newfoundland labrador hydro
a nalcor energy company

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March 2, 2020

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 of Corporate Services & Board Secretary

Dear Ms. Blundon:

Re: Capital Expenditures and Carryover Report for the Year Ending December 31, 2019

Enclosed please find one original and eight copies of Newfoundland and Labrador Hydro's ("Hydro") Capital Expenditures and Carryover Report for the Year Ending December 31, 2019 ("Report").

This Report is filed pursuant to Board Order No. P.U. 46(2018) and provides information on Hydro's capital expenditures for all projects proposed and approved as part of the 2019 Capital Budget Application. The Report also provides information on capital expenditures related to additional Supplemental Capital Budgets approved by the Board as noted within the Report. As per the Capital Budget Application Guidelines (Policy No. 1900.6–October 2007), the Report provides details and explanations regarding the reportable variances between budgeted and actual expenditures for projects with expenditures in the 2019 calendar year. It also provides a listing of funds carried over to future years and specific details regarding the execution of the Remove Safety Hazards project and various In-Service Failures projects.

Should you have any questions, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO

Shirley A. Walsh
Senior Legal Counsel, Regulatory
SAW/sk

Encl.

cc: **Newfoundland Power**
Mr. Gerard M. Hayes

Consumer Advocate
Mr. Dennis M. Browne, Q.C, Browne Fitzgerald Morgan & Avis

Industrial Customer Group
Mr. Paul L. Coxworthy, Stewart McKelvey
Mr. Denis J. Fleming, Cox & Palmer
Mr. Dean A. Porter, Poole Althouse

ecc: **Board of Commissioners of Public Utilities**
Ms. Jacqui Glynn
PUB Official Email

Newfoundland Power
Ms. Kelly C. Hopkins
Regulatory Email

Consumer Advocate
Mr. Stephen F. Fitzgerald, Browne Fitzgerald Morgan & Avis
Ms. Sarah G. Fitzgerald, Browne Fitzgerald Morgan & Avis
Ms. Bernice Bailey, Browne Fitzgerald Morgan & Avis

Iron Ore Company of Canada
Mr. Gregory A.C. Moores, Stewart McKelvey

Labrador Interconnected Group
Mr. Senwung Luk, Olthuis Kleer Townshend LLP
Ms. Julia Brown, Olthuis Kleer Townshend LLP

Capital Expenditures and Carryover Report for the Year Ending December 31, 2019

March 2, 2020

A report to the Board of Commissioners of Public Utilities

newfoundland labrador hydro
a nalcor energy company

Contents

1.0 Capital Expenditure Overview

During 2019, Newfoundland and Labrador Hydro ("Hydro") invested $126.6 million for the execution of capital projects to contribute to the provision of safe, reliable, least-cost electricity to customers. Expenditures to maintain the hydraulic generation equipment and infrastructure across the province totaled $21.2 million, including $2.6 million to refurbish powerhouse station services in Bay d'Espoir and $8.9 million for year one in the Hydraulic Generation Refurbishment and Modernization (2019–2020) project. The thermal generation equipment and infrastructure at the Holyrood Thermal Generating Station ("Holyrood TGS") required expenditures totalling $8.7 million, with the most material expenditure of $2.9 million in the Condition Assessment and Miscellaneous Upgrades project. Gas turbines required $6.4 million in expenditures, over half of which ($3.6 million) was for the Increase Fuel and Water Treatment System Capacity project for the Holyrood Gas Turbine. Sustaining capital for terminal station infrastructure totalled $31.1 million, including $7.9 million in the Upgrade Circuit Breakers project and $9.6 million in the Terminal Station Refurbishment and Modernization (2018–2019) project. In transmission, the Wood Pole Line Management Program continued in 2019, with $2.9 million invested.

This report includes details on the capital expenditures and reportable variances for 2019 and project carryovers to 2020. Actual expenditures in Hydro's overall capital program for 2019 were below budget by $37.6 million (22.9%). Additional information regarding analysis of the variance is included in Section 5.0.

2.0 Capital Expenditures and Variance Summary

Table 1 provides a summary of Hydro's capital expenditures by year for the period 2014–2019 for all capital projects that were active in 2019, and Table 2 provides a breakdown of the summary by asset type.

Table 1: 2019 Capital Expenditures by Year ($000)

	Capital Budget[1]									Actual Expenditure and Forecast									Variance	
	A				B	C	D (B+C)	E	F (A+C+E)	G				H	I	I	J	K (G+H+I+J)	K-F	H-D
Summary	2015	2016	2017	2018	Carryover to 2019	Original 2019	Revised 2019	2020 and Beyond	Total	2015	2016	2017	2018	2019	2020 and Beyond	Carryover to 2020	Total	Project Variance	Annual Variance
2019 Projects	-	-	-	-	-	72,505.3	72,505.3	45,264.2	**117,769.5**	-	-	-	-	65,036.8	43,724.0	3,479.2	**112,240.0**	(5,529.5)	(7,468.5)
2018 Projects	-	-	-	53,107.8	22,217.3	49,813.2	72,030.5	3,715.0	**106,636.0**	-	-	-	29,951.3	43,096.4	3,715.0	13,020.8	**89,783.5**	(16,852.5)	(28,934.1)
2017 Projects	-	-	14,335.8	23,549.2	6,382.5	2,337.6	8,720.1	1,429.6	**41,652.2**	-	-	7,605.7	13,857.8	7,149.4	1,429.6	189.5	**30,232.0**	(11,420.2)	(1,570.7)
2016 Projects	-	8,708.0	18,374.1	21,725.3	2,293.4	6,597.3	8,890.7	11,116.8	**66,521.5**	-	6,346.5	12,429.4	25,603.9	10,030.9	11,116.8	2,220.5	**67,748.0**	1,226.5	1,140.2
2015 Projects	22.7	522.5	-	-	331.2	-	331.2	-	**545.2**	137.0	128.6	26.0	373.9	385.5	-	-	**1,051.0**	505.8	54.3
2014 Projects	4,403.0	75,284.3	194,552.4	17,418.3	1,716.2	-	1,716.2	-	**291,658.0**	2,018.2	59,317.8	213,663.7	10,942.1	875.9	-	-	**286,817.7**	(4,840.3)	(840.3)
Grand Total	**4,425.7**	**84,514.8**	**227,262.3**	**115,800.6**	**32,940.6**	**131,253.4**	**164,194.0**	**61,525.6**	**624,782.4**	**2,155.2**	**65,792.9**	**233,724.8**	**80,729.0**	**126,574.9**	**59,985.4**	**18,910.0**	**587,872.2**	**(36,910.2)**	**(37,619.1)**

[1] Annual budgets previous to 2019 pertain to projects that have expenditures in 2018.

2019 Capital Budget Approved by Board Order No. P.U. 46(2018)	116,140.7
New Project Approved by Board Order No. P.U. 38(2018)	220.1
New Project Approved by Board Order No. P.U. 7(2019)	600.0
New Project Approved by Board Order No. P.U. 9(2019)	12,586.4
New Project Approved by Board Order No. P.U. 22(2019)	673.8
New Project Approved by Board Order No. P.U. 28(2019)	225.5
New Project Approved by Board Order No. P.U. 33(2019)	393.5
2019 New Projects under $50,000 Approved by Hydro	413.4
Total Approved Capital Budget Before Carryovers	**131,253.4**
Carryover Projects 2018 to 2019	32,940.6
Total Approved Capital Budget	**164,194.0**

Table 2: Total Capital Variance Summary by Asset Type ($000)[1]

Asset Type	Board Approved Budget	Total Project Expenditures and Forecast	Variance
Hydraulic	62,311	58,368	(3,943)
Thermal	7,434	8,825	1,391
Gas Turbines	27,611	20,409	(7,202)
Terminal Stations	143,844	122,771	(21,073)
Transmission	294,125	289,691	(4,434)
Distribution	18,417	16,759	(1,658)
Rural Generation	28,721	29,033	312
Properties	2,448	1,854	(594)
Metering	196	178	(18)
Rural Systems Tools and Equipment	2,043	2,026	(17)
Information Systems	1,597	1,444	(153)
Telecontrol	5,485	5,599	114
Transportation	4,264	4,264	-
Administrative	949	839	(110)
Allowance for Unforeseen	1,600	1,276	(324)
Supplemental Projects	23,324	24,159	835
Projects Approved for less than $50,000	413	377	(36)
Total Capital Budget	**624,782**	**587,872**	**(36,910)**

3.0 Capital Expenditures by Category

Table 1 through Table 16 provide Hydro's Capital Expenditures by category including:

- Hydraulic Generation;
- Thermal Generation;
- Gas Turbine Generation;
- Terminal Stations;
- Transmission;
- Distribution;
- Rural Generation;
- Properties;

[1] The Total Capital includes all projects initiated between 2014 and 2019 that had 2019 expenditures. This includes projects completed in 2019 and those that continue through 2020 and beyond. Please refer to Table 1.

- Metering;
- Tools and Equipment;
- Information Systems;
- Telecontrol projects;
- Transportation;
- Administration;
- Allowance for Unforeseen Items;
- Supplemental Capital projects; and
- Projects less than $50,000.

Table 3: 2019 Capital Expenditures: Hydraulic Generation ($000)

	Capital Budget									Actual Expenditure and Forecast								Variance		
	A				B	C	D (B+C)	E	F (A+C+E)	G				H	I	J	K (G+H+I)	K-F	H-D	
	2015	2016	2017	2018	Carryover to 2019	Original 2019	Revised 2019	2020 and Beyond	Total	2015	2016	2017	2018	2019	2020 and Beyond	Carryover to 2019	Total	Project Variance	Annual Variance	Notes
2019 Projects																				
Hydraulic In-Service Failures	-	-	-	-	-	1,250.0	1,250.0	-	**1,250.0**	-	-	-	-	1,374.4	-	-	**1,374.4**	124.4	124.4	1
Hydraulic Generation Refurbishment and Modernization - Various Sites	-	-	-	-	-	10,313.6	10,313.6	5,486.5	**15,800.1**	-	-	-	-	8,893.9	5,486.5	1,876.0	**16,256.4**	456.3	(1,419.7)	2
Purchase Tools and Equipment less than $50,000	-	-	-	-	-	133.50	133.5	-	**133.5**	-	-	-	-	124.4	-	-	**124.4**	(9.1)	(9.1)	
2018 Projects																				
Install Remote Operation of Salmon Spillway - Bay d'Espoir	-	-	-	645.9	(239.5)	1,862.5	1,623.0	-	**2,508.4**	-	-	-	885.4	933.0	-	-	**1,818.4**	(690.0)	(690.0)	3
Refurbish Backfill on Penstock #1 - Bay d'Espoir	-	-	-	1,630.4	1,567.2	-	1,567.2	-	**1,630.4**	-	-	-	63.2	11.5	-	-	**74.7**	(1,555.7)	(1,555.7)	4
Energy Efficiency Improvements - Various Sites	-	-	-	276.2	66.4	168.9	235.3	-	**445.1**	-	-	-	209.8	178.0	-	-	**387.8**	(57.3)	(57.3)	
Hydraulic Generation Refurbishment and Modernization - Various Sites	-	-	-	10,325.4	2,578.7	4,283.1	6,861.8	-	**14,608.5**	-	-	-	5,856.3	3,367.7	-	3,160.5	**12,384.4**	(2,224.1)	(3,494.1)	5
2017 Projects																				
Refurbish Powerhouse Station Services - Bay d'Espoir	-	-	413.2	2,473.3	1,840.0	1,460.6	3,300.6	-	**4,347.1**	-	-	43.0	1,003.5	2,643.4	-	157.2	**3,847.1**	(500.0)	(657.2)	6
Replace Exciter Controls Units 1 to 6 - Bay d'Espoir	-	-	119.2	921.2	9.3	877.0	886.3	1,429.6	**3,347.0**	-	-	182.7	628.9	853.9	1,429.6	32.4	**3,127.5**	(219.5)	(32.4)	
Replace Slip Rings Units 1 to 6 - Bay d'Espoir	-	-	312.6	159.7	352.7	-	352.7	-	**472.3**	-	-	102.4	17.2	181.6	-	-	**301.2**	(171.1)	(171.1)	7
Control Structure Refurbishments	-	-	1,735.3	452.9	144.1	-	144.1	-	**2,188.2**	-	-	991.4	709.3	226.9	-	-	**1,927.6**	(260.6)	82.8	8
2016 Projects																				
Upgrade Work - Cat Arm	-	558.3	1,353.0	-	30.3	-	30.3	-	**1,911.3**	-	240.4	760.6	1,376.3	193.7	-	-	**2,571.0**	659.7	163.4	9
Rehabilitate Shoreline Protection - Cat Arm	-	112.2	1,030.7	-	888.0	-	888.0	-	**1,142.9**	-	104.7	61.0	89.2	(254.9)	-	-	**0.0**	(1,142.9)	(1,142.9)	10
Replace Site Facilities - Bay d'Espoir	-	928.3	4,736.3	6,316.7	904.4	-	904.4	-	**11,981.3**	-	270.4	2,231.6	8,574.9	2,045.0	-	-	**13,121.9**	1,140.6	1,140.6	11
2015 Projects																				
Replace Pump House and Associated Equipment - Bay d'Espoir	22.7	522.5	-	-	331.2	-	331.2	-	**545.2**	137.0	128.6	26.0	373.9	385.5	-	-	**1,051.0**	505.8	54.3	12
Total Hydraulic Generation Projects	**22.7**	**2,121.3**	**9,700.3**	**23,201.7**	**8,472.8**	**20,349.2**	**28,822.0**	**6,916.1**	**62,311.3**	**137.0**	**744.1**	**4,398.8**	**19,787.9**	**21,158.1**	**6,916.1**	**5,226.1**	**58,368.0**	**(3,943.3)**	**(7,663.9)**	

Table 4: 2019 Capital Expenditures: Thermal Generation ($000)

	Capital Budget									Actual Expenditure and Forecast								Variance		
	A				B	C	D (B+C)	E	F (A+C+E)	G				H	I	J	K (G+H+I+J)	K-F	H-D	
	2015	2016	2017	2018	Carryover to 2019	Original 2019	Revised 2019	2020 and Beyond	Total	2015	2016	2017	2018	2019	2020 and Beyond	Carryover to 2020	Total	Project Variance	Annual Variance	Notes
2019 Projects																				
Overhaul Unit 3 Turbine Valve - Holyrood	-	-	-	-	-	3,290.5	3,290.5	-	**3,290.5**	-	-	-	-	2,683.0	-	-	**2,683.0**	(607.5)	(607.5)	13
Condition Assessment and Miscellaneous Upgrades - Holyrood	-	-	-	-	-	1,968.8	1,968.8	-	**1,968.8**	-	-	-	-	2,941.7	-	-	**2,941.7**	972.9	972.9	14
Thermal In-Service Failures	-	-	-	-	-	1,250.0	1,250.0	-	**1,250.0**	-	-	-	-	2,327.4	-	-	**2,327.4**	1,077.4	1,077.4	15
Replace 258 Vdc Battery Banks - Holyrood	-	-	-	-	-	330.0	330.0	-	**330.0**	-	-	-	-	350.7	-	-	**350.7**	20.7	20.7	
Purchase Tools and Equipment less than $50,000	-	-	-	-	-	15.4	15.4	-	**15.4**	-	-	-	-	18.1	-	-	**18.1**	2.7	2.7	
2018 Projects																				
Upgrade Cranes and Hoists - Holyrood	-	-	-	80.3	41.7	300.3	342.0	-	**380.6**	-	-	-	38.6	306.6	-	-	**345.2**	(35.4)	(35.4)	
Install Fire Detection in Outbuildings - Holyrood	-	-	-	198.6	128.2	-	128.2	-	**198.6**	-	-	-	70.4	88.2	-	-	**158.6**	(40.0)	(40.0)	
Total Thermal Generation Projects	**-**	**-**	**-**	**278.9**	**169.9**	**7,155.0**	**7,324.9**	**-**	**7,433.9**	**-**	**-**	**-**	**109.0**	**8,715.6**	**-**	**-**	**8,824.6**	**1,390.7**	**1,390.7**	

Table 5: 2019 Capital Expenditures: Gas Turbine Generation ($000)

	Capital Budget									Actual Expenditures and Forecast								Variance		
	A				B	C	D (B+C)	E	F (A+C+E)	G				H	I	J	K (G+H+I+J)	K-F	H-D	
	2015	2016	2017	2018	Carryover to 2019	Original 2019	Revised 2019	2020 and Beyond	Total	2015	2016	2017	2018	2019	2020 and Beyond	Carryover to 2020	Total	Project Variance	Annual Variance	Notes
2019 Projects																				
Overhaul Olympus Gas Generator - Stephenville	-	-	-	-	-	1,666.8	1,666.8	-	**1,666.8**	-	-	-	-	1,245.1	-	316.9	**1,562.0**	(104.8)	(421.7)	16
Construct Heated Storage for Spare Parts and Lube Oil - Hardwoods and Happy Valley	-	-	-	-	-	49.8	49.8	-	**49.8**	-	-	-	-	62.0	-	-	**62.0**	12.2	12.2	
Upgrade Compressed Air System - Holyrood Gas Turbine	-	-	-	-	-	70.7	70.7	317.7	**388.4**	-	-	-	-	17.7	317.7	53.0	**388.4**	-	(53.0)	
Upgrade HMI and AVR - Hardwoods	-	-	-	-	-	685.9	685.9	-	**685.9**	-	-	-	-	493.8	-	-	**493.8**	(192.1)	(192.1)	17
Replace Main Fuel Valves - Hardwoods	-	-	-	-	-	404.2	404.2	-	**404.2**	-	-	-	-	168.0	-	72.8	**240.8**	(163.4)	(236.2)	18
2018 Projects																				
Gas Turbine Equipment Replacement and Refurbishment - Hardwoods and Stephenville	-	-	-	997.9	480.2	429.3	909.5	-	**1,427.2**	-	-	-	371.3	826.0	-	-	**1,197.3**	(229.9)	(83.5)	19
Increase Fuel and Water Treatment System Capacity - Holyrood Gas Turbine	-	-	-	8,829.9	6,093.1	3,012.7	9,105.8	-	**11,842.6**	-	-	-	2,583.8	3,563.9	-	488.0	**6,635.7**	(5,206.9)	(5,541.9)	20
Turbine Hot Gas Path Level 2 Inspection and Overhaul - Holyrood Gas Turbine	-	-	-	11,146.5	682.9	-	682.9	-	**11,146.5**	-	-	-	9,770.7	58.8	-	-	**9,829.5**	(1,317.0)	(624.1)	21
Total Gas Turbine Generation Projects	**-**	**-**	**-**	**20,974.3**	**7,256.2**	**6,319.4**	**13,575.6**	**317.7**	**27,611.4**	**-**	**-**	**-**	**12,725.8**	**6,435.3**	**317.7**	**930.7**	**20,409.5**	**(7,201.9)**	**(7,140.3)**	

Table 6: 2019 Capital Expenditures: Terminal Stations ($000)

	Capital Budget									Actual Expenditures and Forecast								Variance		
	A				B	C	D (B+C)	E	F (A+C+E)	G				H	I	J	K (G+H+I+J)	K-F	H-D	
	2015	2016	2017	2018	Carryover to 2019	Original 2019	Revised 2019	2020 and Beyond	Total	2015	2016	2017	2018	2019	2020 and Beyond	Carryover to 2020	Total	Project Variance	Annual Variance	Notes
2019 Projects																				
Terminal Station In-Service Failures	-	-	-	-	-	1,000.0	1,000.0	-	**1,000.0**	-	-	-	-	1,744.6	-	-	**1,744.6**	744.6	744.6	22
Upgrade Terminal Station for Mobile Substation - St. Anthony	-	-	-	-	-	89.3	89.3	402.7	**492.0**	-	-	-	-	41.8	402.7	47.5	**492.0**	-	(47.5)	
Terminal Station Refurbishment and Modernization - Various Sites	-	-	-	-	-	10,891.1	10,891.1	19,061.8	**29,952.9**	-	-	-	-	5,891.3	19,061.8	1,199.1	**26,152.1**	(3,800.8)	(4,999.8)	23
																	-			
2018 Projects																	-			
Replace Transformer T1 - Buchans	-	-	-	249.0	150.0	2,086.1	2,236.1	-	**2,335.1**	-	-	-	99.0	2,158.5	-	-	**2,257.5**	(77.6)	(77.6)	
Implement Terminal Station Flood Mitigation - Springdale	-	-	-	186.2	50.4	787.8	838.2	-	**974.0**	-	-	-	135.8	87.0	-	1,047.6	**1,270.4**	296.4	(751.2)	24
Purchase Mobile dc Power Systems	-	-	-	270.9	229.0	695.6	924.6	-	**966.5**	-	-	-	41.9	616.3	-	-	**658.2**	(308.3)	(308.3)	25
Terminal Station Refurbishment and Modernization - Various Sites	-	-	-	8,170.6	5,839.7	18,625.1	24,464.8	-	**26,795.7**	-	-	-	1,983.8	9,616.1	-	6,522.4	**18,122.3**	(8,673.4)	(14,848.7)	26
																	-			
2017 Projects																	-			
Replace 66 kV Station Service Feed - Holyrood	-	-	62.8	1,198.6	945.7	-	945.7	-	**1,261.4**	-	-	80.7	235.0	290.6	-	-	**606.4**	(655.0)	(655.1)	27
Replace Substation - Holyrood	-	-	439.4	758.6	313.1	-	313.1	-	**1,198.0**	-	-	115.4	369.7	306.1	-	-	**791.1**	(406.9)	(7.0)	28
Terminal Station Refurbishment and Modernization - Various Sites	-	-	10,831.3	16,550.8	2,327.7	-	2,327.7	-	**27,382.1**	-	-	5,852.1	10,464.4	2,304.6	-	-	**18,621.1**	(8,761.0)	(23.1)	29
																	-			
2016 Projects																	-			
Upgrade Circuit Breakers - Various Sites	-	6,969.1	10,808.7	15,408.6	479.9	6,597.3	7,077.20	11,116.8	**50,900.5**	-	5,599.5	8,877.8	15,184.2	7,901.7	11,116.8	2,220.5	**50,900.5**	-	824.5	30
Upgrade Data Alarm Systems - Various Sites	-	74.4	234.1	-	(1.8)	-	(1.8)	-	**308.5**	-	49.7	116.0	144.6	51.1	-	-	**361.4**	52.9	52.9	
Install Breaker Failure Protection - Various Sites	-	65.7	211.3	-	(7.4)	-	(7.4)	-	**277.0**	-	81.8	382.4	234.7	94.3	-	-	**793.2**	516.2	101.7	31
Total Terminal Stations Projects	**-**	**7,109.2**	**22,587.6**	**42,793.3**	**10,326.3**	**40,772.3**	**51,098.6**	**30,581.3**	**143,843.7**	**-**	**5,731.0**	**15,424.5**	**28,893.1**	**31,103.8**	**30,581.3**	**11,037.2**	**122,770.8**	**(21,072.9)**	**(19,994.8)**	

Table 7: Capital Expenditures: Transmission ($000)

	Capital Budget									Actual Expenditures and Forecast								Variance		
	A				B	C	D	E	F (A+C+E)	G				H	I	J	K(G+H+I+J)	K-F	H-D	
	2015	2016	2017	2018	Carryover to 2019	Original 2019	Revised 2019	2020 and Beyond	Total	2015	2016	2017	2018	2019	2020 and Beyond	Carryover to 2020	Total	Project Variance	Annual Variance	Notes
2019 Projects																				
Wood Pole Line Management Program - Various Sites	-	-	-	-	-	2,467.0	2,467.0	-	**2,467.0**	-	-	-	-	2,873.4	-	-	**2,873.4**	406.4	406.4	32
2014 Projects																				
230 kV Transmission Line - Bay d'Espoir to Western Avalon	4,403.0	75,284.3	194,552.4	17,418.3	1,716.2	-	1,716.2	-	**291,658.0**	2,018.2	59,317.8	213,663.7	10,942.1	875.9	-	-	**286,817.7**	(4,840.3)	(840.3)	33
Total Transmission Projects	**4,403.0**	**75,284.3**	**194,552.4**	**17,418.3**	**1,716.2**	**2,467.0**	**4,183.2**	**-**	**294,125.0**	**2,018.2**	**59,317.8**	**213,663.7**	**10,942.1**	**3,749.3**	**-**	**-**	**289,691.1**	**(4,433.9)**	**(433.9)**	

Table 8: 2019 Capital Expenditures: Distribution ($000)

	Capital Budget									Actual Expenditure and Forecast								Variance		
	A				B	C	D (B+C)	E	F (A+C+E)	G				H	I	J	K (G+H+I+J)	K-F	H-D	
	2015	2016	2017	2018	Carryover to 2019	Original 2019	Revised 2019	2020 and Beyond	Total	2015	2016	2017	2018	2019	2020 and Beyond	Carryover to 2020	Total	Project Variance	Annual Variance	Notes
2019 Projects																				
Provide Service Extensions - All Service Areas	-	-	-	-	-	4,900.0	4,900.0	-	**4,900.0**	-	-	-	-	3,550.5	-	-	**3,550.5**	(1,349.5)	(1,349.5)	34
Provide Service Extensions - All Service Areas - CIAC	-	-	-	-	-	(200.0)	(200.0)	-	**(200.0)**	-	-	-	-	(173.3)	-	-	**(173.3)**	26.7	26.7	
Upgrade Distribution Systems - All Service Areas	-	-	-	-	-	3,565.0	3,565.0	-	**3,565.0**	-	-	-	-	3,631.7	-	-	**3,631.7**	66.7	66.7	
Upgrade Distribution Systems - All Service Areas - CIAC	-	-	-	-	-	(95.0)	(95.0)	-	**(95.0)**	-	-	-	-	(251.5)	-	-	**(251.5)**	(156.5)	(156.5)	35
Distribution System Upgrades - Various Sites	-	-	-	-	-	390.8	390.8	5,490.1	**5,880.9**	-	-	-	-	422.2	5,490.1	(31.4)	**5,880.9**	-	31.4	
Condition Assessment for Submarine Cable - Farewell Head to Change Islands	-	-	-	-	-	300.1	300.1	-	**300.1**	-	-	-	-	166.3	-	-	**166.3**	(133.8)	(133.8)	36
Additions for Load - Distribution System	-	-	-	-	-	186.7	186.7	-	**186.7**	-	-	-	-	80.9	-	-	**80.9**	(105.8)	(105.8)	37
Install Recloser Remote Control (2019–2020) - Rocky Harbour	-	-	-	-	-	66.1	66.1	319.9	**386.0**	-	-	-	-	22.0	319.9	44.1	**386.0**	-	(44.1)	
2018 Projects																				
Distribution System Upgrades - Various Sites	-	-	-	383.8	190.2	2,771.2	2,961.4	-	**3,155.0**	-	-	-	193.6	3,026.0	-	-	**3,219.6**	64.6	64.6	
Install Recloser Remote Control - English Harbour West and Barachoix	-	-	-	63.7	49.9	275.0	324.9	-	**338.7**	-	-	-	13.8	254.0	-	-	**267.8**	(70.9)	(70.9)	
Total Distribution Projects	**-**	**-**	**-**	**447.5**	**240.1**	**12,159.9**	**12,400.0**	**5,810.0**	**18,417.4**	**-**	**-**	**-**	**207.4**	**10,728.8**	**5,810.0**	**12.7**	**16,758.9**	**(1,658.5)**	**(1,671.2)**	

Table 9: 2019 Capital Expenditures: Rural Generation ($000)

	Capital Budget									Actual Expenditures and Forecast								Variance		
	A				B	C	D	E	F (A+C+E)	E				H	I	J	K (G+H+I+J)	K-F	H-D	
	2015	2016	2017	2018	Carryover to 2019	Original 2019	Revised 2019	2020 and Beyond	Total	2015	2016	2017	2018	2019	2020 and Beyond	Carryover to 2020	Total	Project Variance	Annual Variance	Notes
2019 Projects																				
Overhaul Diesel Units - Various	-	-	-	-	-	2,511.3	2,511.3	-	**2,511.3**	-	-	-	-	2,154.4	-	-	**2,154.4**	(356.9)	(356.9)	38
Additions for Load - Isolated Generation Systems	-	-	-	-	-	1,523.6	1,523.6	658.9	**2,182.5**	-	-	-	-	2,423.6	658.9	(682.0)	**2,400.5**	218.0	900.0	39
Diesel Plant Fire Protection (2019–2020)	-	-	-	-	-	377.2	377.2	1,540.2	**1,917.4**	-	-	-	-	-	-	-	**-**	(1,917.4)	(377.2)	40
Upgrade Diesel Plant Building - Ramea	-	-	-	-	-	352.5	352.5	-	**352.5**	-	-	-	-	272.0	-	-	**272.0**	(80.5)	(80.5)	
Replace Human Machine Interface - Cartwright	-	-	-	-	-	306.9	306.9	-	**306.9**	-	-	-	-	152.9	-	154.0	**306.9**	-	(154.0)	41
Inspect Fuel Storage Tanks - Gray River	-	-	-	-	-	203.1	203.1	-	**203.1**	-	-	-	-	317.0	-	-	**317.0**	113.9	113.9	42
Diesel Genset Replacements (2019–2020)	-	-	-	-	-	525.6	525.6	3,421.8	**3,947.4**	-	-	-	-	140.2	3,421.8	385.4	**3,947.4**	-	(385.4)	43
2018 Projects																				
Diesel Plant Engine Cooling System Upgrades - Various Sites	-	-	-	638.4	489.1	671.6	1,160.7	-	**1,310.0**	-	-	-	149.3	1,013.7	-	147.0	**1,310.0**	-	(147.0)	44
Upgrade Ventilation - Cartwright	-	-	-	465.7	419.2	-	419.2	-	**465.7**	-	-	-	46.5	437.7	-	-	**484.2**	18.5	18.5	
Diesel Plant Fire Protection - Postville	-	-	-	505.6	468.4	336.4	804.8	-	**842.0**	-	-	-	37.2	508.0	-	296.8	**842.0**	-	(296.8)	45
Inspect Fuel Storage Tanks - Black Tickle	-	-	-	818.7	337.0	-	337.0	-	**818.7**	-	-	-	481.7	562.8	-	-	**1,044.5**	225.8	225.8	46
Replace Secondary Containment System Liner - Nain	-	-	-	1,639.2	2,471.7	1,450.4	3,922.1	-	**3,089.6**	-	-	-	672.5	4,508.2	-	-	**5,180.7**	2,091.1	586.1	47
Diesel Genset Replacements - Makkovik	-	-	-	604.1	(981.0)	4,703.3	3,722.3	3,592.8	**8,900.2**	-	-	-	1,585.1	4,174.3	3,592.8	(452.0)	**8,900.2**	-	452.0	48
Replace Automation Equipment - St. Anthony	-	-	-	307.4	180.2	1,565.9	1,746.1	-	**1,873.3**	-	-	-	127.2	1,790.8	-	(44.7)	**1,873.3**	-	44.7	
Total Rural Generation Projects	**-**	**-**	**-**	**4,979.1**	**3,384.6**	**14,527.8**	**17,912.4**	**9,213.7**	**28,720.6**	**-**	**-**	**-**	**3,099.5**	**18,455.5**	**7,673.5**	**(195.4)**	**29,033.1**	**312.5**	**543.1**	

Table 10: 2019 Capital Expenditures: Properties ($000)

	Capital Budget									Actual Expenditure and Forecast								Variance		
	A				B	C	D	E	F (A+C+E)	G				H	I	J	K (G+H+I+J)	K-F	H-D	
	2015	2016	2017	2018	Carryover to 2019	Original 2019	Revised 2019	2020 and Beyond	Total	2015	2016	2017	2018	2019	2020 and Beyond	Carryover to 2020	Total	Project Variance	Annual Variance	Notes
2019 Projects																				
Install Pole Storage Ramps - Wabush	-	-	-	-	-	301.7	301.7	-	**301.7**	-	-	-	-	185.3	-	-	**185.3**	(116.4)	(116.4)	49
Upgrade Line Depots - Roddickton	-	-	-	-	-	344.7	344.7	-	**344.7**	-	-	-	-	313.5	-	-	**313.5**	(31.2)	(31.2)	
2018 Projects																				
Install Energy Efficiency Lighting in Diesel Plants - Various	-	-	-	104.0	36.0	119.0	155.0	122.2	**345.2**	-	-	-	68.0	97.3	122.2	57.7	**345.2**	-	(57.7)	
2017 Projects																				
Construct New Facilities - Various Sites	-	-	422.0	1,034.1	449.9	-	449.9	-	**1,456.1**	-	-	237.8	429.8	342.3	-	-	**1,009.9**	(446.2)	(107.6)	50
Total Properties Projects	**-**	**-**	**422.0**	**1,138.1**	**485.9**	**765.4**	**1,251.3**	**122.2**	**2,447.7**	**-**	**-**	**237.8**	**497.8**	**938.4**	**122.2**	**57.7**	1,853.9	**(593.8)**	**(312.9)**	

Table 11: 2019 Capital Expenditures: Metering ($000)

	Capital Budget									Actual Expenditure and Forecast								Variance		
	A				B	C	D	E	F (A+C+E)	G				H	I	J	K (G+H+I+J)	K-F	H-D	
	2015	2016	2017	2018	Carryover to 2019	Original 2019	Revised 2019	2020 and Beyond	Total	2015	2016	2017	2018	2019	2020 and Beyond	Carryover to 2020	Total	Project Variance	Annual Variance	Notes
2019 Projects																				
Purchase Meters and Metering Equipment - Various	-	-	-	-	-	196.4	196.4	-	**196.4**	-	-	-	-	178.7	-	-	**178.7**	(17.7)	(17.7)	
Purchase Meters and Metering Equipment - Various - CIAC	-	-	-	-	-	-	-	-	**-**	-	-	-	-	(0.6)	-	-	**(0.6)**	(0.6)	(0.6)	
Total Metering Projects	**-**	**-**	**-**	**-**	**-**	**196.4**	**196.4**	**-**	**196.4**	**-**	**-**	**-**	**-**	**178.2**	**-**	**-**	**178.2**	**(18.2)**	**(18.2)**	

Table 12: Capital Expenditures: Tools and Equipment ($000)

	Capital Budget									Actual Expenditure and Forecast								Variance		
	A				B	C	D	E	F (A+C+E)	G				H	I	J	K (G+H+I+J)	K-F	H-D	
	2015	2016	2017	2018	Carryover to 2019	Original 2019	Revised 2019	2020 and Beyond	Total	2015	2016	2017	2018	2019	2020 and Beyond	Carryover to 2020	Total	Project Variance	Annual Variance	Notes
2019 Projects																				
Replace Light Duty Mobile Equipment - Various Sites	-	-	-	-	-	469.6	469.6	-	**469.6**	-	-	-	-	410.1	-	-	**410.1**	(59.5)	(59.5)	
Tools and Equipment less than $50,000	-	-	-	-	-	373.2	373.2	-	**373.2**	-	-	-	-	322.9	-	-	**322.9**	(50.3)	(50.3)	
2018 Projects																				
Replace Off-Road Track Vehicles - Bishop's Falls and Bay d'Espoir	-	-	-	213.7	(35.8)	986.3	950.5	-	**1,200.0**	-	-	-	249.5	12.0	-	1,031.72	**1,293.2**	93.2	(938.5)	51
Total Tools and Equipment	**-**	**-**	**-**	**213.7**	**(35.8)**	**1,829.1**	**1,793.3**	**-**	**2,042.8**	**-**	**-**	**-**	**249.5**	**745.0**	**-**	**1,031.7**	**2,026.2**	**(16.6)**	**(1,048.3)**	

Table 13: 2019 Capital Expenditures: Information Systems

	Capital Budget								Actual Expenditure and Forecast								Variance		
	A				B	C	D	E	F (A+C+E)	G				H	I	J	K (G+H+I+J)	K-F	H-D	
	2015	2016	2017	2018	Carryover to 2019	Original 2019	Revised 2019	2020 and Beyond	Total	2015	2016	2017	2018	2019	2020 and Beyond	Carryover to 2020	Total	Projet Variance	Annual Variance	Notes
2019 Projects																				
Replace Personal Computers - Hydro Place	-	-	-	-	-	496.0	496.0	-	**496.0**	-	-	-	-	455.1	-	-	**455.1**	(40.9)	(40.9)	
Replace Peripheral Infrastructure - Hydro Place	-	-	-	-	-	221.8	221.8	-	**221.8**	-	-	-	-	139.3	-	-	**139.3**	(82.5)	(82.5)	
Upgrade Core IT Infrastructure - Hydro Place	-	-	-	-	-	359.4	359.4	-	**359.4**	-	-	-	-	404.6	-	-	**404.6**	45.2	45.2	
Upgrade Software Applications - Hydro Place	-	-	-	-	-	110.4	110.4	-	**110.4**	-	-	-	-	44.8	-	-	**44.8**	(65.6)	(65.6)	
Refresh Security Software - Hydro Place	-	-	-	-	-	90.7	90.7	-	**90.7**	-	-	-	-	96.0	-	-	**96.0**	5.3	5.3	
Perform Minor Enhancements - Hydro Place	-	-	-	-	-	47.1	47.1	-	**47.1**	-	-	-	-	32.5	-	-	**32.5**	(14.6)	(14.6)	
Upgrade Energy Management System - Hydro Place	-	-	-	-	-	271.7	271.7	-	**271.7**	-	-	-	-	108.9	-	162.8	**271.7**	-	(162.8)	52
Total Information Systems Projects	**-**	**-**	**-**	**-**	**-**	**1,597.1**	**1,597.1**	**-**	1,597.1	**-**	**-**	**-**	**-**	**1,281.3**	**-**	**162.8**	**1,444.0**	**(153.1)**	**(315.8)**	

Table 14: 2019 Capital Expenditures: Telecontrol ($000)

	Capital Budget									Actual Expenditure and Forecast								Variance		
	A				B	C	D	E	F (A+C+E)	G				H	I	J	K (G+H+I+J)	K-F	H-D	
	2015	2016	2017	2018	Carryover to 2019	Original 2019	Revised 2019	2020 and Beyond	Total	2015	2016	2017	2018	2019	2020 and Beyond	Carryover to 2020	Total	Project Variance	Annual Variance	Notes
2019 Projects																				
Upgrade Telecontrol Facilities - Gull Pond Hill and Bay d'Espoir Hill	-	-	-	-	-	96.3	96.3	577.6	**673.9**	-	-	-	-	97.8	577.6	(1.5)	**673.9**	-	1.5	
Replace Teleprotection - TL 202 and TL 206	-	-	-	-	-	196.8	196.8	-	**196.8**	-	-	-	-	225.8	-	-	**225.8**	29.0	29.0	
Replace Network Communications Equipment - Various	-	-	-	-	-	189.5	189.5	-	**189.5**	-	-	-	-	180.4	-	-	**180.4**	(9.1)	(9.1)	
Upgrade Site Facilities - Various	-	-	-	-	-	49.4	49.4	-	**49.4**	-	-	-	-	50.3	-	-	**50.3**	0.9	0.9	
Replace Radomes - Various	-	-	-	-	-	263.5	263.5	-	**263.5**	-	-	-	-	253.1	-	-	**253.1**	(10.4)	(10.4)	
Upgrade Remote Terminal Units - Various	-	-	-	-	-	167.7	167.7	-	**167.7**	-	-	-	-	165.0	-	-	**165.0**	(2.7)	(2.7)	
Purchase Tools and Equipment less than $50,000	-	-	-	-	-	45.6	45.6	-	**45.6**	-	-	-	-	42.1	-	-	**42.1**	(3.5)	(3.5)	
2018 Projects																				
Replace PBX Phone Systems - Various	-	-	-	91.7	(43.2)	1,150.6	1,107.4	-	**1,242.3**	-	-	-	134.9	1,244.7	-	-	**1,379.6**	137.3	137.3	53
Replace MDR 6000 Microwave Radio - Various	-	-	-	64.0	(17.5)	1,137.0	1,119.5	-	**1,201.0**	-	-	-	81.5	1,151.6	-	-	**1,233.1**	32.1	32.1	
Replace Teleprotection - TL 261	-	-	-	57.6	(2.5)	459.8	457.3	-	**517.4**	-	-	-	60.1	432.8	-	-	**492.9**	(24.5)	(24.5)	
Replace Battery Banks and Chargers - Various	-	-	-	382.1	150.8	555.8	706.6	-	**937.9**	-	-	-	231.3	671.9	-	-	**903.2**	(34.7)	(34.7)	
Total Telecontrol Projects	**-**	**-**	**-**	**595.4**	**87.6**	**4,312.0**	**4,399.6**	**577.6**	**5,485.0**	**-**	**-**	**-**	**507.8**	**4,515.5**	**577.6**	**(1.5)**	**5,599.4**	**114.4**	**115.9**	

Table 15: 2019 Capital Expenditures: Transportation and Administrative ($000)

	Capital Budget									Actual Expenditure and Forecast								Variance		
	A				B	C	D	E	F (A+C+E)	G				H	I	J	K (G+H+I+J)	K-F	H-D	
	2015	2016	2017	2018	Carryover to 2019	Original 2019	Revised 2019	2020 and Beyond	Total	2015	2016	2017	2018	2019	2020 and Beyond	Carryover to 2020	Total	Project Variance	Annual Variance	Notes
2019 Transportation Projects																				
Replace Vehicles and Aerial Devices - Various Sites	-	-	-	-	-	1,248.1	1,248.1	594.9	**1,843.0**	-	-	-	-	1,385.0	594.9	(136.9)	**1,843.0**	-	136.9	54
2018 Transportation Projects																				
Replace Vehicles and Aerial Devices - Various Sites	-	-	-	1,667.2	502.1	753.7	1,255.8	-	**2,420.9**	-	-	-	1,165.1	490.1	-	765.7	**2,420.9**	-	(765.7)	55
Total Transportation Projects	**-**	**-**	**-**	**1,667.2**	**502.1**	**2,001.8**	**2,503.9**	**594.9**	**4,263.9**	**-**	**-**	**-**	**1,165.1**	**1,875.1**	**594.9**	**628.8**	**4,263.9**	**-**	**(628.8)**	

	Capital Budget									Actual Expenditure and Forecast								Variance		
	A				B	C	D	E	F (A+C+E)	G				H	I	J	K (G+H+I+J)	K-F	H-D	
	2015	2016	2017	2018	Carryover to 2019	Original 2019	Revised 2019	2020 and Beyond	Total	2015	2016	2017	2018	2019	2020 and Beyond	Carryover to 2020	Total	Project Variance	Annual Variance	Notes
2019 Administrative Projects																				
Remove Safety Hazards - Various	-	-	-	-	-	197.5	197.5	-	**197.5**	-	-	-	-	210.8	-	-	**210.8**	13.3	13.3	
Security Improvements - Hydro Place	-	-	-	-	-	47.1	47.1	-	**47.1**	-	-	-	-	28.3	-	-	**28.3**	(18.8)	(18.8)	
Purchase Office Equipment	-	-	-	-	-	38.0	38.0	-	**38.0**	-	-	-	-	20.4	-	-	**20.4**	(17.6)	(17.6)	
2018 Administrative Projects																				
Upgrade Exterior of Building - Hydro Place	-	-	-	260.2	27.6	405.7	433.3	-	**665.9**	-	-	-	232.6	346.7	-	-	**579.3**	(86.6)	(86.6)	
Total Administrative Projects	**-**	**-**	**-**	**260.2**	**27.6**	**688.3**	**715.9**	**-**	**948.5**	**-**	**-**	**-**	**232.6**	**606.2**	**-**	**-**	**838.8**	**(109.7)**	**(109.7)**	

Table 16: 2019 Capital Expenditures: Allowance for Unforeseen Items, Supplemental Capital Projects, and Projects less than $50,000 ($000)

	Capital Budget									Actual Expenditure and Forecast								Variance		
	A				B	C	D	E	F (A+C+E)	G				H	I	J	K (G+H+I+J)	K-F	H-D	
	2015	2016	2017	2018	Carryover to 2019	Original 2019	Revised 2019	2020 and Beyond	Total	2015	2016	2017	2018	2019	2020 and Beyond	Carryover to 2020	Total	Project Variance	Annual Variance	Notes
2019 Allowance for Unforeseen Projects																				
Contingency Fund	-	-	-	-	-	1,000.0	1,000.0	-	**1,000.0**	-	-	-	-	-	-	-	-	(1,000.0)	(1,000.0)	56
Replace Engine #2051 - Rigolet	-	-	-	-	-	-	-	-	**-**	-	-	-	-	537.6	-	-	**537.6**	537.6	537.6	56
Charlottetown Diesel Plant Restore Service Following Fire	-	-	-	-	-	-	-	-	**-**					738.4		-	**738.4**	738.4	738.4	56
Allowance for Unforeseen - Top Up Board Order No. P.U. 7(2019)	-	-	-	-	-	600.0	600.0	-	**600.0**	-	-	-	-	-	-	-	-	(600.0)	(600.0)	56
Total Allowance For Unforeseen	**-**	**-**	**-**	**-**	**-**	**1,600.0**	**1,600.0**	**-**	**1,600.0**	**-**	**-**	**-**	**-**	**1,276.0**	**-**	**-**	**1,276.0**	**(324.0)**	**(324.0)**	

	Capital Budget									Actual Expenditure and Forecast								Variance		
	A				B	C	D	E	F (A+C+E)	G				H	I	J	K (G+H+I+J)	K-F	H-D	
	2015	2016	2017	2018	Carryover to 2019	Original 2019	Revised 2019	2020 and Beyond	Total	2015	2016	2017	2018	2019	2020 and Beyond	Carryover to 2020	Total	Project Variance	Annual Variance	Notes
2019 Supplemental Capital Projects																				
Muskrat Falls to Happy Valley Interconnection	-	-	-	-	-	12,586.4	12,586.4	7,392.1	**19,978.5**	-	-	-	-	12,528.5	7,392.1	57.9	**19,978.5**	-	(57.9)	
Hinds Lake Unit Major Overhaul	-	-	-	-	-	259.5	259.5	-	**259.5**	-	-	-	-	422.9	-	-	**422.9**	163.4	163.4	57
Level II Cond. Assess. for BDE Penstock 4 and Granite Canal and Hinds Lake Penstocks	-	-	-	-	-	414.3	414.3	-	**414.3**	-	-	-	-	294.4	-	-	**294.4**	(119.9)	(119.9)	58
Refurbishment and Upgrade of Olympus C Gas Generator – Serial Number 202204	-	-	-	-	-	393.5	393.5	-	**393.5**					432.0		(38.5)	**393.5**	-	38.5	
Refurb. Hardwoods GT Alternator Exciter End Bearing & Purchase of Exciter Bearing Liner & Thrust Pads	-	-	-	-	-	225.5	225.5	-	**225.5**					195.6		-	**195.6**	(29.9)	(29.9)	
2018 Supplemental Capital Projects																				
Penstock Condition Assessments - Bay d'Espoir	-	-	-	1,120.6	223.8	-	223.8	-	**1,120.6**	-	-	-	1,682.5	150.1	-	-	**1,832.6**	712.0	(73.7)	59
Mary's Harbour Hydro Integration	-	-	-	195.5	146.3	-	146.3	-	**195.5**	-	-	-	49.2	193.5	-	-	**242.7**	47.2	47.2	
Mary's Harbour Hydro Integration - CIAC	-	-	-	(195.5)	(195.5)	-	(195.5)	-	**(195.5)**	-	-	-	-	(195.5)	-	-	**(195.5)**	-	-	
TL 226 and TL 239 Reroute	-	-	-	712.3	132.5	220.1	352.6	-	**932.4**	-	-	-	579.8	414.3	-	-	**994.1**	61.7	61.7	
Total Supplemental Projects Approved by PUB	**-**	**-**	**-**	**1,832.9**	**307.1**	**14,099.3**	**14,406.4**	**7,392.1**	**23,324.3**	**-**	**-**	**-**	**2,311.5**	**14,435.8**	**7,392.1**	**19.4**	**24,158.8**	**834.5**	**29.4**	

	Capital Budget									Actual Expenditure and Forecast								Variance		
	A				B	C	D	E	F (A+C+E)	G				H	I	J	K (G+H+I+J)	K-F	H-D	
	2015	2016	2017	2018	Carryover to 2019	Original 2019	Revised 2019	2020 and Beyond	Total	2015	2016	2017	2018	2019	2020 and Beyond	Carryover to 2020	Total	Project Variance	Annual Variance	Notes
2019 Projects less than $50,000																				
Building Vestibule Powerhouse - Holyrood	-	-	-	-	-	49.3	49.3	-	**49.3**	-	-	-	-	37.3	-	-	**37.3**	(12.0)	(12.0)	
Procure Spare Fuel Shut-Off Valve - Happy Valley Gas Turbine	-	-	-	-	-	31.2	31.2	-	**31.2**	-	-	-	-	28.6	-	-	**28.6**	(2.6)	(2.6)	
Unit 3 Electrical Testing - Holyrood	-	-	-	-	-	39.1	39.1	-	**39.1**	-	-	-	-	33.4	-	-	**33.4**	(5.7)	(5.7)	
Tanks 3 and 4 Life Expectancy Study - Holyrood	-	-	-	-	-	48.3	48.3	-	**48.3**	-	-	-	-	34.2	-	-	**34.2**	(14.1)	(14.1)	
Replace Silencer and Electrical Cables - Rigolet	-	-	-	-	-	47.3	47.3	-	**47.3**	-	-	-	-	47.3	-	-	**47.3**	-	-	
Supply and Install Replacement Waterline - St. Anthony	-	-	-	-	-	47.4	47.4	-	**47.4**	-	-	-	-	46.6	-	-	**46.6**	(0.8)	(0.8)	
Replace Exciter Bearing - Hardwoods	-	-	-	-	-	48.0	48.0	-	**48.0**	-	-	-	-	44.4	-	-	**44.4**	(3.6)	(3.6)	
Replace Inverter - Hardwoods Gas Turbine	-	-	-	-	-	41.9	41.9	-	**41.9**	-	-	-	-	44.4	-	-	**44.4**	2.5	2.5	
Tools and Equipment - Holyrood	-	-	-	-	-	46.1	46.1	-	**46.1**	-	-	-	-	46.1	-	-	**46.1**	-	(0.0)	
Tools and Equipment - Holyrood	-	-	-	-	-	14.8	14.8	-	**14.8**	-	-	-	-	14.8	-	-	**14.8**	-	(0.0)	
																	-			
Total Projects Less than $50,000	**-**	**-**	**-**	**-**	**-**	**413.4**	**413.4**	**-**	**413.4**	**-**	**-**	**-**	**-**	**377.0**	**-**	**-**	**377.0**	**(36.4)**	**(36.4)**	

4.0 Variance Explanations (Greater than $100,000 and 10% Variance from Budget)

This section provides variance explanations of a project's actual and forecast expenditures when compared to the approved project budgets. A variance explanation is provided for each project in which the total project actual and forecast expenditures exceeded the approved total project budget by more than 10% and $100,000. Variance explanations are also provided if the 2019 project expenditures exceeded the approved 2019 budget by more than 10% and $100,000. The projects are ordered and numbered based upon the order and number they appear in the preceding set of tables.

4.1 Hydraulic Generation Projects (Table 3)

1) Hydraulic In-Service Failures

While a variance explanation is not required for this project, Hydro committed to providing the Board with details for each of the In-Service Failures projects. A detailed list of work executed under the Hydraulic In-Service Failures project is located in Section 9.0.

2) Hydraulic Generation Refurbishment and Modernization (2019–2020) - Various Sites

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	10,313.6	8,893.9	(1,419.7)

This is a two-year project initially planned for 2019–2020 that commenced in 2019 and will carry over into 2021. The variance in 2019 expenditures is primarily attributed to the engineering and a portion of the construction for the refurbishment of Bay d'Espoir Intake 2 being rescheduled from 2019 to 2020. During the development of the 2019 generation outage schedule, it was determined that all required generation outages for Hydro's overall work plan could not be granted. This was primarily a result of the need to advance the Hinds Lake generator refurbishment into 2019. It was determined that the Bay d'Espoir intake gate work was the lowest priority among all significant generation outage requirements for 2019, resulting in a rescheduling of the Intake 1 refurbishment to 2020 (as part of the 2018–2019 Hydraulic Generation Refurbishment and Modernization project). This, in turn, led to the rescheduling of the refurbishment of Intake 2 to 2020–2021 (as part of this 2019–2020 Hydraulic Generation Refurbishment and Modernization Project). The project plan for Intake 2 includes refurbishing the original gate to be removed from Intake 1 and installing it in Intake 2. Since the gate from Intake 1 did

not get removed in 2019, its refurbishment could not be completed in 2019. The 2019 under-expenditure was also attributed to the work to replace control cables and condition monitoring equipment at Bay d'Espoir Generating Station. A portion of this work has been carried over to 2020. The control cables and condition monitoring equipment that were replaced in 2019 were completed for less than the original estimates.

3) Install Remote Operation of Salmon Spillway – Bay d'Espoir

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	1,623.0	933.0	(690.0)
Project	2,508.4	1,818.4	(690.0)

This was a two-year project (2018–2019) that commenced in 2018 and was completed in 2019. The variances in 2019 and overall project expenditures are attributed to the actual expenditure for engineering and materials being less than originally estimated.

4) Refurbish Backfill on Penstock #1 – Bay d'Espoir

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	1,567.2	11.5	(1,555.7)
Project	1,630.4	74.7	(1,555.7)

This was a one-year project that commenced in 2018, carried over into 2019, and was subsequently cancelled. An engineering consultant's report in 2018 concerning a failure of Bay d'Espoir Penstock 1 recommended suspending work on refurbishment of the backfill until completion of a condition assessment of Penstocks 1, 2 and 3. The condition assessment report, finalized in 2019 and filed with the Board on March 29, 2019, included a recommendation that refurbishment of the penstocks be completed within the next three to five years. Completing the backfill refurbishment at the same time as the future penstock refurbishment is the most cost efficient approach to execute the work. The engineering consultant confirmed that deferring the backfill work for three to five years does not introduce any material risk to the asset. Backfill refurbishment for Penstock 1 will be included in the scope of a future penstock refurbishment project.

The project's capital spend to date is being assessed to determine if it will add value to future planned refurbishment of the penstock. In the event the expenditures add value, then the balance will be

transferred to Front End Engineering and Design ("FEED") for inclusion in future work and excluded from the rate base until completion of the job. If it is determined that the expenditures do not add value then the balance will be written off to net income.

5) Hydraulic Generation Refurbishment and Modernization (2018–2019) - Various Sites

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	6,861.8	3,367.7	(3,494.1)

Variance	Budget ($000)	Forecast and Expenditures ($000)	Variance ($000)
Project	14,608.5	12,384.4	(2,224.1)

This is a two-year project (2018–2019) that commenced in 2018 and has carried over into 2020. The variance in 2019 expenditures is primarily attributed to rescheduling of the refurbishment of Bay d'Espoir Intake 1 and Bay d'Espoir Surge Tank 1 to 2020.

During the development of the 2019 generation outage schedule, it was determined that all required generation outages for Hydro's overall work plan could not be granted. This was primarily a result of the need to advance the Hinds Lake generator refurbishment into 2019. It was determined that the Bay d'Espoir intake gate work was the lowest priority among all significant generation outage requirements for 2019, resulting in a rescheduling of the Intake 1 refurbishment to 2020. During project planning it was determined that gate replacement was required in the place of gate refurbishment due to schedule constraints and risk control. This alternative was determined to be within the project estimate.

Internal and external refurbishment of Bay d'Espoir Surge Tank 1 was originally planned for 2018, but the available generation outage duration in 2018 was too short to complete the entire scope. The external tank work was completed in 2018 and the internal tank work was rescheduled to 2019. In 2019, the internal tank work, consisting of tank bowl refurbishment and internal coating application, could not be completed within the available generation outage schedule. It was decided in advance of the outage to proceed with the tank bowl refurbishment in 2019 and carry over the coating application to 2020. In the third quarter of 2019, there was a change to the master outage schedule to accommodate a required outage extension for Bay d'Espoir Unit 7. This resulted in a shortened outage

for Bay d'Espoir Units 1 and 2, which is required for the surge tank work, and resulted in the tank bowl refurbishment also being carried over to 2020.

The forecasted variance in overall project expenditures is reduced due to a reduced volume of work compared to the original estimate for the Bay d'Espoir Unit 2 turbine overhaul completed in 2018. Upon disassembly of the turbine, it was found that the discharge wear ring was able to be refurbished in-place, rather than be replaced as originally planned.

6) Refurbish Powerhouse Station Services – Bay d'Espoir

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	3,300.6	2,643.4	(657.2)

Variance	Budget ($000)	Forecast and Expenditures ($000)	Variance ($000)
Project	4,347.1	3,847.1	(500.0)

This is a three-year project (2017–2019) that commenced in 2017 and has carried over into 2020. The variances in 2019 and overall project expenditures are attributed to the actual costs for engineering and materials being less than originally estimated, as well as the carryover of a portion of the construction into 2020. Most of the upgrades to the station services in Bay d'Espoir Powerhouses 1 and 2 were completed in 2019. Due to resource and outage window constraints, panel board replacement in both powerhouses has carried over into 2020.

7) Replace Slip Rings Units 1-6 – Bay d'Espoir

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	352.7	181.6	(171.1)
Project	472.3	301.2	(171.1)

This was a two-year project (2017–2018) that commenced in 2017 and was carried over and completed in 2019. The variances in 2019 and overall project expenditures are attributed to the actual costs for engineering, materials, and labour being less than originally estimated.

8) Control Structure Refurbishments

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Project	2,188.2	1,927.6	(260.6)

This was a two-year project (2017–2018) that commenced in 2017 and was carried over and completed in 2019. The variance in overall project expenditures is attributed to the actual contract costs being less than originally estimated.

9) Upgrade Work – Cat Arm

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	30.3	193.7	163.4
Project	1,911.3	2,571.0	659.7

This was a two-year project (2016–2017) that commenced in 2016, and was carried over and completed in 2019. The variance in total project expenditures is attributed to actual expenditures being higher than originally estimated for the upgrade of the spherical valve control systems and the installation of deflector servomotors.

For the refurbishment of the spherical valve control system, increased material requirements were identified during the engineering phase. In addition, there were cost increases as a result of a change in construction strategy from the original plan of using internal labor to the use of a contractor due to unavailability of internal resources. This scope was completed in 2018.

The two deflector servomotors purchased and installed as part of this project had a long lead time and could not be ordered until an existing servomotor of the same design was installed, tested, and proven to meet the performance specifications. The existing servomotor was installed in September 2018 and determined to meet the performance specifications. The new servomotors were then ordered in 2018 and received and installed in 2019. The actual engineering and construction costs for this work were higher than originally estimated, resulting in the variance in 2019 expenditures and contributing to the variance in overall project expenditures.

10) Rehabilitate Shoreline Protection – Cat Arm

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	888.0	(254.9)	(1,142.9)
Project	1,142.9	0.0	(1,142.9)

This was a two-year project (2016–2017) that commenced in 2016, carried over into 2019 and was subsequently cancelled. During project planning, it was determined that there is risk of rock fall from the adjacent cliff into the construction zone. The identification of the necessity for risk mitigation to ensure a safe work site resulted in a pause on the project to estimate the associated cost and, if necessary, re-evaluate the project alternatives. A site survey was completed in September 2018 and a cost estimate for mitigation of the safety hazard was completed in December 2018. These costs were used in 2019 to update the project estimate and re-evaluate the cost benefit analysis of project alternatives. The updated analysis showed that the planned shoreline rehabilitation is no longer the least-cost alternative. As a result, the capital project was cancelled in the second quarter of 2019. The shoreline erosion will continue to be monitored and any required remedial work will be undertaken as an operating expense.

Upon the cancellation of the job, Hydro wrote off the balance of the project to net income.

11) Replace Site Facilities – Bay d'Espoir

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	904.4	2,045.0	1,140.6

This was a three-year project (2016–2018) that commenced in 2016 and was carried over and completed in 2019. The overall project expenditures were within 10% of the original budget. The variance in the 2019 expenditures is attributed to additional engineering and construction labour costs associated with managing and completing project deficiencies that carried in 2019.

12) Replace Pumphouse and Associated Equipment – Bay d'Espoir

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Project	545.2	1,051.0	505.8

This was a two-year project (2015–2016) that was carried over and completed in 2019. The variance in overall project expenditures is attributed to higher than expected construction costs. Construction was originally tendered in 2016, but was not awarded since tendered prices were significantly higher than the budget. A reassessment of the design and execution strategy was undertaken, but did not result in any material savings. Replacement of the pump house became critical after damage sustained from flooding during Hurricane Matthew in 2016. The work was re-tendered and construction began in 2018 and was completed in 2019.

4.2 Thermal Generation Projects (Table 4)

13) Overhaul Unit 3 Turbine Valve - Holyrood

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	3,290.5	2,683.0	(607.5)
Project	3,290.5	2,683.0	(607.5)

This was a one-year project that commenced and was completed in 2019. The original project budget was based on historical valve overhaul costs. The extent of work required for a valve overhaul can only be determined after the valve is removed from service and disassembled for inspection, during the project execution. In this case, the extent of required refurbishment following valve disassembly was less than originally estimated.

14) Condition Assessment and Miscellaneous Upgrades - Holyrood

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	1,968.8	2,941.7	972.9
Project	1,968.8	2,941.7	972.9

This was a one-year project that commenced and was completed in 2019. The original project scope of work, determined at the time of budget preparation, was based on best available asset condition information. Additional information was determined through inspections completed during generation unit outages in 2018 and 2019. These inspections revealed that additional scope of work was required for the continued safe and reliable operation of the plant. The additional scope was primarily related to the boiler air heaters, stack breeching, forced draft fans, economizer, and water wall tubing. A detailed

list of the additional work executed under this project is included in Section 11.0 of this report. The variance in total project expenditure is attributed to this additional scope.

15) Thermal In-Service Failures

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	1,250.0	2,327.4	1,077.4
Project	1,250.0	2,327.4	1,077.4

This was a one-year project that commenced and was completed in 2019. The budget for the project was based on prediction of the magnitude of in-service failures using historical data and engineering judgement. The variance in project expenditures is attributed to the actual number of failures incurred. A detailed list of work executed under this project is found in Section 10.0 of this report.

4.3 Gas Turbine Generation Projects (Table 5)

16) Overhaul Olympus Gas Generator - Stephenville

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	1,666.8	1,245.1	(421.7)

This is a one-year project which commenced in 2019 and has carried over into 2020. The variance in 2019 expenditures is attributed to carrying over the final acceptance activities associated with the overhauled gas generator. The gas generator was removed from the generating unit at Stephenville in June 2019 and overhauled at an off-site facility. The overhaul was completed on schedule and the engine passed its performance test at the overhaul facility. In November 2019, the engine was returned to Stephenville, installed and ran for approximately two hours. During this run-up, the engine tripped due to high vibration. Internal and external inspections revealed damage to the on-engine fuel pump gearbox and potential internal damage to the high pressure turbine casing. It was determined that the engine needed to be removed from its berth and returned to the overhaul facility . The engine was shipped back to the overhaul facility on November 28, 2019 and returned to Hydro on February 19, 2020. The engine is in storage in Stephenville for use as a spare for the Stephenville or Hardwoods Gas Turbine.

17) Upgrade HMI and AVR - Hardwoods

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	685.9	493.8	(192.1)
Project	685.9	493.8	(192.1)

This was a one-year project which was completed in 2019. The variance in project expenditures was attributed to actual construction and commissioning costs being less than the original estimates.

18) Replace Main Fuel Valves - Hardwoods

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	404.2	168.0	(236.2)

Variance	Budget ($000)	Forecast and Expenditures ($000)	Variance ($000)
Project	404.2	240.8	(163.4)

This was a one-year project which commenced in 2019 and has carried over into 2020. The new fuel valves were purchased and preparatory construction work was completed in 2019; however, the gas turbine generation outage necessary to complete the construction and commissioning was not available in 2019. The remaining work has been rescheduled to 2020. The forecasted variance in overall project expenditures is attributed to the actual purchase cost of the new valves being less than originally estimated. The variance in 2019 expenditures is due to the lower purchase cost of the valves and the carryover of the remaining construction and commissioning to 2020.

19) Gas Turbine Equipment Replacement and Refurbishment: Hardwoods and Stephenville

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Project	1,427.2	1,197.3	(229.9)

This was a two-year project (2018–2019) which was completed in 2019. The variance in overall project expenditures is due to the cancellation of a portion of the project scope. An updated engineering assessment of the existing demisters at Hardwoods and Stephenville Gas Turbines concluded that they

did not require replacement; instead, a piping modification was made to improve their performance. One demister was purchased and will be kept as a spare.

20) Increase Fuel and Water Treatment System Capacity - Holyrood Gas Turbine

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	9,105.8	3,563.9	(5,541.9)

Variance	Budget ($000)	Forecast and Expenditures ($000)	Variance ($000)
Project	11,842.6	6,635.7	(5,206.9)

This is a two-year project (2018–2019) which commenced in 2018 and has been carried over into 2020. The overall scope of work for this project is to expand the water treatment plant and install two new fuel tanks at the Holyrood Gas Turbine. In 2019, the water treatment plant expansion was completed and put into service. Also in 2019, construction was completed for the two new fuel storage tanks and they were placed in service with manual operation capability. The project has carried over into 2020 to complete the automation of the fuel transfer system and complete secondary containment liner work that was hampered by inclement weather in 2019.

The forecasted variance in overall project expenditures and the variance in 2019 expenditures are attributed to lower than estimated contract prices for the fuel tank construction. At the time of budget preparation, Hydro requested contractor budget pricing; however, the estimates were not received in time for inclusion into the project estimate prior to submission of the 2018 Capital Budget Application. In lieu of current contract estimates, Hydro used historical cost data from the original plant construction.

21) Turbine Hot Gas Path Level 2 Inspection and Overhaul – Holyrood Gas Turbine

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	682.9	58.8	(624.1)
Project	11,146.5	9,829.5	(1,317.0)

This was a two-year project (2018–2019) which was substantially completed in 2018 and closed in 2019. In a letter dated July 26, 2018, Hydro reported to the Board of Commissioners of Public Utilities ("Board"), that the overhaul had to be advanced and completed in 2018 due to greater than anticipated use of the Holyrood Gas Turbine since its last inspection and overhaul. The variance in 2019 expenditures is attributed to the actual expenditures for project close-out activities being less than the remaining project budget. The variance in overall project expenditures is attributed to a reduction of project scope. Upon disassembly and inspection, it was determined that the interstage seals did not require replacement. The inspection and overhaul was completed and the unit was returned to service in the fourth quarter of 2018.

4.4 Terminal Stations Projects (Table 6)

22) Terminal Station In-Service Failures

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	1,000.0	1,744.6	744.6
Project	1,000.0	1,744.6	744.6

This was a one-year project completed in 2019. The budget for the project was based on prediction of the magnitude of in-service failures using historical data and engineering judgement. The 2019 variance is attributed to the actual number of failures incurred. A detailed list of work executed under this project is found in Section 8.0 of this report.

23) Terminal Station Refurbishment and Modernization – Various Sites

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	10,891.1	5,891.3	(4,999.8)

Variance	Budget ($000)	Forecast and Expenditures ($000)	Variance ($000)
Project	29,952.9	26,152.1	(3,800.8)

This is a two-year project (2019-2020) that commenced in 2019 and includes a number of consolidated program-type projects across several sites and a focused refurbishment at Wabush Terminal Station.

The variance in 2019 expenditure is primarily associated with the capital programs for power transformers, protective relays, digital fault recorders and disconnect switches, and the refurbishment of Wabush Terminal Station. The 2019 variance is primarily attributed to rescheduled work due to engineering and construction resource constraints, the cancellation or re-scheduling of various project scope items, and work being completed for less than the original material and labour estimates.

Activities deferred into 2020 due to engineering or construction resource constraints include:

- Various protection and control engineering and material procurement scopes of work;
- The digital fault recorder installation at Berry Hill;
- Disconnect switch procurement for several sites; and
- Wabush breakers and disconnects engineering and procurement.

Items removed from the project scope due to newly acquired condition assessment information indicating that the work was not immediately required include:

- Bay d'Espoir Transformer T1 moisture reduction; and
- Granite Canal Transformer T1 bushing replacement.

Items rescheduled to 2020 due to reassessment of priorities include several transformer refurbishment activities at Bottom Brook Terminal Station, Holyrood Terminal Station, and Sunnyside Terminal Station.

Work scopes that are forecasted to be completed for less than the original estimates include:

- Power transformer upgrades at various sites;
- The digital fault recorder upgrade at Berry Hill; and
- Wabush Terminal Station 230 kV refurbishment.

The forecasted variance in total project expenditure is primarily attributed to an updated forecast for the work to refurbish Wabush Terminal Station. For that work, the actual and forecasted costs for the procurement of replacement circuit breakers is less than originally estimated.

24) Implement Terminal Station Flood Mitigation - Springdale

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	838.2	87.0	(751.2)

Variance	Budget ($000)	Forecast and Expenditures ($000)	Variance ($000)
Project	974.0	1,270.4	296.4

This is a two-year project (2018–2019) that commenced in 2018 and has carried over into 2020. During engineering design, it was determined that the original project alternative to construct a retention berm outside of Hydro's property would cost significantly more than originally estimated. Further evaluation of project alternatives in 2019 demonstrated that the construction of a retention berm along the perimeter of the terminal station could also effectively achieve the desired level of flood mitigation and is the least cost alternative. The change in project alternative resulted in a revised project estimate and carry over of the project construction into 2020, to allow for design and environmental assessment in 2019. The forecasted variance in overall project expenditures and the variance in 2019 expenditures are attributed to this revised estimate and schedule.

25) Purchase Mobile dc Power Systems

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	924.6	616.3	(308.3)
Project	966.5	658.2	(308.3)

This is a two-year project (2018–2019) that was completed in 2019. The variances in overall project and 2019 expenditures are attributed to the actual contract cost for the mobile dc power systems being less than the original estimate.

26) Terminal Station Refurbishment and Modernization – Various Sites

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	24,464.8	9,616.1	(14,848.7)

Variance	Budget ($000)	Forecast and Expenditures ($000)	Variance ($000)
Project	26,795.7	18,122.3	(8,673.4)

This is a two-year project (2018–2019) that commenced in 2018 and has carried over into 2020. The project includes a number of consolidated program-type projects across several sites and a focused refurbishment at Wabush Terminal Station.

The variance in 2019 expenditure is primarily associated with the capital programs for protective relays, insulators, disconnect switches, power transformers, and the refurbishment of Wabush Terminal Station. The 2019 variance is primarily attributed to the rescheduling of work due to system outage constraints; the cancellation or re-scheduling of various project scope items due to new asset condition information, changing priorities for system reliability, or balancing of the overall work plan; and work being completed for less than the original material and labour estimates. Work rescheduled from 2019 to 2020 due to system outage constraints includes:

- Various protection and control system upgrades; and
- The replacement of a circuit breaker and its associated protection and communication systems at Wabush Terminal Station.

The following scope items have been transferred into the 2019-2020 Terminal Station Refurbishment and Modernization project, which has sufficient budget for this work:

- Transformer bushing replacements for Bay d'Espoir T10, Parson's Pond T1, South Brook T1, Hardwoods GT1 and Wabush T6;
- Installation of transformer moisture reduction systems for Oxen Pond T2 and Happy Valley T3;
- Replacement of a disconnect switch at Rattle Brook; and
- Procurement and installation of insulators at Happy Valley and St. Anthony Airport.

Grounding upgrades were partially completed at Hopedale, but a complete upgrade requires additional engineering design due to the rocky conditions found at site. Any additional grounding system upgrades at this location will be proposed as part of a future capital project. Work scopes that are forecasted to be completed for less than the original estimates include:

- Insulators and disconnect switch replacements at various sites;
- Power transformer upgrades at various sites; and
- Refurbishment work at the Wabush Terminal Station.

The forecasted variance in total project expenditure is primarily attributed to the capital programs for insulators, disconnect switches, power transformers, and the Wabush Terminal Station refurbishment particularly:

- The actual and forecasted costs for materials and labour being less than originally estimated, including insulators and disconnect switch replacements at various sites; power transformer upgrades at various sites; and the Wabush Terminal Station refurbishment; and
- Cancelled project scope. The replacement bushings for Bay d'Espoir Transformer T3 and Holyrood T7 were cancelled due to a changed long-term asset plan for these transformers.

27) Replace 66kV Station Service Feed - Holyrood

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	945.7	290.6	(655.1)
Project	1,261.4	606.4	(655.0)

This is a two-year project (2017–2018) that carried over and was completed in 2019. The variances in overall project and 2019 expenditures are attributed to the actual contract cost for the replacement of the station service feed cables being less than the original estimate.

28) Replace Substation - Holyrood

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Project	1,198.0	791.1	(406.9)

This is a two-year project (2017–2018) that carried over and was completed in 2019. During project engineering, connection of a power supply from Newfoundland Power was identified as a viable alternative. This new alternative was estimated and determined to be the least-cost solution compared to the original project scope to construct a new substation. A new project scope and schedule was developed in coordination with Newfoundland Power, and construction was completed in 2019. The variance in overall project expenditures is attributed to the change to the lower cost project alternative.

29) Terminal Station Refurbishment and Modernization – Various Sites

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Project	27,382.1	18,621.1	(8,761.0)

This is a two-year project (2017–2018) that commenced in 2017 and was carried over and closed in 2019. The project included a number of consolidated program-type terminal station projects across several sites. The variance in total project expenditures was primarily associated with the refurbishment or replacement of power transformers and disconnect switches, for which a portion of the work was executed for less that originally estimated. In addition, there was some scope reduction as new asset condition information became available, including the cancellation of the planned replacement of seven disconnect switches at Massey Drive.

The following scope was deferred and completed in 2019 as part of the 2018–2019 Terminal Station Refurbishment and Modernization project, which had sufficient budget for this work:

- Bushing replacements for Holyrood Transformers T5;
- Replacement of four disconnect switches at Western Avalon, Sunnyside, and Holyrood, due to system outage limitations; and
- Installation of breaker failure protection at Berry Hill and Peter's Barren.

The following scope was deferred and is scheduled to be completed in 2020 as part of the 2019-2020 Terminal Station Refurbishment and Modernization project, which has sufficient budget for this work:

- Bushing replacements for Bay d'Espoir Transformer T10;
- Transformer dehydrators for Happy Valley Transformer T3 and Oxen Pond Transformer T2; and

- Grounding system upgrades at Indian River, Coney Arm, and Deer Lake due to more complex designs required to address exceptionally high ground potential rise at these locations.

30) Upgrade Circuit Breakers – Various Sites

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	7,077.2	7,901.7	824.5

This is a five-year project (2016–2020) that commenced in 2016 and includes breaker replacements and refurbishments at a number of terminal station sites each year; it is expected to be completed in 2020. In 2019, three 145 kV circuit breakers and seven 245 kV circuit breakers were replaced and one 245 kV circuit breaker was refurbished. The variance in 2019 expenditures is primarily attributed to changes in timing of various project scope items, with no change in the forecasted total project expenditures.

31) Install Breaker Failure Protection – Various Sites

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	(7.4)	94.3	101.7
Project	277.0	793.2	516.2

This is a two-year project (2016–2017) that carried over and was completed in 2019. The variances in overall and 2019 project expenditures are attributed to higher than estimated engineering, procurement, and construction costs. During the design phase of the project, revisions to Hydro's design standard for breaker failure protection were required. The changes to the standard were made to address lessons learned from system events. The updated standard significantly impacted the overall design for breaker failure protection. This increased the engineering design effort on this project and resulted in increased procurement and construction costs due to the requirement for additional components to adhere to the new standard. In addition, a requirement for additional telecommunications cabling was identified for the work at Howley Terminal Station, Indian River Terminal Station, and Deer Lake Terminal Station.

4.5 Transmission Projects (Table 7)

32) Wood Pole Line Management Program - Various Sites

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	2,467.0	2,873.4	406.4
Project	2,467.0	2,873.4	406.4

This was a one-year project completed in 2019. The variance in expenditures was attributed to the completion of refurbishment work on TL 203 in 2019 that could not be completed as planned in 2018 due to the unavailability of outages of TL 203.

33) 230 kV Transmission Line – Bay d'Espoir to Western Avalon

Variance	Budget	Expenditures	Variance
Annual	1,716.2	875.9	(840.3)

This is a five-year project (2014–2018) that commenced in 2014 and carried over into 2019. The variance in 2019 expenditure is attributed to a portion of the contingency not being required at the end of the project. There is no change to the overall project scope or budget and all work was completed in 2019 and the project is now closed.

4.6 Distribution Projects (Table 8)

34) Provide Service Extensions - All Service Areas

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	4,900.0	3,550.5	(1,349.5)
Project	4,900.0	3,550.5	(1,349.5)

This is an annual budget that is based on data from past experience to provide service extensions to customers. The variance is due to less than forecasted distribution service extension requests.

35) Upgrade Distribution Systems – All Service Areas - CIAC

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	(95.0)	(251.5)	(156.5)
Project	(95.0)	(251.5)	(156.5)

This is an annual budget that is based on past Contributions in Aid of Construction ("CIAC") to provide service extensions to customers. The variance is primarily due to the BlockLab line extension in Wabush, as approved in Board Order P.U.39 (2019). BlockLab contributed $192,550 to this line extension project.

36) Condition Assessment for Submarine Cable – Farewell Head to Change Islands

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	300.1	166.3	(133.8)
Project	300.1	166.3	(133.8)

This was a one-year project completed in 2019. The variance in expenditure is attributed to lower than estimated construction and procurement costs.

37) Additions for Load – Distribution System

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	186.7	80.9	(105.8)
Project	186.7	80.9	(105.8)

This was a one-year project completed in 2019. The variance in overall project and 2019 expenditures is attributed to the actual engineering and construction costs being less than the original estimate.

4.7 Rural Generation Projects (Table 9)

38) Overhaul Diesel Units: Various Sites

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	2,511.3	2,154.4	(356.9)
Project	2,511.3	2,154.4	(356.9)

This was a one-year project completed in 2019. The project is part of an ongoing program to overhaul diesel engines and alternators to sustain reliability of the diesel generating plants. Project estimates are based on the projected number of engines and alternators that will reach the criteria for overhaul and typical extent of refurbishment. Three of the engines and one of the alternators planned for overhaul in 2019 did not proceed. The engine overhaul for Unit 2058 in Little Bay Islands was cancelled in anticipation of the eventual decommissioning of that diesel plant. The engine overhaul for Unit 2089 in Charlottetown (a mobile unit presently servicing the community following the Charlottetown diesel plant fire) was deferred to 2020 as the unit did not reach the expected number of operating hours in 2019. The engine and alternator overhauls for Unit 2063 in McCallum were deferred to 2020 as the unit did not reach the expected number of operating hours in 2019. The project variance is attributed to these cancelled and deferred overhauls.

39) Additions for Load Growth – Isolated Generation Systems

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	1,523.6	2,423.6	900.0

This is a two-year project (2019–2020) that commenced and was substantially completed in 2019, with final close-out activities scheduled for 2020. This project scope includes the construction of a new vertical fuel storage tank and associated earth dyke upgrades in Makkovik. The variance in 2019 expenditures is attributed to an increase in quantity of earthwork required to complete upgrades to the existing dyke, identified during engineering design. The contract costs for mobilization and the tank construction were higher than originally estimated. Prior to contract award, an updated net present value of project alternatives was completed and it was confirmed that the original alternative remains least cost.

40) Diesel Plant Fire Protection (2019–2020)

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	377.2	0.0	(377.2)
Project	1,917.4	0.0	(1,917.4)

This was a two-year project (2019–2020) for Black Tickle that was cancelled. An updated risk ranking for diesel fire protection, to reflect changing demographics in the community of Black Tickle, determined that the project is no longer justified.

41) Replace Human Machine Interface - Cartwright

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	306.9	152.9	(154.0)

This is a one-year project that commenced in 2019 and has carried over into 2020. The variance in 2019 expenditures is a result of the carryover of construction and commissioning activity into 2020. The scope of this project is to replace the existing human machine interface at the Cartwright Diesel Plant. The work was rescheduled from 2019 to 2020 to align with the replacement of a diesel engine as part of another capital project. By completing these two project scopes together, Hydro will avoid potential rework related to programming of the programmable logic controller and supervisory control and data acquisition system.

42) Inspect Fuel Storage Tanks – Grey River

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	203.1	317.0	113.9
Project	203.1	317.0	113.9

This was a one-year project completed in 2019. The internal inspections of two fuel storage tanks in Grey River were completed in 2019 as planned, in accordance with the provincial *Storage and Handling of Gasoline and Associated Products Regulations, 2003* under the *Environmental Protection Act* (O.C.2003-225). One tank did not pass inspection and could not be returned to service and the second tank was recommended for replacement within one year. The project scope was revised to include the replacement of both tanks in 2019 and the tanks were replaced. The variance is attributed to this new scope.

43) Diesel Genset Replacements (2019–2020)

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	525.6	140.2	(385.4)

This is a two-year (2019–2020) project that commenced in 2019. The variance in 2019 expenditures is attributed to a rescheduling of engineering design and procurement activities from 2019 into 2020 due to engineering resources having to shift focus in late 2019 to emergency restoration work at Charlottetown following the diesel plant fire. The overall project schedule is expected to recover with completion in 2020.

44) Diesel Plant Engine Cooling System Upgrades – Various Sites

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	1,160.7	1,013.7	(147.0)

This is a two-year project that commenced in 2018 and has carried into 2020. The variance in 2019 expenditures is attributed to the rescheduling of a portion of the construction activity to 2020. The project scope includes the replacement of cooling equipment at various diesel plants. All of the planned work for 2019 was completed except for the installation of radiators at the Rigolet and St. Anthony Diesel Plants. The construction resources for this work were reassigned to restore generation in Charlottetown following the diesel plant fire in late 2019. The work at Rigolet and St. Anthony has been rescheduled to 2020.

45) Diesel Plant Fire Protection – Postville

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	804.8	508.0	(296.8)

This is a two-year project (2018–2019) that commenced in 2018 and has carried over into 2020. The variance in 2019 expenditures is attributed to the carryover of final construction and commissioning activity into 2020 as a result of several delays in shipping materials from Goose Bay to Postville via the provincial seasonal ferry service. The work has been rescheduled for early 2020.

46) Inspect Fuel Storage Tanks – Black Tickle

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	337.0	562.8	225.8
Project	818.7	1,044.5	225.8

This was a one-year project that commenced in 2018 and was carried over and completed in 2019. The internal inspections of two fuel storage tanks in Black Tickle were completed in 2018 as planned, in accordance with the provincial *Storage and Handling of Gasoline and Associated Products Regulations, 2003* under the *Environmental Protection Act* (O.C.2003-225). The inspection for one of the tanks revealed that minor refurbishment was required and the refurbishment was completed in 2018. The inspection of the second tank revealed that a complete tank bottom replacement was required. Materials were ordered and the tank bottom replacement was completed in 2019. The variances in the overall project and 2019 expenditures are attributed to the additional scope to replace the bottom of one of the tanks.

47) Replace Secondary Containment System Liner – Nain

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	3,922.1	4,508.2	586.1
Project	3,089.6	5,180.7	2,091.1

This was a two-year project (2018–2019) that was completed in 2019. The planned scope included relocation of the four existing fuel tanks to facilitate replacement of the secondary containment system liner. A constructability review was completed early in the project design phase, identifying a risk to cost and schedule. The risk associated with the work required to move the tanks during the liner replacement warranted consideration, given that the three small tanks were 45 years old and had unknown refurbishment requirements. Instead of removing, refurbishing, and reinstalling the three old tanks, an identified alternative was to remove the three tanks and construct a new vertical fuel storage tank. Both alternatives were studied and it was concluded that the estimated cost was not materially different, but the risks to project cost, schedule and asset integrity were materially higher for moving, refurbishing, and reinstalling the old tanks compared to the alternative to construct a new tank. The decision was made to construct a new tank.

The variances in overall project and 2019 expenditures are attributed to higher than estimated cost for civil construction. With the completion of the geotechnical study and detailed design in 2018, it was determined that significantly more earth works were required to replace the dyke liner and provide the required foundation support for the tanks. This work was required regardless of which of the previously noted alternatives was chosen. Additionally, publicly tendered pricing for the construction was higher

than estimated and the quantity of contaminated soil requiring remediation exceeded the original estimate.

48) Diesel Genset Replacements – Makkovik

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	3,722.3	4,174.3	452.0

This is a three-year project (2018–2020) that commenced in 2018. The variance in 2019 expenditures was attributed to the advancement of some of the procurements activities prior to the end of the 2019 shipping season to ensure construction could continue on site in early 2020. In addition, the quantity of contaminated soil requiring remediation exceeded the original estimate.

4.8 Properties Projects (Table 10)

49) Install Pole Storage Ramps – Wabush

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	301.7	185.3	(116.4)
Project	301.7	185.3	(116.4)

This was a one-year project which was completed in 2019. The variance in project expenditures is attributed to the actual construction contract cost being less than the original estimate.

50) Construct New Facilities – Various Sites

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	449.9	342.3	(107.6)
Project	1,456.1	1,009.9	(446.2)

This was a two-year project (2017–2018) that carried over and was completed in 2019. The project scope consisted of the construction of storage buildings at the Makkovik and Charlottetown Diesel Plants and installation of pole storage ramps at various locations. The Charlottetown storage building was constructed in 2017. The pole storage ramps were constructed in 2017–2018. The Makkovik storage building construction, originally planned for 2018, was rescheduled and completed in 2019 in conjunction with a diesel plant building and yard extension. The diesel plant building and yard

extension is part of the scope of a separate project, approved by Board Order No. P.U. 43(2017), to replace a diesel generator set. The variance in 2019 expenditures was attributed to the efficiencies of completing these projects together. The overall project variance was primarily attributed to the actual engineering and construction contract costs being less than originally estimated for the pole storage ramps.

4.9 Metering Projects (Table 11)

There are no reportable variances under Metering Projects.

4.10 Tools and Equipment Projects (Table 12)

51) Replace Off-Road Track Vehicles – Bishop's Falls and Bay d'Espoir

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	950.5	12.0	(938.5)

This is a 2018 project that has carried over into 2020. The specification for the vehicles was changed to a unit that could also support work on new assets (i.e., TL 267) and be used for live line work. Time was required to develop the specification and complete field trials at the manufacturer's facility, resulting in a 2020 delivery schedule for the equipment.

4.11 Information Systems Projects (Table 13)

52) Upgrade Energy Management System – Hydro Place

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	271.7	108.9	(162.8)

This is a one-year project that was planned for completion in 2019. The schedule for final implementation has been moved to 2020. There are no changes to scope or budget.

4.12 Telecontrol Projects (Table 14)

53) Replace PBX Phone Systems – Various

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	1,107.4	1,244.7	137.3
Project	1,242.3	1,379.6	137.3

This was a two-year project (2018–2019) that was completed in 2019. The variances in overall project and 2019 expenditures were attributed to actual labour costs being higher than the original estimate.

4.13 Transportation Projects (Table 15)

54) Replace Vehicles and Aerial Devices – Various Sites

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	1,248.1	1,385.0	136.9

This is a two-year project (2019–2020) that commenced in 2019. The variance in annual expenditures is attributed to material handler units that were more costly than budgeted due to the US exchange rate, tariffs and modifications required to meet towing regulations. There is no anticipated change to the overall project budget.

55) Replace Vehicles and Aerial Devices – Various Sites

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	1,255.8	490.1	(765.7)

This is a two-year project (2018–2019) that has carried over into 2020. The variance in annual expenditures is attributed to a delay in shipping from the manufacturer. The three units that were scheduled for delivery in 2019 are now expected to arrive in 2020.

4.14 Administrative Projects (Table 15)

There are no reportable variances under Administrative Projects.

4.15 Allowance for Unforeseen Items (Table 16)

56) Allowance for Unforeseen Items

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	1,600.0	1,276.0	(324.0)
Project	1,600.0	1,276.0	(324.0)

The Allowance for Unforeseen Items is an annual allotment that permits Hydro to act expeditiously to deal with events affecting the electrical system that cannot wait for specific approval of the Board. Replacement of the Rigolet engine that failed in December 2018 was executed under this project. The report on this item has been filed with the Board. Hydro received approval to replenish the Allowance for Unforeseen Items Account in Board Order No. P.U. 7(2019), increasing the total 2019 allowance to $1.6 million. An additional project was initiated under this account following a fire at the Charlottetown Diesel Plant which occurred on October 7, 2019. Following the fire and loss of the facility, Hydro took steps to provide alternate power and prepare equipment for the winter season. Some costs associated with Hydro's response to the Charlottetown fire will be captured in the 2020 allowance.

4.16 Supplemental Projects (Table 16)

57) Hinds Lake Unit Major Overhaul

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	259.5	422.9	163.4
Project	259.5	422.9	163.4

This is a one-year supplemental capital project that was approved and completed in 2019. The variance in total project and 2019 expenditures is attributed to an increased scope of work associated with the major overhaul of the Hinds Lake generating unit. Following removal of the generator rotor, inspection of the stator indicated that additional electrical testing and subsequent refurbishment was required. The extra work on the stator was necessary to ensure unit reliability for the 2019–2020 winter operating season.

58) Level II Condition Assessments for Bay d'Espoir Penstock 4, Granite Canal Penstock, and Hinds Lake Penstock

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Annual	414.3	294.4	(119.9)
Project	414.3	294.4	(119.9)

This is a one-year supplemental capital project that was approved and completed in 2019. The variance in total project expenditures is attributed to the actual contract costs for the field work being less than the original budget estimate.

59) Penstock Condition Assessments – Bay d'Espoir

Variance	Budget ($000)	Expenditures ($000)	Variance ($000)
Project	1,120.6	1,832.6	712.0

This is a one-year supplemental capital project that was approved in 2018 and was carried over and completed in 2019. The requirement to complete unforeseen work on Penstock 3 (a separate project under the Allowance for Unforeseen Items) led to a revised generation outage schedule, which resulted in the field work for this project being completed later in 2018 than originally planned. The field work was completed and Hydro collected operational data through the fall and winter of 2018–2019. The engineering reports, which were the final deliverables of this project, were produced in 2019. The variance in total project expenditure is attributed to the actual contract costs for the field work completed in 2018 being higher than the original budget estimate.

5.0 Capital Budget versus Actual Expenditures 2010–2019

Table 17 provides a summary of Hydro's capital budget variances for the years 2010–2019.

Table 17: Capital Budgets/Expenditures 2010–2019

Year	Budget ($000)	Actual Expenditures ($000)	Variance ($000)	Variance (%)
2010	63,297	55,553	(7,744)	(12.2)
2011	67,454	63,116	(4,338)	(6.4)
2012	93,840	77,252	(16,588)	(17.7)
2013	116,373	84,755	(31,618)	(27.2)
2014	280,601	204,728	(75,873)	(27.0)
2015	311,177	125,119	(186,058)	(59.8)
2016	350,601	203,941	(146,660)	(41.8)
2017	340,501	340,741	240	0.1
2018	213,050	156,985	(56,065)	(26.3)
2019	164,194	126,575	(37,619)	(22.9)

In 2019, actual expenditures were below budget in Hydro's overall capital program by $37.6 million (22.9%), as shown in Table 17. The following three capital projects were the primary contributors to the variance. Had these projects been on budget, the overall actual expenditures would have been within 10% of the budget.

1) Variance 26: Terminal Station Refurbishment and Modernization 2018–2019 (-$14.8 million). Approximately half of the 2019 under-expenditure for this project is attributed to work being completed for less than the budget estimate and the other half is attributed to work being carried over to future years.

2) Variance 20: Increase Fuel and Water System Treatment Facility – Holyrood Gas Turbine (2018–2019) (-$5.2 million). This 2019 under-expenditure is attributed to work being completed for less than the budget estimate.

3) Variance 23: Terminal Station Refurbishment and Modernization 2019–2020 (-$5.0 million). Approximately half of the 2019 under-expenditure for this project is attributed to work being completed for less than the budget estimate and the other half is attributed to work being carried over to future years.

Hydro completed an analysis of all projects that had an annual under-expenditure of greater than $100,000 in 2019 to determine the primary drivers. Three main causes were identified, accounting for approximately 83% of the overall under-expenditure:

1) Work was completed for less than the budget estimates. This accounted for approximately 46% of the overall under-expenditure for the projects analyzed. Several projects were overestimated and, for many projects, contingency was estimated at 20% but was not required.

2) Work could not be completed due to the planned outages being unavailable or changed. This accounted for approximately 23% of the overall under-expenditure for the projects analyzed. Much of the capital program is dependent on equipment outages and those outages were not always possible in the durations required to complete the project work, due to system constraints or competing outage requirements. This occurred mainly for planned protection system upgrades in Bay d'Espoir, Holyrood, and Wabush Terminal Stations, as well as planned refurbishments of a surge tank and intake gates at Bay d'Espoir Hydroelectric Generating Facility.

3) Cancelled scope attributed to approximately 14% of the overall under-expenditure for the projects analyzed. Three projects totaling $3.1 million in budgeted 2019 expenditures were cancelled: (1) Refurbish Backfill on Penstock #1 - Bay d'Espoir (Variance 4); (2) Rehabilitate Shoreline Protection – Cat Arm (Variance 10); and (3) Diesel Plant Fire Protection - Black Tickle (Variance 40). Additionally, for the Provide Service Extensions - All Service Areas project (Variance 34) there were less customer requests for service extensions in 2019 than expected, resulting in an under-expenditure of $1.3 million.

Hydro continues to implement a number of improvements that are expected to close the gap between budget and actual expenditures for future years.

- Estimates of project contingency are being improved. Analysis completed in 2019 has shown that contingency has been high for many projects. For projects that closed in 2018, the overall contingency was estimated at 18% and only 9% was required. As a result of this analysis, Hydro has been applying additional analysis and rigour to the amount of contingency estimated for projects, starting with the 2020 budget cycle. Approximately 10% contingency was included in the estimates for new projects approved in the 2020 Capital Budget Application. Hydro will

continue to monitor the level of contingency required on projects and will adjust contingency estimates for future projects as appropriate.

- A more rigorous process has been established for project managers, lead estimators, discipline managers, and long-term asset planners for budget review prior to finalizing project proposals. The process includes a review and sign off of scope, schedule, estimates and contingency amount. This process was trialled for the 2019 budget cycle, enhanced, and rolled out for full implementation for the 2020 budget cycle. Hydro intends to continue to review its estimating practices to find areas of improvement other than contingency.

- Hydro continues to take steps for earlier, improved planning of the overall Integrated Annual Work Plan, with an aim to complete Integrated Annual Work Plans ahead of each annual Capital Budget Application and potentially decrease the amount of carryover by verifying that proposed projects are achievable from resource and outage availability perspectives. In 2020, Hydro intends to expand on its underspend analysis by completing a more detailed root cause analysis of the projects that carried over from 2018 and 2019 to identify trends and potential areas for improvement.

As outlined in Hydro's Efficiency and Effectiveness Plan framework,[2] Hydro has identified capital planning as an area of focus to pursue efficiencies and cost savings. As part of this initiative, Hydro will be reviewing its capital budget planning and execution methodologies.

6.0 Carryover Report

Table 18 provides a summary listing of the carryovers for projects initiated between 2016 and 2019.

[2] "Reference to the Board on Rate Mitigation Options and Impacts – Evidence of Nalcor Energy & Newfoundland and Labrador Hydro," September 20, 2019, app. 3.

Table 18: 2019 Carryover Report for the Year Ending December 31, 2019 ($000)

Project Name	PUB Approved Budget 2019	Revised Budget 2019[3]	Total Actual Expenditures 2019	Carryover Amount	Original Completion Year
Additions for Load - Isolated Generation Systems	1,523.6	1,741.6	2,423.6	(682.0)	2020
Diesel Genset Replacements - Makkovik	4,703.3	3,722.3	4,174.3	(452.0)	2020
Diesel Genset Replacements (2019–2020)	525.6	525.6	140.2	385.4	2020
Diesel Plant Engine Cooling System Upgrades - Various Sites	671.6	1,160.7	1,013.7	147.0	2019
Diesel Plant Fire Protection - Postville	336.4	804.8	508.0	296.8	2019
Distribution System Upgrades - Various Sites	390.8	390.8	422.2	(31.4)	2020
Hydraulic Generation Refurbishment and Modernization - Various Sites (2018—2019)	3,890.1	6,198.1	3,037.6	3,160.5	2019
Hydraulic Generation Refurbishment and Modernization - Various Sites (2019–2020)	3,422.0	3,712.8	1,836.8	1,876.0	2020
Implement Terminal Station Flood Mitigation - Springdale	787.8	1,134.6	87.0	1,047.6	2019
Increase Fuel and Water Treatment System Capacity - Holyrood Gas Turbine	3,012.7	4,051.9	3,563.9	488.0	2019
Install Energy Efficiency Lighting in Diesel Plants - Various	119.0	155.0	97.3	57.7	2020
Install Recloser Remote Control (2019–2020) - Rocky Harbour	66.1	66.1	22.0	44.1	2020
Muskrat Falls to Happy Valley Interconnection	-	12,586.4	12,528.5	57.9	2020
Overhaul Olympus Gas Generator - Stephenville	1,666.8	1,562.0	1,245.1	316.9	2019
Refurbish Powerhouse Station Services - Bay d'Espoir	1,460.6	2,800.6	2,643.4	157.2	2019
Refurbishment and Upgrade of Olympus C Gas Generator – Serial Number 202204	-	393.5	432.0	(38.5) [4]	2019
Replace Automation Equipment - St. Anthony	1,565.9	1,746.1	1,790.8	(44.7) [4]	2019
Replace Exciter Controls Units 1 to 6 - Bay d'Espoir	877.0	886.3	853.9	32.4	2020
Replace Human Machine Interface - Cartwright	306.9	306.9	152.9	154.0	2019
Replace Main Fuel Valves - Hardwoods	404.2	240.8	168.0	72.8	2019
Replace Off-Road Track Vehicles - Bishop Falls and Bay d'Espoir	986.3	1,043.7	12.0	1,031.7	2019
Replace Vehicles and Aerial Devices - Various Sites (2018–2019)	753.7	1,255.8	490.1	765.7	2019
Replace Vehicles and Aerial Devices - Various Sites (2019–2020)	1,248.1	1,248.1	1,385.0	(136.9)	2020
Terminal Station Refurbishment and Modernization Program - Various Sites (2018–2019)	10,661.1	11,319.5	4,797.1	6,522.4	2019
Terminal Station Refurbishment and Modernization Program - Various Sites (2019–2020)	9,271.0	5,814.9	4,615.8	1,199.1	2020
Upgrade Circuit Breakers - Various Sites (2016–2020)	6,597.3	10,122.2	7,901.7	2,220.5	2020
Upgrade Compressed Air System - Holyrood Gas Turbine	70.7	70.7	17.7	53.0	2020
Upgrade Energy Management System - Hydro Place	271.7	271.7	108.9	162.8	2019
Upgrade Telecontrol Facilities - Gull Pond Hill and Bay d'Espoir Hill	96.3	96.3	97.8	(1.5)	2020
Upgrade Terminal Station for Mobile Substation - St. Anthony	89.3	89.3	41.8	47.5	2020
Total 2019 Carryover Projects	**55,775.9**	**75,519.1**	**56,609.1**	**18,910.3**	

[3] Revised Budget = Board Approved Budget + Carryovers + Change Management.
[4] Project costs effective December 31, 2019. At that time Hydro had not yet completed Change Management documentation.

7.0 Safety Hazards

In Board Order No. P.U. 38(2010) related to Hydro's 2011 Capital Budget Application, the Board directed Hydro to include in its annual report on capital expenditures an explanation on each project that was undertaken for the Remove Safety Hazards project, setting out the safety hazard that was identified, the location, the steps taken to address the issue, and the amount of the expenditure. Table 19 outlines the projects undertaken in 2019.

Total Approved Budget: **$197,500**

Total Expenditure: **$210,900**

Table 19: Safety Hazards

Project Title and Location	Expenditure ($000)	Safety Hazard Identified	Project Scope
Replace Deteriorated Main Entrance Walkway Holyrood TGS	79.5	The interlocking paver stone walkway for the main building entrance had deteriorated due to age and as a result of a buried process pipe leak in 2019. Uneven surfaces and heaved paver stones posed slip and trip issues while rainwater ponded in places nearly 100 millimetres deep with very slow drainage that resulted in severe ice problems in winter.	Removed existing walkway including sub-surface materials and replaced with steel-reinforced concrete with brushed finish to maximize traction.
Replace Pedestrian Guard Rails in the vicinity of the Pump House Intake Holyrood TGS	65.3	Original construction steel-pipe handrails approximately 50 years old exhibited severe corrosion and could not be relied upon to perform as intended. In addition, their design was non-compliant with current dimensional standards. This put workers at risk of falling into deep fast-moving water.	Purchased and installed approximately 100 metres of new handrail system along the water's edge.
Replace 600 Volt Quick-Connect Receptacles Bay d'Espoir Hydroelectric Generating Facility	39.8	600 Volt receptacles contain a safety interlock switch that de-energizes the contacts until the cord-end plug is fully inserted. However, most site receptacles are from original construction (approximately 50 years old) and the interlock mechanism had failed, exposing workers to arc-flash hazards. Seven receptacles were locked out forcing workers to run longer extension cords introducing additional hazards.	Purchased and installed seven new 600 Volt interlocking receptacles as direct replacement for failed units.
Install Anti-Slip Mats in the Waste Water Basin Building Holyrood TGS	15.3	The building houses large open pools of warm process water. Constant high humidity causes the bare concrete walkways between and around the pools to accumulate puddles and become slick. Workers were subjected to high risk slip hazards near the open pools of water.	Purchased and installed 60 metres of 0.9 metre width open-weave matting designed for wet environments to improve boot-traction.

Project Title and Location	Expenditure ($000)	Safety Hazard Identified	Project Scope
Add Fencing at Quarry Brook Dam and Add Signage at Cooling Water Discharge into Conception Bay Holyrood TGS	11.0	Construction of a second cooling water supply line from Quarry Brook in 2018 created a ten metre gap between the tree line and existing fencing that posed a public safety hazard in non-compliance with corporate Public Safety Around Dams guidelines. The plant cooling water discharge pipes are located alongside a publically accessible trailway and beach area with only large stones separating the discharge area. Sudden operation at 50,000 gallons per minute is possible posing serious risk to anyone that may venture past the stones.	Extended fencing by ten metres to meet the tree line at Quarry Brook Dam. Erected a warning sign advising the public of the water discharge hazard.

8.0 Terminal Station In-Service Failures

Hydro has committed to providing a summary of activities completed under the Terminal Station In-Service Failures project. Table 20 outlines 2019 expenditures under this project.

Total Approved Budget: **$1,000,000**

Total Expenditure: **$1,744,600**

Table 20: Terminal Station In-Service Failures

Project Title and Location	Expenditure ($000)	Failure Identified	Project Scope
Circuit Breaker B3T5 Replacement Bay d'Espoir Terminal Station 1	466.2	Unit 5 at Bay d'Espoir was being prepared for synchronization with both sides of circuit breaker B3T5 being energized. Before automatic synchronization was initiated, the system experienced a B Phase voltage dip of approximately 20 to 30 kV and Transformer T5 tripped an overcurrent relay. The overcurrent relay then commanded breaker B3T5 to open, but it was already in the open position. As a result, breaker failure protection operated and cleared Bus 3 (1.3 seconds later) which included both Unit 5 and Unit 6. Upon further review of the fault records it was determined the breaker had passed current on phase B indicating an internal flash over. Further Doble testing, SF_6 gas quality testing and follow up with the original equipment manufacturer's engineering team	Breaker B3T5 was replaced. The original equipment manufacturer refurbished the failed circuit breaker at a cost to Hydro of only the transportation to and from the factory. The refurbished breaker will serve as a spare.

Project Title and Location	Expenditure ($000)	Failure Identified	Project Scope
		confirmed there was an internal flashover of phase B and the breaker required replacement.	
Circuit Breaker B3T6 Replacement Bay d'Espoir Terminal Station	386.0	While taking Bay d'Espoir Unit 6 off line during a controlled shutdown, breaker failure protection for breaker B3T6 operated causing Bus 3 to clear (0.2 seconds later) and Unit 5 to come offline. When breaker B3T6 was opened, the system experienced a C-Phase fault on the breaker. Upon further review of the fault records, it was determined that breaker B3T6 had passed current on phase C indicating a possible internal flashover. Further doble testing, SF_6 gas quality testing and follow up with the original equipment manufacturer's engineering confirmed there was an internal flashover of phase C and immediate replacement was required.	Breaker B3T6 was replaced. The original equipment manufacturer refurbished the failed circuit breaker at no cost to Hydro. The refurbished breaker will serve as a spare.
Circuit Breaker B2T4 Replacement Bay d'Espoir Terminal Station	354.2	Bay d'Espoir Unit 4 was being prepared for synchronizing with both sides of B2T4 being energized. During synchronization the system experienced a voltage dip on A-Phase and tripped transformer T4 overcurrent relay. The overcurrent relay then commanded breaker B2T4 to open but it was already in the open position. As a result, breaker failure protection operated and cleared Bus 2 which included both Unit 4 and Unit 3. Upon further review of the fault records it was determined breaker B2T4 had passed current on phase A in the open position indicating a possible internal flashover. Further SF_6 gas quality testing of A-Phase showed SO_2 in the gas which also indicates that the breaker had an internal fault. An original equipment manufacturer technician was onsite and breaker B2T4 was opened for inspection; it was confirmed that A-Phase had experienced an internal fault.	Breaker B2T4 was replaced. The original equipment manufacturer will refurbish the failed circuit breaker at no cost to Hydro. The refurbished breaker will be used at an alternate location under the Breaker Replacement Program.

Project Title and Location	Expenditure ($000)	Failure Identified	Project Scope
Station Service Transformer SS2 Replacement Wabush Terminal Station	192.9	Station Service Transformer SS2 failed due to an internal fault. The fault resulted in damage that open-circuited phases of the winding. This station service transformer required replacement in order to restore station service transformer redundancy and also provide a grounding source for Bus 15 and Bus 16. In the Wabush Terminal Station, with one station service transformer out of service and the grounding source removed from Bus 15 and Bus 16, the tie breaker must be closed resulting in only one Synchronous Condenser being operational. This in turn causes a reduction in the load that can be supplied to Labrador West and possible load restrictions to Iron Ore Company of Canada.	Wabush Terminal Station Service Transformer SS2 was replaced.
Purchase Spare Current Transformers ("CT") for Churchill Falls	92.6	One spare 230 kV CT and one spare 230 kV current transformer/power transformer ("CT/PT") combination unit is required for the standby equipment pool due to the long lead time to acquire these units from the manufacturer. Acquisition of a replacement unit could take up to 18 months. This delay could result in long-term outage to customers and reduced system reliability.	One spare 230 kV CT and one spare 230 kV CT/PT combination unit were purchased for the standby equipment pool.
Disconnect Switch L12-1/L12-G1 Replacement Bay L'Argent Terminal Station	86.4	138 kV L12-1/L12-G1 disconnect switch had a damaged ground switch which was unrepairable. The disconnect switch was 50 years old and replacement parts were not readily available. Replacement of this disconnect switch with a spare disconnect from the standby equipment pool was required.	138 kV L12-1/L12-G1 disconnect switch was replaced.
69 kV Breaker Refurbishment Hawke's Bay Terminal Station	56.6	B1L21 is a 69 kV circuit breaker that was identified as leaking SF_6 gas to atmosphere. This is an environmental concern as SF_6 is a potent greenhouse gas. As well, leaking gas could result in a flashover of the breaker or a catastrophic failure resulting in loss of service to customers and compromising the integrity of the electrical system in the area.	69 kV breaker B1L21 was refurbished.

Project Title and Location	Expenditure ($000)	Failure Identified	Project Scope
X1 Surge Arrestor Replacement Bottom Brook Terminal Station	28.4	Surge arrester X1 on Bottom Brook transformer T1 failed on June 19, 2019 causing loss of power to the terminal station leaving customers in Burgeo, Doyles, and Stephenville area without power for approximately 4 hours. Transformer T3 was brought online to restore power to the affected customers. Immediate replacement of the arrester was required to get T1 back into service. There was no obvious reason for this failure. Engineering review identified that an appropriate overvoltage rating for the surge arrestors in this installation is 115 kV, whereas existing arresters are rated for 98 kV. It was therefore recommended that all three surge arrestors be replaced (X1, X2, and X3) to avoid a repeat event on the other phases.	X1, X2 and X3 surge arresters on Transformer T1 were replaced.
TL207 A-Phase Capacitive Voltage Transformer Replacement Sunnyside Terminal Station	19.0	During a scheduled TL 207 Outage, Doble Testing was performed on all three Capacitive Voltage Transformers. Test results were good. On re-energization of TL 207, the A-Phase Capacitive Voltage Transformer failed across its surge suppression device, burning open and melting/heating adjacent wiring and sealing gland plate. Immediate replacement was required to restore TL 207.	TL207 A-Phase Capacitive Voltage transformer was replaced.
Transformer T5 B-Phase Potential Transformer Replacement Holyrood Terminal Station	16.1	During scheduled 6 year maintenance, Doble Testing revealed elevated Power Factor values that were two to three times expected values on Transformer T5 B-Phase potential Transformer. Thorough cleaning and multiple tests were run to confirm results. A comparison was completed of four similar units on Hydro's system (same type, same vintage), that further showed this unit to be failing. Immediate replacement was required to restore 69 kV Bus 7 and Transformer T5 to full function.	Transformer T5 B-Phase Potential Transformer was replaced.

Project Title and Location	Expenditure ($000)	Failure Identified	Project Scope
Compressor Replacement Grand Falls Converter Station	14.5	Grand Falls Converter Station Compressor A failed and was damaged on January 10, 2019. An assessment concluded that it was not repairable and must be replaced.	A direct replacement compressor was purchased and installed.
L34T1 A-Phase Current Transformer Replacement Upper Salmon Terminal Station	14.0	During an outage to Upper Salmon L34T1, an oil leak was identified under L34T1 A-Phase CT. Immediate replacement was required to prevent equipment failure, customer outage and/or collateral damage to other equipment.	L34T1 A-Phase CT was replaced.
B1L39 A-Phase Current Transformer Replacement Deer Lake Terminal Station	12.1	B1L39, a 138 kV current transformer at Deer Lake Terminal Station installed in 1977, was identified as leaking oil. Immediate replacement was required to prevent equipment failure and possible outage and/or collateral damages to other equipment.	B1L39 A-Phase CT was replaced.
Transformer T2 Surge Arrester Replacement St. Anthony Diesel Plant	5.6	The H2 Surge Arrester on transformer T2 at the St. Anthony Diesel Plant failed on September 30, 2019 causing loss of the availability of power from the diesel generating units. Immediate replacement was required to return transformer T2 to service and allow Hydro to utilize diesel generation to complete a major outage planned for Oct 2, 2019.	H2 Surge Arrester on Transformer T2 was replaced.

9.0 Hydraulic Generation In-Service Failures

Hydro has committed to providing a summary of activities completed under the Hydraulic Generation In-Service Failures project. Table 21 outlines 2019 expenditures under this project.

Total Approved Budget: **$1,250,000**

Total Expenditure: **$1,374,400**

Table 21: Hydraulic In-Service Failures

Project Title and Location	Expenditure ($000)	Failure Identified	Project Scope
Coffer Dam 8 (CD-8) Riprap Refurbishment Cat Arm	701.4	On July 30, 2019, an annual inspection was completed on the Cat Arm Dams. Approximately 27% riprap loss was noted during the inspection on CD-8. Riprap is the erosion protection layer on the embankment dams and loss of riprap leaves the dam internal components susceptible to further damage, especially by ice. Continued loss of riprap would lead to the requirement for more extensive rehabilitation and possibly a dam breach.	Riprap was replaced on CD-8. Material was processed from nearby quarry, transported via barge to CD-8, and placed using heavy equipment.
Capital Spares Hinds Lake and Cat Arm	313.3	The following equipment was determined to be required for the standby pool, to allow fast responsive action to future failures of long lead equipment: 1. Hinds Lake Service Station Transformer ($114.3); 2. Hinds Lake Bearing Oil Cooler/Turbine Cooler/Generator Air Cooler ($84.4); 3. Hinds Lake Circuit Breaker ($32.8); and 4. Cat Arm Excitation Transformer ($81.7) to enable responsive action to failures.	The spare equipment was procured for the standby pool.
Crane Bus Bar Replacement Paradise River	71.3	The powerhouse crane conductor bars warped out of shape and no longer provide a safe electric power distribution pathway for the entire overhead crane.	A direct replacement of the bus bar system was procured and installed.
Partial Discharge Analyzer Replacement Bay d'Espoir	66.6	The current Partial Discharge Analyzer has been in service for approximately 25 years and was identified to be faulty with a broken communication port. This Partial Discharge Analyzer was obsolete and discontinued by the manufacturer.	A new Partial Discharge Analyzer was procured and installed.

Project Title and Location	Expenditure ($000)	Failure Identified	Project Scope
Maintenance Air Compressor Replacement Bay d'Espoir Powerhouse 1	46.4	The air compressor used for maintenance and as emergency back-up was seized and became non-operational.	A replacement air compressor was procured.
Control Room Air Conditioning Unit Cat Arm	40.4	The control room air conditioning unit failed due to corroded copper tubing and fittings.	A replacement air conditioning unit was procured in 2018 and installed in 2019.
Generator Guide and Thrust Bearing Replacement Bay d'Espoir Unit 3	39.8	Unit 3 experienced abnormal vibration levels during operation and intervention was required for reliable generation. Offline disassembly and inspection revealed that the thrust and guide bearing assemblies had extensive wear and required replacement.	The existing generator thrust and guide bearing assemblies were replaced.
Fire Alarm System Replacement West Salmon Dam	31.2	The existing fire alarm system had been in operation since 2002. Replacement parts were no longer available and the system was indicating sensor faults due to failure of alarm system components.	Replacement fire alarm panels and field devices were procured and installed.
Fire Pump Replacement Hinds Lake	25.0	Fire Pump No. 2 was in service since 1980. The internal components of the pump as well as the casing had deteriorated to the point where the pump was no longer available for continued operation, thus requiring immediate replacement.	A new fire pump to replace the Fire Pump No. 2 was procured in 2019 and will be installed under the 2020 Hydraulic In-Service Failures project.
Oil Skimmer Replacement Bay d'Espoir Powerhouse 2	15.3	The oil skimmer consists of a mop, motor, housing, and switch. The mop was severely worn causing entanglement issues and required replacement. Replacement components for the oil skimmer are no longer available.	A replacement oil skimmer was procured and installed.
Waste Oil Storage Tank Replacement Cat Arm	13.4	The 960 Liter double-walled waste oil tank experienced a loss of vacuum in the interstitial space, indicating an internal leak, which could not be repaired.	A new waste oil tank was procured and installed.

Project Title and Location	Expenditure ($000)	Failure Identified	Project Scope
Fire Alarm System Replacement Granite Canal	10.3	The existing fire alarm system has been in operation since 2002. Replacement parts were no longer available and the system was indicating sensor faults due to failing alarm system components.	Procurement of replacement alarm panels and field devices was completed in 2019 and installation will occur in 2020, under the 2020 Hydraulic In-Service Failures project, when road conditions allow access to site.

10.0 Thermal Generation In-Service Failures

Hydro has committed to providing a summary of activities completed under the Thermal Generation In-Service Failures project. Table 22 outlines 2019 expenditures under this project.

Total Approved Budget: **$1,250,000**

Total Expenditure: **$2,327,400**

Table 22: Thermal Generation In-Service Failures

Project Title and Location	Expenditure ($000)	Failure Identified	Project Scope
Capital Spares Procurement Holyrood TGS	265.5	The planned scope for the In Service Failures project for 2018 included the procurement of the following spare components: 1. Unit 3 Excitation Transformer 2. Auxiliary Board Transformer 3. dc Lube Oil Pump Motor	The spare components were ordered in 2018 and received in 2019.
Dump Valves Overhaul Holyrood TGS Units 1 and 2	204.4	In 2018, Hydro refurbished the hydraulic system for Unit 1 and Unit 2 control valves as an in-service failure. The refurbishment of the hydraulic systems consumed all of the capital spares in the standby pool. A review of the component failure rate resulted in an update to the standby spare strategy to increase the required number of available spares. In addition, the dump valves, air dryers, and external filters required replacement but were not able to be completed in 2018.	In 2019, the dump valves were refurbished, air dryers were replaced, and external filter units were replaced on Units 1 and 2. Hydraulic servo valves for the Stage 1 turbine hydraulic system were ordered and received in 2019 to serve as spares.

Project Title and Location	Expenditure ($000)	Failure Identified	Project Scope
Control Valve Refurbishment Holyrood TGS Unit 2	200.6	On April 12, 2019 while reducing load on Unit 2, the unit experienced a load rejection of 50 MW, causing multiple unstable boiler conditions including a low drum level, causing the unit to trip. During the unit stabilization following the trip, it was observed that the Main Turbine Control Valves were open 39%; these valves should close automatically following a trip. The hydraulic system was tested and verified to be in proper operation. An attempt was then made to stroke the Main Turbine Control Valves to the open/closed positions, and the valves could not be closed more than 39%, indicating that there was a physical obstruction of the Main Turbine Control Valves or the Hydraulic Cylinder.	The main turbine control valve camshafts were refurbished and the camshaft bearings and hydraulic ram were replaced in 2019.
Capstan Access Platform Replacement Holyrood Marine Terminal	181.5	Inspection revealed that the four capstan extension platforms on the Marine Terminal had deteriorated due to corrosion and required replacement.	The four capstan access extension platforms were replaced in 2019.
Circulating Water ("CW") Elbows Replacement Holyrood TGS Units 2 and 3	174.9	The CW elbows for Units 2 and 3 were found to be extensively corroded and leaking. Previous welding repairs on these elbows were found to have limited success.	New elbows were procured, fabricated, and installed on Units 2 and 3 CW systems.
Fuel Oil Return Line Replacement Holyrood Marine Terminal	169.1	The Marine Terminal 4 inch return line was replaced in 2018 as an in-service failure. There was insufficient time in 2018 to replace the associated heat tracing and insulation.	Installation of heat tracing and insulation on the fuel oil return line was completed in 2019.
Forced Draft ("FD") Fan Bearing Liner Replacement, Holyrood TGS Unit 1	119.3	On June 17, 2018 the Unit 1 East FD fan inboard bearing liner failed, which led to a forced outage on Unit 1. In 2018, the inboard bearing liner was replaced with an available spare and the journal (the bearing surface section of the fan shaft) was refurbished.	A new liner was ordered in 2018 and received in 2019, to replace the liner drawn from inventory.

Project Title and Location	Expenditure ($000)	Failure Identified	Project Scope
Variable Frequency Drive ("VFD") Spare Cells Holyrood TGS	101.6	Six VFD cells failed in service, with no impact on unit production. The VFD system is able to handle one cell failure per phase without affecting production. However, if two cell failures occur on the same phase, a voltage imbalance will negatively impact the torque and speed of the FD Fan motor, thus reducing the amount of combustion air to the boiler and potentially tripping the generating unit.	The six failed cells were replaced using available spares. Three of the failed cells were refurbished and added to inventory as spares. The other three failed cells could not be refurbished; three new cells were purchased to replenish the available spares.
Synchro drive Replacement Holyrood TGS Unit 3	84.2	During the fall of 2018, Holyrood operations were not able to restart the Unit 3 synchronous condenser following a scheduled shutdown. Troubleshooting determined that the Mark VI controller had failed. This controller was obsolete.	The Mark VI controller was replaced with a Mark VIII controller.
Jetty Timbers Replacement Holyrood Marine Terminal	78.2	In 2013, deteriorated timbers on the Jetty Fender No. 2 were replaced with temporary lumber held together by threaded rods due to a lack of spare timbers available and long lead times related to the procurement of new timbers. These temporary timbers were discovered to be deteriorated and required replacement.	The deteriorated timbers on Fender No. 2 were replaced. In addition, spare timbers were purchased and added to the capital spare inventory.
Distributor Control System ("DCS") Computer Stations Replacement Holyrood TGS	75.5	Seven out of eighteen DCS computer stations in the Holyrood Control Room were determined to be obsolete. Three (3) obsolete stations failed between 2018 and 2019 and parts are no longer available.	The seven obsolete DCS computer stations were replaced.
East Fuel Oil Pump Replacement Holyrood TGS Unit 1	70.6	In February 2019, it was identified that Unit 1 was unable to achieve full load due to the East Heavy Fuel Oil Pump failing to meet performance requirements.	Unit 1 East heavy fuel oil pump was replaced.
High Pressure Feed Water Valves Replacement Holyrood TGS Unit 2	67.9	During Unit 2 operation, leaking gate, check, and safety valves were discovered on the Unit 2 High Pressure Feed Water line.	Leaking valves and connected piping for the high pressure feed water were replaced.
East Fuel Oil Pump Replacement Holyrood TGS Unit 2	67.2	The Unit 2 East fuel oil pump was unable to maintain system operating pressure due to extensive damage on internal components (screw impellers and casing) caused by the abrasive properties of No. 6 heavy fuel oil.	The Unit 2 East fuel oil pump was replaced.

Project Title and Location	Expenditure ($000)	Failure Identified	Project Scope
Fuel Oil Pumps Replacement Holyrood TGS Unit 3	56.6	The East and West fuel oil pumps servicing Unit 3 failed and required replacement. Pipe strain was discovered on the suction and discharge flanges on both pumps during the annual 2019 maintenance outage, which contributed to the pump failures.	The East and West fuel oil pumps for Unit 3 were replaced with new pumps and the connecting piping was modified to remove pipe strain on the pumps.
Fuel Oil Mass Flow Meter Replacement Holyrood TGS Unit 1	54.3	Online testing revealed that the mass flow meter and transmitter on Unit 1 was reporting incorrect fuel flows.	The Unit 1 fuel oil mass flow meter and transmitter were replaced with an available spare. A new flowmeter and transmitter was purchased to replace those drawn from the capital spare pool.
Turbine Generator Cooler Control Valve Replacement Holyrood TGS Unit 1	49.2	A high temperature alarm was received on the Unit 1 Turbine Generator Cooling System. Upon investigation, it was determined that the alarm was being caused by binding of the control valve.	The Turbine Generator cooler control valve and actuator were replaced.
East Boiler Feed water Pump (“BFP”) Recirculating Valve Overhaul Holyrood TGS Unit 2	39.1	During operation, it was identified that the East BFP recirculating valve was stuck in a partially open position. Further investigation identified damage to the valve’s stem, seat, and plug and these components required replacement.	An overhaul was completed on the Unit 2 East BFP recirculating valve to replace the damaged internal components.
VFD Blower Reinforcement Kit Procurement Holyrood TGS	38.7	The FD fans have experienced several blower failures since the VFDs were installed. Further investigation into the cause of the blower failures determined that the bearings of the cooling fan motors had been failing due to vibration. The original equipment manufacturer recommended a blower reinforcement kit to address the bearing issues.	Six blower reinforcement kits were purchased and installed.

Project Title and Location	Expenditure ($000)	Failure Identified	Project Scope
Boom Deployment Moorings Replacement Holyrood Marine Terminal	35.9	Two of the three boom deployment moorings on the Marine Terminal failed during a tanker delivery. Upon inspection of the anchors, chains, and buoys, it was determined that the boom deployment moorings all required replacement due to severe corrosion of the chains and deterioration of the concrete anchor structures.	All boom deployment moorings were replaced.
Fire Water Pumps Refurbishment Holyrood TGS	35.3	The electric fire pump was taken out of service to repair a packing leak and damage was discovered to the shaft, bearings, and seals. The jockey pump was also inspected and found to have major cavitation damage on the internal components.	The electric driven fire pump was refurbished to replace the damaged internal components. The jockey pump was replaced with an available spare pump.
Relay Room Condenser Replacement Holyrood TGS	31.9	The tubes of the relay room condenser of one of the Stage 1 air conditioning units were leaking and had to be bypassed. With the condenser bypassed, the air conditioning unit is not adequately cooling the Stage 1 Relay Room.	The relay room condenser was replaced.
Fire Water Piping Isolation Valves Replacement Holyrood TGS Fire System	30.9	It was determined that one of the isolation valves of the fire system was passing fluid and required replacement.	The isolation valve and required piping were replaced.
Vacuum Pump Motors Refurbishment Holyrood TGS Unit 2	27.7	Testing was completed on the motor windings of the Unit 2 north and south vacuum pumps on July 26, 2019. Testing indicated that the windings were shorted to ground. Further assessment indicated a winding short-circuit on the North vacuum pump motor and severe deterioration of the end bell of the South vacuum pump motor.	The north and south vacuum pump motors were refurbished.
Fire Water Distribution Equipment Replacement Holyrood TGS Station	19.6	A leak was discovered in a hydrant takeoff pipe due to crack in the pipe. A hydrant isolation valve was also cracked and leaking.	The failed valve, piping and hydrant were replaced.

Project Title and Location	Expenditure ($000)	Failure Identified	Project Scope
Potential Transformers Capital Spares Procurement Holyrood TGS	19.3	On December 9, 2018, two of the six potential transformers on the generator for Unit 1 failed and were replaced with available spares. Following this event, a review of the failure rate resulted in an update to the standby spare strategy to increase the number of available spares from two to six.	Six spare potential transformers and associated fuses were ordered and received in 2019.
Capstan Gear Box Refurbishment Holyrood Marine Terminal	15.2	One of six Capstan gearboxes seized and failed to operate in 2019. Assessment of the failed gearbox determined that all bearings and seals required replacement.	The failed gearbox was replaced with an available spare. The failed gearbox was overhauled, tested and added to inventory as a spare.
Battery Cell Capital Spare and Charger Procurement Holyrood TGS	13.2	A review of the reliability of the existing battery bank system concluded that a four-cell spare is required to mitigate the risk of failure. On each battery bank, the batteries are connected in series such that the failure of one battery could result in the entire bank going out of service. To return a bank to operation, the failed battery can be bypassed temporarily. However, the bank would have to be removed from service again to replace the failed battery. By installing an on-site charger and spare four-cell battery, the failed battery could be replaced immediately, thus maintaining the reliability level of the three generating units.	A spare four-cell battery and charger were purchased and installed as a hot standby critical spare.

11.0 Condition Assessment and Miscellaneous Upgrades – Holyrood TGS

Hydro has committed to providing a summary of activities completed under the Condition Assessment and Miscellaneous Upgrades - Holyrood project that were not originally contemplated in the project description. Table 23 outlines the additional expenditures under this project, totalling $973,100.

Total Approved Budget: **$1,968,800**

Total Expenditure: **$2,941,700**

Table 23: Condition Assessment and Miscellaneous Upgrades – Holyrood TGS

Item	Description	Cost ($000)	Scope of Work and Justification
1	Refurbished east and west air heater guide bearing assembly, Holyrood TGS Units 1, 2, and 3	397.6	In 2018, there was a failure of an air heater guide bearing trunnion shaft and a separate failure of a guide bearing pot. Following these failures, it was determined that all air heater trunnion shafts, seals, and pots should be replaced and rotors balanced, for the air heaters on Units 1, 2 and 3. Failure of an air heater bearing could lead to a forced unit outage. Refurbishment of the air heater guide bearing assemblies was completed on Units 1, 2, and 3 in 2019.
2	Replaced vertical stack breeching expansion joint and flanges Holyrood TGS Unit 2	153.1	In 2019, Unit 2 stack breeching was inspected and the expansion joint and flanges were determined to be deteriorated. Stack breeching conveys flue gas from the boiler to the stack and a leak in the expansion joint would introduce flue gas into the powerhouse, which is a safety risk. Replacement was completed in 2019.
3	Replaced east & west forced draft fan inlet screens and dampers Holyrood TGS Units 1 and 2	122.5	In 2018, fan inlet screens and dampers were inspected and determined to be corroded and impeding movement of the inlet dampers. This resulted in air flow reduction, which could have led to a forced unit outage. As well, corroded pieces could fall down into the air duct causing damage or disruption to the operation of the fan rotor or variable inlet vanes. Replacement of the screens and dampers was completed in 2019.
4	Replaced air heater gas inlet fabric expansion joints Holyrood TGS Unit 3	84.6	In early 2019, the Unit 3 air heater gas inlet fabric expansion joint was inspected and determined to be deteriorated. A leak in the expansion joint would introduce flue gas into the powerhouse, which is a safety risk. Replacement was completed in 2019.
5	Water Wall Tube Inspection Holyrood TGS Units 1, 2, and 3	82.8	Abnormal chemistry test results for the boiler feedwater led to the need to inspect the water wall tubes. A sample of water wall tubes was inspected on all three units in 2019.

Item	Description	Cost ($000)	Scope of Work and Justification
6	Replaced economizer skin casing and refractory Holyrood TGS Unit 1	48.5	In 2018, gas leaks were identified on the Unit 1 economizer, introducing flue gas into the powerhouse, which is a safety risk. A temporary repair was completed in 2018 and replacement of the deteriorated components was completed in 2019.
7	Replace fuel oil anti-freeze pot piping Holyrood TGS Units 1 and 2	40.1	In 2018, fuel oil anti-freeze pot piping was inspected and found to be partially plugged with debris. This piping is connected to instrumentation used for fuel oil pressure control. Failure could result in fuel oil being emitted from stacks. Replacement of plugged sections of piping was completed in 2019.
8	Inspection and condition assessment of forced draft fans Holyrood TGS Unit 1	30.5	In 2018, Hydro's insurance provider conducted a site review and recommended inspection of the Unit 1 forced draft fans by the original equipment manufacturer in 2019. Hydro accepted this recommendation and a condition assessment was completed in 2019.
9	Replaced air heater water wash header and nozzles Holyrood TGS Unit 2	13.4	In 2018, it was discovered that the air heater water wash header and nozzles were not functioning properly. A header with a different type of nozzle was installed in 2019 to correct the problem.