Distribution Reliability Initiative, Volume III, Distribution - Appendix 3, Attachment B, pages 1- 2 ($949,000)

Q. How does Newfoundland Power balance the issue of cost and reliability as it relates to the performance of the distribution systems?

A. How Newfoundland Power balances the issue of reliability and costs as it relates to the performance of the distribution system was provided in response to Request For Information CA-85 in the Company's 2003 Capital Budget Application. A copy of the response is contained in Attachment A.

Newfoundland Power's Response to CA-85
2003 Capital Budget Application

In the Pre-Filed Evidence of Ludlow, page 5, lines 2-3, it is stated that Newfoundland Power's customers continue to rank reliability of supplies (sic) as one of the most important attributes of electric service:

Q. How much are customers willing to pay for reliability?

A. Customers of Newfoundland Power consistently rank reliability of supply and price as the most important attributes of electrical service. The power policy of the province as set out in the *Electrical Power Control Act, 1994* is, in effect, that customers should pay the lowest possible cost for electricity that is consistent with reliable service.

In the Pre-Filed Evidence of Ludlow, page 5, lines 2-3, it is stated that Newfoundland Power's customers continue to rank reliability of supplies as one of the most important attributes of electric service:

Q. How does Newfoundland Power balance reliability and costs?

A. The following explains how Newfoundland Power balances reliability and costs.

Background

The 1998 Quality of Service Report

In his 1998 Report to the Board on *Newfoundland Light & Power Co. Limited Quality of Service and Reliability of Supply*, (the "1998 Quality Service Report"), Mr. D. G. Brown, P.Eng., concluded that:

> "After a thorough review of the material provided by the Board and the Company, detailed discussion with senior people at the Company's offices and visits to some of the Company's facilities in the St. John's region, the Engineer concludes that the Company is doing an effective job in maintaining and operating its facilities in the provision of electric service to its customers. It is noted that the Company's emphasis, now that there is practically no load growth on the system, is directed more toward customer service than construction of new facilities. ***The reliability of supply to Company customers is considered to be acceptable, although lower than the average for Canadian utilities. It is important that the utility maintain and in fact seek to improve its performance in this regard***."

The 1998 Quality of Service Report identified the two major causes of the Company's reliability performance at that time as defective equipment and adverse weather.

The 1998 Quality of Service Report clearly indicated to the Board and Newfoundland Power that the Company should seek to improve its reliability performance. In response to this, Newfoundland Power has undertaken a number of initiatives to improve its reliability performance.

One example of such initiatives has been Newfoundland Power's targeted efforts to improve reliability on rural distribution feeders.

Improving Rural Distribution Reliability

Newfoundland Power is primarily a distribution utility. Accordingly, improvements in reliability will be to a large extent, but not totally, a function of improving the quality of the distribution system.

Table 1 at page 6 of the Prefiled Evidence of Ludlow contains a list of rural distribution feeders upon which Newfoundland Power has performed significant capital work between 1999 and 2001. The feeders listed in Table 1 with the poorest reliability performance from 1995 to 1999 are OPL-01 and DUN-01.

The history of reliability performance for feeders OPL-01 and DUN-01 provide specific examples of the results of Newfoundland Power's efforts to improve system reliability.

OPL-01

In the period from 1995 to 1999, Newfoundland Power's OPL-01 feeder, which runs from Old Perlican to Bay de Verde, experienced 6.4 times the average number of outages experienced across Newfoundland Power's service territory. In the same period, the duration of outages was almost 12 times the Company average.

In the period 1995 to 1997, civic officials from the communities of Bay de Verde, Old Perlican and Grate's Cove, which is served by OPL-01 feeder, made complaints to the Board regarding the number and length of service outages experienced in their communities. Attachment A is a copy of a report to the Board by the Company in response to the complaint of these communities.

In the 12-month period ending August 31, 2002, reliability performance of OPL-01 feeder has been better than the Company average.

DUN-01

In the period from 1995 to 1999, Newfoundland Power's DUN-01 feeder, which runs from Dunville to Branch and St. Bride's, experienced almost 7 times the average number of outages experienced across Newfoundland Power's service territory. In the same period, the duration of outages was over 7 times the Company average.

In 1995, civic officials from the community of Branch, which is served by DUN-01 feeder, made complaints to the Board regarding the number and length of service outages experienced in the community. Attachment B is a copy of a report to the Board by the Company in response to the complaint of the community of Branch.

In the 12-month period ending August 21, 2002, reliability performance of DUN-01 feeder has been relatively consistent with the Company average.

Context

Newfoundland Power has almost 300 feeders.

OPL-1 and DUN-01 were two of Newfoundland Power's rural feeders with very poor reliability performance. There is little doubt that in 1995, the customers served by those feeders were dissatisfied with the reliability of the service provided.

By targeting capital investment for rural feeders with the poorest reliability performance, the Company has exercised sound engineering judgement. This should help the Company achieve longer-term sustainable improvement in its overall reliability performance.

Newfoundland Power's initiatives to improve rural distribution reliability through feeder rebuilds is an example of the Company's overall efforts to improve reliability. These initiatives have now addressed most individual feeders exhibiting reliability statistics well below the Company average. The next step in the refurbishment of deteriorated distribution plant will be to address smaller sections of deteriorated line. The proposed reconstruction of part of feeder MIL-02 in the 2003 capital budget is one such project.

Reliability Performance

Table 1 provides reliability statistics for Newfoundland Power for the period 1998 through 2001.

Table 1
Reliability: 1998 to 2001

	1998	**1999**	**2000**	**2001**
SAIFI[1]	5.60	6.61	4.93	3.99
SAIDI[2]	7.41	9.71	5.93	3.73

[1] Average number of interruptions per customer.
[2] Average hours of interruption per customer.

The reliability statistics in Table 1 show a measurable improvement in Newfoundland Power's reliability of service over the period from 1998 through 2001.

Table 2 provides a comparison of Newfoundland Power's reliability statistics with the overall national average reported by the Canadian Electricity Association (CEA) for 2000 and 2001.

Table 2
Comparative Reliability: 2000 to 2001

	CEA		**Newfoundland Power**	
	2000	**2001**	**2000**	**2001**
SAIFI	2.26	2.41	4.93	3.99
SAIDI	3.23	3.67	5.93	3.73

While Newfoundland Power's 2001 reliability was improved over 1998, it still has not reached the national average as compiled by the CEA.

The Cost of Reliability

Causes of Costs

Failure and Imminent Failure

Newfoundland Power's reliability will in significant measure reflect the general condition of its plant. If the plant is deteriorated or defective, it will be more prone to failure. The cost of replacement of deteriorated or defective plant is a significant factor in the cost of maintaining or improving the level of service reliability.

As Newfoundland Power is obligated to continue to provide a reasonable level of service to its customers, in cases of plant failure there is usually no question that the plant must be replaced. The only question is how can it be replaced in a least cost manner that contributes effectively to improved reliability.

From Newfoundland Power's perspective, the same essential logic applies to cases of imminent plant failure. It simply would not be prudent for Newfoundland Power to not replace plant which appeared through inspection, experience or sound engineering judgement to be reasonably close to failure or unreasonably prone to failure.

Aging Plant

Maintaining 30 to 40 year old deteriorated plant, particularly in areas subject to severe weather conditions, requires Newfoundland Power to incur operating costs on a recurring basis. These costs include the cost of reinstating service when failures occur, which are often in severe weather conditions. Increased failure reduces the level of reliability that customers experience. These operating costs are ultimately reflected in the rates charged to Newfoundland Power's customers.

Replacing 30 to 40 year old deteriorated plant has tended to help Newfoundland Power reduce its operating costs by reducing failures. Reduced failure also improves the level of reliability that customers experience. Replacement has the effect of increasing capital costs, which is principally the result of long-term inflation. These capital costs are ultimately reflected in the rates charged to Newfoundland Power's customers.

Balancing Cost and Reliability

In cases of failure and imminent failure, Newfoundland Power manages the cost of plant replacement by ensuring the replacement is undertaken in a least cost manner. This is typically achieved through processes such as competitive tendering. Due to the long life of utility assets, the cost of replacement plant will nevertheless generally exceed the historic cost of the plant being replaced.

In cases involving aging or deteriorated plant, Newfoundland Power approaches plant replacement differently. In most cases, the need for replacement is plainly supported by performance or inspection. Given that the cost of plant replacement will exceed historical cost, plant replacement will tend to increase capital costs. On the other hand, as indicated under *Aging Plant* above, it can also tend to reduce overall operating costs.

From a reliability perspective, the year-to-year mix of capital and operating costs that must be recovered in customers' rates is not a matter of fundamental importance. Stability of customer rates is, on the other hand, very important. Newfoundland Power's goal is to improve reliability without significantly increasing the total costs to be recovered in rates from customers. If reliability of service can be improved without causing customers' rates to increase, Newfoundland Power believes it should be.

Newfoundland Power's customers value both reliability of supply and price. Increased investment in the electrical system will contribute to improved reliability. So long as such investments are made in a manner that gives due regard to rate stability, customers expectations and the provincial policy outlined in the response to information request CA-85 (a) will be reasonably fulfilled.

NEWFOUNDLAND AND LABRADOR

BOARD OF COMMISSIONERS OF PUBLIC UTILITIES

P.O. Box 21040
St. John's, Newfoundland
Canada
A1A 5B2

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1995 11 03

Mr. Peter Alteen,
Legal Counsel,
Newfoundland Light & Power Co. Limited,
55 Kenmount Road,
P.O. Box 8910,
St. John's,
A1B 3P6.

Dear Mr. Alteen:

Subject: Trinity-Bay de Verde District Power Outages

The Board met on Tuesday, October 31, with representatives from the Grate's Cove area to discuss power outages in the area. This meeting was a follow-up to a letter to the Board from Mr. Lloyd Snow, Member of the House of Assembly for Trinity-Bay de Verde, dated May 9, 1995 and a meeting with representatives of the area on June 15, 1995. Representatives of Newfoundland Light & Power attended the meeting.

There are a number of issues on which the Board is seeking further clarification. These issues are addressed in the following questions:

* What other areas on the Avalon Peninsula have experienced such serious outages as those experienced in the Grate's Cove, Bay de Verde, Daniel's Cove area? The comment was made by Newfoundland Power Officials at the meeting that the interruption experience of this area is not unusually high in relationship to other areas on the Avalon Peninsula.

...2

* Please document other areas in Newfoundland Power's service area which have experienced outages of the severity experienced in this area.

* Has Newfoundland Power considered the benefits and costs of extending the 66 kV line beyond Old Perlican?

* What other areas in Newfoundland Power's service area are served by low voltage lines such as the 12 kV line (OPL-01) in the Grate's Cove area? Mr. Evans said at the meeting that there are similar areas to OPL-01 and all have been built to the same standards. Please give details of this comparison group. What special attention in terms of exceeding CSA guidelines has been given to OPL-01 in comparison with other similar areas? Examples were given in the June 14 Report.

* At the meeting on October 31, the reasons for outages in 1995 were discussed with regard to whether improvements to the line would have prevented these problems. The Board is requesting that the Company report in detail on each of the outages in '93, '94, and '95 and indicate the extent to which improvements to the line would have prevented the problems.

* There appear to be discrepancies in the information provided by Mr. Doyle and the outages listed by Newfoundland Power. It is our understanding that Mr. Meadus and Mr. Doyle are reviewing these discrepancies. The Board is requesting that the Company confer with them and report back in writing with possible explanations for these discrepancies.

* Because of the problems with OPL-01 the Board suggests that the Company review its decision to remove its crews and equipment from Old Perlican.

* What action does Newfoundland Power propose to take in response to these interruptions?

* What capital expenditures are required in order to bring the frequency of interruptions in line with those experienced by communities on the Bay de Verde Peninsula, South and West of Old Perlican ?

* Please report on the investigation on lines to Daniels Cove and to Grates Cove joining OPL-01 from Old Perlican to Bay de Verde.

Before the Board can decide if further investigation is required, the Board requires that the questions raised herein be addressed.

Should there by any additional information which the Company believes to be relevant to consideration of this matter, the Board will be pleased to receive it.

Yours truly,

Carol Horwood,
Clerk.

c.c. Mr. Lloyd Snow, M.H.A.
Trinity-Bay de Verde

Mr. Bernard Meadus
Chair
Local Service District
Grates Cove

Mr. Gary Doyle
Councillor
Local Service District
Grates Cove

Mr. Tony Doyle
Councillor
Bay de Verde Town Council

Mr. Gerard Noonan
Councillor
Bay de Verde Town Council

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Report into the Trinity Bay De Verde District Power Outages

December 8, 1995

NEWFOUNDLAND POWER

NEWFOUNDLAND POWER

Newfoundland Light & Power Co. Limited

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95 12 08

Board of Commissioners
of Public Utilities
P.O. Box 21040
120 Torbay Road
St. John's, NF
A1A 5B2

Attention: Ms. Carol Horwood
Clerk

Re: Trinity - Bay De Verde District Power Outages

Ladies & Gentlemen:

Enclosed are 12 copies of a report into the Trinity - Bay De Verde District Power Outages which contains responses to the questions raised by the Board in the letter of November 3, 1995 on the power outages in the Trinity - Bay De Verde area.

I trust the enclosed report is sufficiently responsive to the questions raised.

Yours very truly,

Peter Alteen
Counsel

Enclosures

December 8, 1995

A REPORT INTO THE TRINITY BAY DE VERDE DISTRICT POWER OUTAGES

Table of Contents

Trinity Bay de Verde District Power Outages

In response to questions posed in a letter from the Board of Commissioners of Public Utilities dated November 3, 1995, the company presents the following answers and discussion. These answers, subsequent summary and conclusions are intended to present a comprehensive picture of the interruption experience of customers on OPL-01 and the company's response to the customers' concerns. Appendix A is a description of power systems in general. The description of the major components from generation to distribution secondary, focuses on reliability and should help with the understanding of the following answers. For reference purposes, the questions have been numbered from 1 to 10 in the order as listed in the letter.

Q 1. What other areas on the Avalon Peninsula have experienced such serious outages as those experienced in the Grate's Cove, Bay de Verde, Daniel's Cove area? The comment was made by Newfoundland Power Officials at the meeting that the interruption experience of this area is not unusually high in relationship to other area on the Avalon Peninsula.

A 1. Throughout the years there have been areas of the Avalon Region which have experienced power interruptions similar to that of the OPL-01 feeder. In the past NP has experienced outages of similar frequency and duration along the Cape Shore (DUN-01) and St. Mary's Bay area from St. Joseph's towards Portugal Cove South (RVH-01, RVH-02, TRP-01, TRP-02) and in the Placentia Area (CLK-01,02,03,04). For the period of January to the end of September 1995, there were three feeders which experienced more customer minutes of power interruptions than the OPL-01 feeder. Also, there were two feeders where the frequency of interruptions was greater than that of OPL-01. During 1993 the OPL-01 feeder was ranked tenth on the list for total customer minutes of power interruptions and sixteenth for the frequency of interruptions. Table 1 shows a comparison of the reliability of various areas within NP's service area, as indicated by the System Average Interruption Index (SAIDI) averaged over five years (1990 - 1994, excluding December 1994 which was affected by Blackout '94).

Q 2. Please document other areas in Newfoundland Power's service area which have experienced outages of the severity experienced in this area.

A 2 Other areas in NP's service area experience outages of similar severity to that experienced in the Bay de Verde Peninsula. All these areas share some commonalities such as having sections of distribution exposed to severe conditions, contain long distribution feeders, and are often supplied by radial transmssion system. A summary of the interruption statistics for these areas is shown in Table 1. Below is a general description of these areas.

- Other areas of the Avalon as listed in Question 1
- Bottom of the Burin Peninsula between St. Lawrence and Point May (LAU-02)
- Port aux Basque Area from Port aux Basque to Rose Blanche (LGL-01&02, PAB-03,05&06)
- Eastern Part of South Coast at top of Burin Peninsula from Terrenceville to

English Harbour East (MKS-01).
- Tip of Bonavista Peninsula from Amherst Cove through Bonavista to Elliston (BVA-01,02&03)
- Bonavista North from Greenspond through Wesleyville to Deadman's Bay (WES-02, GPD-02)
- Bonavista South from Southern Bay to Knights Cove (SMV-01)
- West Coast South of Stephenville from Heatherton to Highlands (ROB-01)

In all the areas described, the outage statistics can be expected to vary from time to time and the ranking of the feeders will change depending on the period of time over which the statistics are summarized. Reliability in these areas, like reliability in virtually all of Newfoundland Power's service territory, is not simply a function of outages on Newfoundland Power's system. Interruptions are caused by either Newfoundland and Labrador Hydro (NLH) System outages, NP Transmission outages or Distribution outages.

Q 3 Has Newfoundland Power considered the benefits and costs of extending the 66 kV line beyond Old Perlican?

A 3 In the mid 1970's there was a need to extend the 66 kv transmission system beyond New Chelsea due to load growth in the Old Perlican-Bay de Verde area. Based on electrical system modelling, future load growth possibilities and customer service considerations, a substation was constructed at Old Perlican and the 66 kv system extended to that site. Since that time load growth and operating experience in the area have been such that NP has not had to consider extending the 66 kv system beyond Old Perlican.

A review of NP's outage statistics for 1991-1995 (see Appendix B, excluding Blackout '94 and the February 13, 1995 windstorm which were extraordinary) shows that in the Grates Cove/Bay de Verde area, 51% of the unscheduled interruptions, accounting for 44% of the outage time is attributable to the distribution feeder OPL-01. The remaining unscheduled interruptions are due to the radial transmission system serving the area.

If the transmission system were extended and a substation built at a location that could split the OPL-01 distribution outages into two feeders, the improvement to the customers in the Bay de Verde and Grates Cove area due to "distribution" outages would be at most, 25%[1]. However, the extension of the 66 kV system would increase the number of 66 kV transmission outages. It is debatable the extent to which a 66 kV line and substation on the Bay de Verde barrens will perform better than the existing 12.5 kV feeder. It is NP's position that extending the 66 kV system will overall have little or no benefit to the reliability of the customers in the Grates Cove/ Bay de Verde area.

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1 - From appendix B, it can be assumed that approximately 50% of the interruptions are caused by the transmission system and 50% by the distribution plant. If a new substation were placed at a location that split OPL-01 into two sections that experience the same number of distribution outages, the number of outages effecting either of the two new distribution feeders will be reduced by one half. This reduction in distribution caused interruptions along with the transmission outages will reduce the overall number of outages at Grates Cove and Bay de Verde, by 25% (Assuming there is no increase in transmission related power interruptions).

Q 4 What other areas in Newfoundland Power's service area are served by low voltage lines such as the 12 kV line OPL-01 in the Grate's Cove area? Mr. Evans said at the meeting that there are similar areas to OPL-01 and all have been built to the same standards. Please give details of this comparison group. What special attention in terms of exceeding CSA guidelines has been given to OPL-01 in comparison with other similar areas? Examples were given in the June 14 report.

A 4 In Newfoundland Power's Service area all customers are supplied by the distribution primary system (See Appendix A) with voltages ranging from 4.16kV to 25 kV. Approximately 185 of NP's 280 (66%) distribution feeders operate at 12.5 kV. In the Avalon region, there are 44 distribution feeders with forty (90%) operated at 12.5 kv, similar to OPL-01.

All transmission and distribution lines constructed and operated by Newfoundland Power are designed in accordance with NP standards. As a result all customer areas that have comparable reliability to OPL-01 can be considered a reasonable comparison group. A description of these areas is listed in the response to Questions 1 and 2. All of these areas are built to the same NP standards. Many of the transmission and distribution lines feeding these areas have been reinforced due to severe weather conditions.

The company standards are based on meeting and exceeding CSA standards, on the practices of other utilities, and on the experience gained from the performance of equipment in the Newfoundland environment. CSA standards prescribe the minimum design requirements. CSA standards do not constitute complete construction specifications, but only prescribe minimum design requirements that are most important from the point of view of safety to persons, continuity of service and protecting property. CSA standards primarily deal with structural strength and physical clearances between objects and persons. CSA standards do not deal with insulation levels and corrosion which are two major factors affecting NP's standards. CSA structural loading standards classify the Island of Newfoundland as a Heavy Loading District. The CSA specifications require that distribution and transmission plant, as a minimum, withstand 56 mph (90 km/hr) wind with a radial thickness of 1/2 inch (12.7 mm) of ice, and a safety factor of 1.3 for distribution, and a safety factor of 2 to 4 for transmission. NP's Distribution Construction Standards are based on these conditions with a safety factor of 1.67. In addition to the wind and ice design condition, NP has established another design criteria based on a more extreme wind loading. This standard uses a design criteria of 95 mph (153 km/hr) with a safety factor of 1.33. Generally, if a distribution line, especially those with larger conductors, meet this heavy wind loading criteria, it will exceed NP's wind and ice loading criteria. In addition NP's Standards require restricting span lengths to at least 80% of normal in highly exposed areas where wind and ice loading may be exceeded. On the OPL-01 feeder, the span lengths have been shortened beyond 80% of standard through installing mid-span poles. This has significantly increased OPL-01's structural strength.

NP's transmission standards exceed CSA's wind and ice loading requirements as well as safety factors. On the 66 kV transmission line 65L, the H-frame portion has span lengths significantly shorter than required by standards, thereby increasing its structural strength.

Beyond CSA requirements, NP's standards give other considerations to distribution lines that are exposed to severe weather conditions. NP's standards recommend the use of preformed ties, shorter spans lengths, insulators with longer leakage distances (increases insulators ability to withstand salt contamination), and storm guys, in areas where severe conditions exists. The installation of these reinforcements are only completed in areas where severe weather necessitates their use to improve equipment performance. All these reinforcements have been made to various sections of OPL-01. Along OPL-01 span lengths average less than 50 metres (100 meters are typical). Storm guys are installed throughout the length of the line to provide extra strength against the high wind loads. Preformed ties (severe weather ties) instead of hand ties are used to prevent the conductor from coming off the insulators during high winds. The feeder is constructed with insulators that have a longer leakage distance than what NP normally installs to minimize faulting resulting from salt contamination (leakage distance is the distance along the insulator surface between the metal fittings that connect the conductor to the insulator and the metal fittings that connect the insulator to the grounded structure). These types of reinforcements have been used to a varying degree in many areas of NP's service area.

On the 66 kv transmission line (65L), which feeds the area, insulators with a faulty manufacturing process were replaced in 1992 (this was a result of insulator manufacturing problems in the early 1970's), counterweights were installed in 1991/92 to reduce a conductor swing problem, and in the early eighties, a section of the transmission line was changed from single pole to H-frame to increase the lines structural strength and enable it to better withstand the extreme winds that occur in the area.

Q 5 At the meeting on October 31, the reasons for outages in 1995 were discussed with regard to whether improvements to the line would have prevented these outages. The Board is requesting that the Company report in detail on each of the outages in '93, '94, and '95 and indicate the extent to which improvements to the line would have prevented the problems.

A 5 With reference to the June 14, 1995 Report to the PUB, all outages from 1991 to 1995 were detailed. From this list, the problems can be grouped into the following areas.

Floating Phase	Broken/Loose Conductor
Loss of infeed from Hydro	Faulted Insulator
Pole and Crossarm fires	Lightning

NP feels the root causes for much if not most of the trouble on the distribution and transmission system is the extreme wind and ice conditions, and insulator contamination due to salt spray. On occasion the combination of severe wind and ice loading caused the conductor on the distribution feeder to vibrate catastrophically from a phenomenon called galloping. Below are reviews of the salt spray problems and the wind and ice loading problems.

Salt spray

Salt spray accumulates on the insulators and with the right conditions (usually damp weather), the electrical current will track over the insulator causing a fault current great enough to trip the feeder. Often the fault current is sufficient to cause the pole or the crossarm to catch on fire. To reduce outages due to salt contamination NP replaces the standard insulator with those that have longer leakage distances. With a longer leakage distance the insulators can withstand a higher level of salt contamination. The installation of insulators with longer leakage distances has been completed on much of OPL-01.

Severe wind and ice loading

OPL-01 crosses the Bay de Verde barrens which are subject to severe wind conditions and ice loadings. The severe wind conditions are reflected in the over 150 km/hr winds experienced during the February 13, 1995 storm. During severe wind and ice conditions the first point of failure on NP distribution structures is typically the hand tie connecting the conductor to the insulator. When a hand tie fails, the incident is often recorded as a floating phase. Other failure modes due to high winds and ice are loose and broken conductors, and pole and crossarm fires. The pole and crossarm fires often occur when a floating phase makes contact with a pole or crossarm. In extreme ice and wind conditions, pole failures and crossarm failures are also possible. Any potential problems with pole and crossarm failures has been minimized with the mid-span poles.

The normal means to secure the conductor onto the insulator is using a #2 aluminum wire hand tied. The OPL-01 feeder has been reinforced with preformed ties (often called severe weather ties) that strengthen the connection of the conductor to the insulator. This has reduced the number of floating phases but has transferred the weak point to the connection between the insulator and the insulator pin. With extreme winds and conductor galloping problems, NP still experience outages, most commonly, because the insulator has been stripped from the top pin as the conductor galloping places extreme stress on the structure. Reinforcing the insultor pin connection would only transfer the problem to the next weakest point. Until the problem with galloping conductors can be solved, there is no cost effective solution to correct this problem. NP has been involved in research at a national level, and now an international level in the hope that an effective means to minimize these conductor galloping problems can be found. The galloping problems are typically a tuned response and it has been theorized that the phenomenon is dependent upon wind direction, wind speed, and a certain level of ice loading. As a result, simple solutions are difficult to effect.

As a result of the steps taken by NP as outlined in response to question #4 the reliability of the line has increased, with only five unscheduled interruptions in 1993 and four in 1994 due to the feeder. Most of the 1995 power interruptions that resulted from problems on the distribution system , occurred as a result of a severe wind storm on February 13. That storm caused conductor galloping which in turn caused a lot of damage to the feeder and weakened parts of the feeder that subsequently caused five power interruptions over the next month and a half.

Q 6. There appears to be discrepancies in the information provided by Mr. Doyle and the outages listed by Newfoundland Power. It is our understanding that Mr. Meadus and Mr. Doyle are reviewing these discrepancies. The Board is requesting that the Company confer with them and report back in writing with possible explanations for these discrepancies.

A 6. When the list of power interruptions provided by Mr. Meadus was compared with NP's records, there were several discrepancies. On November 14, 1995, Mr. Meadus attended a meeting at NP's Carbonear Office and records were reconciled as much as possible.

- On investigation by Mr. Meadus four of the seven discrepancies were attributed to the incorrect year being listed in Mr. Meadus' record.
- Three of the discrepancies were recorded for the wrong day. e.g. Mr. Meadus recorded an outage for March 13, 1993, NP's records show an interruption for a day later March 14, 1993.

Q 7. Because of the problems with OPL-01 the Board suggests that the company review its decision to remove crews and equipment from Old Perlican.

A 7. NP never had a district service crew stationed in Old Perlican. There were district service crews located in Burnt Point and Heart's Content. These crews were decommissioned in 1986 and 1991 respectively.

These service crews were capable of handling most of the minor service calls such as replacing the service connections and refusing a transformer. However, these service crews were not equipped, nor capable of handling the larger outages. For the larger outages, a crew still had to travel from Carbonear, and were assisted by the local service crew with the restoration of power.

When many of these districts were established, the districts were isolated by poor road networks. With the improved highway system, communications network and the latest in utility equipment, NP has not experienced any problems in servicing the Bay de Verde area from the area office in Carbonear. In addition, NP has in place an evening shift operating from 4pm to midnight to provide customers greater access to service. NP has not experienced any difficulty in providing a timely response to service calls in the Bay de Verde area with this arrangement.

Placing a service crew back in the area would not change the frequency of interruptions and NP feels there would be little change in the duration of interruptions.

Q 8. What action does Newfoundland Power propose to take in response to these interruptions?

A 8. NP's short term response is to conduct ground patrols subsequent to an outage in order to locate and repair faulted equipment, carry out routine inspections following any storm, perform insulator testing on any insulators suspected to be defective, and continue to monitor the overall system performance. The object is to identify the root cause of the interruptions and ultimately implement the necessary corrective action.

In the long term, NP will continue regular scheduled patrols and maintenance. In the 1996 budget, NP has scheduled complete patrols of the two transmission lines (43L & 65L) serving the area as well as the OPL-01 distribution feeder.

Q 9. What capital expenditures are required in order to bring the frequency of interruptions in line with those experienced by communities on the Bay de Verde Peninsula, South and West of Old Perlican?

A 9. The areas South and West of Old Perlican (See Figure 1) have experienced fewer power interruptions than OPL-01 for a number of reasons. The main reason is that the distribution feeders supplying these areas are not subject to the extreme conditions experienced on the Bay de Verde barrens. The areas south of Old Perlican from Caplin Cove to Ochre Pit Cove are serviced by OPL-02. The customers on this feeder experience the same transmission problems as OPL-01 due to the radial transmission system, but experience fewer distribution outages because OPL-02 is not as exposed as OPL-01. The areas southwest of Old Perlican from Lead Cove to Winterton are supplied by two feeders from the New Chelsea Substation (NCH). The Substation is not subject to trouble on 65L, only 43L, and there is generation at New Chelsea. This results in the customers supplied by the NCH distribution feeders experiencing fewer outages caused by the transmission system than those customers supplied by the Old Perlican feeders. Also the NCH feeders are less exposed to extreme conditions than OPL-01 and experience fewer outages.

To make the number of power interruptions caused by the transmission system the same for the all OPL and NCH feeders, will require building a backup line to 43L and 65L. This option is expensive and is not considered a prudent investment.

It does not seem feasible to make the number of power interruptions caused by the distribution system on OPL-01 to be similar to that of OPL-02 and the New Chesea distribution feeders. OPL-01, even though it has been upgraded to withstand more severe conditions than the other distribution feeders, still appears to experience more outages. This is attributable to severe conditions experienced on the Bay de Verde barrens. To go beyond the reinforcements already made to OPL-01 would not provide any significant improvement in reliability unless the galloping problem is addressed. Since NP has yet to determine a cost effective means to reduce the galloping problem, no capital expenditures are currently planned for OPL-01 in NP's five year budget. Any deficiencies identified as a result of the patrols planning for 1996 will be repaired on an emergency basis if required, or will be included in subsequent annual five year capital budget projections.

Q 10. Please report on the investigation on lines to Daniels Cove and to Grates Cove joining OPL-01 from Old Perlican to Bay de Verde.

A 10. Of the ten unscheduled interruptions experienced on the distribution feeder (OPL-01) to end of October 1995 NP has produced the following list. This list includes the locations where NP has experienced trouble which resulted in an unscheduled power interruption to the customers of Old Perlican to Bay de Verde.

In community of Bay de Verde	1
Along trunk feeder on the Bay de Verde barrens (not on lateral to Grates Cove)	4
Outside Substation in Old Perlican	1
Location not recorded	3

Also, not included in the above list is the Feb. 13 outage where there was 14 floating phases on the Grates Cove tap and 26 on the Bay de Verde barrens.

Appendix B shows tables that review the outages from 1991 to October 1995. The tables show the number of outages by year that affected the customers on OPL-01, and classified the outages either NLH's system, NP's transmission system or NP's Distribution feeder OPL-01. It should be noted that the attached tables are based on power interruptions to the end of October, 1995. Since that time there were five interruptions affecting the area from Old Perlican to Bay de Verde, which are listed below:

Nov. 4	2 hrs 55 min.
Nov. 15	1 hr 48 min.
Nov. 20*	16 min.
Nov. 21	2hrs 40 min.
Nov. 21	1hr 36 min.

Patrols subsequent to the first three of these interruptions found no damage. On Nov. 21, OPL-01 feeder was balanced (equal load placed on each of three phases), the relay controls were cleaned, and OPL-01 feeder was patrolled using an ultrasonic noise detector used to detect faulty insulators. The patrol did not reveal any problems. However, a string of faulty insulators on 65L was identified on the New Chelsea end of the transmission line. A scheduled outage was arranged that very same day to replace those insulators. It is NP's view that this faulty insulator string was the cause of the November outages.

* On Nov. 20, 65L tripped due to low voltage as a result of a trip experienced by Hydro on one of their units at the generating station in Holyrood.

Summary and Conclusions:

Summary

NP's rural power system supplies electricity to customers which are widely dispersed along the coast of Newfoundland. The low electricity demands associated with the small rural customer base, results in the most cost effective means of supplying power to the customers being a radial system emanating from the interconnected grid[2]. However, with only one supply line from the interconnected grid, a failure to any component of that line results in those customers further down the line from the point of failure being without electricity. The further a customer is from the interconnected grid, the more outages a customer will experience.

Within NP's system the distance to the interconnected grid is always reducing as load grows. Load growth eventually exceeds the capacity of the existing system and to increase capacity new lines are often required, establishing loop feeds, thereby reducing the length of the radial systems. Examples of this evolution are the completion of the 41L and 80L loop in the Avalon area and NLH's building of the second line ,TL219, to the Burin Peninsula. However, recently load growth in much of the rural systems has been minimal, and a load decline is quite possible in some areas. At this time, no significant system expansion is planned for NP's rural areas. It should be noted that some parts of the radial system contain generation that can supply load in the event of transmission failure, the most significant of which is at Port aux Basques. This generation is a carryover from when that area was not interconnected with the island grid. When these systems where interconnected, the generation was maintained to provide support for generation on the main grid, and to provide backup to the radial system supplying the area. The generation at New Chelsea is another example of this.

With the evolution of the rural Newfoundland systems, the focus on reliability has been to maintain and improve reliability through maintenance and reinforcement of line sections exposed to abnormally severe environmental conditions. This focus is meant to maintain historic reliability levels and over time improve them. However, the reliability experience in many rural areas will always be worse than urban areas so long as the systems remain radial, the length of distribution feeders remain long, and rural feeders continue to be exposed to severe environmental conditions. For all radial systems, reliability is a function of the distance from the interconnected grid, as a results the reliability will always be worse at the ends of the radial systems. This is reflected in the Grates Cove / Bay de Verde areas having a reliability worse than Old Perlican, and the reliability of feeders supplied by the substation "Riverhead" having better reliability than those supplied by the substation at "Trepassey".

NP monitors customer reliability, and compares its reliability experience to other utilities. All utilities have a certain complement of radial systems and it is assumed that the variations in reliability that occur between areas of NP's system are similar to other systems in Canada. As a result, NP gains a certain level of comfort in comparing the company's average customer

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2 - The interconnected grid is defined in the report as being the portion of the transmission system that has backup whereby, loss of any one transmission line does not cause a customer interruption.

reliability to other utilities (Refer to Report issued to PUB on September 19, 1995 "Reliability Indices used by Newfoundland Power").

NP is also involved in areas of research that could impact the reliability of the power system in Newfoundland. These areas included line galloping, and salt contamination of insulators. It is hoped that through research, NP will find cost effective ways to improve the reliability of the power system.

When monitoring customer reliability the company attempts to identify components and feeder locations that are causing an unusually high number of outages. It is from this effort that the company has initiated insulator replacement programs, large scale line reconstruction such as that occurring on DUN-01 and reinforcement of troublesome sections of lines. The installation of mid-span poles, preformed ties, storm guys and insulators with longer leakage distance on OPL-01 is also an example of this. These often expensive undertakings are scheduled as soon as possible after they are discovered subject to budgetary constraints. Insulator replacement and line repairs are considered maintenance items and safety concerns and as such, are a necessary immediate expense. The decision to reinforce a section of line which appears to be vulnerable to extreme environmental conditions, is much more difficult to make. Questions impacting these decisions are:

- Is the apparent high incidence of outages a result of outage clustering a result of weakening of the system from a severe storm, or associated with the random nature of outages, or associated with a real decrease in the performance of equipment?
- Will further reinforcement result in a significant enough improvement to justify the expense?
- With constraints on how much money can be spent, is there a more cost effective solution or other areas where the money can be better spent?
- In light of poor or declining load growth is the expenditure prudent?

Typical reinforcements the company has undertaken in the past include the installation of storm guying, mid-span poles and severe weather guys and the replacement of insulators with those with longer leakage distances.

Conclusions:

In reviewing the reliability in the Bay de Verde area, a number of factors influence NP's approach to the problems currently being experienced.

- Historically, the Distribution Feeder OPL-01 has performed worse than NP's typical feeder. However, its performance has not been at a level unexpected for a feeder of similar length with such exposure to severe weather. Over the years, as possible means of improving the reliability of the feeder have been identified, upgrading has occurred. This effort to identify cost effective means to improve the reliability of the feeder will continue in the future.

- Historically the Transmission Line 65L has performed worse than a typical transmission line. Given 65L's exposure to severe weather, some recently discovered insulator and line swing problems, its poor performance can be understood. All the identified problems have been fixed which should result in an improvement in the number of power interruptions in the future. However, on many transmission lines a problem with tension insulators has been identified. A planned inspection of 43L and 65L in 1996 will determine the extent to which this problem may exist on these lines. Based on the finding of the inspections, corrective action will be taken.

- A recent review of outages on the distribution feeder OPL-01 has indicated that including the conductor galloping problems, there are no identifiable problems that can be cost effectively improved upon. Galloping of conductors is a phenomena seen in many areas of the world, and research is on going into anti-galloping devices. NP is participating in this research effort, and OPL-01 has been used as a test site for this problem. As research continues, it is hoped that a solution can be found that is appropriate for use on OPL-01. Beyond research into conductor galloping, NP will continue to monitor the performance of its equipment. When cost effective means to improve the equipment's performance are identified, the company will implement such improvements.

- Newfoundland Power services a large area subject to diverse, and at times severe weather conditions. At locations throughout the system, there are pockets where the reliability of the system is comparable to that experienced by customers on OPL-01. Each location has a unique environment, and the solution for one area is not necessarily applicable to the other areas. On OPL-01, conductor galloping appears to be a problem while on DUN-01, salt contamination is predominant. NP is continuously reviewing all areas of poor reliability, looking for cost effective means to improve system performance. Due to many factors that could be described as "the nature of electric power distribution" (ie. long radial transmission and distribution systems, pockets of severe weather, etc.), the only solution appears to be major transmission and distribution expansion to provide backup systems. However, given NP's economic constraints, and the low population densities and lack of growth associated with these areas, it is difficult to justify large capital expenditures for major system expansion.

TABLE 1: Comparison of the feeders with the poorest reliability as suggested by the System Average Interruption Duration Index (SAIDI)[1]. (Average of period from 1990 - 1994, excluding Blackout '94)

Substation	Feeder Designation	Transmission		Distribution		Total including NLH related and scheduled outages	
		Unscheduled SAIDI (min.)	Ranking[2]	Unscheduled SAIDI (min.)	Ranking[2]	Unscheduled SAIDI (min.)	Ranking[2]
Laurentian[3]	LAU-02	123	>30	2091	1	2380	1
Dunville	DUN-01	288	>30	1197	2	2291	2
Trepassey	TRP-02	643	6	1191	3	2252	3
Old Perlican	OPL-01	678	1	434	12	1521	4
Long Lake	LGL-02	178	>30	451	11	1512	5
Long Lake	LGL-01	205	>30	454	10	1471	6
Wesleyville	WES-02	355	24	563	5	1437	7
Monkstown	MKS-01	125	>30	1088	4	1348	8
Port aux Basque	PAB-05	118	>30	149	>30	1325	9
Clarkes Pond	CLK-04	471	12	274	>30	1261	10
Bonavista	BVA-03	652	3	335	22	1218	11
Bonavista	BVA-02	660	2	324	24	1204	12
Clarkes Pond	CLK-02	471	13	194	>30	1136	13
Summerville	SMV-01	434	17	465	7	1129	14
Clarkes Pond	CLK-01	471	15	92	>30	1122	15
Clarkes Pond	CLK-03	471	14	238	>30	1109	16
Port aux Basque	PAB-03	42	>30	105	>30	1096	17
Port aux Basque	PAB-06	220	>30	149	>30	1325	18
Trepassey	TRP-01	651	4	262	>30	1041	19
Robinsons	ROB-01	467	16	335	21	1037	20
Bonavista	BVA-01	651	5	146	>30	1035	21
Greenspond	GPD-02	358	22	205	>30	1033	22
Old Perlican	OPL-02	621	7	52	>30	1032	23
Riverhead	RVH-01	421	18	406	15	1030	24

NOTES:

1 - SAIDI is the average number of minutes the average customer on the distribution feeder is without power in a year. It is a combination of the number of customers effected by an interruption and the duration of the interruption. It is regarded as a good overall indicator of reliability. The table reflect the power interruption experience from January 1990 to November 1994. The impact of the severe storm in December 94, is so severe that a reasonable comparison between distribution feeders is not possible when the December 94 storm is included.

2 - The ranking are according to all the approximately 280 distribution feeders in NP's service area.

3 - The Laurentian feeder LAU-02 experienced two severe storms in the early 1990's. This unusually high incidents of severe outages has caused the SAIDI for LAU-02 to be extremely high. These types of incidents do effect many locations at random. Care must be taken in using historical feeder performance to compare feeders and to predict future performance. Upgrading of system components cause future performance not to be the same as historical, and the impact of severe storms has the tendency to make a feeder look worse than it should when comparing feeders.

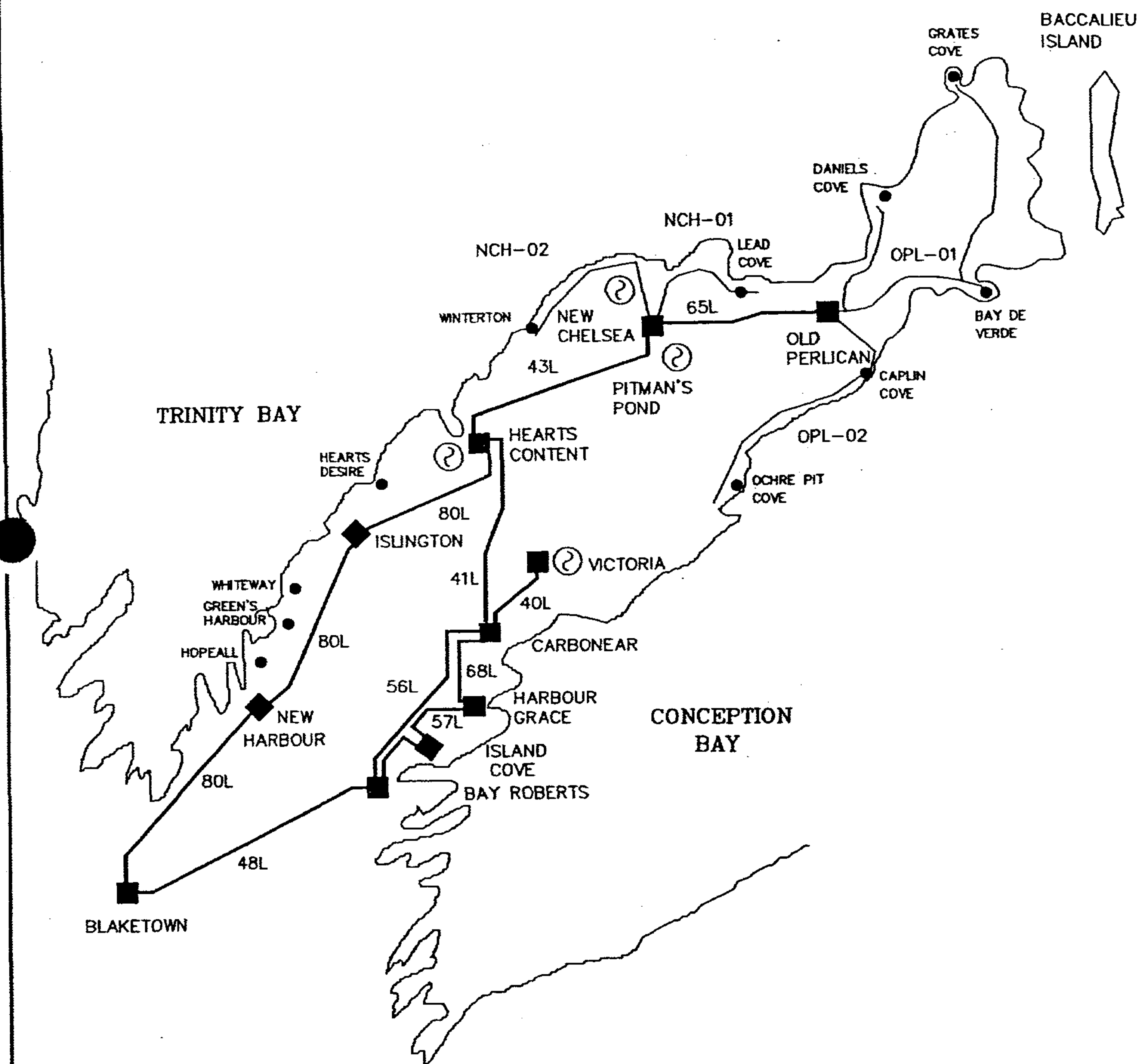

FIGURE # 1

NEWFOUNDLAND POWER

POWER SYSTEM
TRINITY - BAY DE VERDE

GENERAL DESCRIPTION OF AN ELECTRIC POWER SYSTEM FROM A RELIABILITY PERSPECTIVE

To adequately discuss the issue of reliability a basic understanding of the power system is required. The system can be divided into various components. These are outlined below:

Generation

Generators create electricity which is typically delivered directly to the bulk power system. There are automatic switches between each generator and the Bulk Power System. If a generator on the system fails, it is automatically isolated from the bulk power system. If sufficient backup generation is available on the system, no customers experience outages. However, on Newfoundland's Island Interconnected System, an underfrequency load shed scheme[1] often causes customers to have their electricity supply interrupted when a generator fails. This scheme avoids the cost of expensive on-line reserves (spinning reserve). This problem is avoided to a large extent in continental North America because interconnections between utilities permit one utility to avail of anothers generation resources in circumstances of generation failure.

Bulk Power System

This portion of the system is made up of many 230 kV and 138 kV lines which moves electrical energy from generators to large bulk power delivery points (terminal stations). The bulk power system is designed such that if any component were to fail, sufficient spare capacity exists in other components to prevent an outage to any customer. A bulk power system transmission line is automatically isolated at either end when it faults.

Sub-Transmission System

This portion of the power system is made up of 138 kV, 66 kV and 33 kV lines. It moves electrical energy from the bulk power system to small load centres (substations) where the energy is passed on to the distribution system. The level of backup provided for the failure of a component within the sub-transmission system is a function of the amount of load being supplied.

In an urban centre, the sub-transmission system is often a looped system where backup for the loss of any single component is provided. The loop system is often provided because more than one sub-transmission line is required to provide the capacity demanded by the load, resulting in a certain level of backup. Also in urban centres, a single transmission line outage can effect large

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1 - The underfrequency load shed scheme drops load when demand exceeds production and the unbalance causes the speed of generators to slow, resulting in the frequency of the AC electric system to decrease. It is the decreasing frequency that actuates relays that cause distribution feeder breakers to open and interrupt the power supply to customers. The scheme drops load in stages to minimize the amount of load whose electricity supply is interrupted when a unbalance between generation and demand occurs.

numbers of customers and providing backup is relatively inexpensive due to the short distances a backup line would need to cover.

Sub-transmission lines supplying rural distribution centres, typically do not have back-up. They are radial systems. This is due to the low numbers of people in rural areas, and the high cost of providing backup given the long distances the sub-transmission system covers in rural areas.

Distribution System Primary

This portion of the power system is made up of 4.16 kV, 12.47 kV and 25 kV lines called distribution feeders. Distribution feeders take electrical energy from the sub-transmission system at locations called substations, and delivers it the distribution secondary system. Distribution feeders, are made up of trunks and laterals. Feeder trunks typically deliver electricity to neighbourhoods while the laterals tap into the trunk to supply small groups of customers.

Distribution feeders contain a number of isolating devices. Fuses are located where laterals tap into the trunk. Automatic switches (breakers) are located at the point where the distribution primary trunk connects to a substation. When a section of a distribution feeder fails, either the fuse on the lateral isolates the lateral itself, or the main breaker/recloser opens. When a fuse isolates a section of feeder, only the customers on that lateral go without power. When the main breaker operates, all the customers fed through the feeder trunk go without power. This scheme results in customers that are further from the substation experiencing more outages than those close to the substation. Often when a distribution line fault requires a long time to repair, the problem is isolated by opening switches or cutting the conductors in the feeder. This allows restoration of the electricity supply to as many customers as possible while the damage is being repaired.

In urban centres, many distribution feeders are required to supply load. As a result, trunk feeders run in close proximity to each other. When an urban distribution line faults, customers on either side of the fault location can have their power restored by isolating the damaged section and tieing the undamaged portions of the feeder to other distribution feedering thus minimizing the time customers are affected by an outage. The opportunity to tie different feeders together in rural areas does not occur very often, again principally because of geography.

Distribution Secondary System

This portion of the power system operates at customer utilization voltages (120V, 208V, 240V, 346V, 600V). The power is transferred from the primary to the secondary system through distribution transformers. Faults on the secondary system are isolated from the primary system by a fuse on the primary side of distribution transformers. The secondary supplies as many as 15 customers or as few as one.

Appendix B

91 Power Interruptions Affecting OPL-01					
Descriptions		**No. Of Outages**	**% Of Total Outages**	**Duration (hrs)**	**% Of Total Duration**
Hydro		**3**	**50**	**1.5**	**5.0**
Transmission	Scheduled	1	16.6	5.7	18.9
	Unscheduled	1	16.6	14.5	48.0
	Total	**2**	**33.33**	**20.2**	**66.9**
Feeder	Scheduled	0	0	0	0
	Unscheduled	1	16.6	8.5	28.1
	Total	**1**	**16.6**	**8.5**	**28.1**
Total Interruptions		**6**		**30.2**	

92 Power Interruptions Affecting OPL-01					
Descriptions		**No. Of Outages**	**% Of Total Outages**	**Duration (hrs)**	**% Of Total Duration**
Hydro		**0**	**0**	**0**	**0**
Transmission	Scheduled	3	20	13.6	29.9
	Unscheduled	7	46.7	19.9	43.7
	Total	**10**	**66.7**	**33.5**	**73.6**
Feeder	Scheduled	0	0	0	0
	Unscheduled	5	33.3	12	26.4
	Total	**5**	**33.3**	**12**	**26.4**
Total Interruptions		**15**		**45.5**	

93 Power Interruptions Affecting OPL-01

Descriptions		No. Of Outages	% Of Total Outages	Duration (hrs)	% Of Total Duration
Hydro		0	0	0	0
Transmission	Scheduled	1	14.3	1	4.9
	Unscheduled	0	0	0	0
	Total	**1**	**14.3**	**1**	**4.9**
Feeder	Scheduled	1	14.3	6.5	31.7
	Unscheduled	5	71.4	13.0	63.4
	Total	**6**	**85.7**	**19.5**	**95.1**
Total Interruptions		**7**		**20.5**	

94 Power Interruptions Affecting OPL-01					
Descriptions		**No. Of Outages**	**% Of Total Outages**	**Duration (hrs)**	**% Of Total Duration**
Hydro		0	0	0	0
Transmission	Scheduled	1	20	8.9	7.4
	Unscheduled	0	0	0	0
	Total	**1**	**20**	**8.9**	**7.4**
Feeder	Scheduled	0	0	0	0
	Unscheduled	4	80	111.5	92.6
	Total	**4**	**80**	**111.5**	**92.6**
Total Interruptions		**5**		**120.4**	

Note: - Blackout 94 lasted for 105 hrs accounting for 87.2% of the unscheduled feeder interruptions. The blackout was included in feeder problems even though it was a combination of Hydro, Transmission and Distribution.

94 Power Interruptions Affecting OPL-01 Excluding Blackout 94					
Descriptions		**No. Of Outages**	**% Of Total Outages**	**Duration (hrs)**	**% Of Total Duration**
Hydro		0	0	0	0
Transmission	Scheduled	1	25	8.9	44.1
	Unscheduled	0	0	0	0
	Total	**1**	**25**	**8.9**	**44.1**
Feeder	Scheduled	0	0	0	0
	Unscheduled	3	75	6.5	55.9
	Total	**3**	**75**	**6.5**	**55.9**
Total Interruptions		**4**		**20.2**	

Notes: - Excluding the Blackout 94 Storm, their were only three unscheduled interruptions on the OPL-01 feeder averaging 2.2 hours each.

January to October 95 Power Interruptions Affecting OPL-01

Descriptions		No. Of Outages	% Of Total Outages	Duration (hrs)	% Of Total Duration
Hydro		**2**	**13.33**	**1.3**	**2.3**
Transmission	Scheduled	1	6.66	4.5	7.9
	Unscheduled	0	0	0	0
	Total	**1**	**6.66**	**4.5**	**7.9**
Feeder	Scheduled	1	6.66	2.2	3.9
	Unscheduled	11	73.3	48.9	85.9
	Total	**12**	**80**	**51.1**	**89.8**
Total Interruptions		**15**		**56.9**	

January to October 95 Power Interruptions Affecting OPL-01 Excluding the February 13 Outage

Descriptions		No. Of Outages	% Of Total Outages	Duration (hrs)	% Of Total Duration
Hydro		**2**	**14.3**	**1.3**	**4.2**
Transmission	Scheduled	1	7.1	4.5	14.3
	Unscheduled	0	0	0	0
	Total	**1**	**7.1**	**4.5**	**14.3**
Feeder	Scheduled	1	7.1	2.2	7.0
	Unscheduled	10	71.4	23.4	74.5
	Total	**11**	**78.5**	**25.6**	**81.5**
Total Interruptions		**14**		**31.4**	

Notes – 82% of the unscheduled interruptions (OPL-01) for 1995 occurred within a month and half of the Feb. 13 outage, accounting for 97% on the total unscheduled interruptions for the feeder.

Appendix B

91 - 95 Power Interruptions Affecting OPL-01					
Descriptions		**No. Of Outages**	**% Of Total Outages**	**Duration (hrs)**	**% Of Total Duration**
Hydro		**5**	**10.4**	**2.8**	**1**
Transmission	Scheduled	7	14.6	33.7	12.3
	Unscheduled	8	16.6	34.4	12.6
	Total	**15**	**31.2**	**68.1**	**24.9**
Feeder	Scheduled	2	4.2	8.7	3.2
	Unscheduled	26	54.2	193.9	70.9
	Total	**28**	**58.4**	**202.6**	**74.1**
Total Interruptions		**48**		**273.5**	

91 - 95 Power Interruptions Affecting OPL-01 Excluding Blackout 94 & Feb. 13, 95 Outage					
Descriptions		**No. Of Outages**	**% Of Total Outages**	**Duration (hrs)**	**% Of Total Duration**
Hydro		**5**	**10.9**	**2.8**	**2.0**
Transmission	Scheduled	7	15.2	33.7	23.6
	Unscheduled	8	17.4	34.4	24.1
	Total	**15**	**32.6**	**68.1**	**47.6**
Feeder	Scheduled	2	4.3	8.7	6.1
	Unscheduled	24	51.2	63.4	44.3
	Total	**26**	**56.5**	**72.1**	**50.4**
Total Interruptions		**46**		**143.0**	

NEWFOUNDLAND AND LABRADOR

BOARD OF COMMISSIONERS OF PUBLIC UTILITIES

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Manager (Motor Carrier & Insurance)	726-0742
Accountant	726-0553

1995 01 13

Mr. Peter Alteen,
Legal Counsel,
Newfoundland Light & Power Co. Limited,
P.O. Box 8910,
St. John's, NF.
A1B 3P6

Dear Mr. Alteen:

Service Interruptions in the Community of Branch

May we please have a report on the recent service interruption history in the community of Branch. The Board also requests that the Company document its experiences of service interruptions to Branch.

We look forward to your reply.

Yours truly,

Carol Horwood,
Clerk.

NEWFOUNDLAND
POWER

Newfoundland Light & Power Co. Limited

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1995 03 27

Board of Commissioners of
Public Utilities of Newfoundland
P. O. Box 21040
120 Torbay Road
St. John's, NF
A1A 5B2

Ladies & Gentlemen:

As per your request of January 13, 1995, please find attached a "Report on the Service Interruption History for the Community of Branch". This is a final version of the draft report that we filed on February 16, 1995 on this issue.

We will be available to answer any questions arising from this report, if necessary, at the next regularly scheduled meeting with the Board on April 13, 1995.

Yours very truly,

Aidan F. Ryan
President & Chief Executive Officer

Report on the Service Interruption History Community of Branch

Newfoundland Light
& Power Co. Limited
March 27, 1995

1. INTRODUCTION

This is in response to the Board of Commissioners of Public Utilities' (the "Board") request for a report on the recent service interruption history for the community of Branch. The period covered is from September 1994 to January 1995.

2. DESCRIPTION OF SYSTEM

The community of Branch is provided electrical service via a distribution feeder from our Dunville Substation (DUN-01). The DUN-01 feeder is a 25 kV feeder, three phase to St. Bride's with two phases from St. Bride's to Branch. There are approximately 640 customers on DUN-01 feeder with 170 customers in Branch itself. The Dunville Substation is tied into the power grid via our radial transmission line 55L (42.33 km) from Blaketown Substation. These facilities are indicated on Table 1.

The distribution feeder from Dunville to Branch is approximately 90 km in length and is exposed to the sea and the prevailing southwest winds across Placentia Bay. Therefore, as a result of the length of the line and its location, the customers are more susceptible to interruptions than would be experienced in less exposed areas.

3. HISTORICAL BACKGROUND

The original line to Branch was built approximately 35 years ago under the Rural Electrification Program. Typical line construction at the time consisted of #2 ACSR conductor and long span (100 m) construction.

This line is typical of lines in rural areas where there are a small number of customers, resulting in a long feeder fed via a radial transmission line.

When this feeder was originally built, it was along the then main road. In the 1970's the road was upgraded and re-routed to eliminate some of the turns and hills, thereby making the line inaccessible from the travelled road in a number of locations.

Even with the road relocation and upgrading, road conditions are hazardous in the winter because of ice build up and the numerous hills. Heavy drifting is experienced in the Branch Country and Custlett Ridge areas. Other times of the year fog conditions also make driving hazardous.

Interruptions on the Cape Shore and in particular in Branch can be attributed to salt contamination, icing, and high winds. Salt contamination has been a contributing factor in many of the outages on the Cape Shore over the years.

Because most Newfoundland communities are on the coast, the majority of our lines are located near the shoreline where onshore winds play havoc on the system, depositing salt on the insulators causing the feeder to trip. This is a particularly bothersome problem in coastal areas with a southwesterly exposure. This problem manifested itself very early on with DUN-01 feeder. After a couple of years in operation, as a 25 kV feeder, the voltage was reduced to 12.5 kV to combat the salt contamination. We operated the feeder at 12.5 kV until 1980 at which time voltage problems caused by the load and length of the feeder, and improvements in 25 kV construction resulted in a conversion back to 25 kV. Today the line is still operating at 25 kV. Through maintenance and rebuilding, the line is being insulated for 34.5 kV with the new pin type insulators and suspension insulators in an attempt to reduce the outages due to salt contamination.

In the 1970's a test site was established in Little Barasway, on the Cape Shore. This test site was built in conjunction with the Canadian Electrical Association (CEA) to examine the effects of salt contamination on various electrical equipment items used in line construction. Several types of insulators, bushings, paints and other materials are being tested at this site. This site was chosen as it has some of the worst salt contamination in Canada.

The onshore southwesterly winds across Placentia Bay not only contaminate the line with salt but cause other problems as well. High winds cause the lines to slap together and, over time, deteriorate the conductor and equipment.

To address this situation, we installed midspan poles in areas where this problem was prevalent. As a result, midspan poles were placed on approximately 60% of the line. In addition, we installed storm guys on sections of the line to prevent the strong crosswinds from breaking the poles.

While present and potential future loads do not warrant additional transmission lines or substations in the area, we have been reconductoring the line to 4/0 AASC to improve voltage lowered by loading and the length of the line. As well, we have been relocating wherever possible to the road right-of-way.

Approximately $1,220,000 has been spent over the past ten years (see Table 2). Funds have been allocated over the next five years to continue work on this feeder.

As well, communication systems at our Control Centre and our Whitbourne Office have been upgraded over recent years to provide a better communication between our offices and crews working in the Cape Shore area. The latest upgrade provided the capability of linking repeater sites together to increase communication coverage. Additional funds have been allocated to make further enhancements to the radio system on the Avalon peninsula.

4.0 INTERRUPTION HISTORY

Including the December 8th storm there were 11 outages affecting Branch from September 1, 1994 to January 15, 1995.

The December 8th, 1994 failure is the subject of a report already filed with the Board. The December 8th failure was a part of the exceptional storm-related failure of the electrical system which affected virtually every customer on the Avalon peninsula. This one outage did however result in an interruption time of approximately 5700 minutes.

Of the remaining 10 outages, 5 were scheduled and 5 were unscheduled. Two of the scheduled outages were to accommodate upgrading of the DUN-01 feeder. The 5 unscheduled outages were a result of weather in the area and salt contamination on the line. Table 3 provides an individual explanation of each of the interruptions affecting Branch during the September 1994 to January 1995 period. Note that these are outages that affect whole communities, and do not include individual customer outages.

To permit a review of these outages in an historical context, the Company has provided a ten year graphic history of interruptions in this area. (Figures 1, 2 & 3). While the total number of interruptions appear to be high at first blush, it is noteworthy that the number of unscheduled outages for 1994 (excluding the December 8th, 1994 experience) was the lowest of the past ten years for this feeder (Figure 1). The average duration of these unscheduled outages was the third lowest for the past ten year period and the total unscheduled interruption time for 1994 was the second lowest for the time period (Figure 2 & 3).

Also provided are graphic depictions of the frequency, average duration and total interruption time for 1994 interruptions by month (Figure 4, 5 & 6). From these it can be seen that January and December had the highest number of unscheduled interruptions. This is due to the weather conditions at that time of year. High winds combined with icing place extra loading on the line.

5.0 SUMMARY AND CONCLUSIONS

Substantial upgrading has been taking place over the past five years on DUN-01, and will continue for the next five years as the Company continues to replace the existing conductor on the feeder. In the past ten years approximately $1,220,000 has been expended in this effort. During the upgrading the line is being relocated, where possible, to the road right of way. This will improve the serviceability of the line. While there will be planned interruptions required to accomplish the upgrading, for obvious reasons we will try to keep planned interruption time to a minimum.

Upgrading should improve reliability and reduce the number of unscheduled interruptions. However, this alone will not eliminate all of the service difficulties experienced by the residents of Branch. Branch is at the end of a long feeder serviced by a radial transmission line in a hostile environment where salt spray, icing, and high winds impact operations. As such any problem on the transmission line, and almost all problems on the feeder will affect electrical service to the community of Branch. Consequently, interruptions in electrical service can only be kept to a minimum, not eliminated.

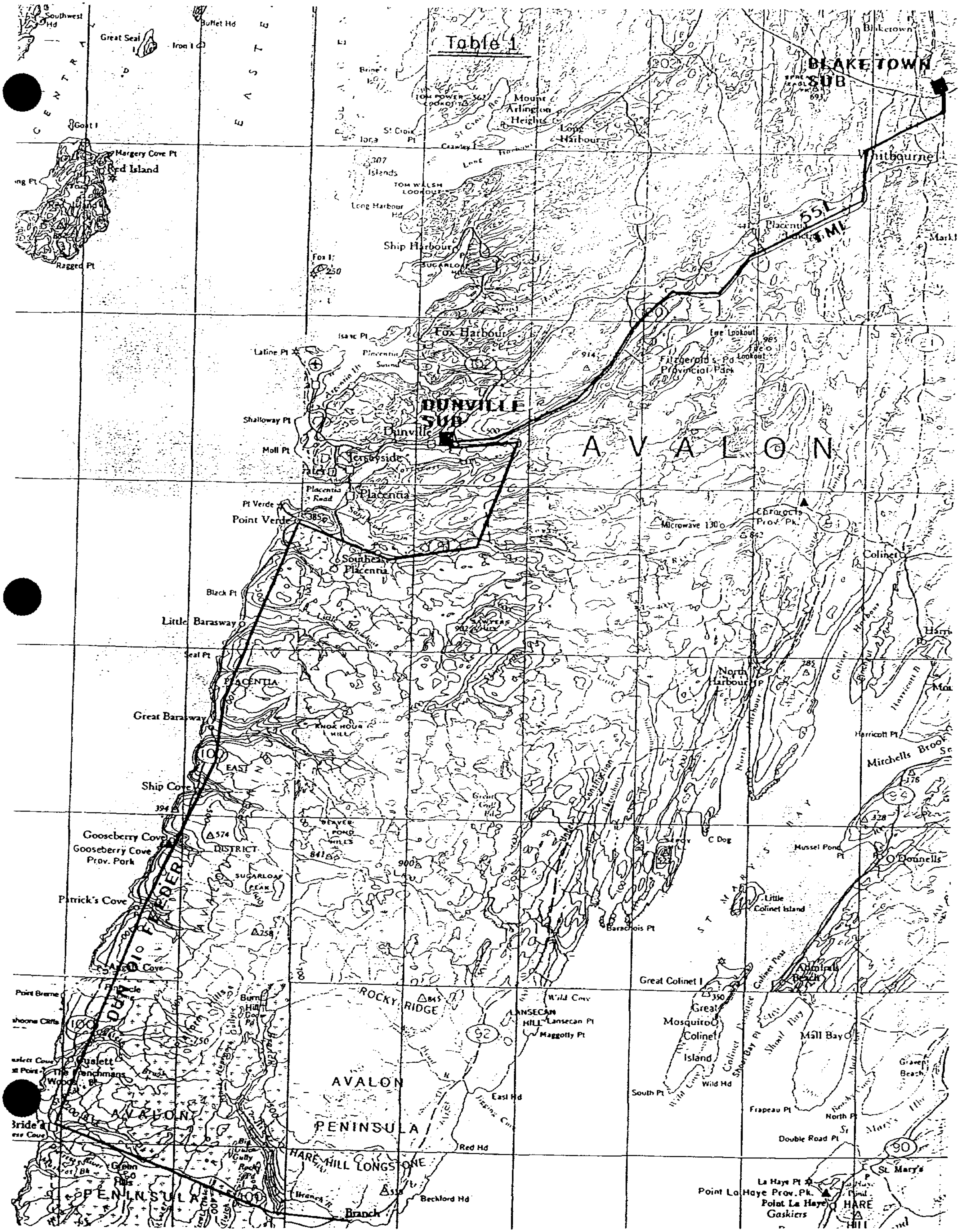
Table 1
BLAKETOWN SUB
Blaketown
Whitbourne
55L
TML
DUNVILLE SUB
Dunville
AVALON
Mount Arlington Heights
Long Harbour
Ship Harbour
Fox Harbour
Fitzgerald's Pd Provincial Park
Jerseyside
Placentia
Point Verde
Southeast Placentia
Little Barasway
Great Barasway
Ship Cove
Gooseberry Cove
Gooseberry Cove Prov. Park
Patrick's Cove
Angels Cove
Point Lance
Branch
Chance Cove Prov. Pk.
Colinet
North Harbour
Great Colinet I
Great Mosquito Colinet Island
Mall Bay
Admirals Beach
Donnells
Point La Haye Prov. Pk.
St. Mary's
ROCKY RIDGE
LANSECAN HILL
HARE HILL LONGSTONE
AVALON PENINSULA
Red Island
Margery Cove Pt
Ragged Pt
Great Seal I
Goat I
Southwest Hd
Buffet Hd
Iona
St Croix Pt
Long Harbour Hd
Fox I
Isaac Pt
Latine Pt
Shalloway Pt
Moll Pt
Pt Verde
Black Pt
Seal Pt
Barachois Pt
Wild Cove
Maggotty Pt
Lansecan Pt
East Hd
Red Hd
Beckford Hd
South Pt
Wild Hd
Frapeau Pt
North Pt
Double Road Pt
La Haye Pt
Mussel Pond Pt
Harricott Pt
Mitchells Brook
Little Colinet Island
C Dog
Microwave 130
Fire Lookout
Gooseberry Cove
Bride
Cuslett
The Frenchmans
Green Hills
Placentia Road
Point La Haye
Gaskiers
HARE HILL

Table #2

Capital Expenditures

The Company has been upgrading the feeder and the transmission line over the past ten years. A breakdown of this expenditure is as follows.

1985	$ 38,000
1986	$ 35,000
1987	$ 74,000
1988	$ 28,000
1990	$ 77,000
1991	$153,000
1992	$162,000
1993	$116,000
1994:	$537,000

Table #3

List of Service Interruptions
Branch
Fall of 1994

September 01	0957 to 1349	Scheduled interruption to replace existing conductor.
September 17	1700 to 2014	Unscheduled interruption to entire distribution line. Equipment at St. Brides had burnt as a result of salt contamination.
September 18	0633 to 1234	Scheduled interruption to replace a pole in the transmission line supplying the Dunville substation.
September 22	1300 to 1407	Scheduled outage associated with the upgrading work on the distribution line supplying Branch and Pt. Lance.
December 8		Unscheduled outage due to the severe snow storm. Power was restored late Monday night.
December 21	1230 to 1438	Scheduled outage to make permanent repairs to a broken pole and damaged conductor as a result of the December 8th storm.
December 23	1050 to 1138	Unscheduled outage to replace a pin type insulator at Big Barachoix.
December 30	0211 to 0735	Unscheduled outage due to snow storm. Conductor had come off the insulator. Restoration of the service was hampered due to severe road conditions. Crews were delayed until road was plowed.
January 3	1030 to 1345	Unscheduled interruption due to equipment failure near Branch. Cause of failure is uncertain but believed to have been caused by the high winds experienced at that time.
January 4	1300 to 1405	Scheduled interruption to make repairs as a result of high winds experienced in the area.
January 4	2316 to 0146	Unscheduled interruption due to equipment failure as a result of high wind conditions at Custlett.

Frequency of Interruptions

Branch

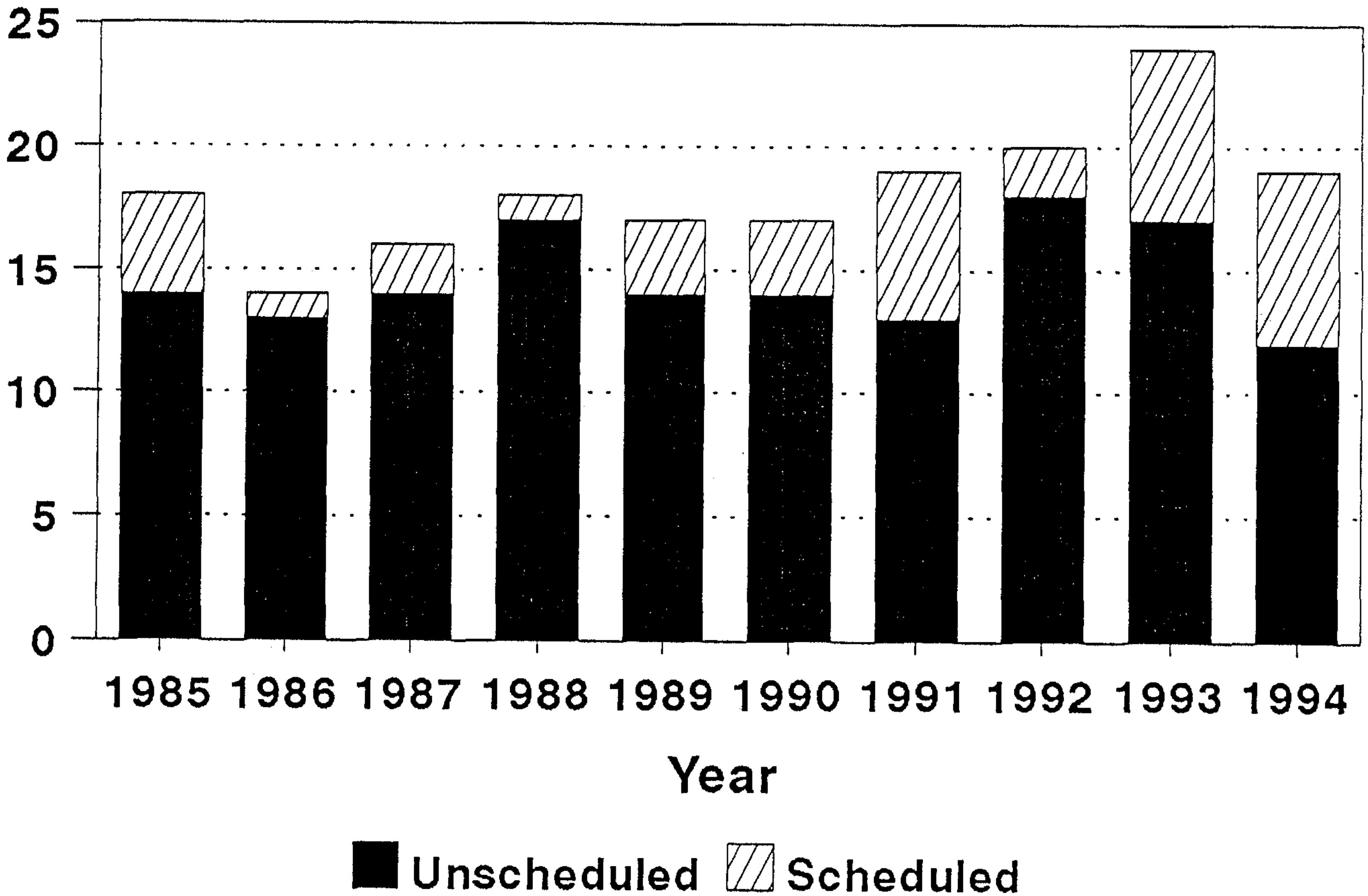

Fig. # 1 (Excludes the Dec. 08 outage)

Average Duration of Interruptions

Branch

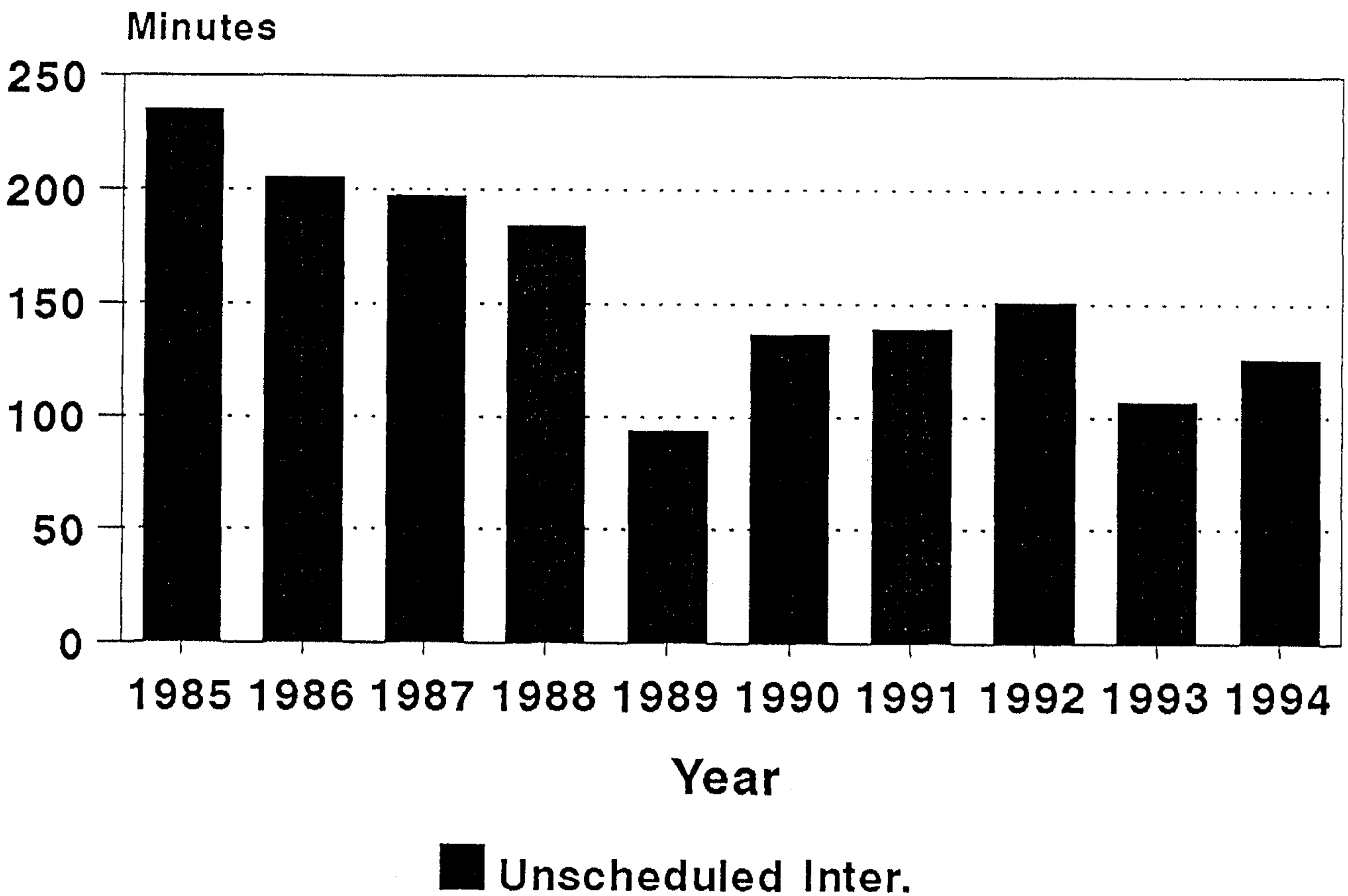

Fig # 2 (Excludes the Dec. 08 outage)

Total Interruption Time
Branch

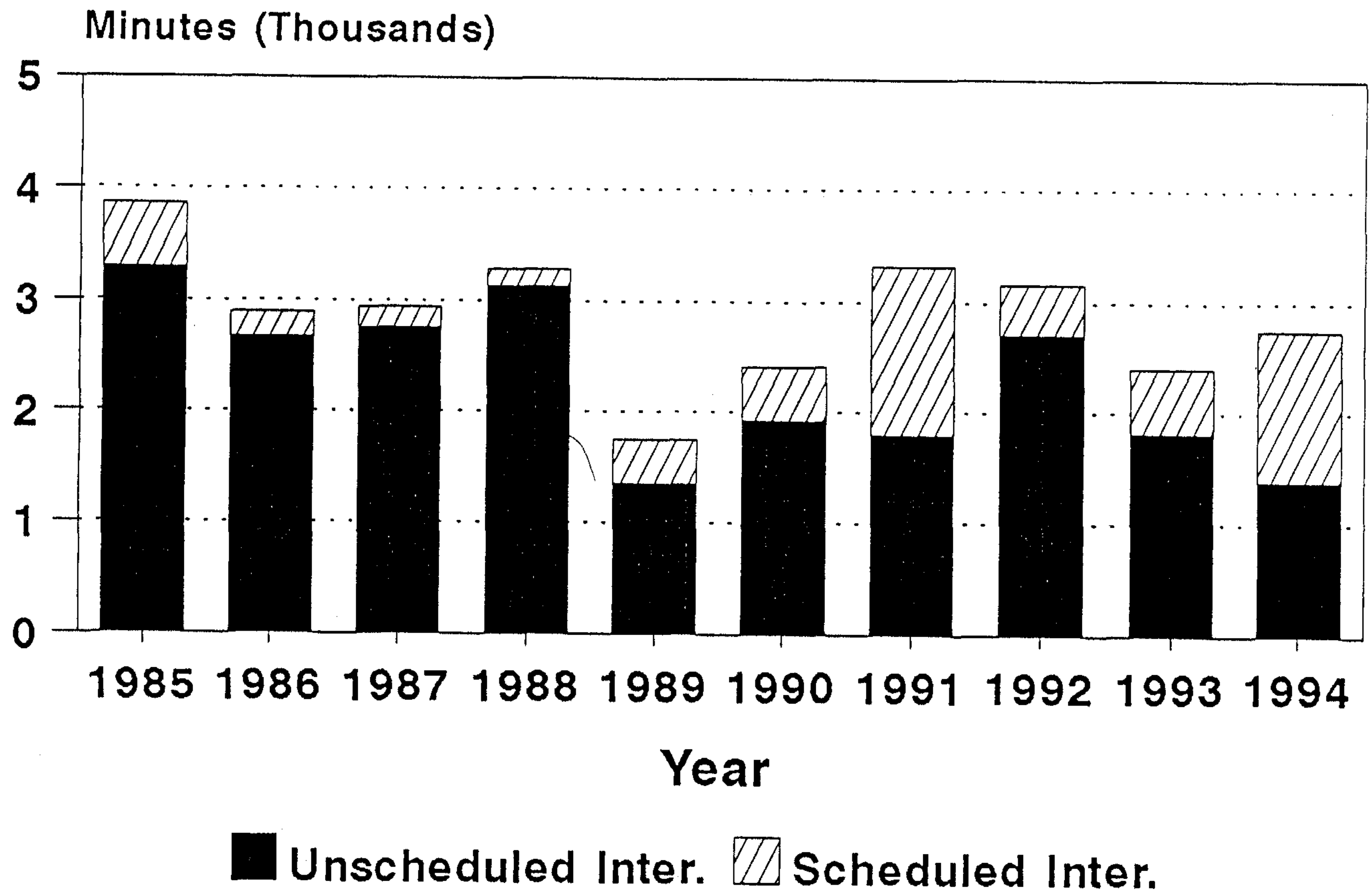

Fig # 3 (Excludes the Dec. 08 outage)

Frequency of Interruptions
Branch, 1994

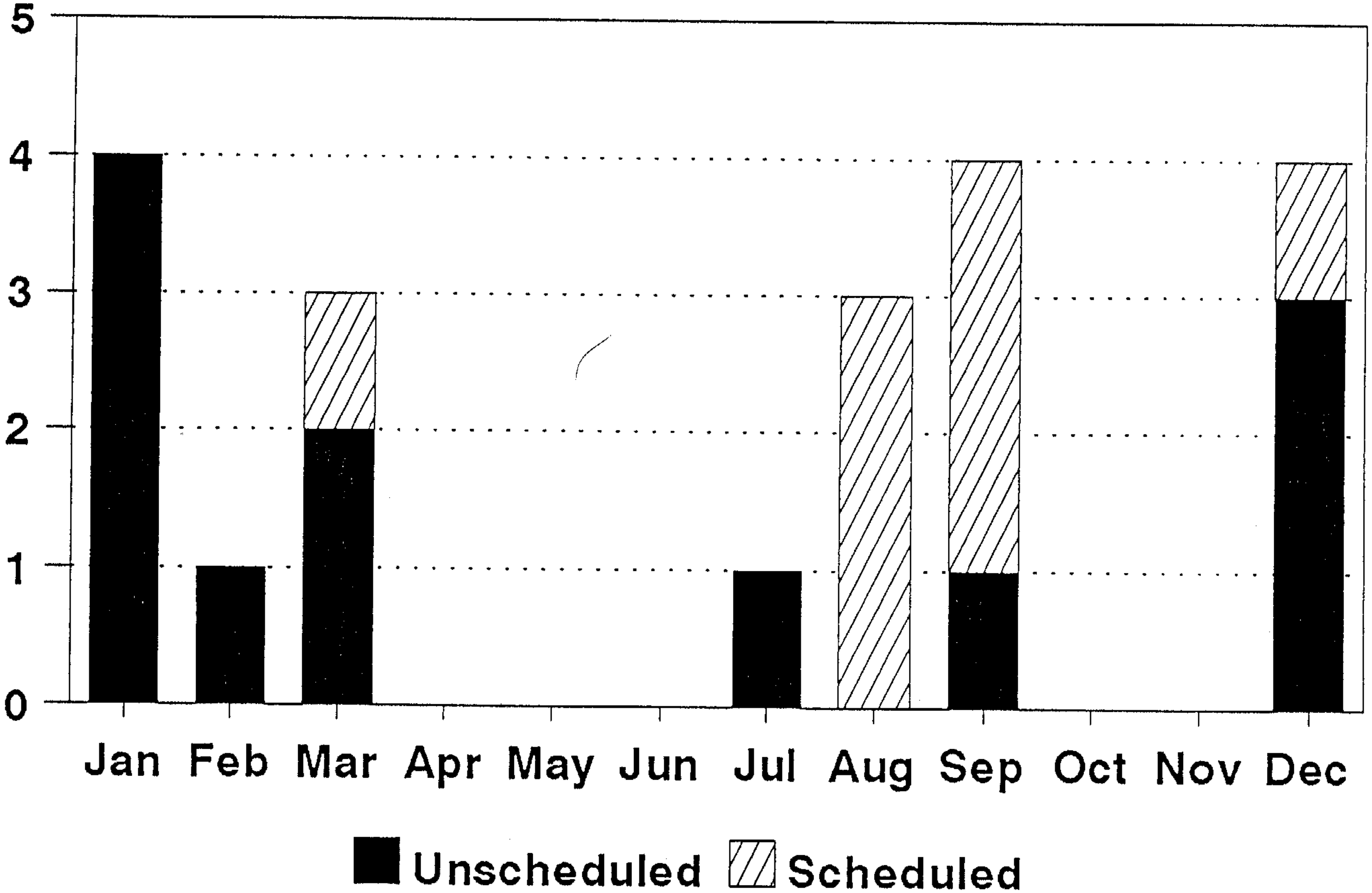

Fig. # 4 (Includes the Dec. 08 outage)

Average Duration of Interruptions
Branch, 1994

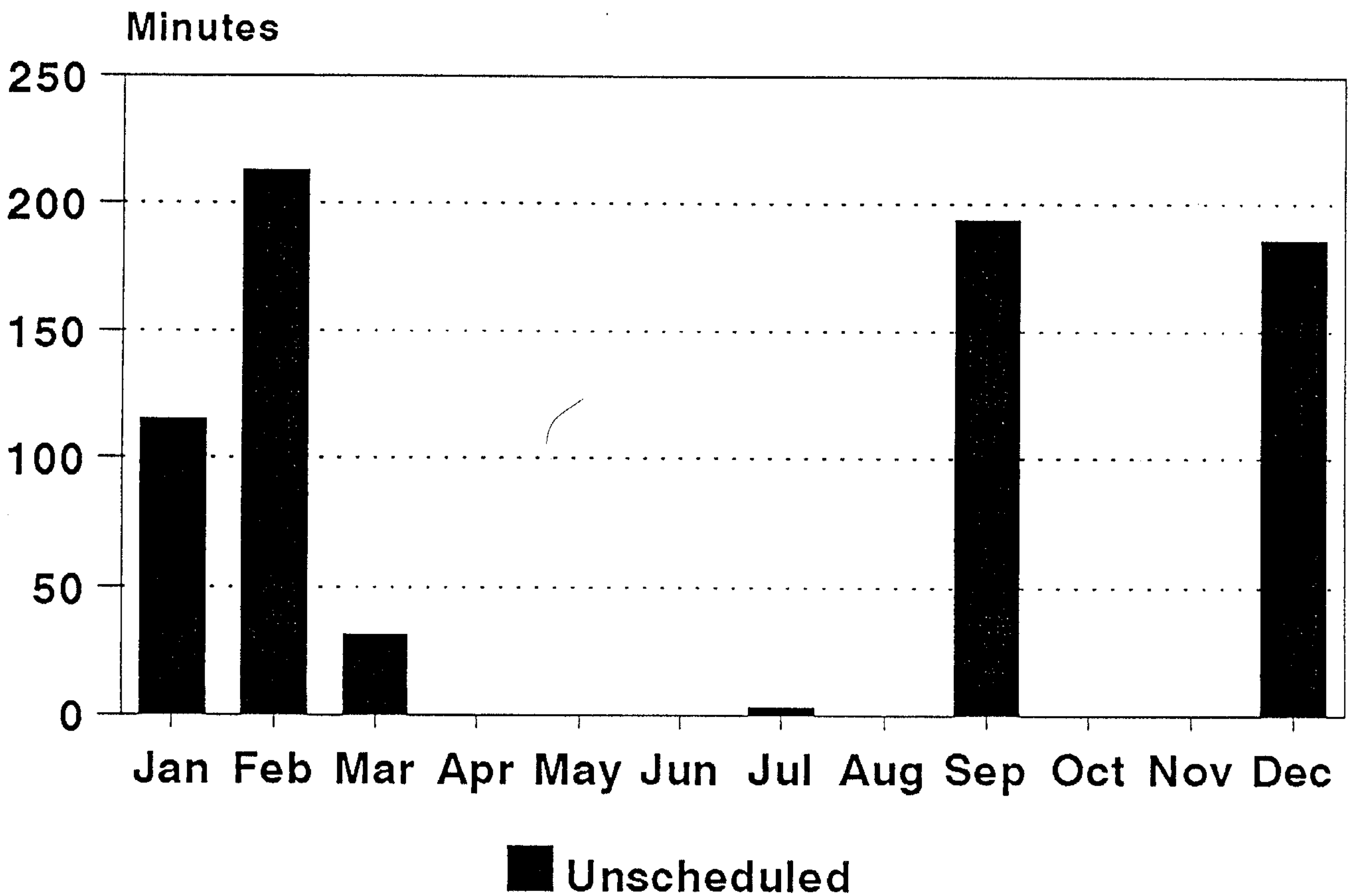

Fig. # 5 (Excludes the Dec. 08 outage)

Total Interruption Time

Branch, 1994

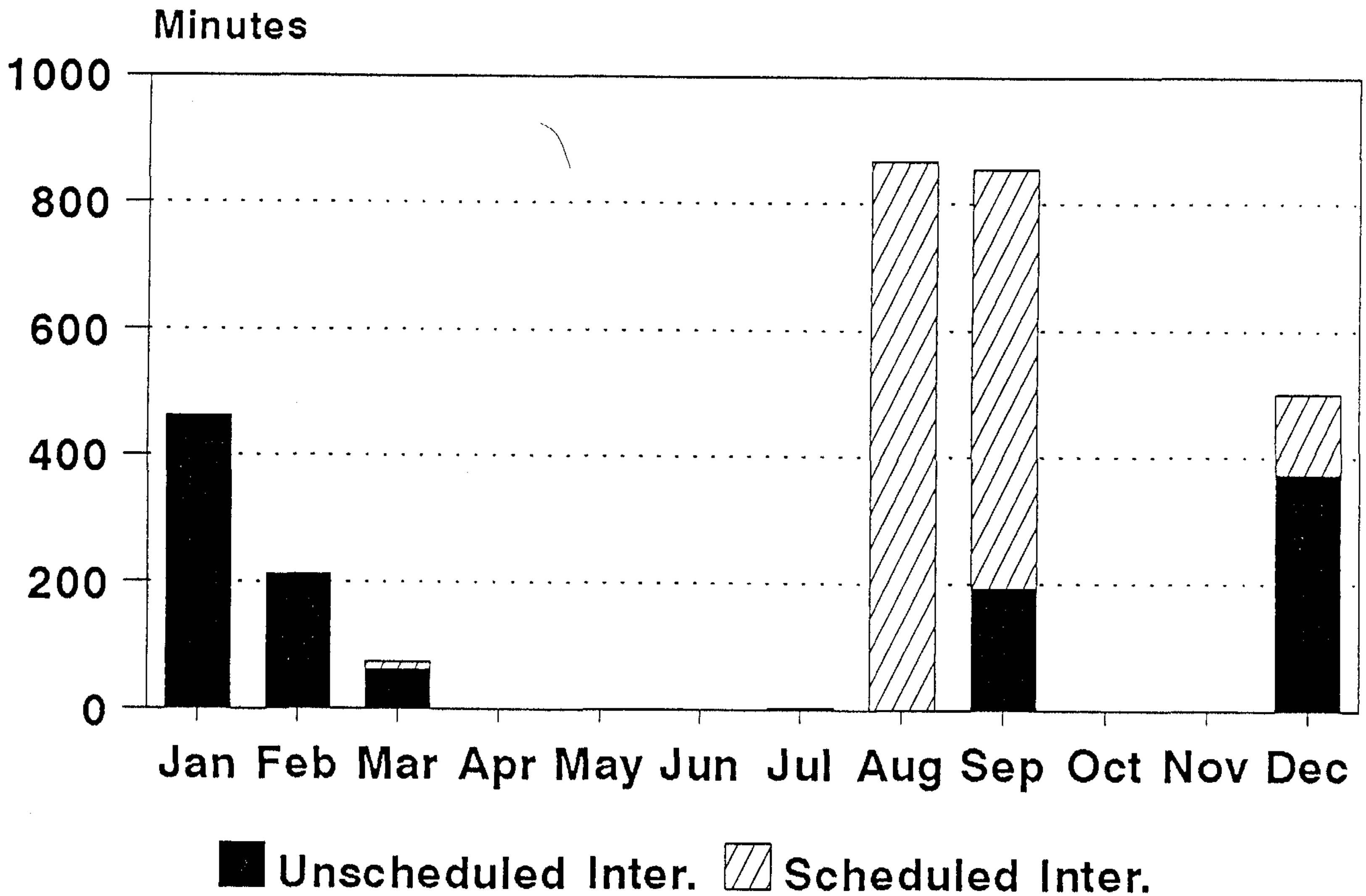

Fig. #6 (Excludes the Dec. 08 outage)