Q. [Data] – For each supplementary item of information obtained from operating personnel concerning practices, plans, policies, outlook, etc. as they relate to life or salvage characteristics, please provide the following:

a. a narrative identification of each separate practice, plan, policy, outlook, etc.;

b. the individual from whom each such practice, plan, etc. was obtained;

c. the inquiry made to elicit the input;

d. all underlying data, reports, documents, etc., that address each separate practice, plan, etc.; and

e. the impact each separate practice, plan, etc. had in the development of each depreciation parameter, by account.

A. Attachment A includes the meeting notes from discussions with Newfoundland Power personnel. Attachment B includes the 2010 Property Inspection reports prepared by Newfoundland Power personnel for each functional plant.

None of the further data is provided as it either does not exist or is not necessary for a satisfactory understanding of the matters to be considered in this Application.

Meeting Notes

NEWFOUNDLAND POWER, INC.

MANAGEMENT MEETING QUESTIONS AND DISCUSSION TOPICS

JUNE 18, 2010

INTRODUCTION

Gannett Fleming is currently assisting Newfoundland Power with a depreciation study of electric property. The primary parameters that need to be estimated for purposes of calculating depreciation are service life and net salvage. Newfoundland Power's plant accounting department has furnished Gannett Fleming with aged historical accounting data covering the period 1948 – 2009 and salvage and cost of removal data covering the period 1951 - 2009. From this data we are able, through the use of actuarial and statistical techniques, to determine on average how long assets have lived from a historical perspective and the average removal costs and salvage amounts for property when it is retired.

If past experience is expected to be representative of the future, then Gannett Fleming can rely on the historical record as a basis for our service life and net salvage estimates. If the past is not expected to be representative of the future, we would like to know why (i.e. what has changed) and would like your input as to how long you expect certain assets will last.

GENERAL QUESTIONS FOR ALL ACCOUNTS

- What have been the primary causes of retirement (i.e. deterioration, technological obsolescence, inadequacy, requirements of government agencies, etc.) for the major classes of assets included in this account?
- What are the expected causes of retirement in the future?
- Have there been significant improvements made to the asset that will affect its service life?

- Is management planning on spending more or less on maintenance in the future (as a percentage of the plant balance)?
- What is the future service life outlook for the assets included in each account? Will anticipated future events alter the service life expectations for the assets or do you expect service lives to stay on trend with those that have been experienced in the past?
- Are there any significant system changes planned that will significantly increase retirements in the near term for this account?
- How will changes in technology affect the assets in each account? Will there be better products available in the near term that will significantly increase the level of retirements for this account?
- How does plant accounting determine the retirement amount associated with a unit of property removed from service (actual cost, FIFO, cumulated average unit cost pricing, LIFO)?
- How does the company account for the removal costs associated with retirements?
- Are there any accounting policy changes that would impact the service lives of assets (i.e. cradle-to-grave accounting vs. location life, changes in capitalization policies, changes in accounting for cost of removal or salvage, changes in property unit categories, etc.)?
- How does the company account for government reimbursements and relocations?
- How does the company account for property that is reused? That is, what value is assigned to the material or equipment that is reused (current cost, net book value, average inventory cost, other)?

HYDRAULIC PRODUCTION PLANT

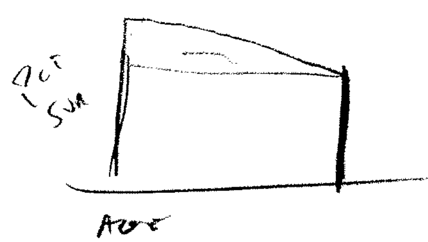
- For hydro site owned by Newfoundland Power, please provide the following:
  - Year operation began
  - MW Capacity
- Please describe any major capital expenditures planned for the next five years.
- Does the company have plans to retire any hydro plants?

OTHER PRODUCTION

- Below are the estimated final retirement dates for the 2005 depreciation study. Are these dates still reasonable estimates of the lives of each generating station?

Plant	Probable Retirement Date	
Port Aux ~~Black~~ Basques Diesel	~~6/2016~~	2021
Port Union Diesel	~~6/2016~~	2010 (12-2...)
Green Hill Gas Turbine	~~6/2016~~	2021
Mobile Diesel #3	6/2036	
Wesleyville Gas Turbine	~~6/2026~~	2021
PORTABLE	~~2016~~ WAS 2026	2016

- Please describe any major capital expenditures planned for the next five years.
- Does the company have any plans to construct any new gas or diesel plants?



SUBSTATION

- Are any major retirements of substation equipment planned in the next five years? How much of the capital budget is for substation equipment?
- What are the transmission voltage levels operated by Newfoundland Power?
- Are there any problematic transformers on the system? What is the primary cause of retirement for transformers?
- Describe Newfoundland Power's maintenance program related to transformers? Please describe any testing programs for this equipment.
- Are transformer rewinds capitalized or expensed?
- What is the expected service life for a transformer installed today? Is this the same is in the past?
- What is the primary cause of retirement for circuit breakers?
- Please describe the types of circuit breaker in service for Newfoundland Power.
- Are spare parts an issue for certain kinds of circuit breakers?
- What is the expected average service life for circuit breakers? Is this the same as in the past?

TRANSMISSION PLANT

ACCOUNT 350 LAND AND LAND RIGHTS

- How does the company determine when land rights are retired?

ACCOUNT 353.1, OVERHEAD CONDUCTORS

- What percentage of the company's conductor is aluminum? What percentage is copper? ACSR? AASC?

- What is the basic retirement property unit for conductor (i.e. one span, one foot, etc.)? Has the company always used the same unit of property?
- Does Newfoundland Power normally replace conductor when poles are replaced? Is the old conductor ever reused?

Account 352.2, Underground Cables

- In what situations does the company run transmission lines underground? What are the voltage levels?
- Are there any major maintenance or operating problems encountered with the underground conductor?
- What type of conduit does Newfoundland Power use for underground transmission?

Account 355.1, Poles and Account 355.2, Pole Fixtures

- What percentage of the company's transmission poles are steel poles? Wood? Other? What are the reasons steel poles are installed instead of wood?
- Are there any transmission system plans that would include modification to or retirement of any transmission pole lines?
- How frequently does Newfoundland Power inspect its transmission poles? What type of testing is performed on wood transmission poles?
- How does Newfoundland Power typically dispose of poles? Does Newfoundland Power reuse poles?
- What is the typical cost to remove a pole (fully loaded cost, including disposal)?

Account 355.3, Insulators

- What are the primary forces of retirement for insulators?

Distribution Plant

Account 360 Land and Land Rights

- How does the company determine when easements are retired?

Accounts 361.1 – 361.15, Overhead Conductor

- What percent of new installations are overhead versus underground?
- What percentage of the company's conductor is aluminum? What percentage is copper? ACSR? AASC? AAAC?
- What is the basic retirement property unit for conductor (i.e. one span, one foot, etc.)? Has the company always used the same unit of property?
- Does Newfoundland Power normally replace conductor when poles are replaced? Is the old conductor ever reused?

Account 361.2, 361.3 and 361.4, Underground and Submarine Cable

- Are there any maintenance or operating problems encountered with underground conductor?
- Describe the different types of underground conductors used at Newfoundland Power. Are the service life outlooks the same for all types?
- What percentage of underground conductor is retired in place and how much is removed?
- Describe the reasons for past retirements of underground conductor.
- What percentage of underground conductor is installed in conduit?
- What material type(s) is currently installed? Is this consistent with past practices?
- Where, in general, is underground conductor being installed?
- Where, in general, is submarine cable being installed

- Is there any scrap value when conductor is retired?

Accounts 362.1, 362.2, 362.3 & 362.4, Poles and Fixtures

- What percentage of the company's poles are wood poles? Steel? Other?
- Does the company treat wood poles? What preservative(s) is used?
- Are crossarm replacements capitalized or expensed?
- Describe Newfoundland Power's maintenance practices related to poles.
- Does the company use C trusses?

Account 363, Street Lights

- Does Newfoundland Power own street lighting or is street lighting primarily municipally owned?
- What kinds of street lights are currently installed? Is this different from in the past?

Account 364.1, Transformers and Mountings

- Describe the corrosion of the steel tanks and the steps undertaken by Newfoundland Power to mitigate corrosion.
- What percent of new installations use stainless steel tanks?
- What is the expected service life of a line transformer with a stainless steel tank? Steel tank?

Account 364.2, Voltage Regulators, Account 364.3 Capacitor Banks, and Account 364.4, Reclosers

- What are the primary causes of retirement for the property in these accounts?

Accounts 365.1 and 365.2, Services

- Are you required to remove (or retire) a service line if the consumer account is inactive for more than one year?

- What are the primary causes of retirements? Are the life expectations for service lines generally shorter than those of overhead conductors?
- What is the outlook for future levels of conductor replacement or retirement?
- Do you reuse service lines that are still in good condition?
- Are there any differences in service life expectations between overhead and underground service lines?
- Are you required to remove underground lines that are direct buried?

Account 366.1, 366.2, 366.3 & 366.4, Meters

- How often are you required to test individual meters?
- Are there certain types of meters that you've encountered problems?
- Are there any technological changes that are likely to occur in the near term that will significantly increase meter retirements?
- What are the primary causes of retirements?
- What percentage of installed meters are AMR meters? What percentage of new installations are AMR meters?
- Please discuss any pending regulations that could impact the service lives of meters.

Account 367.1, Underground Ducts and Manholes

- Generally speaking, when does the company place assets underground?
- In what cases would the company retire underground ducts and manholes?

Account 367.2, Underground Switches and Switchgear

- Generally speaking, when does the company place switches and switchgear underground?

GENERAL PROPERTY

ACCOUNT 371, BUILDINGS AND STRUCTURES

- The estimated retirement dates for Newfoundland Power's major structures are listed below. Are these still reasonable estimates?

Building	Probable Retirement Date	
Topsail Road - Transformer Storage	6-2026	2026
Topsail Road - System Control Center	6-2054	—
Kenmount Road	6-2046	—
Duffy Place	6-2060	—
Carbonear - Office/Warehouse	6-2030	—
Whitbourne	6-~~2033~~	2023
Salt Pond	6-2023	—
Clarenville Regional Building	6-2042	—
Gander	6-~~2023~~	2037
Grand Falls Service Building	6-~~2041~~	2056
Corner Brook - Maple Valley Service Buildings	6-~~2034~~	2057
Stephenville Office and Service Build	6-2028	—
Port Aux Basques	6-2026	—

NEWFOUNDLAND POWER, INC.

MANAGEMENT MEETING QUESTIONS AND DISCUSSION TOPICS

JUNE 18, 2010

INTRODUCTION

Gannett Fleming is currently assisting Newfoundland Power with a depreciation study of electric property. The primary parameters that need to be estimated for purposes of calculating depreciation are service life and net salvage. Newfoundland Power's plant accounting department has furnished Gannett Fleming with aged historical accounting data covering the period 1948 – 2009 and salvage and cost of removal data covering the period 1951 - 2009. From this data we are able, through the use of actuarial and statistical techniques, to determine on average how long assets have lived from a historical perspective and the average removal costs and salvage amounts for property when it is retired.

If past experience is expected to be representative of the future, then Gannett Fleming can rely on the historical record as a basis for our service life and net salvage estimates. If the past is not expected to be representative of the future, we would like to know why (i.e. what has changed) and would like your input as to how long you expect certain assets will last.

GENERAL QUESTIONS FOR ALL ACCOUNTS

- What have been the primary causes of retirement (i.e. deterioration, technological obsolescence, inadequacy, requirements of government agencies, etc.) for the major classes of assets included in this account?

  Transmission lines deteriorate after they have been in service for long periods of time.

  Ice storms may cause plant to be replaced before the end of their useful life.

- What are the expected causes of retirement in the future?

  Same as above. Deterioration and ice storms.

- Have there been significant improvements made to the asset that will affect its service life?

  No?

- Is management planning on spending more or less on maintenance in the future (as a percentage of the plant balance)?

  NP is planning on spending similar amounts on maintenance and rebuild in the future.

- What is the future service life outlook for the assets included in each account? Will anticipated future events alter the service life expectations for the assets or do you expect service lives to stay on trend with those that have been experienced in the past?

  Future service life outlook is similar to current. There is no movement towards transmission line assets that are much different from current assets.

- Are there any significant system changes planned that will significantly increase retirements in the near term for this account?

  No

- How will changes in technology affect the assets in each account? Will there be better products available in the near term that will significantly increase the level of retirements for this account?

  No, in the near term it is unlikely that new technology will significantly increase the level of retirements for Transmission infrastructure.

- How does plant accounting determine the retirement amount associated with a unit of property removed from service (actual cost, FIFO, cumulated average unit cost pricing, LIFO)?

  Unknown?

- How does the company account for the removal costs associated with retirements?

  Removal costs are accounted for by using a separate account number. Capital expenditures begin with a #7, while retirement begins with a #8.

- Are there any accounting policy changes that would impact the service lives of assets (i.e. cradle-to-grave accounting vs. location life, changes in capitalization policies, changes in accounting for cost of removal or salvage, changes in property unit categories, etc.)?

  Unknown

- How does the company account for government reimbursements and relocations?

  Unknown

- How does the company account for property that is reused? That is, what value is assigned to the material or equipment that is reused (current cost, net book value, average inventory cost, other)?

  Unknown

TRANSMISSION PLANT

ACCOUNT 350 LAND AND LAND RIGHTS

- How does the company determine when land rights are retired?

  Unknown

  When we prepare retirement write-ups for each project, we note the amount of easement to be released in addition to poles, structures, etc.

ACCOUNT 353.1, OVERHEAD CONDUCTORS

- What percentage of the company's conductor is aluminum? What percentage is copper?

  ACSR? AASC?

  ACSR: 1392.53km (from table in depreciation report) 68%
  AASC: 369 km (from table in depreciation report) 18%
  ASC: 273 km 13%
  Copper: ~18 km 1%
  Cable 3 km 0.14%

- What is the basic retirement property unit for conductor (i.e. one span, one foot, etc.)? Has the company always used the same unit of property?

  Typically in metres or kilograms.

- Does Newfoundland Power normally replace conductor when poles are replaced? Is the old conductor ever reused?

  For rebuild lines, the conductor is replaced.
  For the relocates, we will typically reuse the conductor.
  For ice storms, depending on the age and condition of the conductor, replacement may or may not occur.

ACCOUNT 353.2, UNDERGROUND CABLES

- In what situations does the company run transmission lines underground? What are the voltage levels?

  We have 4 transmission lines that have some underground (12L, 14L, 4L, 13L); all 66 kV

- Are there any major maintenance or operating problems encountered with the underground conductor?

  Cables are 1966/1978 vintage. Oil-filled. Recently topped up oil, general maintenance of terminations, oil reservoirs.

- What type of conduit does Newfoundland Power use for underground transmission?

  Direct buried (12L, 14L)
  If we put in new, it would be in PVC and concrete.

ACCOUNT 355.1, POLES AND ACCOUNT 355.2, POLE FIXTURES

- What percentage of the company's transmission poles are steel poles? Wood? Other? What are the reasons steel poles are installed instead of wood?

  Less than 1% are steel. Vast majority are wood. Steel poles are installed instead of wood as needed in public watersheds. Some steel towers are located in 4L, 25L, 140L, 144L. NP also owns 3 steel towers on 356L.
  Largest number of steel poles is on 3L (PPWSA) which has 48. 24L has maybe 35.

  Some laminated wood poles on 132L/130L in Grand Falls. Deterioration on tops.

45' CL3	wood $440	steel $1927
55' CL3	wood $720	steel $2536

65' CL2 wood $2000 steel $3236

- Are there any transmission system plans that would include modification to or retirement of any transmission pole lines?

  Yes, we have an annual capital budget project that replaces sections of Transmission line each year.

  In addition, there are customer requests throughout the year that require relocating parts of transmission lines.

  Some talk about removing 102L

- How frequently does Newfoundland Power inspect its transmission poles? What type of testing is performed on wood transmission poles?

  NP inspects transmission poles on an annual basis.

  The type of testing on wooden poles includes:
  1. Visual
  2. Sound test (Randomly on poles < 35 years; Mandatory on everything > 35 years)
  3. If it appears deteriorated, then a core sample is taken.

- How does Newfoundland Power typically dispose of poles? Does Newfoundland Power reuse poles?

  Contractor takes poles.
  Anything over 25 years is not salvageable.
  Less than 10 years can be reused as same class and size.
  Between 10 – 25 years, can be used as service/street light poles.

- What is the typical cost to remove a pole (fully loaded cost, including disposal)?

  BNR is $130 for pole only. For transmission, prices for dismantling are per km amount on the rebuild contract. Typically TML dismantling is $17,700 per km (poles, wires, framing)

Account 355.3, Insulators

- What are the primary forces of retirement for insulators?

  NP has identified porcelain insulators manufactured by the former Canadian Porcelain (CP) and Canadian Ohio Brass (COB) companies as necessary to replace due to cement growth.

  Otherwise, insulators are replaced based on the age of the line.

  All new insulators used on rebuilds.

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NEWFOUNDLAND POWER, INC.

MANAGEMENT MEETING QUESTIONS AND DISCUSSION TOPICS

JUNE 18, 2010

INTRODUCTION

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If past experience is expected to be representative of the future, then Gannett Fleming can rely on the historical record as a basis for our service life and net salvage estimates. If the past is not expected to be representative of the future, we would like to know why (i.e. what has changed) and would like your input as to how long you expect certain assets will last.

GENERAL QUESTIONS FOR ALL ACCOUNTS

- What have been the primary causes of retirement (i.e. deterioration, technological obsolescence, inadequacy, requirements of government agencies, etc.) for the major classes of assets included in this account?
- What are the expected causes of retirement in the future?
- Have there been significant improvements made to the asset that will affect its service life?

- Is management planning on spending more or less on maintenance in the future (as a percentage of the plant balance)?
- What is the future service life outlook for the assets included in each account? Will anticipated future events alter the service life expectations for the assets or do you expect service lives to stay on trend with those that have been experienced in the past?
- Are there any significant system changes planned that will significantly increase retirements in the near term for this account?
- How will changes in technology affect the assets in each account? Will there be better products available in the near term that will significantly increase the level of retirements for this account?
- How does plant accounting determine the retirement amount associated with a unit of property removed from service (actual cost, FIFO, cumulated average unit cost pricing, LIFO)?
- How does the company account for the removal costs associated with retirements?
- Are there any accounting policy changes that would impact the service lives of assets (i.e. cradle-to-grave accounting vs. location life, changes in capitalization policies, changes in accounting for cost of removal or salvage, changes in property unit categories, etc.)?
- How does the company account for government reimbursements and relocations?
- How does the company account for property that is reused? That is, what value is assigned to the material or equipment that is reused (current cost, net book value, average inventory cost, other)?

HYDRAULIC PRODUCTION PLANT

- For hydro site owned by Newfoundland Power, please provide the following: See Hydro Ins Rpt.
    - Year operation began
    - MW Capacity
- Please describe any major capital expenditures planned for the next five years. SEE Cap. Plan
- Does the company have plans to retire any hydro plants?

OTHER PRODUCTION

- Below are the estimated final retirement dates for the 2005 depreciation study. Are these dates still reasonable estimates of the lives of each generating station? SEE 2010 Thermal Insp Rpt.

Plant	Probable Retirement Date
Port Aux ~~Bask~~ Basque Diesel	~~6/2016~~ 2021 (# 10 unit only left)
Port Union Diesel	~~6/2016~~ 2010 Will be ret in 2010
Green Hill Gas Turbine	~~6/2016~~ NEEDS SOME WORK 2021
Mobile Diesel #3	6/2036 ✓
Wesleyville Gas Turbine	~~6/2026~~ NEEDS REPAIR 2021
Port Gas Turb	2016

- Please describe any major capital expenditures planned for the next five years. Cap Plan
- Does the company have any plans to construct any new gas or diesel plants? No, near term.

SUBSTATION See Subst Insp Rpt

- Are any major retirements of substation equipment planned in the next five years? How much of the capital budget is for substation equipment?
- What are the transmission voltage levels operated by Newfoundland Power? 66 138
- Are there any problematic transformers on the system? What is the primary cause of retirement for transformers? Age, Faults, Failure
- Describe Newfoundland Power's maintenance program related to transformers? Please describe any testing programs for this equipment.
- Are transformer rewinds capitalized or expensed?
- What is the expected service life for a transformer installed today? Is this the same is in the past?
- What is the primary cause of retirement for circuit breakers?
- Please describe the types of circuit breaker in service for Newfoundland Power.
- Are spare parts an issue for certain kinds of circuit breakers?
- What is the expected average service life for circuit breakers? Is this the same as in the past?

TRANSMISSION PLANT See Handout w/ typed responses from NFP/Trans. Engineering

ACCOUNT 350 LAND AND LAND RIGHTS

- How does the company determine when land rights are retired?

ACCOUNT 353.1, OVERHEAD CONDUCTORS

- What percentage of the company's conductor is aluminum? What percentage is copper? ACSR? AASC?

- What is the basic retirement property unit for conductor (i.e. one span, one foot, etc.)? Has the company always used the same unit of property?
- Does Newfoundland Power normally replace conductor when poles are replaced? Is the old conductor ever reused?

Account 352.2, Underground Cables

- In what situations does the company run transmission lines underground? What are the voltage levels?
- Are there any major maintenance or operating problems encountered with the underground conductor?
- What type of conduit does Newfoundland Power use for underground transmission?

Account 355.1, Poles and Account 355.2, Pole Fixtures

- What percentage of the company's transmission poles are steel poles? Wood? Other? What are the reasons steel poles are installed instead of wood?
- Are there any transmission system plans that would include modification to or retirement of any transmission pole lines?
- How frequently does Newfoundland Power inspect its transmission poles? What type of testing is performed on wood transmission poles?
- How does Newfoundland Power typically dispose of poles? Does Newfoundland Power reuse poles?
- What is the typical cost to remove a pole (fully loaded cost, including disposal)?

Account 355.3, Insulators

- What are the primary forces of retirement for insulators?

DISTRIBUTION PLANT

CU – 1%
ACSR – 50%
AASC – 49%
~~AAAC~~ –
OTHER –

ACCOUNT 360 LAND AND LAND RIGHTS

- How does the company determine when easements are retired?

ACCOUNTS 361.1 – 361.15, OVERHEAD CONDUCTOR

150 km / yr
149 km – OH
1 km – UG

- What percent of new installations are overhead versus underground? Most O/H
- What percentage of the company's conductor is aluminum? What percentage is copper? – 1% Cu

  ACSR? AASC? AAAC? ACSR majority – some corrosion of steel
  ↳ more recent installs (major)
- What is the basic retirement property unit for conductor (i.e. one span, one foot, etc.)? Has the company always used the same unit of property? LESS THAN 3 SPANS – XP (180 m)
- Does Newfoundland Power normally replace conductor when poles are replaced? Y Is the old conductor ever reused? Few instances. In general, never reused if small move

- CAUSES OF RETS ↳ RELOCATIONS, ICE LOADING – STRETCHED CABLE

ACCOUNT 361.2, 361.3 AND 361.4, UNDERGROUND AND SUBMARINE CABLE

ST JOHN'S + MT. PEARL MOSTLY

- Are there any maintenance or operating problems encountered with underground conductor?
  200 KM OF U/G IN TOTAL (PRIMARY) 10,000 KM AERIAL – PRIMARY
- Describe the different types of underground conductors used at Newfoundland Power. Are the service life outlooks the same for all types?
- What percentage of underground conductor is retired in place and how much is removed?
- Describe the reasons for past retirements of underground conductor.
- What percentage of underground conductor is installed in conduit? Very little – 20% Direct Buried 80%
- What material type(s) is currently installed? Is this consistent with past practices?
- Where, in general, is underground conductor being installed?
- Where, in general, is submarine cable being installed BELL ISLAND (1990's–NOW) + CHARLOTTETOWN (NEAR TERRA NOVA NAT'L PARK)

{ 1/0 CONCENTRIC NEUTRAL – NEWER CONDUCTOR – NO MAJOR EARLY RETS
{ XLPE – PREMATURE RETS IN 1970 – 1980's

- Is there any scrap value when conductor is retired?

Accounts 362.1, 362.2, 362.3 & 362.4, Poles and Fixtures

- What percentage of the company's poles are wood poles? Steel? Other? 100% 300,000 poles
- Does the company treat wood poles? Y What preservative(s) is used? Only 100 STEEL POLES
  RARE just to repl. joint Penta
- Are crossarm replacements capitalized or expensed? Untreated (Near water sx pilings)
  CROSSARM w/ fittings (pins + insulators) → capitalized CCA (Now in use most)
- Describe Newfoundland Power's maintenance practices related to poles.
- Does the company use C trusses? Not ~~[illegible]~~ groundline
  Pole (Rock) cribs – MARSHY / boggy AREA

Account 363, Street Lights

- Does Newfoundland Power own street lighting or is street lighting primarily municipally owned? Yes
- What kinds of street lights are currently installed? MV + HPS Is this different from in the past? No. LED lights is possible – future
  MV – NOT MUCH LEFT (1,000 LEFT) 56K – HPS

Account 364.1, Transformers and Mountings

- Describe the corrosion of the steel tanks and the steps undertaken by Newfoundland Power to mitigate corrosion. Steel in coastal environ – 10-15 yr; repl w/ Stainless
  SS ↑ (SINCE 2001 – 100%)
- What percent of new installations use stainless steel tanks?
  60% is SS (in 2010) in total
- What is the expected service life of a line transformer with a stainless steel tank? 35-45 Steel tank? ~~30~~ 25-35
  SS if failed, co. will repair SS. Not so w/ steel

Account 364.2, Voltage Regulators, Account 364.3 Capacitor Banks, and Account 364.4, Reclosers

- What are the primary causes of retirement for the property in these accounts?

Accounts 365.1 and 365.2, Services

- Are you required to remove (or retire) a service line if the consumer account is inactive for more than one year? No.

Upgrade to larger service, damage, Age, storms

- What are the primary causes of retirements? Are the life expectations for service lines generally shorter than those of overhead conductors? Shorter
- What is the outlook for future levels of ~~conductor replacement or~~ services retirement? SAME Ret causes in future
- Do you reuse service lines that are still in good condition?
- Are there any differences in service life expectations between overhead and underground service lines? About the same life
- Are you required to remove underground lines that are direct buried? No

ACCOUNT 366.1, 366.2, 366.3 & 366.4, METERS

AMR in certain Areas. Shorter life expected

- How often are you required to test individual meters?
- Are there certain types of meters that you've encountered problems?
- Are there any technological changes that are likely to occur in the near term that will significantly increase meter retirements? AMR/AMI → possibly expanding to more customers.
- What are the primary causes of retirements? Age, obsolescence, AMR
- What percentage of installed meters are AMR meters? → 10% and growing What percentage of new installations are AMR meters? AMR - In pilot Areas + hard to read customers. May expand program 25-35% NEW METERS - AMR
- Please discuss any pending regulations that could impact the service lives of meters.

ACCOUNT 367.1, UNDERGROUND DUCTS AND MANHOLES

No changes planned

- Generally speaking, when does the company place assets underground?
- In what cases would the company retire underground ducts and manholes?

Water st - St. John. Spending $ recently for upgrades

ACCOUNT 367.2, UNDERGROUND SWITCHES AND SWITCHGEAR

Spare PARTS HARD TO FIND

- Generally speaking, when does the company place switches and switchgear underground?

Have to replace.

OIL SWITCHES - EXPLODE

NEW COMPONENTS SAME LIFE AS OLD

TEARING UP STREET - EXPENSIVE

OLD, HARD TO GET PARTS (1950's vintages)

GENERAL PROPERTY

ACCOUNT 371, BUILDINGS AND STRUCTURES

- The estimated retirement dates for Newfoundland Power's major structures are listed below. Are these still reasonable estimates?

Building	Probable Retirement Date
Topsail Road - Transformer Storage	6-2026 ✓
Topsail Road - System Control Center	6-2054 ✓
Kenmount Road	6-2046 ✓
Duffy Place	6-2060 ✓
Carbonear - Office/Warehouse	6-2030 ✓
Whitbourne	6-2033 2023
Salt Pond	6-2023 ✓
Clarenville Regional Building	6-2042 ✓
Gander	6-2023 2037
Grand Falls Service Building	6-2041 2056
Corner Brook - Maple Valley Service Buildings	6-2034 2057
Stephenville Office and Service Build	6-2028 ✓
Port Aux Basques	6-2026 ✓

Downsize to smaller structures - L.S. to 2023

Newfoundland Power, Inc.
Management Meeting Attendees June 18, 2010

NAME	TITLE	EMAIL	PHONE
	Team Lead, T&D Engineering		
	Superintendent, Regional Eng		
	Superintendent, Projects		
	Senior Engineer		
	SUPT REG OPs ST. JOHN'S		
	Manager Engineering,		
	Superintendent, Civil Engineering		
	Supt., Generation Engineering		
	Supt Electrical Engineering		
	Senior Electrical Engineer		

NFP TRANSMISSION 9:00 AM

COST OF REMOVAL

COST PER KM FROM CONTRACTOR (BID)
CONDUCTOR RETURNS TO NFP, ALSO GOOD INSULATOR

ACCOUNT 353.1, OH CONDUCTORS

ACSR → ISOLATED INSTANCES OF CORROSION OF STEEL;
- ONE TYPE OF ACSR - 266, NOT INSTALLING ANY MORE

AASC → ALUMINUM ALLOY

H FRAME → 250 M BETWEEN POLES, USE ACSR;
MORE AASC IN RECENT YEARS

2005 - TRANSMISSION LINE REBUILD STRATEGY
→ REPLACING LINES EACH YEAR
- INCREASE IN REPLACEMENTS SINCE 2006

AASC → HAS BEEN INSTALLED SINCE 1980S (MAYBE EARLIER)

REBUILDS → CONTRACTORS

2006-2009; 22-25 KM
2010→2015; ≈ 16 KM (DECREASE IN KM BECAUSE LINES IN THESE YEARS ARE NEAR CITY)

TRANSMISSION LINE - INSPECTED ANNUALLY (DISTRIBUTION EVERY 7 YEARS)

→ $'S FOR DEFICIENCY CORRECTION (IE INDIVIDUAL POLES, FRAMING, ETC.)

HANDHELD DEVICE FOR INSPECTIONS
HAS LED TO MORE FOCUSED & EFFICIENT WORK
- IMPROVED RELIABILITY

REBUILD LINES → REPLACE ALL CONDUCTOR
RELOCATIONS - GENERALLY REUSE CONDUCTOR
ICE STORM - TYPICALLY REPLACED BECAUSE DAMAGED

BONAVISTA ICE STORM — STRONGER, NEWER STRUCTURES
RESULTED IN MORE CONDUCTOR DAMAGE

DETERIORATION;

CAPACITY HAS NOT GENERALLY DRIVEN RETIREMENTS
LITTLE GROWTH OUTSIDE CITY;
IN CITY THERE'S ENOUGH LINES

ACCOUNT 353.2, UNDERGROUND CABLES

4 LINES → 12L, 14L, 4L, 13L; ALL 66 kV

→ 2 km THROUGH UNIVERSITY; DIRECT BURIED

ACCOUNT 355.1 & 355.2 POLES & FIXTURES

PRIMARILY WOOD,
STEEL IN PUBLIC WATERSHEDS (PPWSA)
- REGULATIONS (ENVIRONMENTAL)
SOME LAMINATED STEEL

RELOCATIONS

PRIVATE ROW, REIMBURSED
OTHER ROW - NEGOTIATED RATE

- NORMALLY PLACE NEW POLES W/ RELOCATIONS
(RALPH HAS DETAILS)

ALL CONTRACTORS SINCE AT LEAST 2010

ACCOUNT 355.3, INSULATION

MAY BE REPLACED BEFORE LINE REPLACED

NORMALLY USE TOUGHENED GLASS & GREY PORCELAIN FOR SUSPENSION (H FRAME)

PORCELAIN FOR SINGLE POLE

COMPOSITE WHERE VANDALISM OCCURS

DISTRIBUTION

10:45 AM

LAND RIGHTS

MOVED INTO POLES ACCOUNT
(SURVEY COSTS)

POLES

LAST 5-6 YEARS, (SINCE 2004-2005)
POLES NO LONGER TRACKED BY SPECIFIC POLE # RETURN TO TRUE VINTAGE INFORMATION NOT YEAR

- USE CURVE TO DETERMINE VINTAGE 2004-PRESENT
2011 WILL RETURN TO SPECIFIC POLES

362.1 → POLES UNDER 35 FT

IN 2000, PURCHASE POLES FROM TELEPHONE CO.
~ 82,000 POLES
GENERALLY SHORTER POLES

- MAY TERMINATE AGREEMENT & SELL BACK TO ALLIANT

- PURCHASED POLES
- SOME VERY OLD, SOME VERY NEW
ON AVERAGE OLDER & IN WORSE CONDITION

POLES (CONT'D)

ALMOST 100% WOOD POLES
~100 STEEL POLES

MOST NEW POLES CCA
OUTSIDE COMMUNITIES USE PENTA } SAME COST

CCA MORE AESTHETICALLY PLEASING, LESS LEACHING

POLE INSPECTIONS

EVERY 7 YEARS; SOUND TESTING
NFP CREWS, RECORD DEFICIENCIES
BASED ON INSPECTION STANDARD:
1) REPLACEMENTS
2) REQUIRE FUTURE INSPECTION

1) RECONSTRUCTION - IMMEDIATE FIXES
2) REBUILD - BUDGETED FOR NEXT YEAR

MOST ARE REBUILDS

INSPECTION PROGRAM STARTED APPROX. 1997

~~UNDERGROUND~~

UNDER 35 FOOT

→ ADDITIONS LIKELY SERVICE POLES

LABOR COST SAME FOR ALL POLE TYPES
(CONTRACTOR)

30 FT SERVICE POLE

USED WHEN CUSTOMER LOCATION REQUIRES POLE
- RURAL AREAS; ALSO USED IN SUBDIVISIONS,
BUT NOT ALWAYS

35' & LARGER POLES

35, 40, 45 CLASS 4 ARE STANDARD SIZE

AVG HEIGHT HAS ~~or~~ INCREASED LAST 10 YEARS
→ RARELY REPLACE POLE W/ SMALLER POLE
- TELECOMS HAVE MORE LINES ON POLES

TELECOMS HAVE DRIVEN HIGHER RETIREMENTS
ALTHOUGH RELIABILITY HAS IMPROVED
TELECOM, CABLE COMPANIES LEAD TO INCREASE
RETIREMENTS (CONTRIBUTION)

RETIREMENTS

DECAY, WOODPECKERS
ROT PRIMARILY IN TOP OF POLES
- RARELY CAP POLES TO EXTEND LIFE

CRIB → USED IN MARSHES TO ANCHOR POLE

OLD CRIBBING CAN ROT
CRIBBING CAN SINK

STREET LIGHTS

REMOVE MERCURY VAPOR,
7000 REMAINING IN 2-7
PLAN TO REMOVE ALL IN THREE YEARS
(ENERGY EFFICIENCY)

POLE ~~REPLACEMENTS~~ CONTRACT

NEGOTIATE PRICE W/ SUPPLIER
CONTRACTOR DELIVERS POLE & INSTALLS (STORED IN CONTRACTOR YARD)
$400-700 TO INSTALL NEW POLE + MATERIAL COST
$200 TO REMOVE

CONTRACTOR ACQUIRES POLE ONCE REMOVED
CAN REUSE POLES IF IN GOOD CONDITION
(BASED ON COMPANY INSPECTION)

30 FT → $150
35 FT → $325
40 FT → $350
} NEGOTIATED MATERIAL COST

STEEL POLES

-> PRIMARILY FOR STREET LIGHTS
- TIED TO CUSTOMER GROWTH

~~RE~~ NEW NEW CONCRETE POLES INSTALLED
(LOTS IN 1970s & 1980s)
PROBLEMS WITH SALT ON ROADS, PARKING LOTS

STEEL TOWERS
POSSIBLY WATER CROSSINGS?

METERS

METER STRATEGY FILED IN 2006

- AMR WHERE BUSINESS, SAFETY CASE

BIG BOX STORES => SECURITY REQUIRES AMR
BECAUSE OF LIMITED ACCESS

GROUP FAILURES IN GOV'T MANDATED TESTING
-> FAILURES IN CERTAIN GROUPS REQUIRE REPLACEMENT
OF WHOLE GROUP

- HIGHER RETIREMENTS IN PAST 5 YEARS
- LIKELY TO CONTINUE IF LAWS STAY SAME

POTENTIAL NEW REGULATIONS
- COULD LEAD TO MAX LIFE OF 27 YEARS

DIGITAL METERS

NEW INSTALLATIONS:

15-20K TOTAL
5-6K AMR
ALL DIGITAL

~8% OF TOTAL INVENTORY IS AMR
(18K UNITS)

NO AMR-EXCLUSIVE METER READING ROUTES -> ADDING SOME SOON

AMR HAS ALLOWED GROWTH TO NOT ADD
TO # OF METER READERS

IF GOV'T RULES CHANGE COULD LEAD TO BUSINESS
CASE FOR AMR

NEW METER:

$30 -> NEW
$16 -> FOR AMR

TOTAL METERS

230K -> TOTAL
120K - 150K -> ELECTROMECHANICAL
18K -> AMR

TESTING, REPAIRS CONTRACTED
(METER SHOPS NEED TO BE ACCREDITED)

DEMAND METERS

- COMMERCIAL / INDUSTRIAL
- NEW METERS ARE DIGITAL

- MORE COMPLEX, MAY LEAD TO SHORTER LIFE

LINE TRANSFORMERS

55K - 56K STAINLESS STEEL ($\approx \frac{1}{2}$)
ALL NEW LINE TRANS. ARE STAINLESS STEEL
- SHOULD HELP W/ CORROSION (SINCE 2001)

MINIMAL MAINTENANCE NOW; RUST LEADS TO RETIREMENT J

AVG COST -> ≈ $3,000
(STAINLESS APPROX 25% MORE EXPENSIVE)

2006 -> RETIREMENT ADJUSTMENT TO RECONCILE BOOKS WITH FIELD

75-100 kV IS COMMON SIZE

1996-1998 -> RELIABILITY PROGRAM

DISTRIBUTION RELIABILITY INITIATIVE,
RETIREMENTS INCREASE
REBUILD FEEDERS
EXPECT POST 1998 LEVELS OF RETIREMENTS TO CONTINUE

SERVICES

UNDERGOUND -> IN CONDUIT;
RE DEVELOPER LAYS CONDUIT (& PAD FOR TRANSFORMER)
-> PROB LONGER LIFE; ICE LOADING
BUT UNDERGROUND FROST

CONDUCTOR

RELIABILITY; CONDUCTOR REPLACEMENTS WILL
INCREASE DUE TO RELIABILITY
-> LOAD GROWTH (GROWTH IS HIGH LOAD OR HEAT)
-> ICE LOADING

GENERAL PROPERTY

WHITBOURNE COULD BE SOLD FOR CONSOLIDATION
(LONGER THAN 5 YEARS FROM NOW)
(STEPHENVILLE COULD BE SIMILAR)
→ CHANGE TO 2023

GRAND FALLS }
CORNER BROOK } MAJOR REFURBISHMENTS

GUTTED; ALMOST EVERYTHING ~~THAN~~ BUT SUPERSTRUCTURE REMOVED

GRAND FALLS

REBUILT IN 2006 → EVERYTHING BUT SUPERSTRUCTURE:
SIDING, MECH, WIRING, FLOOR SLABS, ROOF

CORNER BROOK

2007 → SAME AS GRAND FALLS EXCEPT LESS
MECHANICAL WORK (MECH. WAS NEWER)
NEW STORAGE YARD

KENMOUNT RD

2009, 2010, 2011; $2 M

GENERAL PROPERTY

ACCT 372 → PRIMARILY FURNITURE; CUBICLES

ACCT 375 → LAB & TEST EQUIP → CHANGE TO 15 YEARS

- RODNEY WILL SEND LIST

GENERATION - THERMAL

PORT UNION DIESEL

WILL BE RETIRED END OF 2010

PORT AU BASQUES DIESEL 2.5 MW

RECOATED FAN IN 2008
MOVE DATE TO 2021
~~WOULD NOT TO~~
PLAN TO SPEND MONEY ON ELECTRICAL

PORTABLE GAS TURBINE

MOVE TO 2016, MAY PURCHASE
REPLACEMENT IN 2015
NEED TO REPLACE TRAILERS

GREEN HILL - 2021

PROBABLY ONE MORE OVERHAUL,
SYSTEM IN GREEN HILL HAS CHANGED
- BETTER TRANSMISSION (2 RELIABLE LINES)

WESLEYVILLE - 2021,

BUT BUILDING COULD BE 2035, 2041

* NEED TO CHECK BUILDING BALANCES

HYDRO

FALL POND }
VICTORIA } OUTPUT MAY NOT JUSTIFY REFURBISHMENT (500 KW PLANTS);
PT UNION }

- DECOMISSIONING IS EXPENSIVE
  - ESPECIALLY ENVIRONMENTAL, WHICH IS UNKNOWN

75-95% THROUGH MODERNIZATION

HYDRO & THERMAL STEP-UP TRANSFORMERS ARE CLASSIFIED AS SUBSTATION

SUBSTATION

TRANSFORMERS

TESTING:

1. ANALYZE OIL & GASES - ANNUAL
2. THERMAL SCAN - ANNUAL - NP CREWS
3. PROTECTION DEVICE CHECK (6 YEARS)

MAY MITIGATE PROBLEMS BY CHANGING OPERATING PARAMETERS UNTIL FIXED

- NORMAL MAINTENANCE PROGRAM
- MAY MOVE TO VIBRATION ANALYSIS FOR TAP CHANGER

RETIREMENTS:

- FAILURES (LOSS OF WINDING) - PRIMARY CAUSE
- CHANGES TO SYSTEM (i.e. GET RID OF 4160 V; CHANGE 33 kV → 66 kV)

→ OBSOLETE VOLTAGE LEVELS MAY BE RETIRED IF NFP ALREADY HAS A SPARE

- TRY TO CASCADE TRANSFORMERS FROM SUBSTATION UPGRADES → OTHER SITES OR SPARES

- MUCH LOAD GROWTH IS ADDITION OF CAPACITY AS OPPOSED TO REPLACEMENT

- AVERAGE AGE IS 35 YEARS (OLDEST ≈ 60)
- NEWER TRANSFORMERS ARE LESS ROBUST, HOWEVER, MODERN TESTING IS BETTER, WHICH OFFSETS

AVANTIS TRACKS MAINTENANCE SCHEDULES (ASSET MANAGEMENT)

REWINDINGS ARE CAPITALIZED; RETIREMENT MADE

- MAYBE 1 FAIL PER YEAR

- EXPECT ≈ 50 YEARS (MAYBE BETTER)

RELAYS

ELECTROMECHANICAL → LASTED 40-50 YRS
NEWER ELECTRONIC → 15-20 YRS
(COULD BE PLUG & PLAY)

CIRCUIT BREAKERS

BULK OIL → (AVG 38 YRS OLD; OLDEST 78 YR OLD)

FEW FAILURES,
PCB → PROBABLY 50% RETIRED IN NEXT 15 YRS (90 BREAKERS
(RETIRE EVERYTHING OVER 50 PARTS BY 2025)
>500 PTS → EXTENSION TO 2014

SF6 → NOT AS ROBUST, AVG LIFE → 30 YRS
(OLDEST IS 1980; 35 LEFT, AN + BS
RETIRED IN NEXT COUPLE YEARS)

→ 10 BREAKERS PER YEAR OVER NEXT 15 YEARS TOTAL

SOME VACUUM BREAKERS
AIR CIRCUIT BREAKERS (SWITCHGEAR) ≈ 50 TOTAL

ARC FLASH → CAUSE MOVING SWITCHGEAR & CONTROLS
TO SEPARATE BUILDINGS OR DIVIDED BY CINDER BLOCKS

CAPITAL EXPENDITURES

$70 M ~~____~~ 2011 - 2015

-> DRIVEN BY PCBs & LOAD GROWTH

REFURBISHMENT PROJECT -> 2007-2009 DROVE RETIREMENTS

COST OF REMOVAL WILL TREND UP w/ PCB PROGRAM

-> COSTS MAY DEPEND ON TOLERANCE BY
CUSTOMERS FOR DISRUPTIONS
(TO TEST PCBs)

CONTRACTOR COSTS HAVE GONE UP DESPITE CONTRACTOR /

-> 2003 SALVAGE ; (FOLLOW UP w/ PAM)

SPARE PARTS HAVE NOT BEEN DIFFICULT TO RECOVER

2010 Property Inspection Reports

NEWFOUNDLAND POWER
A FORTIS COMPANY

Depreciation Study 2010

Distribution

Table of Contents

Summary

Over the next 5 years distribution capital expenditures related to the replacement of deteriorated, defective or obsolete plant and equipment are expected to remain stable and roughly equivalent to those recorded over the past 5 years.

Expenditure related to customer growth over the next 5 years is also expected to be relatively stable and to be in line with those of the past 5 years.

Plant replacement required to improve reliability or to address deterioration is expected to decrease but will be offset by expenditures to upgrade facilities due to the expansion of telecommunications services across the province.

Plant additions due to new customer connections are expected to decline slightly but will be offset by upgrades required to accommodate the cumulative effect of load growth over the past number of years.

General

Newfoundland Power operates approximately 8,800 km of distribution lines serving over 239,000 customers on 303 feeders. Distribution capital expenditure is principally focused on the prudent refurbishment of existing assets and the extension of the electricity network to meet increasing service requirements. Expenditure is primarily driven by:

- new customers;
- third party requests;
- breakdown capital maintenance;
- distribution preventive capital maintenance;
- system load growth; and
- capital project initiatives

Over the past 5 years capital expenditure in the distribution class has averaged around $35,500,000 per year.

- 55% of the expenditure was required for *new customer connections* i.e. Customer Growth

- 10% of the expenditure was required to deal with specific customer problems (i.e. trouble calls) or requests. [1]

- 32% of the expenditure was required to *maintain the existing distribution system* in a safe, reliable and environmentally responsible manner.

[1] These 2 requirements combined reflect what is referred to by Newfoundland Power as “Customer Driven Expenditure”

- 2% of the expenditure was required due to the requirement to test and replace meters in accordance with Measurement Canada requirements.

- The remaining 1% was work that, although not specifically attributable to either of the requirements identified above, is "justifiable" based on an overall positive impact on Newfoundland Power's operation.

Capital expenditures over the next five years is expected to remain relatively stable and average $37,500,000 per year. The slight increase from the previous 5 year period is principally due to the impact of inflation.

2011-2015 Capital Plan

Annually, as part of its Capital Budget application, Newfoundland Power prepares a five year capital plan. The Capital budget plan for distribution for 2011 – 2015 is summarized in Table 1.

Table 1
2011-2015 Capital Plan - Distribution
(000s)

Project	2011	2012	2013	2014	2015
Extensions	$11,568	$12,024	$12,664	$13,119	$14,160
Meters	1,810	1,627	1,666	1,702	1,739
Services	3,073	3,172	3,334	3,455	3,708
Street Lighting	2,776	2,267	2,364	2,436	2,580
Transformers	7,999	7,783	7,954	8,105	8,259
Reconstruction	3,609	3,729	3,855	3,982	4,113
Rebuild Distribution Lines	3,088	3,182	3,279	3,375	2,678
Relocations For Third Parties	782	809	838	866	896
Distribution Reliability Initiative	521	500	515	530	544
Feeder Additions for Load Growth	1,281	1,030	613	1,110	1,650
Trunk Feeders	160	0	0	486	0
Allowance for Funds Used During Construction	175	179	183	186	190
Total – Distribution	**$36,842**	**$36,302**	**$37,265**	**$39,352**	**$41,312**

Customer Driven Expenditure

Customer driven expenditure is directly related to the quantity of new customer connections. Future estimate are derived from housing start projections based on information from the Canada Mortgage and Housing Corporation and the Conference Board of Canada.

A) New Customer Connections - The majority of the customer growth expenditure is associated with expanding the system to allow for new customer connections. These capital projects principally include the construction of distribution line extensions and the installation of distribution transformers, service drops (the wire installed between the distribution transformer and the customer meter), new street lights and meters. Historical new customer connections for the past 5 years are shown in Table 2.

Table 2
New Customer Connections

2006	2007	2008	2009	2010F
3.952	4,038	4,625	5,051	4,916

Table 3 shows the projected new customer connections for the next 5 years.

Table 3
Future New Customer Connections

2011B	2012	2013	2014	2015
4,625	4,652	4,740	4,755	4,970

New customer connections over the next 5 years are expected to be in line with those over the past 5 years.

In addition to the direct cost associated with new customer connections, a small portion of the expenditure related to growth is required to upgrade existing plant to accommodate growth. These capital projects principally include the upgrade of distribution lines to handle increased loading. Over the past 5 years these have averaged $250,000 per year but are expected to average $1,000,000 per year over the next five years.

B) Customer Requests - Newfoundland Power shares its pole lines with Bell Aliant and various cable TV operators. From time to time these joint use partners install facilities which necessitate pole line upgrades. In addition Newfoundland Power from time to time receives requests from various parties to have plant relocated. These expenditures are typically grouped into a project called Relocate/Replace Distribution Lines for Third Parties. In the past 5 years expenditure has averaged $1,800,000 per year. This level of expenditure is expected to continue over the next 5 years.

Table 4
Customer Request Expenditure ($000s)

2006	2007	2008	2009	2010F
1,801	1,604	1,585	2,077	1,785

Maintaining the Existing Distribution System

Newfoundland Power has practices to ensure the prudent maintenance of the existing distribution assets taking into account the results of annual inspections; the assessment of actual feeder reliability performance; and the inevitability of a degree of failure of electrical network assets on an annual basis.

A) Routine Inspections (*Rebuild Distribution Lines*)

Since 1998 Newfoundland Power has had a formal distribution line inspection program whereby distribution feeders are inspected on a 7 year rotation. Inspections are intended to identify and address:

1) Deficiencies that are a risk to public or employee safety, or that are likely to result in imminent failure of a structure or hardware. This is based on an established inspection standard. This work is scheduled as soon as practical after the inspection has been completed to ensure the risk to public or employee safety is addressed.

2) Items or issues that have been determined from past experience to be a reliability or safety concern but can wait to be addressed in a systematic fashion in the following construction season.
   a. Installation of Lightning Arrestors as per the 2003 Lightning Arrestor Review.
   b. Replacement of CP8080 insulators and 2-piece insulators.
   c. Installation of current limiting fuses where required.
   d. Replacement of hardware with a high risk of failure such as automatic sleeves and porcelain cutouts.

The program has shown positive results and has become the primary method for reviewing and upgrading the distribution system.

Based on inspections carried out in 2010, the feeders inspected will require upgrades over the next year as outlined in Table 5.

Table 5
Distribution Inspections
% Plant Requiring Replacement

Work Req'd	Poles	Framing	Insulators	Transformers
Immediately	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Next Year	< 1%	< 1%	< 1%	5%

The current rate of replacement is expected to continue over the next 5 years. Sample detailed inspections are attached in Appendix A. Details of the distribution inspection standards are outlined in Appendix C.

B) Assessment of Actual Feeder Performance (*Distribution Reliability Initiative*)

Reliability statistics reflect the overall duration and frequency of outages experienced by customers and are an indication of the current condition of Newfoundland Power's distribution system assets. For the five year period from 2000 to 2004 the average SAIDI was 4.32. The average SAIDI for the subsequent 5 years from 2005 to 2009 was 2.81, a 35% improvement.

Newfoundland Power considers current levels of service reliability to be satisfactory. As a result, capital expenditures under the *Distribution Reliability Initiative* are expected to be reduced compared to previous years. Expenditure from 2005 onward is shown in Table 6.

Table 6
Distribution Reliability Initiative – Expenditure ($000s)

2005	2006	2007	2008	2009	2010B	2011F
1,065	3,365	0	1,411	455	447	521

Over the past 5 years expenditure has averaged $1,250,000. This is expected to be reduced to an average of $500,000 over the next 5 years.

C) Response to Problem Calls and Associated Follow Up

Capital expenditure that is required on distribution lines to address immediate concerns is principally reflected in the *Reconstruction Project*, the *Replace Street Lights Project* and the *Replace Services Project*. Response to trouble calls is re-active in nature and is required to address immediate safety or reliability concerns. Historical expenditures are shown in table 7.

Table 7
Problem Call Expenditure ($000s)

	2006	2007	2008	2009	2010F
Reconstruction	2,989	3,563	3,193	4,123	3,359
Street Lights	451	1,112	692	683	677
Services	399	472	427	410	451

No significant change to this type of expenditure is expected over the next 5 years.

Measurement Canada Requirements

Each year a quantity of meters are replaced in accordance with Measurement Canada's meter testing requirements. Historical replacement quantities are shown in table 8.

Table 8
Historical Quantity of Meter Replacements

2006	2007	2008	2009	2010F
15,048	5,213	15,847	15,285	12,058

Excluding potential legislative changes, replacement levels are expected to be similar over the next 5 years.

Potential Items Affecting Future Distribution Plant Retirement

1) Changing construction standards – Some significant standards changes have been implemented over the past 10 years.
   i. In 2006 Newfoundland Power made the installation of clamp top insulators standard.
   ii. Lightning Arrestor installation has been standard on all new transformer installations since the mid 1990's. In addition lightning arrestor installation on transformers has been an integral part of the Rebuild Distribution Lines program.
   iii. Stainless steel transformer tanks now standard. All transformers purchased since 2001 have had stainless steel tanks. It is estimated that 55% of the distribution transformers in service now have stainless steel tanks.
   iv. In 2002 CSA Overhead standards were changed to make the Avalon, Burin and Bonavista Peninsulas Extreme Loading areas

2) Increased failure rates for porcelain cutouts and conductor.

3) Automated Meter Reading – In recent history Newfoundland Power has been installing increased quantities of automated meters. Table 9 shows the growth in AMR meter installations since 2001.

Table 9
AMR Meter Installations
2001 – 2009

Year	Total Number of AMR Meters Installed	Percentage of Total Meters
2001	177	0.08%
2002	905	0.43%
2003	1,905	0.89%
2004	4,718	2.19%
2005	5,017	2.29%
2006	6,334	2.87%
2007	8,612	3.85%
2008	12,886	5.67%
2009	18,050	7.84%

As part of its ongoing assessment of meter reading routes, the Company evaluates if it is cost effective to replace all non-AMR meters with AMR meters on a specific route to take advantage of a high density of AMR meters that exist within a neighbourhood. For 2011 the Company has identified 10 meter reading routes as candidates for becoming AMR only meter reading routes. This will involve replacing 4,888 meters.

4) Measurement Canada Compliance Sampling Regulations – A recent initiative of Measurement Canada to review meter compliance sampling specifications may have an impact on the service life of the existing in service meters. Clarification on the actual specifications is expected to be released late in 2010 or early 2011. At that time the Company will be in a better position to assess these impacts.

Appendix 1

Annual Inspections – Rebuild Distribution Lines

Appendix 2

Distribution Reliability Rebuilds

Unscheduled Distribution Related Outages Five-Year Average 2005-2009 Sorted By Customer Minutes of Interruption				
Feeder	**Annual Customer Interruptions**	**Annual Customer Minutes of Interruption**	**Annual Distribution SAIFI**	**Annual Distribution SAIDI**
DUN-01	2,904	401,689	3.06	7.05
DOY-01	4,720	380,267	2.96	3.97
GLV-02	4,172	371,498	3.22	4.78
RRD-09	2,622	328,010	1.84	3.83
CHA-03	3,828	324,421	1.82	2.56
NWB-02	2,844	300,740	2.72	4.80
BOT-01	3,257	290,314	1.99	2.95
CAB-01	3,712	283,127	3.08	3.92
GFS-02	3,198	270,391	2.23	3.14
BCV-02	2,478	260,706	1.63	2.85
HOL-01	7,258	258,487	3.57	6.14
MIL-02	4,570	252,864	3.30	3.04
CHA-02	2,262	250,136	1.32	2.43
HWD-08	2,695	245,683	1.62	2.47
DLK-03	1,770	236,932	1.53	3.42
Company Average	**899**	**99,319**	**1.18**	**2.18**

Unscheduled Distribution Related Outages Five-Year Average 2005-2009 Sorted By Distribution SAIFI				
Feeder	**Annual Customer Interruptions**	**Annual Customer Minutes of Interruption**	**Annual Distribution SAIFI**	**Annual Distribution SAIDI**
GDL-01	1,980	174,131	3.59	5.26
HOL-01	7,258	258,487	3.57	6.14
VIR-02	1,228	48,354	3.36	2.20
MIL-02	4,570	252,864	3.30	3.04
GLV-02	4,172	371,498	3.22	4.78
HWD-04	2,641	199,431	3.18	3.48
CAB-01	3,712	283,127	3.08	3.92
DUN-01	2,904	401,689	3.06	7.05
FER-01	1,889	142,100	2.99	3.75
DOY-01	4,720	380,267	2.96	3.97
NWB-02	2,844	300,740	2.72	4.80
SLA-13	1,797	71,557	2.67	1.77
SCT-02	643	80,934	2.63	5.51
HOL-02	1,269	181,520	2.57	2.12
GLV-01	2,692	201.952	2.56	3.20
Company Average	**899**	**99,319**	**1.18**	**2.18**

Unscheduled Distribution Related Outages

Five-Year Average
2005-2009
Sorted By Distribution SAIDI

Feeder	Annual Customer Interruptions	Annual Customer Minutes of Interruption	Annual Distribution SAIFI	Annual Distribution SAIDI
DUN-01	2,904	401,689	3.06	7.05
HOL-02	7,258	258,487	3.57	6.14
SCT-02	643	80,934	2.63	5.51
GDL-01	1,980	174,131	3.59	5.26
BUC-02	230	47,262	1.45	4.99
GRH-02	1,855	235,819	2.34	4.96
NWB-02	2,844	300,740	2.72	4.80
GLV-02	4,172	371,498	3.22	4.78
SCT-01	1,094	165,374	1.66	4.17
COL-02	508	79,924	1.55	4.07
MKS-01	484	111,220	1.04	3.99
DOY-01	4,720	380,267	2.96	3.97
CAB-01	3,712	283,127	3.08	3.92
RRD-09	2,622	328,010	1.84	3.83
GIL-01	1,157	221,757	1.18	3.76
Company Average	**899**	**99,319**	**1.18**	**2.18**

Worst Performing Feeders
Summary of Data Analysis

Worst Performing Feeders Summary of Data Analysis	
Feeder	**Comments**
GLV-02	A substantial amount of work was completed on this feeder since 2006. Reliability has improved considerably. No further work is required at this time.
DUN-01	Reliability statistics were poor in both 2006 and 2007; however, the statistics were driven by a sleet storm in 2006, a broken recloser bushing in 2007 and a broken pole in 2008. Reliability performance was below average again in 2009. No work is proposed for 2011, however the feeder's performance will be monitor closely in 2010.
BOT-01	A substantial amount of work was completed on this feeder since 2006. Reliability has improved considerably. No further work is required at this time.
NWB-02	Work has been carried out in 2009 and 2010 on this feeder. Additional work is proposed for 2011.
BCV-02	Problems in 2003, 2004 & 2005. This feeder was rebuilt under the Distribution Reliability Initiative in 2006. There have been no reliability issues since 2006. No work is required at this time.
HOL-02	Poor overall reliability is due to a storm in March 2008. No work is required at this time.
FER-01	Reliability statistics were poor in 2005. Work was carried out under the Rebuild Distribution Lines program in 2005; and with the exception of some sleet related outages in 2009, there have been no reliability issues since 2005. No work is required at this time.
CAB-01	Reliability statistics were poor in 2004. Work was carried out under the Rebuild Distribution Lines program in 2005 and there have been no reliability issues since 2005. Poor statistics in 2008 were due to a broken cutout and a broken insulator. No work is required at this time.
DOY-01	Overall reliability statistics on this feeder have been good. The poor average statistics are driven by a single weather related issue in 2006. No work is required at this time.

Worst Performing Feeders Summary of Data Analysis	
Feeder	**Comments**
MIL-02	The MIL-02 feeder has displayed consistently poor reliability from 2002 to 2006. Significant work was carried out under the Rebuild Distribution Lines program in 2006 and there were no reliability issues since. No work is required at this time.
GRH-02	Reliability statistics were poor in 2004 & 2005. Work was carried out under the Rebuild Distribution Lines program in 2005; and with the exception of a weather related outage in 2009, there have been no reliability issues since 2005. No work is required at this time.
BUC-02	Reliability problems in 2008 were due to three insulator failures in 2008. Insulators were replaced in 2009. No work is required at this time,
SCT-02	Reliability problems in 2008 were due to a storm in March. No work is required at this time.
CHA-02	Reliability statistics were driven by a single event, a broken insulator in June 2009. No work is required at this time.
CHA-03	Reliability problems were due to a single event caused by broken conductor in 2006. No work is required at this time.
COL-02	Reliability statistics were driven by a single sleet related event in May 2006. No work is required at this time.
DLK-03	Reliability statistics were driven by a single event, broken conductor in November 2009. No work is required at this time.
GDL-01	Reliability statistics were driven by a single lightning related event in May 2005. No work is required at this time.
GFS-02	Reliability statistics were driven by a single tree related event in October 2009. No work is required at this time.
GLV-01	Reliability statistics were driven by two events in 2007. One involved a broken pole and the other, a broken conductor. No work is required at this time.

Worst Performing Feeders Summary of Data Analysis	
Feeder	**Comments**
HOL-01	Reliability problems were due to a single event, a broken cutout in January 2007. No work is required at this time.
HWD-04	Reliability statistics were driven by a single weather related event in December 2007. No work is required at this time.
HWD-08	Reliability on HWD-08 has dramatically improved since 2007 principally due to work done under the rebuild distribution line program. No work is required at this time.
MKS-01	Reliability statistics were driven by a single event, a broken cutout in March 2008. No work is required at this time.
RRD-09	Reliability problems were due to a single event, broken conductor in 2008. No work is required at this time.
GIL-01	Reliability statistics were driven by a single sleet related event in March 2009. No work is required at this time.
SCT-01	Reliability problems were due to two tree related events, one in 2008 and the other in 2009. No work is required at this time.
SLA-13	Reliability problems were due to two sleet related events, one in 2005 and the other in 2006. No work is required at this time.
VIR-02	Reliability problems were due to two conductor related events in 2008. No work is required at this time.

Appendix 3

Distribution Inspection Standards

General Properties Review

For

2010 Depreciation Study

Table of Contents

Summary

The purpose of this review is to provide input for Newfoundland Power's 2010 Depreciation Study. This review is based on data collected for the 2000 and 2005 Depreciation Study, the 2009 General Properties Assessment Summary as well as in consultation with existing users as to the present condition of Company facilities.

Buildings were reviewed for the condition of structural framing, capital upgrades during last 5 years, roof, interior finishes, windows and doors, electrical/mechanical and other components which have an effect upon the remaining life of the structure or its intended use.

The most recent inspection of Newfoundland Power General Properties was completed by engineering staff in winter 2009. This inspection only involved the larger general properties. The findings were summarized in the report "2009 General Properties Assessment and 5 Year Plan". Inspection results from past depreciation studies have been used for buildings that have not been inspected recently.

Each report was completed with an estimate of remaining life from a structural point of view. However, many of these buildings will be retired before the structural integrity is compromised due to various other reasons including; changes in intended use and elimination/expansion of districts.

Section 1

Pre-Engineered Steel Buildings

Carbonear Office / Service Building

General

The Carbonear Office / Service Building was reviewed by R. Vivian and S. Marshall in 2009. This building is of pre-engineered steel construction. This building was constructed in 1977 as two separate buildings and expanded in 1989 by constructing a new section between the two original structures to form a single facility. The original structures consisted of a 22.5m x 19.2m office building and a 41.5m x 19.2m service building which provided additional office space. The building currently provides about 1,580m^3 of offices, workshops, storage areas, meeting rooms, lunchrooms, and washroom facilities.

Past Renovations

Extensive renovations were completed in 1989 which included the replacement of all windows and two entrances, electrical and communications upgrading, new heat pump, new washrooms and lunchroom, new carpet and tiles, new ceiling tiles, new wall finishes, exterior painting, and the installation of a backup diesel generator system. The emergency standby diesel generator is housed in an exterior steel building and a 910 litre self-diked steel fuel storage tank is located adjacent to this building.

In 1990 the employee parking lot was paved and the customer parking lot was expanded and paved. During 1993 the metal roof was repaired and in 1998 a new roof was installed. In 1997 a renovation was done in the stores area of the building.

Conclusion

The building is in fair-good condition. This building has suffered minor flood and leak damage since the previous deficiency report and requires minor upgrades and repairs to both the office and service building. Structurally, the building is good, with the remaining life of the building estimated to be in excess of 40 years.

Remarks

Refer to Location 1 on Table 1 for existing property condition

Refer to Table 2 – Expected Maximum Remaining Physical Life

Photographs

Figure 1 - Building Exterior (2010)

Figure 2 - Building Exterior (2010)

Figure 3 - Office Interior (2010)

Figure 4 - Service Bay Interior (2010)

Figure 5 - Cracked Exterior Block (2009)

Figure 6 - Water Damage (2009)

Whitbourne Office / Service Building

General

The Whitbourne Office / Service Building was reviewed by R. Vivian and S. Marshall in 2009. This building is of pre-engineered steel construction and was erected in 1978. The building currently provides about 585 m^2 of offices, workshops, storage areas, a meeting / lunch room, and washroom facilities.

Past Renovations

In 1989, the customer and employee parking lots were paved. Stores area and distribution maintenance areas were renovated in 1998 to accommodate new usage. No capital upgrades have been made since 2005 report.

Conclusion

The building is in fair condition but requires renovations both inside and out including the installation of an HVAC system. These renovations are required for the building to remain healthy, safe and reliable. Structurally, the building is good, with the remaining life of the building estimated to be in excess of 40 years.

Remarks

Refer to Location 2 on Table 1 for existing property condition

Refer to Table 2 – Expected Maximum Remaining Physical Life

Photographs

Figure 7 - Building Exterior (2010)

Figure 8 - Office Interior (2005)

Figure 9 - Service Entrance (2010)

Figure 10 - Warehouse (2005)

Figure 11 - Damaged Siding (2009)

Clarenville Regional Office / Service Building

General

The Clarenville Regional Office / Service Building was reviewed by R. Vivian and S. Marshall in 2009. The building is of pre-engineered steel construction and was erected in 1990. The building is comprised of two main sections, the office area and the distribution and electrical maintenance / stores departments. The total gross floor area of the building is 2,044m^2. The office area, besides providing office space for regional personnel, also contains customer service facilities, training rooms, a lunchroom and washrooms.

The other area contains washrooms, a lunchroom, electrical and mechanical rooms as well as the aforementioned departments. Outside the building there are paved parking lots for both employees and customers, as well as a large unpaved storage area.

Past Renovations

A 150KW backup diesel generator was installed in 2006, with an open transition transfer switch capable of supporting the entire building load.

Conclusion

The building is in good condition. The original finishes are starting to deteriorate and heavy corrosion is appearing around door boxes and garage bays. Large visible cracks are present in the superstructure and need to be investigated. Structurally, the remaining life of the building is estimated to be in excess of 40 years, assuming that cracking does not affect structural integrity.

Remarks

Refer to Location 3 on Table 1 for existing property condition

Refer to Table 2 – Expected Maximum Remaining Physical Life

Photographs

Figure 12 - Building Front (n.d.)

Figure 13 - Building Rear (n.d.)

Figure 14 - Door Corrosion (2009)

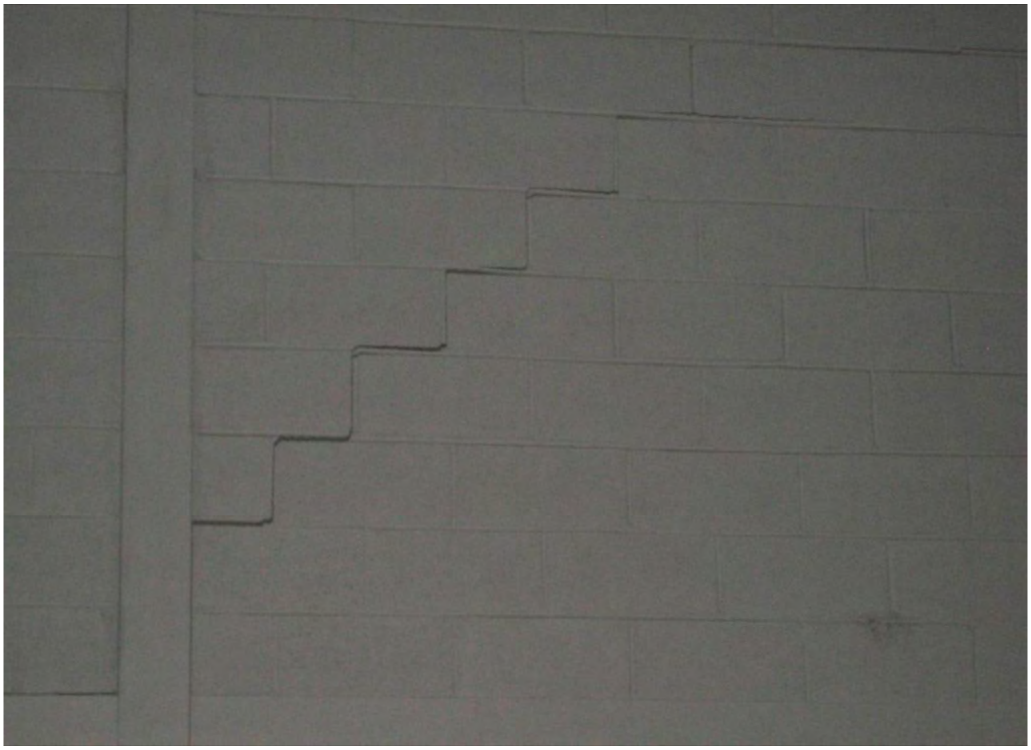

Figure 15 – Crack in Masonry (2009)

Maple Valley (Corner Brook) Service Building

General

The Maple Valley Service Building was reviewed by R. Vivian and S. Marshall during 2009. This building is of pre-engineered steel construction and was constructed in 1979. The building measures about 47.2m x 18.3m and currently provide offices, workshops, storage areas, a meeting room, a lunchroom and washroom facilities.

Past Renovations

A 111 m^2 extension was constructed in 1988 to provide office and meeting facilities. A new concrete loading dock was constructed in 1994 and a new roof in 2003. Major capital upgrades were completed in 2007. This upgrade included a complete interior remodeling that consisted of a new layout of floors, walls and ceilings, installation of new siding and windows, reconfiguration of the HVAC, plumbing and electrical systems, repaving of the driveway and parking area, installation of a new transformer storage ramp and new fencing. A new 150 kW standby diesel generator was also installed in 2007, with a closed transition transfer switch, capable of supporting the entire building load. In 2009 an area of deteriorated pavement was replaced and a renovation completed on the meter room.

Conclusion

The building is well maintained and in good condition. As a result of 2007 renovations, this building requires only routine maintenance work to maintain the present condition. Structurally, the remaining life of the building is estimated to be in excess of 40 years.

Remarks

Refer to Location 4 on Table 1 for existing property condition

Refer to Table 2 – Expected Maximum Remaining Physical Life

Photographs

Figure 16 – Exterior (2009)

Salt Pond (Burin) Service Building

General

The Salt Pond Service/Office Building was reviewed by R. Vivian and S. Marshall in 2009. It was erected in 1974 and measures 24.5m x 18.4m. The building houses workshops, stores, meeting facilities, a washroom and offices.

Past Renovations

The stores area of the service building was renovated in 1987 as well as the installation of fuel tanks. In 1988 the parking lot was paved and in 1994 the roof was replaced. The fuel tanks were removed in 1994 and Interior renovations completed in 2004.

A 75 KW diesel generator was installed in 2008, with a closed transition transfer switch to carry the load of both buildings.

Conclusion

This building is in fair-good condition but requires interior and exterior upgrades to maintain its current condition. Structurally, the remaining life of the building is estimated to be in excess of 40 years.

Remarks

Refer to Locations 6 on Table 1 for existing property conditions.

Refer to Table 2 – Expected Maximum Remaining Physical Life.

Photographs

Figure 17 - Damaged Foundation (2009)

Grand Falls-Windsor Office/Service Building

General

The Grand Falls-Winsor Office/Service Building was in reviewed by R. Vivian and S. Marshall in 2009. This building is of pre-engineered steel construction and was constructed in 1958. The building measures 28.0 m x 33.4 m and currently provides offices, storage areas, a meeting room, a lunchroom and washroom facilities. This building originally served as a service building only with company offices being located at another location within Grand Falls – Windsor. Following renovation in 2006, the office building was sold and all staff moved to the renovated service building.

Past Renovations

The service building has undergone several upgrades from 1969-1977 which included electrical upgrading, landscaping, paving, ceiling insulation, renovations and repairs. A 28.0 m x 10.2 m extension was added in 1988 bringing it to its current dimensions.

In 2007 the service building was renovated to accommodate offices. The Grand Falls office building was then sold. 2007 work included new siding, windows and roof, completer interior renovation which included a new layout of floors, walls and ceilings. There was also a reconfiguration of HVAC, plumbing and electrical systems, the driveway and parking area was repaved and a new 150 kW standby diesel generator, capable of supporting the entire building load, was installed.

Conclusion

As a result of 2007 renovations, this building is in good condition, with only routine maintenance work required to maintain the present condition. Structurally, the remaining life of the building is estimated to be in excess of 40 years.

Remarks

Refer to Locations 7 on Table 1 for existing property condition

Refer to Table 2 – Expected Maximum Remaining Physical Life

Photographs

Figure 18 - Building Exterior (2009)

Gander Service Building

General

The Gander Service Building was reviewed by R. Vivian and S. Marshall in 2009. The Gander Service Building was constructed in 1975. The parking area and parts of the storage yard were paved during 1977 and 1978. The building currently has 1572 m^2 of office space, workshops, storage areas, a meeting room, lunchroom and washrooms.

Past Renovations

In 1986 a 465 m^2 extension was built on along with some interior renovations. A second 212 m^2 extension was added on in 1997 along with additional interior renovations. A new roof was installed over the office area of the building in 2004.

Conclusion

The building is good condition but requires some routine maintenance and small upgrades to maintain its current condition. Structurally, the remaining life of the building is estimated to be in excess of 40 years.

Remarks

Refer to Location 10 on Table 1 for existing property condition.

Refer to Table 2 – Expected Maximum Remaining Physical Life

St. John's Regional (Duffy Place) Service/Office Building

General

This property was reviewed by R. Vivian and S. Marshall in 2009. The St. John's Regional Office/Service Building located on Duffy Place was constructed in 1989. The building currently has 8083 m^2 of office space, customer service facilities, washrooms, lunchrooms, meeting room, service facilities, and storage/maintenance area.

Past Renovations

Renovations to the Regional office/service building include the addition of a Call Center and interior renovations in 1997, addition of a Disaster Recovery Center in 1999 and meter shop and air conditioning upgrades in 2000. Reconfigurations of office spaces and the construction of a new kitchen on the first floor took place in 2008.

Conclusion

The building is in good condition and requires only routine maintenance to remain in its current condition. Structurally, the remaining life of the building is estimated to be in excess of 40 years.

Remarks

Refer to Locations 11 on Table 1 for existing property conditions

Refer to Table 2 – Expected Maximum Remaining Physical Life

Photographs

Figure 19 – Duffy Pl, Main Entrance (2010)

Figure 20 – Duffy Pl, Truck Bays (2010)

Figure 21 - Loading Dock (2009)

Mechanical Maintenance & Vehicle Maintenance Building

General

This property was reviewed by R. Vivian and S. Marshall in 2009. Also constructed in 1989 was Mechanical Maintenance/Vehicle Service building located on the same property. It currently has approximately 730 m^2 of floor space use mainly for mechanical maintenance and vehicle service.

Past Renovations

Several renovations have been made to the Mechanical Maintenance/Vehicle Service building. The vehicle service shop underwent renovations in 1998 to include the mechanical maintenance shop. It underwent further renovations in 2005 to add office space to the mechanical maintenance shop.

Conclusion

The building is in good condition and requires only routine maintenance to maintain its current condition. Structurally, the remaining life of the building is estimated to be in excess of 40 years.

Remarks

Refer to Location 12 on Table 1 for existing property conditions

Refer to Table 2 – Expected Maximum Remaining Physical Life

Photographs

Figure 22 - Vehicle/Mechanical Maintenance, Exterior (2010)

System Control Centre

General

The System Control Centre located on Topsail Road was constructed in 1999. The building is approximately 451 m^2 which includes office space and SCADA system.

Past Renovations

Capital upgrades since 2005 include a new mini-split A/C unit in the computer room.

Conclusion

The building is in very good condition. The leaking roof and corroding doors should be corrected to ensure the building remains in its current condition. Structurally, the remaining life of the building is estimated to be in excess of 40 years.

Remarks

Refer to Location 13 on Table 1 for existing property conditions

Refer to Table 2 – Expected Maximum Physical Life

Photographs

Figure 23 – SCC, Exterior (2010)

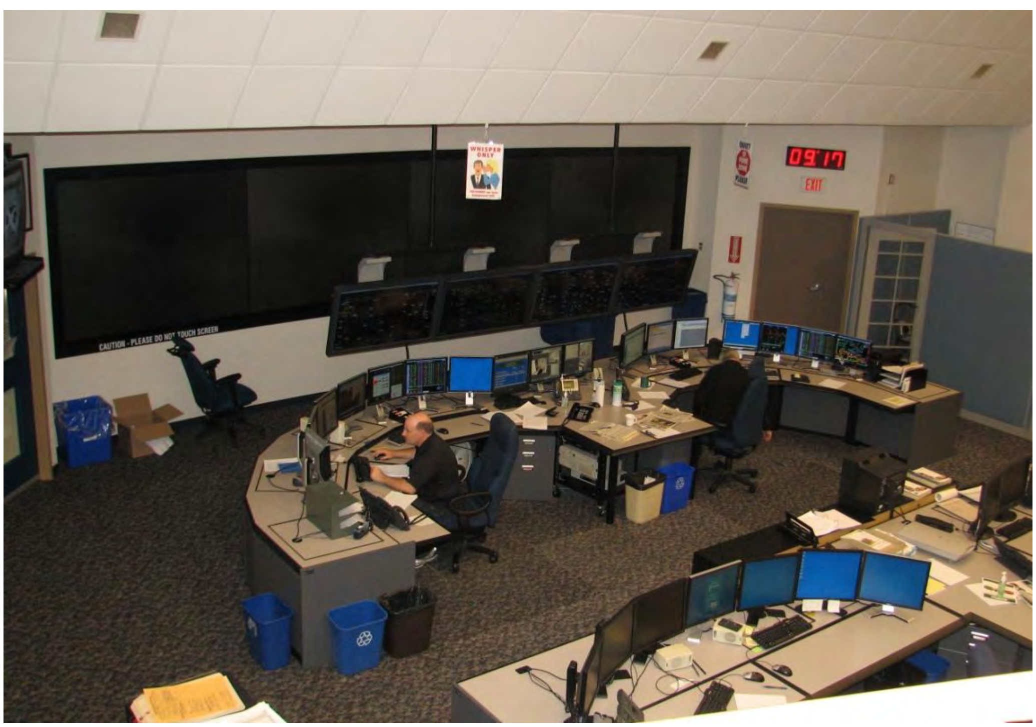

Figure 24 - Control Room Interior

Similar – Pre-Engineered Steel Buildings

Mobile Works Depot	Erected in 1985. Some minor leaks in the roof were repaired in 1991. Roof replacement was completed in 2010.
Gallant Street Building Stephenville	Erected in 1966. 33.8m x 12.2m extended in 1970. The back section is used for Gallant St. Substation Control Centre. The building is also used for transformer maintenance, electrical maintenance storage and dead file storage. Exterior walls painted and roof repaired in 1988. New windows, garage door and interior renovations in completed 2000. New exterior door was installed in 2010.

Remarks

Refer to Locations 5 & 8 on Table 1 for existing property condition

Refer to Table 2 – Expected Maximum Remaining Physical Life

Section 2

Old Type District Buildings

Deer Lake District Building

General

The Deer Lake District Building was reviewed by R. Vivian and G, Humby during May 2010. This building erected in 1969 is typical of the old "Standard" district buildings erected from 1962 to 1974.

This building which is about 6.0m x 5.2m consists of an office/lunchroom area, a storage area for line hardware and tools, and a washroom. As well an outside yard is provided for storage.

The building is of woodframe construction with concrete foundations and floors, a standing seam metal roof and metal siding.

Conclusion

Generally this facility is in fair condition although minor upgrading and painting is recommended.

Remarks

Refer to Location 14 on Table 1 for existing property condition

Refer to Table 2 – Expected Maximum Remaining Physical Life

Wesleyville District Building

General

The Wesleyville District Building was reviewed by R. Vivian and G, Humby during May 2010. This building is typical of the old "Standard" district buildings erected from 1962 to 1974.

This building which is about 6.0m x 7.3m consists of an office/lunchroom area, a storage area for line hardware and tools, and a washroom. As well an outside yard is provided for storage.

The building is of woodframe construction with concrete foundations and floors, a standing seam metal roof and metal siding.

Conclusion

Generally this facility is in fair condition although roof replacement, minor upgrading and painting is recommended.

Remarks

Refer to Location 15 on Table 1 for existing property condition

Refer to Table 2 – Expected Maximum Remaining Physical Life

Photographs

Figure 25 - Building Exterior (2010)

Figure 26 - Storage Area (2010)

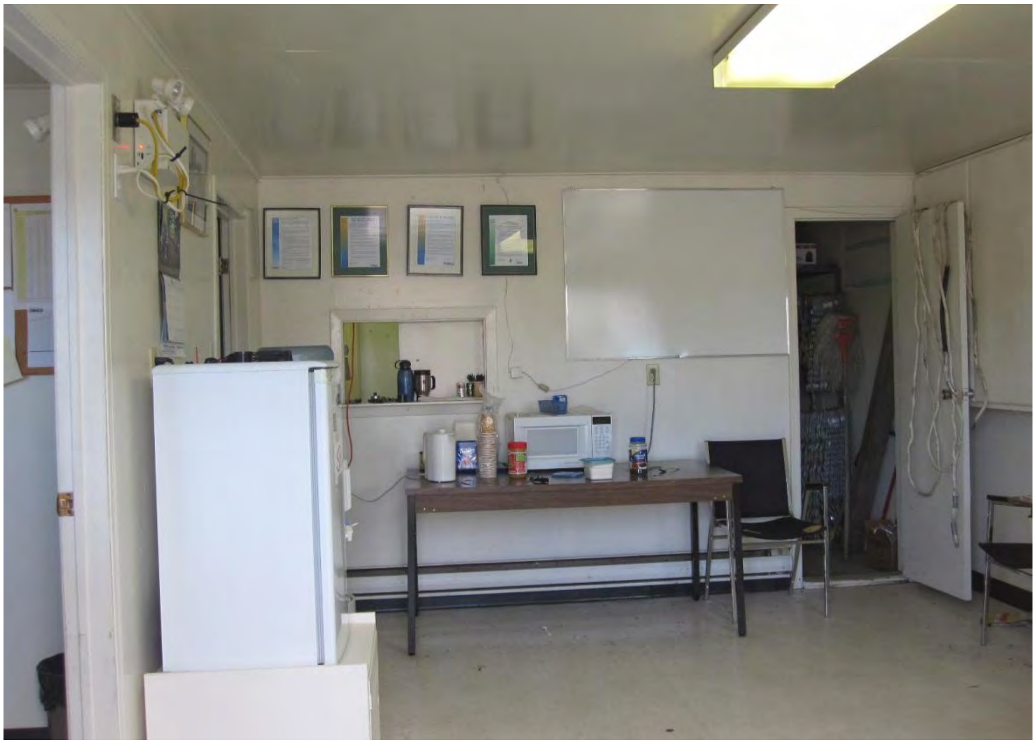

Figure 27 - Lunchroom Area (2010)

Figure 28 - Office Area (2010)

Similar – Old Type District Buildings

These “old standard” district buildings are generally in fair condition and with continued maintenance can function adequately for the next 20 years.

Glovertown	Erected in 1967. 7.6m x 4.6m. Water and sewer installed in 1979. Grounds extended in 1980.
Summerford	Erected in 1968. 6.0m x 4.9m. Water and sewer installed 1970. Water line replaced 1983. Building improvements 1979.
Botwood	Erected in 1963. 6.0m x 3.7m. Presently not in use and will be sold or retired in the near future.
Baie Verte	Erected in 1964. 6.0m x 5.2m. Washroom and deep well constructed in 1974.
Bay Roberts	Erected in 1970. 30.0m x 7.6m. Frame inside and used as a stores/warehouse building.
Bay L’Argent	Erected in 1970. 14.6m x 7.3m. Very well landscaped. Artesian well and filtration system installed in 1988.
Topsail Road, Shed No. 1	Erected in 1966. 13.4m x 6.0m. Renovated for PCB storage in 1981.
Topsail Road, Shed No. 2	Erected in 1966. 13.4m x 6.0m. Renovated in 1982 for use as a tool room and storage by maintenance electricians.
Topsail Road, Shed No. 3	Erected in 1966. 13.4m x 6.0m. Renovated in 1977 for use as a Carpenter Shop.
Lewisporte	Erected in 1962. 6.0m x 3.7m
Springdale	Erected in 1969. 5.8m x 4.6m.

Remarks

Refer to Locations 16 - 26 on Table 1 for existing property condition

Refer to Table 2 – Expected Maximum Remaining Physical Life

Photographs

Figure 29 - EMC Sheds 1,2 &3 (2010)

Section 3

New Type District Buildings

St. David's District Building

General

The St. David's District Building was reviewed by B.Titford during December 2005. This building erected in 1974 is typical of the new "Standard" district buildings erected between 1974 to date.

This building which is about 6.0m x 7.6m consists of an office/lunchroom area, a storage area for line hardware and tools, a room for washing of insulated equipment, and a washroom. As well an outside yard is provided for storage.

The building is of wood construction with concrete foundations and floors, a pitched wood truss roof and metal siding.

Conclusion

Generally this facility is in fair condition although minor maintenance and painting would be recommended.

Remarks:

Refer to Location 27 on Table 1 for existing property condition

Refer to Table 2 – Expected Maximum Remaining Physical Life

Similar – New Type District Buildings

These "new standard" district buildings are generally in fair condition and with continued maintenance can function adequately for the next 15 years.

Bell Island	Erected in 1983.
Trepassey	Erected in 1983. Good condition.
Twillingate	Erected in 1976/77. Good condition.
Doyles	Erected in 1974/75. Good condition.
Grand Bank	Erected in 1974. Landscaped in 1985.
Dunville	Erected in 1990/91.
Gambo	Decommissioned
Calvert	Erected in 1978. Good condition.

Remarks:

Generally these facilities are in fair condition although minor maintenance and painting would be recommended.

Refer to Locations 28 - 34 on Table 1 for existing property condition

Refer to Table 2 – Expected Maximum Remaining Physical Life

Section 4

Wood Frame Buildings

Port aux Basques Office / Service Building

General

The Port aux Basques Office / Service Building was reviewed by R. Vivian and S. Marshall during 2009. This building is of wood frame construction and was built in 1985. The single storey building measures about 17.7m x 9.8m and currently provides office areas, customer service area, a meeting / kitchen room, workshop and storage areas, warehouse, and lunchroom.

Past Renovations

Asphalt paving was added to the customer parking area in 1990. Interior renovations were carried out in 1999.

Conclusion

The building is in fair condition. The replacement or removal of the porch and exterior renovations are required for this building in the near future. The installation of HVAC is also recommended. Structurally, the building is good, with the remaining life of the building estimated to be in excess of 30 years.

Remarks

Refer to Location 35 on Table 1 for existing property condition

Refer to Table 2 – Expected Maximum Remaining Physical Life

Photographs

Figure 30 - Building Exterior (2000)

Figure 31 - Building Exterior (2000)

Figure 32 - Kitchen Area (2009)

Figure 33 - Heaved Entrance (2009)

Salt Pond (Burin) Office Building

General

The office building was erected in 1969 and measures about 15.2m x 12.8m. The building houses office space, customer service facilities, a lunchroom, washrooms and meeting space.

Past Renovations

The office building underwent major interior renovations that included electrical wiring and mechanical systems. Further work was undertaken in 2004 completing a new roof, siding and windows as well as the installation of modular furniture.

A 75 KW diesel generator was installed in 2008, with a closed transition transfer switch to carry the load of both buildings.

Conclusion

This building is in good condition but requires some maintenance and interior upgrades to maintain its current condition. Structurally, the remaining life of the building is estimated to be in excess of 40 years.

Remarks

Refer to Location 37 on Table 1 for existing property conditions.

Refer to Table 2 – Expected Maximum Remaining Physical Life.

Similar – Wood Frame Buildings

Port Union Warehouse	Originally a diesel building taken over as a warehouse in 1969. Several renovations from 1972 to 1984. A 50m2 extension was completed in 1986. Asphalt shingles were replaced in 1994 and interior renovations were carried out in 1999. Building currently measures 17.4m x 17.7m.

Remarks

Refer to Location 36 on Table 1 for existing property condition

Refer to Table 2 – Expected Maximum Remaining Physical Life

Section 5

Miscellaneous Buildings

Stephenville Office / Service Building

General

The Stephenville Office / Service Building was reviewed by R. Vivian and S. Marshall in 2009. This building is of masonry and steel construction and was built in 1958 by the United States Air Force. The building was purchased by Newfoundland Power in 1986. The single storey building has about 1,200m^2 of floor area and currently provides office areas, customer service area, meeting rooms, workshops, storage areas, warehouse, lunchroom, and washroom facilities. The customer service area is no longer in use.

Past Renovations

The building underwent extensive renovations during 1988 including replacement of windows, doors, roof, installation of metal siding, extensive interior renovations, and the upgrading of the parking areas and landscaping. A new roof was installed in 2004 and office renovations initiated during 2005 were completed in 2006.

Conclusion

This building is in good condition and requires routine maintenance work to maintain its present condition. Structurally, the remaining life of the building is estimated to be in excess of 40 years.

Remarks

Refer to Location 38 on Table 1 for existing property condition

Refer to Table 2 – Expected Maximum Remaining Physical Life

Photographs

Figure 34 – Exterior (2000)

Figure 35 - Main Entrance (2000)

Figure 36 - Interior, Customer Service Area (2009)

Figure 37 - Interior Warehouse (2009)

Kenmount Road Office Building

General

The Kenmount Road Office Building was reviewed by R. Vivian and S. Marshall in 2009. The building has four levels of office space with the basement having a gross floor area of 1,348m^2 and the main, second and third floors each having 1,172m^2 for a total gross floor area of 4,864m^2. The basement and main floor was constructed in 1969 and a two floor extension was added in 1980.

The building is the Head Office for Newfoundland Power and contains mainly offices with lunchrooms and washroom facilities. The building also contains service areas including mechanical rooms, electrical room, back-up power generation room (UPS), and computer rooms.

Past Renovations

The building has been continually renovated since construction so fit the needs of the company. Typical renovations include reconfiguration of floor layouts and the construction/remodel of offices and board rooms.

Mechanical upgrades, including the installation of a new HVAC and control system on the lower 2 levels were completed in 2008. The installation of a new HVAC system for the 3rd floor and the replacement of the roof membrane are ongoing in 2010.

Conclusion

This building is in good condition with well maintained grounds. Routine maintenance, the replacement of interior finishes and the planned replacement of 2nd and 3rd floor HVAC systems and roof will improve the condition of this building and allow it to operate effectively for quite some time. Structurally, the remaining life of the building is estimated to be in excess of 40 years.

Remarks

Refer to Location 39 on Table 1 for existing property condition

Refer to Table 2 – Expected Maximum Remaining Physical Life

Photographs

Figure 38 – Exterior (2009)

Figure 39 - 2nd Floor Interior (2010)

Other Miscellaneous Buildings

Topsail Road Electrical Maintenance Center	Erected in the 1940's. The building measures 44.0m X 9.0m. Improvements in 1972 and 1973. New shop lighting in 1977. Steel siding and insulation in 1979. Major architectural renovations in 1983. Roof improvements completed in 2000.
Corner Brook Office Building	Sold in 2007

Remarks

Refer to Locations 40 and 41 on Table 1 for existing property condition

Refer to Table 2 – Expected Maximum Remaining Physical Life

Photographs

Figure 40 - EMC Exterior (2010)

TABLE 1
Existing Condition of Property

	Location	Year Constructed	Foundation	Superstructure and Cladding	Roof	Interior Finish	Windows and Doors	Mechanical and Electrical	Renovations / Comments
1	Carbonear Office & Service Building	1977	Concrete **G**	Steel/Steel **G/F**	Modified Bitumen **G** Warehouse Roof **F**	**F**	**G**	**F/F**	1989 – Extensive Renovations including extension, interior, exterior and backup diesel. 1990 – Paving 1993 – Roof Repair 1997 – Stores Renovation
2	Whitbourne Office & Service Building	1978	Concrete **G**	Steel/Steel **G/F**	Metal **F**	**F**	**F**	**F/G**	1989 – Parking Lots Paved 1998 – Interior Modifications
3	Clarenville Regional Office & Service Building	1990	Concrete **G**	Steel/Steel **G/F**	Metal & Built-up Pitch & Gravel **G**	**G**	**G**	**G/G**	2006 – Install backup Diesel
4	Maple Valley Service Building	1979	Concrete **G**	Steel/Steel **G/G**	Metal **G**	**G**	**G**	**G/G**	1988 – Extension 1994 – Loading Dock 2003 – Roof 2007 – Major interior/Exterior
5	Mobile Works Depot	1985	Concrete **G**	Steel/Steel **G/G**	Modified Bitumen **G**	**F**	**G**	**G/G**	1991 – Roof Repaired 2010 – Roof Replaced

Legend G – Good, F – Fair, X – Needs Repair

Table 1 - Continued

	Location	Year Constructed	Foundation	Superstructure and Cladding	Roof	Interior Finish	Windows and Doors	Mechanical and Electrical	Renovations / Comments
6	Salt Pond Service Building	1974	Concrete **G**	Steel/Steel **G/F**	Modified Bitumen **G**	**F**	**G**	**F/G**	1987 – Stores and Fuel Tanks 1988 – Parking Lot 1994 – Roof, Remove Tanks 2004 – Interior Renovations 2008 - Diesel
7	Grand Falls – Windsor Service Building	1958	Concrete **G**	Steel/Steel **G/G**	Metal **G**	**G**	**G**	**G/G**	1969-1977 – Several Upgrades 1988 – Extension 2007 – Renovated to include offices
8	Gallant Street Building	1966	Concrete **G**	Steel/Steel **F/F**	Metal **G**	**F**	**G**	**F/F**	1988 – Exterior walls and roof painted 2000 – new windows and garage door 2010 – New Exterior Door
9	Grand Falls – Windsor Office Building	1970 (Purchased in 1974) **SOLD 2006**							
10	Gander Service Building	1975	Concrete **G**	Steel/Steel **G/G**	Metal & Built-up Pitch & Gravel **G** Warehouse **G**	**G**	**G**	**G/G**	1986 – Extension 1997 – Extension & Interior renovation 2004 – New Roof over office section

Legend G – Good, F – Fair, X – Needs Repair

Table 1 - Continued

	Location	Year Constructed	Foundation	Superstructure and Cladding	Roof	Interior Finish	Windows and Doors	Mechanical and Electrical	Renovations / Comments
11	St. John's Regional Office & Service Building	1989	Concrete **G**	Steel/Steel **G/G**	Metal & Built-up Pitch & Gravel **G**	**G**	**G**	**G/G**	1997 – Call Centre & Interior 1999 – Disaster Recovery Center 2000 – Meter shop and AC upgrades 2008 – Reconfiguration of offices & new 1st floor kitchen.
12	Mechanical Maintenance & Vehicle Maintenance Building	1989	Concrete **G**	Steel/Steel **G/G**	Metal **G**	**G**	**G**	**G/G**	1998: Construct Mechanical Maintenance Shop 2005: add office space
13	System Control Center	1999	Concrete **G**	Steel/Steel **G/G**	Metal **G**	**G**	**G**	**G/G**	
14	Deer Lake District Building	1969	Concrete **G**	Wood frame /Steel **G/G**	Metal **G**	**G**	**G**	**G/G**	
15	Wesleyville District Building	~ 1969	Concrete **G**	Wood frame / Steel **G/G**	Metal **F**	**F**	**F**	**G/F**	
16	Glovertown District Building	1967	Concrete **G**	Wood frame /Steel **G/F**	Metal **F**	**F**	**F**	**G/G**	

Legend G – Good, F – Fair, X – Needs Repair

Table 1 - Continued

	Location	Year Constructed	Foundation	Superstructure and Cladding	Roof	Interior Finish	Windows and Doors	Mechanical and Electrical	Renovations / Comments
17	Summerford District Building	1968	Concrete **G**	Wood frame /Steel **G/F**	Metal **G**	**G**	**G**	**G/G**	
18	Botwood District Building	1963	Concrete **G**	Wood frame /Steel **G/F**	Metal **F**	**F**	**F**	**G/G**	Not in use and will be retired or sold in the near future
19	Baie Verte District Building	1968	Concrete **G**	Wood frame /Steel **G/F**	Metal **G**	**G**	**G**	**G/G**	
20	Bay Roberts District Building	1970	Concrete **G**	Wood frame /Steel **G/G**	Metal **G**	**G**	**G**	**G/G**	
21	Bay L'Argent District Building	1970	Concrete **G**	Wood frame /Steel **G/G**	Metal **G**	**G**	**G**	**G/G**	1988 – artesian well and filtration system
22	EMC: Shed #1	1966	Concrete **G**	Wood frame /Steel **G/G**	Aspahlt Shingle **G**	**G**	**G**	**G/G**	1981 – PCB Storage
23	EMC: Shed #2	1966	Concrete **G**	Wood frame /Steel **G/G**	Aspahlt Shingle **G**	**F**	**F**	**G/G**	1982 – Electrician tool room & storage

Legend G – Good, F – Fair, X – Needs Repair

Table 1 - Continued

	Location	Year Constructed	Foundation	Superstructure and Cladding	Roof	Interior Finish	Windows and Doors	Mechanical and Electrical	Renovations / Comments
24	EMC: Shed #3	1966	Concrete **G**	Wood frame /Steel **G/G**	Aspahlt Shingle **G**	**F**	**F**	**G/G**	1977 – Carpenter Shop
25	Lewisporte District Building	1962	Concrete **G**	Wood frame /Steel **G/G**	Metal **G**	**G**	**G**	**G/G**	Rebuilt 1997
26	Springdale District Building	1969	Concrete **G**	Wood frame /Steel **G/G**	Metal **G**	**G**	**G**	**G/G**	
27	St. David's District Building	1974	Concrete **G**	Wood frame /Steel **G/F**	Asphalt Shingle **F**	**F**	**F**	**G/G**	Not in use. Building to be sold or retired
28	Bell Island District Building	1983	Concrete **G**	Wood frame /Steel **G/F**	Asphalt Shingle **F**	**F**	**F**	**F/F**	
29	Trepassey District Building	1983	Concrete **G**	Wood frame /Steel **G/G**	Asphalt Shingle **F**	**G**	**G**	**G/G**	

Legend G – Good, F – Fair, X – Needs Repair

Table 1 - Continued

	Location	Year Constructed	Foundation	Superstructure and Cladding	Roof	Interior Finish	Windows and Doors	Mechanical and Electrical	Renovations / Comments
30	Twillingate District Building	1977	Concrete **G**	Wood frame /Steel **G/G**	Asphalt Shingle **F**	**F**	**F**	**G/G**	
31	Doyles District Building	1975	Concrete **G**	Wood frame /Steel **F/F**	Asphalt Shingle **F**	**F**	**F**	**G/G**	
32	Grand Bank District Building	1974	Concrete **G**	Wood frame /Steel **G/G**	Asphalt Shingle **F**	**G**	**G**	**G/G**	
33	Dunville District Building	1991	Concrete **G**	Wood frame /Steel **G/G**	Asphalt Shingle **G**	**G**	**G**	**G/G**	
34	Calvert District Building	1978	Concrete **G**	Wood frame /Steel **G/G**	Asphalt Shingle **F**	**F**	**G**	**G/G**	
35	Port aux Basques Office & Service Building	1985	Concrete **G**	Wood frame /Steel **G/F**	Asphalt Shingle **F**	**G**	**F**	**F/G**	1990-Paving 1999-Interior 2000 - Windows re-sealed

Legend G – Good, F – Fair, X – Needs Repair

Table 1 - Continued

	Location	Year Constructed	Foundation	Superstructure and Cladding	Roof	Interior Finish	Windows and Doors	Mechanical and Electrical	Renovations / Comments
36	Porte Union Warehouse	Constructed as diesel building. Used as warehouse since 1969	Concrete **G**	Wood frame /Steel **G/F**	Asphalt Shingle **G**	**G**	**F**	**G/G**	1972 – 1984 and 1999 Extension – 1986 1994 -Replace shingles
37	Salt Pond Office	1969	Concrete **G**	Wood frame /Steel **G/G**	Asphalt Shingle **G**	**F**	**G**	**F/G**	1994 – Interior 2004 – Roof, Siding, Windows, Furniture 2008 - Diesel
38	Stephenville Office & Service Building	1958	Concrete **G**	Steel/Steel **G/G**	Modified bitumen **F**	**F**	**G**	**G/G**	1986 – Purchased 1988 – Interior & Exterior 2004 – New Roof 2005/2006 – Office Renovations
39	Kenmount Road Office Building	1969	Concrete **G**	Steel/Concrete **G/G**	Modified bitumen **F**	**G**	**F**	**F/G**	1980 – Two Additional Floors 2008 – Ground and First Floor HVAC 2010 –3rd Floor HVAC, Roof
40	Electrical Maintenance Center	1940's	Concrete **G**	Steel/Concrete **G/G**	Concrete deck & Built-up Pitch & Gravel **G**	**G**	**G**	**G/G**	2000 – replace roof 1983 – Interior renovations 1979 – metal siding & insulation
41	Corner Brook Office Building	1951 **SOLD 2007**							

Legend G – Good, F – Fair, X – Needs Repair

Table 2 **EXPECTED MAXIMUM REMAINING PHYSICAL LIFE**		
Location	Remaining Life In Years (Max.)	Comments
Carbonear Office & Service Building	Exceed 40	
Whitbourne Office & Service Building	Exceed 40	
Clarenville Regional Office & Service Bldg.	Exceed 40	
Maple Valley Service Building	Exceed 40	
Mobile Works Depot	Exceed 40	
Salt Pond Service Building	Exceed 40	
Falls – Windsor Service Building	Exceed 40	
Gallant Street Building	Exceed 40	
Grand Falls – Windsor Office Building	Exceed 40	
Gander Service Building	Exceed 40	
St. John's Regional Office & Service Building	Exceed 40	
St. John's Mechanical & Vehicle Maintenance	Exceed 40	
System Control Center	Exceed 40	
Deer Lake District Building	15	Routine maintenance required
Wesleyville District Building	15	Routine maintenance required
Glovertown District Building	15	Routine maintenance required
Summerford District Building	15	Routine maintenance required
Botwood District Building	15	Not in use. To be sold or retired
Baie Verte District Building	15	Routine maintenance required
Bay Roberts District Building	15	Routine maintenance required
Bay L'Argent District Building	15	Routine maintenance required
EMC: Shed #1	15	Routine maintenance required
EMC: Shed #2	15	Routine maintenance required
EMC: Shed #3	15	Routine maintenance required
Lewisporte District Building	30	Rebuilt 1997
Springdale District Building	15	Routine maintenance required
St. David's District Building	10	Routine maintenance required
Bell Island District Building	10	Routine maintenance required
Trepassey District Building	10	Routine maintenance required
Twillingate District Building	10	Routine maintenance required
Doyles District Building	10	Routine maintenance required
Grand Bank District Building	10	Routine maintenance required
Dunville District Building	10	Routine maintenance required
Calvert District Building	10	Routine maintenance required
Port aux Basques Office/Service Bldg.	Exceed 30	
Port Union Warehouse	Exceed 30	

Salt Pond Office	Exceed 30	
Stephenville Office & Service Building	Exceed 40	
Kenmount Road Office Building	Exceed 40	

HYDRO PLANTS
DEPRECIATION STUDY
INSPECTION REPORT
2010

TABLE OF CONTENTS

1 INTRODUCTION

Newfoundland Power owns and operates 23 small hydroelectric plants in 19 developments. These plants are located in various areas of the province with the greatest concentration on the Avalon Peninsula.

The oldest plant in the system is Petty Harbour, which was constructed in 1900, and the newest plant is Rose Blanche, which was constructed in 1998. The installed capacities of the Company's power plants range from a minimum of 360 kW at Fall Pond, to a maximum of 14,800 kW at Rattling Brook. The total installed capacity is approximately 97 MW and production is an average of 428.8 GWh per year.

This report summarizes the results of a general review of all hydro plants owned and operated by Newfoundland Power. The main purpose is to estimate the remaining life of the property and assess other factors which might affect the life of the plants.

The study involved discussions with Newfoundland Power staff to assess the general condition of the properties, to review the level of operation and maintenance of the properties and any other factors affecting the service life of each property.

2 ASSET TYPES

This report focuses on the remaining physical life of the major hydro plant components or assets, which include storage structures, surge tanks, penstocks, main inlet valves, turbines, generators, governors, building and building services, instrumentation/controls, and switchgear.

2.1 Storage Structure

A storage structure is defined as the primary barrier that enables the storage or diversion of water. Newfoundland Power owns and operates many different types of storage structures throughout its 19 hydroelectric developments. Storage structures within the developments include concrete dams, embankment dams (rockfill and/or earthfill), timber crib dams, canal embankments, overflow spillways (concrete, rockfill, and timber crib), and canal control structures. The majority of storage structures are concrete, earthfill embankment, or timber crib.

A gate structure is a primary appurtenance on a site, other than the dam itself which assists in the storage or release of water. The three primary types of gate structures are intake structures, low-level outlets (control gates and sluice gates), and gated spillway structures.

2.2 Surge Tank

A surge tank is essentially a pressure relief device connected to the penstock with a tee. It is typically located near the intersection of the penstock and the powerhouse, where the pressure is the greatest. Not all developments require a surge tank.

2.3 Penstock

A penstock is bounded upstream by an intake structure and downstream by an inlet valve or scroll case (in the case of Sandy Brook plant). Water travels through the penstock from the Forebay reservoir to the powerhouse. The Company has three different types of penstocks: woodstave, steel, and fibre reinforced plastic.

2.4 Main Inlet Valve

The main inlet valve is situated between an upstream flange, on the penstock, and a downstream flange, on the scroll case.

2.5 Turbine

Typically, the main components of a turbine are the operating linkage, scroll case and contents, and runner. The operating linkage, or rotating components, consists of such sub-components as the operating ring, pins and bushings, gate arms and bushings, wicket gate links and bushings, gate stem seals, eccentrics and shear pins. The scroll case and contents, which comprise the embedded components, typically includes the scroll case, head cover and bottom cover (including stationary seals, wicket gate stem bushings), draft tube, wicket gates, shaft seal, drain valves, balance pipes and valves, and turbine shaft (to coupling with generator shaft).

For the purpose of this study, all bearings on the unit have been included with the turbine, in addition to the cooling system and oil system.

2.6 Generator

Typical generator components include the exciter (including the exciter rotor and exciter stator), stator, rotor, brush gear (including slip rings and commutator), generator heating & ventilation, generator braking system, and air compressor.

2.7 Governor

The main components of most governors are the pumping unit, accumulator, permanent magnet generator (PMG), control head, actuator, proportional valve, electronic governor, PLC/CPU, and motor.

2.8 Building/Building Services

This asset group refers to the powerhouse that contains the mechanical equipment involved in power generation. Newfoundland Power has utilizes three types of powerhouse construction: concrete, wood and steel.

For the purpose of this study, building services includes the powerhouse heaters, louvers, crane, security system, fire system, safety equipment, etc.

2.9 Instrumentation / Controls

Instrumentation/Controls refers to the protection and controls of the unit, such as the bearing temperature, vibration, cooling water pressures and temperatures, etc. Most of the control schemes for the plants are programmable logic control (PLC) based.

2.10 Switchgear

Switchgear includes such items as electrical disconnects and circuit breakers used to isolate equipment, such as a generator, from the main electrical system.

3 PLANT OVERVIEW

3.1 Operation and Maintenance

The existing hydro plants were originally designed to provide power from a regulated flow, with water being stored by one or more dams for use as required. With interconnection to the provincial grid, and the construction of major storage and power developments by Newfoundland and Labrador Hydro, the role of the small Newfoundland Power hydro plants changed from that of generating base load energy, to providing peak and secondary energy. Since the necessity of holding water in seasonal storage was reduced, many small upstream storage dams were abandoned and decommissioined. However, the main storage dams and the generating facilities have been maintained and are still in operation.

Since the late 1970s, there has been extensive work carried out on the existing hydro plants with remote control and automation, as well as with the replacements of various components due to deterioration. Replacements have included entire turbine-generator sets, turbine runners, dams, penstocks, surge tanks, switchgear, controls, and other components. As well as replacement, there have been various repairs and upgrading carried out at the plants. A listing of recent major capital projects is included in Appendix A. The intention of Newfoundland Power is to maintain and operate these developments as long as they continue to be an economical source of energy.

Since 2001, there has been an increased focus on Asset Management for the hydro plants. An extensive preventive maintenance program, and accompanying software package, was implemented in 2003 and included regularly scheduled inspections for all major plant equipment and a work flow process for the follow up and correction of the higher priority deficiencies. Predictive maintenance activities such as oil analysis, vibration analysis, infrared thermography, and partial discharge testing programs have also been implemented to allow for the identification and correction of deficiencies before they cause outages and other equipment damage. These activities will in time, serve to extend the life of these assets.

3.2 Hydro Plants

3.2.1 Pierre's Brook (PBK)

The Pierre's Brook plant is situated northwest of the community of Witless Bay on the east coast of the Avalon Peninsula. The development was commissioned in 1931 and has a capacity of 4300 kW under a net head of 80 m. There is one vertical Francis unit, with the turbine manufactured by J.M. Voith and the generator by General Electric.

Work completed in 2006 at this plant include a major overhaul, replacement of the crane hoist, rebuild of the main valve and a limited protection and controls upgrade. In 2007, the rotor was rebuilt and in 2008, the governor was upgraded.

3.2.2 Mobile (MOP)

The Mobile plant is located on the east coast of the Avalon Peninsula in the community of Mobile. The plant has a capacity of 12,000 kW under a net head of 114.6 m. The Mobile and Morris plants share a common watershed. The powerhouse, commissioned in 1950, is located near sea level and contains one generating unit consisting of a vertical Francis turbine manufactured by Voith Hydro and a generator manufactured by Westinghouse.

The Mobile penstock is buried for the majority of its length, and in 2007, fill was added over the buried section.

3.2.3 Morris (MRP)

The Morris powerhouse, commissioned in 1983, is located upstream of Mobile First Pond near the community of Mobile. The plant has a capacity of 1,135 kW under a net head of 30.0 m. There is one horizontal Francis turbine manufactured by Barber Hydraulic Turbines and an Ideal Electric induction generator which was commissioned in 1983.

3.2.4 Tors Cove (TCV)

The Tors Cove development is located on the east coast of the Avalon Peninsula near the community of Tors Cove. Tors Cove and Rocky Pond plants share a common watershed. The Tors Cove plant, with a capacity of 6,500 kW under a net head of 52.7 m, was commissioned in 1942. The plant contains three horizontal Francis turbines and generators, all manufactured by English Electric.

In 2006, two forebay dams were upgraded.

3.2.5 Rocky Pond (ROP)

The Rocky Pond powerhouse, commissioned in 1943, is located upstream of Tors Cove Pond and contains one generating unit with a capacity of 3,250 kW under a net head of 32.6 m. The unit consists of a vertical Francis turbine manufactured by Dominion Turbine and a generator manufactured by Westinghouse.

In 2005, a major overhaul of the turbine was completed and an extension was built into the plant to accommodate the new instrumentation/controls and switchgear, which were replaced in 2006. In 2009, the penstock, intake, main valve, governor and forebay line was replaced. Also in 2009, the rotor was reinsulated and the stator was rewound. Civil work completed in 2009 included improvements to the forebay dam, as well as improvements to storage structures at Butler's and Long Pond.

3.2.6 Cape Broyle (CAB)

The Cape Broyle development was commissioned in 1953 and is located on the east coast of the Avalon Peninsula near the community of Cape Broyle. It shares a common watershed with Horsechops and has a capacity of 6,280 kW under a net head of 54.8 m. The plant contains one vertical Francis turbine manufactured by Canadian Vickers Ltd. and a Westinghouse generator.

The turbine was overhauled and the intake tunnel upgraded in 2006. Rip rap was also added to the forebay dam in 2006. In 2008, Cape Broyle plant protection and controls were upgraded and a new governor was installed. In 2009, improvements were made to roads and the powerhouse crane.

3.2.7 Horse Chops (HCP)

The Horse Chops powerhouse is located upstream of Cape Broyle Pond and contains one generating unit with a capacity of 8,130 kW under a net head of 85.3m. There is one vertical Francis turbine manufactured by Dominion Engineering and commissioned in 1953. General Electric manufactured the generator.

In 2007, rip rap was added to West Dam in the Horse Chops system. In 2008, Mt. Carmel dam, holding the main storage reservoir for this system, was rehabilitated. In 2009, a significant plant protection and controls project was completed along with upgrades to switchgear, the governor, the heating and ventilation system, cooling water, powerhouse crane and the forebay spillway.

3.2.8 Petty Harbour (PHR)

The Petty Harbour plant is located on the east coast of the Avalon Peninsula in the community of Petty Harbour. The original development, constructed in 1900, has undergone various changes and presently has an installed capacity of 5,250 kW under a net head of approximately 57.9 m. There are three horizontal Francis turbines and generators in the plant, all commissioned between 1907 and 1927.

In 2005, the surge tank and roof of the plant were rehabilitated. In 2006, a significant plant protection and controls project was completed along with upgrades to plant electrical systems. In 2006, turbine #2 was overhauled and the penstock coating system was replaced. In 2007, the cooling water system for turbine #2 was upgraded. Cochrane Pond dam was rehabilitated in 2008.

3.2.9 Topsail (TOP)

The Topsail plant, commissioned in 1932, is located on the southern part of Conception Bay near the community of Topsail. The development consists of one horizontal generating unit with a total capacity of 2,250 kW under a net head of about 111.2 m. The horizontal Francis turbine was manufactured by Barber and the generator was manufactured by Ideal Electric. Both were commissioned in 1983, replacing the original 1,200 kW unit.

Three Arm Pond dam was rehabilitated in 2006. The gate was replaced and the dams at paddy’s Pond were upgraded in 2007.

3.2.10 Seal Cove (SCV)

The Seal Cove plant is located on the southern part of Conception Bay in the community of Seal Cove. It has a total capacity of 3,180 kW under a net head of 55.5 m. The development was commissioned in 1924 and consists of two generating units. One unit consists of a Voith turbine and a Westinghouse generator, while the other unit consists of an Allis Chalmers turbine and generator.

Fenelon's Pond dam was rehabilitated in 2005 and Soldier's Pond dam was rehabilitated in 2008. In 2009, turbine #2 was rehabilitated after a piece of concrete was stuck in the wicket gates and damaged several turbine components. The forebay spillway was rehabilitated in 2009 and the roof was also replaced.

3.2.11 Heart's Content (HCT)

The Heart's Content plant is located on the east side of Trinity Bay in the community of Heart's Content. The development, originally built in 1918 and extensively renovated in 1946, has a capacity of 2,370 kW under a net head of about 46.9 m. The plant contains one vertical Francis turbine manufactured by English Electric, and a generator manufactured by Bruce Peebles. Both were commissioned in 1960.

In 2005, Rocky pond dam and the forebay were rehabilitated. In 2006, both Long Pond dam and Seal Cove Pond dam was rehabilitated. The cooling water system was upgraded in 2007 and 2008. The turbine runner was replaced in 2008 and plant electrical system was upgraded. In 2009, Packs Pond dam was improved by adding rip rap.

3.2.12 Victoria (VIC)

The Victoria development is located on the northwest side of Conception Bay in the community of Victoria. It was commissioned in 1904 and has a total capacity of 550 kW under a net head of 64.3 m. There is one Voith turbine and a Westinghouse generator, both installed during a plant expansion in 1914.

The Victoria trash rack was refurbished in 2005. In 2006, Rocky Pond dam was rehabilitated and the turbine bearing was replaced. In 2008, the cooling water system was upgraded.

3.2.13 New Chelsea (NCH)

The New Chelsea plant is located on the east side of Trinity Bay in the community of New Chelsea. The plant has a capacity of 3,700 kW under a net head of 83.8 and was commissioned in 1956. The New Chelsea and Pittman's Pond plants share the same watershed.

The New Chelsea powerhouse, located near sea level, contains one vertical Francis Turbine manufactured by Dominion Engineering, and a generator manufactured by Westinghouse.

In 2009, the roof was replaced and a section of penstock was recoated with improved UV protection..

3.2.14 Pittman's Pond (PIT)

The Pittman's Pond plant is located on the east side of Trinity Bay near the community of New Chelsea, and was commissioned in 1959. The plant contains one generating unit with a capacity of 625 kW under a net head of 21.3 m. The generating unit is comprised of a horizontal Francis turbine manufactured by Gilkes, and a Westinghouse induction generator.

In 2009, cooling water and electrical systems were upgraded.

3.2.15 West Brook (WBK)

The West Brook development is located on the southern part of the Burin Peninsula, near the community of St. Lawrence. It was constructed in 1942 and has a capacity of 680 kW under a net head of about 47.0 m. There is one horizontal Francis turbine manufactured by Leffel and one Westinghouse generator, both commissioned in 1942.

West Brook spillway was rehabilitated in 2007.

3.2.16 Fall Pond (FPD)

The Fall Pond development is located on the southern part of the Burin Peninsula, near the community of Little St. Lawrence. It was commissioned in 1939 and has a capacity of 350 kW under a net head of about 15.2 m. There is one horizontal Francis turbine manufactured by Voith, and generator manufactured by Westinghouse.

There have been no major improvements to Fall Pond development in the past 5 years.

3.2.17 Lawn (LWN)

The Lawn development is located on the southern part of the Burin Peninsula, near the community of Lawn. The development was originally commissioned in 1929 and was substantially refurbished in 1983. It has a capacity of 600 kW under a net head of about 24.3 m. There is one horizontal Francis turbine manufactured by Barber and an Ideal Electric Generator, both of which were installed in 1983 and replaced the two original Voith turbines.

A section of Lawn penstock was fitted with sheet metal in 2008.

3.2.18 Lockston (LOK)

The Lockston plant is located on the Trinity Bay side of the Bonavista Peninsula, near the community of Port Rexton. It was commissioned in 1956 and has an installed capacity of 3,000 kW under a net head of approximately 82.2. m. The plant contains two units each consisting of a horizontal Francis turbine manufactured by Gilkes, and a generator manufactured by General Electric.

There has been no major work completed at the plant in the past 5 years.

3.2.19 Port Union (PUN)

The Port Union plant is located on the Trinity Bay side of the Bonavista Peninsula, in the community of Port Union. The plant was commissioned in 1917 and has a total capacity of 511 kW under a net head of 21.3 m. There are two horizontal Francis turbines manufactured by the Pelton Waterwheel Co. and generators manufactured by General Electric.

Whirl Pond dam and outlet were rehabilitated in 2008. Wells Pond outlet was rehabilitated in 2009.

3.2.20 Rattling Brook (RBK)

The Rattling Brook plant is located in Central Newfoundland in the community of Norris Arm. The development was commissioned in 1958 with additional storage added in 1961. The plant has a capacity of 11,500 kW under a net head of 93.5 m. There are two vertical Francis turbines manufactured by Allis Chalmers and associated General Electric generators.

In 2007, Rattling Brook plant was significantly upgraded. The penstock was replaced and the surge tank was extensively rehabilitated. New switchgear, protection and controls, main valves and governor were installed. The turbines were overhauled and the plant electrical system was upgraded. In 2009, the trash rack was replaced and the gate shaft for Amy's gate was rehabilitated.

3.2.21 Sandy Brook (SBK)

The Sandy Brook plant is located in Central Newfoundland near the town of Grand Falls–Windsor. The plant was commissioned in 1963 and has an installed capacity of 6,310 kW under a net head of 33.5 m. The single unit consists of a Dominion Francis turbine and a Westinghouse generator.

In 2007, West lake outlet was upgraded. In 2008, the forebay trash racks were replaced and the spillway at Sandy Lake was upgraded.

3.2.22 Lookout Brook (LBK)

The Lookout Brook powerhouse, commissioned in 1945, is located on the west coast of Newfoundland near the community of St. Georges. It contains two generating units with a capacity of 5,800 kW under a net head of 154.6 m. The Lookout Brook turbines are both horizontal Francis type. One unit consists of a turbine manufactured by Gilkes in 1958 and generator manufactured by General Electric in 1945. The other unit consists of a turbine manufactured by Barber and was commissioned in 1984. The Barber unit replaced the two original Leffel units.

There has been no major work completed at the plant in the past 5 years. In 2010, this plant will undergo a major protection and controls upgrade along with the installation of new switchgear and governor.

3.2.23 Rose Blanche (RBH)

The Rose Blanche plant is located on the southwest coast of Newfoundland, near the community of Rose Blanche. The plant was commissioned in 1998 and has an installed capacity of 6,000 kW with a net head of 155 m. The development consists of a Sulzer Hydro dual horizontal Francis turbine pair rated at 3,000 kW each, with a General Electric single generator located between the two turbines.

In 2009, the spillway was raised 1.06 meters at Rose Blanche.

4 EXISTING ASSET CONDITION

The general condition of the plants has been summarized in Table 4.1, with the condition category assigned as follows:

E – Excellent. Generally applies to earth and rockfill dams where there is no leakage, and riprap is in good condition. Describes condition of new (4 years old or less) timber dams, pipelines and electrical and mechanical equipment.

G – Good. Applicable to condition of equipment or structure which is not new, but is operating as expected with no problems, and is well maintained.

F – Fair. Applicable to condition of equipment or structure where some deterioration has taken place, but which can be rectified without a major expenditure.

P – Poor. Applicable to condition of equipment or structure which is nearing the end of its service life, or where deterioration has proceeded to such an extent that a major expenditure (40% or more of value of equipment or structure) will be required within the next five years to effect repairs. This could also mean that the equipment or structure is no longer functioning and needs to be replaced or taken out of service.

Table 4.1: SUMMARY OF EXISTING ASSET CONDITION Legend E – Excellent, G – Good, F – Fair, P – Poor

	Storage Structure	Surge Tank	Penstock	Main Inlet Valve	Runner	Windings	Governor	Building Services	Instrumentation / Controls	Switchgear
Pierre's Brook	F-G	G	P	G	G	E	G-E	G	G	F
Mobile	G	E	F-G	E	G	P	F-G	G	F	F
Morris	F-G	-	G	F	F	F		E	F-G	G
Tors Cove G1	G	G	G	P	F-G	F	F	G	F	F-G
Tors Cove G2	G	G	G	G	F-G	G	G	G	G	F-G
Tors Cove G3	G	G	G	G	F-G	F-G	G	G	G	F-G
Rocky Pond	G	-	E	E	E	E	G	G	E	E
Cape Broyle	G	-	E	E	F	E	G	G	G	G
Horse Chops	G	E	E	E	G	P	G	E	E	E-G
Petty Hr G1	G	F	F	P	P-F	P-F	P	G	F	G
Petty Hr G2	G	F	F	G	G	G	G	G	E	G-E
Petty Hr G3	G	F	F	G	G	E	G	G	E	G-E
Topsail	G	-	F-G	G	G-E	F	F-G	G	E	G
Seal Cove G1	F-G	-	E	G	P	F	G	G	E	E
Seal Cove G2	F-G	-	E	G	E	E	G		E	E
Heart's Content	F-G	-	P-F	G-E	E	P-F	F	G	E	F
Victoria	G	-	P	P	P-F	F-G	F	G	G	G
New Chelsea	G	-	E	E	G	P	E	G	E	E
Pittman's Pond	G	-	G	P	F-G	P-F	P-F	G	P-F	F
West Brook	F-G	-	G	P	G-E	F	F	G	G	G
Fall Pond	P	-	E	P	P	F	F	G	G	G
Lawn	F-G	-	G	G	F-G	F	F	G	G	G
* @ Switchgear Lockston G1	G	-	E	F	F	P-F	F	G	P	P
Lockston G2	G	-	E	F	G	P-F	F		P	P
Port Union G1	P-G	-	G	P	F	P-F	P	G	P-F	G
Port Union G2	P-G	-	G	P	F	P-F	P		P-F	G
Rattling Brook G1	F	E	E	E	G	G	E	E	E	E
Rattling Brook G2	F	E	E	E	G	G	E	G	E	E
Sandy Brook	F-G	G	F-G	-	E	P-F	F-G		F-G	F

Lookout Brook G1	G	-	G	G	G	F-G	P-F	G	P	P
Lookout Brook G2	G	-	G	G	G	F-G	G		P	P
Rose Blanche	E	-	E	E	G-E	E	G	E	E	E

5 REMAINING ASSET LIFE

5.1 Benchmark Information

The service life of a plant is typically determined by the overall plant life, taking into account interim replacement of major components. Much of the present condition of a plant depends on how it was operated since commissioning.

Factors taken into account when determining the remaining service life of each generating unit include:

- Major improvements
- Total hours run
- Operating and maintenance history
- Expected operating cycle
- Availability of spare parts
- Anticipated future maintenance requirements

Typically, replacement is required when:

- The equipment becomes too costly to maintain due to:
  - Excessive maintenance
  - Frequent adjustment
  - High failure rate
  - Spare parts are too costly, difficult or impossible to source
- The original or third party manufacturers no longer support the equipment
- There are changes in operational mode of the generating unit

The service life of a hydroelectric plant is well in excess of 50 years. The following table summarizes the service life of various systems comprising a hydroelectric station. (Source: LAWA – Landerarbeitsgemeinschaft Wasser, Working Party on Cost-Benefit Research in the Water Economy – Munich)

Table 5.1 : AVERAGE SERVICE LIFE OF SMALL HYDROELECTRIC FACILITIES

Major Component Group	Average Service Life (yrs)
Concretes structures	80
Operating facilities	40
Rack	20
Structural components	60
Mechanical components	40
Electrical components	30

5.1.1 Turbine

The life expectancy of a turbine runner is somewhat dependant upon a number of factors. For instance, the material from which the runner is made is a factor as bronze runners typically do not have the same life expectancy of those made of steel or stainless steel. Another factor is the actual runner design itself relative to the flow and head conditions, which could determine the amount of cavitation, and thus erosion of runner material.

5.1.2 Generator

The rotating excitation and electromechanical voltage regulator systems are mechanically based and as such, are subject to increasing maintenance requirements as they age. If the exciter is not a totally enclosed unit and is located in a damp and/or dirty environment, the windings may become contaminated. This contamination may result in premature wearing of the insulation surface and overheating of the winding. The same applies to alternators.

The life of the winding of the alternator is load and time dependant. If the alternator is loaded above its design values, the insulation degrades faster than its calculated design life. Conversely, a lightly loaded alternator should last longer.

5.1.3 Governor

The governor, pressurised oil system and ancillary mechanical systems typically have a lifetime that is less than that of the associated turbine. These systems have many moving parts that are subject to wear on the bearing surfaces, component fatigue and vibration leading to a loss of adjustment, sticking, etc. Consequently, they are subject to a regime of increasing maintenance as they age.

5.1.4 Switchgear

Switchgear is subject to deterioration such as breaker contact wear, arcing damage and insulation breakdown. Switchgear should be replaced when no longer supported by the manufacturer, parts availability declines and safety of personnel or equipment potentially becomes compromised as a result.

5.1.5 Instrumentation & Control

For all measuring relays, aging of components such as capacitors, resistors, coils, and worn contacts are sources of failure. Aging mechanisms include corrosion and overheating of contacts, vibration of bearings, wear of bearing surfaces that have exceeded the number of design operations, and failure of insulation material in capacitors and other components due to aging of the materials.

Replacement of electromechanical control systems with modern digital technology generally serves to lessen the number of individual components, thereby lessening the probability of failure, increasing reliability and lowering maintenance costs. One of the main drivers behind the replacement of instrumentation and controls equipment is the technology becomes obsolete.

Once new computer-based control systems are installed in the plants, upgrades may become available prior to the end of the whole system's useful life. These upgrades will be evaluated to determine if they are necessary or if the upgrades will improve the plant controls and protection enough to justify the investment.

5.1.6 Summary by Asset Type

Table 5.2: SUMMARY BY ASSET TYPE

Storage Structure Types:	Typical Useful Life (Years)	Comments
Concrete Dam	70	
Embankment Dam (Rockfill, Earthfill)	60	
Timber Crib Dam	40	
Canal Embankment	60	
Overflow Spillway (Concrete, Rockfill, Timber Crib)	50	
Canal Control Structure	50	
Intake Structure	70	
Low-level Outlet (Control Gate, Sluice Gate)	50	
Gated Spillway	50	
Surge Tank	70	
Penstock Types:		
Woodstave	50	
Steel	70	
Fibre Reinforced Plastic (FRP)	70	
Main Inlet Valve	50	
Turbine	75	
Runner	40	
Generator	75	
Windings	50	
Governor - Original - Electronic	75 25	
Building/Building Services	70	
Instrumentation / Controls	20	
Switchgear	50	

5.2 Life Extension

In addition to planned capital replacement of major components, Newfoundland Power has undertaken initiatives to extend the life of its existing assets.

An asset management program was implemented for the generation group to ensure ongoing asset integrity through effective engineering, maintenance, and inspection strategies. The program focuses on preventive and predictive maintenance.

Some of the predictive maintenance techniques being implemented in the hydroelectric plants are: oil analysis on bearings and governor systems, unit vibration analysis, and generator partial discharge testing. Partial discharge testing, designed to monitor winding insulation deterioration, is useful to predict stator winding failures.

5.3 Estimated Remaining Life

Table 5.3: Estimated Remaining Life (Years) – Summary

	Storage Structure	Surge Tank	Penstock	Main Inlet Valve	Runner	Windings	Governor	Building/ Building Services**	Instrumentation / Controls	Switchgear
PBK	*	50	< 5	35	25	40	20	35	10	10
MOP	*	10/40	15	45	20	< 5	30	30	5	15
MRP	*	-	30	20	15	15	N/A	45	10	25
TCV	*	50	20	5/30/30*	10/10/10*	5/30/25*	10/20/20*	35	5/20/20*	5/15/15
ROP	*	-	70	50	35	50	25	40	20	50
CAB	*	-	50	45	10	35	25	40	20	35
HCP	*	50	50	40	25	<5	25	40	20	35
PHR	*	20	5/60	< 5/25/25*	5/15/15*	5/25/35*	5/15/15*	35	5/20/20*	40/45/45
TOP	*	-	15	25	30	15	15	35	20	25
SCV	*	-	50	40/40*	<5/5*	35/45*	20/20*	35	15	40
HCT	*	-	<5/ 25*	35	40	5	15	35	20	15
VIC	*	-	<5	< 5	10	25	-	35	10	30
NCH	*	-	55	40	25	5	20	35	20	45
PIT	*	-	10	5	20	5	10	35	5	15
WBK	*	-	35	<5	30	15	10	35	10	30
FPD	*	-	50	<5	<5	20	10	35	10	35
LWN	*	-	20	30	20	15	15	35	10	25
LOK	*	-	55	10/10*	5/10*	5/5*	10/10*	35	5/5*	5
PUN	*	-	25	<5/<5*	20/20*	25/20*	5/5*	35	5	30
RBK	*	60	70	50/50*	25/25*	45/40*	25/25*	50	20/20*	50
SBK	*	15	20	-	30	10	30	35+	10	10
LBK	*	N/A	40/20	40/30*	30/30*	5/20*	10/10*	35+	<5/<5	<5/<5*
RBH	*	N/A	65	40/40*	30/30*	40	15	45+	15	40

* See Summary Sheets of individual plants for further detail – Found in Appendix B.
** Plants are original structure with maintenance and upgrades over time, which will continue as needed.

Explanations for Plant Summary Sheets

Storage Structures

The year that some storage structures were installed/replaced/rebuilt cannot be accurately identified due to a number of reasons. For example, the original installation date may be unknown, as some sites were installed prior to Newfoundland Power's ownership and some storage structures may have been upgraded over time, but there has been no major rehabilitation in its history.

APPENDIX A

Significant Capital Work

2005 – 2009

2005	
Plant	**$**
Petty Harbour	
- Petty Harbour Building Rehabilitation	40,525
Horse Chops	
- Horse Chops Wicket Gate Bushing Replacement	173,114
Seal Cove	
- Seal Cove Fenelon's Pond Dam Rehabilitation	402,995
Cape Broyle	
- Cape Broyle Main Valve and Bypass Replacement	318,449
Mobile	
- Mobile Main Valve and Bypass Replacement	304,638
Heart's Content	
- Heart's Content Rocky Pond Dam & Forebay Rehabilitation	310,944
Rocky Pond	
- Rocky Pond Switchgear Replacement (start) Replacement	422,415

2006	
Plant	**$**
Petty Harbour	
- Petty Harbour P and C Upgrade	1,161,759
- Petty Harbour Penstock Coating System Replacement	594,761
- Petty Harbour Turbine Overhaul	95,050
- Petty Harbour Electrical Upgrade	72,136
Pierre's Brook	
- Pierre's Brook Turbine Overhaul	175,878
- Pierre's Brook Replace Crane Hoist Replacement	80,343
- Pierre's Brook Main Valve Rebuild	58,319
- Pierre's Brook P&C Upgrade	57,901
Victoria	
- Victoria Rocky Pond Dam Rehabilitation	71,815
- Victoria Blue Hill Pond Protection	60,334
-Victoria Replace Turbine Bearing Replacement	21,130
Rocky Pond	
- Rocky Pond Wicket Gate Bushing Replacement	137,313
- Rocky Pond Switchgear Replacement (finish)	749,095
Topsail	
- Topsail Three Arm Pond Dam Rehabilitation	28,852
- Tors Cove Forebay Slope Stabilization	116,083
Cape Broyle	
- Cape Broyle Riprap Rehabilitation	40,695
- Cape Broyle Tunnel Upgrade	783,172
Heart's Content	
- Heart's Content Seal Cove Pond Dam Rehabilitation	89,185
- Heart's Content Long Pond Dam Rehabilitation	120,175

2007	
Plant	**$**
Rattling Brook	
- Rattling Brook Penstock Replacement	11,210,136
- Rattling Brook Surge Tank Upgrade	1,929,289
- Rattling Brook P&C Automation Upgrade	2,872,892
- Rattling Brook Main Valves Replacement	1,191,915
Horse Chops	
- Horsechops West Dam Riprap Upg	81,040
- Horsechops -West Dam Upgrd Total	81,699
Topsail	
- Topsail Dam Overtop Protection	22,539
- Topsail Paddy's Pd Outlet Replacement	60,052
Pierre's Brook	
- Pierre's Brook Rotor Rebuild	170,619
Sandy Brook	
- Sandy Brook -West Lake Rehabilitation	34,181
West Brook	
- West Brook Spillway Rehabilitation	94,345
Mobile	
- Mobile Penstock Cover Replacement	38,797

2008	
Plant	**$**
Sandy Brook	
- Sandy Brook Replace Trash Racks Replacement	100,855
- Sandy Brook Spillway Upgrade	96,459
Heart's Content	
- Heart's Content AC Distribution Upgrades	72,184
- Heart's Content Runner Replacement	616,759
Victoria	
- Victoria Cooling Water/Controls Upgrade	84,244
Lawn	
- Lawn Penstock Upgrades	85,097
Port Union	
- Port Union Whirl Pond Dam and Outlet Upgrades	351,978
Cape Broyle	
- Cape Broyle P&C and Governor Upgrades	881,609
Pierre's Brook	
- Pierre's Brook Governor Upgrade	193,923
Seal Cove	
- Seal Cove Soldiers Pond Dam & Spillway	367,143
Horse Chops	
- Horse Chops Mount Carmel Pond Dam Rehabilitation	302,544
Petty harbour	
- Petty Harbour Cochrane Pond Dam Rehabilitation	23,326

2009	
Plant	**$**
Rocky Pond	
- Rocky Pond Long Pond Dam Rehabilitation	67,921
- Rocky Pond Penstock & Intake Replacement	3,606,980
- Rocky Pond Butlers Pond Spillway Rehabilitation	35,387
- Rocky Pond Forebay Dam Upgrades	52,200
- Rocky Pond Main Valve & governor	588,853
- Rocky Pond Rotor Reins/Stator Rewind	928,497
Seal Cove	
- Seal Cove Roof Rehabilitation	40,937
- Seal Cove Forebay Spillway Rehabilitation	115,382
- Seal Cove G2 Turbine Rehabilitation	390,163
Horse Chops	
- Horse Chops Cooling water & piping upgrade	41,102
- Horse Chops P & C, Switchgear, Governor Upgrades	1,129,369
Heart's Content	
- Heart's Content Packs Pond Riprap Replacement	161,054
- Heart's Content Electrical System Upgrades	74,890
Rattling Brook	
- Rattling Brook Trashrack Replacement	75,535
- Rattling Brook Amy's Gate Shaft Replacement	79,525
Rose Blanche	
- Rose Blanche Spillway Raise	504,481
Pitman's	
- Pitman's Cooling Water Upgrade	35,058
Port Union	
- Port Union Wells Pond Outlet Structure Rehabilitation	17,625

APPENDIX B

Remaining Life of Hydro Plant Equipment

2010 DEPRECIATION STUDY

SUBSTATION ASSET REVIEW

Prepared By: G. Richard Spurrell, P. Eng.

Date: 2010-05-31

Executive Summary

Newfoundland Power continues to improve its substation maintenance and asset management practices. Since the 2005 the Company has implemented an annual, comprehensive substation assessment process, which leads to modernization and refurbishment work in specific substations with each year‟s Capital Budget. The maintenance program has been expanded to include all equipment and infrastructure. Mobile computing is being used to more effectively gather maintenance and asset management information. Annual infrared inspections have been introduced along with more frequent transformer oil testing for units over 50 years old.

The Company‟s substation asset management and equipment maintenance programs will maximizes the useful life of existing equipment.

Table of Contents

Introduction

This review was prepared to support the completion of the 2010 Depreciation Study. It is an overview of actions taken to optimize in-service life of substation assets. The report focus will be on improvements and developments since 2005.

Substation Refurbishment and Modernization Projects

Since 2007, the Company has utilized a strategy which annually assesses substation infrastructure. Individual substations are selected to undergo major refurbishment and modernization projects as part of the annual Capital Budget.

One of the objectives of the refurbishment and modernization work is to extend the life of existing substation equipment and infrastructure. Another objective is to replace equipment and infrastructure that is no longer economic or practical to maintain.

These projects implement new technology to improve protective relaying and equipment monitoring systems. As well, work is undertaken to address aging infrastructure. The projects also implement corrective measures to address types and vintages of equipment with histories of problems and failures. Finally, preventive and corrective equipment maintenance requiring equipment to be removed from service can be completed during the outages associated with the refurbishment and modernization project.

Maintenance Program

The Company‟s maintenance management system continues to be supported by the Avantis software application. There has been a continuous effort to increase the effectiveness of the maintenance management system.

Increased Scope

The system has expanded to include all substation infrastructure including protective relaying and automation equipment. Relaying and automation equipment monitor substation activity. Relaying removes electrical faults from the electrical system. Automation equipment in conjunction with SCADA monitors the operation and health of equipment. The maintenance system ensures a higher level of performance of the relaying and automation equipment. Better protection and monitoring of major electrical equipment lowers the risk of damage to major equipment.

Substation Inspections

The largest improvement in the Substation Inspection Program was the introduction of handheld computers. These devices allow inspectors to enter information at the time of inspection.

Quality assurance processes ensure all equipment is inspected and increases the validity of data. The computerization provides faster compilation of data and review problem situations.

The St. John‟s area contains approximately 40% of the major equipment maintained corporately. Maintenance inspections were conducted by personnel from the large pool of maintenance persons in St. John‟s area. This led to inconsistency in the inspection results, making it difficult to establish a rate of deterioration on equipment.

Current practice is to use the same personnel to conduct inspections resulting in more consistent assessment. Thus the onset of problems arising from deterioration can be better identified. Faster, more consistent identification of issues allows equipment to be repaired or replaced before failing, thereby extending equipment life.

Appendix A provides an example of completed inspection forms for two substations. As well, a list of the outstanding issues documented in Avantis and a history of the work completed for the same substations is provided in Appendix B.

From 2005 to April 2010 the average completion rate for substation inspections has been 97%.

Predictive Maintenance

The primary purpose of a predictive approach to maintenance is to identify problems before they cause significant damage. This earlier attention to problems will improve equipment reparability and longevity. Annually, the state of all transformers and breakers is assessed and the annual maintenance plan includes any equipment with unacceptable signs of deterioration.

The Company continues the use of Dissolved Gas-In-Oil Analysis (“DGA”) for its oil-filled transformers and breakers. This analysis includes Transformer Condition Assessment (“TCA”) for power transformers, Tap Changer Signature Analysis (“TASA”) for transformer tap changers and Breaker Oil Analysis (“BOA”) for oil filled circuit breakers.

The TCA analysis, by providing a better indication of transformer health, has allowed the Company to manage the in-service conditions of aging transformer so as to extend their lives.

The TASA analysis identifies transformer tap changer problems. Upon servicing these units the problems were corrected before failure occurs. A tap changer failure could initiate a failure of the entire transformer.

The Company has increased the frequency of DGA testing for transformers over 50 years old. The current practice is to test these units semi-annually. This will allow implementation of corrective action in time to extend the life of these units.

This testing has been very successful with numerous transformers removed from service and maintained before failure occurs.

Similarly, the BOA program identifies oil-filled breaker problems so that maintenance can be completed before failure occurs.

Poor electrical connections and high electrical stresses will cause overheating of equipment, components and connectors. Unattended overheating will cause premature failure and damage. The increased use of infrared thermography has identified many overheating situations and allowed the Company to take corrective measures before significant damage occurs. In recent years, the Company has identified failing transformer lightning arrestors through the use of infrared thermography.

Recloser Replacement for Maintenance

In-service reclosers are replaced and returned to the Electrical Maintenance Centre to undergo preventive maintenance. Undertaking this work in a shop environment ensures a higher level of refurbishment. This approach extends the life of the recloser as compared to doing field servicing.

General Asset Observations

Appendix C provides a listing of the Company‟s substations including when they were established, the transformer capacity and the voltage levels involved. The list also notes significant additions or modifications to the substation.

In 2007, the 4kV section of Ridge Road substation was retired. The transformer was returned to the standby equipment pool. The 4kV switchgear was scrapped. The isolation switch for the transformer is still mounted on the bus structure.

In 2008, the 33kV section of St. Georges substation, was retired. The transformer was returned to the standby equipment pool. The rest was of the infrastructure was scrapped.

In 2009, new Garnish, Rocky Pond and Horsechops substations were built and the old substations were retired. Garnish‟s transformer, recloser and voltage regulators were returned to the standby equipment pool. The rest of the infrastructure is to be scrapped. Rocky Pond‟s transformer was used in the new substation. The rest of the infrastructure except for the switchgear was scrapped. At the old Horsechops substation the entire infrastructure, including the transformer, was scrapped.

There is no plan at this time for future substation retirements except for the 33 kV section of Mobile substation. Transmission line 23L is being converted from 33 kV to 66 kV as part of the 2010 Capital Budget.

Appendix D provides additional information with respect to improvements and modifications made at various substations since 2005.

Corrosion

Corrosion impacts the life span of the company‟s outdoor substation equipment. The salt laden atmosphere in most of the Company‟s service area causes severe deterioration. To counteract this problem, equipment specifications require the use of corrosion resistant materials such as stainless or galvanized steel and epoxy finishes. The result of this requirement has been a reduction or elimination of premature failures associated with corrosion.

Specific Asset Observations

Structures & Buildings

Newfoundland Power's substation structures and buildings are in generally good condition. Since 2003, deteriorated wood pole bus and switch structures continue to be replaced with steel construction. Going forward any new bus and switch structure additions will be of steel construction.

Lightning Arrestor Replacement Program

Silicon carbide lightning arrestors, installed until the early 1980‟s, are at the end of their service life. The Company has replaced most of these arrestors. As a result the quantity of silicon carbide lightning arrestors remaining in service is very small.

Varmint Proofing

Since 2005, the Company varmint proofs rural substations to avoid equipment failures from electrical faults caused by animals and birds in contact with the energized equipment.

Obsolete Equipment

Since 2005, it has been determined that Westinghouse/Siemens SF^6 high voltage breakers, ES105 reclosers and some protective relaying (KD impedance relays and IAC over current relays) can no longer be economically maintained. The Company acquired the SF^6 breakers from 1980 to 1990, the ES105 reclosers from 1973 to 1981 and the relays from early 1950‟s to late 1970‟s.

As problems are experienced with this equipment it is replaced with a more current technology. Similarly, when a Refurbish and Modernization capital project is undertaken in a substation, these breakers, reclosers and relays are identified for replacement.

Transformer Tap Changer Vibration Analysis

The Company is acquiring a transformer tap changer vibration analyzer to diagnosis the state of in-service transformer tap changers. Paired with the DGA analysis, it is expected that the Company will achieve even more success in identifying incipient failures.

Conclusion

The Company‟s substation asset management and equipment maintenance programs will maximizes the useful life of existing equipment.

Appendix A

Sample Substation Inspection Forms

Print

001929 Memorial
April, 2010

MSF002
Form No. 139

NEWFOUNDLAND POWER
A FORTIS COMPANY

Revised: 1/19/2007

Maintenance Standard Report Form

Routine Substation Inspection

Sub: **001929 Memorial**	W.O. Number: **88124**
Inspection Type: **SUBSTATION INSPECTION**	Completed By: ~~Jeff Clark~~ Allan Bartlett
	Date Completed: **2010/04/19**

Mark X in approprate block. Enter measurements as required.
Enter unmultiplied values when asked. Otherwise enter multiplied values.

Arc Flash Equipment

Arc Flash Hoods (2)	Satisfactory	Arc Flash Jackets (2)	Satisfactory
Arc Flash Pants (2)	Satisfactory	Cabinet Signage	Satisfactory
Earplugs	Satisfactory	Outside Signage	Satisfactory

Building & Accessories

AC Lighting	Satisfactory	AC Panel	Satisfactory
Building Condition	Satisfactory	Danger and Caution Tags	Satisfactory
DC Lighting	Satisfactory	DC Panel	Satisfactory
Exit Sign	Satisfactory	Fire Extinguisher	Satisfactory
First Aid Kit	Satisfactory	Flashlight	Satisfactory
Hard Hats	Satisfactory	Heaters	Satisfactory
Housekeeping	Satisfactory	Telephone and Directory	Satisfactory
Wall Cabinet	Satisfactory		

Control Panels

Control Panel Lamps	Satisfactory	Equipment Identification	Satisfactory
Meters	Satisfactory	Relay Targets	Satisfactory

General Properties

*Special Instructions Completed	Satisfactory	Crushed Stone	Satisfactory
Drainage	Satisfactory	Fence and Fence Grounding	Satisfactory
Gates and Locks	Satisfactory	Ground Sticks and/or Hot Sticks	Satisfactory
High Voltage Danger Signs	Satisfactory	Snow Clearing	Satisfactory
Station Service	Satisfactory	Vandalism	Satisfactory
Vegetation	Satisfactory	Yard Clean	Satisfactory
Yard Lighting	Satisfactory		

Miscellaneous Equipment

12L Cable Terminations - A&C Centre	Satisfactory	12L Cable Terminations - MUN	Satisfactory
14L Cable Terminations - CBC	Satisfactory	14L Cable Terminations - MUN	Satisfactory
Oil Filled Cables	Satisfactory	Potheads and Cables	Satisfactory
Switch Blades	Satisfactory		

General Metering

MUN-S/S

Meter Number:	______________	Multiplier:	10.00
KWH: unmultiplied reading (previous: 0.00)	15313.00	Multiplier Correct?	Satisfactory

MUN-T1

Meter Number:	2 278 503	Multiplier:	24000.00
Multiplier Correct?	Satisfactory		

MUN-T2

Meter Number:	8 854 237	Multiplier:	24000.00
Multiplier Correct?	Satisfactory		

MUN-12L-B

210152 - CB-Bulk Oil	Sat Unsat N/A C/C		Sat Unsat N/A C/C
Breaker Position	Remote	Breaker Status	Closed
Bushings	Satisfactory	Cabinet Light	Satisfactory
Conduits	Satisfactory	Counter (previous: 1246.00)	1246.00
Equipment Identification	Satisfactory	Foundation	Satisfactory
Grounding	Satisfactory	Hinges / Hasps / Latches and Handles	Satisfactory
House Heater	Satisfactory	Oil Leaks	Satisfactory
Oil Level	Satisfactory	PCB Label	Satisfactory
Physical Condition	Satisfactory	Springs Charged	Satisfactory
Tank Heater	Satisfactory		

MUN-14L-B

210155 - CB-Bulk Oil	Sat Unsat N/A C/C		Sat Unsat N/A C/C
Breaker Position	Remote	Breaker Status	Closed
Bushings	Satisfactory	Cabinet Light	Satisfactory
Conduits	Satisfactory	Counter (previous: 0.00)	8.00
Equipment Identification	Satisfactory	Foundation	Satisfactory
Grounding	Satisfactory	Hinges / Hasps / Latches and Handles	Satisfactory
House Heater	Satisfactory	Max Amps Phase A (previous: 0.00)	344.60
Max Amps Phase B (previous: 0.00)	368.50	Max Amps Phase C (previous: 0.00)	342.20
Oil Leaks	Satisfactory	Oil Level	Satisfactory
PCB Label	Satisfactory	Physical Condition	Satisfactory
Springs Charged	Satisfactory	Tank Heater	Satisfactory

MUN-T1

200142 - Power Xfmr-TC	Sat Unsat N/A C/C		Sat Unsat N/A C/C
Cabinet Dry	Satisfactory	Cabinet Heater	Satisfactory
Diaphragm in Relief Vent	Satisfactory	Fans	Satisfactory
Foundation	Satisfactory	Gas Detector	Satisfactory
Glass in Gauges	Satisfactory	Grounding	Satisfactory
Hinges / Hasps / Latches and Handles	Satisfactory	Insulators and Bushings	Satisfactory
Max Oil Temp (previous: 0.00)	38.00	Max Winding Temp (previous: 0.00)	42.00
Oil Leaks	Satisfactory	Oil Level	Satisfactory
PCB Label	Satisfactory	Physical Condition	Satisfactory
Silica Gel	Satisfactory		

MUN-T1-B

210341 - CB-Air	Sat Unsat N/A C/C		Sat Unsat N/A C/C
Breaker Status	Closed	Counter (previous: 0.00)	74.00
Cubicle Heater	Satisfactory	Equipment Identification	Satisfactory

Hinges / Hasps / Latches and Handles	Satisfactory	Max Amps Phase A (previous: 0.00)	200.00
Max Amps Phase B (previous: 0.00)	270.00	Max Amps Phase C (previous: 0.00)	270.00
Physical Condition	Satisfactory		

MUN-T2

200273 - Power Xfmr-TC	Sat Unsat N/A C/C		Sat Unsat N/A C/C
Cabinet Dry	Satisfactory	Cabinet Heater	Satisfactory
Cabinet Light	Satisfactory	Diaphragm in Relief Vent	Satisfactory
Fans	Satisfactory	Foundation	Satisfactory
Gas Detector	Satisfactory	Glass in Gauges	Satisfactory
Grounding	Satisfactory	Hinges / Hasps / Latches and Handles	Satisfactory
Insulators and Bushings	Satisfactory	Max Oil Temp (previous: 0.00)	38.00
Max Winding Temp (previous: 0.00)	40.00	Oil Leaks	Satisfactory
Oil Level	Satisfactory	PCB Label	Satisfactory
Physical Condition	Satisfactory	Silica Gel	Satisfactory

MUN-T2-B

210373 - CB-Air	Sat Unsat N/A C/C		Sat Unsat N/A C/C
Breaker Status	Closed	Counter (previous: 0.00)	99987.00
Cubicle Heater	Satisfactory	Equipment Identification	Satisfactory
Hinges / Hasps / Latches and Handles	Satisfactory	Max Amps Phase A (previous: 0.00)	405.00
Max Amps Phase B (previous: 0.00)	410.00	Max Amps Phase C (previous: 0.00)	410.00
Physical Condition	Satisfactory		

MUN-TB-1-2

210372 - CB-Air	Sat Unsat N/A C/C		Sat Unsat N/A C/C
Breaker Status	Closed	Counter (previous: 99921.00)	99921.00
Cubicle Heater	Satisfactory	Equipment Identification	Satisfactory
Hinges / Hasps / Latches and Handles	Satisfactory	Physical Condition	Satisfactory
Springs Charged	Satisfactory		

Special Instructions:

Please verify the legibility of all Power Transformer Nameplates and take pictures of any that are not legible and/or in bad shape.

Print

001916 Pepperrell
April, 2010

MSF002
Form No. 139

NEWFOUNDLAND POWER
A FORTIS COMPANY

Maintenance Standard Report Form

Revised: 10/31/2007

Routine Substation Inspection

Sub: **001916 Pepperrell**	W.O. Number: **88167**
Inspection Type: **SUBSTATION INSPECTION**	Completed By: ~~**Jeff Clark**~~ Wayne England
	Date Completed: **2010/04/14**

Mark X in approprate block. Enter measurements as required.
Enter unmultiplied values when asked. Otherwise enter multiplied values.

Arc Flash Equipment

Arc Flash Hoods (2)	Satisfactory	Arc Flash Jackets (2)	Satisfactory
Arc Flash Pants (2)	Satisfactory	Cabinet Signage	Satisfactory
Earplugs	Satisfactory	Outside Signage	Satisfactory

Building & Accessories

AC Lighting	Satisfactory	AC Panel	Satisfactory
Building Condition	Satisfactory	Danger and Caution Tags	Satisfactory
DC Lighting	Satisfactory	DC Panel	Satisfactory
Exit Sign	Satisfactory	Fire Extinguisher	Satisfactory
First Aid Kit	Satisfactory	Flashlight	Satisfactory
Hard Hats	Satisfactory	Heaters	Satisfactory
Housekeeping	Satisfactory	Telephone and Directory	Satisfactory
Wall Cabinet	Satisfactory		

Control Panels

Control Panel Lamps	Satisfactory	Equipment Identification	Satisfactory
Meters	Satisfactory	Relay Targets	Satisfactory

General Properties

*Special Instructions Completed	Satisfactory	Cable Trench Covers	Satisfactory
Crushed Stone	Satisfactory	Drainage	Satisfactory
Fence and Fence Grounding	Satisfactory	Gates and Locks	Satisfactory
Ground Sticks and/or Hot Sticks	Satisfactory	High Voltage Danger Signs	Satisfactory
Snow Clearing	Satisfactory	Station Service	Satisfactory
Vandalism	Satisfactory	Vegetation	Satisfactory
Yard Clean	Satisfactory	Yard Lighting	Satisfactory

Miscellaneous Equipment

Lightning Arrestors	Satisfactory	Potential Transformers	Satisfactory
Potheads and Cables	Satisfactory	Switch Blades	Satisfactory

General Metering

PEP-S/S

Meter Number: ____________ Multiplier: 30.00

KWH: unmultiplied reading (previous: 0.00)	5266.00	Multiplier Correct?	Satisfactory
PEP-T1			
Meter Number:	______________	Multiplier:	1000.00
Multiplier Correct?			

PEP-01-B

210322 - CB-Air	Sat Unsat N/A C/C		Sat Unsat N/A C/C
Breaker Status	Open	Counter (previous: 674.00)	674.00
Cubicle Heater	Satisfactory	Equipment Identification	Satisfactory
Hinges / Hasps / Latches and Handles	Satisfactory	Physical Condition	Satisfactory
Springs Charged	Satisfactory		

PEP-02-B

210321 - CB-Air	Sat Unsat N/A C/C		Sat Unsat N/A C/C
Breaker Status	Closed	Counter (previous: 554.00)	568.00
Cubicle Heater	Satisfactory	Equipment Identification	Satisfactory
Hinges / Hasps / Latches and Handles	Satisfactory	Physical Condition	Satisfactory
Springs Charged	Satisfactory		

PEP-03-B

210320 - CB-Air	Sat Unsat N/A C/C		Sat Unsat N/A C/C
Breaker Status	Closed	Counter (previous: 520.00)	521.00
Cubicle Heater	Satisfactory	Equipment Identification	Satisfactory
Hinges / Hasps / Latches and Handles	Satisfactory	Physical Condition	Satisfactory
Springs Charged	Satisfactory		

PEP-04-B

210370 - CB-Air	Sat Unsat N/A C/C		Sat Unsat N/A C/C
Breaker Status	Closed	Counter (previous: 306.00)	306.00
Cubicle Heater	Satisfactory	Equipment Identification	Satisfactory
Hinges / Hasps / Latches and Handles	Satisfactory	Physical Condition	Satisfactory
Springs Charged	Satisfactory		

PEP-16L-B

210668 - CB-SF6	Sat Unsat N/A C/C		Sat Unsat N/A C/C
Breaker Position	Remote	Breaker Status	Closed
Bushings	Satisfactory	Cabinet Heater	Satisfactory
Cabinet Light	Satisfactory	Conduits	Satisfactory
Counter (previous: 0.00)	31.00	Equipment Identification	Satisfactory
Foundation	Satisfactory	Gas Pressure (previous: 0.00)	0.00
Gas Pressure	Satisfactory	Grounding	Satisfactory
Hinges / Hasps / Latches and Handles	Satisfactory	Lubrication	Satisfactory
Max Amps Phase A (previous: 0.00)	177.80	Max Amps Phase B (previous: 0.00)	191.40
Max Amps Phase C (previous: 0.00)	186.30	Physical Condition	Satisfactory
Springs Charged	Satisfactory		

PEP-74L-B

210359 - CB-Bulk Oil	Sat Unsat N/A C/C		Sat Unsat N/A C/C
Breaker Position	Remote	Breaker Status	Closed
Bushings	Satisfactory	Cabinet Light	Satisfactory

Conduits	Satisfactory	Counter (previous: 0.00)	180.00
Equipment Identification	Satisfactory	Foundation	Satisfactory
Grounding	Satisfactory	Hinges / Hasps / Latches and Handles	Satisfactory
House Heater	Satisfactory	Max Amps Phase A (previous: 0.00)	72.27
Max Amps Phase B (previous: 0.00)	82.69	Max Amps Phase C (previous: 0.00)	89.01
Oil Leaks	Satisfactory	Oil Level	
PCB Label		Physical Condition	
Springs Charged		Tank Heater	

PEP-BAT

100286- Battery	Sat Unsat N/A C/C		Sat Unsat N/A C/C
Apron and Goggles	Satisfactory	Cleanliness	Satisfactory
Condition of Posts	Satisfactory	Eye Wash	Satisfactory
Fan or Vent	Satisfactory	Fluid Film	Satisfactory
Pilot Cell Temperature oC (previous: 15.40)	15.80		

PEP-CHG

110203 - Charger	Sat Unsat N/A C/C		Sat Unsat N/A C/C
Charger Current A (previous: 2.50)	2.50	Equalize Voltage V (previous: 134.70)	133.80
Equip. Current A (previous: 2.50)	2.50	Float Voltage V (previous: 134.70)	133.80

PEP-T1

200309 - Power Xfmr-TC	Sat Unsat N/A C/C		Sat Unsat N/A C/C
Cabinet Dry	Satisfactory	Cabinet Heater	Satisfactory
Cabinet Light	Satisfactory	Diaphragm in Relief Vent	Satisfactory
Fans	Satisfactory	Foundation	Satisfactory
Gas Detector	Satisfactory	Glass in Gauges	Satisfactory
Grounding	Satisfactory	Hinges / Hasps / Latches and Handles	Satisfactory
Insulators and Bushings	Satisfactory	Max Oil Temp (previous: 0.00)	52.00
Max Winding Temp (previous: 0.00)	53.00	Oil Leaks	Satisfactory
Oil Level	Satisfactory	PCB Label	Satisfactory
Physical Condition	Satisfactory	Silica Gel	Satisfactory

PEP-T1-B

210325 - CB-Air	Sat Unsat N/A C/C		Sat Unsat N/A C/C
Breaker Status	Closed	Counter (previous: 0.00)	57.00
Cubicle Heater	Satisfactory	Equipment Identification	Satisfactory
Hinges / Hasps / Latches and Handles	Satisfactory	Max Amps Phase A (previous: 0.00)	709.00
Max Amps Phase B (previous: 0.00)	765.00	Max Amps Phase C (previous: 0.00)	738.00
Physical Condition	Satisfactory	Springs Charged	Satisfactory

PEP-TB-1-2

210616 - CB-Air	Sat Unsat N/A C/C		Sat Unsat N/A C/C
Breaker Position	Local	Breaker Status	Open
Counter (previous: 0.00)	1386.00	Cubicle Heater	Satisfactory
Equipment Identification	Satisfactory	Hinges / Hasps / Latches and Handles	Satisfactory
Lubrication	Satisfactory	Max Amps Phase A (previous: 0.00)	0.00
Max Amps Phase B (previous: 0.00)	0.00	Max Amps Phase C (previous: 0.00)	0.00
Physical Condition	Un-Satisfactory	Springs Charged	Satisfactory

PEP-TB-1-3

210324 - CB-Air

	Sat Unsat N/A C/C		Sat Unsat N/A C/C
Breaker Status	Closed	Counter (previous: 94.00)	94.00
Cubicle Heater	Satisfactory	Equipment Identification	Satisfactory
Hinges / Hasps / Latches and Handles	Satisfactory	Physical Condition	Satisfactory
Springs Charged	Satisfactory		

Appendix B

Avantis Work List for Sample Substations

Work Order	Work Order Title	Name	Entity location	Date work completed
55354	TO INSTALL GROUNDING STUDS ON MUN T1 CABLES TRANSFORMER SIDE.	200142 - Power Xfmr-TC	MUN-T1	
89526	Transformer Conditional Assessment (TCA)	200142 - Power Xfmr-TC	MUN-T1	
59130	MAINTENANCE IV FOR AIR CIRCUIT BREAKER	210372 - CB-Air	MUN-TB-1-2	
84730	MAINTENANCE IV FOR AIR CIRCUIT BREAKER	210373 - CB-Air	MUN-T2-B	
77642	MUN 14L REPAIR CABLE LEAK	MUN-14L-B	Memorial Substation	
87730	MAINTENANCE III FOR BATTERY CHARGER	110249- Charger	MUN-CHG	4/14/2010
87736	MAINTENANCE III FOR BATTERY	100323- Battery	MUN-BAT-S	4/14/2010
85408	MUN 12L modify wiring and test	MUN-12L-B	Memorial Substation	3/16/2010
75157	MUN 12L modify wiring and test	MUN-12L-B	Memorial Substation	12/10/2009
81825	MAINTENANCE III FOR BATTERY	100323- Battery	MUN-BAT-S	11/25/2009
84556	Mon. sub. man gate	MUN Buildings	Memorial Substation	11/3/2009
82924	Breaker Oil Analysis (BOA)	210152 - CB-Bulk Oil	MUN-12L-B	10/27/2009
84511	Changed Silica Gel	200273 - Power Xfmr-TC	MUN-T2	10/21/2009
82177	Transformer Conditional Assessment (TCA)	200273 - Power Xfmr-TC	MUN-T2	9/2/2009
82178	Breaker Oil Analysis (BOA)	210155 - CB-Bulk Oil	MUN-14L-B	9/2/2009
79368	MUN MAINTENANCE I TO INSTALL BATTERY CHARGER @ MUN SUB	110249- Charger	MUN-CHG	7/9/2009
79369	MUN MAINTENANCE I TO INSTALL BATTERY BANK 100323 @ MUN SUB	100323- Battery	MUN-BAT-S	7/9/2009
79716	Transformer Conditional Assessment (TCA)	200142 - Power Xfmr-TC	MUN-T1	6/18/2009

Work Order	Work Order Title	Name	Entity location	Date work completed
79530	Replaced HV Signs	MUN Buildings	Memorial Substation	5/8/2009
76314	REPAIRS REQUIRED TO BOTTOM RAIL OF GATE	MUN Buildings	Memorial Substation	1/16/2009
67316	GPS SYSTEM NOT WORKING PROPERLY	RTU GPS	MUN RTU	11/30/2008
75099	Problem with Comm Link on 14L	MUN Telecommunication Equipment	MUN	11/26/2008
74388	Replaced HV Signs	MUN Buildings	Memorial Substation	11/8/2008
73129	Breaker Oil Analysis (BOA)	210152 - CB-Bulk Oil	MUN-12L-B	10/2/2008
73549	signage	MUN Buildings	Memorial Substation	10/2/2008
72239	Transformer Conditional Assessment (TCA)	200273 - Power Xfmr-TC	MUN-T2	9/10/2008
72276	Breaker Oil Analysis (BOA)	210155 - CB-Bulk Oil	MUN-14L-B	9/10/2008
72745	Replaced HV Signs	MUN Buildings	Memorial Substation	9/10/2008
71333	Update Local & Area Single Line Diagrams	MUN Buildings	Memorial Substation	8/5/2008
69680	Transformer Conditional Assessment (TCA)	200142 - Power Xfmr-TC	MUN-T1	6/9/2008
70248	Replaced HV Signs	MUN Buildings	Memorial Substation	6/9/2008
70077	Changed Silica Gel	210155 - CB-Bulk Oil	MUN-14L-B	5/27/2008
70084	Changed Silica Gel	210152 - CB-Bulk Oil	MUN-12L-B	5/27/2008
66650	Broken	MUN Buildings	Memorial Substation	2/6/2008
66651	Changed Silica Gel	200273 - Power Xfmr-TC	MUN-T2	2/6/2008
65381	Replaced HV Signs	MUN Buildings	Memorial Substation	12/14/2007
65018	REPLACE GATEWAY AT ROCKY POND SUB	ROP Telecommunication Equipment	ROP	11/27/2007
63105	Breaker Oil Analysis (BOA)	210152 - CB-Bulk Oil	MUN-12L-B	10/11/2007

Work Order	Work Order Title	Name	Entity location	Date work completed
62279	Transformer Conditional Assessment (TCA)	200273 - Power Xfmr-TC	MUN-T2	9/19/2007
62313	Breaker Oil Analysis (BOA)	210155 - CB-Bulk Oil	MUN-14L-B	9/19/2007
55355	TO REPLACE LEAKY OIL CABLES WITH NEW CROSSLINK CABLES	190083 - Cubicle Switchgear	MUN-T1-B	9/5/2007
62652	caution stickers	MUN Buildings	Memorial Substation	8/27/2007
62653	caution stickers	MUN Buildings	Memorial Substation	8/27/2007
61585	Update Local & Area Single Line Diagrams	MUN Buildings	Memorial Substation	8/1/2007
59158	Transformer Conditional Assessment (TCA)	200142 - Power Xfmr-TC	MUN-T1	6/14/2007
59562	Replaced HV Signs	MUN Buildings	Memorial Substation	5/1/2007
55415	CHANGE SWITCH LABELS ON MUN-T1 AND MUN-T2	MUN-T1-D	Memorial Substation	4/2/2007
52584	Update Local & Area Single Line Diagrams	MUN Buildings	Memorial Substation	3/2/2007
55371	OIL SAMPLE FROM CABLES MUN-T1	200142 - Power Xfmr-TC	MUN-T1	1/18/2007
55346	TO ADJUST LIMIT SW. & RE-GREASE RACKING MECK.	190083 - Cubicle Switchgear	MUN-T1-B	11/2/2006
54722	MAINTENANCE IV FOR AIR CIRCUIT BREAKER	210341 - CB-Air	MUN-T1-B	11/1/2006
54507	MAINTENANCE III FOR POWER TRANSFORMER PROTECTION INSPECTIONS	200142 - Power Xfmr-TC	MUN-T1	10/30/2006
53201	Transformer Conditional Assessment (TCA)	200273 - Power Xfmr-TC	MUN-T2	9/15/2006
53235	Breaker Oil Analysis (BOA)	210155 - CB-Bulk Oil	MUN-14L-B	9/15/2006
24437	MAINTENANCE IV FOR TRANSFORMER OFF CIRCUIT TAPCHANGER	200273 - Power Xfmr-TC	MUN-T2	6/2/2006

Work Order	Work Order Title	Name	Entity location	Date work completed
50479	MAINTENANCE III FOR POWER TRANSFORMER PROTECTION INSPECTIONS	200273 - Power Xfmr-TC	MUN-T2	6/1/2006
50617	Transformer Conditional Assessment (TCA)	200142 - Power Xfmr-TC	MUN-T1	6/1/2006
50639	Breaker Oil Analysis (BOA)	210152 - CB-Bulk Oil	MUN-12L-B	6/1/2006
37417	T1-B cubicle heater not working	210341 - CB-Air	MUN-T1-B	5/8/2006
31985	REPLACE COUNTER ON MUN-12L-B (210152)	210152 - CB-Bulk Oil	MUN-12L-B	1/12/2006

Work Order	Work Order Title	Name	Entity location	Date work completed
89432	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	
88510	obtain PAR file from PEP GW	Gateway	PEP	
78620	PEP-04-B AUXILIARY SWITCHES NEED REPAIRS / REPLACEMENT	210370 - CB-Air	PEP-04-B	
78619	PEP-03-B AUXILIARY SWITCHES NEED REPAIRS / REPLACEMENT.	210320 - CB-Air	PEP-03-B	
74425	CHECK / CORRECT AND RESET ALARM ON P142 RELAY AT PEP	PEP-04- Feeder Protection Relay	Pepperrell Substation	
70609	MAINTENANCE IV FOR AIR CIRCUIT BREAKER	210324 - CB-Air	PEP-TB-1-3	
64219	MAINTENANCE III FOR POWER TRANSFORMER PROTECTION INSPECTIONS	200309 - Power Xfmr-TC	PEP-T1	
56420	MAINTENANCE IV FOR AIR CIRCUIT BREAKER	210616 - CB-Air	PEP-TB-1-2	
56417	MAINTENANCE IV FOR AIR CIRCUIT BREAKER	210322 - CB-Air	PEP-01-B	
37617	MAINTENANCE IV FOR AIR CIRCUIT BREAKER	210325 - CB-Air	PEP-T1-B	
35220	INSTALL SUBSTATION ID SIGN	001916 Pepperrell Substation	St. John's (SUB)	
47189	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	1/10/2006
44821	Repair Fan on PEP-T1	200309 - Power Xfmr-TC	PEP-T1	1/10/2006
47849	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	2/2/2006
48705	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	3/8/2006
49557	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	4/3/2006
49406	Eye Wash Substation Maintenance	001916 Pepperrell Substation	St. John's (SUB)	4/18/2006

Work Order	Work Order Title	Name	Entity location	Date work completed
50039	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	5/8/2006
49956	Breaker Oil Analysis (BOA)	210359 - CB-Bulk Oil	PEP-74L-B	5/8/2006
50726	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	6/1/2006
51611	INSTALL ARC FLASH SIGNAGE AND SUITS	001916 Pepperrell Substation	St. John's (SUB)	6/27/2006
51787	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	7/4/2006
51679	Eye Wash Substation Maintenance	001916 Pepperrell Substation	St. John's (SUB)	7/5/2006
52520	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	8/23/2006
53343	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	9/8/2006
54152	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	10/3/2006
53939	Transformer Conditional Assessment (TCA)	200309 - Power Xfmr-TC	PEP-T1	10/3/2006
53922	Eye Wash Substation Maintenance	001916 Pepperrell Substation	St. John's (SUB)	10/3/2006
51203	Substation Grounding Refurbishment	001916 Pepperrell Substation	St. John's (SUB)	10/3/2006
54702	PCB INSPECTION	001916 Pepperrell Substation	St. John's (SUB)	11/3/2006
54537	Record Switch Company ID Numbers	001916 Pepperrell Substation	St. John's (SUB)	11/3/2006
54153	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	11/3/2006
54944	Correct Cabinet Grounding	210668 - CB-SF6	PEP-16L-B	11/6/2006
55566	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	12/12/2006
56573	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	1/9/2007
56462	Eye Wash Substation Maintenance	001916 Pepperrell Substation	St. John's (SUB)	1/9/2007
57340	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	2/1/2007

Work Order	Work Order Title	Name	Entity location	Date work completed
52589	Update Local & Area Single Line Diagrams	PEP Buildings (2)	Pepperrell Substation	2/1/2007
58176	repaired door handle on PEP-03-B cubicle(it had fallen off)	PEP Buildings (2)	Pepperrell Substation	3/5/2007
58175	Cleaned Battery Terminals	PEP-BAT	Pepperrell Substation	3/5/2007
58174	replaced AC lightbulbs	PEP Buildings (2)	Pepperrell Substation	3/5/2007
58173	Changed Silica Gil	PEP-T1	Pepperrell Substation	3/5/2007
57863	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	3/5/2007
55255	THERMOSCAN SUBSTATION	001916 Pepperrell Substation	St. John's (SUB)	3/7/2007
58881	Cleaned Battery Terminals	PEP-BAT	Pepperrell Substation	4/9/2007
58614	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	4/9/2007
58471	Eye Wash Substation Maintenance	001916 Pepperrell Substation	St. John's (SUB)	4/9/2007
58888	MAINTENANCE I TO INSTALL CHARGER 110203 PEPPERELL SUB.	110203 - Charger	Pepperell Sub.	4/16/2007
58886	MAINTENANCE I TO INSTALL BATTERY BANK 100286 AT PEPPERELL SUB	100286- Battery	Pepperell Sub.	4/16/2007
59275	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	5/1/2007
59188	Breaker Oil Analysis (BOA)	210359 - CB-Bulk Oil	PEP-74L-B	5/15/2007
60280	pep	PEP Buildings (2)	Pepperrell Substation	6/11/2007
59982	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	6/11/2007
60806	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	7/4/2007
60690	Eye Wash Substation Maintenance	001916 Pepperrell Substation	St. John's (SUB)	7/5/2007

Work Order	Work Order Title	Name	Entity location	Date work completed
61590	Update Local & Area Single Line Diagrams	PEP Buildings (2)	Pepperrell Substation	8/1/2007
61518	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	8/1/2007
60251	CORRECT GROUND ON WIRING FROM RTU TO PEP-16L-B	RTU - SAGE 2100	PEP	8/29/2007
62431	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	9/20/2007
63216	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	10/9/2007
63072	Eye Wash Substation Maintenance	001916 Pepperrell Substation	St. John's (SUB)	10/9/2007
63085	Transformer Conditional Assessment (TCA)	200309 - Power Xfmr-TC	PEP-T1	10/11/2007
63058	MAINTENANCE III FOR BATTERY	100286- Battery	Pepperell Sub.	10/18/2007
64293	REPAIR HOLE IN YARD LIGHTING JUNCTION BOX	001916 Pepperrell Substation	St. John's (SUB)	11/1/2007
64019	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	11/1/2007
64808	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	12/3/2007
65652	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	1/9/2008
65542	Eye Wash Substation Maintenance	001916 Pepperrell Substation	St. John's (SUB)	1/10/2008
66649	Hotstick Missing from Pepperell Sub	001916 Pepperrell Substation	St. John's (SUB)	2/6/2008
66286	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	2/6/2008
67459	arc suit	PEP Buildings (2)	Pepperrell Substation	3/4/2008
67071	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	3/4/2008
67836	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	4/1/2008

Work Order	Work Order Title	Name	Entity location	Date work completed
68360	MAINTENANCE III FOR BATTERY CHARGER	110203 - Charger	Pepperell Sub.	4/9/2008
67679	MAINTENANCE III FOR BATTERY	100286- Battery	Pepperell Sub.	4/9/2008
67712	Eye Wash Substation Maintenance	001916 Pepperrell Substation	St. John's (SUB)	4/11/2008
68947	Breaker Oil Analysis (BOA)	210359 - CB-Bulk Oil	PEP-74L-B	5/1/2008
69032	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	5/2/2008
69952	MAINTENANCE II FOR SUBSTSTION INSPECTION (GROUP 5)	001916 Pepperrell Substation	St. John's (SUB)	6/11/2008
70756	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	7/4/2008
70636	Eye Wash Substation Maintenance	001916 Pepperrell Substation	St. John's (SUB)	7/4/2008
71718	fence repair	001916 Pepperrell Substation	St. John's (SUB)	7/16/2008
71639	MAINTENANCE II FOR SUBSTSTION INSPECTION (GROUP 5)	001916 Pepperrell Substation	St. John's (SUB)	8/28/2008
71338	Update Local & Area Single Line Diagrams	PEP Buildings (2)	Pepperrell Substation	8/28/2008
72373	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	9/11/2008
73548	signage	PEP Buildings (2)	Pepperrell Substation	10/1/2008
73547	arc suits	PEP Buildings (2)	Pepperrell Substation	10/1/2008
73415	MAINTENANCE II FOR SUBSTSTION INSPECTION (GROUP 5)	001916 Pepperrell Substation	St. John's (SUB)	10/2/2008
73103	Transformer Conditional Assessment (TCA)	200309 - Power Xfmr-TC	PEP-T1	10/2/2008
73077	Eye Wash Substation Maintenance	001916 Pepperrell Substation	St. John's (SUB)	10/2/2008
73050	MAINTENANCE III FOR BATTERY	100286- Battery	Pepperell Sub.	10/29/2008
74403	pest control	PEP Buildings (2)	Pepperrell Substation	11/11/2008
74402	PEP-CHG calibration	110203 - Charger	Pepperell Sub.	11/11/2008

Work Order	Work Order Title	Name	Entity location	Date work completed
73799	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	11/11/2008
73714	Breaker Oil Analysis (BOA)	210359 - CB-Bulk Oil	PEP-74L-B	11/24/2008
75089	Broken	PEP-04-B	Pepperrell Substation	11/25/2008
75088	PEP-04-B P142 Watchdog alarm	PEP-04-B	Pepperrell Substation	11/25/2008
74529	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	12/5/2008
48315	Switch Maintenance PEP-74L-GS	PEP-74L-GS	Pepperrell Substation	12/9/2008
75567	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	1/12/2009
76679	Changed eyewash	PEP Buildings (2)	Pepperrell Substation	1/23/2009
76831	Changed Silica Gel	001916 Pepperrell Substation	St. John's (SUB)	2/3/2009
76426	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 5)	001916 Pepperrell Substation	St. John's (SUB)	2/3/2009
74753	Eye Wash Substation Maintenance	001916 Pepperrell Substation	St. John's (SUB)	2/25/2009
77288	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	3/2/2009
78085	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 5)	001916 Pepperrell Substation	St. John's (SUB)	4/6/2009
77929	MAINTENANCE III FOR BATTERY	100286- Battery	Pepperell Sub.	4/8/2009
77797	MAINTENANCE III FOR BATTERY CHARGER	110203 - Charger	Pepperell Sub.	4/8/2009
79139	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	5/4/2009
80225	hookstick	PEP Buildings (2)	Pepperrell Substation	5/27/2009
79327	Eye Wash Substation Maintenance	001916 Pepperrell Substation	St. John's (SUB)	5/27/2009
79665	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 5)	001916 Pepperrell Substation	St. John's (SUB)	6/3/2009

Work Order	Work Order Title	Name	Entity location	Date work completed
80987	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 5)	001916 Pepperrell Substation	St. John's (SUB)	7/2/2009
78705	MAINTENANCE IV FOR SWITCHGEAR CUBICLE	190206 - Cubicle Switchgear	PEP-02-B	7/21/2009
56416	PEP-02 MAINTENANCE IV FOR AIR CIRCUIT BREAKER	210321 - CB-Air	PEP-02-B	7/28/2009
82564	eyewash station stand	PEP Buildings (2)	Pepperrell Substation	8/11/2009
82563	AC and DC Lighting (Changed all bulbs to CFL)	PEP Buildings (2)	Pepperrell Substation	8/11/2009
81380	Eye Wash Substation Maintenance	001916 Pepperrell Substation	St. John's (SUB)	8/11/2009
81226	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	8/11/2009
82583	METAL PLATE NEEDED TO COVER HOLE IN PEP-T1-B PANEL.	210325 - CB-Air	PEP-T1-B	8/12/2009
82119	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 5)	001916 Pepperrell Substation	St. John's (SUB)	9/2/2009
79439	PEP CHG, CHECK WHY LOW DC VOLTS (123VDC)	110203 - Charger	Pepperell Sub.	9/9/2009
83015	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperrell Substation	St. John's (SUB)	10/1/2009
83796	pest control	PEP Buildings (2)	Pepperrell Substation	10/5/2009
83795	pest control	PEP Buildings (2)	Pepperrell Substation	10/5/2009
83864	pest control	PEP Buildings (2)	Pepperrell Substation	10/6/2009
82918	Transformer Conditional Assessment (TCA)	200309 - Power Xfmr-TC	PEP-T1	10/6/2009
84173	Breaker Oil Analysis (BOA)	210359 - CB-Bulk Oil	PEP-74L-B	11/4/2009
84092	Eye Wash Substation Maintenance	001916 Pepperrell Substation	St. John's (SUB)	11/4/2009
84022	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 5)	001916 Pepperrell Substation	St. John's (SUB)	11/4/2009

Work Order	Work Order Title	Name	Entity location	Date work completed
82883	MAINTENANCE III FOR BATTERY	100286- Battery	Pepperell Sub.	11/25/2009
84834	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperell Substation	St. John's (SUB)	12/7/2009
86277	best lock replaced	PEP Buildings (2)	Pepperell Substation	1/15/2010
86276	repaired yard lights	001916 Pepperell Substation	St. John's (SUB)	1/15/2010
86275	replaced flashlight battery	PEP Buildings (2)	Pepperell Substation	1/15/2010
85731	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 5)	001916 Pepperell Substation	St. John's (SUB)	1/15/2010
86302	Eye Wash Substation Maintenance	001916 Pepperell Substation	St. John's (SUB)	2/5/2010
86392	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperell Substation	St. John's (SUB)	2/26/2010
86828	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 5)	001916 Pepperell Substation	St. John's (SUB)	3/5/2010
87790	PEP-02-B AIR SAMPLING FOR ASBESTOS DUST.	210321 - CB-Air	PEP-02-B	3/24/2010
88509	PEP Gateway replace power supply	Gateway	PEP	4/7/2010
87620	MAINTENANCE III FOR BATTERY CHARGER	110203 - Charger	Pepperell Sub.	4/7/2010
87497	MAINTENANCE III FOR BATTERY	100286- Battery	Pepperell Sub.	4/7/2010
88167	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 3)	001916 Pepperell Substation	St. John's (SUB)	4/14/2010
88930	MAINTENANCE II FOR SUBSTATION INSPECTION (GROUP 5)	001916 Pepperell Substation	St. John's (SUB)	5/17/2010

Appendix C

Detailed Substation List

ST. JOHN'S SUBSTATIONS										
		H.V. STRUCTURE & BUS				L.V. Structure & Bus				
			Structure				Structure			
Substation	**Total Xfmr Capacity (MVA)**	**Year Installed**	**Steel**	**Wood**	**Operating Voltage (kV)**	**Year Installed**	**Steel**	**Wood**	**Operating Voltage (kV)**	**Remarks**
Big Pond	11.1	1977	-	X	66	1977	-	X	12.47	
Broad Cove	25	1955	-	X	66	1977	-	X	12.47	LV bus extended in 1989.
Cape Broyle Plant	6.7 (dist.) 8.4 (gen.)	-	-	X	66	- -	- -	X X	12.47 6.9	
Chamberlains	50	1976	X	-	66	1976	X	-	25	CHA-T2 (200353) and CHA-03 added in 2004. LV bus additions completed in 2004.
Fermeuse	4	2009	X	-	66	1976	-	X	12.47	HV bus first built in 1976
Glendale	50	1976	X	-	66	1976	X	-	12.47	HV bus extended in 1987.
Goulds	10 (trans) 33 (dist)	1990	-	X	66	1990	X	-	12.47	LV steel bus extended in 2007 and wooden bus removed
Hardwoods	65	1966 1984	X X	- -	66 66	1966 1990	X X	- -	12.47 25	HV bus extended in 1990. HWD-08 terminated in 2001.
Horse Chops Plant	12	2009	X	-	66	2009	X	-	6.9	Substation rebuilt in 2009
Kelligrews	14.95	1977	X	-	66	1977	X	-	12.47	
Kenmount	50	1976	X	-	66	1976	X	-	25	LV bus extended in 1990.
Kings Bridge	45	1962 1977	X X	- -	66 66	1977 1959	- -	- -	12.47 4.16	LV Switchgear. LV Switchgear.
Memorial	34.83	1966	X	-	66	1966	-	-	12.47	LV Switchgear.
Mobile	6.7 (dist) 4.7 (trans)	1954	-	X	66	1965	-	X	12.47	HV bus rebuilt in 1990.
Mobile Plant	10	1954	-	X	66	1965	-	X	6.9	

ST. JOHN'S SUBSTATIONS										
		H.V. STRUCTURE & BUS				L.V. Structure & Bus				
			Structure				Structure			
Substation	**Total Xfmr Capacity (MVA)**	**Year Installed**	**Steel**	**Wood**	**Operating Voltage (kV)**	**Year Installed**	**Steel**	**Wood**	**Operating Voltage (kV)**	**Remarks**
Molloy's Lane	50	1967	-	X	66	1972	X	-	12.47	HV bus reconductored in 1990.
Morris Plant	1.5	1983	-	X	66	1983	-	X	2.4	LV Switchgear.
Oxen Pond	13.3	1966	X	-	66	1968	X	-	12.47	
Pepperrell	25	1978	X	-	66	1978	-	-	12.47	LV Switchgear.
Petty Harbour Plant	3 (dist) 6.7 (gen)	-	-	X	33	-	-	X	4.16 2.3	LV Switchgear.
Pierres Brook Plant	5 (trans)	2008	X	-	33	-	-	X	6.9	HV bus rebuilt in 2008
	0.0625					-	-	X	2.4	
Pulpit Rock	25	1976	X	-	66	1978	X	-	12.47	New Feeder PUL-03 terminated in 2004.
Ridge Road	40.00	1963	X	-	66	1965	-	-	12.47	LV Switchgear.
						1975	-	-	12.47	LV 4 kV Switchgear removed in 2007
Rocky Pond Plant	3.5	2009	X	X	66	2009	X	-	6.9	Substation rebuilt in 2009
Seal Cove	11.2 (dist)	-	X	-	66	-	-	X	12.47	LV Switchgear.
	3.3 (gen)					-	-	-	2.4	
St. John's Main	57.5	1954	X	-	66	1973	X	-	4.16	
						1978	-	-	12.47	LV Switchgear.
						1980	-	-	12.47	LV Switchgear.
						1983	-	-	12.47	LV Switchgear.

ST. JOHN'S SUBSTATIONS										
		H.V. STRUCTURE & BUS				L.V. Structure & Bus				
			Structure				Structure			
Substation	**Total Xfmr Capacity (MVA)**	**Year Installed**	**Steel**	**Wood**	**Operating Voltage (kV)**	**Year Installed**	**Steel**	**Wood**	**Operating Voltage (kV)**	**Remarks**
Stamp's Lane	75	1963	X	-	66	1974	X	-	12.47	HV extended in 1988.
						1960	-	-	4.16	LV Switchgear.
Topsail Plant	2.25	-	X	-	25	-	X	-	2.4	LV Switchgear.
Tors Cove Plant	7.5 (trans)	-	-	X	66	-	X	-	6.9	LV Switchgear.
Virginia Waters	73.7	1974	X	-	66	1974	X	-	12.47	15kV Bus extension installed in 2000 during termination of VIR-07. VIR-T3 (200354) installed, including 15kv bus modifications in 2003. VIR-08 terminated in 2005 with 15kV bus modifications.

AVALON SUBSTATIONS										
		H.V. STRUCTURE & BUS				L.V. Structure & Bus				
	Total Xfmr Capacity (MVA)		Structure		Operating Voltage (kV)		Structure		Operating Voltage (kV)	
Substation		Year Installed	Steel	Wood		Year Installed	Steel	Wood		Remarks
Bay Roberts	83.2 (trans)	1978	X	-	138	1966	X	-	66	
	20 (dist)	1984	X	-	138	1978	X	-	12.47	
Blaketown	41.6	1978	X	-	138	2001	-	X	66	Old structures installed in „67 (66kv) & ‛74 (25kv). Complete sub overhauled in 2001.
	20 (dist.)					2001	-	X	25	
Carbonear	25	1976	X	-	66	1976	X	-	12.47	
Clarkes Pond	20	1972	X	-	66	1972	X	-	12.47	
Colliers	16.7	1992	X	-	138	1992	-	X	12.47	COL-02 terminated in 2004 with additions to 12.5kV bus.
Dunville	8.3	1981	-	X	66	1981	-	X	25	
Harbour Grace	16.7	1973	-	X	66	1973	-	X	12.47	
Hearts Content	2.24 (dist)	Prior „66	X	-	66	1966	-	X	12.47	LV Switchgear.
	3 (gen)							-	2.4	
Holyrood	20	1977	X	-	138	1977	X	-	12.47	
Island Cove	13.3	1989	X	-	66	1989	-	X	12.47	
Islington	4	1974	-	X	66	1972	-	X	12.47	66kV poles replaced in 2000.
New Chelsea	6.67 (dist)	Prior „66	X	-	66	Prior „66	X	-	12.47	Complete Substation overhaul in 2004.
	5.33 (gen)					Prior „66	X	-	6.9	
New Harbour	13.3	1981	-	X	66	1981	-	X	12.47	
Quartz	0.725	1968	-	X	66	1968	-	X	4.16	Was called Newlite

AVALON SUBSTATIONS										
		H.V. STRUCTURE & BUS				L.V. Structure & Bus				
	Total Xfmr Capacity (MVA)		Structure		Operating Voltage (kV)		Structure		Operating Voltage (kV)	
Substation		Year Installed	Steel	Wood		Year Installed	Steel	Wood		Remarks
Old Perlican	14.96	1976	-	X	66	1976	-	X	12.47	
Pittmans Pond	2.25	Prior „66	-	X	12.47	Prior „66	X	-	2.4	
Placentia Junction	0.333	-	-	X	66	-	-	X	7.2	PJN-T1 replaced in 2003 with 200081.
Riverhead	6.7	Prior „72	-	X	66	Prior „72	-	X	12.47	
Springfield	20	1976	X	-	138	1976	X	-	12.47	
St. Catherines	6.7 4	2000		X	66	2000		X	25 12.5	Complete substation built in 2000. SCT-T2 (200315) installed in 2001.
Trepassey	6.7	Prior „72	-	X	66	Prior „72	-	X	12.47	
Victoria	0.6 (gen) 13.3 (dist)	Prior „66	-	X	66	Prior „66 Prior „66	- -	X X	12.47 2.4	
Western Avalon	10.0	1972	X	-	66	1974	-	X	12.47	

BURIN SUBSTATIONS										
		H.V. STRUCTURE & BUS				L.V. Structure & Bus				
			Structure				Structure			
Substation	Total Xfmr Capacity (MVA)	Year Installed	Steel	Wood	Operating Voltage (kV)	Year Installed	Steel	Wood	Operating Voltage (kV)	Remarks
Bay L'Argent	6.67	Prior „69	-	X	138	Prior „69	-	X	25	
Fall Pond Plant	0.75	Prior „66	-	X	12.47	1967	-	X	2.4	Replaced FPD-T1 in 2003.
Garnish	3.7	2009	-	-	66	2009	X	-	12.47	Substation rebuilt in 2009. No HV bus as tapped from transmission line
Grand Beach	0.33	1967	-	X	66	Prior „66	-	X	7.2	
Greenhill	20 (dist) 30 (gen)	1975	X	-	66	1979 1975	X -	- -	12.47 13.8	LV Switchgear.
Laurentian	10	1976	X	-	66	1976	X	-	12.47	
Lawn	0.75	Prior „66	-	X	25	Prior „66	-	X	0.6	Two single phase xfmr"s replaced in 2002.
Linton Lake	20	Prior „76	X	-	138	1990	-	X	12.47	
Marystown	20	1976	X	-	138	1976	X	-	12.47	
Monkstown	14.9	1980	-	X	138	1980	-	X	25	
Salt Pond	83.2 (trans) 15 (dist)	1968 1982	- X	X -	66 138	1989	X	-	12.47	HV extended in 1990. 4.16 and 13.8kV buses retired. T5 installed in 2003. Structure modifications in 2000 & 2003.
Webbers Cove	6.7	2001		X	66	2001		X	25	Complete substation built in 2001.
West Brook Plant	0.999	1967	-	X	12.47	Prior „66	-	X	2.4	T1 step-down xfmr"s (3-single phase units) replaced in 2003.

BONAVISTA SUBSTATIONS										
		H.V. STRUCTURE & BUS				L.V. Structure & Bus				
			Structure				Structure			
Substation	Total Xfmr Capacity (MVA)	Year Installed	Steel	Wood	Operating Voltage (kV)	Year Installed	Steel	Wood	Operating Voltage (kV)	Remarks
Bonavista	25	1990	X	-	138	1976	X	-	12.47	
Catalina	16.6 (trans) 20 (dist)	1978	X	-	138	1978 1979	X X	- -	66 12.47	
Clarenville	20 (dist) 25 (trans)	1976	X	-	138	1976 1976	- X	X -	66 12.47	
Lethbridge	6.7	1968	-	X	66	1976	X	-	25	
Lockston Plant	4 (dist) 5 (gen) 4 (gen)	Prior „66	- -	X X	66 46	Prior „66 Prior „66	- -	X X	12.47 6.9	
Milton	16.67	1976	X	-	66	1976	X	-	25	
Northwest Brook	11.2	1992	X	-	138	1992	-	X	25	
Port Blandford	16.7	1990	X	-	138	1990	-	X	25	
Port Union Plant	1	Prior „74	-	X	66	Prior „70	-	X	2.4	
Princeton Pond	-	2000		X	138	2000		X	66	
Summerville	4	Prior „69	-	X	66	Prior „69	-	X	25	
Sunnyside	25	Prior „75	X	-	138	1974	X	-	25	138 kV structure owned by N&LH.

GANDER SUBSTATIONS										
	Total Xfmr Capacity (MVA)	H.V. STRUCTURE & BUS				L.V. Structure & Bus				
		Year Installed	Structure		Operating Voltage (kV)	Year Installed	Structure		Operating Voltage (kV)	
Substation			Steel	Wood			Steel	Wood		Remarks
Boyds Cove	0.3	1988	X	-	66	-	-	-	-	Switching station. 66kV bus extended in 2000.
Cobbs Pond	41.6 (trans) 20 (dist)	1980	X	-	138	1980 1978	X -	- X	12.47 66	138kV bus modifications in 2001.
Gambo	41.6 (trans) 6.67 (dist)	1966 1980 1966	- X -	X - X	138 138 66	1966	-	X	25	
Gander	26.7 (trans) 20 (dist)	1966	X	-	138	Prior „66 2002	- -	X X	66 12.47	Old 12.47kV bus installed prior to ‟66.
Gander Bay	13.3	Prior „68	X	-	66	Prior „68	-	X	25	Substation rebuilt in 2000
Glenwood	8.3	1985	-	X	138	1985	-	X	25	
Glovertown	20	1976	X	-	138	1976	X	-	25	
Greenspond	2.8	1980	-	X	66	1980	-	X	12.47	
Hare Bay	5	1974	-	X	66	1974	-	X	25	
Jonathans Pond	0.333	1978	-	X	66	1978	-	X	7.2	
Roycefield	-	1997		X	66	-	-	-	-	Transmission switching station for direct supply to customer
Summerford	10	1973	-	X	66	1973	-	X	25	
Terra Nova	1	1973	-	X	138	1973	-	X	14.4	Additions to 138kV bus in 2001.
Trinity	5	1980	-	X	66	1980	-	X	25	
Twillingate	13.3	1976	-	X	66	1976	-	X	12.47	
Wesleyville	20 (gen) 13.3 (dist)	1974	-	X	66	1974	-	X	12.47 13.8	Gas Turbine relocated in 2003.

GRAND FALLS SUBSTATIONS										
		H.V. STRUCTURE & BUS				L.V. Structure & Bus				
			Structure				Structure			
Substation	Total Xfmr Capacity (MVA)	Year Installed	Steel	Wood	Operating Voltage (kV)	Year Installed	Steel	Wood	Operating Voltage (kV)	Remarks
Bishops Falls	20	1978	X	-	138	1978	X	-	25	
Botwood	20	1977	X	-	138	1977	X	-	25	
Buchans	-	-	-	-	-	-	-	-	12.47	Switches & recloser in NLH substation
Grand Falls	8.4	Prior „63	-	X	66	-	-	-	4.16	LV Switchgear.
Lewisporte	25	1974	-	X	66	1974	X	-	25	25kV structure replaced and upgrades complete on 66kV structure in 2001.
New Grand Falls	29.7 (trans) 40 (dist)	1977	X	-	138	1977 1977 1979	X X X	- - -	66 25 25	
Notre Dame Jct.		Prior „68	-	X	66	-	-	-	-	25kV Bus Retired.
Rattling Brook Plant	20 (gen) 5 (dist)	1959	-	X	66	1959	-	X	6.9 12.47	RBK-T1, T2 replaced in 2002 by one unit.
Sandy Brook Plant	7 (gen)	1963	-	X	66	1964	-	X	6.9	
Springdale	16.7	-	-	-	-	1978	-	X	25	HV bus owned by N&LH

CORNER BROOK SUBSTATIONS										
		H.V. STRUCTURE & BUS				L.V. Structure & Bus				
			Structure				Structure			
Substation	**Total Xfmr Capacity (MVA)**	**Year Installed**	**Steel**	**Wood**	**Operating Voltage (kV)**	**Year Installed**	**Steel**	**Wood**	**Operating Voltage (kV)**	**Remarks**
Bayview	35	1972	X	-	66	1972	X	-	12.47	T2 installed in 2004 along with other structure modifications.
Deer Lake	16.67	1968	X	-	66	Prior „73 1968	X X	- -	12.47 4.16	
Frenchmans Cove	6.67	1977	-	X	66	1977	-	X	12.47	
Gillams	6.67	1977	-	X	66	1977	-	X	12.47	
Howley	4	-	-	-	-	Prior „78	X	4.16	4.16	HV bus owned by N&LH
Humber	18.9	1968	X	-	66	1968 1982	- X	- -	4.16 12.47	LV Switchgear.
Indian River	2.67	-	-	-	-	Prior „77	-	X	25	HV bus owned by N&LH. Upgrade on structure and transformer complete in 2004.
Marble Mountain	4	1990	-	X	66	1990	-	X	12.47	
Massey Drive	-	Prior „77	-	-	66	-	-	-		Structures owned by N&LH. 12.47kV bus retired.
Pasadena	13.3	1974	X	-	66	1974	X	-	12.47	
Seal Cove Road	8.3	Prior „78	X	-	138	Prior „78	-	X	25	Structures and bus modifications in 2000.
Walbournes	45	1966	X	-	66	1966	-	-	12.47	LV Switchgear. T2 replaced in 2004 which included bus modifications.

STEPHENVILLE SUBSTATIONS										
		H.V. STRUCTURE & BUS				L.V. Structure & Bus				
	Total Xfmr Capacity (MVA)		Structure		Operating Voltage (kV)		Structure		Operating Voltage (kV)	
Substation		Year Installed	Steel	Wood		Year Installed	Steel	Wood		Remarks
Abrahams Cove	13.3	1977	-	X	66	1977	-	X	12.47	
Berry Head	7.46	1982	-	X	66	1982	-	X	12.47	
Doyle's	4									
Gallants Street	26.6	1977	X	-	66	1973	X	-	12.47	
Grand Bay	14.93	1983	X	-	66	1990	X	-	12.47	Completed modifications to structure in 2004.
Harmon	14.9	1968	-	X	66	1973	X	-	12.47	
Long Lake	14.9	1983	-	X	66	1983	-	X	25	T1 (200120) installed in 2000.
Lookout Brook Plant	10 (trans)	Prior 66	X	-	33	Prior 66	-	-	2.4	-
Port Aux Basques	3 (gen) 13.3 (dist)	Prior 68	-	X	66	Prior 66 1980 1984	- X X	X - -	4.16 12.47 12.47	LV Switchgear. 2.4kV bus retired.
Robinsons	6.7	1971	-	X	66	1974	-	X	25	415L re-terminated & addition to structure in 2001.
Rose Blanche Plant	7	1998	-	-	25	1998		X	6.9	Substation feeds directly into feeder, LGL-02
St. Georges	6.7 (dist)	1977	X	-	66	1977	X	-	12.47	
Stephenville Crossing	6.7	1977	X	-	66	1977	X	-	12.47	
Stephenville Gas Turbine	-	1977	X	-	66	-	-	-	-	HV bus owned by N&LH.
Wheelers		1968	-	X	66	-	-	-	-	Switching station.

Appendix D

Additional Substation Modification Information

Substation	Description
Abrahams Cove	2005 replace lightning arrestors; 2008 refurbish transformer and metering; 2009 replace LA
Broad Cove	2005 replace P&C, recloser, switch and voltage regulator; 2007 replace lightning arrestor replacements, replace transformer tap changer, replace power fuses holders
Bishop Falls	2008 Replace battery bank
Berry Head	2005 replace lightning arrestors, 2009 replace station service transformer
Big Pond	2005 replace lightning arrestors, power cables, power fuses and RTU; 2006 Increase transformer capacity and replace P&C; 2007 replace bus; 2008 replace reclosers; 2009 add petro plug; replace heat tracing, revenue metering
Bay L' Argent	2007 replace voltage regulator
Blaketown	2005 add P&C; 2006 add P&C; 2007 replace battery bank, HV switches, potential transformers, lightning arrestors, P&C, add varmint proofing; 2007 Install potential transformer; 2009 replace P&C
Boyles Cove	2006 replace battery bank
Bay Roberts	2005 add new potential transformer, replace P&C, install breaker; 2006 replace battery bank, site improvements, replace lightning arrestors; 2007 bus improvements
Bayview	2006 replace battery bank, breaker, HV switches, LA, transformer radiators, P&C, add PT; 2008 Replace breaker
Bonavista	2005 add voltage regulator
Buchans	2009 replace recloser, structure modifications
Cape Boyle	2005 replace power fuses; 2008 Improve bus structure, replace spill containment heat tracing, P&C improvements, replace lighting arrestors, site improvements; 2009 add petro plug
Carbonear	2005 add gate; 2006 P&C improvements; 2007 P&C improvements; 2009 replace P&C, metering; 2009 replace recloser, AC panel
Catalina	2005 replace metering tank, replace lightning arrestors; 2006 replace lightning arrestors, improve station service,
Chamberlains	2005 P&C improvements; 2006 replace LA & transformer gas detector
Clarkes Pond	2005 add gate, improve bus, install voltage regulator; 2008 replace grounding; 2009 replace grounding; 2009 add petro plugs
Clarenville	2005 install ground switch, add gate replace building roof; 2007 P&C improvements; 2008 replace battery bank and LA, P&C improvements; 2009 procurement for future replacement of P&C, extend poured in place cable trench
Cobbs Pond	2005 replace P&C; 2006 LA replacements, P&C improvements; 2008 Battery bank replacement, P&C improvements
Colliers	2005 replace HV switch, add control building, P&C improvements,
Deer Lake	2005 install recloser

Substation	Description
Doyles	2005 replace voltage regulator; 2006 replace LA, replace P&C; Replace voltage regulator; 2009 replace recloser
Dunville	2006 replace P&C and parts of bus structure; 2007 replace reclosers; 2008 replace grounding, replace VR
Fermeuse	2008 & 2009 extension of yard to accommodate portable substations, termination of new transmission line complete with HV breaker & PC, site improvements, addition of breaker to existing transmission line, addition of control building, P&C additions, bus structure improvements
Fall Pond	2005 replace battery bank & charger
Frenchmens Cove	2005 replace LA; 2008 replacement of reclosers
Gallants	2005 replace gate, replace LA; 2006 replace HV breaker, replace battery bank & charger, 2008 replace transformers tap changer controls and radiators on transformer
Gambo	2005 P&C replacement; 2006 recloser replacements; 2008 recloser replacements, replace transformer tap changer control; 2009 replace LA, HV switch
Gander	2005 replace P&C, 2006 replace LA, replace u/g cables with aerial conductor, remove PT, 2008 replace battery bank & charger, refurbish transformer; 2009 replacements for grounding transformers, P&C (not installed), refurbish transformer tap changer
Garnish	2007 refurbish transformer for temporary placement, 2008 & 2009 construct new substation using existing transformer all other equipment replaced
Grand Beach	2008 refurbish recloser; 2009 replace HV switch, LA, power fuses
Grand Bay	2005 install voltage regulator; 2006 replace transformer tap changer controls
Gander Bay	2005 install voltage regulator; 2008 replace voltage regulator;
Gendale	2006 replace P&C ; 2009 replace LA
Grand Falls	2005 replace battery bank & charger, replace 66 kV CT; 2007 purchase land; 2008 replace P&C; 2009 replace control building door
Gilliams	2006 replace LA; 2008 refurbish voltage regulator; 2009 procurement for transformer radiator replacement
Glenwood	2008 replace HV switch
Glovertown	2005 & 2006 replace reclosers; 2007 install battery bank & charger, construct control building, refurbish foundations, P&C additions, install varmint protection; 2008 replace battery charger

Substation	Description
Goulds	2005 replace HV switch, install voltage regulator; 2006 replace and improve P&C, replace reclosers; 2007 & 2008 replace and improve P&C, replace and add HV switches, improve and replace bus structures, site improvements, grounding improvements, breaker replacements and additions, replace transformer tap changer controls, install voltage regulator; 2009 replace breaker, P&C, refurbish transformer tap changer, breaker, control building roof
Greenspond	2005 replace HV switch; 2006 replace recloser, add P&C
Greenhill	2005 add gate, P&C replacements; 2006 replace breakers, potential transformers, transformer gas detector relay, transformer tap changer controls and P&C, install varmint proofing; 2007 replace voltage regulator
Harmon	2006 add P&C; 2007 replace recloser
Hare Bay	2006 add control building, replace reclosers, add P&C
Horsechops	2006 replace power fuses; 2009 replace transformer, retire rest of old substation and build a new substation
Hearts Content	2005 refurbish breaker; 2007 replace recloser; 2008 replace breaker, power fuses, add petro plug; 2009 replace P&C
Harbour Grace	2006 replace LA; 2007 replace recloser; replace P&C
Holyrood	2005 replace gate, cable potheads and LA; 2007 replace recloser and voltage regulator; 2008 replace battery bank & charger and HV switch; 2009 replace reclosers
Howley	2006 replace bus structure and associated equipment, install new bus structure and equipment for new feeder termination, improve grounding, add step-up transformer
Humber	2005 Improve control building, replace radiators on two transformers, improve P&C, replace reclosers; 2006 replace transformer tap changer controls, replace recloser; 2008 Replace HV breakers
Hardwoods	2005 replace breaker and HV switches; 2006 replace LA, P&C; 2007 replace breaker; 2009 add station service, replace P&C
Indian Bay	2005 replace bus structure and HV switches
Islington	2005 replace gate; 2008 replace power fuses, install voltage regulator
Jonathans Pond	2009 replace power fuse
Kings Bridge	2006 replace LA, improve P&C; 2009 replace cable terminations, P&C, battery bank & charger, station service and AC panel, feeder cable terminations, transformer power cables, yard lighting, CT, 12 kV switchgear building, fencing, add DC panels, inspection ports for switchgear, control building, grounding, refurbish foundations change location of 30L termination
Kelligrews	2006 replace CT; 2009 Replace breaker, PT, LA
Kenmount	2006 replace P&C; 2008 refurbish breaker ; 2009 replace PT, P&C; 2009 rewind transformer, replace P&C, enlarge culvert in driveway

Substation	Description
Laurentian	2005 improve site drainage, replace potential transformer and P&C; 2006 replace battery charger, refurbish foundations; 2008 Move 305L breaker to new bay and install 901E breaker with switches and P&C; 2009 replace recloser
Lookout Brook	2006 replace power fuses; 2007 Improve P&C; 2008 Upgrade bus structure to 66 kV, breaker and transformer refurbishment
Lewisporte	2007 & 2008 replace recloser
Long Lake	2006 replace HV switch and LA; 2007 replace voltage regulator; 2008 replace recloser
Linton Lake	2006 replace P&C; 2008 replace transformer tap changer controls; 2009 add petro plug
Lockston	2005 replace PT; 2007 refurnish breakers and transformers, repair split bottom of T3, replace parts and improve of bus structure, add varmint proofing, replace heat tracing
Little Rapids	2006 & 2007 acquire site for new substation
Massey Drive	2006 refurbish breaker; 2009 replace breaker
MBP	2007 replace battery bank & charger
Milton	2007 replace recloser, 2008 Replace LA and transformer tap changer controls
Monkstown	2007 replace recloser
Mobile	2005 site improvements; 2006 replace battery & charger and breaker; 2008 & 2009 grounding improvements, replace heat tracing, replace P&C and parts of bus structure, metering; 2009 add petro plug;
Mobile Plant	2006 replace LA, PT and P&C; 2007 Replace control building roof and breaker; 2009 add petro plug
Morris Plant	2007 & 2008 temporary installations of transformers to allow repair of failed transformer.
Marystown	2005 add gate; 2006 replace HV switch, lighting and metering, Install varmint proofing; 2007 replace voltage regulator
Memorial	2005 & 2006 replace P&C; 2007 replace power cables
Musgrave Harbour	2006 disposed of land
New Chelsea	2005 site and grounding improvements; 2006 Replace P&C, Add bus P&C; 2007 replace voltage regulator; 2008 replace battery bank and charger; 2009 add petro plug
New Grand falls	2005 replace breaker
New Harbour	2007 replace voltage regulator
Northwest Brook	2006 replace recloser
Old Perilcan	2005 add gate, replace LA; 2007 replace reclosers and voltage regulator, refurbish transformer, replace HV switches
Oxen Pond	2006 refurbish breaker, replace P&C; 2009 improve bus structure, replace HV switch, LA, P&C

Substation	Description
P135	2005 replace P&C,; 2006 replace LA
P335	2006 replace LA and coolers
P435	2005 rewind of transformer
Pasadena	2006 increase capacity of transformer; 2008 replace recloser
Port Blandford	2005 replace HV switches, modify supporting structures and improve grounding and fencing; 2007 replace or refurbish HV switches; 2008 modify switch structure
Pierres Brrok	2006 replace battery bank and charger; 2007 & 2008 construction of new HV section of substation for the installation of new transformer the LV section of the old yard used; 2009 add petro plug
Pepperrell	2005 replace P&C
Petty Harbour	2006 replace breaker, site improvements, LA, gas detector relay and recloser; 2007 replace power fuses; 2008 replace HV switch and recloser, improvements to bus structure, refurbish transformer, replace heat tracing,
Pitmans Pond	2005 replace failed transformer with spare equipment, replace bus structure
Placentia Junction	2005 replace power fuses; 2006 replace transformer with spare equipment
Princeton Pond	2005 Improve HV switches
Port Union	2005 replace reclosers, construct control building and improve P&C; 2008 replace heat tracing
Pulpit	2009 refurbish HV switch, replace insulators
Quartz	2007 replace grounding, LA and parts of bus structure
Rattling Brook	2007 Expand site, add feeder bypass switch, extend cable T2 trench, add CT, replace transformer pad, replace HV switches and power fuses, replace transformer for spares, replace reclosers, replace bus structure and install varmint proofing; 2008 replace battery bank, power cables for T1, add PT, replace heat tracing, replace P&C; 2009 add petro plug
Robinsons	2005 add gate; 2007 replace voltage regulator; 2008 replace LA, refurbish transformer
Rocky Pond	2005 replace battery bank & charger, replace breaker and switchgear; 2006 replace HV switch and power fuses; 2009 refurbish transformer, retire rest of old substation and build a new substation
Ridge Road	2005 replace breaker compressor; 2006 replace breaker, replace P&C; 2007 replace battery bank & charger, add arc flash wall, replace breaker, refurbish foundation, replace cable pothead, add DC panel; 2008 replace battery charger, breaker and P&C ; 2009 replace P&C and breaker; 2009 replace P&C, replace roof and place new siding on control building
Riverhead	2005 install gate; 2006 replace power fuses; 2007 replace voltage regulator

Substation	Description
Sandy Brook	2008 refurbish breaker, replace heat tracing; 2009 add petro plug
Seal Cove	2005 replace breaker, improve grounding; 2009 replace recloser, LA, add petro plugs,
Seal Cove Road	2007 & 2008 remove battery bank & charger; 2009 replace recloser
St. Catherines	2005 replace voltage regulator; 2006 improve site ; 2008 replace heat tracing; 2009 add petro plug
St. Georges	2005 add breaker and P&C; 2006 replace LA and gas detector relay; 2008 retire 33 kV section of substation, install 66 kV section of substation including new bus structure, switches, PT and P&C
St. John's Diesel	2005 Substation retired
St. John's Main	2005 switchgear enclosed by new building; install new sides and roof on switchgear building #3, refurbish breaker; 2006 battery bank & charger, LA, replace PT, P&C ; 2007 replace breakers; 2008 replace breaker; 2009 replace P&C
Stamps Lane	2005 replace battery bank & charger, replace breaker, lighting, add PT, replace cable terminations, LA, transformer cooling fans, install new transformer radiators, replace P&C; 2006 extend control building, replace LA and gas detector relay, replace P&C; 2009 replace P&C, breaker ; transformer radiator purchase (install in 2010)
Springfield	2005 replace battery bank & charger, add gate, 2009 procure transformer radiators, add to ground grid
Salt Pond	2005 retire section of substation related to gas turbine, added synchronizing P&C , replaced P&C for transmission, replace PT; 2006 replace P&C, add bus differential P&C; 2008 replace battery charger, breaker, HV switches, and refurbish transformer;2009 add petro plug
Summerford	2005 replace LA and parts of bus structure; 2007 replace recloser
Sunnyside	2005 replace voltage regulator; 2008 replace voltage regulator
Tors Cove	2005 replace LA; 2008 refurbish breaker; 2009 replace cable termination
Terra Nova	2006 replace LA and gas detector relay
Test Bay	2009 replace battery bank
Topsail	2006 replace foundations, LA , gas detector relay, extend bus structure; 2009 replace transformer
Trinity	2006 construct control building, replace LA, gas detector relay, reclosers
Trepassey	2005 replace LA and power fuses
Twillingate	2009 add petro plug
US Navy	2005 Substation retired
Victoria	2005 add to fence; 2008 replace battery charger; 2009 add petro plug
Virginia Waters	2005 T3 transformer and Vir-08 feeder added Extend yard, fence, grounding and cable trench add breakers, install HV switches, bus structures lighting; 2006 replace LA and P&C; 2008 replace breaker; 2009 refurbish tap changer, spill containment , replace heat tracing

Substation	Description
Walbournes	2006 replace LA and tap changer controllers
Western Avalon	2007 replace recloser and voltage regulator
Webbers Cove	2005 replace LA ; 2007 replace recloser; 2008 replace heat tracing; 2009 replace battery bank & charger, transformer radiators, LA, PT, refurbish HV switches
West Brook	2008 replace heat tracing; 2009 add petro plug
Wesleyville	2005 Install transformer from spare equipment, breaker, P&C, HV switches, extend yard, install grounding and bus structure; 2006 Install P&C, replace reclosers; 2007 replace voltage regulator
Wheelers	2007 replace insulators

Appendix E

Equipment Scrapped Since 2005 Study

Company Number	Equipment Type	Serial Number	Year Purchased	Size (kVA)	Voltage	Manufacturer
100033	Battery Bank	Type 3DU11	1988		120	C & D
100114	Battery Bank	TYPE WX 13	1988		120	Varta
100126	Battery Bank	Type LA	1980		120	Sonnenschein
100133	Battery Bank	Type LA	1990		130	C & D
100141	Battery Bank	Type LA	1997		48	Canadian Energy
100144	Battery Bank	Type LA	1991		120	Varta
100156	Battery Bank	Type LA	1992		48	Exide
100157	Battery Bank	Type LA	1992		125	C & D
100158	Battery Bank	Type LA	1992		120	C & D
100163	Battery Bank	Type ABSOLYTE II - 645A07	1992		120	GNB
100165	Battery Bank	Type LA	1992		120	C & D
100166	Battery Bank	TXE 180	1999		120	Sonnenschein
100169	Battery Bank	Type ST27DC180	2004		54	Exide
100170	Battery Bank	Type LA	1993		130	Exide
100180	Battery Bank	Type LA	1993		120	Exide
100182	Battery Bank	Type LA	1994		130	Exide
100183	Battery Bank	Type LA	1994		120	Exide
100188	Battery Bank	Type LA	1994		130	Exide
100189	Battery Bank	Type LA	1994		2.2	Exide
100191	Battery Bank	Type KDZ-3001	1995		125	GNB
100193	Battery Bank	Type LA	1995		130	Exide
100195	Battery Bank	Type LA	1995		48	NAPA
100196	Battery Bank	Type LA	1995		120	Exide
100200	Battery Bank	Type LA	2007		48	Motomaster
100204	Battery Bank	Type LA	1996		120	C & D
100205	Battery Bank	Type LA	1996		130	C & D
100208	Battery Bank	Type LA	1996		120	Sonnenschein
100212	Battery Bank	Type LA	1996		129	C & D
100214	Battery Bank		1997		48	Canadian Energy
100219	Battery Bank		1997		0	C & D
100220	Battery Bank	Type TXE	1997		0	Sonnenschein
100222	Battery Bank		1997		120	Sonnenschein

Company Number	Equipment Type	Serial Number	Year Purchased	Size (kVA)	Voltage	Manufacturer
100224	Battery Bank		1997		120	Sonnenschein
100225	Battery Bank		1997		0	Motomaster
100227	Battery Bank	Type LA	1998		129	Sonnenschein
100228	Battery Bank	Type LA	1998		129	Sonnenschein
100229	Battery Bank		1999		13.05	Sonnenschein
100230	Battery Bank	Type LA	1997		130	Sonnenschein
100232	Battery Bank	Type LA	1998		120	Sonnenschein
100233	Battery Bank		1998		0	Sonnenschein
100234	Battery Bank		1998		0	Sonnenschein
100241	Battery Bank		1999			Sonnenschein
100245	Battery Bank		1999			Sonnenschein
100247	Battery Bank	Type TXE-180	2000			Sonnenschein
100248	Battery Bank		2001			
100260	Battery Bank		1992			C & D
100320	Battery Bank	Type DEEP CYCLE				NAPA
110002	Battery Charger	6835-7016			120	RH Nichols
110011	Battery Charger					RH Nichols
110013	Battery Charger	2568				ELECT PROD
110015	Battery Charger					General Electric
110016	Battery Charger				38	Staticon
110017	Battery Charger					Dynatron
110025	Battery Charger	36566			22	Powertronic
110029	Battery Charger	17483	1977	15	120 AC - 125 DC	Staticon
110033	Battery Charger	60235-7739			115	RH Nichols
110034	Battery Charger	25101	1982	20	208 AC - 125 DC	Staticon
110036	Battery Charger	33730	1989	20	240 AC - 120 DC	Staticon
110041	Battery Charger	17481	1977	15	120 AC - 125 DC	Staticon
110045	Battery Charger	36156	1992	20	240 AC - 120 DC	Staticon
110046	Battery Charger	35292			120	
110047	Battery Charger	33977	1989	20	240 AC - 120 DC	Staticon
110053	Battery Charger	15480	1975	10	120 AC - 125 DC	Staticon
110054	Battery Charger	4552-5576				RH Nichols
110055	Battery Charger	11448	1972	5	115 AC - 120 DC	Staticon
110057	Battery Charger	14285	1974	10	120 AC - 120 DC	Staticon

Company Number	Equipment Type	Serial Number	Year Purchased	Size (kVA)	Voltage	Manufacturer
110063	Battery Charger	88097			230	Silicon CLM.
110065	Battery Charger	15322	1975	15	120 AC - 125 DC	Staticon
110068	Battery Charger	15319	1975	15	120 AC - 125 DC	Staticon
110073	Battery Charger	84526		22	120 AC - 125 DC	NIFE-Powertronic
110075	Battery Charger	15905	1975	15	120 AC - 125 DC	Staticon
110077	Battery Charger	15321			120	Staticon
110078	Battery Charger	7739			115	CTS of CAN
110079	Battery Charger	14580	1974	10	120 AC - 125 DC	Staticon
110080	Battery Charger	28051	1985	20	240 AC - 120 DC	Staticon
110083	Battery Charger	34619	1990	20	240 AC - 120 DC	Staticon
110093	Battery Charger	LD2080		15	240 AC - 120 DC	Cigentec
110094	Battery Charger	36069	1992	20	240 AC - 120 DC	Staticon
110096	Battery Charger	36066	1992	20	240 AC - 48 DC	Staticon
110097	Battery Charger	36359	1992	20	240 AC - 125 DC	Staticon
110100	Battery Charger	33729	1989	20	240 AC - 120 DC	Staticon
110101	Battery Charger	36304	1992	10	120 AC - 48 DC	Staticon
110102	Battery Charger	30683			240	Staticon
110104	Battery Charger	APS940034		25	120/208/240 AC - 132 DC	C&D
110106	Battery Charger	36149	1992	20	208/240 AC - 120 DC	Staticon
110107	Battery Charger	FES81950			120	C & D
110111	Battery Charger	26802	1984	20	240 AC - 120 DC	Staticon
110112	Battery Charger	34557			240	Staticon
110115	Battery Charger	34012	1989	20	240 AC - 120 DC	Staticon
110118	Battery Charger	27549			240	Staticon
110127	Battery Charger	4556	1991		120	C-CAN Power
110130	Battery Charger	33268	1988	40	120 AC - 48 DC	Staticon
110134	Battery Charger	25101			208	Staticon
110137	Battery Charger		1998		600	NIFE
110140	Battery Charger	7184	1999	20	230 AC - 120 DC	Hayley Industrial
110152	Battery Charger	7183	1999	20	230 AC - 120 DC	Hayley Industrial
110163	Battery Charger	AE5802206			120	C & D

Company Number	Equipment Type	Serial Number	Year Purchased	Size (kVA)	Voltage	Manufacturer
110164	Battery Charger	17482	1977	15	120 AC - 125 DC	Staticon
110165	Battery Charger	19859	1978		120	Staticon
110177	Battery Charger	3023	2004	30	208 AC - 125 DC	Primax
210003	Circuit Breaker	81751	1978	1200	4760	CGE
210022	Circuit Breaker	2-67Y1044	1980	2000	72500	Westinghouse
210042	Circuit Breaker	LSORT23	1960			Reyrolle
210043	Circuit Breaker	LSORT24	1936	600	33000	Reyrolle
210067	Circuit Breaker	41167				General Electric
210085	Circuit Breaker	56469		800	69000	GE
210087	Circuit Breaker	56471		800	69000	GE
210094	Circuit Breaker	58010				General Electric
210094	Circuit Breaker	58010	1932	600	69000	General Electric
210164	Circuit Breaker	63233	1975			General Electric
210167	Circuit Breaker	63236	1975	1200	138000	CGE
210168	Circuit Breaker	63237	1975	1200	138000	CGE
210208	Circuit Breaker	LSORT210				Reyrolle
210217	Circuit Breaker	D512785		1250	24000	Sace
210231	Circuit Breaker	1-67Y1132	1981	1200	72500	Westinghouse
210233	Circuit Breaker	4-67Y1132	1981	1200	72500	Westinghouse
210237	Circuit Breaker	3-67Y1734	1984	1200	72500	Westinghouse
210240	Circuit Breaker	2-67Y1733	1984	1200	72500	Westinghouse
210261	Circuit Breaker	1480052	1958	1200	7500	Westinghouse
210275	Circuit Breaker	1480051	1958	1200	7500	Westinghouse
210276	Circuit Breaker	1480053	1958	1200	6900	Westinghouse
210278	Circuit Breaker	1480055	1958	1200	7500	Westinghouse
210284	Circuit Breaker	1-67Y1733	1984			Westinghouse
210290	Circuit Breaker	81756	1978	1200	4760	CGE
210331	Circuit Breaker	56177	1978			General Electric
210332	Circuit Breaker	56720	1978			General Electric
210356	Circuit Breaker	1-67Y1380	1982	1200	72500	Westinghouse
210364	Circuit Breaker	2-67Y1530	1983	1200	72500	Westinghouse
210546	Circuit Breaker		1977			Merlin Gerlin
210626	Circuit Breaker	LSORT8				Reyrolle
190015	Cubicle Switchgear					ITE

Company Number	Equipment Type	Serial Number	Year Purchased	Size (kVA)	Voltage	Manufacturer
190017	Cubicle Switchgear					ITE
190103	Cubicle Switchgear					
190104	Cubicle Switchgear					Westinghouse
190105	Cubicle Switchgear					Westinghouse
190106	Cubicle Switchgear					Westinghouse
190107	Cubicle Switchgear					Westinghouse
190108	Cubicle Switchgear					Westinghouse
190109	Cubicle Switchgear					Westinghouse
190110	Cubicle Switchgear					Westinghouse
190111	Cubicle Switchgear					Westinghouse
190130	Cubicle Switchgear					Elec. Switchgear
190131	Cubicle Switchgear					Elec. Switchgear
190151	Cubicle Switchgear	36671			4,760	General Electric
190154	Cubicle Switchgear	36674			4,760	General Electric
190178	Cubicle Switchgear					
190179	Cubicle Switchgear					
120022	Current Transformer	0040901-2			25	Kuhlman Electric
100084	Potential Transformer	AE 1043589701	1997		14400/7200	Associated Engineering
130028	Potential Transformer					C & D
130031	Potential Transformer	628736			14400/7200	Associated Eng
130032	Potential Transformer	628732			14400/7200	Associated Eng
130038	Potential Transformer	2-54807			69000	Ferranti Packard
130039	Potential Transformer	2-57859			69000	Ferranti Packard
130066	Potential Transformer	991855			138000	CGE
130067	Potential Transformer	991851			138000	CGE

Company Number	Equipment Type	Serial Number	Year Purchased	Size (kVA)	Voltage	Manufacturer
130068	Potential Transformer	991852			138000	CGE
130083	Potential Transformer	AE 1043589702	1997		14400/7200	Associated Engineering
130084	Potential Transformer	AE 1043579701				Associated ENG.
130113	Potential Transformer	LJ50247				Westinghouse
130114	Potential Transformer	LJ50246				Westinghouse
130117	Potential Transformer	2-431678			138000	Ferranti Packard
130118	Potential Transformer	2-431679			138000	Ferranti Packard
130119	Potential Transformer	2-431680			138000	Ferranti Packard
130138	Potential Transformer					C & D
130203	Potential Transformer	628733		4.5	14400/7200	Associated Engineering
130204	Potential Transformer	628734		4.5	14400/7200	Associated Engineering
130206	Potential Transformer	1140573	1978		69000	CGE
130207	Potential Transformer	562937			69000	Westinghouse
130220	Potential Transformer	20230705	2002			ABB
130229	Potential Transformer	03/10344990	2002			
130231	Potential Transformer	03/10344988	2002			
130255	Potential Transformer	541488005				Kuhlman Electric
130287	Potential Transformer					
130288	Potential Transformer					

Company Number	Equipment Type	Serial Number	Year Purchased	Size (kVA)	Voltage	Manufacturer
130309	Potential Transformer					
130310	Potential Transformer					
130408	Potential Transformer					
130409	Potential Transformer					
???	Potential Transformer	2-252499			40250	Ferranti Packard
13????	Potential Transformer	991854			138000	CGE
13????	Potential Transformer	991856			138000	CGE
130??? - ex MOL-PT	Potential Transformer	2-252500			69000	Ferranti Packard
130??? - ex MOL-PT	Potential Transformer	2-252498			69000	Ferranti Packard
130??? - ex MOL-PT	Potential Transformer	2-86200			69000	Ferranti Packard
Ex-Goulds (130309?)	Potential Transformer	478386			69000/34500	GE
Ex-Goulds (130310?)	Potential Transformer	478387			69000/34500	GE
200081	Power Transformer	211531	1956	500	66000/33000-12470/4160	Packard Electric
200149	Power Transformer	1113	1941			Ferranti Packard
200165	Power Transformer	TP1050	1951	10670	66000/33000 - 6900	Reliance Electric
200194	Power Transformer	P52761	1963			Reliance Electronic
230304	Recloser	R-5491-LB	1970		25800	GE
230316	Recloser	105893			24940	General Electric
230374	Recloser	73H133PR		560	14400	Westinghouse
230377	Recloser	73H135PR	1973	560	15500	Westinghouse
230381	Recloser	74G103ES	1974	560	15500	Westinghouse

Company Number	Equipment Type	Serial Number	Year Purchased	Size (kVA)	Voltage	Manufacturer
230382	Recloser	74G117ES	1974	560	15500	Westinghouse
230383	Recloser	74G108ES	1974	560	15500	Westinghouse
230389	Recloser	74G115ES	1974	560	15500	Westinghouse
230391	Recloser	74G120ES	1974	560	15500	Westinghouse
230397	Recloser	74G114ES	1974	560	15500	Westinghouse
230403	Recloser	75E143ES	1975	560	15500	Westinghouse
230406	Recloser	75E140 ES	1975		12470	Westinghouse
230409	Recloser	75E130 ES	1975	560	15500	Westinghouse
230409	Recloser	75E130ES		560	15500	Westinghouse
230410	Recloser	75E132ES	1975	560	15500	Westinghouse
230427	Recloser	76E124ES	1976	560	15500	Westinghouse
230429	Recloser	76E119ES	1976	560	15500	Westinghouse
230438	Recloser	76E123ES	1976	560	15500	Westinghouse
230544	Recloser	178055	2001	630	27000	NuLec
230571	Recloser	255558	2004	630	27000	NuLec
220038	Voltage Regulator	3-3738-00494-24	1965	219	7200	Allis-Chalmers
220039	Voltage Regulator	3-3738-00494-3	1975	219	7200	Allis-Chalmers
220041	Voltage Regulator	3-3738-00551-74	1966	219	7200	Allis-Chalmers
220048	Voltage Regulator	3-3738-00874-16		219	7200	Allis-Chalmers
220069	Voltage Regulator	698890	1969	100	7200	CGE
220072	Voltage Regulator	698889	1969	100	7200	CGE
220079	Voltage Regulator	675239	1968	100	14400	CGE
220081	Voltage Regulator	700313	1969	100	14400	CGE
220101	Voltage Regulator	3-3738-01350-2	1970	219	7200	Allis-Chalmers
220111	Voltage Regulator	3-3738-01469-9	1970	100	7200	Allis-Chalmers
220116	Voltage Regulator	3-3738-01469-52	1970	100	7200	Allis-Chalmers
220128	Voltage Regulator	699446	1971	100	7200	GE
220132	Voltage Regulator	783089	1971	100	7200	CGE
220134	Voltage Regulator	783090	1971	100	7200	CGE
220141	Voltage Regulator	782890	1971	100	7200	CGE
220148	Voltage Regulator	K-440659	1971	219	7200	GE
220155	Voltage Regulator	782149	1971	100	14400	CGE
220156	Voltage Regulator	782499	1971	100	14400	CGE
220174	Voltage Regulator	3-3738-01697-8	1972	219	7200	Allis-Chalmers

Company Number	Equipment Type	Serial Number	Year Purchased	Size (kVA)	Voltage	Manufacturer
220177	Voltage Regulator	3-3738-01717-19	1972	100	7200	Allis-Chalmers
220179	Voltage Regulator	3-3738-01717-5	1972	100	7200	Allis-Chalmers
220193	Voltage Regulator	3-3738-01717-17	1972	100	7200	Allis-Chalmers
220206	Voltage Regulator	3-3756-01873-21	1973	219	7200	Allis-Chalmers
220208	Voltage Regulator	3-3756-01873-22	1973	219	7200	Allis-Chalmers
220214	Voltage Regulator	3-3757-01939-15	1973	100	14400	Allis-Chalmers
220216	Voltage Regulator	3-3757-01939-14	1973	100	14400	Allis-Chalmers
220218	Voltage Regulator	29N5167	1973	219	7200	GE
220228	Voltage Regulator	873847	1973	219	7200	CGE
220232	Voltage Regulator	879445	1974	219	7200	GE
220233	Voltage Regulator	879444	1973	219	7200	CGE
220248	Voltage Regulator	879446	1973	219	7200	CGE
220257	Voltage Regulator	C-9-3757-41333-19	1974	200	14400	Allis-Chalmers
220268	Voltage Regulator	C-9-3755-41334-7	1974	100	7200	Allis-Chalmers
220271	Voltage Regulator	C-3756-41336-6	1974	219	7200	Allis-Chalmers
220282	Voltage Regulator	C-3756-41336-2	1974	219	7200	Allis-Chalmers
220288	Voltage Regulator	3-3738-01697-15	1975	219	7620	Allis-Chalmers
220305	Voltage Regulator	874219	1975	219	7200	GE
220320	Voltage Regulator	977272	1975	100	7200	CGE
220332	Voltage Regulator	C-1-3795-42930-7	1975	219	7200	Allis-Chalmers
220334	Voltage Regulator	977593	1975		14400	General Electric
220339	Voltage Regulator	3-3755-02529-1	1976	100	7200	Allis-Chalmers
220344	Voltage Regulator	1047599	1976	100	7200	CGE
220365	Voltage Regulator	C-1-3795-5900-2	1977	100	7200	Allis-Chalmers
220375	Voltage Regulator	0-1-3795-61570-3	1978	100	14400	Allis-Chalmers
220382	Voltage Regulator	88214223/1148332	1978	100	14400	CGE
220384	Voltage Regulator	C-13795-66810-1	1979	100	7200	Allis-Chalmers
220385	Voltage Regulator	C-1-3795-63060-9	1979	100	7200	Siemens-Allis
220391	Voltage Regulator	1234574	1979	100	7200	CGE
220392	Voltage Regulator	80PA002001	1980		14400	McGraw Edison
220395	Voltage Regulator	80PA003002	1979	100	14400	McGraw Edison
220405	Voltage Regulator	C-1-3795-76840-3	1979	546	7200	Siemens-Allis
220417	Voltage Regulator	18329	1980	100	7200	CGE
220428	Voltage Regulator	80A 18317	1980	100	14400	GE

Company Number	Equipment Type	Serial Number	Year Purchased	Size (kVA)	Voltage	Manufacturer
220428	Voltage Regulator	18317	1980	100	14400	CGE
220436	Voltage Regulator	C-1-3795-78830-1	1981	100	14400	Siemens-Allis
220437	Voltage Regulator	78830-2	1981	100	14400	Siemens-Allis
220438	Voltage Regulator	C-1-3795-78830-3	1981	100	14400	Siemens-Allis
220446	Voltage Regulator	21664	1981	219	7200	CGE
220452	Voltage Regulator	C-1-3795-91231-3	1982	219	7200	Siemens-Allis
220458	Voltage Regulator	C-13795-91231-2	1982	219	7200	Siemens-Allis
220477	Voltage Regulator	84ZK543-010	1985	219	7200	McGraw Edison
220478	Voltage Regulator	84ZK543-003	1985	219	7200	McGraw Edison
220479	Voltage Regulator	84ZK543-005	1985	219	7200	McGraw Edison
220496	Voltage Regulator	3-3732/04766-11		100	7200	Siemens-Allis
220496	Voltage Regulator	3-3738-01697-22	1985	219	7200	Allis-Chalmers
220505	Voltage Regulator	3-3753-04761-14		200	14400	Siemens-Allis
220513	Voltage Regulator	M132250PYA	1986	219	7200	GE
220518	Voltage Regulator	M165927PTB	1986	219	7200	GE
220552	Voltage Regulator	R111071PVD	1989	100	14400/7200	GE
220553	Voltage Regulator	R111573-PXD	1989	546	7200	GE
220565	Voltage Regulator	90ZK508005	1990	100	14400	Cooper Power
220566	Voltage Regulator	90ZK508006	1990	100	14400	Cooper Power
220567	Voltage Regulator	90ZK508003	1990	100	14400	Cooper Power Systems
220574	Voltage Regulator	P812782TUF	1991	219	7200	GE
220588	Voltage Regulator	91ZJ908001	1991	100	14400	Cooper Power
220592	Voltage Regulator	91ZJ908002	1991	100	14400	Cooper Power
220603	Voltage Regulator	92-9101454	1992	219	7200	Cooper Power
220626	Voltage Regulator	979103739	1997	100	7200	Cooper Power

2010 DEPRECIATION STUDY

TELECOMMUNICATIONS SYSTEMS

June 2010

Prepared by

Tony Hancock P. Eng.

1.0 Introduction

This report has been prepared to provide background information to aid in the development of the Newfoundland Power's 2010 Asset Depreciation Report for Telecommunications systems.

Newfoundland Power ("the Company") employs telecommunication system is to provide communication between fixed locations such as control centres, office buildings, substations and mobile users in Company owned vehicles. Historically the communication traffic has been voice, for mobile radio and telephone users along with slow speed data for control of the power system ("SCADA"). In recent years more extensive use of broadband commercial systems has allowed for wireless data services to mobile and fixed users. The commercial broadband network is utilized for both business and power system control applications.

The standards based focus of telecommunications technologies has allowed the Company to operate with a single telecommunications network providing services for voice, SCADA data and high speed Information Systems ("IS") data traffic. The useful life expectancy of a piece of equipment is typically driven by its ability to cost effectively deliver the service and the ability of service providers to maintain and support the equipment. The availability of new higher bandwidth services, at a lower cost per unit, will frequently justify the replacement of an older technology.

2.0 VHF Radio System

The Company continues to operate a VHF mobile radio system. This infrastructure includes owned and rented VHF repeater sites, mobile radio equipment in Company vehicles, fixed site base station equipment in remote offices, an interface to the corporate network linking the sites together and an interface to the operational voice system at the System Control Centre ("SCC").

Over the past 10 years, with advances in broadband wireless communications, and almost blanket coverage by commercial wireless providers over the Company's service territory, the VHF mobile radio system has devolved into a secondary service. The Company maintains the system in the event of a catastrophic failure of the public wireless network. For example, if a natural disaster such as a hurricane were to hit Newfoundland the public network could receive critical damage. The damage to public infrastructure combined with an avalanche of cell phone calls relating to the severe weather conditions, would render the public network unreliable.[1] In this situation the Company would operate exclusively on its private VHF radio system.

The following sections summarize the condition of the telecommunication assets.

[1] A similar situation could occur during severe weather condition creating an avalanche of cell phone calls on the public wireless infrastructure rendering it practically useless for emergency responders like Newfoundland Power.

2.1 Radio Sites

This item includes the infrastructure required to establish a radio repeater site, roads, buildings, towers and antennas. The sites are in generally good condition. The towers and antennas are maintained in good condition ensuring employee and public safety. The towers are inspected every three years by a consultant, and necessary capital upgrades are made in the year following the inspection.

Factors Affecting Service Life

- Expansion of public wireless networks;
- Government regulations forcing use of other frequency bands or technologies;
- Existing rented sites may be taken out of service by the owners;
- Lower cost alternative services or facilities available from telecommunication providers;
- Lower cost alternative associated with sharing VHF system with Nalcor (formerly Newfoundland & Labrador Hydro).

Remaining Life

With annual building maintenance and tower inspections at regular intervals, it is estimated that the remaining life the radio sites will be in excess of 10 years. Some sites may be retired if more cost effective solutions can be found through leasing space at sites owned by others.

2.2 Radio Repeater Equipment

This item includes radio repeater equipment, radio link equipment interface to the corporate network and the operational voice system at the SCC. Some of the equipment has been in service since 1985. Although most of the equipment is now manufactured discontinued, replacement parts are still available.

Factors Affecting Service Life

- Government regulations forcing use of other frequency bands or technologies;
- Lower cost alternative services or facilities available from telecommunication service providers;
- Lower cost alternative associated with sharing VHF system with Nalcor (formerly Newfoundland & Labrador Hydro).

Remaining Life

There are no current plans to replace this equipment. The system is used infrequently and currently is used as a secondary service, therefore it is estimated that the remaining life is 10 years.

2.3 VHF Mobile Radios

This item includes mobile and fixed transceivers for communicating between vehicles and fixed locations including base stations and the SCC.

Factors Affecting Service Life

- Integration of personal computers into vehicle;
- Government regulations forcing use of other frequency bands or technologies;
- Use of cellular phones and personal communications devices;

Remaining Life

It is estimated that the average life of a mobile radio is 15 years. The Company includes a capital budget item each year to replace units that fail in service.

3.0 Telecommunications – Cables

This item includes both metallic and fibre optic cable and the associated cable protection equipment for telecommunications services such as SCADA data, generating plant protection and telemetry, mobile radio voice, power system protection, corporate network data.

Factors Affecting Service Life

- Deterioration of insulation due to age, e.g. cracking, water ingress, mechanical damage due to storms;
- Damage due to electrical faults, lightning and vehicle striking pole or contacting cable;
- Additional bandwidth for communication traffic (unlikely in the case of fibre optic cable);
- Replacement of cable technology with "wireless" solutions;
- Lower cost alternative services or facilities available from other service providers.

Remaining Life

Most of the metallic cables were installed during the early 1980's and have been replaced or are in the process of being replaced. It is estimated that an outside plant copper cable has an in-service life of twenty-five years. Where practical, telecommunication services on the copper cable plant are being transferred to fibre cable plant. The copper cable plant remaining in service has a life expectancy of between 5 and 10 years. These copper cables provide communications between the forebay and associated hydro plant.

In the 1990s leased fibre optic cable became available in the local marketplace. At that time it was more economical to lease fibre instead of installing our own fibre. Therefore the Company entered into 10 year lease agreements for fibre optic cables with local cable companies. Upon renewal of these contracts the economics had changed and it became more economic to install replacement fibre cables owned by the Company. The Company is completing a 4 year program to install replacement fibre optic cables. The existing fibre optic cables have a remaining life expectancy of approximately twenty years.

4.0 Multiplex Equipment

The Company no longer owns dedicated multiplexer technology for SCADA communications. With the installation of the new SCADA system in 1999 the Company was able to use standards based communications systems removing the requirement for specialized multiplexer technology.

5.0 SCADA System

This item includes the equipment housed in the SCC and the Duffy Place disaster recovery site for the remote monitoring and control of the power system including computers, software, display systems, and operator consoles.

The original SCADA system supplied by Automatec was originally installed in 1984 and provided service for 15 years. In 1999 the Company purchased and installed a new OASyS SCADA system from Neles Automation[2]. A key advantage of the OASyS system is its standards based design making it compatible with modern Internet Protocol based telecommunications technologies.

Factors Affecting Service Life

- Availability of vendor support for hardware and software;
- Need to incorporate advanced applications that are not economically available from the vendor.

Remaining Life

The current system has been under vendor support since it was initially installed. There have been upgrades of the server, operating system, SCADA application and operator computers over the past 10 years.[3] The operator consoles are PC based, and are being upgraded on a three year cycle. The servers are UNIX based, and are sized to meet Newfoundland Power's current requirements. These servers have a life expectancy of five to seven years. The application software and database would be expected to have a ten to fifteen year life with regular upgrades provided by the vendor.

[2] The SCADA system supplier has changed ownership over the past 10 years. It currently operates under the Telvent name.

[3] A detailed list of changes made to the SCADA infrastructure since it was installed in 1999 is included as Appendix A to this report.

6.0 Remote Terminal Units ("RTUs")

This item includes the equipment housed in substations and generating plants to collect power system data and communicate with the SCADA Master Station. The SCADA system RTUs were installed in 2000. As most modern monitoring and control equipment has digital communications interfaces, the Company has implemented a new hardware device called a Gateway to supplement the SCADA RTUs in many locations. These Gateways collect digital data directly from substation and plant devices and sends this information to the SCADA system.

Factors Affecting Service Life

- Obsolescence of equipment, availability of spare parts;
- Increase in the number of intelligent substation devices that communicate directly with the SCADA Master Station;
- Need to incorporate advanced applications that are not economically available from the vendor.

Remaining Life

All RTU equipment was replaced in 2000. It is estimated that the remaining life of the RTUs installed in 2000 will be ten years at which time other computer-based substation technology may replace the need for RTUs.

7.0 Standby Power

This item includes equipment for the supply of continuous power to telecommunications equipment including battery chargers, battery banks, invertors, generators (diesel and propane) and associated equipment. There are three main applications of this equipment. At the radio sites power is supplied to radio equipment using propane generators and 48 VDC battery plant. At the SCC continuous power is supplied to the SCADA computers using a standby diesel generator and a dual redundant Uninterruptible Power Supply (UPS).[4] The Wide Area Network equipment in company offices where there is SCADA data and mobile radio voice circuits is powered from a 48 VDC battery plant to provide continuous power.

Factors Affecting Service Life

- Reliability, e.g., failure of engines to start;
- Availability of spare parts;
- Aging of storage components (batteries);
- Environmental issues associated with the specific electrolytes used in the batteries;
- Technical support provided by manufacturer.

Remaining Life

The age of most of this equipment varies from 1984 to present. The standby generators are used infrequently and maintained regularly. The propane fuel burns very cleanly and

[4] The UPS at the SCC is being replaced in 2010. The unit originally went into service in 1998 at the old Rattling Brook Control Centre

as a result there is very little ware to the fuel combustion parts of the standby generator. Battery play is maintained regularly and replaced at end of life. Chargers, rectifiers, and inverters are of robust design and are replaced when they fail.

The UPS system at the SCC is scheduled to be replaced tin 2010.

Overall this equipment has worked reliably, because of availability of parts it is estimated that the average life remaining in most of this equipment is 10 years.

8.0 Telephone Equipment

This item includes equipment used for providing telephone service to company locations including Key Systems, analog and digital telephone sets and FAX machines. Newfoundland Power uses a telephone exchange based Centrex and voice mail service from Bell Aliant. The Company owns the digital and analog telephone sets. Facsimile transmission is typically provided by the network printers in Company offices.

The Company owns and operates a Voice Over Internet Protocol ("VOIP") telephone system that provides operational voice capability for the SCC operators. The operational voice telephone system is a CISCO Call Manager installed in 2004. The VOIP system provides voice communications through the public telephone network, the internal Centrex (4 digit dial) network and the VHF radio system.

Factors Affecting Life

- Lower cost alternative services or facilities available from other Telecommunication Carriers;
- Regulatory changes with the telecommunications system providers;
- Ability to extend the term of the Centrex contract with Bell Aliant;
- New Technology, e.g. wireless communication;
- Deterioration of telephone sets that occurs with age.

Remaining Life

The telephone handsets in use range in age from 1980 to the present. These sets are replaced as they fail. Due to the large number of sets in service approximately 5% (30 units) sets will fail each year.

9.0 Power Line Carrier Equipment

The Company no longer owns and operates any Power Line Carrier technology.

10.0 Telecommunications Test Equipment

This includes test equipment for installing and maintaining the telecommunication systems. This equipment is specialized for testing and repairing communication systems.

Factors Affecting Service Life

- Equipment it was designed to service being retired;
- Support/Calibration of equipment not being available;
- Spare parts not being available.

Remaining Life

The age of the equipment varies from 1980 to present it is estimated that the average life of this equipment is 15 years.

Appendix A

SCADA System Upgrades

SCADA System Upgrades

Since it's installation in 1999 the Newfoundland Power SCADA system has undergone various upgrades, enhancements and other changes. The table below lists the significant changes to the SCADA infrastructure:

Year	Description
2000	Application deployed to manage the under-frequency load shedding scheme in Company substations
2003	SCADA Application upgraded from OASyS version 6.0 to version 6.3
2003	Historian server hardware upgraded from Alpha Server D20 to Alpha Server DS25
2003	Historian data storage upgraded to Compaq MA8000 Fibre Channel Raid Array
2003	Unix Operating System upgraded to version 5.1B
2003	Operator workstation personal computer hardware upgraded
2004	Upgraded network security infrastructure
2004	Remote SCADA client application installed, giving secure access to SCADA displays to engineering department staff
2006	Operator workstation personal computer hardware upgraded
2006	Inter Control Centre Protocol installed providing connectivity between Newfoundland Power and Newfoundland Hydro SCADA systems
2007	SCADA server hardware upgraded from Alpha Server D20 to Alpha Server DS25
2010	Operator workstation personal computer hardware upgraded

THERMAL PLANTS
DEPRECIATION STUDY
INSPECTION REPORT
2010

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1 INTRODUCTION

Newfoundland Power owns and operates six thermal units in six plants - three diesels and three gas turbines. The plants are located in Port Union, Grand Bank (Greenhill), Port aux Basques, and New-Wes-Valley.

The oldest existing unit is the diesel that was installed in 1962 at Port Union and the newest unit is the mobile diesel at Port aux Basques which was commissioned in 2004. The unit capacities range from the 500 kW diesel at Port Union to the 22,000 kW gas turbine at Greenhill. The total installed capacity is 49.4 MW.

This report provides a general review of all thermal power plants currently owned and operated by Newfoundland Power with the intent to estimate the remaining life of each major plant component including the: engine, power turbine, generator, governor, enclosure, building services, instrumentation / controls, and switchgear..

The study consisted of discussions with Newfoundland Power staff to assess the general condition of the equipment and a review of the operation and maintenance practices and any other factors which could affect the service life.

2 PLANT OVERVIEW

The following table contains key information about Newfoundland Power's current thermal generating plants.

Plant Type	Name	Unit No.	Capacity (kW)	Year Commissioned	Manufacturer
Diesel	Port Union	1	500	1962	Caterpillar
	Port aux Basques	10	2,500	1969	G.M.
	Mobile Diesel #3 *	3	2,500	2004	Detroit Diesel
Gas Turbine	Greenhill	1	22,000	1975	Curtiss Wright
	New-Wes-Valley	1	14,700	1969	AEI
	Mobile Gas Turbine *	1	7,200	1974	Orenda

* Both mobile (portable) units are normally located at Grand Bay Substation in Port aux Basques.

2.1 Operation and Maintenance

Newfoundland Power's thermal plants are typically used during power outage situations due to emergencies such as storm damage or due to planned maintenance or upgrade activities. As such, the plants have been required to run on relatively few occasions.

The availability of mobile generating capacity, one 2.5 MW diesel generator and one 7.2 MW gas turbine, provides the advantage of flexibility and backup to the emergency capacity. In recent years, the mobile generation has been used increasingly for planned upgrades to transmission and distribution lines, allowing Newfoundland Power to minimize outage to customers. These units have been rented periodically by Newfoundland and Labrador Hydro during maintenance of their transmission facilities.

The annual production of the six current thermal plants is shown below:

ANNUAL PRODUCTION (kWh)						
	2005	**2006**	**2007**	**2008**	**2009**	**Avg.**
Diesels						
Port Union	7954	7260	7974	0	0	4638
Port-Aux-Basques #10	37745	100320	61680	42750	40619	56623
Mobile #3	59622	502004	24700	194630	184922	193176
Gas Turbines						
Greenhill	165523	385796	120215	356030	397458	285004
New-Wes-Valley (formerly Salt Pond)	119108	550369	108416	89378	334667	240388
Mobile	105459	155183	96746	652193	189619	239840

Because of the extremely low utilization of these Newfoundland Power plants, most operating and maintenance staff have principal duties beyond the thermal plants. A centralized mechanical maintenance section is responsible for heavy maintenance at both thermal and hydro plants. Electrical and civil maintenance is handled in a similar manner. Day to day maintenance activities are the responsibility of Plant Supervisors and their staff who are also responsible for hydro plant operation. A computerized maintenance management system has been established as a tool for planning and scheduling all maintenance activities associated with the power plants.

Maintenance levels on the various plants have varied. Over the past ten to fifteen years there has been minimal work and replacements done on many of the diesels. The maintenance has tended to be simply that which was required to obtain site operational capability. The intention of Newfoundland Power is to decommission the diesel plants as they reach the end of their useful lives.

However, the maintenance carried out on gas turbines in the past 10 years has been significant. The gas turbines will continue to receive capital improvements in order to extend their lives.

2.2 Diesel Plants

No diesel plants have been decommissioned or added since the 2005 edition of this study. Photographs and technical data sheets for each of the diesel units are located in Appendix A. These units provide emergency or back-up generation in the event of a transmission line or system outage.

2.2.1 Port Union Diesel

The Port Union Plant is located in the town of Port Union on the Bonavista Peninsula. The diesel unit is contained within the Port Union hydroelectric plant powerhouse. The diesel plant is comprised of a 500 kW diesel generator set (Caterpillar engine and Canadian General Electric generator) and includes auxiliaries such as a lube oil cooler, controls, switchgear, and one 9,100 litre # 2 diesel fuel tank. The unit was commissioned in 1962.

Since the 2005 depreciation study no major work has been completed on this unit. It is currently being considered for decommissioning due to its age and condition.

On a monthly basis, the unit is started, synchronized and run on load for one hour.

2.2.2 Port-Aux-Basques Diesel #10

The Port aux Basques Diesel Unit #10 is located at the Grand Bay Substation in the community of Port aux Basques. The packaged EMD (electro-motive diesel) generator set was manufactured by General Motors and installed in 1969. This unit is rated at 2500 kW. Auxiliaries for this unit include coolers, fuel storage, switchgear, and controls. The battery system, control panel and switchgear for the diesel generator are contained in an adjacent building. The diesel generator is supplied with # 2 diesel fuel from one 22,700 litre steel self-dyked tank located outside the powerhouse.

As of December March 31, 2010, the total operating hours on the unit was 2248 hours.

Several items have been replaced since the 2005 depreciation study. The fuel tank was replaced in 2006 and the fan replaced in 2009.

On a monthly basis, the unit is started, synchronized and run on load for one hour.

2.2.3 Mobile Diesel #3

The Mobile Diesel #3 was commissioned in 2004 and is normally located at the Grand Bay Substation in the community of Port aux Basques. This unit is rated at 2500 kW and consists of a single trailer that houses the engine, generator, unit controls, switchgear, and power transformer.

As of March 31, 2010, the total operating hours on the unit was 880 hours.

On a monthly basis, the unit is started, synchronized and run on load for one hour.

2.3 Gas Turbine Plants

These units provide peak load requirements and emergency or back-up generation in the event of transmission line or system outages. Photographs and technical data sheets for each of the gas turbine units are located in Appendix B.

2.3.1 Greenhill Gas Turbine

This plant is located in the community of Grand Bank on the Burin Peninsula. It is comprised of a gas generator, power turbine, electrical generator and auxiliaries such as coolers, pumps, air compressors, switchgear and controls. The Olympus gas generator was manufactured by Rolls-Royce, the power turbine by Curtiss-Wright, and the generator by Brush Electrical Machines. The package was assembled by Curtiss-Wright and is located outside the main building in a separate enclosure. The plant is rated at 22 MW and was commissioned in 1975. Since 2002, fuel for the unit is supplied from two above ground BMI 100,000 liter, double wall, steel, petroleum storage tanks each with interstitial monitoring and overflow protection.

Since the 2005 depreciation study several improvements have been made. The lube oil cooler was replaced in 2005/2006 and improvements were made the air supply in 2009. A fire suppression system was installed in 2009/2010. Air intake refurbishment is planned for 2010.

The usage history of the unit is summarized in the following table:

Gas Generator Operating History*			
Time Since New (TSN)		Time Since Overhaul (TSO)	
Elapsed (hrs)	Starts	Elapsed (hrs)	Starts
N/A	N/A	2001	2634

* As of April 27, 2010.

The unit is run as a synchronous condenser for 30 minutes at least once per year.

On a monthly basis, the unit is started, synchronized and run on load. Every month, the unit is either black started and run on load for 30 minutes or parallel started and run on load for 1 hour, alternating monthly.

2.3.2 New-Wes-Valley Gas Turbine

This plant was originally located in the town of Salt Pond on the Burin Peninsula. In 2003, it was relocated to the town of New-Wes-Valley on the north coast of Bonavista Bay. The 14.7 MW plant is made up of a gas generator, power turbine, electrical generator and auxiliaries such as pumps, heat exchangers, switchgear and controls. The Avon gas generator was manufactured by Rolls Royce and the power turbine and generator by Associated Electrical Industries (AEI). The package was assembled by AEI and commissioned in 1969. Fuel for the unit is supplied from two above ground BMI 75,000 liter, double wall, steel, petroleum storage tanks each with interstitial monitoring and overflow protection that were fabricated and originally installed in 2000. A new powerhouse was constructed in New-Wes-Valley in 2002 in preparation for the unit relocation in 2003. .

The original Avon engine (S/N 37127) supplied with the AEI package was overhauled in 1988 and, in 2005 was replaced with another, overhauled Avon engine (S/N 37116). This replacement engine was built in February 1967.

Some upgrades were made in 2006 including the installation of a new Serkstat Valve. Improvements in 2009 include an upgraded ventilation system for the powerhouse.

The usage history of the unit is summarized in the following tables:

Gas Generator S/N 37127 Operating History			
Time Since New (TSN)		Time Since Overhaul (TSO)	
Operating Hours	Starts	Operating Hours	Starts
2796	1951	776	N/A

Gas Generator S/N 37116 Operating History *			
Time Since New (TSN)		Time Since Overhaul (TSO)	
Operating Hours	Starts	Operating Hours	Starts
8006	2384	335	179

* As of June 14, 2010

On a monthly basis, the unit is started, synchronized and run on load. Every month, the unit is either black started and run on load for 30 minutes or parallel started and run on load for 1 hour, alternating monthly.

2.3.3 Mobile Gas Turbine

The Mobile Gas Turbine is normally located at the Grand Bay Substation in the community of Port aux Basques. The plant is comprised of three trailers; one trailer houses the Orenda gas generator and power turbine and Electric Machinery Manufacturing Co. electrical generator; one trailer houses the unit controls, switchgear, transformer and auxiliary power unit; one trailer is a 32,000 L Bedard fuel tanker. The package, rated at 7.2 MW, was assembled by Orenda and commissioned in 1974.

Minor improvements and repairs have been made since the 2005 depreciation study including the replacement of the lube pump motor and fuel pump receptacle in 2008 and the oil cooler in 2009.

The usage history of the unit is summarized in the following table:

Gas Generator Operating History*			
Time Since New (TSN)		Time Since Overhaul (TSO)	
Elapsed (hrs)	Starts	Elapsed (hrs)	Starts
N/A	N/A	424	N/A

* As of March 31, 2010

On a monthly basis, the unit is started, synchronized and run on load. Every month, the unit is either black started and run on load for approximately 15 minutes or parallel started and run on load for 30 minutes, alternating monthly.

3 EXISTING ASSET CONDITION

An accurate assessment of the condition of the plant is only possible by either partially or fully dismantling the turbines and diesels to assess wear, clearances, wall thicknesses and other critical parameters. Since such work was not in the scope of this study, the general condition of each plant was assessed through a review of the operating and maintenance history together with discussions with plant personnel.

The general condition of the plants has been summarized in the following table, with the condition category assigned as follows:

E – Excellent. Generally applies to condition of new (4 years old or less) equipment.

G – Good. Applicable to condition of equipment which is not new, but is operating as expected with no problems, and is well maintained.

F – Fair. Applicable to condition of equipment where some deterioration has taken place, but which can be rectified without a major expenditure.

P – Poor. Applicable to condition of equipment which is nearing the end of its service life, or where deterioration has proceeded to such an extent that a major expenditure (40% or more of value of equipment or structure) will be required within the next five years to effect repairs. This could also mean that the equipment is no longer functioning and needs to be replaced or taken out of service.

	Diesels			**Gas Turbines**		
	Port Union	Port-Aux-Basques #10	Mobile #3	Greenhill	New-Wes-Valley	Mobile
Engine	P	F	E	G	G	G
Power Turbine	N/A	N/A	N/A	P	F	G
Generator	P	F	E	F	F	F
Governor	P	F	E	G	G	G
Enclosure	N/A	F	E	P	F	P
Building Services	N/A	F	E	G	E	F
Inst / Controls	P	F	E	G	E	G
Switchgear	N/A	F	E	F	E	F

3.1 Diesel Plants

The existing diesel properties are generally in good condition and the equipment is maintained in good operating order.

The Port Union diesel unit is located inside the Port Union hydro plant and so discussion of the enclosure, building services, and switchgear is not included in this report. This unit is in poor condition and is currently out of service. The retirement of this unit is recommended immediately.

The condition of Port-Aux-Basques diesel #10 is not appreciably worse than was reported in the 2005 Depreciation Study. The engine and generator are in relatively good condition partially due to the low operating hours.

Mobile Diesel #3 was purchased new in 2004 and so is in excellent overall condition.

3.2 Gas Turbine Plants

The gas turbine plant properties are generally in good condition and maintained in good operating order.

The power turbine for the Greenhill gas turbine is in poor condition. The casing is cracked and will need to be repaired or replaced if the unit is to run at its peak performance for great lengths of time. The problem is no worse than reported in 2005.

The exhaust stack for the New-Wes-Valley gas turbine is badly corroded and in very poor condition. A planned replacement will likely occur within the next year or two.

The Mobile gas turbine is in reasonably good condition overall with the exception of the chassis which is in need of replacement or major repair.

4 REMAINING ASSET LIFE

The service life of a plant is typically determined by the overall plant life taking into account interim replacement of major components. Much of the present condition of a plant depends on how it was operated over its lifetime.

Most fossil fuel plants were originally designed as base load units and were intended to run steadily with as few starts and stops and as little cycling as possible. As the duty cycle changes, the increased stops, starts and load swings may cause major components to become more susceptible to failure through fatigue or creep.

Factors taken into account in determining the remaining service life of each generating unit include:

- Total hours run
- Operating and maintenance history
- Expected operating cycle
- Availability of spare parts
- Anticipated future maintenance requirements

Typically, replacement is required when:

- The equipment becomes too costly to maintain because of:
  - Excessive maintenance
  - Frequent adjustment
  - High failure rate
  - Spare parts are too costly, difficult or impossible to source
- The original or third party manufacturers no longer support the equipment
- There are changes in operational mode of the generating unit

4.1 Benchmark Information

Based on normal operation, high speed diesels, such as those currently operated by Newfoundland Power, have an expected life of about 30 years.

Aero-derivative gas turbines, such as those operated by Newfoundland Power typically have an expected life of 25 years. Gas turbines are particularly sensitive to fuel and air quality as well as the frequency of starts so these factors have a considerable effect of the life expectancy.

For Avon engines used in base load operations, the average time between overhauls is 30,000 hours of operation. For those used in electrical generation operations, the average is 1,500 cycles, where 1 cycle is equal to 1 successful start (based on the OEM's factor of 20 hours of operation per cycle). This frequency can vary depending on the service conditions of the unit, the environment in which it operates, and the total elapsed time since the last overhaul.

4.2 Life Extension

In addition to planned capital replacement of major components, Newfoundland Power has undertaken initiatives to extend the life of its existing assets.

An asset management program was implemented for the generation group to ensure ongoing asset integrity through effective engineering, maintenance, and inspection strategies. The program focuses on preventive and predictive maintenance.

Some of the predictive maintenance techniques being implemented in the thermal plants are: oil analysis on bearings and governor systems and unit vibration analysis.

4.3 Estimated Remaining Life

The estimated remaining life of the thermal plants is summarized in the following table.

	Diesels			**Gas Turbines**		
	Port Union	Port-Aux-Basques #10	Mobile #3	Greenhill	New-Wes-Valley	Mobile
Engine	-	5	25	10	15	15
Power Turbine (incl. gearbox)	N/A	N/A	N/A	5	5	10
Generator	-	5	25	5	5	5
Governor	-	10	15	10	15	15
Enclosure	N/A	5	25	5	30	<1
Building Services	N/A	5	15	10	30	5
Inst / Controls	-	5	15	10	15	15
Switchgear	N/A	5	15	5	15	5
Overall Plant	-	5	25	10	15	5

APPENDIX A

DIESEL PLANTS

A1 PORT UNION DIESEL

A2 PORT AUX BASQUES DIESEL

A3 MOBILE DIESEL

APPENDIX A1

PORT UNION DIESEL

Engine

Manufacturer:	Caterpillar
Model:	D-398A
Serial No.:	661B127, Series A
Rating (HP):	750
RPM:	1200

Generator

Manufacturer:	Canadian General Electric
Model:	102041-A
Frame:	763S
Serial No.:	754784
Rating (kW):	500
Volts:	2400
PF:	0.80
RPM:	1200

Exciter

Manufacturer:	Canadian General Electric
Model:	101424A
Type:	BF-823
Serial No.:	749761
Rating (kW):	6

Governor

Manufacturer:	Woodward
Type:	OG-8
Serial No.:	698784
Designation:	0 333 33
Customer Order #:	GL 4246


CATERPILLAR

APPENDIX A2

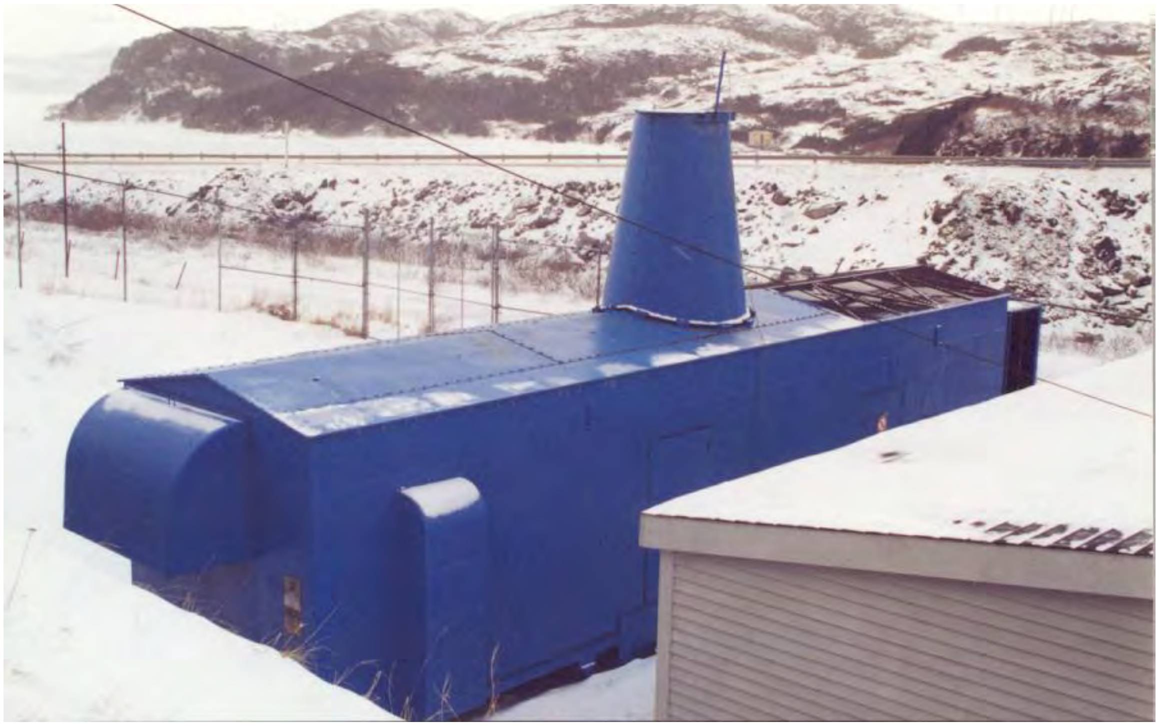
PORT AUX BASQUES #10 DIESEL

Engine

Manufacturer	GM
Type	20-645-E4
Serial No.	64E1 1081
H.P.	3600
Size	20 cyl.
rpm	900

Generator

Type	69-E1-1199
Serial No.	(1081)
Frame	3125
kVa	2500
kW	
P.F.	0.8
Volts	4160
Amps	
Phase	3
Cycle	60

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APPENDIX A3

MOBILE DIESEL

Unit #3

Engine

Manufacturer	Detroit Diesel – Allison Canada East
Model	20V4000G82
Serial No.	528100145
Rating (kW)	2740
Rated Speed	1800 rpm
Cylinders	20
Displacement	90 litres

Alternator

Manufacturer	Newage AVK SEG
Type	MVSI824E2
Serial No.	CO0852294/01
kVA	3060
Amps	424.7
Volts	4160
Phase	3
Hz	60
Rating (kW)	2448
RPM	1800
P.F.	-0.8


POWER


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APPENDIX B

GAS TURBINE PLANTS

B1 GREENHILL

B2 NEW-WES-VALLEY

B3 MOBILE

APPENDIX B1

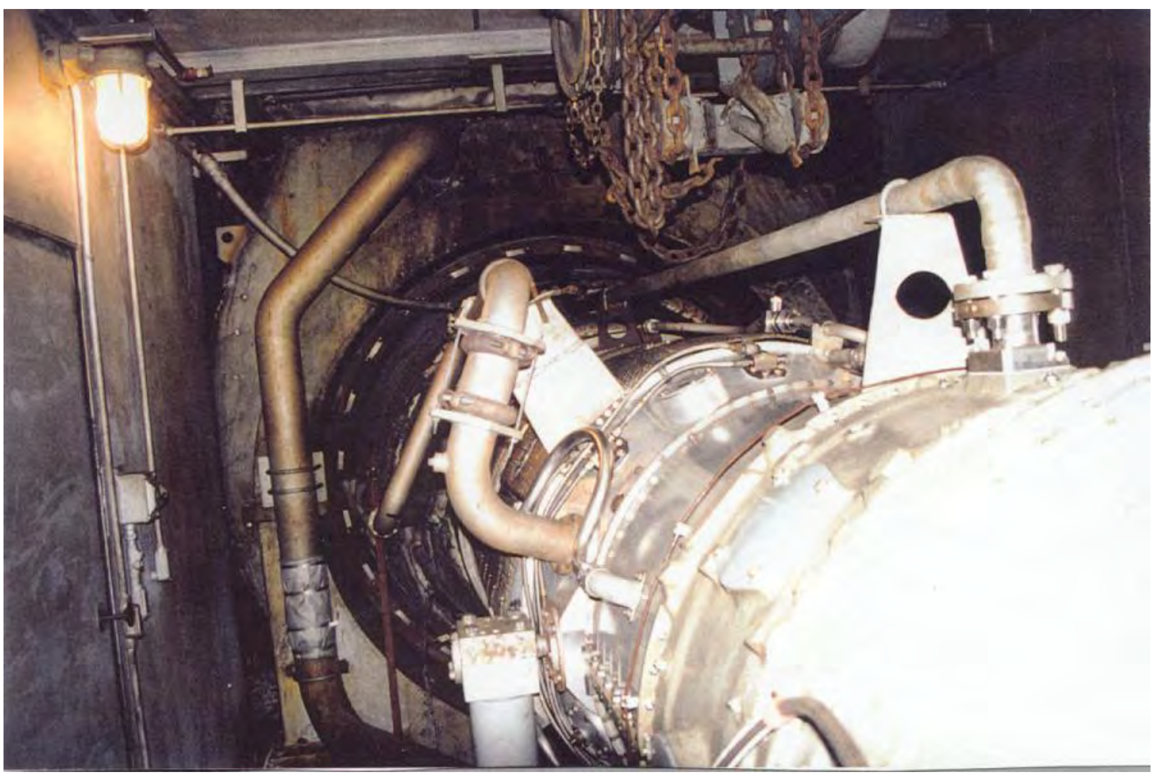
Greenhill Gas Turbine - Data Sheet

Supplier	Curtiss Wright
Gas Generator	Rolls Royce
Engine	Olympus "C"
	Industrial Type Mark No. 2022
Engine Serial No.	202203
Power Turbine	Curtiss Wright - Model No. CT-2
HP Rating/RPM	40500/3600
Serial No.	12042
Generator	Brush Electric

kVa	31800	Frame	B Dax 70.76
rpm	3600	M/C No.	753641
Volts	13800	Rating	MCR
Amps	1329	Spec.	ANSI C5013
Ph./Hz	3/60	Amb. temp.	15 degrees C
Ph. Conn	Star	Altitude	Up to 1000 ft.
Exc. Volts	202	Rotor Insulation	Class B
Exc. Amps	345	Stator Insulation	Class B
Date	1975	P.F.	8
Coolant	Air		

Brushless Exciter

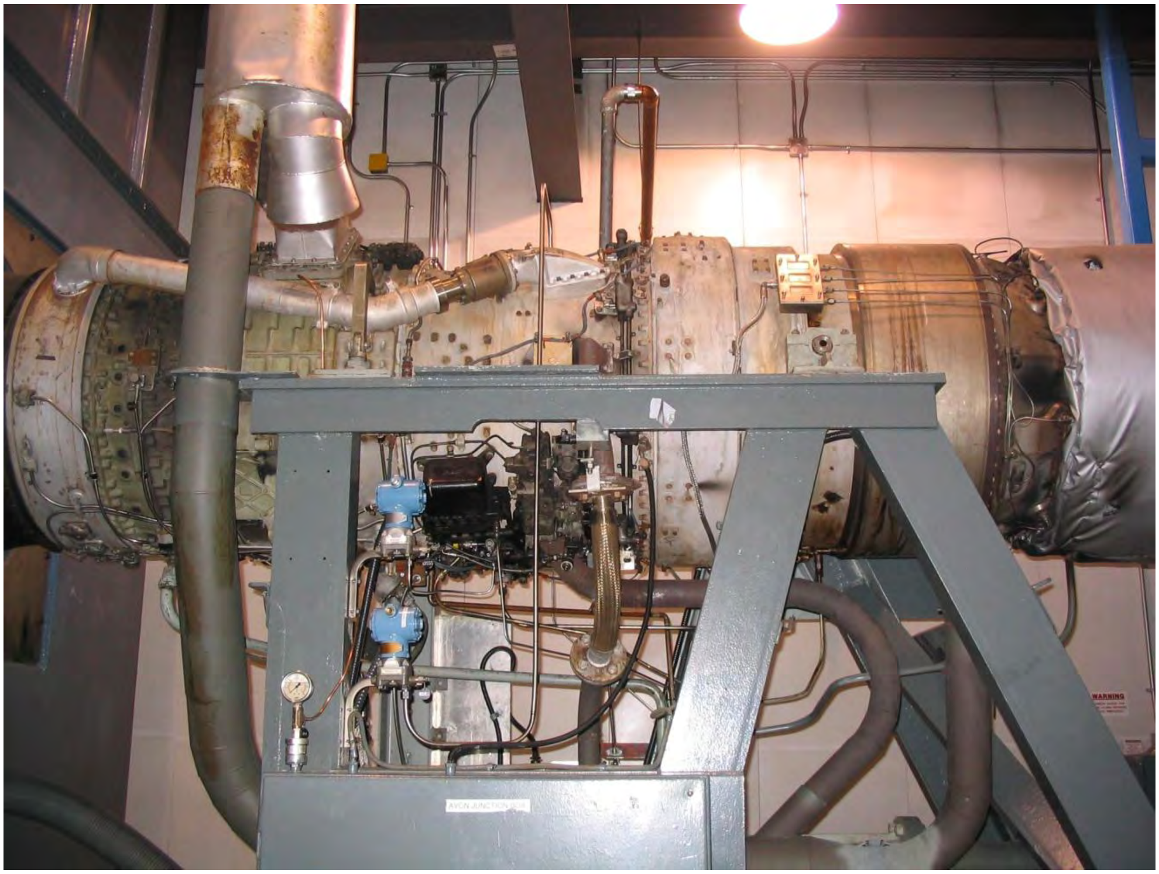
Rect. DC kW	77	Frame	BXJ 215
RPM	3600	M/c. No.	B753642
Rect. DC V	212	Spec.	ANSI C5013
Rect. DC A	363	Amb. Temp	15 degrees C
Ex. V	27.5	Altitude	Up to 1000 ft.
Ex. A	5.5	Rating	Cont.
Phase	3	Arm. Insualtion	B Class
Date	1975	Field Insualtion	B Class



APPENDIX B2

New-Wes-Valley Gas Turbine - Data Sheet

Supplier	Associated Electrical Industries (AEI)
Gas Generator	Rolls Royce
Engine	Avon Mark 1533-52L/10
Serial No.	37116
Power Turbine	AEI
	B Size Power Turbine
	Free Power Turbine
Generator	Associated Electrical Industries (AEI)
Type	AG 80/100
No.	R 230435
Year	1966
kVa	17700
Kw	14150
rpm	1200
Volts	13800
Amps	740
Phase	3
Cycles (Hz)	60
Power Factor	0.8

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APPENDIX B3

Mobile Gas Turbine Unit

Supplier	Orenda	
Type	OT-F-390	
Gas Generator	OT-390, Model 2C	
Serial No.	5907	
Power Turbine	OT-3, Model 6	
Serial No.	5055	
Rating	I.S.O.	Site
Power	7380 kW	7000 kW
Altitude	Sea Level	Sea Level
Ambient Air Temp.	15 degrees C	15 degrees C
rpm	7500	7500
Generator	Electric Machinery Manufacturing Co.	
Serial No.	173184601	
Frame	Turbo 52 x 35	
kVA	8100	
rpm	3600	
Volts	4160	
Phase	3	
Cycles (Hz)	60	
PF	0.9	
Insulation Class	B	
Exciter	Electric Machinery Manufacturing Co.	
Serial No.	173184606	
Frame	8TE1805	

January 14th,2010


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Bedard

2010 DEPRECIATION STUDY
TRANSMISSION

May 31, 2010

Prepared by: Trina L. Troke P. Eng.
Brian Combden

Table of Contents

1 Introduction

This report has been prepared to provide background information to aid in the development of the Newfoundland Power's 2010 Asset Depreciation Report for Transmission Lines.

Newfoundland Power is continuously reviewing and assessing its processes, procedures, and standards for design, material selection, construction, operation, and maintenance of its over 2,000 km of transmission lines. Such revisions and enhancements are expected to increase the life of both existing and new transmission lines.

In 2006, Newfoundland Power officially implemented its Transmission Asset Management program which, among other things, involves a systematic approach to completing annual inspections of every structure on every transmission line. The correction of deficiencies identified during these inspections also follows a systematic approach. A substantial number of deficiencies have been corrected since January 2006, including the replacement of large quantities of historically problematic CP/COB insulators.

In its 2006 Capital Budget Application, Newfoundland Power filed a Transmission Line Rebuild Strategy to establish a plan to rebuild its aging transmission lines. This plan prioritized the investments based on physical condition, risk of failure, and potential customer impact in the event of a transmission line failure. This plan is reviewed and updated annually. Since 2005, Newfoundland Power has planned for and rebuilt 126.8 km of deteriorated lines.

Each year, the Company receives a number of requests, from outside businesses and Governments, to have sections of transmission lines relocated or upgraded due to new residential and commercial development as well as road widening. Sections of lines are also relocated or upgraded because of changes made by Newfoundland Power to its own infrastructure (e.g. new substations). In most cases, this rebuilt plant is not at the end of its life and is therefore retired early.

A third driver for the rebuild of Newfoundland Power's transmission lines is that the electrical system continues to be subjected to harsh weather conditions and the occasional major ice storm. The system on the east coast of the Province was hit by two major ice storms in the past three years (in December 2007 and March 2010). As a result of extensive damage, entire sections of several lines had to be rebuilt.

Newfoundland Power seeks continual improvements in dealing with its Transmission lines in all aspects of design, construction and ongoing maintenance.

2 Current System Status

Newfoundland Power presently has 103 transmission lines in service with a combined total length of 2,056 km. There are only two lines presently operating at 33 kV (3L and 23L), with the remaining lines operating at either 66kV or 138kV. All of the lines are of single pole or H-frame construction and generally use wood poles, with a small number of steel poles, steel towers and laminated wood poles in specific areas. Lines range in age from newly built in 2009 to 68 years of age. A complete line listing can be found in Appendix A and summary statistics are presented in Tables 1 and 2 below.

Transmission Lines by Classification					
Voltage	**Single Pole (km)**	**H-Frame (km)**	**U/G Cable (km)**	**Total Length (km)**	**Total Lines**
33 kV	11	-	-	11	2
66 kV	854	569	3	1426	82
138 kV	6	613	-	619	19
Total	**871**	**1,182**	**3**	**2,056**	**103**

Table 1: Transmission Lines by Classification

Transmission Lines by Vintage	
Vintage	**km**
1940 - 1949	11
1950 - 1959	321
1960 - 1969	470
1970 - 1979	748
1980 -1989	269
1990 - 1999	120
2000 - 2009	117
Total	**2,056**

Table 2: Transmission Lines by Vintage

3 Engineering Standards

Newfoundland Power is continuously reviewing and assessing its design, material and construction standards and revising them based on changes to regulations, industry standards and experience. Several revisions and enhancements have been made in recent years which are expected to lead to increased life of existing and new lines.

3.1 Design Standards

In 2001, the Canadian Standards Association revised its Standard “C22.3 No.1 Overhead Systems” and increased the combined load conditions for supply lines built on the Avalon and Bonavista Peninsulas from 12 mm to 19 mm of radial ice with a wind load of 400 Pascals (Pa). This change, and the creation of a ‘severe’ loading area, was in recognition of the higher ice loads experienced in specific areas of the Country. All subsequent transmission lines built by Newfoundland Power on the Avalon and Bonavista Peninsulas have been built to this revised standard. Newfoundland Power has also extended this severe loading design area to the Burin Peninsula because of similar ice loads experienced in that area.

When a new design is being completed for a particular area, Newfoundland Power reviews its experience in that area, taking wind and ice load experience into consideration. As a result, design criteria often exceed the CSA standard for wind and ice design loads. This results in the construction of stronger and longer lasting lines. In the severe loading areas, designs are completed and ground clearances analyzed with a total of 38mm of radial ice with no wind.

Over the years, Newfoundland Power has changed how it designs lines to take advantage of technological advancement. Prior to 1990, line design was completed manually, requiring manual calculations for conductor sags and equipment loadings. In 1990, a computerized transmission line design software package, TLCADD, was purchased. This greatly enhanced the ability to assess various alternative line designs to ensure optimal and more robust line design.

In 2006, Newfoundland Power purchased the next generation of line design software, TL-PRO. This new software offers many advantages over previous versions and provides improvement of the structural analysis capabilities and optimization technology. Designs are completed using 3-dimensional terrains and all structural components are analyzed and compared to ultimate stress or other defined loading values.

Line routing is at times constrained by existing infrastructure and property issues. However, where practical, rebuilt lines are designed adjacent to existing road corridors making it easier to build, inspect and maintain lines further increasing the durability of these lines.

Over the last 10 years, Newfoundland Power has made several improvements to its design standards. For example, installation of yoke plates has eliminated the problem with double down guys choking and breaking where they wrap around the guy hook attachment on deadend structures. This type of structure provides stability and prevents cascading during catastrophic failure. As well, the implementation of a vertical, horizontal line post, insulator arrangement for single pole construction eliminates the need for crossarms, a wood component that deteriorates more quickly on average than other major components. These changes continue to improve on problems experienced in the past and extending the anticipated service life of new lines.

3.2 Materials Standards

3.2.1 Insulators

Insulators - Composite

While earlier versions of composite insulator technology experienced problems with material, in particular ultraviolet damage, new advancements have been widely used in the industry for a number of years. Newfoundland Power's first full project use of composite line post insulators was in 2002 and 2003 on 301L, a 66kV single pole line on the Burin Peninsula, when sections of this line were rebuilt. Since 2005, composite line post and suspension insulators have been used on a number of 66 kV lines that have been re-built, including 407L, 43L and 20L. Composite insulators offer several advantages over glass and porcelain insulators, depending on the requirement for a particular area. Composite insulators are used in high vandalism areas as they are more resilient to damage. They also offer a high leakage distance in areas where salt contamination is a factor, while maintaining minimal weight limitation compared to porcelain.

Insulators – Toughened Glass

For transmission line applications, Newfoundland Power's standard suspension insulator is toughened glass (TG). The TG suspension insulator has a superior performance record compared to porcelain insulators. They provide greater mechanical performance as the discs do not separate when damaged, thereby holding the conductor attachment intact and preventing further damage. As well, TG does not develop hidden or hairline fractures as can porcelain, caused by ageing, manufacturing defects or rough handling. As well, TG insulator discs shatter during failure making them easier to locate during a patrol and minimizing outage time. TG insulators that are intact maintain 100% of their electrical rating and do not deteriorate over time.

3.2.2 Conductor

Newfoundland Power previously eliminated 266.8 MCM ACSR (aluminum conductor steel reinforced) conductors from its standard conductor listing. This particular conductor has small aluminum stranding making it more susceptible to corrosion than larger strand conductor. Two locations have experienced corrosion problems with this type conductor in the past. There is no planned replacement of this conductor but will be removed from the system over time as lines are being rebuilt. There will be no new installations using this type of conductor. Currently, there are approximately 320 km of 266.8 ACSR conductor left in the system.

In 2007, a new aluminum alloy stranded conductor, 559.5 AASC (aluminum alloy stranded conductor), was introduced on the 20L rebuild. This alloy conductor offers increased rated breaking strength to comparable ACSR conductors, without a steel core thereby eliminating the potential for dissimilar metal corrosion issues. This conductor was also used on the remainder of 20L when it was rebuilt in 2008 and on a section of 110L when it was rebuilt in 2009.

3.2.3 Vibration Dampers

Wind blowing on conductors causes Aeolian vibration, a low amplitude, high frequency movement in the conductor which, over time, can lead to damage and fatigue failure in conductor and hardware. The common solution to Aeolian vibration is to install vibration dampers. A new anti-vibration damper has been used over the past number of years replacing the Company's previous standard, Stockbridge, damper which covered only one resonant frequency. This new damper covers five resonant frequencies thereby further reducing line vibration and conductor and hardware fatigue. Newfoundland Power installs vibration dampers on all H-Frame lines in locations identified by the manufacturer's software.

3.2.4 Anti-galloping Devices

Galloping, a low-frequency high amplitude movement in the conductor, occurs when there is a moderate wind blowing across a line that has accumulated an asymmetrical coating of ice. Galloping can be experienced on both Single Pole and H-Frame transmission line construction. If this galloping is not controlled, severe damage to the structures can occur. Different device types have been installed on transmission lines over the years for evaluation. While there are a variety of anti-galloping devices available, Newfoundland Power has found that for its applications, the interphase spacers (IPS) provide the best protection. The IPS is a composite style insulator that is installed between two conductors and provides a mechanical connection to inhibit movement.

In 2007, additional composite interphase spacers were installed on the remaining sections of 34L and 58L, a crucial double circuit H-Frame construction line feeding the east end of St. John's. These lines have experienced galloping in the past and had IPS installed on certain sections in 2000, with great success. The IPS prevents galloping and thereby reduces potential damage to these transmission lines. Applications of IPS devices have thus far, been limited to H-Frame configuration lines. Evaluation will be carried out in the near future on potential single pole applications for transmission lines 110L, 111L and 72L.

3.3 Construction Standards

Since 2005, Newfoundland Power requires that tension stringing equipment be used to install new conductor for all transmission rebuilds and major projects. Tension stringing equipment allows conductors to be installed under tension, allowing for less physical handling during installation. This provides two distinct advantages over the traditional methods of pulling the conductor over the ground prior to installing it in the poles. First of all, it is a safety related issue as it allows workers to perform the hazardous task of stringing conductor by allowing EPZ grounding and minimizing the handling required. Secondly it prevents the new conductor from being pulled over the ground during installation. Dragging the new conductor across the ground has potential for rock and sharp objects to cause damage to the conductor.

In 2008, a new "Transmission Construction Policy" was developed outlining the process to be followed when new lines are being constructed. The purpose of the policy was to provide direction to project supervisors to ensure consistency between projects, to ensure all projects are being managed effectively and that design criteria and standards are properly adhered to. It outlines activities for which contractors are to be monitored during the construction period and specifying the roles and responsibilities of project supervisors.

All transmission line sections are rebuilt to a high quality standard to ensure the long term reliability of the line. Prior to energizing any new rebuild or relocation project, a climbing inspection is completed by a qualified Planner. This inspection reviews all installed components including poles, hardware, conductors and sags, to identify any deficiencies that need to be corrected prior to energization. In addition, a Pole Footing Report form is completed for each pole as it is installed, and signed by the installer. This report ensures the installer takes overall responsibility for the quality of the installation, verifies that all specifications are being adhered to and provides a detailed documentation of the installation for future reference.

4 Asset Management

Through the 1990's and until late 2005, there was little formalized or consistent process around transmission line inspection and maintenance at Newfoundland Power. An in-house software application, Transmission Line Inspection System (TLIS), was used to maintain any data including a structure listing, and information about inspections and deficiencies on the lines. Any inspections that were completed used paper forms, and data was only sometimes manually entered into TLIS by data entry clerks. Many times the inspections, deficiencies and required follow-ups were never entered into the system, even though the work may have been completed in the field. There was always uncertainty as to whether or not the work had actually been done.

The employees completing the inspections often went to the field without any structured or consistent training in inspection standards and guidelines. This meant there was little consistency in the inspection results and therefore the credibility of the maintenance program was often questioned by employees at various levels of the organization. As well, the due to the fact that there was no consistent approach or standard definitions of deficiency priorities, inspectors often recorded a tremendous number of non-critical deficiencies, the correction of which would not be effective use of precious crew time and would not add value or improve safety or reliability of the electrical system. These low priority deficiencies effectively clogged TLIS, defeating the usefulness of the system. Maintenance jobs resulting from the inspections therefore, were rarely planned in detail, prioritized, scheduled, or even completed.

By late 2005, the new Transmission Asset Management System (TAMS) software within the Company's Avantis database had been rudimentarily implemented. All the asset data from TLIS was uploaded into TAMS and annual inspection work orders were generated for completion in 2006 on each transmission line. Mobile computing (hand held devices) had been purchased to allow inspectors to key their inspection data during their inspections, and, in the future, to review data from previous inspections.

Employees received an orientation to the TAMS software as well as to the hand held devices. While there was little in the way of supporting process or documentation at that point in time, there were some changes made to the Transmission Line Inspection Policy to establish that each structure on each transmission line would be inspected from the ground each year and at least one of every four ground inspections would be carried out with no snow cover present. It established that, during detailed ground inspections of transmission lines, all poles, towers, conductors, insulators, cross arms, cross braces, anchors, guys, and other hardware, as well as the right-of-way, would be inspected and deficiencies that require correction would be identified. The policy established which types of deficiencies should be recorded and which should not. Deficiency priorities were documented (immediate failure, failure within 7 days, failure within 6 months, and failure within 18 months) to ensure that any deficiencies that were identified during inspections were immediately prioritized for correction and to eliminate the possibility of overloading the TAMS database with information that did not add value and about work that would never be completed.

In January 2006, a new position was created so that employees could be dedicated to completing inspections and planning the resultant maintenance activities. Five "Planners" were appointed to this position and a Supervisor was also appointed to manage and bring consistency to the overall process. The Planners themselves were chosen from trades people, typically power line technicians or others with relevant experience, which were familiar with completing the work which they were now being asked to plan and had knowledge of the equipment.

Planning each deficiency correction job requires providing details of what materials will be required, what trades will be required and the level of effort required. Having a job properly planned prior to the start of work, effectively increases the efficiency and productivity of the workforce and improves the overall quality of the work.

In 2006, the Transmission Inspection Policy was revised and associated training modules developed. Periodically in 2006 and 2007, workshops were held with the Planners to provide them with the necessary training on such topics as roles and responsibilities, transmission line inspection procedures, use of the Avantis (TAMS) software, legacy site monitoring, construction site supervision, contract management, the transmission line rebuild strategy, and vegetation management.

In early 2008, organizational changes were made to facilitate the implementation of a Distribution Asset Management program which effectively de-centralized the Transmission Asset Management program. Additional Planners were appointed and all Planners were given the added responsibility of inspections and maintenance planning for all the Distribution Lines as well as all the Transmission Lines in their area. Also, instead of Planners functionally reporting to a single person and a single Superintendent, the program was divided between Eastern Region and Western Region. Each Region now manages its Transmission & Distribution Asset Management program independently of the other Region, in a way that is most efficient and effective for the Region.

4.1 Inspections

Through the transmission asset management program, in 2006 the Planners systematically completed and documented inspections on the entire length (2,062 km) of all 104 Newfoundland Power owned transmission lines, perhaps for the first time ever in a single year. The 2006 line statistics are presented in Table 3 below.

Operating Area	Qty.	Length (km)
St. John’s	39	286.5
Carbonear	15	398.9
Burin	5	138.0
Clarenville	8	381.2
Gander / Grand Falls	18	574.1
Corner Brook	8	135.2
Stephenville	11	148.4
TOTAL	**104**	**2,062.3**

Table 3: 2006 Transmission Line Statistics

During the inspections, the Avantis database was updated to correct the numerous inconsistencies in the structure lists that had been transferred over from the old TLIS system. Deficiencies were prioritized and corrected in accordance with the Policy.

In January 2007, the Planner line assignments were revised to more evenly distribute the workload. Again, urgent deficiencies were promptly corrected, as they were discovered, and further improvements were made to processes and to the equipment database.

In 2008 and 2009, the Planners in Eastern Region and Western Region again completed inspections on 100% of the transmission structures in their respective Regions.

4.2 Deficiency Correction

Each year, any urgent deficiencies, recorded during the transmission line inspections, are promptly addressed. This no doubt results in improved system reliability, although it is often difficult to quantify failures that did not occur.

One notable example of failure prevention followed the first inspection of transmission line 116L, in 2006, where numerous instances of severe conductor damage were noted. Because of the inspection and planning processes, the corrective maintenance work was completed under controlled conditions, with all necessary resources and materials assembled on site prior to the start of work and with planned switching orders in place to make the worksite safe. Should the line have experienced unplanned failure, customers fed from the associated substations would certainly have experienced a lengthy outage.

Contracts are typically put in place to complete planned work to correct many other, non-emergency deficiencies that are identified and recorded during inspections. In 2006, a new Transmission Line Construction Services Agreement was developed and put in place with four contractors. This Agreement blended the flexibility of Newfoundland Power's standard CSA (Contractor Standing Agreement) process and contract format with the functionality of the standard engineering and surveying services contracts format to allow for transmission line maintenance work to be completed in a very efficient manner. In 2007 and 2008, the Transmission Line Construction Services standing agreement was renewed for additional years. It was re-tendered in 2009 for another period.

4.2.1 Specifics of the Work

In 2006, a significant amount of maintenance work (insulator replacements, hardware replacements, conductor repairs, structure replacements, etc.) was completed on 116L, 123L, 146L, and 358L under a single contract. Work completed under the new Transmission Construction Services Agreement included maintenance on transmission lines: 25L, 94L, 95L, 100L, 110L, 134L, and 416L.

In 2007, by the end of Q2, deficiency correction work stemming from inspections, including the replacement of deteriorated cross arms, hardware, insulators, and structures, had been completed on 34 transmission lines. Overall, higher priority deficiencies were corrected on the following 39 transmission lines: 5L, 12L, 13L, 16L, 17L, 20L, 24L, 32L, 39L, 41L, 48L, 56L, 57L, 59L, 64L, 65L, 68L, 69L, 80L, 100L, 101L, 102L, 105L, 108L, 109L, 110L, 124L, 134L, 136L, 140L, 305L, 308L, 356L, 363L, 400L, 401L, 402L, 410L, and 416L.

As well, urgent repairs were completed on transmission lines 64L and 102L due to lightning damage, 66L due to wind storm damage, and 80L, 116L, 123L and 407L due to insulator vandalism.

The 2007 insulator replacement projects were essentially a continuation of work completed in 1994 to address the issue of premature in-service failures of 1965 to 1975 vintage suspension insulators manufactured by the former Canadian Porcelain (CP) and Canadian Ohio Brass (COB) companies. The work addressed many of the outstanding issues. The 2007 insulator replacement projects involved the replacement of at-risk insulators and ball-link eyebolts on transmission lines 103L, 130L, 132L, 133L, 136L, 142L, 144L, and 352L. Work on transmission line 351L was completed in early January 2008.

In 2008, deficiency correction work was completed on the following transmission lines in Eastern Region: 19L, 21L, 22L, 23L, 25L, 34L, 35L, 39L, 48L, 49L, 51L, 52L, 54L, 57L, 58L, 64L, 66L, 67L, 72L, 73L, 79L, 80L, 302L, and 308L. This work typically involved the replacement of insulators, hardware, deteriorated cross arms, and deteriorated structures. Of these transmission lines, at least some CP/COB insulators were replaced on all but 21L and 48L, and on 57L where work involved the replacement of some entire structures.

As well, on transmission line 123L, twelve ‘DH’ structures were replaced with more-robust ‘E1H’ structures. This work came out of recommendations following the December 2007 ice storm which impacted transmission line 123L.

In Western Region, in 2008, deficiency correction work was completed on the following transmission lines: 114L, 140L, 402L, 403L, 410L, and 416L. This work typically involved the replacement of insulators; deteriorated cross arms, cross braces, hardware, poles, cribs, and entire structures; and damaged or deteriorated conductor and overhead ground wire.

In 2009, deficiency correction work was completed on the following transmission lines in Eastern Region: 39L, 48L, 56L, 57L, 64L, 100L, 110L, and 124L. This work typically involved the replacement of CP/COB insulators. However, on 57L and 110L, work involved the replacement of deteriorated cross arms and entire structures.

In Western Region in 2009, deficiency correction work was completed on the following transmission lines: 102L, 105L, 108L, 115L, 116L, 136L, 144L, 146L, 403L, 405L, 406L, and 416L. This work typically involved the replacement of deteriorated poles and entire structures. It also involved the replacement of deteriorated insulators, cross arms, cribs, hardware, dampers, guys and damaged or deteriorated conductor. New anchors and guys were installed in critical locations.

In 2010, Eastern Region plans to replace all remaining CP/COB insulators on transmission lines: 39L, 48L, 64L, 80L, 86L, and 109L, for a total of 291 structures. As well, some deteriorated structures are to be replaced on 20L and 302L.

In 2010, Western Regions has deficiency correction work planned on transmission lines: 101L, 102L, 116L, 130L, 132L, 133L, 136L, 142L, 144L, 146L, 356L, 416L, and 417L. There are numerous insulator replacements (a total of 489 structures). In addition to insulator replacements, work on transmission lines 130L and 417L also involves the replacement of deteriorated cross arms and poles. On 101L and 102L, the work involves the replacement of deteriorated cross arms and poles, and 116L, the work involves the installation of mid-span structures.

5 Rebuilds, Relocations, and Retirements

5.1 Rebuilds

5.1.1 Rebuild Strategy

In its 2006 Capital Budget application to the Public Utilities Board, filed in 2005, Newfoundland Power submitted its Transmission Line Rebuild Strategy outlining a 10-year plan to rebuild aging transmission lines. This plan prioritized the investment in rebuild projects based on physical condition, risk of failure, and potential customer impact in the event of a failure.

The Transmission Line Rebuild Strategy is updated annually to ensure that it reflects the latest reliability data, inspection information, and condition assessments.

With the 2008 Capital Budget application, filed in 2007, the Transmission Line Rebuild Strategy was significantly updated and now showed a 15-year plan. The cost estimates in this revision have been adjusted to reflect the inflationary increases that have affected both labour and non-labour costs since the original strategy was prepared in 2005. As well, the costs presented in the table now utilize escalation factors intended to more accurately indicate the estimated cost of the project in the year in which it will take place.

In 2009, the Company completed a detailed ampacity review of the St. John's Area transmission system to better under the electrical strengths and limitations. The results influenced changes to the Transmission Line Rebuild Strategy for the 2010 Capital Budget Application.

The most recent version of the Transmission Line Rebuild Strategy is presented in Appendix B. The expected life of these assets is reflected by the year in which each line is planned to be rebuilt.

5.1.2 Major Rebuild Work 2006-2010

Since 2006, Newfoundland Power has rebuilt 126.7 km of its existing transmission lines. This is approximately 6 % of total km of line in service. These lines were identified in the Transmission Line Rebuild Strategy for rebuilding due to age and deteriorated condition.

Table 4, below identifies the rebuilds that have been completed during the past 5 years. There were no significant upgrades to these lines since they were originally built however miscellaneous maintenance to replace damaged or deteriorated components such as crossarms, insulators, etc. would have been completed.

Year Rebuilt	Line Number	Length Replaced (km)	Year Originally Built
2006	110L 407L 43L	7.4 7.3 12.0	1958/1973 1956 1956
2007	110L 20L 43L	13.9 7.5 5.8	1958/1973 1951 1956
2008	20L 111L	14.4 13.0	1951 1956
2009	110L 111L	4.7 17.3	1966 1956
2010 (Proposed)	23L 24L 110L	5.4 7.7 10.3	1942 1964 1966
Total Rebuilt		**126.7 km**	

Table 4: Recent Transmission Line Rebuilds

Due to the overall length of some of the Company's transmission lines, a rebuild may take more than one year to complete, with sections prioritized based on the age and condition of the line. Transmission line, located between Heart's Content and New Chelsea, was completely rebuilt over a 3-year period from 2005 to2007. Transmission line 20L, located between Mobile and Cape Broyle, was completely rebuilt during 2007 and 2008. Transmission line 111L, between Lockston and Catalina, was completed during 2008 and 2009. In 2010, the final sections of 24L and 17L will be rebuilt, completing both those lines.

5.1.3 Voltage Conversions 2006-2010

As referenced previously in Table 1, the majority of Newfoundland Power's transmission lines are 66kV and 138kV. At present, there are still two remaining transmission circuits operating at 33kV: 23L in Witless Bay and 3L at Petty Harbour. 23L was scheduled to be converted to 66kV in 2010 but may be delayed.

Transmission line 403L is a 20 km single pole radial line from St. Georges Substation to Lookout Brook Hydroelectric Station, with a 4 km tap going to Robinsons Substation. With the exception of the Robinsons tap, the line was rebuilt in 2001 and 2004 and was totally converted from 33 kV to 66 kV in 2008.

5.2 Relocations

Each year, the Company receives a number of requests, from outside businesses and Governments, to relocate or upgrade sections of transmission lines due to new residential and commercial development as well as road widening. Sections of lines are also relocated or upgraded because of changes made by Newfoundland Power to its own infrastructure (e.g. new substations). In most cases, these sections of transmission lines are not at the end of their useful life and therefore are retired early. Any salvageable material is returned to inventory for future use.

During the period 2006 to the end of 2009, the following lines have had relocation work completed: 4L, 5L, 19L, 21L, 23L, 24L, 35L, 49L, 51L, 54L, 59L (1.1 km), 73L, 74L (0.9 km), 79L, 102L (1.1 km), 110L, 114L, 305L, 359L, 401L and 403L.

Each of these projects involved short sections of line totaling approximately 9.5 km relocated or upgraded during that period.

For 2010 there are a number of relocations proposed due to road widening projects or subdivision developments involving transmission lines: 15L, 19L, 35L, 52L, 54L and 59L.

5.3 Retirements

In addition to the normal upgrading of lines, due to scheduled rebuilds or relocation requests, occasionally lines are retired from service altogether and not replaced.

In 2007, Newfoundland Power retired from service a 66 kV single pole line (53L), 5.9 km in length that had been built in 1961. This line was originally serviced the Golden Eagle Refinery in Holyrood. The electrical load for this facility has decreased substantially over the years and can now be serviced from the distribution system in the area.

301L is a 66kV single pole transmission line between Marystown and Grand Bank. There is a 1.6 km tap (Garnish tap) that connects Garnish Substation to the main transmission line. This tap section, which was constructed in 1959/1966, was removed from service in 2009 and will be dismantled in 2010. A new Garnish Substation has been constructed in the main transmission line with a distribution circuit now replacing the previous 66kV tap.

5.4 Ice Storms

Because of its geographic location, Newfoundland Power's electrical system is subjected to harsh weather conditions. Typically damage is minor and localized but can be quite significant depending on the severity of the storm and the amount of ice involved. However, the transmission system on the east coast of the Province has been hit by two major ice storms in the past 3 years. The first occurred in December 2007 and damaged transmission lines 123L, 110L and 111L on the Bonavista Peninsula. Those same lines were damaged during another ice storm in March 2010, as well as transmission lines at New-Wes-Valley and the on Bay De Verde Peninsula.

5.4.1 December 2007

On December 2, 2007 an ice storm hit the Bonavista Peninsula damaging both transmission line feeds to the area. Transmission line 123L is a 138kV H-Frame line, between Clarenville and Catalina, sustained damage to 13 structures. This included severe damage to a 2 km section (7 structures) and broken crosssarms on an additional 6 structures. The 2 km destruction of 123L was a result of severe ice loading which caused the conductor to break at Port Rexton. The unbalance in tension that resulted caused failure of a DH structure as well as several adjacent structures.

Transmission lines 110L and 111L are 66kV single pole circuits located between Clarenville and Lockston and Lockston and Catalina respectively. Damage to these single pole lines was less severe, with 9 structures being affected in total.

A number of lessons were learned as a result of the damage and restoration of power in December 2007. One of these lessons centered on the vulnerability of “DH” type structure during ice loading conditions. The “DH” structure is a 2-pole configuration where conductors are deadended and tensions on both sides of the structure are balanced, mainly to control uplift situations. However, when the tension on both sides becomes unbalanced, due to uneven ice loading or a conductor breaking, failure can occur and cause a cascading effect resulting in damage to a number of structures in a line. Due to the uneven terrain, there were a number of these particular type of structures located along 123L. In 2008, a total of 12 “DH” structures were replaced with “E1H” deadend structures. “E1H” structures are full tension deadends and are meant to control unbalance tensions. In 2010, one of these 2008 “E1H” structures prevented further cascading of the damages incurred on 123L.

5.4.2 March 2010

On March 6, 2010 an ice storm moved across portions of eastern Newfoundland, damaging transmission lines from Wesleyville to Bay De Verde.

116L, a 66kV single pole (H-Frame in sections) line from Gambo to New-Wes-Valley, sustained damage to 18 structures. This was mainly crossarm damage as a result of the severe ice loading

On the Bonavista Peninsula, damages to both transmission lines resulted to a sustained power interruption to the area. 123L, the 138kV H-Frame line between Clarenville and Catalina, sustained damage to 44 structures in total. Twenty-seven of these structures were located in a 5 km section that was devastated and had to be completely rebuilt, with larger class poles and new conductor. 110L and 111L, both 66kV single pole circuits located between Clarenville and Lockston and Lockston and Catalina respectively, sustained damage to 60 structures in total.

In the Bay De Verde area, damaged occurred to transmission lines 41L, 55L, 65L and 80L. Details of the damage are outlined below.

41L is a 66kV H-Frame transmission line located between Carbonear and Heart’s Content. A 5 km section located across the Heart’s Content barrens was severely damaged and has to be replaced. This section will be surveyed and a design completed using new loading criteria based on the ice load experienced in March.

55L is a 66kV single pole line located along the Argentia Access Road from Blaketown to Argentia, with a 1 km tap to Newlite Quarry Site. A total of 6 structures on the Newlite tap were damaged and replaced, including the poles and conductor.

65L is a 66kV transmission line constructed with both single pole and H-Frame structures, located between New Chelsea and Old Perlican. Damage as a result of the ice was limited to 10 H-frame structures in total .

80L is a 66kV H-Frame transmission line located between Blaketown and Heart's Content. A 5 km section near Heart's Content, rebuilt in 1992, was severely damaged and had to be replaced entirely including new conductor. A total of 21 structures were replaced using larger class poles. Damaged resulted from unbalanced tensions in the line when a conductor burnt off as it sagged to the ground and made contact with a fence.

Overall, ice measurements taken in some of the areas immediately following the ice storm, yielded measurements higher than those designed for, or measured during previous ice storms. Samples of ice were taken from the damaged conductor and weighed and it was determined that the lines were subjected to 2" of equivalent radial ice (ERI). This information will be used to determine future designs conditions in those areas.

6 Conclusion

To extend the life of its transmission assets, Newfoundland Power is continually improving its practices and plans for line design, construction, and maintenance. Improvements in standards, materials and design software, along with stricter construction guidelines, mean new installations are being better built. Systematic maintenance management processes and procedures facilitate the detection, correction, and trending of deficiencies before larger and widespread problems occur and help to maximize the life of existing assets. Finally, a structured long-term plan to re-build aging transmission lines, along with shorter-term plans to rebuild sections of lines due to external influences, is resulting in an ongoing renewal of the transmission system.

APPENDIX A

Transmission Line Listing

(as of May 18, 2010)

LINE #		LOCATION FROM	LOCATION TO	LENGTH Km	YEAR BUILT	LINE TYPE		VOLTS kV	CONDUCTOR SIZE	CONDUCTOR TYPE
3	L	Petty Harbour (1)	Point A (str 13)	0.90	2002	S POLE (STEEL)	Radial	33	4/0	AASC
3	L	Point A (str 14)	Point B (str 61)	3.40	2004	S POLE (STEEL)	Radial	33	4/0	AASC
3	L	Point B (str 62)	Goulds (82)	1.30	2004	S POLE (WOOD)	Radial	33	4/0	AASC
4	L	Goulds (1)	Point A (str 47)	3.35	2000	S POLE	Loop	66	477	ASC
4	L	Point A (str 48)	Pt B (u/g term)(191)	5.50	1979	S POLE	Loop	66	477	ASC
4	L	Point B (u/g term)	Main Sub	0.40	1978	U/G CABLE	Loop	66	1000	CBLE
5	L	Hardwoods (1)	Broad Cove (172)	12.87	1982	S POLE	Radial	66	477	ASC
11	L	Tors Cove	Mobile	4.96	2005	S POLE	Radial	66	4/0	AASC
12	L	Memorial	Point A (u/g term)	0.97	1966	U/G CABLE	Loop	66	350	CBLE
12	L	Pt A (u/g term) (1A)	King's Bridge (60)	2.17	1950	S POLE	Loop	66	1/0	CU
13	L	Main Sub	Point A (u/g term)	0.42	1978	U/G CABLE	Loop	66	1000	CBLE
13	L	Pt A (u/g term) (1)	Point B (str 16)	0.60	1978	S POLE	Loop	66	477	ASC
13	L	Point B (str 17)	Point C (str 64)	1.54	1962	S POLE	Loop	66	477	ASC
13	L	Point C (str 65)	Point D (str 67)	0.20	1994	S POLE	Loop	66	477	ASC
13	L	Point D (str 68)	Stamp's Lane (81)	0.30	1962	S POLE	Loop	66	477	ASC
14	L	Stamp's Lane (1)	Point A (14)	0.45	1993	TRIPLE CCT	Loop	66	477	ASC
14	L	Point A (14)	Pt B (u/g term) (36)	0.68	1950	S POLE	Loop	66	477	ASC
14	L	Point B (u/g term)	Memorial	1.13	1966	U/G CABLE	Loop	66	350	CBLE
15	L	Molloy's Lane (1)	Point A (str 5)	0.60	1970	DBL CCT(STEEL)	Loop	66	477	ASC
15	L	Point A (str 6)	Point B (str 8)	0.30	1970	H FRAME	Loop	66	477	ASC
15	L	Point B (str 9)	Point C (str 16)	0.47	1988	S POLE	Loop	66	477	ASC
15	L	Point C (str 17)	Point D (str 27)	0.44	1958	S POLE	Loop	66	266.8	ACSR
15	L	Point D (str 28)	Stamp's Lane (73)	2.41	1972	S POLE	Loop	66	477	ASC
16	L	King's Bridge (1)	Pepperell (50)	1.98	1950	S POLE	Loop	66	1/0	CU
17	L	Goulds (1)	Point A (str 135)	8.90	2003	S POLE	Radial	66	477	ASC
17	L	Point A (str 227)	Big Pond (223)	0.50	1964	S POLE	Radial	66	3/0	CU
18	L	Glendale (1)	Point A (str 22)	1.13	1977	S POLE	Loop	66	715.5	ASC
18	L	Point A (str 23)	Goulds (84)	4.62	1952	S POLE	Loop	66	266.8	ACSR
19	L	Hardwoods (1)	Point A (133)	8.00	1977	S POLE	Loop	66	715.5	ASC
19	L	Point A (8K)	Point B (6K)	0.30	1970	DBL CCT(WOOD)	Loop	66	477	ASC
19	L	Point B (5K)	Molloy's Lane (1K)	0.60	1971	DBL CCT(STEEL)	Loop	66	477	ASC
20	L	Cape Broyle (1)	H C Tap (str 21)	2.57	2008	H FRAME	Radial	66	559.5	AASC
20	L	H C Tap (str 22)	Hell Hell Pond (str 53)	5.45	2008	H FRAME	Radial	66	559.5	AASC
20	L	Hell Hell Pd (str 53)	ROP (str 92)	7.52	2007	H FRAME	Radial	66	559.5	AASC
20	L	ROP (str 92)	MOB (str 129)	6.33	2008	H FRAME	Radial	66	559.5	AASC
21	L	Horse Chops (1)	HorseChopsTap (37)	5.24	1952	H FRAME	Radial	66	266.8	ACSR
22	L	Morris Plant (1)	Morris Plant Tap (76)	5.45	1983	S POLE	Radial	66	4/0	AASC
23	L	Pierre's Brook (1)	Mobile (114)	5.47	1942	S POLE	Radial	33	3/0	CU
24	L	Mobile (1)	Point A (str 70)	10.80	2002	H FRAME	Radial	66	397.5	ACSR
24	L	Point A (str 71)	Point B (str 197)	7.73	1964	S POLE	Radial	66	3/0	CU
24	L	Point B (str 198)	Big Pond Sub (232)	2.14	2003	S POLE (STEEL)	Radial	66	477	ASC
25	L	Goulds (1)	Main Sub (51)	9.25	1954	H FRAME	Loop	66	477	ACSR
30	L	King's Bridge (1)	Ridge Road (87)	2.91	1959	S POLE	Loop	66	477	ASC
31	L	Stamp's Lane (1)	Oxen Pond (69)	2.62	1993	S POLE	Loop	66	715.5	ASC
32	L	Oxen Pond (1B)	Ridge Road (59)	3.07	1963	S POLE	Loop	66	477	ASC
34	L	Virginia Waters (1)	Point A (str 33)	2.83	1973	HFrame(DBL CCT)	Loop	66	715.5	ASC
34	L	Point A (str 34)	Point B (str 66)	1.53	1976	S POLE	Loop	66	715.5	ASC
34	L	Point B (str 67)	Point C (str 99)	2.83	1986	S POLE	Loop	66	715.5	ASC
34	L	Point C (str 100)	Oxen Pond (140)	2.09	1984	S POLE	Loop	66	715.5	ASC
35	L	Kenmount (1)	Point A (str 22)	1.51	1975	S POLE	Loop	66	715.5	ASC
35	L	Point A (str 23)	Point B (str 57)	3.39	1959	S POLE	Loop	66	4/0	ACSR
35	L	Point B (str 58)	Oxen Pond (86)	2.04	1965	S POLE	Loop	66	477	ASC

LINE #		LOCATION		LENGTH	YEAR	LINE TYPE		VOLTS	CONDUCTOR	
		FROM	TO	Km	BUILT			kV	SIZE	TYPE
38	L	Seal Cove (1)	G Eagle Tap (str 46)	2.74	2004	S POLE	Loop	66	715.5	ASC
38	L	G Eagle Tap (11K)	Duff's (1K)	0.80	1968	S POLE	Loop	66	397.5	ACSR
39	L	Duff's (1)	Holyrood Sub (56)	12.07	1977	H FRAME	Loop	138	397.5	ACSR
39	L	Holyrood Sub (57)	Point A (str 88)	6.60	1977	H FRAME	Loop	138	397.5	ACSR
39	L	Point A (str 89)	Colliers (125)	10.00	1971	H FRAME	Loop	138	397.5	ACSR
39	L	Colliers (126)	Springfield (161)	4.67	1971	H FRAME	Loop	138	397.5	ACSR
39	L	Springfield (162)	Bay Roberts (202)	8.50	1971	H FRAME	Loop	138	397.5	ACSR
40	L	Carbonear (1)	Victoria (29)	5.91	1975	H FRAME	Radial	66	397.5	ACSR
41	L	Carbonear (1)	Point A (str 11)	2.01	1974	H FRAME	Loop	66	397.5	ACSR
41	L	Point A (str 12)	Heart's Content (203)	18.83	1958	H FRAME	Loop	66	4/0	ACSR
43	L	Heart's Content	Point A (str 4)	0.18	2006	S POLE	Radial	66	477	ASC
43	L	Point A (str 4)	Winterton (Str 68)	11.30	2006	H FRAME	Radial	66	397.5	ACSR
43	L	Winterton (Str 68)	Winterton (Str 75)	0.47	2006	S POLE	Radial	66	477	ASC
43	L	Winterton (Str 75)	Hant's Harbour (Str 118)	8.00	2005	H FRAME	Radial	66	397.5	ACSR
43	L	Hant's Harbour (Str 118)	Hant's Harbour (Str 124)	0.39	2007	S POLE	Radial	66	477	ASC
43	L	Hant's Harbour (Str 124)	NCH Forebay (str 148)	4.47	2007	H FRAME	Radial	66	397.5	ACSR
43	L	NCH Forebay (str 148)	NCH Sub	0.96	2007	S POLE	Radial	66	477	ASC
48	L	Bay Roberts (1)	Blaketown (134)	25.35	1967	H FRAME	Loop	138	397.5	ACSR
49	L	Hardwoods (1)	Point A (40)	2.72	1966	S POLE	Loop	66	336.4	ACSR
49	L	Point A (41)	Chamberlains (106)	5.50	1976	S POLE	Loop	66	477	ASC
51	L	Chamberlains (1)	Point A (str 28)	1.60	1986	S POLE(DBL CCT	Loop	66	477	ASC
51	L	Point A (str 29)	Point B (str 93)	4.70	1976	S POLE	Loop	66	477	ASC
51	L	Point B (str 94)	Point C (str 103)	0.70	1995	S POLE	Loop	66	477	ASC
51	L	Point C (str 104)	Kelligrews (146)	3.10	1976	S POLE	Loop	66	477	ASC
52	L	Kelligrews (1)	Seal Cove (110)	8.22	1976	S POLE	Loop	66	477	ASC
54	L	Kenmount (1)	Point A (str 100)	1.53	1975	S POLE	Loop	66	715.5	ASC
54	L	Point A (str 101)	Hardwoods (122)	6.53	1995	S POLE	Loop	66	715.5	ASC
55	L	Blaketown (1)	Point A (str 11)	0.97	1968	S POLE	Radial	66	397.5	ACSR
55	L	Point A (str 12)	Placentia Jct. (140)	12.23	1971	S POLE	Radial	66	4/0	AASC
55	L	Placentia Jct. (141)	NewliteQuarryTap(255)	11.91	1971	S POLE	Radial	66	4/0	AASC
55	L	NewliteQuarryTap(256)	Point B (str 264)	0.80	1971	H FRAME	Radial	66	266.8	ACSR
55	L	Point B (str 265)	Dunville Tap (357)	10.30	1971	S POLE	Radial	66	4/0	AASC
55	L	Dunville Tap (358)	Point C (str 370)	1.61	1971	S POLE	Radial	66	4/0	AASC
55	L	Point C (str 371)	Clarke's Pond (407)	4.51	1971	H FRAME	Radial	66	266.8	ACSR
55	L	NewliteQuarryTap(1K)	NewliteQuarrySub(13K)	1.00	1981	S POLE	Radial	66	4/0	AASC
56	L	Bay Roberts (1)	Riverhead (str 130)	10.79	1974	S POLE	Loop	66	477	ASC
56	L	Riverhead (str 131)	Hr. Grace sub (str217)	4.57	1976	S POLE	Loop	66	477	ASC
56	L	Hr. Grace sub(str 218)	Carbonear (236)	4.67	1976	H FRAME	Loop	66	397.5	ACSR
57	L	Bay Roberts (1)	Point A (str 113)	11.04	1958	H FRAME	Loop	66	4/0	ACSR
57	L	Point A (str 114)	Island Cove (171)	3.97	1989	S POLE	Loop	66	477	ASC
57	L	Island Cove (172)	Point B (str 229)	3.97	1989	S POLE	Loop	66	477	ASC
57	L	Point B (str 230)	Harbour Grace (298)	6.74	1958	H FRAME	Loop	66	4/0	ACSR
58	L	Oxen Pond (1)	Point A (str 47)	3.12	1981	S POLE	Loop	66	715.5	ASC
58	L	Point A (str 48)	Point B (str 57)	0.72	1969	S POLE	Loop	66	715.5	ASC
58	L	Point B (str 58)	Virginia Waters (89)	2.85	1973	HFrame(DBL CCT)	Loop	66	715.5	ASC
59	L	Virginia Waters (1)	Pulpit Rock (92)	6.62	1973	S POLE	Radial	66	477	ASC
59	L	Virginia Waters (1)	Pulpit Rock (92)	1.10	2009	S POLE	Radial	66	477	ASC
64	L	Blaketown (1)	Western Avalon (61)	13.90	1973	H FRAME	Loop	138	397.5	ACSR
65	L	New Chelsea (1)	Point A (str 141)	9.10	1974	S POLE	Radial	66	4/0	AASC
65	L	Point A (str 142)	Point B (str 204)	6.05	1980	H FRAME	Radial	66	4/0	AASC
65	L	Point B (str 205)	Old Perlican (253)	3.30	1974	S POLE	Radial	66	4/0	AASC
66	L	Fermuse (1)	Point A (str 74)	7.00	1976	S POLE	Radial	66	4/0	AASC
66	L	Point A (str 75)	Point B (str 97)	5.00	1976	H FRAME	Radial	66	266.8	ACSR
66	L	Point B (str 98)	Point C (171)	7.20	1976	S POLE	Radial	66	4/0	AASC

LINE #		LOCATION		LENGTH	YEAR	LINE TYPE		VOLTS	CONDUCTOR	
		FROM	TO	Km	BUILT			kV	SIZE	TYPE
66	L	Point C (172)	Cape Broyle (184)	2.20	1976	H FRAME	Radial	66	266.8	ACSR
67	L	Oxen Pond (1)	Point A (str 8)	0.16	1969	S POLE	Loop	66	477	ASC
67	L	Point A (str 9)	Point B (str 44)	3.71	1981	S POLE	Loop	66	715.5	ASC
67	L	Point B (str 45)	Ridge Road (75)	0.59	1985	S POLE	Loop	66	715.5	ASC
68	L	Carbonear (1)	Point A (str 11)	2.01	1974	H FRAME	Loop	66	397.5	ACSR
68	L	Point A (str 12)	Hr. Grace (61)	5.15	1958	H FRAME	Loop	66	4/0	ACSR
69	L	Kenmount (1)	Point A (str 32)	1.32	1980	S POLE	Loop	66	715.5	ASC
69	L	Point A (str 33)	Point B (str 61)	1.98	1951	S POLE	Loop	66	266.8	ACSR
69	L	Point B (str 62)	Point C (str 72)	0.37	1990	S POLE	Loop	66	715.5	ASC
69	L	Point C (str 73)	Stamp's Lane (92)	0.76	1951	S POLE	Loop	66	266.8	ACSR
70	L	Stamp's Lane (1A)	Oxen Pond (68)	2.56	1993	S POLE	Loop	66	715.5	ASC
72	L	Goulds (1)	Point A (str 125)	9.00	1990	S POLE	Loop	66	715.5	ASC
72	L	Point A (str 126)	Point B (str 140)	1.16	1975	S POLE	Loop	66	715.5	ASC
72	L	Point B (str 141)	Hardwoods (161)	1.20	1990	S POLE	Loop	66	715.5	ASC
73	L	Glendale (1)	Point A (str 21)	4.50	1975	S POLE	Loop	66	715.5	ASC
73	L	Point A (str 21)	Point B (str 27)	0.60	2009	S POLE	Loop	66	715.5	ASC
73	L	Point B (str 27)	Hardwoods (109)	1.69	1986	S POLE	Loop	66	715.5	ASC
74	L	Virginia Waters (1)	Pepperell (94)	5.61	1982	S POLE	Loop	66	715.5	ASC
79	L	Chamberlains (1)	Point A (str 27)	1.54	1986	S POLE(DBL CCT)	Loop	66	477	ASC
79	L	Point A (str 28)	Point B (str 110)	5.42	1986	S POLE	Loop	66	477	ASC
79	L	Point B (str 111)	Hardwoods (130)	1.50	1975	S POLE	Loop	66	715.5	ASC
80	L	Blaketown (1)	New Harbour (81)	15.85	1980	H FRAME	Loop	66	397.5	ACSR
80	L	New Harbour (82)	Islington (172)	20.28	1985	H FRAME	Loop	66	397.5	ACSR
80	L	Islington (173)	Point A (str 209)	8.08	1992	H FRAME	Loop	66	397.5	ACSR
80	L	Point A (str 209)	Point A (str 231)	4.89	2010	H FRAME	Loop	66	397.5	ACSR
80	L	Point A (str 231)	Heart's Content (247)	1.13	1992	S POLE	Loop	66	4/0	AASC
86	L	Western Avalon (1)	Blaketown (71)	14.08	1969	H FRAME	Loop	66	266.8	ACSR
94	L	Blaketown (1)	St. Catherine's (180)	36.50	1969	H FRAME	Radial	66	266.8	ACSR
94	L	St. Catherine's (181)	Riverhead (str 290)	21.44	1969	H FRAME	Radial	66	266.8	ACSR
95	L	Riverhead (1)	Trepassey (142)	28.97	1969	H FRAME	Radial	66	266.8	ACSR
100	L	Clarenville (13A)	Point A (1A)	2.01	1975	H FRAME	Loop	138	397.5	ACSR
100	L	Point A (str 875)	Sunnyside (1001)	32.12	1964	H FRAME	Loop	138	397.5	ACSR
101	L	Rattling Brook (1B)	Point A (str 209)	29.50	1957	S POLE	Loop	66	2/0	ACSR
101	L	Point A (str 210)	Point B (str 218)	0.80	1989	S POLE	Loop	66	4/0	AASC
101	L	Point B (str 219)	Grand Falls (241)	2.20	1975	S POLE	Loop	66	4/0	AASC
102	L	Str 319 (Glenwood)	Point A	23.26	1958	S POLE	Loop	66	2/0	ACSR
102	L	Point A (near Goose rest.)	Point B	1.19	2006	S POLE	Loop	66	4/0	AASC
102	L	Point B	Gander (501)	2.01	1958	S POLE	Loop	66	2/0	ACSR
102	L	Rattling Brook (1)	N. Dame Jtn(144)	16.90	1958	S POLE	Loop	66	2/0	ACSR
102	L	Notre Dame Jtn(145)	Glenwood (318)	17.63	1958	S POLE	Loop	66	2/0	ACSR
103	L	Notre Dame Jtn (1)	Lewisporte (142)	13.92	1973	S POLE	Radial	66	4/0	AASC
104	L	Roycefield Mines (1)	Str403 (Tap off 102L)	40.20	1997	SPOLE	Radial	66	1/0	AASC
105	L	Grand Falls (1K)	Point A (str 12K)	0.90	1994	S POLE	Radial	66	4/0	AASC
105	L	Point A (str 12K)	RushyPond(str42K)	1.60	1995	S POLE	Radial	66	4/0	AASC
105	L	Rushy Pond(102)	Sandy Bk Plant(1)	12.65	1963	S POLE	Radial	66	2/0	ACSR
108	L	Gander (498C)	Point A (479)	1.73	1965	DBL CCT	Loop	66	2/0	ACSR
108	L	Point A (1)	Gander Bay (355)	42.20	1965	S POLE	Loop	66	2/0	ACSR
109	L	Clarenville (1)	Sunnyside (150)	34.44	1976	H FRAME	Loop	138	397.5	ACSR
110	L	Clarenville (1)	White Hills Rd	4.30	1966	S POLE	Loop	66	2/0	ACSR
110	L	White Hills Rd	Point 1	0.69	2009	S POLE	Loop	66	477	ASC
110	L	Point 1	Point 2	1.58	2009	H FRAME	Loop	66	559.5	AASC
110	L	Point 2	Point A	2.46	2009	S POLE	Loop	66	477	ASC
110	L	Point A	Milton (92)	1.77	1974	S POLE	Loop	66	4/0	AASC
110	L	Milton (93)	Point B (str 111)	1.77	1974	S POLE	Loop	66	4/0	AASC

LINE #		LOCATION		LENGTH	YEAR	LINE TYPE		VOLTS	CONDUCTOR	
		FROM	TO	Km	BUILT			kV	SIZE	TYPE
110	L	Point B (str 112)	George's Bk (str 140)	2.72	1966	S POLE	Loop	66	2/0	ACSR
110	L	George's Bk (str 141)	Point C (str 264)	10.94	1958	S POLE	Loop	66	1/0	ACSR
110	L	Point C (str 265)	Lethbridge (307)	5.15	1972	S POLE	Loop	66	2/0	ACSR
110	L	Lethbridge (308)	Summerville (535)	21.08	1958	S POLE	Loop	66	1/0	ACSR
110	L	Summerville (1K)	Point D	13.94	2007	S POLE	Loop	66	477	ASC
110	L	Point D	Lockston	7.40	2006	S POLE	Loop	66	477	ASC
111	L	Catalina	Port Union	2.41	2009	S POLE	Loop	66	477	ASC
111	L	Port Union	Point A (str 208)	12.95	2008	S POLE	Loop	66	477	ASC
111	L	Point A (str 208)	Point B (str 405)	13.28	2009	S POLE	Loop	66	477	ASC
111	L	Point B (str 405)	Point C (str 412)	1.22	2009	H FRAME	Loop	66	559.5	AASC
111	L	Point C (str 412)	Lockston	0.40	2009	S POLE	Loop	66	477	ASC
114	L	Gander Bay (1)	Point A (str 16A)	0.80	2000	S POLE	Radial	66	4/0	AASC
114	L	Point A (str 7)	Point B (str 243)	24.78	1972	S POLE	Radial	66	4/0	AASC
114	L	Point B (str 244)	Point C (str 260)	3.12	1972	H FRAME	Radial	66	266.8	ACSR
114	L	Point C (str 261)	Point D (str 332)	6.95	1972	S POLE	Radial	66	4/0	AASC
114	L	Point D (str 333)	Summerford (360)	5.33	1972	H FRAME	Radial	66	266.8	ACSR
115	L	Gambo (1A)	Hare Bay (194A)	20.60	1972	S POLE	Radial	66	4/0	AASC
116	L	Hare Bay (194B)	Trinity (457)	20.28	1973	S POLE	Radial	66	4/0	AASC
116	L	Trinity (458)	Point C (str 515)	11.10	1973	S POLE	Radial	66	4/0	AASC
116	L	Point C (str 516)	Point D (str 534)	1.90	1974	S POLE	Radial	66	4/0	AASC
116	L	Point D (str 535)	str 583 (G'pond Tap)	10.67	1974	H FRAME	Radial	66	266.8	ACSR
116	L	str 584 (G'pond Tap)	Point E (str 601)	3.65	1974	H FRAME	Radial	66	266.8	ACSR
116	L	Point E (str 602)	Wesleyville (717)	11.26	1974	S POLE	Radial	66	4/0	AASC
116	L	Greenspond (1)	str 46 (G'pond tap)	3.54	1980	S POLE	Radial	66	4/0	AASC
117	L	Catalina (1)	Bonavista (65)	14.25	1991	H FRAME	Radial	138	397.5	ACSR
121	L	Glovertown (1)	str 27 (Tap off 124L)	5.31	1976	H FRAME	Radial	138	266.8	ACSR
123	L	Clarenville (1)	Point A (Str # 261)	60.20	1976	H FRAME	Radial	138	397.5	ACSR
123	L	Point A (Str # 261)	Point B (Str # 280)	4.30	1992	H FRAME	Radial	138	244.4	ACSR
123	L	Point B (Str # 280)	Catalina (404)	29.16	1976	H FRAME	Radial	138	397.5	ACSR
124	L	Clarenville (1)	Point A (str 12)	1.99	1986	H FRAME	Loop	138	397.5	ACSR
124	L	Point A (str 13)	Point B (str 15)	0.41	1998	H FRAME	Loop	138	397.5	ACSR
124	L	Point B (str 16)	Point C (str 40)	5.50	2003	H FRAME	Loop	138	397.5	ACSR
124	L	Point C (str 41)	Point D (str 68)	5.20	2001	H FRAME	Loop	138	397.5	ACSR
124	L	Point D (str 832)	Point E (str 817A)	5.00	1964	H FRAME	Loop	138	397.5	ACSR
124	L	Point E (str 89)	Point F (str 115)	6.20	2005	H FRAME	Loop	138	397.5	ACSR
124	L	Point F (str 791)	PBD Tap (759)	8.63	1964	H FRAME	Loop	138	397.5	ACSR
124	L	PBD Tap (1K)	Port Blandford (17K)	3.46	1990	H FRAME	Loop	138	397.5	ACSR
124	L	Gambo (568)	Str 617 (G'town tap)	17.70	1964	H FRAME	Loop	138	397.5	ACSR
124	L	Str 618 (Glovertown tap)	Terra Nova (701)	19.68	1964	H FRAME	Loop	138	397.5	ACSR
124	L	Terra Nova (702)	str 760 (PBD Tap)	16.00	1964	H FRAME	Loop	138	397.5	ACSR
130	L	Grand Falls (1)	Point A (str 14)	1.88	1976	D CCT(LAM)	Loop	138	397.5	ACSR
130	L	Point A (str 15)	Point B (str 41)	5.87	1976	H FRAME	Loop	138	397.5	ACSR
130	L	Point B (str 42)	Stony Brook (58)	2.74	1969	H FRAME	Loop	138	397.5	ACSR
132	L	Grand Falls (1)	Point A (str 14)	1.77	1976	D CCT(LAM)	Loop	138	397.5	ACSR
132	L	Point A (str 15)	Bishop's Falls (67)	12.23	1976	H FRAME	Loop	138	397.5	ACSR
133	L	Bishop's Falls (1)	Stony Brook (86)	16.09	1977	H FRAME	Loop	138	397.5	ACSR
134	L	Botwood (1)	Bishop's Falls (79)	17.70	1975	H FRAME	Radial	138	266.8	ACSR
136	L	Cobb's Pond (1)	Point A (Str # 99)	21.13	1981	H FRAME	Loop	138	397.5	ACSR
136	L	Point A (Str # 99)	Bishop's Falls (378)	59.83	1981	H FRAME	Loop	138	397.5	ACSR
140	L	Summerford (1)	Point A (str 9)	1.20	1975	H FRAME	Radial	66	266.8	ACSR
140	L	Point A (str 10)	Point B (str 34)	2.60	1975	S POLE	Radial	66	4/0	AASC
140	L	Point B (str 35)	Point C (str 94)	12.70	1975	H FRAME	Radial	66	266.8	ACSR
140	L	Pt C str 95 (Main Tickle)	Point D (str 96)	0.78	1967	STEEL TOWER	Radial	66	244.4	ACSR
140	L	Point D (str 97)	Twillingate (133)	6.60	1975	H FRAME	Radial	66	266.8	ACSR

LINE #		LOCATION		LENGTH	YEAR	LINE TYPE		VOLTS	CONDUCTOR	
		FROM	TO	Km	BUILT			kV	SIZE	TYPE
142	L	Clarke's Head (1)	Cobb's Pond (174)	39.11	1978	H FRAME	Loop	66	397.5	ACSR
144	L	Cobb's Pond (1)	Point A (str 17)	3.38	1977	H FRAME	Loop	138	397.5	ACSR
144	L	Point A (str 307)	Gander (314)	2.65	1969	STEEL TOWER	Loop	138	397.5	ACSR
146	L	Gander (415)	Point A (str 466)	13.20	1964	H FRAME	Loop	138	244.4	ACSR
146	L	Point A (str 467)	Point B (str 475)	2.20	1964	H FRAME	Loop	138	397.5	ACSR
146	L	Point B (str 476)	Point C (str 526)	13.90	1964	H FRAME	Loop	138	244.4	ACSR
146	L	Point C (str 527)	Gambo (568A)	11.40	1964	H FRAME	Loop	138	397.5	ACSR
300	L	Linton Lake (1)	Point A (str 22)	4.48	1982	H FRAME	Loop	138	397.5	ACSR
300	L	Point A (str 23)	Marystown (28)	0.88	1976	H FRAME	Loop	138	397.5	ACSR
301	L	Salt Pond (1)	Garnish Sw Yard (234)	15.30	2003	S POLE	Loop	66	4/0	AASC
301	L	Garnish Sw Yard(235)	Grand Beach (481)	16.90	2003	S POLE	Loop	66	4/0	AASC
301	L	Grand Beach (482)	Greenhill (784)	20.80	2002	S POLE	Loop	66	4/0	AASC
302	L	Salt Pond (1)	Point A (str 314)	26.59	1959	S POLE	Loop	66	4/0	ACSR
302	L	Point A (str 315)	Laurentian (339)	2.43	1974	S POLE	Loop	66	2/0	AASC
305	L	Laurentian (2)	Point A (str #28)	6.63	1998	H FRAME	Loop	66	397.5	ACSR
305	L	Point A (str #29)	Point B (str #36)	2.47	1996	H FRAME	Loop	66	397.5	ACSR
305	L	Point B (str #37)	Webbers Cove (str 48A)	3.10	1975	H FRAME	Loop	66	397.5	ACSR
305	L	Webbers Cove (49)	Point C (str 72)	5.52	1998	H FRAME	Loop	66	397.5	ACSR
305	L	Point C (str 73)	Greenhill (149)	19.13	1975	H FRAME	Loop	66	397.5	ACSR
308	L	Salt Pond (2)	Point A (str 53)	11.78	1982	H FRAME	Loop	138	397.5	ACSR
308	L	Point A (str 54)	Marystown (59)	0.88	1976	H FRAME	Loop	138	397.5	ACSR
351	L	Massey Drive (1)	Point A (30)	6.57	1977	H FRAME	Loop	66	397.5	ACSR
351	L	Point A (31)	Walbournes (36)	0.71	1976	S POLE	Loop	66	266.8	ACSR
352	L	Massey Drive (1)	Point A (11)	1.71	1965	H FRAME	Loop	66	266.8	ACSR
352	L	Point A (12)	Point B (31)	3.27	1976	H FRAME	Loop	66	266.8	ACSR
352	L	Point B (32)	Point C (47)	1.71	1965	S POLE	Loop	66	266.8	ACSR
352	L	Point C (48)	Walbournes (53)	0.33	1977	S POLE	Loop	66	477	ASC
353	L	Walbournes (1A)	Frenchman's Cove (118)	24.59	1976	H FRAME	Radial	66	266.8	ACSR
356	L	Massey Drive	Humber	4.76	1967	STEEL	Loop	66	500	ASC
357	L	Massey Drive (1)	Point A (17)	1.16	1987	S POLE	Loop	66	477	ASC
357	L	Point A (18)	Point B (22)	0.30	1992	S POLE	Loop	66	477	ASC
357	L	Point B (23)	Bayview (39)	1.68	2004	S POLE	Loop	66	477	ASC
358	L	Bayview (1)	Gillams (113)	22.90	1976	H FRAME	Radial	66	266.8	ACSR
359	L	Humber (1)	Point A (32)	1.88	1982	S POLE	Loop	66	477	ASC
359	L	Point A (32)	Point B (37)	0.29	2006	S POLE	Loop	66	477	ASC
359	L	Point B (37)	Bayview (43)	0.44	1982	S POLE	Loop	66	477	ASC
363	L	Indian River (402)	Seal Cove Rd (820)	62.76	1963	H FRAME	Radial	138	266.8	ACSR
400	L	Bottom Brook (1)	Wheelers (90)	21.90	1967	H FRAME	Loop	66	266.8	ACSR
401	L	Gallants (1K)	Point A (11K)	0.52	1977	DBL CCT	Loop	66	477	ASC
401	L	Point A (1)	Point B (H Hgwy) str36	1.66	1981	S POLE	Loop	66	477	ASC
401	L	Point B (H Hgwy)str37	Wheelers Tap (str 78)	3.12	1989	S POLE	Loop	66	477	ASC
401	L	Wheelers Tap (str 79)	S'villeGasTurbine(141)	4.68	1989	S POLE	Loop	66	477	ASC
402	L	Gallants (1K)	Point A (10K)	0.52	1977	DBL CCT	Radial	66	477	ASC
402	L	Point A (1)	Point B (39)	2.56	1981	S POLE	Radial	66	477	ASC
402	L	Point B (40)	Pt C (Romaines R) (55)	3.82	1981	H FRAME	Radial	66	397.5	ACSR
402	L	Pt C (Romaines R.)(56)	Berry Head (72)	2.21	1982	H FRAME	Radial	66	397.5	ACSR
403	L	St.George's (1)	Robinson's Tap (34)	2.10	2004	S POLE	Radial	66	4/0	AASC
403	L	Robinson's Tap (35)	Point A (72)	3.00	2004	S POLE	Radial	66	4/0	AASC
403	L	Point A (73)	Lookout Brook (223)	11.57	2001	S POLE	Radial	66	4/0	AASC
403	L	Robinson's (1K)	Flat Bay Brook Xing	3.39	1960	S POLE	Radial	66	1/0	ACSR
403	L	Flat Bay Brook Xing	Flat Bay Brook Xing	0.21	2009	H FRAME	Radial	66	559.5	AASC
403	L	Flat Bay Brook Xing	Point A (str	0.38	2009	S POLE	Radial	66	4/0	AASC
403	L	Point A (str	Robinsons Tap	0.04	1960	S POLE	Radial	66	1/0	ACSR
404	L	Wheelers (1)	Point A (401L) (16)	2.01	1968	S POLE	Loop	66	266.8	ACSR

LINE #		LOCATION FROM	LOCATION TO	LENGTH Km	YEAR BUILT	LINE TYPE		VOLTS kV	CONDUCTOR SIZE	CONDUCTOR TYPE
405	L	S'ville Gas Turbine (1)	Point A (53)	4.25	1975	S POLE	Loop	66	477	ASC
405	L	Point A (54)	Harmon (59)	1.30	1975	H FRAME	Loop	66	397.5	ACSR
406	L	Gallants (1)	Pt A (HansenHgwy)(29)	2.20	1989	S POLE	Loop	66	477	ASC
406	L	Pt A (HansenHgwy)(30)	Harmon (66)	2.50	1981	S POLE	Loop	66	477	ASC
407	L	S'ville Gas Turbine (1)	Point A (11)	1.06	1976	S POLE	Radial	66	4/0	AASC
407	L	Point A (12)	Point B (20)	1.61	1976	H FRAME	Radial	66	266.8	ACSR
407	L	Point B (21)	S'Ville Xing (49)	2.78	1976	S POLE	Radial	66	4/0	AASC
407	L	S'Ville Xing (1K)	Point C (13K)	1.95	1976	H FRAME	Radial	66	4/0	AASC
407	L	Point C (14K)	Main Gut (25K)	1.77	1978	H FRAME	Radial	66	4/0	AASC
407	L	Main Gut (75)	PtD(Barachois Bk)(151)	5.15	2006	S POLE	Radial	66	4/0	AASC
407	L	PtD(Barachois Bk)	Point E	1.60	1992	S POLE	Radial	66	4/0	AASC
407	L	Point E	St.George's	2.18	2006	S POLE	Radial	66	4/0	AASC
410	L	Berry Head (1)	Point A (Gravels) (20)	3.26	1982	H FRAME	Radial	66	397.5	ACSR
410	L	Point A (Gravels) (21)	Aguathuna Tap (34)	2.55	1981	H FRAME	Radial	66	266.8	ACSR
410	L	Aguathuna Tap (35)	Abraham's Cove (92)	12.87	1975	H FRAME	Radial	66	266.8	ACSR
410	L	Abraham's Cove (1K)	Point B (43K)	8.55	1988	H FRAME	Radial	66	266.8	ACSR
410	L	Point B (44K)	Lower Cove Mine(47K)	0.27	1988	S POLE	Radial	66	4/0	AASC
416	L	Long Lake (1)	Point A (94)	21.43	1983	H FRAME	Radial	66	266.8	ACSR
416	L	Point A (95)	Grand Bay (109)	2.64	1983	H FRAME	Radial	66	266.8	ACSR
417	L	Port Aux Basques (1)	Point A (25)	1.89	1969	S POLE	Radial	66	4/0	ACSR
417	L	Point A (26)	Grand Bay (55)	2.64	1969	S POLE	Radial	66	4/0	ACSR

APPENDIX B

Transmission Line Rebuild Strategy

TML Rebuild Strategy - May 28, 2010

Transmission Line Rebuilds - 2011-2015 (kms)							
Line	**Year**	**Replacement Age (Years)**	**2011**	**2012**	**2013**	**2014**	**2015**
012L KBR-MUN	1950	62		2.2			
013L SJM-SLA	1962	52				1.8	
014L SLA-MUN	1950	63			0.7		
015L SLA-MOL	1958	57					0.4
016L PEP-KBR	1950	61	2.0				
018L GOU-GDL	1951	64					4.6
021L 20L-HCP	1952	59	5.3				
025L GOU-SJM	1954	57	9.2				
030L RRD-KBR	1959	56					2.9
032L OXP-RRD	1959	56					2.0
035L OXP-KEN	1963	52					5.5
068L HGR-CAR	1951	63				5.2	
069L KEN-SLA	1951	63				2.7	
110L CLV-LOK	1958	54		10.3	17.3		
124L CLV-GAM	1964	48		5.0			
	Total		**16.5**	**17.5**	**18.0**	**9.7**	**15.4**
Average Age at Replacement		**57**					

Transmission Line Rebuilds - 2016-2022 (kms)									
Line	**Year**	**Replacement Age (Years)**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
041L CAR-HCT	1958	58	3.8	15.0					
049L HWD-CHA	1966	55						2.7	
057L BRB-HGR	1958	58	17.8						
100L SUN-CLV	1964	57						10.0	13.0
101L GFS-RBK	1957	61			9.5	20.0			
102L GAN-RBK	1958	61				10.0	31.0	20.0	
124L CLV-GAM	1964	58							17.0
301L SPO-GRH	1959	58		1.1					
302L SPO-LAU	1959	58		8.0	18.5				
403L TAP-ROB	1960	62							4.0
	Total		**21.6**	**24.1**	**28.0**	**30.0**	**31.0**	**32.7**	**34.0**
Average Age at Replacement		**58**							