivery of the indemnity referred to in Section 4.9; (ix) Review of technical aspects of the Projects, including engineering, water resource and any other required due diligence by the Independent Engineer (as defined herein), and preparation and finalization (as confirmed by the Guarantor and Lenders, acting reasonably) of a technical due diligence report (the "IE DD Report") confirming that the Project execution plans are commercially reasonable, and consistent with Good Utility Practice; and (x) Other Conditions Precedent customarily included in commercial project financing transactions.
Date: ____________________ 3.6 Costs Incurred by Guarantor:	All reasonable third-party costs incurred by the Guarantor in relation to an FLG shall be at the expense of the Borrower for the benefit of which such FLG has been issued.
3.7 Guarantee Fee:	No fees shall be payable to the Guarantor in respect of the provision of any FLG.
3.8. Commitment Fees:	Any fees paid to the Lenders under the Project Financing, such as commitment fees or up-front fees, shall be commercially reasonable.
4. PROJECT DEBT	
4.1 Debt Service Coverage Ratio Definition and Test:	Definition: The Debt Service Coverage Ratio ("DSCR") in respect of any Borrower, and in respect of any 12-month period shall be calculated as follows: DSCR = Base Cash Flow / Debt Service, where: Base Cash Flow = Liquidity Reserves plus Contracted Revenues less Cash Operating Costs Debt Service = Amortization plus Interest Expense Amortization = The amortization amount corresponding to the FLG Amortization profile in respect of each Borrower Interest Expense = The interest expense for the period Contracted Revenues: (i) MF: (a) For purposes of Initial Debt Sizing, DSCR shall include only the Base Block Revenue plus Liquidity Reserve; and (b) For all other purposes, DSCR shall include the Base Block Revenue plus Liquidity Reserve, plus revenue from power purchase agreements with investment grade parties, based on total annual energy sales not to exceed (P50) energy production for MF. (ii) LTA: For all purposes, DSCR shall include LTA Tariff Revenue plus Liquidity Reserve. (iii) LIL: For all purposes, DSCR shall include revenue from NL Hydro under

	indemnifies Canada for any costs it may incur under the FLG as a result of a regulatory decision or regulatory change (including through legislation or policy) that prevents a Borrower from recovering Project costs and fully servicing Guaranteed Debt; (vii) Sanction of all Projects, including ML; (viii) Execution of an agreement (the "Emera Guarantee Agreement") between Canada and Emera, wherein Emera shall guarantee: (a) the payment of $60 million to the Guarantor in the event that Financial Close is not achieved by the date set out herein or funds are not drawn from Guaranteed Debt within a reasonable time after Financial Close; and (b) following the first draw of Guaranteed Debt, Emera will guarantee to complete the ML or to provide required funds to complete the ML; (ix) That all necessary environmental legal and policy authorities have been complied with to the satisfaction of the Guarantor; and (x) That all necessary aboriginal consultation obligations have been complied with to the satisfaction of the Guarantor. B. The following conditions precedent (the "FLG Conditions Precedent") must be satisfied by the applicable Borrower in form and substance acceptable to the Guarantor prior to the execution and delivery of the FLG for each Project of such Borrower: (i) Execution of the FLG Agreements and all other relevant documents necessary to effect Financial Close ("Financing Documents"); (ii) Provision by Credit Rating Agencies of indicative credit ratings for the ML (prepared on a non-guaranteed basis) equal to or higher than investment grade in the event that the UARB decision differs from the application submitted by MLCo; (iii) Satisfaction, in the sole discretion of the Guarantor, of any and all Project-related due diligence deemed necessary by the Guarantor, including satisfactory review of all required revenue-producing agreements and other agreements including the MF PPA, TFA, LIL Assets Agreement; (iv) Approval by the Guarantor, acting reasonably, of the Financing, Financing Structure, Financing Documents, and the Transaction Structure; (v) A report provided by an independent expert that the Projects have sufficient insurance coverage in place that is customary in projects of this nature and size; (vi) As required by the nature of the Financing, an interest rate hedging program be in place to hedge expected interest expense with respect to the Guaranteed Debt; (vii) All necessary permits, approvals, land-use agreements and other authorizations required at Financial Close have been obtained;

	the LIL Assets Agreement plus any Liquidity Reserve. (iv) ML: For all purposes, DSCR shall include revenues collected from ratepayers under the cost-recovery framework imposed by the Nova Scotia Utility and Review Board plus any Liquidity Reserve. Cash Operating Costs includes all cash costs of the Borrower, excluding interest and principal on any Guaranteed Debt. , Test: The DSCR Test shall apply both prospectively and retrospectively except as follows: (a) The DSCR Test shall apply prospectively in the context of the maximum Guaranteed Debt as defined in 3.1; and (b) The DSCR Test shall apply prospectively in the context of the Additional Debt. For purposes of the ML, the prospective calculation of the DSCR shall be based on the UARB-approved return on equity. DSCR will be calculated monthly on a rolling 12-month basis. "Base Block Revenue" means amounts paid by NL Hydro to MF in respect of the Base Block Energy purchase commitments as set out in the MF power purchase agreement and as described in the Memorandum of Principles.
4.2 Debt Service Coverage Ratio:	The DSCR for each Project shall be a minimum of 1.40x.
	If the DSCR falls below 1.40x, then a 30-day consultation process between the Guarantor and the relevant Borrower is triggered during which time information shall be provided to Canada to advise it of the reasons for such a decline and how the Borrower proposes to increase the DSCR. If it falls below 1.20x, then there shall be no distribution to equity holders. If it falls below 1.10x, it shall constitute an Event of Default.
4.3 Cross-Default Provisions:	MF, LTA, and LIL will have cross-default provisions such that an event of default of any one Borrower will represent an event of default of each of the other two Borrowers. There shall be no cross-default provisions in respect of Maritime Link.
4.4 FLG Events of Default:	The following is a non-exhaustive list of Events of Default in respect of each Project for purposes of the FLG: (i) Failure to satisfy any covenants in the Financing Documents or FLG Agreement, and to cure same within 30 days of notice of default; (ii) Misrepresentation, fraud, or breach of material representation; (iii) Bankruptcy, restructuring, and insolvency of a Proponent or a Borrower; (iv) Termination (other than a scheduled termination), invalidity, unenforceability or default (by any party to such agreement) of any key project agreement (eg. the MF PPA, TFA, LIL Assets Agreement, ML revenue collection agreement) that is not cured within any applicable grace period in that agreement (or within 30 days of the date of occurrence of such event if there is no applicable grace period), or replaced by an equivalent agreement within 30 days. This will be an Event of Default for the defaulting Party only; (v) Sale or Change of Control of Nalcor or the Borrowers, other than

	among the Parties, or non-permitted assignment of any key contracts; (vi) Insufficient funding of Cost Overruns or Cost Escalations that continues for 90 days after being identified by the Independent Engineer; (vii) Abandonment of a Project by the owner of the Project; (viii) Breach or termination of any contract of the Borrowers, including the commercial agreements between Nalcor and Emera, that is not cured within any applicable grace period in that agreement, (or within 30 days of the date of occurrence of such event if there is no applicable grace period) or replaced by an equivalent agreement within 30 days. This will be an Event of Default for the defaulting Party only; (ix) Unauthorized sale of any material Project assets; (x) Failure to provide certificate of the Independent Engineer confirming that budgeting and maintenance of the Project is being conducted in conformity with Good Utility Practice and such failure is not cured within 30 days; (xi) The DSCR falls below 1.10x; (xii) Failure to fund or maintain the Debt Service Reserves or the Liquidity Reserves as required in Section 4.16 and to cure same within 5 business days of payment therefrom; (xiii) Failure to pay principal or interest within 5 business days of due date; and (xiv) Other Events of Default customarily included in commercial financing documents.
4.5 Lenders' Events of Default:	The only Lenders' Event of Default in respect of the Guaranteed Debt shall be the failure by a Borrower and the Guarantor to pay a scheduled principal and interest payment. Upon the occurrence of a Lender's Event of Default, Lenders shall have all available remedies.
4.6 Security:	The security for the Guaranteed Debt shall include the following: (i) the assets of the Borrowers (including Liquidity and Debt Service Reserves); (ii) all contracts of the Borrowers, including key project agreements, as identified by the Guarantor; and (iii) the shares of the Borrowers provided that the shares of MFCo, LTACo and LILCo, may only be pledged to Canada or an agent of Canada. For greater certainty, the priorities of Security taken by the Guarantor shall be determined by the Financing Structure agreed upon, and in any event shall be subject in priority only to Security taken by a Lender, if any. The Borrowers shall take all actions necessary, in the opinion of the Guarantor, to maintain the validity, enforceability, and priority of the Guarantor's security.
4.7 Permitted Liens:	The Borrowers shall not be permitted to create or suffer to exist any lien on their assets except liens that are customary in project financing transactions including, without limitation: (i) liens for assessments or governmental charges or levies which are not delinquent (taking into account any relevant grace periods) or, if overdue, the

	validity or amount of which is being contested diligently and in good faith by appropriate proceedings and in respect of which adequate reserves in accordance with the accounting standard that has been adopted by the Borrower, that is, International Financial Reporting Standards, US GAAP or another recognized reporting standard, have been recorded on the balance sheet of such Borrower; (ii) construction, mechanics', carriers', warehousemen's, storage, repairers' and materialmen's liens but only if the obligations secured by such liens are not due and delinquent and no lien has been registered against title to any assets of such Borrower, or if a lien has been registered, same does not affect the Guarantor's priority in the Security and is being defended diligently and in good faith by appropriate proceedings and in respect of which adequate reserves in the amount of the lien plus 20% have been recorded on the balance sheet of such Borrower; (iii) easements, encroachments, rights of way, licences, reservations, covenants, restrictive covenants or other similar rights in land granted to or reserved by other persons provided that they are reasonable and have been complied with and can be assigned to the Guarantor; (iv) any lien securing purchase money obligations permitted to be outstanding, provided that each such lien affects only the property with respect to which the purchase money obligation it secures was incurred; and (v) any lien securing Additional Debt (defined in Section 4.8) permitted to be outstanding.
4.8 Permitted Debt:	The Borrowers shall not incur debt during the Construction Period and the FLG Term except for: (i) Guaranteed Debt (also known as "Project Debt"); (ii) Additional Debt (as described in 4.8(a)); (iii) Debt secured by a lien which is a Permitted Lien (other than a lien securing purchase money obligations); (iv) Trade payables or similar debt incurred in the ordinary course of business and for the purpose of carrying on same, representing the deferred purchase price of property or services; (v) Debt under purchase money obligations provided, however, that the aggregate principal amount of purchase money obligations outstanding at any time shall not exceed at any time: (i) for MF/LTA $15 million; (ii) for LIL $15 million; and (iii) for ML $15 million. 4.8(a) Additional Debt: No additional debt may be incurred by the Borrowers during the term of the FLG, other than: (i) for an operating line of credit to a maximum of $10 million for MF/LTA, for LIL, and for ML; and (ii) additional debt to finance cost increases from the DG3 capital cost estimates provided to the Guarantor and the final estimates at Financial Close ("Cost Escalations"), to finance cost increases after Financial Close ("Cost Overruns"), and to finance costs associated with major repairs and refurbishments after COD, (collectively called "Additional Debt").

	Additional Debt shall be subject to the following conditions: (a) It shall not be covered by the FLG; (b) It may be secured provided that it is subordinate to the Guaranteed Debt; and (c) It must satisfy the Debt Equity Ratios and DSCR-based tests on a prospective, aggregate basis (taking into account the Guaranteed Debt and the Additional Debt) throughout the term of the Additional Debt. Additional Debt with bullet maturities will be subject to a deemed periodic amortization profile in order to preserve the validity of the DSCR-based test.
4.9 Independent Engineer:	An engineer (the "Independent Engineer" or "IE") shall have been appointed to permit each Lender and the Guarantor to complete their due diligence and to ensure compliance with the terms of the FLG Agreements and all Financing Documents required to effect Financial Close. The Independent Engineer will represent the Guarantor and the Lenders. The Borrowers shall provide written confirmation, that has been confirmed in writing by the IE, that they have no contractual or other relationship with the IE other than the obligation to pay the fees of the IE. The IE shall review the Project documents and any information provided in support of any drawdown requested by a Borrower and shall make a recommendation to the Lender by way of an IE certificate. The Independent Engineer shall be assigned a scope of responsibility designed to ensure the Projects are developed, maintained, and operated in a manner which is consistent with Good Utility Practice (as defined herein). The Independent Engineer shall have full access to all information related to the Projects and access to management and employees of the Proponents or Borrowers as required. The cost of the Independent Engineer shall be borne by the Borrowers. The Borrowers shall indemnify and save the Guarantor harmless from and against any liability that the Guarantor incurs solely by virtue of being found, in respect of the Projects, liable as a partner or joint venturer.
4.10 Expected Costs to Complete:	Cost Overruns for a Project must be funded with Equity and/or Additional Debt (subject to the provisions of section 4.8(a)) as follows: (i) Equal annual amounts calculated by dividing such Cost Overrun amount by the number of years remaining until COD. Each annual payment shall be funded no later than the date of the first advance of Guaranteed Debt in each year prior to COD, and the first annual amount shall be funded prior to the first advance under Guaranteed Debt after such calculation is made; (ii) The Independent Engineer will confirm the Borrower's revised estimates of Expected Costs to Complete and any related changes to the construction schedule, all by way of an IE certificate; and (iii) Adjustments may be made to such funding requirements from time to time as estimates of Expected Costs to Complete (and related date at which COD is expected to be achieved) are updated or

	revised, all as confirmed by the Independent Engineer. The foregoing shall not in any way limit the enforceability of the provisions of Sections 3.1 or 4.8. The expected costs to complete ("Expected Costs to Complete") in respect of any Borrower at any given time shall be determined by the Borrowers and reviewed and confirmed by the IE by way of an IE certificate to be provided in connection with any drawdown requests prior to COD. The DG3 Capital Cost Estimates shall form the basis for the Independent Engineer's review of and confirmation of any proposed changes to such estimates on an ongoing basis as construction proceeds. Expected Costs to Complete shall include contingencies and escalation. Expected Costs to Complete shall also include any interest during construction and costs associated with the Financing prior to COD, calculated on a pro forma basis.
4.11 Change of Control:	There shall be,no sale or change of control of any Borrower or subsidiaries, except as among the Parties, and no sale of any material Project assets. There shall be no sale or change of control of Nalcor.
4.12 Independent Engineer Certificate post COD::	On each anniversary following COD, and until the end of the FLG Term, the Borrower or the IE shall provide an Independent Engineer's certificate, in form and substance acceptable to the Guarantor, acting reasonably, confirming that budgeting and maintenance of the Project are being conducted in conformity with Good Utility Practice. Failure of the Borrower to budget and maintain in accordance with Good Utility Practice that results in the IE being unable to provide such certification shall constitute an Event of Default subject to a 30-day cure period.
4.13 Good Utility Practice:	"Good Utility Practice" means those project management design, procurement, construction, operation, maintenance, repair, removal and disposal practices, methods and acts that are engaged in by a significant portion of the electric utility industry in Canada during the relevant time period, or any other practices, methods or acts that, in the exercise of reasonable judgment in light of the facts known at the time a decision is made, could have been expected to accomplish a desired result at a reasonable cost consistent with good business practices, reliability, safety and expedition. Good Utility Practice is not intended to be the optimum practice, method or act to the exclusion of others, but rather to be a spectrum of acceptable practices, methods or acts generally accepted in such electric utility industry for the project management, design, procurement, construction, operation, maintenance, repair, removal and disposal of electric utility facilities in Canada. Notwithstanding the foregoing references to the electric utility industry in Canada, in respect solely of Good Utility Practice regarding subsea HVdc transmission cables, the standards referenced shall be the internationally recognized standards for such practices, methods and acts generally accepted with respect to subsea HVdc transmission cables. Good Utility Practice shall not be determined after the fact in light of the results achieved by the practices, methods or acts undertaken but rather shall be determined based upon the consistency of the practices, methods or acts when undertaken with the standard set forth in the first two sentences of this definition at such time.

4.14 Debt-Equity Contributions:	Construction costs shall be funded only with equity prior to Financial Close. Subject to the conditions provided herein (including, without limitation, the Individual Project Debt Caps in respect of any Guaranteed Debt, and the funding of Cost Overruns), following Financial Close, debt and equity funds shall be invested as follows: (i) 100% debt until such time as the target Debt Equity Ratio is achieved; and (ii) thereafter, debt and equity shall be invested on a *pro rata* basis in accordance with the targeted Debt Equity Ratio for each Project.
4.15 Distributions:	There shall be no distribution to shareholders by the Borrowers: (i) Where the DSCR is below 1.20x; (ii) During the Construction Period; and (iii) Where an Event of Default has occurred which has not been cured during the cure period if same has been provided.
4.16 Debt Service Reserves and Liquidity Reserves:	Each Borrower shall at all times maintain Debt Service Reserves in a dedicated reserve account. The Debt Service Reserves will, at all times, be funded in an amount at least equal to the debt service (principal and interest) obligations of such Borrower for the forward-looking 6-month period. The Debt Service Reserve is for the benefit of the Guarantor and in the event that the Guarantor is required to make payment to the Lenders under the FLG, then it shall be entitled to immediate reimbursement of such amount from the Debt Service Reserve. MFCo and LTACo shall, for the MF/LTA Project, also fund with equity and maintain a Liquidity Reserve in a dedicated reserve account that permits MFCo and LTACo to maintain a DSCR of no less than 1.40x for a period of ten (10) years after COD. LIL and ML may each establish a Liquidity Reserve in connection with the DSCR.
4.17 Prepaid Rent Reserve for LIL:	During the Construction Period all prepaid rent received by LILCo from LIL Opco under the LIL Assets Agreement shall be kept in a reserve account and upon completion and receipt of the first rental payment from LIL Opco the amounts in the prepaid rent reserve shall be released and applied in accordance with the waterfall established under the LIL Project Financing Documents. During the Construction Period, distributions equal to the investment returns on the capital invested in the prepaid rent reserve account may be made to the Nalcor LIL limited partner provided no default or Event of Default exists.

4.18 Reports:	The Guarantor shall be entitled to regular financial and operational reports for the Projects at the expense of the Borrowers. This will include all customary reports and all rights to access and audit as are provided to the Lenders.
4.19 Covenants:	Customary affirmative and negative covenants to be provided by the Borrowers.
4.20 Representations and Warranties:	Customary Representations and Warranties are to be provided by the Borrowers.

SCHEDULE "A"

NL Crown commits to do the following:

1. Approve the creation of those subsidiaries or entities controlled by Nalcor which are required in order to facilitate the development and operation of MF, the LIL and the LTA, and to ensure Nalcor and existing and new subsidiaries or entities have the authorized borrowing powers required to implement the Projects and meet any related contractual or reliability obligations.

2. Provide the base level and contingent equity support that will be required by Nalcor to support successful achievement of in-service for MF, the LTA and the LIL, in cases with and without the participation of Emera.

3. Ensure that, upon MF achieving in-service, the regulated rates for Newfoundland and Labrador Hydro ("NLH") will allow it to collect sufficient revenue in each year to enable NLH to recover those amounts incurred for the purchase and delivery of energy from MF, including those costs incurred by NLH pursuant to any applicable power purchase agreement ("PPA") between NLH and the relevant Nalcor subsidiary or entity controlled by Nalcor that will provide for a recovery of costs over the term of the PPA and relate to:

    a) initial and sustaining capital costs and related financing costs (on both debt and equity), including all debt service costs and a defined internal rate of return on equity over the term of the PPA;

    b) operating and maintenance costs, including those costs associated with transmission service for delivery of MF power over the LTA (as described further in 5 below);

    c) applicable taxes and fees;

    d) payments pursuant to any applicable Impact & Benefit agreements;

    e) payments pursuant to the water lease and water management agreements; and

    f) extraordinary or emergency repairs.

4. Ensure that, upon the LIL achieving in-service, the regulated rates for NLH will allow it to collect sufficient revenue in each year to enable NLH to recover those amounts incurred for transmission services, including those costs incurred by NLH pursuant to any applicable agreements between NLH, the LIL operating entity and/or the entity holding ownership in the LIL assets, that will provide for a recovery of costs over the service life of the LIL and relate to:

    a) initial and sustaining capital costs of the LIL and related financing and debt service costs, including a specific capital structure and regulated rate of return on equity equal to, at least, a minimum value required to achieve the debt service coverage ratio agreed to in lending agreements by the LIL borrowing entity;

b) operating and maintenance costs;

c) applicable taxes and fees; and

d) extraordinary or emergency repairs;

5. Ensure that, upon LTA achieving in-service, the regulated rates for the provision of transmission service over the LTA will provide for a recovery of costs over the service life of the LTA including initial and sustaining capital costs, operating and maintenance costs, extraordinary or emergency repairs, applicable taxes and fees and financing costs (on both debt and equity), including all debt service costs and a defined internal rate of return on equity over the term of any applicable agreement.

This agreement shall ensure to the benefit of Nalcor and Emera and their affiliates including the Borrowers and their respective permitted successors and assigns and shall be binding on the Parties. The Parties represent and warrant that once this agreement is accepted by the Parties as herein provided, it shall constitute the irrevocable, legal, valid and binding obligation of the Parties, enforceable in accordance with its terms.

IN WITNESS WHEREOF each of the Parties has executed this agreement as of the date set forth below.

HER MAJESTY THE QUEEN IN RIGHT OF CANADA, as represented by The Right Honourable Prime Minister of Canada,

Per: ______________________

The Honourable Stephen Harper

Date: ______________________

HER MAJESTY IN RIGHT OF NEWFOUNDLAND AND LABRADOR, as represented by the Premier

Per: ______________________

The Honourable Kathy Dunderdale

Date: ______________________

HER MAJESTY IN RIGHT OF NOVA SCOTIA, as represented by The Premier

Per: ______________________

The Honourable Darrell Dexter

Date: ______________________

NALCOR ENERGY

Per:

Name:

Title:

Date:

I / we have authority to bind the Corporation

EMERA INC.

Per:

Name:

Title:

Date:

I/we have authority to bind the Corporation

NOV 30 2012

APPENDIX M

Key Operating Cash Flow Chart

Structure – Key Operating Cash Flows