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March 3, 2017

The Board of Commissioners of Public Utilities
Prince Charles Building
120 Torbay Road, P.O. Box 21040
St. John's, NL A1A 5B2

Attention: Ms. Cheryl Blundon
Director Corporate Services & Board Secretary

Dear Ms. Blundon:

Re: Updated Integrated Action Plan

In its correspondence of February 17, 2017, the Board of Commissioners of Public Utilities (the Board) requested that Newfoundland and Labrador Hydro (Hydro) provide a status update to the Updated Integrated Action Plan (the Report), filed with the Board on November 30, 2016, with respect to IAP 28, IAP 66 and IAP 72.

Status Update – IAP 28
This action was to complete a risk/reward review of the option of requiring that all 230 kV terminal station transformers be equipped with their own 230 kV breakers. As noted in the Report, this analysis was part of Hydro's 2016 work plan, to be completed on December 31, 2016.

> Update: This work was completed in 2016, as planned, and is attached as Appendix A.

Status Update – IAP 66
This action was to investigate alternatives for managing customer calls in a supply disruption/outage situation, including overflow call options and Interactive Voice Response (IVR) programming for high volume levels, and to implement changes to ensure customer calls are answered in a timelier manner. As noted in the November 30, 2016 update, after-hours customer calls are now being managed by TeleLink rather than the Energy Control Centre (ECC). This has positioned Hydro to be able to respond immediately to customer outage inquiries/phone calls and has proven to be effective in managing after hours calls, allowing ECC staff to focus on System Operation. For day-time calls, Hydro currently manages call volume utilizing its existing three call centre staff, can immediately increase to five as required, and has the infrastructure in place to increase to seven through temporary employees. Hydro continues to investigate the capability of the new IVR system for

managing significant events during business hours, and the option of allowing overflow calls to redirect to TeleLink. The company expects to have a final decision on overflow call outsourcing prior to the Winter 2017/2018.

Update: With implementation of the new phone system, the Customer Service Call Centre now has an installed capacity for 11 Customer Service Representatives (CSRs) to answer customer calls, with capability to add 3 additional phone sets for other designated staff in an emergency situation. This provides for an active compliment of 14 stations to answer customer calls.

The phone centre's dedicated phone system has the capacity to handle 23 incoming calls at one time, including customers being served as well as calls being queued. Based on Hydro's call centre metrics of an average of 36 seconds to answer calls, a large number of customers can be handled with a minimum wait time.

In addition, automated self-serve outage functionality has also been implemented and configured to integrate with myHydro, Hydro's online customer web application. Once an outage has been reported and added to the myHydro system, subscribers will receive notification of the outage through a text message or email. As well, time to restore updates will be distributed to customers as the system is updated. Subscribers that call to report an outage are prompted to enter their phone number in the system and are automatically informed of the outage and restoration time of any recorded outages.

Hydro has made significant investments in process changes and technology to better serve its customers and is well positioned to support a widespread outage to its distribution customers. The new customer self-serve options, coupled with new in-house technology, have provided Hydro with the flexibility and functionality to quickly respond to a major outage situation. Hydro will continue to use TeleLink for outage call handling after normal business hours.

IAP 72

This action was to review Hydro's business continuity plans and contingencies to ensure continued operations and the availability of critical outage response support systems in the event of a supply disruption to Hydro Place.

Update: The Hydro Place Disaster Recovery Plan was completed in the fourth quarter of 2014; however, it was not submitted to the Board. It is attached as Appendix B.

Summary

The November 30, 2016 Updated Integrated Action Plan noted two incomplete items, IAP 28, dealing with a risk/reward study for 230 kV breakers on 230 kV station transformers, and IAP 66, involving the management of customer calls in a supply disruption/outage situation to ensure calls are answered in a timely manner. With the completion of the report in Appendix A for IAP 28, and the upgrade of the phone system and the ongoing Telelink service for IAP 66, Hydro considers that both actions, as detailed above, are now complete. IAP 72, which included the completion of the Hydro Place Disaster Recovery Plan in 2014, has been provided as requested by the Board.

Should you have any questions, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO

Tracey L. Pennell
Senior Counsel, Regulatory

TLP/bs

cc: Gerard Hayes – Newfoundland Power
Paul Coxworthy – Stewart McKelvey Stirling Scales
Roberta Frampton Benefiel – Grand Riverkeeper Labrador
Dennis Browne, Q.C. – Consumer Advocate
Danny Dumaresque

ecc: Denis Fleming- Vale Newfoundland & Labrador Limited
Larry Bartlett – Teck Resources Ltd.

TRANSMISSION SYSTEM ANALYSIS

RISK / REWARD REVIEW OF 230KV TERMINAL STATION TRANSFORMER BREAKER PROTECTION

Date: December 31, 2016

System Planning Department

newfoundland labrador hydro
a nalcor energy company


newfoundland labrador
hydro
a nalcor energy company

1.0 INTRODUCTION

The existing terminal station design for several of Hydro's 230/138 kV and 230/66 kV stations has power transformers connected to the 230 kV bus via motor operated disconnect switches only. Generally the low voltage winding of the transformer is connected to the low voltage bus through a low voltage circuit breaker and disconnect switch (i.e. 138 or 66 kV). Multiple transformers may be connected to a common 230 kV bus with transmission line circuit breakers (either load bus, ring bus or breaker-and-one-half arrangement) providing the fault clearing capability for both 230 kV bus and transformer faults. As a result, a transformer or 230 kV bus fault will result in the loss of multiple transformers with subsequent loss of load. The practice was justified during initial grid construction as a reasonable cost savings measure (i.e. elimination of multiple 230 kV circuit breakers) with minor impact on overall reliability as transformer failures were viewed as rare events and the use of motor operated disconnect switches to isolate a faulted transformer resulted in a quick return to service for the remaining units. Following system disturbances on the Island Interconnected System in January 2014, a recommendation was made that Hydro review the application of high voltage (230 kV) circuit breakers on its 230/138 kV and 230/66 kV transformers to determine the risk/reward to system reliability.

As a result of this recommendation, a risk/reward review of the option of requiring that all 230 kV terminal station transformers be equipped with their own 230 kV breakers has been completed.

The analysis performed involved a review of every 230 kV terminal station design located on the Island to determine an approximate Expected Unserved Energy (EUE) level that each station may be expected to experience due to the failure of a transformer without a high side breaker for protection. This was then compared to the EUE that would result with having a high side breaker for each individual transformer. Class 5 cost estimates have been presented of several key terminal stations for the addition of individual transformer breakers to assist with a risk / reward comparison of such an undertaking.

The analysis is completed using the Siemens Power Technologies Int. software package PSS®E version 32.

2.0 EXPECTED UNSERVED ENERGY (EUE) ANALYSIS

The analysis to determine the EUE was conducted by performing both load flow and stability analysis of a terminal station configuration assuming a three phase fault had occurred on the high side of each unprotected 230kV transformer. The analysis is based on the 2021 Interconnected Island configuration with both the Labrador Island Link (LIL) and Maritime Island Link (ML) in operation along with associated infrastructure.
For the load flow analysis, it is assumed that for a three phase fault on the high side of a transformer, the surrounding protection will operate as designed to isolate the fault. Analysis is based on an assumed restoration time of three hours based on durations required to physically isolate the transformer and restore the surrounding equipment to operation. For stability analysis, it is assumed that for a three phase fault on the high side of a transformer, the surrounding protection will operate within six cycles to isolate the fault.

The load flow and stability analysis were performed on ten separate cases representing typical load flow configurations throughout the year, with Island load ranging from light load to peak load. Figure 1 below shows the expected 2017 Island Load Duration Curve with ten loading scenarios. Table 1 below outlines these ten cases as a percentage of peak load vs. time duration. The 2021 Peak load flow case was used as the base case of analysis. The 2021 Peak Island load was adjusted based on Table 1 percentages to arrive at the ten cases for the subsequent analysis.

Table 1 – 2017 Load Duration Estimation

Case	Island Load (MW)	% of Peak [1]	Interval Duration (%)[2]	Load Duration(%) [3]
1	1676.5	95	1.05	1.05
2	1588.2	90	4.43	5.48
3	1500.0	85	7.25	12.73
4	1411.8	80	7.06	19.79
5	1270.6	72	11.46	31.25
6	1129.4	64	13.10	44.35
7	988.2	56	12.05	56.40
8	847.1	48	17.89	74.29
9	705.9	40	16.11	90.40
10	547.1	31	9.6	100.00

Notes:
1. Based on Peak Island Load of 1764.7 MW for 2017.
2. Percentage of time applied for this Case
3. Percentage of time Island Load is above this level.

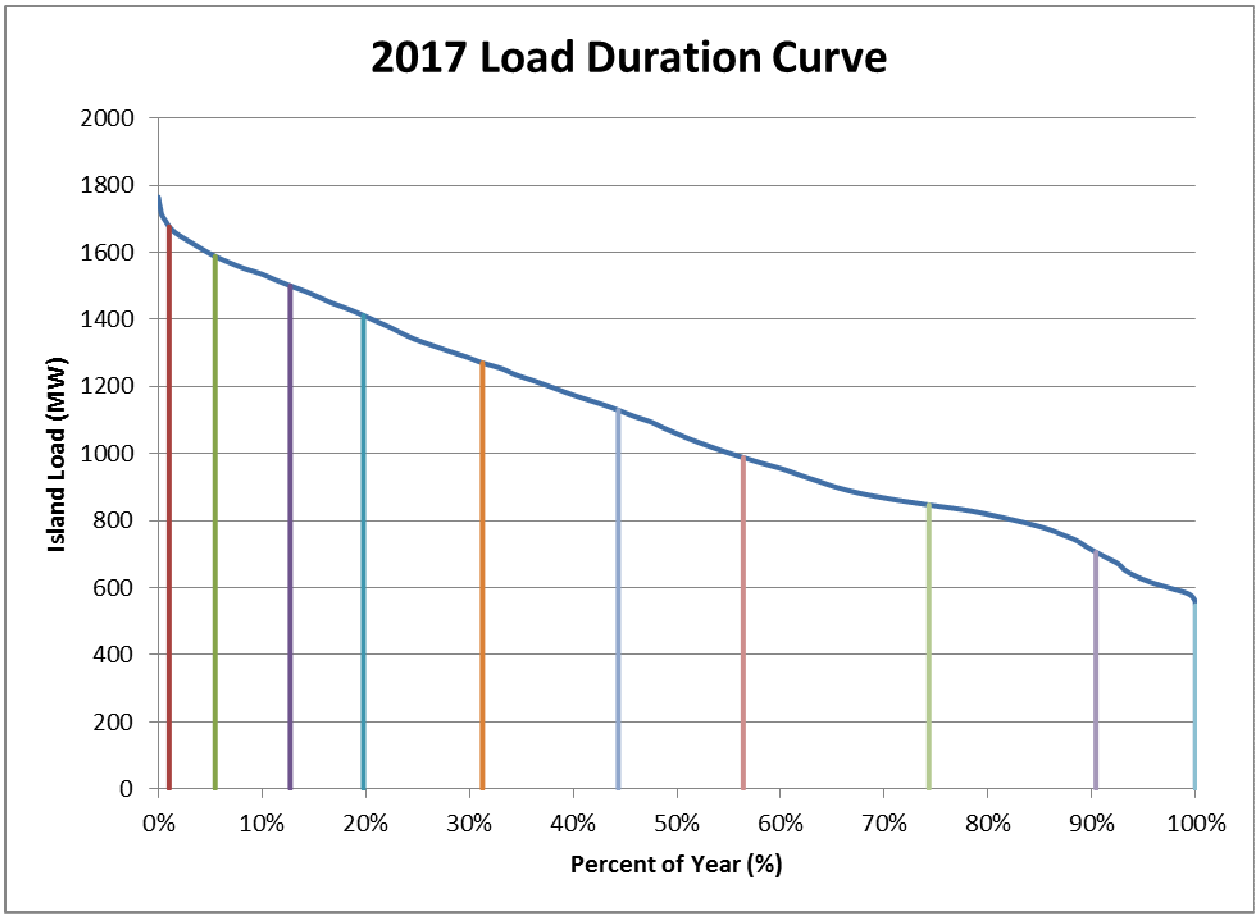


Figure 1
2017 Load Duration Curve with 10 Representative Load Profiles

For each of the cases created, load flow analysis were simulated on each 230kV terminal station configuration with a faulted transformer and subsequent isolation of that fault. Load flow limitations were determined in each case based on line thermal ratings, adjacent transformer overloading or voltage violations. Stability limitations were restricted to loss of load due to load shedding as a result of system generators losing synchronism due to faulted conditions.

Calculation of EUE is based on a combination of factors including the following:

1. 2014 CEA Total Transformer failure rate of 0.15 events per year (0.15/yr)
2. Expected load loss expected per case to maintain emergency rating of adjacent equipment / system.
3. Percent of the year that each case is applicable (ie. 80% system load occurs only 7.06% of the year as per Table 1)

2.1 Load Flow and Stability Analysis of Each 230kV Station

Load flow and stability analysis was completed on those stations identified as having 230kV transformers not individually protected by a 230kV breaker. In total there are 18 230kV terminal stations, not all had transformers requiring additional protection. Table 1 below identifies each station that required further analysis.

Table 1
230kV Stations and Transformers to be Studied

Station	Unprotected Transformer	Comments
Bay d'Espoir	T10 & T12	Considered in analysis
Buchans	None	T1 already protected with 2-230kV breakers
Bottom Brook	None	T1 & T3 to be protected via breaker and half scheme as part of ML upgrade of station
Cat Arm	None	T1 & T2 are generator transformers already protected
Come-by-Chance	T1 & T2	Considered in analysis
Deer Lake	T2	Considered in analysis
Grand Falls Conv	T1, T2 & T3	Considered in analysis
Granite Canal	None	T1 is generator transformer already protected by Upper Salmon and unit breaker
Hardwoods	T1, T2, T3 & T4	Considered in analysis
Holyrood	T6, T7 & T8	Considered in analysis
Massey Drive	T1, T2 & T3	Considered in analysis
Oxen Pond	T1, T2 & T3	Considered in analysis
Stephenville	T3	Considered in analysis
Stony Brook	T1 & T2	Considered in analysis
Sunnyside	T4	Considered in analysis
Upper Salmon	None	T1 is generator transformer already protected
Voisey's Bay Nickel	None	T1 & T2 already protected by dedicated breakers
Western Avalon	T1 – T5	Considered in analysis

Load flow and stability analysis was completed on the stations identified in Table 1 to determine any load restriction requirements or stability issues with faults on the identified unprotected transformers. From that, Expected Unserved Energy was estimated based on the prepared cases representing a full year. Appendix A outlines the results of the analysis for each station. Table 2 below summarizes the results of this analysis.

Table 2
Load Flow / Stability Results

Station	Load Flow EUE (MWh)	Stability
Bay d'Espoir	10.2	Stable – No Load Shedding
Come-by-Chance	12.5	Stable – No Load Shedding
Deer Lake	0	Stable – No Load Shedding
Grand Falls Conv	0	Stable – No Load Shedding
Hardwoods	0	Stable – No Load Shedding
Holyrood	0	Stable – No Load Shedding
Massey Drive	38.6	Loss of CAT / DLP, Load shedding
Oxen Pond	0	Stable – No Load Shedding
Stephenville	1.9	Stable – No Load Shedding
Stony Brook	19.6	Stable – No Load Shedding
Sunnyside	6.0	Stable – Voltage oscillations
Western Avalon	0	Stable – No Load Shedding

2.2 Addition of Dedicated Circuit Breakers for Identified Transformers

For the stations identified and listed in Table 2 above, very high level cost estimates were developed for addition of dedicated circuit breakers for the 230kV transformers listed in Table 1.

Table 3 below outlines what the expected EUE would be before and after additions of the circuit breakers. From this analysis, it is apparent that only five terminal stations would have a reliability improvement with the addition of dedicated transformer breakers. The largest improvement was at Massey Drive while the smallest was Sunnyside.

For the five terminal stations showing reliability improvement with the addition of dedicated transformer breakers, cost estimates were prepared for the breaker additions. Appendix B outlines the single line diagrams of these stations with a high level scope of modifications required. The cost estimates are high level with a built in contingency of 40% and an accuracy range between -20% to +100%, which provides a top of budget level of accuracy. Table 4 presents the overall cost estimate for each terminal station along with high level scope of work. It is noted that for the cost estimates outlined a review of the constructability or construction schedules were not completed.

Table 3
Comparison of EUE Before and After Circuit Breaker Additions

Station	Load Flow EUE (MWh)		Comments
	Before	After Mods	
Bay d'Espoir	10.2	0	Radial feed with parallel transformer, EUE improvement
Come-by-Chance	12.5	0	Radial feed with parallel transformer, EUE improvement
Deer Lake	0	0	No improvement
Grand Falls Conv	0	0	No improvements
Hardwoods	0	0	No improvement
Holyrood	0	0	No improvements
Massey Drive	38.6	0	Largest improvement in EUE and Stability
Oxen Pond	0	0	No improvement
Stephenville	1.9	1.9	No improvement, single radial feed
Stony Brook	19.6	0	EUE improvement
Sunnyside	6.0	0	EUE improvement
Western Avalon	0	0	No improvement

Table 4
Cost Estimate and High Level Scope of Work for Terminal Stations with Improvements

Station	Cost ($ M)	High Level Scope
Bay d'Espoir	16.5	Yard and control building extension required, installation of two breakers and associated infrastructure and 230kV cables.
Come-by-Chance	9.2	Relocation of existing equipment, yard extension required, installation of two breakers and associated infrastructure and modification of 138kV cables.
Massey Drive	50.1	Relocation of existing equipment, yard and control building extension required, installation of three breakers and associated infrastructure.
Stony Brook	7.6	Relocation of existing equipment, installation of two breakers and associated infrastructure.
Sunnyside	10.9	Yard extension required, installation of one breaker and associated infrastructure and 230kV cables.

From a risk / reward perspective, the following stations are listed in order of lowest to highest ratio of cost of upgrade to reliability improvement in $ / MWh:

1. Stony Brook - $ 0.39 Million / MWh
2. Come-by-Chance - $ 0.74 Million / MWh
3. Massey Drive - $ 1.30 Million / MWh
4. Bay d'Espoir - $ 1.62 Million / MWh
5. Sunnyside - $ 1.82 Million / MWh

It is noted that the magnitude of these costs is extreme in comparison to the value of the supplied energy, which can be approximated to be less than $300/MWh ($0.30/kWh) for the purposes of this investigation. For example, Stony Brook Terminal Station demonstrated the least cost reliability improvement. However, this cost was approximated to be $0.39 M/MWh. This equates to more than 1300 times the value of the energy.

On this basis, the reliability improvement that would be afforded by the terminal station modifications would not be justifiable.

3.0 Conclusions

A risk / reward analysis has been completed for the 230kV terminal stations on the Island of Newfoundland. This analysis looked at the high side failure of a transformer, subsequent proper protection operation to isolate the fault, estimate of Expected Unserved Energy and cost to provide protection for required transformers. From a system perspective only five terminal stations showed improvements at varying cost levels, with Massey Drive showing the best reliability improvement and Stony Brook showing the best risk / reward improvement.

It is noted that that the cost of the terminal station modifications is extreme in comparison with the value of the supplied energy. On this basis, the upgrades are not deemed to be justifiable.

APPENDIX A

STATION BY STATION ANALYSIS

Bay d'Espoir

Load Flow Simulations

The only transformers without protection of individual 230kV breakers at Bay d'Espoir are T10 and T12. The following table outlines the loss of load that could be expected as a result of a fault on either T10 or T12 as both transformers would be simultaneously out of service for up to 3 hours to allow for isolation and restoration.

Case	Transformer Fault Event	Equipment Outage	Loss of Load (MW)	Loss Rate CEA (events/yr)	Percent Probability (%)	EUE [1]
1	T10	T10 + T12	18.7	0.15	1.05	0.0884
1	T12	T10 + T12	18.7	0.15	1.05	0.0884
2	T10	T10 + T12	17.7	0.15	4.43	0.3529
2	T12	T10 + T12	17.7	0.15	4.43	0.3529
3	T10	T10 + T12	16.7	0.15	7.25	0.5448
3	T12	T10 + T12	16.7	0.15	7.25	0.5448
4	T10	T10 + T12	15.6	0.15	7.06	0.4956
4	T12	T10 + T12	15.6	0.15	7.06	0.4956
5	T10	T10 + T12	14.2	0.15	11.46	0.7323
5	T12	T10 + T12	14.2	0.15	11.46	0.7323
6	T10	T10 + T12	12.6	0.15	13.10	0.7428
6	T12	T10 + T12	12.6	0.15	13.10	0.7428
7	T10	T10 + T12	10.9	0.15	12.05	0.5911
7	T12	T10 + T12	10.9	0.15	12.05	0.5911
8	T10	T10 + T12	9.2	0.15	17.89	0.7406
8	T12	T10 + T12	9.2	0.15	17.89	0.7406
9	T10	T10 + T12	7.6	0.15	16.11	0.5510
9	T12	T10 + T12	7.6	0.15	16.11	0.5510
10	T10	T10 + T12	6.0	0.15	9.6	0.2592
10	T12	T10 + T12	6.0	0.15	9.6	0.2592
Total EUE						**10.197**

Notes:

1. Based on 3 hours outage, calculation as follows for each event:
   Ex. Case 1 - EUE = 18.7MW x 0.15 x 0.0105 x 3 hrs = 0.0884 MWh

Stability Simulations

There are no Island stability concerns for a three phase fault on either of these transformers for up to six cycles and proper clearing of circuit breakers. No load shedding in this station.

Come-By-Chance

Load Flow Simulations

There are only two transformers at CBC without protection of individual 230kV breakers, T1 and T2. The following system conditions would result from a faults:

Fault on T1 - For a fault on T1, TL207 outage would occur along with tripping of tie breaker B1B2, loss of T1 and approximately 13.9 MW of load for 3 hours until switching could restore CBC internal loading.
Fault on T2 - For a fault on T2, TL237 outage would occur along with tripping of tie breaker B1B2, loss of T2 and approximately 13.9 MW of load for 3 hours until switching could restore CBC internal loading.

Case	Transformer Fault Event	Equipment Outage	Loss of Load (MW)	Loss Rate CEA (events/yr)	Percent Probability (%)	EUE [1]
1	T1	T1 + TL207	13.9	0.15	1.05	0.0657
1	T2	T2 + TL207	13.9	0.15	1.05	0.0657
2	T1	T1 + TL207	13.9	0.15	4.43	0.2771
2	T2	T2 + TL207	13.9	0.15	4.43	0.2771
3	T1	T1 + TL207	13.9	0.15	7.25	0.4535
3	T2	T2 + TL207	13.9	0.15	7.25	0.4535
4	T1	T1 + TL207	13.9	0.15	7.06	0.4416
4	T2	T2 + TL207	13.9	0.15	7.06	0.4416
5	T1	T1 + TL207	13.9	0.15	11.46	0.7168
5	T2	T2 + TL207	13.9	0.15	11.46	0.7168
6	T1	T1 + TL207	13.9	0.15	13.10	0.8194
6	T2	T2 + TL207	13.9	0.15	13.10	0.8194
7	T1	T1 + TL207	13.9	0.15	12.05	0.7537
7	T2	T2 + TL207	13.9	0.15	12.05	0.7537
8	T1	T1 + TL207	13.9	0.15	17.89	1.1190
8	T2	T2 + TL207	13.9	0.15	17.89	1.1190
9	T1	T1 + TL207	13.9	0.15	16.11	1.0077
9	T2	T2 + TL207	13.9	0.15	16.11	1.0077
10	T1	T1 + TL207	13.9	0.15	9.6	0.6005
10	T2	T2 + TL207	13.9	0.15	9.6	0.6005
Total EUE						**12.51**

Notes:

1. Based on 3 hours outage, calculation as follows for each event:

Ex. Case 1 - EUE = 13.9MW x 0.15 x 0.0105 x 3 hrs = 0.0657 MWh

Stability Simulations

There are no Island stability concerns for a three phase fault on either of these transformers for up to six cycles and proper clearing of circuit breakers. No load shedding in this station.

Case	Transformer Fault Event	Equipment Outage	Stability Results
1	T1	T1 + TL207	Stable – No load shedding
1	T2	T2 + TL207	Stable – No load shedding
2	T1	T1 + TL207	Stable – No load shedding
2	T2	T2 + TL207	Stable – No load shedding
3	T1	T1 + TL207	Stable – No load shedding
3	T2	T2 + TL207	Stable – No load shedding
4	T1	T1 + TL207	Stable – No load shedding
4	T2	T2 + TL207	Stable – No load shedding
5	T1	T1 + TL207	Stable – No load shedding
5	T2	T2 + TL207	Stable – No load shedding
6	T1	T1 + TL207	Stable – No load shedding
6	T2	T2 + TL207	Stable – No load shedding
7	T1	T1 + TL207	Stable – No load shedding
7	T2	T2 + TL207	Stable – No load shedding
8	T1	T1 + TL207	Stable – No load shedding
8	T2	T2 + TL207	Stable – No load shedding
9	T1	T1 + TL207	Stable – No load shedding
9	T2	T2 + TL207	Stable – No load shedding
10	T1	T1 + TL207	Stable – No load shedding
10	T2	T2 + TL207	Stable – No load shedding

Deer Lake

Load Flow Simulations

There is only one transformer at DLK without protection of individual 230kV breakers, T2. The following system conditions would result from a fault:

For a fault on T2, breakers B3L47 and B3L48 would operate to isolate TL247 and TL248 as well as tripping Cat Arm generation. In all cases analyzed, there were no system load impacts as generation re-dispatch, LIL import or ML export would alleviate any system generation or overloading conditions.

Case	Transformer Fault Event	Equipment Outage	Loss of Load (MW)	Loss Rate CEA (events/yr)	Percent Probability (%)	EUE
1	T2	T2+TL247+ TL248+CAT	0	0.15	1.05	0.0
2	T2	T2+TL247+ TL248+CAT	0	0.15	4.43	0.0
3	T2	T2+TL247+ TL248+CAT	0	0.15	7.25	0.0
4	T2	T2+TL247+ TL248+CAT	0	0.15	7.06	0.0
5	T2	T2+TL247+ TL248+CAT	0	0.15	11.46	0.0
6	T2	T2+TL247+ TL248+CAT	0	0.15	13.10	0.0
7	T2	T2+TL247+ TL248+CAT	0	0.15	12.05	0.0
8	T2	T2+TL247+ TL248+CAT	0	0.15	17.89	0.0
9	T2	T2+TL247+ TL248+CAT	0	0.15	16.11	0.0
10	T2	T2+TL247+ TL248+CAT	0	0.15	9.6	0.0
Total EUE						**0.0**

Stability Simulations

There are no Island stability concerns for a three phase fault on this transformer for up to six cycles and proper clearing of circuit breakers. No load shedding in this station.

Case	Transformer Fault Event	Equipment Outage	Stability Results
1	T2	T2+TL247+TL248+CAT	Stable – No load shedding
2	T2	T2+TL247+TL248+CAT	Stable – No load shedding
3	T2	T2+TL247+TL248+CAT	Stable – No load shedding
4	T2	T2+TL247+TL248+CAT	Stable – No load shedding
5	T2	T2+TL247+TL248+CAT	Stable – No load shedding
6	T2	T2+TL247+TL248+CAT	Stable – No load shedding
7	T2	T2+TL247+TL248+CAT	Stable – No load shedding
8	T2	T2+TL247+TL248+CAT	Stable – No load shedding
9	T2	T2+TL247+TL248+CAT	Stable – No load shedding
10	T2	T2+TL247+TL248+CAT	Stable – No load shedding

Grand Falls

Load Flow Simulations

There are three transformers at GFL without protection of individual 230kV breakers, T1, T2 and T3. The following system conditions would result from a fault on either transformer:

Breakers B1L35 and L05L35 would operate at the ring bus in Stony Brook to isolate TL235, resulting in loss of generation from Exploits, approximately 63 MW to the grid. In all cases analyzed, there were no system load impacts as LIL import can be adjusted to alleviate any negative system impacts.

Case	Transformer Fault Event	Equipment Outage	Loss of Load (MW)	Loss Rate CEA (events/yr)	Percent Probability (%)	EUE
1	T1 or T2 or T3	T1/T2/T3+TL235 + Exploits Gen	0	0.15	1.05	0.0
2	T1 or T2 or T3	T1/T2/T3+TL235 + Exploits Gen	0	0.15	4.43	0.0
3	T1 or T2 or T3	T1/T2/T3+TL235 + Exploits Gen	0	0.15	7.25	0.0
4	T1 or T2 or T3	T1/T2/T3+TL235 + Exploits Gen	0	0.15	7.06	0.0
5	T1 or T2 or T3	T1/T2/T3+TL235 + Exploits Gen	0	0.15	11.46	0.0
6	T1 or T2 or T3	T1/T2/T3+TL235 + Exploits Gen	0	0.15	13.10	0.0
7	T1 or T2 or T3	T1/T2/T3+TL235 + Exploits Gen	0	0.15	12.05	0.0
8	T1 or T2 or T3	T1/T2/T3+TL235 + Exploits Gen	0	0.15	17.89	0.0
9	T1 or T2 or T3	T1/T2/T3+TL235 + Exploits Gen	0	0.15	16.11	0.0
10	T1 or T2 or T3	T1/T2/T3+TL235 + Exploits Gen	0	0.15	9.6	0.0
Total EUE						**0.0**

Stability Simulations

There are no Island stability concerns for a three phase fault on this transformer for up to six cycles and proper clearing of circuit breakers. No load shedding in this station.

Case	Transformer Fault Event	Equipment Outage	Stability Results
1	T1 or T2 or T3	T1/T2/T3+TL235+Exploits Gen	Stable – No load shedding
2	T1 or T2 or T3	T1/T2/T3+TL235+Exploits Gen	Stable – No load shedding
3	T1 or T2 or T3	T1/T2/T3+TL235+Exploits Gen	Stable – No load shedding
4	T1 or T2 or T3	T1/T2/T3+TL235+Exploits Gen	Stable – No load shedding
5	T1 or T2 or T3	T1/T2/T3+TL235+Exploits Gen	Stable – No load shedding
6	T1 or T2 or T3	T1/T2/T3+TL235+Exploits Gen	Stable – No load shedding
7	T1 or T2 or T3	T1/T2/T3+TL235+Exploits Gen	Stable – No load shedding
8	T1 or T2 or T3	T1/T2/T3+TL235+Exploits Gen	Stable – No load shedding
9	T1 or T2 or T3	T1/T2/T3+TL235+Exploits Gen	Stable – No load shedding
10	T1 or T2 or T3	T1/T2/T3+TL235+Exploits Gen	Stable – No load shedding

Hardwoods

Load Flow Simulations

There are four transformers at HWD without protection of individual 230kV breakers, T1 through to T4. T1 and T2 are directly connected to bus B1, while T3 and T4 are directly connected to bus B2. A fault on either T1 or T2 would result in identical consequences, similarly a fault on T3 or T4 would result in identical consequences. The following system conditions would result from faults on these transformers:

Fault on T1 or T2 – This results in the loss of T1 and T2, operation of breakers B1L01, B1L36 and B1B2 and tripping of lines TL266 and TL236. For heavily loaded cases such as Cases 1-4, transformer overloading of T3 and T4 results beyond nameplate before the Hardwoods Gas Turbine can be started. According to System Operating Instruction T-082, temporary overloading of transformers is acceptable up to 50% overload for less than 30 minutes if the ambient temperature is 0 C or less. For all cases analyzed, transformer overloading is below 35% initially and reduced to 20% once the gas turbine is started. Transformer overloads of up to 26% for 4 hours are acceptable in emergency conditions. Therefore, based on the assumption that service to the non-faulted transformer can be restored within 3 hours, no loss of load is required as a result of this fault condition.

Fault on T3 or T4 - This results in loss of T3 and T4, operation of breakers B2L42 and B1B2 and tripping of line TL242. Overloading of transformers T1 and T2 is avoided completely by operation of the gas turbine, thus no loss of load is required.

Case	Transformer Fault Event	Equipment Outage	Loss of Load (MW)	Loss Rate CEA (events/yr)	Percent Probability (%)	EUE
1	T1 or T2	T1/T2 + TL266 + TL236	0	0.15	1.05	0.0
1	T3 or T4	T3/T4 + TL242	0	0.15	1.05	0.0
2	T1 or T2	T1/T2 + TL266 + TL236	0	0.15	4.43	0.0
2	T3 or T4	T3/T4 + TL242	0	0.15	4.43	0.0
3	T1 or T2	T1/T2 + TL266 + TL236	0	0.15	7.25	0.0
3	T3 or T4	T3/T4 + TL242	0	0.15	7.25	0.0
4	T1 or T2	T1/T2 + TL266 + TL236	0	0.15	7.06	0.0
4	T3 or T4	T3/T4 + TL242	0	0.15	7.06	0.0
5	T1 or T2	T1/T2 + TL266 + TL236	0	0.15	11.46	0.0

5	T3 or T4	T3/T4 + TL242	0	0.15	11.46	0.0
6	T1 or T2	T1/T2 + TL266 + TL236	0	0.15	13.10	0.0
6	T3 or T4	T3/T4 + TL242	0	0.15	13.10	0.0
7	T1 or T2	T1/T2 + TL266 + TL236	0	0.15	12.05	0.0
7	T3 or T4	T3/T4 + TL242	0	0.15	12.05	0.0
8	T1 or T2	T1/T2 + TL266 + TL236	0	0.15	17.89	0.0
8	T3 or T4	T3/T4 + TL242	0	0.15	17.89	0.0
9	T1 or T2	T1/T2 + TL266 + TL236	0	0.15	16.11	0.0
9	T3 or T4	T3/T4 + TL242	0	0.15	16.11	0.0
10	T1 or T2	T1/T2 + TL266 + TL236	0	0.15	9.6	0.0
10	T3 or T4	T3/T4 + TL242	0	0.15	9.6	0.0
Total EUE						**0.0**

Stability Simulations

There are no Island stability concerns for a three phase fault on either of these transformers for up to six cycles and proper clearing of circuit breakers. No load shedding in this station.

Case	Transformer Fault Event	Equipment Outage	Stability Results
1	T1 or T2	T1/T2 + TL266 + TL236	Stable – No load shedding
1	T3 or T4	T3/T4 + TL242	Stable – No load shedding
2	T1 or T2	T1/T2 + TL266 + TL236	Stable – No load shedding
2	T3 or T4	T3/T4 + TL242	Stable – No load shedding
3	T1 or T2	T1/T2 + TL266 + TL236	Stable – No load shedding
3	T3 or T4	T3/T4 + TL242	Stable – No load shedding
4	T1 or T2	T1/T2 + TL266 + TL236	Stable – No load shedding
4	T3 or T4	T3/T4 + TL242	Stable – No load shedding
5	T1 or T2	T1/T2 + TL266 + TL236	Stable – No load shedding
5	T3 or T4	T3/T4 + TL242	Stable – No load shedding
6	T1 or T2	T1/T2 + TL266 + TL236	Stable – No load shedding
6	T3 or T4	T3/T4 + TL242	Stable – No load shedding
7	T1 or T2	T1/T2 + TL266 + TL236	Stable – No load shedding
7	T3 or T4	T3/T4 + TL242	Stable – No load shedding
8	T1 or T2	T1/T2 + TL266 + TL236	Stable – No load shedding
8	T3 or T4	T3/T4 + TL242	Stable – No load shedding
9	T1 or T2	T1/T2 + TL266 + TL236	Stable – No load shedding
9	T3 or T4	T3/T4 + TL242	Stable – No load shedding
10	T1 or T2	T1/T2 + TL266 + TL236	Stable – No load shedding
10	T3 or T4	T3/T4 + TL242	Stable – No load shedding

Holyrood

Load Flow Simulations

There are three transformers at HRD without protection of individual 230kV breakers, T1, T2 and T3. The following system conditions would result from a fault on either transformer:

Breakers B13B15 and B4B15 would operate at Holyrood Terminal Station to isolate Bus B15, resulting in the loss of one half of the 138kV Western Avalon – Holyrood loop feed. In all cases analyzed, there were no system load impacts or voltage violations on the WAV-HRD 138kV loop.

Case	Transformer Fault Event	Equipment Outage	Loss of Load (MW)	Loss Rate CEA (events/yr)	Percent Probability (%)	EUE
1	T1, T2 or T3	T1/T2/T3+B15	0	0.15	1.05	0.0
2	T1, T2 or T3	T1/T2/T3+B15	0	0.15	4.43	0.0
3	T1, T2 or T3	T1/T2/T3+B15	0	0.15	7.25	0.0
4	T1, T2 or T3	T1/T2/T3+B15	0	0.15	7.06	0.0
5	T1, T2 or T3	T1/T2/T3+B15	0	0.15	11.46	0.0
6	T1, T2 or T3	T1/T2/T3+B15	0	0.15	13.10	0.0
7	T1, T2 or T3	T1/T2/T3+B15	0	0.15	12.05	0.0
8	T1, T2 or T3	T1/T2/T3+B15	0	0.15	17.89	0.0
9	T1, T2 or T3	T1/T2/T3+B15	0	0.15	16.11	0.0
10	T1, T2 or T3	T1/T2/T3+B15	0	0.15	9.6	0.0
Total EUE						**0.0**

Stability Simulations

There are no Island stability concerns for a three phase fault on this transformer for up to six cycles and proper clearing of circuit breakers. No load shedding in this station.

Case	Transformer Fault Event	Equipment Outage	Stability Results
1	T1, T2 or T3	T1/T2/T3+B15	Stable – No load shedding
2	T1, T2 or T3	T1/T2/T3+B15	Stable – No load shedding
3	T1, T2 or T3	T1/T2/T3+B15	Stable – No load shedding
4	T1, T2 or T3	T1/T2/T3+B15	Stable – No load shedding
5	T1, T2 or T3	T1/T2/T3+B15	Stable – No load shedding
6	T1, T2 or T3	T1/T2/T3+B15	Stable – No load shedding
7	T1, T2 or T3	T1/T2/T3+B15	Stable – No load shedding
8	T1, T2 or T3	T1/T2/T3+B15	Stable – No load shedding
9	T1, T2 or T3	T1/T2/T3+B15	Stable – No load shedding
10	T1, T2 or T3	T1/T2/T3+B15	Stable – No load shedding

Massey Drive

Load Flow Simulations

There are three transformers at MDR without protection of individual 230kV breakers, T1 through to T3. T1 is directly connected to bus B1, while T2 and T3 are directly connected to bus B5 with both buses connected through a normally closed disconnect switch B1B5. A fault on either T1, T2 or T3 would result in identical consequences. The following system conditions would result from faults on these transformers:

Fault on T1, T2 or T3 – This results in loss of T1, T2 and T3, operation of breakers B1L48, B1L28, B5L11 and tripping of lines TL248, TL228 and TL211.
For heavily loaded cases 1-4, transformer overloading of Deer Lake T1 beyond the 26% (0C ambient) overload capability for 4 hours necessitates the shedding of load in this emergency condition. Similarly, for cases 5 and 6, load reduction is required to reduce DLK T1 overloading below 23% (15C ambient conditions). For cases 7 and 8, load reduction is required to reduce overloading of TL225 and TL233, while cases 9 and 10 require load reduction to reduce overloading of TL233 and Deer Lake Power line L1.

Case	Transformer Fault Event	Equipment Outage	Loss of Load (MW)	Loss Rate CEA (events/yr)	Percent Probability (%)	EUE [1]
1	T1 or T2 or T3	T1/T2/T3 + TL248 + TL228 + TL211	66	0.15	1.05	0.9356
2	T1 or T2 or T3	Same as 1	59	0.15	4.43	3.5285
3	T1 or T2 or T3	Same as 1	53	0.15	7.25	5.1874
4	T1 or T2 or T3	Same as 1	46	0.15	7.06	4.3843
5	T1 or T2 or T3	Same as 1	40	0.15	11.46	6.1884
6	T1 or T2 or T3	Same as 1	27	0.15	13.10	4.7750
7	T1 or T2 or T3	Same as 1	17	0.15	12.05	2.7655
8	T1 or T2 or T3	Same as 1	7	0.15	17.89	1.6906
9	T1 or T2 or T3	Same as 1	30	0.15	16.11	6.5246
10	T1 or T2 or T3	Same as 1	20	0.15	9.6	2.5920
Total EUE						**38.57**

Note:

1. Based on 3 hours outage, calculation as follows for case:

Ex. Case 1 - EUE = 66MW x 0.15 x 0.0105 x 3 hrs x 3 event = 0.9356 MWh

Stability Simulations

There are Island stability concerns for a three phase fault on either of these transformers for up to six cycles and proper clearing of circuit breakers. Load shedding is probable for any of these events.

Case	Transformer Fault Event	Equipment Outage	Stability Results
1	T1 or T2 or T3	T1/T2/T3 + TL248 + TL228 + TL211	Not Stable – CAT and DLP lost synch. Load shed 125MW
2	T1 or T2 or T3	T1/T2/T3 + TL248 + TL228 + TL211	Not Stable – CAT and DLP lost synch. Load shed 120MW
3	T1 or T2 or T3	T1/T2/T3 + TL248 + TL228 + TL211	Not Stable – CAT and DLP lost synch. Load shed 105MW
4	T1 or T2 or T3	T1/T2/T3 + TL248 + TL228 + TL211	Not Stable – CAT and DLP lost synch. Load shed 80MW
5	T1 or T2 or T3	T1/T2/T3 + TL248 + TL228 + TL211	Not Stable – CAT and DLP lost synch. Load shed 80MW
6	T1 or T2 or T3	T1/T2/T3 + TL248 + TL228 + TL211	Not Stable – CAT and DLP lost synch. Load shed 80MW
7	T1 or T2 or T3	T1/T2/T3 + TL248 + TL228 + TL211	Not Stable – DLP lost synch. Load shed 80MW
8	T1 or T2 or T3	T1/T2/T3 + TL248 + TL228 + TL211	Not Stable – DLP lost synch. Load shed 70MW
9	T1 or T2 or T3	T1/T2/T3 + TL248 + TL228 + TL211	Not Stable – DLP lost synch. Load shed 40MW
10	T1 or T2 or T3	T1/T2/T3 + TL248 + TL228 + TL211	Not Stable – DLP lost synch. Load shed 40MW

Oxen Pond

Load Flow Simulations

There are three transformers at OPD without protection of individual 230kV breakers, T1 through to T3. T1 and T2 are directly connected to bus B1, while T3 is directly connected to bus B6. The following system conditions would result from faults on these transformers:

Fault on T1 or T2 – This results in loss of T1 and T2, operation of breakers B1L36 and B1B6 and tripping of line TL236. For heavily loaded cases 1 and 2, minor transformer overloading of Hardwoods T3 results, but is acceptable according to System Operating Instruction T-082 and can be fully alleviated by start-up of the Hardwoods Gas Turbine. Based on the assumption that service to the non-faulted transformer can be restored within 3 hours, no loss of load is required as a result of this fault condition.
Fault on T3 - This results in loss of T3, operation of breakers B6L18 and B1B6 and tripping of line TL218. No overloading of transformers T1 or T2 is experienced, thus no loss of load is required.

Case	Transformer Fault Event	Equipment Outage	Loss of Load (MW)	Loss Rate CEA (events/yr)	Percent Probability (%)	EUE
1	T1 or T2	T1/T2 + TL236	0	0.15	1.05	0.0
1	T3	T3 + TL218	0	0.15	1.05	0.0
2	T1 or T2	T1/T2 + TL236	0	0.15	4.43	0.0
2	T3	T3 + TL218	0	0.15	4.43	0.0
3	T1 or T2	T1/T2 + TL236	0	0.15	7.25	0.0
3	T3	T3 + TL218	0	0.15	7.25	0.0
4	T1 or T2	T1/T2 + TL236	0	0.15	7.06	0.0
4	T3	T3 + TL218	0	0.15	7.06	0.0
5	T1 or T2	T1/T2 + TL236	0	0.15	11.46	0.0
5	T3	T3 + TL218	0	0.15	11.46	0.0
6	T1 or T2	T1/T2 + TL236	0	0.15	13.10	0.0
6	T3	T3 + TL218	0	0.15	13.10	0.0
7	T1 or T2	T1/T2 + TL236	0	0.15	12.05	0.0
7	T3	T3 + TL218	0	0.15	12.05	0.0
8	T1 or T2	T1/T2 + TL236	0	0.15	17.89	0.0
8	T3	T3 + TL218	0	0.15	17.89	0.0
9	T1 or T2	T1/T2 + TL236	0	0.15	16.11	0.0
9	T3	T3 + TL218	0	0.15	16.11	0.0
10	T1 or T2	T1/T2 + TL236	0	0.15	9.6	0.0
10	T3	T3 + TL218	0	0.15	9.6	0.0
Total EUE						**0.0**

Stability Simulations

There are no Island stability concerns for a three phase fault on either of these transformers for up to six cycles and proper clearing of circuit breakers. No load shedding in this station.

Case	Transformer Fault Event	Equipment Outage	Stability Results
1	T1 or T2	T1/T2 + TL236	Stable – No load shedding
1	T3	T3 + TL218	Stable – No load shedding
2	T1 or T2	T1/T2 + TL236	Stable – No load shedding
2	T3	T3 + TL218	Stable – No load shedding
3	T1 or T2	T1/T2 + TL236	Stable – No load shedding
3	T3	T3 + TL218	Stable – No load shedding
4	T1 or T2	T1/T2 + TL236	Stable – No load shedding
4	T3	T3 + TL218	Stable – No load shedding
5	T1 or T2	T1/T2 + TL236	Stable – No load shedding
5	T3	T3 + TL218	Stable – No load shedding
6	T1 or T2	T1/T2 + TL236	Stable – No load shedding
6	T3	T3 + TL218	Stable – No load shedding
7	T1 or T2	T1/T2 + TL236	Stable – No load shedding
7	T3	T3 + TL218	Stable – No load shedding
8	T1 or T2	T1/T2 + TL236	Stable – No load shedding
8	T3	T3 + TL218	Stable – No load shedding
9	T1 or T2	T1/T2 + TL236	Stable – No load shedding
9	T3	T3 + TL218	Stable – No load shedding
10	T1 or T2	T1/T2 + TL236	Stable – No load shedding
10	T3	T3 + TL218	Stable – No load shedding

Stephenville

Load Flow Simulations

There is only one transformer at SVL without protection of individual 230kV breakers, that is T3. A fault on T3 would result in the following system response:

Operation of breakers B1L09 and L09L33 and tripping of line TL209, isolation of SVL load for at least 30 minutes to allow for start-up of SVL gas turbine, thus only loss of 0.5 hours of load.

Case	Transformer Fault Event	Equipment Outage	Loss of Load (MW)	Loss Rate CEA (events/yr)	Percent Probability (%)	EUE [1]
1	T3	T3 + TL209	44.9	0.15	1.05	0.035
2	T3	T3 + TL209	42.1	0.15	4.43	0.140
3	T3	T3 + TL209	39.4	0.15	7.25	0.214
4	T3	T3 + TL209	36.6	0.15	7.06	0.194
5	T3	T3 + TL209	33.0	0.15	11.46	0.284
6	T3	T3 + TL209	28.5	0.15	13.10	0.280
7	T3	T3 + TL209	24.1	0.15	12.05	0.218
8	T3	T3 + TL209	19.7	0.15	17.89	0.264
9	T3	T3 + TL209	15.3	0.15	16.11	0.185
10	T3	T3 + TL209	10.6	0.15	9.6	0.076
Total EUE						**1.89**

Note:

1. Based on 3 hours outage, calculation as follows for case:

Ex. Case 1 - EUE = 44.9MW x 0.15 x 0.0105 x 0.5 hrs = 0.035 MWh

Stability Simulations

There are no Island stability concerns for a three phase fault on this transformer for up to six cycles and proper clearing of circuit breakers. The only load shedding is the radial feed into Stephenville itself, which has been covered off in the load flow analysis.

Case	Transformer Fault Event	Equipment Outage	Stability Results
1	T3	T3 + TL209	Stable
2	T3	T3 + TL209	Stable
3	T3	T3 + TL209	Stable
4	T3	T3 + TL209	Stable
5	T3	T3 + TL209	Stable
6	T3	T3 + TL209	Stable
7	T3	T3 + TL209	Stable
8	T3	T3 + TL209	Stable
9	T3	T3 + TL209	Stable
10	T3	T3 + TL209	Stable

Stony Brook

Load Flow Simulations

There are two transformers at STB without protection of individual 230kV breakers, T1 and T2. T1 is directly connected to bus B1, while T2 are directly connected to bus B2 with both buses connected through a normally closed disconnect switch B1B2. A fault on either T1 or T2 would result in identical consequences. The following system conditions would result from faults on these transformers:

Fault on T1 or T2 – This fault results in operation of breakers B2L04, B1L32, B1L31, B1L35 and loss of both transformers T1 and T2.
For cases 1-6, low voltage conditions exist on the Stony Brook – Sunnyside 138kV loop, that is less than emergency limit of 0.9 pu. Load shedding is required to restore this loop voltage to an acceptable level. Again, it is assumed that one transformer is returned to service within 3 hours of the initial event.

Case	Transformer Fault Event	Equipment Outage	Loss of Load (MW)	Loss Rate CEA (events/yr)	Percent Probability (%)	EUE [1]
1	T1 or T2	T1 and T2	126	0.15	1.05	1.191
2	T1 or T2 or T3	T1 and T2	107	0.15	4.43	4.266
3	T1 or T2 or T3	T1 and T2	86	0.15	7.25	5.612
4	T1 or T2 or T3	T1 and T2	69	0.15	7.06	4.384
5	T1 or T2 or T3	T1 and T2	37	0.15	11.46	3.816
6	T1 or T2 or T3	T1 and T2	3	0.15	13.10	0.354
7	T1 or T2 or T3	T1 and T2	0	0.15	12.05	0
8	T1 or T2 or T3	T1 and T2	0	0.15	17.89	0
9	T1 or T2 or T3	T1 and T2	0	0.15	16.11	0
10	T1 or T2 or T3	T1 and T2	0	0.15	9.6	0
Total EUE						**19.622**

Note:

1. Based on 3 hours outage, calculation as follows for case:

Ex. Case 1 - EUE = 126MW x 0.15 x 0.0105 x 3 hrs x 2 events = 1.191 MWh

Stability Simulations

There are no Island stability concerns for a three phase fault on either of these transformers for up to six cycles and proper clearing of circuit breakers.

Case	Transformer Fault Event	Equipment Outage	Stability Results
1	T1 or T2	T1 and T2	Stable
2	T1 or T2	T1 and T2	Stable
3	T1 or T2	T1 and T2	Stable
4	T1 or T2	T1 and T2	Stable
5	T1 or T2	T1 and T2	Stable
6	T1 or T2	T1 and T2	Stable
7	T1 or T2	T1 and T2	Stable
8	T1 or T2	T1 and T2	Stable
9	T1 or T2	T1 and T2	Stable
10	T1 or T2	T1 and T2	Stable

Sunnyside

Load Flow Simulations

There is only one transformer at SSD without protection of individual 230kV breakers, T4. T4 is directly connected to bus B1 through a normally closed disconnect switch B1T4. A fault on either T4 would result in the following system conditions:

A fault on transformer T4 results in operation of breakers B1T1, B1L03,and B1L02 at Sunnyside and loss of both transformers T1 and T4.
For cases 1-5, low voltage conditions exist on the Stony Brook – Sunnyside 138kV loop, that is less than emergency limit of 0.9 pu. Load shedding is required to restore this loop voltage to an acceptable level. Again, it is assumed that one transformer is returned to service within 3 hours of the initial event.

Case	Transformer Fault Event	Equipment Outage	Loss of Load (MW)	Loss Rate CEA (events/yr)	Percent Probability (%)	EUE [1]
1	T4	T1 and T4	97	0.15	1.05	0.458
2	T4	T1 and T4	75	0.15	4.43	1.495
3	T4	T1 and T4	57	0.15	7.25	1.860
4	T4	T1 and T4	37	0.15	7.06	1.175
5	T4	T1 and T4	20	0.15	11.46	1.031
6	T4	T1 and T4	0	0.15	13.10	0
7	T4	T1 and T4	0	0.15	12.05	0
8	T4	T1 and T4	0	0.15	17.89	0
9	T4	T1 and T4	0	0.15	16.11	0
10	T4	T1 and T4	0	0.15	9.6	0
Total EUE						**6.02**

Note:

1. Based on 3 hours outage, calculation as follows for case:

Ex. Case 1 - EUE = 97MW x 0.15 x 0.0105 x 3 hrs x 1 events = 0.458 MWh

Stability Simulations

There are no Island stability concerns for a three phase fault on either of these transformers for up to six cycles and proper clearing of circuit breakers.

Case	Transformer Fault Event	Equipment Outage	Stability Results
1	T4	T1 and T4	Stable
2	T4	T1 and T4	Stable
3	T4	T1 and T4	Stable
4	T4	T1 and T4	Stable
5	T4	T1 and T4	Stable
6	T4	T1 and T4	Stable
7	T4	T1 and T4	Stable
8	T4	T1 and T4	Stable
9	T4	T1 and T4	Stable
10	T4	T1 and T4	Stable

Western Avalon

Load Flow Simulations

There are five transformers at WAV without protection of individual 230kV breakers, T1 through to T5. T1 and T2 are directly connected to bus B1, while T3 to T5 are directly connected to bus B3. Both buses are connected through breaker B1B3. A fault on either T1 or T2 would result in identical system responses, while a fault on either T3 to T5 would cause identical system responses for that situation. The following system responses could be expected for these faults:

Fault on T1 or T2 - Operation of breakers B1B3, B1L37,and B1L17 at Western Avalon to isolate transformers T1 and T2. For all cases studied, there are no load restrictions on the 66kV system.

Fault on T3 to T5 - Operation of breakers B1B3, B3B5,and B3L08 at Western Avalon to isolate transformers T3 to T5. For all cases studied, voltages at WAV 230kV bus may be slightly higher than 1.05 pu, but within the emergency level, thus no load reductions necessary.

Case	Transformer Fault Event	Equipment Outage	Loss of Load (MW)	Loss Rate CEA (events/yr)	Percent Probability (%)	EUE
1	T1 – T5	T1 and T5	0	0.15	1.05	0
2	T1 – T5	T1 and T5	0	0.15	4.43	0
3	T1 – T5	T1 and T5	0	0.15	7.25	0
4	T1 – T5	T1 and T5	0	0.15	7.06	0
5	T1 – T5	T1 and T5	0	0.15	11.46	0
6	T1 – T5	T1 and T5	0	0.15	13.10	0
7	T1 – T5	T1 and T5	0	0.15	12.05	0
8	T1 – T5	T1 and T5	0	0.15	17.89	0
9	T1 – T5	T1 and T5	0	0.15	16.11	0
10	T1 – T5	T1 and T5	0	0.15	9.6	0
Total EUE						**0**

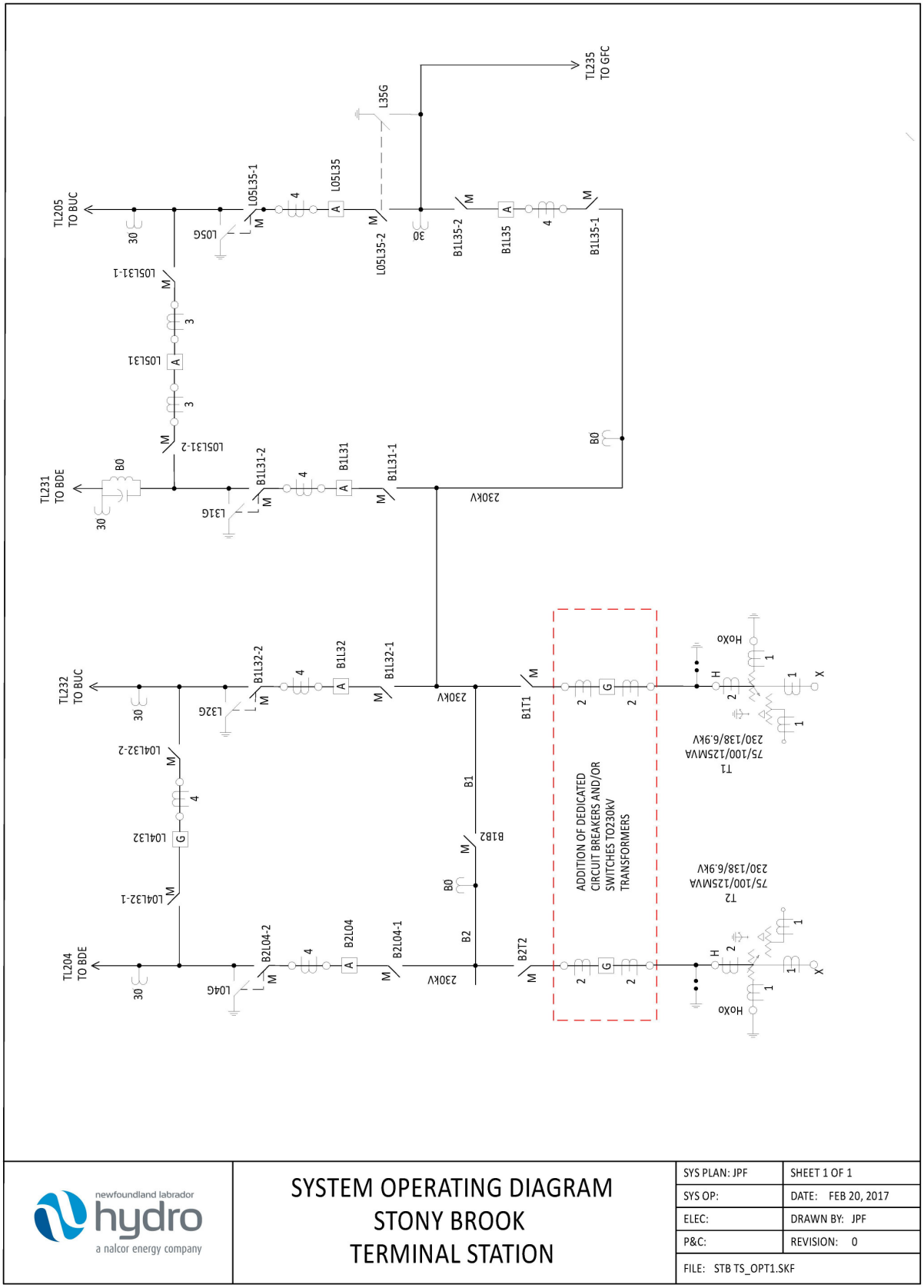
Stability Simulations

There are no Island stability concerns for a three phase fault on either of these transformers for up to six cycles and proper clearing of circuit breakers.

Case	Transformer Fault Event	Equipment Outage	Stability Results
1	T1 – T5	T1 and T5	Stable – No load shedding
2	T1 – T5	T1 and T5	Stable – No load shedding
3	T1 – T5	T1 and T5	Stable – No load shedding
4	T1 – T5	T1 and T5	Stable – No load shedding
5	T1 – T5	T1 and T5	Stable – No load shedding
6	T1 – T5	T1 and T5	Stable – No load shedding
7	T1 – T5	T1 and T5	Stable – No load shedding
8	T1 – T5	T1 and T5	Stable – No load shedding
9	T1 – T5	T1 and T5	Stable – No load shedding
10	T1 – T5	T1 and T5	Stable – No load shedding

APPENDIX B

SINGLE LINE DIAGRAMS OF FIVE STATIONS
SHOWING RELIABILITY IMPROVEMENTS



newfoundland labrador hydro a nalcor energy company	SYSTEM OPERATING DIAGRAM STONY BROOK TERMINAL STATION	SYS PLAN: JPF	SHEET 1 OF 1
		SYS OP:	DATE: FEB 20, 2017
		ELEC:	DRAWN BY: JPF
		P&C:	REVISION: 0
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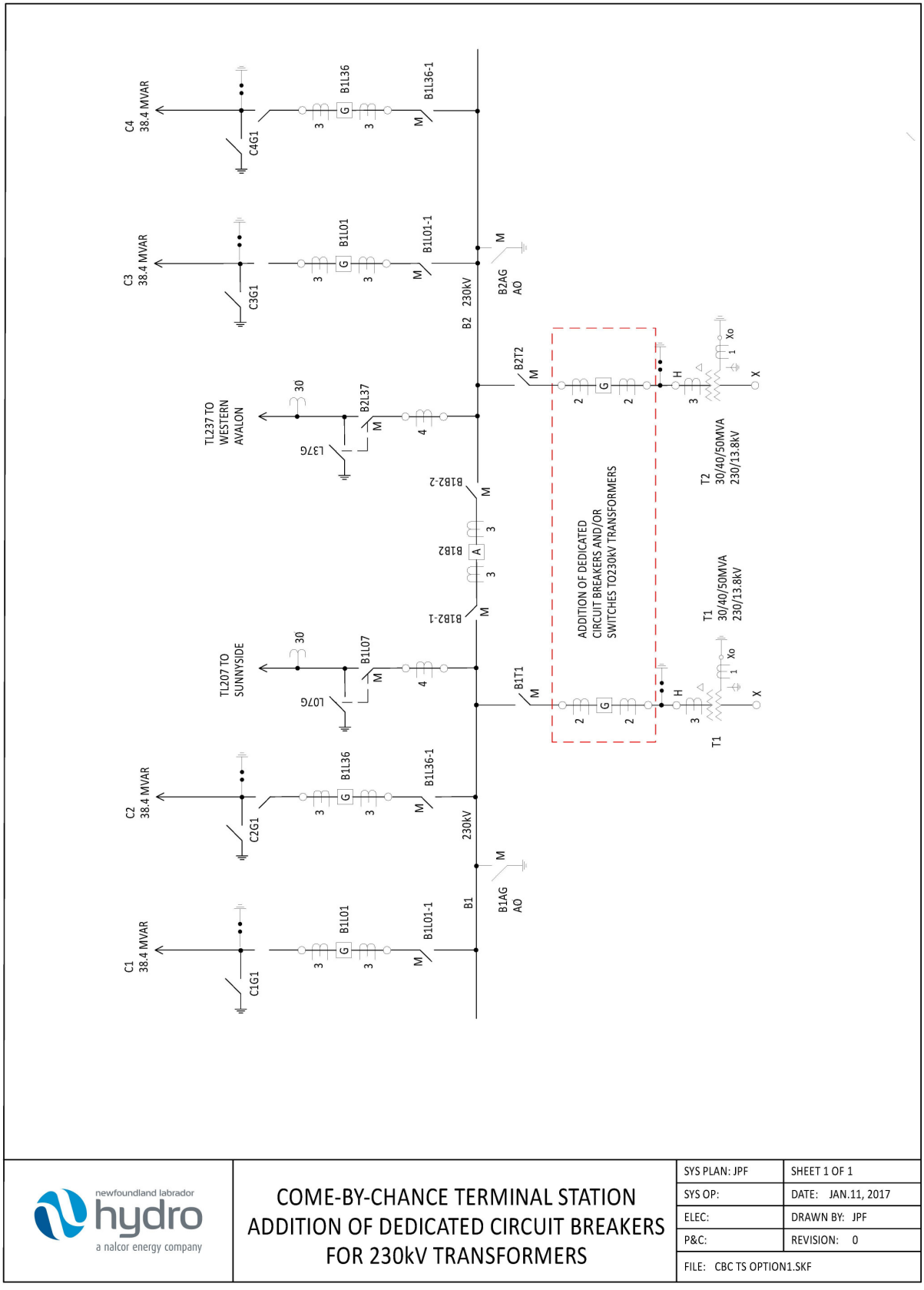

newfoundland labrador hydro a nalcor energy company	COME-BY-CHANCE TERMINAL STATION ADDITION OF DEDICATED CIRCUIT BREAKERS FOR 230kV TRANSFORMERS	SYS PLAN: JPF	SHEET 1 OF 1
		SYS OP:	DATE: JAN.11, 2017
		ELEC:	DRAWN BY: JPF
		P&C:	REVISION: 0
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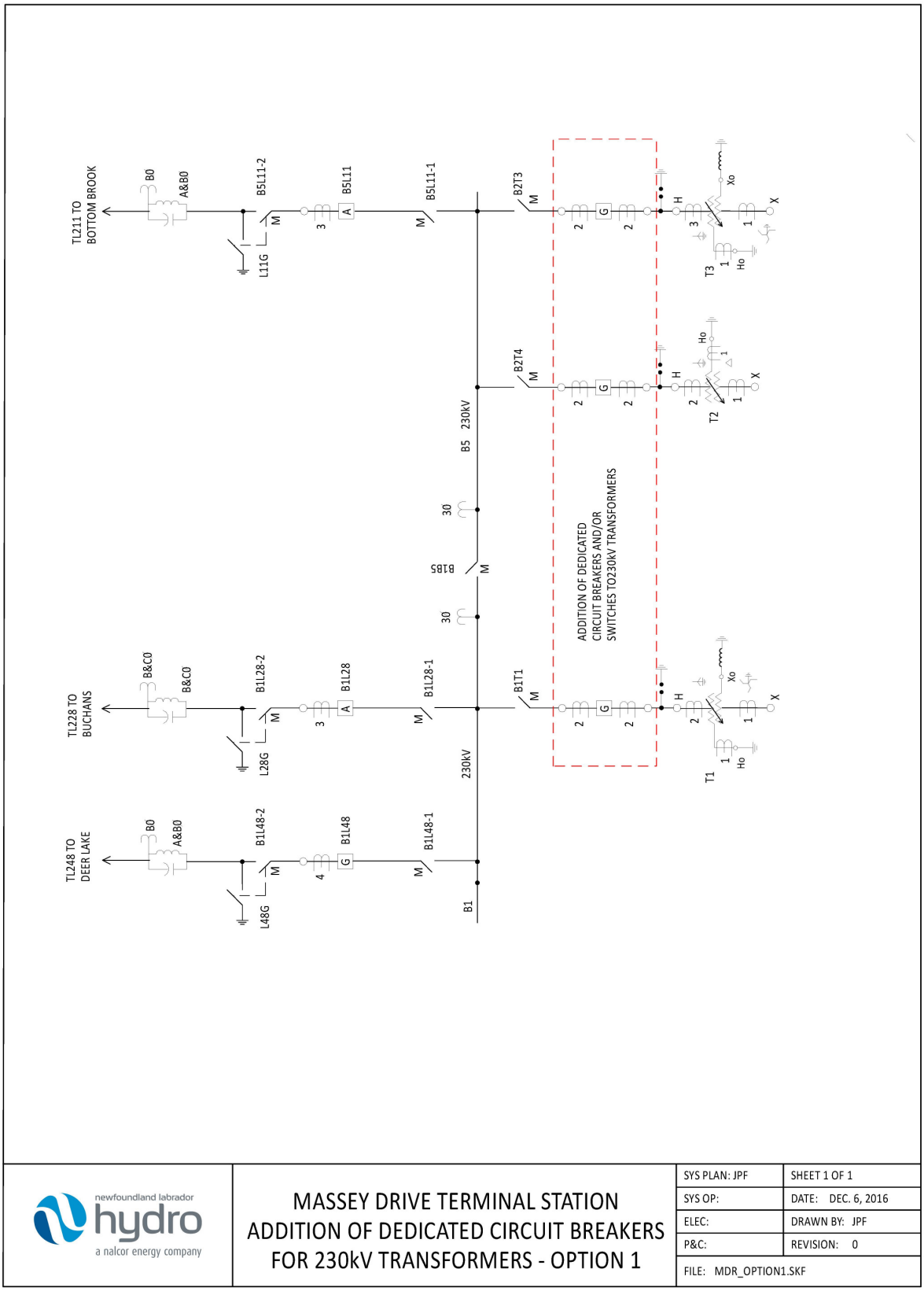
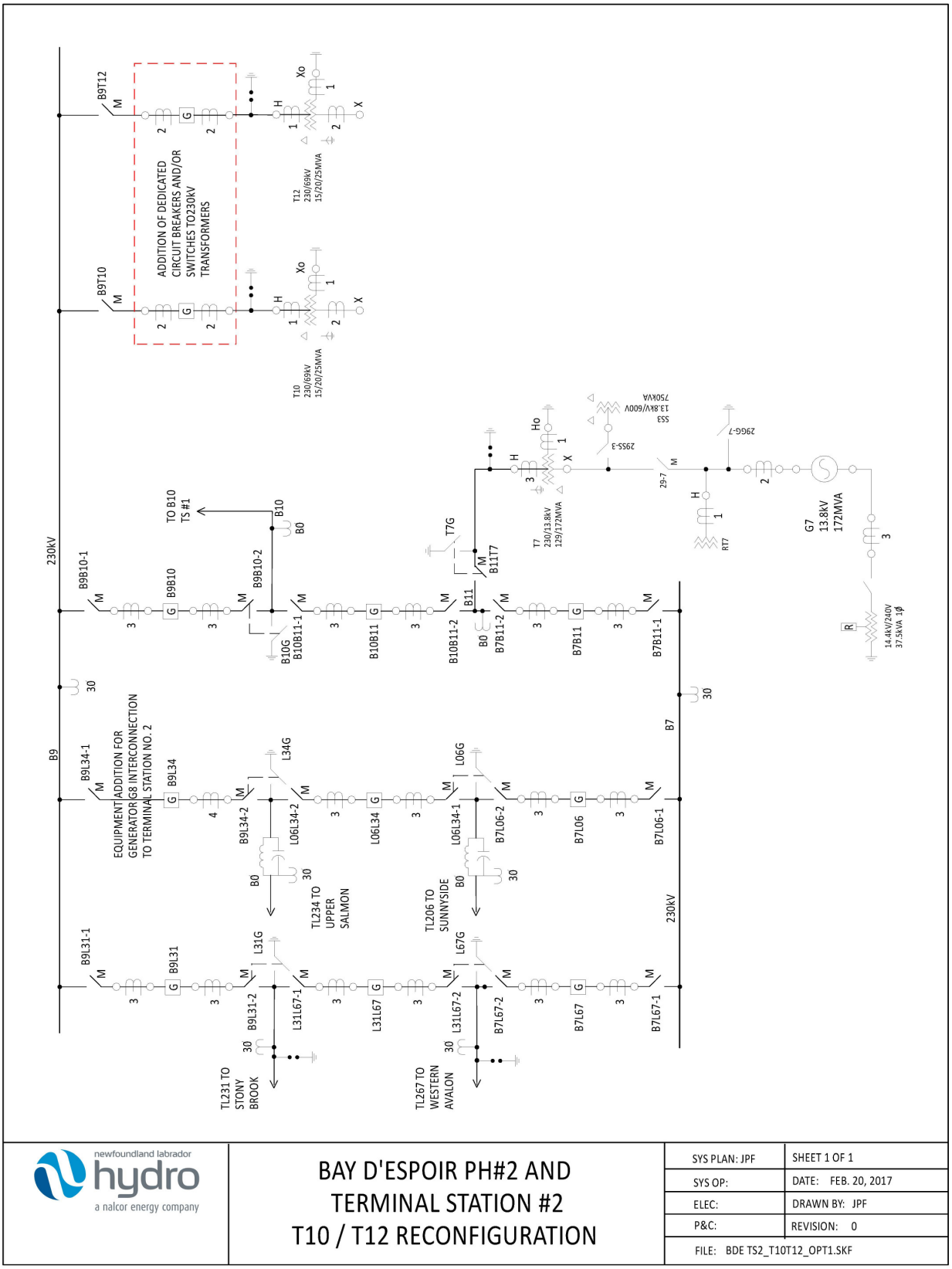

TL211 TO BOTTOM BROOK
B0
A&B0
B5L11-2
L11G
M
3
B5L11
A
B5L11-1
B2T3
G
H
X
Xo
T3
Ho
B2T4
T2
B5 230kV
30
B1B5
ADDITION OF DEDICATED CIRCUIT BREAKERS AND/OR SWITCHES TO230kV TRANSFORMERS
TL228 TO BUCHANS
B&C0
B1L28-2
L28G
B1L28
B1L28-1
B1T1
T1
230kV
TL248 TO DEER LAKE
B1L48-2
L48G
4
B1L48
G
B1L48-1
B1
newfoundland labrador hydro
a nalcor energy company
MASSEY DRIVE TERMINAL STATION
ADDITION OF DEDICATED CIRCUIT BREAKERS
FOR 230kV TRANSFORMERS - OPTION 1
SYS PLAN: JPF
SHEET 1 OF 1
SYS OP:
DATE: DEC. 6, 2016
ELEC:
DRAWN BY: JPF
P&C:
REVISION: 0
FILE: MDR_OPTION1.SKF


ADDITION OF DEDICATED CIRCUIT BREAKERS AND/OR SWITCHES TO230kV TRANSFORMERS
B9T12
B9T10
T12 230/69kV 15/20/25MVA
T10 230/69kV 15/20/25MVA
230kV
TO B10 TS #1
T7G
T7 230/13.8kV 129/172MVA
G7 13.8kV 172MVA
RT7
14.4kV/240V 37.5kVA 1φ
EQUIPMENT ADDITION FOR GENERATOR G8 INTERCONNECTION TO TERMINAL STATION NO. 2
TL234 TO UPPER SALMON
TL206 TO SUNNYSIDE
TL231 TO STONY BROOK
TL267 TO WESTERN AVALON
B9
B7
newfoundland labrador hydro
a nalcor energy company
BAY D'ESPOIR PH#2 AND TERMINAL STATION #2
T10 / T12 RECONFIGURATION
SYS PLAN: JPF
SHEET 1 OF 1
SYS OP:
DATE: FEB. 20, 2017
ELEC:
DRAWN BY: JPF
P&C:
REVISION: 0
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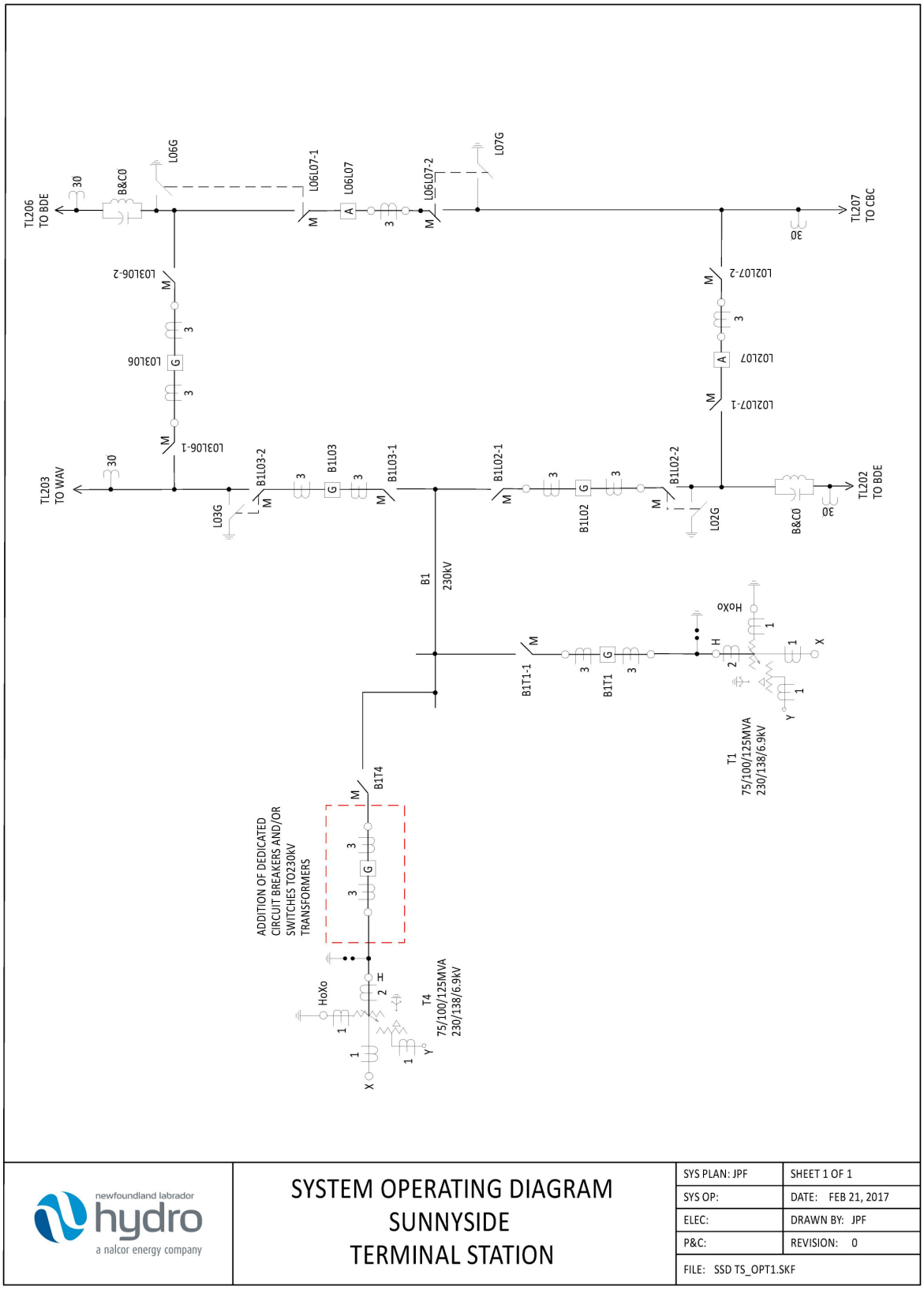

newfoundland labrador hydro a nalcor energy company	SYSTEM OPERATING DIAGRAM SUNNYSIDE TERMINAL STATION	SYS PLAN: JPF	SHEET 1 OF 1
		SYS OP:	DATE: FEB 21, 2017
		ELEC:	DRAWN BY: JPF
		P&C:	REVISION: 0
		FILE: SSD TS_OPT1.SKF	

Hydro Place

Disaster Recovery Plan

Authorized by

Manager

Supply Chain and Administration

Newfoundland & Labrador Hydro

(December 13, 2014)

Distribution List

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	Mike Whelan	NLH, Supply Chain and Administration	

Review Summary

The Disaster Recovery Plan (DRP) will be reviewed at minimum annually or as required to ensure that the Plan reflects the current practices and requirements of the Corporation.

Date	Staff Engaged in Review

Amendment Summary

To ensure that this Disaster Recovery Plan (DRP) reflects the current practices and requirements of the Corporation, amendments may be necessary. All holders of controlled copies may, from time to time, receive updated pages from the Document Controller and shall carry out the instructions contained in the document transmittal. A signed copy of the document transmittal shall be returned to the Document Controller as evidence that the amendments have been received by the Plan holder. Pages that are replaced shall be removed and destroyed.

Number	Date	Description	Sent By

Table of Contents

Acronyms

AM&A	Asset Management and Administration
BCP	Business Continuity Plan
BDR	Business Disruption Response
BIA	Business Impact Analysis
CERP	Corporate Emergency Response Plan
CRA	Continuity Requirements Analysis
DIC	Deputy Incident Commander
DROC	Disaster Recovery Operations Centre
DRP	Disaster Recovery Plan
ECC	Energy Control Centre
ECCERP	Energy Control Centre Emergency Response Plan
EMDRP	Energy Marketing Disaster Recovery Plan
ERP	Hydro Place Emergency Response Plan
HVAC	Heating, Ventilation and Air Conditioning
IC	Incident Commander
ICS	Incident Command System
NLH	Newfoundland Labrador Hydro
NLHC	Newfoundland and Labrador Housing Corporation
RA	Risk Analysis
RV	Risk Value
TI	Threat Impact
TP	Threat Probability

1.0 INTRODUCTION

1.1 General

Newfoundland Labrador Hydro's (NLH) Hydro Place Disaster Recovery Plan (DRP) has been established in keeping with the high regard for the safety of the public and its workers and for the protection of the environment.

Hydro, a Nalcor Energy company, is the primary generator of electricity in Newfoundland and Labrador. The company has an installed generating capacity of 1,626 megawatts. Over 80% of the energy generated is clean, hydroelectric generation. Hydro sells its power to utility, industrial and 38,000 residential and commercial customers in over 200 communities across the province. The company is committed to operational excellence while delivering safe, reliable, least-cost electricity.

1.2 Corporate Responsibility for Hydro Place DRP

Reporting into the NLH Finance department, of the Finance Division, the Supply Chain & Administration department is responsible for the safe and efficient operation of Hydro Place. Direct responsibility for the long term planning, budgeting, and administration is assigned to the Team Lead, Asset Management & Administration, while the responsibility for executing those plans lay with the Supervisor, Hydro Place Operations and Transportation. Each of these positions reports to the Manager of Supply Chain and Administration who in turn reports to the General Manager, NLH Finance.

Newfoundland and Labrador Hydro maintains safety and asset management as two key priorities in all planning. The DRP will provide direction in the event of catastrophic events creating conditions such that portions, or all of Hydro Place, are not able to be occupied for an extended duration. Having an established plan ensures consideration for safety is the documented first consideration in our disaster recovery plan, and that there is a plan in place to allow key business processes to resume in a planned and prompt manner.

While the identification of required resources is the responsibility of the Business Unit Owner, and delivery of those resources is the responsibility of the process owner (Information Services, Network Services, Office Services, etc), Supply Chain & Administration will coordinate the required implementation.

1.3 Purpose/Intent of the DRP

The purpose of the DRP is to:

- Identify threats to the physical building and operations of Hydro Place at the zone, floor and building level;
- Determine responses to those threats; and
- Assign responsibilities to individuals within NLH' Supply Chain and Administration relating to the provision of disaster support and recovery services.

The intent of the DRP is to limit further impact to the premises arising from a threat while ensuring recovery of the facility to an acceptable level of operational capacity within an acceptable period of time. By utilizing the procedures within the DRP, these individuals will be able to:

(a) Effectively mobilize corporate response to Hydro Place disaster situations; and
(b) Execute all necessary corporate disaster support actions.

The DRP provides clear and concise guidance for actions to be taken under all identified disaster scenarios that could reasonably be expected to impact Hydro Place. Within this DRP, a disaster is defined as:

> *Any threat, which if realized, impacts the functionality of Hydro Place at the zone, floor and building level, including the associated grounds, and that impairs the normal operations of those Nalcor/NLH business units/processes operating from the premises.*

Examples include:

- Failure of main water supply and supply of water within building, floors and zones
- Failure of main electrical supply and supply of electricity within building and to floors and zones
- Failure of main sewage/waste water systems within building and floors
- Failure of Heating, Ventilation and Air Conditioning (HVAC) systems within building, floors and zones
- Damage to roof or windows arising from wind/weather event

1.4 Hydro Place Physical Description

Hydro Place is a six-story office building located at 500 Columbus Drive in St. John's, Newfoundland. The facility was constructed in 1988 and comprises a total floor area of approximately 20,054 m2 (215,780 SF) and is currently occupied by some 500 employees.[1]

[1] CONDITION REASSESSMENT AND LONG TERM ASSET MANAGEMENT PLAN OF NALCOR ENERGY HYDRO PLACE, p. 4

The facility and site is nearing maximum capacity. There is a single point of entry to the building at the second level, facing northwest, with a covered drop-off area. There are three service and receiving accesses also at Level 2 on the west side of the building. The site continues to slope down around the north and south sides of the building, thus allowing the full east side of Level 1 to be at grade. The Day-care Centre exterior activity area is on the northeast corner and there is a hard surface patio area on the exterior adjacent to the cafeteria. The full east side of the site along Columbus Drive is professionally landscaped as are the areas adjacent to the main entrance and around the driveways and parking areas.

The site is of adequate size for the building footprint as well as the necessary driveways and parking areas. There are ample areas of landscaping and it appears to be well maintained and updated regularly. The paved surfaces of the parking areas and driveways are also well maintained and drainage appears to work well. The concrete walkways and stairs along with the guard and handrails are maintained at a high standard in keeping with the Corporation's proactive safety standards. Although somewhat limited, there is space for expansion of the building and parking areas.[2]

1.5 Related and/or Specific Emergency Response Documents/Plans

The DRP is related to other building and corporate response plans. These are outlined in Table 1.1 below.

Table 1.1 Related Plans

Plan	Version/Date
Nalcor Energy - Corporate Emergency Response Plan (CERP)	Version 1.6/November 21, 2013
Hydro Place Emergency Response Plan (ERP)	Version 4.9/March 2013
Hydro Place Environmental Emergency Response Manual (EERP)	Revision 17
Nalcor Emergency Communications Plan (ECP)	Version 3.0/November 2013
EMS Disaster Recovery Plan	Version 16, October 2013
Information Systems Disaster Recovery Plan	Revision No. 6/May 2010
Customer Service Business Continuity Disaster Recovery	Version 1.0/November 26, 2014
Other business unit/process plans	As developed

1.6 Supply Chain and Administration Team Member On-Call

A list of Supply Chain Management Team Members On-Call and their contact information is included in Table 1.2 below:

[2] *Ibid.* p. 6

Table 1.2 Team Members On-Call

NAME	TITLE	CELL	HOME
NICHOLAS GALE	Supervisor, Building Operations and Transportation		
RICHARD MURRIN	Building Custodian, (Term)		
GLENN WHIFFEN	Team Lead, Asset Management and Administration		
MIKE WHELAN	Manager, Supply Chain Management and Administration		

Team Lead Asset Management & Administration

The Team Lead Asset Management and Administration is responsible for the long term planning of work in Hydro Place. They are the primary contact for the coordination of external contractors working here, and ensuring the overall work plan, including budgeting is complete. They are responsible for the development and maintenance of the asset management plan, and strategic direction for Hydro Place Operations, as well as administrative and corporate services contracts, such as travel, airlines, and other corporate level agreements.

The Team Lead, Asset Management and Administration are also responsible for Hydro Place Administration, including the supervision of the Reception, and Office Services. This includes coordination of incoming and outgoing mail, printing and binding, maintaining distributing an inventory of office supplies, producing and distributing the Newfoundland & Labrador Hydro customer billings, and a number of other functions to support the administrative requirements of Hydro Place personnel.

Supervisor Hydro Place Operations and Transportation

The Supervisor Hydro Place Operations and Transportation is directly responsible for the daily operation and maintenance of Hydro Place, including the Transportation department and is the prime contact for all maintenance tasks and ensuring Hydro Place operates in a safe and functional manner.

The Supervisor Hydro Place Operations and Transportation is also responsible for the Transportation department, who manages the operation, and maintenance of the Hydro Place pool of fleet vehicles. This includes booking of vehicles, arranging long term rentals, and ensuring the vehicles are maintained, and ready for use as required by fleet pool users.

1.7 Incident Command and Authority of the Supply Chain and Administration Team Member On-Call

In any disaster impacting a zone, floor or the building, the NLH Supply Chain and Administration Team Member On-Call will, for the purpose of mounting and mobilizing an initial response, act as Incident Commander and carry the authority of the NLH Manager, Supply Chain and Administration, until such time as relieved by the NLH Manager, Supply Chain and Administration or designate.

1.8 Hydro Place DRP Team Members, Responsibilities and Succession Plan

The potential threats to Hydro Place may disrupt operations at the equipment, zone, and floor and building level. As a Business Disruption Response (BDR) outlined in Section 5 below may be implemented at the zone, floor or building level, it is anticipated that Managers/Team Leads within impacted areas will be a fundamental part of the BDR (see 4.3 - Level of DRP Team Activation below). The Members of NLH's Hydro Place DRP team, their Major Responsibilities as well as each individual's Succession Plan are listed in Table 1.3 below.

Table 1.3 DRP Team Members, Their Major Responsibilities and Succession Plan

Team Member	Responsibilities	Succession Plan
Manager, Supply Chain and Administration, (or designate)	Overall Disaster Recovery Plan Management. Maintenance, review and update of DRP as necessary Assume Incident Command if necessary Notify Executive Member On-Duty if necessary. Complete normal notifications as per facility ERP/DRP.	Team Lead, Asset Management and Administration (AM&A)
Team Lead, AM&A (or designate)	Maintain and update service provider contacts. Identify nature of incident and appropriate response. Locate and deploy assets, as required. Facilitate relocation of impacted staff to alternative locations in consultation with Managers/Team Leads of impacted areas. Assume Incident Command if necessary Notify Manager, Supply Chain and Administration	n/a
Supervisor, Hydro Place Operations and Transportation (or designate)	Incident Commander until relieved by superior Identify nature of incident and	Custodian

	appropriate response. Notify Team Lead, AM&A and/or Manager, Supply Chain and Administration	
Managers/Team Leads in Impacted areas	Notify Supply Chain and Administration, NHL of threats impacting zone/floor/building. Determine/confirm interim business continuity requirements. Facilitate relocation of impacted staff to alternative locations in consultation with Supply Chain and Administration, Nalcor Energy	As per Business Unit/Process succession plan.

1.9 DRP Training

Training related to the use of the DRP within Supply Chain and Administration will be conducted annually or on an as required basis as new team members are appointed. Training related to the use of the DRP within the Hydro Place DRP Team will be conducted annually or on an as required basis as new DRP team members (Managers/Team Leads) are appointed.

1.10 DRP Review/Exercises

The DRP will be reviewed annually or as required.

1.11 DRP Maintenance/Updates

The Manager, Supply Chain and Administration, has overall responsibility for maintaining the DRP. The Team Lead, Asset Management and Administration, NLH will maintain and update on-call roster, DRP Team Member and service provider contacts.

2.0 RISK ANALYSIS

A Risk Analysis (RA) focusing on environmental, building/structural, system, supplier and other threats was carried out in December 2013. In August 2014 further specific threats within Supply Chain and Administration in relation to equipment failure and access to key services such as reception and shipping and receiving were identified.

2.1 Risk Analysis Methodology

The following formula was used to determine a Risk Value (RV) for each threat identified:

Threat Impact (TI) X Threat Probability (TP) = Risk Value (RV)

Threat Impact (TI) was ranked on a scale of 1-5 where 5 is very high impact and 1 is very low impact and Threat Probability (TP) was ranked on a scale of 1-5 where 5 is very high probability and 1 is very low probability. Assumptions on TI and TP ranking were validated by interviews and a review of existing risk assessments, building assessments and other documentation provided by Nalcor and NLH.

2.2 Risk Value Summary

Generally, those threats with high risk values impacted building-wide operations. Many of those threats with relatively low impacts relate to zone or floor level incidents arising from localized system failures such as HVAC, electrical, water supply or sewage systems where the threat impacts may be moderate or high but only affect the zone or floor and its associated business units/processes. In other instances of low risk values, while the entire building may be impacted the affect on operations is low. For instance the failure of a supplier to provide cafeteria services might result in Hydro Place staff bringing their own lunch rather than relying on food services and this threat, if realized, would have little impact on the operational capacity of business units/processes operating from the building. A summary of risk values for identified threats is provided in **Table 2.1** below.

Table 2.1 Risk Value Summary

Threat	TI	TP	RV
Environmental			
Hurricane/High Winds			
High wind causing damage to roof	4	4	16
High wind causing damage to window(s) - if confined single floor or zone	2	3	6
High wind causing associated property damage or flying debris, i.e. light poles, signage etc.	1	4	4
Flooding			
Storm water drainage failure	3	1	3
Fire			
Grass/forest fire on property	2	2	4
Building fire	5	1	5
Building/Structure			
Roof failure/rain	4	4	16
Damage to building façade/walls impacting access to building	4	4	16
Systems			
Elevator			
Elevator – both elevators if more than a day	5	1	5
Water			
Failure of regional water supply	5	1	5
Failure of supply line to building	5	3	15

Failure of water supply in building (equipment)	5	3	15
Break in water supply in building (interior flooding)	5	3	15
Failure of water supply by floor	1	3	3
Electrical			
Failure of supply from power grid	1	2	2
Failure of supply to building	3	3	9
Failure of main transformers in building	5	3	15
Failure of panel boxes/systems by floor	3	1	3
Failure of panel boxes/systems by zone	3	1	3
Failure of generators (in instance of building electrical failure)	5	1	5
HVAC			
Failure of HVAC systems	3	1	3
Break in HVAC glycol system causing flooding	3	1	3
Failure of HVAC systems by floor	3	1	3
Failure of HVAC systems by zone	3	1	3
Sewage/waste water			
Failure of sewage/waste water outflow	4	2	8
Failure of sewage/waste water outflow by floor or zone	1	3	3
Supply Chain Administration			
Failure of/limited access to Mailroom Equipment	2	1	2
Failure of/limited access to Print Shop Equipment	2	1	2
Limited access to shipping/receiving	1	1	1
Suppliers			
Cafeteria- failure of contractor	1	1	1
Cleaning - failure of contractor	2	2	4
Waste disposal - failure of contractor	1	1	1
Snow clearing - contractor failure to clear roadways and parking areas	4	2	8
Other			
Labour stoppage	3	1	3

3.0 CONTINUITY REQUIREMENTS

A high level Business Impact Analysis (BIA) and Continuity Requirements Analysis (CRA) was carried out among business process owners/managers to determine potential impacts over time of a business disruption on operational capacity and to identify critical human resources, technology and supply requirements necessary to resume normal (or acceptable) levels of operations capacity. A BIA identifies, quantifies and qualifies the impacts of a loss, interruption or disruption of business activities to an organization.[3] A CRA collects information on the resources required to resume and continue business activities in the event of a disruption.[4]

[3] Good Practice Guidelines, p. 48
[4] *Ibid.,* p 52

3.1 Business Impact/Continuity Requirements Overview

A summary of key findings arising from the BIA and CRA process is included as Appendix A. In general, most business units/processes identified a high level of capacity to maintain normal (or acceptable) levels of operational capacity in the event of a business disruption impacting their business unit/process. Many employees have a capacity to work from alternative locations or in the case of the Energy Control Centre (ECC), there is redundancy built into operating procedures. However, a key component of this capacity is continued access to Nalcor/NLH's network and information systems.

There are certain business units/processes that cannot function without access to a suitable configuration of equipment and technology, i.e. customer service call centre and others that require a level of administrative support that cannot be met through access to the network alone.

3.2 Continuity Requirements

Table 3.1 below highlights anticipated continuity requirements in the event of a business disruption impacting various business units/process at the zone, floor and building level. The business unit/process is identified along with the number of staff needing to be accommodated at an alternate location, specific equipment requirements and the timelines within which the alternative location must be established. In the event of a zone or floor level impact (see 4.1 below) these needs will be met primarily by interim relocation within Hydro Place. In the case of building level impacts, these needs will be met through an alternative location(s) for various business units/processes.

Table 3.1 Continuity Requirements

Business Unit/Process	# of Employees	Equipment Requirements	Timelines
Oil and Gas Operations	7	Workstations	After a week (i.e. 5 days)
Health and Safety	6	Workstations	After a week (i.e. 5 days)
Bull Arm/Business Development	0	n/a	n/a
ECC/Systems Operations	0	n/a	n/a
Environmental Services –	4-5	Workstations	After two weeks (i.e. 10 days)
Energy Marketing	TBD	TBD	TBD
Taxation	0	n/a	n/a
Human Resources	0	n/a	n/a
Customer Service	6	Workstations	Immediately

Technical Operations Support	Depends on length of interruption	n/a	After a week (i.e. 5 days)
Information Systems	0	n/a	n/a
NL Hydro – Regulated	18	Workstations and meeting room	After 3-5 days
Executive Leadership	3	3 workstations, meeting room and 2-3 offices	Utilize back up CEOC (Holyrood) in interim but alternative space would be required in medium term (3-5 days)
Supply Chain Management and Administration - Procurement	9	Workstations, IS and network support	After 2-3 days
Supply Chain Management and Administration - Administration	10-11	Workstations and accommodation for Reception, Shipping and Receiving, Office Services and transportation with IS and network support and equipment support as required	After 2-3 days

4.0 DISASTER ORGANIZATION AND COMMUNICATIONS

4.1 Levels of Operational Capacity Impact

Generally, the greater the number the business units/processes impacted by a threat when realized, the greater the impact on operational capacity. Levels of operational capacity impact are identified in **Table 4.1** below.

Table 4.1 Levels of Operational Capacity Impact

Level	Description
Equipment	Impacts that affect a particular activity within NLH's Supply Chain and Administration, i.e. mail processing equipment failure
Zone	Impacts that affect the operational capacity of business units/processes operating from a particular zone within Hydro Place.
Floor	Impacts that affect the operational capacity of business units/processes operating from a particular floor at Hydro Place.
Building	Impacts that affect the operational capacity of the entire Hydro Place premises and the operational capacity of all business units/processes operating from the building.

4.2 Initial Response

The initial response to any incident impacting Hydro Place operations at the equipment, zone, floors and building level will involve the following tasks listed in priority order.

Ensure Safety

Ensure the safety of Nalcor staff, the general public and external contractors/service providers within Hydro Place by evacuating personnel and limiting further access to impacted equipment, zones, floors or the building where necessary.

Limit Impacts

If possible, and if they can be accomplished safely and without negative impacts on other operations, identify and undertake interim measures to limit impacts, i.e. shutting off water supply to impacted zone in instance of water leak.

Assess Impacts

Determine equipment, zone, floor and building operations impacted and associated business units and processes affected to help identify level of DRP activation.

4.3 Level of DRP Team Activation

Levels of operational capacity impact are considered above in Section 4.1. The level of DRP Team and plan activation will be determined by the scale of the incident and impact on equipment, zones, floors and the overall building, the number of business units/processes impacted by the incident and the anticipated duration to return to normal (or acceptable) operational activity.

Equipment-Level Incident Team Activation

An equipment-level incident within NLH Supply Chain and Administration is one that involves equipment failure specific to the business process being carried out, i.e. mail processing equipment. The DRP Team activated will include the Team Lead, Asset Management and Administration.

Zone-Level Incident Team Activation

A zone-level incident is one that impacts one or more business units/processes within a zone and where the incident does not have the potential to impact other zones or floors. The DRP

Team activated will include the Manager of Supply Chain and Administration and/or the Team Lead, Asset Management and Administration, NLH and the Manager(s) and/or Team Lead(s) of business units operating within the impacted zone.

Floor-Level Incident Team Activation

A floor-level incident is one that impacts two or more zones on one floor and where the incident does not have the potential to impact other floors. The DRP Team activated will include the Manager of Supply Chain and Administration and/or the Team Lead, Asset Management and Administration, NLH and the Manager(s) and/or Team Lead(s) of business units operating within the impacted floor.

Building-Level Incident Team Activation

A building-level incident is one that impacts two or more floors or the exterior grounds of the building limiting safe access to Hydro Place. The DRP Team activated will include the Manager of Supply Chain and Administration, and the Manager(s) of all business units operating within the building. An incident of this scale will engage the Hydro Place ERP and Nalcor's CERP and may result in the suspension of Hydro Place operations.

4.4 Integration of DRP with Business Unit/Process Business Continuity Plans

The DRP will be activated in conjunction with an existing business unit/process Business Continuity Plan (BCP)/Disaster Recovery Plans if in place.

4.5 Suspension of Hydro Place Operations

If necessary, Hydro Place operations will be suspended consistent with the terms and conditions outlined within the Hydro Place ERP and Nalcor's CERP.

4.6 Disaster Recovery Operations Centre (DROC)

In the event of a disruption impacting Hydro Place, a Disaster Recovery Operations Centre will be established. If the disruption is zone or floor level, the DROC will be located within a non-impacted area of Hydro Place. If the level of disruption is at the building level, an interim DROC will be located at Newfoundland and Labrador Housing Corporation's (NLHC) building. If the business disruption is of significant duration, a longer term DROC will be established.

5.0 BUSINESS DISRUPTION RESPONSE

5.1 Business Disruption Response (BDR) Summary

Table 5.1 below summarizes potential business disruptions while individual Business Disruption Responses (BDRs) are provided in Appendix B.

Tab #	RV#	BDR #	Description
Building Level			
	16	**BDR 1**	High wind causing damage to roof
	16	**BDR 2**	Roof failure/rain
	15	**BDR 3**	Failure of water supply to building
	15	**BDR 4**	Failure of water supply in building (equipment)
	15	**BDR 5**	Break in water supply in building (interior flooding)
	15	**BDR 6**	Failure of main electrical transformers in building
	15	**BDR 7**	Failure of sewage/waste water outflow
	9	**BDR 8**	Failure of electrical supply to building
	5	**BDR 9**	Building fire
	5	**BDR 10**	Elevator (if more than 1 day)
	5	**BDR 11**	Failure of regional water supply
	5	**BDR 12**	Failure of generators
	4	**BDR 13**	High winds causing property damage (light poles, signage etc.)
	4	**BDR 14**	Grass/forest fire on or near property
	4	**BDR 15**	Failure of snow clearing contractor to clear parking lots and roadways
	4	**BDR 16**	Failure of cleaning contractor
	4	**BRD 17**	High wind causing associated property damage or flying debris, i.e. light poles, signage etc.
	3	**BDR 18**	Storm drainage failure in heavy rain or snow melt
	3	**BDR 19**	Failure of HVAC in entire building
	3	**BDR 20**	Break in glycol system causing flooding
	3	**BDR 21**	Labour stoppage
	2	**BDR 22**	Failure of electrical supply from power grid
	1	**BDR 23**	Failure of cafeteria contractor
	1	**BDR 24**	Failure of waste disposal contractor
Floor Level			
	6	**BDR 25**	High winds causing damage to windows
	3	**BDR 26**	Failure of water supply
	3	**BDR 27**	Failure of panel boxes
	3	**BDR 28**	Failure of HVAC
	3	**BDR 29**	Failure of sewage/waste water system
Zone Level			
	6	**BDR 30**	High winds causing damage to windows
	3	**BDR 31**	Failure of panel boxes
	3	**BDR 32**	Failure of HVAC

	3	**BDR 33**	Failure of sewage/waste water system
Supply Chain and Administration			
	2	**BDR 34**	Mailroom Equipment
	2	**BDR 35**	Printing Equipment
	1	**BDR 36**	Limited Access to shipping/receiving

5.2 BDR Template Overview

Each BDR is reflected in a standard template with a number of common features, ensuring consistency across all potential BDRs. Each BDR addresses key activities in relation to activation, integration with existing plans, communications, Incident Command System (ICS) and supplier engagement. These features include:

- Colour-code linking BDR to overall operational capacity impact
- Overall BDR Number
- Title of BDR
- Risk Analysis (RA) rating
- Incident History/Rationale
- Anticipated impacts by building, floor or zone
- Anticipated impacts by business unit/process
- Invocation/activation authority
- Integration with other plans
- Duration of impact
- Building closure criteria
- Communications
- Incident Command System (ICS)
- Anticipated BDR resources

5.3 Resumption Capacity within Hydro Place

In the event of zone or floor level disruptions, staff of impacted areas will be accommodated within other, non-impacted areas of Hydro Place. The location assignments will be made on the basis of priority of the business unit to overall Nalcor/NLH operations and the requirements of specific business units. A listing of alternate locations within Hydro Place is attached as Appendix C.

5.4 Resumption at Alternative Locations

In the event of a building level disruption or if business units/processes cannot be accommodated within alternative locations within Hydro Place, staff of impacted areas will be accommodated within off-site locations, including other Nalcor Energy facilities in the Avalon region. The location assignments will be made on the basis of priority of the business unit to overall Nalcor/NLH operations and the requirements of specific business units. A listing of contacts for alternative locations is attached as Appendix D.

5.5 Maintenance of Supplier Inventory

As outlined in Table 1.3 above, NLH's Team Lead, Asset Management and Administration will maintain an inventory comprising an up to date listing of all suppliers providing services to Hydro Place, along with related service contracts and equipment specifications. This inventory will be accessible from a remote location.

5.6 Supplier Listings

A detailed supplier inventory is included as Appendix E. Individual suppliers are identified within specific BDRs.

References

Good Practice Guidelines, Business Continuity Institute, 2010

CONDITION REASSESSMENT AND LONG TERM ASSET MANAGEMENT PLAN OF NALCOR ENERGY HYDRO PLACE, BAE-Newplan Group Limited, 2013

Appendix A - Key Findings

December 8, 2014
(Revised DRAFT)

1. BACKGROUND

In December 2013 Resilient Business Continuity Planning (Resilient) was contracted to develop a Disaster Recovery Plan (DRP) for Newfoundland and Labrador Hydro's (NLH) Hydro Place Building on 500 Columbus Drive, St. John's, Newfoundland. Resilient's project lead was Pat Curran, Planning Associate. NLH's key point of contact was Glenn Whiffen, Team Lead, Asset Management and Administration who has overall responsibility for the Hydro Place building.

2. BUSINESS IMPACT ANALYSIS

2.1 Consultative Methodology

A key component of the DRP was the completion of a Business Impact Analysis (BIA) of key business processes/units operating from Hydro Place in the event of an incident that limited or prevented access to the building. A consultative methodology was prepared focusing on interviews with key business process owners. A questionnaire (see attached Appendix) was developed that would form the basis of the BIA interview or alternatively, that could be completed and return to Resilient.

2.2 Key Indicators

Key indicators within the BIA questionnaire were identified to determine:

- Descriptions of business processes within each business unit and the priority of each process to NLH/Nalcor's overall operations
- Dependencies/relationships among business processes that would be impacted in the event of a business disruption of Hydro Place including dependencies on external contract/service providers
- Potential impacts on business process/unit by location and over time
- Identification of critical requirements to resume operations including capacity to work from alternate locations, specialized equipment and technology
- Understanding/awareness of disaster/business continuity planning and need to integrate it within management policy and ongoing awareness, training and review practices

2.3 Data Collection

An introductory email and memo (see attached Appendix) was distributed to key business process owners on behalf of Resilient on April 23, 2014 by Glenn Whiffen. Resilient followed this initial email with a further email on May 5, 2014 requesting an opportunity to schedule an interview with each business process owner. As interview times were established, Resilient forwarded a copy of the BIA questionnaire for review and consideration in advance of the session.

Resilient conducted BIA interviews throughout May and early June 2014, scheduling sessions on May 8 and 22 and June 5. In addition, several business process owners completed and returned the BIA questionnaire without a formal interview. An additional email to business process owners/managers requesting engagement in the BIA was sent by Resilient on May 27, 2014 and by Glenn Whiffen on June 17, 2014. A further email was sent to business process owners/managers by Mike Whelan on August 22, 2014.

As of September 26, 2014, Resilient has completed (7) BIA interviews and an additional (6) questionnaires have been returned. Copies of information recorded during BIA interviews were sent to individual respondents on June 16, 2014 for review and comment before inclusion in this summary report. A summary of BIA participants to date is provided in Table 2.1 below:

Table 2.1 BIA Interview/Questionnaire Responses

Contact	Business/Process Unit	Interview /Questionnaire
Robert Butler	Systems Operations	Interview
Michael Roberts	Human Resources	Interview
Nancy Hart	Bull Arm/Business Development	Interview
Barry Brophy/Ron Lane	Customer Service Department	Interview
Mike Whelan	Supply Chain and Administration	Interview
Scott Crosbie	Technical Operations/Support	Interview
Kim Petley /Rhonda Guay	Oil & Gas	Interview
Helen Sinclair	Information Systems	Questionnaire
Jeannine Fitzgerald	Taxation Finance, Nalcor Energy	Questionnaire
Cathy Vokey	Corporate Finance	Questionnaire
Greg Jones	Energy Marketing	Questionnaire
Marion Organ	Environmental Services	Questionnaire
Rick Green	NLH (Regulated) Finance Group	Questionnaire

3. BIA OVERVIEW

3.1 Business Units/Processes and Priorities

All business process owners (or their designate) who responded had a clear understanding of the various business processes performed by their unit and their role within overall Nalcor/NLH operations. All were in a position to identify what they felt were the priority activities provided by their units – those activities that would be most needed or impacted by a business disruption. These included:

- Access to seismic data in the case of Oil and Gas within Nalcor
- Project execution
- Call centre operations
- Office Services, switchboard and building operations
- Information Systems
- Energy Control Centre (ECC)

In general terms, all business processes owners identified safety as a foremost priority in their organizations, a reflection of Nalcor/NLH's commitment to safety in general.

3.2 Dependencies

All business process owners could identify dependencies within the organization – those other business units/processes upon which they were dependent or conversely, who depended on them. In certain instances, external contractors/suppliers were identified. Virtually all business processes identified a reliance on Information Systems (IS) and associated network(s) and support to perform their primary functions. Individual business processes relied on others for their activities, i.e. the mailroom to facilitate billing etc.

3.3 Impacts

As highlighted above, the single greatest dependency relates to Information Systems and it is in the failure of this service that Nalcor/NLH will be impacted most. As will be seen in the Critical Requirement Analysis below, most business processes can function from a remote location however this functionality is dependent on access to the various networks provided by Information Systems.

Additional impacts relating to a business disruption affecting access to the building are in relation to call centre operations, switchboard and mailing where the provision of service is tied to a physical location within Hydro Place and which cannot be readily performed remotely. In several instances, business process owners/managers identified limited access to information

currently in hard copy format only (i.e. engineering designs) as having a potential impact on their operations.

3.4 Critical Requirements Analysis

As outlined above, the most critical requirement identified by business process owners/managers was access to the network(s) provided by Information Systems enabling most of their staff to work from remote locations. For the most part, business process owners indicated that the majority of their business functions could be performed from alternative work locations and in some instances these locations were identified including the Holyrood Generating Plant and Bull Arm.

Several business process owners identified specific requirements that would have to be met, often within a very narrow time, if key services were to be resumed in the event of a business interruption. These included switchboard, mailroom and call centre operations.

In some instances, even with access to the network secure and uninterrupted, the nature of the work being performed (i.e. engineering design) required specific work station and equipment requirements that could not be reasonability met in a home-based work location.

3.5 Current Readiness and Planning

Business process owners/managers indicated that they have contact details for all staff and can quickly mobilize staff from a remote location. Much of the specific information in relation to equipment specifications, supplier information and warranty/service agreement files is housed within the external network, secure and accessible in the event of a business disruption.

At the time of the initial consultations in May –July 2014, IS and ECC were the only business processes/units that indicated they had formal disaster recovery/business continuity plans in place. Customer Service has subsequently completed a Business Continuity/Disaster Recovery Plan and Energy Marketing is currently in the process of developing one. Respondents generally recognized the value of continuity and disaster recovery planning, indicating that the emphasis on strategic planning is an accepted approach within Nalcor/NLH.

Staff and management engagement in the planning process was recognized as being highly important with more moderate responses on the need to provide ongoing awareness and regular review and exercise of current plans.

4. KEY EXPOSURES ARISING FROM BIA

On the basis of the BIA responses, Resilient has identified the following key areas of exposure around which more detailed disaster recovery/business continuity planning might be undertaken within business units/processes.

4.1 Energy Control Centre (ECC)

The ECC is a self-contained facility adjacent to Hydro Place with independent systems that allows it to operate in the event of a major disruption at Hydro Place. There is redundancy in ECC operations available at Holyrood Generating Station with very clear protocols in place in relation to transferring operations from one location to the other. In the event of a disruption impacting both locations, the ECC function can still be maintained through a third level of redundancy available at the regional level. Disaster and business continuity protocols appear to be well planned.

4.2 Information Systems and Network

The primary exposure identified within the BIA process was that of the network(s) such as JD Edwards managed by Information Systems. There is a very clear understanding within IS of the criticality of this function to other business processes within Nalcor/NLH and an emphasis on security and risk management. Contingencies appear to have been established to help restore critical business systems and mitigation measures are in place to secure the system.

4.3 Customer Service/Call Centre

Customer Service has completed a Business Continuity/Disaster Recovery Plan.

4.4 Switchboard, Reception and Receiving

An incident at Hydro Place that restricted access to the building would impact critical front line services including switchboard operations, reception and receiving. This would present challenges in the receipt of vital information such as incoming telephone calls, tender documents etc.

4.5 Mailroom

Mailroom functions would be impacted in the event of a business disruption at Hydro Place. In addition, there are specific equipment requirements to facilitate mail sorting and preparation that could not be met by solely by staff working from an alternative location. Services could be provided by others until we were ready to operate again.

4.6 Printing

Administration provides in-house printing capacity for most other business processes within Nalcor/NLH that would be impacted by a business disruption at Hydro Place. Similar to the mail room function outlined above, specialized equipment required would limit the capacity of staff to meet this function from an alternative location. Services could be provided by others until we were ready to operate again.

4.7 Access to Hard Copies of Material

In certain instances, particularly within Oil and Gas and Technical Operations, documentation, such as engineering drawings is available in hard format only and stored within a physical location with Hydro Place. Should access to the building, floor or zone where these materials are stored be restricted, staff will have limited access to these resources.

4.8 Daily Backups/Uploads/Data

While many Nalcor/NLH staff have access to laptops and can work from alternative locations utilizing the network, most do not take their laptops with them at the conclusion of each day. Protocols do not appear to be in place in some instances that would require an upload of current project activity at the end of each day. Should access to Hydro Place be limited in the off-hours this data, if not uploaded, will be unavailable to users through the network.

4.9 Engineering Design

Within Oil and Gas, a business disruption that limited access to Hydro Place would impact their engineering/design function which are dependent on a specific configuration of computers and software. These requirements cannot be met from an alternative work location without a relatively advanced work station for each impacted employee.

4.10 Detailed Disaster Recovery Plans by Business Process/Unit

With the exception of the ECC and Customer Service, and the work presently underway within Energy Marketing, there are no specific disaster recovery plans in place across those business processes surveyed although a general consensus exists over the need to invest in contingency planning at that level. Most view Nalcor's Corporate Emergency Response Plan (CERP) as the basic reference document to address a business disruption. However the CERP does not address Hydro Place or the business processes performed there specifically.

5. CONCLUSION

Nalcor/NLH has a fairly robust capacity to respond to a business disruption. Contingent on network availability, most processes can be performed from an alternative work location in the short term. The critical ECC function has two levels of redundancy beyond that performed at Hydro Place. In the short term to medium term additional business functions can be addressed through the utilization of external service providers (i.e. mailroom and printing) or, in the case of engineering/design within Oil and Gas, through reciprocal arrangements with other project partners.

Despite this, there remains a need for business process owners/managers to identify and review their critical exposures, to identify mitigation and recovery measures, to put in place more formal plans at the process level to address potential business disruption and to engage staff in building awareness of these plans and key roles and responsibilities.

Most critical of all is the need to maintain the operational capacity of Hydro Place. Responsibility for meeting this need rests with Supply Chain and Administration and will be the focus of the detailed Hydro Place Disaster Recovery Plan.

Business Impact Analysis Questionnaire

Background

Part of Newfoundland and Labrador Hydro's Asset Management and Administration responsibility is to maintain the operational capacity of Hydro Place. Consistent with Nalcor Energy and Newfoundland and Labrador Hydro's shared values of safety, open communications, leadership, teamwork and accountability, we have initiated the development of a Disaster Recovery Plan (DRP) for our physical premises at Hydro Place and have retained Planning Associate Pat Curran, CBCI of Resilient Business Continuity Planning to assist in completing the plan. Part of Mr. Curran's work will be to assess the potential impact, through the completion of a Business Impact Analysis (BIA), on the various business units of Nalcor Energy and Newfoundland and Labrador Hydro operating from Hydro Place should a threat be realized.

What is a BIA?

A BIA helps to determine impact on a business (or business process/unit) if work was disrupted or even forced to stop. In the analysis, business process owners identify what their process/unit normally does, how they do it (i.e. information, technology/equipment, production inputs and personnel) and the implications (or impact) over time if the process cannot be performed.

Confidentiality

Resilient commits to safeguarding the confidentiality of materials and information received throughout this analysis and has provided a non-disclosure agreement (NDA) to cover all aspects of Resilient's work.

Respondent Details

Interviewee: _____ Date: _____

Organization: _____ Location: _____

Description of Business Unit/Process

1) Can you provide the name of the business unit/process as reflected within NL Hydro/Nalcor's organizations structure?

2) What is the accountability framework of your business unit/process within NL Hydro/Nalcor's management structure?

3) Can you briefly describe the business unit/process or provide a written description?

Process Name	Process Description	Rank

4) How many full time employees work within this business unit/process?

5) If your business unit/process performs multiple processes, can you prioritize those in relation to their criticality to the business unit and/or overall NL Hydro/Nalcor operations?

Relationship to other business units/processes

6) Is your business unit/process performance dependent on other business units/ processes? If so, please identify these dependencies.

Process	Other

7) Is your business unit/process performance dependent on inputs from external services/suppliers etc.? If so, please describe.

Process	External services/suppliers

8) Are other business units/processes dependent on your business unit/process to perform? If so, please describe?

Your Process	Other Business Units/Processes

Potential Impacts on Business

9) What would be the impact on your business unit/process if you could not access your current location at each of the following levels?

Location	Impact
Zone	
Floor	
Building	

10) In your view, what would be the impact on NL Hydro/Nalcor's overall operations if your business unit/process was inoperable for?

Time	Impact
Hours	
1-2 days	
3-5 days	
2 weeks	
More than 2 weeks	

Critical Requirements Analysis

11) How many of your staff could perform their activities from an alternative work location, i.e. home?

12) If working from home was not an alternative, what do you see as the minimum requirements necessary to return your business unit/process to an acceptable level of operational capacity?

Requirement	Description
Staff	
Equipment	
Work Stations	
IT	
Other	

Current Level of Readiness and Planning

13) Do you maintain the following in an accessible location not within Hydro Place?

Information	Y/N
Contact details for all staff	
Equipment specifications	
Supplier information and contact details	
Warranty and service agreement information	
Other	

14) Do you have a business continuity/disaster recovery plan in place within your business unit/process?

15) Do you believe there is a good understanding of the requirement for effective planning to anticipate and mitigate the impacts of disaster and business disruption?

16) In your experience, how important are the following in ensuring stakeholder buy-in and engagement in existing quality, safety and emergency planning processes?

Activity	Level of Importance
Staff engagement in planning	
Management engagement	
Ongoing awareness	
Reviewing and exercising plans	
Other	

17) Is there anything else you would like to add?

Thank you!

MEMO

TO: BUSINESS PROCESS OWNER/MANAGER

FROM: GLENN WHIFFEN

SUBJECT: DEVELOPMENT OF A DISASTER RECOVERY PLAN (DRP) FOR HYDRO PLACE

DATE: APRIL 23, 2014

CC: MIKE WHELAN/PATRICK CURRAN

Part of my responsibility as Team Lead, Asset Management and Administration is to maintain the operational capacity of Hydro Place. I have been tasked with developing a Disaster Recovery Plan for Hydro Place and we are making progress. I have initiated the development of the (DRP) for our physical premises here at Hydro Place and have retained Planning Associate Pat Curran, CBCI of Resilient Business Continuity Planning to assist in completing the plan.

Part of Mr. Curran's work will be to assess the potential impact on the various business units operating at Hydro Place should an incident be realized. With your permission, in the coming days Mr. Curran will be in contact with you to conduct a short survey and/or to arrange a brief interview to discuss existing disaster/business recovery plans in place within your business unit. The objective is to complete a high level disaster recovery plan for Hydro Place that is integrated within existing plans at the business unit/process level, building emergency, safety and other plans/protocols that exist.

If you have any questions or require further information please contact me. Thank you for your anticipated assistance and cooperation in this vital planning process.

Regards,

Glenn Whiffen

Appendix B - Business Disruption Responses

Tab #	RV#	BDR #	Description
Building Level			
	16	**BDR 1**	High wind causing damage to roof
	16	**BDR 2**	Roof failure/rain
	15	**BDR 3**	Failure of water supply to building
	15	**BDR 4**	Failure of water supply in building (equipment)
	15	**BDR 5**	Break in water supply in building (interior flooding)
	15	**BDR 6**	Failure of main electrical transformers in building
	15	**BDR 7**	Failure of sewage/waste water outflow
	9	**BDR 8**	Failure of electrical supply to building
	5	**BDR 9**	Building fire
	5	**BDR 10**	Elevator (if more than 1 day)
	5	**BDR 11**	Failure of regional water supply
	5	**BDR 12**	Failure of generators
	4	**BDR 13**	High winds causing property damage (light poles, signage etc.)
	4	**BDR 14**	Grass/forest fire on or near property
	4	**BDR 15**	Failure of snow clearing contractor to clear parking lots and roadways
	4	**BDR 16**	Failure of cleaning contractor
	3	**BDR 17**	Storm drainage failure in heavy rain or snow melt
	3	**BDR 18**	Failure of HVAC in entire building
	3	**BDR 19**	Break in glycol system causing flooding
	3	**BDR 20**	Labour stoppage
	2	**BDR 21**	Failure of electrical supply from power grid
	1	**BDR 22**	Failure of cafeteria contractor
	1	**BDR 23**	Failure of waste disposal contractor
Floor Level			
	6	**BDR 24**	High winds causing damage to windows
	3	**BDR 25**	Failure of water supply
	3	**BDR 26**	Failure of panel boxes
	3	**BDR 27**	Failure of HVAC
	3	**BDR 28**	Failure of sewage/waste water system
Zone Level			
	6	**BDR 29**	High winds causing damage to windows
	3	**BDR 30**	Failure of panel boxes
	3	**BDR 31**	Failure of HVAC
	3	**BDR 32**	Failure of sewage/waste water system
Supply Chain and Administration			
	2	**BDR 33**	Mailroom Equipment
	2	**BDR 34**	Printing Equipment
	1	**BDR 35**	Limited Access to shipping/receiving

BDR 1	High wind causing damage to roof	RV 16
BDR Description/Background		
Incident History/Rationale	Recent weather events including Hurricane Igor in 2010 and tropical storm Leslie in 2012 have resulted in moderate to severe damage to commercial properties on the northeast Avalon. Following Hurricane Igor in 2010, Hydro Newfoundland officials identified impacts to the integrity of the roof system at Hydro Place with high winds responsible for shifting patio blocks and damaging other layers of roofing material.	
Anticipated Impacts (Hydro Place)	A repeat of this damage, if occurring in conjunction with heavy rains, could result in significant flooding within Hydro Place, particularly on those floors directly beneath the affected areas and potentially throughout the entire building if remediation measures were not implemented to address incoming water.	
Anticipated Impacts (business unit/process)	Impact high on those business units/processes directly beneath affected areas Assuming remediation measures undertaken, impact moderate on other business units/processes not in proximity to affected areas.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP) Nalcor Energy - Corporate Emergency Response Plan (CERP) EMS Disaster Recovery Plan (if affected area includes ECC)	
Duration of Impact	Duration of impact on areas directly affected contingent on assessment. Duration of impact on areas not directly impacted contingent on successful and ongoing remediation efforts.	
Building Closure	As per Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
Anticipated BDR resources include: Structural Engineering to assess condition of roof Roofing repairs Site remediation/restoration services		
Incident Notes		

BDR 2	Roof Failure/Rain	RV 16
BDR Description/Background		
Incident History/Rationale	Following Hurricane Igor in 2010, HNL officials identified impacts to the integrity of the roof system at Hydro Place with high winds responsible for shifting patio blocks and damaging other layers of roofing material.	
Anticipated Impacts (Hydro Place)	A roof system failure occurring in conjunction with heavy rains could result in significant flooding within Hydro Place, particularly on those floors directly beneath the affected areas and potentially throughout the entire building if remediation measures were not implemented to address incoming water.	
Anticipated Impacts (business unit/process)	Impact high on those business units/processes directly beneath affected areas Assuming remediation measures undertaken, impact moderate on other business units/processes not in proximity to affected areas.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP) Nalcor Energy - Corporate Emergency Response Plan (CERP) EMS Disaster Recovery Plan (if affected area includes ECC)	
Duration of Impact	Duration of impact on areas directly affected contingent on engineering structural assessment. Duration of impact on areas not directly impacted contingent on successful and ongoing remediation efforts.	
Building Closure	As per Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
Anticipated BDR resources include: Structural Engineering to assess condition of roof Roofing repairs Site remediation/restoration services		
Incident Notes		

BDR 3	Failure of water supply to building	RV 15
BDR Description/Background		
Incident History/Rationale	There is no known recent history of prolonged outage of water supply.	
Anticipated Impacts (Hydro Place)	Failure of main water supply to building would impact building systems including fire control/suppression system (sprinklers), water and sewer.	
Anticipated Impacts (business unit/process)	Impact on all business units/processes.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP) Nalcor Energy - Corporate Emergency Response Plan (CERP) EMS Disaster Recovery Plan (if affected area includes ECC)	
Duration of Impact	Until water is restored.	
Building Closure	As per Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
City of St. John's, Hubley's Plumbing, Tyco Simplex Grinnell, ADT Monitoring		
Incident Notes		

BDR 4	Failure of water supply equipment In building	RV 15
BDR Description/Background		
Incident History/Rationale	There is no known recent history of such an event.	
Anticipated Impacts (Hydro Place)	Failure of main water supply equipment in building would impact building systems including fire control/suppression system (sprinklers), water and sewer.	
Anticipated Impacts (business unit/process)	Impact on all business units/processes.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP) Nalcor Energy - Corporate Emergency Response Plan (CERP) EMS Disaster Recovery Plan (if affected area includes ECC)	
Duration of Impact	Until equipment failure is fixed and water is restored.	
Building Closure	As per Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
Hubley's Plumbing, site remediation contractor, Tyco Simplex Grinnell		
Incident Notes		

BDR 5	Break in water supply in building with flooding	RV 15
BDR Description/Background		
Incident History/Rationale	There is no known recent history of such an event.	
Anticipated Impacts (Hydro Place)	Break in water supply within building, with associated flooding, would potentially impact all systems situated in the basement. Break would necessitate water main shutoff to facilitate repairs, impacting other systems in the building, i.e. fire control/suppression, water and sewer	
Anticipated Impacts (business unit/process)	Impact on all business units/processes operating from the basement and dependent on extent of flood damage, potentially all other business units/processes contingent on building systems operating from the basement. Building systems impact due to water main shut off for repairs would impact all business units/processes for the duration of the shutoff.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP) Nalcor Energy - Corporate Emergency Response Plan (CERP) EMS Disaster Recovery Plan (if affected area includes ECC)	
Duration of Impact	Until break is fixed and water is restored.	
Building Closure	As per Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
Hubley's Plumbing , Tyco Simplex Grinnell Site remediation/restoration services		
Incident Notes		

BDR 6	Failure of main electrical transformers for building	RV 15
BDR Description/Background		
Incident History/Rationale	There has been one known event with the main transformer for the building. The building was closed for part of a day while investigation-repairs could be completed. A new transformer has since been installed and plans are progressing to have the previous unit in place as a standby.	
Anticipated Impacts (Hydro Place)	Failure in electrical supply to building would impact all building systems dependent on electricity.	
Anticipated Impacts (business unit/process)	Impact all business units/processes Necessitate switch to generators for ECC operations.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP) Nalcor Energy - Corporate Emergency Response Plan (CERP) EMS Disaster Recovery Plan (if affected area includes ECC)	
Duration of Impact	Until repairs are completed.	
Building Closure	As per Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
H&F Electric, Pennecon and potentially other General electrical contractors		
Incident Notes		

BDR 7	Failure of main sewage/waste water outflow	RV 15
BDR Description/Background		
Incident History/Rationale	There was an incident in the past two years that affected level one and subsequently all out flow lines from the building. Problem was traced to toilet tissue and vendor QA process.	
Anticipated Impacts (Hydro Place)	Failure in main sewage/waste water outflow would impact all waste water systems in the building	
Anticipated Impacts (business unit/process)	Impact on all business units/processes.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP) Nalcor Energy - Corporate Emergency Response Plan (CERP) EMS Disaster Recovery Plan (if affected area includes ECC) Hydro Place Environmental Emergency Response Manual (EERP)	
Duration of Impact	Until system is repaired.	
Building Closure	As per Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
City of St. John's Hubley's Plumbing Site Remediation Contractor, Bursey's Janitorial		
Incident Notes		

BDR 8	Failure of electrical supply to building	RV 9
BDR Description/Background		
Incident History/Rationale	In the past 10 years there have been two events. One related to a failure in the building main transformer and the other was related to storm conditions and related outages early in 2014.	
Anticipated Impacts (Hydro Place)	Failure in electrical supply to building would impact all building systems dependent on electricity.	
Anticipated Impacts (business unit/process)	Impact on all business units/processes. Necessitate switch to emergency power for ECC operations.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP) Nalcor Energy - Corporate Emergency Response Plan (CERP) EMS Disaster Recovery Plan (if affected area includes ECC)	
Duration of Impact	Until supply is restored.	
Building Closure	As per Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
TRO Operations staff to investigate, H&F Electric and potentially Pennecon		
Incident Notes		

BDR 9	Building Fire	RV 5
BDR Description/Background		
Incident History/Rationale	One small fire occurred on level 2 in the generator room on a holiday. The fire was isolated to one particular piece of equipment and extinguished quickly by SJRFD. The fire was on a holiday and resulted in local dirt-debris in the area of the fire and an odor of smoke which was confined to level 2. The building opened on the following day to conduct normal operations.	
Anticipated Impacts (Hydro Place)	A building fire, even if limited to a small area, could impact the entire building through smoke and associated smell.	
Anticipated Impacts (business unit/process)	Impact on all business units/processes.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP) Nalcor Energy - Corporate Emergency Response Plan (CERP) EMS Disaster Recovery Plan (if affected area includes ECC)	
Duration of Impact	Until fire is extinguished and remediation complete	
Building Closure	As per Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
St. John's Regional Fire Department Site remediation/restoration services, other disciplines as required.		
Incident Notes		

BDR 10	Failure of both elevators	RV 5
BDR Description/Background		
Incident History/Rationale	There is no known recent history of such an event.	
Anticipated Impacts (Hydro Place)	Failure in both elevators would impact all floors of the building except the main floor,	
Anticipated Impacts (business unit/process)	Impact on all business units/processes not located on the main floor, in particular impacting staff persons with disabilities and mobility impairments.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP) Nalcor Energy - Corporate Emergency Response Plan (CERP)	
Duration of Impact	Until elevator service is restored.	
Building Closure	As per Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
Thyssen Krupp or Otis Elevator as a backup service contractor		
Incident Notes		

BDR 11	Failure of regional water supply	RV 5
BDR Description/Background		
Incident History/Rationale	There is no known recent history of such an event.	
Anticipated Impacts (Hydro Place)	Failure of regional water supply to building would impact building systems including fire control/suppression system (sprinklers), water and sewer.	
Anticipated Impacts (business unit/process)	Impact on all business units/processes.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP) Nalcor Energy - Corporate Emergency Response Plan (CERP) EMS Disaster Recovery Plan (if affected area includes ECC)	
Duration of Impact	Until water is restored.	
Building Closure	Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
City of St. John's, Tyco Simplex Grinnell		
Incident Notes		

BDR 12	Failure of generators	RV 5
BDR Description/Background		
Incident History/Rationale	Early in 2014 there was an issue with a supporting system of the generators which caused the protection equipment to work as designed and shut the units down. The outage was less than one hour, supporting systems and PM programs have been enhanced to ensure a similar event is avoided in future wherever possible.	
Anticipated Impacts (Hydro Place)	n/a	
Anticipated Impacts (business unit/process)	Failure of backup generators would impact capacity of ECC operations to operate from Hydro Place in event of main electrical failure. Necessitate switch to Holyrood for backup ECC operations.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	EMS Disaster Recovery Plan (if affected area includes ECC)	
Duration of Impact	Until generators are repaired.	
Building Closure		
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
Glenn Nichols Engine Service, Newfoundland Caterpillar, Madsen Diesel and Turbine, Emerson Power and/or Schneider Electric, Internal engineering staff		
Incident Notes		

BDR 13	High winds causing property damage, i.e. flying debris, downed light poles, signage etc.	RV 4
BDR Description/Background		
Incident History/Rationale	There is no known recent history of such an event.	
Anticipated Impacts (Hydro Place)	Damage to property due to high winds would impact building parking areas and roadways.	
Anticipated Impacts (business unit/process)	All business units/processes would be impacted in light of NLH OHS programs where accessing the building and grounds might result in injury.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP)	
Duration of Impact	Until conditions improve and necessary repairs are completed.	
Building Closure	Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
EC Boone, H&F Electric, Clean Sweep Property Management		
Incident Notes		

BDR 14	Grass or forest fire on or near property	RV 4
BDR Description/Background		
Incident History/Rationale	There have been several small fires in our vacant lot in the past few years which were quickly identified and addressed by SJRFD.	
Anticipated Impacts (Hydro Place)	Grass or forest fire would impact access to building. Depending on wind direction, there may be intake of smoke in buildings HVAC system Depending on proximity of fire to building, building may be damaged	
Anticipated Impacts (business unit/process)	Grass or forest fire would impact access to building. Building may be forced to evacuate impacting all business units/processes	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP)	
Duration of Impact	Until fire is out or under control and/or emergency service providers advise that building can be accessed.	
Building Closure	As per Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
St. John's Regional Fire Department		
Incident Notes		

BDR 15	Failure of snow clearing contractor	RV 4
BDR Description/Background		
Incident History/Rationale	There is no known recent history of such an event.	
Anticipated Impacts (Hydro Place)	Failure of snow clearing contractor would impact access to building parking areas and roadways.	
Anticipated Impacts (business unit/process)	All business units/processes would be impacted in light of NLH OHS programs where accessing the building and grounds might result in injury.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP) Nalcor Energy - Corporate Emergency Response Plan (CERP) EMS Disaster Recovery Plan (if affected area includes ECC)	
Duration of Impact	Until parking areas and roadways are cleared.	
Building Closure		
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
James R Eales Equipment Rentals, Other local contractors as an emergency measure or contracted snow clearing company for Holyrood.		
Incident Notes		

PDR 16	Storm drain failure	RV 3
BDR Description/Background		
Incident History/Rationale	There is no known recent history of such an event.	
Anticipated Impacts (Hydro Place)	Potential impact on access to building, roadways and parking areas. Potential flooding.	
Anticipated Impacts (business unit/process)	Limited access to building would impact all business units/processes Flooding would impact affected areas	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP) Hydro Place Environmental Emergency Response Manual (EERP) – **Note addition of environmental plan here**	
Duration of Impact	Until drainage system is repaired and/or until weather/melt conditions subside	
Building Closure	As per Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
Crosbie Industrial Services, Pardy's Services, City of St. John's, Civil contractor Modern Paving or Pyramid Construction.		
Incident Notes		

BDR 17	Failure of HVAC in entire building	RV 3
BDR Description/Background		
Incident History/Rationale	There is no known recent history of such an event.	
Anticipated Impacts (Hydro Place)	Dependant on time of year and weather conditions (excessive heat or cold) Damage to temperature/climate sensitive equipment Deteriorating air quality over time	
Anticipated Impacts (business unit/process)	All business units/process would be impacted.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP)	
Duration of Impact	Until repairs undertaken	
Building Closure	Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
Johnson Controls Inc.		
Incident Notes		

BDR 18	Break/leak in glycol system for HVAC	RV 3
BDR Description/Background		
Incident History/Rationale	There has been one known event in the past 10 years. It was isolated to level 1 mechanical room, condenser-water loop and was contained before any major damaged occurred.	
Anticipated Impacts (Hydro Place)	Depending on location of break/leak, flooding would impact immediate floor where leak occurred and eventually lower levels through seepage unless contained If break occurred in basement, volume of glycol in system would cause considerable flooding Risk of glycol entering municipal storm drainage systems/environmental containment necessary	
Anticipated Impacts (business unit/process)	All business units/process would be impacted through shutdown of HVAC system to facilitate repairs and cleanup. Depending on location of break/leak, business units/processes in close proximity would be impacted to facilitate repairs and cleanup.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP) Hydro Place Environmental Emergency Response Manual (EERP) – **Note addition of environmental plan here**	
Duration of Impact	Until repairs and cleanup undertaken	
Building Closure	As per Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources Suppliers -		
Hazardous Materials Handling and Disposal - Crosbie Industrial or Pardy's Services Site Remediation and Restoration Services, Department of Environment, Internal Environmental Staff, Johnson Controls Inc. Pennecon as a backup.		
Incident Notes		

BDR 19	Failure of cleaning contractor	RV 3
BDR Description/Background		
Incident History/Rationale	There is no known recent history of such an event.	
Anticipated Impacts (Hydro Place)	Failure of cleaning contractor would impact the entire building	
Anticipated Impacts (business unit/process)	All business units/processes would be impacted	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP) Hydro Place Environmental Emergency Response Manual (EERP) – **Note addition of environmental plan here**	
Duration of Impact	Until cleaning services restored	
Building Closure	As per Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
Bursey's Cleaning or other local firm to continue services		
Incident Notes		

BDR 20	Labour Stoppage	RV 3
BDR Description/Background		
Incident History/Rationale	There is no known recent history of such an event.	
Anticipated Impacts (Hydro Place)	Impeded access of staff/contractors to building	
Anticipated Impacts (business unit/process)	As above	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Nalcor Energy - Corporate Emergency Response Plan (CERP)	
Duration of Impact	Duration of labour stoppage or until normal/less restricted access restored	
Building Closure	As per Nalcor Energy - Corporate Emergency Response Plan (CERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
n/a		
Incident Notes		

BDR 21	Failure of electrical supply to building	RV 2
BDR Description/Background		
Incident History/Rationale	In the past 10 years there have been two events. One related to a failure in the building main transformer and the other was related to storm conditions and related outages early in 2014.	
Anticipated Impacts (Hydro Place)	Failure in electrical supply from grid would impact all building systems dependent on electricity.	
Anticipated Impacts (business unit/process)	Impact on all business units/processes. Necessitate switch to emergency power for ECC operations.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP) Nalcor Energy - Corporate Emergency Response Plan (CERP) EMS Disaster Recovery Plan (if affected area includes ECC)	
Duration of Impact	Until supply is restored.	
Building Closure	As per Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
Newfoundland Power, H&F Electric and/or Pennecon and internal electrical staff		
Incident Notes		

BDR 22	Failure of cafeteria contractor	RV 1
BDR Description/Background		
Incident History/Rationale	There is no known recent history of such an event.	
Anticipated Impacts (Hydro Place)	Staff would have no access to cafeteria services	
Anticipated Impacts (business unit/process)	n/a	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Nalcor Energy - Corporate Emergency Response Plan (CERP)	
Duration of Impact	Until cafeteria services restored	
Building Closure	n/a	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
A Taste of Class or other catering company as required.		
Incident Notes		

BDR 23	Failure of waste disposal contractor	RV 1
BDR Description/Background		
Incident History/Rationale	There is no known recent history of such an event.	
Anticipated Impacts (Hydro Place)	Failure of waste management contractor would impact timely disposal of waste from waste bins etc. Overall impact to the building would be low.	
Anticipated Impacts (business unit/process)	Impact on business units/processes would be low.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Environmental Emergency Response Manual (EERP) – **Note addition of environmental plan here**	
Duration of Impact	Until waste disposal restored	
Building Closure	n/a	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
Green For Life or other local waste management contractor		
Incident Notes		

BDR 24	High wind causing damage to windows (by floor)	RV 6
BDR Description/Background		
Incident History/Rationale	Recent weather events including Hurricane Igor in 2010 and tropical storm Leslie in 2012 have resulted in moderate to severe damage to commercial properties on the northeast Avalon.	
Anticipated Impacts (Hydro Place)	A repeat of this damage, if occurring in conjunction with heavy rains, could result in significant damage and flooding within Hydro Place.	
Anticipated Impacts (business unit/process)	Impact high on those business units/processes directly adjacent to damaged windows. Assuming remediation measures undertaken, impact moderate on other business units/processes not in proximity to affected areas.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP) Nalcor Energy - Corporate Emergency Response Plan (CERP) EMS Disaster Recovery Plan (if affected area includes ECC)	
Duration of Impact	Duration of impact on areas directly affected contingent on assessment. Duration of impact on areas not directly impacted contingent on successful and ongoing remediation efforts.	
Building Closure	As per Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
Window/Glass Supplier – PPG, Thomas Glass Site Remediation Service		
Incident Notes		

BDR 25	Failure of water by floor	RV 3
BDR Description/Background		
Incident History/Rationale	There is no known recent history of such an event.	
Anticipated Impacts (Hydro Place)	Failure of water supply on floor would necessitate use of washroom facilities on other floors	
Anticipated Impacts (business unit/process)	n/a	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	n/a	
Duration of Impact	Until system is repaired.	
Building Closure	n/a	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
Hubley's Plumbing Limited		
Incident Notes		

BDR 26	Failure of panel boxes (by floor)	RV 3
BDR Description/Background		
Incident History/Rationale	There is no known recent history of such an event.	
Anticipated Impacts (Hydro Place)	Floor level impacts only	
Anticipated Impacts (business unit/process)	Impact all business units/processes on impacted floor	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP)	
Duration of Impact	Until repairs are completed.	
Building Closure	As per Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
H&F Electric		
Incident Notes		

BDR 27	Failure of HVAC by floor	RV 3
BDR Description/Background		
Incident History/Rationale	There is no known recent history of such an event.	
Anticipated Impacts (Hydro Place)	Dependant on time of year and weather conditions (excessive heat or cold) Damage to temperature/climate sensitive equipment Deteriorating air quality over time	
Anticipated Impacts (business unit/process)	All business units/process would be impacted.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP)	
Duration of Impact	Until repairs undertaken	
Building Closure	Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
Johnson Controls Inc.		
Incident Notes		

BDR 28	Failure of sewage/waste water by floor	RV 3
BDR Description/Background		
Incident History/Rationale	In the past two years there was one issue which was traced to a toilet tissue and related vendor QA process. A blockage on level one was noted and addressed within several hours. There was an interruption in washroom usage throughout the building for a period while work was ongoing.	
Anticipated Impacts (Hydro Place)	Failure sewage/waste water outflow on floor would necessitate use of washroom facilities on other floors	
Anticipated Impacts (business unit/process)	n/a	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	n/a	
Duration of Impact	Until system is repaired.	
Building Closure	n/a	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
Hubley's Plumbing Limited.		
Incident Notes		

BDR 29	High wind causing damage to windows (by zone)	RV 6
BDR Description/Background		
Incident History/Rationale	Recent weather events including Hurricane Igor in 2010 and tropical storm Leslie in 2012 have resulted in moderate to severe damage to commercial properties on the northeast Avalon.	
Anticipated Impacts (Hydro Place)	A repeat of this damage, if occurring in conjunction with heavy rains, could result in significant damage and flooding within Hydro Place.	
Anticipated Impacts (business unit/process)	Impact high on those business units/processes directly adjacent to damaged windows. Assuming remediation measures undertaken, impact moderate on other business units/processes not in proximity to affected areas.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP) Nalcor Energy - Corporate Emergency Response Plan (CERP) EMS Disaster Recovery Plan (if affected area includes ECC)	
Duration of Impact	Duration of impact on areas directly affected contingent on assessment. Duration of impact on areas not directly impacted contingent on successful and ongoing remediation efforts.	
Building Closure	As per Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
Window/Glass Supplier - PPG or Thomas Glass Site Remediation Services		
Incident Notes		

BDR 30	Failure of panel boxes (by floor)	RV 3
BDR Description/Background		
Incident History/Rationale	There is no known recent history of such an event.	
Anticipated Impacts (Hydro Place)	Zone level impacts only	
Anticipated Impacts (business unit/process)	Impact all business units/processes on impacted zones	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP)	
Duration of Impact	Until repairs are completed.	
Building Closure	As per Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
H&F Electric		
Incident Notes		

BDR 31	Failure of HVAC by zone	RV 3
BDR Description/Background		
Incident History/Rationale	There is no known recent history of such an event.	
Anticipated Impacts (Hydro Place)	Dependant on time of year and weather conditions (excessive heat or cold) Damage to temperature/climate sensitive equipment Deteriorating air quality over time	
Anticipated Impacts (business unit/process)	All business units/process would be impacted.	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	Hydro Place Emergency Response Plan (ERP)	
Duration of Impact	Until repairs undertaken	
Building Closure	Hydro Place Emergency Response Plan (ERP)	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
Johnson Controls Inc.		
Incident Notes		

BDR32	**Failure of sewage/waste water by floor**	**RV 3**
BDR Description/Background		
Incident History/Rationale	In the past two years there was one issue which was traced to a toilet tissue and related vendor QA process. A blockage on level one was noted and addressed within several hours. There was an interruption in washroom usage throughout the building for a period while work was ongoing.	
Anticipated Impacts (Hydro Place)	Failure sewage/waste water outflow on zone would necessitate use of washroom facilities in other zones and floors, could result in building closure.	
Anticipated Impacts (business unit/process)	n/a	
BDR Invocation/Activation		
Invocation/Activation Authority	As per Sections 1.7 and 4.3	
Integration with Other Plans	n/a	
Duration of Impact	Until system is repaired.	
Building Closure	n/a	
Incident Command System	As per Sections 1.7 and 4.3	
Anticipated BDR Resources		
Hubley's Plumbing, OHS department and site remediation contractor		
Incident Notes		

Appendix C - Alternative Locations within Hydro Place

ROOM NAME	FLOOR	CAPACITY
Upper Salmon	LEVEL 1	**35**
Bay D'Espoir Room	LEVEL 1	**50**
Granite Canal	LEVEL 1	**8**
Public Tender Room	LEVEL 2	**12**
Conference Room 1	LEVEL 2	**10**
Conference Room 2	LEVEL 2	**12**
ECC Boardroom	LEVEL 2	**18**
Meeting Room 1	LEVEL 2	**8**
HROE Interview Room	LEVEL 2	**6**
HROE Meeting Room	LEVEL 2	**12**
Conference Room 1	LEVEL 3	**14**
Conference Room 2	LEVEL 3	**12**
Conference Room 3	LEVEL 3	**16**
Meeting Room 1	LEVEL 3	**4**
Conference Room 1	LEVEL 4	**10**
Conference Room 2	LEVEL 4	**10**
Conference Room 3	LEVEL 4	**10**
Conference Room 4	LEVEL 4	**10**
Conference Room 5	LEVEL 4	**6**
Conference Room 1, Petroleum Club	LEVEL 5	**12**
Energy Marketing Meeting Room	LEVEL 5	**6**
Boardroom	LEVEL 6	**25**

Appendix D - Alternative Locations outside Hydro Place

Hotels

HOTEL NAME	LOCATION	CONTACT
CAPITAL HOTEL	KENMOUNT ROAD, ST. JOHN'S	709-738-4480
COMFORT INN	AIRPORT ROAD, ST. JOHN'S	709-753-3500
COURTYARD BY MARRIOTT	DUCKWORTH STREET, ST. JOHN'S	709-722-6636
DELTA ST JOHN'S HOTEL	NEW GOWER STREET, ST. JOHN'S	709-739-6404
HAMPTON INN & SUITES	STAVANGER DRIVE, ST. JOHN'S	709-738-4888
HOLIDAY INN	PORTUGAL COVE ROAD, ST. JOHN'S	709-722-0506
QUALITY HOTEL	HILL O'CHIPS, ST. JOHN'S	709-754-7788
RAMADA	KENMOUNT ROAD, ST. JOHN'S	709-722-9330
SHERATON HOTEL NEWFOUNDLAND	CAVENDISH SQUARE, ST. JOHN'S	709-726-4980
SUPER 8 MOTEL	HIGGINS LINE	709-739-8888
TRAVELLERS INN	KENMOUNT ROAD, ST. JOHN'S	709-722-5540

Commercial Real Estate Companies

COMPANY	CONTACT
ATLANTIC PROPERTY MANAGEMENT LIMITED	709-722-3800
BAINE JOHNSTON CORP.	709-576-1780
BURKE REALTY	709-757-3721
CHARTER GROUP INC	709-746-5959
EAST PORT PROPERTIES	709-738-4100
FORTIS PROPERTIES CORP	709-737-2800
GENTARA CO LTD	709-753-0442
MARITIME REALTY	709-579-1989
MARTEK MORGAN FINCH	709-754-1090
PERENNIAL MANAGEMENT LIMITED	709-754-2057

Other

In the event of a business disruption, Supply Chain and Administration would utilize other Nalcor Energy facilities in the Avalon region.

Appendix E - Supplier Listing

HYDRO PLACE OPERATIONAL CONTACTS FOR BUILDING OPERATIONS AND ADMINISTRATION						
LAST UPDATED: APRIL 21, 2013						
RESOURCE	**CONTRACTOR NAME/CONTACT**	**CONTACT**	**BUSINESS**	**CELLULAR**	**FAX**	**EMAIL**
Anticipated BDR Resources						
Boom Truck	Holden's Transport	n/a	709 368 3539			
Boom Truck	Billard's Trucking	n/a	709 368 2211			
Cafeteria Services	A Taste of Class	Carolyn Young	709 753 2352 ext. 103		709 753 6690	carolyn@ygoc.ca
Cleaning/Janitorial	Bursey's Cleaning	Rosanne Jones	709-722-9576			bursey@nf.aibn.com
Diesel Generation Engine Service	Glenn Nichols Engine Service	Glenn Nichols	n/a	709 631 2808		glennhdnichols@hotmail.com
Diesel Generator/MCC Service	Madsen Diesel & Turbine	Cameron Spracklin	709 747 7090	709 770 8107	709 747 7093	Cameron.Spracklin-Reid@vikingpower.ca
Electrical Repairs/Upgrades	H&F Electric	Ron Finlay	709 782 3604	709 687 1042	709 782 2074	rfinlay@hfelectrical.ca
Elevator Maintenance Services	Thyssen Krupp	Nina Price-Hussey	709 739 4038	709 689 8409	709 739 0130	nina.hussey@thyssenkrupp.com
Genset Breaker Maintenance & Repair	Schneider Electric	Stephen Moore	902 450 0369	902 802 8659	859 334 9910	stephen.moore@ca.schneider-electric.com
Genset Transfer Switch Maintenance	ASCO/Emerson Network Power	Eric Paquin-Lachance	514 337 2790 ext. 23242	450 275 0480	514 333 1968	Eric.PaquinLachance@emerson.com
Hazardous Materials Handling & Disposal	Newalta	n/a	709 834 7350		709 834 7332	
Heavy Mechnical/Electrical	Pennecon Technical Services	Jim Beaton	709 726 4554	709 699 3350	709 753 6996	jbeaton@pennecon.com
HVAC Maintenance & Repair	Johnson Controls Inc.	Jason Hinks	709 579 5515	709 690 0600	709 579 9015	jason.n.hinks@jci.com
Plumbing	Hubley's Plumbing	Gary Hubley	709 726 2552	709 682 2469		
Roofing Repairs/Maintenance	Flynn Canada	Anthony Upwards	709 739 9006	709 693 8067	709 739 9007	
Site Remediation/Restoration Services	Belfour-Powervac	Brian Critch	709 781 3264		709 781 3265	bcritch@ca.belfor.com
Site Remediation/Restoration Services	Winmar	n/a	709 754 9111		709 754 9311	
Snow Clearing	James R Eales Equipment Rentals	Jim Eales	709 368 3733	709 685 0041		
Vacuum Truck Services	Crosbie Industrial Services	n/a	709 722 8212	709 685 4041	709 739 0602	
Vacuum Truck Services	Pardy's Waste Management	n/a	709 368 4350		709 747 0394	warrenpardy@pardyswaste.com

	Services					
Waste Disposal	Waste Management	n/a	709 753 3030		709 753 3624	
Water treatment/HVAC Equipment Cleaning	Chemaqua	Larry Gray	800 268 0838	709 725 1151	800 795 4755	larry.gray@chemaqua.com
Window/Glass Repair/service	Thomas Glass	n/a	709 722 0234		709 722 1668	
Other Resources						
Airline/Air Freight Carrier	Provincial Airlines	Connie Fillier	709 576 1710	709 682 4272		cfillier@provair.com
Airline/Air Freight Carrier	Air Canada	Susan Grant	902 462 8911			susan.a.grant@aircanada.ca
Airline Carrier	Porter Airlines	Christine Mackinzie	902 407 3670	902 293 6897	902 407 3671	christine.mackenzie@flyporter.com
Auctioneering Services	Fitzpatricks	n/a	709 722 5865		709 722 9612	auctioncenter@nfld.net
Card Access System	Johnson Controls Inc.	Paul Noseworthy	866 283 5746	709 631 0598	709 579 9015	paul.j.noseworthy@jci.com
Cardboard Recycling	Waste management	n/a	709 753 3030		709 753 3624	
Courier Service Local	Millennium Courier	n/a	709 747 7874		709 747 7876	info@millenniumexpressltd.ca
Courier Services Provincial/National	Sameday Courier	Victoria Barnes	709 747 8107	709 728 5367		victoria.barnes@sameday.ca
Daycare Services	Fundamentals Learning Center	Ronnie	709 753 2220	709 728 8151		
Duct work/Kitchen Range Hood Cleaning	Belfour-Powervac	Brian Critch	709 781 3264		709 781 3265	bcritch@ca.belfor.com
Fire Alarm Panel/Supression Systems	Tyco-Simplex Grinnell	Derek Connolly	709 745 6666	709 687 6989	709 745 5669	deconnolly@simplexgrinnell.com
Forklift maintenance & repair	Glenn Nichols Engine Service	Glenn Nichols	n/a	709 631 2808		glennhdnichols@hotmail.com
Freight Transport	Day & Ross	Peter Batstone	709 368 0135		709 368 0134	pcbatsto@dayandrossinc.ca
Interior Repairs/Construction	Leo Keating Limited	Leo Keating	709 437 5856	709 682 8038		
Interior Repairs/Construction	TGW Maintenance	Gord Taylor	709 237 1457	709 691 9998		gwtaylor@nl.rogers.com
Landscaping	Murrays Horticultural	Debbie Preston	709 895 2800			
Lawn Maintenance	Nutrilawn	Boyd Loveless	709 437 9200			
Locksmith Services/door repairs	ACE Locksmithing	Dave Byrne	709 895 7700	709 730 7700		acelocks@nf.sympatico.ca
Mailing Equipment/postage meter	Pitney Bowes	Mark Butler	709 754 0148		709 754 3019	Mark.Butler@pb.com
Mail/Express postal	Canada Post Corp	Duane Mills	709 758 1001	709 743 5597	709 758 1057	duane.mills@canadapost.postescanada.ca

Metal Work/Fabrication	Steelfab Industries	Bill Parsons	709 782 3310			
Metal Work/Fabrication	Harty's Industries	Dave Harty	709 747 3040	709 728 2444	709 745 0995	
Moving Services	Hoytt's Moving and Storage	Anita O'Donnell	709 748 4518			
Office Supplies	Staples Advantage	Susan Matthews	709 748 6308	709 746 9083	709 364 6356	susan.matthews@staples.com
Parking lot markings/signage	Clean Sweep Propoerty Maintenance	Jim Nolan	709 747 4000	709 682 6400	709 747 4202	cleansweep@nf.aibn.com
Paper Shredding	IPS Information Protection Service	Greg Aylward	709 782 4200			gaylward@nl.rogers.com
Pest Control Services	Cabot Pest Control	Ken Pretty	709 753 7378		709 753 7372	cabotpestcontrol@nl.rogers.com
Printer/Copier parts and service	Xerox/Eastern Region Business	Tracy Shave	709 722 9392		709 722 0513	tshave@erbs.nf.ca
Printer Toner	Kel Tech Laser	n/a	709 726 2629			
Printing/stationary/bus forms	Modern Printing Services	Maurice Collins	709 739 5064			csr@mpscopycenter.ca
Printing/stationary/bus forms	Kwik Copy	Tony Cox	709 754 3366			
Printing/stationary/bus forms	Morgans Printing	n/a	709 258-6320		709 258 5142	
Sanitary Supplies	Big Eric's	George Butland	709 778 2761	709 690 7616	709 579 2707	gbutland@bigerics.com
Security Services	Northeastern Protection	Chris Joseph	902 435 1336	902 471 9555	902 435 2110	cjoseph@protectionpartner.ca
Signage Services	E.C. Boone Limited	Perry Dawe	709 726 4610			
System/Office Furniture	Superior Office	Don Patten/Frank Lannon	709 753 3490	709 727 6775	709 753 1682	don@superioroffice.ca
Taxi Services	City Wide Taxi	n/a	709 722 0003			
Taxi Services	Bugden's Taxi	n/a	709 726 4400			
Taxi Services	Jiffy Cabs	n/a	709 722 2222			
Travel Agency	Carlson Wagonlit Travel	Charlotte Barbour	709 726 8188	709 682 0982	709 726 6013	cbarbour@harveystravel-cwt.com
No. 6 Testing and Measurement	Amspec Services	Ryan Matheson	902 464 1500	902 209 3202	902 464 0999	
No. 6 Testing and Measurement	Quantum Services	John Frampton	709 463 5888			
No. 6 Fuel Supply	Trafigura	Denis Garcia	832 203 6400	832 628 3721	832 203 6401	denis.garcia@trafigura.com