Nova Scotia Utility and Review Board

IN THE MATTER OF Section 35A of *The Public Utilities Act,* R.S.N.S. 1989, c.380, as amended

- and -

IN THE MATTER OF an Application by Nova Scotia Power Inc. for Approval of the **2019 Annual Capital Expenditure (ACE) Plan**

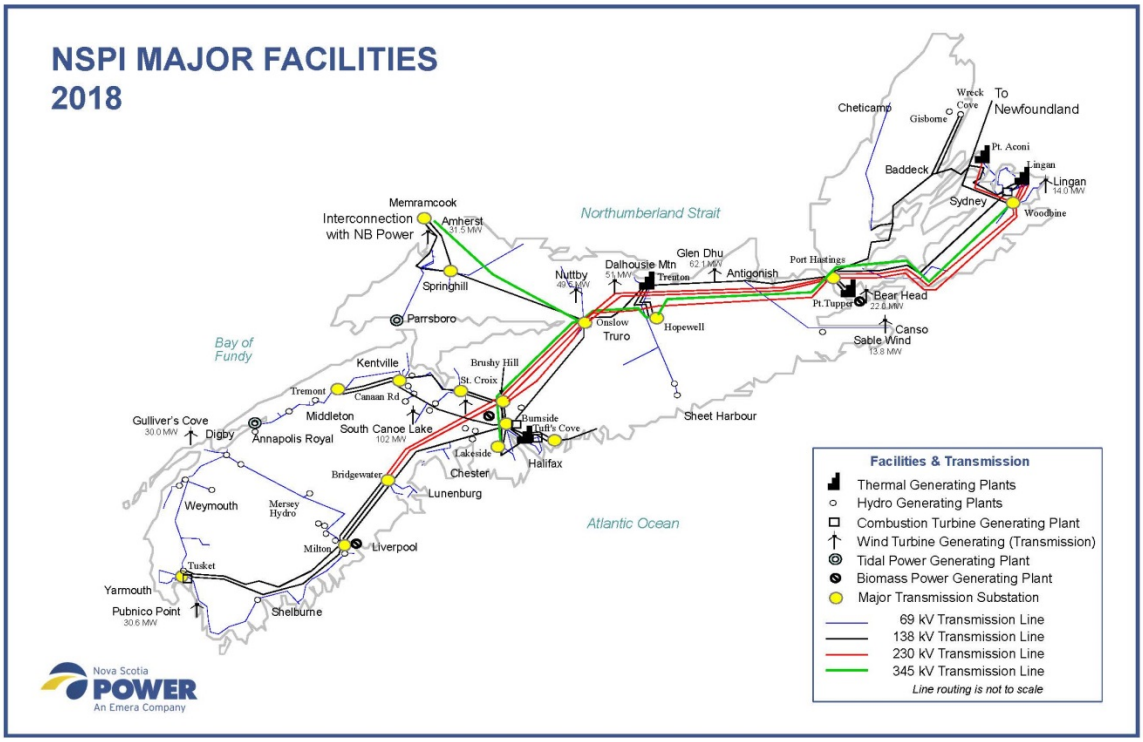
2019 ACE Plan

Date Filed: November 29, 2018

CONFIDENTIAL (Attachments Only)

Nova Scotia Power

2019 Annual Capital Expenditure Plan



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1.0 EXECUTIVE SUMMARY

Nova Scotia Power Incorporated (NS Power, Company) is focused on providing value for customers and is committed to providing them with safe, reliable and cost effective electricity. The Annual Capital Expenditure (ACE) Plan is a critical component of NS Power's capital program and provides the Nova Scotia Utility and Review Board (Board, UARB), customers and regulatory stakeholders with an outlook of the Company's proposed capital investments for the upcoming year. The 2019 ACE Plan is focused on providing safe, reliable service and on sustaining critical infrastructure, while balancing affordability for customers. As with prior ACE Plans, investments are only being proposed where needed in accordance with the Capital Expenditure Justification Criteria (CEJC) and NS Power's asset management methodologies, which are grounded in affordability for customers.

In this Application, NS Power is requesting the Board approve 89 capital work orders and the 2019 capital routine program for an aggregate total of $190.4 million. Almost two thirds of the capital work orders submitted for approval are less than $1 million each, 32 projects are forecast between $250,000 and $500,000, 26 are forecast between $500,000 and $1 million, and 31 exceed $1 million. The 2019 capital expenditure program balances affordability with the level of capital investment required to sustain NS Power's capital assets and provide safe and reliable service for customers.

The benefits and opportunities that are enabled by NS Power's 2019 capital program are:

- **The 2019 capital program is focused on maintaining safe and reliable service for customers -** The 2019 capital plan is required for both sustaining and compliance capital work on the Company's system. These projects are focused on rebuilding or refurbishing aging and deteriorated plant and equipment, compliance with Provincial and Federal regulations, and continuing to sustain the reliability of the generation fleet and the distribution and transmission system for customers.

In 2017 and 2018, the UARB engaged Synapse Energy Economics, Inc. (Synapse) to determine the extent to which it is cost-effective to customers to retain NS Power's thermal (steam) fleet through, and possibly beyond, 2030.[1] Synapse filed its report with the UARB on May 1, 2018. At page two of the Synapse Report, the following is provided:

> Retention of the thermal fleet (all coal units except Lingan 2 and the Tufts Cove units) is indicated through 2030 under scenario 1's parameters, which included: Load levels from NSPI's 2017 load forecast and 2017 sustaining capital forecast; NSPI's indicated wind capacity crediting structure; and an assumption that no more than 100 MW of additional wind is feasible on NSPI's system.[2]

Synapse's results address the Board's question posed as the object for this work; it is cost effective for customers to retain the coal fleet through 2030, and possibly beyond. Moreover, the results provide comfort that the scope of the investments in the 2019 ACE Plan are appropriate as they are near-term investments required to serve customers.

The Synapse Report confirms that the Company's near-term thermal investment strategy remains cost-effective and, barring a change driven by the new carbon regime, will remain so, for the next decade and beyond. With respect to the longer term outlook, the "planning window" this analysis creates, combined with clarity being achieved on carbon policy, will provide NS Power and stakeholders with an important opportunity over the next year to focus on the development of the resource planning assumptions necessary to support the next Integrated Resource Plan (IRP).

- **The 2019 capital program reduces upward pressure on rates -** NS Power's capital investments for 2019 are projected to reduce upward pressure on rates and revenue

[1] Nova Scotia Power Inc. Thermal Generation Utilization and Optimization Economic Analysis of Retention of Fossil-Fueled Thermal Fleet To and Beyond 2030 – M08059, Synapse Energy Economics Inc. (Synapse Report), May 1, 2018, page 1.
[2] The Synapse Report, page 2.

requirement cumulatively over the next five years. This takes into account the additional fixed cost recovery as a result of customer growth achieved through the capital investments made to serve new customers.

- **The 2019 capital program is an investment in communities throughout Nova Scotia** –The Company continues to invest millions of dollars in capital assets in communities throughout the Province, based on where they are needed most. Transmission and distribution capital investments in 2019, for example, provide direct reliability benefits to all counties in which they are undertaken. For example, over $6.5 million will be invested in Cape Breton Island, over $5.4 million in Halifax County, over $3.6 million in Lunenburg County, and over $2.4 million in Cumberland County. These investments provide direct benefits to communities across the Province and the customers served in those communities, through affordable, safe and reliable service.

- **The changing industry environmental landscape will result in innovative solutions that change the way NS Power serves customers into the future -** The Company and customers have undertaken a significant evolution over the last decade with the transition from fossil fuel based generation to renewable generation and through compliance with emissions hard caps. Since 2005, NS Power has more than tripled its renewable generation to 29 percent as of the end of 2017. Over the same period, greenhouse gas emissions were reduced by 37 percent. This reduction, in compliance with Provincial requirements, surpasses the Federal target of reducing CO_2 emissions by 30 percent from 2005 levels by 2030. In addition, installed wind generation on the NS Power system over 600 MW. NS Power remains on track to reach 40 percent renewable generation in 2020.

  On October 23, 2018, it was announced that the Province of Nova Scotia's proposed cap and trade system had been accepted by the federal government.[3]

[3] https://climatechange.novascotia.ca/nova-scotias-cap-trade-program

The cap and trade program will become effective on January 1, 2019. The Province will set annual caps that limit how many tonnes of greenhouse gas emissions are allowed from certain activities in the province each year. The cap will equal the amount of emission allowances that are available each year.

Nova Scotia will continue to transition toward a cleaner, more sustainable future. In addition, the electric industry and electricity customers are together seeing change through opportunities presented through new technologies. The provision of electricity service will look and feel different for customers in the future, with more choice available to them. Innovation projects, now defined in the CEJC, will enable NS Power to prepare for the future impact of renewable energy and evolving customer expectations; some will enable the Company to respond to environmental requirements, while others will position the Company to bring improved solutions to customers to meet their needs and expectations in a rapidly changing electrical landscape.

- **The 2019 ACE Plan is designed to achieve improvements in regulatory efficiency** - The capital investments proposed in the ACE Plan are vetted and planned in accordance with the UARB-approved asset management ranking methodologies.[4] All projects within the 2019 ACE Plan are compliant with the Board-approved CEJC. The 2019 ACE Plan forecasts 33 projects for subsequent submittal during 2019. As a result, close to three quarters of 2019 capital work orders eligible for UARB submission are included in the 2019 ACE Plan for review and approval. This increases the transparency of the Company's 2019 planned capital expenditures, allowing for review as part of a public hearing process and reduced the number of planned capital filings being made throughout 2019.

[4] Summary CEJC, approved by the UARB October 24, 2017, M08278.

2.0 2019 ACE PLAN STRUCTURE

The 2019 ACE Plan Application provides the UARB, regulatory participants, and customers with a comprehensive and transparent view of NS Power's planned capital expenditures for 2019. The following provides an overview of how the 2019 ACE Plan is organized.

- **Section 3.0 - Introduction** - This section provides a high-level summary of the overall expenditures in the 2019 ACE Plan, including a breakdown of expenditures into various categories such as sustaining and strategic capital, as well as a forecast of expenditures in those categories for the next five years.

- **Section 4.0 - Asset Class Overview -** This section provides narratives for generation, transmission & distribution, and general plant asset classes, highlighting factors influencing capital investments in each area.

- **Section 5.0 - 2018 ACE Plan Follow-Up -** This section addresses the status of items from the 2018 ACE Plan, including a list of capital items pending submission in 2018 from the 2018 ACE Plan, the 2018 ACE Plan deferred and cancelled items.

- **Section 6.0 - 2019 ACE Plan -** This section provides a summary of all 2019 capital expenditures. These include the list of projects for which NS Power is seeking approval, the list of projects forecast for subsequent submission, the list of projects with a value of less than $250,000, and the list of projects for the Point Aconi Generating station. NS Power is not seeking approval of those capital projects identified for subsequent submittal at this time. In addition, capital projects under $250,000 and Point Aconi projects do not require UARB approval under the *Public Utilities Act*;[5] however, the Company includes them in its ACE Plan for information purposes and to provide a complete picture of annual capital expenditures on NS Power's system.

[5] Public Utilities Act R.S.N.S., c.380, as amended s. 35 and 36.

- **Section 7.0 - Generation -** This section lists all generation capital projects submitted for approval, as well as related carry-over spending. Generation assets generate electricity through a variety of methods and fuel sources, including hydro, coal, oil and gas, biomass, and wind.

- **Section 8.0 - Transmission -** This section lists all transmission capital projects submitted for approval, as well as related carry-over spending. Transmission assets transmit electricity from the generation plants to the distribution system throughout the Province. Transmission includes assets and equipment operating at 69 kV level or higher.

- **Section 9.0 - Distribution -** This section lists all distribution capital projects submitted for approval, as well as related carry-over spending. Distribution assets include equipment for delivering electric energy from points on the transmission system to customers served at voltages below 69 kV.

- **Section 10.0 - General Plant -** This section lists all general plant capital projects submitted for approval, as well as related carry-over spending. General plant assets include computer infrastructure and communication equipment, which comprise the majority of capital expenditures incurred under this function. Other items such as office equipment, vehicles, construction equipment and buildings (except generating and substation facilities) are also included under this function.

- **Section 11.0 - Routine Capital Program -** This section lists all routine capital items submitted for approval, by generation, transmission, distribution, and general plant. Routine capital items are recurring annual expenditures for replacement of equipment (like-for-like replacement), additions to existing equipment base resulting from system growth, and addition of customers to the system.

- **Section 12.0 - Directives and Miscellaneous –** This section provides information from the Company in response to the various directives issued by the Board in respect to the

Company's ACE Plan over the years as well as other miscellaneous information previously included in the Company's Application. The Board's directives include requests for information on revenue requirement impacts, transmission and distribution investment reliability impacts, and the ranking of projects submitted in the ACE Plan for approval.

The 2019 ACE Plan also includes the following information provided as separate appendices:

- **Confidentiality Matrix (Appendix A)** - The confidentiality matrix provides a listing of capital items submitted for approval, their attachments, and their confidential status so that the Board may evaluate the confidential portions of the ACE Plan. NS Power has minimized the information for which it seeks confidential treatment in this Application in order to facilitate the overall transparency of the ACE Plan.

- **Listing of all 2019 ACE Plan projects in Excel format (Appendix B)** - A complete listing of 2019 ACE Plan projects is provided in Excel format. This provides the Board and interested parties a convenient reference of all expenditures in 2019, regardless of whether they are submitted for approval in the ACE Plan. Details include Capital Item Numbers (CI #s), names, functional class, and investment details.

- **Updated Q3 Capital Reports (Appendix C)** – NS Power's Q3 capital reports, submitted to the UARB on November 5, 2018, have been updated with 2019 ACE Plan projects submitted for approval and subsequent submittal, and provided in Excel format. The updated Q3 capital reports provide a comprehensive listing of the status of all "active" projects (i.e. those that have been submitted to the UARB or referenced on the ACE Plan subsequent submittal list and are currently underway).

- **The Excel version of NS Power's Long-Term Capital Planning & Revenue Requirement table found in Section 12.1.1 (Appendix D)** - The Excel version of NS Power's Revenue Requirement table provides the Board and interested parties the data

required to examine the calculation and assumptions used to calculate the revenue requirement associated with NS Power's ACE Plan expenditures.

3.0 INTRODUCTION

3.1 2019 ACE Plan Summary

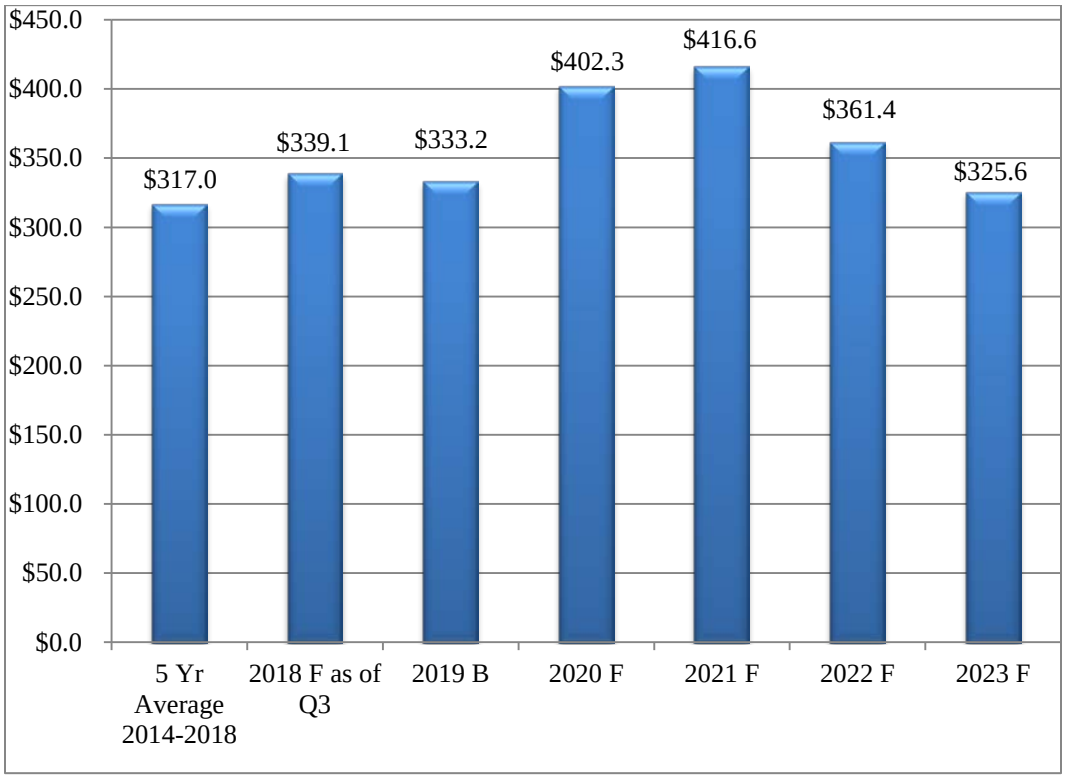
The Company's overall 2019 capital budget (inclusive of capital projects under $250,000 and Point Aconi projects that do not require UARB approval, carryover spending, capital routines, and subsequent submittal items) is $333.2 million. NS Power is requesting UARB approval of 89 capital work orders and the 2019 capital routine program, for a total approval amount of $190.4 million.

The 2019 capital budget also includes strategic capital investments, which are generally considered to be those investments that either add new utility assets or significantly change/replace current utility assets, or how the Company uses them. This includes the installation of Advanced Meter Infrastructure (AMI) (which received UARB approval in June 2018) and the T&D Work and Asset Management (WAM) projects Phases 1 and 2 (CI C0013438, forecast for a 2018 pending submission, and CI 46075, forecast for subsequent submittal in 2019). Spending associated with hydro infrastructure investment is expected to be required in the 2019 and beyond, including re-development of the Mersey Hydro System and a mid-life extension of NS Power's Wreck Cove Hydro Generating Station.

Figure 1 and **Figure 2** below illustrate NS Power's total capital budget for 2019 and forecast spend for 2020 through to 2023, as well as NS Power's total annual capital expenditures by function.

Figure 1: NS Power Total Capital Spend: Historical, Budget and Forecast

(Millions of Dollars)



F = Forecast, B=Budget in above figure

Figure 2: Total Annual Capital Expenditures by Function

(Millions of Dollars)

	Actuals						ACE Plan	Forecast			
Year	**2014**	**2015**	**2016**	**2017**	**2018 Q3 F**	**2018 ACE Budget**	**2019**	**2020**	**2021**	**2022**	**2023**
Generation	$66.0	110.4	115.8	129.6	$98.7	$116.5	$109.6	$168.4	$175.6	$164.0	$140.0
New Renewables	82.8	17.1	-	-	-	-	-	-	-	-	-
Transmission	51.0	54.4	57.5	88.6	82.2	75.7	$46.4	57.0	58.0	59.0	60.1
Distribution	52.8	62.5	68.8	79.1	101.9	108.1	$133.6	119.4	81.1	74.9	76.3
General Plant	21.7	27.1	66.5	94.5	56.3	54.6	$43.7	57.5	101.9	63.5	49.3
Total	**$274.3**	**$271.5**	**$308.6**	**$391.7**	**$339.1**	**$354.9**	**$333.2**	**$402.3**	**$416.6**	**$361.4**	**$325.6**

Note: Figures presented may include $0.1M in rounding differences on some line items.
Note: Includes Maritime Link transmission spend that is currently removed from rate base.

NS Power's capital program continues to focus on sustaining capital assets, representing cost-effective investments to maintain system performance for customers. The emphasis continues to be on making timely investments based on equipment condition and criticality and maintaining the performance of assets for customers.

Generation, transmission, distribution and information technology projects in the 2019 ACE Plan are subject to the Board-approved project selection and asset management methodologies pursuant to Section 6.2 of the CEJC. Only projects that provide the best value to customers are put forward for approval and completion.

As shown in **Figure 3** and **Figure 4** below, NS Power's investments toward sustaining the Company's assets, customer driven investments, and investments required by regulatory or environmental standards are forecast to be relatively stable over the next five years, with a focus on the Company's sustaining capital program.

Figure 3: Breakdown of Capital Forecast by Investment Type

(Millions of dollars)

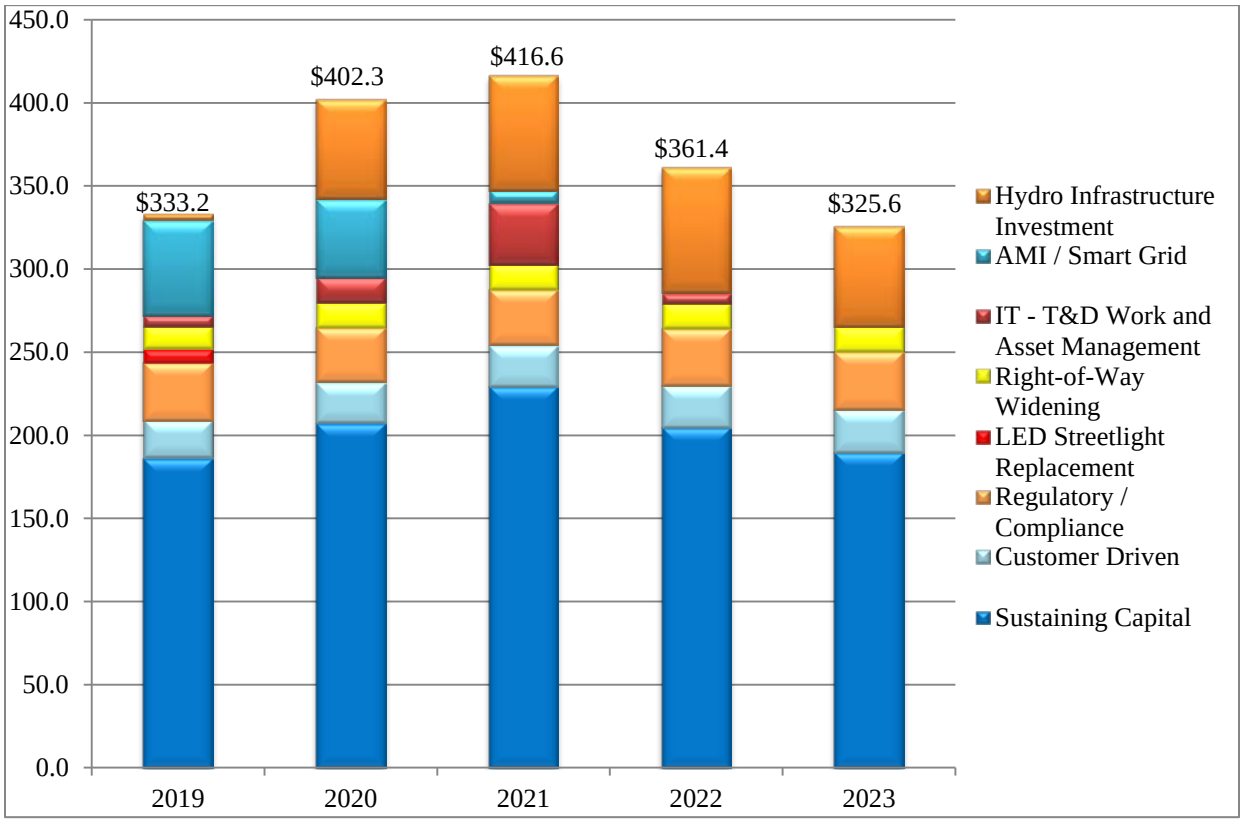


Figure 4: Breakdown of Capital Forecast by Investment Type

(Millions of dollars)

Investment Type	2019	2020	2021	2022	2023
Sustaining Capital	186.5	207.7	229.6	204.6	189.7
Customer Driven	22.7	24.3	24.8	25.3	25.8
Regulatory / Compliance	34.8	32.9	33.6	34.2	34.9
LED Streetlight Replacement	8.1	0.0	0.0	0.0	0.0
Right-of-Way Widening	13.6	15.0	15.0	15.0	15.0
IT - T&D Work and Asset Management	6.8	15.2	36.9	6.5	0.0
AMI / Smart Grid	57.2	47.1	7.5	0.0	0.0
Hydro Infrastructure Investment	3.6	60.1	69.2	75.8	60.2
	333.2	**402.3**	**416.6**	**361.4**	**325.6**

Note: Totals may be off due to rounding.

Note: These figures are the Company's current forecast. The accuracy of these estimates will improve over time as new information informs the potential investments.

Section 12.1.1 of this Application (Impact of 2019 ACE Plan on Revenue Requirement and Affordability) shows that NS Power's capital expenditures for 2019-2023 reduce upward pressure on rates and revenue requirement cumulatively over the next five years. This takes into account the additional fixed cost recovery as a result of customer growth achieved through these capital investments made to serve new customers.

3.2 Forecast Capital Spending

The 2019 ACE Plan continues to focus on capital required to meet the Company's obligations to provide customers with affordable, safe and reliable electricity service. As shown in **Figure 4**, projected costs associated with Sustaining Capital comprise the largest investment type for 2019, which is consistent over the next five years. Other investments in 2019 through 2023 are also forecast to be stable, with increased total expenditures in 2020 and 2021 reflecting investment in larger strategic projects such as AMI, T&D Work and Asset Management, Mersey Redevelopment and Wreck Cove Overhaul.

Changing environments and emerging technology could also influence NS Power's capital investments into the future. For example, based on technological trends and customer expectations, additional capital investments could be required to enable NS Power to meet customers' expectations for service delivery, customer experience and innovation.

3.3 Impact of Performance Standards

The Performance Standards approved by the UARB relating to metrics in reliability and customer service are now in effect.[6] The majority of T&D projects in the 2019 ACE Plan will contribute to meeting these performance standards requirements. Please refer to Section 4.1.2 (Transmission and Distribution) and Section 12.1.7 (Impact of Reliability Projects) for further detail.

[6] Performance Standards, UARB Order, M07387, December 20, 2016.

3.4 Relief Sought from the Board

NS Power respectfully requests Board approval of the following, in accordance with Section 35A of the *Public Utilities Act*:

- 89 Capital Items with 2019 budget investment of $75.9 million and total project investment of $108.1 million (please refer to Section 6.2); and
- Capital routine programs with 2019 budget investment of $82.3 million (please refer to Section 11.1).

4.0 ASSET CLASS OVERVIEW

4.1 Asset Class Overviews

This section provides an overview of the traditional asset classes (generation, transmission and distribution, and general plant).

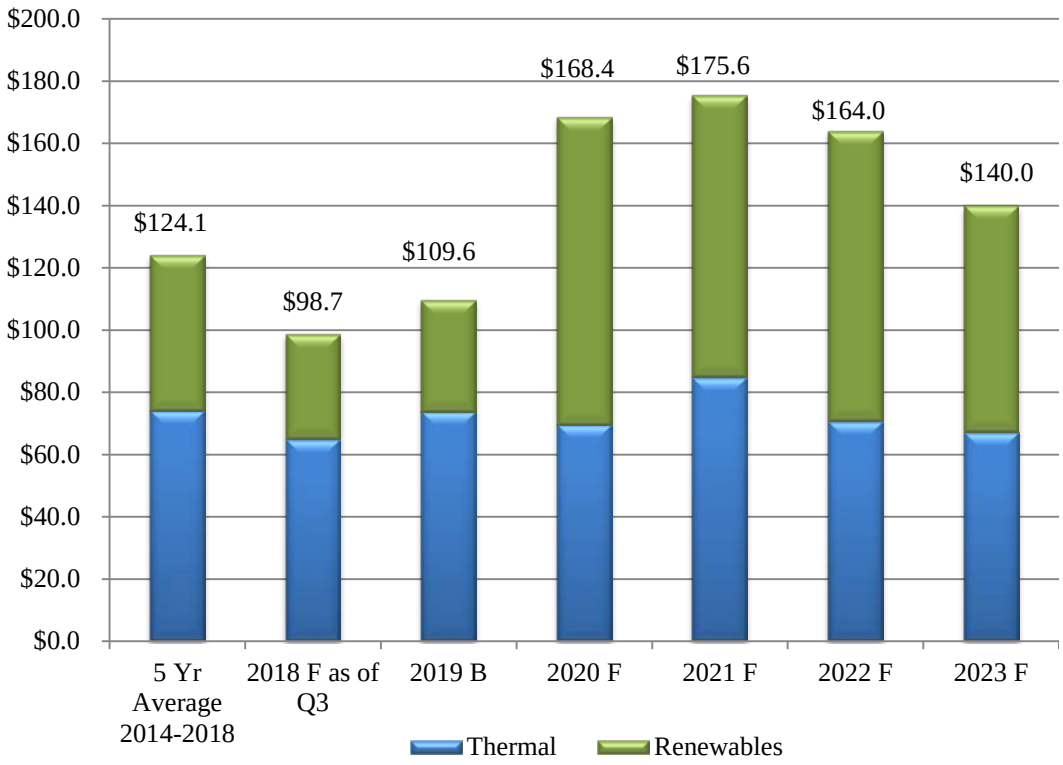
4.1.1 Generation

Generation includes replacements and additions to NS Power's Thermal, Hydro, Wind, Tidal, Combustion Turbine and Biomass facilities. The increase in investment in future years is largely attributable to the forecast investment in the Mersey Hydro System Re-Development and the Wreck Cove Hydro System Life Extension & Modernization (LEM) projects.

Figure 5 below illustrates NS Power's capital investment on generation, including historical, forecast and budget.

Figure 5: Generation Investment – Historical, Forecast and Budget

(Millions of dollars)



F = Forecast, B=Budget in above figure

Figure 6 and **Figure 7** provide a breakdown of the 2019 generation investment by investment type.

Figure 6: 2019 Thermal Investment by Investment Type

(Millions of dollars)

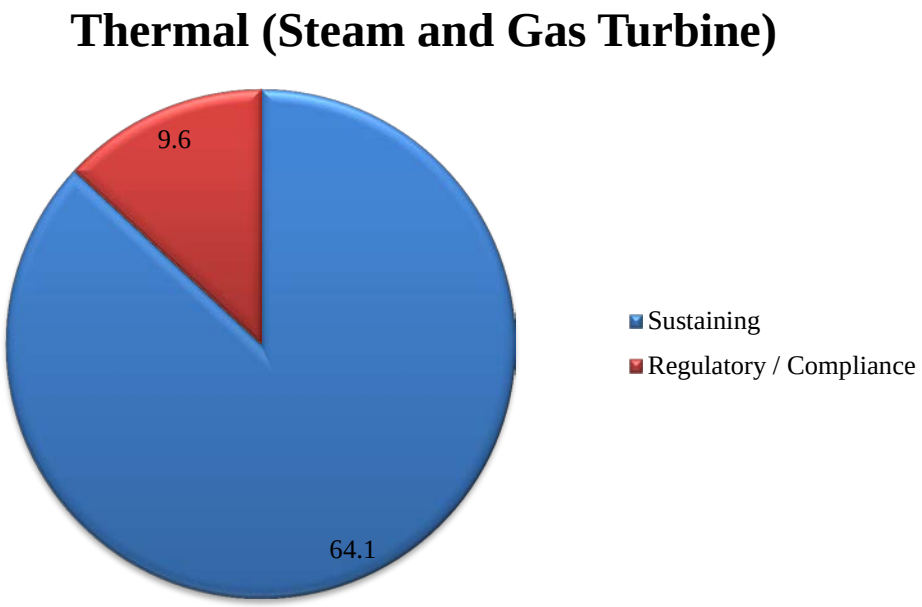
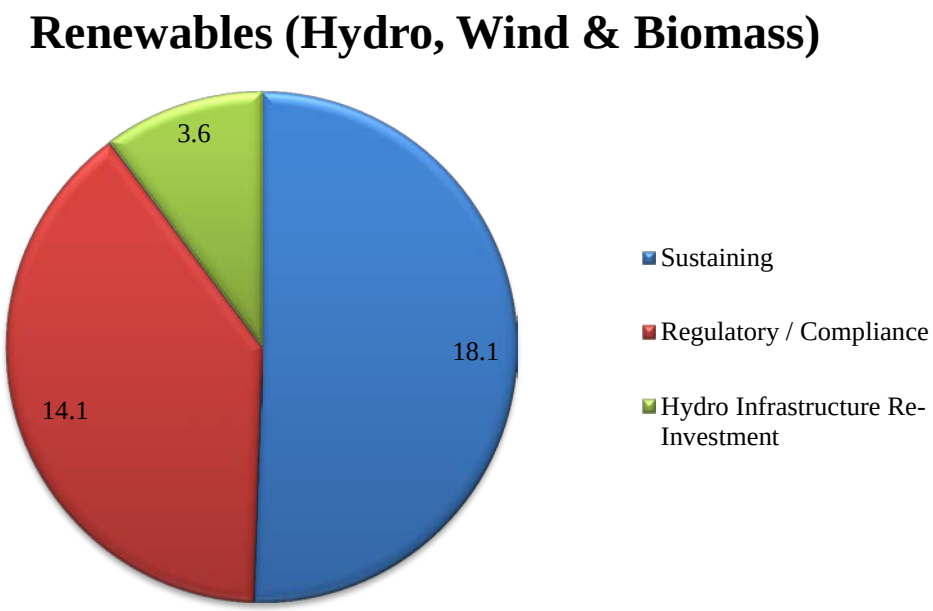


Figure 7: 2019 Renewable Generation Investment by Investment Type

(Millions of dollars)



NS Power's selection of generation related capital investment is based on an asset management approach as described in Section 6.2 of the CEJC. Asset management enables NS Power to determine how to best mitigate risks arising from aging units, changes in unit utilization, and renewable integration using a range of measures.

The Company's asset health and risk profiling methodology determines the condition and criticality of equipment and allows the most appropriate risk mitigation strategy to be implemented, including effective investment of sustaining capital. This enables NS Power to have the information necessary to prioritize decisions to invest in assets only when necessary to maintain safety and reliability, while managing affordability for customers.

Key elements of NS Power's asset management approach include:

- fleet-wide asset class programs;
- application of the latest technologies to enhance understanding of asset health;
- effective operational support tools and infrastructure; and
- risk-based inspection programs.

NS Power engages industry experts to augment the assessment of risks and mitigating measures for the generation fleet.

NS Power's generation asset management approach is focused on optimizing generation resources by mitigating risks through operating procedures, monitoring and assessing assets, and capital investment. The approach also focuses on continuing to develop and improve asset health assessment and risk profiling as the utilization of the generating fleet continues to evolve.

Coal fired generating units will retire in the future. Until that time, capital investments are in these units continue to be required to meet the electricity demands of NS Power customers, avoid customer interruptions, and adhere to safety and regulatory requirements.

Capital investment in NS Power's legacy steam fleet is essential to providing reliable electricity supply to customers while NS Power completes its transition to clean energy generation in the most cost effective manner for customers. The total energy production of the coal fleet declines year over year; however, coal fired units continue to bring value to the power system. Flexible unit operation responds to the need to integrate variable renewable generation on the power system. While valuable, flexibility results in more unit starts, stops and load swings, which increase the wear on the units, which contributes to the requirement for continued capital investments.

A large percentage of the generation projects included in the 2019 ACE Plan are required to be completed in order for NS Power to be in a position to operate these units. These projects are primarily safety-related (e.g. fire protection, high energy piping), a result of environmental regulations or requirements (e.g. ash site investment), or required to meet other regulatory requirements such as Department of Labour (DOL) codes (e.g. selective boiler tube replacement due to minimum tube wall thickness requirements). NS Power will not be able to operate these units if these projects are not completed.

The Company acts proactively to mitigate risks on assets prior to failure and the associated outages or unit deratings. This is the most prudent approach to asset management and investment, which has been evident in sustained steam unit reliability (Derated Adjusted Forced Outage Rates (DAFOR)) despite the significant change in unit utilization triggered by renewables integration. Alternative run to failure strategies will result in higher DAFOR, which increases the risk of safety issues, collateral component damage, potentially high cost replacement energy, and customer interruptions. If multiple failures were to occur at the same time, customers could experience service outages due to a generating capacity shortfall. A proactive, risk based, approach to capital investment, provides operational reliability for the betterment of the power system.

Investment in coal fired units is based on condition assessments, criticality and planned unit utilization. Steam units typically require a planned major outage (such as a significant turbine or

generator investment) every 8 years (nominal interval refined by condition assessment and utilization). A planned major outage is scheduled for Point Tupper in 2019.

In summary, the generation capital investments in the 2019 ACE Plan are required to enable the safe and reliable operation of these units for customers over the near term. These projects are either required for regulatory compliance purposes, or to maintain safe and reliable operation of the units.

Wreck Cove Life Extension and Modernization (LEM) and Mersey Hydro System Re-Development

The objective of the Wreck Cove LEM initiative is to enable the Wreck Cove Generating station to continue to provide renewable energy generation and essential reliability services to the power grid for the next 40 years. There are no capital investments being submitted in the 2019 ACE Plan for approval by the Board related to the Wreck Cove LEM initiative. Preliminary engineering for this project continued throughout 2018 and will continue to occur in 2019 with the corresponding capital work order for the first phase expected to be filed later in 2019 (CI C0013838 HYD – Wreck Cove Unit 1 Overhaul) and further submissions for future phases to follow in the coming years.

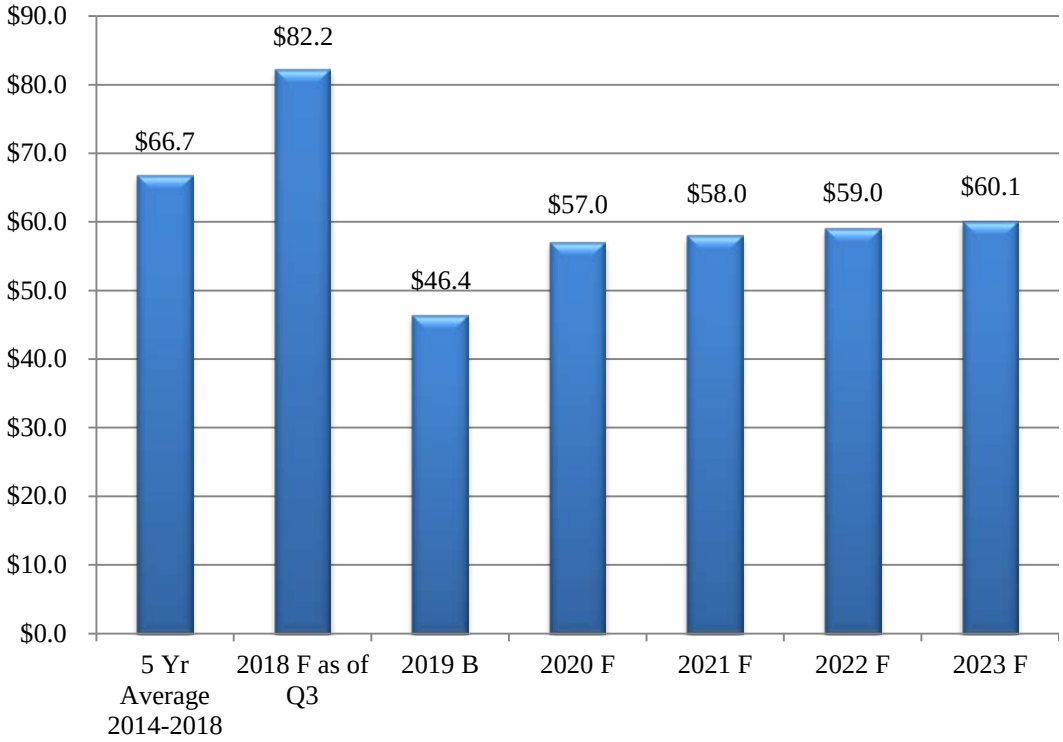
With respect to the Mersey Hydro System Re-Development, due to the age, condition and dam safety requirements of the Mersey Hydro System, it requires a re-development of the powerhouses, generating equipment and water retaining structures in order to continue the generation of renewable energy and the provision of essential reliability services into the future. There are no capital investments being submitted in the 2019 ACE Plan for approval by the Board related to the Mersey Hydro System Re-Development project. Preliminary engineering for this project continued throughout 2018 and will continue to occur in 2019 with the corresponding capital work order for the first phase expected to be filed later in 2019 (CI 39472 HYD – Mersey Redevelopment Phase 1) and further submissions to follow in the coming years.

4.1.2 Transmission and Distribution (T&D)

Transmission includes items for replacement, reinforcement or expansion of the transmission system, which transmits electrical energy from the generation plants to distribution substations throughout the province. Transmission includes assets and equipment operating at 69 kV or higher. NS Power operates over 5,000 km of transmission circuits and related protection, controls and substation equipment. **Figure 8** below illustrates NS Power's capital investment in transmission, including historical, forecast and budget.

Figure 8: Transmission Investment– Historical, Forecast and Budget

(Millions of dollars)

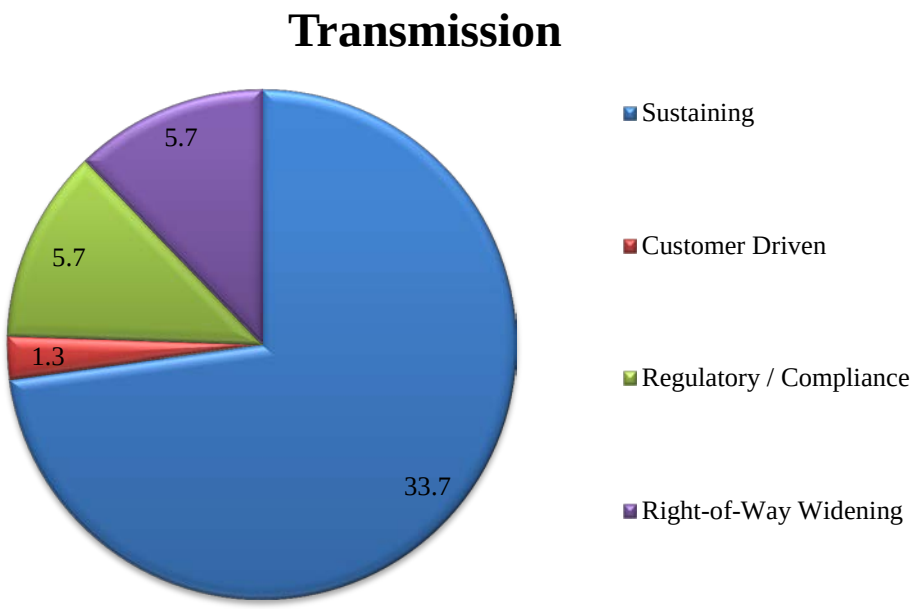


F = Forecast, B=Budget in above figure

Figure 9 provides a breakdown of the 2019 transmission investment by investment type.

Figure 9: 2019 Transmission Investment by Investment Type

(Millions of dollars)



Distribution includes replacement of and additions to equipment for delivering electricity from points on the transmission system to customers served at voltages below 69 kV. NS Power operates 26,972 km of distribution circuits and related protection, controls and transformers. The increased investment levels in 2018-2020 are primarily due to forecast investment in the AMI project. **Figure 10** below illustrates NS Power's capital spending on distribution, including historical, forecast and budget.

Figure 10: Distribution Investment – Historical, Forecast and Budget

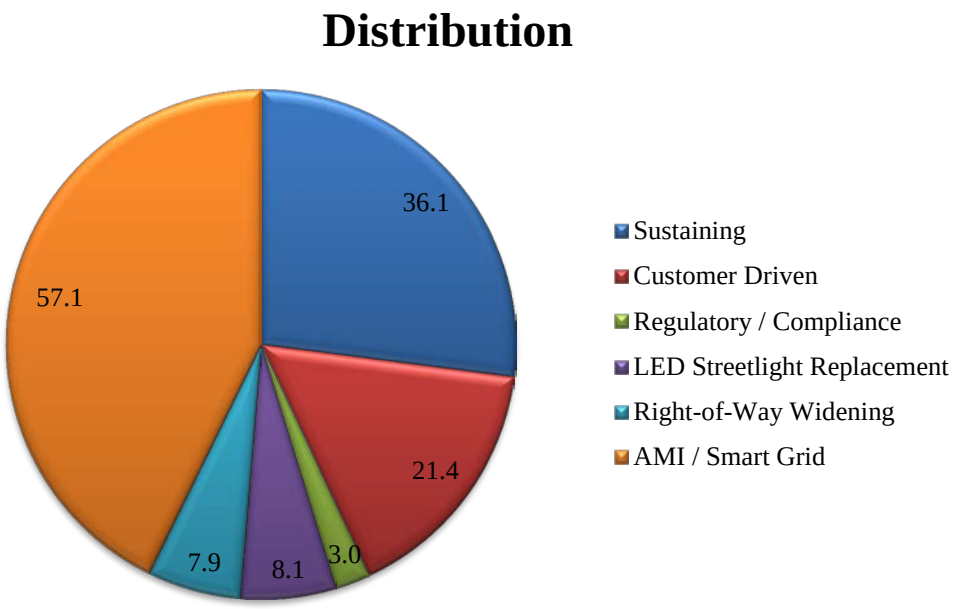
(Millions of dollars)

F = Forecast, B=Budget in above figure

Figure 11 provides a breakdown of the 2019 distribution investment by investment type.

Figure 11: 2019 Distribution Investment by Investment Type

(Millions of dollars)



As mentioned above, and as reflected in, **Figure 11** NS Power's increased 2019 distribution investment is primarily due to forecast investment in the AMI project, which was approved by the Board on June 28, 2018.[7]

T&D investment is driven by the asset management approach as described in Section 6.2 of the CEJC. The asset management approach evaluates condition and criticality to determine the failure risk of different asset groups and provides priorities for the maintenance and replacement of these assets. NS Power's asset management strategy and inspection program results feed into this selection process, aimed largely at sustaining capital investments. This provides NS Power the ability to appropriately invest in assets only where needed, keeping costs as low as possible for the benefit of customers.

[7] M08349, NS Power AMI Application, UARB Order, June 28, 2018.

Inspection programs are established for transmission line, substation and distribution line assets. The frequency for inspection varies by asset class and ranges from on-line monitoring to monthly or bi-annual assessments. The inspection results play an important role in identifying deteriorated equipment and are used to identify and prioritize capital projects. Regulatory and compliance requirements also drive T&D projects, such as the T&D polychlorinated biphenyl (PCB) contaminated equipment replacement projects included in the 2019 ACE Plan.

T&D capital expenditures in the 2019 ACE Plan are benefiting customers by focusing on sustaining capital to maintain the reliability gains achieved in recent years, and to improve storm related reliability through T010, CI 51969, CI C0010042, D010, CI C0001950 and CI C0010040.

Pole Life Extension

In the 2018 ACE Terms of Consensus, NS Power agreed as follows:

> NS Power will investigate and evaluate the merits of instituting a distribution pole life extension program as part of its pole inspection testing procedure update and include its findings in the Company's 2019 ACE Plan Application. In the event the investigation confirms to NS Power the merits of undertaking such a program, NS Power commits to pursuing the program and including an implementation plan for the program in the 2019 ACE Plan.[8]

NS Power has completed an update of the Distribution Engineering Practice DEP 7.5 - Testing Procedures for the Determination of Wood Pole Strength. This document outlines inspection and testing procedures for wood poles including visual inspections, soundings and internal inspections (resistographic). Test equipment has been procured and distributed to field groups to augment the assessment of pole condition during inspections. Beyond this, NS Power continues to consider the merits of distribution pole life extension and at this time research and investigation is still underway. NS Power is contacting other Canadian utilities to better understand their pole life extension programs and is planning to utilize this information to

[8] 2018 ACE Plan Terms of Consensus, Intervenor Issue 5, February 23, 2018, M08350.

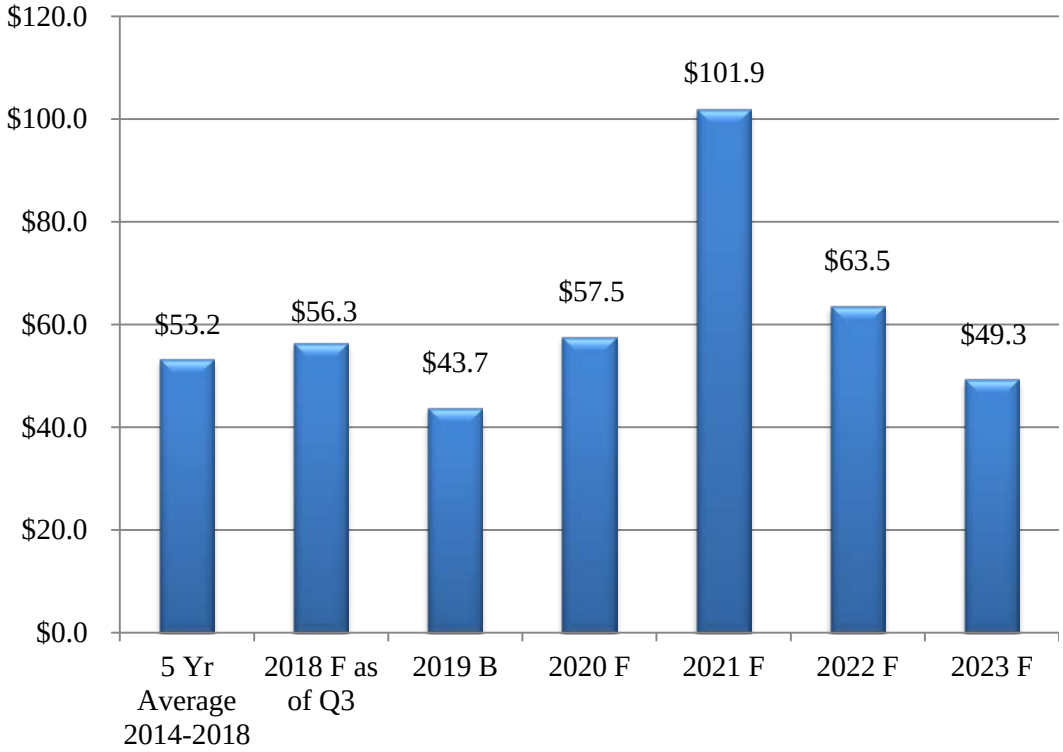
supplement its internal analysis and assumptions. At this time, NS Power has not determined that there is a reason to change its current approach. It intends to analyze the results of its first year of transmission pole retreatment and determine if changes are warranted going forward. NS Power commits to share the outcomes and recommendations associated with this analysis with the Board.

4.1.3 General Plant

General plant includes information technology, computer infrastructure and communication equipment, which comprise the majority of capital expenditures incurred under this function. Other items such as office equipment, vehicles, and construction equipment are also included. The general plant function also includes buildings except generating and substation facilities. It primarily pertains to customer service, work depot and head office facilities. **Figure 12** below illustrates NS Power's capital investment in general plant, including historical, forecast and budget.

Figure 12: General Plant Investment – Historical, Forecast and Budget

(Millions of dollars)

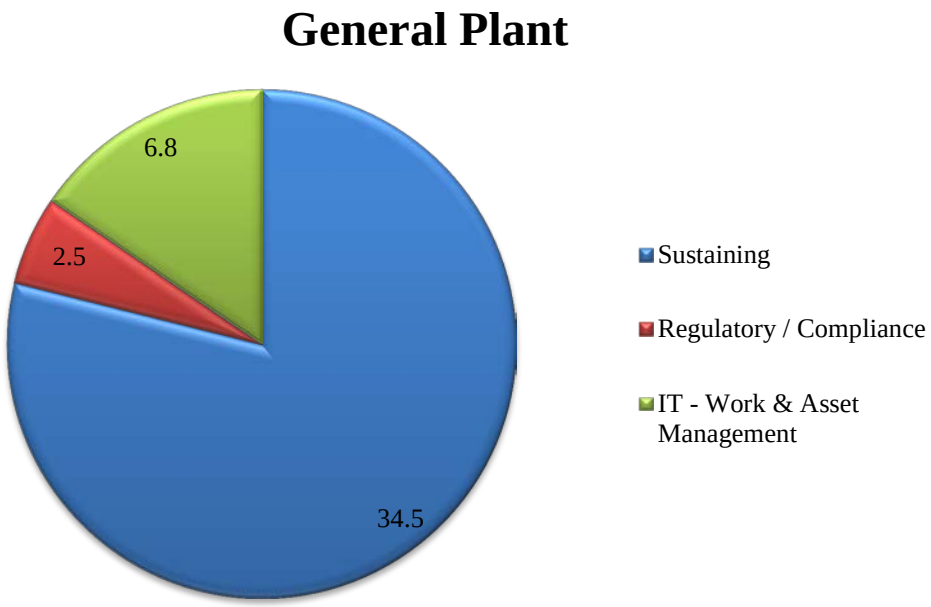


F = Forecast, B=Budget

Figure 13 provides a breakdown of the 2019 general plant spend by investment type.

Figure 13: 2019 General Plant Spend by Investment Type

(Millions of dollars)



NS Power has historically maintained relatively low investments on Information Technology (IT) capital assets to the benefit of customers. These low cost investments were aligned to the conditions and requirements at that time – a period of relative stability with the information technology platforms which were managed to sustain them and extend their useful life to the maximum extent possible, as outlined in the information technology investment plan.[9]

The IT asset management methodology and justification criteria for technically justified IT projects evaluates assets on condition and criticality, providing a methodology for NS Power to prioritize and select those IT projects that are most needed at that time.[10] IT capital projects are

[9] 2017 ACE Plan, NSUARB IR-71 Attachment 1, M07745, January 5, 2017.
[10] Section 6.2 of the CEJC.

also justified in compliance with the CEJC under section 17.13, with Technical, Customer Experience, and Economic sub-justifications.

NS Power has a number of major IT assets that are at or near end-of-life. Major IT projects and initiatives and their forecast timelines are outlined in **Figure 14** below.

Figure 14: Schedule of Major IT Projects

2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	
						Customer Information System (CIS)				$60M
			T&D Work & Asset Management							$73M
		CyberSecurity								$15M
Foundational IT Assets and Services										$28M

Note: All costs subject to revision as projects and scoping progress.

IT projects and initiatives are critical to the operation of the Company, many are highly complex, and have significant levels of uncertainty early in their development, with corresponding uncertainty in their budgets prior to RFP processes.

NS Power's IT capital expenditures over the next several years will be higher than the historical investment profile. These investments will address many of the aforementioned changes currently facing NS Power, and set the Company up for more regular, incremental IT upgrades to keep pace with the rapid evolution of technology and customer demands. NS Power has a governance model to manage these IT assets so that they are appropriately evaluated and justified, risks are mitigated, and are cost effective, and providing clear benefits to customers.

T&D Work and Asset Management Projects

NS Power has been planning the work and associated capital projects to upgrade and replace its aging and obsolete T&D Work and Asset Management (WAM) IT systems. Over time, the scope of the project and NS Power's approach to the completion of that scope has evolved.

As a result of more detailed planning, the project is now forecasted to be completed in three separate and independent phases:

- Phase 1 – Upgrade and replacement of NS Power's GIS and Field Design systems, respectively.
- Phase 2 – Upgrade and replacement of NS Power's Work & Asset Management and Scheduling & Dispatch systems, respectively.
- Phase 3 – Replacement and improvement of NS Power's Field Mobility systems to achieve economic benefit and meet customer demands.

Approval of one phase will not commit the Board to approval of another phase. The scope of Phase 1 will be covered under a new project: CI C0013438 - T&D WAM Phase 1 - Geographical Information System (GIS) and Field Design System. CI C0013438 is expected to be filed with the UARB in December 2018.

The scope of Phase 2 will be covered by CI 46075 – formerly titled "IT - T&D Work and Asset Management" and referenced in prior ACE Plans as a subsequent submittal item. CI 46075 is now titled "IT - T&D WAM Phase 2 – Work Management and Scheduling & Dispatch" and is a 2019 ACE Plan subsequent submittal item. The scope of Phase 3 will be covered by a future CI and is not part of the 2019 ACE Plan.

As with the Company's other asset management programs and methodologies, T&D asset management practices will be subject to continuous improvement initiatives enabled by the foundation established by these capital projects. Among the goals of asset management

initiatives is to achieve potential reliability, economic benefits, and corresponding avoided cost for customers. As presented in this and previous ACE Plans within Asset Management Office (AMO) capital items, further T&D asset management projects will continue to be evaluated on an ongoing basis and will be submitted as new programs and initiatives are evaluated and justify corresponding capital work order submissions.

5.0 2018 ANNUAL CAPITAL EXPENDITURE PLAN FOLLOW-UP

This section addresses items from the 2018 ACE Plan. These items include a summary of the outcome of stakeholder engagement discussions, a list of subsequent submittal capital items from the 2018 ACE Plan that are planned to be submitted before year-end, as well as items from the 2018 ACE Plan that have been deferred or cancelled.

5.1 Stakeholder Engagement

NS Power engaged in stakeholder consultations as an outcome of the 2018 ACE Plan proceeding, consistent with years prior. Stakeholder consultation sessions were held throughout 2018, and a report regarding these was submitted to the UARB on August 31, 2018, along with a revised Detailed and Summary CEJC for the Board's information and approval, respectively. Further to the Board's letter of September 13, 2018, NS Power provided additional information on September 27, 2018 with respect to Intervenor Issues 5 and 9 of the 2018 Terms of Consensus, and a revised Summary CEJC. On November 5, 2018, the UARB provided its Decision regarding the 2018 ACE Plan stakeholder engagement and approved the CEJC which included a new justification criterion for innovation projects.

5.2 2018 Capital Items Pending Submission

The UARB provided the following directive in its 2017 ACE Plan Order:

> 9. The Board directs NSPI to include, as part of their annual ACE Plan submissions, a list of projects which appear as items for subsequent submission in a prior years' ACE Plan filing, which have not been submitted for approval at the time of an ACE Plan filing, but which NSPI intends to submit by the end of the calendar year.[11]

[11] 2017 ACE Plan, UARB Order, M07745, April 4, 2017.

Figure 15 sets out projects included in the 2018 ACE Plan as items for subsequent approval, but not yet submitted to the Board. NS Power has identified three subsequent submittal items that it anticipates will be filed with the UARB for approval by the end of 2018. These projects will carry over into 2019 and total $7.9 of 2019 forecast spending. These budget numbers were estimated at the time the 2018 ACE Plan was prepared and are subject to change as the scope and details of the projects are refined.

Figure 15: Pending 2018 Subsequent Submittal Items

CI#	Project Title	2019 Budget ($)	Project Total ($)
General Plant			
C0013438	IT - T&D WAM Phase 1 - GIS and Field Design System *This project includes the upgrade of NS Power's Geographic Information System (GIS) and the replacement of the Field Design system. The scope of this project was originally foreseen and included in CI 46075 - IT – T&D WAM Phase 2 – Work Management and Scheduling & Dispatch (formerly titled "T&D Work and Asset Management" and referenced in the2018 ACE Plan subsequent submittal list).*	6,431,102	7,978,434
51481	IT - Content Management Software Upgrade *This project will design, implement and test a new Content Management System (CMS) including a new nspower.ca website.*	1,345,914	2,053,010
C0002241	IT - Generation Operations Upgrade *This is a required tool for the economic dispatch of the NS Power generation fleet. NS Power is currently operating on a legacy product that does not have the required support for an essential and required dispatch tool. This project will upgrade to the current version.*	167,984	562,680
	Total New General Plant Spending for Subsequent Approval	**$7,945,001**	**$10,594,124**
	Total Capital Items for Subsequent Approval	**$7,945,001**	**$10,594,124**

5.3 2018 ACE Plan Subsequent Submittal List Status Update (Schedule C from 2018 ACE Plan Decision)

Figure 16 below provides an update to Schedule C from the UARB's 2018 ACE Plan Decision.

Figure 16: Subsequent Submittal Project Status Update

		ACE 2018		Updated		
CI#	**Project Title**	**2018 Budget ($)**	**Project Total ($)**	**2018 Budget ($)**	**Project Total ($)**	**Status**
Generation						
39472	HYD Mersey System Re-Development	1,223,368	83,595,607	1,998,870	115,534,895	Deferred to 2019
48791	HYD - WRC Safety Standards Upgrades	440,182	1,019,928	1,300,796	1,760,570	Approved
51775	HYD Fixed Ladder & Machine Guard	906,249	999,149	1,014,038	1,985,179	Approved
47660	HYD - Dickie Brook Controls Upgrade	228,354	885,586	-	-	Deferred to 2020
52017	HYD ANN Exciter Replacement	465,855	473,350	-	-	Deferred to 2020
51772	HYD Arc Flash Mitigation	262,654	403,175	-	-	Deferred to 2020
47659	HYD - Fall River Controls Upgrade	104,320	302,867	-	-	Deferred to 2026
C0002978	CT's Motor Control Centre Upgrades	1,199,221	1,199,221	-	-	Deferred to 2020
49594	LM6000 TUC5 Airhouse Upgrade	830,287	916,391	(11,814)	980,668	Submitted, Awaiting UARB Review & Approval
51808	TUC HFO Piping Refurbishment	1,291,933	1,291,933	1,110,233	1,239,933	Approved
52107	TUC6 CW Screen Replacement	1,000,676	1,029,787	847,600	856,984	Approved
52321	TUC3 Air Heater Refurbishment	535,728	570,623	139,875	168,058	Project now less than $250,000
49940	LM6000 TUC5 Control System Upgrade	811,559	811,559	266,203	1,275,559	Approved
Distribution						
47794	Heckman Island Underwater Cable Replacement	762,186	1,524,923	23,951	1,042,425	Deferred to 2019
General Plant						
46075	IT - T&D Work and Asset Management	14,498,734	45,509,963	5,841,043	46,467,795	Deferred to 2019
49480	IT - Disaster Recovery	494,282	6,312,277	84,517	4,506,051	Deferred to 2019
49858	IT - MS Exchange Upgrade	1,555,597	1,555,597	-	1,517,875	Deferred to 2019
50112	Customer Experience Consolidated Customer Web Portal	654,004	1,190,588	-	-	Cancelled
49094	IT - Identity Access Mgmt Infrastructure	800,000	977,498	-	-	Deferred to 2020
C0002241	IT-Generation Operation Upgrade	511,673	511,673	315,809	562,680	2018 ACE Plan Pending Submission
52335	IT-Automate Manual Billing	506,403	506,403	-	-	Deferred to 2020
52337	IT-Group Billing Experience	505,823	505,823	-	-	Deferred to 2020

CI#	Project Title	ACE 2018 2018 Budget ($)	ACE 2018 Project Total ($)	Updated 2018 Budget ($)	Updated Project Total ($)	Status
C0002130	ADMS Distribution Fault Location	473,660	473,660	69,212	443,121	Submitted, Awaiting UARB Review & Approval
C0002106	Vegetation Inventory System Upgrade	260,172	260,172	103,761	204,879	Project now less than $250,000
C0002254	IT- MV90 Upgrade	254,062	254,062	187,929	248,109	Project now less than $250,000
51481	IT CMS Upgrade	525,174	564,063	396,303	2,053,010	2018 ACE Plan Pending Submission
48837	AMO Fleet Environmental Data Management	52,500	259,380	252,971	423,356	Approved

5.4 2018 ACE Capital Items Deferred / Cancelled

NS Power's list of deferred and cancelled capital work orders relative to the 2018 ACE Plan are noted in **Figure 17**. Given the timing of the filing of this Application, **Figure 17** does not include 2018 ACE Plan Subsequent Submittal items that are planned to be submitted after this Application has been filed and prior to 2018 year-end, and does not include additional 2019 expenditures.

Of the 27 projects listed, 2 projects were included in the 2018 ACE Plan for approval. 13 of these projects were listed in the 2018 ACE Plan subsequent submittal list, to be filed separately as individual capital items. The remaining 12 projects were listed in the 2018 ACE Plan as projects under $250,000.

These 27 projects were originally included in the 2018 ACE Plan with a forecast investment of $11.5 million in 2018. 8 of these projects have been cancelled, while 19 have been deferred to future years.

Figure 17: 2018 ACE Items – Deferred or Cancelled

CI	Project Title	2018 ACE Project Total	Cancelled / Deferred	Deferred To	Prior Approval	Prior ACE Plan Reference	2019 ACE Plan Reference
Generation							
47659	HYD - Fall River Controls Upgrade *Priorities were reassessed which changed the investment timing of this project, also reviewed with other asset requirements for the system to minimize outage duration.*	302,867	Deferred	2026		Subsequent Submittal	
47660	HYD - Dickie Brook Controls Upgrade *As part of Hydro long term planning, other projects were identified in the near term that would also require an outage, resulting in the deferral of this project to align with future outage requirements and give more time to prepare for the most efficient execution of all projects.*	885,586	Deferred	2020		Subsequent Submittal	
47937	BGT1 Clutch Refurbishment *Deferred to 2020 to align with a full engine overhaul or a generator rotor replacement/refurbishment and minimize the outage duration and execute along with other upcoming projects.*	61,000	Deferred	2020		Less than $250k	
49546	TRE6 FW Heater Level Control *Deferred due to feedwater heater work completed in late 2017 that mitigated any immediate risks.*	187,315	Deferred	2019		Less than $250k	Less than $250k
51868	HYD - 4th Lake Butterfly Valve Refurbishment *This project was intended to provide a lockable actuator for 4th Lake for isolation work. However, an alternate design was able to meet this requirement. As a result this project has been cancelled.*	48,174	Cancelled			Less than $250k	
52178	POT - Fuel Oil Supply Shutoff Valve Installation *This project was originally identified as a possible requirement for insurance reasons but has been deemed as not required. As a result, this project has been cancelled.*	54,857	Cancelled			Less than $250k	
52280	PHB Rotary Valve Replacements *This project is no longer required as previously used valves were refurbished in 2017 and replacement is no longer required at this time.*	57,912	Cancelled			Less than $250k	

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CI	Project Title	2018 ACE Project Total	Cancelled / Deferred	Deferred To	Prior Approval	Prior ACE Plan Reference	2019 ACE Plan Reference
C0001758	AMO CBT & Procedure Management Phase 3 *CI C0003939 was created as a duplicate of CI C001758 in the 2018 ACE Plan in error. CI C0001758 has been canceled whereas its scope is covered under CI C0003939.*	231,446	Cancelled			Less than $250k	
C0002978	CT's Motor Control Centre Upgrades *This project has been deferred due to a delay in the Burnside Unit 4 Motor Control Centre design from the vendor and determining the effectiveness of the solution this design offers.*	1,199,221	Deferred	2020		Subsequent Submittal	
49942	HYD - Tidewater Facility Refurbishment *Design of project is in process and as a result project has been deferred.*	1,234,178	Deferred	2020		Request Approval	
47655	HYD - Paradise Controls Upgrade *Deferred to align with implementing WRC, SHH, and TUS control upgrades to combine similar scopes of work for project management and transparency.*	639,991	Deferred	2021		Request Approval	
51772	HYD Arc Flash Mitigation *Deferred due to a delay in study to rank risk areas and define specific remedies for arc flash risk.*	403,175	Deferred	2020		Subsequent Submittal	
52159	CT VJ1 Varec Gauges Upgrades *The Varec gauges are being replaced with a new fuel monitoring system and will be replaced under CI 52115.*	35,000	Cancelled			Less than $250k	
52160	CT VJ2 Varec Gauges Upgrades *The Varec gauges are being replaced with a new fuel monitoring system and will be replaced under CI 52115.*	35,000	Cancelled			Less than $250k	
51848	HYD - ANN Warehouse Refurbishment *Subsequent to the 2018 ACE Plan, resources were not available to implement in 2018 and it was determined that it could be safely deferred to 2020.*	147,187	Deferred	2020		Less than $250k	
52017	HYD ANN Exciter Replacement *Deferred until further evaluation of the future of the asset.*	473,350	Deferred	2020		Subsequent Submittal	
52152	TRE5 Relay Room Fire Protection *Relay work will be completed at the same time as the wire/cable sprinkler protection slated for 2020*	96,940	Deferred	2020		Less than $250k	

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CI	Project Title	2018 ACE Project Total	Cancelled / Deferred	Deferred To	Prior Approval	Prior ACE Plan Reference	2019 ACE Plan Reference
39472	HYD Mersey System Re-Development *Deferred to better define project scope and consultation and engagement requirements.*	83,595,607	Deferred	2019		Subsequent Submittal	Subsequent Submittal
Distribution							
47794	Heckman Island Underwater Cable Replacement *Subsequent to the 2018 ACE Plan, NS Power re-examined the resource availability and determined that this project could be safely deferred to 2019.*	1,524,923	Deferred	2019		Subsequent Submittal	Subsequent Submittal
General Plant							
52337	IT-Group Billing Experience *Subsequent to the 2018 ACE Plan, NS Power re-examined this project and determined that it could be safely deferred to 2020.*	505,823	Deferred	2020		Subsequent Submittal	
52335	IT-Automate Manual Billing *Subsequent to the 2018 ACE Plan, NS Power re-examined this project and determined that it could be safely deferred to 2020.*	506,403	Deferred	2020		Subsequent Submittal	
52334	IT-Meridium Upgrade *CI 52334 was created as a duplicate in error and is being completed under CI 48039.*	150,000	Cancelled			Less than $250k	
50112	Customer Experience Consolidated Customer Web Portal *Scope of work to be completed under CI 51481, in an effort to combine similar scopes of work for project management and transparency.*	1,190,588	Cancelled			Subsequent Submittal	
49825	Radio Site Grounding Upgrade *Subsequent to the 2018 ACE Plan, resources were not available to implement in 2018 and it was determined that it could be safely deferred to 2019.*	181,197	Deferred	2019		Less than $250k	Less than $250k
49094	IT - Identity Access Mgmt Infrastructure *This project is being deferred while NS Power evaluates and addresses higher risk items.*	977,498	Deferred	2020		Subsequent Submittal	
49858	IT - MS Exchange Upgrade *This project is being deferred in order to evaluate scope and direction.*	1,555,597	Deferred	2019		Subsequent Submittal	Subsequent Submittal
49480	IT - Disaster Recovery *This project is being deferred while NS Power evaluates and addresses higher risk items.*	6,312,277	Deferred	2019		Subsequent Submittal	Subsequent Submittal

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6.0 2019 ANNUAL CAPITAL EXPENDITURE PLAN

6.1 Summary of Expenditures

Figure 18 below provides the proposed capital investment by category for NS Power's 2019 ACE Plan. This Application seeks UARB approval of the 2019 routine capital and other 2019 projects, which total approximately $158.2 million of forecast investment in 2019. Certain items do not require UARB approval but are included in NS Power's annual capital plan for transparency and informational purposes. The 2019 ACE Plan budget also includes investment on multi-year projects that were previously approved by the UARB (Carryover Projects).

Figure 18: 2019 Capital Investments by Category

(Millions of dollars)

2019 ACE Spend	2019 UARB Approval Request	UARB Approval Not Required	Capital Items Forecast for Later Filing & Approval in 2018/2019	Previously Approved Capital Projects with 2019 Carryover	2019 ACE Plan
Capital Item Approval Sought through the 2019 ACE Process (Including Routine Capital Projects)	158.2				**158.2**
2018 ACE Plan Items Pending Submission in 2018			7.9		**7.9**
Capital Items Submitted for Later Approval in 2019			20.5		**20.5**
2019 Carryover Projects				121.9	**121.9**
Capital Items Less Than $250K		15.5			**15.5**
Point Aconi Capital Spend		9.2			**9.2**
2019 ACE Plan	**$158.2**	**$24.7**	**$28.4**	**$121.9**	**$333.2**

Note: NS Power is seeking approval of $82.3 million of routine investment in 2019.
Note: Figures presented in the ACE Plan document reflect rounding differences on some line items.

6.2 2019 ACE Plan Capital Items Submitted for Approval

Figure 19 below provides the list of new Capital Items for which NS Power seeks UARB approval in the 2019 ACE Plan, totaling approximately $75.9 million of spending in 2019, with a total forecast investment of approximately $108.1 million.

Figure 19: 2019 Capital Items Submitted for Approval

Tab #	CI#	Project Title	2019 Budget ($)	Project Total ($)
Generation				
Hydro				
G01	50518	HYD - Ruth Falls Main Dam Refurbishment	1,561,074	7,244,422
G02	C0002539	HYD - Bridge Remediation 2019	3,349,626	6,843,686
G03	46254	HYD - Mill Lake Surge Tank Replacement	189,712	3,598,193
G04	C0004058	HYD - Tidewater 2 Overhaul	1,916,321	1,916,321
G05	C0010957	HYD - Malay Falls Unit 6 Overhaul	1,172,957	1,273,280
G06	C0012158	HYD - Malay Falls Unit 6 Generator Refurbishment	821,088	835,854
G07	48536	HYD - Wreck Cove Brook Dam D-9 Refurbishment	426,632	597,697
G08	C0006859	HYD - Wreck Cove Crane Refurbishment	460,849	498,167
G09	C0003998	HYD - Wreck Cove Station Service Cable Replacement	413,862	429,384
		Total New Hydro Spending	**$10,312,120**	**$23,237,004**
Steam				
Boiler				
G10	C0011076	POT - Boiler Refurbishment 2019	1,388,434	1,388,434
G11	C0010318	TRE6 - Boiler Refurbishment 2019	1,016,388	1,016,388
G12	C0009099	LIN3 - Boiler Refurbishment 2019	788,176	788,176
G13	C0009100	LIN4 - Boiler Refurbishment 2019	754,772	754,772
G14	C0007398	POT - Air Heater Refurbishment	634,780	669,205
G15	C0011064	PHB - Boiler Refurbishment 2019	565,707	565,707
G16	C0010319	TRE5 - Boiler Refurbishment 2019	518,302	518,302
G17	C0009108	LIN4 - Economizer Header Refurbishment	509,373	509,373
G18	C0009092	LIN3 - Reheat Tube Replacement 2019	412,548	412,548
G19	C0009093	LIN4 - Reheat Tube Replacement 2019	412,548	412,548
G20	C0009113	LIN4 - Burner Front Refurbishment	373,290	373,290
G21	47591	TRE5 - Bottom Ash Seal Replacement	350,562	350,562
Turbine				
G22	C0010141	POT - IP/LP Turbine Refurbishment	2,938,186	2,938,990
G23	C0010142	POT - HP Turbine Refurbishment	1,813,237	1,813,421
G24	C0010718	TRE5 - Turbine Main Valve Refurbishment	730,005	730,005
G25	C0010498	POT - Turbine Valve Refurbishment	698,497	698,497
Generator				
G26	C0007638	POT - Generator Auxiliary Equipment Refurbishment	3,444,121	3,473,920

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Tab #	CI#	Project Title	2019 Budget ($)	Project Total ($)
G27	51790	TRE6 - Generator High Voltage Bushings Replacement	694,334	694,334
G28	49664	Fleet AVR Critical Spare	540,778	540,778
G29	C0011085	POT - Hydrogen Panel Replacement	464,252	464,252
Environmental				
G30	C0009088	LIN - 1&2 CEMS Replacement	757,499	757,499
G31	C0010369	TRE5 - Baghouse Filter Replacement Phase 2	542,340	542,340
G32	C0009094	LIN Fly Ash Precipitator Component Refurbishment	414,046	414,046
G33	49991	TUC1 - CEMS Replacement	404,343	404,343
G34	49656	TUC - Waste Water Treatment Plant Controls Upgrade	305,851	305,851
Balance of Plant				
G35	50632	TRE - (Bunker C) HFO Refurbishment Project Phase 2	2,205,665	2,573,137
G36	48638	TRE - Rail Car Fuel Delivery Upgrade	1,154,179	1,236,623
G37	51238	TRE - Asbestos Abatement 2019	979,612	1,030,841
G38	C0010323	TRE6 - Mills Refurbishment 2019	796,370	796,370
G39	C0008098	TRE - Sludge Dewatering Infrastructure	505,886	687,005
G40	C0009096	LIN - Mill Refurbishment 2019	677,819	677,819
G41	C0011458	ICP - Rail System Refurbishment Program 2019	620,192	620,192
G42	49714	TUC - UT3 and ST34 Cable Replacement	606,863	606,863
G43	C0009082	LIN - Reclaim Feeder Refurbishment Phase 3	542,948	542,948
G44	C0010324	TRE5 - Condenser Inlet Piping and Valve Replacement	532,816	532,816
G45	C0009079	LIN - CW Pump Refurbishment 2019	522,011	522,011
G46	C0011088	POT - Coal Mill Refurbishment 2019	472,973	472,973
G47	C0009111	LIN4 - Bottom Ash Refurbishment	448,240	448,240
G48	C0009112	LIN - Ash Silo Stair Replacement	406,737	406,737
G49	C0010325	TRE5 - CW Screen Refurbishment	382,776	382,776
G50	C0009059	LIN - Coal Plant Structural Refurbishment Phase 5	375,902	375,902
G51	C0009080	LIN - CW Screen Refurbishment 2019	354,651	354,651
G52	C0010372	TRE5 - Post Cooler Conveyor Refurbishment	319,596	319,596
G53	C0008559	POT Diesel Generator and Essential Services Switchgear Replacement	294,571	294,571
G54	C0011091	POT - Asbestos Abatement 2019	270,498	270,498
G55	C0010326	TRE6 - Parallel Slide Valve Replacement	256,080	256,080
		Total New Steam Spending	**$34,198,751**	**$34,946,226**
Gas Turbine Generation				
G56	49874	CT - BGT Replace Halon Fire Protection	1,137,554	1,149,153
		Total New Gas Turbine Spending	**$1,137,554**	**$1,149,153**
		Total New Generation Spending	**$45,648,424**	**$59,332,382**
Transmission				
T01	C0010042	2019 Transmission Right-of-Way Widening 69kV	5,650,794	5,650,794
T02	C0010948	2019/2020 Sacrificial Anode Installation Program	750,954	3,099,862
T03	C0010952	2019/2020 Substation Polychlorinated Biphenyl (PCB) Equipment Removal	200,000	2,786,245

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Tab #	CI#	Project Title	2019 Budget ($)	Project Total ($)
T04	C0010949	2019/2020 Steel Tower Life Extension	470,548	2,414,140
T05	C0011339	L6549 - Replacements and Upgrades Phase 2	897,198	2,209,907
T06	C0010950	2019/2020 Steel Tower Refurbishment	362,284	2,009,268
T07	C0011338	L5548 - Replacements and Upgrades	782,778	1,699,381
T08	C0011242	L5541 - Replacements and Upgrades	686,035	1,624,850
T09	C0011241	L5026 - Replacements and Upgrades	692,751	1,498,789
T10	C0011300	L7005 - Replacements and Upgrades	621,103	1,346,026
T11	C0011240	L5511 - Replacements and Upgrades	580,178	1,255,087
T12	C0010978	2019/2020 Transmission Switch & Breaker Replacement	522,074	1,044,148
T13	C0011243	L5551 - Replacements and Upgrades	1,014,077	1,014,077
T14	C0011918	2019 Oil Containment Program	468,041	468,041
T15	C0011851	2019 Tap Changer Replacements/Refurbishments	326,937	326,937
T16	C0011850	2019 Substation Insulator Replacement Program	314,400	314,400
		Total New Transmission Spending	**$14,340,152**	**$28,761,952**
Distribution				
D01	C0010040	New Distribution Rights-of-Way Widening Phase 4	7,932,844	10,275,861
D02	C0011208	2019 Padmount Replacement Program	1,216,836	1,413,544
D03	C0011209	85S-401 - Cabot Trail Rebuild	1,305,919	1,305,919
D04	C0006319	2019 PCB Pole Top Transformer Replacements	1,160,231	1,177,592
D05	C0014019	2019 Substation Recloser Replacements	143,274	808,120
D06	C0011309	54H-304 - Underground Device Replacement	344,798	685,268
D07	C0011197	64N Lourdes Street Conversion Phase 1	231,413	576,031
D08	C0011200	6S-224 - Birch Hill Drive Conversion	542,026	542,026
D09	C0011320	22W-311GA - Hawk Point Road Reconductor Replacement	465,758	465,758
D10	52229	16V-314H - New Edinburgh Phase Extension	454,662	454,662
D11	C0011189	2H-411 - Cowie Hill UG System Replacements Part 3	226,769	449,448
D12	C0013978	11S - Keltic Drive Substation Animal Guards	333,813	333,813
D13	C0011182	15N-202 - Dominion St and Arthur St Rebuild	328,292	328,292
D14	C0011206	102W-311 - Jedediah Rd Rebuild	317,453	317,453
D15	C0011187	5N-301 - Masstown Road Rebuild Phase 2	304,501	304,501
D16	C0011188	23H-303 - Willett Street Underground Replacement	286,624	286,624
D17	C0004165	70W-311G - Crousetown Road Phase Extension	281,547	285,117
		Total New Distribution Spending	**$15,876,759**	**$20,010,027**
		Total New Capital Spending	**$75,865,334**	**$108,104,362**
		Total Routine Capital Spending	**$82,312,222**	**$82,312,222**
		Total Capital Items for which Approval is Sought	**$158,177,556**	**$190,416,583**

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6.3 2019 ACE Plan Capital Items Forecast for Subsequent Approval

Figure 20 below identifies 2019 projects that are not yet ready for submission to the UARB, and that NS Power anticipates will be filed for review and approval throughout 2019. NS Power estimates approximately $20.5 million of investment in 2019 on these projects, which are currently estimated for total investment of approximately $260.7 million. The budget numbers indicated below are estimates as NS Power needs additional time to refine the specific project budget proposals. This section of the application is designed to provide an indication of these anticipated 2019 projects.

Figure 20: 2019 Capital Items Forecast for Subsequent Submittal

CI#	Project Title	2019 Budget ($)	Project Total ($)
Generation			
Hydro			
39472	HYD - Mersey Redevelopment Phase 1 *This project is the first phase of the re-development of the Mersey Hydro System and includes the replacement of the Big Falls Power House, the Lower Great Brook Dam Structure and the redevelopment of the Big Falls Substation.*	3,276,817	115,534,895
C0013838	HYD - Wreck Cove Unit 1 Overhaul *This is the first project of the Wreck Cove Life Extension & Modernization (LEM). This project includes the overhaul of the turbine, generator and spherical valve for Wreck Cove Unit 1.*	369,853	53,732,085
	Total New Hydro Spending for Subsequent Approval	**$3,646,670**	**$169,266,980**
Gas Turbine			
49949	LM6000 - TUC4 Control System Replacement *This project includes the upgrade of the control system on the Tufts Cove Unit#4 LM6000.*	841,373	864,695
52146	LM6000 - TUC4 Enclosure Cooling Upgrade *This project includes the upgrade of the turbine enclosure cooling system on the Tufts Cove #4 LM6000.*	318,033	318,033

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CI#	Project Title	2019 Budget ($)	Project Total ($)
52150	LM6000 - TUC5 Enclosure Cooling Upgrade *This project includes the upgrade of the turbine enclosure cooling system on the Tufts Cove #5 LM6000.*	318,033	318,033
C0011191	CT - Tusket Stack Refurbishment *This project includes the refurbishment of the stack at the Tusket Combustion Turbine*	355,946	355,946
	Total New Gas Turbine Spending for Subsequent Approval	**$1,833,385**	**$1,856,707**
Steam			
52292	TUC - Heavy Fuel Oil Tank Dyke Refurbishment *This project is for the refurbishment of the dykes and liners of the heavy fuel oil containment systems to ensure adequate capacity and function.*	929,867	985,283
48850	AMO - Fleet Mobile Technology Advancement *This project is for development and deployment of additional tools and processes on handheld devices to support Operations and Maintenance activities in Power Production.*	200,197	266,453
C0011092	POT - Unit 2 Turbine Crane Refurbishment *This project is for upgrades to the drive motors and other reliability and operability upgrades for the crane.*	254,342	254,342
	Total New Steam Spending for Subsequent Approval	**$1,384,406**	**$1,506,078**
Wind			
C0010539	AMO - Wind Asset Management *This project is for the design and implementation of Asset Management tools and processes for NS Power's Wind Generation assets.*	197,140	272,430
	Total New Wind Spending for Subsequent Approval	**$197,140**	**$272,430**
	Total New Generation Spending for Subsequent Approval	**$7,061,601**	**$172,902,196**

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CI#	Project Title	2019 Budget ($)	Project Total ($)
Transmission			
C0011261	101W Port Mersey Expansion *This project will expand the current 101W Switching substation to a 25kV distribution substation with two 25kV feeders. This expansion is needed to alleviate overload conditions on the transformer at 50W Milton and also serve new industrial load in the area.*	271,782	2,623,897
C0010956	78W - Substation Relocation and New Power Transformer *This project will relocate the 78W substation in the L5547 transmission line right-of–way and install a new power transformer.*	277,662	2,507,602
C0011039	5V-GT1 - Generating Transformer *The existing Lumsden Hydro 5V-GT1, 3.5 MVA, 66/6.9 kV generating transformer built by GE in 1940 (78 years of age) is approaching its end of life and requires replacement. A new replacement unit is required, to provide continuation of service at this facility.*	205,489	602,155
	Total New Transmission Spending for Subsequent Approval	**$754,933**	**$5,733,654**
Distribution			
C0008638	Cogswell HRM Redevelopment Program *This project includes the costs associated with the proposed redevelopment of the Cogswell Interchange site by Halifax Regional Municipality. This project will require relocation of existing underground infrastructure and the addition and routing of new electrical feeds for additional load growth.*	996,454	4,003,344
47794	Heckman Island Underwater Cable Replacement *This project provides for the replacement of the underwater cable to Heckman's Island near Lunenburg. The targeted underwater cable has reached its end of life due to age, condition and risk. In addition, the load on this cable has increased since its original installation and the cable can no longer support cold-load pick up.*	89,483	1,042,425
	Total New Distribution Plant Spending for Subsequent Approval	**$1,085,937**	**$5,045,769**
General Plant			
46075	IT - T&D WAM Phase 2 – Work Management and Scheduling & Dispatch *This project will upgrade and replace NS Power's T&D Work and Asset Management (WAM) Maximo scheduling and dispatch systems and integrate the Maximo system with the NS Power GIS system, enabling a spatial view of work and assets in Maximo on a platform that is supported by the vendor.*	321,552	46,467,795

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CI#	Project Title	2019 Budget ($)	Project Total ($)
C0011378	Route Network Upgrades *This project provides for the costs associated with the fibre optic system upgrades and the work required to move existing traffic from the old system to the new system.*	945,714	6,440,943
47751	ECC - Dynamic Line Rating Implementation *This project will install devices and technology on transmission lines and within the Cape Breton Export corridor which will monitor conductor heat, wind, temperature, line sag and other environmental elements, which will transmit real time (dynamic) capacity ratings back to the Control Centre for System Operations electronic management.*	136,349	4,748,860
49480	IT - Disaster Recovery *This project will review, design, and deploy the necessary infrastructure to ensure disaster recovery capabilities and processes are in place for all NS Power IT systems based on their classification of criticality.*	1,499,697	4,506,051
C0002137	ECC - Map Board and Technology Modernization *This project will replace the existing map board which was installed around 1988. The map board is reaching the end of its useful life and upgrades can no longer be implemented to extend its useful life.*	828,836	2,568,789
49093	IT - Security Operations Center (SOC) and Security Information Event Monitoring (SIEM) *This project will select and implement required infrastructure and services to provide security operations centre capability.*	1,150,520	2,489,673
C0011059	IT - Database Infrastructure *This project will build a new platform for Oracle and SQL Database Services.*	925,006	1,964,280
C0010019	IT - ADMS Upgrade 2019 *This project will upgrade the ADMS application to a fully supported version and ensure compatibility with newer technologies.*	1,041,111	1,682,043
49858	IT - MS Exchange Upgrade *This project will upgrade the Microsoft Exchange environment as part of NS Power's technology lifecycle management. Microsoft Exchange 2010 is the platform that manages and delivers all email to NS Power employees, schedules calendars and manages contacts.*	1,517,875	1,517,875
C0010838	MCC - HVAC Replacement *Engineering and installation of new chillers and cooling towers and associated piping and water pumps at the Main Computer Centre (MCC) to replace the existing original equipment*	1,071,364	1,071,364
48044	Bentley Nevada Upgrade and Integration to Fleet Monitoring *This project is to upgrade the existing Bentley Nevada turbine monitoring and data management systems across NS Power's fleet of thermal generating stations to provide greater visibility and integration into other tools and processes.*	112,115	880,592

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CI#	Project Title	2019 Budget ($)	Project Total ($)
C0011819	Backup Control Centre SCADA Hardware Replacement *The Backup Control Centre SCADA Hardware Replacement will upgrade the SCADA application servers at the Backup Control Centre and workstations to the vendor's current release.*	477,121	561,496
C0011308	IT - PowerPlan Upgrade *This project will upgrade the PowerPlan application to a fully supported version*	202,642	503,921
C0013718	AMO - Run-up Optimization Tool *The project is for the development, validation and roll-out of a fleet-wide generator run-up assessment tool. This tool will facilitate an objective look at run-up activities across the fleet, and help identify areas for development.*	346,478	428,340
C0011679	AMO - T&D Asset Performance Management Tool *This project includes the identification and roll-out of an Asset Performance Management Tool for NS Power's fleet of Transmission and Distribution assets.*	300,874	372,860
C0011380	2019 Telecom Building Replacement *This project will replace the Sackville telecommunications building which was installed around 1978. The building is deteriorated and replacement of the entire building is required.*	301,380	301,380
50942	AMO - Hydro Data Integration *This project will build on the foundational work completed under CI 46411 – Hydro Asset Management Implementation to improve visibility to information from NS Power's hydro systems, and integrate hydro data into asset management tools and programs.*	135,091	266,867
C0012239	ADMS Enhancement - Fixed Estimated Time to Restore *This project will leverage enhanced functionality releases from the ADMS solution provider, Schneider Electric, to enhance the Estimated Time to Restore (ETR) functionality. This will allow us to assign a specific ETR based on the territory and actual number of customers affected by the outages instead of a general ETR for a broad customer/territory.*	240,431	240,431
	Total New General Plant Spending for Subsequent Approval	**$11,554,154**	**$77,013,561**
	Total Capital Items for Subsequent Approval	**$20,456,626**	**$260,695,180**

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6.4 2019 ACE Plan Capital Items with Estimated Total Project Cost of Less Than $250,000

Figure 23 below sets out capital items with a total project cost of less than $250,000. In accordance with Section 35 of the *Public Utilities Act*, these projects do not require UARB approval but are provided for transparency and informational purposes.

Similar to 2018, the information in this section has been expanded in the 2019 ACE Plan in accordance with the agreement reached with stakeholders pursuant to NS Power's report provided to the UARB on September 5, 2017. Historical dollar values and numbers of projects are now provided in **Figure 21** and **Figure 22** below, respectively. The table of projects under $250,000 now includes brief descriptions of all projects and rankings of those projects in accordance with NS Power's asset management methodology as described in section 6.2 of the CEJC.

Figure 21: Historical Value of Projects Less Than $250,000

(Millions of dollars)

$ Value of Projects Less than $250k				
Function	**2016**	**2017**	**2018**	**2019**
Gas Turbine	0.6	1.7	1.2	0.6
Steam	12.2	16.0	12.5	12.7
Hydro	0.1	0.9	0.8	0.4
Wind	-	-	-	0.1
Transmission	0.6	0.1	0.2	0.2
Distribution	0.6	1.3	1.2	0.4
General Plant	1.2	1.6	1.9	1.0
Total	$15.3	$21.5	$17.9	$15.5

Note: Totals in the tables above may be off due to rounding

Figure 22: Historical Number of Projects Less Than $250,000

# of Projects Less than $250k				
Function	**2016**	**2017**	**2018**	**2019**
Gas Turbine	7	19	15	9
Steam	85	116	87	95
Hydro	1	8	7	4
Wind	-	-	-	1
Transmission	5	1	1	1
Distribution	4	9	6	3
General Plant	9	14	16	8
Total	111	167	132	121

Note: Totals in the tables above may be off due to rounding.

Figure 23: 2019 Capital Items with Estimated Total Project Cost of Less than $250,000

CI#	Project Title	2019 Budget ($)	Project Total ($)	Criticality	Condition	Ranking
Generation						
Hydro						
C0004019	HYD - White Rock Fish Ladder Upgrade	143,182	186,123	4	4	16
This project is for modifications to the White Rock Fish Ladder and Screens to improve fish passage.						
C0011539	HYD - LEQ Roofing Refurbishment	116,723	116,723	3	5	15
This project is to replace the facia and soffit on the Lequille powerhouse.						
C0011185	HYD - Generator Dehumidifier	114,982	114,982	4	4	16
This project is to procure two portable dehumidification units for Hydro production to minimize unit dry out on start-up.						
C0011204	HYD - MIL Metal Fabricator	70,574	70,574	4	4	16
This project includes the purchase of a multipurpose metal fabrication unit for the Hydro Maintenance Services machine shop to create custom replacement parts for Hydro units.						
	Total Hydro Items Less Than $250,000	**$445,461**	**$488,402**			
Steam						
C0009081	LIN - Grating Refurbishment Phase III	248,844	248,844	4	4	16
This project is to replace grating and stair treads on the bottom floor of the boiler house, CW and crusher buildings. The gratings are degrading from corrosion and wear which is affecting the structural integrity and require replacement.						

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CI#	Project Title	2019 Budget ($)	Project Total ($)	Criticality	Condition	Ranking
C0010259	POT - Annex Restoration	240,570	240,570	4	4	16
This project is to renovate the office annex area at POT including flooring and space improvements for an office environment.						
52037	LIN1 - Main FW Control Valve & Actuator	240,006	240,006	4	4	16
This project is for the replacement of the main feedwater control valve and actuator based on condition assessment and associated maintenance strategy.						
C0009083	LIN - Siding Refurbishment Phase III	236,999	236,999	3	5	15
This project is for the replacement of plant siding. The siding is original to the plant and is Galbestos which contains asbestos in the coating.						
C0011958	POT - Pumphouse MCC Replacement Phase 2	235,095	235,095	4	5	20
This project includes the replacement of the cooling water pump house motor control center. The project is needed because the existing MCC has deteriorated due to the harsh environment.						
C0011461	ICP - Rail Car Refurbishment 2019	234,945	234,945	4	4	16
This project is for the refurbishment of coal delivery railcars. The refurbishment will be focused on the replacement of the shield over top of the center beam of the car which helps to protect the air brake lines from damage.						
C0011460	ICP - Rail Car Truck Program 2019	233,077	233,077	4	4	16
This project includes the refurbishment of the rail car trucks which can also be referred to as wheel assemblies.						
C0010942	AMO - LIN3 Enhanced Monitoring	232,840	232,840	3	5	15
This project is for the deployment of devices to enhance NS Power's ability to monitor its generating assets, and expand our ability to identify problem areas early and implement appropriate mitigating measures.						
C0010941	AMO - TUC 3 Enhanced Monitoring	232,824	232,824	3	5	15
This project is for the deployment of devices to enhance NS Power's ability to monitor its generating assets, and expand our ability to identify problem areas early and implement appropriate mitigating measures.						
C0010943	AMO - TRE6 Enhanced Monitoring	231,997	231,997	3	5	15
This project is for the deployment of devices to enhance NS Power's ability to monitor its generating assets, and expand our ability to identify problem areas early and implement appropriate mitigating measures.						
C0009097	LIN4 - Misc. Valve Refurbishment	228,606	228,606	3	5	15
This project includes select valve refurbishments based on condition assessment and associated maintenance strategy.						
C0011462	ICP - Locomotive Refurbishment	220,239	220,239	4	4	16
This project is for the refurbishment of the locomotive.						
C0011095	POT - Plant Siding 2019	219,278	219,278	4	5	20
This project includes replacement of Galbestos plant siding, fasteners, and structural components on the Unit 2 Boiler house.						
C0009098	LIN3 - Misc. Valve Refurbishment	218,802	218,802	3	5	15
This project includes select valve refurbishments based on condition assessment and associated maintenance strategy.						

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CI#	Project Title	2019 Budget ($)	Project Total ($)	Criticality	Condition	Ranking
C0009058	LIN - Plant Lighting Upgrade Phase III	211,943	211,943	3	5	15
This project is to replace out of service lighting with efficient LED fixtures. The main driver of this project is to improve lighting in high risk areas improving plant safety, with the added benefit of reducing station service requirements.						
49054	TRE6 - 6B CW Screen Refurbishments	208,856	208,856	3	5	15
This project includes the refurbishment of the screen assembly to return it to reliable operation, including replacement of corroded screen frames and an overhaul of the upper drive drum assembly.						
41263	TUC6 - General Access Improvement	208,523	208,523	4	4	16
This project is to install access platforms and enclosures on the natural gas duct burner headers and feedwater supply and vent valves on the HRSG units.						
C0009087	LIN - A Coal Chute Replacement Phase II	204,648	204,648	4	4	16
This project will see the replacement of the transfer chute between A and B belt.						
C0012659	TUC - Scaffolding Program 2019	203,786	203,786	3	5	15
This is a multi-year project to procure scaffold and train employees to enable performing more scaffold work in-house rather than contracting out.						
C0011098	POT - Precipitator & ID Fan Ductwork Repairs	202,728	202,728	4	4	16
This project includes the refurbishment of the primary air ducts associated with the precipitator and ID fans.						
C0011063	TUC - HFO Ship Unloading Hose Installation	201,734	201,734	3	5	15
This project is to replace the Heavy Fuel Oil ship unloading arms with flexible hoses to allow for increased safe movement of ship while unloading HFO.						
C0010358	TRE5 - 5-1 Mill Refurbishment	200,572	200,572	3	5	15
This project includes the replacement of worn components on the Trenton Unit 5-1 Coal pulverizer (one of the four coal mills associated with Unit 5). This will maintain efficiency and the ability for the unit to reach fully rated generator output.						
C0011418	PTMT - Shuttle belt replacement	197,219	197,219	4	4	16
This project includes the replacement of the shuttle belt. This conveyor is part of the fuel handling system.						
C0011097	POT - Unit 2 Stack Repairs	195,782	195,782	4	4	16
This project includes the refurbishment of the POT stack to address deficiencies found on the annual inspection program.						
C0009818	TRE6 - Stack Refurbishment	136,816	192,274	4	4	16
This project includes the refurbishment of the Trenton 6 stack. Activities include refurbishment of access platforms, stack top ring, protective coatings, and miscellaneous electrical and structural components.						
49546	TRE6 - FW Heater Level Control	191,287	191,287	4	5	20
This project includes the replacement of obsolete feedwater heater level controls with improved technology that reduces heat rate implications and damage to mechanisms.						
C0011096	POT - Controls Upgrade Phase 2	188,423	188,423	4	4	16
This project is will replace obsolete PLCs as part of the fleet wide PLC replacement program.						
C0010330	TRE6 - Valve Refurbishment 2019	182,292	182,292	4	4	16
This project includes select valve refurbishments based on condition assessment and associated maintenance strategy.						

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CI#	Project Title	2019 Budget ($)	Project Total ($)	Criticality	Condition	Ranking
C0010327	TRE6 - Turbine Oil Filtering System Upgrade	182,118	182,118	4	4	16
This project includes the replacement of the Trenton Unit 6 turbine lube oil filtering system to improve and increase the useful life of the turbine lube oil.						
C0009078	LIN - Instrument Air Compressor Replacement	178,721	178,721	4	4	16
This project is to replace two compressors and associated drying equipment to restore the reliability of the system and eliminate the risk of a unit trip.						
C0011065	PHB - Conveyors and Handling System Refurbishment	178,011	178,011	4	4	16
This project includes the refurbishment of conveyor components, including belts, pulleys, scrappers and structural/electrical components. This conveyor is part of the fuel delivery system.						
C0010329	TRE5 - Valve Refurbishment 2019	175,438	175,438	4	4	16
This project includes select valve refurbishments based on condition assessment and associated maintenance strategy.						
C0010331	TRE6 - Precipitator Controls Upgrade	168,749	168,749	4	4	16
This project includes the controls upgrade to static precipitators. Precipitators are used to remove particulates from stack emissions.						
C0011399	LIN - Condenser Plug Changeout	166,392	166,392	3	5	15
This project is to replace the condensor plugs due to advanced corrosion due to dissimilar metals as a result of a root cause analysis process.						
C0010359	TRE6 - Beck Drive Replacement FD/PA Fans	161,221	161,221	3	5	15
This project includes the replacement of existing pneumatic actuators with electric actuators on the dampers associated with the Draft plant ductwork. This will increase the efficiency and reliability of the boiler.						
C0011459	ICP - Stacker Gearbox Refurbishments	157,385	157,385	4	4	16
This project is to refurbish the gearboxes that drive the coal belts. This is part of the fuel handling system.						
C0012578	TUC - Handrail Upgrade	153,817	153,817	4	4	16
This project is for upgrades to handrails at TUC which are presently not the proper dimensions required by code based on handrail survey.						
C0010360	TRE5 - Conveyor Refurbishment 2019	153,768	153,768	4	4	16
This project includes the refurbishment of conveyor components, including belts, pulleys, scrappers and structural/electrical components. This conveyor is part of the fuel delivery system.						
C0011100	POT - Misc. Valve/Component Refurbishment 2019	153,413	153,413	4	4	16
This project includes the select refurbishment of defective valves. Valves are selected based on condition assessment and associated maintenance strategy.						
C0010332	TRE - Ash Site Management 2019	152,976	152,976	4	4	16
This project includes the intermediate cover of exposed ash, pending final capping. This is required to meet environmental compliance.						
C0010333	TRE6 - Air Heater Expansion Joint Refurbishment	152,339	152,339	4	4	16
This project includes the refurbishment of the expansion joints on the boiler air preheater and to improve efficiency and support more reliable unit operation.						
C0011222	TUC - Plant Lighting Upgrade	146,079	146,079	3	5	15
This project is to replace out of service lighting with efficient LED fixtures. The main driver of this project is to improve lighting in high risk areas improving plant safety, with the added benefit of reducing station service requirements.						

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CI#	Project Title	2019 Budget ($)	Project Total ($)	Criticality	Condition	Ranking
C0009105	LIN - Facilities Upgrades	134,750	134,750	4	4	16
This project is for the renovation of facilities original to the plant. Scope includes washrooms, locker rooms and lunch rooms.						
C0010983	LIN - Coal Crusher Refurbishment	130,789	130,789	4	4	16
This project is for the refurbishment of one coal crusher. The coal crusher is used to break up frozen or large pieces of coal on route to the coal silos.						
47909	TUC - Natural Gas Valves Refurbishment	76,170	126,207	3	5	15
This project is for the refurbishment of natural gas burner valves based on the maintenance strategy. These valves control natural gas flow to the boiler.						
C0009115	LIN - Service Air Compressor	125,903	125,903	3	5	15
This project is for the replacement of 1B Service Air compressor. 1B Service air compressor has a Variable Frequency Drive (VFD) and is used during high peaks of service air use.						
C0011184	TUC1 - Main Feedwater Valve Replacement	123,186	123,186	4	4	16
This project is for the replacement of the main feedwater valve for Tufts Cove unit 1 based on condition assessment and associated maintenance strategy.						
52232	TUC3 - Lube Oil Filter Upgrades	122,159	122,159	4	4	16
This project upgrades the filtering efficiency of the lube oil filtration system on TUC3 Turbine-Generator.						
C0011102	POT - 258V Battery Bank	120,713	120,713	4	4	16
The project is to replace the emergency backup battery bank. This system provides uninterrupted power in the event of a power disruption to auxiliary systems.						
C0010334	TRE - LED Lighting Upgrade	120,114	120,114	4	4	16
This project includes the replacement of out of service plant lighting with LED fixtures. The main driver of this project is to improve lighting in high risk areas improving plant safety, with the added benefit of reducing station service requirements.						
C0011103	POT - Breaker Replace/Upgrade	111,686	111,686	4	4	16
This project is for replacement of POT Unit #2 generator breakers.						
C0011145	POT - Oily water Separator for Vacuum Pumps	110,804	110,804	4	4	16
This project will install an oily water separator on the condenser air extractor vacuum pumps discharge to mitigate potential oil release to environment.						
C0009104	LIN - 4160 600V Breaker Refurbishment	107,022	107,022	4	4	16
This project includes select replacements of defective electrical breakers based on condition assessments.						
C0009109	LIN - Exterior Security Light Upgrade	105,802	105,802	3	5	15
This project is to upgrade plant exterior lighting. This project is required to be in compliance with NERC (North American Electric Reliability Corporation) CIP (Critical Infrastructure Protection) requirements.						
C0010362	TRE6 - Conveyor Refurbishments 2019	105,443	105,443	3	5	15
This project includes the refurbishment of conveyor components, including belts, pulleys, scrappers and structural/electrical components. This conveyor is part of the fuel delivery system.						

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CI#	Project Title	2019 Budget ($)	Project Total ($)	Criticality	Condition	Ranking
C0011698	POT - Mill Knife Gate Valve Refurbishment	104,255	104,255	4	4	16
This project is for the refurbishment of the POT coal mill isolation knife gate valve.						
C0010335	TRE - Waste Water Treatment Plant Chemical Feed System Upgrade	103,044	103,044	4	4	16
This project includes the upgrade to the chemical feed system (including mixing and instrumentation) to automate chemical feed and monitoring of the waste water system.						
C0011520	ICP - Load Out Hydraulics Refurbishment	102,817	102,817	3	5	15
This project is for the rerfubishment of the hydraulics system for loading coal trains.						
C0011022	TUC - Asbestos Abatement 2019	102,510	102,510	5	3	15
This project is for reoccurring asbestos abatement in Tufts Cove.						
C0011818	TRE6 - Auxiliary Cooling Water Line Replacement	100,012	100,012	4	4	16
This project includes the replacement of the auxiliary cooling water pipe that branches off the main cooling water line. This auxiliary cooling water is used to cool the assets associated with Unit 6 (lube oil coolers, hydrogen/water/water cooler, seal oil coolers, auxiliary GSCW coolers etc.).						
C0010336	TRE6 - Boiler Safety Valve Refurbishment	98,521	98,521	4	4	16
This project includes the refurbishment of the Trenton Unit 6 boiler safety valves that are used for relief in the event of over pressurization of the boiler.						
C0009060	LIN - CW Screen Wash Piping Upgrade 2019	97,081	97,081	4	4	16
This project is for the upgrade from bondstrand fiberglass screen wash piping to stainless steel piping.						
49715	TUC - Upgrade PLC Control Panel	93,890	93,890	3	5	15
This project will replace obsolete Prorgramable Login Controllers (PLC's) as part of the fleet wide PLC replacement program.						
C0011199	TUC3 - FD Fan VIV Actuator Replacement	91,994	91,994	3	5	15
This project will replace the Variable Inlet Vane actuator for Tufts Cove unit 3. This actuator is critical for the air flow to the boiler which effects emissions and combustion efficiency.						
C0011210	TUC1 - Bus Duct/Gen Terminal Temperature Monitoring	80,842	88,228	4	4	16
This project will install an online bus duct temperature monitoring system for Tufts Cove unit 1.						
C0011211	TUC2 - Bus Duct/Gen Terminal Temperature Monitoring	80,842	88,228	4	4	16
This project will install an online bus duct temperature monitoring system for Tufts Cove unit 2.						
C0011582	ICP - Furnace Oil Tank Replacement	80,996	80,996	4	4	16
This project is for the replacement of the 35000L fuel tank.						
C0010322	TRE - Floor Plate Replacements 2019	80,450	80,450	4	5	20
This project includes select replacement of pedestrian grating based on condition assessment.						
C0010979	TUC - Wharf Bumper Refurbishment	78,097	78,097	3	5	15
This project is for the refurbishment of damaged wharf bumpers to allow safe docking of HFO Ships.						

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CI#	Project Title	2019 Budget ($)	Project Total ($)	Criticality	Condition	Ranking
C0013240	TRE5 - Sootblower Refurbishment	77,744	77,744	4	5	20
This project is to replace critical sootblower components which will maintain heat rate and reliability of the boiler.						
C0010365	TRE - Admin Washroom Upgrade	77,043	77,043	3	5	15
This project includes the upgrade of the existing women's and men's washrooms in the administrative area of the plant.						
C0011220	TUC1 - Modulating Controls Upgrade	76,138	76,138	4	5	20
This project will replace the pneumatic heater level controls with a digital PLC control.						
C0010320	TRE6 - Primary Air Ductwork Refurbishment	76,038	76,038	4	4	16
This project includes the refurbishment of the primary air ducts associated with boiler/air heater/mills and will improve heat rate and efficiency of the unit.						
C0010338	TRE6 - Main Feedwater Valve Refurbishment	75,225	75,225	4	4	16
This project includes the refurbishment of the Trenton Unit 6 main feedwater valve based on condition assessment and recommended maintenance strategy. This valve controls the flow of water to the boiler.						
C0010337	TRE5 - Main Feedwater Valve Refurbishment	75,225	75,225	4	4	16
This project includes the refurbishment of the Trenton Unit 5 main feedwater valve based on condition assessment and recommended maintenance strategy. This valve controls the flow of water to the boiler.						
C0011143	POT - Ultraflow Flue Gas Monitor	74,876	74,876	4	4	16
This project will replace the ultraflow flue gas stack emission monitoring system to ensure emission compliance.						
C0009085	LIN - Plant Heating Upgrade	73,149	73,149	3	5	15
This project is for the replacement of steam traps, piping, fittings and valves as identified by condition assessment.						
C0011068	PHB - Trancel Screw Refurbishment	72,180	72,180	4	4	16
This project is for the refurbishment of the trancel screw assembly which feeds biomass to the conveyor system.						
C0012658	TUC - Instrument Air Compressor Replacement	72,040	72,040	3	5	15
This project is for the replacement of the TUC Instrument Air Compressor 2 as the machine has exceed its service life.						
C0010370	TRE - Blowdown Tank Header Replacement	71,694	71,694	4	4	16
This project includes the replacement of two damaged blowdown tank headers on Trenton Unit 6. These headers collect high pressure steam from the boiler and turbine.						
C0011400	LIN - Polisher Bypass Valve Refurbishment	67,005	67,005	3	5	15
This project is for the refurbishment of the polisher bypass valve based on condition assessment and recommended maintenance strategy.						
C0011149	POT - Refurbish Common Water System	65,054	65,054	3	5	15
This project is for the refurbishment of common plant water lines in the coal gallery and select locations throughout the plant.						
52282	TUC - Ion Chromatograph Upgrade	64,797	64,797	3	5	15
This project is to upgrade the chemical analytical panels with an Ion Chromatograph providing an anion column and software for the analysis of boiler water on unit start-up.						

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CI#	Project Title	2019 Budget ($)	Project Total ($)	Criticality	Condition	Ranking
C0011069	PHB - Replace Reclaim Belt	58,307	58,307	4	4	16
This project includes the replacement of the reclaimer belt. This conveyor is part of the fuel delivery system.						
C0011579	LIN3 - Sequence of Events Recorder Phase II	56,893	56,893	4	4	16
This project includes the installation of a sequence of events recorder to improve unit reliability and troubleshooting.						
C0011148	POT - Exhaust Fan Control Upgrades	53,913	53,913	4	4	16
This project is will replace obsolete PLCs as part of the fleet wide PLC replacement program.						
52244	PHB - Refurbishment Mini-Bins	44,453	53,434	3	5	15
This project includes the refurbishment of the mini-bins which are part of the fuel delivery system.						
C0010919	TRE6 - Burner Impeller Replacement	53,013	53,013	3	5	15
This project includes the replacement of eight of sixteen burner impellers on Trenton Unit 6. This will help maintain efficiency and minimize NOx emissions.						
C0011581	LIN - Replace O2 analyzers	51,529	51,529	3	5	15
This project is for the replacement of oxygen monitoring system. Oxygen measurement in flue gas is used to determine proper fuel control for optimum combustion.						
41282	TUC - Plant Security Upgrade	51,430	51,430	3	5	15
This project will upgrade plant security with additional security cameras and wharf lighting.						
C0013239	TRE5 - Draft Plant Refurbishment	50,487	50,487	4	4	16
This project is to refurbish key components of the Trenton Unit 5 Induced Draft/Forced Draft fans (key components being inlet and outlet dampers).						
42950	TUC3 - ESP Controls Upgrade	49,975	49,975	3	5	15
This project will upgrade the Electrostatic Precipitators to optimize power usage.						
C0010368	TRE6 - Drum Level Instrumentation Upgrade (Aquarians)	49,095	49,095	3	5	15
This project includes the replacement of the boiler drum level instrumentation.						
C0010366	TRE5 – Fly Ash Air System	48,919	48,919	3	5	15
This project includes the replacement of the fly ash dryer and piping upgrades on Trenton Unit 5.						
C0013238	TRE5 - Precipitator Insulator Replacement	40,922	40,922	3	5	15
This project includes the replacement of the damaged insulators within the Trenton Unit 5 precipitator.						
	Total Steam Items Less Than $250,000	**$12,686,194**	**$12,815,443**			
Gas Turbine						
C0012704	LM6000 - Starter and Clutch Assembly Replacement	141,261	141,261	4	4	16
This project includes the replacement of the starter motor and refurbishment of the clutch assembly.						

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CI#	Project Title	2019 Budget ($)	Project Total ($)	Criticality	Condition	Ranking
C0012702	LM6000 - Switchgear/Breaker Upgrade	88,545	88,545	4	4	16
This project is to upgrade air conditioning and insulation in the switch gear room to prevent moisture accumulation and associated corrosion.						
C0011194	LM6000 - TUC4 Higgot-Kane: Replace Insulation	83,624	83,624	4	5	20
This project will replace the insulation on the exhaust system.						
C0011193	LM6000 - TUC5 Higgot Kane: Replace Insulation	83,624	83,624	4	4	16
This project will replace the insulation on the exhaust system.						
C0012703	CT - BGT Bleed Valve Upgrade	66,806	66,806	4	4	16
This project will upgrade the turbine air pressure bleed valves for additional reliability.						
C0012699	LM6000 - Replace U4 and U5 129V Chargers	46,511	46,511	4	4	16
This project is for the replacement of the battery chargers for Tufts Cove units 4 & 5.						
C0011196	CT - TUS Station Service Cable Replacement	38,978	38,978	4	4	16
This project realigns the Tusket CT station service line to allow for heavy lift access to the unit.						
C0012701	LM6000 - Replace U4 and U5 24V Nicad Batteries	37,773	37,773	4	4	16
This project is for the replacement of the battery banks for Tufts Cove units 4 &5.						
C0012705	CT - BGT AC/DC Fuel Pump Replacement	27,673	27,673	3	5	15
This project will replace the AC/DC fuel pump on Unit 1 and refurbish the fuel pumps on Units 2 & 3.						
	Total Gas Turbine Items Less Than $250,000	**$614,795**	**$614,795**			
Wind						
C0010918	Digby Anchor Bolt Refurbishment	125,653	125,653	5	3	15
This project includes remediation of rusting turbine anchor bolts at the Digby Wind Farm						
	Total Wind Items Less Than $250,000	**$125,653**	**$125,653**			
	Total Generation Items Less Than $250,000	**$13,872,103**	**$14,044,293**			
Transmission						
52261	83V-503 & 83V-504 - Bring Switches to Roadside	247,358	247,358	3	5	15
This project includes the relocation of two switches (83V-503 & 83V-504) to roadside for ease of access.						
	Total Transmission Items Less Than $250,000	**$247,358**	**$247,358**			

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CI#	Project Title	2019 Budget ($)	Project Total ($)	Criticality	Condition	Ranking
Distribution						
C0011180	23W Feeder Exit Cable Replacement	219,054	219,054	5	4	20
This project provides the costs associated with replacing two sets of deteriorated feeder exit cables at the 23W Clyde River substation.						
C0011207	15N Feeder Exit Cable Replacement	159,370	159,370	4	5	20
This project will replace four sets of deteriorated feeder exit cables at the 15N Willow Lane substation in Truro.						
C0006178	84W-302 - Subsea Cable Removal and UG Cable Replacement	51,741	94,841	4	5	20
This project provides for the costs associated for the replacement of a deteriorated subsea cable on 84W-302. Approximately 335m of subsea cable will be replaced with 220m of underground cable.						
	Total Distribution Items Less Than $250,000	**$430,165**	**$473,265**			
General Plant						
C0006958	2019 Transmission Fault Location System	156,689	242,987			
This project will update and enhance the transmission fault location systems currently installed at NS Power's Energy Control Centre.						
C0011820	Damage Assessment Mobile Data Collection Device Replacement	220,677	220,677			
This project will replace the existing mobile devices to ensure optimal device performance is sustained and the devices remain vendor supported.						
49825	Radio Site Grounding Review & Upgrade	218,909	218,909			
This project includes upgrades to grounding at NS Power telecom sites.						
C0002256	IT - WEBAPPSPROD Migration	100,000	201,034	3	5	15
This project includes the upgrade of both server and operating system for hosting applications in use by the Customer Care and Billing Teams.						
52310	Move RTU Circuits to New Backbone Routers	146,214	146,214			
This project is to move approximately 8 RTUs over to the new Multiprotocol Label Switching (MPLS) network. It includes new routers, engineering design, and technician labour.						
C0010739	Power Production Plotter Replacement	54,957	99,668			
This project is for the replacement of four thermal plant vector graphics plotters.						
49832	Victoria Junction Substation Fiber Links	61,540	61,540			
This project includes installation of new Fiber links, from the 415S Victoria Junction Radio to the 2S Victoria Junction substations. This will improve the reliability and capability of the communications to these sites.						
C0010947	AMO - Competency Management Tool	33,652	33,652			
This project is for the development and deployment of a Competency Management tool which will enable tracking and measurement of required document reviews for a number of job functions.						
	Total General Plant Items Less Than $250,000	**$992,638**	**$1,224,682**			
	Total Capital Items Less Than $250,000	**$15,542,265**	**$15,989,598**			

6.5 2019 ACE Plan Capital Items – Point Aconi Generating Station

Figure 24 below provides the Point Aconi capital projects for 2019. These projects do not require UARB Approval but are provided for transparency and informational purposes.

Figure 24: 2019 Capital Items – Point Aconi Generating Station

CI#	Project Title	2019 Budget ($)	Project Total ($)
C0009305	POA - Boiler Refurbishment	1,710,195	1,710,195
49477	POA - ID Fan Motor Replacement	933,858	933,858
C0009300	POA - Boiler Refractory Replacement 2019	812,884	812,884
C0009309	POA - SH3 Boiler Tube Replacement Phase IV	582,646	582,646
C0009324	POA - LS System Refurbishment	333,048	333,048
C0009312	POA - Coal System Refurbishment	272,076	272,076
C0009301	POA - Boiler Arrowhead Replacement	259,533	259,533
C0011502	POA - Plant Sewage Treatment Upgrade	246,417	246,417
C0009313	POA - Ash System Refurbishment	242,724	242,724
C0009317	POA - LS Piping Refurbishment	237,366	237,366
C0009307	POA - Siding Refurbishment	236,999	236,999
C0009306	POA - Ash Silo Bay Refurbishment	230,386	230,386
52084	POA - Turbine Hydraulic Controls	222,946	222,946
C0009314	POA - LS Crusher Refurbishment	199,576	199,576
C0011440	POA - Exterior Lighting Upgrade	184,952	184,952
C0009311	POA - Plant Lighting Upgrade	174,622	174,622
C0011500	POA - 1B Belt Replacement	170,085	170,085
C0009302	POA - Expansion Joint Replacement	164,812	164,812
C0009303	POA - Valve Component Replacement	158,202	158,202
C0009340	POA - Coal Chute Refurbishment	158,581	158,581
C0009310	POA - Access Improvement	154,280	154,280
C0009338	POA - CW Valve Replacement	146,975	146,975
C0009322	POA - BA Center Drain Replacement	139,662	139,662

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CI#	Project Title	2019 Budget ($)	Project Total ($)
C0009315	POA - UU Solid Fuel Cracker Refurbishment	129,369	129,369
C0009319	POA - Facilities Upgrades	121,032	121,032
C0011501	POA - Discharge Compliance Location - Outfall	101,138	101,138
C0011518	POA - Kelly Rock Primary Crusher Refurbishment	101,011	101,011
C0011519	POA - PA Systems Upgrade	85,624	85,624
C0011479	POA - WWTP Caustic Injection System	36,726	36,726
C0011481	POA - Silica Analyzer	27,045	27,045
	Total Point Aconi New Spending	**$8,574,772**	**$8,574,772**
	Point Aconi Carryover Spending	**$77,838**	**$122,321**
	Point Aconi Routine Spending		
10718	POA - Routine Equipment Replacement	236,074	236,074
27858	POA Roofing Routine	117,448	117,448
33865	POA Heat Rate Routine	53,668	53,668
21484	POA Plant Tools & Equipment	52,530	52,530
25647	POA DCMS Equipment Replacement	35,000	35,000
21485	POA - Kelly Rock Limestone Quarry	21,225	21,225
	Point Aconi Routine Spending	**$515,945**	**$515,945**
	Total Point Aconi Capital Spending	**$9,168,555**	**$9,213,038**

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7.0 GENERATION

The focus for generation capital investments in 2019 is sustaining the current thermal asset base and investment in hydro infrastructure renewal. The approximately $110 million generation capital investment plan for 2019 is summarized in **Figure 25** below.

Figure 25: Summary of 2019 Generation Capital Investments

(Millions of dollars)

i	New 2019 capital spending for projects with total estimated project spending greater than $250,000 and for which approval is sought. (As provided in Section 7.2)	45.6
ii	2019 capital spending for projects with total estimated project spending greater than $250,000 for which approval will be sought subsequent to the filing of the 2019 ACE Plan. (As provided in Section 6.3)	7.1
iii	New capital spending for projects with total estimated spending less than $250,000 for which approval is not sought. (As provided in Section 6.4)	13.9
iv	Point Aconi Generating Station capital spending. (As provided in Section 6.5)	9.1
v	Carry-over capital spending. (As provided in Section 7.1)	29.2
vi	Routine capital spending. (As provided in Section 11)	4.8
	Total 2019 Generation Capital Investment Plan	109.6
	Request for ACE Approval (Items i and vi)	50.4

Note: Totals may be off due to rounding.

7.1 Generation – Carry-over Capital Spending Summary

Figure 26: Generation Carry-over Capital Spending Summary

CI#	Project Title	Start Date	Final Date	Previous Expenditure ($)	2019 Budget ($)	Subsequent Spending ($)	Total Estimate ($)
Hydro Generation Plant							
16374	HYD - Gaspereau Dam Safety Remedial Works	2007/05	2021/04	8,485,605	3,784,274	10,473,689	22,743,569
29807	HYD - Tusket Falls Main Dam	2008/01	2022/12	4,561,501	2,424,559	15,323,573	22,309,633
51236	HYD - WRC Tailrace Tunnel Rock Bolting Phase 1	2017/01	2020/12	2,617,048	3,334,643	2,011,137	7,962,828
44978	HYD - Wreck Cove Controls Upgrade	2014/01	2020/06	4,239,095	1,244,317	-	5,483,412
48533	HYD - Lequille Headpond Refurbishment	2015/12	2019/09	4,355,414	4,959	-	4,360,373
49033	HYD - WRC Tunnel T-2 Intake Gate and Hoist Replacement	2016/01	2019/12	2,346,706	437,056	-	2,783,762
51235	HYD - Wreck Cove Main Access Road Refurbishment	2017/06	2020/06	1,137,374	1,575,030	-	2,712,404
47551	HYD - SHH Controls Upgrade	2015/07	2020/12	405,602	403,461	950,426	1,759,489
51775	HYD - Fixed Ladder & Machine Guard Upgrades	2017/06	2020/08	265,188	1,031,688	318,702	1,615,577
51234	HYD - Wreck Cove HVAC Upgrade	2017/04	2021/02	435,573	100,462	1,047,607	1,583,643
48791	HYD - WRC Safety Standards Upgrades	2016/01	2019/12	934,704	450,092	-	1,384,796
C0002103	HYD - Wreck Cove Unit 1 Wicket Gate Thrust Assembly Refurbishment	2018/01	2020/05	774,801	249,293	-	1,024,094
48914	HYD - Malay Falls Facility Refurbishment	2016/02	2019/11	65,172	113	826,911	892,195
52262	HYD - Hells Gate 1 Overhaul	2019/03	2020/05	15,000	873,274	-	888,274
49943	HYD - Ruth Falls Facility Refurbishment	2017/04	2019/12	127,060	631,169	-	758,229
49945	HYD - Malay Falls Switchgear Replacement	2017/12	2020/02	19,784	347,908	348,206	715,898
51972	HYD - Nictaux Canal Embankment Upgrade	2017/09	2020/02	494	595,938	-	596,433
49598	HYD - Gisborne Switchgear Replacement	2016/06	2020/05	313,010	276,348	-	589,358
48712	HYD - Dam Instrumentation Upgrade	2016/06	2020/05	88,735	114,658	305,795	509,188
49944	HYD - Dickie Brook Penstock Refurbishment	2018/05	2019/09	18,126	401,360	-	419,486
52018	HYD - Renewable Energy Generation Meter Upgrade	2017/09	2019/06	261,927	101,993	-	363,920
C0012119	HYD - WRC Diesel Tank Replacement U&U	2018/08	2019/05	215,614	23,589	-	239,204
Total Hydro Generation Plant				**$31,683,533**	**$18,406,185**	**$31,606,046**	**$81,695,764**
Steam Generation Plant							
44267	TRE - Ash Lagoon Site Closure	2013/05	2019/12	6,979,224	1,932,234	-	8,911,457
51808	TUC - HFO Piping Refurbishments	2017/11	2019/06	2,072,910	298,441	-	2,371,351
49897	POT - Fire System Upgrades 2017	2017/04	2020/02	310,659	767,666	-	1,078,325
49534	TRE6 - Turbine Controls Upgrade	2017/05	2019/12	402,373	593,847	-	996,220
41511	TRE6 - Condenser Waterbox and Cooling Water Piping Refurbishment	2017/05	2019/12	306,333	387,107	-	693,440
51811	LIN - Reclaim Feeder Refurbishment Phase 2	2018/07	2019/09	80,000	447,772	-	527,772

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CI#	Project Title	Start Date	Final Date	Previous Expenditure ($)	2019 Budget ($)	Subsequent Spending ($)	Total Estimate ($)
51861	TRE6 - CW Screen Replacement 2018	2018/03	2019/12	346,052	165,375	-	511,427
49537	TRE6 - Analytical Panel Upgrade	2018/03	2020/04	75,063	418,964	-	494,027
52253	LIN3 - Economizer Header Refurbishment	2018/02	2019/09	206,699	225,454	-	432,153
47871	LIN - Stack Re-Coating	2018/01	2019/12	2,888	425,833	-	428,721
49132	PTMT - Dock Winching & Access Refurbishment	2016/03	2019/07	286,411	131,940	-	418,351
49547	TRE5 - 5-1 BFP Refurbishment	2018/05	2019/12	199,819	128,608	-	328,426
51862	TRE6 - Lube Oil Cooler Refurbishment	2018/01	2019/07	33,795	291,309	-	325,104
43429	TRE5 - Turbine Lube Oil Cooler Refurbishment	2018/02	2019/12	38,222	270,281	-	308,503
47593	TRE - Dechlorination System	2016/04	2019/12	12,807	196,801	-	209,608
52321	TUC3 - Air Heater Refurbishment	2017/10	2020/12	157,311	10,747	-	168,058
52043	LIN - A Coal Chute Replacement Phase I	2018/04	2019/12	130,698	30,000	-	160,698
41226	LIN1 - Boiler Feed Pump Proportional Valve Replacements	2012/09	2019/12	62,719	65,225	-	127,944
42973	TUC - WTP DCS Upgrade	2015/08	2019/11	13,387	102,924	-	116,311
51394	LIN3&4 - Operator Control Panel Upgrade	2017/04	2019/12	20,884	40,000	-	60,884
Total Steam Generation Plant				**$11,738,252**	**$6,930,527**	**$0**	**$18,668,779**
Gas Turbine Generation Plant							
52143	LM6000 - 191-332 Hot Section and Engine Refurbishment	2018/01	2019/12	1,622,814	2,276,306	-	3,899,119
49926	LM6000 - TUC4 Airhouse Upgrade	2017/01	2020/01	195,412	818,951	-	1,014,363
49594	LM6000 - TUC5 Airhouse Upgrade	2016/06	2019/12	206,993	718,897	-	925,889
Total Gas Turbine Generation Plant				**$2,025,218**	**$3,814,153**	**$0**	**$5,839,372**
Total Generation Carry Over Spending				**$45,447,003**	**$29,150,865**	**$31,606,046**	**$106,203,914**

7.2 Generation – New 2019 Capital Items for ACE Plan Approval

Figure 27: Generation - New 2019 Capital Items for ACE Plan Approval

Tab #	CI#	Project Title	2019 Budget	Project Total
	Hydro Generation Plant			
G01	50518	HYD - Ruth Falls Main Dam Refurbishment	1,561,074	7,244,422
G02	C0002539	HYD - Bridge Remediation 2019	3,349,626	6,843,686
G03	46254	HYD - Mill Lake Surge Tank Replacement	189,712	3,598,193
G04	C0004058	HYD - Tidewater 2 Overhaul	1,916,321	1,916,321
G05	C0010957	HYD - Malay Falls Unit 6 Overhaul	1,172,957	1,273,280

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Tab #	CI#	Project Title	2019 Budget	Project Total
G06	C0012158	HYD - Malay Falls Unit 6 Generator Refurbishment	821,088	835,854
G07	48536	HYD - Wreck Cove Brook Dam D-9 Refurbishment	426,632	597,697
G08	C0006859	HYD - Wreck Cove Crane Refurbishment	460,849	498,167
G09	C0003998	HYD - Wreck Cove Station Service Cable Replacement	413,862	429,384
		Total Hydro Generation Plant	**$10,312,120**	**$23,237,004**
	Steam Generation Plant			
Boiler				
G10	C0011076	POT - Boiler Refurbishment 2019	1,388,434	1,388,434
G11	C0010318	TRE6 - Boiler Refurbishment 2019	1,016,388	1,016,388
G12	C0009099	LIN3 - Boiler Refurbishment 2019	788,176	788,176
G13	C0009100	LIN4 - Boiler Refurbishment 2019	754,772	754,772
G14	C0007398	POT - Air Heater Refurbishment	634,780	669,205
G15	C0011064	PHB - Boiler Refurbishment 2019	565,707	565,707
G16	C0010319	TRE5 - Boiler Refurbishment 2019	518,302	518,302
G17	C0009108	LIN4 - Economizer Header Refurbishment	509,373	509,373
G18	C0009092	LIN3 - Reheat Tube Replacement 2019	412,548	412,548
G19	C0009093	LIN4 - Reheat Tube Replacement 2019	412,548	412,548
G20	C0009113	LIN4 - Burner Front Refurbishment	373,290	373,290
G21	47591	TRE5 - Bottom Ash Seal Replacement	350,562	350,562
Turbine				
G22	C0010141	POT - IP/LP Turbine Refurbishment	2,938,186	2,938,990
G23	C0010142	POT - HP Turbine Refurbishment	1,813,237	1,813,421
G24	C0010718	TRE5 - Turbine Main Valve Refurbishment	730,005	730,005
G25	C0010498	POT - Turbine Valve Refurbishment	698,497	698,497
Generator				
G26	C0007638	POT - Generator Auxiliary Equipment Refurbishment	3,444,121	3,473,920
G27	51790	TRE6 - Generator High Voltage Bushings Replacement	694,334	694,334
G28	49664	Fleet AVR Critical Spare	540,778	540,778
G29	C0011085	POT - Hydrogen Panel Replacement	464,252	464,252
Environmental				
G30	C0009088	LIN - 1&2 CEMS Replacement	757,499	757,499
G31	C0010369	TRE5 - Baghouse Filter Replacement Phase 2	542,340	542,340
G32	C0009094	LIN Fly Ash Precipitator Component Refurbishment	414,046	414,046
G33	49991	TUC1 - CEMS Replacement	404,343	404,343
G34	49656	TUC - Waste Water Treatment Plant Controls Upgrade	305,851	305,851
Balance of Plant				
G35	50632	TRE - (Bunker C) HFO Refurbishment Project Phase 2	2,205,665	2,573,137
G36	48638	TRE - Rail Car Fuel Delivery Upgrade	1,154,179	1,236,623

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Tab #	CI#	Project Title	2019 Budget	Project Total
G37	51238	TRE - Asbestos Abatement 2019	979,612	1,030,841
G38	C0010323	TRE6 - Mills Refurbishment 2019	796,370	796,370
G39	C0008098	TRE - Sludge Dewatering Infrastructure	505,886	687,005
G40	C0009096	LIN - Mill Refurbishment 2019	677,819	677,819
G41	C0011458	ICP - Rail System Refurbishment Program 2019	620,192	620,192
G42	49714	TUC - UT3 and ST34 Cable Replacement	606,863	606,863
G43	C0009082	LIN - Reclaim Feeder Refurbishment Phase 3	542,948	542,948
G44	C0010324	TRE5 - Condenser Inlet Piping and Valve Replacement	532,816	532,816
G45	C0009079	LIN - CW Pump Refurbishment 2019	522,011	522,011
G46	C0011088	POT - Coal Mill Refurbishment 2019	472,973	472,973
G47	C0009111	LIN4 - Bottom Ash Refurbishment	448,240	448,240
G48	C0009112	LIN - Ash Silo Stair Replacement	406,737	406,737
G49	C0010325	TRE5 - CW Screen Refurbishment	382,776	382,776
G50	C0009059	LIN - Coal Plant Structural Refurbishment Phase 5	375,902	375,902
G51	C0009080	LIN - CW Screen Refurbishment 2019	354,651	354,651
G52	C0010372	TRE5 - Post Cooler Conveyor Refurbishment	319,596	319,596
G53	C0008559	POT Diesel Generator and Essential Services Switchgear Replacement	294,571	294,571
G54	C0011091	POT - Asbestos Abatement 2019	270,498	270,498
G55	C0010326	TRE6 - Parallel Slide Valve Replacement	256,080	256,080
		Total Steam Generation Plant	**$34,198,751**	**$34,946,226**
	Gas Turbine Generation Plant			
G56	49874	CT - BGT Replace Halon Fire Protection	1,137,554	1,149,153
		Total Gas Turbine Generation Plant	**$1,137,554**	**$1,149,153**
	Total Generation New Spending		**$45,648,424**	**$59,332,382**

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8.0 TRANSMISSION

The focus for transmission capital investments in 2019 is on system reliability. The approximately $46 million transmission capital investment plan for 2019 is summarized in **Figure 28** below.

Figure 28: Summary of 2019 Transmission Capital Investments

(Millions of dollars)

i	New 2019 capital spending for projects with total estimated project spend greater than $250,000 and for which approval is sought. (As provided in Section 8.2)	14.3
ii	2019 capital spending for projects with total estimated project spending greater than $250,000 for which approval will be sought subsequent to the filing of the 2019 ACE Plan. (As provided in Section 6.3)	0.8
iii	New capital spending for projects with total estimated spending less than $250,000 for which approval is not sought. (As provided in Section 6.4)	0.2
iv	Carry-over capital spending. (As provided in Section 8.1)	19.5
v	Routine capital spending. (As provided in Section 11)	11.5
vi	Total 2019 Transmission Capital Investment Plan	46.4
	Request for ACE Approval (Items i and v)	25.9

Note 1: Totals may be off due to rounding.

8.1 Transmission – Carry-over Capital Spending Summary

Figure 29: Transmission Carry-Over Capital Spending Summary

CI#	Project Title	Start Date	Final Date	Previous Expenditure	2019 Budget	Subsequent Spending	Total Estimate
Transmission Plant							
52258	2018/2019 Isolated Transmission Structure Replacements	2018/06	2020/12	64	1,025,891	3,845,295	4,871,251
51975	5P - Mobile Substation Replacement	2018/01	2020/06	14,425	1,872,255	2,806,129	4,692,809
51403	2018/2019 Substation PCB Equipment Removal Program	2018/03	2020/05	1,619,277	3,023,111	-	4,642,388
49838	2017/2018 Substation PCB Equipment Removal Program	2017/01	2019/06	4,083,758	411,210	-	4,494,968
52323	Port Hastings 2C - BPS Upgrade	2018/01	2020/12	1,636,410	2,050,239	114,010	3,800,658
46757	88S - Lingan 230kV BPS Upgrades	2015/09	2019/05	3,438,167	4,420	-	3,442,587
47950	L5017 - Replacements and Upgrades	2015/12	2019/03	2,796,369	271,305	-	3,067,674
51402	2018/2019 Sacrificial Anode Installation Program	2018/01	2019/12	2,461,445	563,945	-	3,025,390
51404	2017 - 2019 Steel Tower Life Extension P&A	2017/07	2020/01	2,055,489	925,366	-	2,980,854
C0001900	Mount Hope 69-25kV Substation	2019/01	2020/10	-	1,266,514	1,352,554	2,619,068
49782	L5027B - Replacements and Upgrades	2017/05	2019/03	1,475,428	283,948	-	1,759,376
49779	L6537 - Replacements and Upgrades Phase 2	2018/01	2019/04	879,164	676,919	-	1,556,083
51398	2018 / 2019 Steel Tower Refurbishment	2018/12	2020/06	-	1,553,273	-	1,553,273
52320	L6549 - Replacements & Upgrades	2018/09	2019/06	1,195,647	209,605	-	1,405,251
49774	L5527 - Replacements and Upgrades	2017/04	2019/03	1,237,246	106,521	-	1,343,767
48131	48H-T1 - Transformer Replacement	2017/10	2019/12	-	1,233,175	-	1,233,175
52102	L5014 - Replacements and Upgrades	2018/01	2019/03	790,189	414,239	-	1,204,428
51406	2018/2019 Transmission Switch & Breaker Replacement	2018/03	2019/06	837,342	344,672	-	1,182,014
52328	56N-T1 Transformer Upgrade	2018/01	2020/12	11,239	726	1,138,981	1,150,946
47131	L8001 - Steel Tower Replacements U&U	2015/04	2019/07	689,987	345,212	-	1,035,198
47915	L5053 - Replacements and Upgrades	2017/03	2019/02	331,823	637,170	-	968,993
49790	L5505 - Replacements and Upgrades	2017/08	2019/05	658,668	298,136	-	956,804
49777	L7002 - Replacements and Upgrades	2018/04	2019/05	448,477	481,899	-	930,376
49788	L5564 - Replacements and Upgrades	2018/04	2019/05	669,322	67,470	-	736,792
52059	L5039 - 2018 Replacements and Upgrades	2018/03	2019/05	655,267	68,544	-	723,811
51405	2018/2019 Wood Pole Retreatment Program	2018/04	2020/08	213,871	248,576	152,353	614,800

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CI#	Project Title	Start Date	Final Date	Previous Expenditure	2019 Budget	Subsequent Spending	Total Estimate
47956	L7004 - Replacements and Upgrades	2017/02	2019/03	476,753	98,396	-	575,150
48057	Replace 69kV cables between 2S and 83S	2017/01	2020/05	197,637	327,148	-	524,785
51863	2018 Tap Changer Replacements/Refurbishments	04/18	2019/03	494,545	14,466	-	509,011
52238	2018/2019 Capacitor Bank Breaker Replacements	2018/01	2019/04	160,018	266,904	-	426,922
43268	9W-B53 - Tusket Support Structure Replacement	2018/01	2019/12	6,479	301,524	-	308,003
52305	2018 Substation Insulator Replacement Program	2018/01	2019/05	119,290	69,713	-	189,003
Total Transmission Plant				**$29,653,794**	**$19,462,493**	**$9,409,323**	**$58,525,610**
Total Transmission Carry Over Spending				**$29,653,794**	**$19,462,493**	**$9,409,323**	**$58,525,610**

8.2 Transmission – New 2019 Capital items for ACE Plan Approval

Figure 30: Transmission - New 2019 Capital Items for ACE Plan Approval

Tab #	CI#	Project Title	2019 Budget	Project Total
	Transmission Plant			
T01	C0010042	2019 Transmission Right-of-Way Widening 69kV	5,650,794	5,650,794
T02	C0010948	2019/2020 Sacrificial Anode Installation Program	750,954	3,099,862
T03	C0010952	2019/2020 Substation Polychlorinated Biphenyl (PCB) Equipment Removal	200,000	2,786,245
T04	C0010949	2019/2020 Steel Tower Life Extension	470,548	2,414,140
T05	C0011339	L6549 - Replacements and Upgrades Phase 2	897,198	2,209,907
T06	C0010950	2019/2020 Steel Tower Refurbishment	362,284	2,009,268
T07	C0011338	L5548 - Replacements and Upgrades	782,778	1,699,381
T08	C0011242	L5541 - Replacements and Upgrades	686,035	1,624,850
T09	C0011241	L5026 - Replacements and Upgrades	692,751	1,498,789
T10	C0011300	L7005 - Replacements and Upgrades	621,103	1,346,026
T11	C0011240	L5511 - Replacements and Upgrades	580,178	1,255,087
T12	C0010978	2019/2020 Transmission Switch & Breaker Replacement	522,074	1,044,148
T13	C0011243	L5551 - Replacements and Upgrades	1,014,077	1,014,077
T14	C0011918	2019 Oil Containment Program	468,041	468,041
T15	C0011851	2019 Tap Changer Replacements/Refurbishments	326,937	326,937
T16	C0011850	2019 Substation Insulator Replacement Program	314,400	314,400
		Total Transmission Plant	**$14,340,152**	**$28,761,952**
	Total Transmission New Spending		**$14,340,152**	**$28,761,952**

9.0 DISTRIBUTION

The focus for Distribution capital investments in 2019 continues to reflect localized customer load growth and customer reliability, and the implementation of the AMI project. The approximately $134 million Distribution capital investment plan for 2019 is summarized in **Figure 31** below.

Figure 31: Summary of 2019 Distribution Capital Investments

(Millions of dollars)

i	New 2019 capital spending for projects with total estimated project spend greater than $250,000 and for which approval is sought. (As provided in Section 9.2)	15.9
ii	2019 capital spending for projects with total estimated project spend greater than $250,000 for which approval will be sought subsequent to the filing of the 2019 ACE Plan. (As provided in Section 6.3)	1.1
iii	New capital spending for projects with total estimated spending less than $250,000 for which approval is not sought. (As provided in Section 6.4)	0.4
iv	Carry-over capital spending. (As provided in Section 9.1)	69.5
v	Routine capital spending. (As provided in Section 11)	46.7
	Total 2019 Distribution Capital Investment Plan	133.6
	Request for ACE Approval (Items i and v)	62.6

Note 1: Totals may be off due to rounding.

9.1 Distribution – Carry-over Capital Spending Summary

Figure 32: Distribution Carry-Over Capital Spending Summary

CI#	Project Title	Start Date	Final Date	Previous Expenditure	2019 Budget	Subsequent Spending	Total Estimate
Distribution Plant							
47124	Advanced Metering Infrastructure	2015/01	2021/12	21,495,948	57,123,810	54,608,678	133,228,435
40320	LED Street Light Conversion	2012/07	2019/09	29,549,236	8,065,138	-	37,614,374
52271	2018 Padmount Replacement	2018/01	2019/06	1,302,381	106,188	-	1,408,569
44826	2014 Build-to-Roadside	2014/03	2019/12	716,699	30,091	-	746,790
49841	23H - Rockingham Voltage Conversion-Phase 2	2017/01	2019/06	606,852	34,904	-	641,755
52200	65V-301 - Brickton Reconductor	2018/01	2019/10	225,398	375,075	-	600,474
51400	2018 Substation Recloser Replacements	2018/04	2019/12	-	555,155	-	555,155
52184	37N-412 - Glooscap Trail Rebuild Phase 2	2017/09	2019/06	115,343	430,126	-	545,469
52205	30N-412 - Hwy 242 Fundy Shore Rebuild	2018/02	2019/08	10,115	519,843	-	529,958
52224	532N - Elm Street Conversion Phase 2 & 3	2018/01	2019/03	186,162	298,777	-	484,939
41350	16W-301 - Hebron Rebuild Phase 2	2017/05	2020/12	43,321	206,426	206,426	456,172
50800	1C-411 - Reinsulate and Pole Replacements Phase 1	2017/04	2019/07	146,704	291,300	-	438,004
51744	30N-411 - Maccan River Crossing Rebuild	2018/01	2019/04	25,107	392,440	-	417,546
52194	6S-223 - Harold Street Conversion	2018/04	2019/08	223,068	79,336	-	302,405
51500	2018 Pin Insulator Replacements	2019/02	2019/08	274,946	20,156	-	295,102
52186	4S Feeder Exit Cable Replacement Phase 1	2018/03	2019/12	244,836	14,483	-	259,319
52267	16W-302H - Brenton Rd Rebuild	2018/01	2019/10	243,045	3,981	-	247,026
52204	87W-312G - Big Tancook Island Replacements	2018/05	2019/06	-	239,677	-	239,677
51499	2018 Downline Recloser Replacements	2018/01	2019/07	74,330	159,982	-	234,312
49877	23H-302 - Clayton Park Rebuild Phase II	2017/04	2019/06	724	205,211	-	205,936
49891	509V Recloser and Voltage Regulator Replacement	2017/05	2019/07	134,742	59,106	-	193,848
52201	55V-314GA - Welsford Reconductor	2018/02	2019/12	19,906	172,958	-	192,864
52265	55V-322 - English Mt Rd Reconfiguration	2018/04	2019/06	71,866	55,146	-	127,012
49056	65V-302HAA - Old Liverpool Rd Rebuild	2016/06	2020/01	75,756	29,046	-	104,802
Total Distribution Plant				**$55,786,485**	**$69,468,355**	**$54,815,103**	**$180,069,943**
Total Distribution Carry Over Spending				**$55,786,485**	**$69,468,355**	**$54,815,103**	**$180,069,943**

9.2 Distribution – New 2019 Capital Items for ACE Plan Approval

Figure 33: Distribution - New 2019 Capital Items for ACE Plan Approval

Tab #	CI#	Project Title	2019 Budget	Project Total
	Distribution Plant			
D01	C0010040	New Distribution Rights-of-Way Widening Phase 4	7,932,844	10,275,861
D02	C0011208	2019 Padmount Replacement Program	1,216,836	1,413,544
D03	C0011209	85S-401 - Cabot Trail Rebuild	1,305,919	1,305,919
D04	C0006319	2019 PCB Pole Top Transformer Replacements	1,160,231	1,177,592
D05	C0014019	2019 Substation Recloser Replacements	143,274	808,120
D06	C0011309	54H-304 - Underground Device Replacement	344,798	685,268
D07	C0011197	64N Lourdes Street Conversion Phase 1	231,413	576,031
D08	C0011200	6S-224 - Birch Hill Drive Conversion	542,026	542,026
D09	C0011320	22W-311GA - Hawk Point Road Reconductor Replacement	465,758	465,758
D10	52229	16V-314H - New Edinburgh Phase Extension	454,662	454,662
D11	C0011189	2H-411 - Cowie Hill UG System Replacements Part 3	226,769	449,448
D12	C0013978	11S - Keltic Drive Substation Animal Guards	333,813	333,813
D13	C0011182	15N-202 - Dominion St and Arthur St Rebuild	328,292	328,292
D14	C0011206	102W-311 - Jedediah Rd Rebuild	317,453	317,453
D15	C0011187	5N-301 - Masstown Road Rebuild Phase 2	304,501	304,501
D16	C0011188	23H-303 - Willett Street Underground Replacement	286,624	286,624
D17	C0004165	70W-311G - Crousetown Road Phase Extension	281,547	285,117
		Total Distribution Plant	**$15,876,759**	**$20,010,027**
		Total Distribution New Spending	**$15,876,759**	**$20,010,027**

10.0 GENERAL PLANT

General plant capital investment in 2019 is primarily in IT. The approximately $44 million general plant capital investment plan for 2019 is summarized in **Figure 34** below.

Figure 34: Summary of 2019 General Plant Capital Investments

(Millions of dollars)

i	2019 capital spending for projects with total estimated project spending greater than $250,000 for which approval will be sought subsequent to the filing of the 2019 ACE Plan. (As provided in Section 6.3)	11.6
ii	New capital spending for projects with total estimated spending less than $250,000 for which approval is not sought. (As provided in Section 6.4)	1.0
iii	2019 capital spending for projects included in the 2018 ACE Plan for which approval will be sought in late 2018. (As provided in Section 5.2)	7.9
iv	Point Aconi Generating Station capital spending. (As provided in Section 6.5)	0.1
v	Carry-over capital spending. (As provided in Section 10.1)	3.9
vi	Routine capital spending. (As provided in Section 11)	19.2
	Total 2019 General Plant Capital Investment Plan	43.7
	Request for ACE Approval (Item vi)	19.2

Note 1: Totals may be off due to rounding.

10.1 General Plant – Carry-over Capital Spending Summary

Figure 35: General Plant - Carry-Over Spending Summary

CI#	Project Title	Start Date	Final Date	Previous Expenditure	2019 Budget	Subsequent Spending	Total Estimate
43202	Replace Mobile Radio System	2012/11	2019/12	5,745,801	585,436	-	6,331,237
52308	2018/2019 RTU Replacements Program	2018/03	2020/12	88,925	395,136	365,168	849,229
46572	2017 RTU Replacement Program	2017/01	2019/04	405,274	158,635	-	563,909
C0002130	ADMS Distribution Fault Location	2018/01	2019/08	90,575	353,155	-	443,730
52233	2018 Telecom Building Replacement - Onslow	2018/04	2019/06	193,869	122,739	-	316,608
52312	System Operations Phone Upgrade	2018/01	2019/01	119,801	4,420	-	124,221
Total Telecommunications				**$6,644,245**	**$1,619,520**	**$365,168**	**$8,628,934**
49855	IT - Desktop Software Modernization	2016/08	2019/06	4,466,725	104,648	-	4,571,373
49860	IT - SharePoint Upgrade	2017/01	2019/04	2,691,711	516,430	-	3,208,140
48773	IT - VOIP Expansion	2016/01	2019/10	889,967	664,786	-	1,554,753
48837	AMO - Fleet Environmental Data Management	2016/01	2019/05	325,829	70,185	-	396,015
C0011000	IT - Cloud Access Security Broker	2018/10	2019/09	180,072	191,549	-	371,621
C0002254	IT - MV90 Upgrade	2018/02	2019/06	187,929	60,180	-	248,109
C0002106	Vegetation Inventory System Upgrade	2018/09	2019/10	103,761	101,118	-	204,879
Total Computers				**$8,845,994**	**$1,708,896**	**$0**	**$10,554,891**
49787	Intelligent Feeder/Storage Project (SDTC)	2016/08	2019/12	3,249,435	81,984	-	3,331,419
50955	AMO - NERC CIPv6 Compliance Upgrades	2017/10	2019/12	149,619	87,913	-	237,532
C0002058	Damage Assessment Enhancements	2018/01	2019/08	126,583	102,621	-	229,203
47671	PTMT - Cathodic protection system refurbishment	2017/03	2019/12	920	201,031	-	201,951
50016	AMO - Meridium Dashboard Ph II	2016/12	2019/10	143,295	52,805	-	196,100
Total Other General Plant				**$3,669,852**	**$526,354**	**$0**	**$4,196,206**
Total General Plant Carry Over Spending				**$19,160,091**	**$3,854,770**	**$365,168**	**$23,380,030**

11.0 ROUTINE CAPITAL PROGRAM

NS Power's routine capital program is for recurring annual expenditures of like-for-like replacement of equipment, additions to existing equipment base resulting from system growth, and addition of customers to the system. This section details all routine capital expenditures for generation, transmission, distribution and general plant asset classes. NS Power seeks UARB approval of the 2019 routine capital program in the amount of approximately $82 million.

11.1 Routine Capital Spending by Function Yr/Yr

Figure 36: Routine Capital Spending by Function Yr/Yr

	2017 Actual	2018 Budget	2018 Forecast	2019 ACE Plan
Generation				
Generation Equipment Replacements	3,811,096	3,747,051	3,479,014	3,895,722
Generation Other Hydro	387,364	532,616	530,782	519,702
Generation Other Thermal	380,482	300,319	327,828	358,781
	$4,578,942	$4,579,986	$4,337,624	$4,774,204
Transmission				
Transmission Substation Replacement, Add'ns/Mod'ns	3,462,626	3,070,000	3,338,155	3,066,193
Primary Equipment Spares	230,881	250,000	200,403	252,500
Protection Modification & Replacement	714,522	607,304	523,451	872,941
Transmission Line Replacement, Add'ns/Mod'ns	6,941,896	6,926,213	6,215,009	6,746,565
Transmission Right-of-Way Widening	559,761	599,751	599,811	607,385
	$11,909,687	$11,453,268	$10,876,829	$11,545,585
Distribution				
Meters	3,318,491	3,619,283	3,724,285	2,108,132
Distribution Upgrades and Replacement	26,726,718	21,551,891	33,149,524	21,986,714
New Customers	22,611,018	21,441,842	22,245,264	21,546,337
Joint Use	345,001	508,021	662,141	501,546
Distribution Right-of-Way Widening	515,796	600,095	598,507	603,498
	$53,517,024	$47,721,132	$60,379,721	$46,746,228

	2017 Actual	2018 Budget	2018 Forecast	2019 ACE Plan
General Plant				
Work Vehicles	8,328,908	8,649,700	8,736,819	8,848,000
Tools and Test Equipment	1,751,738	1,576,500	1,280,723	1,636,518
Telecommunications	769,249	870,899	883,370	905,459
Computing Asset Management	2,150,984	2,768,159	2,840,569	2,823,728
Property Improvements and Furniture	4,769,156	5,105,000	5,561,360	3,805,000
Other	1,036,639	1,137,000	954,060	1,227,500
	$18,806,674	$20,107,257	$20,256,900	$19,246,205
Total Routine Capital Spending	**$88,812,327**	**$83,861,643**	**$95,851,075**	**$82,312,222**

Note: The entire routine program totals $82.8 million including Point Aconi routines. The totals presented above and in the following information do not include Point Aconi routines.

11.2 Routine Capital Spending Project Breakdown Yr/Yr

Figure 37: Routine Capital Spending Project Breakdown Yr/Yr

Project #	CI #	Project Title	2017 Actual	2018 Budget	2018 Forecast	2019 ACE Plan
G001	10634	CT - Routine Equipment Replacements	84,511	374,397	200,244	354,000
H001	11622	HYD - Routine Equipment Replacement	979,325	742,181	732,474	735,858
H004	27867	HYD-Roofing Routine	(11,150)	100,048	99,687	100,328
S001	23428	GS - Routine Capital	5,513	0	10,334	0
	10645	POT - Routine Equipment Replacement	312,022	270,546	212,134	293,958
	10673	TRE - Routine Equipment Replacement	492,321	377,287	428,097	382,925
	43646	PHB - Routine Equipment Replacement	131,251	170,331	236,875	177,656
	10621	TUC - Routine Equipment Replacement	348,542	270,697	272,190	255,225
	10626	LIN - Routine Equipment Replacement	665,736	376,624	367,790	428,206
S004	27856	TRE - Roofing Routine	140,895	104,857	21,706	100,410
	27855	POT - Roofing Routine	267,519	209,713	267,772	318,033
	27854	TUC - Roofing Routine	46,307	68,279	70,545	60,996
	C0002249	PHB - Roofing Routine	89,119	52,428	97,192	38,825
	27857	LIN - Roofing Routine	191,374	438,852	269,746	448,088
W001	41830	Wind - Routine Equipment Replacement	67,812	190,811	192,228	201,213
	Generation Equipment Replacements Total		**$3,811,096**	**$3,747,051**	**$3,479,014**	**$3,895,722**

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Project #	CI #	Project Title	2017 Actual	2018 Budget	2018 Forecast	2019 ACE Plan
H005	35583	HYD - Oil Release Risk Assessment	205,053	350,091	346,919	340,833
H006	35584	HYD - Gate Refurbishment	182,311	182,525	183,863	178,869
		Generation Hydro Total	**$387,364**	**$532,616**	**$530,782**	**$519,702**
S005	33871	TUC - Heat Rate Routine	57,552	52,011	54,904	45,974
	33867	POT - Heat Rate Routine	100,094	92,094	107,258	148,288
	33869	TRE - Heat Rate Routine	82,321	80,000	98,319	83,070
	33863	LIN - Heat Rate Routine	140,516	76,215	67,347	81,449
		Generation Thermal Total	**$380,482**	**$300,319**	**$327,828**	**$358,781**
T003	23120	Provincial - Trans Substation Primary	2,635,901	2,200,000	2,640,023	2,184,722
T004	23121	Provincial - Substation Additions & Replacements	826,725	870,000	698,132	881,471
		Transmission Subs Replace, Adds/Mods Total	**$3,462,626**	**$3,070,000**	**$3,338,155**	**$3,066,193**
T018	14973	Primary Equipment Spares	230,881	250,000	200,403	252,500
		Primary Equipment Spares Total	**$230,881**	**$250,000**	**$200,403**	**$252,500**
T016	14841	Protection Modification & Replacement	714,522	607,304	523,451	872,941
		Protection Modification & Replacement Total	**$714,522**	**$607,304**	**$523,451**	**$872,941**
T001	23115	Provincial Transmission Line Replace	1,879,595	1,650,684	1,125,644	1,509,853
T011	23118	Provincial Planned Trans Line Replacement	5,062,301	5,275,529	5,089,365	5,236,713
		Transmission Line Replacements Total	**$6,941,896**	**$6,926,213**	**$6,215,009**	**$6,746,565**
T010	43827	Transmission Right-of-Way Widening	559,761	599,751	599,811	607,385
		Transmission Right-of-Way Widening Total	**$559,761**	**$599,751**	**$599,811**	**$607,385**
D009	26496	Meter Routine	3,318,491	3,619,283	3,724,285	2,108,132
		Meters Total	**$3,318,491**	**$3,619,283**	**$3,724,285**	**$2,108,132**
D005	23158	Unplanned Replace Deteriorated	14,469,036	9,828,485	15,625,313	10,250,252
D006	23135	Regulatory Replacements - Province	894,395	1,320,085	2,070,647	1,312,608
D008	23361	Provincial Storm	3,209,426	2,942,145	7,667,271	2,936,822
D051	29038	System Performance Improvement Routine	851,530	508,772	568,237	510,629

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Project #	CI #	Project Title	2017 Actual	2018 Budget	2018 Forecast	2019 ACE Plan
D055	23137	Planned Replacement Of Distribution	7,302,331	6,952,404	7,218,057	6,976,402
	Distribution Upgrades and Replacement Total		**$26,726,718**	**$21,551,891**	**$33,149,524**	**$21,986,714**
D004	26716	New Customer Upgrades	7,127,395	7,162,551	6,253,178	7,114,373
D018	23511	Primary Equipment Spares - Distribution	238,288	154,435	149,566	155,748
D061	39766	New Customers - Residential	9,523,326	8,597,052	9,243,159	8,684,813
D062	39770	New Customers - Commercial	5,722,009	5,527,804	6,599,360	5,591,403
		New Customers Total	**$22,611,018**	**$21,441,842**	**$22,245,264**	**$21,546,337**
D007	23136	Contractual Replacements (Joint Use)	345,001	508,021	662,141	501,546
		Joint Use Total	**$345,001**	**$508,021**	**$662,141**	**$501,546**
D010	23127	Provincial Widening	515,796	600,095	598,507	603,498
		Right of Way Widening Total	**$515,796**	**$600,095**	**$598,507**	**$603,498**
P006	20945	Replacement and Additional Work Vehicles	180,680	220,000	206,560	220,000
P063	39304	Class 3 Work Vehicle Replacements	418,235	463,000	382,216	463,000
P062	39305	Work Vehicle Replacements	5,916,865	5,986,200	6,041,168	5,982,000
P061	40236	Transportation Vehicle Replacements	1,813,128	1,980,500	2,106,875	2,183,000
		Work Vehicles Total	**$8,328,908**	**$8,649,700**	**$8,736,819**	**$8,848,000**
P002/P016		Meter Shop - Tools and Equipment	1,508,893	1,486,500	1,190,626	1,546,518
P015	11611	Hydro Production Tools, Test Equipment	242,845	90,000	90,097	90,000
		Tools and Test Equipment Total	**$1,751,738**	**$1,576,500**	**$1,280,723**	**$1,636,518**
P025	16365	Mobile Radio Routine	21,896	49,146	45,300	49,729
P027	16551	Telecommunication Radio and Fibre Optics	137,768	150,442	157,496	156,159
P028	16550	Telecommunication Systems Replace & Modifications	436,339	494,936	497,984	519,595
P814	38243	Telecommunications Spares	173,245	176,376	182,590	179,976
		Telecommunications Total	**$769,249**	**$870,899**	**$883,370**	**$905,459**
P010	16073	SCADA Improvements Routine	78,502	113,189	161,085	122,323
P031	29114	NSPI Non-CGI Infrastructure	1,954,775	2,478,970	2,503,257	2,489,000
P040	28522	CT's DCMS Routine	20,420	20,000	14,689	22,404

Project #	CI #	Project Title	2017 Actual	2018 Budget	2018 Forecast	2019 ACE Plan
	25667	POT - DCMS Equipment Replacement Routine	30,418	31,000	59,427	50,000
	25626	TRE - DCMS Equipment Replacement Routine	6,492	40,000	16,667	45,000
	25646	TUC - DCMS Equipment Replacement Routine	59,242	50,000	69,155	60,000
	25668	LIN - DCMS Equipment Replacement Routine	1,135	35,000	16,290	35,000
		Computing Asset Management Total	**$2,150,984**	**$2,768,159**	**$2,840,569**	**$2,823,728**
P001/P030		Property Improvement and Furniture	4,769,156	5,105,000	5,561,360	3,805,000
	Property Improvement and Furniture Total		**$4,769,156**	**$5,105,000**	**$5,561,360**	**$3,805,000**
P012/P041		Other (HYD - Security Improvement & FAC - Land Acquisition)	369,784	450,000	489,728	500,000
P018	48158	Environment Equipment Replacement Routine	88,313	100,000	98,353	100,000
P816	38897	FAC Enviro Property Remed Routine	216,552	198,500	167,247	215,000
P815	38896	FAC Environment Site Assess Routine	190,247	188,500	174,856	212,500
P032	38848	Purchasing Equip & Warehouse Routine	171,743	200,000	23,877	200,000
		Other Total	**$1,036,639**	**$1,137,000**	**$954,060**	**$1,227,500**
		Routine Capital Spending	**$88,812,327**	**$83,861,643**	**$95,851,075**	**$82,312,222**

*Point Aconi amounts have been removed to represent the spend amount that requires UARB approval.

11.3 2019 Routine Capital Spending Project Details

Transmission

Figure 38: Transmission Substation Replacements, Additions and Modifications

T003 Provincial: Transmission Substation Primary Equipment	2019 ACE Plan Forecast
Unplanned Failures	1,300,000
PT and CT Replacements	50,000
Battery Bank & Charger Replacements	50,000

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T003 Provincial: Transmission Substation Primary Equipment	2019 ACE Plan Forecast
Transformer Radiator Replacements	100,000
Transformer Cooler Replacements	125,000
Substation Fencing & Gravel Replacements	25,000
Footing Remediation	200,000
Substation Yard Lighting	10,000
Low Voltage Bus Pole Structure Replacements	85,000
Re-gasket Transformers	50,000
10W-ST4 and 9W 6.9/2.4 kV and 9W Transformer Replacements	132,040
50W Replace deteriorated Section of Substation Ground Grid	57,682
Total T003 Provincial: Transmission Substation Primary Equipment	**$2,184,722**

T004 Provincial: Substation Additions & Replacements	2019 ACE Plan Forecast
Unknown Additions	300,000
Install Animal Guards - Substations	40,000
Transformer Refurbishment	200,000
75W-Update Substation Grounding Grid	106,514
91H Bus and Line Upgrades	36,611
127H Upgrade Switches 603 and 604 For Live Line Operation	174,524
74N Upgrade Power Transformer/Feeder Neutral Grounding Arrangement	23,822
Total T004 Provincial: Substation Additions & Replacements	**$881,471**

Total Transmission Substation Replacements, Additions and Modifications	**$3,066,193**

Figure 39: Primary Equipment Spares

T018 Primary Equipment Spares	2019 ACE Plan Forecast
Spare Online DGA Monitors	152,500
Spare Tap Changer Parts	100,000
Total Primary Equipment Spares	**$252,500**

Figure 40: Protection Modification and Replacement

T016 Protection Modification & Replacement	2019 ACE Plan Forecast
Unplanned Relay Replacement	75,969
Replace Pri & Sec Protection on L-6545 at 85S	70,471
Replace Pri & Sec Protection on L-6549 at 85S	70,471
Replace Pri & Sec Protection on L-5541 at 50W	70,471
Replace Pri Protection on L-6033 at 104H	40,000
Replace SER at 85S	57,296
Replace SER at 4C	57,296
Replace LCBII relays at 50W, 104W, 101W	90,000
Revise Remote Hold-off Installations	120,000
Replace Pri Protection on L-6521 at 1C	35,000
L-5500 - add secondary protection	35,000
Replace A Scheme Protection on L-7009 at 120H	75,969
Replace Wreck Cove frequency Relays	35,000
Replace Sec Protection on L-6551 at 30N	40,000
Total Protection Modification & Replacement	**$872,941**

Figure 41: Transmission Line Replacement, Additions, Modifications

T001 Provincial Transmission Line Replacement (Unplanned)	2019 ACE Plan Forecast
This routine is budgeted based on historical T001 investment	**$1,509,853**

T011 Provincial- Planned Transmission Line Replacement		2019 ACE Plan Forecast
LINE #	**Description**	
L5011	Farrell St. 99H to Imperial Oil 58H	185,559
L5042	Farrell St. 99H to Albro Lake 62H	26,546
L5056	Tap of L5026 to Annapolis Hydro 81V	29,281
L5036	L5053 Tap to Berwick 52V	37,438
L5046	L5017 Tap to Wolfville Ridge 83V	84,318
L5058	Springhill 74N to Pugwash 7N	74,753
L6050	Aerotech Park 127H	119,232
L5047	L5026 Tap to Bridgetown 70W	254,494
L6035	Water St. 1H to Kempt Rd. 104H	50,246
L6042	Tufts Cove 91H to East Dartmouth 113H	155,738
L6051	Brushy Hill 120H to StCroix 17V	220,182
L5546	Bridgewater 99W to Westhavers Elbow 75W	446,292
L7018	Onslow 67N to Brushy Hill 120H	115,739
L6012	St Croix 17V to Canaan Rd 43V	464,946
L6054	Canaan Road 43V to Macdonald Pond 101V	211,670
L6025	Bridgewater 99W to Milton 50W	39,033
L6003	Tufts Cove 91H to Sackville 90H	35,171
L6009	Sackville 90H to Burnside Gas Turbine 108H	97,916
L6008	Sackville 90H to Lakeside 103H	663,270
L5539	Milton Control Centre 50W to Liverpool 48W	301,266
L5015	St Croix 17V to Three Mile Plains 79V	286,077
L6552	Glen Dhu 93N to Lochaber Road 4C	272,766
L5501	Trenton 50N to Stellarton 62N	273,342
L5033	Canaan Road 43V to Hillaton 36V	261,784
L5057	Tap of L5026 to Cornwallis 74V	34,652
Various	1-6 Month Inspection Driven Work	495,000
T011 Provincial- Planned Transmission Line Replacement		$5,236,713
Transmission Line Replacement Total		**$6,746,565**

T010 – Provincial: Transmission Right of Way Widening

In its 2017 ACE Plan Order, the Board directed NS Power as follows:

> The Board directs NSPI to update the cost estimates for vegetation management and right-of-way widening projects in the 2018 ACE Plan (and future years) based on actual historical costs incurred for this project.[12]

NS Power confirms that the cost estimates for vegetation management and right-of-way widening projects in the 2019 ACE Plan are based on actual historical costs incurred. This forecast is also developed based on the known level of widening in the current year as set out in **Figure 42** below:

Figure 42: T010 Forecast by Line

> 69 kV	
L6001	38,584
L6054	57,876
L6012	111,894
L6514	77,168
L6536	57,876
L6537	102,266
L6539	38,584
L7003	84,411
L7009	38,726

Total T010	$607,385

The Board's 2016 ACE Plan Order provided the following directive:

> The Board directs that the Routine for Transmission widening be treated as a separate project, and not a routine, in future ACE Plan Applications. NSPI is to provide an annual progress report on the expenditure, works undertaken, results achieved and future plans as part of the annual ACE Plan submissions.[13]

[12] 2017 ACE Plan, UARB Order, M07745, April 4, 2017.
[13] NS Power 2016 ACE Plan, UARB Order, M07176, June 8, 2016, page 2. NS Power's annual progress report on the expenditure, works undertaken, results achieved and future plans can be found in the 2018 ACE Plan Reliability Directive in section 10.1.7.

CI C0010042 - 2019 Transmission Right-of-Way Widening 69kV is submitted in the 2019 ACE Plan in compliance with the Board's directive. With the addition of a separate capital work order for transmission Right-of-Way widening, the transmission vegetation management program is now carried-out under three broad initiatives:

1. Operating activities for transmission vegetation management;
2. Capital routine T010 - Transmission Right-of-Way Widening (for 138kV, 230kV and 345kV RoWs); and
3. New transmission rights-of-way widening individual capital projects (i.e. CI C0010042 for 69kV RoWs and subsequent phases).

Capital routine T010 remains for the widening of 138kV, 230kV and 345kV rights-of-way. This is the traditional scope of T010, but it has also previously included 69kV rights-of-way which are now assumed under CI C0010042 and subsequent phases. This was the scope of work included in the $43.2 million eight-year program ($5.4 million per year), which the UARB approved in principle and directed NS Power to include in ACE Plan filings for final approval.[14] The 69kV work was removed from T010 but the budget for T010 remains approximately the same due to increased North America Electric Reliability Corporation (NERC) requirements at the other voltage levels (specifically 138kV).

Distribution

In the 2018 ACE Plan Terms of Consensus, the Board requested that NS Power provide stakeholders with an update on the status of the Company's meter purchasing under CI 26496 Routine Meter Replacement in the event the AMI Application (M08349) is approved by the UARB. NS Power provided the UARB and stakeholders with an update on this item in its letter to the Board dated September 27, 2018.

[14] Review of Nova Scotia Power Inc.'s (NSPI) state of preparedness and response to Post-Tropical Storm Arthur, UARB Supplemental Decision, M06321, September 21, 2015, page 16. NS Power 2016 ACE Plan, UARB Decision, M07176, June 8, 2016, pages 26-28.

NS Power confirms that the 2019 meter routine costs have been reduced by approximately $1.6 million, as noted in the table below.

	2017 Actual	2018 Budget	2018 Forecast	2019 ACE Plan
Meters	$3,318,491	$3,619,283	$3,724,285	$2,108,132

Figure 43: Meters - D009 Meter Routine

Item#	Prg#	Meter Type	Meter Style	Description	2019 Forecast	Current Unit Cost	Capital for meters ($)
1.0 Element, 120-240 volt							
1	294	Form 3S (5 jaw)	Itron Centron	240V, 10A, 2W, 5 Jaw, 4 dial	192	70.00	13,440.00
	220	Form 3S (5 Jaw)	Itron Sentinel	T/R, 2W, 4Jaw, TOU (KWH) c/w L.C. (ETS)	30	130.00	3,900.00
2	230	Form 3S (5 Jaw)	Itron Sentinel	T/R, 2W, 5Jaw, KW/KVA dmd	120	125.00	15,000.00
	239	Form 3S (5 Jaw)	Itron Sentinel	T/R, 2W, 5Jaw, TOU(KWH) c/w modem, L.P,L.C. (ETS)	0	350.00	0.00
	240	Form 3S (5 Jaw)	Itron Sentinel	T/R, 2W, 5Jaw, KW/KVA dmd, c/w modem, L.P.	0	325.00	0.00
3	296	Form 3S (5 Jaw)	Itron Sentinel	T/R, 2W, 5jaw, BID, TOU LC(ETS)	20	150.00	3,000.00
1.5 Element, 120-240 volt							
	N/A	C1S	Centron	240V, 200A, 3W,4 Jaw, 5 dial	7200	26.00	187,200.00
6	219	SS1S1T	Sentinel	S/C, 3W, 4Jaw, TOU(KWH) c/w L.C. (ETS)	192	135.00	25,920.00
7	231	SS1S2D	Sentinel	S/C, 3W, 4Jaw, KW/KVA dmd	192	115.00	22,080.00
8	232	SS1S2D	Sentinel	T/R, 3W, 4Jaw, KW/KVA dmd	0	125.00	0.00
	236	SS1S1L	Sentinel	S/C, 3W, 4Jaw, (KWH) c/w modem & L.P.	4	290.00	1,160.00
	241			S/C, 3W, 4Jaw, KW/KVA dmd,c/w modem,L.P.	0	350.00	0.00
	266			S/C, 3W, 4Jaw, (kWh), BID	250	130.00	32,500.00
	291			SC, 3W, 4Jaw, (kWh) TOU, BID, LC (ETS)	12	150.00	1,800.00
	292			S/C, 3W, 4Jaw, kWh/kW, BID	8	130.00	1,040.00

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Item#	Prg#	Meter Type	Meter Style	Description	2019 Forecast	Current Unit Cost	Capital for meters ($)
2.0 Element, 120-480 volt							
9	N/A	CN1S	Centron	120V,200A,3W,5Jaw(9o,clock pos:), 5 dial	600	52.00	31,200.00
10	226	SS2S2D	Sentinel	S/C, 3W, 5Jaw(9 o,clock pos:) KW/KVA dmd,(Mult: 25)	60	110.00	6,600.00
	227	SS3S2D	Sentinel	T/R, 3W, 8Jaw, KW/KVA dmd, c/w KYZ pulses	0	160.00	0.00
11	233	SS2S1T	Sentinel	S/C, 3W, 5Jaw(9 o,clock pos:)TOU(KWH) c/w L.C.(ETS)	16	140.00	2,240.00
12	235	SS3S3L	Sentinel	T/R, 3W, 8Jaw, KW/KVA dmd, c/w modem, L.P.	4	290.00	1,160.00
	246			T/R, 3W, 8Jaw, KW/KVA dmd, c/w modem,L.P, KYZ	4	315.00	1,260.00
	254			S/C,3W, 5jaw(9 o,clock pos:)KW/KVA dmd, modem,LP,(Mult 25)	4	315.00	1,260.00
	271			T/R, 3W, 8 Jaw, kW/kVA dmd, Modem, LP (5-min int)	4	290.00	1,160.00
13	272	SS3S3L	Sentinel	T/R , 3W, 8Jaw, kW/kVA dwd, Modem, LP (5-min int) KYZ	0	425.00	0.00
27	297	SS3S2D	Sentinel	T/R, 3W, 8Jaw, KW/KVA dmd	50	120.00	6,000.00
2.5 Element, 120-347 volt							
14	281	SS5S0	Sentinal	T/R,4W, 13Jaw, 120-480V, 0.1-10A (KWH)	4	105.00	420.00
15	228	SS2S2D	Sentinel	T/R, 4W, 13Jaw, KW/KVA dmd	60	107.00	6,420.00
16	229	SS5S2D	Sentinel	T/R, 4W, 13Jaw, KW/KVA dmd, c/w KYZ	0	135.00	0.00
17	234	SS5S3L	Sentinel	T/R,4W, 13Jaw, KW/KVA dmd c/w modem, L.P.	8	315.00	2,520.00
18	273	SS5S3L	Sentinel	T/R, 4W, 13 Jaw, kW/kVA dmd, modem, LP (5 min int)	0	290.00	0.00
19	274	SS5S3L	Sentinel	T/R, 4W, 13 Jaw, kW/kVA dmd, modem, LP (5 min int), KYZ	0	350.00	0.00
	288			T/R, W, 13 Jaw, kW BID	8	140.00	1,120.00

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Item#	Prg#	Meter Type	Meter Style	Description	2019 Forecast	Current Unit Cost	Capital for meters ($)
3.0 Element, 120-347 volt							
20	247	SS4S0D	Sentinel	S/C, 4 W, 7Jaw, (KWH)	48	110.00	5,280.00
21	248	SS4S0	Sentinel	T/R, 4W, 13Jaw, (KWH)	0	105.00	0.00
22	218	SS4S3L	Sentinal	T/R, 4W, 13Jaw, KW/KVA dmd, c/w modem, L.P.	4	315.00	1,260.00
23	222	SS4S2D	Sentinel	S/C, 4W, 7Jaw, KW/KVA dmd, (Mult 25)	576	110.00	63,360.00
24	223	SS4S2D	Sentinel	T/R, 4W, 13Jaw, KW/KVA dmd	300	110.00	33,000.00
	225	SS4S2D	Sentinel	T/R,4W, 13Jaw, KW/KVA dmd, c/w KYZ	24	150.00	3,600.00
	243	SS4S3L	Sentinel	T/R, 4W, 13Jaw, KW/KVA, dmd, c/w modem, L.P, KYZ	4	350.00	1,400.00
25	275	SS4S3L	Sentinel	T/R, 4W, 13 Jaw, kW/kVA dmd, modem, LP (5 min int)	4	315.00	1,260.00
26	276	SS4S3L	Sentinel	T/R, 4W, 13 Jaw, kW/kVA dmd, modem, LP (5 min int), KYZ	0	400.00	0.00
	283			T/R, 4W, 13 Jak, kWh/kW, BID	24	128.00	3,072.00
	295			S/C, 4W, 7Jaw, kWh/kW, BID	20	128.00	2,560.00
	211			T/R, 4W, 13 Jaw, TOU, kWh	4	128.00	512.00
				TWACS Modules	0	26.00	0.00
				Total Meters	**10050**		**$483,704**
				Misc Meters "ION"	5	8,000.00	40,000.00
				Cellular Meters	50	900.00	45,000.00
				CT and PT requirements			160,000.00
				Wire, Adapters and switches			120,000.00
				Total Materials			**$848,704**
				Applied Overhead			**$689,569**
				Labour			**$569,859**
				D009 Meters Total			**$2,108,132**

Distribution Upgrades and Replacement

Figure 44: Distribution Upgrades and Replacement

D005 Unplanned Replacement Deteriorated Equipment	2019 ACE Plan Forecast
The forecast was developed based on an estimated 3,159 person days of work at a unit cost of $2,673/person day	**$10,250,252**
D006 Regulatory Replacements	
The forecast is developed based on past experience or information from various government agencies. This amount could vary based on current year decisions by these agencies.	**$1,312,608**
D008 Provincial Storm	
This forecast is developed based on past experience. There can be significant variation in this amount based on yearly storm activity.	**$2,936,822**
D051 System Performance Improvement	
59C-403 - Install Sectionalizer French Cove	57,500
58C-405H - Replace R472-094	62,500
84S-302 - Sydney Airport Transfer Scheme	93,000
36V-302 - Hillaton Downline Recloser Upgrades	147,629
83V-303 - Protection Upgrade	150,000
Total D051 System Performance Improvement	**$510,629**
D055 Planned Replacement of Distribution Equipment	
Bin Work. (Work resulting from NS Power's distribution line inspection program that has been identified as requiring follow up within one year.)	1,050,000
Streetlight/service installation & removal. (This funding is to support system upgrades required for street light installations and upgrades. This includes transformer installs, service upgrades and/or new pole installations.)	950,000
Field Driven Work	675,000
20V-311-Bluff Rd Rebuild	295,616
58C-403-Rebuild Hwy 19 Victoria Road	240,000
126H-312-HWY 207- Reinsulate	212,000
539W-311-Sherbrooke Ln Rebuild	200,000
656V-211-Rebuild Birch St	200,000
22W-312-Hwy 330 Centreville Reconductor	200,000
58C-405-Rebuild Margaree	190,000
67C-411-Rebuild Hwy 252 Skye Glen	190,000
Various-2019 Vault Upgrade	187,000
648H-311-Logan Rd Rebuild	182,954
59C402-St. Peters crossing rebuild	180,000

D055 Planned Replacement of Distribution Equipment	2019 ACE Plan Forecast
20H-301G-Old Sambro Rd- Poles Replacements	177,778
22N-402-North Tyndal Lane	177,595
20W-311-Oak Park Repole	150,000
102W-312G-Cayloon Lane Repole	144,000
104S-311G-Highway 105 Rebuild	140,000
658V-211-Blossom Dr Rebuild	125,000
585C-311-Antigonish Harbour Rebuild	113,000
67C-411G-Holly's Hill Re-Insulate	110,000
89W-303-Station Rd and Pinegrove Rd Line Extension	103,890
52C-211-Port Hood Island	98,500
83V-302-Wolfville Dyke Repole	98,500
590C-311-Targeted Equipment Replacement	94,000
36V-303-North Aldershot Rd Reconductor	85,000
1N-405-Salmon River Rebuild	82,021
92H-331-Micou Island	76,548
Various-2019 Padmount Switch Replacement	78,500
Various-2019 Manhole Equipment Replacement	62,500
Various-2019 Kentville URD Replacement	61,000
Various-2019 Manhole Cover Replacement	46,000
Total D055 Planned Replacement of Distribution Equipment	**$6,976,402**
Distribution Upgrades and Replacement Total	**$21,986,714**

New Customers

Figure 45: New Customers

D004 New Customer Upgrades	2019 ACE Plan Forecast
This forecast developed as a % of D061 and D062 net of capital contributions. In 2019, this is estimated to be 50%.	**$7,114,373**
D018 Primary Equipment Spares Distribution	
This forecast is developed based on the probable amount of distribution spare equipment required during the year.	**$155,748**
D061 New Customers - Residential	
This forecast is for the costs associated with new residential customers net of capital contributions. Costs include metered services, unmetered services, line extensions and underground services.	**$8,684,813**

D062 New Customers - Commercial	2019 ACE Plan Forecast
This forecast is for the costs associated with new commercial customers net of capital contributions. Costs include metered services, unmetered services, line extensions and underground services.	**$5,591,403**
Total New Customers	**$21,546,337**

Joint Use

Figure 46: Joint Use

Joint Use Total	2019 ACE Plan Forecast
This forecast is developed based on prior spending levels for both Joint Use requests from Nova Scotia Power's Joint Use Partner, Bell Aliant and communication utility requests.	**$501,546**
Distribution Total	**$46,142,729**

Distribution Right of Way Widening

In its 2017 ACE Plan Order, the Board directed NS Power as follows:

> The Board directs NSPI to update the cost estimates for vegetation management and right-of-way widening projects in the 2018 ACE Plan (and future years) based on actual historical costs incurred for this project.[15]

NS Power confirms that the cost estimates for vegetation management and right-of-way widening projects in the 2019 ACE Plan are based on actual historical costs incurred. This forecast is also developed based on the known level of widening in the current year.

The spend in this routine reflects the work that will be required to widen the rights-of-way to standard is noted in **Figure 47**.

[15] 2017 ACE Plan, UARB Order, M07745, April 4, 2017.

Figure 47: Distribution of Right of Way Widening

Feeder Section	Geographic Location	Length (Km)	Managed Length (Km)	Avg Cost per Km	Cost	Contract Overhead	Total Segment Cost
15N-403	Hilton/Truro	5.00	4.00	21,600	86,400	18,556	104,956
1N-405	Valley	10.00	6.00	21,600	129,600	27,834	157,434
665H-311	Malay Falls	2.00	2.00	21,600	43,200	9,278	52,478
Provincial	Clear Cut Buffers (Other Forestry Operations) TBD	2.00	2.00	21,600	43,200	9,278	52,478
84W-301G	Chester-Vaughn (Highway 14)	3.00	3.00	21,600	64,800	13,917	78,717
1V-443	New Ross (NewRossRoad-R414-001)	3.00	3.00	21,600	64,800	13,917	78,717
77V-302	Sissiboo Rd/North Range Cross/Doucetteville	3.00	3.00	21,600	64,800	13,917	78,717
Total Distribution Right of Way Widening							$603,498

Pursuant to CI 49611 - New Distribution Rights-of-Way Phase I, submitted to the UARB on November 1, 2016, Liberty Consulting Groups report on its review of NS Power's response to Post Tropical Storm Arthur (PTSA) included a recommendation that for distribution rights-of-way NS Power should "develop a comprehensive plan for reclaiming and/or widening the overgrown ROW corridors".[16] In its Supplemental Decision on September 21, 2015, the Board directed NS Power as follows:

> [36] A circumstance where it will take 32 years for the distribution vegetation management program to become sustainable causes the Board significant concern.
>
> //
>
> [38] The Board is intrigued by the stakeholder discussion concerning innovative financing options and directs NSPI to pursue that issue and report back to the Board the results of those discussions. [17]

[16] Review of Nova Scotia Power Inc.'s (NSPI) state of preparedness and response to Post-Tropical Storm Arthur, M06321, Liberty Consulting Group, Comments on Review of NS Power's Storm Response, Exhibit A-4, September 9, 2014, page 7.

[17] Review of Nova Scotia Power Inc.'s (NSPI) state of preparedness and response to Post-Tropical Storm Arthur, M06321, UARB Supplemental Decision, September 21, 2015, page 14. NS Power responded with its proposal to increase spend in D010 in the 2016 ACE Plan.

In response to the Board's concerns, and in order to further reduce the likelihood of tree contact related outages like those during the PTSA event, NS Power increased the budget for in the 2016 ACE Plan. NS Power's 2016 ACE Plan provided the following:

> NS Power is seeking approval as part of the 2016 ACE Plan of $3 million for the distribution widening routine, D010, in 2016. The $3 million comes from the portion of the annual $10.4 million that is spent on managing the vegetation in distribution ROWs to a sustainable state.[18]

In its 2016 ACE Plan Decision regarding D010, the Board directed NS Power as follows:

> …the Board assumes that NSPI has increased the distribution Routine budget by an amount of $2.4 million from the operating budget over the $600,000 in the 2015 ACE Plan. This means that NSPI is reducing its operating expenses by $2.4 million in 2016, thus increasing profits, with a corresponding increase in its rate base. This action will only increase rates which the Board does not approve. Accordingly, the Board reduces the routine budget for D010 to $600,000, to be in line with the 2015 ACE Plan amount.[19]

Consistent with the 2017 and 2018 ACE Plans, for the 2019 ACE Plan, NS Power has not increased the budget for D010 in response to the PTSA findings; rather, additional investment has been broken out into a separate capital work order, C0010040 – 2019 New Distribution ROW Widening. The distribution vegetation management program is now carried-out under three broad initiatives:

1. Operating activities for distribution vegetation management;
2. Capital Routine D010 - Distribution Right-of-Way Widening; and
3. New distribution rights-of-way individual capital projects (i.e. C0010040 and subsequent phases).

[18] 2016 ACE Plan, M07176, November 12, 2015, page 72.
[19] 2016 ACE Plan, UARB Decision, M07176, June 8, 2016, page 18.

No reductions in investment for operating activities have been transferred to fund either D010 or C0010040.

The scope of work completed under operating activities will continue to focus on existing right-of-way asset reclamation, urban cycle trimming in municipalities, reactive maintenance, hazard tree mitigation, vegetation removal during storm events, customer requested tree trimming, and maintaining sustainability of existing rights-of-way.

The scope of work completed under the D010 routine will continue to focus on widening of existing rights-of-way to the current standard beyond the Department of Nova Scotia Transportation and Infrastructure Renewal (NSTIR) right-of-way.

C0010040 and subsequent phases will establish new rights-of-way where none have previously existed.

General Plant

Figure 48: Work Vehicles

P006 Replacement and Additional Work Vehicles	Quantity	Avg Unit Price	2019 ACE Plan Forecast
Reel and Pole Trailers	8	28,125	225,000
		Salvage	-5,000
Total P006 Replacement and Additional Work Vehicles			**$220,000**
P061 Transportation Vehicle Replacements	54	41,565	2,244,500
		Salvage	-61,500
			$2,183,000
P062 Work Vehicle Replacements	21	303,095	6,365,000
		Salvage	-383,000
			$5,982,000

	Quantity	Avg Unit Price	2019 ACE Plan Forecast
P063 Class 3 Work Vehicle Replacements	4	119,500	478,000
		Salvage	-15,000
			$463,000
	Total Work Vehicles		**$8,848,000**

Figure 49: Tools and Test Equipment

Description	Quantity	Estimated Unit Cost	Estimated Total
Meter Shop Tools and Equipment			**$52,500**
Provincial Line Tools & Equipment			
Western Territory			243,690
North Eastern Territory			45,692
Cape Breton Territory			213,229
Central Territory			67,015
T&D Asset			475,194
System Maintenance			94,430
P002 Tools and Equipment Total			**$1,191,750**
P015 Hydro Production Tools & Test Equipment			**$90,000**
P016 Thermal Production Tools & Test Equipment			
POT Tools & Equipment			74,955
TUC Tools & Equipment			76,500
TRE Tools & Equipment			80,000
LIN Tools & Equipment			52,313
CT Tools & Equipment			28,000
PHB Tools & Equipment			43,000
P016 Thermal Production Tools & Test Equipment Total			**$354,768**
Tools and Test Equipment Total			**$1,636,518**

Figure 50: Telecommunication

P025 Mobile Radio	2019 ACE Plan Forecast
Replacement Radio Equipment Hardware and Upgrades	10,000
Equipment repairs, antenna replacements and repairs	17,000
Miscellaneous Support for system	22,729
P025 Mobile Radio Total	**$49,729**
P027 Telecommunication Radio & Fibre Ops	
HVAC & Generator Upgrades	104,451
Radio Site repairs - Miscellaneous	25,766
Add Generator Alarms And Controls	5,710
Miscellaneous Upgrades and Replacements	20,232
P027 Telecommunication Radio & Fibre Ops Total	**$156,159**
P028 Telecommunication Systems Replace & Modifications	
Miscellaneous tele-protection equipment upgrades (as required)	26,000
Upgrade miscellaneous radio links (as required)	30,000
Misc. Telecom Equipment (as required)	7,500
Nokia Equipment Repairs and Support	16,000
Telecom engineering services	50,650
Telecom engineering support services	23,900
Battery Replacements	38,500
Replace Miscellaneous Power Supplies	6,000
UPS Replacements Various Sites	6,000
Network standardization documentation	25,000
Cable & Entrance Protection - Positron	15,000
Switched Communications - System Operations Phones	5,000
Replace Fibre Optic Equipment (NEC & ADC)	35,750
Install Fibre Links for telecom sites	77,003
Network Monitoring - upgrades	41,816
Alarm Commissioning for new sites into SCADA	41,816
Review and Update System Drawings and Records	29,499
Support Services for Nokia/ALU	26,000
Tower Lighting Upgrades	18,161
P028 Telecommunication Systems Replace & Modifications Total	**$519,595**

	2019 ACE Plan Forecast
P814 Telecommunications Spares	
Alcatel-Lucent MPR9500 Microwave Radio	10,500
Net Guardian Alarm Monitoring Equipment	15,500
7705 MPLS Router Spares	15,500
Ethernet Spares	5,976
MDS SD9, Transnet, INet	10,500
SEL 2505, 2506 Spares	10,500
RFL IMUX and 9745 Spares	50,500
Battery Charger Spare	10,500
RTU and Misc. Spares	50,500
P814 Telecommunications Spares Total	**$179,976**
Telecommunications Total	**$905,459**

Figure 51: Computing Asset Management

P010 SCADA Improvements			**2019 ACE Plan Forecast**
	This forecast is developed based on SCADA equipment/operator interfaces failures or modifications		
P010 SCADA Improvements Total			**$122,323**
P031 NS Power IT Infrastructure			
Infrastructure Component	**Asset Management Plan**	**Volume to be Refreshed**	**2019 ACE Plan Forecast**
Voice and Data Network	Network Infrastructure & Equipment		300,000
Servers	Servers Refresh, Licenses, & Storage		100,000
Laptop and Desktop Computers, Personal Devices	Computers that have or will reach four (4) years old	464	1,689,000
	New laptop or desktop computers	60	78,000
	Mobile Devices	100	100,000
	Laptop/Desktop Mgmt Tool-capacity upgrade		50,000
	Software & software licenses		132,000
Power Supplies	Replaced after 10 years		10,000
Accessories	Accessories		30,000
P031 NS Power IT Infrastructure Total			**$2,489,000**

Infrastructure Component	Asset Management Plan	Volume to be Refreshed	2019 ACE Plan Forecast
P040 DCMS Equipment Replacement			
	CT's DCMS Equipment Replacement		22,404
	POT DCMS Equipment Replacement		50,000
	TRE DCMS Equipment Replacement		45,000
	TUC DCMS Equipment Replacement		60,000
	LIN DCMS Equipment Replacement		35,000
			$212,404
	Computing and Asset Management Total		**$2,823,728**

Figure 52: Property Improvement and Furniture

	Property Improvement and Furniture	2019 ACE Plan Forecast
P001	Building Protective Coatings	50,000
	Roofing & Emergency Refurbishment	230,000
	Grading / Drainage	100,000
	Fencing	75,000
	Pole Brow	300,000
	General Refurbishment Work	551,000
	Ashphalt / Paving	73,000
	Consulting	70,000
	HVAC Improvements	235,000
	Substations	35,000
	Generator	90,000
	Protective Signage	5,000
	Security Improvements	20,000
	1H General Refurbishments	271,000
	Substation / Depot Improvements	1,700,000
	Property Improvement and Furniture Total	**$3,805,000**

Figure 53: Other

Other		2019 ACE Plan Forecast
P012	HYD - Security Improvement	450,000
P018	Environmental Equipment Replacement	100,000
P041	FAC - Land Acquisition Routine	50,000
P816	FAC - Environment Property Remediation	215,000
P815	FAC - Environment Site Assessment	212,500
P032	FAC - Equipment & Warehouse	200,000
	Other Total	**$1,227,500**
	General Plant Total	**$19,246,205**

12.0 DIRECTIVES AND MISCELLANEOUS

12.1 UARB ACE Plan Directives and Stakeholder Commitments

NS Power has received a number of Directives from prior ACE Plan Decisions. The Company has also made a number of commitments to interested parties. Responses to each of these Directives and commitments are provided below.

12.1.1 Impact of 2018 ACE Plan on Revenue Requirement and Affordability

Introduction

Over the years, the UARB has directed NS Power to provide information regarding the ACE Plan's revenue requirement impact. Directive 7 of the 2011 ACE Plan Decision and Directive 12 of the 2012 ACE Plan Decision direct NS Power to provide the estimated effect the ACE Plan may have on revenue requirement over the next five years. This information is provided in **Figure 54** below.

This information has been provided in prior ACE Plans and, through discussion and agreement with stakeholders as well as further direction from the UARB, has grown to include tables breaking out the revenue requirement impact of:

- Current Asset capital investments (2014 stakeholder engagement);
- Work Support Facilities capital investments (UARB 2013 ACE Plan Decision Directive 13); and
- A version of NS Power's "Long-Term Capital Planning & Revenue Requirement" table incorporating stakeholder assumptions (2016 stakeholder engagement).

Considered as a whole, NS Power's assumptions and corresponding information provide the UARB and customers an impression of the impact NS Power's capital program is expected to

have on revenue requirement. The 2019 ACE Plan is focused on the provision of safe and reliable electric service, investing where required to best maintain the performance and reliability of the Company's assets, while minimizing upward pressure on rates.

The overall revenue requirement table, "Long-Term Capital Planning & Revenue Requirement" contained in **Figure 54** shows that NS Power's capital expenditures have a cumulative decreasing effect on NS Power's revenue requirement for customers over the next five years taking into account the contribution to fixed costs provided by new customer additions.

Overall Revenue Requirement

The overall revenue requirement calculation shows the effect on rate base and the effect on revenue requirement. The underlying assumption of this calculation is that, to the extent capital expenditures equal depreciation expense in a given year, there is no incremental effect on rate base or associated revenue requirement and therefore it is not included in the calculation.

The revenue requirement assessment incorporates the following inputs:

- Capital expenditures compared to forecast depreciation expense annually.
- Administrative overhead credit based on the proration of capital expenditures in excess of depreciation expense in each year.
- Depreciation expense of assets added during the examined timeframe based on the proportion of capital expenditures in excess of depreciation expense of all assets in each year.
- Incremental interest based on the cost of debt multiplied by the portion of debt to total capital of the incremental rate base.
- AFUDC based on the proportion of capital expenditures in excess of depreciation expense of all assets in each year.
- Income taxes based on the resultant effects and prorated Capital Cost Allowance for tax purposes.

- Net earnings based on the rate of return multiplied by the portion of equity to total capital of the incremental rate base.
- Additional fixed cost recovery received from customer growth achieved through capital investment to serve these customers.

Depreciation expense and additional fixed cost recoveries are delineated in the overall revenue requirement calculation.

This method does not address the revenue requirement effect should capital projects not be completed. Costs resulting from not completing certain projects include items such as increased operating costs, increased fuel costs, increased repair costs, and other risks or implications. Avoided cost benefits are not included in this revenue requirement calculation.

Figure 54: Long-Term Capital Planning & Revenue Requirement

LONG-TERM CAPITAL PLANNING & REVENUE REQUIREMENT

NOVA SCOTIA POWER ($M)	2019	2020	2021	2022	2023
Estimated Investment Related to five-year Capital Plan					
Capital Expenditures (Investment)	$333.2	$402.3	$416.6	$361.4	$325.6
Less: Depreciation of all assets	221.0	228.0	236.2	244.1	251.1
Incremental Investment over Depreciation (Growth)	112.2	174.3	180.4	117.3	74.5
Incremental Investment as a portion of Total Investment	33.7%	43.3%	43.3%	32.5%	22.9%
New Incremental Regulated Capital Assets					
Beginning Balance	-	112.2	286.5	466.8	584.1
Capital Investment	333.2	402.3	416.6	361.4	325.6
Depreciation	221.0	228.0	236.2	244.1	251.1
Ending Balance	112.2	286.5	466.8	584.1	658.6
Average Incremental Net Book Value of projects in five-year plan	56.1	199.3	376.6	525.5	621.4
Capital Cost Allowance					
Depreciation of Assets added 2019-2023	3.5	14.7	26.2	27.3	23.6
Impact on Net Earnings					
Expenses					
OM&G	(3.5)	(7.0)	(10.5)	(14.0)	(17.5)
Administrative Overhead	(12.3)	(17.8)	(16.8)	(11.5)	(7.7)
Depreciation	1.0	4.3	7.9	8.5	7.6
Interest	2.0	7.0	13.2	18.4	21.7
AFUDC	(1.7)	(4.0)	(3.9)	(2.8)	(1.6)
Earnings before tax	(3.0)	(2.3)	3.2	12.3	20.1
Income Tax less Impact of Administrative Overhead	(2.2)	(5.2)	(5.9)	(2.9)	0.8
Income Tax Impact of Administrative Overhead	(2.7)	(3.9)	(3.6)	(2.5)	(1.7)
Net Earnings	$1.9	$6.7	$12.7	$17.7	$21.0
Incremental Revenue Requirement of five-year capital plan	-	-	-	-	-
Including Fixed Cost Recovery:	-	-	-	-	-
Incremental Revenue Requirement of five-year capital plan	(17.5)	(19.8)	(7.0)	10.9	22.6
Change in Incremental Revenue Requirement from Previous Year	(17.5)	(2.3)	12.8	17.8	11.7
Rate Impact of five-year capital Plan	-1.4%	-1.6%	-0.5%	0.9%	1.8%
Excluding Fixed Cost Recovery:					
Incremental Revenue Requirement of five-year capital plan	(14.0)	(12.8)	3.5	24.9	40.1
Change in Incremental Revenue Requirement from Previous Year	(14.0)	1.2	16.3	21.3	15.2
Rate Impact of five-year capital Plan	-1.1%	-1.0%	0.3%	2.0%	3.2%

The overall revenue requirement shown in **Figure 54**, in the line item "Incremental Revenue Requirement of five-year capital plan" including Fixed Cost Recovery, shows a cumulative decreasing revenue requirement for years 2019 to 2023 as a result of the new capital investment. This is due to additional fixed cost recovery received from customer growth achieved through capital investments to serve these customers, Administrative Overhead and AFUDC credits related to construction of capital assets, and the income tax impact of new capital investment.

Stakeholder Revenue Requirement Table

In compliance with the 2016 ACE Plan Terms of Consensus and the subsequent stakeholder engagement process, NS Power has included an additional revenue requirement table using assumptions requested by stakeholders. The table shown in **Figure 55** below, first included in the 2017 ACE Plan, evolved through the 2017 ACE Plan Stakeholder Engagement process. It now includes the following significant differences from NS Power's "Long-Term Capital Planning & Revenue Requirement" table above:

- Elimination of the impact of additional fixed cost recovery as well as the administrative overhead and AFUDC credits from the revenue requirement calculation.

- Elimination of the application of the incremental spend as a portion of total spend percentage to the calculated depreciation expense and capital cost allowance in the revenue requirement calculation.

- Elimination of the reduction of depreciation of all assets in the calculation of New Incremental Regulated Capital Assets.

NS Power believes the assumptions reflected in the table shown in **Figure 55** do not accurately reflect the impact of the Company's capital program because:

- Including the reduction in fixed costs in the model demonstrates the decrease in revenue requirement for current customers related to having more customers connected and sharing the fixed costs.

- Including the AO and AFUDC credits in the calculation of revenue requirement is consistent with how rates are calculated and that the inclusion of these credits in the revenue requirement directive is appropriate.

- Since NS Power does not have the option to cease investment in its capital infrastructure at a sustaining level, a five year capital plan should be viewed in the context of costs that the capital program is driving in comparison to maintaining the asset base.

Figure 55: Long-Term Capital Planning & Revenue Requirement (Stakeholder Table)

LONG-TERM CAPITAL PLANNING & REVENUE REQUIREMENT (STAKEHOLDER TABLE)

NOVA SCOTIA POWER ($M)	2019	2020	2021	2022	2023
Capital Expenditures (Investment)	$333.2	$402.3	$416.6	$361.4	$325.6
Less: Depreciation of all assets	221.0	228.0	236.2	244.1	251.1
Incremental Investment over Depreciation (Growth)	112.2	174.3	180.4	117.3	74.5
Incremental Investment as a portion of Total Investment	33.7%	43.3%	43.3%	32.5%	22.9%
Revenue Requirement Calculation					
OM&G	-	-	-	-	-
Depreciation	3.0	10.0	18.2	26.1	33.1
Interest	5.8	18.7	33.0	46.6	58.7
AFUDC	-	-	-	-	-
Return on Equity	5.6	18.0	31.9	45.0	56.6
Income Tax less Impact of Administrative Overhead	(0.7)	(2.5)	(4.5)	(5.8)	(5.8)
Administrative Overhead	-	-	-	-	-
Income Tax Impact of Administrative Overhead	-	-	-	-	-
Incremental Revenue Requirement of five-year capital plan	**13.8**	**44.3**	**78.6**	**112.0**	**142.6**
Change in Incremental Revenue Requirement from Previous Year	13.8	30.5	34.3	33.4	30.6
Rate Impact of five-year capital Plan	1.1%	3.5%	6.2%	8.8%	11.2%
RECAP					
Expenses					
OM&G	-	-	-	-	-
Administrative Overhead	-	-	-	-	-
Depreciation	3.0	10.0	18.2	26.1	33.1
Interest	5.8	18.7	33.0	46.6	58.7
AFUDC	-	-	-	-	-
Earnings before tax	5.0	15.6	27.3	39.2	50.8
Income Tax less Impact of Administrative Overhead	(0.7)	(2.5)	(4.5)	(5.8)	(5.8)
Income Tax Impact of Administrative Overhead	-	-	-	-	-
Net Earnings	$5.6	$18.0	$31.9	$45.0	$56.6
New Incremental Regulated Capital Assets					
Beginning Balance	-	333.2	735.5	1,152.1	1,513.5
Capital Investment	333.2	402.3	416.6	361.4	325.6
Ending Balance	333.2	735.5	1,152.1	1,513.5	1,839.2

LONG-TERM CAPITAL PLANNING & REVENUE REQUIREMENT (STAKEHOLDER TABLE)

NOVA SCOTIA POWER ($M)	2019	2020	2021	2022	2023
Average Balance	166.6	534.4	943.8	1,332.8	1,676.4
	-	-	-	-	-
Capital Cost Allowance					
Depreciation of Assets added 2019-2023	10.1	33.6	60.2	83.9	102.7

Categories of Capital Expenditures and Revenue Requirement

Like the functional classes of capital expenditures noted throughout the ACE Plan, overall revenue requirement can be broken down into different sub-categories. A table breaking out "Current Asset Investment" is provided in **Figure 56**.

Current Asset Investment is made up of all capital investment on our current asset base which includes both compliance and sustaining capital projects. It does not include investment that creates new assets (e.g. customer growth and wind farms) or substantially alters current assets (e.g. AMI).

Figure 56: Current Asset Investment

CURRENT ASSET INVESTMENT

NOVA SCOTIA POWER ($M)	2019 ACE	2020	2021	2022	2023
Estimated Investment Related to five-year Capital Plan					
Capital Expenditures (Investment)	$219.8	$255.8	$300.1	$245.4	$224.7
Less: Depreciation of all assets	221.0	225.5	231.2	237.0	242.5
Incremental Investment over Depreciation (Growth)	(1.2)	30.3	68.9	8.4	(17.8)
Incremental Investment as a portion of Total Investment	-0.6%	11.8%	23.0%	3.4%	-7.9%
Average Incremental Net Book Value of projects in five-year plan	(0.6)	13.9	63.6	102.2	97.5
Impact on Net Earnings					
Expenses					

CURRENT ASSET INVESTMENT

NOVA SCOTIA POWER ($M)	2019 ACE	2020	2021	2022	2023
OM&G					
Administrative Overhead	0.1	(2.9)	(6.2)	(0.8)	1.9
Depreciation	(0.0)	0.8	2.8	0.6	(1.8)
Interest	(0.0)	0.5	2.2	3.6	3.4
AFUDC	0.0	(0.5)	(0.9)	(0.1)	0.2
Earnings before tax	0.0	(1.3)	(2.2)	4.1	7.2
Income Tax less Impact of Administrative Overhead	0.0	(1.2)	(3.0)	0.8	3.5
Income Tax Impact of Administrative Overhead	0.0	(0.6)	(1.4)	(0.2)	0.4
Net Earnings	$0.0	$0.5	$2.1	$3.4	$3.3
Incremental Revenue Requirement of five-year capital plan					
Incremental Revenue Requirement of five-year capital plan	0.1	(3.6)	(4.4)	7.3	10.8
Change in Incremental Revenue Requirement from Previous Year	0.1	(3.7)	(0.8)	11.7	3.5
Rate Impact of five-year capital Plan	0.0%	-0.3%	-0.3%	0.6%	0.9%

Compliance investment is required to meet a variety of regulatory requirements.

Sustaining investment includes projects in T&D, work support facilities, and generation necessary to sustain those assets:

- Sustaining investment in work support facilities is based on technical, economic or regulatory requirements of the assets.

- Sustaining investment in our generation, transmission and distribution assets is done through our asset management program and developed through ongoing inspection programs and based on condition and criticality of the asset.

Current Asset investments represent those projects that NS Power is required to complete to maintain system reliability and performance.

Reductions in NS Power's current asset investment in T&D assets could lead to a decrease in reliability. Likewise, reductions in current asset investment in generation assets could lead to reduced generation performance and outages resulting in an increase in revenue requirement due to incurring expenses that would otherwise be avoided.

Conclusion

NS Power's capital program for 2019 forecasts reduced upward pressure on rates and revenue requirement. In addition, NS Power's capital program is expected to cumulatively reduce upward pressure on rates and revenue requirement over the next five years when fixed cost recovery is taken into account.

Investment in the Current Asset Base has a small impact on revenue requirement while still maintaining reliability and performance of assets, and is justified based on need in accordance with the requirements of the CEJC.

NS Power recognizes that this describes the influence of our capital program only. NS Power also recognizes that all aspects of our business contribute to the complete picture of our revenue requirement in any given year. Those other aspects include, broadly, fuel costs, operating, maintenance, and general (OM&G) costs, and past investments.

The 2019 ACE Plan, emphasizes affordability for customers by maintaining its focus on sustaining capital expenditures, and appropriate maintenance of NS Power's generation, transmission and distribution systems.

Addendum: Work Support Facilities

In **Figure 57**, NS Power has broken out the revenue requirement effect of Work Support Facilities and IT projects. Work Support Facilities projects, as set out in the CEJC, are those associated with building, facilities replacement, and modifications, and telecontrol and

telecommunications. Information Technology projects, as set out in the CEJC, are those associated with software and hardware capital investments justified on either a technical, economic, or customer experience basis.

Those Work Support Facilities or IT projects that NS Power submits for approval either provide a clear benefit or are considered necessary pursuant to indvidual project justifications. For example, IT related capital projects are frequently necessary due to a number of factors including obsolescence of previous technology, manufacturer support expiring, or improving work practices in line with industry trends and customer expectations. Capital work orders for Work Support Facilities will be assessed and submitted in accordance with the criteria found in the CEJC, and will describe the corresponding justification for the project, be it technical or economic.

Figure 57: Work Support Facilities

WORK SUPPORT FACILITIES

NOVA SCOTIA POWER ($M)	2019	2020	2021	2022	2023
Estimated Investment Related to five-year Capital Plan					
Capital Expenditures (Investment)	$41.6	$42.4	$43.3	$44.2	$45.0
Less: Depreciation of all assets	27.6	24.1	24.5	29.8	34.7
Incremental Investment over Depreciation (Growth)	14.0	18.4	18.7	14.3	10.3
	-	-	-	-	-
Incremental Investment as a portion of Total Investment	33.7%	43.3%	43.3%	32.5%	22.9%
Average Incremental Net Book Value of projects in five-year plan	7.0	23.2	41.8	58.3	70.6
Impact on Net Earnings					
Expenses					
OM&G					
Administrative Overhead	(0.6)	(0.8)	(0.8)	(0.6)	(0.4)
Depreciation	0.1	0.6	1.0	1.1	1.1
Interest	0.2	0.8	1.5	2.0	2.5

WORK SUPPORT FACILITIES

NOVA SCOTIA POWER ($M)		2019	2020	2021	2022	2023
	AFUDC	(0.2)	(0.3)	(0.3)	(0.2)	(0.2)
Earnings before tax		(0.1)	0.2	0.7	1.6	2.4
	Income Tax less Impact of Administrative Overhead	(0.2)	(0.4)	(0.5)	(0.2)	0.1
	Income Tax Impact of Administrative Overhead	(0.1)	(0.2)	(0.2)	(0.1)	(0.1)
Net Earnings		$0.2	$0.8	$1.4	$2.0	$2.4
		-	-	-	-	-
Incremental Revenue Requirement of five-year capital plan						
Incremental Revenue Requirement of five-year capital plan		(0.5)	0.6	2.2	4.0	5.3
Change in Incremental Revenue Requirement from Previous Year		(0.5)	1.1	1.6	1.8	1.4

Note: NS Power has not determined the future planned investments in Work Support Facilities and IT beyond 2019. As such, the analysis assumes that the level of investment would increase by an inflation rate of 2 percent annually. The incremental spend as a portion of total spend is assumed to be the same as the entire capital program. The revenue requirement effect includes the same factors as those used in the Long-Term Capital Planning & Revenue Requirement table.

12.1.2 Sustaining Capital – 2019 ACE Plan Alignment with the Integrated Resource Plan (IRP)

The 2015 ACE Plan Terms of Consensus provide the following:

> NS Power will also engage with interested stakeholders on the issue of NS Power including information in future ACE Plans to show how its long-term planning assumptions regarding projections of sustaining capital investment in existing thermal plants presented in the IRP and future ACE Plans are consistent. This stakeholder consultation process will begin within 30 days of the Board issuing its decision in this matter.[20]

During the stakeholder consultation process in early 2015, NS Power discussed the issue of including information in future ACE Plans to show how its long-term planning assumptions regarding projections of sustaining capital investment in existing thermal plants presented in the IRP and future ACE Plans are consistent. A mock-up of this commitment was provided to and agreed upon by stakeholders pursuant to NS Power's report submitted to the Board on June 30, 2015.[21] NS Power provides this information in **Figure 58** below.

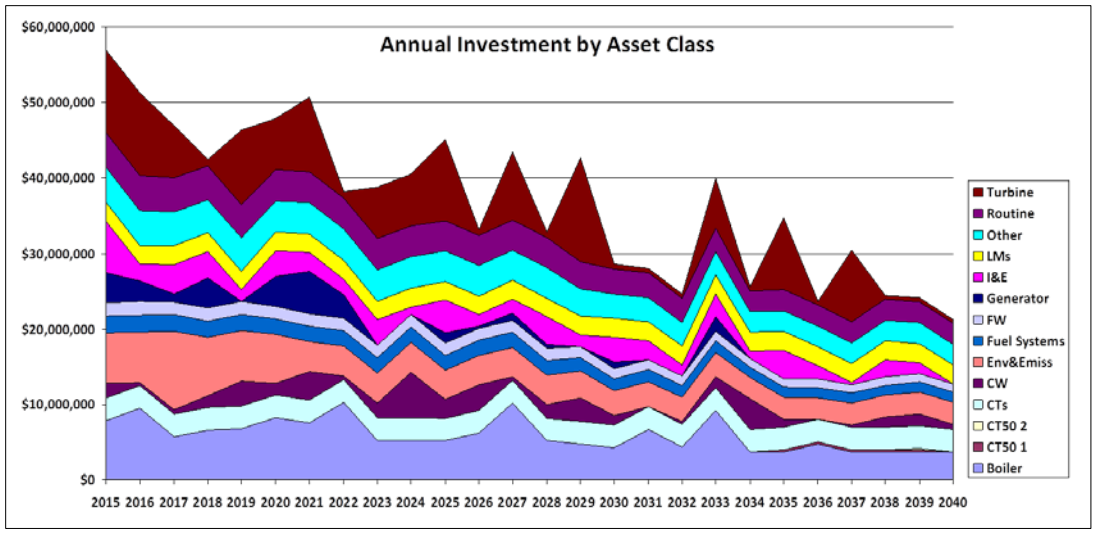
[20] 2015 ACE Plan, Terms of Consensus Agreement, M06514/P-128.15, February 18, 2015, page 2.
[21] 2015 ACE Plan Stakeholder Engagement Report, M06963, June 30, 2015.

NS Power introduced sustaining capital assumptions for the thermal generating fleet for the first time in the 2014 IRP. This was made necessary by efforts to include unit retirement assumptions in the IRP analysis. The 2019 ACE Plan was derived using the same asset management practices used for the sustaining capital forecast assumptions for the 25 year planning period of the 2014 IRP.

When comparing a single capital year from an ACE Plan to a long term planning exercise such as the IRP, it is important to take into consideration the leveling of investment used for the 25 year capital forecast used within the IRP. Outside of major asset classes (turbines, generators, combustion turbines etc.), the investment in asset classes are levelized throughout the expected life of the associated generating unit. With respect to major asset classes it should be expected that the timing of investments will change from long term projections as annual assessments based on the latest operational information are essential to optimizing investment.

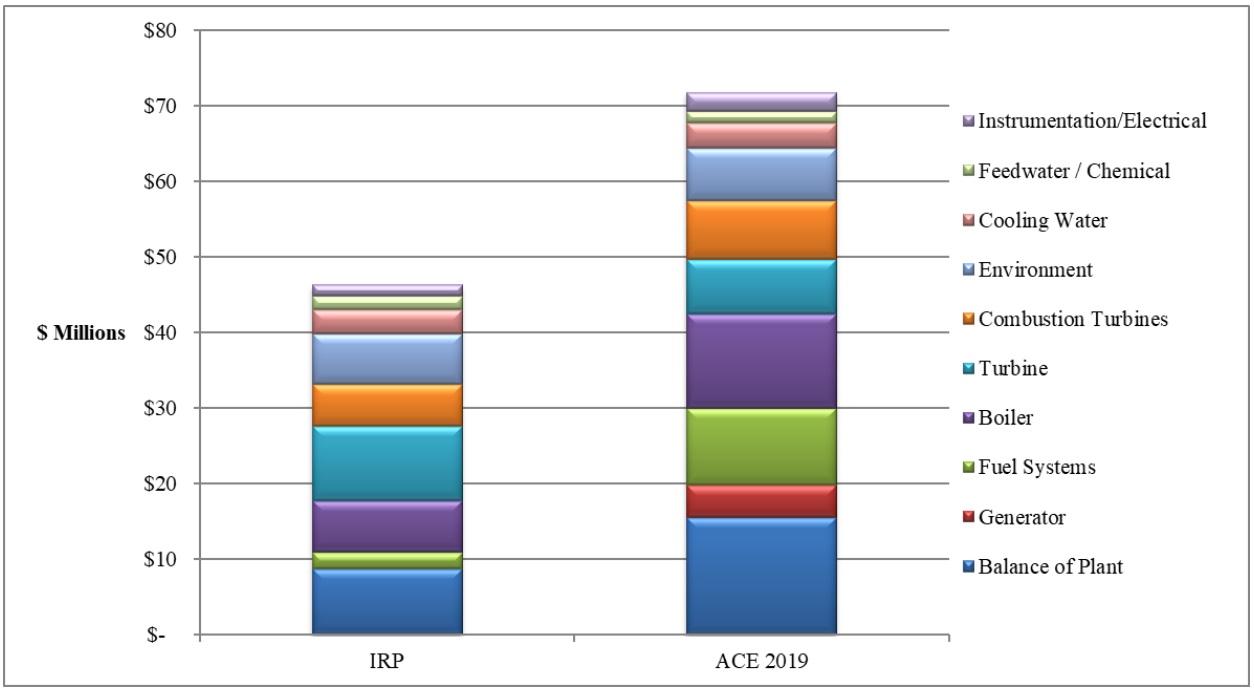
The capital investment forecast used in the 2014 IRP is shown in **Figure 58** below.

Figure 58: 2014 IRP Sustaining Capital Forecast



As shown in **Figure 59**, NS Power has completed a more detailed, single year capital forecast; the 2019 capital forecast has changed as compared to the amount assumed in the 2014 IRP.

Figure 59: 2014 IRP vs. 2019 ACE Forecast Comparison by Asset Class



While the 2019 ACE Plan forecast is higher than the 2014 IRP forecast for 2019, the variance is largely due to the following factors:

- The utilization factor of the thermal fleet has not declined to the forecasted levels outlined in the 2014 IRP. The capacity factors of the thermal fleet have declined but due to the requirement of more flexible operation from the integration of renewables the utilization remaining high. Higher utilization factor requires sustained capital investment to maintain safe reliable operation.

- The 2014 IRP was completed using 2014 dollars and did not include any form of inflation for future years and was at a time where the Canadian dollar was relatively on par with the US dollar. When applied to the 2014 IRP forecast, a conservative estimate of the increase in that forecast would be $7-10 million.

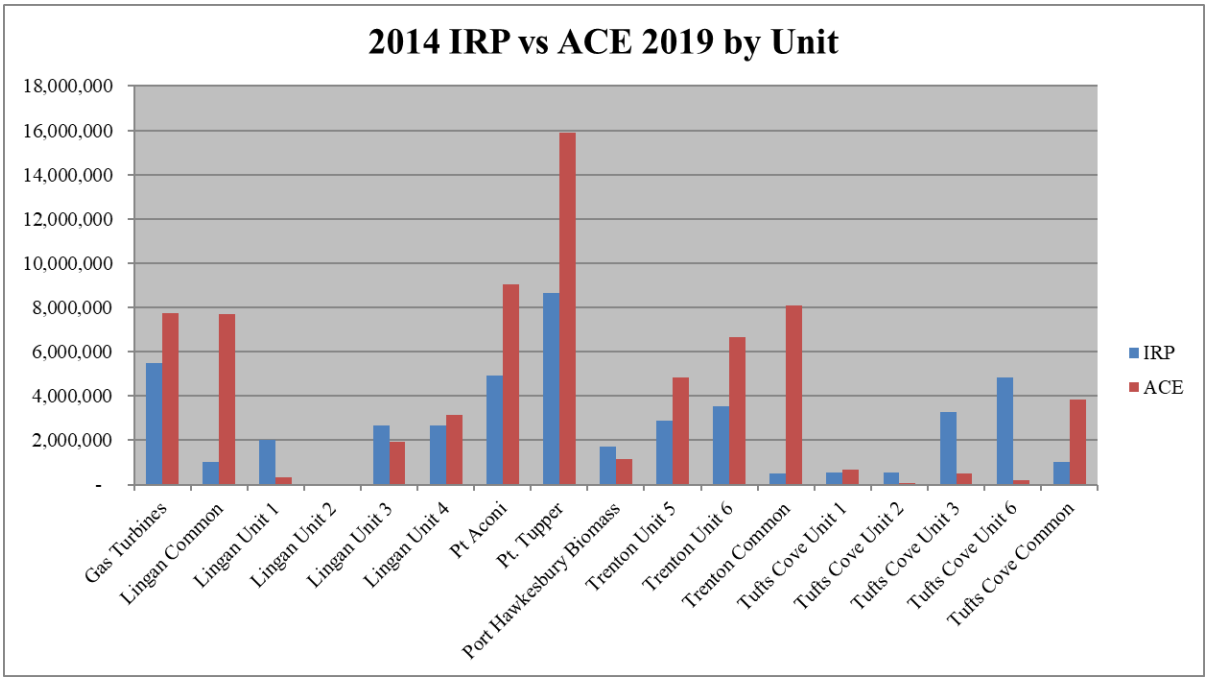
- Major Outage intervals are determined via unit utiliziation and condition assessments. These intervals are dynamic and would not align with 2014 IRP assumptions due to varability in the planning models. There is a major generator refurbishment at Point Tupper in 2019 which represents a $4 million increase over the 2014 IRP.

- Another driver for the increase is the investment in Fuel Delivery Systems. These assets would not have had a detailed future forecast in the IRP Assumption development that would have evaluated requirements for major refurbishment projects. Overall, this represents approximately $8.6 million of the increase from the IRP forecast for 2019.

- The remaining amount is due to an increase in the investment in boilers and balance of plant assets. The boiler investment across all units was levelized in the 2014 IRP. In practice, investments are planned to address specific requirements resulting from inspections and assessments, which will vary from the levelized IRP forecast. Balance of plant items would not have had a detailed future forecast in the IRP assumption development work. The condition of these assets was not understood as well as many of the complex asset classes (turbines, generators, etc) at the time of the IRP assumption development.

Figure 60 below provides a comparison of IRP assumed investments versus the 2019 ACE Plan forecast investments by generation unit.

Figure 60: 2014 IRP vs. 2019 ACE Forecast Comparison by Unit



Asset classes related to Lingan, Tufts Cove and Trenton Common include costs associated with ash and other elements of the station which are common to the generating units.

12.1.3 Summary of 2019 ACE Plan Capital Items Related to NERC and/or NPCC Standards

The UARB's 2011 ACE Plan Order Directive 9 provided as follows:

> NSPI is ordered to provide a summary sheet as part of future ACE Plan applications showing the list of projects, location, amounts and year in which each project related to NERC and/or NPCC standards is planned, in addition to the information currently provided.[22]

Figure 61 below is provided pursuant to the Board's directive.

[22] 2011 ACE Plan, UARB Order, NSUARB-P-128.11, June 23, 2011.

Figure 61: NERC and/or NPPC Capital Projects

CI#	Project Title	2019 ACE Plan	Total Estimate	2019 ACE Category
46757	88S - Lingan 230kV BPS Upgrades	4,420	3,442,587	Carryover
50955	AMO - NERC CIPv6 Compliance Upgrades	87,913	237,532	Carryover
52323	Port Hastings 2C - BPS Upgrade	2,050,239	3,800,658	Carryover
C0011819	Backup Control Centre SCADA Hardware Replacement	477,121	561,496	Subsequent Submittal
	NERC and/or NPCC Compliance Total	**$2,619,693**	**$8,042,274**	

* The primary justification for the projects listed is compliance with NERC Standards and/or NPCC Criteria. Other capital projects (e.g. generation projects that preserve reserve margins or maintain Black-Start Capability) support NERC compliance but this is not presented as the primary project justification.

12.1.4 Annual Rating/Prioritization of Capital Projects

Pursuant to the UARB's 2011 ACE Plan directive 11 and 2013 ACE Plan directive 7, below is NS Power's capital project rating criteria.

Pursuant to Section 6.1 of the CEJC, NS Power's generation, transmission and distribution capital projects are rated according to the following criteria:

- Health and Safety: Regulatory Requirements, Operating Permits, Protection of Equipment and Personnel Safety, and JOHSC actions.

- Environment/Regulatory Compliance: Renewable Energy Standards, Greenhouse Gas (GHG) Regulations, or Air Emission Regulations.

- Business Sustainability: SAIDI, SAIFI, CAIDI; unit reliability; system upgrade requirements; code requirements; NERC/NPCC Requirements, or economics (based on payback period, and revenue requirement); requirement to serve.

Technically justified IT projects are broadly rated using the following criteria:

- Customer: service impacts to customers as a result of technical failure

- Finance: financial impacts to the Company as a result of technical failure

- Compliance: safety, environmental, security, legal or regulatory requirements (e.g. NERC/CIP and NI-52 compliance).

- Operating Sustainability: ability for NS Power staff or contractor to perform critical functions of the business.

NS Power's project rating methodology is described in section 6.2 of the CEJC. This methodology uses a rating matrix which results in a final rating of 1 to 25. The rating (also termed risk) is developed by determining the "Criticality" (ranked 1 to 5) and "Condition" (ranked 1 to 5) of each asset and multiplying the two to determine the overall risk.

Criticality and Condition values are typically influenced by one predominant factor and rated accordingly. However, other factors may also influence the ranking of a project. In the event that multiple factors are present for a project, individual ratings will be taken into consideration in determining the overall Criticality ratings. For example, Health and Safety considerations for a project may warrant a Criticality rating of serious (3), while Environmental considerations for the same project may also independently warrant a Criticality rating of serious (3); this project may therefore warrant a higher Criticality rating of 4 or 5 due to multiple influencing factors.

Multiple influencing factors, ratings, and the order of completion of projects ahead of others, are subject to the evaluation and professional judgment of NS Power staff and third party industry experts.

Figure 62 to **Figure 66** below identify the projects included in the 2019 ACE Plan, their ranking categories and ranking values, where applicable.

Generation

Figure 62: Hydro – 2019 ACE Plan Capital Item Ratings

CI	Project Title	2019 ACE Budget	Ranking Category	Criticality	Condition	Rating
39472	HYD - Mersey Redevelopment Phase 1	3,276,817	Business Sustainability	4	5	20
C0013838	HYD - Wreck Cove Unit 1 Overhaul	369,853	Business Sustainability	4	4	16
50518	HYD - Ruth Falls Main Dam Refurbishment	1,561,074	Health & Safety	5	3	15
C0002539	HYD - Bridge Remediation 2019	3,349,626	Business Sustainability	5	4	20
46254	HYD - Mill Lake Surge Tank Replacement	189,712	Business Sustainability	5	3	15
C0004058	HYD - Tidewater 2 Overhaul	1,916,321	Business Sustainability	4	4	16
C0010957	HYD - Malay Falls Unit 6 Overhaul	1,172,957	Business Sustainability	4	4	16
C0012158	HYD - Malay Falls Unit 6 Generator Refurbishment	821,088	Business Sustainability	4	4	16
48536	HYD - Wreck Cove Brook Dam D-9 Refurbishment	426,632	Health & Safety	4	4	16
C0006859	HYD - Wreck Cove Crane Refurbishment	460,849	Health & Safety	4	4	16
C0003998	HYD - Wreck Cove Station Service Cable Replacement	413,862	Business Sustainability	4	4	16
C0004019	HYD - White Rock Fish Ladder Upgrade	143,182	Environment	4	4	16
C0011539	HYD - LEQ Roofing Refurbishment	116,723	Business Sustainability	3	5	15
C0011185	HYD - Generator Dehumidifier	114,982	Business Sustainability	4	4	16
C0011204	HYD - MIL Metal Fabricator	70,574	Business Sustainability	4	4	16

1 **Figure 63: Steam – 2019 ACE Plan Capital Item Ratings**

CI	Project Title	2019 ACE Budget	Ranking Category	Criticality	Condition	Rating
C0007638	POT - Generator Auxiliary Equipment Refurbishment	3,444,121	Business Sustainability	4	4	16
C0010141	POT - IP/LP Turbine Refurbishment	2,938,186	Business Sustainability	5	3	15
50632	TRE - (Bunker C) HFO Refurbishment Project Phase 2	2,205,665	Business Sustainability	4	4	16
C0010142	POT - HP Turbine Refurbishment	1,813,237	Business Sustainability	5	3	15
C0011076	POT - Boiler Refurbishment 2019	1,388,434	Business Sustainability	4	4	16
48638	TRE - Rail Car Fuel Delivery Upgrade	1,154,179	Health & Safety	4	4	16
51238	TRE - Asbestos Abatement 2019	979,612	Health & Safety	5	3	15
C0010318	TRE6 - Boiler Refurbishment 2019	1,016,388	Business Sustainability	4	5	20
52292	TUC - Heavy Fuel Oil Tank Dyke Refurbishment	929,867	Environment	5	4	20
C0010323	TRE6 - Mills Refurbishment 2019	796,370	Business Sustainability	4	4	16
C0009099	LIN3 - Boiler Refurbishment 2019	788,176	Business Sustainability	4	4	16
C0009088	LIN - 1&2 CEMS Replacement	757,499	Environment	4	4	16
C0009100	LIN4 - Boiler Refurbishment 2019	754,772	Business Sustainability	4	4	16
C0010718	TRE5 - Turbine Main Valve Refurbishment	730,005	Health & Safety	4	5	20
C0010498	POT - Turbine Reheat Valve Refurbishment	698,497	Business Sustainability	4	4	16
51790	TRE6 - Generator High Voltage Bushings Replacement	694,334	Business Sustainability	4	4	16
C0008098	TRE - Sludge Dewatering Infrastructure	505,886	Environment	4	4	16
C0009096	LIN - Mill Refurbishment 2019	677,819	Business Sustainability	3	5	15
C0007398	POT - Air Heater Refurbishment	634,780	Business Sustainability	4	4	16
C0011458	ICP - Rail System Refurbishment Program 2019	620,192	Health & Safety	4	5	20
49714	TUC - UT3 and ST34 Cable Replacement	606,863	Business Sustainability	4	4	16
C0011064	PHB - Boiler Refurbishment 2019	565,707	Business Sustainability	4	4	16
C0009082	LIN - Reclaim Feeder Refurbishment Phase 3	542,948	Health & Safety	3	5	15
C0010369	TRE5 - Baghouse Filter Replacement Phase 2	542,340	Environment	4	4	16
49664	Fleet AVR Critical Spare	540,778	Business Sustainability	4	4	16

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CI	Project Title	2019 ACE Budget	Ranking Category	Criticality	Condition	Rating
C0010324	TRE5 - Condenser Inlet Piping and Valve Replacement	532,816	Business Sustainability	4	4	16
C0009079	LIN - CW Pump Refurbishment 2019	522,011	Business Sustainability	4	4	16
C0010319	TRE5 - Boiler Refurbishment 2019	518,302	Business Sustainability	4	5	20
C0009108	LIN4 - Economizer Header Refurbishment	509,373	Business Sustainability	4	4	16
C0011088	POT - Coal Mill Refurbishment 2019	472,973	Business Sustainability	4	4	16
C0011085	POT - Hydrogen Panel Replacement	464,252	Health & Safety	4	4	16
C0009111	LIN4 - Bottom Ash Refurbishment	448,240	Business Sustainability	4	4	16
C0009094	LIN Fly Ash Precipitator Component Refurbishment	414,046	Business Sustainability	4	5	20
C0009092	LIN3 - Reheat Tube Replacement 2019	412,548	Health & Safety	3	5	15
C0009093	LIN4 - Reheat Tube Replacement 2019	412,548	Health & Safety	3	5	15
C0009112	LIN - Ash Silo Stair Replacement	406,737	Health & Safety	3	5	15
49991	TUC1 - CEMS Replacement	404,343	Environment	4	4	16
C0010325	TRE5 - CW Screen Refurbishment	382,776	Business Sustainability	4	4	16
C0009059	LIN - Coal Plant Structural Refurbishment Phase 5	375,902	Health & Safety	4	4	16
C0009113	LIN4 - Burner Front Refurbishment	373,290	Business Sustainability	4	4	16
C0009080	LIN - CW Screen Refurbishment 2019	354,651	Business Sustainability	4	4	16
47591	TRE5 - Bottom Ash Seal Replacement	350,562	Business Sustainability	4	4	16
C0010372	TRE5 - Post Cooler Conveyor Refurbishment	319,596	Business Sustainability	4	4	16
49656	TUC - Waste Water Treatment Plant Controls Upgrade	305,851	Business Sustainability	4	4	16
C0008559	POT Diesel Generator and Essential Services Switchgear Replacement	294,571	Business Sustainability	4	4	16
C0011091	POT - Asbestos Abatement 2019	270,498	Health & Safety	5	5	25
48850	AMO - Fleet Mobile Technology Advancement	200,197	Business Sustainability	3	5	15
C0010326	TRE6 - Parallel Slide Valve Replacement	256,080	Business Sustainability	4	4	16
C0011092	POT - Unit 2 Turbine Crane Refurbishment	254,342	Business Sustainability	3	5	15
C0009081	LIN - Grating Refurbishment Phase III	248,844	Business Sustainability	4	4	16
C0010259	POT - Annex Restoration	240,570	Business Sustainability	4	4	16

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CI	Project Title	2019 ACE Budget	Ranking Category	Criticality	Condition	Rating
52037	LIN1 - Main FW Control Valve & Actuator	240,006	Business Sustainability	4	4	16
C0009083	LIN - Siding Refurbishment Phase III	236,999	Business Sustainability	3	5	15
C0011958	POT - Pumphouse MCC Replacement Phase 2	235,095	Business Sustainability	4	5	20
C0011461	ICP - Rail Car Refurbishment 2019	234,945	Business Sustainability	4	4	16
C0011460	ICP - Rail Car Truck Program 2019	233,077	Business Sustainability	4	4	16
C0010942	AMO - LIN3 Enhanced Monitoring	232,840	Business Sustainability	3	5	15
C0010941	AMO - TUC 3 Enhanced Monitoring	232,824	Business Sustainability	3	5	15
C0010943	AMO - TRE6 Enhanced Monitoring	231,997	Business Sustainability	3	5	15
C0009097	LIN4 - Misc. Valve Refurbishment	228,606	Business Sustainability	3	5	15
C0011462	ICP - Locomotive Refurbishment	220,239	Business Sustainability	4	4	16
C0011095	POT - Plant Siding 2019	219,278	Business Sustainability	4	5	20
C0009098	LIN3 - Misc. Valve Refurbishment	218,802	Business Sustainability	3	5	15
C0009058	LIN - Plant Lighting Upgrade Phase III	211,943	Business Sustainability	3	5	15
49054	TRE6 - 6B CW Screen Refurbishments	208,856	Business Sustainability	3	5	15
41263	TUC6 - General Access Improvement	208,523	Business Sustainability	4	4	16
C0009087	LIN - A Coal Chute Replacement Phase II	204,648	Health & Safety	4	4	16
C0012659	TUC - Scaffolding Program 2019	203,786	Business Sustainability	3	5	15
C0011098	POT - Precipitator & ID Fan Ductwork Repairs	202,728	Business Sustainability	4	4	16
C0011063	TUC - HFO Ship Unloading Hose Installation	201,734	Business Sustainability	3	5	15
C0010358	TRE5 - 5-1 Mill Refurbishment	200,572	Business Sustainability	3	5	15
C0011418	PTMT - Shuttle belt replacement	197,219	Health & Safety	4	4	16
C0011097	POT - Unit 2 Stack Repairs	195,782	Business Sustainability	4	4	16
C0009818	TRE6 - Stack Refurbishment	136,816	Business Sustainability	4	4	16
49546	TRE6 - FW Heater Level Control	191,287	Business Sustainability	4	5	20
C0011096	POT - Controls Upgrade Phase 2	188,423	Business Sustainability	4	4	16
C0010330	TRE6 - Valve Refurbishment 2019	182,292	Business Sustainability	4	4	16

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CI	Project Title	2019 ACE Budget	Ranking Category	Criticality	Condition	Rating
C0010327	TRE6 - Turbine Oil Filtering System Upgrade	182,118	Business Sustainability	4	4	16
C0009078	LIN - Instrument Air Compressor Replacement	178,721	Business Sustainability	4	4	16
C0011065	PHB - Conveyors and Handling System Refurbishment	178,011	Business Sustainability	4	4	16
C0010329	TRE5 - Valve Refurbishment 2019	175,438	Business Sustainability	4	4	16
C0010331	TRE6 - Precipitator Controls Upgrade	168,749	Business Sustainability	4	4	16
C0011399	LIN - Condenser Plug Changeout	166,392	Business Sustainability	3	5	15
C0010359	TRE6 - Beck Drive Replacement FD/PA Fans	161,221	Business Sustainability	3	5	15
C0011459	ICP - Stacker Gearbox Refurbishments	157,385	Business Sustainability	4	4	16
C0012578	TUC - Handrail Upgrade	153,817	Health & Safety	4	4	16
C0010360	TRE5 - Conveyor Refurbishment 2019	153,768	Business Sustainability	4	4	16
C0011100	POT - Misc. Valve/Component Refurbishment 2019	153,413	Business Sustainability	4	4	16
C0010332	TRE - Ash Site Management 2019	152,976	Business Sustainability	4	4	16
C0010333	TRE6 - Air Heater Expansion Joint Refurbishment	152,339	Business Sustainability	4	4	16
C0011222	TUC - Plant Lighting Upgrade	146,079	Health & Safety	3	5	15
C0009105	LIN - Facilities Upgrades	134,750	Business Sustainability	4	4	16
C0010983	LIN - Coal Crusher Refurbishment	130,789	Business Sustainability	4	4	16
47909	TUC - Natural Gas Valves Refurbishment	76,170	Business Sustainability	3	5	15
C0009115	LIN - Service Air Compressor	125,903	Business Sustainability	3	5	15
C0011184	TUC1 - Main Feedwater Valve Replacement	123,186	Business Sustainability	4	4	16
52232	TUC3 - Lube Oil Filter Upgrades	122,159	Business Sustainability	4	4	16
C0011102	POT - 258V Battery Bank	120,713	Business Sustainability	4	4	16
C0010334	TRE - LED Lighting Upgrade	120,114	Business Sustainability	4	4	16
C0011103	POT - Breaker Replace/Upgrade	111,686	Business Sustainability	4	4	16
C0011145	POT - Oily water Separator for Vacuum Pumps	110,804	Business Sustainability	4	4	16
C0009104	LIN - 4160 600V Breaker Refurbishment	107,022	Business Sustainability	4	4	16
C0009109	LIN - Exterior Security Light Upgrade	105,802	Business Sustainability	3	5	15

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CI	Project Title	2019 ACE Budget	Ranking Category	Criticality	Condition	Rating
C0010362	TRE6 - Conveyor Refurbishments 2019	105,443	Business Sustainability	3	5	15
C0011698	POT - Mill Knife Gate Valve Refurbishment	104,255	Business Sustainability	4	4	16
C0010335	TRE - Waste Water Treatment Plant Chemical Feed System Upgrade	103,044	Business Sustainability	4	4	16
C0011520	ICP - Load Out Hydraulics Refurbishment	102,817	Business Sustainability	3	5	15
C0011022	TUC - Asbestos Abatement 2019	102,510	Health & Safety	5	3	15
C0011818	TRE6 - Auxiliary Cooling Water Line Replacement	100,012	Business Sustainability	4	4	16
C0010336	TRE6 - Boiler Safety Valve Refurbishment	98,521	Business Sustainability	4	4	16
C0009060	LIN - CW Screen Wash Piping Upgrade 2019	97,081	Business Sustainability	4	4	16
49715	TUC - Upgrade PLC Control Panel	93,890	Business Sustainability	3	5	15
C0011199	TUC3 - FD Fan VIV Actuator Replacement	91,994	Business Sustainability	3	5	15
C0011210	TUC1 - Bus Duct/Gen Terminal Temperature Monitoring	80,842	Business Sustainability	4	4	16
C0011211	TUC2 - Bus Duct/Gen Terminal Temperature Monitoring	80,842	Business Sustainability	4	4	16
C0011582	ICP - Furnace Oil Tank Replacement	80,996	Business Sustainability	4	4	16
C0010322	TRE - Floor Plate Replacements 2019	80,450	Business Sustainability	4	5	20
C0010979	TUC - Wharf Bumper Refurbishment	78,097	Business Sustainability	3	5	15
C0013240	TRE5 - Sootblower Refurbishment	77,744	Business Sustainability	4	5	20
C0010365	TRE - Admin Washroom Upgrade	77,043	Business Sustainability	3	5	15
C0011220	TUC1 - Modulating Controls Upgrade	76,138	Business Sustainability	4	5	20
C0010320	TRE6 - Primary Air Ductwork Refurbishment	76,038	Business Sustainability	4	4	16
C0010338	TRE6 - Main Feedwater Valve Refurbishment	75,225	Business Sustainability	4	4	16
C0010337	TRE5 - Main Feedwater Valve Refurbishment	75,225	Business Sustainability	4	4	16
C0011143	POT - Ultraflow Flue Gas Monitor	74,876	Business Sustainability	4	4	16
C0009085	LIN - Plant Heating Upgrade	73,149	Business Sustainability	3	5	15
C0011068	PHB - Trancel Screw Refurbishment	72,180	Business Sustainability	4	4	16
C0012658	TUC - Instrument Air Compressor Replacement	72,040	Business Sustainability	3	5	15
C0010370	TRE - Blowdown Tank Header Replacement	71,694	Business Sustainability	4	4	16

CI	Project Title	2019 ACE Budget	Ranking Category	Criticality	Condition	Rating
C0011400	LIN - Polisher Bypass Valve Refurbishment	67,005	Business Sustainability	3	5	15
C0011149	POT - Refurbish Common Water System	65,054	Business Sustainability	3	5	15
52282	TUC - Ion Chromatograph Upgrade	64,797	Business Sustainability	3	5	15
C0011069	PHB - Replace Reclaim Belt	58,307	Business Sustainability	4	4	16
C0011579	LIN3 - Sequence of Events Recorder Phase II	56,893	Business Sustainability	4	4	16
C0011148	POT - Exhaust Fan Control Upgrades	53,913	Business Sustainability	4	4	16
52244	PHB - Refurbishment Mini-Bins	44,453	Business Sustainability	3	5	15
C0010919	TRE6 - Burner Impeller Replacement	53,013	Business Sustainability	3	5	15
C0011581	LIN - Replace O2 analyzers	51,529	Business Sustainability	3	5	15
41282	TUC - Plant Security Upgrade	51,430	Business Sustainability	3	5	15
C0013239	TRE5 - Draft Plant Refurbishment	50,487	Business Sustainability	4	4	16
42950	TUC3 - ESP Controls Upgrade	49,975	Environment	3	5	15
C0010368	TRE6 - Drum Level Instrumentation Upgrade (Aquarians)	49,095	Business Sustainability	3	5	15
C0010366	TRE5 - Flyash Air System	48,919	Business Sustainability	3	5	15
C0013238	TRE5 - Precipitator Insulator Replacement	40,922	Business Sustainability	3	5	15

Figure 64: Combustion Turbine – 2019 ACE Plan Capital Item Ratings

CI	Project Title	2019 ACE Budget	Ranking Category	Criticality	Condition	Rating
49874	CT - BGT Replace Halon Fire Protection	1,137,554	Health & Safety	4	4	16
49949	LM6000 - TUC4 Control System Replacement	841,373	Business Sustainability	4	4	16
C0011191	CT - Tusket Stack Refurbishment	355,946	Business Sustainability	4	4	16
52146	LM6000 - TUC4 Enclosure Cooling Upgrade	318,033	Business Sustainability	4	4	16
52150	LM6000 - TUC5 Enclosure Cooling Upgrade	318,033	Business Sustainability	4	4	16
C0012704	LM6000 - Starter and Clutch Assembly Replacement	141,261	Business Sustainability	4	4	16
C0012702	LM6000 - Switchgear/Breaker Upgrade	88,545	Business Sustainability	4	4	16
C0011194	LM6000 - TUC4 Higgot-Kane: Replace Insulation	83,624	Business Sustainability	4	5	20
C0011193	LM6000 - TUC5 Higgot Kane: Replace Insulation	83,624	Business Sustainability	4	4	16
C0012703	CT - BGT Bleed Valve Upgrade	66,806	Business Sustainability	4	4	16
C0012699	LM6000 - Replace U4 and U5 129V Chargers	46,511	Business Sustainability	4	4	16

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CI	Project Title	2019 ACE Budget	Ranking Category	Criticality	Condition	Rating
C0011196	CT - TUS Station Service Cable Replacement	38,978	Business Sustainability	4	4	16
C0012701	LM6000 - Replace U4 and U5 24V Nicad Batteries	37,773	Business Sustainability	4	4	16
C0012705	CT - BGT AC/DC Fuel Pump Replacement	27,673	Business Sustainability	3	5	15

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Transmission & Distribution

Figure 65: Transmission and Distribution – 2019 ACE Plan Capital Item Ratings

CI	Project Title	2019 ACE Budget	Ranking Category	Criticality	Condition	Rating
Transmission Capital Items Included in 2019 ACE Plan						
C0010042	2019 Transmission Right-of-Way Widening 69kV	5,650,794	Business Sustainability	4	4	16
C0010948	2019/2020 Sacrificial Anode Installation Program	750,954	Business Sustainability	4	4	16
C0010952	2019/2020 Substation Polychlorinated Biphenyl (PCB) Equipment Removal	200,000	Environment	5	4	20
C0011261	101W Port Mersey Expansion	271,782	Business Sustainability	4	5	20
C0010956	78W - Substation Relocation and New Power Transformer	277,662	Business Sustainability	4	4	16
C0010949	2019/2020 Steel Tower Life Extension	470,548	Business Sustainability	4	4	16
C0011339	L6549 - Replacements and Upgrades Phase 2	897,198	Business Sustainability	5	4	20
C0010950	2019/2020 Steel Tower Refurbishment	362,284	Business Sustainability	5	3	15
C0011338	L5548 - Replacements and Upgrades	782,778	Business Sustainability	4	4	16
C0011242	L5541 - Replacements and Upgrades	686,035	Business Sustainability	4	4	16
C0011241	L5026 - Replacements and Upgrades	692,751	Business Sustainability	5	4	20
C0011300	L7005 - Replacements and Upgrades	621,103	Business Sustainability	4	4	16
C0011240	L5511 - Replacements and Upgrades	580,178	Business Sustainability	4	4	16
C0010978	2019/2020 Transmission Switch & Breaker Replacement	522,074	Business Sustainability	4	5	20
C0011243	L5551 - Replacements and Upgrades	1,014,077	Business Sustainability	4	4	16
C0011039	5V-GT1 - Generating Transformer	205,489	Business Sustainability	4	5	20
C0011918	2019 Oil Containment Program	468,041	Environment	4	4	16
C0011851	2019 Tap Changer Replacements/Refurbishments	326,937	Business Sustainability	4	4	16
C0011850	2019 Substation Insulator Replacement Program	314,400	Business Sustainability	4	4	16
52261	83V-503 & 83V-504 - Bring Switches to Roadside	247,358	Business Sustainability	3	5	15
Distribution Capital Items Included in 2019 ACE Plan						
C0010040	New Distribution Rights-of-Way Widening Phase 4	7,932,844	Business Sustainability	4	4	16
C0008638	Cogswell HRM Redevelopment Program	996,454	Business Sustainability	4	4	16
C0011208	2019 Padmount Replacement Program	1,216,836	Business Sustainability	4	4	16
C0011209	85S-401 - Cabot Trail Rebuild	1,305,919	Business Sustainability	4	4	16
C0006319	2019 PCB Pole Top Transformer Replacements	1,160,231	Environment	4	4	16
47794	Heckman Island Underwater Cable Replacement	89,483	Business Sustainability	5	4	20
C0014019	2019 Substation Recloser Replacements	143,274	Business Sustainability	4	4	16
C0011309	54H-304 - Underground Device Replacement	344,798	Business Sustainability	4	4	16
C0011197	64N Lourdes Street Conversion Phase 1	231,413	Business Sustainability	4	5	20
C0011200	6S-224 - Birch Hill Drive Conversion	542,026	Business Sustainability	4	5	20
C0011320	22W-311GA - Hawk Point Road Reconductor Replacement	465,758	Business Sustainability	4	5	20
52229	16V-314H - New Edinburgh Phase Extension	454,662	Business Sustainability	4	4	16
C0011189	2H-411 - Cowie Hill UG System Replacements Part 3	226,769	Business Sustainability	4	5	20
C0013978	11S - Keltic Drive Substation Animal Guards	333,813	Business Sustainability	4	4	16
C0011182	15N-202 - Dominion St and Arthur St Rebuild	328,292	Business Sustainability	4	4	16

CI	Project Title	2019 ACE Budget	Ranking Category	Criticality	Condition	Rating
C0011206	102W-311 - Jedediah Rd Rebuild	317,453	Business Sustainability	4	5	20
C0011187	5N-301 - Masstown Road Rebuild Phase 2	304,501	Business Sustainability	4	5	20
C0011188	23H-303 - Willett Street Underground Replacement	286,624	Business Sustainability	4	4	16
C0004165	70W-311G - Crousetown Road Phase Extension	281,547	Business Sustainability	4	5	20
C0011180	23W Feeder Exit Cable Replacement	219,054	Business Sustainability	5	4	20
C0011207	15N Feeder Exit Cable Replacement	159,370	Business Sustainability	4	5	20
C0006178	84W-302 - Subsea Cable Removal and UG Cable Replacement	51,741	Business Sustainability	4	5	20

Information Technology

Figure 66: IT - 2019 ACE Plan Capital Item Ratings

CI	Project Title	2019ACE Budget	Ranking Category	Criticality	Condition	Ranking
46075	IT - T&D WAM Phase 2 – Work Management and Scheduling & Dispatch	321,552	Business Sustainability	4	4	16
49480	IT - Disaster Recovery	1,499,697	Business Sustainability	5	3	15
49093	IT - Security Operations Center (SOC) and Security Information Event Monitoring (SIEM)	1,150,520	Business Sustainability	4	5	20
C0011059	IT - Database Infrastructure	925,006	Business Sustainability	4	4	16
C0010019	IT - ADMS Upgrade 2019	1,041,111	Business Sustainability	4	4	16
49858	IT - MS Exchange Upgrade	1,517,875	Business Sustainability	4	4	16
C0011308	IT - PowerPlan Upgrade	202,642	Business Sustainability	4	4	16
C0002256	IT - Customer Care & Billing Server Migration	100,000	Business Sustainability	3	5	15

12.1.5 2019 to 2023 Forecasted ACE Plan Expenditures by Functional Class and Spending Program

Pursuant to 2011 ACE Plan directive 12, NS Power provides its forecast investments by functional class and spending program. Justifications for projects determined as capital investments are scoped on an annual basis. Capital investment on the basis of health and safety, environmental compliance and requirement to serve remains non-discretionary. **Figure 67** below identifies anticipated sustaining capital by function and specific notable investments included in this ACE Plan. Investment levels from 2019 to 2023 are subject to change based on operating conditions, updated asset assessments, regulatory directives, or legislation/regulations.

Sustaining capital funding levels represent typical annual investment by function in a given year to sustain the integrity of existing assets. Notable capital projections reflect specific projects. Included in these specific projects are transformative multi-year program investments and asset growth.

Figure 67: Forecasted ACE Plan Expenditures by Functional Class and Spending Program
(Millions of dollars)

	2019 ACE	2020	2021	2022	2023
Thermal Generation	67.1	62.4	80.8	67.7	62.7
Combustion Turbines	7.8	9.4	8.0	5.4	6.7
Hydro Generation	30.5	36.3	17.4	14.8	10.1
Wind Generation	0.5	0.2	0.2	0.2	0.2
Transmission	40.7	51.0	52.0	53.0	54.1
Distribution	60.5	63.3	64.6	65.9	67.3
General Plant	36.9	37.3	40.0	32.0	39.3
Total Base Capital Expenditure	**244.1**	**259.9**	**263.0**	**239.1**	**240.4**
General Plant:					
IT - CIS Replacement	0.0	5.0	25.0	25.0	10.0
IT - T&D Work and Asset Management	6.8	15.2	36.9	6.5	
Distribution:					
Advanced Metering Infrastructure	57.1	47.1	7.5	0.0	0.0
Distribution R.O.W Widening	7.9	9.0	9.0	9.0	9.0
LED Streetlights	8.1				
Transmission:					
Transmission R.O.W Widening	5.7	6.0	6.0	6.0	6.0

	2019 ACE	2020	2021	2022	2023
Hydro:					
Hydro Infrastructural Renewal					
Wreck Cove Overhaul	0.4	33.8	23.4	27.1	19.6
Annapolis Overhaul	0.0	1.5	1.0	0.0	0.6
Mersey Re-Development	3.3	24.8	44.8	48.7	40.0
Total Notable Capital	**89.2**	**142.4**	**153.6**	**122.3**	**85.2**
Total Annual Capital Investment	**333.2**	**402.3**	**416.6**	**361.4**	**325.6**

12.1.6 Routine Expenditures

The UARB's 2013 ACE Plan Order Directive 2 provided as follows:

> The Board directs NSPI, in the next ACE Plan application, to analyze the routine expenditures to determine what are the "like-for-like" totals. NSPI is further directed to explain why those totals, if they are similar in magnitude to the Board's analysis, are growing at an annual rate in excess of inflation.[23]

A summary of NS Power's total routine and like-for-like routine spending is provided in **Figure 68** below.

Figure 68: Annual Cost of Like for Like Routine Replacements

NOVA SCOTIA POWER ($M)	2015 Actuals	2016 Actuals	2017 Actuals	2018 Forecast	2019 ACE
Total Routine Spending	75.8	85.2	88.8	95.9	82.3
Less:					
New Customers	24.1	22.4	22.6	22.2	21.5
System Growth and Performance	2.8	8.2	3.1	2.8	3.0
Other	1.0	1.4	1.1	1.3	1.4
Like-for-Like	47.9	53.1	62.0	69.5	56.4
Work Vehicles (Like-for-like)	6.2	7.1	8.3	8.7	8.8
Net (Like-for-like)	41.8	46.0	53.7	60.8	47.6

Note: Point Aconi amounts have been removed in order to reflect the spend totals that require UARB approval.
Note: Totals may be off slightly due to rounding.

[23] 2013 ACE Plan, UARB Order, NSUARB-P-128.13, June 4, 2013.

Routine classifications are determined by the primary classification of each routine project. If the majority of the work completed under the routine is like-for-like replacements, the routine is classified as like-for-like. New Customer routines, System Growth and Performance routines (such as heat rate, system improvement and right-of-way widening routines) and other routines (such as environmental assessment routines) were not included in the like-for-like totals.

12.1.7 Impact of Reliability Projects

The UARB's 2013 ACE Plan Decision provided the following directive:

> …the Board expects NSPI to monitor the impact of the deferral of reliability projects in the original 2013 ACE Plan closely and to provide a report on the results in the next ACE Plan.[24]

Pursuant to NS Power's commitment noted in the 2015 ACE Plan Terms of Consensus, this directive is expanded to include additional information regarding continued sustaining capital investments and maintaining reliability performance.

The UARB's 2017 ACE Plan Order provided the following directive:

> The Board directs NSPI to identify and list any proposed capital investments related to performance standards established by the Board in future ACE Plan applications.[25]

T&D projects in the 2019 ACE Plan will contribute to meeting these performance standards targets. T&D projects in the 2019 ACE Plan are selected based on the asset management methodology pursuant to section 6.2 of the CEJC, guiding investments to where they are needed most. As noted by NS Power during the Performance Standards proceeding, no additional capital investment beyond the regular sustaining capital investments NS Power makes through its ACE Plan program are required to meet these standards.

[24] 2013 ACE Plan, UARB Decision, M05339, May 27, 2013, page 44, line 174.
[25] 2017 ACE Plan, UARB Order, M07745, April 4, 2017.

Finally, the UARB directed NS Power to continue providing the same information with respect to reliability and severe weather events notwithstanding the UARB's approval of the performance standards in 2017 and the Company's obligations to report on those standards:

> …[T]o what extent, if any, certain aspects of the information set out in Section 8.1.7 of the 2017 ACE Plan will be reproduced in the report required by the Performance Standards Decision remains to be seen.
>
> It is not clear such items as, for example, plans for replacement of aging transmission and distribution equipment, and storm performance information, beyond the 48-hour restoration metric, will be fully explored in the context of performance standard metrics reporting.
>
> As there is some uncertainty, and a part of the information provided in Section 8.1.7 is derived from an agreement between stakeholders, as part of the 2015 ACE Plan process, the Board will not direct any changes to the current ACE Plan reporting related to reliability as this time. The Board will monitor the ongoing relevancy of this part of the ACE Plan.
>
> The first report arising from the Performance Standards Decision is due March 31, 2018. Once that report has been filed and analyzed, the matter should be revisited in the context of a future ACE Plan. [26]

Reliability Statistics

As shown in **Figure 69** and **Figure 70** below, with the exception of 2016 due to challenging weather conditions, NS Power's annual outage frequency and duration continues to be below the average of Atlantic Canada utilities. The data for 2014 is higher due to Post Tropical Storm Arthur, but NS Power is still below the average of the Atlantic Canadian utilities, as reported annually to the Canadian Electrictiy Association (CEA).

[26] 2017 ACE Plan, UARB Decisions, M07745, April 4, 2017, para 98 to 101.

Figure 69: Annual Atlantic Canada Outage Frequency

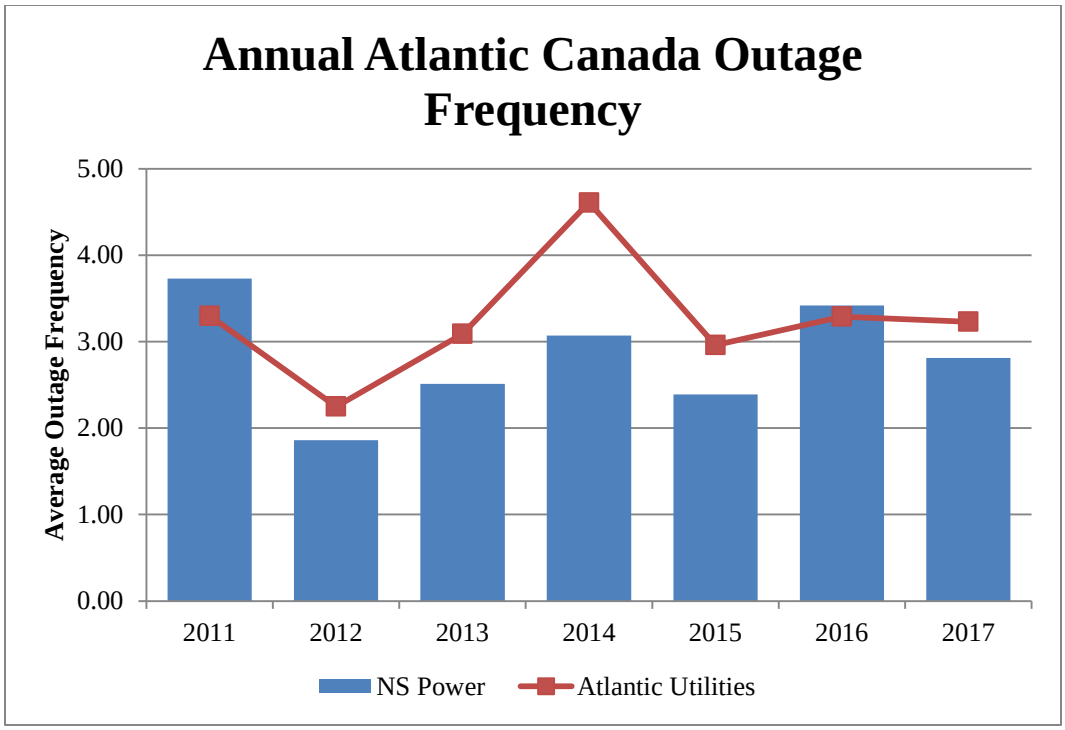


Figure 70: Annual Atlantic Canada Outage Duration

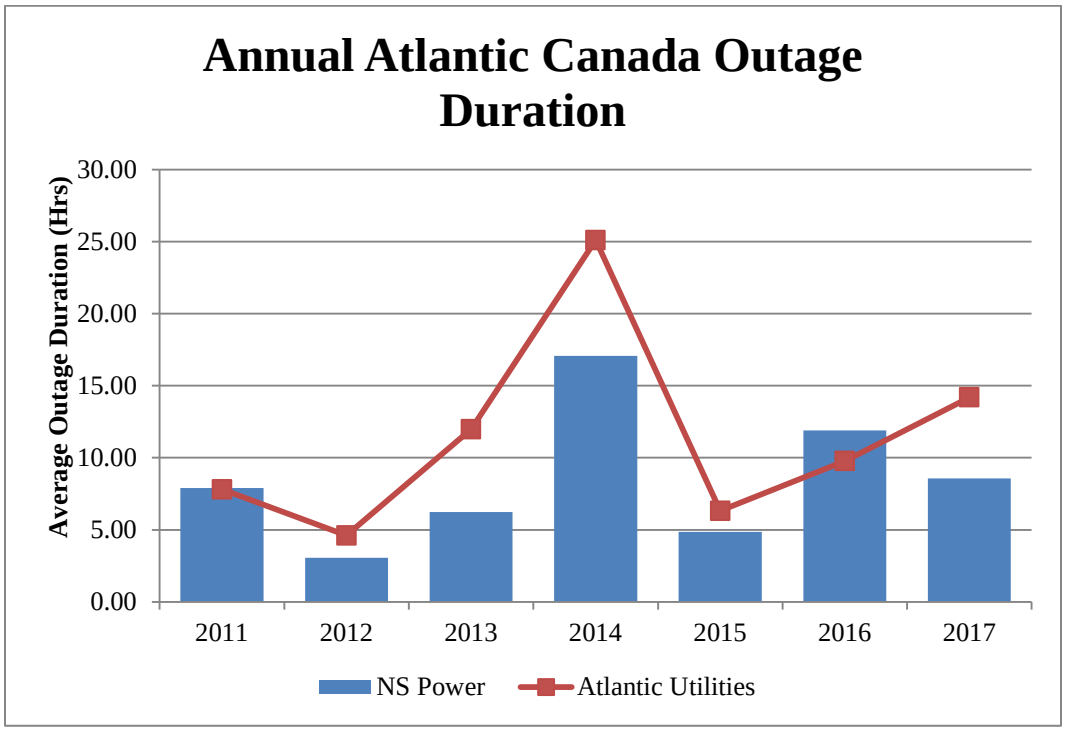


Figure 71 and **Figure 72** below represent NS Power's reliability statistics with Major and Extreme Events (such as Post-Tropical Storm Arthur and as defined by IEEE-1366) removed from the data. This shows a normalized comparison between yearly reliability performance. Increases observed in 2015 and 2016 were largely the result of a significant number of storm events, including heavy snowfall, that while falling short of the IEEE-1366 standard for a major event, lead to more frequent and longer outages than would have been experienced in previous years. This in turn led to an increase in SAIFI and SAIDI. The 10 year trend shows overall reliability sustainability for customers.

Figure 71: NS Power Annual SAIFI (Major/Extreme Events Excluded)

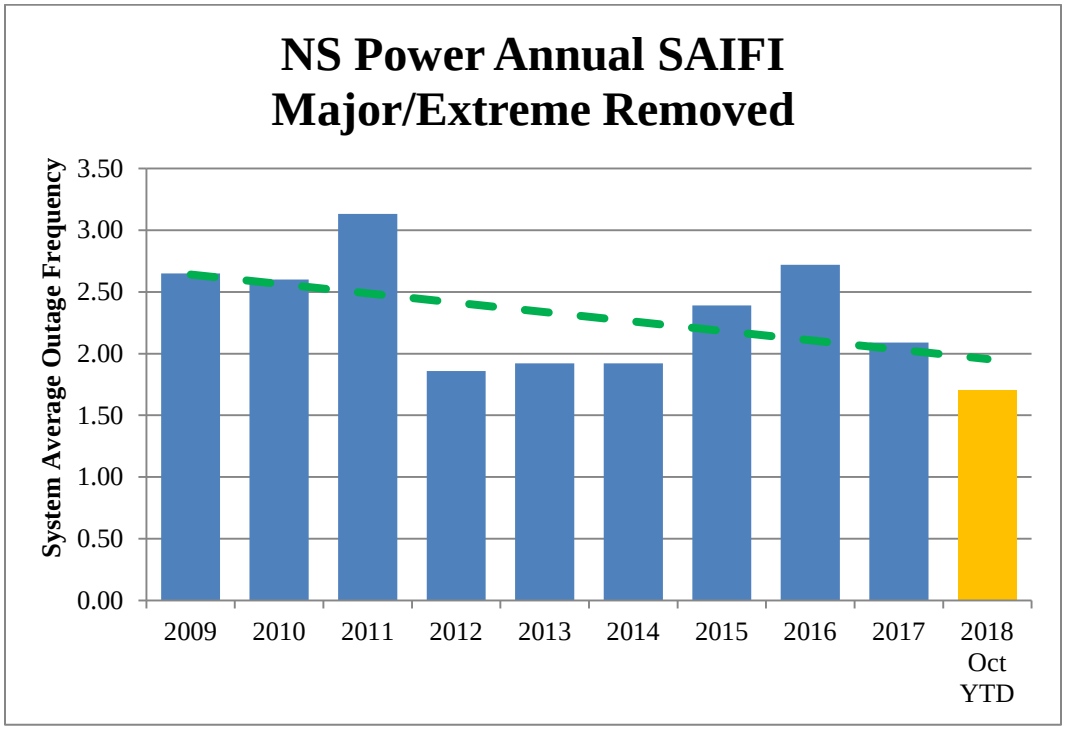


Figure 72: NS Power Annual SAIDI (Major/Extreme Events Excluded)

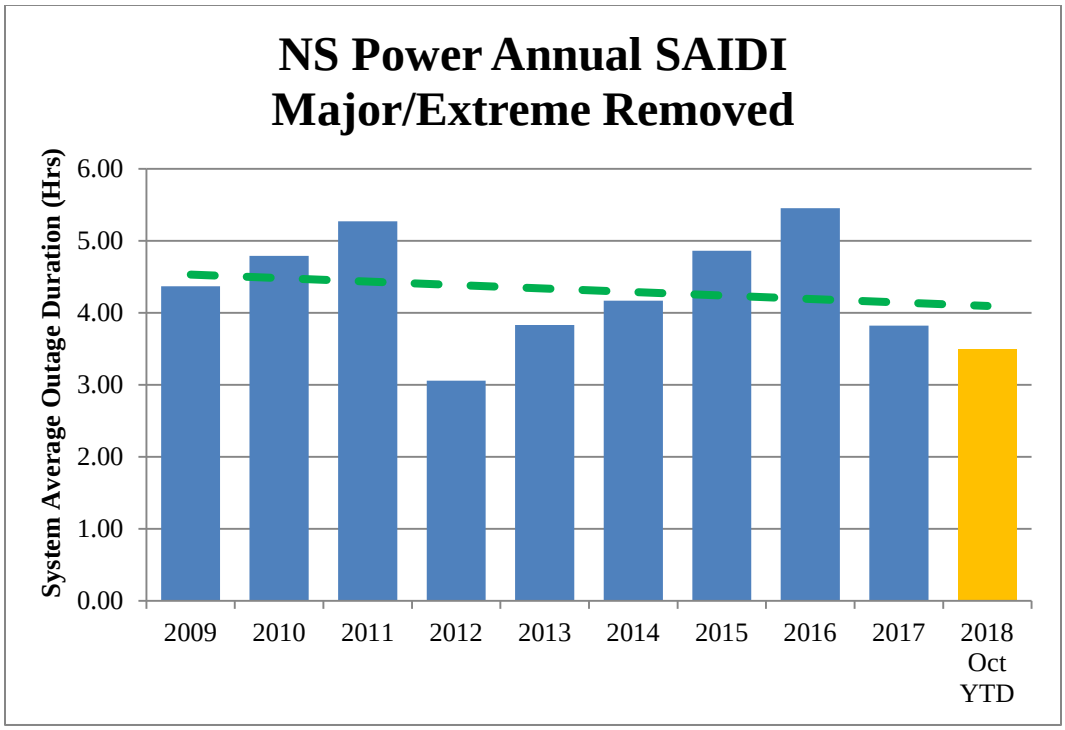


Figure 73 and **Figure 74** below represent NS Power's reliability statistics with Major and Extreme Events included.

Figure 73: NS Power Annual SAIFI (Major and Extreme Events Included)

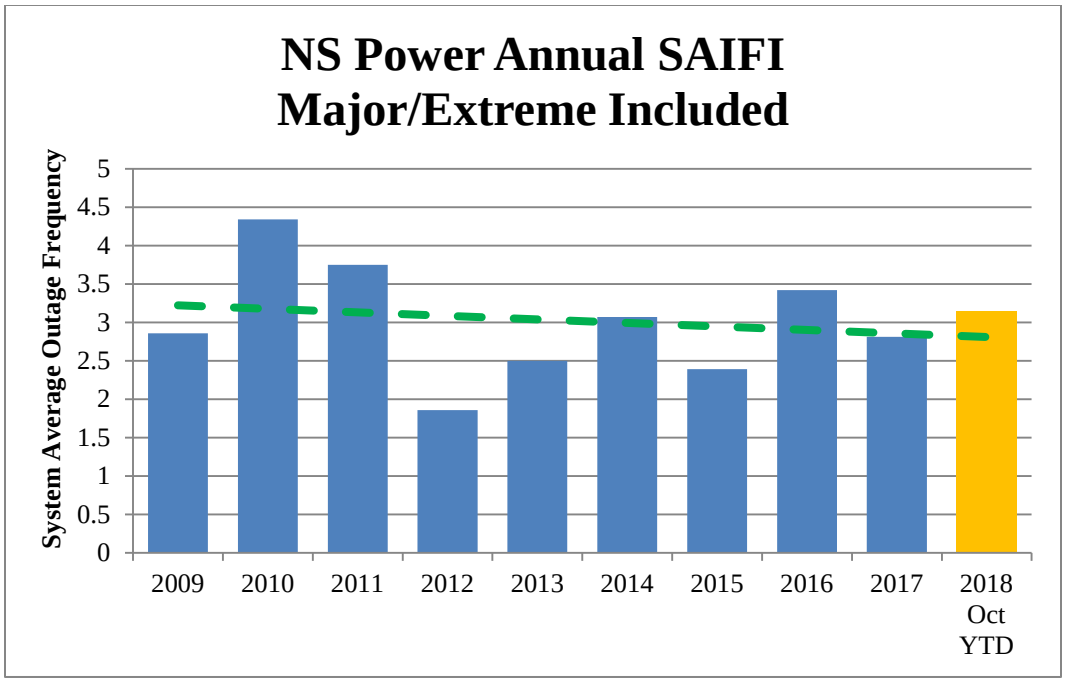
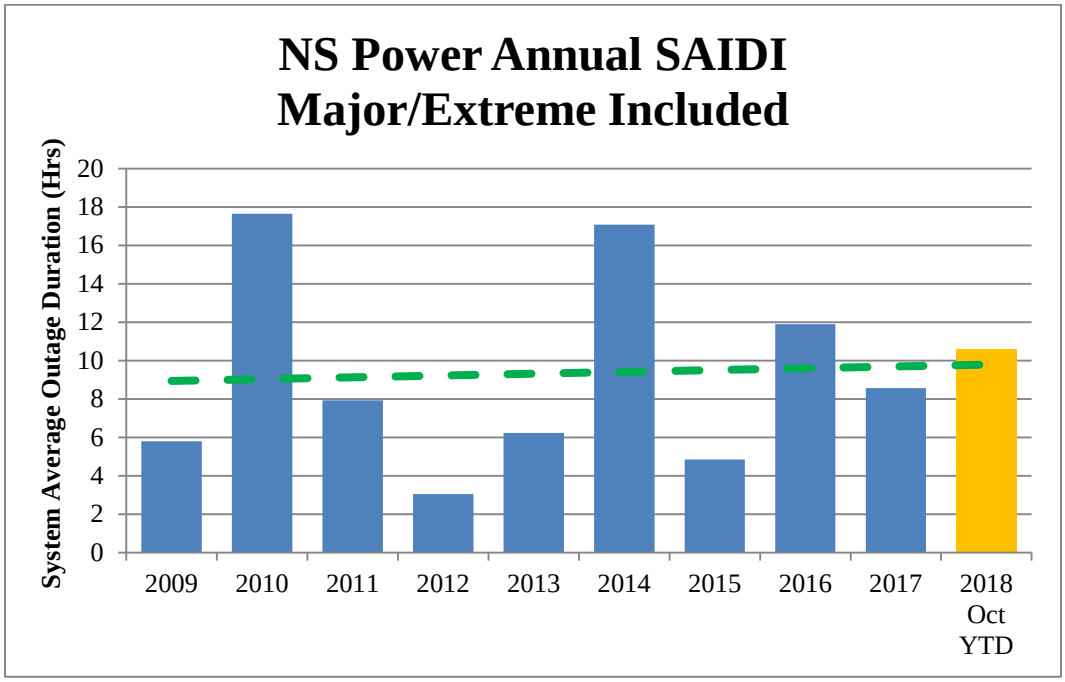


Figure 74: NS Power Annual SAIDI (Major and Extreme Events Included)



The slight increasing overall trend with annual SAIDI when major and extreme events are included is due to a number of extreme event days over the last several years, including Arthur, and a significant event day in October of this year. NS Power continues to see more severe weather events as a trend which is expected to continue. Notwithstanding, NS Power's remains below the Atlantic Canada outage average for frequency and duration, and the Company continues to see decreasing (improving) trends overall for SAIFI and SAIDI with major and extreme events removed, and SAIFI with major and extreme events included. Continued investment in annual rights-of-way clearing and other capital investment initiatives noted herein are expected to continue to sustain reliablity over the long term.

Outage Causes

Historically, two of the leading causes of NS Power customer outages for all days (all significant event days included) are Defective Equipment and Tree Contacts. These outage causes and NS Power's associated investments are described in more detail below.

Defective Equipment

Figure 75 and **Figure 76** below show the generally sustained reliability results realized through upgrades and replacements of targeted distribution equipment resulting from the Reliability Investment Strategy. There has been sustained reliability in both customer interruptions and customer hours of interruption due to defective equipment.

The increased customer interruptions for 2016 is partially a result of a number of failures of a particular type of in-line disconnect switches in Metro Halifax. These resulted in high customer interruptions but short duration outages; as shown in the second chart, customer hours of interruptions in 2016 increased proportionally less, with in-line disconnects representing 5.68 percent of defective equipment customer hours of interruption. In 2017, there were fewer customers impacted by outages related to these types of switches resulting in a decrease in customer interruption for that period. Planned replacement of these devices to address reliabilty

concerns continues. The increased Customer Hours of Interruption for 2017 is a result of a number of pin-insulator failures, primarily in Cape Breton, that resulted in longer than average customer interruptions. NS Power has initiated renewed focus on equipment reliability for T&D by leveraging additional asset management practices. Reliability teams are investigating improvements in maintenance strategies to identify failure modes for asset classes with the highest contributions to customer impacts.

Figure 75: Annual Defective Equipment – Customer Interruptions

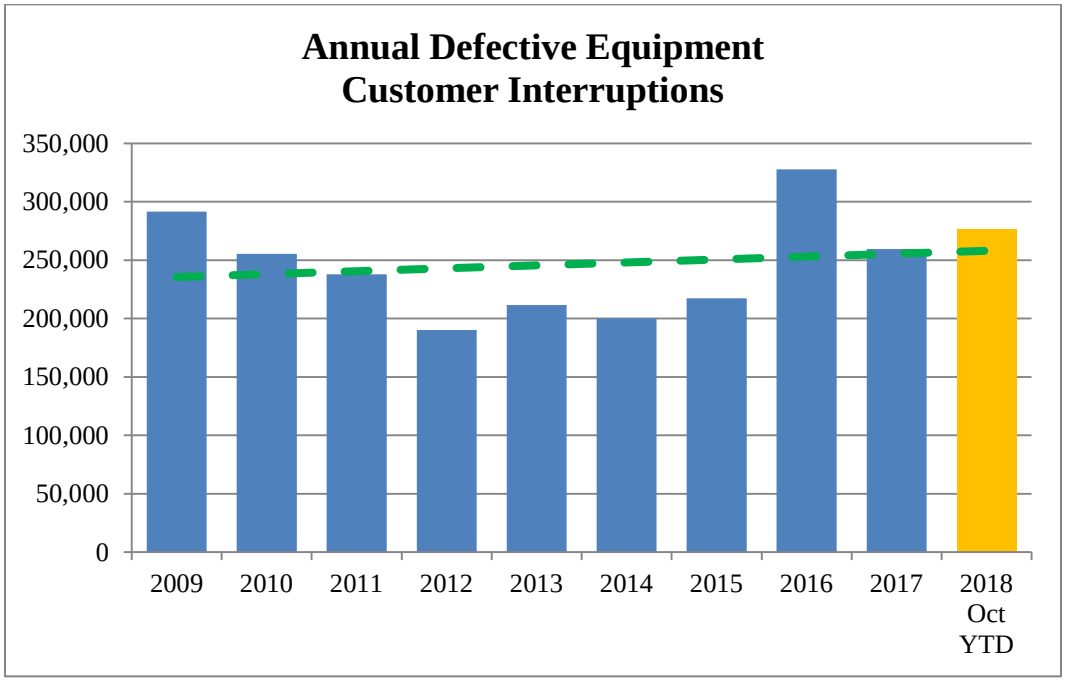
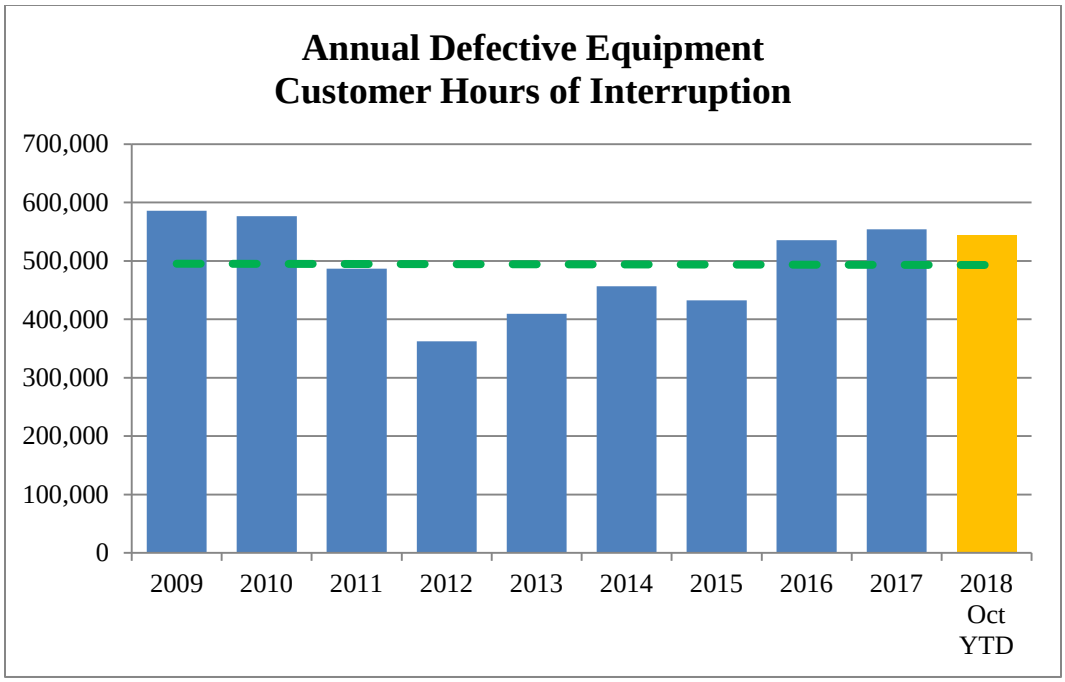


Figure 76: Annual Defective Equipment – Customer Hours of Interruption



Taking a further look into the 2017 reliability data, defective equipment outages can be classified by device type. This is shown in **Figure 77** below.

Figure 77: Customer Hours of Interruption

Customer Hours of Interruption		
Device Type	**2017**	**% of Hours**
Primary Aerial Conductor	105,716	22.95%
Pin Insulator	91,228	19.80%
Wood Pole	66,081	14.35%
Tie Wire	35,431	7.69%
Cutout	35,323	7.67%
Lead	20,223	4.39%
Hot Tap	13,760	2.99%
Jumper	13,208	2.87%
Recloser	12,632	2.74%
Polemount TX	9,057	1.97%

All distribution capital projects and routines that replace deteriorated equipment will sustain system reliability and address the device failures referenced in the table above.

The scope of the following capital projects include elements that will result in sustaining reliability by improving outage response:

- CI C0011209 - 85S-401 Cabot Trail Rebuild
- CI 52229 - D-16V-314H-New Edinburgh Phase Extension
- CI 52184 - 37N-412 Glooscap PH3 Rebuild

Tree Contacts

Tree Contacts are the largest source of outage hours for NS Power's customers. **Figure 78** and **Figure 79** below show both customer interruptions and customer hours of interruption due to tree contacts under normal and severe weather conditions.

Figure 78: Annual Tree Contact – Customer Interruptions

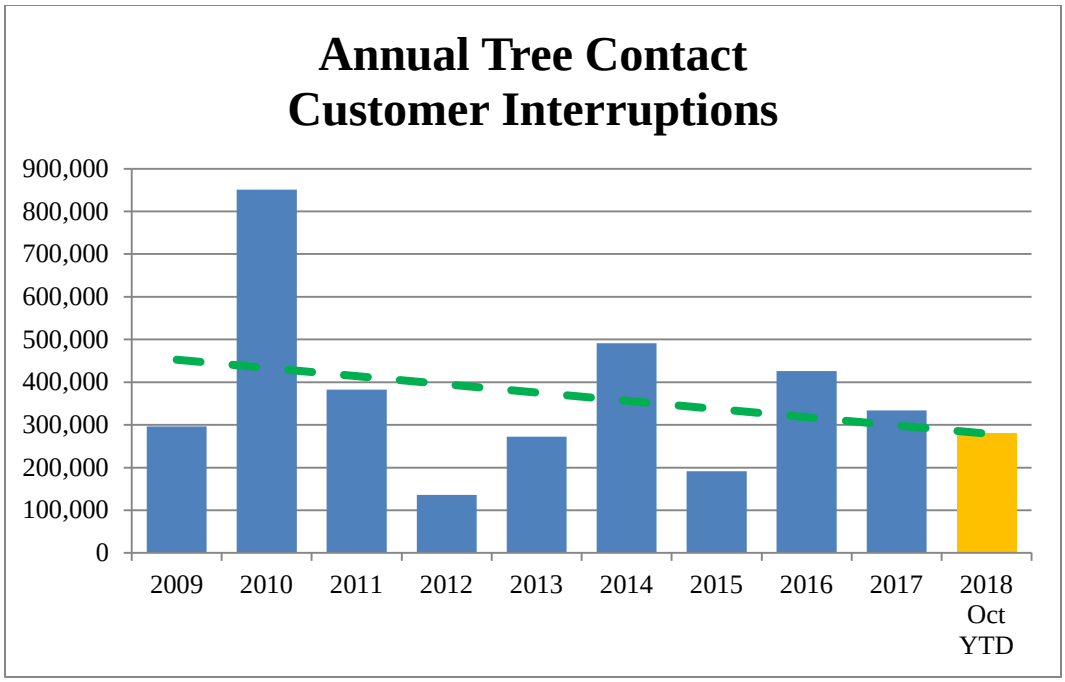


Figure 79: Annual Tree Contact – Customer Hours of Interruption

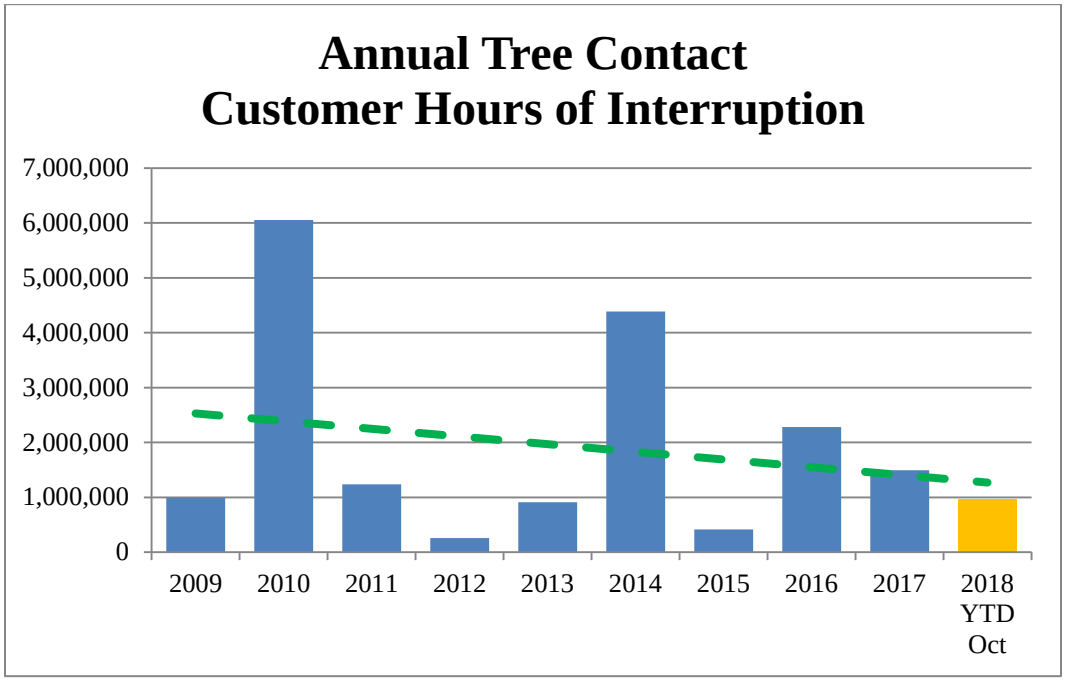


Figure 80 and **Figure 81** below show the tree contact data normalized with Major and Extreme Events removed. With these events removed, the data demonstrates the vegetative effects of major storms and their impact for months following the extreme event.

Figure 80: Annual Tree Contact – Customer Interruptions (Major/Extreme Events Removed)

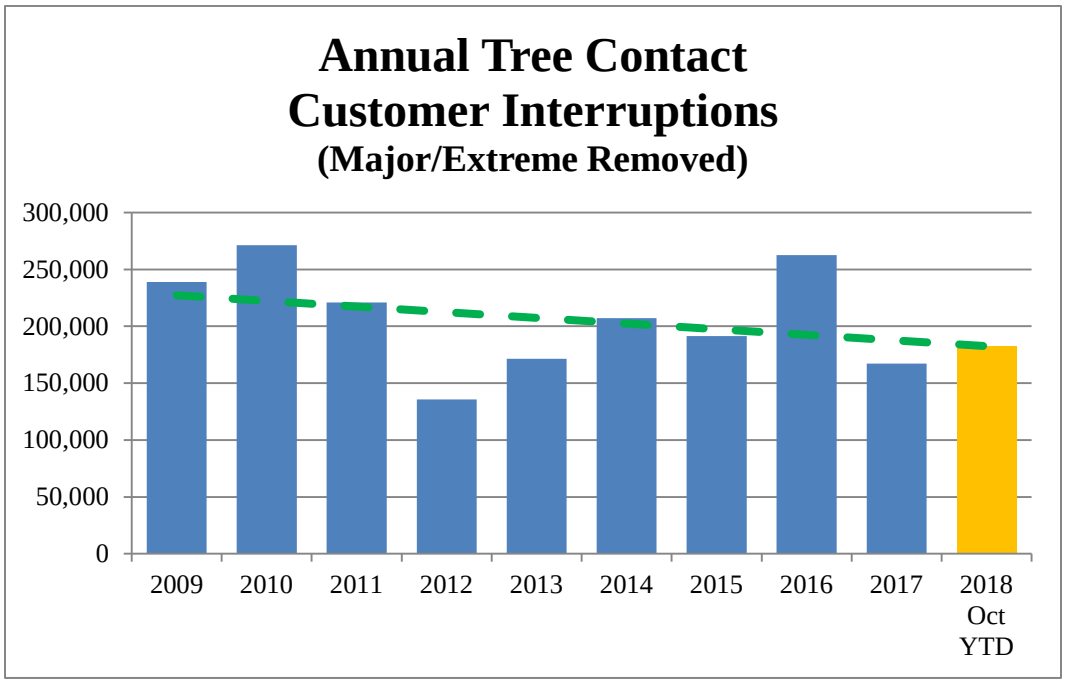
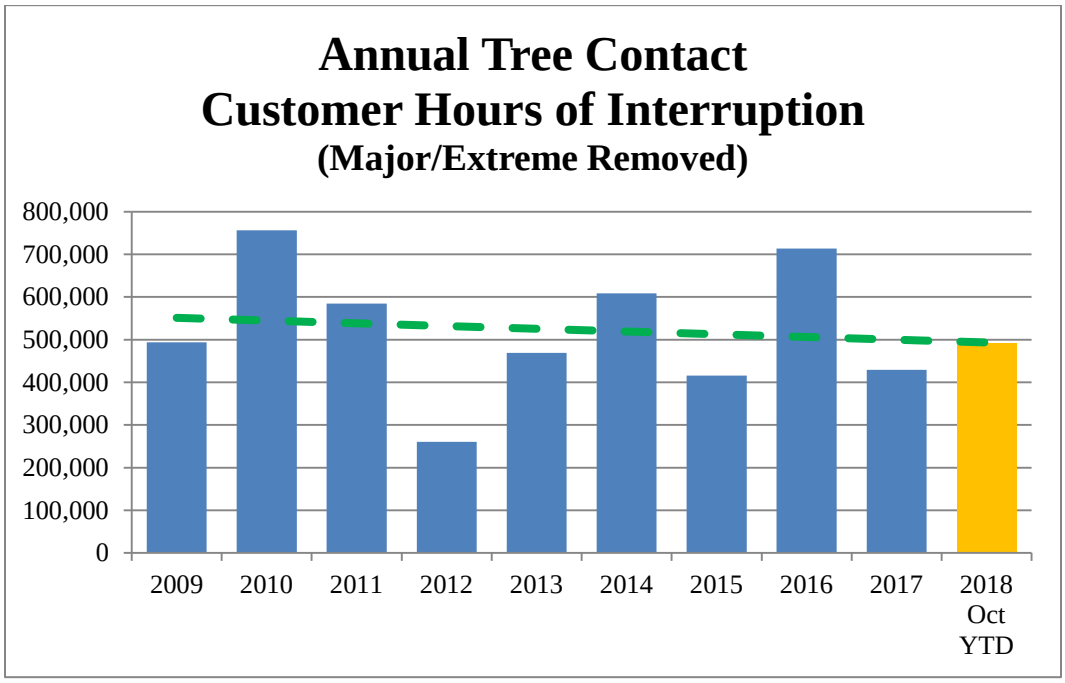


Figure 81: Annual Tree Contact – Customer Hours of Interruption (Major/Extreme Events Removed)



In a continued effort to minimize storm effects and overall reliability, NS Power has proposed the following spending in 2019 for transmission and distribution vegetation management. These targeted investments for managing vegetation aim to minimize outage frequency and duration, while seeking to improve access to the system.

- C0010040 – 2019 New Distribution ROW Widening
- C0010042 – 2019 Transmission ROW Widening 69kV
- D010 Distribution Right of Way Routine
- T010 Transmission Right of Way Routine

Update on storm performance and related capital investments

The effect of storms and storm response varies storm-to-storm and year-to-year. The wind speeds, rainfalls, time of year, time of day and weather forecast accuracy all contribute to a storm's impact.

NS Power uses the 2.5 Beta Method (IEEE-3366 Standard) to classify Major Event Days. The same methodology is applied to further classify Significant Event Days (2.0 Beta) and Extreme Event Days (3.5 Beta).

As of October 31, 2018, NS Power experienced 5 significant event days, 5 major event days, and 1 extreme event day.

NS Power has the following capital programs for storm response and reactive work for 2019:

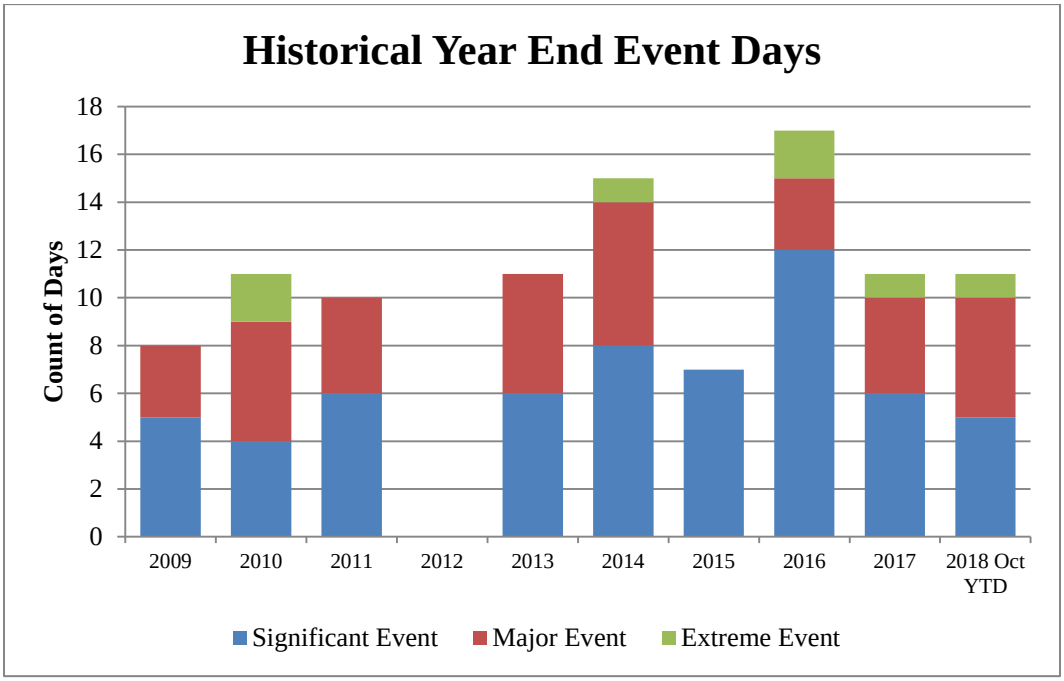
- D008 – Provincial Storm Distribution
- T001 – Transmission Line Unplanned

As noted above, NS Power continues to invest on vegetation management. These investments aim to minimize tree contact and maximize access to our transmission and distribution systems as provided for in routines T010 and D010, as well as capital work orders CI 51969 and CI 50796.

2018 Storm Performance vs. Previous Years

Figure 82 to **Figure 87** below show the count of the previously identified event day[27] classifications, and their SAIFI and SAIDI contributions annually. They outline the frequency and impact of significant event days[28] to customers.

Figure 82: Historical Year End Event Days



[27] The term "Event Day", rather than the previous term "Storm Day" is used here to refer to those events significantly exceeding normal operations, in order to better reflect that event thresholds determined using the IEEE 1633 methodology are not exclusively due to storms or other inclement weather.
[28] The term "Significant Event Day", rather than the previous term "Storm Day" is used here to reflect that event thresholds determined using the IEEE 1633 methodology, in this case the 2β threshold, are not exclusively due to storms or other inclement weather.

Figure 83: Count of Annual Event Days – Oct YTD

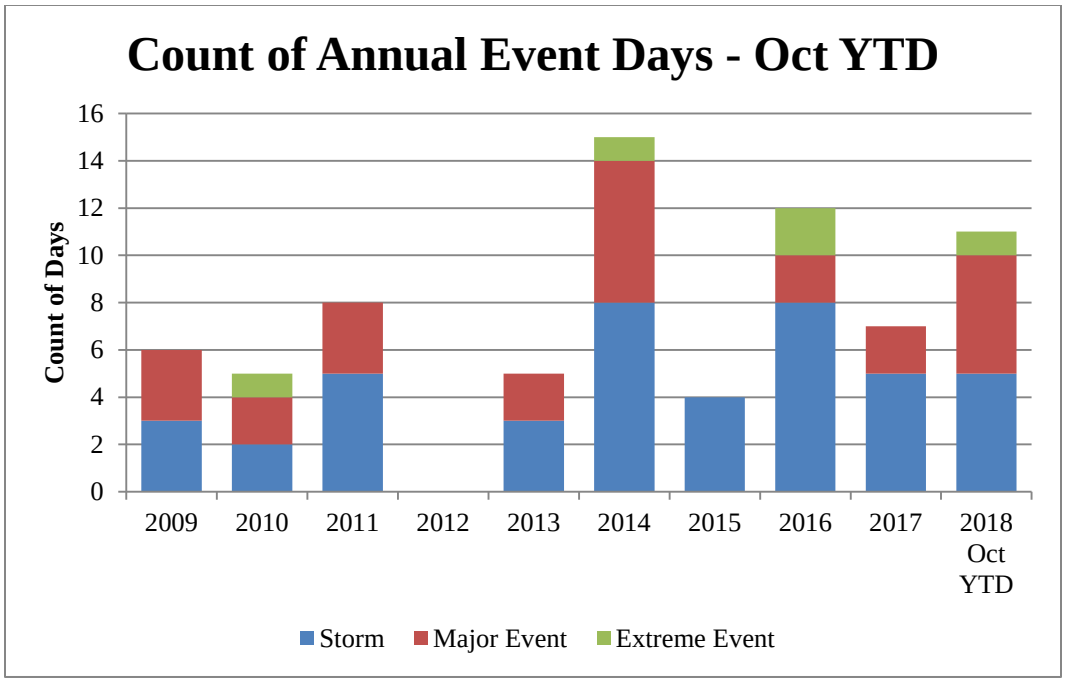


Figure 84: SAIFI- Event Class Contribution

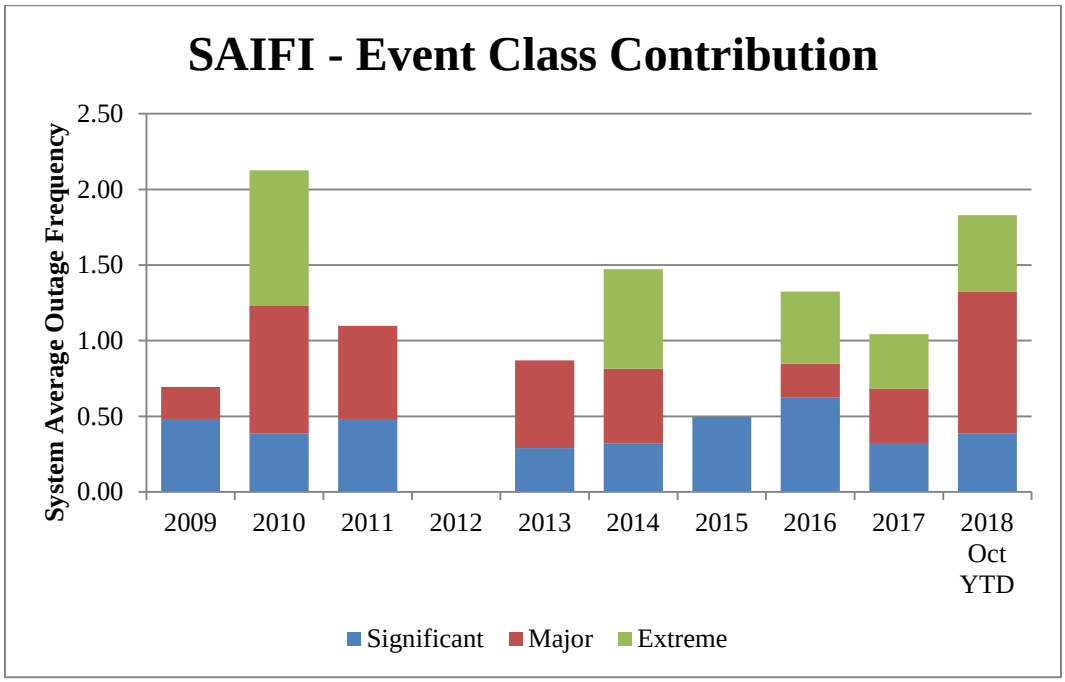


Figure 85: SAIFI Event Class Contribution – Oct YTD

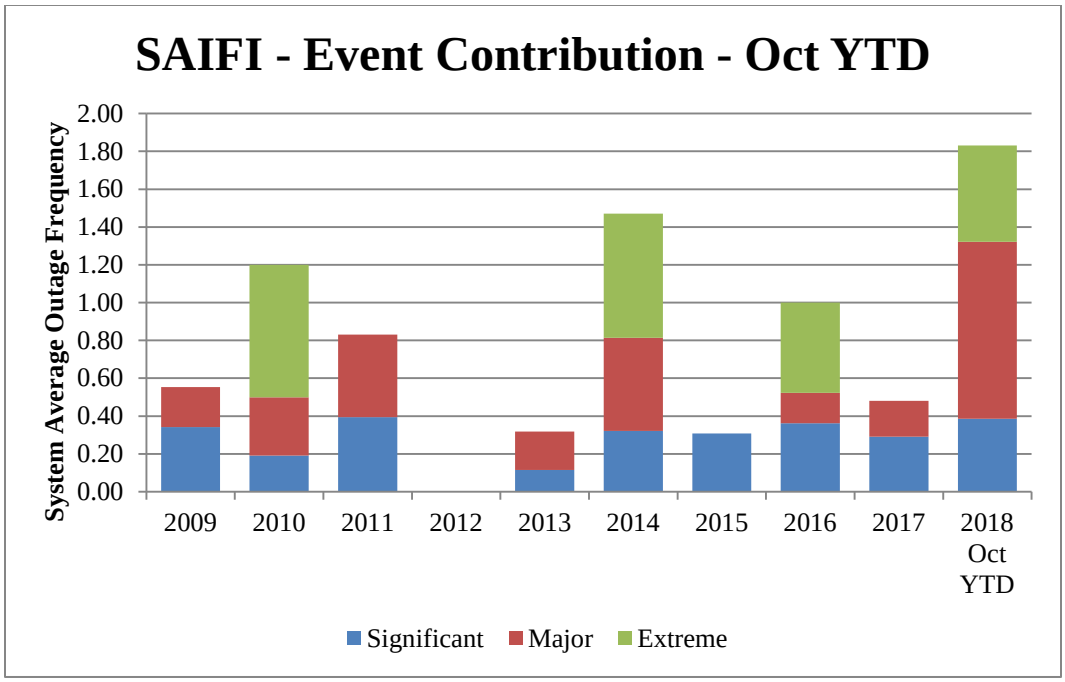


Figure 86: SAIDI – Event Class Contribution

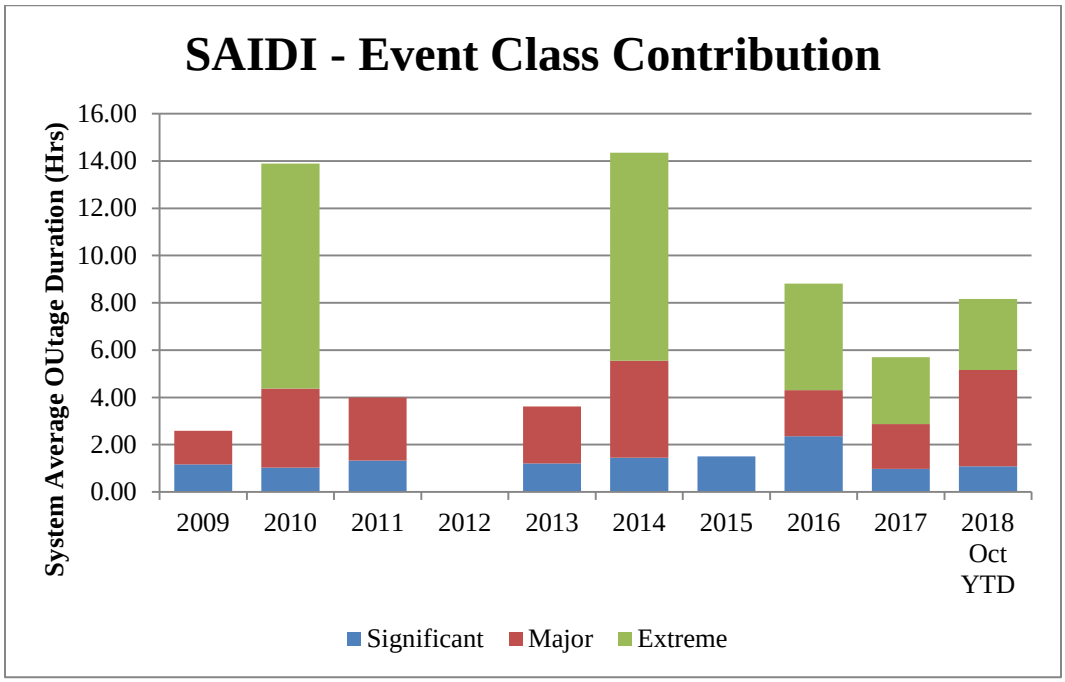
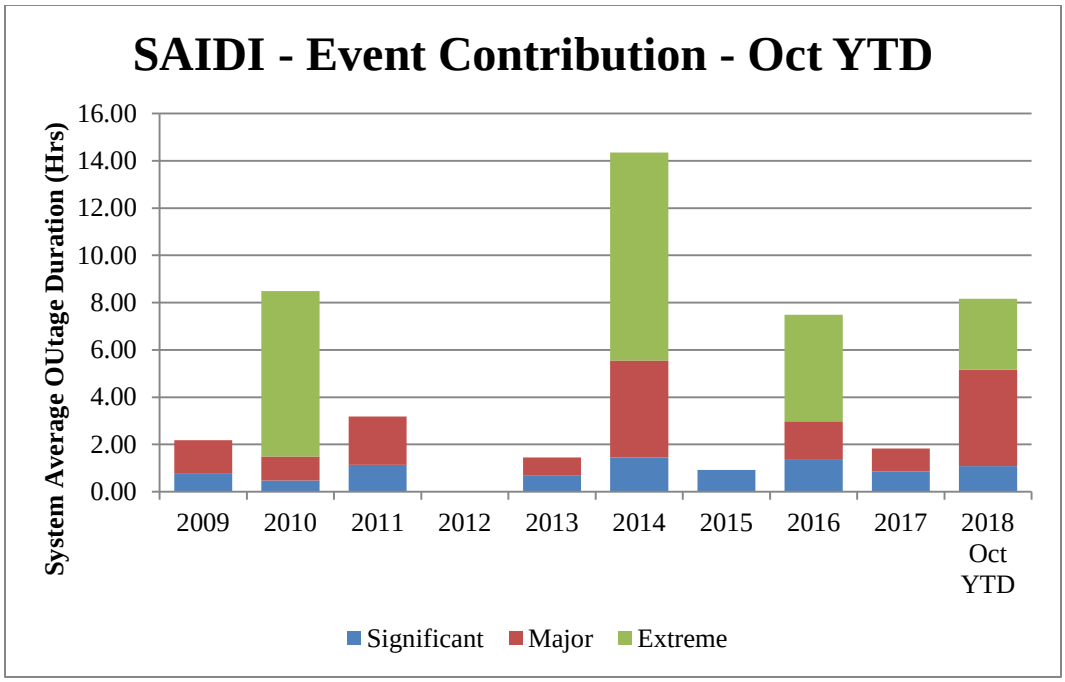


Figure 87: SAIDI Event Class Contribution – Oct YTD



Note: 2012 experienced no severe weather days.

Figure 88 below provides detail on outage causes for the 11 event days experienced so far in 2018.

Figure 88: Detail on Outage Causes for identified Event Days

		Significant	Major	Extreme	
CEA Cause Code	**Description**	**Hours of Interruption**	**Hours of Interruption**	**Hours of Interruption**	**% of Hours**
0	Unknown/Other	6,838	118,859	179,722	7%
1	Scheduled Outage		3		0%
2	Loss of Supply	108,381	191,521	55,838	9%
3	Tree Contacts	285,317	313,016	158,818	18%
4	Lightning				0%
5	Damaged Equipment	24,093	149,373	63,263	6%
6	Adverse Weather	128,664	1,249,592	1,056,931	59%
7	Adverse Environment	31	4,287	20,799	1%
8	Human Element		24	9	0%

		Significant	Major	Extreme	
CEA Cause Code	**Description**	**Hours of Interruption**	**Hours of Interruption**	**Hours of Interruption**	**% of Hours**
9	Foreign Interference	493	42,486	543	1%
	Total	**$553,817**	**$2,069,160**	**$1,535,923**	

18 percent of all identified event day outages year to date in 2018 have been caused by tree contacts. While NS Power always strives to minimize tree caused outages, the importance is further stressed in storm conditions. Continued investment for vegetation management and right-of-way widening will help minimize these outages in all weather conditions.

The following capital projects are identified to address vegetation management and right-of-way widening for 2019:

- C0010040 – 2019 New Distribution ROW Widening
- C0010042 – 2019 Transmission Right-of-Way Widening 69kV
- D010 Distribution Right of Way Routine
- T010 Transmission Right of Way Routine

T010 and D010 Report

In the 2016 ACE Plan Order, the UARB directed as follows:

> The Board approves the 2016 Routine capital expenditures, with the exception of the Distribution ROW widening (D010) which is reduced to $600,000. The Board directs that the Routine for Transmission widening be treated as a separate project, and not a routine, in future ACE Plan Applications. NSPI is to provide an annual progress report on the expenditure, works undertaken, results achieved and future plans as part of the annual ACE Plan submissions.[29]

[29] 2016 ACE Plan, UARB Order, M07176, June 8, 2016.

In accordance with the Board's directive, NS Power provides its progress report on D010 and T010 below as of October 31, 2018.

In its 2017 ACE Plan Order, the Board directed as follows:

> The Board directs NSPI to update the cost estimates for vegetation management and right-of-way widening projects in the 2018 ACE Plan (and future years) based on actual historical costs incurred for this project.[30]

NS Power confirms that the cost estimates for vegetation management and right-of-way widening projects in the 2019 ACE Plan are based on actual historical costs incurred.

Expenditures, Works Undertaken, and Results

The following progress was made on 69kV transmission widening under CI 51969:

- 95 percent of planned work has been completed as of October 31, 2018
- 100 percent completion is forecasted for year end 2018
- Forecast year end spend is approximately $5,400,000
- Substitutions have been made from the original plan, due to revised priorities:
- L-5015 and L-5016 replaced with L-5031, L-5532, L-5535, and L-5547

The following progress was made on >69kV transmission widening under T010:

- 100 percent of planned work has been completed as of October 31, 2018
- 100 percent completion is forecast for year end 2018
- Forecast year end spend is approximately $600,000

[30] 2017 ACE Plan, UARB Order, M07745, April 4, 2017.

The following progress was made on distribution widening under D010:

- 30 percent of planned work has been completed as of October 31, 2018
- 100 percent completion forecast for year end.
- Forecast year end spend is approximately $600,000

Plans for Replacement of Aging T&D Equipment & Storm Performance

The 2015 ACE Plan Terms of Consensus included two commitments with respect to reliability:

(4) As part of the reliability directive in future ACE Plans, NS Power will provide additional information regarding its plans for replacement of aging transmission and distribution equipment in accordance with the following recommendation on this matter made by the SBA's consultant, Mary Neal, at page 12 of her evidence in this proceeding dated January 16, 2015:

> "I recommend NSPI provide more information regarding its plans for replacement of aging transmission and distribution equipment to better show how it justified the target investments. This should include (where possible):
>
> - Descriptions of assets to be replaced and their ages,
> - Goals for strategic replacement programs, such as targets for age profiles of different asset classes,
> - Expected improvements in asset age profiles due to each ACE Plan project involving replacement of transmission and distribution equipment considered at end-of-life,
> - More detailed descriptions of how NSPI targets specific assets every year, whether based on age, performance degradation, or other factors, and
> - Any recent, relevant inspection data"

(5) As part of the reliability directive in future ACE Plans, NS Power will provide an update on its storm performance and related capital investment strategies to improve storm performance.[31]

The Terms of Consensus were approved by the UARB on May 5, 2015. Thesetwo commitments are addressed below.

Plans for Replacement of Aging Transmission and Distribution Equipment

The multi-year Reliability Investment Strategy has resulted in sustained reliability for NS Power customers. NS Power continually monitors outages and performance of transmission, substation and distribution assets, and future investments will continue at an appropriate level to provide affordable and reliable service. To sustain these reliability performance improvements, NS Power follows its asset management principles to prioritize investments in T&D plant in accordance with Section 6.2 of the CEJC. The project risk rating methodology found therein determines condition and criticality to rate projects for the replacement and refurbishment of T&D assets. This reduces the overall risk for the asset class.

Annual estimated replacement ranges developed based on asset age profiles, and the Iowa Survivor curves for equipment failure are used as a guide in reducing the overall risk for each asset class. While the suitable investments for a specific asset class may vary from year to year depending on system performance, the estimated replacements analysis provides a working range in which to evaluate the appropriateness of proposed sustaining capital investments.

NS Power uses a variety of factors to determine the specific assets targeted for replacement as part of the annual capital investment program. Generally, targeted assets have experienced degradation in performance manifesting in decreased reliability, increased maintenance frequency and cost, or reduced functionality. These effects are identified through reliability tracking, field inspections, and test results of the impacted assets. Criticality of the asset to

[31] 2015 ACE Plan, Terms of Consensus, M06514, February 18, 2015, page 2 of 5.

continued operations of the NS Power system and any risks posed to people and the environment contribute to determining specific assets for replacement.

Asset age is a concern when the frequency of required maintenance is increased, the availability of replacement parts or critical spares is limited, or performance is negatively impacted. This information can be used to inform project prioritization. However, age profiles are used in concert with asset condition, performance, and legislated requirements; it is never the single determining element in an investment decision. Capital project justifications outline the reasoning behind a given replacement program considering all relevant elements.

In 2014, NS Power embarked on further formalizing the identification and prioritization of assets for replacement by creating a regimented framework to determine the condition, criticality, and risk individual assets within a given class pose to the NS Power system. While the risk score of an asset does not determine its suitability for replacement alone, it can aid in identifying assets requiring more detailed investigation by technical experts and subsequent risk mitigation activities.

The target ranges for T&D assets covered by this analysis is provided in **Figure 89** below.

Figure 89: Age Based Replacement Ranges for T&D Assets

		High Range Replacements	Low Range Replacements		
Asset Classification	**Quantity on Grid**	**Estimated Useful Life**	**Annual Replacements**	**Estimated Useful Life**	**Annual Replacements**
Distribution Conductor (km)	43,081	45	957	55	783
Distribution Structure	354,527	50	7,090	60	5908
Pole Top Transformer	139,844	35	3,995	45	3107
Underground Conductor (km)	784	45	17	55	14
Padmount Transformers	4,187	35	120	45	93
Transmission Conductor (km)	5,304	55	96	65	82

		High Range Replacements	Low Range Replacements		
Asset Classification	**Quantity on Grid**	**Estimated Useful Life**	**Annual Replacements**	**Estimated Useful Life**	**Annual Replacements**
Transmission Structure	30,648	55	557	65	472
Substation Breakers	557	45	12	55	10
Substation Transformer	356	50	7	60	6

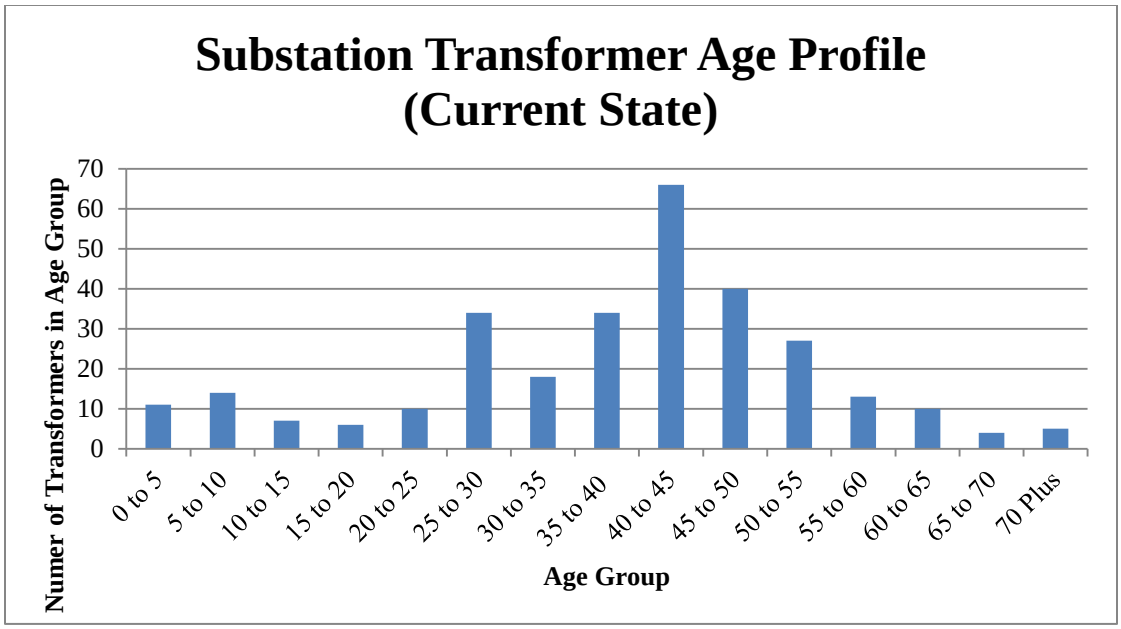
Age demographics information is presently not available for all transmission and distribution asset classes. Substation transformers, substation breakers, transmission conductor, downline reclosers and padmount transformers are asset classes for which this information is available at this time. As asset information improves for individual asset classes, their age profiles provide a more complete picture of the current state across the T&D system.

As T&D equipment reaches end-of-life, capital investments are used to mitigate impacts related to aging infrastructure. This being said, it is important to note here, and for context with the following sections (**Figures 90-99**), that age is not the only determinent of useful life and therefore reliability or risk; older equipment can have lower risk ratings than newer equipment due to design or utilization or other operating conditions and there continues to be advancements in technologies to enable re-validation of useful life. Therefore, in addition to age-driven identificaiton and justification for capital replacements or upgrades, observed or calculated condition, risk, reliability impact, and other factors are considered in deteriming a given asset class' capital program in any given year. The noted expected ranges of replacement per asset class per year serve as a guide or calibration range and are based on the age arithmetic; actual replacement plans will vary depending on the assessment of the assets' conditions and priorities in the context of each year's overall plan.

Substation Transformers

Figure 90 below shows the substation transformer age profile (current state).

Figure 90: Substation Transformers Age Profile (Current State)

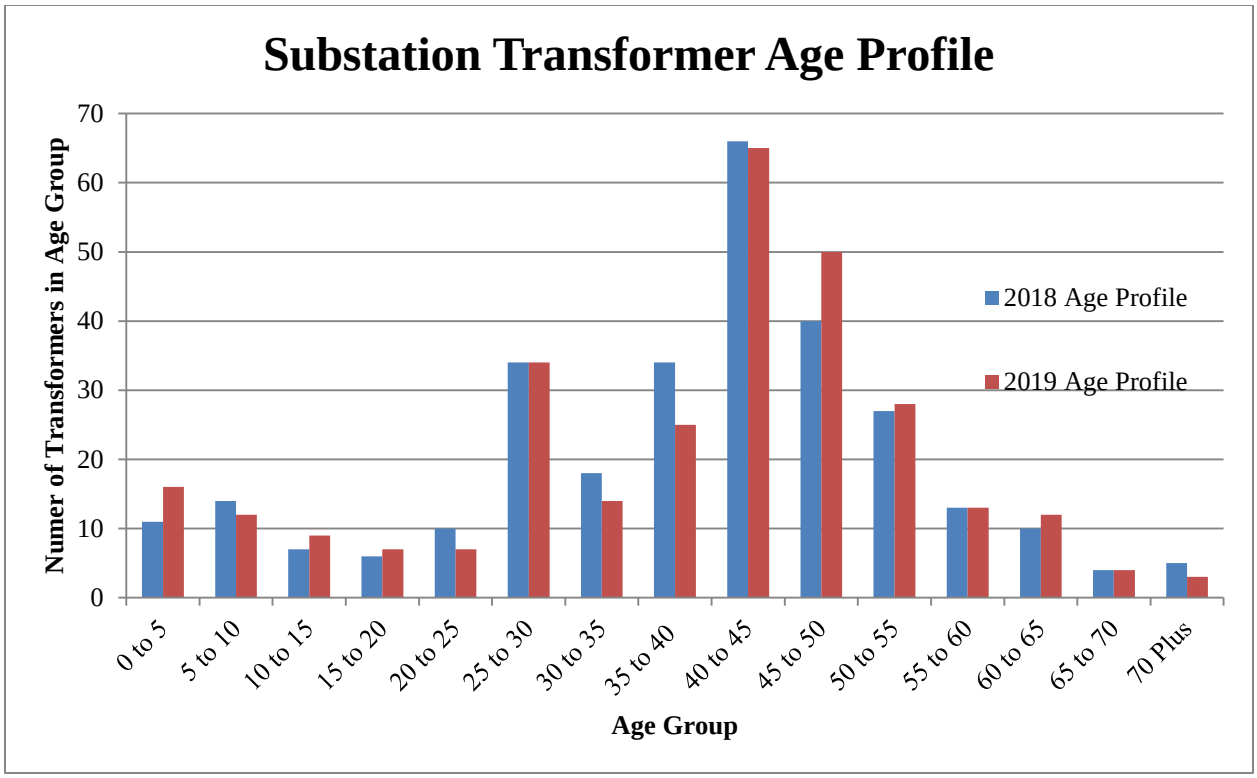


- Expected useful life of 50-60 years depending on the transformer type, utilization, and environmental conditions.

- Age Demographics – 19.7 percent of Transformers are beyond 50 years of service.

- Changes to age demographics – As a result of the proposed 2019 capital investments in substation transformers, the age profile for this asset class will experience an increase of <1 percent in assets beyond 50 years of age. Age is only one of multiple factors in determining targeted assets in a given year. To support mitigation of risk associated with this asset class, continuation of the strategic transformer spares program and mobile substation program is planned. Proactive transformer replacements in future years will again focus on the overall condition of each unit and system criticality. **Figure 91** illustrates the overall change in asset age profile for Substation Transformers between 2018 and 2019.

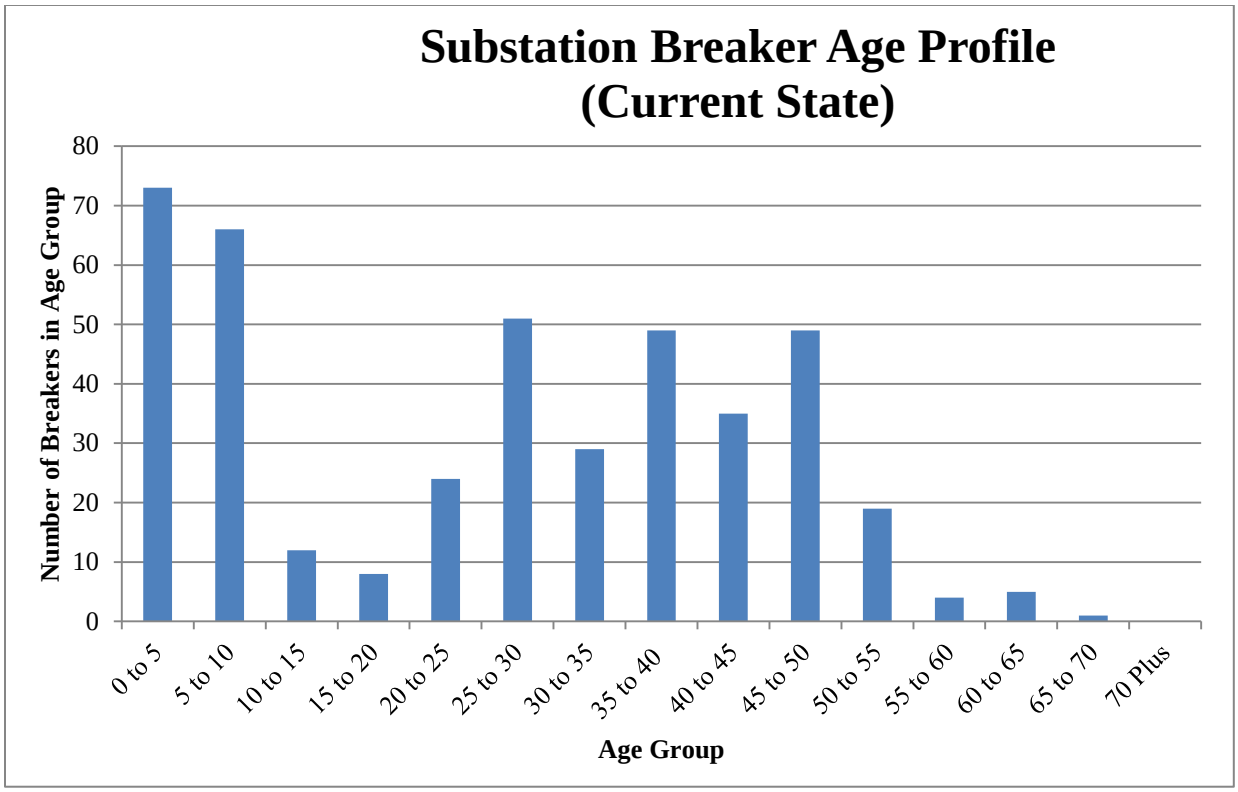
Figure 91: Substation Transformer Age Profile



Substation Breakers

Figure 92 below shows the substation breaker age profile (current state).

Figure 92: Substation Breakers Age Profile (Current State)



- Expected useful life of 45-55 years depending on the breaker type, operations count, and environmental conditions.

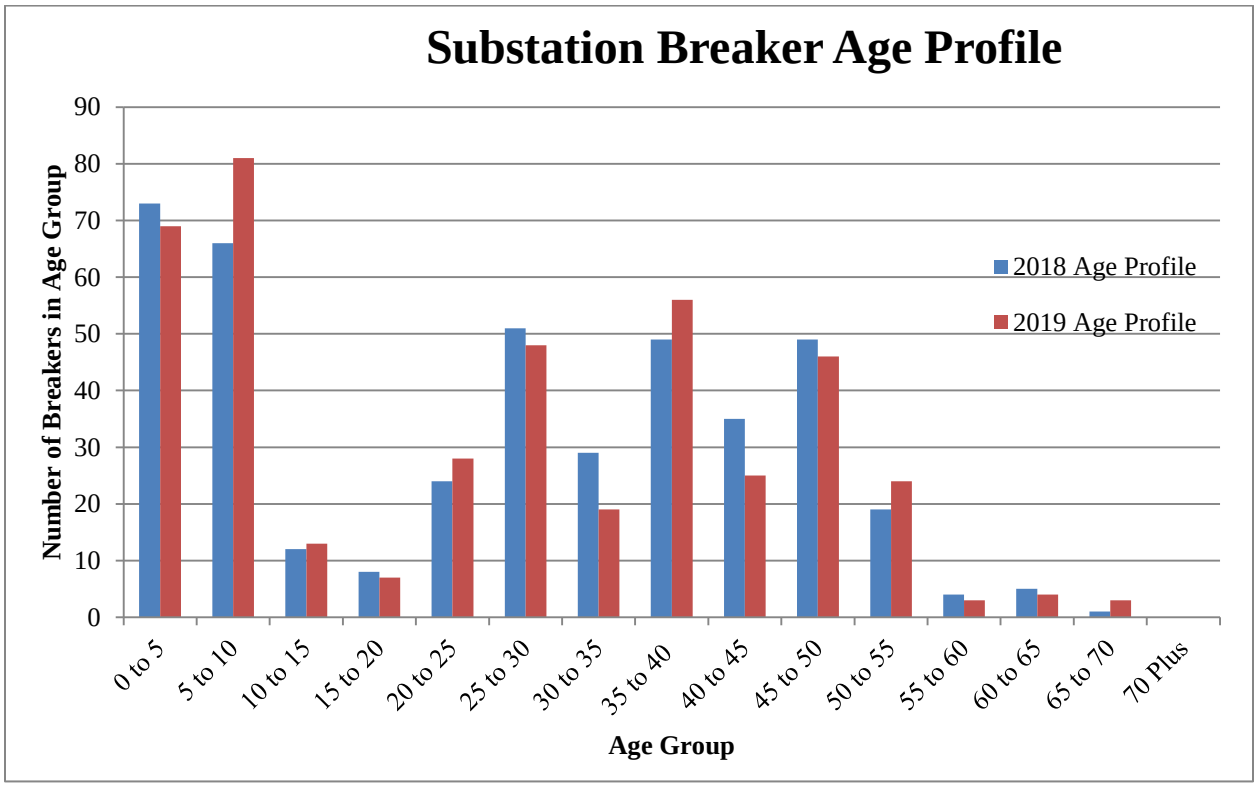
- Age Demographics – 18 percent of breakers are beyond 45 years of service.

- Expected range of annual replacement – 10-12 units per year.

- Changes to age demographics – As a result of the proposed capital investments in Substation Breakers during 2019, the age profile for this asset class will maintain approximately the same percentage (<1% change) of assets beyond 45 years of age. Age is only one of multiple factors in determining targeted assets in a given year. To support mitigation of risk associated with this asset class, continuation of the strategic breaker

spares program is planned. **Figure 93** illustrates the overall change in asset age profile for Substation Breakers between 2018 and 2019.

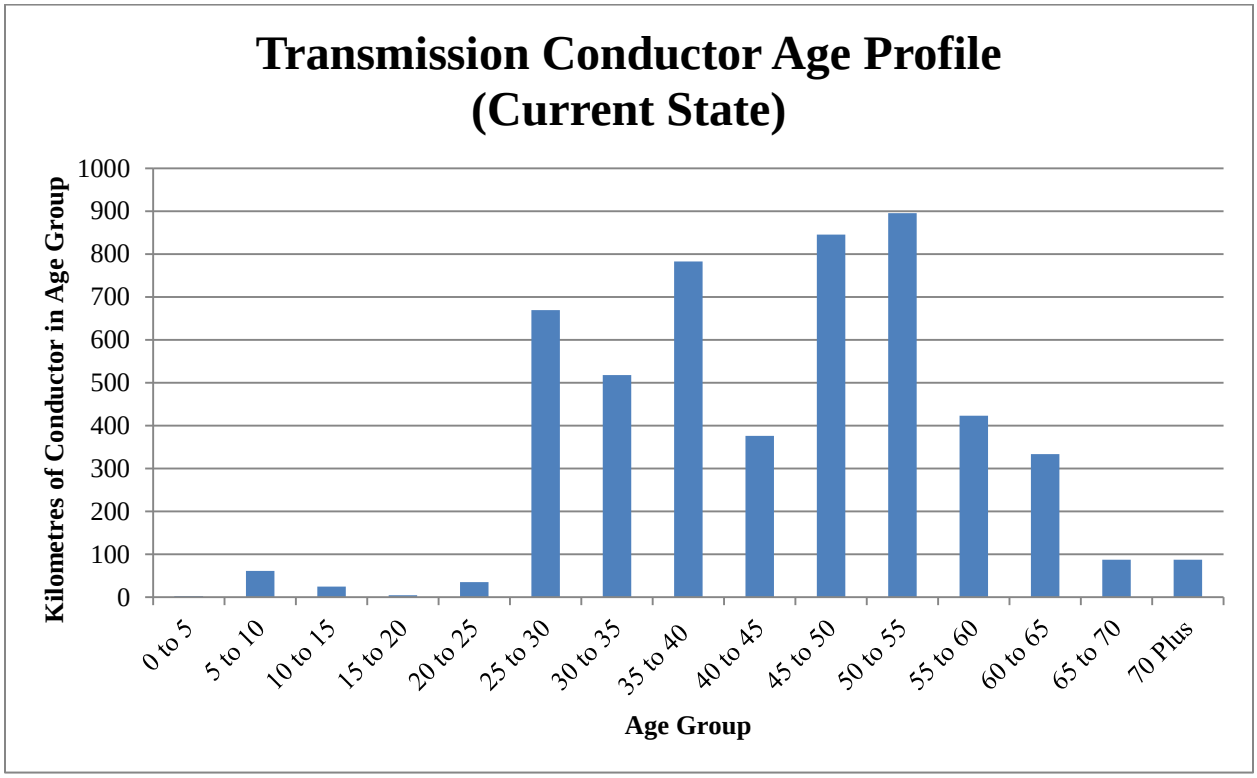
Figure 93: Substation Breaker Age Profile



Transmission Conductor

Figure 94 below shows the transmission conductor age profile (current state).

Figure 94: Transmission Conductor Age Profile (Current State)



- Expected useful life of 55-65 years depending on the conductor design and environmental conditions.

- Age Demographics – 18.1 percent of conductor is beyond 55 years of service.

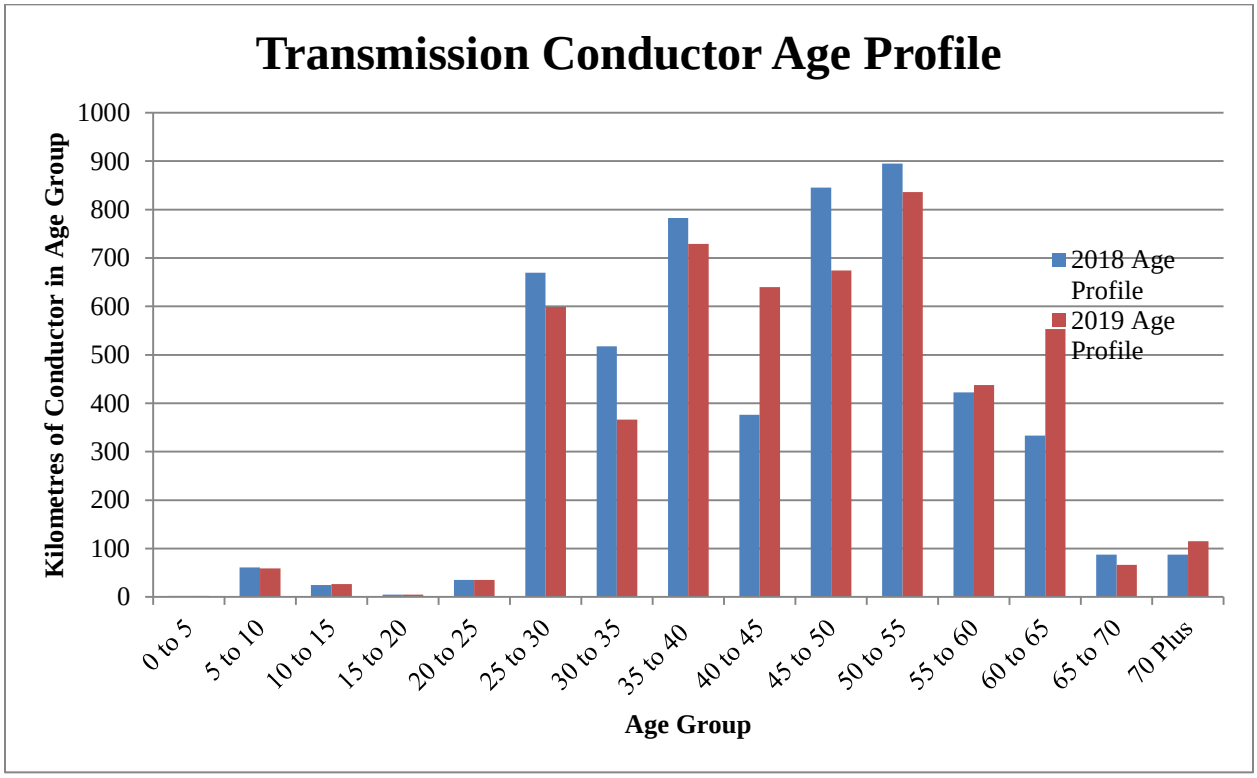
- Expected range of annual replacement – 82 to 96 km per year.

- Changes to age demographics – As a result of proposed capital investments in transmission conductor in 2019, the age profile for this asset class will experience an approximately 4.5 percent increase in assets beyond 55 years of age. Age is only one of

multiple factors in determining targeted assets in a given year. In order to help mitigate risks associated with transmission conduction, innovative testing of conductor over 60 years old is taking place to further assess condition as required.

Figure 95 illustrates the overall change in asset age profile for transmission conductor between 2018 and 2019.

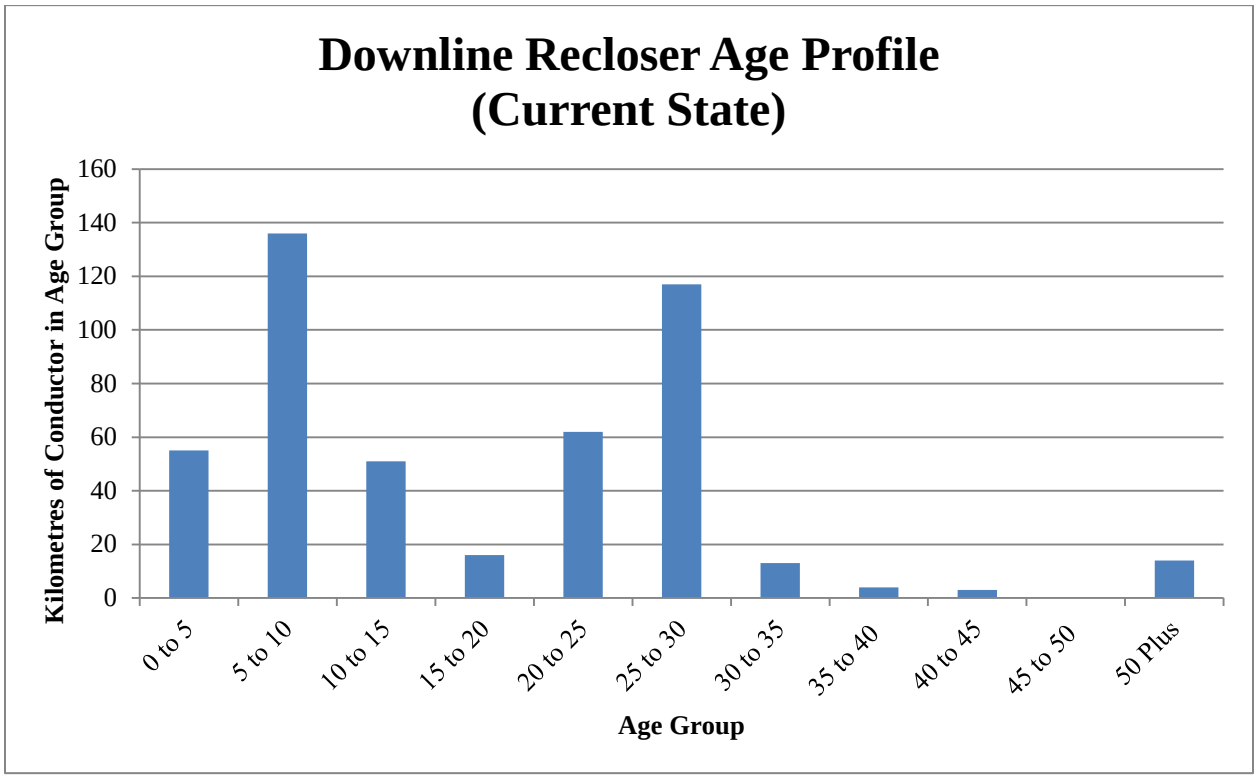
Figure 95: Transmission Conductor Age Profile



Downline Reclosers

Figure 96 below shows the downline reclosers age profile (current state).

Figure 96: Downline Reclosers Age Profile (Current State)



- Expected useful life of 30-40 years depending on the downline recloser design, loading, and environmental conditions.

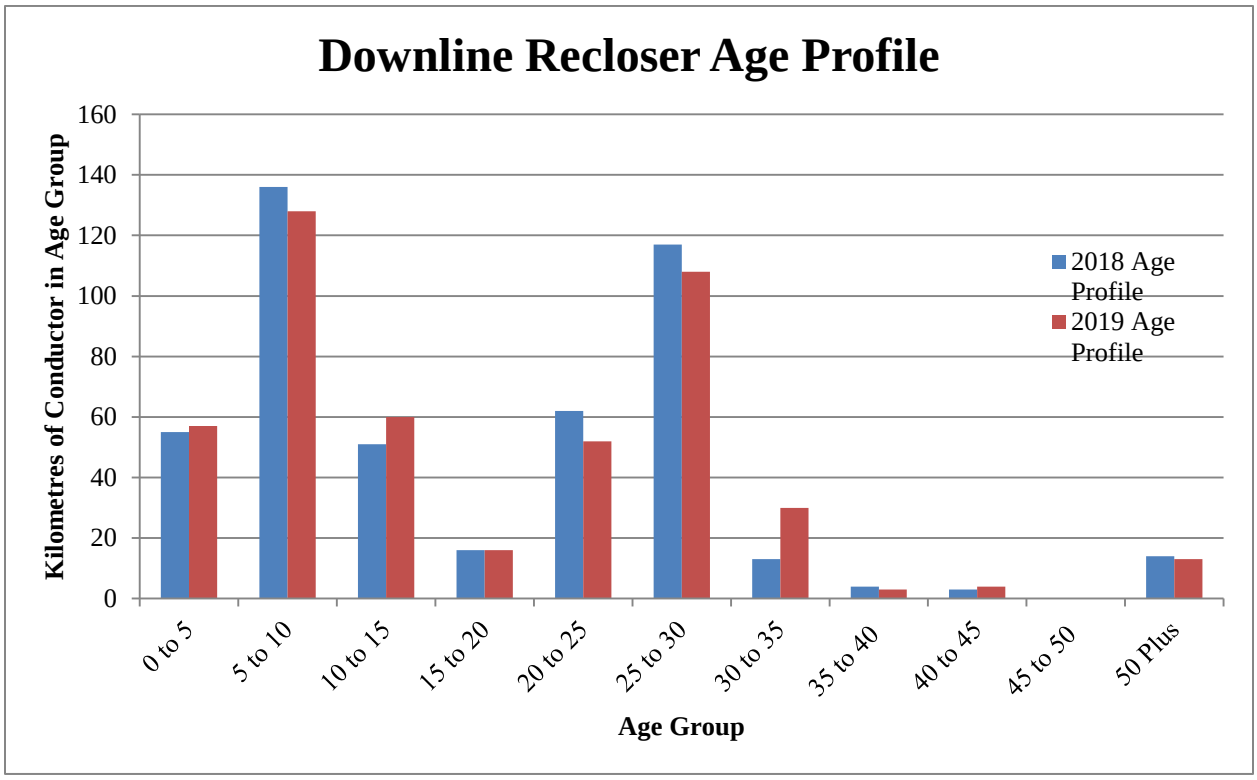
- Age Demographics – 7.2 percent of Downline Reclosers are beyond 30 years of service.

- Expected range of annual replacement – 16 to 21 units per year.

- Changes to age demographics – As a result of the proposed capital investments in Downline Reclosers during 2019, the age profile for this asset class will experience an approximately 3 percent increase in assets beyond 30 years of age. Age is only one of

multiple factors in determining targeted assets in a given year. To support mitigation of risk associated with this asset class, continuation of the strategic transformer Downline Recloser spares program is planned. **Figure 97** below illustrates the overall change in asset age profile for Downline Reclosers between 2018 and 2019.

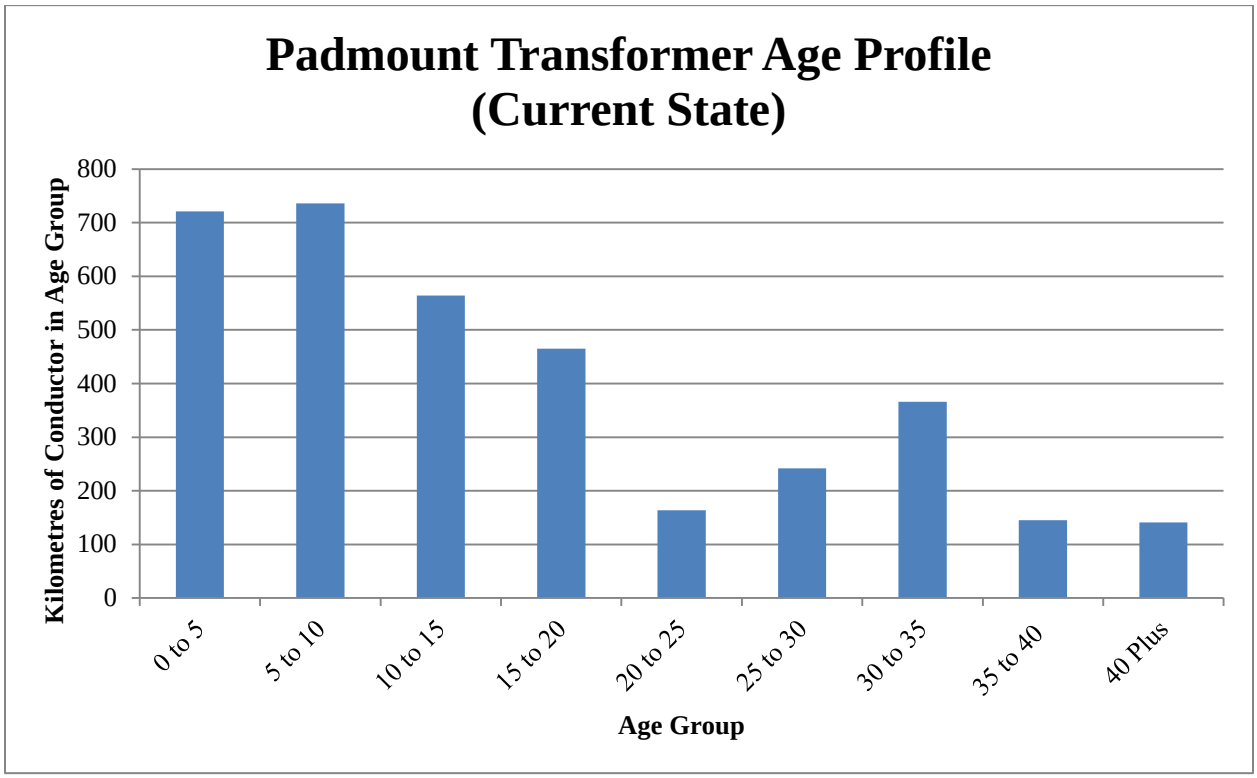
Figure 97: Downline Recloser Age Profile



Padmount Transformers

Figure 98 below shows the Padmount Transformer age profile (current state).

Figure 98: Padmount Transformers Age Profile (Current State)



- Expected useful life of 35-45 years depending on the padmount design, loading, and environmental conditions.

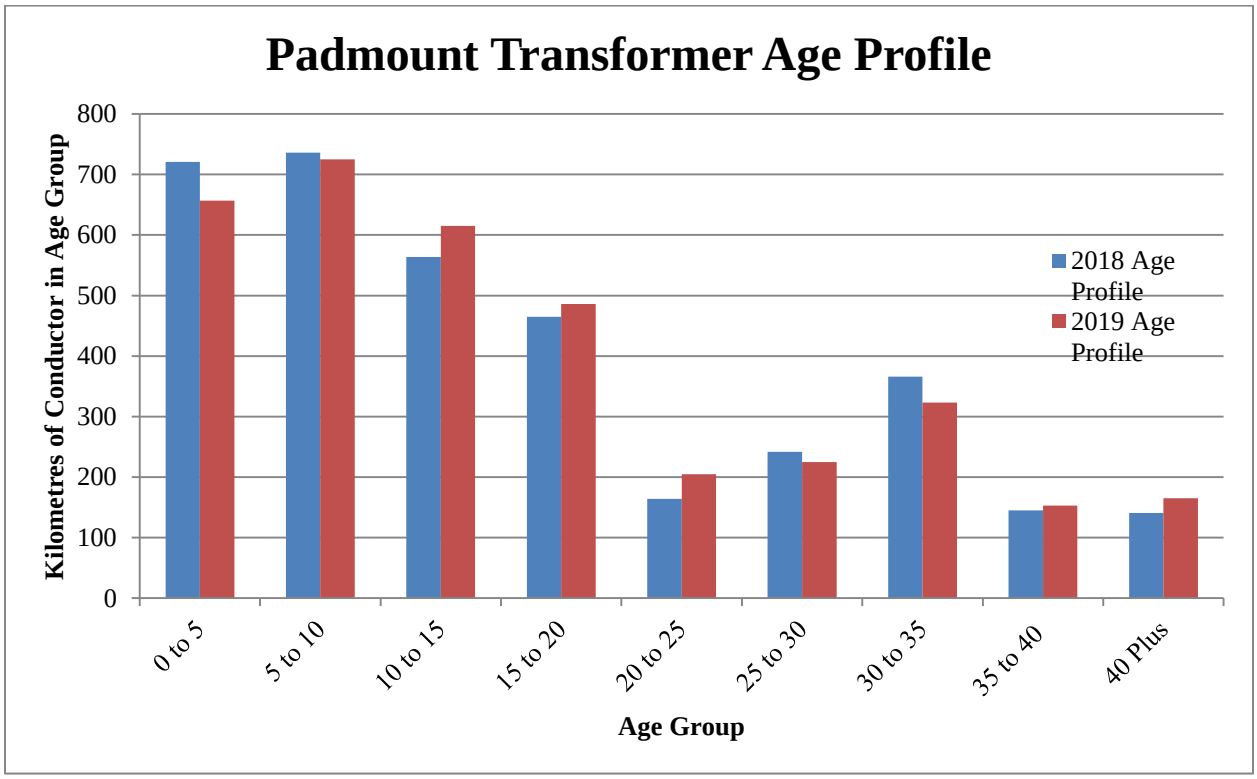
- Age Demographics – 8.1 percent of padmounts are beyond 35 years of service.

- Expected range of annual replacement – 93 to 120 units per year.

- Changes to age demographics – As a result of the proposed capital investments in Padmount Transformers during 2019, the age profile for this asset class will experience an approximately 0.9 percent increase in assets beyond 35 years of age.

- **Figure 99** below illustrates the overall change in asset age profile for Padmount Transformers between 2018 and 2019.

Figure 99: Padmount Transformer Age Profile



12.2 2019 Capital Spending by Justification Criteria

Items in the 2019 ACE Plan have been developed in accordance with the CEJC. Definitions of the various criteria referenced in **Figure 100** below are included in the CEJC.

Figure 100: Capital Expenditures by Justification Criteria

(Millions of dollars)

Justification Criteria	2019 Budget	Projects included for Approval	Routine Spend	Less than $250K	2018 ACE Items for Filing in late 2018	Items for Subsequent Submission	Carryover	Pt. Aconi
Distribution System*	$73.3	$14.7	$44.6	$0.4	$0.0	$1.1	$12.4	$0.0
Thermal	59.9	25.6	3.4	12.6	0.0	3.7	5.9	8.7
Work Support*	41.6	0.0	18.1	1.0	7.9	11.1	3.5	0.0
Hydro	18.1	7.9	1.8	0.4	0.0	3.8	4.1	0.0
Health and Safety	26.9	10.0	0.0	0.6	0.0	0.0	15.9	0.4
Transmission Plant	42.2	13.7	11.5	0.2	0.0	0.8	16.0	0.0
Environmental	11.9	4.0	0.7	0.2	0.0	0.0	6.9	0.0
Metering Equipment	59.2	0.0	2.1	0.0	0.0	0.0	57.1	0.0
System Design	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Facilities/Land and Right-of-Way	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Total	**$333.2**	**$75.9**	**$82.3**	**$15.5**	**$7.9**	**$20.5**	**$121.9**	**$9.2**

*Note: Details of justification sub-criteria are provided on the following section.
Note: Figures presented may include $0.1M in rounding differences on some line items.

12.3 2019 Capital Spending by Justification Sub-Criteria

Figure 101 below provides 2019 capital spending by justification sub-criteria.

Figure 101: **2019 Capital Spending by Justification Sub-Criteria**

(Millions of dollars)

Justification Sub-Criteria	2019 Budget	Projects included for Approval	Routine Spend	Less than $250K	2018 ACE Items for Filing in late 2018	Items for Subsequent Submission	Carryover
Distribution System							
Requirement to Serve	$37.9	$0.3	$36.6	$0.0	$0.0	$1.0	$0.0
Pole Strength	7.3	0.3	7.0	0.0	0.0	0.0	0.0
Joint Use Agreement	0.5	0.0	0.5	0.0	0.0	0.0	0.0
Deteriorated Conductor	3.3	0.9	0.0	0.2	0.0	0.0	2.2
Equipment Replacement	15.3	5.3	0.0	0.2	0.0	0.1	9.7
Outage Performance	8.6	7.9	0.6	0.0	0.0	0.0	0.0
Overloaded Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Capacity	0.4	0.0	0.0	0.0	0.0	0.0	0.4
Other Distribution System	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Total	**$73.3**	**$14.7**	**$44.6**	**$0.4**	**$0.0**	**$1.1**	**$12.4**
Work Support Facilities							
Buildings	$5.1	$0.0	$4.0	$0.1	$0.0	$1.1	$0.0
Furniture & Fixtures	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Telecommunications	4.1	0.0	0.9	0.4	0.0	1.2	1.6
Computers / IT	20.3	0.0	2.7	0.3	7.9	7.7	1.7
Tools & Equipment	1.6	0.0	1.6	0.0	0.0	0.0	0.0

Justification Sub-Criteria	2019 Budget	Projects included for Approval	Routine Spend	Less than $250K	2018 ACE Items for Filing in late 2018	Items for Subsequent Submission	Carryover
Vehicles	8.8	0.0	8.8	0.0	0.0	0.0	0.0
Equipment Replacement	1.0	0.0	0.0	0.0	0.0	1.0	0.0
Other General Plant	0.6	0.0	0.0	0.3	0.0	0.1	0.2
Total	**$41.6**	**$0.0**	**$18.1**	**$1.0**	**$7.9**	**$11.1**	**$3.5**

Note: Figures presented may include $0.1M in rounding differences on some line items

12.4 Quick Reference Sheet

2019 AFUDC Rate for Capital 6.89%

In the Board's Weighted Average Cost of Capital (WACC) and Allowance for Funds Used During Construction (AFUDC) Order dated December 21, 2017, the UARB directed NS Power as follows:

1. The WACC and AFUDC rates are established at 6.89%, effective January 1, 2018;
2. NSPI is directed to continue to file an application for approval annually, no later than November 30, of the calculation of WACC/AFUDC, unless there is a general rate application in the same year, using the principles outlined in the Board's Decision in M07215.[32]

Consistent with the Board's Order, the 2019 ACE Plan projects use the Board's approved AFUDC rate of 6.89 percent.

An application for the calculation of the updated WACC/AFUDC rate will be filed by the Company by November 30, 2018.

[32] WACC/AFUDC Application, UARB Order, M07215, January 12, 2017, page 2.

2019 O/H Rates

Generation		Customer Operations		Shared Services	
PP Regular	26.13%	Regular	77.56%	IT	42.98%
Hydro	39.29%	Contract	21.48%		
Contract	12.02%	Vehicle	43.45%		

12.5 2019 Depreciation Rates

Figure 102: 2018 Depreciation Rates

	2019
Steam Production Plant	
Lingan	
Lingan 1-2	4.12%
Lingan 3-4	2.28%
Lingan – Common	4.48%
Total Lingan	3.35%
Point Aconi 1	2.27%
Point Tupper	
Point Tupper 1 (Common)	3.97%
Point Tupper 2	2.82%
Total Point Tupper	2.89%
Trenton	
Trenton 5	3.10%
Trenton 6	2.34%
Trenton – Common	0.47%
Total Trenton	2.47%
Tufts Cove	
Tufts Cove 1	4.24%
Tufts Cove 2	3.68%
Tufts Cove 3	2.33%
Tufts Cove – Common	3.44%
Total Tufts Cove	3.27%
Port Hawkesbury Biomass	2.50%
Point Tupper Marine Terminal	4.06%
International Coal Pier	2.60%
General	2.82%
Total Steam Production Plant	**2.82%**

2019 Annual Capital Expenditure Plan
CONFIDENTIAL (Attachments Only)

	2019
Hydro Production Plant	
Avon	3.02%
Bear River	1.80%
Black River	2.04%
Dickie Brook	3.16%
Fall River	1.82%
Harmony	4.55%
Lequille System	2.33%
Roseway	2.29%
Mersey	2.00%
St. Margaret's	2.85%
Sheet Harbour	3.38%
Tusket	2.64%
Wreck Cove System	1.67%
Annapolis Tidal	2.32%
General	2.10%
Total Hydro Production	**2.10%**

1

	2019
Other Production - Combustion Turbines	
Burnside	2.40%
Tusket	6.42%
Victoria Junction	3.17%
Tufts Cove Unit 4	2.55%
Tufts Cove Unit 5	2.77%
Tufts Cove Unit 6	3.03%
Wind Turbines	
Pre 2009 Wind	5.52%
Post 2009 Wind	4.0%
Transmission Plant	
Land Rights - Easements	1.26%
Station Equipment	2.14%
Towers & Fixtures	1.26%
Poles & Fixtures	4.32%
Overhead Conductors & Devices	1.96%
Underground Conduit	1.53%
Underground Conductors & Devices	2.61%
Roads, Trails & Bridges	1.74%
Total Transmission Plant	**2.35%**

2

2019 Annual Capital Expenditure Plan
CONFIDENTIAL (Attachments Only)

	2019
Distribution Plant	
Land Rights - Easements, Surveys & Clearing	1.56%
Structures & Improvements	5.31%
Station Equipment	1.28%
SCADA Equipment	9.68%
Remote Monitoring Equipment	10.32%
Station Equipment – Miscellaneous	12.49%
Poles, Towers & Fixtures	3.79%
Overhead Conductors & Devices	3.33%
Underground Conduit	1.51%
Underground Conductors & Devices	3.17%
Line Transformers	4.09%
Services	5.33%
Meters	6.87%
Street Lighting & Signal Systems	5.33%
Total Distribution Plant	**3.89%**

1

	2019
General Plant	
Land Rights - General Plant	1.93%
Structures & improvements	2.85%
Office Furniture & Equipment	9.26%
Office Furniture & Equip - Comp Hardware	20.00%
Office Furniture & Equip - Comp Software	10.00%
Transportation Equipment	9.55%
Stores Equipment	14.97%
Communication Equipment	4.38%
Communication Equipment - SCADA Eq	1.33%
Remote Monitoring Equipment	10.27%
Miscellaneous Equipment	5.02%
Roads, Bridges & Trails (Kelly Rock)	2.58%
Mining Equipment (Kelly Rock)	2.92%
Total General Plant	**8.16%**

2

CI Number: 50518

Title: HYD Ruth Falls Main Dam Refurbishment

Start Date: 2017/02
In-Service Date: 2020/12
Final Cost Date: 2021/06
Function: Hydro
Forecast Amount: $7,244,422

DESCRIPTION:

The project involves the refurbishment of the Ruth Falls Main Dam water-retaining structures (embankments, spillway and sluiceway) to address the structural and freeboard deficiencies and to meet the requirements of the Canadian Dam Association (CDA) Guidelines.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Hydro projects includes "work completed on the same generating unit and dam structures, but not necessarily the same asset."

- 2017 CI 47551 Sheet Harbour Controls Upgrade $1,749,212
- 2018 CI 49943 Ruth Falls Facility Refurbishment $1,234,931

Depreciation Class: Hydraulic Projection Plant - Sheet Harbour

Estimated Life of the Asset: 50 Years

JUSTIFICATION:

Justification Criteria: Health & Safety

Why do this project?

The most recent Dam Safety Review (Kleinschmidt, 2015) concluded that the Ruth Falls Main Dam embankment was in satisfactory condition with the exception of the upstream riprap slope protection, which was observed to be inconsistent along the length of the dam. The embankment structures did not meet the slope stability requirements for all loading conditions. The spillway and sluiceway were in fair physical condition. The spillway structure did not meet the stability requirements for the Inflow Design Flood (IDF) loading condition. The sluiceway structure did not meet the stability requirements for the IDF and earthquake loading conditions.

The Ruth Falls Main Dam was classified as High hazard as part of the 2015 Flood Study/Dam Safety Review. According to the CDA Guidelines, the dam is classified as a High hazard dam due to a permanent Population At Risk (PAR) and a potential loss of life being 10 or fewer in the event of a dam breach. For a High classification dam, the IDF is 1/3 between the 1/1,000-year flood and Probable Maximum Flood (PMF).

Why do this project now?

This project was identified as a high priority within NS Power's dam safety risk prioritization due to the deteriorated condition of the concrete structures and the stability deficiencies in the embankment and spillway/sluiceway structures. The refurbishment of the dam is scheduled to begin in 2019 with the procurement of the rubber dams and vertical lift gates, followed by construction in 2020.

Why do this project this way?

Preliminary engineering was undertaken to determine the most economic option to correct the deficiencies in the Ruth Falls Main Dam water-retaining structures (embankments, spillway and sluiceway) and to complete the designs required to meet the requirements of the CDA Guidelines.

As part of the conceptual design phase, five alternatives were reviewed for the refurbishment of the dam, spillway and sluiceway. The following options were reviewed:

Option 1 - Replace the existing stoplogs with screw stem vertical lift gates;

Option 2 - Replace approximately half of the existing stoplog bays and construct an uncontrolled overflow section, and replace the remaining stoplog bays with screw stem vertical lift gates;

Option 3 - Replace approximately half of the existing stoplog bays and construct an uncontrolled labyrinth spillway, and replace the remaining stoplog bays with screw stem vertical lift gates;

Option 4 - Remove the stoplog bays and install rubber dams on the left portion of the dam, looking downstream, and install an uncontrolled overflow spillway and rubber dams on the right portion of the dam. The existing sluiceway gates, located in the central portion of the dam, would be replaced with screw stem vertical lift gates;

Option 5 - Construct a new dam immediately downstream of the existing dam. This design option would be similar to Option 4 with an uncontrolled overflow section, deep sluice gates, and a rubber dam section.

For each of the vertical lift gate options, the options/costs for screw stem operators and hydraulic operators were considered. The screw stem operators were the more economic option.

Option 4 was selected as the preferred alternative as it is the most cost effective. Option 4 is approximately $500,000 less costly than the next closest option. Option 4 also meets the operational requirements to manage system and the design flows.

CI Number 50518 - HYD Ruth Falls Main Dam Refurbishment **Project Number** 50518

Parent CI Number : 1359 Ruth Falls Common Property

Asset Location : 1359 **Budget Version** 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	2800 - HGP - Dams & Spillways	6,936,921
Retirements	2800 - HGP - Dams & Spillways	307,500
	Total Cost:	7,244,422
	Original Cost:	466,958

Capital Project Detailed Estimate

Location: Hydro
CI#: 50518
Title: HYD Ruth Falls Main Dam Refurbishment
Execution Year: 2019/2020

Item	Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
	Regular Labour						
	Hydro River Staff - Construction	days	12	365	4,225		
	Environmental Staff	days	14	405	5,738		
	Project Support Staff	days	402	405	162,701		
	Administrative Support	days	7	365	2,629		
				Sub-Total	175,293		
	Term Labour						
	Project Support Term	days	4.8	365	1,759		
				Sub-Total	1,759		
	Travel Expenses						
	Travel	lot	1	17,074	17,074		
				Sub-Total	17,074		
	Materials						
	Gates and Actuators	lot	1	[redacted]		Attachment 1 Items 7 and 8	
	Rubber Dam (Supply)	lot	1			Attachment 1 Item 10	
	Compressor and Blower House	lot	1			Attachment 1 Item 10	
				Sub-Total	[redacted]		
	Contracts						
	Contractor Costs (Mob/Demob, etc.)	lot	1	[redacted]		Attachment 1 Item 1	
	Environmental Controls	lot	1			Attachment 1 Item 2	
	Site Access (Roads, Laydown Areas, Staging, etc.)	lot	1			Attachment 1 Item 3	
	Crane Rental and Operation	lot	1			Attachment 1 Items 4 and 5	
	Dewatering - Cofferdam & Pumping	lot	1			Attachment 1 Item 6	
	Gate Installation & Modification to Gate Guides	lot	1			Attachment 1 Item 9	
	Concrete Installation	lot	1			Attachment 1 Item 12	
	Rubber Dam Installation	lot	1			Attachment 1 Item 10	
	Access Walkway (approx. 200')	lot	1			Attachment 1 Item 13	
	Access Bridge (approx. 200')	lot	1			Attachment 1 Item 14	
	Embankment Dam Upgrades (Riprap, etc.)	lot	1			Attachment 1 Item 16	
	Construction Supervision	lot	1				
	Methodology and Costing for Archaeological Screening	lot	1				
	Engineering Support	lot	1				
	Concrete Removal & Disposal	lot	1			Attachment 1 Items 11 and 15	
				Sub-Total	[redacted]		
	Consulting						
	Design	lot	1	142,281	142,281		
	RFP Support	lot	1	6,000	6,000		
	Construction Support	lot	1	17,500	17,500		
	Environmental	lot	1	4,780	4,780		
	KMKNO Capacity Payments	lot	1	76,002	76,002		
				Sub-Total	246,562		
	Meals and Entertainment						
	Meals	lot	1	5,378	5,378		
				Sub-Total	5,378		
	Other Goods and Services						
	Contingency	%	15%	$ 5,618,097	$ 842,715		
				Sub-Total	$ 842,715		
	Interest Capitalized						
	AFUDC				$ 272,553		
				Sub-Total	$ 272,553		
	Administrative Overhead						
	Labour AO				$ 72,085		
	Contractor AO				$ 438,973		
				Sub-Total	$ 511,058		
				Sub-Total (no AO, AFUDC)	$ 6,460,811		
				TOTAL (AO, AFUDC included)	$ 7,244,422		
	Original Cost				$ 466,958		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

PREFERRED OPTION
RUTH FALLS SPILLWAY MODIFICATIONS
OPTION 4 - 50' STRAIGHT UNCONTROLLED SPILLWAY, 350' RUBBER DAM, AND 3 SCREW STEM VERTICAL GATES

CONCEPTUAL LEVEL - OPINION OF PROBABLE CONSTRUCTION COST
(COST IN $2018)

ITEM#	ITEM DESCRIPTION	QUANTITY		UNIT PRICE ($)	UNIT TOTAL ($)	TOTAL ($)
A. GENERAL						
1	MOBILIZATION/DEMOBILIZATION	1	LS			$
2	ENVIRONMENTAL PROTECTION DEVICES	1	LS			
3	SITE ACCESS					
	GENERAL	1	LS			
	STAGING/SCAFFOLDING	1	LS			
	TEMPORARY ACCESS ROAD ACROSS LEFT SECTION	1985	YD^3			
	BARGE U/S OF DAM FOR RIVER RIGHT RUBBER DAM WORK	1	MONTH			
4	CRANE MOBILIZATION AND DEMOBILIZATION	1	LS			
5	CRANE RENTAL AND OPERATION	3	MONTH	/MONTH		
B. DEWATERING						
6	DEWATER/WATER MANAGEMENT	24	WK	/WK		
C. NEW SPILLWAY GATES						
7	NEW GATES (SLUICEWAYS)	3	EA	/EA		
8	GATE ACTUATORS (SLUICEWAYS)	3	EA	/EA		
9	NEW GATE INSTALLATION	3	EA	/EA		
D. SPILLWAY MODIFICATIONS						
10	RUBBER DAM					
	SUPPLY OF RUBBER DAM	350	LF	/LF		
	CONSTRUCTION (SEE TAKEOFFS FOR DETAILS)	350	LF	/LF		
	COMPRESSOR AND BLOWER HOUSE	1	LS			
11	CONCRETE DEMOLITION					
	STOPLOG BAYS TO UNCONTROLLED SPILLWAY	90	CY	/CY		
	STOPLOG BAYS TO RUBBER DAM	590	CY	/CY		
	RESURFACING OF SLUICEWAYS	150	CY	/CY		
12	NEW CONCRETE					
	STOPLOG BAYS TO UNCONTROLLED SPILLWAY	320	CY	/CY		
	STOPLOG BAYS TO RUBBER DAM	330	CY	/CY		
	RESURFACING OF SLUICEWAYS	150	CY	/CY		
	NEW PIERS (6 TOTAL)	85	CY	/CY		
13	NEW ACCESS WALKWAY (APPROXIMATELY 200')					
	NEW STEEL (from sluiceway to right abutment)	86,000	LB	/LB		
	WALKWAY MOUNTING CONNECTIONS	1	LS			
14	NEW ACCESS BRIDGE (200')					
	NEW STEEL	120,000	LB	/LB		
	CONNECTIONS	1	LS			
	INTERMIDIATE CONCRETE PIERS	25	CY	/CY		
15	CONCRETE DISPOSAL (INCLUDING LOADING & HAULING)	1	LS			
16	LEFT & RIGHT CONCRETE/EARTHEN ABUTMENTS	1	LS			
	TOTAL OF DIRECT CONSTRUCTION COSTS					

NOTES:
1. OWNER ADMINISTRATION AND OVERHEAD COSTS ARE NOT INCLUDED.
2. COSTS FOR HYDRO UNIT DOWN TIME RESULTING FROM INSTALLATION ARE NOT INCLUDED.
3. COSTS ASSOCIATED WITH SALES TAX, HST, AND INSURANCE ARE NOT INCLUDED.
4. MOBILIZATION AND DEMOBILIZATION COSTS WERE BASED ON CLIENT PROVIDED INFORMATION.
5. INDIRECT COSTS SUCH AS PERMITTING, ENGINEERING, AND CONSTRUCTION MONITORING WERE NOT INCLUDED BASED ON CLIENT PREFERENCE.

BY: KLEINSCHMIDT ASSOCIATES

CI Number: C0002539

Title: HYD Bridge Remediation 2019

Start Date: 2017/12
In-Service Date: 2020/11
Final Cost Date: 2021/05
Function: Hydro
Forecast Amount: $6,843,686

DESCRIPTION:

This project includes the remediation of five NS Power bridges which provide access to four different hydro facilities. There were seven bridges identified through the bridge inspection work that required upgrades. The two bridges not included in this project were completed under CI 48396 - HYD Bridge Remediation 2017 (Avon Bridge #2 and Avon Bridge #3).

The Lower Lake Falls Bridge #14 and the Big Falls Access Bridge #15, constructed in 1930, involve the rehabilitation of the Steel Deck Truss Bridge on the main access road to the Lower Lake Falls Powerhouse, Control Structures and Substation and the Big Falls Powerhouse, Control Structures and Substation off River Road in Milton. The superstructure for the existing bridges will be replaced with a new superstructure, and upgrades to the concrete supports will also be completed.

The Nictaux Canal Dam Access Bridge #16, constructed in the mid 1950s, involves the rehabilitation of the Steel Truss/Timer Deck Bridge on the main access to the Nictaux Canal Spill Structure off Highway 10 in Nictaux. The superstructure for the existing bridge will be replaced with a new superstructure, and upgrades to the concrete abutments will also be completed.

The Lequille Canal Access Bridge #13, constructed in 1967, involves the rehabilitation of the Steel Truss Timber Deck Bridge on the main access road to the Lequille Canal Spill Structure off Highway 101 near Bear River. The superstructure for the existing bridge will be replaced with a new superstructure, and upgrades to the concrete abutments will also be completed.

The Lower Lake Falls Access Bridges #37, constructed in 1930, involves the rehabilitation of a Steel Girder Timbers Deck on the main access road to the Lower Lake Falls Powerhouse, Spill Structure and Substation off of River Road in Milton. The superstructure for the existing bridge will be replaced with a new superstructure, and upgrades to the concrete abutments and supports will also be completed.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Hydro projects includes "work completed on the same generating unit and dam structures, but not necessarily the same asset."

- 2017 CI 48396 HYD Bridge Remediation 2017 $677,591

Depreciation Class: Hydraulic Production Plant – Mersey
Hydraulic Production Plant – Total Lequille System

Estimated Life of the Asset: 50 Years

JUSTIFICATION:

Justification Criteria: Hydro, Wind and Biomass

Why do this project?

NS Power completed initial bridge inspections through a third party engineering firm in 2016, through which a list of bridge deficiencies was identified. These structural deficiencies are considered to be safety risks and have led to load restrictions on bridge structures. Five bridges are being upgraded under this project to restore operational capacity to the structures.

The Lower Lake Falls Access Bridge #14 and the Big Falls Bridge #15 are identical bridges built in the same time frame (in 1930). Inspection (please refer to Attachment 1) indicated that the load rating at the time of construction could not be determined. The inspection report recommended a load rating of 11 tonnes on the structure post evaluation; therefore, some line trucks, heavy equipment delivery trucks or dump trucks could not safely access the Powerhouse, Spill Structure, or Substation. In addition, the bridges must be able to support planned construction upgrades of the Powerhouse, Control Structure and Substation which require a construction Volvo A40 Articulated truck. The bridge was originally installed with a steel deck truss and timber deck on a cast-in-place concrete foundation. The rehabilitation of the steel girder timbers deck on the main access road to the Lower Lake Falls and Big Falls Powerhouses, Control Structures and Substations, is required to allow for unrestricted safe access for all modes of maintenance, operation and construction.

The Lequille Canal Access Bridge #13 inspection (please refer to Attachment 2) indicated that the load rating at the time of construction could not be determined. The inspection report recommended a load restriction of 3 tonnes on the structure post evaluation, therefore, dump trucks, or boom trucks could not safely access the canal or Spill Structures. In addition, the bridge must be able to support planned construction upgrades of the embankment dams which require heavy construction CAT 740 articulated vehicles. The bridge was installed in the mid 1960s and has a riveted steel truss configuration. The rehabilitation of the steel truss timber deck bridge on the main access road to the Lequille spill structure and embankment dams is required to allow for unrestricted safe access for all modes of maintenance and operation.

The Nictaux Canal Access Bridge #16 inspection (please refer to Attachment 3) indicated that the load rating at the time of construction could not be determined. The inspection report recommended a load restriction of 8 tonnes on the structure post evaluation; therefore, some line trucks, heavy equipment delivery trucks or dump trucks could not safely access the dam or spill structure. The bridge was installed in the mid 1950s and has a riveted steel truss configuration. The rehabilitation of the steel truss timber deck bridge on the main access road to the Nictaux spill structure and embankment dams is required to allow for unrestricted safe access for all modes of maintenance and operation.

The Lower Lake Falls Access Bridge #37 inspection (please refer to Attachment 4) indicated that the load rating at the time of construction could not be determined. The inspection report recommended a load restriction of 13 tonnes on the structure post evaluation; therefore, heavy delivery and maintenance vehicles and vehicles required for the redevelopment of the Mersey system could not safely access the site. The bridge was installed in 1930 with a riveted steel truss configuration. The rehabilitation of the bridge is required to allow for unrestricted safe access for all modes of maintenance, operation and construction.

Why do this project now?

As noted in Attachments 1 through 4, these bridges were evaluated in 2016/2017 by a third party consultant and found to require remediation to increase load capacity and address corresponding safety concerns. The deteriorated state of the bridges and corresponding load restrictions are also restricting operational access to Hydro plants and water control structures.

The project needs to be completed in 2019 to lift the operational restrictions and restore capacity for operational service vehicles and equipment loading. Failure to execute this project in 2019 increases the risk of delays in getting heavy vehicle and equipment to site in the event of equipment failure and slows response times.

Why do this project this way?

As noted in Attachment 5 through 8, a second third party consultant was contracted to confirm the initial assessment, provide options for remediation and identify cost estimates to carry out the corrective action.

In general, the same options were reviewed:

1. Replacement – This option removes the current bridge superstructure in one piece for disposal on land. The superstructure will be replaced with a prefabricated bridge superstructure, minimizing bridge access down time and site work required. This option is less expensive than refurbishment for all but one of the bridges. This option has a shorter execution schedule and a decreased risk of unexpected scope increases that are inherent in trying to rehabilitate an aged structure where the initial material information is unknown. In addition to this, the future maintenance costs for the replacement option are estimated to be lower than the refurbishment alternative. As a result, this was chosen as the preferred option for all five bridges.

2. Refurbishment – This option considered refurbishing the bridge structure in place. Refurbishing bridges in place requires an increased amount of work to be carried out over water for a longer period than would be required under the replacement option. The bridge structures contain lead paint and replacement of rivets and corroded structural members over water increases the risk of contamination to the water shed. Mitigation measures required to minimize the risk would increase the cost and timelines of the project and this was therefore not chosen as the preferred option.

CI Number : C0002539 - HYD Bridge Remediation 2019 **Project Number** C0002539

Parent CI Number : -

Asset Location : 1370 - 1370 Hydro General **Budget Version** 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	2600 - HGP - Rds,Trls.Brdgs.	6,169,079
Retirements	2600 - HGP - Rds,Trls.Brdgs.	674,606
	Total Cost:	6,843,686
	Original Cost:	410,656

Capital Project Detailed Estimate

Location: Hydro
CI#: C0002539
Title: HYD Bridge Remediation 2019
Execution Year: 2019/2020

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Hydro River Staff	PD	32	$ 365	$ 11,673		
Engineering Staff	PD	430	$ 405	$ 174,220		
Environmental Staff	PD	75	$ 332	$ 24,805		
Project Support Staff	PD	71	$ 405	$ 28,777		
Preliminary Engineering Labour	PD	17	$ 365	$ 6,201		
			Sub-Total	$ 245,677		48396
Travel Expenses						
Site Visits	Lot	1	$ 48,100	$ 48,100		
			Sub-Total	$ 48,100		
Materials						
C8004 - LLF Bridge 14	Lot	1	[redacted]		Attachment 5, Page 15, Item 6	
C8004 - LLF Bridge 37	Lot	1			Attachment 8, Page 14, Item 6	
C8202 - Big Falls Bridge 15	Lot	1			Attachment 5, Page 17, Item 6	
C8203 - Nictaux Bridge 16	Lot	1			Attachment 6, Page 12, Item 6	
C8205 - LEQ Canal Bridge 13	Lot	1			Attachment 7, Page 12, Item 6	
			Sub-Total	[redacted]		
Contracts						
C8004 - LLF Bridge 14	Lot	1	[redacted]		Attachment 5, Page 15, Items 1-5, 7-17	
C8004 - LLF Bridge 37	Lot	1			Attachment 8, Page 14, Items 1-5, 7-14	
C8202 - Big Falls Bridge 15	Lot	1			Attachment 5, Page 17, Items 1-5, 7-17	
C8203 - Nictaux Bridge 16	Lot	1			Attachment 6, Page 12, Items 1-5, 7-17	
C8205 - LEQ Canal Bridge 13	Lot	1			Attachment 7, Page 12, Items 1-5, 7-17	
Geotech, Surveys, Concrete Services	Lot	1				
Temp Access Road	Lot	1	$ 200,000	$ 200,000		
Construction Management	Lot	1	$ 95,000	$ 95,000		
			Sub-Total	[redacted]		
Consulting						
C8004 - LLF Bridge 14	Lot	1	$ 78,467	$ 78,467		
C8004 - LLF Bridge 37	Lot	1	$ 78,467	$ 78,467		
C8202 - Big Falls Bridge 15	Lot	1	$ 120,000	$ 120,000		
C8203 - Nictaux Bridge 16	Lot	1	$ 144,510	$ 144,510		
C8205 - LEQ Canal Bridge 13	Lot	1	$ 103,920	$ 103,920		
Mi'kmaq	Lot	1	$ 75,000	$ 75,000		
Inspection	Lot	1	$ 28,900	$ 28,900		
			Sub-Total	$ 629,264		
Meals						
Site Visits	Lot	1	$ 3,316	$ 3,316		
			Sub-Total	$ 3,316		
Other Goods and Services						
Construction Contingency	%	10%	[redacted]			
Steel Tariff Contingency	%	25%				
			Sub-Total	$ 1,007,718		
Interest Capitalized						
AFUDC				$ 164,647		
			Sub-Total	$ 164,647		
Administrative Overhead						
Labour AO				$ 97,264		
Contractor AO				$ 263,700		
			Sub-Total	$ 360,964		
			Sub-Total (no AO, AFUDC)	$ 6,318,075		
			TOTAL (AO, AFUDC included)	$ 6,843,686		
Original Cost				$ 410,656		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

EASTPOINT

Date: **February 28, 2017**

Project: **480081 - NSPI - Hydro and Wind Level 2 - Bridge Inspections and Load Ratings**

Bridge No. 14 – Mersey – Lower Lake Falls and Bridge No. 15 Mersey – Lower lake Falls

Subject: **Bridge No.14 and 15 - Load Rating Summary and Associated Recommendations**

1. **Summary of Structures:**

   Bridges No. 14 and No. 15 are identical bridges as shown in drawings H-003W1-1-131-00-004 and H-003W1-1-131-00-005 (provided by NSPI).

   6-span steel deck truss with timber deck on cast in place concrete foundation.

   Based on drawing, original construction was around 1930.

   Based on drawings, on 1992: foundation rehabilitation (100% partial depth repair), trusses re-painted, deck and rail replacement.

   - Bridge Length = 245'-3" = 74.75m
   - Overall width = 4.99m
   - Transverse Stringers (timber) = 3x12" @ 15" c/c (drawings) - @18-20" (inspection).
   - Transverse stringers supported on a built-up top chord.
   - Built-up Top chord I-web PL 10"x3/8"; Flanges 2L 3 ½" x 2 ½" x 5/16"
   - Overall depth of truss = 4'- 6 ¾" = 1.39m
   - Trusses 2.44 m c/c

2. **Current conditions for main elements** (inspection date – November 8, 2016)**:**

   Bridge No. 14:

   a. Stringers (fair):
      i. 3" x 12" stringers, 18-20" on centers
      ii. Stringer weathered on ends but 5-10 years left.
   b. Steel trusses: (good):
      i. Minor bend in lower chord
      ii. Top chord reinforced with 7/8" or 1/2" plate, full width plus 1" on side; lower inside chord reinforced at panel points.
      iii. Second span from north had reinforcement on both bottom chord, full length
   c. Abutments (good):
      i. Both abutments in good condition
      ii. Some debris on bearing seat.
   d. Piers (good):
      i. Minor cracking on upper left shaft, no problems
      ii. Footings are abraded, but not causing any problems
      iii. No signs of undermining (based on drawings footings are ~10' below surface).

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Bridge No. 15:

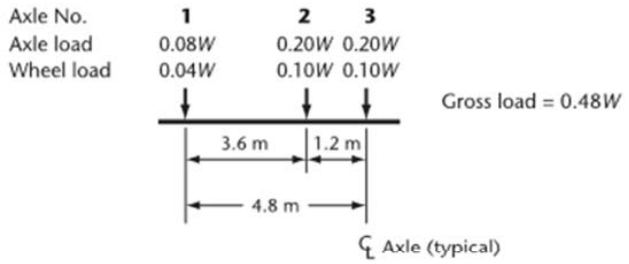
a. Stringers (good):
    i. Replaced 2 years ago (according to NSP employee)
    ii. Minor split
    iii. Nails tight
b. Steel trusses (good):
    i. Some wear of corrosion and paint loss, but minor
    ii. Not reinforced like upper lake bridge
    iii. A few dings/bends in lower chord-minor
    iv. Bearings good
    v. Lower chord has been repaired at abutments
    vi. Portions of top chord have been repaired in some places
    vii. Welds are not typically desirable on structures of this vintage and should be carefully monitored for cracking
c. Abutments (good):
    i. Good condition
    ii. Pattern cracks
    iii. Dirt on bearing surfaces
d. Piers (good):
    i. Good condition
    ii. Typical minor cracking
    iii. No signs of undermining but water was murky.

3. Overview of load rating:

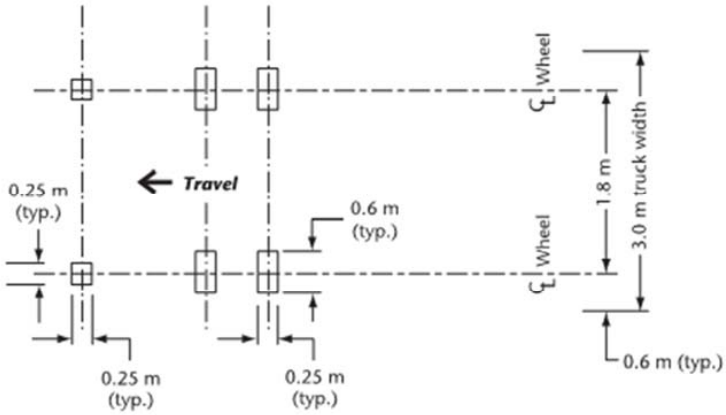
a. Assumptions:
    i. Top chord (built-up section) was assumed as W200x42 for S-Frame model (W section with closest properties to the built-up section). The rest of the evaluation was done considering the built-up properties (manual calculations).
    ii. Yield strength for steel members was taken as Fy = 210 MPa, considering bridge construction as shown in the drawings 1928 (Table 14.1 S6-14).
    i. 1.0kpa was assumed for snow and ice (live load) along with vehicular live loads.
    ii. Timber material was assumed as Hem-fir No.1.
    iii. Current reinforcements on top chords of Bridge No.14 were ignored.
    iv. Due to the unknowns related to geotechnical conditions and qualities of concrete and reinforcement, it has been assumed for the load rating analysis that the substructure will not be the limiting component of the bridge.
b. The bridge was evaluated following the Section 14 "Evaluation" of "Canadian Highway Bridge Design Code S6-14".
c. Evaluation parameters:
    i. Inspection level INSP2: Inspection to the satisfaction of the evaluator.
    ii. System Behavior – S2: element failure probably will not lead to total collapse.
    iii. Element Behavior – E3: gradual failure.
d. The resistance forces of existing elements were calculated according to S6-14, Section 9 "Wood Structures", and Section 10 "Steel Structures".
e. Loads:
    i. Live Loads: an Evaluation level 3 (single-unit vehicle) was considered as the most likely type of vehicle that would use the bridge. Also, for bridges with short spans,

the shorter truck causes larger forces on the bridge because all of its weight is concentrated in a smaller area.

Evaluation level 3 - CL3-625; GVW= 300kN=30.6 tonnes, according to Figure 14.3 S6-14.



CL3-W Truck Load (elevation)



CL3-W Truck Load (plan)

ii. A moving load generation was done in order to find the worst scenarios.
iii. Dead Loads: effect of dead loads and self-weights were considered.
iv. Seismic or wind loads were not considered.

f. The bridge was modeled in S-Frame program version 11.00.22.
g. Two supporting conditions were analyzed: Trusses pinned at both ends, and Trusses pinned at one end and released (roller) at the other end.
h. Worst scenarios were considered in order to calculate the Ultimate Limit States
i. The Ultimate Limit State was calculated for each main member as follows (S6-14 Section 14.15.1):

$$F = \frac{UR - \sum \alpha_D D - \sum \alpha_A A}{\alpha_L L(1+I)}$$

Where:
U: Resistance factor; R: Resistance; D: Dead loads; A: Additional loads; L: Live Load; I: Dynamic Load Allowance; α: Load factors.

j. Results:
   i. Live load capacity factors:

   i. Stringers (3"x12"):
      a. $F_{flexure}$=1.03 > 1 OK
      b. F_{shear} =0.50 < 1 Needs posting – Limiting

   ii. Top Chord (built-up section d=10"):
      a. $F_{flexure}$= 0.83 < 1 Needs posting
      b. F_{shear}=0.96 < 1 Needs posting
      c. F_{comp}=0.72 < 1 Needs posting
      d. $F_{beam-col}$=0.50 < 1 Needs posting – limiting

   iii. Bottom Chord (2L127x89x7.9):
      a. F_{comp}=1.02>1 OK
      b. $F_{tension}$=0.76 < 1 Needs posting

   iv. Vertical members - end of span (2L89x64x7.9):
      a. F_{comp}=0.82 < 1 Needs posting

   v. Vertical members – mid of span (2L64x64x7.9):
      a. F_{comp}=0.53 < 1 Needs posting

   vi. Main bracings – end of span (2L102x76x7.9):
      a. $F_{tension}$=0.69 < 1 Needs posting

   vii. 2nd span bracings (2L76x64x7.9):
      a. $F_{tension}$=0.74 < 1 Needs posting
      b. F_{Comp} = 0.99 <1 Needs posting

   viii. 3rd span (middle) bracings (1L64x64x7.9):
      a. $F_{tension}$= 1.19 > 1 OK

4. Summary:

The Posted Factor (P) was obtained from Figure 14.8 (S6-14) "Posting loads for gross vehicle weight", based on the maximum Live Load Capacity factor (F) and considering an Evaluation Level 3 (Live load CL3-625). In this regard, the Posted Weight Limit (Pt) was obtained multiplying the Posted Factor (P) by the Gross load (W) according to S6-14 clause14.17.3.1.

P=0.019 (from Figure 14.8 - S6-14; Evaluation Level 3 and F=0.50)
Pt=PxW=0.019x625=**11.8tonnes** (according to S6-14 clause14.17.3.1)

Resulting Load Rating for F=0.50 and Evaluation Level 3 is:

Pt=**11 tonnes**

5. Recommendations:

a. The bridge should be posted for a maximum load of **11 tonnes.**
Posting shall show the gross vehicle weight in tonnes. The following figure is a suggested sign that can be erected (as per S6-14 C14.17.3):

(a) Single posting

b. Although the stringers, top chord and vertical members are limiting the load capacity of the bridge (F=0.50 and F=0.53), a re-design of such elements could result in an upgrade to the load rating to approximately 16 tonnes.

6. References:

a. CSA S6-14 - Canadian Highway Bridge Design Code
b. Bridge 14 and 15 inspection reports dated November 6, 2016
c. Existing drawings H-003W1-1-131-00-004 and H-003W1-1-131-00-005 (provided by NSPI)

Analysis prepared by: Daniel Yanez, B.Eng. (Civil).

Reviewed by: Stephen Morrison, P.Eng.

Checked by: Colin Fisher, P.Eng.

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Level Two Structure Inspection Form

Site Number: BRIDGE 14

Inventory Data:

Structure Name	LOWER LAKE FALLS		
Main Hwy/Road #	On ☐ Under ☐	Crossing Type:	☐ Navig. Water ☐ Non-Navig. Water ☐ Rail ☐ Road ☐ Ped. ☐ Other
Hwy/Road Name	UNKNOWN		
Structure Location	ACCESS ROAD TO LOWER LAKE FALLS POWER HOUSE		
Northing	4891477.67 m N	Easting	341919.79 m E
Owner(s)	NSPI	Heritage Designation:	☐ Not Cons. ☐ Cons./not App. ☐ List/not Desig. ☐ Desig./not List ☐ Desig. & List
Region	MERSEY	Road Class:	☐ Freeway ☐ Arterial ☐ Collector ☐ Local
District		Posted Speed	NONE
		No. of Lanes	1
		AADT	N/A
		% Trucks	N/A
		Inspection Route Sequence	N/A
Structure Type	STEEL DECK TRUSS	Interchange Number	N/A
Total Deck Length	74.0 (m)	Interchange Structure Number	N/A
Overall Str. Width	4.9 (m)	Min. Vertical Clearance	N/A (m)
Total Deck Area	327 (sq.m)	Special Routes:	☐ Transit ☐ Truck ☐ School ☐ Bicycle
Roadway Width	4.5 (m)	Detour Length Around Bridge	NONE (km)
Skew Angle	0 (Degrees)	Direction of Structure	N-S
No. of Spans Span	6	Fill on Structure	0 (m)
Lengths	6 @ 12.5 (m)		

Historical Data:

Year Built	APPROX 1930	Year of Last Major Rehab.	1992
Last Inspection	UNKNOWN	Last Evaluation	UNKNOWN
Last Enhanced Inspection	UNKNOWN	Current Load Limit	/ / (tonnes)
Enhanced Access Equipment (ladder, boat, lift, etc.)	NOT REQUIRED	Load Limit By-Law #	N/A
Last Underwater Inspection	NOT REQUIRED	By-Law Expiry Date	N/A
Last Condition Survey	UNKNOWN		

Rehab History: (Date/description) BASED ON DRAWING ORIGINAL CONSTRUCTION AROUND 1930.

1992: FOUNDATION REHABILITATION (100% PARTIAL DEPTH REPAIR), TRUSSES RE-PAINTED, DECK AND RAIL REPLACEMENT...BASED ON RECORD DRAWINGS.

Page 1

Digitally signed by Colin Fisher, P.Eng.
Date: 2017.01.26 13:34:57-04'00'

Level Two Structure Iuspection Form **Site Number:**

Field Inspection Information:			
Date of Inspection:	NOV 8 2016	Type of Inspection:	Visual ✓ Enhanced
Inspector:	COLIN FISHER P.ENG. & STEVE MORRISON P.ENG - EASTPOINT		
Others in Party:	SCOTT HANCOCK P.ENG. - NSPI		
Access Equipment Used:	NONE		
Weather:	CLEAR/SUNNY		
Temperature:	0C		

Additional Investigations Required:	Priority		
	None	Normal	Urgent
Material Condition Survey			
Detailed Deck Condition Survey:	X		
Non-destructive Delamination Survey of Asphalt-Covered Deck:	X		
Concrete Substructure Condition Survey:	X		
Detailed Coating Condition Survey:	X		
Detailed Timber Investigation	X		
Post-Tensioned Strand Investigation	X		
Underwater Investigation:	X		
Fatigue Investigation:	X		
Seismic Investigation:	X		
Structure Evaluation:	X		
Monitoring			
Monitoring of Deformations, Settlements and Movements:	X		
Monitoring Crack Widths:	X		
Investigation Notes: WELDS SHOULD BE CLOSELY MONITORED THROUGH THE LIFE OF THIS STRUCTURE FOR SIGNS OF CRACKING AT THE INTERFACE WITH BASE METAL			

Overall Structure Notes:	
Recommended Work on Structure:	None Minor Rehab. ✓ Major Rehab. Replace
Timing of Recommended Work:	1 to 5 years ✓ 6 to 10 years
Overall Comments:	REPLACE DECK AND PAINT RAIL, TOUCH UP TRUSS, CLEAN OFF BEARING SEATS
Date of Next Inspection:	2019

Suspected Performance Deficiencies

01 Load carrying capacity
02 Excessive deformations (deflections & rotations)
03 Continuing settlement
04 Continuing movements
05 Seized bearings
06 Bearing not uniformly loaded/unstable
07 Jammed expansion joint
08 Pedestrian/vehicular hazard
09 Rough riding surface
10 Surface ponding
11 Deck drainage
12 Slippery surfaces
13 Flooding/channel blockage
14 Undermining of foundation
15 Unstable embankments
16 Other

Maintenance Needs

01 Lift and Swing Bridge Maintenance
02 Bridge Cleaning
03 Bridge Handrail Maintenance
04 Painting Steel Bridge Structures
05 Bridge Deck Joint Repair
06 Bridge Bearing Maintenance
07 Repair to Structural Steel
08 Repair of Bridge Concrete
09 Repair of Bridge Timber
10 Bailey bridges - Maintenance
11 Animal/Pest Control
12 Bridge Surface Repair
13 Erosion Control at Bridges
14 Concrete Sealing
15 Rout and Seal
16 Bridge Deck Drainage
17 Scaling (Loose Concrete or ACR Steel)
18 Other

Element Data

Element Group:	ROADWAY	**Length:**	N/A
Element Name:	APPROACHES	**Width:**	6M
Location:		**Height:**	N/A
Material:	GRAVEL	**Count:**	
Element Type:		**Total Quantity:**	
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	☐
Protection System:			**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure** 100%		
Comments:	CLOSE TO INTERSECTION ON NORTH END. SMALL POTHOLES AT END APPROACH CAUSING A BIT OF DECK WEAR. NO LOAD POSTING.		
Recommended Work:	☐ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years	**Maintenauce Needs:**	☐ Urgent ☐ 1 year ☐ 2 year
POST LOAD LIMIT.			

Element Group:	SUPERSTRUCTURE	**Length:**	FULL LENGTH OF BRIDGE
Element Name:	RAILING SYSTEM	**Width:**	
Location:		**Height:**	1.05M FROM DECK
Material:	SINLGE LAYER FLEXBEAM	**Count:**	
Element Type:		**Total Quantity:**	
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	☐
Protection System:	PAINT AND GALV		**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure**		
Comments:	APPROACH RAILS NOT CONNECTED TO BRIDGE RAIL. RAIL SYSTEM CONSISTENT WITH 1992 DRAWING. DISCONTINUES AT EACH SPAN. NOT AN IDEAL DETAIL, BUT NECESSARY FOR EXP/CONSTRUCTION. GALVANIZING AND PAINT FAILING FOR APPROX 50% OF RAIL		
Recommended Work:	☑ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years	**Maintenance Needs:**	☐ Urgent ☐ 1 year ☐ 2 year
REVIEW EXP JOINT AND APPROACH RAIL DETAILS AND CONSIDER IMPROVING.			

Element Group:	SUPERSTRUCTURE	**Length:**	FULL LENGTH
Element Name:	DECK	**Width:**	4.0m
Location:		**Height:**	
Material:	4" x 8" TT WEARING	**Count:**	
Element Type:		**Total Quantity:**	
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	☐
Protection System:	TREATTED TIMBER		**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure**		
Comments:	4" x 8" WEARING SURFACE, 3" x 4" SUBDECK - WEARING SURFACE 25% WORN. NAIL HEADS STICKING OUT OF SURFACE. 3" x 12" STRINGERS, 18-20" O/C - STRINGER WEATHERED ON ENDS BUT 3-5 YRS LEFT.		
Recommended Work:	☐ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years	**Maintenance Needs:**	☐ Urgent ☐ 1 year ☐ 2 year
REPLACE DECK 50% OF WEARING SURFACE IN 2-3 YEARS OR CONSIDER COMPLETE DECK REPLACEMENT, INCLUDING STRINGER TO GET 20-25 YRS			

Element Data

Element Group:	SUBSTRUCTURE	**Length:**	
Element Name:	ABUTMENTS	**Width:**	
Location:		**Height:**	SEE DRAWINGS
Material:	CIP CONCRETE	**Count:**	
Element Type:		**Total Quantity:**	
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	☐
Protection System:			**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure** N& S 100%		
Comments: BOTH ABUTMENTS IN GOOD CONDITION, SOME DEBRIS ON BEARING SEAT.			
Recommended Work: ☐ Rehab ☐ Replace ☑ 1-5 years ☐ 6-10 years CLEAN OFF BEARING SEATS.		**Maintenance Needs:** ☐ Urgent ☐ 1 year ☐ 2 year	

Element Group:	SUBSTRUCTURE	**Length:**	
Element Name:	PIERS	**Width:**	
Location:		**Height:**	SEE DRAWINGS
Material:	CIP CONCRETE	**Count:**	
Element Type:		**Total Quantity:**	
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	☐
Protection System:			**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure** 100%		
Comments: MINOR CRACKING ON UPPER LEFT SHAFT, NO PROBLEMS; FOOTINGS ARE ABRADED, BUT NOT CAUSING ANY PROBLEMS; NO SIGNS OF UNDERMINING (BASED ON DRAWINGS FOOTINGS ARE ~10' BELOW SURFACE).			
Recommended Work: ☐ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years		**Maintenance Needs:** NONE ☐ Urgent ☐ 1 year ☐ 2 year	

Element Group:	SUPERSTRUCTURE	**Length:**	12.5m
Element Name:	STEEL TRUSSES	**Width:**	2.43m
Location:		**Height:**	1.39m
Material:	STEEL ANGLES	**Count:**	
Element Type:		**Total Quantity:**	
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	☐
Protection System:	PAINT		**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure** 100%		
Comments: MINOR BEND IN BOTTOM CHORD, E SIDE OF S TRUSS; TOP CHORD REINFORCED WITH 7/8" OR 1/2" PLATE, PROBABLY FULL WIDTH PLUS 1" ON SIDE, WELDED FULL LENGTH ON BOTH SIDES (FIELD WELDING IS NOT NORMALLY ADVISED ON STRUCTURES OF THIS VINTAGE); LOWER INSIDE CHORD REINF AT PANEL POINTS; 2ND SPAN FROM N HAD REINF ON BOTH BOTTOM CHORDS, FULL LENGTH;			
Recommended Work: ☐ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years CUT TREES DOWN UNDER BRIDGE; MONITOR WELDS		**Maintenance Needs:** ☐ Urgent ☐ 1 year ☐ 2 year	

EASTPOINT

FILE: 480081
DESCRIPTION: B14 MERSEY LOWER LAKE FALLS
NOV 8 2016

Photo 1 -LOOKING N ACROSS BRIDGE

Photo 2 - SW APPROACH RAIL

EASTPOINT

FILE: 480081
DESCRIPTION: B14 MERSEY LOWER LAKE FALLS
NOV 8 2016

Photo 3 - MINOR BEND IN SE BRIDGE RAIL

Photo 4 - TYPICAL "EXPANSION JOINT"

EASTPOINT

FILE: 480081
DESCRIPTION: B14 MERSEY LOWER LAKE FALLS
NOV 8 2016

Photo 5 - TYPICAL DECK - WORN AND PUNKY IN SPOTS. LOOSE SPIKES.

Photo 6 -LOOKING DOWN AT TYPICAL STRINGER AT PIER

EASTPOINT

FILE: 480081
DESCRIPTION: B14 MERSEY LOWER LAKE FALLS
NOV 8 2016

Photo 7 -LOOKING N FROM BRIDGE

Photo 8 - LOOKING AT N ABUTMENT

EASTPOINT

FILE: 480081
DESCRIPTION: B14 MERSEY LOWER LAKE FALLS
NOV 8 2016

Photo 9 - LOOKING AT MINOR BEND IN E BOT CHORD OF N TRUSS

Photo 10 - TYPICAL UNDERSIDE OF DECK AND TRUSS. NOTE REINF TOP CHORD

EASTPOINT

FILE: 480081
DESCRIPTION: B14 MERSEY LOWER LAKE FALLS
NOV 8 2016

Photo 11 - PLATE WELDED ON BOTTOM CHORD IN SEVERAL LOCATIONS

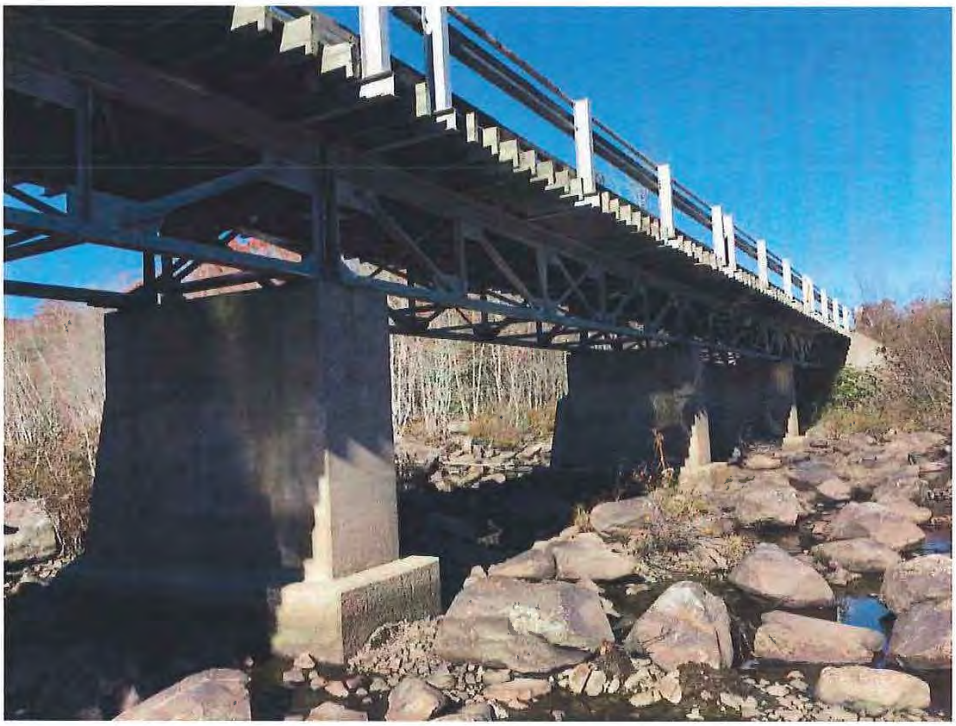

Photo 12 - N SIDE OF TRUSS AND PIERS

Level Two Structure Inspectiou Forn **Site Number:** BRIDGE 15

Inventory Data:					
Structure Name	BIG FALLS				
Main Hwy/Road #	N/A	On ✓ Under ☐	Crossing Type:	✓ Navig. Water ☐ Non-Navig. Water ☐ Rail ☐ Road ☐ Ped. ☐ Other	
Hwy/Road Name	MERSEY FISH HATCHERY RD				
Structure Location					
Northing	4889044.73 m N		Easting	345622.93 m E	
Owner(s)	NSPI		Heritage Designation:	☐ Not Cons. ☐ Cons./not App. ☐ List/not Desig. ☐ Desig./not List ☐ Desig. & List	
Region	MERSEY - BIG FALLS		Road Class:	☐ Freeway ☐ Arterial ☐ Collector ☑ Local	
District	MERSEY		Posted Speed	NONE	No. of Lanes: 1
			AADT	N/A	% Trucks: N/A
			Inspection Route Sequence	N/A	
Structure Type	STEEL DECK TRUSS		Interchange Number	N/A	
Total Deck Length	74.0 (m)		Interchange Structure Number	N/A	
Overall Str. Width	4.9 (m)		Min. Vertical Clearance	N/A (m)	
Total Deck Area	327 (sq.m)		Special Routes:	☐ Transit ☐ Truck ☐ School ☐ Bicycle	
Roadway Width	4.5 (m)		Detour Length Around Bridge	NONE (km)	
Skew Angle	0 (Degrees)		Direction of Structure	E-W	
No. of Spans Span	6		Fill on Structure	0 (m)	
Lengths	6 @ 12.5 (m)				

Historical Data:			
Year Built	1930 (EST)	Year of Last Major Rehab.	1992
Last Inspection	UNKNOWN	Last Evaluation	UNKNOWN
Last Enhanced Inspection	UNKNOWN	Current Load Limit	UNKNOWN (tonnes)
Enhanced Access Equipment (ladder, boat, lift, etc.)	BOAT	Load Limit By-Law #	N/A
Last Underwater Inspection	UNKNOWN	By-Law Expiry Date	N/A
Last Condition Survey	UNKNOWN		

Rehab History: (Date/description) BASED ON DRAWING ORIGINAL CONSTRUCTION AROUND 1930.

1992: FOUNDATION REHABILITATION (100% PARTIAL DEPTH REPAIR), TRUSSES RE-PAINTED, DECK AND RAIL REPLACEMENT...BASED ON RECORD DRAWINGS.

Page 1

Digitally signed by Colin Fisher, P.Eng.
Date: 2017.01.26 10:30:10-04'00'

Level Two Structure Inspection Form **Site Number:**

Field Inspection Information:			
Date of Inspection:	NOV 8 2016	Type of Inspection:	Visual ✓ Enhanced
Inspector:	COLIN FISHER, P.ENG. & STEVE MORRISON, P.ENG. - EASTPOINT		
Others in Party:	SCOTT HANCOCK, P.ENG. - NSPI		
Access Equipment Used:	BOAT		
Weather:	CLEAR/SUNNY		
Temperature:	0C		

Additional Investigations Required:	Priority		
	None	Normal	Urgent
Material Condition Survey			
Detailed Deck Condition Survey:	X		
Non-destructive Delamination Survey of Asphalt-Covered Deck:	X		
Concrete Substructure Condition Survey:	X		
Detailed Coating Condition Survey:	X		
Detailed Timber Investigation	X		
Post-Tensioned Strand Investigation	X		
Underwater Investigation:	X		
Fatigue Investigation:	X		
Seismic Investigation:	X		
Structure Evaluation:	X		
Monitoring			
Monitoring of Deformations, Settlements and Movements:	X		
Monitoring Crack Widths:	X		
Investigation Notes:			

Overall Structure Notes:	
Recommended Work on Structure:	None Minor Rehab. ✓ Major Rehab. Replace
Timing of Recommended Work:	1 to 5 years ✓ 6 to 10 years
Overall Comments:	IN GOOD CONDITION FOR ITS AGE. TOUCH-UP PAINTING OF TRUSSES AND RAIL COULD EXTEND LIFE SIGNIFICANTLY.
Date of Next Inspection:	2019

Suspected Performance Deficiencies

01	Load carrying capacity	06	Bearing not uniformly loaded/unstable	12	Slippery surfaces
02	Excessive deformations (deflections & rotations)	07	Jammed expansion joint	13	Flooding/channel blockage
03	Continuing settlement	08	Pedestrian/vehicular hazard	14	Undermining of foundation
04	Continuing movements	09	Rough riding surface	15	Unstable embankments
05	Seized bearings	10	Surface ponding	16	Other
		11	Deck drainage		

Maintenance Needs

01	Lift and Swing Bridge Maintenance	07	Repair to Structural Steel	13	Erosion Control at Bridges
02	Bridge Cleaning	08	Repair of Bridge Concrete	14	Concrete Sealing
03	Bridge Handrail Maintenance	09	Repair of Bridge Timber	15	Rout and Seal
04	Painting Steel Bridge Structures	10	Bailey bridges - Maintenance	16	Bridge Deck Drainage
05	Bridge Deck Joint Repair	11	Animal/Pest Control	17	Scaling (Loose Concrete or ACR Steel)
06	Bridge Bearing Maintenance	12	Bridge Surface Repair	18	Other

Element Data

Element Group:	SUPERSTRUCTURE	**Length:**	12.5M
Element Name:	STEEL TRUSSES	**Width:**	12.43M
Location:		**Height:**	1.39M
Material:	STEEL	**Count:**	6
Element Type:		**Total Quantity:**	6
Environment:	Benign / Moderate / Severe	**Limited Inspection**	☐ BY BOAT
Protection System:	PAINTED		**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure** YES		
Comments:	SOME WEAR OF CORROSION AND PAINT LOSS, BUT MINOR; NOT REINFORCED LIKE UPPER LAKE BRIDGE; A FEW DINGS/BENDS IN LOWER CHORD-MINOR; BEARINGS GOOD, LOWER CHORD HAS BEEN REPAIRED AT ABUTMENTS; PORTIONS OF TOP CHORD HAVE BEEN RAPAIRED IN SOME PLACES; WELDS ARE NOT TYPICALLY DESIREABLE ON STRUCTURES OF THIS VINTAGE AND SHOULD BE CAREFULLY MONITORED FOR CRACKING		
Recommended Work:	☐ Rehab ☐ Replace ☑ 1-5 years ☐ 6-10 years TOUCH-UP PAINT, REMOVE BRUSH FROM UNDER BRIDGE	**Maintenance Needs:**	NONE ☐ Urgent ☐ 1 year ☐ 2 year

Element Group:	SUBSTRUCTURE	**Length:**	
Element Name:	PIERS	**Width:**	
Location:		**Height:**	
Material:	CIP CONCRETE	**Count:**	
Element Type:		**Total Quantity:**	
Environment:	Benign / Moderate / Severe	**Limited Inspection**	✓ MURKY WATER
Protection System:	NONE		**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure** 100%		
Comments:	GOOD CONDITION - TYPICAL MINOR CRACKING; NO SIGNS OF UNDERMINING BUT WATER WAS MURKY.		
Recommended Work:	☐ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years	**Maintenance Needs:**	NONE ☐ Urgent ☐ 1 year ☐ 2 year

Element Group:	SUBSTRUCTURE	**Length:**	SEE 1992 DRAWINGS
Element Name:	ABUTMENTS	**Width:**	
Location:		**Height:**	
Material:	CIP CONCRETE	**Count:**	
Element Type:		**Total Quantity:**	
Environment:	Benign / Moderate / Severe	**Limited Inspection**	☐
Protection System:	NONE		**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure** 100%		
Comments:	GOOD CONDITION; PATTERN CRACKS; DIRT ON BEARING SURFACES;		
Recommended Work:	☐ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years	**Maintenance Needs:**	NONE ☐ Urgent ☐ 1 year ☐ 2 year

Element Data

Element Group:	APPROACH			**Length:**	N/A	
Element Name:	ROADWAY			**Width:**	5-6M	
Location:				**Height:**	N/A	
Material:	GRAVEL			**Count:**		
Element Type:				**Total Quantity:**		
Environment:	**Benign / Moderate / Severe**			**Limited Inspection** ☐		
Protection System:	N/A					**Perform. Deficiencies**
Condition Data:	**Excellent**	**Good**	**Fair**	**Serious**	**Imminent Failure**	
		YES				
Comments: POT HOLE AT ENT., GAP BETWEEN RAIL AND BRIDGE APPROX 2.5M						
Recommended Work: ☐ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years				**Maintenance Needs:**	NONE	
				☐ Urgent ☐ 1 year ☐ 2 year		

Element Group:	SUPERSTRUCTURE			**Length:**	FULL LENGTH	
Element Name:	RAILING SYSTEM			**Width:**		
Location:	E/S			**Height:**	1060 ABOVE DECK	
Material:	GALV FLEX BEAM AND HSS			**Count:**		
Element Type:				**Total Quantity:**		
Environment:	**Benign / Moderate / Severe**			**Limited Inspection** ☐		
Protection System:	GALV AND PAINT					**Perform. Deficiencies**
Condition Data:	**Excellent**	**Good**	**Fair**	**Serious**	**Imminent Failure**	
		75%	25%			
Comments: SAME DETAILS AS REHAB DRAWINGS. GAPS IN RAIL AT TRUSSES. MINOR WAVES AND DIPS IN RAIL. MINOR PAINT DETERIORATION APPROX 25% OF SURFACE AREA						
Recommended Work: ☐ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years				**Maintenance Needs:**		
				☐ Urgent ☐ 1 year ☐ 2 year		
REPAINT POSTS						

Element Group:	DECK			**Length:**	FULL - RANDOM	
Element Name:	DECK AND SUB DECK			**Width:**	3920 BETWEEN CURBS	
Location:				**Height:**	4X8 ON 3X8 WITH 1" GAP	
Material:				**Count:**		
Element Type:				**Total Quantity:**		
Environment:	**Benign / Moderate / Severe**			**Limited Inspection** ☐		
Protection System:						**Perform. Deficiencies**
Condition Data:	**Excellent**	**Good**	**Fair**	**Serious**	**Imminent Failure**	
	100%					
Comments: REPLACED 2 YEARS AGO (ACCORDING TO NSP EMPLOYEE); MINOR SPLIT, NAILS TIGHT						
Recommended Work: ☐ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years				**Maintenance Needs:**	NONE	
				☐ Urgent ☐ 1 year ☐ 2 year		

EASTPOINT

FILE: 480081
DESCRIPTION: B15 MERSEY BIG FALLS
NOV 8, 2016

Photo 1 - LOOKING E ACROSS BRIDGE

Photo 2 - LOOKING W ACROSS BRIDGE

EASTPOINT

FILE: 480081
DESCRIPTION: B15 MERSEY BIG FALLS
NOV 8, 2016

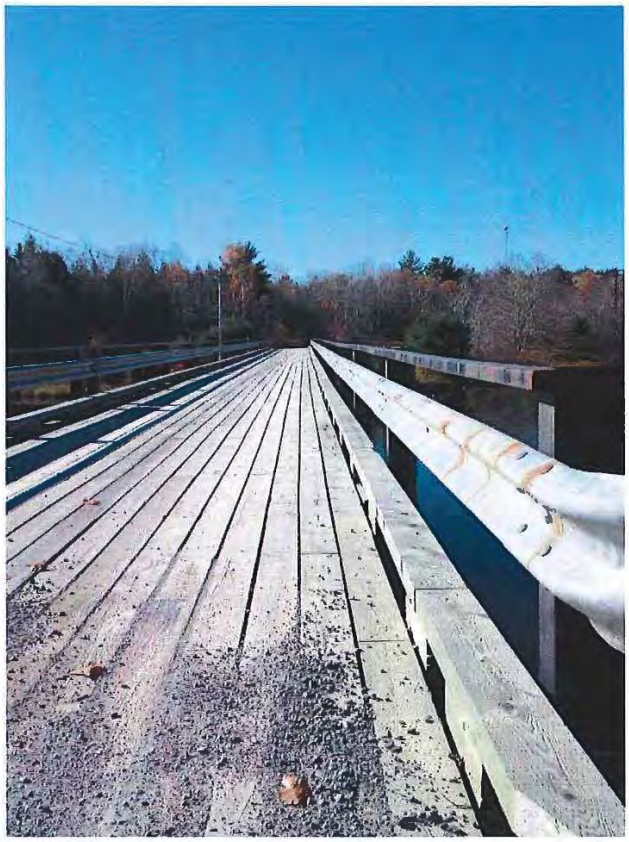

Photo 4 - LOOKING E ALONG S RAIL, TYPICAL

EASTPOINT

FILE: 480081
DESCRIPTION: B15 MERSEY BIG FALLS
NOV 8, 2016

Photo 5 - TYPICAL "EXPANSION JOIT" BETWEEN TRUSSES

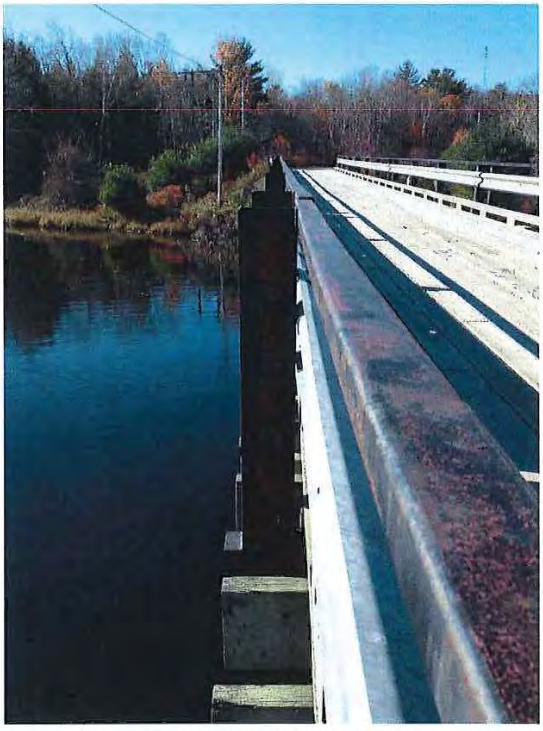

Photo 6 - TYPICAL RAIL POST

EASTPOINT

FILE: 480081
DESCRIPTION: B15 MERSEY BIG FALLS
NOV 8, 2016

Photo 7 -SE WINGWALL, SOME PATCHING

Photo 8 - W BREASTWALL/BEARING SEAT

EASTPOINT

FILE: 480081
DESCRIPTION: B15 MERSEY BIG FALLS
NOV 8, 2016

Photo 9 - PAST REPAIR TO BOT CHORD, SE BEARING ON E SPAN

Photo 10

EASTPOINT

FILE: 480081
DESCRIPTION: B15 MERSEY BIG FALLS
NOV 8, 2016

Photo 11

Photo 12 - TYPICAL UNDERSIDE OF DECK/STRINGERS

EASTPOINT

FILE: 480081
DESCRIPTION: B15 MERSEY BIG FALLS
NOV 8, 2016

Photo 13 - APPARENT REPAIR TO BOT FLANGE OF TOP CHORD, E SPAN

Photo 14 - xxxxxxxx

EASTPOINT

FILE: 480081
DESCRIPTION: B15 MERSEY BIG FALLS
NOV 8, 2016

Photo 15 - CORROSION AT PANEL POINT, TYPICAL AT E END OF E SPAN

Photo 16 - TYPICAL UNDERSIDE OF TRUSS

EASTPOINT

FILE: 480081
DESCRIPTION: B15 MERSEY BIG FALLS
NOV 8, 2016

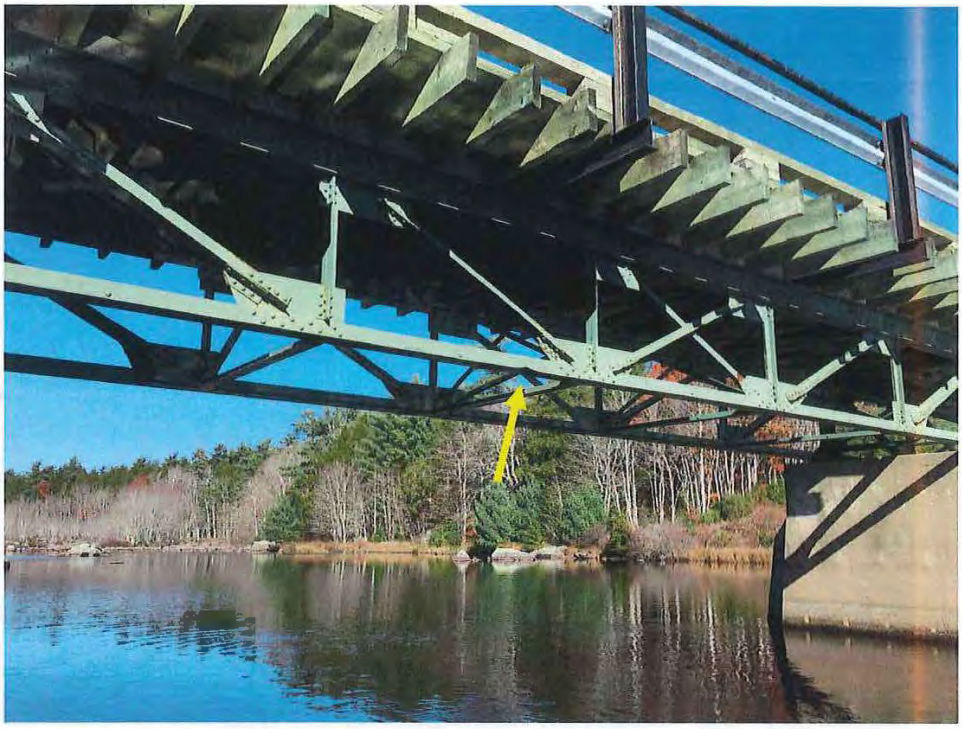

Photo 17 - MINOR DENT IN BOTTOM CHORD OF 3RD TRUSS FROM W

Photo 18 - TYPICAL PANEL POINT, MINOR CORROSION

EASTPOINT

FILE: 480081
DESCRIPTION: B15 MERSEY BIG FALLS
NOV 8, 2016

Photo 19 - W BREASTWALL/BEARING SEAT

Photo 20 - PAST REPAIR TO SW BOT CHORD AT BEARING

EASTPOINT

FILE: 480081
DESCRIPTION: B15 MERSEY BIG FALLS
NOV 8, 2016

Photo 21 - SW WINGWALL REPAIRED

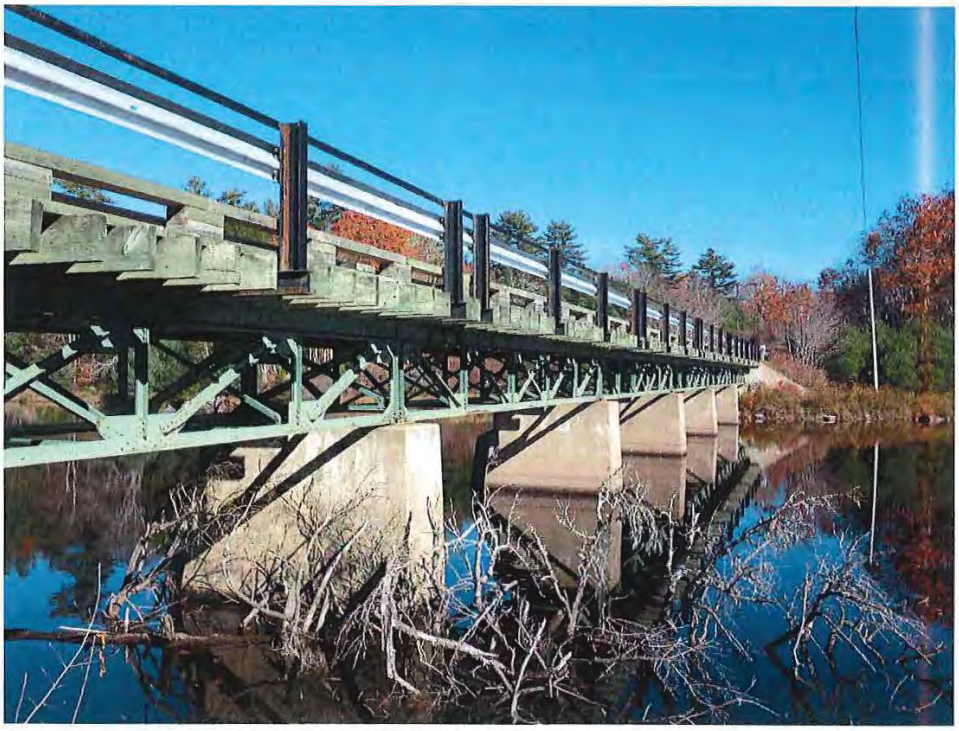

Photo 22 - LOOKING AT S SIDE OF BRIDGE

EASTPOINT

Date: June 29, 2018

Project: 480081 - NSPI - Hydro and Wind Level 2 - Bridge Inspections and Load Ratings

Bridge No. 13 - Lequille – Lequille Canal:

Subject: Bridge No.13 Load Rating Summary and Associated Recommendations

1. **Summary of Structure:**

   Single span steel deck truss with timber deck on cast in place concrete substructure.
   Complete superstructure drawings (dated 1967) were provided by NSPI.
   Bridge's Details:

   - Bridge Length = 9.93m
   - Overall width = 3.43m
   - Stringers (timber) = 4x12" @ 12" c/c
   - Steel Deck beam: I Beam: 9x4¼"
   - Truss depth = 1.32m
   - Trusses 2.44 m c/c

2. **Current conditions for main elements** (inspection date - June 9, 2016)**:**

   a. Stringers (95% good – 5% fair):
      i. 100(w)x300(h) Treated Timbers - generally good condition;
      ii. SE corner stringer split at SE guard post connection.
   b. Steel deck beams (good):
      i. Localized coating failure, but no major section loss;
      ii. Coating failure at heat affected zone at welded bearing stiffer locations over trusses.
   c. Truss girders (90% good – 10% fair):
      i. Riveted steel construction, generally good condition;
      ii. Localized coating failure/expansive pack rust at connections;
      iii. Severe section loss where bottom chords meet abutment (typ. 50% of horizontal leg of bottom chord angles);
      iv. East interior diaphragm cross brace bottom double angle steel member bent
   d. Deck sheathing (fair):
      i. Sheathing 75(h)x200(w) - fair condition, checking at ends;
      ii. 75mm thick wearing surface in wheel tracks - fair condition;
      iii. Limited inspection - viewed from top side, abutments, and stop log catwalk.
   e. Abutments (good):
      i. Abutments built integral with wingwalls and concrete stop log structure.
      ii. Good condition

3. **Overview of load rating:**
   a. Assumptions:
      i. Since there is not a W Shape with exact dimensions 9x4¼", the steel deck beams were assumed as W200x22, which is conservative (d=9"=228.6mm> W200x22 – d=206mm)
      ii. Yield strength for steel members was taken as Fy = 230 MPa, considering bridge construction as shown in the drawings 1967 (1933-1975 – Table 14.1 S6-14).
      iii. 1.0kpa was assumed for snow and ice (live load) along with vehicular live loads.
      iv. Timber material was assumed as Hem-fir No..1

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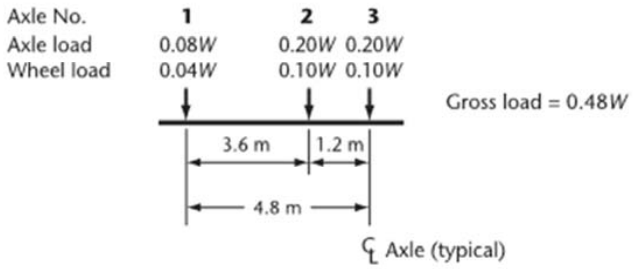
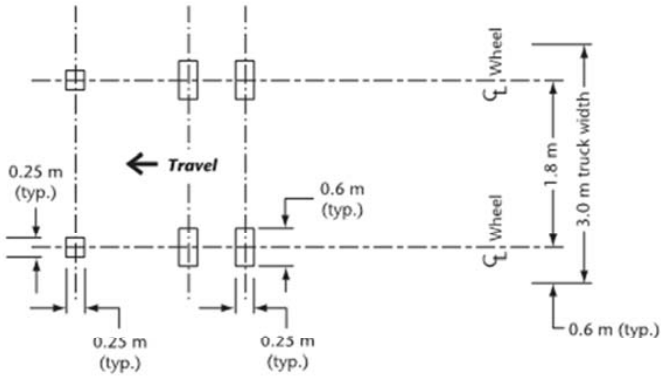
v. For bottom chord section loss, it was assumed an L section equivalent to 50% of the area of original section (Original 2L102x76x6.4; A=2180mm^2. For section loss evaluation was assumed 2L64x51x4.8; A=1040mm^2).
vi. Due to the unknowns related to geotechnical conditions and qualities of concrete and reinforcement, it has been assumed for the load rating analysis that the substructure will not be the limiting component of the bridge.

b. The bridge was evaluated following the Section 14 "Evaluation" of "Canadian Highway Bridge Design Code S6-14".
c. Evaluation parameters:
   i. Inspection level INSP2: Inspection to the satisfaction of the evaluator.
   ii. System Behavior – S2: element failure probably will not lead to total collapse.
   iii. Element Behavior – E3: gradual failure.
d. The resistance forces of existing elements were calculated according to S6-14, Section 9 "Wood Structures", and Section 10 "Steel Structures".
e. Loads:
   i. Live Loads: an Evaluation level 3 (single-unit vehicle) was considered as the most likely type of vehicle that would use the bridge. Also, for bridges with short spans, the shorter truck causes larger forces on the bridge because all of its weight is concentrated in a smaller area.

      Evaluation level 3 - CL3-625; GVW= 300kN=30.6 tonnes, according to Figure 14.3 S6-14.



CL3-W Truck Load (elevation)



CL3-W Truck Load (plan)

i. A moving load generation was done in order to find the worst scenarios.
ii. Dead Loads: effect of dead loads and self-weights were considered.
iii. Seismic or wind loads were not considered.

f. The bridge was modeled in S-Frame program version 11.00.22.
g. Two supporting conditions were analyzed: Trusses pinned at both ends, and Trusses pinned at one end and released (roller) at the other end, to simulate the possible performance of section loss of bottom chord.
h. Worst scenarios were considered in order to calculate the Ultimate Limit States
i. The Ultimate Limit State was calculated for each main member as follows (S6-14 Section 14.15.1):

$$F = \frac{UR - \sum \alpha_D D - \sum \alpha_A A}{\alpha_L L(1+I)}$$

Where:
U: Resistance factor; R: Resistance; D: Dead loads; A: Additional loads; L: Live Load; I: Dynamic Load Allowance; α: Load factors.

j. Results:
i. Live load capacity factors:

1. Stringers (4x12" @ 12" c/c):
   a. $F_{flexure}$=1.09 > 1 OK
   b. F_{shear} =0.82 < 1 Needs posting

2. Steel Deck beams:
   a. $F_{flexure}$= 0.53 < 1 Needs posting
   b. F_{shear}=0.92 < 1 Needs posting

3. Truss - Diagonal bracings (longitudinal bracings 2L64x64x6.4):
   a. $F_{tension}$=0.85 < 1 Needs posting
   b. F_{comp}=0.42 < 1 Needs posting – Limiting

4. Vertical Members:
   a. F_{comp}=0.67 < 1 Needs posting

5. Bottom Chord
   a. $F_{tension}$=1.22 > 1 OK
   b. F_{comp}=0.67 < 1 Needs posting

6. Top Chord
   a. F_{comp}=2.08 > 1 OK

7. Evaluation of section loss of bottom chord:
   a. F_{comp}= 0.38 < 1 Needs posting

4. Summary:

a. The Posted Factor (P) was obtained from Figure 14.8 (S6-14) "Posting loads for gross vehicle weight", based on the maximum Live Load Capacity factor (F) and considering an Evaluation Level 3 (Live load CL3-625). In this regard, the Posted Weight Limit (Pt) was obtained multiplying the Posted Factor (P) by the Gross load (W) according to S6-14 section14.17.3.1.

b. Resulting Load Rating for the bridge considering the section loss in the bottom chord, for F=0.38 and Evaluation Level 3:

P=0.014 (from Figure 14.8 - S6-14; Evaluation Level 3 and F=0.38)
Pt=PxW=0.014x625=**8.75tonnes** (according to S6-14 clause14.17.3.1)

Pt=8 tonnes

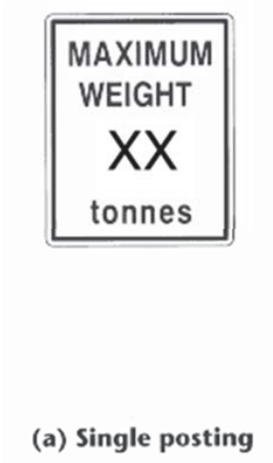
c. Resulting Load Rating for the bridge after repairing the section loss in the bottom chord, for F=0.42 and Evaluation Level 3:

P=0.015 (from Figure 14.8 - S6-14; Evaluation Level 3 and F=0.42)
Pt=PxW=0.015x625=**9.38 tonnes** (according to S6-14 clause14.17.3.1)

Pt=9 tonnes

5. Recommendations:

a. The bridge can be temporarily posted for a maximum load of **8 tonnes**
b. After the rehabilitation of bottom chords, the bridge can be posted for a maximum load of **9 tonnes**
Posting shall show the gross vehicle weight in tonnes. The following figure is a suggested sign that can be erected (as per S6-14 C14.17.3):



(a) Single posting

c. After the rehabilitation, the diagonal bracings will limit the load rating (with F=0.42). Consideration should be given to re-design or reinforce the diagonal bracings which will lead to an upgrade of the load rating up to approximately **12 tonnes**.

6. References:

a. CSA S6-14 - Canadian Highway Bridge Design Code
b. Bridge 13 inspection report dated June 09, 2016
c. Existing drawing No. H-012V1-1-131-00-011 dated Aug. 15, 1967 (provided by NSPI).

Analysis prepared by: Daniel Yanez, P.Eng

Reviewed by: Joshua Pidgeon, P.Eng.

Level Two Structure Inspection Form

Site Number: BRIDGE 13

Inventory Data:

Structure Name	BRIDGE 13 - LEQUILLE - LEQUILLE CANAL		
Main Hwy/Road #	NEAR HWY 101 On ☐ Under ☐	Crossing Type:	☐ Navig. Water ☑ Non-Navig. Water ☐ Rail ☐ Road ☐ Ped. ☐ Other
Hwy/Road Name	-		
Structure Location	OVER LEQUILLE CANAL		
Northing	-	Easting	-
Owner(s)	NOVA SCOTIA POWER	Heritage Designation:	☐ Not Cons. ☐ Cons./not App. ☐ List/not Desig. ☐ Desig./not List ☐ Desig. & List
Region	-	Road Class:	☐ Freeway ☐ Arterial ☐ Collector ☐ Local
District	-	Posted Speed	- No. of Lanes -
		AADT	- % Trucks -
		Inspection Route Sequence	-
Structure Type	STEEL TRUSS/TIMBER DECK	Interchange Number	-
Total Deck Length	9.93 (m)	Interchange Structure Number	-
Overall Str. Width	3.43 (m)	Min. Vertical Clearance	- (m)
Total Deck Area	34.06 (sq.m)	Special Routes:	☐ Transit ☐ Truck ☐ School ☐ Bicycle
Roadway Width	3.0 (m)	Detour Length Around Bridge	- (km)
Skew Angle	0 (SQUARE) (Degrees)	Direction of Structure	E/W
No. of Spans Span	1	Fill on Structure	- (m)
Lengths	9.93 (m)		

Historical Data:

Year Built	1967	Year of Last Major Rehab.	UNKNOWN
Last Inspection	UNKNOWN	Last Evaluation	UNKNOWN
Last Enhanced Inspection	UNKNOWN	Current Load Limit	UNKNOWN (tonnes)
Enhanced Access Equipment (ladder, boat, lift, etc.)	-	Load Limit By-Law #	UNKNOWN
Last Underwater Inspection	UNKNOWN	By-Law Expiry Date	UNKNOWN
Last Condition Survey	UNKNOWN		

Rehab History: (Date/description)

TREATED TIMBER DECK AND STINGERS APPEAR NEWER, NOT ORIGINAL TO 1967 CONSTRUCTION DRAWINGS

Level Two Structure Inspection Form

Site Number: BRIDGE 13

Field Inspection Information:			
Date of Inspection:	JUNE 9, 2016	Type of Inspection:	Visual ✓ Enhanced
Inspector:	EASTPOINT (MH/AK)		
Others in Party:	-		
Access Equipment Used:	-		
Weather:	SUNNY		
Temperature:	15 DEGREES		

Additional Investigations Required:	Priority		
	None	Normal	Urgent
Material Condition Survey			
Detailed Deck Condition Survey:	×		
Non-destructive Delamination Survey of Asphalt-Covered Deck:	×		
Concrete Substructure Condition Survey:	×		
Detailed Coating Condition Survey:	×		
Detailed Timber Investigation	×		
Post-Tensioned Strand Investigation	×		
Underwater Investigation:	×		
Fatigue Investigation:	×		
Seismic Investigation:	×		
Structure Evaluation:	×		
Monitoring			
Monitoring of Deformations, Settlements and Movements:	×		
Monitoring Crack Widths:	×		
Investigation Notes: NONE			

Overall Structure Notes:	
Recommended Work on Structure:	None ☐ Minor Rehab. ✓ Major Rehab. ☐ Replace ☐
Timing of Recommended Work:	1 to 5 years ✓ 6 to 10 years ☐
Overall Comments:	CLEAN DECK SURFACE; REPLACE SPLIT O/S STRINGER AT SE CORNER ; REPIAR STEEL TRUSSES AT BRGS (APPROX 50% SECTION LOSS AT HOR. LEGS OF BTM CHORDS, RIVETS AT THESE CONNECTIONS DETERIORATED). REPROFILE ABUTMENT SURFACE TO SHED WATER AWAY FROM BRGS: REINFORCE GUARD POST CONNECTIONS.
Date of Next Inspection:	RECOMMEND LIMIT GWV TO 3 TONNES UNTIL LOAD RATING DETERMINED

Suspected Performance Deficiencies

01 Load carrying capacity
02 Excessive deformations (deflections & rotations)
03 Continuing settlement
04 Continuing movements
05 Seized bearings
06 Bearing not uniformly loaded/unstable
07 Jammed expansion joint
08 Pedestrian/vehicular hazard
09 Rough riding surface
10 Surface ponding
11 Deck drainage
12 Slippery surfaces
13 Flooding/channel blockage
14 Undermining of foundation
15 Unstable embankments
16 Other

Maintenance Needs

01 Lift and Swing Bridge Maintenance
02 Bridge Cleaning
03 Bridge Handrail Maintenance
04 Painting Steel Bridge Structures
05 Bridge Deck Joint Repair
06 Bridge Bearing Maintenance
07 Repair to Structural Steel
08 Repair of Bridge Concrete
09 Repair of Bridge Timber
10 Bailey bridges - Maintenance
11 Animal/Pest Control
12 Bridge Surface Repair
13 Erosion Control at Bridges
14 Concrete Sealing
15 Rout and Seal
16 Bridge Deck Drainage
17 Scaling (Loose Concrete or ACR Steel)
18 Other

Element Data

Element Group:	SUPERSTRUCTURE	**Length:**	10.8 M CLEAR SPAN (APPROX)
Element Name:	DECK STRINGERS	**Width:**	0.10 M
Location:	LONGITUDINAL BETWEEN DECK BEAMS	**Height:**	0.30 M
Material:	TREATED TIMBER	**Count:**	12 X 3 SPANS
Element Type:	-	**Total Quantity:**	36
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	✓
Protection System:			**Perform. Deficiencies**

Condition Data:	**Excellent**	**Good**	**Fair**	**Serious**	**Imminent Failure**
		95%	5%		

Comments: 100(W)X300(H) TREATED TIMBERS - GENERALLY GOOD CONDITION;
12 PCS ACROSS AND DECK END SPANS, 13 PCS ON CENTER SPAN;
SE CORNER STRINGER SPLIT AT SE GUARD POST CONNECTION.

Recommended Work:	✓ Rehab ☐ Replace	**Maintenance Needs:**	
	✓ 1-5 years ☐ 6-10 years	☐ Urgent ☐ 1 year ☐ 2 year	
REPLACE SE DECK STRINGER AND ATTACH GUARD WITH IMPROVED DETAIL.			

Element Group:	SUPERSTRUCTURE	**Length:**	3.43 M
Element Name:	STEEL DECK BEAMS	**Width:**	0.114 M
Location:	TRANSVERSE BETWEEN GIRDER TRUSSES	**Height:**	0.228 M
Material:	STEEL	**Count:**	2
Element Type:	-	**Total Quantity:**	2
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	✓ VIEWED FR. ABUTMENTS/CATWALK
Protection System:			**Perform. Deficiencies**

Condition Data:	**Excellent**	**Good**	**Fair**	**Serious**	**Imminent Failure**
		100%			

Comments: LOCALIZED COATING FAILURE, BUT NO MAJOR SECTION LOSS;
COATING FAILURE AT HEAT AFFECTED ZONE AT WELDED BEARING STIFFNER LOCATIONS OVER TRUSSES.

Recommended Work:	✓ Rehab ☐ Replace	**Maintenance Needs:**	
	✓ 1-5 years ☐ 6-10 years	☐ Urgent ☐ 1 year ☐ 2 year	
RECOAT			

Element Group:	SUPERSTRUCTURE	**Length:**	9.91
Element Name:	TRUSSES	**Width:**	-
Location:	LONGITUDINGAL BETWEEN ABUTMENTS	**Height:**	1.328 M
Material:	STEEL	**Count:**	2
Element Type:	-	**Total Quantity:**	2
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	✓ VIEWED FR. ABUTMENTS/CATWALK
Protection System:			**Perform. Deficiencies**

Condition Data:	**Excellent**	**Good**	**Fair**	**Serious**	**Imminent Failure**
		%90	%10		

Comments: RIVETED STEEL CONSTRUCTION, GENERALLY GOOD CONDITION;
LOCALIZED COATING FAILURE/EXPANSIVE PACK RUST AT CONNECTIONS;
SEVERE SECTION WHERE BOTTOM CHORDS MEET ABUTMENT (TYP 50% OF HOR. LEG OF BTM CHORD ANGLES);
EAST INTERIOR DIAPHRAGM CROSS BRACE BOTTOM DOUBLE ANGLE STEEL MEMBER BENT

Recommended Work:	✓ Rehab ☐ Replace	**Maintenance Needs:**	
	✓ 1-5 years ☐ 6-10 years	☐ Urgent ☐ 1 year ☐ 2 year	
REINFORCE TRUSS BEARINGS / BOTTOM CHORDS AT ABUTMENTS			

Element Data

Element Group:	APPROACHES	**Length:**	-
Element Name:	APPROACH ROADS	**Width:**	-
Location:	EAST AND WEST	**Height:**	-
Material:	GRAVEL	**Count:**	2
Element Type:	-	**Total Quantity:**	2
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	☐
Protection System:			**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure**		
	100%		

Comments: VEGETATION AND WHEEL TRACKS CHANEL WATER TOWARD BRIDGE;
GOOD LINES OF SIGHT.

Recommended Work: ☑ Rehab ☐ Replace ☑ 1-5 years ☐ 6-10 years	**Maintenance Needs:** ☐ Urgent ☐ 1 year ☐ 2 year
REGRADE APPRAOCHES AND IMPROVE DRAINAGE.	-

Element Group:	SUPERSTRUCTURE	**Length:**	-
Element Name:	GUARDS	**Width:**	-
Location:	BRIDGE SPAN	**Height:**	-
Material:	STEEL WITH GALV FLEX BEAM	**Count:**	2
Element Type:	-	**Total Quantity:**	2
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	☐
Protection System:			**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure**		
	100%		

Comments: STRUCTURAL STEEL HAS COATING FAILURE AND SURFACE CORROSION;
STEEL FLEX BEAM C/W RETURNS GOOD CONDITION;
100X100 WHEEL GUARDS C/W 100X100 BLOCKING - GOOD CONDITION;
STIFFNER AT BOTTOM OF GUARD POST IS CONNECTED WITH POOR DETAIL.

Recommended Work: ☑ Rehab ☐ Replace ☑ 1-5 years ☐ 6-10 years	**Maintenance Needs:** ☐ Urgent ☐ 1 year ☐ 2 year
REINFORCE CONNECTION AT GUARD POSTS TO DECK BEAMS.	

Element Group:	SUPERSTRUCTURE	**Length:**	3.65 M
Element Name:	DECK SHEATHING	**Width:**	0.20 M
Location:	TRANSVERSE BETWEEN STRINGERS	**Height:**	0.075 M
Material:	TREATED TIMBER	**Count:**	-
Element Type:	-	**Total Quantity:**	-
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	☑ LIMITED ACCESS TO U/S
Protection System:	-		**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure**		
	100%		

Comments: SHEATHING 75(H)X200(W) - FAIR CONDITION, CHECKING AT ENDS;
75 THK WEARING SURFACE IN WHEEL TRACKS - FAIR CONDITION;
LIMITED INSPECTION - VIEWED FROM TOP SIDE, ABUTMENTS, AND STOP LOG CATWALK.

Recommended Work: ☐ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years	**Maintenance Needs:** ☐ Urgent ☐ 1 year ☐ 2 year
NONE	NONE

Element Data

Element Group:	SUBSTRUCTURE	**Length:**	-
Element Name:	ABUTMENTS	**Width:**	-
Location:	EAST AND WEST	**Height:**	-
Material:	REINFORCED CONCRETE	**Count:**	2
Element Type:	-	**Total Quantity:**	2
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	✓
Protection System:			**Perform. Deficiencies**

Condition Data:	**Excellent**	**Good**	**Fair**	**Serious**	**Imminent Failure**	
		100%				

Comments: ABUTMENTS BUILT INTEGRAL WITH WINGWALLS AND CONCRETE STOP LOG STRUCTURE. GOOD CONDITION

Recommended Work:	☐ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years	**Maintenance Needs:**	☐ Urgent ☐ 1 year ☐ 2 year
NONE			

Element Group:		**Length:**	
Element Name:		**Width:**	
Location:		**Height:**	
Material:		**Count:**	
Element Type:		**Total Quantity:**	
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	☐
Protection System:			**Perform. Deficiencies**

Condition Data:	**Excellent**	**Good**	**Fair**	**Serious**	**Imminent Failure**	

Comments:

Recommended Work:	☐ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years	**Maintenance Needs:**	☐ Urgent ☐ 1 year ☐ 2 year

Element Group:		**Length:**	
Element Name:		**Width:**	
Location:		**Height:**	
Material:		**Count:**	
Element Type:		**Total Quantity:**	
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	☐
Protection System:			**Perform. Deficiencies**

Condition Data:	**Excellent**	**Good**	**Fair**	**Serious**	**Imminent Failure**	

Comments:

Recommended Work:	☐ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years	**Maintenance Needs:**	☐ Urgent ☐ 1 year ☐ 2 year

EASTPOINT

FILE: 480081
DESCRIPTION: BRIDGE 13 - LEQUILLE - LEQUILLE CANAL
JUNE 9, 2016

Photo 1 -APPROACH LOOKING EAST

Photo 2 - APPROACH LOOKING WEST

EASTPOINT

FILE: 480081
DESCRIPTION: BRIDGE 13 - LEQUILLE - LEQUILLE CANAL
JUNE 9, 2016

Photo 3 -NORTH ELEVATION

Photo 4 - SOUTH ELEVATION

EASTPOINT

FILE: 480081
DESCRIPTION: BRIDGE 13 - LEQUILLE - LEQUILLE CANAL
JUNE 9, 2016

Photo 5 - ON BRIDGE LOOKING SOUTH

Photo 6 -ON BRIDGE LOOKING NORTH

FILE: 480081
DESCRIPTION: BRIDGE 13 - LEQUILLE - LEQUILLE CANAL
JUNE 9, 2016

Photo 7 -SECTION LOSS AT NE TRUSS BEARING

Photo 8 - SECTION LOSS AT SE TRUSS BEARING

EASTPOINT

FILE: 480081
DESCRIPTION: BRIDGE 13 - LEQUILLE - LEQUILLE CANAL
JUNE 9, 2016

Photo 9 - SECTION LOSS AT SW TRUSS BEARING

Photo 10 - TYP. CORROSION ON DECK BEAMS OPPOSITE BEARING STIFFENERS

FILE: 480081
DESCRIPTION: BRIDGE 13 - LEQUILLE - LEQUILLE CANAL
JUNE 9, 2016

Photo 11 - DEFORMED BOTTOM CHORD OF WEST DIAPHRAGM BRACE

Photo 12 - TYPICAL PACK RUST AT CONNECTIONS

FILE: 480081
DESCRIPTION: BRIDGE 13 - LEQUILLE - LEQUILLE CANAL
JUNE 9, 2016

Photo 13 - SPLIT TIMBER BEAM AT SE CORNER GUARDRAIL CONNECTION

Photo 14 - WEAK STIFFENER DETAIL AT GUARD TO DECK BEAM CONNECTION

EASTPOINT

FILE: 480081
DESCRIPTION: BRIDGE 13 - LEQUILLE - LEQUILLE CANAL
JUNE 9, 2016

Photo 15 - TYPICAL CHECKING AT ENDS OF DECK SHEATHING

Level Two Structure Inspection Form

Site Number: BRIDGE 16

Inventory Data:

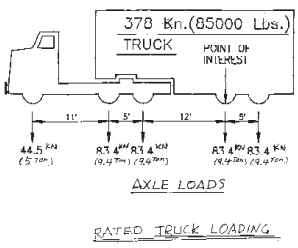
Structure Name	BRIDGE 16 - NICTAUX - NICTAUX CANAL		
Main Hwy/Road #	NEAR HIGHWAY 10	On ☐ Under ☐	Crossing Type: ✓ Navig. Water ☐ Non-Navig. Water ☐ Rail ☐ Road ☐ Ped. ☐ Other
Hwy/Road Name			
Structure Location	OVER NICTAUX CANAL		
Northing	-	Easting	-
Owner(s)	NOVA SCOTIA POWER	Heritage Designation: ☐ Not Cons. ☐ Cons./not App. ☐ List/not Desig. ☐ Desig./not List ☐ Desig. & List	
Region	-	Road Class: ☐ Freeway ☐ Arterial ☐ Collector ☐ Local	
District	-	Posted Speed	-
		No. of Lanes	-
		AADT	-
		% Trucks	-
		Inspection Route Sequence	-
Structure Type	STEEL TRUSS/TIMBER DECK	Interchange Number	-
Total Deck Length	16.77 (m)	Interchange Structure Number	-
Overall Str. Width	3.61 (m)	Min. Vertical Clearance	- (m)
Total Deck Area	60.54 (sq.m)	Special Routes: ☐ Transit ☐ Truck ☐ School ☐ Bicycle	
Roadway Width	3.0 (m)	Detour Length Around Bridge	- (km)
Skew Angle	20 DEGREES (Degrees)	Direction of Structure	N/S
No. of Spans Span	1	Fill on Structure	- (m)
Lengths	16.77 (m)		

Historical Data:

Year Built	UNKNOWN	Year of Last Major Rehab.	1992
Last Inspection	UNKNOWN	Last Evaluation	UNKNOWN
Last Enhanced Inspection	UNKNOWN	Current Load Limit	/ / (tonnes)
Enhanced Access Equipment (ladder, boat, lift, etc.)	-	Load Limit By-Law #	UNKNOWN
Last Underwater Inspection	UNKNOWN	By-Law Expiry Date	UNKNOWN
Last Condition Survey	UNKNOWN		

Rehab History: (Date/description) 1992-REDECKING (HAVE RECORD DRAWINGS)

RECORD DRAWINGS SHOW RATED SEMI-TRUCK WITH FOLLOWING AXLES:



Digitally signed by Colin Fisher, P.Eng.
Date: 2016.06.21 16:40:16-03'00'

Level Two Structure Inspection Form

Site Number: BRIDGE 16

Field Inspection Information:			
Date of Inspection:	JUNE 9, 2016	Type of Inspection:	Visual ✓ Enhanced
Inspector:	EASTPOINT (MH/AK)		
Others in Party:	-		
Access Equipment Used:	-		
Weather:	OVERCAST		
Temperature:	15 DEGREES		

Additional Investigations Required:	Priority		
	None	Normal	Urgent
Material Condition Survey			
Detailed Deck Condition Survey:	×		
Non-destructive Delamination Survey of Asphalt-Covered Deck:	×		
Concrete Substructure Condition Survey:	×		
Detailed Coating Condition Survey:	×		
Detailed Timber Investigation	×		
Post-Tensioned Strand Investigation	×		
Underwater Investigation:	×		
Fatigue Investigation:	×		
Seismic Investigation:	×		
Structure Evaluation:	×		
Monitoring			
Monitoring of Deformations, Settlements and Movements:	×		
Monitoring Crack Widths:	×		
Investigation Notes: NONE			

Overall Structure Notes:	
Recommended Work on Structure:	None ☐ Minor Rehab. ☐ Major Rehab. ✓ Replace ☐
Timing of Recommended Work:	1 to 5 years ✓ 6 to 10 years ☐
Overall Comments:	REGRADE APPROACHES TO PROTECT DECK EDGE AND IMPROVE DRAINAGE; REPLACE DECKING AND ADD WEARING SURFACE; REPLACE WHEEL GUARD; REMOVE DEBRIS FROM TRUSS BEARINGS; REPAIR N TRUSS W BEARING; REPLACE WING WALL EXTENSIONS: REPAIR DELAMINATION/CRACKED CONCRETE ON ABUTMENT FACES.
Date of Next Inspection:	RECOMMEND LIMIT GVW TO 3 TONNES UNTIL LOAD RATING DETERMINED

Suspected Performance Deficiencies

01 Load carrying capacity
02 Excessive deformations (deflections & rotations)
03 Continuing settlement
04 Continuing movements
05 Seized bearings
06 Bearing not uniformly loaded/unstable
07 Jammed expansion joint
08 Pedestrian/vehicular hazard
09 Rough riding surface
10 Surface ponding
11 Deck drainage
12 Slippery surfaces
13 Flooding/channel blockage
14 Undermining of foundation
15 Unstable embankments
16 Other

Maintenance Needs

01 Lift and Swing Bridge Maintenance
02 Bridge Cleaning
03 Bridge Handrail Maintenance
04 Painting Steel Bridge Structures
05 Bridge Deck Joint Repair
06 Bridge Bearing Maintenance
07 Repair to Structural Steel
08 Repair of Bridge Concrete
09 Repair of Bridge Timber
10 Bailey bridges - Maintenance
11 Animal/Pest Control
12 Bridge Surface Repair
13 Erosion Control at Bridges
14 Concrete Sealing
15 Rout and Seal
16 Bridge Deck Drainage
17 Scaling (Loose Concrete or ACR Steel)
18 Other

Element Data

Element Group:	APPROACHES	**Length:**	-
Element Name:	APPROACH ROADS	**Width:**	-
Location:	EAST AND WEST	**Height:**	-
Material:	GRAVEL	**Count:**	2
Element Type:	-	**Total Quantity:**	2
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	☐
Protection System:			**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure**		
	100%		

Comments: GOOD LINE OF SIGHT E. APPROACH;
POOR LINE OF SIGHT W. APPROACH (TREES/BUSHES/CORNER);
E APPROACH APPROX 50MM LOW;
W APPROACH LARGE POTHOLES.

Recommended Work: ☑ Rehab ☐ Replace ☑ 1-5 years ☐ 6-10 years	**Maintenance Needs:** ☐ Urgent ☐ 1 year ☐ 2 year
REGRADE APPRAOCHES TO PROTECT DECK EDGE AND IMPROVE DRAINAGE; TRIM W APPROACH BUSHES TO IMPROVE L.O.S	

Element Group:	SUPERSTRUCTURE	**Length:**	3.65M
Element Name:	DECK SHEATHING	**Width:**	0.200M
Location:	TRANSVERSE ON DECK BEAMS	**Height:**	0.100M
Material:	INCIZED TREATED TIMBER	**Count:**	-
Element Type:		**Total Quantity:**	-
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	✓ U/S ACCESS LIMITED
Protection System:			**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure**		
	100%		

Comments: SURFACE ABRADED, LOTS OF SPLIT EDGES (POSSIBLE TRACKED VEHICLE CROSSING?);

RECORD DRAWINGS FROM 1992 SHOW 100MM THICK TRANSVERSE DECK WITH 20MM THICK LONGITUDINAL WEARING SURFACE, BUT LONG. WEARING SURFACE NOT PRESENT (ONLY 100 THK TRANSVERSE DECK FOUND)

Recommended Work: ☑ Rehab ☐ Replace ☑ 1-5 years ☐ 6-10 years	**Maintenance Needs:** ☐ Urgent ☐ 1 year ☐ 2 year
REPLACE DECK SHEATHING - SPLITS IN TOP EDGES WILL ACCELERATE DETERIORATION; ADD WEARING SURFACE.	

Element Group:	SUPERSTRUCTURE	**Length:**	-
Element Name:	GUARD	**Width:**	-
Location:	BRIDGE SPAN	**Height:**	-
Material:	STEEL	**Count:**	2
Element Type:	-	**Total Quantity:**	2
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	✓ INSPECTED FROM BRIDGE DECK
Protection System:			**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure**		
	100%		

Comments: STEEL I - BEAM POST C/W HSS TOP RAIL AND GALV FLEX BEAM MID RAIL - TOP RAIL COATING POOR.

TIMBER WHEEL GUARD 130(H)X130(W) - SOUTH GUARD SCUFFED, BROKEN AT SW CORNER

Recommended Work: ☑ Rehab ☐ Replace ☑ 1-5 years ☐ 6-10 years	**Maintenance Needs:** ☐ Urgent ☐ 1 year ☐ 2 year
REPLACE SOUTH WHEEL GUARD	

Element Data

Element Group:	SUPERSTRUCTURE	**Length:**	3.96M
Element Name:	DECK STRINGERS	**Width:**	0.130M
Location:	LONGITUDINGAL	**Height:**	0.305M
Material:	TREATED TIMBER	**Count:**	10 X 5 SPANS
Element Type:	-	**Total Quantity:**	50 PCS
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	✓ LIMITED ACCESS TO U/S
Protection System:			**Perform. Deficiencies**

Condition Data:	**Excellent**	**Good**	**Fair**	**Serious**	**Imminent Failure**	**Perform. Deficiencies**
		100%				

Comments: TREATED/INCIZED, GOOD CONDITION.

Recommended Work:	**Maintenance Needs:**
☐ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years	☐ Urgent ☐ 1 year ☐ 2 year
NONE	

Element Group:	SUPERSTRUCTURE	**Length:**	3.65M
Element Name:	STEEL FLOOR BEAMS	**Width:**	0.115M
Location:	TRANSVERSE OVER GIRDER TRUSSES	**Height:**	0.250M
Material:	STEEL	**Count:**	6
Element Type:		**Total Quantity:**	6
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	✓ VIEWED FROM ABUTMENTS
Protection System:			**Perform. Deficiencies**

Condition Data:	**Excellent**	**Good**	**Fair**	**Serious**	**Imminent Failure**	**Perform. Deficiencies**
		100%				

Comments: MINOR LOCALIZED COATING FAILURE AT FLANGE EDGES, BUT GOOD CONDITION.

Recommended Work:	**Maintenance Needs:**
☐ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years	☐ Urgent ☐ 1 year ☐ 2 year
NONE	

Element Group:	SUPERSTRUCTURE	**Length:**	
Element Name:	TRUSSES	**Width:**	
Location:	E/W	**Height:**	
Material:	RIVETED STEEL	**Count:**	
Element Type:		**Total Quantity:**	
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	☐
Protection System:			**Perform. Deficiencies**

Condition Data:	**Excellent**	**Good**	**Fair**	**Serious**	**Imminent Failure**	**Perform. Deficiencies**
			100%			

Comments: SIGNIFICANT COATING FAILURE; EXPANSIVE PACK RUST AT BUILT UP MEMBER CONNECTIONS; CONNECTION GUSSETS HAVE COATING FAILURE, HEAVY PITTING RUST BUT NO CRACKING NOTED; SCALE RUST ON TOP OF BOTTOM CHORDS/LOCALIZED; SEVERE SECTION LOSS AT NW TRUSS BEARING; EAST BEARINGS BURRIED IN DEBRIS, SOME CORRISION BUT NO SIGNIFICANT SECTION LOSS; MOST DIAGONALS REINFORCED WITH WELDED PLATE.

Recommended Work:	**Maintenance Needs:**
✓ Rehab ☐ Replace ✓ 1-5 years ☐ 6-10 years	☐ Urgent ☐ 1 year ☐ 2 year
CONSIDER RECOATING. REMOVE DEBRIS/CLEAN BEARING; REINFORCE NE BEARING AT ABUTMENT.	

Element Data

Element Group:	SUBSTRUCTURE	**Length:**	-
Element Name:	ABUTMENT	**Width:**	-
Location:	EAST	**Height:**	-
Material:	CONCRETE/BUILT INTO BED ROCK	**Count:**	1
Element Type:	-	**Total Quantity:**	1
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	✓
Protection System:			**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure**		
	100%		

Comments: SIGNIFICANT MAP CRACKING WITH EFFIORESENCE; FULL LENGTH 6MM WIDE LONGITUDINAL CRACK ACROSS TOP, 150MM FROM FACE; CONCRETE SEGGREGATION AT BASE OF FOOTING; BREAST WALL - WIDE HORIZONTAL CRACK WITH BULGING SURFACE; WING WALLS EXTENDED WITH LIGHT ANGLE FRAMES (DISTRESSED); INSPECTION LIMITED BY DEBRIS / BUSHES AND ONLY FRONT FACES VISIBLE DURING REVIEW.

Recommended Work: ✓ Rehab ☐ Replace ✓ 1-5 years ☐ 6-10 years	**Maintenance Needs:** ☐ Urgent ☐ 1 year ☐ 2 year
REPLACE WING WALL EXTENSIONS; RESURFACE DELAMINATING CONCRETE; MONITOR CRACKS.	

Element Group:	SUBSTRUCTURE	**Length:**	-
Element Name:	ABUTMENT	**Width:**	-
Location:	WEST	**Height:**	-
Material:	CONCRETE/BUILT INTO BED ROCK	**Count:**	1
Element Type:		**Total Quantity:**	1
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	✓
Protection System:			**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure**		
	100%		

Comments: SIGNIFICANT MAP CRACKING WITH EFFIORESENCE; 5MM WIDE CRACKS ON TOP; CONCRETE SEGGREGATION AT BASE OF FOOTING; BREAST WALL - WIDE HORIZONTAL CRACK WITH BULGING SURFACE; WING WALLS EXTENDED WITH LIGHT ANGLE FRAMES (DISTRESSED); INSPECTION LIMITED BY DEBRIS / BUSHES AND ONLY FRONT FACES VISIBLE DURING REVIEW.

Recommended Work: ✓ Rehab ☐ Replace ✓ 1-5 years ☐ 6-10 years	**Maintenance Needs:** ☐ Urgent ☐ 1 year ☐ 2 year
REPLACE WING WALL EXTENSIONS; RESURFACE DELAMINATING CONCRETE; MONITOR CRACKS.	

Element Group:		**Length:**	
Element Name:		**Width:**	
Location:		**Height:**	
Material:		**Count:**	
Element Type:		**Total Quantity:**	
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	
Protection System:			**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure**		

Comments:

Recommended Work: ☐ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years	**Maintenance Needs:** ☐ Urgent ☐ 1 year ☐ 2 year

EASTPOINT

FILE: 480081
DESCRIPTION: BRIDGE 16 - NICTAUX - NICTAUX CANAL
JUNE 9, 2016

Photo 1 - APPROACH LOOKING WEST

Photo 2 - APPROACH LOOKING EAST

EASTPOINT

FILE: 480081
DESCRIPTION: BRIDGE 16 - NICTAUX - NICTAUX CANAL
JUNE 9, 2016

Photo 3 -SOUTH ELEVATION

Photo 4 - PARTIAL N. ELEVATION SHOWING REINFORCED TRUSS MEMBERS

EASTPOINT

FILE: 480081
DESCRIPTION: BRIDGE 16 - NICTAUX - NICTAUX CANAL
JUNE 9, 2016

Photo 5 - ON BRIDGE LOOKING SOUTH (UP-STREAM)

Photo 6 -ON BRIDGE LOOKING NORTH (DOWNSTREAM)

EASTPOINT

FILE: 480081
DESCRIPTION: BRIDGE 16 - NICTAUX - NICTAUX CANAL
JUNE 9, 2016

Photo 7 -WEST APPROACH WITH POOR VISIBILITY

Photo 8 - BROKEN WHEEL GUARD SW CORNER

EASTPOINT

FILE: 480081
DESCRIPTION: BRIDGE 16 - NICTAUX - NICTAUX CANAL
JUNE 9, 2016

Photo 9 - EDGES OF DECK TIMBERS SPLIT (TRACKED MACHINE DAMAGE)

Photo 10 - TRUSS BEARINGS BURRIED IN DEBRIS AT E ABUTMENT

FILE: 480081
DESCRIPTION: BRIDGE 16 - NICTAUX - NICTAUX CANAL
JUNE 9, 2016

Photo 11 - TYPICAL COATING FAILURE AND CORROSION AT CONNECTIONS

Photo 12 - CORROSION ON TOP SURFACE OF BOTTOM TRUSS CHORD

FILE: 480081
DESCRIPTION: BRIDGE 16 - NICTAUX - NICTAUX CANAL
JUNE 9, 2016

Photo 13 - SEVERE SECTION LOSS AT NW TRUSS BEARING PLATE

Photo 14 - SEVERE SECTION LOSS AT NW TRUSS BEARING VERTICAL

FILE: 480081
DESCRIPTION: BRIDGE 16 - NICTAUX - NICTAUX CANAL
JUNE 9, 2016

Photo 15 - E ABUTMENT CRACKING, EFFLORESCENCE, AND SEGREGATION

Photo 16 - LONGITUDINGAL CRACK ON TOP OF E ABUTMENT

Photo 17 - E ABUTMENT MAP CRACKING IN BACKWALL

Photo 18 - TYPICAL WINGWALL EXTENSION

EASTPOINT

Date: **July 28, 2017**

Project: **480081 - NSPI - Hydro and Wind Level 2 - Bridge Inspections and Load Ratings**

Bridge No. 37 – Mersey – Lower Lake Falls and Bridge

Subject: **Bridge No.37 - Load Rating Summary and Associated Recommendations**

1. **Summary of Structures:**

   Single span steel girder bridge with timber deck on cast in-situ concrete substructure

   No existing drawings available.
   Dimensions were taken from site as follows:

   - Bridge Length = 70' = 21.34m
   - Clear width = 170"= 4.32m
   - Cross beams (timber) = 3"x10" (75x250mm) spanned.
   - Steel Girders: W section ~ 34"=860mm deep.
   - Wearing surface 4"x8" (100x200mm)

2. **Current conditions for main elements** (inspection date – July 5, 2017)**:**

   a. Cross Beams (good):
      i. Cross beams 3"x10" (75x250mm) spanned
      ii. Upper side not inspected
      iii. All cross beams in good conditions.

   b. Steel trusses: (good):
      i. 3 girders W section height = 34"=860mm
      ii. Horizontal and vertical cross braces (angle sections)
      iii. Minor surface corrosion on all steel members (W and angles)
      iv. Girders generally in good conditions.

   c. Abutments (good):
      i. Both abutments and wing walls visually in good condition

3. **Overview of load rating:**

   a. Assumptions:
      i. Based on a single dimension taken on site (approx. section depth=34"=860mm), the girders were assumed as W840x176.
      ii. Yield strength for steel members was taken as Fy = 230 MPa.
      iii. 1.0kpa was assumed for snow and ice (live load) along with vehicular live loads.
      iv. Timber material was assumed as Hem-fir No.1.
      v. Due to the unknowns related to geotechnical conditions and qualities of concrete and reinforcement, it has been assumed for the load rating analysis that the substructure will not be the limiting component of the bridge.

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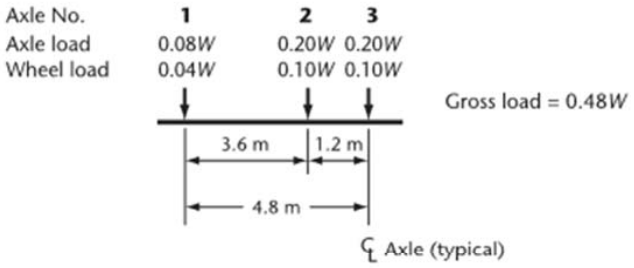
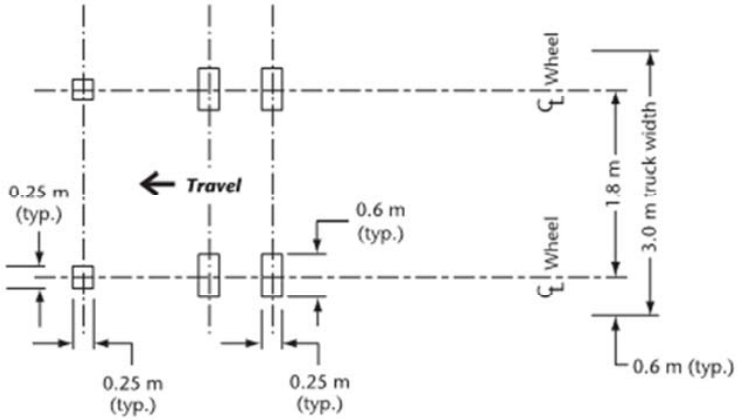
b. The bridge was evaluated following the Section 14 "Evaluation" of "Canadian Highway Bridge Design Code S6-14".
c. Evaluation parameters:
    i. Inspection level INSP-1: Members partially inspected. Girders and cross beams inspected from abutments, upper sides uninspected.
    ii. System Behavior – Girders - S2: element failure probably will not lead to total collapse.
    iii. System Behavior – Cross beams - S3: local failure
    iv. Element Behavior – E3: gradual failure.
d. Resistance forces of existing elements were calculated according to S6-14, Section 9 "Wood Structures", and Section 10 "Steel Structures".
e. Loads:
    i. Live Loads: an Evaluation level 3 (single-unit vehicle) was considered as the most likely type of vehicle that would use the bridge. Also, for bridges with short spans, the shorter truck causes larger forces on the bridge because all of its weight is concentrated in a smaller area.

    Evaluation level 3 - CL3-625; GVW= 300kN=30.6 tonnes, according to Figure 14.3 S6-14.



CL3-W Truck Load (elevation)



CL3-W Truck Load (plan)

ii. A moving load generation was done in order to find the worst scenarios.
iii. Dead Loads: effect of dead loads and self-weights were considered.
iv. Seismic or wind loads were not considered.

f. The bridge was modeled in S-Frame program version 11.00.22.
g. Worst scenarios were considered in order to calculate the Ultimate Limit States
h. The Ultimate Limit State was calculated for each main member as follows (S6-14 Section 14.15.1):

$$F = \frac{UR - \sum \alpha_D D - \sum \alpha_A A}{\alpha_L L(1+I)}$$

Where:
U: Resistance factor; R: Resistance; D: Dead loads; A: Additional loads; L: Live Load; I: Dynamic Load Allowance; α: Load factors.

i. Results:

Live load capacity factors:

i. Cross beams (75x250):
   a. $F_{flexure}$=1.25 > 1 OK
   b. F_{shear} =0.64 < 1 Needs posting

ii. Girders (W840x176):
   a. $F_{flexure}$= 0.54 < 1 Needs posting – Limiting
   b. F_{shear}=3.58 > 1 OK

4. Summary:

The Posted Factor (P) was obtained from Figure 14.8 (S6-14) "Posting loads for gross vehicle weight", based on the limiting Live Load Capacity factor (F) and considering an Evaluation Level 3 (Live load CL3-625). In this regard, the Posted Weight Limit (Pt) was obtained multiplying the Posted Factor (P) by the Gross load (W) according to S6-14 clause14.17.3.1.

P=0.021 (from Figure 14.8 - S6-14; Evaluation Level 3 and F=0.54)
Pt=PxW=0.021x625=13.3 tonnes (according to S6-14 clause14.17.3.1)

Resulting Load Rating for F=0.54 and Evaluation Level 3 is:

Pt=13 tonnes

5. Recommendations:

a. The bridge should be posted for a maximum load of **13 tonnes.**
Posting shall show the gross vehicle weight in tonnes. The following figure is a suggested sign that can be erected (as per S6-14 C14.17.3):

(a) Single posting

6. **References:**

a. CSA S6-14 - Canadian Highway Bridge Design Code
b. Bridge 37 inspection reports dated July 5, 2017

Analysis prepared by: Daniel Yanez Sanchez, P.Eng.

Checked by: Stephen Morrison, P.Eng.

Level Two Structure Inspection Form

Site Number: BRIDGE 37

Inventory Data:

Structure Name	BRIDGE 37 - MERSEY - LOWER LAKE FALLS		
Main Hwy/Road #	N/A On ☐ Under ☐	Crossing Type:	☐ Navig. Water ✓ Non-Navig. Water ☐ Rail ☐ Road ☐ Ped. ☐ Other
Hwy/Road Name	UNKNOWN		
Structure Location	ACCESS ROAD TO LOWER LAKE FALLS POWER HOUSE		
Northing	4891295.00 m N	Easting	341950.00 m E
Owner(s)	NSPI	Heritage Designation:	☐ Not Cons. ☐ Cons./not App. ☐ List/not Desig. ☐ Desig./not List ☐ Desig. & List
Region	MERSEY	Road Class:	☐ Freeway ☐ Arterial ☐ Collector ☐ Local
District		Posted Speed	NONE — No. of Lanes: 1
		AADT	N/A — % Trucks: N/A
		Inspection Route Sequence	N/A
Structure Type	STEEL GIRDERS, TIMBER DECK, RC SUBST	Interchange Number	N/A
Total Deck Length	21.34 (m)	Interchange Structure Number	N/A
Overall Str. Width	4.32 (m)	Min. Vertical Clearance	N/A (m)
Total Deck Area	92.19 (sq.m)	Special Routes:	☐ Transit ☐ Truck ☐ School ☐ Bicycle
Roadway Width	4.5 (m)	Detour Length Around Bridge	NONE (km)
Skew Angle	0 (Degrees)	Direction of Structure	N-S
No. of Spans Span	1	Fill on Structure	VAR 0.05 - 0.10 (m)
Lengths	21.34 (m)		

Historical Data:

Year Built	UNKNOWN	Year of Last Major Rehab.	UNKNOWN
Last Inspection	UNKNOWN	Last Evaluation	UNKNOWN
Last Enhanced Inspection	UNKNOWN	Current Load Limit	11 POSTED (tonnes)
Enhanced Access Equipment (ladder, boat, lift, etc.)	UNKNOWN	Load Limit By-Law #	N/A
Last Underwater Inspection	UNKNOWN	By-Law Expiry Date	N/A
Last Condition Survey	UNKNOWN		

Rehab History: (Date/description) UNKNOWN

Page 1

Digitally signed by Daniel Yanez Sanchez, P.Eng.
Date: 2017.07.28 14:42:22-03'00'

Level Two Structure Inspection Form **Site Number:**

Field Inspection Information:			
Date of Inspection:	JULY 5, 2017	Type of Inspection:	Visual ✓ Enhanced
Inspector:	EASTPOINT: STEPHEN MORRISON, P.ENG & DANIEL YANEZ SANCHEZ, P.ENG		
Others in Party:	N/A		
Access Equipment Used:	NONE		
Weather:	CLEAR/SUNNY		
Temperature:	20 C		

Additional Investigations Required:	Priority		
	None	Normal	Urgent
Material Condition Survey			
Detailed Deck Condition Survey:	X		
Non-destructive Delamination Survey of Asphalt-Covered Deck:	X		
Concrete Substructure Condition Survey:	X		
Detailed Coating Condition Survey:	X		
Detailed Timber Investigation	X		
Post-Tensioned Strand Investigation	X		
Underwater Investigation:	X		
Fatigue Investigation:	X		
Seismic Investigation:	X		
Structure Evaluation:	X		
Monitoring			
Monitoring of Deformations, Settlements and Movements:	X		
Monitoring Crack Widths:	X		
Investigation Notes:			

Overall Structure Notes:	
Recommended Work on Structure:	None ☐ Minor Rehab. ✓ Major Rehab. ☐ Replace ☐
Timing of Recommended Work:	1 to 5 years ✓ 6 to 10 years ☐
Overall Comments:	CONSIDER COMPLETE RAILING SYSTEM REPLACEMENT, REPLACE BROKEN WHEEL GUARDS AT N-E CORNER, REMOVE GRAVEL FROM DECK SURFACE, REPLACE WEARING SURFACE (WHEEL TRACKS). REPAIR APPROACH ROAD AT NORTH END BY FILLING AND LEVELING WITH NEW GRAVEL MATERIAL ENSURING CROSS-SLOPES.
Date of Next Inspection:	2020

Suspected Performance Deficiencies

01	Load carrying capacity	06	Bearing not uniformly loaded/unstable	12	Slippery surfaces
02	Excessive deformations (deflections & rotations)	07	Jammed expansion joint	13	Flooding/channel blockage
03	Continuing settlement	08	Pedestrian/vehicular hazard	14	Undermining of foundation
04	Continuing movements	09	Rough riding surface	15	Unstable embankments
05	Seized bearings	10	Surface ponding	16	Other
		11	Deck drainage		

Maintenance Needs

01	Lift and Swing Bridge Maintenance	07	Repair to Structural Steel	13	Erosion Control at Bridges
02	Bridge Cleaning	08	Repair of Bridge Concrete	14	Concrete Sealing
03	Bridge Handrail Maintenance	09	Repair of Bridge Timber	15	Rout and Seal
04	Painting Steel Bridge Structures	10	Bailey bridges - Maintenance	16	Bridge Deck Drainage
05	Bridge Deck Joint Repair	11	Animal/Pest Control	17	Scaling (Loose Concrete or ACR Steel)
06	Bridge Bearing Maintenance	12	Bridge Surface Repair	18	Other

Element Data

Element Group:	ROADWAY	**Length:**	N/A
Element Name:	APPROACHES	**Width:**	5/6M
Location:		**Height:**	N/A
Material:	GRAVEL	**Count:**	
Element Type:		**Total Quantity:**	
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	☐
Protection System:			**Perform. Deficiencies**
Condition Data:	**Excellent** 70%	**Good**	**Fair** 30% **Serious** **Imminent Failure**
Comments:	RUT DEPRESSION AT NORTH SIDE OF THE BRIDGE. ROAD EDGE EROSION AT N/W CORNER / CONNECTION WITH WING WALL CURRENT POSTING LOAD AT APPROACHES = 11 TONNES.		
Recommended Work:	☑ Rehab ☐ Replace ☑ 1-5 years ☐ 6-10 years	**Maintenance Needs:**	☐ Urgent ☑ 1 year ☐ 2 year
REPAIR GRAVEL ROAD (RUT AND EDGE EROSION AT NORTH END) BY FILLING AND LEVELING THE GRAVEL SURFACE WITH NEW GRAVEL MATERIAL.			

Element Group:	SUPERSTRUCTURE	**Length:**	FULL LENGTH OF BRIDGE
Element Name:	RAILING SYSTEM	**Width:**	
Location:		**Height:**	
Material:	TREATED TIMBER (TT)	**Count:**	
Element Type:		**Total Quantity:**	
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	☐
Protection System:	TREATED TIMBER		**Perform. Deficiencies**
Condition Data:	**Excellent** **Good** **Fair** 60% **Serious** 40% **Imminent Failure**		
Comments:	TT POST 100X100 @ 1.21m TF. TT RAILS 50X100, WHEEL GUARDS 300X300 SEVERAL POSTS AND RAILS ROTTEN AND BROKEN. WHEEL GUARD ROTTEN AT N/E CORNER		
Recommended Work:	☐ Rehab ☑ Replace ☑ 1-5 years ☐ 6-10 years	**Maintenance Needs:**	☐ Urgent ☐ 1 year ☐ 2 year
CONSIDER COMPLETE RAILING SYSTEM REPLACEMENT			

Element Group:	SUPERSTRUCTURE	**Length:**	FULL LENGTH
Element Name:	DECK	**Width:**	4.32M
Location:		**Height:**	
Material:	TREATED TIMBER (TT)	**Count:**	
Element Type:		**Total Quantity:**	
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	☑ Upper side of stringers not visible
Protection System:			**Perform. Deficiencies**
Condition Data:	**Excellent** **Good** 70 **Fair** 30 **Serious** **Imminent Failure**		
Comments:	WEARING SURFACE TT 100X200. TWO WHEEL TRACKS 1.4M WIDE, ON TT CROSS BEAMS 75X250 SPANNED WEARING SURFACE APPROX. 30% WORN. NAIL HEADS STICKING OUT OF SURFACE CROSS BEAMS IN GOOD CONDITIONS		
Recommended Work:	☐ Rehab ☑ Replace ☑ 1-5 years ☐ 6-10 years	**Maintenance Needs:**	☐ Urgent ☐ 1 year ☐ 2 year
REPLACE WEARING SURFACE.			

Element Data

Element Group:	SUBSTRUCTURE	**Length:**	
Element Name:	ABUTMENTS AND WINGWALLS	**Width:**	
Location:	BRIDGE ENDS	**Height:**	
Material:	CIP CONCRETE	**Count:**	
Element Type:		**Total Quantity:**	
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	☐
Protection System:			**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure** 100%		
Comments: BOTH ABUTMENTS AND WINGWALLS VISUALLY IN GOOD CONDITION			
Recommended Work: ☐ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years		**Maintenance Needs:** ☐ Urgent ☐ 1 year ☐ 2 year	

Element Group:	SUPERSTRUCTURE	**Length:**	70 FT APPROX.
Element Name:	GIRDERS	**Width:**	
Location:	BRIDGE DECK	**Height:**	34"
Material:	STEEL	**Count:**	3
Element Type:		**Total Quantity:**	3
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	✓ VIEWED FROM ABUTMENTS
Protection System:			**Perform. Deficiencies**
Condition Data:	**Excellent Good Fair Serious Imminent Failure** 100%		
Comments: 3 GIRDERS W SECTION HEIGHT = 860MM HORIZONTAL AND VERTICAL CROSS BRACES (ANGLE SECTIONS) MINOR SURFACE CORROSION ON ALL STEEL MEMBERS (W AND ANGLES) GIRDERS GENERALLY IN GOOD CONDITIONS.			
Recommended Work: ☐ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years		**Maintenance Needs:** ☐ Urgent ☐ 1 year ☐ 2 year	

Element Group:		**Length:**	
Element Name:		**Width:**	
Location:		**Height:**	
Material:		**Count:**	
Element Type:		**Total Quantity:**	
Environment:	**Benign / Moderate / Severe**	**Limited Inspection**	☐
Protection System:			**Perform. Deficiencies**
Conditiou Data:	**Excellent Good Fair Serious Imminent Failure**		
Comments:			
Recommended Work: ☐ Rehab ☐ Replace ☐ 1-5 years ☐ 6-10 years		**Maintenance Needs:** ☐ Urgent ☐ 1 year ☐ 2 year	

EASTPOINT

FILE: 480081
DESCRIPTION: Bridge # 37 - Mersey - Lower Lake Falls
July 05, 2017

Photo 1 - North Approach Looking South - Rut and Edge Erosion

Photo 2 - South Approach

EASTPOINT

FILE: 480081
DESCRIPTION: Bridge # 37 - Mersey - Lower Lake Falls
July 05, 2017

Photo 3 - Edge Erosion

Photo 4 - Railing broken at S/W corner

EASTPOINT

FILE: 480081
DESCRIPTION: Bridge # 37 - Mersey - Lower Lake Falls
July 05, 2017

Photo 5 - Wearing Surface looking south

Photo 6 - Nails sticking out of wearing surface

EASTPOINT

FILE: 480081
DESCRIPTION: Bridge # 37 - Mersey - Lower Lake Falls
July 05, 2017

Photo 7 - Wheel Guard and railing broken at N/E corner

Photo 8 - Girders and Cross Beams - Looking North

EASTPOINT

FILE: 480081
DESCRIPTION: Bridge # 37 - Mersey - Lower Lake Falls
July 05, 2017

Photo 9 - Girders and Abutment - looking north

Photo 10 - Wingwall

CBCL LIMITED
Consulting Engineers

1489 Hollis Street
PO Box 606
Halifax, Nova Scotia
Canada B3J 2R7

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www.cbcl.ca

Solving today's problems with tomorrow in mind

BEST MANAGED COMPANIES

February 16, 2018

Mr. Colin MacDonald, P.Eng.
Civil Project Engineer
Nova Scotia Power Inc.
PO Box 910
Halifax, NS B3J 2W5

Dear Mr. MacDonald:

RE: Upgrades and Rehabilitation of Bridge 14 – Lower Lake Falls and Bridge 15 – Big Falls DRAFT Report

CBCL is pleased to provide the following report in acco dance with the requirements for Phase A of the rehabilitation/upgrade of Bridge 14 and 15. The existing conditions of each bridge is described, followed by our two proposed concepts of superstructure rehabilitation and superstructure replacement. Finally, cost estimates and projected construction schedule are provided for both concepts.

EXISTING CONDITION – BRIDGE 14 – LOWER LAKE FALLS

A site visit was performed on November 9th, 2017 to confirm that the condition of the bridge was consistent with the "Level Two Structure Inspection and Load Rating" report provided by Eastpoint Engineering dated February 28, 2017. The bridge condition has remained largely unchanged. Photos of the existing structure can be found in **Appendix A**.

Substructure

The substructure is comprised of two concrete abutments and five concrete piers. The abutments are in fair condition with no unsound concrete detected during hammer soundings. The concrete piers are in fair condition with no unsound concrete detected during hammer soundings. According to record drawings provided by NSPI the concrete piers were repaired in 1992. This work consisted of removing unsound concrete and reinstatement to original conditions with new concrete.

Superstructure

The structural elements in the superstructure were largely in fair condition. The timber floor beams, decking and guard rails appear to have been replaced in 1992 along with re-coating of the steel truss elements. The timber elements are in fair condition with minor splitting and weathering at the ends. The guard rails are in fair condition. The steel protective coating system is beginning to show localized areas of failure on the guard rails and steel truss members.

Approaches and Approach Rails

Timber and steel components of the approach rails are in fair condition. The approach rails are not continuous with the superstructure, which is common for older bridge structures but not recommended by today's design codes. No loss of material was observed behind the bridge indicating the backwall and wingwalls remain functional.

EXISTING CONDITION – BRIDGE 15 – BIG FALLS

A site visit was performed on November 9th, 2017 to confirm that the condition of the bridge was consistent with the "Level Two Structure Inspection and Load Rating" report provided by Eastpoint Engineering dated February 28, 2017. The bridge condition has remained largely unchanged. Photos of the existing structure can be found in **Appendix A**.

Substructure

The substructure is comprised of two concrete abutments and five concrete piers. The abutments are in fair condition with no unsound concrete detected during hammer sounding. The concrete piers are in fair condition with no unsound concrete detected during hammer soundings. No record drawings were provided by NSPI for Bridge 15 – Big Falls. The concrete piers appear to have the same refurbishment as Bridge 14 - Lower Lake Falls and it would appear they were completed at roughly the same time.

Superstructure

The structural elements in the superstructure were largely in fair condition. The timber floor beams, decking and guard rails appear to have been in recent times replaced along with re-coating of the steel truss elements below, likely around 1992 when Bridge 14 – Lower Lake Falls was refurbished. The timber elements are in fair condition with minor splitting and weathering at the ends. The guard rails are in fair condition. The steel protective coating system is beginning to show localized areas of failure on the guard rails and steel truss members.

Approaches and Approach Rails

Timber and steel components of the approach rails are in fair condition. The approach rails are not continuous with the superstructure which is common for older bridge structures but not recommended by today's design codes. No loss of material was observed behind the bridge indicating the backwall and wingwalls remain functional.

PROPOSED CONCEPTS – BRIDGE 14 – LOWER BIG FALLS & BRIDE 15 – BIG FALLS

As per discussion with NSPI, it is desirable to have bridge structures capable of supporting a CL-625 design vehicle, consideration for a Volvo A40 Articulated Truck (Volvo A40) has also been provided in accordance with CSA S6-14. It should be noted that the total loaded weight of the Volvo A40 is not only heavier than the typical highway design truck (CL-625) but transfers the weight through three axles as opposed to the five on the CL-625. CBCL has completed a preliminary structural analysis and evaluation of the existing structure for both the CL-625 Loading and the Volvo A40. The analysis was required to assess the level of rehabilitation required to achieve a CL-625 and/or Volvo A40 design vehicle load rating and develop possible repair options. The analysis largely agrees with the previous structural evaluation provided by NSPI titled "Level Two Structure Inspection and Load Rating" and dated February 28, 2017.

The concepts detailed below are for both bridge 14 and 15.

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Concept 1 – Superstructure Rehabilitation

Concept 1 involves rehabilitating the existing superstructures and includes the following repair items for both the CL-625 and/or Volvo A40 loading:

- Removal of timber decking, timber floor beams, bridge rails, and approach rails;
- Strengthening the truss top and bottom chords;
- Strengthening several truss diagonal members by the addition of steel plates;
- Strengthening truss vertical members at bearing;
- Replacement of truss horizontal bracing;
- Replacement of the timber floor beams with new steel channel floor beams. Preliminary design indicated C250x37 spaced at 500mm c/c;
- Re-decking over the floor beams. Preliminary designed indicated 200mm x 200mm pressure treated timbers;
- Installation of new bridge rail;
- Installation of new approach rail;
- Recoating all structural steel to protect from further corrosion; and
- Standard guard rails/approach rails details are provided by the Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) and have been included as **Appendix B**. These details will be adapted to fit the requirements of this structure.

The Volvo A40 does not currently fit within the bridge travel way, during the re-decking process the width of superstructure will need to be increased to accommodate the larger vehicle. As discussed previously, the loading requirements for a Volvo A40 are more severe than a typical CL-625 design vehicle.

Due to the extents of the repairs, normal access to the powerhouse cannot be maintained throughout construction. Alternate means of access will be necessary.

Concept 2 – Superstructure Replacement

Concept 2 involves replacing the entire bridge superstructure, inclusive of the bearings. The replacement structure will be to the same CL-625 design truck loading or Volvo A40. The preliminary concept uses a prefabricated steel bridge superstructure, complete with a timber deck and galvanized steel flex beam rail system. The proposed structure will be relatively light allowing for quick erection. In the development of this concept, it is assumed the existing foundations will be adequate for re-use. Since the existing abutments and piers will be utilized, access to the powerhouse cannot be maintained throughout construction. Alternate means of access will be necessary.

This option will require additional services, which may likely include a geotechnical investigation and a site survey. An allowance for substructure concrete repairs has been included, but an assessment (including testing) of the remaining concrete service life should be completed prior to detailed design of this option.

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Additional Repairs and Alternatives

Though not included in the scope of work, an alternative design for Concept 2 can allow access to be maintained to the powerhouse over the existing bridge throughout construction. The alternative would locate a new superstructure on a new substructure located south of the existing structure. This alternative would also require new retaining walls, additional approach rail, and modified approach road alignment, all at additional cost. Further, in-water work and associated regulatory permitting would impact schedule. Following review of this report, if NSPI would like to investigate this possibility, CBCL would be pleased to provide additional work scope.

COST/SCHEDULE

We have prepared a class "D" (high level) cost estimate for both Concept #1 and Concept #2. A full cost breakdown has been provided in **Appendix C**. A summary is provided for the two concepts in the table below:

Concept	Estimated Construction Cost (Excl. HST)		Premium for use of Volvo A40
	CL-625	Volvo A40	
#1 – Bridge 14 – Superstructure Rehabilitation	[redacted]		
#2 – Bridge 14 – Superstructure Replacement			

Concept	Estimated Construction Cost (Excl. HST)		Premium for use of Volvo A40
	CL-625	Volvo A40	
#1 – Bridge 15 – Superstructure Rehabilitation	[redacted]		
#2 – Bridge 15 – Superstructure Replacement			

The cost for Concept #1 includes localized recoating of the structural steel. Also, the above Concept #2 costs includes an allowance for investigation work for the existing concrete substructure.

A comparison of each concept is provided below:

Evaluation Criteria	Concept #1 – Rehab (either load rating)	Concept #2 – Replace (either load rating)
Lower Cost		✓
Shorter Schedule		✓
Maintains Access		
Longer Future Service Life		✓
Utilize Existing Abutments	✓	✓

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We anticipate construction work can be completed in approximately 12 – 20 weeks for Concept #1, and 6-10 weeks for Concept #2. Fabrication of the superstructure in Concept #2 has not been included in this schedule. As already discussed, a total bridge shutdown will be required for both concepts. The cost of an alternative concept of placing a completely new structure south of the existing structure has not been included.

RECOMMENDATIONS

Based on the lower cost and the shorter anticipated construction schedule, CBCL recommends Concept #2 with either the CL-625 or Volvo A40 load rating, whichever is deemed necessary for future work. Further, CBCL recommends a detailed condition assessment and necessary materials testing be completed on the substructure concrete prior to proceeding with detailed design.

It should be noted that the recommendation of structure replacements is driven by lack of capacity rather than deterioration and poor condition in the existing structures for both evaluated vehicles. Additionally, the existing structure width is not sufficient to accommodate the crossing of a Volvo A40. With this in mind, following removal, these structures can be removed, stored and repurposed at NSPI locations with less demand. The cost benefit of this has not been included in the cost estimates above but is discussed to reinforce the recommendation.

Following NSPI's indication of a preferred option and load rating, CBCL can provide a preliminary schematic drawing to present the concept prior to deciding to proceed with detailed design (Phase B). We trust this report is complete and answers any queries you may have regarding this project. We are prepared to commence detailed design upon your selection of the desired concept. Please call or email if you have any questions or concerns.

Yours truly,

CBCL Limited

DRAFT

Prepared by:
Aaron Kennedy, P.Eng.
Structural Engineer
Phone: (902) 421-7241 Ext. 2568
E-Mail: akennedy@cbcl.ca

DRAFT

Reviewed by:
Colin Jim, P.Eng.
Structural Engineer

Attachments: Appendix A – Photos of Existing Structures
Appendix B – Standard Rail Details
Appendix C – Class D Cost Estimate

Project No: 170237.03

APPENDIX A

Photos

Photo No. 1 – Bridge 14 – Lower Lake Falls – Bridge Deck

Photo No. 2 – Bridge 14 – Lower Lake Falls – Bridge Abutment

Photo No. 3 – Bridge 14 – Lower Lake Falls – Bridge Elevation

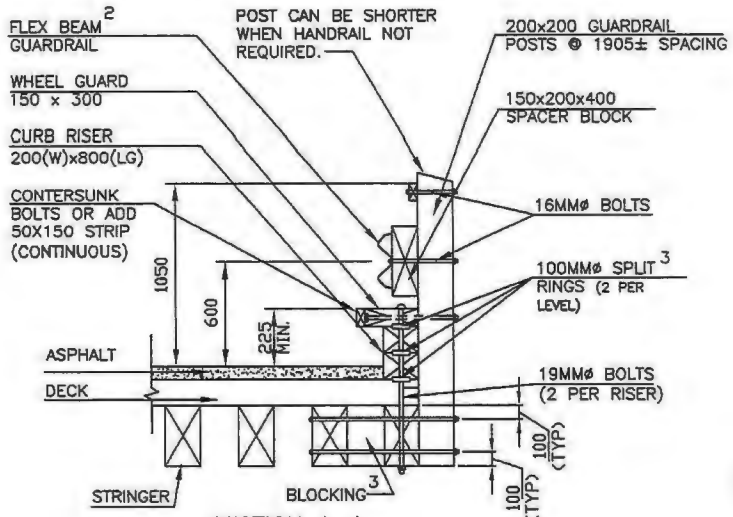
Photo No. 4 – Bridge 15 – Big Falls – Bridge Deck

Photo No. 5 – Bridge 15 – Big Falls Bridge Abutment

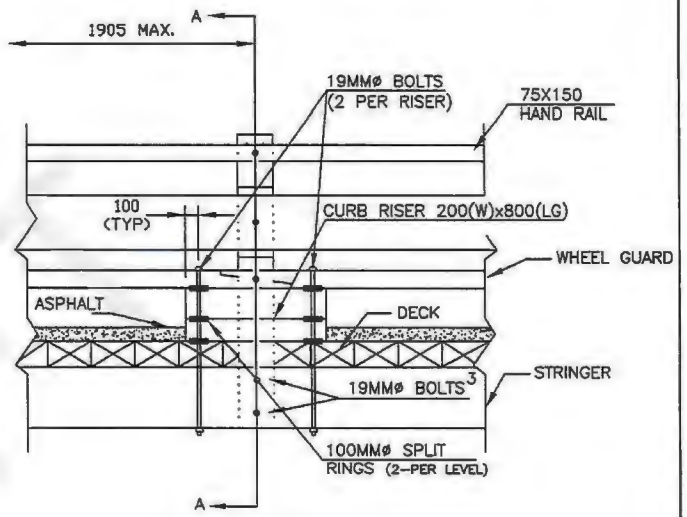
Photo No. 6 – Bridge 15 – Big Falls – Bridge Elevation

APPENDIX B

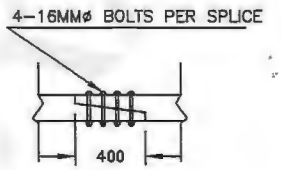
NSTIR STD Drawings



SECTION A–A



ELEVATION



WHEEL GUARD SPLICE

NOTES:
1. GALVANIZED WASHERS 75X75X8 PLACED ON BOTH ENDS OF ALL BOLTS.
2. IF AADT > 2000VPD, USE THRIE BEAM OR DOUBLE LAYER FLEXBEAM GUARDRAIL.
3. IF AADT < 2000VPD, SPLIT RINGS ARE NOT REQUIRED; CONNECTION TO ONE STRINGER ONLY
IF DEPTH OF STRINGER IS => 450MM; IF CONNECTION TO ONE STRINGER ONLY, OUTSIDE STRINGER TO BE BLOCKED AND CONNECTED TO NEXT STRINGER AT A MAXIMUM 4.0M SPACING WITH 2–19MMø BOLTS.
4. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

Manager Structural Engineering

Director Highway Engineering Services

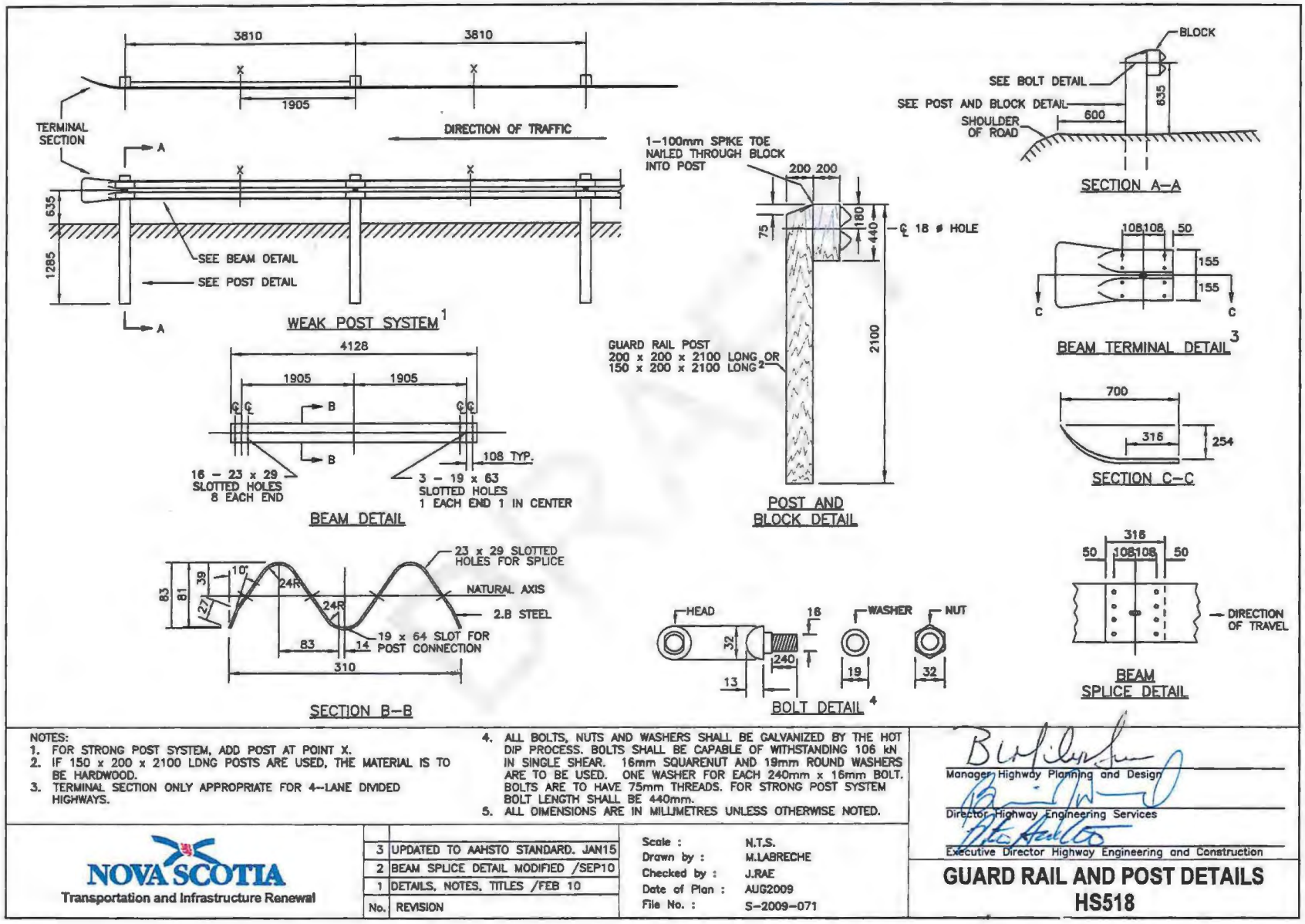
Executive Director Highway Engineering and Construction

NOVA SCOTIA
Transportation and Infrastructure Renewal

No.	REVISION

Scale :	N.T.S.
Drawn by :	WRP
Checked by :	R.SWINEMAR
Date of Plan :	2007–05–29
File No. :	B–2007–146

TIMBER BRIDGE BARRIER
PL1



NOTES:
1. FOR STRONG POST SYSTEM, ADD POST AT POINT X.
2. IF 150 x 200 x 2100 LONG POSTS ARE USED, THE MATERIAL IS TO BE HARDWOOD.
3. TERMINAL SECTION ONLY APPROPRIATE FOR 4–LANE DIVIDED HIGHWAYS.
4. ALL BOLTS, NUTS AND WASHERS SHALL BE GALVANIZED BY THE HOT DIP PROCESS. BOLTS SHALL BE CAPABLE OF WITHSTANDING 106 kN IN SINGLE SHEAR. 16mm SQUARENUT AND 19mm ROUND WASHERS ARE TO BE USED. ONE WASHER FOR EACH 240mm x 16mm BOLT. BOLTS ARE TO HAVE 75mm THREADS. FOR STRONG POST SYSTEM BOLT LENGTH SHALL BE 440mm.
5. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.

Manager Highway Planning and Design

Director Highway Engineering Services

Executive Director Highway Engineering and Construction

NOVA SCOTIA
Transportation and Infrastructure Renewal

No.	REVISION
3	UPDATED TO AAHSTO STANDARD. JAN15
2	BEAM SPLICE DETAIL MODIFIED /SEP10
1	DETAILS, NOTES, TITLES /FEB 10

Scale :	N.T.S.
Drawn by :	M.LABRECHE
Checked by :	J.RAE
Date of Plan :	AUG2009
File No. :	S–2009–071

GUARD RAIL AND POST DETAILS
HS518

APPENDIX C

Cost Estimates

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OPINION of PROBABLE CONSTRUCTION COST
Nova Scotia Power Incorporated
Mersey River System - Bridge # 14 - Lower Big Falls
Loading CL-625

DATE:	December 18, 2017
CBCL FILE No.:	170237.03
PREPARED BY:	AK/AT
EST. DESCRIPTION:	Class D

Item	DESCRIPTION	UNIT	Qty.	Option # 1 Strengthen Existing Structure	Option # 2 Replace with Pre-Eng. Algonquin Bridge
1	Mobilization & Demobilization, Bonds, Insurance, Permits	LS	1	[redacted]	[redacted]
2	Excavation, Backfill Wing Walls & Adjust Approach Grades	LS	1		
3	Removals/Disposal Decking Floor Beams & Stringers	LS	1		
4	Demolition & Disposal of Steel Truss Structure	LS	1		
5	Concrete Abutments, Wing Walls & Pier Modifications	LS	1		
6	Pre-Engineered Algonquin Bridge - Supply Only	LS	1		
7	Pre-Engineered Algonquin Bridge - Erection	LS	1		
8	Strengthen Existing Truss Members	LS	1		
9	Steel Floor Beams (Supply and Install)	LS	1		
10	Transverse Stringers (Supply and Install)	LS	1		
11	PT Wood Decking & Timber Curb	LS	1		
12	Bridge Rail (Supply and Install)	LS	1		
13	Approach Rail (Supply and Install)	LS	1		
14	Bearing Replacement	LS	1		
15	Concrete Substructure Repairs	LS	1		
16	Recoat Structural Steel	LS	1		
17	Additional Investigation Allowance	LS	1		
18	Design Development Contingency - Note 1				
19	Contractors General Conditions & Fees				
	Total Direct & Indirect Construction Costs				
20	Construction Contingency - Note 2	%	15%	10%	
21	Escalation / Inflation (Based on 2017 Dollars) - Note 3				
22	Location Factor - Note 4				
	Total Direct & Indirect Construction Costs c/w Contingencies				
	Add HST		15%		
	Total Construction Budget with HST				

THIS OPINION OF PROBABLE COSTS IS PRESENTED ON THE BASIS OF EXPERIENCE, QUALIFICATIONS, AND BEST JUDGEMENT. IT HAS BEEN PREPARED IN ACCORDANCE WITH ACCEPTABLE PRINCIPLES AND PRACTICES. MARKET TRENDS, NON-COMPETITIVE BIDDING SITUATIONS, UNFORESEEN LABOUR AND MATERIAL ADJUSTMENTS AND THE LIKE ARE BEYOND THE CONTROL OF CBCL LIMITED. AS SUCH WE CANNOT WARRANT OR GUARANTEE THAT ACTUAL COSTS WILL NOT VARY FROM THE OPINION

Note 1	A Design Development Contingency is to allow for necessary design changes as the work is better defined
Note 2	A Construction Contingency is to allow for C.O. cost of additional work over and above the contract Awarded price.
Note 3	The Escalation/Inflation allowance is for increases in construction costs from time the budget to Tender Call
Note 4	The Location Factor is for variances between construction costs at the location of the project & historical costs data

Form CBCL 035.Rev 1

170237.03 ES001 CURRENT Bridge # 14 Class D Budget 18-12-2017_ak_at.xlsx

CBCL LIMITED
Consulting Engineers

OPINION of PROBABLE CONSTRUCTION COST
Nova Scotia Power Incorporated
Mersey River System - Bridge # 14 - Lower Big Falls
Loading Volvo A40, CL-625

DATE:	Febuary 8, 2018
CBCL FILE No.:	170237.03
PREPARED BY:	AK/AT/TMD
EST. DESCRIPTION:	Class D

Item	DESCRIPTION	UNIT	Qty.	Option # 1 Strengthen Existing Structure	Option # 2 Replace with Pre-Eng. Algonqiun Bridge
1	Mobilization & Demobilization, Bonds, Insurance, Permits	LS	1	[redacted]	[redacted]
2	Excavation, Backfill Wing Walls & Adjust Approach Grades	LS	1		
3	Removals/Disposal Decking Floor Beams & Stringers	LS	1		
4	Demolition & Disposal of Steel Truss Structure	LS	1		
5	Concrete Abutments, Wing Walls & Pier Modifications	LS	1		
6	Pre-Engineered Algonquin Bridge - Supply Only	LS	1		
7	Pre-Engineered Algonquin Bridge - Erection	LS	1		
8	Strengthen Existing Truss Members	LS	1		
9	Steel Floor Beams (Supply and Install)	LS	1		
10	Transverse Stringers (Supply and Install)	LS	1		
11	PT Wood Decking & Timber Curb	LS	1		
12	Bridge Rail (Supply and Install)	LS	1		
13	Approach Rail (Supply and Install)	LS	1		
14	Bearing Replacement	LS	1		
15	Concrete Substructure Repairs	LS	1		
16	Recoat Structural Steel	LS	1		
17	Additional Investigation Allowance	LS	1		
18	Design Development Contingency - Note 1				
19	Contractors General Conditions & Fees				
	Total Direct & Indirect Construction Costs				
20	Construction Contingency - Note 2	%	15%	10%	
21	Escalation / Inflation (Based on 2018 Dollars) - Note 3				
22	Location Factor - Note 4				
	Total Direct & Indirect Construction Costs c/w Contingencies				
	Add HST		15%		
	Total Construction Budget with HST				

THIS OPINION OF PROBABLE COSTS IS PRESENTED ON THE BASIS OF EXPERIENCE, QUALIFICATIONS, AND BEST JUDGEMENT. IT HAS BEEN PREPARED IN ACCORDANCE WITH ACCEPTABLE PRINCIPLES AND PRACTICES. MARKET TRENDS, NON-COMPETITIVE BIDDING SITUATIONS, UNFORESEEN LABOUR AND MATERIAL ADJUSTMENTS AND THE LIKE ARE BEYOND THE CONTROL OF CBCL LIMITED. AS SUCH WE CANNOT WARRANT OR GUARANTEE THAT ACTUAL COSTS WILL NOT VARY FROM THE OPINION

Note 1 A Design Development Contingency is to allow for necessary design changes as the work is better defined
Note 2 A Construction Contingency is to allow for C.O. cost of additional work over and above the contract Awarded price.
Note 3 The Escalation/Inflation allowance is for increases in construction costs from time the budget to Tender Call
Note 4 The Location Factor is for variances between construction costs at the location of the project & historical costs data

Form CBCL 035.Rev 1

170237.03 ES002 CURRENT Bridge # 14 Class D Budget 18-12-2017_ak_at_tmd.xlsx

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OPINION of PROBABLE CONSTRUCTION COST
Nova Scotia Power Incorporated
Mersey River System - Bridge # 15 - Big Falls
Loading CL-625

DATE:	December 18, 2017
CBCL FILE No.:	170237.03
PREPARED BY:	AK/AT
EST. DESCRIPTION:	Class D

Item	DESCRIPTION	UNIT	Qty.	Option # 1 Strengthen Existing Structure	Option # 2 Replace with Pre-Eng. Algonqiun Bridge
1	Mobilization & Demobilization, Bonds, Insurance, Permits	LS	1	[redacted]	[redacted]
2	Excavation, Backfill Wing Walls & Adjust Approach Grades	LS	1		
3	Removals/Disposal Decking Floor Beams & Stringers	LS	1		
4	Demolition & Disposal of Steel Truss Structure	LS	1		
5	Concrete Abutments, Wing Walls & Pier Modifications	LS	1		
6	Pre-Engineered Algonquin Bridge - Supply Only	LS	1		
7	Pre-Engineered Algonquin Bridge - Erection	LS	1		
8	Strengthen Existing Truss Members	LS	1		
9	Steel Floor Beams (Supply and Install)	LS	1		
10	Transverse Stringers (Supply and Install)	LS	1		
11	PT Wood Decking & Timber Curb	LS	1		
12	Bridge Rail (Supply and Install)	LS	1		
13	Approach Rail (Supply and Install)	LS	1		
14	Bearing Replacement	LS	1		
15	Concrete Substructure Repairs	LS	1		
16	Recoat Structural Steel	LS	1		
17	Additional Investigation Allowance	LS	1		
18	Design Development Contingency - Note 1				
19	Contractors General Conditions & Fees				
	Total Direct & Indirect Construction Costs				
20	Construction Contingency - Note 2	%	15%	10%	
21	Escalation / Inflation (Based on 2017 Dollars) - Note 3				
22	Location Factor - Note 4				
	Total Direct & Indirect Construction Costs c/w Contingencies				
	Add HST		15%		
	Total Construction Budget with HST				

THIS OPINION OF PROBABLE COSTS IS PRESENTED ON THE BASIS OF EXPERIENCE, QUALIFICATIONS, AND BEST JUDGEMENT. IT HAS BEEN PREPARED IN ACCORDANCE WITH ACCEPTABLE PRINCIPLES AND PRACTICES. MARKET TRENDS, NON-COMPETITIVE BIDDING SITUATIONS, UNFORESEEN LABOUR AND MATERIAL ADJUSTMENTS AND THE LIKE ARE BEYOND THE CONTROL OF CBCL LIMITED. AS SUCH WE CANNOT WARRANT OR GUARANTEE THAT ACTUAL COSTS WILL NOT VARY FROM THE OPINION

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Note 2 A Construction Contingency is to allow for C.O. cost of additional work over and above the contract Awarded price.
Note 3 The Escalation/Inflation allowance is for increases in construction costs from time the budget to Tender Call
Note 4 The Location Factor is for variances between construction costs at the location of the project & historical costs data

Form CBCL 035.Rev 1

170237.03 ES001 CURRENT Bridge # 15 Class D Budget 18-12-2017_ak_at.xlsx

CBCL LIMITED
Consulting Engineers

OPINION of PROBABLE CONSTRUCTION COST
Nova Scotia Power Incorporated
Mersey River System - Bridge # 15 - Big Falls
Loading Volvo A40, CL-625

DATE:	Febuary 8, 2018
CBCL FILE No.:	170237.03
PREPARED BY:	AK/AT/TMD
EST. DESCRIPTION:	Class D

Item	DESCRIPTION	UNIT	Qty.	Option # 1 Strengthen Existing Structure	Option # 2 Replace with Pre-Eng. Algonqiun Bridge
1	Mobilization & Demobilization, Bonds, Insurance, Permits	LS	1	[redacted]	[redacted]
2	Excavation, Backfill Wing Walls & Adjust Approach Grades	LS	1		
3	Removals/Disposal Decking Floor Beams & Stringers	LS	1		
4	Demolition & Disposal of Steel Truss Structure	LS	1		
5	Concrete Abutments, Wing Walls & Pier Modifications	LS	1		
6	Pre-Engineered Algonquin Bridge - Supply Only	LS	1		
7	Pre-Engineered Algonquin Bridge - Erection	LS	1		
8	Strengthen Existing Truss Members	LS	1		
9	Steel Floor Beams (Supply and Install)	LS	1		
10	Transverse Stringers (Supply and Install)	LS	1		
11	PT Wood Decking & Timber Curb	LS	1		
12	Bridge Rail (Supply and Install)	LS	1		
13	Approach Rail (Supply and Install)	LS	1		
14	Bearing Replacement	LS	1		
15	Concrete Substructure Repairs	LS	1		
16	Recoat Structural Steel	LS	1		
17	Additional Investigation Allowance	LS	1		
18	Design Development Contingency - Note 1				
19	Contractors General Conditions & Fees				
	Total Direct & Indirect Construction Costs				
20	Construction Contingency - Note 2	%	15%	10%	
21	Escalation / Inflation (Based on 2018 Dollars) - Note 3				
22	Location Factor - Note 4				
	Total Direct & Indirect Construction Costs c/w Contingencies				
	Add HST		15%		
	Total Construction Budget with HST				

THIS OPINION OF PROBABLE COSTS IS PRESENTED ON THE BASIS OF EXPERIENCE, QUALIFICATIONS, AND BEST JUDGEMENT. IT HAS BEEN PREPARED IN ACCORDANCE WITH ACCEPTABLE PRINCIPLES AND PRACTICES. MARKET TRENDS, NON-COMPETITIVE BIDDING SITUATIONS, UNFORESEEN LABOUR AND MATERIAL ADJUSTMENTS AND THE LIKE ARE BEYOND THE CONTROL OF CBCL LIMITED. AS SUCH WE CANNOT WARRANT OR GUARANTEE THAT ACTUAL COSTS WILL NOT VARY FROM THE OPINION

Note 1	A Design Development Contingency is to allow for necessary design changes as the work is better defined
Note 2	A Construction Contingency is to allow for C.O. cost of additional work over and above the contract Awarded price.
Note 3	The Escalation/Inflation allowance is for increases in construction costs from time the budget to Tender Call
Note 4	The Location Factor is for variances between construction costs at the location of the project & historical costs data

Form CBCL 035.Rev 1

170237.03 ES002 CURRENT Bridge # 15 Class D Budget 18-12-2017_ak_at_tmd.xlsx

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BEST MANAGED COMPANIES

January 15, 2018

Mr. Colin MacDonald, P.Eng.
Civil Project Engineer
Nova Scotia Power Inc.
PO Box 910
Halifax, NS B3J 2W5

Dear Mr. MacDonald:

RE: Upgrades and Rehabilitation of Bridge 16 – Nictaux Canal DRAFT Report

CBCL is pleased to provide the following report in accordance with the requirements for Phase A of the rehabilitation/upgrade of Bridge 16. The existing conditions of the bridge is described, followed by our two proposed concepts of superstructure rehabilitation and superstructure replacement. Finally, cost estimates and projected construction schedule are provided for both concepts.

EXISTING CONDITION – BRIDGE 16 – NICTAUX CANAL

A site visit was performed on November 8th, 2017 to confirm that the condition of the bridge was consistent with the "Level Two Structure Inspection" report provided by Eastpoint Engineering dated June 9, 2017. The bridge condition has remained largely unchanged. Photos of the existing structure can be found in **Appendix A**.

Substructure

The substructure is comprised of two concrete abutments, which appear to be founded on bedrock. The abutments are in fair condition with minor unsound concrete detected during hammer soundings on the South abutment. No recorded drawings were provided by NSPI showing the original construction date or any repair work to the concrete abutments. Since the original construction it appears that the bridge approaches were regraded, this has turned the approach rails into makeshift wing walls. The current wing walls do not reach the proper elevation for finished grade.

Superstructure

The structural elements in the superstructure were largely in fair condition. According to record drawings provided by NSPI the timber decking and timber stringers were replaced in 1992. The timber members are in fair condition. The steel members are starting to show signs of localized coating failure, but generally remain in fair condition. Several steel truss web members and the bottom chord appear to have additional steel plate reinforcement added sometime after the original construction. The guardrails are in fair condition and were also replaced in 1992.

Approaches and Approach Rails

The current structure has no approach rails, as the rails are almost at finished grade and acting as wing walls. No loss of material was observed behind the bridge indicating the backwall and wingwalls remain functional.

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PROPOSED CONCEPTS – BRIDGE 16 – NICTAUX CANAL

As per discussion with NSPI, it is desirable to have a bridge structure capable of supporting a CAT 740 Articulated Truck in accordance with CSA S6-14. It should be noted that the total loaded weight of this truck is not only heavier than the typical highway design truck (CL-625) but also transfers the weight through three axles as opposed to five on the CL-625. CBCL has completed a preliminary structural analysis and evaluation of the existing structure. The analysis was required to assess the level of rehabilitation required to achieve a CAT 740 Articulated Truck load rating and develop possible repair options.

Concept 1 – Superstructure Rehabilitation

Concept 1 involves rehabilitating the existing superstructure and includes the following repair items:

- Removal of timber decking, steel floor beams, bridge rails, and approach rails;
- Strengthen the truss top and bottom chords;
- Strengthen most truss diagonal members and vertical members;
- Replacement of steel floor beams; a preliminary design indicates a W200x21 would be sufficient;
- Replacement of timber stringers and wearing surface; a preliminary design indicated 114x289 S.P.F No.1 or better stringers would be sufficient;
- Extension of the concrete wing walls to match finished grade elevation;
- Concrete repairs to the South wing wall and abutment;
- Installation of new bridge guard rail;
- Installation of new approach rail;
- Recoating all structural steel to protect from further corrosion; and
- Standard guard rail/approach rails details are provided by the Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) and have been included as **Appendix B**. These details will be adapted to fit the requirements of this structure.

The CAT 740 articulating truck does not currently fit within the bridge travel way, during the re-decking process the width of superstructure will need to be increased to accommodate the larger vehicle. As discussed previously, the loading requirements for a CAT 740 articulating truck are more severe than a typical CL-625 design vehicle. Some of the repairs detailed above might not be required to accommodate only the CL-625 design vehicle. This has not been investigated in detail, nor has a cost estimate been provided.

Due to the extents of the repairs, normal access to the powerhouse cannot be maintained throughout construction. Alternate means of access will be necessary.

Concept 2 – Superstructure Replacement

Concept 2 involves replacing the entire bridge superstructure, inclusive of the bearings. The design live load for the replacement structure will be the same CAT 740 articulating truck loading. The preliminary concept uses a prefabricated steel bridge superstructure, complete with a timber deck and galvanized steel flex beam rail system. The new structure will be wide enough to accommodate the new design vehicle. The proposed structure will be relatively light allowing for quick erection. In the development of this concept, it is assumed the existing foundations will be adequate for re-use. Since the existing abutments will be utilized, access to the powerhouse cannot be maintained throughout construction. Alternate means of access will be necessary.

This option will require additional services, which may likely include a site survey. An allowance for substructure concrete repairs has been included, but an assessment (including testing) of the remaining concrete service life should be completed prior to detailed design of this option.

Additional Repairs and Alternatives

Though not included in the scope of work, an alternative design for Concept 2 can allow access to be maintained to the powerhouse over the existing bridge throughout construction. The approach would locate a new superstructure on a new substructure located either side of the existing structure. This alternative would also require new retaining walls, additional approach rail, and modified approach road alignment, all at additional cost. Further, in-water work and associated regulatory permitting would impact schedule. Following review of this report, if NSPI would like to investigate this possibility, CBCL would be pleased to provide additional work scope.

COST/SCHEDULE

We have prepared a class "D" (high level) cost estimate for both Concept #1 and Concept #2. A full cost breakdown has been provided in **Appendix C**. A summary is provided for the two concepts in the table below:

Concept	Approx. Estimated Construction Cost (Excl. HST)
#1 – Bridge 16 – Superstructure Rehabilitation	[redacted]
#2 – Bridge 16 - Superstructure Replacement	

The cost for Concept #1 includes localized recoating of the structural steel. Also, the above Concept #2 costs includes an allowance for investigation work for the existing concrete substructure.

A comparison of each concept is provided below:

Evaluation Criteria	Concept #1 – Rehab	Concept #2 - Replace
Lower Cost		✓
Shorter Schedule		✓
Maintains Access		
Longer Future Service Life		✓
Utilize Existing Abutments	✓	✓

We anticipate construction work can be completed in approximately 6 – 8 weeks for Concept #1, and 3-5 weeks for Concept #2. Fabrication of the superstructure in Concept #2 has not been included in this schedule. As already discussed, a total bridge shutdown will be required for both concepts. The cost of an alternative concept of placing a completely new structure adjacent to the existing structure has not been included.

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RECOMMENDATIONS

Based on the lower cost and the shorter anticipated construction schedule, CBCL recommends Concept #2. Further, CBCL recommends a detailed condition assessment and necessary materials testing be completed on the substructure concrete prior to proceeding with detailed design.

It should be noted that the recommendation of structure replacements is driven by lack of capacity rather than deterioration and poor condition in the existing structure. With this in mind, following removal, the structure can be removed, stored and repurposed at an NSPI location with less demand. The cost benefit of this has not been included in the cost estimates above but is discussed to reinforce the recommendation.

Following NSPI's indication of a preferred option, CBCL can provide a preliminary schematic drawing to present the concept prior to deciding to proceed with detailed design (Phase B). We trust this report is complete and answers any queries you may have regarding this project. We are prepared to commence detailed design upon your selection of the desired concept. Please call or email if you have any questions or concerns.

Yours truly,

CBCL Limited

DRAFT

Prepared by:
Aaron Kennedy, P.Eng.
Structural Engineer
Phone: (902) 421-7241 Ext. 2568
E-Mail: akennedy@cbcl.ca

DRAFT

Reviewed by:
Colin Jim, P.Eng.
Structural Engineer

Attachments: Appendix A – Photos of Existing Structure
Appendix B – Standard Rail Details
Appendix C – Class D Cost Estimate

Project No: 170237.05

APPENDIX A

Photos of Existing Structure

Photo No. 1 – Existing bridge superstructure.

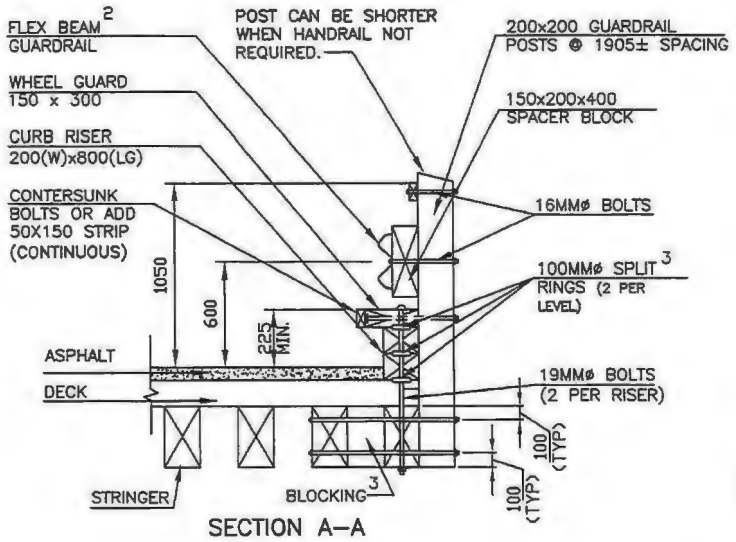
Photo No. 2 – Existing abutment wing wall.

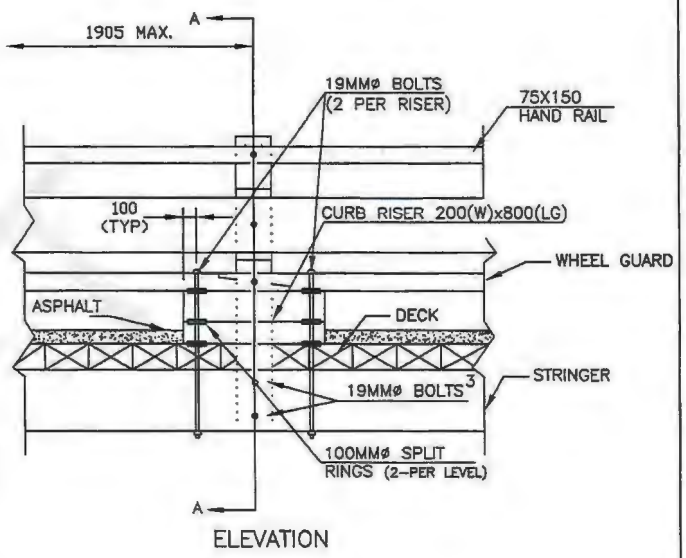
Photo No. 3 – Existing abutment wing wall.

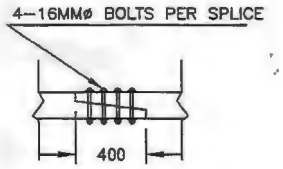
Photo No. 4 – Existing superstructure elevation.

APPENDIX B

Standard Rail Details







NOTES:
1. GALVANIZED WASHERS 75X75X8 PLACED ON BOTH ENDS OF ALL BOLTS.
2. IF AADT > 2000VPD, USE THRIE BEAM OR DOUBLE LAYER FLEXBEAM GUARDRAIL.
3. IF AADT < 2000VPD, SPLIT RINGS ARE NOT REQUIRED; CONNECTION TO ONE STRINGER ONLY
   IF DEPTH OF STRINGER IS => 450MM; IF CONNECTION TO ONE STRINGER ONLY, OUTSIDE STRINGER TO BE BLOCKED AND CONNECTED TO NEXT STRINGER AT A MAXIMUM 4.0M SPACING WITH 2–19MMø BOLTS.
4. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

NOVA SCOTIA
Transportation and Infrastructure Renewal

No.	REVISION

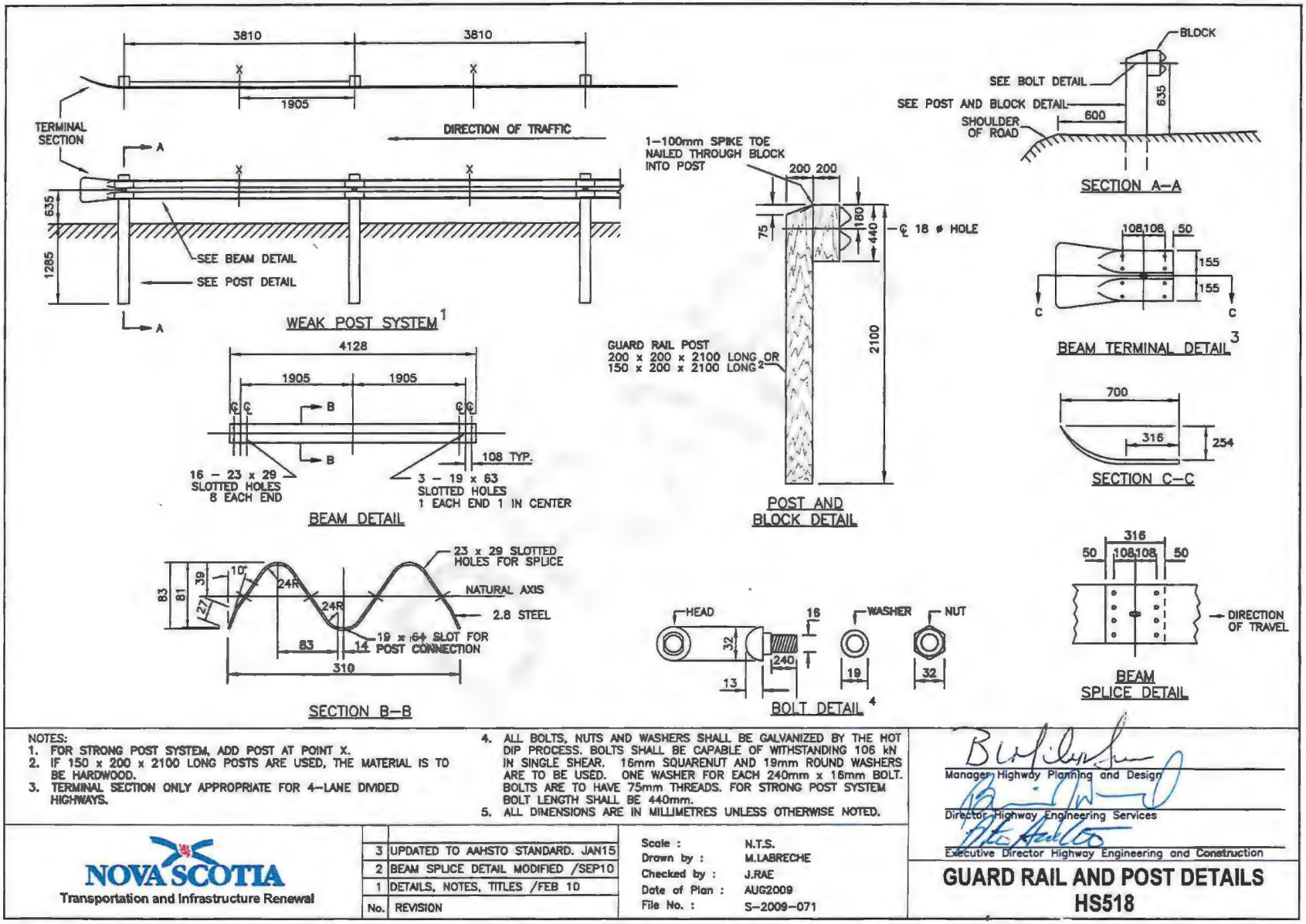
Scale :	N.T.S.
Drawn by :	WRP
Checked by :	R.SWINEMAR
Date of Plan :	2007–05–29
File No. :	B–2007–146

Manager Structural Engineering

Director Highway Engineering Services

Executive Director Highway Engineering and Construction

TIMBER BRIDGE BARRIER
PL1



NOTES:
1. FOR STRONG POST SYSTEM, ADD POST AT POINT X.
2. IF 150 x 200 x 2100 LONG POSTS ARE USED, THE MATERIAL IS TO BE HARDWOOD.
3. TERMINAL SECTION ONLY APPROPRIATE FOR 4–LANE DIVIDED HIGHWAYS.
4. ALL BOLTS, NUTS AND WASHERS SHALL BE GALVANIZED BY THE HOT DIP PROCESS. BOLTS SHALL BE CAPABLE OF WITHSTANDING 106 kN IN SINGLE SHEAR. 16mm SQUARENUT AND 19mm ROUND WASHERS ARE TO BE USED. ONE WASHER FOR EACH 240mm x 16mm BOLT. BOLTS ARE TO HAVE 75mm THREADS. FOR STRONG POST SYSTEM BOLT LENGTH SHALL BE 440mm.
5. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.

Manager Highway Planning and Design

Director Highway Engineering Services

Executive Director Highway Engineering and Construction

NOVA SCOTIA
Transportation and Infrastructure Renewal

No.	REVISION
3	UPDATED TO AAHSTO STANDARD. JAN15
2	BEAM SPLICE DETAIL MODIFIED /SEP10
1	DETAILS, NOTES, TITLES /FEB 10

Scale : N.T.S.
Drawn by : M.LABRECHE
Checked by : J.RAE
Date of Plan : AUG2009
File No. : S–2009–071

GUARD RAIL AND POST DETAILS
HS518

APPENDIX C

Class D Cost Estimate

CBCL LIMITED
Consulting Engineers

OPINION of PROBABLE CONSTRUCTION COST
Nova Scotia Power Incorporated
Bridge # 16 - Nictaux Canal
CLASS D BUDGET

DATE:	January 15, 2018
CBCL FILE No.:	170237.05
PREPARED BY:	TMD/AT/AK
EST. DESCRIPTION:	Class D

Item	DESCRIPTION	UNIT	Qty.	Option # 1 Strengthen Existing Structure	Option # 2 Replace with Pre-Eng. Algonqiun Bridge
1	Mobilization & Demobilization, Bonds, Insurance, Permits	LS	1	[redacted]	[redacted]
2	Excavation, Backfill Wing Walls & Adjust Approach Grades	LS	1		
3	Removals/Disposal Decking Floor Beams & Stringers	LS	1		
4	Demolition & Disposal of Steel Truss Structure	LS	1		
5	Concrete Abutments, Wing Walls & Pier Modifications	LS	1		
6	Pre-Engineered Algonquin Bridge - Supply Only	LS	1		
7	Pre-Engineered Algonquin Bridge - Erection	LS	1		
8	Strengthen Existing Truss Members	LS	1		
9	Steel Floor Beams (Supply and Install)	LS	1		
10	PT Wood Decking & Timber Curb	LS	1		
11	Bridge Rail (Supply and Install)	LS	1		
12	Approach Rail (Supply and Install)	LS	1		
13	Bearing Installation	LS	1		
14	Concrete Substructure Repairs	LS	1		
16	Recoat Structural Steel	LS	1		
17	Additional Investigation Allowance	LS	1		
18	Design Development Contingency - Note 1		20%	10%	
19	Contractors General Conditions & Fees				
	Total Direct & Indirect Construction Costs				$
20	Construction Contingency - Note 2	%	20%	10%	
21	Escalation / Inflation (Based on 2018 Dollars) - Note 3				
22	Location Factor - Note 4				
	Total Direct & Indirect Construction Costs c/w Contingencies				
	Add HST		15%		$
	Total Construction Budget with HST				

THIS OPINION OF PROBABLE COSTS IS PRESENTED ON THE BASIS OF EXPERIENCE, QUALIFICATIONS, AND BEST JUDGEMENT. IT HAS BEEN PREPARED IN ACCORDANCE WITH ACCEPTABLE PRINCIPLES AND PRACTICES. MARKET TRENDS, NON-COMPETITIVE BIDDING SITUATIONS, UNFORESEEN LABOUR AND MATERIAL ADJUSTMENTS AND THE LIKE ARE BEYOND THE CONTROL OF CBCL LIMITED. AS SUCH WE CANNOT WARRANT OR GUARANTEE THAT ACTUAL COSTS WILL NOT VARY FROM THE OPINION

Note 1	A Design Development Contingency is to allow for necessary design changes as the work is better defined
Note 2	A Construction Contingency is to allow for C.O. cost of additional work over and above the contract Awarded price.
Note 3	The Escalation/Inflation allowance is for increases in construction costs from time the budget to Tender Call
Note 4	The Location Factor is for variances between construction costs at the location of the project & historical costs data

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Copy of 170237# 16 Class D Budget 15-01-2018 tmd at - AK Edit.xlsx 15/01/2018

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BEST MANAGED COMPANIES CANADA'S

January 15th, 2018

Mr. Colin MacDonald, P.Eng.
Civil Project Engineer
Nova Scotia Power Inc.
PO Box 910
Halifax, NS B3J 2W5

Dear Mr. MacDonald:

RE: Upgrades and Rehabilitation of Bridge 13 – Lequille Canal DRAFT Report

CBCL is pleased to provide the following report in accorda ce with the requirements for Phase A of the rehabilitation/upgrade of Bridge 13. The existing conditions of the bridge is described, followed by our two proposed concepts of superstructure rehabilitation and superstructure replacement. Finally, cost estimates and projected construction schedule are provided for both concepts.

EXISTING CONDITION – BRIDGE 13 – LEQUILLE CANAL

A site visit was performed on November 8th, 2017 to confirm that the condition of the bridge was consistent with the "Level Two Structure Inspection and Load Rating" report provided by Eastpoint Engineering dated February 28, 2017. The bridge condition has remained largely unchanged. Photos of the existing structure can be found in **Appendix A.**

Substructure

The substructure is comprised of two concrete abutments. The abutment footings were below water during the inspection, thus no visual inspection was completed. The exposed abutments are in fair condition with no unsound concrete detected during hammer soundings. Record drawings provided by NSPI show the foundations were originally constructed in approximately 1968. No record drawings were provided of any remedial work completed since the original construction.

Superstructure

The structural elements in the superstructure were largely in fair condition. Record drawings provided by NSPI show the superstructure steel was originally constructed in approximately 1967. No record drawings were provided of any remedial work completed since the original construction, although, the timber decking and steel protective coating do not appear to be original construction. The timber members are in fair condition. The steel members are starting to show signs of localized coating failure, but generally remain in fair condition. The guardrails are in fair condition.

Approaches and Approach Rails

The current structure has no approach rails. No loss of material was observed behind the bridge indicating the backwall and wingwalls remain functional.

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PROPOSED CONCEPTS – BRIDGE 13 – LEQUILLE CANAL

As per discussion with NSPI, it is desirable to have a bridge structure capable of supporting a CAT 740 Articulated Truck in accordance with CSA S6-14. It should be noted that the total loaded weight of this truck is not only heavier than the typical highway design truck (CL-625) but also transfers the weight through three axles as opposed to five on the CL-625. CBCL has completed a preliminary structural analysis and evaluation of the existing structure. The analysis was required to assess the level of rehabilitation required to achieve a CAT 740 Articulated Truck load rating and develop possible repair options.

Concept 1 – Superstructure Rehabilitation

Concept 1 involves rehabilitating the existing superstructure and includes the following repair items:

- Removal of timber decking, steel floor beams, bridge rails, and approach rails;
- Strengthen the truss bottom chord;
- Strengthen most truss diagonal members and vertical members;
- Replacement of steel floor beams; a preliminary design indicates a W200x21 would be sufficient;
- Replacement of timber stringers and wearing surface; a preliminary design indicated 114x289 S.P.F No.1 or better stringers would be sufficient;
- Installation of new bridge guard rail;
- Installation of new approach rail;
- Recoating all structural steel to protect from further corrosion; and
- Standard guard rail/approach rail details are provided by the Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) and have been included as **Appendix B**. These details will be adapted to fit the requirements of this structure.

The CAT 740 articulating truck does not currently fit within the bridge travel way, during the re-decking process the width of superstructure will need to be increased to accommodate the larger vehicle. As discussed previously, the loading requirements for a CAT 740 articulating truck are more severe than a typical CL-625 design vehicle. Some of the repairs detailed above might not be required to accommodate only the CL-625 design vehicle. This has not been investigated in detail, nor has a cost estimate been provided.

Due to the extents of the repairs, normal access to the powerhouse cannot be maintained throughout construction. Alternate means of access will be necessary.

Concept 2 – Superstructure Replacement

Concept 2 involves replacing the entire bridge superstructure, inclusive of the bearings. The design live load for the replacement structure will be the same CAT 740 articulating truck loading. The preliminary concept uses a prefabricated steel bridge superstructure, complete with a timber deck and galvanized steel flex beam rail system. The new structure will be wide enough to accommodate the new design vehicle. The proposed structure will

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be relatively light allowing for quick erection. In the development of this concept, it is assumed the existing foundations will be adequate for re-use. Since the existing abutments will be utilized, access to the powerhouse cannot be maintained throughout construction. Alternate means of access will be necessary.

This option will require additional services, which may likely include a site survey. An assessment (including testing) of the remaining concrete service life should be completed prior to detailed design of this option.

Additional Repairs and Alternatives

Though not included in the scope of work, an alternative design for Concept 2 can allow access to be maintained to the powerhouse over the existing bridge throughout construction. The approach would locate a new superstructure on a new substructure located either side of the existing structure. This alternative would also require new retaining walls, additional approach rail, and modified approach road alignment, all at additional cost. Further, in-water work and associated regulatory permitting would impact schedule. Following review of this report, if NSPI would like to investigate this possibility, CBCL would be pleased to provide additional work scope.

COST/SCHEDULE

We have prepared a class "D" (high level) cost estimate for both Concept #1 and Concept #2. A full cost breakdown has been provided in **Appendix C**. A summary is provided for the two concepts in the table below:

Concept	Approx. Estimated Construction Cost (Excl. HST)
#1 – Bridge 13 – Superstructure Rehabilitation	[redacted]
#2 – Bridge 13 - Superstructure Replacement	[redacted]

The cost for Concept #1 includes localized recoating of the structural steel. Also, the above Concept #2 costs includes an allowance for investigation work for the existing concrete substructure.

A comparison of each concept is provided below:

Evaluation Criteria	Concept #1 – Rehab	Concept #2 - Replace
Lower Cost	✓	
Shorter Schedule		✓
Maintains Access		
Longer Future Service Life		✓
Utilize Existing Abutments	✓	✓

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We anticipate construction work can be completed in approximately 6 – 8 weeks for Concept #1, and 3-5 weeks for Concept #2. Fabrication of the superstructure in Concept #2 has not been included in this schedule. As already discussed, a total bridge shutdown will be required for both concepts. The cost of an alternative concept of placing a completely new structure adjacent to the existing structure has not been included.

RECOMMENDATIONS

Although capital costs for concept #1 are estimated slightly lower, rehabilitation carries with it an uncertainty that creates a risk for this number to inflate. Rehabilitating an existing superstructure is also anticipated to carry a higher life-cycle costs. Based on these points and the shorter anticipated construction schedule, CBCL recommends Concept #2. Further, CBCL recommends a detailed condition assessment and necessary materials testing be completed on the substructure concrete prior to proceeding with detailed design.

It should be noted that the recommendation of structure replacements is driven by lack of capacity rather than deterioration and poor condition in the existing structure. With this in mind, following removal, the structure can be stored and repurposed at an NSPI location with less demand. The cost benefit of this has not bee included in the cost estimates above but is discussed to reinforce the recommendation.

Following NSPI's indication of a preferred option, CBCL can provide a preliminary schematic drawing to present the concept prior to deciding to proceed with detailed design (Phase B). We trust this report is complete and answers any queries you may have regarding this project. We are prepared to commence detailed design upon your selection of the desired concept. Please call or email if you have any questions or concerns.

Yours truly,

CBCL Limited

DRAFT

Prepared by:
Aaron Kennedy, P.Eng.
Structural Engineer
Phone: (902) 421-7241 Ext. 2568
E-Mail: akennedy@cbcl.ca

DRAFT

Reviewed by:
Colin Jim, P.Eng.
Structural Engineer

Attachments: Appendix A – Photos of Existing Structure
Appendix B – Standard Rail Details
Appendix C – Class D Cost Estimate

Project No: 170237.05

APPENDIX A

Photos of Existing Structure

Photo No. 1 – Bridge Superstructure

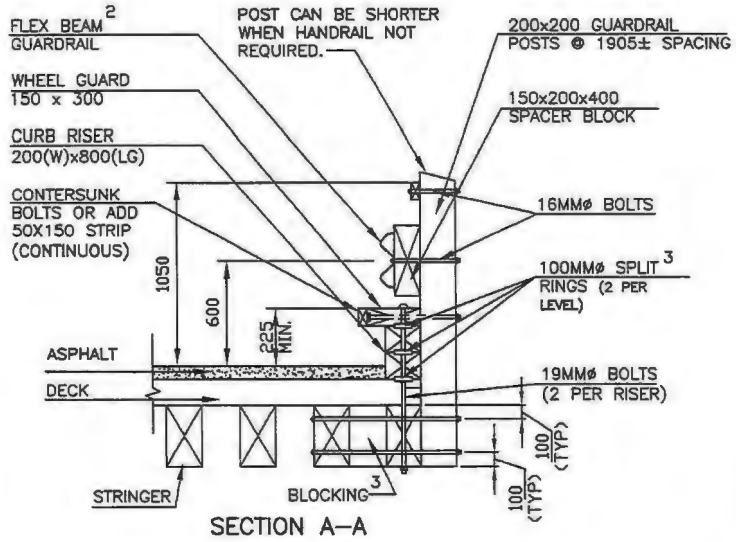
Photo No. 2 – Bridge Elevation

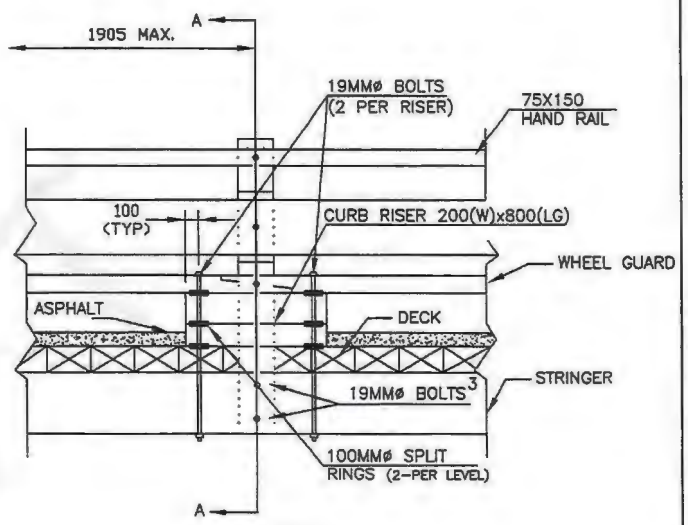
Photo No. 3 – Bridge Partial Elevation

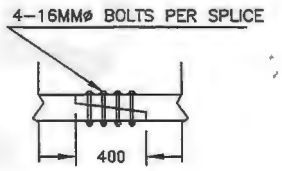
Photo No. 4 – Bearing Seat

APPENDIX B

Standard Rail Details







NOTES:
1. GALVANIZED WASHERS 75X75X8 PLACED ON BOTH ENDS OF ALL BOLTS.
2. IF AADT > 2000VPD, USE THRIE BEAM OR DOUBLE LAYER FLEXBEAM GUARDRAIL.
3. IF AADT < 2000VPD, SPLIT RINGS ARE NOT REQUIRED; CONNECTION TO ONE STRINGER ONLY
IF DEPTH OF STRINGER IS => 450MM; IF CONNECTION TO ONE STRINGER ONLY, OUTSIDE STRINGER TO BE BLOCKED AND CONNECTED TO NEXT STRINGER AT A MAXIMUM 4.0M SPACING WITH 2–19MMø BOLTS.
4. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

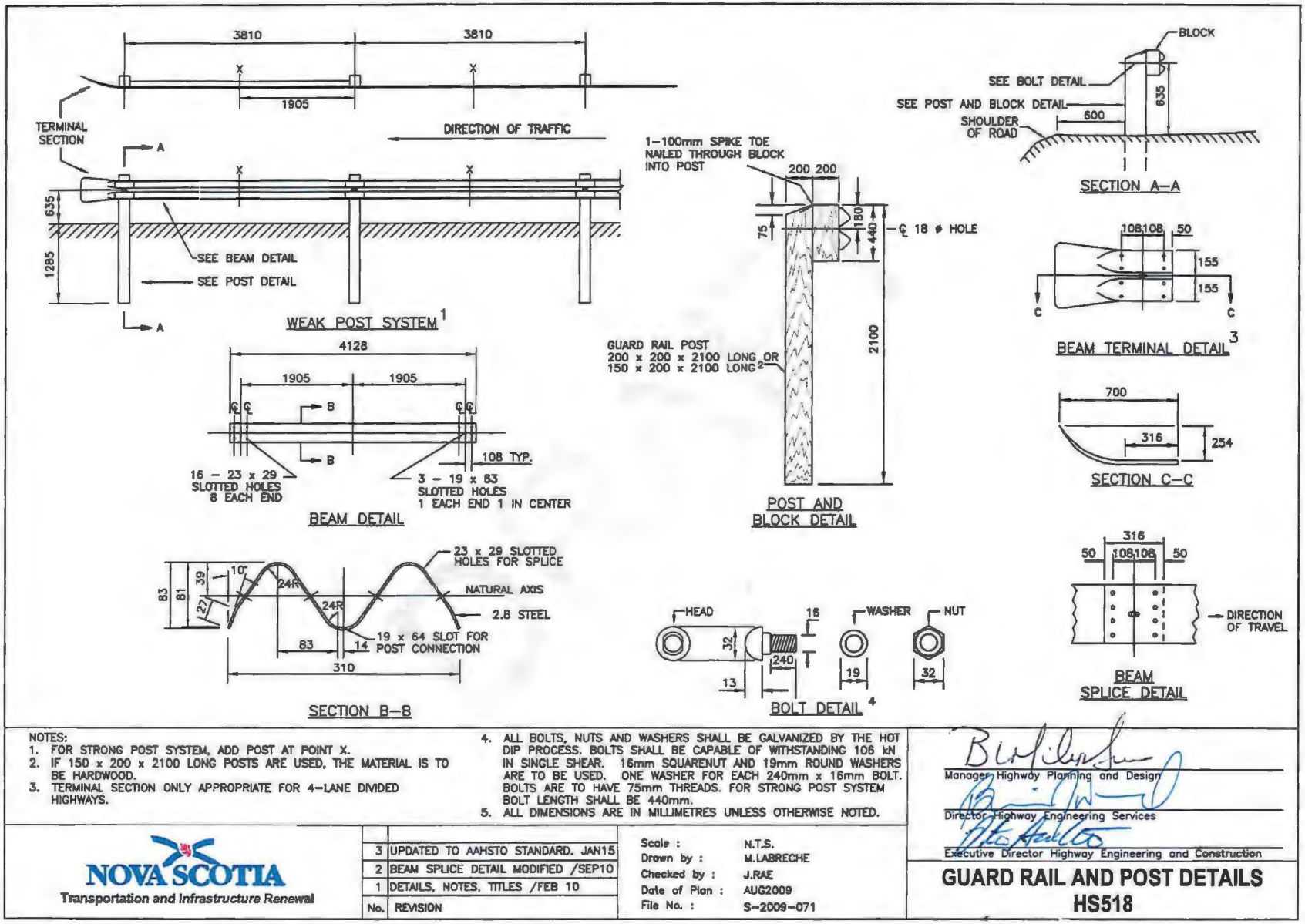
NOVA SCOTIA
Transportation and Infrastructure Renewal

No.	REVISION

Scale : N.T.S.
Drawn by : WRP
Checked by : R.SWINEMAR
Date of Plan : 2007–05–29
File No. : B–2007–146

Manager Structural Engineering
Director Highway Engineering Services
Executive Director Highway Engineering and Construction

TIMBER BRIDGE BARRIER
PL1



NOTES:
1. FOR STRONG POST SYSTEM, ADD POST AT POINT X.
2. IF 150 x 200 x 2100 LONG POSTS ARE USED, THE MATERIAL IS TO BE HARDWOOD.
3. TERMINAL SECTION ONLY APPROPRIATE FOR 4–LANE DIVIDED HIGHWAYS.
4. ALL BOLTS, NUTS AND WASHERS SHALL BE GALVANIZED BY THE HOT DIP PROCESS. BOLTS SHALL BE CAPABLE OF WITHSTANDING 106 kN IN SINGLE SHEAR. 16mm SQUARENUT AND 19mm ROUND WASHERS ARE TO BE USED. ONE WASHER FOR EACH 240mm x 16mm BOLT. BOLTS ARE TO HAVE 75mm THREADS. FOR STRONG POST SYSTEM BOLT LENGTH SHALL BE 440mm.
5. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.

Manager Highway Planning and Design

Director Highway Engineering Services

Executive Director Highway Engineering and Construction

NOVA SCOTIA
Transportation and Infrastructure Renewal

No.	REVISION
3	UPDATED TO AAHSTO STANDARD. JAN15
2	BEAM SPLICE DETAIL MODIFIED /SEP10
1	DETAILS, NOTES, TITLES /FEB 10

Scale : N.T.S.
Drawn by : M.LABRECHE
Checked by : J.RAE
Date of Plan : AUG2009
File No. : S–2009–071

GUARD RAIL AND POST DETAILS
HS518

APPENDIX C

Class D Cost Estimate

CBCL LIMITED
Consulting Engineers

OPINION of PROBABLE CONSTRUCTION COST
Nova Scotia Power Incorporated
Bridge # 13 - Lequille Canal
CLASS D BUDGET

DATE:	January 15, 2018
CBCL FILE No.:	170237.04
PREPARED BY:	TMD/AT/AK
EST. DESCRIPTION:	Class D

Item	DESCRIPTION	UNIT	Qty.	Option # 1 Strengthen Existing Structure	Option # 2 Replace with Pre-Eng. Algonquin Bridge
1	Mobilization & Demobilization, Bonds, Insurance, Permits	LS	1	$ [redacted]	[redacted]
2	Excavation, Backfill Wing Walls & Adjust Approach Grades	LS	1	$	
3	Removals/Disposal Decking Floor Beams & Stringers	LS	1	$	
4	Demolition & Disposal of Steel Truss Structure	LS	1		
5	Concrete Abutments, Wing Walls & Pier Modifications	LS	1		
6	Pre-Engineered Algonquin Bridge - Supply Only	LS	1		
7	Pre-Engineered Algonquin Bridge - Erection	LS	1		
8	Strengthen Existing Truss Members	LS	1	$	
9	Steel Floor Beams (Supply and Install)	LS	1	$	
10	PT Wood Decking & Timber Curb	LS	1	$	
11	Bridge Rail (Supply and Install)	LS	1	$	
12	Approach Rail (Supply and Install)	LS	1	$	
13	Bearing Installation	LS	1		
14	Concrete Substructure Repairs	LS	1		
16	Recoat Structural Steel	LS	1	$	
17	Additional Investigation Allowance	LS	1	$	
18	Design Development Contingency - Note 1		20%	$	0%
19	Contractors General Conditions & Fees				
	Total Direct & Indirect Construction Costs			$	
20	Construction Contingency - Note 2	%	20%	$	0%
21	Escalation / Inflation (Based on 2018 Dollars) - Note 3				
22	Location Factor - Note 4				
	Total Direct & Indirect Construction Costs c/w Contingencies			$	
	Add HST		15%	$	
	Total Construction Budget with HST			$	

THIS OPINION OF PROBABLE COSTS IS PRESENTED ON THE BASIS OF EXPERIENCE, QUALIFICATIONS, AND BEST JUDGEMENT. IT HAS BEEN PREPARED IN ACCORDANCE WITH ACCEPTABLE PRINCIPLES AND PRACTICES. MARKET TRENDS, NON-COMPETITIVE BIDDING SITUATIONS, UNFORESEEN LABOUR AND MATERIAL ADJUSTMENTS AND THE LIKE ARE BEYOND THE CONTROL OF CBCL LIMITED. AS SUCH WE CANNOT WARRANT OR GUARANTEE THAT ACTUAL COSTS WILL NOT VARY FROM THE OPINION

Note 1	A Design Development Contingency is to allow for necessary design changes as the work is better defined
Note 2	A Construction Contingency is to allow for C.O. cost of additional work over and above the contract Awarded price.
Note 3	The Escalation/Inflation allowance is for increases in construction costs from time the budget to Tender Call
Note 4	The Location Factor is for variances between construction costs at the location of the project & historical costs data

Form CBCL 035.Rev 1

170237# 13 Class D Budget 15-01-2018 tmd at - AK EDIT.xlsx 15/01/2018

CBCL LIMITED
Consulting Engineers

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PO Box 606
Halifax, Nova Scotia
Canada B3J 2R7

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Fax: 902 423 3938
E-mail: info@cbcl.ca
www.cbcl.ca

Solving today's problems with tomorrow in mind

BEST MANAGED COMPANIES

February 16, 2018

Mr. Colin MacDonald, P.Eng.
Civil Project Engineer
Nova Scotia Power Inc.
PO Box 910
Halifax, NS B3J 2W5

Dear Mr. MacDonald:

RE: Upgrades and Rehabilitation of Bridge 37 – Lower Lake Falls Tailrace DRAFT Report

CBCL is pleased to provide the following report in accordance with the requirements for Phase A of the rehabilitation/upgrade of Bridge 37. The existing conditions of the structure are described, followed by our two proposed concepts of superstructure rehabilitation and superstructure replacement. Finally, cost estimates and projected construction schedule are provided for both concepts.

EXISTING CONDITION – BRIDGE 37 – LOWER LAKE FALLS TAILRACE

A site visit was performed on December 14th, 2017 with the help of KTM Limited who provided remote access to the superstructure soffit and concrete abutments. The purpose of the site visit was to confirm that the condition of the bridge was consistent with the "NSPI Hydro and Wind Level Two Bridge Inspection and Load Rating" report provided by Eastpoint Engineering dated July 28, 2017, and to confirm the condition of areas previously not inspected, due to limited access. The bridge condition has remained largely unchanged. Photos of the existing structure can be found in **Appendix A.**

Substructure

The substructure is comprised of two concrete abutments. The abutments have a casting dated 1971 into the concrete face and appear to be in fair condition with limited unsound/spalled concrete noted on the North abutment. No record drawings of the abutments were available for CBCL to review.

Superstructure

The structural steel girders are in fair condition, but are experiencing significant coating failure. Expanding "flaking" corrosion is present at several bearing points. There are steel angle braces provided throughout the structure to support the steel girders. The steel angles are in fair condition, but are also experiencing significant coating failure. The timber decking is in fair condition and appears to have been treated with creosote to help extend the useful service life of the timbers. The timber railing and wheel guards are in poor condition with sections missing. Theses timber elements also appear to be treated with creosote.

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Approaches and Approach Rails

The structure currently uses large stones to function as approach rails on the south side of structure. It appears that the south approach was re-graded after the large stones were placed, leaving them largely buried. The north side has no approach rails or stone, several ruts are present at the approach. There is a steel fence which appears to restrict use. No loss of material was observed behind the bridge indicating the backwall and wingwalls remain functional.

PROPOSED CONCEPTS – BRIDGE 37 – LOWER BIG FALLS TAILRACE

As per discussion with NSPI, it is desirable to have bridge structures capable of supporting a CL-625 design vehicle, consideration for a Volvo A40 Articulated Truck (Volvo A40) has also been provided in accordance with CSA S6-14. It should be noted that the total loaded weight of the Volvo A40 is not only heavier than the typical highway design truck (CL-625) but transfers the weight through three axles as opposed to the five on the CL-625. CBCL has completed a preliminary structural analysis and evaluation of the existing structure for both the CL-625 Loading and the Volvo A40. The analysis was required to assess the level of rehabilitation required to achieve a CL-625 and/or Volvo A40 design vehicle load rating and develop possible repair options.

The analysis differs with the previous structural evaluation prepared by NSPI titled "NSPI Hydro and Wind Level Two Bridge Inspection and Load Rating" report provided by EastPoint Engineering dated July 28, 2017. It appears during the EastPoint analysis the girder dimensions were not field verified, during the CBCL field inspection the girders were determined to be larger than originally assumed by EastPoint, thus providing additional calculated capacity.

Concept 1 – Superstructure Rehabilitation

Concept 1 involves rehabilitating the existing superstructure in accordance with CBHDC Chapter 14 – Evaluation of Existing Structures. The following items are recommended for rehabilitation:

- Removal of timber floor beams, timber wearing surface and guard rails;
- Installation of additional top and bottom flange reinforcement (for Volvo A40 loading only);
- modification of existing approach guard stone detail;
- Installation of new timber deck. A preliminary design indicates 75x250 S.P.F No. 1 or better (on edge) continuous along the full girder length;
- Installation of new timber wearing surface;
- Repairs to the concrete abutments where unsound/spalled concrete was found;
- Repairs to the steel girders at the bearing location;
- Installation of new bridge rail;
- Recoating all structural steel; and
- Standard guard rail detail as provided by the Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) and have been included as **Appendix B**. These details will be adapted to fit the requirements of this structure.

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It should be noted that CHBDC Chapter 14 generally only evaluates a structure based upon the ultimate limit states capacity (ULS) and neglects the serviceability limit state (SLS) if the following items are met:

- No evidence of serviceability-related defects; and
- The structure use is not changing nor has the behaviour of the bridge changed.

This structure appears to meet these requirements. In the interest of completeness CBCL has completed an SLS analysis on the existing structure and the girders do not meet the minimum deflection requirements when compared to a new build structure.

The live load deflection with CL-625 loading will be approximately 50mm (2"). This level of deflection would be noticeable to drivers of heavy vehicles and may result in discomfort/concern despite the structure having adequate strength to carry the load. This deflection could be brought to within code limits through additional reinforcement to the three steel girders. This would be at additional cost which is not reflected in the costs provided below.

The deck and girders do not have sufficient reserve capacity to safely support the Volvo A40 loading, additional reinforcement would be required. This reinforcement would also be used to bring the girders within the deflection limits. The current live load deflection from a Volvo A40 is 85mm (3.34").

Due to the extents of the repairs, normal access to the NSPI facility cannot be maintained throughout construction. Alternate means of access will be necessary.

Concept 2 – Superstructure Replacement

Concept 2 involves replacing the entire bridge superstructure, inclusive of the bearings. The replacement structure will be to the same CL-625 design truck loading or Volvo A40. The preliminary concept uses a prefabricated steel bridge superstructure, complete with a timber deck and galvanized steel flex beam rail system. The proposed structure will be relatively light allowing for quick erection. In the development of this concept, it is assumed the existing foundations will be adequate for re-use. Since the existing abutments and piers will be utilized, access to the powerhouse cannot be maintained throughout construction. Alternate means of access will be necessary.

This option will require additional services, which may likely include a site survey. An allowance for substructure concrete repairs has been included, but an assessment (including testing) of the remaining concrete service life should be completed prior to detailed design of this option.

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Additional Repairs and Alternatives

Though not included in the scope of work, an alternative design for Concept 2 can allow access to be maintained to the NSPI facility over the existing bridge throughout construction. The alternative would involve construction of a new superstructure on a new substructure located east or west of the existing structure. This alternative would also require new retaining walls, additional approach rail, and modified approach road alignment, all at additional cost. Further, in-water work and associated regulatory permitting would impact schedule. Following review of this report, if NSPI would like to investigate this possibility, CBCL would be pleased to provide additional work scope.

COST/SCHEDULE

We have prepared a class "D" (high level) cost estimate for both Concept #1 and Concept #2. A full cost breakdown has been provided in **Appendix C**. A summary is provided for the two concepts in the table below:

Concept	Estimated Construction Cost (Excl. HST)		Premium for use of Volvo A40
	CL-625	Volvo A40	
#1 – Bridge 37 – Superstructure Rehabilitation	[redacted]		
#2 – Bridge 37 – Superstructure Replacement			

The cost for Concept #1 includes recoating of the structural steel. Also, the above Concept #2 costs includes an allowance for investigation work for the existing concrete substructure.

A comparison of each concept is provided below:

Evaluation Criteria	Concept #1 – Rehab	Concept #2 - Replace
Lower Cost (CL-625 Loading)	✓	
Lower Cost (Volvo A40 Loading)		✓
Shorter Schedule		✓
Maintains Access		
Longer Future Service Life		✓
Utilize Existing Abutments	✓	✓

We anticipate construction work can be completed in approximately 6 – 8 weeks for Concept #1, and 4 - 5 weeks for Concept #2. Fabrication of the superstructure in Concept #2 has not been included in this schedule. As already discussed, a total bridge shutdown will be required for both concepts. The cost of an alternative concept of placing a completely new structure has not been included.

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Consulting Engineers

RECOMMENDATIONS

Based on the life cycle cost and the shorter anticipated construction schedule, CBCL recommends Concept #2 (replacement) with either the CL-625 Loading or Volvo A40 Loading, whichever is deemed necessary for future work. Further, CBCL recommends a detailed condition assessment and necessary materials testing be completed on the substructure concrete prior to proceeding with detailed design. If purchasing a prefabricated bridge superstructure as anticipated, it is also recommended to survey the substructure in tandem with detailed design.

It should be noted that the recommendation of structure replacement is driven by excessive serviceability deflection and overall life cycle cost savings rather than overall capacity, deterioration and poor condition in the existing structure. With this in mind, following removal, the structure can be removed, stored and repurposed at an NSPI location with less demand. The cost benefit of this has not been included in the cost estimates above but is discussed to reinforce the recommendation.

Following NSPI's indication of a preferred option, CBCL can provide a preliminary schematic drawing to present the concept prior to deciding to proceed with detailed design (Phase B). We trust this report is complete and answers any queries you may have regarding this project. We are prepared to commence detailed design upon your selection of the desired concept. Please call or email if you have any questions or concerns.

Yours truly,

CBCL Limited

DRAFT

Prepared by:
Aaron Kennedy, P.Eng.
Structural Engineer
Phone: (902) 421-7241 Ext. 2568
E-Mail: akennedy@cbcl.ca

DRAFT

Reviewed by:
Colin Jim, P.Eng.
Structural Engineer

Attachments: Appendix A – Photos of Existing Structures
Appendix B – Standard Rail Details
Appendix C – Class D Cost Estimate

Project No: 170237.06

APPENDIX A

Photos

Photo No. 1 – Bridge Deck and Gate

Photo No.2 – Bridge Approach

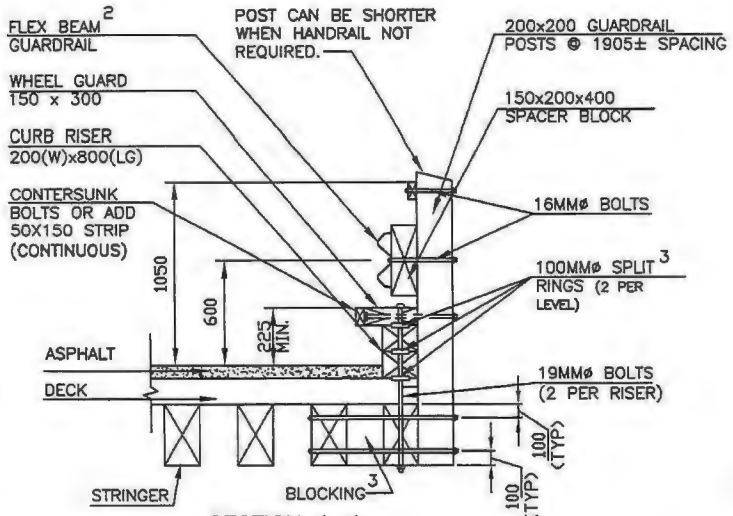
Photo No. 3 – Bridge Deck

Photo No. 4 – Damaged Guard Rail

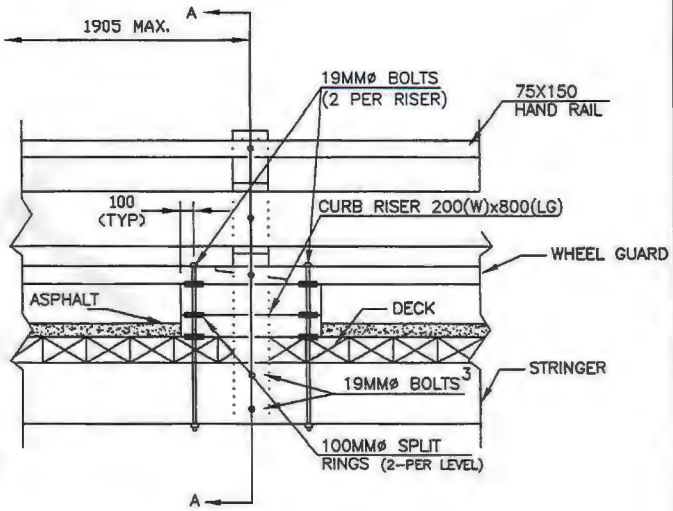
Photo No. 5 – Bridge Elevation

APPENDIX B

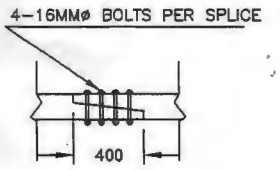
NSTIR STD Drawings



SECTION A–A



ELEVATION



WHEEL GUARD SPLICE

NOTES:
1. GALVANIZED WASHERS 75X75X8 PLACED ON BOTH ENDS OF ALL BOLTS.
2. IF AADT > 2000VPD, USE THRIE BEAM OR DOUBLE LAYER FLEXBEAM GUARDRAIL.
3. IF AADT < 2000VPD, SPLIT RINGS ARE NOT REQUIRED; CONNECTION TO ONE STRINGER ONLY
IF DEPTH OF STRINGER IS => 450MM; IF CONNECTION TO ONE STRINGER ONLY, OUTSIDE STRINGER TO BE BLOCKED AND CONNECTED TO NEXT STRINGER AT A MAXIMUM 4.0M SPACING WITH 2–19MMø BOLTS.
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NOVA SCOTIA
Transportation and Infrastructure Renewal

No.	REVISION

Scale :	N.T.S.
Drawn by :	WRP
Checked by :	R.SWINEMAR
Date of Plan :	2007–05–29
File No. :	B–2007–146

Manager Structural Engineering

Director Highway Engineering Services

Executive Director Highway Engineering and Construction

TIMBER BRIDGE BARRIER
PL1

APPENDIX C

Cost Estimates

CBCL LIMITED
Consulting Engineers

OPINION of PROBABLE CONSTRUCTION COST
Nova Scotia Power Incorporated
Mersey River System - Bridge # 37 - Lower Big Falls Tailrace
Loading CL-625

DATE:	January 8, 2018
CBCL FILE No.:	170237.06
PREPARED BY:	TMD/AT
EST. DESCRIPTION:	Class D

Item	DESCRIPTION	UNIT	Qty.	Option # 1 Strengthen Existing Structure		Option # 2 Replace with Pre-Eng. Algonquin Bridge
1	Mobilization & Demobilization, Bonds, Insurance, Permits	LS	1	[redacted]		[redacted]
2	Excavation, Backfill Wing Walls & Adjust Approach Grades	LS	1			
3	Removals/Disposal Decking Floor Beams & Stringers	LS	1			
4	Demolition & Disposal of Steel Truss Structure	LS	1			
5	Concrete Abutments and Wing Wall Repairs	LS	1			
6	Pre-Engineered Algonquin Bridge - Supply Only	LS	1			
7	Pre-Engineered Algonquin Bridge - Erection	LS	1			
8	Recoating Existing Girders and Cross Members	LS	1			
10	PT Wood Decking & Timber Curb	0	-			
11	Bridge Rail (Supply and Install)	LS	1			
12	Approach Rail (Supply and Install)	LS	1			
13	Bearing Rehabilitation / Replacement	LS	1			
17	Additional Investigation Allowance	LS	1			
18	Design Development Contingency - Note 1		15%		10%	
19	Contractors General Conditions & Fees					
	Total Direct & Indirect Construction Costs					
20	Construction Contingency - Note 2	%	15%		10%	
21	Escalation / Inflation (Based on 2017 Dollars) - Note 3					
22	Location Factor - Note 4					
	Total Direct & Indirect Construction Costs c/w Contingencies					
	Add HST		15%			
	Total Construction Budget with HST					

THIS OPINION OF PROBABLE COSTS IS PRESENTED ON THE BASIS OF EXPERIENCE, QUALIFICATIONS, AND BEST JUDGEMENT. IT HAS BEEN PREPARED IN ACCORDANCE WITH ACCEPTABLE PRINCIPLES AND PRACTICES. MARKET TRENDS, NON-COMPETITIVE BIDDING SITUATIONS, UNFORESEEN LABOUR AND MATERIAL ADJUSTMENTS AND THE LIKE ARE BEYOND THE CONTROL OF CBCL LIMITED. AS SUCH WE CANNOT WARRANT OR GUARANTEE THAT ACTUAL COSTS WILL NOT VARY FROM THE OPINION

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Form CBCL 035.Rev 1

CBCL LIMITED
Consulting Engineers

OPINION of PROBABLE CONSTRUCTION COST
Nova Scotia Power Incorporated
Mersey River System - Bridge # 37 - Lower Big Falls Tailrace
Loading Volvo A40, CL-625

DATE:	January 8, 2018
CBCL FILE No.:	170237.06
PREPARED BY:	TMD/AT
EST. DESCRIPTION:	Class D

Item	DESCRIPTION	UNIT	Qty.	Option # 1 Strengthen Existing Structure	Option # 2 Replace with Pre-Eng. Algonqiun Bridge
1	Mobilization & Demobilization, Bonds, Insurance, Permits	LS	1	[redacted]	[redacted]
2	Excavation, Backfill Wing Walls & Adjust Approach Grades	LS	1		
3	Removals/Disposal Decking Floor Beams & Stringers	LS	1		
4	Demolition & Disposal of Steel Truss Structure	LS	1		
5	Concrete Abutments and Wing Wall Repairs	LS	1		
6	Pre-Engineered Algonquin Bridge - Supply Only	LS	1		
7	Pre-Engineered Algonquin Bridge - Erection	LS	1		
8	Rehabilitation with Steel Plating	LS	1		
9	Recoating Existing Girders and Cross Members	LS	1		
10	PT Wood Decking & Timber Curb	LS	1		
11	Bridge Rail (Supply and Install)	LS	1		
12	Approach Rail (Supply and Install)	LS	1		
13	Bearing Rehabilitation / Replacement	LS	1		
14	Additional Investigation Allowance	LS	1		
15	Design Development Contingency - Note 1		15%		
16	Contractors General Conditions & Fees				
	Total Direct & Indirect Construction Costs				
17	Construction Contingency - Note 2	%	15%		
18	Escalation / Inflation (Based on 2017 Dollars) - Note 3				
19	Location Factor - Note 4				
	Total Direct & Indirect Construction Costs c/w Contingencies				
	Add HST		15%		
	Total Construction Budget with HST				

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Note 4	The Location Factor is for variances between construction costs at the location of the project & historical costs data

Form CBCL 035.Rev 1

170237.06 ES002 # 37 Lower Big Falls Trail Race Class D Budget 09-02-2018 tmd at.xlsx

CI Number: 46254

Title: HYD Mill Lake Surge Tank Replacement

Start Date: 2015/09
In-Service Date: 2020/10
Final Cost Date: 2021/04
Function: Hydro
Forecast Amount: $3,598,193

DESCRIPTION:

This project is for the replacement of the Mill Lake surge tank. Mill Lake is a hydro generating station on the St. Margaret's Bay hydro system. The surge tank was constructed in 1922 and was last refurbished in 1995. The surge tank's purpose is to regulate water flow variations in the pipeline (or penstock) relative to generator output from the connected hydro facility. It protects the pipeline from pressure transient damage in the event of a sudden trip of the Mill Lake hydro units. The condition assessment completed in 2013 (Attachment 1) demonstrated a loss of a section of the main tank, deteriorated rivet heads that secure metal sections and internal coating failures. Sections of the access platform have rusted through. The tank is in need of replacement to provide continued reliable operation of the Mill Lake Hydro Station.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Hydro projects includes "work completed on the same generating unit and dam structures, but not necessarily the same asset."

- 2021 C0009342 HYD Mill Lake Facility Refurbishment $TBD

Depreciation Class: Hydraulic Production Plant- St. Margaret's Bay

Estimated Life of the Asset: 50 Years

JUSTIFICATION:

Justification Criteria: Hydro, Wind and Biomass

Why do this project?

Mill Lake is a hydro generating station on the St. Margaret's Bay Hydro System which generates an average of approximately 4,200 MWh annually. The Mill Lake branch of the St Margaret's Bay Hydro System conveys water from Wright's Lake to Coon Pond then to the Mill Lake Powerhouse via a pipeline and the Mill Lake surge tank. The surge tank was constructed in 1922 and was last refurbished in 1995. The condition assessment completed in 2013 (Attachment 1) demonstrated a loss of a section of the tank, risers and support structure, deteriorated rivet heads and protective coating failures. Sections of the access platform have rusted through. The tank presents a risk rating exceeding the tolerance level for NS Power based on the Asset Management Mechanism, and has been reviewed for mitigation actions. Mitigation actions of refurbishment or replacement were chosen for consideration to allow for continued safe, reliable power generation from the Mill Lake Hydro Station.

Why do this project now?

The condition of the surge tank has been monitored since 2013 as a mitigation strategy to ensure the level of deterioration did not progress to a level that would risk reliability. This tank was risk ranked alongside the remaining surge tanks and investment has been planned based on risks posed at each site. Higher risk surge tanks have been addressed in the last 5 years.

The surge tank structure is corroding, and the rate of corrosion will increase as the remnants of the existing coating system are lost. As a result, the structural integrity of surge tanks may soon become affected.

Why do this project this way?

Two mitigation actions, replacement and refurbishment, were considered to mitigate the asset risk.

1. Replacement: is the more economic alternative. It results in a higher initial investment but expected future investments are eliminated due to the tank design and construction.

2. Refurbishment: This option potentially extends the life of the tank for 15 years, based on protective coating expected life, and performance of the last refurbishment. The option has a less capital intensive initial investment, and only defers the replacement requirement for the asset. The result is an overall less economic alternative, which also carries a higher residual asset risk.

CI Number : 46254-H728 - HYD Mill Lake Surge Tank Replacement

Project Number 46254-H728

Parent CI Number : -

Asset Location : 1360 - 1360 Mill Lake Common Property

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	2700 - HGP - Waterways	3,374,149
Retirements	2700 - HGP - Waterways	224,044
	Total Cost:	3,598,193
	Original Cost:	232,178

Capital Project Detailed Estimate

Location: Hydro
CI#: 46254
Title: HYD Mill Lake Surge Tank Replacement
Execution Year: 2019/2020

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Hydro River Staff	day	29	$ 365	$ 10,500		
Project Support Staff	day	192	$ 405	$ 77,707		
Administrative Support	day	4	$ 365	$ 1,506		
T&D Labour	day	0	$ 365	$ 175		
			Sub-Total	$ 89,888		
Term Labour						
Hydro Term Labour	day	5	$ 365	$ 1,881		
			Sub-Total	$ 1,881		
Travel Expenses						
Travel	lot	1	$ 6,689	$ 6,689		
			Sub-Total	$ 6,689		
Materials						
Surge Tank Foundation	lot	1	[redacted]		Attachment 2, Item 3 - Split between materials and contracts	47167
Surge Tank Pedestal & Tank	lot	1			Attachment 2, Item 4 - Split between materials and contracts	
Electrical	lot	1			Attachment 2, Item 6 - Split between materials and contracts	
			Sub-Total	$ 1,268,000		
Contracts						
Project Manager Technical	day	114	$ 750	$ 85,583		
Construction Supervision	day	87	$ 750	$ 65,000		
General Construction Items	lot	1	[redacted]		Attachment 2, Item 1	47167
Surge Tank Foundation Construction	lot	1			Attachment 2, Item 3 - Split between materials and contracts	
Surge Tank Pedestal & Tank Construction	lot	1			Attachment 2, Item 4 - Split between materials and contracts	
Earthworks	lot	1			Attachment 2, Item 5	
Electrical	lot	1			Attachment 2, Item 6 - Split between materials and contracts	
Surge Tank Removal	lot	1			Attachment 2, Item 2	
			Sub-Total	$ 1,231,583		
Consulting						
Conceptual Design	lot	1	$ 50,049	$ 50,049		
Detailed Design	lot	1	$ 114,405	$ 114,405		
Assistance During Proposal/ Construction	lot	1	$ 50,000	$ 50,000		
Decommissioning Study	lot	1	$ 37,996	$ 37,996		
			Sub-Total	$ 252,449		
Meal and Entertainment						
Meals	lot	1	550	$ 550		
			Sub-Total	$ 550		
Other Goods and Services						
Contingency	%	15%	3,131,218	$ 466,975.06		
			Sub-Total	$ 466,975		
Interest Capitalized						
AFUDC				$ 107,010		
			Sub-Total	$ 107,010		
Administrative Overhead						
Labour AO				$ 25,696		
Contracts AO				$ 147,472		
			Sub-Total	$ 173,168		
			Sub-Total (no AO, AFUDC)	$ 3,318,016		
			TOTAL (AO, AFUDC included)	$ 3,598,193		
Original Cost				$ 232,178		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Mill Lake Surge Tank Replacement
Summary of Alternatives

Division :	Power Production	**Date :**	**28-Nov-18**
Department :		**CI Number:**	46254
		Project No. :	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Replacement in 2019	5.83%	3,209,305	-2,579,107	1	-7.43%	0.0 years
B	Refurbish in 2019, Replace in 2032	5.83%	3,881,937	-3,404,192	2	-10.33%	0.0 years
	0	NA	NA	NA	NA	#NUM!	0.0 years
	0	NA	NA	NA	NA	#NUM!	0.0 years

Recommendation :

Proceed with the replacement of the Mill Lake surge tank in 2019 as this is more economic than refurbishment.

Notes/Comments :

Replacement in 2019

Includes the project costs associated with replacement of the Mill Lake Surge tank in 2019. If the surge tank is replaced in 2019, no future capital expenditures related to the surge tank are anticipated.

Refurbish in 2019, Replace in 2032

Includes the project costs associated with refurbishment of the Mill Lake Surge tank in 2019. If the surge tank is refurbished in 2019 the surge tank will require replacement in 2032.

0

0

Mill Lake Surge Tank Replacement
Summary of Sensitivities

Division :	Power Production	**Date :**	**28-Nov-18**
Department :		**CI Number:**	46254
		Project No. :	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Replacement in 2019	5.83%	3,209,305	-2,579,107	3	-7.43%	0.0 years
B	Refurbish in 2019, Replace in 2032	5.83%	3,881,937	-3,404,192	4	-10.33%	0.0 years
	0	NA	0	NA	1	#NUM!	0.0 years
	0	NA	0	NA	1	#NUM!	0.0 years

	Alternative Variance on Capital Spend	Variance (%)	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Replacement in 2019	10%	3,530,235	-2,837,018	3	-7.43%	0.0 years
B	Refurbish in 2019, Replace in 2032	10%	4,270,131	-3,744,612	4	-10.33%	0.0 years
	0	10%	0	0	1	#NUM!	0.0 years
	0	10%	0	0	1	#NUM!	0.0 years
Change:	**A**		320,930	-257,911	0	0.00%	0.0 years
	B		388,194	-340,419	0	0.00%	0.0 years
			0	#VALUE!	0	#NUM!	0.0 years
			0	#VALUE!	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	Variance (%)	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Replacement in 2019	-10%	3,209,305	-2,579,107	3	-7.43%	0.0 years
B	Refurbish in 2019, Replace in 2032	-10%	3,881,937	-3,404,192	4	-10.33%	0.0 years
	0	-10%	0	0	1	#NUM!	0.0 years
	0	-10%	0	0	1	#NUM!	0.0 years
Change:	**A**		0	0	0	0.00%	0.0 years
	B		0	0	0	0.00%	0.0 years
			0	#VALUE!	0	#NUM!	0.0 years
			0	#VALUE!	0	#NUM!	0.0 years

Mill Lake Surge Tank Replacement
Avoided Cost Calculations

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	28-Nov-18
Department :		**CI Number:**	46254
		Project No. :	

Replacement in 2019

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2018**	**2019**	**2018**	**2019**	**2018**	**2019**
Replacement Energy Cost ($/MWh)	0.00	0.00				
Repair Cost ($)			0	0		
Events/Outages (#)	0	1	0	1		
Probability of Occurance (%)	0%	50%	0%	50%		
Capacity Factor (%)	100%	100%				
Energy Replaced (MW)	0.0	0.0				
Duration (Hours or Years)	0	0				
Totals	$0	$0	$0	$0	$0	$0

Total Capital Cost of Alternative **$3,598,193**

Refurbish in 2019, Replace in 2032

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2018**	**2019**	**2018**	**2019**	**2018**	**2019**
Replacement Energy Cost ($/MWh)	0.00	0.00				
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	50%	0%	50%		
Capacity Factor (%)	100%	100%				
Energy Replaced (MW)	0.0	0.0				
Duration (Hours or Years)	0	0				
Totals	$0	$0	$0	$0	$0	$0

Total Capital Cost of Alternative **$7,058,715**

0

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2018**	**2019**	**2018**	**2019**	**2018**	**2019**
Replacement Energy Cost ($/MWh)	0.00	0.00				
Repair Cost ($)			0	0		
Events/Outages (#)	0	1	0	1		
Probability of Occurance (%)	0%	50%	0%	50%		
Capacity Factor (%)	100%	100%				
Energy Replaced (MW)	0.0	0.0				
Duration (Hours or Years)	0	0				
Totals	$0	$0	$0	$0	$0	$0

Total Capital Cost of Alternative **$0**

0

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2018**	**2019**	**2018**	**2019**	**2018**	**2019**
Replacement Energy Cost ($/MWh)	0.00	0.00				
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	100%	100%				
Energy Replaced (MW)	0.0	0.0				
Duration (Hours or Years)	0	0				
Totals	$0	$0	$0	$0	$0	$0

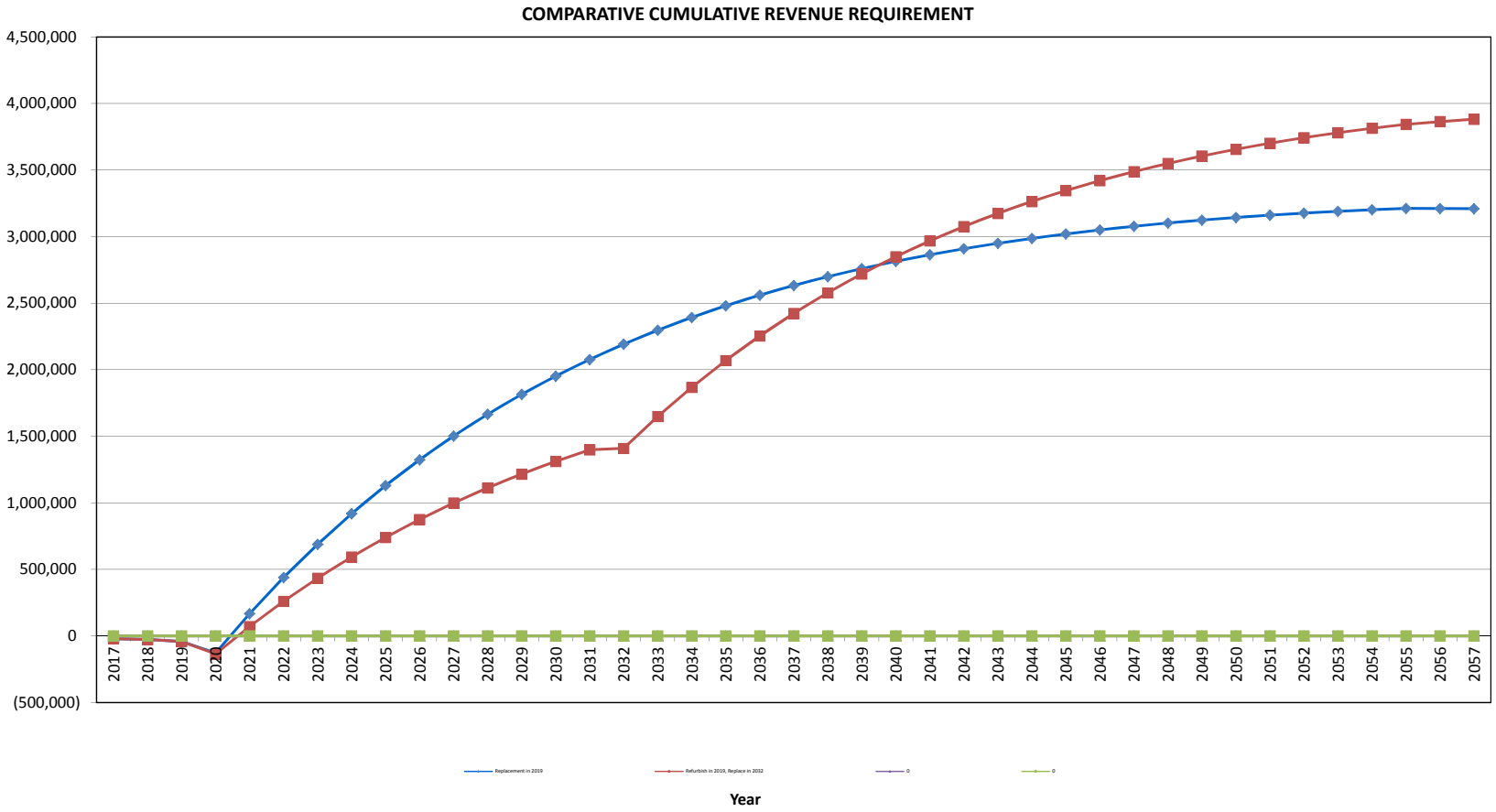
Total Capital Cost of Alternative **$0**

Mill Lake Surge Tank Replacement
Replacement in 2019

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2017	-	-	-	(81,690.3)	-	-	(81,690.3)	-	(81,690.3)	(81,690.3)	1.00	(81,690.3)
2018	-	-	-	(214,906.9)	-	-	(214,906.9)	-	(214,906.9)	(203,068.0)	0.94	(284,758.3)
2019	-	-	-	(183,056.2)	-	-	(183,056.2)	-	(183,056.2)	(163,443.2)	0.89	(448,201.5)
2020	-	-	-	(2,945,371.9)	66,360.3	3,301,527.6	(2,945,371.9)	20,571.7	(2,924,800.2)	(2,467,571.9)	0.84	(2,915,773.5)
2021	-	-	-	-	130,066.2	3,167,388.5	-	40,320.5	40,320.5	32,143.3	0.80	(2,883,630.1)
2022	-	-	-	-	124,863.6	3,038,614.9	-	38,707.7	38,707.7	29,157.7	0.75	(2,854,472.4)
2023	-	-	-	-	119,869.0	2,914,992.3	-	37,159.4	37,159.4	26,449.4	0.71	(2,828,023.0)
2024	-	-	-	-	115,074.3	2,796,314.6	-	35,673.0	35,673.0	23,992.7	0.67	(2,804,030.3)
2025	-	-	-	-	110,471.3	2,682,384.0	-	34,246.1	34,246.1	21,764.1	0.64	(2,782,266.2)
2026	-	-	-	-	106,052.4	2,573,010.6	-	32,876.3	32,876.3	19,742.5	0.60	(2,762,523.7)
2027	-	-	-	-	101,810.3	2,468,012.2	-	31,561.2	31,561.2	17,908.8	0.57	(2,744,614.9)
2028	-	-	-	-	97,737.9	2,367,213.7	-	30,298.8	30,298.8	16,245.3	0.54	(2,728,369.6)
2029	-	-	-	-	93,828.4	2,270,447.1	-	29,086.8	29,086.8	14,736.4	0.51	(2,713,633.3)
2030	-	-	-	-	90,075.3	2,177,551.2	-	27,923.3	27,923.3	13,367.6	0.48	(2,700,265.7)
2031	-	-	-	-	86,472.3	2,088,371.2	-	26,806.4	26,806.4	12,125.9	0.45	(2,688,139.7)
2032	-	-	-	-	83,013.4	2,002,758.3	-	25,734.1	25,734.1	10,999.6	0.43	(2,677,140.1)
2033	-	-	-	-	79,692.8	1,920,569.9	-	24,704.8	24,704.8	9,977.9	0.40	(2,667,162.2)
2034	-	-	-	-	76,505.1	1,841,669.1	-	23,716.6	23,716.6	9,051.1	0.38	(2,658,111.1)
2035	-	-	-	-	73,444.9	1,765,924.3	-	22,767.9	22,767.9	8,210.4	0.36	(2,649,900.6)
2036	-	-	-	-	70,507.1	1,693,209.4	-	21,857.2	21,857.2	7,447.8	0.34	(2,642,452.9)
2037	-	-	-	-	67,686.8	1,623,403.0	-	20,982.9	20,982.9	6,756.0	0.32	(2,635,696.8)
2038	-	-	-	-	64,979.4	1,556,388.8	-	20,143.6	20,143.6	6,128.5	0.30	(2,629,568.4)
2039	-	-	-	-	62,380.2	1,492,055.3	-	19,337.9	19,337.9	5,559.2	0.29	(2,624,009.1)
2040	-	-	-	-	59,885.0	1,430,295.0	-	18,564.3	18,564.3	5,042.9	0.27	(2,618,966.3)
2041	-	-	-	-	57,489.6	1,371,005.2	-	17,821.8	17,821.8	4,574.5	0.26	(2,614,391.8)
2042	-	-	-	-	55,190.0	1,314,087.0	-	17,108.9	17,108.9	4,149.6	0.24	(2,610,242.3)
2043	-	-	-	-	52,982.4	1,259,445.5	-	16,424.5	16,424.5	3,764.1	0.23	(2,606,478.1)
2044	-	-	-	-	50,863.1	1,206,989.6	-	15,767.6	15,767.6	3,414.5	0.22	(2,603,063.6)
2045	-	-	-	-	48,828.6	1,156,632.0	-	15,136.9	15,136.9	3,097.3	0.20	(2,599,966.3)
2046	-	-	-	-	46,875.4	1,108,288.7	-	14,531.4	14,531.4	2,809.6	0.19	(2,597,156.6)
2047	-	-	-	-	45,000.4	1,061,879.2	-	13,950.1	13,950.1	2,548.7	0.18	(2,594,608.0)
2048	-	-	-	-	43,200.4	1,017,326.0	-	13,392.1	13,392.1	2,311.9	0.17	(2,592,296.0)
2049	-	-	-	-	41,472.4	974,554.9	-	12,856.4	12,856.4	2,097.2	0.16	(2,590,198.8)
2050	-	-	-	-	39,813.5	933,494.7	-	12,342.2	12,342.2	1,902.4	0.15	(2,588,296.4)
2051	-	-	-	-	38,220.9	894,076.9	-	11,848.5	11,848.5	1,725.7	0.15	(2,586,570.7)
2052	-	-	-	-	36,692.1	856,235.8	-	11,374.6	11,374.6	1,565.4	0.14	(2,585,005.3)
2053	-	-	-	-	35,224.4	819,908.4	-	10,919.6	10,919.6	1,420.0	0.13	(2,583,585.3)
2054	-	-	-	-	33,815.4	785,034.0	-	10,482.8	10,482.8	1,288.1	0.12	(2,582,297.2)
2055	-	-	-	-	32,462.8	751,554.6	-	10,063.5	10,063.5	1,168.5	0.12	(2,581,128.8)
2056	-	-	-	-	31,164.3	719,414.4	-	9,660.9	9,660.9	1,059.9	0.11	(2,580,068.8)
2057	-	-	-	-	29,917.7	688,559.8	-	9,274.5	9,274.5	961.5	0.10	(2,579,107.4)
Total	**-**	**-**	**-**	**(3,425,025.3)**	**2,599,989.6**		**(3,425,025.3)**	**805,996.8**	**(2,619,028.6)**	**(2,579,107.4)**		

Mill Lake Surge Tank Replacement
Refurbish in 2019, Replace in 2032

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2017	-	-	-	(81,690.3)	-	-	(81,690.3)	-	(81,690.3)	(81,690.3)	1.00	(81,690.3)
2018	-	-	-	(214,896.0)	-	-	(214,896.0)	-	(214,896.0)	(203,057.8)	0.94	(284,748.1)
2019	-	-	-	(183,056.2)	-	-	(183,056.2)	-	(183,056.2)	(163,443.2)	0.89	(448,191.3)
2020	-	-	-	(1,848,738.4)	44,858.8	2,292,026.8	(1,848,738.4)	13,906.2	(1,834,832.2)	(1,547,996.4)	0.84	(1,996,187.7)
2021	-	-	-	-	87,923.3	2,154,316.1	-	27,256.2	27,256.2	21,728.5	0.80	(1,974,459.2)
2022	-	-	-	-	84,406.4	2,066,140.0	-	26,166.0	26,166.0	19,710.3	0.75	(1,954,748.9)
2023	-	-	-	-	81,030.1	1,981,491.0	-	25,119.3	25,119.3	17,879.5	0.71	(1,936,869.4)
2024	-	-	-	-	77,788.9	1,900,227.9	-	24,114.6	24,114.6	16,218.8	0.67	(1,920,650.6)
2025	-	-	-	-	74,677.4	1,822,215.3	-	23,150.0	23,150.0	14,712.3	0.64	(1,905,938.3)
2026	-	-	-	-	71,690.3	1,747,323.2	-	22,224.0	22,224.0	13,345.7	0.60	(1,892,592.6)
2027	-	-	-	-	68,822.7	1,675,426.8	-	21,335.0	21,335.0	12,106.1	0.57	(1,880,486.4)
2028	-	-	-	-	66,069.8	1,606,406.3	-	20,481.6	20,481.6	10,981.7	0.54	(1,869,504.8)
2029	-	-	-	-	63,427.0	1,540,146.6	-	19,662.4	19,662.4	9,961.6	0.51	(1,859,543.2)
2030	-	-	-	-	60,889.9	1,476,537.3	-	18,875.9	18,875.9	9,036.3	0.48	(1,850,506.8)
2031	-	-	-	-	58,454.3	1,415,472.4	-	18,120.8	18,120.8	8,197.0	0.45	(1,842,309.8)
2032	-	-	-	(4,343,760.3)	224,438.0	5,457,189.0	(4,343,760.3)	69,575.8	(4,274,184.5)	(1,826,927.5)	0.43	(3,669,237.4)
2033	-	-	-	-	215,460.4	5,234,262.5	-	66,792.7	66,792.7	26,976.7	0.40	(3,642,260.7)
2034	-	-	-	-	206,842.0	5,020,253.1	-	64,121.0	64,121.0	24,471.0	0.38	(3,617,789.7)
2035	-	-	-	-	198,568.3	4,814,804.1	-	61,556.2	61,556.2	22,198.0	0.36	(3,595,591.7)
2036	-	-	-	-	190,625.6	4,617,573.1	-	59,093.9	59,093.9	20,136.1	0.34	(3,575,455.6)
2037	-	-	-	-	183,000.6	4,428,231.3	-	56,730.2	56,730.2	18,265.8	0.32	(3,557,189.8)
2038	-	-	-	-	175,680.6	4,246,463.2	-	54,461.0	54,461.0	16,569.2	0.30	(3,540,620.7)
2039	-	-	-	-	168,653.3	4,071,965.7	-	52,282.5	52,282.5	15,030.1	0.29	(3,525,590.5)
2040	-	-	-	-	161,907.2	3,904,448.2	-	50,191.2	50,191.2	13,634.1	0.27	(3,511,956.5)
2041	-	-	-	-	155,430.9	3,743,631.4	-	48,183.6	48,183.6	12,367.7	0.26	(3,499,588.8)
2042	-	-	-	-	149,213.7	3,589,247.3	-	46,256.2	46,256.2	11,218.9	0.24	(3,488,369.9)
2043	-	-	-	-	143,245.1	3,441,038.5	-	44,406.0	44,406.0	10,176.8	0.23	(3,478,193.0)
2044	-	-	-	-	137,515.3	3,298,758.1	-	42,629.8	42,629.8	9,231.6	0.22	(3,468,961.5)
2045	-	-	-	-	132,014.7	3,162,168.9	-	40,924.6	40,924.6	8,374.1	0.20	(3,460,587.4)
2046	-	-	-	-	126,734.1	3,031,043.2	-	39,287.6	39,287.6	7,596.3	0.19	(3,452,991.1)
2047	-	-	-	-	121,664.8	2,905,162.6	-	37,716.1	37,716.1	6,890.7	0.18	(3,446,100.4)
2048	-	-	-	-	116,798.2	2,784,317.2	-	36,207.4	36,207.4	6,250.6	0.17	(3,439,849.8)
2049	-	-	-	-	112,126.2	2,668,305.7	-	34,759.1	34,759.1	5,670.1	0.16	(3,434,179.7)
2050	-	-	-	-	107,641.2	2,556,934.6	-	33,368.8	33,368.8	5,143.4	0.15	(3,429,036.3)
2051	-	-	-	-	103,335.5	2,450,018.3	-	32,034.0	32,034.0	4,665.7	0.15	(3,424,370.7)
2052	-	-	-	-	99,202.1	2,347,378.7	-	30,752.7	30,752.7	4,232.3	0.14	(3,420,138.4)
2053	-	-	-	-	95,234.0	2,248,844.7	-	29,522.6	29,522.6	3,839.2	0.13	(3,416,299.2)
2054	-	-	-	-	91,424.7	2,154,252.0	-	28,341.7	28,341.7	3,482.6	0.12	(3,412,816.6)
2055	-	-	-	-	87,767.7	2,063,443.0	-	27,208.0	27,208.0	3,159.1	0.12	(3,409,657.6)
2056	-	-	-	-	84,257.0	1,976,266.4	-	26,119.7	26,119.7	2,865.7	0.11	(3,406,791.9)
2057	-	-	-	-	80,886.7	1,892,576.9	-	25,074.9	25,074.9	2,599.5	0.10	(3,404,192.4)
	-	**-**	**-**	**(6,672,141.2)**	**4,509,707.2**		**(6,672,141.2)**	**1,398,009.2**	**(5,274,132.0)**	**(3,404,192.4)**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
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Nova Scotia Power Hydro
Coon Pond

Visual and UT Inspection, December 2013

Submitted by
RAT International Inc.

Prepared by
Cory Dearman PID 5667

Table of Contents

Inspection Procedure

Upon the request of Aileen Woodman, P.Eng of Nova Scotia Power Inc, Remote Access Technology carried out the Visual and Ultrasonic inspection of the elevated tank on the Coon Pond Surge Tank. The inspection was performed from December 2nd to 5th, 2013.

The surge tank was broken down into the following categories, external and internal elevated tank, exterior riser and platforms. All the individual components of each categories were inspected with all anomalies being documented and photographs taken.

Inspection Techniques

Visual and Ultrasonic inspection techniques were used to perform the inspection of Coon Pond surge tank.

It should be noted that due to excessive pitting bellow the water line of the elevated tank surface it was difficult to obtain consistent and reliable results for the UT inspection.

The following references were used for the inspection:

ASTM D610 - 08 Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces

API 575 - 05 Guidelines and Methods for Inspection of Existing Atmospheric and Low-pressure Storage Tanks

API Standard 653 - 10 Tank Inspection, Repair, Alteration and Reconstruction

NACE Standard RP0288 - 04 Inspection of Linings on Steel and Concrete

ASTM E1901 -08 Standard Guide for Detection and Evaluation of Discontinuities by Contact Pulse-Echo Straight-Beam Ultrasonic Methods

Summary

Exterior Elevated Tank

The exterior elevated tank was Visually and Ultrasonically (UT) inspected and was found in satisfactory condition with the protective coating being the greatest concern. Uneven and poor application of the coating have resulted in mild corrosion and rust staining of the elevated tank surface. The protective coating for the elevated tank has reached the end of it's service life.

Refer to Section 1.0 for detailed inspecting results.

Recommendations:

1. Grit blast and apply new protective coating

Internal Elevated Tank

The internal elevated tank was inspected and found to be in poor to fair condition. The areas of concern were the protective coating, pitting below the water and the deterioration of the rivet heads in the bowl of the tank. It was also noted that their was no pigeon fencing between the roof and the tank. Pigeons have taken up residence inside the tank with large amounts of feces and feathers being found on the tank bottom.

Refer to Section 2.0 for detailed inspection results.

Recommendations:

1. Grit blast and apply new protective coating
2. Install pigeon fencing
3. Prior to new coating installation perform UT on the tank bottom
4. Reinforce riveted connection were needed with an approved method
5. Repair pitting by approved by method if deemed necessary by an engineer

External Riser

The external riser inside the elevated tank was visually inspected and found to be poor to fair condition. The major areas of concern were the coating failures and pitting of the riser.

Refer to Section 3.0 for detailed inspection results.

Recommendations:

1. Grit blast and apply new protective coating
2. Reinforce riveted connection were needed with an approved method
3. Repair pitting by if deemed necessary by an engineer with an approved method

Platforms

The access platform located at the base of the elevated tank was found in poor condition. The hand rail connections to the platform have deteriorated and are no longer adequately secured to the deck. The original decking located beneath the repair has deteriorated significantly and no longer offers sufficient support to the newer steel above.

Refer to Section 4.0 for detailed inspection results.

Recommendations:

1. Replace entire deck structure located at the base of the elevated tank

1.0 External Elevated Tank

The external elevated tank was Visually and Ultrasonically (UT) inspected and was found in satisfactory condition with coating failure and mild corrosion being found.

Coating

The coating that was applied in 1995 has reached the end of it service life with rust bleeding through the remaining coating and chalking from UV damage. It was noted during the inspection that the previous coating was applied in a very poor manner with numerous drips and insufficient and uneven film thickness over the entire tank.

Refer to photos 1-4

Steel and Riveted Connections

The overall condition of the steel and riveted connections of the external elevated tank were good with only areas were coating failure has occurred showing signs of mild corrosion. The predominant area of concern was the steel support structure for the roof.

Ultrasonic Inspection

UT was performed on the exterior of the tank in accordance to the Specification provided by NSPI. The inspection was performed in four drops 90 degrees apart on the SW, SE, NW and NE sides of the tank. On each drop there were 8 steel coarse and within each coarse three measurements were taken with the average of the three being recorded. The coarse were numbered with the highest elevation (top of the tank) being 1 and the lowest (bottom of the tank) being 8. The results were as follows:

Coarse	Southwest	Southeast	Northwest	Northeast
1	0.285	0.264	0.269	0.287
2	0.287	0.262	0.28	0.274
3	0.297	0.254	0.268	0.273
4	0.27	0.263	0.272	0.285
5	0.256	0.23	0.205	0.268
6	0.215	0.215	0.215	0.29
7	0.293	0.317	0.268	0.265
8	0.353	0.297	0.342	0.306

Note: All measurements were taken in inches

UT was also performed at each leg connection on the elevated tank with measurements being taken on the tank to the left, middle and right sides of each leg. Three recorded measurement were taken for each side. The legs were numbered 1 through 4 going clockwise with leg 1 being the leg with the access ladder. The results were as follows:

Leg 1

	Left	Middle	Right
1	0.377	0.382	0.352
2	0.401	0.261	0.38
3	0.305	0.298	0.404

Leg 2

	Left	Middle	Right
1	0.413	0.417	0.358
2	0.401	0.286	0.343
3	0.423	0.437	0.345

Leg 3

	Left	Middle	Right
1	0.367	0.347	0.386
2	0.381	0.325	0.291
3	0.379	0.406	0.313

Leg 4

	Left	Middle	Right
1	0.387	0.405	0.365
2	0.396	0.378	0.377
3	0.317	0.383	0.382

Note: All measurements were taken in inches

2.0 Internal Elevated Tank

The internal elevated tank was inspected and found to be in poor to fair condition. The areas of concern were the protective coating, pitting below the water and the deterioration of the rivet heads in the bowl of the tank. It was also noted that their was no pigeon fencing between the roof and the tank. Pigeons have taken up residence inside the tank with large amounts of feces and feathers being found on the tank bottom (refer to photo 15).

The tank was divided into two sections the tank wall and the bowl. The tank wall has 8 steel coarse with the top being 1 and the bottom being 8. The bowl has 12 steel sections which were numbered with the plate with the access ladder being 1 and counting clockwise. The bowl sections were numbered with fluorescent paint to aid in future inspections.

Coating

Large sections of the protective coating have failed below the water line on the tank wall with the largest being 4ft by 5ft section. The coating was intact on the tank bottom.

Refer to photos 5-7

Rivets

The riveted connections below the water line on the tank wall and tank bowl were in poor condition. The deterioration increased as you progressed lower into the tank with the worst being on the tank bottom.

Refer to photos 7-9

Ultrasonic

Two UT shots were taken on each of the 12 sections that make up the tank bottom. One shot near the tank wall (outside) and the second near the riser (inside). It should be noted that due to excessive pitting on the tank bowl and the coating, it was difficult to obtain consistent and reliable results for the UT inspection. The results were as follows.

	Outside	Inside
Section 1	0.348	0.321
2	0.378	0.305
3	0.362	0.307
4	0.412	0.325
5	0.333	0.302
6	0.376	0.287

	Outside	Inside
Section 7	0.401	0.363
8	0.399	0.328
9	0.377	0.301
10	0.422	0.286
11	0.354	0.329
12	0.361	0.269

3.0 External Riser Inside the Elevated Tank

The external riser inside the elevated tank was visually inspected and found to be to in fair condition. The major concerns was the coating failure and the pitting of the riser.

The coating has failed on the stiffening rings above and below the water line and the riser support legs resulting in surface corrosion of the steel.

Refer to photos 10-11

Pitting was consistent and covered 90% of the riser below the water line.

Refer to photo 11

4.0 Platforms

The main access platform located at the base of the elevated tank was in poor condition with the two areas of concern being the handrails and the decking.

The connections at the base of the hand rails to the platform were corroded and the handrails are no longer secured properly to the platform.

It was noted that the decking had been repaired. The repair consisted of welding new steel on top of the degraded steel. Overtime the original steel has deteriorated considerably it no longer offers sufficient support to the new steel above.

Refer to photos 16-20

Photo Record

Photo Number 1

Location: Exterior Tank

Description:
General photo of the exterior tank. Note: uneven film thickness and drip and sags of coating. This was consistent for the entire exterior tank.

Photo Number 2

Location: Exterior Tank

Description
General photo of the exterior tank, Note chalking or blushing of the coating due to UV damage. This was consistent for the entire exterior tank.

RAT

Photo Record

Photo Number 3

Location: Exterior Tank

Description:
Coating failure near the top of the tank. The condition was consistent the for the entire tank. Note: absence of pigeon fencing.

Photo Number 4

Location: Exterior Tank

Description
Coating failure of roof support structure. The condition was consistent the for the entire tank. Note: absence of pigeon fencing.

RAT

Photo Record

Photo Number 5

Location: Interior Tank

Description:
Large blisters in coating near the water line.

Photo Number 6

Location: Interior Tank

Description
Large blisters in coating near the water line. Note: increase in size since previous inspection.

RAT

Photo Record

Photo Number 7

Location: Interior Tank

Description:
Coating failure at riveted seam. Note: poor condition of rivet heads.

Photo Number 8

Location: Interior Tank

Description
Coating failure at riveted seam. Note: poor condition of rivet heads.

RAT

Photo Record

Photo Number 9

Location: Interior Tank

Description:
Coating failure on rivets resulting in mild corrosion.

Photo Number 10

Location: Exterior Riser

Description
Bent flange on 2nd stiffening ring from the bottom. Note pitting on the riser.

Photo Record

Photo Number 11

Location: Exterior Riser

Description:
General photo of the riser at the water line. Note: coating failure on the stiffening rings and pitting.

Photo Number 12

Location: Exterior Riser

Description
Cracking around the welded hatch cover at the bottom of the bowl.

RAT

Photo Record

Photo Number 13

Location: Exterior Riser

Description:
Coating failure on riser support leg. Note pigeon feces and nests.

Photo Number 14

Location: Exterior Riser

Description
General photo of riser support leg connection.

RAT

Photo Record

Photo Number 15

Location: Exterior Riser

Description:
General photo on the bottom of the bowl. Note: heavy build-up of pigeon feces.

Photo Number 16

Location: Platforms

Description
Deteriorated handrail connection

RAT

Photo Record

Photo Number 17

Location: Platforms

Description:
Deteriorated handrail connection

Photo Number 18

Location: Platforms

Description
Heavy corrosion and deterioration of decking. Note: size increase from previous inspection.

RAT

Photo Record

Photo Number 19

Location: Platforms

Description:
Heavy corrosion and deterioration of original decking.

Photo Number 20

Location: Platforms

Description
Underside of tank platform. Extreme deterioration of original decking.

Construction Cost Estimate

Client: Nova Scotia Power Inc.
Project Name: Mill Lake (Coon Pond)
Project Number: H728

Description: Conceptual Design for Mill Lake Surge Tank Replacement
Accuracy Range = ± 30%

Item	Description	Estim. Quantity	Unit	Unit Price	Amount
1	**General Items**				
1.1	Access Road and Laydown Area Improvements	1	LS	[redacted]	[redacted]
1.2	Environmental Management/ Water Control	1	LS		
	Subtotal				
2	**Existing Surge Tank Demolition**				
2.1	Removal of Existing Surge Tank	1	LS	[redacted]	[redacted]
	Subtotal				
3	**Surge Tank Foundation**				
3.1	Supply and Install New Lateral Tee with Elbow and expansion joints	1	LS	[redacted]	[redacted]
3.2	Supply and Installation of New Reinforced Concrete Surge Tank Tee/ Saddle Foundation	500	cu. yd.		
3.3	Steel staircase, guardrail, handrail	1	LS		
	Subtotal				
4	**Surge Tank**				
4.1	Mob and demob	1	LS	$ [redacted]	[redacted]
4.1	Supply and Installation of Steel Stand Pipe Reservoir, Roof and Concrete Pedestal	1	LS		
4.2	Removal and Reuse of Existing Riser Pipe	1	LS		
4.3	Supply and Install Thimble in Tank Floor	1	LS		
4.4	Supply and Install Expansion Joint Below Tank Floor	1	LS		
4.5	Supply and Install Lateral Support Platforms	1	LS		
4.6	Construction of Utility Room at Base of Concrete Pedestal	1	LS		
4.7	Supply and Installation of Bubbler System	1	LS		
	Subtotal				
5	**Earthworks**				
5.1	Excavation/backfill	1200	CU YD	$ [redacted]	[redacted]
6	**Electrical**				
6.1	Electrical Works	1	LS	[redacted]	[redacted]
6.2	Electrical Service Upgrade	1	LS		
6.3	Tank and Foundation Grounding	1	LS		
	Subtotal				
Total Estimated Construction Cost without Contingency					[redacted]

Exclusions:

- Engineering design and environmental studies
- Owner's engineering costs (project management, tendering, site supervision, QA testing)
- Owner's other costs (financing/IDC, taxes, land acquisition, legal surveys)
- Construction Insurance and Bonds
- Mitigation measures for protection of archaeological areas (if applicable)
- Concrete testing

Available Information:

- Cost estimates based on Greatario quote and recent other NSPI projects (actuals and tendered)

Other Notes/Assumptions:

- Unit prices for concrete include formwork, reinforcing steel
- Cost estimate developed without comprehensive condition assessment of existing structures and site conditions
- Local contractor (minimal per diems)
- Existing structures assumed to be in acceptable condition and meet stability requirements
- Bedrock presumed to be sound and in good condition (geotech investigation required before final design)
- Bedrock can be removed using excavator with ft-lb breaker
- Site supervision assumed to be included in other items
- Road access and area beside powerhouse assumed to be adequate for construction equipment and crane access
- Concrete surface preparation is considered incidental to the work (not a separate pay item)
- Dewatering managed by NSPI (outage planned for Tidewater)
- Existing power distribution adequate
- Service upgrade may be required
- 6 month construction schedule

CI Number: C0004058

Title: HYD Tidewater 2 Overhaul

Start Date: 2019/01
In-Service Date: 2019/08
Final Cost Date: 2020/02
Function: Hydro
Forecast Amount: $1,916,321

DESCRIPTION:

The project is for the remediation and recoating of the scroll case, replacement of the operating ring and wicket gates, refurbishment of the exciter and rewind of the rotor poles as well as general unit refurbishment of all wear items, replacement of protective coatings and repair of damaged components.

Tidewater is located on the St. Margaret's Bay Hydro system and has been in service since 1922. Tidewater Unit 2 is rated at 2.2 MW and produces approximately 8.5 GWh/year.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Hydro projects includes "work completed on the same generating unit and dam structures, but not necessarily the same asset."

- No other projects in 2017, 2018, 2019, 2020 or 2021

Depreciation Class: Hydraulic Production Plant – St. Margaret's Bay

Estimated Life of the Asset: 40 Years

JUSTIFICATION:

Justification Criteria: Hydro, Wind and Biomass

Why do this project?

The condition of Tidewater Unit 2 has been assessed and this project must be completed to mitigate risks to the reliable operation of the unit. The last overhaul to this unit was completed in 1984 and the most recent condition assessment has identified risks to the reliable operation of this unit. The issues identified include significant looseness in the wicket gate bushings, rotor and stator general condition and age, cavitation and erosion damage in the water passage and wicket gate bodies, as well as wear on the turbine seal rings. Unplanned failure of the unit would place flow restrictions on the upstream generating units, limiting generation by up to 50 percent for the river system. It would also result in risk of exceeding environmental flow requirements while water on the system is balanced to accommodate this lost generation.

Why do this project now?

Tidewater Unit 2 rotor, stator and turbine are in poor condition with many components in excess of normal tolerance. The unit is unable to run at less than 70 percent of capacity due to excessive vibration, making it unreliable for flexible operation at less than 70 percent of capacity.

Why do this project this way?

Refurbishing this unit is the most economical way to maintain reliability. Replacement of specific worn components under an overall refurbishment is significantly more economic than a full unit replacement. To maximize output of the unit, the refurbishment will be timed to minimize spilled water (lost generation).

CI Number : C0004058 - HYD Tidewater 2 Overhaul **Project Number** C0004058

Parent CI Number : -

Asset Location : 1360 - 1360 Tide Water 2, 2 Mwh on St. Margaret's Bay **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	2400 - HGP - Turbine (Hydro)	1,738,456
Retirements	2400 - HGP - Turbine (Hydro)	177,865
	Total Cost:	1,916,321
	Original Cost:	791,862

Capital Project Detailed Estimate

Location: Hydro
FP#: C0004058
Title: HYD Tidewater 2 Overhaul
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Hydro River Staff - Construction	day	700	$ 365	255,351		47172 - HYD Tidewater Unit 1 Overhaul
Engineering Staff	day	150	$ 405	60,796		
Hydro River Staff - Removal	day	75	$ 365	27,359		
			Sub-Total	343,506		
Travel Expenses						
Site Visits	Lot	1	$ 1,500	1,500		
Accommodations	Lot	1	$ 25,000	25,000		
			Sub-Total	26,500		
Materials						
Wicket Gate Supply	Lot	1	$ 60,000	60,000		47172 - HYD Tidewater Unit 1 Overhaul
Bushing, Pins, Bearings, Rings, etc.	Lot	1	$ 70,000	70,000		
Isolating Blank for Unit 2	Lot	1	$ 20,000	20,000		
Consumables	Lot	1	$ 25,000	25,000		
Turbine Shaft and Sleeve	Lot	1	$ 15,000	15,000		
Turbine Seal Rings	Lot	1	$ 35,213	35,213		
New Operating Ring	ea	1	$ 30,000	30,000		
			Sub-Total	255,213		
Contracts						
Exciter Refurbishment	Lot	1	$ 49,379	49,379		47172 - HYD Tidewater Unit 1 Overhaul
Scroll Case Clean, Blast, Refurb, Paint	Lot	1	$ 118,624	118,624		
Rotor Pole Rewind	Lot	1	$ 173,749	173,749		
Misc. Contracts	Lot	1	$ 50,000	50,000		
Scroll Case Machining	Lot	1	$ 80,683	80,683		
Stator Alignment	Lot	1	$ 53,761	53,761		
Spring Bed Assembly	Lot	1	$ 15,205	15,205		
Electrical Cleaning/Testing	Lot	1	$ 100,000	100,000		
Distributor Refurbishment	Lot	1	$ 53,366	53,366		
			Sub-Total	694,766		
Consulting						
Lifting Devices/Flange Design	Lot	1	$ 20,000	$ 20,000		47172 - HYD Tidewater Unit 1 Overhaul
FARO Survey	Lot	1	$ 5,000	$ 5,000		
Project Management	Month	7	$ 7,000	$ 49,000		
Isolation Design	Lot	1	$ 20,000	$ 20,000		
Testing Services	Lot	1	$ 20,000	$ 20,000		
Design of New Operating Ring	Lot	1	$ 10,000	$ 10,000		
			Sub-Total	$ 124,000		
Meals						
Meals	Lot	1	$ 6,250	$ 6,250		
			Sub-Total	$ 6,250		
Other Goods and Services						
Contingency	%	15%	$ 1,450,234	$ 217,535		
			Sub-Total	$ 217,535		
Interest Capitalized						
AFUDC				$ 30,071		
			Sub-Total	$ 30,071		
Administrative Overhead						
Labour AO				$ 134,956		
Contractor AO				$ 83,525		
			Sub-Total	$ 218,481		
			Sub-Total (no AO, AFUDC)	$ 1,667,770		
			TOTAL (AO, AFUDC included)	$ 1,916,321		
Original Cost				$ 791,862		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0010957

Title: HYD – Malay Falls Unit 6 Overhaul

Start Date: 2018/09
In-Service Date: 2019/07
Final Cost Date: 2020/01
Function: Hydro
Forecast Amount: $1,273,280

DESCRIPTION:

This project includes refurbishment of the exciter, headcover, and runner, and replacement of the wicket gates and turbine shafts. This project also includes general unit refurbishment of all wear items, replacement of protective coatings and refurbishment or replacement of damaged minor components. Turbine bearings will be converted to modern technologies

The Malay Falls Hydro Station is located on the Sheet Harbour hydro system and has been in service since 1924. Malay Falls Unit 6 is rated at 1.2 MW and produces approximately 5.3 GWh/year.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for hydro projects includes "work completed on the same generating unit and dam structures, but not necessarily the same asset."

- 2018 CI 49945 HYD Malay Falls Switchgear Replacement $958,631
- 2018 CI C0047551 HYD SHH Controls Upgrade $1,749,212
- 2019 CI C0012158 HYD Malay 6 Generator Refurbishment $835,854

Depreciation Class: Hydraulic Production Plant – Sheet Harbour

Estimated Life of the Asset: 50 Years

JUSTIFICATION:

Justification Criteria: Hydro, Wind & Biomass

Why do this project?

A condition assessment was completed in 2018 and identified the unit has worn out links and bushings resulting in excessive clearances in the operating mechanisms. This resulted in decreased reliability and operating restrictions, limiting output of the unit to approximately 80 percent. There was evidence of the runner contacting the upper and lower seals while running, resulting in a need for re-machining. Additionally, the wicket gates, turbine shaft and intermediate shaft are original to the plant, over 90 years old, and should be replaced to allow for continued reliability and unit availability.

Why do this project now?

The current condition of Malay Falls Unit 6 is imposing an operating restriction of approximately 80 percent of the unit's generating capacity and is making it unreliable for remote operations. This project, along with CI 49945 Malay Falls Switchgear Replacement and CI 47551 Sheet Harbour Controls Upgrade, will allow for improved remote and flexible operation.

Why do this project this way?

Refurbishing this unit is the most economical way to maintain reliability. Replacement of specific worn components is significantly more economic than a full unit replacement. To maximize output of the unit, the refurbishment will be timed to minimize spilled water (lost generation).

CI Number : C0010957 - HYD - Malay Falls Unit 6 Overhaul

Project Number C0010957

Parent CI Number : -

Asset Location : 1359 - 1359 Malay Falls 6, 1 Mwh on Sheet Harbour System

Budget Version 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	2400 - HGP - Turbine (Hydro)	1,226,986
Retirements	2400 - HGP - Turbine (Hydro)	46,294
	Total Cost:	1,273,280
	Original Cost:	82,594

Capital Project Detailed Estimate

Location: Hydro
CI#: C0010957
Title: HYD - Malay Falls Unit 6 Overhaul
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Hydro River Staff	day	346	365	$ 126,257		
Engineering Staff	day	85	405	$ 34,451		
			Sub-Total	$ 160,708		43607
Term Labour						
Hydro River Staff	day	160	$ 365	$ 58,366		
			Sub-Total	$ 58,366		
Travel Expenses						
Site Visits	lot	1	$ 2,500	$ 2,500		
Accommodations	lot	1	$ 36,000	$ 36,000		
			Sub-Total	$ 38,500		
Materials						
Wicket Gate Supply	each	16	$ 11,130	$ 178,080		43607
Bushings, bearings, pins	lot	1	$ 60,000	$ 60,000		
New Turbine Shaft	each	1	$ 39,522	$ 39,522		43607
New Intermediate Shaft	each	1	$ 50,000	$ 50,000		
Consumables	lot	1	$ 20,000	$ 20,000		
Misc. Electrical Material	lot	1	$ 20,000	$ 20,000		
			Sub-Total	$ 367,602		
Contracts						
Confined Space Support	week	8	$ 12,019	$ 96,156		
Exciter/Electrical Refurbishment	lot	1	$ 35,000	$ 35,000		
Machining (Headcover, Seal rings, brakes)	lot	1	$ 130,000	$ 130,000		
Coating (steel framework/misc. components)	lot	1	$ 30,000	$ 30,000		
Misc.	lot	1	$ 10,000	$ 10,000		
			Sub-Total	$ 301,156		
Consulting						
Lifting devices	lot	1	$ 30,000	$ 30,000		
Testing/Inspection (Headcover/turbine)	lot	1	$ 30,000	$ 30,000		
Drafting services	lot	1	$ 45,000	$ 45,000		
			Sub-Total	$ 105,000		
Meals						
Site Visits	lot	1	$ 3,000	$ 3,000		
Temporary Report Point	lot	1	$ 16,000	$ 16,000		
			Sub-Total	$ 19,000		
Other Goods and Services						
Contingency	%	10%	$ 773,758	$ 77,376		
			Sub-Total	$ 77,376		
Interest Capitalized						
AFUDC				$ 22,354		
			Sub-Total	$ 22,354		
Administrative Overhead						
Labour AO				$ 87,014		
Contractor AO				$ 36,205		
			Sub-Total	$ 123,219		
			Sub-Total (no AO, AFUDC)	$ 1,127,707		
			TOTAL (AO, AFUDC included)	$ 1,273,280		
Original Cost				$82,594		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0012158

Title: HYD – Malay Falls Unit 6 Generator Refurbishment

Start Date: 2018/10
In-Service Date: 2019/07
Final Cost Date: 2020/01
Function: Hydro
Forecast Amount: $835,854

DESCRIPTION:

This project is for the rewind and restacking of the stator and rewind of the rotor on Malay Falls Unit 6.

The Malay Falls Hydro Station is located on the Sheet Harbour Hydro system and has been in service since 1924. Malay Falls Unit 6 is rated at 1.2 MW and produces approximately 5.3 GWh/year.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Hydro projects includes "work completed on the same generating unit and dam structures, but not necessarily the same asset."

- 2018 CI 49945 HYD Malay Falls Switchgear Replacement $958,631
- 2018 CI C0047551 HYD SHH Controls Upgrade $1,749,212
- 2019 CI C00010957 HYD – Malay Falls Unit 6 Overhaul $1,273,280

JUSTIFICATION:

Justification Criteria: Hydro, Wind & Biomass

Why do this project?

The Malay Falls Unit 6 stator was last rewound in 1971; however, it has a known hotspot where a coil failed, and caused damage to the iron core in 1997. A patch was placed on the core as a temporary repair. Over time, this has resulted in limiting the air flow in that area and increased winding temperature. The degraded condition of the windings also allows the ingress of moisture when offline, resulting in an extensive dry out period prior to being synchronized to the grid. These factors result in reduced reliability which also places constraints on how the unit and overall river system can be operated.

Rewinding the generator will improve the unit's ability to resist moisture absorption and improve its reliability. Restacking the stator's core will eliminate the localized heating from the previous repair. If the unit is not rewound and restacked, the generator insulation will continue to degrade, which will result in reduced reliability and potentially lost generation.

Why do this project now?

Following an inspection completed in 2018 (Attachment 1), heavy contamination and insulation deterioration of the rotor and stator poles was identified and noted as requiring repair within one year. This project will address these deficiencies while Malay Falls Unit 6 is scheduled to undergo a mechanical overhaul in 2019. By completing this project and the overhaul to the unit (CI C0010957) during the same planned outage, labour effort to disassemble and remove the generator is reduced and loss of generation minimized.

Why do this project this way?

Refurbishment of the generator by rewinding the rotor and stator is more cost effective than a full generator replacement and will still result in similar estimated useful lives of the components. The existing stator frame will be reused to also help reduce costs.

CI Number : C0012158 - HYD - Malay Falls Unit 6 Generator Refurbishment **Project Number** C0012158

Parent CI Number : -

Asset Location : 1359 - 1359 Malay Falls 6, 1 Mwh on Sheet Harbour System **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	2500 - HGP - Generator	699,085
Retirements	2500 - HGP - Generator	136,769
	Total Cost:	835,854
	Original Cost:	110,327

Capital Project Detailed Estimate

Location: Hydro
CI #: C0012158
Title: HYD - Malay Falls Unit 6 Generator Refurbishment
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Hydro River Staff	PD	50	365	$ 18,240		
Engineering Staff	PD	44	405	$ 17,833		
Project Support Staff	PD	28	405	$ 11,349		
			Sub-Total	$ 47,422		
Term Labour						
Hydro River Staff	PD	30	$ 365	$ 10,944		
			Sub-Total	$ 10,944		
Travel Expenses						
Site Visits	Lot	1	$ 2,000	$ 2,000		
			Sub-Total	$ 2,000		
Materials						
Cabling	Lot	1	$ 12,000	$ 12,000		
Consumables	Lot	1	$ 20,000	$ 20,000		
			Sub-Total	$ 32,000		
Contracts						
Rotor Rewind	Lot	1	$ 212,962	$ 212,962		48020
Stator Rewind/Restack	Lot	1	$ 318,120	$ 318,120		
			Sub-Total	$ 531,082		
Meals and Entertainment						
Meals and Entertainment	Lot	1	$ 2,000	$ 2,000		
				$ -		
			Sub-Total	$ 2,000		
Freight/ Postage/ Delivery						
Transport	lot	1	$ 20,000	$ 20,000		
				$ -		
			Sub-Total	$ 20,000		
Other Goods and Services						
Contingency	%	15%	$ 645,448	$ 96,817		
			Sub-Total	$ 96,817		
Interest Capitalized						
AFUDC				$ 6,464		
			Sub-Total	$ 6,464		
Administrative Overhead						
Labour AO				$ 23,278		
Contractor AO				$ 63,847		
			Sub-Total	$ 87,125		
			Sub-Total (no AO, AFUDC)	$ 742,265		
			TOTAL (AO, AFUDC included)	$ 835,854		
Original Cost				$ 110,327		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

NSP-27T HYDRO UNIT INSPECTION CRITERIA		
PLANT: 95H-G6		**DATE: June 12, 2018**
UNIT #: 95H-G6		**CREW: _____**
		WORK ORDERS:76114,92441,84696,84704,92497,84701, 92487
INSPECTION COMPONENT	**RATING**	**COMMENTS/OBSERVATIONS**
Balance of Plant Inspections		**Note: Inspection Criteria is to be used in addition to PM checklists as well as the Overhaul Parts Inspection Checklist**
Condition of anodes	NA	
Condition of manhole cover and studs, and lifting attachments	2	Studs need to be replaced and nuts added to secure covers. Davit arm needs certified to be used.
Condition of deck plates	NA	
Oil Leaks	4	Unit has multiple oil leaks at governor and on unit causing oil mist combined with dirt and carbon have caused significant contamination to rotor and stator.
Temperature probes	3	Temperature Probes are mechanical in operation and need frequent maintenance and have a history of failure. To be replaced with RTD's
Hand rails, deck plating, access ways	1	Reasonable condition
Type of material ORRA piping	4	No ORRA in planning stage
Seal of Head gate	4	Significant leakage head gate sill needs immediate replacement. Portion of sill Missing
Penstock - Condition of Drain	4	Drain Valve seal leaking. Drain valve shaft has broken free of supports and is no longer functioning with handle.
Penstock - Condition of cooling water takeoff	NA	
Exciter Inspection		
Static Air Gap (Pilot)	1	Within tolerances
Collector Ring Wear	2	Collector ring has some ghosting that could be resurfaced
Collector Ring Cleanliness	2	Frequently contaminated with build up of carbon and oil
Exciter Housing Condition	2	Excess carbon and dirt build up clean and paint required
Commutator Wear	3	Wear groves on comm 0.031 and increasing
Exciter Age	1	Unknown winding age insulation contaminated requires cleaning and re painted
Control Circuit Test	1	operates within normal parameters
Operation and Maintenance History	1	No known issues other
Power Circuitry Test	3	Cables for power circuit require replacing. Field breaker over 30 years of age
Spare Parts Availability	3	current AVR obsolete repair existing or replace with current model
Governor Inspection		
Bearings	1	Replaced Annually during maintenance
pins	3	Pins and linkages worn and will need evaluation before automation
bushings	3	Worn and will need evaluation before automation
Connecting rod for quad/terminal shaft	4	Governor will only reach 85% under load conditions. Poor Governor response. Risk of governor not operating properly during a trip or stop.
bearings	1	Replaced Annually during maintenance
Governor Age	3	Governor Original to unit 1923

Operation and Maintenance History	4	Annual maintenance completed, poor response from governor and connected mechanical components making it difficult to and maintain specific load. Governor oil testing reveals oil requires filtration to remove contaminants in oil. Governor or mechanical components not allowing full range of operation
Performance and Response	4	Poor performance and response due to wear of governor and other mechanical control components.
Spare Parts Availability	4	Spare components beginning to become difficult to source due to age. Long lead time for remanufactured parts.
Rotor Inspection		
Winding Age	2	Unknown winding age insulation contaminated requires cleaning and re painted
Vibration	NA	No vibration readings specific to rotor taken
Operation and Maintenance History	2	Interconnecting cables and those for field breaker require replacing. No known rotor issues
Rotor Shaft - Excessive Runout (upper)	NA	Measurements not Taken
Rotor Shaft - Excessive Runout (lower)	1	Within tolerances 0.006 "@ 100%
Rotor Pole Cleanliness	4	Rotor poles heavily contaminated
Braking surface	1	Nothing Noted
Brake pads wear	1	Brake Pads all greater than 0.5"
Insulation Testing RI & PI	3	Rotor passes yearly testing but is heavily contaminated. Insulation readings have decreased dramatically in past 3 years.
Stator Inspection		
Winding Age	3	Rewind 1973
Hot spots (windings)	3	known hotspot where a coil failed and iron core was damaged. A patch was placed on core limiting the air flow in that area increasing winding Temperature
Operation and Maintenance History	4	Unit frequently requires dry outs during short outages, effecting unit availability and reliability.
Winding Cleanliness & Condition	4	Windings heavily contaminated and insulating epoxy paint is separating from windings.
Insulation Testing RI & PI	4	Unit frequently requires dry outs during short outages, effecting unit availability and reliability. Unit requires significant time to dry out during high humidity. Risk of coil failure.
Turbine Inspection		
Runner - Seal Clearance	4	Lower and upper seals showing sings of contact with turbine. Lower seal loose in various spots 0.010 feeler can be place behind seal. Upper head cover seal and lower seal appear to be offset.
Gate Link Bushing Wear	4	All gate link bushings are completely worn out.
Eccentric pin and gate link pin wear	4	Eccentrics journals are rusty and pitted. Some eccentrics are also rusty and pitted.
Push Pull Rod Bushing Clearance	3	Push pull rods on operating ring worn Quadrant shaft bottom bearing worn.
Operating Ring Bushing Wear	1	Nothing Noted other than push pull rods
Wicket Gate - Seals	NA	

Turbine Water Seal Wear (Carbon, Labyrinth, Packing)	NA	
Liner Deterioration (filler)	NA	
Concrete Deterioration	2	Some deterioration but in good condition
Separation of liner and concrete	NA	
Water Passage - Condition	2	Some deterioration but in good condition
Wicket Gate Clearance	4	Excessive Wicket gate Clearances
Upper & Lower Seal Cavitation	4	No cavitation visible but seal contact noted Above and offset from head cover seal
Wicket Gates - Cavitation	2	No visible cavitation but significant organic growth on wicket gates limits visibility
Wicket Gates - Cracking	2	No visible cracks but significant organic growth on wicket gates limits visibility
Runner Condition	1	Some frosting visible on lower buckets. No visible cracks but runner covered with significant organic growth
Seal Ring Condition	4	Lower and upper seals showing sings of contact with turbine. Upper seal shows sings of stainless steel rolling over to form a burr.
Stay Vanes - Condition	NA	
Runner - Alignment	1	Alignment within tolerances
Vacuum valves	NA	
Excessive Run Out	1	Turbine 0.004 Lower guide 0.004 @ 100%
Turbine bearing supply piping	NA	
Excessive leakage (oil, air, water)	3	Oil leaks present on upper guide / thrust and lower guide bearing housings
Vibration analysis	1	0.02 inch/sec @85%
Bearing temperature	1	Bearings running within tolerances: Exciter 46 deg C Upper Guide 42 Deg C Lower Guide 45 Deg C Thrust 58 Deg C temperatures taken at 26 deg plant Ambient Temperature.
Oil Analysis	3	Unit oil analysis reveals contaminates in oil.
Probes not working	3	Temperature Probes are mechanical in operation and need frequent maintenance and have a history of failure. To be replaced with RTD's
Operation and Maintenance History	1	no significant operational history

Revised Inspection Rating System
1) Component is within tolerance. No Change since Last Inspection
2) Component is above normal operating range (wear, temperature or leakage) but does not affect unit operation. Repairs recommended within 5 years
3) Component is in excess of normal tolerance and is affecting unit operation but is not likely to cause immediate failure. Repairs Required within three years (Economics, Runners, Spill)
4) Component deficiencies are affecting unit operation and are likely to fail prior to next annual inspection. Requires repair within one year
5) Component has failed or is likely to fail within the next six months. Immediate Repair Required (Safety, System Security, Lost Generation)

CI Number: 48536

Title: Wreck Cove Brook Dam D-9 Refurbishment

Start Date: 2015/12
In-Service Date: 2019/09
Final Cost Date: 2020/03
Function: Hydro
Forecast Amount: $597,697

DESCRIPTION:

The project is for the refurbishment of the Wreck Cove Brook Dam D-9 to address stability and freeboard deficiencies and to meet the requirements of the Canadian Dam Association Dam Safety Guidelines (CDA Guidelines).

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Hydro projects includes "work completed on the same generating unit and dam structures, but not necessarily the same asset."

- 2017 CI 50151 HYD WRC Main Access Entrance Bridge Replacement $716,508
- 2017 CI 51771 HYD WRC Tailrace Road Refurbishment U&U $321,226
- 2018 CI 48791 HYD WRC Safety Standards Upgrade $1,760,570
- 2018 CI 49033 HYD Tunnel T-2 Intake Replacement $2,851,582
- 2018 CI 51234 HYD WRC HVAC Upgrade $1,876,537
- 2018 CI 51235 HYD WRC Main Access Rd Refurbishment $2,686,075
- 2018 CI 51236 HYD WRC Tailrace Rock Bolting Ph 1 $8,861,996
- 2018 CI 52256 HYD WRC Helipad Construction $161,695
- 2018 CI C0001578 HYD WRC Bus Duct Monitors $158,439
- 2018 CI C0002231 HYD WRC DHA Purchase $50,000
- 2019 CI C0003998 HYD WRC Station Service Cable Replacement $429,384
- 2019 CI C0006859 HYD WRC Crane Refurbishment $498,167
- 2020 CI C0006418 HYD WRC Tailrace Rock Bolting Ph 3 $TBD
- 2020 CI 51233 HYD WRC Surface Maintenance Building $TBD
- 2021 CI TBD HYD WRC Dam D6 & D5 Refurbishment $TBD

JUSTIFICATION:

Justification Criteria: Health & Safety

Why do this project?

The most recent Dam Safety Review (DSR) (Hatch, 2010) concluded that Dam D-9 did not meet the Normal or Minimum Freeboard requirements. A slope stability assessment, specific to Dam D-9, was not completed on this structure as part of the 2010 Dam Safety Review. Given the design configuration and height of Dam D-9 and the stability results of the similar dams in the hydro system, the stability of Dam D-9 needed to be verified to ensure it met the CDA Guideline requirements. Dam D-9 has a dam classification of High, and therefore, the inflow design flood (IDF) is 1/3 between the 1/1000-year and the PMF (Probable Maximum Flood).

The stability assessment of the structure was undertaken by Amec Foster Wheeler in 2016 (Attachment 1). A geotechnical investigation was undertaken at the dam to determine the appropriate material properties to be used in the stability assessment. Topographic surveying was also undertaken to determine the geometry of the dam. The results of the assessment concluded that the dam did not meet the CDA Guideline downstream slope stability requirements.

Based on the stability results, a downstream toe stability berm was designed that would satisfy the slope stability requirements. The stability berm is only required to be installed in the highest portion of the dam and will be roughly 135 feet in length and approximately 30 feet high. The shorter slopes met the stability requirements.

The freeboard requirements were also reviewed by Amec Foster Wheeler and it was verified that the dam did not meet the freeboard requirements as noted in the 2010 DSR. The crest of the dam will be raised by two feet to address the freeboard requirements.

Why do this project now?

This project was identified as a priority within NS Power's dam safety risk prioritization looking at all the water-retaining structures for the hydro systems based on the Canadian Dam Association guideline requirements. The freeboard and stability requirements did not meet CDA Guidelines. The rehabilitation of the dam is scheduled to be implemented in 2019 as part of a general dam safety improvement program.

Why do this project this way?

Based on the Amec Foster Wheeler assessment (Attachment 1), it was determined that the addition of a rockfill toe berm at the downstream toe of the dam is the most common and the least intrusive option for addressing stability requirements, due to the selection of the minimum intervention. As well, the rockfill toe berm option was considered a practical solution that would utilize leftover rockfill from Dam D-4 that is still available at that site. Raising the crest of the dam by two feet will meet the freeboard requirements and is the least intrusive and direct option. Another option would be to rebuild a section of the dam; however, this would likely be more than what is required to meet the minimum intervention and would be more costly so it was not considered.

CI Number : 48536-H753 - Wreck Cove Brook Dam D-9 Refurbishment

Project Number 48536-H753

Parent CI Number : -

Asset Location : 1361 - 1361 Wreck Cove Common Property

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	2800 - HGP - Dams & Spillways	597,697
	Total Cost:	597,697
	Original Cost:	

Capital Project Detailed Estimate

Location: **Hydro**
CI#: 48536
Title: Wreck Cove Brook Dam D-9 Refurbishment
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Hydro River Staff - Construction	days	3	365	$ 1,154		
Environmental Staff	days	6	405	$ 2,430		
Project Support Staff	days	104	405	$ 42,102		
Administrative Support	days	10	365	$ 3,574		
			Sub-Total	$ 49,261		
Term Labour						
Project Support Term	days	1	365	$ 269		
Administrative Support	days	3	365	$ 1,168		
			Sub-Total	$ 1,437		
Travel Expense						
Engineering Staff	lot	1	4,576	$ 4,576		
			Sub-Total	$ 4,576		
Contracts						
Water Management	lot	1	[redacted]			
Mobilization/Demobilization, Clearing etc.	lot	1			Attachment 2, Item 1	
Crest Raise	lot	1			Attachment 2, Item 2	
Stability Berm	lot	1			Attachment 2, Item 3	
Construction Management	lot	1	30,000	30,000		
			Sub-Total	268,430		
Consulting						
Topographic Surveying	lot	1	9,665	9,665		
Leading Edge	lot	1	35,501	35,501		
Consulting	lot	1	69,198	69,198		
Design Consultant (Construction Support)	lot	1	10,000	10,000		
			Sub-Total	124,364		
Meals and Entertainment						
Engineering Staff	lot	1	800	800		
			Sub-Total	800		
Other Goods and Services						
Contingency	%	15%	448,868	67,330		
			Sub-Total	67,330		
Interest Capitalized						
AFUDC				$ 27,081		
			Sub-Total	$ 27,081		
095 Administrative Overhead						
Labour AO				$ 22,167		
Contractor AO				$ 32,250		
			Sub-Total	$ 54,417		
			Sub-Total (no AO, AFUDC)	$ 516,199		
			TOTAL (AO, AFUDC included)	$ 597,697		
Original Cost				$ -		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Memo

To	**Aaron Alderman**	File No	**TV163002**
From	**Joseph Fakhri**	c.c.:	**Ilia Wainshtein, AmecFW**
Date	**January 11, 2017**		

Subject **Wreck Cove Brook Dam D-9 Refurbishment**
Conceptual Design Memo and Options Analysis

1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure (AmecFW) was retained by Nova Scotia Power Inc. (NSPI) to perform Conceptual and Detailed Design for the Refurbishment of Dam D-9 and provide measures for refurbishment of the existing dam to meet the current Canadian Dam Safety (CDA) Guidelines. As part of this process, this memo provides the conceptual design, options analysis and cost estimates for the refurbishment of the dam.

2.0 BACKGROUND

Dam D-9 is a part of the Wreck Cove Hydro System. The Wreck Cove Hydro System is comprised of 21 earth dams and is located in the Cape Breton Highlands of Nova Scotia. NSPI operates the Wreck Cove Hydro System, which consists of two (2) hydroelectric generating stations on the edge of the escarpment of the Cape Breton Highlands near Wreck Cove Brook in Victoria County, Nova Scotia. Construction of the hydro system was completed in 1977.

Dam D-9 is an earthfill dam with a crest length of 747 ft, a crest width of 20 ft and a maximum height of 52 ft. The nominal crest elevation of the dam is 1206 ft. Based on the design drawings (Surveyer, Nenniger & Chenevert Inc, 1976) provided by NSPI, the dam is constructed of a homogenous silty sand and gravel fill with a rockfill cover. The foundation of the dam consists of till over bedrock (Diorite) except at the narrow highest portion of the dam where the dam is founded directly on bedrock. The top 5 to 10 ft of the bedrock was reported to be fractured and the bedrock was not grouted prior to the dam construction.

The general layout of Dam D-9 is shown on Figure 1.

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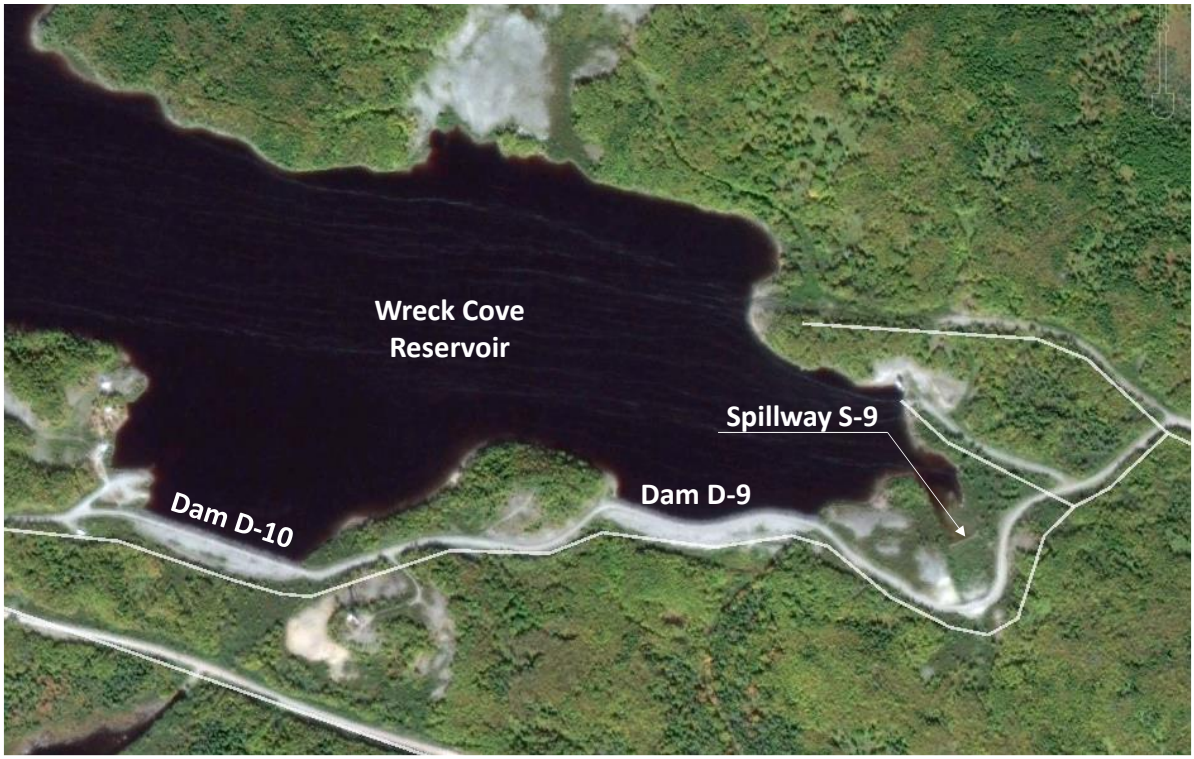

Figure 1. General layout of Dam D-9

Typical design cross-sections of the dam on bedrock (35 ft to 55 ft high) and on glacial till over bedrock (35 ft to 45 ft high) are shown on Figures 2 and 3 respectively.

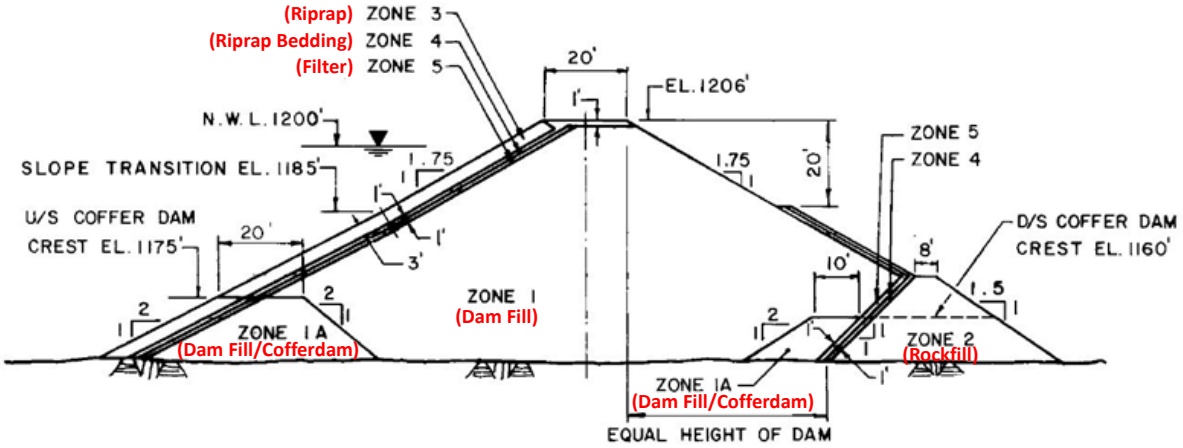

Figure 2: Typical Design Cross-Sections of Dam D-9 on Bedrock (Surveyer, Nenniger & Chenevert Inc, 1976).

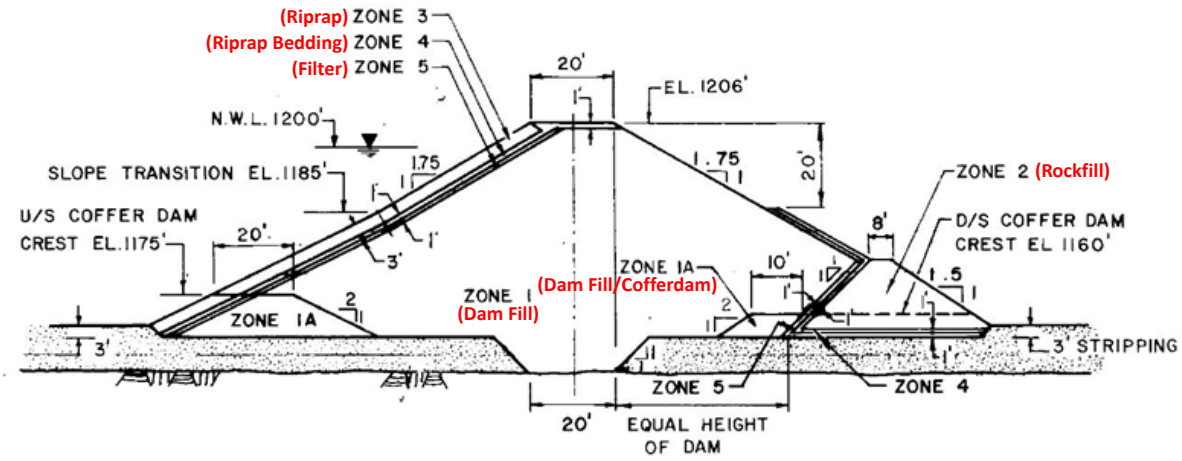

Figure 3: Typical Design Cross-Sections of Dam D-9 on Glacial Till (Surveyer, Nenniger & Chenevert Inc, 1976).

According to the RFP, Dam D-9 does not meet the requirements of the CDA Dam Safety Guidelines and is tentatively scheduled to be rehabilitated in 2017. A conceptual and detailed design is required for refurbishment of this project to meet the current CDA Guidelines.

Based on the RFP, stability assessments were not completed for Dam D-9 as part of the 2010 Dam Safety Review (DSR) for the Wreck Cove Hydro System by Hatch. However based on the stability assessment results of similar structures within the hydro system, the specific issues that have to be addressed on Dam D-9 are the following:

- Dam D-9 does not meet the Normal and Minimum Freeboard requirements and the downstream slope does not meet the CDA stability requirements for steady state seepage.

Options for raising the dam to meet the Normal and Minimum Freeboard requirements and for constructing a rock toe berm to stabilize the dam are presented below. As stated in the design basis memorandum (DBM) issued by AmecFW on 16 May 2016 (attached in Appendix A), without altering the spillway length, the crest of the dam needs to be raised by 1.26 ft. to meet the Normal and Minimum Freeboard requirements. However, NSPI desire to raise the dam by 2.0 ft. to a crest elevation of 1208.0 ft.

3.0 PROPOSED OPTIONS

The refurbishment options that have been developed for Dam D-9 to meet the CDA requirements for the Normal and Minimum Freeboard and for the steady state seepage are described below.

To meet the Normal and Minimum Freeboard requirements, the dam will be raised by 2.0 ft. This option involves removing the existing rockfill from the crest and raising the dam by 2.0 ft to elevation 1208.0 ft in lifts using similar silty sand and gravel material covered with geotextile and rockfill. This option is shown on Figure 4.

To meet the CDA stability requirements for steady state seepage, the construction of a stabilization toe berm is required. This option involves constructing a toe berm of free draining

rock fill along the downstream slope. Two toe berms shown on Figures 5 and 6 are designed, based on the typical design section heights and foundation material type.

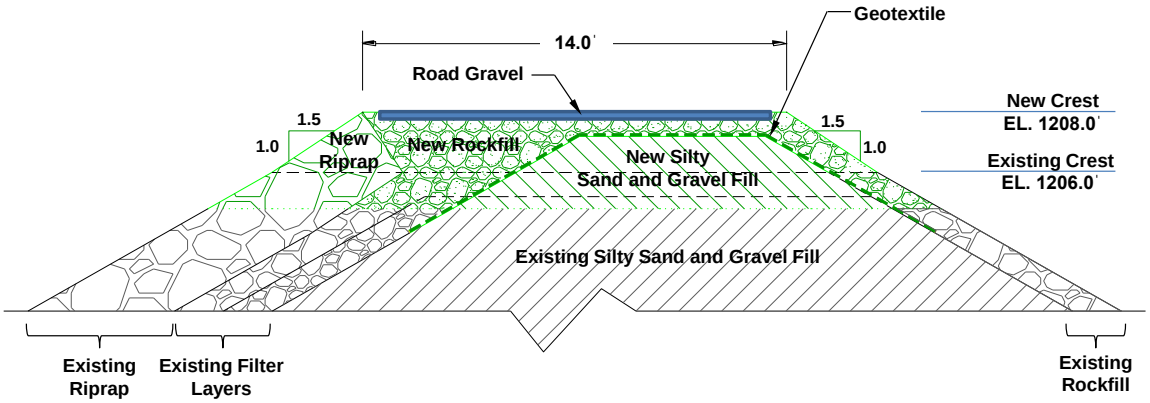

Figure 4: Raising the Dam

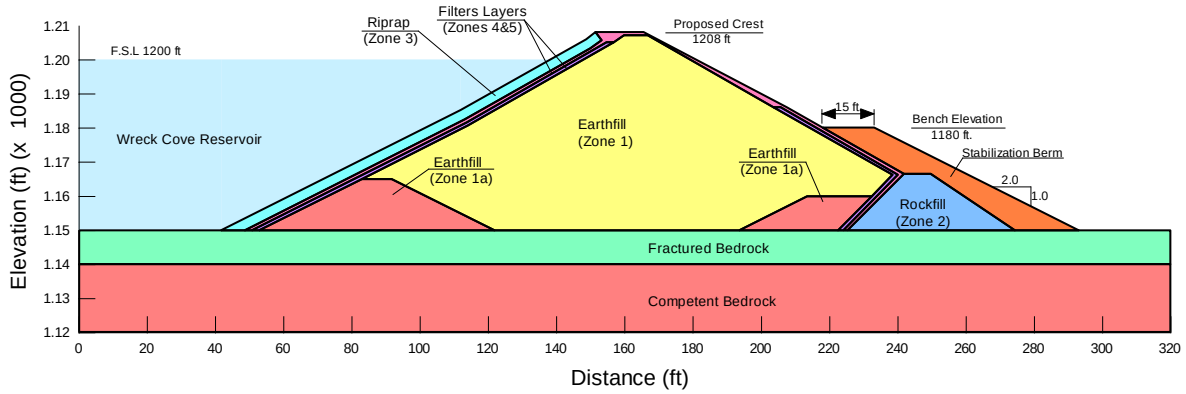

Figure 5: Typical Section on Bedrock

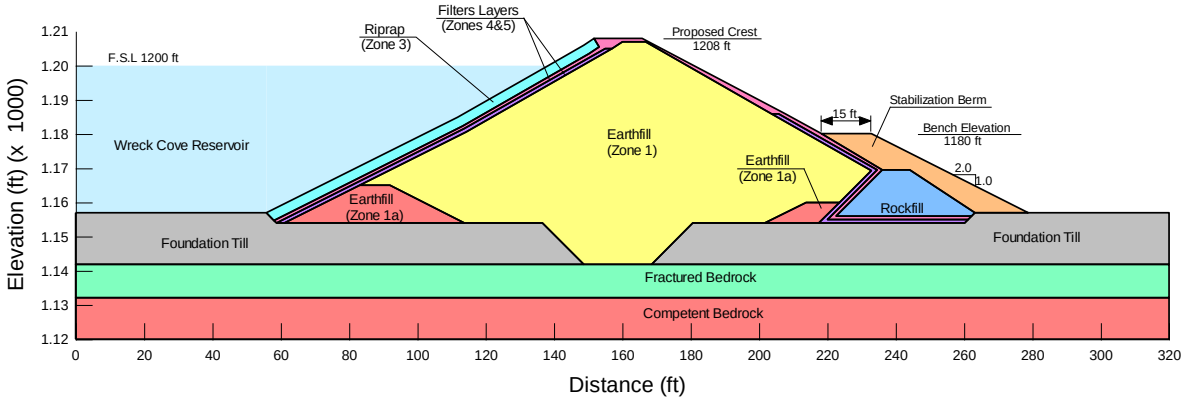

Figure 6: Typical Section on Glacial Till

It should be noted that the stabilization rockfill berm is only required at the dam cross-sections higher than 35 ft. A general site plan showing an approximate extent of the proposed stabilization

berm is provided in Appendix B (Drawing B-2). This appendix also includes an existing site plan (Drawing B-1) and a typical cross-section through the proposed rockfill berm (Drawing B-3).

4.0 COST ESTIMATES

The cost estimates for the refurbishment of Dam D-9 are presented below.

		Unit	Qty	Unit Price $	Cost $
	Mob/Demob, incl. Access Road Widening	ls	1	40,000	$40,000
Stabilization Berm	Rockfill	yd ^{3}	2,000	31	$62,000
	Grubbing	yd ^{2}	200	7	$1,400
Dam Raise	Excavation	yd ^{3}	950	10	$9,500
	Common fill	yd ^{3}	635	27	$17,145
	Rockfill	yd ^{3}	650	31	$20,150
	Road Gravel	yd ^{3}	220	32	$7,040
	Riprap	yd ^{3}	340	37	$12,580
	Geotextile	yd ^{2}	1,500	3.3	$4,950
				Total Cost:	**$174,765**

It should be noted that the cost estimates presented above represents an accuracy of +/- 40 percent.

5.0 CLOSING REMARKS

Please review and contact the undersigned with questions or comments at your earliest convenience.

Sincerely,

Amec Foster Wheeler Environment & Infrastructure
A division of Amec Foster Wheeler Americas Limited

Joseph Fakhri, M.A.Sc., P.Eng.
Project Manager

amec foster wheeler

APPENDIX A

DESIGN BASIS MEMORANDUM

Memo

To	**Aaron Alderman**	File No	**TV163002**
From	**Joseph Fakhri**	c.c.:	**Ilia Wainshtein, AmecFW** **Andy Small, AmecFW**
Date	**May 16, 2016**		

Subject **Wreck Cove Brook Dam D-9 Refurbishment**
Design Basis Memorandum

1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure (AmecFW) was retained by Nova Scotia Power Inc. (NSPI) to evaluate the condition of the (referred to as Dam D-9) and provide measures for refurbishment of the existing dam to meet the current Canadian Dam Safety (CDA) Regulations and Guidelines. As part of this process, this design basis memorandum was prepared to document and confirm with NSPI the key design parameters that will be used for the refurbishment design of the dam.

2.0 BACKGROUND

Dam D-9 is a part of the Wreck Cove Hydro System. The Wreck Cove Hydro System is comprised of 21 earth dams and is located in the Cape Breton Highlands of Nova Scotia. NSPI operates the Wreck Cove Hydro System, which consists of two (2) hydroelectric generating stations on the edge of the escarpment of the Cape Breton Highlands near Wreck Cove Brook in Victoria County, Nova Scotia. Construction of the hydro system was completed in 1977.

Dam D-9 is an earthfill dam with a crest length of 747 ft, a crest width of 20 ft and a maximum height of 52 ft. The nominal crest elevation of the dam is 1206 ft. Based on the design drawings (Surveyer, Nenniger & Chenevert Inc, 1976) provided by NSPI, the dam is constructed of a homogenous silty sand and gravel fill with a rockfill cover. The foundation of the dam consists of till over bedrock (Diorite) except at the narrow highest portion of the dam where the dam is founded directly on bedrock. The top 5 to 10 ft of the bedrock was reported to be fractured and the bedrock was not grouted prior to the dam construction.

The general layout of Dam D-9 is shown on Figure 1.

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Fax +1 (902) 468-1314
www.amec.com

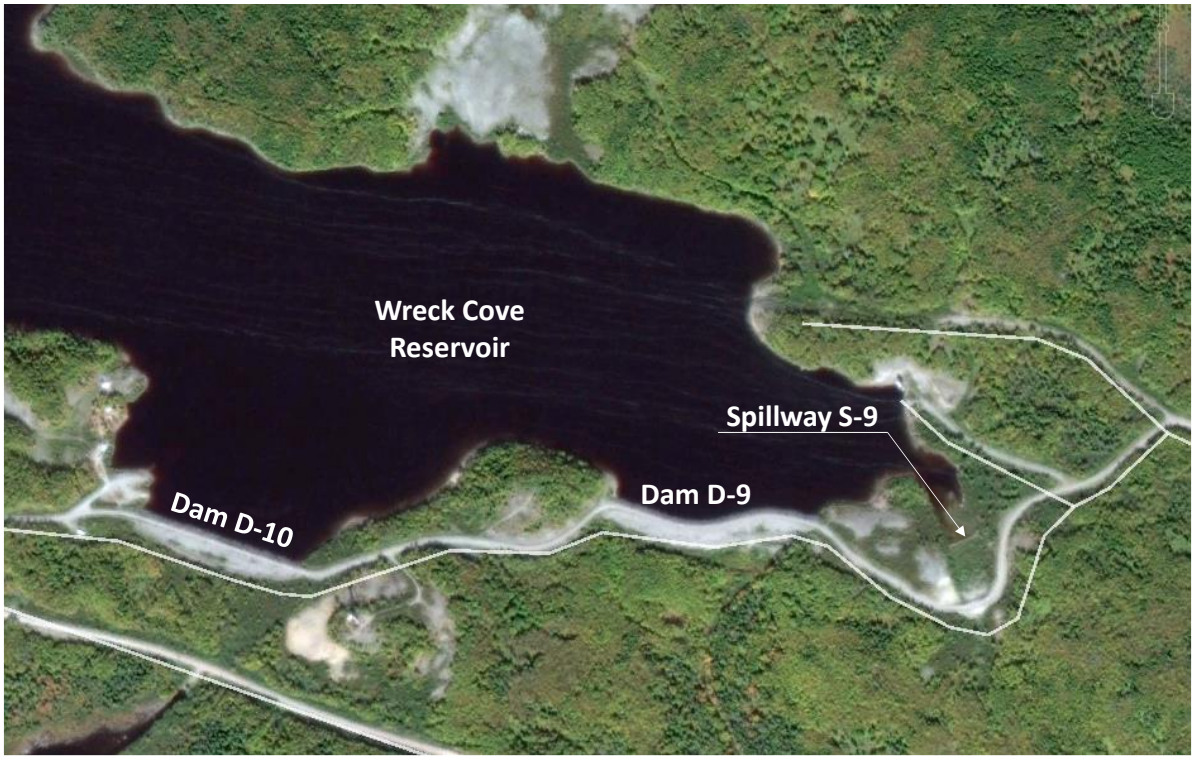


Figure 1. General layout of Dam D-9

Typical design cross-sections of the dam on bedrock (35 ft to 55 ft high) and on glacial till over bedrock (35 ft to 45 ft high) are shown on Figures 2 and 3 respectively.

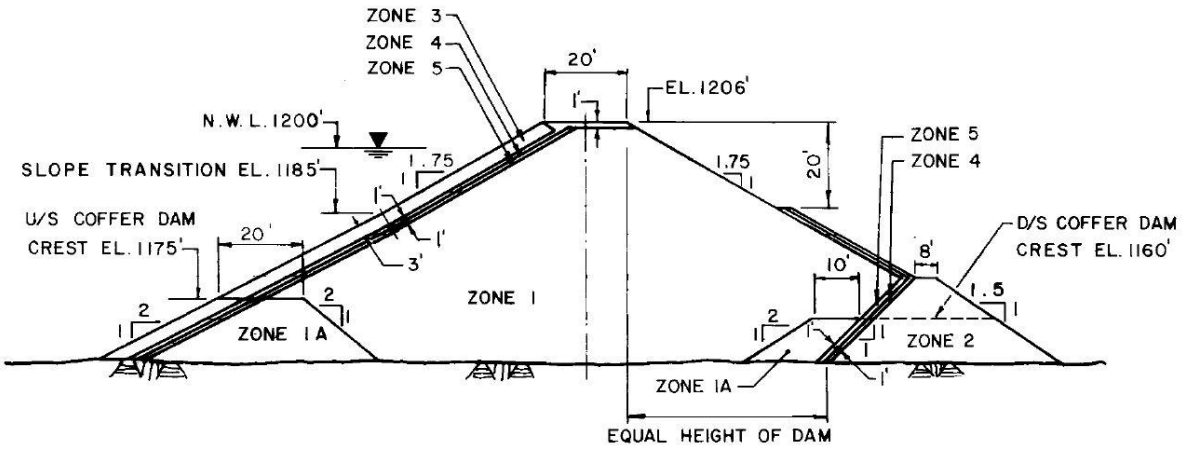


Figure 2. Typical Design Cross-Sections of Dam D-9 on Bedrock (Surveyer, Nenniger & Chenevert Inc, 1976).

(Zone 1 & 1A: Dam Fill; Zone 2: Rockfill; Zone 3: Riprap; Zone 4: Riprap Bedding; Zone 5: Filter)

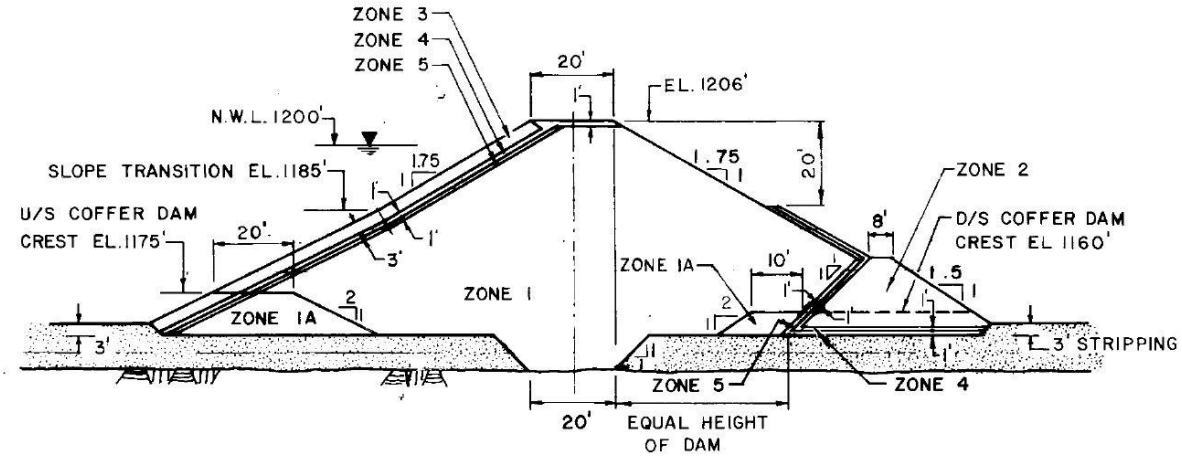


Figure3. Typical Design Cross-Sections of Dam D-9 on Glacial Till (Surveyer, Nenniger & Chenevert Inc, 1976).

According to the RFP, Dam D-9 does not meet the requirements of the CDA Dam Safety Guidelines and is tentatively scheduled to be rehabilitated in 2017. A conceptual and detailed design is required for refurbishment of this project to meet the current CDA Guidelines.

Based on the RFP, stability assessments were not completed for Dam D-9 as part of the 2010 Dam Safety Review (DSR) for the Wreck Cove Hydro System by Hatch. However based on the stability assessment results of similar structures within the hydro system, the specific issues that have to be addressed on Dam D-9 are the following:

- Dam D-9 does not meet the Normal and Minimum Freeboard requirements and likely the downstream slope does not meet the CDA stability requirements for steady state seepage. Raising the dam to meet the Normal and Minimum Freeboard requirements is being considered. Extending the length of the spillway to meet the freeboard requirements is not desired by NSPI. A rock toe berm to stabilize the dam is being considered.

A conceptual and detailed design will be undertaken for refurbishment of Dam D-9 to meet the current CDA Guidelines.

3.0 DAM CLASSIFICATION

Dam classification is required to provide guidance on the design criteria, in particular recommendations for the inflow design flood and earthquake design ground motion. Based on the 2010 Dam Safety Review (DSR) for the Wreck Cove Hydro System by Hatch, the Dam Classification for Dam D-9 is High based on the potential loss of life and the potential infrastructure and economic impacts that may occur if the structure was to fail. Verifying the dam classification is beyond this assignment. The recommended IDF for the Gisborne Dam is 1/3 between the 1/1,000-year and PMF. The existing Full Supply Level (FSL) for the development is 1,200 ft.

4.0 DESIGN CRITERIA

The design criteria are summarized in Table 1.

Table 1. Design Criteria.

DESIGN CRITERIA	UNITS	VALUE
Full Supply Level	ft	1200
Dam Classification		High
IDF		1/3 between 1/1,000 and PMF
Maximum water level during IDF[1]	ft	1204.6
Wind Speed (Normal Freeboard)		1/1,000-year wind speed
Wind Speed (Minimum Freeboard)		1/2-year wind speed
Normal Freeboard Required[1]:	ft	6.23
Minimum Freeboard Required[1]:	ft	2.66
Peak Ground Acceleration (PGA) – Operational (1/2,475-year EDGM) For analysis: Horizontal (50% PAG) Vertical (50% of horizontal)	g g g	0.056 0.028 0.014
Factor of Safety (FOS) Long term (steady-state seepage, FSL), downstream slope Long term (steady-state seepage, FSL), upstream slope Full or partial rapid drawdown Pseudo-static Post-earthquake		 1.5 1.3 1.2 – 1.3 1.0 1.2 – 1.3

[1]: From the Wreck Cove Hydro System 2010 Flood Study by Hatch. Verifying these values is beyond the scope of this assignment.

As noted above, the crest elevation of the dam is 1206 ft and the required Normal Freeboard is 6.23 ft, above the FSL of 1200 ft, hence, there is not enough freeboard for the normal operating conditions.

As noted in Table 1, the routed IDF level through the existing spillway is 1204.6 ft and the required Minimum Freeboard is 2.66 ft, which results in a required crest elevation of 1207.26 ft, 1.26 ft higher than the crest elevation.

Hence, without altering the spillway length, the crest of the dam needs to be raised by 1.26 ft. However, NSPI desire to raise the dam by 2.0 ft. to a crest elevation of 1208.0 ft. The top of the competent (below frost) core of the raised dam will be at 1205.0 ft (assuming 3 ft frost depth).

Based on the Wreck Cove Hydro System 2010 Flood Study by Hatch, the IDF and wind setup is at elevation 1204.6 ft, which is 0.4 ft below the top of the competent core.

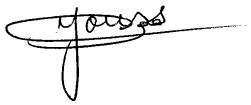
It should be noted that Dam D-9 is a low permeability structure and that hydraulic stability (internal erosion) must be maintained. Based on our experience with Dam D-4 in the area, an exit hydraulic gradient of 0.2 to 0.25 would be considered acceptable.

5.0 CLOSING REMARKS

Please review and confirm these key design parameters. Should you have any questions or comments, please contact the undersigned at your earliest convenience.

Sincerely,

Amec Foster Wheeler Environment & Infrastructure
A division of Amec Foster Wheeler Americas Limited



Joseph Fakhri, M.A.Sc., P.Eng.
Project Manager

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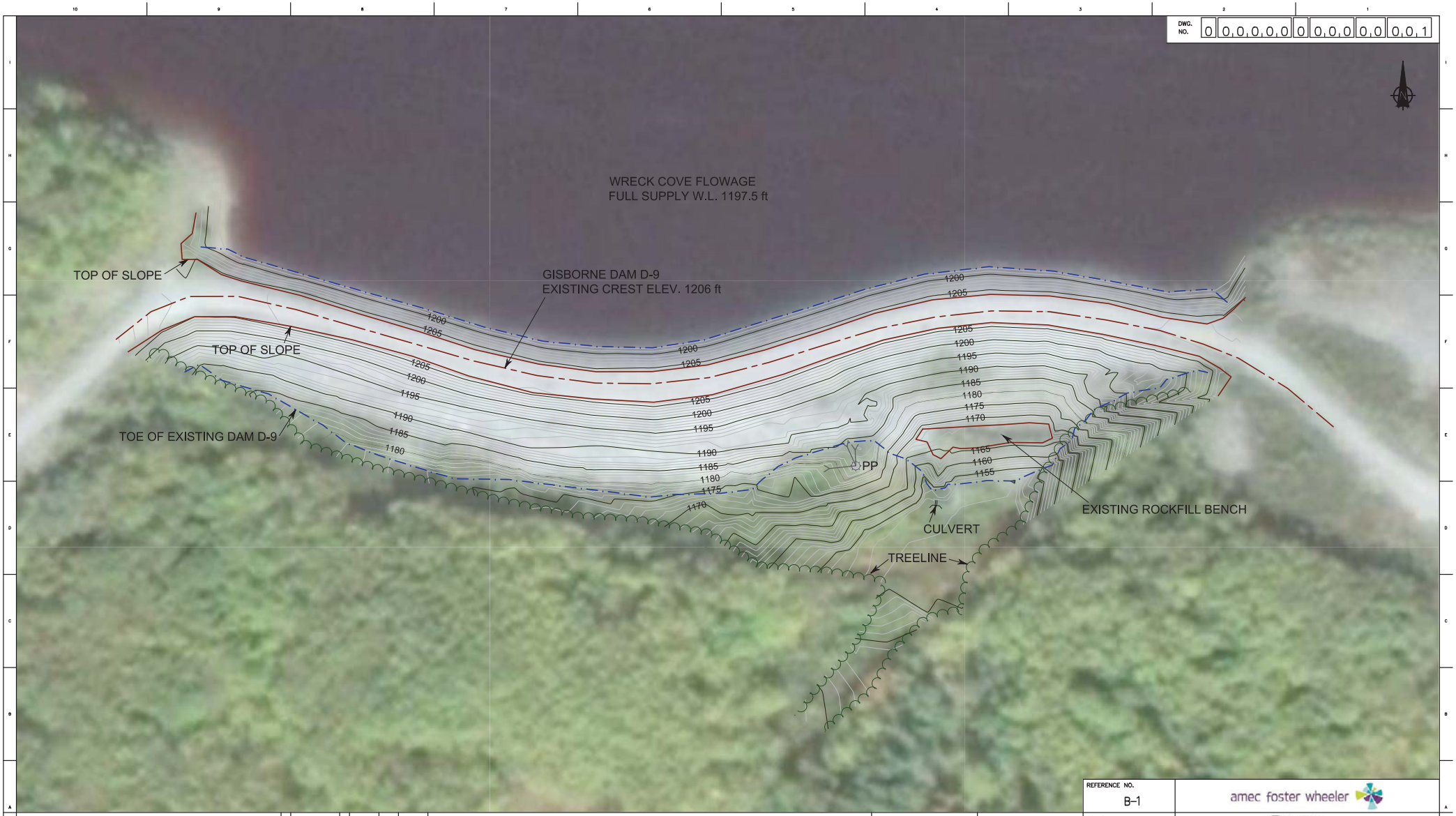
APPENDIX B

CONCEPTUAL DESIGN DRAWINGS



DWG. NO. 0 0,0,0,0,0 0 0,0,0 0,0 0,0,1

NOTES:
1. Elevation contours shown are at intervals of 1.0 ft.
2. Existing ground elevations east of eastern treeline are assumed, and may vary from those shown.

0' 30' 60' 90'
1" = 60'

REV	DS	CIVIL	MECH	E & I	CONST	ENVIRO

REFERENCE DRAWINGS | DWG.NO.

SEAL

DEPARTMENTAL APPROVALS

CIVIL	E & I
MECH	CONST
APPROVED	
DATE	

REFERENCE NO. B-1

amec foster wheeler

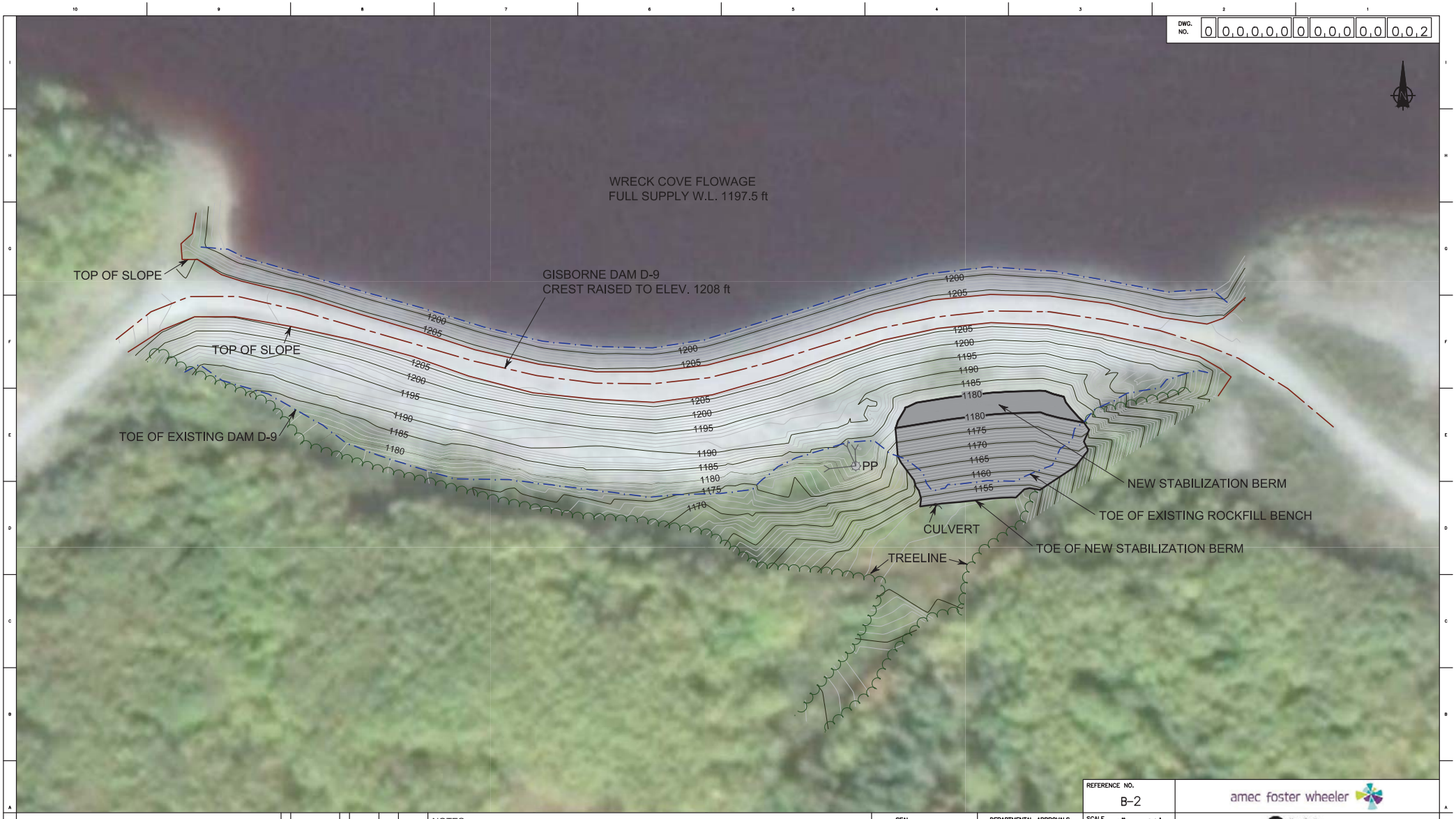
SCALE	1" = 60'
UNITS	FEET
DESIGNED	JF/IW
DRAWN	BC
CHECKED	JF
CHECKED	
DATE	28/06/2016
W.O.	

Nova Scotia POWER An Emera Company

GISBORNE DAM D-9
DAM REFURBISHMENT

GENERAL SITE PLAN
EXISTING CONDITIONS

0 0,0,0,0,0 0 0,0,0 0,0 0,0,1 REV. A



DWG. NO. 0 0,0,0,0,0 0 0,0,0 0,0 0,0,2

NOTES:
1. Elevation contours shown are at intervals of 1.0 ft.
2. Existing ground elevations east of eastern treeline are assumed, and may vary from those shown.

0' 30' 60' 90'
1" = 60'

REV	DS	CIVIL	MECH	E & I	CONST	ENVIRO

REFERENCE DRAWINGS | DWG.NO.

SEAL

DEPARTMENTAL APPROVALS

CIVIL	E & I
MECH	CONST
APPROVED	
DATE	

REFERENCE NO. B-2

amec foster wheeler

SCALE	1" = 60'
UNITS	FEET
DESIGNED	JF/IW
DRAWN	BC
CHECKED	JF
CHECKED	
DATE	28/06/2016
W.O.	

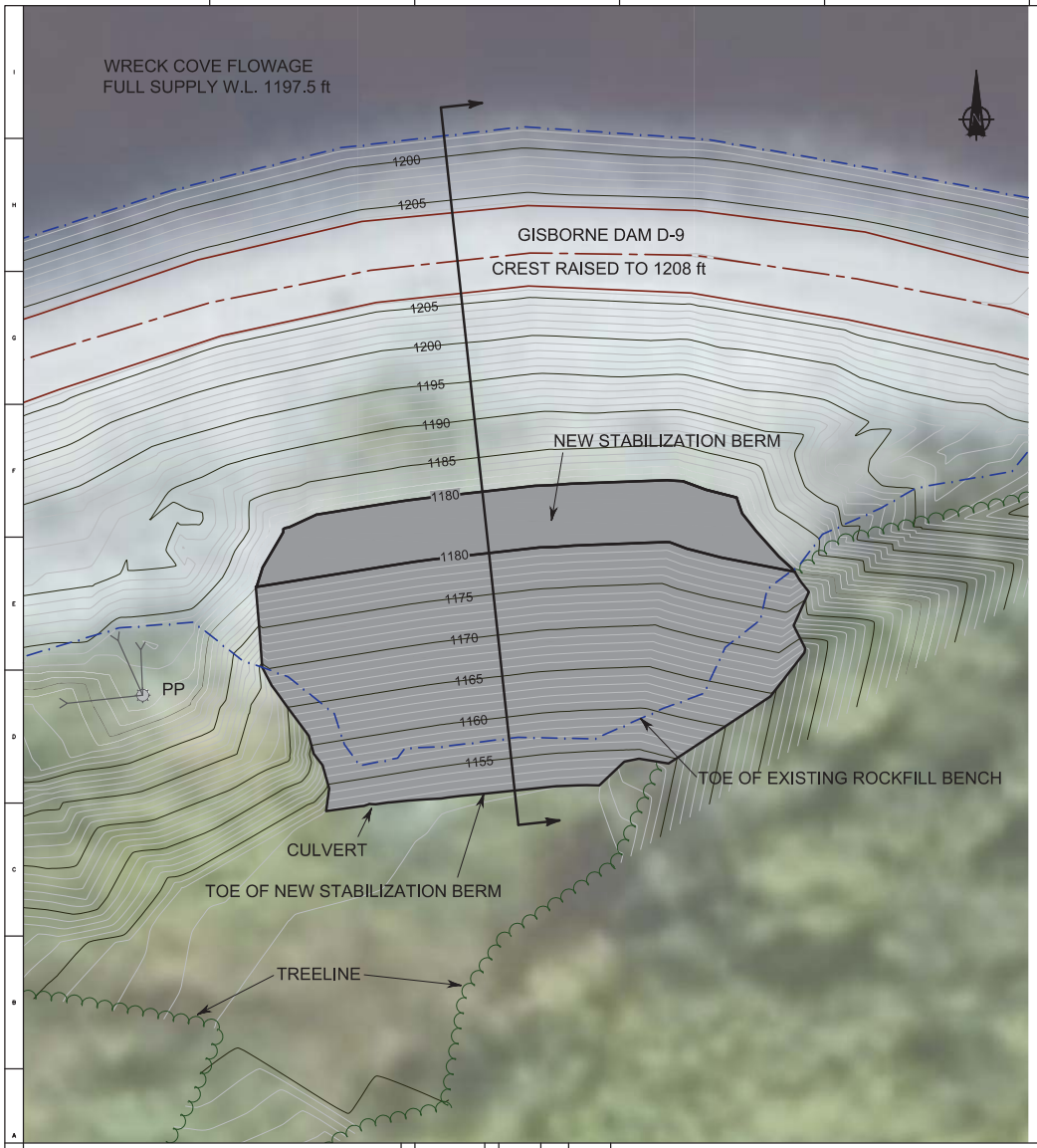
Nova Scotia POWER An Emera Company

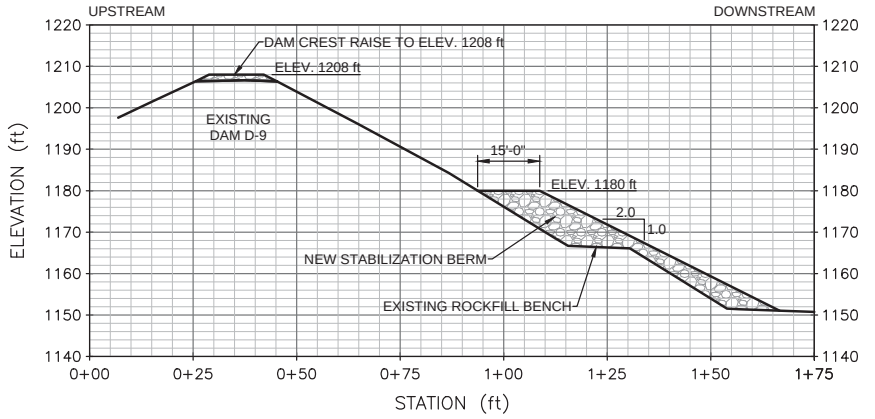
GISBORNE DAM D-9
DAM REFURBISHMENT

GENERAL SITE PLAN
PROPOSED REFURBISHMENTS

0 0,0,0,0,0 0 0,0,0 0,0 0,0,2 REV. A

DWG. NO. 0 0,0,0,0,0 0 0,0,0 0,0 0,0,3





TYPICAL SECTION

NOTES:
1. Elevation contours shown are at intervals of 1.0 ft.
2. Existing ground elevations east of eastern treeline are assumed, and may vary from those shown.

0' 15' 30' 45'
1" = 30'

REV	DS	CIVIL	MECH	E & I	CONST	ENVIRO
0						

SEAL

DEPARTMENTAL APPROVALS

CIVIL	E & I
MECH	CONST
APPROVED	
DATE	

REFERENCE NO.	B-3
SCALE	1" = 30'
UNITS	FEET
DESIGNED	JF/IW
DRAWN	BC
CHECKED	JF
CHECKED	
DATE	04/07/2016
W.O.	

amec foster wheeler

Nova Scotia POWER An Emera Company

GISBORNE DAM D-9
DAM REFURBISHMENT

STABILIZATION BERM
PLAN VIEW AND TYPICAL SECTION

REFERENCE DRAWINGS | DWG.NO. 0 0,0,0,0,0 0 0,0,0 0,0 0,0,3 | REV. A

Memo

To	**Aaron Alderman**	File No	**TV163002**
From	**Joseph Fakhri**	c.c.:	
Date	**June 14, 2018**		

Subject **Wreck Cove Brook Dam D-9 Refurbishment**
Revised Cost Estimate

Please find attached the revised cost estimate for Dam D-9, reflecting the increased quantities and a [redacted] contingency added.

Should you have any questions, please feel free to contact me.

Sincerely,

Wood Environment & Infrastructure Solutions
A division of Wood Canada Limited

Joseph Fakhri, M.A.Sc., P.Eng.
Project Manager

Wood Environment and Infrastructure Solutions,
A division of Wood Canada Limited
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www.woodplc.com

Dam D-9
Wreck Cove Hydro System

Construction Cost Estimate (based on Amec Foster Wheeler estimate from January 2017)
1-Jun-18

Item No.	Description	Unit	Quantity	Unit Price	Total
General					
1.1	Mobilization	L.S.	1	[redacted]	[redacted]
1.2	Demobilization	L.S.	1	[redacted]	[redacted]
1.3	Access Road Upgrade	L.S.	1	[redacted]	[redacted]
1.4	Environmental Management	L.S.	1	[redacted]	[redacted]
1.5	Clearing & Grubbing	L.S.	1	[redacted]	[redacted]
				Subtotal	[redacted]
Crest Raise					
2.1	Excavation	yd^3	1140	[redacted]	[redacted]
2.2	Common Fill	yd^3	702	[redacted]	[redacted]
2.3	Rockfill	yd^3	1020	[redacted]	[redacted]
2.4	Type 2 Gravel	yd^3	264	[redacted]	[redacted]
2.5	Riprap	yd^3	408	[redacted]	[redacted]
2.6	Geotextile	yd^2	3600	[redacted]	[redacted]
				Subtotal	[redacted]
Stability Berm					
3.1	Toe Drain Material	yd^3	180	[redacted]	[redacted]
3.2	Rockfill	yd^3	2220	[redacted]	[redacted]
3.3	Grubbing	yd^3	240	[redacted]	[redacted]
				Subtotal	[redacted]
				Total	[redacted]

CI Number: C0006859

Title: HYD Wreck Cove Crane Refurbishment

Start Date: 2018/02
In-Service Date: 2019/06
Final Cost Date: 2019/12
Function: Hydro
Forecast Amount: $498,167

DESCRIPTION:

The crane at the Wreck Cove Generating station has been in service since 1978. The Centre for Energy Advancement through Technological Innovation (CEATI) Crane Assessment Guide indicates a higher asset risk after 35 years of age. CEATI is an electrical industry technical reference organization. A condition assessment and recommendations completed in 2018 identified items that require upgrade to allow for continued safe and reliable use of the overhead crane.

This project includes replacement of following components of the crane:

1. Electrical collectors;
2. Auxiliary Hoist Gearbox;
3. Wire rope;
4. Bridge travel drive;
5. Main hook; and
6. New load cell

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Hydro projects includes "work completed on the same generating unit and dam structures, but not necessarily the same asset."

- No other projects in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Health & Safety

Why do this project?

The main overhead crane in the Wreck Cove hydro plant has been in service since 1978 and is rated for 165 tonnes. This crane is required to complete all major lifts during shutdowns and generator/turbine removals. A condition assessment was completed in 2018 (please refer to Attachment 1) that identified increased risk to the asset. There have been signs of arcing observed in electrical components, as well as wear on the teeth of the hoist gearbox. Without a replacement of the bridge travel drive, load swing is difficult to manage. The addition of a load cell on the hoist will increase safety such that the crane is not being overloaded during lifts. While the existing crane meets the required safety standards, the risks to the continued safe and reliable operation of the crane over its remaining life will be mitigated through completion of this project.

Why do this project now?

A condition assessment and recommendations completed in 2018 identified items that require replacement to allow for continued safe and reliable use of the overhead crane. These replacements are also required in advance of the Wreck Cove life extension and modernization, as the crane will be relied on for heavy use as well as maximum capacity lift during this life extension.

Completing this project now will ensure the continued safe and reliable operation of the crane.

Why do this project this way?

A condition assessment was completed by the Original Equipment Manufacturer (OEM) to determine what would be required to bring the existing crane up to acceptable levels of safety and reliability. In comparison to a complete crane replacement, this upgrade is a more cost-effective option.

CI Number : C0006859 - HYD Wreck Cove Crane Refurbishment **Project Number** C0006859

Parent CI Number : -

Asset Location : 1361 - 1361 Wreck Cove Common Property **Budget Version** 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0300 - HGP - Bldg.,Struct.Grnd.	449,604
Retirements	0300 - HGP - Bldg.,Struct.Grnd.	48,563
	Total Cost:	498,167
	Original Cost:	124,759

Capital Project Detailed Estimate

Location: Hydro
CI#: C0006859
Title: HYD Wreck Cove Crane Refurbishment
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Hydro River Staff	day	36	365	$ 13,142		
Engineering Staff	day	31	405	$ 12,551		
			Sub-Total	$ 25,694		
Term Labour						
Hydro River Staff	day	3	$ 365	$ 1,050		
			Sub-Total	$ 1,050		
Term Labour - Overtime						
Hydro River Staff	day	0	$ 730	$ 164		
			Sub-Total	$ 164		
Travel Expenses						
Travel to Site	lot	1	$ 5,061	$ 5,061		
			Sub-Total	$ 5,061		
Materials						
Plant Conductor System	lot	1	[redacted]		Attachment 2	
Gear Box Replacement	lot	1			Attachment 3	
Misc Consumables	lot	1	$ 5,100	$ 5,100		
Crane Hook	lot	1	$ 40,000	$ 40,000		
			Sub-Total	$ 99,940		
Contracts						
Remove/Install Bay Conductor Bar	lot	1	[redacted]		Attachment 2	
Remove/Install Bridge Drive VFD	lot	1			Attachment 4	
Remove/Install Bridge Conductor Bar	lot	1			Attachment 5	
Installation of Crane Gearbox	lot	1	$ 20,000	$ 20,000		
Remove/Install Wire Ropes (Main + Aux)	lot	1	$ 29,000	$ 29,000		
Manlift Rental	Month	3	$ 5,000	$ 15,000		
Remove/Install Load Cell	$	2	$ 10,800	$ 21,600		
Crane Condition Assessment	$	1	$ 19,468	$ 19,468		
			Sub-Total	$ 228,518		
Consulting						
Inspection/Support	lot	1	$ 30,000	$ 30,000		
			Sub-Total	$ 30,000		
Meals						
Meals	lot	1	$ 3,388	$ 3,388		
			Sub-Total	$ 3,388		
Freight						
Freight	lot	1	[redacted]		Attachment 2	
			Sub-Total			
Other Goods and Services						
Contingency	%	[redacted]				
			Sub-Total			
Interest Capitalized						
AFUDC				$ 6,364		
			Sub-Total	$ 6,364		
Administrative Overhead						
Labour AO				$ 10,819		
Contractor AO				$ 27,023		
			Sub-Total	$ 37,842		
			Sub-Total (no AO, AFUDC)	$ 453,960		
			TOTAL (AO, AFUDC included)	$ 498,167		
Original Cost				$ 124,759		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

R&W CRANE & HOIST LTD.

Crane and Hoist Inspections

Prepared for:
NOVA SCOTIA POWER INC.
42338 CABOT TRAIL
WRECK COVE NS B0C 1H0
#1499- MAY 16-19, 2018

R&W CRANE & HOIST LTD.
5 – 790 Redwood Square, Oakville, Ontario L6L 6N3
TEL. 905 825 5500 T.F. 800 461 8499 FAX. 905 825 5315 RWHOIST.COM
OAKVILLE • SARNIA • LONDON • CONCORD

Overview

Breakdown by Form

Form Type	High	Med	Low	# Forms
R & W Inspection Report	6	8	2	1
Overall:	**6**	**8**	**2**	**1**

Breakdown by Location

Location	High	Med	Low	# Forms
Wreck Cove O.R. Service Crane	6	8	2	1
Overall:	**6**	**8**	**2**	**1**

Breakdown by Asset

Asset Type	High	Med	Low	# Assets
Material Lifting Equipment	6	8	2	1
Overall:	**6**	**8**	**2**	**1**

R & W Crane & Hoist Ltd.
5 – 790 Redwood Square
Oakville, ON L6L 6N3
905-825-5500

R & W Inspection Report

NOVA SCOTIA POWER INC.
42338 CABOT TRAIL
WRECK COVE, NS B0C 1H0

FolderID: #1499- MAY 16-19, 2018
FormID: 3422959

Material Lifting Equipment

Completed by: Mark Jones on 5/18/2018

Location:	Wreck Cove O.R. Service Crane
Crane Serial Number:	113B1115
Equipment Number:	113B1115
Status:	Active

Description: Turbine Hall Crane

Equipment Type:	Overhead Crane
Manufacturer:	Richards-Wilcox
Model Number:	11-330

Priorities Found: **6 - High** **8 - Medium** **2 - Low** **60 - Good**

Bridge General

1.	Rated Load Marking	**Pass**	P1
2.	Warning Device	**Pass**	
3.	Footwalks	**Pass**	P4
	Open hole over cab. No hatch. Drop in hatch recommended.		
4.	Ladders and Stairs	**Pass**	
5.	Cab	**Fail**	P6
	Hydraulic brake reservoir empty. Origin of leak if any unknown. Cab joystick controllers in good overall condition and function normally at this time.		
6.	Running Test	**Pass**	
	Operators report slow speed a little quick for heavier load operations. A VFD upgrade may be considered.		
7.	Structure / Welds	**Fail**	P8
	Visual inspection only. Loose connection bolts observed. No access at this time. Recommend full evaluation. One bolt missing.		
8.	General Condition	**Pass**	
	Surface corrosion developing on all exposed surfaces.		
9.	Lubrication	**Pass**	
10.	Contactors	**Pass**	
	Minimal contact tip wear.		
11.	Resistors	**Pass**	
	Older type wiring. Still functional.		
12.	Pendant	**Pass**	P14
	Cattron radio control		
13.	Mainline Contactor	**Pass**	

Bridges/End Trucks

14.	Gears	**Pass**	
15.	Rails/Clamps	**Pass**	
16.	Attachments	**Pass**	
17.	Structure	**Pass**	
	Visual inspection only.		

18.	Brakes	**Pass**	
	Set on wide side but crane stopping performance is adequate.		
19.	Drive Shaft	**Pass**	
20.	Sprockets	**Pass**	
21.	Guards/Covers	**Pass**	
22.	Motors	**Pass**	
	Can not inspect slip rings. Cover screws rusted in place. Functional at this time.		
23.	Bridge Bumpers	**Pass**	
24.	Rail Sweeps	**Pass**	
25.	Collectors	**Pass**	P30
	Hoist trolley collectors. 33 runs of Insul-8 bar (200 amp 11008). Corrosion throughout. Insulation damage and breakdown throughout. Melted collectors. Shoes worn at varying degrees. 17 M-839 30 amp assemblies (13133)and 16 larger 100A assemblies(13631). Replacement recommended. 13 suspension points. One suspension bracket assembly bent. Broken splice covers in areas. Rework recommended. Collector post supports bent visibly. Nearby junction box heavily corroded and breaking free of mounts (8x10x4). Runway down shop collectors buckled and bent in areas, apparently from expansion contraction. No expansion gaps installed. 150 foot system. 200 amp lat mount Insul-8 collectors.		
26.	Stops	**Pass**	
27.	Girders	**Pass**	
28.	Gear Case	**Pass**	P34
29.	Line Shaft	**Pass**	
30.	Bearings / Babbitts	**Pass**	
31.	Couplings	**Pass**	
32.	Wheels / Bearings	**Pass**	
	Minimal tread wear. No flange wear observed		
33.	Covers	**Pass**	
34.	Limit Switches	**Pass**	
Runways & Supporting Structure			
35.	Runway / Support	**Pass**	
	Inspected visually in vicinity of crane only at this time.		
36.	Runway Stops	**Pass**	
37.	Rail Clamps	**Pass**	
38.	Rail Splicing	**Pass**	
39.	Rail Spacing	**Pass**	
Main Hoist			
40.	Hoist Contactor	**Pass**	P63
	Wound rotor resistor wiring in one area has damaged insulation from contact with hot resistors. Older braided wiring in use. Replacement should be considered. 12 runs high temp. x12'. Support wires away from resistors. Only minimal contact tip wear observed on contactors at this point. Topped up dash pots as required.		
41.	Hoist Brake	**Pass**	P64
	Minimal brake pad wear observed at this time. Ok at present.		
42.	Hoist Motor	**Pass**	
43.	Load Chain/Wire Rope	**Pass**	
	Inspected on the drum only at this time. No deficiencies observed. A lot of buildup on wire rope. Customer indicates wire ropes may be original. Check replacement criteria and confirm with customer.		
44.	Lower Hook	**Pass**	P68
	Some impact marking on main pin. Ok at present. Articulation of hook normal at this time.		
45.	Lubrication	**Pass**	
46.	Line Shaft	**Pass**	
47.	Bearings / Babbitts	**Pass**	
48.	Couplings	**Pass**	

49.	Rope Drums	**Pass**	P74
	Minimal wear observed. Ok at present		
50.	Limit Switches	**Fail**	
	Not set properly. Block actuates safety gravity upper limit. Proper adjustment required. Lower limit can not be checked at this time as hook travels below floor elevation. Eddy current brake unit functional at present. Unit dirty. Internal component condition unknown without disassembly.		
51.	Covers	**Fail**	
52.	Gear Case	**Pass**	P77
	No inspection port available. Fluid has some discolouration at this time.		
53.	Upper Sheaves	**Pass**	
54.	Lower Sheaves	**Pass**	
Auxiliary Hoist			
55.	Hoist Contactor	**Pass**	
	Resistor bank wiring older type braided high temp. Functional at present. Slight to moderate tip wear observed on contactors . Ok at present.		
56.	Hoist Brake	**Fail**	P82
	Irregular, uneven shoe wear. Inside shoe worn more heavily. Brake hub key loose. Condition of bushing and interference fit unknown without disassembly. Rework required.		
57.	Hoist Motor	**Pass**	P83
	Rotor slip rings are not aligned with brush holders resulting in irregular brush wear. Repair recommended to prevent premature wear on brush assemblies. New brushes required prior to shifting holders due to ridges in brushes.		
58.	Load Chain/Wire Rope	**Pass**	
	Inspected on the drum at this time. No deficiencies observed. A lot of buildup on wire rope. Customer indicates wire rope may be original. Check recommended replacement criteria and confirm with customer.		
59.	Lower Hook	**Pass**	
	Some sheave spacer wear observed. Ok at present.		
60.	Lubrication	**Pass**	
61.	Line Shaft	**Pass**	
62.	Bearings / Babbitts	**Pass**	
63.	Couplings	**Pass**	
64.	Rope Drums	**Pass**	P92
	A felt ring has been added to stem grease leakage. Pillow block seal poor. Replacement should be considered.		
65.	Covers	**Pass**	
66.	Gear Case	**Pass**	P95
	No proper seal on lid. Oil leaking. Heavier wear developing on 2nd, 3rd motion and bull gears. Micro pitting, rippling and some spalling is visible. Repair should be scheduled.		
67.	Upper Sheaves	**Pass**	
68.	Lower Sheaves	**Pass**	
	Slight wear apparent on spacers. Ok at present		
69.	Limit Switches	**Fail**	
	Not set properly. Block actuates safety upper. Proper adjustment of rotary limits required. Lower limit can not be checked at this time as hook travels below floor elevation. Eddy current brake functional at present. Unit dirty but internal component condition unknown without disassembly.		
Trolley			
70.	Trolley Contactor	**Pass**	
	Minor contact tip wear observed at this time		
71.	Trolley Motor	**Pass**	
	Minor brush wear observed. Slip rings starting to show wear. Ok at present. Play developing in coupling assembly. Strip and evaluation recommended.		
72.	Trolley Brake	**Pass**	
	Minimal wear observed to brake pads. Ok at present.		

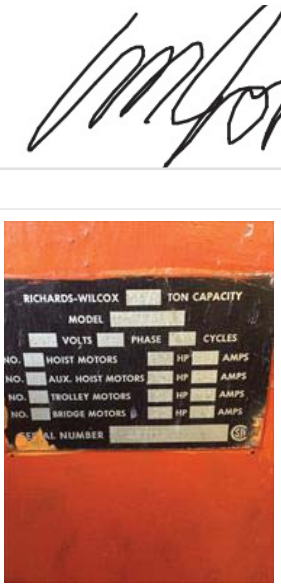
73.	Trolley Wheels	**Pass**	
	Minimal tread wear. No appreciable flange or spacer wear observed st this time.		
74.	Gearcase	**Pass**	P103
	Fluid dirty. Flush and fill recommended. Internal components have no appreciable wear at this time.		

MPI / Visual Inspection

75.	Capacity	**Pass**	
76.	Welds	**Pass**	
	Visual inspection only		

Verification

77.	Inspector Signature	**Mark Jones**



P1.1

P1.2


P4.3

P6.4


P6.5


P8.6


P8.7


P8.8


P14.9


P14.10

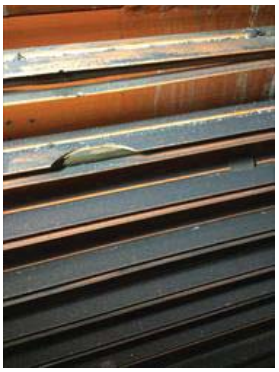

P30.11


P30.12


P30.13


P30.14


P30.15


P30.16


P30.17


P30.18


P30.19


P30.20


P30.21

P30.22


P30.23


P30.24


P30.25


P30.26


P30.27


P30.28


P34.29


P63.30


P63.31


P63.32


P64.33


P68.34


P68.35


P74.36


P77.37


P82.38


P82.39


P82.40


P82.41


P83.42

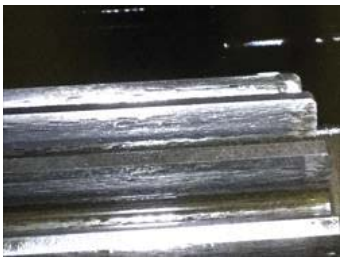

P83.43


P83.44


P83.45


P92.46


P95.47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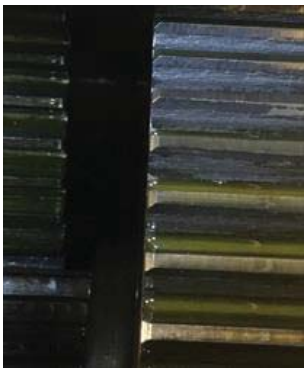
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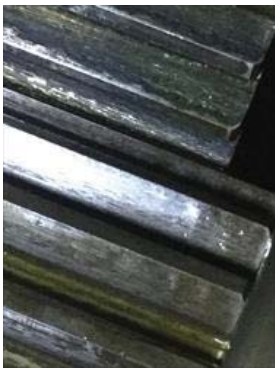
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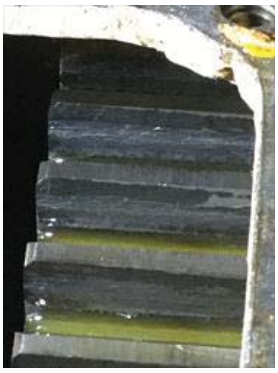
P95.51


P103.52


P103.53

Quote №180674DW **May 29, 2018**

Nova Scotia Power
16 River Rd, Milton
N.S. BOT 1P0

Attn: Martina Huntley

Re: Main generating bay Conductor Bar installation

Supply the following:

250 Amp conductor bar system (replacement parts readily available)
4 Bar system (three phase with Ground bar)
To suit you exiting complete runway.
Includes replacing all tandem collectors to match new conductor bar.

Price: [redacted] taxes extra
Delivery: 1-2 weeks
Freight to your site: [redacted]

Removal of old system, and Installation of new system, and travel expenses: [redacted]

Price based on regular working hours
Note: Price in effect for 30 days from date of quotation

Terms: 50% with order, balance net 30 days

if you require any further information please call me.
Regards
Dave White, President
C: 905-484-0490

R&W CRANE & HOIST LTD.
5 – 790 Redwood Square, Oakville, Ontario L6L 6N3
TEL. 905 825 5500 T.F. 800 461 8499 FAX. 905 825 5315 RWHOIST.COM
OAKVILLE • **SARNIA** • **LONDON** • **CONCORD**

Quote #181034DW August 30, 2018

Nova Scotia Power 0001237-00001
Po Box 910
Halifax NS B3J 2W5
Canada

Attn: Martin Huntley

Supply the following:

165/25 Ton Richard Wilcox Power house crane.
Supply new Auxiliary hoist gear box Reducer complete
Model #14020

Work Site: Nova Scotia Power, Wreck Cove, RR#1, Englishtown, 42338 Cabot Trail, Wreck Cove, NS
Site Contact: Martin Huntley (902-354-7141 ext. 2405)

Quote is for Material, crating & shipping

Lot Price-[redacted]taxes extra

Terms: 50% with order, balance net 30 days

Dave White

R&W Crane & Hoist LTD.

Quote #180847DW July 3, 2018

Nova Scotia Power 0001237-00001
Po Box 910
Halifax NS B3J 2W5
Canada

Attn: Martin Huntley

Supply labour & Material to carry out the following:

165/25 Ton Richard Wilcox Power house crane.

Supply & Install new electromotive Bridge VFD (variable frequency drive)
Remove old bridge motor and install new 20 H.P. Bridge motor for VFD.
Install new bridge drive motor coupling.
Install new bridge drive VFD panel on bridge catwalk.
Disable old wound rotor controls on bridge.
Set new VFD acceleration & deceleration rates as per customers preference.

Work Site: Nova Scotia Power, Wreck Cove, RR#1, Englishtown, 42338 Cabot Trail, Wreck Cove, NS
Site Contact: Martin Huntley (902-354-7141 ext. 2405)

Customer to provide manlift and any site specific safety training required.

Quote is for Material, labour & Travel expenses.

Lot Price [redacted]

Terms: 50% with order, balance net 30 days

Dave White
President
R&W Crane & Hoist LTD.

Quote #180681DW March 30, 2018

Nova Scotia Power 0001237-00001
Po Box 910
Halifax NS B3J 2W5
Canada

Attn: Martin Huntley

Supply labour & Material to carry out the following:

165/25 Ton Richard Wilcox Power house crane.

Removal of all existing cross bridge conductor bar.
Removal of all cross bridge collectors.
Repair bent cross bridge collector arm.
Supply and install new cross bridge conductors with
200 Amp Conductix conductor bar.
Install new cross bridge collectors and collector brackets.

Work Site: Nova Scotia Power, Wreck Cove, RR#1, Englishtown, 42338 Cabot Trail, Wreck Cove, NS
Site Contact: Martin Huntley (902-354-7141 ext. 2405)

Customer to provide manlift and any site specific safety training required.

Quote is for Material, labour & Travel expenses.

Lot Price- [redacted]

Terms: 50% with order, balance net 30 days

Dave White
President
R&W Crane & Hoist LTD.

FP Number: C0003998

Title: HYD Wreck Cove Station Service Cable Replacement

Start Date: 2018/02
In-Service Date: 2019/11
Final Cost Date: 2020/05
Function: Hydro
Forecast Amount: $429,384

DESCRIPTION:

This project is for the replacement of 900 metres of primary station service cable from the Wreck Cove substation to the power house, as well as power trench cover plates. These high voltage cables are original to the station and provide service to the underground powerhouse.

NS Power has operated the 200 MW hydroelectric station at Wreck Cove since 1978.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Hydro projects includes "work completed on the same generating unit and dam structures, but not necessarily the same asset."

- No other projects in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Hydro, Wind & Biomass

Why do this project?

The station service cables experienced a ground fault in September of 2017. A temporary splice was installed at the time and now requires replacement. These 40 year old cables are original to plant construction and have reached the end of their expected life. The station service cables must be replaced to maintain the long term reliability of the Wreck Cove facility.

The station service power cables supply 3-phase power from the switch yard on the surface down to the underground powerhouse approximately 900 meters away. The station service cables supply power to the powerhouse's lighting and the auxiliary plant systems such as the sump pumps, spherical valves and stator cooling water pumps.

Why do this project now?

This project needs to be completed now to mitigate the risk of primary station service loss to the Wreck Cove Powerhouse. The primary station service cables experienced a fault with the cable insulation and the temporary splice is in place to allow for a planned replacement.

Why do this project this way?

All cables require end termination with no splices permitted. There is no way to repair the insulation on the power cables; replacement is the only option to restore the insulation capacity. Existing cables will remain in service until the new cables have been installed and connected.

CI Number : C0003998 - HYD Wreck Cove Station Service Cable Replacement **Project Number** C0003998

Parent CI Number : -

Asset Location : 1361 - 1361 Wreck Cove Common Property **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	2300 - HGP - Power Equip.-Station S	379,780
Retirements	2300 - HGP - Power Equip.-Station S	49,605
	Total Cost:	429,384
	Original Cost:	105,384

Capital Project Detailed Estimate

Location: Hydro
CI# : C0003998
Title: HYD Wreck Cove Station Service Cable Replacement
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	55	$ 358	$ 19,705		
Engineering	PD	35	$ 405	$ 14,186		
Maintenance Trades	PD	16	$ 365	$ 5,884		
Hydro River Staff	PD	20	$ 365	$ 7,296		
			Sub-Total	$ 47,071		
Materials						
Cabling	Meter	[redacted]			Attachment 1	
Trench Covers	Meter	72	$ 900	$ 65,000		
Misc consumables and supplies	lot	1	$ 10,000	$ 10,000		
			Sub-Total	[redacted]		
Contracts						
Replacement of Service Cable	lot	1	[redacted]		Attachment 2	
			Sub-Total	[redacted]		
Other Goods & Services						
Contingency	%	15%	$ 293,409	$ 44,011		
				$ -		
			Sub-Total	$ 44,011		
Interest Capitalized						
AFUDC				$ 9,053		
			Sub-Total	$ 9,053		
Administrative Overhead						
Labour AO				$ 18,853		
Contracts AO				$ 16,987		
			Sub-Total	$ 35,841		
			SUB-TOTAL (no AO, AFUDC)	$ 384,491		
			TOTAL (AO, AFUDC included)	429,384		
Original Cost				$ 105,384		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

ANIXTER

QUOTATION

See attached Anixter Terms and Conditions of Sale

Date: 02/21/2018
Quote #: 00318
Customer #: 012310

CHARLES CHAMBERS
NOVA SCOTIA POWER

Anixter Canada Inc.
86 Troop Avenue, Unit H
Dartmouth, Nova Scotia
B3B 1Z1

Phone:
Fax:

Item	Quantity	Anixter Catalog Number and Description	Unit	Unit Price	Extended Price
01	2700	N/S GENERAL CA 3/0 FC 1/C 3/0AWG (18W MIN) CPT FILL CU 0.280: TRXLPE, 100% INSUL. 90C INS DIAM. MIN 0.975" MAX 1.070" 25X12 AWG CU CN 0.050" LLDPE JKT. LTGG (-40)	KM	[redacted]	[redacted]

Page Total: CAD [redacted]
Quote Total: CAD [redacted]

TERMS NET30THPROX, subject to credit approval
F.O.B. SHIP.PT., PREPAID
SHIPMENT:
NOTES:

Please refer all inquiries to:
NATASHA OICKLE

ANIXTER CANADA INC.
86 TROOP AVE.

DARTMOUTH, N.S. B3B 1Z1

Phone: 902-481-3611
Fax: 902-468-8422

COMMENTS:

ANIXTER TERMS AND CONDITIONS OF SALE

1. This proposal will become a contract upon receipt by Seller of Buyer's acceptance. Acceptance must be in writing and received by Seller within seven (7) days of the proposal date unless otherwise stated. Shipment by Seller and acceptance by Buyer of all or any part of the products covered by this proposal shall constitute acceptance by Buyer of this proposal. Prior to acceptance by Buyer, Seller may withdraw or modify this proposal. The agreement between Seller and Buyer (the “contract") with respect to the products (the "products") and/or services (the "services") described in this proposal shall consist of the terms contained herein together with any additions or revisions of such terms mutually agreed to in writing by Seller and Buyer. Seller objects to and shall not be bound by any additional or different terms,
whether printed or otherwise, in any purchase order or other communication from Buyer to Seller unless specifically agreed to by Seller in writing. Prior courses of dealing, and verbal agreements not reduced to a writing signed by Seller, to the extent they modify, add to or detract from the contract, shall not be binding on Seller. Failure by Seller to exercise any right or remedy under the contract will not be deemed a waiver of such right or remedy unless in a writing signed by Seller, nor shall any waiver be implied from the acceptance of any payment. No waiver by Seller of any right shall extend to or affect any other right, nor shall a waiver by Seller of any breach extend to any
subsequent similar or dissimilar breach. The contract shall be for the benefit of Seller and Buyer and not for the benefit of any other person.
Buyer may not assign this contract without the express written approval of Seller. Any provision of this contract that is prohibited or unenforceable in any jurisdiction shall, as to such jurisdiction, be limited or eliminated to the minimum extent required by that jurisdiction,
and the remaining provisions of the contract will remain in full force and effect.

2. This contract may not be modified or rescinded except by a writing signed by Seller and Buyer. If all or part of the contract is terminated by
such modification or rescission, Buyer, in the absence of a contrary written agreement between Seller and Buyer, shall pay termination charges based upon cost determined by accepted accounting principles, plus a reasonable profit on the entire order. Cost shall include any amount Seller must pay to its suppliers due to any termination by Seller of a purchase order for products or services intended for Buyer.

3. Buyer shall pay the purchase price for the products within thirty (30) days from the date of invoice, and for the services within thirty (30)
days from the date the services are rendered. Cash discounts do not apply to cases, reels, spools or transportation charges. The purchase price for the products is F.O.B. first point of shipment unless otherwise agreed to in writing. Seller reserves the right to modify or
withdraw credit terms at any time without notice and to require guarantees, security or payment in advance of the amount of sale. Seller may setoff any amount due from Buyer to Seller, whether or not under this contract, from any amounts due to Buyer under this contract. Title to and risk of loss of the products pass to Buyer upon delivery to the carrier at Seller’s facility. Title to any software purchased shall
remain with the licensor and Buyer shall be granted a license for the software according to the license agreement for such software. Buyer agrees to be bound by any license terms pertaining to software sold hereunder. In the event Buyer fails to pay the total purchase price within said thirty (30) day period, the maximum allowable service charge allowed by applicable laws shall be applied to all past due accounts commencing from the due date of the invoice until paid. Seller shall also be entitled, in addition to all other remedies available at
law or in equity, to recover reasonable attorneys’ fees and/or other expenses in collecting the purchase price or otherwise enforcing or successfully defending itself in respect of this contract.

4. Any tax or other governmental charge upon the provision of services, or the production, sale, shipment, transfer, consumption, or use of the
products which Seller is required to pay or collect from Buyer shall be paid by Buyer to Seller, unless Buyer furnishes Seller with exemption
certificates acceptable to taxing authorities. Such amount shall be due whether or not included on the invoice.

5. Shipping date or other applicable performance date is estimated on the basis of immediate receipt by Seller of Buyer's order and all information, drawings and approvals to be furnished by Buyer, and the absence of delays, direct or indirect, resulting from or contributed to
by circumstances beyond Seller's reasonable control. Seller will in good faith endeavor to ship products or perform services by the estimated date. Seller shall have the right to make partial shipments. All changes in specifications or estimated shipping or performance date will be by mutual written agreement of Seller and Buyer and where such changes affect Seller's time or cost of performance, an equitable adjustment in estimated shipping/performance date or purchase price, or both, will be made. Prior to shipping, Seller, if requested, will afford Buyer a reasonable opportunity to inspect the products in Seller's plant. If no packaging, loading or bracing requirements are stated, Seller will comply with minimum specifications for the method of transportation specified. If no method of transportation is specified, shipment will be by a reasonable method of transportation.

6. Buyer shall submit all claims for shortages in writing to Seller within thirty (30) days from the date that Buyer receives the products;

otherwise such claims shall be waived. Quantities are subject to normal manufacturer allowances. In the case of wire and cable such allowances are plus 10% and minus 5%. The purchase price for products will equal the unit price specified in this proposal multiplied by the quantity shipped. Installation and final inspection of products prior to installation will be Buyer's obligation.

7. Seller passes on and assigns to Buyer the warranties made to Seller by its suppliers, which at a minimum, include a warranty that the products at the time of shipment to Buyer will be free from defects in materials and workmanship, and will be materially in accordance with specifications provided by the manufacturer. Seller's warranty in its entirety shall be deemed limited to and shall not extend beyond such manufacturers' warranties. The length of the warranty period will be the length established by the manufacturer of the product and if no length is specified by the manufacturer, shall in no event extend beyond one (1) year from the date of shipment. Buyer shall proceed exclusively and directly against such supplier at Seller's request. This warranty does not cover wear and tear and shall be ineffective and shall not apply to products that have been subjected to misuse or abuse, neglect, accident, damage, improper installation, or maintenance. Buyer will inspect the products upon delivery and will promptly notify Seller in writing of any defect in the products. Seller's sole obligation under these warranties will be limited to either, at Seller's option and expense, repairing or furnishing a replacement for the products or parts thereof which Seller reasonably determines do not conform with these warranties, and Buyer's exclusive remedy for breach of any such warranties will be enforcement of such obligation of Seller. All transportation costs of and in-transit risk of loss and damage to products or parts thereof returned for warranty repair, and to such repaired or replacement products or parts thereof returned to Buyer, will be borne by Buyer. No agent, employee or representative of Seller has any authority to bind Seller to any representation, affirmation or warranty concerning the products and any such representation, affirmation or warranty shall not be deemed to have become part of the basis of this contract and shall be unenforceable. Seller will perform the services in accordance with Seller's customary procedures. Seller makes no warranty that software will operate uninterrupted or error free. THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF, AND BUYER WAIVES ALL OTHER WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND OF ANY OTHER TYPE, WHETHER EXPRESS OR IMPLIED, ARISING BY LAW (STATUTORY OR OTHERWISE) AND WHETHER OR NOT OCCASIONED BY SELLER'S NEGLIGENCE.

8. IN NO EVENT SHALL SELLER OR ITS SUPPLIERS BE LIABLE FOR SPECIAL, INCIDENTAL, INDIRECT, PUNITIVE, OR CONSEQUENTIAL DAMAGES, HOWEVER ARISING, INCLUDING SUCH DAMAGES OCCASIONED BY SELLER'S NEGLIGENCE, nor shall Seller's liability on any claims for damages arising out of or connected with the contract or the manufacture, sale, delivery or use of the products exceed the purchase price of the products and/or services giving rise to the claim. Seller shall not be liable for any failure to perform its obligations under the contract resulting directly or indirectly from or contributed to acts of God, acts of Buyer, civil or military authority, fires, strikes or other labor disputes, accidents, floods, war, riot, inability to secure material or transportation facilities, acts or omissions of carriers, or any other circumstances beyond Seller's reasonable control. Seller shall have no liability under this contract than otherwise expressly provided in this contract.

9. Seller will hold Buyer harmless against any rightful claim of any third person by way of infringement of any United States Letters Patent by products which are of Seller's own manufacture, but if Buyer furnishes specifications to Seller, Buyer will hold Seller harmless against any such claim which arises out of compliance with the specifications; provided that the party seeking to be held harmless notifies the other party and gives it the right to defend. Seller makes no warranty that the products will be delivered free of the rightful claim of any third party by way of infringement of any intellectual property rights or the like. Seller's obligation under this paragraph shall not apply to any infringement consisting of the use of products as part of goods manufactured by Buyer or others.

10. Buyer understands that products supplied by Seller may be subject to the jurisdiction of U.S. export controls and trade sanctions, and Buyer represents and warrants that it will not violate U.S. export-related laws with respect to products supplied by Seller.

11. Buyer will not disclose or make available to any third party Seller's data or other proprietary information without Seller's prior written authorization.

12. This proposal and contract shall be governed by the Uniform Commercial Code ("UCC") as adopted in the State of Seller's principal place of business as effective and in force on the contract date. Wherever a term defined by said UCC is used in these terms and conditions, the definition contained in the UCC is to control. Any action for breach of the contract or any covenant or warranty must be commenced within one (1) year after the cause of action accrues.

Ideal Electric Ltd.
Electrical Contractor
Commercial - Industrial

80 Marine Drive
P. ***O. Box 61***
Sydney, N. S. B1P 6G9

Telephone (902)562-6082
Facsimilie (902)562-2040
idealelectric@ns.sympatico.ca

March 12 2018

Replacement of Service Cable at Wreck Cove Generating Station
Request for Proposal P-18-022

Attention Linda Gates

To complete the work as per tender documents and site visit

PRICE QUOTED - [redacted] HST EXTRA

Includes addendums 1-5

Yours truly,

Doug Wrathall

Ideal Electric Ltd.
Electrical Contractor
Commercial - Industrial

80 Marine Drive Sydport
P. ***O. Box 61***
Sydney, N. S. B1P 6G9

Telephone (902)562-6082
Facsimilie (902)562-2040
idealelectric@ns.sympatico.ca
Cell (902)565-8977

Mar 12 2018

Ideal Electric was formed in 1984
Company owners Doug Wrathall, Reg Desveaux
Member of NSCSA

Projects completed

Open Hearth Park Sydney
Point Aconi Cooling Tunnel(sub contractor to Foundation Harry V) Lighting, TBM connection,elevator power,communications.
Sydney Airport Airfield Lighting
Traffic Lighting systems- North Sydney,Glace Bay, King's Road Sydney, Spar Road
Waste Water Treatment Plant Dominion
Liquid Air Plant Sydney
Heating System Seaboard Power Plant
Tesma Plc Projects North Sydney
Street Lighting Projects Glace Bay, Louisbourg, Cheticamp, Sydney, 125 highway Sydney River

HST# 10244 7612

Any questions you may have about us please feel free to call.

Yours truly,

Doug Wrathall

Attached are Worker's Comp reports, safety plan outline, including company safety policy, a pre-job hazard assessment, blank daily hazard assessment, and subcontractor checklist.

It is understood that Ideal will comply with all NSPI safety programs and practices.

Ideal has not been convicted of any regulatory offences.
Ideal has not recieved any regulatory directives/ orders.

Workers' Compensation Board of Nova Scotia
Experience Rating Statement for 2018

P.O. Box 1150
Halifax, Nova Scotia
B3J 2Y2

Telephone: (902) 491-8324
Toll Free: (877) 211-9267
Fax: (902) 491-8326
Website: www.wcb.ns.ca

IDEAL ELECTRIC LIMITED
PO BOX 61
SYDNEY NS B1P 6G9

Business No:	10244 7612 NW0001
Firm Number:	724840 12
Date:	15/08/2017

Page:	1

Your 2018 assessment rate: [redacted] **per $100 assessable payroll**

SECTION A: Your Rate Components

Basic Industry Rate: [redacted]

Experience Rating Merit/Demerit: [redacted] see details in Section D below

Rate Surcharge: N/A

Levy - NS Construction Safety Assoc: [redacted]

TOTAL RATE for 2018 [redacted] per $100 assessable payroll

Note: Your company's workplace injuries and the associated costs determine your Experience Rating Adjustment. You can control your rate by eliminating workplace injuries and helping injured workers return to work in a safe and timely manner. **Your 2018 rate could have been as low as:** [redacted] **or as high as:** [redacted]

SECTION B: SIC and Industry Group

To set rates, we classify employers by the industry in which they operate, and group industries with similar activities and risk into industry groups.

Your Standard Industrial Classification (SIC) Code:
4261 ELECTRICAL WORK

Your Industry Group for 2018
4260 Electrical Services

SECTION C: Cost and Payroll

Assessable Payroll
2016
2015
2014
TOTAL [redacted]

Cost of New Injuries
from 2014 to 2016 : [redacted]

SECTION D: Your Experience Rating Details

Experience Rating for 2018 is calculated using injury and payroll data from the years 2014 to 2016 . The 3-year costs and payroll are determined, and costs are weighted so that the more recent experience has more impact on rates.

The key measure in determining your Experience Rating is the "cost ratio", which is your weighted cost figure divided by your payroll. The lower your cost ratio relative to your rate group, the lower your rate will be.

Your Cost Ratio is: **100.00%** **LOWER** Than Your Rate Group's Cost Ratio

Resulting Merit/Demerit: **10.00%** **MERIT** Produces an Experience Rating Adjustment of [redacted]

Workers' Compensation Board of Nova Scotia
Experience Rating Statement for 2017

P.O. Box 1150
Halifax, Nova Scotia
B3J 2Y2

Telephone: (902) 491-8324
Toll Free: (877) 211-9267
Fax: (902) 491-8326
Website: www.wcb.ns.ca

IDEAL ELECTRIC LIMITED
PO BOX 61
SYDNEY NS B1P 6G9

Business No:	10244 7612 NW0001
Firm Number:	724840 12
Date:	17/08/2016

Page:	1

Your 2017 assessment rate: [redacted] **per $100 assessable payroll**

SECTION A: Your Rate Components

Basic Industry Rate: [redacted]

Experience Rating Merit/Demerit: [redacted] see details in Section D below

Rate Surcharge: N/A

Levy - NS Construction Safety Assoc: [redacted]

TOTAL RATE for 2017 [redacted] per $100 assessable payroll

Note: Your company's workplace injuries and the associated costs determine your Experience Rating Adjustment. You can control your rate by eliminating workplace injuries and helping injured workers return to work in a safe and timely manner. **Your 2017 rate could have been as low as:** [redacted] **or as high as:** [redacted]

SECTION B: SIC and Industry Group

To set rates, we classify employers by the industry in which they operate, and group industries with similar activities and risk into industry groups.

Your Standard Industrial Classification (SIC) Code:
4261 ELECTRICAL WORK

Your Industry Group for 2017
4260 Electrical Services

SECTION C: Cost and Payroll

Assessable Payroll
2015
2014
2013
TOTAL [redacted]

Cost of New Injuries
from 2013 to 2015 : [redacted]

SECTION D: Your Experience Rating Details

Experience Rating for 2017 is calculated using injury and payroll data from the years 2013 to 2015 . The 3-year costs and payroll are determined, and costs are weighted so that the more recent experience has more impact on rates.

The key measure in determining your Experience Rating is the "cost ratio", which is your weighted cost figure divided by your payroll. The lower your cost ratio relative to your rate group, the lower your rate will be.

Your Cost Ratio is: **100.00%** **LOWER** Than Your Rate Group's Cost Ratio

Resulting Merit/Demerit: **11.50%** **MERIT** Produces an Experience Rating Adjustment of [redacted]

Company Health and Safety Policy

Scope
This policy will apply to *Company Name / Organization* and all of its locations.

Policy
Company Name / Organization is committed to providing a safe and healthful work environment for its employees and is dedicated to the objective of eliminating the possibility of injury and illness. To express that commitment, we issue the following policy.

As (*President, Owner, Operator, CEO, Etc.*), I give you my personal promise to take all reasonable precautions to prevent harm to workers.

Company Name / Organization through all levels of management, will co-operate with the Joint Occupational Health and Safety Committee (JOHS), or the representative and employees to create a safe and healthful work environment. The same co-operation will be extended to others such as contractors, owners, officers, etc.

Managers and supervisors will be trained and held responsible for ensuring that the employees, under their supervision, follow this policy, use safe work practices and receive training to protect their health and safety. Managers and supervisors also have a general responsibility for ensuring the safety of equipment and facility.

The employees of *Company Name / Organization* will be required to support this organizations health and safety initiative and to co-operate with the Occupational Health and Safety Committee representative and with others exercising authority under the applicable laws. Management commits to working in a spirit of consultation and co-operation with the employees in achieving the company's health and safety initiatives.

It is the responsibility of all personnel employed by this company to report to their supervisor, manager, safety representative or member of the JOHS committee as soon as possible, any hazardous conditions, injury, accident, or illness related to the workplace. Also, employees must protect their health and safety by complying with applicable Acts and Regulations and to follow policies, procedures, rules and instructions as prescribed by *Company Name / Organization.*

Company Name / Organization will, where possible, eliminate hazards and, thus, the need for personal protective equipment. If that is not possible, and where there is a requirement, employees will be required to use safety equipment, clothing, devices and materials for personal protection.

Company Name / Organization recognizes the employees' duty to identify hazards and supports and encourages employees to play an active role in identifying hazards and to offer suggestions or ideas to improve the health and safety program.

Signed: _____ Date: 9 March 15

IDEAL ELECTRIC LTD.

COMPANY RULES

All accidents, injuries or near misses shall be reported to your supervisor

All unsafe conditions and practices shall be reported to your immediate supervisor

All work shall be carried out in accordance with Regulations, supervisor's direction and the appropriate safe work practices and job procedures

All employees will keep their individual work areas neat,clean and orderly

All employees will wear the appropriate PPE prescribed by the regulations and the supervisor

All electrical hand tools shall be grounded or double insulated

All hand tools shall only be used for the purpose for which they were intended

All damaged or worn parts of equipment or tools shall be promptly reported for repair or replacement

All mobile equipment shall be operated in accordance with DMV requirements and in accordance with manufacturer specs

All employees are asked to actively participate in the system requirements set out in the NSCSA Certificate of Recognition program

All employees using medication prescribed by a physician, shall inform the immediate supervisor of any side effects

All employees shall refer to the material safety data sheets when working with an unfamiliar controlled product

Possession or consumption of intoxicating beverages while on the job is strictly prohibited and constitutes grounds for dismissal

Fighting .horseplay ,stealing, and possession of firearms are strictly prohibited on the job and constitute grounds for dismissal

Signed this 9 day of March 2015

Reg Desveaux

Doug Wrathall

Supervision

Ideal Electric Ltd will have supervision on site- Doug Wrathall, Reg Desveaux or Don Macneil.

Duties will include

Monitor site safety including sub contractors
weekly toolbox talks
daily jobsite inspections
daily hazard assessments
new hire orientations

IDEAL ELECTRIC LIMITED
EMERGENCY RESPONSE PLAN/PROCEDURES

STEPS TO FOLLOW:

1. Secure the area. Keep non-emergency personnel away from area and danger.

2. Assess the area before entering. Approach with caution, do not rush, keep upwind if vapour is present.

3. Identify products: refer to MSDS Manual if dangerous products are present.

4. Assess the situation:
   - Is there a fire
   - Is there a spill or leak
   - Type of terrain
   - What or who is at risk
   - What should be done
   - What can be done right away

5. Respond:
   - Appropriate manuals
   - Set up command post
   - Lines of communication
   - Rescue operation, if necessary
   - Control the site
   - Reassess the situation
   - Protect safety of others and yourself.

Safety Training

All employees will be trained in

First Aid/CPR
WHIMIS
Follow PPE requirements

site safety orientations will be held in co-ordination with NSPI

Subcontractor Checklist jobsite:

subcontractor

NSCSA certification		
WCB letter		
Safety Plan		
Hazard Assessment		
Employee training		
Meeting with safety rep		
Site orientation		
MSDS sheets		

Ideal Electric
Hazard Assessment

Job site_____ **Date**_____

Risk level High Workers_____ _____
Medium _____ _____
Low _____ _____

Ideal Electric
Primary Hazards

Fall Protection	Confined Space	Electrical Isolation
scaffolding used platform lifts training & equipment	hazard assessment confined space certified contractor on site	Live Power ? Lockout/tag out req'd?

Other Hazards

signage & barriers	set at correct angle secured at top and bottom	CSA rated ? firm & level base correct size	inspected and tagged
GFI receptacles ext cords in good shape	in good condition	adequate lighting dry conditions? no excessive heat/cold	msds sheets PPE
qualified rigger certified boom truck	daily inspection operating ticket	slip hazards debris	fire extinguisher muster point locate
check in plan procedures reviewed			

Ideal Electric
Pre-job Hazard Assessment
Wreck Cove

To be addressed before work begins

Site orientations with NSPI
All vehicles and generators in the tunnel to be diesel powered
CO masks to be carried in case of CO alarm
Tag out/Lock out procedure to be reviewed with NSPI
Support for step ladders to be built to level out the tunnel slope

Environment Plan

All materials removed from the site will be taken to the proper disposal locations- ie recycling for cardboards, paper, plastics, compost facility, materials taken to dump site will be separated- into proper categories. A written record of all materials will be kept and turned over to NSPI.

Also a procedure for containing any possible leakage of fluids from equipment will be submitted to NSPI for approval .

It is understood that Ideal will comply with NSPI's environmental requirements

Ideal has never been convicted of any environmental regulatory offence
Ideal has never received any environmental regulatory orders.

Nova Scotia POWER
An Emera Company

ATTACHMENT "G"

QUANTITIES AND PRICES

Description	Lump Sum Price ($)
Wreck Cove Cable Installation	[redacted]

CI Number: C0011076

Title: POT Boiler Refurbishment 2019

Start Date: 2019/04
In-Service Date: 2019/05
Final Cost Date: 2019/11
Function: Steam
Forecast Amount: $1,388,434

DESCRIPTION:

The scope of work for this project is to refurbish and replace tubes, tube bends and shields on the Point Tupper boiler as part of a planned outage in 2019. The scope of this project is determined as part of the annual boiler condition data collection and analysis. This effort includes evaluation and prioritization of activities to be undertaken during the annual outage. Protective erosion shields identified as missing or degraded will be replaced with new shields. Tubes and bends will be replaced in the areas where the wall thickness readings are below American Society of Mechanical Engineers (ASME) specifications and Nova Scotia Labour and Advanced Education (NSLAE) regulations. Adherence to this tolerance maximizes the tube life while maintaining boiler reliability.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 CI 49419 POT Boiler Refurbishment 2017 $969,292
- 2018 CI 51825 POT Boiler Refurbishment 2018 $568,740
- 2020 CI TBD POT Boiler Refurbishment 2020 $TBD
- 2021 CI TBD POT Boiler Refurbishment 2021 $TBD

Depreciation Class: Steam Production Plant – Point Tupper Unit 2

Estimated Life of the Asset: 25 years

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement / Refurbishment

Why do this project?

This project is being undertaken to prevent boiler failure and preserve the unit's availability. Ongoing asset management activities have identified the requirement for boiler component replacement to maintain the reliability of the boiler and mitigate the risk of unplanned outages due to tube leaks. Boiler tube failures represent the industry's single largest source of outages for steam-based generation. NS Power has a long history of managing this issue with comprehensive boiler inspection and proportional investment programs to address the various failure mechanisms.

Why do this project now?

The scope of this project is determined as part of the annual boiler condition data collection and analysis. In order to mitigate the risk of unplanned outages indicated by the condition data collection and analysis, annual boiler refurbishment activities are required. Some of the tubes to be inspected and replaced are difficult to access and sufficient time during a planned outage is required to complete refurbishment or replacements. The annual planned outage duration will afford the time necessary to assess, locate and replace tubes and shields.

Why do this project this way?

Replacing deteriorated tubes, tube bends and shields will mitigate the risk of tube leaks and minimize the number of unplanned outages. Based on boiler assessments, these upgrades are necessary to maintain reliable operation of the boiler. Refurbishment of these components is not an option once they are outside acceptable tolerances. For tubes, wall thickness tolerances are established by industry standard (ASME) and governed by legislative requirements.

CI Number : C0011076 - POT Boiler Refurbishment 2019 **Project Number** C0011076

Parent CI Number : -

Asset Location : 1152 - 1152 Point Tupper Unit 2 **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1300 - SGP - Boiler	856,393
Retirements	1300 - SGP - Boiler	532,041
	Total Cost:	1,388,434
	Original Cost:	548,937

Capital Project Detailed Estimate

Location: Point Tupper Generating Station
CI# : C0011076
Title: POT Boiler Refurbishment 2019
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Maintenance Trades	PD	20	$ 365	$ 7,296		
Utility Worker	PD	80	$ 240	$ 19,214		
			Sub-Total	$ 26,510		51825, 49419
OT Labour						
Maintenance Trades	PD	15	$ 730	$ 10,944		
Utility Worker	PD	40	$ 480	$ 19,214		
			Sub-Total	$ 30,158		51825, 49419
Term Labour						
Maintenance Trades	PD	40	$ 365	$ 14,591		
Utility Worker	PD	120	$ 240	$ 28,821		
			Sub-Total	$ 43,413		51825, 49419
Travel Expense						
Travel Expenses	lot	1	$ 500	$ 500		
			Sub-Total	$ 500		
Materials						
Boiler Tubing, Shields, Pins, etc.	lot	1	$ 192,838	$ 192,838		
Consumables and Miscellaneous	lot	1	$ 10,000	$ 10,000		
			Sub-Total	$ 202,838		51825, 49419
Rentals						
Rentals	lot	1	$ 5,000	$ 5,000		
			$ -	$ -		
			Sub-Total	$ 5,000		
Contracts						
Boiler Tube Replacement and Refurbishment	lot	1	$ 840,722	$ 840,722		
				$ -		
				$ -		
			Sub-Total	$ 840,722		51825, 49419
Meals						
Meals and Expenses	lot	1	$ 500	$ 500		
			Sub-Total	$ 500		
Overtime Meals						
OT Meals	lot	1	$ 500	$ 500		
			Sub-Total	$ 500		
Other Goods & Services						
Contingency	%	10%	$ 1,150,141	$ 115,014		
				$ -		
			Sub-Total	$ 115,014		
Administrative Overhead						
Thermal Reg. Labour AO				$ 22,208		
Thermal / Hydro Contracts AO				$ 101,072		
			Sub-Total	$ 123,279		
			SUB-TOTAL (no AO, AFUDC)	$ 1,265,155		
			TOTAL (AO, AFUDC included)	$ 1,388,434		
Original Cost				$ 548,937		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0010318

Title: TRE6 Boiler Refurbishment 2019

Start Date: 2019/07
In-Service Date: 2019/08
Final Cost Date: 2020/02
Function: Steam
Forecast Amount: $1,016,388

DESCRIPTION:

The scope of work for this project is to refurbish and replace deteriorated boiler tubes, tube bends and shields on the Trenton Unit 6 boiler as part of the planned outage in 2019. The scope of this project is determined as part of the annual boiler condition data collection and analysis. This effort includes evaluation and prioritization of activities to be undertaken during the annual outage. Protective erosion shields identified as missing or degraded will be replaced with new shields. Tubes and bends will be replaced in the areas where the thickness readings are below American Society of Mechanical Engineers (ASME) specifications. This tolerance maximizes the economic tube life while maintaining boiler reliability.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 CI 49533 TRE6 Boiler Refurbishment $1,259,454
- 2020 CI TBD TRE6 Boiler Refurbishment 2020 $TBD
- 2021 CI TBD TRE6 Boiler Refurbishment 2021 $TBD

Depreciation Class: Steam Production Plant – Trenton Unit 6

Estimated Life of the Asset: 25 years

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

This project is being undertaken to prevent boiler tube failure in the identified zones and preserve the unit's availability. Ongoing asset management activities have identified the requirement for boiler component replacement to maintain the long term reliability of the boiler and mitigate the risk of unplanned outages due to tube leaks. Boiler tube failures represent the industry's single largest source of outages for steam-based generation. NS Power has a long history of managing this issue with comprehensive boiler inspection and proportional investment programs to match the various failure mechanisms.

Why do this project now?

To mitigate the risk of unplanned outages, regular boiler refurbishment activities are required. Some of the tubes to be inspected and replaced are difficult to access and sufficient time during a planned outage is required to complete refurbishment or replacements. The annual planned outage duration will afford the time necessary to assess, locate and replace the tubes and shields.

Why do this project this way?

Replacing deteriorated boiler tubes, tube bends and shields will mitigate the risk of tube leaks and minimize the number of unplanned outages. Based on boiler assessments, these upgrades are necessary to maintain reliable operation of the boiler. Refurbishment of these components is not an option once they are outside acceptable tolerances because there is industry code and legislative requirements governing allowable tolerances. For tubes, tolerances are established by industry standard (ASME). Shield replacement is determined by inspector assessment of the degree of deterioration.

CI Number : C0010318 - TRE6 Boiler Refurbishment 2019 **Project Number** C0010318

Parent CI Number : -

Asset Location : 1166 - 1166 Trenton Unit 6; Commissioned 1991, 170 Mwh **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1300 - SGP - Boiler	753,465
Retirements	1300 - SGP - Boiler	262,923
	Total Cost:	1,016,388
	Original Cost:	468,309

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI# : C0010318
Title: TRE6 Boiler Refurbishment 2019
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Engineering	PD	10	$ 405	$ 4,053		CI 49533
Maintenance Trades	PD	20	$ 365	$ 7,296		CI 49533
Utility Worker	PD	100	$ 240	$ 24,018		CI 49533
Supervision	PD	80	$ 405	$ 32,425		
			Sub-Total	$ 67,792		
OT Labour						
Utility Worker	PD	20	$ 480	$ 9,607		
				$ -		
			Sub-Total	$ 9,607		
Term Labour						
Utility Worker	PD	160	$ 240	$ 38,429		
				$ -		
			Sub-Total	$ 38,429		
Materials						
Tubes	ft	500	$ 40	$ 20,000		
Bifurcates	ea	30	$ 2,600	$ 78,000		
			Sub-Total	$ 98,000		
Contracts						
Suspended Floor	lot	1	$ 25,000	$ 25,000		CI 49533
Vacuum Services	lot	1	$ 50,000	$ 50,000		CI 49533
Inspection	PD	80	$ 950	$ 76,000		CI 49533
Boilermaker Labour	PD	500	$ 1,000	$ 500,000		CI 49533
			Sub-Total	$ 651,000		
OT Meals						
Meals	lot	1	$ 1,000	$ 1,000		
			Sub-Total	$ 1,000		
Other Goods & Services						
Contingency	%	5%	$ 865,828	$ 43,291		
			Sub-Total	$ 43,291		
Administrative Overhead						
Labour AO	lot	1	$ 31,073	$ 29,006		
Contracts AO	lot	1	$ 81,655	$ 78,263		
			Sub-Total	$ 107,269		
			SUB-TOTAL (no AO, AFUDC)	$ 909,119		
			TOTAL (AO, AFUDC included)	$ 1,016,388		
Original Cost				$ 468,309		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0009099

Title: LIN3 Boiler Refurbishment 2019

Start Date: 2018/05
In-Service Date: 2018/06
Final Cost Date: 2018/12
Function: Steam
Forecast Amount: $788,176

DESCRIPTION:

The scope of work for this project is to refurbish and replace deteriorated boiler tubes, tube bends and shields on the Lingan Unit 3 boiler as part of the planned outage in 2019. The scope of this project is determined as part of the annual boiler condition data collection and analysis. This effort includes evaluation and prioritization of activities to be undertaken during the annual outage. Protective erosion shields identified as missing or degraded will be replaced with new shields. Tubes and bends will be replaced in the areas where the thickness readings are below American Society of Mechanical Engineers (ASME) specifications and with Nova Scotia Labour and Advanced Education (NSLAE) regulations. This tolerance maximizes the economic tube life while maintaining boiler reliability.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2018 - CI 47684 - LIN 3 Boiler Refurbishment 2018 - $739,657
- 2020 - CI TBD - LIN3 Boiler Refurbishment 2020 - $TBD
- 2021 - CI TBD - LIN3 Boiler Refurbishment 2021 - $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement / Refurbishment

Why do this project?

This project is primarily justified on unit reliability. On-going asset management activities have identified the requirement for boiler component replacement to maintain the long term reliability of the boiler and mitigate the risk of unplanned outages due to tube leaks. Boiler tube failures represent the industry's single largest source of outages for steam based generation. NS Power has a long history of managing this risk with comprehensive boiler inspection and investment programs to address the various failure mechanisms.

Why do this project now?

The scope of this project is determined as part of the annual boiler condition data collection and analysis. In order to mitigate the risk of an unplanned outage based on the findings of the condition data, boiler refurbishment activities are required in 2019. Some of the tubes to be inspected and replaced are difficult to access and sufficient time during a planned outage is required to complete refurbishment or replacements. The annual planned outage duration will afford the time necessary to assess, locate and replace tubes and shields.

Why do this project this way?

Replacing deteriorated tubes, tube bends and shields will mitigate the risk of tube leaks and minimize the number of unplanned outages. Based on boiler assessments, these upgrades are necessary to maintain reliable operation of the boiler. Refurbishment of these components is not an option once they are outside acceptable tolerances. For tubes, wall thickness tolerances are established by industry standard (ASME) and governed by legislative requirements.

CI Number : C0009099 - LIN3 Boiler Refurbishment 2019 **Project Number** C0009099

Parent CI Number : -

Asset Location : 1133 - 1133 Lingan Unit 3; Commissioned 1983, 164Mwh **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1300 - SGP - Boiler	612,057
Retirements	1300 - SGP - Boiler	176,119
	Total Cost:	788,176
	Original Cost:	278,790

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# : C0009099
Title: LIN3 Boiler Refurbishment 2019
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Utility Worker	PD	20	$ 240	$ 4,804		
			Sub-Total	$ 4,804		47684
Term Labour						
Utility Worker	PD	60	$ 240	$ 14,411		
			Sub-Total	$ 14,411		
Materials						
Boiler Tubes	lot	1	$ 21,000	$ 21,000		
Boiler Shields	lot	1	$ 20,000	$ 20,000		
Misc Consumables	lot	1	$ 6,000	$ 6,000		
			Sub-Total	$ 47,000		47684
Contracts						
Boiler Maintenance Contractor	$	1	$ 580,000	$ 580,000		
Industrial Cleaning Services	$	1	$ 60,000	$ 60,000		
			Sub-Total	$ 640,000		
Administrative Overhead						
Labour AO				$ 5,020		
Contracts AO				$ 76,941		
			Sub-Total	$ 81,961		
			SUB-TOTAL (no AO, AFUDC)	$ 706,215		
			TOTAL (AO, AFUDC included)	$ 788,176		
Original Cost				$ 278,790		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0009100

Title: LIN4 Boiler Refurbishment 2019

Start Date: 2019/03
In-Service Date: 2019/04
Final Cost Date: 2019/10
Function: Steam
Forecast Amount: $754,772

DESCRIPTION:

The scope of work for this project is to refurbish and replace deteriorated boiler tubes, tube bends and shields on the Lingan Unit 4 boiler as part of the planned outage in 2019. The scope of this project is determined as part of the annual boiler condition data collection and analysis. This effort includes evaluation and prioritization of activities to be undertaken during the annual outage. Protective erosion shields identified as missing or degraded will be replaced with new shields. Tubes and bends will be replaced in the areas where the thickness readings are below American Society of Mechanical Engineers (ASME) specifications and with Nova Scotia Labour and Advanced Education (NSLAE) regulations. This tolerance maximizes the economic tube life while maintaining boiler reliability.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2018 - CI 51805 - LIN4 Boiler Refurbishment 2018 - $739,657
- 2020 - CI TBD - LIN4 Boiler Refurbishment 2020 - $TBD
- 2021 - CI TBD - LIN4 Boiler Refurbishment 2021 - $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement / Refurbishment

Why do this project?

This project is primarily justified on unit reliability. On-going asset management activities have identified the requirement for boiler component replacement to maintain the long term reliability of the boiler and mitigate the risk of unplanned outages due to tube leaks. Boiler tube failures represent the industry's single largest source of outages for steam based generation. NS Power has a long history of managing this risk with comprehensive boiler inspection and investment programs to match the various failure mechanisms.

Why do this project now?

The scope of this project is determined as part of the annual boiler condition data collection and analysis. In order to mitigate the risk of an unplanned outage based on the findings of the condition data, annual boiler refurbishment activities are required. Some of the tubes to be inspected and replaced are difficult to access and sufficient time during a planned outage is required to complete repairs or replacements. The annual planned outage duration will afford the time necessary to assess, locate and repair tubes and shields.

Why do this project this way?

Replacing deteriorated tubes, tube bends and shields will mitigate the risk of tube leaks and minimize the number of unplanned outages. Based on boiler assessments, these upgrades are necessary to maintain reliable operation of the boiler. Refurbishment of these components is not an option once they are outside acceptable tolerances. For tubes, wall thickness tolerances are established by industry standard (ASME) and governed by legislative requirements.

CI Number : C0009100 - LIN4 Boiler Refurbishment 2019 **Project Number** C0009100

Parent CI Number : -

Asset Location : 1134 - 1134 Lingan Unit 4; Commissioned 1984, 160 Mwh **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1300 - SGP - Boiler	578,653
Retirements	1300 - SGP - Boiler	176,119
	Total Cost:	754,772
	Original Cost:	263,575

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# : C0009100
Title: LIN4 Boiler Refurbishment 2019
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Utility Worker	PD	20	$ 240	$ 4,804		
			Sub-Total	$ 4,804		51805
Term Labour						
Utility Worker	PD	60	$ 240	$ 14,411		
				$ -		
			Sub-Total	$ 14,411		
Materials						
Boiler Tubes	lot	1	$ 15,000	$ 15,000		
Boiler Shields	lot	1	$ 15,000	$ 15,000		
Misc Consumables	lot	1	$ 6,000	$ 6,000		
				$ -		
			Sub-Total	$ 36,000		51805
Contracts						
Boiler Maintenance Contractor	$	1	$ 560,000	$ 560,000		
Industrial Cleaning Services	$	1	$ 60,000	$ 60,000		
				$ -		
			Sub-Total	$ 620,000		51805
Administrative Overhead						
Labour AO				$ 5,020		
Contracts AO				$ 74,536		
			Sub-Total	$ 79,557		
			SUB-TOTAL (no AO, AFUDC)	$ 675,215		
			TOTAL (AO, AFUDC included)	$ 754,772		
Original Cost				$ 263,575		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0007398

Title: POT Air Heater Refurbishment

Start Date: 2018/05
In-Service Date: 2019/05
Final Cost Date: 2019/11
Function: Steam
Forecast Amount: $669,205

DESCRIPTION:

This project is to refurbish the air heaters at the Point Tupper Generating station, including replacing the hot end baskets and seals.

Air heaters are located directly in the boiler gas pass and subjected to continuous gas flow. These air heaters incorporate two layers of heat transferring elements referred to as hot-end baskets and cold-end baskets which act to recover energy and improve the operating efficiency of the unit. In order to efficiently operate an air heater of this design, metal seals are used to prevent air migration from the air stream to the gas stream during heat transfer. If an effective seal is not maintained, heat transfer is reduced, which yields a reduction in boiler efficiency and increased fuel consumption. As these operate within the gas flow of the unit they are subject to the effects of heating and erosion. The frequency of refurbishment is a function of operating hours, gas velocity and ash loading.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 – CI 49111 - Air Heater Refurbishment - $272,538

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

The air heaters are part of the original design of the plant (1973). Their function is to recover heat (transfer from outgoing flue gas to incoming combustion air). Air heater performance deteriorates over operating time. Air heater baskets wear out, seal clearances and integrity deteriorate and air heater drive components wear. Refurbishment is required to maintain the air heater in service and to maintain its effectiveness to transfer heat and have a positive effect on efficiency.

This project is being undertaken to prevent air heater failure, thereby preserving the unit's reliability.

Why do this project now?

During the planned outage in 2018, hot end baskets, radial, circumferential and post hot end seals were identified as requiring replacement to ensure reliability of the unit is maintained and assist with maintained heat transfer. The planned outage in 2019 is the next opportunity to perform this refurbishment in a planned manner.

Why do this project this way?

As the air heater is situated in the Boiler Gas Pass, this work must be completed during a unit outage. Refurbishment of air heaters by replacing baskets and seals is necessary to ensure efficient reliable performance of air heaters. Air heater baskets and seals are replaceable parts of the main equipment that make up the air heaters and the air heaters are designed to be refurbished as part of their operational lifespan. A full replacement of the air heater is not required and is significantly more costly.

CI Number : C0007398 - POT Air Heater Refurbishment

Project Number C0007398

Parent CI Number : -

Asset Location : 1152 - 1152 Point Tupper Unit 2

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1300 - SGP - Boiler	502,172
Retirements	1300 - SGP - Boiler	167,033
	Total Cost:	669,205
	Original Cost:	90,519

Capital Project Detailed Estimate

Location: Point Tupper Generating Station
CI# : C0007398
Title: POT Air Heater Refurbishment
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Maintenance Trades	PD	80	$ 365	$ 29,183		
Utility Worker	PD	80	$ 240	$ 19,214		
			Sub-Total	$ 48,397		
OT Labour						
Maintenance Trades	PD	35	$ 730	$ 25,535		
Utility Worker	PD	35	$ 480	$ 16,812		
			Sub-Total	$ 42,348		
Term Labour						
Maintenance Trades	PD	230	$ 365	$ 83,901		
Utility Worker	PD	230	$ 240	$ 55,241		
			Sub-Total	$ 139,142		
Materials						
Hot End Baskets	lot	1	[redacted]		Attachment 2	
Misc. and Consumables	lot	1	$ 34,076	$ 34,076		
			Sub-Total	[redacted]		
Contracts						
Field Service Technician	lot	2	[redacted]		Attachment 3	
High Pressure Cleaning	lot	2	$ 8,000	$ 16,000		
			Sub-Total	[redacted]		
Meals						
Meals	lot	1	$ 1,000	$ 1,000		
			Sub-Total	$ 1,000		
Overtime Meals						
Overtime Meals	lot	1	$ 1,000	$ 1,000		
			Sub-Total	$ 1,000		
Other Goods & Services						
Contingency	%	10%	$ 552,058	$ 55,206		
			Sub-Total	$ 55,206		
Interest Capitalized						
AFUDC				$ 2,762		
			Sub-Total	$ 2,762		
Administrative Overhead						
Labour AO				$ 54,287		
Contracts AO				$ 4,893		
			Sub-Total	$ 59,180		
			SUB-TOTAL (no AO, AFUDC)	$ 607,264		
			TOTAL (AO, AFUDC included)	$ 669,205		
Original Cost				$ 90,519		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

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FIELD SERVICE REPORT

PROJECT INFORMATION			
Project #:	A034573	**Customer:**	NS Power
On-site Date & Time:	4-24-18	**Project Site:**	PT TUPPER GEN STN 4137 PORT MALCOM RD PT TUPPER, NS B9A 1Z4
Estimated Duration On-site:	Approx 1 week	**Site Contact Information:**	Mark Taylor mark.taylor@nspower.ca 902-625-2323 x3622
Equipment:	24-VIR-54	**Sales Office & Rep Info:**	Rick Lawrence, Gary Seely Gary C. Seely Ltd. Ph: (506) 847-0990 FX: (506) 847-9996
Original Equipment Order Number:	(1109)	**Customer PO:**	2011551
Serial #:	Unknown	**Assigned Technical Advisor:**	Avie Cross
G.A. Drawing #:	NA	**Field Service Supervisor:**	MIKE COATSWORTH
Parts Project No.	NA	**Project Manager**	NA
Testing Equipment Used On Project (Brand-Model & S/N):	NA	**Project Completion Date:**	04-25-2018
FOLLOW UP (TA…check appropriate boxes)			
Service Complete:	☒Yes ☐No	Quote Required:	☒Yes ☐No
Return Trip Required:	☐Yes ☒No	Parts List provided to Customer:	☐Yes ☒No
Additional Info. Required:	☐Yes ☒No	Does HNA Sales Rep need to contact Customer:	☒Yes ☐No

24/7 EMERGENCY SERVICE 800.458.FANS (3267)

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Objective/Job Scope:

Howden has been requested to be on site to direct the Inspection of Pt. Tupper 24-VIR-54 air preheaters in POT2 boiler.

Conclusions / Recommendations:

Upon arrival at the Point Tupper plant operated by Nova Scotia Power, the Howden TA was greeted by Mr. Mark Taylor. It was learned that the cold side element had been replaced in a previous outage the year before. This inspection would focus on the condition of the hot side element and the sealing systems associated with the rotors.

The unit consists of two size 24 VIR rotors of 1950's vintage. Although some items had been upgraded over the years, the basic pre 64 design still remains.

Unless otherwise noted, these findings are typical of both air preheater rotors.

The inspection would involve the north and south hot air ducts and the cold gas ducts of both rotors. The other access points were not available for the inspection. However, the rotors were rotated 180 degrees offering a more conclusive view of the hot end element. The overall condition of the rotors is very good for their age. With some new element and minor seal repairs, the units should operate as designed for several years to come.

The following conditions were found and the recommendations follow for each deficiency.

- The hot side elements are thinned and have extensive pluggage issues. The north rotor is approximately 30% fouled. The south rotor is approximately 35-40% fouled. It was revealed during consultations with Mr. Mark Taylor that the plant had recently done a high pressure-wash on the element. This fouling is persistent in the "A" and "E" baskets with other baskets showing effects also.

- The hot side element has sheets that are closed off due to the element being thinned and suffering impact by foreign objects from above. The element closes off to the adjacent sheet and the flow is prevented from entering and moving through the sheets.

- The hot and cold side circumferential seals are worn heavily and are in need of replacement. The hardware for securing the seal needs to be replaced with new seals.

- The hot and cold radial seals are in serviceable condition, but are in need of adjustments to minimize leakage. When these seals are reset, the seals need to have new hardware installed to secure them. It was found that the hardware on the north rotor's inboard and first intermediate cold end radials were missing and is assumed to have not been tightened properly. The radial seal bolts are to be torqued to 100 lbs.

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- The sootblowers are of the old swing arm design and function adequately. The blower lance on the south unit has a leak at the 90 degree elbow that extends to the nozzle. This is evidence of water condensate accumulating in the line. The nozzles here do not have a shield at the park position to divert any moisture that may be in the lance at the moment of cycle start. Shield installations here or a more consistent water trap to remove the condensate will extend the life of the new cold element and the hot element when installed.

- The rotor structures were found to be in good serviceable condition where visually accessible. No cracks were found at the rotor stub diaphragm welds or at the stay plates where visible.
- All housing super structure components are in good condition and will serve well into the future.
- All of the expansion joints have good shielding and show no adverse effects.
- The oil levels in the rotor bearings were checked and found to be full at their marks on their respective dipsticks. No leakage issues were found. No open bearing inspections were done during these inspections.
- The trunnion air seals appear in good serviceable condition and require no attention at this time.

The rotor drives were inspected and found to be in very good condition. The pinion gears and the pin racks appear to have been replaced in the recent past and wear is nominal. The only issue that was found here is the elevation of the gears. *The north rotor's pinion gear is running close to the upper rail on the pin rack during operations. The gear needs to be lowered to 3/8" from the edge of the lower rail of the pin rack. This is to prevent drag on the main motor plus preventing any damage to the output shaft bearing of the reducer.* The pinion gear on the south rotor drive is high, but it is not in danger of contact with the pin rack.

Work Performed/Observations:

Rotor Housing:

The structure was inspected for expansion cracks and/or erosion holes. No issues were found with the expansion joints or channel bracing. The sealing surface that is part of the super structure for the overall support of the air preheater was found to be in good condition.

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Although there is some ash accumulation in the duct corners, the overall wash that was done prior to the arrival of the Howden TA had cleaned the units and allowed for a more detailed inspection.

This is the typical view of contact from radial seals on the sealing surface. The separation of the gas and air is critical to the efficiency of the unit. The scarring is representative of a phonographic record of old. This is a hot end view and there is a gap between the radial seals and the sealing surface. This is due to excessive wear and possibly a setting that was not as tight as it could have been when completed.

The sealing surfaces on these units should be good for many more years of operation. The surfaces are made of a plate that is equivalent to ar400 steel.

The hot end radial seals on both units show wear, but the seals are still in good condition and can be reset. The gaps that are present as of now can be adjusted to provide more sealing against the sealing plates and provide a better return on operating costs.

Rotor Structure:

The rotor structure was inspected where accessible. No stay plate cracks were found from diaphragm to diaphragm on the hot side. The diaphragms to rotor stub diaphragm welds were checked and no issues were discovered.

It must be noted as mentioned before that the access ducts were limited to the hot air and cold gas.

The rotors were inspected for weld cracks and erosion and/or corrosion holes. No issues were revealed.

It must be noted that the hot baskets appear to be small in the compartments and this is demonstrated by the baskets all being stripped with perimeter sealing stripes to close off flow escape. This covers the stay plate welds and many welds could not be visually inspected.

The end plates at the rotor post were all found to be in good condition and no maintenance is required in this area. Although the interior of the rotor stub diaphragms could not be seen, the problem areas typically begin at the extreme hot end and progress to the cold end. The following photos show the rotor post view that was available.

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The cold end grating that supports the cold baskets appeared in good condition. The grating sits on blocks that are welded to the diaphragms. The grating free floats on these blocks so that it does not restrict expansion of the rotor under load.

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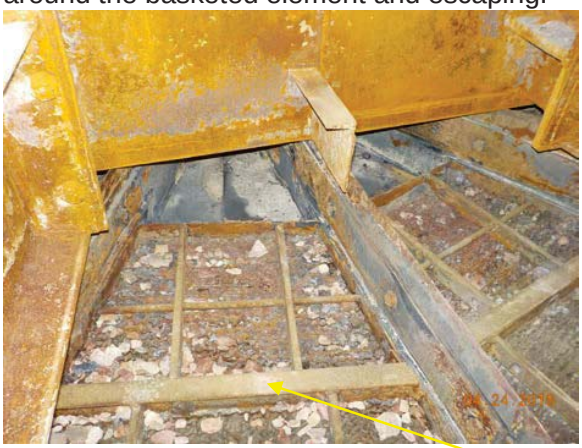
The following photos show the sealing flat bars that have been installed to keep the flow from going around the basketed element and escaping.



These strips are covering gaps that persist around the basket perimeter and are a stop gap measure for pressure loss and loss of return. They also cover the ends of the stay plates and prevent weld inspections. No issues were found at these locations, but the problems persist because the baskets are small for the compartments.

Heat Transfer Element:

The cold end element has been replaced within the last year and appears to be in great condition. The only issue discovered during the inspection is that the pluggage from the hot side has started to drift down upon the cold element. This is evident at the “A” baskets.

The “A” basket above this cold side basket is completely plugged and the sootblower cannot penetrate and prevent the accumulation of ash into the cold side which is fairly new.

The cold element is showing ash build up and the beginning of pluggage coming primarily from the hot side condition.

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The hot side element is in poor condition with thinning causing the element to be damaged from any impact from above in the hot ducting. The pluggage is severe in the “A” and “E” baskets. This problem is also progressing to the middle baskets. The north rotor is approximately 30% plugged and the south rotor is approximately 35-40% plugged. It was learned in consultations with Mr. Mark Taylor that a high pressure water wash was done recently. The wash did not remove the pluggage from the baskets.

The photo to the left shows the plugging that is progressing into the “D” baskets. This will continue to degrade the performance of the air preheater rotor due to its inability to absorb flow through the sheets.

The following photo shows the plugging as it makes it way into the “C” baskets. The ash is starting to build its way along the diaphragms and later into the middle of the basket. The sootblower on the cold side is not able to affect this build up due to its solidification to the thinning sheets.

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The hot end basketed element needs to be replaced with element that will allow for more particles to pass and afford clean ability with the existing sootblower. Howden offers new element that would perform very well here and would make the units operate near optimum efficiency.

The rotors were rotated during the inspection so a more complete look at the pluggage was available. This was only done on the hot side and didn't offer access to the sections of the rotor's 12 compartments that were under the sealing surfaces at the moment.

Sealing Systems:

The hot and cold end radial seals are in need of resetting. There should be minimal gaps on the hot end for the radials. The cold end radials are not sealing off against the sealing surface/center sections. The cold end radials need to be set 1/8" closer to the sealing surface. This will offer the seal a chance to wear in when the unit is brought up to full load.

The circumferential seals on both rotors are worn heavily and are in need of replacing. The end of the sealing tab should have a radius on the corner. When these seals are worn away, the radius turns into a square 90 degree corner. That is the common sign looked for in the field when looking at these seals.

The rotor post seals are in good serviceable condition for now and need no attention.

The trunnion air seals were found in good condition and should not need any service as of now.

The following photos show the conditions of the fore mentioned seals.

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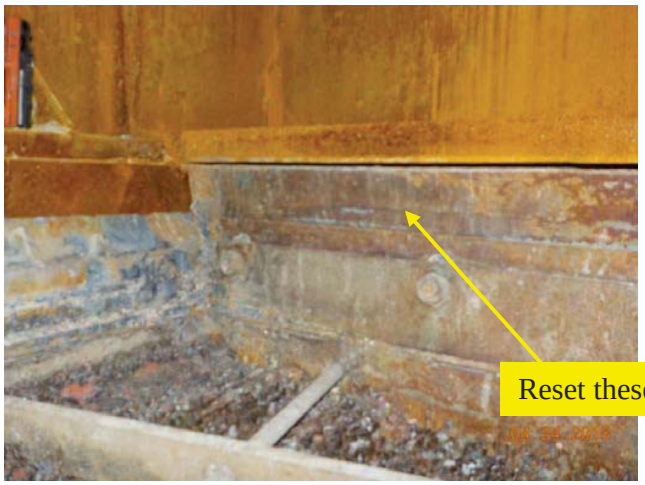

Rotor Bearings:

No open bearing inspection was performed during these inspections. No issues were reported by plant personnel. The oil levels were checked and were found to be at the full marks on their dipsticks. It was revealed that the oil would be changed before the end of the outage in all of the bearings. The oil that was checked appeared clean and of good quality. The oil circulation system with a good filter has taken good care of the bearings.

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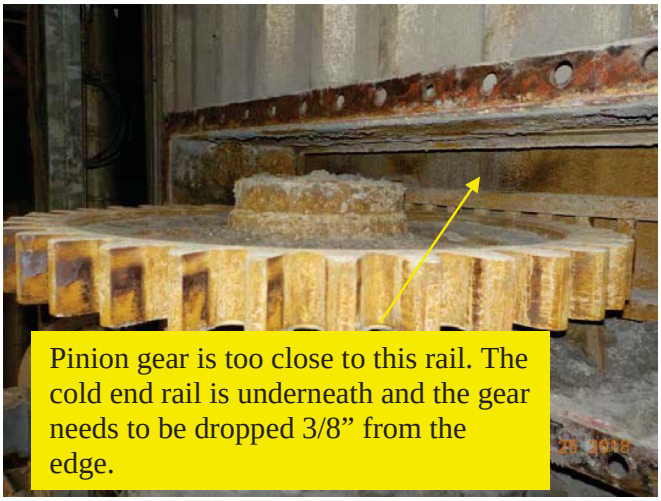
No leaks at the oil lines or bearing housings were found. The following photo is typical of the conditions that were found.

Rotor Drive:

The drive reducers were checked for oil levels and found to be full. The pinion gear guards were removed from both rotors for a view of the root gap and pin rack/pinion gear condition.

The gears and pin racks are in great condition and appear to have been replaced recently. The only issue that was found is that the gears are too high in elevation. The north rotor is the worst and is in need of resetting. The south rotor can be run in its current condition and reset later if desired.



The pinion gear needs to be set 3/8" from the cold pin rack rail. The rotor will turn down when under load and heat. The goal is to have the gear run more in the center of the pin rack when under full load.

The pinion gear is held in place with a taper lock bushing and a replacement needs to be on site before this is attempted. The gear on the north rotor as in the photo is running close to the rail during operations due to thermal deformation.

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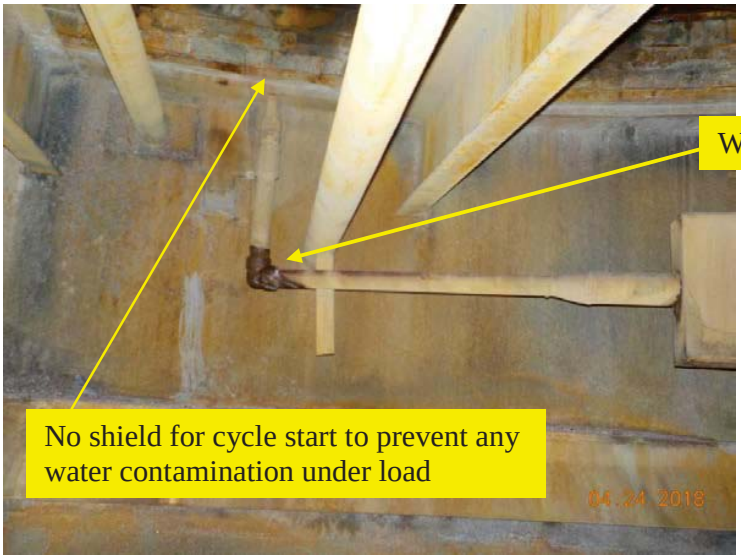
Sootblowers:

These units use the original swing arm type sootblowers. They function normally and appear to be in good serviceable condition. The only issue found is that the south lance inside the cold gas duct has a water/condensate leak. The lance nozzles are in great shape, but they do not have any shields in the park position. If there is any water retained or accumulated in the lances prior to cycle start, the cold end element is saturated with it.



These are good blowers and with the correct pressure settings and water displacement and protection will be very capable of cleaning the new hot end element once it is installed.

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Water Wash Header:

The water wash pipes are still in place on these units, but they are no longer used. They would offer a high volume, low pressure wash when the unit is offline. The high pressure wash that has been used recently is tough on elements and Howden recommends that it be limited to once a year usage.

Parts Consumed/Recommendations:

No parts were used during the stay of the Howden TA. The recommendations at the beginning of this report would bring the units to high performance operation.

Parts recommended:
Hot and cold side circumferential seals.
Hardware for hot and cold radial seals.
Hot end baskets.
Pinion gear taper lock bushing.

The units are in great shape for their age which is beyond the normal life span of air preheaters. The oil in the bearings should be sampled every 6 months for any contamination. The maintenance schedules outlined in the O&M manuals should be followed for maintain the units and this appears to be true as the conditions of the units are very good.

It was a pleasure working with Mr. Mark Taylor and his staff at the Tupper Point plant. The repairs here to these units are small with the replacement of the plugged and thinned hot end element being the main issue.

Please call Howden North America with all of your air preheater needs and we can bring these units to near optimum operating conditions.

Sincerely,

Avie Cross

Field Service Technical Advisor
Howden North America, Inc.

Quotation (Aftermarket)

ISO 9001:2008 Certified

Attention:	Ben Breen	From:	Phillip Edgerton
Company/Representative:	Point Tupper Generating Station	Phone:	919-324-2388
Plant/Site:	Point Tupper Generating Station	Email:	phillip.edgerton@howden.com
Your Reference:			
Our Reference:	24-VIR-54 (1109)	Fax:	866-810-9419
Market:	Power	Quote #:	HNAGAT.AFM.004201/A
General Assembly Drawing:		Date:	02/12/2018

Howden North America presents our offer as follows:

Item	Part Number	Description	Qty	Price Each	Lead Time to Site
1	BASE: HOT LAYER	HE Elements Air Heater BASKETS: Heater Designation: 24 VIR 54" Number of Sets: 2 Total Number Baskets: 168 Baskets Material : Carbon Steel (EN 10025-2) Baskets Type: MK-IV ELEMENTS: Elements Depth: 42.0 inches Element Profile: HS7 Element Thickness: 22 gauge Element Material : Carbon Steel (EN-10130) Total Aprx. Shipping Weight: 162529 lbs Estimated Container: 4 x 40' Cont. STD	1	[redacted]	18 Week(s)

**** PLEASE NOTE ABOVE PRICING INCLUDES TRANSPORTATION TO JOBSITE ****
Unloading of containers and site logistics is the responsibility of the customer.

Howden Field Service is available to Supervise or Assist at the jobsite, see attached Rate Sheet.

All orders are subject to credit approval by Howden's Accounting Department.

The following drawings are included in the price quoted above:
Basket Arrangement Drawing
Lifting Sling Arrangement
Sootblowing Recommendations

Prices are in CAD

Freight:	DDP at Point Tupper Generating Station. Incoterms 2010. Freight Allowed.

This quote is subject only to Howden North America's Standard Terms and Conditions of Sale, (available at www.howden.com). Unless otherwise negotiated and agreed to by HNA in writing, no other terms shall apply regardless of any statement on Buyer's documents to the contrary.

Howden North America does not accept Liquidated Damages or in place warranty as standard business practice.
*If quoted lead time does not meet your requirements, please advise.
For Prepay and Charge orders, there will be a 4% charge of the net selling price applied to Buyer's invoice as a separate item to cover the standard transportation and handling expenses to the first North American destination. This does not apply to overseas or expedited shipments. In addition, any expense incurred by Seller because of special delivery arrangements requested by Buyer shall be billed to Buyer. Howden does not provide copies of freight invoices.
Pricing does not include Federal, State, Local, or Export taxes or duties.
Payment terms are 30% with order, 70% upon shipment, payable Net 30 days.
Quote expires 30 days from noted and is subject to customer credit approval.
Minimum order value is $350.00.
Non inventory parts are not returnable; returned inventory parts are subject to restocking charges.
Quoted lead time is based upon material availability and factory loading at time of quotation, and may be subject to adjustment at order placement/acknowledgement.

If you have any questions, please contact us.

Sincerely,

Phillip Edgerton

Quotation (Field Service)

ISO 9001:2008 Certified

Attention:		From:	Lynn Dolegala
Company/Representative:	Point Tupper Generating Station	Phone:	+17167062812
Plant/Site:	Point Tupper Generating Station	Email:	Lynn.Dolegala@howden.com
Your Reference:			
Our Reference:		Fax:	866-810-9419
Market:	Power	Quote #:	HNAGAT.AFM.003998/A
General Assembly Drawing:		Date:	1/10/2018

Howden North America presents our offer as follows:

No.	Item	Description	Price
1		Field service to provide a TA to direct trouble shootin of leakage issues NS Power Point Tupper air heater. QUOTE INCLUDES TIME AND EXPENSES FOR: (3) 8 HOUR WEEKDAYS AND (2) 10 HOUR TRAVEL DAYS	[redacted]
Total			[redacted]

Prices are in CAD

This estimate was developed using the attached rate sheet as a guide. This is an approximate cost. The invoiced amount will be derived using the actual costs as outlined on the attached rate sheet and actual hours as required/requested by site personnel.

Typically our service advisors will travel with diagnostic equipment only and would advise a mechanic/millwright with tools.

Attached you will find Howden North America's applicable rate sheet. We request that you include the following terms reference on any purchase order:

Please do not hesitate to contact me if you have any questions in this regard.
Howden North America greatly appreciates your business.

Ts & Cs Notice: HNA performs services pursuant only to its Standard Terms and Conditions of Sale. Note that the current version can be obtained via the Internet at: http://www.howden.com/en/Businesses/HowdenNorth America's/standardtermsandconditionsofsale. All other, additional, and/or different terms and conditions proposed to HNA (whether in the past, present, and/or future), are hereby objected to and rejected even if HNA renders services pursuant to a Purchase Order referencing different or additional terms.

1. This quote is subject to current Howden North America's Standard Terms and Conditions of Sale, unless otherwise negotiated and agreed to by HNA in writing, no other terms shall apply regardless of any statement on Buyer's documents to the contrary.

2. Howden North America does not accept Liquidated Damages or in place warranty as standard business practice.
3. The total price is only estimated and will be subject to actual cost and expenses will be assessed a 10% administration fee.
4. Labor charge may apply to base rate, overtime rate and double time rate depending on actual hours on workday(s), weekend(s) and HNA observed holiday(s). Minimum daily charge is 8 hours. For detail please see attached rate sheet.
5. Pricing does not include Federal, State, Local, or Export taxes or duties.
6. Payment Terms, Payment Terms are Net Thirty (30) days from invoice date, which is based on the freight terms quoted above. .
7. Quote expires 30 days from date noted and is subject to customer credit approval.
8. In order to schedule a Field Service to your site, your acknowledgement requesting the dispatch of Field Service and a copy of an approved purchase order is required.

Payment Terms are Net Thirty (30) days from invoice date, which is based on the freight terms quoted above.

If you have any questions, please contact us.

Sincerely,

Lynn Dolegala

CI Number: C0011064

Title: PHB Boiler Refurbishment 2019

Start Date:	2019/08
In-Service Date:	2019/08
Final Cost Date:	2019/02
Function:	Steam
Forecast Amount:	$565,707

DESCRIPTION:

Refurbishment of sections of the Port Hawkesbury Biomass (PHB) boiler is required to maintain reliable operation of the co-generation unit. Due to the volume of biomass fuel that passes through the boiler, it has many erosion susceptible areas including conveyors, feed screws and reciprocating grates. This project falls within the projected sustaining capital investment for the biomass plant. Similar to the boilers on coal-fired units, the biomass boiler will require refurbishment and select component replacements over its life in response to continuous exposure to elevated temperatures, temperature cycling, erosion and corrosion.

Specifically, replacements will be made on the boiler's fuel insertion screw conveyors, boiler reciprocating grate, and pressure parts. On the electrostatic precipitator, the collecting system alignment will be improved and casing refurbishments undertaken to reduce air ingress.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 - CI 49499 - PHB - Boiler Refurbishment 2017 - $593,740
- 2018 - CI 51818 - PHB Boiler Refurbishment 2018 - $440,315
- 2020 - CI TBD - PHB Boiler Refurbishment 2020 - $TBD
- 2021 - CI TBD - PHB Boiler Refurbishment 2021 - $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

Legislation:

NS Power is required to maintain PHB unit as a base load cogeneration facility, and operate the plant on an economic dispatch basis or as required for system reliability. PHB capital projects and routines are designed to maintain PHB unit in that capacity. Section 5(2A) of the Renewable Electricity Regulations provide as follows:

> 5(2A) NSPI must maintain the Port Hawkesbury biomass power generation plant available as a base load cogeneration facility and NSPI must operate the plant on an economic dispatch basis or as required for system reliability."

Renewable Energy Standards:

The PHB generation station was designed to meet requirements under the Renewable Energy Standards (RES), providing ready and reliable renewable energy, while contributing to system stability. The Port Hawkesbury Biomass Cogeneration Facility is the only NS Power-owned renewable resource whose output can be increased to meet RES obligations in the event of a low wind/hydro output year. Continued investment in the biomass facility diversifies NS Power's energy portfolio in renewables, and will contribute to RES requirements of 40 percent of NS Power's electric sales being from renewable energy sources in 2020.

Contractual Obligations:

The PHB arrangement was designed and approved as a cogeneration operation. The boiler's steam output is for the purpose of producing renewable electrical energy and supplying Port Hawkesbury Paper's (PHP) mill steam requirements.

As a cogeneration facility, the biomass unit is highly integrated into the operation of the paper mill. NS Power and PHP entered into a Shared Services and Steam Supply Agreement dated September 28, 2012 (the Agreement). Within the Agreement, NS Power agreed to provide steam and related services to PHP over the term of the contract.

Asset Condition:

Ongoing asset management activities identified the requirement for boiler component replacement to maintain the near term and long term reliability of the boiler, and mitigate the risk of unplanned outages due to tube leaks. Due to the biomass that passes through the boiler, it has many areas susceptible to erosion including conveyors, feed screws and reciprocating grates.

Why do this project now?

Some of the boiler tubes and other equipment to be inspected and replaced are difficult to access. This project is required to be completed during an outage of sufficient duration to complete the necessary work. The planned outage for the biomass boiler in 2019 will be of sufficient duration to complete the work.

Why do this project this way?

Completing this work in this manner is the only feasible way to allow for reliable and efficient operation of the boiler. Refurbishing the boiler through component replacement is a more cost effective alternative than full boiler replacement.

CI Number : C0011064 - PHB Boiler Refurbishment 2019 **Project Number** C0011064

Parent CI Number : -

Asset Location : 1401 - 1401 Port Hawkesbury Biomass **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1300 - SGP - Boiler	432,194
Retirements	1300 - SGP - Boiler	133,513
	Total Cost:	565,707
	Original Cost:	394,373

Capital Project Detailed Estimate

Location: Port Hawkesbury Biomass
CI# : C0011064
Title: PHB Boiler Refurbishment 2019
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Utility Worker	PD	40	$ 240	$ 9,607		
			Sub-Total	$ 9,607		
OT Labour						
Utility Worker	PD	10	$ 480	$ 4,804		
			Sub-Total	$ 4,804		
Term Labour						
Utility Worker	PD	10	$ 240	$ 2,402		
			Sub-Total	$ 2,402		
Materials						
Grates, Stationary	ea	100	$ 678	$ 67,800		
Grates, Reciprocating	ea	100	$ 872	$ 87,200		
Grates Parts - Beams, Sliders, Wear Plates, etc.	lot	1	$ 10,000	$ 10,000		
Structural Steel, Steel Plate, etc.	lot	1	$ 7,000	$ 7,000		
Precipitator Rotary Valves	ea	4	$ 17,000	$ 68,000		
Valve Actuator	ea	1	$ 10,000	$ 10,000		
			Sub-Total	$ 250,000		
Contracts						
Boiler Refurbishment Services Provider	lot	1	$ 215,000	$ 215,000		
Non-Destructive Testing	lot	1	$ 5,000	$ 5,000		
			Sub-Total	$ 220,000		
Other Goods & Services						
Contingency	%	10%	$ 486,812	$ 48,681		
			Sub-Total	$ 48,681		
Administrative Overhead						
Labour AO				$ 3,765		
Contract AO				$ 26,448		
			Sub-Total	$ 30,213		
			SUB-TOTAL (no AO, AFUDC)	$ 535,494		
			TOTAL (AO, AFUDC included)	$ 565,707		
Original Cost				$ 394,373		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0010319

Title: TRE5 Boiler Refurbishment 2019

Start Date: 2019/10
In-Service Date: 2019/11
Final Cost Date: 2020/05
Function: Steam
Forecast Amount: $518,302

DESCRIPTION:

The scope of work for this project is to refurbish and replace deteriorated boiler tubes, tube bends and shields on the Trenton Unit 5 boiler as part of the planned unit outage in 2019. The scope of this project is determined as part of the annual boiler condition data collection and analysis. This effort includes evaluation and prioritization of activities to be undertaken during the annual outage. Protective erosion shields identified as missing or degraded will be replaced with new shields. Tubes and bends will be replaced in the areas where the thickness readings are below American Society of Mechanical Engineers (ASME) specifications and Nova Scotia Labour and Advanced Education (NSLAE) regulations. This tolerance maximizes the economic tube life while maintaining boiler reliability.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 CI 49536 TRE5 Boiler Refurbishments 2017 $717,589
- 2018 CI 51802 TRE5 Boiler Refurbishments 2018 $1,212,228
- 2020 CI TBD TRE5 Boiler Refurbishment 2020 $TBD
- 2021 CI TBD TRE5 Boiler Refurbishment 2021 $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

This project is being undertaken to prevent boiler tube failure in identified zones and preserve the unit's availability. Ongoing asset management activities have identified the requirement for boiler component replacement to maintain the long term reliability of the boiler and mitigate the risk of unplanned outages due to tube leaks. Boiler tube failures represent the industry's single largest source of outages for steam-based generation. NS Power has a long history of managing this issue with comprehensive boiler inspection and proportional investment programs to match the various failure mechanisms.

Why do this project now?

To mitigate the risk of unplanned outages, annual boiler refurbishment activities are required. Some of the tubes to be inspected and replaced are difficult to access and sufficient time during a planned outage is required to complete refurbishment or replacements. The annual planned outage duration will afford the time necessary to assess, locate and replace the tubes and shields.

Why do this project this way?

Replacing deteriorated boiler tubes, tube bends and shields will mitigate the risk of tube leaks and minimize the number of unplanned outages. Based on boiler assessments, these upgrades are necessary to maintain reliable operation of the boiler. Refurbishment of these components is not an option once they are outside acceptable tolerances because there is industry code and legislative requirements governing allowable tolerances. For tubes, tolerances are established by industry standard (ASME). Shield replacement is determined by inspector assessment of the degree of deterioration.

CI Number : C0010319 - TRE5 Boiler Refurbishment 2019 **Project Number** C0010319

Parent CI Number : -

Asset Location : 1165 - 1165 Trenton Unit 5; Commissioned 1969, 160 Mwh **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1300 - SGP - Boiler	395,149
Retirements	1300 - SGP - Boiler	123,153
	Total Cost:	518,302
	Original Cost:	58,178

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI# : C0010319
Title: TRE5 Boiler Refurbishment 2019
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Engineering	PD	20	$ 405	$ 8,106		
Maintenance Trades	PD	8	$ 365	$ 2,918		
Utility worker	PD	40	$ 240	$ 9,607		
Power Engineer	PD	15	$ 390	$ 5,856		
Electrician	PD	4	$ 358	$ 1,433		CI49536
			Sub-Total	$ 27,921		
OT Labour						
Utility worker	PD	20	$ 480	$ 9,607		
				$ -		
			Sub-Total	$ 9,607		CI49536
Term Labour						
Utility worker	PD	30	$ 240	$ 7,205		
				$ -		
			Sub-Total	$ 7,205		CI49536
Materials						
Boiler Tubes	ea	15	$ 1,500	$ 22,500		
Shields	ea	100	$ 100	$ 10,000		
Alignment Brackets	ea	50	$ 954	$ 47,700		
			Sub-Total	$ 80,200		
Contracts						
Inspection	PD	80	$ 950	$ 76,000		CI49536
Boiler Refurbishment	PD	170	$ 1,000	$ 170,000		CI49536
Suspended Floor	lot	1	$ 25,000	$ 25,000		CI49536
Vacuum Services	lot	1	$ 50,000	$ 50,000		CI49536
			Sub-Total	$ 321,000		
OT Meals						
Meals	lot	1	$ 1,000	$ 1,000		
			Sub-Total	$ 1,000		
Other Goods & Services						
Contingency	%	5%	$ 446,933	$ 22,347		
			Sub-Total	$ 22,347		
Administrative Overhead						
Labour AO	lot	1		$ 10,432		
Contracts AO	lot	1		$ 38,591		
			Sub-Total	$ 49,023		
			SUB-TOTAL (no AO, AFUDC)	$ 469,280		
			TOTAL (AO, AFUDC included)	$ 518,302		
Original Cost				$ 58,178		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0009108

Title: LIN4 Economizer Header Refurbishment

Start Date: 2019/03
In-Service Date: 2019/04
Final Cost Date: 2019/10
Function: Steam
Forecast Amount: $509,373

DESCRIPTION:

The scope of work for this project is to refurbish the economizer inlet header through the replacement of the economizer header inlet T and attached economizer tubes at the T section on Lingan Unit 4.

The economizer inlet header distributes the feedwater entering the boiler through the economizer tube bank. A tube from each platen of the lower economizer is connected to the header. The feedwater enters the header through the main feedwater pipe attached to the center of the header forming a T section. This section has experienced flow accelerated corrosion (FAC).

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- No other projects on Lingan 4 in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

In 2017, Lingan Unit 3 experienced a tube leak which had developed at the economizer header in the T section to the feedwater inlet. The header and tubing in this area were found to exhibit material loss. Lingan Unit 3 and Unit 4 are of similar vintage and configuration. As a result, the header and tubing in both units is in the same condition and pose the same risks. The economizer headers on Unit 4 have thinned in the T connection to the main feedwater line due to FAC. During FAC, iron ions from the mild steel piping or tubing dissolve in the passing feedwater. The rate of FAC is dependent on temperature being between 120 and 205°C, geometry of the piping or tubing, plain or low alloy carbon steel metallurgy, dissolved oxygen concentration, and ph. The section proposed to be replaced operates in the FAC temperature range, has a T geometry that promotes FAC, and is a susceptible steel metallurgy.

A tube or header leak in the economizer area of Unit 3, as experienced in 2017, would force the unit offline and also cause water to leak into the air heater directly below, plugging off the air heater baskets and forcing an air heater clean.

Why do this project now?

This project must be completed in 2019 in order to mitigate the risk of tube and header failures due to the known material loss on the economizer header at the T connection to the feedwater inlet pipe and the attached economizer tubes in that area of the header.

Why do this project this way?

Replacement of the T section and attached economizer tubes affected by the FAC will allow the remainder of the header to stay in service, avoiding the extra cost of replacing the whole header. The condition of the T section and economizer tubes does not allow for refurbishment.

CI Number : C0009108 - LIN4 Economizer Header Refurbishment **Project Number** C0009108

Parent CI Number : -

Asset Location : 1134 - 1134 Lingan Unit 4; Commissioned 1984, 160 Mwh **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1300 - SGP - Boiler	413,940
Retirements	1300 - SGP - Boiler	95,433
	Total Cost:	509,373
	Original Cost:	181,737

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# : C0009108
Title: LIN4 Economizer Header Refurbishment
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Utility Worker	PD	25	$ 240	$ 6,004		
			Sub-Total	$ 6,004		52252, 49433
Term Labour						
Utility Worker	PD	40	$ 240	$ 9,607		
			Sub-Total	$ 9,607		
Materials						
Economizer Tubes	lot	1	$ 6,000	$ 6,000		
Economizer Header T	ea	1	$ 20,000	$ 20,000		
				$ -		
			Sub-Total	$ 26,000		52252, 49433
Contracts						
Boiler Maintenance Contractor	lot	1	$ 340,000	$ 340,000		
Heat Treatment Contractor	lot	1	$ 40,000	$ 40,000		
			Sub-Total	$ 380,000		52252, 49433
Other Goods & Services						
Contingency	%	10%	$ 380,000	$ 38,000		
				$ -		
			Sub-Total	$ 38,000		
Administrative Overhead						
Labour AO	lot	1	$ 4,079	$ 4,079		
Contract AO	lot	1	$ 45,684	$ 45,684		
			Sub-Total	$ 49,762		
			SUB-TOTAL (no AO, AFUDC)	$ 459,611		
			TOTAL (AO, AFUDC included)	$ 509,373		
Original Cost				$ 181,737		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0009092

Title: LIN3 Reheat Tube Replacement 2019

Start Date: 2018/03
In-Service Date: 2018/04
Final Cost Date: 2018/10
Function: Steam
Forecast Amount: $412,548

DESCRIPTION:

The scope of work for this project is to replace reheat tube bends that pass through the waterwall and connect to the reheat header. These bends are subject to systematic soot blowing which is required for the removal of ash build up on the reheat tubes. The soot blowing causes erosion on the tube bends as they enter the waterwall opening on route to the reheat header. Over years of operation, the tube bends required pad welding during each planned outage to rebuild the tube wall thickness. Pad welded repairs are more susceptible to future tube failures and pulls due to thermal stresses. The future planned operational state of the Unit 3 boiler will see increased cycling which will increase potential thermal stresses on theses pad weld repairs. The location of these tubes passing through the waterwall into a header vestibule could allow an external boiler steam leak to occur if the tubes fail. The reheat tube replacement will be completed in a phased approach enabling the work to be completed over regular planned shutdown intervals.

Summary of Related CIs (+/- 2 years):
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2018 - CI 51849 LIN3 - RH Tube Replacement 2018 - $399,546
- 2020 – CI TBD LIN3 - RH Tube Replacement 2020 - $TBD
- 2021 – CI TBD LIN3 - RH Tube Replacement 2021 - $TBD

JUSTIFICATION:

Justification Criteria: Health & Safety

Why do this project?

This project needs to be completed to reduce the risk of reheat boiler tube leaks in the area where the tubes exit the waterwall on route to the reheat header. A leak on a reheat tube bend in this area could allow steam to leak into the header vestibule external to the boiler, potentially causing waterwall damage. External boiler steam leaks can lead to serious safety hazards for plant personnel.

This project is primarily justified on safety, and secondarily justified on unit reliability.

Why do this project now?

In order to mitigate the risk of an external steam leak and unplanned outage, reheat tube replacement activities are required.

Why do this project this way?

Replacing the deteriorated tube bends will mitigate the risk of tube leaks and minimize the number of unplanned outages. Based on boiler assessments, these upgrades are necessary to maintain reliable operation of the boiler. Refurbishment of these components is not an option due to the failure modes present in the pad welded tubes.

CI Number : C0009092 - LIN3 Reheat Tube Replacement 2019 **Project Number** C0009092

Parent CI Number : -

Asset Location : 1133 - 1133 Lingan Unit 3; Commissioned 1983, 164Mwh **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1300 - SGP - Boiler	337,768
Retirements	1300 - SGP - Boiler	74,781
	Total Cost:	412,548
	Original Cost:	148,294

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# : C0009092
Title: LIN3 Reheat Tube Replacement 2019
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Utility Worker	PD	20	$ 240	$ 4,804		
			Sub-Total	$ 4,804		51849
Term Labour						
Utility Worker	PD	77	$ 240	$ 18,411		
			Sub-Total	$ 18,411		51849
Materials						
Boiler Tubes	lot	1	$ 30,000	$ 30,000		
Misc Consumables	lot	1	$ 6,000	$ 6,000		
			Sub-Total	$ 36,000		51849
Contracts						
Boiler Maintenance Contractor	$	1	$ 280,000	$ 280,000		
Industrial Cleaning Services	$	1	$ 30,000	$ 30,000		
			Sub-Total	$ 310,000		51849
Administrative Overhead						
Labour AO				$ 6,065		
Contracts AO				$ 37,268		
			Sub-Total	$ 43,333		
			SUB-TOTAL (no AO, AFUDC)	$ 369,215		
			TOTAL (AO, AFUDC included)	$ 412,548		
Original Cost				$ 148,294		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0009093

Title: LIN4 Reheat Tube Replacement 2019

Start Date: 2018/03
In-Service Date: 2018/04
Final Cost Date: 2018/10
Function: Steam
Forecast Amount: $412,548

DESCRIPTION:

The scope of work for this project is to replace reheat tube bends that pass through the waterwall and connect to the reheat header. These bends are subject to systematic soot blowing which is required for the removal of ash build up on the reheat tubes. The soot blower action causes erosion on the tube bends as they enter the waterwall opening on route to the reheat header. Over years of operation the tube bends required pad welding to rebuild the tube wall thickness during each planned outage. Pad welded repairs are more susceptible to future tube failures and pulls due to thermal stresses. The future planned operational state of the Unit 4 boiler will see increased cycling which will increase potential thermal stresses on theses pad weld repairs. The location of these tubes passing through the waterwall into a header vestibule could allow an external boiler steam leak to occur. The reheat tube replacement will be completed in a phased approach enabling the work to be completed over regular planned shutdown intervals.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2018 – CI 51850 - LIN4 RH Tube Replacement 2018 - $399,546
- 2020 – CI TBD - LIN4 RH Tube Replacement 2020 - $TBD
- 2021 – CI TBD - LIN4 RH Tube Replacement 2021 - $TBD

JUSTIFICATION:

Justification Criteria: Health & Safety

Why do this project?

This project needs to be completed to reduce the risk of reheat boiler tube leaks in the area where the tubes exit the waterwall on route to the reheat header. A leak on a reheat tube bend in this area could allow steam to leak into the header vestibule external to the boiler. External boiler steam leaks can lead to serious safety hazards for plant personnel.

This project is primarily justified on safety, and secondarily justified on unit reliability.

Why do this project now?

In order to mitigate the risk of an external steam leak and unplanned outage, reheat tube replacement activities are required. Scope of replacements due to degradation of the reheat tube bends is finalized during the planned shut-down of the unit.

Why do this project this way?

Replacing the deteriorated tube bends will mitigate the risk of tube leaks and minimize the number of unplanned outages. Based on boiler assessments, these upgrades are necessary to maintain reliable operation of the boiler. Refurbishment of these components is not an option due to the failure modes present in the pad welded tubes.

CI Number : C0009093 - LIN4 Reheat Tube Replacement 2019 **Project Number** C0009093

Parent CI Number : -

Asset Location : 1134 - 1134 Lingan Unit 4; Commissioned 1984, 160 Mwh **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1300 - SGP - Boiler	337,768
Retirements	1300 - SGP - Boiler	74,781
	Total Cost:	412,548
	Original Cost:	148,294

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# : C0009093
Title: LIN4 Reheat Tube Replacement 2019
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Utility Worker	PD	20	$ 240	$ 4,804		
			Sub-Total	$ 4,804		51850
Term Labour						
Utility Worker	PD	77	$ 240	$ 18,411	.	
			Sub-Total	$ 18,411		51850
Materials						
Boiler Tubes	lot	1	$ 30,000	$ 30,000		
Misc Consumables	lot	1	$ 6,000	$ 6,000		
			Sub-Total	$ 36,000		51850
Contracts						
Boiler Maintenance Contractor	$	1	$ 280,000	$ 280,000		
Industrial Cleaning Services	$	1	$ 30,000	$ 30,000		
			Sub-Total	$ 310,000		51850
Administrative Overhead						
Labour AO				$ 6,065		
Contracts AO				$ 37,268		
			Sub-Total	$ 43,333		
			SUB-TOTAL (no AO, AFUDC)	$ 369,215		
			TOTAL (AO, AFUDC included)	$ 412,548		
Original Cost				$ 148,294		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0009113

Title: LIN4 Burner Front Refurbishment

Start Date: 2019/03
In-Service Date: 2019/04
Final Cost Date: 2019/10
Function: Steam
Forecast Amount: $373,290

DESCRIPTION:

NS Power coal fired units utilize burner assemblies which deliver and distribute pulverized coal and combustion air to the boiler combustion zone. These assemblies include ductwork and support structures, burner assemblies (buckets), nozzles, and associated pneumatic control mechanisms. The delivery elements are subjected to wear as a result of transporting a fuel/air mixture at high velocity. The components nearer the boiler front are subjected to the boiler environment and they wear due to heat and erosion. Refurbishment rates for burner assemblies are a function of operating hours, load and fuel quality. Regular assessments determine condition and guide scope of refurbishment and replacement of components.

This project covers the replacement of the burner front components on LIN Unit #4. The burner fronts internal to the boiler were inspected during the 2018 planned outage and were determined to require replacement in 2019. The burner condition has a direct impact on unburned carbon, oxygen levels and boiler temperatures, which all have an effect on heat rate and fuel efficiency.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- No other projects on Lingan Unit 4 in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Refurbishment/Replacement

Why do this project?

Burner performance and integrity deteriorates over operating time. Burner distribution to the combustor and fuel air mix will become less uniform as elements in the burner system deteriorate, resulting in less efficient utilization of fuel. Supporting structures, seal mechanisms and the integrity of ducts and buckets will deteriorate and provide opportunity for burner fires (outside the combustor) which is a safety concern. Refurbishment is required to maintain the Burner system in a safe and effective operating condition.

Why do this project now?

Inspections completed during the 2018 planned outage by NS Power and the Original Equipment Manufacturer (OEM) indicated the condition of the components require replacement to allow for the continued reliable performance of the generating unit. As the burner system is essential to boiler operation and the duration of the work is typically greater than two weeks, this work must be completed during the planned unit outage in 2019.

Why do this project this way?

A combination of component refurbishment and replacement will be completed. Some tips, nozzles and burners will be replaced based on condition. Supporting structures are typically refurbished in situ. Both replacement and refurbishment are options on the various elements to optimize the overall cost and sustain burner system performance. When possible, components will be replaced if it is more cost effective to do so.

CI Number : C0009113 - LIN4 Burner Front Refurbishment **Project Number** C0009113

Parent CI Number : -

Asset Location : 1134 - 1134 Lingan Unit 4; Commissioned 1984, 160 Mwh **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1300 - SGP - Boiler	312,234
Retirements	1300 - SGP - Boiler	61,056
	Total Cost:	373,290
	Original Cost:	296,820

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# : C0009113
Title: LIN4 Burner Front Refurbishment
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Power Plant Technician	PD	10	$ 375	$ 3,746		
Utility Worker	PD	35	$ 235	$ 8,254		
			Sub-Total	$ 12,000		C0007718
Materials						
Coal Burner Tips	ea	9	$ 5,227	$ 47,043		
Convert USD to CDN	%	30%	$ 47,043	$ 14,113		
Burner Nozzles	ea	5	$ 8,789	$ 43,944		
Seals and Misc Supplies	ea	1	$ 1,005	$ 1,005		
			Sub-Total	$ 106,105		C0007718
Contracts						
Boiler Maintenance Contractor	lot	1	$ 225,000	$ 225,000		
			Sub-Total	$ 225,000		C0007718
Administrative Overhead						
Labour AO				$ 3,135		
Contracts AO				$ 27,050		
			Sub-Total	$ 30,185		
			SUB-TOTAL (no AO, AFUDC)	$ 343,105		
			TOTAL (AO, AFUDC included)	$ 373,290		
Original Cost				$ 296,820		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 47591

Title: TRE5 Bottom Ash Seal Replacement

Start Date: 2019/10
In-Service Date: 2019/10
Final Cost Date: 2020/04
Function: Steam
Forecast Amount: $350,562

DESCRIPTION:

The scope of work for this project is to replace the bottom ash seal on the Trenton Generating Station Unit 5 boiler as part of the planned unit outage in 2019. The Trenton Unit 5 boiler has a dry bottom ash system which collects the bottom ash from the bottom of the boiler and transports it to a nearby silo for delivery to the landfill. The bottom ash is sealed in the bottom of the boiler with an expansion joint. This expansion joint is critical to minimizing air leakage and allowing for proper negative pressure inside the boiler which maintains the draft within the boiler to allow for proper gas flow.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 CI 49536 TRE5 Boiler Refurbishments 2017 $717,589
- 2018 CI 51802 TRE5 Boiler Refurbishments 2018 $1,212,228
- 2019 CI C0010319 TRE5 Boiler Refurbishment 2019 $518,302
- 2020 CI TBD TRE5 Boiler Refurbishment 2020 $TBD
- 2021 CI TBD TRE5 Boiler Refurbishment 2021 $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

This project is being undertaken to mitigate risk of bottom ash seal failure and preserve the unit's availability. Ongoing asset management activities have identified the requirement for boiler component replacement to maintain the long term reliability of the boiler and mitigate the risk of unplanned outages.

Why do this project now?

Tube failures on Unit 5 in 2017 and 2018 have been occurring in the lower water wall and bottom ash seal area of the boiler. These boiler tube outages have caused damage to the expansion joint. Replacement of the boiler tubes in this area have occurred where necessary; however, isolated repairs to the bottom ash seal are not possible due to the composition of the expansion joint (steel mesh). The 2019 planned outage duration will afford the time necessary to replace the bottom ash seal.

Why do this project this way?

This project will replace the seal with a new seal to allow for the continued integrity of the seal on an ongoing basis. Loss of sealing of boiler gases would result in unit outage. Replacement of the bottom ash seal is the only way to maintain appropriate draft within the boiler. Patches to the deficiencies in the seal are not possible due to the composition of the expansion joint.

CI Number : 47591 - TRE5 Bottom Ash Seal Replacement **Project Number** 47591

Parent CI Number : -

Asset Location : 1165 - 1165 Trenton Unit 5; Commissioned 1969, 160 Mwh **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1300 - SGP - Boiler	296,055
Retirements	1300 - SGP - Boiler	54,507
	Total Cost:	350,562
	Original Cost:	44,065

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI# : 47591
Title: TRE5 Bottom Ash Seal Replacement
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Engineering	PD	10	$ 405	$ 4,053		
Power Engineer	PD	15	$ 390	$ 5,856		
			Sub-Total	$ 9,909		
OT Labour						
Utility Worker	PD	20	$ 480	$ 9,607		
				$ -		
			Sub-Total	$ 9,607		
Term Labour						
Utility Worker	PD	30	$ 240	$ 7,205		
				$ -		
			Sub-Total	$ 7,205		
Materials						
Bottom Ash Seal (Expansion Joint)	ea	1	$ 75,000	$ 75,000		
			Sub-Total	$ 75,000		
Contracts						
Seal Remove / Install	PD	150	$ 1,000	$ 150,000		
Safety Services	lot	1	$ 20,000	$ 20,000		
Technical Advisor	lot	1	$ 20,000	$ 20,000		
			Sub-Total	$ 190,000		
OT Meals						
Meals	lot	1	$ 1,000	$ 1,000		
			Sub-Total	$ 1,000		
Other Goods & Services						
Contingency	%	10%	$ 292,721	$ 29,272		
			Sub-Total	$ 29,272		
Administrative Overhead						
Labour AO				$ 5,726		
Contracts AO				$ 22,842		
			Sub-Total	$ 28,568		
			SUB-TOTAL (no AO, AFUDC)	$ 321,994		
			TOTAL (AO, AFUDC included)	$ 350,562		
Original Cost				$ 44,065		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0010141

Title: POT IP/LP Turbine Refurbishment

Start Date: 2018/07
In-Service Date: 2019/07
Final Cost Date: 2020/01
Function: Steam
Forecast Amount: $2,938,990

DESCRIPTION:

This project is to replace rows 7-10 blades on the intermediate pressure (IP) turbine at Point Tupper Generating Station and to open, clean and inspect the Dual Flow Low Pressure Turbine (DFLP) steam path, including surface reconditioning of the DFLP rotating and stationary blades.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2019 CI C0010142 POT HP Turbine Refurbishment $1,813,421
- 2019 CI C0010498 POT Turbine Valve Refurbishment $698,497

Depreciation Class: Steam Production Plant – Point Tupper Unit 2

Estimated Life of the Asset: 10 Years

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

The rows 7-10 blades on the IP turbine are original to 1973 startup and have accumulated more than 300,000 hours of service. These are a grouped blade design with brazed integral shrouds. In 2011, rows 7-10 were found to have lost most of the inter shroud braze material. The failure of this braze material results in 'tile lifting' (bending of the shroud) and rubbing of shrouds and seals in service. Temporary repairs were performed in 2011 by welding shrouds with Inconel filler. The Inconel filler remains substantially intact; however, NS Power's experience with this type of repair indicates that the repair life is limited due to cracking of the Inconel filler. Separation of adjacent shrouds leads to further tile lifting These have a temporary repair performed on them due to 'tile lifting' (bending of the shroud) in 2011. This repair did not provide long term reliability and was an interim solution before the blades could be replaced.

During the 2013 outage, performance reconditioning opportunities were identified in the DFLP steam path. Reconditioning will reduce surface roughness improving the DFLP's efficiency and performance.

Why do this project now?

These blades are required to be replaced now with an improved integral shroud design to prevent tile lifting and improve the reliability concerns associated with these blade rows. The blades have already being repaired in the past and the Original Equipment Manufacturer (OEM) recommends replacement as the only option. Additional repairs are not feasible and would cause unnecessary risks.

Steam path assessments of surface condition requires access to the internals of the DFLP. Performing this work within the planned outage will provide the most efficient outcome, without requiring additional outage weeks and resourcing.

Why do this project this way?

In 2019, Point Tupper will have a scheduled major outage. The planned outage is of sufficient duration to complete the work required on the IP and DFLP at this time. Replacing individual blades row is lower cost that replacing that entire IP Rotor.

Steam path assessments require access to the internals of the DFLP. Performing this work during the current planned outage will be most efficient time to complete the work.

CI Number : C0010141 - POT IP/LP Turbine Refurbishment

Project Number C0010141

Parent CI Number : -

Asset Location : 1152 - 1152 Point Tupper Unit 2

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1000 - SGP - Turbo Gen.Instal.	1,965,010
Retirements	1000 - SGP - Turbo Gen.Instal.	973,980
	Total Cost:	2,938,990
	Original Cost:	354,202

Capital Project Detailed Estimate

Location: Point Tupper Generating Station
CI# : C0010141
Title: POT IP/LP Turbine Refurbishment
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						48893
Electrician	PD	8	$ 358	$ 2,866		
Engineering	PD	15	$ 405	$ 6,080		
Maintenance Trades	PD	76	$ 365	$ 27,724		
Power Plant Technician	PD	8	$ 382	$ 3,057		
Utility Worker	PD	60	$ 240	$ 14,411		
			Sub-Total	$ 54,137		
OT Labour						
Maintenance Trades	PD	42	$ 730	$ 30,660		
Utility Workers	PD	42	$ 480	$ 20,160		
Power Plant Technician	PD	4	$ 764	$ 3,056		
Power Engineers	PD	2	$ 780	$ 1,560		
			Sub-Total	$ 55,436		
Term Labour						
Maint. Trades	PD	144	$ 365	$ 52,529		
Utility Workers	PD	76	$ 240	$ 18,254		
Power Plant Technician	PD	4	$ 382	$ 1,528		
			Sub-Total	$ 72,311		
Travel Expense						
Travel Expenses	lot	1	$ 10,000	$ 10,000		
			Sub-Total	$ 10,000		
Materials						
Row 7-10 Spindle Blades	lot	1	[redacted]		Attachment 1 Item 0001	
Machined Shrouds	lot	1			Attachment 1 Item 0002	
Row 7 Cyl Seal Segment	ea	12			Attachment 1 Item 0008	
Row 9 Cyl Seal Segment	ea	12			Attachment 1 Item 0009	
Row 8 Cyl Seal Segment	ea	12			Attachment 1 Item 0010	
Row 10 Cyl Seal Segment	ea	12			Attachment 1 Item 0011	
Stock Turbine Parts	lot	1	$ 50,000	$ 50,000		
Foreign Material Exclusion Kit	lot	1	$ 15,000	$ 15,000		
			Sub-Total	$ 666,415		
Contracts						
OEM Support Including Craft Labour	lot	1	$ 1,385,600	$ 1,385,600		
NDE Inspections	lot	1	$ 25,000	$ 25,000		
Sandblasting Subcontractor	lot	1	$ 80,000	$ 80,000		
Steam Path Audit	lot	1	$ 50,000	$ 50,000		
				$ -		
			Sub-Total	$ 1,540,600		
Consulting						
Project Management	lot	1	$ 20,000	$ 20,000		
Technical Consulting (Project Preparation)	lot	1	$ 37,500	$ 37,500		
			Sub-Total	$ 57,500		
Meals & Entertainment						
Meals and Expenses	Lot	1	$ 2,000	$ 2,000		
			Sub-Total	$ 2,000		
Other Goods & Services						
Contingency	%	10%	$ 2,458,399	$ 245,840		
			Sub-Total	$ 245,840		
Interest Capitalized						
AFUDC				$ 9,279		
				$ -		
			Sub-Total	$ 9,279		
Administrative Overhead						
Labour AO				$ 40,278		
Contracts AO				$ 185,194		
			Sub-Total	$ 225,472		
			SUB-TOTAL (no AO, AFUDC)	$ 2,704,239		
			TOTAL (AO, AFUDC included)	$ 2,938,990		
Original Cost				$ 354,202		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

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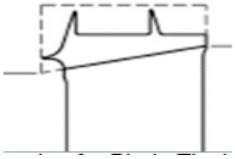
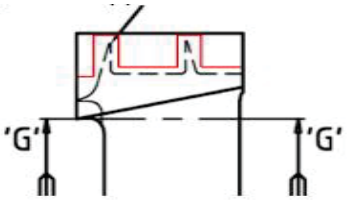
Ref: Our SF171174763 Rev 2
NOVA SCOTIA POWER RFQ # NSP-POT2 2019 OUTAGE

Date: **June 29, 2018**

To: GREG CARLIN

Subject: **PROPOSAL FOR NSPI-PT2-STG MAJOR INSPECTION 2019 OUTAGE SPARES**

With reference to your requirement, we are pleased to provide the following revised proposal for your consideration.

RFQ ITEM	DESCRIPTION	UNIT PRICE CDN $	Total Price CDN $	EST DELIVERY (ARO)
0001	Rows 7-10 IP Spindle Blades Scope includes fixings & fastenings required for installation Please Note: All rotating blading will be supplied with the shroud left as block for turning during assembly to the rotor at site.  On site machining drawing for Blade Tipping will be provided. QTY: 1 SET	[redacted]	[redacted]	25 Working Weeks
0002	Option to rough machine shrouds All Rotating blading to be supplied with shrouds part machined (see sketch below).  On site machining drawing for Blade Tipping will be provided. QTY: 1 SET	[redacted]	[redacted]	25 Working Weeks

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0003	HP Cylinder Seals Rows 1 - 5 Supplied with fittings With following configuration: Assembly Drawing No.: SA142087.001 – 17 QTY: 1 PC	[redacted]	[redacted]	21 WORKING WEEKS
0004	LH Intercept Cover (drilled) With following configuration: Assembly Drawing No.: SL17254.002 Detail Drawing No.: 47AM1188 QTY: 1 PC	[redacted]	[redacted]	27 WORKING WEEKS
0005	Intercept Valve Top Bush With following configuration: Assembly Drawing No.: SL17254.007 Detail Drawing No.: 47AU1157 QTY: 1 PC	[redacted]	[redacted]	21 WORKING WEEKS
0006	Intercept Valve Bottom Bush With following configuration: Assembly Drawing No.: SL17254.008 Detail Drawing No.: 47AU1195 QTY: 1 PC	[redacted]	[redacted]	21 WORKING WEEKS
0007	Nozzle Quadrants 1 set of Nozzle Quadrants per the following Drawing and Mk numbers. Assembly Drawing: 24MC61517 Mk Numbers: 1, 2, 3, 4, 5 ,6, 7, 8. QTY : 1 SET	[redacted]	[redacted]	20 WORKING WEEKS
0008	ROW 7 CYL. SEAL SEGMENT With following configuration: Assembly Drawing No.: SA142335 Detail Drawing No.: 25AA313949 QTY: 12 PCS	[redacted]	[redacted]	19 WORKING WEEKS

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0009	ROW 9 CYL. SEAL SEGMENT With following configuration: Assembly Drawing No.: SA142335 Detail Drawing No.: 25AA313951 QTY: 12 PCS	[redacted]	[redacted]	19 WORKING WEEKS
0010	ROW 8 CYL. SEAL SEGMENT With following configuration: Assembly Drawing No.: SA142335 Detail Drawing No.: 25AA313950 QTY: 12 PCS	[redacted]	[redacted]	19 WORKING WEEKS
0011	ROW 10 CYL. SEAL SEGMENT With following configuration: Assembly Drawing No.: SA142335 Detail Drawing No.: 25AA313952 QTY: 12 PCS	[redacted]	[redacted]	19 WORKING WEEKS
	TOTAL PROPOSAL PRICE		[redacted]	

Prices: Price shown is in Canadian funds, include any import duties that may be applicable, FOB Point Tupper GS, INCO Term 2010 but do not include any taxes. Price shown is also based on the quantities quoted. Should the order quantity differ from the quoted quantity, we reserve the right to amend the prices.

Location of Supply: Siemens PLC UK.
A Division of Siemens Power Generation
Newcastle UK.

Validity: This proposal is valid for a period of 90 days from date of submission, unless extended, modified or withdrawn by Siemens Energy Services and limits acceptance to the terms set forth herein. The return of a purchase order or any other reasonable manner of acceptance communicated to Siemens during such validity period will be sufficient to form an agreement on the terms and conditions of this offer.

Due to recent significant movements in material costs and availability, our offer is subject to review beyond the validity period.

Environmental, Health & Safety:

This offer is based on Siemens' "Zero Harm" program and in accordance with COR Certification Requirements. Siemens EHS program is outlined in a Priority One Plan.

Quality Program:

This offer is based on a Quality Program in accordance with ISO 9001:2015.

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Terms of Payment:

Net 30 days. Overdue accounts will be charged a 2% per month carrying Charge.

Conditions of Sale:

All work performed for the supply of hardware associated with the parts in this proposal shall be completed in accordance with the Siemens terms and conditions as defined in the Selling Policy 1200C.

If we fail to dispatch the parts within the time quoted or within any extension thereof and as a result NSPI suffers a loss, we undertake to pay for each week or part week of delay liquated damages at the rate of 0.5% per week up to maximum of 10% of the hardware value.

Limitation of Liability: Notwithstanding any other provisions of this Contract, in no event shall the aggregate liability of Siemens Canada or its affiliates, partners and subcontractors exceed the final agreed Contract Price or any agreed increase to the Contract Price.

Siemens obligation to fulfill this agreement is subject to the proviso that the fulfillment is not prevented by any impediments arising out of national or international foreign trade and customs requirements or any embargos [or other sanctions].

Feel free to contact us should you have any questions. We look forward to receive your purchase order.

Regards,

IJAZ IMRAN
Digitally signed by IJAZ IMRAN
DN: cn=IJAZ IMRAN, o=Siemens, email=imran.ijaz@siemens.com
Reason: I have reviewed this document
Location: Oakville
Date: 2018.06.29 10:12:43 -04'00'

Digitally signed by JERMARK JASON
DN: cn=JERMARK JASON, o=Siemens, email=jason.jermark@siemens.com
Date: 2018.06.29 11:25:31 -04'00'

Imran Ijaz
Sales Manager
imran.ijaz@siemens.com

Senior Management Approval

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CI Number: C0010142

Title: POT HP Turbine Refurbishment

Start Date: 2018/08
In-Service Date: 2019/07
Final Cost Date: 2020/01
Function: Steam
Forecast Amount: $1,813,421

DESCRIPTION:

This project includes the replacement of the Point Tupper Unit 2 steam turbine High Pressure (HP) cylinder bolting (bolts and studs) to allow for the continued safe and reliable operation of the steam turbine. The HP cylinder bolts and studs, which are exposed to operating temperatures in excess of 1000 degrees Fahrenheit, are monitored for replacement as described in NS Power's Thermal Maintenance Practice (TMP) - Steam Turbine - High Temperature Bolting Maintenance Practice.

The function of these bolts is to maintain a tight joint with no steam leakage into other sections of the turbine or into the plant.

The project will also include other refurbishments including replacement of spring back seals and inspection and possible replacement of HP Turbine Control Stage Nozzle and other items that may be discovered during inspection.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2019 C0010141 POT IP/LP turbine refurbishment $2,938,990
- 2019 C0010498 POT Turbine valve refurbishment $698,497

Depreciation Class: Steam Production Plant – Point Tupper Unit 2

Estimated Life of the Asset: 8 Years

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

Due to limited rupture ductility of high temperature materials, studs and bolts have a finite service life. The Point Tupper Unit 2 HP cylinder bolts and studs are exposed to steam temperatures in excess of 1000 degrees Fahrenheit, with an operating pressure of 1,800 PSI at the HP steam inlet.

The function of these bolts is to maintain a tight joint with no steam leakage into other sections of the turbine or into the plant. Steam leaking from high pressure joints is a critical safety issue, that also lowers the efficiency of the unit. Forced outages and repairs could be required to address the failures to the turbine caused by broken bolts in the HP section. Additionally, leaking joints within the steam turbine can result in steam bypassing portions of the intended steam path and loss of efficiency.

Spring seals provide proper steam flow through the turbine for maximum efficiency. The Control Stage Nozzle directs steam flow and may require replacement pending results of inspection per Original Equipment Manufacturer (OEM) recommendations and service bulletins.

Why do this project now?

These bolts have reached the end of their life span based on the OEM recommended calculation method and NS Power's Thermal Maintenance Practice. The basic criteria for evaluating the consumed life for steam turbine high temperature bolts are the material, number of times the bolts have been tightened, number of unit start/stop cycles, running hours, bolt operating temperature and critical maintenance data. OEM recommended consumed life calculations indicate that Unit 2 HP cylinder bolts and studs are now at the end of their life span and must be replaced.

To continue with the current bolts would pose an unacceptable risk to safety and the reliable operation of the unit. This project needs to be completed now to mitigate the safety and reliability risk due to the failure of the HP cylinder bolting. Replacement of the spring back seals is expected based on previous inspections. Replacement of the Control Stage Nozzles is expected as per OEM product Bulletin PB3-08-9001-ST-EN-01 (Confidential Attachment 1).

Why do this project this way?

Refurbishment of the HP turbine through component replacement as required versus complete replacement is the most cost effective mitigating measure that will ensure safe and reliable operation of the Steam Turbine. In addition to allowing for continued safe and reliable operation of the turbine is maintained, completing the HP turbine refurbishment during the 2019 planned outage will allow for efficient operation of the unit and will meet NS Power's asset management strategy.

CI Number : C0010142 - POT HP Turbine Refurbishment **Project Number** C0010142

Parent CI Number : -

Asset Location : 1152 - 1152 Point Tupper Unit 2 **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1000 - SGP - Turbo Gen.Instal.	1,266,045
Retirements	1000 - SGP - Turbo Gen.Instal.	547,376
	Total Cost:	1,813,421
	Original Cost:	1,141,997

Capital Project Detailed Estimate

Location: Point Tupper Generating Station
CI# : C0010142
Title: POT HP Turbine Refurbishment
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	10	$ 358	$ 3,583		
Engineering	PD	10	$ 405	$ 4,053		
Maintenance Trades	PD	40	$ 365	$ 14,591		
Utility Worker	PD	30	$ 240	$ 7,205		
			Sub-Total	$ 29,433		
OT Labour						
Maintenance Trades	PD	20	$ 730	$ 14,591		
Utility Worker	PD	20	$ 480	$ 9,607		
			Sub-Total	$ 24,199		
Term Labour						
Electrician	PD	10	$ 358	$ 3,583		
Maintenance Trades	PD	40	$ 365	$ 14,591		
Utility Worker	PD	30	$ 240	$ 7,205		
			Sub-Total	$ 25,380		
Travel Expense						
Travel	lot	1	$ 10,000	$ 10,000		
			Sub-Total	$ 10,000		
Materials						
HP Cylinder Seals	lot	1	[redacted]		Attachment 2 Item 0003	
HP Nozzle Quadrants	lot	1			Attachment 2 Item 0007	
Spacer Ring	lot	1			Attachment 3	
Life Expired Bolting	lot	1			Attachment 4	
High Temperature Bolting	lot	30	$ 300	$ 9,000		
			Sub-Total	$ 437,135		
Contracts						
OEM support and Craft Labour	lot	1	$ 866,000	$ 866,000		
NDE and Other Testing	lot	1	$ 25,000	$ 25,000		
			Sub-Total	$ 891,000		
Consulting						
Project Oversight	lot	1	$ 70,000	$ 70,000		
Project Preparation Technical Consulting	lot	1	$ 37,500	$ 37,500		
			Sub-Total	$ 107,500		
Overtime Meals						
Overtime Meals	lot	1	$ 1,000	$ 1,000		
			Sub-Total	$ 1,000		
Meals						
Meals	lot	1	$ 1,000	$ 1,000		
			Sub-Total	$ 1,000		
Other Goods & Services						
Contingency	%	10%	$ 1,526,646	$ 152,665		
			Sub-Total	$ 152,665		
Interest Capitalized						
AFUDC				$ 9,519		
			Sub-Total	$ 9,519		
Administrative Overhead						
Labour AO				$ 17,476		
Contracts AO				$ 107,116		
			Sub-Total	$ 124,592		
			SUB-TOTAL (no AO, AFUDC)	$ 1,679,310		
			TOTAL (AO, AFUDC included)	$ 1,813,421		
Original Cost				$ 1,141,997		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

C0010142 Attachment 1 has been removed due to confidentiality.

SIEMENS

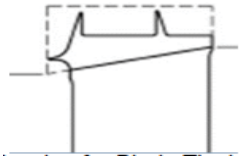
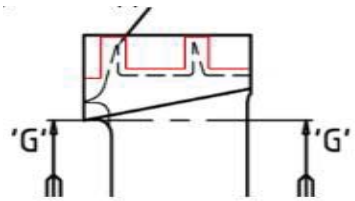
Ref: Our SF171174763 Rev 1
NOVA SCOTIA POWER RFQ # NSP-POT2 2019 OUTAGE

Date: **June 19, 2018**

To: GREG CARLIN

Subject: **PROPOSAL FOR NSPI-PT2-STG MAJOR INSPECTION 2019 OUTAGE SPARES**

With reference to your requirement, we are pleased to provide the following proposal for your consideration.

RFQ ITEM	DESCRIPTION	UNIT PRICE CDN $	Total Price CDN $	EST DELIVERY (ARO)
0001	Rows 7-10 IP Spindle Blades Scope includes fixings & fastenings required for installation Please Note: All rotating blading will be supplied with the shroud left as block for turning during assembly to the rotor at site.  On site machining drawing for Blade Tipping will be provided. QTY: 1 SET	[redacted]	[redacted]	25 Working Weeks
0002	Option to rough machine shrouds All Rotating blading to be supplied with shrouds part machined (see sketch below).  On site machining drawing for Blade Tipping will be provided. QTY: 1 SET	[redacted]	[redacted]	25 Working Weeks

Siemens Canada Limited
Power Generation Services
1577 North Service Road
Oakville, Ontario L6H 0H6

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0003	HP Cylinder Seals Rows 1 - 5 Supplied with fittings With following configuration: Assembly Drawing No.: SA142087.001 – 17 QTY: 1 PC	[redacted]	[redacted]	21 WORKING WEEKS
0004	LH Intercept Cover With following configuration: Assembly Drawing No.: SL17254.002 Detail Drawing No.: 47AM1188 QTY: 1 PC	[redacted]	[redacted]	27 WORKING WEEKS
0005	Intercept Valve Top Bush With following configuration: Assembly Drawing No.: SL17254.007 Detail Drawing No.: 47AU1157 QTY: 1 PC	[redacted]	[redacted]	21 WORKING WEEKS
0006	Intercept Valve Bottom Bush With following configuration: Assembly Drawing No.: SL17254.008 Detail Drawing No.: 47AU1195 QTY: 1 PC	[redacted]	[redacted]	21 WORKING WEEKS
0007	Nozzle Quadrants 1 set of Nozzle Quadrants per the following Drawing and Mk numbers. Assembly Drawing: 24MC61517 Mk Numbers: 1, 2, 3, 4, 5 ,6, 7, 8. QTY : 1 SET	[redacted]	[redacted]	20 WORKING WEEKS
0008	ROW 7 CYL. SEAL SEGMENT With following configuration: Assembly Drawing No.: SA142335 Detail Drawing No.: 25AA313949 QTY: 12 PCS	[redacted]	[redacted]	19 WORKING WEEKS

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0009	ROW 9 CYL. SEAL SEGMENT With following configuration: Assembly Drawing No.: SA142335 Detail Drawing No.: 25AA313951 QTY: 12 PCS	[redacted]	[redacted]	19 WORKING WEEKS
0010	ROW 8 CYL. SEAL SEGMENT With following configuration: Assembly Drawing No.: SA142335 Detail Drawing No.: 25AA313950 QTY: 12 PCS	[redacted]	[redacted]	19 WORKING WEEKS
0011	ROW 10 CYL. SEAL SEGMENT With following configuration: Assembly Drawing No.: SA142335 Detail Drawing No.: 25AA313952 QTY: 12 PCS	[redacted]	[redacted]	19 WORKING WEEKS
	TOTAL PROPOSAL PRICE		[redacted]	

Prices: Price shown is in Canadian funds, include any import duties that may be applicable, FOB Point Tupper GS, INCO Term 2010 but do not include any taxes. Price shown is also based on the quantities quoted. Should the order quantity differ from the quoted quantity, we reserve the right to amend the prices.

Location of Supply: Siemens PLC UK.
A Division of Siemens Power Generation
Newcastle UK.

Validity: This proposal is valid for a period of 90 days from date of submission, unless extended, modified or withdrawn by Siemens Energy Services and limits acceptance to the terms set forth herein. The return of a purchase order or any other reasonable manner of acceptance communicated to Siemens during such validity period will be sufficient to form an agreement on the terms and conditions of this offer.

Due to recent significant movements in material costs and availability, our offer is subject to review beyond the validity period.

Environmental, Health & Safety:

This offer is based on Siemens' "Zero Harm" program and in accordance with COR Certification Requirements. Siemens EHS program is outlined in a Priority One Plan.

Quality Program:

This offer is based on a Quality Program in accordance with ISO 9001:2015.

SIEMENS

Terms of Payment:

Net 30 days. Overdue accounts will be charged a 2% per month carrying Charge.

Conditions of Sale:

All work performed for the supply of hardware associated with the parts in this proposal shall be completed in accordance with the Siemens terms and conditions as defined in the Selling Policy 1200C.

If we fail to dispatch the parts within the time quoted or within any extension thereof and as a result NSPI suffers a loss, we undertake to pay for each week or part week of delay liquated damages at the rate of 0.5% per week up to maximum of 10% of the hardware value.

Limitation of Liability: Notwithstanding any other provisions of this Contract, in no event shall the aggregate liability of Siemens Canada or its affiliates, partners and subcontractors exceed the final agreed Contract Price or any agreed increase to the Contract Price.

Siemens obligation to fulfill this agreement is subject to the proviso that the fulfillment is not prevented by any impediments arising out of national or international foreign trade and customs requirements or any embargos [or other sanctions].

Feel free to contact us should you have any questions. We look forward to receive your purchase order.

Regards,

IJAZ IMRAN

Digitally signed by IJAZ IMRAN
DN: cn=IJAZ IMRAN, o=Siemens, email=imran.ijaz@siemens.com
Reason: I have reviewed this document
Location: Oakville
Date: 2018.06.19 09:26:31 -04'00'

Digitally signed by JERMARK JASON
DN: cn=JERMARK JASON, o=Siemens, email=jason.jermark@siemens.com
Date: 2018.06.25 08:05:55 -04'00'

Imran Ijaz
Sales Manager
imran.ijaz@siemens.com

Senior Management Approval

SIEMENS

Ref: OUR SF181292418
RFQ ref TBA

Date: 12-Aug-18

To: Ray Barrett

Subject: PROPOSAL FOR HP / IP PATCH PLATE

With reference to your requirement, we are pleased to provide the following proposal for your consideration.

ITEM	DESCRIPTION	UNIT PRICE CDN$	Total Price CDN$	EST DELIVERY (ARO)
0001	Spacer Ring NOTE: 11/16" thick patch plate will be supplied with a 3/16" machining allowance for final adjustment during installation at site. Assembly Drawing No.: 30MC61620.008 Detail Drawing No.: 30MC61621 QTY: 1 PC	[redacted]	[redacted]	15 WORKING WEEKS
TOTAL PROPOSAL PRICE			[redacted]	

Prices: Price shown is in Canadian funds, include any import duties that may be applicable, FOB Pt. Tupper, NSPI, but do not include any taxes. Price shown is also based on the quantities quoted. Should the order quantity differ from the quoted quantity, we reserve the right to amend the prices.

Location of Supply: Siemens plc, C.A. Parsons Works, Division E FP, Newcastle Upon Tyne UK

Validity:

This proposal is valid for a period of 60 days from date of submission, unless extended, modified or withdrawn by Siemens Canada Limited and limits acceptance to the terms set forth herein. The return of a purchase order or any other reasonable manner of acceptance communicated to Siemens during such validity period will be sufficient to form an agreement on the terms and conditions of this offer.

Due to recent significant movements in material costs and availability, our offer is subject to review beyond the validity period.

Siemens Canada Limited
Power Generation Services
1577 North Service Road
Oakville, Ontario L6H 0H6

SIEMENS

ref TBA

Environmental, Health & Safety:

This offer is based on Siemens' "Zero Harm" program and in accordance with COR Certification Requirements. Siemens EHS program is outlined in a Priority One Plan.

Quality Program:

This offer is based on a Quality Program in accordance with ISO 9001

Terms of Payment:

Net 30 days. Overdue accounts will be charged a 2% per month carrying Charge.

Conditions of Sale:

All work performed for the supply of hardware associated with the parts in this proposal shall be completed in accordance with the Siemens terms and conditions as defined in the Selling Policy 1200C (copy attached) except as modified in this proposal.

Limitation of Liability: Notwithstanding any other provisions of this Contract, in no event shall the aggregate liability of Siemens Canada or its affiliates, partners and subcontractors exceed the final agreed Contract Price or any agreed increase to the Contract Price.

Siemens obligation to fulfill this agreement is subject to the proviso that the fulfillment is not prevented by any impediments arising out of national or international foreign trade and customs requirements or any embargos [or other sanctions].

Feel free to contact us should you have any questions. We look forward to receive your purchase order.

Regards,

IJAZ IMRAN

Digitally signed by IJAZ IMRAN
DN: cn=IJAZ IMRAN, o=Siemens, email=imran.ijaz@siemens.com
Reason: I have reviewed this document
Location: Oakville
Date: 2018.08.12 23:06:02 -04'00'

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Imran Ijaz
Sales Manager
Imran.ijaz@siemens.com

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Selling Policy 1200C

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SIEMENS

Ref: Siemens - SF181294660 Rev 1
NSPI RFQ ref TBA

Date: 20-Aug-18

To: Ray Barrett
CC: Brent MacLeod

Subject: BUDGETARY PROPOSAL – MAJOR INSPECTION OF LIFE EXPIRED BOLTING FOR HP & IP CYLINDER

With reference to your requirement, we are pleased to provide the following budgetary proposal for your consideration.

Item #	Arrgt Drg	Assembly Drawing	Mk No.	Description	Qty	Comments
1	307-41110-008	20MC61645	48	7/8" UNF Nuts for Eccentric Bushes Studs (Ref. 47)	24	
2	307-41110-008	20MC61645	49	5/8" UNF Studs for Gland & Steam Cond. Facings	16	A = 2-3/16"
3	307-41110-008	20MC61645	50	5/8" UNF Studs for Gland & Leak Off	8	A = 2-3/8"
4	307-41110-008	20MC61645	51	5/8" UNF Studs for Gland & Leak Off	8	A = 2-3/16"
5	307-41110-008	20MC61645	52	5/8" UNF Nuts for Refs. 49, 50, 51, & 57	40	
6	307-41110-008	20MC61645	56	3/4" UNF Studs for Special Flange (Ref. 27)	4	A = 3"
7	307-41110-008	20MC61645	57	5/8" UNF Studs for Cooling Steam Facing	8	A = 2-1/2"
8	307-41110-008	20MC61645	58	Flange for Ref. 19 Lad SM 3/4" Bore Slip on Scoid Table	1	
9	307-41110-008	20MC61645	59	3/4" UNF Nuts for Ref. 55 (Jack Screws)	4	
10	307-41110-008	20MC61645	63	1/2" UNF Studs for Press Gauge Connection	8	A = 2"
11	307-41110-008	20MC61645	64	1/2" UNF Nuts for Ref. 63	8	
12	307-41110-008	20MC61645	65	3/4" UNF Studs for Flange (Ref. 58)	8	
13	307-41110-008	20MC61645	66	3/4" UNF Nuts for Ref. 65	8	
14	307-41110-009	20MC61646	34	7/8" UNF Studs for Equalizing Branches	32	A = 3-5/8"
15	307-41110-009	20MC61647	35	5/8" UNF Studs for Gland Leak-Off Connections	4	
16	307-41110-009	20MC61648	36	5/8" UNF Studs for Gland Steam	16	Shorten to

SIEMENS

NSPI

				& Condenser Connections		2-5/16"
17	307-41110-009	20MC61650	52	7/8" UNF Nuts for Ref. 34	48	
18	307-41110-009	20MC61651	53	5/8" UNF Nuts for Ref. 35, 36, & 39	60	
19	307-41110-009	20MC61652	82	7/8" UNF Studs for Shaft Cooling	8	
20	307-41110-009	20MC61653	83	7/8" UNF Nuts for Ref. 82	8	
21	307-41110-010	SMC64503	9	3/4" UNF Socket Head Screw Caps	4	
22	307-41110-008	SMC 61645	-	7/8" UNF Studs	12	
23	307-41110-008	SMC 61645	-	7/8" UNF Studs	4	
24	307-41110-008	SMC 61645	-	5/8" UNF Studs	8	
25	307-41110-008	SMC 61645	-	1/2" UNF Studs	8	
26	307-41110-008	SMC 61645	-	3/4" UNF Socket Head Cap Screws	8	
27	307-41110-008	SMC 61645	-	5/8" UNF Studs	4	
28	307-41110-008	SMC 61645	-	5/8" UNF Studs	4	
29	307-41110-008	SMC 61645	-	5/8" UNF Studs	4	
30	307-41110-008	SMC 61645	-	5/8" UNF Studs	4	
31	307-41110-009	20MC61646	-	7/8" UNF Studs for Equalizing Branches	8	
32	307-41110-009	20MC61646	-	5/8" UNF Studs for Steam to Gland Condenser	8	
33	307-41110-009	20MC61646	-	5/8" UNF Studs	4	
34	307-41110-009	20MC61646	-	5/8" UNF Studs	4	

Lead time: 15 weeks for the full order after PO has been issued.

Total Budgetary Price [redacted]

Prices: Price shown is in Canadian funds, include any import duties that may be applicable, FOB Point Tupper, NSPI, but do not include any taxes. Price shown is also based on the quantities quoted. Should the order quantity differ from the quoted quantity, we reserve the right to amend the prices.

Location of Supply: Siemens plc, C.A. Parsons Works, Division E FP, Newcastle Upon Tyne UK

SIEMENS

NSPI

Validity:

This proposal is valid for a period of 60 days from date of submission, unless extended, modified or withdrawn by Siemens Canada Limited and limits acceptance to the terms set forth herein. The return of a purchase order or any other reasonable manner of acceptance communicated to Siemens during such validity period will be sufficient to form an agreement on the terms and conditions of this offer. Due to recent significant movements in material costs and availability, our offer is subject to review beyond the validity period.

Environmental, Health & Safety:

This offer is based on Siemens' "Zero Harm" program and in accordance with COR Certification Requirements. Siemens EHS program is outlined in a Priority One Plan.

Quality Program:

This offer is based on a Quality Program in accordance with CSA Z299.4

Terms of Payment:

Net 30 days. Overdue accounts will be charged a 2% per month carrying Charge.

Conditions of Sale:

All work performed for the supply of hardware associated with the parts in this proposal shall be completed in accordance with the Siemens terms and conditions as defined in the Selling Policy 1200C (copy attached) except as modified in this proposal.

Limitation of Liability: Notwithstanding any other provisions of this Contract, in no event shall the aggregate liability of Siemens Canada or its affiliates, partners and subcontractors exceed the final agreed Contract Price or any agreed increase to the Contract Price.

Siemens obligation to fulfill this agreement is subject to the proviso that the fulfillment is not prevented by any impediments arising out of national or international foreign trade and customs requirements or any embargos [or other sanctions].

Feel free to contact us should you have any questions. We look forward to receive your purchase order.

Regards,

IJAZ IMRAN

Digitally signed by IJAZ IMRAN
DN: cn=IJAZ IMRAN, o=Siemens, email=imran.ijaz@siemens.com
Reason: I have reviewed this document
Location: Oakville
Date: 2018.08.20 08:59:53 -04'00'

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Imran Ijaz
Sales Manager
Imran.ijaz@siemens.com

CI Number: C0010718

Title: TRE5 Turbine Main Valve Refurbishment

Start Date: 2019/10
In-Service Date: 2019/10
Final Cost Date: 2020/04
Function: Steam
Forecast Amount: $730,005

DESCRIPTION:

This project addresses the component replacement of the turbine main steam and control valves on the Trenton Generating Station's Unit 5 Turbine. This will include replacement or refurbishment of valve stems and bushings, hydraulic valves and control oil pressure regulators.

The Trenton Unit 5 turbine is a Parsons unit which produces approximately 150 MW at full load. It has been in service since 1969. The primary function of the main steam valves is to regulate the steam flow to the turbine, and thus control the power output of the steam turbine generator. The turbine control valves interrupt the steam flow promptly during an emergency trip and cuts-off the steam supply when the unit is shut down. These valves are critical components of the steam turbine. Their functionality and reliability are necessary to the safe operation of the unit.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2018 CI 51820 TRE5 Reheat Turbine Valves $450,408

JUSTIFICATION:

Justification Criteria: Health & Safety

Why do this project?

Refurbishment intervals on these valves are a function of the unit's Utilization Factor, which is determined based on operating hours, cycles and asset condition. Annual planning efforts consider these factors to determine the timing and scope of the Turbine Valve refurbishment. This risk-based approach based on the maintenance strategy has determined that these valve refurbishments should be scheduled in 2019. These maintenance strategies are developed through Original Equipment Manufacturer (OEM) experience, Third Party Industry Experts, and NS Power's operating experience. Failure to execute on these maintenance strategies puts the unit at risk of valve failure which could result in steam leaks, loss of turbine control, and/or forced outages.

Why do this project now?

Completing this project as part of the 2019 planned outage will mitigate the risk of unplanned outages. It will address possible valve failures, which could occur by operating the unit with out of tolerance components (physical dimensions have worn past OEM standards). A valve failure could lead to a potential over-speed event, which would put NS Power personnel in the plant at risk and would include significant damage to the turbine and other plant equipment.

Why do this project this way?

The refurbishment work is recommended in accordance with NS Power's asset management strategy. Total valve replacement is another alternative but is a more costly option and not considered necessary at this time.

CI Number : C0010718 - TRE5 Turbine Main Valve Refurbishment **Project Number** C0010718

Parent CI Number : -

Asset Location : 1165 - 1165 Trenton Unit 5; Commissioned 1969, 160 Mwh **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1000 - SGP - Turbo Gen.Instal.	604,109
Retirements	1000 - SGP - Turbo Gen.Instal.	125,896
	Total Cost:	730,005
	Original Cost:	568,970

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI# : C0010718
Title: TRE5 Turbine Main Valve Refurbishment
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	4	$ 358	$ 1,433		
Engineering	PD	5	$ 405	$ 2,027		
Maintenance Trades	PD	10	$ 365	$ 3,648		
Power Plant Technician	PD	6	$ 382	$ 2,293		
Power Engineer	PD	10	$ 390	$ 3,904		
Utility Worker	PD	10	$ 240	$ 2,402		
			Sub-Total	$ 15,706		C0003739
OT Labour						
Maintenance Trades	PD	20	$ 730	$ 14,600		
			Sub-Total	$ 14,600		C0003739
Term Labour						
Maintenance Trades	PD	20	$ 365	$ 7,296		
			Sub-Total	$ 7,296		
Materials						
Turbine Valve Parts	lot	1	$ 150,000	$ 150,000		C0003739
			Sub-Total	$ 150,000		
Contracts						
Technical Field Advice	lot	1	$ 150,000	$ 150,000		C0003739
External Supervision	lot	1	$ 15,000	$ 15,000		
Insulation Services	lot	1	$ 20,000	$ 20,000		
Inspection Services	lot	1	$ 20,000	$ 20,000		
Contract Labour	lot	1	$ 190,000	$ 190,000		C0003739
			Sub-Total	$ 395,000		
Freight						
	lot	1	$ 20,000	$ 20,000		
				$ -		
			Sub-Total	$ 20,000		
Consulting						
Consulting	lot	1	$ 17,000	$ 17,000		
				$ -		
			Sub-Total	$ 17,000		
OT Meals						
	lot	1	$ 500	$ 500		
				$ -		
			Sub-Total	$ 500		
Other Goods & Services						
Contingency	%	10%	$ 545,000	$ 54,500		
				$ -		
			Sub-Total	$ 54,500		
Administrative Overhead						
Labour AO				$ 7,917		
Contracts AO				$ 47,487		
			Sub-Total	$ 55,403		
			SUB-TOTAL (no AO, AFUDC)	$ 674,601		
			TOTAL (AO, AFUDC included)	$ 730,005		
Original Cost				$ 568,970		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0010498

Title: POT Turbine Valve Refurbishment

Start Date: 2019/04
In-Service Date: 2019/07
Final Cost Date: 2020/01
Function: Steam
Forecast Amount: $698,497

DESCRIPTION:

This project is to replace the left hand intercept valve cover on Point Tupper Unit 2 turbine and to perform refurbishment on both left and right hand intercept valves. Both left and right hand valves are at their allocated hours for overhaul and need to be opened for inspection and refurbishment.

The primary function of these valves is to regulate the steam flow to the turbine, and thus control the power output of the steam turbine generator. These valves are critical components of the steam turbine. Their functionality and reliability are necessary to the safe operation of the unit.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2019 C0010141 POT – IP/LP turbine refurbishment $2,938,990
- 2019 C0010142 POT – HP Turbine Refurbishment $1,813,421

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

The turbine intercept valves are critical to the safe operation of the turbine. Failure of these components to operate as required could lead to various levels of damage to the turbine. Refurbishment will address possible valve failures, which could occur by operating the unit with out of tolerance components (physical dimensions have worn past Original Equipment Manufacturer (OEM) standards).

The Left Hand Intercept Valve cover is original to 1973. The cover had a crack identified at a recent overhaul interval that required an extensive weld repair to enable a return to service. The OEM considers the repair activity to be a temporary solution and recommends the cover be replaced. The cover is being replaced to reduce risk of the crack propagating to a failure point.

Why do this project now?

The left and right hand valves have reached a refurbishment interval based on thermal maintenance practices and unit utilization. This risk based approach has determined that these valves require refurbishments in 2019.

Replacement of the Left Hand Intercept Valve cover will mitigate deterioration risks and reduce complex re-inspection and revalidation activities associated with the weld repair during future refurbishment intervals.

Why do this project this way?

Disassembly and inspection during an outage is the only method of assessing the condition and all the failure mechanisms associated with these valves.

Refurbishment of the left and right hand valves is lower cost than complete replacement. Completing the intercept valve cover replacement in conjunction with the refurbishment activity is the best use of resources since both activities require equipment disassembly.

CI Number : C0010498 - POT Turbine Valve Refurbishment

Project Number C0010498

Parent CI Number : -

Asset Location : 1152 - 1152 Point Tupper Unit 2

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1000 - SGP - Turbo Gen.Instal.	554,331
Retirements	1000 - SGP - Turbo Gen.Instal.	144,166
	Total Cost:	698,497
	Original Cost:	500,017

Capital Project Detailed Estimate

Location: Point Tupper Generating Station
CI# : C0010498
Title: POT Turbine Valve Refurbishment
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	10	$ 358	$ 3,583		
Maintenance Trades	PD	80	$ 365	$ 29,183		
Utility Worker	PD	10	$ 240	$ 2,402		
			Sub-Total	$ 35,168		
OT Labour						
Maintenance Trades	PD	34	$ 730	$ 24,805		
			Sub-Total	$ 24,805		
Term Labour						
Maintenance Trades	PD	80	$ 365	$ 29,183		
			Sub-Total	$ 29,183		
Materials						
LH Intercept Cover	ea	1	[redacted]		Attachment 1, Item 0004	
Intercept Valve Top Bush	ea	2			Attachment 1, Item 0005	
Intercept Valve Bottom Bush	ea	2			Attachment 1, Item 0006	
Stock Materials	lot	1	$ 45,915	$ 45,915		
P1 Cover and Bushings	ea	1	$ 89,345	$ 89,345		
Misc. and Consumables	lot	1	$ 5,000	$ 5,000		
			Sub-Total	$ 284,345		
Contracts						
OEM Support and Craft Labour	lot	1	$ 129,900	$ 129,900		
NDE	lot	1	$ 20,000	$ 20,000		
Sandblasting	lot	1	$ 10,000	$ 10,000		
			Sub-Total	$ 159,900		
Consulting						
Project Oversight	lot	1	$ 10,000	$ 20,000		
Project Preparation Technical Consulting	lot	1	$ 37,500	$ 37,500		
			Sub-Total	$ 57,500		
Rentals						
Rentals	lot	1	$ 5,000	$ 5,000		
			Sub-Total	$ 5,000		
Other Goods & Services						
Contingency	%	10%	$ 590,901	$ 59,090		
			Sub-Total	$ 59,090		
Interest Capitalized						
AFUDC				$ 4,231		
			Sub-Total	$ 4,231		
Administrative Overhead						
Labour AO				$ 20,053		
Contracts AO				$ 19,223		
			Sub-Total	$ 39,276		
			SUB-TOTAL (no AO, AFUDC)	$ 654,991		
			TOTAL (AO, AFUDC included)	$ 698,497		
Original Cost				$ 500,017		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

SIEMENS

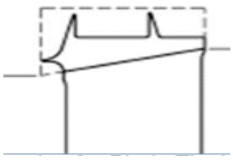
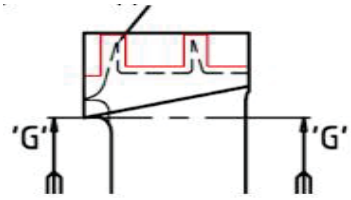
Ref: Our SF171174763 Rev 2
NOVA SCOTIA POWER RFQ # NSP-POT2 2019 OUTAGE

Date: **June 29, 2018**

To: GREG CARLIN

Subject: **PROPOSAL FOR NSPI-PT2-STG MAJOR INSPECTION 2019 OUTAGE SPARES**

With reference to your requirement, we are pleased to provide the following revised proposal for your consideration.

RFQ ITEM	DESCRIPTION	UNIT PRICE CDN $	Total Price CDN $	EST DELIVERY (ARO)
0001	Rows 7-10 IP Spindle Blades Scope includes fixings & fastenings required for installation Please Note: All rotating blading will be supplied with the shroud left as block for turning during assembly to the rotor at site.  On site machining drawing for Blade Tipping will be provided. QTY: 1 SET	[redacted]	[redacted]	25 Working Weeks
0002	Option to rough machine shrouds All Rotating blading to be supplied with shrouds part machined (see sketch below).  On site machining drawing for Blade Tipping will be provided. QTY: 1 SET	[redacted]	[redacted]	25 Working Weeks

SIEMENS

0003	HP Cylinder Seals Rows 1 - 5 Supplied with fittings With following configuration: Assembly Drawing No.: SA142087.001 – 17 QTY: 1 PC	[redacted]	[redacted]	21 WORKING WEEKS
0004	LH Intercept Cover (drilled) With following configuration: Assembly Drawing No.: SL17254.002 Detail Drawing No.: 47AM1188 QTY: 1 PC	[redacted]	[redacted]	27 WORKING WEEKS
0005	Intercept Valve Top Bush With following configuration: Assembly Drawing No.: SL17254.007 Detail Drawing No.: 47AU1157 QTY: 1 PC	[redacted]	[redacted]	21 WORKING WEEKS
0006	Intercept Valve Bottom Bush With following configuration: Assembly Drawing No.: SL17254.008 Detail Drawing No.: 47AU1195 QTY: 1 PC	[redacted]	[redacted]	21 WORKING WEEKS
0007	Nozzle Quadrants 1 set of Nozzle Quadrants per the following Drawing and Mk numbers. Assembly Drawing: 24MC61517 Mk Numbers: 1, 2, 3, 4, 5 ,6, 7, 8. QTY : 1 SET	[redacted]	[redacted]	20 WORKING WEEKS
0008	ROW 7 CYL. SEAL SEGMENT With following configuration: Assembly Drawing No.: SA142335 Detail Drawing No.: 25AA313949 QTY: 12 PCS	[redacted]	[redacted]	19 WORKING WEEKS

SIEMENS

0009	ROW 9 CYL. SEAL SEGMENT With following configuration: Assembly Drawing No.: SA142335 Detail Drawing No.: 25AA313951 QTY: 12 PCS	[redacted]	[redacted]	19 WORKING WEEKS
0010	ROW 8 CYL. SEAL SEGMENT With following configuration: Assembly Drawing No.: SA142335 Detail Drawing No.: 25AA313950 QTY: 12 PCS	[redacted]	[redacted]	19 WORKING WEEKS
0011	ROW 10 CYL. SEAL SEGMENT With following configuration: Assembly Drawing No.: SA142335 Detail Drawing No.: 25AA313952 QTY: 12 PCS	[redacted]	[redacted]	19 WORKING WEEKS
	TOTAL PROPOSAL PRICE		[redacted]	

Prices: Price shown is in Canadian funds, include any import duties that may be applicable, FOB Point Tupper GS, INCO Term 2010 but do not include any taxes. Price shown is also based on the quantities quoted. Should the order quantity differ from the quoted quantity, we reserve the right to amend the prices.

Location of Supply: Siemens PLC UK.
A Division of Siemens Power Generation
Newcastle UK.

Validity: This proposal is valid for a period of 90 days from date of submission, unless extended, modified or withdrawn by Siemens Energy Services and limits acceptance to the terms set forth herein. The return of a purchase order or any other reasonable manner of acceptance communicated to Siemens during such validity period will be sufficient to form an agreement on the terms and conditions of this offer.

Due to recent significant movements in material costs and availability, our offer is subject to review beyond the validity period.

Environmental, Health & Safety:

This offer is based on Siemens' "Zero Harm" program and in accordance with COR Certification Requirements. Siemens EHS program is outlined in a Priority One Plan.

Quality Program:

This offer is based on a Quality Program in accordance with ISO 9001:2015.

SIEMENS

Terms of Payment:

Net 30 days. Overdue accounts will be charged a 2% per month carrying Charge.

Conditions of Sale:

All work performed for the supply of hardware associated with the parts in this proposal shall be completed in accordance with the Siemens terms and conditions as defined in the Selling Policy 1200C.

If we fail to dispatch the parts within the time quoted or within any extension thereof and as a result NSPI suffers a loss, we undertake to pay for each week or part week of delay liquated damages at the rate of 0.5% per week up to maximum of 10% of the hardware value.

Limitation of Liability: Notwithstanding any other provisions of this Contract, in no event shall the aggregate liability of Siemens Canada or its affiliates, partners and subcontractors exceed the final agreed Contract Price or any agreed increase to the Contract Price.

Siemens obligation to fulfill this agreement is subject to the proviso that the fulfillment is not prevented by any impediments arising out of national or international foreign trade and customs requirements or any embargos [or other sanctions].

Feel free to contact us should you have any questions. We look forward to receive your purchase order.

Regards,

IJAZ IMRAN

Digitally signed by IJAZ IMRAN
DN: cn=IJAZ IMRAN, o=Siemens, email=imran.ijaz@siemens.com
Reason: I have reviewed this document
Location: Oakville
Date: 2018.06.29 10:12:43 -04'00'

Digitally signed by JERMARK JASON
DN: cn=JERMARK JASON, o=Siemens, email=jason.jermark@siemens.com
Date: 2018.06.29 11:25:31 -04'00'

Imran Ijaz
Sales Manager
imran.ijaz@siemens.com

Senior Management Approval

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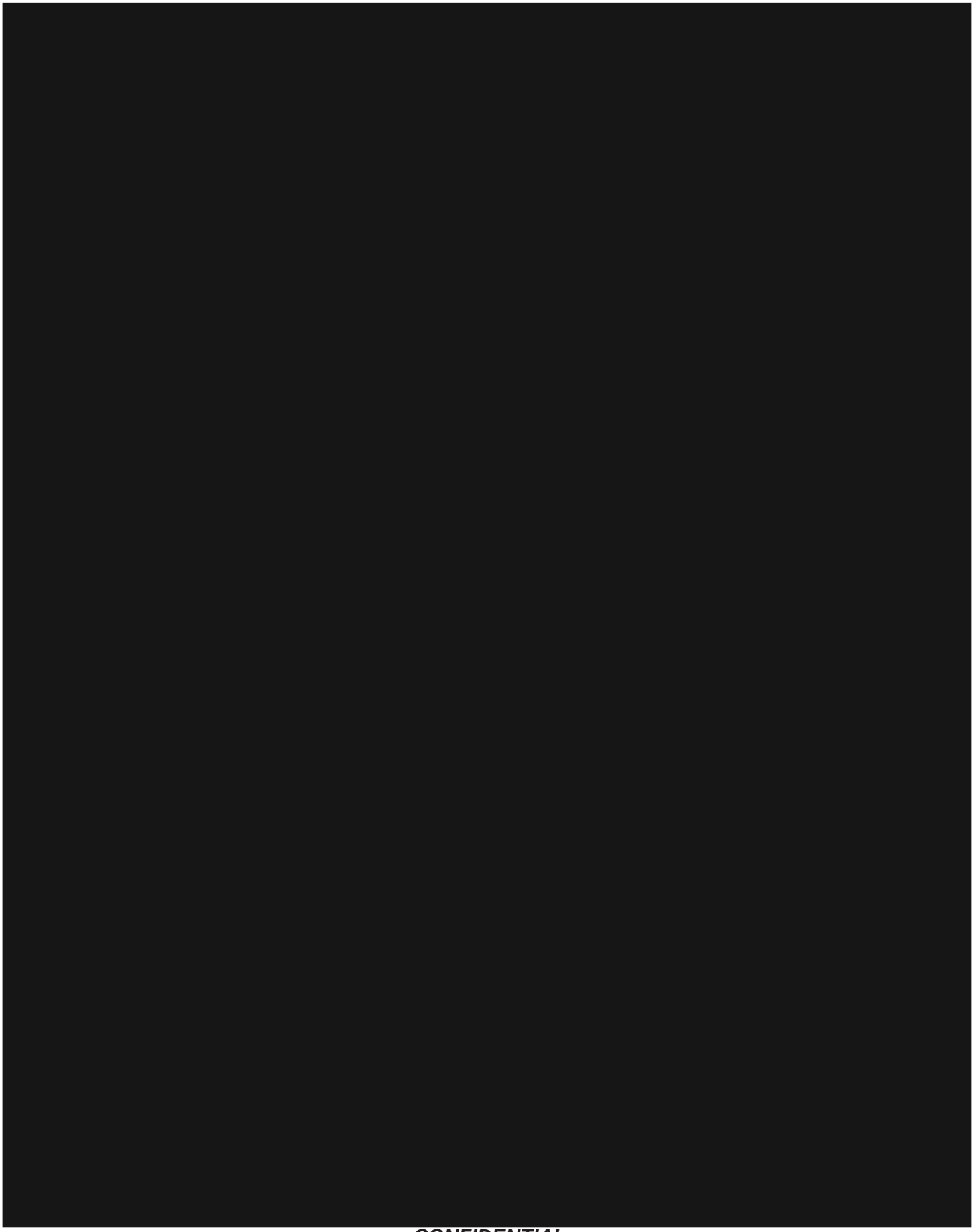

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CI Number: C0007638

Title: POT – Generator Auxiliary Equipment Refurbishment

Start Date: 2018/05
In-Service Date: 2019/07
Final Cost Date: 2020/01
Function: Steam
Estimated cost: $3,473,920

DESCRIPTION:

This project is for the replacement of six generator high voltage bushings (HVB) on the Point Tupper Unit 2 generator. This project also includes the replacement of the inner and outer radial pins, the rebuild of the existing turbine turning gear and refurbishment of the turning gear meshing motor.

The generator is hydrogen cooled and operates at 14.4 kV. The generator HVBs provide a high current electrical connection from the generator stator winding, leads through the generator casing and connects to the Isolated Phase Bus (IPB) system (main electrical output) external to the generator. The generator bushings are insulated and also provide a hydrogen seal to prevent hydrogen from inside the generator leaking through the bushings.

The radial pins are the main connection point between the generator rotor and the up shaft leads to the main exciter and also provide hydrogen from escaping through the center bore of the generator rotor. The turning gear is an integral part of any steam driven turbine generator; it is used to ensure the slow steady rotation of the entire train of shafts when cooling the machine down when the unit is off line. The meshing motor is used to engage the turning gear to the main drive. The turning gear is original to design and requires refurbishment to ensure it is fit for service when required.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- No other projects in 2017, 2018, 2019, 2020, or 2021

Depreciation Class: Steam Production Plant – Point Tupper Unit 2

Estimated Life of the Asset: 10 Years

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

High Voltage Bushings (HVBs) are installed on the three phases of the generator primary electrical connections and also seal hydrogen gas in the generator. Each phase requires two bushings for phase connections, primary and neutral. Hydrogen gas is a highly effective cooling medium commonly used in large utility generators. Over time, and through normal operating degradation, hydrogen leaks can occur around the generator bushings. Based on past experience the radial pins may not be reusable and will also have to be replaced.

Why do this project now?

A 6 week generator outage is typically required for this project to be completed. Replacement of the bushings during a scheduled major outage reduces the risk of unexpected failure. The planned outage in 2019 provides the opportunity for the bushings to be replaced within a pre-existing outage window. Without this work, the probability of bushing failures and related hydrogen leaks will increase as the service of the generator increases. As Point Tupper Unit 2 ages and changes utilization, the probability of a bushing failure increases. When changing the HVBs, the generator rotor will have to be removed. Once removed from the generator housing, the radial pins will be accessible and able to be replaced ensuring that the hydrogen sealing system and the integrity of the pins is maintained for continued service. The 2019 planned outage will also provide sufficient time to rebuild the turning gear.

Why do this project this way?

Replacing the high voltage bushings, the radial pins and overhauling the turning gear during the 2019 planned outage, as part of NS Power's asset management strategy, will allow for the continued safe and efficient long term operation of Point Tupper Unit 2. Replacement of the HVBs instead of refurbishment will lower execution risk for this project and provide a better product compared to refurbishment.

CI Number : C0007638 - POT - Generator Auxiliary Equipment Refurbishment

Project Number C0007638

Parent CI Number : -

Asset Location : 1152 - 1152 Point Tupper Unit 2

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1000 - SGP - Turbo Gen.Instal.	2,234,162
Retirements	1000 - SGP - Turbo Gen.Instal.	1,239,758
	Total Cost:	3,473,920
	Original Cost:	1,811,392

Capital Project Detailed Estimate

Location: Point Tupper Generating Station
CI# : C0007638
Title: POT - Generator Auxiliary Equipment Refurbishment
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
						51573 and 51813
Regular Labour						
Electrician	PD	60	$ 358	$ 21,497		
Engineering	PD	20	$ 405	$ 8,106		
Maintenance Trades	PD	40	$ 365	$ 14,591		
Power Plant Technician	PD	16	$ 382	$ 6,114		
Utility Worker	PD	40	$ 240	$ 9,607		
			Sub-Total	$ 59,915		
OT Labour						
Electrician	PD	32	$ 717	$ 22,930		
Maintenance Trades	PD	32	$ 730	$ 23,347		
Utility Worker	PD	20	$ 480	$ 9,600		
			Sub-Total	$ 55,876		
Term Labour						
Maintenance Trades	PD	40	$ 365	$ 14,592		
Electrician	PD	60	$ 358	$ 21,497		
Utility Worker	PD	40	$ 240	$ 9,607		
			Sub-Total	$ 45,696		
Materials						
Terminal Bushings	ea	6	[redacted]		Attachment 1, Page 2, Item 0010	
Radial Pins	lot	1	$ 25,286	$ 25,286		
Sealing Kit Upgrade for Radial Pins and Terminal Plate	lot	1	[redacted]		Attachment 2, Page 3	
Meshing Motor	ea	1	[redacted]		Attachment 3	
Spares	lot	1	[redacted]		Attachment 4, Page 7	
Turning Gear	lot	1	[redacted]		Attachment 5, Page 4	
Misc Material	lot	1	$ 15,000	$ 15,000		
			Sub-Total	$ 646,782		
Contracts						
OEM Support Including Craft Labour	lot	1	$ 1,948,500	$ 1,948,500		
NDT and Other Testing	lot	1	$ 70,000	$ 70,000		
			Sub-Total	$ 2,018,500		
Consulting						
Project Oversight	lot	1	$ 20,000	$ 20,000		
Project Preparation Technical Consulting	lot	1	$ 37,500	$ 37,500		
				$ -		
			Sub-Total	$ 57,500		
Meals						
Meals	lot	1	$ 1,000	$ 1,000		
				$ -		
			Sub-Total	$ 1,000		
Overtime Meals						
OT Meals	lot	1	$ 1,000	$ 1,000		
				$ -		
			Sub-Total	$ 1,000		
Other Goods & Services						
Contingency	%	10	$ 2,886,270	$ 288,627		
			Sub-Total	$ 288,627		
Interest Capitalized						
AFUDC				$ 21,684		
			Sub-Total	$ 21,684		
Administrative Overhead						
Labour AO				$ 34,868		
Contractor AO				$ 242,471		
				$ -		
			Sub-Total	$ 277,339		
			SUB-TOTAL (no AO, AFUDC)	$ 3,174,897		
			TOTAL (AO, AFUDC included)	$ 3,473,920		
Original Cost				$ 1,811,392		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

SIEMENS

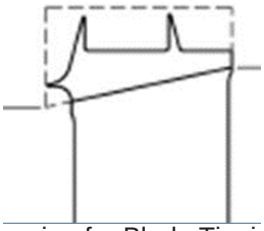
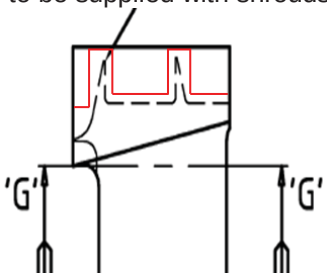
Ref: Our SF171174763
NOVA SCOTIA POWER RFQ # NSP-POT2 2019 OUTAGE

Date: **17 Jan 2018**

To: GREG CARLIN

Subject: **PROPOSAL FOR NSPI-PT2-STG MAJOR INSPECTION 2019 OUTAGE SPARES**

With reference to your requirement, we are pleased to provide the following proposal for your consideration.

RFQ ITEM	DESCRIPTION	UNIT PRICE CDN $	Total Price CDN $	EST DELIVERY (ARO)
0001	Rows 7-10 IP Spindle Blades Scope includes fixings & fastenings required for installation Please Note: All rotating blading will be supplied with the shroud left as block for turning during assembly to the rotor at site.  On site machining drawing for Blade Tipping will be provided. QTY: 1 SET	[redacted]	[redacted]	25 Working Weeks
0002	Option to rough machine shrouds All Rotating blading to be supplied with shrouds part machined (see sketch below).  On site machining drawing for Blade Tipping will be provided. QTY: 1 SET	[redacted]	[redacted]	25 Working Weeks

Siemens Canada Limited
1577 North Service Road East Oakville
Oakville ON L6H 0H6, Canada

0003	HP Cylinder Seals Rows 1 - 5 Supplied with fittings With following configuration: Assembly Drawing No.: SA142087.001 – 17 QTY: 1 PC	[redacted]	[redacted]	21 WORKING WEEKS
0004	LH ESV Cover (undrilled) With following configuration: Assembly Drawing No.: SL17180.009 Detail Drawing No.: 41AS5026 QTY: 1 PC	[redacted]	[redacted]	27 WORKING WEEKS
0005	ESV Gland Bush Top With following configuration: Assembly Drawing No.: SL17180.012 Detail Drawing No.: 41AU1097 QTY: 1 PC	[redacted]	[redacted]	19 WORKING WEEKS
0006	ESV Gland Bush Bottom With following configuration: Assembly Drawing No.: SL17180.011 Detail Drawing No.: 41AU1587 QTY: 1 PC	[redacted]	[redacted]	19 WORKING WEEKS
0007	LH Intercept Cover (undrilled) With following configuration: Assembly Drawing No.: SL17254.002 Detail Drawing No.: 47AM1188 QTY: 1 PC	[redacted]	[redacted]	27 WORKING WEEKS
0008	Intercept Valve Top Bush With following configuration: Assembly Drawing No.: SL17254.007 Detail Drawing No.: 47AU1157 QTY: 2 PCS	[redacted]	[redacted]	21 WORKING WEEKS
0009	Intercept Valve Bottom Bush With following configuration: Assembly Drawing No.: SL17254.008 Detail Drawing No.: 47AU1195 QTY: 2 PCS	[redacted]	[redacted]	21 WORKING WEEKS
0010	Terminal Bushings (M/C 4324) With following configuration: Assembly Drawing No.: SL26187	[redacted]	[redacted]	40 WORKING WEEKS

	Detail Drawing No.: 60345SA033166 QTY: 6 PCS			
0011	Nozzle Quadrants 1 set of Nozzle Quadrants per the following Drawing and Mk numbers. Assembly Drawing: 24MC61517 Mk Numbers: 1, 2, 3, 4, 5 ,6, 7, 8. QTY : 1 SET	[redacted]	[redacted]	20 WORKING WEEKS
0012	Pilot Valve & Spindle With following configuration: Assembly Drawing No.: SL17180.004 Detail Drawing No.: 41AS5024 QTY: 1 PC	[redacted]	[redacted]	23 WORKING WEEKS
0013	No.2 ESV Spindle With following configuration: Assembly Drawing No.: SL17180.010 Detail Drawing No.: 41AS5027 QTY: 1 PC	[redacted]	[redacted]	23 WORKING WEEKS
0014	No.1 Gov Valve Spindle (Guided Flow) With following configuration: Assembly Drawing No.: SL17180.035 Detail Drawing No.: 41AS232 QTY: 1 PC	[redacted]	[redacted]	23 WORKING WEEKS
0015	No.2 Gov Valve Spindle (Guided Flow) With following configuration: Assembly Drawing No.: SL17180.036 Detail Drawing No.: 41AS233 QTY: 1 PC	[redacted]	[redacted]	23 WORKING WEEKS
0016	Reheat Emergency Valve & Spindle With following configuration: Assembly Drawing No.: SL17254.003 Detail Drawing No.: 47AS1416 QTY: 1 PC	[redacted]	[redacted]	19 WORKING WEEKS
0017	Intercept Valve Spindle With following configuration: Assembly Drawing No.: SL17254.004 Detail Drawing No.: 47AS1191 QTY: 1 PC	[redacted]	[redacted]	19 WORKING WEEKS

Prices: Price shown is in Canadian funds, include any import duties that may be applicable, FOB Point Tupper GS, INCO Term 2010 but do not include any taxes. Price shown is also based on the quantities quoted. Should the order quantity differ from the quoted quantity, we reserve the right to amend the prices.

Location of Supply: Siemens PLC UK.
A Division of Siemens Power Generation
Newcastle UK.

Validity: This proposal is valid for a period of 60 days from date of submission, unless extended, modified or withdrawn by Siemens Energy Services and limits acceptance to the terms set forth herein. The return of a purchase order or any other reasonable manner of acceptance communicated to Siemens during such validity period will be sufficient to form an agreement on the terms and conditions of this offer.

Due to recent significant movements in material costs and availability, our offer is subject to review beyond the validity period.

Environmental, Health & Safety:

This offer is based on Siemens' "Zero Harm" program and in accordance with COR Certification Requirements. Siemens EHS program is outlined in a Priority One Plan.

Quality Program:

This offer is based on a Quality Program in accordance with ISO 9001:2015.

Terms of Payment:

Net 30 days. Overdue accounts will be charged a 2% per month carrying Charge.

Conditions of Sale:

All work performed for the supply of hardware associated with the parts in this proposal shall be completed in accordance with the Siemens terms and conditions as defined in the Selling Policy 1200C.

If we fail to dispatch the parts within the time quoted or within any extension thereof and as a result NSPI suffers a loss, we undertake to pay for each week or part week of delay liquated damages at the rate of 0.5% per week up to maximum of 10% of the hardware value.

Limitation of Liability: Notwithstanding any other provisions of this Contract, in no event shall the aggregate liability of Siemens Canada or its affiliates, partners and subcontractors exceed the final agreed Contract Price or any agreed increase to the Contract Price.

Siemens obligation to fulfill this agreement is subject to the proviso that the fulfillment is not prevented by any impediments arising out of national or international foreign trade and customs requirements or any embargos [or other sanctions].

Feel free to contact us should you have any questions. We look forward to receive your purchase order.

Regards,

IJAZ IMRAN
Digitally signed by IJAZ IMRAN
DN: cn=IJAZ IMRAN, o=Siemens, email=imran.ijaz@siemens.com
Reason: I have reviewed this document
Location: Oakville
Date: 2018.01.19 09:53:43 -05'00'

Digitally signed by JERMARK JASON
DN: serialNumber=Z0007MAU, givenName=JASON, sn=JERMARK, o=Siemens, cn=JERMARK JASON
Date: 2018.01.19 11:08:59 -05'00'

Imran Ijaz
Manager – Parts Sales
Siemens Canada Limited
Power Generation Services Division
imran.ijaz@siemens.com

Senior Management Approval

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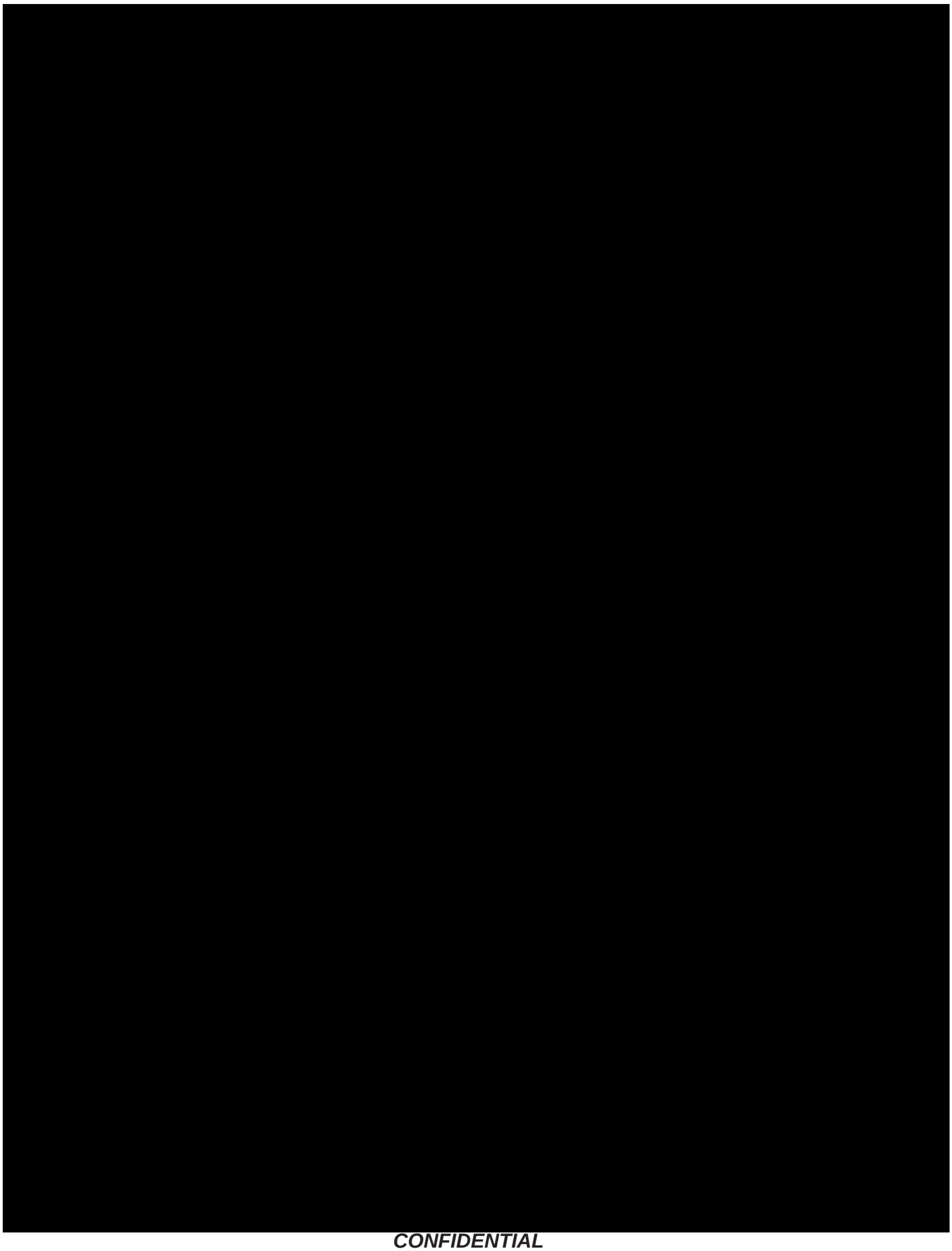

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Selling Policy 1200C

SIEMENS

NSPI

Ref: OUR SF181262669
RFQ ref TBA

Date: 11-Jun-18

To: Ray Barrett
CC: Brent McLeod

Subject: PROPOSAL FOR RADIAL PIN SEAL KIT & IMPROVED SEALING ON BUSHING TERMINAL PLATE

With reference to your requirement via RFQ ref TBA , we are pleased to provide the following proposal for your consideration.

ITEM	DESCRIPTION	UNIT PRICE CDN$	Total Price CDN$	EST DELIVERY (ARO)
0001	Self-Locking Nyloc Nuts With following configuration: Assembly Drawing No.: SL25515.010 QTY: 6 PCS	[redacted]	[redacted]	9 WORKING WEEKS
0002	Equalizing Washer With following configuration: Assembly Drawing No.: SL25515.018 QTY: 6 PCS	[redacted]	[redacted]	9 WORKING WEEKS
0003	Sealing Ring With following configuration: Assembly Drawing No.: SL25515.020 QTY: 6 PCS	[redacted]	[redacted]	9 WORKING WEEKS
0004	O-Ring for ref 21 With following configuration: Assembly Drawing No.: SL25515.022 QTY: 6 PCS	[redacted]	[redacted]	10 WORKING WEEKS
0005	O-Ring for ref 19 With following configuration: Assembly Drawing No.: SL25515.024 QTY: 6 PCS	[redacted]	[redacted]	9 WORKING WEEKS
0006	O-Ring for ref 19 With following configuration: Assembly Drawing No.: SL25515.025	[redacted]	[redacted]	9 WORKING WEEKS

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	QTY: 6 PCS			
0007	Washer for ref.32 With following configuration: Assembly Drawing No.: SL25515.034 QTY: 10 PCS	[redacted]	[redacted]	10 WORKING WEEKS
0008	Insulating Tube With following configuration: Assembly Drawing No.: SL25515.035 QTY: 6 PCS	[redacted]	[redacted]	11 WORKING WEEKS
0009	Insulating Bush With following configuration: Assembly Drawing No.: SL25515.036 QTY: 10 PCS	[redacted]	[redacted]	11 WORKING WEEKS
0010	Sealing Washer With following configuration: Assembly Drawing No.: SL25515.042 QTY: 2 PCS	[redacted]	[redacted]	13 WORKING WEEKS
0011	Outer Compression Ring With following configuration: Assembly Drawing No.: SL30156.045 Detail Drawing No.: 463A09491 QTY: 6 PCS	[redacted]	[redacted]	11 WORKING WEEKS
0012	3/8" Plain Bolt With following configuration: Assembly Drawing No.: SL30156.046 Detail Drawing No.: 463A39488 QTY: 72 PCS	[redacted]	[redacted]	11 WORKING WEEKS
0013	3/8" Spring Lockwasher With following configuration: Assembly Drawing No.: SL30156.047 Detail Drawing No.: 21175113 QTY: 72 PCS	[redacted]	[redacted]	11 WORKING WEEKS
0014	12.7mm Dia Extruded Cord With following configuration: Assembly Drawing No.: SL30156.048 QTY: 12 PCS	[redacted]	[redacted]	11 WORKING WEEKS

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0015	1/2" UNF Fitting Bolt With following configuration: Assembly Drawing No.: SL30156.049 Detail Drawing No.: 463A39489 QTY: 24 PCS	[redacted]	[redacted]	11 WORKING WEEKS
0016	1/2" UNF Hex Full Nut With following configuration: Assembly Drawing No.: SL30156.050 QTY: 24 PCS	[redacted]	[redacted]	11 WORKING WEEKS
0017	1/2" Spring Lockwasher With following configuration: Assembly Drawing No.: SL30156.051 Detail Drawing No.: 21175115 QTY: 48 PCS	[redacted]	[redacted]	11 WORKING WEEKS
TOTAL PROPOSAL PRICE			[redacted]	

Prices: Price shown is in Canadian funds, include any import duties that may be applicable, FOB Point Tupper, NSPI, but do not include any taxes. Price shown is also based on the quantities quoted. Should the order quantity differ from the quoted quantity, we reserve the right to amend the prices.

Location of Supply: Siemens plc, C.A. Parsons Works, Division E FP, Newcastle Upon Tyne UK

Validity:

This proposal is valid for a period of 60 days from date of submission, unless extended, modified or withdrawn by Siemens Canada Limited and limits acceptance to the terms set forth herein. The return of a purchase order or any other reasonable manner of acceptance communicated to Siemens during such validity period will be sufficient to form an agreement on the terms and conditions of this offer.

Due to recent significant movements in material costs and availability, our offer is subject to review beyond the validity period.

Environmental, Health & Safety:

This offer is based on Siemens' "Zero Harm" program and in accordance with COR Certification Requirements. Siemens EHS program is outlined in a Priority One Plan.

SIEMENS

Quality Program:

This offer is based on a Quality Program in accordance with ISO 9001

Terms of Payment:

Net 30 days. Overdue accounts will be charged a 2% per month carrying Charge.

Conditions of Sale:

All work performed for the supply of hardware associated with the parts in this proposal shall be completed in accordance with the Siemens terms and conditions as defined in the Selling Policy 1200C (copy attached) except as modified in this proposal.

Limitation of Liability: Notwithstanding any other provisions of this Contract, in no event shall the aggregate liability of Siemens Canada or its affiliates, partners and subcontractors exceed the final agreed Contract Price or any agreed increase to the Contract Price.

Siemens obligation to fulfill this agreement is subject to the proviso that the fulfillment is not prevented by any impediments arising out of national or international foreign trade and customs requirements or any embargos [or other sanctions].

Feel free to contact us should you have any questions. We look forward to receive your purchase order.

Regards,

IJAZ IMRAN

Digitally signed by IJAZ IMRAN
DN: cn=IJAZ IMRAN, o=Siemens, email=imran.ijaz@siemens.com
Reason: I have reviewed this document
Location: Oakville
Date: 2018.06.11 15:12:28 -04'00'

Imran Ijaz
Sales Manager
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SIEMENS

Ref: OUR SF181229057 REV 1
NSPI Internal Email Request

Date: **4-Jul-18**

To: Ray Barrett

Subject: **PROPOSAL FOR Point Tupper U2 - Meshing Motor & Gear Box Replacement**

With reference to your requirement via internal email request, we are pleased to provide the following proposal for your consideration.

ITEM	DESCRIPTION	UNIT PRICE CDN$	Total Price CDN$	EST DELIVERY (ARO)
0001	**U2 M/C 4324 AUX.MESHING MOTOR & PARTS** QUOTATION INCLUDES:- FINALISE MOTOR GEARBOX SPECIFICATION DESIGN, DRAW OUT INTERFACE, MOUNTING DETAILS SOURCE & SUPPLY REPLACEMENT HARDWARE KIT. HARDWARE SCOPE KIT INCLUDES:- 5/16" UNF HEX SOCK SET SCREW - SM17159.113 KEY FOR REF 200 - 5/16" X 5/16" X 1.9.16" - SM17159.114 AUXILARY MESHING MOTOR - SM17159.117 SPRAG CLUTCH - SM17159.119 DRIVING PINION - SM17159.126 KEY FOR REF 126 - 3/16" X 3/16" X 1.1/2" - SM17159.127 DRIVING SLEEVE - SM17159.199 DRIVING CLUTCH - SM17159.200 ADJUSTING NUT - SM17159.201 BELLEVILLE WASHERS - SM17159.202 No.10 UNF GRUB SCREWS - SM17159.203 No.10 UNF GRUB SCREWS - SM17159.204 QTY: 1	[redacted]	[redacted]	21 WORKING WEEKS
TOTAL PROPOSAL PRICE			[redacted]	

Prices: Price shown is in Canadian funds, include any import duties that may be applicable, FOB NSPI I, Point Tupper Generating Station, but do not include any taxes. Price shown is also based on the quantities quoted. Should the order quantity differ from the quoted quantity, we reserve the right to amend the prices.

Location of Supply: Siemens plc, C.A. Parsons Works, Division E FP, Newcastle Upon Tyne UK

SIEMENS

Validity:

This proposal is valid for a period of 60 days from date of submission, unless extended, modified or withdrawn by Siemens Canada Limited and limits acceptance to the terms set forth herein. The return of a purchase order or any other reasonable manner of acceptance communicated to Siemens during such validity period will be sufficient to form an agreement on the terms and conditions of this offer.

Due to recent significant movements in material costs and availability, our offer is subject to review beyond the validity period.

Environmental, Health & Safety:

This offer is based on Siemens' "Zero Harm" program and in accordance with COR Certification Requirements. Siemens EHS program is outlined in a Priority One Plan.

Quality Program:

This offer is based on a Quality Program in accordance with ISO 9001

Terms of Payment:

Net 30 days. Overdue accounts will be charged a 2% per month carrying Charge.

Conditions of Sale:

As per MASTER SERVICES AGREEMENT between NEW BRUNSWICK POWER CORPORATION and SIEMENS CANADA LIMITED for POINT LEPREAU GENERATING STATION dated April 13, 2017 except as modified in this proposal.

Limitation of Liability: Notwithstanding any other provisions of this Contract, in no event shall the aggregate liability of Siemens Canada or its affiliates, partners and subcontractors exceed the final agreed Contract Price or any agreed increase to the Contract Price.

Siemens obligation to fulfill this agreement is subject to the proviso that the fulfillment is not prevented by any impediments arising out of national or international foreign trade and customs requirements or any embargos [or other sanctions].

Feel free to contact us should you have any questions. We look forward to receive your purchase order.

Regards,

IJAZ IMRAN

Digitally signed by IJAZ IMRAN
DN: cn=IJAZ IMRAN, o=Siemens, email=imran.ijaz@siemens.com
Reason: I have reviewed this document
Location: Oakville
Date: 2018.07.04 13:43:03 -04'00'

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Imran Ijaz
Manager – Parts Sale
Imran.ijaz@siemens.com

SIEMENS

Ref: OUR SF181252699
NSPI RFQ ref TBA

Date: 26-Jul-18

To: RAY BARRETT
CC. BRENT MACLEOD

Subject: PROPOSAL FOR NSPI PT TUPPER 2019 OUTAGE SPARE PARTS

With reference to your requirement via RFQ ref TBA, we are pleased to provide the following proposal for your consideration.

ITEM	DESCRIPTION	UNIT PRICE CDN$	Total Price CDN$	EST DELIVERY (ARO)
0001	O RING With following configuration: Assembly Drawing No.: SL26187.012 Detail Drawing No.: 25123273 QTY: 12 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0002	PAD FOR TERMINAL PLATE With following configuration: Assembly Drawing No.: SL26187.025 Detail Drawing No.: 463U1760 QTY: 6 PC	[redacted]	[redacted]	15 WORKING WEEKS
0003	FILLING FOR TERMINAL JOINT With following configuration: Assembly Drawing No.: SL26187.045 QTY: 6 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0004	INSULATION FOR TERMINAL JOINT (SAMICA SHEET) With following configuration: Assembly Drawing No.: SL26187.046 QTY: 6 PC	[redacted]	[redacted]	15 WORKING WEEKS
0005	SAMICA TAPE 800M (0.25MM X 25MM) With following configuration: Assembly Drawing No.: SL26187.047 QTY: 1 PC	[redacted]	[redacted]	15 WORKING WEEKS

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ref TBA

0006	TERYLENE TAPE 200M 25MM With following configuration: Assembly Drawing No.: SL26187.048 QTY: 1 PC	[redacted]	[redacted]	15 WORKING WEEKS
0007	GLASS TAPE 200 M With following configuration: Assembly Drawing No.: SL26187 QTY: 1 PC	[redacted]	[redacted]	15 WORKING WEEKS
0008	10L INSULATING VARNISH With following configuration: Assembly Drawing No.: SL26187 QTY: 1 PC	[redacted]	[redacted]	15 WORKING WEEKS
0009	5 L EPOXY RESIN MY750 With following configuration: Assembly Drawing No.: SL26187 QTY: 1 PC	[redacted]	[redacted]	15 WORKING WEEKS
0010	HARDENER HY951 With following configuration: Assembly Drawing No.: SL26187 QTY: 1 PC	[redacted]	[redacted]	15 WORKING WEEKS
0011	O RING FOR HYDROGEN SEAL RING With following configuration: Assembly Drawing No.: SL 26668.009 Detail Drawing No.: 493U1841 QTY: 2 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0012	CUP PACKING RING With following configuration: Assembly Drawing No.: SL 26668.010 Detail Drawing No.: 493S126 QTY: 2 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0013	COLLAR STUDS FOR CUP PACKING RING With following configuration: Assembly Drawing No.: SL 26668.015 Detail Drawing No.: 493U1698 QTY: 24 PCs	[redacted]	[redacted]	15 WORKING WEEKS

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0014	LOCKING NUT FOR COLLAR STUD With following configuration: Assembly Drawing No.: SL 26668.016 Detail Drawing No.: 21686442 QTY: 24 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0015	12 FT INSULATING SLEEVE FOR THERMOCOUPLE With following configuration: Assembly Drawing No.: SL 26668.024 Detail Drawing No.: E61/5 QTY: 1 PC	[redacted]	[redacted]	15 WORKING WEEKS
0016	INSULATING WASHER With following configuration: Assembly Drawing No.: SL 26668.031 Detail Drawing No.: 450712-04 QTY: 40 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0017	INSULATING FLANGE With following configuration: Assembly Drawing No.: SL 26668.033 Detail Drawing No.: 493U1121 QTY: 2 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0018	INSULATING BUSH With following configuration: Assembly Drawing No.: SL 26668.044 QTY: 12 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0019	INSULATING WASHERS With following configuration: Assembly Drawing No.: SL 26668.051 QTY: 48 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0020	INSULATING FLANGE With following configuration: Assembly Drawing No.: SL 26668.052 Detail Drawing No.: 402S288 QTY: 4PCS	[redacted]	[redacted]	15 WORKING WEEKS
0021	INSULATING WASHERS With following configuration: Assembly Drawing No.: SL 26668.067 QTY: 20 PCS	[redacted]	[redacted]	15 WORKING WEEKS

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ref TBA

0022	INSULATING BUSH With following configuration: Assembly Drawing No.: SL 26668.068 QTY: 20 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0023	INSULATING FLANGE With following configuration: Assembly Drawing No.: SL 26668.072 Detail Drawing No.: 493U1362 QTY: 2 PC	[redacted]	[redacted]	15 WORKING WEEKS
0024	DIAPHRAGM EXCITER END With following configuration: Assembly Drawing No.: SL 26668.090 Detail Drawing No.: 493U1510 QTY: 1 PC	[redacted]	[redacted]	15 WORKING WEEKS
0025	DIAPHRAGM TURBINE END With following configuration: Assembly Drawing No.: SL 26668.091 Detail Drawing No.: 493U1731 QTY: 1 PC	[redacted]	[redacted]	15 WORKING WEEKS
0026	PLUNGER SPRING ASSEMBLY With following configuration: Assembly Drawing No.: SL 26668-17/22 QTY: 24 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0027	BEARING PAD FOR SEAL RINGS With following configuration: Assembly Drawing No.: SL 26668.014 Detail Drawing No.: 493U1451 QTY: 16 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0028	COLLAR STUDS FOR CUP PACKING RING With following configuration: Assembly Drawing No.: SL26565.016 Detail Drawing No.: 456U8613 QTY: 96 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0029	COLLAR STUDS FOR CUP PACKING RING With following configuration: Assembly Drawing No.: SL26565.017 Detail Drawing No.: 456U8614 QTY: 96 PCS	[redacted]	[redacted]	15 WORKING WEEKS

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0030	GASKET FOR FIXED END With following configuration: Assembly Drawing No.: SL26565.021 Detail Drawing No.: 456M8612-01 QTY: 6 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0031	GASKET FOR FLEXIBLE END With following configuration: Assembly Drawing No.: SL26565.022 Detail Drawing No.: 456M8612-02 QTY: 6 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0032	1/4" UN8 SECURING BOLTS With following configuration: Assembly Drawing No.: SL26643.021 Detail Drawing No.: 406U1744 QTY: 20 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0033	JOINT BOLTS (0.030" OVERSIZED ON DIA) 1 With following configuration: Assembly Drawing No.: SL26643.026 Detail Drawing No.: 406U1750 QTY: 1 PC	[redacted]	[redacted]	15 WORKING WEEKS
0034	1/2" 20 UNF LONG JOINT BOLTS 2A X 2" L With following configuration: Assembly Drawing No.: SL26643.005 Detail Drawing No.: 21673301 QTY: 85 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0035	1/2" 20 UNF 2B NUTS With following configuration: Assembly Drawing No.: SL26643.006 Detail Drawing No.: 21682445 QTY: 102 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0036	1/3" DIA DOUBLE COIL SPRING WASHERS With following configuration: Assembly Drawing No.: SL26643.007 Detail Drawing No.: 21175715 QTY: 102 PCS	[redacted]	[redacted]	15 WORKING WEEKS

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0037	5/8" 18 UNF 2A x 1 3/4" Long Securing bo With following configuration: Assembly Drawing No.: SL26643.008 Detail Drawing No.: 21665740 QTY: 91 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0038	5/8" Dia. Double coil spring washers With following configuration: Assembly Drawing No.: SL26643.009 Detail Drawing No.: 21175717 QTY: 127 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0039	1/2" Fitting bolts for inner end covers With following configuration: Assembly Drawing No.: SL26643.010 Detail Drawing No.: 406U1753 QTY: 17 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0040	5/8" 18 UNF 2A Collar bolts With following configuration: Assembly Drawing No.: SL26643.012 Detail Drawing No.: 406U1742 QTY: 36 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0041	5/8" 18 UNF 2B Castle Nuts With following configuration: Assembly Drawing No.: SL26643.013 Detail Drawing No.: 21685117 QTY: 36 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0042	1/8" Split pins With following configuration: Assembly Drawing No.: SL26643.014 Detail Drawing No.: 21161166 QTY: 36 PCS	[redacted]	[redacted]	15 WORKING WEEKS
0043	5/8" 18 UNF 2B Nuts With following configuration: Assembly Drawing No.: SL26643.015 Detail Drawing No.: 21682447 QTY: 36 PCS	[redacted]	[redacted]	15 WORKING WEEKS

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0044	Seal rubber cord 20FT QTY: 1 PC	[redacted]	[redacted]	15 WORKING WEEKS
TOTAL PROPOSAL PRICE			[redacted]	

Prices: Price shown is in Canadian funds, include any import duties that may be applicable, FOB Point Tupper, NSPI, but do not include any taxes. Price shown is also based on the quantities quoted. Should the order quantity differ from the quoted quantity, we reserve the right to amend the prices.

Location of Supply: Siemens plc, C.A. Parsons Works, Division E FP, Newcastle Upon Tyne UK

Validity:

This proposal is valid for a period of 60 days from date of submission, unless extended, modified or withdrawn by Siemens Canada Limited and limits acceptance to the terms set forth herein. The return of a purchase order or any other reasonable manner of acceptance communicated to Siemens during such validity period will be sufficient to form an agreement on the terms and conditions of this offer.

Due to recent significant movements in material costs and availability, our offer is subject to review beyond the validity period.

Environmental, Health & Safety:

This offer is based on Siemens' "Zero Harm" program and in accordance with COR Certification Requirements. Siemens EHS program is outlined in a Priority One Plan.

Quality Program:

This offer is based on a Quality Program in accordance with ISO 9001

Terms of Payment:

Net 30 days. Overdue accounts will be charged a 2% per month carrying Charge.

Conditions of Sale:

All work performed for the supply of hardware associated with the parts in this proposal shall be completed in accordance with the Siemens terms and conditions as defined in the Selling Policy 1200C (copy attached) except as modified in this proposal.

Limitation of Liability: Notwithstanding any other provisions of this Contract, in no event shall the aggregate liability of Siemens Canada or its affiliates, partners and

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subcontractors exceed the final agreed Contract Price or any agreed increase to the Contract Price.

Siemens obligation to fulfill this agreement is subject to the proviso that the fulfillment is not prevented by any impediments arising out of national or international foreign trade and customs requirements or any embargos [or other sanctions].

Feel free to contact us should you have any questions. We look forward to receive your purchase order.

Regards,

IJAZ IMRAN

Digitally signed by IJAZ IMRAN
DN: cn=IJAZ IMRAN, o=Siemens, email=imran.ijaz@siemens.com
Reason: I have reviewed this document
Location: Oakville
Date: 2018.07.26 15:11:37 -04'00'

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Imran Ijaz
Sales Manager
Imran.ijaz@siemens.com

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Selling Policy 1200C

SIEMENS

Ref: OUR SF171174763
RFQ ref TBA

Date: 14-Aug-18

To: Greg Carlin

Subject: PROPOSAL FOR TURNING GEAR PARTS

With reference to your requirement, we are pleased to provide the following proposal for your consideration.

ITEM	DESCRIPTION	UNIT PRICE CDN$	Total Price CDN$	EST DELIVERY (ARO)
0001	3rd Reduction Pinion With following configuration: Assembly Drawing No.: SM17159.064 Detail Drawing No.: 67UC61521 SHT 2 QTY: 1 PC	[redacted]	[redacted]	29 WORKING WEEKS
0002	2nd Reduction Wheel With following configuration: Assembly Drawing No.: SM17159.065 Detail Drawing No.: 67SC61522 QTY: 1 PC	[redacted]	[redacted]	29 WORKING WEEKS
0003	2nd Reduction Pinion With following configuration: Assembly Drawing No.: SM17159.066 Detail Drawing No.: 67UC61523 QTY: 1 PC	[redacted]	[redacted]	29 WORKING WEEKS
0004	1st Reduction Wheel With following configuration: Assembly Drawing No.: SM17159.067 Detail Drawing No.: 67SC61524 QTY: 1 PC	[redacted]	[redacted]	29 WORKING WEEKS
0005	1st Reduction Pinion With following configuration: Assembly Drawing No.: SM17159.068 Detail Drawing No.: 67UC61525	[redacted]	[redacted]	29 WORKING WEEKS

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	QTY: 1 PC			
0006	Bearing Housing for Ref 1 With following configuration: Assembly Drawing No.: SM17159.006 Detail Drawing No.: 67SC61501 QTY: 1 PC	[redacted]	[redacted]	11 WORKING WEEKS
0007	Bearing Housing for Ref 1 With following configuration: Assembly Drawing No.: SM17159.007 Detail Drawing No.: 67SC61502 QTY: 1 PC	[redacted]	[redacted]	11 WORKING WEEKS
0008	2" Dia Deep Groove Ball Bearing With following configuration: Assembly Drawing No.: SM17159.023 Detail Drawing No.: 23132418 QTY: 1 PC	[redacted]	[redacted]	8 WORKING WEEKS
0009	2" Roller Bearing With following configuration: Assembly Drawing No.: SM17159.024 Detail Drawing No.: 23161418 QTY: 1 PC	[redacted]	[redacted]	8 WORKING WEEKS
0010	2.1/2" Dia Deep Groove Ball Bearing With following configuration: Assembly Drawing No.: SM17159.025 Detail Drawing No.: 23132422 QTY: 1 PC	[redacted]	[redacted]	8 WORKING WEEKS
0011	2.1/2" Roller Bearing With following configuration: Assembly Drawing No.: SM17159.026 Detail Drawing No.: 23161422 QTY: 1 PC	[redacted]	[redacted]	8 WORKING WEEKS
0012	3" Dia Deep Groove Ball Bearing With following configuration: Assembly Drawing No.: SM17159.027 Detail Drawing No.: HOFFMAN M.S.19 QTY: 1 PC	[redacted]	[redacted]	8 WORKING WEEKS

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0013	Washer With following configuration: Assembly Drawing No.: SM17159.029 Detail Drawing No.: 67UC61508 QTY: 1 PC	[redacted]	[redacted]	11 WORKING WEEKS
0014	Oil Seal With following configuration: Assembly Drawing No.: SM17159.043 Detail Drawing No.: 25122174 QTY: 2 PCS	[redacted]	[redacted]	8 WORKING WEEKS
0015	Oil Seal With following configuration: Assembly Drawing No.: SM17159.078 Detail Drawing No.: 25145128 QTY: 1 PC	[redacted]	[redacted]	8 WORKING WEEKS
0016	Clutch Housing With following configuration: Assembly Drawing No.: SM17159.120 Detail Drawing No.: 67UC61541 QTY: 1 PC	[redacted]	[redacted]	7 WORKING WEEKS
0017	Oil Seal With following configuration: Assembly Drawing No.: SM17159.125 Detail Drawing No.: 25123247 QTY: 2 PC	[redacted]	[redacted]	7 WORKING WEEKS
0018	Driving Pinion With following configuration: Assembly Drawing No.: SM17159.126 Detail Drawing No.: 67UC61542 QTY: 1 PC	[redacted]	[redacted]	29 WORKING WEEKS
0019	2.3/4" Nuts With following configuration: Assembly Drawing No.: SM17159.100 Detail Drawing No.: 67UC61540 QTY: 4 PC	[redacted]	[redacted]	10 WORKING WEEKS
0020	1.3/4" Nuts With following configuration: Assembly Drawing No.: SM17159.102 Detail Drawing No.: 67AU5750	[redacted]	[redacted]	10 WORKING WEEKS

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	QTY: 2 PC			
0021	2" Nut With following configuration: Assembly Drawing No.: SM17159.103 Detail Drawing No.: 67AU5751 QTY: 2 PC	[redacted]	[redacted]	10 WORKING WEEKS
0022	2.1/4" Nut With following configuration: Assembly Drawing No.: SM17159.104 Detail Drawing No.: 67AU5752 QTY: 4 PC	[redacted]	[redacted]	10 WORKING WEEKS
TOTAL PROPOSAL PRICE			[redacted]	

Prices: Price shown is in Canadian funds, include any import duties that may be applicable, FOB Pt. Tupper, NSPI, but do not include any taxes. Price shown is also based on the quantities quoted. Should the order quantity differ from the quoted quantity, we reserve the right to amend the prices.

Location of Supply: Siemens plc, C.A. Parsons Works, Division E FP, Newcastle Upon Tyne UK

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SIEMENS

ref TBA

Terms of Payment:

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Siemens obligation to fulfill this agreement is subject to the proviso that the fulfillment is not prevented by any impediments arising out of national or international foreign trade and customs requirements or any embargos [or other sanctions].

Feel free to contact us should you have any questions. We look forward to receive your purchase order.

Regards,

IJAZ IMRAN

Digitally signed by IJAZ IMRAN
DN: cn=IJAZ IMRAN, o=Siemens, email=imran.ijaz@siemens.com
Reason: I have reviewed this document
Location: Oakville
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Imran Ijaz
Sales Manager
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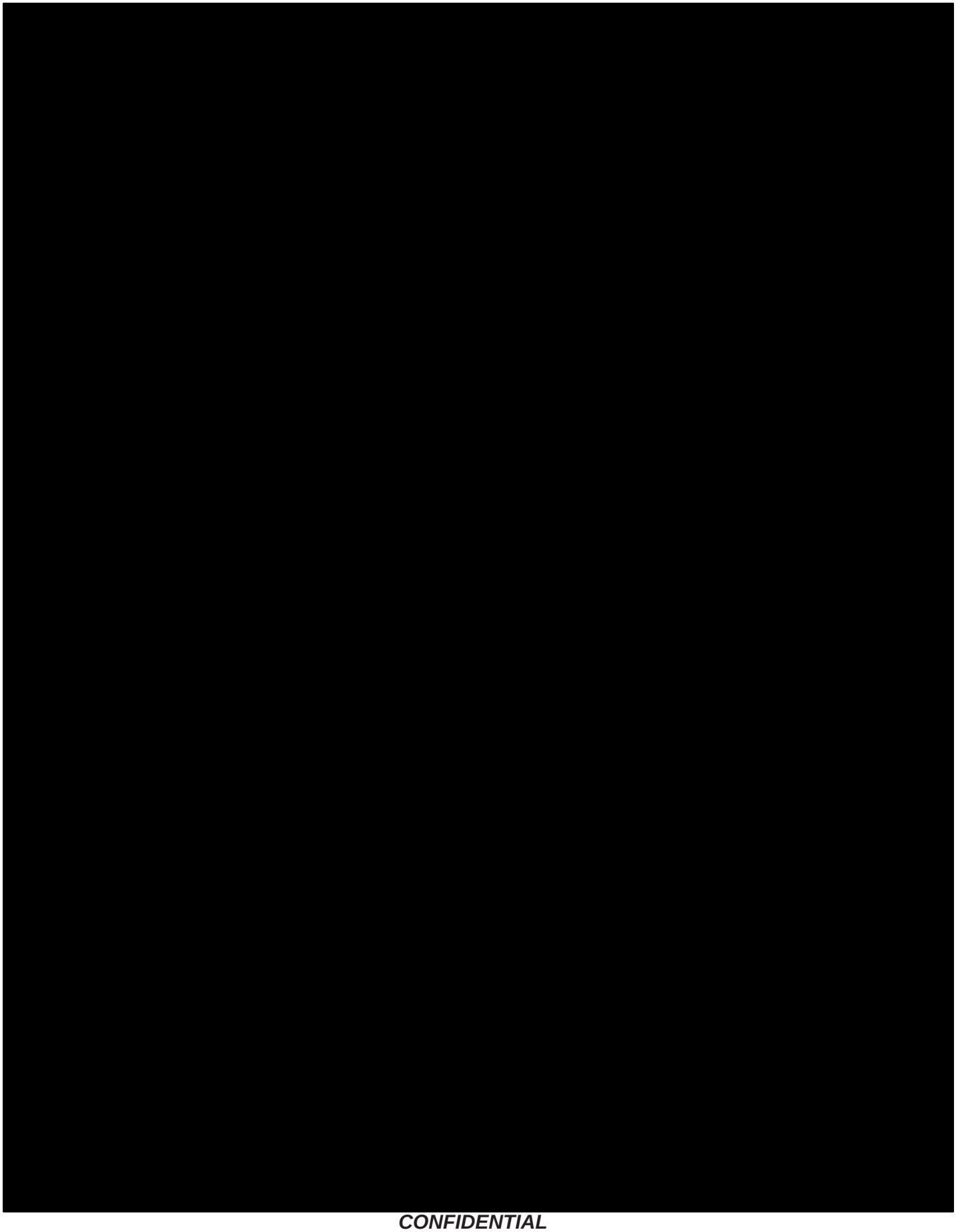

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CI Number: 51790

Title: TRE6 Generator High Voltage Bushings Replacement

Start Date: 2019/07
In-Service Date: 2019/08
Final Cost Date: 2020/02
Function: Steam
Forecast Amount: $694,334

DESCRIPTION:

The scope of this project is to replace the high voltage generator bushings on Trenton Generating Unit 6 in order to reduce the risk of a failure. This project will be completed during a planned outage in 2019.

Trenton 6 generator was commissioned in 1992 and has been in service for 26 years with greater than 198,000 operating hours. It is a 160 MW nominally rated unit and is driven by the Trenton 6 Steam Turbine. It operates at 3600 RPM and is a hydrogen cooled unit. The last major disassembly of this generator was in 2017.

High voltage bushings are installed on the three phases of the generator primary electrical connections to seal hydrogen gas in the generator. Each phase requires two bushings for electrical connections. Hydrogen gas is safe and highly effective as a cooling medium in its purest form and used extensively in large utility generators.

As the generator is hydrogen cooled, hydrogen leaks pose a major risk to the generator and surrounding plant due to its combustible nature when mixed with air.

Summary of Related CIs +/- 2 years:

Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 - CI 49538 - TRE6 Generator Rotor Flux Probe Installation - $784,610
- 2017 - CI 51052 - TRE6 Generator High Voltage Bushings Critical Spare - $264,250

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

Over time, hydrogen leaks may occur around the generator bushings, requiring replacement or refurbishment to prevent extended outages and minimize safety risks. The Original Equipment Manufacturer (OEM) is recommending refurbishment and/or replacement of the generator bushings to maintain the reliability of generator. The recommendation is consistent with NS Power's experience in life cycle of high voltage bushings across the fleet.

Why do this project now?

Trenton 6 generator was commissioned in 1992 and has been in service for 26 years with greater than 198,000 operating hours. It is a 160 MW nominally rated unit and is driven by the Trenton 6 Steam Turbine. It operates at 3600 RPM and is a hydrogen cooled unit. The last major disassembly of this generator was in 2017.

Hydrogen leaks around generator bushings on other similar generators at NS Power have been observed after 170,000 hours in service. It is common industry practice to change the bushings because over time the sealing components become more rigid and allow the passage of hydrogen. Industry practice is to take a pre-emptive action to avoid an extended outage should a leak occur. Hydrogen leaks are a serious risk. The interval chosen is based on the OEM's recommendation and NS Power's experience over time. The replacement High Voltage Bushings were obtained in 2017 under CI 51052 TRE6 Generation High Voltage Bushing Critical Spare in the event that immediate replacement was required as the lead time for new bushings is six months. At the time of assessment in 2017, the OEM replaced the sealing compound at the base of the bushings. The bushing insulation properties when the generator stator was tested passed. The bushings form part of the circuit and were tested along with the windings. This was a temporary mitigation strategy to extend the life of the bushings until the next outage interval when they could be replaced.

A minimum of a four week generator outage is required for this project to be completed. The Unit 6 planned outage in 2019 is planned to be 6 weeks in duration, which provides the opportunity for the bushings to be replaced. Without completing this work, the probability of bushing failures and related hydrogen leaks will increase as the hours in service of the generator increase.

Why do this project this way?

The project approach is to replace the high voltage bushings in 2019 to preclude potentially long forced outages of in-service failure.

CI Number : 51790-SI90 - TRE6 Generator High Voltage Bushings Replacement

Project Number 51790-SI90

Parent CI Number : -

Asset Location : 1166 - 1166 Trenton Unit 6; Commissioned 1991, 170 Mwh

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1000 - SGP - Turbo Gen.Instal.	534,682
Retirements	1000 - SGP - Turbo Gen.Instal.	159,652
	Total Cost:	694,334
	Original Cost:	332,327

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI# : 51790
Title: TRE6 Generator High Voltage Bushings Replacement
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	40	$ 358	$ 14,331		
Engineering	PD	15	$ 405	$ 5,960		
Power Engineer	PD	10	$ 390	$ 3,904		
Utility Worker	PD	60	$ 240	$ 14,411		
			Sub-Total	$ 38,606		CI 47657
OT Labour						
Electrician	PD	10	$ 717	$ 7,166		
Utility Worker	PD	10	$ 480	$ 4,804		
			Sub-Total	$ 11,969		CI 47657
Term Labour						
Maintenance Trades	PD	10	$ 365	$ 3,648		
Utility Worker	PD	20	$ 240	$ 4,804		
			Sub-Total	$ 8,451		CI 47657
Materials						
HVB Insulator and Consumables	Lot	1	$ 80,000	$ 80,000		
Misc. Wiring and Connectors	Lot	1	$ 5,000	$ 5,000		
Rigging	Lot	1	$ 5,000	$ 5,000		
Replacement Standoff Insulators	Lot	1	$ 25,000	$ 25,000		
			Sub-Total	$ 115,000		CI 47657
Contracts						
HVB Installation	USD	1	[redacted]		Attachment 1, Item 3	
OEM Evaluation	USD	1				
USD Exchange	%	32%				
Silver Plate Contacts	Lot	1				
Scaffolding Services	Lot	1	$ 25,000	$ 25,000		
Project Coordination	Lot	1	$ 25,000	$ 25,000		
			Sub-Total	$ 409,800		CI 47657
OT Meals						
	Lot	1	$ 500	$ 500		
			Sub-Total	$ 500		
Other Goods & Services						
Contingency	%	10%	$ 468,827	$ 46,883		
			Sub-Total	$ 46,883		
Administrative Overhead						
Labour AO				$ 13,858		
Contracts AO				$ 49,266		
			Sub-Total	$ 63,124		
			SUB-TOTAL (no AO, AFUDC)	$ 631,209		
			TOTAL (AO, AFUDC included)	$ 694,334		
Original Cost				$ 332,327		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

MITSUBISHI HITACHI POWER SYSTEMS CANADA, LTD.
Power Division
460 Southport Road SW, Calgary, AB T2W 4Y1 Canada TEL: (403) 278-1881 FAX: (403) 278-1810
www.psca.mhps.com

Friday, January 27, 2017

Nova Scotia Power Inc.
Trenton Generating Station
P.O. Box 190
Trenton, NS
B0K 1X0

Attention: Fred Jordan,

Subject: Your Request for Quotation: HVB Replacement, Refurbishment, plus Onsite Service Work
Mitsubishi Hitachi Power Systems Canada, Ltd. Quotation No: QT-11040

Fed,

We thank you for allowing us this opportunity to provide our quotation in response to the above referenced Request for Quotation. MHPSC is pleased to offer prices as presented within the following pages. We ask that you please take note of the remarks section that forms part of our quotation.

We trust that this will meet your requirements and look forward to receiving your purchase order for the quoted items. In the meantime should you wish to discuss any technical or commercial aspects of our quotation or if we may be of assistance to you in any other way please don't hesitate to contact our office.

Best regards,

Tim Edwards
Plant Services Manager
Mitsubishi Hitachi Power Systems Canada, Ltd. (MHPSC)
Power Division

Encl:

QUOTATION

Mitsubishi Hitachi Power Systems Canada, Ltd.
Power Division
460-10655 Southport Road S. W.
Calgary, AB
Canada T2W 4Y1
Telephone: (403) 278-1881
Fax: (403) 278-1810

Date: January 27, 2017

Our Ref. No.: QT-11040
Revision:
Sales Inquiry No.:
Final Customer: XTN6

NOVA SCOTIA POWER INC.
Trenton Generating Station
PO Box 190
TRENTON, NS B0K 1X0
CANADA

In accordance with your request we are pleased to quote as follows:

DELIVERY: TBD

PAYMENT: Net 30

Item	Quantity	Description	Unit Price	Total Price CDN$
1	6	NEW HIGH VOLTAGE BUSHING (HVB) SUPPLY 1. Scope Includes: - Supply of new Non-OEM HVBs. - Delivery of new bushings to site. 2. Scope does NOT include: - Removal of existing HVBs. - Installation of new HVBs. Estimated duration: 7~8 weeks after receipt of purchase order. This is a fixed price quotation.	[redacted]	[redacted]
2	6	REFURBISH EXISTING HIGH VOLTAGE BUSHING 1. Scope Includes: - Refurbishment of existing HVBs non-expedited. - Delivery of refurbished bushings to site. 2. Scope does NOT include: - Removal of existing HVBs. - Installation of refurbished HVBs. - Packaging & shipping of existing HVBs to MD&A St. Louis facility. Estimated duration: 3~4 weeks after receipt of existing bushings. This is a fixed price quotation.	[redacted]	[redacted]

3	1	REMOVE & INSTALL HIGH VOLTAGE BUSHING 1. Scope Includes: - Stripping of existing insulation from HVBs to connection ring leads. - Removal of bushing enclosures (assuming enclosures are bolted and not welded) - Mechanical removal of existing HVBs, CTs & peripheral containment. - Mechanical installation of new or refurbished HVBs, CTs & peripheral containment. - Re-installation of bushing enclosures (assuming enclosures are bolted and not welded) - Reinsulating of HVBs to connection ring leads. 2. Scope does NOT include: - Supply of new or refurbished HVBs. - Standby or multiple dispatches of installation crews. - Customer is required to disconnect and reconnect CT wiring and associated conduit. - Scaffolding to access and remove HVBs, CTs & peripheral containments. Scaffold must be erected and tagged for use before teh HVB crew arrival. 3. Additional Notes: - This is an estimate only, final pricing will be billed at Time & Material rates. - USD costs will be converted to CAD for final billing using Bank of Canada posted conversion rate. - Estimated duration: 1 shift/day, 10 days - Pricing is based on reusing existing hardware (i.e. bolts, washers, nuts, etc.)	[redacted]	[redacted]
			TOTAL	[redacted]

OTHER TERMS AND CONDITIONS:
Please take note of the following remarks that form part of our offer:

1) Validity: This quotation is valid until April 27, 2017.
2) All parts quoted are DDP Site (INCOTERMS 2010).
3) Delivery/Schedule:
- Delivery is subject to availability of material and resources at time of order.
- Delivery is to be confirmed after receipt of order
- Pricing reflects lead time for manufacture & delivery as quoted. If delivery is required earlier than the period quoted, pricing will be adjusted accordingly
- Pricing reflects standard transportation for delivery. If expedited delivery is required, another line item will be added to reflect additional expedited transportation costs in effect at the time the shipment is made.
4) Pricing is based on order of all items quoted. Pricing is subject to change for partial orders.
5) Items to be manufactured to OEM manufacturing drawings, and with OEM material.
6) Order cannot be accepted or placed until after receipt of acceptable PO. Acceptable PO must have pricing and terms that conform to this quote.
7) All PO's issued toward this quote must reference the appropriate Mitsubishi Hitachi Power Systems Canada quote number
8) In accordance with MHPS Standard Terms & Conditions for Parts & Services Rev.20160503

Tim Edwards, Plant Services Manager

CI Number: 49664

Title: Fleet AVR Critical Spare

Start Date:	2019/01
In-Service Date:	2019/09
Final Cost Date:	2020/03
Function:	Steam
Forecast Amount:	$540,778

DESCRIPTION:

This project will procure a Digital Static Exciter Automatic Voltage Regulator (AVR) as a critical capital spare for NS Power Thermal units.

The excitation system for a synchronous generator provides the DC field current to the generator rotor. This excitation system includes an AVR, rotating exciter and exciter motor. The AVR automatically controls the generator voltage via field current regulation and is integral to the excitation system.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- No other related projects on Tufts Cove Unit 1 in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

NS Power utilizes a spare AVR as part of the maintenance strategy for generators to reduce outage times in the event of an excitation failure in the NS Power Fleet. The current spare is no longer in operable condition and requires replacement.

The Tuft's Cove Unit 1 excitation system and the AVR are also past the expected useful life and are no longer supported by the Original Equipment Manufacturer (OEM). The AVR and controls were upgraded in 1999; the rotating exciter is original equipment installed in 1964 and is now 54 years old. The Tuft's Cove Unit 1 rotating exciter has been refurbished 10 times throughout its life and is observed to be overheating, sparking, and exhibiting vibrations due to deterioration of the armature windings; therefore, the current rotating exciter and the AVR are no longer reliable and require replacement.

The delivery time for a new AVR is approximately 39 weeks so the purpose of this project is to purchase a critical spare as the risk mitigation strategy. In the event of a failure of the existing AVR, the downtime on TUC Unit 1 or another unit would be reduced by eliminating the long lead time to procure a replacement AVR at that time.

Why do this project now?

The OEM for the existing AVR at TUC 1 no longer supports the equipment with spare components or technical expertise and the rotating exciter component has reached end of life. A failure of any one of these AVR components would require the unit to be taken offline.

Why do this project this way?

Procuring a spare AVR in advance of a potential failure of the existing AVR will ensure replacement materials are available and avoid a lengthy forced outage. In the event of a failure, replacement is the only option as the existing equipment is no longer supported. Utilizing a critical spare as the risk mitigation strategy will allow TUC 1 to continue to operate without installing a new AVR. This is the lower cost option based on the low forecasted future utilization of TUC1. The critical spare AVR is compatible with 9 other generating units across the NS Power fleet and could be used to minimized outage times in the event of a failure at those stations also.

CI Number : 49664 - Fleet AVR Critical Spare

Project Number 49664

Parent CI Number :

Asset Location : 1297 - 1297 Steam General

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	2200 - SGP - Elec Contr.Equip.	540,778
	Total Cost:	540,778
	Original Cost:	0

Capital Project Detailed Estimate

Location: Steam General
CI# : 49664
Title: Fleet AVR Critical Spare
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Engineering	PD	20	$ 405	$ 8,106		
			Sub-Total	$ 8,106		
Travel Expense						
Engineer Travel	lot	1	$ 5,000	$ 5,000		
			Sub-Total	$ 5,000		
Materials						
Basler DECS-2100 Static Exciter (AVR)	ea	1	[redacted]		Attachment 1, Item 1	
USD to CDN Conversion	USD	31%				
			Sub-Total	[redacted]		
Freight						
Freight	lot	1	[redacted]			
			Sub-Total	[redacted]		
Other Goods & Services						
Contingency	%	10%	$ 489,254	$ 48,925		
			Sub-Total	$ 48,925		
Interest Capitalized						
AFUDC				$ 481		
			Sub-Total	$ 481		
Administrative Overhead						
Labour AO				$ 2,118		
.						
			Sub-Total	$ 2,118		
			SUB-TOTAL (no AO, AFUDC)	$ 538,179		
			TOTAL (AO, AFUDC included)	$ 540,778		
Original Cost				$ -		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Basler Electric

Highland, Illinois USA

Suzhou, China - Singapore

www.basler.com

BUDGETARY ESTIMATE

TO: **Nova Scotia Power Inc.** **QUOTATION (SQ) No.:** **880792**

DATE of QUOTE: **July 17, 2017**

ATTN: Mr. Willard Cameron

REF: Mobile Exciter

Base Offer

Item	Description	Qty	Price Each	Price Extended

As proposal is budgetary at this time, Basler cannot confirm ease of transport of currently quoted exciter/PPT/house. All dimensions/features are preliminary and based upon typical outdoor projects (and not necessarily outdoor projects capable of frequent transport). More detail and discussion will be required to determine the final transport capabilities desired by the customer. A trailer for the equipment has not been included in the scope of supply.

1 **DECS-2100 Static Exciter** **1** **USD** [redacted] **USD** [redacted]

NEMA 1 Excitation Enclosure, approximately 180"W x 60.5"D x 102"H, consisting of:
Dual ECM-2 digital control channel
(Bulletin ECB found at www.basler.com/downloads)
Power Drawer Rectifier Bridges, 6-SCR, with N+1 Redundancy
Continuous current rating of 2400Adc
Minimum forcing voltage of 150% Vdc ceiling for 30sec (based upon new PPT offered herein)
De-Excitation and Crowbar protection modules
AC Disconnect Device (41A)
Two (2) Analog I/O Modules per system (AIOM-2)
Two (2) Digital I/O Modules per system (DIOM-2)
Shaft Voltage suppressor
Linear Field Discharge Resistors (FDR)
AC Line Filter Assemblies
SEL-387, Door Mounted
Door mounted Interactive Display Panel Model IDP-1500, consisting of:
Interactive Display Panel (HMI),
15.6" (diagonal), high-resolution color touchscreen operator's interface to monitor status of DECS-2100, to control operation, to adjust setpoints, etc.
DC Field Flashing circuit (assumed from 125 Vdc source, customer to confirm)
AC Field Flashing circuit (assumed from 600 Vac source, customer to confirm)
One (1) – 64F Field Ground Protection Module
Control Power: 100-125 Vdc (to be confirmed)
CT Secondary Input: 5 Amps (to be confirmed)
Rated for 40C ambient environment (interior temperature of outdoor house provided in item 2) at an altitude up to 1000m asl

Exciter/house will require connection power source (heating/cooling/control power) when being stored, total minimum loading TBD

Form FT100018 Last Rev.: 9/7/16	CHECK THE MASTER LIST - VERIFY THAT
W.I. WT100007	THIS IS THE LATEST VERSION BEFORE USE

Item	Description	Qty	Price Each	Price Extended
2	**Outdoor Control House**	**1**	**USD** [redacted]	**USD** [redacted]

The ICB is for Outdoor use and will be approximately 10' wide (outer dimension) x 29' long (excluding HVAC). The floor to ceiling height is 120 inches, outside building height of approximately 144 inches, ANSI-70 gray exterior. Building dimensions do not include roof overhang or air conditioners.

HVAC:

Each ICB will be provided with two (2) 6-ton air conditioners for redundancy as required to cool exciter dissipating approximately 12KW. A master controller will be provided to cycle the air conditioners on and off and to control temperature. Each air conditioning system will have integral heaters, supply and return registers and grilles for maintaining an ambient of 13C to 35C inside the house (lowest possible storage temperature w/o additional external heating source TBD).

Miscellaneous

- Cutout for incoming 600VAC input cables.
- DC bus outgoing cutout in floor (back section of exciter control cubicle)
- Exciter access doors provided for rear of exciter. Doors will be removable, hinged, dustproof and insulated with provisions for padlocking.
- Distribution Panel for accessory power (600VAC, 3 phase) to be provided by house supplier

Exciter/house will require connection power source (heating/cooling/control power) when being stored, total minimum loading TBD

Item	Description	Qty	Price Each	Price Extended
3	**Transformer, Outdoor Installation**	**1**	**USD** [redacted]	**USD** [redacted]

Transformer: Dry Type, per the following:

KVA: 2000 at 600Vac, 2250KVA at 660Vac (to deliver 2400Adc continuously)

Phases: Three (3)

Frequency: 60

Conductor: Copper

Primary/Secondary Voltage: 4160Vac Wye Primary, 600Vac Delta Secondary, tapped for 660Vac and 415Vac

Primary Termination: Cables

Secondary Termination: Cables

Duty: Exciter Duty/Nonlinear load

Primary fused disconnect switch

Approx. Enclosure Size: to be confirmed at design

Machine Data

- Application - Synchronous Generator
- Machine Voltage - 13800 Vac
- Frequency - 60Hz
- Rating - 100000 kW
- Power Factor - 0.90 PF
- Prime Mover - Steam Turbine
- Excitation Field Type - Static
- Full Load Rated Amps - 2400 Adc
- Full Load Rated Voltage - 600 Vdc
- Excitation Power Source - Generator Output (Shunt Fed)
- PPT Supply - New Basler Supplied PPT
- Primary Voltage - 4160 Vac
- Number of Phases - Three Phase

Commercial Notes

Delivery

Freight terms for this quotation are **FOB Basler Factory shipping**, title and risk of loss shall pass to Buyer at point of shipment, **freight prepay and add with insurance.** Estimated delivery is as stated below in the following table:

Project Milestone	Weeks	Explanation
Engineering Drawing Creation	8	Approximately 8 weeks ARO, consists of interconnection diagram and system outline.
Customer Drawing Review & Approval	4	On hold until approval received. If approval process extends beyond 4 weeks, Basler may re-evaluate ship date based on delays.
System Manufacturing Process	24	Based on production and material lead times, typical manufacturing time is 24 weeks after approved designs are released.
Total Time ARO (After Receipt of Order) Estimate	**36**	**Time covers Drawings, Customer Approval, Procurement, and Manufacturing, subject to change upon firm quote.**

International Packaging / Shipping: Basler Electric's international shipping practice includes bug-free skids with fully enclosed crating for all equipment shipping outside the U.S. Any other special requested packaging requirements may be subject to re-quote and must be specified at time of order. Changes requested less than 2 weeks from ship date may be subject to scheduling changes and/or price adjustments. For equipment shipments that use an open trailer, Basler requires the trucking company to fully tarp the item(s) to protect it from the weather.

PSS Tuning: In accordance with Section 9.3 of the Field Service Terms, Conditions, and Rates **Form No. FA100006**, if this quotation includes Power System Stabilizer (PSS) tuning, the attached PSS data collection form must be completed and submitted to Basler Electric Company 30 days prior to the requirement of such tuning.

Field Service: Field service is not included with the price of the equipment. Attached you will find a copy of Basler Electric's current *FIELD SERVICE TERMS AND CONDITIONS*, Form № FA100006, for on-site technical support pertaining to services limited to Basler Electric equipment. These terms and conditions are subject to change without notice. The attached copy of Form № FA100006 may vary from the applicable terms and conditions in force at the time your service work on-site is actually required. All Field Service requests shall be sent to Basler Electric's Sales and Customer Service Department in Highland, IL, USA.

Terms and Conditions: Basler Terms and Conditions **Form No. FA100001** apply to this quotation. All prices are quoted in United States Dollars (US$). The unit price for equipment quoted included in this quotation is valid for 60 days from the date of issuance, which is based on current costs of raw material and purchased parts. However, due to the present state of unprecedented instability of these costs, adjustments to the selling price may be required when the order is released for production. If this quotation includes an ESTIMATE for field service work, please note that the ESTIMATED price is not fixed, and those rates are subject to change dependent upon the date the service is actually required.

Progress payment invoices against the equipment portion of this quotation may be issued, upon credit approval at time of order placement, with final structure TBD at this time.

Your Basler Sales Rep is:

Roger Labbe
Henery & Sons, Inc.
87 Aurora
Pointe-Claire, Quebec H9R 3G5
Phone: 514.697.4197
Email: rlabbe@henery.ca

Worldwide Sales And Support

Suzhou, China
chinainfo@basler.com

Singapore
singaporeinfo@basler.com

CI Number: C0011085

Title: POT Hydrogen Panel Replacement

Start Date: 2019/04
In-Service Date: 2019/07
Final Cost Date: 2020/01
Function: Steam
Forecast Amount: $464,252

DESCRIPTION:

This project includes the replacement of the Point Tupper Unit 2 hydrogen gas panel station. This hydrogen panel is original to Point Tupper Unit 2, is approximately 40 years old, and has reached the end of its expected useful life. As the hydrogen panel has aged, the system has experienced failures in components (valves, sensors, and piping connections) which can lead to unsafe working conditions due to the hazardous properties of hydrogen gas.

Hydrogen is used as the medium to ensure adequate cooling of the generator stator and associated equipment. The hydrogen panel is designed to control the flow of hydrogen gas and to monitor and regulate the gas purity in the system.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- No other projects in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Health & Safety

Why do this project?

Due to the age of the hydrogen panel, the system has experienced failures in components (valves, sensors, and piping connections). This can lead to hydrogen gas releases causing unsafe working conditions and unit shutdown until the leak is repaired. The system continues to deteriorate and needs replacement to maintain the integrity of the hydrogen system to allow for continued safe and reliable generator cooling.

This project is primarily justified under health and safety, and secondarily to maintain unit reliability and availability.

Why do this project now?

This hydrogen panel is original to Point Tupper Unit 2, is approximately 40 years old, and has reached the end of its expected useful life. As the hydrogen panel has aged, the plant has experienced failures in components (valves, sensors, and piping connections) which can lead to unsafe working conditions. As the system continues to age, the likelihood of a more significant system failure (larger releases of hydrogen) increases, thereby increasing risk to a level where mitigating actions are required.

Why do this project this way?

The method of resolving hydrogen panel leaks to date has been to repair or replace valve components, instrument components and piping elements as they fail. As the equipment ages and begins to deteriorate, this approach is less effective, resulting in a greater probability of significant failure. System replacement is the recommended approach to mitigate this risk and eliminate the requirement to continue individual component replacements.

CI Number : C0011085 - POT Hydrogen Panel Replacement **Project Number** C0011085

Parent CI Number : -

Asset Location : 1152 - 1152 Point Tupper Unit 2 **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1000 - SGP - Turbo Gen.Instal.	435,655
Retirements	1000 - SGP - Turbo Gen.Instal.	28,597
	Total Cost:	464,252
	Original Cost:	120,889

Capital Project Detailed Estimate

Location: Point Tupper Generating Station
CI# : C0011085
Title: POT Hydrogen Panel Replacement
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	36	$ 358	$ 12,898		
Engineering	PD	30	$ 405	$ 12,159		
Maintenance Trades	PD	83	$ 365	$ 30,277		
Power Plant Technician	PD	10	$ 382	$ 3,821		
Utility Worker	PD	5	$ 240	$ 1,201		
CADD Operators	PD	5	$ 294	$ 1,470		
			Sub-Total	$ 61,827		
Materials						
Hydrogen Control Panel	lot	1	$ 250,000	$ 250,000		
Misc Pipe, Cable, Tubing, Instruments	lot	1	$ 25,000	$ 25,000		
			Sub-Total	$ 275,000		
Contracts						
Scaffolding	lot	1	$ 17,500	$ 17,500		
Commissioning Representative	lot	1	$ 15,000	$ 15,000		
			Sub-Total	$ 32,500		
Consulting						
Engineering / Project Management	lot	1	$ 20,000	$ 20,000		
			Sub-Total	$ 20,000		
Freight						
Shipping	ea	1	$ 10,000	$ 10,000		
			Sub-Total	$ 10,000		
Other Goods and Services						
Contingency	%	10%	$ 399,327	$ 39,932.69		
			Sub-Total	$ 39,933		
Interest Capitalized						
AFUDC				$ 4,932		
			Sub-Total	$ 4,932		
Administrative Overhead						
Labour AO				$ 16,153		
Contracts AO				$ 3,907		
			Sub-Total	$ 20,060		
			SUB-TOTAL (no AO, AFUDC)	$ 439,260		
			TOTAL (AO, AFUDC included)	$ 464,252		
Original Cost				$ 120,889		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0009088

Title: LIN 1&2 CEMS Replacement

Start Date: 2019/08
In-Service Date: 2019/09
Final Cost Date: 2020/03
Function: Steam
Forecast Amount: $757,499

DESCRIPTION:

The scope of work of this project includes the purchase, installation and certification testing of new continuous emission monitoring system (CEMS) equipment for the Unit 1 stack at the Lingan Generating Station.

The current CEMS that monitors sulfur dioxide (SO_2) and nitrogen oxide (NOx) for Unit 1 and 2 at Lingan has surpassed its expected useful life and requires replacement. It was installed in 2001 and the recommended useful life of the equipment is 10 years. NS Power has been informed by the manufacturer that the support for the current system can no longer be guaranteed as of June 30, 2017, as much of the equipment has become obsolete (Attachment 1). The existing in-situ monitoring system will be replaced by a dilution extractive monitoring unit, which will allow for a dual range measurement of NOx and SO_2 to enable compliance with the provincial Air Emission Regulations.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- No other projects on Lingan Unit 1&2 in 2017, 2018, 2019, 2020, or 2021

JUSTIFICATION:

Justification Criteria: Environment

Why do this project?

NS Power is required to operate and maintain a CEMS to continuously monitor the level of SO_2 and NOx in the flue gas emissions at each thermal generating facility, including Lingan, in accordance with the facility's Operating Approval issued by the Nova Scotia Department of Environment.

The CEMS at Lingan has limited spare parts, is no longer supported by the manufacturer, and must be replaced to ensure operating approval is maintained.

Why do this project now?

The Lingan CEMS is no longer supported by the manufacturer and there are limited spare parts available through either NS Power or the manufacturer to use for repair in the event of a failure. The existing CEMS system is showing signs of deterioration and requires replacement at this time to mitigate the risk of failure and allow the facility to continue operation in compliance with its Operating Approval.

Why do this project this way?

Replacement of the CEMS is the only option due to the obsolescence of the existing equipment. The recommended approach is to replace the in-situ CEMS with a dilution extractive unit capable of dual range measurements. This is a new monitoring system that NS Power has begun implementing at other plants through the following capital items:

- CI 50017 - TUC4 CEMS Installation U&U, approved by the UARB on June 30, 2017
- CI 50018 - TUC5 CEMS Installation U&U, approved by the UARB on June 30, 2017
- CI 49551- TRE5 CEMS Replacement, approved by the UARB on October 6, 2017
- CI 50020- LIN 3&4 CEMS Replacement, approved by the UARB on February 9, 2018

These fleet-wide replacements will support technical expertise and the maintenance of a centralized repository of spare parts. In addition, the new CEMS is capable of dual range measurement of NOx and SO_2, as is required by provincial Air Emission Regulations.

CI Number : C0009088 - LIN 1&2 CEMS Replacement

Project Number C0009088

Parent CI Number : -

Asset Location : 1138 - 1138 Lingan Common Plant

Budget Version 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0700 - SGP - Environmental	702,600
Retirements	0700 - SGP - Environmental	54,899
	Total Cost:	757,499
	Original Cost:	518,148

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI#: C0009088
Title: LIN 1&2 CEMS Replacement
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Engineering	PD	8	$ 405	$ 3,242		
Maintenance Trades	PD	24	$ 365	$ 8,755		
Utility Worker	PD	85	$ 240	$ 20,503		
			Sub-Total	$ 32,500		50020, 49551
OT Labour						
Utility Worker	PD	6	$ 480	$ 3,000		
			Sub-Total	$ 3,000		50020, 49551
Term Labour						
Electrician	PD	32	$ 358	$ 11,465		
Power Plant Technician	PD	22	$ 382	$ 8,535		
			Sub-Total	$ 20,000		
Materials						
TML-675 CEM System	ea	1	[redacted]		Attachment 2, Item A	
CO Analyzer Addition	ea	1			Attachment 2, Item A-1	
CO2 Analyzer Addition	ea	1			Attachment 2, Item A-2	
O2 Analyzer Addition	ea	1			Attachment 2, Item A-3	
Dilution Sample Umbilical	ft	300			Attachment 2, Item C	
UltraFlow 150 Flow Monitor	ea	1			Attachment 2, Item D	
Lighthawk Opacity Monitor	ea	1			Attachment 2, Item E	
Standard Model CEM Shelter	ea	1			Attachment 2, Item F	
Calibration Accessories	ea	1			Attachment 2, Item G	
Scroll Enclosed Air Compressor	ea	1			Attachment 2, Item H-1	
USD to CDN Exchange Rate	%	30%				
Cables/Electrical Materials	ea	1	$ 25,000	$ 25,000		
Miscellaneous Consumables	ea	1	$ 10,117	$ 10,117		
Platform for CEMS Access	ea	1	$ 10,000	$ 10,000		
Transformer	ea	1	$ 8,000	$ 8,000		
DCS Materials	lot	1	$ 8,000	$ 8,000		
			Sub-Total	$ 432,250		50020, 49551
Contracts						
CSA Inspection	lot	1	[redacted]		Attachment 2, Item I	
Factory Acceptance Test	lot	1			Attachment 2, Item K	
System Start Up	lot	1			Attachment 2, Item M	
Basic Training Course	lot	1			Attachment 2, Item O	
USD to CDN Exchange Rate	%	30%				
Compressor Building Layout/Design, Platform Design	lot	1	$ 5,000	$ 5,000		
Project Manager	lot	1	$ 15,000	$ 15,000		
Insulation	lot	1	$ 3,000	$ 3,000		
Construct Compressor Foundation	lot	1	$ 20,000	$ 20,000		
CEMS Line Installation	lot	1	$ 50,000	$ 50,000		
HVAC for Compressor Room	lot	1	$ 5,000	$ 5,000		
Air Testing Services	lot	1	$ 15,000	$ 15,000		
Sheet Metal	lot	1	$ 5,000	$ 5,000		
			Sub-Total	$ 165,844		
Freight						
Shipping	ea	1	$ 4,500	$ 4,500		
				$ -		
			Sub-Total	$ 4,500		
Other Goods & Services						
Contingency	%	10%	$ 653,594	$ 65,359		
			Sub-Total	$ 65,359		
Administrative Overhead						
Labour AO				$ 14,108		
Contracts AO				$ 19,938		
			Sub-Total	$ 34,046		
			SUB-TOTAL (no AO, AFUDC)	$ 723,453		
			TOTAL (AO, AFUDC included)	$ 757,499		
Original Cost				$ 518,148		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

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March 29, 2018

To: All SM8200/SM8160/SM8175 Users

Subject: SM8200 Product Discontinuation Notice

Dear Valued Customer,

This letter serves as formal notification that Teledyne Monitor Labs (TML) is discontinuing the SM8200 insitu analyzer. Reduced emissions requirements coinciding with the installation of advanced scrubbing technology has limited the applications for this technology to the point where demand is too low to continue production. Teledyne Monitor Labs acknowledges the obligation to promptly inform its customers regarding the discontinuation of products to allow reasonable time to prepare for alternatives.

Currently, we have a number of instruments in stock, which are available for customers who would like to purchase a complete instrument or a spare transceiver. Spare parts and factory or field repair will continue to be available. Please be advised that TML will support this product, to the best of our abilities, for ten years from the date of last sale to allow for future planning.

With this notification, Teledyne Monitor Labs extends the opportunity to purchase the SM8200 or spare transceiver subject to the following conditions:

- Standard warranty for any SM8200 analyzer/transceiver purchase applies
- Date for last order acceptance is June 30, 2018

Please feel free to contact your regional sales manager or me directly with any questions or concerns.

Regards,

Robert Bott
Vice President North American Sales
Teledyne Monitor Labs
E-mail: Robert.Bott@Teledyne.com
Tel. +1 (303) 792-4200
Fax. +1 (303) 799-1409
Web Address: http://www.teledyne-ml.com

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Quote# 1705001-1

February 16, 2018

Nova Scotia Power
Lingan Generating Station
2599 Hinchey Ave Lingegan
New Waterford, NS B1H-5N9

Reference: Dilution CEMS for Lingan Site

Dear Lindsey Hall,

Teledyne Monitor Labs is pleased to provide Quotation No. 1705001-1 for our ML675 CEM System, Equipment, and Services. This proposal's competitive pricing is based on the entire package. TML has grouped various components in the item column below for comparison purposes. The purchase or exclusion of individual items must be discussed with TML.

The ML675 Extractive Monitoring System combines the benefits of field-proven extractive technology with innovative, flexible design to satisfy a vast range of process monitoring and compliance needs. Each extractive system is a pre-engineered package of high quality components, designed to economically and reliably meet specific application requirements.

If you have any questions regarding this quotation, please contact our Regional Sales Manager, Mr. Rob Bott, at 303-792-4200.

Sincerely,

Ryan Silkworth
Application Engineer

TELEDYNE MONITOR LABS
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Quote# 1705001-1

Teledyne Monitor Labs, a business unit of Teledyne Instruments, Inc.
35 Inverness Drive East
Englewood, Colorado, USA 80112-5189
+1-303-792-3300 Fax +1-303-799-1409
www.teledyne-ml.com

REPRESENTATIVE
Mr. Rob Bott Office: 303-792-4200 Fax: 303-799-1409 rbott@teledyne.com

CUSTOMER NAME & ADDRESS	QUOTE DATE	APPROXIMATE SHIP DATE
Nova Scotia Power Lingan Generating Station 2599 Hinchey Ave Lingegan New Waterford, NS B1H-5N9 Reference: Dilution CEMS Attention: Lindsey Hall	February 16, 2018	Dependent on Purchase Order Acceptance
	QUOTE NUMBER	**SHIP TERMS**
	1705001-1	EXW: Origin, PP&A
	QUOTE VALID FOR	**TERMS OF PAYMENT**
	90 Days	30 Days

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
A	1	**TML-675 Continuous Emission Monitoring System** for the **single** point **Dilution Extractive** measurement of ***NO_X and SO_2***. Includes the following: ➢ T100 T SERIES® SO_2 Analyzer ➢ T200 T-SERIES® NO_X Analyzer ➢ 316 SS Dilution Extractive Probe with 316 SS Straw ➢ Open Rack Mounting ➢ Complete Sample Transport, Air Cleanup and Conditioning System ➢ Controller/PLC for System Sequencing and Control (detail below) ➢ Instrument Air Regulation and Distribution ➢ Automatic Probe Calibration with Multi-Valve Manifold ➢ Automatic Back Purge with Valve ➢ Two (2) sets of Standard Drawings and Two (2) Standard Manuals (on CD) ➢ System Integration and Factory Test ➢ Project management and Engineering	[redacted]	[redacted]
A-1	1	***Optional CO Analyzer Addition to 675 System Above*** ➢ T300 T-SERIES® CO Analyzer	[redacted]	[redacted]
A-2	1	***Optional CO_2 Analyzer Addition to 675 System Above*** ➢ T360 T-SERIES® CO_2 Analyzer	[redacted]	[redacted]

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Quote# 1705001-1

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
A-3	1	**Zircona Oxygen Sensor** for Wet O_2 Measurement ➢ Addition to the 316 SS Dilution Extractive Probe	[redacted]	[redacted]
		Option: Choose ***<u>One (1)</u>*** Controller/PLC Below		
B	1	**Allen Bradley CompactLogix Programmable Logic Controller** Includes the following: ➢ L-3 Controller Dual Ethernet & 2MB Memory Processor ➢ Power Supply ➢ MVI69 Serial Communication Module ➢ Protocol Converter (Modbus) ➢ 16-channel digital input module **(Qty 1)** ➢ 16-channel digital output module **(Qty 1)** ➢ 4-channel analog input module **(Qty 1)** ➢ 4-channel analog output module **(Qty 1)** ➢ Panel View 600® display ➢ PLC Programming Labor **Please note:** Specific module and configuration may change after final engineering is complete. This proposal assumes all customer-supplied inputs are linear and compatible with required unit of measure.	[redacted]	[redacted]
B-1	1 1	**Teledyne Monitor Labs C3i/o® Controller** for System Sequencing and Control Includes the following: ➢ 8 Digital Inputs ➢ 8 Digital Outputs ➢ 4 Analog Inputs **(Qty. 2)** ➢ 2 Analog Outputs **(Qty. 2)** ➢ 19” Rack Mount Control Panel **Teledyne Monitor Labs RPD2®** for Instrument Control, Alarms, and Data Collection Includes the following: ➢ 12 Digital Inputs ➢ 4 Digital Outputs ➢ 4 Analog Inputs **(Qty. 2)** ➢ 2 Analog Outputs **(Qty. 2)**	[redacted]	[redacted]

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Quote# 1705001-1

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
C	Feet	**DILUTION SAMPLE UMBILICAL** The system is designed to use a seven-core sample transport bundle to carry the diluted gas sample from the probe to the cabinet for analysis. Within this bundle, a ⅜" PFA Teflon line transports the diluted sample, a 1/4" PFA Teflon line transports calibration gas, a 1/4" Teflon line supplies the dilution eductor vacuum indication, one 1/4" Teflon line carries bypass eductor air to the probe, a 1/4" Teflon line supplies backflush air, a 1/4" Teflon line carries the orifice pressure indication and finally, a 1/4" Teflon line transports dilution air to the probe. The entire bundle is encased in a rugged, fire-retardant PVC sheath to facilitate installation. Since any moisture is diluted with dry air, only freeze protection for the diluted sample line is supplied. This includes self-regulating heating element(s) located inside the sample bundle, which will operate at approximately 50F. **The quoted price is for lengths greater than 100 feet. Pricing for lengths less than 100 feet are subject to higher pricing per foot, and may require site-specific information.	[redacted]	[redacted]
D	1	**UltraFlow™ 150 Flow Monitor** Monitor Includes: ➢ Dual 50 kHz Transducer Assemblies ➢ Transducer Interface Enclosure (TIE) ➢ Enhanced Remote Panel (ERP) ➢ Single 110CFM Purge Blower w/ Weather Cover ➢ Zero (0) feet of Data Cable **Long Range (20kHz) or Extended Range (14kHz) Transducers may be required per TML review of site-specific Installation Checklist. Dual 42CFM Blowers are required in this configuration.	[redacted]	[redacted]
E	1	LightHawk ***560*** **Compliance Opacity Monitor** Base System includes: ➢ Optical Head & Retro-Reflector ➢ Enhanced Remote Panel (ERP) ➢ Dual 42 CFM Blowers & Aluminum Weather Covers ➢ Without Fail Safe Shutters ➢ Without High Temp. Options (Temp. < 500F) ➢ Zero (0) feet of Data Cable	[redacted]	[redacted]

TELEDYNE MONITOR LABS
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Quote# 1705001-1

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
F	1	**Standard Model CEMS Shelter** 8'W(OD) x 12'L(OD) x 8'H(ID) For placement in a general area classification. Channel skid base, galv. steel framing. white 24GA pre-finished steel interior & exterior cladding with finished stainless steel trim. White duro-last roofing system. Aluminum tread plate flooring. 3x7 insulated steel door with stainless steel hinges. Insulation. Built to the most current local and/or state building code applicable to factory built structures. **Note:** Item includes assembly and engineering labor to install the CEMS, and all accessories, for easy field installation. Also Includes: ➢ Power distribution including lights and receptacles ➢ HVAC 24k BTU, 5k Heat, thermostat, disc. sw ➢ Load Center, 100A, 3PH, 30 POS, NEMA 1 *typical* ➢ Surge Suppressor 3PH *typical* ➢ Disconnect Switch, Non-fused, NEMA 3R *typical* ➢ Single Doors Access (Panic Bar, 12x21 Window Tempered Glass, Automatic Hydraulic Closer) ➢ Interior Partition Wall, alike cladding (bottle bay) ➢ Double Doors access to Bottle Bay ➢ Ground Pad, Copper, NEMA 2-hole, bonded to frame ➢ Exterior light, LED wall pack 25W, 120V ➢ Smoke Alarm, Fire Extinguisher ➢ Canopy 24" projection 7-8 ft. width ➢ Exit Sign, Emergency Light, Battery Backup **Specific components and configuration may change after final engineering is complete.	[redacted]	[redacted]
G	Lot	**Calibration Accessories** Includes: ➢ Stainless Steel Regulators **(Qty. 7)** ➢ Bottle Rack (8 Bottle Capacity) **(Qty. 1)** ***Teledyne Monitor Labs has provided our best estimate of gas requirements at the time of quotation. Additional gases may be required after permit review and final engineering is complete but are not part of this proposal.*	[redacted]	[redacted]

TELEDYNE MONITOR LABS
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Quote# 1705001-1

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
H	1	**Scroll Enclosed Air Compressor** Model Number SES0208 Scroll Enclosure 2 HP system, complete with one 2-HP oil-less scroll compressors, mounted inside of a rigid steel enclosure. Enclosure to have a powder coat finish, and shall include sound deadening insulation. Noise levels shall not exceed 49 dBA with all compressor units in operation. Each compressor pump has a 1750-rpm, ODP motor, V-belt drive, and air-cooled aftercooler. Twin tower, heatless, desiccant air dryer is provided with integrated water separation/pre-filter and 1-micron final filtration. Dryer requires separate 115V power supply. Adjustable output pressure regulator is provided with gauge and installed downstream of the final filter.	[redacted]	[redacted]
H-1	1	**Redundant Scroll Enclosed Air Compressors with Automatic Control Package** **Two (2)** Scroll Enclosure 2 HP system, complete with one 2-HP oil-less scroll compressors, mounted inside of a rigid steel enclosure. Enclosure to have a powder coat finish, and shall include sound deadening insulation. Each compressor pump has a 1750-rpm, ODP motor, V-belt drive, and air-cooled aftercooler. **One (1)** Alternating control package PEI200SEAJ. **One (1)** Custom Frame for Stacking Compressors.	[redacted]	[redacted]
I	1	**CSA Inspection** at Teledyne Monitor Labs Facility	[redacted]	[redacted]

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Quote# 1705001-1

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
J	1	**RegPerfect® CEMS Compliance Data Acquisition and Handling System** Includes the following: ➢ RAID-1 Hot-Plug Tower Server Hardware ➢ Intel® Xeon® Quad Core Processor, 2.4 GHz or better ➢ 146/300 GB 15K RPM SCSI hard drive **(Qty 4)** ➢ 16 GB RAM ➢ CD/DVD-ROM ➢ 500 GB External Hard Drive Backup ➢ Network, video, and sound cards ➢ Tower Case with power supply ➢ Two (2) Year Extended On-Site Hardware Warranty ➢ UPS PRO 420 Power Back Up ➢ Keyboard, mouse ➢ 24" LCD Monitor ➢ HP LaserJet 2 Pro ➢ RS Logix Programming Software ➢ Microsoft Windows® Server (CAL=5) ➢ Microsoft SQL® (CAL=5) ➢ Microsoft Office® Home and Business	[redacted]	[redacted]
J-1	1	**Client Workstation Tower Hardware** Includes the following: ➢ Intel i7® Processor Mother Board ➢ 450 GB hard drive ➢ 4 GB RAM ➢ DVD +/-RW, 8X ➢ Network, video, and sound cards ➢ Mid-Tower case ➢ UPS 300 Power Back Up ➢ Keyboard, mouse ➢ 24" LCD monitor ➢ Windows® ➢ Microsoft Office® Home and Business ➢ RegPerfect® software, configuration and test	[redacted]	[redacted]

TELEDYNE MONITOR LABS
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Quote# 1705001-1

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
J-2	1	**TML RegPerfect® Proprietary Server Software License for Windows®** ➢ Spotlight Real-time Graphical Interface and Data Display ➢ Alarm User Interface (Included in Spotlight) ➢ Trending Interface (Included in Spotlight) ➢ Browser Enabled Report Interface ➢ Data Base Editor ➢ Windows® Integrated Security ➢ RegPerfect® software, configuration and testing **Regulatory Disclaimer:** The proposal includes a RegPerfect® Client and/or Server license to meet the specific regulatory recordkeeping and reporting requirements identified in the bid specification. If a valid site-specific operating permit was not provided in the bid specification, TML reserves the right to review the permit, when provided, to determine if additional costs may be necessary to configure the RegPerfect® software to meet the applicable recordkeeping and reporting requirements. A purchase or contract change order may be required for the costs associated with any additional configuration work required to meet the applicable recordkeeping and reporting requirements not originally identified in the bid specification. **Configuration Disclaimer:** ***Configuration Disclaimer for VOC, PM, PM10, HAPS, NH_3, NH_3 Slip, NO_X, SO_2, CO:*** When there is not an instrument input or measured analog signal to the PLC or DAS, TML specifies that all parameter limits comply with the facility permit by annual or other scheduled facility compliance testing by customer unless estimation formulas are specified by the customer. These parameters will not be recorded or reported by the TML DAHS and are not included as a part of this quotation. **Configuration Requirement for RegPerfect®**: A high-speed connection of 1.5MB/sec is required for configuration via remote support. A phone modem is not considered high speed and would require a site visit and additional charges. A site visit would typically be shown as a separate line item in this proposal.	[redacted]	[redacted]

TELEDYNE MONITOR LABS
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Quote# 1705001-1

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
K	1	**Factory Acceptance Test (FAT)** ***One (1)*** day at Teledyne Monitor Labs' factory for customer personnel to confirm operation of the entire, integrated system. A Factory Witness Test protocol will be submitted for customer reference two (2) weeks prior to the test. Teledyne Monitor Labs' Quality Control and Assurance Department will submit a certified FAT report with the delivery of the CEMS. Customer is responsible for travel and expenses.	[redacted]	[redacted]
L	1	**Installation Supervision** ***One (1)*** plant visit with ***three (3)*** days on-site by a TML Certified Field Service Engineer to oversee and checkout equipment installation. **Please Note:** Fixed price is based upon ***one (1)*** trip with a site time of up to ***twenty-four (24)*** hours (eight hours = one day) during normal business hours. Price includes up to two (2) hours to complete site specific training and any paperwork required to work at the site. Delays resulting in additional time and/or expenses will be billed at standard general service rates. The Service Department requires a minimum of three (3) weeks written notification prior to the actual date that Installation Supervision is desired. Failure to provide proper written notification may result in additional charges for Installation Supervision services. Any hours over the allotted time will be billed at standard general service rates. In addition, be aware that delays may result in the need for a return trip to the site. Expenses and Travel Time for a return trip will be charged to the customer and scheduling for such a trip will depend on Engineer availability. If this Service is not scheduled within six (6) months of System shipment, additional charges may apply. If the customer requests a schedule change after a firm date for services has been set, there may be additional costs associated with changes in travel arrangements. If the customer requests a schedule change after a firm date for services has been set, there may be additional costs associated with changes in travel arrangements.	[redacted]	[redacted]

TELEDYNE MONITOR LABS
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Quote# 1705001-1

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
M	1	**System Startup** during ***two (2)*** mobilizations with ***six (6)*** days on-site by a TML Certified Field Service Engineer. Includes the following services: 1. **Installation Checkout:** Inspect all aspects of the installation and note or direct correction of errors in installation. 2. **System Inspection:** Examine the internal workings of the system to determine if damage occurred during shipment and installation. 3. **System Startup:** Supervise the application of electrical power and other utilities; test all system functions and observe on-line operation. 4. During the startup period Teledyne Monitor Labs' field personnel will familiarize the purchaser's operating and maintenance personnel with the basics of proper operating and preventative maintenance procedures. This familiarization is *not a substitute* for formal classroom system training for either the hardware or software. **NOTES:** **A)** Labor to correct customer installation errors shall be billed at actual time and materials at prevailing service rates when work is performed. **B)** Fixed price is based upon ***two (2)*** mobilizations with a site time of up to ***forty-eight (48)*** hours (eight hours = one day) during normal business hours. Price includes up to two (2) hours to complete site specific training and any paperwork required to work at the site. Waiting time due to client delays shall be billed in addition to the fixed price at prevailing service rates. In addition, be aware that delays may result in the need for a return trip to the site. Expenses and Travel Time for a return trip will be charged to the customer and scheduling for such a trip will depend on Engineer availability. If this Service is not scheduled within six (6) months of System shipment, additional charges may apply. **C)** Teledyne Monitor Labs requires a minimum of four (4) weeks notification prior to Startup. Failure to provide proper written notification may result in additional charges. **D)** If the customer requests a schedule change after a firm date for services has been set, there may be additional costs associated with changes in travel arrangements.	[redacted] [redacted]	[redacted]

TELEDYNE MONITOR LABS
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Quote# 1705001-1

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
N	1	**Certification Test Assistance** of Teledyne Monitor Labs CEM System ***for SO_2, NO_X, CO, CO_2, and Flow.*** TML will provide a technician and regulatory **support** during the On-Site Reference Method testing to assist with documentation, data reduction and verification, relative accuracy, and calibration drift test assistance, according to procedures and specifications of the Code of Federal Regulations, ***Title 40, Part 75, Appendix A, or Title 40, Part 60, Appendix B, Performance specifications 1, 2, 3, 4, 5, & 6,*** as applicable to above system. The pricing quoted for Certification Test Assistance is a one-time charge with any retesting required due to the fault of our instrument performed at no additional charge for our services, provided the following: 1. This service assumes a Teledyne Monitor Labs Field Service Engineer already performed the system Startup, and the system has run for approximately 14 days to ensure stability. 2. The Customer will contract a qualified Stack Sampler to perform Reference Method testing for the CEMS Certification. Testing for each source to occur in one business calendar day during normal business hours. Our price is based upon ***one (1)*** mobilization with up to ***twenty-four (24) hours*** on-site. Delays, other than those caused by Teledyne Monitor Labs, during testing which result in additional Teledyne Monitor Labs Field Service Engineering hours or expenses that are beyond the scope will be billed to the customer at Teledyne Monitor Labs general service rates. 3. Others to provide all calibration gases for CEMS certification. 4. Ongoing QA/QC activities (Annual RATAs) not included. 5. Customer is responsible for providing adequate facilities (i.e. electricity, port, & platforms) required during the testing period. 6. If the customer requests a schedule change after a firm date for services has been set, there may be additional costs associated with changes in travel arrangements. 7. TML Requests a 30-day notice prior to the certification date to schedule a field service technician and stack sampler. 8. Others are responsible for providing the relative accuracy, ***P75 linearity, cycle time response,*** and drift test assessment, expressed in units of the reporting standard, in a report format ready for submittal to the applicable regulatory agencies. Any additional costs for additional time, retesting, and mobilizations by the stack sampler or others will be borne by others. 9. Certification needs to be scheduled within 90 days from completion of Startup; otherwise additional trip charges may apply for pre-cert. CEM system check out and calibration.	[redacted]	[redacted]

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Quote# 1705001-1

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
O	1	**Basic Training Course** We are proposing a ***three (3)*** day On-Site training course held at customer's plant site. The price includes transportation and expenses for the instructor, course materials for up to ***ten (10)*** participants, and will utilize the customer's instruments. The customer will have the responsibility of providing an adequate classroom facility for the On-Site training course. This training class is designed to give your personnel basic operation and theoretical knowledge of the system quoted, and will cover each system component in as much depth as time permits. Arrangements for this training class should be made at least 60 days in advance with Teledyne Monitor Labs. **Factory Instrument Specific Training Courses**. Teledyne Monitor Labs also regularly offers a variety of in-depth instrument-specific training classes on individual system components at our facility. Participants in on-site training will receive a discounted price for factory classroom training classes. These training courses cover theory of operation, troubleshooting, circuit and system functions, maintenance, repair procedures, and actual “hands-on” training. Course dates can be arranged with Teledyne Monitor Labs' Training Department at 1-800-422-1499. **Please Note:** Tuition fees are fully refundable for any cancellation of registration received 30 days prior to class date. Since we keep our class sizes to a minimum to provide maximum value to our clients, cancellation charges of 25% will be applied for cancellations under 30 days and full tuition is due for cancellation under seven (7) days. If the customer requests a schedule change after a firm date for services have been set, there may be additional costs associated with changes in travel arrangements.	[redacted]	[redacted]

TELEDYNE MONITOR LABS
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Quote# 1705001-1

EXHIBIT C
EXCEPTIONS AND CLARIFICATIONS

Teledyne Monitor Labs Definitions:

Clarification = RFQ section is acceptable with noted adjustments
Exception = RFQ section is unacceptable and requires major adjustments.

APPLICATION
Clarification

This quotation was prepared based on our best estimate of the instrumentation that is required to fulfill your stated application requirements. We have not received or reviewed the detailed site-specific application data, which is required to verify the adequacy of the proposed instrument/system configuration. Before we can process an order for the quoted instrumentation, it will be necessary for you to provide the detailed application information described in our Application Data Setup form (Exhibit E). Upon review of this information, we reserve the right to re-evaluate the proposed configuration for compatibility with your site-specific data and make changes to the quoted instrument configurations as necessary to ensure satisfactory operation of the instrument in your application. If changes are required, they may impact prices quoted herein.

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Quote# 1705001-1

TELEDYNE MONITOR LABS' TERMS OF PAYMENT:

- 45% of contract price on submittal of drawings for review.
- 45% of contract price on shipment of equipment.
- 10% of contract price on startup, but not to exceed 90 days after receipt of equipment.

Payment terms for all invoices are NET 30 days from the date of the invoice. Unless otherwise agreed to in writing, payments for drawing submittals must be received by Teledyne Monitor Labs prior to shipment of equipment. Late payment will be considered a breach of contract and Teledyne reserves the right in such instances to cease activity until payment issues are resolved.

NOTE: Prices do not include sales tax. Sales tax will be added to each invoice as a separate line item unless the customer provides Teledyne with a sales and use tax certificate.

PLEASE NOTE: Spare parts ordered after delivery of the instrumentation quoted herein should be based on the final system design and spare parts lists provided with manuals and final drawings.

REGARDING MAINTENANCE AGREEMENT PURCHASES:
If an order resulting from this quotation includes an on-going maintenance agreement for hardware, software, or both, payment for the maintenance agreement(s) may be broken out from the contract price and billing schedule above and billed separately as services are performed.

Maintenance agreement contracts do not include the supply of spare or replacement parts. Spare or replacement parts are billed separately to the holder of the maintenance agreement. For that reason it is recommended that maintenance agreements be purchased by the end user of the equipment rather than an intermediary such as a construction or engineering firm.

The system description and product brochures provided herein describe in detail the instruments/systems included in this proposal. The descriptions are accurate to the best of our knowledge as of the date of this proposal; however, as additional information is obtained, variations may be required to enhance system performance. Teledyne Monitor Labs reserves the right to make changes in the design and construction of any system as it deems appropriate to meet the performance requirements of the application, with proper notification given to customer. Any changes made by Teledyne Monitor Labs will conform to U.S. EPA reference or equivalency method designations where applicable.

Other terms and conditions of sale, including warranty terms, are included with this quotation and can be found at our web site: www.teledyne-ml.com. Successful startup shall be the criteria of acceptance, with such startup defined as calibration of each gas parameter with zero and span gas.

These items are controlled by the U.S. Government and authorized for export only to the country of ultimate destination for use by the ultimate consignee or end-user(s) herein identified. They may not be resold, transferred, or otherwise disposed of, to any other country or to any person other than the authorized ultimate consignee or end-user(s), either in their original form or after being incorporated into other items, without first obtaining approval from the U.S. government or as otherwise authorized by U.S. law and regulations.

CI Number: C0010369

Title: TRE5 Baghouse Filter Replacement Phase 2

Start Date: 2019/10
In-Service Date: 2019/11
Final Cost Date: 2020/05
Function: Steam
Forecast Amount: $542,340

DESCRIPTION:

The scope of this project is to replace the filter bags on 4 of 8 modules of the Trenton Unit 5 baghouse.

The Trenton Unit 5 baghouse is a dust collector; a device that removes particulates from the flue gases of the Unit 5 boiler. The baghouse was constructed and commissioned in 2009. The baghouse consists of eight modules, each containing 493 filter bags, for a total of 3,944 filter bags. The filter bags have a finite life of approximately five years, and must be replaced over time. Approximately half the filter bags were replaced in 2018 and the other half will be replaced in 2019.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2018 CI C0006238 TRE5 Baghouse Filter Replacement P&A $313,508

JUSTIFICATION:

Justification Criteria: Environment

Why do this project?

This project must be completed to ensure that the baghouse remains fully operational. The baghouse is used in series with an electrostatic precipitator to remove fly ash and other particulate from the boiler flue gas prior to release to the atmosphere, thus reducing the amount of emissions. This equipment is required to provide particulate removal from the flue gas to reduce the impact to the environment and meet regulatory guidelines as stipulated in the Trenton Operating Approval (Attachment 1, Section 3.n, page 8). The baghouse also allows for greater flexibility in coal fuel blends because of its high fly ash capture rate.

Why do this project now?

The filter bags have a finite lifespan based on unit utilization. Recent failures of several filter bags have occurred, indicating that the bags are aging, requiring replacement now. This project is the second phase of a two phase approach and will be completed during the planned 2019 Trenton Unit 5 outage.

Why do this project this way?

Filter bag replacements are the only option to allow continued, reliable operation of the baghouse, and removal of particulates.

CI Number : C0010369 - TRE5 Baghouse Filter Replacement Phase 2 **Project Number** C0010369

Parent CI Number : -

Asset Location : 1165 - 1165 Trenton Unit 5; Commissioned 1969, 160 Mwh **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0700 - SGP - Environmental	467,982
Retirements	0700 - SGP - Environmental	74,358
	Total Cost:	542,340
	Original Cost:	440,330

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI# : C0010369
Title: TRE5 Baghouse Filter Replacement Phase 2
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Power Engineer	PD	3	$ 390	$ 1,171		CI 46395
Power Plant Technician	PD	3	$ 382	$ 1,146		CI 46395
Utility Worker	PD	5	$ 240	$ 1,201		CI 46395
			Sub-Total	$ 3,518		
OT Labour						
Power Plant Technician	PD	2	$ 764	$ 1,528		CI 46395
Utility Worker	PD	10	$ 480	$ 4,804		CI 46395
			Sub-Total	$ 6,332		CI 46395
Term Labour						
Maintenance Trades	PD	5	$ 365	$ 1,824		CI 46395
Utility Worker	PD	5	$ 240	$ 1,201		CI 46395
			Sub-Total	$ 3,025		
Materials						
Filter Bags	ea	2000	$ 90	$ 180,000		CI 46395
Cages	ea	250	$ 70	$ 17,500		CI 46395
Level Switch (Probe)	ea	2	$ 2,000	$ 4,000		CI 46395
USD Conversion	lot	30%	$ 201,500	$ 60,450		
Miscellaneous Materials	lot	1	$ 2,500	$ 2,500		
			Sub-Total	$ 264,450		
Contracts						
Boilermakers - Changing Filter Bags	PD	192	$ 1,000	$ 192,000		CI 46395
Vacuum Truck Services	lot	1	$ 10,000	$ 10,000		CI 46395
Supervision	lot	1	$ 10,000	$ 10,000		
			Sub-Total	$ 212,000		
OT Meals						
Meals	lot	1	$ 500	$ 500		
				$ -		
			Sub-Total	$ 500		
Other Goods & Services						
Contingency	%	5%	$ 489,825	$ 24,491		
				$ -		
			Sub-Total	$ 24,491		
Administrative Overhead						
Labour AO	lot	1	$ 2,717	$ 2,537		
Contracts AO	lot	1	$ 26,591	$ 25,487		
			Sub-Total	$ 28,023		
			SUB-TOTAL (no AO, AFUDC)	$ 514,316		
			TOTAL (AO, AFUDC included)	$ 542,340		
Original Cost				$ 440,330		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

NOVA SCOTIA

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APPROVAL

Province of Nova Scotia
Environment Act, S.N.S. 1994-95, c.1 s.1

APPROVAL HOLDER: NOVA SCOTIA POWER INCORPORATED

SITE PID: 00863050, 00863076, 00864637, 00927046, 00961110, 65036048, 65042152, 65051468, 65150948, 65186249, 65200024, 65200123, 65200131, 65200149, 65200156, 65200164, 65200172, 65200180, 65200198, 65200206, 65200214, 65200222, 65200289, 65207615, 65207664, 65207714, 65207722, 65212151

APPROVAL NO: 2006-054488-10

EXPIRY DATE: June 30, 2022

Pursuant to Part V of the *Environment Act*, S.N.S. 1994-95, c.1 s.1 as amended from time to time, approval is granted to the Approval Holder subject to the Terms and Conditions attached to and forming part of this Approval, for the following activity:

Industrial - Power Plant

Administrator: Paul Currie

Effective Date: January 30, 2018

The Minister's powers and responsibilities under the Act with respect to this Approval have been delegated to the Administrator named above. Therefore, any information or notifications required to be provided to the Minister under this Approval can be provided to the Administrator unless otherwise advised in writing.

TERMS AND CONDITIONS OF APPROVAL

Nova Scotia Environment

Approval Holder: NOVA SCOTIA POWER INCORPORATED

Project: Trenton Generating Station

Site:

PID	Civic #	Street Name	Street Type	Community	County
00863050				ABERCROMBIE	PICTOU COUNTY
00863076				MOUNT WILLIAM	PICTOU COUNTY
00864637				ABERCROMBIE	PICTOU COUNTY
00927046				TRENTON	PICTOU COUNTY
00961110				MOUNT WILLIAM	PICTOU COUNTY
65036048				TRENTON	PICTOU COUNTY
65042152	71	POWER PLANT	RD.	TRENTON	PICTOU COUNTY
65051468				MOUNT WILLIAM	PICTOU COUNTY
65150948				TRENTON	PICTOU COUNTY
65186249				TRENTON	PICTOU COUNTY
65200024				ABERCROMBIE	PICTOU COUNTY
65200123	2227	GRANTON ABERCROMBIE	RD.	ABERCROMBIE	PICTOU COUNTY
65200131				ABERCROMBIE	PICTOU COUNTY
65200149				ABERCROMBIE	PICTOU COUNTY
65200156				ABERCROMBIE	PICTOU COUNTY
65200164				ABERCROMBIE	PICTOU COUNTY
65200172				ABERCROMBIE	PICTOU

		COUNTY
65200180	ABERCROMBIE	PICTOU COUNTY
65200198	ABERCROMBIE	PICTOU COUNTY
65200206	MOUNT WILLIAM	PICTOU COUNTY
65200214	ABERCROMBIE	PICTOU COUNTY
65200222	ABERCROMBIE	PICTOU COUNTY
65200289	MOUNT WILLIAM	PICTOU COUNTY
65207615	TRENTON	PICTOU COUNTY
65207664	TRENTON	PICTOU COUNTY
65207714	TRENTON	PICTOU COUNTY
65207722	TRENTON	PICTOU COUNTY
65212151	ABERCROMBIE	PICTOU COUNTY

Approval No: 2006-054488-10

File No: 92100-30-PIC-2006-054488

Reference Documents

- Application submitted January 26, 2018 and attachments.
- NSE Approval Number 2006-054488-A05 and associated Reference Documents

1. Definitions

a. Act means Environment Act. 1994-95, c.1, s.1, and includes, unless the context otherwise requires, the regulations made pursuant to the Act, as amended from time to time.

b. Administrator means a person appointed by the Minister for the purpose of this Act, and includes an acting administrator.

c. Approval means an Approval issued pursuant to this Act with respect to an activity.

d. Approval Holder means Nova Scotia Power Incorporated (NSPI).

e. Continuous Emission Monitoring System (CEMS) means the total equipment required to sample, condition, analyze or measure and provide a permanent record of emissions or process parameters.

f. Department means the Department of Environment, and the contact for the Department for this approval is:
Nova Scotia Environment
Eastern Region, Pictou Office
20 Pumphouse Road
Granton, Nova Scotia B2H 5C6

Phone: (902) 396-4194
Fax: (902) 396-4765

g. Effluent Treatment System means the series of three (3) collection ponds, two (2) pumps, two (2) settling basins, chemical storage and addition systems, online monitoring instrumentation and associated works as identified in Nova Scotia Power Trenton Generating Station, Effluent Treatment System Evaluation (CBCL, 2013).

h. Geo-environmental Liner means a compacted clay liner, a geosynthetic clay liner, or a geomembrane liner.

i. Grab sample means an individual sample collected in less than 30 minutes and which is representative of the substance sampled.

j. Letter of Authorization means a letter, signed by an Administrator, granting permission to the Approval Holder to conduct a specific action or utilize a specific method, document or plan.

k. Minister means the Minister of Environment and includes any person appointed as a designate of the Minister.

l. Net Engergy Output means gross energy output minus unit service power requirements.

m. Opacity means the degree to which visible emissions obstruct the passage of light.

n. Primary Fuel means coal or blend of coal (domestic and/or imported) and petroleum coke.

o. Routine Maintenance means work planned and performed on a routine basis to

maintain and preserve the condition of the boiler units and associated pollution control equipment.

p. Shut-down means the planned cessation of fossil fuel combustion at an electrical generating unit resulting in an inoperative state and no power generation for at least one (1) or more hours.

q. Site means the place where the designated activity and/or undertaking is occurring or may occur.

r. Source Testing Event means a phase of performance testing activities that involves the site set-up and the actual testing. For each source the test consists of a preliminary survey, and at least three (3) repetitions of appropriate source testing methodologies.

s. Start-up means the initiation of fossil fuel combustion at an electrical generating unit following one (1) or more hours of non-operation (i.e. no combustion).

t. Storm Water System means any work or undertaking that is used for the collection and deposit of storm water runoff on the site, which is not directed to the Effluent Treatment System.

u. 720 Hour Rolling Average means for each air pollutant, the average of the consecutive hourly mean emission rates, determined for the preceding 720 hours of facility operation. Intervals of time where the emission rate is at or near zero, when the facility is not in operation, are not to be included in the calculation of rolling averages.

2. Scope

a. This Approval (the "Approval") relates to the Approval Holder(s) and their application and supporting documentation, as listed in the reference documents above, for the reclaimation, operation or reclamation of a power plant in which hot water, steam, or thermal electric power is produced.

b. This Approval to operate the power plant includes Unit 5 (Trenton 5), Unit 6 (Trenton 6) and associated works at or near Trenton and Abercrombie in Pictou County as described in the application and supporting documentation.

c. The Site shall not extend beyond the area as outlined in the application and supporting documentation.

3. General

a. The Approval Holder(s) shall construct, operate and reclaim the Facility in accordance with the following provisions:

i. Environment Act S.N.S. 1994-1995, c.1, s.1 as amended from time to time

ii. Regulations pursuant to the above Act, as amended from time to time

b. No authority is granted by this Approval to enable the Approval Holder(s) to construct or operate the Facility on lands which are not in the control or ownership of the Approval Holder(s). It is the responsibility of the Approval Holder(s) to ensure that such a contravention does not occur.

c. If there is a discrepancy between the reference documents and the terms and conditions of this Approval, the terms and conditions of this Approval shall apply.

d. Any request for renewal or extension of this Approval is to be made in writing, to the Department, at least ninety (90) days prior to the Approval expiry.

e. This Approval is not transferable without the consent of the Minister.

f. If the Minister determines that there has been non-compliance with any or all of the terms and conditions contained in this Approval, the Minister may cancel or suspend the Approval pursuant to subsections 58A(1) and 58A(2) of the Act, until such time as the Minister is satisfied that all terms and conditions have been met.

g. If the Minister cancels or suspends this Approval, the Approval Holder(s) remains subject to the penalty provisions of the Act and regulations.

h. The Approval Holder(s) shall advise the Department in writing prior to any proposed extensions or modifications to the Site. An amendment to this Approval may be required before implementing any extension or modification.

i. Pursuant to Section 60 of the Act, the Approval Holder(s) shall submit to the Minister any new and relevant information respecting any adverse effect that actually results, or may potentially result, from any activity to which the Approval relates and that comes to the attention of the Approval Holder(s) after the issuance of the Approval.

j. The Approval Holder(s) shall notify the Department of any incidents of non-compliance with this Approval within one (1) business day.

k. The Approval Holder(s) shall bear all expenses incurred in carrying out the environmental monitoring required under the terms and conditions of this Approval.

l. Unless specified otherwise in this Approval, all samples required to be collected by this Approval shall be collected, preserved and analysed, by qualified personnel, in accordance with recognized industry standards and procedures.

m. Unless written authorization is received otherwise from the Minister, all samples required by this Approval shall be analysed by a laboratory that meets the requirements of the Department's Policy on Acceptable Certification of Laboratories as amended from time to time.

n. The Approval Holder(s) shall ensure that all pollution control equipment at the Site is maintained, operated and functional to ensure compliance with the Act, Regulations made pursuant to the Act, and the Terms and Conditions of this Approval.

o. Upon any changes to the Registry of Joint Stock Companies information, the Approval Holder(s) shall provide a copy to the Department.

p. The Approval Holder(s) shall submit any monitoring results or reports required by this Approval to the Department. Unless specified otherwise in this Approval, all monitoring results shall be submitted within 30 days following the month of monitoring.

q. The Approval Holder(s) shall provide two (2) hard copies and one (1) electronic copy of all reports to the Department within the specified time frames as required under the Terms and Conditions of this Approval.

r. This Approval does not supersede any Federal or Municipal regulatory requirements.

4. Air Quality Management

General

a. The Approval Holder(s) shall ensure that emissions from the facility do not contribute to an exceedance of the maximum permissible ground level concentrations specified in Schedule A of the Air Quality Regulations.

b. The Approval Holder(s) shall demonstrate compliance with this Approval through an ambient air monitoring and reporting program. The ambient air monitoring and reporting program shall include, but is not limited to:

i. Ambient air monitoring;

ii. Continuous emissions monitoring (or equivalent technology approved by the Department);

iii. Source testing; and

iv. Air dispersion modelling.

c. The Approval Holder shall conduct an Air Dispersion Modelling Study (Study) and submit the completed report to the Department by June 30, 2017. This Study shall determine the impact of air emissions of fine particulate (including PM10 and PM2.5), and the air contaminants of Schedule A of the Air Quality Regulations. The Study shall, at a minimum:

i. Provide an estimate of the maximum ground level concentrations with frequency analysis at discrete receptor locations outside the boundaries of

the facility for each of the air contaminants being emitted from the facility, during routine operations under the proposed operating conditions;

ii. Model the operations of at least three (3) different load ranges that typify operating conditions expected during the term of this Approval;

iii. Evaluate emission sources at any stationary vent, stack and storage area at the facility that releases, or has the potential to release air contaminants to the environment;

iv. Include emission source characterization comprised of:

(a) The identification of stack and/or vent:
1. Heights above adjacent ground level;
2. Diameters;
3. Gas exit velocities; and
4. Gas temperatures.

(b) The measured mass emission rate of the source air contaminants for each emission source identified at the facility for different load conditions.

v. Include air quality dispersion modelling that shall:

(a) Utilize a multi-source model that is sensitive to the terrain and building downwash effects and is acceptable to the Department;

(b) Utilize inputs of the local topography, five (5) years of hourly MM5 processed meteorological data, measured emission rates of the emission source characterization component of the Study, and discrete receptor locations within a 25 (or greater) kilometer radius of the facility;

(c) Utilize a scenario that uses actual operating data from the facility for the occasion when the highest concentration of air contaminant at ground level would occur. The operating condition that corresponds to the maximum ground level concentration may occur when the facility is at the maximum production level or running at a lower level or when the process is in transition;

(d) Provide a description of the operating conditions of the significant sources that result in the maximum ground level concentration of a contaminant;

(e) Provide an estimate of the maximum ground level concentrations for the averaging periods associated with the air contaminants in Schedule A of the Air Quality Regulations and fine particulate (including PM10 and PM2.5), with an averaging period of 24 hours;

(f) Provide a frequency distribution analysis where modelling predicts potential exceedances to the air contaminants in Schedule A of the Air Quality Regulations;

(g) Provide mapping identifying the receptors, the location, and magnitude of ground level concentrations; and

(h) Provide a comparison of results to the concentrations of contaminants listed in Schedule A of the Air Quality Regulations.

vi. Include evaluation of the existing ambient air monitoring network that utilizes the results from the air quality dispersion modelling component of the Study to determine whether additional ambient monitors are required and whether existing monitors are sited in appropriate locations. The results of this evaluation shall recommend the quality and location of ambient air quality monitoring stations required to satisfy compliance with Schedule A fo the Air Quality Regulations. If the results of this evaluation indicate that additional monitor(s) are required, the implementation schedule for the installation of such monitor(s) shall be submitted with the Study.

Ambient Air

d. The Approval Holder shall operate ambient air quality stations and monitors at the following locations:

i. Station Name: Hillside - 109 Chance Harbour Road, Hillside (PID 00869461)

ii. Station Name: Trenton Airport - 178 Duke Street, Trenton (PID 65147688)

iii. Station Name: Frasers Mountain - 1629 Frasers Mountain Road, New Glasgow (PID 00867168)

iv. Station Name: Lourdes - 109 North Foord Street, Stellarton (PID 01004290)

v. Station Name: Abercrombie - 2016 Granton-Abercrombie Road, Abercrombie (PID 00864538)

vi. Station Name: Trenton Middle School - 37 Dickie Street, Trenton (PID 01021179)

e. The Approval Holder(s) shall measure the following parameters at each of the stations identified above, with the exception of the Trenton Middle School Station:

i. Continuous monitoring of sulphur dioxide capable of reporting 1-hour and 24-hour rolling average concentration in parts per hundred million by

volume; and

ii. Meteorological data: wind speed, wind direction.

f. The Approval Holder(s) shall conduct continuous monitoring of nitrogen oxides (excluding nitrous oxide) and collectively expressed as nitrogen dioxide at Hillside and Frasers Mountain stations, capable of reporting 1-hour rolling average concentration in parts per hundred million by volume.

g. The Approval Holder(s) shall conduct monitoring of total suspended particulate (TSP) at the Trenton Middle School Station capable of reporting 24-hour average concentration in micrograms per cubic metre (µg/m3).

h. The Approval Holder(s) shall maintain the ambient air quality stations and monitors identified in this Approval, in accordance with the Ambient Air Monitoring Quality Assurance Program, Version: 6 (Nova Scotia Power, 2010), unless otherwise authorized by the Department.

i. The Approval Hoolder(s) may maintain ambient air quality stations and monitors identified in this Approval, in accordance with a revised Ambient Air Monitoring Quality Assurance Program, providing the Approval Holder(s) has received a Letter of Authorization from an Administrator.

j. The Approval Holder(s) shall calibrate and maintain the meteorological equipment at all ambient air monitoring stations in accordance with equipment manufacturer's requirements. Calibration and maintenance shall be completed, as a minimum, once per calendar year and/or where data is determined or suspected to be inaccurate.

k. The Approval Holder(s) shall maintain records of ambient air quality station maintenance, monitor maintenance and calibrations conducted per this Approval.

l. If air quality results measured at the ambient air quality stations identified in this approval demonstrate an exceedance of the maximum permissible ground level concentrations specified in Schedule A of the Air Quality Regulations, the Approval Holder(s) shall respond immediately to ameliorate ground level concentrations and notify the Department.

m. The Approval Holder(s) shall conduct an analysis associated with any exceedance measured per this Approval and implement corrective action for any causes associated with plant operations.

5. Air Emissions

General

a. The Approval Holder(s) shall limit the mean rate of discharge of particulate matter in flue gas emissions to comply with the limits of the In-Stack Limit: Particulate

Matter table, attached.

b. The Approval Holder(s) shall ensure opacity of stack emissions are maintained at or below 20 percent (%) except visible emissions may increase in opacity to 40% for a maximum of six (6) minutes in the 60 minutes following any increase in opacity above 20%. Opacity shall be measured with continuous emission monitors (CEMS) and calculated as a six (6) minute arithmetic average of instantaneous observations.

c. The Approval Holder(s) shall report all opacity exceedances to the Department. Exceedances occuring during start-up, shut-down, and routine maintenance do not require reporting if the Approval Holder(s) has implemented a response plan, approved by the Department through issuance of a Letter of Authorization. The Department may require the Approval Holder(s) to revise an approved plan, if as determined by the opinion of the Department, the plan does not effectively minimize the opacity of emissions.

d. The use of front end (prior to combustion) sorbent enhancement additive for the purpose of increased mercury capture is restricted to the use of chlorine based halogens only. Use of any other type of sorbent enhancement additives requires prior written autorization from the Minister or Administrator.

e. The use of back end (post combustion) sorbent injection for the purpose of mercury capture is restricted to the use of activated carbon or activated carbon amended with chlorinated or borminated substances. Use of any other type of sorbent injection substance requires prior written authorization from the Minister or Administrator.

f. Source testing and air dispersion modelling conducted under Approval Number 2006-054488-A03 shall be used to inform the Approval Holder(s) as to the maximum halogen content of primary fuels, sorbent enhancement additives and sorbent injection substances utilized at the facility, to ensure compliance with maximum permissible ground level concentrations in the Air Contaminants: Maximum Ground Level Concentration Limits table, attached.

Source Testing

g. The Approval Holder(s) shall undertake source testing at least once per calendar year, no closer than two (2) months apart, to determine the emission rate and concentrations of particulate matter (including fine particulate PM10 and PM2.5), mercury and mercury compounds in the flue gas from each stack using the test methodologies identified below. Source testing shall be proposed in the pre-test plan required under this Approval each year that will reflect testing at variable generation rates subject to the approval of an Administrator.

Test Methods:

i. Particulate Matter - Environment Canada Reference Methods for Source Testing: Measurement of Releases of Particulate from Stationary Sources (EPS 1/RM/8)

ii. Fine Particulate - USEPA Method 201a - Determination Of PM10 And PM2.5 Emissions From Stationary Sources (Constant Sampling Rate Procedure)

iii. Mercury - ASTM D6784-02 Standard Test Method for Elemental, Oxidized, Particulate-Bound and Total Mercury in Flue Gas Generated from Coal-Fired Stationary Sources (Ontario Hydro Method).

h. Test results associated with source testing conducted for this Approval for nitrogen oxide and sulphur dioxide shall include the calculated emission rates for each pollutant reported in kilograms per hour, kilograms per megawatt-hour net energy output and concentrations in parts per million. All concentrations of gaseous pollutants are to be measured on a dry volume basis and the volumetric flow rate calculations based on actual oxygen levels in the flue gas.

i. Test results associated with source testing conducted for this Approval for particulate matter and fine particulate matter shall include the calculated emission rate reported in kilograms per hour, kilograms per megawatt-hour net energy output and concentration of dry gas in milligrams per cubic meter at reference conditions of 25 degrees Celsius (°C), 101.3 kilopascals (kPa) and corrected to three (3) percent (%) oxygen.

j. Test results associated with source testing conducted for this Approval for mercury and mercury compounds, shall include mercury emitted in gaseous form and mercury associated with particulate emissions. Total mercury, particulate bound, oxidized and elemental mercury shall each be reported separately. The report shall include calculated emission rates reported in grams per hour, grams per megawatt-hour net energy output and concentrations of dry gas in micrograms per cubic meter at reference conditions of 25 degrees Celsius (°C), 101.3 kilopascals (kPa), for each form. The emission rate, volumetric flow rate and concentration calculations shall be based on actual oxygen levels in the flue gas.

Continuous Emission Monitoring Systems

k. The Approval Holder(s) shall operate and maintain a Continuous Emission Monitoring System (CEMS) at a point downstream of the air pollution control equipment on each stack to continuously measure and log the rates of release of sulphur dioxide and nitrogen oxides in the flue gas at all times during which the facility is in operation. These CEMS shall be equipped with a hard copy recording device or with software to store historical data. Records of such measurements shall include the hourly and calculated 720 hour rolling average emission rate of sulphur dioxide and nitrogen oxides (expressed as nitrogen dioxide) in units of

kilograms per hour and kilograms per megawatt-hour net energy output. Records shall be retained for a minimum of two (2) years and made available to the Department upon request.

l. The Approval Holder(s) shall operate and maintain a CEMS at a point downstream of the air pollution control equipment on the stack of Unit 5 to continuously measure and log the rates of release of gaseous phase mercury in the flue gas at all times during which the unit is in operation. The CEMS shall be equipped with a hard copy recording device or with software to store historical data. Records of such measurements shall include the hourly emission rate of mercury in units of micrograms per cubic meter (µg/m3) and micrograms per hour (µg/hr). Records shall be retained for a minimum of two (2) years and made available to the Department upon request.

m. The CEMS described in this Approval shall be maintained, operated and evaluated in accordance with the Protocols and Performance Specifications for Continuous Monitoring of Gaseous Emissions from Thermal Power Generation, EPS 1/PG/7 (revised)(Environment Canada, 2005), as amended from time to time.

n. The CEMS described in this Approval shall comply with the USEPA Title 40 CFR Part 60 Performance Standard 12 - Specifications and Test Procedures for Total Vapor Phase Mercury Continuous Emission Monitoring Systems in Stationary Sources (PS-12A). The CEMS shall be maintained, operated and evaluated in accordance with USEPA Title 40 CFR Part 60 Procedure 5. Quality Assurance Requirements for Vapor Phase Mercury Continuous Emission Monitoring Systems and Sorbent Trap Monitoring Systems Used For Compliance Determination at Stationary Sources (Procedure 5).

o. The Approval Holder(s) shall operate and maintain a CEMS at a point downstream of the air pollution control equipment on each stack to continuously measure and log the opacity of flue gas emissions at all times during which the facility is in operation. Each CEMS shall be equipped with a hard copy recording device or with software to store historical data. The CEMS for opacity shall meet or exceed the requirements of Environment Canada publication EPS 1-AP-75-2, Standard Reference Methods for Source Testing: Measurement of Opacity of Emissions from Stationary Sources. The Approval Holder(s) shall also ensure that such monitors undergo manual calibration and cleaning in accordance with manufacturers specifications, at such frequency so as to ensure accurate measurement of opacity emissions. Records shall be retained for a period of two (2) years and made available to the Department upon request.

p. Each CEMS shall monitor and log data continuously and shall have data availability of equal to or greater than 95 percent (%) of the source operating time.

Air Emissions Reporting

q. The Approval Holder shall submit a Pre-test Plan to the Department at least 30 days prior to the date of commencement of all source testing.

r. Within 90 days of completion of source testing the Approval Holder(s) shall submit a final Source Testing Report to the Department. The final Source Testing Report shall also include pertinent operating information collected during testing and detailed readings from applicable CEMS.

s. The Approval Holder(s) shall notify the Department of any failure of QA/QC testing of RATA testing of CEMS required under EPS 1/PG/7, USEPA PS-12A and/or USEPA Procedure 5, within 30 days of receiving the results of RATA testing.

6. Management of Contaminants

a. The Approval Holder(s) shall utilize a Site Professional to assess existing soil, groundwater, sediment and/or surface water conditions at the Site to verify and delineate sources of historical contamination as follows:

i. File a Phase 1 Environmental Site Assessment (ESA) report with the Department in accordance with protocol PRO-300, pursuant to the Contaminated Sites Regulations June 30, 2017

ii. File a Phase 2 ESA report with the Department in accordance with protocol PRO-400, pursuant to the Contaminated Sites Regulations June 30, 2019.

iii. File a Remedial Action Plan (RAP) in accordance with protocol PRO-600, Remedial Action Plan Protocol, as defined in the Contaminated Sites Regulations. Where required the RAP shall be submitted to the Department by June 30, 2020.

b. File an Environmental Risk Management Plan (ERMP) that provides long-term means and measures required to manage risks to human health and ecological receptors on and off the Site, by June 30, 2020.

c. Submissions to the Department, under this Section shall bear the signature of a Site Professional.

7. Groundwater Management

a. The Approval Holder(s) shall install monitoring wells in each area of the Site if data gaps have been identified in conjunction with the Management of Contaminants section of this Approval, no later than June 30, 2019. This work shall be completed under the supervision of a Site Professional. Groundwater sampling for newly installed wells shall meet minimum parameter and frequency requirements as per the Groundwater Sampling Requirements table, attached.

b. The Approval Holder(s) shall conduct analytical sampling of groundwater wells as per the Groundwater Sampling Requirements table under the supervision of a Site Professional. The Approval Holder(s) may apply for an amendment to the groundwater monitoring program based on the terms and conditions of the Management of Contaminants and Groundwater sections of this Approval with sufficient rationale provided to the Department.

c. During each groundwater sampling event, the Approval Holder(s) shall:

   i. Ensure each monitoring well is assessed for its physical condition and integrity, and where necessary, repair or decommission the well in accordance with the requirements under the Contaminated Sites Regulations; and

   ii. Identify and record any wells from the Groundwater Sampling Requirements table not sampled with rationale. A Monitoring Well Decommissioning Report shall be provided to the Department.

d. Groundwater Management Systems for Ash Management Site Disposal Cells shall include:

   i. A minimum of one (1) groundwater monitoring well installed hydraulically above the gradient of the disposal cell and at least three (3) monitoring wells installed below the gradient direction;

   ii. A sufficient number of multi-level well nests for measurement of vertical gradients;

   iii. Locations of monitoring wells that are sufficiently close to the active disposal area to allow early detection of contamination and implementation of remedial measures; and

   iv. Monitoring wells are to be retained throughout the lifespan of the Ash Management Sites.

e. The Approval Holder(s) shall maintain records of the groundwater monitoring program onsite as outlined above. This information shall be provided to the Department upon request.

8. Domestic Wells

a. The Approval Holder(s) shall conduct sampling of the three (3) domestic wells (DW#1, DW#3 and DW#5) surrounding the Abercrombie Ash Management Site on an annual basis unless otherwise approved in writing by the Minister or Administrator.

b. A minimum list of parameters to be included within the sampling program for the domestic well sampling is outlined in the Minimum List of Parameters for

Groundwater, Domestic Well, and Surface Water Analytical Packages table, attached.

c. The groundwater quality analysis results obtained from the domestic well sampling shall be submitted to the respective property owner within 60 days of the date of sampling.

d. In conjunction with the Phase 2 ESA program, the Approval Holder(s) may apply for an amendment to the domestic well monitoring program.

9. Effluent Management

Wastewater Management

Effluent Treatment System

a. The Approval Holder(s) shall ensure industrial wastewater generated at the facility can be directed to the effluent treatment system including but is not limited to:

i. Wastewater and stormwater runoff generated from coal pipe drainage; drains from Unit 5, Unit 6, Ash Silo, and yards south of the plant;

ii. Unit 6 grease pit drain and condenser pit effluent;

iii. Sump drainage for Units 5 and 6;

iv. Wastewater generated from the boiler water treatment system;

v. Boiler blowdown and chemical clean effluent; and

vi. Runoff from Unit 5 and 6, rail area, and Unit 6 transformer area.

b. The Approval Holder(s) shall ensure all wastewater, including drainage that may be impacted by petroleum hydrocarbons from the Site be collected and directed to an oil/water separator for treatment prior to entering the effluent treatment system.

c. The Approval Holder(s) shall complete the following minimum monitoring and sampling requirements for liquid effluent discharged from the effluent treatment system:

i. Record the date, time and volume of each batch of effluent discharged from the effluent treatment system. Flow monitoring equipment must be maintained and calibrated as per manufacturer's recommendations.

ii. Effluent shall be analyzed for concentration of total iron, total suspended solids (TSS), and pH for each batch after treatment and prior to discharge. Discharge shall not occur if the results exceed the limits specified in the

Discharge Limits: Effluent Treatment System table, attached.

iii. At a minimum, a weekly grab sample of the effluent shall be submitted for independent laboratory analysis of general chemistry, petroleum hydrocarbon (benzene, toluene, ethylbenzene, xylene, and total petroleum hydrocarbons), and metals parameters specified in the Discharge Limits: Effluent Treatment System table and the Minimium List of General Chemistry Parameters for Wastewater Management Analytical Packages table, attached. Samples shall be collected at least three (3) days after any other sample.

d. Prior to January 31, 2018, the Approval Holder(s) shall:

i. Ensure discharge from the effluent treatment system meets the following interim limits specified in the Interim Discharge Limits: Effluent Discharge table, attached.

ii. Collect confirmatory samples to determine the ambient (upstream) concentrations of phosphorus for the Site.

iii. The Approval Holder(s) may apply for an amendment to the Discharge Limits: Effluent Treatment System table provided a minimum 30 days prior to December 31, 2017. Supporting rationale shall be provided to the Department in advance for review with any application for amendment.

e. Subsequent to January 31, 2018, the Approval Holder(s) shall ensure effluent discharge from the effluent treatment system as calculated by monthly arithmetic average for the results from the monitoring and sampling conducted for this Approval meets the discharge limits specified in the Discharge Limits: Effluent Treatment System table and the Minimum List of General Chemistry Parameters for Wastewater Management Analytical Packages table, attached.

f. The Approval Holder(s) shall provide the Department with written notification at least 60 days prior to conducting any chemical cleaning of boilers at the facility. The notification shall include:

i. A description of the cleaning process;

ii. Chemicals to be used;

iii. Expected chemical composition of the wastewater; and

iv. A plan to characterize the wastewater produced.

g. The Approval Holder(s) shall obtain a Letter of Authorization from an Administrator before conducting the chemical cleaning of boilers at the facility.

h. The Approval Holder(s) shall develop an approach for, or alternative methodology equivalent to, conducting annual leak tests of the effluent treatment

system ponds and associated underground piping. A description of the approach (or methodology) as well as the results of the leak test shall be submitted to the Department on an annual basis. Leak tests shall be completed under similar conditions each year (i.e. within the same season, similar water level in the pond) for data comparison.

Ash Management Sites

i. The Approval Holder(s) shall ensure all wastewater generated at the active ash disposal areas at the Trenton Ash Management Site and Abercrombie Ash Management Site is directed to the associated treatment ponds.

j. The Approval Holder(s) shall complete the following minimum monitoring and sampling requirements for liquid effluent discharge from the Trenton Ash Management Site (i.e. up until the point of closure) and Abercrombie Ash Management Site treatment ponds:

   i. Record the date, time, volume and duration of each discharge from the treatment pond.

   ii. Effluent shall be analyzed for total iron, totals suspended solids (TSS), and pH for each batch after treatment and prior to discharge. Discharge shall not occur if the results exceed the limits specified in the Discharge Limits: Trenton Ash Management Site (TAMS) Treatment Pond table and the Discharge Limits: Abercrombie Ash Management Site (AAMS) Treatment Pond table, attached, as applicable.

   iii. At minimum, a weekly grab sample of the effluent shall be submitted for independent laboratory analysis of general chemistry, metals, and total petroleum hydrocarbon parameters specified in the Discharge Limits: Trenton Ash Management Site (TAMS) Treatment Pond table, the Discharge Limits: Abercrombie Ash Management Site(AAMS) Treatment Pond table, and the Minimum List of General Chemistry Parameters for Wastewater Management Analytical Packages table, attached. Samples shall be collected at least three (3) days after any other sample.

k. Prior to January 31, 2018, the Approval Holder(s) shall:

   i. Ensure effluent discharge from the Trenton Ash Management Site (i.e., up until the point of closure) and Abercrombie Ash Management Site meets the interim limits specified in Interim Discharge Limits: Effluent Discharge table, attached.

   ii. Collect confirmatory samples to determine the ambient (upstream) concentrations of phosphorus for the Trenton Ash Management Site and Abercrombie Ash Management Site.

   iii. The Approval Holder(s) may apply for an amendment to the Discharge

Limits: Trenton Ash Management Site (TAMS) Treatment Pond table and the Discharge Limits: Abercrombie Ash Management Site (AAMS) Treatment Pond table, a minimum of 30 days prior to December 31, 2017. Supporting rationale shall be provided to the Department in advance for review with any application for amendment.

l. Subsequent to January 31, 2018, the Approval Holder(s) shall ensure effluent discharge results from sampling and monitoring for this Approval meets the discharge limits specified in the Discharge Limits: Trenton Ash Management Site (TAMS) Treatment Pond table, the Discharge Limits: Abercrombie Ash Management Site (AAMS) Treatment Pond table and the Minimum List of General Chemistry Parameters for Wastewater Management Analytical Packages table, attached.

Effluent Treatment System and Ash Management Sites

m. If a discharge limit is identified to exceed, the Approval Holder(s) shall notify the Department within one (1) business day, and submit a mitigation strategy to the Department within 30 days that will:

i. Identify the known or suspected cause of the exceedance; and

ii. Reduce reported concentrations to levels not exceeding the discharge limits in this Approval.

n. The Approval Holder(s) shall maintain records for wastewater effluent monitoring program onsite as outlined in this Approval, as well as submit an annual summary of analytical results to the Department.

o. The Approval Holder(s) shall notify the Department of any change in the flocculent used at the effluent treatment system, Trenton Ash Management Site and Abercrombie Ash Management Site treatment ponds, and submit a Material Safety Data Sheet for the flocculent a minimum of 15 days in advance of the change.

Surface and Storm Water Management

p. The Approval Holder(s) shall conduct analytical sampling of surface water / strom water as per the Surface and Storm Water Sampling Requirements table, attached.

q. The Approval Holder(s) shall maintain records of the surface water monitoring program, as well as submit an annual summary of analytical results to the Department.

r. The Approval Holder(s) shall maintain the surface water collection system and sedimentation ponds at the Abercrombie Ash Management Site to ensure they can contain runoff from contributing disposal cell sub-watershed expected during

one (1) in 100 year rainfall event over a 24 hour period, at minimum.

s. Erosion and sedimentation control devices shall be installed prior to construction at the Site and shall remain in place and be maintained until disturbed areas are stabilized.

t. No authority is granted by this Approval to enable the Approval Holder(s) to discharge surface water onto adjoining lands without the authorization of the affected landowner(s). It is the responsibility of the Approval Holder(s) to ensure authorizations are current and valid.

Cooling Water Management

u. The Approval Holder(s) shall continuously monitor temperatures at the condenser inlet and outlet for all units and record the maximum daily temperature at the condenser inlet and outlet for all units. This information shall be maintained onsite for a period of two (2) years and made available to the Department on request.

v. The Approval Holder(s) shall ensure the once through cooling water system is operated, maintained and monitored in a manner that protects against adverse effects to fish and other aquatic life.

w. This approval does not authorize the use of chlorination to control biofouling in the cooling water system.

10. Sound Levels

a. The Approval Holder(s) shall not contribute to an exceedance of the following equivalent sound levels (Leq):

i. 65 dBA 0700-1900 hours

ii. 60 dBA 1900-2300 hours

iii. 55 dBA 2300-0700 hours

b. Monitoring shall be conducted by the Approval Holder(s) at the request of the Department.

c. The Approval Holder(s) shall address all noise complaints received in relation to the facility operations as per standard procedures developed as a condition of this Approval.

d. The Approval Holder(s) shall carry out additional investigations and/or mitigation strategies at the request of the Department, where new information becomes available.

11. Solid Waste

Asbestos Management

a. This Approval does not authorize any additional disposal of asbestos waste other than the existing area of historically buried asebestos waste located at the Trenton Ash Management Site.

Dredging

b. Written notification shall include a dredge management plan, including but not limited to the following:

   i. A description of the potential contaminants of concern;

   ii. An assessment of the dredge material relative to the proposed disposal method and relevant environmental quality standards;

   iii. Disposal and/or treatment options analysis for the dredged material and the methodology used in the selection process of the proposed disposal option; and

   iv. An overview of the proposed dredging and disposal methodologies, including a plan to address dewatering, water management, sediment transport/control, odour, noise, material handling/transportation and long term management, where applicable.

c. The Approval Holder shall provide the Department with a written notification at least 60 days prior to conducting dredging and land based disposal at the Site and/or in the water lot associated with the Site.

Ash Management: Disposal Sites

Abercrombie Ash Management Site

d. Coal Combustion Products (CCPs), including fly and bottom ash, shall be disposed of at the Abercrombie Ash Management Site unless otherwise sold or used for beneficial alternative use, as specified in this Approval.

e. If temporary stockpiling is required for CCPs to be used for beneficial alternative use, the Approval Holder(s) shall provide an updated Ash Management Plan. The updated Ash Management Plan shall be reviewed and accepted by the Department prior to stockpiling any CCPs.

f. Spent resin generated from the facility's industrial water demineralization process may be disposed of at the Abercrombie Ash Management Site, provided the chemical characteristics of the spent resin remains consistent with the material outlined in the email correspondence issued by the Approval Holder(s) to the Department, entitled Resin Disposal, dated 4/3/2014.

g. The Approval Holder(s) shall obtain a Letter of Authorization from an

Administrator prior to the disposal of materials other than CCPs or spent resin from the facility's industrial water demineralization process at the Abercrombie Ash Management Site.

h. The Approval Holder(s) shall notify the Department in writing:

   i. Within ten (10) business days of ocmpletion of a disposal cell prior to capping. This notification shall include the schedule and timeline developed for capping the cell; and

   ii. Three (3) days prior to the construction of a new disposal cell.

i. The Approval Holder(s) shall maintain an up to date Operations Manual for the Abercrombie Ash Management Site, available to the Department upon request. At minimum, the Operations Manual shall be reviewed annually and updated accordingly. The Operations Manual shall include but not be limited to, content related to procedures developed for:

   i. Disposal cell liner systems, including geo-environmental liners with:

      (a) Permeability of 0.000001 cm/s or less; and

      (b) Placed at depths not less than 1 metre below ground surface.

   ii. Disposal cell cover systems, including:

      (a) Disposal Cell Interim Cover Systems:
      1. Comprised of native till or other acceptable material;
      2. Frequency of cover application is to occur no less than once every month; and
      3. More frequent cover placement shall occur to mitigate fugitive dusting events, as required.

      (b) Disposal Cell Final Cover Systems:
      1. Final cover shall be placed at the earliest possible time on all areas that have reached the final design elevation;
      2. A suitable vegetative cover shall be established to prevent erosion and all measures must be taken to ensure that vegetation is still growing two (2) years after installation of the final cover; and
      3. The final surface shall be graded such that water does not pool over the disposal cell.

   iii. Leachate Management Systems:

      (a) In the event that natural leachate attenuation capabilities of a disposal cell are not sufficient to prevent the contamination of adjacent groundwater and surface water resources, the Approval Holder(s) shall install leachate collection and removal/treatment

systems.

iv. Surface Water Management Systems:

(a) Divert surface and storm water from the disposal areas of cell;

(b) Control run-off discharge from the disposal cell;

(c) Control erosion, sedimentation, siltation, and flooding; and

(d) Minimize generation of leachate.

v. Groundwater Management Systems: as specified in the Groundwater Management section of this Approval.

vi. Disposal of Non-Ash Material(s) Monitoring:

(a) Accurate estimation of the approved material(s) to be buried, in conjunction with the requirements outline in associated Letters of Authorization;

(b) Inspection of the approved material to be buried before it is unloaded; and

(c) Details of the method(s) to be used to recover improperly discarded materials for removal from the disposal cell(s).

vii. Quality Control/Assurances, including but not limited to:

(a) Inspections and activities that provide assurances that the design, manufacture and installation of systems and materials used in the disposal cells meets the purposes for which the systems and materials are intended; and

(b) Analysis of disposal cell slope stability shall be included in the quality control/assurance procedures.

viii. Emergency contact information; and

ix. Notification processes (e.g. to the Department etc.).

Trenton Ash Management Site

j. The Approval Holder(s) shall complete the decommissioning of the Trenton Ash Management Site, at minimum, as per the schedule specified in the Decommissioning Plan, Trenton Generating Station - Ash Management Site Closure (CBCL, 2014).

k. The Approval Holder(s) shall obtain a Letter of Authorization from an Administrator prior to implementing changes to the approved decommissioning

schedule.

l. The Approval Holder(s) shall maintain an up to date Inspection Manual for the Trenton Ash Management Site, available to the Department upon request. At minimum, the Inspection Manual shall be reviewed annually and updated accordingly. The Inspection Manual shall include but not be limited to, content related to procedures developed for:

i. Quality Control/Assurances, including but not limited to:

(a) Inspections and activities that provide assurances that the design, manufacture and installation of systems and materials used in the disposal cell closure design, as specified in the Closure Design Ash Management Site Trenton Generating Station, Final Report (CBCL, 2014), meet the purposes for which the systems and materials are intended (e.g. such as, the final cap, lateral drainage collection system, surface water drainage system, as well as erosion and other geotechnical protection measures etc.).

(b) Analysis of disposal cell slope stability shall be included in the quality control/assurance procedures.

ii. Emergency contact information; and

iii. Notification processes (e.g. to the Department etc.)

Ash Management: Alternative Use

m. Fly ash may be:

i. Used in the manufacture of concrete, precast concrete products, or other cementitious products where fly ash is an ingredient that is fully bound within the product and meets the applicable ASTM and/or CSA specification(s).

n. CCPs may be:

i. Used for other products or applications, if authorized by a Letter of Authorization;

ii. Used for research and development (R&D), if authorized by a Letter of Authorization; or

iii. Removed from the disposal location for beneficial alternative use, if authorized by a Letter of Authorization.

o. The Approval Holder(s) shall provide the following information when requesting a Letter of Authorization under this approval:

i. Detailed description of beneficial alternative use or R&D project;

ii. Estimate of amounts to be used and duration;

iii. An assessment of the composition of the CPP, potential exposures and receptors related to its use, and mitigation measures to be used to manage those risks, including a site or project-specific risk assessment based on the proposed beneficial alternative use;

iv. Detailed sampling and reporting protocols; and

v. Details of any CCP blending, conditioning or processing required.

p. CPPs exported for any beneficial alternative use must meet the regulatory requirements of the importing province, state, region or country.

q. The Approval Holder shall maintain records of the amount of CCPs sent for beneficial alternative use, and provide them to the Department upon request.

Municipal Solid Waste

r. The Approval Holder(s) shall ensure all Municipal Solid Waste is disposed of at an approved Municipal Solid Waste Facility.

Wastewater Sludge

s. All sludge generated at the Site shall be managed in accordance with a documented Standard Operating Procedure or Sludge Management Plan to be submitted to the Department within 60 days of this Approval being issued. Acceptance of the Sludge Management Plan will be provided by the Department through a Letter of Authorization.

12. Fuel and Petroleum Management

Fuel Specification

a. The Approval Holder(s) shall burn a combination of coal and petroleum coke as primary fuel for this facility.

b. The primary fuel shall comply with the fuel specification identified in the document titled Trenton Generating Station Fuel Specifications dated Revision 3 June 8, 2016.

c. The Approval Holder(s) may burn No. 2 and No. 6 fuel oil as secondary fuels at the facility. The sulphur content of the No. 2 or No. 6 fuel burned at the facility shall comply with the requirements of the Air Quality Regulations, as amended from time to time.

d. The Approval Holder(s) may use No. 2 fuel oil as an ignition fuel at the facility.

e. The Approval Holder shall maintain fuel consumption records for all fuel consumed at the facility for a minimum of two (2) years to demonstrate compliance with this Approval.

Alternate Fuels

f. Test burns of alternate fuels may be conducted under a Letter of Authorization on a case-by-case basis provided the following information has been submitted to the Department and deemed acceptable:

   i. Written notification of the intent to test the use of an alternate fuel identifying the type, volume, source and rate of consumption;

   ii. Analytical data identifying trace metals and/or contaminants in the proposed fuel;

   iii. Identification of potential air contaminants resulting from combustion of the fuel and the anticipated change to emissions for the proposed fuel combustion scenario;

   iv. Proposed feed rate and feed method;

   v. Identification of test methods proposed to confirm that air emissions are acceptable;

   vi. Identification of air quality standards proposed for comparison during testing; and

   vii. Proposed testing scenarios to demonstrate that testing will be conducted for the cases when the highest concentration of air contaminants would occur.

g. Should a Letter of Authorization be issued by the Department for a test burn of an alternate fuel, the Approval Holder shall be required to submit:

   i. A schedule to conduct the test burn. The maximum duration of the test burn shall be 120 hours (unless otherwise approved in writing by the Department); and

   ii. Submission of a Final Report outlining the results of the test burn. This report shall include, but not be limited to, the test methods and analytical results, air quality standards used, the feed rates, quantity and quality of fuel used, monitoring data from the CEMS and any other operational data deemed pertinent during the test burn, summary of any equipment problems or failures, and the overall effectiveness of the material as an alternate fuel.

Petroleum Management

h. The Approval Holder(s) shall ensure that all petroleum storage systems and related infrastructure are constructed, operated and maintained in accordance with the Petroleum Management Regulations and the Nova Scotia Standards for the Construction and Installation of Petroleum Storage Tank Systems, 1997 edition, as amended from time to time.

i. The Approval Holder(s) shall undertake an assessment of each petroleum storage tank at the facility on a five (5) year cycle against the Petroleum Management Regulations and the current edition of the Nova Scotia Standards for Construction and Installation for Petroleum Storage Tanks Systems, 1997 edition, as amended from time to time. The assessment shall be performed by and bear the signature of a registered professional engineer. The results of the next assessment as well as upgrades to the facility, if necessary, shall be submitted to the Department no later than August 26, 2020.

j. The Approval Holder shall undertake an assessment of the Bunker C Storage Tank System, during the next out of service inspection date in 2018.

k. If results of the petroleum storage tank assessments indicate that the petroleum storage tanks require maintenance or upgrades, the Approval Holder(s) shall:

    i. Where the deficiency is causing or likely to cause an immediate release from a petroleum storage tank system or related infrastructure, undertake maintenance or replacement within 60 days of the completion of the assessment report.

    ii. Where a deficiency is not causing or likely to cause a release from a petroleum storage tank system or related infrastructure, undertake the necessary maintenance or upgrades within one (1) year of any deficiency being identified. Where deficiencies cannot be corrected within one (1) year of being identified, the Approval Holder(s) shall submit in writing, a minimum of 60 days prior to the deadline, a request for an extension including the details surrounding the request and a proposal for a revised schedule. Details surrounding the request shall include an explanation as to why the maintenance and upgrades could not be completed within one (1) year of being identified;

    iii. Following completion of any maintenance, replacement or upgrade activities, the equipment shall be retested or reassessed against the Petroleum Management Regulations and the current edition of the Nova Scotia Standard for Construction and Installation for Petroleum Storage Tank Systems to ensure that maintenance, replacement or upgrade activities were effective.

l. The Approval Holder(s) shall provide the Department with written confirmation by September 30, 2016, that all of the non-compliance items and associated recommendations identified in the report entitled References: Trenton Generating

Station Environmental Code Compliance Assessment of Five Petroleum Systems (Rev 4) (Stantec, 2015) have been addressed and brought into compliance.

m. Oil inventory reconciliation shall include, but not be limited to, the following measures:

   i. Visual inspections of tanks, tank yards, fuel lines and adjacent water bodies twice daily as part of site environmental checks;

   ii. Daily inventory measurement and recording;

   iii. Monthly reconciliation of daily measurements with respect to fuel consumption records; and

   iv. Preventative maintenance checks on tanks and fuel lines as per Nova Scotia Power Thermal Plant Maintenance Practices (Revision 3, May 2011). The Approval Holder may complete preventative maintenance checks on tanks and fuel lines in accordance with a revised version of Nova Scotia Power Thermal Plant Maintenance Practices, providing the Approval Holder has received a Letter of Authorization from an Administrator.

n. Any water retained within dyke around petroleum storage tanks shall be assessed for the presence of any petroleum hydrocarbon prior to release by visual inspection or analysis. If inspection including, but not limited to visible observation or analysis confirms the presence of hydrocarbons the affected water shall be transferred to a system or facility approved for the treatment of petroleum-contaminated water. Results of analyses or visible observation shall be retained at the Site for a period of two (2) years from the date of collection and will be available to the Department upon request.

o. Any transfer of petroleum products to a third party from the Site shall require an approval as a fuel oil facility issued under the Activities Designation Regulations.

Burning and Storage of Used Oil

p. The Approval Holder(s) may store used oil on the Site for the purpose of used oil as an alternative fuel, conditional on compliance with the Used Oil Regulations, Petroleum Management Regulations and all terms and conditions in the Approval.

q. Storage and burning of used oil shall be limited to used oil generated from industrial operations on the Site. This Approval does not permit the receipt, storage or burning of used oil generated from off-site sources.

r. Prior to burning any used oil, it shall be verified through laboratory analyses that the used oil is not classified as "contaminated used oil" pursuant to the Used Oil Regulations, as amended from time to time. Where the used oil is identified as a

contaminated used oil, it will be classified and managed as a waste dangerous good.

s. Laboratory certificates of analysis shall be available for any instances where used oil is transferred into a fuel tank on site for use as a fuel. Laboratory certificates of analysis as a result of a condition of this Approval shall be maintained on-site for a period of at least two (2) years following the burning of the used oil and shall be made available to the Department upon request.

t. Any areas used for the transfer of used oil, either to or from approved storage tanks, shall have a concrete or impervious flooring which is sloped to an oil/water separator or other containment device capable of containing any spill.

u. The Approval Holder(s) shall submit a written report to the Department prior to January 31st of each year, detailing the volume of used oil burned during the previous year of operations and estimated quantity of used oil in storage.

13. Dangerous Goods/Waste Dangerous Goods

General Requirements

a. The Approval Holder(s) shall ensure the facility is constructed, operated and maintained in accordance with the Dangerous Goods Management Regulations, as amended from time to time.

b. This Approval authorizes the Approval Holder to store and handle dangerous goods at the facility, as listed in documentation dated December 11, 2015 in support of the application for renewal to the Department.

c. The approved list of dangerous goods shall be updated as necessary with any revisions or changes proposed for the approval of an Administrator by Letter of Authorization.

d. The Approval Holder(s) shall maintain written standard procedures for the handling of dangerous goods (reviewed and updated on an annual basis). These standard procedures shall be readily available to all employees. A copy of these procedures shall be made available to the Department upon request.

Storage and Handling

e. The Approval Holder shall conduct a Tank Assessment Study to determine the integrity and suitability of the Dangerous Goods bulk storage tanks to store the associated type and quantity of dangerous goods. The assessment shall be performed by and bear the signature of a registered professional engineer. The tank(s) shall be assessed on a five (5) year cycle, against standard(s) acceptable to the Department. The results of the next assessment as well as upgrades to the facility, if necessary, shall be submitted to the Department no later than June 30, 2017.

f. If the results of the Tank Assessment Study indicate that the dangerous goods bulk storage tanks require maintenance or upgrades, then the Approval Holder(s) shall:

i. Where a deficiency is causing or is likely to cause an immediate release from a tank system or related infrastructure, undertake maintenance or replacement within 60 days of the completion of the assessment report.

ii. Where a deficiency is not causing or is likely to cause a release from a tank system or related infrastructure, undertake the necessary maintenance or upgrades within one (1) year of being identified. If these deficiencies cannot be corrected within one (1) year of being identified, then the reasons shall be submitted in writing 60 days prior to the deadline with a proposal for a revised schedule, and a request for an extension.

iii. Following completion of the maintenance or upgrades, the tank(s) shall be retested in accordance with standard(s) acceptable to the Department to ensure the maintenance or upgrades were effective.

g. The Approval Holder shall provide the Department with written confirmation by September 30, 2016 that all of the recommendations identified in the Atlantic Environmental Training, On-Site Services Incorporated Report entitled Dangerous Goods and Waste Dangerous Goods Assessment For Trenton Generating Station (dated October 14, 2014) have been addressed.

Waste Dangerous Goods

h. The Approval Holder(s) shall not accept waste dangerous goods at the facility that the Approval Holder(s) did not produce.

i. The disposal of waste dangerous goods, including radioactive sources and contaminated used oil, shall be at a facility licensed or approved for the disposal of such waste dangerous goods by the applicable regulatory agency having jurisdiction.

14. Spills or Release Management

a. All spills or releases shall be reported in accordance with the Act and the Environmental Emergency Regulations.

b. All spills or releases shall be remediated in accordance with the Act and the Contaminated Sites Regulations.

Controlled Generator De-Gassing and Normal Venting/Leaking of Hydrogen

c. Controlled generator de-gassing and normal venting/leaking of hydrogen is considered to be part of normal operating practices within the thermal stations and does not have to be reported under the Environmental Emergency

Regulations.

d. When necessary, hydrogen shall be released to atmosphere through a vent stack that dischrages at elevated point, at a controlled rate of emission in an isolated area remote from sources of ignition and away from air intakes. The hydrogen shall be vented at concentrations below flammable limits.

e. Unplanned and unauthorized releases of any compressed gases, including hydrogen, equal to or greather than 100 litres are subject to the Environmental Emergency Regulations.

15. Reporting and Notifications

General Requirements

a. The Reporting and Notifications section of this Approval provides a summary of ongoing reporting requirements for the Site. Reporting requirements for individual studies requested under the terms and conditions of this Approval have not been summarized in this section.

b. The Approval Holder shall provide an annual report to the Department by June 30th of each year summarizing the following information collected during the previous year of operations, as required by the terms and conditions of this Approval, including:

i. Ash management and alternative use reporting requirements;

ii. All complaints and responses/resolutions to each;

iii. All incidents of non-compliance with the terms and conditions of this Approval and corrective action taken; and

iv. Summary of any updates to the Contingency Plan over the previous year of operation, including the current revision number and date of review(s) and, if applicable, the dates of revision(s).

c. The Approval Holder(s) shall provide the following subject specific annual reports to the Department by June 30th of each year summarizing the following information collected during the previous year of operations, as required by the terms and conditions of this Approval:

i. Air Quality Summary Report;

ii. Groundwater Summary Report;

iii. Surface Water / Storm Water Summary Report; and

iv. Wastewater Effluent Summary Report.

Air Quality Summary Report

d. The Air Quality Summary Report the Approval Holder shall submit to the Department shall include, but not be limited to discussion of:

   i. A summary of any air quality related emergency and non-emgergency incidents pursuant to the Environment Act, the Air Quality Regulation or this Approval, including the date and time of the incident(s);

   ii. A summary of any operational problems related to the continuous emission monitoring devices, enviornmental control equipment and/or ambient air monitors, including the date and time of the incident(s) and action(s) taken to resolve the issue(s);

   iii. A summary of the quality assured, quality controlled (QA/QC) ambient air quality data from the ambient air monitor(s) including the maximum concentrations for each air contaminant for the associated averaging periods of Schedule A of the Air Quality Regulations, hourly average wind speed and wind direction, including the dates used to calculate the averages.

   iv. A summary of any complaints received from the public and how they were responded to by the Approval Holder, including the date and time of the incident(s);

e. A summary of air emissions data recorded by CEMS and results of the QA/QC program, including but not limited to:

   (a) Minimum, hourly average and the maximum 720 hour rolling average of emissions in kilograms per megawatt-hour net energy output for nitrogen oxide (excluding nitrous oxides and collectively expressed as nitrogen dioxide) and sulphur dioxide;

   (b) Minimum, hourly average and maximum average of emissions in micrograms per cubic meter and micrograms per hour of vapour phase mercury in flue gas emissions of Unit 5;

   (c) An annual summary of opacity results for flue gas emissions from Units 5 and 6, including a comparison of the results to the exceedances reported;

   (d) Summaries of quarterly gas cylinder audits;

   (e) Monitor availability;

   (f) Data backfilling;

   (g) Quarterly Relative Accuracy Audit (RAA) results;

(h) Annual Relative Accuracy Test Audit (RATA) reports; and

(i) System recommendations and any corrective actions implemented.

i. Graph the annual generation rates for each Unit.

f. The Approval Holder shall maintain electronic spreadsheets of the quality assured, quality controlled (QA/QC) ambient air quality data for each monitor for a period of not less than five (5) years. These spreadsheets shall be made available to the Department upon request.

Groundwater Summary Report

g. The annual Groundwater Summary Report the Approval Holder shall submit to the Department shall include, but not be limited to discussion of:

i. A summary of any spill or release events that may have impacted soil and/or groundwater quality in the preceding calendar year;

ii. A description of field methodologies, including sampling techniques;

iii. A description of the groundwater monitoring network;

iv. Well inspection results including details on integrity of the well cap/casing and a summary of monitoring well repairs/modifications. A description of general condiiton assessment for the monitoring well network including: any repairs, decommissioning, and monitoring logs;

v. A description of the current groundwater monitoring program and recommendations for repairs, additions, subtractions and/or modifications;

vi. Current and historical static water elevation data in tabular format;

vii. Groundwater gradients and flow direction;

viii. Current and historical groundwater quality including an analysis of spatial and temporal trends with comparison to applicable guidelines and historical (baseline) data in tabular format;

ix. Laboratory certificates of analysis; and

x. The identification of any adverse impacts to groundwater as a result of site activities and associated recommendations.

h. The annual report shall be prepared by or under the direction of a Professional Geoscientist or Professional Engineer licensed to practice in Nova Scotia by the Association of Professional Geoscientists of Nova Scotia (APGNS) or Engineers Nova Scotia (ENS).

Surface Water / Storm Water Summary Report

i. The annual Surface Water / Storm Water Summary report the Approval Holder shall submit to the Department shall include, but not be limited to discussion of:

i. A review of field methodologies, including sampling techniques;

ii. A review of the current monitoring program and recommendations for modifications, as applicable;

iii. Current and historical water quality data including an analysis of temporal trends with comparison to applicable guidelines in tabular format;

iv. Laboratory certificates of analysis; and

v. The identification of any adverse impacts to surface water as a result of site activities and associated recommendations, as applicable.

j. The annual report shall be prepared by or under the direction of a Professional Engineer licensed to practice in Nova Scotia by the Engineers Nova Scotia (ENS).

Wastewater Effluent Summary Report

k. The annual Wastewater Effluent Summary report the Approval Holder shall submit to the Department shall include, but not be limited to discussion of:

i. The total weekly basin volume documented during batch monitoring of liquid effluent discharge;

ii. The results of daily total iron, suspended solids (TSS), and pH analysis collected;

iii. The results and trending of weekly general chemistry, total metals, and petroleum hydrocarbon analyses collected as grab samples;

iv. A description of all incidents of non-compliance with wastewater discharge limits established in this Approval and corrective actions taken; and

v. Results of the Effluent Treatment System Pond Leak Tests.

16. Rehabilitation Planning

a. One (1) year prior to decommissioning/closure of the facility, or any part thereof, the Approval Holder shall submit a detailed closure plan to the Department for review. The plan shall include but not be limited to, the management of all wastes and residual materials/contamination in accordance with any provincial legislation including the Act, Regulations, Policies, Procedures, Guidelines or other agreements entered into by the Province which may impact rehabilitation, as well as a long term monitoring plan for the Site. The closure plan shall include the method and practices for the handling and disposal of all products and wastew

materials on Site.

b. The Approval Holder shall reclaim the Site within 12 months of abandonment and in accordance with the latest reclaimation plan submitted by the Approval Holder unless an alternate time frame is provided by the Department through a Letter of Authorization.

17. Complaint Response

a. The Approval Holder shall have standard procedures to address complaints associated with the facility which shall include:

i. An immediate investigation of the cause of the complaint and the undertaking of appropriate action, to correct the problem;

ii. A record or description of operations assessed in regards to the investigation, at the time of the complaint (e.g.,such as weather conditions, wind direction, plumes, units operating, etc.);

iii. A record of all complaints and documentation of the date, time, name, address and telephone number of the individual lodging the complaint. The record shall also state any cause of the complaint and the action taken to correct the problem; and

iv. Records associated with complaints required by this Approval shall be made available to the Department upon request.

18. Contingency Plan

a. The Approval Holder shall maintain and routinely update a Contingency Plan for the facility in accordance with the Department's Contingency Planning Guidelines dated May 10, 2016, as amendedfrom time to time. The Contingency Plan shall be made available to the Department upon request.

b. The Approval Holder shall ensure that all personnel are trained to address environmental emergencies in a manner consistent with the facility's approved contingency plan and that the necessary equipment and materials are available at all times for such purpose.

c. A copy of the Contingency Plan is to be maintained onsite at all times.

19. Records Maintenance

a. The Approval Holder shall keep all chemical and physical analyses reports required under this Approval for a period of not less than ten (10) years, unless otherwise stated in this Approval.

b. The Approval Holder shall keep all calibration and maintenance records for a period of not less than six (6) years, unless otherwise stated in this Approval.

c. The Approval Holder shall maintain all other data for a period of not less than ten (10) years, unless otherwise stated in this Approval.

In-Stack Limit: Particulate Matter	
Units	**Particulate Matter (mg/RM^3)***
5	30
6	160

* milligrams per reference cubic meter of dry fuel gas at standard reference conditions of 25 degrees Celsius (°C) and 101.3 kilopascals (kPa) corrected to 3 percent (%) oxygen, as confirmed through source testing required by this Approval

Air Contaminants: Maximum Ground Level Concentration Limits				
Air Contaminant	**CAS Number**	**½ Hour Standard Concentration* (µg/m^3)****	**1 Hour Standard Concentration* (µg/m^3)****	**24 Hour Standard Concentration* (µg/m^3)****
Bromine	7726-95-6	70		20
Chlorine	7782-50-5	30		10
Hydrogen Bromide	10035-10-6	800	668	
Hydrogen Chloride	7647-01-0	60		20

* Summary of Standards and Guidelines to support Ontario Regulation 419/05 – Air Pollution – Local Air Quality, Standards Development Branch, Ontario Ministry of the Environment, April 2012
** µg/m^3 – micrograms per cubic meter

Groundwater Sampling Requirements			
Sampling Requirements*	**Sampling Frequency**	**Location**	**Well Identifier**
General Chemistry, Dissolved Metals, Polycyclic Aromatic Hydrocarbons (PAHs), Petroleum Hydrocarbons (BTEX/TPH), Water Level (geodetic)	Quarterly** Sampling shall be conducted for a period of two (2) years following the issuance of Approval 2006-054488-A05 (Sept. 12, 2016)	Trenton Ash Management Site	MW12-02A, MW12-02B, MW12-04A, MW12-04B, MW12-06, BH-06, BH14-01, BH14-02, BH14-07S, BH14-07D, BH14-08S, BH14-08D, BH14-09S, BH14-09D, BH14-11S, BH14-11D, Weir-06*****
General Chemistry, Dissolved Metals, Polycyclic Aromatic Hydrocarbons (PAHs), Petroleum Hydrocarbons (BTEX/TPH), Water Level (geodetic)	Annual*** Sampling shall be conducted for a period of two (2) years following the issuance of Approval 2006-054488-A05 (Sept. 12, 2016)	Trenton Ash Management Site	MW12-02A, MW12-02B, MW12-03, MW12-04A, MW12-04B, MW12-05A, MW12-06, BH-06, BH14-01, BH14-02, BH14-07S, BH14-07D, BH14-08S, BH14-08D, BH14-09S, BH14-09D, BH14-11S, BH14-11D
General Chemistry, Dissolved Metals, Polycyclic Aromatic Hydrocarbons (PAHs), Petroleum Hydrocarbons (BTEX/TPH), Water Level (geodetic)	Tri-Annual****	Trenton Ash Management Site	MW10-01, MW10-02, MW10-03, MW12-01, MW12-02C, MW12-04C, MWE12-05B, BH-05, BH14-11S, BH14-11D
General Chemistry, Dissolved Metals, Water Level (geodetic)	Quarterly**	Abercrombie Ash Management Site	12MW-01S, 12MW-01D, 12MW-02S, 12MW-02D, 12MW-03S, 12MW-03D, 12MW-04S, 12MW-04D, 12MW-05S, 12MW-05D, 12MW-06S, 12MW-06D, 12MW-07S, 12MW-07D, Well to be installed at the northwest toe of the Phase I ash pile, as recommended in the Hydrogeological Investigation Plant Site and Abercrombie Ash Management Site Trenton Generating Station (CBCL, 2013)
Polycyclic Aromatic Hydrocarbons (PAHs), Water	Tri-Annual****	Abercrombie Ash Management Site	12MW-01S, 12MW-01D, 12MW-02S, 12MW-02D,

Groundwater Sampling Requirements			
Sampling Requirements*	**Sampling Frequency**	**Location**	**Well Identifier**
Level (geodetic)			12MW-03S, 12MW-03D, 12MW-04S, 12MW-04D, 12MW-05S, 12MW-05D, 12MW-06S, 12MW-06D, 12MW-07S, 12MW-07D, Well to be installed at the northwest toe of the Phase I ash pile, as recommended in the Hydrogeological Investigation Plant Site and Abercrombie Ash Management Site Trenton Generating Station (CBCL, 2013)
General Chemistry, Dissolved Metals, Water Level (geodetic)	Annual***	Plant Site	PN1, PN2, PN3, PN4, PN5B, PN6, PN7, PN8
Polycyclic Aromatic Hydrocarbons (PAHs), Petroleum Hydrocarbons (BTEX/TPH), Water Level (geodetic)	Tri-Annual****	Plant Site	PN1, PN2, PN3, PN4, PN5B, PN6, PN7, PN8

* A minimum list of parameters to be included for each of the listed sampling requirements is attached
** Quarterly sampling frequency means samples shall be collected four (4) times per calendar year within the following quarterly timeframes: January-March; April-June; July-September; October-December
*** Annual sampling frequency means samples shall be collected once per calendar year during the same quarterly timeframe each year
**** Tri-Annual sampling frequency means samples shall be collected once every three (3) years during the month of September
***** The primary function of the weir is to allow for monitoring of pH and conductivity of water seeping from the toe of the Trenton Ash Management Site berm

Minimum List of Parameters for Groundwater, Domestic Well, and Surface Water Analytical Packages	
Metals (see Total vs Dissolved Metals notes below)	**Petroleum Hydrocarbons**
Aluminum	Benzene
Antimony	Toluene
Arsenic	Ethylbenzene
Barium	Xylenes
Boron	Modified Total Petroleum Hydrocarbons (Gasoline, Fuel Oil, Lube Oil)
Cadmium	
Chromium	**Polycyclic Aromatic Hydrocarbons (PAHs)**
Cobalt	Naphthalene
Copper	1 – Methylnaphthalene
Iron	2 – Methylnaphthalene
Lead	Acenaphthene
Manganese	Acenaphthylene
Mercury	Anthracene
Molybdenum	Fluorene
Nickel	Phenanthrene
Selenium	Pyrene
Silver	Carcinogenic PAH Compounds
Strontium	Benzo[a]pyrene (BaP) Total Potency Equivalents (calculated)
Thallium	Benzo[a]anthracene
Tin	Benzo[a]pyrene
Uranium	Benzo[b,j,k]fluoranthene isomers
Vanadium	Benzo[g,h,i]perylene
Zinc	Chrysene
	Dibenz[a,h]anthracene
	Indeno[1,2,3-c,d]pyrene

* All groundwater samples shall be analyzed for “Dissolved Metals” with exception of Mercury that shall be analyzed as Total Mercury
** All domestic well water and surface water / storm water samples shall be analyzed for “Total Metals”

Minimum List of Parameters for Groundwater, Domestic Well, and Surface Water Analytical Packages (Continued)	
General Chemistry	
pH	Dissolved Calcium
Reactive Silica as SiO2	Dissolved Magnesium
Chloride	Dissolved Phosphorous
Fluoride	Bicarb. Alkalinity (as CaCO3)
Sulphate	Carb. Alkalinity (as CaCO3)
Alkalinity	Hydroxide
True Color	Calculated TDS
Turbidity	Hardness
Electrical Conductivity	Langelier Index (@20C)
Nitrate + Nitrite as N	Langelier Index (@4C)
Nitrate as N	Saturation pH (@20C)
Nitrite as N	Saturation pH (@4C)
Ammonia as N	Anion Sum
Total Organic Carbon	Cation Sum
Ortho-Phosphate as P	% Difference / Ion Balance (NS)
Dissolved Sodium	Total Suspended Solids (TSS)
Dissolved Potassium	

Discharge Limits: Effluent Treatment System	
Parameters	**Discharge Limit**
pH	6.0 to 9.5
Total Suspended Solids (TSS)	25 mg/L
Gasoline	12.52* mg/L
Diesel/#2 Oil	0.84* mg/L
Lube Oil	0.48* mg/L
Arsenic	0.44 mg/L
Cadmium	0.0041 mg/L
Chromium (Total)	0.50 mg/L
Chromium (Hexavalent)	0.053 mg/L
Copper	0.070 mg/L
Iron	1.5 mg/L
Lead	0.069 mg/L
Mercury	Sample, but no current limit
Nickel	0.29 mg/L
Selenium	0.070 mg/L
Thallium	0.75 mg/L
Zinc	0.33 mg/L

* Limits for Gasoline, Diesel/ #2 Oil and Lube Oil are for each sample, not the monthly arithmetic average

Discharge Limits: Trenton Ash Management Site (TAMS) Treatment Pond	
Parameters	**Discharge Limit**
pH	6.0 to 9.5
Total Suspended Solids (TSS)	25* mg/L
Arsenic	0.12 mg/L
Chromium (Total)	0.56 mg/L
Chromium (Hexavalent)	0.015 mg/L
Copper	0.020 mg/L
Iron	1.5 mg/L
Lead	0.069 mg/L
Mercury	Sample, but no current limit
Nickel	0.080 mg/L
Selenium	0.020 mg/L
Zinc	0.098 mg/L

* Suspended Sediments (Canadian Water Quality Guidelines for the Protection of Aquatic Life, Canadian Council of Ministers of the Environment, 1999)

clear flow
Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24 h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).

high flow
Maximum increase of 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L. Should not increase more than 10% of background levels when background is ≥ 250 mg/L.

Discharge Limits: Abercrombie Ash Management Site (AAMS) Treatment Pond	
Parameters	**Discharge Limit**
pH	6.0 to 9.0
Total Suspended Solids (TSS)	25* mg/L
Aluminum	0.75** mg/L
Arsenic	0.34 mg/L
Cadmium	0.0011 mg/L
Chromium (Total)	0.18 mg/L
Chromium (Hexavalent)	0.016 mg/L
Copper	0.0072 mg/L
Iron	1.5 mg/L
Lead	0.022 mg/L
Molybdenum	2.0 mg/L
Nickel	0.22 mg/L
Phosphorus	0.153** mg/L
Selenium	0.062 mg/L
Zinc	0.062 mg/L

* Suspended Sediments (Canadian Water Quality Guidelines for the Protection of Aquatic Life, Canadian Council of Ministers of the Environment, 1999)

clear flow
Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24 h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).

high flow
Maximum increase of 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L. Should not increase more than 10% of background levels when background is ≥ 250 mg/L.

Background samples for the AAMS shall be taken from Beggs Brook, upstream of where the unnamed tributary discharges.

** Discharge limits for aluminum and phosphorus in effect as of December 31, 2020

Minimum List of General Chemistry Parameters for Wastewater Management of Analytical Packages	
General Chemistry	
pH	Dissolved Calcium
Reactive Silica as SiO2	Dissolved Magnesium
Chloride	Dissolved Phosphorous
Fluoride	Bicarb. Alkalinity (as CaCO3)
Sulphate	Carb. Alkalinity (as CaCO3)
Alkalinity	Hydroxide
True Color	Calculated TDS
Turbidity	Hardness
Electrical Conductivity	Langelier Index (@20C)
Nitrate + Nitrite as N	Langelier Index (@4C)
Nitrate as N	Saturation pH (@20C)
Nitrite as N	Saturation pH (@4C)
Ammonia as N	Anion Sum
Total Organic Carbon	Cation Sum
Ortho-Phosphate as P	% Difference / Ion Balance (NS)
Dissolved Sodium	Total Suspended Solids (TSS)
Dissolved Potassium	

Interim Discharge Limits: Effluent Discharge	
Parameters	**Interim Discharge Limit**
pH	6.0 to 9.5 (continuous)
Total Suspended Solids (TSS)	25 mg/L
Total Petroleum Hydrocarbons	15 mg/L
Iron	1.5 mg/L
Chromium (Total)	0.5 mg/L
Copper	0.5 mg/L
Nickel	0.5 mg/L
Zinc	1.5 mg/L

Surface and Storm Water Sampling Requirements			
Sampling Requirements*	**Sampling Frequency**	**Location**	**Sampling Identifier**
General Chemistry, Total Metals, Polycyclic Aromatic Hydrocarbons (PAHs), Petroleum Hydrocarbons (BTEX/TPH)	Quarterly**	Trenton Ash Management Site	• Discharge locations specified as per the closure plan • Other locations specified as the result of changing drainage conditions and assessments conducted per the Management of Contaminants terms and conditions
General Chemistry, Total Metals, Polycyclic Aromatic Hydrocarbons (PAHs), Petroleum Hydrocarbons (BTEX/TPH)	Quarterly**	Abercrombie Ash Management Site	• WS Pt No:1 • WS Pt No:2 • Other locations specified as the result of changing drainage conditions and assessments conducted per the Management of Contaminants terms and conditions

* A minimum list of parameters to be included for each of the listed sampling requirements is attached
** Quarterly sampling frequency means water samples shall be collected four (4) times per calendar year. Quarterly sampling shall occur within the following allotted timeframes: January-February; April-May; July-August; October-November

CI Number: C0009094

Title: LIN Fly Ash Precipitator Component Refurbishment

Start Date: 2019/03
In-Service Date: 2019/07
Final Cost Date: 2020/01
Function: Steam
Forecast Amount: $414,046

DESCRIPTION:

This project will refurbish the level controls, valves, and aeration system on the intermediate hoppers in the precipitator hopper rooms of the Lingan fly ash system. The fly ash system consists of precipitator collection hoppers, a precipitator ash transfer system, fly ash receivers, fly ash pressure vessels and the fly ash transfer pipeline to the silo and ash silo unloading. The precipitator hoppers (16 each unit) empty to an intermediate hopper; the surge system transports the ash via vacuum pumps (Unit 1 / 2) or medium pressure blowers (Unit 3 / 4) through piping to the Manutair receivers. This project will help restore the ash handling capability to mitigate risk of deration due to backed-up ash in the system.

The precipitator and associated fly ash collection system are part of the environmental controls at Lingan Generating station. The system is used to lower emissions from the units and is required as part of the stations environmental operating approval.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 CI 47116 LIN Fly Ash System Upgrade $244,923
- 2018 CI C0007383 LIN U&U Fly Ash cone valve and piping Replacements $207,022
- 2020 CI TBD LIN Fly Ash System Upgrade 2020 $TBD
- 2021 CI TBD LIN Fly Ash System Upgrade 2021 $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

Fly ash must be removed from the boiler in order to allow it to operate. The amount of ash from different coal blends changes and the fly ash system must be capable of removing the ash at a rate greater than it is produced at full load.

The aeration piping over time has deteriorated due to corrosion and is no longer in service. This has led to a number of hoppers that do not effectively empty leading to high alarm levels which require operations personnel to intervene and manually run equipment to try and empty the hopper. If not remedied this will lead to high alarm levels in the precipitator hoppers and increased opacity.

Why do this project now?

The fly ash system is currently having difficulty keeping up with the fly ash being generated, especially during the heavy loaded winter months due to the degradation of the aeration piping. Deferring the project could lead to the inability of the unit to transfer fly ash and therefore increased costs for a contractor vacuum truck for removal or in the extreme case removing a unit from service for opacity excursions. These refurbishments will allow the fly ash systems performance to be maintained.

Why do this project this way?

Refurbishment of the system components that are degraded is the most cost effective option for the plant to maintain full load as replacement of the system would be more costly.

CI Number : C0009094 - LIN Fly Ash Precipitator Component Refurbishment

Project Number C0009094

Parent CI Number : -

Asset Location : 1138 - 1138 Lingan Common Plant

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	2100 - SGP - Ash Handling	345,962
Retirements	2100 - SGP - Ash Handling	68,084
	Total Cost:	414,046
	Original Cost:	319,051

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# : C0009094
Title: LIN Fly Ash Precipitator Component Refurbishment
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	8	$ 358	$ 2,866		
Engineering	PD	11	$ 405	$ 4,560		
Maintenance Trades	PD	202	$ 365	$ 73,643		
Power Engineer	PD	20	$ 390	$ 7,808		
Power Plant Technician	PD	50	$ 382	$ 19,105		
Utility Worker	PD	100	$ 240	$ 24,018		
			Sub-Total	$ 132,000		C0007383, 47116
Term Labour						
Maintenance Trades	PD	69	$ 365	$ 25,308		
Utility Worker	PD	70	$ 240	$ 16,692		
			Sub-Total	$ 42,000		
Materials						
Replacement Valves	lot	11	$ 6,603	$ 72,633		
Piping and Elbow Replacements	lot	1	$ 20,000	$ 20,000		
Miscellaneous Consumables	ea	1	$ 7,367	$ 7,367		
			Sub-Total	$ 100,000		
Contracts						
Industrial Cleaning Services	lot	1	$ 82,000	$ 82,000		
			Sub-Total	$ 82,000		C0007383, 47116
Interest Capitalized						
AFUDC				$ 2,729		
			Sub-Total	$ 2,729		
Administrative Overhead						
Labour AO				$ 45,459		
Contracts AO				$ 9,858		
			Sub-Total	$ 55,317		
			SUB-TOTAL (no AO, AFUDC)	$ 356,000		
			TOTAL (AO, AFUDC included)	$ 414,046		
Original Cost				$ 319,051		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 49991

Title: TUC1 CEMS Replacement

Start Date:	2019/03
In-Service Date:	2019/11
Final Cost Date:	2020/05
Function:	Steam
Forecast Amount:	$404,343

DESCRIPTION:

The scope of work for this project includes the purchase and installation of a new Continuous Emissions Monitoring System (CEMS) on Unit 1 at Tufts Cove Generating Station. The new CEMS will be an Extractive Unit capable of measuring Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_x), Carbon Dioxide (CO_2), Carbon Monoxide (CO), and Oxygen (O^2).

The CEMS that monitors SO_2 and NO_x at Tufts Cove Unit 1 has surpassed its expected useful life and requires replacement. The current CEMS is a Teledyne SM8175 and was installed in 2003. The expected lifespan of the equipment is 10 years.

The CEMS is no longer reliable and has required repairs several times over recent years, including repairs for issues related to on-board sensors, optic alignment, calibration mechanisms, and remote electronics.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- No other related projects on Tufts Cove Unit 1 in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Environment

Why do this project?

NS Power is required to operate and maintain a CEMS to continuously monitor the emissions of SO_2 and NO_x in the flue gas at Tufts Cove as per the Operating Approval. The CEMS at Tufts Cove Unit 1 has surpassed its expected useful life and recently experienced technical issues. A replacement CEMS is required to allow the facility to continue to operate in compliance with the Operating Approval. NS Power has been informed by the manufacturer that parts and service for the CEMS are available on a "best effort basis" as much of the equipment has become obsolete.

Why do this project now?

The Tufts Cove Unit 1 CEMS has surpassed its expected lifespan and recently experienced technical issues. The CEMS requires replacement at this time to allow the facility to continue operation in compliance with the Nova Scotia Environment Operating Approval. Recent failures involved parts that are no longer being manufactured. The instrumentation technicians have made repairs with miscellaneous parts, which may prove unreliable. If the CEMS fails, the Unit cannot operate.

Why do this project this way?

An alternative type of monitoring system, predictive emission monitoring system (PEMS) was trialed for Units 1-3 but it could not be certified on Heavy Fuel Oil (HFO). The Tufts Cove units are not able to burn HFO without an accurate monitoring system that is certified on HFO such as the CEMS being installed.

Full replacement of the CEMS is the only technically viable option (see above) due to the obsolescence of the existing equipment. The recommended approach is to replace the current CEMS with an extractive unit capable of dual range measurements. This is a new monitoring system that the NS Power fleet has begun implementing at other plants, most recently on Tufts Cove LM6000 Units #4 and #5, through CI 50017 TUC4 U&U CEMS Installation and CI 50018 TUC5 U&U CEMS Installation, both approved by the UARB on June 30, 2017; on Tufts Cove Unit #3, through CI 49316 TUC3 CEMS Replacement U&U, approved by the UARB on September 29, 2017; and on Tufts Cove Unit #2 through CI 49676 TUC2 CEMS Replacement, approved by the UARB on April 25, 2018.

Other considerations for using the extractive system instead of current system include:

- Dual range measurement for concentrations of NOx and SO2 since the ranges for the two parameters is a large scale difference.
- Installing a dual range system allows for flexibility with future fuel blends and does not limit the sulfur content in fuel.
- Extractive units provide the capability of measuring CO_2. With the current Federal and Provincial focus on CO2, accurately measuring emissions is an improvement on NS Power's current mass balance approach.
- Extractive units also provide the capability of measuring CO and O_2. The O_2 monitoring is critical for flow measurement as it is based on fuel consumption. This eliminates the need to to install and service a new flow meter inside the stack.

The extractive Teledyne CEMS is the best alternative among the CEMS as the Company currently uses these systems at other locations in the fleet. NS Power is familiar with the equipment. This type of replacement will continue on other units across the fleet that have not been replaced in 2017/2018.

CI Number : 49991 - TUC1 CEMS Replacement **Project Number** 49991

Parent CI Number : -

Asset Location : 1171 - 1171 Tufts Cove Unit 1; Commissioned 1965, 85 Mwh **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0700 - SGP - Environmental	398,570
Retirements	0700 - SGP - Environmental	5,773
	Total Cost:	404,343
	Original Cost:	307,349

Capital Project Detailed Estimate

Location: Tufts Cove Generating Station
CI# : 49991
Title: TUC1 CEMS Replacement
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	35	$ 358	$ 12,539		
Engineering	PD	20	$ 405	$ 8,106		
Maintenance Trades	PD	35	$ 365	$ 12,768		
Power Engineer	PD	8	$ 390	$ 3,123		
Utility Worker	PD	10	$ 240	$ 2,402		
			Sub-Total	$ 38,938		
Term Labour						
Electrician	PD	130	$ 358	$ 46,577		
			Sub-Total	$ 46,577		
Freight						
Freight	Lot	1	$ 5,542	$ 5,542		
USD to CDN Exchange Rate	%	32%	$ 5,542	$ 1,773		
			Sub-Total	$ 7,315		
Materials						
TML CEMS Extractive Incl SO2, NOx, CO, CO2 & O2 Sensors	lot	1	[redacted]		Attachment 1 - Item A	
TML Heated Sample Line ($47.50/ft x 200 ft)	Foot	200	[redacted]		Attachment 1 - Item C	
NEMA12 Cabinet 80"Hx24"Wx36"D for Mounting CEMS Indoors in Clean Environment	Lot	1	[redacted]		Attachment 2 - Item E	
USD to CDN Conversion	%	32%	[redacted]			
Structural Steel & Piping Materials	lot	1	$ 2,000	$ 2,000		
Materials for New Breeching Test Ports	lot	1	$ 1,000	$ 1,000		
Electrical Materials	lot	1	$ 5,000	$ 5,000		
Calibration Gas	lot	1	$ 5,000	$ 5,000		
			Sub-Total	$ 142,830		
Contracts						
Stack Testing	lot	1	$ 15,000	$ 15,000		
Scaffolding & Sheet Metal	lot	1	$ 17,500	$ 17,500		
Engineering (Electrical & Structural Engineering Design)	lot	1	$ 10,000	$ 10,000		
Project Management & Supervision	lot	1	$ 22,000	$ 22,000		
DCS Design and Programming	lot	1	$ 12,500	$ 12,500		
Mobile Crane Services	lot	1	$ 5,000	$ 5,000		
TML Certified Field Service Engineer	PD	3	[redacted]		Attachment 1 - Item E	
Mobilization	lot	1	[redacted]		Attachment 1 - Item E	
USD to CDN Exchange Rate	USD	32%	[redacted]			
High Angle Confined Space Rescue Services	lot	1	$ 3,000	$ 3,000		
High Pressure Wash Cleaning	lot	1	$ 3,000	$ 3,000		
			Sub-Total	$ 96,865		
Other Goods and Services						
Contingency	%	10%	$ 332,525	$ 33,253		
			Sub-Total	$ 33,253		
Interest Capitalized						
AFUDC				$ 4,579		
			Sub-Total	$ 4,579		
Administrative Overhead						
Labour AO				$ 22,342		
Contractor AO				$ 11,645		
			Sub-Total	$ 33,987		
			SUB-TOTAL (no AO, AFUDC)	$ 365,778		
			TOTAL (AO, AFUDC included)	$ 404,343		
Original Cost				$ 307,349		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

TELEDYNE MONITOR LABS
Everywhereyoulook™

Quote #1704052-3

August 16, 2017

Nova Scotia Power
Tufts Generating Station
315 Windmill Road
Dartmouth, Nova Scotia
Canada B3J 2W5

Dear Mr. Nowlan,

Teledyne Monitor Labs is pleased to provide Quotation No. 1704052-3 for our ML660 CEM System, Equipment, and Services for Unit 3. This proposal's competitive pricing is based on the entire package. TML has grouped various components in the item column below for comparison purposes. The purchase or exclusion of individual items must be discussed with TML.

If you have any questions regarding this quotation, please contact our Vice President of Sales, Mr. Rob Bott at (303) 792-4200.

Sincerely,

Ryan Silkworth
Quotation Engineer

TELEDYNE MONITOR LABS
Everywhereyoulook™

Quote #1704052-3

Teledyne Monitor Labs, a business unit of Teledyne Instruments, Inc.
35 Inverness Drive East
Englewood, Colorado, USA 80112-5189
+1-303-792-3300 Fax +1-303-799-1409
www.teledyne-ml.com

REPRESENTATIVE
Robert (Rob) Bott Vice President of Sales Phone: (303) 792-4200 E-mail: rbott@teledyne.com

CUSTOMER NAME & ADDRESS	QUOTE DATE	APPROXIMATE SHIP DATE
Nova Scotia Power Tufts Generating Station 315 Windmill Road Dartmouth, Nova Scotia Canada B3J 2W5 Attn: Karl Nowlan	August 16, 2017	Dependent on order acceptance
	QUOTE NUMBER	**F.O.B. POINT**
	1704052-3	Englewood, PP&A
	QUOTE VALID FOR	**TERMS OF PAYMENT**
	90 Days	30 Days

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
A	1	**TML-660 Continuous Emission Monitoring System** for the **single point** measurement of **NO_x, SO_2, CO, CO_2, & O_2**. Includes the following: ➢ T100 /CO_2 T-SERIES® SO_2 Analyzer w/ CO_2 Sensor **(Qty 1)** ➢ T200 /O_2 T-SERIES® NO_x Analyzer w/ O_2 Sensor **(Qty 1)** ➢ T300 T-SERIES® CO Analyzer **(Qty 1)** ➢ 316 SS Extractive Probe with 316 SS Straw ➢ Open Rack Mounting ➢ Complete Sample Transport and Conditioning System ➢ System Controller for Sequencing and Control (detailed below in Item B) ➢ Instrument Air Regulation and Distribution ➢ Automatic Probe Calibration with Multi-Valve Manifold ➢ Automatic Back Purge with Valve ➢ Valves for Manual Calibration at the Cabinet ➢ System Integration, Factory Testing, and Project Management ➢ Project Engineering with Two (2) sets of Standard Drawings and Two (2) Standard Manuals (on CD)	[redacted]	[redacted]
B	1	**Teledyne Monitor Labs C3i/o® Controller** for System Sequencing and Control ➢ Data Buffering with RegPerfect® ➢ Modbus Communications ➢ 8 Digital Inputs & 8 Digital Outputs ➢ 4 Analog Inputs **(Qty. 2)** ➢ 2 Analog Outputs **(Qty. 2)** ➢ 19” Rack Mount Control Panel **Note:** CEMS to DCS communication available via Modbus/TCP	Included in Item (A) Above	Included in Item (A) Above

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Quote #1704052-3

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
C	200 Feet	**Heated Sample Line (HSL)** and unheated Probe Support Bundle (PSB) are in one (1) sheath. Heated sample line includes **two (2)** ⅜" Stainless Steel tube for sample transport, and a spare maintained at high temperatures with a constant watt density heating element. Probe support bundle includes **one (1)** ¼" Polyethylene tube for back purge, **one (1)** ¼" PFA Teflon tube for calibration gas transport, **one (1)** 14 AWG Triad for probe heater power, and **three (3)** 16 AWG twisted pair for low probe temperature alarm, back flush, and a spare. The HSL and PSB are contained in a fire retardant polyurethane sheath. **The quoted price is for lengths greater than 100 feet. Pricing for lengths less than 100 feet are subject to higher per foot pricing, and may require site-specific information.	[redacted] per foot	[redacted]
D	1	**Standard 8'W (OD) x 10'L (OD) x 8'H (ID) CEMS Shelter** For placement in a general area classification. Channel skid base, galv. steel framing. White 24GA pre-finished steel interior & exterior cladding with mill finished aluminum trim. White duro-last roofing system. Aluminum tread plate flooring. 3x7 insulated steel door with stainless steel hinges. R21 Insulation. Built to the most current local and/or state building code applicable to factory built structures. ***This item includes engineering, design, and assembly labor.*** The CEM System, and all accessories, are installed in the shelter for easy field installation. Includes: ➢ Power Distribution Including Lights and Receptacles ➢ Load Center 100A, 3 PH NEMA 1 ➢ HVAC with Upgraded Coated Coils ➢ Single Doors Access (Panic Bar, 12x21 Window Tempered Glass, Automatic Hydraulic Closer) ➢ Smoke and Carbon Monoxide Alarm ➢ Bulkhead Panel, Fixed Plate up to 12" H x 18" W (Alum.) ➢ Ground Pad, Copper, NEMA 2-hole, bonded to frame ➢ Exit Sign / Emergency Light & Fire Extinguisher	[redacted]	[redacted]

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Quote #1704052-3

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
E	1	**System Startup** of (Item A) CEMS during ***one (1)*** plant visit with up to ***two (2)*** days on-site by a TML Certified Field Service Engineer. Includes the following services: 1. **Installation Checkout:** Inspect all aspects of the installation and note or direct correction of errors in installation. 2. **System Inspection:** Examine the internal workings of the system to determine if damage occurred during shipment and installation. 3. **System Startup:** Supervise the application of electrical power and other utilities. Test all system functions and observe on-line operation. 4. During the startup period Teledyne Monitor Labs' field personnel will familiarize the purchaser's operating and maintenance personnel with the basics of proper operating and preventative maintenance procedures. This familiarization is *not a substitute* for formal classroom system training for either the hardware or software. **NOTES:** **A)** Labor to correct customer installation errors shall be billed at actual time and materials at prevailing service rates when work is performed. **B)** Fixed price is based upon ***one (1)*** trip with a site time of up to ***sixteen (16)*** hours (eight hours = one day) during normal business hours. Waiting time due to client delays shall be billed in addition to the fixed price at prevailing service rates. In addition, be aware that delays may result in the need for a return trip to the site. Expenses and Travel Time for a return trip will be charged to the customer and scheduling for such a trip will depend on Engineer availability. If this Service is not scheduled within six (6) months of System shipment, additional charges may apply **C)** Teledyne Monitor Labs requires a minimum of four (4) weeks notification prior to Start-up. Failure to provide proper written notification may result in additional charges. **D)** If the customer requests a schedule change after a firm date for services has been set, there may be additional costs associated with changes in travel arrangements	Per Mobilization [redacted] Per Day On-Site [redacted]	[redacted]

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Quote #1704052-3

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
F	1	**CSA Inspection**	[redacted]	[redacted]
G	1	**Basic Training Course** A ***Three (3)*** day on-site training course held at customer's plant site. The instruction price includes transportation and expenses for the instructor, course materials for up to ten (10) participants, and will utilize the customer's instruments. The customer will have the responsibility of providing an adequate classroom facility for the On-Site training course. This training class is designed to give your personnel basic operation and theoretical knowledge of the system quoted, and will cover each system component in as much depth as time permits. Arrangements for this training class should be made at least 60 days in advance with Teledyne Monitor Labs. **Factory Instrument Specific Training Courses**. In-depth, focused training classes on the individual system components are held regularly at our facility. Participants in on-site training receive a discounted price for factory classroom training. Teledyne Monitor Labs offers a variety of instrument-specific courses at our facilities. These training courses cover theory of operation, troubleshooting, circuit and system functions, maintenance, repair procedures, and actual “hands-on” training. Course dates can be arranged with Teledyne Monitor Labs' Training Department at 1-800-422-1499. **Please Note:** Tuition fees are fully refundable for any cancellation of registration received 30 days prior to class date. Since we keep our class sizes to a minimum to provide maximum value to our clients, cancellation charges of 25% will be applied for cancellations under 30 days and full tuition is due for cancellation under seven (7) days. If the customer requests a schedule change after a firm date for services have been set, there may be additional costs associated with changes in travel arrangements.	[redacted]	[redacted]
H	1	**Addition of Unit 3 to RegPerfect® CEMS Compliance System** Additional remote software programming labor to add Unit 3 CEM systems to existing on-site RegPerfect system	[redacted]	[redacted]

TELEDYNE MONITOR LABS
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Quote #1704052-3

TELEDYNE MONITOR LABS' TERMS OF PAYMENT:

- 40% of contract price on submittal of drawings for review.
- 40% of contract price on shipment of equipment.
- 20% of contract price on startup, but not to exceed 90 days after receipt of equipment.

Payment terms for all invoices are NET 30 days from the date of the invoice. Unless otherwise agreed to in writing, payments for drawing submittals must be received by Teledyne Monitor Labs prior to shipment of equipment. Late payment will be considered a breach of contract and Teledyne reserves the right in such instances to cease activity until payment issues are resolved.

NOTE: Prices do not include sales tax. Sales tax will be added to each invoice as a separate line item unless the customer provides Teledyne with a sales and use tax certificate.

PLEASE NOTE: Spare parts ordered after delivery of the instrumentation quoted herein should be based on the final system design and spare parts lists provided with manuals and final drawings.

REGARDING MAINTENANCE AGREEMENT PURCHASES:
If an order resulting from this quotation includes an on-going maintenance agreement for hardware, software, or both, payment for the maintenance agreement(s) may be broken out from the contract price and billing schedule above and billed separately as services are performed.

Maintenance agreement contracts do not include the supply of spare or replacement parts. Spare or replacement parts are billed separately to the holder of the maintenance agreement. For that reason it is recommended that maintenance agreements be purchased by the end user of the equipment rather than an intermediary such as a construction or engineering firm.

The system description and product brochures provided herein describe in detail the instruments/systems included in this proposal. The descriptions are accurate to the best of our knowledge as of the date of this proposal; however, as additional information is obtained, variations may be required to enhance system performance. Teledyne Monitor Labs reserves the right to make changes in the design and construction of any system as it deems appropriate to meet the performance requirements of the application, with proper notification given to customer. Any changes made by Teledyne Monitor Labs will conform to U.S. EPA reference or equivalency method designations where applicable.

Other terms and conditions of sale, including warranty terms, are included with this quotation and can be found at our web site: www.teledyne-ml.com

Successful start-up shall be the criteria of acceptance, with such start-up defined as calibration of each gas parameter with zero and span gas.

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Quote #1704052-2

June 27, 2017

Nova Scotia Power
Tufts Generating Station
315 Windmill Road
Dartmouth, Nova Scotia
Canada B3J 2W5

Dear Mr. Nowlan,

Teledyne Monitor Labs is pleased to provide Quotation No. 1704052-2 for our ML660 CEM System, Equipment, and Services for Units 1, 2, & 3. This proposal's competitive pricing is based on the entire package. TML has grouped various components in the item column below for comparison purposes. The purchase or exclusion of individual items must be discussed with TML.

If you have any questions regarding this quotation, please contact our Vice President of Sales, Mr. Robert (Rob) Bott at (303) 792-4200.

Sincerely,

Ryan Silkworth
Quotation Engineer

TELEDYNE MONITOR LABS
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Quote #1704052-2

Teledyne Monitor Labs, a business unit of Teledyne Instruments, Inc.
35 Inverness Drive East
Englewood, Colorado, USA 80112-5189
+1-303-792-3300 Fax +1-303-799-1409
www.teledyne-ml.com

REPRESENTATIVE
Robert (Rob) Bott Vice President of Sales Phone: (303) 792-4200 E-mail: rbott@teledyne.com

CUSTOMER NAME & ADDRESS	QUOTE DATE	APPROXIMATE SHIP DATE
Nova Scotia Power Tufts Generating Station 315 Windmill Road Dartmouth, Nova Scotia Canada B3J 2W5 Attn: Karl Nowlan	June 27, 2017	Dependent on order acceptance
	QUOTE NUMBER	**F.O.B. POINT**
	1704052-2	FOB Origin, PP&A
	QUOTE VALID FOR	**TERMS OF PAYMENT**
	90 Days	30 Days

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
A	3	**TML-660 Continuous Emission Monitoring System** for the **single point** measurement of **NO_x, and SO_2**. Includes the following: ➢ T100 T-SERIES® SO_2 Analyzer **(Qty 1)** ➢ T200 T-SERIES® NO_x Analyzer **(Qty 1)** ➢ 316 SS Extractive Probe with 316 SS Straw ➢ Open Rack Mounting ➢ Complete Sample Transport and Conditioning System ➢ System Controller for Sequencing and Control (detailed below Item C & C-1) ➢ Instrument Air Regulation and Distribution ➢ Automatic Probe Calibration with Multi-Valve Manifold ➢ Automatic Back Purge with Valve ➢ Valves for Manual Calibration at the Cabinet ➢ System Integration, Factory Testing, Project Management, and Engineering. ➢ Two (2) sets of Standard Drawings and Two (2) Standard Manuals (on CD)	$[redacted]	$[redacted]
A-1	3	***Optional CO Analyzer Addition to TML-660 System Above*** ➢ T300 T-SERIES® CO Analyzer	$[redacted]	$[redacted] ***Optional***
A-2	3	***Optional CO_2 Sensor Addition to TML-660 System Above*** ➢ CO_2 Sensor Option for T200 T-SERIES® NOx Analyzer	$[redacted]	$[redacted] ***Optional***

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Quote #1704052-2

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
A-3	3	***Optional O_2 Sensor Addition to TML-660 System Above*** ➢ O_2 Sensor Option for T100 T-SERIES® SO_2 Analyzer	$[redacted]	$[redacted] ***Optional***
B	3	**TML-675 Continuous Emission Monitoring System** for the single point **Dilution Extractive** measurement of ***NO_X and SO_2*.** Includes the following: ➢ T100 T-SERIES® SO2 Analyzer **(Qty 1)** ➢ T200 T-SERIES® NOx Analyzer **(Qty 1)** ➢ 316 SS Dilution Extractive Probe with 316 SS Straw ➢ Open Rack Mounting ➢ Complete Sample Transport, Air Cleanup and Conditioning System ➢ Controller/PLC for System Sequencing and Control (detailed below Item C & C-1) ➢ Instrument Air Regulation and Distribution ➢ Automatic Probe Calibration with Multi-Valve Manifold ➢ Automatic Back Purge with Valve ➢ System Integration, Factory Testing, Project Management, and Engineering. ➢ Two (2) sets of Standard Drawings and Two (2) Standard Manuals (on CD)	$[redacted]	$[redacted]
B-1	3	***Optional CO Analyzer Addition to TML-675 System Above*** ➢ T300 T-SERIES® CO Analyzer	$[redacted]	[redacted] ***Optional***
B-2	3	***Optional CO_2 Analyzer Addition to TML-675 System Above*** ➢ T360 T-SERIES® CO_2 Analyzer Sensor	$[redacted]	$[redacted] ***Optional***
B-3	3	***Optional O_2 Sensor Addition to TML-675 System Above*** ➢ Zirconia O_2 Sensor Option for Dilution Extractive Probe	$[redacted]	$[redacted] ***Optional***

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Quote #1704052-2

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
C	3	**Teledyne Monitor Labs C3i/o® Controller** for System Sequencing and Control Includes: ➢ Data Buffering with RegPerfect® ➢ Modbus Communications ➢ 8 Digital Inputs & 8 Digital Outputs ➢ 4 Analog Inputs **(Qty. 2)** ➢ 2 Analog Outputs **(Qty. 2)** ➢ 19" Rack Mount Control Panel **Note:** CEMS to DCS communication available via Modbus/TCP	Included in Items (A or B) Above	Included in Items (A or B) Above
C-1	3	**Allen Bradley ControlLogix Programmable Logic Controller** *In lieu of TML C3i/o® Controller Above* Includes the following: ➢ L-71 Controller with 2MB Memory Processor ➢ Power Supply ➢ MVI56 Serial Communication Module ➢ Protocol Converter (Modbus) ➢ 16-channel digital input module **(Qty. 1)** ➢ 16-channel digital output module **(Qty. 1)** ➢ 4-channel analog input module **(Qty. 1)** ➢ 4-channel analog output module **(Qty. 1)** ➢ PanelView Plus Compact 600 HMI ➢ Red Lion Ethernet Modbus TCP/IP Module ➢ RS Logix Programming Software ➢ PLC Programming Labor **Please note:** Specific module and configuration may change after final engineering is complete. This proposal assumes all customer-supplied inputs are linear and compatible with required unit of measure.	[redacted]	$[redacted] ***Optional***

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Quote #1704052-2

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
D	Feet	**Heated Sample Line (HSL)** and unheated Probe Support Bundle (PSB) are in one (1) sheath. Heated sample line includes one (1) ⅜" Stainless Steel or Teflon tube for sample transport maintained at high temperatures with a constant watt density heating element. Probe support bundle includes one (1) ¼" Polyethylene tube for back purge, one (1) ¼" PFA Teflon tube for calibration gas transport, one (1) 14 AWG Triad for probe heater power, and three (3) 16 AWG twisted pair for low probe temperature alarm, back flush, and a spare. The HSL and PSB are contained in a fire retardant polyurethane sheath. **The quoted price is for lengths greater than 100 feet. Pricing for lengths less than 100 feet are subject to higher per foot pricing, and may require site-specific information.	$[redacted]	TBD
D-1	Feet	**DILUTION SAMPLE UMBILICAL** The system is designed to use a seven-core sample transport bundle to carry the diluted gas sample from the probe to the cabinet for analysis. Within this bundle, a ⅜" PFA Teflon line transports the diluted sample, a 1/4" PFA Teflon line transports calibration gas, a 1/4" Teflon line supplies the dilution eductor vacuum indication, one 1/4" Teflon line carries bypass eductor air to the probe, a 1/4" Teflon line supplies backflush air, a 1/4" Teflon line carries the orifice pressure indication and finally, a 1/4" Teflon line transports dilution air to the probe. The entire bundle is encased in a rugged, fire-retardant PVC sheath to facilitate installation. Since any moisture is diluted with dry air, only freeze protection for the diluted sample line is supplied. This includes self-regulating heating element(s) located inside the sample bundle, which will operate at approximately 50°F. **The quoted price is for lengths greater than 100 feet. Pricing for lengths less than 100 feet are subject to higher per foot pricing, and may require site-specific information.	[redacted]	TBD
E	3	**NEMA 12 Cabinet 80"H x 24"W x 36"D** (for installation indoors) ***This item includes engineering, design, and assembly labor.*** The CEM System, and all accessories, are installed in the cabinet for easy field installation. Includes air conditioner/fan sized for indoor temperature range from 60F – 90F.	$[redacted]	$[redacted]

TELEDYNE MONITOR LABS
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Quote #1704052-2

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
E-1	3	**Insulated Stainless Steel Dual-Bay Cabinet 6'H x 5W' x 3'D** ***This item includes engineering, design, and assembly labor.*** The CEM System, and all accessories, are installed in the cabinet for easy field installation. Includes: ➢ Single Access, Double Door, Lexan Viewing Window ➢ SST Hinges and Hardware ➢ 3-Point Lockable Latches and Handles ➢ Internal 19" Rack System with Rails for One Side ➢ HVAC (120V, NEMA 3R/4, 10 micron filter, cUL certified) ➢ Pour in Place Gasket System	$[redacted]	[redacted]
E-2	3	**Standard 8'x8'x8' CEMS Shelter** For placement in a general area classification. Channel skid base, galv. steel framing. White 24GA pre-finished steel interior & exterior cladding with mill finished Stainless Steel trim. White duro-last roofing system. Aluminum tread plate flooring. 3x7 insulated steel door with stainless steel hinges. R21 Insulation. Built to the most current local and/or state building code applicable to factory built structures. ***This item includes engineering, design, and assembly labor.*** The CEM System, and all accessories, are installed in the shelter for easy field installation. Includes: ➢ Raised Galvanized Steel Grating/Ice Shield ➢ Power Distribution Including Lights and Receptacles ➢ HVAC with Upgraded Coated Coils ➢ Load Center NEMA 1 ➢ Disconnect Switch, Non-fused, NEMA 3R ➢ Surge Suppressor ➢ Single Doors Access (Panic Bar, 12x21 Window Tempered Glass, Automatic Hydraulic Closer) ➢ Smoke and Carbon Monoxide Alarm ➢ Bulkhead Panel, Fixed Plate up to 12" H x 18" W (Alum.) ➢ Ground Pad, Copper, NEMA 2-hole, bonded to frame ➢ Canopy 24" Projection, 5-6 ft. width, SS (High Wind)	$[redacted]	$[redacted]

TELEDYNE MONITOR LABS
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Quote #1704052-2

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
F	Lot	**System Startup for Three TML-660 Systems (Item A)** **Note**: TML Estimates **Two (2)** Mobilizations and **Six (6**) Days On-Site Will Be Required to Startup **U1, U2, and U3 CEM Systems.** Includes the following services: 1. **Installation Checkout:** Inspect all aspects of the installation and note or direct correction of errors in installation. 2. **System Inspection:** Examine the internal workings of the system to determine if damage occurred during shipment and installation. 3. **System Startup:** Supervise the application of electrical power and other utilities. Test all system functions and observe on-line operation. 4. During the startup period Teledyne Monitor Labs' field personnel will familiarize the purchaser's operating and maintenance personnel with the basics of proper operating and preventative maintenance procedures. This familiarization is *not a substitute* for formal classroom system training for either the hardware or software. **NOTES:** **A)** Labor to correct customer installation errors shall be billed at actual time and materials at prevailing service rates when work is performed. **B)** Fixed price is based upon ***Two (2)*** trips with a site time of up to ***16*** hours **per system** (eight hours = one day) during normal business hours. Waiting time due to client delays shall be billed in addition to the fixed price at prevailing service rates. In addition, be aware that delays may result in the need for a return trip to the site. Expenses and Travel Time for a return trip will be charged to the customer and scheduling for such a trip will depend on Engineer availability. If this Service is not scheduled within six (6) months of System shipment, additional charges may apply **C)** Teledyne Monitor Labs requires a minimum of four (4) weeks notification prior to Start-up. Failure to provide proper written notification may result in additional charges. **D)** If the customer requests a schedule change after a firm date for services has been set, there may be additional costs associated with changes in travel arrangements	Per M[redacted]n Per Day On-Site [redacted]	[redacted]

TELEDYNE MONITOR LABS
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Quote #1704052-2

ITEM	QTY	DESCRIPTION OF ARTICLES AND/OR SERVICES	UNIT PRICE	AMOUNT
G	1	**Factory Acceptance Test (FAT):** ***One (1)*** day at the Teledyne Monitor Labs' factory for customer personnel to confirm operation of the entire, integrated system. A Factory Witness Test protocol will be submitted for customer reference Two (2) weeks prior to the test. Teledyne Monitor Labs' Quality Control and Assurance Department will submit a certified FAT report with the delivery of the CEMS. Customer is responsible for travel and expenses.	$[redacted]	$[redacted]
H	1	**CSA Inspection**	$[redacted]	[redacted]
I	1	**Basic Training Course**. We are proposing a ***Three (3)*** day On-Site training course held at customer's plant site. The instruction price includes transportation and expenses for the instructor, course materials for up to ten (10) participants, and will utilize the customer's instruments. The customer will have the responsibility of providing an adequate classroom facility for the On-Site training course. This training class is designed to give your personnel basic operation and theoretical knowledge of the system quoted, and will cover each system component in as much depth as time permits. Arrangements for this training class should be made at least 60 days in advance with Teledyne Monitor Labs. In-depth, focused training classes on the individual system components are held regularly at our facility. Participants in on-site training receive a discounted price for factory classroom training. **Factory Instrument Specific Training Courses**. Teledyne Monitor Labs offers a variety of instrument-specific courses at our facilities. These training courses cover theory of operation, troubleshooting, circuit and system functions, maintenance, repair procedures, and actual "hands-on" training. Course dates can be arranged with Teledyne Monitor Labs' Training Department at 1-800-422-1499. **Please Note:** Tuition fees are fully refundable for any cancellation of registration received 30 days prior to class date. Since we keep our class sizes to a minimum to provide maximum value to our clients, cancellation charges of 25% will be applied for cancellations under 30 days and full tuition is due for cancellation under seven (7) days. If the customer requests a schedule change after a firm date for services have been set, there may be additional costs associated with changes in travel arrangements.	$[redacted]	$[redacted]
J	1	Addition of Units 1, 2, & 3 to **RegPerfect RegPerfect® CEMS Compliance System** Additional remote software programming labor to add U1, U2, and U3 CEM systems to RegPerfect system for U4 and U5	[redacted]	$[redacted]

TELEDYNE MONITOR LABS
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Quote #1704052-2

TELEDYNE MONITOR LABS' TERMS OF PAYMENT:

- 40% of contract price on submittal of drawings for review.
- 40% of contract price on shipment of equipment.
- 20% of contract price on startup, but not to exceed 90 days after receipt of equipment.

Payment terms for all invoices are NET 30 days from the date of the invoice. Unless otherwise agreed to in writing, payments for drawing submittals must be received by Teledyne Monitor Labs prior to shipment of equipment. Late payment will be considered a breach of contract and Teledyne reserves the right in such instances to cease activity until payment issues are resolved.

NOTE: Prices do not include sales tax. Sales tax will be added to each invoice as a separate line item unless the customer provides Teledyne with a sales and use tax certificate.

PLEASE NOTE: Spare parts ordered after delivery of the instrumentation quoted herein should be based on the final system design and spare parts lists provided with manuals and final drawings.

REGARDING MAINTENANCE AGREEMENT PURCHASES:
If an order resulting from this quotation includes an on-going maintenance agreement for hardware, software, or both, payment for the maintenance agreement(s) may be broken out from the contract price and billing schedule above and billed separately as services are performed.

Maintenance agreement contracts do not include the supply of spare or replacement parts. Spare or replacement parts are billed separately to the holder of the maintenance agreement. For that reason it is recommended that maintenance agreements be purchased by the end user of the equipment rather than an intermediary such as a construction or engineering firm.

The system description and product brochures provided herein describe in detail the instruments/systems included in this proposal. The descriptions are accurate to the best of our knowledge as of the date of this proposal; however, as additional information is obtained, variations may be required to enhance system performance. Teledyne Monitor Labs reserves the right to make changes in the design and construction of any system as it deems appropriate to meet the performance requirements of the application, with proper notification given to customer. Any changes made by Teledyne Monitor Labs will conform to U.S. EPA reference or equivalency method designations where applicable.

Other terms and conditions of sale, including warranty terms, are included with this quotation and can be found at our web site: www.teledyne-ml.com

Successful start-up shall be the criteria of acceptance, with such start-up defined as calibration of each gas parameter with zero and span gas.

CI Number: 49656

Title: TUC Waste Water Treatment Plant Controls Upgrade

Start Date: 2019/04
In-Service Date: 2019/10
Final Cost Date: 2020/04
Function: Steam
Forecast Amount: $305,851

DESCRIPTION:

This project is to upgrade the existing Waste Water Treatment Plant (WWTP) Programmable Logic Controller/Human Machine Interface (PLC/HMI) controls that are obsolete. It will also include the installation of additional instrumentation that will allow the WWTP control system to perform additional monitoring and enhance the plant's reliability. In addition to upgrading the Main PLC in the WWTP, the PLC located in the main plant that controls various raw water pumping stations will be upgraded. The existing HMI stations located inside the Lab and Control room will also be replaced to improve reliability and functionality.

The WWTP is used to treat waste from generating unit operations so that it can be discharged is accordance with the station's operating permit.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- No other related projects in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

This project will improve the reliability of both the WWTP and various Pumping Stations. The existing PLC is obsolete and no longer supported by the Original Equipment Manufacturer (OEM). In the event of a failure, the lack of spares and technical support would cause an extended forced outage of the Tufts Cove Generating Station.

Why do this project now?

Upgrades to the control system now will improve the functionality of the WWTP which will improve its reliability. Considering the obsolescence of the equipment, doing this project now will mitigate the risk of forced outage of the WWTP and consequently the Tufts Cove generating units.

Why do this project this way?

The existing controls of the WWTP were manufactured by Allen Bradley. Upgrading to the next generation of Allen Bradley controls (AB Control Logix) is the solution that NS Power has adopted. Replacement with this type of controls will allow for consistency across the thermal fleet as several other thermal plants in the NS Power fleet have already undergone replacement of obsolete PLC with these controls.

CI Number : 49656 - TUC Waste Water Treatment Plant Controls Upgrade **Project Number** 49656

Parent CI Number : -

Asset Location : 1178 - 1178 Tufts Cove Common Plant **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	2200 - SGP - Elec Contr.Equip.	302,976
Retirements	2200 - SGP - Elec Contr.Equip.	2,875
	Total Cost:	305,851
	Original Cost:	190,804

Capital Project Detailed Estimate

Location: Tufts Cove Generating Station
CI# : 49656
Title: TUC Waste Water Treatment Plant Controls Upgrade
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	
Regular Labour						
Electrician	PD	50	$ 358	$ 17,914		
Engineering	PD	25	$ 405	$ 10,133		
CADD Operators	PD	5	$ 294	$ 1,470		
Technologists	PD	6	$ 332	$ 1,993		
Hydro River Staff	PD	7	$ 365	$ 2,554		
Lab Operators	PD	15	$ 358	$ 5,374		
			Sub-Total	$ 39,437		
OT Labour						
Electrician	PD	2	$ 717	$ 1,434		
Term Electrician	PD	2	$ 717	$ 1,434		
			Sub-Total	$ 2,868		
Term Labour						
Term Electrician	PD	10	$ 358	$ 3,583		
			Sub-Total	$ 3,583		
Materials						
WWTP Main PLC	ea	1	[redacted]		Attachment 1, Item 3.1	
Raw water Pumping PLC	ea	1	$ 20,000	$ 20,000		
Magnetic Flow Meter	ea	1	[redacted]		Attachment 2	
pH Meter	ea	2			Attachment 3 Item 1	
pH Meter	ea	2			Attachment 3 Item 2	
Turbidity Meter	ea	1			Attachment 4	
I/S Barriers	lot	1	$ 5,000	$ 5,000		
Cables / Elect Fittings	ea	1	$ 10,000	$ 10,000		
Control Rm & Lab HMI Option	ea	1	$ 30,000	$ 30,000		
Miscellaneous Materials	lot	1	$ 5,000	$ 5,000		
			Sub-Total	$ 199,872		
Contracts						
Additional Onsite Engineering PLC Commissioning	PD	5	[redacted]		Attachment 1, Item 3.2	
			Sub-Total	[redacted]		
Consulting						
Project Engineering	lot	1	$ 15,000	$ 15,000		
			Sub-Total	$ 15,000		
Other Goods & Services						
Contingency	lot	10%	[redacted]			
			Sub-Total	[redacted]		
Interest Capitalized						
AFUDC				$ 5,424		
			Sub-Total	$ 5,424		
Administrative Overhead						
Labour AO				$ 11,614		
Contractor AO				$ 866		
			Sub-Total	$ 12,480		
			SUB-TOTAL (no AO, AFUDC)	$ 287,947		
			TOTAL (AO, AFUDC included)	$ 305,851		
Original Cost				$ 190,804		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

NOVA SCOTIA POWER INCORPORATED
TUFTS COVE GENERATING STATION

PROPOSAL

FOR

TUFTS COVE
WASTE WATER TREATMENT PLANT CONTROLS UPGRADE

FPS Reference 18x094
Revision 0 – April 23rd, 2018

Fossil Power Systems Inc.
10 Mosher Drive
Dartmouth, NS
Canada B3B 1N5

Ph. (902) 468-2743
Fax. (902) 468-2323
www.Fossil.ca

PART 1. OVERVIEW

1.1 INTRODUCTION

The following proposal is to design, manufacture and provide assistance during the onsite commissioning of a control system upgrade for NSPI – Tufts Cove Generating Station (Chemical Waste Water Treatment Plant PLC and the Chemical Waster Water Pumping PLC).

This proposal is based on the following assumptions:

a) *FPS will not be responsible for the supply or installation of any field equipment, cabling, or wiring, unless otherwise stated.*
b) *All project documentation will be provided in English only.*
c) *The following I/O is included as part of the Chemical Wate Water Treatment Plant PLC as part of this project, including required spare capacity – 32 120VAC discrete isolated inputs, 80 discrete 24VDC inputs,32 120VAC isolated discrete outputs, 16 120 VAC discrete outputs, 16 analog inputs, 8 analog outputst.*
d) *The following IO is included as part of the Chemical Waste Water Treatment Plant Pumping PLC including sprare capacity – 16 120VAC Isolated discrete inputs, 48 24VDC discrete inputs, 16 120VAC Isolated discrete outputs,16 24VDC discrete outputs and 16 analog inputs.*

PART 2. STANDARD DELIVERABLES

The proposed control upgrade will include the following standard items.

1. Chemical Waste Water Treatment Control Cabinet c/w PLC power supply, rack, processor, ethernet card, IO cards and terminal blocks and breakers pre-wired and ready to accept field terminations. If Zener barriers are required for interface to the Lagoon electrical and instrument equipment they will be provided.
2. Chemical Waste Water Treatment Pumping PLC Backpanel c/w PLC power supply,rack, processor, ethernet card, IO cards, termnial blocks and breakers. Customer will wire exisitng termination wiring arm conductors to the new controllogix wiring arms during field installation.Existing pump health monitor relays will be re-used and rewired by the customer.
3. Control System Logic and Wiring Design for both the Chemical Waster Water Treatment PLC and the Chemical Waste Water Treatment Pumping PLC.
4. FactoryTalk View Operator Interface Grahpics and Control Computer mounted in the Chemical Waste Water Treatment Control Panel.
5. Onsite Commissioning Support.
6. Documentation.

2.1 MAIN CONTROL CABINET

The Chemical Waste Water Treatment PLC Control Cabinet will include one (1) free-standing NEMA-12 cabinet provided complete with power distribution, control equipment for the system, industrial touchscreen operator interface, and terminal blocks for all field wiring. The control cabinet will be designed and tested to CSA standards and will be supplied with a CSA approval label affixed.

The Chemical Waste Water Treatment Pumping PLC controls will include a factory assembled backpanel which will inlclude the controls hardware, racks, ethernet cards, power supplies, power distribution terminal blocks as required to complete the job. The existing PLC wiring arm conductors will be reused and reconenected by customer personel during field installation. Exiting pump alarm modules will be re-used and installed by the customer during installtion.

Both systems control equipment will be based on Allen Bradley ControlLogix platform and the operator interface will be based on Allen Bradley FactoryTalk. The touchscreen panel will be factory installed in the cabinet doors to enable operator control of the system. The cabinet will also be supplied with a system UPS and industrial Ethernet switch.

The cabinet doors will be supplied complete with locking handles and the door will include a switch used to operate internal cabinet lighting. The cabinet will be provided complete with a cabinet cooler sized to provide adequate cooling of the control hardware and computer equipment.

2.2 CONTROL SYSTEM DESIGN

Both systems will be fully designed, configured and tested as per customer specifications. Each system will be designed using a single **Allen Bradley ControlLogix** processor (model 1756-L71) and all I/O will be rack-mounted 1756-series. Each system will include a single PLC power supply and an Ethernet communication module. The PLC-based control system will replace the existing Allen Bradley 1771 series IO system. The system will be designed to allow the operator start/stop and control the waste water treatment and pumping equipemnt in a manner identical to that currently provided by the existing system.

2.3 OPERATOR INTERFACE

This system supply will include the design and supply of an operator interface. An industrial touch screen computers will be supplied and for installation in the main control cabinet. Support for remote monitoring of the process in the plant lab and the main plant control room will be included. Interface to the customer PI system will be supported using the existing site infrastructure. Remote monitoring of the process will be provided through the Unit #2 DCS Servers by tieing the system in via the common DMZ.

2.4 ONSITE COMMISSIONING SUPPORT

FPS will provide engineering support for commissioning of the supplied system. It has been estimated that five 8-hour days will be sufficient for commissioning. This time (including applicable expenses) has been included with this quotation. If additional time is required, there will be extra costs as per our standard charge rate (see section 3.2).

2.5 DOCUMENTATION

Complete engineering, drafting and related documentation is included as listed below. All documentation to be provided in English only and will be provided in both electronic (one copy) and paper format (five copies). Electronic documentation to be provided in Adobe Acrobat, AutoCAD, Microsoft Word, Microsoft Excel, and/or Microsoft Project, as required.

a) System I/O list
b) Equipment list
c) Equipment architecture and layout drawings, including bill of materials
d) Power distribution drawings
e) Terminal block wiring and equipment interface drawings
f) Communication interface drawings
g) System logic drawings
h) Control narrative
i) Onsite commissioning checklist and schedule
j) Recommended spare parts list
k) Operating and maintenance (O&M) manuals

PART 3. COMMERCIAL TERMS

3.1 PRICING SUMMARY

Total pricing to complete the contract is as follows. All pricing is shown in Canadian currency.

PROJECT TOTAL	[redacted]

3.2 ADDITIONAL ONSITE ENGINEERING

This proposal includes five 8-hour days for commissioning support. Any additional onsite engineering which is requested for commissioning, service, installation supervision, and/or training will be provided at our standard charge out rate. The customer will be responsible for all time and expenses incurred during this time.

The standard FPS engineering service rate for NSPI is as follows. All pricing is shown in Canadian currency.

Per Diem:	[redacted]
Engineering base:	Halifax, NS
Reg Hours (incl travel):	8 hours per day, Mon to Fri
Time / Weekend rate:	1.5 x per diem rate
Expenses:	Cost

3.3 COMMERCIAL INFORMATION

Delivery:	16 weeks after receipt of order
Shipping Costs:	Included
Taxes and Duties:	Extra (if applicable)
Country of Origin:	Canada
Bid Validity:	July 30, 2018
Terms of Payment:	To be determined

QUOTE

Omnitech Inc.

10 Akerley Boulevard, Suite 1
Dartmouth, Nova Scotia, Canada, B3B 1J4
tel: (902) 468-5911, fax: (902) 468-5912, email: mail@omnitech.ca

Quote No.
1853659

Quote Date
Jun 19, 2018

QUOTED TO

Mr. Tyler Crowdis
E & I Supervisor
Nova Scotia Power Inc.
Tufts Cove Generation Station
315 Windmill Road
Dartmouth, NS B3A 1H3
Fax: Phone: (902) 428-7671

COMMENTS

We are pleased to quote the following items. If further information is required or the specifications change please do not hesitate to call for an update on this quotation.

Quantity	Item	Price each	Extended Price
1	2-5100W/5000-FDK-FDK	[redacted]	[redacted]
	Description: Siemens MAG 5100W Flow Meter w/ Remote MAG 5000 Converter Part Number: 7ME6520-2YJ13-2AA2/7ME6910-1AA10-1AA0 Size: 2", Flange: ANSI Class 150, Body: Carbon Steel, Liner: NBR Hard Rubber, Electrodes: Hastelloy C, Ingress Protection: IP68, Output: (1) mA, (1) Digital, (1) Relay, Accuracy: ± 0.40%, Supply: 120 VAC, Display, C/W Wall Mount Bracket. Cable: Extra		
1	SIEMENS MAG CABLE KIT	[redacted]	[redacted]
	Description: Siemens Electrode & Coil Cable (1) Standard Coil Cable / (1) Double Shielded Electrode Cable Kit. Recommended For Use With IP67/68 Flow Tubes, Length: Per Foot.		

F.O.B.:	Omnitech Dartmouth
Delivery:	Stock Omnitech
Terms:	Net 30
Taxes:	Extra as required

Quote valid for 30 days.
See www.omnitech.ca for Standard Terms and Conditions of Sale

Quote Total	[redacted]
Quoted by:	Matt Clarke
Signed	

Thank you for considering Omnitech, we look forward to serving you.

ATLANTIC CONTROLS
32 McIlveen Drive
Saint John (New Brunswick) E2J 4Y7
Telephone: (506) 634-7437
Fax: (506) 634-0859
www.atlanticcontrols.ca

Quotation

Attention: Tyler Crowdis NOVA SCOTIA POWER INC P.O. BOX 910 HALIFAX, NS B3J 2W5 tyler.crowdis@nspower.ca Telephone: (902) 428-7671 Ext: Fax:	Quote #: JD2017-37-22948 Date: 06-Feb-2017 From: Jeff Diamond (506) 634-7437 jeff.diamond@atlanticcontrols.ca CC: Stan McPhee Sales Representative
Reference: NSP170206AJ - pH Transmitters & Sensors	

Tyler,

Per your discussion with Stan McPhee, please find price and delivery for four Rosemount 1056 Dual-Input Analyzers complete with 3900VP pH sensors. Two of these analyzers are offered complete with a panel mount and two are offered with a pipe mount.

Note that I have included 20' of cable. The 3900VP is offered with a watertight sensor-to cable connector which eliminates re-wiring and cable twisting when replacing sensors. This sensor may be used with a cable length up to 50', beyond that a SMART preamplifier option would be required.

Should you require any additional information, please do not hesitate to contact us.

By:_____

Jeff Diamond

Please carefully review materials of construction, conditions of service and all details, including specifications stated or on attachments, to verify our understanding of your requirements.

Item	Qty	Model Description	Delivery	Unit Price	Total
1	2	1056-01-22-38-AN / 23820-00 / 3900VP-02-10 / 24281-07 Rosemount model 1056 multi-parameter analyzer with 2 inputs, 85-265VAC, 50/60 Hz power supply with two (2) 4-20 mA analog outputs, Input 1: pH/ORP, Input 2: No Selection, No Digital Communication c/w Pipe/Wall Mounting Bracket for Models 1066, 1056, 1057, 5081, 6081, and XMT c/w Rosemount model 3900VP General purpose pH/ORP sensor with VP connection, No Preamplifier, General Purpose Low Resistivity (GPLR) pH Glass (0-14pH) c/w 20' VP8 Cable	Delivery: 3-4 Weeks	[redacted]	[redacted]
2	2	1056-01-22-38-AN / 23823-00 / 3900VP-02-10 / 24281-07 Rosemount model 1056 multi-parameter analyzer with 2 inputs, 85-265VAC, 50/60 Hz power supply with two (2) 4-20 mA analog outputs, Input 1: pH/ORP, Input 2: No Selection, No Digital Communication c/w Panel Mount Kit c/w Rosemount model 3900VP General purpose pH/ORP sensor with VP connection, No Preamplifier, General Purpose Low Resistivity (GPLR) pH Glass (0-14pH) c/w 20' VP8 Cable	Delivery: 3-4 Weeks	[redacted]	[redacted]
				Quote Total	[redacted]

Special Instructions:

Clarifications: EXW: Kirkland, QC

Item	Qty	Model Description	Delivery	Unit Price	Total

Quote Validity: 30 Days
Payment Terms: Net 30 Days
Delivery:
Freight Terms: Collect
Currency: CAN dollars
Sales Tax:
Duty:

This Quote is subject to Atlantic Controls Ltd Terms and Conditions of sale. All stock items are subject to prior sale. The stated leadtime corresponds to the longest leadtime of all quoted items. Please feel free to call us if you should have any questions on this proposal.

Please reference the quote number on any eventual order.

Recent volatility in currency markets has resulted in unpredictable conditions entirely beyond our control. We reserve the right to change our prices prior to order acceptance if the exchange rate CAN/US were to change by +/- 3 % from the quote date to the time of order.

Deliveries quoted are based on local stock availability and/or factory published prospectus at time of quotation. Should you require a firm delivery please do not hesitate to contact our office.

LAURENTIDE controls

TERMS AND CONDITIONS OF SALE

These terms and conditions, the attendant quotation or acknowledgment, and all documents incorporated by reference therein, binds seller (Laurentide Controls ltd) hereinafter the Seller, and the buyer, hereinafter Buyer, and constitutes the entire agreement (Agreement) between Buyer and Seller for the provision of services (Services) and/or the sale of goods (Goods) including (except as provided in Section 10) firmware incorporated therein.

1. **PRICES:** Unless otherwise specified by Seller, Seller's price for the Goods and/or Services shall remain in effect for thirty (30) days after the date of Seller's quotation or acceptance of the order for the Goods/Services, whichever is delivered first, provided an unconditional, complete authorization for the immediate manufacture and shipment of the Goods and/or provision of Services pursuant to Seller's standard order processing procedures is received and accepted by Seller within such time period. If such authorization is not received by Seller within such thirty (30) day period, Seller shall have the right to change the price for the Goods/Services to Seller's price in effect for the Goods/Services at the time the order is released to final manufacture. Prices for Goods do not cover storing, installing, starting up or maintaining Goods unless expressly stated in Seller's quotation. Notwithstanding the foregoing, the price for Goods/Services sold by Seller, but manufactured by others, shall be Seller's price in effect at the time of shipment to Buyer.

2. **DELIVERY, ORDER ACCEPTANCE AND DOCUMENTATION:** All shipping dates are approximate and are based upon Seller's prompt receipt of all necessary information from Buyer to properly process the order. Notwithstanding any provisions to the contrary in this or other documents related to this transaction, and regardless of how price was quoted, whether FOB, FAS, EXW or otherwise, legal title to the Goods and risk of loss thereto shall transfer to Buyer upon delivery to the freight carrier at the shipping point. Seller shall provide Buyer with that data/documentation which is specifically identified in the quotation. If additional copies of data/documentation or non-standard data/documentation are to be provided by Seller, they shall be provided to Buyer at Seller's price then in effect. Data/documentation marked as confidential or proprietary may not be reproduced or used for any purpose other than the purpose for which it was provided and may not be disclosed to third parties without the prior written permission of Seller.

3. **EXCUSE OF PERFORMANCE:** Seller shall not be liable for delays in performance or for non-performance due to failure or interruption of computer or telecommunication systems, acts of God, war, riot, fire, terrorism, labor trouble, unavailability of materials or components, explosion, accident, compliance with governmental requests, laws, regulations, orders or actions, or other unforeseen circumstances or causes beyond Seller's reasonable control. In the event of such delay, the time for performance or delivery shall be extended by a period of time reasonably necessary to overcome the effect of the delay.

4. **TERMINATION AND SUSPENSION BY BUYER:** Buyer may terminate or suspend its order for any or all of the Goods/Services covered by the Agreement only upon Seller's written consent or pursuant to Seller's applicable policy or practices covering such termination or suspension.

5. **LIMITED WARRANTY:** Subject to the limitations contained in Section 6 herein, Seller warrants that the licensed firmware embodied in the Goods will execute the programming instructions provided by Seller, and that the Goods manufactured by Seller will be free from defects in materials or workmanship under normal use and care and Services will be performed by trained personnel using proper equipment and instrumentation for the particular Service provided. The foregoing warranties will apply until the expiration of the applicable warranty period. Goods are warranted for twelve (12) months from the date of initial installation or eighteen (18) months from the date of shipment by Seller, whichever period expires first. Consumables and Services are warranted for a period of 90 days from the date of shipment or completion of the Services. Products purchased by Seller from a third party for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer. Buyer agrees that Seller has no liability for Resale Products beyond making a reasonable commercial effort to arrange for procurement and shipping of the Resale Products. If Buyer discovers any warranty defects and notifies Seller thereof in writing during the applicable warranty period, Seller shall, at its option, correct any errors that are found by Seller in the firmware or Services or repair or replace F.O.B. point of manufacture that portion of the Goods or firmware found by Seller to be defective, or refund the purchase price of the defective portion of the Goods/Services. All replacements or repairs necessitated by inadequate maintenance, normal wear and usage, unsuitable power sources or environmental conditions, accident, misuse, improper installation, modification, repair, use of unauthorized replacement parts, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty, and shall be at Buyer's expense. Seller shall not be obligated to pay any costs or charges incurred by Buyer or any other party except as may be agreed upon in writing in advance by Seller. All costs of dismantling, reinstallation and freight and the time and expenses of Seller's personnel and representatives for site travel and diagnosis under this warranty clause shall be borne by Buyer unless accepted in writing by Seller. Goods repaired and parts replaced by Seller during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Seller and can be amended only in a writing signed by Seller. THE WARRANTIES AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE. THERE ARE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES.

6. **LIMITATION OF REMEDY AND LIABILITY:** SELLER SHALL NOT BE LIABLE FOR DAMAGES CAUSED BY DELAY IN PERFORMANCE. THE REMEDIES OF BUYER SET FORTH IN THIS AGREEMENT ARE EXCLUSIVE. IN NO EVENT, REGARDLESS OF THE FORM OF THE CLAIM OR CAUSE OF ACTION (WHETHER BASED IN CONTRACT, INFRINGEMENT, NEGLIGENCE, STRICT LIABILITY, OTHER TORT OR OTHERWISE), SHALL SELLER'S LIABILITY TO BUYER AND/OR ITS CUSTOMERS EXCEED THE PRICE TO BUYER OF THE SPECIFIC GOODS MANUFACTURED OR SERVICES PROVIDED BY SELLER GIVING RISE TO THE CLAIM OR CAUSE OF ACTION. BUYER AGREES THAT IN NO EVENT SHALL SELLER'S LIABILITY TO BUYER AND/OR ITS CUSTOMERS EXTEND TO INCLUDE INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES. THE TERM "CONSEQUENTIAL DAMAGES" SHALL INCLUDE, BUT NOT BE LIMITED TO, LOSS OF ANTICIPATED PROFITS, REVENUE OR USE AND COSTS INCURRED INCLUDING WITHOUT LIMITATION FOR CAPITAL, FUEL AND POWER, AND CLAIMS OF BUYER'S CUSTOMERS.

7. **PATENTS:** Subject to the limitations contained in Section 6, Seller shall defend any suits brought against Buyer based on a claim that use of the Goods sold by Seller constitutes an infringement of a valid patent of the United States, and shall pay any damages awarded therein against Buyer, provided that Buyer: promptly notifies Seller in writing of the filing of such suit or the threat thereof; permits Seller to control completely the defense or compromise of such claim of infringement; and provides all reasonable assistance and cooperation requested by Seller for the defense of such suit. In the event that only the Goods sold by Seller are held to be infringing in such suit and their use is enjoined, Seller shall, at its sole option and expense, provide a commercially reasonable alternative, including, but not limited to, procuring for Buyer the right to continue using the Goods, replacing them with a non-infringing product or modifying them so they become non-infringing. Buyer agrees that Seller shall not be liable for infringement, and that Buyer shall fully indemnify Seller therefore, if infringement is based upon the use of Goods in connection with goods not sold by Seller or in a manner for which the Goods were not designed by the Seller or if the Goods were not designed by the Seller or if the Goods were designed by the Buyer or were modified by or for the Buyer in a manner to cause them to become infringing.

8. **TAXES:** Any tax or governmental charge payable by the Seller because of the manufacture, sale or delivery of the Goods, or provision of Services, may at Seller's option be added to the price herein specified. The foregoing shall not apply to taxes based upon Seller's net income.

9. **TERMS OF PAYMENT:** Unless otherwise agreed by Seller, and subject to the approval of Seller's Credit Department, terms are EXW shipping point, net 30 days from date of Seller's invoice in Cdn currency, except for applicable milestone payments or export shipments for which Seller may require other arrangements. Periodic milestone payments shall be made by Buyer when the price of the Goods exceeds $100,000. In such cases, invoices shall be issued by Seller and paid by Buyer based on the following milestones: Milestone 1: 30% of price upon acceptance of order by Seller. Milestone 2: 30% of price upon release by Seller of approved bills of material to manufacturing for assembly. Milestone 3: 40% of price upon shipment of the Goods by Seller. Seller reserves the right to designate additional Milestones where the Agreement provides for engineering services in excess of $50,000. In this case services will be invoiced for work done on a monthly basis. Freight charges may include shipping and handling charges, and Buyer shall pay all such charges. If any payment owed to Seller hereunder is not paid when due, it shall bear interest, at a rate to be determined by Seller which shall not exceed the maximum rate permitted by law, from the date on which it is due until it is received. Seller shall have the right, among other remedies, either to terminate the Agreement or to suspend further deliveries under this and/or other agreements with Buyer in the event Buyer fails to make any payment hereunder when due. Buyer shall be liable for all expenses attendant to collection of past due amounts, including attorneys' fees.

10. **SOFTWARE AND FIRMWARE:** Notwithstanding any other provision herein to the contrary, Seller or applicable third party owner shall retain all rights of ownership and title in its respective firmware and software, including all copyrights relating to such firmware and software and all copies of such firmware and software. Except as otherwise provided herein, Buyer is hereby granted a nonexclusive, royalty free license to use firmware and software, and copies of firmware and software, incorporated into the Goods only in conjunction with such Goods and only at the Buyer's plant site where the Goods are first used. Buyer's use of certain firmware (as specified by Seller) and all other software shall be governed exclusively by Seller's and/or third party owner's applicable license terms.

11. **BUYER SUPPLIED DATA:** To the extent that Seller has relied upon any data or information supplied by Buyer to Seller ("Data") in the selection or design of the Goods and/or provision of the Services and the preparation of Seller's quotation, and the Data is inadequate or inaccurate, any warranties or other provisions contained herein which are affected by such conditions shall be null and void.

12. **RETURNS:** Goods may only be returned for credit upon prior approval by the seller and subject to a re-stocking charge to be determined by the Seller. The amount of credit shall be subject to further reduction in an amount to be determined by seller depending upon the condition of the goods when returned to seller. All returned goods must be returned freight prepaid by the buyer.

13. **GENERAL PROVISIONS:** (a) Buyer shall not assign its rights or obligations under the Agreement without Seller's prior written consent. (b) There are no understandings, agreements or representations, express or implied, not specified in the Agreement. (c) No action, regardless of form, arising out of transactions under the Agreement, may be brought by either party more than two (2) years after the cause of action has accrued. (d) Any modification of these terms and conditions must be set forth in a written instrument signed by a duly authorized representative of Seller. (e) This contract is to be construed according to the laws of the Province of Quebec and the federal laws of Canada applicable therein. (f) UNLESS OTHERWISE SPECIFICALLY PROVIDED IN SELLER'S QUOTATION, GOODS AND SERVICES HEREUNDER ARE NOT INTENDED FOR USE IN ANY NUCLEAR OR NUCLEAR RELATED APPLICATIONS. Buyer (i) accepts Goods and Services in accordance with the restriction set forth in the immediately preceding sentence, (ii) agrees to communicate such restriction in writing to any and all subsequent purchasers or users and (iii) agrees to defend, indemnify and hold harmless Seller from any and all claims, losses, liabilities, suits, judgments and damages, including incidental and consequential damages, arising from use of Goods and Services in any nuclear or nuclear related applications, whether the cause of action be based in tort, contract or otherwise, including allegations that the Seller's liability is based on negligence or strict liability. (g) The 1980 United Nations Convention on Contracts for the International Sale of Goods does not apply to this Agreement. (h) If any provision of the Agreement is invalid under any statute or rule of law, such provision, to that extent only, shall be deemed to be omitted without affecting the validity of the remainder of the Agreement.

TC Rev-02-2009

From: Alan Heighton <aheighton@ccii.com>
Sent: Tuesday, September 04, 2018 10:51 AM
To: Nowlan, Karl
Cc: Carol Dotten; John Barkhouse
Subject:RE: TUC - Turbidity Meter
Attachments: DS_4690-EN Rev C.pdf

This is an external email - exercise caution
Hey Karl
Budgetary pricing for the ABB 4690 turbidity analyzer (0-40 ntu range or 0-400ntu range available)
Would be [redacted] with wall mount transmitter/flow through sensor with auto clean
One 4-20 mA output 115Vac power
data sheet attached
Thanks
Al

Best Regards,
Alan Heighton

20 Duke Street, Suite 107
Bedford, NS
B4A 2Z5
Ph. 902-835-9337
Fax 902-835-8166
Cell 902-489-7839

Check out our NEW WEBSITE – www.ccii.com

From: Nowlan, Karl [mailto:Karl.Nowlan@nspower.ca]
Sent: Tuesday, September 04, 2018 10:25 AM
To: Alan Heighton
Cc: Carol Dotten
Subject: RE: TUC - Turbidity Meter

Waste water

From: Alan Heighton [mailto:aheighton@ccii.com]
Sent: Tuesday, September 04, 2018 10:20 AM
To: Nowlan, Karl
Cc: Carol Dotten
Subject: RE: TUC - Turbidity Meter

This is an external email - exercise caution
Hey Karl
ABB has a couple of different turbidity models
Is this going to be high level (waste water) or low level (potable water)

Best Regards,
Alan Heighton

20 Duke Street, Suite 107
Bedford, NS
B4A 2Z5
Ph. 902-835-9337
Fax 902-835-8166
Cell 902-489-7839

Check out our NEW WEBSITE – www.ccii.com

From: Nowlan, Karl [mailto:Karl.Nowlan@nspower.ca]
Sent: Tuesday, September 04, 2018 9:46 AM
To: Alan Heighton; Carol Dotten
Subject: TUC - Turbidity Meter

Al / Carol;

We are considering buying a online turbidity meter for next year

Im guessing at a ABB 4670 series model

Does Coastal rep this product or similar

If so can you give me a very basic ball park cost ?

Thanks
Karl

Karl Nowlan
Sr. Electrical Engineer
Tufts Cove Generating Station
Nova Scotia Power
315 Windmill Rd.
Dartmouth, N.S.
B3A 1H3

902-428-7673 o
902-456-6719 c

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CI Number: 50632

Title: TRE (Bunker C) HFO Refurbishment Project Phase 2

Start Date: 2017/06
In-Service Date: 2019/09
Final Cost Date: 2020/03
Function: Steam
Forecast Amount: $2,573,137

DESCRIPTION:

Units 5 and 6 at the Trenton Generating Station have boilers that are front-fired to burn coal with Heavy Fuel Oil (HFO) as a backup. The HFO for both units is stored in an above ground storage tank on site. The storage tank was constructed in 1968, and when filled to capacity, provides enough fuel for one unit to operate (exclusively on HFO) at full load for approximately six days. Availability of HFO is critical to allow uninterrupted operation of the plant in the event that coal becomes unavailable. Firing HFO can also sustain unit output if solid fuel has too much moisture during winter months.

The HFO system at the Trenton Generating Station is being refurbished in a phased approach. Phase 1 of this project restored full functionality and increased reliability of the HFO system by replacing the steam piping from the plant to the HFO tank suction heaters and rebuilding the Unit 6 HFO pump.

The scope of work for Phase 2 is to refurbish a major portion of the HFO piping and pumping system. The project includes replacement of a large portion of the pump and piping system from the storage tank containment berm through to the outlet area of the HFO circulation heaters. The major equipment for replacement includes the main oil forwarding pumps, recirculation pump, suction strainers, valves and circulation heater, as well as piping, heat-tracing, instrumentation and controls.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2018 - CI C0001419 - TRE (Bunker C) HFO Refurbishment Phase 1 - $340,618

Depreciation Class: Steam Production Plant – Trenton Common

Estimated Life of the Asset: 30 years

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement / Refurbishment

Why do this project?

The purpose of this project is to complete inspection, repair, and replacement work of the HFO supply and return piping, pumps, strainers and heaters to decrease the potential of release of fuel into the environment and increase the reliability of the system. This will mitigate environmental risks for ongoing operation of the HFO System.

Why do this project now?

The condition of HFO system at Trenton has deteriorated due to corrosion and erosion of components over 50 years of operation. A system upgrade project was completed in 2015 where approximately 30 percent of the system was

replaced due to deterioration, environmental risks and to align with current industry standards. Also, targeted repairs and measures have been made to extend the life of the remaining system, but these are no longer feasible on a go forward basis. A pipe inspection of the HFO system, undertaken in 2017 (please refer to Attachment 1) highlight some system defects which need to be addressed and upgrades that need to be made to bring the HFO system up to a current operation standard for reliability and reduce the environmental risk associated with this fuel piping system.

Why do this project this way?

In the past, when system failures have occurred, required specific repairs have been completed on the HFO system. However, the age and overall condition of the HFO system is such that replacement of the targeted equipment is the only option. Selective replacement of targeted piping and components is more cost effective than complete replacement of the HFO system.

CI Number : 50632-SI77 - TRE (Bunker C) HFO Refurbishment Project Phase 2

Project Number 50632-SI77

Parent CI Number : -

Asset Location : 1168 - 1168 Trenton Common Property

Budget Version 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1900 - SGP - Fuel Hndlg.Oil	1,983,006
Retirements	1900 - SGP - Fuel Hndlg.Oil	590,131
	Total Cost:	2,573,137
	Original Cost:	281,803

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI# : 50632
Title: TRE (Bunker C) HFO Refurbishment Project Phase 2
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Engineering	PD	75	$ 405	$ 30,398		
Electrician	PD	30	$ 358	$ 10,748		
Maintenance Trades	PD	10	$ 365	$ 3,648		
Utility worker	PD	42	$ 240	$ 10,068		
			Sub-Total	$ 54,863		
OT Labour						
Utility worker	PD	7	$ 480	$ 3,329		
Maintenance Trades	PD	6	$ 730	$ 4,377		
			Sub-Total	$ 7,706		
Term Labour						
Maintenance Trades	PD	16	$ 365	$ 5,837		
			Sub-Total	$ 5,837		
Travel						
Travel	lot	1	$ 10,000	$ 10,000		
			Sub-Total	$ 10,000		
Materials						
HFO Recirculating Pumps	ea	1	[redacted]		Attachment 2, Item 1	
HFO Supply Pumps	ea	2			Attachment 2, Item 2	
Strainers	ea	1			Attachment 3, Item 1	
HFO Circulating Heater (USD)	ea	2			Attachment 4, Item 2	
USD to CAD	%	30%				
Valves, Meters, Pipe Accessories	lot	1	$ 100,000	$ 100,000		
Piping	lot	1	$ 75,000	$ 75,000		
Electrical Components and Cable	lot	1	$ 35,500	$ 35,500		
Instrumentation Components	lot	1	$ 25,000	$ 25,000		
Controls	lot	1	$ 10,000	$ 10,000		
Civil / Structural	lot	1	$ 20,000	$ 20,000		
Heat Trace System	lot	1	[redacted]		Attachment 5	
			Sub-Total	$ 755,549		
Contracts						
Installation, Civil/Structural Works, Demolition	lot	1	[redacted]		Attachment 6	
Heat Trace Installation	lot	1				
Electrical Installation	lot	1	$ 25,000	$ 25,000		
Instrumentation Installation	lot	1	$ 15,000	$ 15,000		
Insulation & Asbestos Cleanup	lot	1	$ 35,000	$ 35,000		
Cable Demolition	lot	1	$ 12,600	$ 12,600		
Oil Cleanup	lot	1	$ 40,000	$ 40,000		
			Sub-Total	$ 1,047,600		
Consulting						
Preliminary Engineering	lot	1	$ 131,000	$ 131,000		
Detailed Design	lot	1	$ 100,000	$ 100,000		
			Sub-Total	$ 231,000		
Meals						
Meals	lot	1	$ 1,000	$ 1,000		
			Sub-Total	$ 1,000		
Overtime Meals						
OT Meals	lot	1	$ 4,000	$ 4,000		
			Sub-Total	$ 4,000		
Freight						
Freight	lot	1	$ 7,500	$ 7,500		
			Sub-Total	$ 7,500		
Rentals						
Cranes, boom-trucks, and trailers	lot	1	$ 65,000	$ 65,000		
Hydro vacuum truck	lot	1	$ 8,000	$ 8,000		
			Sub-Total	$ 73,000		
Other Goods & Services						
Contingency	%	10%	$ 1,871,554	$ 187,155		
			Sub-Total	$ 187,155		
Interest Capitalized						
AFUDC				$ 46,002		
			Sub-Total	$ 46,002		
Administrative Overhead						
Labour AO				$ 19,046		
Contracts AO				$ 122,880		
			Sub-Total	$ 141,925		
			SUB-TOTAL (no AO, AFUDC)	$ 2,385,210		
			TOTAL (AO, AFUDC included)	$ 2,573,137		
Original Cost				$ 281,803		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

ACUREN	Piping Inspection Report	Acuren Job No.	190-NSPOW-204808
		Report No.	ER204808-1
		Report Date	10Oct2017

Project Information			
Client	Nova Scotia Power	PO/WO#	303193
Site/Plant	Trenton	Project	HFO System Assessment
Work Location	Trenton, NS	NDT Report (ref1)	NA
Unit/Location	HFO System	NDT Report (ref2)	
Equipment Desc.	HFO Supply, and Suction	NDT Report (ref3)	
Equipment ID	03512	NDT Report (ref4)	
Equipment Information			
Manufacturer	NA	Serial Number	NA
Construction Code	ASME B31.1 (1965)?	Year Commissioned	1968
Stamp	None	Inspection guide	API-570
Service	Fuel Oil	Operating Temp.	200 – 240 F
Drawing No.	A 050N0 2 351 51 001 - 003	Operating Pressure	100 psig
Specifications	12 NPS schd 40 CS		

Remaining Useful Life		
Remaining Useful Life (RUL)	Years	Location
RUL (Min)	NA	
RUL (Avg)	NA	

Next Inspection Recommendation		
Inspection	Rec. Next Inspection	Comments
API-570 (Visual External)	2021	Perform external visual every 5 years as per requirements in API-570
API-570 (Thickness Measurements)	NA	

Recommendations	
No.	Recommendation
1	Repair all supports along the plant. The following steps should be taken: 1 Strip insulation and measure pipe wall thickness at locations identified in figures 11 to 19 where external corrosion is visually observed; 2 Evaluate pipe integrity along this area and replace if necessary (compare wall thickness to minimum required); 3 Replace supports along this side of the plant and ensure steel is elevated out of the range of the soil to avoid future corrosion.
2	Perform a thickness measurement NDE inspection using ultrasound of all areas identified in figures and evaluate the integrity of the piping.
3	Re-insulate areas and repair cladding of all areas identified in figures and ensure all openings are sealed.
4	Repair plywood floor near HFO pumps inside plant (note that the plant was informed of this immediately after the inspection was completed).

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General Comments

This inspection includes only a visual technique at this time. The purpose was to evaluate the piping and supports to provide an accurate scope of work for thickness measurement and other NDE techniques if recommended.

The primary failure mechanisms acting on the piping system is corrosion under insulation, and atmospheric corrosion. Internal corrosion is unlikely unless water contamination is an issue in the tank.

Many of the supports along the exterior of the plant are completely corroded through. The piping sits at the bottom of the berm/hill causing dirt/mud to cover the bottom of the supports. This is likely the cause of the increased corrosion rate of the supports. These supports should be replaced and the piping evaluated along this area. The following steps should be taken:

- Strip insulation and measure pipe wall thickness at locations identified in figures 11 to 19 where external corrosion is visually observed.
- Evaluate pipe integrity along this area and replace if necessary (compare wall thickness to minimum required)
- Replace supports along this side of the plant and ensure steel is elevated out of the range of the soil to avoid future corrosion.

The insulation and cladding requires attention in a number of locations to prevent corrosion under insulation from allowing moisture to saturate the insulation. These locations should be stripped of insulation and the pipe wall thickness measured where it is visually corroded. Insulation should be stripped until it is dry.

The plywood floor near the fuel oil pumps inside the plant was broken and collapsing into the trench below creating a safety hazard (note that the plant was informed of this immediately after the inspection was completed).

This line was evaluated in accordance with the API-570 in-service piping recommended practice. The design code was not known at the time of inspection however this would have no impact on the results of this assessment at this time.

Responsibilities

The asset owner has final responsibility for the developing, documenting, implementing, executing and assessing piping inspection systems and procedures that meet the requirements of the inspection code. The owner also controls all activities related to the rerating, repair and alterations of the asset. As such it is the responsibility of the owner to make the final decision regarding the validity and priority of recommended inspection intervals and tasks contained in this report.

Recommended inspection dates contained in this report are based on the inspection code and are independent of any jurisdiction, regulation, RBI analysis, or other documentation. The owner is responsible for the final decision on when and what type of inspection to perform and all inputs should be considered.

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		Report No.	ER204808-1
		Report Date	10Oct2017

Report Information			
Report:	ER204808-1	Date:	10-Oct-2017
Revision:		Date:	
Revision Comments:			

Written By:	Reviewed By
	
Wesley Albert P.Eng, API-570, API-580 Senior Reliability Engineer	Scott Raithby NS Reliability Services Manager

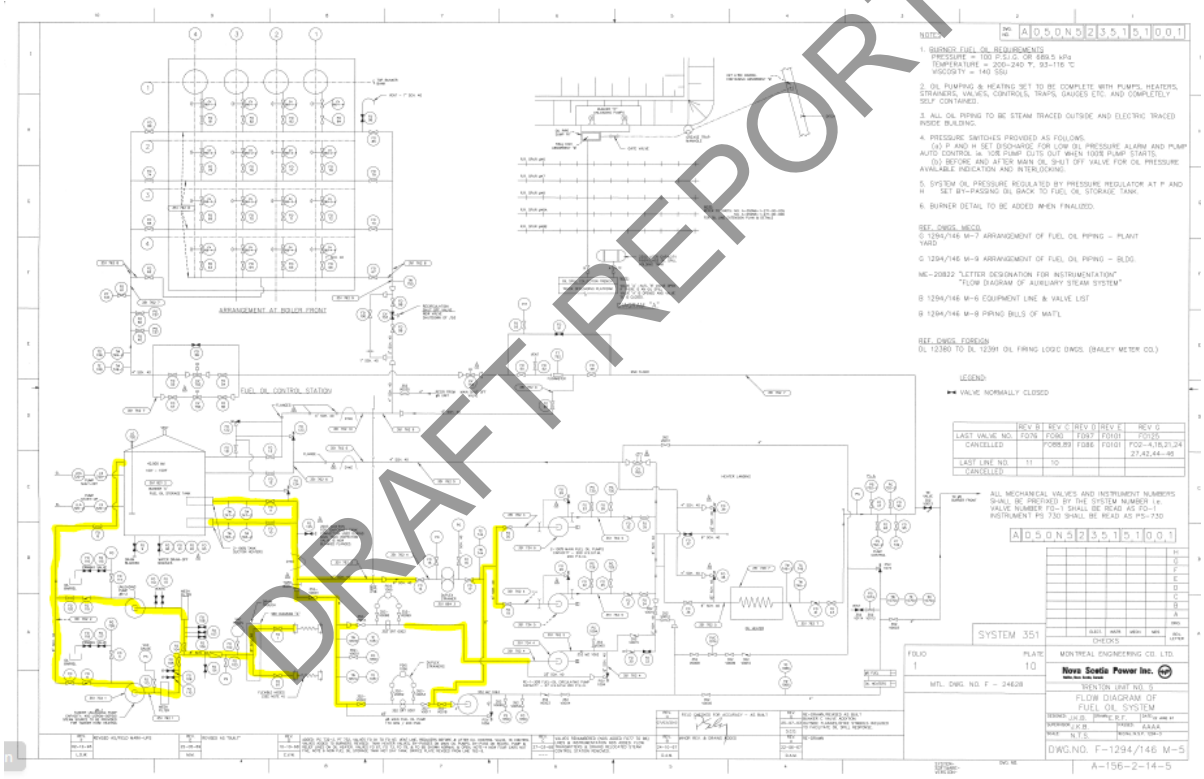
ACUREN	Piping Inspection Report	Acuren Job No.	190-NSPOW-204808
		Report No.	ER204808-1
		Report Date	10Oct2017

Scope of Assessment

The scope of the current inspection and assessment is highlighted in yellow in Figure 1, and in the drawings at the end of the report. The current inspection included a visual inspection only to evaluate the line and identify potential issues from CUI, or other failure mechanisms that can be inspected with NDE techniques in the future if required. The following technologies were used:

- Visual (VT) – Visual inspection is performed by an API qualified individual in accordance with the inspection code. 100% of the highlighted section was inspected visually with the insulation and cladding left in place.

Figure 1 – P&ID Scope



ACUREN	Piping Inspection Report	Acuren Job No.	190-NSPOW-204808
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Visual Inspection

A = Acceptable, U = Unacceptable, N/A = not applicable

General Piping Visual Inspection				
Parameter	A	U	N/A	Comments
General condition		X		See issues in general comments and other sections. Further testing is required to fully understand the general condition.
Signs of leaks	X			
Alignment	X			
Heat tracing	X			
Vibration	X			
Coating/Paint			X	
External corrosion		X		Areas left uninsulated appear to have some external corrosion and requires NDE methods to determine wall thickness.
Hangers/Supports Visual Inspection				
Parameter	A	U	N/A	Comments
Shoes/Supports aligned	X			
Hanger distorted/broken	X			
Hanger bottom/topped out	X			
Loose brackets	X			
Hanger/support corrosion		X		A number of supports corroded through wall along the back side of the plant
Slide plates/rollers			X	
Inadequate support		X		
Insulation Visual Inspection				
Parameter	A	U	N/A	Comments
Damage		X		See figures
Penetration		X		See figures
Missing insulation		X		See figures
Seals/Caulking		X		See figures
Bulging	X			
Banding missing/broken	X			
General Visual Inspection Comments				

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See comments above. No apparent leaks from piping or external damage directly to piping. CUI is evident on one area where insulation had been removed and therefore is likely present in areas of damaged insulation.

Supports along back side of plant are corroded through likely due to being buried in soil (wet and corrosive).

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		Report Date	10Oct2017

Visual Figures and Specific Recommendations

Recommendation	Insulate piping at the truck unloading station.
Comment	Unloading station not insulated, piping exposed to environmental corrosion.

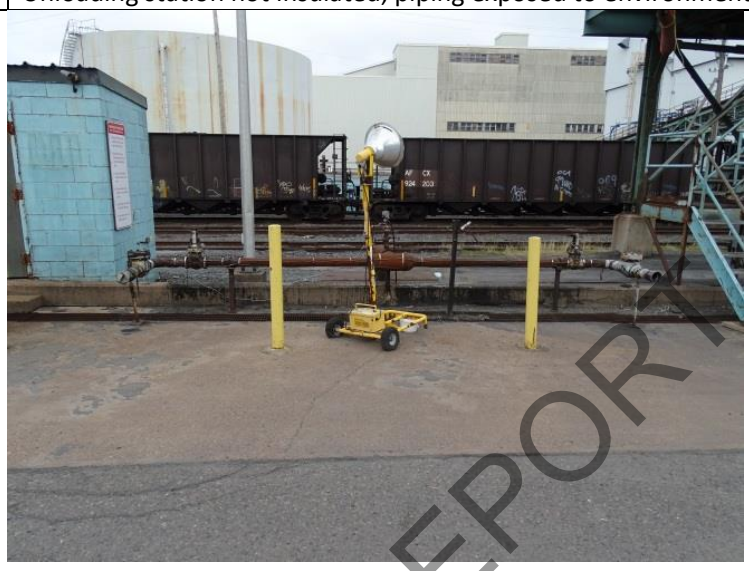

Figure 2

Recommendation	Seal piping around valve to ensure water does not enter the insulation
Comment	Cladding not sealed where insulation passes under the road and into the valve

Figure 3

ACUREN	Piping Inspection Report	Acuren Job No.	190-NSPOW-204808
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		Report Date	10Oct2017

Recommendation	Insulate piping as it leaves the pumping building at the unloading station.
	Not insulated, piping exposed to atmospheric corrosion
	

Figure 4

Recommendation	Strip 1' to 2' of insulation and measure thickness with UT for a minimum of 2' on each side of the support. Remove pipe support and ensure one UT bad lines up with where the support is resting on the pipe. When reinsulating ensure insulation cladding is sealed.
Comments	Uninsulated section ends – cladding not sealed, support corroded, external of piping pitted / corroded. Support s of this type can cause the accumulation of water along the surface of the pipe increasing the corrosion rate in this area.
	

Figure 5

ACUREN	Piping Inspection Report	Acuren Job No.	190-NSPOW-204808
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Recommendation	Remove insulation 1' of both sides of the support and measure thickness with UT.
Comments	Insulation not sealed at support
	

Figure 6

Recommendation	Remove wet insulation and visually inspect valve, re-insulate and ensure all areas are sealed. If wet insulation proceeds down the pipe, remove insulation from pipe upstream/downstream of the valve and measure thickness.
Comments	Insulation not sealed around valve, moss growing on caulking.
	

Figure 7

ACUREN	Piping Inspection Report	Acuren Job No.	190-NSPOW-204808
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Recommendation	Remove insulation 1’ from both sides of support and measure pipe wall thickness. Re-insulate and ensure support is sealed.
Comments	Insulation not sealed
	

Figure 8

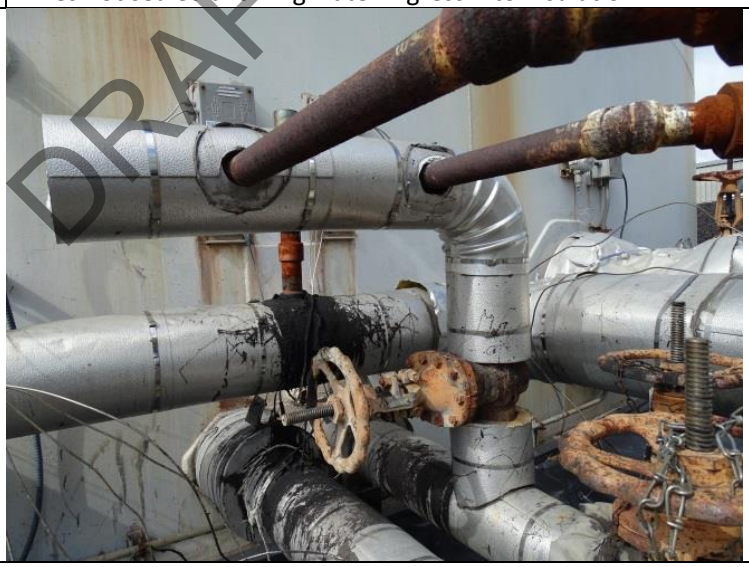
Recommendation	Insulate small lines and valves and ensure they are sealed
Comment	Lines not sealed allowing water ingress into insulation.
	

Figure 9

ACUREN	Piping Inspection Report	Acuren Job No.	190-NSPOW-204808
		Report No.	ER204808-1
		Report Date	10Oct2017

Recommendation	Seal protrusion around bagged insulation
Comments	Protrusion not sealed allowing water ingress into insulation.

Figure 10

Recommendation	Seal insulation around valve flanges
Comment	Insulation not sealed

Figure 11

ACUREN	Piping Inspection Report	Acuren Job No.	190-NSPOW-204808
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Recommendation	Replace pipe support
Comment	Pipe support corroded completely through approximately 90% around circumference.

Figure 12

Recommendation	Replace pipe support
Comment	Corrosion hole in pipe support

Figure 13

ACUREN	Piping Inspection Report	Acuren Job No.	190-NSPOW-204808
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Recommendation	Replace pipe support
Comment	Corroded pipe support, hole through approximately 75%.
	

Figure 14

Recommendation	Replace pipe support
Comment	Corroded pipe support
	

Figure 15

ACUREN	Piping Inspection Report	Acuren Job No.	190-NSPOW-204808
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Recommendation	Replace pipe support.
Comments	Pipe support buried in mud and corroded.

Figure 16

Recommendation	Replace pipe support
Comments	Corrosion holes in support

Figure 17

ACUREN	Piping Inspection Report	Acuren Job No.	190-NSPOW-204808
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Recommendation	Strip insulation for 1’ (minimum) on both sides of where electrical heat tracing enters cladding and measure pipe wall thickness.
Comments	Insulation not sealed allowing water ingress into insulation.
	

Figure 18

Recommendation	Replace pipe support
Comment	Corroded pipe support
	

Figure 19

ACUREN	Piping Inspection Report	Acuren Job No.	190-NSPOW-204808
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Recommendation	Strip insulation a minimum of 1' upstream and 1' downstream of holes, and measure pipe wall thickness.
Comment	Holes in cladding, allowing water ingress
	

Figure 20

Recommendation	Strip insulation, measure pipe wall thickness on elbow and replace insulation. Ensure insulation is sealed around flange and protrusions.
Comments	Cladding missing allowing water to soak insulation.
	

Figure 21

Recommendation	Place cap/seal penetration. Inspect bottom of elbow with real time radiography.

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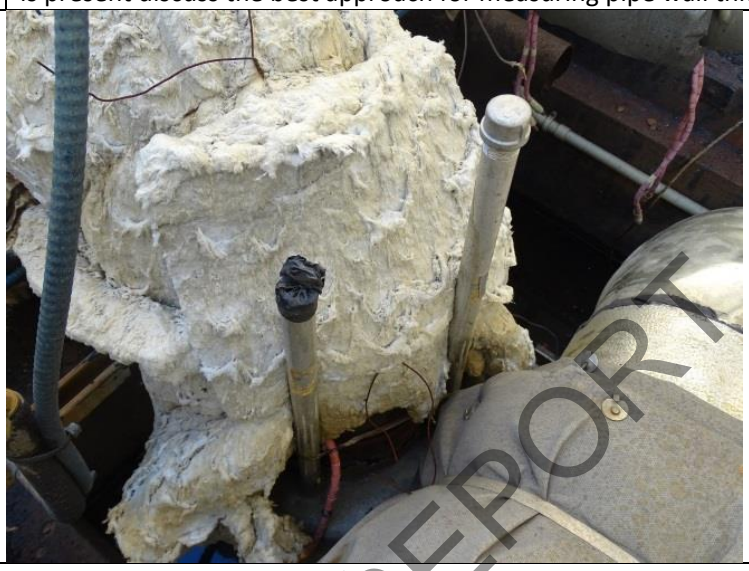
Comments	Two small conduits enter sealed piping which goes into trench. Pipe in trench is covered with fiberglass which will cause water to become trapped in the insulation at the lowest level of the elbow. Inspection of pipe wall may be difficult in this area – use real time radiography to determine if external corrosion is present. If it is present discuss the best approach for measuring pipe wall thickness.
	

Figure 22

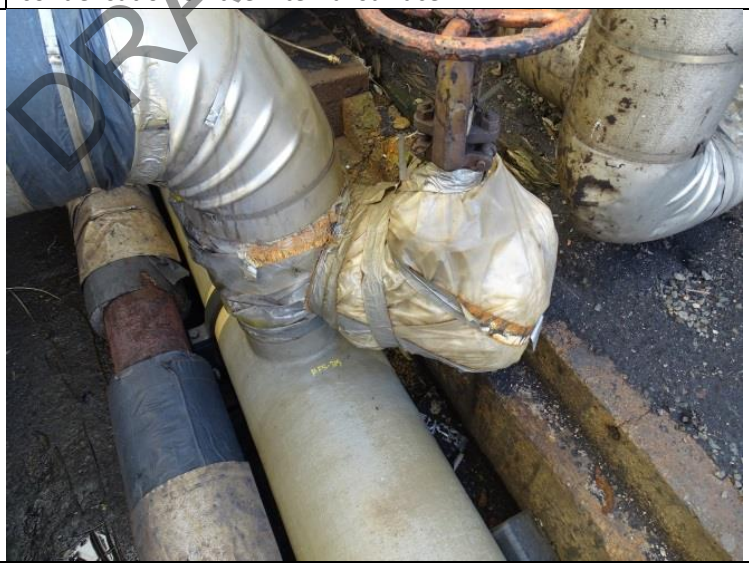
Recommendation	Remove plastic and visually inspect valve. Trip insulation around elbow and measure pipe wall thickness. Inspection bottom pipe (fiberglass cladding) with real time radiography and if external corrosion is present measure wall thickness with appropriate technology.
Comments	Valve and pipe sealed with plastic bag and duct tape – plastic was full of condensation on the internal surface.
	

Figure 23

ACUREN	Piping Inspection Report	Acuren Job No.	190-NSPOW-204808
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Recommendation	Strip insulation between the valve and where it enters the plant and measure pipe wall thickness.
Comment	Insulation cladding damaged and not sealed

Figure 24

Recommendation	Strip a 2’ section of insulation where it is damaged and measure pipe wall thickness.
Comment	Cladding damaged/dented and not sealed, Piping is inside therefore CUI is not likely a concern. Inspecting pipe wall thickness inside to evaluate potential for corrosion.

Figure 25

ACUREN	Piping Inspection Report	Acuren Job No.	190-NSPOW-204808
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Recommendation	Repair or replace floor where it passes over trench
Comment	Plywood floor damaged under piping where it passes over trench. Plywood is rotten and collapsing into the trench creating a safety hazard.
	

Figure 26

ACUREN	Piping Inspection Report	Acuren Job No.	190-NSPOW-204808
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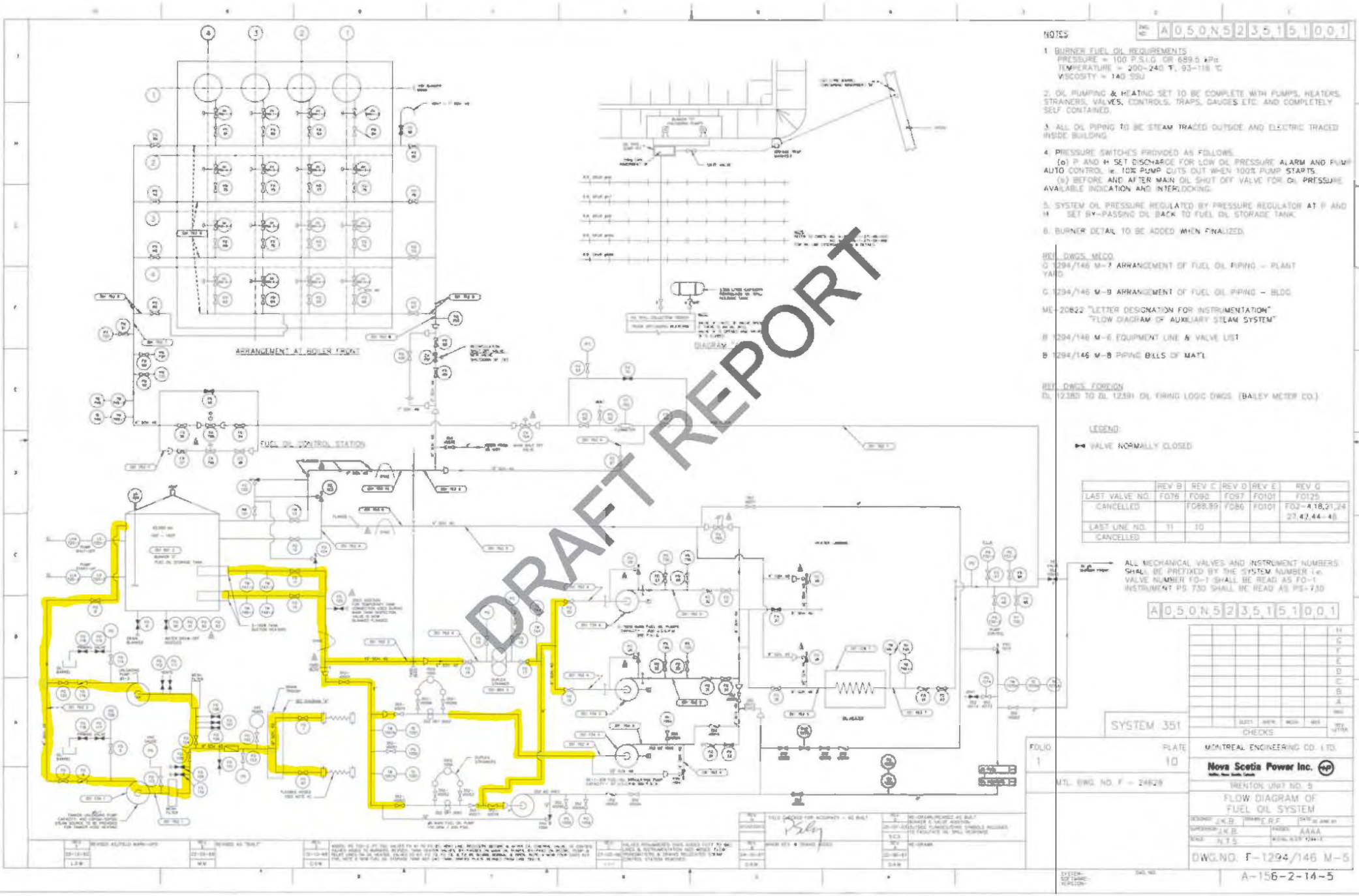
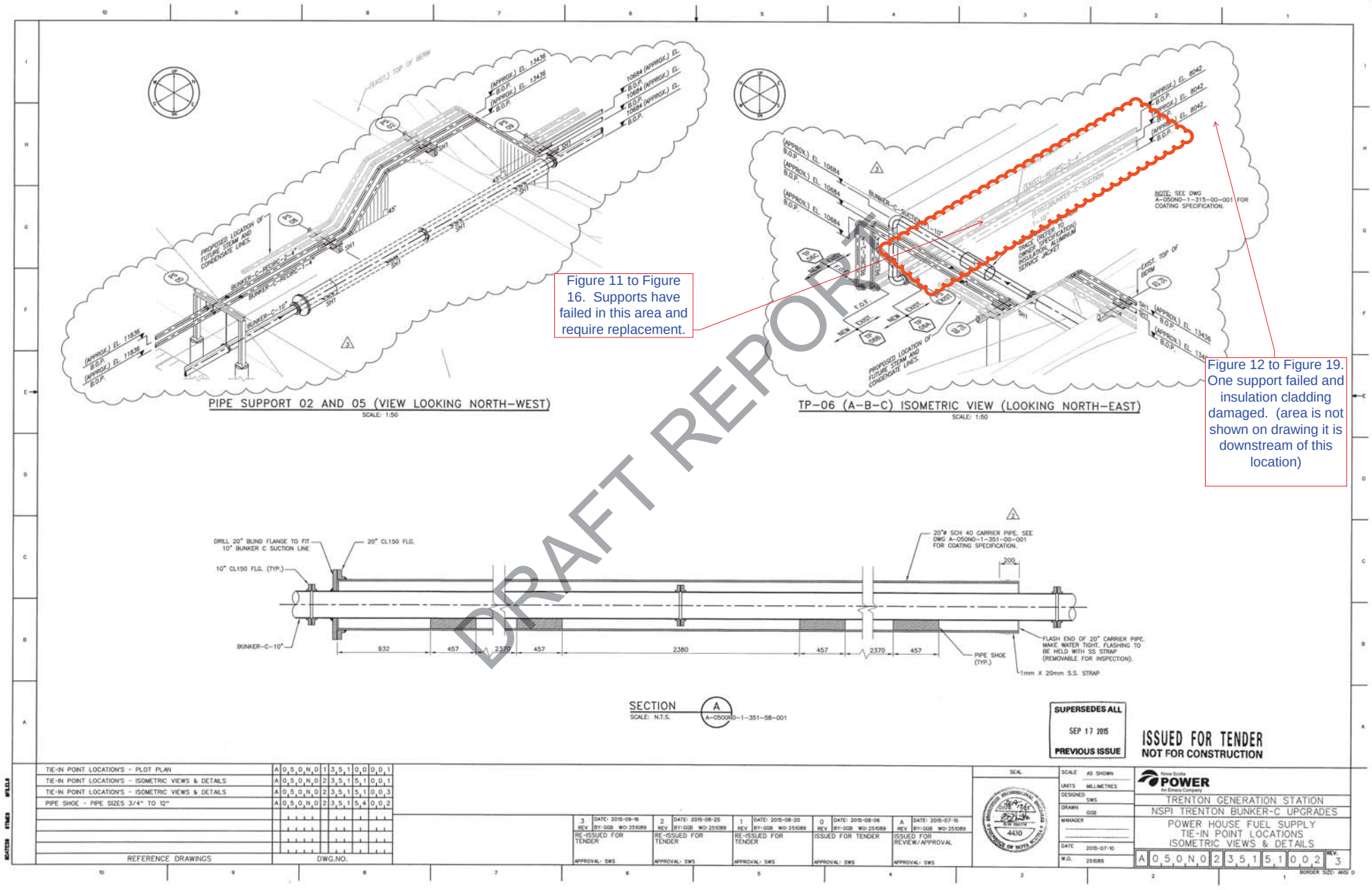
Appended Drawings

- A 050N5 2 351 51 001 - Supply Line Inspection Scope
- A 050N0 2 351 51 001 – Inspection
- A 050N0 2 351 51 002 – Inspection
- A 050N0 2 351 51 003 - Inspection





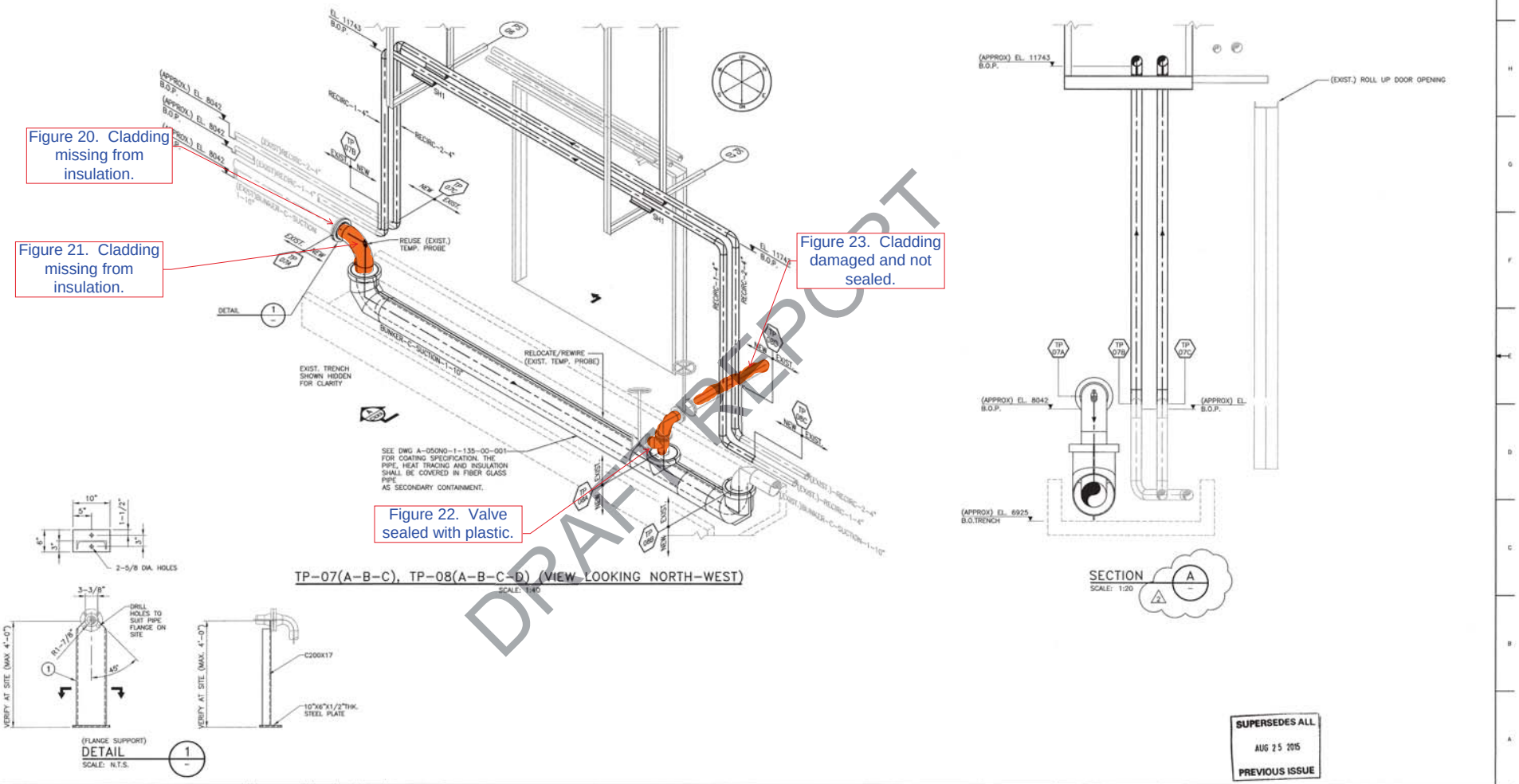


Figure 20. Cladding missing from insulation.
Figure 21. Cladding missing from insulation.
Figure 22. Valve sealed with plastic.
Figure 23. Cladding damaged and not sealed.
TP-07(A-B-C), TP-08(A-B-C-D) (VIEW LOOKING NORTH-WEST)
SCALE: 1:40
SECTION
SCALE: 1:20
DETAIL
SCALE: N.T.S.
(FLANGE SUPPORT)
SUPERSEDES ALL
AUG 25 2015
PREVIOUS ISSUE
DRAFT REPORT
REFERENCE DESCRIPTION
SECTIONS AND DETAILS
PLAN AND DETAILS
DEMOLITION PLAN
REFERENCE DRAWINGS
DWG.NO.
POWER
TRENTON GENERATION STATION
NSPI TRENTON BUNKER-C UPGRADES
POWER HOUSE FUEL SUPPLY
TIE-IN POINT LOCATIONS
ISOMETRIC VIEWS & DETAILS

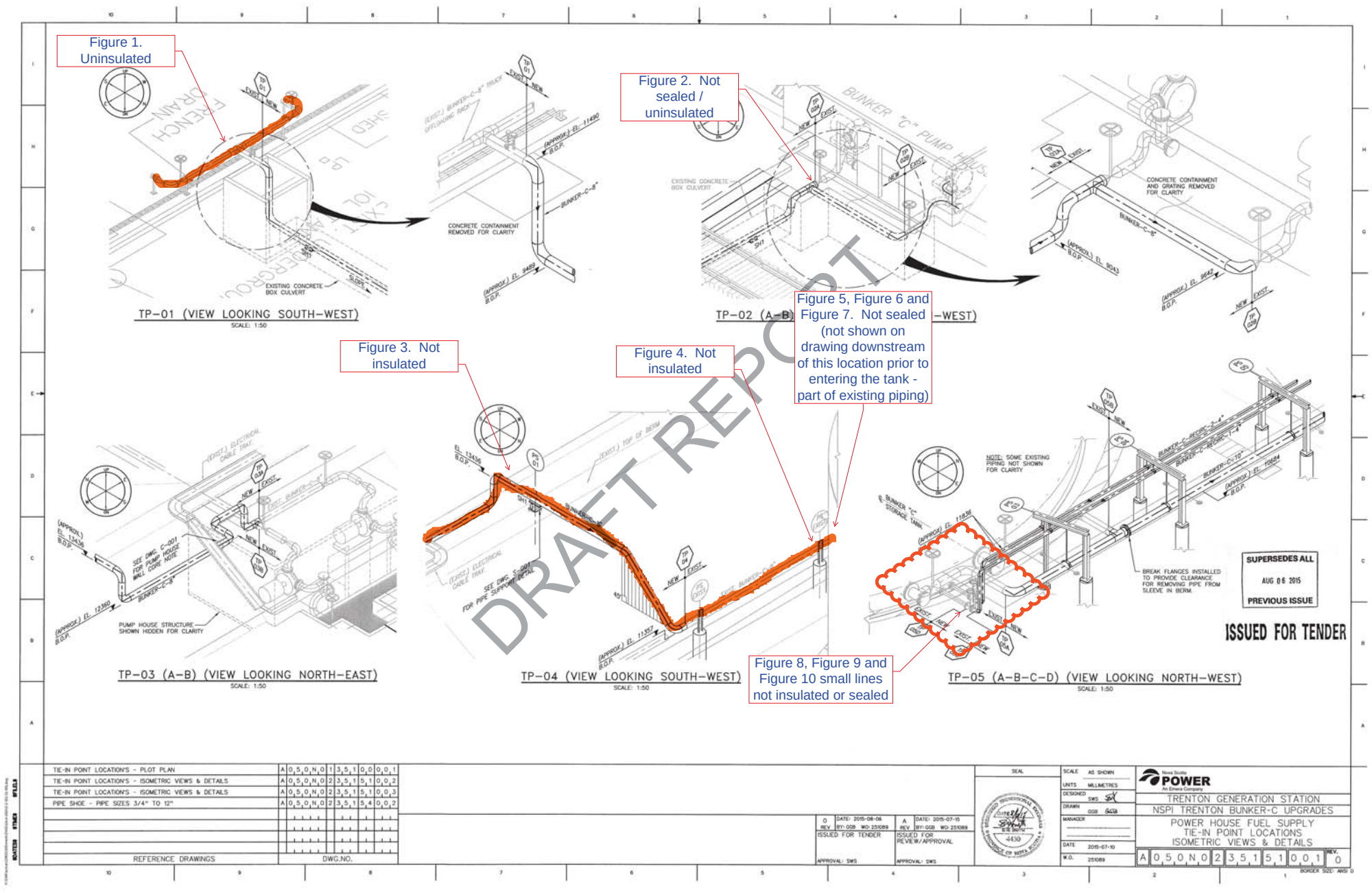


Figure 1. Uninsulated
Figure 2. Not sealed / uninsulated
Figure 3. Not insulated
Figure 4. Not insulated
Figure 5, Figure 6 and Figure 7. Not sealed (not shown on drawing downstream of this location prior to entering the tank - part of existing piping)
Figure 8, Figure 9 and Figure 10 small lines not insulated or sealed
TP-01 (VIEW LOOKING SOUTH-WEST)
TP-02 (A-B) (VIEW LOOKING NORTH-WEST)
TP-03 (A-B) (VIEW LOOKING NORTH-EAST)
TP-04 (VIEW LOOKING SOUTH-WEST)
TP-05 (A-B-C-D) (VIEW LOOKING NORTH-WEST)
DRAFT REPORT
SUPERSEDES ALL
AUG 06 2015
PREVIOUS ISSUE
ISSUED FOR TENDER
TRENTON GENERATION STATION
NSPI TRENTON BUNKER-C UPGRADES
POWER HOUSE FUEL SUPPLY
TIE-IN POINT LOCATIONS
ISOMETRIC VIEWS & DETAILS
A 0 5 0 N 0 2 3 5 1 5 1 0 0 1 REV. 0

PumpsPlus Ltd
97 Simmonds Drive
Dartmouth, NS B3B 1N7
Phone (902) 468-2971
Fax (902) 468-2480

September 5, 2018

NSPower

Re: NSPower Bunker Pumps
Our Proposal No: 180905CW1

We thank you very much for the above mentioned inquiry.

We are pleased to offer the following pumps for your review and consideration.

98 gpm Pump
IMO Model G3DH-250
Standard Construction
'H' seal for Bunker Service
c/w steel baseplate, coupling
c/w 15hp 575/3/60 volt TEFC Motor

Unit Price: [redacted] Item 1
Delivery: 6 to 8 wks after drawing approval

248 gpm Pump
IMO Model G3DH-350
Standard Construction
'H' seal for Bunker Service
c/w steel baseplate, coupling
c/w 50hp 575/3/60 volt TEFC Motor

Unit Price: [redacted] Item 2
Delivery: 6 to 8 wk

Commercial Notes:

- Prices in CAD, all taxes extra
- Delivery Terms: ex-works PumpsPlus Dartmouth, NS
- Payments Terms: Net 30 days on approved credit.
- Quotation valid for thirty (30) days.

Best Regards

COLFAX Fluid Handling	Pump Selector Program Version: 2.20.189 / 17.05.08 / F14.12.03 Pump Type 3D250 (D)	Customer: Order Comments:	Created By: Ed McCleave	Date: 8/23/2017 7:45:03 AM

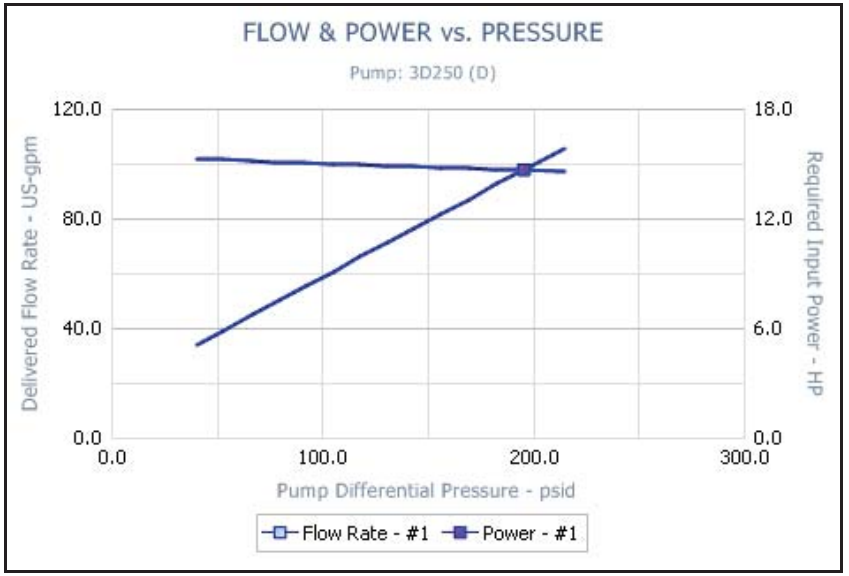
SYSTEM INFORMATION

			RV Set Pressure	220	psig
Max Gas Entrainment	0	%	RV Full Accumulation	242	psig
Max Contamination	0	%	Standard	Hydraulic Institute	
Pumping Fluid	Fuel - Fuel Oil - No. 6		Specific Gravity	0.88	

SELECTION COMMENTS

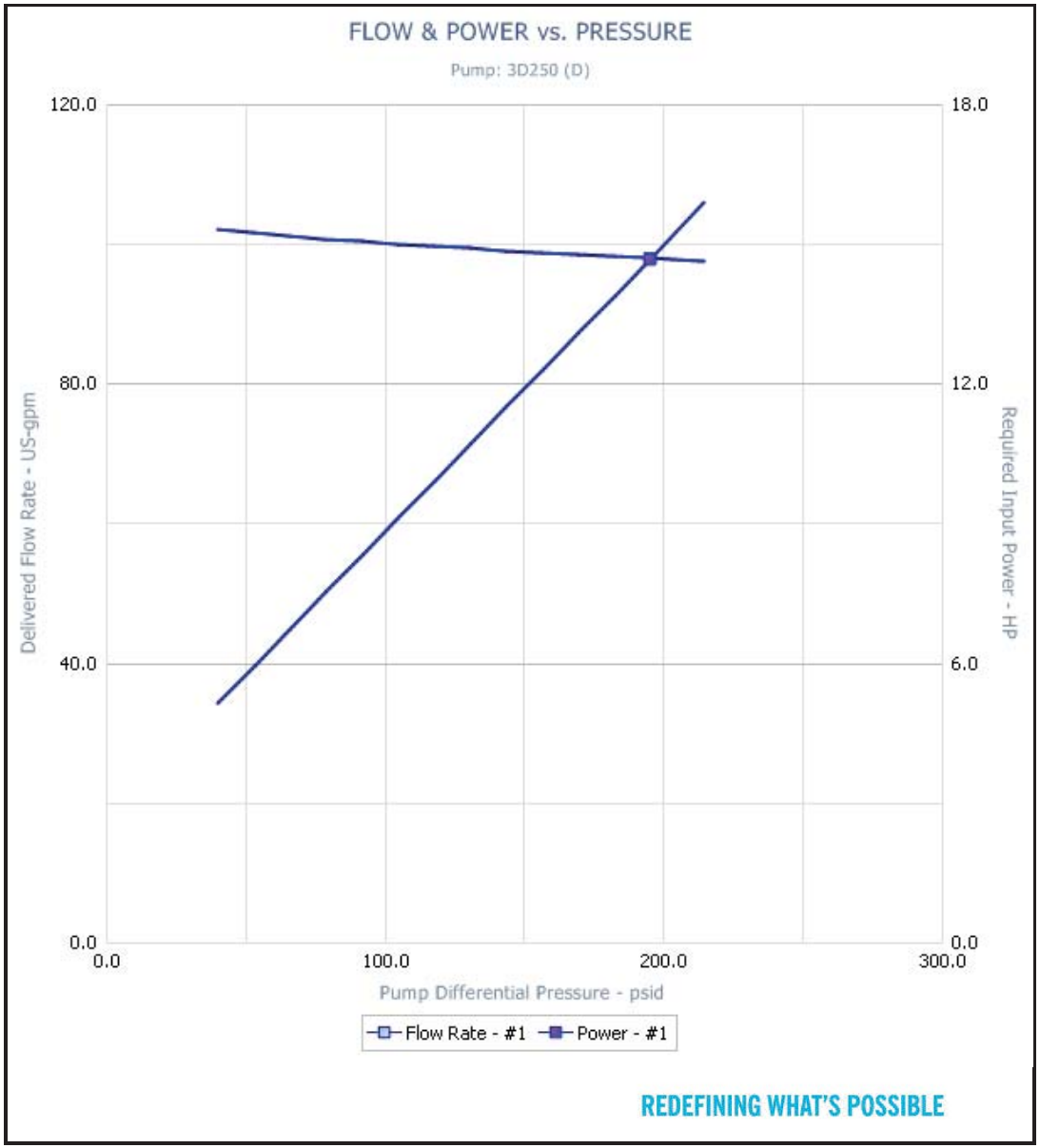
PUMP PERFORMANCE INFORMATION

	ITEM	UNITS	OPERATING CONDITIONS #1	#2	#3	#4
INPUTS	Shaft Operating Speed	rpm	1750			
	Discharge Pressure	psig	200			
	Inlet Pressure	psig	5			
	Inlet Temperature	°F	150			
	Inlet Viscosity	SSU	500			
	Required Flow Rate	US-gpm	79			
CALCULATIONS	Delivered Flow Rate	US-gpm	98.1			
	Pump Diff Pressure	psid	195			
Rq'd BHP @	Operating Conditions	HP	14.7			
	RV Set Pressure	HP	15.93			
	RV Accumulation Pressure	HP	17.28			
	110% Max Opr Cond Pwr	HP	17.52			
	Net Inlet Pressure Required	psi	4.68			
	Volumetric Efficiency	%	92.9			
	Overall Efficiency	%	75.9			
	Theoretical Flow Rate	US-gpm	105.5			
	Orifice Flow Rate	US-gpm				
	Slip Flow Rate	US-gpm	7.45			
	Theoretical Oil Power	HP	12.01			
	Mechanical Loss	HP	2.69			
	Hydraulic Power	HP	11.16			
Rq'd Torque @	Operating Conditions	ft-lbs	44.11			
	RV Set Pressure	ft-lbs	47.81			
	RV Accumulation Pressure	ft-lbs	51.9			
	110% Max Opr Cond Trq	ft-lbs	52.6			
	External Cooler Size	btu/hr	---			
	Internal Cooler Size	btu/hr	---			



REDEFINING WHAT'S POSSIBLE

COLFAX Fluid Handling	Pump Selector Program Version: 2.20.189 / 17.05.08 / F14.12.03 Pump Type 3D250 (D)	Customer:	Created By: Ed McCleave	Date: 8/23/2017 7:45:03 AM
		Order Comments:		



SYSTEM INFORMATION

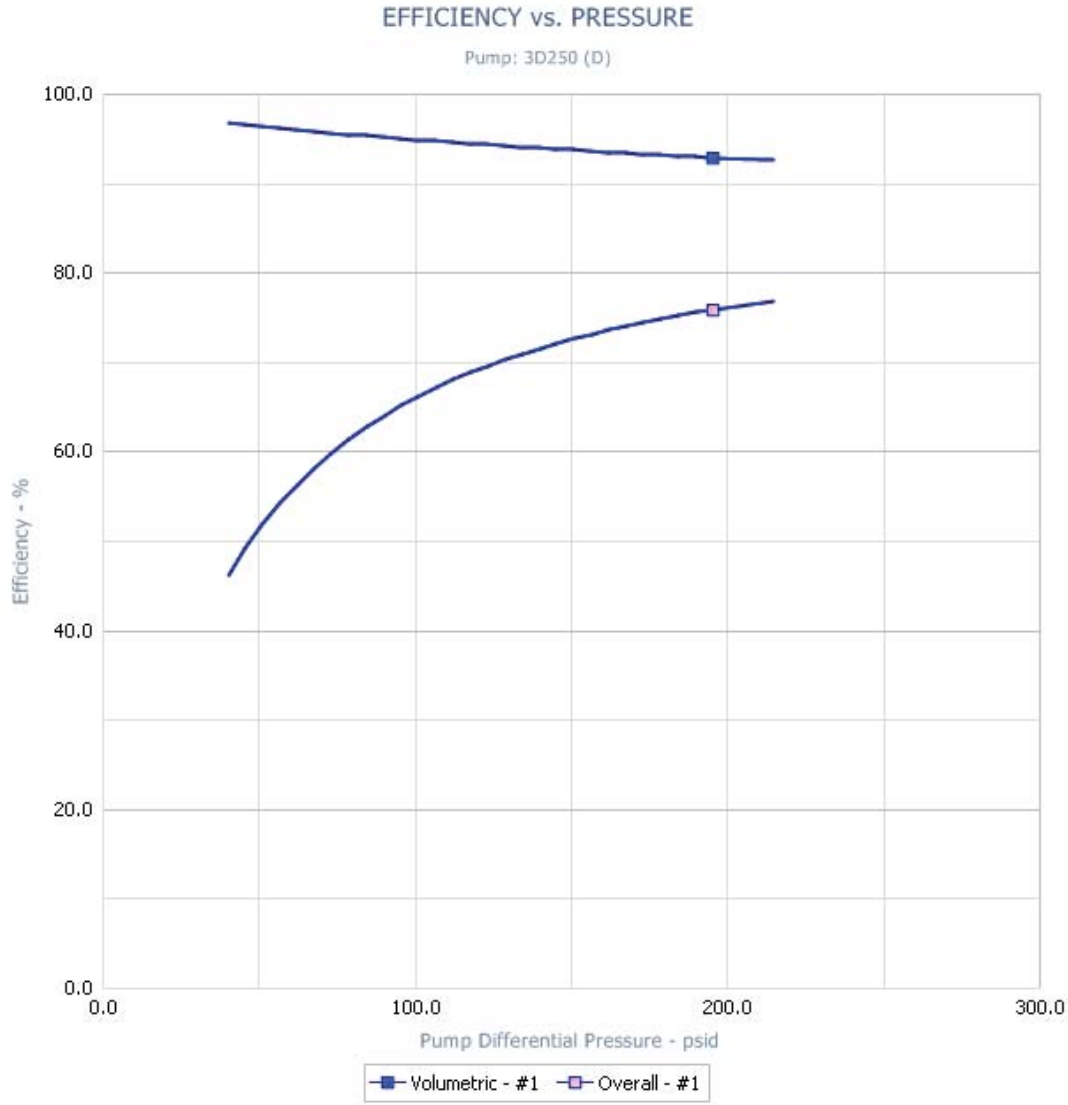
			RV Set Pressure	220	psig
Max Gas Entrainment	0	%	RV Full Accumulation	242	psig
Max Contamination	0	%	Standard	Hydraulic Institute	
Pumping Fluid	Fuel - Fuel Oil - No. 6			S. Gravit	0.88

PUMP PERFORMANCE INFORMATION

	ITEM	UNITS	OPERATING CONDITIONS #1	#2	#3	#4
INPUTS	Shaft Operating Speed	rpm	1750			
	Discharge Pressure	psig	200			
	Inlet Pressure	psig	5			
	Inlet Temperature	°F	150			
	Inlet Viscosity	SSU	500			
	Required Flow Rate	US-gpm	79			
CALCULATIONS	Delivered Flow Rate	US-gpm	98.1			
	Pump Diff Pressure	psid	195			
Rq'd BHP @	Operating Conditions	HP	14.7			
	RV Set Pressure	HP	15.93			
	RV Accumulation Pressure	HP	17.28			
	110% Max Opr Cond Pwr	HP	17.52			
	Net Inlet Pressure Require	psi	4.68			
	Volumetric Efficiency	%	92.9			
	Overall Efficiency	%	75.9			

SELECTION COMMENTS

COLFAX Fluid Handling	Pump Selector Program Version: 2.20.189 / 17.05.08 / F14.12.03 Pump Type 3D250 (D)	Customer: Order Comments:	Created By: Ed McCleave	Date: 8/23/2017 7:45:03 AM



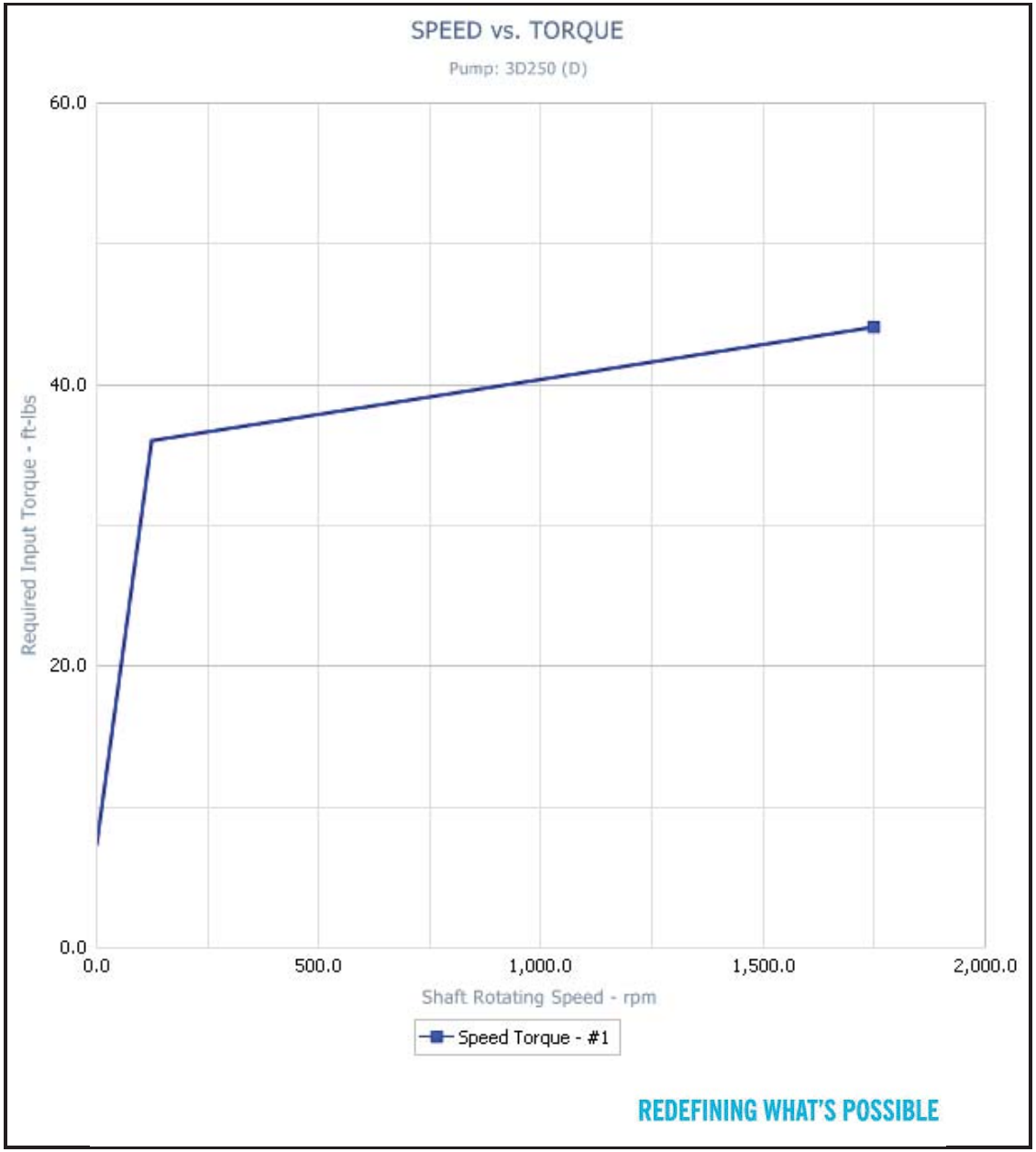
SYSTEM INFORMATION					
			RV Set Pressure	220	psig
Max Gas Entrainment	0	%	RV Full Accumulation	242	psig
Max Contamination	0	%	Standard	Hydraulic Institute	
Pumping Fluid	Fuel - Fuel Oil - No. 6			S. Gravit	0.88

PUMP PERFORMANCE INFORMATION

	ITEM	UNITS	OPERATING CONDITIONS #1	#2	#3	#4
INPUTS	Shaft Operating Speed	rpm	1750			
	Discharge Pressure	psig	200			
	Inlet Pressure	psig	5			
	Inlet Temperature	°F	150			
	Inlet Viscosity	SSU	500			
	Required Flow Rate	US-gpm	79			
CALCULATIONS	Delivered Flow Rate	US-gpm	98.1			
	Pump Diff Pressure	psid	195			
Rq'd BHP @	Operating Conditions	HP	14.7			
	RV Set Pressure	HP	15.93			
	RV Accumulation Pressure	HP	17.28			
	110% Max Opr Cond Pwr	HP	17.52			
	Net Inlet Pressure Require	psi	4.68			
	Volumetric Efficiency	%	92.9			
	Overall Efficiency	%	75.9			

SELECTION COMMENTS

COLFAX Fluid Handling	Pump Selector Program Version: 2.20.189 / 17.05.08 / F14.12.03 Pump Type 3D250 (D)	Customer: Order Comments:	Created By: Ed McCleave	Date: 8/23/2017 7:45:03 AM



SYSTEM INFORMATION					
			RV Set Pressure	220	psig
Max Gas Entrainment	0	%	RV Full Accumulation	242	psig
Max Contamination	0	%	Standard	Hydraulic Institute	
Pumping Fluid	Fuel - Fuel Oil - No. 6			S. Gravit	0.88

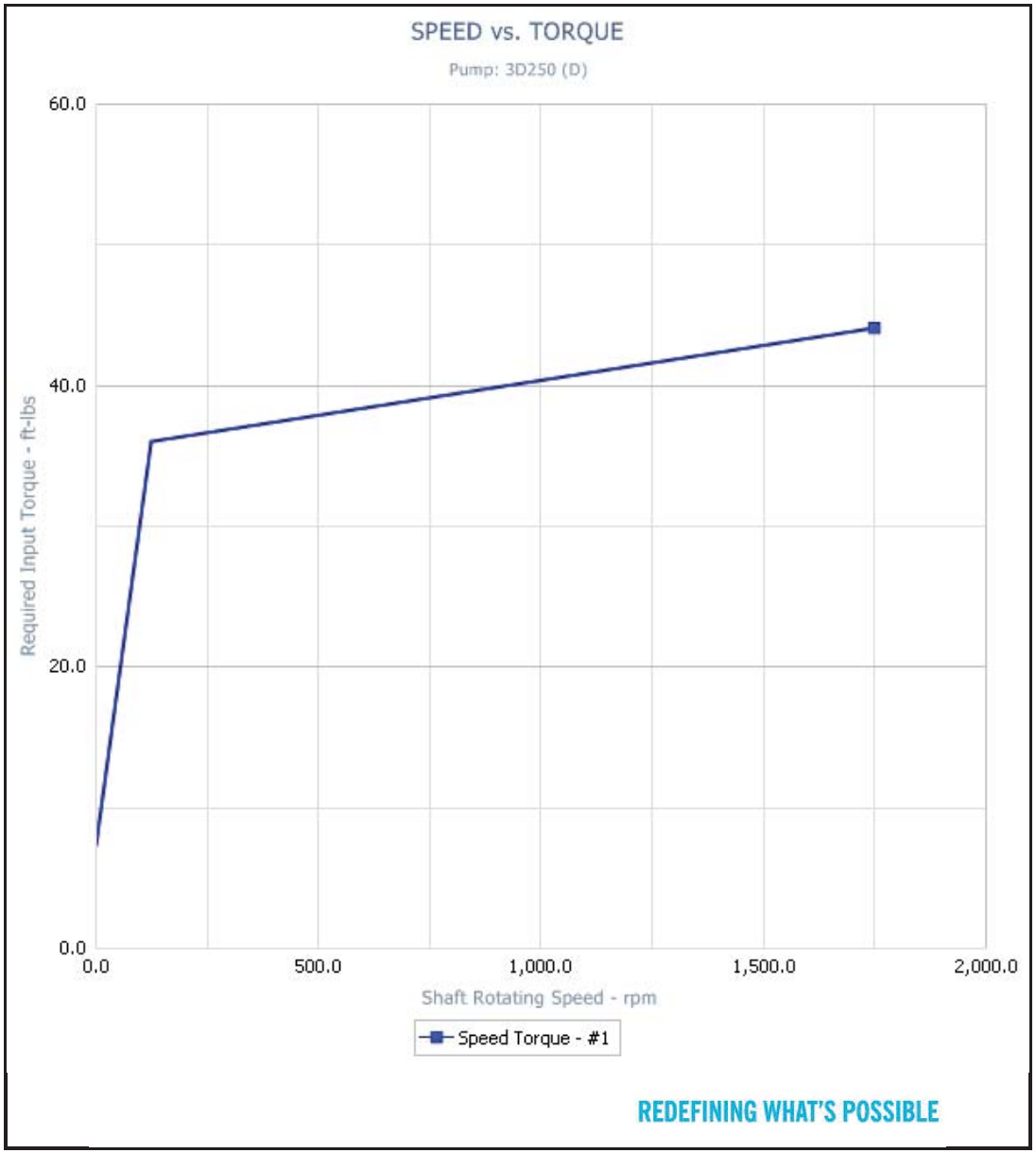
PUMP PERFORMANCE INFORMATION

	ITEM	UNITS	OPERATING CONDITIONS #1	#2	#3	#4
INPUTS	Shaft Operating Speed	rpm	1750			
	Discharge Pressure	psig	200			
	Inlet Pressure	psig	5			
	Inlet Temperature	°F	150			
	Inlet Viscosity	SSU	500			
	Required Flow Rate	US-gpm	79			
CALCULATIONS	Delivered Flow Rate	US-gpm	98.1			
	Pump Diff Pressure	psid	195			
Rq'd BHP @	Operating Conditions	HP	14.7			
	RV Set Pressure	HP	15.93			
	RV Accumulation Pressure	HP	17.28			
	110% Max Opr Cond Pwr	HP	17.52			
	Net Inlet Pressure Require	psi	4.68			
	Volumetric Efficiency	%	92.9			
	Overall Efficiency	%	75.9			

SELECTION COMMENTS

COLFAX Fluid Handling

Pump Selector Program Version: 2.20.189 / 17.05.08 / F14.12.03	Customer:	Created By: Ed McCleave Date: 8/23/2017 7:45:03 AM
Pump Type 3D250 (D)	Order Comments:	



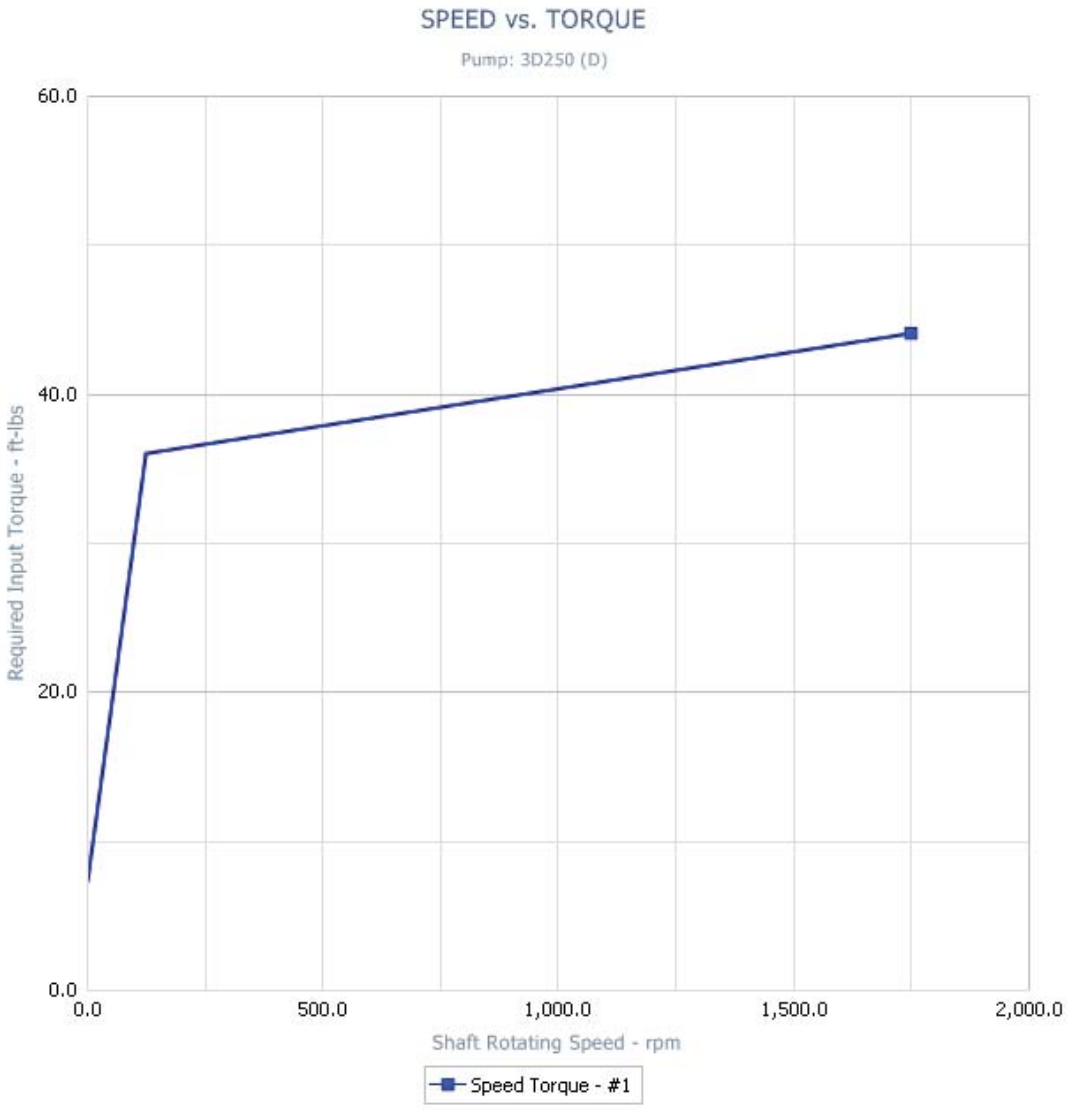
SYSTEM INFORMATION					
			RV Set Pressure	220	psig
Max Gas Entrainment	0	%	RV Full Accumulation	242	psig
Max Contamination	0	%	Standard	Hydraulic Institute	
Pumping Fluid	Fuel - Fuel Oil - No. 6			S. Gravit	0.88

PUMP PERFORMANCE INFORMATION

	ITEM	UNITS	OPERATING CONDITIONS #1	#2	#3	#4
INPUTS	Shaft Operating Speed	rpm	1750			
	Discharge Pressure	psig	200			
	Inlet Pressure	psig	5			
	Inlet Temperature	°F	150			
	Inlet Viscosity	SSU	500			
	Required Flow Rate	US-gpm	79			
CALCULATIONS	Delivered Flow Rate	US-gpm	98.1			
	Pump Diff Pressure	psid	195			
Rqd BHP @	Operating Conditions	HP	14.7			
	RV Set Pressure	HP	15.93			
	RV Accumulation Pressure	HP	17.28			
	110% Max Opr Cond Pwr	HP	17.52			
	Net Inlet Pressure Require	psi	4.68			
	Volumetric Efficiency	%	92.9			
	Overall Efficiency	%	75.9			

SELECTION COMMENTS

COLFAX Fluid Handling	Pump Selector Program Version: 2.20.189 / 17.05.08 / F14.12.03 Pump Type 3D250 (D)	Customer:	Created By: Ed McCleave	Date: 8/23/2017 7:45:03 AM
		Order Comments:		



SYSTEM INFORMATION					
			RV Set Pressure	220	psig
Max Gas Entrainment	0	%	RV Full Accumulation	242	psig
Max Contamination	0	%	Standard	Hydraulic Institute	
Pumping Fluid	Fuel - Fuel Oil - No. 6			S. Gravit	0.88

PUMP PERFORMANCE INFORMATION

	ITEM	UNITS	OPERATING CONDITIONS			
			#1	#2	#3	#4
INPUTS	Shaft Operating Speed	rpm	1750			
	Discharge Pressure	psig	200			
	Inlet Pressure	psig	5			
	Inlet Temperature	°F	150			
	Inlet Viscosity	SSU	500			
	Required Flow Rate	US-gpm	79			
CALCULATIONS	Delivered Flow Rate	US-gpm	98.1			
	Pump Diff Pressure	psid	195			
Rqd BHP @	Operating Conditions	HP	14.7			
	RV Set Pressure	HP	15.93			
	RV Accumulation Pressure	HP	17.28			
	110% Max Opr Cond Pwr	HP	17.52			
	Net Inlet Pressure Require	psi	4.68			
	Volumetric Efficiency	%	92.9			
	Overall Efficiency	%	75.9			

SELECTION COMMENTS

COLFAX Fluid Handling

Pump Selector Program	Customer:	Created By: Ed McCleave	Date: 8/23/2017 7:41:13 AM
Version: 2.20.189 / 17.05.08 / F14.12.03	Order Comments:		
Pump Type 3D350G (H)			

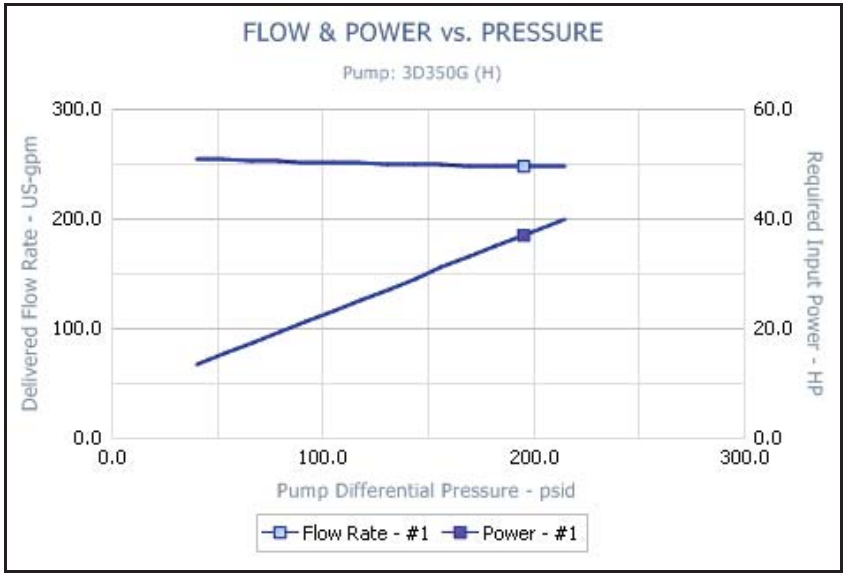
SYSTEM INFORMATION

			RV Set Pressure	220	psig
Max Gas Entrainment	0	%	RV Full Accumulation	242	psig
Max Contamination	0	%	Standard	Hydraulic Institute	
Pumping Fluid	Fuel - Fuel Oil - No. 6		Specific Gravity	0.88	

SELECTION COMMENTS

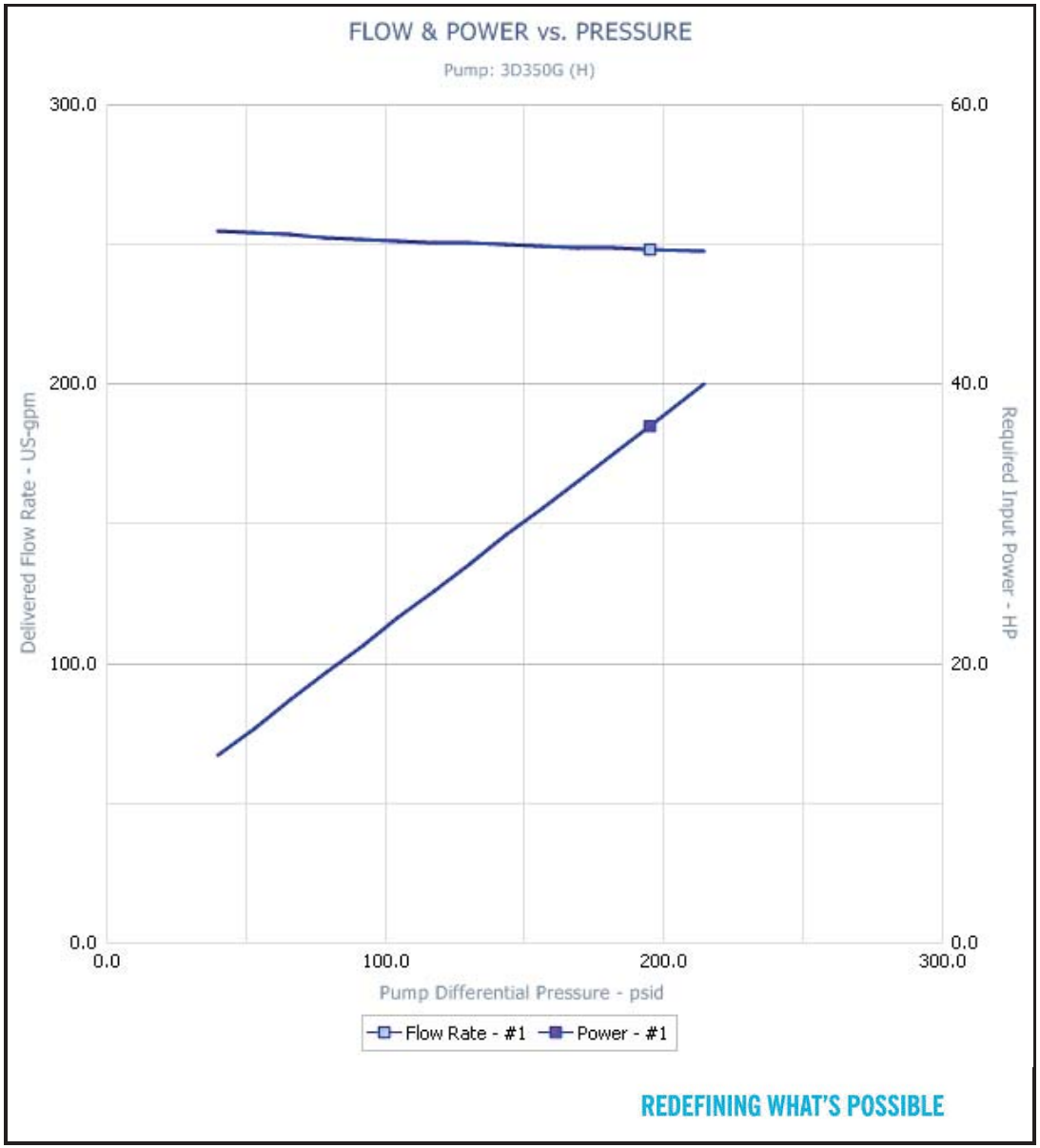
PUMP PERFORMANCE INFORMATION

	ITEM	UNITS	OPERATING CONDITIONS #1	#2	#3	#4
INPUTS	Shaft Operating Speed	rpm	1750			
	Discharge Pressure	psig	200			
	Inlet Pressure	psig	5			
	Inlet Temperature	°F	150			
	Inlet Viscosity	SSU	500			
	Required Flow Rate	US-gpm	200			
CALCULATIONS	Delivered Flow Rate	US-gpm	248.2			
	Pump Diff Pressure	psid	195			
Rq'd BHP @	Operating Conditions	HP	37.04			
	RV Set Pressure	HP	40.08			
	RV Accumulation Pressure	HP	43.42			
	110% Max Opr Cond Pwr	HP	44.09			
	Net Inlet Pressure Required	psi	6.14			
	Volumetric Efficiency	%	95.2			
	Overall Efficiency	%	76.2			
	Theoretical Flow Rate	US-gpm	260.7			
	Orifice Flow Rate	US-gpm				
	Slip Flow Rate	US-gpm	12.44			
	Theoretical Oil Power	HP	29.65			
	Mechanical Loss	HP	7.38			
	Hydraulic Power	HP	28.24			
Rq'd Torque @	Operating Conditions	ft-lbs	111.1			
	RV Set Pressure	ft-lbs	120.3			
	RV Accumulation Pressure	ft-lbs	130.3			
	110% Max Opr Cond Trq	ft-lbs	132.3			
	External Cooler Size	btu/hr	---			
	Internal Cooler Size	btu/hr	---			



REDEFINING WHAT'S POSSIBLE

COLFAX Fluid Handling	Pump Selector Program Version: 2.20.189 / 17.05.08 / F14.12.03 Pump Type 3D350G (H)	Customer:	Created By: Ed McCleave	Date: 8/23/2017 7:41:13 AM
		Order Comments:		



SYSTEM INFORMATION

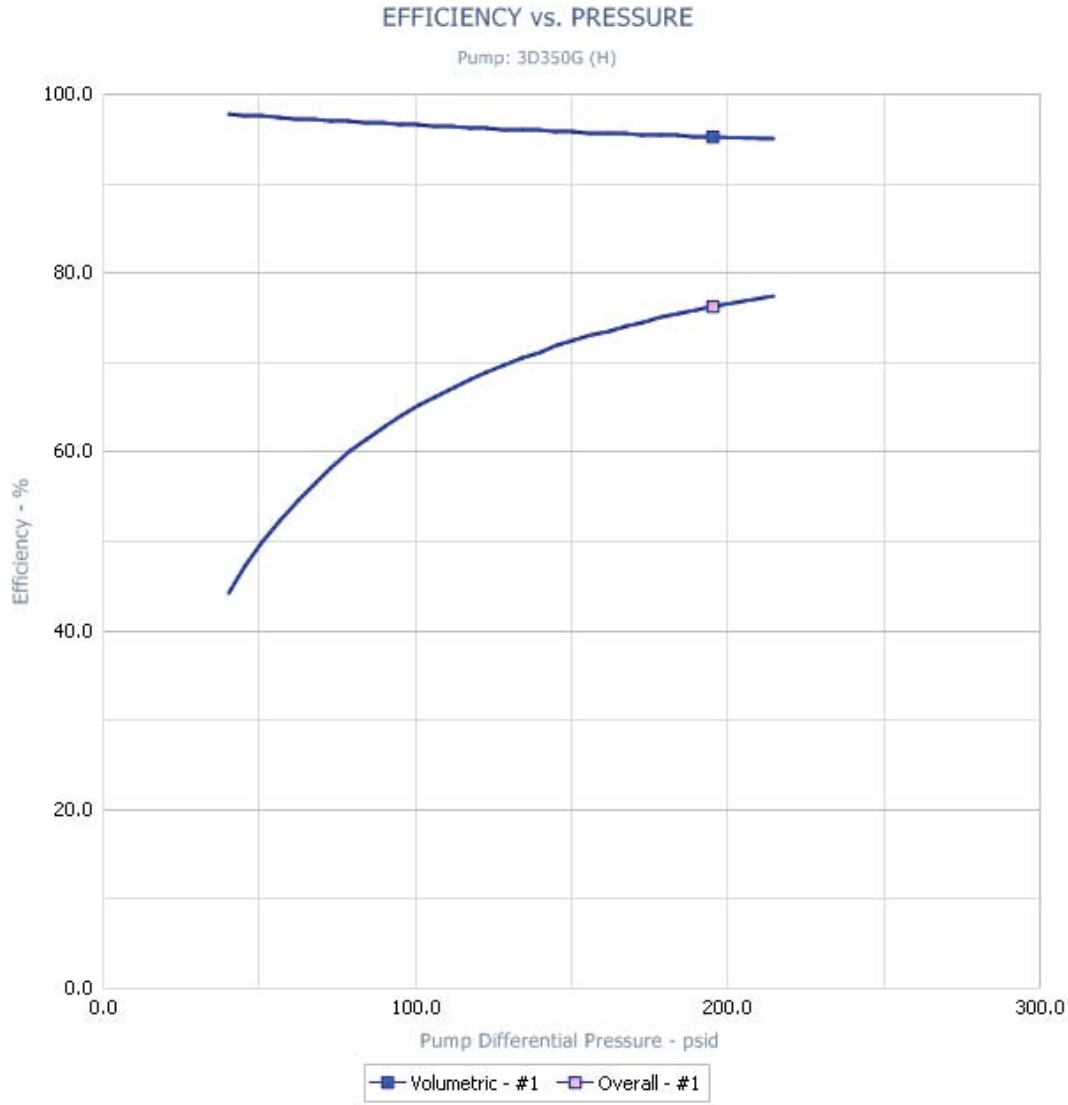
			RV Set Pressure	220	psig
Max Gas Entrainment	0	%	RV Full Accumulation	242	psig
Max Contamination	0	%	Standard	Hydraulic Institute	
Pumping Fluid	Fuel - Fuel Oil - No. 6			S. Gravit	0.88

PUMP PERFORMANCE INFORMATION

	ITEM	UNITS	OPERATING CONDITIONS #1	#2	#3	#4
INPUTS	Shaft Operating Speed	rpm	1750			
	Discharge Pressure	psig	200			
	Inlet Pressure	psig	5			
	Inlet Temperature	°F	150			
	Inlet Viscosity	SSU	500			
	Required Flow Rate	US-gpm	200			
CALCULATIONS	Delivered Flow Rate	US-gpm	248.2			
	Pump Diff Pressure	psid	195			
Rq'd BHP @	Operating Conditions	HP	37.04			
	RV Set Pressure	HP	40.08			
	RV Accumulation Pressure	HP	43.42			
	110% Max Opr Cond Pwr	HP	44.09			
	Net Inlet Pressure Require	psi	6.14			
	Volumetric Efficiency	%	95.2			
	Overall Efficiency	%	76.2			

SELECTION COMMENTS

COLFAX Fluid Handling	Pump Selector Program Version: 2.20.189 / 17.05.08 / F14.12.03 Pump Type 3D350G (H)	Customer: Order Comments:	Created By: Ed McCleave	Date: 8/23/2017 7:41:13 AM



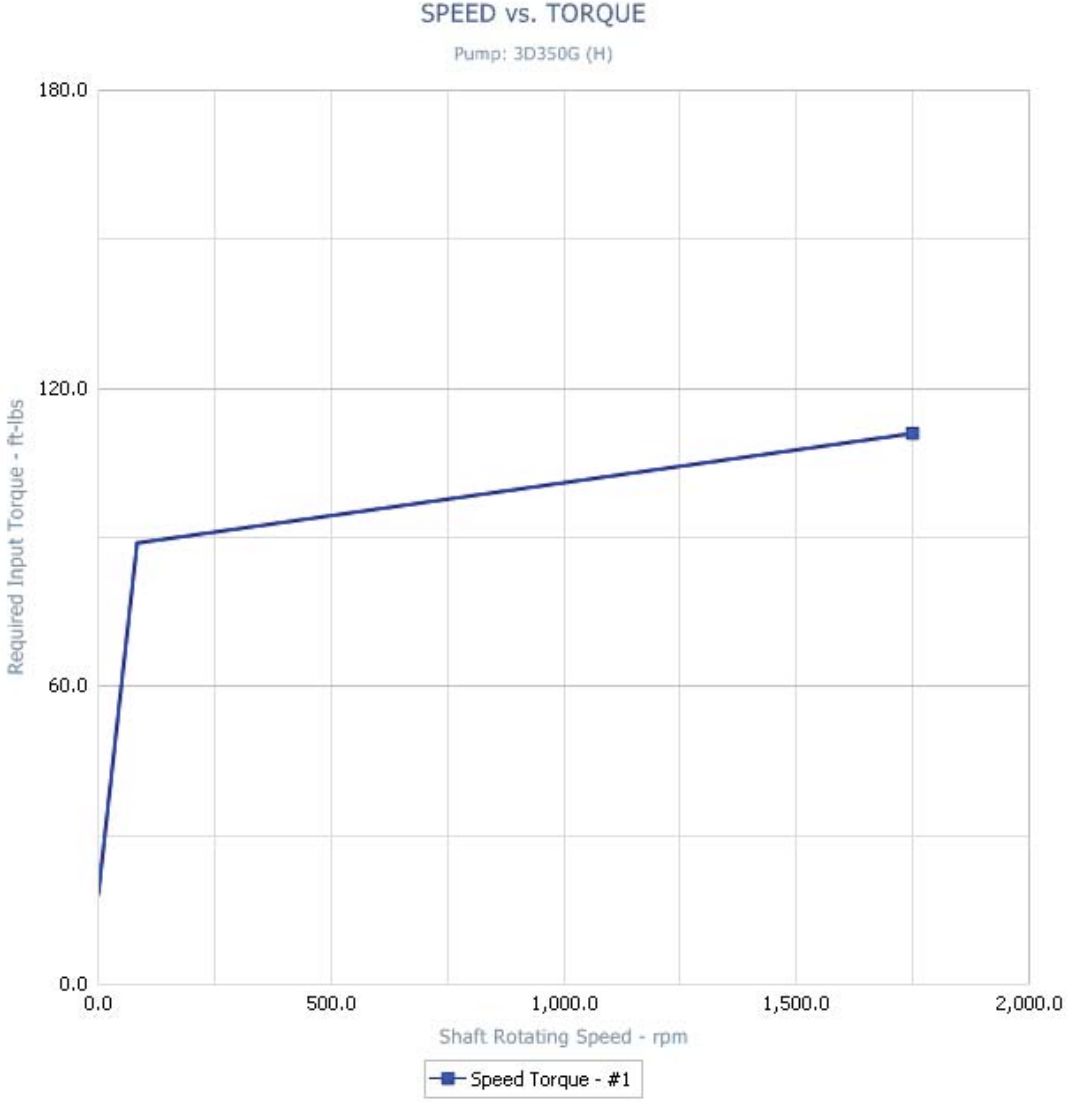
SYSTEM INFORMATION					
			RV Set Pressure	220	psig
Max Gas Entrainment	0	%	RV Full Accumulation	242	psig
Max Contamination	0	%	Standard	Hydraulic Institute	
Pumping Fluid	Fuel - Fuel Oil - No. 6			S. Gravit	0.88

PUMP PERFORMANCE INFORMATION

	ITEM	UNITS	OPERATING CONDITIONS #1	#2	#3	#4
INPUTS	Shaft Operating Speed	rpm	1750			
	Discharge Pressure	psig	200			
	Inlet Pressure	psig	5			
	Inlet Temperature	°F	150			
	Inlet Viscosity	SSU	500			
	Required Flow Rate	US-gpm	200			
CALCULATIONS	Delivered Flow Rate	US-gpm	248.2			
	Pump Diff Pressure	psid	195			
Rq'd BHP @	Operating Conditions	HP	37.04			
	RV Set Pressure	HP	40.08			
	RV Accumulation Pressure	HP	43.42			
	110% Max Opr Cond Pwr	HP	44.09			
	Net Inlet Pressure Require	psi	6.14			
	Volumetric Efficiency	%	95.2			
	Overall Efficiency	%	76.2			

SELECTION COMMENTS

COLFAX Fluid Handling	Pump Selector Program Version: 2.20.189 / 17.05.08 / F14.12.03 Pump Type 3D350G (H)	Customer:	Created By: Ed McCleave	Date: 8/23/2017 7:41:13 AM
		Order Comments:		



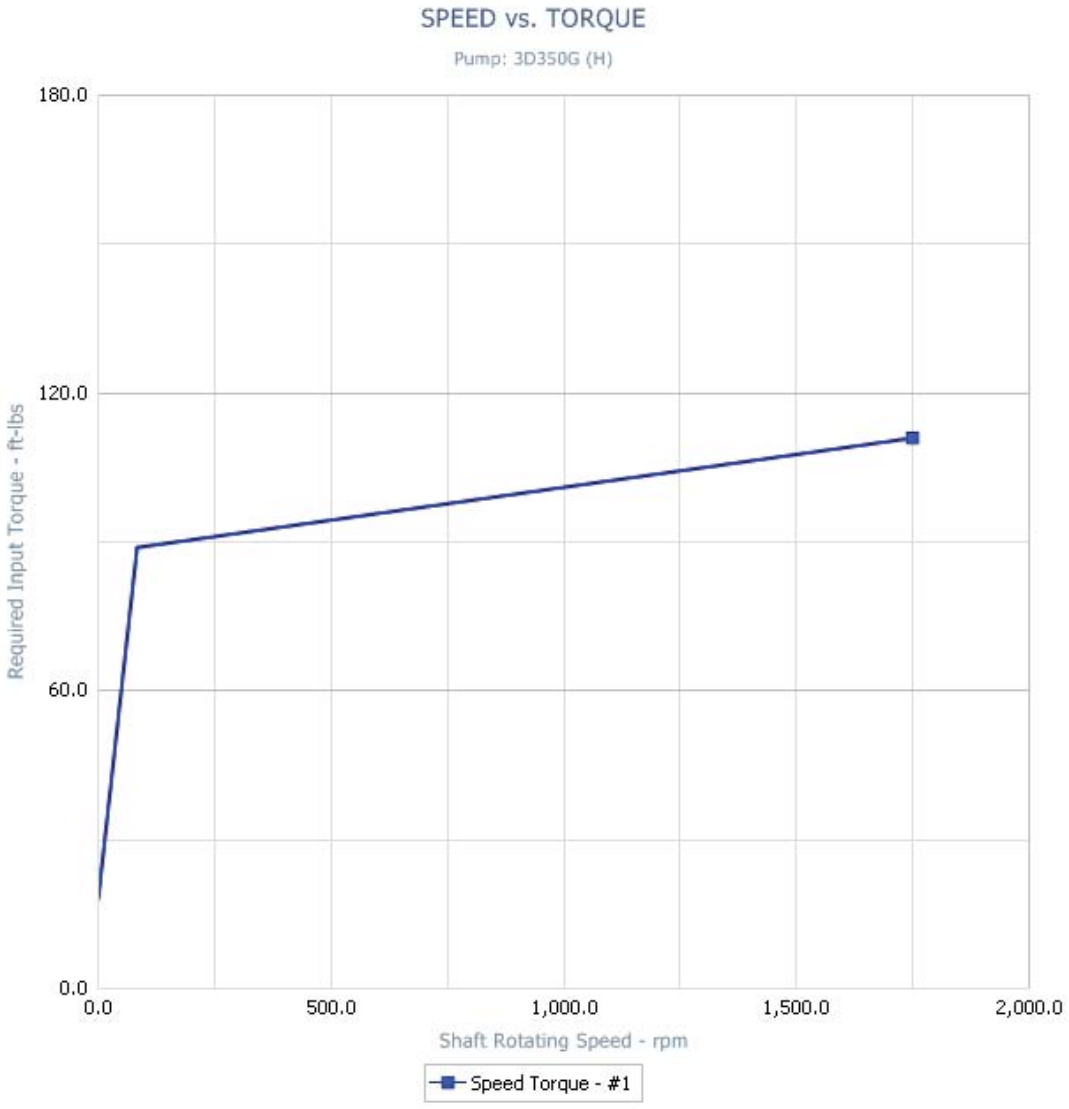
SYSTEM INFORMATION					
			RV Set Pressure	220	psig
Max Gas Entrainment	0	%	RV Full Accumulation	242	psig
Max Contamination	0	%	Standard	Hydraulic Institute	
Pumping Fluid	Fuel - Fuel Oil - No. 6			S. Gravit	0.88

PUMP PERFORMANCE INFORMATION

	ITEM	UNITS	OPERATING CONDITIONS #1	#2	#3	#4
INPUTS	Shaft Operating Speed	rpm	1750			
	Discharge Pressure	psig	200			
	Inlet Pressure	psig	5			
	Inlet Temperature	°F	150			
	Inlet Viscosity	SSU	500			
	Required Flow Rate	US-gpm	200			
CALCULATIONS	Delivered Flow Rate	US-gpm	248.2			
	Pump Diff Pressure	psid	195			
Rq'd BHP @	Operating Conditions	HP	37.04			
	RV Set Pressure	HP	40.08			
	RV Accumulation Pressure	HP	43.42			
	110% Max Opr Cond Pwr	HP	44.09			
	Net Inlet Pressure Require	psi	6.14			
	Volumetric Efficiency	%	95.2			
	Overall Efficiency	%	76.2			

SELECTION COMMENTS

COLFAX Fluid Handling	Pump Selector Program Version: 2.20.189 / 17.05.08 / F14.12.03 Pump Type 3D350G (H)	Customer: Order Comments:	Created By: Ed McCleave	Date: 8/23/2017 7:41:13 AM



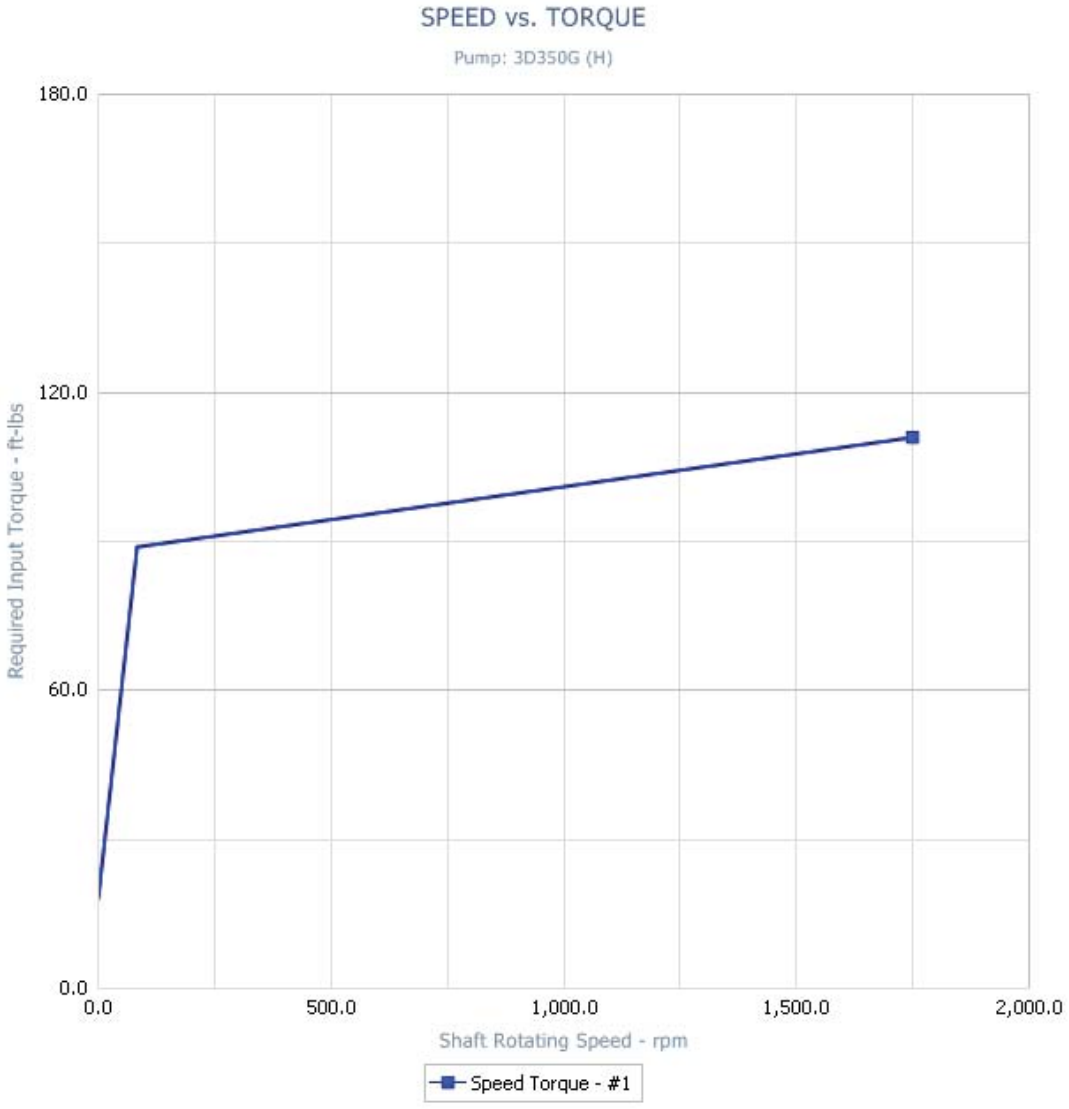
SYSTEM INFORMATION					
			RV Set Pressure	220	psig
Max Gas Entrainment	0	%	RV Full Accumulation	242	psig
Max Contamination	0	%	Standard	Hydraulic Institute	
Pumping Fluid	Fuel - Fuel Oil - No. 6			S. Gravit	0.88

PUMP PERFORMANCE INFORMATION

	ITEM	UNITS	OPERATING CONDITIONS #1	#2	#3	#4
INPUTS	Shaft Operating Speed	rpm	1750			
	Discharge Pressure	psig	200			
	Inlet Pressure	psig	5			
	Inlet Temperature	°F	150			
	Inlet Viscosity	SSU	500			
	Required Flow Rate	US-gpm	200			
CALCULATIONS	Delivered Flow Rate	US-gpm	248.2			
	Pump Diff Pressure	psid	195			
Rqd BHP @	Operating Conditions	HP	37.04			
	RV Set Pressure	HP	40.08			
	RV Accumulation Pressure	HP	43.42			
	110% Max Opr Cond Pwr	HP	44.09			
	Net Inlet Pressure Require	psi	6.14			
	Volumetric Efficiency	%	95.2			
	Overall Efficiency	%	76.2			

SELECTION COMMENTS

COLFAX Fluid Handling	Pump Selector Program Version: 2.20.189 / 17.05.08 / F14.12.03 Pump Type 3D350G (H)	Customer: Order Comments:	Created By: Ed McCleave	Date: 8/23/2017 7:41:13 AM



SYSTEM INFORMATION					
			RV Set Pressure	220	psig
Max Gas Entrainment	0	%	RV Full Accumulation	242	psig
Max Contamination	0	%	Standard	Hydraulic Institute	
Pumping Fluid	Fuel - Fuel Oil - No. 6			S. Gravit	0.88

PUMP PERFORMANCE INFORMATION

	ITEM	UNITS	OPERATING CONDITIONS #1	#2	#3	#4
INPUTS	Shaft Operating Speed	rpm	1750			
	Discharge Pressure	psig	200			
	Inlet Pressure	psig	5			
	Inlet Temperature	°F	150			
	Inlet Viscosity	SSU	500			
	Required Flow Rate	US-gpm	200			
CALCULATIONS	Delivered Flow Rate	US-gpm	248.2			
	Pump Diff Pressure	psid	195			
Rqd BHP @	Operating Conditions	HP	37.04			
	RV Set Pressure	HP	40.08			
	RV Accumulation Pressure	HP	43.42			
	110% Max Opr Cond Pwr	HP	44.09			
	Net Inlet Pressure Require	psi	6.14			
	Volumetric Efficiency	%	95.2			
	Overall Efficiency	%	76.2			

SELECTION COMMENTS

QUOTATION

QUOTE #: 081618-CS-CBCL

DATE: August-17-18

441-A Applewood Crescent Concord
Ontario, Canada, L4K 4J3
TEL: 905-761-9000
FAX: 905-761-9001

PAGES: 1 of 2

To: Carl Zinck
Company: CBCL Limited
Address: 1489 Hollis Street
Halifax, NS
B3L 2R7
Email: carlz@cbcl.ca
Phone: 902-421-7241

FROM: Bill Clements
EMAIL: billc@generalfiltration.com

Carl,

General Filtration is pleased to provide CBCL Limited with the following quotation for a 6 inch flanged duplex strain in three options.

The selection was based on the information provided:

Fluid	**No. 6 fuel oil**
Operating Temperature	**100°F**
Viscosity	**430 cSt**
Operating Pressure	**10 psi**
Contaminant	**Dirt, debris etc.**
Material	**Carbon Steel or stainless steel**
Connection	**150 LB**

Specific gravity: 1.03 **If different please supply correct**

If there are any changes, or any of the information is incorrect please forward the information.

Should you have any questions or need any additional information please contact either the outside sales representative Cody Sabourin at 647-468-0726, or myself.

Thank you for the opportunity to quote on requirements.

We look forward to a positive response.

William Clements
Inside Technical Sales

OPTION ONE: CARBON UNIT WITH BRONZE DIVERTER PLUG

Part Number	Description	Qty	Unit Price	Total Price	Lead Time
ST0500600R31C	Carbon Steel construction 200 PSI @ 100 F 6 inch #150 RF flanged With bronze diverter plug Buna-N seals Comes with 2, SS baskets, see below for part number	1	[redacted] CAD each	[redacted] CAD Net	One in stock at the factory 13 to 17 weeks if no stock
ST521SGXX	316SS basket 1/8 perforation (other perforation are available)	2	N/C	N/C	shipping with the strainer

OPTION TWO: STAINLESS STEEL UNIT WITH STAINLESS STEEL DIVERTER PLUG

Part Number	Description	Qty	Unit Price	Total Price	Lead Time
ST0500600R32C	Carbon Steel construction 200 PSI @ 100 F 6 inch #150 RF flanged With stainless steel diverter plug Buna-N seals Comes with 2, SS baskets, see below for part number	1	[redacted] CAD each	[redacted] CAD Net	Three in stock at the factory 13 to 17 weeks if no stock
ST521SGXX	316SS basket 1/8 perforation (other perforation are available)	2	N/C	N/C	Shipping with the strainer

Item 1

OPTION THREE: STAINLESS STEEL UNIT WITH STAINLESS STEEL DIVERTER PLUG

Part Number	Description	Qty	Unit Price	Total Price	Lead Time
ST0500600R22C	Stainless Steel construction 200 PSI @ 100 F 6 inch #150 RF flanged With stainless steel diverter plug Viton seals Comes with 2, SS baskets, see below for part number	1	[redacted] CAD each	[redacted] CAD Net	One in stock at factory 13 to 17 weeks if no stock
ST521SGXX	316SS basket 1/8 perforation (other perforation are available)	2	N/C	N/C	Shipping with the strainer

PAYMENT TERMS: Visa/Master Card
CURRENCY: Canadian Dollars
TAXES: Extra, if applicable
FREIGHT CHARGES: Extra
F.C.A: Concord, Ontario
VALIDITY: 30 days from date of offer
DELIVERY SHOWN SUBJECT TO PRIOR SALE

KOCH HEAT TRANSFER COMPANY LP

ALCO PRODUCTS | BOS-HATTEN | BROWN FINTUBE INNOVATORS IN HEAT TRANSFER

DATE: September 11, 2018

QUOTATION #: **17001463 – E2**
Rev # **C**

TO: Nova Scotia Power
ATTN: Terry Evans
LOCATION Halifax, NS
EMAIL: Terry.Evans@NSPower.com
PHONE: 902-42428-6690

CUST. REF. **E496-77-1 & B2086-2**
END USER/ LOCATION: **Nova Scotia Power- Halifax, NS**

Technical Contact
Amanda Bryan
713-849-8149
amanda.bryan@khtlp.com

Commercial Contact
Gary Vogt
713.849.8152
Gary.Vogt@khtlp.com

Prices are in US Funds

ITEM	QTY	DESCRIPTION	BUDGETARY EACH	BUDGETARY TOTAL
1	1	**KHT Suction Heater for:** **Model: S2BEU1622** **Originally supplied on BFT S/N: E496-77-1** **CRN: 60-01.8** **Materials:** - **Tubes: SA 214 Carbon Steel** - **Shell: Carbon Steel**	[redacted]	[redacted]

Scope of Work: Scope of the work provided on this quote will be as follows. Any exceptions to this scope of work will be detailed below in the additional options section.

Inspection		Materials		Radiography		Pressure Testing				Document Submission	
KHT	X	KHT AML	X	KHT Std.	X	H2O (w/rust inhb.)	X	Helium		Outline Drawings	Submit for information
ASME	X	Tube Wld		Per Code	X	*Cust		Air/soap			
*Customer		U-Bnd Wld		*Customer Spec.		Hold Time		Charts		WPS/PQR	Not Submitted
Nat Bd.	X	Cust. AML		Other		20 Min		No		O&I Bulletin	Electronic Copy
Construction		**PMI**		**Surface Prep & Paint**						Test/NDE	Not Submitted
KHT Std.	X	KHT Std.		Non-Silica Blast			Paint			ITP	Submit for information
ASME	X	*Cust.		SP-10	X	Other		CZ11	X	Other	CRN	Will apply for new if required
Shipping Preparation				**Tube to tube sheet joint**			**Shell Material**			Calculations	Not Submitted
Metal, Plastic or Wood Covers				Strength Weld			SA-106 B				

Tube Material	SA-214	Tube Sheet Material	Carbon Steel	

Additional Options

ITEM	QTY	DESCRIPTION	BUDGETARY EACH	BUDGETARY TOTAL
2	2	**KHT Complete Exchanger for:** **Model: 4BEU2410** **Originally supplied on BFT S/N: B2086-2** **CRN: 7131.8** **Materials** - **Tubes: SA 214 Carbon Steel** - **Shell: Carbon Steel**	[redacted]	[redacted]

Scope of Work: Scope of the work provided on this quote will be as follows. Any exceptions to this scope of work will be detailed below in the additional options section.

Inspection		Materials		Radiography		Pressure Testing				Document Submission	
KHT	X	KHT AML	X	KHT Std.	X	H2O (w/rust inhb.)	X	Helium		Outline Drawings	Submit for information
ASME	X	Tube Wld		Per Code	X	*Cust		Air/soap			
*Customer		U-Bnd Wld		*Customer Spec.		Hold Time		Charts		WPS/PQR	Not Submitted
Nat Bd.	X	Cust. AML		Other		20 Min		No		O&I Bulletin	Electronic Copy

Construction		PMI		Surface Prep & Paint						Test/NDE	Not Submitted
KHT Std.	X	KHT Std.		Non-Silica Blast			Paint			ITP	Submit for information
ASME	X	*Cust.		SP-10	X	Other	CZ11	X	Other	CRN	Will apply for new if required

Shipping Preparation	Tube to tube sheet joint	Shell Material	Calculations	Not Submitted
Metal, Plastic or Wood Covers	Strength Weld	SA-106 B		

Tube Material	SA-214	Tube Sheet Material	Carbon Steel	

Additional Options

ITEM	QTY	DESCRIPTION	BUDGETARY EACH	BUDGETARY TOTAL
2A	2	**KHT Replacement in Kind Multi-Tube Bundle for:** **Model: 4BEU2410 (Bundle Only)** **Originally supplied on BFT S/N: B2086-2** **CRN: 7131.8** **Materials** - **Tubes: SA 214 Carbon Steel** - **Tubesheet: Carbon Steel**	[redacted]	[redacted]

Scope of Work: Scope of the work provided on this quote will be as follows. Any exceptions to this scope of work will be detailed below in the additional options section.

Inspection		Materials		Radiography		Pressure Testing				Document Submission	
KHT	X	KHT AML	X	KHT Std.	X	H2O (w/rust inhb.)	X	Helium		Outline Drawings	Submit for information
ASME	X	Tube Wld		Per Code	X	*Cust		Air/soap			
*Customer		U-Bnd Wld		*Customer Spec.		Hold Time		Charts		WPS/PQR	Not Submitted
Nat Bd.	X	Cust. AML		Other		20 Min		No		O&I Bulletin	Electronic Copy
Construction		**PMI**		**Surface Prep & Paint**						Test/NDE	Not Submitted
KHT Std.	X	KHT Std.		Non-Silica Blast			Paint			ITP	Submit for information
ASME	X	*Cust.		SP-10		Other	CZ11		Other	CRN	Will apply for new if required
Shipping Preparation				**Tube to tube sheet joint**			**Shell Material**			Calculations	Not Submitted
Metal, Plastic or Wood Covers				Strength Weld			N/A				
Tube Material		SA-214		**Tube Sheet Material**			Carbon Steel				

Additional Options

THIS QUOTATION IS SUBJECT TO KOCH HEAT TRANSFER GENERAL TERMS AND CONDITIONS OF SALE (Attached)

PRICES: Budgetary for (14) days / USD **SHIPPING:** Domestic Prep./Skid

SHIPMENT: FCA INCOTERMS 2010 Rules (R) KHT Facility

28-32 weeks ARO -After Receipt of Order

This proposal is based on Koch Heat Transfer purchasing materials prior to "Approved" drawings to meet the shipment schedule.

Sales tax extra, if applicable. Freight to site, if arranged by Koch Heat Transfer Company, will be charged at actual freight cost plus 30% to cover the administrative cost. If freight is paid directly by client, the handling charge will be waived.

Shipping date subject to material availability and shop backlog of our Houston and Canadian facilities at time of order.

****PRICE AND DELIVERY IS CONTINGENT ON ACCEPTANCE OF ALL TERMS AND CONDITIONS OF THIS QUOTATION**

PAYMENT TERMS:
Progressive Payments:
25% W/Purchase Order
25% W/Receipt of Major Materials
Balance Net 30

BY: *Amanda Bryan*

An Irrevocable Letter of Credit drawn on and confirmed through a United States bank is required. The Letter of Credit must be valid for a minimum of sixty days beyond the scheduled quoted delivery date. All banking charges associated with the Letter of Credit are to be for Buyer's account.

GENERAL NOTES and CLARIFICATIONS

1. Please note schedule quoted by Koch Heat Transfer is based upon timely receipt of the Canadian Jurisdictional Design Registration (CRN) and the schedule may need adjustment based on actual response time by the Jurisdictional agency.
2. All submissions shall be electronic. Koch Heat Transfer provides all documents utilizing PDF electronic file format. Native file formats are not provided.
3. Koch Heat Transfer may execute the engineering and fabrication at any Koch Heat Transfer affiliate location or any Koch Heat Transfer approved subcontractor.
4. We have reviewed your inquiry and are pleased to offer the following budgetary proposal. This budgetary proposal is intended only as an estimate to facilitate your planning processes and does not constitute a commitment of offer on our part. Any firm offer or binding quotation will be the subject of a formal proposal at a future date and will be subject to restricted party screening and the full disclosure of the parties involved, including but not limited to the end-user and ultimate destination.

GENERAL TERMS AND CONDITIONS OF SALE (GOODS AND SERVICES)

1. **APPLICATION.** These General Terms and Conditions of Sale ("**Terms and Conditions**") will apply to all quotations and sales for goods, material, equipment and services by **Koch Heat Transfer Company, LP** ("**Seller**") and are hereby incorporated into the quotation, invoice or other document to which they are attached ("**Order**" and, together with the Terms and Conditions, the "**Contract**"). All purchases by customer, owner or its agent ("**Buyer**") are expressly limited and conditioned upon acceptance of the Terms and Conditions. Seller objects to and rejects any provision additional to or different from the Terms and Conditions that may appear in Buyer's purchase order, acknowledgement, confirmation, writing, or in any other prior or later communication from Buyer to Seller, unless such provision is expressly agreed to by Seller in a writing signed by Seller. For the purposes of these Terms and Conditions, the term "**Goods**" shall refer to the goods, material and equipment listed on the Order as well as all equipment or other materials provided in connection with any Services, and the term "**Services**" shall refer to the services listed on the Order as well as all ancillary services provided with any Goods. Terms not defined herein shall have the meanings set forth in the Order.

2. **QUOTATIONS.** Unless otherwise stated in the Order, any quotation from Seller is valid for 30 days from the date of the quotation. The quotation supersedes all previous quotations or correspondence concerning the same transaction or inquiry. Quotations contain proprietary information of Seller and are provided to Buyer solely for Buyer's internal purposes. Quotations may not be disclosed to any third party or used in preparation of any request for quotation for goods similar to, or as a substitution for, Goods quoted by Seller.

3. **PRICE MODIFICATION AND OTHER CHARGES.** Unless otherwise stated in the Order, Seller's price does not include: (a) transportation, handling, crating or packaging charges, or (b) sales, harmonized sales, goods and services, use or value-added tax or any other tax, excises, duties, tariffs, fees or other governmental charges that Seller may be required to pay or collect under any existing or future law, with respect to the import/export, sale, transportation, delivery or storage of any Goods or the provision of any Services sold by Seller.

4. **PAYMENT TERMS.** (a) Unless otherwise specified in the Order, payment must be received by Seller net 30 days from invoice date. (b) All payments shall be made in the currency listed in the Order, or, if not so listed, then in U.S. dollars. (c) If the payment due date is not a business day, Seller must receive such payment on the next business day after such due date. (d) Each shipment of Goods and each provision of Services is a separate transaction and payment shall be made accordingly. (e) Interest may be charged on all past due amounts owed by Buyer hereunder at an interest rate equal to the prevailing EURIBOR rate of interest, expressed as an annual percent, plus 3% from the payment due date until paid in full, or the highest interest rate allowed by applicable law, whichever is less.

5. **CREDIT TERMS.** If, in Seller's judgment, the creditworthiness or future performance of Buyer is impaired or unsatisfactory, Seller may suspend performance hereunder. Buyer will be responsible for any costs associated with such suspension (including charges for reactivation). In addition, Seller may, for any reason, (a) require prepayment by wire transfer at least two business days prior to a scheduled shipment of Goods or provision of Services, and/or (b) require Performance Assurance at least three business days prior to a scheduled shipment of Goods or provision of Services. "**Performance Assurance**" means collateral in the form of either cash or letter(s) of credit in a form, and from an issuing bank, acceptable to Seller.

6. **DELIVERY.** (a) Unless otherwise stated in the Order, all Goods will be delivered to Buyer EX Works the manufacturing facility of the Goods (the "**Facility**"). (b) If Buyer has not issued inspection and shipping instructions by the time the Goods are available to Buyer, Seller may either, at its sole discretion, (i) store the Goods at Buyer's risk and cost, or (ii) select any reasonable method of shipment, without liability by reason of its selection, costs and risk of shipment to be paid for by Buyer. (c) Shipments or Goods in storage may be insured at Buyer's expense, and Seller will not place a valuation upon shipments or Goods stored unless specifically requested in writing by Buyer or required for export purposes. (d) Unless otherwise stated in the Order, the provisions of the most current version of INCOTERMS, International Chamber of Commerce Publication, are incorporated herein by reference.

7. **TITLE/RISK OF LOSS.** Title in the Goods shall pass to Buyer only upon payment in full. The risk of loss or damage to the Goods shall pass to Buyer upon delivery in accordance with the Contract.

8. **INSPECTION/REJECTION OF GOODS.** All Goods shall be received subject to Buyer's reasonable inspection and rejection. If Buyer finds any of the Goods not to comply with any of the specifications contained in the Contract, Buyer, may, at its sole election, reject that portion of the Goods that fail to comply. Rejected Goods will be held at Seller's risk for a reasonable time, to be returned or disposed of by Buyer at Seller's written instruction and at Seller's sole cost and expense. A failure by Buyer to reject the Goods in writing within 30 days after receipt shall constitute an unqualified acceptance of such Goods by Buyer and a waiver by Buyer of all claims with respect thereto.

9. **WARRANTY.** (a) Seller warrants that (i) the Goods shall be new and good quality and shall conform to the specifications specifically set forth in the Order and title to the Goods shall be free from any security interest, lien or encumbrance upon Seller's receipt of full payment for the Goods, and (ii) Seller shall perform the Services in a workmanlike manner in accordance with the specifications specifically set forth in the Order. (b) The foregoing warranties will last for the following period (the "Warranty Period"): (i) for Goods, 18 months after the date that the Goods are available for shipment or one year after first start-up, whichever occurs first, and (ii) for Services, three months after completion of the Services. If during the Warranty Period any Goods or Services prove upon examination by Seller not to meet the warranties set forth above, Seller will repair the Goods or supply identical or substantially similar replacement Goods EX Works the Facility, at Seller's sole discretion, or re-perform the Services (as applicable). Any replacement Goods or re-performed Services will be warranted for the unexpired portion of the Warranty Period applicable to the particular Goods or Services. (c) Seller will not be responsible for transportation costs or for the costs of removal, installation, re- installation or making of access of any Goods or items, where such transportation, removal, installation, re-installation or making of access is required to repair or replace any defective Goods or to re-perform Services. Furthermore, Seller will not be responsible for and assumes no liability for materials or workmanship, labor costs or other related expenses for any work performed by third parties in the repair or replacement of defective Goods or the re-performance of Services. (d) This warranty will be voided if (i) the Goods or the subject of the Services have not been stored, installed, maintained or operated in accordance with accepted industrial practice or any specific instructions provided by Seller; (ii) the Goods or the subject of the Services have been subjected to any accident, misapplication, environmental contaminant, corrosion, damage, debris, improper passivation, abuse or misuse; (iii) Buyer has modified the Goods or the subject of the Services without Seller's prior written consent; (iv) Buyer has used or repaired the Goods or the subject of the Services after discovery of the defect without Seller's prior written consent; (v) Buyer refuses to permit Seller to examine the Goods or the subject of the Services and operating data to determine the nature of the defect claimed; or (vi) Buyer fails to meet its obligations. (e) Goods not manufactured by Seller are subject only to warranties of Seller's vendors and Seller hereby assigns to Buyer all rights in such vendor's warranties, however, Seller shall furnish to Buyer reasonable assistance in enforcing such rights. (f) Inexpensive items requiring repair or replacement and routine maintenance-related or consumable items shall be outside the scope of these limited warranties. (g) Seller's performance guarantees, if any, shall be deemed to be met by a satisfactory demonstration of the guaranteed performance parameters during a performance test, which shall be the responsibility of Buyer and to be based on test procedures as specified in the Order or, if not specified in the Order, to be based on test procedures mutually agreed upon by Seller and Buyer. In the absence of a performance test within 60 days of first startup, unless otherwise specified in the Order, Seller's performance guarantees are deemed to have been met. (h) ALL WARRANTIES OR REPRESENTATIONS NOT SPECIFICALLY INCLUDED IN THE TERMS AND CONDITIONS, INCLUDING THOSE WITH RESPECT TO MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE WHETHER EXPRESSED, IMPLIED, STATUTORY OR ARISING FROM A COURSE OF DEALING, USAGE OF THE TRADE OR OTHERWISE WITH RESPECT TO ANY GOODS OR SERVICES, ARE EXPRESSLY EXCLUDED. NO EXPRESS OR IMPLIED WARRANTY IS GIVEN AS TO THE CAPACITY, EFFICIENCY OR PERFORMANCE OF ANY GOODS, EXCEPT AS MAY BE PROVIDED IN A SEPARATE WRITTEN AGREEMENT SIGNED BY SELLER. (i) BUYER'S REMEDIES ARE SPECIFICALLY LIMITED TO THE REPAIR OR REPLACEMENT OF THE GOODS OR THE RE-PERFORMANCE OF THE SERVICES, AS APPLICABLE, DURING THE WARRANTY PERIOD, AND ARE EXCLUSIVE OF ALL OTHER REMEDIES. SHOULD THESE REMEDIES BE FOUND INADEQUATE OR TO HAVE FAILED OF THEIR ESSENTIAL PURPOSE FOR ANY REASON WHATSOEVER, BUYER AGREES THAT RETURN OF THE AMOUNT PAID BY BUYER TO SELLER UNDER THE CONTRACT SHALL PREVENT THE REMEDIES FROM FAILING OF THEIR ESSENTIAL PURPOSE AND SHALL BE CONSIDERED BY BUYER AS A FAIR AND ADEQUATE REMEDY.

10. **OBLIGATION OF BUYER.** Buyer is solely responsible for identifying and defining all processes and mechanical considerations and site requirements, which may affect the performance, reliability or operation of the Goods. Seller's quotation and any sale is based upon the covenant by Buyer that all information and data provided to Seller by or for Buyer is current, complete, accurate and does not contain information which is misleading.

11. **LIMITATION OF LIABILITY.** (a) THE LIABILITY OF SELLER AND ITS AFFILIATES IS LIMITED TO THE PRICE ALLOCABLE TO THE GOODS OR SERVICES DETERMINED DEFECTIVE, AND IN NO EVENT WILL THE CUMULATIVE LIABILITY OF SELLER AND ITS AFFILIATES BE IN EXCESS OF THE TOTAL PAYMENTS RECEIVED FROM BUYER UNDER THE CONTRACT, WHETHER ARISING UNDER WARRANTY/GUARANTEE, CONTRACT, NEGLIGENCE, STRICT LIABILITY, INDEMNIFICATION, DEFENSE OR ANY OTHER CAUSE OR COMBINATION OF CAUSES WHATSOEVER. ALL INSURANCE, BOND AND BANK GUARANTEE OR LETTER OF CREDIT PROCEEDS WHICH MAY BE PAID TO BUYER BY THE INSURERS, SURETIES OR BANKS OF SELLER OR ITS AFFILIATES WILL BE CREDITED AGAINST THE LIMITATION STATED ABOVE AND REDUCE THE AMOUNT OF THE CUMULATIVE LIABILITY OF SELLER AND ITS AFFILIATES. (b) NEITHER PARTY WILL BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING LOSS OF PROFITS, REVENUES OR OTHER ECONOMIC LOSSES, WHETHER ARISING UNDER WARRANTY/GUARANTEE, CONTRACT, NEGLIGENCE (INCLUDING NEGLIGENT MISREPRESENTATION), STRICT LIABILITY, INDEMNIFICATION, OR ANY OTHER CAUSE OR COMBINATION OF CAUSES, INCLUDING ANY THEORIES OF CONCURRENT LIABILITY ARISING FROM A DUTY OF CARE BY OPERATION OF LAW OR OTHERWISE. (c) THESE LIMITATIONS SHALL APPLY NOTWITHSTANDING ANY FUNDAMENTAL BREACH OR FAILURE OF ESSENTIAL PURPOSE OF ANY LIMITED REMEDY. BUYER'S REMEDIES ARE LIMITED TO THOSE REMEDIES STATED HEREIN AND THESE REMEDIES SHALL NOT FAIL THEIR ESSENTIAL PURPOSE BECAUSE BUYER IS LIMITED TO THE EXCLUSIVE REMEDIES AS STATED HEREIN. THIS SECTION 11 SHALL APPLY TO ANY ADDITIONAL PURCHASES OF EQUIPMENT (INCLUDING SPARE PARTS AND AFTER MARKET PARTS) BY BUYER FROM SELLER AFTER THE DATE OF THE ORDER.

12. **DEFAULT.** Upon the occurrence of any of the following events: (a) Seller, or any affiliate of Seller, shall not have received a payment due from Buyer, or any affiliate of Buyer, hereunder by the date such payment is due under the Contract, and such failure shall remain uncured for a period of three business days after Buyer's receipt of written notice from Seller of such non-payment; (b) the failure of Buyer or Seller to perform any other obligation in the Contract (excluding Section 5, CREDIT TERMS, which is subject to (d) below) and such failure is not excused or cured within 30 days after written notice thereof; (c) the occurrence of a Bankruptcy Event; or (d) the failure of Buyer to timely provide prepayment or Performance Assurance as set forth in Section 5, CREDIT TERMS, then the non-defaulting party, in its sole discretion and without prior notice (other than as provided above) to the defaulting party, may do any one or more of the following: (x) suspend performance under the Contract; or (y) terminate the Contract, whereby any and all obligations of the defaulting party, including payments or deliveries due, will, at the option of the non-defaulting party, become immediately due and payable or deliverable, as applicable. If, as a result of a default by Buyer, Seller suspends performance and withholds delivery of the Goods as permitted above, it may sell the Goods to a third party and deduct from the proceeds of such sale the purchase price and all reasonable costs resulting from Buyer's default as identified above, including all costs associated with the transportation (including demurrage and other vessel or shipping related charges), storage, and sale of the Goods. The foregoing rights, which shall include specific performance, shall be cumulative and alternative and in addition to any other rights or remedies to which the non-defaulting party may be entitled at law or in equity. The non-defaulting party shall be entitled to recover from the defaulting party all court costs, reasonable attorneys' fees and expenses incurred by the non-defaulting party in connection with the defaulting party's default, and interest on past due amounts as set forth in Section 4, PAYMENT TERMS. In addition, Seller will have the right to maintain a lien on the Goods until payment in full is received by Seller. "**Bankruptcy Event**" means the occurrence of any of the following events with respect to either Buyer or Seller : (a) filing of a petition or otherwise commencing, authorizing or acquiescesing in the commencement of a proceeding or cause of action under any bankruptcy, insolvency, reorganization or similar law; (b) making of an assignment or any general arrangement for the benefit of creditors; (c) having a bankruptcy petition filed against it and such petition is not withdrawn or dismissed within 30 days after such filing; (d) otherwise becoming bankrupt or insolvent (however evidenced); (e) having a liquidator, administrator, custodian, receiver, trustee, conservator or similar official appointed with respect to it or any substantial portion of its property or assets; or (f) being generally unable to pay its debts as they fall due.

Revised 1-24-11

13. **INTELLECTUAL PROPERTY.** (a) Seller will defend and indemnify Buyer from any claim, suit or proceeding brought against Buyer based on a claim that the Goods as manufactured and furnished by Seller and used in the manner for which it was intended and sold to Buyer constitutes an infringement of any United States, Canadian or European Union-member patent, if Seller is notified promptly in writing and given authority, information and assistance for the defense of such claim, suit or proceeding. All aspects of the defense and settlement of any such claim, suit or proceeding shall be within Seller's sole discretion. Buyer remains solely responsible for its own costs, including all fees and expenses of its own counsel, if any, or its personnel, which are incurred in conjunction with the defense of such claim, suit or proceeding. Should it be held that the Goods constitute infringement and the use of the Goods is enjoined, Seller will, at its sole discretion and at its own expense, either procure for Buyer the right to continue using the Goods, replace the Goods with non-infringing goods, modify the Goods to become non-infringing or refund the purchase price for the infringing Goods. This indemnification does not apply to any liability for infringement (i) of any method patent where the Goods are used with other apparatus for carrying out a process resulting in a combination of steps which is deemed to infringe a method patent or patent directed to a combination of steps, (ii) the Goods are modified by Buyer, (iii) the Goods are used by Buyer in a manner different than the use communicated to and understood by Seller at the time the Goods were sold to Buyer and such use constitutes infringement, or (iv) with respect to claims of infringement where the Goods were designed and manufactured in accordance with the design or specifications furnished or required by Buyer. Seller's obligations under this indemnity, including all of its costs associated with the defense of any such suit or proceeding, shall in no event exceed the purchase price of the infringing Goods. (b) Buyer will indemnify and hold harmless Seller from any suit or proceeding brought against Seller by any third party based on claims resulting from exceptions (i), (ii), (iii) or (iv) as stated above. (c) Seller retains all intellectual property rights, whether registered or un-registered, including trademarks, patents, and copyright of all documents, drawing rights, design rights, developed programs, software, models and other data provided or developed in the course of the Contract. Seller will, if so required by Buyer, grant Buyer a non-exclusive, non-assignable royalty free license to use the same only for the purposes of operating or maintenance of the equipment by Buyer. (d) Buyer represents and warrants to Seller that Buyer has all necessary rights and permissions to provide all information provided by or on behalf of Buyer to Seller and shall indemnify Seller from any third party with respect to Seller's use of such information in connection with the Contract.

14. **DELIVERY DATE.** Seller shall use reasonable efforts to meet Buyer's requested delivery date, but Seller does not guarantee a specific delivery date.

15. **BACKCHARGES.** No backcharges will be paid or allowed by Seller unless: (a) Seller is notified in writing of any defect claim or omission pursuant to Section 9, WARRANTY, and (b) Seller provides prior approval of such backcharges in writing.

16. **CANCELLATION FEE.** Buyer may not cancel any part of the Contract except upon written notice and payment to Seller of: (a) all reasonable costs arising from the Order prior to the date of cancellation. (b) all reasonable costs arising due to the cancellation, plus (c) a cancellation fee. Unless otherwise specified in the Order, the cancellation fee shall be the higher of 35% of the total price of the Contract or $250.00. The parties agree that Seller's damages following a termination of any part of the Contract by Buyer are difficult to determine and that the cancellation fee provided by this provision is a genuine pre-estimate of loss and not a penalty and is reasonable in light of the circumstances. Seller shall be entitled to the payments set forth above if Seller terminates the Contract pursuant to Section 12, DEFAULT, or Section 17, SUSPENSION. Title to all works in progress and all materials not delivered to Buyer prior to the date of cancellation will remain with Seller.

17. **SUSPENSION AND DELAYS.** (a) Buyer may only suspend an Order upon receipt of Seller's prior written consent, which may be withheld by Seller for any reason. (b) If Buyer or any of its agents delays Seller's performance due to failure to promptly approve drawings or procedures or due to any other action or non-action on part of Buyer or its agents: (i) Buyer shall reimburse Seller for all costs incurred by Seller as of a result of such delay (including costs of reactivation), (ii) the delivery time shall be adjusted, and (iii) milestone payments (if applicable) will be adjusted to keep Seller whole for verifiable costs incurred up to the date of delay or suspension. (c) If, due to any action or non-action on the part of Buyer or its agents, Seller is delayed for more than 45 days, or such longer period of time as deemed reasonable by Seller in its sole discretion, Seller may elect to terminate the Agreement, such termination to be at Seller's sole discretion. Seller will be entitled to the payments provided in Section 16 following any such termination.

18. **FORCE MAJEURE.** Force Majeure means any circumstances beyond the reasonable control of either party, including fire, explosion, breakdown of machinery or equipment, plant shutdown, strikes or other labor disputes, acts of terrorism or war, riots or other civil disturbances or voluntary or involuntary compliance with any law, order regulation, recommendation or request of any governmental authority, inability to obtain materials necessary for manufacturer of the Goods, total or partial failure of any of Seller's usual means of transportation of the Goods, or for failure to obtain necessary governmental approvals, permits or licenses. Neither party will have any liability, other than for the payment of monies owing, for their failure to perform any of their contractual obligations arising out of or in connection with events of Force Majeure.

19. **ASSIGNABILITY.** The rights and duties under the Contract are not assignable or transferable by Buyer, in whole or in part, by operation of law or otherwise, without the prior written consent of Seller that may be granted or withheld in its sole discretion. Any assignment or attempted assignment in contravention of the foregoing shall be null and void, shall be considered a breach of the Contract and shall permit Seller, in addition to any other rights which it may have, to terminate the Contract. Seller shall have the right to assign any rights or obligations under the Contract to any third party.

20. **GOVERNING LAW.** The Contract and its execution, performance, interpretation, construction and enforcement shall be governed by the law, both procedural and substantive, of the State of Kansas, without regard to its conflicts of law rules. Any action or proceeding between Buyer and Seller relating to the Contract shall be commenced and maintained exclusively in the State or federal courts in Wichita, Kansas, and Buyer submits itself unconditionally and irrevocably to the personal jurisdiction of such courts. BUYER AND SELLER EACH WAIVE, TO THE FULLEST EXTENT PERMITTED BY LAW, ANY RIGHT IT MAY HAVE TO A TRIAL BY JURY IN RESPECT OF ANY SUIT, ACTION, CLAIM OR PROCEEDING RELATING TO THE CONTRACT.

21. **NOTICE.** All notices, consents, communications or transmittals under the Contract shall be in writing and shall be deemed received on the day of delivery if personally hand delivered or sent by facsimile or electronic transmission (with written confirmation of the completed transmittal); or within two business days if mailed as certified or registered mail with return receipt, postage prepaid addressed to the party to whom such notice is given at the address of such party stated in the Contract.

22. **ENTIRE AGREEMENT; AMENDMENT; WAIVERS.** The Contract shall supersede all prior negotiations, discussions, and dealings concerning the subject matter hereof, and shall constitute the entire agreement between Seller and Buyer concerning the subject matter hereof. There are no understandings, inducements, commitments, conditions, representations or warranties of any kind, whether direct, indirect, collateral, express or implied, oral or written, from either party to the other, other than as contained in this Agreement. Neither party shall claim any amendment, modification or release of any provisions hereof unless the same is in writing and signed by both parties. No waiver by Buyer of any breach of any terms, conditions or obligations under the Contract shall be deemed a waiver of any continuing or subsequent breach of the same or any other terms, conditions or obligations hereunder.

23. **ELECTRONIC TRANSACTIONS.** The Contract may be digitally copied and stored on computer tapes and disks (the "**Imaged Agreement**"). The Imaged Agreement (once digitally regenerated to paper form), and any facsimile, and all computer records of the foregoing, if introduced as evidence in any judicial, arbitration, mediation or administrative proceedings, will be admissible as between the parties to the same extent and under the same conditions as other business records originated and maintained in documentary form and neither party shall object on the basis that such business records were not originated or maintained in documentary form under any rule of evidence.

24. **COMPLIANCE.** (a) Buyer and Seller shall comply fully with all applicable laws and regulations in their respective performances of the Contract and shall neither take nor refrain from taking any action that could result in liability for either Buyer or Seller under applicable law, including the U.S. Foreign Corrupt Practices Act, the OECD Anti-Bribery Convention or any other applicable anti-bribery law or treaty, or those regulations maintained by the U.S. Treasury Department's Office of Foreign Assets Control (31 C. F. R. Chapter V) or the U.S. Commerce Department's Bureau of Industry and Security (15 C.F.R. Parts 730 et. Seq.). Neither Buyer nor Seller shall be required to take or refrain from taking any action impermissible or penalized under United States or other applicable laws. (b) Without restricting the generality of the foregoing: (i) Buyer does hereby acknowledge that any distribution, sale, transfer or re-export of the Goods is governed by and subject to the trade control laws of the United States. (ii) Buyer will not distribute, sell, transfer or re-export the Goods, except in conformance with United States law. (iii) If Buyer knows or has reason to know that any of its customers intends to distribute, sell, transfer or re-export the Goods, either directly or through incorporation into other products, then Buyer shall inform the customer that the customer is responsible for obtaining any licenses or other approvals from the U.S. Government before such distribution, sale, transfer or re-export, by including the following language in Buyer's purchase order acknowledgement or other appropriate documentation to its customer: *NOTICE: The products, technical data, and/or software included in this Order were provided in compliance with the laws and regulations of the United States. Customer is responsible for obtaining all licenses, permits or other approvals that may be necessary under the laws of the United States before any distribution, sale, transfer or re-export of such items and for ensuring that the end-user and end use of these products are permitted under U.S. law. Re-export, diversion, transshipment, or use contrary to U.S. law is prohibited and is cause for cancellation of this [purchase order].*" (c) Buyer's breach of this Section shall constitute cause for immediate termination of the Contract by Seller.

25. **INDEPENDENT CONTRACTORS.** Seller and Buyer are independent contractors only and are not partners, master/servant, principal/agent or involved herein as parties to any other similar legal relationship with respect to the transactions contemplated under the Contract or otherwise, and no fiduciary, trust, or advisor relationship, nor any other relationship imposing vicarious liability shall exist between the parties under the Contract or otherwise at law.

26. **NO THIRD PARTY BENEFICIARIES.** The Contract is solely for the benefit of, and shall inure to the benefit of, Buyer and Seller, and shall not otherwise be deemed to confer upon or give to any third party any right, claim, cause of action or other interest herein.

27. **SEVERABILITY.** The invalidity or unenforceability of any provision of the Contract shall not affect the validity or enforceability of its other provisions and the remaining provisions shall remain in full force and effect.

28. **CONFIDENTIALITY.** All information that Buyer acquires from Seller hereunder, directly or indirectly, and all information that arises out of the sale of the Goods or Services hereunder, concerning such Goods, Services, and/or proprietary processes involved, including information concerning Seller's current and future business plans, information relating to Seller's operations, know-how, and other Seller-furnished information shall be deemed Seller's "**Proprietary Information**". Buyer shall (a) hold Seller's Proprietary Information in strictest confidence, (b) not disclose it to others, (c) use it solely for purposes of this Agreement and (d) upon Seller's request, either promptly deliver to Seller all such Proprietary Information that is in written, electronic or other form, including copies and summaries, or, at Seller's option, destroy such Proprietary Information and provide Buyer certification of such destruction. The obligations under this Section shall survive the expiration or termination of the Contract.

29. **LANGUAGE.** The parties hereto confirm that it is their wish that this Agreement, as well as all other documents relating hereto, including all notices, have been and shall be drawn up in the English language only.

30. **MISCELLANEOUS.** The captions and section headings set forth in the Contract are used for convenience only and shall not be used in defining or construing any of the terms and conditions set forth in the Contract. The term "**days**", as used herein, shall mean actual days occurring, including, Saturdays, Sundays and holidays where banks are authorized to be closed in the city where Seller's chief executive office is located. The term "**business days**" shall mean days other than Saturdays, Sundays and holidays where banks are authorized to be closed in the city where Seller's chief executive office is located. The term "**including**" or any variation thereof means "**including, without limitation**" and shall not be construed to limit any general statement that it follows to the specific items immediately following it. Unless the context indicate otherwise, words importing the singular number shall include the plural and vice versa, and words importing person shall include firms, association, partnerships and corporations, including public bodies and governmental entities, as well as natural persons, and words of masculine gender shall be deemed to include correlative words of the feminine gender and vice versa as the circumstances may require. The United Nations Convention on Contracts for the International Sale of Goods shall not apply.

[End of General Terms and Conditions of Sale]

Revised 1-24-11

CHROMALOX
Advanced Thermal Technologies

September 28, 2018

TERRY EVANS
NS POWER – TRENTON G.S.
108 POWER PLANT RD.
TRENTON, NS B0K 1X0 Canada

Quote #: 349929 - 00
Valid Until 10/28/2018

Subject: Trenton Generating Station EHT

	Part #	Description	Qty.	Unit Price	Ext. Price
1	388375	SRM/E 20-2CT 20W/FT 240V 388375	1,200	[redacted]	[redacted]
	Manufacturing Lead Time: 1 working day **FOB Point: WHSE**				
2	388316	SRM/E 15-2CT 15W/FT 240V 388316	1,000	[redacted]	[redacted]
	Manufacturing Lead Time: 1 working day **FOB Point: WHSE**				
3	388121	SRM/E 5-2CT 5W/FT 240V	180	[redacted]	[redacted]
	Manufacturing Lead Time: 1 working day **FOB Point: WHSE**				
4	393553	UPC POWER CONNECTION KIT	13	[redacted]	[redacted]
	Manufacturing Lead Time: 1 working day **FOB Point: WHSE**				
5	393561	UMC POWER CONNECTION KIT	5	[redacted]	[redacted]
	Manufacturing Lead Time: 1 working day **FOB Point: WHSE**				
6	393570	UES END SEAL KIT	22	[redacted]	[redacted]
	Manufacturing Lead Time: 1 working day **FOB Point: WHSE**				
7	317340	RBF185M-HT-0304-18RD-93SB	16	[redacted]	[redacted]
	Manufacturing Lead Time: 1 working day **FOB Point: WHSE**				
8	382256	PS-20 PIPE STRAP	17	[redacted]	[redacted]
	Manufacturing Lead Time: 1 working day **FOB Point: WHSE**				
9	382379	PS-10 PIPE STRAP	49	[redacted]	[redacted]
	Manufacturing Lead Time: 1 working day **FOB Point: WHSE**				
10	382360	PS-3 PIPE STRAP	6	[redacted]	[redacted]
	Manufacturing Lead Time: 1 working day **FOB Point: WHSE**				

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11	393609	SPA - SMALL PIPE ADAPTER	4	[redacted]	[redacted]
	Manufacturing Lead Time: 1 working day **FOB Point: WHSE**				
12	389941	FT-3 3/8" GLS CLOTH TAPE 66FT	110	[redacted]	[redacted]
	Manufacturing Lead Time: 1 working day **FOB Point: WHSE**				
13	382424	CL-1 CAUTION LABEL KIT	42	[redacted]	[redacted]
	Manufacturing Lead Time: 1 working day **FOB Point: WHSE**				
14	Heat Trace Skid	See below	1	[redacted]	[redacted]
	3 weeks for approval drawings ***8-10 weeks for production*** Pricing includes CSA certification for skid SGA0075KK 75KVA, 3PH, 480-480Y/277V 60Hz transformer NEMA 4 rack Part Number: 307447474 Model Number:ITLS-2433(24-1P)6-0X364115 Line Sensing Model: ITLS Number of Circuits: 24 Line Voltage: 480/277 VAC, 3 Phase 4 Wire Relay: (SSR) Solid State Relay 30 Amp Circuit Breaker(s) include the following quantities: (24) 277 Volt / 1 Pole Circuit Breaker(s) Other Options include the following: Heater Power and RTD Terminal Blocks Powered Receptacle (on separate breaker) Copper ground bus bar Main Circuit Breaker: 125A Thermal Magnetic Enclosure: NEMA 4 Single-Door Wall-Mount Steel Enclosure Enclosure Size:60.0H x 36.0W x 12.0D RTD Inputs: 24 Inputs Communications: (1) Standard: ModBus RTU/RS485 or Modbus TCP/Ethernet Temperature Sensing Options: (1) Standard Wired Sensing **Manufacturing Lead Time: 45 working days** **FOB Point: TN**				
15	562351016	Cable Isometric Drawings	16	[redacted]	[redacted]
	Manufacturing Lead Time: 15 working days **FOB Point: WHSE**				
				Materials Total:	[redacted]
				Ungrouped Total (CAD):	[redacted]

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Group 1

	Part #	Description	Qty.	Unit Price	Ext. Price
1	387364	DTS-HAZ DIG T'STAT SSR HAZ 120-277VAC,-40/+40C,30A,AC ALM	2	[redacted]	[redacted]
	Manufacturing Lead Time: 1 working day **FOB Point: WHSE**				
				Materials Total:	[redacted]
				Grouped Total (CAD):	[redacted]

Note: Quoted lead times begin when the part is engineered and upon receipt of approved credit and/or drawing approval. Shipping time is not included. If drawings are required for approval or as-built, they will be provided in PDF format only. Additional documentation fees may apply.

Comments

Terms

Net 30 Days with approved credit

Thank you for the opportunity to earn your business.

Paul Kurylowicz

pkurylowicz@provan.ca

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For more information please visit our website at www.chromalox.com

The latest Chromalox Terms and Conditions can be found on our website at:
http://www.chromalox.com/customer-service/policies/termsofsale.aspx

Due to recent large fluctuations in raw material prices, a materials surcharge may be applied at the time of shipment if applicable.

On Non-Stock items, a $300 minimum, per line item, will apply. A "Setup Charge" equal to $300 minus the net extended line item price will apply to all non-stock products less than $300. Non-stock heat tracing products require a 2000 foot minimum order.

The above quotation is valid for 30 days.

In the manufacture of non-stock products (such as: cartridge heaters, strip heaters (plain and finned), tubular heaters (plain and finned), ring heaters, silicone laminated heaters, type RI immersion heaters, we initiate production of more pieces than ordered to compensate for anticipated manufacturing losses. Chromalox reserves the right to ship Variations In Quantity (VIQ) on your order according to the chart listed below. If this is not acceptable, this VIQ can be waived for a 5% net adder to the order value. Please notify Chromalox in writing if you wish to exercise this option.

Quantity Variation

1-5 None	6-10 ±1 unit	11-25 ±2 units
26-50 ±3 units	51-75 ±4 units	76-99 ±5 units
100+ ±5 percent		

Unless otherwise noted in the proposal, large project payment terms are:
- Under $25,000 sales value are net 30 days from shipment
- $25,000 to $75,000 sales value are 30% due at drawing submittal; 70% upon shipment net 30 days
- Over $75,000 sales value are 15% due at drawing submittal; 35% release to manufacture; 50% upon shipment net 30 days

Cancellation charges are:
- 25% prior to delivery of drawings
- 50% after delivery of drawings, prior to release to manufacturing
- 100% after release to manufacturing

Depending on the use/user/destination, a U.S. Department of Commerce Export License may be required. Please provide us with the following information when placing an order:
(1) Final destination of the goods to be shipped.
(2) Name/address of the end user.
(3) End use or application of the product.

Black & McDonald Limited
60 Cutler Avenue, Dartmouth, Nova Scotia B3B 0J6
Phone: 902-468-3101 | Fax: 902-468-3102 | Web: www.blackandmcdonald.com

B&M Proposal #18-0513

September 26, 2017

Nova Scotia Power Inc.

Attention: **Terry Evans, P.Eng.**
Mechanical Engineer

Trenton HFO System Upgrade - Phase 2, Budget
Trenton, Nova Scotia

Black & McDonald Limited is pleased to submit for your review and consideration our proposal for the above referenced project. Our proposal is based upon the scope of work presented in the documents provided, listed herein, and as noted in the clarifications below.

Detailed Scope of Work

- Remove existing 10" and both 4" lines per marked up Drawing A 050N0 1 351 00 001
- Supply/Installation of new 10" fuel supply line as per Drawing A 050N0 1 351 00 001
- Supply/Installation of new 4" recirculation line per Drawing A 050N0 1 351 00 001
- Replace all pipe supports as per the drawings (13 Type 1 & 1 Type 2)
- Remove all piping, valves, pumps, heaters, and equipment per drawings A 050N6 2 352 51 003, 004, 005, and 007
- Supply/Installation of new piping per drawings A 050N6 2 352 51 003, 004, 005, and 007
- Installation of Owner supplied valves, pumps, heaters, and equipment per drawings A 050N6 2 352 51 003, 004, 005, and 007
- All insulation based on fiberglass with aluminum jacket with removable insulation blankets on valves and flanges

Project Clarifications / Notes

- Proposal is based on work during regular working hours
- Electrical and heat trace scopes not included at this time
- Supply of all heaters, pumps, strainers, non-manual valves, and instruments by NSPI
- Disposal of contaminated soil (if required)
- Payment Terms Net 30 days
- Proposal does not include for Liquidated Damages or Bonding Costs
- Terms and conditions are based on CCDC2 contract document
- Proposal valid for 45 days

Our Budget for above scope is: [redacted] **Taxes extra, Canadian funds**

Black & McDonald Limited
60 Cutler Avenue, Dartmouth, Nova Scotia B3B 0J6
Phone: 902-468-3101 | Fax: 902-468-3102 | Web: www.blackandmcdonald.com

Black & McDonald would like to thank you for the opportunity to submit this proposal. Please contact the undersigned directly at (902) 481-6820 if you have any questions regarding the above.

Regards,

Dale DeMings
Mechanical Estimator
Black & M^{c}Donald Limited

CI Number: 48638

Title: TRE Rail Car Fuel Delivery Upgrade

Start Date: 2015/12
In-Service Date: 2019/10
Final Cost Date: 2020/04
Function: Steam
Forecast Amount: $1,236,623

DESCRIPTION:

The scope of work for this project includes the supply and installation of rail car heaters near the entrance of the coal unloading shaker house at the Trenton Generating Station.

The Trenton Generating Station currently receives over half of its solid fuel by rail. The coal is unloaded by the Coal Unloading personnel from bottom dumping rail cars into one of 4 hoppers beneath the "shaker house" through vibratory feeders onto a conveyor, which leads to the surface for deposition to either Unit 5 or Unit 6 coal piles. The shaker house was built in the late 1980s. During the winter months, doors freeze on the incoming rail cars, which are subject to moisture coming off the coal and sub-zero temperatures.

This project will install windbreak structures on either side of the railway tracks and radiant heaters will be placed within the track space near the entrance of the shaker house. The heaters will be positioned to preheat the rail car doors and facilitate unloading of the rail cars during the winter months. The electrical components required to equip the site for the heaters include:

- 16 spectrum infrared heaters, 60,000 kW each.
- Medium voltage switchgear
- Switchboard
- Motor Control Center
- 1 MVA transformer
- Two 11 circuit contactor cabinets
- Connection to existing utility line
- Underground conduit and cabling from main transformer to power distribution center

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- No other projects in 2017, 2018, 2019, 2020 or 2021

Depreciation Class: Steam Production Plant – Trenton – Common

Estimated Life of the Asset: Heaters - 5 Years
Electrical Equipment – 20 Years

JUSTIFICATION:

Justification Criteria: Health & Safety

Why do this project?

Water that is contained within the loaded coal naturally migrates to the bottom of the rail cars where it freezes during winter coal delivery. To be able to unload the coal from the cars, Coal Unloading personnel use torches to thaw the car doors and a slicer to help break up the coal in the cars. The installation and use of rail car heaters to preheat the rail car door area will allow for a safer, more efficient method to remove the coal from the cars.

Why do this project now?

The domestic coal currently being supplied as part of the fuel mix for the Trenton Generating Station is scheduled to deplete by the end of 2019. The only option for fuel replacement at this facility at that time will be imported coal delivered by rail. This will increase the coal delivered to Trenton by rail. With this increase, this upgrade will be required to handle the increased volume of coal arriving by rail safely and efficiently during the winter months. This increase in rail delivered coal will also produce longer unloading times due to the higher number of rail cars arriving at the station. This increased time will in turn allow loaded rail cars to sit for longer periods thereby adding risk of further freezing of the coal and rail car door mechanisms.

Why do this project this way?

In 2016, CDG Engineers (CDG) was retained by NS Power to evaluate the solid fuel handling for the fueling system at the Trenton Generating Station due to concerns about the future availability of domestic coal, and the ability to handle an increased amount of imported coal. The findings of this assessment are documented in the CDG report No. 15102, dated May 25, 2016 (Partially Confidential Attachment 1).

Two options were considered:

1. Store more coal by having it delivered in the summer months
2. Having more coal delivered during the winter months

Coal pile construction on adjacent real estate was evaluated. Costs and environmental concerns associated with the adjacent property precluded this first option. Having more coal delivered in the winter months would require increased efficiency to meet the demand. An improved method of thawing frozen rail car doors was determined to be through the installation of radiant heaters adjacent to the shaker house. This option will allow for a safer, more efficient method to remove the coal from the rail cars.

CI Number : 48638 - TRE Rail Car Fuel Delivery Upgrade

Project Number 48638-SF54

Parent CI Number : -

Asset Location : 1168 - 1168 Trenton Common Property

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1800 - SGP - Fuel Hndlg.Coal	1,236,623
	Total Cost:	1,236,623
	Original Cost:	

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI# : 48638
Title: TRE Rail Car Fuel Delivery Upgrade
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	10	$ 358	$ 3,583		
Engineering	PD	50	$ 405	$ 20,265		
Maintenance Trades	PD	5	$ 365	$ 1,824		
Power Engineer	PD	4	$ 390	$ 1,562		
Utility Worker	PD	10	$ 240	$ 2,402		
			Sub-Total	$ 29,635		
OT Labour						
Engineering	PD	2	$ 811	$ 1,621		
Maintenance Trades	PD	2	$ 365	$ 730		
Utility Worker	PD	2	$ 240	$ 480		
			Sub-Total	$ 2,831		
Term Labour						
Maintenance Trades	PD	10	$ 365	$ 3,648		
				$ -		
			Sub-Total	$ 3,648		
Travel Expenses						
Travel Expenses	lot	1	$ 5,000	$ 5,000		
				$ -		
			Sub-Total	$ 5,000		
Materials						
Switchgear	ea	1	[redacted]		Attachment 2, Item 2	
Switchboard	ea	1			Attachment 2, Item 3	
Motor Control Center	ea	1			Attachment 2, Item 4	
Transformer	ea	1			Attachment 2, Item 5	
Radiant Heaters	ea	16				
Windbreak Structures	lot	1	$ 50,000	$ 50,000		
				$ -		
			Sub-Total	$ 275,810		
Contracts						
Installation	lot	1	$ 675,000	$ 675,000		
				$ -		
			Sub-Total	$ 675,000		
Consulting						
Solid Fuel Study	lot	1	$ 50,796	$ 50,796		
			Sub-Total	$ 50,796		
OT Meals						
	lot	1	$ 250	$ 250		
				$ -		
			Sub-Total	$ 250		
Other Goods & Services						
Contingency	%	10%	$ 950,810	$ 95,081		
				$ -		
			Sub-Total	$ 95,081		
Interest Capitalized						
AFUDC				$ 5,491		
				$ -		
			Sub-Total	$ 5,491		
Administrative Overhead						
Labour AO				$ 11,932		
Contracts AO				$ 81,149		
			Sub-Total	$ 93,080		
			SUB-TOTAL (no AO, AFUDC)	$ 1,138,052		
			TOTAL (AO, AFUDC included)	$ 1,236,623		
Original Cost				$ -		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Solid Fuel Handling Study

Trenton Generating Station and Point Tupper Marine Terminal

Prepared for:

Nova Scotia Power
An Emera Company

Nova Scotia Power
4137 Port Malcom Road
Port Hawkesbury, Nova Scotia B9A 1Z4

Prepared by:

CDG ENGINEERS

One Campbell Plaza
St. Louis, Missouri 63139
(314) 781-7770
www.cdgengineers.com

CDG Project No. 15102

May 25, 2016

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EXECUTIVE SUMMARY

CDG Engineers (CDG) was requested to perform a solid fuel handling study for the fueling system at Nova Scotia Power's (NSP) Point Tupper Marine Terminal and the Trenton Generating Station. The request was made due to concerns about the future availability of domestic coal and the ability of the existing systems to handle an increase in imported coal. A site visit was undertaken, and a meeting record and trip report were prepared and forwarded to NSP for review.

A larger reliance on imported coal will mean more deliveries by rail between the Point Tupper Marine Terminal and the Trenton Generating Station. Several issues have been identified that reduce efficiency and limit capacity currently that will be magnified if rail deliveries increase. Issues include frozen coal and railcar doors, conveyors running at less than rated capacity due to spillage concerns, and limited storage capacity at Point Tupper and Trenton.

An improved method of thawing frozen rail hopper car doors has been identified, and a vendor that CDG knows has successfully supplied these radiant heaters has submitted a proposal to supply a system at the Trenton station. CDG has arranged with two CDG electric utility client firms to host site visits and discuss the operation of the heaters with plant staff. It is suggested that if NSP is seriously considering the installation of these heaters, then a timely response and scheduling of such visits be set at your earliest convenience. As stated below, these visits would also allow discussions about several other issues that have been expressed by NSP to be of interest to you.

The same two CDG clients that have agreed to discuss the operation of the radiant heaters also have addressed coal handling mobile equipment safety issues. Such a trip as stated above, and discussions with these electric utilities, would also include opportunities to get direct information about the methods chosen to address these safety issues. Also, one of these electric utilities also has side car shakers installed at two power stations. That style of shaker could also be viewed in operation and discussed.

CDG is also recommending that the coal receiving and reclaim systems at Trenton be serviced in the near future, such that spillage, fugitive dust issues and optimum capacity can be addressed soon. A thorough review of the system has not been completed at this time. To that end, this report contains some general recommendations about design and maintenance issues for such coal handling systems. Due to the lack of redundancy in the coal handling system, upgrades would need to be performed during an outage. In addition, the lack of redundancy would make the maintenance of these systems all the more crucial for the reduction of unplanned outages.

After our latest discussions, it was revealed that a stockpile expansion is being considered at the unit 6 solid fuel stockpile area at Trenton through the possible purchase of real estate adjacent to the existing stockpile area. Additionally, a stockpile expansion at the Point Tupper Marine Terminal is being considered, generally in the area that was considered under a previous study. Plans for utilization of the reclaimed ash pond area near Trenton are no longer being considered. Also, although it does not appear that stockpile ground area for unit 5 may not be practical, CDG still recommends that consideration be given to the construction of a concrete perimeter wall to allow more volume of coal to be retained, both at unit 5, and at the possible expanded area for unit 6.

Order of Magnitude Costs:

Radiant Heaters - [redacted]
Railcar Shakers [redacted]
Conveyor System Upgrades – Unable to provide without thorough investigation of system.
Conveyor/Radial Stacker at PTMT - [redacted]
Second Rail Track at PTMT - [redacted]

Note: NSP has requested that minimal time is spent on compiling the above information, therefore, estimated ranges are given.

INTRODUCTION

Nova Scotia Power (NSP) has requested that CDG Engineers (CDG) conduct a solid fuel storage and handling study at the Point Tupper Marine Terminal (PTMT) and the Trenton Generating Station. The study has been requested due to concerns about the availability of domestic coal sources in the near future. Coal reserves at the current domestic source (Nova) are diminishing. A second source (Springhill) is being reviewed, however, it is not known if it will be commercially viable prior to the end of the current source. Switching to 100% imported coal would increase rail deliveries to the Trenton Station by approximately 360,000 tonnes with the same amount processed through the PTMT. This study reviews existing facilities and equipment and their ability to handle the increase in imported coal.

The Trenton Generating Station has 2 units; Unit 5 and Unit 6. The burn rate capacity is 2600 tonnes per day with 1400 tonnes directed to Unit 5 and 1200 going to Unit 6. The actual current burn rate is 2200 tonnes per day. In the future, summer coal use is expected to decrease due to alternative energy sources being utilized in cooperation with New Brunswick Power. During the winter months, Unit 5 burns a mix of 50% mid-sulfur and 50% low-sulfur coal blended in railcars at the PTMT. NSP plans to standardize on that mix for the entire year. Unit 6 burns an 80% domestic low-sulfur, 20% imported blend.

The capacity of most vessels unloaded at the PTMT is 50,000 to 55,000 tonnes with laker vessels being approximately 25,000 tonnes. The current storage capacity at the PTMT is approximately 120,000 tonnes, which is just over two of the larger vessels. This can cause problems when deliveries to Trenton are disrupted, which is common during winter months. Most vessels unloaded are self-unloading with a nominal rate of 3000 MTPH. The burn rate at the Point Tupper Generating Station, which is adjacent to the PTMT, is approximately 100 tonnes per day.

NSP currently uses steel railcars to transport coal between the PTMT and the Trenton Station. Twenty-five (25) additional steel hopper cars have been acquired by lease to supplement the current fleet of 60 hopper cars. Car gross weights are limited to 263,000 pounds, not the higher 286,000 pound gross weights often used by larger railroads, due to railroad weight limitations. There is a question about the continuing availability of steel cars. If NSP were to switch to aluminum cars, full advantage of the additional capacity cannot be taken, due to the weight limitation. This assumes that the aluminum cars would be rated for 286,000 gross pound service.

Current issues with rail delivery such as frozen coal, loading and unloading capacity and storage capacity will be magnified with increased use of imported coal. This report reviews the various issues, discusses the various solutions with recommendations, and includes order of magnitude costs for some of those solutions.

COAL HANDLING ISSUES AND RECOMMENDATIONS

Trenton Generating Station

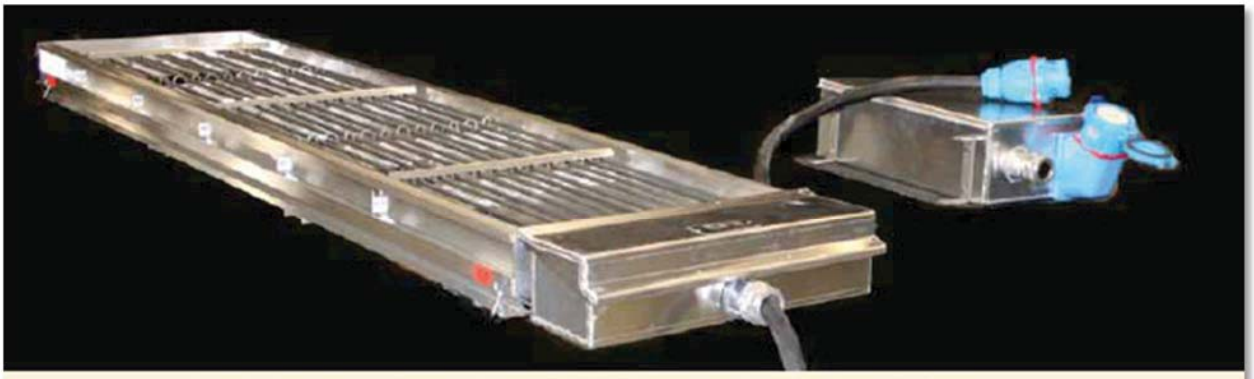
Coal Freezing in Railcars

NSP owns a fleet of bottom-dump coal carrying railcars that are aging and likely to be replaced in the next several years. The cars are shuttled between Point Tupper Marine Terminal and the Trenton Plant. The cars are emptied at the Trenton Plant normally during the warm months but the late fall and winter temperatures cause the doors on the railcars to freeze. Any water that is contained within the loaded coal naturally migrates to the bottom of the railcars where it freezes during the winter months. The current operation utilizes propane torches to thaw the doors for unloading operations. This is tedious, inefficient and potentially dangerous. Since unloading production is significantly slowed, the unloaded cars are exposed to the freezing temperatures longer, exacerbating the problem further.

Plant staff have stated that the cars generally do not freeze solid and only require the thawing of the doors and the first few inches of the coal in direct contact with the doors on the bottom of the railcar. It is this ice that is preventing the doors from operating properly which must be thawed. Once the doors are freed to open, the coal is reported to flow freely with very little residual in the emptied car under normal winter operations.

The equipment that is typically employed for thawing frozen doors is electric radiant or infrared heaters. These are typically installed between, and sometimes just outside the tracks leading to the loadout shed. These units are modular and if configured correctly, may be removed and stored in the off-season to extend their useful life.

Courtesy of Spectrum Infrared Heaters



Courtesy of Spectrum Infrared Heaters

We recommend an array of heaters that would be installed on the sleepers between the rails, with four (4) sets of two (2), 60,000 kW, side-by-side infrared heaters for each car for a system total of sixteen (16). The system would be set up to heat two cars at a time, with one car length of space in between the last set of heaters and the first dump hopper location. With the total array of heaters that are recommended, the total power usage at full load would be 960 kW – or approximately 1 MW. This load is not insignificant and will require a source, feeder and transformer in the coal handling auxiliary power system.

The heaters are usually a stock item and can be delivered readily. The heaters have a custom control cabinet to provide timing and intensity of heater operations. It is highly recommended that the manufacturer's controls be procured with the heaters. The controllers vary the amount of heat along the car width based on your conditions. This will reduce the amount of power required for the heating system.

Since the railcars tend to freeze only in the lower portion and not through the entire load, a full thaw shed may not be necessary. However, windbreak structures around the heaters could improve their performance by blocking cross winds.

We understand as railcars are retired from the current fleet and steel cars become more scarce, NSP is planning to incorporate aluminum cars. Although many aluminum cars are equipped with steel doors and hopper segments, these hybrid-type cars are susceptible to damage from over-exposure to the heaters, so precise controls are even more critical.

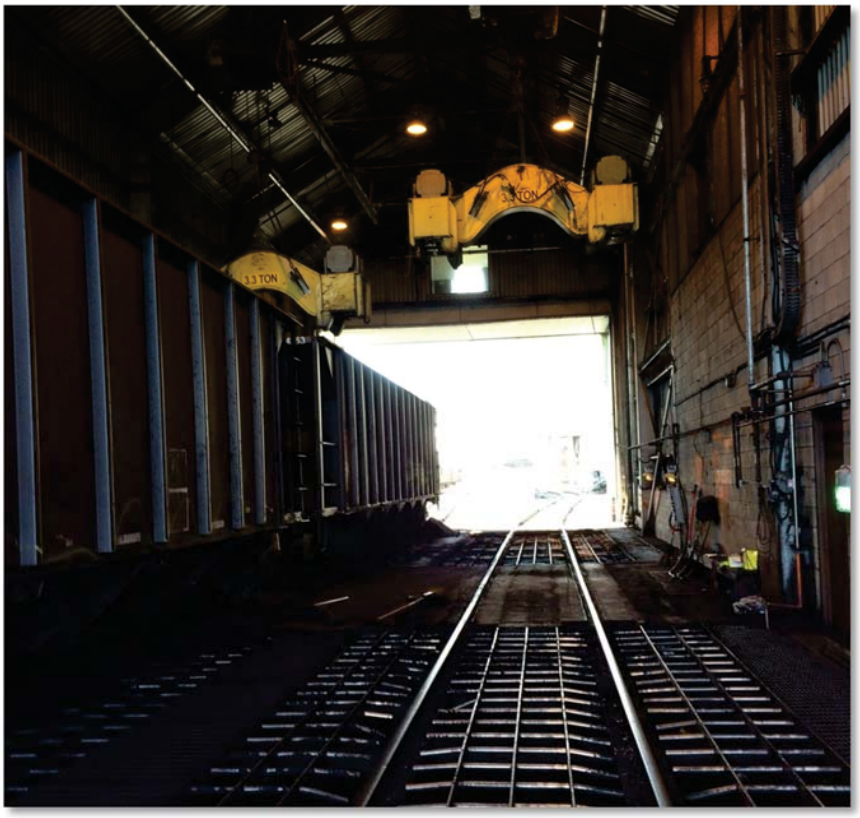
We also recommend purchasing a quantity of spare heating modules and elements for quick replacement and repairs. The modules are serviceable with replacement heating elements. With the quick disconnect option, replacement time is reduced to minutes.

During discussions with NSP some items proposed for the railcar unloading building were determined to not warrant further discussion at this time. Those items include enclosure of the ends, building insulation, and steam unit heaters.

Order of Magnitude Costs – Railcar Heaters: [redacted]

Side Railcar Shakers

As the steel cars are changed out, the aluminum cars are not able to handle the forces from the existing car top shaker system. The cars will structurally fail with continued use of the existing system.



Existing Car Top Shaker System

We recommend a different style of car shaker that contacts the sides of the car and distributes the forces across multiple structural ribs along the side of the railcar. The stationary railside car shaker is a permanently mounted vibration system designed to speed the loading and unloading of bulk material from railcars while keeping the aluminum cars intact.

The rolling railside car shaker extends to contact and shake the railcar as it rolls by (railcars do not need to come to a stop during operation). The shaker features a contact surface made of composite slider blocks reinforced with heavy duty mechanical tubing to withstand the rigors associated with contacting moving cars and to provide maximum service life.

Both the stationary and rolling types are available in pneumatic or electric. They may also be operated from a remote location, and can be integrated into an automated unloading process.

Order of Magnitude Cost – Railcar Shaker Installation: [redacted]

Typical Rolling Rail Side Car Shaker

Reclaim Hopper Safety

The relatively compact coal storage piles at the Trenton Plant require the coal to be stacked higher than industry norm. Additionally, the smaller stockpile has higher amount of dozer traffic that compacts the coal and enhances the risk of bridging. The result is a tendency for the development of voids near the reclaim areas under the stacker. The plant experienced an accidental dropping of a dozer into a void near a reclaim. This situation has resulted in the plant employing a backhoe on the pile with a long-reach bucket to pull coal away from the reclaim area. This operation provides the dozer operators with a visible safe boundary from the reclaim draw down areas to avoid dropping the dozers into any voids. The use of the backhoe is not efficient and slows the entire plant fueling system.

Trenton Coal Storage Pile

There are measures that can be taken to ensure the safety of the dozer operators and eliminate the need for the backhoe system. There are systems designed for avoidance of the potentially dangerous areas prone to voids like the reclaim areas. Additionally, we have recommendations for the situation when a dozer drops into a void to keep the operators safe until rescue measures can begin.

Dozer Positioning System

Many utilities utilize dozer positioning systems to ensure the dozers stay a safe distance from the reclaim areas. The employment of position indicating devices to assist the dozer driver in determining location of draw down points in high risk zones should be used. Audible or visual alarms should be provided to alert the dozer driver. Some systems utilize GPS data for this purpose. The resolution of such systems may not be adequate for tighter sites. There are also proximity alarm systems that can be utilized to create a "bubble" around the protected area. Some of these systems provide visual data via external cameras and a screen in the cab of the dozer. The appropriate selection of the system will require further coordination with equipment vendors and the physical constraints of the Trenton site.

Operator Protection

In the event of an accident, the dozer operator must be protected. We recommend reinforcement of the cab to withstand engulfment forces of at least 40psi (280kpa). We also recommend the dozers be outfitted with defeatable tilt switches that will automatically shut the dozer engine down to prevent fire hazard and carbon monoxide poisoning. The tilt switches could be by-passed by the operator after confirmation the operator is in control.

The dozer should have an emergency stop pushbutton installed to immediately stop the reclaim systems and minimize further sliding and engulfment. This will be a wireless system tied to the existing reclaim controls. The wireless system will be required to be certified for safety shutdown to meet CSA standards.

Additional Coal Storage

CDG Engineers has studied numerous options for expansion of the coal handling storage at the Trenton Plant site. As measures to improve winter railcar unloading are incorporated and the coal handling system is upgraded and improved, we are anticipating the need for large pre-season stockpiles will be mitigated. Further study will be required to determine if that is a valid assumption.

A remote trucked storage area to the south of the plant was considered in the early part of the study. The land for this is an area that was previously a coal ash impoundment. The feasibility of this solution is not favorable due to the distance and the potential ash impoundment mitigation requirements.

If, after further study, it is determined that expanded stockpiling is required or desired, we would first recommend the construction of a 3 meter (10') wall surrounding the Units 5 and 6 stockpiles. In discussions with NSP, expansion of the Unit 5 stockpiles was not selected for further evaluation. There is a facility adjacent to the Trenton Plant site on the southeast side. NSP has expressed interest in acquiring part of that facility to use to expand the Unit 6 stockpiles.

Coal Handling System Upgrades and Maintenance

It has been recognized that there is an ongoing problem with spillage and operations issues on both the receiving and reclaim systems for handling coal at Trenton. The plant has been operating equipment at less than its rated capacity to reduce this spillage. Since a complete inspection of the systems was not performed, we will include herewith some general issues and recommendations for addressing them for such systems.

Vibrating Feeders

The drawings state the capacity of the vibrating feeders underneath the railcar unloading hoppers at 400 MTPH. The subsequent conveyors are rated for 600 MTPH. To take full advantage of the conveyor system after the upgrades, the feeder capacity would need to be increased. From initial evaluations, it appears that is possible, however, further evaluation is required for confirmation.

Upstream Coal Handling

Often times, problems with upstream material handling equipment cause surges that the downstream conveyors cannot handle, causing spillage and downtime. Proper selection and maintenance of upstream equipment such as feeders, and design of chutework is important. The entire material handling circuit should be viewed as a "System", and each element should be properly designed and constructed.

Loading Points

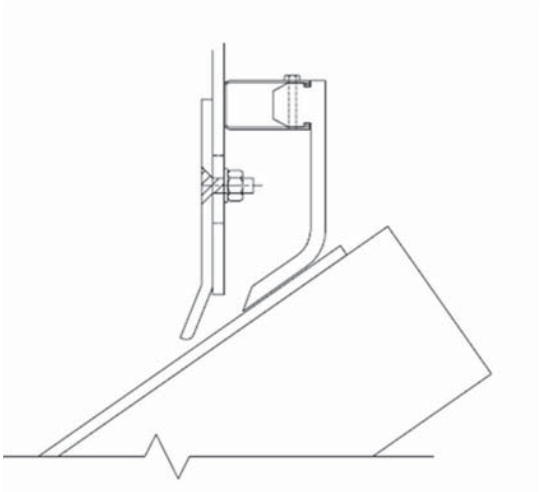
The loading chute should be designed to minimize material free fall velocity and manage entrained air. The chute should be designed to deliver coal to the take away belt as close to its belt speed as is possible. This will reduce the energy required to accelerate material, reduce turbulence in coal flow minimizing dust, and reduce belt cover wear. The loading point should center the coal on the belt, thus keeping the belt from getting pushed off center and introducing spillage and training problems. This is one of the basic causes of spillage at the load point.

Tail Pulley Transition Distance

This is the distance in which the flat portion of the belt coming off the tail pulley is transitioned to troughed in the idlers. Guidelines for this distance are well publicized and should be followed. Shorter than recommended transition distance can cause ply separation of the belting.

Impact Zones and Skirtboards

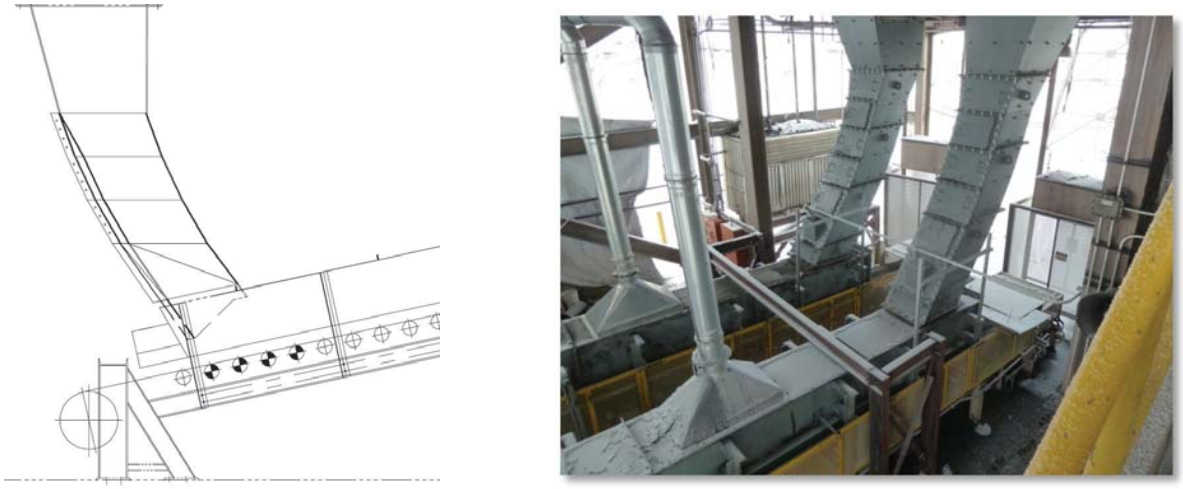
An impact bed with center impact rolls should be employed in the impact zone. This will allow a good seal between the skirt rubber and the troughed wings of belting that are now supported on a flat rigid surface. There are a variety of such products available in the market. A standard idler should be located just before the belt enters the impact zone. This idler should be shimmed up by ½" to 1", so the belt enters the impact bed with minimal friction. The skirtboards and seal rubber should continue for 3' for every 100 FPM of belt speed, to allow the material to reach full acceleration, and all "boiling" has subsided. The idlers in this zone should be closely spaced to 12" to 18" center. The skirtboards should be equipped with high hardness liner with a bent edge near the belting to protect the skirt rubber seal. Used belting should never be utilized for skirt seals.



Modified Skirtboard Seal

While CEMA has standards regarding skirtboard height, a taller skirtboard provides a stilling effect. Flexible neoprene rubber strips can be hung inside in a staggered pattern to minimize entrained air turbulence as it exits the skirtboard.

Existing Loading Zone at Trenton



Example of Improved CDG Designed Chute and Loading Zone

Conveyor Belt Training

A rigid belt structure and proper construction will help in belt training. Training idlers should be employed at 50' to 75' spacing, with proper orientation, so that vertical training rollers are on the belt entry side. An analogy between bicycle handle bars and belt training can be drawn. The training idler acts as do bicycle handle bars, and steers the belt towards the center of the structure. This can only happen if the training idler is free to pivot. It is a little more challenging to train the return side as belting is not as rigid as troughed belting. V-return idlers on wider belts are recommended. A poorly trained return run will rub the belt structure resulting in belt edge damage, and perhaps creating a fire hazard. (In the US, MSHA considers this a safety violation). A poorly trained return strand is often a cause of off center loading of the belt at the load point, and causes spillage.

Typical V- Return Idler – Courtesy of ASGCO

Head Chutes

The head chute should be designed to minimize entrained air with the material being conveyed. A "hungry board" arrangement (skirtboards without rubber strips at entrance to the head chute) with neoprene curtains will reduce entrained air. Rubber blocking strips should be employed on the top and bottom sides of exiting return belt to block open area.

Belt Cleaners

There are a variety of belt cleaners available. However, they need to be properly installed and maintained to be most effective. Generally, a pair of belt cleaners is employed for maximum benefit. A poorly cleaned belt will lead to material build up on return idlers resulting in poor belt training.

Order of Magnitude Cost – Conveyor System Upgrades: Estimates cannot be determined until a thorough evaluation of the system has been completed.

Dust Control

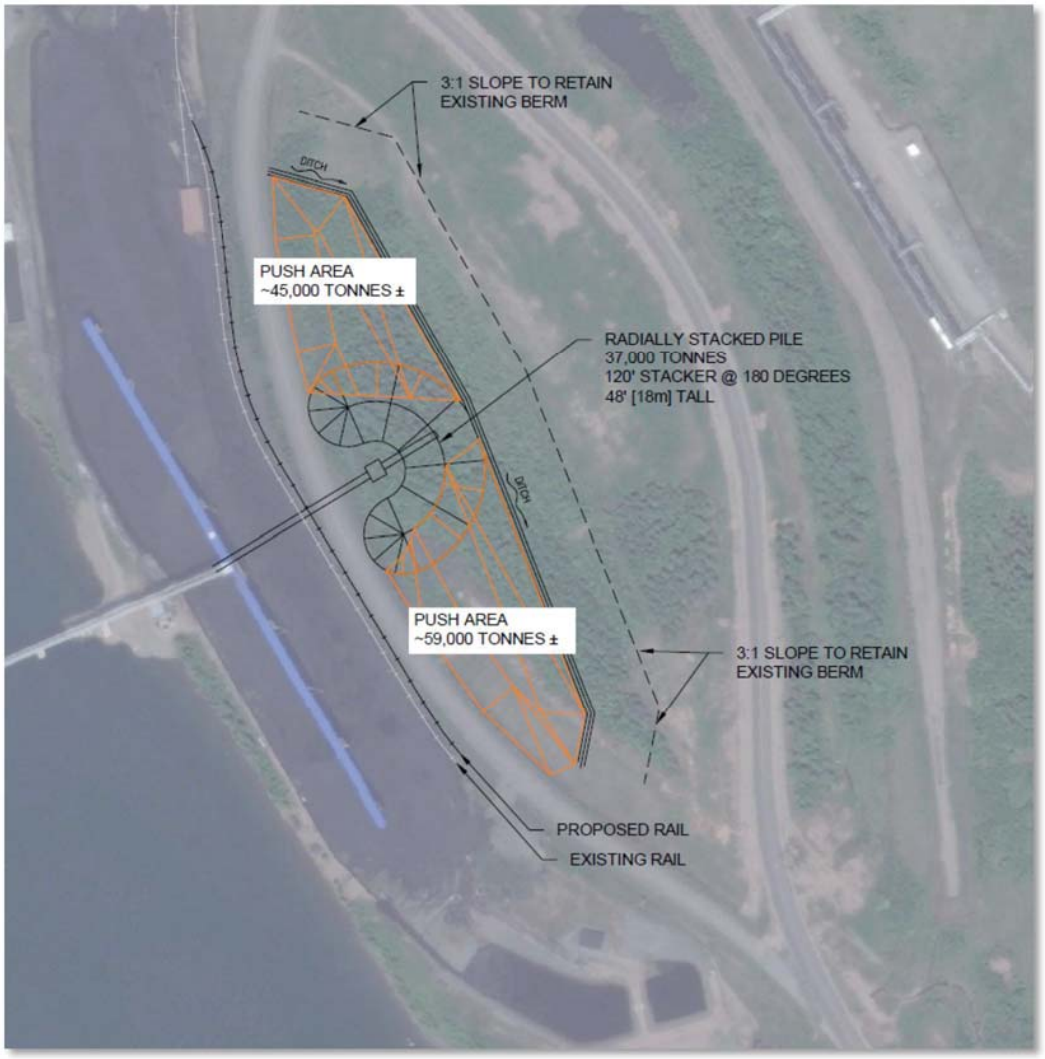
Controlling dust at various locations including the unloading building, reclaim, and stockpiles were discussed with NSP. However, it was not selected for further evaluation at this time.

Point Tupper Marine Terminal

Additional Coal Storage

The single largest cost benefit for the Point Tupper Marine terminal coal storage capacity expansion is to construct an additional coal storage area in the location of the abandoned road. This area is roughly parallel with the existing storage area that is located under the tripper conveyor stockpiling system. It was reported that this proposed additional storage area was once considered for construction, and a previous study exists that provides more details. Additionally, we recommend constructing an additional loadout railroad track, parallel to the existing loadout railroad track. This will allow for more cars to be loaded, which may be required if the domestic coal source for Trenton is no longer available.

Order of Magnitude Cost – Second Storage Pile: [redacted]
Order of Magnitude Cost – Second Rail Track: [redacted]



Potential Storage Expansion at PTMT

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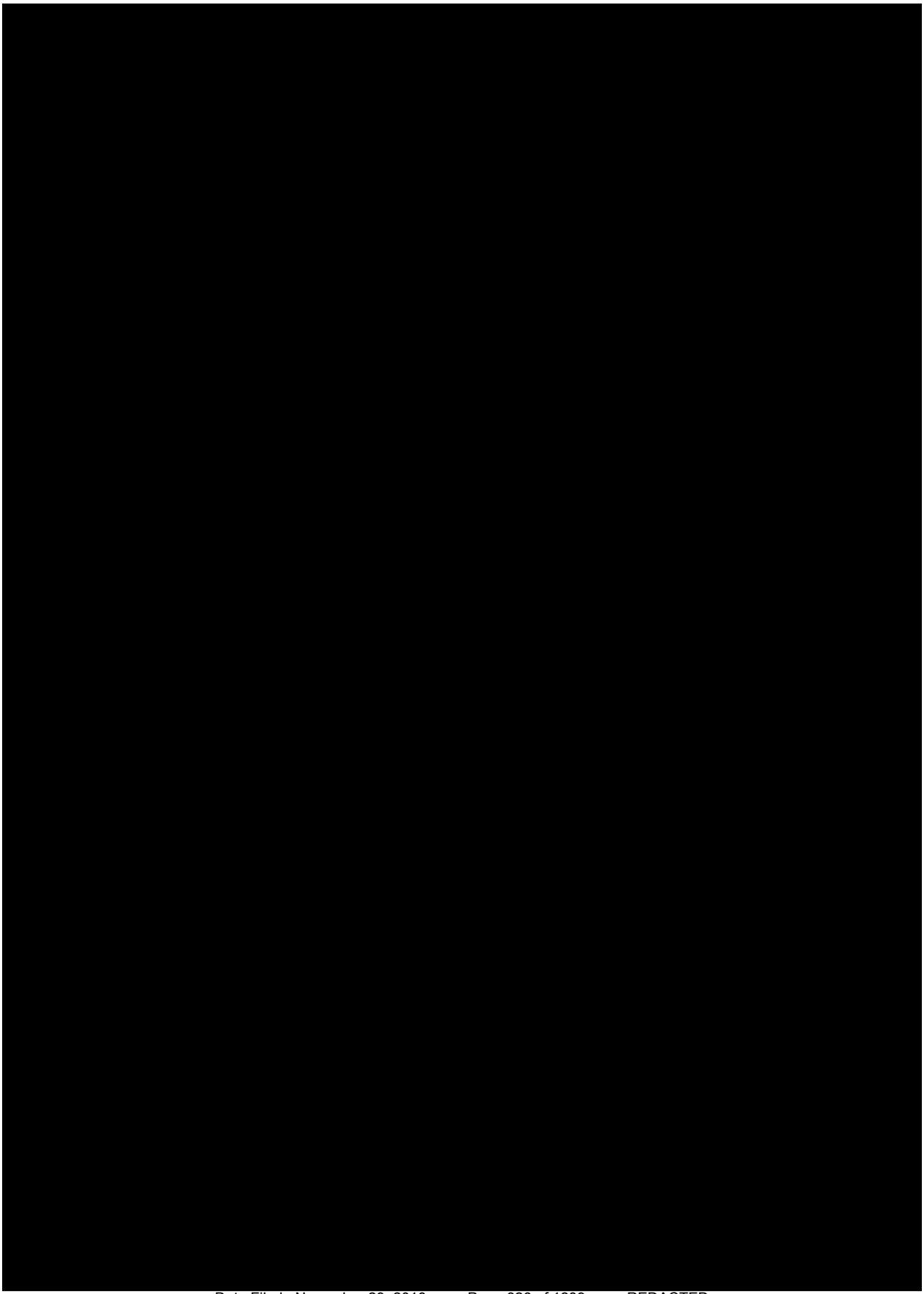

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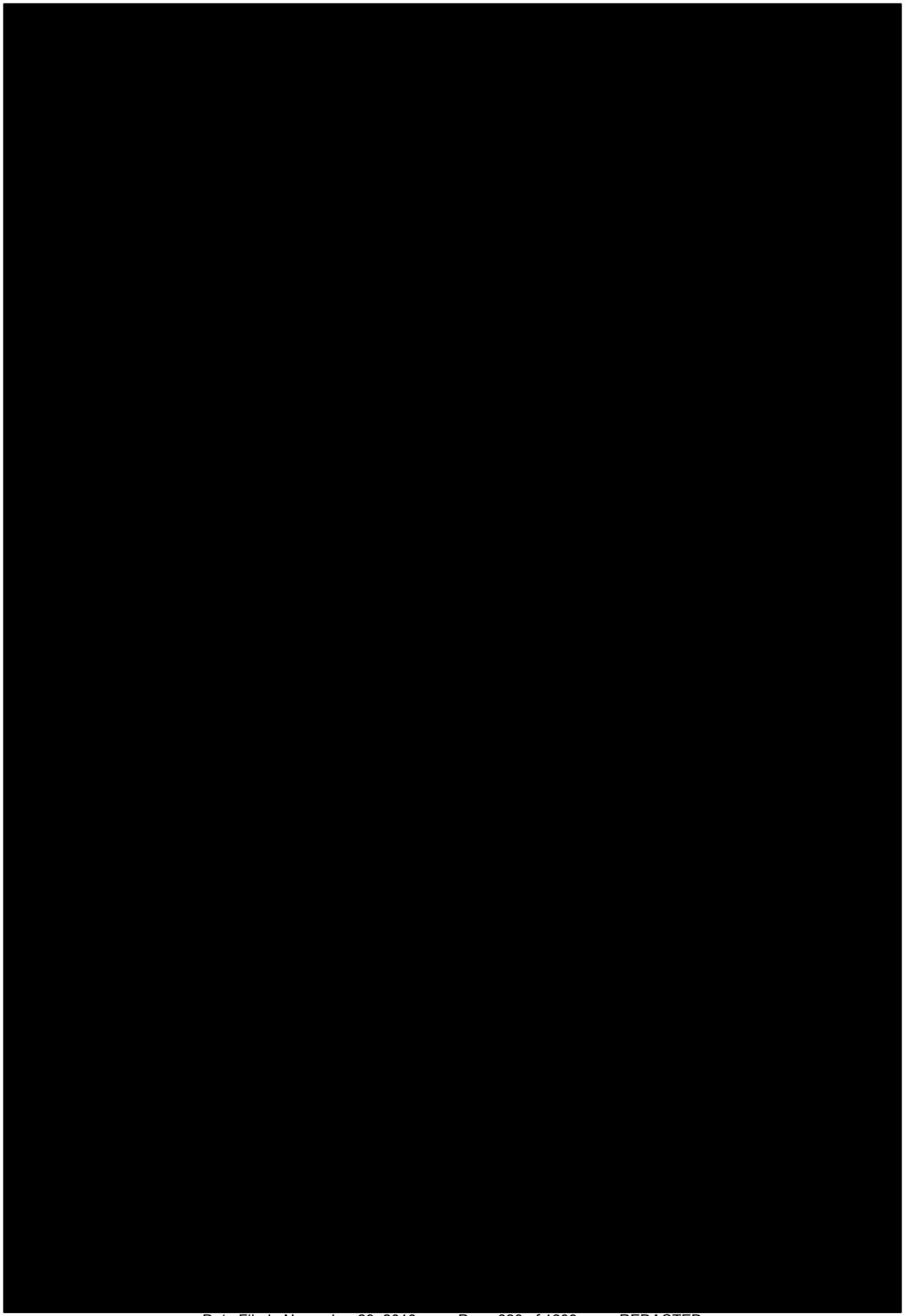

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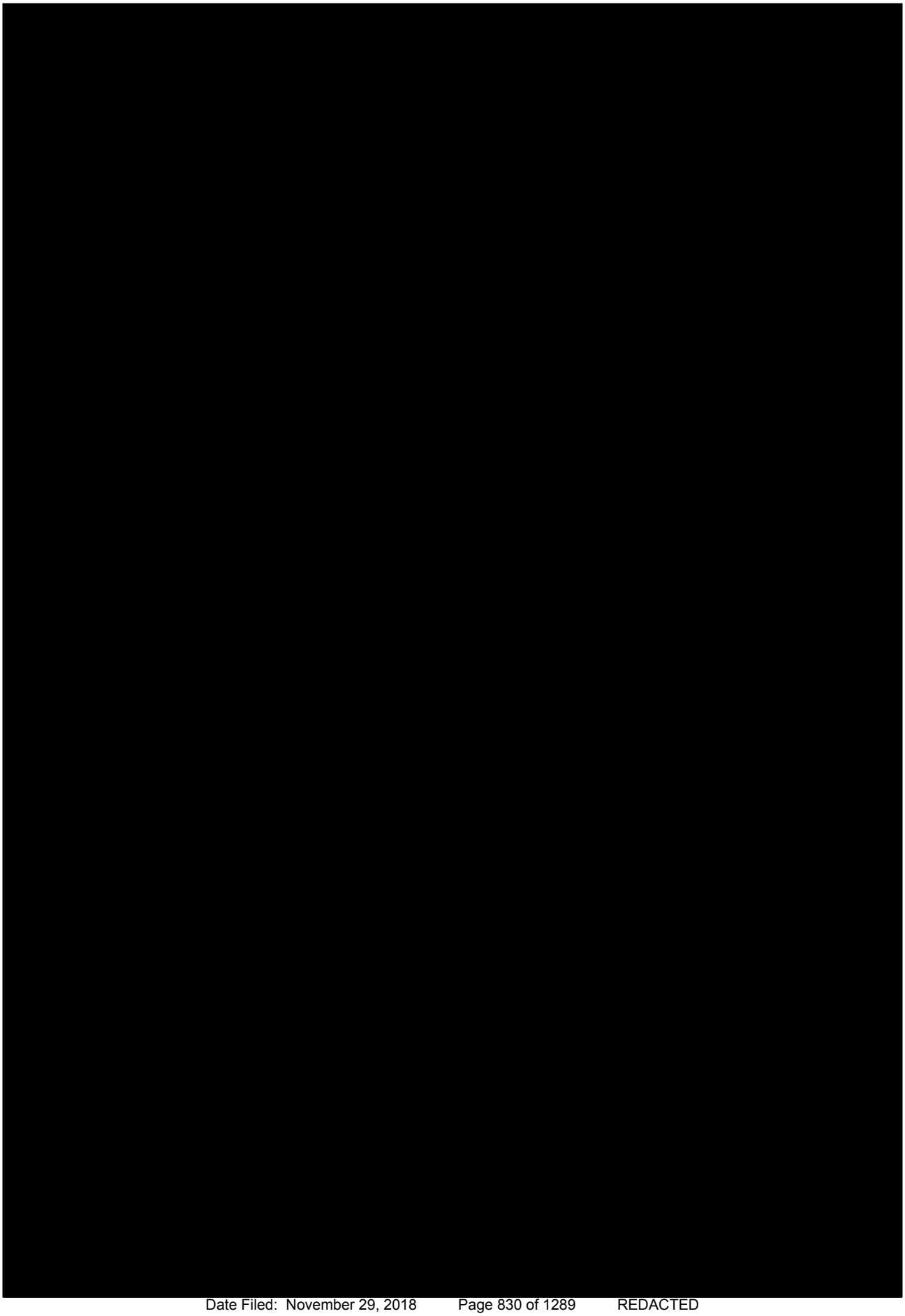

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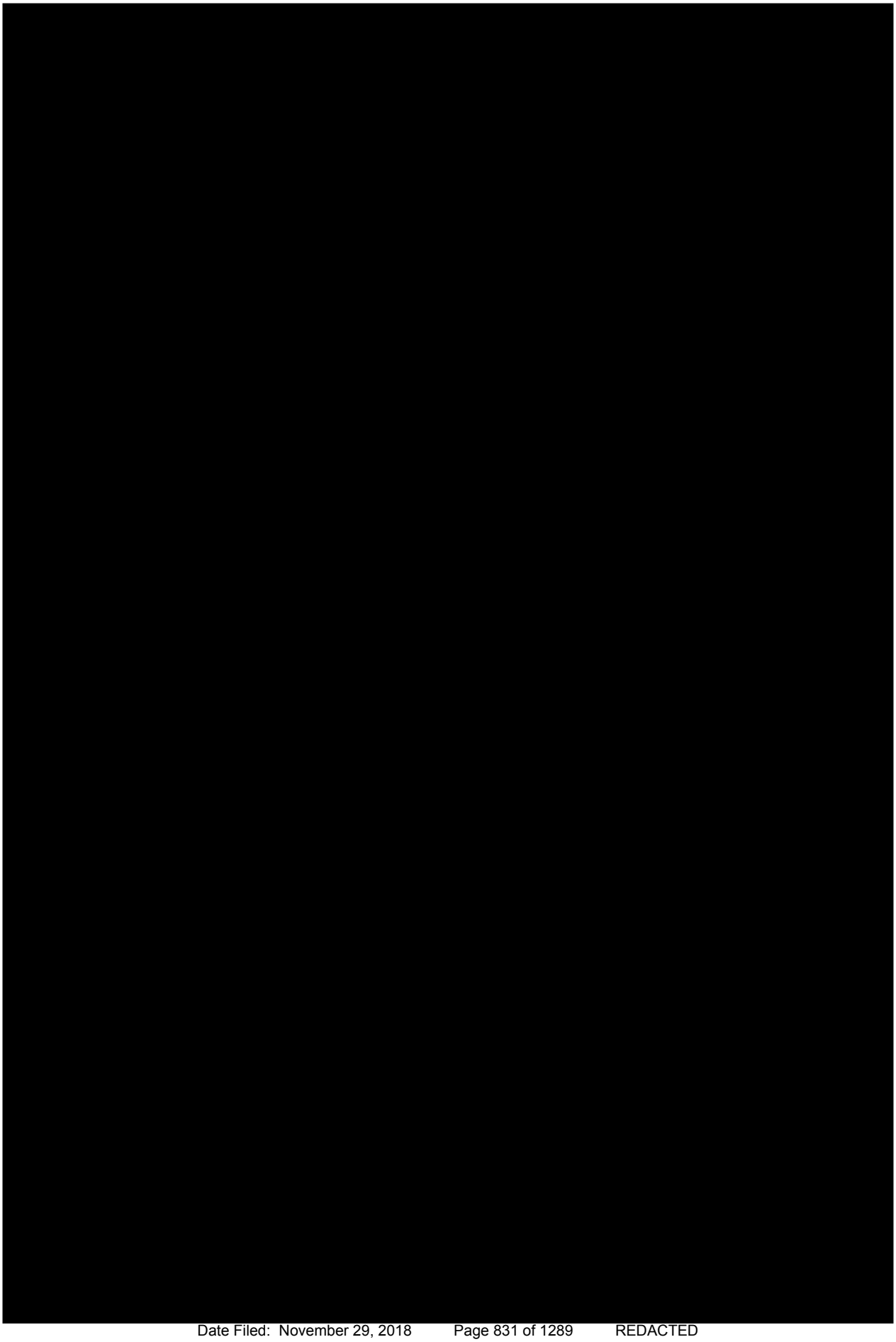

APPENDIX C - DRAWINGS

GENERAL NOTES:

QUANTITY CALCULATIONS ASSUME:

1. 55 # / CU FT COAL DENSITY
2. 35 DEGREE ANGLE OF REPOSE

****PRELIMINARY****
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SITE PLAN
SCALE: 1" = 100'

PLOT SCALE FACTOR 0.5

0 100 200 Feet

REV.	DATE	DESCRIPTION	APPROVED
A	10/14/15	SHOWN AT GOTO MEETING	RDL

CDG ENGINEERS
One Campbell Plaza
St. Louis, Missouri 63139
T: 314.781.7779
F: 314.781.8076

Nova Scotia POWER
An Emera Company

Chervek
May 19, 2016

POINT TUPPER PLAN
GENERAL ARRANGEMENTS
SOLID FUEL HANDLING STUDY
NOVA SCOTIA, CANADA

CDG PROJECT NO.
15102

DRAWING NO.
15102-C01

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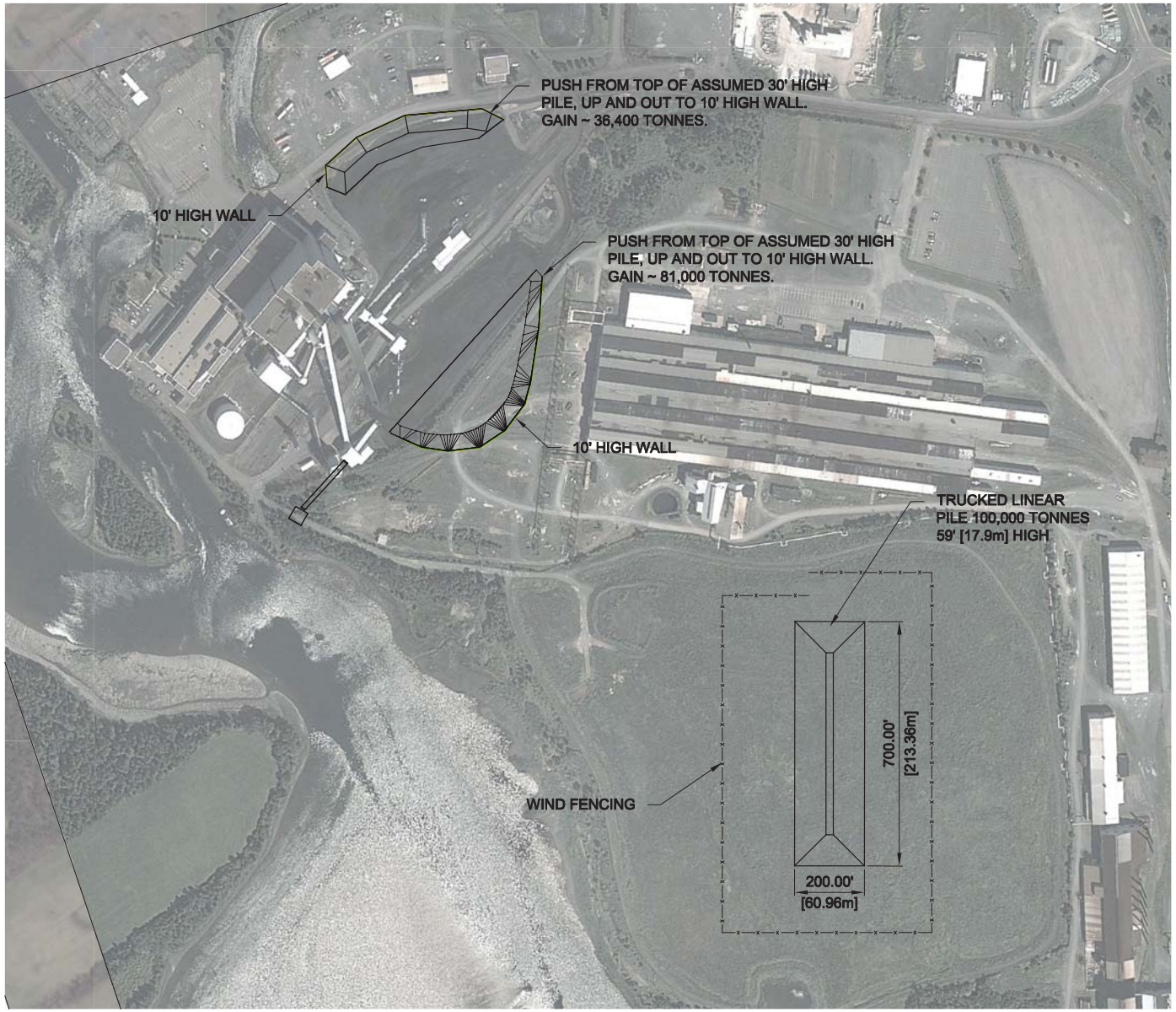

GENERAL NOTES:

QUANTITY CALCULATIONS ASSUME:

1. 55 # / CU FT COAL DENSITY
2. 35 DEGREE ANGLE OF REPOSE

SITE PLAN
SCALE: 1" = 150'

0 150 300 Feet

PLOT SCALE FACTOR 0.5

REV.	DATE	DESCRIPTION	APPROVED
B	12/09/15	MODIFIED NORTH PILE	RDL
A	10/14/15	SHOWN AT GOTO MEETING	RDL

****PRELIMINARY****
WORK-IN-PROGRESS
5/19/2016 4:33:23 PM

CDG ENGINEERS
One Campbell Place, St. Louis, Missouri 63139
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Nova Scotia POWER
An Emera Company

Hardin
December 31, 2015

TRENTON PLAN
GENERAL ARRANGEMENTS
SOLID FUEL HANDLING STUDY
NOVA SCOTIA, CANADA

CDG PROJECT NO.
15102

DRAWING NO.
15102-C02

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GE Energy Connections
Industrial Solutions

Sobhi Dimassi
1940 Onesime-Gagno
Lachine, QC H8T 3M6
sobi.dimassi@ge.com
+1 514-420-2864
June 07, 2018
Quote No.: CA7-00000044 Rev. 0.1
Project: Trenton Coal Rail Car Heaters

Greg Dennis
NS Power

Dear Greg Dennis,

Thank you for your inquiry for **Trenton Coal Rail Car Heaters**. We are pleased to respond with our proposal based on the requirements of your inquiry. Please contact us with any questions. We look forward to working with you on this opportunity.

Best Regards,

Sobhi Dimassi
GE Industrial Solutions

Summary of Proposal

Item No.	Product Description	Mark(s)	Quantity
2	Medium Voltage Switchgear, SecoGear IEEE 4.76kV		1
3	Switchboard, Spectra Bolt-On AV2		1
4	Motor Control Center	MCC OPTION DRAW OUT	1
5	Oil Type Transformer 1 MVA		1

Total Net Price by Line Item

Item No.	Product Description	Marks	Quantity	Unit Price (CAD)	Extended Price (CAD)
2	Medium Voltage Switchgear, SecoGear IEEE 4.76kV		1	[redacted]	[redacted]
3	Switchboard, Spectra Bolt-On AV2		1		
4	Motor Control Center	MCC OPTION DRAW OUT	1		
5	Oil Type Transformer 1 MVA		1		

Total Net Price (CAD): [redacted]

Bill of Material(s)

Item No.	Quantity	Description
2	1	**Medium Voltage Switchgear, SecoGear IEEE 4.76kV**

1 Section(s), Nema 1 Indoor
1200A, 3 Phase 3 Wire, 4.16kV, 60Hz
Bus Peak Withstand: 104kA, BIL: 60kV
4.76kV, 3-phase, Solidly Grounded, 60Hz system
Front and Rear Accesible
Front and Rear Aligned
ANSI/IEEE C37.06, ANSI/IEEE C37.09, IEEE C37.04,
IEEE C37.20.2, ANSI/IEEE C57.13, ANSI/IEEE
C37.20.7, IEEE C37.11-2014, IEEE C37.010

Auxiliary-VT and CPT and Breaker-Feeder 201
H (in.): 90, W (in.): 36, D (in.): 95, Est. Weight (lbs.): 2880
Silver Plated Copper Bus

PVC Supp

1	**Section : Auxiliary-VT/CPT/Breaker-Feeder**
1	- Back Assembly(Auxiliary / Breaker)
1	- 1200A Bus Bar Branches
1	- Wall Bushing Cover Plate
1	- FRONT END COVER-LH
1	- REAR END COVER-LH
1	- Wall Bushing Cover Plate
1	- FRONT END COVER-RH
1	- REAR END COVER-RH
1	**Compartment : Top**
1	- Bottom VT/CPT Compartment Assembly
1	- Auxiliary-VT/CPT Wiring
1	- Auxiliary-VT/CPT
4	- 4200/120V with 2 fuses, two bushing
2	- 2 (Open Delta) Mounting
1	**Compartment : Bottom**
1	- Bottom 1200A VCB Compartment Assembly
1	- Bottom 1200A Branch Assembly
1	- Breaker-Feeder Wiring
1	- Cable support asm
3	- Cable Boot (PVC)
1	- Phase CT 1200A:5A Top Set 1
1	- ZSCT mounting asm
2	- Infrared Viewing Window (3 inch Fluke)
1	- MOC with 8a and 8b contacts(Auxiliary Switch)
1	- TOC with 4a and 4b contacts(Position Switch)
1	- Breaker Control Switch 52CS, with Red and Green LED indicating lights
1	- Test Switch
1	- 86 Lockout Relay - 2 Pos

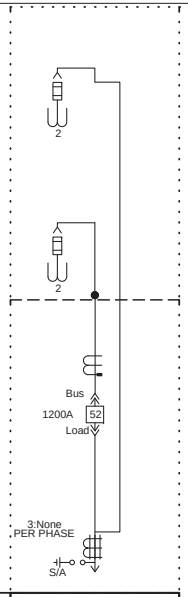
Item No.	Quantity	Description
	1	- Seco VAC VCB-4.76KV_1200A_40KA
	1	- 850-Protection Relay-850EP5NNG5HNNANNGMSBCSENNBN
	1	- Surge Arrestor mounting asm
	3	- Intermediate Class Arrester (Poly) - 3kV
	1	**Line Up Options**
	1	- Certified Test Reports
	2	- Wire Tags, Origin and/or Dest.
	1	- UL / cUL Label
3	1	**Switchboard, Spectra Bolt-On AV2**
		2 Section(s) Service Entrance
		Estimated Shipping Weight:1665 lbs
	1	Service Entrance Labeling
		cUL Label
		3P4W/600/347V/60Hz
		1600A 22 kAIC Fully Rated
		Incoming Feed: Bottom
		Incoming Left Feeding Right
		Type 1 Enclosure
		Front Only Access
	1	Spectra Switchboard Lineup
		Estimated total factory connected wiring points for the lineup 4
	1	Main Section 30W 40D 90H (Est.) lbs 813
	1	Group Mounted Feeder Section 35W 25D 90H (Est.) lbs 852
	2	Bus Bracing 65000 AIC
	2	Fully Rated Copper Bus 1000 A/Sq. in.
	2	Ground: Equipment U/L With Lugs
	1	Full Height Side Barriers
		Main Breaker
	1	1600A 3 Pole SSD (1600A Frame) Indiv. Mtd. Main
		Manually Operated MAIN
		Drawout Mounting
		Programmer(ETU) LSIG
	20	Compression (2 Hole) CU Line Lugs
		Feeders
	18	90A 3 Pole SFHA (250A Frame)
	18	Manually Operated
	18	PADLOCK PROVISION
	18	Mechanical AL Load Lugs
		Others
	19	Engraved Nameplates
	19	Screw-On Nameplates
		Others
	1	Lifting Brackets
	1	Racking Tool
	1	Lifting Bar

Item No.	Quantity	Description
	1	Spectra Bolt-On (C/B feeders only) 28X
	9	6P SFHA Double BR Module
	18	Neutral Lugs
	1	Bonding Jumper
	23	Equipment Ground Lugs
	1	Ground Lug
4	**1**	**Motor Control Center**
		Marks: MCC OPTION DRAW OUT
		4 Section(s), NEMA 1 with Gasketing
		Not Suitable for Service Entrance
		1600 Amps, 3 Phase 4 Wire, 600 V ac, 60 Hz
		Minimum Interrupt Rating: 22kA Fully Rated; Bus Bracing Rating: 65 kA
		Top Incoming Feed
		Incoming Left Feeding Right
		Front Only Mounting
		NEMA Wiring Classification II-BT "Class 2-BT (Independent units and Factory interconnecting wires, load wiring to Terminal Board (Size 1&2))"
		UL 845 Certified for US and Canada, NEMA ICS 18, NEC
		Seismic Certified IBC-2012
		Enclosure Paint: ANSI-61 (Light Gray) tested to minimum withstand of 1000 hour humidy and salt spray test.
		Dimensions and Weight (Estimated)
		Section 1 "AA":
		Height=90 in; Width=24 in; Depth=30 in
		Section 2 "AB":
		Height=90 in; Width=20 in; Depth=22 in
		Section 3 "AC":
		Height=90 in; Width=20 in; Depth=22 in
		Section 4 "AD":
		Height=90 in; Width=20 in; Depth=22 in
		Lineup Total:
		Height=90 in; Width=84 in; Depth=30 in
		List of Materials
	1	NEMA 1 With Gasketing Enclosure 24W
	3	NEMA 1 With Gasketing Enclosure 20W
	1	Fully Rated COPPER Standard Tin plated Bus 1600A 24 Wide
	3	Fully Rated COPPER Standard Tin plated Bus 1600A 20 Wide
	1	Ground COPPER Standard Tin plated Bus 300A 24 Wide
	3	Ground COPPER Standard Tin plated Bus 300A 20 Wide
	1	Neutral COPPER Standard Tin plated Bus 800A 24 Wide
	3	Neutral COPPER Standard Tin plated Bus 800A 20 Wide
	3	Vertical COPPER Standard Tin plated Bus 600A 72 High
		Options
	1	Seismic Rating
	4	Double-Bolted Main Bus
	3	Standard Catalog Renewal Parts Book
	19	Engraved Nameplates Black with White Text

Item No.	Quantity		Description
		4	NEMA Wiring Classification: II-BT "Class 2-BT (Independent units and Factory interconnecting wires, load wiring to Terminal Board (Size 1&2))"
			Control Wire Type: MTW VW1 (Standard)
			Control Wire Markers: Heat Shrink Non PVC
			Control Wire Terminal: Stripped Wire (Standard)
			Control Terminal Board: Hi Density Standard
		18	Power Wire Type: MTW VW1 (Standard)
		18	Power Wire Markers: Heat Shrink Non PVC
		18	Power Wire Terminal: Stripped Wire (Standard)
		18	Power Wire Terminal Board: Standard
			Main Circuit Breaker
		1	Circuit Breaker, 1600 A Frame, 1600 A Trip, 3 Pole, Thermal Magnetic SHF1600
			Manually Operated Circuit Breaker
			Programmer (ETU) LSIG
		12	#2 AWG - 600 MCM Mechanical (2-Hole) ALUMINUM Line Lugs (3) Cables Per Phase and Neutral
			Feeder
		18	Circuit Breaker, 100 A Frame, 90 A Trip, 3 Pole, Thermal Magnetic, SELT
			Retractable Stab
		54	#12 - 3/0 AWG MCM Mechanical Aluminum Load Lugs
5	**1**		**Oil Type Transformer 1 MVA**

OVERALL EQUIPMENT RATING

TYPE: SecoGear IEEE - 4.76kV
RATED VOLTAGE: 4.76kV
SYSTEM VOLTAGE: 4.16kV
BIL: 60kV
FREQUENCY: 60Hz
SHORT CIRCUIT RATING: 40kA
BUS PEAK WITHSTAND: 104kA
MAIN BUSBAR CURRENT: 1200A
MAIN BUS MATERIAL & PLATING: Copper Bus - Silver Plated
BREAKER CONTROL POWER: 120VAC/125VDC
HEATER/LIGHTING VOLT: 120VAC
ENCLOSURE: Nema 1 Indoor



TOP COMPARTMENT	Circuit Description	Auxiliary-VT/CPT
	Circuit Designation	
	Vacuum Circuit Breaker	
	CT Top Set #1 CT Top Set #2	None None
	CT Bottom Set #1 CT Bottom Set #2	None None
	Voltage Transformer	4 YES
	Surge Arrestor	None
	Zero Sequence CT	None
	Protection Relay	None
	Meters	None
	CPT	NO
	Key Interlock	NO
BOTTOM COMPARTMENT	Circuit Description	Breaker-Feeder
	Circuit Designation	
	Vacuum Circuit Breaker	VB2+ 4.76kV-1200A-40kA Trip Coil: 120VAC/125VDC Close Coil: 120VAC/125VDC Chg Mtr: 120VAC/125VDC
	CT Top Set #1 CT Top Set #2	1200A:5A None
	CT Bottom Set #1 CT Bottom Set #2	None None
	Voltage Transformer	N/A
	Surge Arrestor	Intermediate Class Arrester (Poly)
	Zero Sequence CT	50A:5A
	Protection Relay	850
	Meters	None
	CPT	N/A
	Key Interlock	NO
	Dimension(Width*Depth*Height)	36x95x95
	Section No.	201

PROJECT NAME : Trenton Coal Rail Car Heaters	DRAWING TITLE: Single Line Diagram	CREATED BY:	PRODUCT NAME: SecoGEAR SWITCHGEAR
CUSTOMER: AESCO CORP LIMITED, DARTMOUTH		CHECKED BY:	
		APPROVED BY:	
		DATE: 6/7/2018 5:19:47 PM	
		REVISION NO. 1	

GE Industrial Solutions

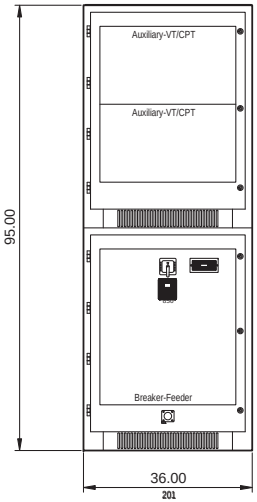
DRAWING NO:	
ITEM NO:	2
MARKS:	
QUOTE NO:	CA7-00000044
SHEET:	1

VERSION.DATE.TIME

DRAWING NOTES:

1. Shipping weights shown do not include SecoVac Breakers, or Auxiliary VT/CPT trays which are shipped separately. The weights of these devices can be found in the Device Weight Chart. The total installed weight including these devices is 4,137 lbs.

2. Battery and Battery Charger are not included

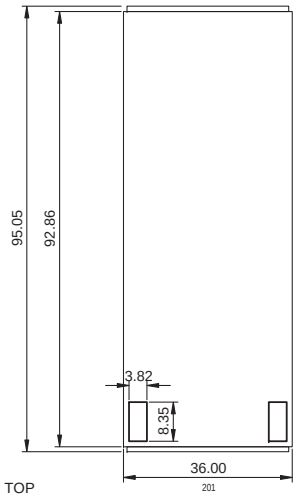


FRONT

DISCLAIMER: THIS DRAWING IS A PRELIMINARY PRINT AND IS NOT INTENDED FOR MANUFACTURING OR CONSTRUCTION PURPOSES. ANY MANUAL CHANGES WILL VOID THIS DRAWING AND COULD AFFECT LAYOUT OR DIMENSIONS.

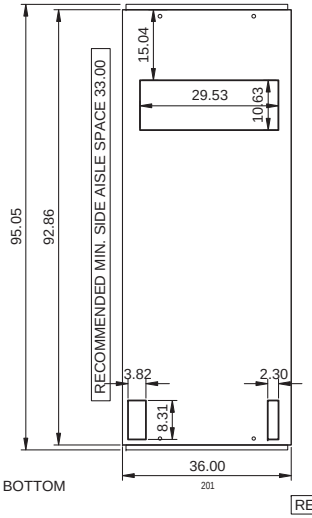
PROJECT NAME : Trenton Coal Rail Car Heaters	DRAWING TITLE: General Arrangement	CREATED BY:	PRODUCT NAME: SecoGEAR SWITCHGEAR	GE Industrial Solutions	DRAWING NO:
		CHECKED BY:			ITEM NO: 2
CUSTOMER: AESCO CORP LIMITED, DARTMOUTH		APPROVED BY:			MARKS:
		DATE: 6/7/2018 5:19:47 PM			QUOTE NO: CA7-00000044
		REVISION NO. 1			SHEET: 1

VERSION.DATE.TIME



TOP

RECOMMENDED MIN. REAR AISLE SPACE 35.00



BOTTOM

RECOMMENDED MIN. AISLE SPACE 78.00 TO REMOVE BREAKERS

DISCLAIMER: THIS DRAWING IS A PRELIMINARY PRINT AND IS NOT INTENDED FOR MANUFACTURING OR CONSTRUCTION PURPOSES. ANY MANUAL CHANGES WILL VOID THIS DRAWING AND COULD AFFECT LAYOUT OR DIMENSIONS.

PROJECT NAME : Trenton Coal Rail Car Heaters	DRAWING TITLE: Plan View	CREATED BY:	PRODUCT NAME: SecoGEAR SWITCHGEAR	GE Industrial Solutions	DRAWING NO:
		CHECKED BY:			ITEM NO: 2
CUSTOMER: AESCO CORP LIMITED, DARTMOUTH		APPROVED BY:			MARKS:
		DATE: 6/7/2018 5:19:47 PM			QUOTE NO: CA7-00000044
		REVISION NO. 1			SHEET: 1

VERSION.DATE.TIME

ACCESS TO:	Front Only	PHASE:	3P4W
CLASS:	2	AMPERE:	1600A
LABEL:	CUL SE	BUS MTL:	Cu 1000A/in²
VOLTAGE:	600/347V	PLATE:	Silver Plate
STYLE:	Bolt-On	RATING:	Fully Rated
BUS BRACING (RMS SYM):			65000A
DEV.MIN.INT.RATING (RMS SYM):			22000A

Switchboard / Device Information

Circuit No.	Device	Amps	Poles	Nameplates	Lugs/Cable Size	Notes
Main	SSD	1600	3			8,9,10,11,12
1	SFHA	90	3		(1) - #8 - 350 MCM CU - Mech. AL	11
2	SFHA	90	3		(1) - #8 - 350 MCM CU - Mech. AL	11
3	SFHA	90	3		(1) - #8 - 350 MCM CU - Mech. AL	11
4	SFHA	90	3		(1) - #8 - 350 MCM CU - Mech. AL	11
5	SFHA	90	3		(1) - #8 - 350 MCM CU - Mech. AL	11
6	SFHA	90	3		(1) - #8 - 350 MCM CU - Mech. AL	11
7	SFHA	90	3		(1) - #8 - 350 MCM CU - Mech. AL	11
8	SFHA	90	3		(1) - #8 - 350 MCM CU - Mech. AL	11
9	SFHA	90	3		(1) - #8 - 350 MCM CU - Mech. AL	11
10	SFHA	90	3		(1) - #8 - 350 MCM CU - Mech. AL	11
11	SFHA	90	3		(1) - #8 - 350 MCM CU - Mech. AL	11
12	SFHA	90	3		(1) - #8 - 350 MCM CU - Mech. AL	11
13	SFHA	90	3		(1) - #8 - 350 MCM CU - Mech. AL	11
14	SFHA	90	3		(1) - #8 - 350 MCM CU - Mech. AL	11
15	SFHA	90	3		(1) - #8 - 350 MCM CU - Mech. AL	11
16	SFHA	90	3		(1) - #8 - 350 MCM CU - Mech. AL	11
17	SFHA	90	3		(1) - #8 - 350 MCM CU - Mech. AL	11
18	SFHA	90	3		(1) - #8 - 350 MCM CU - Mech. AL	11

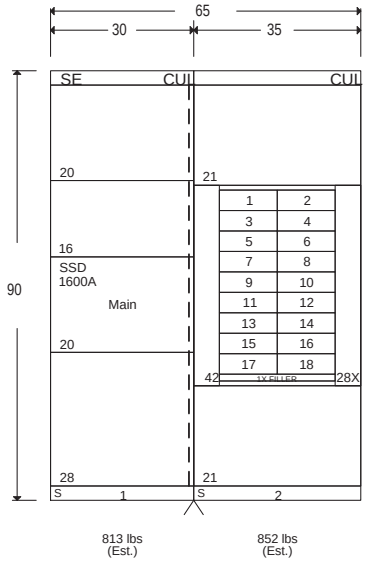
NOTES:

1. Equipment ground bus furnished with lugs.
2. Copper ground bus furnished.
3. Switchboard furnished with Nameplates.
4. All Nameplates to be fastened with screws.
5. Shipping splits between each section, ship each section separately.
6. Switchboard furnished with fully rated panel.
7. Maintenance, wiring terminals and feeder device installations are front accessible.
   Access to rear of switchboard is required for assembling switchboard sections.
8. Device furnished with ETU (LSIG) programmer.
9. Device is furnished with integral ground fault protection.
10. Device furnished with drawout mounting.
11. Device furnished with padlocking provisions.
12. Device requires RELT or ZSI feature if Authority having jurisdiction has adopted NEC 2014 code requirements.
13. Estimated total factory connected wiring points for the lineup 4.
14. Estimated shipping weight for the lineup is 1665 lbs.

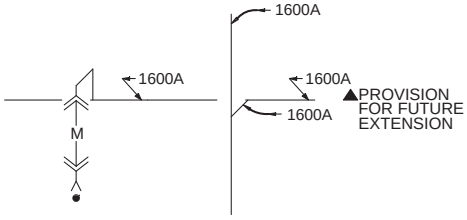
PROJECT NAME : Trenton Coal Rail Car Heaters	DWG TITLE: Device Information	CREATED BY: Dimassi, Sobhi	PRODUCT NAME: *Spectra Series* ™ *Switchboard*	GE Industrial Solutions	DRAWING NO:
CUSTOMER: AESCO CORP LIMITED, DARTMOUTH		CHECKED BY:			ITEM NO: 3
		APPROVED BY:			MARKS:
		DATE: 6/7/2018 4:28:23 PM			QUOTE NO: CA7-00000044
		REVISION NO.:			SHEET: 1 of 3

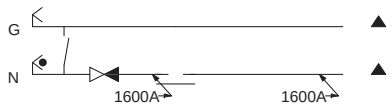
W2 Date:6/7/2018 4:48:35 PM 410001229

ACCESS TO:	Front Only	PHASE:	3P4W
CLASS:	2	AMPERE:	1600A
LABEL:	CUL SE	BUS MTL:	Cu 1000A/in²
VOLTAGE:	600/347V	PLATE:	Silver Plate
STYLE:	Bolt-On	RATING:	Fully Rated
BUS BRACING (RMS SYM):			65000A
DEV.MIN.INT.RATING (RMS SYM):			22000A



FRONT VIEW





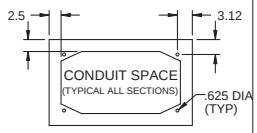
BUSSING DIAGRAM

●(5) 500 MCM CU
COMPRESSION (2 HOLE) CU
PER PHASE & NEUTRAL

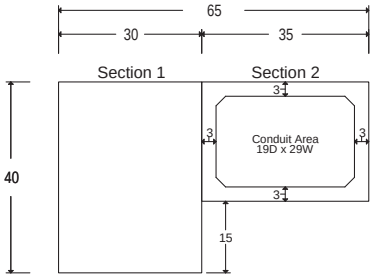
PROJECT NAME : Trenton Coal Rail Car Heaters	DWG TITLE: Front View/ Bussing	CREATED BY: Dimassi, Sobhi	PRODUCT NAME: *Spectra Series ™ Switchboard*	GE Industrial Solutions	DRAWING NO:
CUSTOMER: AESCO CORP LIMITED, DARTMOUTH		CHECKED BY:			ITEM NO: 3
		APPROVED BY:			MARKS:
		DATE: 6/7/2018 4:28:23 PM			QUOTE NO: CA7-00000044
		REVISION NO.:			SHEET: 2 of 3

W2 Date:6/7/2018 4:48:35 PM 410001229

ACCESS TO:	Front Only	PHASE:	3P4W
CLASS:	2	AMPERE:	1600A
LABEL:	CUL SE	BUS MTL:	Cu 1000A/in²
VOLTAGE:	600/347V	PLATE:	Silver Plate
STYLE:	Bolt-On	RATING:	Fully Rated
BUS BRACING (RMS SYM):			65000A
DEV.MIN.INT.RATING (RMS SYM):			22000A

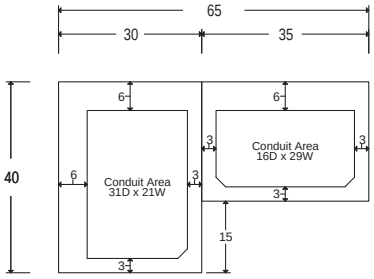


Top Conduit Area



Front Plan View

Bottom Conduit Area



Front Plan View

PROJECT NAME : Trenton Coal Rail Car Heaters	DWG TITLE: Conduit View	CREATED BY: Dimassi, Sobhi	PRODUCT NAME: *Spectra Series ™ Switchboard*	GE Industrial Solutions	DRAWING NO:	
CUSTOMER: AESCO CORP LIMITED, DARTMOUTH		CHECKED BY:			ITEM NO:	3
		APPROVED BY:			MARKS:	
		DATE: 6/7/2018 4:28:23 PM			QUOTE NO:	CA7-00000044
		REVISION NO.:			SHEET:	3 of 3

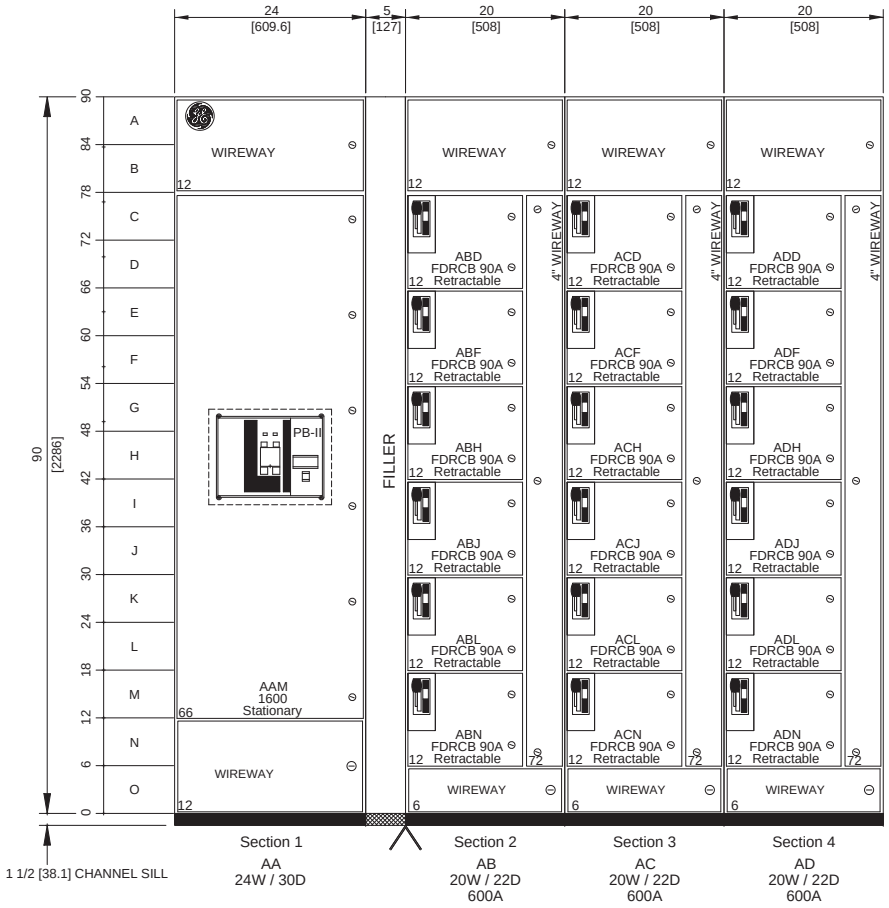
W2 Date:6/7/2018 4:48:34 PM 410001229

ALL DIMENSIONS SHOWN ARE IN INCHES [MM].

DESIGNATES SHIPPING SPLIT

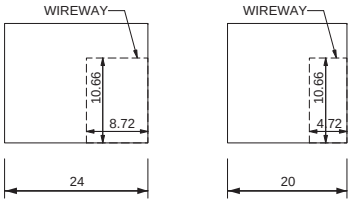
OVERALL EQUIPMENT RATING

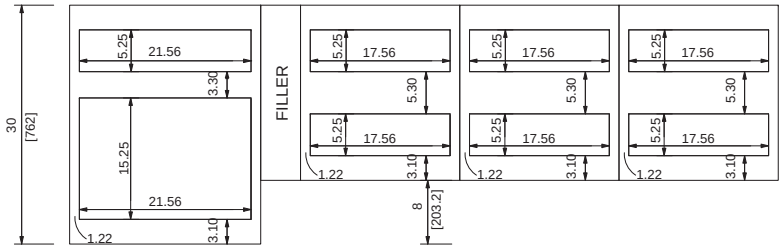
SYSTEM VOLTAGE: 600V
PHASE - WIRE 3P4W
FREQUENCY 60 Hertz
SYSTEM CURRENT RATING: 1600
SHORT CIRCUIT RATING: 22000
MAIN BUS AMPS: 1600
GROUND AMPS: 300A
NEUTRAL: 50% Rating
BUS BRACING: 65000
BUS MATERIAL / PLATING TYPE: COPPER/TIN (STD)
ENCLOSURE: NEMA 1G
MOUNTING TYPE: Front Only
WIRE CLASS: II-BT
CONTROL VOLTAGE: 120
VERTICAL MINIMUM BUS CURRENT RATING: 300
STANDARD: cUL
NUMBER OF SECTIONS 4

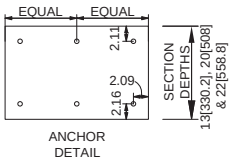


PROJECT NAME: Trenton Coal Rail Car Heaters	DRAWING TITLE: Front View	CREATED BY: Dimassi, Sobhi	PRODUCT NAME: E9000 EVOLUTION Motor Control Center	GE Industrial Solutions	DRAWING NO:
CUSTOMER: AESCO CORP LIMITED,- DARTMOUTH		CHECKED BY:			ITEM NO: 4
W1 Date:6/7/2018 4:48:56 PM		APPROVED BY:			MARKS: MCC OPTION DRAW OUT
		DATE: 6/7/2018 4:28:23 PM			QUOTE NO: CA7-00000044
		REVISION NO. 006A000000c0tKbIAI			SHEET:

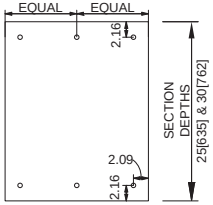
ALL DIMENSIONS SHOWN ARE IN INCHES [MM].



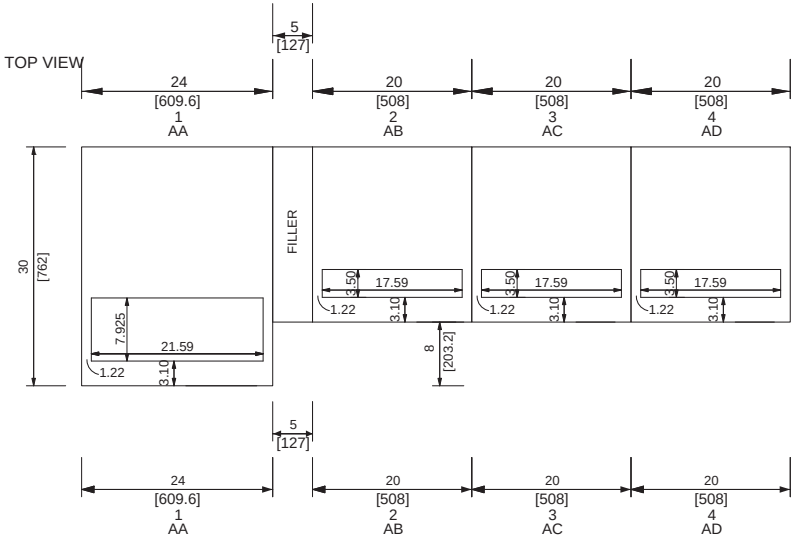




ANCHOR DETAIL



ANCHOR DETAIL



PROJECT NAME : Trenton Coal Rail Car Heaters	DRAWING TITLE: Conduit View	CREATED BY: Dimassi, Sobhi	PRODUCT NAME: E9000 EVOLUTION Motor Control Center	GE Industrial Solutions	DRAWING NO:
CUSTOMER: AESCO CORP LIMITED,- DARTMOUTH		CHECKED BY:			ITEM NO: 4
		APPROVED BY:			MARKS: MCC OPTION DRAW OUT
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		REVISION NO. 006A000000c0tKbIAI			SHEET:

W1 Date:6/7/2018 4:48:56 PM

UNIT LOC	CIRCUIT NAME	WIRE DIAGRAM	FUNCTION	HEIGHT	SIZE	HP, KW, K=KW	FULL LOAD AMPS	RPM	SERVICE FACTOR	OVERLOAD HEATER	OVERLOAD RELAY	CIRCUIT BREAKER/ SWITCH	TRIP FUSE/ CLIP	FUSES BY	TOTAL INTERLOCK NO	TOTAL INTERLOCK NC	CPT VA	INDICATING LIGHTS	SWITCH	PUSH BUTTON	NOTES
AAM	BLANK NP		MAINCB	66								SHF1600	1600A								
	Stationary Stab.																				
ABD	BLANK NP		FDRCB	12								SELT	90A								
	Retractable Stab.																				
ABF	BLANK NP		FDRCB	12								SELT	90A								
	Retractable Stab.																				
ABH	BLANK NP		FDRCB	12								SELT	90A								
	Retractable Stab.																				
ABJ	BLANK NP		FDRCB	12								SELT	90A								
	Retractable Stab.																				
ABL	BLANK NP		FDRCB	12								SELT	90A								
	Retractable Stab.																				
ABN	BLANK NP		FDRCB	12								SELT	90A								
	Retractable Stab.																				
ACD	BLANK NP		FDRCB	12								SELT	90A								
	Retractable Stab.																				
ACF	BLANK NP		FDRCB	12								SELT	90A								
	Retractable Stab.																				
ACH	BLANK NP		FDRCB	12								SELT	90A								
	Retractable Stab.																				
ACJ	BLANK NP		FDRCB	12								SELT	90A								
	Retractable Stab.																				
ACL	BLANK NP		FDRCB	12								SELT	90A								
	Retractable Stab.																				
ACN	BLANK NP		FDRCB	12								SELT	90A								
	Retractable Stab.																				
ADD	BLANK NP		FDRCB	12								SELT	90A								
	Retractable Stab.																				
ADF	BLANK NP		FDRCB	12								SELT	90A								
	Retractable Stab.																				
ADH	BLANK NP		FDRCB	12								SELT	90A								
	Retractable Stab.																				
ADJ	BLANK NP		FDRCB	12								SELT	90A								
	Retractable Stab.																				
ADL	BLANK NP		FDRCB	12								SELT	90A								
	Retractable Stab.																				
ADN	BLANK NP		FDRCB	12								SELT	90A								
	Retractable Stab.																				

PROJECT NAME : Trenton Coal Rail Car Heaters	DRAWING TITLE: Unit Summary	CREATED BY: Dimassi, Sobhi	PRODUCT NAME: E9000 EVOLUTION Motor Control Center	GE Industrial Solutions	DRAWING NO:
CUSTOMER: AESCO CORP LIMITED,- DARTMOUTH		CHECKED BY:			ITEM NO: 4
W1 Date:6/7/2018 4:48:56 PM		APPROVED BY:			MARKS: MCC OPTION DRAW OUT
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		REVISION NO. 006A000000c0tKbIAI			SHEET:

GENERAL NOTES FOR ENTIRE JOB:

1. UL Labeled Section can be determined by UL in top wireway of Front View Drawing. UL Labeled Unit can be determined from column marked UL label on unit summary drawing.
2. MCC Enclosure is furnished per Nema Type 1 Gasketed specifications.
3. All Drawout type units will be provided with Shielded Disconnect Screw.
4. Heat shrink non PVC wire markers required on both ends of all control wires.
5. Heat Shrink all power wire markers.
6. Tin-Plated Stabs are furnished with stab units.
7. Hi-Density Pull-Apart Control Terminal Boards will be supplied.
8. Lineup contains units with Retractable Stabs.
9. MTW VW1 wire required for all control wire.
10. MTW VW1 wire required for all power wire.
11. Standard Stripped wire connections on all power wire.
12. Standard stripped wire connections on all control wires.
13. Standard power terminal boards will be supplied.
14. Communication wiring will NOT be provided from the factory for any devices in the lineup.
15. Standard blank doors provided for starter units without any pilot lights, selector switches or push buttons selected.
16. MCC Furnished with Black with White Text Unit Nameplates.
17. Main, Vertical, Ground and Neutral Bus will be furnished with Double Bolt Joints.
18. MCC qualified for Seismic Ratings per publication DET-463 and OSP-0093-10.
19. Each vertical section will be provided with Rear Covers.

PROJECT NAME : Trenton Coal Rail Car Heaters	DRAWING TITLE: Notes Sheet	CREATED BY: Dimassi, Sobhi	PRODUCT NAME: E9000 EVOLUTION Motor Control Center	GE Industrial Solutions	DRAWING NO:
CUSTOMER: AESCO CORP LIMITED,- DARTMOUTH		CHECKED BY:			ITEM NO: 4
		APPROVED BY:			MARKS: MCC OPTION DRAW OUT
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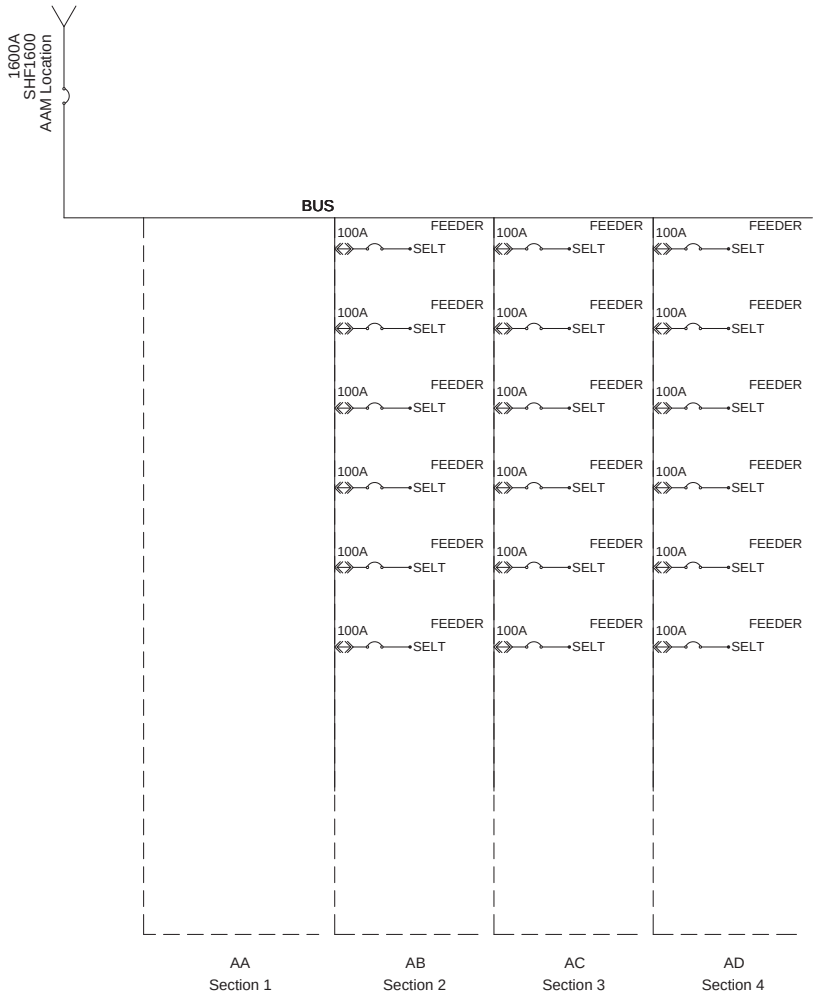

PROJECT NAME : Trenton Coal Rail Car Heaters	DRAWING TITLE: Line Diagram	CREATED BY: Dimassi, Sobhi	PRODUCT NAME: E9000 EVOLUTION Motor Control Center	GE Industrial Solutions	DRAWING NO:
CUSTOMER: AESCO CORP LIMITED,- DARTMOUTH		CHECKED BY:			ITEM NO: 4
		APPROVED BY:			MARKS: MCC OPTION DRAW OUT
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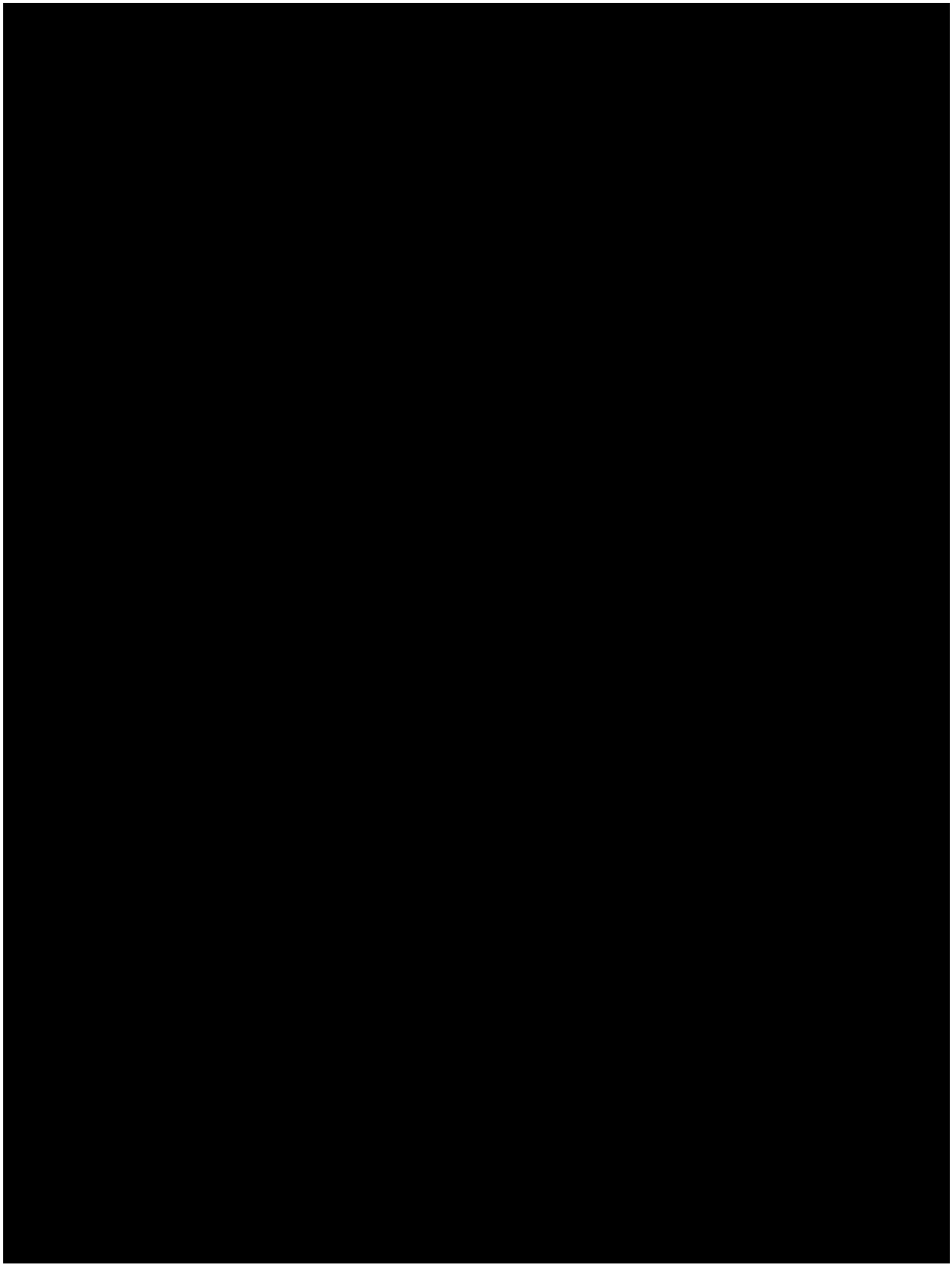

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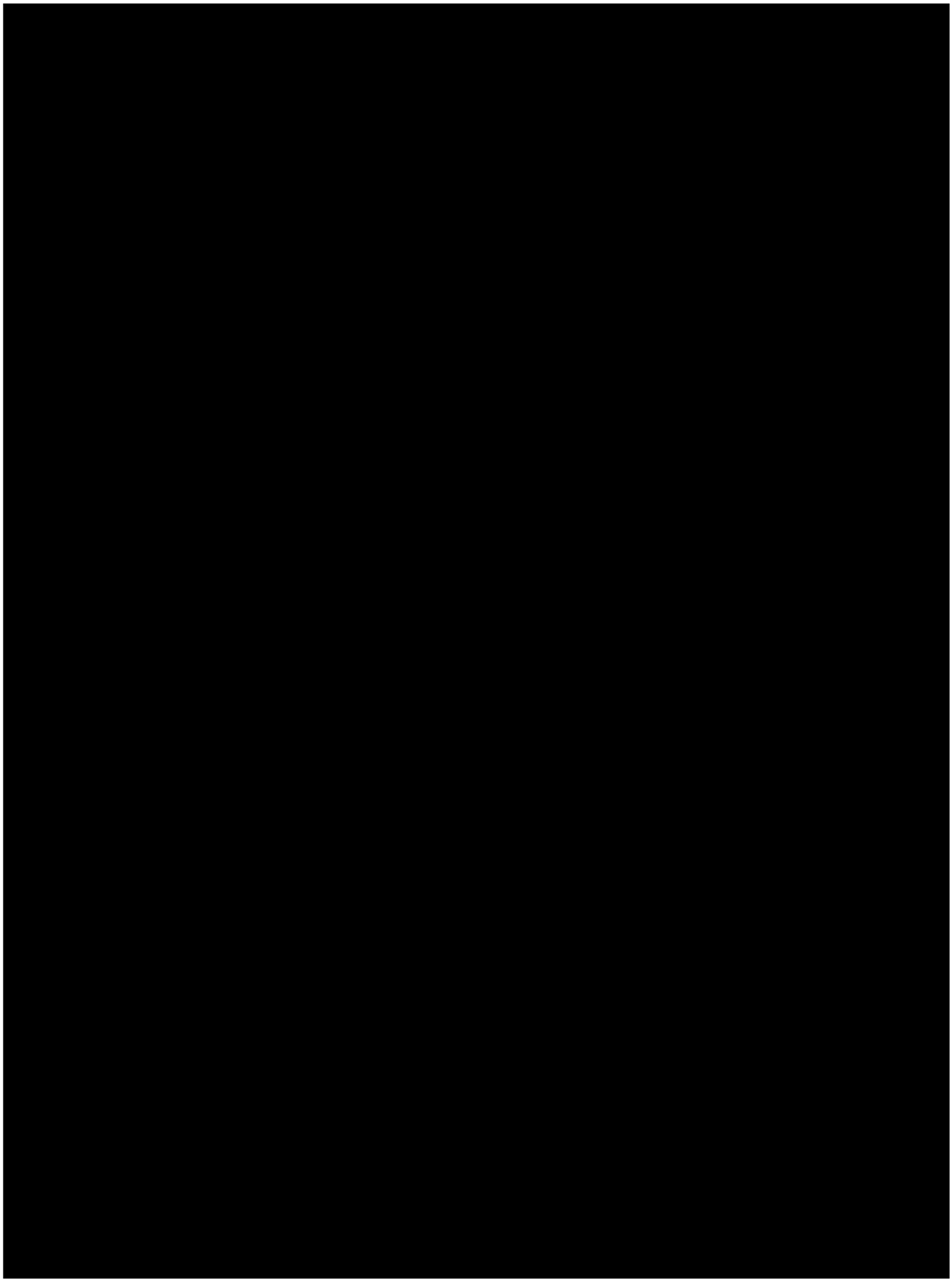

CI Number: 51238

Title: TRE Asbestos Abatement 2019

Start Date:	2017/07
In-Service Date:	2019/11
Final Cost Date:	2020/05
Function:	Steam
Forecast Amount:	$1,030,841

DESCRIPTION:

Unit 5 of the Trenton Generating Station has been in operation since 1969. Much of the insulation used during the construction of Unit 5 was asbestos-based. Trenton Units 3 and 4 were also constructed when asbestos was prevalent for industrial insulating purposes. Much of the asbestos from these two units has been removed over the years, though some remains. The asbestos remaining in these areas continues to be inspected and is included in the Trenton asbestos monitoring plan. NS Power has been completing asbestos abatement at the Trenton Generating Station as part of a multi-year plan. Pursuant to the Board's direction in its Decision regarding CI 47600 - TRE Asbestos Abatement (2016) and NS Power's update letter of December 28, 2017 (M07855), the Company will provide another update to the UARB regarding its asbestos management efforts prior to the end of 2018. This project continues the removal of asbestos contaminated insulation materials from the Trenton Generating Station that may become exposed through regular operation, maintenance activities and equipment vibration.

The scope of this project is to conduct asbestos abatement in multiple areas of the Trenton Generating Station, in accordance with the Occupational Health and Safety Act (OHSA) and the Department of Labour's "Asbestos in the Workplace" guide which states:

> Where asbestos is present or believed to be present in a workplace to which the Occupational Health and Safety Act applies, the owner of the building and any employer whose workplace in the building may contain asbestos have a duty under the Act to take all reasonable precautions to ensure the health and safety of persons at or near that workplace.

The utilization of Trenton 5 will continue to decrease as more of NS Power's electricity requirements are met by renewable sources. Lower operating hours will increase unit cycling causing more thermal pipe expansion and deteriorating of asbestos insulation.

The 2019 project will continue the abatement effort with the following activities:

- Abatement of Unit 5 High Energy Piping:

  During the planned outage for Unit 5 in 2019, asbestos abatement will be completed on select areas of high energy piping and infrastructure. The areas for abatement will concentrate on piping that is prone to large movement during boiler starts and stops, which are thereby susceptible to repeated deterioration of the asbestos encapsulation. Areas for abatement will also be based on current site conditions and high traffic such as the 1st floor of the Unit 5 boiler house around the Boiler Feed Pumps on the north side of the boiler house. This area also requires frequent (annual) assessment of the high energy piping for flow assisted corrosion (HEP/FAC).

  Finalization of abatement for the areas to be addressed under this project will require select bends and elbows insulation to be removed to complete the assessment. Considerations of the other outage work being completed in the area and the length of the outage will be the final determination of how much of the area can be completed. Completing the abatement on this area will decrease risks to plant personnel. Completing the abatement during the unit outage will maximize the efficient execution of the abatement and lower the cost by completing a large portion of the abatement at one time.

These measures will be taken to properly mitigate the potential spread of asbestos fibers throughout the boiler house. The scope of work generally includes scaffolding to access the piping, installation of temporary enclosure over the entire area, the removal and disposal of asbestos-contaminated insulation, and re-insulation of the piping with asbestos-free insulation. This abatement work must be done while the unit is offline.

- Balance of Plant Encapsulation/Abatement:

  Over the course of 2019, regular inspections of the asbestos inventory will be conducted. The inspections will enable NS Power to identify deficiencies and to complete the balance of plant repairs/encapsulation/cleanup for unplanned miscellaneous asbestos issues as they are identified through day to day plant activities and operations.

- Unit 5 Outage Support:

  Based on previous experience, it is evident that despite regular inspection and encapsulation, some affected areas remain mostly undiscovered until such time that maintenance is required. With the increased amount of maintenance that occurs with a planned outage, NS Power will have asbestos abatement support available to monitor and complete encapsulation/abatement as required during the outage.

A breakdown of the approximate abatement/encapsulation costs by scope is as follows:

Project	Estimated Contract Cost
U5 High Energy Piping – temporary enclosure and abatement	$653K
U5 Boilerhouse – Quarterly Inspections and encapsulation (Q1 through Q4)	$20K
U5 Balance of plant – Unplanned	$20K
U5 2018 Outage Support – Miscellaneous Items	$25K
Risk Ranking Assessment	$50K

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 CI 49553 TRE Asbestos Abatement 2017 $728,886
- 2018 CI 51816 TRE Asbestos Abatement 2018 $509,035
- 2020 CI TBD TRE Asbestos Abatement 2020 $TBD
- 2021 CI TBD TRE Asbestos Abatement 2021 $TBD

JUSTIFICATION:

Justification Criteria: Health & Safety

Why do this project?

Exposure of asbestos fibers poses a health risk to plant personnel. Degenerated asbestos insulation causes maintenance delays, increased down time and increased operating costs. Asbestos abatement and encapsulation are required to remove or mitigate health hazards to plant personnel associated with exposure to asbestos fibers. This project is in accordance with the Occupational Health and Safety Act (OHSA) and the Department of Labour's "Asbestos in the Workplace" guide.

The removal of asbestos-based insulation at the Trenton Generation Station is being completed in a multi-phase program based on risk, Joint Occupational Health and Safety Committee (JOSHC) recommendations, and equipment replacement requirements and planned outages.

Why do this project now?

The abatement and encapsulation work completed in this project is required to safely continue to operate the plant and to execute planned outage work (in some cases), as well as plan for future maintenance work. The operation of the unit will continue to vary due to decreased utilization and capacity as more of NS Power's electricity requirements are met by renewable sources. With more stops and starts occurring on the unit, the level of vibrations and potential for asbestos disturbances will increase.

In accordance with the Occupational Health and Safety Act (OHSA) and the Department of Labour's "Asbestos in the Workplace" guide, the Trenton Station has an asbestos management plan in place to manage the risks and protect the employees. This management plan includes an inventory of the asbestos containing insulation, which requires inspection on a regular basis. Subsequent to the inspections, any necessary encapsulation/abatement is completed.

Why do this project this way?

The scope of work itself is driven by safety compliance. A continued effort is required to monitor, remove and encapsulate asbestos containing materials. Ongoing inspection and selective abatement based on condition and wear are the best options to reduce further disruption and lost production due to repairs/maintenance that will be required in this area now and in the future.

CI Number 51238 - TRE Asbestos Abatement Program 2019

Project Number 51238-SI71

Parent CI Number : -

Asset Location : 1168 - 1168 Trenton Common Property

Budget Version 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0300 - SGP - Bldg.,Struct.Grnd.	370,191
Retirements	0300 - SGP - Bldg.,Struct.Grnd.	660,650
	Total Cost:	1,030,841
	Original Cost:	55,099

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI# : 51238
Title: TRE Asbestos Abatement 2019
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Utility	PD	80	$ 240	$ 19,214		
Power Plant Tech (Chem)	PD	5	$ 382	$ 1,911		
				$ -		
			Sub-Total	$ 21,125		CI 49553/51816
OT Labour						
Utility	PD	20	$ 480	$ 9,607		
Power Plant Tech (Chem)	PD	5	$ 764	$ 3,821		
			Sub-Total	$ 9,607		CI 49553/51816
Term Labour						
Utility	PD	80	$ 240	$ 19,214		
				$ -		
			Sub-Total	$ 19,214		CI 49553/51816
Materials						
Misc. Materials	lot	1	$ 500	$ 500		
			Sub-Total	$ 500		
Contracts						
Asbestos Abatement U5 High Energy Piping	lot	1	$ 248,000	$ 248,000		CI 49553/51816
Asbestos Abatement Balance of Plant	lot	1	$ 40,000	$ 40,000		CI 49553/51816
U5 outage Abatement Support	lot	1	$ 25,000	$ 25,000		CI 49553/51816
Staging Setup and Inspection	lot	1	$ 300,000	$ 300,000		CI 49553/51816
Re-insulation	lot	1	$ 80,000	$ 80,000		CI 49553/51816
Supervision	lot	1	$ 25,000	$ 25,000		CI 49553/51816
Abatement Consultant - Risk Ranking Assessment	lot	1	$ 50,000	$ 50,000		
				$ -		
			Sub-Total	$ 768,000		
OT Meals						
Meals	lot	1	$ 500	$ 500		
			Sub-Total	$ 500		
Rentals						
Staging	lot	1	$ 10,000	$ 10,000		
JLG Boom Lift	lot	1	$ 5,000	$ 5,000		
			Sub-Total	$ 15,000		
Freight						
Staging	lot	1	$ 1,000	$ 1,000		
			Sub-Total	$ 1,000		
Other Goods & Services						
Contingency	lot	10%	$ 817,947	$ 81,795		
			Sub-Total	$ 81,795		
Interest Capitalized						
AFUDC				$ 10,770		
			Sub-Total	$ 10,770		
Administrative Overhead						
Labour AO				$ 12,301		
Contracts AO				$ 91,028		
			Sub-Total	$ 103,329		
			SUB-TOTAL (no AO, AFUDC)	$ 916,741		
			TOTAL (AO, AFUDC included)	$ 1,030,841		
Original Cost				$ 55,099		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.

CI Number: C0010323

Title: TRE6 Mills Refurbishment 2019

Start Date: 2019/07
In-Service Date: 2019/08
Final Cost Date: 2020/02
Function: Steam
Forecast Amount: $796,370

DESCRIPTION:

This project is to refurbish the coal mills on Trenton 6, which utilize two Foster Wheeler D-10 Ball Mill Coal Pulverizers (6A & 6B) to size the coal for combustion in the boiler. These mills were originally installed and commissioned in 1991 and have been subjected to continuous use since this time, with the exception of shutdowns.

Refurbishments for these mills are scheduled every two years to coincide with planned unit outages. These mills were last refurbished in 2017. Completing refurbishments during the 2019 planned outage is important for unit reliability.

Scope for this project includes the following:
- Replace raw coal pipes
- Replace trunnion bearing seals
- Replace ribbon conveyors and bearings
- Replace grinding media

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 CI 49535 TRE6 Mill Refurbishment 2017 $822,141
- 2021 CI TBD TRE6 Mills Refurbishments 2021 $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

This project is being undertaken to preserve the unit's performance. Mill maintenance can be a significant cost to the station, and a number of initiatives have been undertaken to extend component life, reduce mill forced outages, maximize mill availability and extend running hours between overhauls in efforts to reduce these costs. This project, similar to previous mill refurbishment projects, focuses on employing optimal practices in order to improve the performance of the raw coal supply system to each mill and to extend the reliability of mill rotating elements and associated components. In the event of an unplanned failure of these mills, the unit would experience a 70MW derate in generating capacity.

Why do this project now?

The 2019 Unit 6 planned outage is a six-week shutdown, and will provide the ideal timeframe to complete the aforementioned refurbishment of both mills in a planned and cost effective manner. If not completed now, reliability of the mills will be at risk.

Why do this project this way?

Replacement parts are now required due to age and wear on many of the mill components. Refurbishment of these components is not an option due to the age and wear. Re-establishing Original Equipment Manufacturer (OEM) physical specifications and the replacement of worn components will prevent degradation in mill and plant performance.

CI Number : C0010323 - TRE6 Mills Refurbishment 2019 **Project Number** C0010323

Parent CI Number : -

Asset Location : 1166 - 1166 Trenton Unit 6; Commissioned 1991, 170 Mwh **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1800 - SGP - Fuel Hndlg.Coal	642,238
Retirements	1800 - SGP - Fuel Hndlg.Coal	154,132
	Total Cost:	796,370
	Original Cost:	628,308

Capital Project Detailed Estimate

Location: **Trenton Generating Station**
CI# : C0010323
Title: TRE6 Mills Refurbishment 2019
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	15	$ 358	$ 5,374.23		
Engineering	PD	30	$ 405	$ 12,159		
Maintenance Trades	PD	300	$ 365	$ 109,436		
Utility Worker	PD	60	$ 240	$ 14,411		
			Sub-Total	$ 141,380		CI 49535
OT Labour						
Maintenance Trades	PD	60	$ 730	$ 43,774		
Utility	PD	60	$ 480	$ 28,821		
			Sub-Total	$ 72,596		CI 49535
Term Labour						
Maintenance Trades	PD	300	$ 365	$ 109,437		
Utility	PD	50	$ 240	$ 12,005		
			Sub-Total	$ 121,442		CI 49535
Materials						
Ribbon Conveyors	ea	4	$ 25,900	$ 103,600		CI 49535
Grinding Media (Balls)	lot	1	$ 60,000	$ 60,000		CI 49535
Trunion Bearing Seals	lot	1	$ 12,000	$ 12,000		CI 49535
Ribbon Conveyor Bearings	lot	1	$ 14,000	$ 14,000		CI 49535
Plate	lot	1	$ 5,000	$ 5,000		CI 49535
Spokes	lot	1	$ 8,000	$ 8,000		CI 49535
Fire Sprinklers	lot	1	$ 5,000	$ 5,000		CI 49535
Lubricants	lot	1	$ 7,000	$ 7,000		
Consumables	lot	1	$ 10,000	$ 10,000		CI 49535
			Sub-Total	$ 224,600		
Contracts						
Forklift Rental	lot	1	$ 7,000	$ 7,000		
Vacuum Services	lot	1	$ 40,000	$ 40,000		
Machining	lot	1	$ 20,000	$ 20,000		
Boom Truck Rental	lot	1	$ 2,000	$ 2,000		
TA Support	lot	1	$ 20,000	$ 20,000		
			Sub-Total	$ 89,000		CI 49535
Rentals						
Ball Sorter	lot	1	$ 7,000	$ 7,000		
			Sub-Total	$ 7,000		
Freight						
Ball Sorter	lot	1	$ 7,000	$ 7,000		
			Sub-Total	$ 7,000		
OT Meals						
Meals	lot	1	$ 1,000.00	$ 1,000		
			Sub-Total	$ 1,000		
Other Goods & Services						
Contingency	%	10%	$ 435,042	$ 43,504		
				$ -		
			Sub-Total	$ 43,504		
Administrative Overhead						
Labour AO	lot	1	$ 83,718	$ 78,148		
Contracts AO	lot	1	$ 11,163	$ 10,700		
			Sub-Total	$ 88,848		
			SUB-TOTAL (no AO, AFUDC)	$ 707,522		
			TOTAL (AO, AFUDC included)	$ 796,370		
Original Cost				$ 628,308		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0008098

Title: TRE Sludge Dewatering Infrastructure

Start Date: 2018/05
In-Service Date: 2019/07
Final Cost Date: 2020/01
Function: Steam
Forecast Amount: $687,005

DESCRIPTION:

This project is to install the permanent infrastructure required to provide the Trenton Generating Station with a means to dewater the sludge produced by the Waste Water Treatment Plant (WWTP) basins in order to be able to transport the sludge off-site for disposal. This sludge can no longer be hauled to the Trenton Ash Management Site as Nova Scotia Environment (NSE) will not permit hauling sludge to the Trenton Ash Management Site after 2018. Dewatering infrastructure will allow for plant personnel to complete the dewatering activities without the use of contractors and pumper trucks to remove the sludge from the basins. The infrastructure construction for the dewatering area will include the following components:

- a laydown area, fill, pipework, and fencing;
- a concrete containment pad and push wall;
- polymer feed / mixing system; and
- sludge pumps, valves and controls.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."
No other projects in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Environment

Why do this project?

Operating Approval 2006-054488-10 for the Trenton Generating Station Section 9 outlines the discharge limits for the Waste Water Treatment Plant. In order to meet effluent requirements, the process water from the Trenton Generating Station is treated at the WWTP. The resulting sludge from this treatment process is also managed in accordance with the Operating Approval (Section 11. s.) and Sludge Management Plan (originally approved under the former Operating Approval 2006-054488-A05).

Dependent on unit utilization and planned outage intervals (due to boiler or air heater wash, for example) the basins require sludge "cleanout". The current active Ash Management Site is located 11 km away from the plant, which means the sludge needs to be dewatered for a more cost and time effective means to transport the sludge for disposal. This sludge can no longer be hauled to the Trenton Ash Management Site as NSE will not permit hauling sludge to the Trenton Ash Management Site after 2018. The current method for dewatering is labour intensive and requires coordination with a contractor to remove the sludge and provide mixing tanks/hoses to facilitate the process. Having permanent infrastructure in place will allow plant staff to be self-sufficient with the dewatering and sludge management activities, and will also remove the requirement for rentals and vacuum truck services.

Why do this project now?

This sludge can no longer be hauled to the Trenton Ash Management Site as NSE does not permit the hauling of sludge to the Trenton Ash Management Site after 2018. This project needs to be completed in 2019 so further sludge from the Trenton Generating Station can be treated and hauled to the Abercrombie Ash Site for disposal as per section 11. s. of the Operating Approval.

Why do this project this way?

NS Power engaged CBCL to assist with the evaluation of alternatives for treatment of the sludge (Attachment 1). The options analysis considered several possible de-watering solutions. The report concludes that the use of dewatering bags (geotubes) is the best option considering the characteristics of the site and the sludge.

CI Number : C0008098 - TRE Sludge Dewatering Infrastructure

Project Number C0008098

Parent CI Number : -

Asset Location : 1168 - 1168 Trenton Common Property

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0700 - SGP - Environmental	687,005
	Total Cost:	687,005
	Original Cost:	

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI# : C0008098
Title: TRE Sludge Dewatering Infrastructure
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	12	$ 358	$ 4,299		
Engineering	PD	20	$ 405	$ 8,106		
Utility Worker	PD	4	$ 240	$ 961		
			Sub-Total	$ 13,366		
OT Labour						
Engineering	PD	3	$ 811	$ 2,278		
			Sub-Total	$ 2,278		
Term Labour						
Power Plant Technician	PD	15	$ 382	$ 5,732		
			Sub-Total	$ 5,732		
Term OT Labour						
Power Plant Technician	PD	0	$ 764	$ 154		
			Sub-Total	$ 154		
Travel						
Travel	lot	1	$ 2,000	$ 2,000		
			Sub-Total	$ 2,000		
Materials						
Dewatering Bags for Trial	lot	2	$ 3,575	$ 7,151		
Dewatering Bags	lot	2	$ 2,681	$ 5,362		
Misc Valves, Hoses, Piping	lot	1	[redacted]		Attachment 2, Division 40	
Pollution Control Equipment	Lot	1			Attachment 2, Division 44	
Misc Equipment	lot	1	$ 10,000	$ 10,000		
			Sub-Total	$ 205,213		
Contracts						
Dewatering Bag Trials	lot	1	$ 89,398	$ 89,398		
General Mob/Setup	lot	1	[redacted]		Attachment 2, Division 1	
Concrete Works	lot	1			Attachment 2, Division 3	
Metal Works	lot	1			Attachment 2, Division 5	
Moisture Protection	lot	1			Attachment 2, Division 7	
Wiring	lot	1			Attachment 2, Division 26	
Earthworks	lot	1			Attachment 2, Division 31, 32, 33	
Overheads	lot	1			Attachment 2	
Project Manager	lot	1	$ 26,528	$ 26,528		
			Sub-Total	$ 283,117		
Consulting						
Preliminary Engineering/Design	lot	1	$ 34,485	$ 34,485		
Engineering/Design	lot	1	$ 28,215	$ 28,215		
			Sub-Total	$ 62,700		
Meals						
Meals	lot	1	$ 175	$ 175		
				$ -		
			Sub-Total	$ 175		
OT Meals						
Meals	lot	1	$ 325	$ 325		
				$ -		
			Sub-Total	$ 325		
Other Goods & Services						
Contingency	%	10%	$ 564,396	$ 56,440		
				$ -		
			Sub-Total	$ 56,440		
Interest Capitalized						
AFUDC				$ 19,181		
				$ -		
			Sub-Total	$ 19,181		
Administrative Overhead						
Labour AO				$ 5,023		
Contracts AO				$ 31,302		
			Sub-Total	$ 36,324		
			SUB-TOTAL (no AO, AFUDC)	$ 631,499		
			TOTAL (AO, AFUDC included)	$ 687,005		
Original Cost				$ -		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

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May 1, 2017

Ms. Jane Hatchard
Trenton Generating Station
Nova Scotia Power Inc.

Dear Ms. Hatchard:

RE: Sludge Management Options Study DRAFT

Background

Sludge management for the Trenton Effluent Treatment System has included the disposal of wet sludge into the Trenton Ash Management Site (TAMS) since the plant began operation in the early 1990s. The closure of the TAMS necessitates the development of a new sludge management plan. Prior to confirming the sludge management plan, treatment and disposal options must first be reviewed and the most applicable option selected. The study herein includes a review of the existing sludge management methods and identifies treatment and disposal options for future sludge management following the closure of TAMS. The study was prepared with the understanding that disposal can occur at the Abercrombie Ash Management Site (AAMS) in the future. If the provincial permit instead requires Trenton's sludge to meet Nova Scotia Landfill Guidelines, this sludge management study will need to be revised to meet the new disposal criteria.

Effluent Treatment Process

The Trenton Generating Station wastewater treatment system consist of multiple settling ponds and chemical treatment processes to remove suspended solids and dissolved metals. The effluent is received from coal pile runoff, sumps, boiler blowdown, ash silo drainage, chemical cleaning effluent, and drainage from various other parts site. Runoff collects into three leachate settling ponds (Pond A, Pond B, and Pond C) to remove heavy sediments such as coal fines, ash and various other particulate materials. Pond C is the final collection point upstream of effluent treatment basins. Pond C wastewater is chemically treated to adjust the pH and precipitate dissolved metals. Following metals precipitation, wastewater is directed to the effluent treatment basins for final settling of metals precipitate before final discharge.

This process is designed to accumulate sludge in the ponds and basins overtime as solids are removed from wastewater. When treated effluent quality is negatively affected by sludge volumes, sludge must be removed from the ponds. Historically, effluent treatment basin sludge has been removed using a vacuum truck while the sludge from Ponds A–C was removed via excavator. Sludge removals occur about 3–4 times per year, mainly from the effluent treatment settling basins. All sludge to-date extracted from these ponds and basins has been disposed of at TAMS.

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Sludge Characterization

Before confirming the future sludge management plan, it is advised to collect and analyze fresh sludge samples from all ponds and basins and to test percent solids and the specific sludge parameters outlined in the most recent Industrial Permit. The historical characteristics of Ponds A–C and the ETS basins are described below.

Ponds A-C

Ponds A–C contain the most highly dense sludge as this is where the majority of coal and ash particulate is settled. At an estimated 35% solids, NSP reports that approximately 40 truckloads (400 m^3) of wet sludge are removed from Pond A and 20 truckloads (200 m^3) are removed from Pond B every two years (accumulating 200 m^3 and 100 m^3 per year respectively). Pond C does not accumulate solids as rapidly and requires sludge removal infrequently. It is estimated that Pond C accumulates 25 m^3 of 35% sludge annually in comparison.

The sludge in Ponds A–C is composed mainly of coal fine, ash, and occasional boiler blowdown solids (iron, metal particulates). Of the wet solids removed from these ponds, coal fines are identified visually by staff and placed back on coal piles for drying and incorporation back into the fuel mix. All other materials deemed unsuitable to incorporate with the fuel mix are disposed of at TAMS via dump truck.

Effluent Treatment Basins (A&B)

Not to be confused with Ponds A & B, the effluent treatment basins (Basin A and Basin B) contain metal precipitate sludge from the chemically treated wastewater. This sludge accumulates at much higher rates than Ponds A–C and is removed more frequently to maintain effluent quality. Approximately 350 m^3 per year of wet sludge is reportedly removed from Basin A and Basin B at an estimated 5-20% solids concentration.

Future Disposal Options

While there are privately owned disposal facilities in the Province, with the closure of TAMS it is unlikely that disposal at a privately owned facility will be an economical alternative due to the additional costs associated with transportation and tipping fees. Therefore, the practical management options consist of dewatering and disposal in the Abercrombie ash management cell. Dewatering is anticipated to be the main treatment criteria for disposal at Abercrombie. Treatment requirements will be revised if the sludge must meet the Nova Scotia Landfill Guidelines in the future.

Ponds A, Pond B, & Pond C

NSP will continue to remove solids from Ponds A–C and dispose via dump trucks due to the high percent solids of the sludge removed from the ponds. Lined trucks can be utilized for transportation to Abercrombie if trucks are anticipated to leak. Also, drying beds can potentially be constructed for temporary storage at the Trenton site and can provide some additional moisture removal. However, bench top scale testing should be conducted to determine if this method of dewatering is applicable.

Effluent Treatment System Basins A & B

The sludge in Basins A & B will not continue to be disposed wet as this requires a higher cost of transportation and adds additional moisture to the ash piles. De-watering will be

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conducted at the Trenton site and dry solids or cake will be transported via truck to Abercrombie for disposal.

Dewatering Options

Typically a solids concentration of 35% is desired to dispose of sludge in landfills such as the Abercrombie ash management facility. Solids dewatering equipment to increased solids concentrations of sludge can include mechanical devices such as vacuum filters or centrifuges as well as non-mechanical methods such as drying beds and geotubes. Third party dewatering onsite with mobile equipment can also be utilized as a hybrid treatment option that is less permanent. Dewatering options are discussed and compared below.

1. **Vacuum Rotating Drum Filter**
   Vacuum drum filters utilized a horizontal rotating drum to pick up wet solids on the head box side of the drum and remove dried cake on the dry side of the drum with a blade or scraper (Figure 1). The solids increase in dryness as the drum rotates while under vacuum, continuously removing the filtered water to the drum internal space. For dewatering of Trenton effluent treatment sludge, a sludge pump would convey solids slurry from the bottom of the treatment lagoons to the filter head box as needed i.e. when effluent quality is negatively affected. The filtered water (filtrate) would be drained or piped back to the effluent treatment system (Pond C). Solids would be scraped into bins or directly into a truck for transport to Abercrombie. The feed stream may require chemical feed such as polymer to enhance filterability. Vacuum filters can also be configured with a coating, known as pre-coat filters. These filters remove specific fine solids or soluble contaminants of concern using such coatings as dematiaceous earth, carbon, or ion exchange materials. One would select an uncoated filter or a pre-coated type filter typically based on solid or liquid discharge criteria. Operating costs include such items as power to operate vacuum pumps and drum rotation and preventative maintenance items such as regular cleaning, parts replacements on wear, etc. During operation, an operator would be required to verify cake quality and check filtrate, making equipment and chemical adjustments as necessary. Vacuum drum filters can produce solids up to 55% dry by weight depending on solids characteristics. Additional bench scale or pilot scale work would be required to confirm expected removal efficiencies at Trenton.

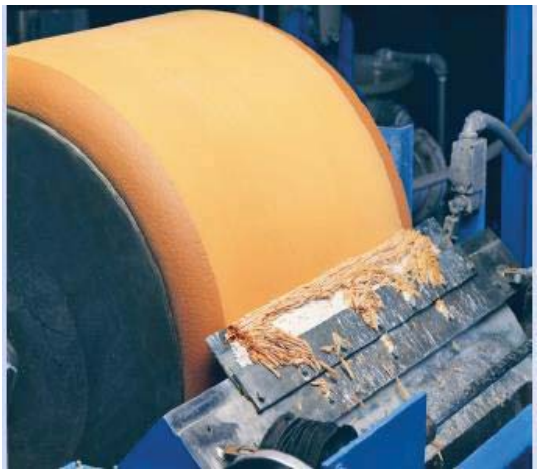

Figure 1: Dry cake being scraped off of a pre-coated filter drum (www.alarcorp.com)

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A vacuum rotating drum filter for performing metal hydroxide sludge dewatering can be purchased for approximately [redacted] excluding applicable taxes. The total estimated cost for implementing a permanent treatment system of this kind with provision for a building is approximately [redacted]

2. Centrifuge

The centrifuge (also known as the decanter) uses centrifugal or G-forces to separate materials of different densities. Wastewater centrifuges are often horizontally orientated (Figure 2). They can be operated at variable speeds, permitting the operator to change the rate based on the influent flow or solids concentration.

Similar to the vacuum filter, to operate a centrifuge at Trenton, solids would be conveyed by a sludge pump from the bottom of the treatment lagoons to the centrifuge bowl as needed. As the slurry moves through the centrifuge, water (centrate) and solids are continuously separated and removed at high rates. The centrate would be drained or piped back to the effluent treatment system. Solids would be directed to a bin or directly into a truck for transport to Abercrombie. Centrifuges also may require chemical treatment such as polymer to improve efficiency of dewatering. Operating the system would be similar to that of a vacuum drum filter, requiring a regular check on solids and water quality to make adjustments. Maintenance and energy costs can be high with a centrifuge due to the mechanical force exerted on rotational parts which is required for adequate dewatering. Centrifuges can often produce a cake of 15-20% dry solids. However, additional bench scale or pilot scale work would be required to confirm expected removal efficiencies at Trenton.

A centrifuge for performing metal hydroxide sludge dewatering can be purchased for approximately [redacted] excluding applicable taxes. The total estimated cost for implementing a permanent treatment system of this kind with provision for a building is approximately [redacted]

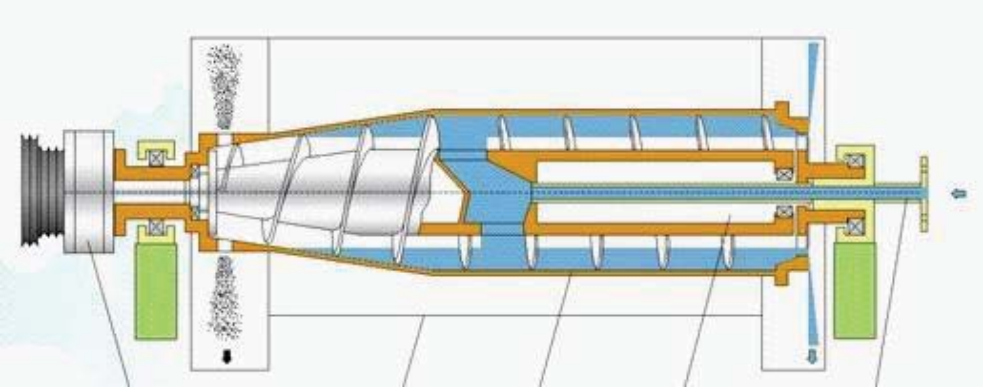

Figure 2: Section graphic of a horizontal centrifuge during operation (www.separator-centrifuge.com)

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3. **Intermittent Onsite De-Watering by Third Party**
   Rather than implement a permanent treatment system, Trenton may wish to hire a third party company to dewater sludge onsite with mobile equipment. The greatest costs associated with this type of short term dewatering is the mobilization, demobilization, and commissioning/decommissioning costs. For a point of reference, to hire a crew in Nova Scotia to perform onsite temporary centrifuge dewatering (trucking solids to Abercrombie the responsibility of NSP), the following costs can be expected:
   - Mobilization/De-Mob, Commissioning/De-Comm., approx. [redacted]
   - Site processing, 24 hour, approx. [redacted]
   - For once per year dewatering, a two week period would cost approx. [redacted]

   The operational risk associated with this arrangement is the performance of the effluent treatment ponds in the time between sludge removals. The site would likely opt to use a storage cell between dewatering options if this option were selected. A 1,000 m^3 (1-2 year storage) earth works type of storage cell can be constructed for a ballpark cost of [redacted]

4. **Geotubes**
   Geotubes are textile bags that are filled with a slurry, draining off filtrate and containing solids within the bag. They are placed on a surface that will divert drained water to an appropriate holding location. At Trenton, geotubes would be placed on a newly constructed concrete pad adjacent to the effluent treatment system, designed to drain water back to Pond C. Similar to the mechanical dewatering options, effective dewatering using geotubes would likely require an addition of chemical such as polymer to the sludge as it is pumped into the geotube from the basins. With operation mainly consisting of maintaining the sludge pump and chemical injection system, the operation of geotubes has a modest cost associated with it and contains few mechanical components to service. Geotubes can provide percent solids greater than 35% depending on the capacity, storage time and local environmental conditions. The geotubes at Trenton will most likely be emptied once every year or two, depending on the size and number of textile bags installed.

   The total ballpark cost of installing geotubes at Trenton is estimated at [redacted] Bench scale or pilot scale work should be conducted to confirm design criteria and geotube textile selection for best performance.

Of the dewatering methods discussed, geotubes will likely be the most applicable to the Trenton facility based on the volumes of sludge produced and the intermittent nature of the sludge handling operation. Additional benefits of geotubes include the ability for long term sludge storage and the capability of producing a sludge of higher percent solids than mechanical dewatering. Construction and installation costs are anticipated to be significantly lower than mechanical dewatering options presented in this report and operational costs are expected to be modest in comparison.

In the following section, CBCL has provided a description of the potential configuration, a summary of projected operating parameters, and an itemized opinion of probable costs for the installation of geotubes at Trenton Generating Station.

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Geotube Proposed Configuration

Process Description

The geotube dewatering process would consist of submersible sludge pumps, a new piping system extending from the plant side of the settling basins to a geotube containment pad, a polymer injection and static mixing pip section, the geotubes themselves, and drain piping to collect leachate from the tubes and release the liquid back to the collection system (Pond C).

Effective dewatering using geotubes requires an additional polymer dose into the sludge as it is pumped into the geotube. This will minimize the dissolution of precipitated metals into the leachate and maximize solids retention within the geotube. Only a small dosage of polymer at a modest cost is required for this purpose.

The geotube piping and containment pad could potentially be located as shown in yellow below in Figure 2.

Figure 2 Potential Geotube Dewatering Layout

Cost Estimates

The major cost items for geotube dewatering would consist of a concrete containment pad for the geotubes and the associated pumps and piping to transfer the sludge from the basins to the geotube and from the geotube back to Pond C. A preliminary cost opinion for the capital costs associated with the geotube dewatering option is presented below in Table 1.

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Table 1 Preliminary Construction Cost Opinion for Geotube Dewatering Option

Item Description	Cost
Site Civil	
Site prep, granular fill, pipework, fencing and reinstatement	$ [redacted]
Concrete & Waterproofing	
Geotube containment pad with push wall	$ [redacted]
Process Equipment Supply	
Polymer feed System, sludge pumps	$ [redacted]
Mechanical & Electrical	
Installation, valves, power and controls	$ [redacted]
Subtotal	$ [redacted]
Design Development Contingency (15%)	$ [redacted]
Construction Contingency (10%)	$ [redacted]
Total Estimated Construction Cost (not including taxes)	$ [redacted]

This estimate is based on a maximum sludge volume of 900 m^3 per year at 5% solids sludge dried in geotubes to an estimated volume of 70 m^3 to 50% solids cake. The sludge will form cake inside the geotube over time and the solids can be left for several years (depending on the size of the tube) before being emptied and disposed of at the ash management site. The geotube could be filled frequently during the year as it does not need to be full to achieve good performance, or only filled infrequently as needed. The frequency would depend on what best improves the treatment performance in the plant (keeping the basin bottom free of sludge vs. allowing sludge to remain and potentially help in co-precipitation reactions). Based on an estimated maximum dry sludge production of 127 kg/d, a preliminary operating costs opinion for the geotube dewatering option are shown below in Table 2.

Table 2 Preliminary Operating Cost Opinion for Geotube Dewatering Option

Item Description	Cost
Labour – 1 hr per week @ [redacted]	$ [redacted]
Geotubes – one tube with 1000 m^3 capacity per year	$ [redacted]
Polymer – 10 kg/dry tonne	$ [redacted]
Disposal - [redacted]	$ [redacted]
Total Estimated Annual Operating Cost	$ [redacted]

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Next Steps

NSP Trenton Generation Station must decide which sludge management options they would like to pursue for the two major types of sludge removals:

1. Pond A, Pond B, and Pond C:
   Sludge sampling and analysis of percent solids and regulated parameters should be conducted to determine if sludge can be transported directed to Abercrombie after excavation or if additional drying should be considered. Bench scale testing can be conducted to evaluate drying characteristics of this sludge.
2. Effluent Treatment Basin A and Basin B:
   Sludge sampling and analysis of percent solids and regulated parameters should also be conducted on Effluent Treatment System Basin A and Basin B. Bench scale or pilot scale testing can be conducted to determine the design constraints of the selected dewatering method going forward.

Conclusion

This report was prepared to present concept level comparisons of sludge management and dewatering options for the Trenton Generating Station wastewater system, assuming disposal at Abercrombie will be permitted by the Industrial Approval. Please inform us of any questions you may have pertaining to the contents of this report. This study can be modified to include other considerations requested by NSP or the regulator.

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BUDGET SUMMARY

CLASS D - Opinion of Probable Cost
Nova Scotia Power Inc. - Trenton Generating Station
WWTP Dewatering System

DATE:	August 24, 2018
CBCL FILE No.:	183419.00
PREPARED BY:	M. Theriault
EST. DESCRIPTION:	CLASS D

ITEM / No.	DESCRIPTION	UNIT	EST. QUANTITY	UNIT COST	TOTAL
	Division 1 - General Conditions				
1	Mobilizations & Demobilizations	allow	1		[redacted]
2	Temporary Facilities	allow	1	$	
3	Environmental / Weather Protection / Cleaning	allow	1	$	
4	Construction Waste Management and Disposal	allow	1	$	
				SUBTOTAL	[redacted]
	Division 3 - Concrete				
1	Containement Pad Concrete Accessories, Insulation, VB	allow	1	$	[redacted]
2	Containement Pad Formwork & Finishing	allow	1	$	
3	Containement Pad Reinforcing	allow	1	$	
4	Containement Pad Cast In Place Concrete	m^3	108	$	
5	Housekeeping Pads	allow	1	$	
				SUBTOTAL	[redacted]
	Division 5 - Metals				
1	Modifying Steel Ladders in Basin	allow	1	$	[redacted]
2	Steel Modifications in Building (railings, stairs & supports)	allow	1	$	
				SUBTOTAL	[redacted]
	Division 7 - Thermal and Moisture Protection				
1	Sealants, Building Penetrations & Other	allow	1	$	[redacted]
				SUBTOTAL	[redacted]
	Division 26 - Electrical				
1	Electrical Systems, Controls Wiring & Integrations	allow	1	$	[redacted]
				SUBTOTAL	[redacted]
	Division 31, 32 & 33 - Earthwork, Exterior Improvements & Utilities				
1	Site Preparation & Excavation	allow	1	$	[redacted]
2	Imported fill and Granular Materials	allow	1	$	
3	Yard Piping for Pad Drains	allow	1	$	
4	Existing Basin Coring & Connection for Drain	allow	1	$	
5	Site Finishes & Reinstatement (Fine Grading, No asphalt or Landscaping)	allow	1	$	
				SUBTOTAL	[redacted]
	Division 40 - Process Integration				
1	Instrumentation (Flow meter)	allow	1	$	[redacted]
2	Fittings, Valves, misc. piping materials (316 SS)	allow	1	$	
3	Flexible hose, PVC polymer piping/fittings	allow	1	$	
4	Utility Water Piping Connection	allow	1	$	
5	Flexible Hose & Fittings for Fabric Filter	allow	1	$	
6	Process Piping (316SS - Schedule 40)	m	110	$	
				SUBTOTAL	[redacted]
	Division 44 - Pollution Control Equipment				
1	Process Pumps (Submersible)	ea	2	$	[redacted]
2	Davit Crane & accessories	allow	2	$	
3	Polymer Makedown Skid System	allow	1	$	
4	Woven Dewatering Fabric	ea	2	$	
				SUBTOTAL	[redacted]
				TOTAL	[redacted]
	Construction Overheads & Profits	7%			[redacted]
	Design Contingency	10%			
	Construction Contingency	10%			
	TOTAL CONSTRUCTION COST				
	Taxes (HST)			15%	$ [redacted]
	TOTAL				[redacted]

THIS OPINION OF PROBABLE COSTS IS PRESENTED ON THE BASIS OF EXPERIENCE, QUALIFICATIONS, AND BEST JUDGEMENT. IT HAS BEEN PREPARED IN ACCORDANCE WITH ACCEPTABLE PRINCIPLES AND PRACTICES. MARKET TRENDS, NON-COMPETITIVE BIDDING SITUATIONS, UNFORESEEN LABOUR AND MATERIAL ADJUSTMENTS AND THE LIKE ARE BEYOND THE CONTROL OF CBCL LIMITED. AS SUCH WE CANNOT WARRANT OR GUARANTEE THAT ACTUAL COSTS WILL NOT VARY FROM THE OPINION PROVIDED.

Form CBCL 034.Rev 1

Note 1: Unit costs are for supply and installation.
Note 2: Assumes all equipment can be powered through existing MCC including VFDs for pumps
Note 3: Provides provision for 2 x fabric filters of dimensions 45 ft circumference and 57 ft length when filled

CI Number: C0009096

Title: LIN Mill Refurbishment 2019

Start Date: 2019/04
In-Service Date: 2019/07
Final Cost Date: 2020/01
Function: Steam
Forecast Amount: $677,819

DESCRIPTION:

Lingan Generating Station has sixteen Raymond Bowl style mills used to pulverize coal for combustion in the boiler. Two of the sixteen mills have components that have reached the end of their expected useful lives and require replacement. Based on experienced wear characteristics, component failures will occur if not replaced. The consequence of such a failure could include unplanned unit derating.

This capital item includes the replacement of welded steel rollers and tables with ceramic wear components, worm gear and shaft, vertical shaft and other non-repairable mill components. As part of the planned outage in 2019, a condition assessment during teardown will determine which components must be replaced. In future, additional capital investment on the Lingan mills will be required to extend asset life and ensure the reliability of this equipment is maintained.

Each unit at the Lingan generating station is served by four mills. The current expectation is that this project will not include the refurbishment of mills on Unit 2 which is currently scheduled for retirement in 2020. However, if mills on Unit 2 are found to require refurbishment in 2019, investment on Unit 2 is still the best option. All four units at Lingan are similar and the components refurbished on this coal mill can be transferred to any of the other Lingan coal mills when Lingan Unit 2 is retired. This includes welded steel rollers and tables with ceramic wear components, worm gear and shaft, vertical shaft and other components that will be addressed in this capital item.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 CI 49431 LIN Mill Refurbishment 2017 $665,839
- 2018 CI 51806 LIN Mill Refurbishment 2018 $673,153
- 2020 CI TBD LIN Mill Refurbishment 2020 $TBD
- 2021 CI TBD LIN Mill Refurbishment 2021 $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement / Refurbishment

Why do this project?

This project is being undertaken to mitigate risk of unit deratings and to reduce the risk of in service mill failures. A mill failure could limit the ability of a unit to reach rated generation depending on the fuel blend. Mills are required to be available full time between planned outages in order to maintain unit performance at rated capacity. The replacement of mechanical components and the upgrading of the ceramic surfaces are necessary to achieve the most economic operation of the unit.

Why do this project now?

A total of sixteen coal mills are installed on the four units at Lingan. A phased approach to mill refurbishment manages the availability of the assets and supports the operation of the generating units that they serve. Operating and maintenance experience with the mills has identified several areas of concern that need to be addressed in order for the mills to meet availability targets. Replacement parts are now needed due to age and wear of many of the components. During periods of lower load it is possible to take one of four mills out of service without affecting generation. Isolated repairs and minor refurbishment are not typically possible for the mills. It is often necessary to disassemble major components and therefore an overall refurbishment verses isolated repairs is more effective.

Why do this project this way?

A phased approach to upgrading the mills allows for scheduled outages of selected mills, reducing the risk of extended unplanned outages. By planning refurbishments in a given year, the refurbishment efforts can be made more efficient, with dedicated labour and parts available as required.

CI Number : C0009096 - LIN Mill Refurbishment 2019 **Project Number** C0009096

Parent CI Number : -

Asset Location : 1138 - 1138 Lingan Common Plant **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1800 - SGP - Fuel Hndlg.Coal	612,233
Retirements	1800 - SGP - Fuel Hndlg.Coal	65,586
	Total Cost:	677,819
	Original Cost:	535,303

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# : C0009096
Title: LIN Mill Refurbishment 2019
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Engineering	PD	12	$ 405	$ 4,864		
Maintenance Trades	PD	196	$ 365	$ 71,577		
Power Engineer	PD	10	$ 390	$ 3,904		
Utility Worker	PD	86	$ 240	$ 20,655		
			Sub-Total	$ 101,000		51806
Term Labour						
Maintenance Trades	PD	196	$ 365	$ 71,345		
Utility Worker	PD	86	$ 240	$ 20,655		
			Sub-Total	$ 92,000		51806
Materials						
OEM and Locally Manufactured Parts	ea	1	430,000	$ 430,000		
			Sub-Total	$ 430,000		51806
Interest Capitalized						
AFUDC	lot	1	$ 4,396	$ 4,396		
			Sub-Total	$ 4,396		
Administrative Overhead						
Labour AO	lot	1	$ 50,423	$ 50,423		
			Sub-Total	$ 50,423		
			SUB-TOTAL (no AO, AFUDC)	$ 623,000		
			TOTAL (AO, AFUDC included)	$ 677,819		
Original Cost				$ 535,303		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011458

Title: ICP Rail System Refurbishment Program 2019

Start Date: 2019/04
In-Service Date: 2019/08
Final Cost Date: 2020/02
Function: Steam
Forecast Amount: $620,192

DESCRIPTION:

This project is for the refurbishment of the rail system between the International Coal Pier and the Lingan Generating Station. Coal is delivered to the Lingan Generating Station via a 15.5 mile track owned by NS Power. The refurbishments will include rail crossing rehabilitations, track tie replacements, track surfacing, and rail bridge refurbishments. The condition of the track has deteriorated over time due to rail traffic and exposure to the elements. Public safety on and around the rail system is monitored and regulated by Transport Canada.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 CI 49913 ICP Railway Tie Upgrade Program $149,894
- 2017 CI 49313 ICP Mile 8.0 Track Replacement $240,653
- 2018 CI 52093 ICP Rail System Refurbishment Program 2018 $592,402
- 2020 CI TBD ICP Rail System Refurbishment Program 2020 $TBD
- 2021 CI TBD ICP Rail System Refurbishment Program 2021 $TBD

JUSTIFICATION:

Justification Criteria: Health & Safety

Why do this project?

This project needs to be completed to allow for the safe operation of the Sydney Coal Railway through the communities of Sydney and New Waterford on route to the Lingan Generating Station. These refurbishments will mitigate the risk of potential train derailments. This project is required in order to replace deteriorated track ties which degrade over time due to rot and need to be maintained to avoid failure and potential derailments. Track surfacing is required to ensure the track ties are level, preventing highs and lows which could lead to derailments caused by severe track height differences.

Why do this project now?

This project needs to be completed now as the condition of the track has deteriorated over time due to rail traffic and natural deterioration from exposure to the elements. The rail system is monitored and regulated by Transport Canada for public safety. These refurbishments are required to allow the track to continue to meet Transport Canada regulations.

Why do this project this way?

Completing refurbishment activities over a number of years allows for little to no delivery disruption and maintains track safety compared to wholesale rail tie, track, or bridge replacements, which are not considered necessary at this time.

CI Number : C0011458 - ICP Rail System Refurbishment Program 2019 **Project Number** C0011458

Parent CI Number : -

Asset Location : 1114 - 1114 International Coal Pier **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1800 - SGP - Fuel Hndlg.Coal	508,170
Retirements	1800 - SGP - Fuel Hndlg.Coal	112,022
	Total Cost:	620,192
	Original Cost:	240,972

Capital Project Detailed Estimate

Location: International Coal Pier
CI# : C0011458
Title: ICP Rail System Refurbishment Program 2019
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Engineering	PD	50	$ 397	$ 20,000		
			Sub-Total	$ 20,000		52093, 49913
Materials						
Track Ties	ea	800	$ 55	$ 44,000		
Switch Ties	ea	200	$ 200	$ 40,000		
80ft 115lb Rail	ea	20	$ 2,000	$ 40,000		
Track Spikes	lot	1	$ 4,800	$ 4,800		
USD to CDN Conversion	%	30%	$ 128,800	$ 38,640		
Rip Rap	lot	1	$ 5,000	$ 5,000		
Rail Seal and Clips	lot	1	$ 9,000	$ 9,000		
				$ -		
				$ -		
			Sub-Total	$ 181,440		52093, 49913
Contracts						
Rail Crossing Rehabilitation	ea	2	$ 25,000	$ 50,000		
Paving	ea	2	$ 15,000	$ 30,000		
Track Surfacing	ea	1	$ 90,000	$ 90,000		
Track Tie Installation	ea	1	$ 55,000	$ 55,000		
Bridge Rip Rap Installation	ea	1	$ 5,000	$ 5,000		
Bridge Anchor Bolt Replacement	ea	1	$ 10,000	$ 10,000		
Bridge Stringer Refurbishment	ea	1	$ 80,000	$ 80,000		
			Sub-Total	$ 320,000		52093, 49913
Other Goods & Services						
Contingency	%	10%	$ 501,440	$ 50,144		
			Sub-Total	$ 50,144		
094 Interest Capitalized						
AFUDC				$ 4,912		
			Sub-Total	$ 4,912		
095 Administrative Overhead						
Labour AO				$ 5,225		
Contracts AO				$ 38,470		
			Sub-Total	$ 43,696		
			SUB-TOTAL (no AO, AFUDC)	$ 571,584		
			TOTAL (AO, AFUDC included)	$ 620,192		
Original Cost				$ 240,972		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 49714

Title: TUC – UT3 and ST34 Cable Replacement

Start Date:	2019/01
In-Service Date:	2019/09
Final Cost Date:	2020/03
Function:	Steam
Forecast Amount:	$606,863

DESCRIPTION:

This project is for the replacement of the 5kV cables that run from Unit Transformer #3 (UT3) and its associated switchgear, along with the 5kV cables that run from Station Transformer #34 (ST34) and its associated switchgear.

The cables were installed in 1975 and they have reached the end of their expected useful life.

This project includes the replacement of the cables and termination kits; and any modifications necessary to the transformer termination box, switchgear enclosure and supports.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- No other related projects in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

The cables have been in service for more than 40 years, which is past their 25-year expected useful life, and the cables' insulation condition is such that there is risk of failure which could cause a fault resulting in a forced outage of the Unit. This fault could also cause an electrical fire which could result in damage to adjacent cables on other units.

Why do this project now?

The cables and associated equipment have reached the end of their expected useful life. Due to the wet environment that these cables are in, the risk of a failure is high. The cables need to be replaced now to mitigate the risk of failure which could impact plant production by causing a unit trip.

Why do this project this way?

Cables of this size and capacity are not repairable. Replacement of the cables and associated switchgear is the only option to eliminate the risk to the plant.

CI Number : 49714 - TUC - UT3 and ST34 Cable Replacement

Project Number 49714

Parent CI Number :

Asset Location : 1178 - 1178 Tufts Cove Common Plant

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	2300 - SGP - Power Equip.-Station S	623,401
Retirements	2300 - SGP - Power Equip.-Station S	(16,539)
	Total Cost:	606,863
	Original Cost:	138,016

Capital Project Detailed Estimate

Location: Tufts Cove Generating Station
CI# : 49714
Title: TUC - UT3 and ST34 Cable Replacement
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	46	$ 358	$ 16,481		
Engineering	PD	70	$ 405	$ 28,371		
CADD Operators	PD	4	$ 294	$ 1,176		
			Sub-Total	$ 46,029		44729
Term Labour						
Electrician	PD	40	$ 358	$ 14,331		
			Sub-Total	$ 14,331		
Materials						
Fittings and Heat Shrink	lot	1	$ 2,608	$ 2,608		
New 5kV Cable (3 cond/phase +1 spare/transformer)	metre	1718	$ 111	$ 190,511		
Miscellaneous Materials	lot	1	$ 15,000	$ 15,000		
			Sub-Total	$ 208,119		44729
Contracts						
Cable Removal and Installation	lot	1	$ 254,449	$ 254,449		
			Sub-Total	$ 254,449		44729
Salvage						
Cable Salvage	lot	1	$ (30,000)	$ (30,000)		
				$ -		
			Sub-Total	$ (30,000)		
Other Goods & Services						
Contingency	%	10%	$ 522,928	$ 52,293		
				$ -		
			Sub-Total	$ 52,293		
Interest Capitalized						
AFUDC				$ 15,282		
			Sub-Total	$ 15,282		
Administrative Overhead						
Labour AO				$ 15,770		
Contractor AO				$ 30,590		
			Sub-Total	$ 46,360		
			SUB-TOTAL (no AO, AFUDC)	$ 545,221		
			TOTAL (AO, AFUDC included)	$ 606,863		
Original Cost				$ 138,016		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0009082

Title: LIN Reclaim Feeder Refurbishment Phase 3

Start Date: 2019/05
In-Service Date: 2019/08
Final Cost Date: 2020/02
Function: Steam
Forecast Amount: $542,948

DESCRIPTION:

This project is Phase 3 of the refurbishment of the Lingan coal reclaim feeder through component replacement. Phase 1 included the refurbishment of the 1A feeder. Phase 2 included the refurbishment of the B2, C1 and C2 feeders. Phase 3 will continue with the next three most degraded reclaim vibratory feeders based on the results of assessments to be done in 2019. Phase 4 is expected to take place in 2020 and focus on an additional three of Lingan's 12 feeders. The work is completed in phases as there is limited time to complete work on a continuously running facility.

This project (Phase 3) includes the replacement of the three vibratory feeder and support structures at the Lingan live coal storage reclaim due to the degradation of those assets.

The Lingan live storage coal operation has six reclaim locations (A to F) with two parallel reclaim feeders at each location. These vibratory feeders are located in a conveyer tunnel below the coal pile base. The vibratory feeders draw coal from the pile and deliver it to a conveyer which delivers the coal to the plant conveyance systems. Numerous feeders are active at any given time to provide sufficient coal supply to the plant and to allow blending of up to six different coal types.

Personnel must access the feeder locations for various maintenance and inspection activities, so it is important that support structures are adequate and feeder housings do not allow coal spillage. Repair of reclaim feeders in situ is possible with appropriate safe guards, however is not preferred due to the hazardous coal tunnel location and constricted work area.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 – CI 49436 - LIN Reclaim Feeder Replacement - $233,494
- 2018 – CI 51811 - LIN Reclaim Feeder Replacement Phase 2 - $534,666
- 2020 – CI TBD - LIN Reclaim Refurbishment Phase 4 - $TBD

JUSTIFICATION:

Justification Criteria: Health & Safety

Why do this project?

Feeder 1A was refurbished in 2017 and feeders B2, C1 and C2 were refurbished in 2018 based upon the deterioration of components. The three feeders planned for refurbishment as part of this project are in similar deteriorated condition. Because of the condition, refurbishment is recommended. A significant failure in one feeder would allow coal from the pile above to flow into the reclaim tunnel, leading to safety risks to plant personnel. Additionally, availability of all six reclaims is necessary for the plant to supply the prescribed blend of fuel necessary for unit loading and environmental targets.

This project is primarily driven by safety reasons and is secondarily justified on unit reliability.

Why do this project now?

Allowing the three planned feeders and support structures to continue to deteriorate increases the risk of a structural failure which would be difficult to safely access and repair in situ. Doing the extraction and replacement in lower load, dry summer months is preferable.

Why do this project this way?

The feeder structure and support mechanism have had numerous repairs and metal replacements over time. These repairs were temporary in nature, and further repairs are not deemed feasible as they cannot be made structurally sound. Removing and replacing isolated components in situ may be possible but would present worker risk due to the constrained work area and coal dust hazards. In the repair in situ scenario, the A belt would have to be out of service for the duration of the work. It is preferable to remove the grizzly and chutes and extract the complete assembly by crane. The new assembly will be placed from above, limiting work in the tunnel and belt down time. The extracted feeder and support structure will be examined, and further determination made regarding whether refurbishment or re-engineering options for use as a spare are feasible.

CI Number : C0009082 - LIN Reclaim Feeder Refurbishment Phase 3 **Project Number** C0009082

Parent CI Number : -

Asset Location : 1138 - 1138 Lingan Common Plant **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1800 - SGP - Fuel Hndlg.Coal	475,645
Retirements	1800 - SGP - Fuel Hndlg.Coal	62,302
	Total Cost:	542,948
	Original Cost:	144,793

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# / FP#: C0009082
Title: LIN Reclaim Feeder Refurbishment Phase 3
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	28	$ 358	$ 10,032		
Maintenance Trades	PD	64	$ 365	$ 23,263		
Utility worker	PD	30	$ 240	$ 7,205	MMMP	
			Sub-Total	$ 40,500		51811, 49434
OT Labour						
Maintenance Trades	PD	21	$ 730	$ 15,000		
			Sub-Total	$ 15,000		
Term Labour						
Maintenance Trades	PD	81	$ 365	$ 29,546		
Utility worker	PD	30	$ 240	$ 7,205		
Electrician	PD	30	$ 358	$ 10,748		
			Sub-Total	$ 47,500		51811, 49434
Materials						
Replacement Vibrator Feeder	ea	3	$ 56,000	$ 168,000		
Exchange USD to CDN	%	30%	$ 168,000	$ 50,400		
Feeder Support Structure	ea	3	$ 8,000	$ 24,000		
Impact Bed	ea	3	$ 6,000	$ 18,000		
Misc. Consumables	ea	3	$ 3,200	$ 9,600		
			Sub-Total	$ 270,000		51811, 49434
Contracts						
Chute Refurbishment	ea	3	$ 30,000	$ 90,000		
Crane Services	ea	5	$ 5,000	$ 25,000		
			Sub-Total	$ 115,000		
Other Goods & Services						
Contingency	%	10%	$ 115,000	$ 11,500		
			Sub-Total	$ 11,500		
Interest Capitalized						
AFUDC				$ 4,672		
			Sub-Total	$ 4,672		
Administrative Overhead						
Labour AO				$ 24,950		
Contracts AO				$ 13,825		
			Sub-Total	$ 38,776		
			SUB-TOTAL (no AO, AFUDC)	$ 499,500		
			TOTAL (AO, AFUDC included)	$ 542,948		
Original Cost				$ 144,793		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0010324

Title: TRE5 Condenser Inlet Piping and Valve Replacement

Start Date: 2019/09
In-Service Date: 2019/10
Final Cost Date: 2020/04
Function: Steam
Forecast Amount: $532,816

DESCRIPTION:

The scope of this project is to replace/refurbish the inlet piping and valves to the condenser on Trenton Generating Station Unit 5. Approximately 300 feet of piping and four isolation valves are identified for replacement as part of this project.

Steam discharge from the low pressure section of the turbine is condensed by seawater delivered through a large tubular condenser located under the turbine. The condensed water is then pumped back through the feedwater system and boiler to produce steam again. The seawater in the condenser is delivered from the circulating water (CW) Pumphouse via 42 inch diameter underground steel pipelines to the condenser waterboxes, which feed the tube side of the exchanger.

Due to the corrosive and abrasive nature of the river water which is brackish and silt laden, the CW Piping, which is over 45 years old, is prone to failure from internal and external corrosion. The valves on the system also degrade over time, requiring replacement. Through inspections carried out by NS Power plant personnel, it was discovered that the inner coating on the pipes has deteriorated and areas of the pipes are showing reduced wall thicknesses. Sections of pipe will be cut out and replaced and where possible, the piping will be grit blasted to remove rust and recoated.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2018 CI 52182 TRE5 Condenser Tubesheet Coating $220,699

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

The piping to the condenser is exposed to corrosive sea water conditions and has shown signs of internal and external degradation. Leaks in the condenser piping contribute to condenser inefficiency and if severe enough, the unit must be taken offline to repair.

Inspections during the 2018 planned Unit 5 outage revealed that the piping system has degraded over its lifetime, both internally and externally. Internal inspection of the valves indicated that the lining of the valves has failed, allowing for degradation of the housing, and affecting the valve's ability to seal correctly.

Why do this project now?

The coatings have failed in various parts of the circulating water system and sections of piping must be replaced in their entirety to maintain the integrity of the system. Some of the isolation valves have also degraded and must be replaced. Performing the work during the 2019 unit outage will allow the work to be done without requiring a forced outage.

Why do this project this way?

Replacement of some of the piping is required, as the condition and original construction methodology is such that repair is no longer feasible. Where possible, sections of the pipe will be remediated for extended use rather than replacement.

CI Number : C0010324 - TRE5 Condenser Inlet Piping and Valve Replacement

Project Number C0010324

Parent CI Number : -

Asset Location : 1165 - 1165 Trenton Unit 5; Commissioned 1969, 160 Mwh

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1400 - SGP - Circ.Water Sys.	453,495
Retirements	1400 - SGP - Circ.Water Sys.	79,322
	Total Cost:	532,816
	Original Cost:	67,498

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI#: C0010324
Title: TRE5 Condenser Inlet Piping and Valve Replacement
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Engineering	PD	10	$ 405	$ 4,053		
Maintenance Trades	PD	40	$ 365	$ 14,591		
Power Engineer	PD	10	$ 390	$ 3,904		
Utility worker	PD	30	$ 240	$ 7,205		
			Sub-Total	$ 29,754		
OT Labour						
Engineering	PD	5	$ 811	$ 4,053		
Maintenance Trades	PD	20	$ 730	$ 14,591		
Utility worker	PD	10	$ 480	$ 4,804		
			Sub-Total	$ 23,448		
Term Labour						
Maintenance Trades	PD	40	$ 365	$ 14,591		
Utility worker	PD	30	$ 240	$ 7,205		
			Sub-Total	$ 21,797		
Materials						
Piping	lot	1	$ 60,000	$ 60,000		
Replacement Fasteners	lot	1	$ 3,000	$ 3,000		
Expansion Joints	ea	2	$ 6,000	$ 12,000		
42" Valve and Actuator	ea	1	$ 80,000	$ 80,000		
Miscellaneous Consumables and Materials	lot	1	$ 10,000	$ 10,000		
			Sub-Total	$ 165,000		CI 43086
Contracts						
Coatings/ Injection	lot	1	40,000	$ 40,000		
Industrial Cleaning	lot	7	$ 1,700	$ 11,900		
Coating of Field Joints	lot	1	$5,000	$ 5,000		
Superwrap Discharge Lines	lot	4	$25,000	$ 100,000		
Site Safety Monitoring	lot	1	$14,000	$ 14,000		
Equipment Rentals	lot	1	$5,000	$ 5,000		
			Sub-Total	$ 175,900		CI 43086
Consulting						
Engineering Project Management	lot	1	$ 40,000	$ 40,000		
				$ -		
				$ -		
			Sub-Total	$ 40,000		
Freight and Postage						
Freight for Materials	lot	1	$ 5,000	$ 5,000		
				$ -		
			Sub-Total	$ 5,000		
Overtime Meals						
Overtime Meals	lot	1	$ 150	$ 150		
			Sub-Total	$ 150		
Other Goods & Services						
Contingency	lot	10%	$ 340,900	$ 34,090		
			Sub-Total	$ 34,090		
Administrative Overhead						
Thermal Labour AO				$ 16,531		
Thermal Contracts AO				$ 21,147		
			Sub-Total	$ 37,678		
			SUB-TOTAL (no AO, AFUDC)	$ 495,139		
			TOTAL (AO, AFUDC included)	$ 532,816		
Original Cost				$ 67,498		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0009079

Title: LIN CW Pump Refurbishment 2019

Start Date: 2019/03
In-Service Date: 2019/07
Final Cost Date: 2020/01
Function: Steam
Forecast Amount: $522,011

DESCRIPTION:

This project is for refurbishment of one of eight Cooling Water (CW) pumps at Lingan. As pump performance degrades, the CW flow becomes insufficient to maintain cooling in the condenser and auxiliary cooling equipment, resulting in efficiency and production losses. The pump selected for refurbishment will be identified during the 2019 unit outages. Lingan Unit 2 is not currently expected to require a CW pump refurbishment. However, if Unit 2 is found to require a refurbishment, despite the unit's planned retirement in 2020 the investment risk is minimal due to the applicability of common components across all four units.

The refurbishment includes re-surfacing and re-building of worn, corroded and damaged surfaces. A new sleeveless, chromed stainless pump shaft and new marine bearings will be installed. The refurbishment also includes the installation of an additional bearing on the pump shaft. This bearing will help to maintain alignment and reduces the movement of the pump shaft if misalignment occurs, improving pump reliability.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 - CI 49430 - LIN CW Pump Refurbishment 2017 - $516,270
- 2018 - CI 51815 - LIN CW Pump Refurbishment 2018 - $520,436
- 2020 - CI TBD - LIN CW Pump Refurbishment 2020 - $TBD
- 2021 - CI TBD - LIN CW Pump Refurbishment 2021 - $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

This project is being undertaken primarily to prevent unit deratings and preserve the unit's availability. Each generating unit is equipped with two CW pumps that supply cooling water to each unit's condenser as well as other auxiliary equipment. Adequate condenser cooling is necessary to ensure proper condenser vacuum, which is a major contributor to unit efficiency. During the cooler months, one CW pump per operating unit is capable of providing adequate condenser cooling. During warmer months both pumps are required. If one of a unit's two pumps is unavailable during the warmer months, the unit's heat rate or ability to generate full load is restricted due to higher seawater temperatures. The loss of both pumps would lead to an unplanned outage. Therefore, the reliability and availability of these pumps is critical to plant operation. The CW pumps are subject to solid particle erosion and corrosion from sand entrainment effects related to their salt water environment (which includes sea water, kelp, eel grass and other sea debris). These deterioration mechanisms are managed through periodic overhauls.

Why do this project now?

Health assessments are determined from pump performance, condition based assessment and operating hours. A typical operating period between pump refurbishments is partly dependent upon the unit's utilization. Several pumps are approaching an actionable risk threshold and refurbishment should be completed in order to adequately mitigate the risk. Final determination of which pump is to be refurbished will be based on the latest performance and condition based monitoring (CBM) results. Additionally, CW Pump refurbishment has a lead time of upwards of six months, therefore proactive planning for these refurbishments is necessary to avoid lengthy unit deratings from unplanned failures.

Why do this project this way?

Compared to options such as full replacement or operating the pump until failure, the most economic and efficient solution is to rebuild deteriorated CW pumps. New pumps have an 11-month lead time and cost approximately 50 percent more than refurbishment.

CI Number : C0009079 - LIN CW Pump Refurbishment 2019 **Project Number** C0009079

Parent CI Number : -

Asset Location : 1138 - 1138 Lingan Common Plant **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1400 - SGP - Circ.Water Sys.	509,398
Retirements	1400 - SGP - Circ.Water Sys.	12,613
	Total Cost:	522,011
	Original Cost:	437,008

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# : C0009079
Title: LIN CW Pump Refurbishment 2019
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	8	$ 358	$ 2,866		
Maintenance Trades	PD	80	$ 365	$ 29,167		51815, 47507
Utility Worker	PD	37	$ 240	$ 8,766		
			Sub-Total	$ 40,800		
Term Labour						
Maintenance Trades	PD	86	$ 358	$ 30,500		51815, 47507
			Sub-Total	$ 30,500		
Materials						
CW Pump Refurbishment Sulzer	ea	1	$ 400,000	$ 400,000		51815, 47507
			Sub-Total	$ 400,000		
Contracts						
Machining Contractor	ea	1	$ 10,000	$ 10,000		
			Sub-Total	$ 10,000		
Freight						
Transportation & Shipping	ea	1	$ 20,000	$ 20,000		
				$ -		
			Sub-Total	$ 20,000		
Interest Capitalized						
AFUDC				$ 881		
			Sub-Total	$ 881		
Administrative Overhead						
Labour AO				$ 18,628		
Contracts AO				$ 1,202		
			Sub-Total	$ 19,830		
			SUB-TOTAL (no AO, AFUDC)	$ 501,300		
			TOTAL (AO, AFUDC included)	$ 522,011		
Original Cost				$ 437,008		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011088

Title: POT Coal Mill Refurbishment 2019

Start Date: 2019/09
In-Service Date: 2019/11
Final Cost Date: 2020/05
Function: Steam
Forecast Amount: $472,973

DESCRIPTION:

Point Tupper Unit 2 has four Raymond Bowl style mills to pulverize coal for combustion in the boiler. One of the four mills has components that have reached the end of their expected useful life and require replacement. Based on experienced wear characteristics, component failures will occur if not replaced. The consequence of such a failure could include unit derating.

This capital item includes the replacement of welded steel rollers and tables with ceramic wear components, and other non-repairable mill components. As part of the planned outage for the mill in 2019, a condition assessment during teardown will determine additional components to be replaced. Future investments will be required for these Mills. Investment intervals and scope will be determined by utilization and condition assessments.

In 2018, an additional mill refurbishment was completed under C0008005 POT – B Coal Mill Overhaul due to increased unit utilization. More operating hours resulted in increased erosion and wear of mill and feeder components requiring refurbishment.

NS Power utilizes a condition-based approach for completing mill refurbishments. The efficiency of a condition-based methodology is realized by completing a planned refurbishment versus an unplanned refurbishment. Completing this work in an unplanned forced outage would result in both higher replacement energy and resource costs to complete the work.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 - CI 49463 - POT Coal Mill Overhauls 2017 - $328,410
- 2018 - CI 51852 - POT Coal Mill Refurbishment 2018 - $327,267
- 2018 - C0008005 – POT – B Coal Mill refurbishment - $406,011
- 2020 - CI TBD - POT Coal Mill Refurbishment 2020 - $TBD
- 2021 - CI TBD - POT Coal Mill Refurbishment 2021 - $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement / Refurbishment

Why do this project?

This project is being undertaken to prevent unit deratings and to mitigate the risk of mill failure. A mill failure could limit the ability of the unit to generate at full capacity depending on the fuel blend. Mills are required to be available full time between planned outages in order to maintain unit performance at rated capacity.

Why do this project now?

Operating and maintenance experience with the mills has identified several areas of concern that need to be addressed in order for the mills to meet availability targets. Replacement parts are now needed due to age and wear on many of the components. During periods of lower load it is possible to take one of four mills out of service without affecting generation. Isolated repairs and minor refurbishment are not typically possible for the mills. It is often necessary to disassemble major components and therefore an overall refurbishment versus isolated repairs is more effective.

Why do this project this way?

A condition-based approach to reinvesting in the mills allows for optimized scheduling of selected mills and reduces the risk of extended unplanned outages. By planning replacements in a given year, efforts can be made more efficient with dedicated labour and parts available as required.

CI Number : C0011088 - POT Coal Mill Refurbishment 2019 **Project Number** C0011088

Parent CI Number : -

Asset Location : 1152 - 1152 Point Tupper Unit 2 **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1800 - SGP - Fuel Hndlg.Coal	425,696
Retirements	1800 - SGP - Fuel Hndlg.Coal	47,277
	Total Cost:	472,973
	Original Cost:	400,800

Capital Project Detailed Estimate

Location: Point Tupper Generating Station
CI#: C0011088
Title: POT Coal Mill Refurbishment 2019
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	2	$ 358	$ 703		
Maintenance Trades	PD	39	$ 365	$ 14,305		
Power Plant Technician	PD	10	$ 382	$ 3,746		
Utility worker	PD	49	$ 240	$ 11,773		
			Sub-Total	$ 30,527		
OT Labour						
Electrician	PD	2	$ 717	$ 1,405		
Maintenance Trades	PD	4	$ 730	$ 2,861		
Power Plant Technician	PD	2	$ 764	$ 1,498		
Utility worker	PD	2	$ 480	$ 942		
			Sub-Total	$ 6,706		
Term Labour						
Maintenance Trades	PD	98	$ 365	$ 35,763		
			Sub-Total	$ 35,763		
Travel Expense						
Travel	lot	1	$ 1,000	$ 1,000		
			Sub-Total	$ 1,000		
Materials						
Mill rolls	lot	[redacted]			Attachment 1, Item 000010	
Journal head and trunnion shaft assembly	lot				Attachment 1, Item 000020	
Grinding table	lot	1				
Rejects table	lot	1	$ 6,000	$ 6,000		
Roll seals	lot	1	$ 2,000	$ 2,000		
Main table seals	lot	1	$ 2,000	$ 2,000		
Riffle boxes	lot	1	$ 6,000	$ 6,000		
Scraper assemblies	lot	2	$ 2,500	$ 5,000		
Mill side liners	lot	1	$ 10,000	$ 10,000		
Rejects side liners	lot	1	$ 10,000	$ 10,000		
Exhauster periphery liners	lot	1	$ 12,000	$ 12,000		
Door assemblies	lot	3	$ 3,000	$ 9,000		
Trunion bushings	lot	1	$ 3,500	$ 3,500		
Bowl ring extension	lot	1	$ 5,000	$ 5,000		
Exhauster fan	lot	1	$ 5,000	$ 5,000		
Exhauster bearings	lot	1	$ 2,000	$ 2,000		
Feeder parts	lot	1	$ 10,000	$ 10,000		
Transition piece	lot	1	$ 15,000	$ 15,000		
Coal pipe	lot	1	$ 6,000	$ 6,000		
Lubricating oil	lot	1	$ 4,500	$ 4,500		
Misc. and consumables	lot	1	$ 10,000	$ 10,000		
			Sub-Total	$ 292,374		
Contracts						
Cranes	lot	1	$ 3,000	$ 3,000		
			Sub-Total	$ 3,000		
Consulting						
Consulting	lot	1	$ 20,000	$ 20,000		
			Sub-Total	$ 20,000		
Meals						
Meals	lot	1	$ 1,000	$ 1,000		
			Sub-Total	$ 1,000		
Overtime Meals						
Overtime meals	lot	1	$ 1,000	$ 1,000		
			Sub-Total	$ 1,000		
Freight & Delivery						
Freight	lot	1	$ 5,000	$ 5,000		
			Sub-Total	$ 5,000		
Rentals						
Rentals	lot	1	$ 1,000	$ 1,000		
				$ -		
			Sub-Total	$ 1,000		
Other Goods & Services						
Contingency	%	15%	$ 373,371	$ 56,006		
				$ -		
			Sub-Total	$ 56,006		
Interest Capitalized						
AFUDC				$ 1,040		
			Sub-Total	$ 1,040		
Administrative Overhead						
Labour AO				$ 18,195		
Contract AO				$ 361		
			Sub-Total	$ 18,556		
			SUB-TOTAL (no AO, AFUDC)	$ 453,377		
			TOTAL (AO, AFUDC included)	$ 472,973		
Original Cost				$ 400,800		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

ALSTOM POWER CANADA INC.
1430 Blair Place, Suite 500, Ottawa ON K1J 9N2

QUOTATION

Your Reference

RFQ number: B1 - Brent MacLeod
RFQ date: 09/10/2018
Contact name:
Phone number:
Fax number:
Email address:

NOVA SCOTIA POWER INCORPORATED
1223 LOWER WATER STREET
HALIFAX NS B3J 3S8

Our Reference

Quotation number: 20154269
Quotation date: 09/15/2018
Contact name: Joanice Torres
Phone number:
Fax number:
Email address: JOANICE.TORRES@GE.COM

Your Teranga Code:
Your Customer Number: 10073497

Plant Name: POINT TUPPER
Plant ID: P000002362
Unit Name: POINT TUPPER 2
Unit ID: UNI008622

SUMMARY CONDITIONS

Quotation validity date: 10/15/2018
INCOTERM: DDP, DESTINATION
Packing specification:
Currency: CAD

DELIVERY DETAILS

NOVA SCOTIA POWER
POINT TUPPER GENERATING STATION
Record not in GPM.Please create
4137 PORT MALCOM ROAD
POINT TUPPER NS B9A 1Z4
Tel: 902 6252323

TOTAL QUOTATION VALUE: [redacted]

Terms of Payment: Payable within 30 days due net inv date

ALSTOM POWER CANADA INC.
1430 Blair Place, Suite 500
Ottawa, Ontario K1J 9N2
Ph: (613) 747-5222
Fax: (613) 747-5888

Quotation number: 20154269
RFQ number: B1 - Brent MacLeod

Quotation details

Item	Part of Item	Qty	UoM	Material Tax code/Description Technical description Pricing conditions	Price/ Unit	Weight UoM Volume UoM	Delivery Time	Amount	Curr.
000010		[redacted]	EA	74-144		3,180.000 LB	32 Weeks		
				Journal Head					
				Base Price	[redacted]			[redacted]	CAD
				Canada GST/HST	15.00 %				CAD

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Quotation number: 20154269
RFQ number: B1 - Brent MacLeod

Quotation details

Item	Part of Item	Qty	UoM	Material Tax code/Description Technical description Pricing conditions	Price/ Unit	Weight UoM Volume UoM	Delivery Time	Amount	Curr.
000020		[redacted]	EA	PARTSQUOTE		12,000.000 LB	32 Weeks		
				Jrnl Head & Trunnion Shaft Assembly					
				Base Price	[redacted]			[redacted]	CAD
				Canada GST/HST	15.00 %				CAD
				Parts Included in the Trunnion Shaft Assembly: 74-144 Journal Head MP-8683-H Groove-Pin 74-143 Trunnion Shaft 70-138 End Cap Thrust End 70-138-A End Cap Free End MP-7311-E Trunnion Shaft Bushing 70-140 Trunnion Bushing Retainer Thrust End 70-141 Trunnion Bushing Retainer Free End 70-137 Thrust Plate Thrust End 70-158 Thrust Plate Free End 70-156 Bushing Washer Free End GP-1604 Taper Pin					

TOTAL QUOTATION VALUE	[redacted]	CAD

ALSTOM POWER CANADA INC.
1430 Blair Place, Suite 500
Ottawa, Ontario K1J 9N2
Ph: (613) 747-5222
Fax: (613) 747-5888

Quotation number: 20154269
RFQ number: B1 - Brent MacLeod

This budget proposal gives a preliminary indication of the basis of which the scope of work described herein can be provided, and does not constitute a firm price, offer or commitment as to such scope. We look forward to discussing the content of this proposal and, when appropriate, submitting a more formal offer. At that time, we can review and comment to your organization's Terms and Conditions or we will reference our Standard Terms and Conditions or a previously agreed upon set of Terms with your organization that may be appropriate for this project.

In consideration for the care, fitness and accuracy of installation of the above component, due consideration is recommended for using the services of a qualified GE Technical Services Representative. The cost of this service is not included in the component quotation, but can be provided separately upon request. In cases where no GE technical or construction services support is used, and installation by others is found to be incorrect, the warranty may be compromised.

The above delivery dates are subject to the availability of material and the manufacturing schedule at time of order.

** Please note: If the incoterms are shown as FCA, allow an extra 1 to 2 weeks for transit time only.

The above is being processed in accordance with GE Terms and Conditions of Sale, including the following clauses.

Currency Fluctuation: The above pricing has been converted from a foreign currency and is subject to a price adjustment due to fluctuation in the US currencies, up to the time of contract award. You will be notified of any changes in pricing prior to acceptance of an order.

Potential Tariff: In the event that, after the acceptance of a purchase order, new tariffs or duties come into effect which impact the cost of materials included in the equipment or work supplied under this Proposal, GE shall have the right to increase the overall price of such equipment or work to reflect the increased cost of such material to GE.

We thank you for your submission. The information listed above is our understanding of your requirements. Please inform us as soon as possible if there are any discrepancies.

INQUIRIES:
Please do not hesitate to contact Joanice Torres should you have any questions concerning the above at Phone (860) 285.2709.

ALSTOM POWER CANADA INC.
1430 Blair Place, Suite 500
Ottawa, Ontario K1J 9N2
Ph: (613) 747-5222
Fax: (613) 747-5888

Quotation number: 20154269
RFQ number: B1 - Brent MacLeod

OUR CONTACT DETAILS:

ALSTOM POWER CANADA INC.
1430 Blair Place, Suite 500
Ottawa ON K1J 9N2

OUR BANKING DETAILS:

By Electronic Funds Transfer (EFT):
Beneficiary Name: Alstom Power Canada Inc
Bank Name: Royal Bank of Canada, Main Branch-Montreal,
1 Place Ville-Marie, Montreal, Quebec H3C 3B5
Bank Identifier: 003
Transit:00001
Swift: ROYCCAT2
Bank Account Number(CAD):1011139

In Paying by EFT, please include invoice number 20154269 or payment reference when making payment. Please forward the payment remittance advice/memo to ***Remit.Power@ge.com***

ALSTOM POWER CANADA INC.
1430 Blair Place, Suite 500
Ottawa, Ontario K1J 9N2
Ph: (613) 747-5222
Fax: (613) 747-5888

CI Number: C0009111

Title: LIN4 Bottom Ash Refurbishment

Start Date: 2019/03
In-Service Date: 2019/04
Final Cost Date: 2019/10
Function: Steam
Forecast Amount: $448,240

DESCRIPTION:

This project is for the refurbishment of the Lingan Unit 4 bottom ash system's seal trough, dip plate, submerged chain conveyor discharge chute and wear plate, as well as associated refractory. The bottom ash system is required to remove heavy bottom ash from the boiler and must be reliable to allow the unit to operate. The gas seal keeps combustion gas from escaping outside of the boiler.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- No other projects on Lingan Unit 3 in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

The bottom ash system is exposed to a wet operating environment, coupled with the acidic and abrasive nature of the ash that contributes to the wear and degradation of the bottom ash removal system. The severe operating conditions have weakened the structural integrity of the seal trough, submerged chain conveyor and refractory over time. Refurbishment is necessary to ensure the bottom ash system works reliably. This project will also help to avoid the bottom furnace from slagging over and creating a potential safety hazard from ash build up due to a poorly functioning bottom ash system and submerged chain conveyor. It will also allow for the safety of personnel by maintaining a gas seal at the boiler bottom.

This project is primarily justified under unit reliability and secondarily for health and safety.

Why do this project now?

Assessments made during the 2018 outage indicated the condition of the bottom ash system requires refurbishment to allow the continued reliable performance of the generating unit, and its safe operation. This project needs to be completed in 2019 during a planned outage in order to avoid a lengthy forced shutdown for bottom ash repairs.

Why do this project this way?

Refurbishment of the bottom ash system gas seal and chute refurbishment is the only option to allow the unit to return to service when required. Full replacement of the bottom ash system would be cost and time prohibitive compared to refurbishment of these components.

CI Number : C0009111 - LIN4 Bottom Ash Refurbishment **Project Number** C0009111

Parent CI Number : -

Asset Location : 1134 - 1134 Lingan Unit 4; Commissioned 1984, 160 Mwh **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	2100 - SGP - Ash Handling	352,067
Retirements	2100 - SGP - Ash Handling	96,173
	Total Cost:	448,240
	Original Cost:	324,681

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# : C0009111
Title: LIN4 Bottom Ash Refurbishment
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Maintenance Trades	PD	115	$ 365	$ 41,773		
Power Engineer	PD	10	$ 390	$ 3,904		
Utility Worker	PD	18	$ 240	$ 4,323		
			Sub-Total	$ 50,000		
OT Labour						
Maintenance Trades	PD	82	$ 730	$ 59,732		
Utility Worker	PD	43	$ 240	$ 10,268		
			Sub-Total	$ 70,000		
Term Labour						
Maintenance Trades	PD	187	$ 365	$ 68,188		
Utility Worker	PD	70	$ 240	$ 16,812		
			Sub-Total	$ 85,000		
Materials						
SCC Idlers	ea	4	$ 5,845	$ 23,378		
SCC Trough Plates	ea	1	$ 20,000	$ 20,000		
SCC Wear Plate	ea	25	$ 76	$ 1,898		
Flyte Bars	ea	54	$ 431	$ 23,247		
Misc. Consumables	lot	1	$ 1,477	$ 1,477		
			Sub-Total	$ 70,000		
Contracts						
Industrial Cleaning	lot	1	$ 45,000	$ 45,000		
High Pressure Washing	lot	1	$ 25,000	$ 25,000		
Refractory Installation	lot	1	$ 45,000	$ 45,000		
			Sub-Total	$ 115,000		
Administrative Overhead						
Labour AO				$ 44,414		
Contract AO				$ 13,825		
			Sub-Total	$ 58,240		
			SUB-TOTAL (no AO, AFUDC)	$ 390,000		
			TOTAL (AO, AFUDC included)	$ 448,240		
Original Cost				$ 324,681		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0009112

Title: LIN Ash Silo Stair Replacement

Start Date: 2019/07
In-Service Date: 2019/09
Final Cost Date: 2020/03
Function: Steam
Forecast Amount: $406,737

DESCRIPTION:

This project is for the replacement of the ash silo stairs. The ash silos (A and B) store fly ash from the coal combustion process. The roof structure of the silo needs to be accessed weekly for maintenance of the equipment on the roof. The stairs used to access the equipment on the roof are not constructed to meet the latest edition of the National Building Code of Canada and pose a safety risk to personnel.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- No other projects in 2017, 2018, 2019, 2020, or 2021

JUSTIFICATION:

Justification Criteria: Health & Safety

Why do this project?

An engineering survey (Attachment 1) of the current condition of the stairs was completed in December 2017. The current stairs on the silo do not meet the latest 2015 edition of the National Building Code of Canada as well as the Nova Scotia Health and Safety Act and they pose a safety risk to personnel accessing the roof.

Why do this project now?

The stairs were originally installed in 1979 and do not meet the latest 2015 edition of the National Building Code of Canada or the Nova Scotia Health and Safety Act. NS Power has been working to resolve issues related to ladders and stairs that do not meet the requirements of the National Building Code across the organization. This project is being completed now as it is considered a safety risk to personnel accessing the roof.

Why do this project this way?

Two options were considered to correct the stairs as described in Attachment 1.

- Upgrade: This includes upgrades to the ash silo stair system.
- Replacement: This includes removal of the existing stairs and replacing them with a new set of stairs independent of the ash silo.

Replacement of the stairs was chosen as it will allow for a more customizable solution and require less ongoing maintenance for the remainder of the life of the silos. Additionally, the option to upgrade the ash silo stairs would cause a delay with the daily operation of the silo while the new stairs will be installed between the two silos and not affect the existing stairs during construction.

CI Number : C0009112 - LIN Ash Silo Stair Replacement

Project Number C0009112

Parent CI Number : -

Asset Location : 1138 - 1138 Lingan Common Plant

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0300 - SGP - Bldg.,Struct.Grnd.	311,478
Retirements	0300 - SGP - Bldg.,Struct.Grnd.	95,259
	Total Cost:	406,737
	Original Cost:	94,818

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# : C0009112
Title: LIN Ash Silo Stair Replacement
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Engineering	PD	16	$ 397	$ 6,358		
Maintenance Trades	PD	128	$ 358	$ 45,598		
Utility worker	PD	120	$ 235	$ 28,139		
			Sub-Total	$ 80,095		
Materials						
Structural Steel	ea	1	$ 25,000	$ 25,000		
Misc Materials and fasteners	ea	1	$ 5,000	$ 5,000		
			Sub-Total	$ 30,000		
Contracts						
Fabrication of Steel Stairs	ea	1	[redacted]		Attachment 1, page 17	
Onside Concrete and structural	ea	1				
			Sub-Total	$ 243,873		
Interest Capitalized						
AFUDC				$ 2,526		
			Sub-Total	$ 2,526		
Administrative Overhead						
Labour AO				$ 20,926		
Contracts AO				$ 29,318		
			Sub-Total	$ 50,244		
			SUB-TOTAL (no AO, AFUDC)	$ 353,968		
			TOTAL (AO, AFUDC included)	$ 406,737		
Original Cost				$ 94,818		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

February 14, 2018

Nova Scotia Power, Inc.
Lingan Generating Station
2599 Hinchey Ave., Lingan
NS, B1H 5E6

Attention: Mr. Jason March, P. Eng.

RE: Ash Silo Stairway and Handrail Inspection

DILLON CONSULTING

275
Charlotte Street
Sydney
Nova Scotia
Canada
B1P 1C6
Telephone
(902) 562-9880
Fax
(902) 562-9890

Dillon Consulting
Limited

INTRODUCTION

Photographs referenced within this letter are in Appendix A, supporting Figures are in Appendix B, and Cost Estimates are attached in Appendix C. All dimensions given in the report are in metric, with imperial designation in parenthesis ( ).

BACKGROUND

Dillon Consulting Limited (Dillon) was contracted by NSPI's Lingan Generating Station to complete a detailed inspection of the circular stairway leading to the top of the Ash Silo, as well as a review of the hand railing around the roof of the Ash Silo. Dillon understands that some of the NSPI employees do not feel safe using the stair system and there are concerns as to whether it meets the applicable code requirements.

INVESTIGATION

Dillon Consulting Limited completed a site visit to the Lingan Generating Station on December 21, 2017. This inspection included a condition assessment of the stairway and handrail structures, a review of applicable codes and design standards to determine whether the structures meet requirements, and preparation of cost estimates for required upgrading versus replacement of structures.

EXISTING CONDITIONS

The stair system consists of five (5) flights with 14, 7, 9, 34, and 35 risers, respectively, from ground elevation to the roof of the Ash Silo, with intermediate landings. The stair system runs circular around the North Silo and leads to a catwalk joining the roof of each silo. The first two flights of stairs have handrail on both sides, while the proceeding flights have only one exterior handrail. Typical view of the stairs is shown in Photo No. 1, 2 and 3. The entire stair system was found to be in good shape, with minimal corrosion / rusting of steel members and connections.

The handrail for the Ash Silo roof extends along the full circumference of each silo as well as the catwalk joining the two silos. Typical view of the handrail is shown in Photo No. 4. The handrail did show some minor corrosion, especially on the bottom kick plate, as can be seen in Photo 5.

Sections of the existing stairway and handrails are shown in Figure 1.

CODE REQUIREMENTS

The stairway and handrail were checked for compliance with National Building Code of Canada (NBCC) 2015 as per the Occupational Health and Safety Act of Nova Scotia, and the deficiencies are noted as follows:

- The hand railing along all flights of stairs do not meet the height requirement as specified in Cl. 9.8.8.3.(1) in the NBCC, which states height of all guards to be a minimum of 1070 mm (42") high. The existing top rail is only 914 mm (36"). The top rail of the hand railing on the stairway landings and the roof do meet this height requirement of 1070 mm (42").

- The existing 25 mm (1") dia. top rail of all hand railing (stairway, landings and roof) does not meet the size requirements of the Nova Scotia Occupational Health and Safety Act – Part 13, Section 141/142, which specifies a minimum top railing size of 40 mm (1 5/8").

- The 25 mm (1") diameter top rail and the PL51x6.4 (2"x ¼") middle rail are not adequate to resist their respective NBCC loading requirements of 1.0 kN and 0.5 kN horizontal loads as per clause 9.8.8.2.(1). It should be noted that the PL76x13.5 handrail posts do meet these loading requirements.

- The outer PL229x6.4 (9"x¼") stair stringer along the top two flights of stairs does not meet the requirements for the NBCC live load of 4.8 kPa (100 psf) as per Clause 9.8.9.1 of the NBCC. The stringer has a bolted splice connection in the middle of the span, i.e. it provides minimal moment transfer and relies on the cantilever action of the stair tread for support.

- The first two flights of stairs do not have tread nosings, which are required by NBCC Cl. 9.8.4.8. The other three flights of stairs do have tread nosings.

- The top three flights of stairs only have a handrail on the exterior. NBCC Clause 9.8.7.1 specifies that the two sides of a stairway are required to have handrails.

UPGRADING OPTION (1)

To upgrade the Ash Silo stair system and roof hand railing, the following work would be required for each component:

1. **Stair Flights:**
   - Remove existing top and middle hand rails.
   - Install new 6" extensions on all hand rail posts.
   - Install new top and middle rails, meeting NBCC and NSOHS requirements, e.g. DN32 STD pipe.
   - Install additional top rail on the stair flights No. 3, 4 and 5.
   - Install new kick plate – recommended on stair flights No. 4 and 5 as a minimum.
   - Install additional supports to reduce the span of the PL229x6.4 (9"x¼") stringer on stair flights No. 4 and 5.
   - Install tread nosings on stair flights No. 1 and 2.

2. **Stair Landings:**
   - Remove existing top and middle rails.
   - Install new top and middle rails meeting NBCC and NSOHS requirements.

3. **Stairway Canopy:**
   - Install new inclined roof canopy, complete with HSS beams and strut supports with continuous bent plate roof deck support. The new roof deck is to be a metal slippery roof to limit snow build-up.

4. **Roof Handrail:**
   - Remove existing top and middle rails of handrail.
   - Sand Blast and Re-paint existing handrail posts and kick plate.
   - Install new top and middle rails meeting NBCC and NSOHS requirements.

Upgrading requirements for each of the three components above is summarized in Figure 2 and 3. An opinion of probable cost for this upgrading option is [redacted] A detailed cost breakdown is attached in Appendix C.

REPLACEMENT OPTION (2)

A second option would be to remove the entire existing stair and replace it with a new set of stairs independent of the ash silo. This would include a new concrete foundation and a steel structure to support the new stairs. We have prepared a preliminary design for this replacement option, as illustrated in Figure 4. The roof

handrail, as described in component 4 of the Upgrading Option 1 would also need to be repaired as described above.

The option to replace the existing stairs with a new stair structure would include the following items:

- A reinforced concrete foundation complete with pilasters under each of the four steel columns. This foundation would be constructed to provide 1.2 meters of frost cover.
- Excavation and backfilling, in the area where the new stairs are to be located. This includes the gravel and compaction required for proper bearing of the footings.
- Four hollow structural steel (HSS) columns placed at each corner will support the steel beams and other secondary steel members.
- Steel beams will form the supporting framing required to install the new flights of stairs.
- Steel channels will be used as stair stringers spanning from one beam to another.
- Steel grating supported by beams and channels will form the intermediate landings and stair treads.
- Steel pipes and plates will be used as handrails and kick plates on each side of the stair runs and at each landing.
- Finally, steel angles installed between columns will act as cross-bracing to provide the structure with lateral bracing.

The replacement option will allow for a more customizable solution and further increase the life expectancy of the Ash Silo. This Option 2 will also require the upgrading of the handrail around the roof of the Ash Silos, which is included as item 4 in Option 1.

Based on a preliminary design of a new stair system, our opinion of probable cost for this option is [redacted] A detailed cost breakdown is also attached in Appendix C.

RECOMMENDATIONS

It is recommended to proceed with the detailed design and construction for the Upgrading Option 1 or the Replacement Option 2 to address the code requirements and safety concerns for these existing stairs.

REFERENCES

- National Building Code of Canada, 2015
- Occupational Health and Safety Act of Nova Scotia

If you have any questions concerning the above, or if additional information is required, please contact the undersigned at your earliest convenience.

Yours truly,
DILLON CONSULTING LIMITED

Brian Latimer, P. Eng.
Associate/ Project Manager

BL:kme

Appendix A
Photos

Photo 1: Showing a view of the Ash Silos – Stair System runs along the back side of the North (right) Silo.

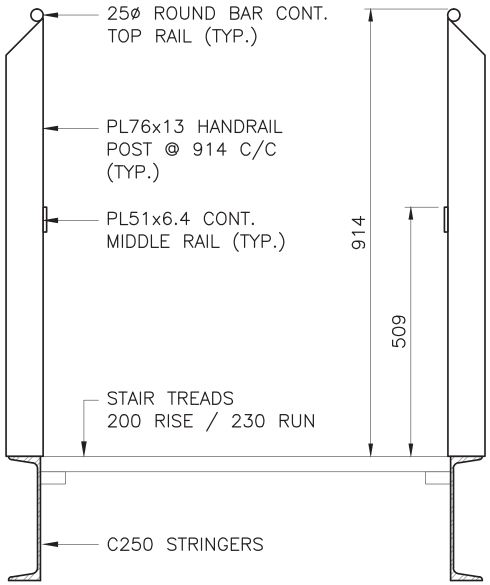
Photo 2: Showing a view of the first two stair run (from ground elevation).

Photo 3: Showing a view mid-way up the stair system.

Photo 4: Showing a view of the Ash Silo Roof hand rail.

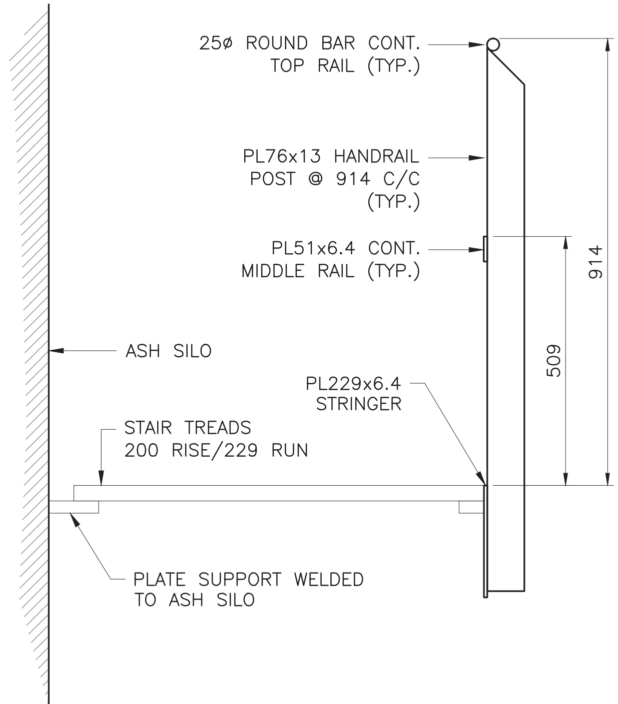
Photo 5: Showing a view of the Ash Silo roof kick plate with minor corrosion present.

Appendix B
Figures



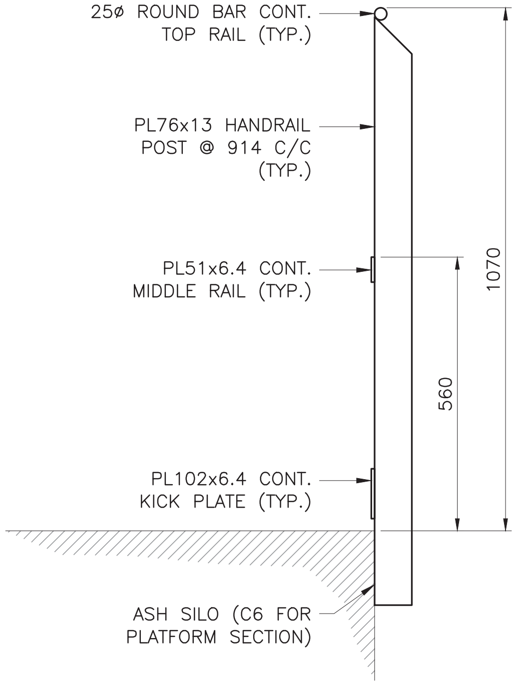
A STAIRWAY SECTION
1:10

SECTION IS TYPICAL THROUGH STAIR FLIGHT NO. 1 AND 2



B STAIRWAY SECTION
1:10

SECTION IS TYPICAL THROUGH STAIR FLIGHT NO. 3, 4, & 5

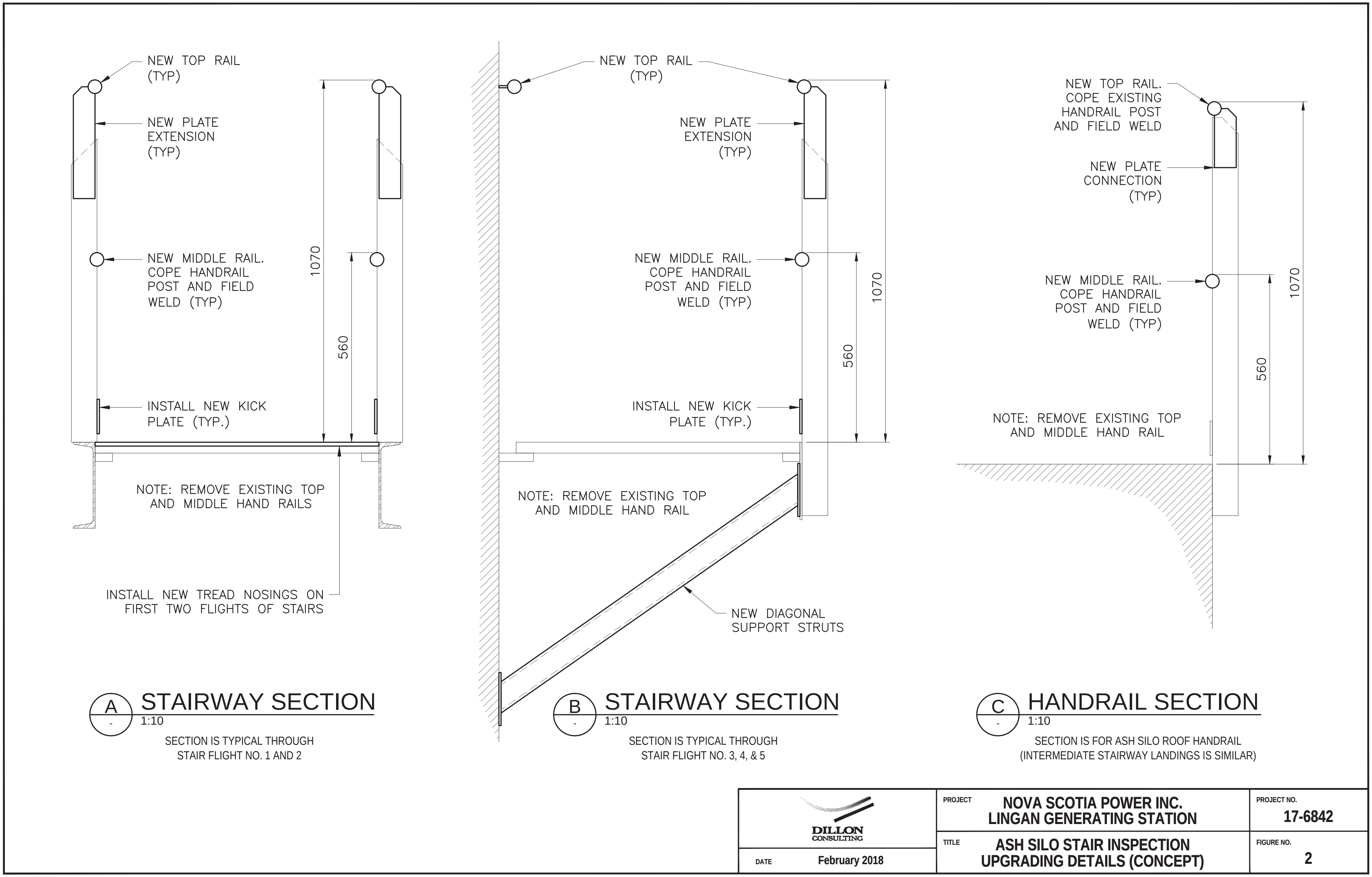


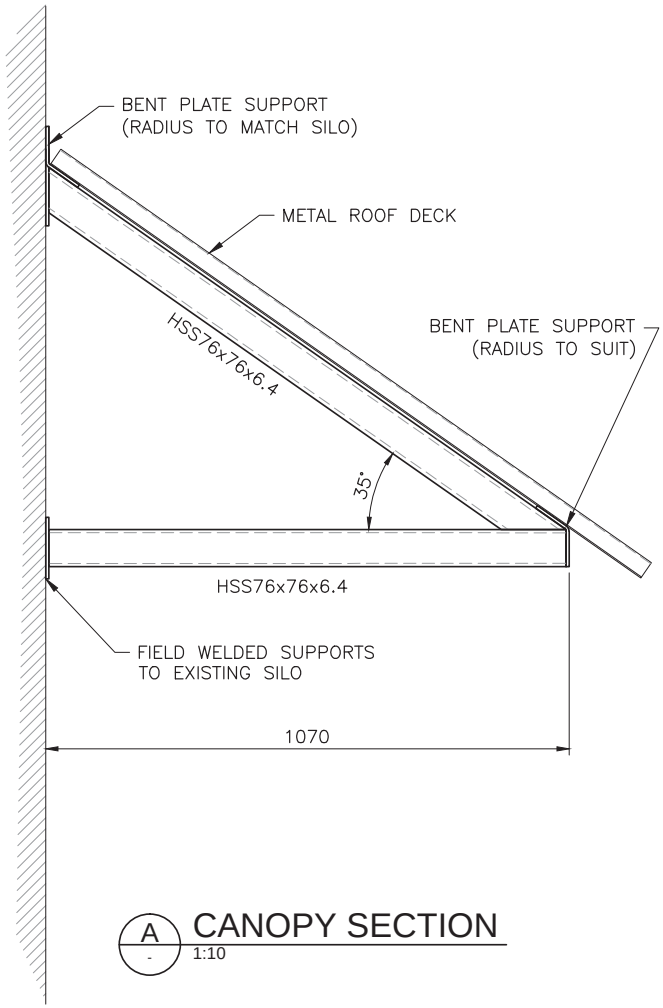
C HANDRAIL SECTION
1:10

SECTION IS FOR ASH SILO ROOF HANDRAIL (INTERMEDIATE STAIRWAY LANDINGS IS SIMILAR)

DILLON CONSULTING	PROJECT: NOVA SCOTIA POWER INC. LINGAN GENERATING STATION	PROJECT NO. 17-6842	
DATE: February 2018	TITLE: ASH SILO STAIR INSPECTION EXISTING DETAILS	FIGURE NO. 1	

FileName:c:\projectwise\working directory\active\52df\d0617423\176842-09-str-fig.dwg

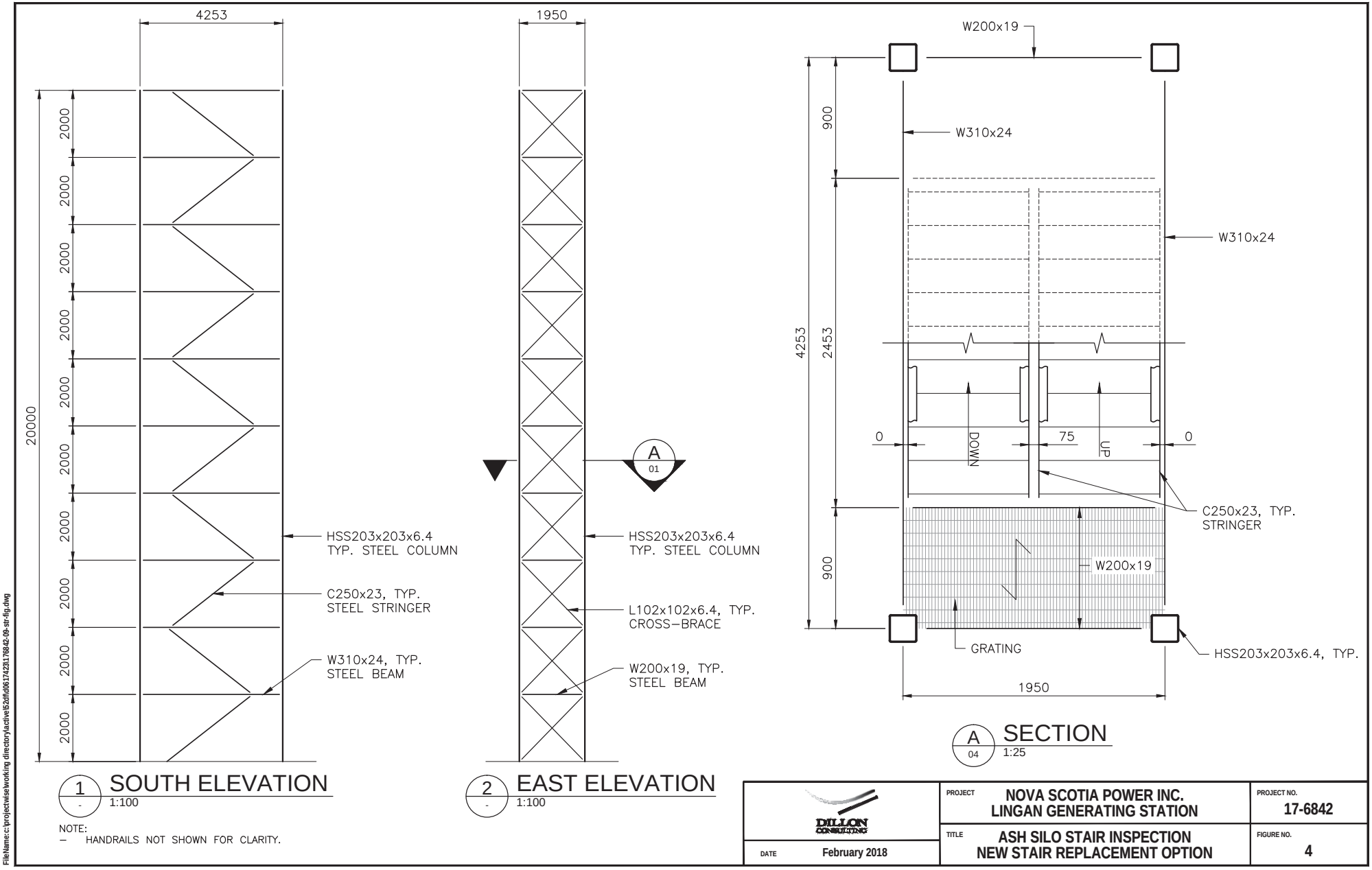

NEW TOP RAIL (TYP)
NEW PLATE EXTENSION (TYP)
NEW MIDDLE RAIL. COPE HANDRAIL POST AND FIELD WELD (TYP)
INSTALL NEW KICK PLATE (TYP.)
1070
560
NOTE: REMOVE EXISTING TOP AND MIDDLE HAND RAILS
INSTALL NEW TREAD NOSINGS ON FIRST TWO FLIGHTS OF STAIRS
A STAIRWAY SECTION
1:10
SECTION IS TYPICAL THROUGH STAIR FLIGHT NO. 1 AND 2
NEW TOP RAIL (TYP)
NEW PLATE EXTENSION (TYP)
NEW MIDDLE RAIL. COPE HANDRAIL POST AND FIELD WELD (TYP)
INSTALL NEW KICK PLATE (TYP.)
1070
560
NOTE: REMOVE EXISTING TOP AND MIDDLE HAND RAIL
NEW DIAGONAL SUPPORT STRUTS
B STAIRWAY SECTION
1:10
SECTION IS TYPICAL THROUGH STAIR FLIGHT NO. 3, 4, & 5
NEW TOP RAIL. COPE EXISTING HANDRAIL POST AND FIELD WELD
NEW PLATE CONNECTION (TYP)
NEW MIDDLE RAIL. COPE HANDRAIL POST AND FIELD WELD (TYP)
1070
560
NOTE: REMOVE EXISTING TOP AND MIDDLE HAND RAIL
C HANDRAIL SECTION
1:10
SECTION IS FOR ASH SILO ROOF HANDRAIL (INTERMEDIATE STAIRWAY LANDINGS IS SIMILAR)
DILLON CONSULTING
DATE February 2018
PROJECT NOVA SCOTIA POWER INC. LINGAN GENERATING STATION
TITLE ASH SILO STAIR INSPECTION UPGRADING DETAILS (CONCEPT)
PROJECT NO. 17-6842
FIGURE NO. 2



A - CANOPY SECTION
1:10

DILLON CONSULTING	PROJECT: NOVA SCOTIA POWER INC. LINGAN GENERATING STATION	PROJECT NO.: 17-6842
DATE: February 2018	TITLE: ASH SILO STAIR INSPECTION CANOPY DETAIL (CONCEPT)	FIGURE NO.: 3

FileName:c:\projectwise\working directory\active\52dfl\d06174231768\42-09-str-fig.dwg


4253
20000
2000
HSS203x203x6.4
TYP. STEEL COLUMN
C250x23, TYP.
STEEL STRINGER
W310x24, TYP.
STEEL BEAM
1 SOUTH ELEVATION
1:100
1950
A
01
HSS203x203x6.4
TYP. STEEL COLUMN
L102x102x6.4, TYP.
CROSS-BRACE
W200x19, TYP.
STEEL BEAM
2 EAST ELEVATION
1:100
W200x19
900
W310x24
W310x24
4253
2453
0
DOWN
75
UP
0
C250x23, TYP.
STRINGER
W200x19
900
GRATING
HSS203x203x6.4, TYP.
1950
A
04
SECTION
1:25
NOTE:
– HANDRAILS NOT SHOWN FOR CLARITY.
DILLON CONSULTING
DATE February 2018
PROJECT NOVA SCOTIA POWER INC.
LINGAN GENERATING STATION
PROJECT NO. 17-6842
TITLE ASH SILO STAIR INSPECTION
NEW STAIR REPLACEMENT OPTION
FIGURE NO. 4
FileName:c:\projectwise\working directory\active\52dfl\d06174281176842-09-str-fig.dwg

Appendix C
Cost Estimates

ESTIMATED CONSTRUCTION COST, CLASS 'D'
OPTION 1

Ash Silo Stair Inspection
Lingan, NS

PREPARED FOR:

Nova Scotia Power Inc.
Lingan Generating Station
Lingan, NS

DILLON CONSULTING

Project Manager:	B. Latimer
Est. by: D. Ferguson	Checked by: B. Latimer
Dillon PROJECT No.:	17-6842
UPDATED:	February 14, 2018

ITEM DESCRIPTION	QUANTITY NUMBER	QUANTITY UNIT	UNIT COST	TOTAL INCL. O&P	EXTENDED TOTALS
ITEM No. 1 - Mobilization/Demobilization					[redacted]
Mobilization	1	LS	[redacted]	[redacted]	
Demobilization	1	LS	[redacted]	[redacted]	
ITEM No. 2 - Stair and Landing Upgrades					[redacted]
Demolition of Existing Top and Middle Rails	1	LS	[redacted]	[redacted]	
Miscellaneous Steel (See Breakdown Below)	0.65	tonne	[redacted]	[redacted]	
• New Top and Middle Rails	425	kg			
• New Kick Plate	200	kg			
• New HSS Stringer Diagonal Supports	5	kg			
• New Tread Nosings	23	kg			
ITEM No. 3 - Stair Roof Canopy					[redacted]
Miscellaneous Steel (See Breakdown Below)	1.80	tonne	[redacted]	[redacted]	
• HSS Framing Members	750	kg			
• Bent Plate Deck Support	1,050	kg			
Roof Cladding	50	m²	[redacted]	[redacted]	
ITEM No. 4 - Ash Silo Roof Handrail Upgrades					[redacted]
Demolition of Existing Top and Middle Rails	1	LS	[redacted]	[redacted]	
Sandblasting & Painting Existing Posts & Kick PL	1	LS	[redacted]	[redacted]	
Miscallaneous Steel (See Breakdown Below)	0.66	tonne	[redacted]	[redacted]	
• New Top Railing	355	kg			
• New Middle Railing	305	kg			
SUBTOTAL (Construction Cost)					[redacted]
Other Costs					[redacted]
Design Fees	(Subtotal x 10 %)				[redacted]
Contingency	(Subtotal x 20 %)				[redacted]
PROJECT GRAND TOTAL (Including Contingency)					[redacted]

ESTIMATED CONSTRUCTION COST, CLASS 'D' OPTION 2

Ash Silo Stair Inspection
Lingan, NS

PREPARED FOR:

Nova Scotia Power Inc.
Lingan Generating Station
Lingan, NS

DILLON CONSULTING

Project Manager:	B. Latimer
Est. by: M. Ward	Checked by: B. Latimer
Dillon PROJECT No.:	17-6842
UPDATED:	February 14, 2018

ITEM DESCRIPTION	QUANTITY NUMBER	QUANTITY UNIT	UNIT COST	TOTAL INCL. O&P	EXTENDED TOTALS
ITEM No. 1 - Mobilization/Demobilization					[redacted]
Mobilization	1	LS	[redacted]	[redacted]	
Demobilization	1	LS	[redacted]	[redacted]	
ITEM No. 2 - Existing Stair Demolition					[redacted]
Demolition of Stairs, Landings and Handrails	1.00	LS	[redacted]	[redacted]	
ITEM No. 3 - New Steel Stairs					[redacted]
Structural Steel Framing	7.66	tonne	[redacted]	[redacted]	
Miscellaneous Steel (See Breakdown Below)	2.68	tonne	[redacted]	[redacted]	
• New Top Rails, Middle Rails & Posts	1,090	kg			
• New Kick Plate	475	kg			
• New Steel Cross-Brace	1,110	kg			
New Steel Grating	40	m^2	[redacted]	[redacted]	
ITEM No. 4 - New Concrete Foundation					[redacted]
Concrete Foundation	14	m^3	[redacted]	[redacted]	
ITEM No. 5 - Ash Silo Roof Handrail Upgrades					[redacted]
Demolition of Existing Top and Middle Rails	1	LS	[redacted]	[redacted]	
Sandblasting & Painting Existing Posts & Kick Plate	1	LS	[redacted]	[redacted]	
Miscellaneous Steel (See Breakdown Below)	0.66	tonne	[redacted]	[redacted]	
• New Top Railing	355	kg			
• New Middle Railing	305	kg			
SUBTOTAL (Construction Cost)					[redacted]
Other Costs					[redacted]
Design Fees	(Subtotal x 10 %)				[redacted]
Contingency	(Subtotal x 20 %)				[redacted]
PROJECT GRAND TOTAL (Including Contingency)					[redacted]

CI Number: C0010325

Title: TRE5 CW Screen Refurbishment

Start Date: 2019/10
In-Service Date: 2019/10
Final Cost Date: 2020/04
Function: Steam
Forecast Amount: $382,776

DESCRIPTION:

The scope of this project is to refurbish the cooling water (CW) traveling water screens on the Trenton Unit 5.

The Unit 5 traveling water screens are an integral part of the CW intake system for the Trenton plant. The screen system consists of two separate units (5-1 and 5-2 CW screens), each of which consist of numerous framed screens that rotate through the CW intake system. The main priority of these units is to filter out the foreign material from the water as it is being extracted from the river. A failure of one or both of the screens would either allow foreign matter into the CW system in the event of a screen breach, or result in a blockage of the screen system and reduction of CW flow to the pumps in the event of a drive train failure. In each case, the result would be severe impact to the cooling water system performance. At best there would be reduction in unit efficiency due to fouling, at worst the unit would be de-rated or taken off line for repairs or refurbishment. Refurbishment includes new screen frames, sprockets, bushings, shafts, chain linkage and other various components as required.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 CI 51317 TRE5 CW Inlet System Refurbishment U&U $390,035
- 2021 CI TBD TRE5 CW Screens Refurbishment 2021 $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

The cooling water screen units are original equipment from the commissioning in 1969 and were supplied by the REX Corporation. Due to the effects of air and salt water corrosion, the components of the cooling water screen system normally do not have a long life span and require refurbishment periodically.

Why do this project now?

The Unit 5 traveling water screen components have reached a point where corrosion and wear mean the system is approaching the end of its service life. These components require refurbishment to allow for long term reliability. Current equipment condition would make reliable operation beyond 2019 questionable. Replacing key components during the planned outage in 2019 provides the best balance between extending useful life and preserving dependability.

Why do this project this way?

Refurbishment of these components can only be practically accomplished during an outage when the equipment can be dewatered and regular labor can be planned / utilized in a cost effective manner. This job requires planning and preliminary work to facilitate installation of the stop logs, coordinate with divers, remove the old screen components, and the raise the steelwork. Performing the work this way preserves the asset and several other components of the CW system. Failure to complete this work would lead to risk of damage to the downstream equipment such as the CW pumps. Replacement was not considered as it would be more costly to replace the entire CW system than to refurbish only the components that require refurbishment.

CI Number : C0010325 - TRE5 CW Screen Refurbishment

Project Number C0010325

Parent CI Number : -

Asset Location : 1165 - 1165 Trenton Unit 5; Commissioned 1969, 160 Mwh

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1400 - SGP - Circ.Water Sys.	299,974
Retirements	1400 - SGP - Circ.Water Sys.	82,801
	Total Cost:	382,776
	Original Cost:	282,249

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI# : C0010325
Title: TRE5 CW Screen Refurbishment
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	3	$ 358	$ 1,075		
Engineering	PD	10	$ 405	$ 4,053		
Maintenance Trades	PD	50	$ 365	$ 18,239		
Power Engineer	PD	5	$ 390	$ 1,952		
Utility Worker	PD	20	$ 240	$ 4,804		
			Sub-Total	$ 30,123		CI 46431/46377
OT Labour						
Maintenance Trades	PD	20	$ 730	$ 14,591		
Utility Worker	PD	20	$ 480	$ 9,607		
			Sub-Total	$ 24,199		CI 46431/46377
Term Labour						
Maintenance Trades	PD	100	$ 365	$ 36,479		
Utility Worker	PD	50	$ 240	$ 12,005		
			Sub-Total	$ 48,484		CI 46431/46377
Materials						
Screen Frames	each	60	$ 1,000	$ 60,000		
Rollers, Bushings, Pins, Center Blocks	lot	2	$ 8,000	$ 16,000		
Miscellaneous Materials	lot	2	$ 5,000	$ 10,000		
Chain Assembly	lot	2	$ 5,500	$ 11,000		
			Sub-Total	$ 97,000		CI 46431/46377
Contracts						
Miscellaneous Machining Costs	lot	2	$ 5,000	$ 10,000		
Divers	lot	1	$ 10,000	$ 10,000		
Supervision	lot	1	$ 15,000	$ 15,000		
Crane	lot	1	$ 15,000	$ 15,000		
Fabrication of Sprockets and Idler Shafts	lot	2	$ 20,000	$ 40,000		
Vacuum services	lot	1	$ 20,000	$ 20,000		
			Sub-Total	$ 110,000		CI 46431/46377
Rentals						
Staging	lot	1	$ 10,000	$ 10,000		
			Sub-Total	$ 10,000		
OT Meals						
Meals	lot	1	$ 500	$ 500		
			Sub-Total	$ 500		
Other Goods & Services						
Contingency	%	10%	$ 255,484	$ 25,548		
				$ -		
			Sub-Total	$ 25,548		
Administrative Overhead						
Labour AO	lot	1	$ 25,387	$ 23,698		
Contracts AO	lot	1	$ 13,797	$ 13,224		
			Sub-Total	$ 36,922		
			SUB-TOTAL (no AO, AFUDC)	$ 345,854		
			TOTAL (AO, AFUDC included)	$ 382,776		
Original Cost				$ 282,249		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0009059

Title: LIN Coal Plant Structural Refurbishment Phase 5

Start Date: 2019/05
In-Service Date: 2019/09
Final Cost Date: 2020/03
Function: Steam
Forecast Amount: $375,902

DESCRIPTION:

This project is Phase 5 of the refurbishment of the structural system in the Lingan coal reclaim. This project is required as a result of the damage caused by corrosion of the conveyer system over time. The structural refurbishment will address the associated safety concerns related to corrosion damage of the support structures while ensuring the coal handling demands are met in a safe and reliable manner.

Coal is delivered to bunkers in the Lingan Plant through a coal conveyor system. An integral part of the conveyor system is the support structure and roller support system. The conveyor system's structural support has experienced damage over time as a result of the corrosive nature of the coal and the high humidity to which it is subjected. This project will continue the refurbishment of the structural system mainly in the coal reclaim and C coal conveyor.

Phase 1 (completed in 2015) focused on the coal system conveyor support structures mainly in coal reclaim (D belts), and the B belt which travels outside along the coal pile. Phase 2 (completed in 2016) focused on the refurbishment of the structural system in the coal reclaim and crusher building. Phase 3 (completed in 2017) focused primarily on the conveyor structure, roller and roller frame replacements. Phase 4 (completed in 2018) focused on the conveyor structure and rollers. Phase 5 will continue to the focus on conveyor structure and rollers. It is estimated that this work will continue for the next 2 to 4 years. The work needs to be phased because the coal system is operated daily, and the work is aligned with time available during non-operating periods.

Summary of Related CIs +/- 2 years
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 – CI 49427 - LIN Coal Plant Structural Refurbishment Phase 3 - $365,003
- 2018 – CI 51839 - LIN Coal Plant Structural Refurbishment Phase 4 - $354,067
- 2019 – CI TBD - LIN Coal Plant Structural Refurbishment Phase 6 - $TBD
- 2020 – CI TBD - LIN Coal Plant Structural Refurbishment Phase 7 - $TBD

JUSTIFICATION:

Justification Criteria: Health & Safety

Why do this project?

Coal is delivered into the Lingan Plant through a coal conveyor system. An integral part of the conveyor system is the support structure and legs which support the conveyor roller system that the conveyor belt runs on. The corrosive nature of the coal and the high humidity conditions that exist in the conveyor system galleries and reclaim lead to corrosion damage of the support legs and roller structures over time, resulting in safety concerns from potential structure failures and roller hot spots. The conveyor support structure must be in good condition in order to allow safe operation of the coal handling equipment and reliable performance of the generating units at Lingan.

This project is being undertaken primarily to address safety concerns, and is secondarily undertaken to maintain unit availability.

Why do this project now?

Based on the deteriorated condition of the structural system, shown in the pictures below, the conveyor support structure must be refurbished to address safety concerns related to the corrosion damage that the support structures have suffered over time. This will allow the coal system to meet the coal handling demands of the plant in a safe and reliable manner. If Phase 5 of the refurbishment is not completed in 2019, the safe operation of the coal system and reliable supply of coal to the generating units will be at risk.

Why do this project this way?

Refurbishment of the support structure is the only option to allow coal supply to the plant to continue, as a full replacement is not necessary, more costly and would require a full plant shutdown. Typically, coal is hoisted one shift per day during off-peak season, which allows for refurbishment work to be conducted on the non-hoisting shifts. Retirement of the structure is not feasible, as the coal system is required to operate all four Lingan units.

Wear and corrosion on coal chute as seen on the outside of the structure, internal patches have been applied until a permanent solution can be completed.

Conveyor belt return roll support structure corroded due to nature of coal and dampness at the bottom of the E gallery.

Corrosion around the flange of the coal chute where coal flows onto the E belt which takes the coal into the plant.

Structural steel corrosion at the bottom of the support leg caused by residual coal at the transfer point from the crusher to the E belt coupled with the dampness in that particular area.

CI Number : C0009059 - LIN Coal Plant Structural Refurbishment Phase 5 **Project Number** C0009059

Parent CI Number : -

Asset Location : 1138 - 1138 Lingan Common Plant **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1800 - SGP - Fuel Hndlg.Coal	312,839
Retirements	1800 - SGP - Fuel Hndlg.Coal	63,063
	Total Cost:	375,902
	Original Cost:	95,232

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# : C0009059
Title: LIN Coal Plant Structural Refurbishment Phase 5
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	34	$ 351	$ 11,943		
Maintenance Trades	PD	350	$ 358	$ 125,092		51839, 49427
Utility Worker	PD	140	$ 235	$ 32,966		51839, 49427
			Sub-Total	$ 170,000		
Term Labour						
Maintenance Trades	PD	84	$ 358	$ 30,000		51839, 49427
			Sub-Total	$ 30,000		
Materials						
Structural Steel	ea	1	$ 30,000	$ 30,000		51839, 49427
Troughing Roller	ea	600	$ 54	$ 32,640		
Trough Roller Support	ea	250	$ 217	$ 54,250		
Miscellaneous Consumables	ea	1	$ 3,110	$ 3,110		
			Sub-Total	$ 120,000		
Interest Capitalized						
AFUDC				$ 3,650		
			Sub-Total	$ 3,650		
Administrative Overhead						
Labour AO				$ 52,252		
			Sub-Total	$ 52,252		
			SUB-TOTAL (no AO, AFUDC)	$ 320,000		
			TOTAL (AO, AFUDC included)	$ 375,902		
Original Cost				$ 95,232		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0009080

Title: LIN CW Screen Refurbishment 2019

Start Date: 2019/03
In-Service Date: 2019/07
Final Cost Date: 2020/01
Function: Steam
Forecast Amount: $354,651

DESCRIPTION:

The scope of this project includes work to be completed on two Cooling Water (CW) screens in 2019, based on condition assessments completed in 2019. There are eight travelling screens (two per unit) at the Lingan Generating Station. The self-cleaning screens remove debris from the incoming seawater before it enters the CW pump and downstream cooling systems, including unit condensors.

The travelling screen assemblies consist of bottom, top and intermediate sections. The bottom section includes the tail sprocket assembly and support structure. The top section is comprised of the drive sprocket assembly and the support structure. The intermediate section spans vertically between the bottom and top sections, and supports the entire structure. The bottom and intermediate sections are submerged in seawater, and the upper sections are wetted components, and in a salt spray environment.

Seasonally, during periods of low seaweed loading in the cooling water intake, screens can be taken out of service and refurbished with no impact to production. Screens are selected for refurbishment based on performance, condition, and operational strategy for the unit.

Each generating unit is equipped with two CW travelling screens. The current expectation is that this project will not include the refurbishment of the screens on Unit 2. However, if screens on Unit 2 were found to require refurbishment in 2019, investment in Unit 2 is still the best option regradless of its planned retirement in 2020. The components refurbished or replaced on the CW travelling screens can be transferred to any of the other Lingan CW travelling screens when Lingan Unit 2 is retired, and therefore the investment risk is minimal due to the applicability of common components across all four units.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 CI 49434 LIN CW Screen Refurbishment 2017 $347,062
- 2018 CI 51851 LIN CW Screen Refurbishment 2018 $350,534
- 2020 CI TBD CW Screen Refurbishment 2020 $TBD
- 2021 CI TBD CW Screen Refurbishment 2021 $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

This project is being undertaken primarily to mitigate the risk of unit deratings and preserve the unit's availability. Debris (eel grass/seaweed) passing through degraded or non-functioning traveling screen panels results in downstream fouling of equipment at CW and Auxiliary CW locations. This increases the risk of unit de-rating or forced outages due to inadequate cooling capacity, particularly during the late summer and fall. The degree of eel grass fouling also results in high mechanical loading on the screens and circulating water pumps. This high loading causes component failure at the screens and CW pumps and increases the risk of de-rating or forced outages due to insufficient cooling water flow.

Why do this project now?

The screens degrade over time due to wear and corrosion. Based on latest inspections it is anticipated that two screens will require refurbishment in 2019. Final selection will be based on 2019 inspections. Completing this project will reduce existing issues with the circulating water system during periods of heavy seaweed and debris. This will reduce the risk of unit de-ratings.

Why do this project this way?

The screens operate in a harsh seawater environment and have experienced related corrosion and wear. The most cost effective solution is to replace the corroded and worn components, as opposed to replacing the complete screen assembly. Primary components to be refurbished include the top drives (sprocket refurbishment, bearing replacement, shaft refurbishment, top boot replacement with stainless steel material), intermediate section (guides, supports and screen panels replacement) and lower section (sprocket refurbishment, bearing replacement, shaft refurbishment, bottom boot replacement with stainless steel material).

CI Number : C0009080 - LIN CW Screen Refurbishment 2019 **Project Number** C0009080

Parent CI Number : -

Asset Location : 1138 - 1138 Lingan Common Plant **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1400 - SGP - Circ.Water Sys.	326,904
Retirements	1400 - SGP - Circ.Water Sys.	27,748
	Total Cost:	354,651
	Original Cost:	301,474

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# : C0009080
Title: LIN CW Screen Refurbishment 2019
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	9	$ 351	$ 2,986		
Maintenance Trades	PD	230	$ 358	$ 82,186		51851, 49434
Utility Worker	PD	29	$ 235	$ 6,829		
			Sub-Total	$ 92,000		
Term Labour						
Maintenance Trades	PD	162	$ 358	$ 58,000		51851, 49434
			Sub-Total	$ 58,000		
Materials						
Top Boot Screen Components	ea	2	$ 21,000	$ 42,000		51851, 49434
Screen Section Panels-Stainless	ea	2	$ 30,000	$ 60,000		
Bottom Boot Screen Components	ea	2	$ 19,000	$ 38,000		
			Sub-Total	$ 140,000		
Contracts						
Machining Contractor	ea	1	$ 20,000	$ 20,000		
				$ -		
			Sub-Total	$ 20,000		
Interest Capitalized						
AFUDC				$ 3,058		
				$ -		
			Sub-Total	$ 3,058		
Administrative Overhead						
Labour AO				$ 39,189		
Contracts AO				$ 2,404		
			Sub-Total	$ 41,593		
			SUB-TOTAL (no AO, AFUDC)	$ 310,000		
			TOTAL (AO, AFUDC included)	$ 354,651		
Original Cost				$ 301,474		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0010372

Title: TRE5 Post Cooler Conveyor Refurbishment

Start Date: 2019/05
In-Service Date: 2019/10
Final Cost Date: 2020/04
Function: Steam
Forecast Amount: $319,596

DESCRIPTION:

This project is to refurbish the post cooler conveyor of the Trenton Unit 5 bottom ash conveyor system.

The bottom ash removal system on Trenton Unit 5 consists of two conveyors to remove ash from the bottom of the boiler. The MAC conveyor removes the bottom ash from the boiler (cooler conveyor) and places the ash on the ECOMAG conveyor, which removes the ash from the plant building (post cooler conveyor). Each conveyor is equipped with a sifting conveyor to remove the fines that spill off the conveyors. The bottom ash system was installed in 1999 when the mechanism for bottom ash on Trenton Unit 5 was changed from a wet ash sluice system to dry ash.

The ECOMAG (post cooler) conveyor takes the material from the MAC conveyor and transfers it out of the building to the ash conditioner before it is transported away for sale or disposal. The ECOMAG is also needed to maintain proper boiler operation as it is a continuation of the MAC conveyor.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 – CI C0002938 - TRE5 Post Cooler Sifting Conveyor - $77,166

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

A recent equipment inspection (July 2018) identified that the belt and mesh on the ECOMAG post cooler conveyor are in need of replacement (please refer to Attachment 1, Section 5). This project is required to allow for the long-term reliability of the bottom ash system and to preserve unit reliability and availability. If the conveyor is not able to remove the ash from the bottom of the boiler, the boiler will fill up with ash and could flame out a group of burners and bring the unit offline. This would result in a large effort to remove the built up ash quickly before it solidifies.

Why do this project now?

Inspection has confirmed that several key components of the post cooler conveyor require prompt replacement in order to effectively refurbish the system. The project must be completed during the 2019 planned outage for Unit 5, due to the current condition of the components of the bottom ash system. Delaying this work will increase the likelihood of a forced outage to complete more costly repairs.

Why do this project this way?

Due to the deterioration of the belt and mesh, replacement of the components is the only way to return this asset to full operating efficiency.

CI Number : C0010372 - TRE5 Post Cooler Conveyor Refurbishment

Project Number C0010372

Parent CI Number : -

Asset Location : 1165 - 1165 Trenton Unit 5; Commissioned 1969, 160 Mwh

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	2100 - SGP - Ash Handling	291,849
Retirements	2100 - SGP - Ash Handling	27,748
	Total Cost:	319,596
	Original Cost:	204,316

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI# : C0010372
Title: TRE5 Post Cooler Conveyor Refurbishment
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	4	$ 358	$ 1,433		
Engineering	PD	5	$ 405	$ 2,027		
Maintenance Trades	PD	60	$ 365	$ 21,887		
Power Plant Technician	PD	6	$ 382	$ 2,293		
Utility Worker	PD	20	$ 240	$ 4,804		
			Sub-Total	$ 32,443		CI 50879
OT Labour						
Maintenance Trades	PD	30	$ 730	$ 21,900		
			Sub-Total	$ 21,900		CI 50879
Term Labour						
Maintenance Trades	PD	60	$ 365	$ 21,887		
			Sub-Total	$ 21,887		CI 50879
Materials						
Belt	lot	71	[redacted]		Attachment 2	
Mesh	lot	1			Attachment 2	
Pan Plates	lot	15			Attachment 2	
Pan Plates with Cleats	lot	15			Attachment 2	
Screw Kit and Plates	lot	5			Attachment 2	
USD Conversion	%	31%				
			Sub-Total	[redacted]		
Contracts						
Envirosystems	lot	1	$ 30,000	$ 30,000		
			Sub-Total	$ 30,000		
Freight						
Freight	lot	1	$ 20,000	$ 20,000		
				$ -		
			Sub-Total	$ 20,000		
OT Meals						
Overtime Meals	lot	1	$ 500	$ 500		
				$ -		
			Sub-Total	$ 500		
Other Goods & Services						
Contingency	%	10%	[redacted]			
				$ -		
			Sub-Total	[redacted]		
Interest Capitalized						
AFUDC				$ 2,793		
				$ -		
			Sub-Total	$ 2,793		
Administrative Overhead						
Labour AO				$ 17,055		
Contracts AO				$ 3,607		
			Sub-Total	$ 20,662		
			SUB-TOTAL (no AO, AFUDC)	$ 296,142		
			TOTAL (AO, AFUDC included)	$ 319,596		
Original Cost				$ 204,316		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

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SERVICE REPORT
NOVA SCOTIA POWER

Domenico Antonelli

By: Service Department
Magaldi Power S.p.a

Date: June 20th ,2018

Inspection: June 18th & 19th ,2018

Customer: NOVA SCOTIA POWER
Plant: TRENTON

Contacts: DION ANTLE ; FRED JORDAN ; LEWIS JACK; JAMES DYSON

INTRODUCTION:

The aim of this visit was to check the Magaldi Equipments.

In order to highlight some important aspects regarding the actual status of the equipments, please find below our considerations.

The general conditions are good, also thanks to your very good maintenance. Please find attached the list of our considerations and the activities to be done.

Ing. Domenico Antonelli
Service Area Manager

Italy: Mobil +39 348 707 2973

E-mail domenico.antonelli@magaldi.com

SUMMARY

1 MECHANICAL SEAL BOTTOM DOORS AND SKIRT BOARDS

1.1 Mechanical seal

- It has not been possible to make the inspection, since the boiler was under operation and it's not possible to check the mechanical seal from outside.

1.2 Bottom doors

- We checked all bottom doors and all bottom doors they work very well.
- The boiler was under operation and it's not possible to check the refractory of bottom doors and hopper.

Action to be carried out during next boiler outage: check all bottom doors to ensure that they are working properly and check the refractory

1.3 Skirt boards

- It was not possible to check the skirt boards because the boiler was running

2 MAC EXTRACTOR

2.1 Belt

- The belt is in good conditions, I noted that missing few lateral wings (please refer to the picture below):

Action to be carried out immediate: replace the missing lateral wings

Action to be carried out weekly:

Please check the whole belt.

- Check pan plate: if some pan plate is damaged replace promptly.
- Check the screws: a missing screw can cause a fast pan plates bending and a bend pan plate can block in the other parts of the conveyor.

Action to be carried during next boiler outage:

1. Replace the pan plate with missing lateral wing and check all belt.

2.2 Mesh

- The belt mesh presents , 5-10 % of wear on left and right side per 4" (100 mm) of length (normal wear) (please refer to the attachment):

The original diameter of the spirals is 0,16" (4 millimetres); the maximum admitted wear is 40% of the original diameter, so they should measure the diameters in a lot of point of the mesh to be sure that the medium value is more than 0,095" (2,4 millimetres) (measured in vertical direction).

2.3 Belt alignment and guide idlers

2.3.1 Alignment

The alignment has been checked from the tail pulley to the head pulley and is well aligned:

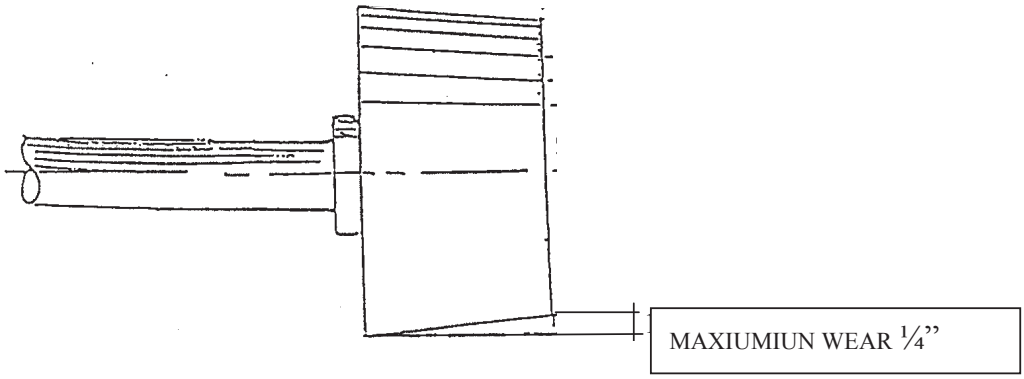
Left side tail section **Right side tail section**

Action to be carried out weekly:

- Check - if the first guide idler in the tail section is turning; check the last guide idler in the head section is turning; the belt needs to be aligned in the tail section and or head section
- Check the alignment in all sections and align it according to the maintenance manual.
- Check the wear on the guide idlers.

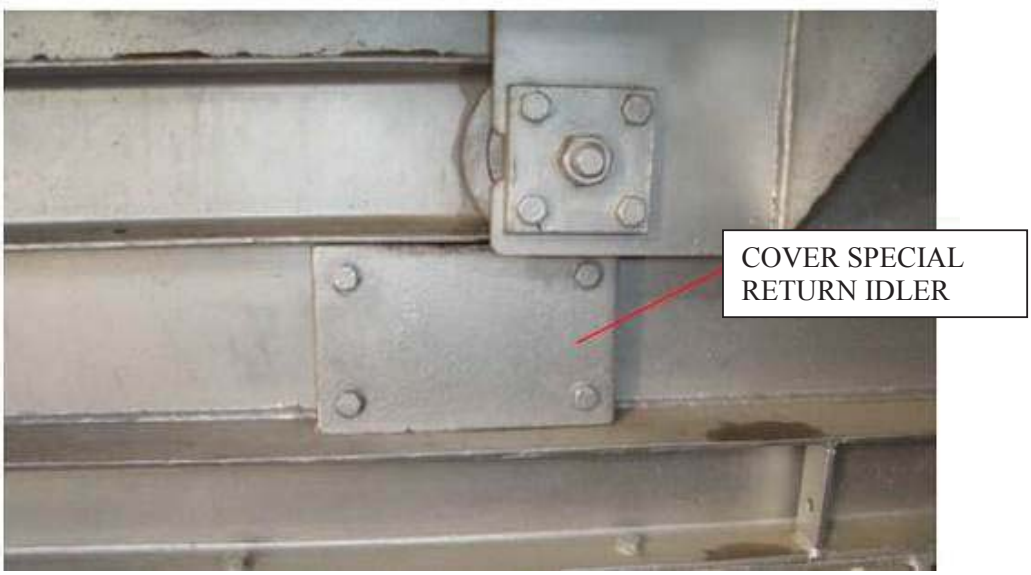
1.1 Carrying and return idlers and supports

The return idlers have a conic wear



- The first return idlers (one on left side and one on right side) are special. These are the only ones with internal bearings and supports. They are the same as the guide idlers.

From the outside you will see only the cover:



Actions to be carried out montly: Check the free rotation of all the idlers. If jammed replace promptly: a jammed carrying idler will wear the mesh; a jammed return idler will wear the belt lateral wings. Please note that if the return idlers have more that ¼" of wear they need to be changed.

2.4 Take – up system

- The residual cylinder stroke is about 16" of the available 20". Magaldi advises you to shorten the belt when it reaches the value of 20% of the stroke available – 4". Please refer to the picture below:

Action to be carried out monthly:

- Please check the elongation of the belt.

Action to be carried out during the next boiler outage:

- At the moment there are no problems regarding the residual stroke, but I suggest that the belt be shortened during the next outage to avoid problems during normal operation.

2.5 Drive

I can't check the oil level because missing the oil level indicator.

The temperature of the Motor and gearbox is normal (please refer to the picture below)

Action to be carried out immedite: Check the oil level. If low add or replace.

3 MAC SPILL-CHAIN

3.1 Spill chain

Spill chain

The spill chain is in good condition. The bottom surface of the scrapers are not worn. But Please note that we founded the scrapers not parallel at the Tail shaft as you can see on the following picture:

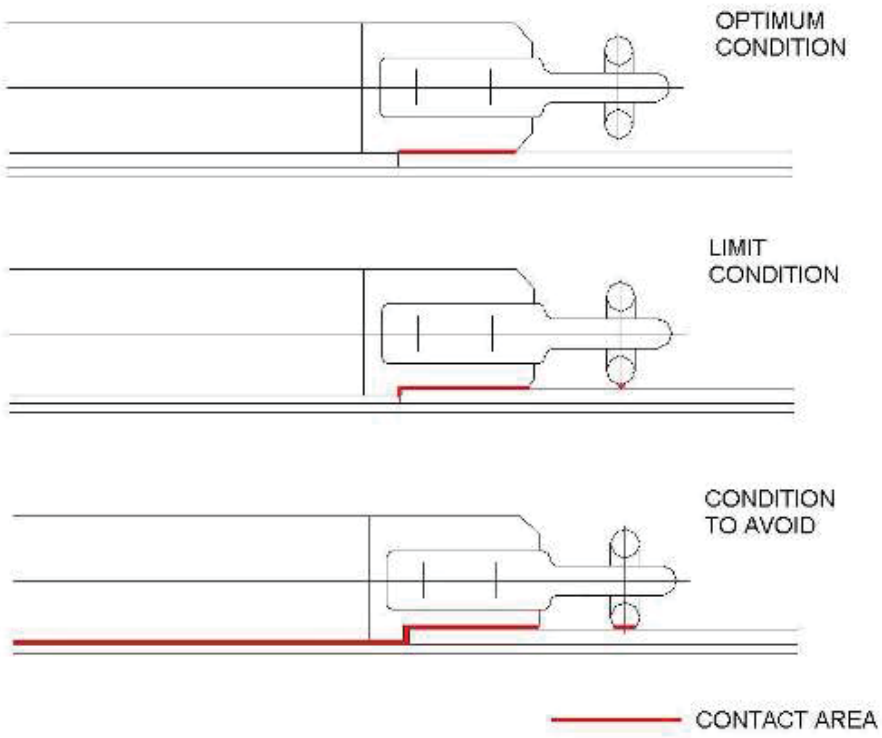
The cause of the tilt is due to the stretch in the north side chain. The cause of the stretching has a number of probable reasons such as:

1) Uneven chain tension applied from take up air cylinders
2) Unequal temperature applied to chains, resulting in the north chain being stretched
3) Obstacle collision such as a solid bunker C causing unnecessary stress on the north chain.

Action to be carried out immedite to make repairs/replacement in order to correct the misalignment:

a) Replace both take up cylinders to prevent future uneven chain stretch
b) Swap every second chain link between spill chain scrapers to even out the north and south chains.

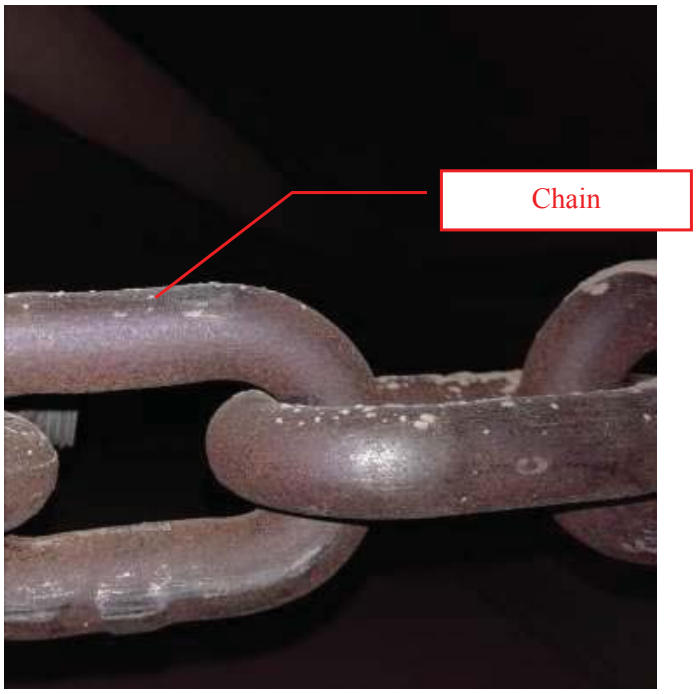
Action to be carried out monthly: Check spill chain , according to the following diagram



3.2 Chain

Chain

The chain is in good condition (please refer to the picture below):



3.3 Head tail sprockets

The tail sprockets are in good condition (please refer to the picture below):

- It was not possible to check the head sprockets (pocket wheels), because the boiler was running.

3.4 Drive

The Gear Box is in good condition.

It was not possible to check the oil level in the gearbox because missing the viewing glass. Everything else is good.

The temperature of the motor and gearbox are normal (please refer to the picture below):

Actions to be carried out at your earliest convenience : Check the oil level. If low , add or replace.

3.5 Take-up system

- The residual cylinder stroke is about 7” of the available 10”. Magaldi advises you to shorten the belt when it reaches the value of 20% of the stroke available – 2” (Please refer to the picture below):

Action to be carried out monthly: Please check the elongation of the spill chain.

Action to be carried out during the next boiler outage: At the moment there are no problems regarding the residual stroke, but I would like to suggest that you could shorten the belt during the next outage to avoid problems during normal operation.

3.6 Chain rollers and supports

All the chain rollers are freely rotating and their supports are in good condition.

Action to be carried out weekly: Check the free rotation of all the idlers. If jammed, replace promptly: a jammed roller will wear the chain.

4 PRIMARY CRUSHER

4.1 Wear plates and cams

It was not possible to check plates and cams because the equipment was running. But I understand that is scheduling to be changed on next outage in August 2018.

Action to be carried out monthly: Check the plates and cams. If worn, replace them.

4.2 Drive

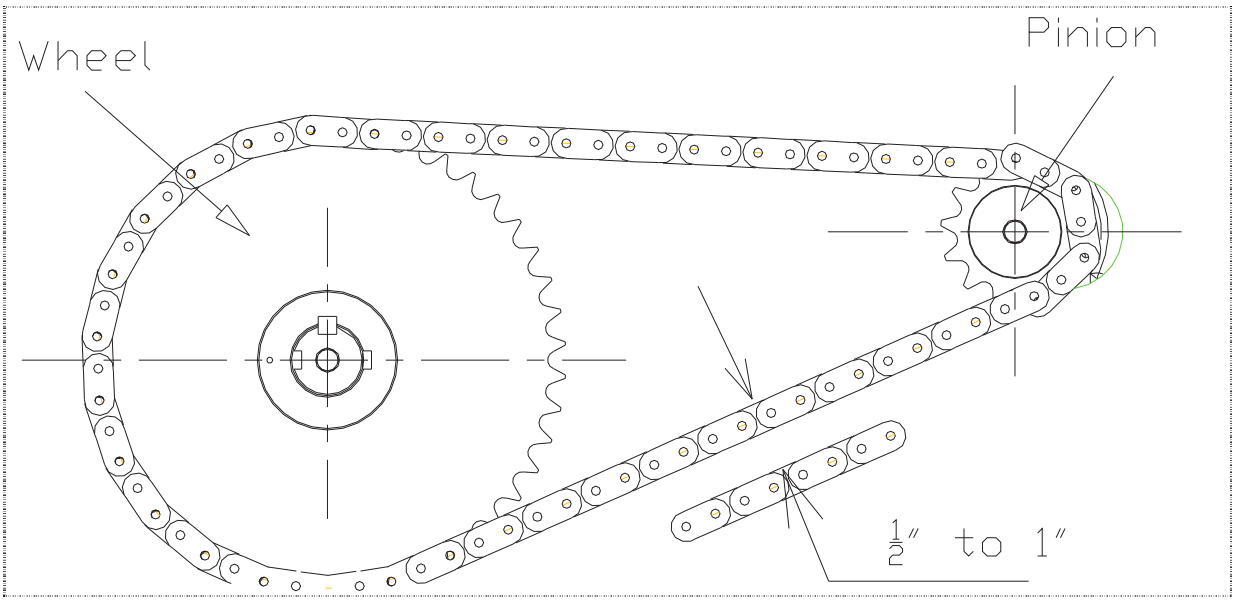
The oil level it appere to be OK.

The temperature of the gearbox is correct (please refer to the picture below)

Action to be carried out monthly: Check the oil level. If low missing, add or replace. Reinstall the automatic lubricator.

Action to be carried at your earliest convenience:

- Check the chain tension according to the following drawing: if necessary set the right tension



5 ECOMAG

5.1 Belt

- The pan plates are not in good conditions, many wings are missing,please refer to the picture below:

Action to be carried during the boiler outage:

Replace the pan plate with missing lateral wing or you will have fast wear on the mesh

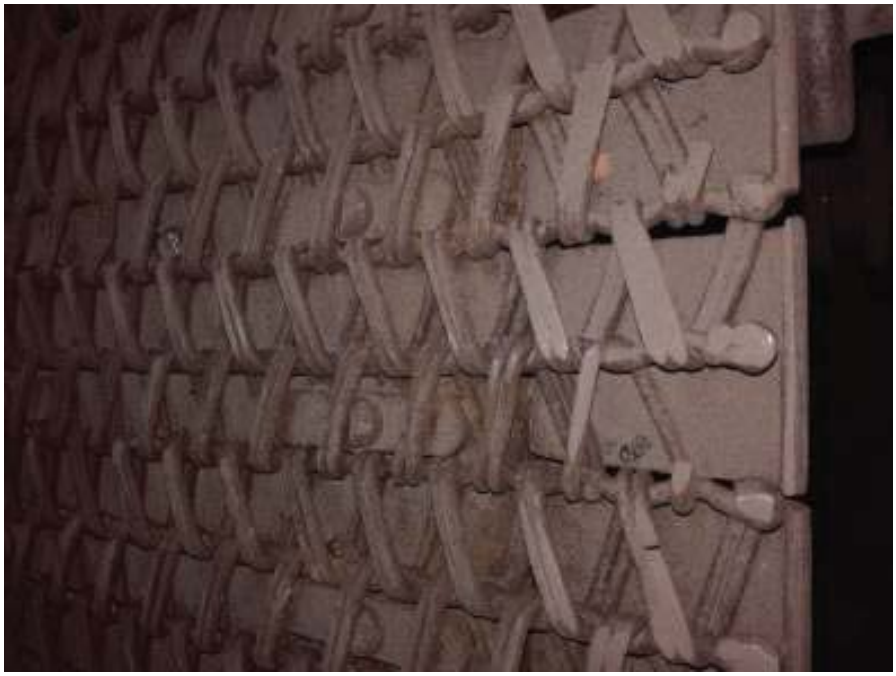
Action to be carried out weekly:

Please check the whole belt.

- Check pan plate: if some pan plate is damaged replace promptly.
- Check the screws: a missing screw can cause a fast pan plates bending and a bend pan plate can block in the other parts of the conveyor.

5.2 Mesh

- The mesh is not in good conditions. The mesh presents, 40 % of wear on left and right side per 2" (50 millimetres) of length (normal wear) (please refer to the attachment):



The original diameter of the spirals is 0,16" (4 millimetres); the maximum admitted wear is 30% of the original diameter, so they should measure the diameters in a lot of point of the mesh to be sure that the medium value is more than 0,095" (2,4 millimetres) (measured in vertical direction).

5.3 Belt alignment and guide idlers

5.3.1 Alignment

- The alignment has been checked from the tail pulley to the head and is well aligned:

Left side tail section

Right side tail section

Action to be carried out weekly:

- Check - if the first guide idler in the tail section is turning; check the last guide idler in the head section is turning; the belt needs to be aligned in the tail section and or head section
- Check the alignment in all sections and align it according to the maintenance manual.
- Check the wear on the guide idlers.

5.3.2 Guide Idler

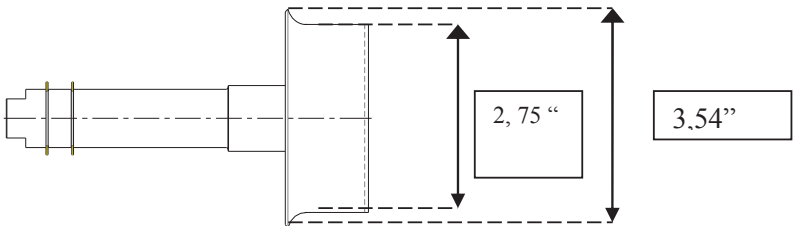
- The guide idlers are ok

Action to be carried out monthly:

- Check the guide idlers.

5.4 Carrying and return idlers and supports

- Two carrying idlers number 4 and 6 from the tail section are not turning
- **Actions to be carried out immediately:** Change the carrying idlers **MAGALDI CODE RUL003E** and the relative supports **MAGALDI CODE COT0363**
- The return idlers have a conic wear



Actions to be carried out monthly: Check the free rotation of all the idlers. If jammed replace promptly: a jammed carrying idler will wear the mesh; a jammed return idler will wear the belt lateral wings. Please note that if the return idlers have more that 0,4” of wear they need to be changed.

5.5 Take – up system

- The residual cylinder stroke is about 0” of the available 20.

Actions to be carried out immediately: Shorten the belt.

Action to be carried out monthly:

- Check the elongation of the belt.

5.6 Drive

The oil level it appear to be OK please refer to the picture below

The temperature of the gearbox is normal (please refer to the picture below)

Action to be carried out as soon as possible: Check the oil level. If low add or replace it. Please, install the oil level indicator

6 ECOMAG SPILL-CHAIN

6.1 Spill chain

The spill chain has been removed. They inform me that in schedule to install next month the complete scpill chain. They need keep cleaning the bottom with vacum.

6.2 Head tail sprockets

Please note that when you will change the whole spill chain you need to change also the tail and head sprocket.

6.3 Drive

The Gear Box is in good condition.

The oil level in the gearbox appears to be low (please refer to the picture below

The temperature of the motor and gearbox are normal (please refer to the picture below)

Actions to be carried out at your earliest convenience : Check the oil level. If low , add or replace it

7 VIBROFEEDER

- The vibrofeeder is in good conditions please refer to the attachment:

8 MIXER

- The paddle of the mixer are in good conditions (please refer to the attachment):

9 MILL REJECTS SYSTEM

- The equipment are in good conditions (please refer to the attachment):

Ing. Domenico Antonelli
Service Area Manager

MAGALDI TECHNOLOGIES LLC
370 Great Southwest Parkway
ATLANTA GA
30336
www.magaldi.com

Spare parts proposal

RFQ:

RFQ	BY EMAIL
Date	July 10th,2018

Contacts:

Service Area Manager	**Domenico Antonelli** **Mobil +39 348 707 2973** **e-mail:domenico.antonelli@magaldi.com**

Data:

Proposal number	**106279-R00**
Date	July 12th,2018
By	Mr.Domenico Antonelli
Attention	Mr. FRED JORDAN
Company	NOVA SCOTIA POWER INC.
Power plant/unit	TRENTON
Address	P.O. BOX 190 B0K 1X0 TRENTON

Supply conditions:

Proposal expiry date	15 days
Delivery terms	DDP TRENTON Please note that the material will be shipment from Italy so this means that at your cure the payment of Customs Duty when the materials will arrive to CANADA country
Delivery time	Shown in the column "Delivery time"
Terms Payment	A) 40% by direct cable remittance to Magaldi Technologies LLC. bank account nominated by Magaldi Technologies LLC, within thirty (30) days from invoice date. The Invoice will be issued upon Contract signature. (B) 40% at purchase of main materials, against presentation of un-priced PO's and without supplier's name (C) 20% at 30 days after delivery. Payments for amounts B) and C) shall be done by wire transfer at sight, whereas C) should be payable at 30 days after delivery. If the receipt of above payment (A) a is delayed from the agreed schedule, the delivery schedule of the supply of the equipment will be delayed by the same period of time. The Contract will be cinsidered in force and any contractual obligation for Magaldi Technologies LLC will be in force only after the receipt of payment of the 30% down-payment.
Currency	USD

Pos.	*EQUIPMENT*	*Code*	*Description*	*Quanity*	*Unit*	*Unit price*	*Total price*	*Delivery time DDP TRENTON*
10	POSTCOOLER	BLT003445	SUPERBELT TYPE ED6.AC.0655.255/S	71	NR.	[redacted]	[redacted]	16 WEEK
20	POSTCOOLER	GRP247A-D	MESH DISASEMBLED TYPE 2833/D C50 B=0800	1	NR.	[redacted]	[redacted]	16 WEEK
30	POSTCOOLER	GRP004064	PAN PLATE E.AC.0655.205/S	15	NR.	[redacted]	[redacted]	16 WEEK
40	POSTCOOLER	GRP004065	PAN PLATE WITH CLEAT ES.AC.0655.205/S	15	NR.	[redacted]	[redacted]	16 WEEK
50	POSTCOOLER	CSK0011	KIT SCREW AND PLATES	5	KIT	[redacted]	[redacted]	16 WEEK

TOTAL INCLUDING PACKING	[redacted]

Best Regards,

Domenico Antonelli
Service Department

CI Number: C0008559

Title: POT Diesel Generator and Essential Services Switchgear Replacement

Start Date: 2019/09
In-Service Date: 2019/10
Final Cost Date: 2020/04
Function: Steam
Forecast Amount: $294,571

DESCRIPTION:

This project is to replace the existing generator control panel and the switchgear it ties into that is original equipment from 1968. The diesel generator provides power to essential plant services during extended outages.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2020 C0008321 POT – 4160V Switchgear Replacement $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

This equipment needs to be replaced to improve the reliability of the backup power system for essential plant services. In the event of a panel failure, the generator would experience an extended outage leaving the limited supply battery backup as the only source of power. Losing power to the essential plant services could cause damage to the units.

Why do this project now?

This equipment is beyond its expected service life and is no longer reliable after equipment failed to operate during testing in 2017 resulting in a plant blackout. The equipment needs to be replaced to improve the reliability of the backup power system for essential plant services. The 2019 planned outage is the next available opportunity of sufficient length to perform the required work.

Why do this project this way?

Complete replacement is required as individual components are not suitable for replacement/refurbishment. The proposed new automatic transfer switch, circuit breakers, Programmable Logic Control (PLC), Human Machine Interface (HMI) touch screen, protective relays, Automatic Voltage Regulator, and switchgear are not compatible with the obsolete electro-mechanical relays and breakers that are currently used to perform the same function.

CI Number : C0008559 - POT Diesel Generator and Essential Services Switchgear Replacement

Project Number C0008559

Parent CI Number : -

Asset Location : 1152 - 1152 Point Tupper Unit 2

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	2200 - SGP - Elec Contr.Equip.	273,025
Retirements	2200 - SGP - Elec Contr.Equip.	21,545
	Total Cost:	294,571
	Original Cost:	38,799

Capital Project Detailed Estimate

Location: Point Tupper Generating Station
CI# : C0008559
Title: POT Diesel Generator and Essential Services Switchgear Replacement
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Electrician	PD	40	$ 358	$ 14,331		
Engineering	PD	20	$ 405	$ 8,106		
Maintenance Trades	PD	10	$ 365	$ 3,648		
CADD Operators	PD	10	$ 294	$ 2,941		
			Sub-Total	$ 29,026		
OT Labour						
Electrician	PD	8	$ 717	$ 5,733		
			Sub-Total	$ 5,733		
Travel Expense						
Site Travel	lot	1	$ 2,000	$ 2,000		
			Sub-Total	$ 2,000		
Materials						
CAT Parts	lot	1	[redacted]		Attachment 1, Item a	
			Sub-Total	[redacted]		
Contracts						
Installation and Commissioning	lot	1	[redacted]		Attachment 1, Items b-e	
			Sub-Total	[redacted]		
Freight						
Freight	lot	1	$ 2,200	$ 2,200		
			Sub-Total	$ 2,200		
Meals						
Meals	Lot	1	$ 1,000	$ 1,000		
			Sub-Total	$ 1,000		
Other Goods & Services						
Contingency	%	10%	$ 100,468	$ 10,047		
			Sub-Total	$ 10,047		
Administrative Overhead						
Labour AO				$ 8,332		
Contracts AO				$ 7,274		
			Sub-Total	$ 15,607		
			SUB-TOTAL (no AO, AFUDC)	$ 278,964		
			TOTAL (AO, AFUDC included)	$ 294,571		
Original Cost				$ 38,799		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Toromont CAT

175 Akerley Bldv, PO Box 953
Dartmourh, NS
Canada B2Y 3Z6
Tel.: 902-468-0581
www.toromont.com

July 11, 2018

Mr. Greg Dennis
Nova Scotia Power Inc.
PT TUPPER GEN STN 4137 PORT MALCOM RD
PT TUPPER, NS B9A
902-210-6012

Subject : Switchgear Proposal
Your Customer No. 1016236
Our Proposal 300-2018-11-07

Hi Greg,

Further to your requested, we are please to submit our proposal to replace your existing generator control panel.

Our offer consists of:

a)

- Complete new 1000A switchgear;
- 2 Draw out air circuit breaker 1000A, 65kA LSIG;
- Synchronizing devices with utility;
- Protective relay approved by Hydro Québec;
- New automatic voltage regulator;
- HMI Touch screen system;
- PLC;
- I line feeder including.

1 X 200A Molded Case Breaker
1 X 250A Molded Case Breaker
1 X 400A Molded Case Breaker
1 X 600A Molded Case Breaker
1X 1200A Molded Case Breaker

Our Price Budgetary [redacted]
Freight-Montreal,QC to Point Tupper [redacted] *(Customer responsible for unloading on site)*

TOROMONT Power Systems CAT

Our Proposal 300-2018-11-07
Page 2 of 3

b)

To supply and install one EMCP 4.2 control panel mounted on the generator set.

Our Price Budgetary ..... [redacted]

c)

To supply and install one 1000A LSIG Molded Case circuit breaker on the generator set.

Our Price Budgetary ..... [redacted]

d)

To supply 4 Caterpillar automatic transfer switch, 400A 600V model CTG.

Our Price Budgetary ..... [redacted]

e)

Initial and Start up.

Our Price Budgetary ..... [redacted]

CONDITIONS OF SALE

Delivery : Twenty (20) to twenty-two (22) weeks, after receipt of an order, subject to confirmation upon receipt of same.

Warranty : Six (6) months for Caterpillar parts and 90 days for allied parts.

Taxes : Federal Goods and Services Tax (G.S.T.) is not included and will be charged extra, if applicable.

Validity : Prices quoted are valid for a period of thirty (30) days, after which time they will have to be reconfirmed in writing.

Terms : Net 30 days. The whole is subject to the approval of our credit department.

Interest : Interest rate on unpaid balance will be at 24% per annum and will be charged monthly.

Our Proposal 300-2018-11-07
Page 3 of 3

24-HOUR /7-DAY EMERGENCY SERVICE AT
TOLL FREE NUMBER 1-877-428-5228

We hope that this proposal will be found satisfactory and remain at your disposal for any assistance or information you may require.

Yours truly,

TOROMONT CAT

Justin Boone
EPG-Account Manager
Parts and Service, Energy Division
Tel. : (902) 223-6744
Fax. : (902) 468-4222
Email : JBoone@toromont.com

CI Number: C0011091

Title: POT Asbestos Abatement 2019

Start Date: 2019/04
In-Service Date: 2019/05
Final Cost Date: 2019/11
Function: Steam
Forecast Amount: $270,498

DESCRIPTION:

This project is the next phase of a multi-year program underway to remove asbestos insulation from the Point Tupper Generating Station. Quarterly air samples, in conjunction with known areas of asbestos insulation requiring frequent repairs, will be considered to determine the location and extent of asbestos insulation to be removed. The work will be identified and tendered to an approved asbestos removal contractor. This contractor will be responsible for the removal of the asbestos insulation and the supply and re-installation of non-asbestos insulation.

The Point Tupper Generating station has been in operation since the mid-1960s. Much of the insulation used during construction of both units was asbestos based. In 1997, an extensive asbestos removal project was undertaken on Unit 1. This removed the majority of the asbestos contained in the boiler house and turbine area for the unit. Unit 1 had been decommissioned some time earlier.

During the conversion of Unit 2 from oil to coal (completed in 1987), the asbestos on the boiler was removed. This significantly reduced the quantity of asbestos contained in the unit. The asbestos on the majority of the boiler piping and the turbine, as well as feedwater piping and building heating was not addressed.

A third party consulting firm has recently assessed the plant's existing asbestos insulation and this report will assist in prioritizing and compartmentalizing future work to ensure it is done in a cost-effective manner without impacting operation of the generating station.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- 2017 – 49519 POT - Asbestos management 2017 $213,811
- 2018 – 52243 POT Asbestos Abatement 2018 $221,668
- 2020 – CI TBD POT Asbestos Abatement 2020 $TBD
- 2021 – CI TBD POT Asbestos Abatement 2021 $TBD

JUSTIFICATION:

Justification Criteria: Health & Safety

Why do this project?

Exposure to asbestos fibers poses a health risk to plant personnel. Degenerated asbestos insulation causes maintenance delays, increased down time and increased operating costs. Asbestos abatement and encapsulation are required to remove or mitigate health hazards to plant personnel associated with exposure to asbestos fibers. This project is in accordance with the Occupational Health and Safety Act (OHSA) and the Department of Labour's "Asbestos in the Workplace" guide.

The removal of asbestos-based insulation at the Point Tupper Generation Station is being completed in a multi-phase program based on risk, Joint Occupational Health and Safety Committee (JOSHC) recommendations, equipment replacement requirements and planned outages.

Why do this project now?

The abatement and encapsulation work completed in this project is required to safely continue to operate the plant and to execute planned outage work (in some cases), as well as plan for future maintenance work. The operation of the unit will continue to vary due to decreased utilization as more of NS Power's electricity requirements are met by renewable sources. With more stops and starts occurring on the unit, the level of vibrations and potential for asbestos disturbances will increase.

In accordance with the Occupational Health and Safety Act (OHSA) and the Department of Labour's "Asbestos in the Workplace" guide, the Point Tupper Generating Station has an asbestos management plan in place to manage the risks and protect the employees. This management plan includes an inventory of the asbestos containing insulation, which requires inspection on a regular basis. Subsequent to the inspections, any necessary encapsulation/abatement is completed.

Why do this project this way?

The scope of work is driven by safety compliance. A continued effort is required to monitor, remove and encapsulate asbestos containing materials. Ongoing inspection and selective abatement based on condition and wear are the best options to reduce further disruption and lost production due to repairs/maintenance that will be required in this area now and in the future.

CI Number : C0011091 - POT Asbestos Abatement 2019 **Project Number** C0011091

Parent CI Number : -

Asset Location : 1152 - 1152 Point Tupper Unit 2 **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0300 - SGP - Bldg.,Struct.Grnd.	182,366
Retirements	0300 - SGP - Bldg.,Struct.Grnd.	88,132
	Total Cost:	270,498
	Original Cost:	32,872

Capital Project Detailed Estimate

Location: Point Tupper Generating Station
CI# : C0011091
Title: POT Asbestos Abatement 2019
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Utility Worker	PD	10	$ 240	$ 2,402		
			Sub-Total	$ 2,402		
OT Labour						
Utility Worker	PD	4	$ 480	$ 1,921		
			Sub-Total	$ 1,921		
Term Labour						
Utility Worker	PD	10	$ 240	$ 2,402		
			Sub-Total	$ 2,402		
Materials						
Insulation and Cladding	lot	1	$ 60,000	$ 60,000		
			Sub-Total	$ 60,000		
Contracts						
Scaffolding	lot	1	$ 50,000	$ 50,000		
Asbestos Abatement	lot	1	$ 50,000	$ 50,000		
Reinsulation	lot	1	$ 50,000	$ 50,000		
			Sub-Total	$ 150,000		
Meals						
Meals	lot	1	$ 1,500	$ 1,500		
			Sub-Total	$ 1,500		
Other Goods & Services						
Contingency	%	15%	$ 218,225	$ 32,734		
			Sub-Total	$ 32,734		
Administrative Overhead						
Labour AO				$ 1,506		
Contracts AO				$ 18,033		
			Sub-Total	$ 19,539		
			SUB-TOTAL (no AO, AFUDC)	$ 250,959		
			TOTAL (AO, AFUDC included)	$ 270,498		
Original Cost				$ 32,872		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0010326

Title: TRE6 Parallel Slide Valve Replacement

Start Date: 2019/07
In-Service Date: 2019/08
Final Cost Date: 2020/04
Function: Steam
Forecast Amount: $256,080

DESCRIPTION:

The scope of this project is to replace the parallel slide valve on the Trenton Unit 6 6-B Boiler Feed Pump.

There are various processes within a thermal power station that require the ability to isolate equipment with the unit in-service in order to avoid maintenance outages and the resulting replacement energy costs. These high-pressure isolations on Unit 6 at the Trenton Generating Station are obtained by utilizing various sizes of parallel slide valves, and they are used on the feed water heaters, boiler feed pumps, and boiler isolations. These valves have been in-service since the unit was commissioned in 1991. Select valves have been refurbished at different intervals since they were originally installed, as they have reached the end of useful life based on performance.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Steam projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- No other projects in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement/Refurbishment

Why do this project?

The ability to provide reliable and safe isolation of equipment is a basic requirement to allow in-service maintenance to be executed without removing the unit from operation. The replacement of parallel slide valves is recommended to restore design operational conditions and restore valve internal conditions.

Why do this project now?

The 6-B Boiler feed pump valve is no longer providing complete isolation of the water coming out of the boiler feed pump to the feedwater system. To maintain unit reliability and ensure redundancy in boiler feed pump availability in the case of a pump failure, the valve needs to be replaced. The valve replacement can only be completed when the unit is offline. The 2019 annual planned outage duration will afford the time necessary to perform this work and will mitigate risk of a forced outage in the event of a valve failure.

Why do this project this way?

Replacement of the parallel slide valve is the only option to maintain unit reliability and ensure redundancy in boiler feed pump availability. The valve has been previously refurbished, and replacement is now required to restore design operational conditions and restore valve internal conditions.

CI Number : C0010326 - TRE6 Parallel Slide Valve Replacement

Project Number C0010326

Parent CI Number : -

Asset Location : 1166 - 1166 Trenton Unit 6; Commissioned 1991, 170 Mwh

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	1600 - SGP - Feed Water Sys.	206,782
Retirements	1600 - SGP - Feed Water Sys.	49,298
	Total Cost:	256,080
	Original Cost:	128,523

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI# : C0010326
Title: TRE6 Parallel Slide Valve Replacement
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Engineering	PD	10	$ 405	$ 4,053		
Maintenance Trades	PD	10	$ 365	$ 3,648		
Power Engineer	PD	5	$ 390	$ 1,952		
Power Plant Technician	PD	4	$ 382	$ 1,528		
Utility Worker	PD	30	$ 240	$ 7,205		
			Sub-Total	$ 18,387		CI 51534
OT Labour						
Maintenance Trades	PD	2	$ 729.57	$ 1,459		
Power Plant Technician	PD	1	$ 764.21	$ 764		
	PD			$ -		
			Sub-Total	$ 2,223		CI 51534
Term Labour						
Electrician	PD	2	$ 358	$ 717		
Maintenance Trades	PD	20	$ 365	$ 7,296		
Power Plant Technician	PD	1	$ 382	$ 382		
			Sub-Total	$ 8,394		CI 51534
Materials						
Valve	lot	1	[redacted]		Cost Support 1	
Rotor	lot	1			Cost Support 1	
Misc Materials	lot	1				
			Sub-Total	[redacted]		
Contracts						
Inspection	lot	1	$ 5,000	$ 5,000		
Labour	PD	100	$ 1,000	$ 100,000		
Stress Relief Weld Testing	lot	1	$ 20,000	$ 20,000		
				$ -		
			Sub-Total	$ 125,000		
Freight						
Freight	lot	1	$ 2,000	$ 2,000		
				$ -		
				$ -		
			Sub-Total	$ 2,000		
OT Meals						
Meals	lot	1	$ 500	$ 500		
			Sub-Total	$ 500		
Other Goods & Services						
Contingency	%	[redacted]				
			Sub-Total	[redacted]		
Administrative Overhead						
Thermal Labour AO				$ 7,287		
Thermal Contracts AO				$ 15,028		
			SUB-TOTAL (no AO, AFUDC)	$ 233,765		
			TOTAL (AO, AFUDC included)	$ 256,080		
Original Cost				$ 128,523		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

MacGillivray, Danya

From: Jordan, Fred
Sent: Wednesday, July 25, 2018 1:57 PM
To: MacGillivray, Danya
Cc: Lewis, Jack
Subject: FW: Parallel slide valves
Attachments: 8-venturi.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Fred

Fred L. Jordan, P.Eng | Engineering Specialist | Nova Scotia Power | Trenton Generating Station
T: 902-755-5811 x4210 | C: 902-396-9182 | F: 902-755-3722 | E: fred.jordan@nspower.ca

From: Herbert Icaza [mailto:Herbert.Icaza@mail.weir]
Sent: Friday, July 13, 2018 12:27 PM
To: Jordan, Fred
Subject: RE: Parallel slide valves

This is an external email - exercise caution

Hello Fred,

I can provide a budgetary price of [redacted] CDN for the valve including equalizer valve, I have attached a **reference** drawing

We can estimate about [redacted] or the Rotork actuator, however it will depend on the model of actuator (bells and whistles), also if the plan is to re-use one of the existing actuators then we need to confirm the available torque of the existing actuator.

Your order **2018658** is scheduled to arrive August 17th, 2018

Hope this helps, I will call you to follow-up.

Regards,

Herbert Icaza

Weir Flow Control
Montreal, Quebec
Canada

M 1 514-210-1833

Herbert.icaza@mail.weir
flowcontrol.canada@mail.weir

From: Jordan, Fred [mailto:FREDERICK.JORDAN@nspower.ca]
Sent: July 13, 2018 8:16 AM
To: Herbert Icaza
Subject: [EXTERNAL] RE: Parallel slide valves

The valve delivery is for next year, around this time, I believe. Of course, the first thing we need to do is get this in front of our management, so we need an order of magnitude number. Tre 6 valve is the most critical, as we cannot work on the pump while we're on line due to the inability to isolate the pump .

Fred

Fred L. Jordan,P.Eng | Engineering Specialist | Nova Scotia Power | Trenton Generating Station
T: 902-755-5811 x4210 | C: 902-396-9182 | F: 902-755-3722 | E: fred.jordan@nspower.ca

From: Herbert Icaza [mailto:Herbert.Icaza@mail.weir]
Sent: Thursday, July 12, 2018 8:47 PM
To: Jordan, Fred
Subject: RE: Parallel slide valves

This is an external email - exercise caution

Hello Fred,

Well received, I will have an update to your order in the morning. Also can you advise the required delivery for this installation? Normally delivery for these valves are about 32 weeks.

We might need the actuator information(full model) and application pressure and temps in order to ensure that the existing actuator will work. Will call you to review.

Regards,

Herbert Icaza

Weir Flow Control
Montreal, Quebec
Canada

M 1 514-210-1833

Herbert.icaza@mail.weir
flowcontrol.canada@mail.weir

From: Jordan, Fred [mailto:FREDERICK.JORDAN@nspower.ca]
Sent: July 12, 2018 3:31 PM
To: Herbert Icaza
Subject: [EXTERNAL] Parallel slide valves

Herb:

Please provide budgetary pricing and delivery for Parallel slide valves to replace existing units on our Trenton 5 and 5 HP Feedwater systems.

These are all on boiler feedwater service and are typically supplied with 3-way equalizing valves. We would like pricing to include the cost of Rotork actuators mounted on the valves as an extra- as per the original configurations (attached) for Tre 6, or shipped loose for retrofitting on existing actuator supports for Tre 5.

Tre 5: Piping is 10" sch 160 A106B. Existing valves are Hopkinsons –Ferranti 8" bore Fig 24950W w/ ¾" bypass, extensions and actuators. DWG R643B/88. Existing valves are identified as FW ,9,10,11,12

Tre 6:
21000 kPa @ 280C Note- piping is 10" Sch 160 A106C . Existing valve is a class 1690 Int class per Ansi B16.34. The valve to be replaced actually has a slightly lower design temp of 165C Existing valve is Dewrance P73ER250RCFB.

As an aside- do you have an update on the gaskets and fasteners for our check valves on order **2018658**

Fred L. Jordan,P.Eng | Engineering Specialist | Nova Scotia Power | Trenton Generating Station
T: 902-755-5811 x4210 | C: 902-396-9182 | F: 902-755-3722 | E: fred.jordan@nspower.ca

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CI Number: 49874

Title: CT – BGT Replace Halon Fire Protection

Start Date: 2018/10
In-Service Date: 2019/10
Final Cost Date: 2020/04
Function: Gas Turbine
Forecast Amount: $1,149,153

DESCRIPTION:

The scope of work for this project is to replace the existing Halon Gas Fire Suppression system at the Burnside Combustion Turbine site. This project is for the replacement of the fire detection, alarm and suppression systems for each of the combustion turbine and generator buildings as well as the central control buildings. The new suppression technology has a larger foot print and will require the addition of a small building enclosure to house and protect the suppression gas storage cylinders.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the Detailed CEJC, related CIs for Gas Turbine projects includes "work completed on the same asset (turbine, boiler, etc.) and on the same unit (Lingan Unit #3, for example)."

- No other projects in 2017, 2018, 2019, 2020 or 2021

Depreciation Class: Other Production – Gas Turbines - Burnside

Estimated Life of the Asset: 20 Years

JUSTIFICATION:

Justification Criteria: Health & Safety

Why do this project?

Per the Federal Ozone-depleting Substances Regulations, 1998 (ODSR 1998), the import and manufacture of ozone-depleting substances, including Halons was banned. Existing fire suppression systems that utilized halon as a media were permitted to remain in service; however, recharging of the media was made impossible. This project will replace the existing Halon Gas suppression technology with a gas (INERGEN) that is available to refill in the event of a discharge. INERGEN is an inert gas composed of nitrogen, argon and carbon dioxide and is recognized as not exhibiting any ozone depleting potential or contributing to global warming by the Government of Canada.

Why do this project now?

Production of the existing suppression system (Halon) has ceased, and is no longer available for use in Nova Scotia. The existing detection and alarm system has become obsolete. The condition of the cable insulation in some locations is deteriorated such that the insulation has become brittle and hard and is cracking. The current Halon system has one charge remaining and if it were to discharge, NS Power has no replacement suppression available. Discharge would render the fire protection inoperable and render the unit unserviceable until a temporary fire protection measure could be reinstated.

Why do this project this way?

It is necessary to replace the fire suppression system with a suppression media that is available, and does not have negative impacts on personnel safety, the environment or the generating equipment. The replacement fire alarm control panel, detection equipment and cabling will allow for continued reliability, and extend the life of the entire fire suppression system.

CI Number : 49874 - CT - BGT Replace Halon Fire Protection

Project Number 49874

Parent CI Number :

Asset Location : 1213 - 1213 Burnside Unit 3, 30 Mwh unit

Budget Version 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0300 - GTG - Bldg.,Struct.Grnd.	1,108,825
Retirements	0300 - GTG - Bldg.,Struct.Grnd.	40,328
	Total Cost:	1,149,153
	Original Cost:	51,159

Capital Project Detailed Estimate

Location: Gas Turbine
CI# : 49874
Title: CT - BGT Replace Halon Fire Protection
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Maintenance Trades	PD	10	$ 365	$ 3,648		
Engineering	PD	50	$ 405	$ 20,265		
Electrician	PD	20	$ 358	$ 7,166		
Gas Turbine Operators	PD	20	$ 358	$ 7,166		
CADD Operators	PD	3	$ 294	$ 882		
			Sub-Total	$ 39,127		
OT Labour						
Gas Turbine Operators	PD	20	$ 358	$ 7,166		
			Sub-Total	$ 7,166		
Travel Expense						
Site Visits	lot	1	$ 1,000	$ 1,000		
			Sub-Total	$ 1,000		
Materials						
Inergen Fire Protection Package Mechanical Installations, Fire Alarm Panel Installations, Electrical Wiring and Additions	lot	1	[redacted]		Attachment 1, 50% for materials	
Buildings (for Inergen bottles)	lot	1				
			Sub-Total	$ 440,075		
Contracts						
Inergen Fire Protection Package Mechanical Installations, Fire Alarm Panel Installations, Electrical Wiring and Additions	lot	1	[redacted]		Attachment 1, 50% for contracts	
Buildings (for Inergen bottles)	lot	1				
Halon Disposal	lot	1	$ 40,000	$ 40,000		
			Sub-Total	$ 480,075		
Meals						
Site Visits	lot	1	$ 2,000	$ 2,000		
			Sub-Total	$ 2,000		
Other Goods & Services						
Contingency	%	10%	$ 969,442	$ 96,944		
			Sub-Total	$ 96,944		
Interest Capitalized						
AFUDC				$ 14,169		
			Sub-Total	$ 14,169		
Administrative Overhead						
Labour AO				$ 11,067		
Contracts AO				$ 57,530		
			Sub-Total	$ 68,597		
			SUB-TOTAL (no AO, AFUDC)	$ 1,066,387		
			TOTAL (AO, AFUDC included)	$ 1,149,153		
Original Cost				$ 51,159		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Troy Life & Fire Safety Ltd.

November 1, 2018

Nova Scotia Power Incorporated
Attention: Cordell Randell

Re: **Burnside Site**
Six Inergen Suppression systems (4 turbines and 2 control buildings)
Troy Quotation # 380-TM-2719

Troy Life & Fire Safety Ltd. is pleased to submit for your review our quotation for the above referenced project. Our price is based upon our site visit of March 1, 2018 and requirements for Inergen systems per NFPA 2001, and the Provincial Building Code.

Total Price to complete this work, excluding all applicable taxes: [redacted]

Scope of Work (Goods or Services included in this price):

- Installation and material for 6 Inergen Systems (4 turbines and 2 control buildings) on supplied CAD files
- Fire alarm riser drawing
- Electrical labour and materials for Inergen systems, lights and heat for 2 Inergen buildings
- Engineering review and approval of the Inergen design and installation
- All installation labour to be performed by CASA qualified sprinkler fitters
- All material to make for a complete installation
- Fan test for all Inergen protected areas
- Site preparation and clean up throughout the construction process, of our area and materials
- One-year warranty on workmanship & materials from date of substantial completion.
- Complete Test documents, As-built Drawings, and Operation & Maintenance manuals
- All Work performed during a regular daytime shift, Monday to Friday [between 7am and 4pm]

The following Items are excluded in our quotation:

- Painting or coating of piping
- Maximum ambient temperature during release at 54C
- Coring & Drilling
- Removal of existing Halon bottles and piping
- Fire-stopping and smoke-sealing
- Asbestos Report
- Inergen protection in cylinder enclosures
- Asbestos identification, abatement and/or any related remedial work
- Working/Disturbing with any asbestos containing material
- Exterior enclosures to house new Inergen cylinders
- Weather tight pipe tray to house piping between cylinder enclosure to protected areas
- Cable trays for new electrical installation
- Cutting, patching, furring-in or boxing in of pipe (bulkheads)
- Removal, replacement or Installation of ceiling tiles
- Heat-tracing and insulation
- Fire Dampers/Louvers
- All costs associated with additional fan seal testing, should the first test fail.
- Fire Watch
- Work performed after regular weekday working hours

Troy
Life & Fire Safety Ltd.

Pricing on this quotation has been prepared based on standard sales and payment terms of NET 30 days from date of invoice, on approved credit. Troy Life & Fire Safety Ltd., will not agree to a contract that contains "paid when paid"/"paid if paid" payment terms without commercially reasonable limitations that are mutually acceptable to both parties. The foregoing is a condition of a provision of Services at the price quoted.

Our quote is based on industry standard contractual terms for consideration should Troy Life & Fire Safety Ltd. be the successful proponent. We anticipate that should reasonable amendments or clarifications be required that they may be addressed by the parties acting in good faith.

This quotation for delivery of Goods or Services described herein is subject to Troy Life & Fire Safety Ltd.'s General Terms and Conditions attached hereto and pricing shall remain in effect for a period of 30 days unless extended by formal request. To proceed with this work, please complete the "Customer Authorization" section at the bottom of this document and return to me at your earliest convenience.

Thank you for the opportunity to provide this proposal. Should you require any clarification or additional information, please contact me at your convenience.

Respectfully Yours,

Ted Martin
Fire Protection Manager
ted.martin@troylfs.com
Troy Life & Fire Safety Ltd.
80 Raddall Avenue
Dartmouth, Nova Scotia
B3B 1T7
Phone (902) 468-9500 ext. 226
www.troylfs.com

Troy Life & Fire Safety Ltd.

General Terms and Conditions.

For the purposes of construction projects, items not specifically addressed within Troy Life & Fire Safety Ltd., General Terms and Conditions and where Seller is providing Goods and Services as subcontract work, such work shall be governed by CCA 1 Stipulated Price Subcontract in its most recent form. Where Seller is providing Goods and Services direct with a Customer who is the owner of the project, such items not specifically addressed herein shall be governed by CCDC 2 Stipulated Price Contract in its most recent form.

The Customer and Troy Life & Fire Safety Ltd. ("Seller") have entered into an binding quotation for the provision of the "Goods" or "Services" described therein and is expressly conditioned on Customer's assent to the following General Terms and Conditions that will take priority over and exclude any terms and conditions proposed by Customer dealing with the same or similar subject matter, including but not limited to any pre-printed terms and conditions on the Customer's purchase order.

Sales and payment terms. Terms are net 30 days from date of invoice, unless mutually agreed otherwise in writing. If payment is not received when due, Customer will be responsible for all collection and legal fees and Seller shall be entitled to charge interest at a rate of the lesser of **[eighteen percent (18%)]** per annum, and the highest rate permissible by applicable law. Customer may not retain payment on account of any claim that it may have against Seller or offset any such claim against the invoiced price. Nothing shall serve to void Seller's construction lien and/or bonding claim rights in accordance with provincial law. If Customer has an account in arrears with Seller, Seller reserves the right to withhold documentation including verification reports and/or inspection certificates until such time account is current.

Delivery, title, and risk of loss. All shipments of Goods will be FOB shipping point. Delivery, shipment, and installation dates are estimated dates only, and unless otherwise specified are figured from date of receipt of complete technical data and approved drawings as such may be necessary. Seller will ship via its preferred carrier. Seller reserves the right to make partial shipments unless specifically stated otherwise on Customer's purchase order. Freight charges will be prepaid by Seller and invoiced to Customer unless mutually agreed otherwise in writing. Customer must promptly file claims for damaged items with the freight carrier. Seller will determine the point of shipment and Goods may be shipped from multiple locations. All Services will be FOB destination.

Force Majeure. Seller shall not be liable, directly or indirectly, for non-delivery, delays in performance, or any other failure to comply with our obligations under these terms and conditions if same is due to labour difficulties, inability to secure transportation, shortages, lockouts, strikes or stoppages of any sort, fires, floods, accidents (in manufacture or otherwise), failure or delay in obtaining materials or manufacturing facilities, acts of government, weather, embargoes, civil unrest, terrorism, war, invasion, riots, acts (or omissions) of Customer or Customer's suppliers or agents including (but not limited to) Customer's failure to promptly supply all necessary documentation or acts of God or any other cause beyond our reasonable control, and, when such delays arise, all of our obligations and estimated dates shall be extended for a period equal to the time lost by reason of delay, plus such additional time as may be reasonably necessary to overcome the effect of the delay. Seller will be entitled to an equitable price and performance adjustment.

Cancellation and Return of Goods. Goods may be cancelled only with Seller's written consent and upon payment of reasonable and proper cancellation charges. Goods may be returned only when specifically authorized by Seller in writing. Customer may be required to pay reasonable charges including cost of placing returned Goods in saleable condition, sales expenses further incurred, a restocking charge and transportation costs (incoming and outgoing) which Seller pays.

Governing law. This Agreement shall be governed by the laws of the jurisdiction in which the Goods and Services are provided and performed.

WARRANTY. SELLER WARRANTS TO CUSTOMER THAT (I) THE GOODS WILL BE SHIPPED FREE FROM DEFECTS IN MATERIAL, WORKMANSHIP AND TITLE AND THAT(II) THE SERVICES WILL BE PERFORMED IN A COMPETENT AND REASONABLE MANNER IN ACCORDANCE WITH ANY MUTUALLY DETERMINED SPECIFICATIONS IN WRITING. ALL GOODS (INCLUDING INCIDENTAL MATERIALS AND CONSUMABLES USED IN THE SERVICES AND SOFTWARE) WILL CARRY ONLY THE WARRANTY OF THEIR ORIGINAL MANUFACTURER OR SOFTWARE PROVIDER. Unless otherwise stated in the binding quotation, the warranty period for Goods and Services is one year from substantial completion of Sellers work. If Goods or Services do not meet the above warranties, Customer will promptly notify Seller in writing within the warranty period. Seller will thereupon (i) at Seller's option, repair or replace the defective Goods, or (ii) re-perform or correct the defective Services. Where a failure cannot be corrected by Seller's reasonable efforts, the parties will negotiate an equitable adjustment in price. Any repair, replacement, modification or reperformance by Seller hereunder will not extend the applicable warranty period. Customer will bear the costs of access (including removal and replacement of systems, structures or other parts of Customer's facility), de-installation, decontamination, re-installation and transportation of Goods to Seller and back to Customer. These warranties and remedies are conditioned upon (a) the proper storage, installation, operation, and maintenance of the Goods and conformance with the proper operation instruction manuals provided by Seller or its suppliers or subcontractors, (b) Customer keeping proper records of operation and maintenance during the warranty period and providing Seller access to those records, and (c) modification or repair of the Goods only as authorized by Seller in writing. Seller does not warrant the Goods or any repaired or replacement parts against normal wear and tear or damage caused by misuse, accident, or use against the advice of Seller. Any modification or repair of any of the Goods not authorized by Seller including any third party repair or attempted repair will render the warranty null and void. This clause provides the exclusive remedies for all claims based on breach or a failure of or defect in Goods and Services, whether the breach, failure or defect arises before or during the applicable warranty period and whether a claim, however described, is based on contract, warranty, indemnity, tort/extra contractual liability (including negligence), strict liability or otherwise. THE WARRANTIES PROVIDED IN THIS CLAUSE ARE EXCLUSIVE AND IN LIEU OF, AND SELLER EXPRESSLY EXCLUDES ANY AND ALL OTHER WARRANTIES, GUARANTEES, OBLIGATIONS, LIABILITIES, REPRESENTATIONS (INNOCENT OR NEGLIGENT) OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABLE QUALITY, FITNESS FOR A PARTICULAR PURPOSE, DURABILITY, SUITABILITY, QUALITY OR CONDITION OR ANY CONDITION OR WARRANTY ARISING BY STATUTE OR OTHERWISE IN LAW OR IN EQUITY OR FROM A COURSE OF DEALING OR USAGE OF TRADE.

Limitation of Liability. Seller is not an insurer, and payments for Seller's Goods and Services are based solely on the value of the Goods and Services provided and are unrelated to the value of the Customer's premises, its contents or occupants. SELLER SHALL NOT BE LIABLE TO CUSTOMER OR ANY PERSON WHETHER IN CONTRACT, TORT, EQUITY OR OTHERWISE, OR UNDER ANY STATUTE OR REGULATION, FOR ANY COST OR EXPENSE, NOR FOR ANY CLAIMS ARISING OUT OF THE SERVICES PROVIDED BY SELLER, THE SUPPLY OR USE OF THE GOODS FURNISHED BY SELLER, NOR FOR ANY PENALTY, EXPENSE, LOSS OR DAMAGE OF ANY KIND OR NATURE WHATSOEVER IN ANY MANNER RESULTING FROM ANY BREACH OR FAILURE IN PERFORMANCE BY SELLER HEREUNDER, WHETHER OR NOT FROM NEGLIGENCE, FUNDAMENTAL BREACH OR BREACH OF A FUNDAMENTAL TERM OTHER THAN FOR CUSTOMER"S ACTUAL DIRECT DAMAGES WHICH IN NO EVENT SHALL EXCEED THE INVOICE PRICE PAID TO SELLER FOR THE GOODS THAT ARE THE SUBJECT OF CUSTOMER"S CLAIM, OR THE PRICE PAID DURING THE YEAR IN WHICH THE SERVICES WERE

PERFORMED. IN NO EVENT AND UNDER NO CIRCUMSTANCES SHALL SELLER BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, PUNITIVE, CONSEQUENTIAL (INCLUDING LOSS OF PROFITS) OR OTHER SIMILAR DAMAGES, REGARDLESS OF THE LEGAL THEORY OF ANY CLAIM, EVEN IF ADVISED OF THE POSSIBILITY THEREOF. The foregoing limitation of liability is a condition of sale of the Goods and provision of Services at the price quoted and shall apply notwithstanding any defect in or failure of, including total failure of any Goods. If Customer is supplying the Goods to a third party, Customer will require the third party to agree to be bound by this clause and will indemnify, defend and hold Seller harmless from and against any and all claims made by the third party in excess of the limitations and exclusions of this clause. Seller will not be liable for any advice or assistance that is not required under the Agreement.

Title / Non-Payment / Intellectual Property. Title to the products and to the work product arising from any Goods or Services shall not pass to Customer until Seller has been paid in full for such Goods and Services. Products shall be and remain personal or moveable property, notwithstanding their mode of attachment to realty or other property. If default is made in any of the payments herein, Customer agrees Seller may retain all payments which have been made on account of the purchase price as liquidated damages, and shall be free to enter the premises where the products may be located and remove them as Seller's property, without prejudice to its rights to recover any further expenses or damages suffered by reason of non-payment.

"Intellectual Property" shall mean all patents, copyrights, trademarks, confidential Information and other similar rights and information contained in, arising out of, or applicable to, work performed by Seller or the deliverables (including, but not limited to, any digital or written materials such as reports, software code, drawings, schematics, programming, evaluations, etc.) or specified to be performed as part of the Goods or Services hereunder.

Customer acknowledges and agrees that Seller and its licensors own all Intellectual Property and proprietary rights underlying in the Goods and Services provided to Customer. Customer's use of the Intellectual Property and proprietary rights is authorized only in accordance with the licenses provided to it. Unless otherwise agreed, upon termination of these General Terms and Conditions for any reason, such authorization will cease.

Hazardous Substances. Customer shall be responsible for all costs, expenses, damages, fines, penalties, claims and liabilities associated with or incurred in connection with any hazardous materials or substances, including but not limited to asbestos, upon, beneath, about or inside customer's equipment , facility or property. Title to, ownership of, and legal responsibility and liability for any and all such hazardous materials or substances, shall at all times remain with Customer. Customer shall be responsible for the removal, handling and disposal of all hazardous materials or substances in accordance with all applicable governmental regulations. Customer shall defend, indemnify, reimburse and hold harmless Seller and its officers, directors, agents, and employees from and against any and all claims, damages, costs, expenses, liabilities, actions, suits, fines, and penalties (including without limitation, attorneys' fees and expenses) suffered or incurred by any of such indemnified parties, based upon arising out of or in any way relating to exposure to, handling of, or disposal of any hazardous materials or substances in connection with the Services performed hereunder. Seller shall have the right to suspend its work with no penalty to Seller until such hazardous materials or substances are removed. The time for completion of the work shall be extended to the extent caused by the suspension and the Service price equitably adjusted.

Entire Agreement. This Agreement and provisions of the binding quotation made in respect of the Goods and Services represents the entire agreement between the parties for the purchase of the Goods or Services. Notwithstanding any negotiations or discussions or any provision to the contrary in any purchase order or other document, all terms and conditions in any document which modify, add to or are at variance with the provisions in this Agreement will be binding only if Seller expressly accepts them in writing.

Language. It has been agreed between the parties hereto that this Agreement and all related documents thereto be drawn in the English language. Il a été convenu entre les parties aux présentes que ce Contrat ainsi que tous les documents y afférents soient rédigés en langue anglaise.

Miscellaneous. This Agreement cannot be waived, varied, modified or amended in any manner (including subsequent conduct between the parties) unless agreed upon in writing by both parties. Seller reserves the right to terminate this Agreement for Customer's failure to pay when due or Customer's insolvency. If any provision of this Agreement is found by a court of competent jurisdiction to be illegal, invalid or unenforceable, that provision shall be severed from this Agreement to the extent of its illegality, invalidity or unenforceability and the remaining provisions of this Agreement shall continue in full force and effect.

In consideration of mutual agreement, Troy Life & Fire Safety Ltd. and the Customer agree that the quotation for services and/or type of equipment coverage to be supplied or performed herein at the above-mentioned project location(s) will be provided in accordance with the terms of this quotation.

Authorization

Name of Customer: *PO Number:*

Name and Title of Person Signing:

Signature: *Date:*

CI Number: C0010042

Title: 2019 Transmission Right-of-Way Widening 69kV

Start Date: 2019/01
In-Service Date: 2019/01
Final Cost Date: 2020/06
Function Class: Transmission
Forecast Amount: $5,650,794

DESCRIPTION:

This project will widen rights-of-way to reduce the occurrence of edge and off right-of-way tree contacts by increasing the separation between trees and transmission lines. The vegetation management practices performed under NS Power's maintenance program target vegetation within the rights-of-way and maintain existing, sustainable rights-of-way. These activities prevent tree growth from causing outages, but do not address edge or off right-of-way trees.

This is year four of the eight year 69 kV Transmission Right-of-Way Widening Plan accepted by the UARB through the Post Tropical Storm Arthur review process. Increasing the right-of-way width for 69 kV transmission lines to 30-40 meters where possible will significantly reduce the risk of trees contacting power lines during storms. Currently, 247 km of transmission right-of-way is targeted for widening in 2019.

The 69 kV transmission lines and the length of right-of-ways currently planned for widening in 2019 are shown in the table below. The transmission lines completed can be expected to vary as further inspections, and changes in prioritization occur throughout 2019.

Line #	Length of Right-of way to be Widened (km)
L-5025	16.0
L-5003	11.7
L-5004	13.8
L-5011	10.4
L-5031	20.3
L-5037	7.1
L-5048	8.7
L-5058	66.8
L-5505	18.2
L-5548	8.9
L-5559	43.5
L-5532	21.4
TOTAL	**246.8**

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- 2017 CI 49992 - 2017 Transmission Right of Way Widening 69kV - $5,400,855
- 2018 CI 51969 - 2018 Transmission Right of Way Widening 69kV - $5,487,686
- 2020 CI TBD - 2019 Transmission Right of Way Widening 69kV - $TBD
- 2019 CI TBD - 2020 Transmission Right of Way Widening 69kV - $TBD

Depreciation Class: Transmission Plant- Land Rights- Easements

JUSTIFICATION:

Justification Criteria: Transmission Plant

Why do this project?

NS Power's standard right-of-way width for a 69 kV transmission line was previously 20 meters. Given the power line structure is usually in the centre of the right-of-way, this resulted in a cleared area of 10m on each side of the centre line. The distance between the forest edge and conductor varies, depending on structure type. While this distance provides ample clearance for the safe maintenance and operation of all types of structures, it is not wide enough to prevent many tree species that are tall enough to span the entire right-of-way width from making contact with the power lines when they fall. Increasing the right-of-way width for 69kV transmission lines to 30-40 meters will significantly reduce the risk of trees contacting the power lines during storms.

Why do this project now?

This is year four of the eight year 69 kV Transmission Right-of-Way Widening Plan. The transmission right-of-ways currently targeted for widening in 2019 are noted above and consistent with the prioritization outlined in the Widening Plan. The transmission right-of-ways completed can be expected to vary as prioritization can change throughout the program due to inspections and/or reliability data.

This project is deemed in-service when the first transmission right-of-way is widened (January 2019), therefore the Final Cost date (June 2020) is six months after the last right-of-way is expected to be completed on this project (December 2019).

Why do this project this way?

Prioritizing the widening of the 69 kV transmission rights-of-way based on customer count and redundancy will provide the largest reliability benefit.

CI Number : C0010042 - 2019 Transmission Right-of-Way Widening 69kV

Project Number C0010042

Parent CI Number : -

Asset Location : 1455 - 1455 Transmission Plant General

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0200 - TP - Land Rights	5,650,794
	Total Cost:	5,650,794
	Original Cost:	

Capital Project Detailed Estimate

Location: **Transmission**
CI# / FP#: C0010042
Title: 2019 Transmission Right-of-Way Widening 69kV
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Royalties & Easements						
Easement Costs	Lot	1	$ 80,000	$ 80,000		
			Sub-Total	$ 80,000		
Travel Expense						
Travel	Lot	1	$ 10,000	$ 10,000		
			Sub-Total	$ 10,000		
Contracts						
Tree Trimming	Lot	1	$ 4,577,651	$ 4,577,651		
			Sub-Total	$ 4,577,651		
Administrative Overhead						
Contract AO				$ 983,142		
			Sub-Total	$ 983,142		
			SUB-TOTAL (no AO, AFUDC)	$ 4,667,651		
			TOTAL (AO, AFUDC included)	$ 5,650,794		
Original Cost						

Note 1: The labor figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0010948

Title: 2019/2020 Sacrificial Anode Installation Program

Start Date: 2019/01
In-Service Date: 2019/01
Final Cost Date: 2021/06
Function Class: Transmission
Amount: $3,099,862

DESCRIPTION:

This project will systematically install sacrificial anodes, highly active metals used for cathodic protection, on steel transmission structures and key tower anchors which have been identified as corroding or at a high risk for corrosion. This program, along with the inspection of transmission steel towers and the steel tower refurbishment, will identify and address corrosion issues on steel assets throughout the province.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- 2017 CI 49813 2017 Sacrificial Anode Installation Program $1,532,340
- 2018 CI 51402 2018/2019 Sacrificial Anode Installation Program $3,023,668
- 2020 CI TBD 2020/2021 Sacrificial Anode Installation Program $TBD
- 2021 CI TBD 2021/2022 Sacrificial Anode Installation Program $TBD

Depreciation Class: Transmission Equipment – Towers and Fixtures

Estimated Useful Life: 15-20 years

JUSTIFICATION:

Justification Criteria: Transmission Plant

Why do this project?

Based on transmission line inspections, the age of NS Power infrastructure and the corrosion rate of steel once galvanization is breached, sacrificial anodes, which have proven effective in other jurisdictions to protect steel transmission structure assets and slow the rate of corrosion, have been recommended as a corrosion solution by NS Power's Transmission & Distribution engineering group.

Why do this project now?

Based on the age of NS Power's steel transmission structure assets, the galvanization is at or near the end of the anticipated life. Cathodic protection provided by the installation of sacrificial anodes will extend the life of the steel structure.

This project is deemed in-service when the first anode is installed (January 2019), therefore the Final Cost Date (June 2021) is listed as six months after the last anode is installed (December 2020).

Why do this project this way?

The installation of sacrificial anodes protects the existing assets once the galvanization is ineffective, deferring costly replacement.

CI Number : C0010948 - 2019/2020 Sacrificial Anode Installation Program

Project Number C0010948

Parent CI Number : -

Asset Location : 1455 - 1455 Transmission General

Budget Version 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	3700 - TP - Steel Towers	3,099,862
	Total Cost:	3,099,862
	Original Cost:	

Capital Project Detailed Estimate

Location: Transmission
CI# / FP#: C0010948
Title: 2019/2020 Sacrificial Anode Installation Program
Execution Year: 2019/2020

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Site Supervision	PD	128	$ 389	$ 49,792		
Procurement / Financial Support	Lot	1	$ 2,869	$ 2,869		
			Sub-Total	$ 52,661		
Materials						
Anodes & Test Stations	EA	950	$ 151	$ 143,450		
			Sub-Total	$ 143,450		
Contracts						
Contract Line Work	EA	1	$ 2,000,000	$ 2,000,000		
Contract Supervision	EA	1	$ 100,000	$ 100,000		
			Sub-Total	$ 2,100,000		
Consulting						
External Program Consulting	Lot	1	$ 50,000	$ 50,000		
			Sub-Total	$ 50,000		
Meals						
Meals	Lot	2	$ 2,000	$ 4,000		
				$ -		
			Sub-Total	$ 4,000		
Other Goods & Services						
Contingency	%	10%	$ 2,350,111	$ 235,011		
				$ -		
			Sub-Total	$ 235,011		
Vehicle Overhead						
Vehicle AO				$ 22,882		
				$ -		
			Sub-Total	$ 22,882		
Administrative Overhead						
Labour AO				$ 40,841		
Contract AO				$ 451,017		
			Sub-Total	$ 491,858		
			SUB-TOTAL (no AO, AFUDC)	$ 2,585,122		
			TOTAL (AO, AFUDC included)	$ 3,099,862		
Original Cost				$ -		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0010952

Title: 2019/2020 Substation Polychlorinated Biphenyl (PCB) Equipment Removal

Start Date: 2019/12
In-Service Date: 2019/12
Final Cost Date: 2021/11
Function Class: Transmission
Forecast Amount: $2,786,245

DESCRIPTION:

This project will replace substation devices that have polychlorinated biphenyl (PCB) levels of 50 mg/kg or more to comply with 2008 Federal Environmental PCB Regulations. PCB sampling of all accessible substation equipment was completed in previous year projects and the focus is now on equipment removal.

A portion of the capital costs associated with this capital item will contribute toward settling the Company's Asset Retirement Obligation for PCB contaminated oil.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- 2017 CI 49838 2017/2018 Substation PCB Equipment Removal $4,127,023
- 2018 CI 51403 2018/2019 Substation PCB Equipment Removal $4,402,342
- 2020 CI TBD 2020/2021 Substation PCB Equipment Removal $TBD
- 2021 CI TBD 2021/2022 Substation PCB Equipment Removal $TBD

Depreciation Class: Transmission Plant – Station equipment

Estimated Useful Life: 40 Years

JUSTIFICATION:

Justification Criteria: Environment

Why do this project?

This project is required to enable NS Power to comply with the revised 2008 PCB Regulations as set by the Federal Government, which includes a deadline of year end 2025 for the elimination of all equipment containing PCBs in concentrations at or above 50 mg/kg.

Why do this project now?

This project must be completed to comply with the replacement of all applicable PCB contaminated substation equipment before the deadline of year end 2025.

This project is deemed in-service when the first device is removed (December 2019), therefore the Final Cost Date (November 2021) is listed as six months after the last device is removed (May 2021).

Why do this project this way?

The replacement of equipment containing greater than 50 mg/kg concentration of PCBs must be planned over a period of several years to manage outages effectively and comply with the 2008 Federal PCB Regulations.

CI Number : C0010952 - 2019/2020 Substation Polychlorinated Biphenyl (PCB) Equipment Removal **Project Number** C0010952

Parent CI Number : -

Asset Location : 1455 - 1455 Transmission Plant General **Budget Version** 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0300 - TP - Bldg.,Struct.Grnd.	189,928
Additions	2200 - TP - Elec Contr.Equip.	356,675
Additions	4300 - TP - Substn Dev.	1,463,059
Additions	4400 - TP - Substn.Transf.	659,213
Retirements	4300 - TP - Substn Dev.	117,370
	Total Cost:	2,786,245
	Original Cost:	466,744

Capital Project Detailed Estimate

Location: Transmission
CI# : C0010952
Title: 2019/2020 Substation Polychlorinated Biphenyl (PCB) Equipment Removal
Execution Year: 2019/2020

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Electrician/Technician	PD	360	$ 373	$ 134,139		
T&D Labour - Design	PD	511	$ 386	$ 197,230		
T&D Labour - Commissioning	PD	139	$ 386	$ 53,748		
Procurement / Financial Support	Lot	1	$ 25,455	$ 25,455		
			Sub-Total	$ 410,572		
Travel Expense						
Travel Expenses	Lot	1	$ 4,070	$ 4,070		
			Sub-Total	$ 4,070		
Materials						
Buildings, Structures and Grounds	Lot	1	$ 28,710	$ 28,710		
Electrical Control Equipment	Lot	1	$ 96,140	$ 96,140		
Substation Transformers	Lot	1	$ 600,000	$ 600,000		
Substation Devices	Lot	1	$ 747,880	$ 747,880		
			Sub-Total	$ 1,472,730		
Contracts						
Buildings, Structures and Grounds	Lot	1	$ 29,865	$ 29,865		
Substation Devices	Lot	1	$ 132,380	$ 132,380		
			Sub-Total	$ 162,245		
Other Goods & Services						
Contingency	%	10%	$ 2,049,617	$ 204,962		
				$ -		
			Sub-Total	$ 204,962		
Vehicle Overhead						
Vehicle AO				$ 178,402		
			Sub-Total	$ 178,402		
Administrative Overhead						
Labour AO				$ 318,419		
Contract AO				$ 34,845		
			Sub-Total	$ 353,264		
			SUB-TOTAL (no AO, AFUDC)	$ 2,254,579		
			TOTAL (AO, AFUDC included)	$ 2,786,245		
Original Cost				$ 466,744		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0010949

Title: 2019/2020 Steel Tower Life Extension

Start Date: 2019/06
In-Service Date: 2019/06
Final Cost Date: 2021/03
Function Class: Transmission
Forecast Amount: $2,414,140

DESCRIPTION:

This project is to apply protective coating to lattice steel towers near Burnside and various areas around Halifax to extend the life of the structures. The towers to be coated will be prioritized based on the latest inspection data. Current inspection results indicate that the towers in the Burnside area and Halifax area should be recoated in order to extend the life of the assets. The cost includes the removal, collection, and disposal of lead paint where required, working at heights in proximity to energized lines, as well as material costs for coating on 20 steel towers in Burnside and 20 steel towers in Halifax. Applying protective coatings on steel transmission structures is a common and accepted form of corrosion control used in the utility industry.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- 2017 CI 49814 2017/2018 Steel Tower Life Extension $1,462,100
- 2017 CI 51404 2017-2019 Steel Tower Life Extension P&A $2,981,318
- 2020 CI TBD 2020/2021 Steel Tower Life Extension $TBD
- 2021 CI TBD 2021/2022 Steel Tower Life Extension $TBD

Depreciation Class: Transmission Equipment – Towers and Fixtures

Estimated Useful Life: 55 years (65 years with coating)

JUSTIFICATION:

Justification Criteria: Transmission Plant

Why do this project?

The environmental conditions that these towers are exposed to have led to the deterioration of the protective coating on the structures. These structures range from 54 to 62 years old and are showing signs of steel structure corrosion.

Why do this project now?

Current inspection results indicate the towers in the Burnside area, as well as towers in the Halifax area, should be recoated in order to extend the life of the assets. These towers require recoating to be completed in order to reduce the loss of metal, which will extend the life of the towers beyond their originally estimated useful life of 50-55 years. A conservative estimate for the life extension from coating the tower is 10 years, resulting in a revised useful life of 60-65 years. The towers will be selected based on the age and condition of the structures. Restoration of protective coating before failure of the coating system prevents corrosion damage to structural steel tower components.

This project is deemed in-service when the first tower is completed (June 2019), therefore the Final Cost Date (March 2021) is listed as six months after the last tower is completed (September 2020).

Why do this project this way?

The most cost effective approach is to recoat the steel towers prior to the failure of the protective coating which would lead to corrosion damage to the structural steel. If corrosion damage occurs in the structural steel components of a transmission tower, costly replacement of steel members may be necessary to preserve the integrity of the tower. The

average cost of a tower replacement is $500,000 and protective coating costs approximately $50,000 per tower. The protective coating extends the expected useful life of the steel tower by 10 years (from 55 years to 65 years). Additionally, the average cost per year of service for a steel tower without protective coating is $9,090 ($500,000 / 55 years); with the protective coating applied, the average cost per year for the additional 10 years of service is reduced to $5,000 ($50,000 / 10 years).

CI Number : C0010949 - 2019/2020 Steel Tower Life Extension

Project Number C0010949

Parent CI Number : -

Asset Location : 1455 - 1455 Transmission General

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	3700 - TP - Steel Towers	2,414,140
	Total Cost:	2,414,140
	Original Cost:	

Capital Project Detailed Estimate

Location: Transmission
CI#: C0010949
Title: 2019/2020 Steel Tower Life Extension
Execution Year: 2019-2020

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - PLT	PD	20	$ 372	$ 7,444		
T&D Labour - Site Supervision	PD	120	$ 389	$ 46,680		
Procurement / Financial Support	Lot	1	$ 2,876	$ 2,876		
				$ -		
			Sub-Total	$ 57,000		
OT Labour						
T&D Labour - PLT	PD	120	$ 734	$ 88,020		
			$ -	$ -		
			Sub-Total	$ 88,020		
Travel Expense						
Travel	Lot	1	$ 5,000	$ 5,000		
				$ -		
			Sub-Total	$ 5,000		
Materials						
Coating for Towers (HFX)	EA	20	$ 5,000	$ 100,000		
Coating for Towers (BRN)	EA	20	$ 5,000	$ 100,000		
				$ -		
			Sub-Total	$ 200,000		
Contracts						
Coating of Towers - External Contracts (HFX)	EA	20	$ 30,000	$ 600,000		
Coating of Towers - External Contracts (BRN)	EA	20	$ 30,000	$ 600,000		
External Engineering Assessments	EA	60	$ 617	$ 37,020		
Grounding & Permit Holding - External Contracts	EA	40	$ 5,000	$ 200,000		
External Quality Auditing	EA	40	$ 295	$ 11,818		
				$ -		
			Sub-Total	$ 1,448,838		
Meals & Entertainment						
Meals	Lot	1	$ 2,000	$ 2,000		
			Sub-Total	$ 2,000		
Other Goods & Services						
Contingency	%	10%	$ 1,798,859	$ 179,886		
			Sub-Total	$ 179,886		
Vehicle Overhead						
Vehicle AO				$ 43,891		
			Sub-Total	$ 43,891		
Administrative Overhead						
Labour AO				$ 78,338		
Contract AO				$ 311,167		
			Sub-Total	$ 389,505		
			SUB-TOTAL (no AO, AFUDC)	$ 1,980,744		
			TOTAL (AO, AFUDC included)	$ 2,414,140		
Original Cost				$ -		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011339

Title: L6549 – Replacements and Upgrades Phase 2

Start Date: 2019/01
In-Service Date: 2019/01
Final Cost Date: 2021/06
Function Class: Transmission
Forecast Amount: $2,209,907

DESCRIPTION:

L6549 is a 45 kilometer (205 structure) 138kV transmission line, built in 1977, that connects 5S Glen Tosh and 85S Wreck Cove substations. This project is required to replace deteriorated assets that have been identified through NS Power's transmission inspection program. This project includes the replacement of deteriorated assets on approximately 103 structures. This project will be completed over 2 years.

The project scope includes:

- Structure Replacements: 13 Structures
- Pole and Insulator Replacements: 5 Structures
- Timber and Insulator Replacements: 41 Structures
- Insulator Replacements: 44 Structures

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- 2018 CI 52320 L6549 Replacements & Upgrades $1,406,535

Depreciation Class: Transmission Plant- Poles and Fixtures
Transmission Plant- Overhead Conductors and Devices

Estimated Life of the Asset: 45 years

JUSTIFICATION:

Justification Criteria: Transmission Plant

Why do this project?

The transmission inspection program identified deteriorated assets that require replacement to avoid transmission interruptions. Failure to complete this project would compromise the reliable operation of this line.

Why do this project now?

This work has been prioritized based on transmission inspection results. This project is required to support the reliable operation of the transmission line.

This project is deemed in-service when the first portion of the work is complete (January 2019), therefore the Final Cost Date (June 2021) is listed as six months after the final work is completed (December 2020).

Why do this project this way?

Replacing the existing deteriorated assets is more cost effective than rebuilding the entire line.

CI Number : C0011339 - L6549 - Replacements and Upgrades Phase 2 **Project Number** C0011339

Parent CI Number : -

Asset Location : 1455 - 1455 L6549 Municipality of the County of Victoria **Budget Version** 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	3500 - TP - Wood Poles	827,870
Additions	3800 - TP - Insulators	429,870
Additions	3900 - TP - O/H Cond.	697,063
Retirements	3500 - TP - Wood Poles	152,576
Retirements	3800 - TP - Insulators	102,529
	Total Cost:	2,209,907
	Original Cost:	328,456

Capital Project Detailed Estimate

Location: Transmission
CI# / FP#: C0011339
Title: L6549 - Replacements and Upgrades Phase 2
Execution Year: 2019-2020

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Site Supervision	PD	79	$ 389	$ 30,569		
Procurement / Financial Support	Lot	1	$ 3,744	$ 3,744		
			Sub-Total	$ 34,313		
Materials						
Wood Poles	Lot	1	$ 128,188	$ 128,188		
Insulators	Lot	1	$ 58,992	$ 58,992		
			Sub-Total	$ 187,179		
Contracts						
Wood Poles	Lot	1	$ 504,952	$ 504,952		
Insulators	Lot	1	$ 277,974	$ 277,974		
O/H Conductor	Lot	1	$ 394,395	$ 394,395		
Environmental	Lot	1	$ 286,619	$ 286,619		
			Sub-Total	$ 1,463,941		
Other Goods & Services						
Contingency	%	10%	$ 1,685,433	$ 168,543		
			Sub-Total	$ 168,543		
Vehicle Overhead						
Vehicle AO				$ 14,909		
			Sub-Total	$ 14,909		
Administrative Overhead						
Labour AO				$ 26,611		
Contract AO				$ 314,411		
			Sub-Total	$ 341,022		
			SUB-TOTAL (no AO, AFUDC)	$ 1,853,976		
			TOTAL (AO, AFUDC included)	$ 2,209,907		
Original Cost				$ 328,456		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0010950

Title: 2019/2020 Steel Tower Refurbishment

Start Date: 2019/09
In-Service Date: 2019/09
Final Cost Date: 2021/06
Function Class: Transmission
Amount: $2,009,268

DESCRIPTION:

This project is required to replace deteriorated steel tower components. NS Power has approximately 2,000 steel towers installed on the transmission system. These deteriorated steel tower components are identified through the NS Power transmission inspection program. Components that will be replaced include hardware, guy wires, tower legs and grillages, footings and steel members. The age profile of the steel tower fleet is illustrated in the table below.

Age Range	Kilometres of Steel Structures	% of Steel Structures
0-10	0	0%
11-20	5	1%
21-30	335	47%
31-40	93	13%
41-50	131	18%
51-55	33	5%
55+	120	17%

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- 2017 CI 49815 2017/2018 Steel Tower Refurbishment $2,003,317
- 2018 CI 51398 2018/2019 Steel Tower Refurbishment $1,992,692
- 2020 CI TBD 2020/2021 Steel Tower Refurbishment $TBD
- 2021 CI TBD 2021/2022 Steel Tower Refurbishment $TBD

Depreciation Class: Transmission Plant - Towers and Fixtures

Estimated Useful Life: 50-55 Years

JUSTIFICATION:

Justification Criteria: Transmission

Why do this project?

NS Power's transmission inspection program has identified deteriorated components on steel towers that require replacement. The lines on these towers are critical to the reliable operation of the transmission system. Work on these deficiencies will be prioritized based on inspection results and engineering assessments, consistent with how work has been completed under this program in the past. The specific towers that will be refurbished will be determined throughout the prioritization process.

Why do this project now?

This work will be prioritized based on transmission inspection results. Many of these steel tower components have reached the end of their expected service lives and if replacements are not completed, the reliability of the transmission lines will be compromised.

This project is deemed in-service when refurbishment of the first tower is completed (February 2019); therefore, the Final Cost Date (June 2021) is listed as six months after the last tower is forecasted to be completed (December 2020).

Why do this project this way?

Replacing the existing deteriorated steel tower components is more cost effective than entire steel tower replacements.

CI Number : C0010950 - 2019/2020 Steel Tower Refurbishment

Project Number C0010950

Parent CI Number : -

Asset Location : 1455 - 1455 Transmission Plant General

Budget Version 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	3700 - TP - Steel Towers	1,855,721
Retirements	3700 - TP - Steel Towers	153,547
	Total Cost:	2,009,268
	Original Cost:	308,130

Capital Project Detailed Estimate

Location: Transmission
CI#: C0010950
Title: 2019/2020 Steel Tower Refurbishment
Execution Year: 2019-2020

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Site Supervision	PD	127	$ 389	$ 49,403		
Procurement / Financial Support	Lot	1	$ 2,400	$ 2,400		
			Sub-Total	$ 51,803		
Materials						
Steel Tower Components	Lot	1	$ 120,000	$ 120,000		
			Sub-Total	$ 120,000		
Contracts						
Contract Line Work	Lot	1	$ 1,174,800	$ 1,174,800		
External Supervision	Lot	1	$ 75,000	$ 75,000		
			Sub-Total	$ 1,249,800		
Consulting						
External Civil Design	Lot	1	$ 100,000	$ 100,000		
			Sub-Total	$ 100,000		
Meals & Entertainment						
Meals	Lot	1	$ 4,000	$ 4,000		
			Sub-Total	$ 4,000		
Other Goods & Services						
Contingency	%	10%	$ 1,525,603	$ 152,560		
			Sub-Total	$ 152,560		
Vehicle Overhead						
Vehicle AO				$ 22,509		
			Sub-Total	$ 22,509		
Administrative Overhead						
Labour AO				$ 40,176		
Contract AO				$ 268,420		
			Sub-Total	$ 308,595		
			SUB-TOTAL (no AO, AFUDC)	$ 1,678,163		
			TOTAL (AO, AFUDC included)	$ 2,009,268		
Original Cost				$ 308,130		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011338

Title: L5548 Replacements and Upgrades

Start Date: 2019/01
In-Service Date: 2019/01
Final Cost Date: 2021/06
Function Class: Transmission
Forecast Amount: $1,699,381

DESCRIPTION:

This project will replace deteriorated assets on approximately 75 structures on L5548, a 16.8 kilometer (151 structures) 69kV transmission line, built in 1966, that connects 30N Maccan to 20N Park St. and 17N Brownell Ave. substations. These deteriorated assets have been identified through NS Power's transmission inspection program. This project will be completed over 2 years.

The project scope includes:

- Structure Replacements: 14 Structures
- Pole and Insulator Replacements: 2 Structures
- Timber Replacements: 2 Structures
- Timber and Insulator Replacements: 45 Structures
- Insulator Replacements: 11 Structures
- Other Deteriorated Assets: 1 Structures

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- No other projects in 2017, 2018, 2019, 2020 or 2021

Depreciation Class: Transmission Plant– Poles and Fixtures
Transmission Plant – Overhead Conductors and Devices

Estimated Life of the Asset: 45 years

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

The transmission inspection program identified deteriorated assets that require replacement to avoid transmission interruptions. Not completing this project would compromise the reliable operation of this line and the service to 2400 customers in the Amherst area.

Why do this project now?

This work has been prioritized based on transmission inspection results and is required to support the reliable operation of the transmission line.

This project is deemed in-service when the first portion of the work is complete (January 2019), therefore the Final Cost Date (June 2021) is listed as six months after the final work is completed (December 2020).

Why do this project this way?

Replacing the existing deteriorated assets is more cost effective than rebuilding the entire line.

CI Number : C0011338 - L5548 Replacements and Upgrades **Project Number** C0011338

Parent CI Number : -

Asset Location : 1455 - 1455 L5548 Municipality of the County of Cumberland **Budget Version** 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	3500 - TP - Wood Poles	932,565
Additions	3800 - TP - Insulators	239,284
Additions	3900 - TP - O/H Cond.	371,167
Retirements	3500 - TP - Wood Poles	101,476
Retirements	3800 - TP - Insulators	54,890
	Total Cost:	1,699,381
	Original Cost:	133,709

Capital Project Detailed Estimate

Location: Transmission
CI# / FP#: C0011338
Title: L5548 Replacements and Upgrades
Execution Year: 2019-2020

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Site Supervision	PD	68	$ 389	$ 26,401		
Procurement / Financial Support	Lot	1	$ 2,333	$ 2,333		
			Sub-Total	$ 28,733		
Materials						
Wood Poles	Lot	1	$ 92,344	$ 92,344		
Insulators	Lot	1	$ 24,030	$ 24,030		
O/H Conductor	Lot	1	$ 260	$ 260		
			Sub-Total	$ 116,634		
Contracts						
Wood Poles	Lot	1	$ 575,385	$ 575,385		
Insulators	Lot	1	$ 163,481	$ 163,481		
O/H Conductor	Lot	1	$ 222,403	$ 222,403		
Environmental	Lot	1	$ 175,195	$ 175,195		
Survey and Mapping	Lot	1	$ 8,000	$ 8,000		
			Sub-Total	$ 1,144,465		
Other Goods & Services						
Contingency	%	10%	$ 1,289,832	$ 128,983		
			Sub-Total	$ 128,983		
Vehicle Overhead						
Vehicle AO				$ 12,485		
			Sub-Total	$ 12,485		
Administrative Overhead						
Labour AO				$ 22,284		
Contract AO				$ 245,797		
			Sub-Total	$ 268,081		
			SUB-TOTAL (no AO, AFUDC)	$ 1,418,815		
			TOTAL (AO, AFUDC included)	$ 1,699,381		
Original Cost				$ 133,709		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011242

Title: L5541 Replacements and Upgrades

Start Date: 2019/01
In-Service Date: 2019/01
Final Cost Date: 2021/06
Function Class: Transmission
Forecast Amount: $1,624,850

DESCRIPTION:

This project will replace deteriorated assets on approximately 95 structures on L5541, a 15.3 kilometer (117 structure) 69kV transmission line, built in 1988, that connects 50W Milton and 3W Big Falls substations. These deteriorated assets have been identified for replacement through NS Power's transmission inspection program. This project will be completed over 2 years.

The project scope includes:

- Timber and Insulator Replacement: 46 Structures
- Insulator Replacement: 9 Structures
- Structure Replacement: 37 Structures
- Other Deteriorated Assets: 3 Structures

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- No other projects in 2017, 2018, 2019, 2020 or 2021

Depreciation Class: Transmission Plant – Poles and Fixtures
Transmission Plant – Overhead Conductors and Devices

Estimated Life of the Asset: 45 years

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

The transmission inspection program identified deteriorated assets that require replacement to avoid transmission interruptions. Not completing this project would compromise the reliable operation of this line. Asset failures on this line could compromise the operation of the Mersey Hydro system and result in radial service to customers served on transmission line L5532 at substations 91W Middlefield, 57W Caledonia and 76V Maitland.

Why do this project now?

This work has been prioritized based on transmission inspection results and is required to support the reliable operation of the transmission line.

This project is deemed in-service when the first portion of the work is complete (January 2019), therefore the Final Cost Date (June 2021) is listed as six months after the final work is completed (December 2020).

Why do this project this way?

Replacing the existing deteriorated assets is more cost effective than rebuilding the entire line.

CI Number : C0011242 - L5541 Replacements and Upgrades

Project Number C0011242

Parent CI Number : -

Asset Location : 1455 - 1455 L5541 Region of Queens Municipality

Budget Version 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	3500 - TP - Wood Poles	930,350
Additions	3800 - TP - Insulators	30,095
Additions	3900 - TP - O/H Cond.	433,649
Retirements	3500 - TP - Wood Poles	142,036
Retirements	3800 - TP - Insulators	60,876
Retirements	3900 - TP - O/H Cond.	27,844
	Total Cost:	1,624,850
	Original Cost:	652,816

Capital Project Detailed Estimate

Location: Transmission
CI# / FP#: C0011242
Title: L5541 Replacements and Upgrades
Execution Year: 2019-2020

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Site Supervision	PD	59	$ 389	$ 23,026		
Procurement / Financial Support	Lot	1	$ 3,706	$ 3,706		
			Sub-Total	$ 26,732		
Materials						
Wood Poles	Lot	1	$ 164,380	$ 164,380		
Insulators	Lot	1	$ 2,782	$ 2,782		
O/H Conductor	Lot	1	$ 18,134	$ 18,134		
			Sub-Total	$ 185,296		
Contracts						
Wood Poles	Lot	1	$ 523,564	$ 523,564		
Insulators	Lot	1	$ 54,307	$ 54,307		
O/H Conductor	Lot	1	$ 245,742	$ 245,742		
Environmental	Lot	1	$ 210,234	$ 210,234		
			Sub-Total	$ 1,033,847		
Other Goods & Services						
Contingency	%	10%	$ 1,245,875	$ 124,588		
			Sub-Total	$ 124,588		
Vehicle Overhead						
Vehicle AO				$ 11,616		
			Sub-Total	$ 11,616		
Administrative Overhead						
Labour AO				$ 20,732		
Contract AO				$ 222,039		
			Sub-Total	$ 242,771		
			SUB-TOTAL (no AO, AFUDC)	$ 1,370,463		
			TOTAL (AO, AFUDC included)	$ 1,624,850		
Original Cost				$ 652,816		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011241

Title: L5026 - Replacements and Upgrades

Start Date: 2019/01
In-Service Date: 2019/01
Final Cost Date: 2021/06
Function Class: Transmission
Forecast Amount: $1,498,789

DESCRIPTION:

This project will replace deteriorated assets on approximately 57 structures on L5026, a 47.4 kilometre (280 Structure) 69kV transmission line, built in 1990, that connects 13V Gulch and 11V Paradise substations (serving substations 69V, 70V, 12V, 81V, and 74V). This project will be completed over 2 years.

The project scope includes:

- Timber and Insulator Replacements: 51 Structures
- Insulator Replacements: 6 Structures

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- No other projects in 2017, 2018, 2019, 2020 or 2021

Depreciation Class: Transmission Plant – Poles and Fixtures
Transmission Plant – Overhead Conductors and Devices

Estimated Life of the Asset: 45 years

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

The transmission inspection program identified deteriorated assets that require replacement to avoid transmission interruptions. Not completing this project would compromise the reliable operation of this line. Asset failures on this line would result in extended power outages.

Why do this project now?

This work has been prioritized based on transmission inspection results. This project is required to support the reliable operation of the transmission line.

This project is deemed in-service when the first portion of the work is complete (January 2019), therefore the Final Cost Date (June 2021) is listed as six months after the final work is completed (December 2020).

Why do this project this way?

Replacing the existing deteriorated assets is more cost effective than rebuilding the entire line.

CI Number : C0011241 - L5026 - Replacements and Upgrades **Project Number** C0011241

Parent CI Number : -

Asset Location : 1455 - 1455 L5026 Municipality of the County of Annapolis **Budget Version** 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account		Forecast Amount
Additions	3500 - TP - Wood Poles		372,299
Additions	3800 - TP - Insulators		168,088
Additions	3900 - TP - O/H Cond.		863,452
Retirements	3500 - TP - Wood Poles		49,185
Retirements	3800 - TP - Insulators		45,764
		Total Cost:	1,498,789
		Original Cost:	318,493

Capital Project Detailed Estimate

Location: **Transmission**
CI#: C0011241
Title: L5026 - Replacements and Upgrades
Execution Year: 2019-2020

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Site Supervision	PD	67	$ 389	$ 26,202		
Procurement / Financial Support	Lot	1	$ 1,719	$ 1,719		
			Sub-Total	$ 27,921		
Materials						
Wood Poles	Lot	1	$ 64,408	$ 64,408		
Insulators	Lot	1	$ 21,522	$ 21,522		
			Sub-Total	$ 85,929		
Contracts						
Wood Poles	Lot	1	$ 201,912	$ 201,912		
Insulators	Lot	1	$ 111,621	$ 111,621		
O/H Conductor	Lot	1	$ 506,341	$ 506,341		
Environmental	Lot	1	$ 191,140	$ 191,140		
Survey and Mapping	Lot	1	$ 8,000	$ 8,000		
			Sub-Total	$ 1,019,013		
Other Goods & Services						
Contingency	%	10%	$ 1,132,863	$ 113,286		
			Sub-Total	$ 113,286		
Vehicle Overhead						
Vehicle AO				$ 12,132		
			Sub-Total	$ 12,132		
Administrative Overhead						
Labour AO				$ 21,654		
Contract AO				$ 218,854		
			Sub-Total	$ 240,507		
			SUB-TOTAL (no AO, AFUDC)	$ 1,246,150		
			TOTAL (AO, AFUDC included)	$ 1,498,789		
Original Cost				$ 318,493		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011300

Title: L7005 Replacements and Upgrades

Start Date: 2019/01
In-Service Date: 2019/01
Final Cost Date: 2021/06
Function Class: Transmission
Forecast Amount: $1,346,026

DESCRIPTION:

This project will replace deteriorated assets on approximately 58 structures on L7005, a 159.3 kilometer (740 structure) 230kV transmission line, built in 1983, that connects 67N Onslow and 3C Port Hastings substations. These deteriorated assets have been identified through NS Power's transmission inspection program. This project will be completed over 2 years.

The project scope includes:

- Structure Replacements: 23 Structures
- Insulator Replacements: 2 Structures
- Timber and Insulator Replacements: 13 Structures
- Timber Replacements: 2 structures
- Bond or Guy Wire Replacements: 8 structures
- Other Deteriorated Assets: 10 Structures

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- No other projects in 2017, 2018, 2019, 2020 or 2021

Depreciation Class: Transmission Plant – Poles and Fixtures
Transmission Plant – Overhead Conductors and Devices
Transmission Plant – Towers and Fixtures

Estimated Life of the Asset: 45 years

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

The transmission inspection program identified deteriorated assets that require replacement to mitigate the risk of transmission interruptions. Not completing this project would compromise the reliable operation of this bulk power transmission line.

Why do this project now?

This work has been prioritized based on transmission inspection results and is required to support the reliable operation of the transmission line.

This project is deemed in-service when the first portion of the work is complete (January 2019), therefore the Final Cost Date (June 2021) is listed as six months after the final work is completed (December 2020).

Why do this project this way?

Replacing the existing deteriorated assets is more cost effective than rebuilding the entire line.

CI Number : C0011300 - L7005 Replacements and Upgrades **Project Number** C0011300

Parent CI Number : -

Asset Location : 1455 - 1455 L7005 Municipality of the County of Antigonish **Budget Version** 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	3500 - TP - Wood Poles	847,498
Additions	3700 - TP - Steel Towers	996
Additions	3800 - TP - Insulators	78,169
Additions	3900 - TP - O/H Cond.	206,335
Retirements	3500 - TP - Wood Poles	196,787
Retirements	3800 - TP - Insulators	16,243
	Total Cost:	1,346,026
	Original Cost:	412,912

Capital Project Detailed Estimate

Location: Transmission
CI# / FP#: C0011300
Title: L7005 Replacements and Upgrades
Execution Year: 2019-2020

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Site Supervision	PD	48	$ 389	$ 18,659		
Procurement / Financial Support	Lot	1	$ 3,861	$ 3,861		
			Sub-Total	$ 22,520		
Materials						
Wood Poles	Lot	1	$ 181,808	$ 181,808		
Insulators	Lot	1	$ 11,210	$ 11,210		
O/H Conductor	Lot	1	$ 24	$ 24		
			Sub-Total	$ 193,042		
Contracts						
Wood Poles	Lot	1	$ 452,861	$ 452,861		
Insulators	Lot	1	$ 42,680	$ 42,680		
O/H Conductor	Lot	1	$ 101,946	$ 101,946		
Environmental	Lot	1	$ 224,718	$ 224,718		
Steel Towers	Lot	1	$ 492	$ 492		
			Sub-Total	$ 822,698		
Other Goods & Services						
Contingency	%	10%	$ 1,038,259	$ 103,826		
			Sub-Total	$ 103,826		
Vehicle Overhead						
Vehicle AO				$ 9,785		
			Sub-Total	$ 9,785		
Administrative Overhead						
Labour AO				$ 17,465		
Contract AO				$ 176,691		
			Sub-Total	$ 194,156		
			SUB-TOTAL (no AO, AFUDC)	$ 1,142,085		
			TOTAL (AO, AFUDC included)	$ 1,346,026		
Original Cost				$ 412,912		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011240

Title: L5511 Replacements and Upgrades

Start Date: 2019/01
In-Service Date: 2019/01
Final Cost Date: 2021/06
Function Class: Transmission
Forecast Amount: $1,255,087

DESCRIPTION:

This project will replace deteriorated assets on approximately 71 structures on L5511, a 31.7 kilometer (271 structure) 69kV transmission line, built in 1970, that connects 89H Trafalgar to 88H Upper Musquodoboit substations. These deteriorated assets have been identified through NS Power's inspection program. This project will be completed over 2 years.

The project scope includes:

- Timber Replacements: 18 Structures
- Insulator Replacements: 13 Structures
- Timber and Insulator Replacements: 22 Structures
- Pole Replacements: 1 Structure
- Structure Replacements: 12 Structures
- Other Deteriorated Assets: 5 Structures

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- No other projects in 2017, 2018, 2019, 2020 or 2021

Depreciation Class: Transmission Plant – Poles and Fixtures
Transmission Plant – Overhead Conductors and Devices

Estimated Life of the Asset: 45 years

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

The transmission inspection program identified deteriorated assets that require replacement to avoid transmission interruptions. Not completing this project would compromise the reliable operation of this line. Asset failures on this transmission line, a radial feed to 2,900 customers, could result in extended power outages.

Why do this project now?

This work has been prioritized based on transmission inspection results and is required to support the reliable operation of the transmission line.

This project is deemed in-service when the first portion of the work is complete (January 2019), therefore the Final Cost Date (June 2021) is listed as six months after the final work is completed (December 2020).

Why do this project this way?

Replacing the existing deteriorated assets is more cost effective than rebuilding the entire line.

CI Number : C0011240 - L5511 Replacements and Upgrades

Project Number C0011240

Parent CI Number : -

Asset Location : 1455 - 1455 L5511 Halifax Regional Municipality

Budget Version 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	3500 - TP - Wood Poles	305,302
Additions	3800 - TP - Insulators	109,889
Additions	3900 - TP - O/H Cond.	760,304
Retirements	3500 - TP - Wood Poles	54,522
Retirements	3800 - TP - Insulators	25,070
	Total Cost:	1,255,087
	Original Cost:	58,595

Capital Project Detailed Estimate

Location: **Transmission**
CI#: C0011240
Title: L5511 Replacements and Upgrades
Execution Year: 2019-2020

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Site Supervision	PD	60	$ 389	$ 23,225		
Procurement / Financial Support	Lot	1	$ 1,389	$ 1,389		
			Sub-Total	$ 24,613		
Materials						
Wood Poles	Lot	1	$ 60,602	$ 60,602		
Insulators	Lot	1	$ 8,406	$ 8,406		
O/H Conductor	Lot	1	$ 441	$ 441		
			Sub-Total	$ 69,449		
Contracts						
Wood Poles	Lot	1	$ 170,389	$ 170,389		
Insulators	Lot	1	$ 74,750	$ 74,750		
O/H Conductor	Lot	1	$ 448,338	$ 448,338		
Environmental	Lot	1	$ 159,778	$ 159,778		
			Sub-Total	$ 853,255		
Other Goods & Services						
Contingency	%	10%	$ 947,318	$ 94,732		
			Sub-Total	$ 94,732		
Vehicle Overhead						
Vehicle AO				$ 10,695		
				$ -		
			Sub-Total	$ 10,695		
Administrative Overhead						
Labour AO				$ 19,089		
Contract AO				$ 183,253		
				$ -		
			Sub-Total	$ 202,342		
			SUB-TOTAL (no AO, AFUDC)	$ 1,042,049		
			TOTAL (AO, AFUDC included)	$ 1,255,087		
Original Cost				$ 58,595		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number C0010978

Title: 2019/2020 Transmission Switch & Breaker Replacement

Start Date: 2019/04
In-Service Date: 2019/04
Final Cost Date: 2020/12
Function Class: Transmission
Amount: $1,044,148

DESCRIPTION:

This project provides for the replacement of deteriorated substation circuit breakers and transmission switches on the NS Power transmission system. The project estimate includes the retirement and replacement of three 69 kV breakers, one 138 kV breaker and five 69 kV switches. The breakers and switches being replaced are prioritized based on the maintenance history, age, number of operations, electrical test results, design or manufacturing issues, inspection results, customers supplied, system redundancy, and safety and environmental issues.

NS Power anticipates that a portion of the capital costs associated with this capital item will contribute toward settling the Company's Asset Retirement Obligation for PCB contaminated oil.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- 2017 CI 49818 2017/2018 Transmission Switch & Breaker Replacement $1,074,472
- 2018 CI 51406 2018/2019 Transmission Switch & Breaker Replacement $1,405,891
- 2020 CI TBD 2020/2021 Transmission Switch & Breaker Replacement $TBD
- 2021 CI TBD 2021/2022 Transmission Switch & Breaker Replacement $TBD

Depreciation Class: Transmission Plant – Station Equipment
Transmission Plant – Overhead Conductors and Devices
Transmission Plant – Poles and Fixtures

Estimated Useful Life: 40 Years

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

This project will replace deteriorated substation circuit breakers and transmission switches. Completing this project will mitigate transmission supply interruptions and maintain reliable operation of the transmission system for customers.

This project is being done primarily to replace end-of-life assets, and secondly to reduce environmental risks by removing oil filled equipment.

Why do this project now?

The circuit breakers being replaced are, on average, 50 years old. The expected useful life of a circuit breaker is 40 years. Switches have an expected useful life of 40 years and the switches being evaluated for replacement are approaching or past this expected useful life.

This project is deemed in-service when the first disconnect switch or circuit breaker is replaced (March 2019), therefore the Final Cost Date (December 2020) is listed as six months after the last item is completed (June 2020).

Why do this project this way?

Due to the age of the devices, spare parts are no longer available for the majority of the circuit breakers that are being replaced. The breakers being replaced are often oil filled so this project also serves to remove oil filled equipment from the fleet, reducing the environmental liability.

CI Number : C0010978 - 2019/2020 Transmission Switch & Breaker Replacement **Project Number** C0010978

Parent CI Number : -

Asset Location : 1455 - 1455 Transmission General **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0300 - TP - Bldg.,Struct.Grnd.	114,685
Additions	2200 - TP - Elec Contr.Equip.	110,826
Additions	3500 - TP - Wood Poles	2,533
Additions	3900 - TP - O/H Cond.	12,569
Additions	4300 - TP - Substn Dev.	731,421
Retirements	4300 - TP - Substn Dev.	72,115
	Total Cost:	1,044,148
	Original Cost:	394,600

Capital Project Detailed Estimate

Location: Transmission
CI# / FP#: C0010978
Title: 2019/2020 Transmission Switch & Breaker Replacement
Execution Year: 2019/2020

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Electrician/Technician	PD	225	$ 373	$ 83,955		
T&D Labour - Design	PD	175	$ 386	$ 67,610		
T&D Labour - Commissioning	PD	53	$ 386	$ 20,475		
Procurement / Financial Support	Lot	1	$ 8,986	$ 8,986		
			Sub-Total	$ 181,026		
Travel Expense						
Travel Expenses	Lot	1	$ 3,145	$ 3,145		
			Sub-Total	$ 3,145		
Materials						
Buildings, Structures and Grounds	Lot	1	$ 28,060	$ 28,060		
Electrical Control Equipment	Lot	1	$ 43,700	$ 43,700		
Overhead Conductor	Lot	1	$ 5,025	$ 5,025		
Substation Devices	Lot	1	$ 371,060	$ 371,060		
Wood Poles	Lot	1	$ 1,500	$ 1,500		
			Sub-Total	$ 449,345		
Contracts						
Buildings, Structures and Grounds	Lot	1	$ 39,133	$ 39,133		
Substation Devices	Lot	1	$ 51,400	$ 51,400		
			Sub-Total	$ 90,533		
Consulting						
Ground Resistance Measurement and Design	Lot	1	$ 8,000	$ 8,000		
			Sub-Total	$ 8,000		
Meals & Entertainment						
Meals	Lot	1	$ 360	$ 360		
			Sub-Total	$ 360		
Other Goods & Services						
Contingency	%	10%	$ 732,409	$ 73,241		
			Sub-Total	$ 73,241		
Vehicle Overhead						
Vehicle AO				$ 78,659		
			Sub-Total	$ 78,659		
Administrative Overhead						
Labour AO				$ 140,395		
Contract AO				$ 19,444		
			Sub-Total	$ 159,839		
			SUB-TOTAL (no AO, AFUDC)	$ 805,650		
			TOTAL (AO, AFUDC included)	$ 1,044,148		
Original Cost				$ 394,600		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011243

Title: L5551 Replacements and Upgrades

Start Date: 2019/01
In-Service Date: 2019/01
Final Cost Date: 2021/06
Function Class: Transmission
Forecast Amount: $1,014,077

DESCRIPTION:

This project will replace deteriorated assets on approximately 40 structures on L5551, a 9.8 kilometer (47 structure) 69kV transmission line, built in 1971, that connects 79W Lunenburg and 80W Riverport substations. These deteriorated assets have been identified for replacement through NS Power's transmission inspection program. This project will be completed over 2 years.

The project scope includes:

- Timber and Insulator Replacement: 10 Structures
- Structure Replacement: 22 Structures
- Other Deteriorated Assets: 8 Structures

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- No other projects in 2017, 2018, 2019, 2020 or 2021

Depreciation Class: Transmission Plant – Poles and Fixtures
Transmission Plant – Overhead Conductors and Devices

Estimated Life of the Asset: 45 years

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

The transmission inspection program identified deteriorated assets that require replacement to avoid transmission interruptions. Not completing this project would compromise the reliable operation of this line. Asset failures on this line, a radial feed to 3,000 NS Power customers and the municipally owned utilities of Riverport, Lunenburg and Mahone Bay, could result in extended power outages.

Why do this project now?

This work has been prioritized based on transmission inspection results and is required to support the reliable operation of the transmission line.

This project is deemed in-service when the first portion of the work is complete (January 2019), therefore the Final Cost Date (June 2021) is listed as six months after the final work is completed (December 2020).

Why do this project this way?

Replacing the existing deteriorated assets is more cost effective than rebuilding the entire line.

CI Number : C0011243 - L5551 -Replacements and Upgrades **Project Number** C0011243

Parent CI Number :

Asset Location : 1455 - 1455 L5551 Municipality of the District of Lunenburg **Budget Version** 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account		Forecast Amount
Additions	3500 - TP - Wood Poles		438,035
Additions	3800 - TP - Insulators		26,131
Additions	3900 - TP - O/H Cond.		482,541
Retirements	3500 - TP - Wood Poles		59,739
Retirements	3800 - TP - Insulators		7,632
		Total Cost:	1,014,077
		Original Cost:	67,541

Capital Project Detailed Estimate

Location: Transmission
CI# / FP#: C0011243
Title: L5551 Replacements and Upgrades
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Site Supervision	PD	43	$ 389	$ 16,674		
Procurement / Financial Support	Lot	1	$ 2,179	$ 2,179		
			Sub-Total	$ 18,853		
Materials						
Wood Poles	Lot	1	$ 106,746	$ 106,746		
Insulators	Lot	1	$ 2,201	$ 2,201		
			Sub-Total	$ 108,947		
Contracts						
Wood Poles	Lot	1	$ 262,898	$ 262,898		
Insulators	Lot	1	$ 18,265	$ 18,265		
O/H Conductor	Lot	1	$ 267,871	$ 267,871		
Environmental	Lot	1	$ 92,987	$ 92,987		
Survey and Mapping	Lot	1	$ 5,000	$ 5,000		
			Sub-Total	$ 647,021		
Other Goods & Services						
Contingency	%	10%	$ 774,821	$ 77,482		
			Sub-Total	$ 77,482		
Vehicle Overhead						
Vehicle AO				$ 8,192		
			Sub-Total	$ 8,192		
Administrative Overhead						
Labour AO				$ 14,622		
Contract AO				$ 138,961		
			Sub-Total	$ 153,582		
			SUB-TOTAL (no AO, AFUDC)	$ 852,303		
			TOTAL (AO, AFUDC included)	$ 1,014,077		
Original Cost				$ 67,541		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011918

Title: 2019 Oil Containment Program

Start Date:	2019/06
In-Service Date:	2019/10
Final Cost Date:	2020/04
Function:	Transmission
Forecast Amount:	$468,041

DESCRIPTION:

The Oil Containment Program began in 2016 to mitigate the risk of oil release from substation transformers to the local environment. NS Power completed a survey of the main power transformers without an oil containment system. The sites were also reviewed to determine their proximity to sensitive environmental sites, such as watercourses and wetlands along with the presence of pathways for contaminants to reach the receptors. From these environmental risk assessments, a prioritized list of substation sites has been developed for retrofitting oil containment systems, thereby reducing the environmental risk. The 2019 project includes the installation of four oil containment systems at three transmission substations (4C Locharber Rd., 50N Trenton and 88S Lingan**)**. The overall program is planned for completion in 2021.

In 2013, Nova Scotia Environment released the Contaminated Sites Regulations which outlines new cleanup criteria for spills, increasing cleanup and assessment costs. Cleanups and ongoing assessment costs for oil releases from substation transformers can account for a significant cost to NS Power. These regulations can be found at the following link: https://www.novascotia.ca/just/regulations/regs/envcontsite.htm.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- 2017 - CI 49833 - 2017 Oil Containment Program - $432,518
- 2018 - CI 51797 - 2018 Oil Containment Program - $331,507
- 2020 - CI TBD - 2020 Oil Containment Program - $TBD
- 2021 - CI TBD - 2021 Oil Containment Program - $TBD

JUSTIFICATION:

Justification Criteria: Environment

Why do this project?

NS Power has identified that there is risk of oil from substation transformers being released to nearby sensitive environmental areas at locations that currently do not have oil containment systems. Installation of oil containment systems will reduce the risk to the environment and public safety surrounding substations.

This project is primarily justified under environment, and secondarily justified under safety.

Why do this project now?

Proactively adding oil containment systems to the highest environmental risk sites will mitigate the risk of costs associated with oil spill cleanups and will protect the adjacent areas from possible contamination.

Why do this project this way?

A total of 303 sites were evaluated for this project. Approximately 76 of these have known environmentally sensitive areas in the immediate vicinity that are at risk for possible contamination should an oil release occur. NS Power then identified the 30 sites which had the highest risk of pathways to be created between the potential contamination and the receptors. These are the sites to be addressed in this program.

Installation of oil containment was completed at five sites in the 2016 Oil Containment Program (CI 48067), four sites in the 2017 Oil Containment Program (CI 49833) and will be completed at four sites in the 2018 Oil Containment Program (CI 51797). The 2019 project includes the installation of oil containment systems at three substation main power transformer sites. The overall program is planned for completion in 2021. Installing oil containment in these highest risk sites, using a prioritized approach, will reduce the risk of oil being released from NS Power's substations to nearby sensitive areas.

CI Number : C0011918 - 2019 Oil Containment Program

Project Number C0011918

Parent CI Number : -

Asset Location : 1455 - 1455 Transmission General

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0700 - TP - Environmental	468,041
	Total Cost:	468,041
	Original Cost:	

Capital Project Detailed Estimate

Location: Transmission
CI#: C0011918
Title: 2019 Oil Containment Program
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Design	PD	11	$ 386	$ 4,120		
			Sub-Total	$ 4,120		
Contracts						
Environmental Installation	LOT	1	$ 329,000	$ 329,000		
Field Supervision and Operations	LOT	1	$ 16,000	$ 16,000		
			Sub-Total	$ 345,000		
Other Goods & Services						
Contingency		10%	$ 349,120	$ 34,912		
				$ -		
				$ -		
			Sub-Total	$ 34,912		
Interest Capitalized						
AFUDC				$ 4,928		
			Sub-Total	$ 4,928		
Vehicle Overhead						
Vehicle AO				$ 1,790		
			Sub-Total	$ 1,790		
Administrative Overhead						
Labour AO				$ 3,195		
Contract AO				$ 74,096		
			Sub-Total	$ 77,291		
			SUB-TOTAL (no AO, AFUDC)	$ 384,032		
			TOTAL (AO, AFUDC included)	$ 468,041		
Original Cost						

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011851

Title: 2019 Tap Changer Replacements/Refurbishments

Start Date: 2019/05
In-Service Date: 2019/08
Final Cost Date: 2020/02
Function: Transmission
Forecast Amount: $326,937

DESCRIPTION:

This project is the third year of a multiple year program to refurbish aging tap changers at substations throughout the province. The scope of the 2019 project is to refurbish the tap changers on six transformers: 91H-T62 (Tufts Cove), 3C-T71 (Port Hastings), 3C-T72 (Port Hastings), 101S-T81 (Woodbine), 50N-T8 (Trenton) and 67N-T71 (Onslow). The transformers completed under this project may vary due to changing priorities. This program is expected to be complete in 2020.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- 2017 - CI 49929 - 2017 Tap Changer Replacements - $318,236
- 2018 - CI 51863 - 2018 Tap Changer Replacements/Refurbishments - $306,102
- 2020 - CI TBD - 2020 Tap Changer Replacements/Refurbishments - $TBD

JUSTIFICATION:

Justification Criteria: Transmission Plant

Why do this project?

Tap changers are critical pieces of equipment to the NS Power transmission system. Tap changers are required to match transformer voltages to the system voltage and refurbishment of these devices is required to support the reliable operation of the transmission system. A tap changer failure could lead to outages or power quality issues for customers.

NS Power, in consultation with the tap changer manufacturer, developed a plan for tap changer refurbishment based on the number of operations (i.e. the number of times the tap changer has operated to match the transformer voltage to the system voltage), age of unit, available outage windows, type of tap changer, and long term replacement plans for transformers. Details on the tap changers planned for 2019 are given below (data as of August 2018):

Asset	Description	Location	Manu. Yr.	Operations	Serial #
109186	TAPCHANGER, 138, M111-D500-11OC	91H-T62*	1981	5584**	86951
103975	TAPCHANGER, 345, M1-802-150	3C-T71	1978	12559	84551
103983	TAPCHANGER, 345, M1-802-150	3C-T72	1978	13018	84550
100199	TAPCHANGER, 345, M1-1500Y-220	101S-T81	1993	13283	187886
105348	TAPCHANGER, 138, F111-600-060	50N-T8	1969	15695	50720
106849	TAPCHANGER, 345, M1-802-150	67N-T71	1978	39083	84549

*****Tap changer 91H-T62 was previously identified for replacement in 2018; however, it was exchanged for 120H-T72 due to a change in priorities within the year.
** The tap changer counter at 91H-T62 is not functioning, as such, this count does not represent the full number of operations.

Why do this project now?

The six targeted tap changers are due for refurbishment based on the number of operations (i.e. the number of times the tap changer has operated to match the transformer voltage to the system voltage), age of unit, maintenance schedules, available outage windows, type of tap changer, and long term replacement plan for transformers.

Why do this project this way?

The refurbishment of the tap changers under this project are being completed per the OEM's recommendation. Technicians from the tap changer manufacturer will complete the refurbishment of several components with the assistance of NS Power technicians/electricians. The project requires highly skilled expertise and knowledge of rebuilding these complex assets and therefore it is most efficient to engage the manufacturer to complete the work.

CI Number : C0011851 - 2019 Tap Changer Replacements/Refurbishments

Project Number C0011851

Parent CI Number : -

Asset Location : 1455 - 1455 Transmission General

Budget Version 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	4400 - TP - Substn.Transf.	291,248
Retirements	4400 - TP - Substn.Transf.	35,689
	Total Cost:	326,937
	Original Cost:	127,631

Capital Project Detailed Estimate

Location: Transmission
CI# : C0011851
Title: 2019 Tap Changer Replacements/Refurbishments
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Electrician / Technician	PD	161	$ 373	$ 60,000		
			Sub-Total	$ 60,000		
Materials						
Tap Changers	ea	6	$ 6,400	$ 38,400		
Oil & Shop Supplies	Lot	1	$ 12,000	$ 12,000		
			Sub-Total	$ 50,400		
Contracts						
Boom Rental	Lot	1	$ 3,266	$ 3,266		
Tap Changer Overhaul (Manufacturer)	ea	6	$ 16,073	$ 96,439		
			Sub-Total	$ 99,705		
Other Goods & Services						
Contingency	%	10%	$ 210,105	$ 21,010		
			Sub-Total	$ 21,010		
Vehicle Overhead						
Vehicle AO				$ 26,071		
			Sub-Total	$ 26,071		
Interest Capitalized						
AFUDC				$ 1,803		
			Sub-Total	$ 1,803		
Administrative Overhead						
Labour AO				$ 46,533		
Contract AO				$ 21,414		
			Sub-Total	$ 67,947		
			SUB-TOTAL (no AO, AFUDC)	$ 231,115		
			TOTAL (AO, AFUDC included)	$ 326,937		
Original Cost				$ 127,631		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011850

Title: 2019 Substation Insulator Replacement Program

Start Date: 2019/04
In-Service Date: 2019/04
Final Cost Date: 2020/04
Function: Transmission
Forecast Amount: $314,400

DESCRIPTION:

The aim of this project is to identify the remaining installations of Canadian Porcelain and Canadian Ohio Brass insulators at substations, and remove them from service, replacing them with new insulators.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- 2017 - CI 49878 - 2017 Substation Insulator Replacement Program - $508,893
- 2018 - CI 52305 - 2018 Substation Insulator Replacement Program - $316,348
- 2020 - CI TBD - 2020 Substation Insulator Replacement Program - $TBD

JUSTIFICATION:

Justification Criteria: Transmission Plant

Why do this project?

In past years, NS Power has experienced reliability issues with strain insulators manufactured by Canadian Porcelain and Canadian Ohio Brass. These insulators are vulnerable to cement growth, an issue in which the cement used to seal the insulator begins to absorb moisture and swell, eventually leading to electrical and mechanical failure. These insulators can be found inside substations and on transmission lines, where failure can lead to lines being dropped to the ground, or on energized equipment, potentially leading to extensive outages and/or damage to equipment. These insulators are well known in the industry for being prone to failure. Replacing them proactively will prevent unnecessary outages and damage to equipment.

Why do this project now?

These insulators have been known to be an issue within the utility industry for several years. Installations of this type of insulator at substations have been identified and they should be replaced as soon as possible to avoid unnecessary outages.

This project is forecasted to be in-service once the first insulator is replaced (April 2019), therefore the forecasted Final Cost date (April 2020) is six months after the last structure is forecasted to be replaced (October 2019).

Why do this project this way?

Replacing the existing defective insulators with the new insulators is the only option.

CI Number : C0011850 - 2019 Substation Insulator Replacement Program

Project Number C0011850

Parent CI Number : -

Asset Location : 1455 - 1455 Transmission General

Budget Version 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	3800 - TP - Insulators	25,007
Additions	4300 - TP - Substn Dev.	246,808
Retirements	3800 - TP - Insulators	3,918
Retirements	4300 - TP - Substn Dev.	38,668
	Total Cost:	314,400
	Original Cost:	34,358

Capital Project Detailed Estimate

Location: Transmission
CI# : C0011850
Title: 2019 Substation Insulator Replacement Program
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Electrician/Technician	PD	123	$ 370	$ 45,680		
Procurement / Financial Support	Lot	1	$ 3,510	$ 3,510		
			Sub-Total	$ 49,190		
OT Labour						
T&D Labour - Electrician/Technician	PD	23	$ 740	$ 17,270		
			Sub-Total	$ 17,270		
Travel Expense						
Travel	Lot	1	$ 4,680	$ 4,680		
				$ -		
			Sub-Total	$ 4,680		
Materials						
Insulators	Lot	1	$ 50,602	$ 50,602		
Contractors	Lot	1	$ 42,353	$ 42,353		
Jumper Wire	Lot	1	$ 15,415	$ 15,415		
			Sub-Total	$ 108,370		
Contracts						
Contract Line Labour	Lot	1	$ 20,580	$ 20,580		
Boom Truck	Lot	1	$ 13,720	$ 13,720		
				$ -		
			Sub-Total	$ 34,300		
Meals & Entertainment						
Meals	Lot	1	$ 1,700	$ 1,700		
				$ -		
			Sub-Total	$ 1,700		
Other Goods & Services						
Contingency	%	10%	$ 215,510	$ 21,551		
				$ -		
			Sub-Total	$ 21,551		
Vehicle Overhead						
Vehicle AO				$ 25,126		
			Sub-Total	$ 25,126		
Administrative Overhead						
Labour AO				$ 44,847		
Contract AO				$ 7,367		
			Sub-Total	$ 52,213		
			SUB-TOTAL (no AO, AFUDC)	$ 237,061		
			TOTAL (AO, AFUDC included)	$ 314,400		
Original Cost				$ 34,358		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0010040

Title: New Distribution Rights-of-Way Phase 4

Start Date: 2019/01
In-Service Date: 2019/01
Final Cost Date: 2021/06
Function Class: Distribution
Amount: $10,275,861

DESCRIPTION

This project is to establish new rights-of-way for distribution feeders where none have previously existed on targeted circuits and where current vegetation management maintenance practices have limited impact on preventing off right-of-way tree contacts. The new rights-of-way will primarily be established adjacent to the road right-of-way edge, where the majority of distribution feeders are currently located and bordered by vegetation.

The total New Distribution Rights-of-Way program is estimated to cost between $80 million and $97 million. NS Power anticipates the annual cost of the 10 year program to be between $8 million to $10 million.

The targeted circuits expected to be included in this project, subject to change based on factors such as feeder performance, permissions and easements, are:

Feeder	Geographic Location	Kilometresof Treatment
36V-302	Canard	10
91W-411	Middlefield	15
84W-301	Chester Basin	20
9C-303	Little Narrows	20
104S-311	Baddeck	20
78W-302	Lunenburg	10
18V-413	Brooklyn	30
3S-403	North Sydney	5
81S-302	Glace Bay	5
84S-304	Sydney	11
62N-416	Stellerton	30
65V-301	Nictaux	15
77V-401	Digby	30
73W-411	New Germany	50
70V-311	North Mountain (Bridgetown)	15
103C-314	Cheticamp	5
100C-421	Havre Bouche	30
36W-301	Lockeport	10
36W-304	Lockeport	10
50N-415	Trenton	10

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include “Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line).”

- 2017 CI 50796 New Distribution Rights-of-Way Phase 2 $3,353,445
- 2018 CI C0001950 New Distribution Rights-of-Way Phase 3 $9,822,493
- 2020 CI TBD New Distribution Rights-of-Way Phase 5 $TBD
- 2021 CI TBD New Distribution Rights-of-Way Phase 6 $TBD

Depreciation Class: Distribution Plant - Land Rights- Easements, Surveys and Clearing

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Outage Performance

Why do this project?

Tree contacts are the leading cause of outages, both during non-storm and storm events. Over the last five years, tree contacts have caused over 16,000 outage events, 1.7 million customer interruptions and 9.5 million customer hours of interruption, which represents 26 percent, 24 percent and 39 percent of these totals, respectively. Approximately 80 percent of these tree contacts are caused by fallen trees from outside of the right-of-way. The vegetation management practices performed under NS Power's maintenance program target vegetation within the rights-of-way and maintain existing rights-of-way. These activities prevent tree growth from causing outages, but do not address edge or off right-of-way trees. Establishing new rights-of-way will reduce the occurrence of edge of road right-of-way and off road right-of-way tree contacts by increasing the separation between trees and distribution feeders.

Why do this project now?

During the Post-Tropical Storm Arthur Review (M06321), the Board's consultant, The Liberty Consulting Group (Liberty) recommended NS Power accelerate the Distribution Right-of-Way sustainability efforts in order to achieve additional reliability benefits during major storm events. As set out in NS Power's February 13, 2015 Stakeholder Consultation Report, there was general stakeholder support for accelerating the sustainability program.

A focus on removing trees within and along the edge of the NSTIR rights-of-way will result in more immediate improvements in reliability and require less reactive maintenance going forward. Proactive establishment of new distribution rights-of-way will further improve customer reliability during major and extreme weather events.

This project is forecast to be in-service when the first right of way is widened (January 2019), therefore the Final Cost date (June 2021) is six months after the last new right of way is forecast to be established (December 2020).

Why do this project this way?

Liberty's report on its review of NS Power's response to Post-Tropical Storm Arthur included the recommendation that, for distribution rights-of-way, NS Power should "develop a comprehensive plan for reclaiming and/or widening the overgrown ROW corridors".[1]

The distribution vegetation management program will be carried-out under three broad initiatives:

(1) Operating activities for distribution vegetation management
(2) Capital Routine D010 - Distribution Right-of-Way Widening
(3) New Distribution Right-of-Ways individual capital projects (i.e. CI 49611, CI 50796, CI C0001950, and CI C0010040)

Taken together, these initiatives will address the findings of the Post-Tropical Storm Arthur proceeding. The scope of work to be completed under this CI and subsequent phases is to establish new rights-of-way where none have previously existed. The new rights-of-way will primarily be established adjacent to the road right-of-way edge, where the majority of distribution feeders are currently located and bordered by vegetation.

[1] Review of Nova Scotia Power Inc.'s (NSPI) state of preparedness and response to Post-Tropical Storm Arthur, M06321, The Liberty Consulting Group, Comments on Review of NS Power's Storm Response, Exhibit A-4, September 9, 2014, page 7.

CI Number : C0010040 - New Distribution Rights-of-Way Phase 4 **Project Number** C0010040

Parent CI Number : -

Asset Location : 1456 - 1456 Distribution Plant General **Budget Version** 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0200 - DP - Land Rights	10,275,861
	Total Cost:	10,275,861
	Original Cost:	

Capital Project Detailed Estimate

Location: Distribution
CI# / FP#: C0010040
Title: New Distribution Rights-of-Way Phase 4
Execution Year: 2019/2020

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Contracts						
36V-302	km	10	$ 24,100	$ 241,000		
91W-411	km	15	$ 24,100	$ 361,500		
84W-301	km	20	$ 24,100	$ 482,000		
9C-303	km	20	$ 24,100	$ 482,000		
104S-311	km	20	$ 24,100	$ 482,000		
78W-302	km	10	$ 24,100	$ 241,000		
18V-413	km	30	$ 24,100	$ 723,000		
3S-403	km	5	$ 24,100	$ 120,500		
81S-302	km	5	$ 24,100	$ 120,500		
84S-304	km	11	$ 24,100	$ 265,100		
62N-416	km	30	$ 24,100	$ 723,000		
65V-301	km	15	$ 24,100	$ 361,500		
77V-401	km	30	$ 24,100	$ 723,000		
73W-411	km	50	$ 24,100	$ 1,205,000		
70V-311	km	15	$ 24,100	$ 361,500		
103C-314	km	5	$ 24,100	$ 120,500		
100C-421	km	30	$ 24,100	$ 723,000		
36W-301	km	10	$ 24,100	$ 241,000		
36W-304	km	10	$ 24,100	$ 241,000		
50N-415	km	10	$ 24,100	$ 241,000		
			Sub-Total	$ 8,459,100		
Administrative Overhead						
Contract AO				$ 1,816,761		
				$ -		
			Sub-Total	$ 1,816,761		
			SUB-TOTAL (no AO, AFUDC)	$ 8,459,100		
			TOTAL (AO, AFUDC included)	$ 10,275,861		
Original Cost						
				$ -		

Note 1: The labor figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011208

Title: 2019 Padmount Replacement Program

Start Date: 2019/02
In-Service Date: 2019/02
Final Cost Date: 2020/06
Function Class: Distribution
Forecast Amount: $1,413,544

DESCRIPTION:

This project will replace 70 padmount transformers identified through the padmount inspection program to be at or near end of expected useful life. NS Power has 4,205 padmount transformers across its fleet which is inspected annually. The expected useful life of these assets is between 35-45 years. This is an ongoing program as part of lifecycle and condition management of the in-service distribution padmount transformer inventory.

NS Power anticipates that a portion of the costs associated with this capital item will contribute toward settling the Company's Asset Retirement Obligation for Polychlorinated Biphenyls (PCB) contaminated oil.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- 2017 CI 49806 2017 Padmount Replacement Program $1,703,774
- 2018 CI 52271 2018 Padmount Replacement Program $1,657,205
- 2020 CI TBD 2020 Padmount Replacement Program $TBD
- 2021 CI TBD 2021 Padmount Replacement Program $TBD

Depreciation Class: Distribution Plant- Line Transformers
Distribution Plant- Underground Conductors and Devices

Estimated Useful Life: 40 years

JUSTIFICATION:

Justification Criteria: Distribution System

Why do this project?

Padmount transformer inspections have identified transformers that need to be replaced due to deterioration. Proactive, planned replacement of end of expected useful life padmount transformers mitigates the potential for prolonged, unplanned customer outages from transformer failure.

This project will also aid in the prevention of environmental incidents, as padmount transformer failures can result in an oil release, which is prohibited by environmental regulations and would result in remediation costs.

Why do this project now?

At or near end of expected useful life padmount transformers were identified through the padmount inspection process, and prioritized for replacement. They are being replaced in a planned manner as part of NS Power's environmental due diligence.

This project is deemed in-service when the first transformer is completed (February 2019), therefore the Final Cost Date (June 2020) is listed as six months after the last transformer is completed (December 2019).

Why do this project this way?

Padmount transformers are typically associated with commercial customers. Planned replacement of end of expected useful life padmount transformers is conducted during an outage coordinated with the customer. The replacement of these transformers will minimize unplanned customer outages and mitigate potential environmental impact.

CI Number : C0011208 - 2019 Padmount Replacement Program

Project Number C0011208

Parent CI Number : -

Asset Location : 1456 - 1456 Distribution General

Budget Version 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	4600 - DP - U/G Conductor	84,393
Additions	4800 - DP - U/G Line Transf.	1,242,191
Retirements	4800 - DP - U/G Line Transf.	86,959
	Total Cost:	1,413,544
	Original Cost:	545,375

Capital Project Detailed Estimate

Location: Distribution
CI# : C0011208
Title: 2019 Padmount Replacement Program
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Electrician / Technician	PD	266	$ 372	$ 99,193		
Procurement Labour	Lot	1	$ 4,198	$ 4,198		
			Sub-Total	$ 103,391		
Materials						
Materials	Lot	1	$ 973,000	$ 973,000		
			Sub-Total	$ 973,000		
Contracts						
Transformer Deliveries (Crane/Boom Truck)	Lot	1	$ 70,000	$ 70,000		
Flagging	Lot	1	$ 9,408	$ 9,408		
			Sub-Total	$ 79,408		
Other Goods & Services						
Contingency	%	10%	$ 1,155,799	$ 115,580		
			Sub-Total	$ 115,580		
Vehicle Overhead						
Vehicle AO				$ 44,925		
			Sub-Total	$ 44,925		
Administrative Overhead						
Labour AO				$ 80,185		
Contract AO				$ 17,054		
			Sub-Total	$ 97,239		
			SUB-TOTAL (no AO, AFUDC)	$ 1,271,379		
			TOTAL (AO, AFUDC included)	$ 1,413,544		
Original Cost				$ 545,375		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011209

Title: 85S-401 Cabot Trail Rebuild

Start Date: 2019/01
In-Service Date: 2019/05
Final Cost Date: 2019/11
Function Class: Distribution
Forecast Amount: $1,305,919

DESCRIPTION:

This project will upgrade approximately 1.2 kilometres of existing single-phase line to three-phase line and add approximately 3.6 kilometres of new three-phase line on primary distribution feeder 85S-401 along Cabot Trail in Cape Breton Highlands National Park in Ingonish. This work will facilitate the removal of approximately 3.3 kilometres of deteriorated line on feeder 85S-401 that is currently located off-road. This project will see the addition of approximately 13 kilometres of 336 AASC primary conductor, associated framing and insulators, and addition/replacement of 70 poles.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- No other projects in 2017, 2018, 2019, 2020 or 2021

Depreciation Class: Distribution Plant – Poles, Towers and Fixtures
Distribution Plant – Overhead Conductors and Devices

Estimated Life of Assets: 45 years

JUSTIFICATION:

Justification Criteria: Distribution System

Why do this project?

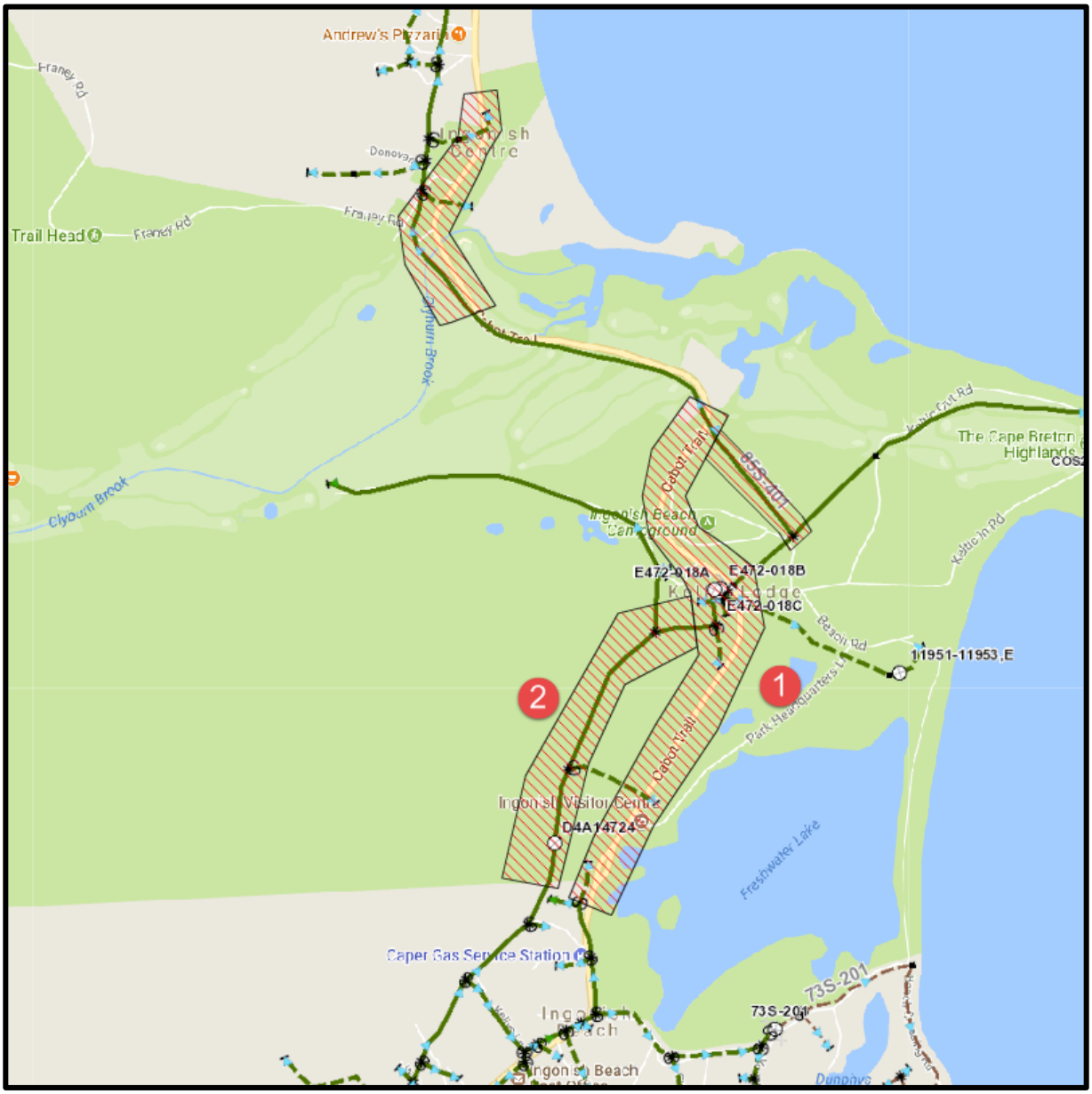
The existing poles are deteriorated and at risk of failure due to their age and condition. In addition, the targeted section is currently located off-road. Rebuilding the new line to roadside will improve accessibility for maintenance and outage restoration, and improve reliability by reducing exposure to tree contacts.

Why do this project now?

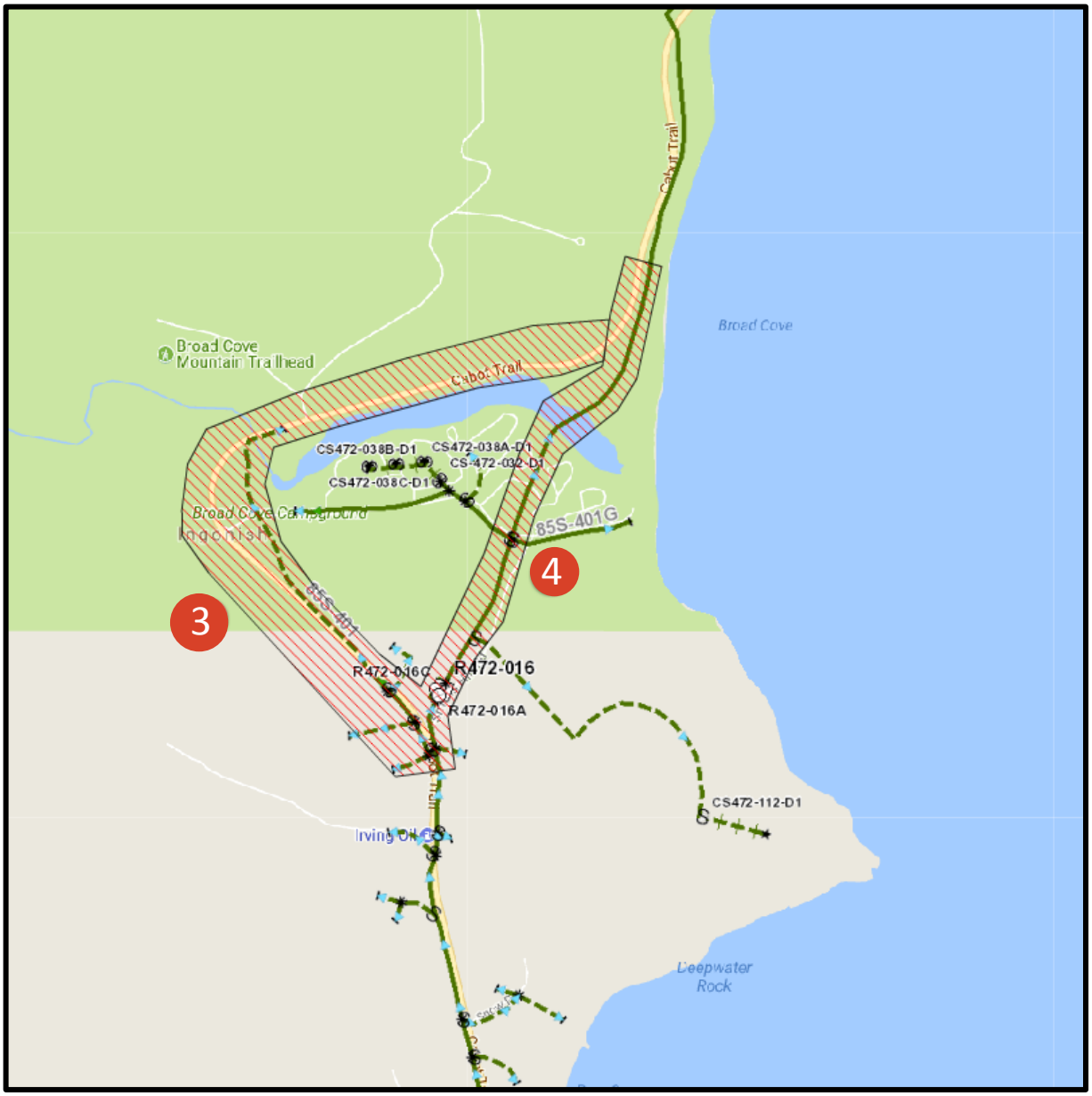
The existing off-road line is approximately 48 years old and has reached the end of its expected service life. Inspection of the targeted devices and assessment based on age, condition and risk of failure has determined that replacement is required. In addition, bringing this line to roadside will eliminate the need for off-road equipment during outage events.

Why do this project this way?

There is no alternative source of supply for the customers in the targeted area. Rebuilding the existing line to roadside is a more cost effective solution than rebuilding the line in its current location due to the increased cost for off-road equipment and additional tree trimming required to create access points to carry out construction.



1. Construct a new 2.35 km, three-phase line along Cabot Trail.
2. Remove existing off-road and deteriorated three-phase line.



3. Construct a new 1.27 km, three-phase line and upgrade approximately 1.19 km of existing single-phase line to three-phase.
4. Remove existing off-road line, and deteriorated three-phase line.

CI Number : C0011209 - 85S-401 Cabot Trail Rebuild **Project Number** C0011209

Parent CI Number : -

Asset Location : 1456 - 1456 Distribution General **Budget Version** 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	3500 - DP - Wood Poles	352,167
Additions	3800 - DP - Insulators	13,733
Additions	3900 - DP - O/H Cond.	812,225
Additions	4000 - DP - O/H Cond.Devices	11,668
Additions	4100 - DP - O/H Line Transf.	38,001
Retirements	3500 - DP - Wood Poles	26,786
Retirements	3800 - DP - Insulators	1,623
Retirements	3900 - DP - O/H Cond.	42,411
Retirements	4000 - DP - O/H Cond.Devices	2,435
Retirements	4100 - DP - O/H Line Transf.	4,870
	Total Cost:	1,305,919
	Original Cost:	149,313

Capital Project Detailed Estimate

Location: Distribution
CI#: C0011209
Title: 85S-401 Cabot Trail Rebuild
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Design	PD	11	$ 386	$ 4,365		
Procurement / Financial Support	LOT	1	$ 3,264	$ 3,264		
			Sub-Total	$ 7,629		
Materials						
Wood Poles	LOT	1	$ 73,613	$ 73,613		
Insulators	LOT	1	$ 739	$ 739		
O/H Cond.	LOT	1	$ 74,866	$ 74,866		
O/H Cond.Devices	LOT	1	$ 1,160	$ 1,160		
O/H Line Transf.	LOT	1	$ 12,827	$ 12,827		
			Sub-Total	$ 163,204		
Contracts						
Trees	LOT	1	$ 60,000	$ 60,000		
Flagging	LOT	1	$ 85,655	$ 85,655		
Backhoe	LOT	1	$ 149,400	$ 149,400		
External Contractor	LOT	1	$ 445,064	$ 445,064		
Off-road Equipment	LOT	1	$ 30,000	$ 30,000		
Rock Breaking	LOT	1	$ 30,000	$ 30,000		
			Sub-Total	$ 800,119		
Land Rights						
Easement	LOT	1	$ 10,000	$ 10,000		
Permit	LOT	1	$ 30,000	$ 30,000		
			Sub-Total	$ 40,000		
Other Goods & Services						
Contingency	%	10%	$ 1,010,953	$ 101,095		
			Sub-Total	$ 101,095		
Interest Capitalized						
AFUDC				$ 12,797		
			Sub-Total	$ 12,797		
Vehicle Overhead						
Vehicle AO				$ 3,315		
			Sub-Total	$ 3,315		
Administrative Overhead						
Labour AO				$ 5,917		
Contract AO				$ 171,842		
			Sub-Total	$ 177,759		
			SUB-TOTAL (no AO, AFUDC)	$ 1,112,048		
			TOTAL (AO, AFUDC included)	$ 1,305,919		
Original Cost				$ 149,313		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0006319

Title: 2019 PCB Pole Top Transformer Replacements

Start Date: 2018/05
In-Service Date: 2019/01
Final Cost Date: 2020/06
Function: Distribution
Forecast Amount: $1,177,592

DESCRIPTION:

This project provides for the systematic removal of equipment containing polychlorinated biphenyl (PCB) materials in accordance with federal guidelines. Regulations state that all pole top equipment containing PCBs in a concentration greater than 50 mg/kg must be removed from service by December 31, 2025. In 2019, NS Power will replace approximately 300 of the known PCB-contaminated road-side transformers. This project includes the destruction of materials, as required.

A portion of the capital costs associated with this capital item will contribute toward settling the Company's Asset Retirement Obligation for PCB contaminated oil.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- 2017 CI 49919 2017 PCB Pole Top Transformer Replacements $2,446,051
- 2018 CI 51493 2018 PCB Pole Top Transformer Replacements $1,360,354
- 2020 CI TBD 2020 PCB Pole Top Transformer Replacements $TBD
- 2021 CI TBD 2021 PCB Pole Top Transformer Replacements $TBD

Depreciation Class: Distribution Plant – Poles, Towers and Fixtures
Distribution Plant – Line Transformers
Distribution Plant – Overhead Conductors and Devices

Estimated Useful Life: 25-30 years

JUSTIFICATION:

Justification Criteria: Environment

Why do this project?

The Canadian Council of Ministers of the Environment (CCME) has committed to a policy of phasing out the use of all PCBs in Canada. In support of this policy, NS Power will be focusing on eliminating all pole top electrical transformers and related pole top auxiliary electrical equipment containing PCBs in a concentration of 50 mg/kg or more before December 31, 2025.

Why do this project now?

Proceeding with this work over a multi-year timeframe will allow the work to be incorporated into NS Power's existing work plan and resources.

This project is deemed in-service when the first pole top transformer is replaced (January 2019), therefore the Final Cost Date (June 2020) is listed as six months after the last pole top transformer is installed under this project (December 2019).

Why do this project this way?

NS Power has received oil samples on more than 18,000 pole top transformers to date, and there are approximately 10,000 transformers remaining that have PCB-contamination potential and need to be sampled and if contamination is present, removed. Based on oil sampling and testing data from 2014-2017, approximately 5.7 percent of the sampled pole-top transformers contained PCBs at a concentration equal to or above 50 mg/kg. Based on that percentage and the resumption of transformer oil sampling, NS Power anticipates there will be approximately 300 PCB-contaminated transformers to replace in 2019.

CI Number : C0006319 - 2019 PCB Pole Top Transformer Replacements

Project Number C0006319

Parent CI Number : -

Asset Location : 1456 - 1456 Distribution General

Budget Version 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	3500 - DP - Wood Poles	15,448
Additions	4000 - DP - O/H Cond.Devices	15,448
Additions	4100 - DP - O/H Line Transf.	845,405
Additions	4200 - DP - O/H Ln.Transf.Dev.	15,448
Retirements	3500 - DP - Wood Poles	1,536
Retirements	4000 - DP - O/H Cond.Devices	1,536
Retirements	4100 - DP - O/H Line Transf.	281,234
Retirements	4200 - DP - O/H Ln.Transf.Dev.	1,536
	Total Cost:	1,177,592
	Original Cost:	197,426

Capital Project Detailed Estimate

Location: Distribution
CI# : C0006319
Title: 2019 PCB Pole Top Transformer Replacements
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
PLT Labor	PD	336	$ 372	$ 125,114		
Engineering Support	PD	61	$ 386	$ 23,490		
			Sub-Total	$ 148,604		
Travel Expense						
Travel - Engineering	lot	1	$ 250	$ 250		
			Sub-Total	$ 250		
Materials						
Transformer Materials	ea	300	$ 1,903	$ 570,900		
Misc.	lot	1	$ 3,000	$ 3,000		
			Sub-Total	$ 573,900		
Contracts						
Traffic Control	lot	1	$ 50,000	$ 50,000		
PCB Destruction	lot	1	$ 98,543	$ 98,543		
Misc. Backhoe/Tree Trimming	lot	1	$ 5,000	$ 5,000		
			Sub-Total	$ 153,543		
Meals						
Meals - Engineering	lot	1	$ 100	$ 100		
				$ -		
			Sub-Total	$ 100		
Other Goods & Services						
Contingency	%	10%	$ 876,397	$ 87,640		
				$ -		
			Sub-Total	$ 87,640		
Vehicle Overhead						
Vehicle AO				$ 64,357		
			Sub-Total	$ 64,357		
Administrative Overhead						
Labour AO				$ 116,185		
Contract AO				$ 33,013		
			Sub-Total	$ 149,198		
			SUB-TOTAL (no AO, AFUDC)	$ 964,037		
			TOTAL (AO, AFUDC included)	$ 1,177,592		
Original Cost				$ 197,426		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0014019

Title: 2019 Substation Recloser Replacements

Start Date: 2019/04
In-Service Date: 2019/04
Final Cost Date: 2021/03
Function Class: Distribution
Forecast Amount: $808,120

DESCRIPTION:

This project will retire and replace 14 substation reclosers on the NS Power system. NS Power has an in-service inventory of over 440 substation reclosers, with an estimated useful life of 30-35 years. Oil filled reclosers have been targeted for replacement due to recent failures.

The solid dielectric models with microprocessor controls that are being installed through this program have benefits that the existing models being replaced do not, including an increased number of protection curves, which facilitate coordination of feeder protection. Integrated instrument transformers provide data collection capabilities for planning studies and operations. It is also easier to integrate these into existing protection schemes due to the availability of programmable input/output.

The substation recloser replacement program was initiated in 2010 and approximately 229 of 440 substation reclosers have been replaced to date.

NS Power anticipates that a portion of the costs associated with this capital item will contribute toward settling the Company's Asset Retirement Obligation for PCB contaminated oil.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- CI 50341 2017 Substation Recloser Replacements $604,889
- CI 51400 2018 Substation Recloser Replacements $644,710
- CI TBD 2020 Substation Recloser Replacements $TBD
- CI TBD 2021 Substation Recloser Replacements $TBD

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Equipment Replacement

Why do this project?

The targeted reclosers are deteriorated and at risk of failure due to their age and condition. Failure of substation reclosers results in outages to the entire feeder, and often to the entire substation, and can cause significant customer outages. Recloser life expectancy is approximately 30-35 years, as designed by the manufacturer, with sufficient maintenance.

This project is being done primarily to replace end-of-life assets, and secondly to reduce environmental risks by removing oil filled equipment.

Why do this project now?

The targeted assets are over 30 years old and have reached the end of their expected service life. Inspection of the targeted assets and assessment based on age, condition and risk of failure have determined that replacements are required. In addition, some recloser failures have occurred. This project targets the replacement of oil filled reclosers that have reached the end of their useful lives. To mitigate the risk of an in-service failure, replacement is necessary.

This project is deemed in-service when the first recloser is replaced (April 2019), therefore the Final Cost Date (March 2021) is listed as six months after the last recloser is replaced (September 2020).

Why do this project this way?

Substation reclosers are required in order to provide protection from faults for safety and reliability. Spare parts are becoming increasingly difficult to obtain for the installed fleet of oil filled reclosers. This necessitates replacing them with a modern, solid dielectric equivalent. This also serves to remove oil filled equipment from the fleet, thus reducing the potential for environmental harm through leakage.

CI Number : C0014019 - 2019 Substation Recloser Replacements

Project Number C0014019

Parent CI Number : -

Asset Location : 1456 - 1456 Distribution General

Budget Version 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0300 - DP - Bldg.,Struct.Grnd.	111,221
Additions	3900 - DP - O/H Cond.	18,078
Additions	4300 - DP - Substn Dev.	636,323
Retirements	0300 - DP - Bldg.,Struct.Grnd.	29,899
Retirements	4300 - DP - Substn Dev.	12,599
	Total Cost:	808,120
	Original Cost:	341,720

Capital Project Detailed Estimate

Location: Distribution
CI#: C0014019
Title: 2019 Substation Recloser Replacements
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Electrician/Technician	PD	155	$ 373	$ 57,656		
T&D Labour - Design	PD	139	$ 386	$ 53,644		
T&D Labour - Commissioning	PD	27	$ 386	$ 10,238		
Procurement / Financial Support	Lot	1	$ 6,728	$ 6,728		
			Sub-Total	$ 128,266		
Materials						
Buildings, Structures and Grounds	LOT	1	$ 980	$ 980		
Electrical Control Equipment	LOT	1	$ 9,450	$ 9,450		
Overhead Conductor	LOT	1	$ 7,280	$ 7,280		
Substation Devices	LOT	1	$ 313,710	$ 313,710		
			Sub-Total	$ 331,420		
Contracts						
Conduit	LOT	1	$ 28,000	$ 28,000		
Conduit Installation	LOT	1	$ 28,000	$ 28,000		
Concrete Foundations (Recloser Slab)	LOT	1	$ 28,000	$ 28,000		
Other	LOT	1	$ 28,000	$ 28,000		
			Sub-Total	$ 112,000		
Other Goods & Services						
Contingency	%	10%	$ 571,686	$ 57,169		
			Sub-Total	$ 57,169		
Vehicle Overhead						
Vehicle AO				$ 55,734		
			Sub-Total	$ 55,734		
Administrative Overhead						
Labour AO				$ 99,477		
Contract AO				$ 24,054		
			Sub-Total	$ 123,531		
			SUB-TOTAL (no AO, AFUDC)	$ 628,855		
			TOTAL (AO, AFUDC included)	$ 808,120		
Original Cost				$ 341,720		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011309

Title: 54H-304 Underground Device Replacement

Start Date: 2019/07
In-Service Date: 2019/12
Final Cost Date: 2020/06
Function Class: Distribution
Forecast Amount: $685,268

DESCRIPTION:

This project will replace approximately 1.1 kilometres of deteriorated underground cables and various underground devices on primary distribution feeder 54H-304. The targeted equipment is part of the Dartmouth underground system, and is located in four separate vaults in the downtown area. Replacements include underground cables, submersible transformers, submersible switchgear, switching cubicle, fault indicators and related hardware.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- No other projects in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Deteriorated Conductor

Why do this project?

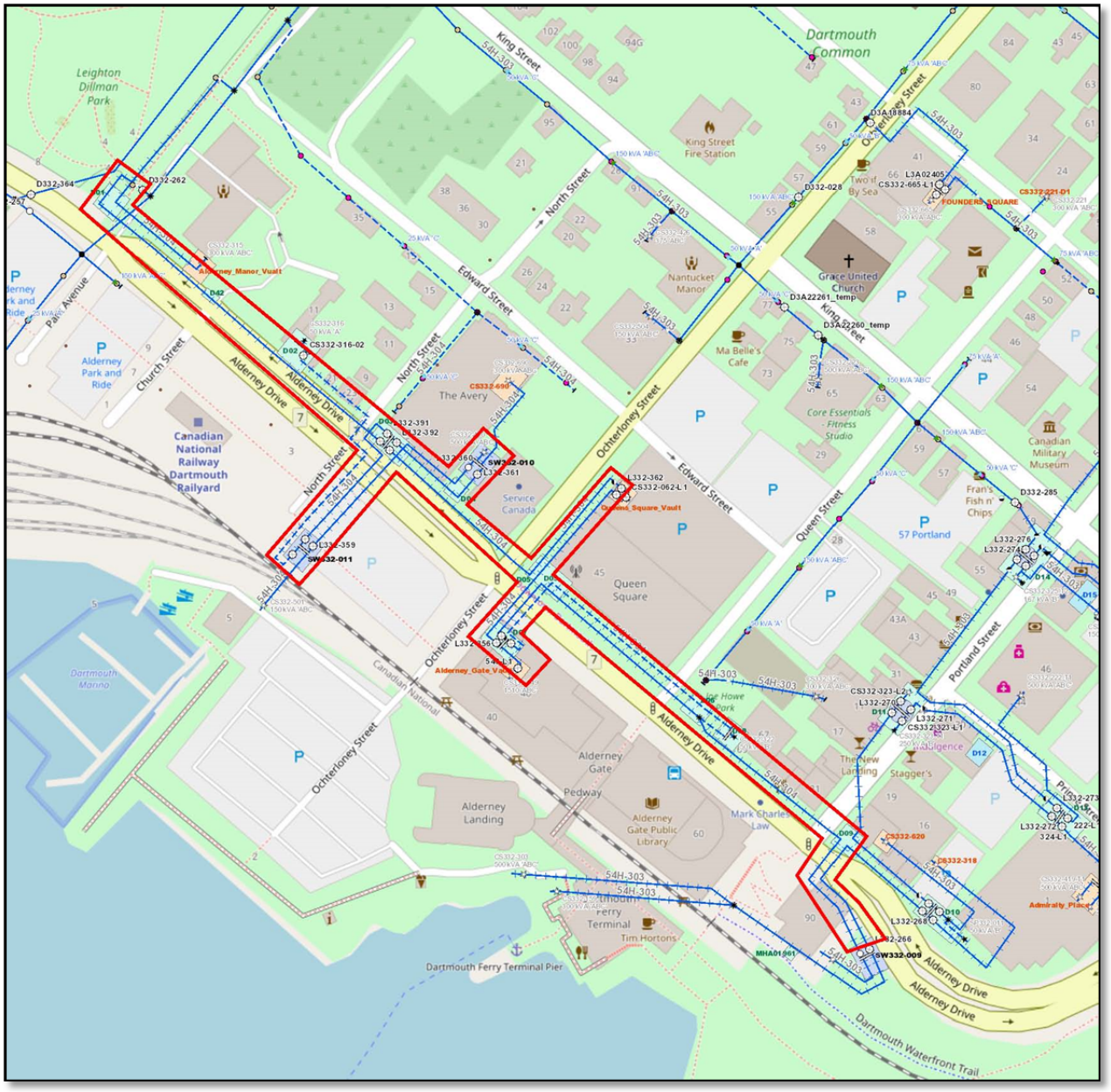
The targeted cables, transformers, switchgear and related equipment are approximately 35 years old, and have reached the end of their expected useful lives. Failure of this equipment would result in outages to Downtown Dartmouth (approximately 1,394 customers) including multiple commercial customers.

Why do this project now?

The existing cables and related equipment are deteriorated and at risk of failure due to their age and condition. Inspections of the targeted devices and assessments based on age, condition, and risk of failure have determined that replacements are required. There have been four asset failures on this underground feeder since 2016 due to the condition of the assets. These events resulted in lengthy outages to customers due to the time required to isolate the faulted section and make the required repairs.

Why do this project this way?

There is no alternate source of supply for customers served by the targeted underground equipment. Replacing the targeted assets is a more cost effective solution than rebuilding the entire underground line. Planned cable replacements can be performed with little to no customer interruptions, as switching can be performed between vaults to supply customers.



1. Replace 1.1 kilometers of deteriorated underground cables and various underground devices (3Ph cables).
2. Replace operators.
3. Replace submersible transformers and switching cubicles.
4. Install/replace fault indicators in vaults. Replace cables trays and cable brackets.

CI Number : C0011309 - 54H-304 Underground Device Replacement

Project Number C0011309

Parent CI Number : -

Asset Location : 1456 - 1456 Distribution General

Budget Version 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	4600 - DP - U/G Conductor	483,207
Additions	4700 - DP - U/G Conductor Devices	99,400
Additions	4800 - DP - U/G Line Transf.	68,572
Retirements	4600 - DP - U/G Conductor	33,515
Retirements	4700 - DP - U/G Conductor Devices	574
	Total Cost:	685,268
	Original Cost:	264,613

Capital Project Detailed Estimate

Location: Distribution
CI#: C0011309
Title: 54H-304 Underground Device Replacement
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Engineering	PD	56	$ 386	$ 21,576		
T&D Labour	PD	328	$ 372	$ 122,191		
Procurement / Financial Support	Lot	1	$ 4,120	$ 4,120		
			Sub-Total	$ 147,887		
Materials						
U/G Conductor	Lot	1	$ 151,287	$ 151,287		
U/G Conductor Devices	Lot	1	$ 54,692	$ 54,692		
U/G Line Transformer	Lot	1	$ 25	$ 25		
			Sub-Total	$ 206,004		
Contracts						
U/G Conductor	Lot	1	$ 64,151	$ 64,151		
U/G Conductor Devices	Lot	1	$ 15,415	$ 15,415		
U/G Line Transformer	Lot	1	$ 6,156	$ 6,156		
			Sub-Total	$ 85,722		
Other Goods & Services						
Contingency	%	10%	$ 439,613	$ 43,961		
			Sub-Total	$ 43,961		
Interest Capitalized						
AFUDC				$ 4,329		
			Sub-Total	$ 4,329		
Vehicle Overhead						
Vehicle AO				$ 64,260		
			Sub-Total	$ 64,260		
Administrative Overhead						
Labour AO				$ 114,694		
Contract AO				$ 18,411		
			Sub-Total	$ 133,104		
			SUB-TOTAL (no AO, AFUDC)	$ 483,575		
			TOTAL (AO, AFUDC included)	$ 685,268		
Original Cost				$ 264,613		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011197

Title: 64N Lourdes Street Conversion Phase 1

Start Date: 2019/09
In-Service Date: 2020/02
Final Cost Date: 2020/08
Function Class: Distribution
Forecast Amount: $576,031

DESCRIPTION:

This project will implement recommendations 6.1.2 of the New Glasgow/Stellarton 4kV Distribution Planning Study 362-0615-E30 (please refer to Attachment 1). Section 6.1.2 recommends targeted conversion of the existing 4kV line that is being supplied from 64N Lourdes Street substation. In order to complete this conversion, the existing 25kV feeder 62N-411 will be extended along North Street, Athletic Street and Riverview Street. Additional replacements include upgrading 3 kilometres of existing primary conductor with a 2/0 AASC, replacement of approximately 15 deteriorated poles, framing and insulators and the replacement of all existing single-tap transformers with dual-tap transformers.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- 2020 CI TBD 64N Lourdes Street Conversion Phase 2 $TBD

JUSTIFICATION:

Justification Criteria: Distribution System

Why do this project?

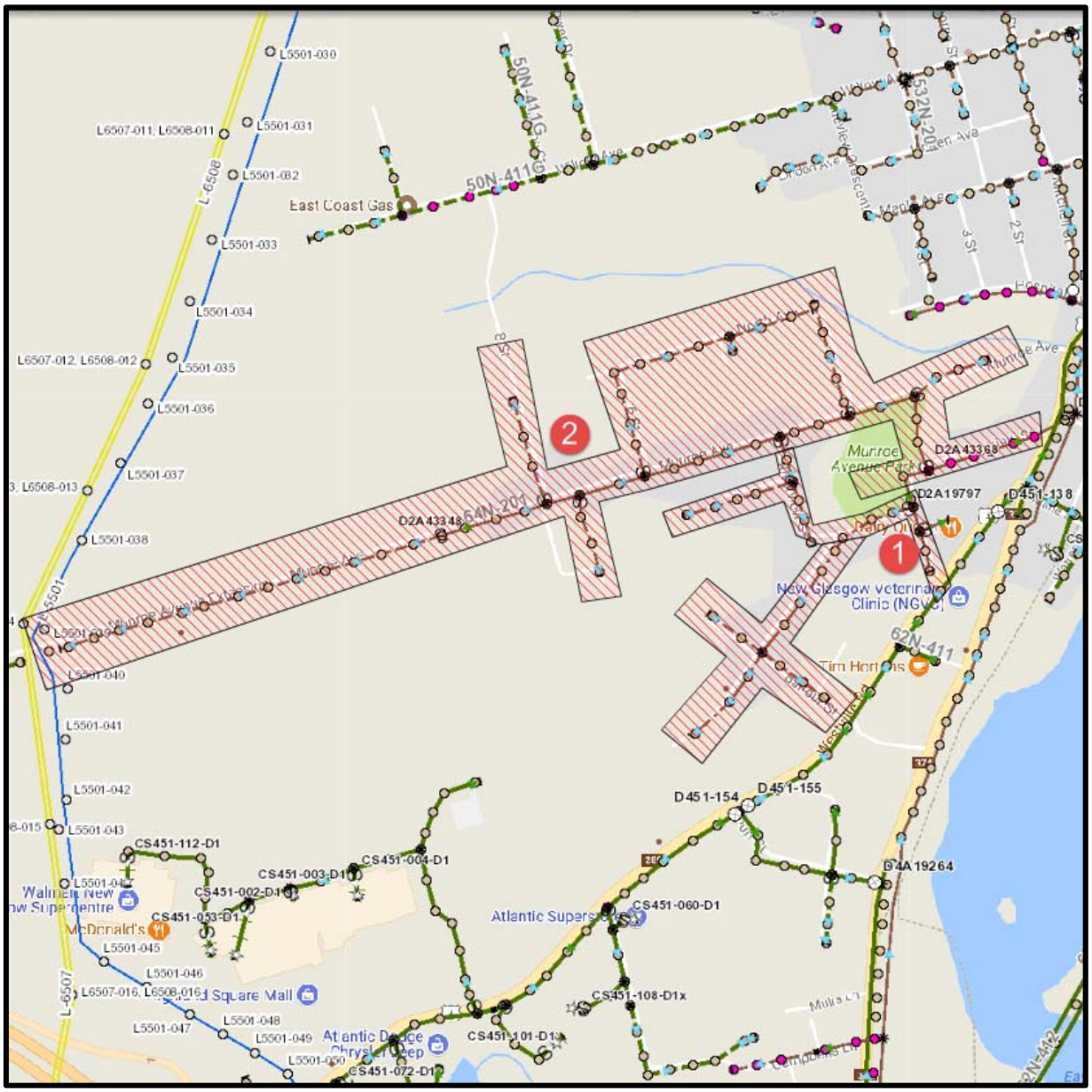
The existing 64N-Lourdes Street step-down substation equipment, infrastructure, and associated 4kV distribution system are deteriorated. The condition of the targeted assets is further described in section 2.4.4 of planning study 362-0615-E30 (please refer to Attachment 1). In the event of 64N-T1 failure, outage duration would be significant due to the work required to setup a mobile transformer since the 532N substation retirement is in-progress and load transfer is not a viable option.

Why do this project now?

The 64N-Lourdes step-down substation equipment and associated 4kV distribution plant are approximately 52 years old and have reached the end of their expected useful lives, as outlined in section 2.4.4 and section 4.3. This project was recommended for 2016 in section 6.1, however was deferred to 2019 to allow for the conversion of the planning study of 532N-Elm street substation under CI 49799 – 532N Elm Street Conversion Phase 1 and CI 52224 – 532N Elm Street Conversion Phase 2 & 3 to avoid lengthy customer outage.

Why do this project this way?

Alternatives are outlined in section 5.1 of the planning study, including voltage conversion to decommission the 64N substation, replacement of the step-down substation transformer with a padmount transformer, and replacement of the 64N step-down substation transformer with pole mounted step-down transformers.



1. Extend 62N-411along North Street using 2/0 AASC primary conductor and 2/0 AASC neutral conductor.
2. Upgrade targeted deteriorated conductor to 2/0AASC, replace poles and single-tap transformers with dual-tap transformers to convert the existing 4kV line to 25kV.

CI Number : C0011197 - 64N Lourdes Street Conversion Phase 1 **Project Number** C0011197

Parent CI Number : -

Asset Location : 1456 - 1456 Distribution General **Budget Version** 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0200 - DP - Land Rights	28,442
Additions	3500 - DP - Wood Poles	159,038
Additions	3800 - DP - Insulators	15,456
Additions	3900 - DP - O/H Cond.	97,594
Additions	4100 - DP - O/H Line Transf.	124,091
Additions	4800 - DP - U/G Line Transf.	76,589
Retirements	3500 - DP - Wood Poles	15,200
Retirements	3900 - DP - O/H Cond.	17,102
Retirements	4100 - DP - O/H Line Transf.	26,798
Retirements	4800 - DP - U/G Line Transf.	15,722
	Total Cost:	576,031
	Original Cost:	60,707

Capital Project Detailed Estimate

Location: Distribution
CI# / FP#: C0011197
Title: 64N Lourdes Street Conversion Phase 1
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Design	PD	7	$ 386	$ 2,688		
Procurement / Financial Support	Lot	1	$ 2,874	$ 2,874		
			Sub-Total	$ 5,562		
Materials						
Wood Poles	LOT	1	$ 13,439	$ 13,439		
Insulators	LOT	1	$ 608	$ 608		
O/H Conductor	LOT	1	$ 7,769	$ 7,769		
O/H Line Transformer	LOT	1	$ 68,739	$ 68,739		
U/G Line Transf.	LOT	1	$ 53,125	$ 53,125		
			Sub-Total	$ 143,681		
Contracts						
Flagging	LOT	1	$ 46,134	$ 46,134		
Backhoe	LOT	1	$ 16,200	$ 16,200		
Tree Trimming	LOT	1	$ 10,000	$ 10,000		
External Contractor	LOT	1	$ 206,212	$ 206,212		
Other contracts	LOT	1	$ 18,000	$ 18,000		
			Sub-Total	$ 296,546		
Land Rights						
Easements	LOT	1	$ 10,000	$ 10,000		
			Sub-Total	$ 10,000		
Other Goods & Services						
Contingency		10%	$ 455,789	$ 45,579		
			Sub-Total	$ 45,579		
Interest Capitalized						
AFUDC	Lot	1	$ 3,854	$ 4,244		
				$ -		
			Sub-Total	$ 4,244		
Vehicle Overhead						
Vehicle AO				$ 2,417		
			Sub-Total	$ 2,417		
Administrative Overhead						
Labour AO				$ 4,313		
Contract AO				$ 63,689		
			Sub-Total	$ 68,003		
			SUB-TOTAL (no AO, AFUDC)	$ 501,368		
			TOTAL (AO, AFUDC included)	$ 576,031		
Original Cost				$ 60,707		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

New Glasgow/Stellarton 4kV
DISTRIBUTION PLANNING STUDY

Report number 362-0615-E30

Revision		Date	Drafted By	Reviewed by	Approved By
0	Issued for Study	25-June-2015	BH		
1	Issued for Release	5-Jan-2016	BH	AB	

EXECUTIVE SUMMARY

This study was initiated by the Eastern Territory, to determine solutions for aging/defective 4kV stepdown transformers in New Glasgow. The scope of this study encompasses the solutions to correct high priority issues in New Glasgow and the future of the 4kV system.

It was determined that conversion to 25kV is the best solution for all 4kV distribution remaining in the Stellarton area. Priority of conversions was determined through discussion with representatives from distribution planning, regional engineering, capital engineering, system maintenance and environmental services. Some temporary measures were identified, and assuming their completion, the following priority was agreed upon:

1. 532N-Elm St
2. 64N-Lourdes
3. 61N-Provost St
4. 528N-Granville St

This study makes recommendations by capital year for the phased conversion of these 4kV systems. There are currently no recommendations for capital work on the 25kV systems in this area; however, they should be studied again by 2020. To enable this study, communication work needs to be completed to enable the collection of interval data at 50N-Trenton and all interconnected distribution generation sites in the Stellarton area. This will allow for peak feeder loads to be determined annually.

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1.0 SCOPE

This study was initiated by the Eastern Territory, to determine solutions for aging/defective 4kV stepdown transformers in New Glasgow. The scope of this study includes the solutions to correct high priority issues in New Glasgow as well as a longer term plan for the remaining 4kV distribution.

The 4kV step-downs under study are fed from 50N-Trenton and 62N-Bridge Ave. The state of these substations will be considered within this study, although there are no imminent issues with either of these 25kV distribution networks. Timing for a future study will be recommended.

The focus of this study will be on the 4kV step-down sites in New Glasgow: 61N-Provost, 528N-Granville, 532N-Elm and 64N-Lourdes. There have been a variety of issues identified at these sites which pose risks to the environment as well as the reliability of the 4kV distribution in this area.

2.0 EXISTING SYSTEMS

2.1 Transmission

The 50N-Trenton substation serves as the connection point for Trenton Thermal Generating Station and is along the route of a major transmission corridor spanning from Cape Breton to the hub in Truro. The 230kV transmission passes by this station as the 138kV system supplies sub-transmission in the area via lines: L-6503, L-6507, L-6508 and L-6511. The transmission system will not be affected within the scope of this study.

2.2 Sub-Transmission

The sub-transmission system within the Stellarton area operates at 69kV. It is supplied by two 138-69kV auto-transformers located at 50N-Trenton. From there, a 69kV N.O. loop is made with 62N-Bridge Ave (L-5500 and L-5501) as well as a radial feed to 54N-Abercrombie (L-5502). From 62N-Bridge Ave another radial feed (L5510) goes to 89H-Trafalgar. The sub-transmission system will not be affected within the scope of this study.

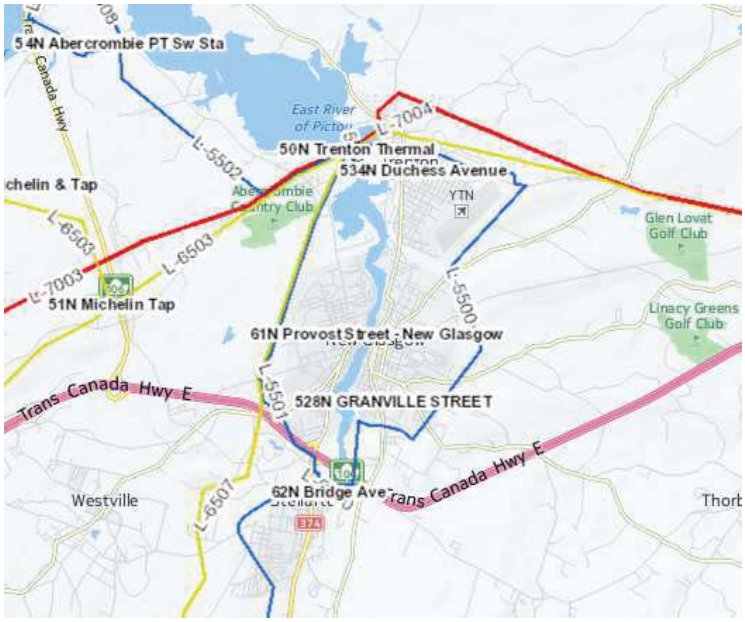

Figure 1 Stellarton Area Transmission

2.3 Distribution (25kV)

The 25kV distribution is not the area of focus for this planning study; however 25kV circuits from 50N-Trenton and 62N-Bridge Ave feed the 4kV distribution that is under study. There are no current or imminent issues with the 25kV distribution system that would justify capital expenditure, however the timing for a future study will be recommended.

2.3.1 50N-Trenton

The 50N-Trenton substation has two power transformers, T51 and T13. Transformer T51 has one 13.8kV feeder which supplies industrial customers along the East River of Pictou in Trenton. Transformer T13 has four feeders which cover a large area including: Trenton, Abercrombie, Pictou Landing, the north half of New Glasgow and the eastern extents of the Stellarton depot.

2.3.2 62N-Bridge Ave

The 62N-Bridge Ave substation in Stellarton has a unique configuration that is not standard for NS Power. There are two power transformers (T1/T2) which are connected in parallel to service six feeders. These feeders cover a large area including: Stellarton, Westville, the south half of New Glasgow and the southern extents of the Stellarton depot.

2.4 Distribution (4kV)

The 4kV distribution, stepped-down from 25kV circuits of 50N-Trenton and 62N-Bridge Ave, will be the focus of this study.

Error! Reference source not found.1 provides the transformer data for the 4kV step-downs that are directly impacted by the scope of this study. The stepdown substations will be looked at in greater detail. The phasing out of 4kV single phase pole or platform mounted transformers will be recommended as part of this study, but studied in less detail.

Table 1 Stellarton 4kV Step-down Transformers

Substation	25kV Source	Transformer Data				
		ID	MAN	kV	Rating kVA	Year
61N-Provost	50N-412	T1	Pioneer Electric	24-4.16	5000/6667	1968
528N-Granville	62N-412	T1	General Electric	22-4	5000/5600	1967
532N-Elm St	50N-411G	T41	Brown Boveri	23.9-4.16	2000	1956
64N-Lourdes	62N-411	T1	Packard Electric	22.55-4	1000	1956
534N-Duchess	50N-412	T1	General Electric	24.94-4.16	1000	1958
519N-Drummond	62N-416	T1	N/A	24.94-4.16	1500	1970
658N-Pictou Landing (platform)	50N-415	T41	N/A	14.4-2.4	333x1ph	N/A
536N-Woodburn (platform)	50N-410	T1	N/A	14.4-2.4	500x1ph	N/A
664N-Claremont (platform)	62N-415	T1	N/A	14.4-2.4	167x2ph	N/A
530N-Thorburn (pole)	62N-413	T1	N/A	14.4-2.4	100x1ph	N/A

2.4.1 61N-Provost Street

The 24-4.16kV 5MVA power transformer T1 at 61N-Provost Street was commissioned in 1968. It is fed from 50N-Trenton Thermal feeder 412. The feeders from 61N-Provost supply most of downtown New Glasgow, east of the river, as shown in Figure 2. There are approximately 1600 customers fed from this stepdown, mostly residential with some commercial.

This stepdown transformer has 4 feeders: 61N-201, 202, 203 and 204. Two of these 4kV feeders are tied to feeders from a nearby stepdown transformer at 528N-Granville Street:

- 61N-201 ties to 528N-201 on Stewart Street
- 61N-202 ties to 528N-202 on Marsh Street

This transformer is not overloaded and growth has been relatively flat in the area. The main area of concern in this location is the risk of environmental contamination. There are visible signs oil leakages and the oil level is intentionally left low to prevent excessive leakage.

Running this transformer below recommended oil levels also puts it at greater risk of failure. In the event of failure, this substation has the space and cable runs required to accommodate a mobile transformer.

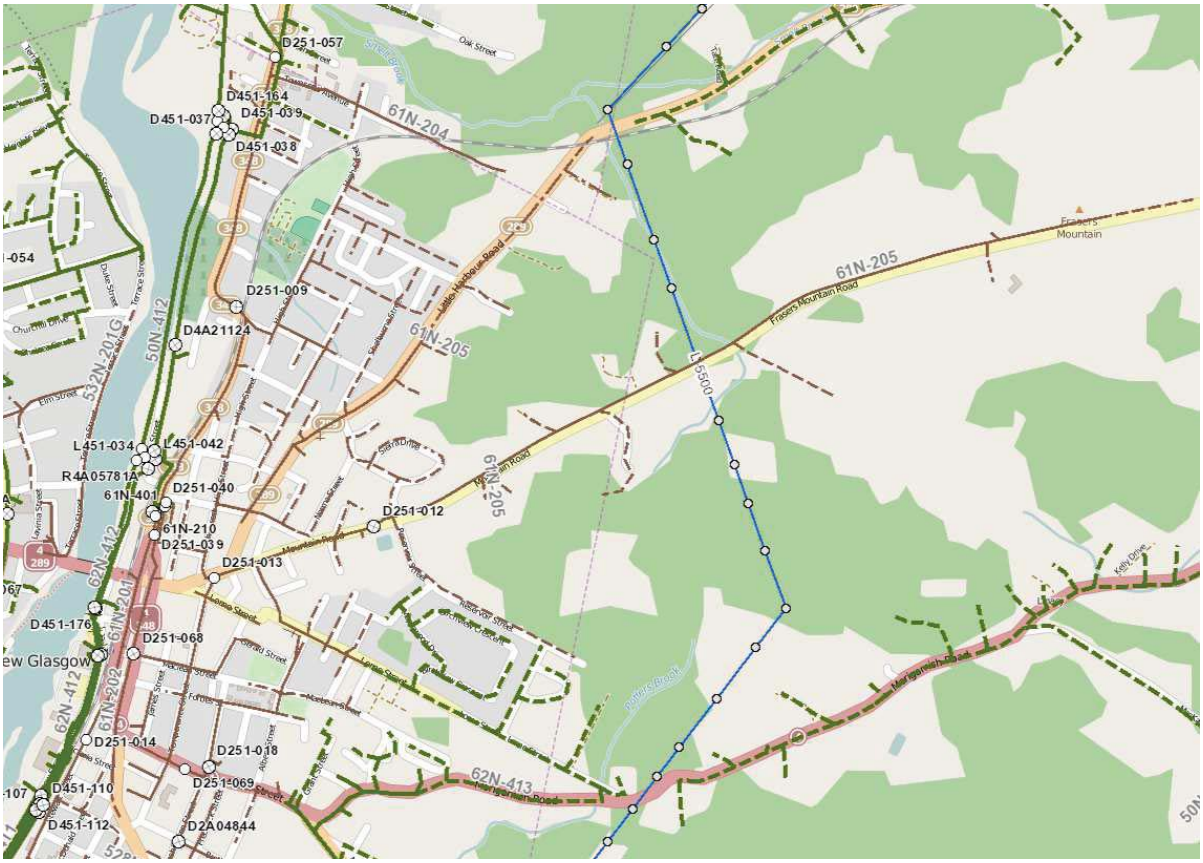

Figure 2 61N-Provost Street Extents

Figure 3 Photos of 61N-Provost St

2.4.2 528N-Granville Street

The 22-4kV 5MVA power transformer T1 at 528N-Granville Street was commissioned in 1967. A voltage regulator was installed to buck the voltage on the high side and allow this transformer to operate as a 25-4kV stepdown. This substation supplies load to southeast New Glasgow as shown in Figure 4.

The original voltage regulator is out of service but was not removed because it sits on the same set of support rails as the transformer and acts as a counter-weight. Engineering of a solution to allow for its removal is underway. This voltage regulator introduces environmental risk to the site as it is an oil filled container and its failure could go unnoticed for some time since it is out of service. There are also visible signs of oil leakages and the oil level is intentionally left low to prevent excessive leakage.

The stepdown transformer has 2 feeder exits: 528N-201 and 202. They are tied to 61N-201 and 202 as mentioned above. There is no space for a mobile transformer at this location.

This transformer is lightly loaded in an area with little growth.

Figure 4 **528N-Granville St Extents**

Figure 5 **Photos of 528N-Granville St**

2.4.3 532N-Elm Street

The 23.9-4.16kV 2MVA power transformer T41 at 532N-Elm Street was commissioned in 1956. To operate as a 25-4kV stepdown, three pole top transformers were installed in reverse polarity to buck the voltage to 2400V. The cases of the pole top transformers are painted red and are considered to be live as they are mounted on insulators. These transformers are suspected to be PCB contaminated, since they are of a pre-1982 vintage.

There are visible signs of oil leakages on this power transformer and the oil level is intentionally left low to prevent excessive leakage. There would be risk in maintaining this unit, as there are no spare parts available for it.

The 25kV underground cables appear weathered and the potheads are at about 7 feet above the ground. Due to this, any work on this transformer would likely be within the limits of approach specified in our safety standards.

This stepdown transformer has 1 feeder exit, 532N-201. It is tied to adjacent 4kV feeder 64N-201. There is no space for a mobile transformer at this location.

Overall, this is an unsightly substation in an established residential neighbourhood without readily available contingency. The load growth is flat in this area and has not reached the nameplate capacity of this transformer.

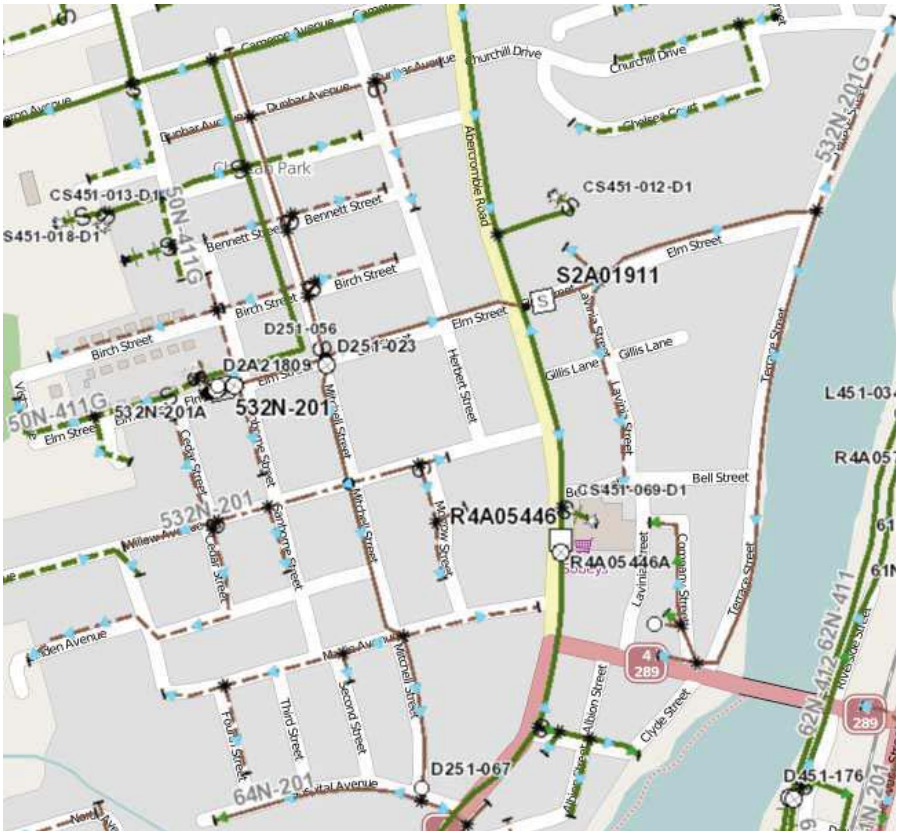

Figure 4 532N-Elm St Extents

Figure 6 Photos of 532N-Elm St

2.4.4 64N-Lourdes

The 22.55-4kV 5MVA power transformer T1 at 64N-Lourdes was commissioned in 1956. It is the most visually appealing of the four stepdown substations in New Glasgow, but also the most heavily loaded.

There are visible signs of oil leakages on this power transformer and the oil level is intentionally left low to prevent excessive leakage.

This stepdown transformer has 1 feeder exit, 64N-201. It is tied to adjacent 4kV feeder 532N-201. There is space on this site for a mobile transformer, although there are no existing provisions for one to be installed.

Figure 7 64N-Lourdes Extents

Figure 8 Photos of 64N-Lourdes

2.4.5 534N-Duchess Avenue

The 24.94-4.16kV 1MVA power transformer at 534N-Duchess was commissioned in 1958.

Due to heavy overload of this transformer, a large section of its load was converted to 25kV in 2014 (see Figure 10). Based on the reduction from 2990 to 2135kVA (connected) and 60 to 327 customers, it is estimated that the load on this transformer was reduced by 30%.

There are visible signs of oil leakages on this power transformer and the oil level is intentionally left low to prevent excessive leakage.

This stepdown transformer has one feeder exit, 534N-201, which is isolated from other 4kV feeders. In the event of failure, there is space for a mobile transformer.

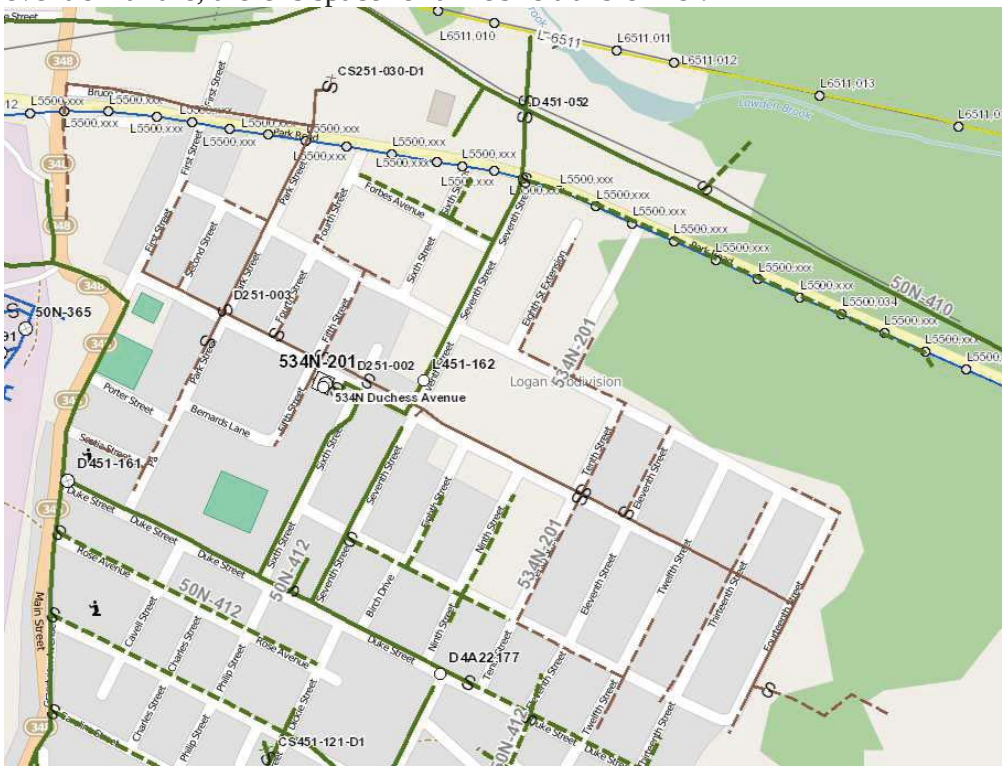

Figure 9 534N-Duchess Extents (2015)

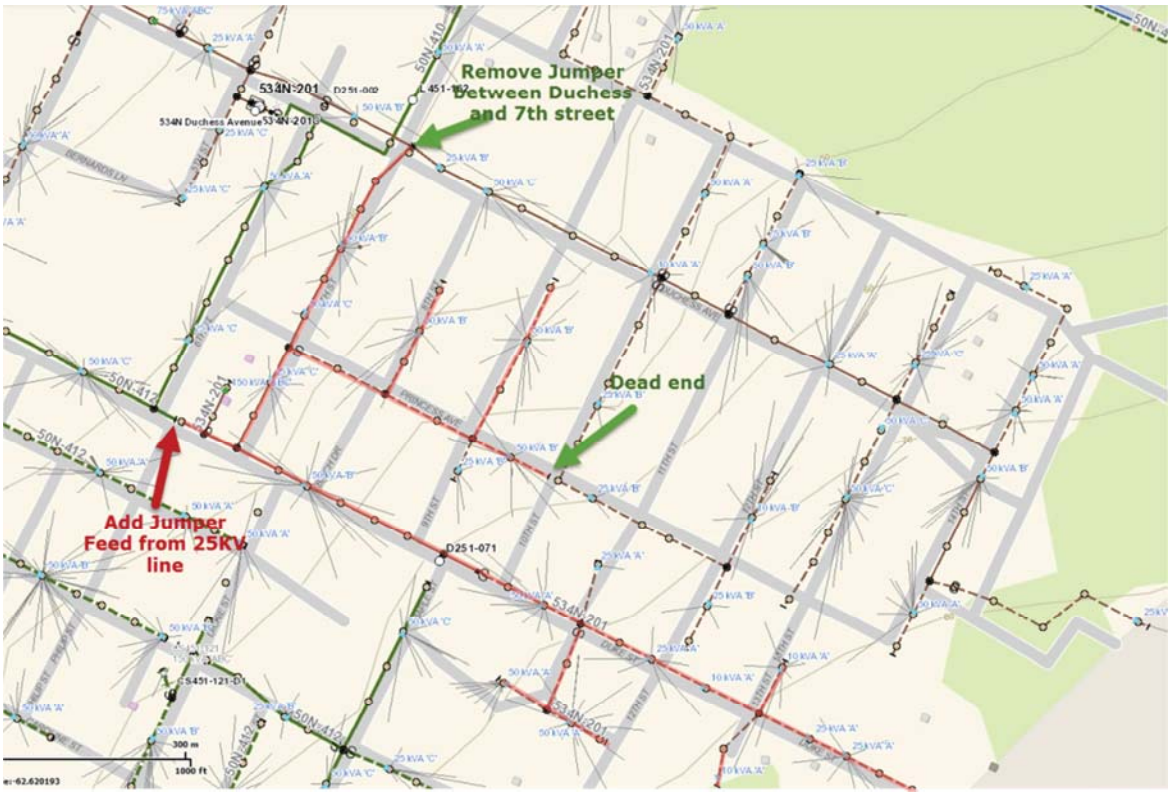

Figure 10 **534N-Duchess Conversion (2014)**

Figure 11 **Photo of 534N-Duchess Ave**

2.4.6 519N-Drummond Road

The 24.94-4.16kV 1.5MVA power transformer at 519N-Drummond was commissioned in 1970.

In 2012, a partial conversion to 25kV was completed in this area (See Figure 13). Based on the reduction from 674 to 484 customers, it is estimated that the load on this transformer was reduced by 30%.

This stepdown transformer has one feeder exit, 519N-201, which is isolated from other 4kV feeders. In the event of failure, there is minimal to no space for a mobile transformer.

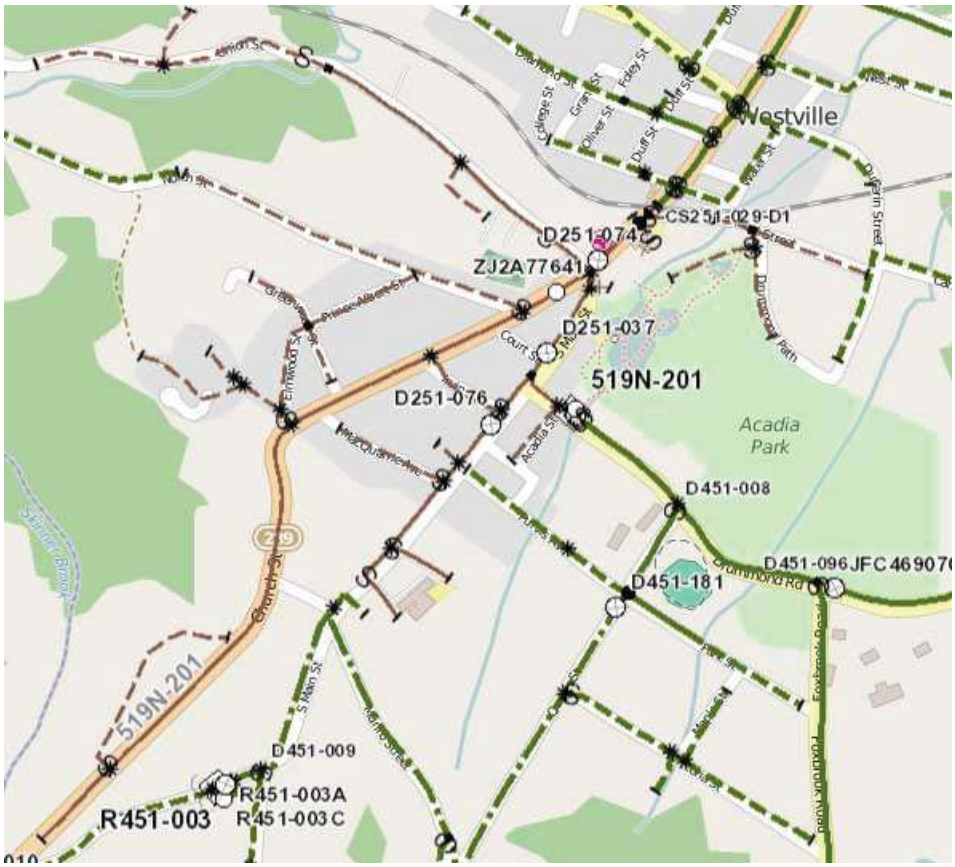

Figure 12 519N-Drummond Extents

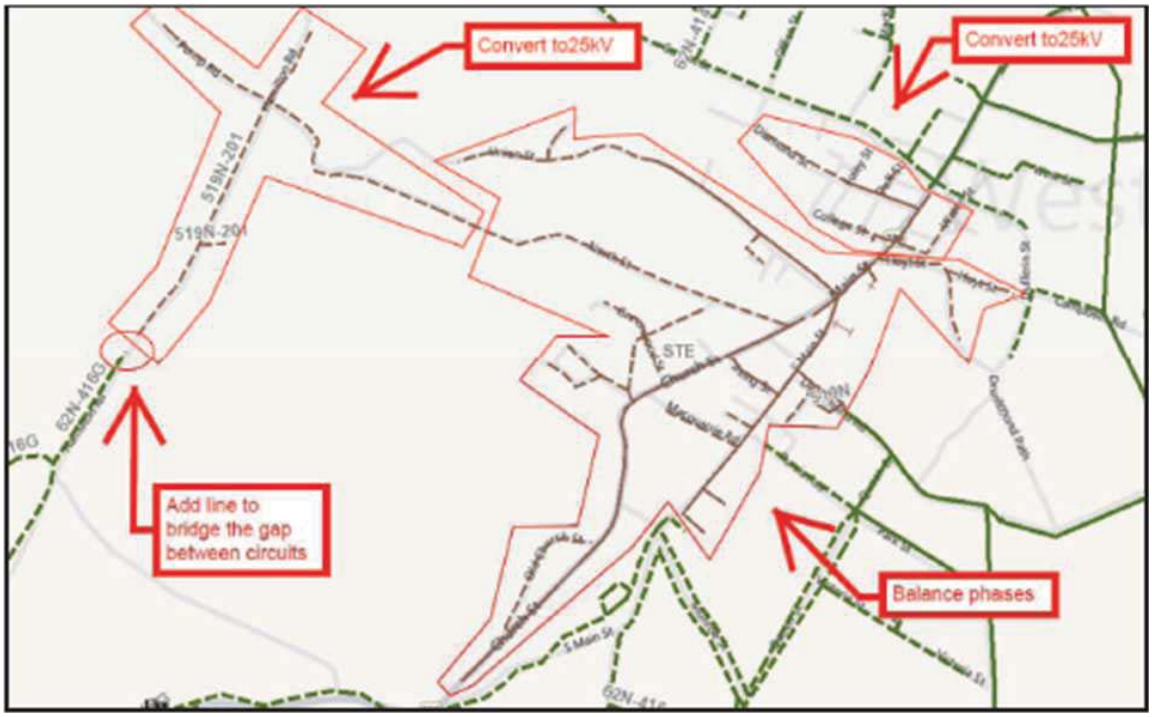

Figure 13 519N-Drummond Conversion (2012)

Figure 14 Photo of 519N-Drummond

2.5 Distributed Generation

There are currently three distributed generation sites in service and two more planned for the Stellarton area on 25kV distribution from 50N and 62N.

Table 2 Stellarton Distributed Generation

IR#	Site#	Name	Feeder	Size	In Service Date
IR312	717N	Auld's Mountain	50N-410	4.6MW	April 2015
IR257	82N	Irish Mountain	62N-413	1.99MW	November 2013
IR388/464	718N	Forbes Lake	62N-413	6.4MW	April 2015
IR308	724N	Avondale	50N-410	1.6MW	Future (Oct 2015)
IR333	722N	Limerock	62N-414	4.8MW	Future (Aug 2015)

The distributed generation does not affect the peak data or recommendations for the 4kV distribution. For the 25kV distribution, 82N Irish Mountain may have distorted peak feeder readings for 62N-413 for 2014 and 2015 peaks. Unfortunately there is no interval (PI) data available for this feeder during these peaks, however there is interval (MV90) data available for 82N itself.

3.0 LOAD HISTORY AND FORECAST

The 25kV distribution is comprised of long rural feeders and small towns. The 4kV distribution under study is mostly residential with a small number for commercial customers. As illustrated in the load history for these feeders, Appendix B, the feeders being studied have had a larger winter peak than summer. Historical load data for the feeders and transformers being studied was collected from the Distribution Load Check Database and PI data where available. Historical data was used to determine load growth rate and forecast future peak loads. Peak loads should be compared against the rated load and the Capital Expenditure Justification Criteria (CEJC).

3.1 Load Forecast

Customer load has grown at a modest pace in the Stellarton area. There is insufficient data for a load history/forecast for 534N, 519N, 658N, 536N, 664N and 530N. Clip data recorded in the Eastern Region Load Protection Report was used to determine if overloads exist on these stepdown transformers.

Table 3 Load Protection Report Clip Data

Transformer	Customers (#)	Rating (kVA)	2014 Clip (kVA)	2015 Clip (kVA)	% Loading (max)
519N-T1	484	1500	1236	1145	82%
534N-T1	327	1000	1308	NA	131%
530N-T1	41	100	130	89	130%
536N-T1	108	500	283	NA	57%
658N-T41	186	333	300	NA	90%
664N-T1 Ph A	101	167	220	218	132%
664N-T1 Ph C	108	167	182	200	120%

The growth rates indicated in following tables were determined through examination of the peak load check data over the past 15 years. The forecasted load growth was then calculated using the 90th percentile of a linear fit, to determine potential peak load growth in the area. In **bold** are actual recorded values, other values have been estimated from historical data. The 25kV feeders have not been included in these tables, but plots can be found in Appendix B.

Table 4 90th Percentile Load Forecast 25kV

Year / Peak MVA	50N-T13	62N-T1/T2
Rating/CEJC	**28/37.2 MVA**	**40/53.2 MVA**
Current Customers	**5015**	**9735**
Load Growth	**1.13%**	**1.10%**
2014	**24**	**44.1**
2015	**28.5**	46.5
2016	29.0	47.0
2017	29.3	47.6
2018	29.7	48.1
2019	30.0	48.7
2020	30.4	49.2
2021	30.7	49.8
2022	31.1	50.3
2023	31.4	50.9
2024	31.8	51.4
2025	32.1	52.0
2026	32.5	52.5
2027	32.8	53.1
2028	33.2	53.6
2029	33.5	54.2
2030	33.9	54.7

Table 5 90th Percentile Load Forecast 61N-Provost

Year / Peak MVA	61N-T1	61N-201	61N-202	61N-204	61N-205
Rating/CEJC	**6.67/8.87 MVA**	**300/325 A**	**300/325 A**	**300/325 A**	**300/325 A**
Current Customers	**1604**	**132**	**332**	**559**	**581**
Load Growth	**0.55%**	**0.32%**	**-1.16%**	**0.70%**	**1.92%**
2014	**5.0**	**72**	**234**	**222**	**290**
2015	**5.1**	**70**	**212**	**236**	**306**
2016	5.4	73	222	238	313
2017	5.4	73	220	239	320
2018	5.4	73	218	241	326
2019	5.5	73	215	243	333
2020	5.5	74	213	245	340
2021	5.5	74	210	246	347
2022	5.6	74	208	248	353
2023	5.6	74	206	250	360
2024	5.6	75	203	251	367
2025	5.7	75	201	253	374
2026	5.7	75	199	255	380
2027	5.7	75	196	257	387
2028	5.7	76	194	258	394
2029	5.8	76	192	260	401
2030	5.8	76	189	262	407

Table 6 90th Percentile Load Forecast 528N-Granville, 532N-Elm, 64N-Lourdes

Year / Peak MVA	528N-T1	528N-201	528N-202	532N-T41	64N-T1	532N/64N
Rating/CEJC	**5.6/7.45 MVA**	**300/325 A**	**300/325 A**	**2/2.66 MVA**	**1/1.33 MVA**	**Coincidence**
Current Customers	**802**	**395**	**407**	**494**	**374**	**Factor**
Load Growth	**0.62%**	**-0.76%**	**0.77%**	**-1.16%**	**1.24%**	**90%**
2014	1.91*	**170**	115*	**1.44**	**1.22**	**2.39**
2015	2.02*	**142.0**	148*	**1.44**	**1.21**	**2.39**
2016	2.13	166.7	150.5	1.58	1.40	2.68
2017	2.15	165.4	151.7	1.56	1.42	2.69
2018	2.16	164.2	152.9	1.54	1.44	2.69
2019	2.18	163.0	154.1	1.53	1.46	2.69
2020	2.19	161.8	155.3	1.51	1.48	2.69
2021	2.20	160.6	156.5	1.49	1.50	2.69
2022	2.22	159.4	157.7	1.48	1.52	2.69
2023	2.23	158.2	158.9	1.46	1.53	2.69
2024	2.24	157.0	160.1	1.44	1.55	2.70
2025	2.26	155.7	161.3	1.42	1.57	2.70
2026	2.27	154.5	162.5	1.41	1.59	2.70
2027	2.29	153.3	163.8	1.39	1.61	2.70
2028	2.30	152.1	165.0	1.37	1.63	2.70
2029	2.31	150.9	166.2	1.36	1.65	2.70
2030	2.33	149.7	167.4	1.34	1.67	2.70

***Data not available, values approximated using scaled clip measurements.**

4.0 JUSTIFICATION FOR EXPENDITURE

The following section identifies issues that warrant correction based on NSPI's *Capital Expenditure Justification Criteria*.

4.1 Overloads

There is only one overload condition that is expected within the study period for 25kV distribution: 62N-T1/T2 transformer is expected to peak above 133% of rating in 2028, based on load history

There are two overload conditions expected within the study period for 4kV distribution:

- 61N-205 feeder is expected to peak above 325A in 2018, unless load is transferred
- 64N-T1 transformer peaked above 133% of rating in 2012 and 2013 and is expected to reach similar peak values in the coming years.

An overload condition was present on 534N-T1 in 2013 and 2014 above 133% of rating. Data is not available for 2015 winter peak. In 2014, approximately 30% of the connected kVA was removed from this stepdown through conversion to 25kV. Based on this, the 2015 winter peak is estimated at 100% of rating. The peak winter load is not expected to exceed 133% of rating within the study period.

There are single phase stepdown transformers that are at or approaching overload. Based on 2014 clip data in the Eastern Region Load Protection Report, it is very likely that 530N-Thorburn and 664N-Claremont have exceeded 133% of rating during winter peak.

4.2 Contingency Loss of Supply

The 4kV distribution in New Glasgow is divided by the East River of Pictou. There are two stepdown substations on each side, but they are unable to provide full contingency on either side. The conclusions within this section were determined through modeling single contingency situations during 2015 winter peak loading. Other 4kV in the Stellarton area is completely isolated from alternate supplies.

4.2.1 532N-Elm St and 64N-Lourdes

These two substations supply similar loads. They are tied by a long run of #2 bare copper conductor, which causes voltage drop well below acceptable limits in a situation where 64N provides contingency for 532N. Peak load would greatly exceed 133% of the rating of 64N-T1. There is no room for a mobile transformer near the 532N-Elm St substation. There would be an extended outage to approximately 500 customers if 532N-T41 were to fail.

In the event of 64N-T1 failure, it is possible that Elm St could pick up the load, however voltage drop would be a concern in some areas during peak load. The 2015 peak load for 532N and 64N is just under 133% of 532N-T41 rating, however based on forecasted load, this would be exceeded in 2016. There is space for a mobile transformer at the 64N-Lourdes site, however there is nothing currently in place to facilitate installation. The outage duration would be the length of time required to transfer load in most cases, and the time required to install a mobile transformer during peak load. There are approximately 375 customers supplied by 64N.

4.2.2 61N-Provost and 528N-Granville

There are feeder ties between 61N-201/528N-201 as well as 61N-202/528N-202. These feeder ties cannot be used for contingency during winter peak conditions due to voltage drop below acceptable limits. In an off-peak situation, load could be transferred between these feeders for contingency. For feeders 61N-204 and 205 the load cannot be picked up by 528N-Granville, even off-peak.

In the event of 61N-T1 failure during peak load, customers would experience outages until the mobile transformer could be installed at the 61N-Provost site. The site has been built to accommodate a mobile transformer. There are approximately 1600 customers supplied from this substation.

In the event of 528N-T1 failure during peak load, outage duration would be dependent on the installation of an available replacement transformer. There is no space for a mobile unit at the 528N-Granville site. There are approximately 800 customers supplied from this substation.

4.2.3 534N-Duchess

There are no other 4kV feeders near 534N-Duchess. In the event of 534N-T1 failure, outage duration would be dependent on the installation of an available replacement transformer or mobile transformer. The site has not been built to accommodate a mobile transformer, but there is some space available. There are approximately 330 customers supplied from this substation.

4.2.4 519N-Drummond

There are no other 4kV feeders near 519N-Drummond. In the event of 519N-T1 failure, outage duration would be dependent on the installation of an available replacement transformer. There is no space for a mobile unit at the 519N-Drummond site. There are approximately 485 customers supplied from this substation.

4.2.5 Single Phase Stepdowns

The four other small pockets of 4kV in the Stellarton area: 658N-Pictou Landing, 536N-Woodburn, 664N-Claremont and 530N-Thorburn have similar deteriorated plant.

There are no other 4kV feeders near any of these platform or pole mounted stepdowns. In the event of failure, the outage duration would be dependent on the installation of an available replacement transformer. For 530N-Thorburn, replacement from stores should be very straight forward as it is only a 100kVA pole mounted transformer. Spares should also be available for the platform mounted transformers, however outage impact would be greater.

4.3 Deteriorated Plant

The majority of 4kV distribution plant in Stellarton is greater than 50 years old. There are many safety, environmental and reliability concerns due to the age of this equipment:

- Deteriorated #4 copper conductor has decreased tensile strength and presents a greater hazard for live line work.
- Chronically weeping transformers are left running on low oil to prevent excessive leakage. Lids can be tightened, however tightening of leaking gaskets could cause more harm than good. There are signs of oil leakage around the base of transformers. This condition is present at all 4kV substations in the Stellarton area: 532N, 64N, 61N, 528N, 534N and 519N.
- Historically, equipment failure has caused 4kV conversion to 25kV to proceed unplanned. This results in a much higher cost and customer impact than a planned approach.
- The 4kV voltage level is no longer one of the standard voltages for distribution at NSPI – in service and spare equipment will be phased out when possible.

Unique conditions exist at certain substations as explained in the Existing Systems section. These conditions provide additional justification for expenditure:

- 532N-Elm St
  - Using pole top transformers with possible PCBs to buck voltage and allow a 23.9-4.16kV transformer to be used to step down 25kV.
  - Unsightly equipment and graffiti, in an established residential neighbourhood.
  - 25kV potheads are only 7 feet above ground, so it is easy to be within the limits of approach
  - Center phase pothead has been replaced; failure of other two phases may be imminent.
- 528N-Granville St
  - Out-of-service, oil-filled regulator is sitting on the same rails as power transformer, acting as a counter weight. This presents an unnecessary environmental risk.
  - Sagging timbers support switches (A, B, C)

5.0 SOLUTIONS AND EVALUATION

There is significant justification to correct the deficiencies present in the 4kV distribution in Stellarton. The alternative to "Do Nothing" has not been considered as this would certainly result in environmental incidents, extended customer outages and economic loss for NSPI.

Deteriorated plant conditions and loss of supply contingency requirements have been used to prioritize the areas to correct. Top priorities were agreed upon by key stakeholders from System Maintenance, Regional Engineering, Capital Engineering, Environmental Services and Distribution Planning:

1. 532N-Elm Street
2. 528N-Granville Street
3. 61N-Provost Street
4. 64N-Lourdes

System Maintenance and Environmental Services will be performing work to alleviate certain issues in the short term:

- Install mobile transformer at 61N-Provost to allow: site clean-up and soil testing, transformer maintenance to potentially slow leaking of oil
- Engage a Civil Engineer to design a solution for the removal of the out of service regulator at 528N-Granville

This study recommends the phased conversion of 532N-Elm St and 64N-Lourdes proceeds immediately, followed by the phased conversion of 61N-Provost and 528N-Granville. All other conversions should follow based on observed conditions.

Within the scope of conversion to 25kV is the replacement of all distribution transformers, along with a percentage of conductor, poles, insulators and anchoring. The estimates are based on the scoping of one section of the 4kV distribution from 532N-Elm St. The rest of the 4kV distribution in New Glasgow is of approximately the same age and condition.

5.1 532N-Elm and 64N-Lourdes (New Glasgow East)

To resolve the issues at 532N-Elm Street and 64N-Lourdes, three options were considered:

- Convert the area to 25kV and decommission both substations
- Install 3 platform mounted stepdown locations and decommission both substations
- Replace both transformers with new padmounts and maintain 4kV distribution

Each alternative is proposed in phases and completed in 2017.

5.1.1 Alternative NG East-A, Convert to 25kV

This alternative is a phased approach to converting all of 532N and 64N load to 25kV. The conversion of this area would be completed in three phases for 532N-Elm St and two phases for 64N-Lourdes. The conversions should overlap, with both substations being decommissioned in 2017.

This conversion strategy allows both existing substations to remain in service and provide contingency for each other during conversion. Once the first phase of each conversion is complete, either substation could handle the remaining 4kV winter peak. Once conversion is complete, contingency is handled within the 25kV system. Recommendations for specific conversion steps by capital year can be found in Section 6.

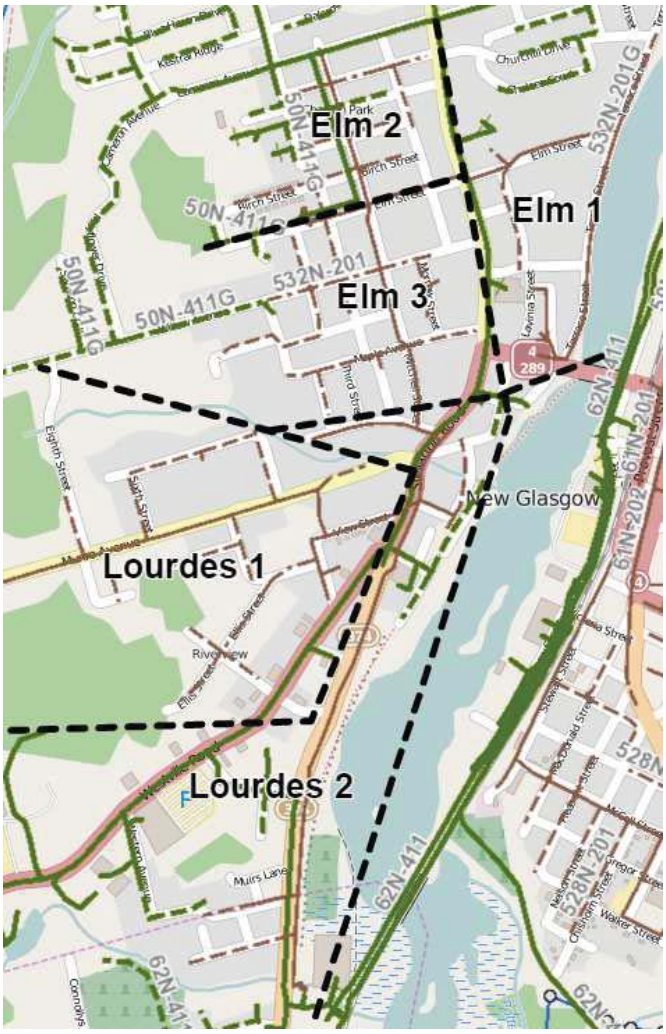

Figure 15 Geographic Overview of NG East-A Phases

5.1.2 Alternative NG East-B, Three Stepdown Locations

This alternative replaces the existing 4kV substations at 532N-Elm and 64N-Lourdes with three new 500kVA/phase stepdown transformers. There are very few appropriate locations for these platform-mounted transformers and there could be push back from the town of New Glasgow if this alternative were to go ahead. For the purpose of this study, suggested stepdown locations were assumed to be allowable:

1. Terrace Street near 25kV source 50N-411G
2. Elm St at or near existing substation location
3. N Foord Street at existing 64N substation location

This approach allows for the 4kV load in East New Glasgow to be shared by three stepdown locations and provides contingency for the loss of one stepdown. It also facilitates a phased conversion in the future, as its intent is to defer the eventual conversion to 25kV (complete by 2030). Within the scope of this alternative is the installation of one stepdown location per year, including any required conductor replacement – most notably, a long section of #2 Copper on Stellarton Avenue.

Figure 16 Geographic Overview of NG East-B Stepdowns

5.1.3 Alternative NG East-C, Replace Substations with Padmounts

This alternative replaces the existing transformers at 532N-Elm St and 64N-Lourdes with new 3MVA padmount transformers. Unlike alternative B, these substation locations are established and cleaning the sites up with new padmounts would be well received. These padmounts would provide contingency for each other. Unfortunately, this alternative does not facilitate the eventual conversion to 25kV (complete by 2030).

Within the scope of this alternative is the installation of new padmounts, site work, protection equipment, temporary transformers during removal of existing units and reconductoring of #2 Copper on Stellarton Avenue.

5.1.4 532N-Elm and 64N-Lourdes Recommendation

Based on the Economic Analysis Model (EAM) in Appendix C, Alternative NG East-A, Convert to 25kV is the most economical solution. Conversion to 25kV is also the preferred method to correct issues with deteriorated 4kV plant for a variety of reasons. Below is a summary of advantages/disadvantages for each alternative. This will give context for why these solutions were explored.

Alternative NG East-A, Convert to 25kV

- Most economical solution, based on alternatives deferring this eventuality by 15 years
- Results in the most old conductor and equipment being replaced – reliability improvements not considered in EAM
- Most visually appealing alternative
- Reduced cost of losses due to conversion (Appendix D) – considered in EAM as operating expense
- Historically, conversion to 25kV has been performed whenever possible throughout NSPI
- 25kV feeders are very accessible, which facilitates the conversion

Alternative NG East-B, Three Stepdown Locations

- Much less demanding on capital resources
- Configuration facilitates future conversion
- Unsightly platforms in residential neighbourhoods may have strong opposition
- NSPI has committed to phase out 4kV as a standard voltage level for distribution
- Spare units are available in stores

Alternative NG East-C, Replace Substations with Padmounts

- Less demanding on capital resources
- Does not facilitate future conversion
- Clean up of existing substation sites would be well received
- NSPI has committed to phase out 4kV as a standard voltage level for distribution
- A spare padmount would need to be purchased for stores

5.2 61N-Provost and 528N-Granville (New Glasgow West)

The 4kV distribution in the west of New Glasgow is very similar to the east. With the results of the previous economic analysis, it is apparent that alternatives to conversion would not provide economic benefit for the west side of New Glasgow. Further benefits of conversion over other alternatives:

- 61N-Provost St is a large substation with 4 feeder exits, a padmount replacement would not be practical in this situation
- There is four times more load in west New Glasgow compared to the east. To replace the substations with platform-mounted stepdowns, more units would be required and locations for them would be very difficult to find

A strategy for conversion to 25kV can be found in the Recommendations section. Timing is based on the priority discussed previously and predicted resource availability.

5.3 534N-Duchess and 519N-Drummond

The first phase of conversion to 25kV has been completed for each of these islands of 4kV. Based on this precedence and the analysis in Section 5.1, conversion is the preferred alternative for these locations. Phased conversions should proceed as resources are available.

5.4 Single Phase Stepdowns

Conversion is the preferred alternative for the other four small pockets of 4kV in the Stellarton area: 658N-Pictou Landing, 536N-Woodburn, 664N-Claremont and 530N-Thorburn. Phased conversions should proceed as resources are available. These locations should be addressed when overloaded, but not given priority over the 4kV substations.

6.0 RECOMMENDATIONS

This section will outline recommendations for the conversion to 25kV of 532N-Elm, 64N-Lourdes, 61N-Provost and 528N-Granville. These 4kV substations were identified as the highest priority and some strategy is required to complete conversion, based on priority of work, maintaining contingency and minimizing customer outages. Deteriorated 4kV plant should be replaced as required during conversion. Open points should be created as required to maintain the load between 50N and 62N.

Other pockets of 4kV should be converted to 25kV whenever possible. These include: 534N-Duchess, 519N-Drummond, 658N-Pictou Landing, 536N-Woodburn, 664N-Claremont and 530N-Thorburn. These conversions are quite linear, so different strategies for conversion have not been considered. These stations are lower priority in the big picture; in the event of imminent failure, measures should be taken to correct, but also to avoid deferral of recommended timeline below.

There are currently no capital recommendations for the 25kV substations, 50N-Trenton Thermal and 62N-Bridge Avenue. Based on projected load growth, these 25kV systems should be studied again by 2020. To enable this study, communication work needs to be completed to enable the collection of feeder load data in PI for 50N, which is currently not functional. Also, interval data at all distribution generation sites needs to be made available so that the peak feeder load can be determined annually. This study will be advanced or deferred based on new developments and requests from regional engineering.

6.1 2016 Capital Year

It is recommended that conversions to 25kV begin immediately, given the large scope of work required to relieve the issues identified. Since resources will not be available for 2015, the first phases of conversion should proceed in 2016. With the first phase of each conversion completed, the two 4kV substations will be able to provide contingency for each other. At this point, it would be possible to decommission one of these substations if required.

6.1.1 Terrace Street Conversion (532N-Elm Phase 1)

The first phase of conversion for 532N-Elm St covers Terrace St and Elm St east of Abercrombie. Extend a new 25kV branch onto George St from Abercrombie Rd to be used as a source for converting the 4kV in sections back to Elm St through Terrace St.

Figure 17 Terrace Street Conversion (532N-Elm Phase 1)

6.1.2 View Street Conversion (64N-Lourdes Phase 1)

The first phase of conversion for 64N-Lourdes covers the 4kV branch from Stellarton Rd on View St.

- Extend a new 25kV branch onto North St from Westville Rd
- Convert North St up to and including the Ellis St branch
- Rebuild Athletic St and Riverview Dr to 3 phase to Monroe Ave and convert
- Convert Monroe Ave east of Riverview Dr and 8th St
- Convert 6th St and North Ave
- Convert the rest of Monroe Ave and remove off-road section
- Finish conversion on View St

Figure 18 View Street Conversion (64N-Lourdes Phase 1)

6.2 2017 Capital Year

In 2016, the phased conversion of 532N should be completed.

6.2.1 North Mitchell Street Conversion (532N-Elm Phase 2)

The second phase of conversion for 532N-Elm St covers Mitchell Street north of Elm Street. There is an existing 25kV supply on north Mitchell St. so each branch can be converted independently.

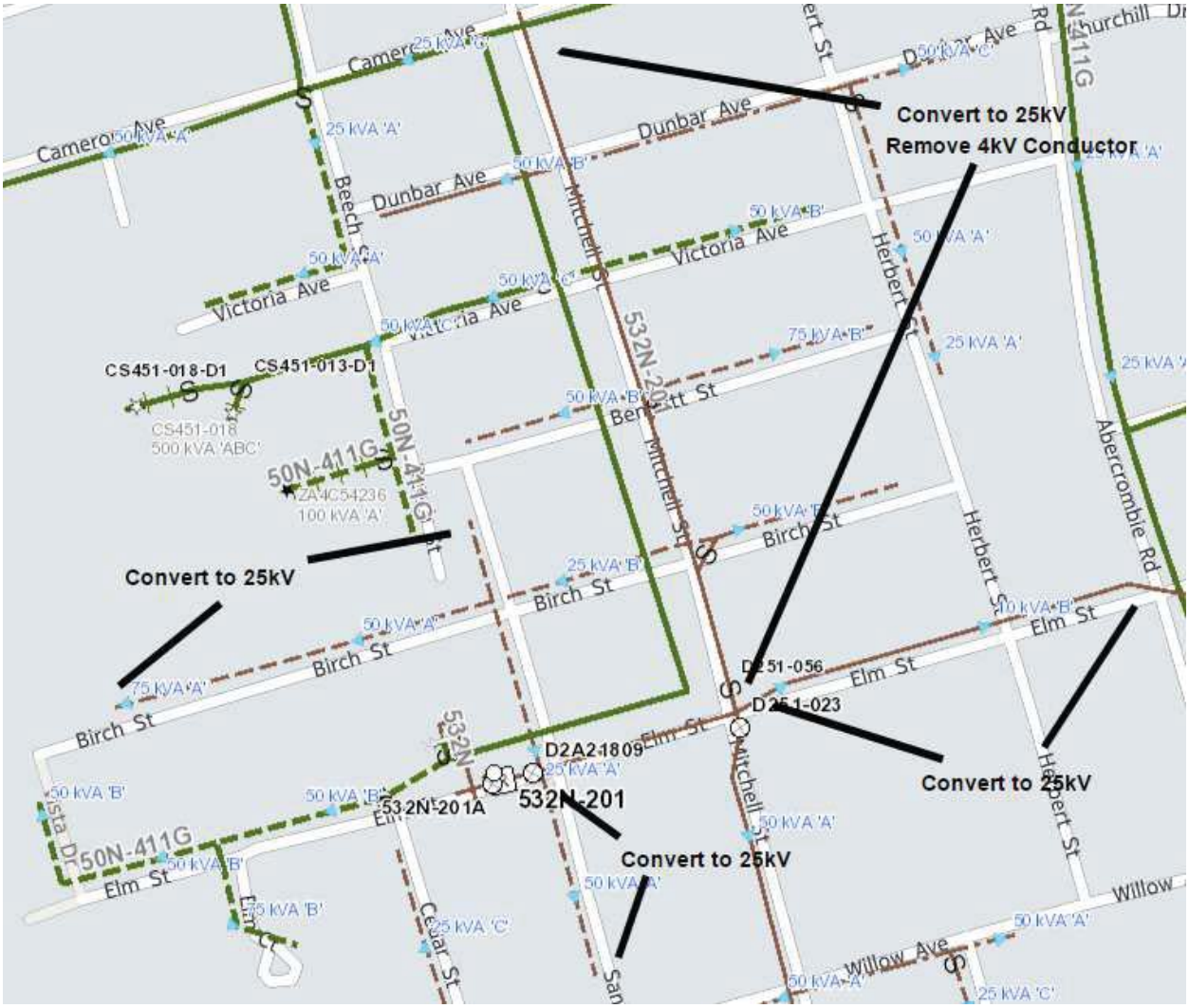

Figure 19 North Mitchell Street Conversion (532N-Elm Phase 2)

6.2.2 South Mitchell Street Conversion (532N-Elm Phase 3)

The final phase of conversion for 532N-Elm St covers Mitchell Street south of Elm Street.

- Extend a new 25kV branch from Stellarton Ave onto Hospital Ave and convert
- Convert sections of Mitchell St and branches until Elm St
- Convert the remaining 4kV on Elm St and decommission the 532N site

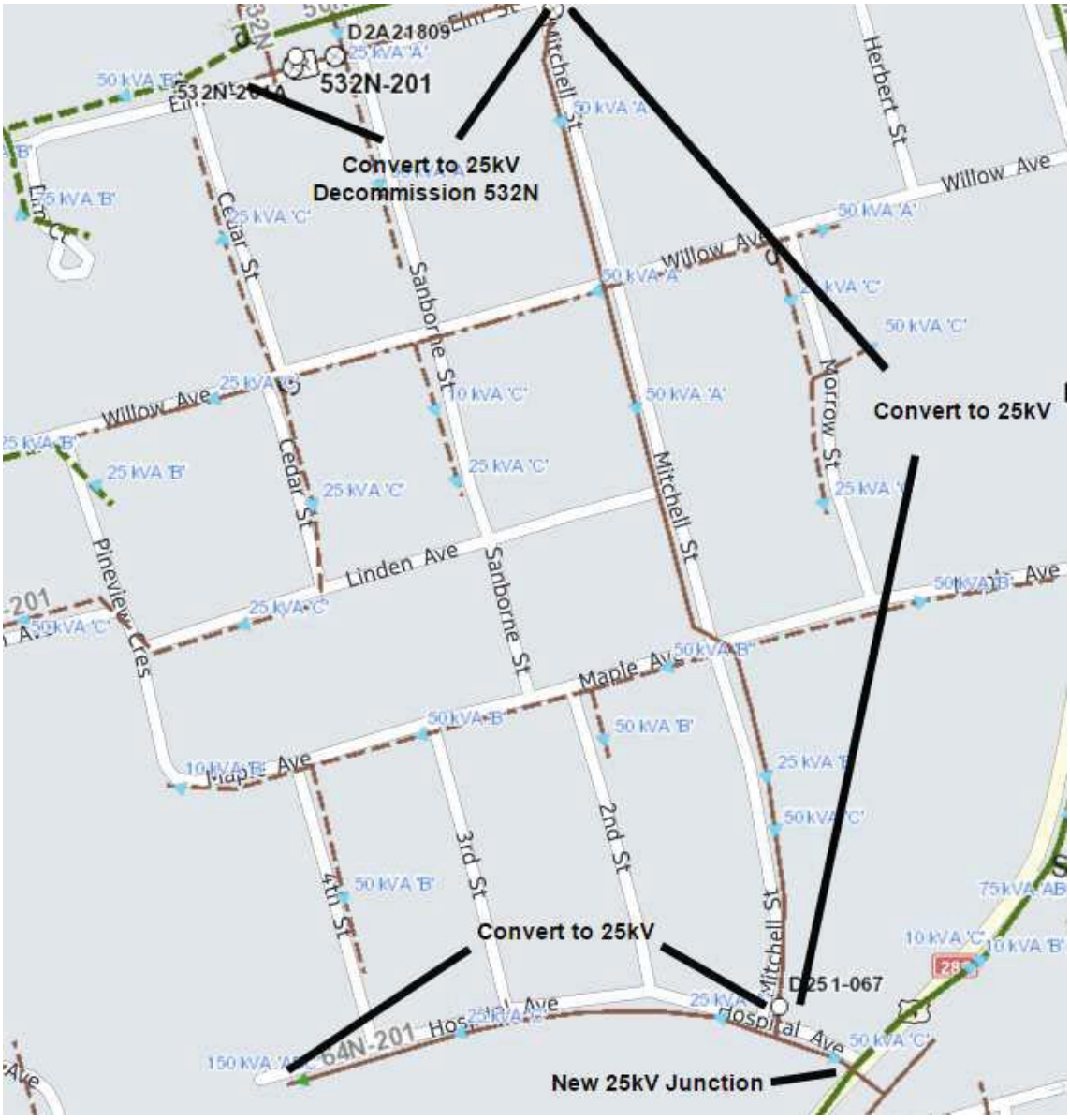

Figure 20 South Mitchell Street Conversion (532N-Elm Phase 3)

6.3 2018 Capital Year

The final phase of 64N-Lourdes conversion should be completed in 2017. Once this is complete, both 532N-Elm and 64N-Lourdes sites can be retired. With the top priority 4kV plant dealt with, the phased conversion of 61N-Provost should begin. The conversion strategy for Provost will start with 204 and 205 feeders which are not tied to adjacent 4kV substation 528N-Granville.

6.3.1 Stellarton Road Conversion (64N-Lourdes Phase 2)

The final phase of conversion for 64N-Lourdes covers the remaining 4kV along Stellarton Rd from Hospital Ave to the 64N-Lourdes site.

- Convert sections of Stellarton Rd back to the intersection of Westville Rd
- Extend 25kV on Stellarton Rd from Westville Rd to Duff St
- Convert the remaining 4kV and decommission the 64N site

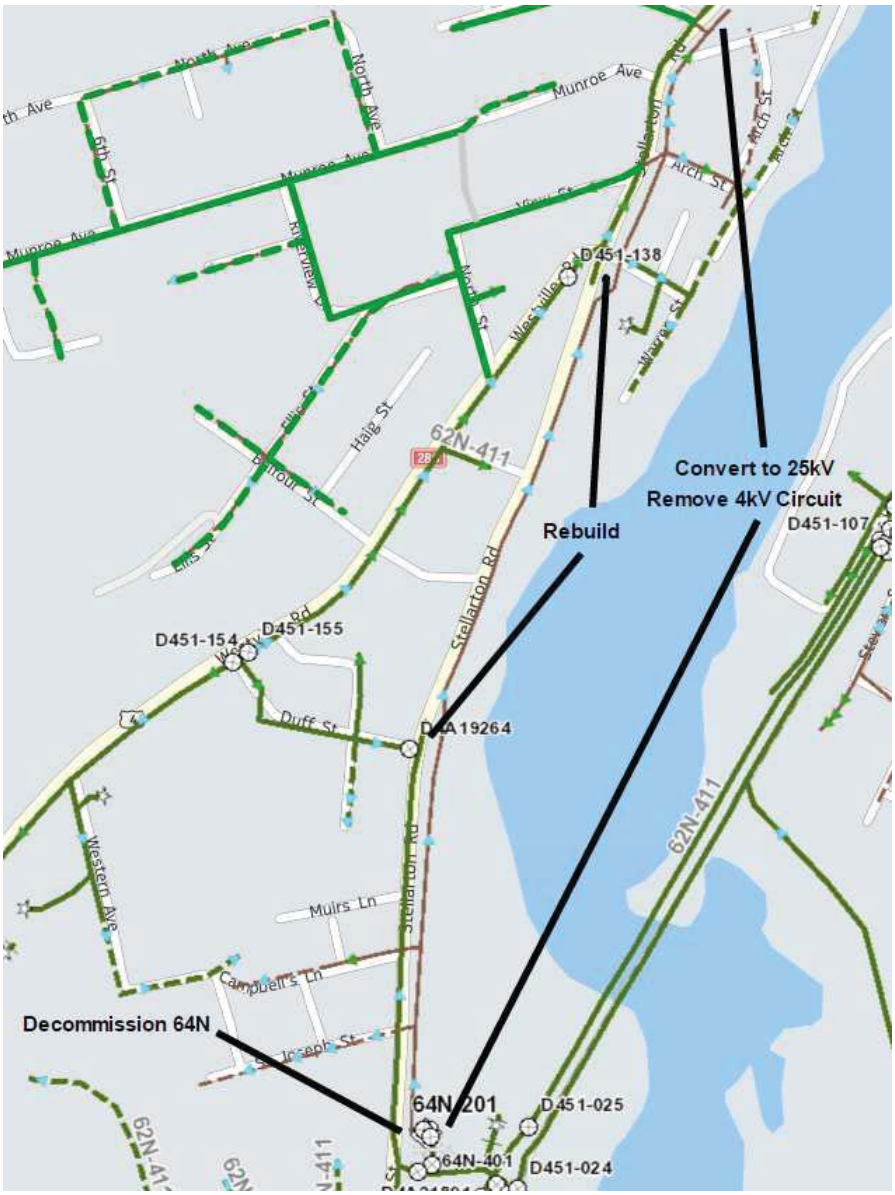

Figure 21 Stellarton Road Conversion (64N-Lourdes Phase 2)

6.3.2 Townsend Avenue Conversion (61N-Provost Phase 1)

The first phase of conversion for 61N-Provost covers Townsend Avenue and back to D251-009 on Trenton Road.

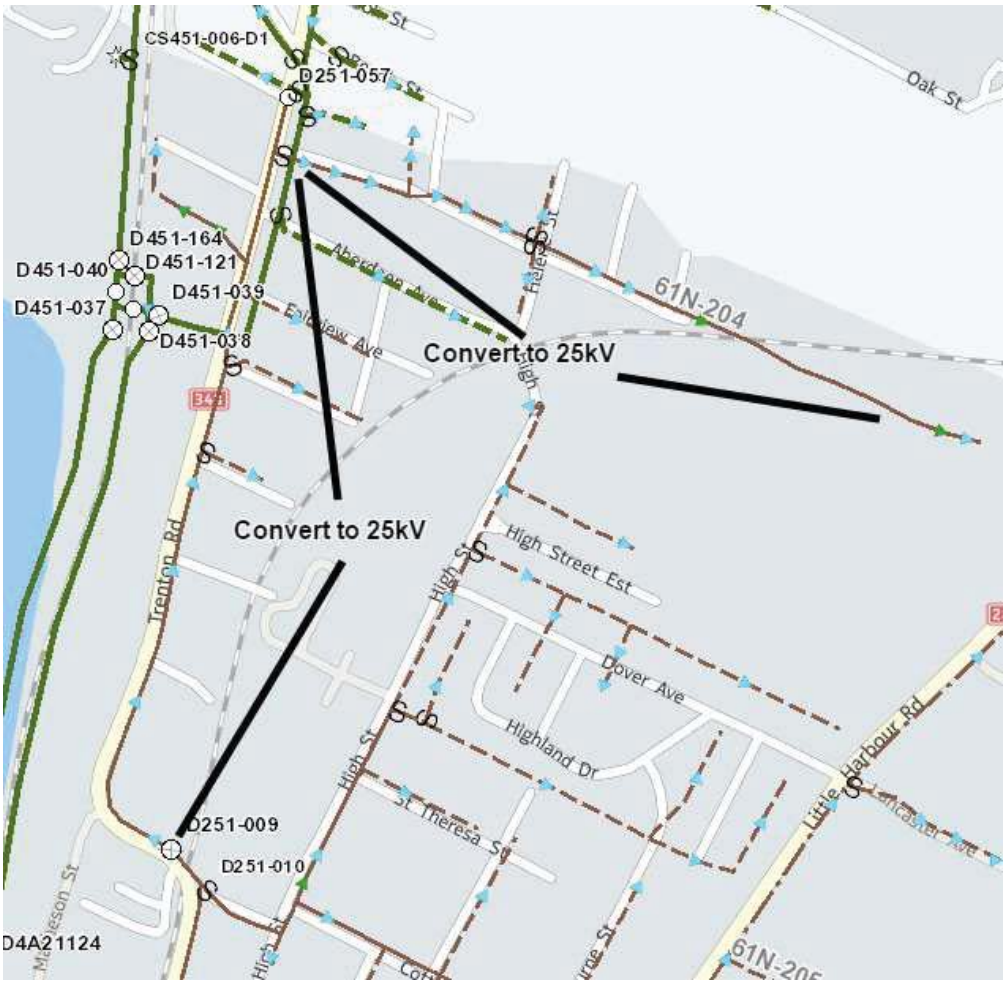

Figure 22 Townsend Avenue Conversion (61N-Provost Phase 1)

6.3.3 664N-Claremont Avenue Conversion

The two 167kVA single phase transformers (664N-T1) on Claremont Avenue are suspected to be at or near capacity. This small pocket of 4kV should be converted when resources are available. The conversion has no sequential effect on other conversions, so it can be advanced or deferred as required or broken down into small phases.

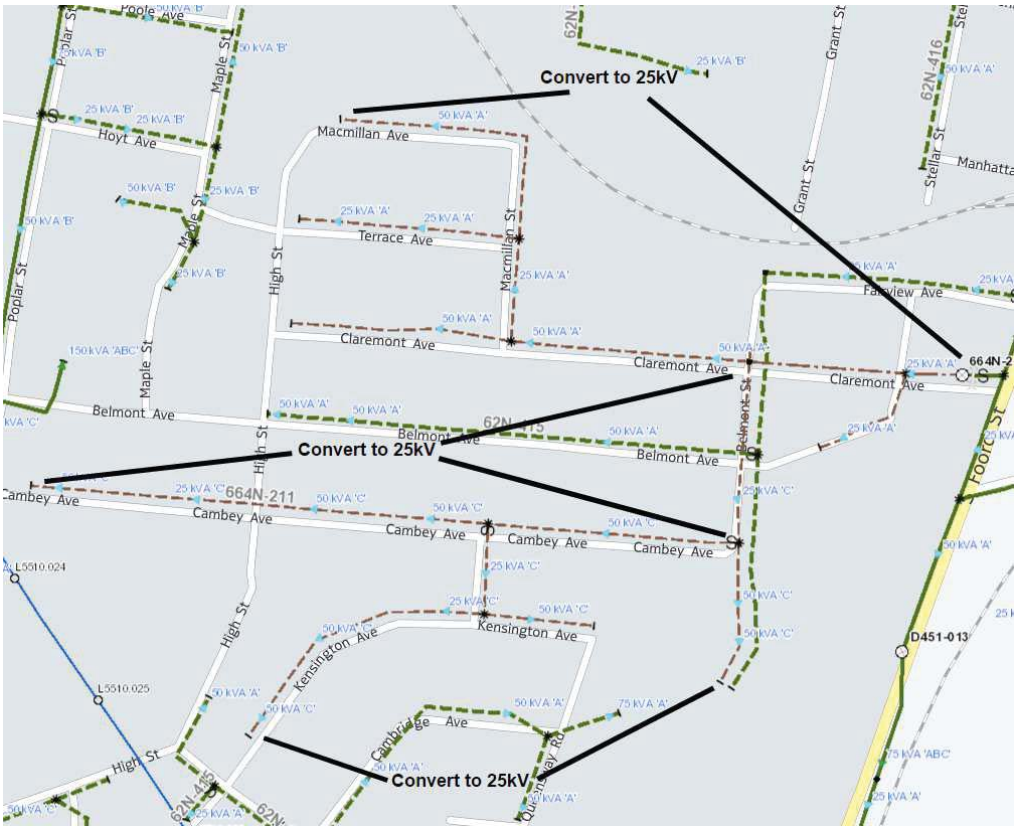

Figure 23 664N-Claremont Avenue Conversion

6.4 2019 Capital Year

In 2019, the phased conversion of 61N-Provost should continue.

6.4.1 High Street Conversion (61N-Provost Phase 2)

The second phase of conversion for 61N-Provost covers High Street and completes the conversion of 61N-204.

- Rebuild to 3 phase and extend 25kV from Townsend Street (rail crossing will need to be obtained in advance)
- Convert High Street and branches back to D251-010
- Create new open point at D251-010
- Convert Trenton Road back to 61N to retire 61N-204

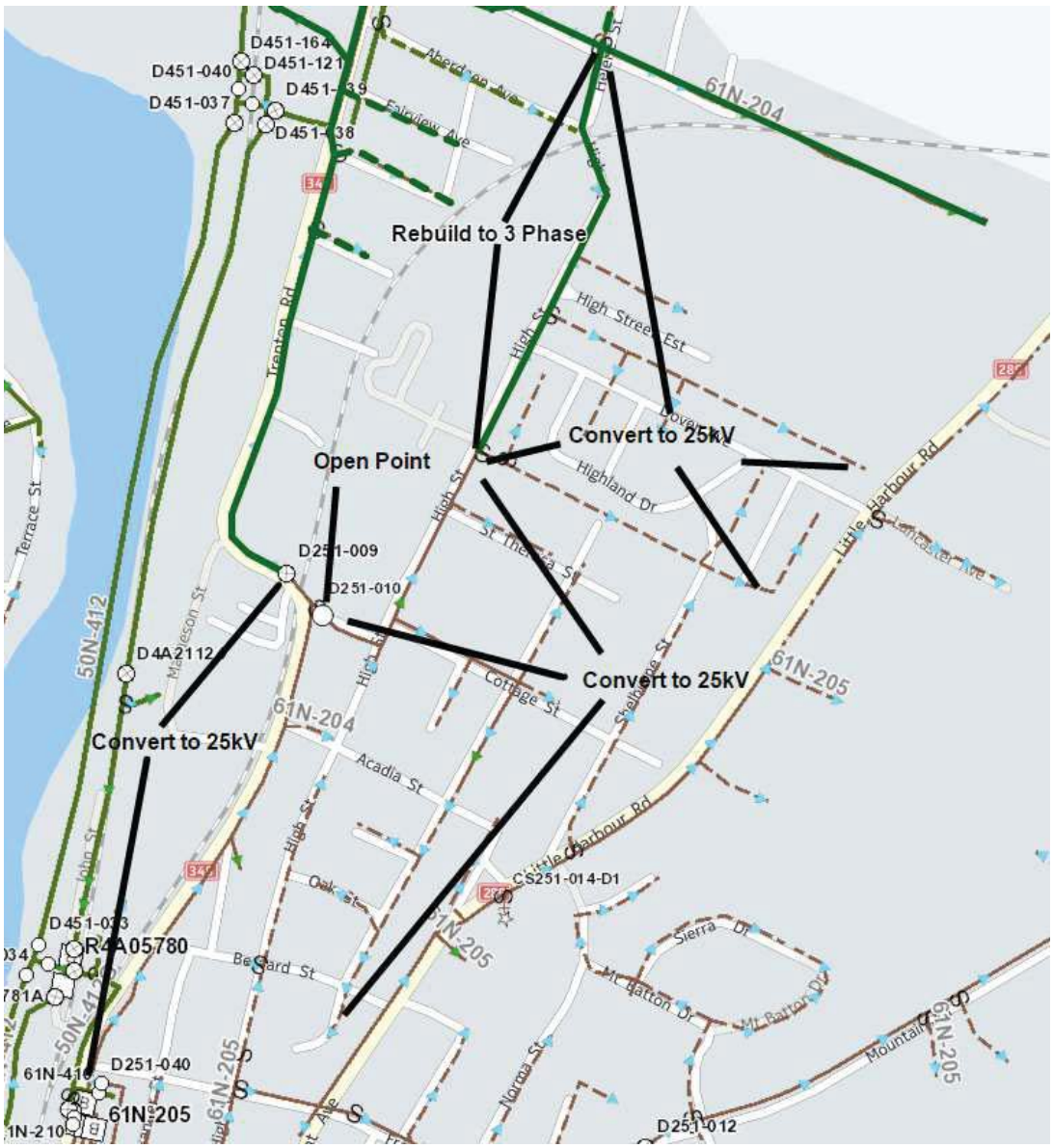

Figure 24 High Street Conversion (61N-Provost Phase 2)

6.4.2 Little Harbour Road Conversion (61N-Provost Phase 3)

The third phase of conversion for 61N-Provost begins to remove load from 61N-205 on Little Harbour Road.

- Rebuild Dover Avenue to 3 phase and move roadside
- Rebuild Little Harbour Road to 3 phase back to existing 3 phase
- Convert sections of Little Harbour Road, Almont Avenue and Fraser Street back to High Street
- Finish conversion of High Street

Figure 25 Little Harbour Road Conversion (61N-Provost Phase 3)

6.4.3 530N-MacLellan Mountain Road Conversion (Thorburn)

The 100kVA single phase transformer (530N-T1) on MacLellan Mountain Road is suspected to be at or near capacity. This small pocket of 4kV should be converted when resources are available. The conversion has no sequential effect on other conversions, so it can be advanced or deferred as required.

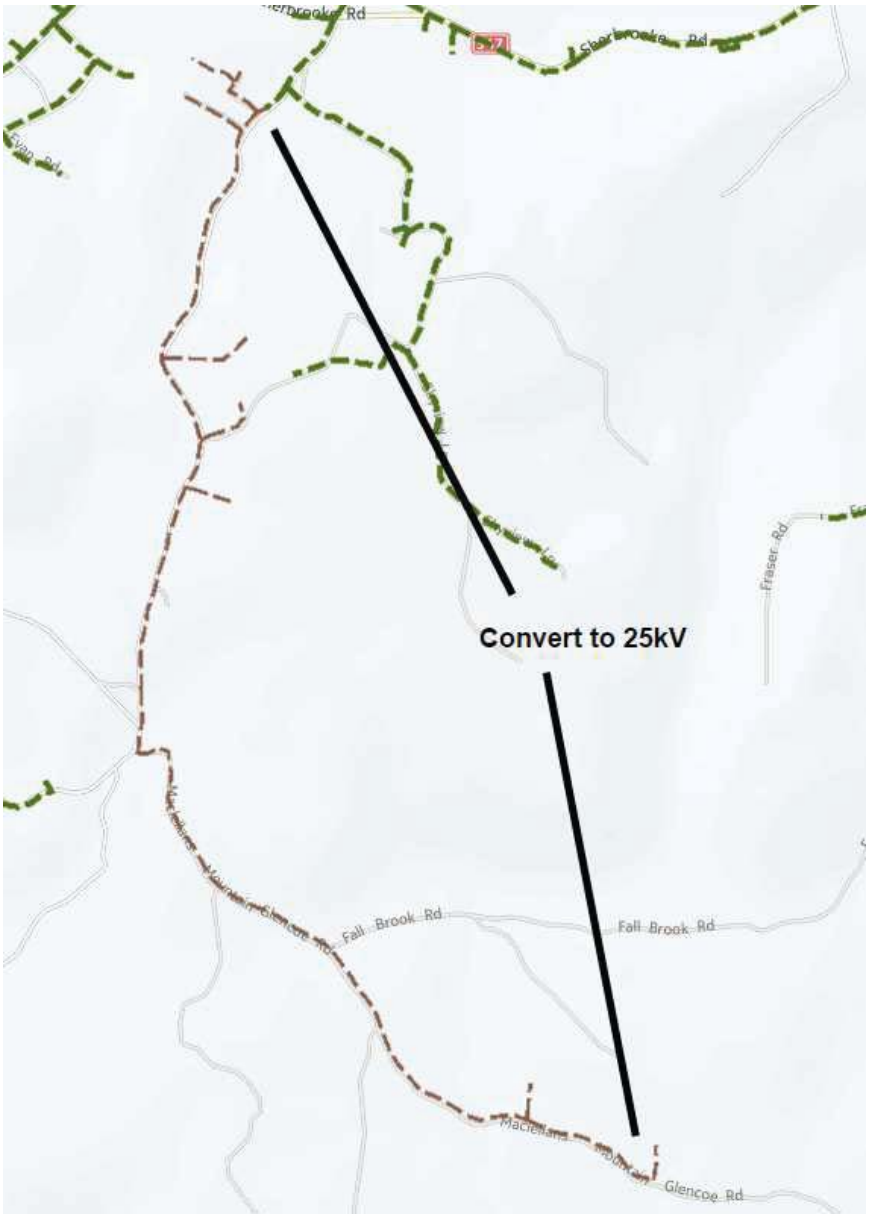

Figure 26 530N-MacLellan Mountain Road Conversion (Thorburn)

6.5 2020 Capital Year

In 2020, the conversion of 61N-205 should be mostly completed and the phased conversion of 528N should begin.

6.5.1 Frasers Mountain Road Conversion (61N-Provost Phase 4)

The fourth phase of conversion for 61N-Provost will cover Fraser Mountain Road.

- Rebuild and convert three phase from Little Harbour Road to Fraser Mountain Road
- Convert the long rural northwest extent of Fraser Mountain Road, dual voltage transformers could be used to limit outage time
- Convert Mountain Road in sections back to D251-013

Figure 27 Frasers Mountain Road Conversion (61N-Provost Phase 4)

6.5.2 Albert Street Conversion (528N-Granville Phase 1)

The first phase of conversion for 528N-Granville extends 25kV from Lorne Street onto Albert St and back to D251-018 on Washington Street.

Figure 28 Albert Street Conversion (528N-Granville Phase 1)

6.6 2021 Capital Year

In 2021, the conversion of 61N-205 and 528N-202 should be completed.

6.6.1 528N-202 Conversion (528N-Granville Phase 2)

The second phase of conversion for 528N-Granville completes the conversion of 528N-202. This conversion will break the tie between 528N-202 and 61N-202.

- Extend 25kV three phase on Marsh Street
- Convert feeder 528N-202 in sections back from

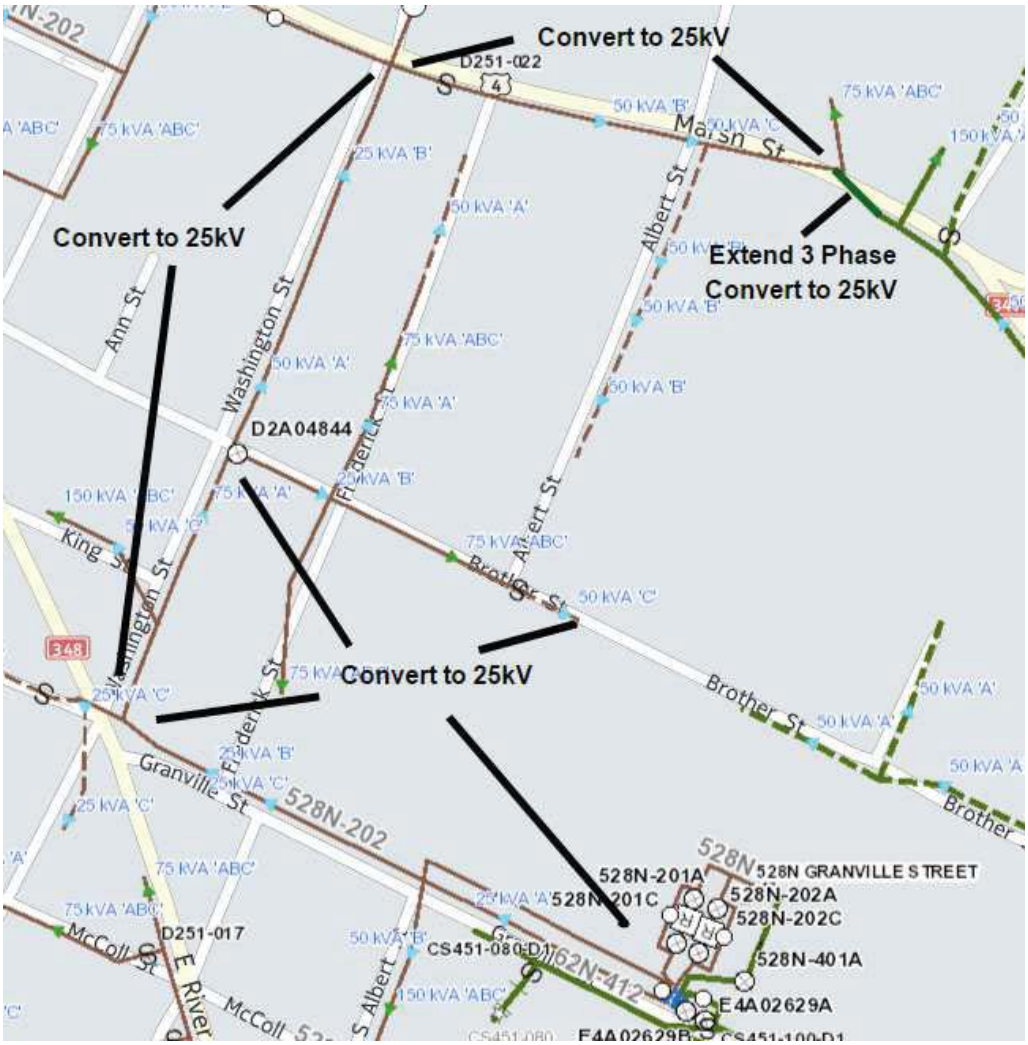

Figure 29 528N-202 Conversion (528N-Granville Phase 2)

6.6.2 Temperance Conversion (528N-Granville Phase 3)

The third phase of conversion for 528N-Granville (and 61N-Provost) covers Temperance Street, from Marsh Street back to 61N-Provost Street substation.

Figure 30 Temperance Conversion (528N-Granville Phase 3)

6.7 2022 Capital Year

In 2022, the conversion of 61N and 528N should be completed.

6.7.1 Archimedes Street Conversion (61N-Provost Phase 5)

The fifth phase of conversion for 61N-Provost covers Archimedes Street back to 61N substation.

- Extend 25kV three phase from Donald Street to Archimedes
- Convert Archimedes to 25kV in sections from Donald Street to 61N substation

Figure 31 Archimedes Street Conversion (61N-Provost Phase 5)

6.7.2 61N-201/528N-201 Conversions (528N-Granville Phase 4)

This final phase will complete the conversion of 61N and 528N to 25kV. Use the 61N-201 feeder to provide a 4kV source while the conversion is completed in sections back from 528N-Granville.

Figure 32 61N-201/528N-201 Conversions (528N-Granville Phase 4)

6.8 2023 Capital Year

The remainder of the 4kV conversions have been included in the 2023 capital year to maintain visibility. These areas are pockets of 4kV and have no impact on other conversions. They should be advanced or deferred as required.

6.8.1 534N-Duchess Avenue Conversion

This will complete the conversion of Duchess Avenue which began in 2014. It is unlikely this transformer will be overloaded, but deterioration issues will be present. This conversion could be divided into two phases.

Figure 33 534N-Duchess Avenue Conversion

6.8.2 519N-Drummond Road Conversion

This will complete the conversion of Drummond Road which began in 2012. It is unlikely this transformer will be overloaded, but deterioration issues will be present. This conversion could be divided into two phases.

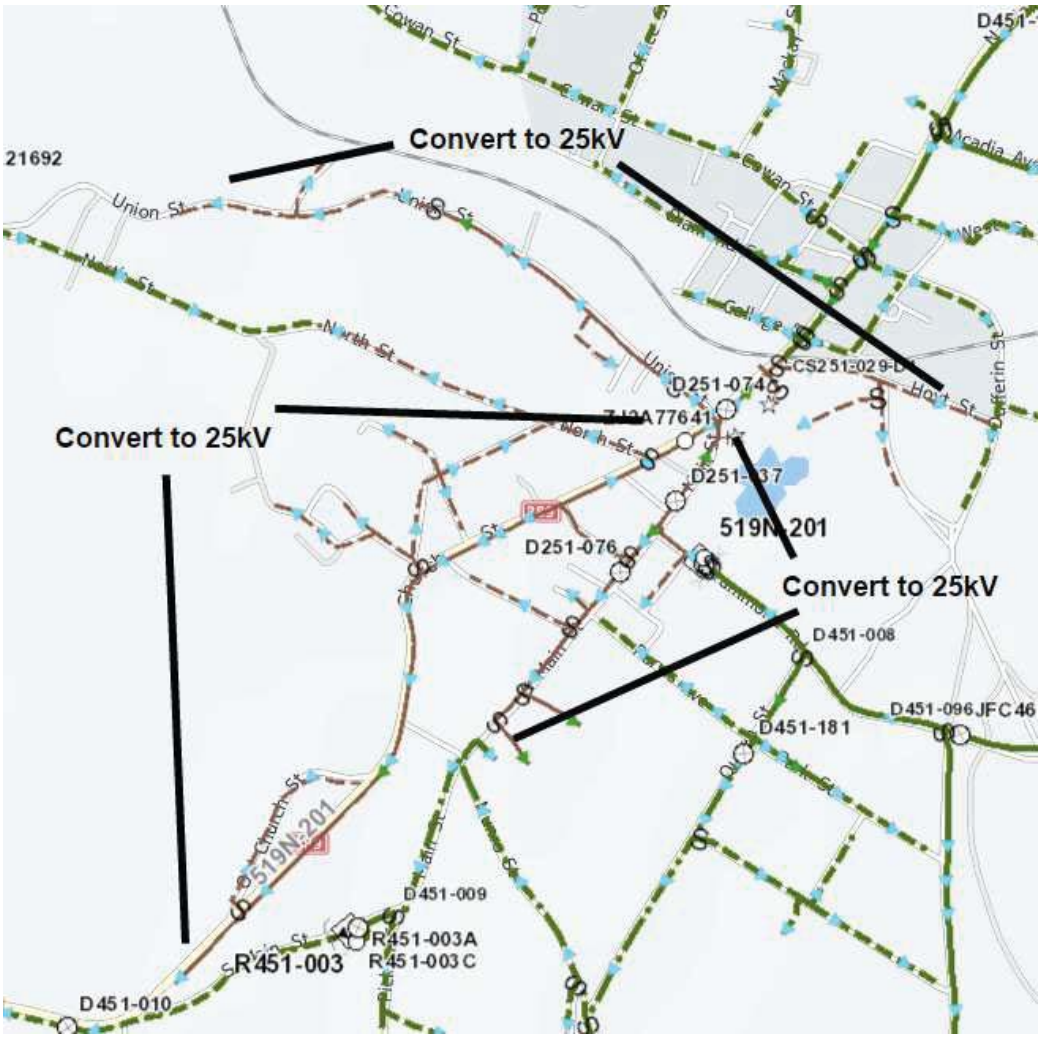

Figure 34 519N-Drummond Road Conversion

6.8.3 658N-Pictou Landing Conversion

This will complete the conversion of Pictou Landing 4kV. It is unlikely this transformer will be overloaded, but deterioration issues will be present.

Figure 35 658N-Pictou Landing Conversion

6.8.4 536N-Woodburn Conversion

This will complete the conversion of Pictou Landing 4kV. It is unlikely this transformer will be overloaded, but deterioration issues will be present. With this conversion, the voltage regulator E2A01301 and step up transformer 547N-T1 can be removed.

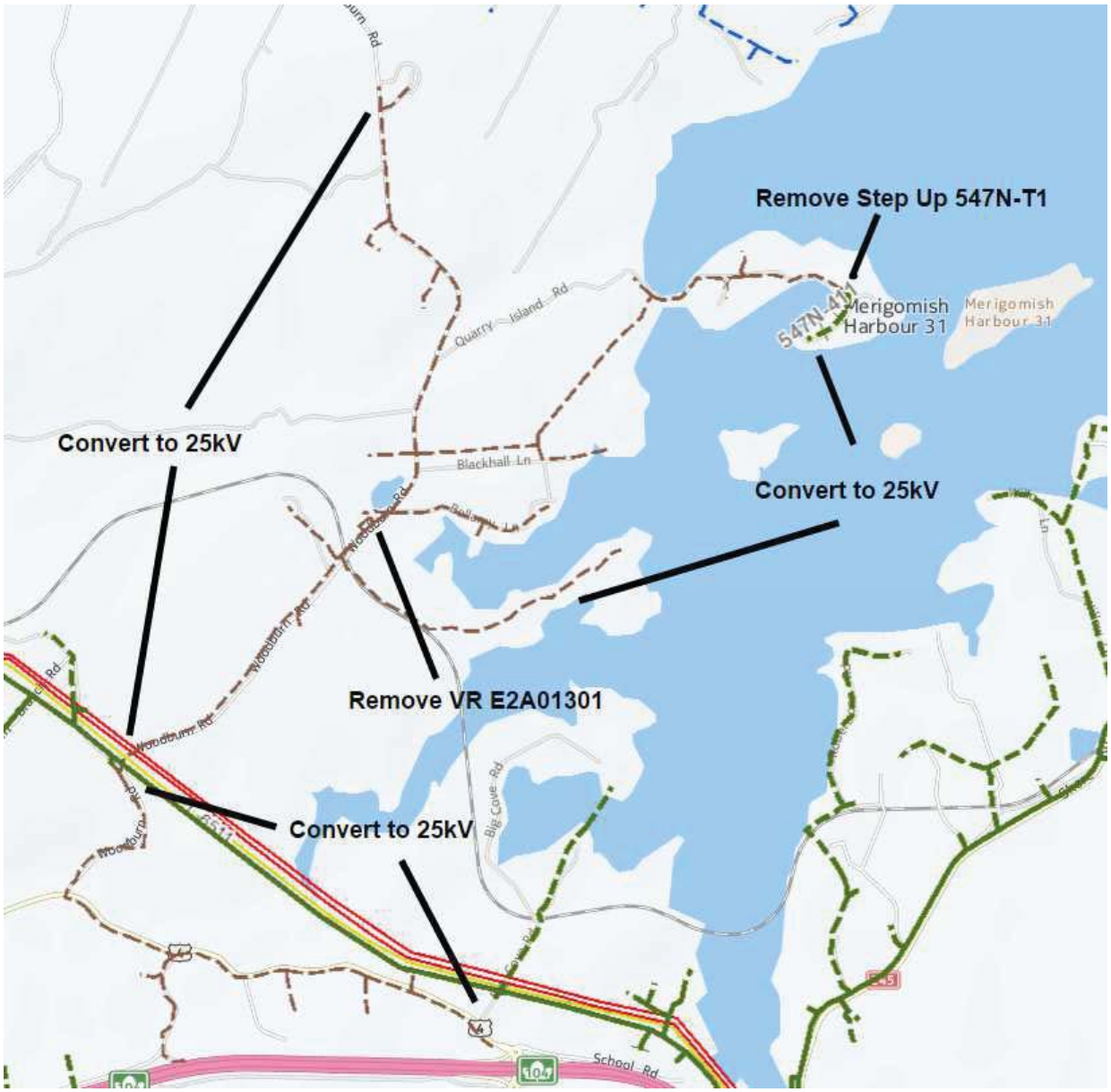

Figure 36 536N-Woodburn Conversion

APPENDIX A

System Operating Diagrams

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Appendix A: System Operating Diagrams

Figure 37 System Operating Diagram 50N-Trenton Thermal

THIS DIAGRAM IS CONFIDENTIAL

Appendix A: System Operating Diagrams

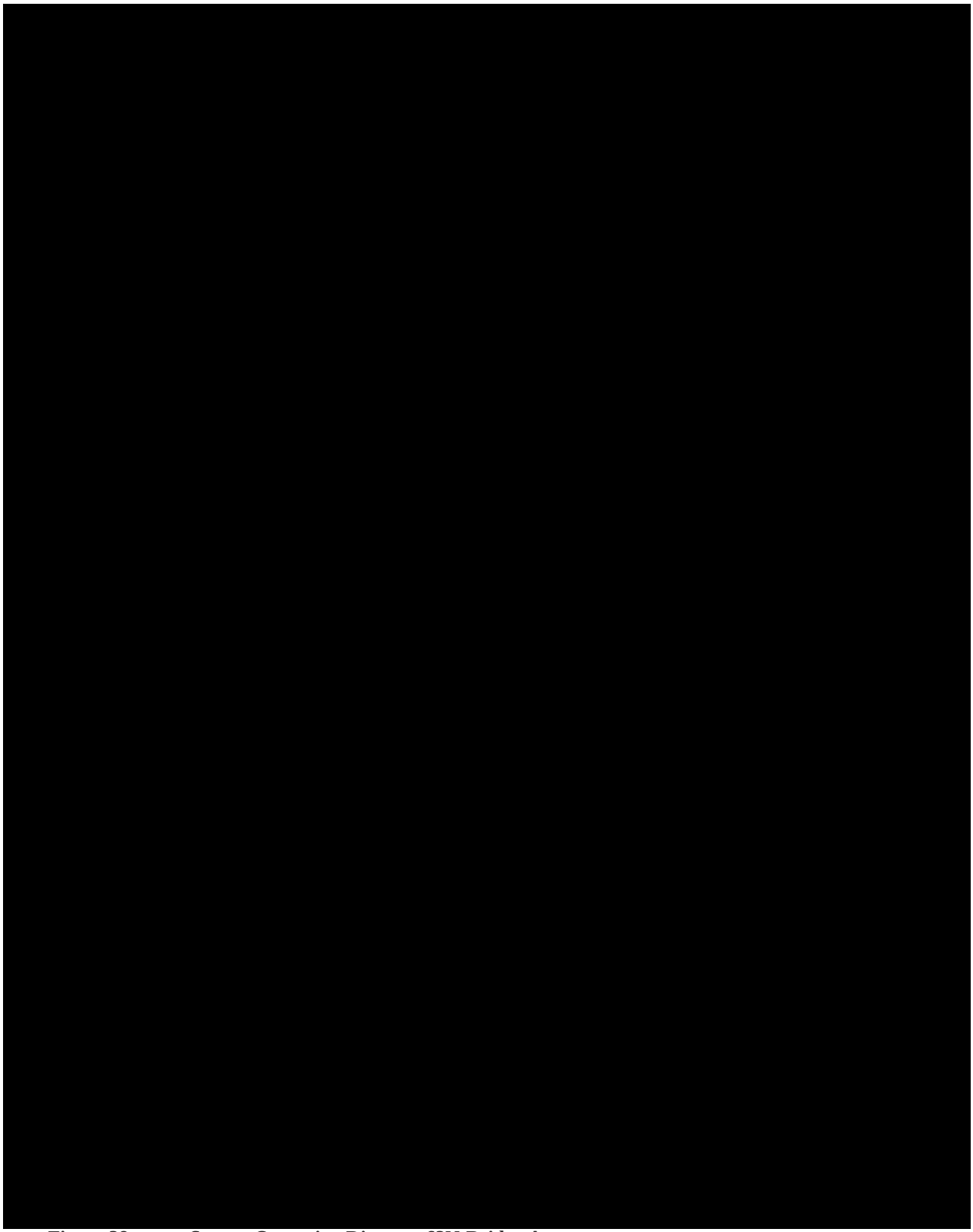


Figure 38 System Operating Diagram 62N-Bridge Ave

APPENDIX B

Load History and Forecast

Appendix B: Load History and Forecast

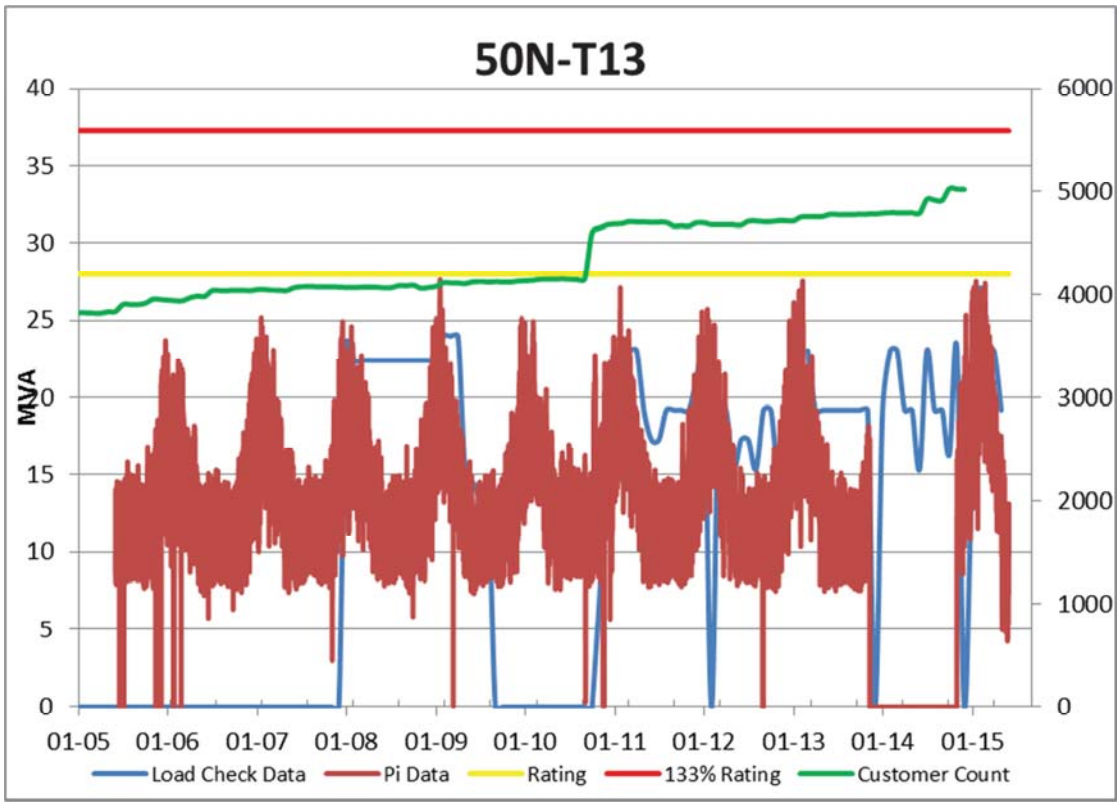


Figure 39 50N-T13 Load History

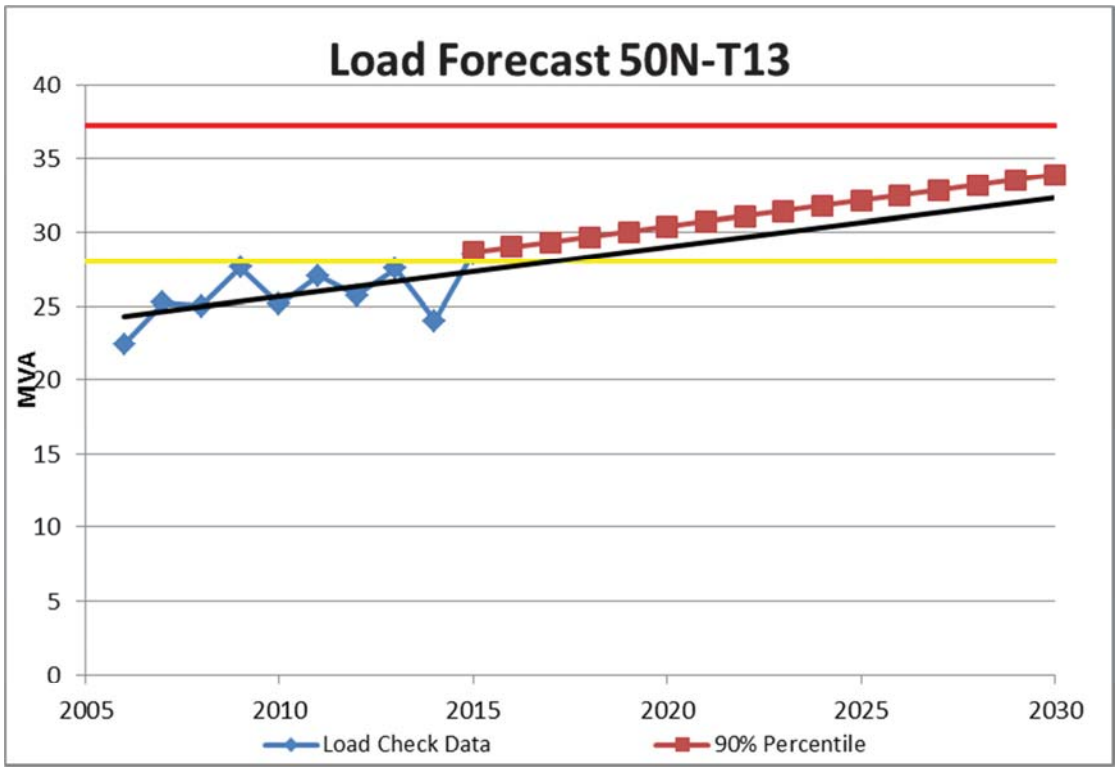


Figure 40 50N-T13 Load Forecast

Appendix B: Load History and Forecast

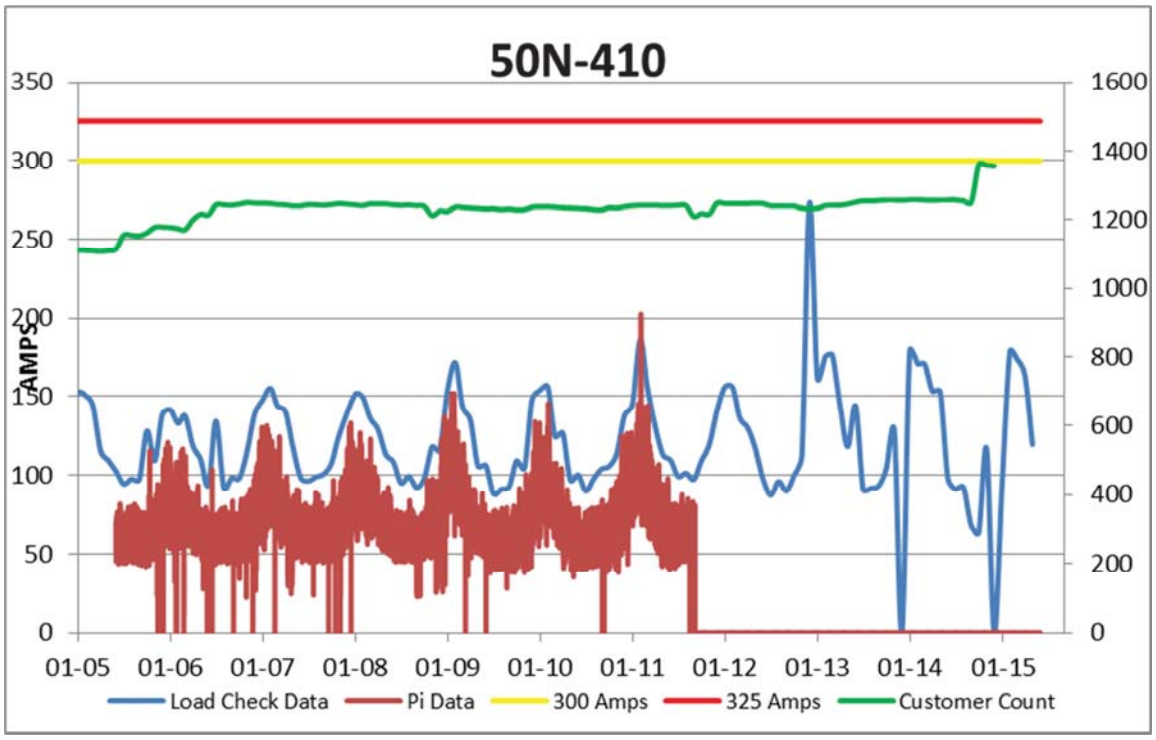


Figure 41 50N-410 Load History

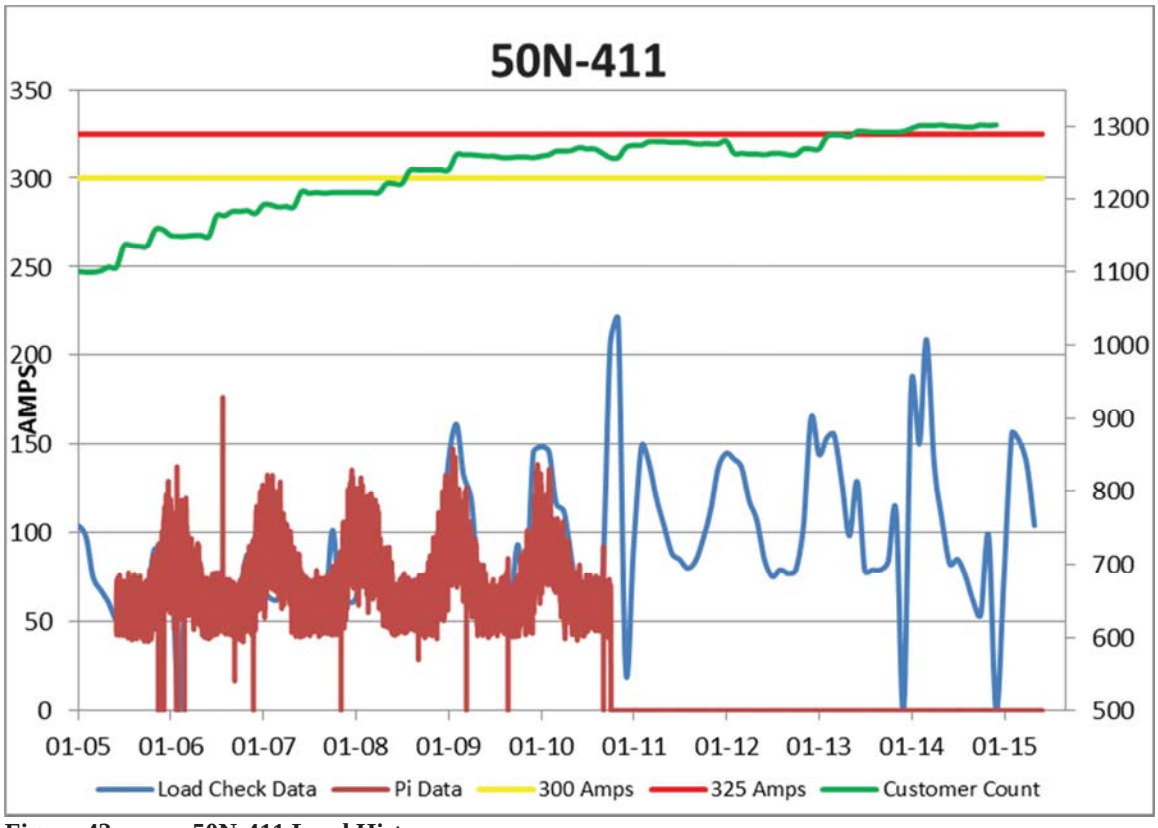


Figure 42 50N-411 Load History

Appendix B: Load History and Forecast

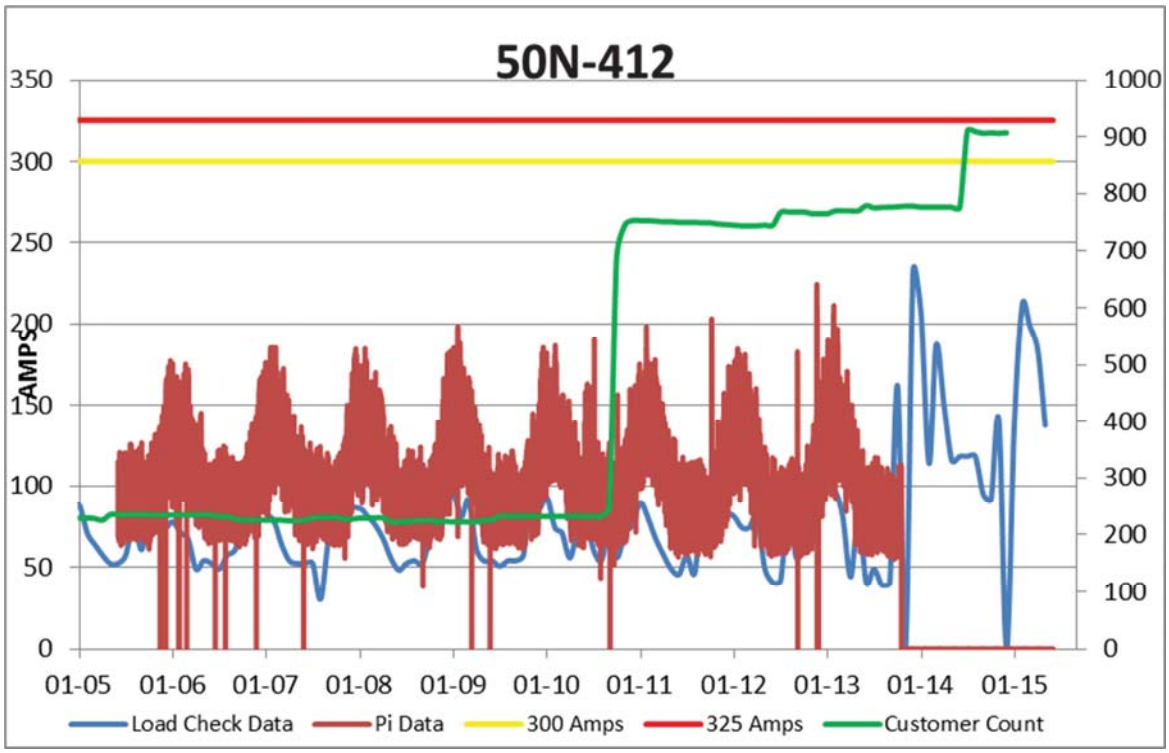


Figure 43 50N-412 Load History

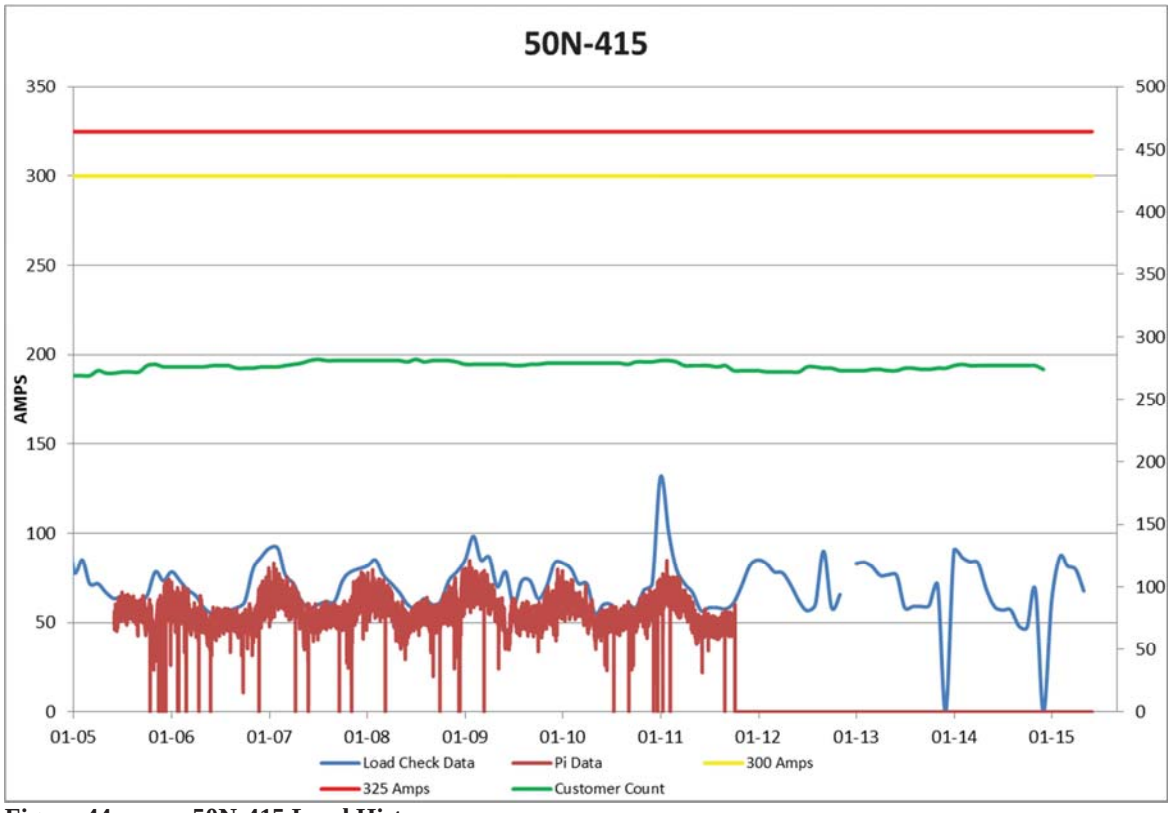


Figure 44 50N-415 Load History

Appendix B: Load History and Forecast

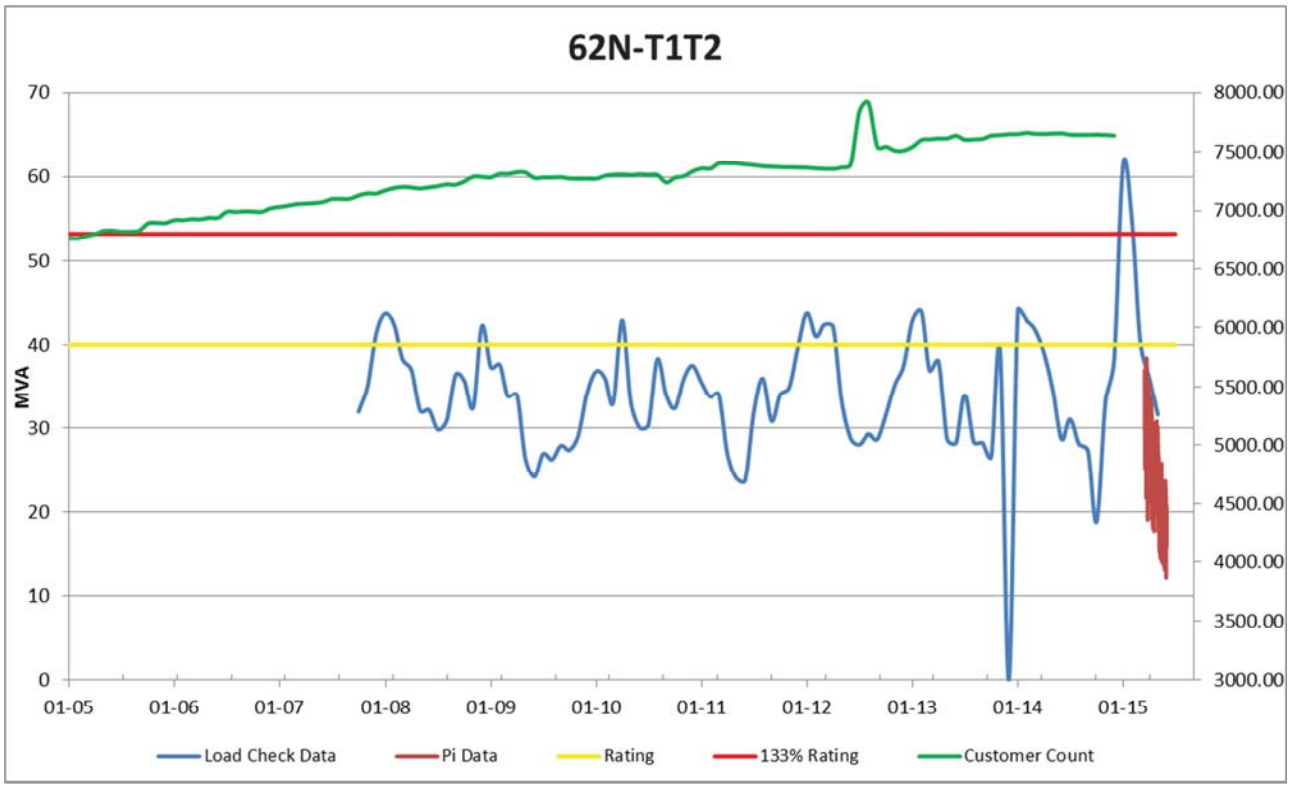


Figure 45 62N-T1T2 Load History

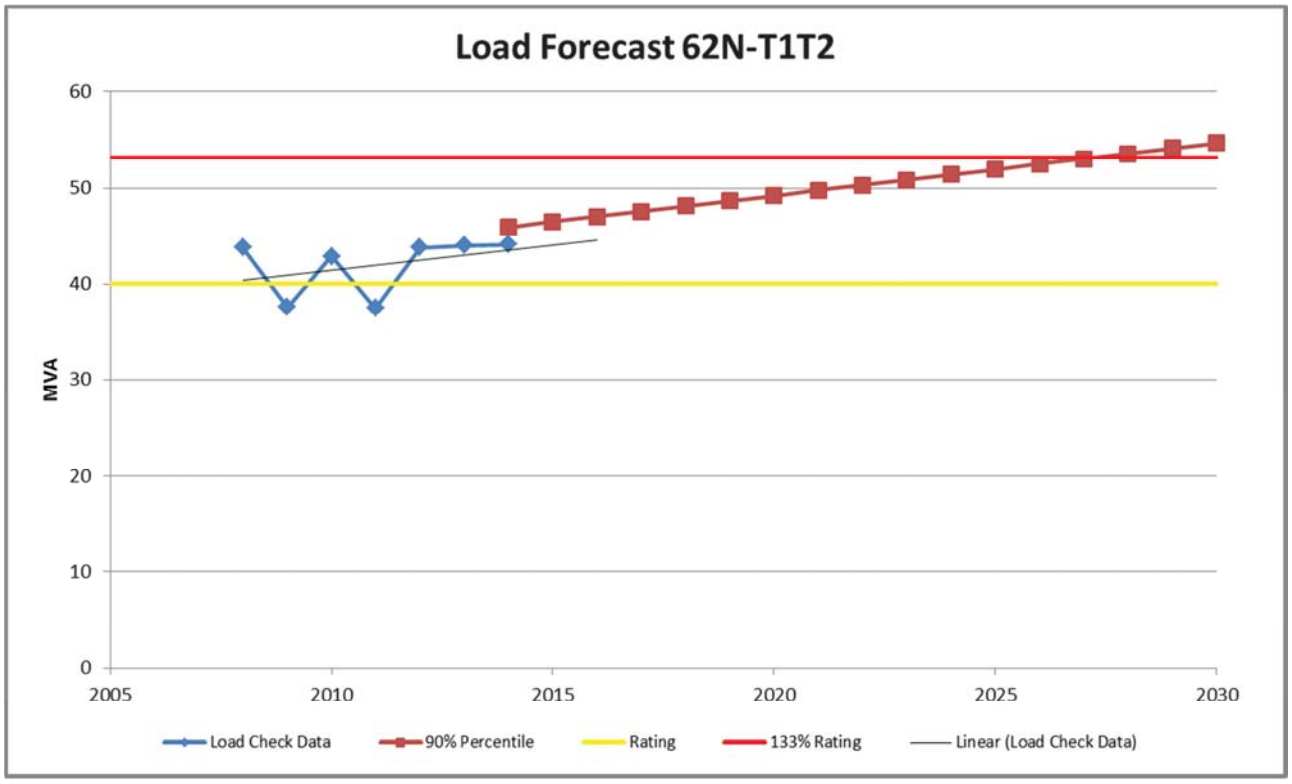


Figure 46 62N-T1T2 Load Forecast

Appendix B: Load History and Forecast

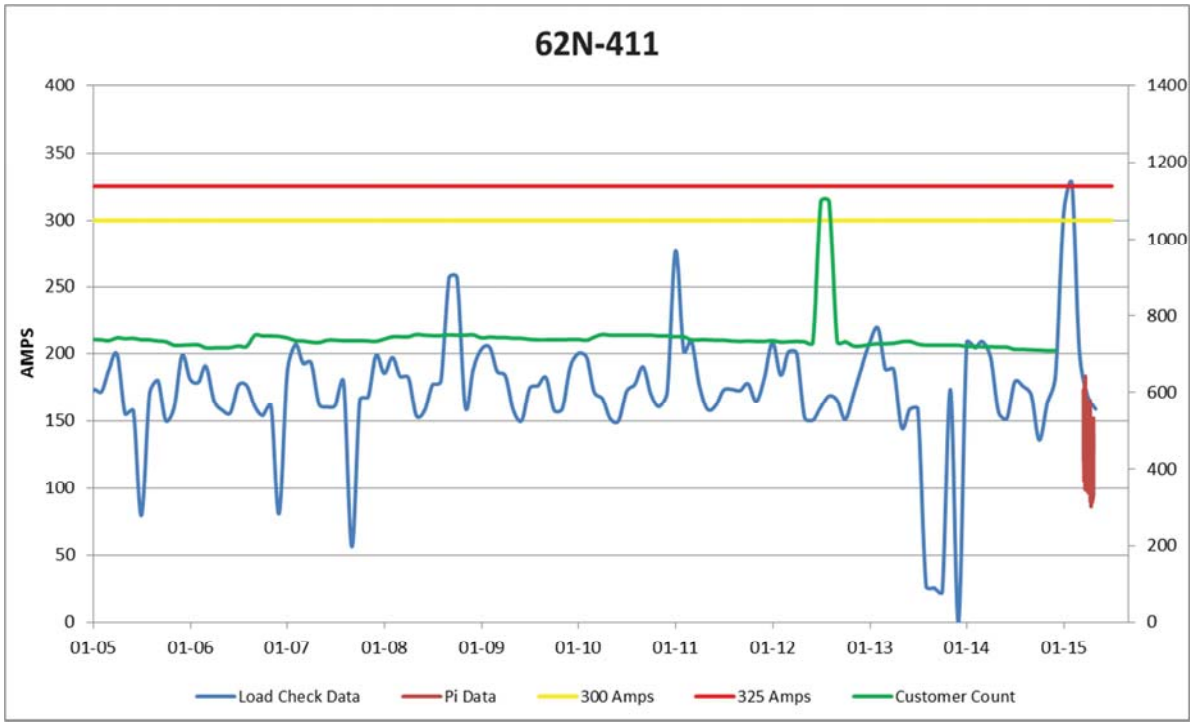


Figure 47 62N-411 Load History

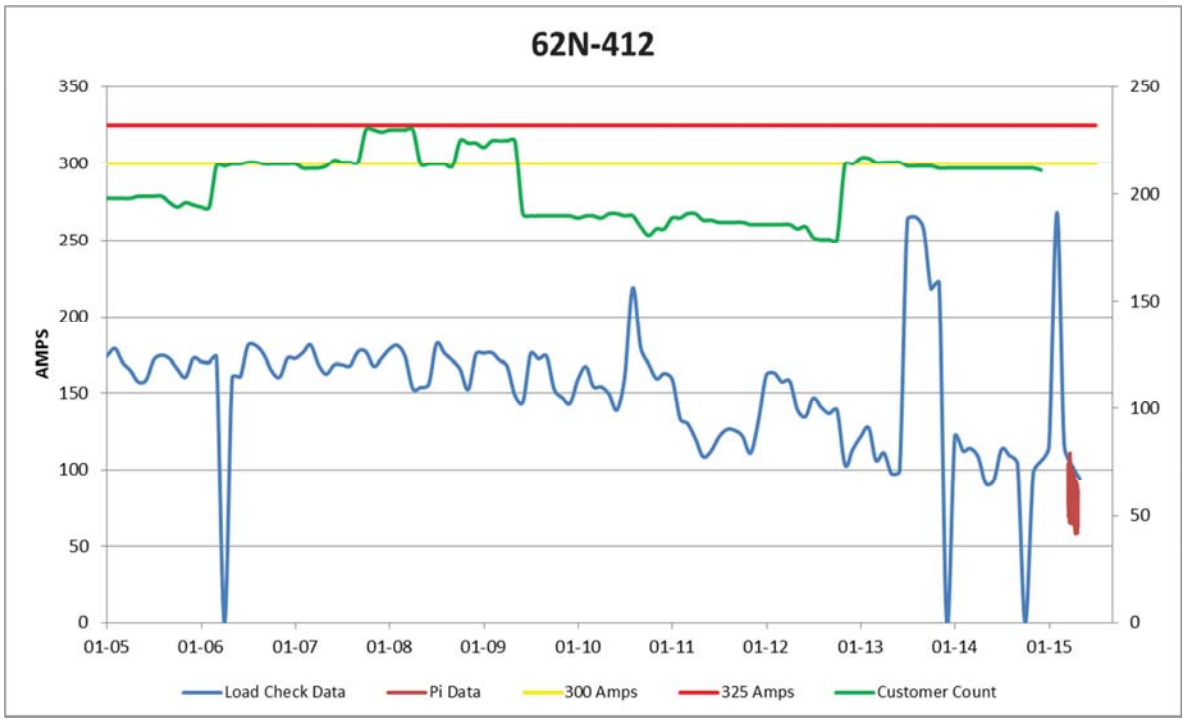


Figure 48 62N-412 Load History

Appendix B: Load History and Forecast

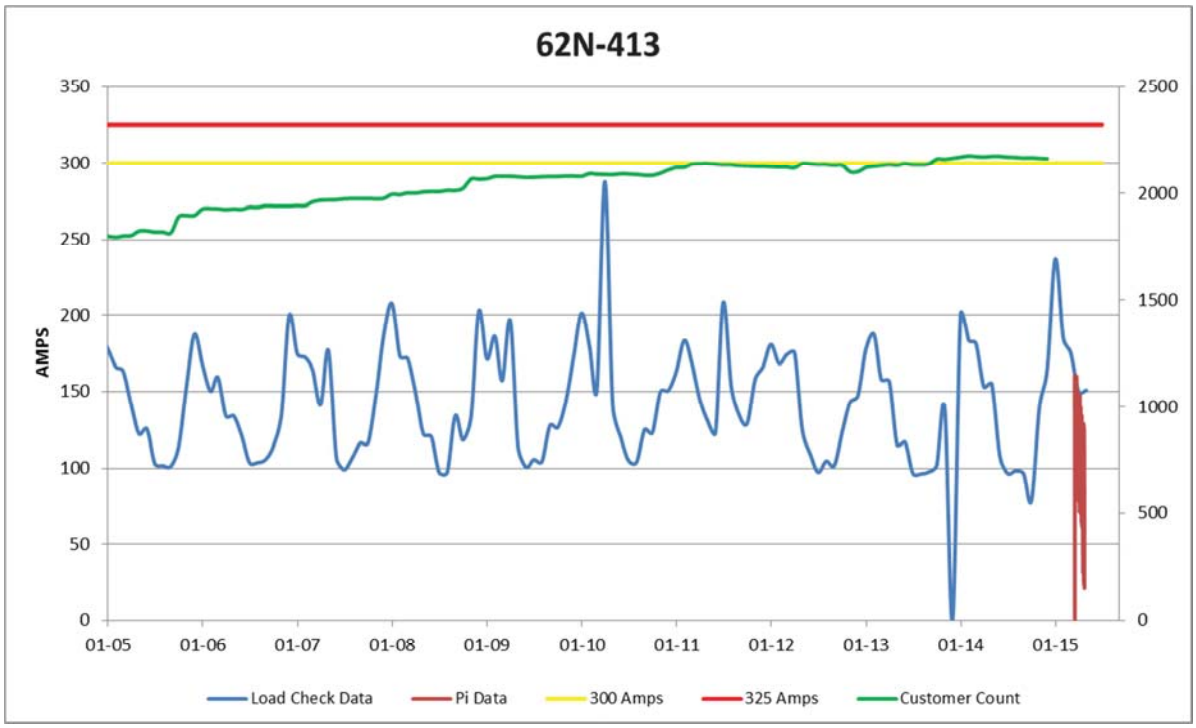


Figure 49 62N-411 Load History

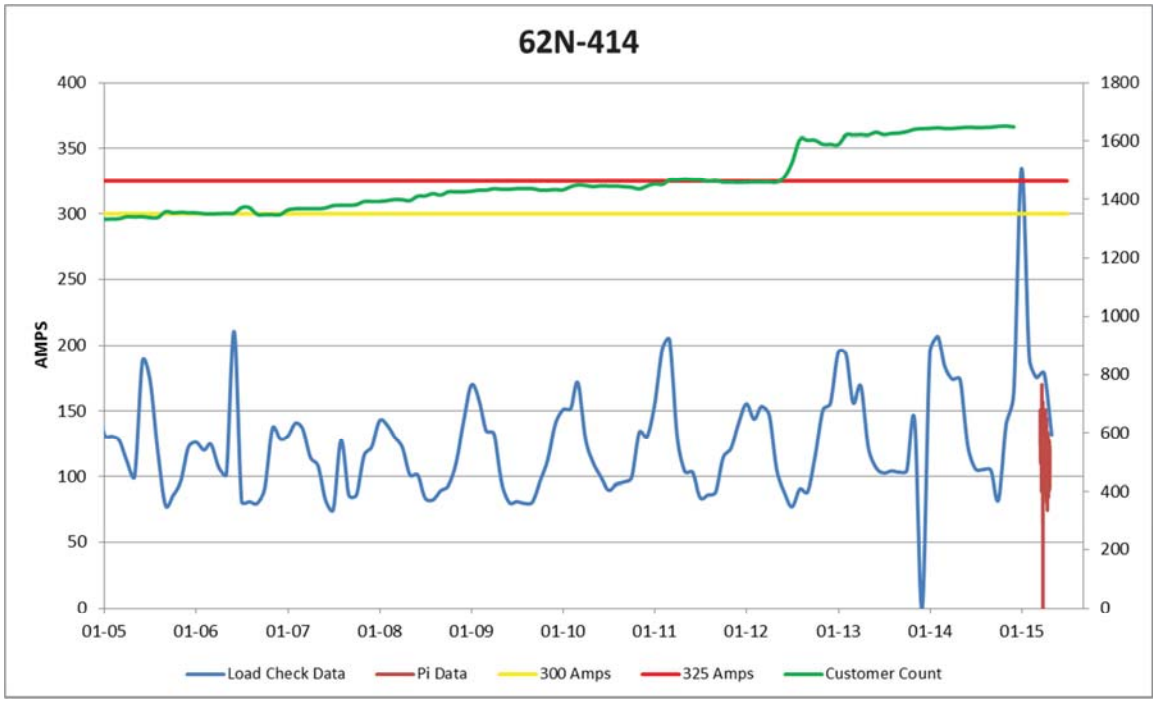


Figure 50 62N-411 Load History

Appendix B: Load History and Forecast

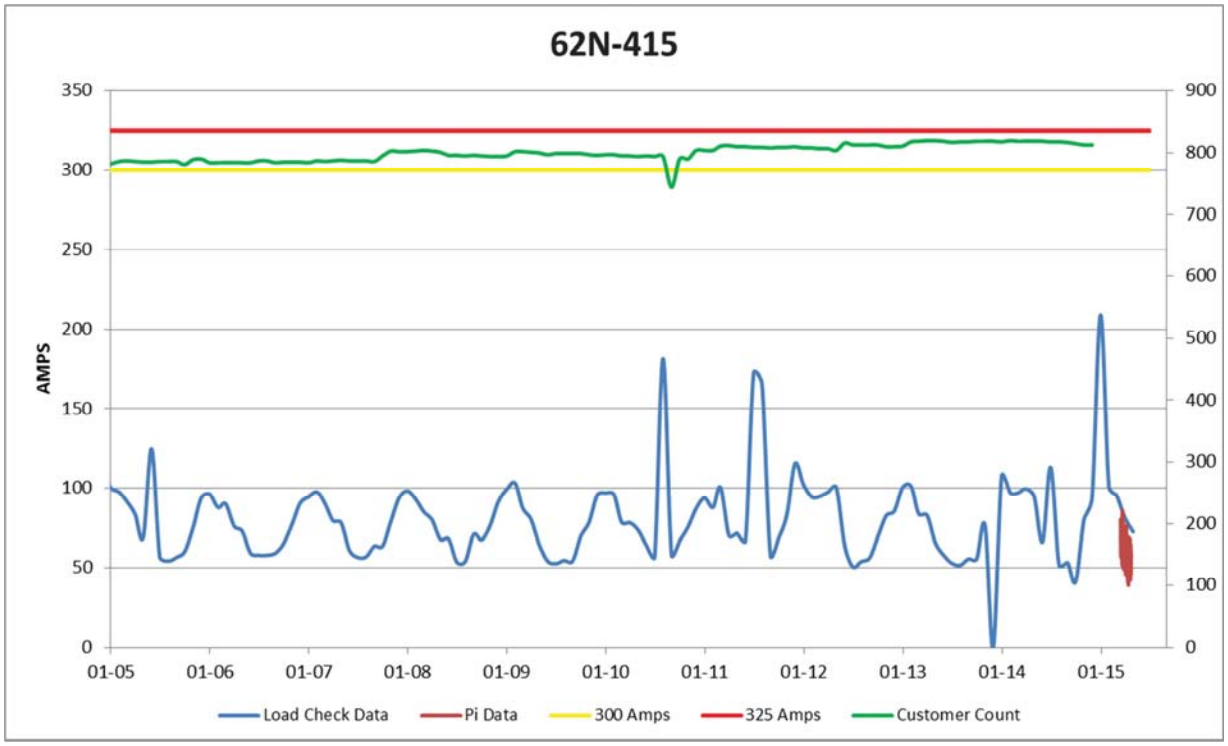


Figure 51 62N-411 Load History

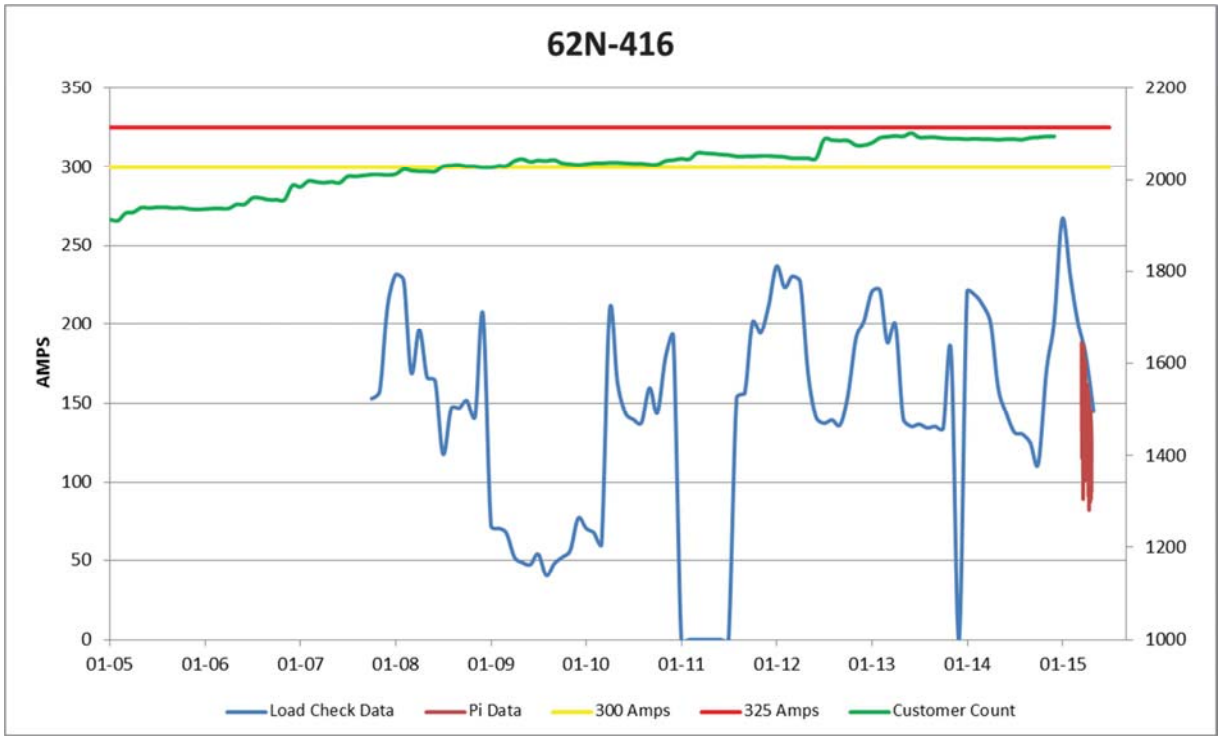


Figure 52 62N-411 Load History

APPENDIX C

Economic Analysis

532N-Elm St and 64N-Lourdes Alternatives

Summary of Alternatives

Stellarton 4kV
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :		**Date :**	**13-Aug-15**
Department :	Distribution Planning	**CI Number:**	
Originator :	Brendon Henderson	**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Convert to 25kV	6.07%	1,672,608	-1,275,336	1	-8.03%	0.0 years
B	Three Stepdown Locations	6.07%	1,768,459	-1,465,093	2	-11.17%	0.0 years
C	Two Padmounts	6.07%	1,924,374	-1,823,638	3	#NUM!	0.0 years
	0	NA	NA	NA	NA	#NUM!	0.0 years

Recommendation :

The conversion to 25kV has a greater up front cost, but is the most economical choice in the long term. Further intangible benefits for converting are explained in full planning study. This analysis is valid for all 4kV pockets in Stellarton area, given their similarities.

Notes/Comments :

Convert to 25kV

Complete a phased conversion of all 4kV plant to 25kV. Retire 532N-Elm and 64N-Lourdes in 2018.

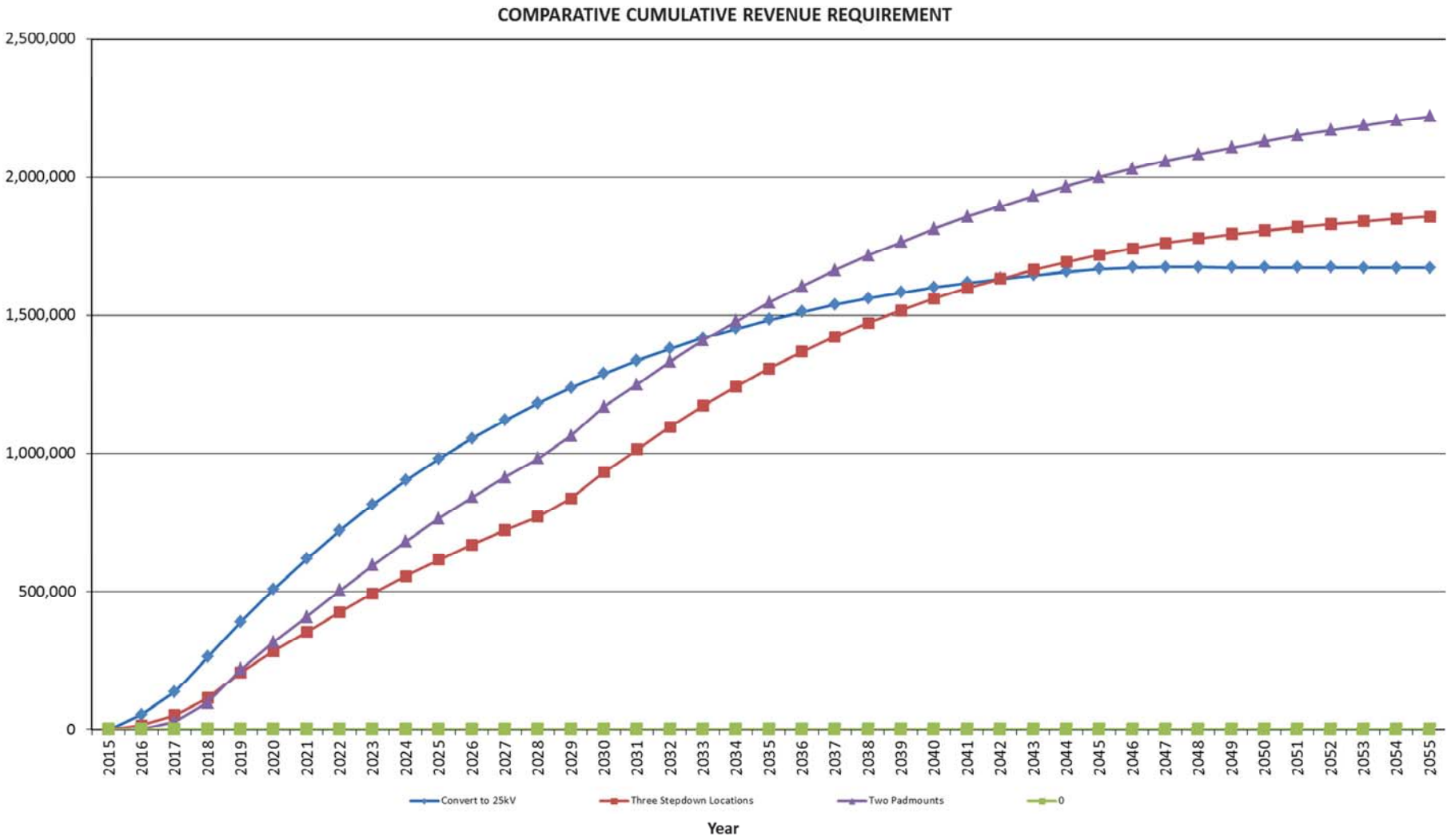
Three Stepdown Locations

Install new platform mounted stepdown transformers to remove load from 4kV substations to allow retirement of 532N-Elm and 64N-Lourdes in 2018. This delays the conversion to 25kV by 15 years.

Two Padmounts

Replace existing 4kV substations with padmount transformers. Both 532N-Elm and 64N-Lourdes replaced by 2018. This delays the conversion to 25kV by 15 years.

NPV Comparison



Appendix C: Economic Analysis

Alternative A- Convert to 25kV

Stellarton 4kV
Convert to 25kV

Nova Scotia POWER An Emera Company

Go to: Working Capital | Capital | Expenses | Revenue

Add Operating Item | Add Capital | Project Description | Delete Item

Select: In-Service Month: January | In-Service Year: 2016

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Capital Invested																	
1. Elm St - Terrace		293,760															
2. Elm St - North Mitchell			262,181														
3. Elm St - South Mitchell			374,544														
4. Lourdes - View St		512,448															
5. Lourdes - Stellarton Rd				299,897													
6.																	
7.																	
8.																	
9.																	
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12.																	
13.																	
14.																	
15.																	
16.																	
17.																	
18.																	
19.																	
20.																	
Total Direct Capital Invested by Year		806,208	636,725	299,897													
AFUDC (entered as a positive value)																	
AO (entered as a positive value)																	
Total Indirect Capital Invested by Year																	
Total Capital Invested by Year		806,208	636,725	299,897													

*This alternative was used as the baseline for operating costs, additional cost is shown for other alternatives.

Appendix C: Economic Analysis

Alternative B- Three Stepdown Locations

Stellarton 4kV
Three Stepdown Locations
Nova Scotia POWER An Emera Company

Go to: Working Capital | Capital | Expenses | Revenue

Add Operating Item | Add Capital | Project Description | Delete Item

Select: In-Service Month: January; In-Service Year: 2016

Capital Invested

		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
1.	Terrace St Stepdown		163,200															
2.	Elm St Stepdown			166,464														
3.	Lourdes Stepdown				275,914													
4.	Terrace Conversion															380,010		
5.	North Mitchell Conversion																339,159	
6.	South Mitchell Conversion																484,513	
7.	View St Conversion															662,906		
8.	Stellarton Rd Coversion																	387,950
9.																		
10.																		
11.																		
12.																		
13.																		
14.																		
15.																		
16.																		
17.																		
18.																		
19.																		
20.																		
	Total Direct Capital Invested by Year		163,200	166,464	275,914											1,042,916	823,672	387,950
	AFUDC (entered as a positive value)																	
	AO (entered as a positive value)																	
	Total Indirect Capital Invested by Year																	
	Total Capital Invested by Year		163,200	166,464	275,914											1,042,916	823,672	387,950

Expense

	Description		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	Stepdown Transformation Losses	Cost	1,310	1,241	1,226	1,174	2,827	2,027	1,981	2,571	2,623	2,621	2,716	2,705	2,765	2,848	2,888	2,975	3,072
		$/Unit		3	6	9	9	9	9	9	9	9	9	9	9	9	9	9	
		Expense-Subtotal		3,722	7,354	10,570	25,441	18,240	17,829	23,139	23,611	23,592	24,448	24,345	24,889	25,632	25,993	26,773	
2.	532N 4kV Distribution Tx Losses (less 25kV	Cost	5,244	4,985	4,933	4,743	9,949	7,487	7,364	9,589	9,750	9,764	10,095	10,092	10,339	10,668	10,827	11,169	11,556
		$/Unit		0.33	0.66	1	1	1	1	1	1	1	1	1	1	1	1	1	
		Expense-Subtotal		1,645	3,256	4,743	9,949	7,487	7,364	9,589	9,750	9,764	10,095	10,092	10,339	10,668	10,827	11,169	
3.	64N 4kV Distribution Tx Losses (less 25kV Distribution losses)	Cost	4,899	4,654	4,605	4,425	9,162	6,930	6,820	8,908	9,052	9,067	9,373	9,374	9,607	9,916	10,065	10,387	10,751
		$/Unit			0.5	1	1	1	1	1	1	1	1	1	1	1	1	1	
		Expense-Subtotal			2,302	4,425	9,162	6,930	6,820	8,908	9,052	9,067	9,373	9,374	9,607	9,916	10,065	10,387	
4.	532N 4kV Conductor Losses	Cost	1,624	1,544	1,528	1,469	4,232	2,858	2,773	3,494	3,591	3,578	3,720	3,683	3,749	3,842	3,892	3,992	4,101
		$/Unit		0.33	0.66	1	1	1	1	1	1	1	1	1	1	1	1	1	
		Expense-Subtotal		509	1,008	1,469	4,232	2,858	2,773	3,494	3,591	3,578	3,720	3,683	3,749	3,842	3,892	3,992	
5.	64N 4kV Conductor Losses	Cost	6,829	6,490	6,422	6,174	17,790	12,016	11,658	14,689	15,095	15,044	15,638	15,483	15,759	16,153	16,361	16,784	17,242
		$/Unit			0.5	1	1	1	1	1	1	1	1	1	1	1	1	1	
		Expense-Subtotal			3,211	6,174	17,790	12,016	11,658	14,689	15,095	15,044	15,638	15,483	15,759	16,153	16,361	16,784	

Appendix C: Economic Analysis

Alternative C- Two Padmounts

Stellarton 4kV
Two Padmounts

Nova Scotia POWER An Emera Company

Go to: Working Capital | Capital | Expenses | Revenue

Add Operating Item | Add Capital | Project Description | Delete Item

Select:
In-Service Month: January
In-Service Year: 2016

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Capital Invested																	
1. Elm St Padmount			436,968														
2. Lourdes Stepdown				445,707													
3. Terrace Conversion															380,010		
4. North Mitchell Conversion																339,159	
5. South Mitchell Conversion																484,513	
6. View St Conversion															662,906		
7. Stellarton Rd Coversion																	387,950
8.																	
9.																	
10.																	
11.																	
12.																	
13.																	
14.																	
15.																	
16.																	
17.																	
18.																	
19.																	
20.																	
Total Direct Capital Invested by Year			436,968	445,707											1,042,916	823,672	387,950
AFUDC (entered as a positive value)																	
AO (entered as a positive value)																	
Total Indirect Capital Invested by Year																	
Total Capital Invested by Year			436,968	445,707											1,042,916	823,672	387,950

Appendix C: Economic Analysis

Expense

	Description		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	Stepdown Transformation Losses	Cost	10,456	9,904	9,784	9,377	22,770	16,274	15,902	20,607	21,035	21,016	21,781	21,684	22,164	22,820	23,140	23,829	24,600
		$/Unit			1.0	2	2	2	2	2	2	2	2	2	2	2	2	2	
		Expense-Subtotal			9,784	18,755	45,540	32,549	31,804	41,215	42,070	42,032	43,563	43,368	44,327	45,639	46,280	47,659	
2.	532N 4kV Distribution Tx Losses (less 25kV Distribution Losses)	Cost	5,244	4,985	4,933	4,743	9,949	7,487	7,364	9,589	9,750	9,764	10,095	10,092	10,339	10,668	10,827	11,169	11,556
		$/Unit		0.33	0.66	1	1	1	1	1	1	1	1	1	1	1	1	1	
		Expense-Subtotal		1,645	3,256	4,743	9,949	7,487	7,364	9,589	9,750	9,764	10,095	10,092	10,339	10,668	10,827	11,169	
3.	64N 4kV Distribution Tx Losses (less 25kV Distribution losses)	Cost	4,899	4,654	4,605	4,425	9,162	6,930	6,820	8,908	9,052	9,067	9,373	9,374	9,607	9,916	10,065	10,387	10,751
		$/Unit			0.5	1	1	1	1	1	1	1	1	1	1	1	1	1	
		Expense-Subtotal			2,302	4,425	9,162	6,930	6,820	8,908	9,052	9,067	9,373	9,374	9,607	9,916	10,065	10,387	
4.	532N 4kV Conductor Losses	Cost	1,624	1,544	1,528	1,469	4,232	2,858	2,773	3,494	3,591	3,578	3,720	3,683	3,749	3,842	3,892	3,992	4,101
		$/Unit		0.33	0.66	1	1	1	1	1	1	1	1	1	1	1	1	1	
		Expense-Subtotal		509	1,008	1,469	4,232	2,858	2,773	3,494	3,591	3,578	3,720	3,683	3,749	3,842	3,892	3,992	
5.	64N 4kV Conductor Losses	Cost	6,829	6,490	6,422	$6,173.71	$17,789.85	$12,015.86	$11,657.93	$14,689.29	$15,095.17	$15,043.77	$15,637.66	$15,483.20	$15,759.03	$16,153.20	$16,360.88	$16,783.88	$17,242.04
		$/Unit			0.5	1	1	1	1	1	1	1	1	1	1	1	1	1	
		Expense-Subtotal			3,211	6,174	17,790	12,016	11,658	14,689	15,095	15,044	15,638	15,483	15,759	16,153	16,361	16,784	
6.	Monthly Subchecks	Cost				1,146	1,169	1,192	1,216	1,241	1,265	1,291	1,317	1,343	1,370	1,397	1,425	1,454	
		$/Unit				1	2	2	2	2	2	2	2	2	2	2	2	2	
		Expense-Subtotal				1,146	2,338	2,384	2,432	2,482	2,530	2,582	2,634	2,686	2,740	2,794	2,850	2,908	
7.	B Maintenance	Cost				637	649	662	676	689	703	717	731	746	761	776	792	808	
		$/Unit				1	2	2	2	2	2	2	2	2	2	2	2	2	
		Expense-Subtotal				637	1,298	1,324	1,352	1,378	1,406	1,434	1,462	1,492	1,522	1,552	1,584	1,616	
8.	C Maintenance (annualized)	Cost				1,327	1,353	1,380	1,408	1,436	1,465	1,494	1,524	1,554	1,585	1,617	1,649	1,682	
		$/Unit				1	2	2	2	2	2	2	2	2	2	2	2	2	
		Expense-Subtotal				1,327	2,706	2,760	2,816	2,872	2,930	2,988	3,048	3,108	3,170	3,234	3,298	3,364	
9.	Grounds upkeep	Cost				2,653	2,706	2,760	2,815	2,872	2,929	2,988	3,047	3,108	3,171	3,234	3,299	3,365	
		$/Unit				1	2	2	2	2	2	2	2	2	2	2	2	2	
		Expense-Subtotal				2,653	5,412	5,520	5,630	5,744	5,858	5,976	6,094	6,216	6,342	6,468	6,598	6,730	

APPENDIX D

Cost of Losses

D1. Station Transformer Losses

The losses of existing substation stepdown transformers were estimated using similar transformer test data as shown below. Note that the loss values of these transformers were not used in the EAM, since they do not remain in service for any of the alternatives.

Table 7 4kV Substation Transformer Loss Approximation

Station Transformers					
Station	**Man**	**Size (MVA)**	**Load (MVA)**	**LL (kW)**	**NLL (kW)**
61N-T1	Pioneer	5	4.16	30.45	10.715
528N-T1	GE	5	1.62	30.45	10.715
532N-T41	Brown Boveri	1	0.99	6.83	3.4
64N-T1	Packard	1	0.98	6.83	3.4

Table 8 Comparable 4kV Transformer Loss Data

Similar Transformers Test Data							
Location	**Station**	**Man**	**MVA**	**HV (kV)**	**LV (kV)**	**LL (kW)**	**NLL (kW)**
Tufts	36D-T1	Ferranti	0.9	22	4	6.83	3.4
HRM	1H-T51	Moloney	2	22.8	4	9.46	7.14
HRM	1H-T13/14	Brown Boveri	5	23	4	36.6	7.93
HRM	1H-T71	Bonar Long	5	22.8	4	24.3	13.5

D2. Stepdown Transformer Losses

The losses of the platform mounted stepdown transformers proposed in Alternative B were estimated using the document 'Old Transformer Losses' which is available on the Distribution Planning SharePoint under COST ESTIMATES.

Table 9 500kVA Stepdown Transformer Loss Approximation

Stepdown Transformers (500kVA)		
Station	**LL (kW)**	**NLL (kW)**
500kVA S.D.	3.57	0.96

D3. Padmount Transformer Losses

The losses of the padmount transformers proposed in Alternative C was estimated using the datasheet from a similar transformer installed on NSPI's system, 700S-T31.

Table 10 700S-T31 Padmount Loss Data

Padmount Transformers				
Station	**Man**	**Size (MVA)**	**LL (kW)**	**NLL (kW)**
700S	CARTE	5	29.488	7.32

D4. Distribution Transformer Losses

The difference in losses between existing 4kV and new 25kV distribution transformers was determined. This information was obtained from the document 'Historical Losses of Standard Design' and '2015 NSPI CARTE Transformers Data'. In the tables below, 'New' refers to the CARTE 25kV transformers we would buy today and 'Old' refers to 4kV transformers bought circa 1960. The number of distribution transformers currently fed from 532N-Elm and 64N-Lourdes was used to estimate the loss savings resulting from conversion.

Table 11 Distribution Transformer Loss Data

Dist. Transformer Test Data			
	Size (kVA)	LL (W)	NLL (W)
New	25	368	56
	50	569	94.5
Old	25	505	130
	50	819	187

Table 12 Distribution Transformer Loss Savings from Conversion

Distribution Transformers									
			Old 4kV Tx		New 25kV Tx		Load Loss Savings		
Station	# of 50kVA	# of 25kVA	LL (W)	NLL (W)	LL (W)	NLL (W)	LL (kW)	NLL (kW)	Total (kW)
532N	51	18	50859	11877	35643	5827.5	15.22	6.05	21.27
64N	28	44	45152	10956	32124	5110	13.03	5.85	18.87

D5. Conductor Losses

The difference in conductor losses, before and after conversion to 25kV, was determined using CYME software. The existing system configurations for 532N-Elm and 64N-Lourdes were modelled at 4kV as well as 25kV. The built-in tool was used to calculate conductor losses. The following table summarizes the results.

Table 13 Line Losses Before and After Conversion

Line Losses from CYME after Conversions				
		Before (kW)	After (kW)	Savings (kW)
64N-Lourdes	201	34	0.83	33.17
532N-Elm	201	8.1	0.21	7.89

D6. The Cost of Losses

Alternative A was used as the baseline for losses in the EAM. The additional losses that would result from selecting Alternative B and Alternative C were determined in kilowatts. These values were converted to dollars using the tables found in '2015 Cost of Losses'. The future cost of losses at 31% loss factor was used for stepdown transformation and conductor losses. The future cost of losses at 12% loss factor was used for distribution transformers servicing customers. For background information, see report '254-0807-A48 Cost of NSPI Distribution System Losses'.

Appendix C: Economic Analysis

Table 14 Future Cost of Distribution Losses – 12% Loss Factor

	Future Cost of Distribution Losses - 12%					
YEAR	Load Losses			No Load Losses		
	Demand $/kW	Energy $/kW	Total	Demand $/kW	Energy $/kW	Total
2015	$33.54	$67.28	$100.81	$52.72	$560.64	$613.36
2016	$34.21	$63.07	$97.28	$53.78	$525.60	$579.38
2017	$34.89	$62.02	$96.91	$54.85	$516.84	$571.69
2018	$35.59	$58.87	$94.46	$55.95	$490.56	$546.51
2019	$211.06	$58.87	$269.93	$475.07	$490.56	$965.63
2020	$118.97	$63.07	$182.04	$254.21	$525.60	$779.81
2021	$112.60	$64.12	$176.73	$238.37	$534.36	$772.73
2022	$117.96	$95.66	$213.62	$250.56	$797.16	$1,047.72
2023	$125.84	$94.61	$220.44	$268.77	$788.40	$1,057.17
2024	$124.11	$95.66	$219.77	$264.01	$797.16	$1,061.17
2025	$130.77	$97.76	$228.53	$279.27	$814.68	$1,093.95
2026	$126.15	$99.86	$226.01	$267.55	$832.20	$1,099.75
2027	$125.31	$104.07	$229.38	$264.86	$867.24	$1,132.10
2028	$124.91	$109.32	$234.23	$263.20	$911.04	$1,174.24
2029	$125.78	$111.43	$237.20	$264.57	$928.56	$1,193.13
2030	$125.83	$116.68	$242.51	$263.96	$972.36	$1,236.32
2031	$125.06	$122.99	$248.05	$261.38	$1,024.92	$1,286.30
2032	$117.61	$132.45	$250.07	$242.82	$1,103.76	$1,346.58
2033	$122.73	$120.89	$243.62	$254.30	$1,007.40	$1,261.70
2034	$123.69	$144.01	$267.71	$255.81	$1,200.12	$1,455.93
2035	$124.25	$159.78	$284.03	$256.34	$1,331.52	$1,587.86
2036	$125.67	$168.19	$293.86	$258.91	$1,401.60	$1,660.51
2037	$128.77	$174.50	$303.27	$265.51	$1,454.16	$1,719.67
2038	$131.35	$177.99	$309.34	$270.82	$1,483.24	$1,754.06
2039	$133.98	$181.55	$315.52	$276.23	$1,512.91	$1,789.14
2040	$136.66	$185.18	$321.84	$281.76	$1,543.17	$1,824.92
2041	$139.39	$188.88	$328.27	$287.39	$1,574.03	$1,861.42
2042	$142.18	$192.66	$334.84	$293.14	$1,605.51	$1,898.65
2043	$145.02	$196.51	$341.53	$299.00	$1,637.62	$1,936.62
2044	$147.92	$200.44	$348.36	$304.98	$1,670.37	$1,975.36
2045	$150.88	$204.45	$355.33	$311.08	$1,703.78	$2,014.86
2046	$153.90	$208.54	$362.44	$317.31	$1,737.86	$2,055.16
2047	$156.97	$212.71	$369.69	$323.65	$1,772.61	$2,096.26
2048	$160.11	$216.97	$377.08	$330.12	$1,808.07	$2,138.19
2049	$163.32	$221.31	$384.62	$336.73	$1,844.23	$2,180.95
2050	$166.58	$225.73	$392.32	$343.46	$1,881.11	$2,224.57
2051	$169.91	$230.25	$400.16	$350.33	$1,918.73	$2,269.06

Appendix C: Economic Analysis

Table 15 Future Cost of Distribution Losses – 31% Loss Factor

Future Cost of Distribution Losses - 31%						
YEAR	Load Losses			No Load Losses		
	Demand $/kW	Energy $/kW	Total	Demand $/kW	Energy $/kW	Total
2015	$32.09	$173.80	$205.88	$38.37	$560.64	$599.01
2016	$32.73	$162.94	$195.66	$39.14	$525.60	$564.74
2017	$33.38	$160.22	$193.60	$39.92	$516.84	$556.76
2018	$34.05	$152.07	$186.12	$40.72	$490.56	$531.28
2019	$384.25	$152.07	$536.32	$459.54	$490.56	$950.10
2020	$199.31	$162.94	$362.25	$238.37	$525.60	$763.97
2021	$185.81	$165.65	$351.46	$222.21	$534.36	$756.57
2022	$195.73	$247.12	$442.85	$234.08	$797.16	$1,031.24
2023	$210.68	$244.40	$455.08	$251.96	$788.40	$1,040.36
2024	$206.42	$247.12	$453.54	$246.86	$797.16	$1,044.02
2025	$218.89	$252.55	$471.44	$261.78	$814.68	$1,076.46
2026	$208.80	$257.98	$466.78	$249.71	$832.20	$1,081.91
2027	$206.25	$268.84	$475.10	$246.67	$867.24	$1,113.91
2028	$204.56	$282.42	$486.98	$244.64	$911.04	$1,155.68
2029	$205.39	$287.85	$493.24	$245.63	$928.56	$1,174.19
2030	$204.56	$301.43	$506.00	$244.64	$972.36	$1,217.00
2031	$202.08	$317.73	$519.81	$241.68	$1,024.92	$1,266.60
2032	$186.24	$342.17	$528.41	$222.73	$1,103.76	$1,326.49
2033	$195.50	$312.29	$507.79	$233.81	$1,007.40	$1,241.21
2034	$196.42	$372.04	$568.45	$234.90	$1,200.12	$1,435.02
2035	$196.52	$412.77	$609.29	$235.02	$1,331.52	$1,566.54
2036	$198.31	$434.50	$632.80	$237.16	$1,401.60	$1,638.76
2037	$203.46	$450.79	$654.25	$243.32	$1,454.16	$1,697.48
2038	$207.53	$459.81	$667.33	$248.19	$1,483.24	$1,731.43
2039	$211.68	$469.00	$680.68	$253.15	$1,512.91	$1,766.06
2040	$215.91	$478.38	$694.29	$258.22	$1,543.17	$1,801.38
2041	$220.23	$487.95	$708.18	$263.38	$1,574.03	$1,837.41
2042	$224.64	$497.71	$722.34	$268.65	$1,605.51	$1,874.16
2043	$229.13	$507.66	$736.79	$274.02	$1,637.62	$1,911.64
2044	$233.71	$517.82	$751.53	$279.50	$1,670.37	$1,949.87
2045	$238.39	$528.17	$766.56	$285.09	$1,703.78	$1,988.87
2046	$243.15	$538.74	$781.89	$290.79	$1,737.86	$2,028.65
2047	$248.02	$549.51	$797.53	$296.61	$1,772.61	$2,069.22
2048	$252.98	$560.50	$813.48	$302.54	$1,808.07	$2,110.61
2049	$258.04	$571.71	$829.75	$308.59	$1,844.23	$2,152.82
2050	$263.20	$583.14	$846.34	$314.76	$1,881.11	$2,195.88
2051	$268.46	$594.81	$863.27	$321.06	$1,918.73	$2,239.79

CI Number: C0011200

Title: 6S-224 Birch Hill Drive Conversion

Start Date: 2019/01
In-Service Date: 2019/04
Final Cost Date: 2019/10
Function Class: Distribution
Forecast Amount: $542,026

DESCRIPTION:

This project will implement recommendation 6.1.6.1 of the Sydney 4kV Conversion and Membertou Load Growth Planning Study 283-0212-E27 (please refer to Attachment 1). Section 6.1.6.1 recommends extending the existing 12kV feeder on Upper Prince Street onto Birch Hill Drive, to allow for the existing 4kV circuit along Birch Hill Drive and its surrounding streets to be converted to 12kV, which will facilitate the retirement of the 6S substation.

This conversion will require the upgrade of approximately 2 kilometres of existing primary conductor to a mixture of 336 AASC and 2/0 AASC primary conductor, replacement of 20 deteriorated poles, framing, insulators, cut-outs, and replacement of all existing single-tap transformers with dual-tap transformers.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- 2018 CI 52194 6S-223 Harold Street Conversion $642,368
- 2020 CI TBD 6S-225 Townsend Street Conversion $TBD

JUSTIFICATION:

Justification Criteria: Distribution System

Why do this project?

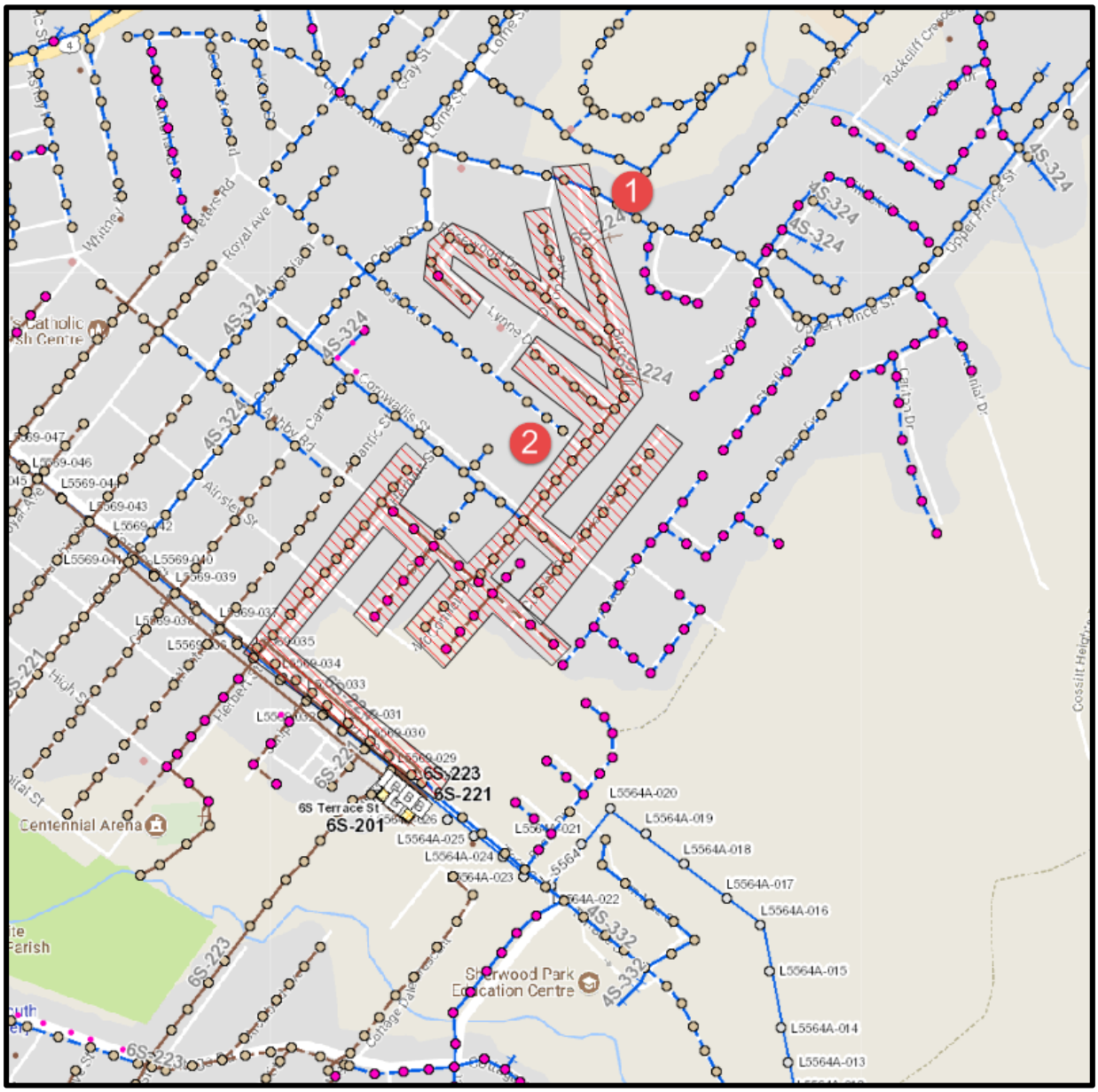
The existing 6S-Terrace Street substation equipment, infrastructure, and associated 4kV distribution plant are deteriorated due to age. The condition of the targeted assets is further described in Sections 2.3.2 and 4.3 of planning study 283-0212-E27 (please refer to Attachment 1). The customer load on 6S-Terrace Street needs to be converted from 4kV to 12kV and transferred in order to accommodate for the planned retirement of the 6S substation.

Why do this project now?

The 6S substation equipment and 4kV distribution plant are over 40 years old and are at or nearing the end of their expected service lives, as outlined in section 4.3. Multiple phases of conversion and load transfer must be completed over multiple years before 6S can be retired, as outlined in section 6.0 and sequentially under section 6.1, with the retirement of 6S retirement recommended in 2021.

Why do this project this way?

Alternatives are outlined in Section 5.2, including three variations on timing of conversions and one on rebuilding the 6S substation. 4kV distribution systems are no longer a NS Power standard and are being phased out. Conversion of the existing 4kV feeders from 6S-Terrace Street is therefore the only feasible solution to accommodate the retirement of the 6S substation.



1. Extend feeder 4S-324 along Birch Hill Drive using 336 AASC primary conductor and 2/0 AASC neutral conductor.
2. Replace targeted deteriorated conductor, poles and single-tap transformers with dual-tap transformers to convert existing 4kV line to 12kV.

CI Number : C0011200 - 6S-224 Birch Hill Drive Conversion - **Project Number** C0011200

Parent CI Number : - 1456 Distribution General

Asset Location : 1456 **Budget Version** 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0200 - DP - Land Rights	21,982
Additions	3500 - DP - Wood Poles	169,302
Additions	3800 - DP - Insulators	14,180
Additions	3900 - DP - O/H Cond.	164,875
Additions	4000 - DP - O/H Cond.Devices	7,322
Additions	4100 - DP - O/H Line Transf.	37,037
Additions	4800 - DP - U/G Line Transf.	46,939
Retirements	3500 - DP - Wood Poles	18,276
Retirements	3900 - DP - O/H Cond.	33,105
Retirements	4000 - DP - O/H Cond.Devices	3,512
Retirements	4100 - DP - O/H Line Transf.	16,130
Retirements	4800 - DP - U/G Line Transf.	9,366
	Total Cost:	542,026
	Original Cost:	118,824

Capital Project Detailed Estimate

Location: Distribution
CI# / FP#: C0011200
Title: 6S-224 Birch Hill Drive Conversion
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Design	PD	7	$ 386	$ 2,779		
Procurement / Financial Support	Lot	1	$ 1,770	$ 1,770		
			Sub-Total	$ 4,549		
Materials						
Wood Poles	LOT	1	$ 19,761	$ 19,761		
Insulators	LOT	1	$ 528	$ 528		
O/H Conductor	LOT	1	$ 17,106	$ 17,106		
O/H Cond.Devices	LOT	1	$ 1,673	$ 1,673		
O/H Line Transformer	LOT	1	$ 17,579	$ 17,579		
U/G Line Transf.	LOT	1	$ 31,875	$ 31,875		
			Sub-Total	$ 88,522		
Contracts						
Flagging	LOT	1	$ 48,276	$ 48,276		
Backhoe	LOT	1	$ 24,300	$ 24,300		
Tree Trimming	LOT	1	$ 15,000	$ 15,000		
External Contractor	LOT	1	$ 223,210	$ 223,210		
Other Contracts	LOT	1	$ 10,000	$ 10,000		
			Sub-Total	$ 320,786		
Easements						
Easements	LOT	1	$ 8,000	$ 8,000		
			Sub-Total	$ 8,000		
Other Goods & Services						
Contingency		10%	$ 421,857	$ 42,186		
			Sub-Total	$ 42,186		
Interest Capitalized						
AFUDC	Lot	1	$ 3,532	$ 3,583		
			Sub-Total	$ 3,583		
Vehicle Overhead						
Vehicle AO				$ 1,977		
			Sub-Total	$ 1,977		
Administrative Overhead						
Labour AO				$ 3,528		
Contract AO				$ 68,895		
			Sub-Total	$ 72,423		
			SUB-TOTAL (no AO, AFUDC)	$ 464,043		
			TOTAL (AO, AFUDC included)	$ 542,026		
Original Cost				$ 118,824		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Sydney 4kV Conversion and Membertou Load Growth DISTRIBUTION PLANNING STUDY

Report number 283-0212-E27

Revision		Date	Drafted By	Reviewed by	Approved By
0	Issued for Study	16-Feb-2012	JMQ		
1	Issued for Release	16-Aug-2013	JMQ	MGS PZ	
2	Issued for Release	7-Apr-2014	JMQ	JC	JC
3	Issued for Release	5-June-2015	BH	YL/MD	

EXECUTIVE SUMMARY

This study was initiated by the Eastern Territory, in order to determine solutions to the anticipated large load growth in the Membertou area, of Sydney. Solutions were studied and recommendations made to address near and long term load growth in previous revisions. This revision was initiated to address two changes since the last revision:

- Additional reduction of 69kV load required as per transmission planning study, 049-2013-TSMG
- Unable to procure land for proposed substation location

Sydney 4kV to 12kV conversions are underway: Mason St, Cabot St and Rockdale Ave conversions are complete. Further conversion projects will continue until the eventual retirement of 6S-Terrace Street. The advancement or deferral of the 6S-Terrace Street conversion projects will be influenced by factors including residential/commercial development, feeder reconfigurations and/or ranking of capital projects within the ACE plan.

Creation of another supply into Membertou is partially completed. This will enable the transfer of load from the existing feeders, to a feeder that is more lightly loaded. The long term solution for the growth in Membertou is a new substation, which will now be located on Gabarus Hwy in Prime Brook, rather than on George St. This substation will be NSPI standard construction with a capacity of 15/20/25MVA rather than the initially recommended 15MVA pad-mounted option.

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1.0 SCOPE

This study was initiated by the Eastern Territory and undertaken by the Distribution Planning Department to identify solutions to meet the anticipated load growth in the Membertou area. Membertou is currently one of the fastest growing areas in the province. With the amount of development that has been announced for the area, there is a need to ensure enough capacity is available to meet this anticipated growth. This study outlined near and long term solutions to meet the growth in the Membertou area. This current revision (Rev 3), will address changes since the last revision:

- Additional reduction of 69kV load required as per transmission planning study, 049-2013-TSMG
- Unable to procure land for proposed substation location on George Street

Capital work for the recommended short term solution is underway. This solution eliminated an island of 4kV distribution and retired the 533S-Mason Street step-down. Reconfiguration of the feeders on Kings Road will allow the removal of a deteriorated off-road section of feeder 4S-333. A new feeder tie on Alexandra Street will create an additional 12kV supply into Membertou, which will allow balancing between existing feeders. These recommendations are unchanged in revision 3.

This study outlines the conversion of load from 6S-T1, in preparation for retirement of this substation. The first phases of conversions have been completed. The current 4kV breakers are being replaced with reclosers in 2015 to allow the substation to operate until its retirement. These recommendations are unchanged in revision 3.

The construction of a new 15/20/25MVA substation at the intersection of the transmission corridor and Gabarus Hwy will provide the long term solution for Membertou. This replaces the original recommendation for a 15MVA 138-12kV pad-mounted substation, as it does not meet the required capacity. Transmission planning study, 049-2013-TSMG, specified a 20MVA reduction of the 69kV load forecast in 2018, contingent on a new 138-12kV substation near Membertou. The release of this transmission study was the driver for revision 3 of this study.

A Distribution Automation study will be completed to outline future development of automatic transfer schemes in the Sydney area.

2.0 EXISTING SYSTEMS

2.1 Transmission

Presently, a transmission corridor exists from 2S-Victoria Junction to 101S-Woodbine. Prior to the corridor crossing the Louisburg Highway (Highway 22), one of the 138kV transmission lines, L-6539, separates from this corridor to join L-5564, which extends to 3S-Gannon Road. The System Operating Diagrams are attached, in Appendix A.

Table 1 Transmission Line Ratings

Transmission Line	Substation		MVA Rating	
	From	To	Summer	Winter
L-7011	88S-Lingan	3C-Port Hastings	298	383
L-7012	88S-Lingan	3C-Port Hastings	398	398
L-7014	88S-Lingan	101S-Woodbine	404	462
L-6516	2S-Victoria Junction	2C-Port Hastings	110	115
L-6539	2S-Victoria Junction	3S-Gannon Road	115	115
L-5564	2S-Victoria Junction	3S-Gannon Road	55	72
L-5563	2S-Victoria Junction	4S-Townsend Street	31	45
L-5560	2S-Victoria Junction	4S-Townsend Street	29	42
L-5569	4S-Townsend Street	6S-Terrace Street	43	43

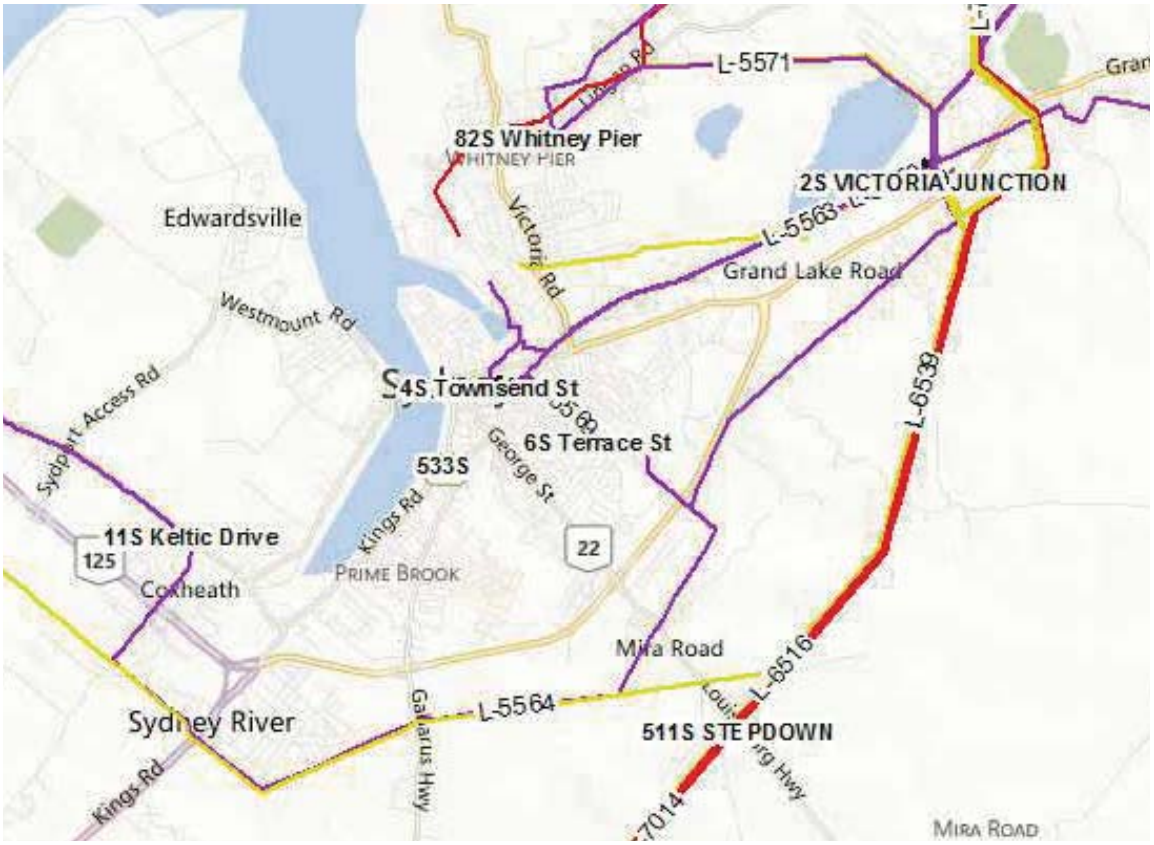


Figure 1 Industrial Cape Breton Transmission

2.2 Sub-Transmission

The sub-transmission system within the Sydney area operates at 69kV. It is supplied by three 138-72kV auto-transformers, two located at 2S-Victoria Junction and one located at 3S-Gannon Road. The System Operating Diagrams are attached, in Appendix A.

Table 2 Sydney Area Sub-Transmission

Substation	Auto-Transformer Data				
	ID	MAN	kV	Rating	Age
2S-Victoria Junction	T1	CGE.	138-72	60/80/100//112	1973
2S-Victoria Junction	T2	CGE.	138-72	60/80/100//112	1972
3S-Gannon Road	T1	CGE	138-72	30/40/50//56	1972

2.3 Distribution

The distribution system being studied in this report includes the 12kV feeders supplied from 4S-Townsend Street and 11S-Keltic Drive substation. The 4kV feeders supplied by the 6S-Terrace Street substation are also considered. The 25kV feeders from 11S-Keltic Dive have not been considered in this study.

Table 3 provides the transformer data for the substations that are directly impacted by the scope of this study.

Table 3 Sydney Area Distribution Transformers

Substation	Transformer Data				
	ID	MAN	kV	Rating	Age
4S-Townsend Street	T52	Federal Pioneer	69-12.47	15/20//24.6	1972
4S-Townsend Street	T53	Federal Pioneer	69-12.47	15/20//22.4	1973
6S-Terrace Street	T1	Moloney Electric	69-4.16	7.5/10	1969
11S-Keltic Drive	T51	Federal Pioneer	69-12.47	10/13.3//14.9	1972
11S-Keltic Drive	T52	Federal Pioneer	69-12.47	10/13//14.8	1972
11S-Keltic Drive	T53	Virginia Transformer	69-26.4	15/20/25	1999

2.3.1 533S-Mason Street

This area has been converted to 12kV as recommended in revision 2 of this study.

2.3.2 6S-Terrace Street

The lone transformer at the 6S-Terrace Street substation (6S-T1) was placed into service in 1969. This 69-4kV transformer is rated at 7.5/10MVA. The transformer annually peaks above 6MVA, with a recent maximum winter peak of 6.7MVA, recorded in the winter 2010 / 2011.The only suitable mobile transformer, in the NSPI fleet, is 3P-MS, which is rated at 6MVA, at 4kV. Given this, the mobile transformer is unable to assume the peak load on 6S-T1 without transferring a portion of customer load to 534S; the lone neighbouring 4kV stepdown transformer (near 4S-Townsend Street). While this response to a loss of 6S-T1 is feasible, it would extend the duration of the outage experienced by customers due to the failure of 6S-T1. The 4kV area covered by Terrace Street, as of 2014, can be found below in Figure 2. As per revision 2 of this study, this area has been partially converted as a short term solution. This reduces the load at 6S and allow mobile to be used in contingency situations. The remainder of the 4kV conversions will be planned for the future. See further details in the recommendations section.

The average age of the distribution plant in the area is greater than 40 years. At the present time, there is difficulty with maintaining the substation breakers due to the age and condition of the building structure. There is also an inability to source replacement components for the breakers themselves, representing a significant reliability concern. Replacement of these breakers is underway and will be completed in 2015. See further details in the recommendations section.

Figure 2 **6S-Terrace Street extents as of 2014**

3.0 LOAD HISTORY AND FORECAST

The loading for those feeders being studied is largely residential, with a small number of commercial customers. As illustrated in the load history for these feeders, Appendix B, the feeders being studied have had a larger winter peak than summer. Historical load data for the feeders and transformers studied in revision 2 was collected from the Distribution Load Check Database and presented in the tables below.

3.1 Load Forecast

Customer load has been generally consistent in the Sydney area, demonstrating a slight overall growth in recent years. That being stated, the community of Membertou has seen the largest growth in Sydney in recent years. This load growth is anticipated to continue for the next several years, due to the proposed developments outlined in subsequent sections of this study.

The growth rates indicated in following tables were determined through examination of the peak load check data over the past 15 years. The forecasted load growth was then calculated using the 90th percentile, to determine potential peak load growth in the area. The forecasted loading of the substation transformers are indicated in Table 7.

Table 4 90th Percentile Load Forecast for 4S-Townsend Street, in Amps (2014)

Year / Load Growth	4S-321	4S-322	4S-323	4S-324	4S-331	4S-332	4S-333	4S-334
Load Growth	2.64%	-0.97%	1.48%	0.03%	2.76%	-0.05%	1.53%	2.72%
2014 Peak	**234**	**188**	**256**	**290**	**118**	**279**	**244**	**67**
2014 / 2015	236	226	269	289	190	297	283	129
2015 / 2016	244	223	274	289	197	297	288	134
2016 / 2017	252	221	278	289	204	297	294	139
2017 / 2018	261	219	283	289	211	297	299	144
2018 / 2019	269	217	288	289	218	296	304	148
2019 / 2020	277	215	293	289	226	296	310	153
2020 / 2021	285	213	298	289	233	296	315	158
2021 / 2022	294	210	303	289	240	296	320	163
2022 / 2023	302	208	307	289	247	296	325	167
2023 / 2024	310	206	312	290	254	296	331	172
2024 / 2025	319	204	317	290	261	296	336	177
2025 / 2026	327	202	322	290	268	295	341	182
2026 / 2027	335	199	327	290	275	295	346	186
2027 / 2028	344	197	332	290	283	295	352	191
2028 / 2029	352	195	336	290	290	295	357	196
2029 / 2030	360	193	341	290	297	295	362	201

Note:

- 4S-331 supplies the 534S-Stepdown transformer, near 4S-Townsend Street.
- 4S-333 current supply to Membertou area and 533S-Mason Street.

Table 5 90th Percentile Load Forecast for 6S-Terrace Street, in Amps (2014)

Year / Load Growth	6S-221	6S-223	6S-224	6S-225
2014 Load Clip	**54**	**163**	**153**	**263**

Note:

- Load Clip measurements are presented for the 6S-Terrace Street feeders, as there isn't enough data to accurately forecast the load.
- These clip measurements were taken on a day with ambient temperature of -12^{o}C.

Table 6 90th Percentile Load Forecast for 11S-Keltic Drive, in Amps (2014)

Year / Load Growth	11S-301	11S-302	11S-303	11S-304	11S-305	11S-306
Load Growth	0.83%	0.52%	0.57%	-0.53%	0.21%	0.61%
2014 Peak	**190**	**240**	**240**	**210**	**300**	**244**
2013 / 2014	197	237	307	151	307	246
2014 / 2015	199	238	309	150	307	248
2015 / 2016	201	239	311	149	308	250
2016 / 2017	202	241	313	148	309	251
2017 / 2018	204	242	315	147	309	253
2018 / 2019	206	243	317	146	310	255
2019 / 2020	208	245	319	146	311	256
2020 / 2021	210	246	321	145	311	258
2021 / 2022	212	248	323	144	312	260
2022 / 2023	214	249	325	143	313	261
2023 / 2024	215	250	327	142	313	263
2024 / 2025	217	252	329	142	314	265
2025 / 2026	219	253	331	141	314	266
2026 / 2027	221	255	333	140	315	268
2027 / 2028	223	256	334	139	316	270
2028 / 2029	225	257	336	138	316	271

Note:

- 11S-305 is the alternate supply to the Membertou area.

Table 7 90th Percentile Load Forecast for Sydney Transformers, in MVA (2014)

Year / Load Growth	4S-T52	4S-T53	6S-T1	11S-T51	11S-T52
Load Growth	0.42%	1.77%	-0.02%	0.51%	0.49%
2014 Peak	**20.9**	**14.4**	**4.6***	**13.4**	**13.4**
2013 / 2014	20.8	19.3	6.5	15.4	15.2
2014 / 2015	20.9	19.7	6.5	15.5	15.2
2015 / 2016	21.0	20.2	6.5	15.6	15.3
2016 / 2017	21.0	20.6	6.5	15.7	15.4
2017 / 2018	21.1	21.0	6.5	15.8	15.5
2018 / 2019	21.2	21.4	6.5	15.9	15.6
2019 / 2020	21.3	21.9	6.5	16.0	15.6
2020 / 2021	21.4	22.3	6.5	16.1	15.7
2021 / 2022	21.5	22.7	6.5	16.1	15.8
2022 / 2023	21.6	23.1	6.5	16.2	15.9
2023 / 2024	21.7	23.6	6.5	16.3	16.0
2024 / 2025	21.8	24.0	6.5	16.4	16.1
2025 / 2026	21.9	24.4	6.5	16.5	16.1
2026 / 2027	22.0	24.8	6.5	16.6	16.2
2027 / 2028	22.1	25.3	6.5	16.7	16.3
2028 / 2029	22.2	25.7	6.5	16.8	16.4

Note:

- No Peak load data for 2014 available for 6S-T1, 2014 peak values have been indicated (*****).

4.0 OVERLOADS AND OTHER CONSIDERATIONS

The following section identifies issues that warrant correction based on NSPI's *Capital Expenditure Justification Criteria*.

4.1 Feeder Overloads

There are several feeders whose peak loading is approaching 325A. These peak values can be seen in the feeder histories, located in Appendix B. These feeders include

- 6S-224 consistently peaked above 300A,with a peak above 325A in 2010
- 6S-225 peaked above 300A, in 2003 and 2004
- 4S-321 peaked above 325A, in 2007

4.2 Contingency Loss of Supply

4.2.1 6S-T1

The lone transformer at 6S-Terrace Street, 6S-T1, has not exceeded its nameplate rating, in recent years; however the peak winter loading was exceeding the capacity of the mobile substation, 3P-MS, as of 2014. Conversions have been completed which should allow the mobile transformer to be used under peak loading conditions.

4.2.2 533S-Mason Street

This area was converted to 12kV and 533S transformer retired as per revision 2 of this study.

4.3 Age of Plant

The average age of poles and equipment in the Hardwood Hill area of Sydney is greater than 40 years old. Inspections have confirmed this equipment is at or is nearing full service life.

The current breakers at 6S-Terrace Street are obsolete. The breaker manufacturer is no longer in business. The sourcing of replacement components is nearly impossible. Added to this is the deteriorated condition of the breaker house. In the event of a breaker failure, the duration of an outage would be significant in length.

Replacement of deteriorated plant is underway, including the replacement of 6S breakers which will be completed in 2015. The remainder will be budgeted and completed in phases.

4.4 Proposed Load Growth

There are several areas of load growth in the Sydney area impacting this study. The two largest developments are detailed below.

4.4.1 Membertou Load Growth

The community of Membertou is in the midst of large growth, through commercial and residential developments within the community. The anticipated increase in load has been considered throughout this study. Future development plans in the community include:

- Multi-surface ice rink (construction commencing summer 2013)
- New School
- New overpass across Highway 125 related to a new multi-unit Business Park,
- Expanding residential housing areas

Currently there are three supplies into the area, via Churchill Drive and Membertou Street, as seen in Figure 3 and Figure 4. The two feeders capable of supplying the area from the Kings Road side of the development, 11S-305 and 4S-333, do not have excess capacity to serve this proposed growth. The third feeder, 4S-332, has less capacity than those feeders capable supplying from the other side of the development. From the 2011/2012 winter load checks these feeders were measured at 249amps, 269amps, and 292amps respectively. Accordingly, a prolonged outage of one of these feeders could result in an extended customer outage, as the remaining feeders cannot support the peak winter load.

Figure 3 Feeders Currently Serving Membertou from Kings Road area

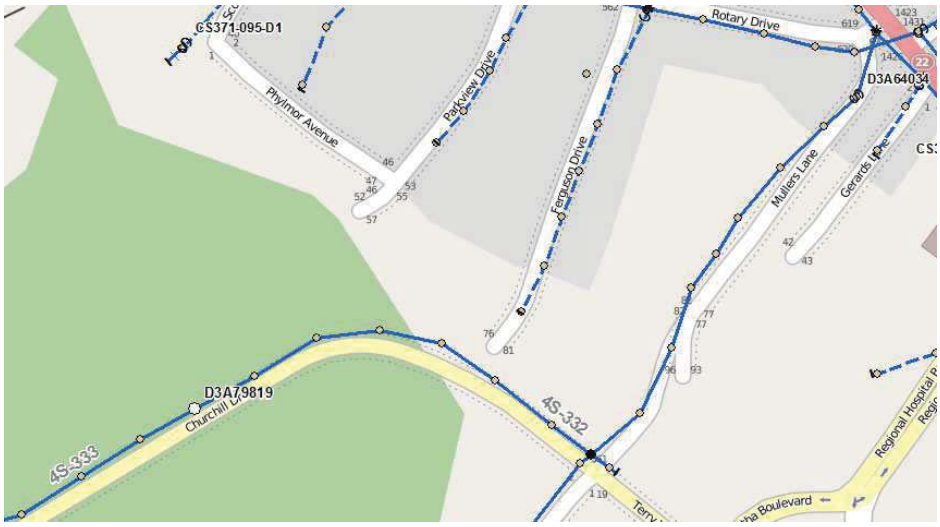


Figure 4 Feeder Currently Serving Membertou from George Street area

4.4.2 Cossitt Heights New Housing Development

A new housing development is planned for the Cossitt Heights area. This new subdivision is approximately 114 Acres and is slated to have both detached homes and multi-unit dwellings. This load will be added to one of the following feeders; 4S-324 or 4S-331. The area of this proposed development is shown below, in Figure 5.

Figure 5 Cossitt Heights Residential Development

5.0 SOLUTIONS AND EVALUATION

Membertou is in the midst of large growth, in both residential and commercial developments. Due to the proposed and developing construction, the amount of expected load will exceed the existing capacity available. NSPI is obligated to accommodate this increased load growth, both in the short and long term.

The short term solution to meet this load growth is to create an additional supply into Membertou via existing distribution feeders. This is underway and the additional feeder, 4S-334, will pick up load from Membertou in 2015. Remainder of work will be completed in 2016, which will remove deteriorated off-road sections of 4S-333.

The longer term solution is to construct a new substation to supply this growing load and provide additional contingency to the distribution system in Sydney.

5.1 Mason Street

Currently, there are three feeders capable of supplying the Membertou area: 11S-305, 4S-333 and 4S-332. Two of these feeders, 11S-305 and 4S-333 supply Membertou from the Alexandra Street. 4S-332 enters from the George Street side of the community, but does not supply load in Membertou. Presently, these three feeders are heavily loaded, with 4S-332 serving as the primary supply for the Cape Breton Regional Hospital. Reducing the load on the existing feeder supplying Membertou or the extension of another feeder into Membertou is required to meet the forthcoming load, currently in the early project stages.

There were four alternatives outlined in revision 2 of this study. Alternative 533S-B was selected and capital work is in progress. The Mason Street area has been converted to 12kV and the step-down transformer (533S) has been retired. An additional feeder, 4S-334, will pick up Membertou load in 2015. Work will be completed in 2016 which will allow remaining deteriorated off-road sections of feeder 4S-333 to be removed. Full details of Alternative 533S-B are outlined below. Other alternatives have been removed in this revision.

5.1.1 Alternative 533S-B Convert 533S-Mason Street, via Bentinck Street

Alternative 533S-B would see the supply on Kings Road between School Street and Churchill Drive change from 4S-333 to 4S-334. This alternative would also see the conversion to 12kV of the islanded 4kV supplied by 533S-Mason Street to 12kV. Also included in this alternative would be the creation of another supply into Membertou via Towerview Place. Refer to Figure 6 for an overview of this proposed work.

Currently, Kings Road is supplied by 4S-333 which has a large off-road section, between Townsend Street and Kings Road. This off-road section is along the existing railway tracks, limiting access and prolonging response time to faults on this section of line. This off-road section is deteriorated and approaching its end of service life. Feeder 4S-334 currently supplies a portion of Kings Road from Falmouth Street to just prior to School Street; extending 4S-334 along Kings Road would be accomplished through the reconfiguration of the distribution at the Kings Road and School Street intersection. This reconfiguration would enable the use of a lightly loaded feeder, 4S-334, to supply Kings Road and Membertou.

In addition to resupplying a portion of Kings Road, the removal of the islanded 4kV supplied by 533S-Mason Street would also be addressed. The conversion, as outlined in Alternative 533S-A would entail the conversion of the lone 4kV feeder, 533S-211, to 12kV. Supplying this new section of 12kV would be accomplished through the rebuilding of Bentinck Street and supplying Argyle Street via 4S-333.

With the newly converted section of 4S-333 along Alexandra Street, the opportunity exists to create an additional supply into Membertou, as outlined in Alternative 533S-A, through the extension and rebuilding of Alexandra Street from Xavier Drive to Castle Drive. Extending the 3 phase circuit along Towerview Place to the Millard Street intersection would bring a second lightly loaded feeder into Membertou, 4S-333.

The detailed outline of this conversion and feeder tie creation is outlined in the recommendations section of this study.

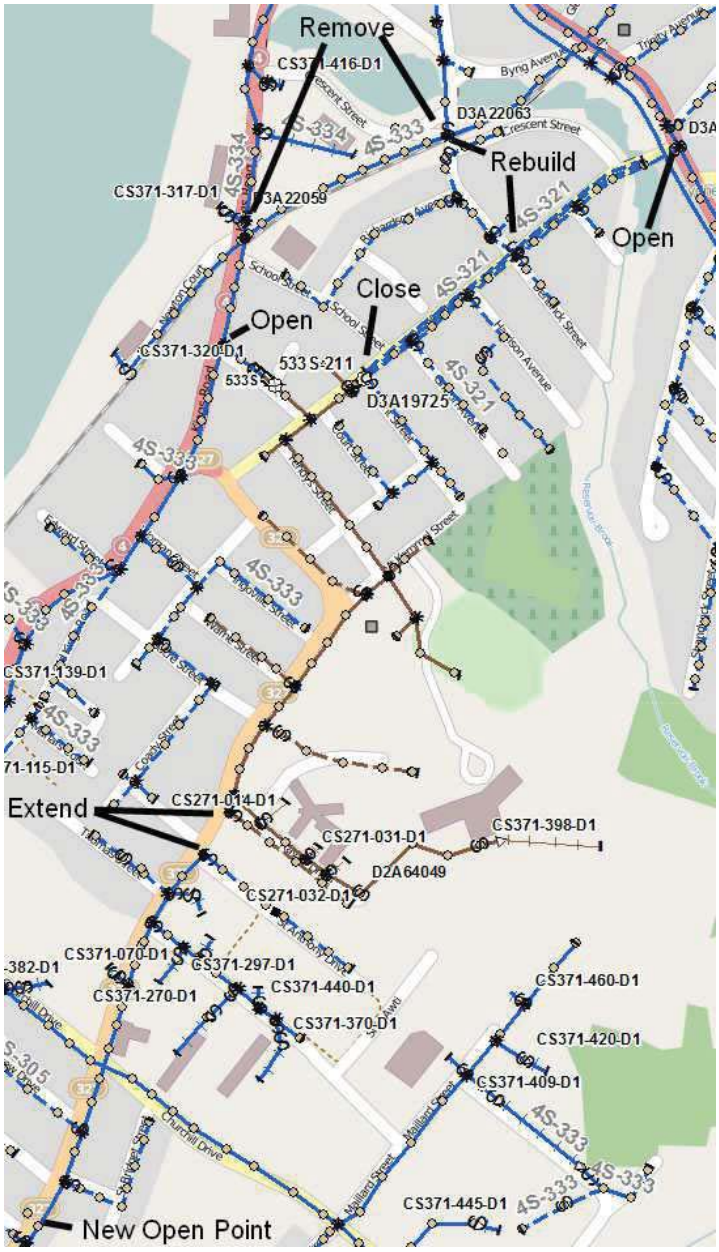


Figure 6 Alternative 533S-B Reconfigure Shipyard Supply

5.2 6S-Terrace Street

The substation infrastructure at the 6S-Terrace Street substation is approaching its end of service life. In order to extend the service life of the substation, the replacement of the existing breakers with reclosers is

required. In order to facilitate the replacement of these breakers, an overall reduction of load on 6S-T1 is necessary. Additionally, the 4kV distribution plant supplied by 6S-Terrace Street is approaching end of service life. This eventually leads to the planned retirement of 6S-T1 upon completion of the 4kV conversion.

There were three alternatives outlined in revision 2 of this study. These alternatives explored the timing conversions and retirement date for 6S. The fourth alternative to rebuild 6S with a new 69-4kV transformer was not considered since the 4kV voltage level is being phase out in Nova Scotia. The sections on each alternative have been removed in this revision as they only spoke to the timing of the recommended work.

The recommended solution would see retirement of 6S-Terrace Street by 2021. Capital work is in progress: initial 4kV to 12kV conversions are complete, which allow the mobile transformer to be installed under peak conditions, without the need to transfer a portion of the load to 534S. Upgrades to 6S will be completed in 2015, as outlined in recommendations section. The retirement of 6S-Terrace Street is planned for 2021, but this will depend on completion of remaining conversions which are dependent on the progress of other capital work outlined in this study.

5.3 Sydney Transformation

To meet the anticipated load growth in the Membertou area, a new source in Sydney will be required. Given the layouts at both 4S-Townsend Street and 11S-Keltic Drive, the ability to install additional feeders to supply developing load would be quite difficult. It makes sense to have a new source close to developing load.

Revision 2 of this study recommended Alternative Sub-D, the installation of a 15MVA 138-12kV pad-mounted substation at the intersection of existing 138kV transmission corridor and George Street. This recommendation has been re-evaluated since the release of transmission study, 049-2013-TSMG, which indicated a 20MVA reduction on the 69kV load forecast in 2018. The location of this substation was also revised due to issues with the purchase of land at this location. The new proposed location for alternatives Sub-A and Sub-D will be at intersection of Gabarus Hwy and existing 138kV transmission corridor – in Prime Brook. The construction year for all options was also revised to 2016.

The details of the four alternative solutions are outlined in further detail below.

5.3.1 Alternative Sub-A New Substation in Prime Brook

This alternative would address growth in Membertou with construction of a new 15/20/25MVA substation near the transmission right-of-way. This new 138-12kV substation would need to be in service prior to the end of 2016 to meet the developing load in the area. This substation would allow for the offloading of the the 69kV system. The location of this new substation would be near the intersection of existing transmission corridor and Gabarus Hwy. In constructing this substation, an additional 12kV supply would be added to the Sydney area for additional contingency to meet the load growth in the Membertou area. Creating a tap off of L-6539 would remove load from the existing 69kV loop that feeds 4S-Townsend Street, 6S-Terrace Street and 11S-Keltic Drive via 2S-Victoria Junction or 3S-Ganon Road.

Initially 4 new 12kV feeders would be able to provide new feeds to the Membertou community, as well as George Street and Alexandra Street. Additional feeders could be used to reduce loading or for contingency purposes for both 4S-Townsend Street and 11S-Keltic Drive feeders, further reducing loading on the 69kV.

In order for this alternative to proceed, land would need to be acquired and a new tap off of L-6539 would need to be engineered. In addition to this preliminary work, further investigation into the substation design would need to be considered. Refer to Figure 7 below for a proposed location.

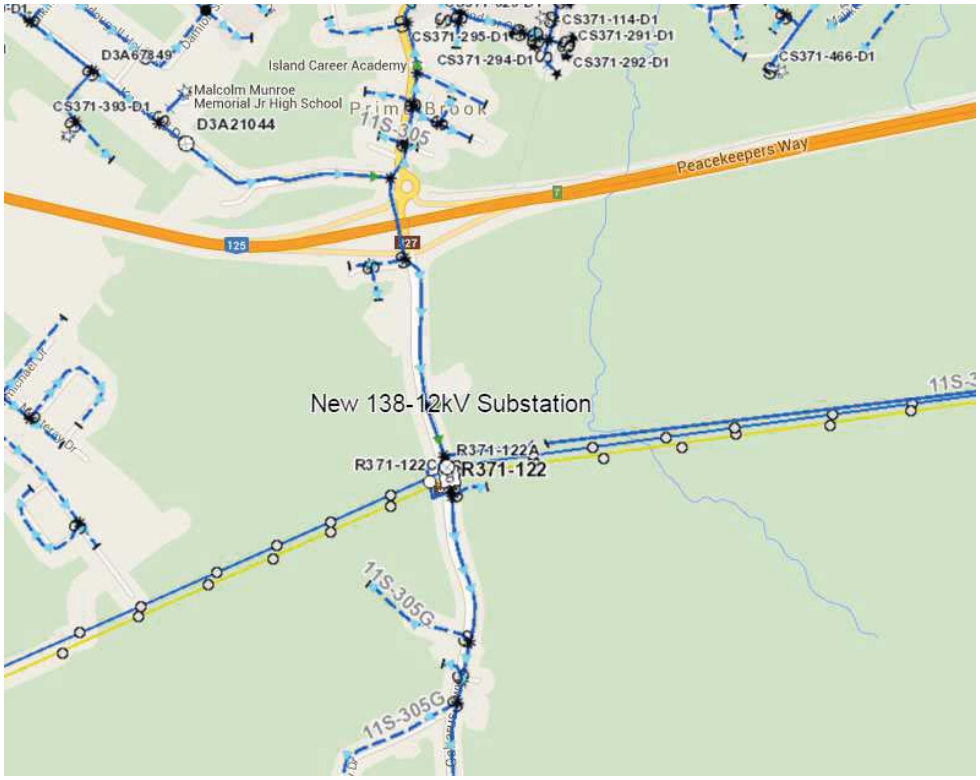


Figure 7Alternative Sub-A Construct New Substation in Prime Brook

5.3.2 Alternative Sub-B New 138-25kV Substation in Prime Brook

Similarly to Alternative Sub-A, the construction of a new substation near the transmission right-of-way would be capable of supplying the newly developing load in the Membertou area. Construction of the new 15/20/25MVA 138-25kV substation would be off of the Highway 327, near the transmission corridor and within close proximity to the existing 25kV distribution feeders in Sydney River. In constructing this substation, an additional 15/20/25MVA 25kV supply would be added to the Sydney area for additional contingency of 11S-Keltic Drive and to meet the load growth in the Membertou area. Creating a tap off of L-6539 would transfer existing load from the 69kV loop that supplies 4S-Townsend Street, 6S-Terrace Street and 11S-Keltic Drive, via 2S-Victoria Junction or 3S-Ganon Road. The loading on the 69kV loop would be further reduced with future customer conversions from 12kV to 25kV, in Sydney River and on Alexandra Street.

These new 25kV feeders would be able to provide feeders directly to the new growth in Membertou. Conversion of portions of Sydney River would enable the creation of new feeder ties between the new feeders and 11S-Keltic Drive 25kV feeders.

In order for this alternative to proceed land would need to be acquired and a new tap off of L-6539 would need to be engineered. In addition to this preliminary work, further investigation into the substation design would need to be considered. Refer to below Figure 8 for a proposed location.

Figure 8Alternative Sub-B Construct New Substation on Alexandra Street

5.3.3 Alternative Sub-C New 69-12kV transformer at 6S-Terrace Street

To meet the planned growth in Membertou, a new 69-12kV 7.5/10/12.5MVA power transformer would be installed, at the 6S-Terrace Street property, in 2015. This new transformer would initially be limited to loading, as the existing 4kV load is reduced. The new transformer would assume the load of the current 4kV transformer, upon load conversions to 12kV.This new transformer would also provide an alternate supply to the George Street area.

Another substation, possibly a padmount design would be required to further supply the Membertou load as it continues to materialize. The padmount substation would require a smaller footprint and be able to supply an additional two feeders to the developing load. It is estimated that this substation would be required in 2017, as the load growth continues, in Membertou. Annual monitoring of the load growth in the Sydney area would be required to ensure that the installation of additional transformation in the area coincides with the continued load growth in the area.
Refer to Figure 9 for an overview of the area.

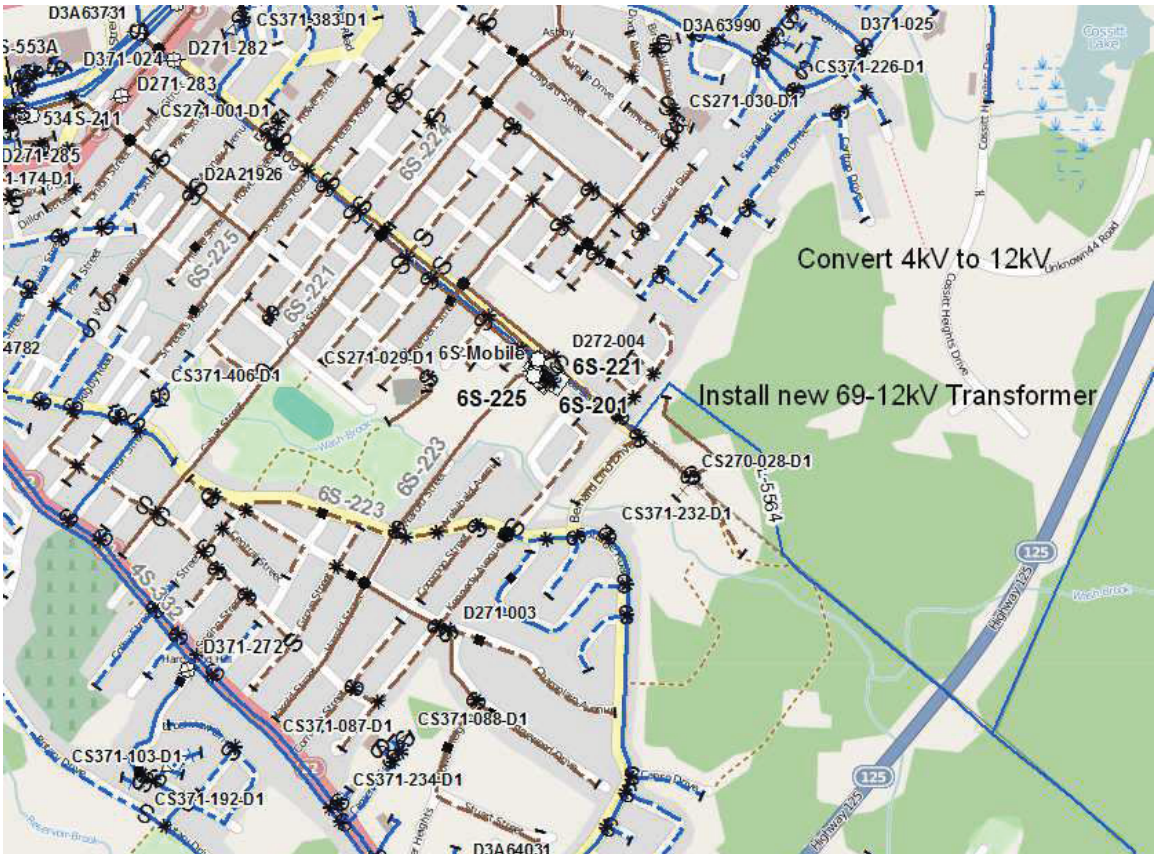


Figure 9 Alternative Sub-C Install New 69-12kV Transformer

5.3.4 Alternative Sub-D New 138-12kV Pad-Mounted Substation

This alternative is similar to Alternative Sub-A, in that a new 15MVA 12kV source would be constructed near the 138kV transmission corridor and George Street. Refer to Figure 10 below. The alternatives differ, in that this substation will have less capacity and be pad-mounted in design. The new 15MVA transformer would be supplied via a new tap off of L-6539, one of the 138kV transmission lines in the area. This substation would require less space than a traditional substation and does not require a substation fence, as all of the equipment is dead-front.

Unlike Alternative Sub-A, only three feeders would be supplied via this substation. One of these feeders would supply Membertou via a new highway crossing. This feeder will reduce the loading on the existing Membertou supply (4S-333). The second feeder will continue along the transmission Right of Way (ROW) to Alexandra Street. Load from 11S-305 will be transferred to this new feeder, allowing for a load reduction on 11S-305. The third feeder will extend to George Street and assume a portion of the loading along George Street.

As the load continues to grow, in both the Sydney and Membertou area, continual monitoring will indicate the need for any future additional transformation in the area. Given the modularity of the pad-mounted substation, future installations could occur near the 138kV transmission line, closer to the developing load center, when required. Initially, it was thought that expansion would not be required until 2027, but due to transmission planning requirements, an additional transformer would be required in 2018.

As with the introduction of any new equipment, spare components will be required with the initial purchase, but not necessarily for subsequent applications.

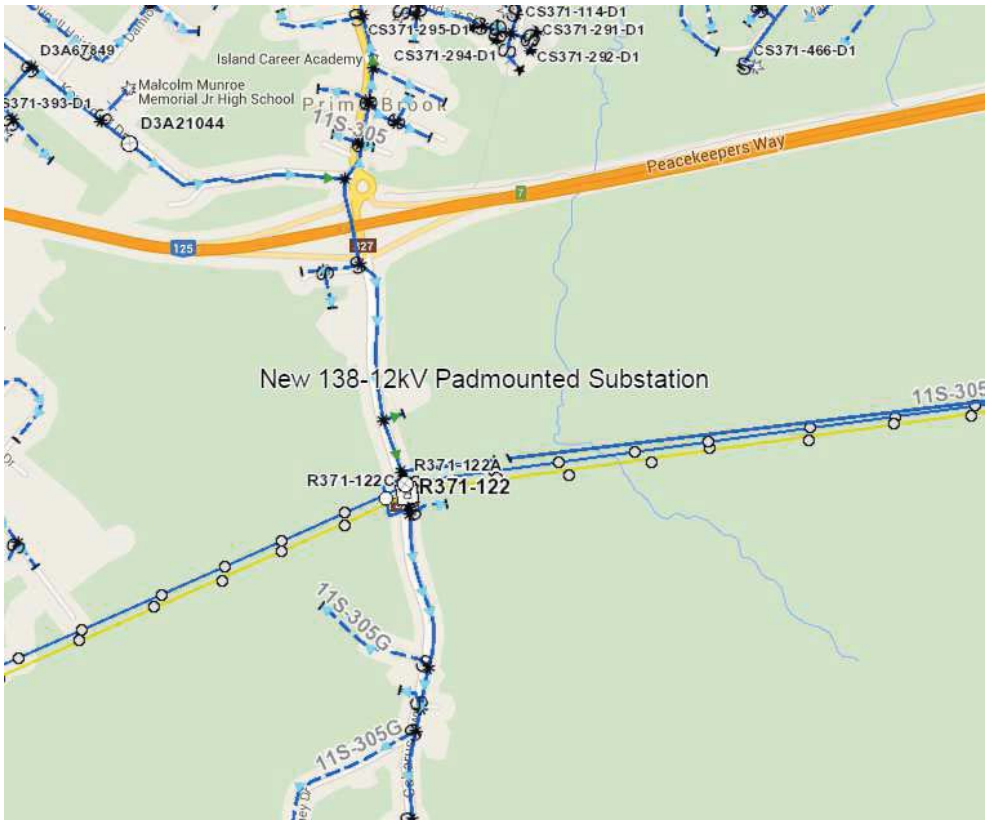


Figure 10 Alternative Sub-D New 138-12kV Pad-Mounted Substation

5.3.5 Sydney Transformation Recommendation

Alternative Sub-D was the least cost option when the Economic Assessment was completed in revision 2 (see Appendix C). With the requirement to remove 20MVA from the 69kV forecast by 2018, an additional pad-mounted transformer must be planned in the short term, rather than 2027. By moving the second pad-mount expansion to 2018, the cost of alternative Sub-D does not offer economic advantage over alternative Sub-A. The additional advantages to alternative Sub-A make it the best choice:

- Less risk due to standard substation construction
- No new spare equipment required
- Standard substation can accommodate mobile transformer, whereas pad-mounted option cannot

A detailed outline of conversions and substation construction is outlined in the recommendations section of this study.

6.0 RECOMMENDATIONS

In summary, the following provide the impetus for the recommendations contained herein:

- The existing feeders supplying the Membertou area are at or near their criteria limits and cannot be utilized to supply the long term capacity needs of Membertou.
- Membertou load growth is forecasted to continue as there are plans for a retail centre adjacent to Hwy125 at the site of the new highway interchange presently under construction
- The 4kV distribution facilities at 6S-Terrace Street are nearing their end of life and key components are obsolete, exposing customers to prolonged outages.
- The 4kV distribution facilities at 533S-Mason Street and 6S-Terrace Street are islanded 4kV that are susceptible to prolonged outages as load cannot be transferred to an adjacent feeder.
- Transmission study has indicated the need to remove 20MVA from 69kV system peak

This study revision does not recommend any change to the capital work underway for the conversion of 533S-Mason Street, as outlined in Alternative 533-B, section 5.1.1.

The recommendation for 4kV conversion and retirement of 6S-Terrace Street is unchanged in this revision. The Economic Assessment Model, refer to Appendix C, recommends the conversions of the 4kV distribution supplied by 6S-Terrace Street be converted to 12kV by 2020, as outlined in Alternative 6S-C, in section 5.2.3. Upon completion of these conversions, the 6S-Terrace Street substation will be retired. The advancement or deferment of these projects may be influenced by factors including: residential/commercial development, feeder reconfigurations and/or ranking of capital projects within the ACE plan.

The second Economic Assessment Model, refer to Appendix D, recommends the installation of a pad-mounted substation, with three feeders prior to the 2015/2016 winter peak. This has been re-evaluated in revision 3 of this study, as outlined in section 5.3. The new recommendation will be for a standard 15/20/25MVA substation constructed in 2016. This added transformation in the Sydney area will meet the area load growth for the next several years and allow for 20MVA reduction of forecasted peak load on 69kV system.

A detailed outline of the components of each of these alternatives is outlined below, organized by capital year completion. The originally recommended capital years were left intact for items that were not modified within this revision of the study. Comments were added to indicate the progress of each recommendation.

6.1 Recommendations by Capital Year

6.1.1 2013 Capital Year

The capital items to be completed in 2013 include the work associated with the conversion of 533S-Mason Street, as well as the work associated with the reduction of 4kV load at 6S-Terrace Street, to enable the retirement of the existing breakers at the substation.

The Shipyard Area Reconfigure and Mason Street Conversion were grouped as one capital item that is well underway. Full completion expected in summer 2015.

The Cabot Street and Rockdale Avenue conversions are complete and the 6S-Terrace Street substation upgrades are in their final stages.

6.1.1.1 Shipyard Area Reconfigure

This portion of the project outlines the change of supply within the Shipyard area, of Sydney. The supply for Kings Road will be changed from 4S-333 to 4S-334.The supply for Argyle Street will also be changed from 4S-321 to 4S-333. Refer to Figure 11 below. The details of this work are as follows:

- Dead-end 4S-333 adjacent to railway tracks, at Bentinck Street and open.
- Jumper 4S-334, to the existing 4S-333, on Kings Road.
- Remove the de-energized section of 4S-333, adjacent to the railway tracks, from Kings Road to Bentinck Street.
- Rebuild Bentinck Street, from Crescent Street to Argyle Street, to 3 phases.
- Open Argyle Street at George Street.

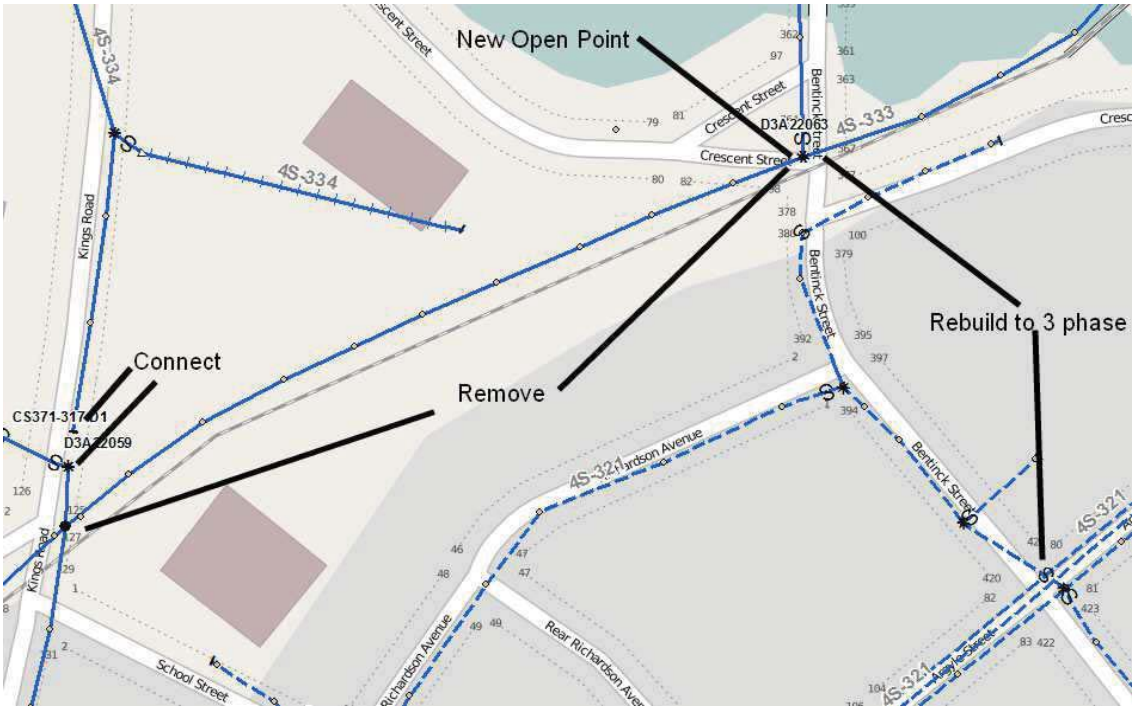


Figure 11 2013 Reconfigure Supply to Shipyard Area

6.1.1.2 533S- Mason Street Conversion

This portion of the project will convert 533S-Mason Street changing the supply to the area from Kings Road to Argyle Street. This portion of the project will also see the removal of the 533S-Mason Street stepdown, upon completion of the conversion to 12kV. Upon completion of this portion of the project, Alexandra Street will be supplied by 4S-333 from Yendys Street to Harbourview Drive. Refer to Figure 12 below. The details are as follows;

- Reconductor Mason Street to 336.
- Open Mason Street, at Kings Road
- Close D3A19725 on Argyle Street, at Kent Street
- Replace neutral on Argyle Street and Yendys Streets to 4/0.
- Reconductor primary and neutral on Xavier Drive to 2/0ACSR.
- Remove single phase primary on Xavier Drive.
- Convert area from 4kV to 12kV.

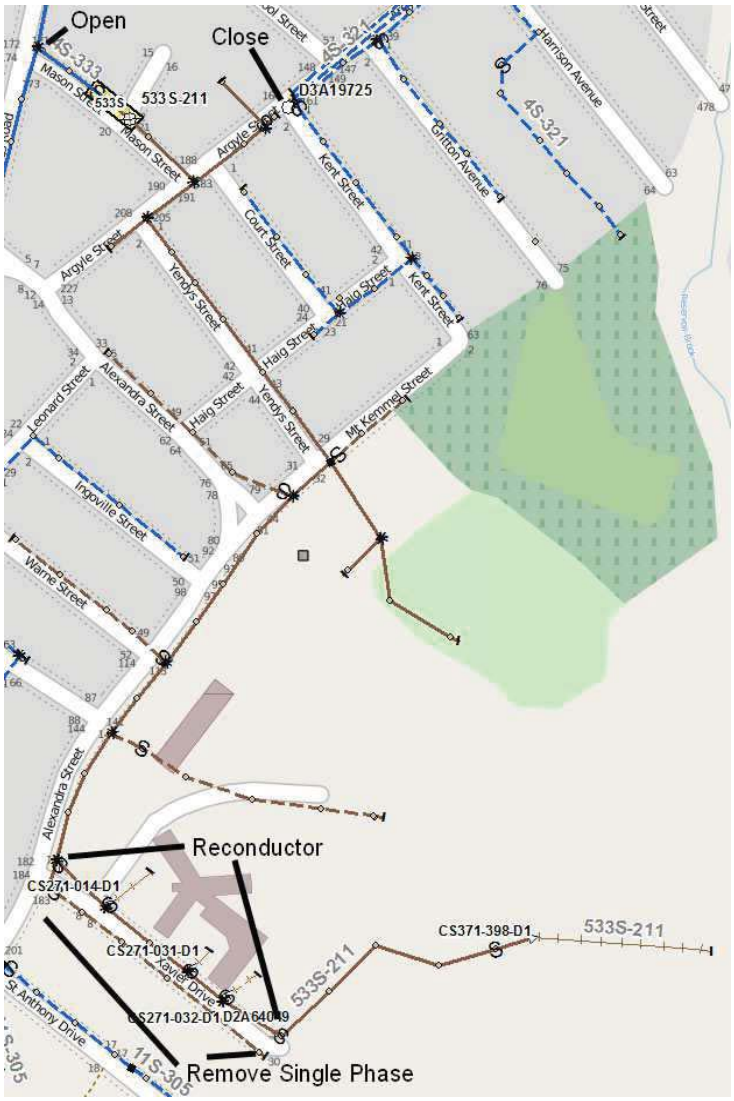


Figure 12 2013 533S-Mason Street Conversion

6.1.1.3 Cabot Street Conversion

This portion of the project will convert Cabot Street, north of Terrace Street. This conversion, along with the Rockdale Avenue conversion, will reduce the load on 6S-T1, to enable the installation of the mobile substation, minimizing the requirement to transfer load to 534S. Refer to Figure 13 below. This will be accomplished by:

- Fill in the gap on Cabot Street and Upper Prince Street
- Create open point at Cabot and Terrace.
- Install open point on Cornwallis Street at McConnell Drive.
- Convert shaded areas, including side streets.

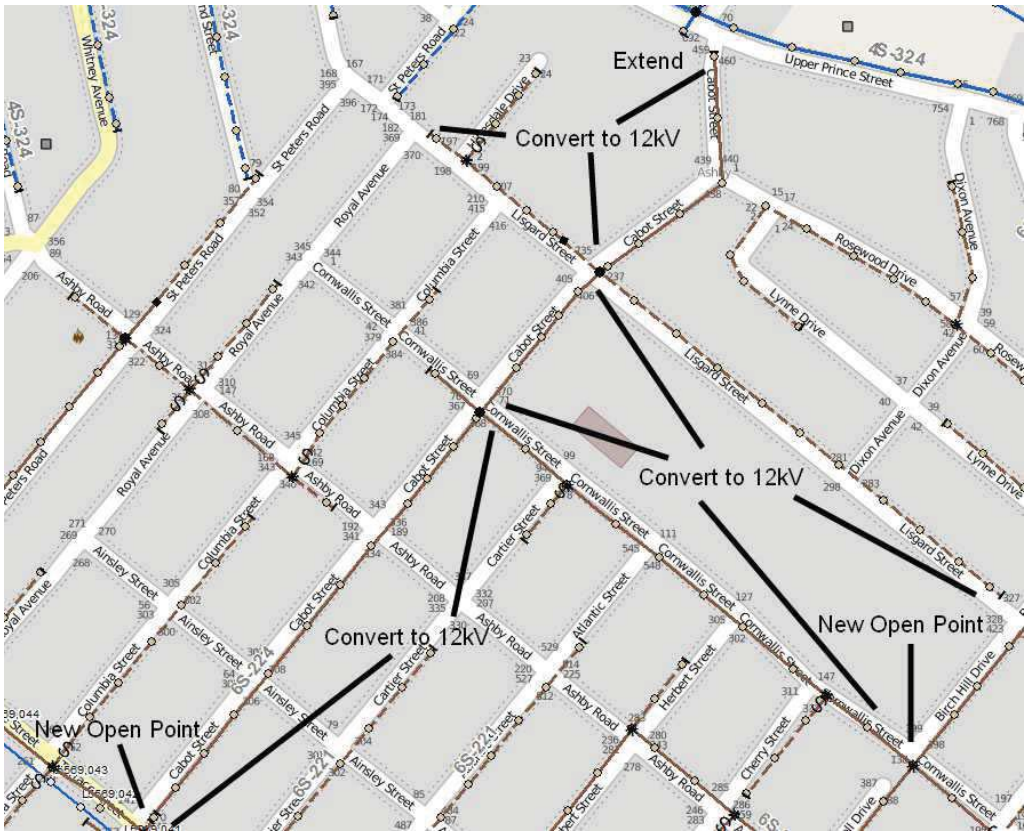


Figure 13 2013 Cabot Street Conversion

6.1.1.4 Rockdale Avenue Conversion

This portion of the project will convert Rockdale Avenue and Cottage Road to Harold Street. This phase of the project will further reduce the overall load on 6S-T1, reducing the need to transfer customer load to 534S, when the mobile substation is installed. Refer to Figure 14 below. This will be accomplished by:

- Close switch at Oxford Street onto George Street.
- Install cutout, on single phase along Cottage Road, at the intersection with Oxford Street.
- Open Harold and Cottage Road.
- Convert Oxford Street, to open point on Cottage Road, from 4kV to 12kV.
- Convert Rockdale Avenue, Champlain Avenue and Cottage Road, to Harold Street, including all side streets and branch lines, as indicated in Figure 14.

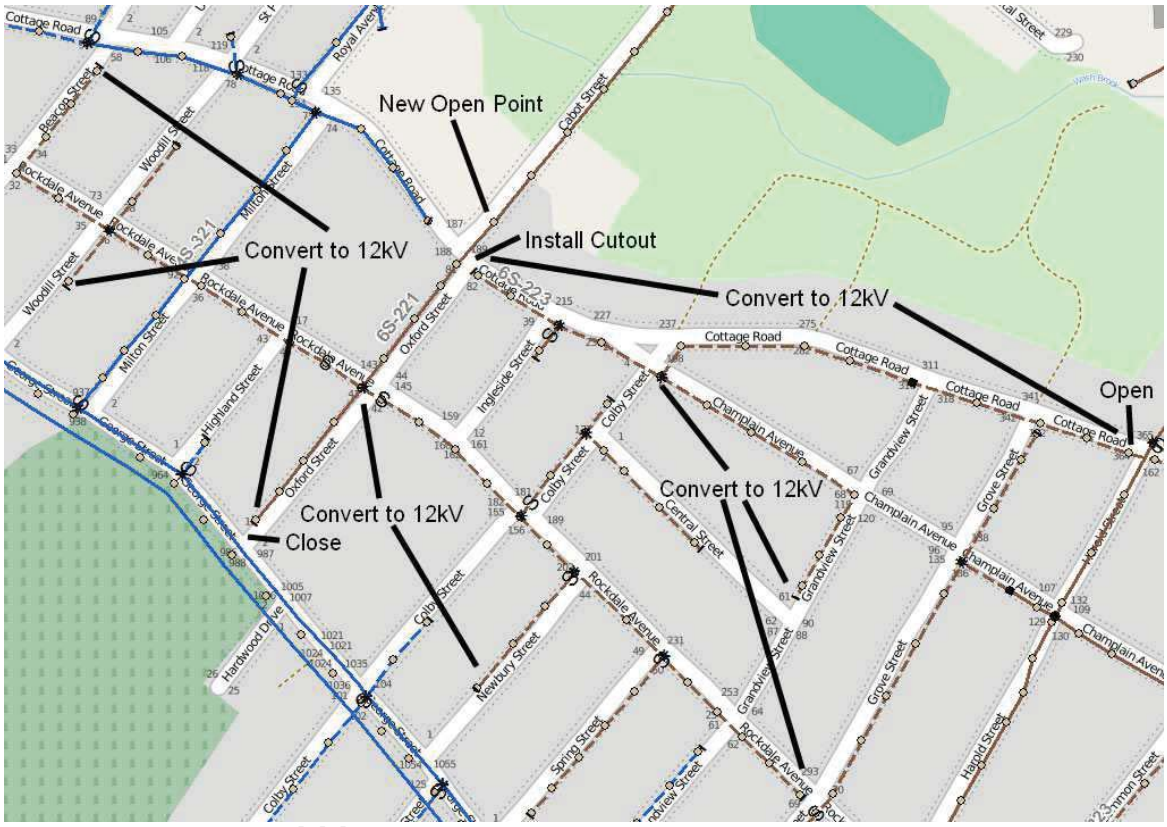


Figure 14 2013 Rockdale Conversion

6.1.1.5 6S-Terrace Street Substation Upgrades

This portion of the project will see the removal of the existing switchgear building, as well as the installation of pole mounted reclosers. This will be accomplished by:

- Installation of three dedicated power cables and buried ducts.
- The installation of three temporary pole mounted reclosers, to be supplied from new power cables.
- Removal of existing 4kV switchgear and building.

6.1.2 2014 Capital Year

The 2014 capital year includes completion of the reconfiguration of the Shipyard area supply, as well as the construction of a new feeder tie into Membertou. This continuation of work will increase the reliability and contingency within the Shipyard and Membertou areas.

The Membertou feeder tie has been completed and the new open point on Kings Road will be done in the summer of 2015. The Bentinck Street upgrades have been deferred until 2016.

New George Street pad-mounted substation preliminary engineering work has been removed.

6.1.2.1 Bentinck Street Upgrades

This portion of the project will upgrade the remaining conductor on Bentinck Street, to enable the removal of the remaining off-road section of feeder, along the railway tracks. This feeder 4S-333, is deteriorated and approaching its end of life. Rebuilding Bentinck Street and reconductoring the previously retired 4kV conductor on Townsend Street will enable 4S-333 to be adjacent to the road, from the substation to the majority of the load it supplies. Refer to Figure 15 below. The details are as follows:

- Reconductor Bentinck Street, from Crescent Street to Townsend Street.
- Reconductor lower circuit on Townsend Street, from 4S-Townsend Street to Bentinck Street, with 336.
- Remove 4S-333, adjacent to the railway tracks, from Bentinck Street to Townsend Street, except for the first two spans from George Street towards Townsend Street.
- Install new 3 phase tap from the remaining portion of 4S-333 to the top circuit along George Street, to supply the customers at the start of Glenwood Street.

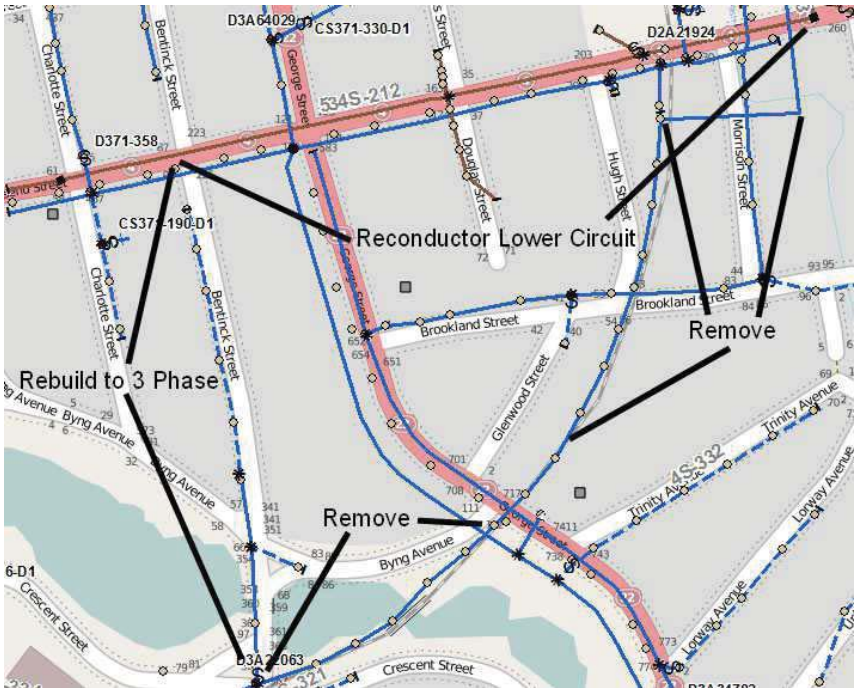


Figure 15 2014 Bentinck Street Upgrades

6.1.2.2 Membertou Feeder Tie

This portion of the project will see the creation of a feeder tie between the recently converted portion of Alexandra Street and the existing feeder on Alexandra Street. Also included in this portion of work is the construction of an additional feeder tie with the primary Membertou supply, on Maillard Street. Refer to Figure 16 below. The details are as follows:

- Extend newly converted 12kV (4S-333) along Alexandra Street to St. Anthony Drive, reconductoring from St Anthony Drive to the new open point with 336.
- Create new, normally closed, solid blade, sectionalizing point on Alexandra Street, at Xavier Drive.
- Create new open point on Alexandra Street, between Castle Drive and Harbourview Drive.
- Reconductor Towerview Place and extend to Maillard Street.
- Create new open point, on Maillard Street, on the north side of the intersection of Churchill Drive and Maillard Street.

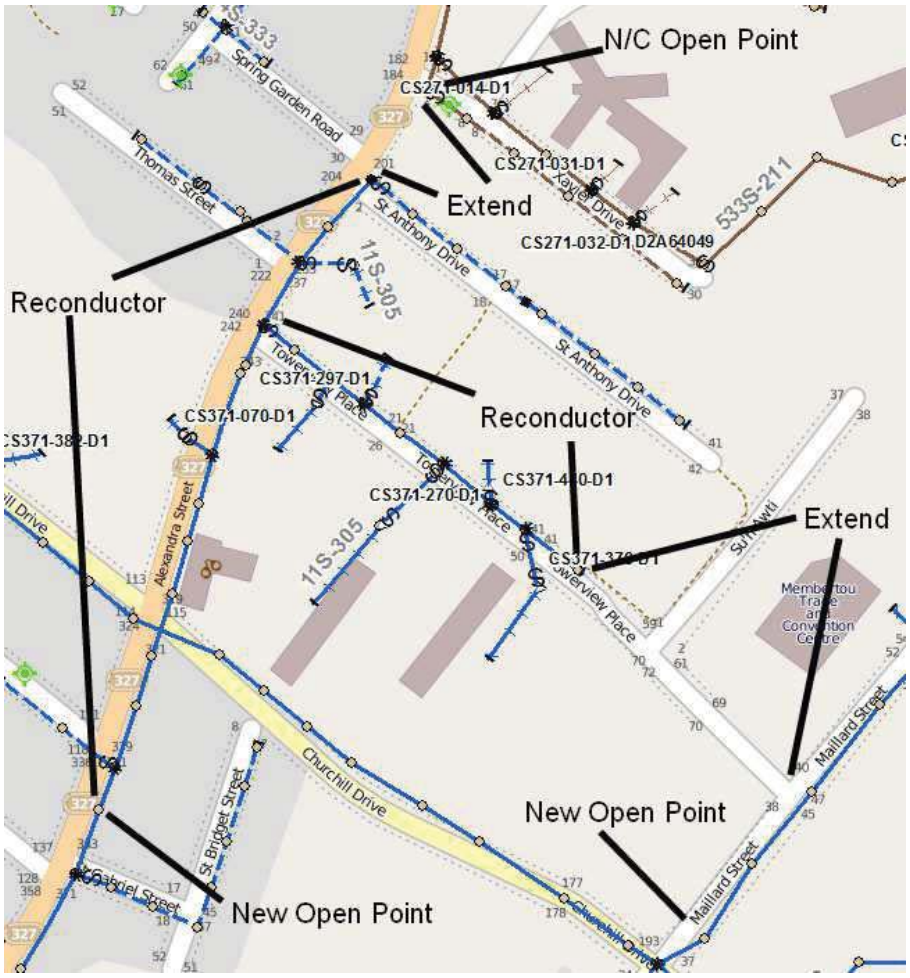


Figure 16 2014 Membertou Feeder Tie

6.1.2.3 New Kings Road Open Point

This portion of the project will enable the transfer of a portion of load from 4S-Townsend Street to 11S-Keltic Drive. This load transfer will reduce the overall loading on 4S-334 that will be supplying Membertou via Churchill Drive. Refer to Figure 17 below. The details are as follows:

- Install new open point on Kings Road, between Harbourview Drive and Churchill Drive.

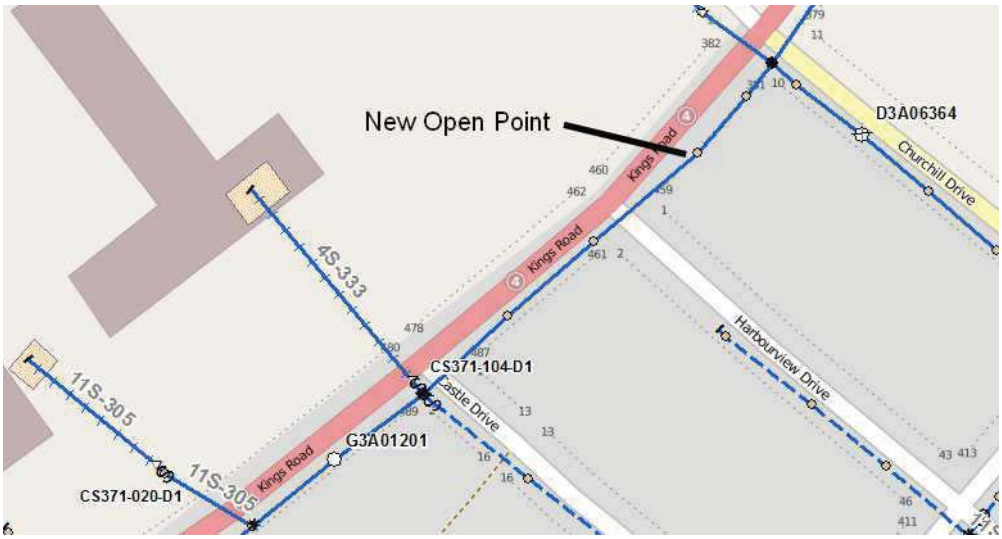


Figure 17 2014 Kings Road Open Point

6.1.3 2015 Capital Year

The capital 2015 work includes the completion of items noted above in 2013 and 2014 Capital Year sections, as well as the preliminary engineering of the new Prime Brook substation. Further 4kV to 12kV conversions at 6S-Terrace Street will be deferred until after substation construction.

6.1.3.1 New Prime Brook Substation Preliminary Work

This portion of the project will detail the preliminary work required with the construction of the new 15/20/25MVA 138-12kV substation on Gabarus Hwy, near the intersection of the 138kV and 69kV transmission lines, L-6539 and L-5564. Refer to Figure 18 below. This will be accomplished by:

- Secure land rights to new substation location.
- Completion of the substation engineering and sourcing of long lead items.

6.1.4 2016 Capital Year

6.1.4.1 New Prime Brook Substation Construction

This portion of the project will detail the construction of the new 15/20/25MVA 138-12kV substation in Prime Brook. Refer to Figure 18 below. This will be accomplished by:

- Construction of a new tap off of L-6539 and the installation of associated equipment.
- Construction of 15/20/25MVA 138-12kV substation and associated equipment.

6.1.4.2 New Prime Brook Substation Feeders

This portion of the project will construct the new feeders, from the new Prime Brook substation. Refer to Figure 18 below. This will be accomplished by:

- Four new feeder exits will be created.
- The first feeder will connect to existing 11S-305 feeder on Gabarus Hwy.
- Existing 11S-305 feeder along transmission ROW will be rebuilt to double circuit which will extend from the substation to George Street and toward Highway 125 up to existing highway crossing. One feeder will tie to existing 4S-321 feeder at highway crossing. The other feeder will extend beyond existing highway crossing and tie to existing 4S-332 feeder. The location of R371-103 will be determined in a subsequent distribution protection study.
- The fourth feeder will extend north of the substation and use existing ducting to cross Highway 125 and tie to existing 4S-333 feeder on Tupsi Drive.

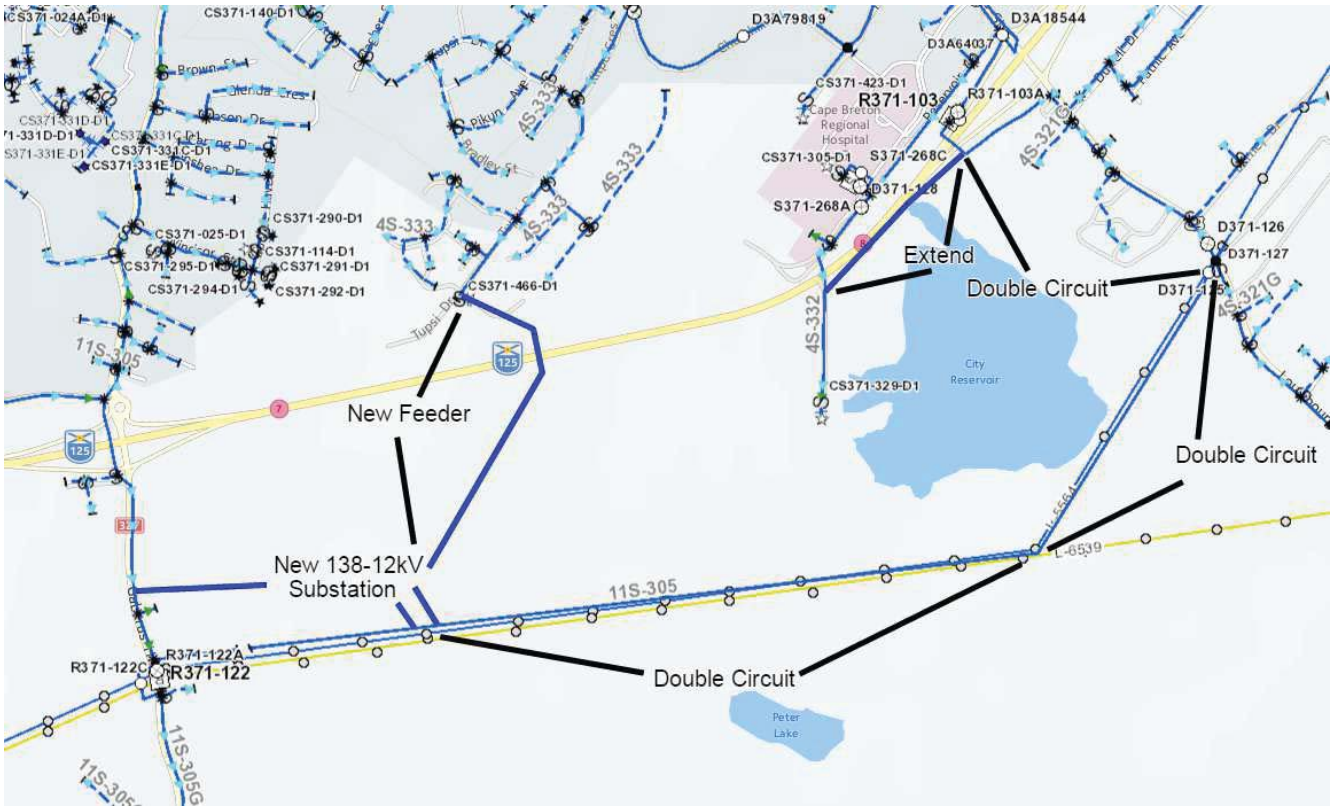


Figure 18 2016 New Prime Brook Substation

6.1.5 2017 Capital Year

Remaining 4kV to 12kV conversions will be dependent on the completion of Prime Brook substation. These conversions have been redistributed based on the new timeline for substation construction. The 2021 retirement of 6S-Terrace Street substation has been maintained.

6.1.5.1 Harold Street Conversion

This portion of the project will see the conversion of the Harold Street area, south of the 6S-Terrace Street substation. This will also include the conversion of the remaining sections of Champlain Avenue, Cottage Road and adjacent streets. This new conversion will be supplied via one of the 12kV feeders, on George Street. The off-road section of the existing 4kV feeder will be removed, between Harold Street and Holly Street. Holly Street will remain at 4kV. Refer to Figure 19below. This will be accomplished through the following:

- Create new N/C open point on Harold Street at George Street.
- Rebuild Cottage Road to Bernard Lind Drive with 3phase, 336ACSR.
- Create a new open point on Cottage Road, at Bernard Lind.
- Convert east of Harold Street to 12kV, as well as Grove Street.
- Remove off-road portion of feeder between Harold Street and Holly Street.
- Extend one phase on Holly Street to Terrace Street and remove the remaining two phases.
- Remove 2 phases from Harold Street, from Cottage Road towards Holly Street.

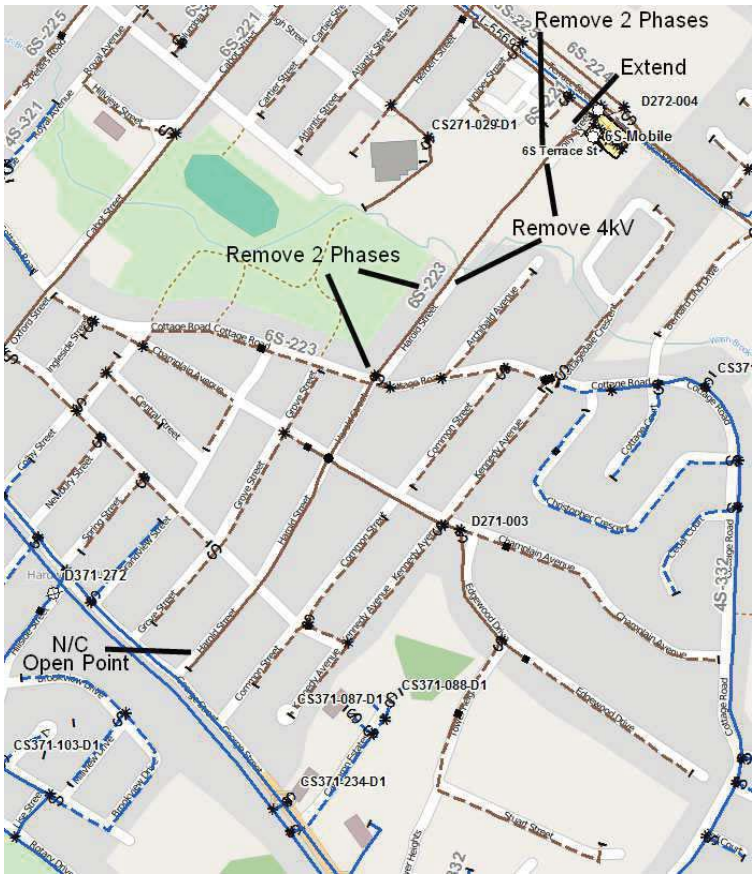


Figure 19 2015 Harold Street Conversion

6.1.5.2 Bernard Lind Drive Rebuild

This portion of the project will convert Terrace Street, east of the 6S-Terrace Street substation. This portion of the project will also see the addition of two phases along Bernard Lind Drive, supplying the area via Cottage Road. Refer to Figure 20 below. This will be accomplished by:

- Rebuild Bernard Lind Drive with three phase 4/0 primary and 4/0 neutral, from Cottage Road to Terrace Street.
- Install a new open point east of the 6S-Terrace Street substation.
- Convert Terrace Street east of the 6S-Terrace Street substation.
- Create new Open Point at the end of Bernard Lind Drive and Cottage Road.

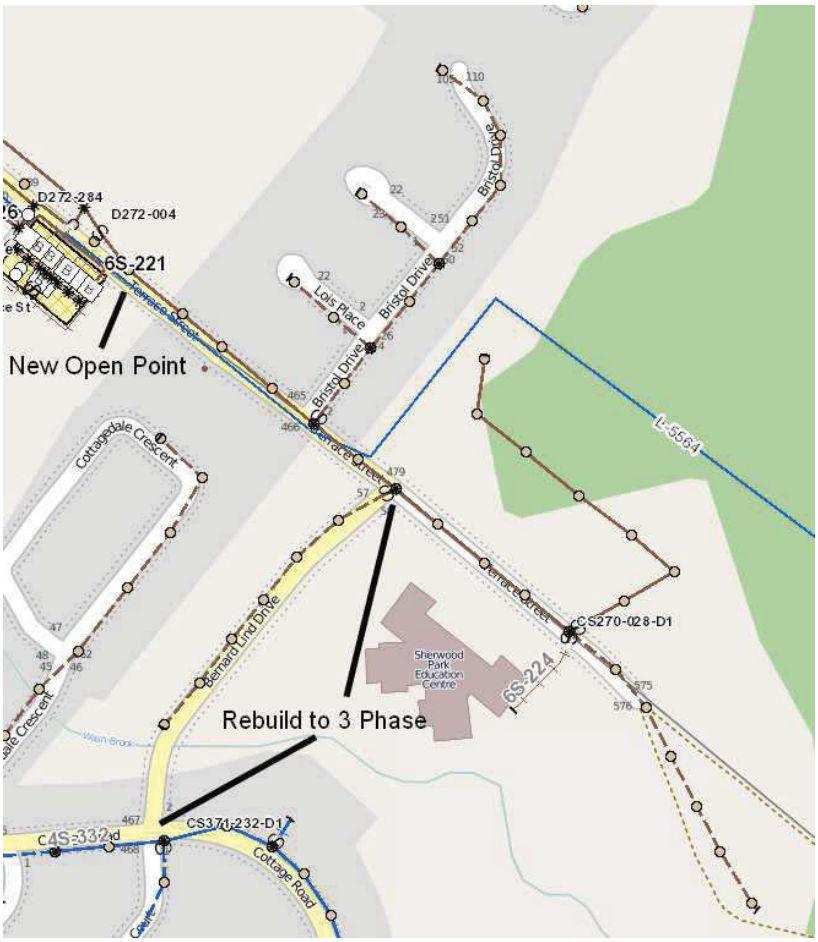


Figure 20 2016 Bernard Lind Rebuild

6.1.6 2018 Capital Year

6.1.6.1 Birch Hill Drive Conversion

This portion of the project will convert Birch Hill Drive and its side streets from 4kV to 12kV. This newly converted section will be supplied via 4S-324. Refer to Figure 21 below. The details are as follows;

- Extend 3phase on Birch Hill Drive to Upper Prince Street.
- Create new N/C open point at the intersection of Birch Hill Drive and Upper Prince Street.
- Convert Birch Hill Drive, McConnell Drive, Ashby Road and Herbert Street to Terrace Street, including side streets, from 4kV to 12kV.
- Change supply of Herbert Street, south of Terrace Street, to 6S-221. This portion of the street will be converted in a following portion of work.

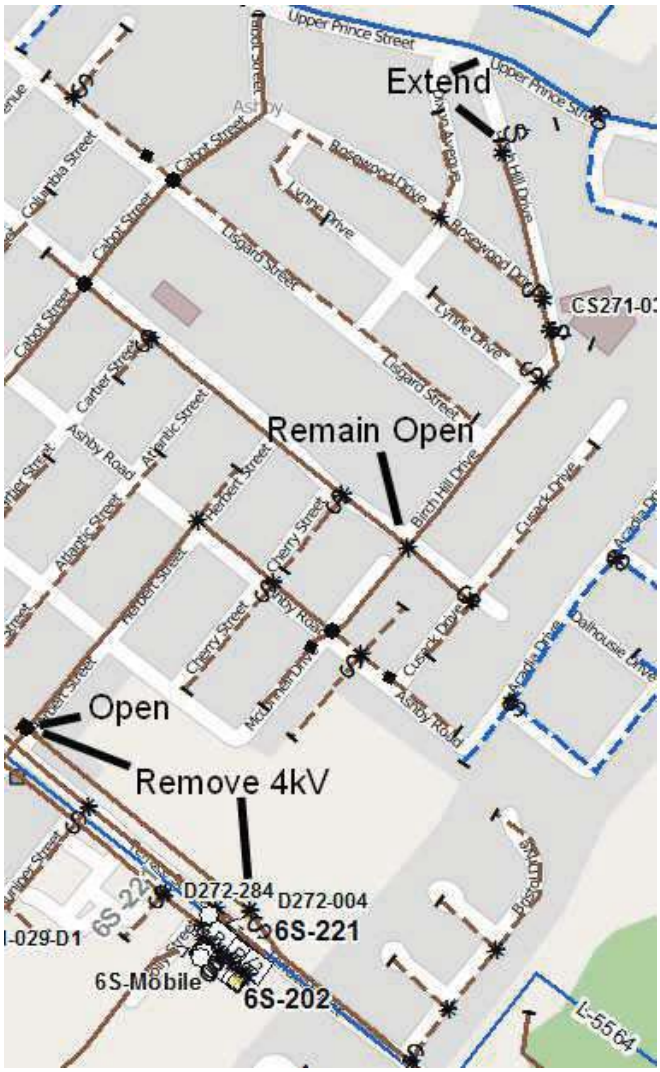


Figure 21 2017 Birch Hill Drive Conversion

6.1.6.2 Townsend Street Conversion

This portion of the project will convert the 4kV customer load on Terrace Street, from St. Peters Road to Townsend Street. The load will be supplied via 4S-324, until the remaining section of Terrace Street is converted. High Street, from St. Peters Road to Townsend Street will continue to be supplied via 6S-225. Refer to Figure 22 below. The details are as follows;

- Install open point on Terrace Street, between Howe Street and St. Peters Road.
- Open Howe Street, between High Street and Terrace Street.
- Install new open point on the north side of the Howe Street and High Street intersection.
- Install new tap on south Howe Street, to High Street.
- Open D271-283.
- Extend High Street to St Peters Road.
- Install new open point on Park Street, at Terrace Street.
- Convert Terrace Street, from St. Peters Road to Townsend Street, as well as the side streets indicated in Figure 22.

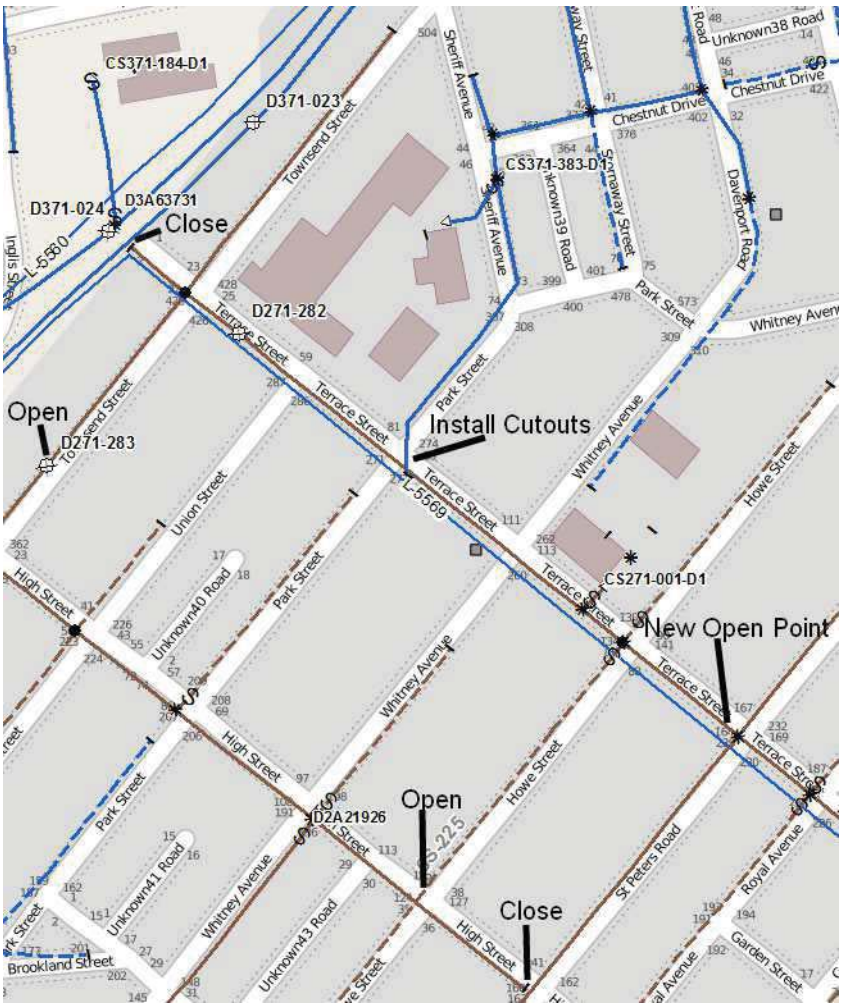


Figure 22 2018 Townsend Street Conversion

6.1.7 2019 Capital Year

6.1.7.1 High Street Conversion

This portion of the project will convert the High Street area, from 4kV to 12kV. The load will be supplied by 4S-324, via the open point on Townsend Street. Upon completion of this portion of work, the 534S stepdown will be removed from service, as there will be no load able to be transferred to it. Refer to Figure 23 below. The details are as follows;

- Close D271-283, on Townsend Street.
- Install new Open Point on Terrace Street, between St. Peters Road and Royal Avenue.
- Convert High Street, from Styles Lane (534S stepdown) to St. Peters Road, including all side streets.
- Convert St. Peters Road, including all side streets.
- Remove 534S stepdown.

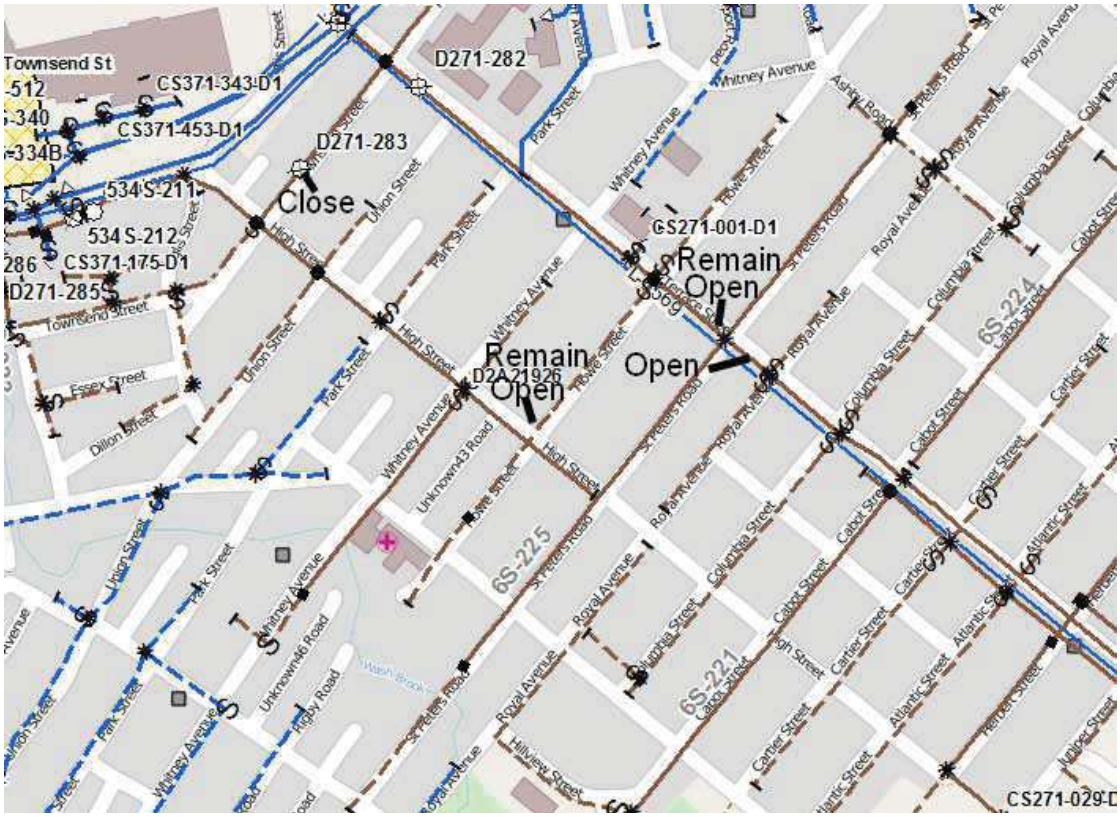


Figure 23 2019 High Street Conversion

6.1.8 2020 Capital Year

6.1.8.1 Terrace Street

This portion of the project will see the conversion of the remaining 4kV, east of the 6S-Terrace Street substation. This conversion will include rebuild of a section of Terrace Street, from the substation to Cabot Street. This rebuild will reduce the feeders along Terrace Street from a maximum of three to one. Refer to Figure 24 below. The details are as follows;

- Convert Terrace Street, from the 6S-Terrace Street substation to St. Peters Road, from 4kV to 12kV, including all side streets that have not been previously converted.
- Rebuild Terrace Street, from the 6S-Terrace Street substation, to St. Peters Road with one, 3-phase 336, circuit.

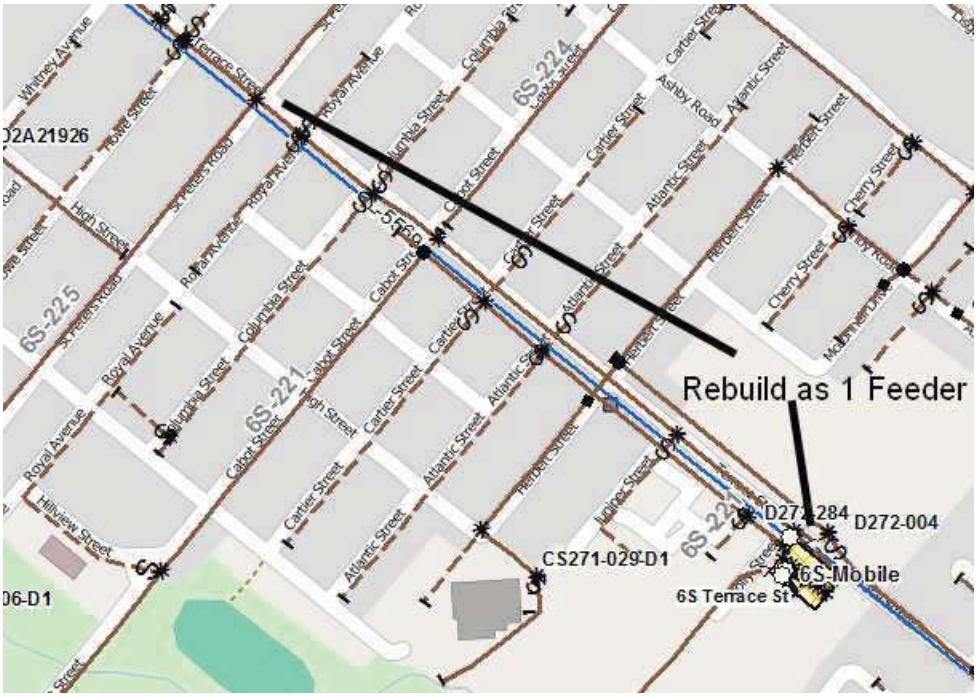


Figure 24 2020 Terrace Street

6.1.9 2021 Capital Year

6.1.9.1 6S-Terrace Street Retirement

This portion of the project will see the retirement of the 6S-Terrace Street substation. This will include the decommissioning of 6S-T1, as well as the removal of most substation equipment. A requirement to modify the 69kV transmission will be necessary, to facilitate the removal of the substation buswork. Refer to Figure 25 below. This will be accomplished by:

- Decommission 6S-T1.
- Reconfigure L-5564, in front of the 6S-Terrace Street substation, to bypass the substation.
- Remove buswork and all NSPI owned equipment.

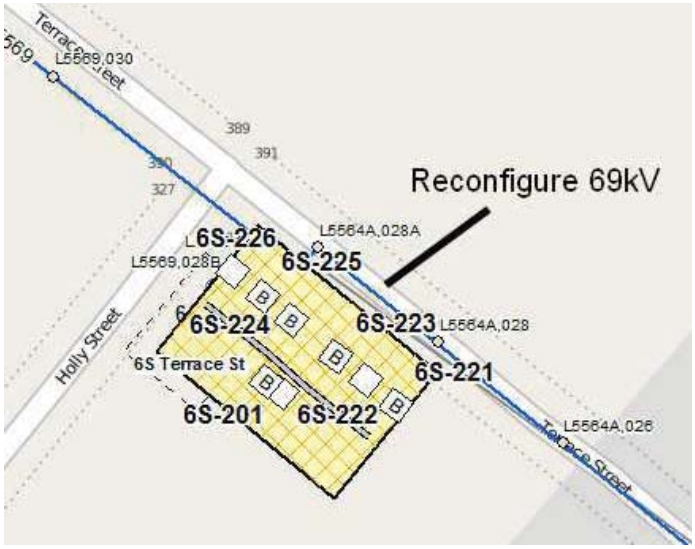


Figure 25 2021 6S-Terrace Street Retirement

APPENDIX A

System Operating Diagrams

THIS DIAGRAM IS CONFIDENTIAL

Figure 26 System Operating Diagram 2S-Victoria Junction

THIS DIAGRAM IS CONFIDENTIAL

Appendix A: System Operating Diagrams

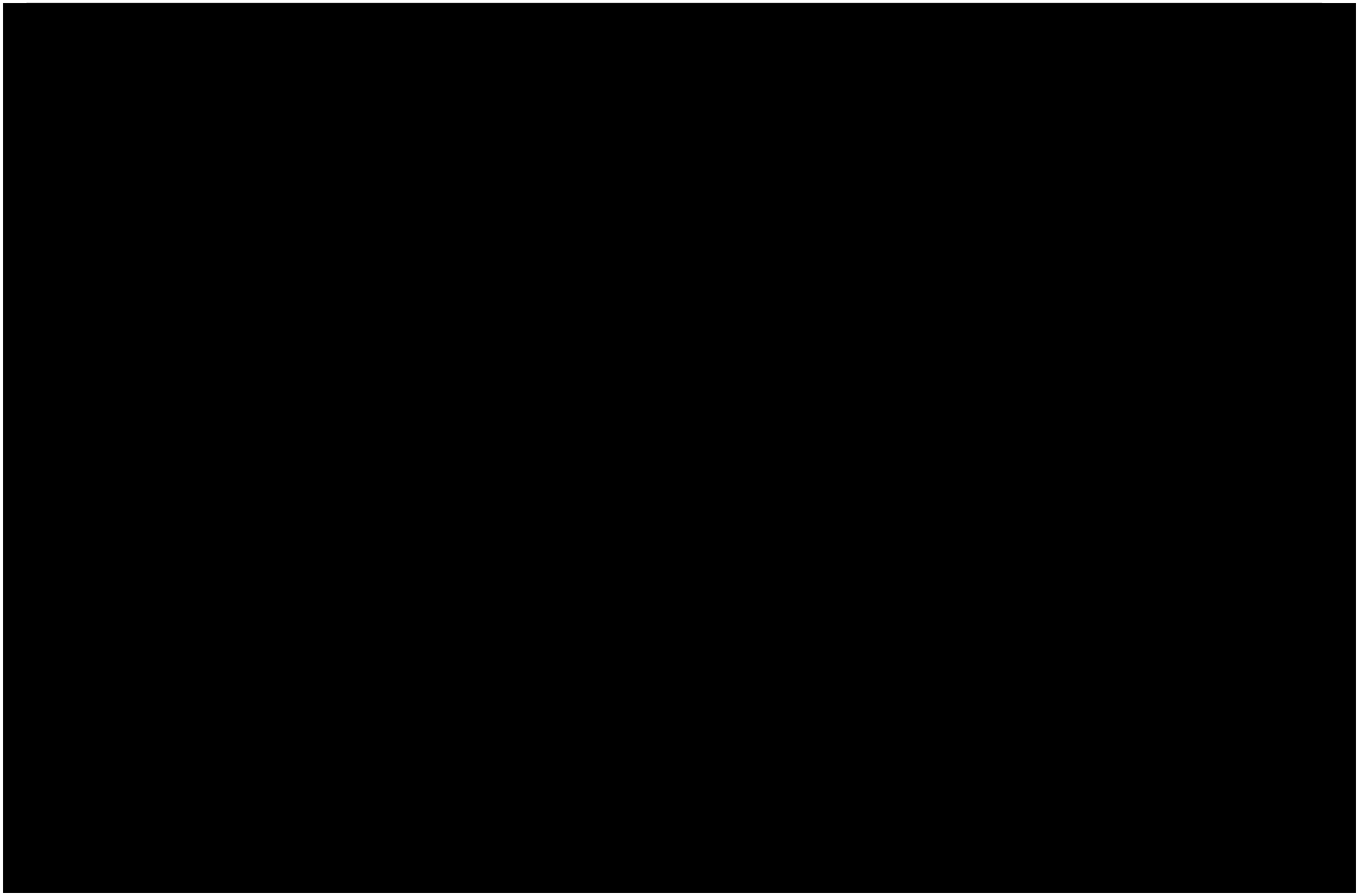


Figure 27 System Operating Diagram 3S-Ganon Road

THIS DIAGRAM IS CONFIDENTIAL

Appendix A: System Operating Diagrams

Figure 28 System Operation Diagram 4S-Townsend Street

THIS DIAGRAM IS CONFIDENTIAL

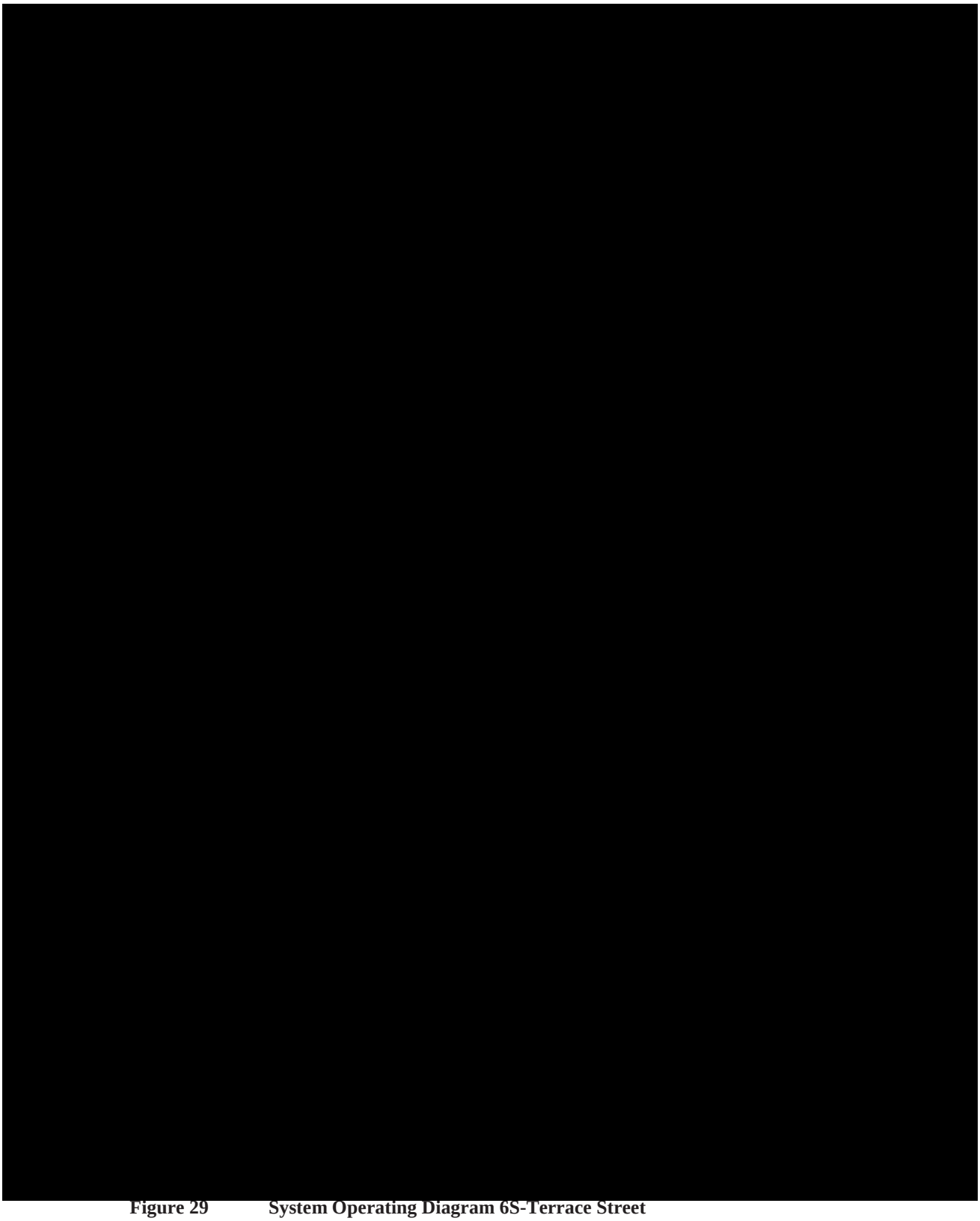


Figure 29 System Operating Diagram 6S-Terrace Street

THIS DIAGRAM IS CONFIDENTIAL

Figure 30 System Operating Diagram 11S-Keltic Drive

THIS DIAGRAM IS CONFIDENTIAL

Appendix A: System Operating Diagrams

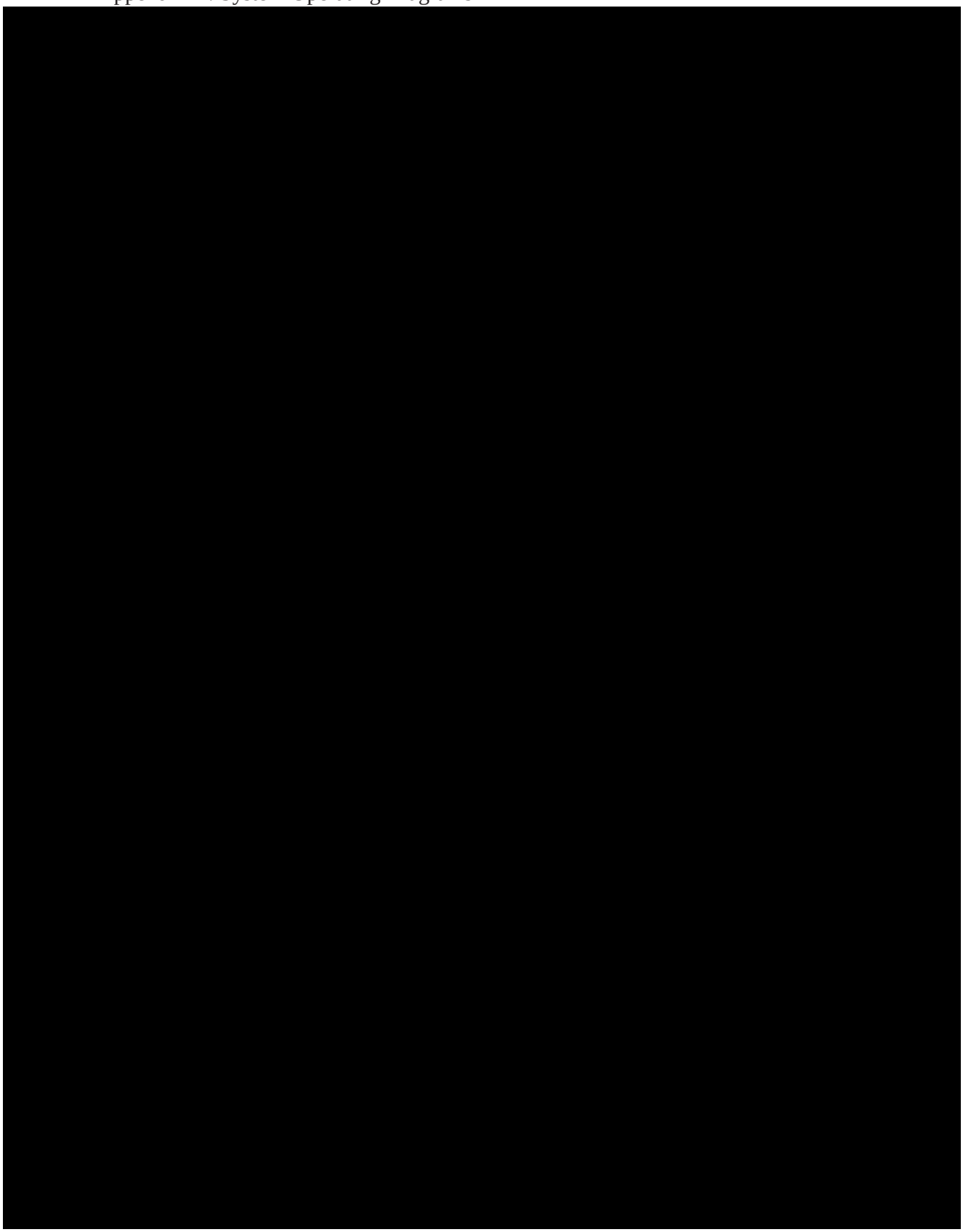


Figure 31 System Operating Diagram 3P-MS Mobile Substation

APPENDIX B

Load History and Forecast

Please refer to section 3.2 Load Forecast for the 90th Percentile Data values

Appendix B: Load History and Forecast

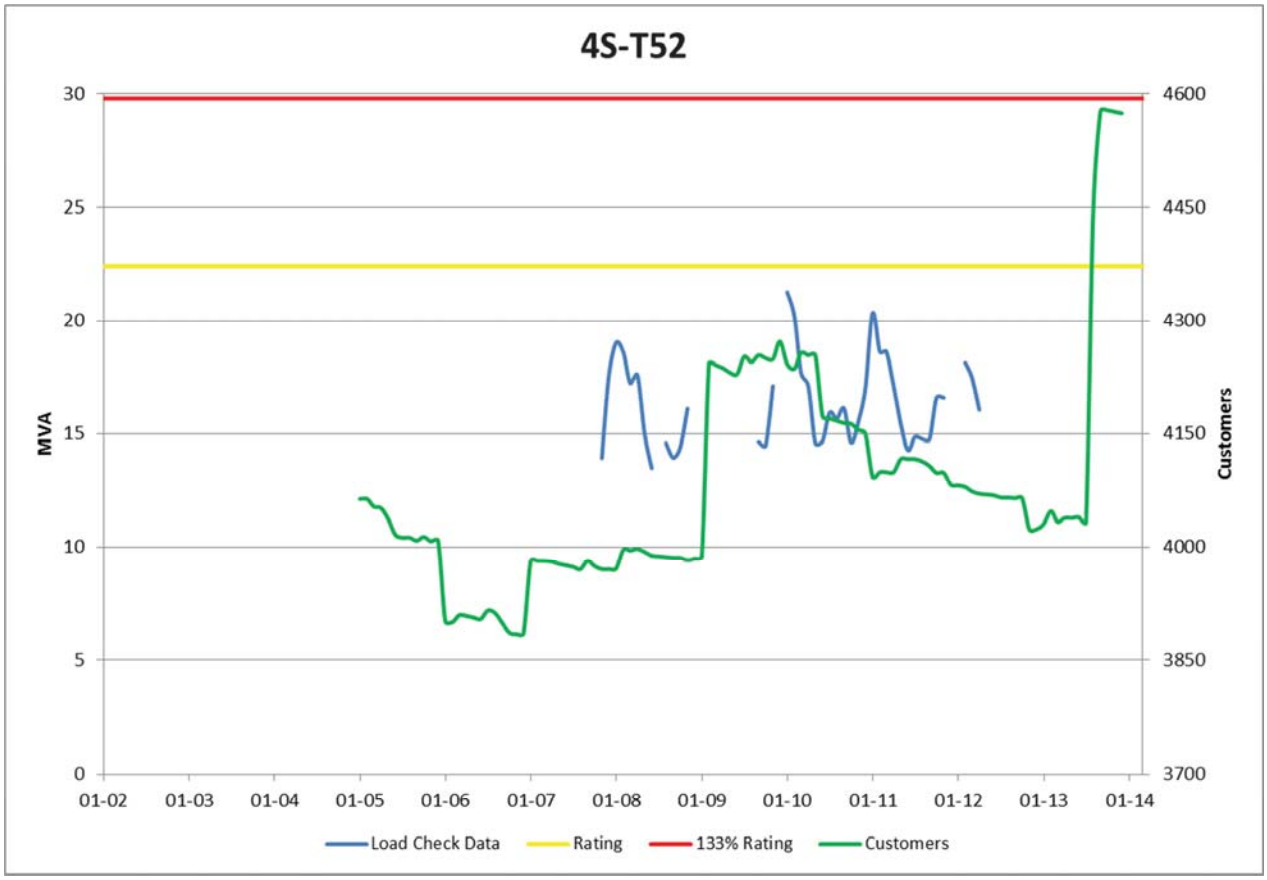


Figure 32 **4S-T52 Load History**

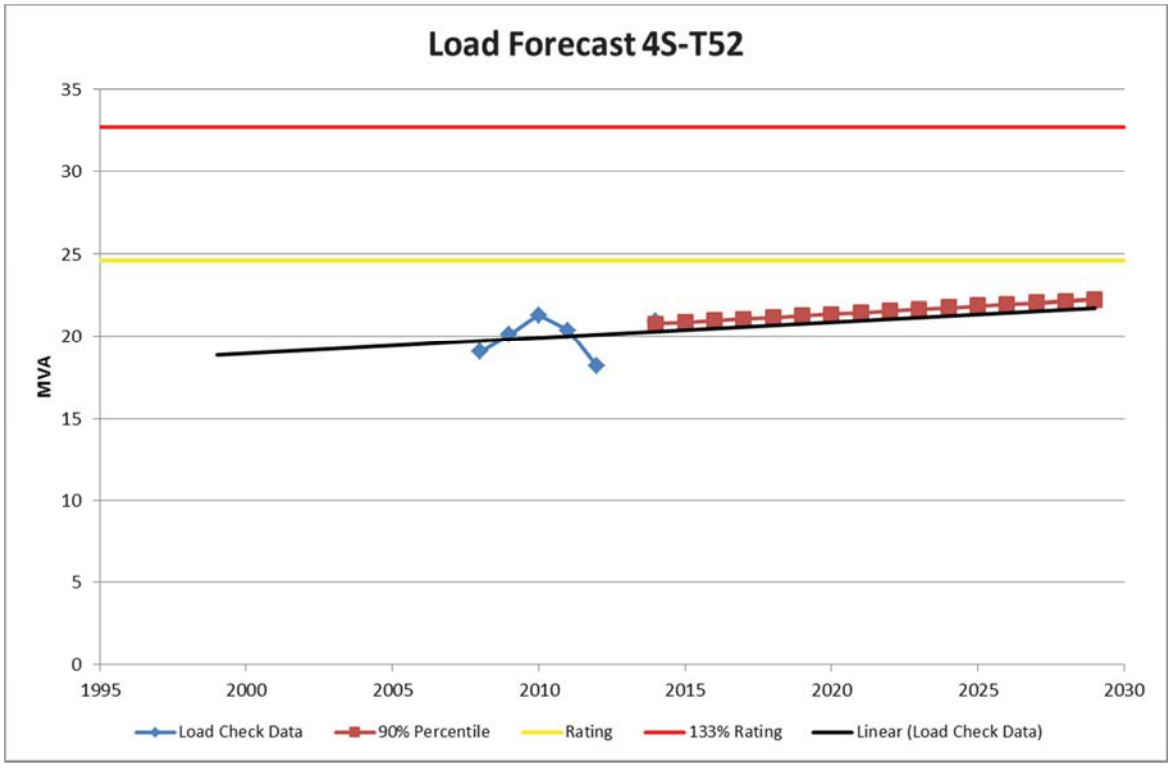


Figure 33 **4S-T52 Load Forecast**

Load Growth **0.42%****

Appendix B: Load History and Forecast

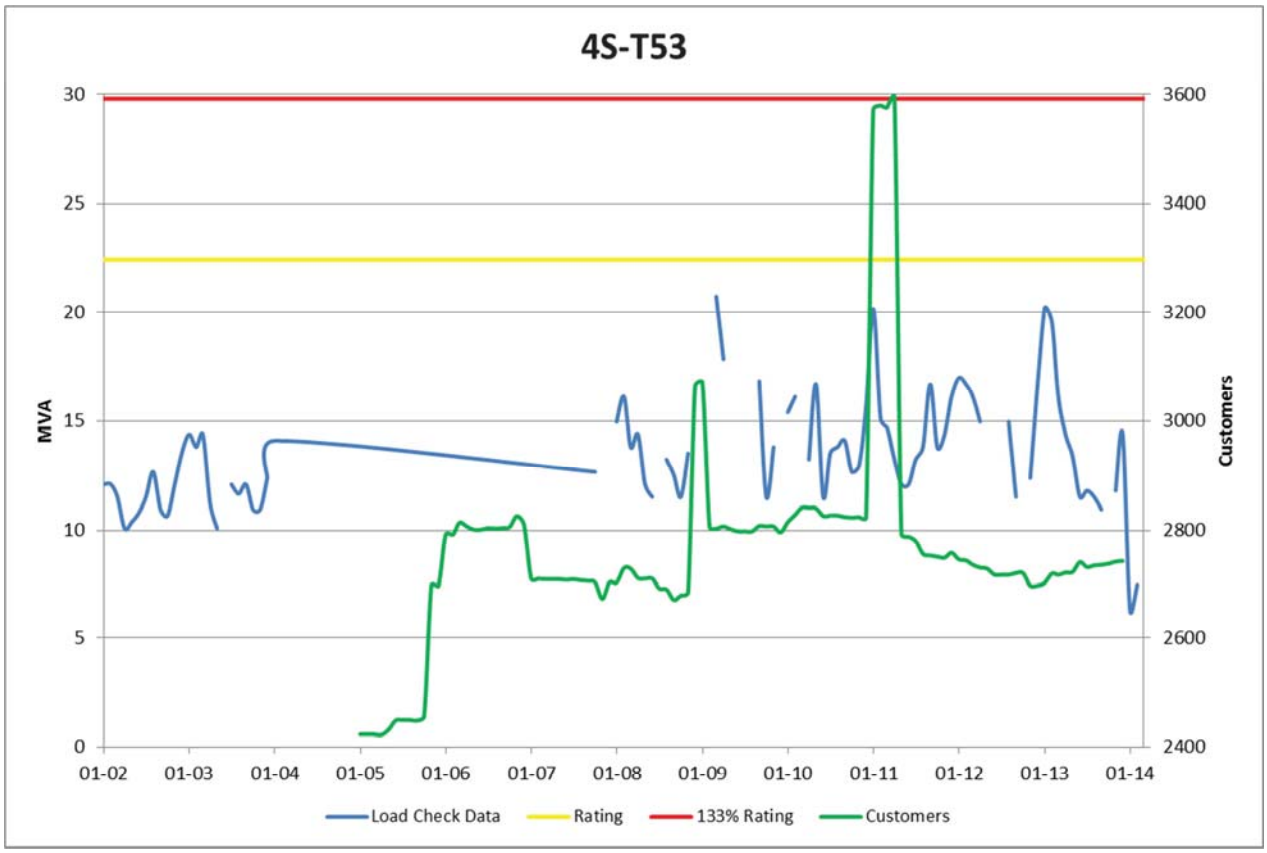


Figure 34 4S-T53 Load History

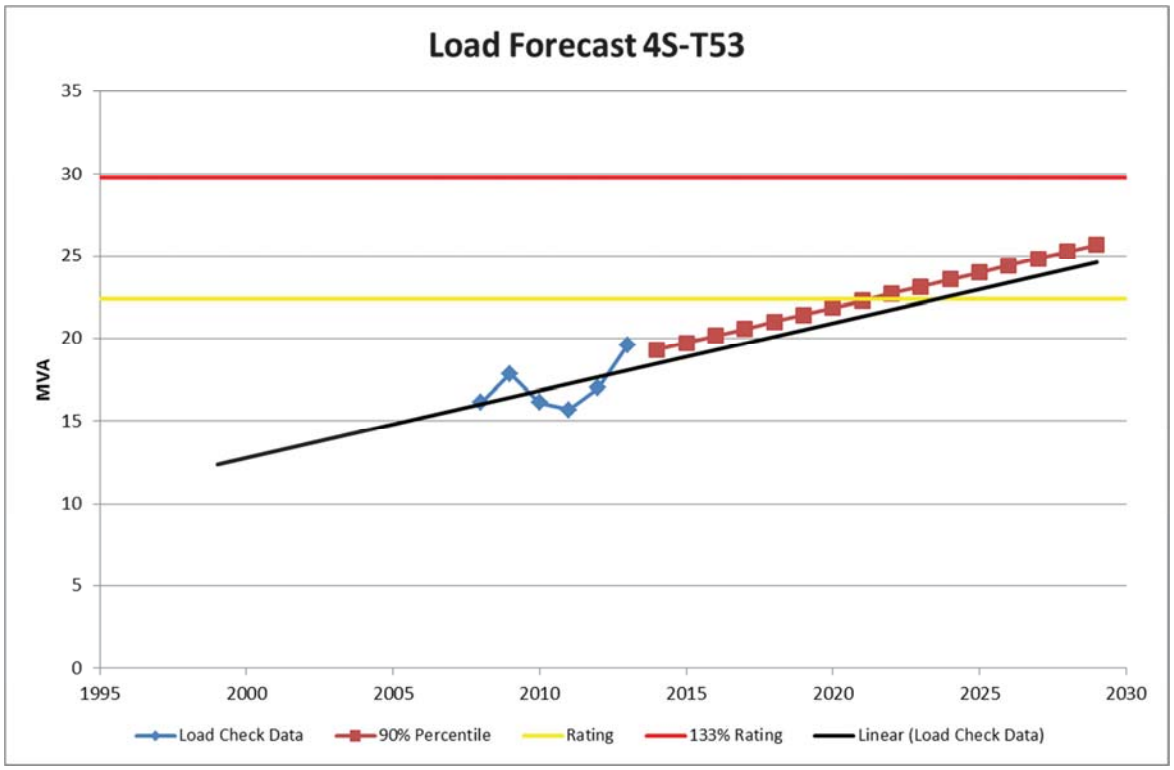


Figure 35 4S-T53 Load Forecast
Load Growth 1.77%

Appendix B: Load History and Forecast

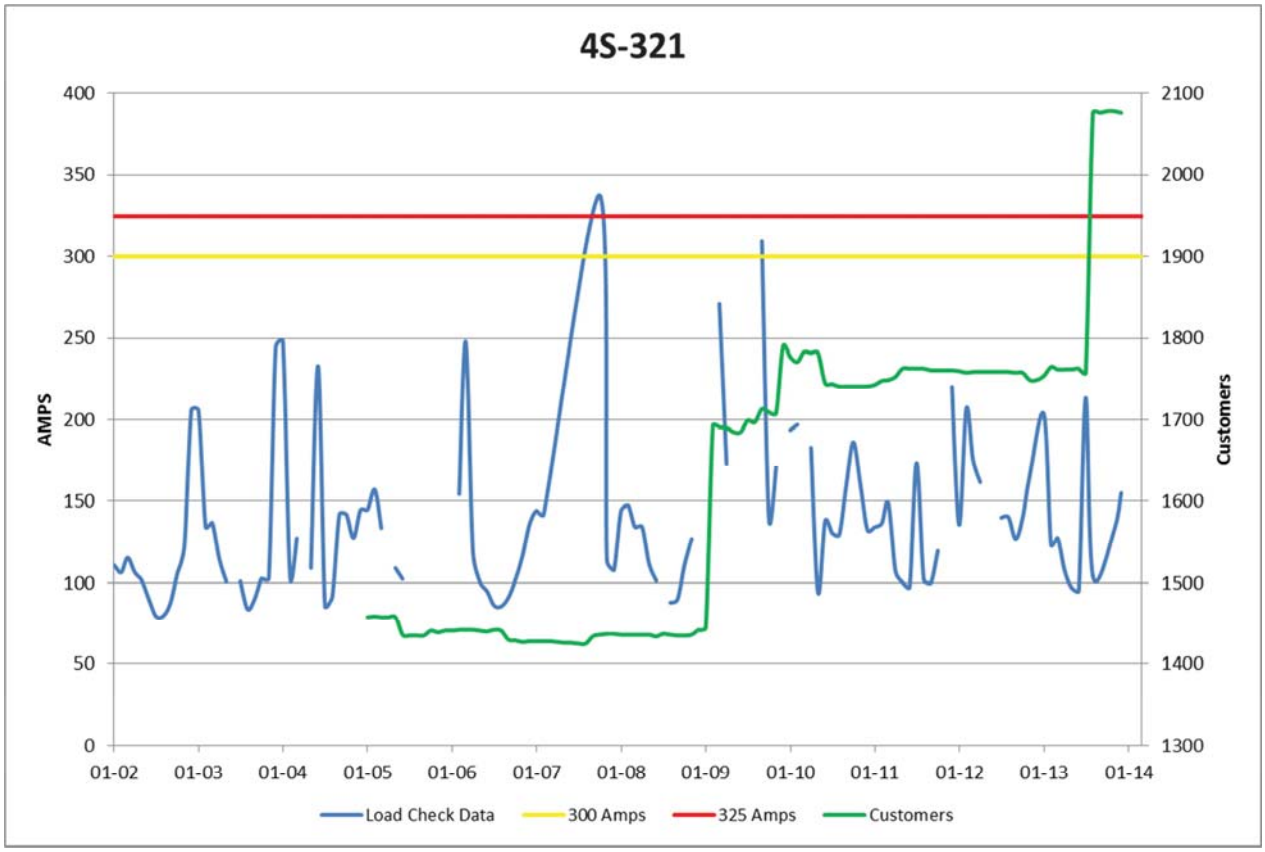


Figure 36 **4S-321 Load History**

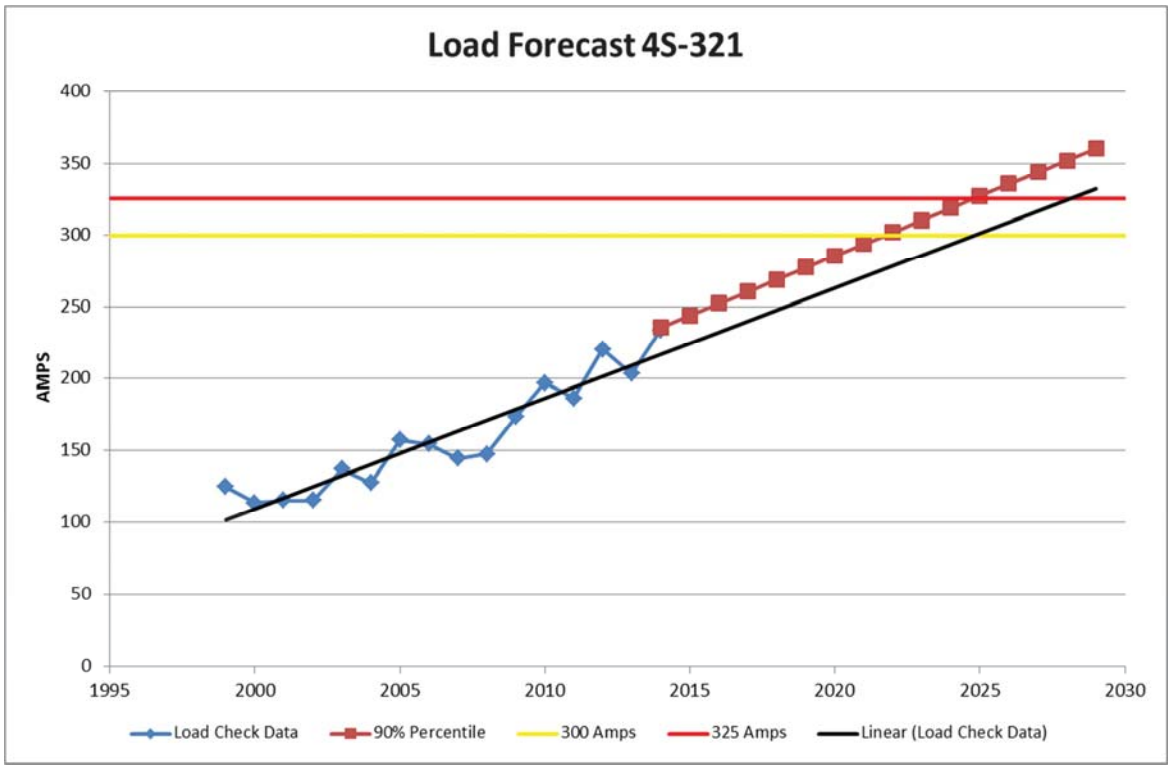


Figure 37 **4S-321 Load Forecast**

Load Growth **2.64%**

Appendix B: Load History and Forecast

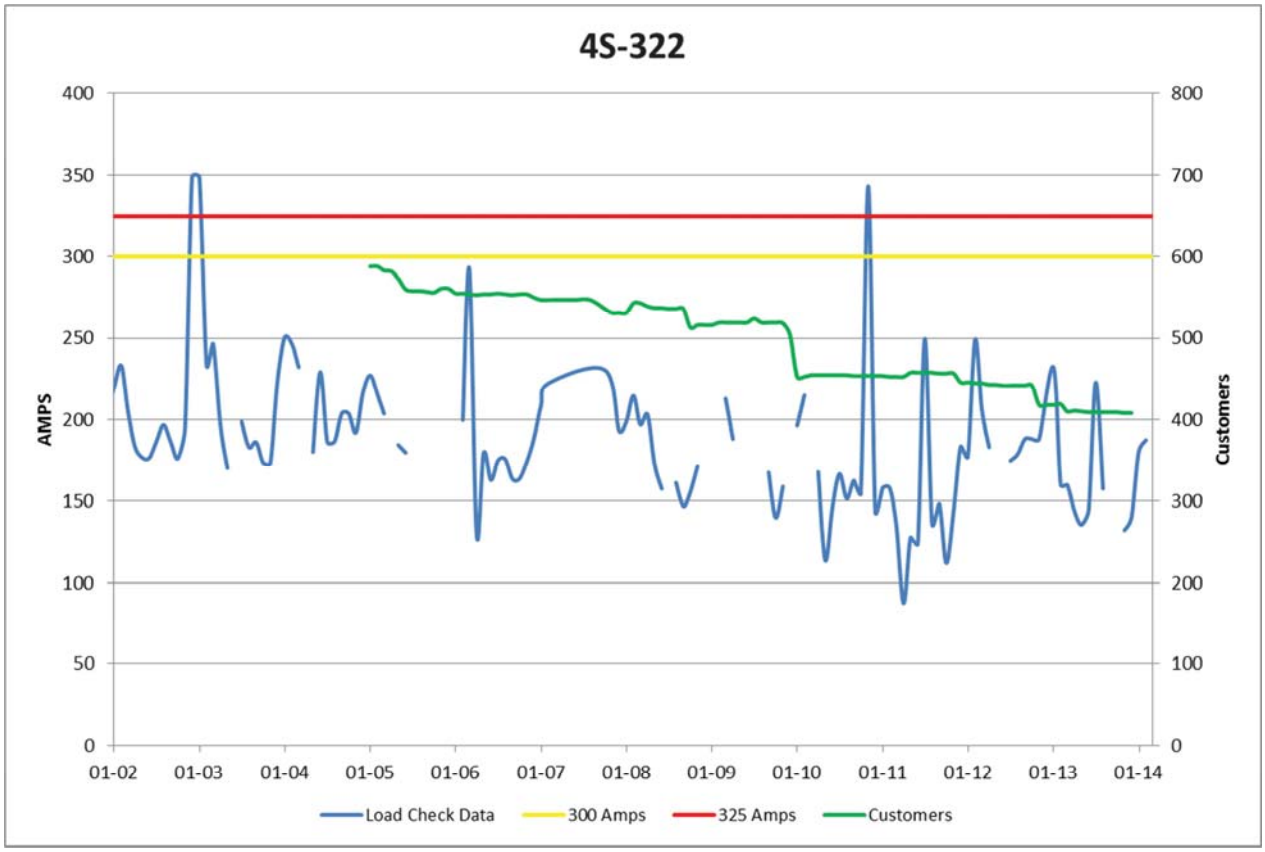


Figure 38 4S-322 Load History

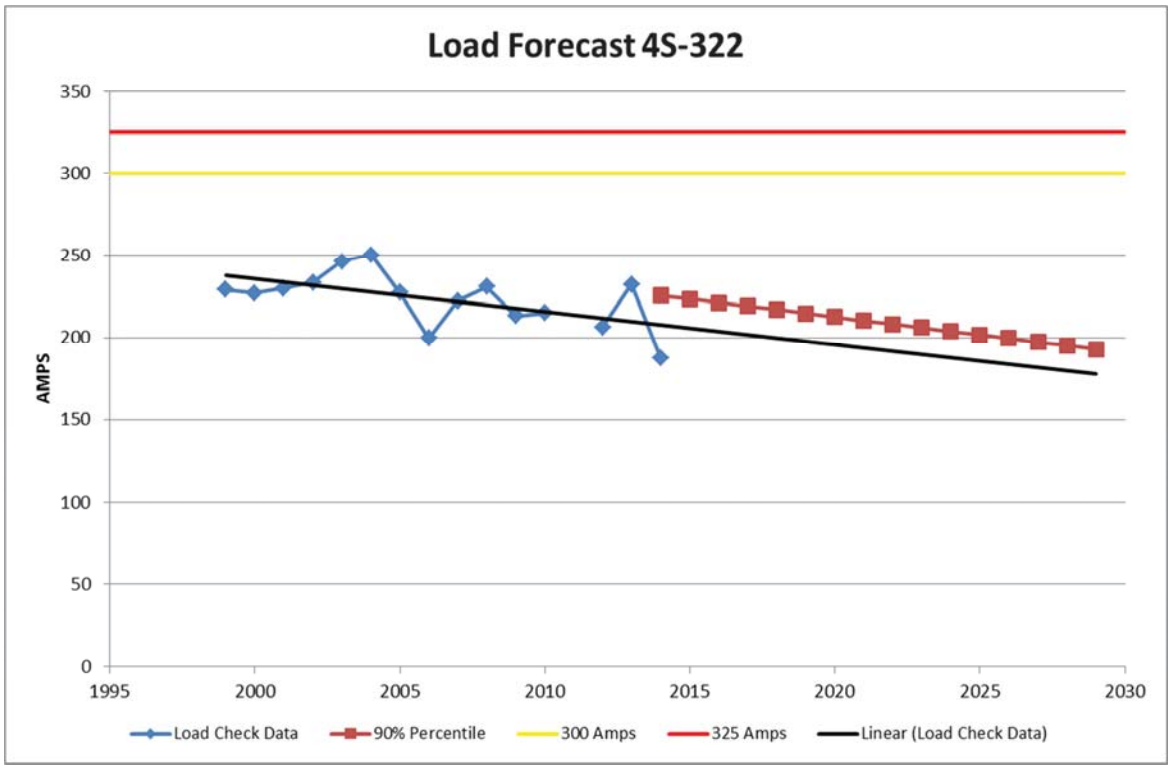


Figure 39 4S-322 Load Forecast

Load Growth -0.97%

Appendix B: Load History and Forecast

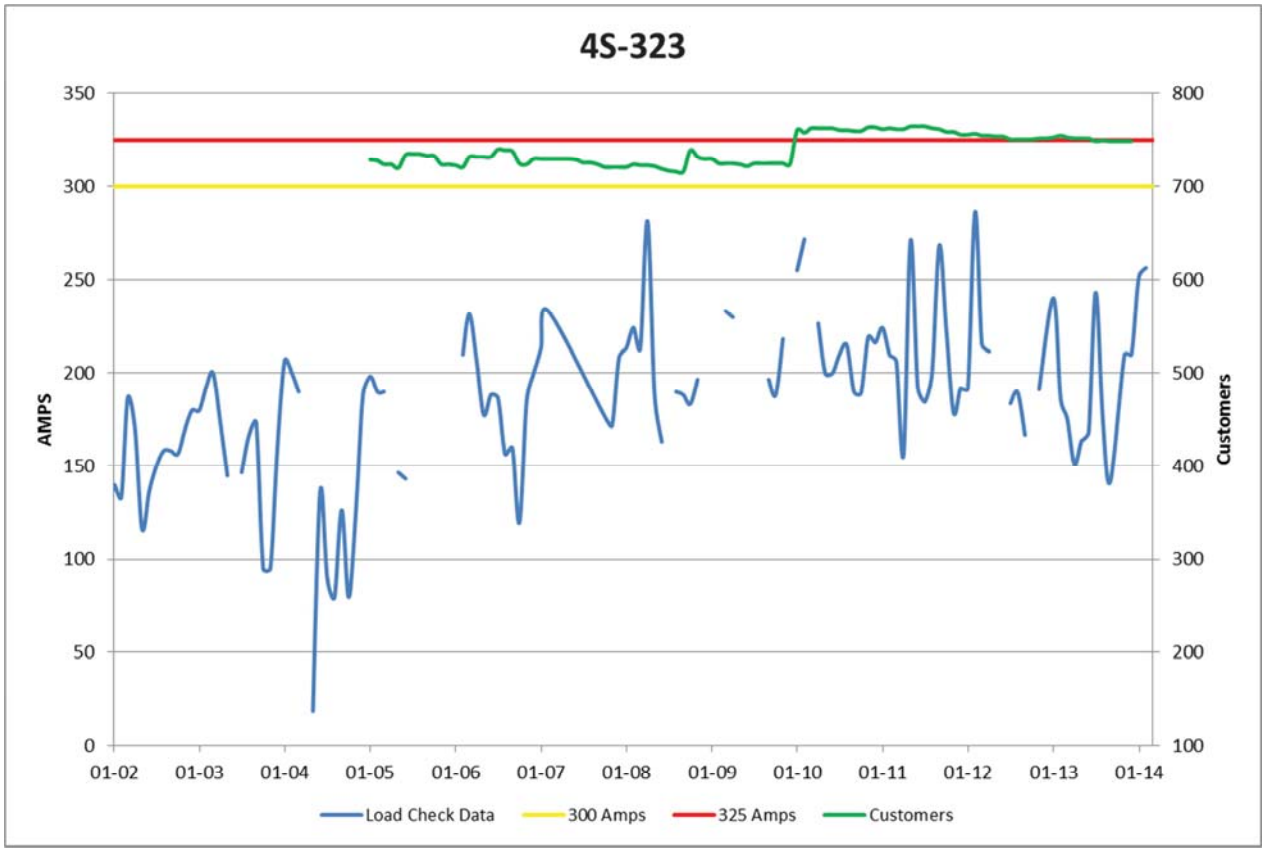


Figure 40 **4S-323 Load History**

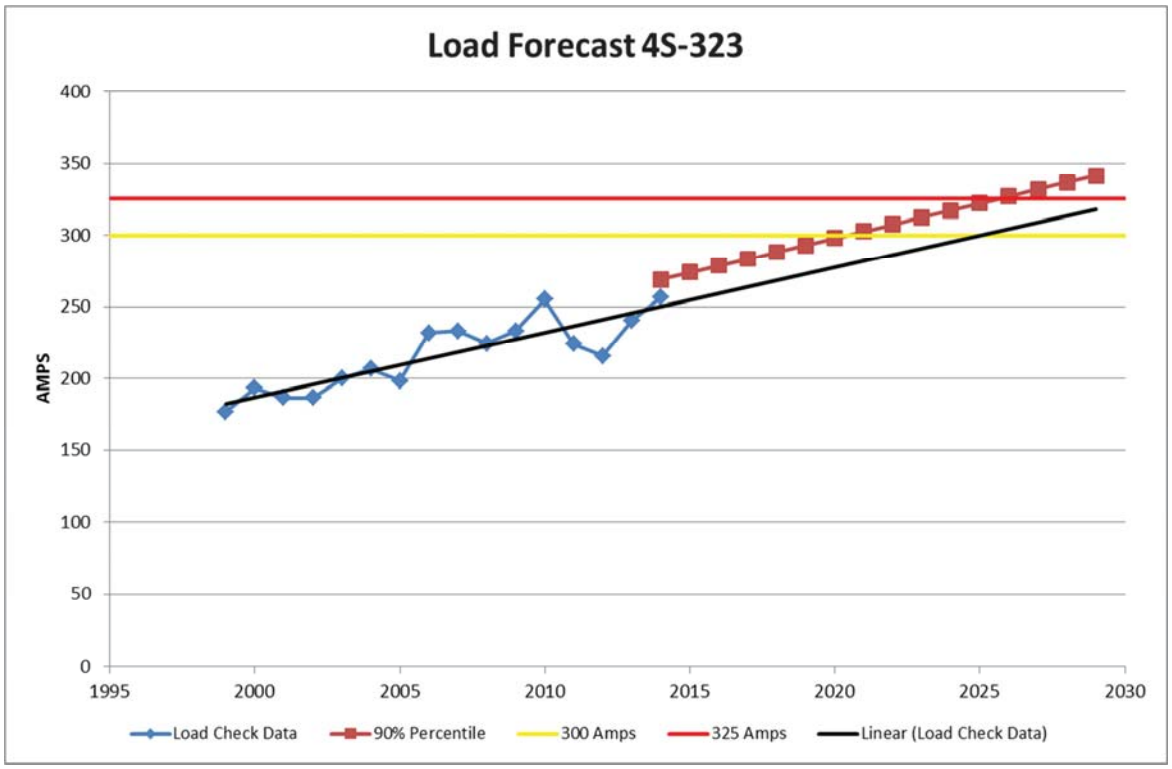


Figure 41 **4S-323 Load Forecast**

Load Growth **1.48%**

Appendix B: Load History and Forecast

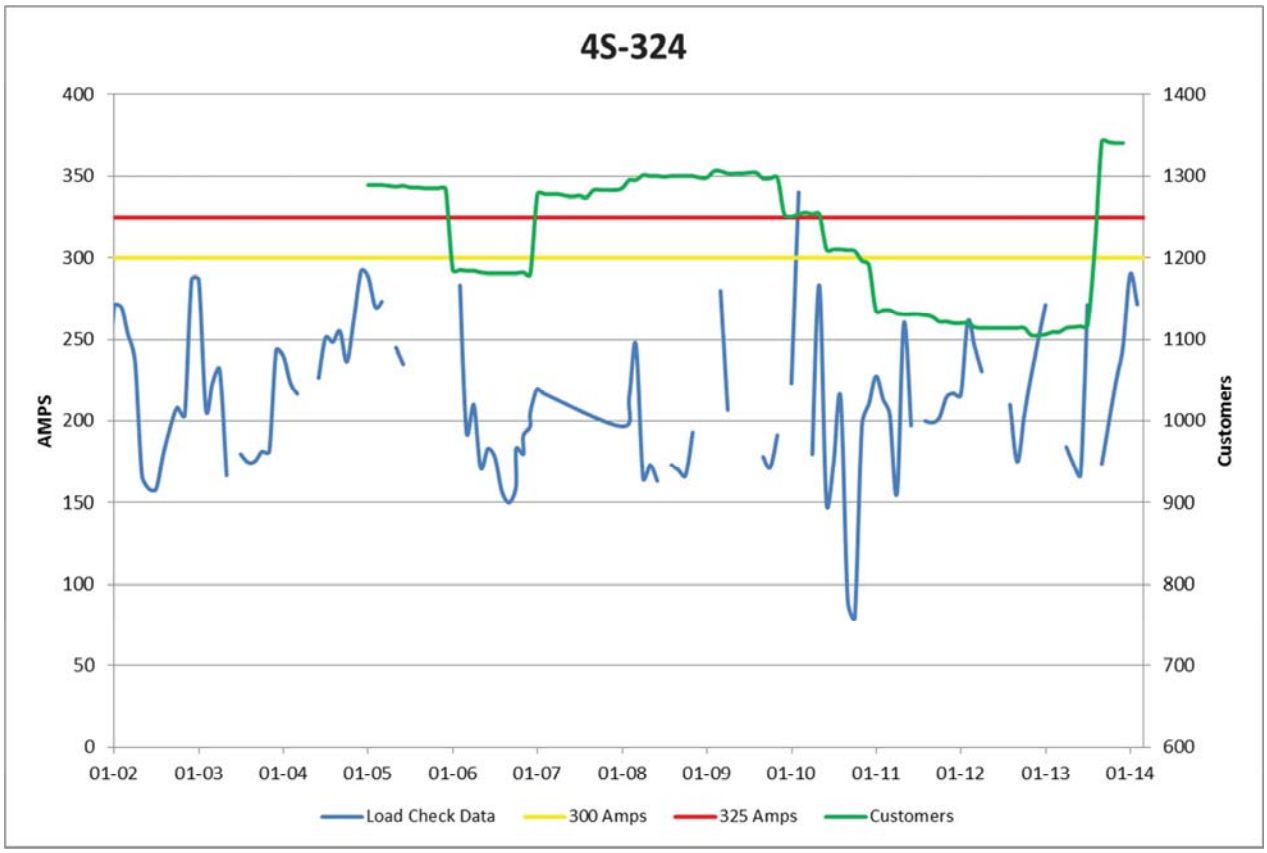


Figure 42 4S-324 Load History

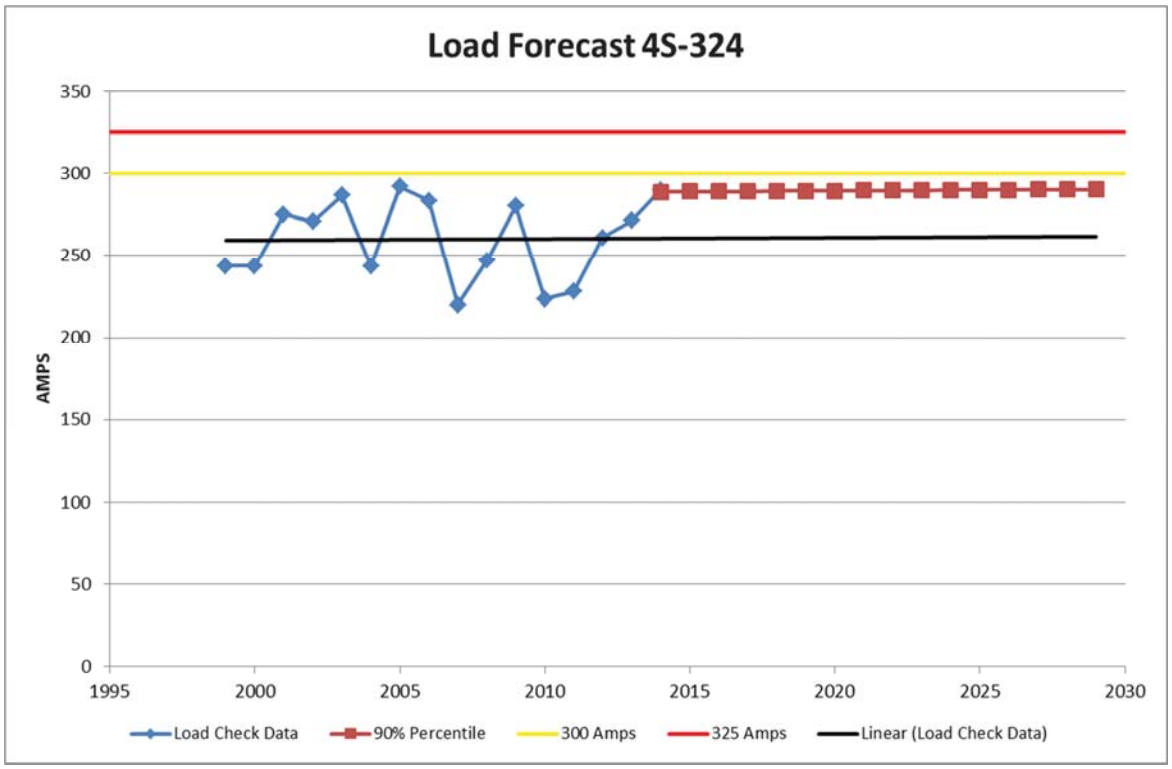


Figure 43 4S-324 Load Forecast

Load Growth 0.03%

Appendix B: Load History and Forecast

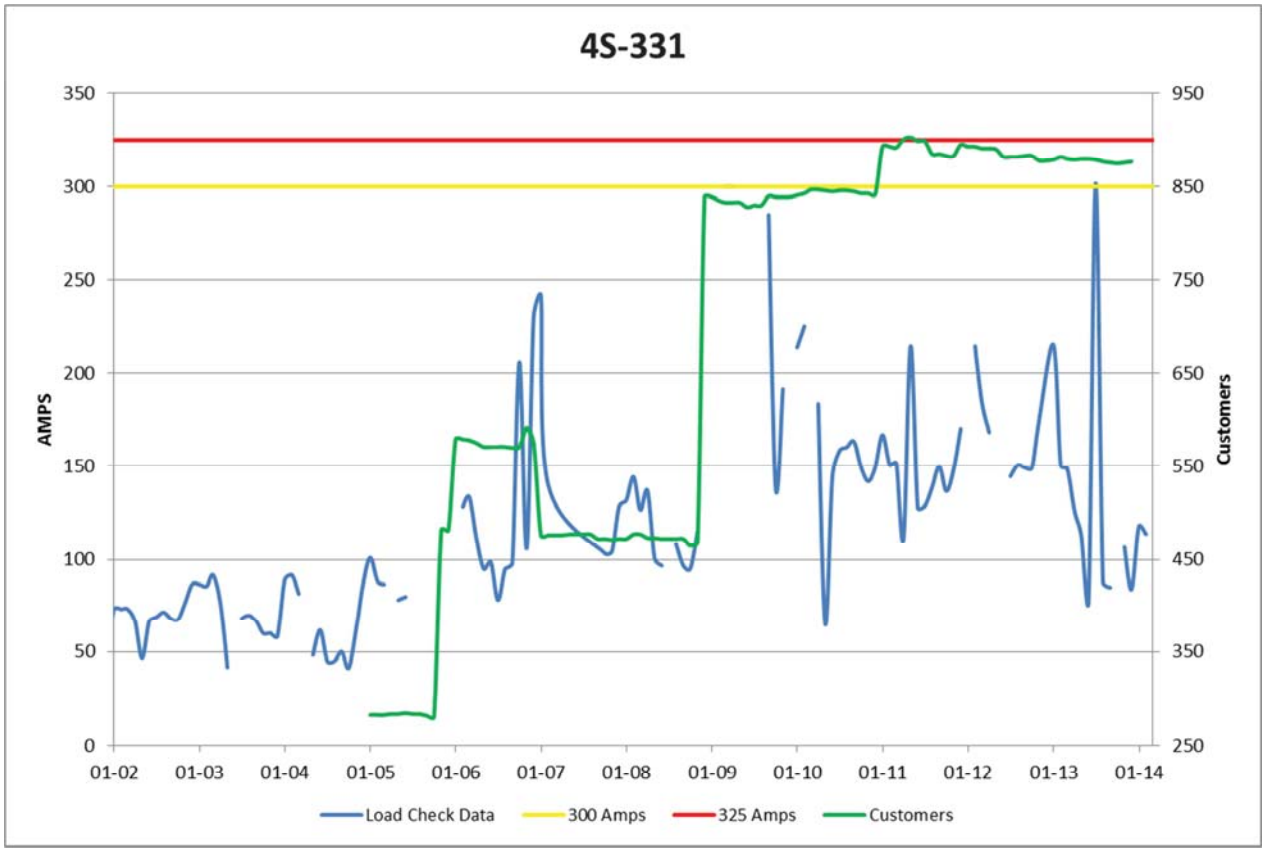


Figure 44 4S-331 Load History

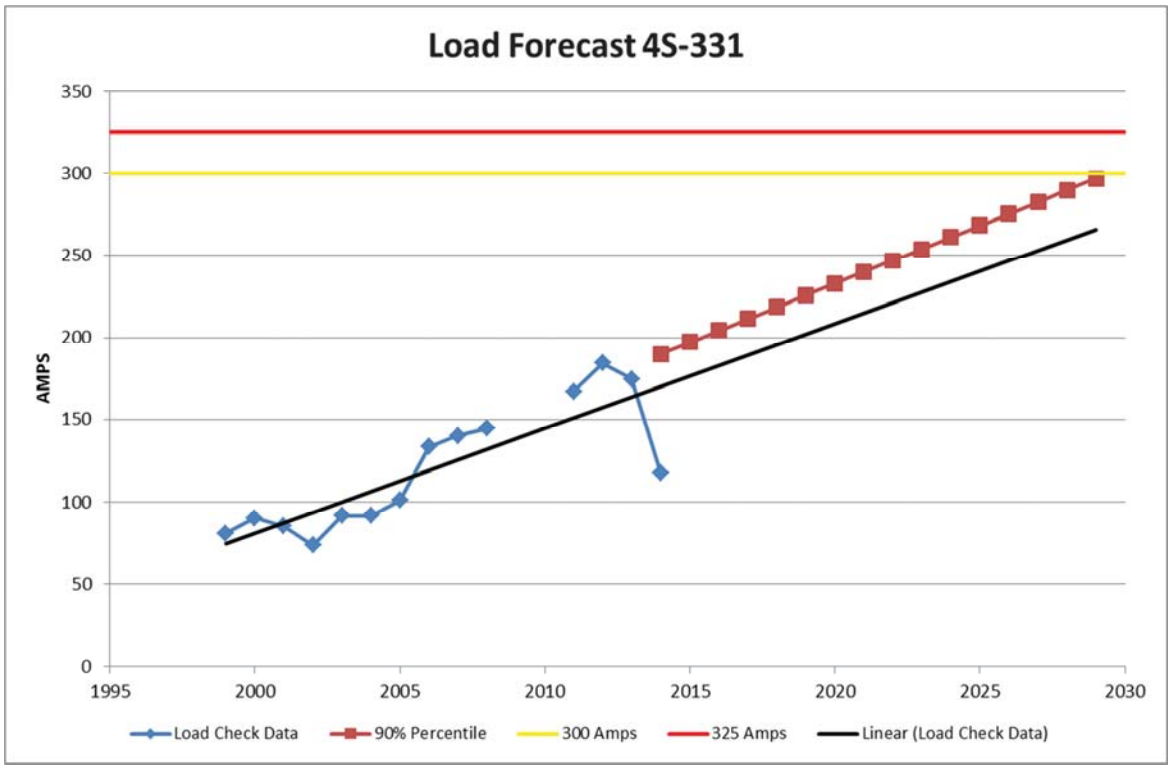


Figure 45 4S-331 Load Forecast
Load Growth 2.76%

Appendix B: Load History and Forecast

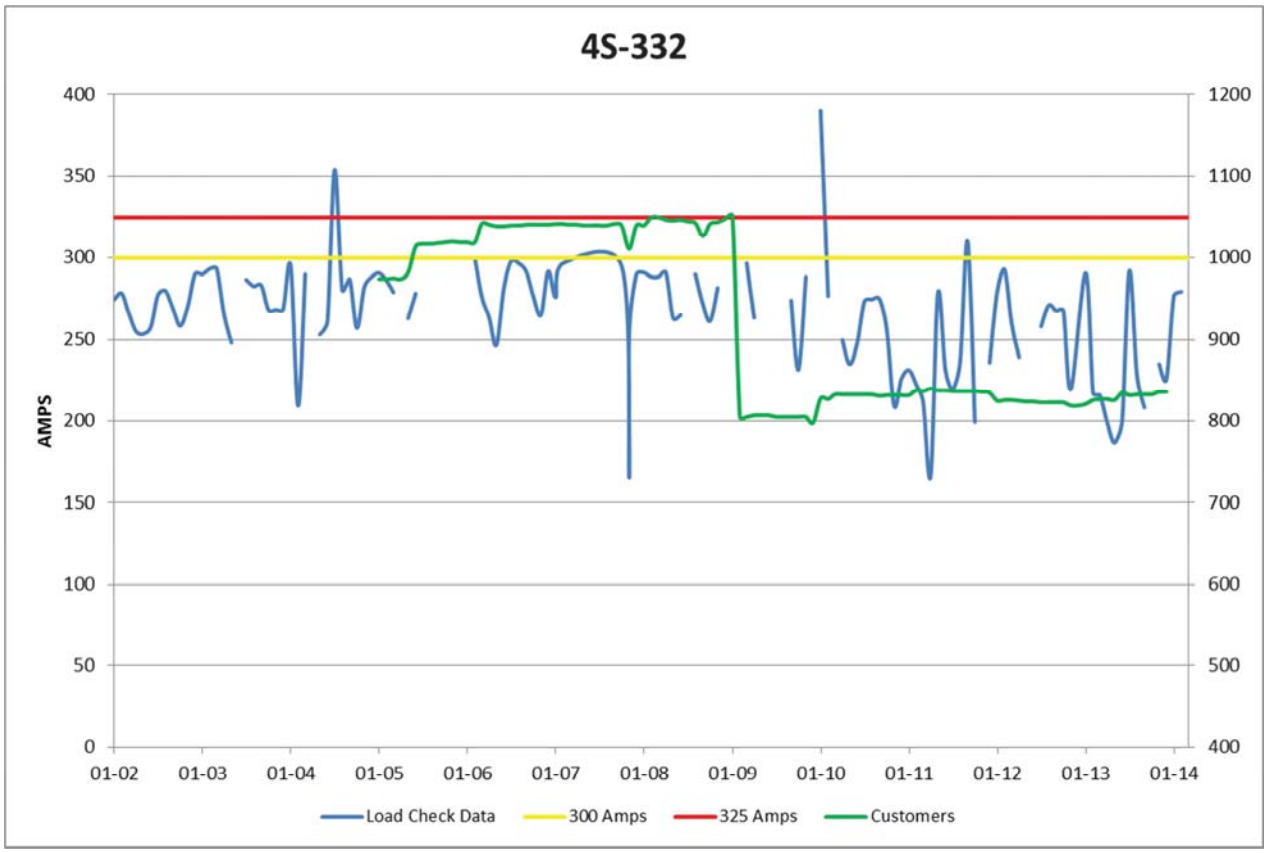


Figure 46 **4S-332 Load History**

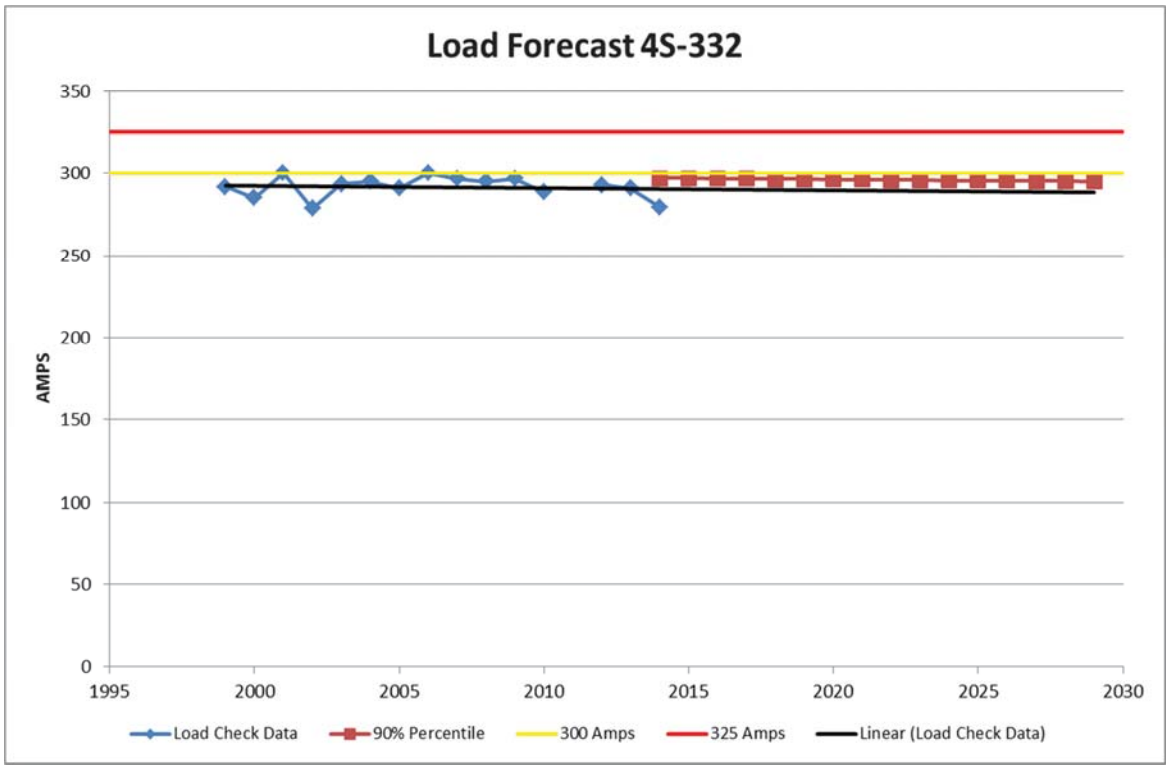


Figure 47 **4S-332 Load Forecast**

Load Growth **-0.05%**

Appendix B: Load History and Forecast

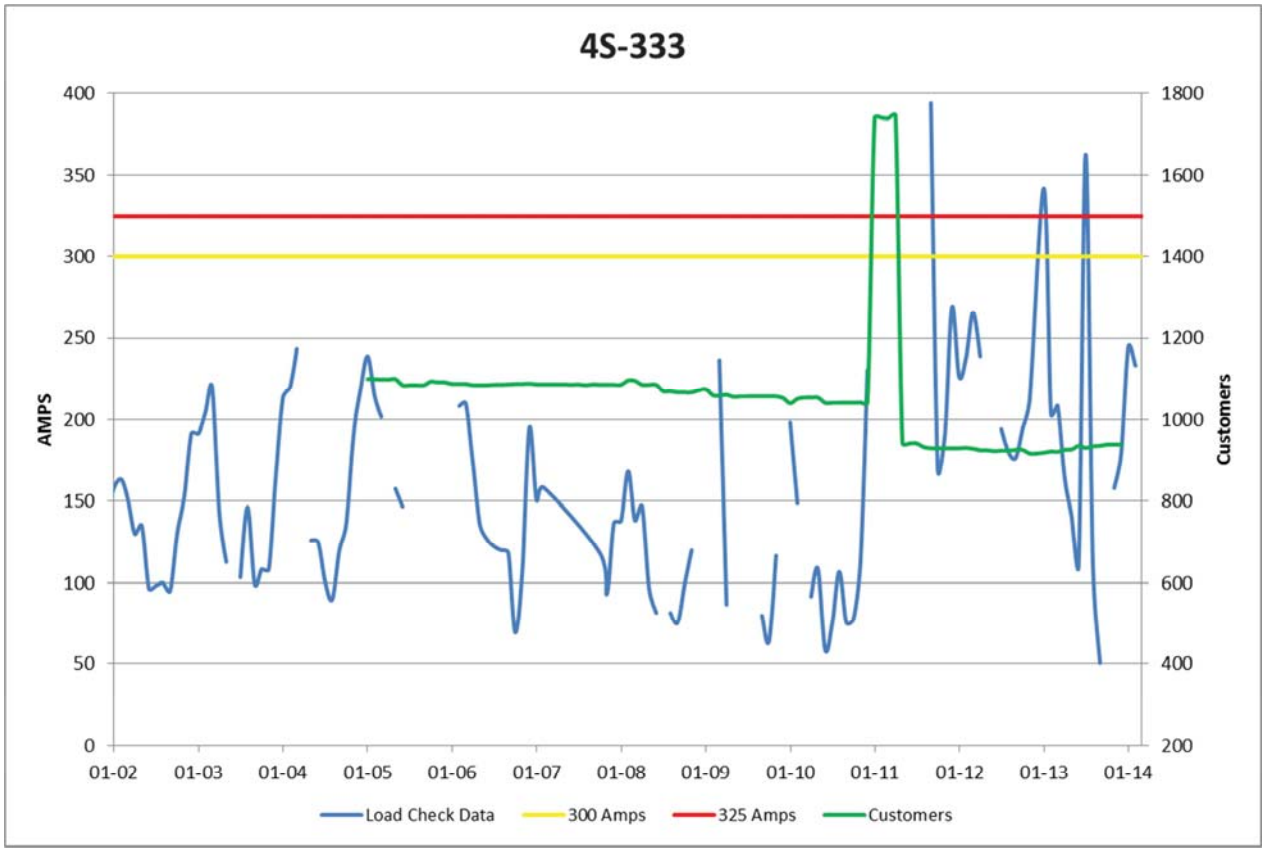


Figure 48 **4S-333 Load History**

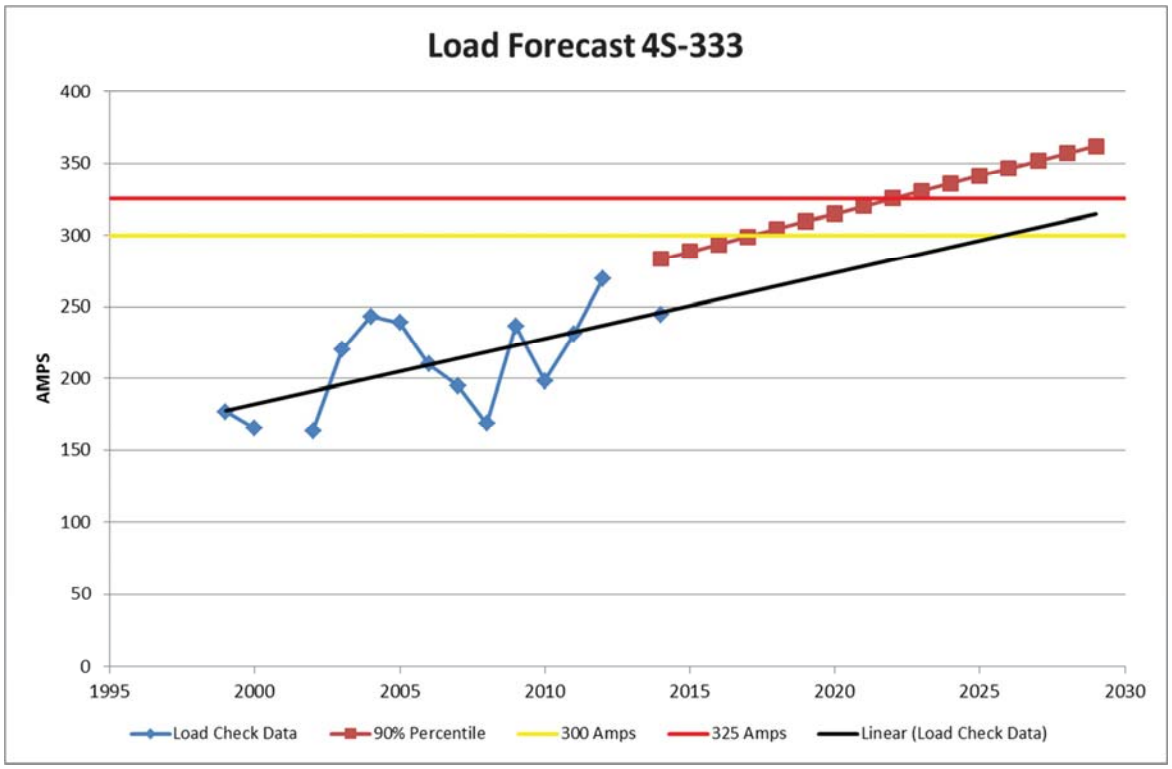


Figure 49 **4S-333 Load Forecast**
Load Growth **1.53%**

Appendix B: Load History and Forecast

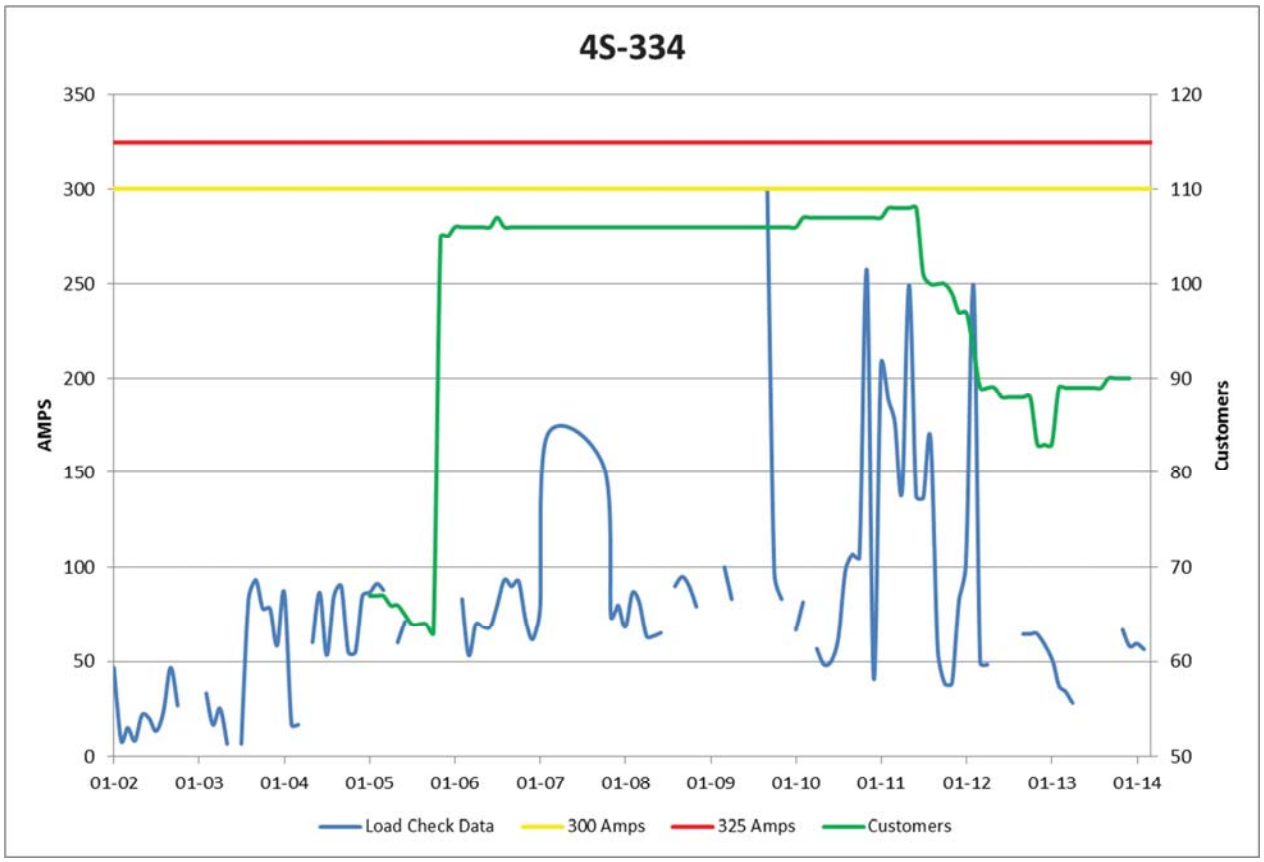


Figure 50 **4S-334 Load History**

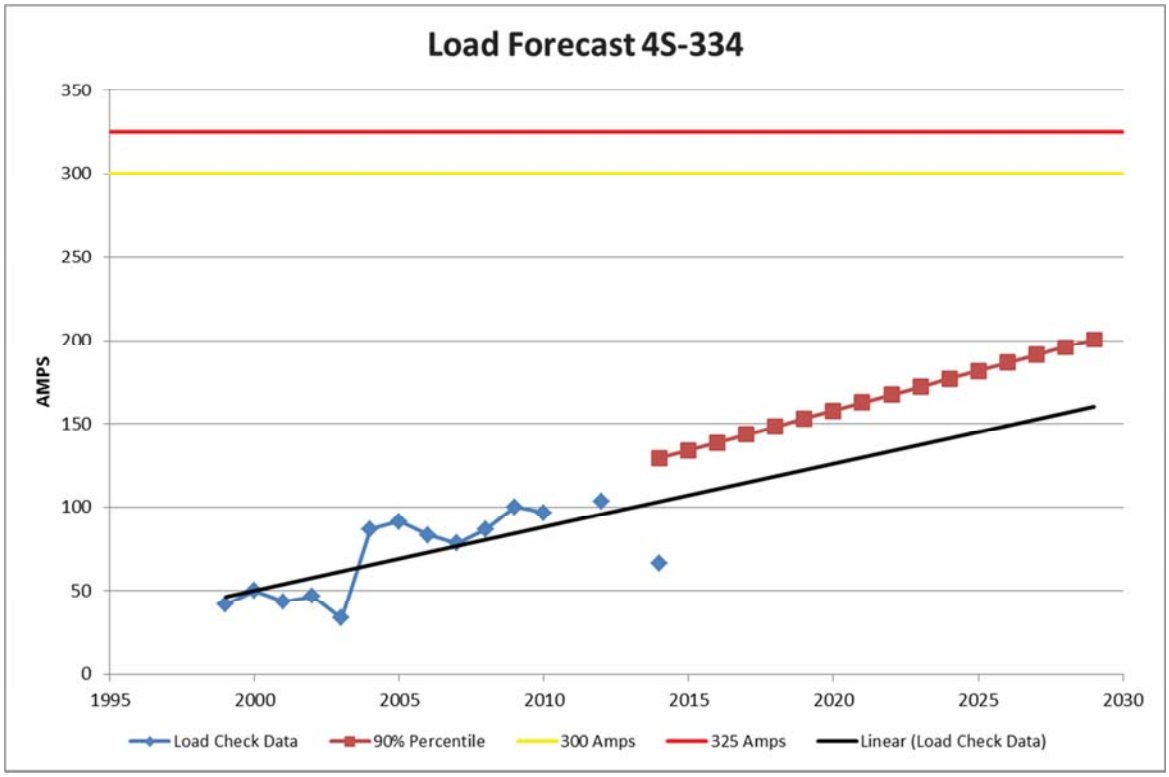


Figure 51 **4S-334 Load Forecast**

Load Growth **2.72%**

Appendix B: Load History and Forecast

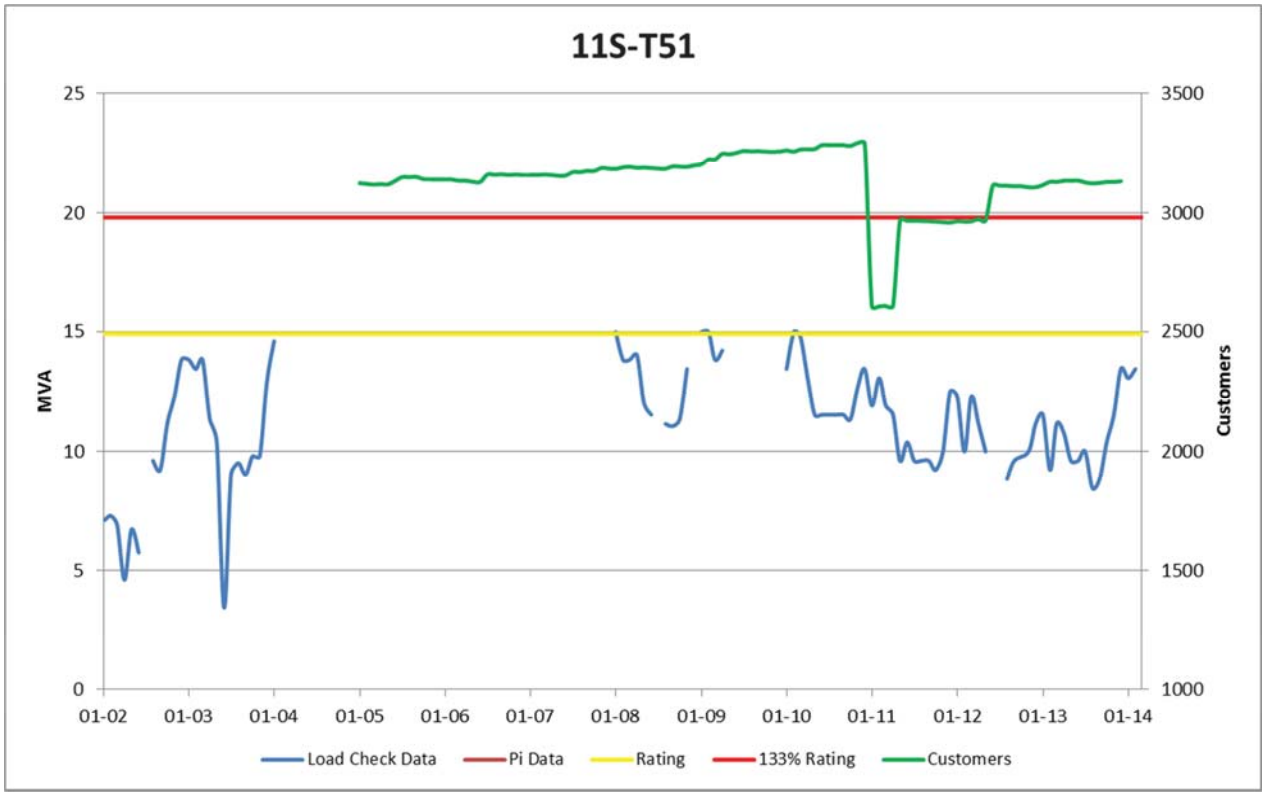


Figure 52 11S-T51 Load History

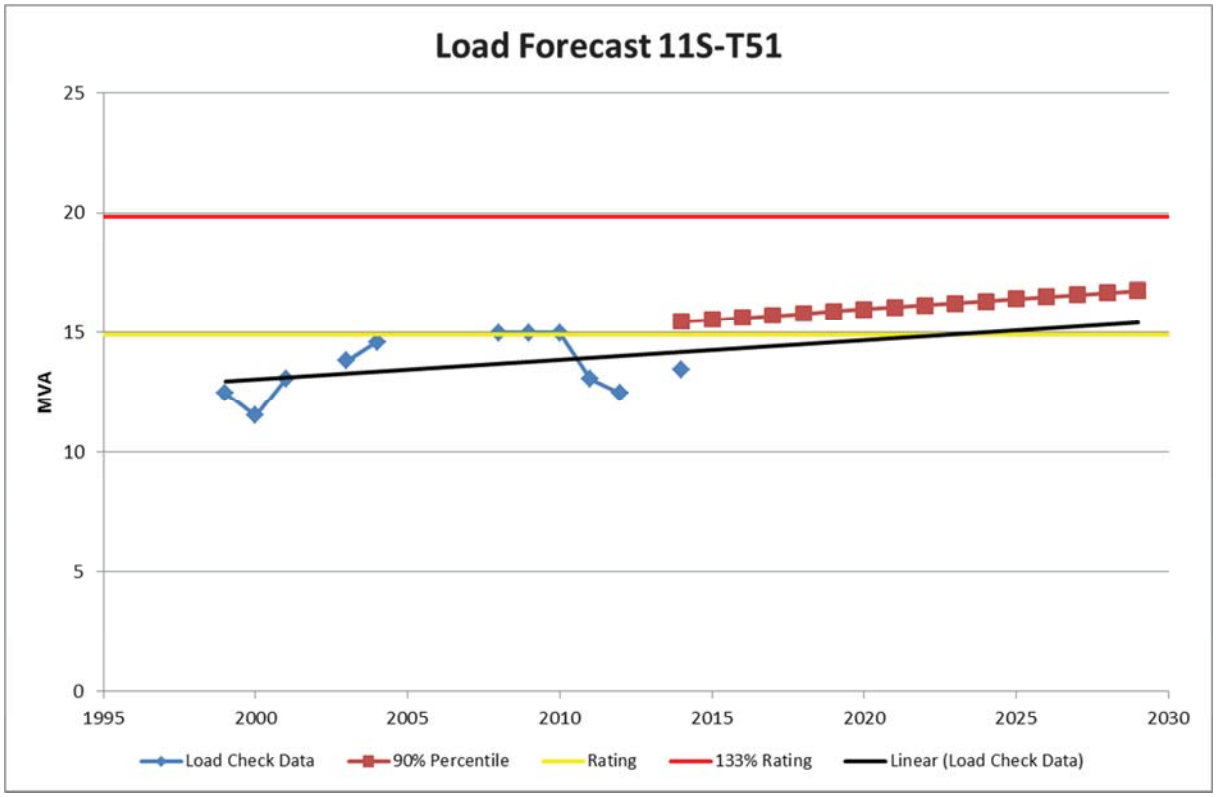


Figure 53 11S-T51 Load History

Load Growth 0.51%

Appendix B: Load History and Forecast

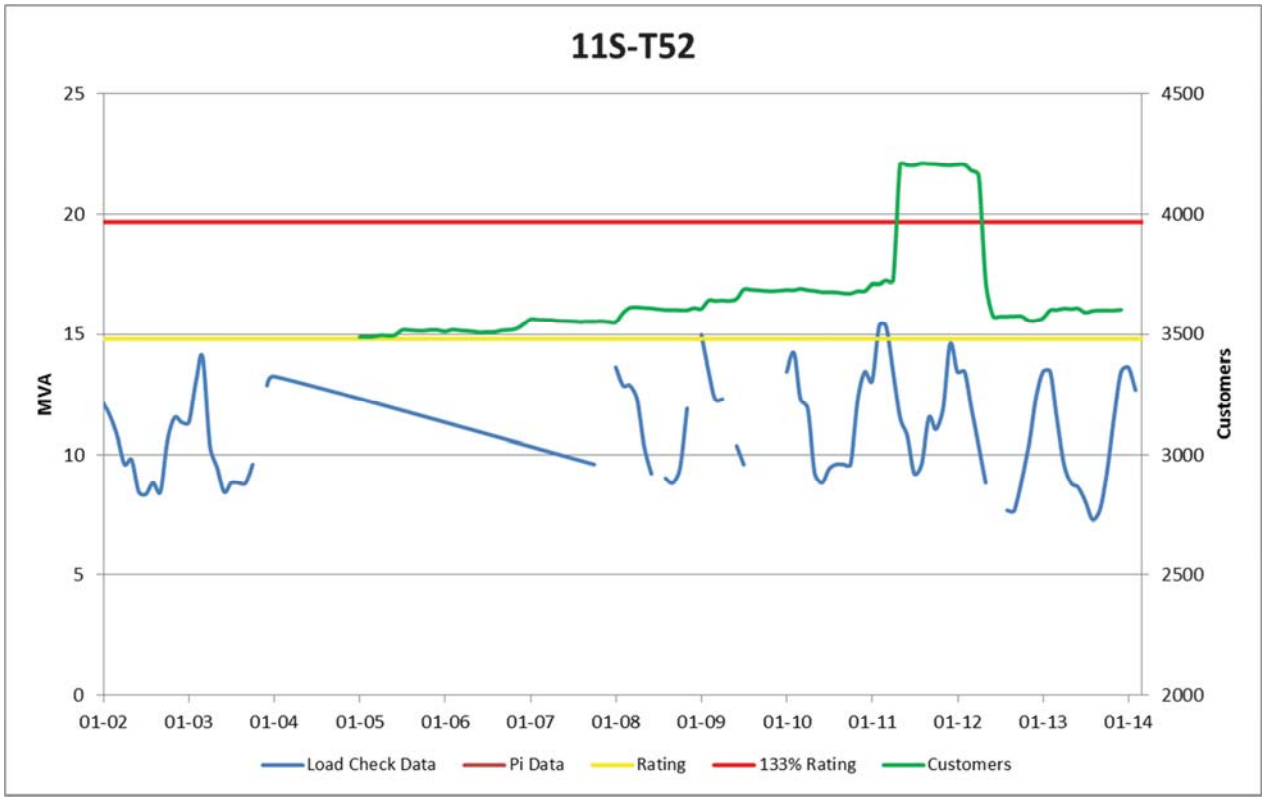


Figure 54 11S-T52 Load History

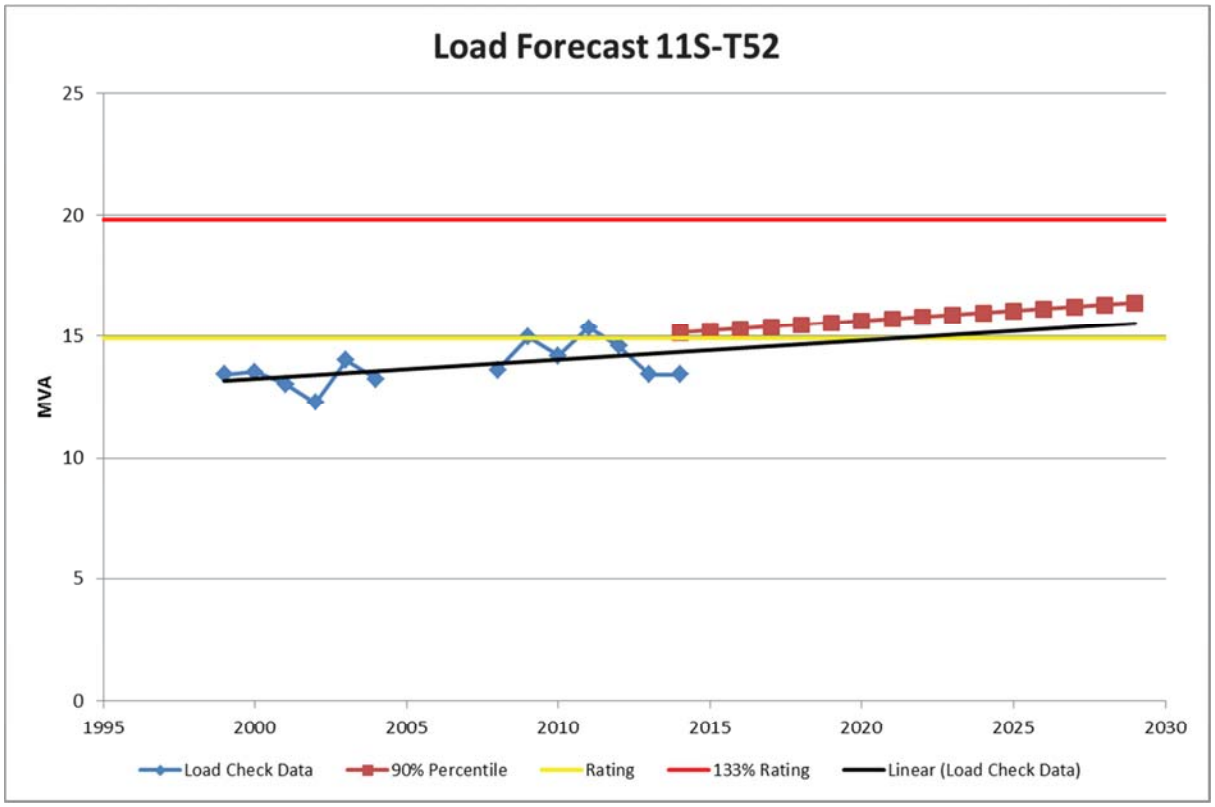


Figure 55 11S-T52 Load Forecast

Load Growth 0.49%

Appendix B: Load History and Forecast

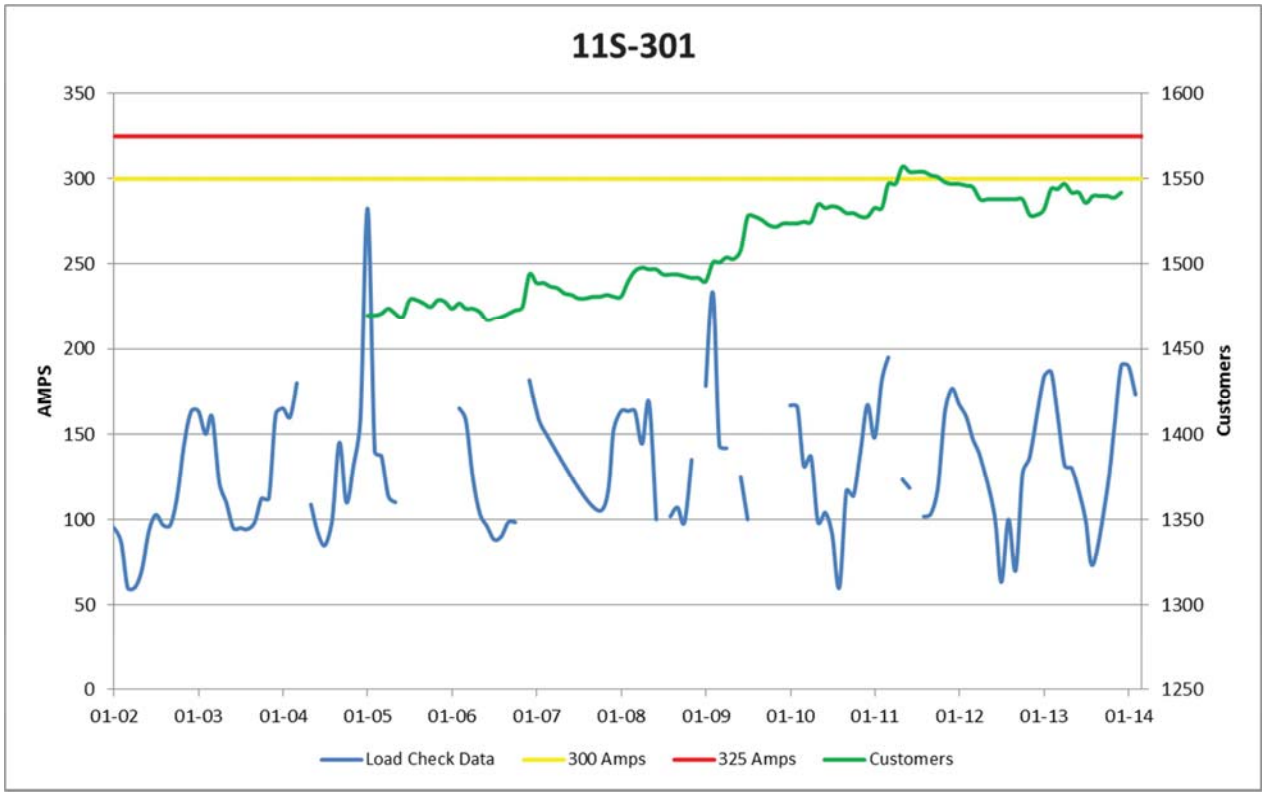


Figure 56 11S-301 Load History

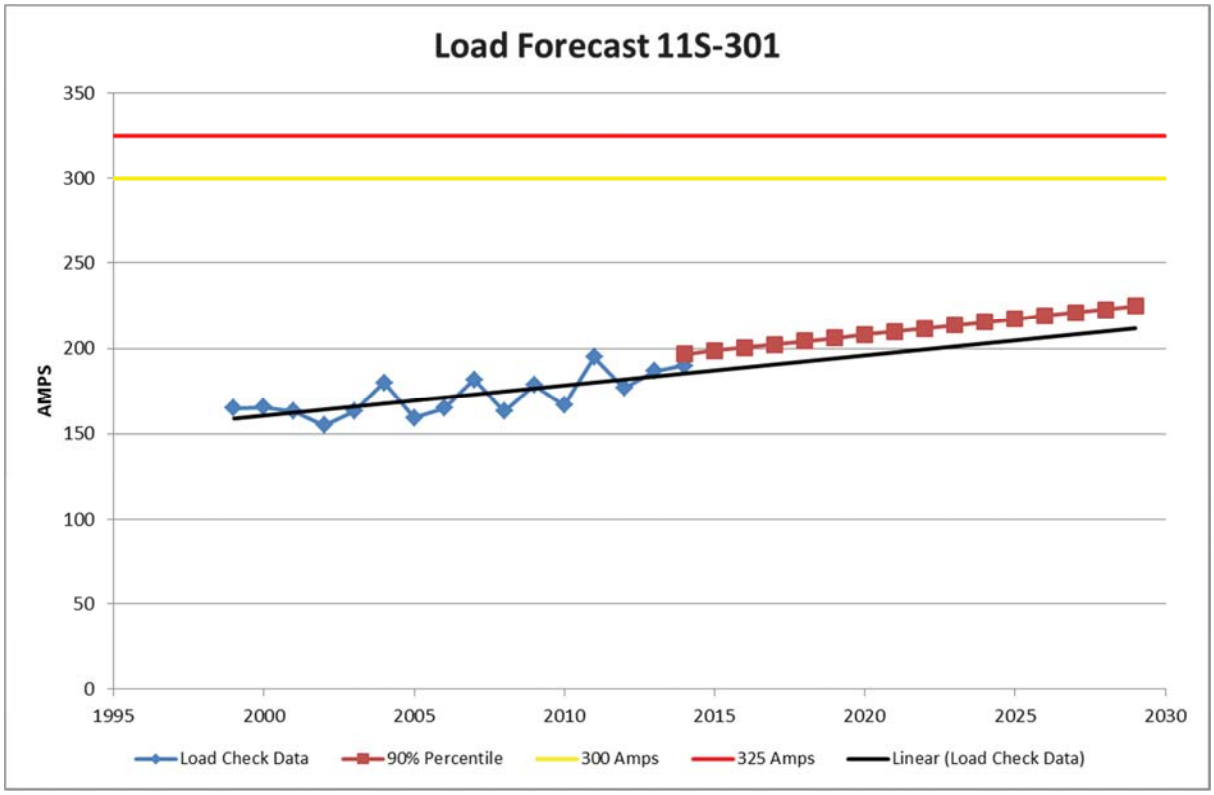


Figure 57 11S-301 Load Forecast

Load Growth 0.83%

Appendix B: Load History and Forecast

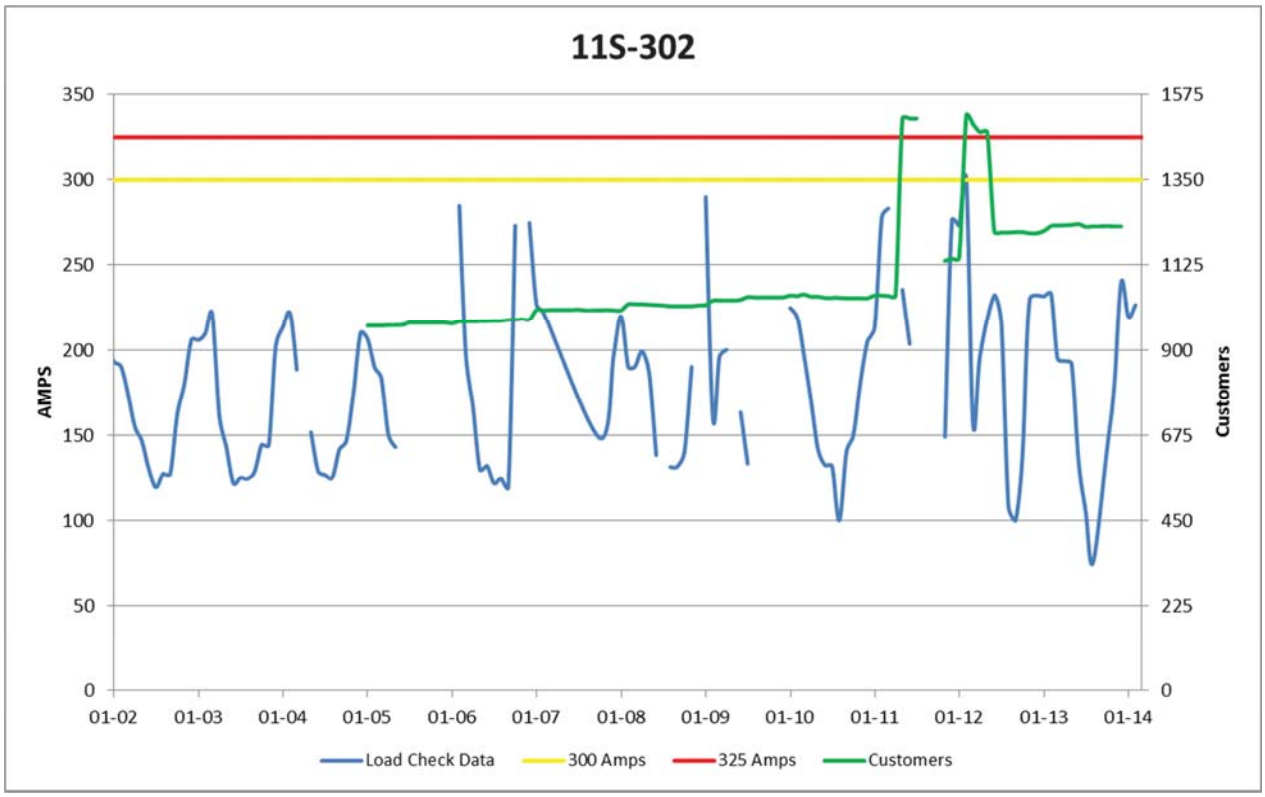


Figure 58 11S-302 Load History

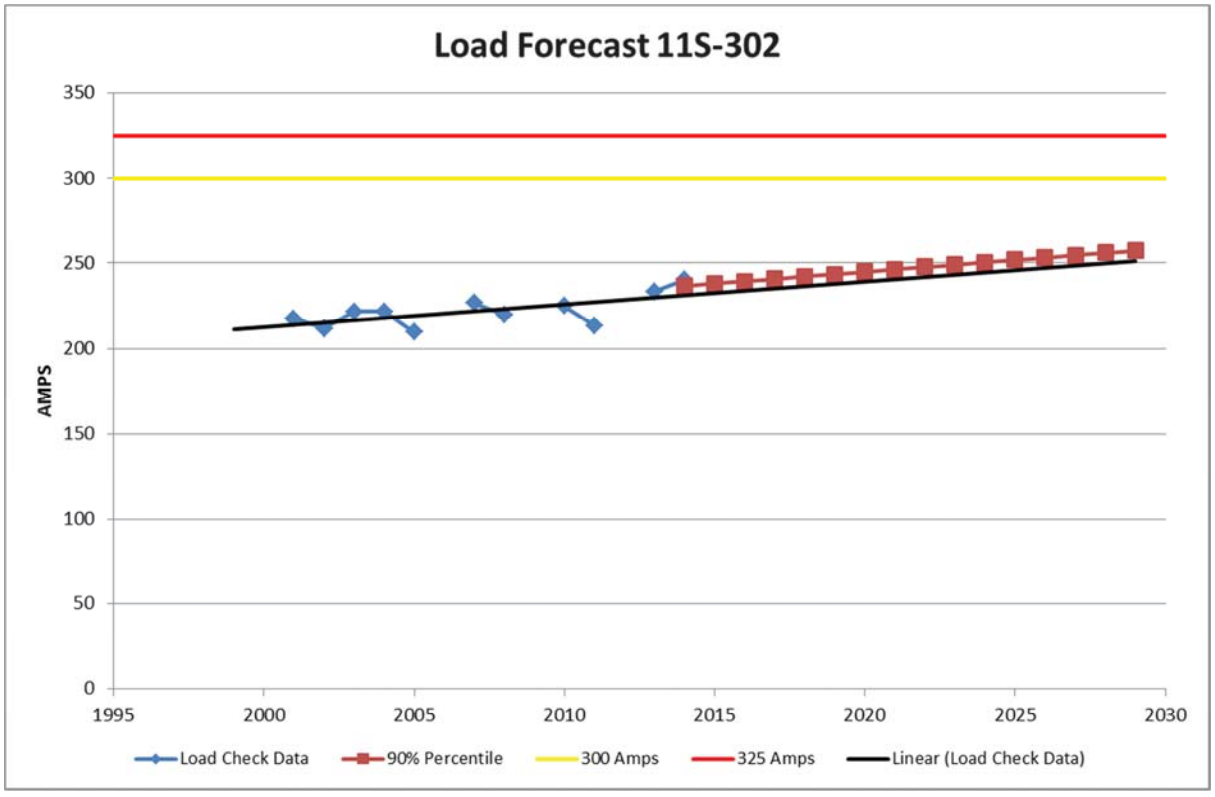


Figure 59 11S-302 Load Forecast

Load Growth 0.52%

Appendix B: Load History and Forecast

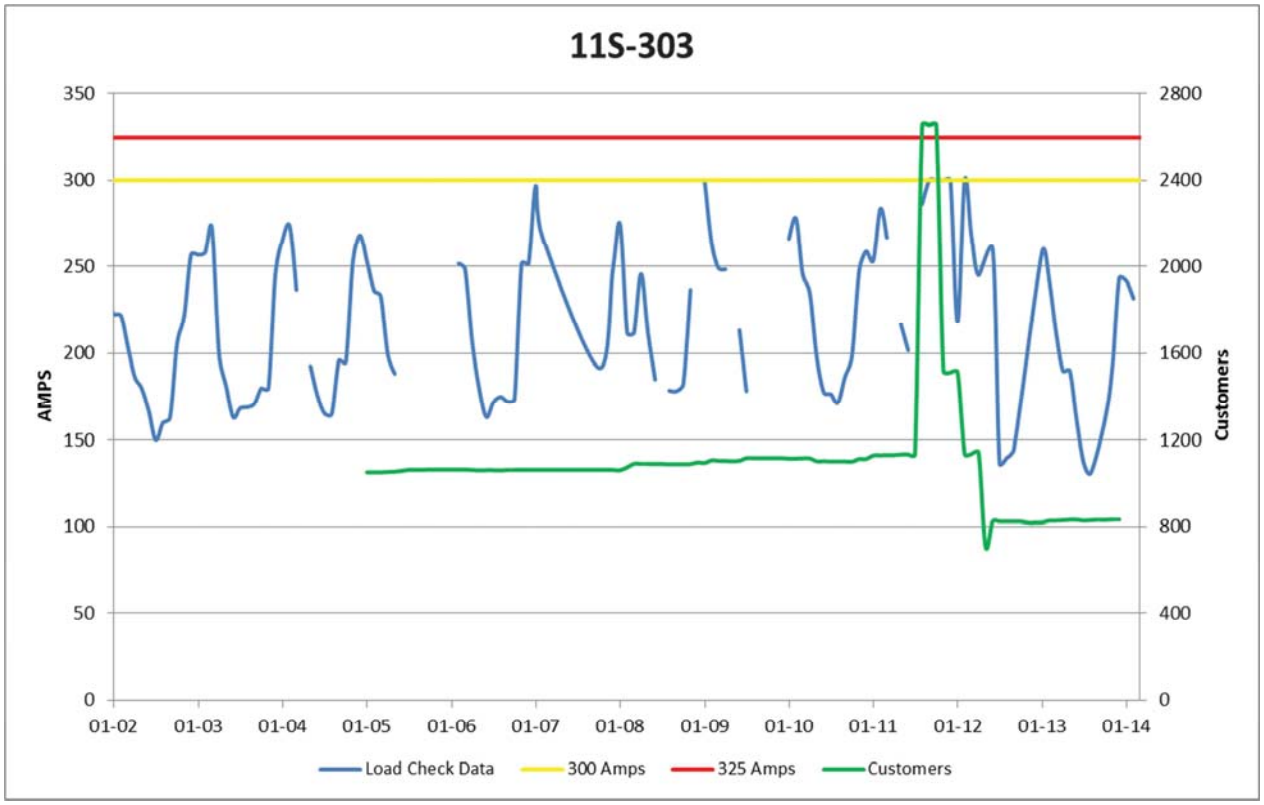


Figure 60 **11S-303 Load History**

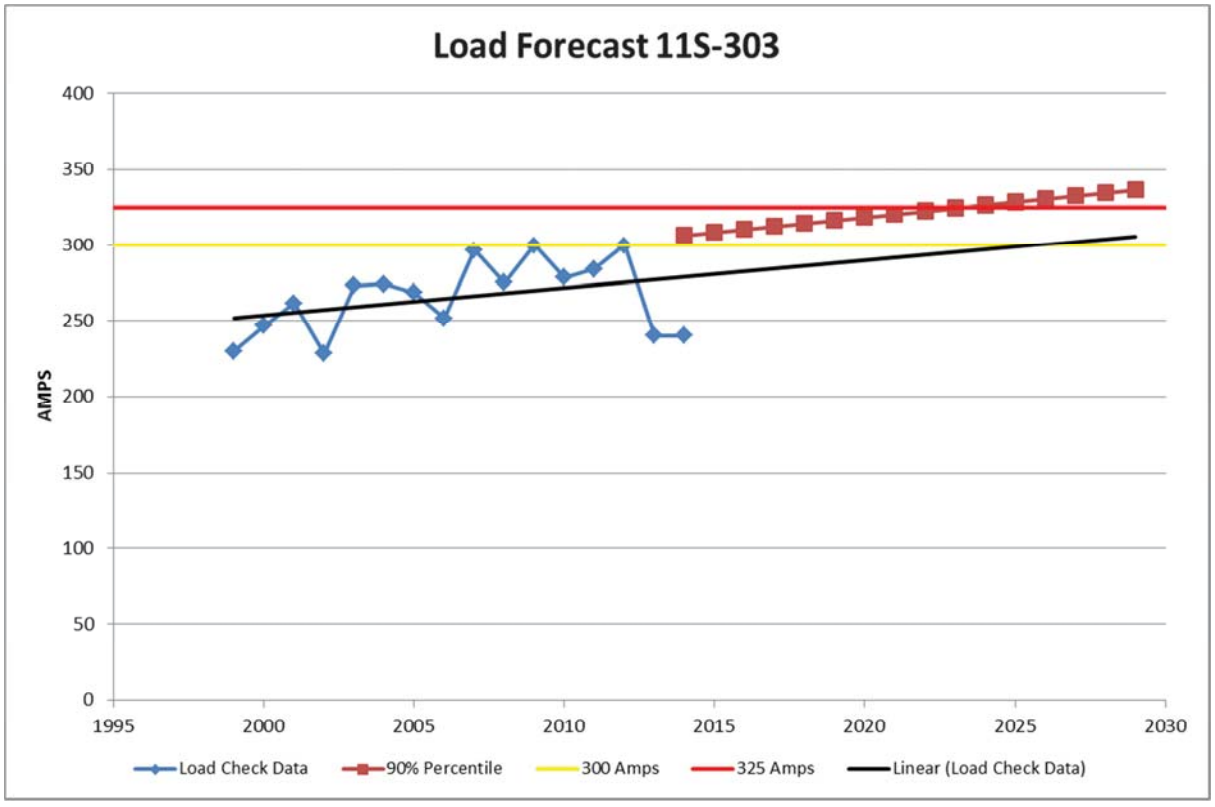


Figure 61 **11S-303 Load Forecast**

Load Growth **0.57%**

Appendix B: Load History and Forecast

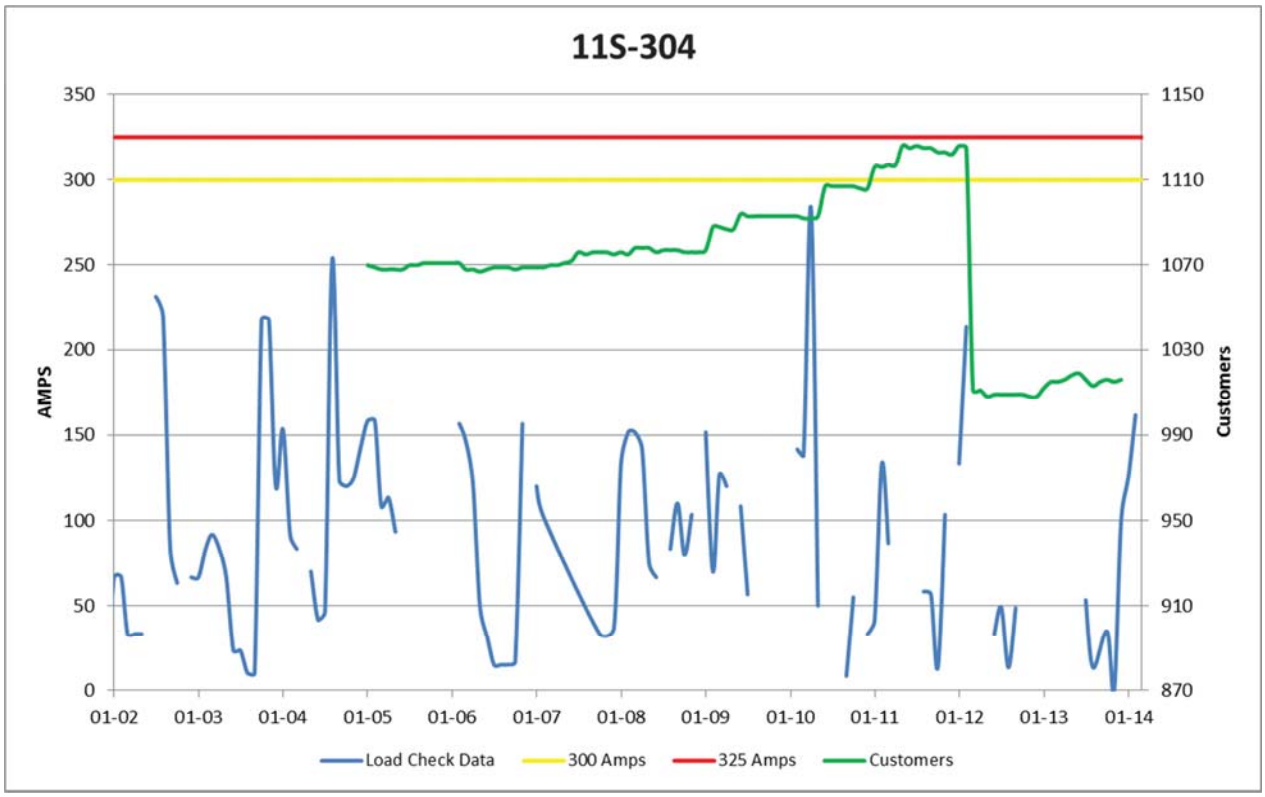


Figure 62 11S-304 Load History

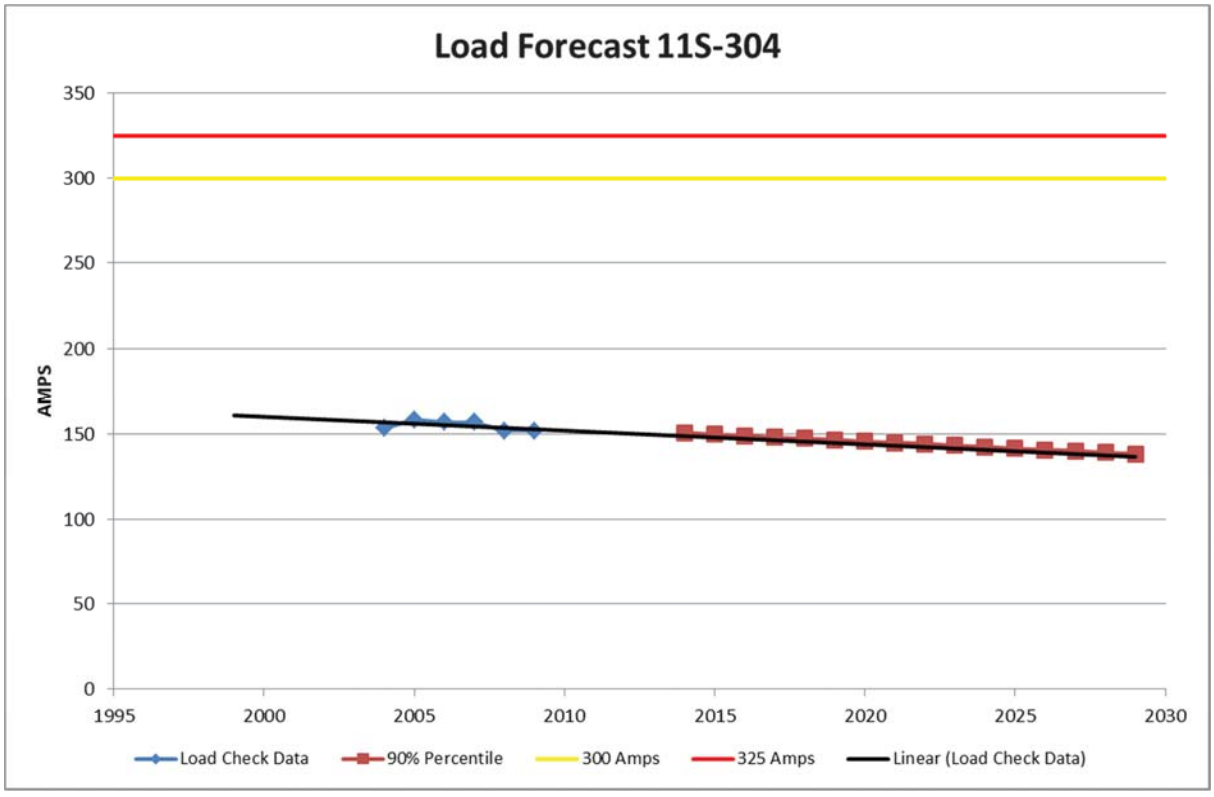


Figure 63 11S-304 Load Forecast

Load Growth -0.53%

Appendix B: Load History and Forecast

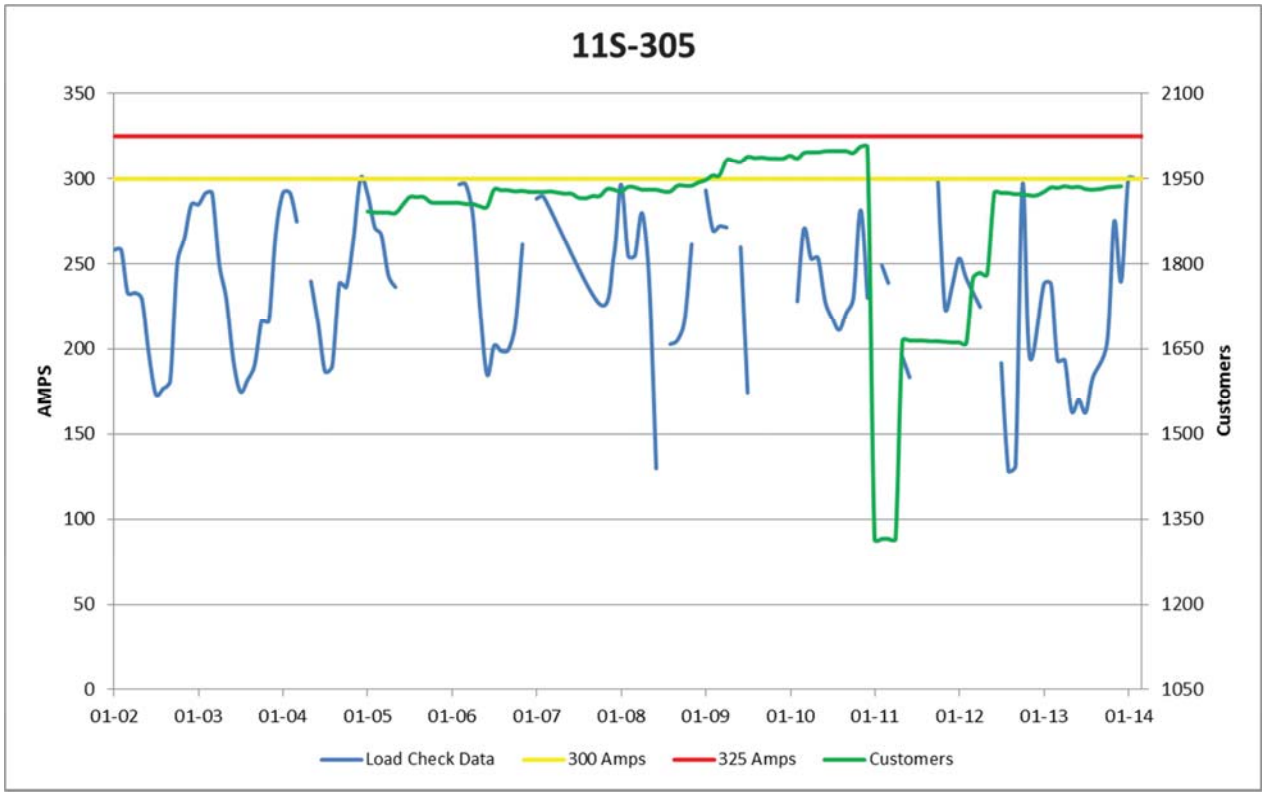


Figure 64 11S-305 Load History

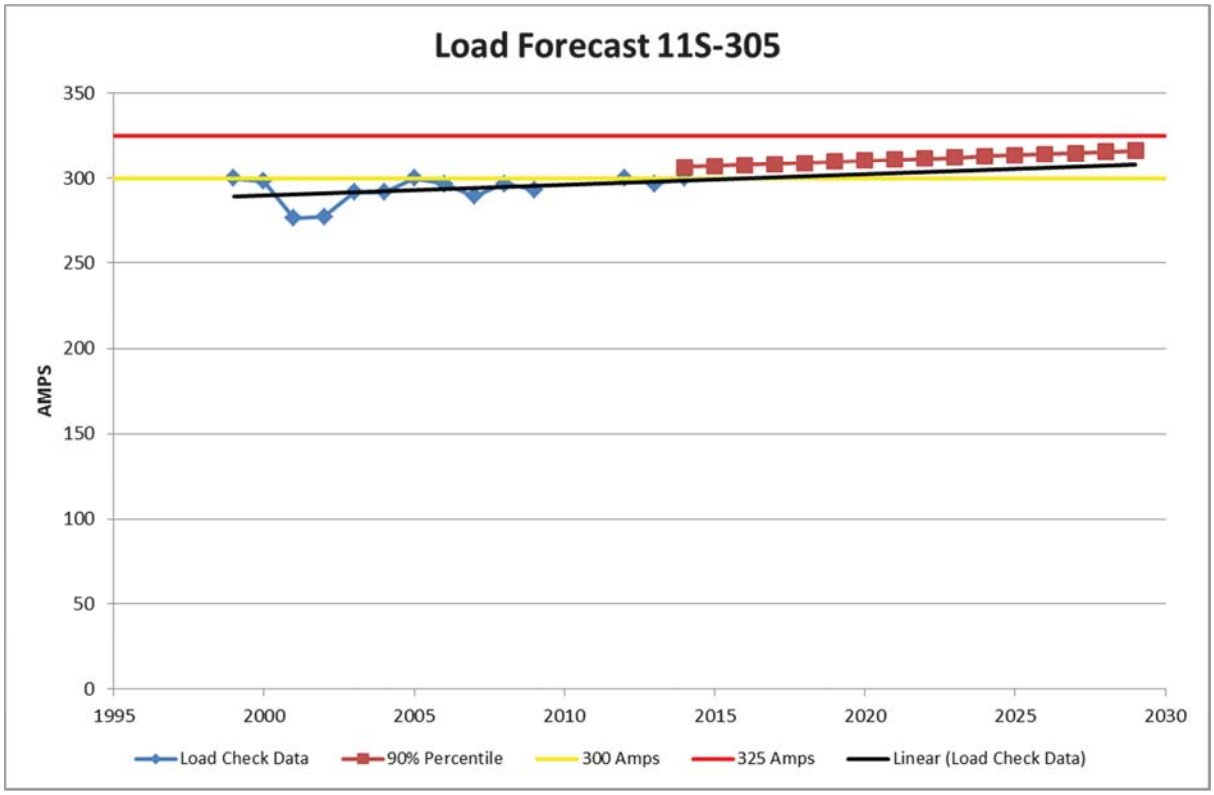


Figure 65 11S-305 Load Forecast

Load Growth 0.21%

Appendix B: Load History and Forecast

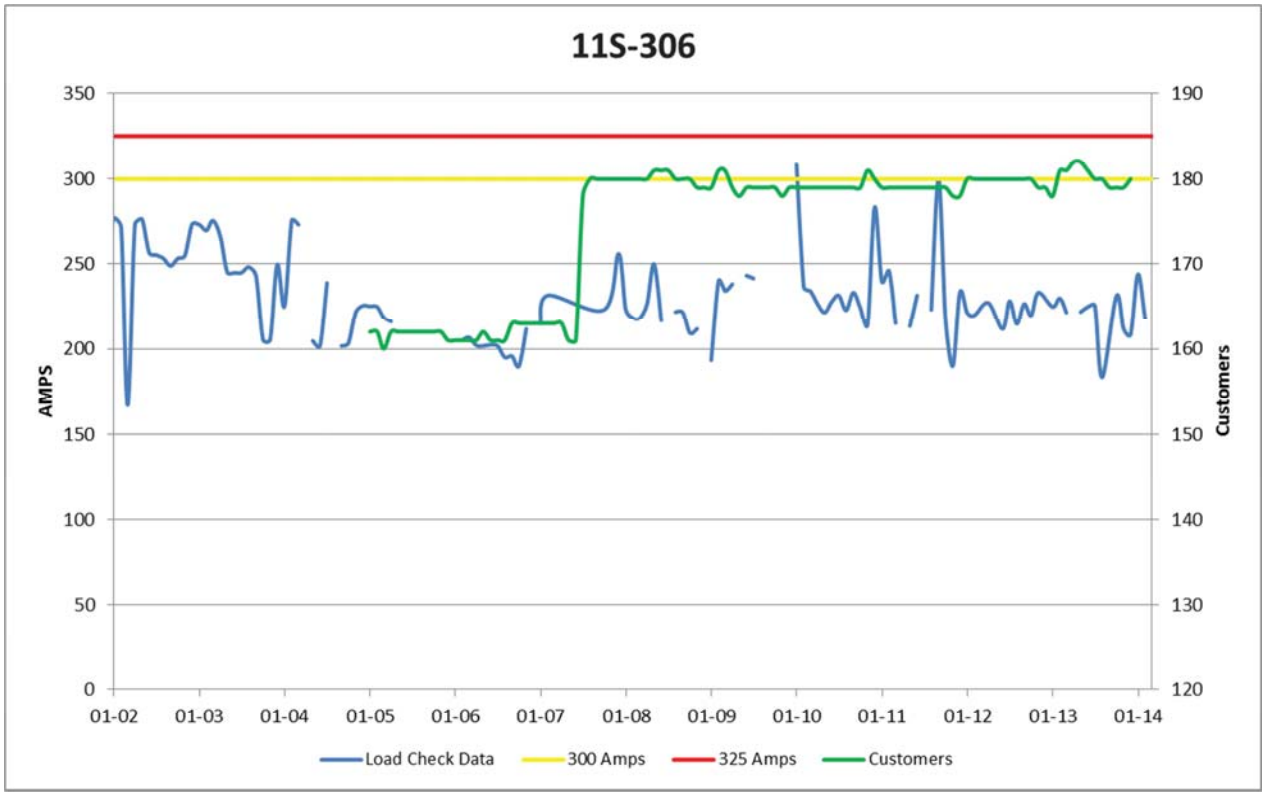


Figure 66 11S-306 Load History

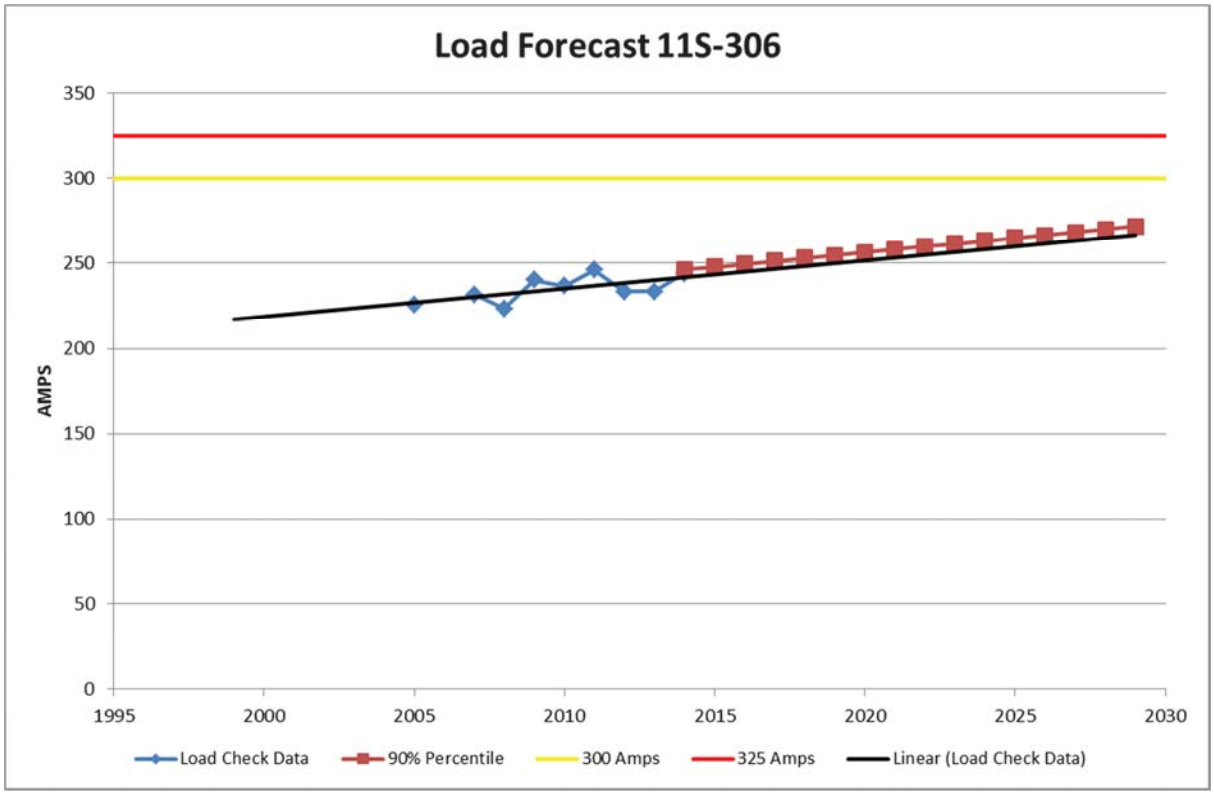


Figure 67 11S-306 Load Forecast

Load Growth 0.61%

Appendix B: Load History and Forecast

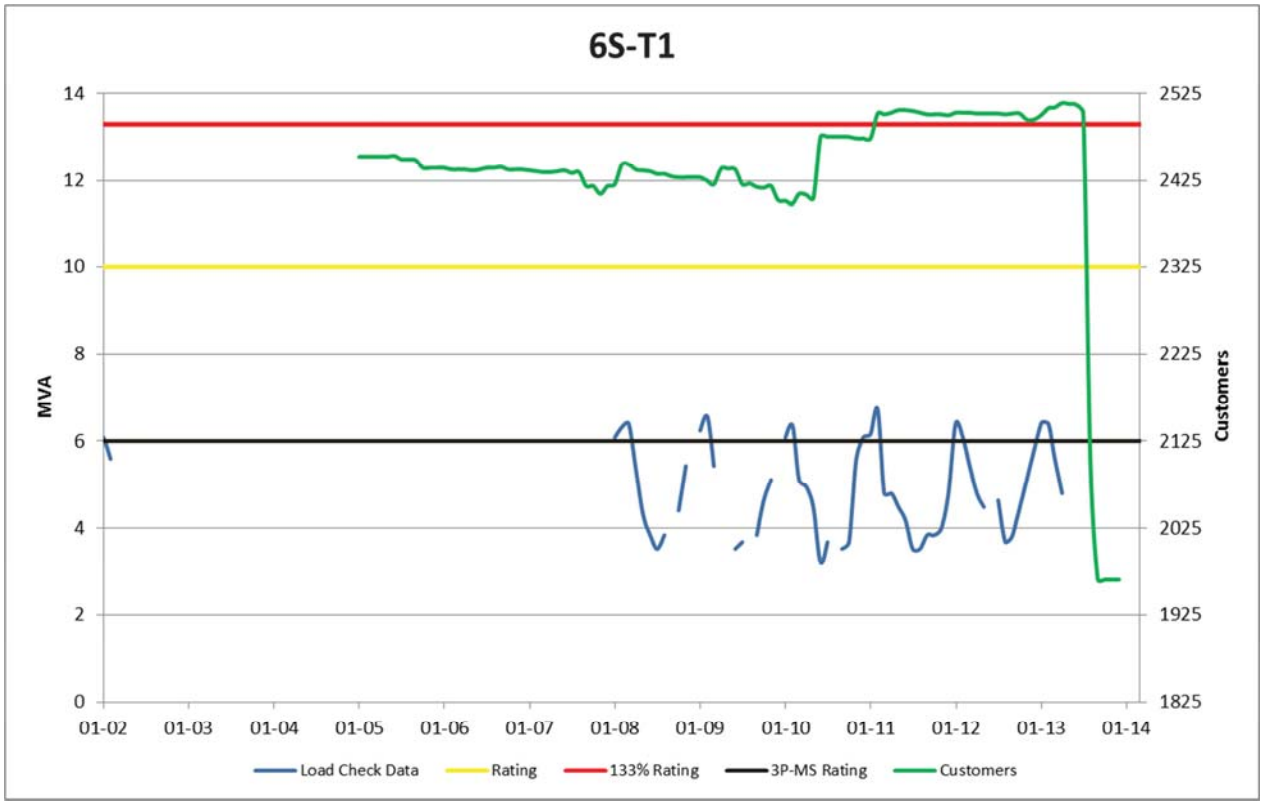


Figure 68 6S-T1 Load History

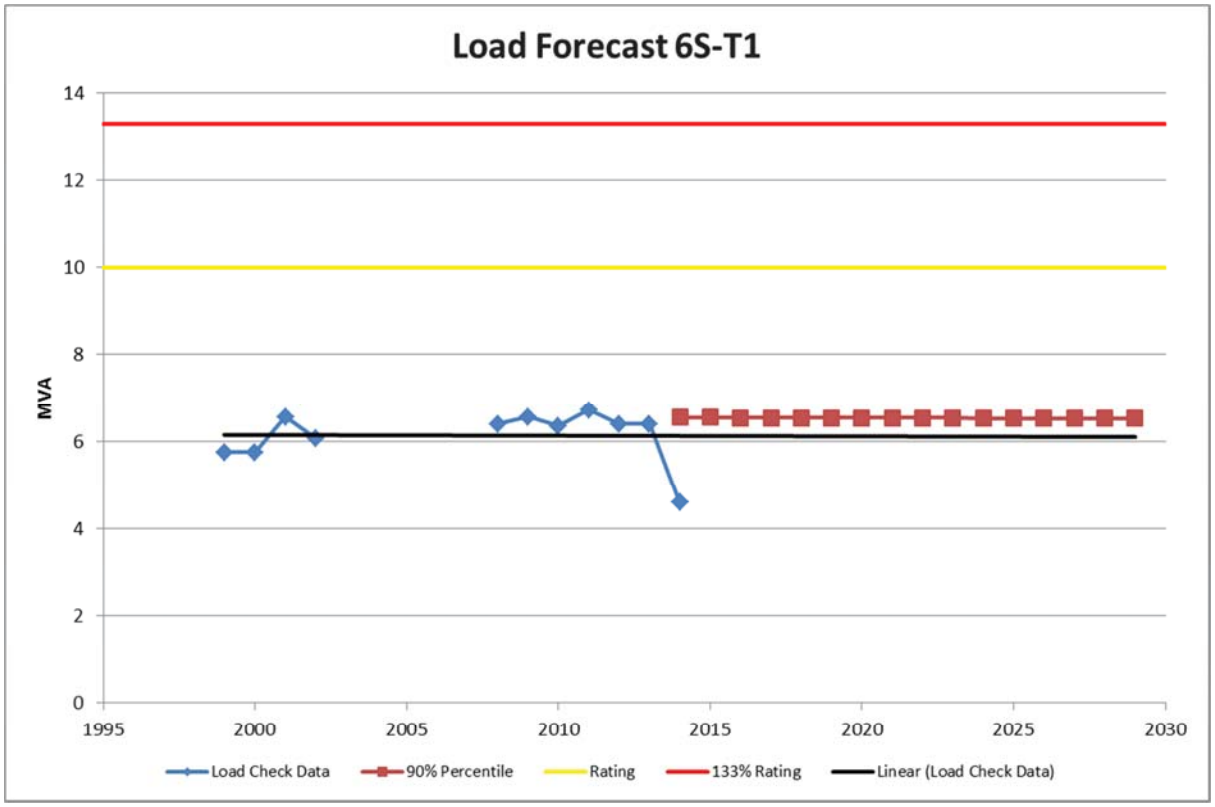


Figure 69 6S-T1 Load Forecast

Load Growth 0.02%

Appendix B: Load History and Forecast

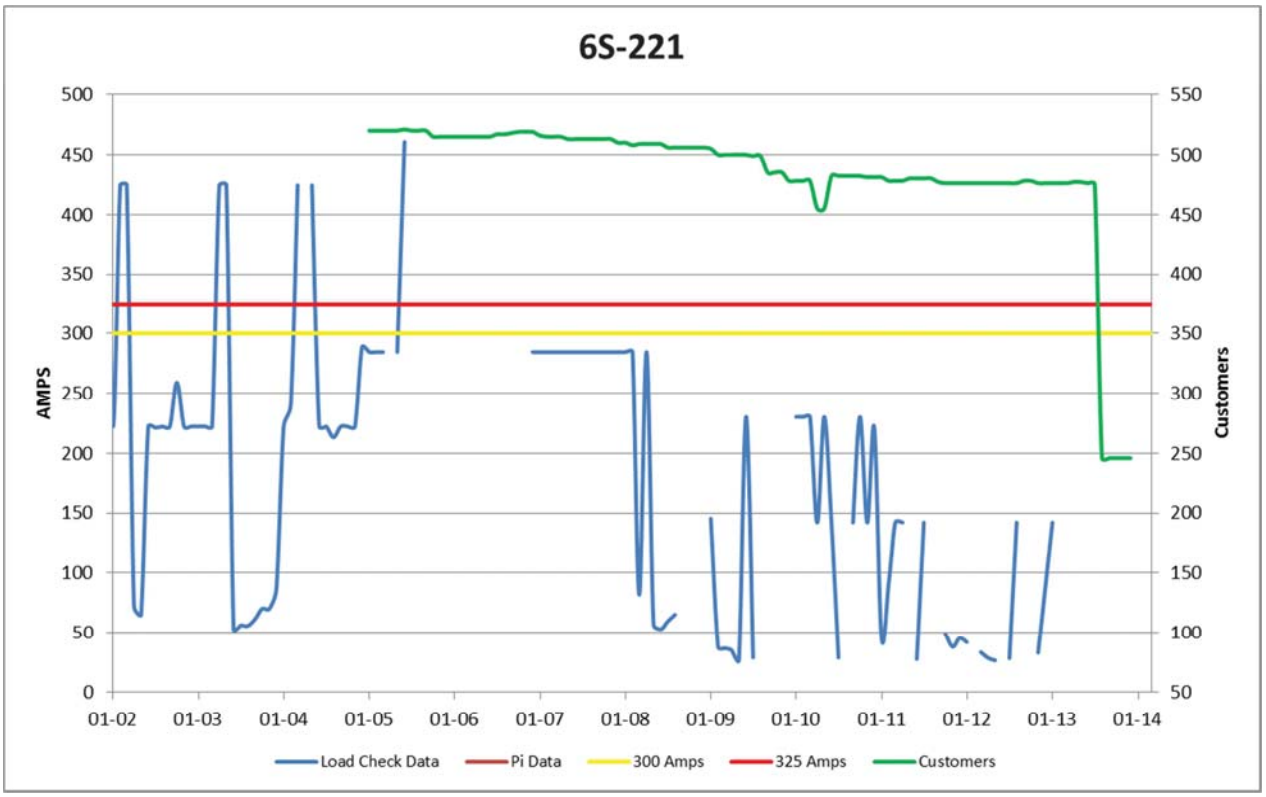


Figure 70 6S-221 Load History

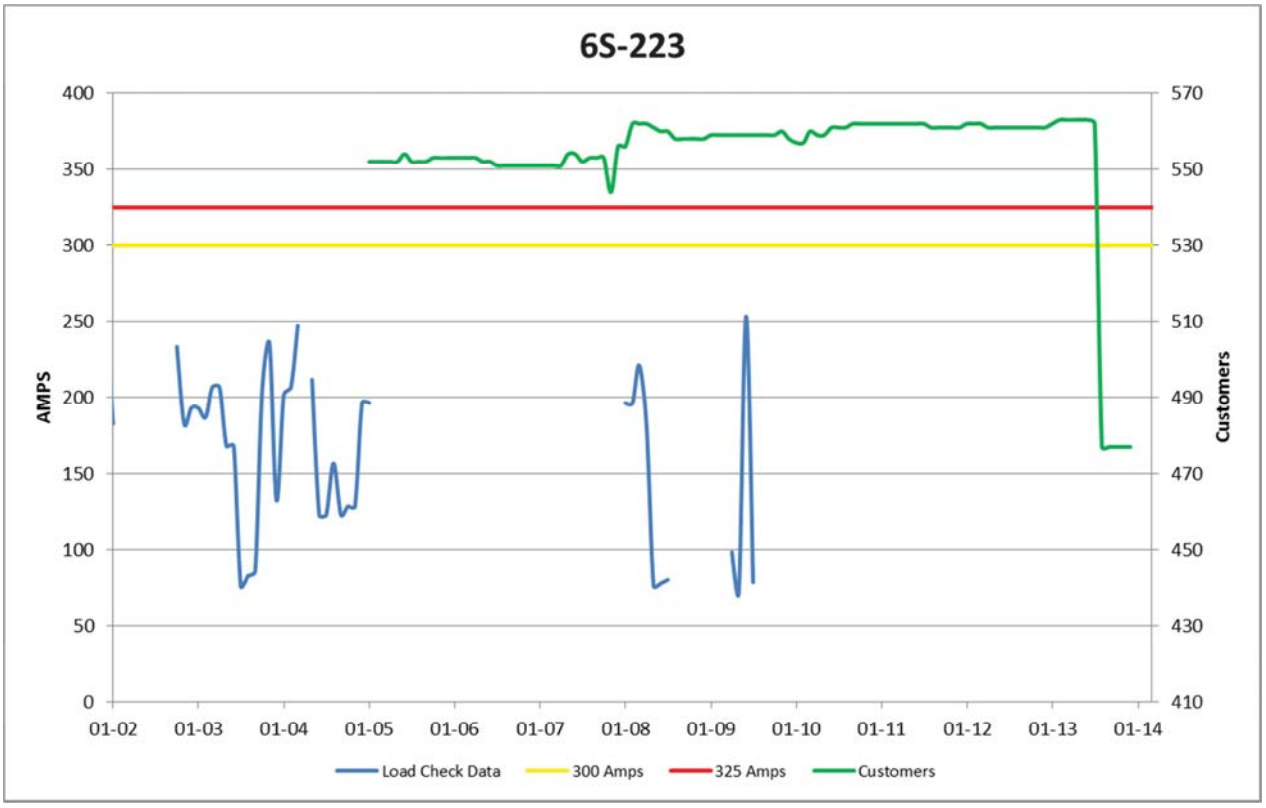


Figure 71 6S-223 Load History

Due to the ability to transfer 4kV load at 6S-Terrace Street, only the transformer forecast (6S-T1) will be presented.

Appendix B: Load History and Forecast

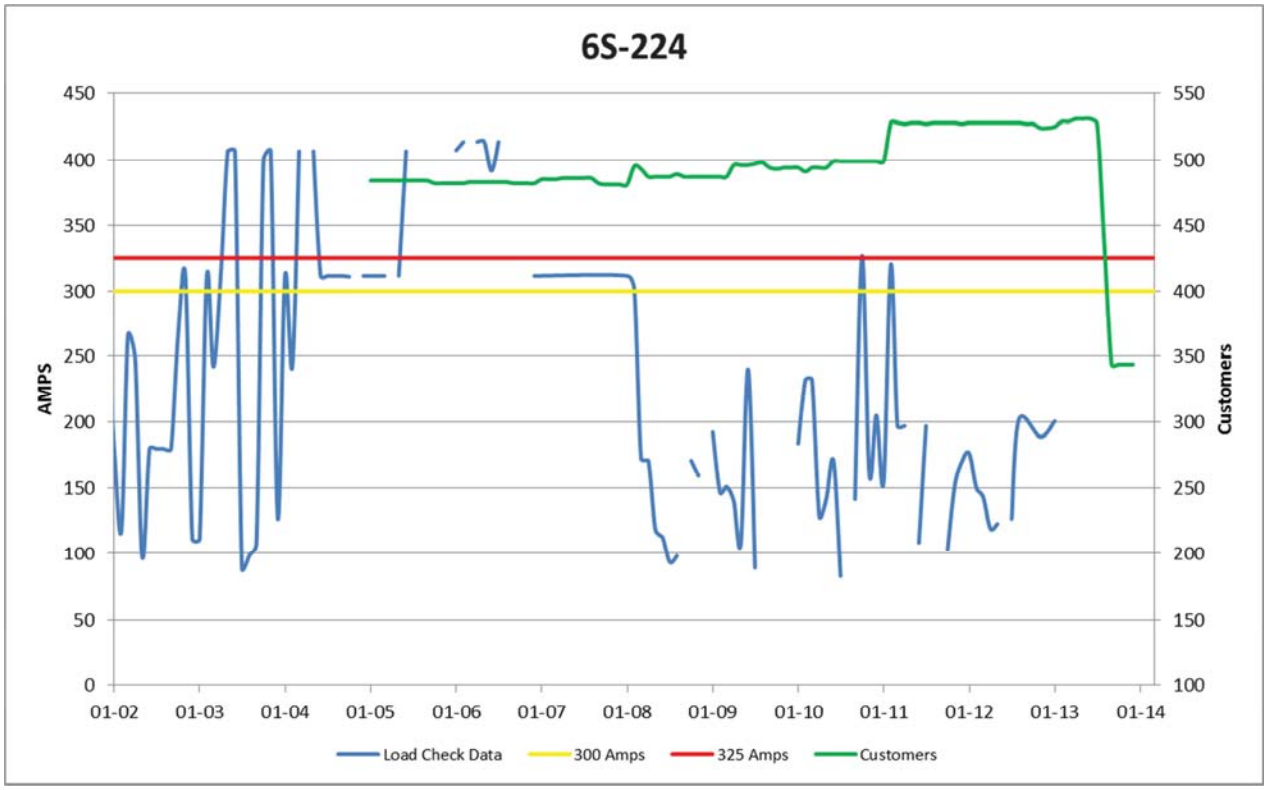


Figure 72 6S-224 Load History

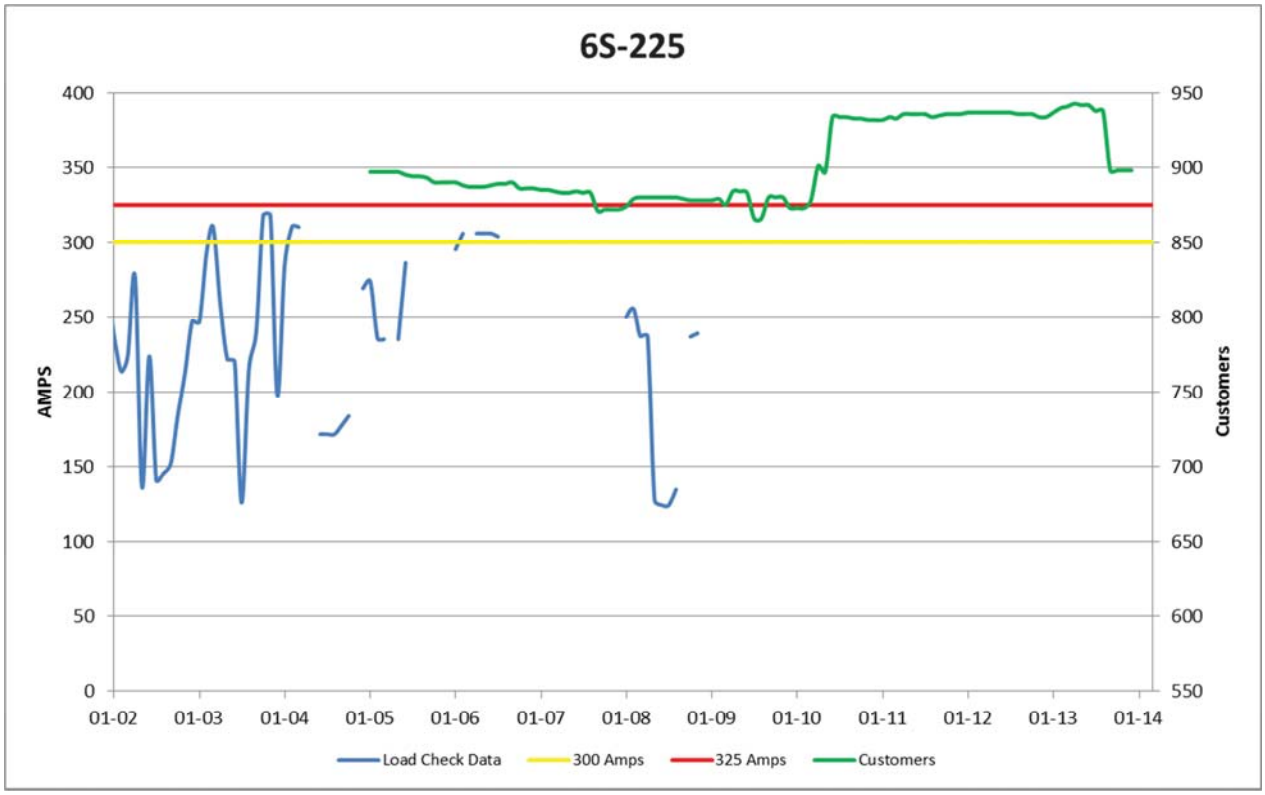


Figure 73 6S-225 Load History

APPENDIX C

Economic Analysis

533S-Mason Street Conversion and 6S-Terrace Street Retirement

Summary of Alternatives

Sydney 4kV Conversions
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :		Date :	23-Jul-13
Department :	Distribution Planning	CI Number:	
Originator :	James MacQueen	Project No. :	

	Alternative	After Tax WACC	PV of EVA / NPV	Rank	IRR	Disc Pay
A	533S-B 6S-A; Convert and Retire 6S-Terrace Street by 2016	6.48%	-2,074,838	3	-7.86%	0.0 years
B	533S-B 6S-B; Convert and Retire 6S-Terrace Street by 2018	6.48%	-2,029,860	2	-7.97%	0.0 years
C	533S-B 6S-C; Convert and Retire 6S-Terrace Streert by 2021	6.48%	-2,010,029	1	-8.28%	0.0 years
	0	NA	NA	NA	#NUM!	0.0 years

Recommendation :

This Economic Assessment recommends the following:
1. Conversion of 533S-Mason Street, from 4 to 12kV, supplied via Bentinck Street
2. Conversion of 4kV load supplied by 6S-Terrace Street to 12kV, over an 8 year period
3. Retirement of 6S-Terrace Street substation in 2021

Notes/Comments :

533S-B 6S-A; Convert and Retire 6S-Terrace Street by 2016

2013: Conversion of 533S-Mason Street stepdown
Conversion at 6S-Terrace Street to reduce overall loading for the installation of mobile substation
Replacement of 4kV breakers and related equipment at 6S-Terrace Street
2014-2015: Continued conversion of 6S-Terrace Street load to 12kV
2016: Retirement of 6S-Terrace Street substation

533S-B 6S-B; Convert and Retire 6S-Terrace Street by 2018

2013: Conversion of 533S-Mason Street stepdown
Conversion at 6S-Terrace Street to reduce overall loading for the installation of mobile substation
Replacement of 4kV breakers and related equipment at 6S-Terrace Street
2014-2017: Continued conversion of 6S-Terrace Street load to 12kV
2018: Retirement of 6S-Terrace Street substation

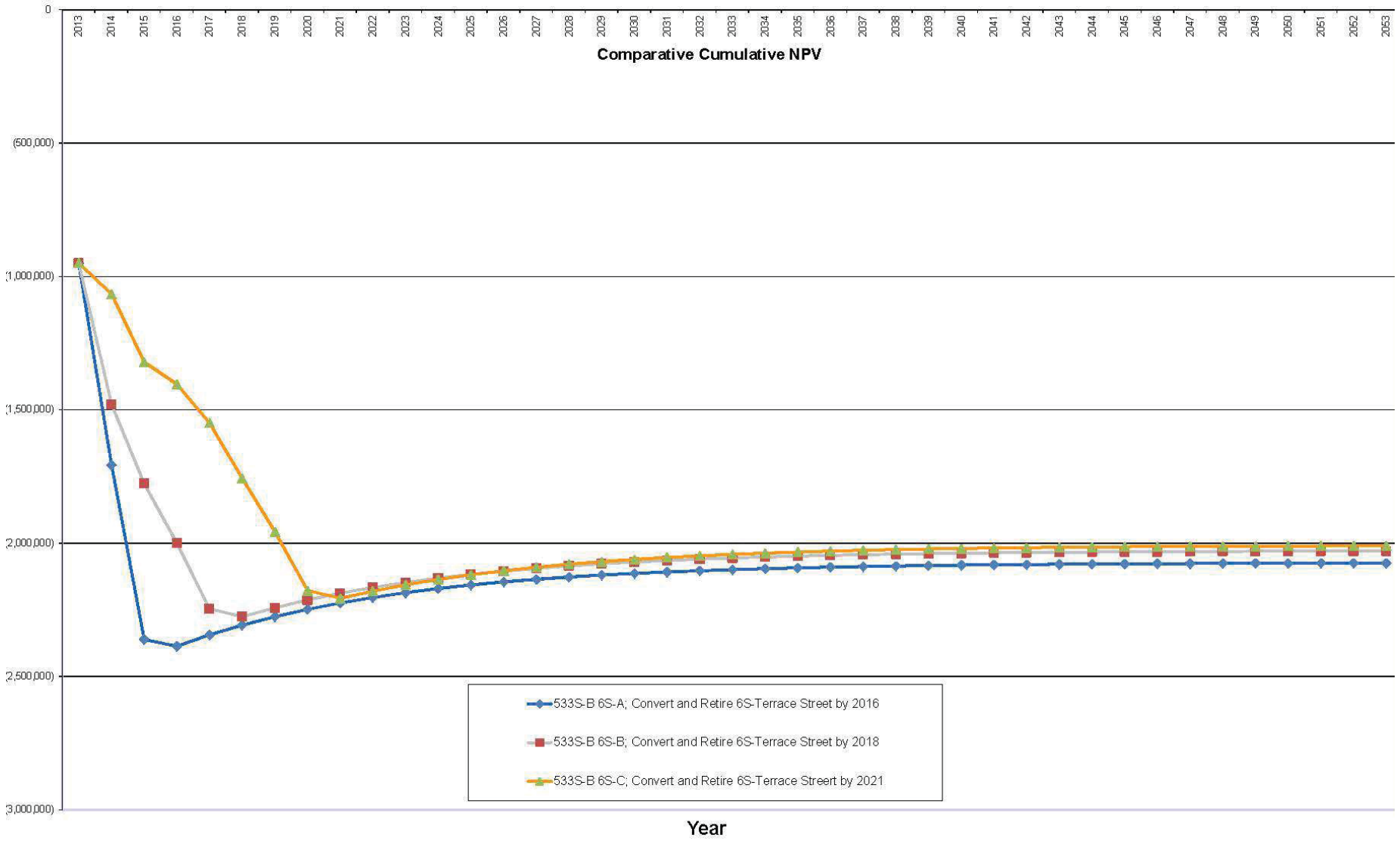
533S-B 6S-C; Convert and Retire 6S-Terrace Streert by 2021

2013: Conversion of 533S-Mason Street stepdown
Conversion at 6S-Terrace Street to reduce overall loading for the installation of mobile substation
Replacement of 4kV breakers and related equipment at 6S-Terrace Street
2014-2020: Continued conversion of 6S-Terrace Street load to 12kV
2018: Maintain 6S-T1, as part of maintenance cycle
2021: Retirement of 6S-Terrace Street substation

0

2013 Sydney 4kV Conversion EAM 7/23/2013

NPV Comparison



Alternative A- 533S-B and 6S-A: Convert and Retire 6S-Terrace Street by 2016

Sydney 4kV Conversions — Go to: Working Capital

533S-B 6S-A; Convert and Retire 6S-Terrace Street by Capital Expenses Revenue

Nova Scotia POWER An Emera Company

Add Operating Item

Project Description

Select:

In-Service Month: January

In-Service Year: 2014

Capital Invested

	Description	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
1.	Shipyard Reconfigure	35,042									
2.	533S-Msaon Street Conversion	274,188									
3.	Bentinck Street Reconfigure		102,510								
4.	Membertou Feeder Tie		35,228								
5.	Cabot Street Conversion	104,080									
6.	Rockdale Avenue Conversion	134,835									
7.	6S-Terrace Street Upgrade	401,500									
8.	Birch Hill Drive Conversion		211,271								
9.	Harold Street Conversion		315,355								
10.	Townsend Street Conversion		164,201								
11.	High Street Conversion			313,381							
12.	Terrace Street Conversion			358,471							
13.	Bernard Lind Conversion			132,214							
14.	6S-Terrace Street Retirement				90,203						
15.											
16.											
17.											
18.											
19.											
20.											
	Total Direct Capital Invested by Year	949,645	828,564	804,066	90,203						
	AFUDC (entered as a positive value)										
	AO (entered as a positive value)										
	Total Indirect Capital Invested by Year										
	Total Capital Invested by Year	**949,645**	**828,564**	**804,066**	**90,203**						

Alternative B- 533S-B and 6S-B: Convert and Retire 6S-Terrace Street by 2018

Sydney 4kV Conversions

533S-B 6S-B; Convert and Retire 6S-Terrace Street by

Nova Scotia POWER An Emera Company

Go to: Working Capital | Capital Expenses | Revenue

Add Operating Item

Project Description

Select:

In-Service Month: January

In-Service Year: 2014

Capital Invested

	Description	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
1.	Shipyard Reconfigure	35,042									
2.	533S-Mason Street Conversion	274,188									
3.	Bentinck Street Reconfigure		102,510								
4.	Membertou Feeder Tie		35,228								
5.	Caobt Street Conversion	104,080									
6.	Rockdale Avenue Conversion	134,835									
7.	6S-Terrace Street Upgrades	401,500									
8.	Birch Hill Drive Conversion			215,496							
9.	Harold Street Conversion		315,355								
10.	Townsend Street Conversion			167,485							
11.	High Street Conversion				319,649						
12.	Terrace Street Conversion					372,953					
13.	Bernard Lind Conversion		129,622								
14.	6S-Terrace Street Retirement						93,847				
15.											
16.											
17.											
18.											
19.											
20.											
	Total Direct Capital Invested by Year	949,645	582,715	382,981	319,649	372,953	93,847				
	AFUDC (entered as a positive value)										
	AO (entered as a positive value)										
	Total Indirect Capital Invested by Year										
	Total Capital Invested by Year	**949,645**	**582,715**	**382,981**	**319,649**	**372,953**	**93,847**				

Alternative C- 533S-B and 6S-C: Convert and Retire 6S-Terrace Street, by 2021

Sydney 4kV Conversions

533S-B 6S-C; Convert and Retire 6S-Terrace Streert t

Nova Scotia POWER An Emera Company

Go to: Working Capital | Capital Expenses | Revenue

Add Operating Item

Project Description

Select:

In-Service Month: January

In-Service Year: 2014

Capital Invested

	Description	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
1.	Shipyard Reconfigure	35,042									
2.	533S-Mason Street Conversion	274,188									
3.	Bentinck Street Reconfigure		102,510								
4.	Membertou Feeder Tie		35,228								
5.	Cabot Street Conversion	104,080									
6.	Rockdale Avenue Conversion	134,835									
7.	6S-Terrace Street Upgrades	401,500									
8.	Birch Hill Drive Conversion					224,202					
9.	Harold Street Conversion			321,663							
10.	Townsend Street Conversion						177,736				
11.	High Street Conversion							339,214			
12.	Terrace Street Conversion								395,781		
13.	Bernard Lind Conversion				134,858						
14.	Maintain 6S-T1						150,000				
15.	6S-Terrace Street Retirement									99,591	
16.											
17.											
18.											
19.											
20.											
	Total Direct Capital Invested by Year	949,645	137,738	321,663	134,858	224,202	327,736	339,214	395,781	99,591	
	AFUDC (entered as a positive value)										
	AO (entered as a positive value)										
	Total Indirect Capital Invested by Year										
	Total Capital Invested by Year	**949,645**	**137,738**	**321,663**	**134,858**	**224,202**	**327,736**	**339,214**	**395,781**	**99,591**	

APPENDIX D

Economic Analysis

Membertou Load Growth

Summary of Alternatives

Membertou Load Growth
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :		**Date :**	25-Mar-14
Department :	Distribution Planning	**CI Number:**	
Originator :	James MacQueen	**Project No. :**	

	Alternative	After Tax WACC	PV of EVA / NPV	Rank	IRR	Disc Pay
A	New George Street Substation, 138kV-12kV	6.48%	-3,585,299	2	-8.15%	0.0 years
B	New Alexandra Street Substation, 138kV-25kV	6.48%	-4,175,037	4	-8.17%	0.0 years
C	6S-Terrace Street Replacement, 69kV - 12kV	6.48%	-3,920,697	3	-8.25%	0.0 years
D	George Street Pad-Mounted Substation 138kV - 12kV	6.48%	-3,098,378	1	-9.04%	0.0 years

Recommendation :

This economic assessment recommends the construction of a pad-mounted substation, near George Street, as outlined in the Distribution Planning Study.

An expansion of the pad-mounted substation will be required, as load materializes and has been accounted for in this EAM.

Notes/Comments :

New George Street Substation, 138kV-12kV

2014-2015: Construction of new 138-12kV sustation off of George Street

New Alexandra Street Substation, 138kV-25kV

2014-2015: Construction of new 138-25kV sustation off of Alexandra Street, with 15/20/25MVA initial transformation
2015: Conversion of 11S-305G from 12 to 25kV
2015: Conversion of Membertou from 12 to 25kV
2016: Conversion of remaining 12kV in Sydney River to 25kV

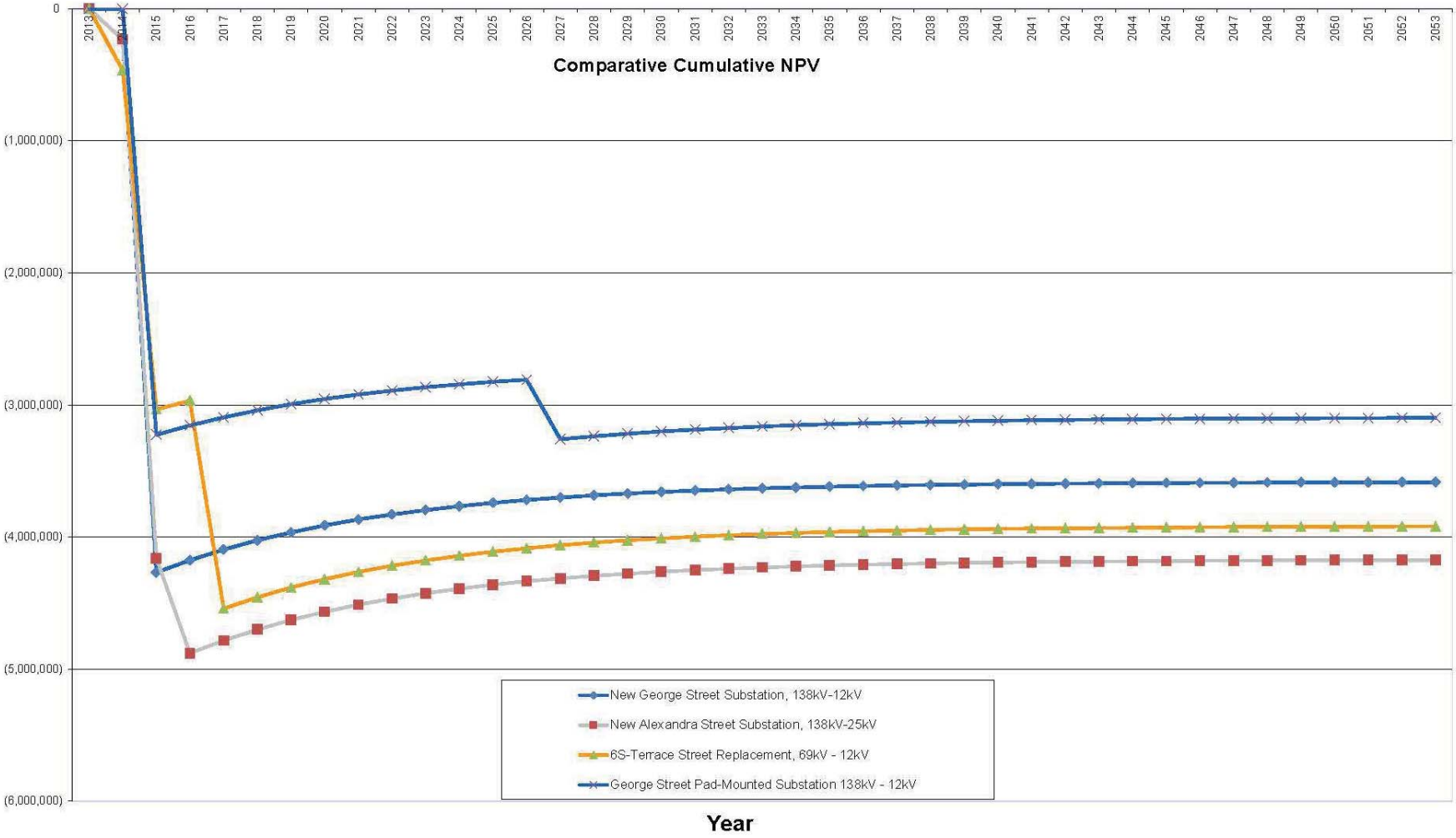
6S-Terrace Street Replacement, 69kV - 12kV

2014-2015: Installation of new 10/12/15MVA 69-12kV transformer at 6S-Terrace Street
2017: Installation of new pad-mounted substation to supply Membertou area

George Street Pad-Mounted Substation 138kV - 12kV

2015: Installation of new 15MVA 138-12kV pad-mounted substation near George Street
2027: Expansion of pad-mounted substation

NPV Comparison



Appendix C: Economic Analysis

Alternative Sub-A- New George Street Substation

Membertou Load Growth
New George Street Substation, 138kV-12kV

Nova Scotia POWER An Emera Company

Go to: Working Capital | Capital | Expenses | Revenue

Add Operating Item

Project Description

Select:
In-Service Month: January
In-Service Year: 2014

Capital Invested

	Description	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1.	New George Street Substation, Part 1		250,000													
2.	New George Street Substation, Part 2			3,500,000												
3.	New George Street Substation Distribution Upgardes			1,200,000												
4.																
5.																
6.																
7.																
8.																
9.																
10.																
11.																
12.																
13.																
14.																
15.																
16.																
17.																
18.																
19.																
20.																
	Total Direct Capital Invested by Year		250,000	4,700,000												
	AFUDC (entered as a positive value)															
	AO (entered as a positive value)															
	Total Indirect Capital Invested by Year															
	Total Capital Invested by Year		**250,000**	**4,700,000**												

Appendix C: Economic Analysis

Alternative Sub-B- New Alexandra Street Substation

Membertou Load Growth
New Alexandra Street Substation, 138kV-25kV

Nova Scotia POWER An Emera Company

Go to: Working Capital | Capital | Expenses | Revenue

Add Operating Item
Project Description

Select:
In-Service Month: January
In-Service Year: 2014

Capital Invested

	Description	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1.	New Alexandra Street Substation, Part 1		250,000													
2.	New Alexandra Substation, Part 2			3,500,000												
3.	11S-305G Conversion from 12-25kV			425,000												
4.	Membertou Conversion from 12 to 25kV			650,250												
5.	Sydney River Conversion from 12-25kV				1,002,842											
6.																
7.																
8.																
9.																
10.																
11.																
12.																
13.																
14.																
15.																
16.																
17.																
18.																
19.																
20.																
	Total Direct Capital Invested by Year		250,000	4,575,250	1,002,842											
	AFUDC (entered as a positive value)															
	AO (entered as a positive value)															
	Total Indirect Capital Invested by Year															
	Total Capital Invested by Year		**250,000**	**4,575,250**	**1,002,842**											

Appendix C: Economic Analysis

Alternative Sub-C- 6S-Terrace Street Replacement, 69kV-12kV

Membertou Load Growth
6S-Terrace Street Replacement, 69kV - 12kV

Go to: Working Capital | Capital Expenses | Revenue

Add Operating Item
Project Description

Select:
In-Service Month: January
In-Service Year: 2014

Capital Invested

	Description	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1.	6S-Terrace Street 69-12kV Preparation		500,000													
2.	6S-Terrace Street 69-12kV Completion			3,000,000												
3.	Pad-Mounted Substation, George Street					1,900,000										
4.	Pad-Mounted Substation Distribution Upgrades					250,000										
5.																
6.																
7.																
8.																
9.																
10.																
11.																
12.																
13.																
14.																
15.																
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17.																
18.																
19.																
20.																
	Total Direct Capital Invested by Year		500,000	3,000,000		2,150,000										
	AFUDC (entered as a positive value)															
	AO (entered as a positive value)															
	Total Indirect Capital Invested by Year															
	Total Capital Invested by Year		500,000	3,000,000		2,150,000										

Appendix C: Economic Analysis

Alternative D- Sub-D George Street Pad-Mounted Substation, 138kV-12kV

Membertou Load Growth
George Street Pad-Mounted Substation 138kV - 12kV

Go to: Working Capital | Capital | Expenses | Revenue

Add Operating Item
Project Description

Select:
In-Service Month: January
In-Service Year: 2014

Capital Invested

	Description	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1.	Pad-Mounted Substation, George Street			1,900,000												
2.	Pad-Mounted Substation Expansion															900,000
3.	New George Street Substation Distribution Upgrades			1,000,000												
4.	Spare Pad-Mounted substation equipment			850,000												
5.	Distribution Upgrades for Substation Expansion															250,000
6.																
7.																
8.																
9.																
10.																
11.																
12.																
13.																
14.																
15.																
16.																
17.																
18.																
19.																
20.																
	Total Direct Capital Invested by Year			3,750,000												1,150,000
	AFUDC (entered as a positive value)															
	AO (entered as a positive value)															
	Total Indirect Capital Invested by Year															
	Total Capital Invested by Year			3,750,000												1,150,000

CI Number: C0011320

Title: 22W-311GA Hawk Point Road Reconductor Replacement

Start Date): 2019/06
In-Service Date: 2019/08
Final Cost Date: 2020/02
Function Class: Distribution
Amount: $465,758

DESCRIPTION:

This project provides for the costs associated with the replacement of deteriorated three-phase primary and neutral conductor and associated insulators and framing on approximately 2.3 kilometres of existing three-phase line on primary distribution feeder 22W-311GA along Hawk Point Road on Cape Sable Island. This section of line requires the replacement of approximately 135 clamp top insulators and associated hardware and framing. Additional replacements include 21 fused cutouts and 13 pole top transformers.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- No other projects in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Deteriorated Conductor

Why do this project?

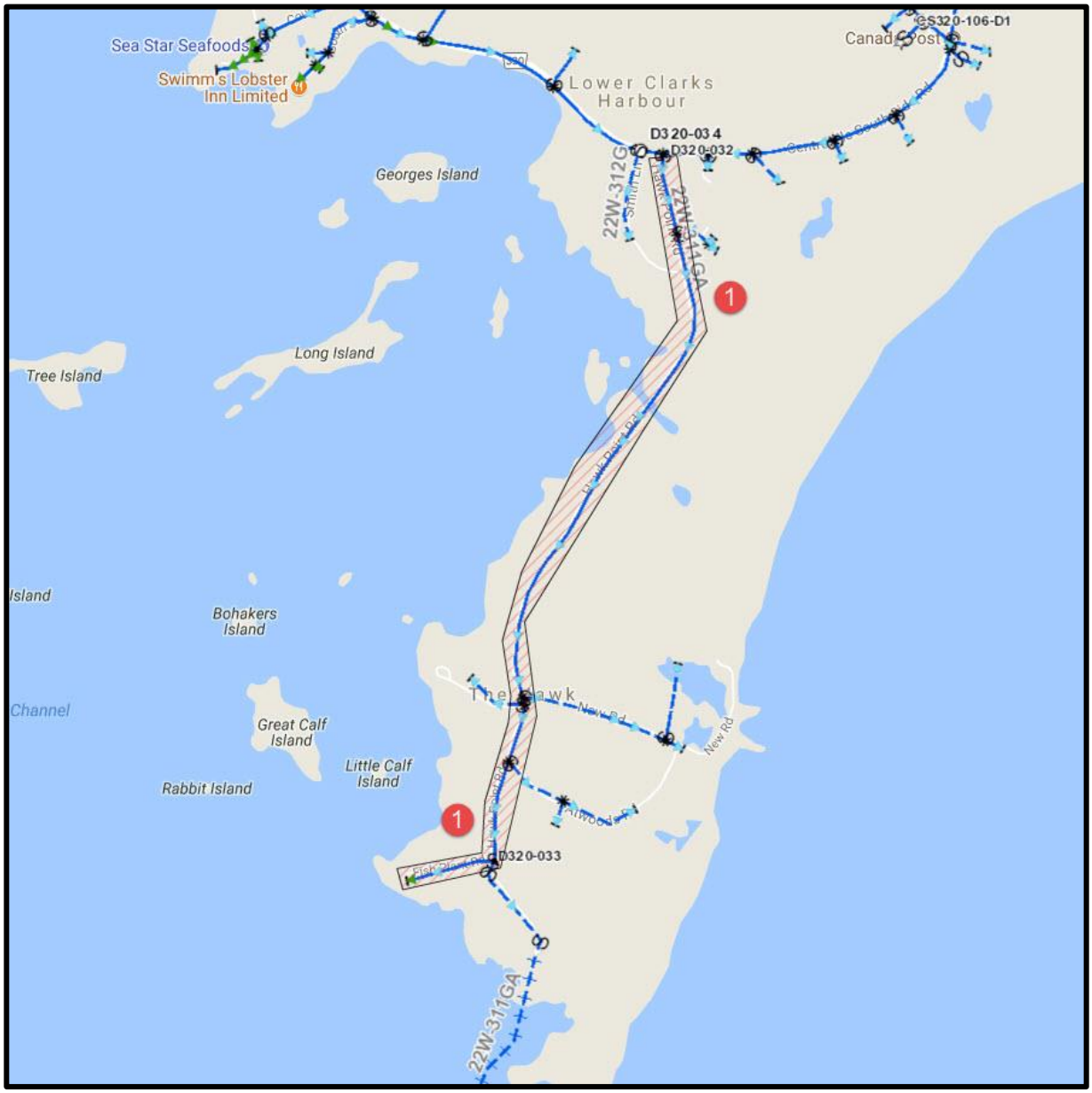
The existing poles and conductor are over 45 years old and have reached the end of their expected useful lives. As a result of the equipment deterioration, a number of sections of the conductor can no longer be worked on under live conditions which increases the need for planned outages.

Why do this project now?

The existing conductor and targeted poles are deteriorated and at risk of failure due to their age and condition. Inspections of the targeted devices and assessment based on age, condition and risk of failure have determined that replacements are required. In addition, outages have started to occur on this section of line and will likely increase in frequency until this project is complete.

Why do this project this way?

There is no alternative to supply the customers in the targeted area. Completing this project is the only alternative to mitigate the risk of failure.



1. Replace targeted conductor, framing and insulators.

CI Number : C0011320 - 22W-311GA Hawk Point Road Reconductor Replacement

Project Number C0011320

Parent CI Number : -- 1456 Distribution General

Asset Location : 1456

Budget Version 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0200 - DP - Land Rights	7,489
Additions	3500 - DP - Wood Poles	110,878
Additions	3900 - DP - O/H Cond.	253,851
Additions	4000 - DP - O/H Cond.Devices	2,053
Additions	4100 - DP - O/H Line Transf.	43,306
Retirements	3500 - DP - Wood Poles	16,650
Retirements	3900 - DP - O/H Cond.	23,414
Retirements	4100 - DP - O/H Line Transf.	8,117
	Total Cost:	465,758
	Original Cost:	53,959

Capital Project Detailed Estimate

Location: Distribution
CI# / FP#: C011320
Title: 22W-311GA Hawk Point Rd Reconductor Replacement
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Design	PD	16	$ 386	$ 6,232		
Procurement / Financial Support	Lot	1	$ 870	$ 870		
			Sub-Total	$ 7,102		
Materials						
Wood Poles	Lot	1	$ 7,917	$ 7,917		
O/H Cond.	Lot	1	$ 14,098	$ 14,098		
O/H Line Transf.	Lot	1	$ 21,494	$ 21,494		
			Sub-Total	$ 43,509		
Contracts						
Trees	Lot	1	$ 5,000	$ 5,000		
Flagging	Lot	1	$ 45,058	$ 45,058		
Contractor Labour	Lot	1	$ 239,359	$ 239,359		
Feeder Inspection	Lot	1	$ 12,199	$ 12,199		
			Sub-Total	$ 301,616		
Easements						
Easement	Lot	1	$ 2,500	$ 2,500		
			Sub-Total	$ 2,500		
Other Goods & Services						
Contingency	%	10%	$ 354,727	$ 35,473		
			Sub-Total	$ 35,473		
Interest Capitalized						
AFUDC				$ 2,186		
			Sub-Total	$ 2,186		
Vehicle Overhead						
Vehicle AO				$ 3,086		
			Sub-Total	$ 3,086		
Administrative Overhead						
Labour AO				$ 5,508		
Contract AO				$ 64,778		
			Sub-Total	$ 70,286		
			SUB-TOTAL (no AO, AFUDC)	$ 390,199		
			TOTAL (AO, AFUDC included)	$ 465,758		
Original Cost				$ 53,959		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 52229

Title: 16V-314H New Edinburgh Phase Extension

Start Date: 2019/08
In-Service Date: 2019/12
Final Cost Date: 2020/06
Function Class: Distribution
Forecast Amount: $454,662

DESCRIPTION:

This project provides for the costs associated with extending two additional phases along New Edinburgh Road near Weymouth for approximately 3.3 kilometres between Highway 1 and Riverside Drive and for the replacement of 670 metres of deteriorated 3-phase overhead line and the underwater cable crossing the Sissiboo River with approximately 3.2 kilometres of 2/0 AASC primary and associated framing. Additional replacements include approximately 1 kilometre of 2/0 AASC neutral conductor, 4 poles, 1 overhead transformer, 5 cutouts and 13 services.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- No other projects in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Deteriorated Conductor

Why do this project?

The existing underwater cable and associated overhead line are deteriorated and at risk of failure due to their age and condition.

Why do this project now?

The existing underwater cable and associated overhead line were installed in 1960 and have reached the end of their expected service lives. Inspection of the targeted devices and assessment based on age, condition and risk of failure has determined that replacement is required. A failure on this cable would result in an extended outage to three phase customers in the area until this project could be completed.

Why do this project this way?

The addition of two new phases along New Edinburgh Road was determined to be the least cost option to maintain reliable three phase power to existing customers. Other options considered were replacing the underwater cable and overhead line in kind or extending two additional phases along Riverside Road.

1. Extend two phases of 2/0 AASC.
2. Retire underwater cable and associated overhead section.

CI Number : 52229 - 16V-314H New Edinburgh Phase Extension **Project Number** 52229

Parent CI Number : -

Asset Location : 1456 - 1456 Distribution Plant General **Budget Version** 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0200 - DP - Land Rights	123,923
Additions	3500 - DP - Wood Poles	101,631
Additions	3900 - DP - O/H Cond.	180,120
Additions	4000 - DP - O/H Cond.Devices	1,487
Additions	4100 - DP - O/H Line Transf.	5,101
Additions	5000 - DP - Street Lights	301
Additions	5200 - DP - Services	3,915
Retirements	3500 - DP - Wood Poles	17,079
Retirements	3900 - DP - O/H Cond.	14,676
Retirements	4000 - DP - O/H Cond.Devices	4,026
Retirements	4100 - DP - O/H Line Transf.	520
Retirements	4600 - DP - U/G Conductor	1,883
	Total Cost:	454,662
	Original Cost:	33,230

Capital Project Detailed Estimate

Location: Distribution
CI#: 52229
Title: 16V-314H New Edinburgh Phase Extension
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Design	PD	8	$ 386	$ 3,064		
Procurement / Financial Support	Lot	1	$ 443	$ 443		
			Sub-Total	$ 3,507		
Materials						
Wood Poles	LOT	1	$ 7,714	$ 7,714		
O/H Cond.	LOT	1	$ 12,116	$ 12,116		
O/H Line Transf.	LOT	1	$ 1,912	$ 1,912		
O/H Cond.Devices	LOT	1	$ 414	$ 414.35		
			Sub-Total	$ 22,155		
Contracts						
Trees	LOT	1	$ 88,000	$ 88,000		
Flagging	LOT	1	$ 33,507	$ 33,507		
Backhoe	LOT	1	$ 8,550	$ 8,550		
Contractor Labour	LOT	1	$ 174,969	$ 174,969		
Feeder Inspection	LOT	1	$ 12,785	$ 12,785		
			Sub-Total	$ 317,811		
Other Goods & Services						
Contingency		10%	$ 343,474	$ 34,347		
			Sub-Total	$ 34,347		
Interest Capitalized						
AFUDC				$ 4,340		
			Sub-Total	$ 4,340		
Vehicle Overhead						
Vehicle AO				$ 1,524		
			Sub-Total	$ 1,524		
Administrative Overhead						
Labour AO				$ 2,720		
Contract AO				$ 68,256		
			Sub-Total	$ 70,976		
			SUB-TOTAL (no AO, AFUDC)	$ 377,821		
			TOTAL (AO, AFUDC included)	$ 454,662		
Original Cost				$ 33,230		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011189

Title: 2H-411 Cowie Hill UG System Replacement Part 3

Start Date: 2019/05
In-Service Date: 2019/12
Final Cost Date: 2020/06
Function: Distribution
Forecast Amount: $449,448

DESCRIPTION:

The Cowie Hill subdivision of Halifax is served by an underground system for both the primary and secondary voltage cables. Multiple failures have occurred in the past indicating that the existing cables have reached their end of life and should be replaced. The existing cables are direct buried and will be replaced and installed in a new duct system as per current NS Power standards, to allow for improved access, maintainability and reliability.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- 2017 D055 2H-411 – Cowie Hill UG System Replacement Part 1 $56,849
- 2018 D055 2H-411 – Cowie Hill UG System Replacement Part 2 $56,000
- 2020 CI TBD 2H-411 – Cowie Hill UG System Replacement Part 4 $TBD
- 2021 CI TBD 2H-411 – Cowie Hill UG System Replacement Part 5 $TBD

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Deteriorated Conductor

Why do this project?

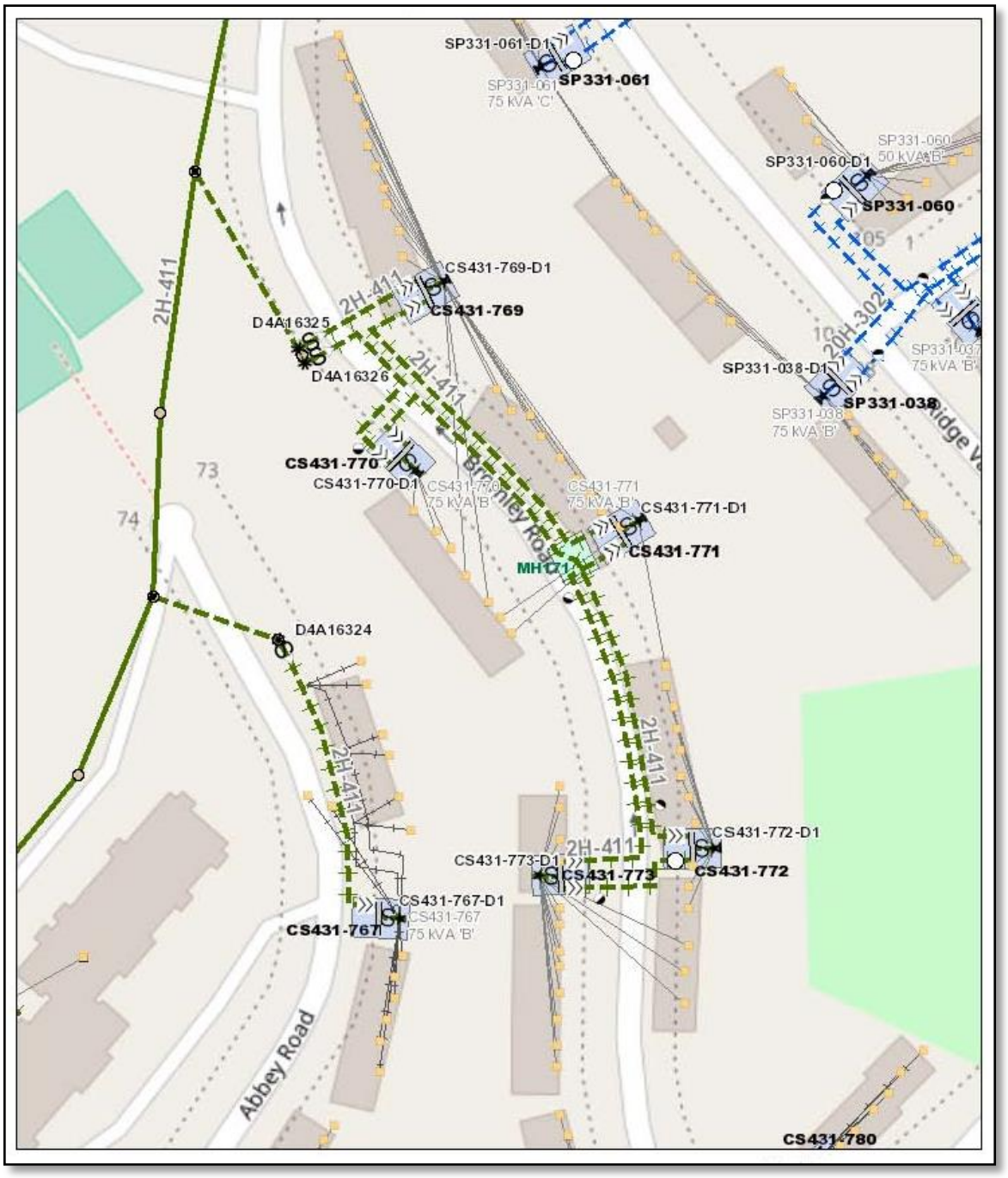
This project addresses an existing issue on the underground distribution system at Cowie Hill. The cables are approximately 20 years old and failures that have occurred on these cables indicate that they have reached their end of life and should be replaced with new cables and underground boxes bringing the subdivision to the current NS Power standard. In addition, this project will allow us to improve the reliability to our customers.

Why do this project now?

Multiple failures have occurred in the last two years indicating that the existing cables have reached their end of life and should be replaced. The cables are approximately 20 years old and have reached the end of their expected useful life and need to be replaced now to mitigate risk of further failures in the future.

Why do this project this way?

Replacing the targeted assets is a more cost effective solution than rebuilding the entire underground line, or building new overhead lines. Replacing the deteriorated, direct buried cables with new cables installed in a duct system allows for improved access, maintainability and reliability of the distribution system and is consistent with current NS Power standards.



1. Construct a new conduits system.
2. Install New underground secondary junction box (URD)
3. Replace/install new secondary cables and meter base.

CI Number : C0011189 - 2H-411 Cowie Hill UG System Replacement Part 3

Project Number C0011189

Parent CI Number : - 1456 Distribution General

Asset Location : 1456

Budget Version 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	4500 - DP - U/G Conduit	30,521
Additions	4600 - DP - U/G Conductor	357,525
Additions	4700 - DP - U/G Conductor Devices	50,790
Retirements	4600 - DP - U/G Conductor	7,830
Retirements	4700 - DP - U/G Conductor Devices	2,783
	Total Cost:	449,448
	Original Cost:	273,293

Capital Project Detailed Estimate

Location: Transmission
CI#: C0011189
Title: 2H-411 Cowie Hill UG System Replacement Part 3
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - PLT Labour	PD	171	$ 372	$ 63,797		
T&D Labour - Engineering & Design	PD	28	$ 386	$ 10,638		
Procurement / Financial Support	Lot	1	$ 1,085	$ 1,085		
			Sub-Total	$ 75,521		
Materials						
U/G Conduit	Lot	1	$ 2,478	$ 2,478		
U/G Conductor	Lot	1	$ 44,875	$ 44,875		
U/G Conductor Devices	Lot	1	$ 6,900	$ 6,900		
			Sub-Total	$ 54,253		
Contracts						
Flagging	Lot	1	$ 20,302	$ 20,302		
Backhoe	Lot	1	$ 1,000	$ 1,000		
Duct bank	Lot	1	$ 106,001	$ 106,001		
Concrete (FDNS)	Lot	1	$ 20,500	$ 20,500		
Other Contracts	Lot	1	$ 12,850	$ 12,850		
			Sub-Total	$ 160,653		
Other Goods & Services						
Contingency	%	10%	$ 290,426	$ 29,043		
			Sub-Total	$ 29,043		
Interest Capitalized						
AFUDC				$ 4,091		
			Sub-Total	$ 4,091		
Vehicle Overhead						
Vehicle AO				$ 32,815		
			Sub-Total	$ 32,815		
Administrative Overhead						
Labour AO				$ 58,570		
Contract AO				$ 34,503		
			Sub-Total	$ 93,073		
			SUB-TOTAL (no AO, AFUDC)	$ 319,469		
			TOTAL (AO, AFUDC included)	$ 449,448		
Original Cost				273,293		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0013978

Title: 11S Keltic Drive Substation Animal Guards

Start Date: 2019/05
In-Service Date: 2019/09
Final Cost Date: 2020/03
Function: Distribution
Forecast Amount: $333,813

DESCRIPTION:

This project provides for the installation of polyurethane animal guards on low voltage (less than 69 kV) equipment in the 11S Keltic Drive substation in Sydney. Animal guards will be installed on insulators, bushings, surge arrestors, conductor, switches, bus work, and fused cutouts. Animal guards provide a physical barrier over energized equipment to mitigate risk of animal electrical contacts resulting in outages and often damage to equipment.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- No other projects in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Requirement to Serve

Why do this project?

Substations, especially transformers, give off heat, which attracts animals. The 11S Keltic Drive substation has three distribution power transformers and twelve feeders and has had multiple outages caused by animals in the past. The installation of fitted animal guards in the substation will reduce the risk of animals making electrical contact with the energized equipment and improve reliability, prevent equipment damage and reduce animal injuries and fatalities.

Why do this project now?

The 11S Keltic Drive substation has experienced incidents and equipment damage involving animals entering the area around the substation. Individual Feeder outages can affect up to 3000 customers and a power transformer outage could affect up to 5300 customers. Installing animal guards on this substation equipment reduces the risk of further animal related incidents in the future.

Why do this project this way?

Installing animal guards is the most practical and cost-effective way to minimize outages and animal injuries or fatalities caused by animal contacts with energized equipment in outdoor substations. The alternative of installing substation equipment indoors is not as cost-effective. The chosen supplier of the animal guards is an industry leader and provides custom designs to fit the specific substation components, which vary in age, design, and manufacturer.

CI Number : C0013978 - 11S Keltic Drive Substation Animal Guards

Project Number C0013978

Parent CI Number : -

Asset Location : 1456 - 1456 Distribution General

Budget Version 2019 ACE

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0700 - DP - Environmental	333,813
	Total Cost:	333,813
	Original Cost:	

Capital Project Detailed Estimate

Location: Distribution
CI# : C0013978
Title: 11S Keltic Drive Substation Animal Guards
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
Technician - Animal Guard Installs	PD	63	$ 373	$ 23,330		
Engineering Support	PD	6	$ 405	$ 2,593		
			Sub-Total	$ 25,923		
Travel Expense						
Travel - Engineering	lot	1	$ 250	$ 250		
			Sub-Total	$ 250		
Materials						
Animal Guard Materials	lot	1	[redacted]		Attachment 1	
Misc. Tools/Equipment for Install	lot	1				
			Sub-Total	$ 232,900		
Contracts						
Technical Support	lot	2	[redacted]		Attachment 1	
Technical Support	lot	10			Attachment 1	
Crane Rental	lot	1				
			Sub-Total	$ 22,500		
Meals						
Meals - Engineering	lot	1	$ 100	$ 100		
			Sub-Total	$ 100		
Other Goods & Services						
Contingency	%	5%	$ 281,673	$ 14,084		
			Sub-Total	$ 14,084		
Vehicle Overhead						
Vehicle AO				$ 11,264		
			Sub-Total	$ 11,264		
Interest Capitalized						
AFUDC				$ 1,855		
			Sub-Total	$ 1,855		
535705 Administrative Overhead						
Labour AO				$ 20,105		
Contract AO				$ 4,832		
			Sub-Total	$ 24,937		
			SUB-TOTAL (no AO, AFUDC)	$ 295,757		
			TOTAL (AO, AFUDC included)	$ 333,813		
Original Cost				$ -		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

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BUDGETARY ESTIMATE FOR GREENJACKET

Customer: NOVA SCOTIA POWER
Attention: Kevin Moore
E-mail: kevin.moore@nspower.ca
Telephone: 902-428-3000
Cellular: (902) 229-9919

Date: October 19, 2017
Project #: 153381
Project Name: KELTIC DRIVE 11s
SPP Version: A

Item	Description	Qty.	Unit Price ($)	Amount ($)
Greenjacket/Material	Scope as defined in the Site Protection Plan (SPP).			
	*includes Greenjacket, conductor cover, and fasteners			
PAGE 3	TRANSFORMER	1	[redacted]	
PAGE 4	MAIN SWITCH	1		
PAGE 5	BUS SUPPORT - BEFORE METERING	1		
PAGE 6	METERING	1		
PAGE 7	STRUCTURE NAME	4		
PAGE 8	MOBILE SUB CONNECTION	1		
PAGE 9	SWITCH - LINE SIDE	3		
PAGE 10	RECLOSER	2		
PAGE 11	SWITCH - LOAD SIDE	3		
PAGE 12	SWITCH - GANG - BYPASS	3		
PAGE 13	UG'S	2		
PAGE 14	TRANSFER BUS	4		
PAGE 16	TRANSFORMER	2		
PAGE 17	MAIN SWITCH	1		
PAGE 18	OPERATING BUS - WEST SIDE	1		
PAGE 19	BUS TIE	1		
PAGE 20	OPERATING BUS - EAST SIDE	1		
PAGE 21	SWITCH - LINE SIDE	4		
PAGE 22	RECLOSER	4		
PAGE 23	SWITCH - LOAD SIDE	4		
PAGE 24	METERING - EAST END	1		
PAGE 25	METERING - WEST END	1		
PAGE 26	TRANSFER BUS	1		
Technical Support (SA)	Site assessment to collect data of equipment and/or substation			Request Quote
	[redacted] for first day on site, [redacted] per additional day			
	*includes travel days			
Technical Support (IN)	On site technical support of client installation team			Request Quote
	* [redacted] for first day on site [redacted] per additional day			
	*includes travel days			
Project Total			CAD	[redacted]

1) Applicable taxes extra.
2) Estimate valid for 90 days.
3) **This is an estimate only. A purchase order cannot be issued from this estimate.**
4) Greenjacket is a custom, precise-fit solution. Coverage represented in the Site Protection Plan may differ from the completed design.
5) Accuracy is contingent on the detail obtained from the customer supplied images and drawings. Final part selection and configuration can only be determined after the image data collected from a Site Assessment (SA) has been processed.
6) Shipping and handling not included.

CI Number: C0011182

Title: 15N-202 Dominion St and Arthur St Rebuild

Start Date): 2019/03
In-Service Date: 2019/06
Final Cost Date: 2019/12
Function Class: Distribution
Amount: $328,292

DESCRIPTION:

This project will replace approximately 1.4 kilometres of existing single-phase line on primary distribution feeder 15N-202 along Dominion St, Arthur St, Duke St and King St in Truro. This will require the replacement of approximately 1.4 kilometres of existing primary and neutral conductor with 2/0 AASC primary and neutral. Additional replacements include approximately 21 poles, 17 transformers and 120 insulators.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- No other projects in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Deteriorated Conductor

Why do this project?

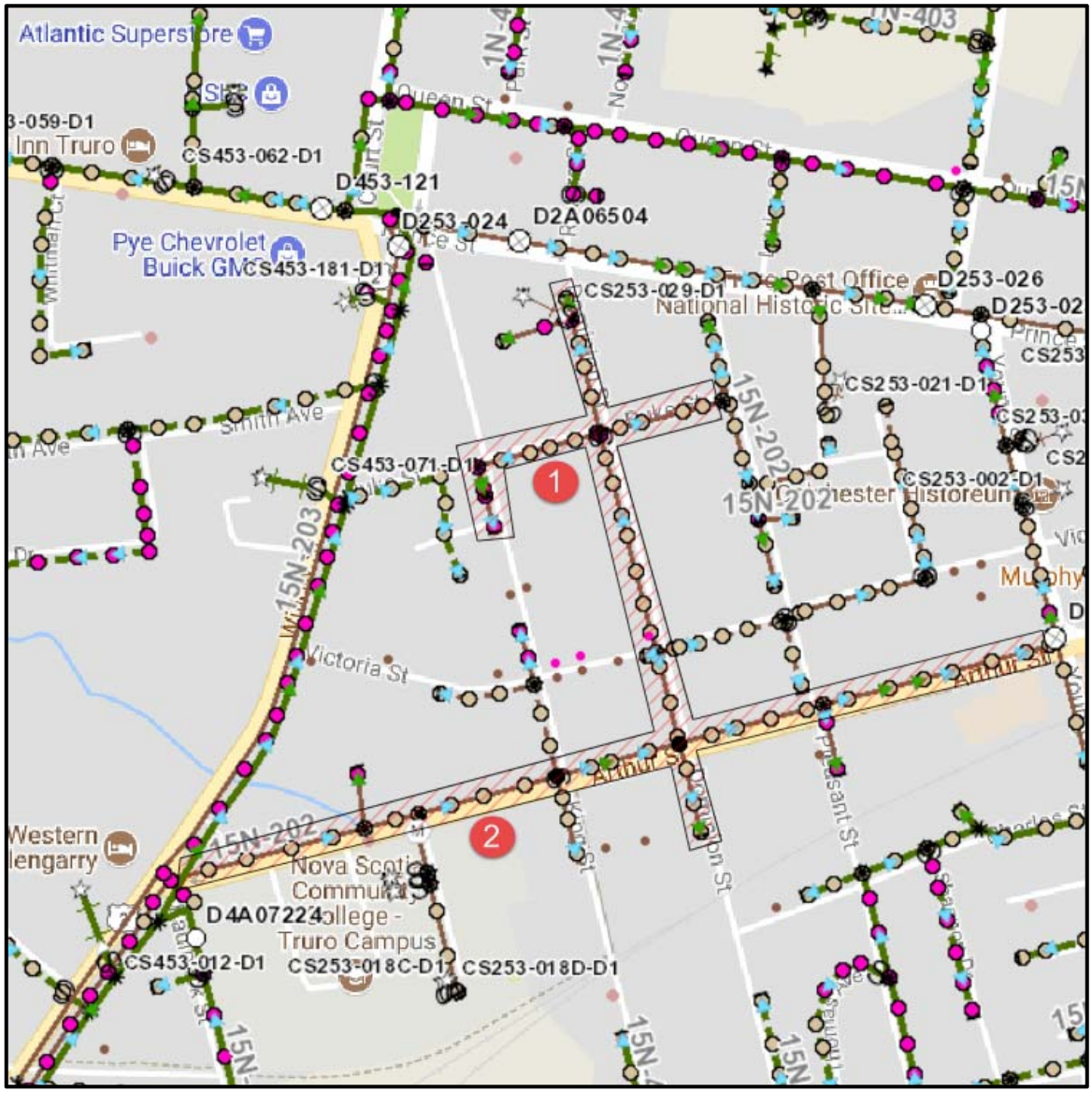
The existing conductor and poles are deteriorated and at risk of failure due to their age and condition. The sections of line targeted for this project were built to the standard at the time of its original construction. As assets are replaced on these sections of line they will also be brought up to current NS Power standards.

Why do this project now?

The targeted assets are approximately 53 years old and have reached the end of their expected service lives. Inspection of the targeted devices and assessment based on age, condition and risk of failure have confirmed that replacement is required.

Why do this project this way?

There is no alternative source of supply for customers in the targeted area. Replacing the targeted assets is a more cost effective solution than rebuilding the entire line.



1. Replace targeted device at Dominion St, Duke St and King St.
2. Replace targeted device at Arthur St.

CI Number : C0011182 - 15N-202 Dominion St and Arthur St Rebuild

Project Number C0011182

Parent CI Number : -

Asset Location : 1456 - 1456 Distribution General

Budget Version 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	3500 - DP - Wood Poles	65,805
Additions	3900 - DP - O/H Cond.	113,359
Additions	4000 - DP - O/H Cond.Devices	1,344
Additions	4100 - DP - O/H Line Transf.	49,925
Additions	4600 - DP - U/G Conductor	11,846
Additions	4800 - DP - U/G Line Transf.	65,860
Retirements	3500 - DP - Wood Poles	6,864
Retirements	3900 - DP - O/H Cond.	6,992
Retirements	4000 - DP - O/H Cond.Devices	77
Retirements	4100 - DP - O/H Line Transf.	2,674
Retirements	4600 - DP - U/G Conductor	563
Retirements	4800 - DP - U/G Line Transf.	2,982
	Total Cost:	328,292
	Original Cost:	37,552

Capital Project Detailed Estimate

Location: Distribution
CI#: C0011182
Title: 15N-202 Dominion St and Arthur St Rebuild
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - PLT Labour	PD	125	$ 372	$ 46,616		
T&D Labour - Design	PD	8	$ 386	$ 3,132		
Procurement / Financial Support	Lot	1	$ 1,999	$ 1,999		
			Sub-Total	$ 51,748		
Materials						
Wood Poles	Lot	1	$ 11,984	$ 11,984		
O/H Cond.	Lot	1	$ 8,521	$ 8,521		
O/H Line Transf.	Lot	1	$ 37,778	$ 37,778		
O/H Cond.Devices	Lot	1	$ 223	$ 223		
U/G Conductor	Lot	1	$ 2,605	$ 2,605		
U/G Line Transf.	Lot	1	$ 38,856	$ 38,856		
			Sub-Total	$ 99,968		
Contracts						
Trees	Lot	1	$ 20,000	$ 20,000		
Flagging	Lot	1	$ 27,668	$ 27,668		
Backhoe	Lot	1	$ 18,900	$ 18,900		
Padmount Replacement	Lot	1	$ 6,980	$ 6,980		
			Sub-Total	$ 73,548		
Easements						
Easement	Lot	1	$ 1,000	$ 1,000		
			Sub-Total	$ 1,000		
Other Goods & Services						
Contingency		10%	$ 226,263	$ 22,626		
			Sub-Total	$ 22,626		
Interest Capitalized						
AFUDC				$ 989		
			Sub-Total	$ 989		
Vehicle Overhead						
Vehicle AO				$ 22,485		
			Sub-Total	$ 22,485		
Administrative Overhead						
Labour AO				$ 40,133		
Contract AO				$ 15,796		
				$ -		
			Sub-Total	$ 55,929		
			SUB-TOTAL (no AO, AFUDC)	$ 248,890		
			TOTAL (AO, AFUDC included)	$ 328,292		
Original Cost				$ 37,552		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011206

Title: 102W-311 Jedediah Rd Rebuild

Start Date): 2019/07
In-Service Date: 2019/11
Final Cost Date: 2020/05
Function Class: Distribution
Amount: $317,453

DESCRIPTION:

This project will replace approximately 1.5 kilometres of existing single phase line on primary distribution feeder 102W-311 along the coast on Jedediah Road near Raynardton. This will require the replacement of approximately 1.5 kilometres of AASC primary and neutral conductor, the replacement of 19 poles and associated framing and insulators, 4 fused cutouts, and 1 pole top transformer.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- No other projects in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Deteriorated Conductor

Why do this project?

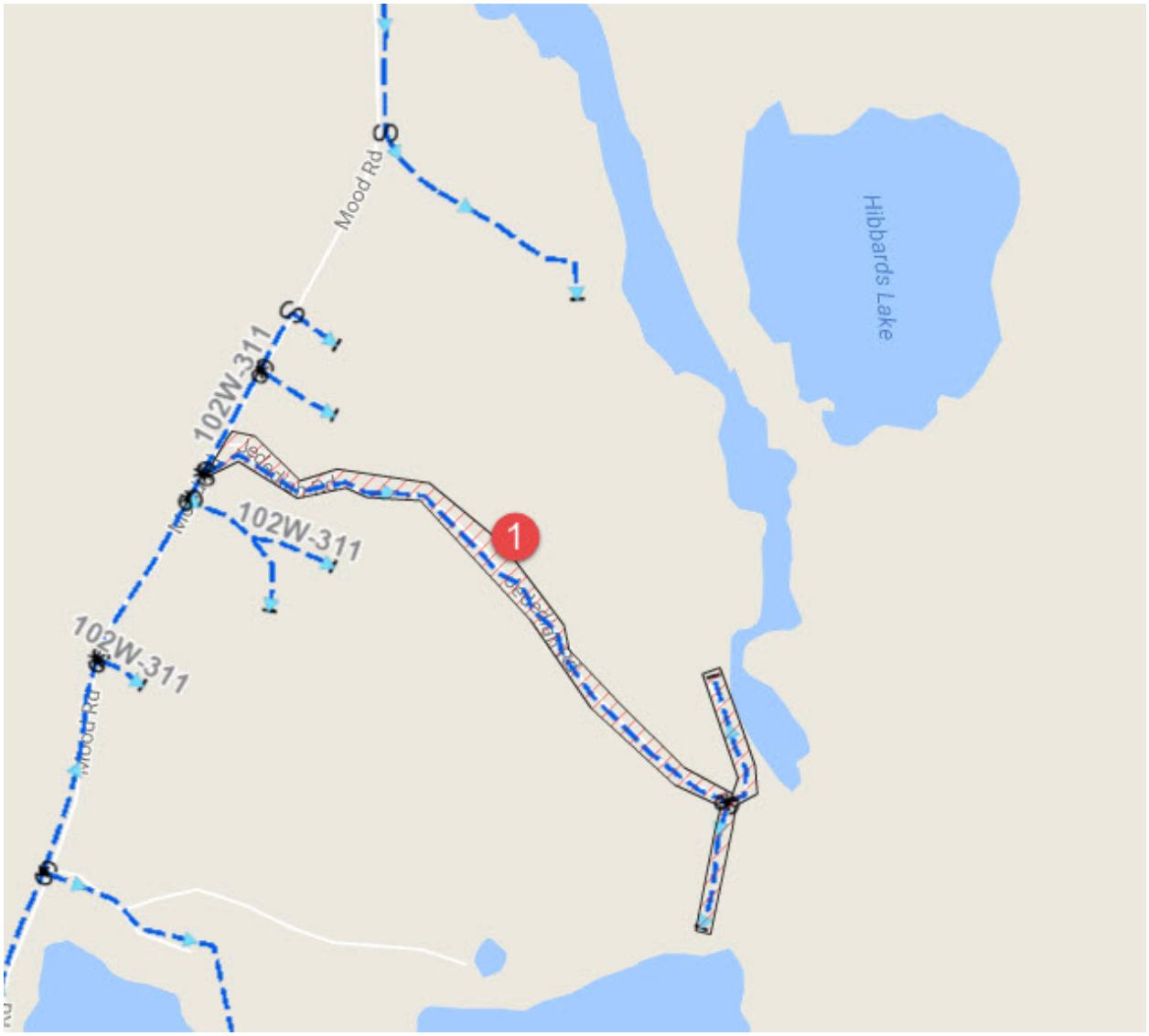
The existing conductor and poles are deteriorated and at risk of failure due to their age and condition.

Why do this project now?

The existing conductor and poles are approximately 45 years old and have reached the end of their expected service lives. Inspections of the targeted devices and assessment based on age, condition and risk of failure have confirmed that replacement is required.

Why do this project this way?

There is no alternative source of supply for the customers in the targeted area. Replacing the targeted assets is a more cost effective solution than rebuilding the entire line.



1. Targeted section of line to be rebuilt.

CI Number : C0011206 - 102W-311 Jedediah Rd Rebuild

Project Number C0011206

Parent CI Number : -

Asset Location : 1456 - 1456 Distribution General

Budget Version 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0200 - DP - Land Rights	91,615
Additions	3500 - DP - Wood Poles	141,367
Additions	3900 - DP - O/H Cond.	50,761
Additions	4000 - DP - O/H Cond.Devices	1,455
Additions	4100 - DP - O/H Line Transf.	3,969
Additions	5200 - DP - Services	2,552
Retirements	3500 - DP - Wood Poles	15,582
Retirements	3900 - DP - O/H Cond.	8,499
Retirements	4000 - DP - O/H Cond.Devices	354
Retirements	4100 - DP - O/H Line Transf.	708
Retirements	5200 - DP - Services	590
	Total Cost:	317,453
	Original Cost:	32,840

Capital Project Detailed Estimate

Location: Distribution
CI#: C0011206
Title: 102W-311 Jedediah Rd Rebuild
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Design	PD	7	$ 386	$ 2,514		
Procurement / Financial Support	Lot	1	$ 347	$ 347		
			Sub-Total	$ 2,861		
Materials						
Wood Poles	LOT	1	$ 9,768	$ 9,768		
O/H Cond.	LOT	1	$ 4,965	$ 4,965		
O/H Line Transf.	LOT	1	$ 1,822	$ 1,822		
O/H Cond.Devices	LOT	1	$ 370	$ 370		
Services	LOT	1	$ 408	$ 408		
			Sub-Total	$ 17,333		
Contracts						
Trees	LOT	1	$ 60,000	$ 60,000		
Flagging	LOT	1	$ 18,909	$ 18,909		
Backhoe	LOT	1	$ 26,250	$ 26,250		
Feeder Inspection	LOT	1	$ 8,941	$ 8,941		
Contractor Labour	LOT	1	$ 89,743	$ 89,743		
			Sub-Total	$ 203,842		
Easements						
Easement	LOT	1	$ 18,850	$ 18,850		
			Sub-Total	$ 18,850		
Other Goods & Services						
Contingency		10%	$ 242,886	$ 24,289		
			Sub-Total	$ 24,289		
Interest Capitalized						
AFUDC				$ 3,037		
			Sub-Total	$ 3,037		
Vehicle Overhead						
Vehicle AO				$ 1,243		
			Sub-Total	$ 1,243		
Administrative Overhead						
Labour AO				$ 2,219		
Contract AO				$ 43,779		
			Sub-Total	$ 45,998		
			SUB-TOTAL (no AO, AFUDC)	$ 267,174		
			TOTAL (AO, AFUDC included)	$ 317,453		
Original Cost				$ 32,840		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011187

Title: 5N-301 Masstown Road Rebuild Phase 2

Start Date:	2019/06
In-Service Date:	2019/08
Final Cost Date:	2020/02
Function:	Distribution
Forecast Amount:	$304,501

DESCRIPTION:

This project provides for the replacement of deteriorated poles, conductor and insulators on the 5N-301 stepdown distribution feeder section from 81N-411 along Masstown Road in Debert. Approximately 16 poles will be replaced and upgraded as per the current NS Power standards. In addition, 3 kilometers of the existing three-phase #6 ACSR primary and 1 kilometre of #6 ACSR neutral conductor will be replaced with 2/0 AASC primary conductor and neutral. Additional replacements include approximately 48 insulators and 11 transformers.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- 2018 - CI 52306 - 5N-301 Masstown Road Rebuild Phase 1 - $165,446

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Equipment Replacement

Why do this project?

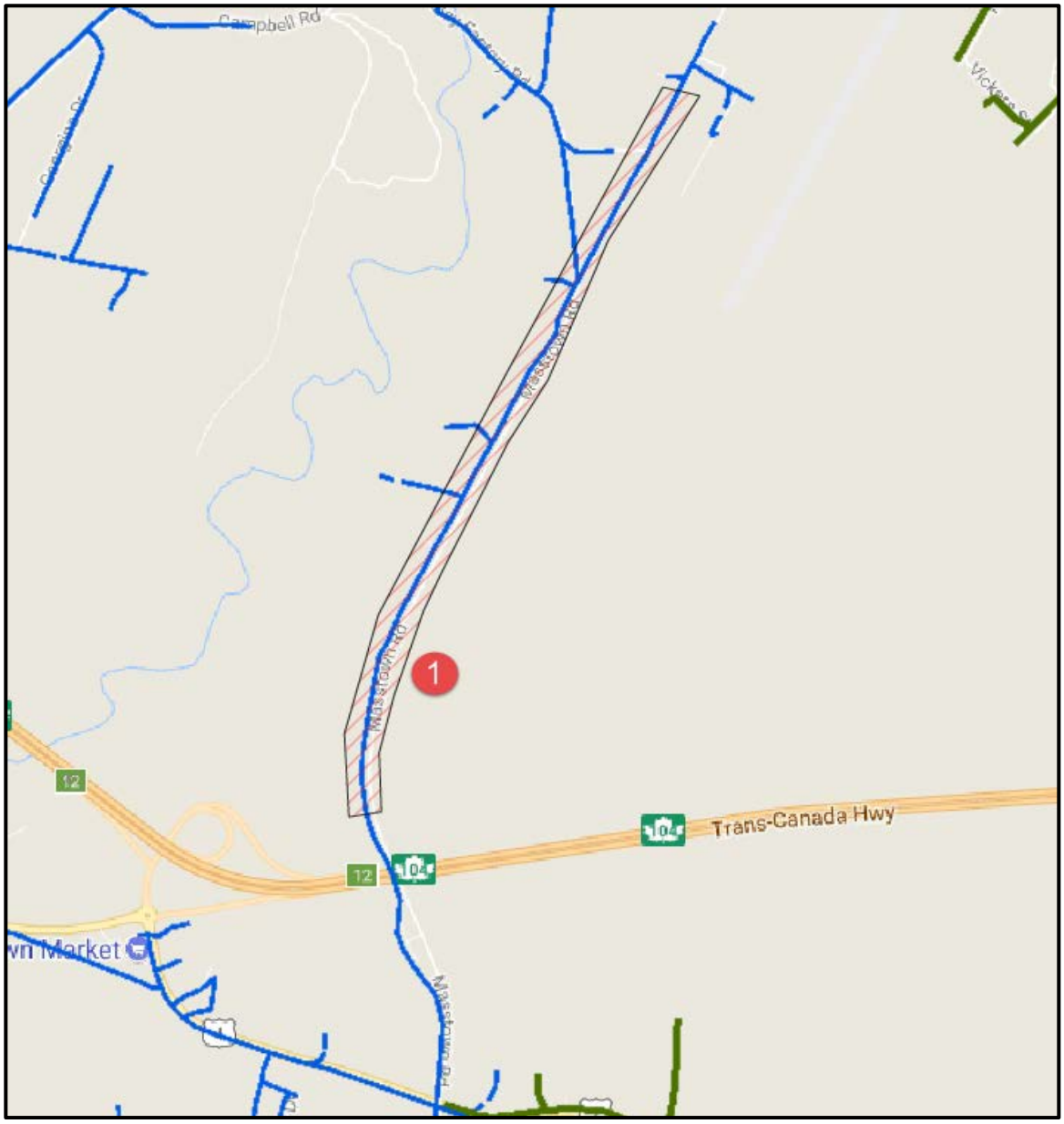
The existing conductor and poles in the targeted area are deteriorated and at risk of failure due to their age and condition.

Why do this project now?

The existing poles and conductor are over 55 years old and have reached the end of their service life. Inspections of the targeted devices and assessment based on age, condition and risk of failure have determined that replacements are required. In addition, several poles on the targeted section have already required replacement in a reactive manner.

Why do this project this way?

There is no alternative source of supply for the customers in the targeted area. Replacing the targeted assets is a more cost-effective solution than rebuilding the entire line. Poles will be upgraded in accordance with current NS Power standards.



1. Replace targeted poles, conductor, transformers and insulators on Masstown Rd.

CI Number : C0011187 - 5N-301 Masstown Road Rebuild Phase 2 **Project Number** C0011187

Parent CI Number : -

Asset Location : 1456 - 1456 Distribution General **Budget Version** 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	3500 - DP - Wood Poles	49,002
Additions	3900 - DP - O/H Cond.	165,979
Additions	4100 - DP - O/H Line Transf.	64,721
Retirements	3500 - DP - Wood Poles	5,345
Retirements	3900 - DP - O/H Cond.	16,967
Retirements	4100 - DP - O/H Line Transf.	2,488
	Total Cost:	304,501
	Original Cost:	17,480

Capital Project Detailed Estimate

Location: Distribution
CI#: C0011187
Title: 5N-301 Masstown Road Rebuild Phase 2
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - PLT Labour	PD	148	$ 372	$ 55,173		
T&D Labour - Design	PD	7	$ 386	$ 2,602		
Procurement / Financial Support	Lot	1	$ 1,023	$ 1,023		
			Sub-Total	$ 58,797		
Materials						
Wood Poles	Lot	1	$ 9,725	$ 9,725		
O/H Cond.	Lot	1	$ 20,676	$ 20,676		
O/H Line Transf.	Lot	1	$ 20,731	$ 20,731		
			Sub-Total	$ 51,133		
Contracts						
Trees	Lot	1	$ 25,000	$ 25,000		
Flagging	Lot	1	$ 44,144	$ 44,144		
Backhoe	Lot	1	$ 14,400	$ 14,400		
			Sub-Total	$ 83,544		
Easements						
Easement	Lot	1	$ 1,000	$ 1,000		
			Sub-Total	$ 1,000		
Other Goods & Services						
Contingency	%	10%	$ 194,474	$ 19,447		
				$ -		
			Sub-Total	$ 19,447		
Interest Capitalized						
AFUDC				$ 1,489		
			Sub-Total	$ 1,489		
Vehicle Overhead						
Vehicle AO				$ 25,548		
			Sub-Total	$ 25,548		
Administrative Overhead						
Labour AO				$ 45,600		
Contract AO				$ 17,943		
			Sub-Total	$ 63,543		
			SUB-TOTAL (no AO, AFUDC)	$ 213,921		
			TOTAL (AO, AFUDC included)	$ 304,501		
Original Cost				$ 17,480		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0011188

Title: 23H-303 Willett Street Underground Replacement

Start Date:	2019/04
In-Service Date:	2019/12
Final Cost Date:	2020/06
Function:	Distribution
Forecast Amount:	$286,624

DESCRIPTION:

This project will replace approximately 0.4 kilometres of deteriorated underground cables on distribution feeder 23H-303 on Willett St, Halifax. The cables are deteriorated and have reached end of expected life. The existing cables are direct buried, which is nonstandard construction that cannot be readily accessed, or repaired. A failure on one of these cables could result in a lengthy outage to allow for replacement of the failed underground section.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- No other projects in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Deteriorated Conductor

Why do this project?

The existing direct buried cables are 40 years old and are at risk of failing due to their age and condition. The expected useful life of an underground cable is 35 years. The direct buried cables will be replaced with new cables in an underground duct bank system, which will allow for improvements in the reliability of the system.

Why do this project now?

The cables are approximately 40 years old, are deteriorated and have reached their end of their expected useful lives. Not completing this project would expose the customers in this area to the risk of lengthy outages from the failure of these cables.

Why do this project this way?

Replacing the targeted assets is a more cost effective solution than rebuilding the entire underground line or building new overhead lines. Replacing the deteriorated, direct buried cables with new cables installed in a duct system allows for improved access, maintainability and reliability of the distribution system and is consistent with current NS Power standards.

1. Construct a duct bank system.
2. Replace 0.4 kilometres of deteriorated underground cables.
3. Install/replace fault indicators in transformers.

CI Number : C0011188 - 23H-303 Willett Street Underground Replacement **Project Number** C0011188

Parent CI Number : -

Asset Location : 1456 - 1456 Distribution General **Budget Version** 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0200 - DP - Land Rights	19,184
Additions	3500 - DP - Wood Poles	29,755
Additions	3900 - DP - O/H Cond.	159,616
Additions	4600 - DP - U/G Conductor	55,409
Additions	4800 - DP - U/G Line Transf.	6,904
Retirements	3500 - DP - Wood Poles	377
Retirements	3900 - DP - O/H Cond.	10,190
Retirements	4600 - DP - U/G Conductor	5,189
	Total Cost:	286,624
	Original Cost:	44,123

Capital Project Detailed Estimate

Location: Distribution
CI#: C0011188
Title: 23H-303 Willett Street Underground Replacement
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - PLT	PD	78	$ 372	$ 28,868		
T&D Labour - Design	PD	29	$ 386	$ 11,055		
Procurement	Lot	1	$ 170	$ 170		
			Sub-Total	$ 40,094		
Materials						
Poles	Lot	1	$ 1,119	$ 1,119		
Conductor	Lot	1	$ 7,371	$ 7,371		
			Sub-Total	$ 8,490		
Contracts						
Tree Trimming	Lot	1	$ 9,750	$ 9,750		
Flagging	Lot	1	$ 13,030	$ 13,030		
Crane	Lot	1	$ 5,000	$ 5,000		
Backhoe	Lot	1	$ 1,800	$ 1,800		
Survey	Lot	1	$ 10,000	$ 10,000		
Grounding/Duct Bank	Lot	1	$ 79,000	$ 79,000		
Pad Install	Lot	1	$ 16,500	$ 16,500		
			Sub-Total	$ 135,080		
Royalty, Easement, Appraisal						
Permits	Lot	1	$ 1,000	$ 1,000		
			Sub-Total	$ 1,000		
Other Goods & Services						
Contingency	%	10%	$ 184,663	$ 18,466		
			Sub-Total	$ 18,466		
Vehicle Overhead						
Vehicle AO				$ 17,422		
			Sub-Total	$ 17,422		
Administrative Overhead						
Labour AO				$ 31,095		
Contractor AO				$ 29,011		
			Sub-Total	$ 60,106		
Interest Capitalized						
AFUDC				$ 5,967		
			Sub-Total	$ 5,967		
			SUB-TOTAL (no AO, AFUDC)	$ 203,129		
			TOTAL (AO, AFUDC included)	$ 286,624		
Original Cost				$ 44,123		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: C0004165

Title: 70W-311G Crousetown Road Phase Extension

Start Date: 2018/06
In-Service Date: 2019/06
Final Cost Date: 2019/12
Function: Distribution
Forecast Amount: **$**285,117

DESCRIPTION:

This project will replace and upgrade approximately 300 metres of existing single-phase line with three-phase line on the primary distribution feeder 70W- 311G crossing over Petite Riviere at the intersection of Conquerall Road and Crousetown Road. This project will also replace and upgrade approximately 525 metres of existing single-phase line with three-phase line down Crousetown to Lake Road in Conquerall Mills. This will require the replacement of approximately 825 metres of 1/0 ACSR primary and neutral conductor with 2/0 AASC, and associated framing and insulators. Additional replacements include approximately 9 poles, 44 pin insulators, 2 transformers and 6 cutouts.

Summary of Related CIs +/- 2 years:
Pursuant to Section 11.2 of the CEJC, related CIs for Transmission/Distribution include "Work completed on the same asset class (Padmount transformers, Breakers, etc.) or in the same location (feeder, Transmission Line)."

- No other projects in 2017, 2018, 2019, 2020 or 2021

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Voltage Unbalance

Why do this project?

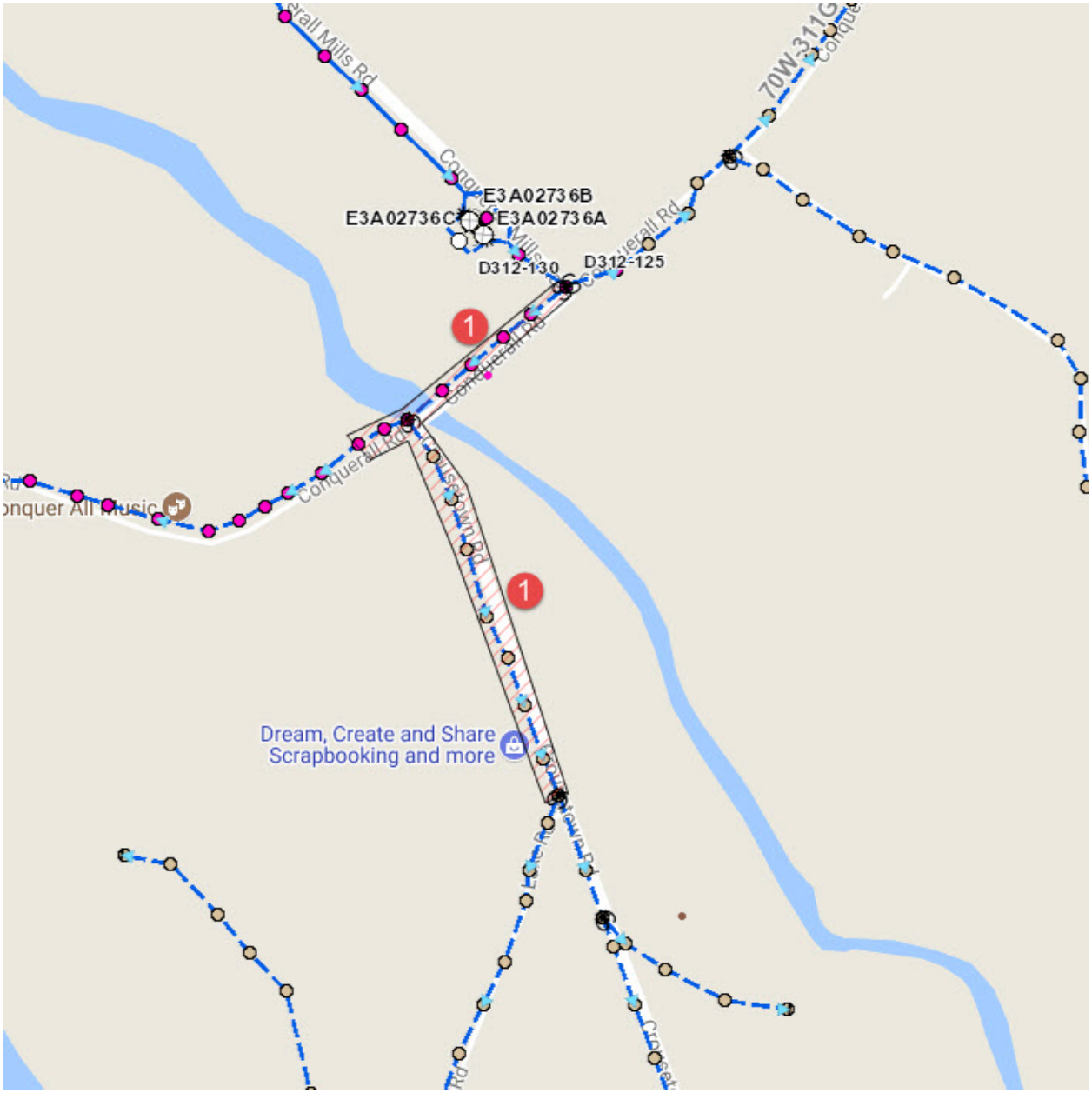
The voltage on 70W-311G is unbalanced due to extended single phase sections restricting the options to rebalance the feeder. Upgrading the targeted 825 metres of single-phase line to three-phase line allows for feeder balancing to be completed and will alleviate cold-load pick-up issues during outages over the winter months. Outages during previous winter storms were compounded due to cold-load pick-up (high current flow upon line re-energization); resulting in extended outages for several additional hours after the initial damage was repaired.

Why do this project now?

The voltage imbalance and extended outages due to cold-load pick-up have caused reliability issues on this section of line. Completing this work will address both the load balancing and cold-load pick-up issues that have been experienced in the past year.

Why do this project this way?

Upgrading the existing crossing to three-phase 2/0 AASC is the least cost option. Transferring load to the adjacent feeder section 70W-311H was examined but required substantial upgrades to 70W-311H and was not pursued further. No other option exists to supply the customers in this area other than the existing 70W-311G or 70W-311H.



1. Targeted crossing to be upgraded to three phase 2/0 AASC.

CI Number : C0004165 - 70W-311G Crousetown Road Phase Extension **Project Number** C0004165

Parent CI Number : -

Asset Location : 1456 - 1456 Distribution General **Budget Version** 2019 ACE Plan

Capital Item Accounts

Exp. Type	Utility Account	Forecast Amount
Additions	0200 - DP - Land Rights	72,525
Additions	3500 - DP - Wood Poles	82,515
Additions	3900 - DP - O/H Cond.	98,871
Additions	4000 - DP - O/H Cond.Devices	1,731
Additions	4100 - DP - O/H Line Transf.	11,504
Additions	5200 - DP - Services	4,287
Retirements	3500 - DP - Wood Poles	7,232
Retirements	3900 - DP - O/H Cond.	4,891
Retirements	4000 - DP - O/H Cond.Devices	1,249
Retirements	4100 - DP - O/H Line Transf.	312
	Total Cost:	285,117
	Original Cost:	37,391

Capital Project Detailed Estimate

Location: Distribution
CI#: C0004165
Title: 70W-311G Crousetown Road Phase Extension
Execution Year: 2019

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
Regular Labour						
T&D Labour - Design	PD	7	$ 386	2,811		
Procurement / Financial Support	Lot	1	$ 366	366		
			Sub-Total	3,177		
Materials						
Wood Poles	Lot	1	$ 7,742	7,742		
O/H Cond.	Lot	1	$ 5,917	5,917		
O/H Line Transf.	Lot	1	$ 3,965	3,965		
Other	Lot	1	$ 699	699		
			Sub-Total	18,323		
Contracts						
Trees	Lot	1	$ 48,000	48,000		
Flagging	Lot	1	$ 15,880	15,880		
Backhoe	Lot	1	$ 17,850	17,850		
Contractor Labour	Lot	1	$ 79,326	79,326		
Feeder Inspection	Lot	1	$ 7,532	7,532		
Other	Lot	1	$ 6,500	6,500		
			Sub-Total	175,088		
Easements						
Easement	Lot	1	$ 7,448	7,448		
			Sub-Total	7,448		
Consulting						
Consulting	Lot	1	$ 16,000	16,000		
			Sub-Total	16,000		
Other Goods & Services						
Contingency	%	10%	$ 220,037	22,004		
			Sub-Total	22,004		
Interest Capitalized						
AFUDC				1,628		
			Sub-Total	1,628		
Vehicle Overhead						
Vehicle AO				1,381		
			Sub-Total	1,381		
Administrative Overhead						
Labour AO				2,464		
Contract AO				37,604		
			Sub-Total	40,068		
			SUB-TOTAL (no AO, AFUDC)	242,040		
			TOTAL (AO, AFUDC included)	285,117		
Original Cost				37,391		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

REDACTED (CONFIDENTIAL INFORMATION REMOVED)

CONFIDENTIALITY MATRIX

LEGEND	
Confidential in Entirety (shaded)	TS = Technical Support
Partially Confidential (Italicized)	CS = Cost Support
(1) = Commercial/Cost Information	
(2) = Third Party Proprietary Information	*Includes Description, PowerPlant (PP), Detailed Cost Estimate (DCE), and Economic Analysis Model (EAM).
(3) = System Security	

Function/Tab#	Capital Work Order	Work Order Main Body*	Attachment 1	Attachment 2	Attachment 3	Attachment 4	Attachment 5	Attachment 6	Attachment 7	Attachment 8
Generation										
	Hydro Projects									
G01	50518 - HYD - Ruth Falls Main Dam Refurbishment	*DCE (1)*	*CS: Vendor Quote (1)*							
G02	C0002539 - HYD - Bridge Remediation 2019	*DCE (1)*	TS: Inspection Report	TS: Inspection Report	TS: Inspection Report	TS: Inspection Report	*TS/CS: Inspection Report (1)*	*TS/CS: Inspection Report (1)*	*TS/CS: Inspection Report (1)*	*TS/CS: Inspection Report (1)*
G03	46254 - HYD - Mill Lake Surge Tank Replacement	*DCE (1)*	TS: Inspection Report	*CS: Vendor Cost Estimate (1)*						
G04	C0004058 - HYD - Tidewater 2 Overhaul									
G05	C0010957 - HYD - Malay Falls Unit 6 Overhaul									
G06	C0012158 - HYD - Malay Falls Unit 6 Generator Refurbishment		TS: Inspection Report							
G07	48536 - HYD - Wreck Cove Brook Dam D-9 Refurbishment	*DCE (1)*	TS: Stability Assessment	*CS: Vendor Cost Estimate (1)*						
G08	C0006859 - HYD - WRC Crane Refurbishment	*DCE (1)*	TS: Inspection Report	*CS: Vendor Quote (1)*	*CS: Vendor Quote (1)*	*CS: Vendor Quote (1)*	*CS: Vendor Quote (1)*			
G09	C0003998 - HYD - Wreck Cove Station Service Cable Replacement	*DCE (1)*	*CS: Vendor Quote (1)*	*CS: Vendor Bid (1)*						
	Steam Projects									
	Boiler									
G10	C0011076 - POT - Boiler Refurbishment 2019									
G11	C0010318 - TRE6 - Boiler Refurbishment 2019									
G12	C0009099 - LIN3 - Boiler Refurbishment 2019									
G13	C0009100 - LIN4 - Boiler Refurbishment 2019									
G14	C0007398 - POT - Air Heaters Refurbishment	*DCE (1)*	TS: Inspection Report	*CS: Vendor Quote (1)*	*CS: Vendor Quote (1)*					
G15	C0011064 - PHB - Boiler Refurbishment 2019									
G16	C0010319 - TRE5 - Boiler Refurbishment 2019									
G17	C0009108 - LIN4 - Economizer Header Refurbishment									
G18	C0009092 - LIN3 - Reheat Tube Replacement 2015									
G19	C0009093 - LIN4 - Reheat Tube Replacement 2015									
G20	C0009113 - LIN4 - Burner Front Refurbishment									
G21	47591 - TRE5 - Bottom Ash Seal Replacement									
	Turbine									
G22	C0010141 - POT - IP/LP Turbine Refurbishment	*DCE (1)*	*CS: Vendor Quote (1)*							
G23	C0010142 - POT - HP Turbine Refurbishment	*DCE (1)*	TS: Product Bulletin (2)	*CS: Vendor Quote (1)*	*CS: Vendor Quote (1)*	*CS: Vendor Quote (1)*				
G24	C0010718 - TRE5 - Turbine Main Valve Refurbishment									
G25	C0010498 - POT - Turbine Valve Refurbishment	*DCE (1)*	*CS: Vendor Quote (1)*							
	Generator									
G26	C0007638 - POT - Generator Auxiliary Equipment Refurbishment	*DCE (1)*	*CS: Vendor Quote (1)*	*CS: Vendor Quote (1)*	*CS: Vendor Quote (1)*	*CS: Vendor Quote (1)*	*CS: Vendor Quote (1)*			
G27	51790 - TRE6 - Generator High Voltage Bushings Refurbishment	*DCE (1)*	*CS: Vendor Quote (1)*							
G28	49664 - AVR Critical Spare	*DCE (1)*	*CS: Vendor Quote (1)*							
G29	C0011085 - POT - Hydrogen Panel Replacement									
	Environmental									
G30	C0009088 - LIN 1&2 - CEMS Replacement	*DCE (1)*	TS: Discontinuation Notice	*CS: Vendor Quote (1)*						
G31	C0010369 - TRE5 - Baghouse Filter Replacement Phase 2		TS: Operating Approval							
G32	C0009094 - LIN - Fly Ash Precipitator Component Refurbishment									
G33	49991 - TUC1 - CEMS Replacement	*DCE (1)*	*CS: Vendor Quote (1)*	*CS: Vendor Quote (1)*						
G34	49656 - TUC - Waste Water Treatment Plant Controls Upgrade	*DCE (1)*	*CS: Vendor Proposal (1)*	*CS: Vendor Quote (1)*	*CS: Vendor Quote (1)*	*CS: Vendor Quote (1)*				
	Balance of Plant									
G35	50632 - TRE - (Bunker C) HFO Refurbishment Project Phase 2	*DCE (1)*	TS: Inspection Report	*CS: Vendor Proposal (1)*	*CS: Vendor Quote (1)*	*CS: Vendor Quote (1)*	*CS: Vendor Quote (1)*	*CS: Vendor Proposal (1)*		
G36	48638 - TRE - Rail Car Fuel Delivery Upgrade	*DCE (1)*	*TS: Solid Fuel Handling Study (1)*	*CS: Vendor Quote (1)*						
G37	51238 - TRE - Asbestos Abatement 2019									
G38	C0010323 - TRE6 - Mills Refurbishment 2019									
G39	C0008098 - TRE - Sludge Dewatering Infrastructure	*DCE (1)*	*TS: Sludge Management Options Study (1)*	*CS: Vendor Opinion of Probable Cost (1)*						
G40	C0009096 - LIN - Mill Refurbishment 2019									
G41	C0011458 - ICP - Rail System Refurbishment Program 2019									
G42	49714 - TUC - UT3 and ST34 Cable Replacement									
G43	C0009082 - LIN - Reclaim Feeder Refurbishment Phase 3									
G44	C0010324 - TRE5 - Condenser Inlet Piping and Valve Replacement									
G45	C0009079 - LIN - CW Pump Refurbishment 2019									
G46	C0011088 - POT - Coal Mill Refurbishment 2019	*DCE (1)*	*CS: Vendor Quote (1)*							
G47	C0009111 - LIN4 - Bottom Ash Refurbishment									
G48	C0009112 - LIN - Ash Silo Stair Replacement	*DCE (1)*	*CS: Inspection Report (1)*							
G49	C0010325 - TRE5 - CW Screen Refurbishment									
G50	C0009059 - LIN - Coal Plant Structural Refurbishment Phase 5									
G51	C0009080 - LIN - CW Screen Refurbishment 2019									
G52	C0010372 - TRE5 - Post Cooler Conveyor Refurbishment	*DCE (1)*	TS: Service Report	*CS: Vendor Proposal (1)*						
G53	C0008559 - POT - Diesel Generator and Essential Services Switchgear Replacement	*DCE (1)*	*CS: Vendor Quote (1)*							
G54	C0011091 - POT - Asbestos Abatement 2015									
G55	C0010326 - TRE6 - Parallel Slide Valve Replacement	*DCE (1)*	*CS: Vendor Quote (1)*							
	Gas Turbine									
G56	49874 - CT - BGT Replace Halon Fire Protection	*DCE (1)*	*CS: Vendor Quote (1)*							
Transmission										
T01	C0010042 - 2019 Transmission Right-of-Way Widening 69kV									
T02	C0010948 - 2019/2020 Sacrificial Anode Installation Program									
T03	C0010952 - 2019/2020 Substation PCB Equipment Removal									
T04	C0010949 - 2019/2020 Steel Tower Life Extension									
T05	C0011339 - L6549 - Replacements and Upgrades Phase 2									
T06	C0010950 - 2019/2020 Steel Tower Refurbishment									
T07	C0011338 - L5548 - Replacements and Upgrades									
T08	C0011242 - L5541 - Replacements and Upgrades									
T09	C0011241 - L5026 - Replacements and Upgrades									
T10	C0011300 - L7005 - Replacements and Upgrades									
T11	C0011240 - L5511 - Replacements and Upgrades									
T12	C0010978 - 2019/2020 Transmission Switch & Breaker Replacement									
T13	C0011243 - L5551 - Replacements and Upgrades									
T14	C0011918 - 2019 Oil Containment Program									
T15	C0011851 - 2019 Tap Changer Replacements/Refurbishments									
T16	C0011850 - 2019 Substation Insulator Replacement Program									
Distribution										
D01	C0010040 - New Distribution Rights-of-Way Phase 4									

CONFIDENTIALITY MATRIX

LEGEND	
Confidential in Entirety (shaded)	TS = Technical Support
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(1) = Commercial/Cost Information	
(2) = Third Party Proprietary Information	*Includes Description, PowerPlant (PP), Detailed Cost Estimate (DCE), and Economic Analysis Model (EAM).
(3) = System Security	

Function/Tab#	Capital Work Order	Work Order Main Body*	Attachment 1	Attachment 2	Attachment 3	Attachment 4	Attachment 5	Attachment 6	Attachment 7	Attachment 8
D02	C0011208 - 2019 Padmount Replacement Program									
D03	C0011209 - 85S-401 - Cabot Trail Rebuild									
D04	C0006319 - 2019 PCB Pole Top Transformer Replacements									
D05	C0014019 - 2019 Substation Recloser Replacements									
D06	C0011309 - 54H-304 - Underground Device Replacement									
D07	C0011197 - 64N - Lourdes Street Conversion Phase 1		*TS: Planning Study (3)*							
D08	C0011200 - 6S-224 - Birch Hill Drive Conversion		*TS: Planning Study (3)*							
D09	C0011320 - 22W-311GA Hawk Point Road Reconductor Replacement									
D10	52229 - 16V-314H - New Edinburgh Phase Extension									
D11	C0011189 - 2H-411 - Cowie Hill UG System Replacement Part 3									
D12	C0013978 - 11S - Keltic Drive Substation Animal Guards	*DCE (1)*	*CS: Vendor Estimate (1)*							
D13	C0011182 - 15N-202 - Dominion St & Arthur St Rebuild									
D14	C0011206 - 102W-311 - Jedediah Rd Rebuild									
D15	C0011187 - 5N-301 - Masstown Road Rebuild Phase 2									
D16	C0011188 - 23H-303 - Willett Street Underground Replacement									
D17	C0004165 - 70W-311G - Crousetown Road Phase Extension									

1 - Commercial Information

To protect value for customers and mitigate the risk of prospective proponents having access to the information itemized in the confidentiality matrix, and maintain good business relations with vendors, this information is confidential.

The more a supplier is aware of NS Power's specific requirements and a competing vendor's costs, the better the supplier's ability to obtain the highest price, reduce competition and ultimately increase the cost for NS Power and its customers. The cost of such transparency is not always immediately evident. Information from regulatory proceedings can provide competitive advantages over other suppliers, and that could be advantageous in bidding or negotiation. Higher prices, or avoidable contractual constraints, will result in unnecessary higher costs to customers.

NS Power seeks to keep the terms and conditions of suppliers pricing and arrangements confidential from their other customers or potential competitors. This prevents competitors from using the information to gain a competitive advantage. This is equally true for NS Power, which desires to protect its ability to acquire services and equipment on the most competitive terms. Those "best" terms may not be available if there is a risk that they will be disclosed to the customers or competitors of the supplier.

Since NS Power customer rates are cost-based, the maintenance of confidentiality for this item is to the direct benefit of customers.

2 - Third Party Proprietary Information

This is information belonging to third parties for which those third parties have asserted confidentiality over proprietary cost and technical information.

3 - System Security

One-Line diagrams frequently included in system planning studies are confidential due to system security concerns. Protection of the power system preserves reliability and reduces the risks associated with external threats.

2019 ACE Appendix B has been filed electronically only.

NS Power 2018 Capital Spend
3rd Quarter Overview - as of September 30, 2018

	Generation	Distribution	Transmission	General Property	Total NS Power
2018 Submitted ACE Total	**$ 116,436,251**	**$ 107,375,828**	**$ 75,670,933**	**$ 55,432,907**	**$ 354,915,919**
Total YTD Spend	73,520,735	77,743,623	64,757,061	33,843,061	249,864,480
Variance YTD/ACE Spend	(42,915,517)	(29,632,205)	(10,913,872)	(21,589,845)	(105,051,439)
Percentage of ACE Spent as of September 30, 2018	63%	72%	86%	61%	70%
Add:					
ATOs	458,843	-	2,484,659	-	2,943,502
U&Us/P&As	3,702,717	1,065,773	1,748,886	114,071	6,631,448
Changes to ACE Items for Subsequent Approval	425,843	-	10,957	(203,977)	232,823
Total Increase	**4,587,404**	**1,065,773**	**4,244,502**	**(89,906)**	**9,807,773**
Less:					
Projects cancelled	(444,641)	-	-	(804,004)	(1,248,644)
Projects deferred	(5,395,922)	(762,186)	-	(3,549,020)	(9,707,128)
Total Decrease	**(5,840,562)**	**(762,186)**	**-**	**(4,353,024)**	**(10,955,772)**
2018 Potential Capital Spend	**$ 115,183,093**	**$ 107,679,416**	**$ 79,915,435**	**$ 50,989,977**	**$ 353,767,920**

* Amounts do not reflect the reforecast of capital projects since the 2018 ACE Plan submission, or reforecasting of subsequent items filed.

NS Power Capital Item Status Update
2018 3rd Quarter Overview - Updated for ACE 2019
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Status	Category	CI Number	Title	ACE Plan Reference (or U&U and P&A)	Submission/Date	ACE Amount	Submission or Approved Amount	Actual Spend	FIN Submission Date	FIN Amount	Variance
Approved	Generation	49693	TUC HFO Tank Dyke Piping Refurbishments	2017 ACE Plan (<$250K)	OTQ - September 15, 2017	$ 219,022	$ 664,753	$ 906,217			
Approved	Transmission	45882	103H-T63 Transformer	U&U - 2015	Q2 2015 - July 31, 2015		$ 1,706,615	$ 1,402,349			
Approved	Distribution	43177	103W-311 Gold River Reconductor Phase 3	2014 ACE Plan	2014 ACE Plan	$ 377,721	$ 377,721	$ 576,067			
Approved	Distribution	43234	104S-313 Baddeck Rebuild	2015 ACE Plan	2015 ACE Plan	$ 778,470	$ 778,470	$ 957,095			
Approved	Transmission	44976	10H 25kV Breaker Replacement	2015 ACE Plan	2015 ACE Plan	$ 953,521	$ 953,521	$ 1,157,140			
Approved	Distribution	47776	111S Prime Brook Feeder Exits & Feeders	2017 ACE Plan (for Subsequent Approval)	Q3 2016 - November 18, 2016	$ 1,503,986	$ 1,504,630	$ 1,625,164			
Approved	Distribution	49836	11S-302 11S-401 Rebuild Coxheath Phase 2	2017 ACE Plan	2017 ACE Plan	$ 807,456	$ 807,456	$ 769,234			
Approved	Transmission	46339	120H Brushy Hill - SVC Controls Replacement	2015 ACE Plan	2015 ACE Plan	$ 9,959,330	$ 9,959,330	$ 10,027,941			
Approved	Distribution	47786	129H Kearney Lake Load Transfer	2016 ACE Plan (for Subsequent Approval)	Q3 2017 - October 30, 2017	$ 311,817	$ 286,280	$ 315,287			
Approved	Distribution	47471	131H-422G-East Uniacke Road Load Growth P&A	P&A - 2015	OTQ - August 31, 2015		$ 904,331	$ 731,035			
Approved	Distribution	47732	131H-424/137H-412 Hammonds Plains Feeder Tie	2016 ACE Plan	2016 ACE Plan	$ 337,133	$ 337,133	$ 302,906			
Approved	Transmission	43267	13V Gulch Hydro Replace 13V-GT1 and 13V-VR1	2015 ACE Plan	2015 ACE Plan	$ 1,061,902	$ 1,061,902	$ 564,359			
Approved	Distribution	48610	16N-301 Stewiacke - Load Trans Ph1	P&A	Q3 2016 - November 18, 2016		$ 852,654	$ 816,670			
Approved	Distribution	46458	16N-302 Stewiacke Reconductor	2015 ACE Plan	2015 ACE Plan	$ 965,830	$ 965,830	$ 791,877			
Approved	Transmission	52241	16V-T2 Weymouth Hydro Transformer Replacement	2018 ACE Plan	2018 ACE Plan	$ 889,253	$ 889,253	$ 531,142			
Approved	Distribution	41350	16W-301 Hebron Rebuild Phase 2	2013 ACE Plan	2017 ACE Plan	$ 904,732	$ 904,732	$ 42,996			
Approved	Distribution	52267	16W-302H-Brenton Rd Rebuild	2018 ACE Plan	2018 ACE Plan	$ 387,767	$ 387,767	$ 103,739			
Approved	Distribution	47734	1C-411 Highway 4 Reconductor	2016 ACE Plan	2016 ACE Plan	$ 437,410	$ 437,410	$ 580,220			
Approved	Distribution	50800	1C-411 Reinsulate and Pole Replacements Phase 1	P&A	OTQ - April 4th, 2017		$ 442,732	$ 146,921			
Approved	Transmission	52314	1C-GT1/UT1 Replacement	2018 ACE Plan	2018 ACE Plan	$ 2,032,393	$ 2,032,393	$ 42,004			
Awaiting Approval	Distribution	C0011738	1H Firewall Construction	U&U	OTQ - October 1, 2018		$ 850,483	$ 108,208			
Approved	Distribution	44826	2014 Build-to-Roadside	2014 ACE Plan	2014 ACE Plan	$ 791,268	$ 791,268	$ 672,198			
Approved	General Plant	44966	2014 Microwave System Capacity Upgrade	2014 ACE Plan	2014 ACE Plan	$ 397,729	$ 397,729	$ 401,907			
Approved	General Plant	44967	2014 Multiplexer Network Upgrades	2014 ACE Plan	2014 ACE Plan	$ 435,618	$ 435,618	$ 452,193			
Approved	General Plant	43227	2014 RTU Replacements	2014 ACE Plan	2014 ACE Plan	$ 687,839	$ 687,839	$ 857,093			
Approved	Distribution	45003	2015 Hydraulic Recloser Replacements	2015 ACE Plan	2015 ACE Plan	$ 260,524	$ 260,524	$ 237,079			
Approved	General Plant	46308	2015 Microwave System Capacity Upgrade	2015 ACE Plan	2015 ACE Plan	$ 316,142	$ 316,142	$ 291,845			
Approved	General Plant	46307	2015 Multiplexer Network Upgrades	2015 ACE Plan	2015 ACE Plan	$ 446,538	$ 446,538	$ 412,205			
Approved	Transmission	46586	2015 PCB Removal - Substation	2015 ACE Plan (for Subsequent Approval)	Q1 2015 - April 30, 2015	$ 1,262,087	$ 1,236,351	$ 1,476,014			
Approved	Transmission	46354	2015 Reactor Breaker Replacements	2015 ACE Plan	2015 ACE Plan	$ 460,691	$ 460,691	$ 519,492			
Approved	Transmission	43490	2015 Steel Tower Life Extension	2015 ACE Plan	2015 ACE Plan	$ 1,441,709	$ 1,441,709	$ 833,329			
Approved	Transmission	46353	2015 Substation Recloser Replacements	2015 ACE Plan	2015 ACE Plan	$ 596,893	$ 596,893	$ 386,145			
Approved	General Plant	46306	2015 Telecom Building Replacement	2015 ACE Plan	2015 ACE Plan	$ 251,727	$ 251,727	$ 249,516			
Approved	Transmission	46340	2015 Transmission Switch & Breaker Replacements	2015 ACE Plan	2015 ACE Plan	$ 1,581,599	$ 1,581,599	$ 1,505,928			
Approved	Transmission	48067	2016 Oil Containment Program	2016 ACE Plan	2016 ACE Plan	$ 468,963	$ 468,963	$ 338,333			
Approved	Distribution	48093	2016 Padmount Replacement Program	2016 ACE Plan	2016 ACE Plan	$ 1,911,470	$ 1,911,470	$ 1,515,042			
Approved	Distribution	47721	2016 PCB Phase-out for Pole Top Transformers	2016 ACE Plan	2016 ACE Plan	$ 4,409,579	$ 4,409,579	$ 4,199,398			
Approved	Transmission	48116	2016 Sacrificial Anode Installation Program	2016 ACE Plan	2016 ACE Plan	$ 970,909	$ 970,909	$ 1,198,820			
Approved	General Plant	48155	2016 SCADA Application Upgrade	2017 ACE Plan (for Subsequent Approval)	OTQ - December 16, 2016	$ 400,688	$ 400,688	$ 480,493			
Approved	Transmission	48114	2016 Steel Tower Life Extension	2016 ACE Plan	Q1 2017 - May 2, 2017	$ 1,477,739	$ 1,465,712	$ 1,513,386			
Approved	Distribution	48092	2016 Substation Recloser Replacements	2016 ACE Plan	2016 ACE Plan	$ 529,270	$ 529,270	$ 619,496			
Approved	Transmission	48063	2016/2017 Capacitor Bank Breaker Replacements	2016 ACE Plan	2016 ACE Plan	$ 385,850	$ 385,850	$ 245,971			
Approved	Transmission	48062	2016/2017 Reactor Breaker Replacements	2016 ACE Plan	2016 ACE Plan	$ 384,974	$ 384,974	$ 372,318			
Approved	Transmission	48066	2016/2017 Substation Polychlorinated Biphenyl (PCB) Equipmer	2016 ACE Plan	2016 ACE Plan	$ 3,500,427	$ 3,500,427	$ 3,524,192			
Approved	Transmission	48059	2016/2017 Transmission Switch & Breaker Replacements	2016 ACE Plan	2016 ACE Plan	$ 980,999	$ 980,999	$ 1,174,454			
Approved	Transmission	49798	2017 / 2018 Capacitor Bank Breaker Replacements	2017 ACE Plan	2017 ACE Plan	$ 378,150	$ 378,150	$ 151,868			
Approved	Transmission	49814	2017 / 2018 Steel Tower Life Extension	2017 ACE Plan	2017 ACE Plan	$ 1,462,100	$ 1,462,100	$ 1,641,814			
Approved	Transmission	49815	2017 / 2018 Steel Tower Refurbishment	2017 ACE Plan	2017 ACE Plan	$ 2,003,317	$ 2,003,317	$ 1,135,673			
Approved	Transmission	49833	2017 Oil Containment Program	2017 ACE Plan	2017 ACE Plan	$ 432,518	$ 432,518	$ 292,157			
Approved	Distribution	49806	2017 Padmount Replacement Program	2017 ACE Plan	2017 ACE Plan	$ 1,703,774	$ 1,703,774	$ 1,681,513			
Approved	Distribution	49919	2017 PCB Pole Top Transformer Replacement	2017 ACE Plan	2017 ACE Plan	$ 2,446,051	$ 2,446,051	$ 1,484,679			
Approved	General Plant	46572	2017 RTU Replacement Program	2017 ACE Plan	2017 ACE Plan	$ 693,354	$ 693,354	$ 260,201			
Approved	Transmission	49813	2017 Sacrificial Anode Installation Program	2017 ACE Plan	2017 ACE Plan	$ 1,532,340	$ 1,532,340	$ 1,731,802			
Approved	Transmission	49878	2017 Substation Insulator Replacement Program	2017 ACE Plan	2017 ACE Plan	$ 508,893	$ 508,893	$ 339,764			
Approved	Distribution	50341	2017 Substation Recloser Replacements	2017 ACE Plan (for Subsequent Approval)	Q1 2017 - May 2, 2017	$ 577,388	$ 604,889	$ 543,079			
Approved	General Plant	49902	2017 Telecom Building Replacement - Wittenburg	2017 ACE Plan	2017 ACE Plan	$ 294,000	$ 294,000	$ 194,874			
Approved	Transmission	49792	2017 Transmission Line Retirement Program	2017 ACE Plan	2017 ACE Plan	$ 526,064	$ 526,064	$ 538,083			
Approved	Transmission	49992	2017 Transmission Right of Way Widening	2017 ACE Plan	2017 ACE Plan	$ 5,400,855	$ 5,400,855	$ 5,492,162			
Approved	Transmission	43200	2017 Wood Pole Retreatment Program	2013 ACE Plan	2017 ACE Plan	$ 841,821	$ 841,821	$ -			
Approved	Transmission	49948	2017/2018 Isolated Structure Replacements	2017 ACE Plan	2017 ACE Plan	$ 3,822,487	$ 3,822,487	$ 2,534,418			
Approved	Transmission	49838	2017/2018 Substation Polychlorinated Biphenyl (PCB) Equipmer	2017 ACE Plan	2017 ACE Plan	$ 4,127,023	$ 4,127,023	$ 4,148,543			
Approved	Transmission	49818	2017/2018 Transmission Switch & Breaker Replacement	2017 ACE Plan	2017 ACE Plan	$ 1,074,472	$ 1,074,472	$ 1,008,544			
Approved	Transmission	51797	2018 Oil Containment Program	2018 ACE Plan	2018 ACE Plan	$ 331,507	$ 331,507	$ 22,050			
Approved	Distribution	52271	2018 Padmount Replacement	2018 ACE Plan	2018 ACE Plan	$ 1,657,205	$ 1,657,205	$ 1,175,968			
Approved	Distribution	51493	2018 PCB Pole Top Transformer Replacement	2018 ACE Plan	2018 ACE Plan	$ 1,360,354	$ 1,360,354	$ 615,891			
Approved	Transmission	51403	2018 PCB Removal Program	2018 ACE Plan	2018 ACE Plan	$ 4,402,342	$ 4,402,342	$ 1,521,253			
Approved	Distribution	51500	2018 Pin Insulator Replacements	2018 ACE Plan	2018 ACE Plan	$ 350,100	$ 350,100	$ 13,439			
Approved	General Plant	52308	2018 RTU Replacement Program	2018 ACE Plan	2018 ACE Plan	$ 988,056	$ 988,056	$ 59,490			
Approved	Distribution	51400	2018 Sub Recloser Replacements	2018 ACE Plan	2018 ACE Plan	$ 644,710	$ 644,710	$ 13,309			
Approved	Transmission	52305	2018 Substation Insulator Replacement	2018 ACE Plan	2018 ACE Plan	$ 316,348	$ 316,348	$ 69,448			
Approved	Transmission	51863	2018 Tap Changer Replacements	2018 ACE Plan	2018 ACE Plan	$ 306,102	$ 306,102	$ 372,275			
Approved	General Plant	52233	2018 Telecom Building Replacement	2018 ACE Plan	2018 ACE Plan	$ 314,929	$ 314,929	$ 10,767			

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Status	Category	CI Number	Title	ACE Plan Reference (or U&U and P&A)	Submission/Date	ACE Amount	Submission or Approved Amount	Actual Spend	FIN Submission Date	FIN Amount	Variance
Approved	Transmission	51969	2018 Transmission ROW Widening 69kV	2018 ACE Plan	2018 ACE Plan	$ 5,487,686	$ 5,487,686	$ 4,561,090			
Approved	Transmission	51405	2018 Wood Pole Retreatment Program	2018 ACE Plan	2018 ACE Plan	$ 1,361,076	$ 1,361,076	$ 125,457			
Approved	Transmission	52238	2018/2019 Capacitor Bank Breaker Replacement	2018 ACE Plan	2018 ACE Plan	$ 433,719	$ 433,719	$ 9,000			
Approved	Transmission	52258	2018/2019 Isolated Structure Replacement	2018 ACE Plan	2018 ACE Plan	$ 4,818,521	$ 4,818,521	$ 89,236			
Approved	Transmission	51402	2018/2019 Sacrificial Anode Installation	2018 ACE Plan	2018 ACE Plan	$ 3,023,668	$ 3,023,668	$ 2,015,110			
Approved	Transmission	51404	2018/2019 Steel Tower PA	P&A	OTQ - September 15, 2017	$ -	$ 2,981,318	$ 2,164,376			
Approved	Transmission	51398	2018/2019 Steel Tower Refurbishment	2018 ACE Plan	2018 ACE Plan	$ 1,992,692	$ 1,992,692	$ 59,571			
Approved	Transmission	51406	2018/2019 Transmission Switch & Breaker Replacement	2018 ACE Plan	2018 ACE Plan	$ 1,405,891	$ 1,405,891	$ 137,082			
Approved	Distribution	46398	20H Spryfield Voltage Conversion	2015 ACE Plan (for Subsequent Approval)	Q1 2015 - April 30, 2015	$ 444,970	$ 480,510	$ 607,212			
Approved	Distribution	48152	20H-Spryfield Voltage Conversion Ph	2016 ACE Plan (for Subsequent Approval)	OTQ - June 30, 2016	$ 375,848	$ 460,246	$ 404,343			
Approved	Distribution	52206	20V-311-Bishop Ville Rd	2018 ACE Plan	2018 ACE Plan	$ 303,533	$ 303,533	$ 95,103			
Approved	Distribution	46304	20W-311 Argyle Sound Reconductor	2015 ACE Plan	2015 ACE Plan	$ 430,435	$ 430,435	$ 632,921			
Approved	Distribution	46651	23H-303G Rockingham Conversion Part 1	2015 ACE Plan (for Subsequent Approval)	Q3 2015 - October 30, 2015	$ 572,750	$ 566,694	$ 704,868			
Approved	Distribution	49841	23H-Rockingham Voltage Conversion-Phase 2	2017 ACE Plan	2017 ACE Plan	$ 743,213	$ 743,213	$ 507,796			
Approved	Distribution	43217	24C-442G Hwy 16 Rebuild Phase 1	2014 ACE Plan	2014 ACE Plan	$ 800,769	$ 800,769	$ 830,186			
Approved	Distribution	47753	24C-442GB Highway 16 Reconductor Phase 2	2016 ACE Plan (for Subsequent Approval)	OTQ - December 17, 2015	$ 1,154,302	$ 1,425,322	$ 1,335,742			
Approved	Transmission	44981	2C Port Hastings Add 138-25kV Transformer	2016 ACE Plan	2016 ACE Plan	$ 2,053,799	$ 2,053,799	$ 1,952,790			
Awaiting Approval	Distribution	C0009898	2C-402 Reinsulate	P&A	Q2 - August 7, 2018		$ 861,166	$ 160,273			
Approved	Distribution	47787	2H Armdale New Feeders	2017 ACE Plan (for Subsequent Approval)	OTQ - July 7, 2017	$ 1,285,679	$ 988,498	$ 170,319			
Approved	Transmission	46811	2H Armdale Transformer Addition	2016 ACE Plan (For Subsequent Approval)	OTQ - June 30, 2016	$ 2,545,596	$ 2,566,861	$ 2,035,830			
Approved	Distribution	51744	30N-411 Maccan River Rebuild	2018 ACE Plan	2018 ACE Plan	$ 473,044	$ 473,044	$ 75,738			
Approved	Distribution	52205	30N-412 Hwy 242 Fundy Shore Rebuild	2018 ACE Plan	2018 ACE Plan	$ 536,670	$ 536,670	$ -			
Approved	Distribution	47756	36V-303 Reconductor Middle Dyke Rd	2016 ACE Plan (Items less than $250K)	OTQ - March 31, 2017	$ 226,303	$ 287,779	$ 287,678			
Approved	Distribution	46251	36V-303 Saxon Double Circuit	2015 ACE Plan	2015 ACE Plan	$ 425,838	$ 425,838	$ 515,500			
Approved	Distribution	50772	37N-412 Glooscap Trail Rebuild Phase 1	P&A	OTQ - April 4th, 2017		$ 771,476	$ 371,119			
Approved	Distribution	52184	37N-412-Glooscap Trail Rebuild Phase 2	2018 ACE Plan	2018 ACE Plan	$ 858,046	$ 858,046	$ 54,695			
Approved	Distribution	47773	3N - Oxford Conversion Phase 2 P&A	P&A - 2015	Q3 2015 - October 30, 2015		$ 631,686	$ 720,286			
Approved	Distribution	45031	3N Oxford Conversion Phase 1	2015 ACE Plan	2015 ACE Plan	$ 716,167	$ 716,167	$ 845,161			
Approved	Distribution	49791	3N Oxford Conversion Phase 3	2017 ACE Plan	2017 ACE Plan	$ 358,369	$ 358,369	$ 575,198			
Approved	Distribution	52208	3S Feeder Exit Cable Replacement Phase 2	2018 ACE Plan	2018 ACE Plan	$ 293,228	$ 293,228	$ 553,536			
Approved	Distribution	49591	3S Feeder Exit Cable Replacement	2017 ACE Plan	2017 ACE Plan	$ 335,842	$ 335,842	$ 582,729			
Approved	Transmission	49928	3S Gannon Road – Bus Reconfiguration	2017 ACE Plan (for Subsequent Approval)	OTQ - April 16, 2018	$ 364,777	$ 741,486	$ 784,513			
Approved	Transmission	44977	3W Breaker, Switch & Cable Replacements	2014 ACE Plan	2014 ACE Plan	$ 401,463	$ 401,463	$ 645,760			
Approved	Transmission	48131	48H-T1 Replacement	2018 ACE Plan	2018 ACE Plan	$ 1,281,449	$ 1,281,449	$ 26,578			
Approved	Distribution	52186	4S Feeder Exit Cable Replacement Phase 1	2018 ACE Plan	2018 ACE Plan	$ 293,509	$ 293,509	$ 14,575			
Approved	Distribution	50073	4S-332 Bernard Lind Drive Rebuild	2017 ACE Plan	2017 ACE Plan	$ 302,893	$ 302,893	$ 260,483			
Approved	Distribution	47752	4S-333 Bentinck St. Rebuild	2016 ACE Plan	2016 ACE Plan	$ 575,357	$ 575,357	$ 816,088			
Approved	Distribution	49891	509V Recloser and Voltage Regulator Replacement	2017 ACE Plan	2017 ACE Plan	$ 319,649	$ 319,649	$ 128,892			
Approved	Distribution	47769	509V-301 Overcove Rd Replacements	2017 ACE Plan	2017 ACE Plan	$ 402,493	$ 402,493	$ 358,406			
Approved	Distribution	52185	50N-410 Rebuild Phase 2	2018 ACE Plan	2018 ACE Plan	$ 695,098	$ 695,098	$ 448,424			
Approved	Distribution	49862	50N-410 Rebuild Trenton Phase 1	2017 ACE Plan (<$250K)	OTQ - April 4th, 2017	$ 247,773	$ 440,329	$ 468,345			
Approved	Distribution	49866	512N-Toney River Upgrade	2017 ACE Plan	2017 ACE Plan	$ 285,219	$ 285,219	$ 449,872			
Approved	Distribution	49799	532N Elm Street Conversion Phase 1	2017 ACE Plan	2017 ACE Plan	$ 548,688	$ 548,688	$ 521,983			
Approved	Distribution	52224	532N-Elm Street Conversion Phase 2	2018 ACE Plan	2018 ACE Plan	$ 722,113	$ 722,113	$ 28,239			
Approved	Distribution	C0001802	54C-211 Queen Street Conversion	2018 ACE Plan	2018 ACE Plan	$ 705,316	$ 705,316	$ 520,244			
Approved	Distribution	52192	54H-303 Underground Device Replacement	2018 ACE Plan	2018 ACE Plan	$ 309,230	$ 309,230	$ 286,486			
Approved	Distribution	49918	54H-303 Underground Device Replacements Phase I	2017 ACE Plan	2017 ACE Plan	$ 469,604	$ 469,604	$ 515,667			
Approved	Distribution	49867	55V-313-Berwick North Replacements	2017 ACE Plan	2017 ACE Plan	$ 345,565	$ 345,565	$ 415,899			
Approved	Distribution	52201	55V-314GA-Welsford Reconductor	2018 ACE Plan	2018 ACE Plan	$ 275,161	$ 275,161	$ 31,477			
Approved	Transmission	52328	56N-T1 Transformer Upgrades	2018 ACE Plan	2018 ACE Plan	$ 1,279,271	$ 1,279,271	$ 35,644			
Approved	Distribution	43203	58C-405 / 11C Belle Cote Phase 1	2015 ACE Plan	2015 ACE Plan	$ 339,419	$ 339,419	$ 307,313			
Approved	Distribution	47765	58C-405 Belle Cote Phase 2	2016 ACE Plan	2016 ACE Plan	$ 477,154	$ 477,154	$ 426,959			
Approved	Transmission	51975	5P Mobile Substation Replacement	2018 ACE Plan	2018 ACE Plan	$ 4,829,458	$ 4,829,458	$ 115,041			
Approved - FIN'd Internally	Distribution	47754	63V-313 Ward Rd Reconductor	2016 ACE Plan	2016 ACE Plan	$ 308,994	$ 308,994	$ 203,211			
Approved	Distribution	52200	65V-301 Brickton Reconductor	2018 ACE Plan	2018 ACE Plan	$ 594,362	$ 594,362	$ 241,621			
Approved	Distribution	52207	678H-211 McNab's Island Replacement	2018 ACE Plan	2018 ACE Plan	$ 350,176	$ 350,176	$ 281,753			
Deferred	Transmission	45053	69Kv Structure Replacements West	2017 ACE Plan (for Subsequent Approval)		$ 4,818,017		$ 225,685			
Approved	Transmission	51956	6P Mobile Substation Rewind U&U	U&U	Q3 2017 - October 30, 2017	$ -	$ 1,516,121	$ 276,082			
Approved	Distribution	52194	6S-223 Harold Street Conversion	2018 ACE Plan	2018 ACE Plan	$ 642,368	$ 642,368	$ 24,632			
Approved	Transmission	43261	6V-GT1 Hollow Bridge Hydro Transformer Replacement	2015 ACE Plan	2015 ACE Plan	$ 550,938	$ 550,938	$ 533,273			
Approved	Distribution	47766	70V-302 Centerlea Rebuild	2016 ACE Plan	2016 ACE Plan	$ 456,314	$ 456,314	$ 381,587			
Approved	Transmission	49879	77V-T52 Replacement	2017 ACE Plan (for Subsequent Approval)	OTQ - December 16, 2016	$ 775,082	$ 772,208	$ 472,418			
Approved	Transmission	41438	85S Cable Termination Replacement Wreck Cove	2012 ACE Plan		$ 291,194	$ 291,194	$ 427,630			
Approved	Distribution	47760	85S-402 Re-Insulate	2017 ACE Plan (for Subsequent Approval)	OTQ - March 31, 2017	$ 1,259,666	$ 1,551,859	$ 1,671,382			
Approved	Distribution	52204	87W-312G-Tancook Island Replacement	2018 ACE Plan	2018 ACE Plan	$ 454,096	$ 454,096	$ 17,426			
Approved	Transmission	46757	88S Lingan 230kV BPS Upgrades	2016 ACE Plan	2016 ACE Plan	$ 3,218,221	$ 3,218,221	$ 3,293,810			
Approved	Transmission	46591	88S Lingan Replace 230kV GIS	2015 ACE Plan (for Subsequent Approval)	2016 ACE Plan	$ 14,249,882	$ 14,249,882	$ 13,175,447			
Approved	Distribution	43218	88W-323A Tusket Islands Phase 3	2018 ACE Plan	2018 ACE Plan	$ 654,721	$ 654,721	$ 22,129			
Approved	Distribution	49311	93V-312 Lower Saulnierville Conduct	P&A	OTQ - July 15, 2016		$ 549,642	$ 223,276			
Approved	Transmission	44984	9C Aberdeen Transmission Line Installation	2014 ACE Plan (for Subsequent Approval)	Q3 2014 - October 31, 2014	$ 846,755	$ 834,595	$ 831,032			
Approved	Transmission	43268	9W-B53 Tusket Replace Structure	2018 ACE Plan	2018 ACE Plan	$ 375,523	$ 375,523	$ 14,192			
Awaiting Approval	General Plant	C0002130	ADMS Distribution Fault Location	2018 ACE Plan (for Subsequent Approval)	Q3 - November 5, 2018	$ 473,660	$ 443,121	$ -			

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Approved	Distribution	47124	Advanced Metering Infrastructure	2017 ACE Plan (for Subsequent Approval)	OTQ - October 19, 2017	$ 8,274,738	$ 133,228,952	$ 11,651,372			
Approved	General Plant	48837	AMO Fleet Environmental Data Management	2018 ACE Plan (for Subsequent Approval)	Q1 2018 - May 7, 2018	$ 259,380	$ 423,356	$ 209,865			
Approved	General Plant	46411	AMO Hydro Asset Management PE	2015 ACE Plan (for Subsequent Approval)	OTQ - March 31, 2015	$ 376,637	$ 590,884	$ 652,286			
Approved	General Plant	46552	Backbone Communications System Upgrade	2015 ACE Plan (for Subsequent Approval)	OTQ - September 30, 2015	$ 12,525,792	$ 8,913,092	$ 8,862,264			
Deferred	Generation	44752	BGT1 - Generator Rotor Retaining Ring Replacement	2015 ACE Plan (for Subsequent Approval)		$ 357,869		$ -			
Deferred	Generation	45117	BGT1 - PLC and Field Device Control Upgrade	2015 ACE Plan (for Subsequent Approval)		$ 253,768		$ -			
Deferred	Generation	44788	BGT1 Vibration Monitoring & Protection System Upgrade	2016 ACE Plan (for Subsequent Approval)		$ 252,674		$ -			
Awaiting Approval	Generation	49273	BGT2 Engine Refurbishment	2017 ACE Plan (for Subsequent Approval)	OTQ - July 7, 2017	$ 1,019,832	$ 2,170,157	$ 1,981,224			
Approved	Generation	45116	CT - BGT1 GG4C-1D Engine Refurbishment	2015 ACE Plan		$ 1,168,167	$ 1,168,167	$ -			
Deferred	Generation	46483	CT - Tusket Control System Upgrade	2015 ACE Plan (for Subsequent Approval)		$ 441,816		$ -			
Approved	Generation	20511	CT – Victoria Junction Replace Halon Fire Protection System	2015 ACE Plan	OTQ - May 31, 2017	$ 268,467	$ 619,750	$ 590,636			
Awaiting Approval	Generation	51711	CT Burnside #2 Generator Replacement	P&A	OTQ - July 17, 2018		$ 3,306,710	$ 1,370,739			
Approved	Generation	33142	CT- Burnside #4 Unit Restoration	2015 ACE Plan (for Subsequent Approval)	OTQ - September 15, 2017	$ 3,469,160	$ 9,552,963	$ 9,434,307			
Approved	Generation	45733	CT Burnside Unit #3 Generator Refurb	U&U - 2014	OTQ - December 2, 2014		$ 2,567,808	$ 2,595,189			
Awaiting Approval	Generation	51526	CT Tusket Generator Replacement	P&A	OTQ - July 17, 2018		$ 3,810,417	$ 1,857,508			
Approved - FIN'd Internally	Generation	49605	CTs- BGT 3 Engine Refurbishment	U&U	OTQ - December 16, 2016		$ 2,032,866	$ 2,126,857			
Deferred	Generation	C0002978	CTs Motor Control Centre Upgrades	2018 ACE Plan (for Subsequent Approval)		$ 1,199,221		$ -			
Approved	General Plant	48238	Customer Billing Experience Improve	2017 ACE Plan (for Subsequent Approval)	OTQ - December 16, 2016	$ 490,878	$ 405,324	$ 409,881			
Deferred	Distribution	47792	Distribution Automation Remote Communications	2016 ACE Plan (for Subsequent Approval)		$ 415,762		$ -			
Approved	Transmission	48111	East Switch Upgrades 15S	2016 ACE Plan (Items less than $250K)	OTQ - March 31, 2017	$ 122,220	$ 304,379	$ 149,379			
Approved	Distribution	44836	Halifax 4kV Conversion Part 2	2015 ACE Plan (for Subsequent Approval)	OTQ - December 17, 2015	$ 842,670	$ 678,393	$ 772,156			
Approved	Distribution	48195	Halifax 4kV Conversion Ph 3	2016 ACE Plan (for Subsequent Approval)	OTQ - August 31, 2016	$ 250,336	$ 429,235	$ 455,788			
Approved	Generation	51866	HYD - 4th Lake Penstock Refurbishment	2018 ACE Plan	2018 ACE Plan	$ 696,963	$ 696,963	$ 899,793			
Approved	Generation	46791	HYD - Annapolis Runner Refurbishment U&U	U&U - 2015	OTQ - March 31, 2015		$ 526,329	$ 663,996			
Approved - FIN'd Internally	Generation	41130	HYD - Avon #2 Generator Stator Rewind	2015 ACE Plan (for Subsequent Approval)	Q4 2014 - January 30, 2015	$ 694,096	$ 633,484	$ 652,128			
Approved	Generation	48396	HYD - Bridge Remediation	2017 ACE Plan (for Subsequent Approval)	Q3 2017 - October 30, 2017	$ 404,616	$ 677,591	$ 411,007			
Approved	Generation	48712	HYD - Dam Instrumentation Upgrade	2018 ACE Plan	2018 ACE Plan	$ 476,207	$ 476,207	$ 84,682			
Deferred	Generation	47660	HYD - Dickie Brook Controls Upgrade	2018 ACE Plan (for Subsequent Approval)		$ 885,586		$ -			
Approved	Generation	49944	HYD - Dickie Brook Penstock Refurbishment	2018 ACE Plan	2018 ACE Plan	$ 478,820	$ 478,820	$ 4,061			
Deferred	Generation	47659	HYD - Fall River Controls Upgrade	2018 ACE Plan (for Subsequent Approval)		$ 302,867		$ -			
Approved	Generation	49804	HYD - Fall River Pipeline Repair	U&U	OTQ - August 31, 2016	$ -	$ 275,841	$ 287,106			
Approved	Generation	49946	HYD - Fourth Lake Overhaul	2018 ACE Plan	2018 ACE Plan	$ 1,025,769	$ 1,025,769	$ 863,695			
Approved - FIN'd Internally	Generation	47397	HYD - Gisborne Dam D4 and Spillway S4 Refurbishment PE	2016 ACE Plan	2016 ACE Plan	$ 2,050,519	$ 2,050,519	$ 2,021,236			
Approved	Generation	47654	HYD - Gulch Penstock & Surge Tank Replacement	2017 ACE Plan (for Subsequent Approval)	OTQ - March 31, 2017	$ 3,629,655	$ 4,970,542	$ 5,058,739			
Approved	Generation	48631	HYD - Gulch Spillway Refurbishment	2017 ACE Plan	2017 ACE Plan	$ 617,034	$ 617,034	$ 581,254			
Approved	Generation	52262	HYD - Hells Gate 1 Overhaul	2018 ACE Plan	2018 ACE Plan	$ 854,993	$ 854,993	$ -			
Approved	Generation	49596	HYD – Hells Gate 2 Overhaul	2017 ACE Plan (for Subsequent Approval)	OTQ - March 8, 2017	$ 970,827	$ 1,204,263	$ 1,142,954	Q2 - August 7, 2018	$ 1,134,326	$ (69,937)
Approved	Generation	44595	HYD - Hollow Bridge Canal & Intake	2016 ACE Plan (for Subsequent Approval)	Q4 2016 - January 31, 2017	$ 3,137,002	$ 4,600,336	$ 4,676,743			
Approved - FIN'd Internally	Generation	43066	HYD - Little Indian Dam / Mill Lake Upgrade	2015 ACE Plan	2015 ACE Plan	$ 1,409,587	$ 1,409,587	$ 1,355,055			
Approved - FIN'd Internally	Generation	43607	HYD - Malay Falls #5 Unit Overhaul	2015 ACE Plan	2015 ACE Plan	$ 1,077,255	$ 1,077,255	$ 1,102,889			
Approved	Generation	48914	HYD - Malay Falls Facility Repair	2017 ACE Plan (for Subsequent Approval)	Q3 2017 - October 30, 2017	$ 446,237	$ 1,034,045	$ 62,294			
Approved	Generation	49945	HYD - Malay Falls Switchgear Replacement	2018 ACE Plan	2018 ACE Plan	$ 958,631	$ 958,631	$ 19,784			
Deferred	Generation	47166	HYD - McAskill Brook Decommissioning	2017 ACE Plan (for Subsequent Approval)		$ 562,684		$ 88,945			
Approved	Generation	47332	HYD - Methals Overhaul	2016 ACE Plan	2016 ACE Plan	$ 1,392,927	$ 2,380,900	$ 2,620,830			
Approved	General Plant	48774	HYD - Milton Shop HVAC Upgrade	2017 ACE Plan	2017 ACE Plan	$ 564,347	$ 564,347	$ 766,179			
Awaiting Approval	Generation	20758	HYD - Nictaux Pipeline Replacement & Intake Refurbishment	2014 ACE Plan (Deferred/Cancelled)	2013 ACE Plan/OTQ - March 4, 2014	$ 4,379,301	$ 3,522,588	$ 3,522,588	Q3 - November 5, 2018	$ 3,522,588	$ (0)
Approved - FIN'd Internally	Generation	45958	HYD - Nictaux Rotor Rewind U&U	U&U - 2014	Q3 2014 - October 29, 2014		$ 413,143	$ 450,522			
Deferred	Generation	47655	HYD - Paradise Controls Upgrade	2018 ACE Plan	2018 ACE Plan	$ 639,991	$ 639,991	$ 49,198			
Approved	Generation	52018	HYD - RES Revenue Meter Replacement	2018 ACE Plan	2018 ACE Plan	$ 378,248	$ 378,248	$ 130,905			
Approved	Generation	47432	HYD - Ridge Overhaul	2016 ACE Plan	2016 ACE Plan	$ 869,304	$ 869,304	$ 1,041,882			
Approved	Generation	48020	HYD - RUT3 Generator Refurbishment	2016 ACE Plan (for Subsequent Approval)	Q4 2015 - January 29, 2016	$ 1,030,940	$ 992,418	$ 1,213,592			
Approved	Generation	49943	HYD - Ruth Falls Facility Refurbishment	2018 ACE Plan	2018 ACE Plan	$ 1,234,931	$ 1,234,931	$ 32,333			
Approved	Generation	47167	HYD - Sandy Lake Surge Tank Ref. PE	2016 ACE Plan (for Subsequent Approval)	OTQ - March 18, 2016	$ 1,358,796	$ 2,955,458	$ 3,144,477			
Approved	Generation	47551	HYD - SHH Controls Upgrade	2016 ACE Plan (for Subsequent Approval)	Q4 2015 - January 29, 2016	$ 1,092,851	$ 1,749,212	$ 402,870			
Deferred	Generation	49942	HYD - Tidewater Facility Refurbishment	2018 ACE Plan	2018 ACE Plan	$ 1,234,178	$ 1,234,178	$ 3,647			
Approved	Generation	47163	HYD - Tusket Controls Upgrade	2016 ACE Plan (for Subsequent Approval)	Q4 2015 - January 29, 2016	$ 880,570	$ 906,688	$ 294,300			
UARB Review Deferred	Generation	48913	HYD - Tusket Facility Refurbishment	2017 ACE Plan (for Subsequent Approval)	Q3 2017 - October 30, 2017	$ 657,956	$ 1,183,470	$ 31,238			
Awaiting Approval	Generation	29807	HYD - Tusket Falls Main Dam	2017 ACE Plan (for Subsequent Approval)	OTQ - July 5, 2017	$ 9,940,664	$ 18,157,609	$ 4,433,119			
Approved	Generation	45189	HYD - Upper Lake Falls #2 Overhaul	2014 ACE Plan	2014 ACE Plan	$ 441,716	$ 441,716	$ 363,409			
Approved	Generation	43136	HYD - Weymouth Headcover Replacement	2013 ACE Plan	2013 ACE Plan	$ 438,158	$ 751,989	$ 982,643			
Approved	Generation	46232	HYD - WHR Pipeline Replacement	2015 ACE Plan (for Subsequent Approval)	OTQ - March 31, 2015	$ 538,454	$ 685,805	$ 644,694			
Approved - FIN'd Internally	Generation	45330	HYD - WRC C3 Culvert Replacement	2014 ACE Plan (less than $250K)	OTQ - March 18, 2016	$ 116,396	$ 660,123	$ 677,092			
Approved	Generation	47814	HYD - WRC Evacuation Tunnel Upgrade	U&U - 2015	Q4 2015 - January 29, 2016		$ 503,962	$ 648,492			
Approved	Generation	51234	HYD - WRC HVAC Upgrade	2018 ACE Plan	2018 ACE Plan	$ 1,876,537	$ 1,876,537	$ 407,339			
Approved	Generation	50151	HYD - WRC Main Access Entr Bridge	U&U	Q3 2016 - November 18, 2016	$ -	$ 716,508	$ 797,753			
Approved	Generation	51235	HYD - WRC Main Access Rd Refurbishment	2018 ACE Plan	2018 ACE Plan	$ 2,686,075	$ 2,686,075	$ 260,308			
Approved	Generation	48791	HYD - WRC Safety Standards Upgrades	2018 ACE Plan (for Subsequent Approval)	OTQ - June 4, 2018	$ 1,019,928	$ 1,760,570	$ 639,474			
Approved	Generation	51236	HYD - WRC Tailrace Rock Bolting	2018 ACE Plan	2018 ACE Plan	$ 8,861,996	$ 8,861,996	$ 1,181,108			
Approved - FIN'd Internally	Generation	45370	HYD - WRC Unit 1 Excitation System	2015 ACE Plan	2015 ACE Plan	$ 578,113	$ 578,113	$ 627,787			
Approved	Generation	47476	HYD – Wreck Cove Tailrace Rockfall U&U	U&U - 2015	OTQ - August 31, 2015		$ 2,422,964	$ 2,608,434			
Approved - FIN'd Internally	Generation	44968	HYD - Wreck Cove Unit 2 Excitation System	2014 ACE Plan	2014 ACE Plan	$ 601,088	$ 601,088	$ 506,901			
Deferred	Generation	52017	HYD ANN Exciter Replacement	2018 ACE Plan (for Subsequent Approval)		$ 473,350		$ -			

NS Power Capital Item Status Update

2018 3rd Quarter Overview - Updated for ACE 2019

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Status	Category	CI Number	Title	ACE Plan Reference (or U&U and P&A)	Submission/Date	ACE Amount	Submission or Approved Amount	Actual Spend	FIN Submission Date	FIN Amount	Variance
Approved	Generation	48052	HYD Annapolis HVAC Upgrade	2017 ACE Plan (for Subsequent Approval)	OTQ - March 8, 2017	$ 1,498,367	$ 1,573,596	$ 1,091,979			
Approved	Generation	C0001660	HYD Annapolis Stator Repair	U&U	Q4 2017 - February 5, 2018		$ 308,776	$ 377,649			
Deferred	Generation	51772	HYD Arc Flash Mitigation	2018 ACE Plan (for Subsequent Approval)		$ 403,175		$ 27,696			
Awaiting Approval	Generation	C0009621	HYD Big Falls 6 Exciter Replacement U&U	U&U	Q3 - November 5, 2018		$ 485,209	$ 163,810			
Approved	Generation	46298	HYD Five Mile Lake Dam Refurbishment	2016 ACE Plan	2016 ACE Plan	$ 2,209,018	$ 2,209,018	$ 2,422,525			
Approved	Generation	51775	HYD Fixed Ladder & Machine Guard	2018 ACE Plan (for Subsequent Approval)	OTQ - June 4, 2018	$ 999,149	$ 1,985,179	$ 289,329			
Awaiting Approval	Generation	C0012718	HYD Fourth Lake Turbine Hub Refurbishment U&U	U&U	Q3 - November 5, 2018		$ 271,630	$ 97,797			
Approved	Generation	43128	HYD Gisborne Gearbox and Bearing Replacement	2013 ACE Plan	OTQ - March 31, 2017	$ 360,731	$ 829,447	$ 1,018,516			
Approved	Generation	49598	HYD Gisborne Switchgear Replacement	2017 ACE Plan (for Subsequent Approval)	OTQ - March 31, 2017	$ 623,814	$ 747,450	$ 248,982			
Approved	Generation	38931	HYD Harmony Site Stabilization	2017 ACE Plan (for Subsequent Approval)	Q3 2017 - October 30, 2017	$ 1,106,122	$ 816,412	$ 777,750			
Approved	Generation	C0003238	HYD LEQ Plant Output Cable Replacement U&U	U&U	OTQ - January 12, 2018		$ 784,311	$ 657,646			
Approved	Generation	49039	HYD Lequille Controls Upgrades	2017 ACE Plan (for Subsequent Approval)	OTQ - March 31, 2017	$ 304,121	$ 762,912	$ 717,007			
Approved	Generation	48533	HYD Lequille Headpond Refurbishment	2018 ACE Plan	2018 ACE Plan	$ 4,472,369	$ 4,472,369	$ 3,051,583			
Approved	Generation	47876	HYD Lequille Overhaul	2017 ACE Plan (for Subsequent Approval)	OTQ - January 12, 2018	$ 1,155,418	$ 2,170,697	$ 2,286,786			
Approved	Generation	47682	HYD Lequille Switchgear Replacement	2017 ACE Plan (for Subsequent Approval)	OTQ - March 31, 2017	$ 698,659	$ 776,391	$ 730,002			
Approved	Generation	51972	HYD Nictaux Canal Embank Refurbishment	2018 ACE Plan	2018 ACE Plan	$ 789,918	$ 789,918	$ 1,919			
Approved	Generation	47396	HYD Nictaux Powerhouse Dam Refurbishment	2016 ACE Plan	2016 ACE Plan	$ 1,792,968	$ 1,792,968	$ 1,224,610	OTQ - July 3, 2018	$ 1,224,610	$ (568,358)
Approved - FIN'd Internally	Generation	46171	HYD Paradise Bearing Replacement U&U	U&U - 2014	Q3 2014 - October 29, 2014		$ 349,957	$ 425,409			
Awaiting Approval	Generation	48535	HYD Scragg Lake Dam and Spillway Refurbishment	2017 ACE Plan	2017 ACE Plan	$ 1,956,298	$ 1,625,672	$ 1,625,687	Q3 - November 5, 2018	$ 1,625,672	$ -
Approved	Generation	46594	HYD Sissiboo Falls Overhaul	2015 ACE Plan	2015 ACE Plan	$ 817,153	$ 817,153	$ 1,052,713			
Approved - FIN'd Internally	Generation	46065	HYD- Tom's Lake Spillway Refurbishment	U&U - 2014	OTQ - December 2, 2014		$ 612,312	$ 597,934			
Awaiting Approval	Generation	49633	HYD Trout River Lake Canal Refurbishment	U&U	OTQ - March 8, 2017		$ 165,818	$ 165,818	Q3 - November 5, 2018	$ 165,818	$ (0)
Approved	Generation	46294	HYD U&U WRC Unit 1 Stator Repair	U&U - 2014	Q2 2014 - July 31, 2014		$ 366,027	$ 171,588			
Approved	Generation	44667	HYD Upper Lake Falls Unit #1 Overhaul	2015 ACE Plan	2015 ACE Plan	$ 477,533	$ 477,533	$ 641,840			
Approved	Generation	17581	HYD Weymouth Electrical Replacement	2013 ACE Plan	Q1 2017 - May 2, 2017	$ 1,641,359	$ 2,366,025	$ 2,330,599			
Approved	Generation	49632	HYD White Rock Canal Refurbishment	U&U	OTQ - March 8, 2017		$ 590,670	$ 378,898			
Approved	Generation	51771	HYD WRC Trailrace Road Refurbishment	U&U	Q1 2018 - May 7, 2018		$ 321,226	$ 329,980			
Approved	Generation	49033	HYD WRC Tunnel T-2 Intake Replacement	2018 ACE Plan	2018 ACE Plan	$ 2,851,582	$ 2,851,582	$ 1,840,932			
Approved	Generation	C0002103	HYD WRC Unit 1 Wicket Gate Thrust Assembly Refurbishment	2018 ACE Plan (less then $250K)	Q1 2018 - May 7, 2018	$ 200,574	$ 928,320	$ 366,896			
Approved	Generation	51593	HYD WRC WG Thrust Assembly Refurb U&U	U&U	Q2 - July 31, 2017	$ -	$ 667,024	$ 904,695			
Approved	Generation	45171	HYD-Avon 1 Pipeline Replacement	2015 ACE Plan (for Subsequent Approval)	OTQ - March 31, 2015	$ 547,780	$ 1,012,419	$ 1,128,917			
Approved	Generation	44978	HYD-Wreck Cove Automation	2015 ACE Plan (for Subsequent Approval)	Q2 2015 - July 31, 2015	$ 2,379,999	$ 3,802,446	$ 4,149,166			
Approved	Generation	47648	HYO Lequille Pipeline Replacement	2017 ACE Plan (for Subsequent Approval)	OTQ - March 8, 2017	$ 1,384,448	$ 1,121,253	$ 924,170			
Approved	Generation	52093	ICP Rail Crossing Refurbishment	2018 ACE Plan	2018 ACE Plan	$ 592,402	$ 592,402	$ 233,911			
Approved	Generation	49869	ICP UU Armour Stone Replacement	U&U	OTQ - December 16, 2016		$ 2,793,935	$ 2,949,003			
Approved	Distribution	49787	Intelligent Feeder Project	2017 ACE Plan (for Subsequent Approval)	OTQ - March 31, 2017	$ 2,399,368	$ 2,782,384	$ 3,023,588			
Approved	Transmission	43684	Interconnection Substation South Canoe Wind Project	2014 ACE Plan (2013 CIs Pending)	OTQ - Dec 23, 2013	$ 6,688,062	$ 7,760,891	$ 7,981,090			
Approved	General Plant	48633	IT - Java Security	2016 ACE Plan (for Subsequent Approval) - 4747	OTQ - June 30, 2016	$ 2,536,182	$ 548,032	$ 731,277			
Approved	General Plant	49953	IT - CIS High Availability	2017 ACE Plan (for Subsequent Approval)	OTQ - November 17, 2017	$ 354,578	$ 519,023	$ 541,299			
Awaiting Approval	General Plant	C0011000	IT – Cloud Access Security Broker	P&A	Q3 - November 5, 2018		$ 373,647	$ -			
Approved	General Plant	41425	IT - Cognos Upgrade	2016 ACE Plan (for Subsequent Approval)	OTQ - December 17, 2015	$ 1,431,257	$ 1,527,747	$ 1,559,651			
Deferred	General Plant	49601	IT - Data loss Prevention	2017 ACE Plan (for Subsequent Approval)		$ 1,199,013		$ -			
Approved	General Plant	48635	IT - Endpoint Data Encr & Malwre Pr	2016 ACE Plan (for Subsequent Approval) - 4747	OTQ - August 31, 2016	$ 2,536,182	$ 813,587	$ 798,086			
Deferred	General Plant	49094	IT - Identity Access Mgmt. Infrastructure	2018 ACE Plan (for Subsequent Approval)		$ 977,498		$ 255,963			
Approved	General Plant	46073	IT - Lotus Notes Applications Replacement	2016 ACE Plan (for Subsequent Approval)	Q4 2015 - January 29, 2016	$ 744,698	$ 776,331	$ 531,744			
Approved	General Plant	49212	IT - My Account Single Sign-On	U&U	OTQ - May 31, 2016		$ 465,079	$ 642,485			
Deferred	General Plant	49600	IT - Network Architecture Redesign	2017 ACE Plan (for Subsequent Approval)		$ 1,183,826		$ 251,258			
Approved	General Plant	47477	IT - Next Generation Firewall	2016 ACE Plan (for Subsequent Approval)	OTQ - May 31, 2016	$ 2,536,182	$ 3,927,576	$ 3,800,614			
Approved	General Plant	48254	IT - Outage Comm Tech Cap Improvement	2016 ACE Plan (for Subsequent Approval)	OTQ - May 31, 2016	$ 1,500,000	$ 2,146,079	$ 2,006,658			
Approved	General Plant	46739	IT - Outage Map Technology Upgrades	2015 ACE Plan (for Subsequent Approval)	OTQ - September 30, 2015	$ 1,023,269	$ 2,895,963	$ 2,933,848			
Approved	General Plant	49861	IT - PI System Upgrade	2017 ACE Plan	2017 ACE Plan	$ 801,253	$ 801,253	$ 606,753			
Approved	General Plant	49860	IT - Sharepoint Upgrade	2017 ACE Plan (for Subsequent Approval)	Q3 2017 - October 30, 2017	$ 4,021,915	$ 3,903,594	$ 2,237,807			
Approved	General Plant	49857	IT - Storage Infrastructure Upgrade	2017 ACE Plan (for Subsequent Approval)	OTQ - November 17, 2017	$ 5,045,955	$ 1,901,189	$ 1,129,267			
Approved	General Plant	48773	IT - VOIP Expansion to NSPI sites	2017 ACE Plan (for Subsequent Approval)	Q3 2017 - October 30, 2017	$ 1,499,731	$ 1,708,923	$ 686,065			
Deferred	General Plant	49859	IT - Windows Server 2008 Upgrade	2017 ACE Plan (for Subsequent Approval)		$ 2,069,258		$ -			
Approved	General Plant	49855	IT Desktop SW Modernization	2017 ACE Plan (for Subsequent Approval)	Q3 2017 - October 30, 2017	$ 2,013,034	$ 4,620,516	$ 4,388,944			
Approved	Genreal Plant	51484	IT SCADA Network Firewall Replacement	U&U	OTQ - November 17, 2017		$ 365,737	$ 245,747			
Approved	General Plant	51485	IT Threat Management Gateway Replacement P&A	P&A	OTQ - November 17, 2017		$ 818,495	$ 726,579			
Deferred	General Plant	52335	IT-Automate Manual Billing	2018 ACE Plan (for Subsequent Approval)		$ 506,403		$ -			
Approved	General Plant	49043	IT-Contact Centre Infrastructure	U&U	OTQ - November 1, 2016		$ 2,499,405	$ 2,696,560			
Deferred	General Plant	52337	IT-Group Billing Experience	2018 ACE Plan (for Subsequent Approval)		$ 505,823		$ -			
Approved	General Plant	44671	IT-Oracle Financials Upgrade	2016 ACE Plan (for Subsequent Approval)	OTQ - November 10, 2016	$ 9,891,170	$ 89,664,000	$ 88,286,397			
Approved	Transmission	49775	L5004 Replacements and Upgrades	2017 ACE Plan	2017 ACE Plan	$ 995,712	$ 995,712	$ 623,534			
Approved	Transmission	52102	L5014-2018 Replacements and Upgrades	2018 ACE Plan	2018 ACE Plan	$ 849,700	$ 849,700	$ 930,626			
Approved	Transmission	47950	L5017 Replacements & Upgrades	2016 ACE Plan	Q1 2018 - May 7, 2018	$ 2,182,142	$ 3,062,664	$ 2,867,347			
Approved	Transmission	49783	L5027A Replacements and Upgrades	2018 ACE Plan	2018 ACE Plan	$ 648,292	$ 648,292	$ 36,965			
Approved	Transmission	49782	L5027B Replacements and Upgrades	2017 ACE Plan	OTQ - July 3, 2018	$ 1,093,542	$ 1,655,146	$ 1,526,422			
Approved	Transmission	47949	L-5028 Replacements and Upgrades	2016 ACE Plan	2016 ACE Plan	$ 1,144,355	$ 1,144,355	$ 854,792			
Approved	Transmission	52059	L5039 - 2018 Replacements and Upgrades	2018 ACE Plan	2018 ACE Plan	$ 719,825	$ 719,825	$ 34,015			
Approved	Transmission	47935	L5040 Replacements	2016 ACE Plan	2016 ACE Plan	$ 1,241,298	$ 1,241,298	$ 1,107,472			
Approved	Transmission	47915	L5053 Replacements and Upgrades	2017 ACE Plan	2017 ACE Plan	$ 692,706	$ 692,706	$ 396,104			
Approved	Transmission	52119	L5054 2018 Replacements and Upgrades	2018 ACE Plan	2018 ACE Plan	$ 560,143	$ 560,143	$ 731,578			

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Status	Category	CI Number	Title	ACE Plan Reference (or U&U and P&A)	Submission/Date	ACE Amount	Submission or Approved Amount	Actual Spend	FIN Submission Date	FIN Amount	Variance
Approved	Transmission	49790	L5505 Replacements and Upgrades	2017 ACE Plan	2017 ACE Plan	$ 1,223,571	$ 1,223,571	$ 44,112			
Approved	Transmission	49774	L5527 Replacements and Upgrades	2017 ACE Plan	2017 ACE Plan	$ 1,537,852	$ 1,537,852	$ 1,348,688			
Approved	Transmission	44979	L5527 Structure Replacements	2015 ACE Plan	2015 ACE Plan	$ 721,068	$ 721,068	$ 699,325			
Approved	Transmission	49778	L5535 Replacements and Upgrades	2017 ACE Plan	OTQ - April 16, 2018	$ 1,261,920	$ 2,590,269	$ 1,991,420			
Approved	Transmission	46360	L5545B Reconductor	2016 ACE Plan (Items less than $250K)	OTQ - March 18, 2016	$ 202,492	$ 820,437	$ 810,736			
Approved	Transmission	46362	L5560 Transmission Line Reconductor	2015 ACE Plan	2015 ACE Plan	$ 626,895	$ 626,895	$ 799,127			
Approved	Transmission	49788	L5564 Replacements and Upgrades	2018 ACE Plan	2018 ACE Plan	$ 738,853	$ 738,853	$ 27,921			
Approved	Transmission	46582	L5569 Upgrade	2015 ACE Plan	2015 ACE Plan	$ 369,032	$ 369,032	$ 149,514			
Approved	Transmission	45795	L6503 Upgrade	2015 ACE Plan (for Subsequent Approval)	OTQ - August 31, 2015	$ 780,641	$ 870,870	$ 825,251			
Approved	Transmission	49789	L6515 Replacements and Upgrades	2017 ACE Plan	2017 ACE Plan	$ 2,340,989	$ 2,340,989	$ 2,565,374			
Approved	Transmission	49779	L6537 Replacements and Upgrades	2018 ACE Plan	2018 ACE Plan	$ 1,255,220	$ 1,255,220	$ 563,258			
Approved	Transmission	47914	L-6537 Replacements and Upgrades	2016 ACE Plan	2016 ACE Plan	$ 1,382,705	$ 1,382,705	$ 1,450,755			
Approved	Transmission	46333	L6538 Replacements	2015 ACE Plan (for Subsequent Approval)	OTQ - August 31, 2015	$ 1,019,443	$ 1,008,356	$ 911,107			
Approved	Transmission	52320	L6549 2018 Replacements & Upgrades	2018 ACE Plan	2018 ACE Plan	$ 1,406,535	$ 1,406,535	$ 126,538			
Approved	Transmission	47912	L-6552 Replacements and Upgrades	2016 ACE Plan	2016 ACE Plan	$ 1,054,326	$ 1,054,326	$ 947,930			
Approved	Transmission	45033	L7001 Replacements	2014 ACE Plan	2014 ACE Plan	$ 813,226	$ 813,226	$ 699,379			
Approved	Transmission	46331	L7001 Replacements - Phase 2	2015 ACE Plan	2015 ACE Plan	$ 888,192	$ 888,192	$ 822,291			
Approved	Transmission	47952	L-7001 Replacements (Phase 3 & 4)	2016 ACE Plan	2016 ACE Plan	$ 1,725,284	$ 1,725,284	$ 1,509,307			
Approved	Transmission	49777	L7002 Replacements and Upgrades	2018 ACE Plan	2018 ACE Plan	$ 926,777	$ 926,777	$ 27,839			
Approved	Transmission	44987	L7003 Lidar Upgrades	2015 ACE Plan (for Subsequent Approval)	OTQ - August 31, 2015	$ 6,885,817	$ 11,032,275	$ 10,232,479			
Approved	Transmission	47956	L7004 Replacements and Upgrades	2017 ACE Plan	2017 ACE Plan	$ 672,131	$ 672,131	$ 476,753			
Approved	Transmission	49776	L7008 Replacements and Upgrades	2017 ACE Plan	2017 ACE Plan	$ 876,277	$ 876,277	$ 726,741			
Approved	Transmission	49793	L7011 Replacements and Upgrades	2017 ACE Plan	2017 ACE Plan	$ 3,343,484	$ 3,343,484	$ 3,698,929			
Approved	Transmission	47954	L7012 Replacements and Upgrades	2017 ACE Plan	2017 ACE Plan	$ 4,428,520	$ 4,428,520	$ 3,960,022			
Approved	Transmission	47131	L8001 Steel Tower Replacements U&U	U&U - 2015	OTQ - June 30, 2015		$ 928,377	$ 689,987			
Approved w/ Directives	Distribution	40320	LED Street Light Conversion	2015 ACE Plan (for Subsequent Approval)	OTQ - July 3, 2015	$ 40,609,354	$ 36,041,594	$ 27,593,425			
Approved	Generation	46055	LIN - Coal Mill Refurbishment 2015	2015 ACE Plan	2015 ACE Plan	$ 736,546	$ 736,546	$ 777,173			
Approved	Generation	46057	LIN - CW Screen Refurbishment 2015	2015 ACE Plan	2015 ACE Plan	$ 292,634	$ 292,634	$ 374,520			
Approved	Generation	50020	LIN 3&4 CEMS Replacement	2017 ACE Plan (<$250K)	OTQ - November 17, 2017	$ 170,281	$ 633,355	$ 497,529			
Approved	Generation	49438	LIN A Gallery Floor Replacement	2017 ACE Plan (for Subsequent Approval)	OTQ - May 31, 2017	$ 593,814	$ 591,761	$ 404,299			
Approved	Generation	47874	LIN Ash Scale Replacement	2016 ACE Plan (Items less than $250K)	OTQ - May 31, 2017	$ 237,241	$ 481,252	$ 520,502			
Approved	Generation	47505	LIN Coal Mill Refurbishment 2016	2016 ACE Plan	2016 ACE Plan	$ 749,183	$ 749,183	$ 852,620			
Approved	Generation	49429	LIN Coal Pile Run Off Pond Expansion	2017 ACE Plan	2017 ACE Plan	$ 311,793	$ 311,793	$ -			
Approved	Generation	51839	LIN Coal Plant Structural Refurbishment	2018 ACE Plan	2018 ACE Plan	$ 354,067	$ 354,067	$ 234,982			
Approved	Generation	49427	LIN Coal Plant Structural Refurbishment Phase 3	2017 ACE Plan	2017 ACE Plan	$ 365,003	$ 365,003	$ 466,638			
Approved	Generation	46068	LIN CW Debris Removal System	2015 ACE Plan (for Subsequent Approval)	Q2 2015 - July 31, 2015	$ 1,575,866	$ 1,746,988	$ (30)			
Approved	Generation	49430	LIN CW Pump Refurbishment 2017	2017 ACE Plan	2017 ACE Plan	$ 516,270	$ 516,270	$ 560,231			
Approved	Generation	51815	LIN CW Pump Refurbishment 2018	2018 ACE Plan	2018 ACE Plan	$ 520,436	$ 520,436	$ 586,612			
Approved	Generation	49434	LIN CW Screen Refurbishment 2017	2017 ACE Plan	2017 ACE Plan	$ 347,062	$ 347,062	$ 334,390			
Approved	Generation	51851	LIN CW Screen Refurbishment 2018	2018 ACE Plan	2018 ACE Plan	$ 350,534	$ 350,534	$ 131,343			
Approved	Generation	47872	LIN E Gallery Structural Steel Protective Coating	2016 ACE Plan	2016 ACE Plan	$ 481,492	$ 481,492	$ 542,127			
Approved	Generation	49431	LIN Mill Refurbishment 2017	2017 ACE Plan	2017 ACE Plan	$ 665,839	$ 665,839	$ 763,974			
Approved	Generation	51806	LIN Mill Refurbishment 2018	2018 ACE Plan	2018 ACE Plan	$ 673,153	$ 673,153	$ 752,800			
Approved	Generation	47953	LIN Railcar Positioner Upgrade	2016 ACE Plan (for Subsequent Approval)	2017 ACE Plan	$ 566,619	$ 566,619	$ 541,489			
Approved	Generation	51811	LIN Reclaim Refurbishment Phase 2	2018 ACE Plan	2018 ACE Plan	$ 534,666	$ 534,666	$ 574			
Approved	Generation	47871	LIN Stack Re-Coating	2018 ACE Plan	2018 ACE Plan	$ 381,034	$ 381,034	$ 6,593			
Approved	Generation	51409	LIN Track Dozer Replacement U&U	U&U	OTQ - May 31, 2017	$ -	$ 985,497	$ 914,172			
Approved	Generation	48514	LIN U&U Coal Truck Scale	U&U	OTQ - May 31, 2017	$ -	$ 308,468	$ 326,435			
Approved	Generation	49437	LIN Vacuum Pump Cooler Refurbishment	2017 ACE Plan	2017 ACE Plan	$ 282,034	$ 282,034	$ 198,374			
Approved	Generation	52156	LIN Vacuum Pump Upgrades	2018 ACE Plan	2018 ACE Plan	$ 302,714	$ 302,714	$ 166,956			
Approved	Generation	47761	LIN1 Boiler Refurbishment	2016 ACE Plan	2016 ACE Plan	$ 506,845	$ 506,845	$ 603,845			
Approved	Generation	C0005181	LIN1 Bottom Ash Refurbishment P&A	P&A	OTQ - April 16, 2018		$ 374,953	$ 161,230			
Approved	Generation	47961	LIN1 Condenser Tube Coating	2016 ACE Plan	2016 ACE Plan	$ 333,944	$ 333,944	$ -			
Approved	Generation	C0009103	LIN1 P&A Boiler Refurbishment 2018	P&A	OTQ - September 4, 2018		$ 739,657	$ 849,478			
Approved	Generation	49433	LIN1 SH5 Boiler Tube Replacement	2017 ACE Plan	Q2 - July 31, 2017	$ 493,396	$ 848,377	$ 930,561			
Approved	Generation	52252	LIN1 SH5 Tube Replacement	2018 ACE Plan	2018 ACE Plan	$ 521,259	$ 521,259	$ 937,264			
Approved	Generation	47684	LIN3 Boiler Refurbishment 2018	2018 ACE Plan	2018 ACE Plan	$ 739,657	$ 739,657	$ 790,433			
Approved	Generation	52253	LIN3 Economizer Header Refurbishment	2018 ACE Plan	2018 ACE Plan	$ 499,951	$ 499,951	$ 206,699			
Approved	Generation	51824	LIN3 ID Fan Damper and VIV Refurbishment	2018 ACE Plan	2018 ACE Plan	$ 443,311	$ 443,311	$ 449,050			
Approved	Generation	51849	LIN3 RH Tube Replacement	2018 ACE Plan	2018 ACE Plan	$ 399,546	$ 399,546	$ 499,759			
Approved	Generation	51853	LIN3 Turbine Valve Refurb 2018	2018 ACE Plan	2018 ACE Plan	$ 295,709	$ 295,709	$ 351,786			
Approved	Generation	C0007500	LIN3 U&U Bottom Ash Refurbishment	U&U	OTQ - September 4, 2018		$ 424,051	$ 449,110			
Approved	Generation	C0007718	LIN3 U&U Burner Front Refurbishment	U&U	OTQ - September 4, 2018		$ 345,903	$ 345,903			
Approved	Generation	51804	LIN3&4 ACW Duplex Strainer Replacement	2018 ACE Plan	2018 ACE Plan	$ 333,808	$ 333,808	$ 16,230			
Approved	Generation	47689	LIN4 - Air Heater Refurbishment	2016 ACE Plan	2016 ACE Plan	$ 521,951	$ 521,951	$ 550,720			
Approved	Generation	47762	LIN4 Analytical Panel Replacement	2016 ACE Plan	2016 ACE Plan	$ 401,658	$ 401,658	$ 509,639			
Approved	Generation	51805	LIN4 Boiler Refurbishment 2018	2018 ACE Plan	2018 ACE Plan	$ 739,657	$ 739,657	$ 814,560			
Approved	Generation	47690	LIN4 Burner Front Refurbishment	2016 ACE Plan	2016 ACE Plan	$ 480,349	$ 480,349	$ 561,308			
Approved	Generation	48811	LIN4 Feedwater Heater Level Control Upgrade	U&U	OTQ - March 31, 2017		$ 296,832	$ 292,634			
Approved	Generation	47673	LIN4 Generator Rotor Rewind	2016 ACE Plan	2016 ACE Plan	$ 2,602,159	$ 2,602,159	$ 2,522,604			
Approved	Generation	47657	LIN4 High Voltage Bushing Refurbishment	2016 ACE Plan	2016 ACE Plan	$ 822,570	$ 822,570	$ 897,926			
Approved	Generation	51850	LIN4 RH Tube Replacement	2018 ACE Plan	2018 ACE Plan	$ 399,546	$ 399,546	$ 501,554			

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Status	Category	CI Number	Title	ACE Plan Reference (or U&U and P&A)	Submission/Date	ACE Amount	Submission or Approved Amount	Actual Spend	FIN Submission Date	FIN Amount	Variance
Approved	Generation	47755	LIN4 Turbine High Temperature Fasteners Replacement	2016 ACE Plan	2016 ACE Plan	$ 1,073,877	$ 1,073,877	$ 1,099,663			
Approved	Generation	48951	LIN4 UU 72" CW Condenser Pipe Repl.	U&U	OTQ - August 31, 2016	$ -	$ 414,715	$ 414,801			
Approved	Generation	49415	LIN4 UU HP IP Seal Replacement	U&U	OTQ - August 31, 2016	$ -	$ 531,485	$ 552,137			
Approved	Generation	49351	LIN4 UU LTSH1 Tube Replacement	U&U	OTQ - August 31, 2016	$ -	$ 352,205	$ 320,815			
Awaiting Approval	Generation	C0006618	Little Brook Wind Turbine Decommissioning	P&A	Q3 - November 5, 2018		$ 437,734	$ -			
Awaiting Approval	Generation	52008	LM6000 - 191-253 Hot Section and Engine Refurbishment P&A	P&A	OTQ - September 28, 2018		$ 3,041,675	$ 2,861,134			
Awaiting Approval	Generation	52143	LM6000 - 191-332 Hot Section and Engine Refurbishment	2018 ACE Plan	OTQ - September 28, 2018	$ 1,776,275	$ 3,227,436	$ 918,290			
Approved	Generation	49061	LM6000 191-443 Engine Repair	U&U	OTQ - December 16, 2016		$ 1,047,421	$ 1,077,840			
Awaiting Approval	Generation	49926	LM6000 TUC4 Airhouse Upgrade	2017 ACE Plan (for Subsequent Approval)	OTQ - July 3, 2018	$ 815,633	$ 987,141	$ 217,837			
Awaiting Approval	Generation	49594	LM6000 TUC5 Airhouse Upgrade	2018 ACE Plan (for Subsequent Approval)	OTQ - July 3, 2018	$ 916,391	$ 980,668	$ 212,764			
Approved	Generation	49940	LM6000 TUC5 Control System Upgrade	2017 ACE Plan (for Subsequent Approval)	OTQ - July 3, 2018	$ 1,018,769	$ 1,275,559	$ -			
Approved	General Plant	47403	Load Research Sample Update	2016 ACE Plan (for Subsequent Approval)	OTQ - August 31, 2016	$ 322,387	$ 440,453	$ 418,034			
Approved	General Plant	46365	Maximo Enhancements for Substation Field Mobility	2015 ACE Plan	2015 ACE Plan	$ 315,242	$ 315,242	$ 257,307			
Approved	General Plant	46364	Maximo Enhancements for Telecom & Relays	2015 ACE Plan	2015 ACE Plan	$ 272,539	$ 272,539	$ 293,873			
Approved	Transmission	49821	Mersey River Hydro Spare Transformer	2017 ACE Plan	2017 ACE Plan	$ 519,994	$ 519,994	$ 442,851			
Approved	General Plant	49880	Meter Shop Test Console Replacement	2017 ACE Plan	2017 ACE Plan	$ 410,457	$ 410,457	$ 199,183			
Approved	Transmission	46587	Metro Voltage Support Add Capacitor	2015 ACE Plan (for Subsequent Approval)	2016 ACE Plan	$ 3,373,511	$ 3,373,511	$ 3,131,486			
Approved	General Plant	41705	Milton Hydro Office Renovation and Upgrade	2014 ACE Plan (2013 CIs Pending)	Q1 2014 - April 30, 2014	$ 716,836	$ 733,611	$ 739,021			
Approved	Transmission	C0001900	Mount Hope 69-25kV Substation	2018 ACE Plan	2018 ACE Plan	$ 2,982,338	$ 2,982,338	$ 61,920			
Approved	General Plant	46671	NERC CIP Version 5 Implementation	2016 ACE Plan (for Subsequent Approval)	Q4 2015 - January 29, 2016	$ 1,528,492	$ 2,433,239	$ 2,563,772			
Approved	Distribution	C0001950	New Distribution Rights-of-Way Ph 3	2018 ACE Plan	2018 ACE Plan	$ 9,822,493	$ 9,822,493	$ 9,424,266			
Approved	Distribution	49611	New Distribution Rights-of-Way Phase 1	2016 ACE Plan - Routines	OTQ - November 1, 2016	$ 2,400,000	$ 2,215,397	$ 2,055,132			
Approved	Distribution	50796	New Distribution Rights-of-Way Phase II	P&A	OTQ - April 4th, 2017		$ 3,353,445	$ 3,446,612			
Approved	Transmission	48061	New Mobile Substation 7.5MVA	2016 ACE Plan (for Subsequent Approval)	OTQ - June 30, 2016	$ 1,728,234	$ 2,390,744	$ 2,394,222			
Approved	General Plant	46050	Operator Training Simulator	2015 ACE Plan	2015 ACE Plan	$ 531,119	$ 531,119	$ 720,681			
Approved - FIN'd Internally	Generation	49499	PHB Boiler Refurbishment 2017	2017 ACE Plan (for Subsequent Approval)	OTQ - July 7, 2017	$ 484,730	$ 593,740	$ 401,915			
Approved	Generation	51818	PHB Boiler Refurbishment 2018	2018 ACE Plan	2018 ACE Plan	$ 440,315	$ 440,315	$ 219,603			
Approved	Transmission	52323	Port Hastings 2C BPS Upgrade	P&A	Q2 - August 7, 2018		$ 4,201,449	$ 549,764			
Approved	Generation	C0008005	POT - B Coal Mill Overhaul U&U	U&U	OTQ - October 1, 2018		$ 406,011	$ 44,346			
Approved	Generation	30163	POT - Control room and permit room	2013 ACE Plan (Under $250K)	Q3 2016 - November 18, 2016	$ 201,956	$ 387,997	$ 425,094			
Approved	Generation	47611	POT - Demolish Unit 1 Stack	2016 ACE Plan	2016 ACE Plan	$ 1,732,346	$ 1,732,346	$ 42,527			
Approved	Generation	49897	POT - Fire System Upgrades 2017	2017 ACE Plan	2017 ACE Plan	$ 538,437	$ 538,437	$ 41,213			
Approved - FIN'd Internally	Generation	47668	POT - Plant Siding 2016	2016 ACE Plan	2016 ACE Plan	$ 287,926	$ 287,926	$ 324,888			
Approved	Generation	49111	POT Air Heater Refurbishment	2017 ACE Plan (for Subsequent Approval)	OTQ - March 31, 2017	$ 471,204	$ 272,538	$ 363,699			
Approved	Generation	46422	POT Automatic Trash Rack Cleaning System	2015 ACE Plan (Items less than $250K)	OTQ - June 30, 2015	$ 233,741	$ 329,721	$ 524,740			
Approved	Generation	47687	POT Boiler Chemical Reconditioning	2017 ACE Plan	OTQ - September 15, 2017	$ 974,604	$ 1,603,103	$ 1,588,495			
Approved	Generation	49419	POT Boiler Refurbishment 2017	2017 ACE Plan	2017 ACE Plan	$ 969,292	$ 969,292	$ 1,180,397			
Approved	Generation	51825	POT Boiler Refurbishment 2018	2018 ACE Plan	2018 ACE Plan	$ 568,740	$ 568,740	$ 633,135			
Approved - FIN'd Internally	Generation	47662	POT Coal Mill Overhauls 2016	2016 ACE Plan	2016 ACE Plan	$ 324,874	$ 324,874	$ 225,216			
Approved	Generation	49463	POT Coal Mill Overhauls 2017	2017 ACE Plan	2017 ACE Plan	$ 328,410	$ 328,410	$ 501,140			
Approved - FIN'd Internally	Generation	44191	POT Coal Nozzle and Bucket Replacement	2015 ACE Plan	2015 ACE Plan	$ 570,309	$ 570,309	$ 761,780			
Approved	Generation	51852	POT Mill Refurbishment 2018	2018 ACE Plan	2018 ACE Plan	$ 327,267	$ 327,267	$ 453,036			
Approved	Generation	C0003739	POT Turbine Valve Replacement	P&A	Q4 2017 - February 5, 2018		$ 658,753	$ 445,081			
Approved	Transmission	45306	Prime Brook Substation Addition	2015 ACE Plan (for Subsequent Approval)	Q2 2015 - July 31, 2015	$ 4,300,627	$ 3,442,582	$ 3,691,720			
Approved	Generation	49466	PTMT - Dock and Inhaul Conveyor Replacement	2017 ACE Plan	OTQ - September 15, 2017	$ 467,607	$ 920,823	$ 884,433			
Approved - FIN'd Internally	Generation	48058	PTMT - Railcar Access Ramp U&U	U&U - 2015	Q3 2015 - October 30, 2015		$ 309,180	$ 485,036			
Approved	Generation	49132	PTMT Dock Winching & Access Refurb	U&U	Q2 - July 31, 2017	$ -	$ 416,998	$ 120,133			
Deferred	General Plant	49876	Real Time Economic Dispatch	2017 ACE Plan (for Subsequent Approval)		$ 1,161,618		$ 728,558			
Approved	Transmission	44985	Replace 230kV Kearney Disconnect Switch Assemblies	2014 ACE Plan	2014 ACE Plan	$ 319,246	$ 319,246	$ 242,773			
Approved	Transmission	48057	Replace 69kV cables between 2S and 83S	2017 ACE Plan	2017 ACE Plan	$ 459,931	$ 459,931	$ 20,317			
Approved	General Plant	43202	Replace Mobile Radio System	2017 ACE Plan (for Subsequent Approval)	Q4 2016 - January 31, 2017	$ 6,537,700	$ 6,296,878	$ 5,106,108			
Approved	Generation	40785	Sable Wind Project	2014 ACE Plan (2013 Capital Items Pending Subr	May 1, 2014	$ 13,198,950	$ 12,936,847	$ 12,367,441			
Approved	General Plant	48236	Self Serve Dev Phase 1	2016 ACE Plan (for Subsequent Approval)	Q3 2016 - November 18, 2016	$ 1,802,719	$ 811,203	$ 1,007,747			
Approved	General Plant	50153	Self Serve Development Phase 2	2017 ACE Plan (for Subsequent Approval)	OTQ - September 15, 2017	$ 1,827,720	$ 1,160,528	$ 884,179			
Pending Submission	Transmission	43678	Separate L8004/L7005 on Canso Crossing Double Circuit Tower((	2017 ACE Plan (for Subsequent Approval)		$ 16,183,691		$ 20,019,432			
Awaiting Approval	Transmission	43681	South Canoe Wind Project Network Upgrades	2014 ACE Plan (2013 CIs Pending)	OTQ - Dec 23, 2013	$ 3,761,382	$ 4,270,258	$ 4,270,258	Q3 - November 5, 2018	$ 4,270,258	$ (0)
Awaiting Approval	Transmission	43683	South Canoe Wind Project Transmission Line	2014 ACE Plan (2013 CIs Pending)	OTQ - Dec 23, 2013	$ 5,193,391	$ 5,179,767	$ 5,179,767	Q3 - November 5, 2018	$ 5,179,767	$ (0)
Approved	Transmission	48022	Spider Lake Substation Addition	2016 ACE Plan (for Subsequent Approval)	OTQ - November 5, 2018	$ 6,348,981	$ 6,839,528	$ 7,218,250			
Approved	Generation	46499	Stator Rewind Kit Capital Spare	2017 ACE Plan (for Subsequent Approval)	OTQ - March 8, 2017	$ 5,219,939	$ 2,871,003	$ 2,865,425			
Approved	General Plant	50071	T&D Inspection Application Upgrade Phase 1	2017 ACE Plan	2017 ACE Plan	$ 411,191	$ 411,191	$ 621,217			
Approved	Transmission	49929	Tap Changer Replacements	2017 ACE Plan (for Subsequent Approval)	OTQ - March 31, 2017	$ 262,526	$ 318,236	$ 496,093			
Approved	Distribution	44749	Tiverton Tower Refurbishment	2017 ACE Plan (for Subsequent Approval)	Q3 2017 - October 30, 2017	$ 1,058,200	$ 1,465,132	$ 752,624			
Approved	Transmission	43260	Transmission Line Insulator Replacements	2013 ACE Plan	2013 ACE Plan	$ 2,472,103	$ 2,472,103	$ 303,626	OTQ - July 3, 2018	$ 303,626	$ (2,168,477)
Approved	Generation	47600	TRE Asbestos Abatement (2016)	2016 ACE Plan (Items less than $250K)	Q4 2016 - January 31, 2017	$ 154,303	$ 2,096,391	$ 2,088,671			
Approved	Generation	49553	TRE Asbestos Abatement 2017	2017 ACE Plan (<$250K)	OTQ - July 7, 2017	$ 226,451	$ 728,886	$ 644,234			
Approved	Generation	51816	TRE Asbestos Abatement 2018	2018 ACE Plan	2018 ACE Plan	$ 509,035	$ 509,035	$ 753,165			
Partial Approval	Generation	44267	TRE Ash Lagoon Site Closure	2015 ACE Plan	OTQ - July 7, 2017 (partially approved)	$ 7,994,849	$ 8,993,879	$ 6,976,332			
Approved	Generation	C0001419	TRE HFO Refurbishment Phase 1	2018 ACE Plan	2018 ACE Plan	$ 340,618	$ 340,618	$ 6,804			
Approved - FIN'd Internally	Generation	47552	TRE5 – Boiler Refurbishment 2016	2016 ACE Plan	OTQ - March 31, 2017	$ 1,204,387	$ 2,429,444	$ 2,337,507			
Approved	Generation	49547	TRE5 5-1 BFP Refurbishment	2018 ACE Plan	2018 ACE Plan	$ 345,523	$ 345,523	$ 172,741			
Approved	Generation	47554	TRE5 5-1 FD Fan Refurbishment	2016 ACE Plan	2016 ACE Plan	$ 494,802	$ 494,802	$ 569,532			
Approved	Generation	51821	TRE5 Air Heater Refurbishment	2018 ACE Plan	2018 ACE Plan	$ 487,376	$ 487,376	$ 112,127			

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Status	Category	CI Number	Title	ACE Plan Reference (or U&U and P&A)	Submission/Date	ACE Amount	Submission or Approved Amount	Actual Spend	FIN Submission Date	FIN Amount	Variance
Approved	Generation	46352	TRE5 Air Heater Refurbishment	2015 ACE Plan	OTQ - March 31, 2017	$ 530,139	$ 1,088,844	$ 1,079,177			
Approved	Generation	C0006238	TRE5 Baghouse Bag Replacement P&A	P&A	OTQ - April 16, 2018		$ 313,508	$ 427,528			
Approved	Generation	51802	TRE5 Boiler Refurbishment 2018	2018 ACE Plan	2018 ACE Plan	$ 1,212,228	$ 1,212,228	$ 1,464,404			
Approved	Generation	49536	TRE5 Boiler Refurbishments 2017	2017 ACE Plan	2017 ACE Plan	$ 717,589	$ 717,589	$ 925,492			
Approved	Generation	51857	TRE5 Burner Refurbishments 2018	2018 ACE Plan	2018 ACE Plan	$ 332,497	$ 332,497	$ 199,527			
Approved	Generation	49551	TRE5 CEMS Replacement	2017 ACE Plan (<$250K)	Q2 - July 31, 2017	$ 162,647	$ 679,922	$ 757,765			
Approved	Generation	51317	TRE5 CW Inlet System Refurbishment	U&U	OTQ - July 7, 2017	$ -	$ 390,035	$ 397,263			
Approved	Generation	43429	TRE5 Lube Oil Cooler Retube	2018 ACE Plan	2018 ACE Plan	$ 338,398	$ 338,398	$ 43,975			
Approved	Generation	51836	TRE5 Mill Refurbishments 2018	2018 ACE Plan	2018 ACE Plan	$ 409,458	$ 409,458	$ 470,449			
Approved	Generation	51860	TRE5 PF Mill Line Replacement	2018 ACE Plan	2018 ACE Plan	$ 258,761	$ 258,761	$ 203,474			
Approved	Generation	51820	TRE5 Reheat Turbine Valves	2018 ACE Plan	2018 ACE Plan	$ 450,408	$ 450,408	$ 533,544			
Approved	Generation	47606	TRE5 Sootblower Controls Upgrade	2016 ACE Plan (Items less than $250K)	OTQ - March 31, 2017	$ 158,399	$ 285,301	$ 286,649			
Approved	Generation	41511	TRE6 - Condenser Waterbox and Cooling Water Piping Refurbish	2013 ACE Plan	2017 ACE Plan	$ 700,809	$ 700,809	$ 306,333			
Approved	Generation	49532	TRE6 Air Heater Refurbishment	2017 ACE Plan	2017 ACE Plan	$ 1,428,236	$ 1,428,236	$ 1,548,759			
Approved	Generation	49537	TRE6 Analytical Panel Upgrade	2017 ACE Plan	2017 ACE Plan	$ 438,216	$ 438,216	$ 75,567			
Approved	Generation	49533	TRE6 Boiler Refurbishment	2017 ACE Plan	2017 ACE Plan	$ 1,259,454	$ 1,259,454	$ 1,490,212			
Approved	Generation	C0002020	TRE6 Boiler Water Wall Replacement U&U	U&U	OTQ - January 12, 2018		$ 879,008	$ 884,688			
Approved	Generation	47597	TRE6 Bottom Ash Chain Replacement	2017 ACE Plan	OTQ - January 12, 2018	$ 793,792	$ 1,170,884	$ 1,159,004			
Approved	Generation	50577	TRE6 CEMS Replacement	2018 ACE Plan	2018 ACE Plan	$ 715,562	$ 715,562	$ 636,029			
Approved	Generation	51861	TRE6 CW Screen Replacement 2018	2018 ACE Plan	2018 ACE Plan	$ 513,192	$ 513,192	$ 1,168			
Approved	Generation	49534	TRE6 EHG/Turbine Controls Upgrade	2018 ACE Plan	2018 ACE Plan	$ 2,725,344	$ 2,725,344	$ 47,232			
Approved - FIN'd Internally	Generation	47617	TRE6 Elevator Controls Upgrade	2016 ACE Plan	2016 ACE Plan	$ 320,704	$ 320,704	$ 329,472			
Approved	Generation	49057	TRE6 Excitation System Replacement	2017 ACE Plan	2017 ACE Plan	$ 904,011	$ 904,011	$ 893,489			
Approved	Generation	51052	TRE6 Generator High Voltage Bushings Critical Spare	2017 ACE Plan (for Subsequent Approval)	OTQ - March 31, 2017	$ 411,766	$ 264,250	$ 265,783			
Approved	Generation	49538	TRE6 Generator Rotor Flux Probe Installation	2017 ACE Plan (for Subsequent Approval)	OTQ - March 31, 2017	$ 411,766	$ 784,610	$ 852,173			
Approved	Generation	51791	TRE6 Generator Stator Re-wedge and Collector Ring U&U	U&U	OTQ - January 12, 2018		$ 779,954	$ 717,705			
Approved	Generation	51870	TRE6 HEP and FAC Refurbishment U&U	U&U	OTQ - January 12, 2018		$ 419,909	$ 385,139			
Approved	Generation	51053	TRE6 HIP Turbine Diaphragm Partition Refurbishment	2017 ACE Plan (for Subsequent Approval)	Q1 2017 - May 2, 2017	$ 2,322,487	$ 1,185,445	$ 1,313,987			
Approved	Generation	51862	TRE6 Lube Oil Cooler Refurbishment	2018 ACE Plan	2018 ACE Plan	$ 341,769	$ 341,769	$ 32,040			
Approved	Generation	49535	TRE6 Mills Refurbishment 2017	2017 ACE Plan	2017 ACE Plan	$ 822,141	$ 822,141	$ 860,580			
Approved	Generation	51788	TRE6 Turbine Packing, Diaphragm and Journal U&U	U&U	OTQ - January 12, 2018		$ 1,935,087	$ 1,948,096			
Approved	Generation	47531	TRE6 Turbine Refurbishments	2017 ACE Plan (for Subsequent Approval)	Q1 2017 - May 1, 2017	$ 2,322,487	$ 1,704,784	$ 1,784,153	OTQ - June 4, 2018	$ 1,784,152	$ 79,370
Approved	Generation	47553	TRE6 Turbine Valve Refurbishment	2017 ACE Plan (for Subsequent Approval)	OTQ - March 8, 2017	$ 392,887	$ 570,600	$ 565,005			
Approved	Generation	51793	TRE6 Valve Refurbishment 2017 U&U	U&U	OTQ - January 12, 2018		$ 387,934	$ 385,304			
Approved	Generation	44729	TUC - Station & Unit Transformer Connection Cable Replacemen	2014 ACE Plan	2014 ACE Plan	$ 313,042	$ 313,042	$ 555,085			
Approved	Generation	46484	TUC - Unit 1&2 Analytical Panel Replacement	2015 ACE Plan	2015 ACE Plan	$ 386,607	$ 386,607	$ 523,179			
Approved	Generation	47945	TUC Electrode-ionization (EDI) Unit Replacement	2016 ACE Plan	2016 ACE Plan	$ 275,154	$ 275,154	$ 329,981			
Approved	Generation	51808	TUC HFO Piping Refurbishments	2018 ACE Plan (for Subsequent Approval)	Q3 - November 5, 2018	$ 1,291,933	$ 1,239,933	$ 925,586			
Approved	Generation	48157	TUC Main Auxiliary Boiler Instal	2016 ACE Plan (for Subsequent Approval)	OTQ - March 18, 2016	$ 2,822,565	$ 3,478,421	$ 3,715,630			
Approved	Generation	46506	TUC Noise Monitoring System	U&U	OTQ - April 16, 2018		$ 319,894	$ 315,468			
Approved	Generation	44775	TUC#4 LM6000 Generator Stator Refur	2016 ACE Plan (for Subsequent Approval)	OTQ - August 31, 2016	$ 1,722,180	$ 1,177,954	$ 1,204,252			
Approved	Generation	44776	TUC#5 LM6000 Generator Stator Re-wedge	2017 ACE Plan (for Subsequent Approval)	OTQ - May 31, 2017	$ 1,073,280	$ 1,361,301	$ 1,115,484			
Approved - FIN'd Internally	Generation	46464	TUC1 - Turbine Valve Refurbishment	2015 ACE Plan	2015 ACE Plan	$ 541,162	$ 541,162	$ 527,454			
Approved	Generation	47911	TUC1 High Temperature Fastener Replacement	2016 ACE Plan	2016 ACE Plan	$ 828,968	$ 828,968	$ 837,458			
Approved	Generation	48018	TUC1 IP Blading Refurbishments	2016 ACE Plan	2016 ACE Plan	$ 1,137,208	$ 1,137,208	$ 1,093,482			
Approved	Generation	49751	TUC1 PE LP Blading Refurbishment	U&U	OTQ - September 30, 2016	$ -	$ 709,259	$ 952,315			
Approved	Generation	49674	TUC2 - Boiler Selective Waterwall Tube Replacements	2017 ACE Plan (for Subsequent Approval)	OTQ - March 8, 2017	$ 390,898	$ 421,518	$ 656,906			
Approved	Generation	44717	TUC2 - Condenser Vacuum Pump Replacement	2014 ACE Plan	2014 ACE Plan	$ 428,783	$ 428,783	$ 577,813			
Approved	Generation	42939	TUC2 - South Circulating Water Pump Refurbishment	2014 ACE Plan	2014 ACE Plan	$ 431,536	$ 431,536	$ 307,749			
Approved	Generation	42943	TUC2 - T-G Areas Fire Protection	2014 ACE Plan	2014 ACE Plan	$ 292,621	$ 292,621	$ 388,809			
Approved	Generation	51807	TUC2 Boiler Lower Vestibule Refurbishment	2018 ACE Plan	2018 ACE Plan	$ 412,872	$ 412,872	$ 193,667			
Approved	Generation	49676	TUC2 CEMS Replacement	2018 ACE Plan	2018 ACE Plan	$ 380,140	$ 380,140	$ 116,364			
Approved	Generation	49675	TUC2 Cooling Water Piping Refurbishment	2017 ACE Plan	2017 ACE Plan	$ 568,673	$ 568,673	$ 812,353			
Approved	Generation	51803	TUC2 Generator Flux Probe Installation	2018 ACE Plan	2018 ACE Plan	$ 840,158	$ 840,158	$ 873,130			
Approved	Generation	51835	TUC2 H2 Panel Upgrades	2018 ACE Plan	2018 ACE Plan	$ 454,886	$ 454,886	$ 499,007			
Approved	Generation	49707	TUC2 High Voltage Bushing	2017 ACE Plan	OTQ - April 16, 2018	$ 440,082	$ 956,939	$ 743,648			
Approved	Generation	44716	TUC2 North Boiler Feedwater Pump Refurbishment	2015 ACE Plan (Items less than 250K)	Q1 2017 - May 2, 2017	$ 191,007	$ 274,951	$ 487,911			
Approved	Generation	46465	TUC2 Turbine Valve Refurbishment	2016 ACE Plan	2016 ACE Plan	$ 651,362	$ 651,362	$ 496,421			
Approved	Generation	46505	TUC2 UU LP Row6 Blade Replace	U&U - 2015	Q4 2015 - January 29, 2016		$ 570,207	$ 696,718			
Approved - FIN'd Internally	Generation	46473	TUC3 - Turbine Valve Refurbishment	2015 ACE Plan	2015 ACE Plan	$ 609,870	$ 609,870	$ 780,580			
Approved	Generation	45592	TUC3 – U & U Turbine-IP Row 2 Blading Phase 1	U&U - 2014	OTQ - March 4, 2014		$ 509,816	$ 372,616			
Approved - FIN'd Internally	Generation	47934	TUC3 CW Piping Refurbishment	U&U - 2015	Q4 2015 - January 29, 2016		$ 584,991	$ 585,372			
Approved	Generation	48893	TUC3 IP Turbine Refurbishment	2017 ACE Plan (for Subsequent Approval)	OTQ - April 16, 2018	$ 4,798,475	$ 5,357,054	$ 5,371,676			
Approved	Generation	47893	TUC3 PE Generator Hydrogen Panel Replacement	2016 ACE Plan (for Subsequent Approval)	2017 ACE Plan	$ 423,798	$ 423,798	$ 467,585			
Approved	Generation	45876	TUC3 U&U Generator Refurbishment	U&U - 2014	Q1 2014 - April 30, 2014		$ 1,500,239	$ 1,217,175	Q2 - August 7, 2018	$ 1,217,217	$ (283,022)
Approved	Generation	49316	TUC3 UU CEMS Installation	U&U	OTQ - September 15, 2017	$ -	$ 461,704	$ 324,868			
Approved - FIN'd Internally	Generation	48471	TUC3 UU HEP FAC Upgrades	U&U	OTQ - March 18, 2016		$ 313,287	$ 323,491			
Approved	Generation	50017	TUC4 CEMS Installation U&U	U&U	OTQ - May 31, 2017	$ -	$ 410,817	$ 392,125			
Approved	Generation	50018	TUC5 CEMS Installation U&U	U&U	OTQ - May 31, 2017	$ -	$ 450,496	$ 389,756			
Approved - FIN'd Internally	Generation	46713	TUC5 LM6000 – Engine 191-332 Refurbishment P&A	P&A - 2014	Q4 2014 - January 30, 2015		$ 7,768,463	$ 8,066,077			
Approved	Generation	47947	TUC6 Condenser Waterbox Coating Replacement	2016 ACE Plan (Items less than $250K)	OTQ - March 8, 2017	$ 225,210	$ 366,978	$ 368,637			
Approved	Generation	52239	TUC6 Main and Induction Stop Valve Refurbishment	2018 ACE Plan (less then $250K)	Q1 2018 - May 7, 2018	$ 160,053	$ 335,569	$ 281,353			

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Status	Category	CI Number	Title	ACE Plan Reference (or U&U and P&A)	Submission/Date	ACE Amount	Submission or Approved Amount	Actual Spend	FIN Submission Date	FIN Amount	Variance
Approved	Generation	52107	Tufts Cove Unit 6 CW Screen Replacement	2018 ACE Plan (for Subsequent Approval)	Q1 2018 - May 7, 2018	$ 1,029,787	$ 856,984	$ 940,358			
Approved	Generation	46191	Tusket Fuel System Upgrade	2016 ACE Plan (for Subsequent Approval)	OTQ - May 31, 2016	$ 892,178	$ 1,952,408	$ 2,142,505			
Approved	Transmission	49253	U&U 20V-T1 Transformer Replacement	U&U	OTQ - May 31, 2016		$ 1,305,748	$ 914,578			
Approved	Transmission	47631	U&U Capacitor Bank Breaker Replacement	U&U - 2015	Q2 2015 - July 31, 2015		$ 411,871	$ 273,737			
Approved	Transmission	49922	Western Switching Upgrades	2017 ACE Plan (for Subsequent Approval)	Q4 2016 - January 31, 2017	$ 353,906	$ 378,843	$ 726,061			
Approved	General Plant	46657	Wire Inspection Services - Analyzer Replacement	2015 ACE Plan	2015 ACE Plan	$ 448,300	$ 448,300	$ 322,217			
Awaiting Approval	Generation	50518	HYD - Ruth Falls Main Dam Refurbishment	2019 ACE Plan	2019 ACE Plan	$ 7,244,422	$ 7,244,422	$ 179,073			
Awaiting Approval	Generation	C0002539	HYD - Bridge Remediation 2019	2019 ACE Plan	2019 ACE Plan	$ 6,843,686	$ 6,843,686	$ 110,530			
Awaiting Approval	Generation	46254	HYD - Mill Lake Surge Tank Replacement	2019 ACE Plan	2019 ACE Plan	$ 3,598,193	$ 3,598,193	$ 184,008			
Awaiting Approval	Generation	C0004058	HYD - Tidewater 2 Overhaul	2019 ACE Plan	2019 ACE Plan	$ 1,916,321	$ 1,916,321	$ -			
Awaiting Approval	Generation	C0010957	HYD - Malay Falls Unit 6 Overhaul	2019 ACE Plan	2019 ACE Plan	$ 1,273,280	$ 1,273,280	$ -			
Awaiting Approval	Generation	C0012158	HYD - Malay Falls Unit 6 Generator Refurbishment	2019 ACE Plan	2019 ACE Plan	$ 835,854	$ 835,854	$ -			
Awaiting Approval	Generation	48536	HYD - Wreck Cove Brook Dam D-9 Refurbishment	2019 ACE Plan	2019 ACE Plan	$ 597,697	$ 597,697	$ 158,834			
Awaiting Approval	Generation	C0006859	HYD - Wreck Cove Plant Crane Refurbishment	2019 ACE Plan	2019 ACE Plan	$ 498,167	$ 498,167	$ 31,878			
Awaiting Approval	Generation	C0003998	HYD - Wreck Cove Station Service Cable Replacement	2019 ACE Plan	2019 ACE Plan	$ 429,384	$ 429,384	$ 17,260			
Awaiting Approval	Generation	C0011076	POT - Boiler Refurbishment 2019	2019 ACE Plan	2019 ACE Plan	$ 1,388,434	$ 1,388,434	$ -			
Awaiting Approval	Generation	C0010318	TRE6 - Boiler Refurbishment 2019	2019 ACE Plan	2019 ACE Plan	$ 1,016,388	$ 1,016,388	$ -			
Awaiting Approval	Generation	C0009099	LIN3 - Boiler Refurbishment 2019	2019 ACE Plan	2019 ACE Plan	$ 788,176	$ 788,176	$ -			
Awaiting Approval	Generation	C0009100	LIN4 - Boiler Refurbishment 2019	2019 ACE Plan	2019 ACE Plan	$ 754,772	$ 754,772	$ -			
Awaiting Approval	Generation	C0007398	POT - Air Heater Refurbishment	2019 ACE Plan	2019 ACE Plan	$ 669,205	$ 669,205	$ 34,425			
Awaiting Approval	Generation	C0011064	PHB - Boiler Refurbishment 2019	2019 ACE Plan	2019 ACE Plan	$ 565,707	$ 565,707	$ -			
Awaiting Approval	Generation	C0010319	TRE5 - Boiler Refurbishment 2019	2019 ACE Plan	2019 ACE Plan	$ 518,302	$ 518,302	$ -			
Awaiting Approval	Generation	C0009108	LIN4 - Economizer Header Refurbishment	2019 ACE Plan	2019 ACE Plan	$ 509,373	$ 509,373	$ -			
Awaiting Approval	Generation	C0009092	LIN3 - Reheat Tube Replacement 2019	2019 ACE Plan	2019 ACE Plan	$ 412,548	$ 412,548	$ -			
Awaiting Approval	Generation	C0009093	LIN4 - Reheat Tube Replacement 2019	2019 ACE Plan	2019 ACE Plan	$ 412,548	$ 412,548	$ -			
Awaiting Approval	Generation	C0009113	LIN4 - Burner Front Refurbishment	2019 ACE Plan	2019 ACE Plan	$ 373,290	$ 373,290	$ -			
Awaiting Approval	Generation	47591	TRE5 - Bottom Ash Seal Replacement	2019 ACE Plan	2019 ACE Plan	$ 350,562	$ 350,562	$ -			
Awaiting Approval	Generation	C0010141	POT - IP/LP Turbine Refurbishment	2019 ACE Plan	2019 ACE Plan	$ 2,938,990	$ 2,938,990	$ 5,316			
Awaiting Approval	Generation	C0010142	POT - HP Turbine Refurbishment	2019 ACE Plan	2019 ACE Plan	$ 1,813,421	$ 1,813,421	$ 182			
Awaiting Approval	Generation	C0010718	TRE5 - Turbine Main Valve Refurbishment	2019 ACE Plan	2019 ACE Plan	$ 730,005	$ 730,005	$ -			
Awaiting Approval	Generation	C0010498	POT - Turbine Reheat Valve Refurbishment	2019 ACE Plan	2019 ACE Plan	$ 698,497	$ 698,497	$ -			
Awaiting Approval	Generation	C0007638	POT - Generator Auxiliary Equipment Refurbishment	2019 ACE Plan	2019 ACE Plan	$ 3,473,920	$ 3,473,920	$ 29,325			
Awaiting Approval	Generation	51790	TRE6 - Generator High Voltage Bushings Replacement	2019 ACE Plan	2019 ACE Plan	$ 694,334	$ 694,334	$ -			
Awaiting Approval	Generation	49664	Fleet AVR Critical Spare	2019 ACE Plan	2019 ACE Plan	$ 540,778	$ 540,778	$ -			
Awaiting Approval	Generation	C0011085	POT - Hydrogen Panel Replacement	2019 ACE Plan	2019 ACE Plan	$ 464,252	$ 464,252	$ -			
Awaiting Approval	Generation	C0009088	LIN - 1&2 CEMS Replacement	2019 ACE Plan	2019 ACE Plan	$ 757,499	$ 757,499	$ -			
Awaiting Approval	Generation	C0010369	TRE5 - Baghouse Filter Replacement Phase 2	2019 ACE Plan	2019 ACE Plan	$ 542,340	$ 542,340	$ -			
Awaiting Approval	Generation	C0009094	LIN Fly Ash Precipitator Component Refurbishment	2019 ACE Plan	2019 ACE Plan	$ 414,046	$ 414,046	$ -			
Awaiting Approval	Generation	49991	TUC1 - CEMS Replacement	2019 ACE Plan	2019 ACE Plan	$ 404,343	$ 404,343	$ -			
Awaiting Approval	Generation	49656	TUC - Waste Water Treatment Plant Controls Upgrade	2019 ACE Plan	2019 ACE Plan	$ 305,851	$ 305,851	$ -			
Awaiting Approval	Generation	50632	TRE - (Bunker C) HFO Refurbishment Project Phase 2	2019 ACE Plan	2019 ACE Plan	$ 2,573,137	$ 2,573,137	$ 149,765			
Awaiting Approval	Generation	48638	TRE - Rail Car Fuel Delivery Upgrade	2019 ACE Plan	2019 ACE Plan	$ 1,236,623	$ 1,236,623	$ 82,485			
Awaiting Approval	Generation	51238	TRE - Asbestos Abatement 2019	2019 ACE Plan	2019 ACE Plan	$ 1,030,841	$ 1,030,841	$ 50,375			
Awaiting Approval	Generation	C0010323	TRE6 - Mills Refurbishment 2019	2019 ACE Plan	2019 ACE Plan	$ 796,370	$ 796,370	$ -			
Awaiting Approval	Generation	C0008098	TRE - Sludge Dewatering Infrastructure	2019 ACE Plan	2019 ACE Plan	$ 687,005	$ 687,005	$ 163,665			
Awaiting Approval	Generation	C0009096	LIN - Mill Refurbishment 2019	2019 ACE Plan	2019 ACE Plan	$ 677,819	$ 677,819	$ -			
Awaiting Approval	Generation	C0011458	ICP - Rail System Refurbishment Program 2019	2019 ACE Plan	2019 ACE Plan	$ 620,192	$ 620,192	$ -			
Awaiting Approval	Generation	49714	TUC - UT3 and ST34 Cable Replacement	2019 ACE Plan	2019 ACE Plan	$ 606,863	$ 606,863	$ -			
Awaiting Approval	Generation	C0009082	LIN - Reclaim Feeder Refurbishment Phase 3	2019 ACE Plan	2019 ACE Plan	$ 542,948	$ 542,948	$ -			
Awaiting Approval	Generation	C0010324	TRE5 - Condenser Inlet Piping and Valve Replacement	2019 ACE Plan	2019 ACE Plan	$ 532,816	$ 532,816	$ -			
Awaiting Approval	Generation	C0009079	LIN - CW Pump Refurbishment 2019	2019 ACE Plan	2019 ACE Plan	$ 522,011	$ 522,011	$ -			
Awaiting Approval	Generation	C0011088	POT - Coal Mill Refurbishment 2019	2019 ACE Plan	2019 ACE Plan	$ 472,973	$ 472,973	$ -			
Awaiting Approval	Generation	C0009111	LIN4 - Bottom Ash Refurbishment	2019 ACE Plan	2019 ACE Plan	$ 448,240	$ 448,240	$ -			
Awaiting Approval	Generation	C0009112	LIN - Ash Silo Stair Replacement	2019 ACE Plan	2019 ACE Plan	$ 406,737	$ 406,737	$ -			
Awaiting Approval	Generation	C0010325	TRE5 - CW Screen Refurbishment	2019 ACE Plan	2019 ACE Plan	$ 382,776	$ 382,776	$ -			
Awaiting Approval	Generation	C0009059	LIN - Coal Plant Structural Refurbishment Phase 5	2019 ACE Plan	2019 ACE Plan	$ 375,902	$ 375,902	$ -			
Awaiting Approval	Generation	C0009080	LIN - CW Screen Refurbishment 2019	2019 ACE Plan	2019 ACE Plan	$ 354,651	$ 354,651	$ -			
Awaiting Approval	Generation	C0010372	TRE5 - Post Cooler Conveyor Refurbishment	2019 ACE Plan	2019 ACE Plan	$ 319,596	$ 319,596	$ -			
Awaiting Approval	Generation	C0008559	POT Diesel Generator and Essential Services Switchgear Replace	2019 ACE Plan	2019 ACE Plan	$ 294,571	$ 294,571	$ -			
Awaiting Approval	Generation	C0011091	POT - Asbestos Abatement 2019	2019 ACE Plan	2019 ACE Plan	$ 270,498	$ 270,498	$ -			
Awaiting Approval	Generation	C0010326	TRE6 - Parallel Slide Valve Replacement	2019 ACE Plan	2019 ACE Plan	$ 256,080	$ 256,080	$ -			
Awaiting Approval	Generation	49874	CT - BGT Replace Halon Fire Protection	2019 ACE Plan	2019 ACE Plan	$ 1,149,153	$ 1,149,153	$ 95			
Awaiting Approval	Transmission	C0010042	2019 Transmission Right-of-Way Widening 69kV	2019 ACE Plan	2019 ACE Plan	$ 5,650,794	$ 5,650,794	$ -			
Awaiting Approval	Transmission	C0010948	2019/2020 Sacrificial Anode Installation Program	2019 ACE Plan	2019 ACE Plan	$ 3,099,862	$ 3,099,862	$ -			
Awaiting Approval	Transmission	C0010952	2019/2020 Substation Polychlorinated Biphenyl (PCB) Equipmer	2019 ACE Plan	2019 ACE Plan	$ 2,786,245	$ 2,786,245	$ -			
Awaiting Approval	Transmission	C0010949	2019/2020 Steel Tower Life Extension	2019 ACE Plan	2019 ACE Plan	$ 2,414,140	$ 2,414,140	$ -			
Awaiting Approval	Transmission	C0011339	L6549 - Replacements and Upgrades Phase 2	2019 ACE Plan	2019 ACE Plan	$ 2,209,907	$ 2,209,907	$ -			
Awaiting Approval	Transmission	C0010950	2019/2020 Steel Tower Refurbishment	2019 ACE Plan	2019 ACE Plan	$ 2,009,268	$ 2,009,268	$ -			
Awaiting Approval	Transmission	C0011338	L5548 - Replacements and Upgrades	2019 ACE Plan	2019 ACE Plan	$ 1,699,381	$ 1,699,381	$ -			
Awaiting Approval	Transmission	C0011242	L5541 - Replacements and Upgrades	2019 ACE Plan	2019 ACE Plan	$ 1,624,850	$ 1,624,850	$ -			
Awaiting Approval	Transmission	C0011241	L5026 - Replacements and Upgrades	2019 ACE Plan	2019 ACE Plan	$ 1,498,789	$ 1,498,789	$ -			
Awaiting Approval	Transmission	C0011300	L7005 - Replacements and Upgrades	2019 ACE Plan	2019 ACE Plan	$ 1,346,026	$ 1,346,026	$ -			

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Status	Category	CI Number	Title	ACE Plan Reference (or U&U and P&A)	Submission/Date	ACE Amount	Submission or Approved Amount	Actual Spend	FIN Submission Date	FIN Amount	Variance
Awaiting Approval	Transmission	C0011240	L5511 - Replacements and Upgrades	2019 ACE Plan	2019 ACE Plan	$ 1,255,087	$ 1,255,087	$ -			
Awaiting Approval	Transmission	C0010978	2019/2020 Transmission Switch & Breaker Replacement	2019 ACE Plan	2019 ACE Plan	$ 1,044,148	$ 1,044,148	$ -			
Awaiting Approval	Transmission	C0011243	L5551 - Replacements and Upgrades	2019 ACE Plan	2019 ACE Plan	$ 1,014,077	$ 1,014,077	$ -			
Awaiting Approval	Transmission	C0011918	2019 Oil Containment Program	2019 ACE Plan	2019 ACE Plan	$ 468,041	$ 468,041	$ -			
Awaiting Approval	Transmission	C0011851	2019 Tap Changer Replacements/Refurbishments	2019 ACE Plan	2019 ACE Plan	$ 326,937	$ 326,937	$ -			
Awaiting Approval	Transmission	C0011850	2019 Substation Insulator Replacement Program	2019 ACE Plan	2019 ACE Plan	$ 314,400	$ 314,400	$ -			
Awaiting Approval	Distribution	C0010040	New Distribution Rights-of-Way Widening Phase 4	2019 ACE Plan	2019 ACE Plan	$ 10,275,861	$ 10,275,861	$ -			
Awaiting Approval	Distribution	C0011208	2019 Padmount Replacement Program	2019 ACE Plan	2019 ACE Plan	$ 1,413,544	$ 1,413,544	$ -			
Awaiting Approval	Distribution	C0011209	85S-401 - Cabot Trail Rebuild	2019 ACE Plan	2019 ACE Plan	$ 1,305,919	$ 1,305,919	$ -			
Awaiting Approval	Distribution	C0006319	2019 PCB Pole Top Transformer Replacements	2019 ACE Plan	2019 ACE Plan	$ 1,177,592	$ 1,177,592	$ 24,012			
Awaiting Approval	Distribution	C0014019	2019 Substation Recloser Replacements	2019 ACE Plan	2019 ACE Plan	$ 808,120	$ 808,120	$ -			
Awaiting Approval	Distribution	C0011309	54H-304 - Underground Device Replacement	2019 ACE Plan	2019 ACE Plan	$ 685,268	$ 685,268	$ -			
Awaiting Approval	Distribution	C0011197	64N Lourdes Street Conversion Phase 1	2019 ACE Plan	2019 ACE Plan	$ 576,031	$ 576,031	$ -			
Awaiting Approval	Distribution	C0011200	6S-224 - Birch Hill Drive Conversion	2019 ACE Plan	2019 ACE Plan	$ 542,026	$ 542,026	$ -			
Awaiting Approval	Distribution	C0011320	22W-311GA - Hawk Point Road Reconductor Replacement	2019 ACE Plan	2019 ACE Plan	$ 465,758	$ 465,758	$ -			
Awaiting Approval	Distribution	52229	16V-314H - New Edinburgh Phase Extension	2019 ACE Plan	2019 ACE Plan	$ 454,662	$ 454,662	$ -			
Awaiting Approval	Distribution	C0011189	2H-411 - Cowie Hill UG System Replacements Part 3	2019 ACE Plan	2019 ACE Plan	$ 449,448	$ 449,448	$ -			
Awaiting Approval	Distribution	C0011182	15N-202 - Dominion St and Arthur St Rebuild	2019 ACE Plan	2019 ACE Plan	$ 328,292	$ 328,292	$ -			
Awaiting Approval	Distribution	C0011206	102W-311 - Jedediah Rd Rebuild	2019 ACE Plan	2019 ACE Plan	$ 317,453	$ 317,453	$ -			
Awaiting Approval	Distribution	C0011187	5N-301 - Masstown Road Rebuild Phase 2	2019 ACE Plan	2019 ACE Plan	$ 304,501	$ 304,501	$ -			
Awaiting Approval	Distribution	C0011188	23H-303 - Willett Street Underground Replacement	2019 ACE Plan	2019 ACE Plan	$ 286,624	$ 286,624	$ -			
Awaiting Approval	Distribution	C0004165	70W-311G - Crousetown Road Phase Extension	2019 ACE Plan	2019 ACE Plan	$ 285,117	$ 285,117	$ 5,855			
Awaiting Approval	Distribution	C0013978	11S - Keltic Drive Substation Animal Guards	2019 ACE Plan	2019 ACE Plan	$ 333,813	$ 333,813	$ -			
Pending Submission	General Plant	C0013438	IT - T&D WAM Phase 1 - GIS and Field Design System	2019 ACE Plan (2018 Pending Submission)		$ 7,978,434		$ -			
Pending Submission	General Plant	51481	IT - Content Management Software Upgrade	2019 ACE Plan (2018 Pending Submission)		$ 2,053,010		$ 434,791			
Pending Submission	General Plant	C0002241	IT - Generation Operations Upgrade	2019 ACE Plan (2018 Pending Submission)		$ 562,680		$ 41,347			
Pending Submission	Generation	39472	HYD - Mersey Redevelopment Phase 1	2019 ACE Plan (for Subsequent Approval)		$ 115,534,895		$ 4,458,882			
Pending Submission	Generation	C0013838	HYD - Wreck Cove Unit 1 Overhaul	2019 ACE Plan (for Subsequent Approval)		$ 53,732,085		$ -			
Pending Submission	Generation	49949	LM6000 - TUC4 Control System Replacement	2019 ACE Plan (for Subsequent Approval)		$ 864,695		$ 23,322			
Pending Submission	Generation	52146	LM6000 - TUC4 Enclosure Cooling Upgrade	2019 ACE Plan (for Subsequent Approval)		$ 318,033		$ -			
Pending Submission	Generation	52150	LM6000 - TUC5 Enclosure Cooling Upgrade	2019 ACE Plan (for Subsequent Approval)		$ 318,033		$ -			
Pending Submission	Generation	C0011191	CT - Tusket Stack Refurbishment	2019 ACE Plan (for Subsequent Approval)		$ 355,946		$ -			
Pending Submission	Generation	52292	TUC - Heavy Fuel Oil Tank Dyke Refurbishment	2019 ACE Plan (for Subsequent Approval)		$ 985,283		$ -			
Pending Submission	Generation	48850	AMO - Fleet Mobile Technology Advancement	2019 ACE Plan (for Subsequent Approval)		$ 266,453		$ -			
Pending Submission	Generation	C0011092	POT - Unit 2 Turbine Crane Refurbishment	2019 ACE Plan (for Subsequent Approval)		$ 254,342		$ -			
Pending Submission	Generation	C0010539	AMO - Wind Asset Management	2019 ACE Plan (for Subsequent Approval)		$ 272,430		$ -			
Pending Submission	Transmission	C0011039	5V-GT1 - Generating Transformer	2019 ACE Plan (for Subsequent Approval)		$ 602,155		$ -			
Pending Submission	Transmission	C0011261	101W Port Mersey Expansion	2019 ACE Plan (for Subsequent Approval)		$ 2,623,897		$ -			
Pending Submission	Transmission	C0010956	78W - Substation Relocation and New Power Transformer	2019 ACE Plan (for Subsequent Approval)		$ 2,507,602		$ -			
Pending Submission	Distribution	C0008638	Cogswell HRM Redevelopment Program	2019 ACE Plan (for Subsequent Approval)		$ 4,003,344		$ -			
Pending Submission	Distribution	47794	Heckman Island Underwater Cable Replacement	2019 ACE Plan (for Subsequent Approval)		$ 1,042,425		$ 985			
Pending Submission	General Plant	46075	IT - T&D WAM Phase 2 – Work Management and Scheduling & D	2019 ACE Plan (for Subsequent Approval)		$ 46,467,795		$ 5,403,449			
Pending Submission	General Plant	C0011378	Route Network Upgrades	2019 ACE Plan (for Subsequent Approval)		$ 6,440,943		$ -			
Pending Submission	General Plant	47751	ECC - Dynamic Line Rating Implementation	2019 ACE Plan (for Subsequent Approval)		$ 4,748,860		$ 148,275			
Pending Submission	General Plant	49093	IT - Security Operations Center (SOC) and Security Information E	2019 ACE Plan (for Subsequent Approval)		$ 2,489,673		$ 397,463			
Pending Submission	General Plant	49480	IT - Disaster Recovery	2019 ACE Plan (for Subsequent Approval)		$ 4,506,051		$ 287,483			
Pending Submission	General Plant	C0011059	IT - Database Infrastructure	2019 ACE Plan (for Subsequent Approval)		$ 1,964,280		$ -			
Pending Submission	General Plant	C0010019	IT - ADMS Upgrade 2019	2019 ACE Plan (for Subsequent Approval)		$ 1,682,043		$ -			
Pending Submission	General Plant	49858	IT - MS Exchange Upgrade	2019 ACE Plan (for Subsequent Approval)		$ 1,517,875		$ 2,922			
Pending Submission	General Plant	C0010838	MCC - HVAC Replacement	2019 ACE Plan (for Subsequent Approval)		$ 1,071,364		$ -			
Pending Submission	General Plant	48044	Bentley Nevada Upgrade and Integration to Fleet Monitoring	2019 ACE Plan (for Subsequent Approval)		$ 880,592		$ 82,302			
Pending Submission	General Plant	C0011819	Backup Control Centre SCADA Hardware Replacement	2019 ACE Plan (for Subsequent Approval)		$ 561,496		$ -			
Pending Submission	General Plant	C0011308	IT - PowerPlan Upgrade	2019 ACE Plan (for Subsequent Approval)		$ 503,921		$ -			
Pending Submission	General Plant	C0013718	AMO - Run-up Optimization Tool	2019 ACE Plan (for Subsequent Approval)		$ 428,340		$ -			
Pending Submission	General Plant	C0011679	AMO - T&D Asset Performance Management Tool	2019 ACE Plan (for Subsequent Approval)		$ 372,860		$ -			
Pending Submission	General Plant	C0011380	2019 Telecom Building Replacement	2019 ACE Plan (for Subsequent Approval)		$ 301,380		$ -			
Pending Submission	General Plant	50942	AMO - Hydro Data Integration	2019 ACE Plan (for Subsequent Approval)		$ 266,867		$ -			
Pending Submission	General Plant	C0012239	ADMS Enhancement - Fixed Estimated Time to Restore	2019 ACE Plan (for Subsequent Approval)		$ 240,431		$ -			
Pending Submission	General Plant	C0002137	ECC - Map Board and Technology Modernization	2019 ACE Plan (for Subsequent Approval)		$ 2,568,789		$ -			

NS Power 2018 ACE Plan Items – Deferred or Cancelled

This report includes any deferred or cancelled projects that were included in the 2018 ACE Plan.

CI	Project Title	2018 ACE Amount	2018 ACE Project Total	Cancelled / Deferred	Deferred To	Prior Approval	2018ACE Plan Reference	Commentary
Generation								
47659	HYD - Fall River Controls Upgrade	104,320	302,867	Deferred	2026		Subsequent Submittal	Priorities were reassessed which changed the investment timing of this project, also reviewed with other asset requirements for the system to minimize outage duration.
47660	HYD - Dickie Brook Controls Upgrade	228,354	885,586	Deferred	2020		Subsequent Submittal	As part of Hydro long term planning, other projects were identified in the near term that would also require an outage, resulting in the deferral of this project to align with future outage requirements and give more time to prepare for the most efficient execution of all projects.
47937	BGT1 Clutch Refurbishment	61,000	61,000	Deferred	2020		Less than $250k	Deferred to 2020 to align with a full engine overhaul or a generator rotor replacement/refurbishment and minimize the outage duration and execute along with other upcoming projects.
49546	TRE6 FW Heater Level Control	187,315	187,315	Deferred	2019		Less than $250k	Deferred due to feedwater heater work completed in late 2017 that mitigated any immediate risks.
51868	HYD - 4th Lake Butterfly Valve Refurbishment	48,006	48,174	Cancelled			Less than $250k	This project was intended to provide a lockable actuator for 4th Lake for isolation work. However, an alternate design was able to meet this requirement. As a result this project has been cancelled.
52178	POT - Fuel Oil Supply Shutoff Valve Installation	54,857	54,857	Cancelled			Less than $250k	This project was originally identified as a possible requirement for insurance reasons but has been deemed as not required. As a result, this project has been cancelled.
52280	PHB Rotary Valve Replacements	57,912	57,912	Cancelled			Less than $250k	This project is no longer required as previously used valves were refurbished in 2017 and replacement is no longer required at this time.
C0001758	AMO CBT & Procedure Management Phase 3	213,866	231,446	Cancelled			Less than $250k	CI C0003939 was created as a duplicate of CI C001758 in the 2018 ACE Plan in error. CI C0001758 has been canceled whereas its scope is covered under CI C0003939.
C0002978	CTs Motor Control Centre Upgrades	1,199,221	1,199,221	Deferred	2020		Subsequent Submittal	This project has been deferred due to a delay in the Burnside Unit 4 Motor Control Centre design from the vendor and determining the effectiveness of the solution this design offers.
49942	HYD - Tidewater Facility Repairs	1,230,442	1,234,178	Deferred	2020		Request Approval	Design of project is in process and as a result project has been deferred.
47655	HYD - Paradise Controls Upgrade	218,179	639,991	Deferred	2021		Request Approval	Deferred to align with implementing WRC, SHH, and TUS control upgrades to combine similar scopes of work for project management and transparency.
51772	HYD Arc Flash Mitigation	262,654	403,175	Deferred	2020		Subsequent Submittal	Deferred due to a delay in study to rank risk areas and define specific remedies for arc flash risk.
52159	CT VJ1 Varec Gauges Upgrades	35,000	35,000	Cancelled			Less than $250k	The Varec gauges are being replaced with a new fuel monitoring system and will be replaced under CI 52115.
52160	CT VJ2 Varec Gauges Upgrades	35,000	35,000	Cancelled			Less than $250k	The Varec gauges are being replaced with a new fuel monitoring system and will be replaced under CI 52115.
51848	HYD - ANN Warehouse Reno	118,275	147,187	Deferred	2020		Less than $250k	Subsequent to the 2018 ACE Plan, resources were not available to implement in 2018 and it was determined that it could be safely deferred to 2020.
52017	HYD ANN Exciter Replacement	465,855	473,350	Deferred	2020		Subsequent Submittal	Deferred until further evaluation of the future of the asset.
52152	TRE5 Relay Room Fire Protection	96,940	96,940	Deferred	2020		Less than $250k	Relay work will be completed at the same time as the wire/cable sprinkler protection slated for 2020
39472	HYD Mersey System Re-Development	1,223,368	83,595,607	Deferred	2019		Subsequent Submittal	Deferred to better define project scope and consultation and engagement requirements.
Distribution								
47794	Heckman Island Underwater Cable Rep	762,186	1,524,923	Deferred	2019		Subsequent Submittal	Subsequent to the 2018 ACE Plan, NS Power re-examined the resource availability and determined that this project could be safely deferred to 2019.
General Plant								
52337	IT-Group Billing Experience	505,823	505,823	Deferred	2020		Subsequent Submittal	Subsequent to the 2018 ACE Plan, NS Power re-examined this project and determined that it could be safely deferred to 2020.
52335	IT-Automate Manual Billing	506,403	506,403	Deferred	2020		Subsequent Submittal	Subsequent to the 2018 ACE Plan, NS Power re-examined this project and determined that it could be safely deferred to 2020.
52334	IT-Meridium Upgrade	150,000	150,000	Cancelled			Less than $250k	CI 52334 was created as a duplicate in error and is being completed under CI 48039.
50112	Customer Experience Consolidated Customer Web Portal	654,004	1,190,588	Cancelled			Subsequent Submittal	Scope of work to be completed under CI 51481, in an effort to combine similar scopes of work for project management and transparency.
49825	Radio Site Grounding Upgrade	181,197	181,197	Deferred	2019		Less than $250k	Subsequent to the 2018 ACE Plan, resources were not available to implement in 2018 and it was determined that it could be safely deferred to 2019.
49094	IT - Identity Access Management Infrastructure	800,000	977,498	Deferred	2020		Subsequent Submittal	This project is being deferred while NS Power evaluates and addresses higher risk items.
49858	IT - MS Exchange Upgrade	1,555,597	1,555,597	Deferred	2019		Subsequent Submittal	This project is being deferred in order to evaluate scope and direction.
49480	IT - Disaster Recovery	494,282	6,312,277	Deferred	2019		Subsequent Submittal	This project is being deferred while NS Power evaluates and addresses higher risk items.
Previously listed as deferred, now active in 2018.								
51972	HYD Nictaux Canal Embank Refurb	779,686	789,918	Deferred	2020		Request Approval	Engineering has begun in 2018 and project is now expected to be completed in 2019 along with the Nictaux Bridge.
52262	HYD - Hells Gate 1 Overhaul	854,993	854,993	Deferred	2020		Request Approval	Upon re-evaluation of capital work this work cannot wait until 2020 and was subsequently prioritized for 2018/2019.
49945	HYD - Malay Falls Switchgear Replac	957,136	958,631	Deferred	2019		Request Approval	Engineering has begun in 2018 and project is now expected to be completed in 2019 to align with control upgrades
48712	HYD - Dam Instrumentation Upgrade	395,505	476,207	Deferred	2019		Request Approval	Project is being completed in a staged implementation beginning in 2018.
52059	L5039 - 2018 Replacements and Upgrades	719,825	719,825	Deferred	2019		Request Approval	While much of the work has been deferred to to 2019, project execution has begun in 2018 and project is currently underway.
52320	L6549 2018 Replacements & Upgrades	657,710	1,406,535	Deferred	2019		Request Approval	While much of the work has been deferred to to 2019, project execution has begun in 2018 and project is currently underway.
52119	L5054 2018 Replacements and Upgrades	560,143	560,143	Deferred	2019		Request Approval	Project is now nearing completion in 2018.
52204	87W-312G-Tancook Island Replacement	208,236	454,096	Deferred	2019		Request Approval	While much of the work has been deferred to to 2019, project execution has begun in 2018 and project is currently underway.
51398	2018/2019 Steel Tower Refurb	461,426	1,992,692	Deferred	2019		Request Approval	While much of the work has been deferred to to 2019, project execution has begun in 2018 and project is currently underway.
52205	30N-412 Hwy 242 Fundy Shore Rebuild	536,670	536,670	Deferred	2019		Request Approval	While much of the work has been deferred to to 2019, project execution will begin in Q4 2018.

Final Cost Report

This report includes a list of all FIN capital work orders that have fallen outside the timelines under the CEJC. (Within six months of in-service.)
These projects have either been completed and are outside the FIN tolerances or forecasted to be outside of the FIN tolerances. (The greater of +/- 5% or +/- $250,000.)
Projects that have been in-service for 6 months, but have a project forecast within the allowed FIN tolerance, are not included on this list.

Project #	Project	In-service Date	UARB Approval	Spend to September 30, 2018	Comment
20758	HYD - Nictaux Pipeline and Intake	11/30/2015	4,472,431	3,522,588	FIN CWO submitted to the UARB on November 5, 2018
29009	Right of Way Purchase Northern NS	1/31/2012	4,462,493	3,323,282	Project remains ongoing. Land related projects go in-service when first parcel of land is purchased, therefore filing a FIN within six months of the in-service date is not feasible.
33562	FAC Land Registration Act	1/1/2012	1,899,162	664,726	Project remains ongoing. Land related projects go in-service when first parcel of land is purchased, therefore filing a FIN within six months of the in-service date is not feasible.
35083	LIN 2011 Ash Site Sealing and Capping	11/30/2015	1,112,451	831,104	Project remains ongoing. As portions of the ash site are sealed and capped the project is made operational, therefore filing a FIN within six months of the in-service date is not feasible.
40103	U&U Load Control Demo	12/31/2010	4,293,793	3,610,833	NS Power withheld the Final Cost application for this project while the smart grid strategy for NS Power was being developed. This was necessary to determine the direction of the work related to this CI. Project is now completed and expected to be submitted for Final Cost application in 2019.
40648	IT - Field Mobility System	9/30/2015	3,332,515	1,993,697	This project has completed a portion of the intended scope, which is operational. The remaining work is tied to the future T&D Work & Asset Management project. NS Power has delayed the remaining work to ensure proper alignment between the two efforts.
43490	Steel Tower Life Ext - Halifax Harbour	8/31/2016	1,441,709	833,329	This project was placed in-service when the first structures were replaced, therefore filing a FIN within six months of the in-service date is not feasible. Project is now completed and expected to be submitted for Final Cost application in 2019.
43681	South Canoe Subs. Network Upgrades	10/17/2014	4,650,955	4,270,258	FIN CWO submitted to the UARB on November 5, 2018
43683	South Canoe Wind Project Tx Line	10/31/2014	5,831,002	5,179,767	FIN CWO submitted to the UARB on November 5, 2018
45882	103H-T63 Transformer Replacement	11/30/2015	1,706,615	1,402,349	Transformer was placed in-service in 2015, but remaining bushing work on the replaced transformer (being converted to a spare) was completed in 2017. Project is now completed and expected to be submitted for Final Cost application in 2019.
47949	L5028 Replacements and Upgrades	8/31/2016	1,144,355	854,792	Project remains ongoing. This project was placed in-service when the first structures were replaced, therefore filing a FIN within six months of the in-service date is not feasible.
48093	2016 Padmount Replacement Program	7/31/2016	1,911,470	1,515,042	This project goes in-service when the first padmount is replaced, therefore filing a FIN within six months of the in-service date is not feasible. Project is now completed and expected to be submitted for Final Cost application in 2019.
48535	HYD Scragg Lake Dam Spillway Refurb	11/30/2017	1,956,298	1,625,687	FIN CWO submitted to the UARB on November 5, 2018
49253	U&U 20V-T1 Transformer Replacement	10/31/2017	1,305,748	914,578	Project is in the final stages of completion and will be final costed in 2018.
49633	HYD - Trout River Lake Canal Refurb	12/31/2017	519,531	165,818	FIN CWO submitted to the UARB on November 5, 2018
Projects that have been in-service for 6 months, but have a project forecast within the allowed tolerance (Greater of 5% or $250,000) are not included on this list.					

2019 ACE Appendix D has been filed electronically only.