Lower Churchill Hydroelectric Project

Report of
the Environmental
Assessment Panel

DECEMBER 1980

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PANEL REPORTS
TO THE MINISTER OF THE ENVIRONMENT
ON THE PANEL PROJECTS

1. Nuclear Power Station at Point Lepreau, New Brunswick. (May 1975)

2. Hydro Electric Power Project, Wreck Cove, Cape Breton Island, Nova Scotia. (August 1976)

3. Alaska Highway Gas Pipeline Project, Yukon Territory. (Interim report, August 1977)

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6. Eastern Arctic Offshore Drilling - South Davis Strait Project, N.W.T. (November 1978)

7. Lancaster Sound Offshore Drilling Project, N.W.T. (February, 1979)

8. Eldorado Uranium Hexafluoride Refinery, Ontario. (February, 1979)

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11. Banff Highway Project (east gate to km 13). (October, 1979)

12. Boundary Bay Airport Reactivation, British Columbia. (November 1979)

13. Eldorado Uranium Refinery, R.M. of Corman Park, Saskatchewan. (July 1980)

14. Arctic Pilot Project (Northern Component) N.W.T. (October, 1980)

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Environmental Assessment Review
Examen des évaluations environnementales

Hull, Quebec
K1A 0H3

The Honourable John Roberts, P.C., M.P.
Minister of the Environment
Ottawa, Ontario

Dear Minister:

In accordance with the Federal Environmental Assessment and Review Process the Lower Churchill Environmental Assessment Panel has completed a review of a proposal to develop the hydroelectric potential of the Lower Churchill River. We are pleased to submit the Panel's report for your consideration.

The Panel has evaluated the project, as proposed by the Lower Churchill Development Corporation and considers it acceptable, provided certain environmental and socio-economic conditions, outlined in the report, are met.

Respectfully yours,

P.J. Paradine

P.J. Paradine
Chairman
Lower Churchill
Environmental Assessment Panel

TABLE OF CONTENTS

EXECUTIVE SUMMARY

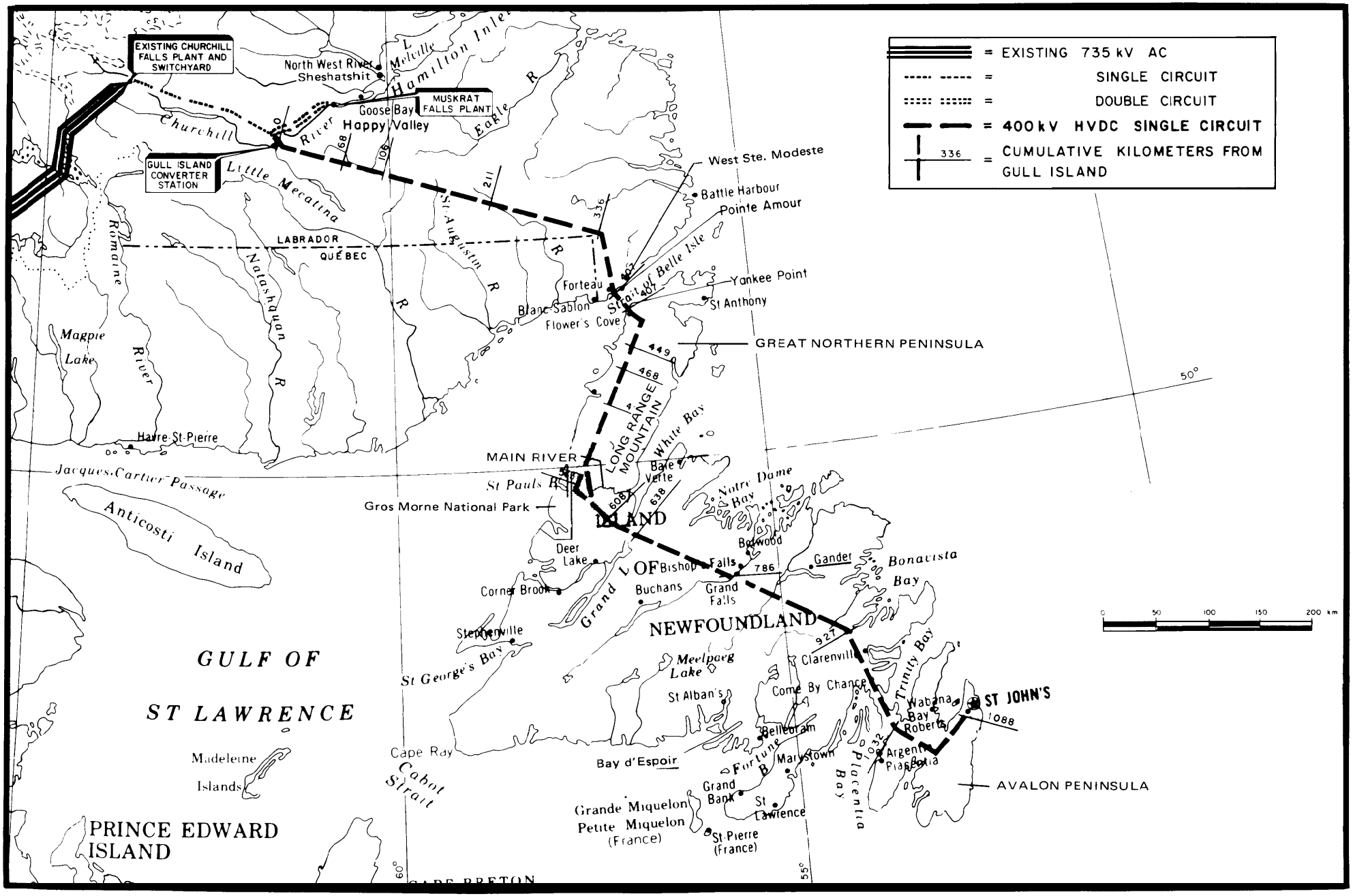


Figure 1 — *Proposed Transmission Lines Route*

This report results from a review by an Environmental Assessment Panel of a proposal to build power generating stations on the Lower Churchill River and associated transmission lines across Newfoundland and Labrador. The Proponent of the project, the Lower Churchill Development Corporation (LCDC) is a crown corporation with shares owned by Canada and the Province of Newfoundland and Labrador. The federal agency involved in funding of LCDC, the Department of Energy, Mines and Resources, requested this review in accordance with its responsibilities under the Federal Environmental Assessment and Review Process (EARP).

Following the formation of LCDC in 1978, the Environmental Assessment Panel was requested to consider both the transmission lines component and potential power generating sites at Muskrat Falls and Gull Island. Environmental Impact Statements were completed by the Proponent by early 1980. After soliciting comments from government agencies and the public, the Panel held public meetings in seven communities in Newfoundland and Labrador during September 1980.

After careful consideration of all information received, the Panel reached a number of conclusions and formulated certain recommendations contained in this report. The Panel found that the project could be acceptable, provided certain environmental and socio-economic conditions are met.

The Panel concluded that the use of the land and wildlife by Indians in Labrador would continue to be a viable option during and after construction of' the project. However, special measures affecting local communities will be necessary because of the potential for social disruption resulting from an influx of construction workers.

The Panel concluded that the proposed project will not necessarily lead to other developments in Labrador. However, the Panel strongly recommends that, should specific industrial developments be proposed in the future, the potential for negative effects, and in particular impact on native cultures, be fully assessed prior to irrevocable decisions being made.

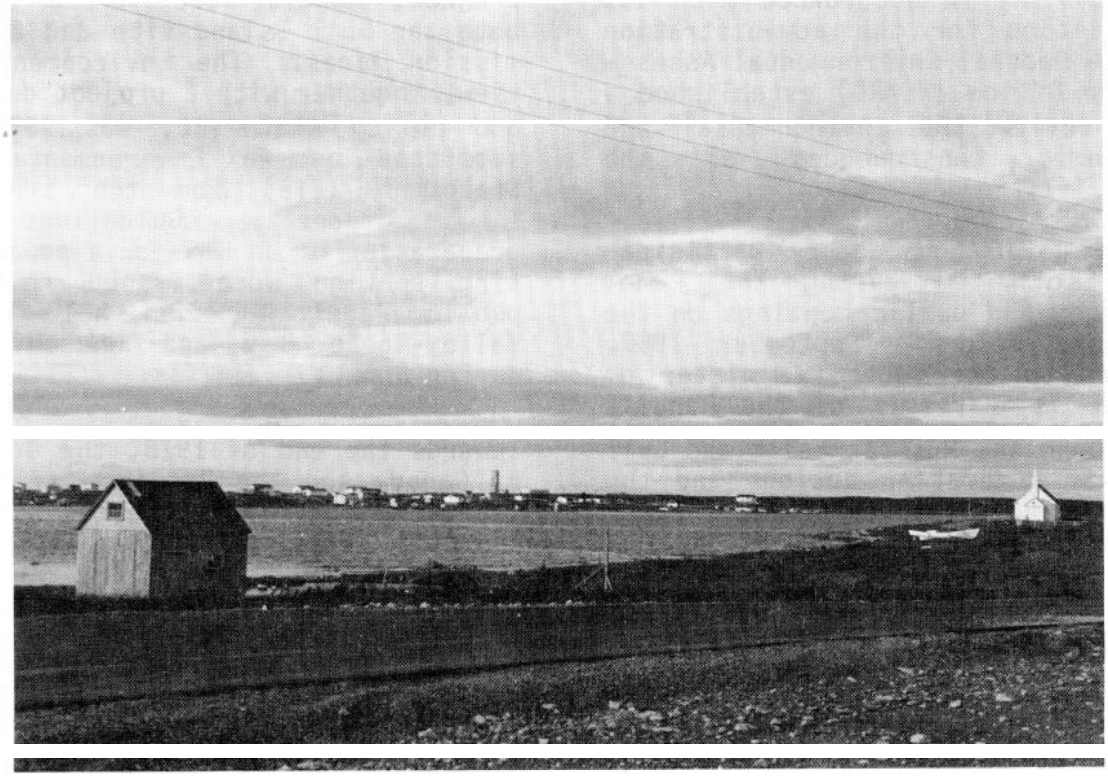
Specific conditions have been established to mitigate or compensate for various environmental effects. These address fisheries, forestry, wildlife and other impacts, particularly in the areas to be flooded by the proposed reservoirs. Certain conditions have also been established for the crossing of the Strait of Belle Isle and for the transmission lines generally.

Opportunities exist to construct portions of the project in alternative ways which may have greater long-term resource benefits. Accordingly, recommendations have been made on the salvage of timber from the proposed reservoirs and the use of existing transmission line routes.

The Panel considers that the development of this indigenous renewable energy source is a rational choice to meet demonstrated needs. However, to ensure that local economic benefits are optimized, establishment of liaison committees will be necessary. Specific measures such as training will also be required to increase local employment.

CHAPTER 1

PROJECT AND REVIEW PERSPECTIVE



1.1 Introduction

The Lower Churchill Hydro project is a proposal to build power generating stations on the Lower Churchill River and associated transmission lines across Newfoundland and Labrador. The Proponent of the project, the Lower Churchill Development Corporation Limited (LCDC) is a crown corporation whose shares are owned by Canada and the Province of Newfoundland and Labrador. LCDC's responsibilities are specific to this project.

The federal agency involved in the funding of the project, the Department of Energy, Mines and Resources (the Initiator), requested a formal review under the Environmental Assessment and Review Process (EARP). In accordance with its responsibilities for the administration of EARP the Federal Environmental Assessment Review Office (FEARO) established a Panel to review the environmental and socio-economic consequences of the project.

Public and government agency participation was solicited during the Panel review stage, and public meetings on the project were held in September 1980. This report to the federal Minister of Environment is a result of the Panel's review of both the Muskrat Falls and Gull Island power generating options and the transmission of hydroelectric power within the Province of Newfoundland and Labrador.

1.2 Project Background

The hydroelectric power potential of the undeveloped lower portion of the Churchill River in Labrador has been studied since the late 1960s as an additional energy source following completion of the 5,225 megawatt (MW) generating station at Churchill Falls. Approximately 1700MW are available from Gull Island and 600MW from Muskrat Falls.

The original proposal to develop the Lower Churchill River consisted of a power generating site at Gull Island with transmission lines to the Island of Newfoundland and Churchill Falls. In 1975, difficulties with the marketing of the energy and thus the financing of the project caused the plans for this development to be delayed.

Although this project was under consideration before EARP became operational, a preliminary Environmental Overview was produced in December 1974, under a federal-provincial cost-shared agreement. In view of the federal involvement in the project, Panels were formed to review both the Gull Island site and the transmission lines. The Environmental Overview, together with a project description and policy statement, was subsequently submitted as an Environmental Impact Statement (EIS) for the transmission lines component. Guidelines for the preparation of an EIS for a power generating station were issued following a public Panel workshop held in Happy Valley-Goose Bay and Churchill Falls during June 1978.

Towards the end of 1978, the Governments of Canada and the Province of Newfoundland and Labrador created the Lower Churchill Development Corporation, with 51% of the shares owned by the Province and 49% by Canada through the Department of Energy, Mines and Resources. The mandate given to LCDC by both governments was: to select the best initial project (Gull Island or Muskrat Falls); to finalize project design; to determine the cost of the project; to establish a construction timetable; to prepare plans for financing the project and marketing the power, and finally; to complete

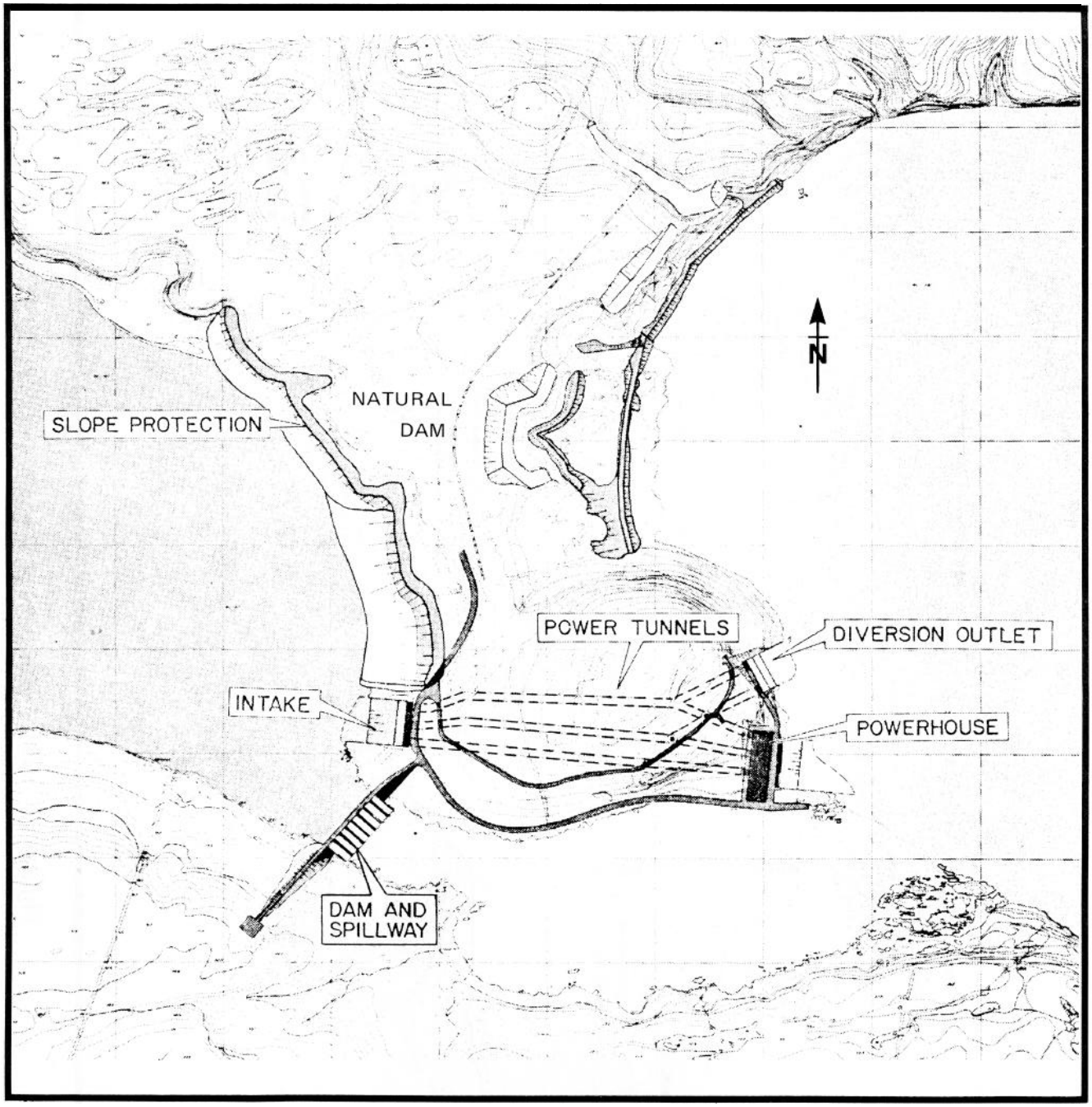


Figure 2 — Muskrat Falls Power Generation Site General Layout

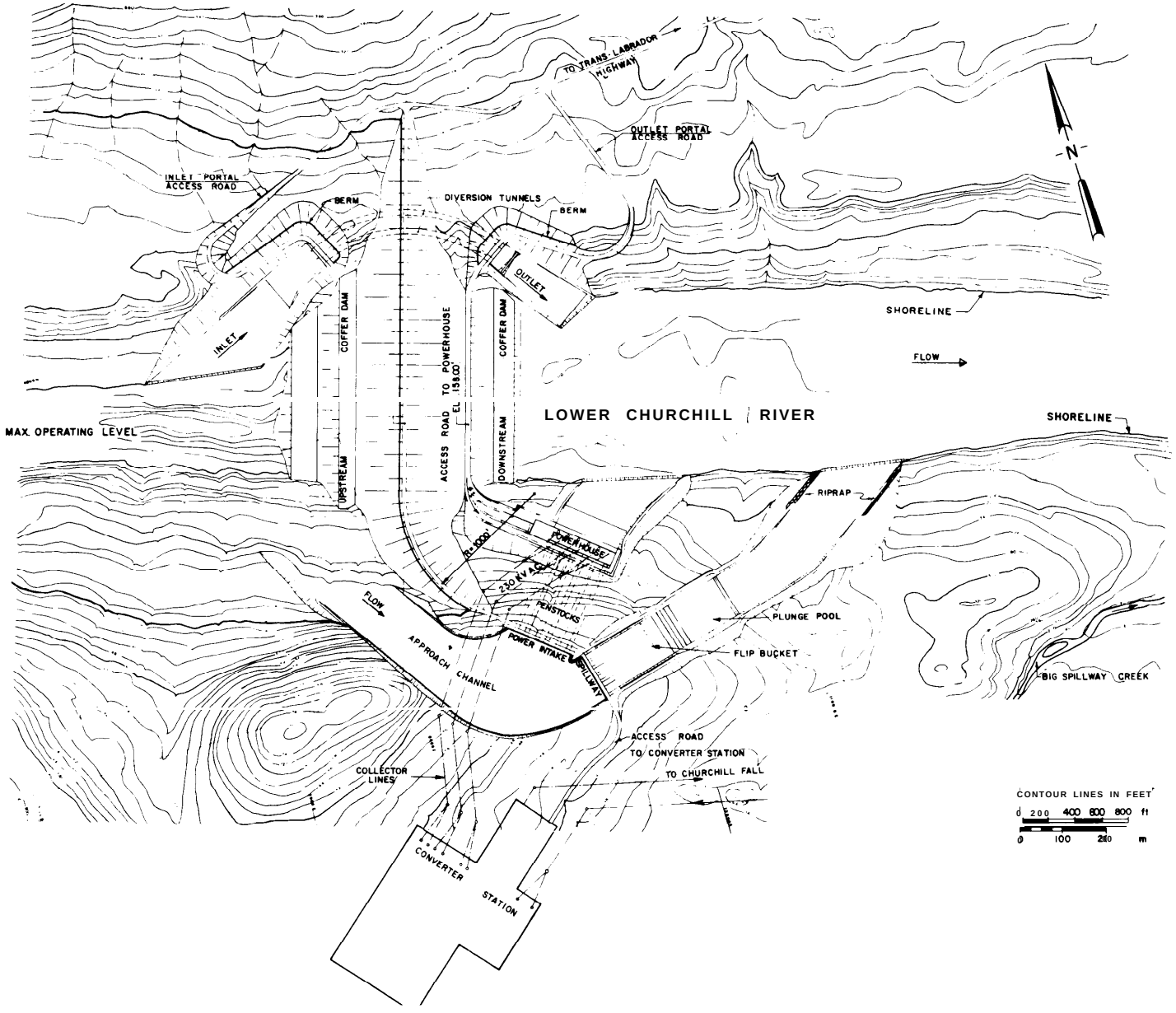


Figure 3 — Gull Island Power Generation Site
General Layout

necessary environmental and social studies.

With the creation of LCDC, the proposal was modified to include a power generating station at Muskrat Falls and, with the referral of this site for review under EARP, Panels previously reviewing separate components were amalgamated to allow for review of the total Lower Churchill project by one Panel.

In a June, 1980 report to the shareholders, the Board of Directors of LCDC recommended development of the Muskrat Falls site. However, the report points out that Gull Island is the most economic alternative in the long-term to serve the Province's load, provided suitable markets for the surplus energy can be found.

1.3 Project Setting

The community nearest to the proposed power generating sites is the Town of Happy Valley-Goose Bay, a service and commercial centre for Central Labrador. Access to both sites is via a 300 km road built between Happy Valley-Goose Bay and Churchill Falls at the time of construction of the Churchill Falls project. The Muskrat Falls and Gull Island sites are 40 and 90 km respectively from Happy Valley-Goose Bay (figure 1).

Other nearby communities in the Central Labrador area are North West River and Sheshatshit, on the north and south sides respectively of the North West River. These communities are approximately 40 km northeast of Happy Valley-Goose Bay.

The proposed transmission lines crossing southern Labrador and Newfoundland pass near coastal communities along the Strait of Belle Isle but otherwise avoid population centres except for termination points at Grand Falls and on the Avalon Peninsula (St. John's).

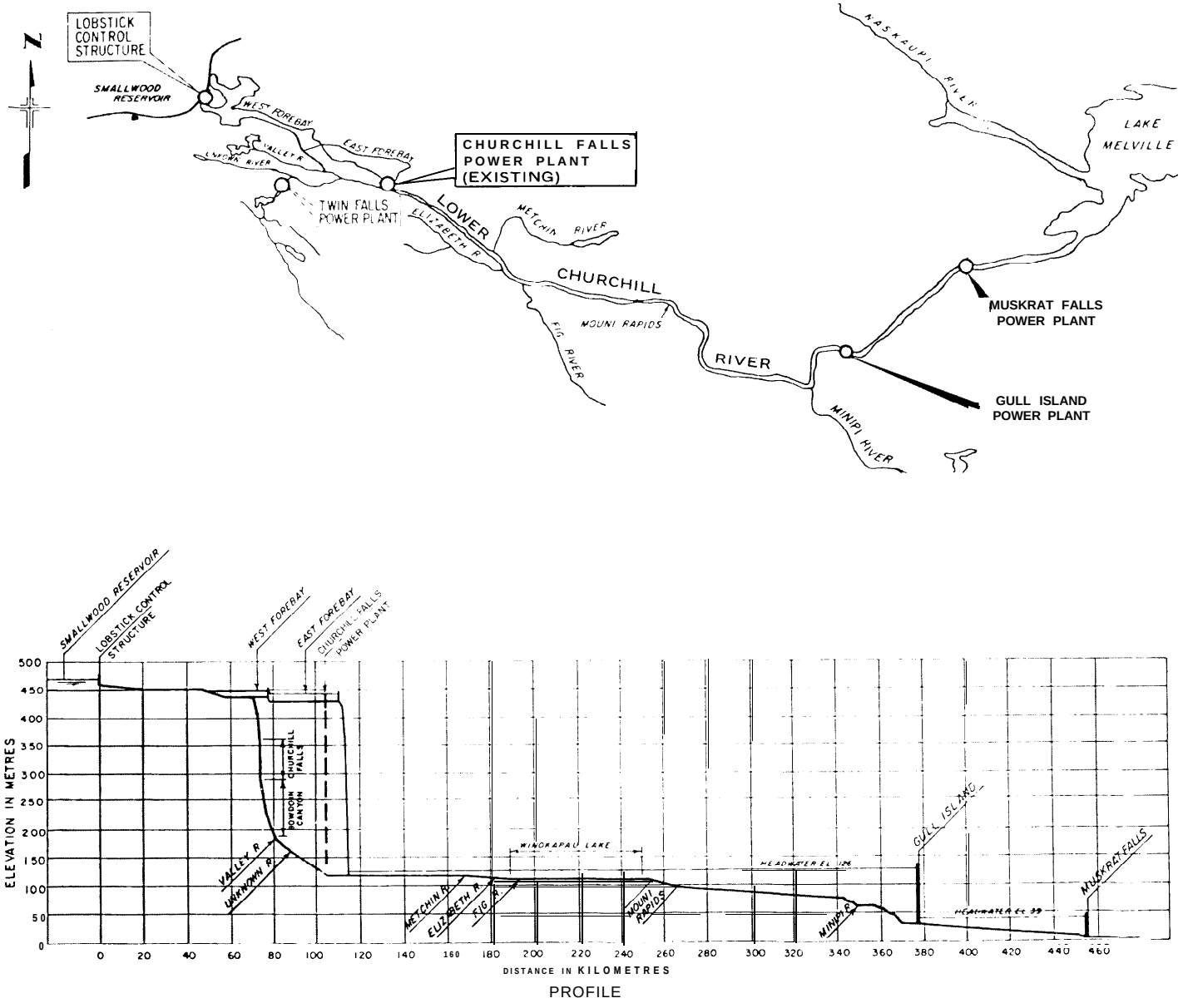
1.4 Project Description

The Muskrat Falls project would involve a dam consisting of a spillway and flanking dykes (Figure 2). A powerhouse would be located at the bottom of the rock knoll to the north of the falls. Intake tunnels through the knoll would feed the three initial and one future generating units. A natural dam, between the rock knoll and the north shore of the river, would be stabilized as part of the construction work. The normal reservoir elevation would be 39 m above sea level and discharge would be into the Churchill River close to sea level.

At Gull Island a rockfill dam would be located at the head of Grizzle Rapids with diversion tunnels on the north bank and flip bucket spillway and power house on the south bank (Figure 3). Water intake to the powerhouse would be from the approach channel, via penstocks to drive six generating units. The normal reservoir elevation would be 123 m above sea level and discharge would be at the level of the Muskrat Falls reservoir.

Operation of these facilities would be tied into the Churchill Falls generating station from where they would be remotely controlled (figure 4). A water management agreement between LCDC and Hydro Quebec, and intertie of transmission lines, would be required to integrate and optimize operation of the Lower Churchill and Churchill Falls generating stations. The proposed intertie would also allow for recall of power from the Churchill Falls generating station and the possible export of surplus power.

The proposed alternating current (AC) intertie line (188 km) would generally



PROFILE

Figure 4 — Power Generation Stations on the Lower Churchill River

follow the existing road from Churchill Falls to Happy Valley-Goose Bay, crossing the Lower Churchill River at Gull Island where a converter station is planned for the south side of the river. A further 66 km of AC lines are proposed to link Muskrat Falls with Gull Island.

In the event that both power generating sites are developed, the transmission of power between Labrador and the Island of Newfoundland would require two ±400 KVDC lines. In Labrador the required 400 km of 1 ines would generally parallel a preliminary routing of the proposed Trans-Labrador Highway to Point Amour on the Labrador coast. Submarine cables would cross the Strait of Belle Isle at its narrowest point (18 km). Four seabed cables would be placed in two parallel trenches 200 m apart. The earlier option of a tunnel has been discarded.

From Yankee Point, on the Newfoundland side of the Strait, to just north of Gros Morne National Park, the lines would be routed down the Great Northern Peninsula staying approximately 15 km inland. To ensure reliability in extreme weather conditions, two line routes would cross the Long Range Mountains, joining together and avoiding the Main River before proceeding southeasterly to an inverter station near Grand Falls. The section from Yankee Point to Grand Falls would be 380 km long. From Grand Falls a 314 km ±400 KvDC line would continue to the Avalon Peninsula, passing south of Gander and terminating in another inverter station at Soldiers Pond near St. John's.

The estimated cost of development of Gull Island and its associated transmission facilities is $4.3 billion. The estimated cost of Muskrat Falls and its associated transmission facilities is $3.2 billion. The construction of Gull Island would require 6.5 years and Muskrat Falls, 5.5 years.

1.5 Environmental Assessment and Review Process

1.5.1 Process Description

The responsibility of the federal Minister of the Environment is cited in the Government Organization Act, 1979. The Minister is specifically charged with ensuring that new projects in which the federal government is involved are assessed for potential adverse effects on the environment.

The Environmental Assessment and Review Process (EARP) was established in December 1973 to ensure that:

- environmental effects are taken into account early in the planning of new federal projects, programs and activities;
- an environmental assessment is conducted for all projects which may have an adverse effect on the environment before commitments or irrevocable decisions are made, and those which may have significant adverse effects are referred to the Minister of the Environment for formal review, and
- the results of these assessments are used in planning, decision making and implementation.

Federal projects are defined as those involving federal funds, lands or initiatives.

1.5.2 Environmental Assessment Panel

In accordance with EARP directives, a Panel was formed to review the environmental and socio-economic consequences of the project and make recommendations to the federal Minister of the Environment. The composition of the Lower Churchill


LOWER CHURCHILL
ENVIRONMENTAL ASSESSMENT PANEL

Environmental Assessment Panel is as follows:

Mr. Philip Paradine (Panel Chairman)
Federal Environmental Assessment
Review Office
Hull, Quebec

Miss Irene Baird
St. John's Hospital Council
St. John's, Newfoundland

Dr. Gordon Beanlands
Dalhousie University
Halifax, Nova Scotia

Mr. Andre Ducharme
Department of Fisheries and Oceans
Halifax, Nova Scotia

Dr. Frederick Pollett
Department of the Environment
St. John's, Newfoundland

Mr. Martin Warnes
Department of Energy, Mines and Resources
Ottawa, Ontario

Biographies of Panel members are contained in Appendix A.

1.5.3 Public Information and Participation

The Panel Secretariat attempted to ensure that all persons and organizations having an interest in the project received the information necessary to assist them in making their views known to the Panel.

Following the release of the EIS for the transmission lines in November 1978, notices of the review were placed in urban newspapers and sent to rural householders along the proposed route. Copies of the EIS were placed in viewing centres across the Province and sent to individuals. Visits were also made by the Panel Secretariat to communities where interest had been expressed, in order to explain the review process. Following the identification of deficiencies in the EIS by government agencies, interest groups and the general public, the Panel, in March 1979, requested the Proponent to provide further information.

Visits to various communities were also made by the Proponent in the fall of 1979 to provide information on the project. In December 1979, LCDC submitted an addendum to the transmission line EIS. This addendum, with the EIS for the power generating site submitted in April 1980, were reviewed by interested parties. Availability of all related project documents was widely publicized. As a result of EIS documentation review for the power generating sites and transmission lines, a total of 24 written submissions were received.

1.5.4 Public Meetings

On the basis of interest expressed by various communities, and discussions between community representatives and the Panel Secretariat, the location and the timing of the public meetings were decided by the Panel. Notices of the meetings were advertised and mailed to interested parties. Procedures for the meetings were also made available to interested parties in advance.

To hear the views of the residents of the smaller communities who had expressed interest in the review, the Panel held meetings in Flowers Cove (September 4), Forteau (September 5), West St. Modeste (September 6), Sheshatshit (September 8) and North West River (September 8). At the community meetings a wide range of concerns and views were presented to the Panel.


WALLY READ
DAVE COLLETT

Public meetings were also held in St. John's on September 2 and 3 and in Happy Valley-Goose Bay on September 9, 10, 11 and 12. In St. John's, sessions were held to allow both technical agencies and the public to make presentations. In Happy Valley-Goose Bay, detailed discussions on various technical issues took place. Issues discussed included socio-economic impact of the project as well as environmental issues related to the transmission lines and the power generating sites. A session to hear general concerns of the community was also held. At the final session participants presented closing statements summarizing their position concerning the project, taking into account information presented by others during the meetings. With the exception of the final session, the Panel, Proponent, participants and the audience were given an opportunity to ask questions after each presentation.

LCDC was represented by senior officials throughout the meetings, and assisted during the technical sessions by consultants who had helped prepare the EIS documents. Representatives of the media were present throughout the public meetings, with the exception of West St. Modeste.

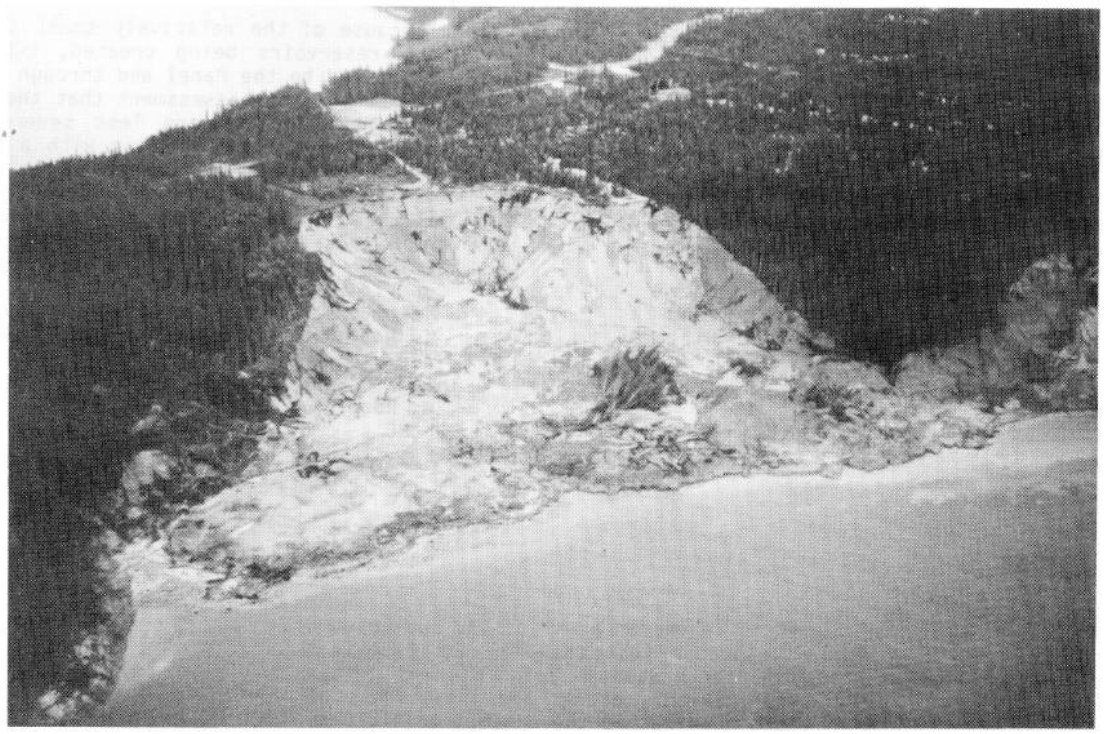
Representatives of the federal Departments of Environment, Fisheries and Oceans, and Energy, Mines and Resources as well as a number of public groups and local residents participated in the meetings at Happy Valley-Goose Bay and/or St. John's. The government of the Province of Newfoundland and Labrador, although supporting the review, indicated that representatives of provincial departments would not participate at the meetings.

A total of 133 presentations were heard by the Panel. Naskapi/English translation service was provided during the meetings at Sheshatshit and Happy Valley-Goose Bay. Transcripts of all meetings were made and are available through the Federal Environmental Assessment Review Office. Forty-five written submissions were received by the Panel during and after the public meetings. In addition, the Proponent provided further information in response to corrrnents received by the Panel. A list of those having made presentations or submitted briefs is contained in Appendix B.

From an evaluation of the EIS documentation, the written submissions, and other information presented, tabled or obtained from questions and answers at the public meetings, the Panel acquired a thorough understanding of the issues relating to the potential impacts of the project.

CHAPTER 2

ISSUES AND IMPACTS



"It is the opinion of the NMIA that the removal of our people into the alien and socially dangerous environment of construction camps, and the loss to our families of the able-bodied men who maintain our use of the land and support their families in the country, combined with the kinds of social pathology described above and the consequence for the Innut of being caged in the community, because there are no men to take the families into the country, will be to obliterate a culture that has survived intact for many thousands of years, and leave our people hopeless destitutes ravaged by alcoholism and exiled from Ntesinan, the land for which we feel deeply and to whose fortunes we are attached."

G. Andrew
Naskapi Montagnais Innu Association
Sheshatshit

"Briefly, I would like to comment that in going through the information and having lived in the area and been associated with some of the activities over the last few years, I am familiar with the extensive biological research, physical research which has gone into the planning of this project. I am a little concerned that similar research has not occurred in the people patterns, if you will, of the area."

D. Lough
District Vocational School
Happy Valley - Goose Bay

"EMR support of this project is based on a long standing national energy policy objective, and that is to achieve energy self-reliance... The policy supports development of renewable energy resources such as, but not restricted to hydro electricity, the replacement of oil-fired thermal electric generation, and reliance on indigenous sources of energy. The Lower Churchill Hydro project will contribute to each of these goals."

R. Edwards
Energy, Mines and Resources, Ottawa

"Because of the relatively small size of the reservoirs being created, LCDC has submitted to the Panel and through you to the public, our assessment that the environmental impacts are less severe than occur when you are dealing with a hydroelectric development where large reservoirs have to be created. Nevertheless, there are effects and some of them are illustrative of things we have experienced before in these hearings, a conflict between resource uses. Others involve a resource loss and must be judged in the context of balancing resource uses.'

W. Read
LCDC

"It is in the interest of the public good in Labrador that the Labrador Institute of Northern Studies joins with all other organizations, groups and individuals at these hearings in the attempt to exercise the responsibility of ensuring that developments such as the Lower Churchill River create the maximum benefits for all concerned and minimize the negative impacts of such developments."

A. Williamson
Labrador Institute of Northern Studies
Happy Valley - Goose Bay

2.1 Introduction to Issues

Before and during the public meetings the Panel heard viewpoints on a range of environmental and socio-economic issues. Although federal government departments considered the environmental sections of the EIS and addendum for the transmission lines to be conditionally acceptable, concern remained whether the most environmentally acceptable routing had been chosen between Grand Falls and the Avalon Peninsula and in crossing the Long Range Mountains. This, and other issues concerning the transmission lines were discussed in depth during the public meetings.

With regard to the power generating sites, the federal departments considered that impacts related to erosion, reservoir preparation, water resources and fisheries required identification beyond that provided in the EIS. Information on these issues was provided by the Proponent and participants during the course of the public meetings.

Comments received prior to the public meetings identified the socio-economic portions of both EISs to be deficient, particularly with regard to communities in Labrador. During the meetings many of the presentations by residents of these communities concerned socio-economic issues.

Information about the Indian community of Sheshatshit and its use of natural resources was considered by some participants to be inadequate. The Panel heard many presentations from residents of that community. Similarly, several presentations were made by people familiar with the northern Labrador coastal communities. Participants considered the effects on this area were also not sufficiently covered in the EIS.

Groups involved in commercial resource use voiced concerns about possible impacts of the project on fisheries, forestry and trapping, and a few asked for compensation.

The Panel heard many presentations on the use of the land by the Indians. Many of these were personal descriptions of hunting, trapping and fishing activities. Past and present uses of the land were displayed on maps being prepared for land claims and by an audio-visual presentation about families living on the land.

At most of the communities, methods by which the project could be made more beneficial were suggested. Concerns expressed on socio-economic issues often focused on previous negative experience with development projects in Labrador. In fact, development of Labrador was an underlying issue throughout the meetings since many groups saw the Lower Churchill as a spur to further projects. Indian speakers saw only problems, rather than benefits, from any development, past, present or future.

On a number of issues outside its mandate, LCDC could provide only general information. Among these were the development of associated projects, land claims, provision of hydroelectric power in the Straits area, transportation improvements, and provision of government services. The fact that the Province did not intervene during the meetings was of concern to some participants.

Some Sheshatshit residents expressed dissatisfaction with EARP, including lack of funding for independent technical studies. A preference for a "Berger-style" enquiry to consider all the impacts of possible development in Labrador was mentioned.

In general, opinions on major environmental issues such as route alternatives, reservoir preparation and fisheries remained unchanged throughout the public meetings. The Proponent foresaw some disruption of the natural environment, and felt that economics must be taken into account in any decisions. Some federal departments stated that loss of resources should be reduced to a minimum and that mitigation and compensation measures had not been adequately defined.

Sheshatshit residents stated that development would destroy their traditional lifestyle and the land that they claim is rightfully theirs. It was emphasized that participation in the review and discussion by experts would not alter this stand.

2.2 Need and Rationale

The Proponent foresaw a need for the Lower Churchill project because present sources are not expected to meet provincial power requirements beyond 1984. The difference between present provincial power demands and available hydroelectric capacity on the Island of Newfoundland is met by oil-fired thermal generators at Holyrood. While some expansion of both these existing sources is being considered to meet shortfalls until Lower Churchill power becomes available, the Proponent saw these measures as insufficient, or uneconomic and unreliable for meeting long-term needs.

LCDC stated that the output of the proposed Muskrat Falls power generating site would more closely match the initial provincial requirements, since Newfoundland and Labrador Hydro has indicated that the full output of this component of the Lower Churchill project could be absorbed in the provincial power grid by 1989. Gull Island's generating capacity is greater than the demand projected for the provincial system for some years beyond 1989. Marketing of surplus power, either through adjoining provinces or large-scale industrial development within the Province would therefore be required to make construction of Gull Island financially viable at the present time.

The Proponent and the Department of Energy, Mines and Resources maintained that the projects would help meet the national energy objective of self-reliance. The reduction of oil usage at Holyrood in favour of natural resource hydro generation was seen by some participants as guaranteeing supply. National and provincial economic benefits for balance of payments, manufacturing and industrial development, as well as job-creation were also mentioned.

Alternative large-scale forms of generation such as coal or nuclear power were rejected by LCDC on the grounds of economic or capacity problems. Although one participant suggested peat fired plants or non-conventional and soft energy alternatives, LCDC did not believe that these could provide suitable quantities of economic energy in the period envisioned.

The Panel concludes that evidence of project need has been adequately demonstrated and the project would contribute to the national policy objective of energy self-reliance, through development of an indigenous, renewable energy resource.

2.3 Geological Impacts

The Lower Churchill River valley is narrow and steep sided, infilled with deep sandy drift of glacial and fluvial origin, forming terraces on either side of the river. Rock outcrops occur at the prdposed dam sites at Muskrat Falls and

Gull Island and certain other locations along the river.

During the review of the project, some comments related to possible seismic effects which might be induced as a result of reservoir filling. Although, this effect has been recorded elsewhere, particularly in large deep reservoirs, the size of the impoundments at Muskrat Falls and Gull Island, and the fact that the area has low potential for seismicity, make the occurrence of a significant event unlikely.

Of greater concern to participants was slope instability along the river bank, where natural slumping in a number of locations is already apparent, including the area of the natural' dam at Muskrat Falls. The possibility of increased slumping, as a result of reservoir formation was mentioned.

Forty-five percent of the Muskrat Falls impoundment and seventy-five percent of the Gull Island impoundment would have shorelines involving steep banks and the Proponent anticipates erosion and slumping until an equilibrium is reached, with the formation of a sandy shoreline.

Slumping within the reservoirs could cause large waves and release silt and vegetation. It was generally agreed that reservoir filling will aggravate the slumping problem in the river valley but the Proponent maintained that measures to stabilize the natural dam would improve that specific situation, since otherwise this area was likely to fail in the future.

Participants raised concerns about possible increased erosion downstream of Muskrat Falls. Local groups noted that the Town of Happy Valley-Goose Bay had spent large amounts on erosion control following the occurrence of problems along the river bank in the 1960's. The Proponent recognized increased potential for erosion below Muskrat Falls as the river picked up sediment load. However, it was maintained that this would only occur in the first kilometre or so rather than along the whole length of the river to Happy Valley-Goose Bay. LCDC proposed to monitor the area it suspected would be the most vulnerable.

Since there would likely be increased erosion for some distance below the Muskrat Falls dam, monitoring would be necessary to determine the nature and extent of such changes. If slumping occurs in the area initially surveyed, the area to be monitored would have to be extended beyond that, proposed by the Proponent. If the project was demonstrated to have increased erosion the Proponent would have to assume the responsibility for necessary corrective actions.

On the basis of data provided in the EIS and subsequent technical discussions held during the public meetings, the Panel concluded that any potential seismicity and river bank stability problems affecting the integrity of the power generating structures could be addressed by the application of current technology at the design and construction stages.

2.4 Hydrology and Water Quality Impacts

The Churchill River descends 126 metres from the tail-race of the existing Churchill Falls generating station to sea level at Happy Valley-Goose Bay. In addition to controlled discharge from the Churchill Falls generating station, this lower section of the Churchill River also receives unregulated flows from several tributaries.

This combination of flow and height creates a large hydroelectric potential

which the Proponent wishes to develop, by constructing two dams with maximum heads of 36 m and 88 m, at Muskrat Falls and Gull Island respectively. This would create two reservoirs and necessitate flooding of the Lower Churchill River between Churchill Falls and Muskrat Falls; including Lake Winokapau (figure 4).

While construction of storage capacity above Churchill Falls modified flows in the Lower Churchill considerably, and flooded approximately 2,640 km^2 of land, the narrowness of the Lower Churchill valley precludes development of substantial storage capacity. Therefore, the Proponent proposes to operate on a "run of the river" basis. The increase in water surface areas of Muskrat Falls and Gull Island reservoirs would be 36 km^2 and 86 km^2 (approximately twice present areas) and drawdowns would be limited to one metre and six metres respectively.

The Proponent maintained that proposed water flows represented no substantial change from existing conditions and hence no impact of concern. Water quality changes within the reservoir were projected as slight by LCDC on the basis of experience with the Churchill Falls project and the small volume of impoundment involved. However, an increase in sedimentation in the reservoirs and a temporary increase in mercury levels were predicted and a monitoring program proposed for the latter.

Federal departments noted that flooding, and preparatory activities in the reservoir, could cause negative water quality impacts, particularly in the short-term. The federal Department of the Environment (DOE) was of the opinion that long-term water quality impacts would not be significant.

The possibility of changes in ice formation affecting either erosion at Happy Valley-Goose Bay, or transportation between Happy Valley-Goose Bay and Mud Lake, a community on the other side of the river, was raised. The Proponent considered that construction of the reservoirs would improve ice conditions due to a reduction in ice-jams downstream of Muskrat Falls.

In contrast to most hydro projects, the reservoirs formed above either of the proposed dam structures would involve minimal flooding and the "run of the river" operation of the project would not significantly alter existing flow downstream.

Impacts on down-stream water users would be limited to the time of flow reduction during reservoir filling and alternative sources exist for this temporary period.

The only changes in water quality of importance relate to (i) increased erosion capability downstream because of deposition of sediment load in the reservoirs; (ii) elevation of mercury levels in fish. These impacts are discussed in the sections on geology and fisheries. While some turbidity and flotsam may result from slumping, referred to in the previous section, the minimal drawdown to be used with this project would limit this problem.

2.5 Fisheries Impacts

During the review of the project the Panel heard much discussion on the implications for fisheries resources. Issues raised included those related to the proposed impoundments such as the loss of salmonid habitat, possible obstruction of resident (non-anadromous) species, nitrogen supersaturation, mercury contamination, dewatering of the river during

reservoir filling as well as effects of crossing of the Strait of Belle Isle and various streams.

At present the Lower Churchill River and its tributaries are inhabited by 16 species of fish of which salmonids are the most important. Brook trout and white fish are the most abundant of the salmonids. There is no commercial fishing but subsistence fishing by Indians and angling were mentioned. The Proponent claimed that there is a low level of fishing activity in the Lower Churchill River at present. The Proponent and the Department of Fisheries and Oceans (DFO) agreed that there would be limited potential for a commercial fishery on any Lower Churchill reservoirs because of low productivity. The options for sport fishing were the subject of discussion at the public meetings.

The major impact of dam construction would be the loss by flooding of some 57 km^2 of excellent salmonid rearing area representing about 80% of that existing at the present time. According to DFO, impoundments on the Lower Churchill River could change the species composition within the reservoirs to a pike/sucker dominated community. DFO contended that the opening of previously inaccessible areas in the tributaries as proposed by LCDC would provide only token (6 km^2) mitigation for the loss of salmonid habitat.

DFO also requested that the Proponent make a detailed statement regarding its proposal to stock ouananiche as the most appropriate method to compensate for the loss of brook trout. Another form of compensation was also discussed by LCDC at the public meetings. This was the artificial production of Atlantic salmon smolts utilizing waste heat from generator cooling waters. LCDC proposed that the generating plant design allow for this possibility.

Another potential impact perceived by DFO, concerns resident species at the Gull Island dam. It is known that lake whitefish have congregated at the downstream end of the Lobstick Control structure in the Upper Churchill and that large fish kills have occured. LCDC believed that the possibility of major migratory movement is low since the species involved are not anadromous and contended that the possibility of future whitefish movements across the area where the dams are to be located could not be predicted. DFO wanted the Proponent to recognize that significant impact might occur and to commit itself to provide whatever mitigation or compensation might be necessary.

Mortality through entrainment was mentioned by the Proponent and DFO as a possible problem. DOE, DFO and the Proponent also commented on the possibility of nitrogen supersaturation occuring as a result of water plunging down spillways or through turbines. Nitrogen supersaturation causes a gas-bubble disease in fish similar to "bends" in humans and can cause fish mortalities. While the Proponent and DFO agreed that there is difficulty in mitigating impacts from nitrogen supersaturation, DFO considered that the problem could be more severe than predicted by the Proponent and that compensation should be provided if this occured.

Members of the community of Sheshatshit expressed concern about mercury contamination. Research results show that in the past, certain fish species in both the Churchill Falls impoundment and Lake Winokapau have had mercury levels high enough to warrant limitation of consumption. The mercury problem is believed to be related to leaching from newly flooded areas. However, establishment of a commercial whitefish fishery, with federal aid, by Indians on the Upper Churchill impoundment was recently approved. LCDC

"The present policy of the Department with respect to carrying out its responsibilities under the Fisheries Act basically is Zero Net Habitat Loss. That is an objective; it is a policy objective. And obviously, the extent to which the Department, the Minister pursues or the amount of vigor that he demonstrates in pursuing that objective will be determined by the specifics of the given project at hand.

Now within that policy of Zero Net Habitat Loss, the Department normally requires mitigation of those impacts that it considers to be significant. If, for economic or technological reasons that mitigation is judged to be impractical, impossible, the Department then pursues a policy of compensation. This compensation is then obviously in lieu of mitigation."

R. Wiseman
Department of Fisheries and Oceans
St. John's

'We, the Southern Labrador Development Association have very little to gain from the development of Gull Island and/or Muskrat Falls Hydro Development but we have a lot to protect from such developments. Protection should be given to the harvesting of the commercial fishery in particular the cod fishery. We feel quite strongly that any underwater development in the Strait of Belle Isle has to cause interference to fish movements and hardship to the fishermen. The fisherman who fishes in the vicinity of the site allocated for underwater cable laying stands to lose his livelihood."

L. O'Brian
South Labrador Development Assocation
Forteau

maintained that the area to be flooded was not extensive and increases in mercury levels should be minor and of short duration. DFO concurred generally with the Proponent's prediction and felt that the fishery resource would not be significantly affected, although they considered that impacts could last longer and elevate downstream levels somewhat as well.

The dewatering of fish habitat during reservoir filling is primarily of concern to DFO if the Gull Island project proceeds before Muskrat Falls. A 90% flow reduction is proposed by the Proponent over a maximum 11 day period in the fall while the Gull Island reservoir is filled. DFO suggested that a flow release from the Jacobie structure on the Upper Churchill could mitigate this impact. LCDC's position was that adequate refuges would occur in deeper sections of the river bed and flow release from Gull Island during filling would be a difficult and costly feature.

No significant impact was foreseen by the Proponent as a result of the proposed cable-crossing of the Strait of Belle Isle. DFO and DOE did not dispute this position. However, concerns were expressed by fishermen in the Straits area. These relate to the impact of construction on fishing activities and the resource itself. Several fishermen expressed the opinion that construction equipment such as barges and tender vessels could interfere with fishing activity in their immediate area. The Proponent argued that once started, construction would proceed rapidly (approximately 100 days) and that access to a relatively small area (0.5 km^2) of the Strait would be restricted by machinery at any given time. Concerns were also voiced by fishermen in the Straits area about seabed disturbance and related siltation during overburden removal that must precede trenching. This could affect groundfish, scallop beds and fishing gear. The Proponent feels this disturbance would be minimal and of short duration. Fishermen requested compensation for damages or lost income as a result of installation of the submarine cable.

The Panel concludes that the major impoundment related fishery impact would be the loss of most of the existing salmonid habitat. There is also a possibility of fish kills through nitrogen supersaturation, turbine entrainment and dewatering below Gull Island during the reservoir filling process.

A limited number of opportunities for mitigation or compensation were proposed at the meetings. However the best alternatives would not be apparent until the specific quantitative consequences of impoundment on fish habitat are known. A long term post impoundment monitoring program would be needed. This would permit identification of other opportunities for compensation.

A temporary impact that would likely occur as a result of flooding of the reservoir is increased mercury intake by fish. Because the area to be flooded is small the increase in mercury levels would not likely be serious. As demonstrated with the Upper Churchill project, fishing is not precluded in newly flooded areas but mercury levels would have to be monitored both in the reservoirs and below them to give guidance on use of various species.

The submarine cable crossing might cause disruption to fishing in the area by exclusion of fishermen from a restricted zone for a limited period during construction. Negotiation of financial compensation might be necessary if this were to cause lost fishing income that

could not be replaced by use of another area. Use could be made of fisheries landing records and statistics for the Straits area for verification purposes.

DFO would require detailed review of the plans for the generating stations, certain stream crossings and the crossing of the Strait of Belle Isle to ensure conformance with the Fisheries Act. Mitigation or compensation measures to reduce the impact of the projected dewatering could be considered at this time if necessary.

2.6 Wildlife and Land Use Impacts

Although the technical agencies did not express specific concern, Indians expressed much interest in possible impacts related to wildlife and land use. The Naskapi Montagnais Innu Association (NMIR) considered the Proponent's EIS deficient, because the importance to Indians of subsistence activities had not been recognized. In its view small game hunting, trapping and fishing, particularly in the interior of Labrador, had been ignored. The NMIA also felt that the nutritional and cultural importance of traditional foods had been overlooked.

Several speakers at the meeting in Sheshatshit related how they had lived a nomadic life style in the past and how they continued to use their traditional skills today outside of fixed communities. The Panel was advised that recently up to one-third of the families in Sheshatshit spent some time living on the land. The locations of camp areas occupied in the last few years, both north and south of the Churchill River, were shown on maps.

Members of the Indian community stated that they had experience in hunting and use of the land, that the number of animals in the area had diminished as development took place, that the proposed project would aggravate the situation and that losses could not be compensated.

The Panel also noted information from the Department of Indian Affairs and Northern Development stating that in the last decade the Indian people have begun to increase their hunting and trapping activities, reoccupying traditional areas by use of modern technology (aircraft, snowmobiles and two-way radios), while maintaining year-round residency at Sheshatshit. Federal and provincial funds are provided to assist these activities and allow use of areas remote from existing developments.

The effect of the proposed development on caribou, particularly the transmission line component, was an issue. Specific concerns included caribou disturbance, effects on population dynamics, hunting pressures and enforcement of regulations.

The Proponent was not aware of any disturbance to migrating caribou caused by transmission lines and cited examples of where crossings are known to take place. LCDC also noted that from studies done there were very few caribou presently in the Labrador section of the proposed project. At present the vast majority of the total Labrador caribou population is located well north of the Churchill River. However, it was pointed out to the Panel that the Proponent's studies did not take into account habitat utilization throughout Labrador over the long term.

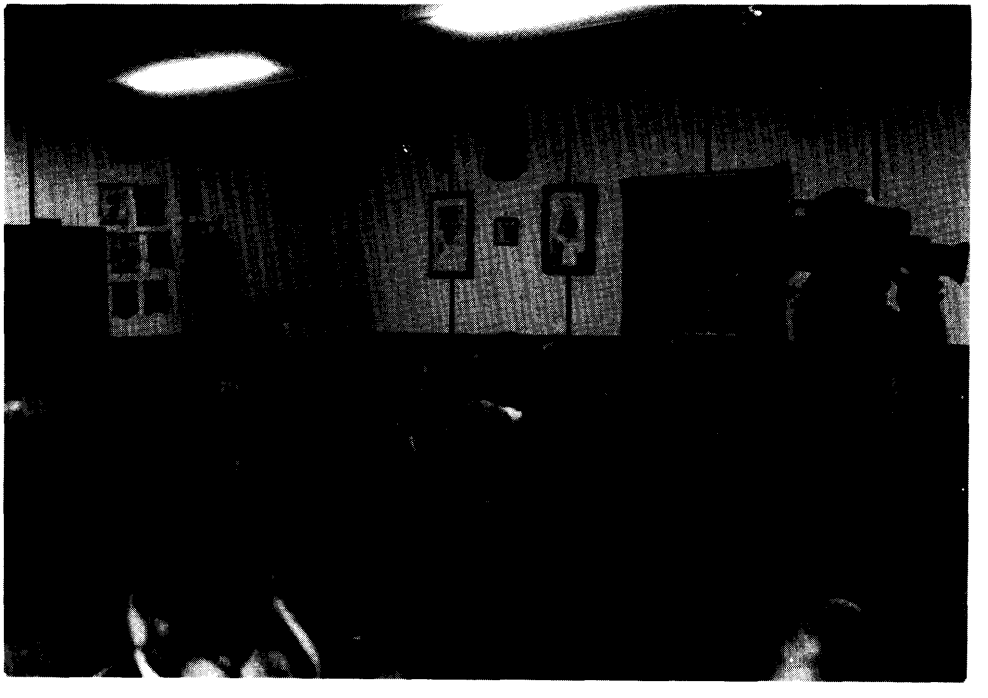
A major impact identified by the Proponent in the EIS was loss of animal habitat due to flooding of 122 km^2 in the impoundment areas. Some selective clearing is intended around the proposed reservoir shoreline to encourage succession

"I was wondering when you do your transmission line, if it will be available for people to use with all-terrain vehicles and so on like that. Obviously, it is not going to be a road, but will the public have access to this; will it be usable by the public?"

L. Squires
Flowers Cove

"I guess the restriction on the use of it would be more a policy of the agencies within government that have responsibilities with regard to protection of wildlife and so on."

W. Read
LCDC



"There is a lot of trapping going on in this area. My brothers are trappers, part-time, usually. My father was always a full-time trapper and gets a lot of fur all the time. I don't think this transmission line will affect the trapping that much and maybe it will improve it, to put a road through, but as for the animals leaving the area, I don't think it will make that big a difference."

T. Montague
North West River, Labrador

"In view of the fact that the Lower Churchill River will destroy some of the remaining active traplines and loss of a long history of trapping traditions, we recommend that compensation formula to hunters-trappers for loss of traditional land and resource use areas be established based on income loss and heritage value."

E. Bennett
Labrador Resources Advisory Council
Happy Valley - Goose Bay

"In regard to the wildlife, especially the caribou, we don't agree with some of the experts expressing the expectation of the wildlife in the area of the proposed hydro project. We base that on the experience that we have from hunting, even though we don't have any techniques to use to determine what is going to happen to this wildlife as a result of the land development here. We don't believe that the caribou will be there once the land is disturbed. It is going to be gone and it is going to be gone forever."

J. Pokue
Sheshatshit

"Moreover, in the judgment of the Department, the imposition of the transmission line on the landscape south of Gander Lake will set a dangerous precedent that will pave the way for further indiscriminant placements of transmission lines in the future. Pretty soon, the whole landscape will be criss-crossed with transmission lines. The negative visual impacts of such imposition should be sufficient justification for following existing corridors."

B. Case
Environment Canada, St. John's

to scrub forest and replace some lost range by habitat manipulation. It is anticipated that there would still be a reduction in small mammal populations and a displacement of moose after flooding. Moose have only recently appeared in the area and further studies on their habitats and activities are planned by the Proponent. At the present time there is reported to be some trapping activity in the Lower Churchill Valley. One trapper from North West River advised the Panel that his trap line would be flooded. Occasional trapping by residents of Happy Valley-Goose Ray is also reported. The NMIA mentioned that at least two Indian family groups had used the area in the last five years.

It is evident to the Panel that the maintenance of the possibility of a lifestyle based upon using the land and wildlife, as opposed to living full-time in Sheshatshit or working on the project, is very important to Indian participants because of cultural considerations. The Panel has carefully taken into account the specific factors involved in this particular project and concludes that use of the land and wildlife by Indians would continue to be a viable option in Labrador during and after construction of the project.

The Panel considers that the major impact of the proposed project on wildlife would be the loss of prime moose habitat. Establishment of moose browse along the banks of the reservoirs could mitigate this habitat loss. Ensuring that moose access to the water is not restricted by debris would also be necessary. Further studies on moose habitats and activities would be required to develop detailed mitigation measures. An impact on moose, caribou and other wildlife could also result from increased hunting pressure along the transmission line, particularly in Newfoundland. It may be addressed by resource management agencies through hunting regulations and enforcement.

The Panel considers that the major impact of the project on trapping activities would occur where there are active traplines in the area of the proposed reservoirs. Negotiation of financial compensation would be required where it could be established that trapping income has been unavoidably lost as a result of flooding.

2.7 Forestry Impacts

Implementation of the Proponent's proposal for preparation of the reservoirs of Muskrat Falls and Gull Island would leave the forests largely uncleared. LCDC contends that there are no environmental reasons for completely clearing the reservoirs. According to LCDC, the major impact, if no clearing is undertaken, is the reduced opportunity of using the reservoir for other purposes such as fishing. The aesthetics of the shoreline would also be severely impacted if a no-clearing option were followed. As mitigation, it is proposed that select clearing be conducted along the perimeter of both reservoirs. Cleared zones would extend to three metres below minimum drawdown level to ensure boat access to shoreline.

DOE stated that the strategy of selective cutting along the perimeters would be acceptable in terms of impact on water quality. It was noted, however, that LCDC had not defined the actual areas in which clearing and salvage would take place nor had they elaborated the procedures and methods by which it would be done. The areas and preparation methods could affect environmental impacts including debris and water quality. Other participants mentioned the possibility of

accelerated slumping if clearing took place on steep slopes.

LCDC stated that they are in the process of defining more clearly the details of their proposed clearing operation. This information would be provided as soon as possible. There are no plans for commercial harvesting. Access would be by boat and clearing methods would limit the use of heavy equipment. LCDC claimed that this approach would minimize environmental impacts and allow greater use of local manpower.

In LCDC's opinion there is no economic advantage to be gained from any degree of reservoir clearing and a strategy should be based only on environmental effects. LCDC also believes that difficulties would arise in marshalling a logging force to undertake more extensive cutting than proposed.

Some participants stated that LCDC had not provided a balanced viewpoint on costs and benefits of reservoir clearing. It was contended that contrary to LCDC's opinion markets exist for pulpwood and lumber from Labrador. LCDC was requested by the Panel to estimate the value of wood resources within the Gull Island and Muskrat Falls reservoir areas. This would involve the identification of merchantable stands and the value of potential products such as fuel, pulpwood, lumber and poles. In addition, a request was made for a projection of savings associated with debris removal and disposal. LCDC in reply stated that without more detailed surveys and improved topographical mapping to better delineate the flood zone, it would not be possible to prepare such an estimate.

Forestry concerns were also covered in a brief from a pulp and paper company which raised concerns about the adequacy of existing supplies of timber for long-term needs. The company advised that rights of way and other needs had reduced their holdings by 30%. The Provincial wood inventory is also being considerably damaged by current spruce budworm infestation. It was noted that once timber lands are used for hydro purposes the potential of these areas for wood production is precluded. The company's recommendation was that the transmission line route create the least adverse effect on timber stands and that compensation be determined according to a standard formula.

Discussion of reservoir clearing did not indicate any significant overall environmental benefit that would result from any of the possible choices. The Panel concludes that, at a minimum, clearing would need to be undertaken in selected areas along the perimeter of both reservoirs to protect options for uses other than power generating. The Panel is concerned that a strategy for perimeter clearing of the reservoir has not been prepared. The Panel concludes that a detailed plan is required to determine the areas to be cleared and the procedures to be used. The plan is essential to minimize environmental impact and maximize habitat restoration.

The Panel also notes that flooding would result in the loss of over 500 000 cords of wood between existing and new shorelines. If this wood is not salvaged the options for its future use would be precluded with the permanent removal of this productive forest land from inventory. The Panel was not provided with sufficient information by the Proponent to judge the financial feasibility of salvaging merchantable forest stands. The Proponent has not conducted a benefit analysis to estimate potential values of products that could be derived from harvesting.

". ..the fact is that to just turn around and flood that area, to kill some of the finest forest products located in Labrador, when we at the moment are just starting to develop our forestry and to increase the number of sawmills in this area, we feel that there should be other factors looked at."

C. Warr
Labrador North Chamber of Commerce
Happy Valley - Goose Bay

"It is interesting to note that the consultant suggests that the float and burn method is cheaper, but requires more planning, financing and organization. If this process was used we would have all the debris located in a tangled mass, immediately above the dam sites where it could be very difficult to remove due to the current as compared to Lake Williston."

D. Eadie
Happy Valley-Goose Bay Development Corp.
Happy Valley - Goose Bay

The Panel also concludes that negotiation of compensation would be required where existing forestry resource use was precluded by the proposed transmission line.

2.8 General Environmental Impacts

A number of general impacts involving environmental, resource use and physical effects were also considered during the public meetings. Federal departments raised questions and concerns related to transmission line routing, herbicide application, electrical field effects, tote road requirements, borrow pits, contaminants and spill contingency plans. The proposed submarine cable crossing scheme was also examined.

The major issue with the line routing was whether the use of additional transmission line corridors should be avoided. The Proponent proposes to run the two transmission lines along separate routes across the Long Range Mountains to the Main River area. For the Grand Falls to Avalon Peninsula section the Proponent proposes to create a new route rather than follow existing rights of way via Gander or Baie d'Espoir.

The Proponent defended the proposal to split the line routing in the Long Range mountains on the basis that different storm conditions occur along each route. The separate routes would ensure continuation of transmission if one line failed.

In the EIS route alternatives were suggested for consideration along the Grand Falls to Avalon Peninsula section. One route parallels the existing transmission line from Grand Falls to Baie d'Espoir and from there to the Avalon Peninsula. A second route parallels another transmission line from Grand Falls to the Avalon Peninsula via Gander. These alternatives were stated in the EIS as being $12 and $16.9 million more expensive respectively than the line chosen, due to their greater lengths. These projected costs were revised upwards by the Proponent during the public meetings. LCDC stated that the route chosen from Grand Falls to the Avalon Peninsula had been selected on the basis of economic and environmental considerations. It considered that the proposed route was environmentally acceptable and that the additional cost of the alternative routes could not be justified.

DOE stated that insufficient emphasis had been placed on environmental considerations and that permanent disruption of the landscape through indiscriminate placement of transmission line corridors was not acceptable. It maintained that existing corridors should be used where the effects would not be detrimental to the environment and suggested that a provincial regulation be established to this effect. In its opinion it had not been demonstrated that the alternative chosen was the best one.

The application of herbicides for right of way maintenance was another issue on which some concerns were expressed. It was estimated by DOE that this project could involve a doubling of the amount of herbicide now used by Newfoundland and Labrador Hydro. Both DOE and DFO stated that residue analysis should be carried out as part of the monitoring program. The Proponent advised that ground-level application would be limited to specific land areas avoiding water bodies. It was also emphasized that approval and conditions for actual use of herbicides would have to be obtained through an existing Pesticide Review Board before application. No usage in Labrador was foreseen.

Possible biological effects due to electric fields from transmission lines were also discussed. There has been reference in scientific literature to possible harmful effects on employees constantly working close to high voltage equipment. However, the Proponent maintained that a number of studies on comparable transmission lines constructed to North American standards have so far demonstrated no such effects. National Research Council studies and tests on the proposed conductor configurations demonstrated that the line would operate within accepted limits for noise and communication interference. A Department of Communications official advised that operation of a similar line in Manitoba had not brought complaints of any communications interference. Only 13 residences within 100 m of the line in the Avalon Peninsula area would potentially be affected (11 of these are reported to be seasonal cabins). Corrective measures are available and are the responsibility of the Proponent.

Some participants from Labrador believed that transmission line construction should include a tote road to link Happy Valley-Goose Bay and the Strait of Belle Isle. Federal government departments were concerned about the possible negative environmental impacts of tote roads. The Proponent stated that access to the line would be by off-highway vehicles or helicopters with stream crossing by fording. Thus, it would not be a requirement of the project to build a tote road.

Questions raised concerning the submarine cable crossing queried the reliability of the method chosen to withstand the action of grounding icebergs. The trenching technique chosen for installation of the cable is new to North America. The Proponent considered that the 1.5 m deep and 45 cm wide trench would provide adequate protection. The Department of Energy, Mines and Resources concurred with this conclusion.

Other issues raised included the choice and rehabilitation of borrow pits, contaminant storage and transportation and spill contingency plans. In the case of borrow pits the Proponent's approach was that they would prefer to take precautions and follow the requirements of a provincial permit rather than choose other sites that DOE considered to be less sensitive. LCDC advised that a contingency plan for spills was being updated and that as details on contaminants became available they would be supplied to regulatory agencies.

With regard to the transmission line routing the Panel considers the rationale for use of two crossings of the Long Range mountains to be reasonable and does not feel that unnecessary disruption would be caused. The section from Grand Falls to the Avalon Peninsula, while environmentally acceptable, may not be the best route for long-term resource management. More information on alternatives would be required to ensure choice of a route that optimizes use of resources.

The Panel concludes that opening a new 'right of way' between Grand Falls and the Avalon Peninsula could be avoided by use of existing transmission line routes and that this option warrants further consideration by Provincial policy-making authorities.

On the remaining issues in this section the Panel concludes that existing government procedures and standards would be adequate to cope with construction and operation of the project.

2.9 Socio-Economic Impacts

2.9.1 Introduction

The importance of socio-economic matters related to the proposal was raised by many participants because of the perceived impacts on the human environment. These impacts were considered during the socio-economic session and during many of the general presentations in the communities.

Before entering into a discussion of the issues raised during the review, it would be appropriate to briefly outline the existing situation of those communities likely to be most affected by the project; Happy Valley-Goose Bay, North West River, Sheshatshit and communities along the Strait of Belle Isle.

The economic base of Happy Valley-Goose Bay has changed significantly over the last few years. Goose Bay was established as a military air force base during the Second World War and Happy Valley developed as a result of employment on the base. The second major economic base was the forestry industry through the operations of Labrador Linerboard. At that time, the population was in excess of 15 000. With the withdrawal of the U.S. Air Force and closing of the Labrador Linerboard mill, Happy Valley-Goose Bay suffered a double set back and today the population is approximately 7 000. The economic base is now primarily a commercial and service centre for Central and Northern Labrador.

Although the economic base has changed to a service type economy, no industrial development has taken place in the area to offset previous employment losses. The latest seasonal unemployment figures obtained by the Proponent from the Canada Employment Centre indicate that 938 people in Happy Valley-Goose Bay were seeking employment during Summer 1979.

A trading post at North West River was established in 1743. The arrival of the Hudson Bay Company in North West River in the 1830's initiated a period of expanding fur trade. After the First World War the International Grenfell Association (IGA) established a hospital serving outlying communities.

A permanent Indian settlement at North West River was not established until 1952, although the area had previously been a summer base camp for families having a nomadic life style.

Before April 1980, the name North West River applied to communities on both sides of the North West River. The community on the north side is still referred to now as North West River, whereas the Indian community on the south side adopted the name Sheshatshit.

The Proponent estimated the 1979 population of North West River at 550 and Sheshatshit at 525. LCDC indicated that the IGA hospital accounts for approximately half the employment in North West River. Using Canada Employment Centre figures for July, 1980 the Proponent estimated the summer unemployment rate in North West River at 57%. Fishing/trapping was listed by 32% of the male population in Sheshatshit as their occupation according to the Official List of Electors, 1979. Using July 1980 statistics provided by the Canada Employment Centre in Happy Valley-Goose Bay, the Proponent estimated the summer unemployment rate in Sheshatshit at 64%.

The total population for the Labrador Side of the Strait in 1979 was approximately 2 100, distributed among eight corrinunities. The economy of this area is based on the fishing industry. More than half of the region's total labour force are employed in fish harvesting or processing. The fishery consists mainly of

inshore and mid-range fishery. Figures provided by the Proponent show an unemployment rate of 19.1% in 1976.

The population of the fourteen communities from Big Brook to Anchor Point on the Newfoundland side of the Strait is estimated at approximately 2 600. Here the economic base is also dominated by the fishing industry. Approximately half of the region's total labour force of about 1 000 are either fishermen or employed in fish processing plants. Figures provided by the Proponent indicate that 24.4% of the labour force were unemployed in 1976.

2.9.2 Impacts

Many issues of common interest to various groups were related to the construction phase such as: local employment opportunities and the need for training; the effects of an influx of people on existing services (particularly health care and housing); and prices in the area. Social disturbance was a significant issue particularly for the Indian people. Other issues of concern included future industrial development, local supply of electricity, and improvement of transportation for Labrador.

The need for jobs was expressed in most communities visited by the Panel. As demonstrated in the opening section of this chapter, the rate of unemployment in Labrador is very high. In view of this phenomenon, many participants made representation at the meetings, requesting that the Proponent commit itself to a local hiring policy during construction. The Panel was also told that maintenance jobs should be given to local residents when and where possible. Residents of Sheshatshit said they were unwilling to become part of a large scale wage economy* A preference was expressed for a resource based economy, incorporating hunting, trapping and small-scale commercial exploitation of fisheries and forestry resources under local control.

LCDC stated that the work force required for the construction of Gull Island and Muskrat Falls would peak at 2 300 and 1 300 respectively. A further 1 600 workers would be required at peak for the construction of the transmission lines. The average work force over the period of construction would be 1 000 at Gull Island, 900 at Muskrat Falls and 600 - 700 on the transmission lines and terminals. About 50 of the transmission line jobs were foreseen for both sides of the Strait of Belle Isle. The extent to which these requirements could be met from local areas would depend on the size and the availability of the work force in the areas where construction is taking place. However, the Proponent has stated that its policy would be to fill its requirements from the local area, wherever possible.

Another issue related to jobs, that of training, was discussed at many locations. In St. John's, the Strait of Belle Isle, and Happy Valley-Goose Bay, local training was requested to help residents to prepare for jobs resulting from such a development. Concern was expressed that training facilities may not be adequate to provide the type and numbers of workers required. Certain technical courses are available in St. John's and Happy Valley-Goose Bay, but expansion would be required in both facilities and curriculum. The need for sufficient lead time was emphasized. On this issue, LCDC corrrnitted itself to detailed discussions with government officials on training programs as soon as the project is approved.

Opinions were voiced by many participants with regard to the strain that the project would cause on existing services

". ..during the past three years, our town has seen approximately seven hundred (700) permanent jobs vanish and the effect on this community has been staggering. We have seen businesses close up both voluntarily and as a result of bankruptcy. We have seen many of our citizens, both long-term and new, part with their belongings and move to areas where job opportunities are growing instead of declining. The population has declined in our community; it has decreased by approximately 3,500 people in the past three and a half (33) years."

L. Dalton
Town of Happy Valley-Goose Bay

"Being or living in this part of this Province, I feel and maybe I am wrong, but I feel there should be some unified rate to hydro power, whether you are diesel or hydro. It is not my fault I am not on hydro.

It looks like we are going to get very few benefits from this project and the disturbance it is going to create - and I think it is something to look forward to getting, something equal to the rest of the Province.

Another question is, what will be the transactions in this area and what will local people and local business have to prepare themselves for in order to reap some of the spin-offs?"

S. Letto
L'Anse-au-Clair

"An immediate study should be done by government, through the Gull Island consultants to ascertain the manpower requirements through each and every phase of the transmission line construction. Special care should be taken to ascertain the numbers of employees requiring specialist skills, and the exact numbers in each category."

A. Thorne
International Brotherhood of Electrical Workers, St. John's

"We have a vocational school here in Happy Valley that is closed during the summer months and could be used much more in the evenings and weekends during the winter months. I think LCDC in conjunction with the school administration, should take advantage of this excellent facility to begin an intensive training program."

L. Michelin
Happy Valley - Goose Bay

"There is a very real sensitivity on the part of Labradorians about the development of their resources for the use and profit of concerns outside Labrador, with very little or no advantage returned to them."

J. Rowe11
Labrador Institute for Northern Studies
Happy Valley - Goose Bay

particularly medical, educational, social and policing. LCDC maintained that as a result of the decrease in the population of Happy Valley-Goose Bay over the last few years, existing services were under-utilized.

In particular the Panel was told by several participants that medical facilities in Central Labrador were not adequate for the current requirements. LCDC was willing to acknowledge a responsibility for upgrading medical facilities if it could be demonstrated that the construction of the project would create a situation whereby existing facilities are being overloaded by in-migration of people coming to work on the project.

The viewpoint was also expressed that all workers and families should be located in Happy Valley-Goose Bay so that the community could maximize economic benefits. The provisions for Gull Island are for a 2 500 worker single status camp on site with 200 families to be located possibly at Happy Valley-Goose Bay. For Muskrat Falls, the provisions are for a 1 500 worker single status camp on site and 150 families in Happy Valley-Goose Bay. LCDC thought that as far as Muskrat Falls was concerned, housing single status workers in or near the Town was feasible but not for Gull Island.

Local businessmen in Happy Valley-Goose Bay as well as the Straits area requested that LCDC use local businesses for purchase of materials, goods and services required for construction and operation. It was further suggested that contracts be kept to a size that would enable local contractors to bid. One participant suggested that native people might be involved in supplying local foods, thereby permitting them to pursue their traditional ways of life and receive some benefits from the project. However, the Indians had not been previously contacted about this proposal. LCDC reiterated its commitment to local preference in contracting for certain services that could be provided by the community of Happy Valley-Goose Bay, or areas on the Straits.

Some participants pointed out that inflation could occur through high wages typical of large construction projects. A resident of W. St. Modeste noted that some workers might leave their present employment to obtain the higher paying construction jobs. This would create a manpower drain for certain local industries and would create hardship for local businessmen unable to afford high wages. Participants pointed out that inflationary effects such as higher prices and poorer quality of service might also be felt in communities relying on Happy Valley-Goose Bay for supplies. The establishment of a socio-economic monitoring authority backed up by a contingency fund to alleviate adverse impacts was also suggested.

LCDC expressed the view that inflationary impacts of such a project relate more to wage levels than to purchasing policies. LCDC maintained that the local purchasing should create a larger turnover and therefore may decrease prices. Rather than a monitoring authority, LCDC advocates the creation of community liaison committees to help LCDC address concerns expressed on all aspects of the project.

A concern raised, particularly by Indian representatives was that of social change resulting from major developments. Some parties considered that potential negative impacts on the Indian community had been either understated or ignored. The NMIA noted that while the actual social impact of large industrial developments can only be assessed once the project is in operation or under construction, the Proponent could have made predictions by

". ..this morning, the point was made that previous developments in Labrador have already greatly and negatively impacted the Naskapi-Montagnais people. In this village, the people themselves are beginning to recover. They are trying to make the tremendous effort that is involved in firmly re-establishing their own culture as a healthy, vital way of life."

L. MacEachern
Sheshatshit

"The Labrador Friendship Centre is also concerned with the number of unemployed native people currently residing in the Happy Valley-Goose Bay area. Many of these people will be seeking employment during the construction phase and because there is a lack of skilled native personnel, we must assume that many of the job requirements will have to be filled from outside the local area."

R. Simms
Labrador Friendship Centre
Happy Valley - Goose Bay

"This type of project brings about other types of development. These other kinds of development resulting from the existence of this project will also cause certain types of socio-economic impacts on Labradorians."

R. Sweetnam
Labrador Inuit Association
Nain, Labrador

using research results based on major developments in northern areas.

The Panel was told that various problems such as violence, alcoholism and sexual exploitation had resulted from industrial developments in Alaska and the Canadian North and that such social problems would affect the native people of Labrador if development took place. The opinion was expressed that the boom created by the air force base and the Labrador Linerboard had brought some of these problems to the community of Sheshatshit. Participants maintained that the resulting problems were only just beginning to subside. The NMIA stated that the issue is not merely the physical or mental health of individuals but the continued existence of the Indian culture. The Proponent saw the social problems of Sheshatshit as part of a broader problem and noted that remedial programs were underway by others.

Residents of Sheshatshit expressed concern that the project would provide the impetus for other industrial developments with additional negative impact on their culture. Other participants urged such developments as a way of avoiding economic downturn after construction.

Along the Strait of Belle Isle, many participants asked LCDC if this project could provide more and cheaper electricity for their communities. LCDC stated that since the transmission system would be DC, it would be prohibitively expensive to provide electricity to the Straits area from this source. LCDC promised to make representations to Newfoundland and Labrador Hydro on this issue.

Various organizations stated that energy from the project should be reserved for Happy Valley-Goose Bay to attract industry to the area. LCDC indicated that the marketing of energy in the Province is the responsibility of Newfoundland and Labrador Hydro. The improvement of transportation systems was mentioned as a requirement for industrial development of Labrador. References were made to the need for a year round port on Lake Melville and the desire for a road between Happy Valley-Goose Bay and the Strait of Belle Isle. It was also suggested that a development policy for Labrador is required.

The Panel notes the considerable interest that people of Newfoundland and Labrador expressed in preparing themselves for jobs which would be available on the project. Training related to potential employment opportunities is not necessarily available. The Panel concludes that increased local employment could be achieved by provision of training specifically geared to the worker requirements of the project. However, early warning of the numbers and types of workers required would be necessary to effectively expand or modify existing training sources and their facilities.

During the construction period an influx of workers will place additional demands on hospital, housing, municipal, school, social and policing services. Early information as to the likely timing and extent of population increases will be needed. The Panel concludes that social disruption could be reduced if the various agencies providing services to the community have the time and information to plan and prepare for the increased load.

The Panel notes that considerable planning is being done to prepare for potential oil and gas developments in Newfoundland. It is anticipated that extensive planning would also be required for the Lower Churchill, given the magnitude of the project. Some measures might have

to be ready before project approval if the demands of construction scheduling appear likely to conflict with manpower training and community service requirements.

As pointed out during the meetings measures such as local preference purchasing or creation of new employment can have both positive and negative effects on different segments of the comnunity. The provision of information and the opportunity to feed-back concerns would be important to optimize economic spin-offs of the project for local communities. The Panel concludes that comnunity liaison committees would help maximize local opportunities for participation in the project and avoid unnecessary detrimental effects. The role of the committees would not necessarily be limited to economic concerns but could include social and other matters which affect the community.

Large scale construction projects involving an influx of workers can cause social upheaval for local residents. Experience has shown that native groups can be particularly vulnerable because of cultural differences. The Panel concludes that special measures would be necessary with regard to the Indian and Inuit peoples of Labrador.

The Panel notes that more recent northern projects, planned with an awareness of potential problems, can avoid unnecessary effects on native cultures. Policies such as placing living accommodation outside existing communities, sensitization of workers to cultural differences, and restriction or discouragement of activities liable to create social conflict, can prevent problems. Similarly policies have also been implemented elsewhere to make cultural transitions easier for native people wishing to be employed on such projects.

There was evidence at the public meetings of poor communications between the Proponent and the Indian people. An individual with experience in communicating with native groups would be necessary to deal effectively with the variety of matters affecting native people.

While the issue of future developments in Labrador was of great concern to many participants, the Panel concludes that these will not necessarily occur as a result of the Lower Churchill project. However any specific future industrial development proposals should be fully assessed, with particular attention to the potential for negative impacts on native cultures, before irrevocable decisions are made.

2.10 Land Claims

Before and during the meetings references were made by several participants to the issue of land claims. The NMIA claims that the land area affected by the project in Labrador belongs to the Naskapi Montagnais Innu and refer to it as part of their homeland, Ntesinan. A wish for self determination was expressed and reference to a Statement of Claim was made by the NMIA.

The Proponent's position was that resolution of land claims was not part of their mandate and that discussion of this topic would have to be held between the governments and the native groups concerned. LCDC would require an assurance that it could occupy the property in question and proceed with construction activities.

While some participants considered that progress on land claims might allow the project to proceed, the NMIA declared their intention to contest by legal means any attempt to develop the Lower Churchill.

Although the Panel's mandate does not include land claims, it notes the great importance that Indian people attach to the issue of ownership and use of land in Labrador.

2.11 Enforcement and Surveillance

The Proponent plans to incorporate standard Environmental Protection Clauses developed by Newfoundland and Labrador Hydro (N&L Hydro) in all construction contracts, with specific environmental requirements as necessary. Environmental requirements would be enforced by a Project Manager retained by LCDC to supervise construction. LCDC also proposes to hire and train local people who could direct remedial action by contractors and would report to the Project Manager. The Environmental Services Division of N&L Hydro would provide direction and advice as required on particular problems.

Comnents received prior to the public meetings indicated this issue was important to several parties because of past experience with other projects. However, after discussions, the Proponent and DOE and DFO were close to agreement on enforcement matters including discretionary powers of the Project Manager and the need for improving the existing environmental clauses.

The Panel concludes that the proposed method of enforcement would be adequate to cope with construction of the project, if rigorously applied by sufficient staff.

CHAPTER 3

SUMMARY OF MAJOR CONCLUSIONS

The Panel reached a number of conclusions, many of which were considered of major importance and are listed in this chapter.

The Panel concluded that:

1. The need for the project involving power generating stations at Gull Island and Muskrat Falls, and associated transmission facilities, has been adequately demonstrated.

2. The project would contribute to a national policy objective of energy self-reliance, through development of an indigenous, renewable energy resource.

3. Any potential seismicity and river bank stability problems affecting the integrity of the proposed power generating structures could be addressed through the application of current technology at the design and construction stages.

4. Monitoring of erosion below Muskrat Falls would be required for potential river bank slumping downstream of the power generating station.

5. Compensatory measures would be required for non-mitigatable loss of salmonid habitat due to reservoir formation.

6. Compensatory measures would be required in the event that fish kills occur because of nitrogen supersaturation, turbine entrainment or reservoir filling.

7. A long-term post-impoundment monitoring program would be required to provide information for the development of options for fisheries compensatory measures.

8. Negotiation of financial compensation would be required if construction of the submarine cable crossing causes lost fishing income that cannot be replaced by use of other areas.

9. Monitoring of mercury levels in the reservoirs, and downstream, would be necessary, as part of a post-impoundment program, to give guidance on use of various species.

10. The use of the land and wildlife by the Indians in Labrador would continue to be a viable option during and after construction of the project.

11. Negotiation of financial compensation would be required where it can be established that trapping income has been unavoidably lost as a result of flooding.

12. Further studies on moose habitats and activities would be required to develop detailed mitigation measures for moose populations in the reservoir areas.

13. Clearing would be required in selected areas along the perimeter of both reservoirs to protect options for uses other than power generation.

14. A detailed plan would be required to delimit the reservoir perimeter areas to be cleared and the procedures to be used. This plan should minimize environmental impact and maximize habitat restoration.

15. Clearing of the reservoir beyond the perimeter area would not have a significant overall environmental benefit.

16. Further studies would be required to assess the financial benefits of

salvaging forest stands to be flooded by the proposed reservoirs.

17. Opening a new right of way between Grand Falls and the Avalon Peninsula could be avoided by use of existing transmission line routes.

18. Negotiation of compensation would be required where existing forestry resource use was precluded by the proposed transmission line.

19. Increased local employment could be achieved by provision of training specifically geared to the worker requirements of the project.

20. Early warning of the numbers and types of workers required would be necessary to effectively expand or modify existing training sources and their facilities.

21. Disruption of local communities could be minimized by ensuring that the various agencies providing services to the community have the time and information to plan and prepare for an influx of people.

22. Information exchanges between LCDC and community groups, through liaison committees, would help maximize local opportunities for benefit from the project and avoid unnecessary detrimental effects.

23. Native people in particular would be vunerable to social upheaval during the construction stage and special measures would be required with regard to the Indian and Inuit populations of Labrador.

24. The proposed project would not necessarily lead to other developments in Labrador.

25. The proposed methods of surveillance and enforcement would be adequate to cope with construction of the project, if rigorously applied by sufficient staff.

CHAPTER 4

OVERALL CONCLUSIONS

After careful review of all information the Panel concludes that:

1. Development of this indigenous renewable energy source is a rational choice to meet demonstrated needs.

2. Construction and operation of the project will be acceptable provided certain environmental and socio-economic conditions are met.

3. Opportunities exist to construct portions of the project in an alternative manner which may have greater long-term resource benefit.

4. Future development in Labrador can be assessed for potentially significant effects separately from consideration of the Lower Churchill project.

The Panel therefore concludes that the project may be allowed to proceed subject to conditions presented in recommendation 5.1 of the next chapter. Additional recommendations are made in 5.2 for consideration by appropriate authorities.

The main conditions of approval relating to the natural environment deal with the requirements for compensation and monitoring. With regard to the human environment specific measures are proposed to prevent events overtaking the capability of organizations and individuals to respond.

CHAPTER 5

RECOMMENDATIONS

5.1 The Panel recommends that the project be allowed to proceed subject to the conditions indicated here under:

1. Erosion below Muskrat Falls be monitored and mitigation measures be implemented if results reveal a problem.

2. A long-term monitoring program be formulated to identify opportunities for mitigation and compensatory measures for fisheries resource losses in the proposed reservoir areas.

3. Mitigation and compensatory measures be negotiated for fisheries resource losses in the area of the proposed reservoirs, based on results from long-term monitoring studies and actual post-flooding impacts.

4. Monitoring of mercury levels in fish in the reservoirs, and downstream, be carried out as part of the post-flooding program.

5. Financial compensation be negotiated for any fishing income losses that cannot be replaced by use of other areas while construction of the submarine cable crossing is underway.

6. Further studies on moose and their habitats be carried out and measures implemented to mitigate impacts in the proposed reservoir areas.

7. Financial compensation be negotiated where it can be established that trapping income has been unavoidably lost as a result of flooding.

8. Clearing be carried out in selected areas along the perimeter of both reservoirs to protect options for uses other than power generation.

9. A detailed plan be developed delineating the areas to be cleared and specifying the procedures to be used in reservoir clearing.

10. Compensation be negotiated where existing forestry resource use is precluded by the proposed transmission lines.

11. Residents of the area be given opportunities to acquire skills needed for jobs on the project through provision of suitable training courses.

12. Sufficient information be given to agencies far enough in advance to enable them to provide additional services required because of the project.

13. Representatives of community groups be invited to participate on community liaison committees which should endeavor to optimize community benefits from the project.

14. Living accommodation for single status workers be located on site at both Gull Island and Muskrat Falls to reduce social disturbance to existing communities.

15. Successful policies implemented elsewhere and involving resource development in areas inhabited by native peoples be reviewed for possible application to this project.

16. Steps be taken to reduce cultural conflict through a program to sensitize workers to the native cultures of Labrador.

17. An individual with experience in communicating with native peoples be appointed to deal with matters affecting the Indians and Inuit.

18. Adequate staff for surveillance and enforcement during construction be provided by the Proponent and appropriate authorities.

5.2 The Panel also recommends that:

1) The opportunity for salvage of merchantable timber to be flooded be considered by the appropriate provincial resource management authorities in light of declining Provincial inventories, future market options and cost-benefit analysis.

2) The opportunity to use existing transmission line routes between Grand Falls and the Avalon Peninsula be given further consideration by Provincial policy-making authorities.

3) Any specific future industrial development proposals in Labrador should be fully assessed by the appropriate authorities, with particular attention to the potential for negative impacts on native cultures, prior to irrevocable decisions being made.

LOWER CHURCHILL
ENVIRONMENTAL ASSESSMENT PANEL

P. Paradine
(Chairman)

I. Baird

A. Ducharme

G. Beanlands

F. Pollett

M. Warnes

APPENDICES

APPENDIX A - PANEL MEMBERS BIOGRAPHIES

Mr. Philip J. Paradine, Chairman

Mr. Paradine graduated with a B.Sc. (Civil Engineering) and later completed a M.Eng. (Water Resources) at the University of Ottawa.

He joined the Public Service of Canada in 1967 and held positions as a professional engineer with Transport Canada, the National Capital Commission and Environment Canada. Since 1973 he has specialized in environmental protection and assessment.

In 1978, Mr. Paradine joined the Federal Environmental Assessment Review Office (FEARO) and has been responsible for the administration of several Panels including reviews of various linear transmission facilities and resource development projects.

He is currently Director, Panel Operations, Atlantic Area and Chairman of the Grand Banks Environmental Assessment Panel.

Miss Irene M. Baird

Irene M. Baird was born in St. John's, Newfoundland. She graduated from Memorial University with a degree in Sociology and in 1975 from the University of North Carolina at Chapel Hill with a Master of Public Health. Her graduate work included courses in Environmental Science.

As a provincial public servant Miss Baird held a number of senior positions with the Department of Health before being appointed in 1976 as Director of Social Policy in the Cabinet Secretariat of the Government of Newfoundland and Labrador. In this capacity she was responsible for advising Cabinet on policies and programs emanating from the seven social departments of Government.

Her work in the Cabinet Secretariat and the Department of Health gave her extensive exposure to the problems and issues confronting the people of Labrador and an opportunity to see first hand the living conditions there.

In June, 1980, Miss Baird was appointed Executive Director of the St. John's Hospital Council.

Dr. Gordon E. Beanlands

Educated at the University of New Brunswick and Dalhousie University, Dr. Beanlands received his Ph.D. in Ecology from the latter institution in 1971.

Following a period of work as a federal research scientist in Fredericton, he joined the Environment Conservation Authority in Alberta where he was involved in environmental impact studies of major resource development projects.

In 1973 he assumed the position of Atlantic Region Director, Lands Directorate, Environment Canada, in Halifax. In this capacity he administered a number of operational programs including ecological surveys, coastal management studies and environmental impact assessments.

In July, 1980, Dr. Beanlands started a two-year secondment to the Institute for Resource and Environmental Studies at Dalhousie University where he is principal investigator on a study designed to develop guidelines for the application of ecological principles to environmental impact assessment in Canada.

Mr. André Ducharme

Born in Kenogami, Quebec, Mr. Ducharme graduated with a B.Sc. in Biology from the University of Montreal in 1960.

He joined the Public Service of Canada in 1960 and has held positions as a biologist with the Department of Fisheries in Newfoundland and Halifax since that time.

His career has involved environmental studies of the James Bay Hydroelectric Development (1971) and a period (1973-75) as a Project Limnologist with the Food and Agricultural Organization (FAO) in Colombia, South America.

He is currently Senior Biologist with the Fish Habitat Protection and Engineering Services Section of the Department of Fisheries and Oceans in Halifax and a member of the Shubenacadie and Stewiacke River Basin Board.

Dr. Frederick C. Pollett

Born in Buchans, Newfoundland, Dr. Pollett obtained a B.A., B.Sc. and M. Sc. from Memorial University of Newfoundland and later completed a Ph.D. at the University of Durham.

During his career with the Canadian Forestry Service he has served on various federal-provincial committees involved in environmental assessments, including some of the first hydroelectric project assessments undertaken in Newfoundland.

Dr. Pollett is currently the Program Manager of Forest Resources and Environmental Research at the Newfoundland Forest Research Centre. He is responsible for the management of research programs in forest science as well as related programs dealing with energy and long range transport of air pollutants.

An internationally known authority on peatlands, Dr. Pollett holds office or serves on a variety of national and international committees involved in resource assessment and utilization.

Mr. E. Martin Warnes

Mr. Warnes graduated from Heriot-Watt University, Edinburgh, Scotland in 1947 with a B.Sc in Electrical Power Engineering.

Since 1953 he has been involved in the electric power field in Canada and has held various positions in system planning and analysis with the Shawinigan Water and Power Company and later Hydro Quebec.

Prior to joining the federal Government in 1972, he was Staff Consultant, Electric Power Systems, the Acres Group, Niagara Falls and Senior Power Systems Engineer to the East Pakistan (Bangla Desh) General Consultancy.

Currently an Assistant Advisor in the energy policy section of the Department of Energy, Mines and Resources Ottawa, Mr. Warnes is a professional engineer and has prepared numerous technical papers and reports on energy subjects during his career.

APPENDIX B - PARTICIPANTS IN PUBLIC REVIEW

1 - Presentations to the Panel at the Public Meetings.

A. Groups

1. Association of Professional Engineers of Newfoundland
2. Beak Consultants Limited
3. Bowater Newfoundland Limited
4. International Brotherhood of Electrical Workers
5. Happy Valley-Goose Bay Development Corporation
6. Happy Valley District Vocational School
7. Labrador Friendship Centre
8. Labrador Institute for Northern Studies
9. Labrador Inuit Association
10. Labrador North Chamber of Commerce
11. Labrador Resources Advisory Council
12. Labrador Straits Chamber of Commerce
13. Lower Churchill Development Corporation (proponent)
14. Naskapi Montagnais Innu Association
15. Proctor and Redfern Consultants
16. SNC - Lavalin Consultant
17. South Labrador Development Association
18. Town of Happy Valley-Goose Bay

B. Federal Government Departments

1. Energy, Mines and Resources (initiator)
2. Environment
3. Fisheries and Oceans

C. Individuals (affiliation)

E. Abraham

A. Adam

B. Andrew (A.14)

C. Andrew

G. Andrew (A.14)

S. Andrew

P. Ashini

H. Bain (B.3)

E. Bennett (A.11)

M. Blake

Dr. Bokhout

B. Bromley

F. Bursey (A.3)

J. Bursey (B.2)

P. Cabot

B. Case (B.2)

J. Clarke (B.2)

D. Collett (A.13)

L. Dalton (A.18)

H. Dyer (A.1)

D. Eadie (A.5)

Dr. C.J. Edmonds (B.2)

R. Edwards (B.1)

S. Flynn (A.12)

H. Genge

I. Genge

R. Gregorie

C. Hiscock

E. Hiscock (MHA)

Dr. N. Hobbs

B. Jack

A. Jenkinson

J. Keefe (B.2)

A. Langlais

B. LeDrew (A.13)

S. Letto

D. Lough (A.6)

S. Luttich

L. MacEachern

B. Michel

P. Michel

S. Michel

L. Michelin

T. Montague

J. Nuna Sr.

S. Nuna Sr.

L. O'Brien (A.17)

S. O'Rafferty (A.15)

N. Pasteen

F. Peneshue

G. Peneshue (A.14)

M. Peneshue

P. Peneshue

S. Peneshue

S. Penunsi

F. Phillips

J. Pokue

A. Pone

Dr. G. Pope (A.2)

F. Pye (A.17)

W. Read (A.13)

E. Rich

S. Rich

D. Rowe (B.3)

J. Rowell (A.8)

Dr. S. Sandeman (B.3)

H. Shouse

R. Simms (A.7)

L. Squires

G. Stetski (technical witness)

R. Sweetnam (A.9)

A. Thorne (A.4)

C. Vincent (A.18)

C. Warr (A.10)

G. Warren (MHA)

R. Watts

K. Whelan

P. Wiebe (A.16)

A. Williams

A. Williamson (A.8)

R. Wiseman (B.3)

2. Written briefs received by the Panel

A. Groups

1. Association of Professional Engineers of Newfoundland
2. Bowater Newfoundland Limited
3. Consulting Engineers of Newfoundland and Labrador
4. International Brotherhood of Electrical Workers
5. Happy Valley-Goose Bay Development Corporation
6. Labrador Friendship Centre
7. Labrador Institute for Northern Studies
8. Labrador Inuit Association
9. Labrador North Chamber of Commerce
10. Labrador Resources Advisory Council
11. Lower Churchill Development Corporation
12. Memorial University of Newfoundland - Some members of the Faculty.
13. Naskapi Montagnais Innu Association
14. Northern Fisheries Ltd. - West St. Modeste
15. South Labrador Development Association
16. The Exploits Valley Development Association
17. Town of Happy Valley-Goose Bay

B. Government Agencies
Federal Departments

1. Energy, Mines and Resources
2. Environment

3. Fisheries and Oceans

4. Indian Affairs and Northern Development

5. Parks

Provincial Agencies

1. Executive Council of Newfoundland and Labrador

2. Newfoundland Museum (Historic Resources)

C. Individuals

E. Hiscock, MHA

A. Jenkinson

B. Michelin

L. Michelin

H. Sheppard

G. Stetski

W. Thurlow M.D.

G. Warren, MHA

APPENDIX C - BIBLIOGRAPHY

Environmental Impact Statements for Transmission Lines component consisting of:

- Environmental Overview of the Gull Island Hydro Electric Project - Lower Churchill Power Development - November 1974, (Thurlow and Associates), prepared for the Department of Provincial Affairs and Environment, Government of Newfoundland and Labrador, and Environment Canada.

- Gull Island Project - Transmission Facilities, Project Description and Environmental Policy Statement, July 1978, Newfoundland and Labrador Hydro.

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Compendium of comments presented to the Panel on the proposed Newfoundland and Labrador Transmission Line, March 1979, issued by the Panel Secretariat.

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- Stream Monitoring Study - Lower Churchill Transmission Line Project, March 1979, (Acres Consulting Services Ltd.), prepared for Newfoundland and Labrador Hydro.

- I.B.P. Sites, (transmission line and reservoir) Lower Churchill Development, December 1979, (Northland Associates Ltd.), prepared for the Lower Churchill Development Corporation.

- Stream Monitoring Survey, 1979, - Baseline Studies, Summer of 1979 - Lower Churchill Development, February 1980, (Atlantic Biological Services Ltd.), prepared for the Lower Churchill Development Corporation.

- Socio-Economic Study - Transmission, March 1980, (Beak Consultants Ltd.), prepared for the Lower Churchill Development Corporation.

- Biophysical Assessment of the Proposed Lower Churchill Transmission Line, Volumes I and II, February 1980, (Northland Associates Ltd.), prepared for the Lower Churchill Development Corporation.

Environmental Impact Statement - Lower Churchill Project Generation Facilities consisting of:

- Volume I, Overview Summary, April 1980.

- Volume II, Environmental Impact Statement, April 1980.

and supporting documents consisting of:

- Fisheries Resources of Tributaries of the Lower Churchill River, with Map Appendix, February 1980, (Beak Consultants Ltd.), prepared for the Lower Churchill Development Corporation.

- Biophysical Study - Lower Churchill River, Volumes I and II, with Biophysical Map Series and Reservoir Flood Zone and Contour Series, Revised 1978, (Beak Consultants Ltd. - Hunter

and Associates), prepared for Newfoundland and Labrador Hydro.

- Wildlife Studies - Lower Churchill Development, with Wildlife Atlas - Phases I and II, March 1980, (Northland Associates Ltd.), prepared for the Lower Churchill Development Corporation.

- Avian Studies - Lower Churchill Development, with Atlas, March 1980, (Northland Associates Ltd.), prepared for the Lower Churchill Development Corporation.

- Socio-Economic Study - Power Sites, April 1980, (Beak Consultants Ltd.), prepared for the Lower Churchill Development Corporation.

- Reservoir Preparation Study - Lower Churchill Hydroelectric Project, with Forestry Atlas, April 1980, (Proctor and Redfern Ltd.), prepared for the Lower Churchill Development Corporation.

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APPENDIX D - GLOSSARY OF TERMS

AC: Alternating current, i.e., varying in magnitude and direction of flow over brief intervals of time.

Anadromous: Refers to a migration phenomenon associated with the reproduction behaviour of some species of fish which grow and mature at sea but must ascend into freshwater to reproduce, e.g. the salmon species.

Compensation: The provision of alternative benefits where environmental or associated resource impacts are non-mitigatable. This includes compensatory measures such as artificial enhancement of the resource affected, enhancement of another resource in replacement, or financial settlements.

Converter Station: An electric facility the purpose of which is to change AC to DC.

DC: Direct current, i.e., constant in both magnitude and direction of flow over long intervals of time.

Drawdown: A change in water surface level in a reservoir resulting from the withdrawal of water.

Entrainment: The accidental passage of fish through turbine intakes or spillways at hydroelectric generating stations.

Flip Bucket: A device constructed at the foot of the spillway of a hydroelectric generating station to dissipate hydraulic energy and so reduce downstream erosion.

Fluvial: Pertaining to or produced by the action of a stream or river.

Impoundment: A reservoir.

Inverter Station: An electric facility the purpose of which is to change DC to AC.

KV: A measure of voltage equal to one thousand volts.

MW: A measure of electric power equal to one million watts, or one thousand kilowatts.

Merchantable stands: Stands of wood with sufficient volume to merit commercial harvesting.

Mitigation: The adoption of special measures or techniques to minimize or neutralize negative impacts on the environment and the resources within.

Penstock: A closed water conduit controlled by valves and located between the intake and the turbine in a hydroelectric plant.

Run of the River: A type of hydroelectric generating station, which uses the available river flow and having little or no reservoir capacity for storage.

Salmonid: (Family salmonidae) A group of inter-related species of fish including all species of trout, char, salmon and the whitefishes.

Seismicity: The degree to which a region is subject to earthquakes.

Slumping: A type of landslide characterized by the downward slipping of a mass of unconsolidated material.

Spillway: A passage in or about a dam for escape of surplus water.

Stability: The resistance of a structure or river bank to sliding, overturning or collapsing.

Tote Road: A road constructed for the purpose of transporting materials or equipment, usually constructed to minimum standards.

APPENDIX E - ACKNOWLEDGEMENTS

The Panel wishes to express its appreciation to those who contributed to the public review of the project. In particular all those who participated in the public meetings or provided briefs to the Panel are thanked for their efforts.

A special note of thanks is extended to the staff who assisted in the review and preparation of the report including the Panel Secretary, Guy Riverin, Katrina Hodgson who administered a field office in St. John's, Céline Boivin and Ginette Crites who provided typing services, and others too numerous to mention.

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