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NEWFOUNDLAND AND LABRADOR HYDRO

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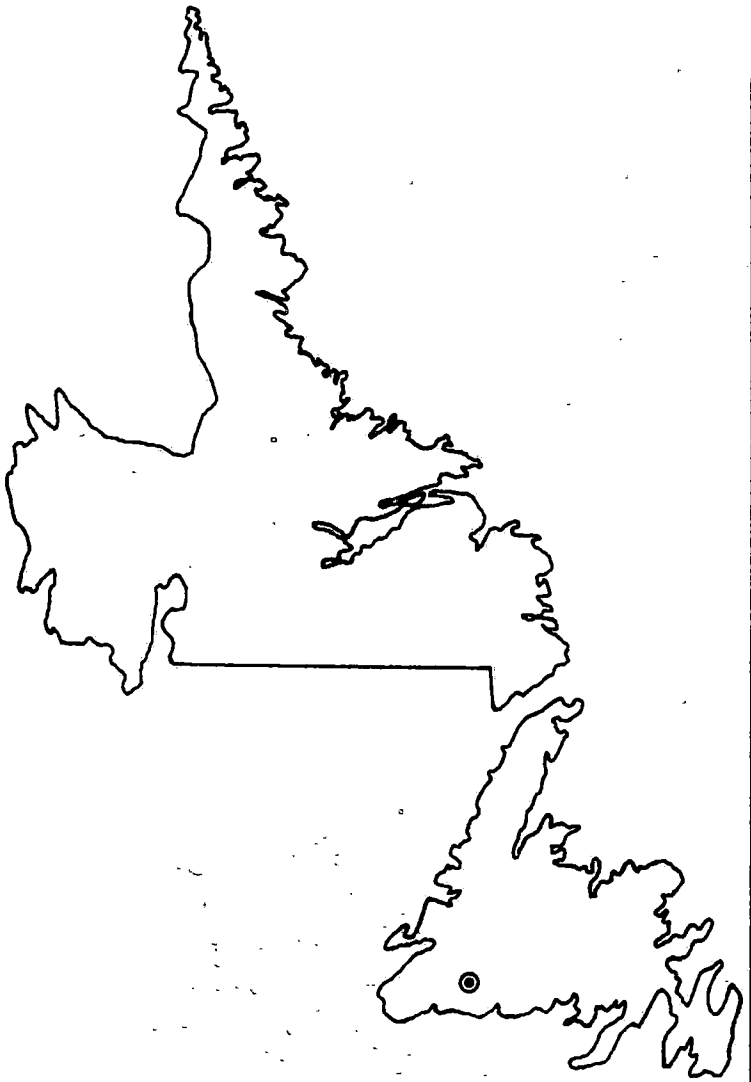
DRY POND HYDRO DEVELOPMENT



FEASIBILITY STUDY

AND

COST CONTROL ESTIMATE

ENGINEERING AND CONSTRUCTION DEPARTMENT
NEWFOUNDLAND AND LABRADOR HYDRO

HYDRO

NEWFOUNDLAND AND LABRADOR HYDRO
Head Office: St. John's, Newfoundland A1A 2X8 • Telephone (709) 737-1400 • Telex 016-4503

February 8th, 1982

Mr. L. J. Cole
Vice-President, Engineering and Construction
Newfoundland and Labrador Hydro
P.O. Box 9100
ST. JOHN'S, Newfoundland A1A 2X8

RE: DRY POND HYDRO DEVELOPMENT
FEASIBILITY REPORT AND COST ESTIMATE

Dear Mr. Cole:

We present herewith our report on the Feasibility Study and Control Cost Estimate for the Dry Pond Development on the south coast of the Province.

The report was based on the conceptual development outlined in The Four Rivers Study, prepared by ShawMont Newfoundland Limited in 1979. The information in the Study has been supplemented with additional field information, updated cost data based on unit prices being tendered on the ongoing major projects and budget quotations from suppliers. Survey information has been obtained in sufficient detail to undertake conceptual design for most structures.

The cost is given for two (2) - 2600 kW Units with provisions for the addition of the Third Unit.

You will note that the Direct Costs for the project has increased substantially since the budget estimate last year. We point out that all previous estimates prepared by our Department were based on the cost given in The Four Rivers Study, adjusted for the change in schedule and escalated in accordance with the escalation figures provided for this type of construction.

We have included the detailed Capital Cost Estimate in the report as Appendix D. However, we suggest this document not be given wide circulation outside Hydro without first removing the detailed Cost Estimate sheets.

In order to complete the Civil Work in the 1983 construction season and to have the plant Generation Power prior to the spring runoff of 1984, a decision on the project will have to be made by May 1, 1982.

see page 2....

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Prior to that date the tender document for the road and major equipment will have to be prepared for release shortly thereafter. Work on preparation of these documents must start by March 1, 1982.

In view of the final cost it is suggested that a review of the concept of the Dry Pond Hydro Development may be required in order to identify the most economical solution. Possibly a one unit run of the river plant in combination with Diesel Generation may be an alternative. There are other alternatives outlined in the report which should be given consideration.

We trust that this report will enable the Environmental Assessment to proceed so that a decision on the project can be made.

We wish to express our thanks to the people throughout the Engineering and Construction Department who worked on this assignment and who put in long hours to compile and edit the report.

Yours very truly,

L.G. Sturge, P.Eng.
Manager of Engineering

Att:

JJC/gw

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NEWFOUNDLAND AND LABRADOR HYDRO

DRY POND HYDRO DEVELOPMENT

"FEASIBILITY STUDY AND COST CONTROL ESTIMATE"

Prepared by:

ENGINEERING AND CONSTRUCTION DEPARTMENT
NEWFOUNDLAND AND LABRADOR HYDRO
P.O. BOX 9100
ST. JOHN'S, NEWFOUNDLAND A1A 2X8

1982 02 08

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INTRODUCTION

Introduction

Purpose

The preparation of this report was undertaken by the Engineering and Construction Division to meet the requirement of Newfoundland and Labrador Hydro to undertake a review of the feasibility of the Dry Pond Hydro Development (without Top Pond Diversion)and confirm the validity of the Project.

Intent of Study

The intent of the study was to confirm the technical feasibility of the project, to gather information for input to the Environmental Impact Statement (E.I.S.), and to update the Capital Cost and Construction Schedule for the project.

Information for E.I.S.

Information required by our Environmental Department included:

- Description of the project,
- Identify road alternatives and stream crossing requirements,
- Identify material requirements and borrow sources,
- Identify land requirements.

Previous Engineering Studies

A number of reports were reviewed and referred to during the course of the work. They include the following:

1. ShawMont Newfoundland Limited Report # SMR-9-79 on the Hydro-electric potential study for Dry Pond Brook, Pinware River, Lake Michel and Cloud River.
2. ShawMont Newfoundland Limited Report # SMR-19-80, Four River, further studies on Dry Pond Brook and Pinware River Developments.
3. ShawMont Newfoundland Limited Report dated 1981-07-10 (letter form) on Regulation Studies for Dry Pond Development.

These reports covered the overall concepts and general arrangements, hydrology, and regulation studies for the Development and were used as the basis for the present study.

Scope of Work

In the fall of 1981, the Engineering and Construction Division carried out field and office programs to meet the terms of the study.

The Field Program included:

- Control and Engineering Surveys,
- Field investigation and test pit work,
- Geotechnical review of Structure sites.

The Office Program included:

- Aerial photo interpretation work,
- Preparation of plans, profiles and cross sections of recent surveys,
- Review of all Structures using latest field data.
- Determination of quantities and review of costs,
- Review of Construction Schedule,
- Preparation of report and updated Capital Cost Estimate.

It should be noted that optimization studies were not undertaken and the updated cost estimate was prepared using latest field data to determine quantities using conceptual designs in the previous Shawmont Nfld. Ltd. Report. Some changes in elevations are shown in the Headpond Powerhouse area, however, these relate to the control survey undertaken in 1981 to bring all information to one permanent geodetic datumn.

PROJECT SUMMARY AND CONCLUSIONS

PROJECT SUMMARY AND CONCLUSIONS

The Dry Pond Development is technically feasible from a design and construction point of view, and with the possible exception of construction of the high pressure penstock and the latter part of the access road to the Powerhouse on the existing steep grade, no exceptional problems of a construction nature should be encountered.

However, increase direct construction costs for access roads and dams due to rough terrain and lack of good impervious material and other granular materials, together with a substantial reduction in firm flow resulting in a reduction in firm and average energy output because of the deletion of the Top Pond Diversion makes the project much less attractive from an economical point of view.

The essential data for the Development is summarized below:

Energy Structures	7,959,000
Power Structures	2,659,000
Telecontrol	196,000
Permanent Support	1,639,000
Temporary Support	375,000
TOTAL DIRECT COST	12,828,000
Management & Engineering	2,398,000
Owner's Costs	230,000
Escalation	2,767,000
Interest during Construction	2,116,000
Contingency	1,530,000
Corporate Overheads	220,000
TOTAL CAPITAL COST	22,089,000
Annual Costs	2,938,000
Installed Capacity	5,200 kW
Annual Energy Production:	
Firm	14.2 gWh
Average Secondary	17.3 gWh
Total	31.5 gWh
Cost of Firm Energy	[redacted]
Cost of Average Energy	[redacted]

Energy Calculations

Firm Energy:

Net Head	90.0 metres
Firm Flow	2.45 cu. metres per second
Efficiency (o/a)	0.75
Firm Energy	14.2 gWh/p.a.

Secondary Energy:

Net Head	89.0 metres
Average Flow	5.35 cu. metres per second
Efficiency (o/a)	0.77
Average Energy Output	31.5 gWh/p.a.
Secondary Energy	17.3 gWh/p.a.

Efficiencies assumed were based on the following:

Turbine (operating to produce firm energy only)	.89
Turbine (operating to produce firm and secondary)	.91
Generator	.99
Transformer	.99
Plant	.99
Water Utilization	.90

The Construction Schedule as presented is realistic, however, due to delivery of the turbine-generator units the on-power date will be March 31, 1984 based on a project release of May 1, 1982. To maintain the schedule as presented it will be necessary to undertake some preliminary work commencing on March 1, 1982.

This would include preparation of tender documents for the access roads and for the supply of the turbine-generator units.

In summary, in light of the substantial increase in the unit cost (mils/kWh) of producing energy from the scheme as it is now "envisaged", it is suggested that consideration be given to review of alternatives and further studies including:

- Optimization studies of structures under present scheme.
- Regulation and cost studies to determine feasibility of increasing the firm flow by either reconsidering the Top Pond Diversion, or other diversions including Seal Brook to the south and/or Northwest Brook to the North. The Seal Brook Diversion could now become attractive as the road to the Dry Pond structure will pass near the area and cross Devils Knob Brook to obtain materials from the esker in the area.
- Review of other alternative plant schemes.

PART A FEASIBILITY STUDY

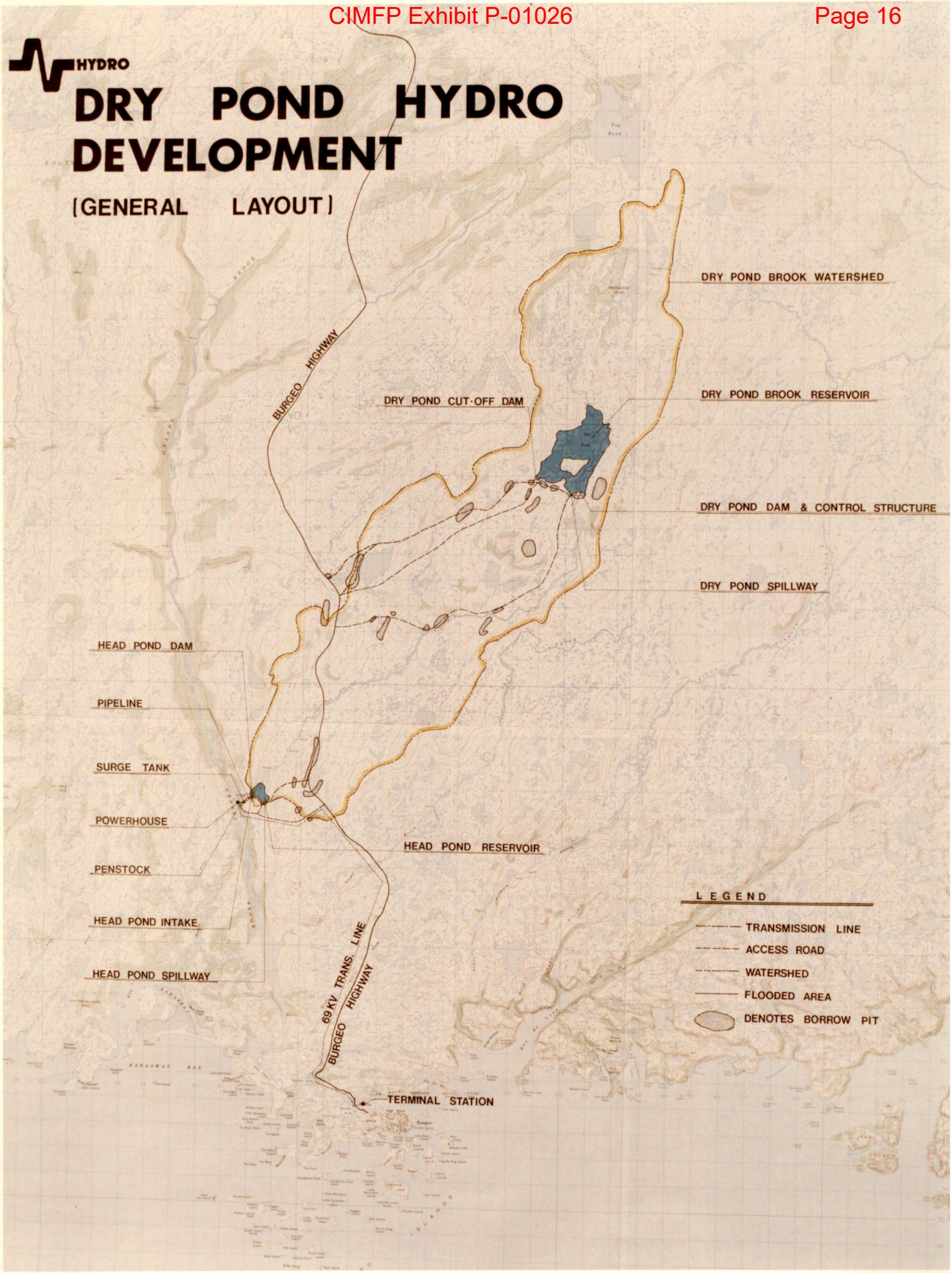
PART A - SECTION 1

PROJECT MAP

HYDRO

DRY POND HYDRO DEVELOPMENT

[GENERAL LAYOUT]



PART A SECTION 2

PROJECT DESCRIPTION

PROJECT DESCRIPTION

DRY POND HYDRO DEVELOPMENT

1. General

The Dry Pond Hydro Development will be situated in the southern part of the Island of Newfoundland with its proposed generating station located approximately 14 kilometres north northwest of the town of Burgeo.

The entire development covers an area of about 6 kilometres wide by about 30 kilometres long with its axis running in a northeasterly direction from the powerhouse at Grandy Brook to the uppermost storage reservoir at Dry Pond.(see drawing Bl-128-C-1).

Access to this site will be by the Burgeo to Bottom Brook Highway which runs through the project area and comes within 4 kilometres of the powerhouse. The road is completed and has been built to a minimum standard conforming to AASHTO HS 20-40 loading.

firm energy

The installation as proposed would completely replace the combined ? electrical loads from the diesel generating plants at Burgeo until the end of 1984. The development also has the advantage that as load growth continues, it could satisfy the base load at Burgeo alone, while providing significant amounts of secondary energy for the years beyond 1984. The development is centred around the following main areas:

(a) -- Dry Pond reservoir and associated structures located approximately 17 kilometres upstream of the powerhouse; will have a live storage of 12.3 million cubic metres and will operate between a full supply level of 333.5 metres and low supply level of 329.5 metres.(see Figures 6-2,6-7&6-8)

(b) -- The Headpond and associated structures - All structures in this area are within 1 kilometre of Grandy Brook at its confluence with Devils Knob Brook.

The Headpond will provide a live storage of 0.2 million cubic metres and will operate between a full supply level of 102.0 metres and a low supply level of 100.0 metres. (see Figures 3-1 and 6-3).

Elevations used in this statement are related to permanent geodetic benchmarks.

2. DESCRIPTION OF STRUCTURES

2.1. Dry Pond Structures

The structures associated with Dry Pond are the Dry Pond Dam, Control Structure, and Spillway; and the Dry Pond Cut-Off Dam.

2.1.1 Dry Pond Dam

The structure regulating the Dry Pond reservoir consists of the Dry Pond Dam which also incorporates the control structure and overflow spillway. This structure is located 1.5 kilometres downstream of the outlet of Dry Pond.

The Dry Pond Dam will be of hybrid construction, the deeper central portion near the river will consist of rolled rockfill with an impervious core section. On the banks of the river when the embankment height diminishes to 5 metres or less, a homogeneous earthfill section will be used. There will be transitions on both abutments where the embankment changes from rockfill to earthfill.

The dam will have a crest elevation of 335.5 metres, a crest length of 645 metres, maximum height of 19 metres and will require about 93,000 cubic metres of fill. This includes 17,000 cubic metres of material for the cofferdam.

Unwatering of the dam will be through a short rock channel, with a gated upstream section. This section is designed to pass the 1:20 year construction flood and will be closed off after the spring flood and then only after the control structur- is complete.

2.1.2 Dry Pond Control Structure

The control structure is essentially a gated steel conduit running through the dam. It is designed to pass at low supply level 90% of the firm flow required at the plant. Operation of the gate will be entirely manual. The 1.25 metre diameter slide gate, fitted to the 1.25 metre conduit will be enclosed in a 3 metre x 3 metre x 9 metre deep reinforced concrete well. Access to the gate will be via the crest of the dam.

2.1.3 Dry Pond Spillway

The spillway will be situated in the westerly abutment of the dam and will have a maximum height of 2 metres. The spillway will be of the concrete gravity type with concrete wing walls on both sides. The spillway crest elevation will be 333.5 metres and the crest length 50 metres. The spilllay is designed to pass the 1:1000 year flood with the Dry Pond reservoir at the designed maximum flood level.

2.1.4 Dry Pond Cut-off Dam

The Dry Pond Cut-off Dam is located 1.5 kilmetres southwest of Dry Pond in a low spot on the edge of the reservoir. The dam will be a homogeneous earthfill structure with a crest elevation of 335.5 metres, crest length of 165 metres and maximum height of 10.0 metres. The volume of fill required is 12,000 cubic metres. (see Figire 6-9).

2.2 Headpond Structures

The structures associated with the Headpond are the headpond dam, intake, spillway, pipeline, surge tank, penstock and powerhouse.

2.2.1 Headpond Dam

The Headpond dam will be located about 50 metres upstream of the falls on Devils Knob Brook where it empties into Grandy Brook.

The 11 metre high dam will be of rolled rockfill type construction with a central core of impervious material. The crest of the dam will be at elevations 104 metres with a crest length of 225 metres and will contain 40,000 cubic metres of material. This includes 6000 cubic metres required for construction of a cofferdam. (see Figire 6-11).

The headpond damsite will be dewatered by an upstream cofferdam which diverts the river flows through an 8.0 metre wide rock channel excavated through the southerly abutment at the site of the proposed intake. This 150 metre long, 8.0 metre wide channel having sideslopes of 4.0 vertical to 1 horizontal coverges to a 4.0 metre wide section with almost vertical sides in the area of the intake.

The 4.0 metre section is lined with concrete for a distance of 8 metres and equipped with stoplogs which will be closed off at the appropriate time during construction to enable the prefabricated intake steelworks, concrete cut-off wall and closure section of the pipeline to be built.

2.2.2 Intake Structure

In light of the relatively small plant rated flow, a prefabricated steel intake structure is proposed. The steel intake structure will be designed to withstand a 230 kN ice thrust in any direction and will include a trashrock, emergency head-gate operating mechanism and a maintenance deck.

The trashracks, approximately 3.5 metres high by 3.0 metres wide, will accommodate a differential head of 5 metres. A transmitter will be incorporated to annunciate a high differential pressure across the trashracks and initiate head-gate closure.

2.2.2 Intake Structure (continued)

The rectangular-shaped intake will limit intake velocity to 2.70 metres per second. A conical transition piece will transform the rectangular intake into a circular exit 1.6 metres in diameter. The circular conduit will be fitted with a standard flange or provided with a flexible coupling arrangement suitable for connection to the proposed penstock.

All equipment will be compartmentalized and shielded from potential vandalism by heavy metal.

An anti-vacuum, air vent will be provided downstream of the headgate. The vent will be heat traced to prevent freezing during the winter season.

2.2.3 Headpond Spillway

The headpond spillway will be located at the most southern point of the headpond reservoir. The spillway will be of the concrete gravity type with concrete wing walls and bridge abutments on both sides. It will have a maximum height of 2 metres, a crest elevation of 102 metres and a crest length of 100 metres. The spillway is designed to pass the 1:1000 year flood with the headpond reservoir at full supply level.(see Drawing B1-128-C-6).

2.2.4 Low Pressure Pipeline and Penstock

The low pressure pipeline will be of welded steel construction and will be buried for the total length. It will have a 1.83 metre diameter, a thickness of 6 mm and will be 460 metres long. The high pressure penstock will be of welded steel construction and will be buried for the total length. It will also have a diameter of 1.83 metres, a minimum thickness of 12 millimetres and will be 230 metres long. Anchor blocks will be located at strategic positions along the route. The pipeline and penstock will be externally coated with a zinc primer and vinyl paint. (see Figure 6-12A).

2.2.5 Surge Tank

The surge tank will be lcated at the edge of the hill before the point where the penstock plunges to the powerhouse. It will be of the elevated tank type and is designed to limit pressure fluctuations in the pipeline/penstock.

2.2.6 Powerhouse and Tailrace

The powerhouse will be located approximately 65 metres upstream of Grandy Brook. It will be set back in towards the bottom of the hill to minimize the length of penstock and to be above the maximum flood levels expected in Grandy Brook. Access will be via an access road off the Burgeo Highway.

2.2.6 Powerhouse and Tailrace (continued)

The powerhouse will house two units and will have provisions for a third. The powerhouse will be unmanned, but will have water, sewage, and lunchroom facilities for daily operational and maintenance visits.

The powerhouse will have a structural steel superstructure metal cladding, and metal roof.

The powerhouse will have afloor elevation of 10 metres. The powerhouse will be equipped with 2 horizontal Francis turbines capable of an output of 2600 kW each operating under a minimum net head of 90 metres and a rated flow of 3.65 cubic metres per second (see Figure 6-13A).

The tailrace will be excavated to meet the most southerly branch of Devils Knob Brook near its confluence with Grandy Brook. The tailrace will be excavated to a depth of 4 metres for a length of 15 metres. At the end of the tailrace an overflow weir will be located on an existing bedrock outcrop. From the overflow weir the outflow will pass over approximately 50 m length of streambed, dispersing the flow before entering Grandy Brook.

2.2.7 Switchyard

The switchyard will be located to the south of the powerhouse and will be 30 metre x 30 metre in area. The switchyard will consist of one (1)-6.5/8.7/10.8 MVA Transformer and a 69 kV transmission line termination (see proposed single line diagram A-128-E-1). The switchyard will be enclosed with a standard 2.4 metre high chain link fence.

2.3 ACCESS ROADS

2.3.1 Permanent Powerhouse Access Road

A permanent access road will be built between the Burgeo Highway and the powerhouse site, passing near the spillway and headpond dam and following along part of the penstock route. The road is to be constructed through rough terrain and will be of a low profile construction.

The 3.2 kilometres of permanent access road will be constructed with a 6.0 metre gravel driving surface. Road drainage crossings will be accomplished by various C.M.P. culverts as required and by one concrete abutment, steel beam, wood deck bridge incorporated into the headpond spillway structure.

2.3.1 Permanent Powerhouse Access Road (continued)

Two alternative road routes were investigated in the field study of October 1981. Access from the Burgeo Highway for Alternative G is located south of Manrock Pond (Dwg. Bl-128-C-4). This route is through rough terrain and is approximately 4.0 kilometres in length and maintaining our bridge crossing at the spillway no other stream crossings would be encountered.

The preferred alternative road route E-H is located to the north of Alternative G and access is from the Burgeo Highway near an existing gravel pit opposite Manrock Pond. While this route is through rough terrain, it is not as difficult as Alternate G. The length of Alternate E-H access road is 3.2 kilometres, most of which is over boulders and exposed bedrock.

The base will be constructed of blasted rock which shall be quarried in a location shown on Dwg. Bl-128-C-3. The subgrade will be constructed of pit material obtained from borrow areas indicated on Figure Bl-128-C-3. The road topping shall be obtained by processing pit run material from selected borrow areas.

2.3.2 Permanent Dry Pond Dam Access Road

A permanent access road will be built between the Burgeo Highway and the Dry Pond Dam site. This road is to be constructed through rough terrain and will be of a low profile construction.

The 12.2 kilometres of permanent access road will be constructed with a 5 metre gravel driving surface. Road drainage crossings will be accomplished by various C.M.P. culverts as required whereas major stream crossings shall be constructed with large diameter culverts sized to accommodate the 1:25 year return flood.

Four alternative road routes were investigated in the field study of October 1981. Access from the Burgeo HIghway for Alternative A-B is located at an existing borrow pit on the Burgeo Highway 0.3 kilometres south of Wood Tilt Brook. This route passes through an existing borrow area and heads in a general north easterly direction. This route maneouvres gentle slopes with acceptable grades and very little side slopes. Clearing on this route would be limited to approximately 1.0 hectare and only one significant stream crossing would be encountered.

Access from the Burgeo Highway for Alternative A-C is located approximately one kilometre south of the intersection for Alternative A-B. This route is identical to Alternative B-A except that first 2.6 kilometres were rerouted to enable access to a potential borrow pit and less difficult terrain. Unfortunately potential borrow areas with acceptable road construction material were not encountered along or near these alternative routes.

2.3.2 Permanent Dry Pond Dam Access Road (continued)

Access for Alternative D originates at the same point as Alternative A-C and heads in a general northeasterly direction roughly paralleling Alternate A-B. This route encounters two major stream crossings that would require large culvert installations. The general paucity of good road construction material along this route and difficult terrain makes this alternative unfavourable.

Access from the Burgeo Highway for Alternative D would be located approximately 2 kilometres south of the existing borrow pit near Woodtilt Brook. The first 6.0 kilometres heads in a general easterly direction over rugged terrain to an esker located on the south side of Devils Knob Brook. At that point the road turns in a northeasterly direction and roughly parallels Devils Knob Brook over fairly level terrain to the Dry Pond Dam. Several areas along this route have been identified as potential borrow areas with acceptable construction materials for the access roads and power and energy structures. This route encounters three major stream crossings that would require major culvert installations, in addition, temporary access would be required across Devils Knob Brook to the esker identified on Drawing No. B1-128-C-3. Although this route is slightly longer than alternative A-B or A-C and is over more difficult terrain; the benefit of encountering good construction materials makes this alternative the preferred route.

2.3.3 Temporary Access Roads

A temporary access road will be constructed from the Dry Pond Dam to the Dry Pond Cut-off Dam. This road will be approximately 1.5 kilometres in length and will traverse mainly exposed bedrock and boulders. The driving surface shall be 4 metres wide and will be constructed to the minimum requirements necessary to allow heavy equipment access to the Dry Pond Cut-off Dam site. Since it is anticipated material for the cut-off dam will be available in the immediate area vehicular traffic over this section of road is expected to be minimal.

Temporary access roads to borrow areas will be constructed in a low profile manner and to the minimum requirements necessary to permit heavy equipment access from the permanent access road to the borrow areas. It is not possible to indicate at present the actual location and length of temporary access road required until borrow areas to be used are chosen by contractors.

2.4 Burgeo Terminal Station

This terminal station will be located on the easterly side of the community of Burgeo, approximately 300 metres from the Burgeo Highway. It will include facilities to stepdown to area distribution voltages from the 69 kV Transmission Line. Access to the site from the highway will be an existing road which will be upgraded.

2.5 Alternatives Considered

Work under the present study utilized the overall concepts for structures and general arrangements as presented in the previous reports by Shawmont Nfld. Ltd. However, alternatives were considered in two (2) areas, namely, the Headpond Spillway and all premanent access roads.

Head Pond Spillway

The estimate used in this report and the Spillway as described in Section 2.2.3 is based on the conceptual design described in the previous studies.

During the study concern was expressed on the cost of providing for a bridge at the Spillway to accommodate the permanent access road to the Powerhouse and the environmental effects of discharges from the Spillway into a small creek adjacent to the Devil Knob Brook watershed and back into Grandy's Brook.

An alternative arrangement for the Spillway was conceived which incorporated the Spillway into the northside of the Head Pond Dam.(see Drawing Bl-128-C-7). This scheme would divert the water back into Devils Knob Brook, however, there is some concern on discharge of the water back into the gorge below the Head Pond Dam and improvements in the brook near the Powerhouse would be required to by-pass flood flows.

Further investigation and Engineering evaluation would be required to confirm the validity of this scheme.

Additional field review of the present scheme indicated that it may not be a major problem from an environmental point of view and a cost comparison indicated no major cost savings and thus the previous scheme of a separate Spillway was maintained.

Permanent Access Roads

Alternative access road routings were considered during the study and these are described in Section 2.31 and 2.32.

PART A SECTION 3

HYDROLOGY

3. HYDROLOGY

.1 Drainage Areas

The drainage area to be included in the development is 144 square kilometres. The drainage area was obtained from a 1:50,000 topographic map produced by the Department of Energy, Mines and Resources.

The location of the drainage area is delineated in yellow on the project map in section 1 of Part A. A notable feature of the development area is the scarity of vegetation such as scrub and mature trees and the abundance of exposed bedrock.

.2 River Flows

The river gradient is steep, flow rapid and natural storage minimal. The flow pattern from the Isle Aux Mort River to represent monthly flows for Devils Knob Brook was used by prorating Isle Aux Morts flows by drainage area and runoff ratios of 0.87 and 0.66 respectively.

Since a twenty year data base is desirable for regulation studies and only sixteen years were available on the Isle aux Morts these records were extended to cover the missing period 1957-1961. Attempts to relate Isle aux Morts flows to precipitation at Port aux Basques were unsuccessful and it was found more practical to extend Isle aux Morts flows by reference to stream data on the Lewaseechjeech Brook. Simple two parameter regression models were obtained for the following months - January, March, April, May, June, October, November and December; Models for February, July, August and September, generally the low flow months, were not statistically significant. For these months Isle aux Morts flows were estimated by simple drainage area ratios. As a check on this method annual runoff rates for Dry Pond Brook were also estimated from Grey River records and Burgeo precipitation. The resulting values were close to those predicted and confirm the general accuracy of this method.

.3 Flood Frequency Analysis

Design flood for the Devils Knob Brook was estimated by the transposition of flood statistics obtained from the frequency analyses of the streamflow from the Isle aux Morts river.

A log normal distribution was assumed in these analyses and the curves fitted by the method of moments. Design floods were based on 'parent' drainage areas as shown in the table below:

Flood Peaks (Daily Maxima) cu. m. per sec.

	Return Period (years)				
Devils Knob Brook	2	10	20	100	1000
Devils Knob Brook	95	173	297	278	396

Selection of design floods are made in accordance with the U.S. Army Corpos. of Engineers design flood criteria*. Where the Maximum Probable Flood (MPF) Method is recommended, floods of equivalent return periods are used: specifically for 1/2 MPF a 1 in 1000 year floor and for the MPF a 1 in 10,000 year flood is used. These equivalents were established in other flood studies for small watersheds in Newfoundland.

.4 Ice Problems

The most common icing problem affecting the operation of hydro plants is the clogging of the intake trash racks with accumulations of frazile ice which occurs when inflow is super cooled, the result of critical temperature gradients combined with open water conditions. The accepted solution is to provide a tranquil headpond and adequate intake submergence to facilitate the formation and maintenance of a stable ice cover over the power plant headpond.

The headpond identified in this study will provide sufficient surface area and depth to sustain the desired ice covers. It was felt however that the Dry Pond Reservoir may not have an adequate volume to handle the influx of loose river ice carried downstream, on breakup, from the rapids section between the headpond and Dry Pond Reservoir where large amounts of ice would be created during periods of extreme cold. An approximate but conservative method has been used to estimate the volume of ice that could be generated in this portion of the river and hence the reservoir volume needed to counteract such an ice influx. These calculations indicate that a minimum reservoir volume of approximately 250,000 cubic metres is required for the headpond. (see Figire 6-3).

PART A SECTION 4

GEOTECHNICAL INFORMATION

4. GEOTECHNICAL INFORMATION

General

On October 19 and 20, 1981 a geotechnical consulting firm was retained to conduct a field reconnaissance at the proposed Dry Pond Hydro Development. The purpose of this examination was to make a preliminary evaluation of geological and geotechnical conditions at the structure sites. Our investigation disclosed that the proposed development is located in terrain which has been heavily glaciated. The ground surface of the upper plateau exhibits low to moderate relief apart from several bedrock hills and the steep valley walls of Grandy's Brook. Overburden is typically thin or non-existent except for a number of well-defined glacial landform features. Bedrock underlying the area is granitic for the most part with frequent outcrops and exposures. Vegetation over most of the site area comprises moss and grasses supported on a thin organic deposit except along the valley wall of Grandy's Brook where a moderate growth of conifers has developed.

The competent bedrock at shallow depth will provide excellent support for the principal dam structures and powerhouse, although some grouting will be required to seal joints in the rock forming the dam foundations. The pipeline route crosses moderately sloping terrain, while the penstock will traverse the steep valley wall which is relatively stable along the major portion of the route.

Bedrock in the immediate area is suitable as rockfill for dam construction and concrete aggregate. Sources of impervious material and good quality granular materials appear relatively scarce, however, borrow areas have been investigated where impervious material and filters could be produced with minimal processing.

The observations made and the implications related to project development are described together with considerations related to design and construction of the structures in the geological report in Appendix A.

PART A SECTION 5

CONSTRUCTION MATERIALS

5. Construction Materials

Detailed surface and subsurface field investigations were conducted by Hydro in the fall of 1981. In general, the availability of glacial till and granular materials in the immediate development area as a source of road construction materials and as impervious and filter materials for the construction of the dams is very limited. Field data indicated that a sufficient quantity can only be obtained by processing material from select borrow areas. It is not anticipated that any material will have to be hauled in from outside the project area.

The amounts and types of material required for construction of the access road, both permanent and temporary and the dams are estimated below:

TYPE	DAMS	ACCESS ROADS
Impervious Fill	55,000	-
Sand and Gravel	33,000	35,000
Rock	61,000	53,000

Coarse aggregates for concrete will be obtained from the sand and gravel deposits located in the northeast of the project area or from processing quarry rock in the immediate work area.

Locations of potential borrow pits and quarries are shown on Drawing B1-128-C-3 and information on land forms in the project area is shown on Drawing B1-128-C-5.

Test pitting work was undertaken during the 1981 field program and the location of all test pits are shown on Drawing B1-128-C-10.

A visual inspection of samples taken was made. A visual classification of materials is given in Appendix A.

Specification of materials required for the project and a detailed summary of materials required for each structure and the possible sources is provided in Appendix C.

PART A SECTION 6

CONSTRUCTION SCHEDULE, CONTRACT PACKAGES AND MANPOWER

6. CONSTRUCTION SCHEDULE, CONTRACT PACKAGES AND MANPOWER:

a) Construction Schedule

The construction schedule shown on drawing B1-128-C-9 is based on a project release of May 1, 1982.

Due to delivery of the turbine-generator the on-power date is March 31, 1984.

Generally the project will be constructed in two phases.

The program for the first year is to complete access to all construction sites as well as to do most of the preliminary site work including some of the preliminary unwatering work, so that work in the second year can start as soon as possible.

The second year's program is to complete all work except the installation of the turbine, generator units in the Powerhouse. The construction of dams is scheduled such that placement of impervious and filter materials occurs in July-August and placement of concrete is complete before winter. Initial work on dams must also occur after the spring runoff. Major powerhouse mechanical work can not start until January of the third year because of delivery schedules, and thus is not complete until March of the third year.

In order to achieve the commissioning dates for the plant and to meet the on-power date of March 31, 1984 it will be necessary to construct the main civil works in accordance with the following schedule:

- Main access roads, July 1982 to November 1982.
- Powerhouse, Tailrace and Switchyard, May 1983 to March 1984.
- Penstock and Surge Tank, May 1983 to October 1983
- Headpond Dam and Intake, May 1983 to November 1983.
- Dry Pond Dam, Control Structure and Spillway, May 1983 to November 1983.
- Dry Pond Cut-Off Dam, May 1983 to November 1983.

b) Construction Contract Packages

Construction schedules have been evolved to meet the site requirements with durations governed, for the most part, by target dates for major contracts as shown on the construction schedules. Construction work would be divided into a few interrelated work packages to ensure efficient execution of the work. These work packages would be:

CONTRACT 1

Access Roads and Site Preparation - A preliminary contract which would include construction of the main access roads and clearing and stripping of the main structure sites.

CONTRACT 2A & 2B

Civil Works - Normally a main civil works contract would be awarded to undertake: construction and operation of a camp, construction of project roads, all earth works, concrete works, architectural works and landscaping. Where the project includes two geographically separate structure sites or sub-projects, two secondary civil works contracts would be awarded. One will incorporate the Dry Pond Structures and the other will incorporate the Head Pond/ Penstock/Powerhouse Structures.

CONTRACT 3

Pipeline Construction - The low pressure pipeline and penstocks comprise an important component of the overall construction work. It would be advantageous to employ a specialist contractor for this work rather than leave it as the responsibility of the civil works contractor.

CONTRACT 4

Equipment Contracts - This contract would include the design, supply, transportation, erection and testing of the major pieces of equipment including but not limited to turbines, valves, generator, etc.

CONTRACT 5

Electrical and Mechanical Erection - A single erection contract would be awarded for the installation of electrical and mechanical auxiliaries.

Obviously these separate contracts, though conveived as separate entities will have to fit into the master construction schedule.

c) Construction Manpower

The project will be constructed over a construction period of approximately 18 months with an average manpower of about 100 man-months. Peak period would be between July-October of 1983.

PART A SECTION 7

CONSTRUCTION CAMPS

7. CONSTRUCTION CAMPS

The contractors working on the various aspects of the project will be responsible for their own living accommodations. Costs associated with the provision of such accommodations are included in the estimated unit prices.

In the first year of construction it is envisaged that the road contractor will use a floating/moving type camp that will move as construction progresses. The Owners representatives will use local accommodations.

In the second year of construction it is envisaged that the two civil contractors will set-up a fixed location camp at sites geographically suitable for their operations. The owner will provide his own living/office accommodations which will be set-up and serviced by the appropriate contractor. Other contractors will be on site for a relatively short time and will secure either local accommodations or will make use of the civil contractors accommodations.

PART A SECTION 8

ENGINEERING AND MANAGEMENT SCHEDULE

8. ENGINEERING AND MANAGEMENT SCHEDULE

Engineering and management manhours were established on a basis of a simple project organization chart as shown in Appendix B, Table 1 and are summarized as follows:

(a)	Design ----------	6,000 manhours
(b)	Field Engineering, Construction Supervision and Control -----	32,000 manhours

PART A SECTION 9

PROGRAM OF ON-GOING STUDIES

plus installed capacity optimization

9. PROGRAM OF ONGOING STUDIES

.1 General

Several studies and investigations are required in the early stages of the next phase of engineering to firm up the project and to provide sufficient data for detailed final design and data for tenderers.

.2 Reservoir Full Supply Level

It has been noted in the project description of this report that the optimum reservoir F.S.L. in the headpond is in the range of elevation 102 metres. Studies should be undertaken to optimize this water level using all relevant additional data included in proposed future investigations.

.3 Geotechnical Investigations

The 1982 geotechnical program should be augmented in early summer of 1982. The program objectives should be:

- appropriate testing of soil samples taken during the 1981 field program to confirm sources of potential impervious, granular and concrete aggregate materials.

- boreholes, rock probes and test pits at structure sites as recommended by the geotechnical consultant in his report (see Appendix A.)

.4 Facilities

Further design of the penstock and surge tank should be undertaken to optimize penstock diameter and wall thickness in addition to surge tank diameter and height.

The Headpond spillway location should be reviewed to determine which of the alternative locations would be most feasible both economically and technically.

.5 Hydrology

Optimization of flows available and power output should be carried out by further regulation studies based on unit flow requirements.

Optimization of the powerhouse floor elevations should be carried out by further flood and/or ice studies of Grandy's Brook in the powerhouse area.

PART A SECTION 10

LAND REQUIREMENTS

10. LAND REQUIREMENTS

Land Requirements for the project are shown on drawing B1-128-C-2 and are summarized as follows:

Block # 1	Power Structures	63.2 ha
Block # 2	Channel Improvements for Spillway	2.5 ha
Block # 3	Dry Pond Dam, Control Structure and Spillway	22.5 ha
Block # 4	Dry Pond Cut-Off Dam	4.0 ha
Block # 5	Temporary Access Road to Dry Pond Cut-Off	10.0 ha
Block # 6	Permanent Road to Dry Pond Dam, Control Structure and Spillway	61.0 ha
Block # 7	Permanent Road to Powerhouse	11.0 ha
Block # 8	Budget Substation	1.0 ha
Block # 9	Temporary Trailer Court	2.0 ha

PART A SECTION 11

LIST OF DRAWINGS

LIST OF DRAWINGS

GENERAL INFORMATION DRAWINGS

B1-128-C-1	GENERAL LAYOUT
B1-128-C-2	LAND REQUIREMENTS
B1-128-C-3	BORROW PITS AND QUARRY AREAS
B1-128-C-4	ALTERNATIVE PERMANENT ACCESS ROADS
B1-128-C-5	LAND FORMS
B1-128-C-6	HEAD POND AND POWERHOUSE AREA (ALT.1) SPILLWAY LOCATION
B1-128-C-7	HEAD POND AND POWERHOUSE AREA (ALT.2) SPILLWAY LOCATION
B1-128-C-9	CONSTRUCTION SCHEDULE
B1-128-C-10	TEST PIT LOCATIONS
A -128-E-1	PROPOSED SINGLE LINE DIAGRAM
FIGURE 3-1	FIRM FLOW VS STORAGE REQUIREMENTS
FIGURE 6-2	DRY POND STORAGE VOLUME CURVE
FIGURE 6-3	HEAD POND STORAGE VOLUME CURVE

STRUCTURE DRAWINGS

FIGURE 6-7	DRY POND DAM AND CONTROL STRUCTURE (SH.1of2)
FIGURE 6-8	DRY POND DAM AND CONTROL STRUCTURE (SH.2of2)
FIGURE 6-9	DRY POND CUT-OFF DAM
FIGURE 6-11	HEAD POND STRUCTURES (SH.2of3)
FIGURE 6-12A	HEAD POND STRUCTURES (SH.3of3)
FIGURE 6-13A	POWERHOUSE - PLAN AND SECTIONS

SURVEY DRAWINGS (not included)

B1-128-C-8	HEAD POND & POWERHOUSE AREA CONTOUR PLAN
B1-128-C-11	PENSTOCK ROUTING, SITE SURVEY, ELEV'S, CONTOURS AND PROFILE (4 SHEETS)
B1-128-C-12	DRYPOND CONTROL DAM, SITE SURVEY, ELEV'S, CONTOURS AND PROFILE
B1-128-C-13	DRY POND CUT-OFF DAM, SITE SURVEY, ELEV'S, CONTOURS AND PROFILE
B1-128-C-14	HEAD POND DAM, SITE SURVEY, ELEV'S, CONTOURS AND PROFILE
B1-128-C-15	HEAD POND SPILLWAY, SITE SURVEY, ELEV'S & CONTOURS
B1-128-C-16	HEAD POND SPILLWAY, DOWNSTREAM CHANNEL IMPROVEMENTS, SITE SURVEY

PART B SUMMARY INFORMATION OF COST

PART B SECTION 1

BASIS OF ESTIMATE

BASIS OF ESTIMATES

1. CIVIL WORKS

Quantities

Basic material quantities used in preparing the cost estimate have been determined from recent engineering plans, profiles, and cross-sections produced from the 1981 Engineering Survey Program, using the conceptual development and structure drawings from The Four River's Study produced by ShawMont Newfoundland limited in 1979.

Refinement to the conceptual development in the Four River's Study were made using information obtained by aerial photo interpretation (A.P.I.), Geotechnical reconnaissance study, and subsurface investigation (test pits) work undertaken in 1981.

The main access roads quantities are based upon typical sections that are felt to be appropriate for the actual field conditions.

Unit Prices

The unit prices in January 1982 dollars applied to civil quantities have been obtained from updated cost data based on unit prices being tendered on the ongoing major projects such as The Upper Salmon Development and Cat Arm Development, prices experienced on other similiar projects on the island, and review of recent cost estimates for the Cat Arm Development.

The prices for the major earthworks and the large structures recognize the efficiences of the large scale operations and the remoteness of the Dry Pond Hydro Project.

2. ELECTRICAL AND MECHANICAL

The method of estimating employed in the definitive estimate, all in January 1982 dollars for electrical and mechanical equipment, may be generally categorized as follows:

a) Cost estimates were requested where feasible from suppliers and budget costs received were used and modified based on whether the specific supplier is likely to be a low tenderer or whether other factors are applicable as below.

b) Previous tenders and purchase/contract prices for other projects were evaluated in relation to Dry Pond Hydro requirements and with due account for escalation to January 1982.

c) Adjustments made for the special and specific requirements for Dry Pond Hydro Development as foreseen from the feasibility study and field investigations.

d) Costs also recognized in some cases step increases identified by formally or informally quoted prices where these prices have significantly exceeded the recognized escalation rates over the comparison periods used.

e) Transportation rates for major equipment have been estimated for foreign trans-oceanic shipments where such is likely to occur. Most other rates are predicated on deliveries from Ontario.

PART B SECTION 2

SUMMARY COST CONTROL ESTIMATE
BY
FACILITY

DRY POND HYDRO DEVELOPMENT

SUMMARY COST CONTROL ESTIMATE
BY
FACILITY

		ESTIMATE
PART 1	WORK RESPONSIBILITIES	Base Cost
		January 1982 Dollars
1.	Energy Structures	$ 2,659,000
2.	Power Structures	7,959,000
3.	Telecontrol	196,000
4.	Permanent Support	1,639,000
5.	Temporary Support	375,000
6.	Management & Engineering	2,398,000
7.	Owner Administration	
	a) OWNER'S COSTS	230,000
	b) CORPORATE OVERHEADS	220,000
8.	Escalation	2,767,000
9.	Interest During Construction	2,116,000
10.	Contingency	1,530,000
	TOTAL PROJECT ESTIMATE =	$22,089,000

PART B SECTION 3

COST CONTROL ESTIMATE BY STRUCTURE

DRY POND HYDRO DEVELOPMENT

COST CONTROL ESTIMATE
BY
STRUCTURE

Code	Structure	ESTIMATE Cost Estimate January 1982 Dollars
1. Energy Facility		
1.120	Dry Pond Dam Control Structure and Spillway	$2,365,000
.121	Cut-off Dam	294,000
2. Power Facility		
2.102	Headpond Dam and Intake	1,657,000
.103	Headpond Overflow Spillway	773,000
.104	Low Pressure Pipeline and Penstock	1,760,000
.105	Surge Tank	104,000
.106	Powerhouse and Tailrace	3,492,000
.107	Switchyard	173,000
3. Telecontrol		
3.100	Telecontrol	196,000

		Cost Estimate January 1982 Dollars
4. Permanent Support		
4.100	Permanent Access Roads	$ 1,639,000
5. Temporary Support Facilities		
.193	Temporary Access Roads	375,000
6. Management & Engineering		
6.190	General Services	202,000
.191	Construction Site Services	418,000
.192	Personnel Accommodations	408,000
.193	Engineering & Management Manhours	1,370,000
7. Owner's Administration		
	a) Owner's Costs	230,000
	b) Corporate Overheads	220,000
8. Escalation		2,767,000
9. I.D.C.		2,116,000
10. Contingency		1,530,000
TOTAL DRY POND HYDRO DEVELOPMENT COST CONTROL ESTIMATE*	=	$22,089,000

* Excludes (i) Terminal Station at Burgeo

(ii) 69 kV Transmission Line

(iii) Terminal Station at Dry Pond Hydro Development | difference to Switchyard?

PART C WORK DEFINITIONS

WORK DEFINITIONS

General

The Work Definitions included in this section of the report outline the technical details of the various structures of the project as it is now "envisaged" and will serve as additional information in the description of the project as covered in PART A, Section 2 "Project Description".

The general layout of the project is shown on Drawing B1-128-C-1 and details of the main structures of the project are shown in the structure drawings included in the report and it was from these that the Work Definitions were prepared.

The Work Definitions outlined the principal elements of each structure and other pertinent information used in the preparation of the Cost Estimate for the Dry Pond Hydro Development.

PART C SECTION 1

ENERGY STRUCTURES

HYDRO
NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W.O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION
1.000.000	ENERGY STRUCTURES

(1) Reservoir Clearing: It is anticipated that there will be no reservoir clearing because of the scarity of timber in the flooded area.

(2) Dry Pond Dam: Includes the construction of a rolled rockfill impervious core dam for a total length of 645 metres and a maximum height of 19 metres.

(3) Control Structure: Includes a gated steel conduit running through the dam. Operation of the gate will be manual and will be enclosed in a 3 m x 3 m x 9 m deep reinforced concrete well.

(4) Spillway: Includes the construction of an overflow spillway in the westerly abutment of the dam and will have a maximum height of 2 metres. The crest length will be 50 metres and will be of the concrete gravity type with concrete wing walls.

(5) Cut-off Dam: Includes the construction of a homogeneous earthfill structure with a crest length of 165 metres and a maximum height of 10.0 metres.

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W. O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION
1.120.000	DRY POND DAM

General

The structure is located on Devils Knob Brook 1.5 kilometres downstream of the outlet of Dry Pond. The dam will incorporate the control structure and overflow spillway.

The Dry Pond Dam will be of hybrid construction, the deeper control portion near the river will consist of rolled rockfill with an impervious core section. On the banks of the brook when the embankment height diminishes to 5 metres or less, a homogeneous earthfill section will be used. There will be transitions on both abutments where the embankment changes from rockfill to earthfill.

Technical

(a) The dam will have a crest elevation of 333.5 metres, a crest length of 645 metres, maximim height of 19 metres and will require 93,000 cubic metres of fill including the cofferdam.

The principal elements of the dam are:

(1) Core Trench -- excavated to bedrock or acceptable impervious material. It has a minimum width of half the height of the dam and is backfilled to the stripped ground level with impervious glacial fill.

(2) Impervious core -- placed above and integrally with the core trench to a maximum elevation of 333.0 m. The core has a top width of 3.50 m below which the upstream and downstream faces are sloped at 1 horizontal to 4 vertical to the prepared core trench fill.

(3) Filters -- upstream and downstream of the impervious core a 2000 mm thick fine filter zone is provided as a transition zone between the core and a coarse filter zone which is also 2000 mm thick and provided as a transition zone between the fine filter zone and the rockfill shell of the dam.

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W.O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE ___ REV. No. ___

ACCOUNT No.	DESCRIPTION

The principal elements of the dam are: (continued)

(4) Rockfill -- will provide a rockfill shell necessary for the stability of the central impervious core. The upstream and downstream slopes of the rockfill are stable at 1.75 horizontal to 1 vertical.

(5) Rip Rap -- a 1000 mm thick layer placed on the upstream face of the dam to provide erosion protection for the rockfill against wave action.

(6) Unwatering -- during construction of the dam the flow of Devils Knob Brook will have to be diverted around the site to permit construction of the central (brook) portion of the dam in the dry. These unwatering works include:

- a 5 metre wide rock channel approximately 120 metres long and approximately 3 metres deep.

(7) Grouting -- will provide a grout cut-off curtain benearth the dam.

(8) Control Structure is essentially a gated steel conduit running through the dam. It is designed to pass at low supply level 90% of the firm flow required at the plant. The 1.25 metre diameter sluice gate will be enclosed in a 3 m x 3 m x 9 m deep concrete well.

The principal elements of the Control Structure are:

(1) sluice gate -- 1.25 metre diameter to control the flow through the conduit.

(2) Conduit -- 1.25 metre conduit approximately 35 m long through the dam.

(3) Intake -- Bellmouth intake encased in reinforced concrete.

(4) Well -- reinforced concrete wet well located in the centre of the dam.

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W. O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION

The principal elements of the Control Structure are: (con't

(5) Anchor Block -- a concrete block will be located at the downstream end of the conduit.

(C) Spillway is an overflow spillway located in the westerly abutment. It will have a maximum height of 2 metres, a crest elevation of 102 metres and a crest length of 100 metres. The spillway is designed to pass the 1:1000 year flood with the headpond reservoir at full supply level.

The principal elements of the spillway are:

(1) Concrete weir -- The crest is essentially a concrete overflow weir founded on bedrock.

(2) Concrete abutments -- wing walls will be constructed to protect the dam during times of spilling.

HYDRO
NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W.O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION

DRY POND CUT-OFF DAM

General

The dam will be a homogeneous earthfill structure located 1.5 kilometres southwest of Dry Pond in a low spot on the edge of the lake.

Technical

The structure has a crest elevation of 335.5 metres and is comprised of self supporting elements founded on original ground.

The crest length will be 165 metres and the dam will have a maximum height of 10.0 metres.

PART C SECTION 2

POWER STRUCTURES

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W.O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION
2.102.000	HEADPOND DAM AND INTAKE

General

The structure is located on Devils Knob Brook about 650 metres upstream of the intersection with Grandy Brook.

The dam will be of rolled rockfill type construction with a central core of impervious material. The dam will incorporate an upstream cofferdam which will divert the river flow through an 8.0 m wide rock channel excavated through the southerly abutment. This unwatering channel will be the location of the intake and penstock when the dam nears completion.

Technical

The crest elevation of the dam is 104 metres with a full supply level at 102 metres and a low supply level at 100.0 metres. The maximum height above the river is 11 metres and the crest length is 225 metres. The dam will contain 40,000 cubic metres of material, including 6000 cubic metres of material for the cofferdam.

The intake is essentially a gated steel conduit running through the dam. The bellmouth intake will be a prefabricated steel structure. The structure will be designed to withstand a 230 kN ice tthrust in any direction and will include a trackrack and emergency head gate operating mechanism.

The principal elements of the Headpond Dam are:

(1) Core Trench -- excavated to bedrock or acceptable impervious material. It has a minimum width of half the height of the dam and is backfilled to the stripped ground level with impervious glacial fill.

(2) Impervious core -- placed above and integrally with the core trench to a maximum elevation of 103.50 m. The core has a top width of 3.59 m below which the upstream and downstream faces are sloped at 1 horizontal to 4 vertical to the prepared core trench fill.

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

W. O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

FACILITY STRUCTURE GENERAL DESCRIPTION

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION

The principal elements of the Headpond Dam are: (continued)

(3) Filters -- upstream and downstream of the impervious core a 2000 mm thick fine filter zone is provided as a transition zone between the core and a coarse filter zone which is also 2000 mm thick and provided as a transition zone between the fine filter zone and the rockfill shell of the dam.

(4) Rockfill -- will provide a rockfill shell necessary for the stability of the central impervious core. The upstream and downstream slopes of the rockfill are stable at 1.75 horizontal to 1 vertical.

(5) Rip Rap -- a 1000 mm thick layer placed on the upstream face of the dam to provide erosion protection for the rockfill against wave action.

(6) Unwatering -- during construction of the dam the flow of Devils Knob Brook will have to be diverted around the site to permit construction of the central (brook) portion of the dam in the dry. These unwatering works include:

- an 8 metre wide rock channel approximately 150 metres long and approximately 6 metres deep.

(7) Grouting -- will provide a grout cut-off curtain beneath the dam.

(8) Steel intake -- a rectangular shaped bell with a conical transition piece to transform the rectangular intake into a circular exit 1.83 metres in diameter.

(9) Well -- reinforced concrete wet well located in the dam.

(10) Auxiliary Building -- a prefabricated steel building measuring 4 m x 4 m, insulated and heated is provided over the wet well. This building will provide space for the water level measuring equipment, gate control equipment and anti-vacuum vent.

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W. O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION
2.103.000	HEADPOND OVERFLOW SPILLWAY AND BRIDGE

General

The structure is located on the extreme southerly edge of the headpond reservoir. It will be formed by making a low concrete weir at the top of the saddle. A 100 metre wide approach and exit channel will convey the floor down to Grandy Brook.

A structural steel bridge with wood decking and concrete abutments will be incorporated into the construction of the spillway.

The principal elements of the bridge are:

(1) Structural Steel - the bridge consists of five 20 metre spans. Each span is composed of two I-beam on crete piers.

(2) Wood Decking - the substructure will be decked with timber and a guardrail will will be provided.

Technical

The overflow spillway will have a crest elevation of 102.0 metres and a crest length of 100.0 metres. The maximum height of the dam spillway will be 1.0 metres and will require 170 cubic metres of concrete.

The principal elements of the Spillway are:

(1) Concrete weir - essentially a concrete wall founded on competent bedrock.

)2) Dowels - includes drilling of holes and the supply and placing of dowels and grout.

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W. O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION
2.104.000	LOW PRESSURE PIPELINE AND PENSTOCK

General

The low pressure pipeline will be of welded steel construction and will be buried for the total length. The high pressure penstock will be of welded steel construction and also will be buried for the total length. Anchor blocks will be located at strategic positions along the route. The pipeline and penstock will be externally coated with a zinc primer and vinyl paint.

Technical

The low pressure pipeline will have a 1.83 metre diameter, a thickness of 6 mm and will be 460 metres in length. The high pressure penstock will have a 1.83 metre diameter, a thickness of 12 mm and will be 230 metres long.

The principapal elements of the low pressure pipeline and penstock are:

(1) Trench -- excavated to twice the width of the pipeline and depth as required to suite the grade.

(2) Select Backfill -- placed underneath and immediately next to the pipeline.

(3) Low pressure pipeline -- welded steel construction, 460 metres long.

(4) High pressure penstock -- welded steel construction, 230 metres long.

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W.O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION
2.105.000	

SURGE TANK

General

The tank will be located at the edge of the hill before the point where the penstock plunges to the powerhouse. It is the elevated tank type and is designed to limit pressure fluctuations in the pipeline/penstock.

Technical

The surge tank will be constructed on concrete foundations anchored to bedrock. The height of the tank will be 13.7 metres and it will have a diameter of 1.83 metres. The tank will be of a welded steel construction and will be heated to prevent freezing.

The principal elements of the surge tank are:

(1) Rock Excavation -- includes the removal and disposal of rock to form a level area for construction of the tank.

(2) Concrete Foundation -- supply and placing of concrete for the surge tank foundation.

(3) Surge Tank -- welded steel tank 1.83 m diameter x 13.7 m high.

(4) Heating System -- two heaters, circulating pumps, valves, piping and appurtenances providing 100% back-up.

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W. O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION
2.106.000	POWERHOUSE AND TAILRACE

General

The powerhouse will be located approximately 65 metres upstream of Grandy Brook. It will be set back in towards the bottom of the hill to minimize the length of penstock and to be protected from maximum flood levels expected in Grandy Brook.

The powerhouse will house two units with provision for a third and will have water and sewerage facilities and lunchroom facilities.

The building will be a prefabricated metal building.

The tailrace will be excavated to meet the most southerly branch of Devils Knob Brook. An overflow weir will be located on an existing outcrop at the end of the tailrace.

Technical

The powerhouse will be a prefabricated metal building measuring 15 m wide x 19 m long x 6 m high. The powerhouse will have a structural steel superstructure metal cladding and metal roof. The tailrace will be excavated to a depth of 2 metres for a length of 11 metres.

The powerhouse will have a floor elevation of 10 metres. The powerhouse will be equipped with 2 horizontal Francis turbines capable of an output of 2600 kW each, operating under a net head of 88 metres and a rated flow of 3.4 cubic metres per second. The powerhouse will have a standby diesel generator system, service air system, fire protection system, and powerhouse crane.

The powerhouse includes a battery room, washroom, office, lunchroom, storage and service bay.

The area around the powerhouse will be graded and landscaped.

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W. O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION
2.107.000	SWITCHYARD General The switchyard will be located to the south of the power-house on an existing level area. The switchyard will consist of one (1) 6.5/8.7/10.8 MVA, 69/4.16 kV transformer and transmission line termination structures. The structures will be constructed on concrete foundations and the yard will be fenced with 2.4 metre high chain link fence. Technical The main power transformer will be a 6.5/8.7/10.8 MVA, 69/4.16 kV grounded WYE/DELTA 60 Hz, 3-phase, 350 kV BIL for the H.V. winding and 50 kV BIL for the L.V. winding. This includes off-load tap changer, one 4.16 kV Current Transformer phase and one Neutral Current Transformer. The main power cables will be 5000 volt, 3 conductor Tech cable, 250 and 500 MCM.

PART C SECTION 3

TELECONTROL

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W. O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION
3.100.000	TELECONTROL General This item involves the Dry Pond Communications and SCADA. This will provide direct comunication between Dry Pond and Burgeo to maintain system safety and security.

PART C SECTION 4

PERMANENT SUPPORT

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W.O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE ___ REV. No. ___

ACCOUNT No.	DESCRIPTION
4.100.000	PERMANENT ACCESS ROAD

General

Permanent Access Raods will be built between the (1) Burgeo Highway and Dry Pond Dam and (2) Burgeo Highway and the Powerhouse. The road is to be constructed through difficult terrain and will be of a low profile construction. Every effort has been done to maintain the most practical grades.

Technical

The 3.2 kilometres of Permanent Access Road between the Burgeo Highway and the Powerhouse will be constructed with a 6.0 m gravel driving surface. Road drainage crossings will be accmplihsed by various C.M.P. culverts as required and by one concrete abutment, steel beam, wood deck bridge.

The 12.2 kilometers of Permanet Access Road between the Burgeo Highway and the Dry Pond Dam will be constructed with a 5.0 m gravel driveway surface. Road drainage crossings will be accomplished by various C.M.P. culverts as required and by two large diameter C.M.P. culvert crossings and one timber crib abutment, steel beam and wood deck bridge at the major streams.

Both roads will be construced with a 0.4 m rockfill subbase, 0.2 m base course and 0.1 m topping course to the required widths.

PART C SECTION 5

TEMPORARY SUPPORT FACILITIES

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W.O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION
5.000.00	TEMPORARY SUPPORT FACILITIES General Temporary Support Facilities is limited only to roads to borrow pits and structures.

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W.O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE ___ REV. No. ___

ACCOUNT No.	DESCRIPTION
5.193.000	

TEMPORARY ACCESS ROADS

General

(1) Access Roads to Borrow Pits

Borrow Access Roads provides for the construction and maintenance to selected borrow pits located near the permanent access road and structures.

(2) Access Road to Dry Pond Cut-off Dam

Temporary Access Raod provides for the construction and maintenance of that structure only.

Technical

The 4.0 kilometres of Temporary Access Roads will consist of 2.0 kilometres between the Dry Pond Dam and the Dry Pond Cut-off Dam as well as 2.0 kilometres between the Main Access Road and the various borrow areas. Included also is a timber crib, steel beam, wood deck bridge across Devils Knob Brook to gain access to a major borrow area.

Both roads will be constructed to a width of 4.0 m and will consist of 0.4 m of rockfill, 0.2 m of base course and 0.1 m of topping.

PART C SECTION 6

MANAGEMENT AND ENGINEERING

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W.O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION
6.000.000	MANAGEMENT AND ENGINEERING Project engineering and management direct and indirect costs are established to meet the demands of the project. Engineering and management direct costs include the cost of office design, field engineering and construction supervision and job administration. Indirect costs consist mainly of design office and field office expenses and the cost of board and lodging of field personnel during construction. The management and engineering costs are established on a basis of a simple project organization chart as shown in Appendix B, table 1.

NEWFOUNDLAND AND LABRADOR HYDRO

W.O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

FACILITY STRUCTURE GENERAL DESCRIPTION

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION
6.190.000	GENERAL SERVICES Includes for such items as communications,(office and field) photographs, field investigations and bonding.

NEWFOUNDLAND AND LABRADOR HYDRO

W.O. No. 1291 PAGE ___ OF ___

PROJECT GULL POND BROOK DEVELOPMENT

FACILITY STRUCTURE GENERAL DESCRIPTION

DATE ___ REV. No. ___

ACCOUNT No.	DESCRIPTION
6.191.000	CONSTRUCTION SITE SERVICES Includes provision for safety, medical, security, vehicles, office buildings, furnishing and equipment.

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W. O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION
6.192.000	PERSONNEL ACCOMMODATIONS Provides for purchase, set-up and maintenance of trailers. Cost under M & E include development of site and all services, however, it may be more feasible to have the main civil contractor provide these services as he will be providing his own services. This will be reviewed during final design. Technical Trailers -- 8 standard trailer units, 5.25 m x 20.75 m.

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

W. O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

FACILITY STRUCTURE GENERAL DESCRIPTION

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION
6.193.000	ENGINEERING AND MANAGEMENT MANHOURS Provides for all manhours associated with Office Design, Job Administration, Field Engineering and Construction Supervision. Costs are established on a basis of an estimate of Management and Engineering manhours as shown in Appendix B, table 2.

PART C SECTION 7

OWNERS ADMINISTRATION

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W. O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION
7.000.000	OWNERS'S ADMINISTRATION Includes: (a) Corporate Overheads Hydro's planned charges against the project to defray all services related, but not restricted, to corporate planning; financial assistance and financing; cheque writing; Internal legal counsel; Operations Assistance and co-ordination and endorsement of project design concepts, etc. (b) Owner's Costs Owner's costs include the cost of Engineering and Construction Division cost during design and construction of the project and cost of the Engineering Feasibility Study.

PART C SECTION 8

ESCALATION

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W. O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION
8.000.000	ESCALATION This section covers the escalation cost for the project using January 1982 as the base and escalated in accordance with the following rates: 1982 - 11% 1983 - 10.5% 1984 - 10.5%

PART C SECTION 9

INTEREST DURING CONSTRUCTION

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W. O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION
0.000.000	INTERST DURING CONSTRUCTION Interest during construction is calculated on the basis of the project cost flow of expenditures on construction, equipment purchases and engineering costs taking into account, holdbacks which apply on construction and equipment contracts.

PART C SECTION 10

CONTINGENCY

HYDRO NEWFOUNDLAND AND LABRADOR HYDRO

FACILITY STRUCTURE GENERAL DESCRIPTION

W. O. No. 1091 PAGE ___ OF ___

PROJECT DRY POND BROOK DEVELOPMENT

DATE _____ REV. No. _____

ACCOUNT No.	DESCRIPTION
10.000.000	Contingency The contingency is an allowance to cover unexpected expenditures which maybe encountered during the execution of the project. A contingency of 10% has been allowed based on the total of direct Construction costs, Management and Engineering costs and Owner's costs. (less the cost of the feasibility study)

PART D COST AND CASH SCHEDULES

SECTION 1 - COST AND CASH FLOW REQUIREMENTS

PREPARED BY: J. J. Carnell

APPROVED BY:

CAPITAL COST ESTIMATE & CASH FLOW REQUIREMENTS

1982-84 FISCAL YEAR, PREPARED 1982-02-02

($'s x 1,000)

DRY POND HYDRO DEVELOPMENT

(Project Description)

PERIOD	Capital Cost Estimate (Budget)												
	Energy Structures	Power Structures	Telecontrol	Permanent & Temporary Supports	Management and Engineering	Owner's Cost	Contingency	Escalation	Corporate Overheads	SUB-TOTAL	IDC	TOTAL PROJECT	CASH FLOW "Excl. IDC"
PRIOR YR. END													
1982 Jan.													
Feb.													
Mar.													
Apr.													
May	-	-	-	-	10	115	-	-	-	125	-	125	115
June	-	-	-	-	70	10	-	-	-	80	2	82	20
July	-	7	-	247	45	5	30	21	1	356	2	358	87
Aug.	-	21	-	590	70	5	69	54	1	810	3	813	61
Sep.	-	191	-	365	66	5	64	56	4	751	6	757	382
Oct.	-	-	-	290	39	5	33	33	8	408	14	422	809
Nov.	68	-	-	297	47	5	42	46	7	512	24	536	701
Dec.	-	-	-	-	10	5	2	2	5	24	31	55	436
TOTAL	68	219	-	1789	357	155	240	212	26	3066	82	3148	2611
1983 1st Qtr.	-	548	-	-	155	15	73	97	14	902	130	1032	1313
2nd Qtr.	740	2302	40	225	934	15	426	756	20	5458	175	5633	1779
3rd Qtr.	1851	3601.5	40	-	635	15	615	1248	77	8082.5	348	8430.5	7479
4th Qtr.	-	510	40	-	143	15	71	171	53	1003	655	1658	4694.5
TOTAL	2591	6961.5	120	225	1867	60	1185	2272	164	15,455.05	1308	16753.5	15265.5
BEYOND	-	778.5	76	-	174	15	105	283	30	1461.5	726	2187.5	2096.5
TOTAL PROJECT	2659	7959	196	2014	2398	230	1530	2767	220	19973	2116	22089	19973

SECTION 2 - CASH FLOW ESTIMATE

PARED BY J. J. Carnell

ROVED BY

JECT DESCRIPTION DRY POND HYDRO DEVELOPMENT

CASH FLOW ESTIMATE
1982 FISCAL YEAR

PAGE 1 OF 3

DATE 1982-02-02

ACCOUNT DESCRIPTION	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
Energy Structures					-	-	-	-	-	-	-	-	-
Power Structures					-	-	-	-	7	21	171	20	219
Telecontrol					-	-	-	-	-	-	-	-	-
Permanent & Temporary Support					-	-	-	-	247	590	365	290	1492
Sub-Total Direct Construction.					-	-	-	-	254	611	536	310	1711
Management & Engineering					-	10	70	45	70	66	39	47	347
Owner's Costs					115	10	5	5	5	5	5	5	155
Sub-Total					115	20	75	50	329	682	580	362	2213
Contingency					-	-	8	5	33	68	58	36	208
Escalation					-	-	3	5	16	51	56	33	164
Sub-Total					115	20	86	60	378	801	694	431	2585
Capitalized Expense 1%					-	-	1	1	4	8	7	5	26
Total Cash Flow					115	20	87	61	382	809	701	436	2611
Interest During Construction					-	2	2	3	6	14	24	31	82
Total Cost					115	22	89	64	388	823	725	467	2693
Accumulated Cash Flow					115	135	222	283	665	1474	2175	2611	

PREPARED BY J. J. Carnell

APPROVED BY

PROJECT DESCRIPTION DRY POND HYDRO DEVELOPMENT

CASH FLOW ESTIMATE
1983 FISCAL YEAR

PAGE 2 OF 3.
DATE 1982-02-02

ACCOUNT DESCRIPTION	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
Energy Structures	61.0	7.0	-	-	-	-	92.0	648	615	980	230	26	2659
Power Structures	-	520	-	28	-	520	610	1172	1635	1439.5	602	32	6558.5
Telecontrol	-	-	-	-	40	-	-	40	-	-	40	-	120
Permanent & Temporary Support	267	30	-	-	-	-	150	67	8	-	-	-	522
Sub-Total Direct Construction.	328	557	-	28	40	520.	852	1927	2258	2419.5	872	58	9859.5
Management & Engineering	10	50	50	55	291	418	225	260	215	160	46	35	1815
Owner's Costs	5	5	5	5	5	5	5	5	5	5	5	5	60
Sub-Total	343	612	55	88	336	943	1082	2192	2478	2584.5	923	98	11734.5
Contingency	34	61	6	9	34	94	108	219	248	258	92	10	1,173.0
Escalation	64	114	10	16	63	176	202	410	463	483	173	20	2,194.0
Sub-Total	441	787	71	113	433	1213	1,392	2,821	3,189	3,325.5	1,188	128	15,101.5
Capitalized Expense 1%	5	8	1	2	5	13	15	29	33	35	14	4	164.0
Total Cash Flow	446	795	72	115	438	1,226	1,407	2,850	3,222	3,360.5	1,202	132	15,265.5
Interest During Construction	36	44	50	52	56	67	85	112	151	194	225	236	1,308.
Total Cost	482	839	122	167	494	1293	1,492	2,962	3,373	3,554.5	1,427	368	16,573.5
Accumulated Cash Flow	3,057	3,852	3,924	4,039	4,477	5,703	7,110	9,960	13,182	16,542.5	17,744.5	17,876.5	

PREPARED BY J. J. Carnell

APPROVED BY

PROJECT DESCRIPTION DRY POND HYDRO DEVELOPMENT

CASH FLOW ESTIMATE
1984 FISCAL YEAR

PAGE 3 OF 3

DATE

ACCOUNT DESCRIPTION	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
Energy Structures	-	-	-	-	-	-	-	-	-	-	-	-	-
Power Structures	29.0	374.0	263.0	329.0	166.5	20.0							1,181.5
Telecontrol	-	60.0	-	16.0	-	-	-	-	-	-	-	-	76.0
Permanent & Temporary Support	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub-Total Direct Construction.	29.0	434.0	263.0	345.0	166.5	20.0	-	-	-	-	-	-	1,257.5
Management & Engineering	62	67	58	49	-	-	-	-	-	-	-	-	236
Owner's Costs	5	5	5	-	-	-	-	-	-	-	-	-	15
Sub-Total	96	506	326	394.0	166.5	20							1,508.5
Contingency	10	51	33	36	17	2							149.0
Escalation	26	137	89	106	46	5							409.0
Sub-Total	132	694	448	536	229.5	27							2,066.5
Capitalized Expense 1%	4	9	7	8	2	-							30
Total Cash Flow	136	703	455	544	231.5	27							2,096.5
Interest During Construction	234	241	251	-	-	-							726.0
Total Cost	370	944	706	544	231.5	27							2,822.5
Accumulated Cash Flow	18,012.5	18,715.5	19,170.5	19,714.5	19,946.	19,973							

APPENDIX A

GEOTECHNICAL INFORMATION

A-1 Report on Preliminary Geotechnical Reconnaissance. Dry Pond Hydro Development.

A-2 Proposed Dry Pond Hydro Development Visual Classification of Soil Samples.

REPORT ON PRELIMINARY GEOTECHNICAL RECONNAISSANCE
DRY POND HYDRO DEVELOPMENT

DRY POND STRUCTURES

(a) Main Dam

Dry Pond Brook has cut a channel 5 to 7 m into bedrock below the general plateau level at this location. The adjacent plateau exhibits little relief with shallow organic cover bedrock, very little overburden present and scattered boulders. Along the west leg of the dam several shallow bedrock ridges oriented at 20 to 25° Az are evident, while east of the brook the bedrock outcrops are typically rectangular in shape.

Bedrock comprises biotite and porphyritic granite which is massive and slightly weathered but contains well developed joint system. The principal sets are near-vertical, oriented at 135 to 150° Az, and at 35° Az dipping at about 75° southeast. A sub-horizontal joint set, which is not continuous, dips slightly westward but is only visible along the stream banks. The joints are for the most part moderately spaced and typically about 25 mm wide at the ground surface but have opened along the stream banks.

Along the proposed dam axis an overhung bedrock cliff about 7 m high forms the east wall of the brook. Loose rock blocks are present on the face of the cliff and at the toe. Upstream at the cofferdam location the rock cliff height decreases to about 4 m and it is partially covered with vegetation. Along the west side of the brook the bedrock surface slopes moderately and is covered with shallow overburden and a few surface boulders near the dam axis. Upstream at the proposed cofferdam a rock cliff about 5 m high exists. Downstream from the main dam axis the valley widens abruptly into the west bank of the brook. The stream bed contains numerous boulders.

Topographic and foundation conditions are generally suitable for the structures proposed. The competent bedrock will provide excellent support but foundation preparation comprising grouting and dental concrete will be required to reduce seepage losses. Removal of some rock at the east abutment will also be necessary.

(b) Overflow Weir/Spillway

This structure will be supported directly on competent bedrock beneath the shallow organic material. Some dental concrete is required.

(c) Cut-off Dam

This structure will extend across a small valley cut in a glacio-fluvial deposit with moderate relief. No bedrock outcrop is obvious, and the subsurface conditions apparently comprise a shallow organic layer underlain by fine to medium sand of moderate depth.

Foundation conditions appear generally suitable for the moderate structure proposed, but a cutoff will be necessary to minimize underseepage in the foundation soils of medium permeability.

(d) Future Shoreline Erosion/Sedimentation

Erosion of soil along the future shoreline of Dry Pond at full supply level is not expected to be significant. The major portion of the shoreline will be located in areas underlain by sand or shallow glacial drift over bedrock. Soils with a substandial silt or clay content are not prevalent and sedimentation problems are thus not anticipated. In addition runoff flow velocities towards the pond will be generally low over the gently sloping terrain which predominates.

HEAD POND

(a) Spillway

The low spillway structure will be supported directly on conpetent granite bedrock. Spillway excavation will require the removal of shallow organic material and bedrock.

(b) Dam

This site is underlain by competent granite bedrock which is widely exposed in the stream bed. At the south end of the dam a prominent bedrock shoulder is overlain by shallow organic cover. At the north abutment shallow overburden and organic not overlies the gently sloping bedrock. Dry Pond Brook plunges over the crest of a falls immediately downstream from the dam site. The stream bed contains frequent boulders and rock blocks in addition to the exposed bedrock.

The granite bedrock is generally massive, slightly to moderately weathered and contains several well-developed joint sets. The principal joints are near-vertical and strike at about 8°, 68° and 104° Az. Another prominent set is sub-horizontal and dips about 5° Northwest. The joints typically vary in width from 25 to 75 mm at the surface, and are usually debris-filled. At some locations separation of the rock blocks has occurred and the joints are open. Joint spacing is typically 0.6 to 1.5 m.

The competent bedrock will provide excellent support for the structure with rock abutments on both sides of the stream. Foundation preparation including grouting and dental concrete will be required to minimize underseepage. Suitable foundation conditions apparently exist for the upstream cofferdam also, although bedrock exposures are not as obvious in the streambed. In view of the promimity of the crest of the waterfall to the downstream toe of the dam it is suggested that consideration be given to moving the southerly end of the dam axis towards the east 20 to 30 m although embankment quantities will be increased somewhat.

PIPELINE/PENSTOCK/SURGE TANK

(a) The initial 300 m of the pipeline route traverses terrain of moderate cross slope with shallow overburden and organic cover over bedrock. Rock outcrop is infrequent. Vegetation along this section comprises grasses and low bushes while on steeper sections of the valley slope spruce trees of low to moderate height are present.

Beyond Stn 300 the cut line examined for the pipeline and penstock traverses moderately to steeply-sloping but rugged terrain. Separated rock blocks, boulders and bedrock outcrops are common, and overburden is shallow or not present. At several locations this route passes adjacent to and above steep slope sections where the surface materials appear marginally stable. These areas are localized, however, and no indication of general instability of the valley wall was observed. On the basis of a preliminary examination the majority of these potentially unstable areas can be avoided by moving the penstock alignment about 20 m south of the cut line from about Stn 470 to the powerhouse site. With this realignment stable support for the pipeline and penstock will be provided using conventional designs and construction practices. Excavation and fill sections will be required along this route to provide adequate support and a suitable grade along the penstock.

(b) Surge Tank

A suitable topographic location for the surge tank was identified subject to hydraulic requirements. Foundation support on competent bedrock at this or a nearby site will be available for this structure.

POWERHOUSE

Competent biotite granite bedrock is at shallow depth in the vicinity of the proposed powerhouse location near the southerly exit of Day Pond Brook into Grandy's Brook. Bedrock exposures

are present along the south shoreline of Dry Pond Brook and the easterly shoreline of Grandy's Brook near this intersection, and about 50 m downstream from this point along Grand's Brook. The bed of Dry Pond Brook in this area is comprised of numerous medium to very large boulders and rock blocks. At the powerhouse site the bedrock is overlain by shallow granular overburden and small to medium boulders. Vegetative cover is continuous and comprises conifers of low to medium height and alder bushes.

The coarse-grained biotite granite is generally massive and slightly to moderately weathered but exhibits a well developed joint system. Prominent joints strike to 85 to 92° Az with a near-vertical dip and at about 13° Az dipping about 75° East. Joint spacing is typically 1 to 2 m although closer occasionally. At the surface joint openings are generally 25 to 50 mm and filled with debris but some are tight. A granitic dike about 400 mm wide was noted along the shoreline of Grandy's Brook striking about 13° Az with a dip angle of about 75° East.

The bedrock will provide excellent foundation support for the powerhouse. Relatively steep excavation slopes are possible for the most part and dewatering should be relatively straight forward.

ROADS/MATERIALS

(a) Powerhouse Access Raod

The permanent access road to the pwoerhouse will traverse an area of shallow overburden and organic material overlying bedrock from the highway to the Headpond Dam. From this location to the powerhouse it must negotiate the mderately to steeply sloping terrain in the vicinity of the pipeline/penstock. Between the surge tank and the powerhouse selection of the alignment must consider the localized areas of potential surface instability in addition to the terrain slope variations. Throughout the length of this access road materials suitable for embankment fill are very scarce apart from the excavated bedrock which will be quite suitable.

(b) Construction Roads

Substantial deposits of fine to medium sand are present along the routes being considered for construction access to Dry Pond. Visual examination of several test pits indicate that these materials should be suitable generally for embankment construction, but will be difficult to handle in wet weather, and are not suitable for road surfacing. The final construction road alignment should be selected in consideration of the location of material sources, particularly with reference to select materials for embankment construction as noted in the following section.

(c) Embankment Materials

With present information regarding soil materials available in the site development area it appears that impervious borrow, and clean, well-graded granular materials suitable for road surfacing and filter zones are relatively scarce.

The results of a visual examination and classification of soil samples collected by Hydro personnel are presented in the Appendix. The general suitability of these materials has been indicated on the basis of this preliminary classification. More definitive comments regarding material suitability will be made after the results of conventional laboratory index tests are available.

In summary the majority of the samples examined comprise fine to medium sand or sand and silt. The finer grained soils are moderately impervious and acceptable as dam core material but will require wide sections for suitable performance. The fine to medium sand is suitable as general embankment fill and road subgrade but will be difficult to place and compact during periods of precipitation. No deposits of good-quality impervious fill were sampled. Select granular material suitable for granular filter zones and road surfacing were sampled at several localized areas in addition to the major esker deposits and near existing gravel pits.

The bedrock underlying virtually the whole development area will provide an excellent source of rockfill for dam construction, riprap and concrete aggregate.

ADDITIONAL GEOTECHNICAL INVESTIGATIONS

Additional field data will be necessary for final design and costing for this project. As requested, recommendations for additional geotechnical investigation are presented herein based on the conditions observed. Most areas of the site are accessible to a backhoe mounted on a muskeg carrier, but boreholes will be required to adequately assess the dam foundation conditions.

1. Headpond Spillway - Test pits or rock probes on 20 m grid.

2. Headpond Dam - Three to four sampled boreholes with water pressure test to determine bedrock characteristics, supplemented by test pits. Geological mapping.

3. Pipeline/Penstock Route - Test Pits and/or rock probes at 50 m spacing to surge tank, visual examination of final penstock alignment.

4.	Surge Tank	- Visual examination supplemented by test pits.
5.	Powerhouse	- One sampled borehole to confirm bedrock.
6.	Tailrace	- Visual examination. Bedrock probes.
7.	Dry Pond Dam and Control Structure	- Three to four sampled boreholes with water pressure tests to evaluate bedrock characteristics near stream, supplemented by about six test pits. Geological mapping.
8.	Dry Pond Cut Off Dam	- Three sampled boreholes to evaluate foundation soil and bedrock characteristics.
9.	Borrow Areas	- Four to six machine - dug test pits per deposit to confirm quantities, with routine laboratory tests to determine index and engineering properties.
10.	Access Roads	- Visual examination and surface mapping.

In view of the apparent scarcity of impervious and good quality borrow materials within the development area it is suggested that a review of available data and aerial photograph s be undertaken after laboratory test results are available. From this review a planned investigation program for a more detailed evaluation of available materials would be developed.

APPENDIX A-2

PROPOSED DRY POND HYDRO DEVELOPMENT
VISUAL CLASSIFICATION OF SOIL SAMPLES

General

(a) Soils classified by Unified Soil Classification System (Modified).

(b) Soils identified in a particular use category are generally not suitable in a higher category as listed in code below.

(c) E-type soils will typically be difficult to place and compact when wet.

(d) I-type soils will be unsuitable for general embankment construction because of susceptibility to distrubance when wet.

(e) Soils classified SM are moderately to slightly frost susceptible.

SUITABILITY CODE

F - Filter or Select Granular

R - Road Surfacing

E - Embankment Fill

I - Semipervious to Relatively Impervious

1 - Suitable

2 - Acceptable - possibly requiring minor processing.

3 - Probably Acceptable with considerable processing.

PROPOSED DRY POND HYDRO DEVELOPMENT
VISUAL CLASSIFICATION OF SOIL SAMPLES

ea	PIT No.	Sample No.	Depth (m)	Description (Visual)	USC Class. (Visual)	Suitability Preliminary
st de c. y	1	DPB-007	1.8	SAND/SILT - fine sand, tr. medium sand, occ. med. gravel sizes, lt. brn.	SM	I-2
	2	DPB-008	0.5	SAND - fine, some silt, reddish brn.	SM	E-1
rock d	2	DPB-008	2.4	SAND/SILT - fine sand, tr. med. sand, lt. brn.	SM	I-2
	3	DPB-009	0.5	SAND - fine, some medium, some silt, trace organics, dk. brn.	SM	E-1
	3	DPB-009	2.4	SILTY SAND - fine to med. sand, tr. coarse sand, tr. gravel, lt. brn.	SM	I-2
rock d						
	1	DPB-001	0.6-0.9	SAND - fine to medium, tr. silt, tr. fine gravel, lt. brn.	SW	F-2
	1	DPB-001	1.5	SAND & GRAVEL - tr. silt, well graded, fine sand to coarse gravel, reddish brn.	SW-GW	(F-2 (R-2
	1	DPB-001	2.4	SAND & GRAVEL - tr. silt, well graded, fine sand to coarse gravel, med. brn.	SW-GW	(F-2 (R-2
	2	DPB-002	0.6	SAND - some silt, some gravel, well graded, tr. organics, dr. brn.	SM	R-2

PROPOSED DRY POND HYDRO DEVELOPMENT
VISUAL CLASSIFICATION OF SOIL SAMPLES

ce	PIT No.	Sample No.	Depth (m)	Description (Visual)	USC Class. (Visual)	Suitability Preliminary
nrock nd	2	DPB-002	2.4	SAND/SILT - fine sand, tr. med., tr. gravel, moist, lt. brn.	SM	I-2
	3	DPB-003	0.6	SAND - fine, some medium sand, some silt, reddish brn.	SM	E-1
	3	DPB-003	2.4	SILTY SAND - fine to med. sand, tr. coarse sand, lt. brn.	SM	I-2
nrock nd	1	DPB-004	0.6	SAND/SILT - fine sand, tr. med. to coarse sand, lt. brn.	SM	I-2
	1	DPB-004	2.4	SAND - fine to med., tr. - some silt, some gravel, reddish brn.	SP-SM	E-1
	2	DPB-005	0.6	SAND - fine to med., some silt, tr. gravel, wet, reddish brn.	SM	E-1
avel t at nrock nd		DPB-006	2.1	SILTY SAND - fine, tr. med. to c. sand, tr. gravel, lt. brn.	SM	I-2
hind . Pit 5 km. . Road Dry nd				SANDY GRAVEL - tr. silt, well graded, fine sand to coarse gravel, lt. brn.	GW	(F-2 (R-2
				SAND - fine to med., tr. coarse, tr. gravel, tr. silt, lt. brn.	SW	F-2

PROPOSED DRY POND HYDRO DEVELOPMENT
VISUAL CLASSIFICATION OF SOIL SAMPLES

ea	PIT No.	Sample No.	Depth (m)	Description (Visual)	USC Class. (Visual)	Suitability Preliminary
t ottage) e side y at cess . to y Pond	'A'	DPB-026		SAND & GRAVEL - tr. silt, well graded med sand to med gravel, brn. red.	GW-SW	(F-2 (R-2
	'B'	DPB-027		SANDY GRAVEL - fine to coarse, fine to med. sand, tr. silt, well graded.	GW	(R-2
	1	DPB-028		SAND & GRAVEL - tr. silt, well graded, med. sand to c. gravel, brn.	GW-SW	(R-2 (R-2
t # 1	1	DPB-029	1.5	SAND - fine to med. some silt, lt. brn.	SM	E-1
t # 1	2	DPB-030	1.5	SAND/SILT - fine sand, tr. med., tr. gravel, moist, lt. brn.	SM	I-2
t # 2	1	DPB-031	1.2	SAND/SILT - fine sand, tr. med., moist, lt. brn.	SM	I-2
t # 2	2	DPB-032	1.5	SAND - fine, tr. med. to course, some silt, lt. brn.	SM	E-1
t # 2	3	DPB-033	1.2	SAND - fine, some med., tr. coarse, tr.	SP-SM	E-1
t # 3	East End	DPB-010	1.5	SAND/SILT - fine sand, tr. med., tr. gravel, lt. brn.	SM	I-2
t # 3	West End	DPB-011	1.5	SAND - fine to medium, tr. coarse, some gravel, tr. silt, brn.	SW	F-2
t # 3	1 middle	DPB-012	1.5	SAND/SILT - fine sand, tr. med., tr. to some gravel, moist, lt. brn.	SM	I-2

PROPOSED DRY POND HYDRO DEVELOPMENT
VISUAL CLASSIFICATION OF SOIL SAMPLES

	PIT No.	Sample No.	Depth (m)	Description (Visual)	USC Class. (Visual)	Suitability Preliminary
t #4	1	DPB-018	1.5	SAND/SILT - fine sand, some med., tr fine to coarse gravel, lt. brn.	SM	I-2
t #5		DPB-019	1.5	SAND & GRAVEL - fine sand to coarse grave, well graded, tr. silt, brn.	SW	(F-2 (R-2
t #7		DPB-016	1.5	SAND - fine to medium, tr. silt, some gravel, lt. brn.	SP-SW	E-1
t # 8		DPB-014		SAND - fine, some med., some silt, tr. f. med. gravel, lt. brn.	SM	E-1
t # 9		DPB-015	1.5	SAND/SILT - fine, some med., lt. brn.	SM	I-2
t #10		DPB-017	Bot.	SAND/SILT - fine sand, tr. med., lt. brn	SM	I-2
t # 10			0.3	SAND/SILT - fine sand, tr. med., tr. organics, dk. brn.	SM	I-2
ker at de of nd		DPB-023		SAND & GRAVEL - fine sand to coarse gravel, well graded, tr. silt, brn.	GW	(F-2 (R-2
ker	1	DPB-020		GRAVELLY SAND - med. to coarse sand, fine to coarse gravel, well graded, brn.	SW	(F-2 (R-2
ker	2	DPB-021		SAND & GRAVEL - fine sand to coarse gravel, well-graded, med. brn.	SW	(F-2 (R-2
ker ar Pond	3	DPB-024		SANDY GRAVEL - fine sand to coarse gravel, tr. silt, med. brn.	GW	(F-2 (R-2
ker ar Pond		DPB-025		SAND - fine to coarse, some gravel, tr. silt, well-graded, brn.	SW	(F-2 (R-2

PROPOSED DRY POND HYDRO DEVELOPMENT
VISUAL CLASSIFICATION OF SOIL SAMPLES

APPENDIX A-2

Area	PIT No.	Sample No.	Depth (m.)	Description (Visual)	USC Class. (Visual)	Suitability Preliminary
13	1	DPB-036	1.8	SAND & GRAVEL - tr. silt, fine sand to gravel, well-graded, brn.	SW-GW	(F-2 (R-2
13		DPB-037	1.8	SAND - fine, some med. to course, tr. to some silt, tr. gravel, lt. brn.	SP-SM	E-1
13	3	DPB-038	1.5	SAND & GRAVEL - tr. silt, fine to med. sand fine to coarse gravel, well-graded, brn.	SW-GW	(F-2 (R-2
14	1	DPB-039		SAND - fine, some silt, uniform, lt. brn.	SM	E-1
14	3	DPB-040	1.3	SAND - fine, tr. to some silt, uniform, lt. brn.	SP-SM	E-1
15	1	DPB-041		GRAVEL & SAND - med. to coarse sand, fine to med. gravel, tr. fine sand, well-graded, brn.	GW-SW	(F-2 (R-2
15	3	DPB-043		SAND & GRAVEL - tr. silt, fine to med. sand, fine to coarse gravel, well-graded, brn.	SW-GW	(F-2 (R-2
15	7	DPB-046		GRAVEL & SAND - med. to coarse sand, fine to med. gravel, tr. fine sand, well-graded, brn.	GW-SW	(F-2 (R-2
15	12	DPB-051		SAND & GRAVEL - fine to med. sand, fine to coarse gravel, tr. to some silt, well-graded, brn.	SW-SM	(R-2 (F-3
15	14	DPB-053		SAND & GRAVEL - fine to med. sand, fine to coarse gravel, tr. to some silt, well-graded, brn.	SW-SM	(R-2 (F-3

PROPOSED DRY POND HYDRO DEVELOPMENT
VISUAL CLASSIFICATION OF SOIL SAMPLES

APPENDIX A-2

rea	PIT No.	Sample No.	Depth (m)	Description (Visual)	USC Class. (Visual)	Suitability Preliminary
15	15	DPB-054		GRAVEL - sandy, med. to coarse sand, fine to coarse gravel, rel. well-graded, brn.	GW	(F-2 (R-2
16	.2	DPB-059		SAND - fine to med., tr. coarse sand, tr. gravel, some silt, lt. brn.	SM	E-1
16	3	DPB-060		SAND - fine to coarse, some fine to med. gravel, tr. silt, well-graded, med. brn.	SW	F-2
16	4	DPB-061		SAND - fine to coarse, some med. to coarse gravel, tr. silt, rel. well-graded, lt. brn.	SW	F-2
PIT - 1/2 km. S of Hwys. Depot at Peter Stride R.				SAND & GRAVEL - fine sand to coarse gravel, tr. silt, well-graded, brn.	SW-GW	(F-2 (R-2
Road cut - 1/2 km N. of Hwys, Depot at Peter Stride River.				SAND - fine to medium, some coarse, some fine to coarse gravel, tr. to some silt, lt. brn.	SW-SM	(R-2 (F-3

NOTE: Suitability rating assumes that material available has a water content near or less than the optimum value for compaction.

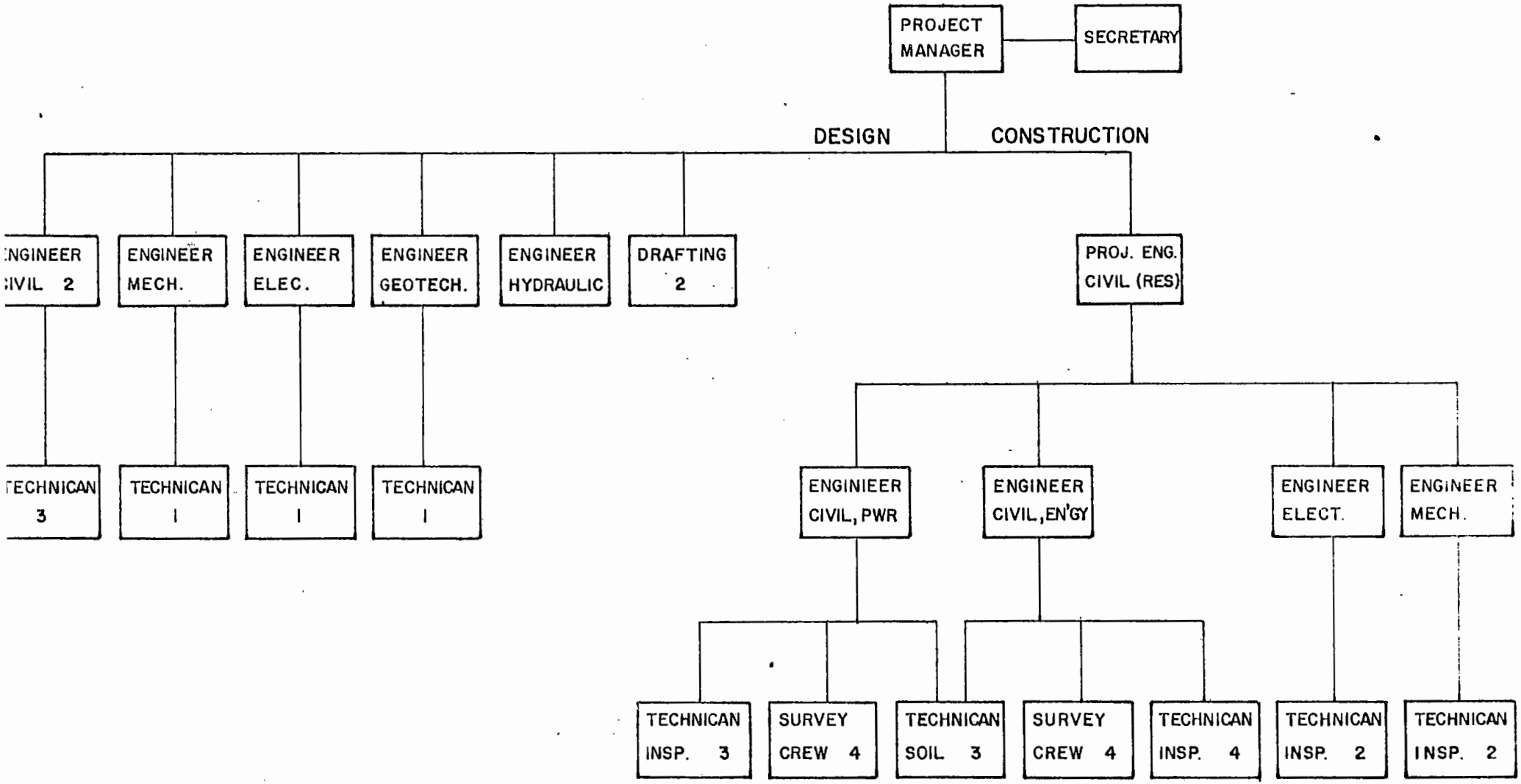
APPENDIX B

MANAGEMENT AND ENGINEERING INFORMATION

(a) Table 1 - M&E Organization Chart

(b) Table 2 - M&E Manhours

M & E -- ORGANIZATION CHART



APPENDIX B, TABLE 2

MANAGMENT AND ENGINEERING MANHOURS

A. Office Design

No.	Classification	Duration (mths)	Hours
1	Project Manager	3	500
1	Secretary	3	500
2	Civil Engineer	3	1000
1	Electrical Engineer	3	500
1	Mechanical Engineer	3	500
4	Technicians	3	1400
2	Draftsmen	3	1000
1	Hydrology Engineer	2	300
1	Geotechnical Engineer	2	300
		TOTAL	6000

B. Field Engineering and Construction Supervision

No.	Classification	Duration (mths)	Hours
(year #1)			
1	Project Engineer	4	600
3	Technician/Insp.	4	1800
4	Survey Crew	4	2400
(year #2)			
1	Project Manager	12	1800
1	Secretary	12	1800
1	Project Engineer	12	1800
2	Civil Engineers	6	1800
1	Electrical Engineer	3	500
1	Mechanical Engineer	3	500
3	Soil Inspectors	6	2500
8	Survey Crew	6	7000
11	Technician/Insp.	6	7500
		TOTAL	30,000

C. Job Administration

No.	Classification	Duration (mths)	Hours
1	Project Controller	12	2000
		TOTAL	2000

APPENDIX C

BORROW MATERIAL INFORMATION

C-1 - Material Specification

C-2 - Material Requirements and Source

APPENDIX C-1 - MATERIAL SPECIFICATION

DRY POND HYDRO DEVELOPMENT

A. IMPERVIOUS FILL (Zone 1)

1. Description

Materials for impervious fill shall consist of a well graded glacial till obtained from approved borrow areas. The minus No. 4 size fraction shall contain not less than 20% passing the No. 200 sieve size.

2. Borrow Areas

a) Pit No. 11 will be utilized as a source of material for the Headpond Dam. This material requires no processing for use in the dam.

b) Pits No.s 9 and 10 will be utilized as a source of material for the Dry Pond Dam and the Cut-off Dam. It is anticipated that this material will not require processing prior to use in the structures.

B. FINE FILTER (Zone 2)

1. Description

Filter material shall consist of a well graded, processed, free draining mixture of sand and gravel. The filter material shall range within 40 to 70 percent gravel sizes graded from 75 mm to 10 mm. The remaining minus 10 mm material shall comprise 30 to 60 percent of the material and shall contain not more than 2 percent passing the 200 mesh size.

2. Borrow Areas

Pit No. 15 (Esker) will be utilized as a source of material for the Headpond Dam, Dry Pond Dam and the Cut-off Dam. this material requires washing and screening to remove the silt and oversize material.

C. COARSE FILTER AND GRAVEL (Zone 3)

1. Description

Materials for coarse filter shall consist of a well graded sand and gravel with approximately 20 percent greater than 75 mm and not more than 7 percent passing the 200 mesh size. The maximum size shall be 2/3 the thickness of the lift being placed. (300 mm)

C. COARSE FILTER AND GRAVEL (continued)

2. Borrow Areas

Pit No. 15 (Esker) will be utilized as a source of material for the Headpond Dam, Dry Pond Dam and the Cut-off Dam. This material will require washing and screening to remove the silt and oversize material.

D. ROCKFILL (Zone 4)

1. Description

Materials for rockfill shall consist of particles of hard, durable, dense rock which shall be well graded within the following limits:

MATERIALS SIZE (mm)	PERCENT FINER THAN BY WEIGHT
600	100
300	80-100
50	40-75
25	0-50
12	0-30
3	0-10

Material finer than a No. 100 sieve will not exceed 5 percent by weight of the fraction passing the 500 mm sieve.

2. Borrow Areas

Quarries will be established near structures as required by the contractor.

E. RIP RAP (Zone 5)

1. Description

Rip Rap material shall consist of particles of hard, durable, dense rock which shall be well graded within the following limits:

E. RIP RAP (continued)

MATERIALS SIZE (mm)	PERCENT FINER THAN BY WEIGHT
900	100
600	90-100
300	35-60
50	0-5

Particles less than 2 inches in size shall comprise not more than 5 percent by volume of the material placed.

2. Borrow Areas

Quarries shall be established near structures as required by the contractor.

APPENDIX C-2: MATERIAL REQUIREMENTS AND SOURCE

STRUCTURE ZONE	MATERIAL SOURCE	QUANTITY REQUIRED (m^3)	PROCESSING REQUIRED	MATERIAL AVAILABLE (m^3)	REMARKS
1. ENERGY STRUCTURES					
1.1 Dry Pond Dam					
Impervious	Pits 9 and 10	35,000	None	56,000	Alternate Pit 16 and 19
Fine Filter	Pit 15	7,500	Washing	500,000	Alternate Pit 16 and 19
Coarse Filter	Pit 15	9,150	Washing & Screening	500,000	Alternate Pit 16 and 19
Rockfill	Quarry at Site	36,700	Crushing	Unlimited	
Rip Rap	Quarry at Site	6,600	Blasting	Unlimited	Rock Exc. 3000 m^3
1.2 Cut-Off Dam					
Impervious	Pits 9 and 10	8,500	None	56,000	Alternate Pit 16 and 19
Fine Filter					Alternate Pit 16 and 19
Coarse Filter	Pit 15	2,250	Washing	500,000	Alternate Pit 16 and 19
Rockfill	(Same as	1,450	Crushing	Unlimited	No Rock Exc. Required
Rip Rap	(Dry Pond Dam	1,450	Blasting	Unlimited	
3. POWER STRUCTURES					
3.1 Headpond Dam					
Impervious	Pit No. 11	11,000	None	700,000	
Fine Filter	Pit 15	6,000	Washing	500,000	(
Coarse Filter	Pit 15	8,700	Washing & Screening	500,000	($37,000 in Estimate for Overhaul
Rockfill	Quarry at Site or	12,200	Crushing	Unlimited	13,800 m^3 Available From Excavation 12,500 m^3 Available From Surge Tank
Rip Rap	Process Exc.Rock	2,800	Blasting	Unlimited	15,500 m^3 Available From Spillway

APPENDIX C-2

STRUCTURE ZONE	MATERIAL SOURCE	QUANTITY REQUIRED (m^3)	PROCESSING REQUIRED	MATERIAL AVAILABLE (m^3)	REMARKS
. Penstock					
Select Backfill	Pit 15	5,500	None	500,000	
Rock/Common Backfill	Excavation	10,000	None		8,500 m^3 Rock Exc. Available 1000 m Common Exc. Available
. Powerhouse	Excavation	3,000	No	25,000 from Exc.	
. Switchyard					
Coarse Filter	Pit No. 12 & 15	500	None		
Rockfill	Powerhouse/Tail-race Excavation	1,000	None		25,000 m^3 Rock Exc. from Powerhouse
. CONCRETE (ALL STRS)					
Gravel	Pit 15	1,200	Washing & Screening	500,000	(Processing should be cheaper (than trucking from Stephenville
Sand	Pit 15	900	Washing & Screening	500,000	
). ROADS					
.. Powerhouse Access Road					
Rockfill	Quarry	11,000	None	Unlimited	
Base Coarse	Existing Pit	5,000	Crushing	20,000	Alternate Pit 13 & 15
Topping	Existing Pit	2,000	reening & Crushing	29,000	Alternate Pit 13 & 15

STRUCTURE ZONE	MATERIAL SOURCE	QUANTITY REQUIRED (m^3)	PROCESSING REQUIRED	MATERIAL AVAILABLE (m^3)	REMARKS
2. Dry Pond Dam Road					
Subgrade Fill	Quarry	32,000	None	Unlimited	
Base Coarse	Pits 13 and 15	15,000	None	545,000	Alternate Pit 16 and 19
Topping	Pits 13 and 15	6,500	Screening & Crushing	545,000	Alternate Pit 16 and 19
3. Temp. Access Road					
Subgrade Fill	Quarry	10,000	None	Unlimited	
Base Coarse	Pit # 15	4,000	None	500,000	Alternate Pit 16 and 19
Topping	Pit # 15	2,000	Screening & Crushing	599,000	Alternate Pit 16 and 19

APPENDIX D

DETAILED COST ESTIMATE

WORK ORDER No. 1091

BASE DATE 1982

NEWFOUNDLAND AND LABRADOR HYDRO
DRY POND BROOK DEVELOPMENT
WORK DEFINITION AND DEFINITIVE ESTIMATE

ESTIMATED BY _____ DATE _____

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REV. No. ___

ACCOUNT NUMBER	DESCRIPTION				COSTS (NEAREST DOLLAR)		
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
1.120.000			DRY POND DAM, CONTROL STRUCTURE & SPILLWAY				
		L.S.	Unwatering includes for all measures to provide and maintain the excavation free from water, snow, ice and water materials for the duration of the contract.	25,000	25,000	25,000	
			Stripping and Earth Excavation - Stripping includes for removal and disposal of all topsoil and surface vegetation, tree stumps, roots, surface boulders, muskeg, and other unsuitable surface materials. Earth excavation includes all other materials which can be excavated by mechanical means.				
	9200	m^3	Stripping from dam site.	5.00	46,000		
	3600	m^3	Stripping for borrow pits and quarries.	5.00	18,000		
	1250	m^3	Earth excavation.	4.00	5,000	69,000	
	3000	m^3	Rock Excavation includes for removal and disposal of all boulders in excess of one cubic metre in size, in place bedrock requiring drilling and blasting prior to excavation and preshearing for core trench and overflow spillway.	25.00	75,000	75,000	

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REV. No. ___

ACCOUNT NUMBER	DESCRIPTION				COSTS (NEAREST DOLLAR)		
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
	13000	m^2	Foundation Preparation includes all hand cleaning of the bedrock surface to receive impervious fill within the contact area of the impervious fill to bedrock and hand placing and hand compacting of an initial contact layer as required.	5.00	65,000	65,000	
			Impervious Fill and Overhaul includes supply, placing and compaction of the impervious fill in the core trench and the core of the dam together with the cost of overhaul from the borrow pits to dam site.				
	35000	m^3	Impervious fill for dam.	16.00	560,000		
	0	t-km	Impervious fill overhaul.	.165		560,000	
			Fine Filter includes supply, placing and compaction of the coarse filter zones.				
	7500	m^3	Fine filter.	16.00	120,000		
	90,000	t-km	Fine filter overhaul	.165	15,000	135,000	

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ACCOUNT NUMBER	DESCRIPTION				COSTS (NEAREST DOLLAR)		
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			Coarse Filter includes supply, placing and compaction of the coarse filter zones.				
	8500	m^3	Coarse filter.	16.00	136,000		
	100,000	t-km	Coarse filter overhaul.	.165	17,000	153,000	
			Gravel includes supply, placing and compaction of the gravel surfaces at the crest of the dam.				
	625	m^3	Gravel	16.00	10,000		
	6000	t-km	Gravel overhaul.	.165	1,000	11,000	
	36,000	m^3	Rockfill includes supply, placing and compaction of the rockfill in the dam.	18.00	648,000	648,000	
	6600	m^3	Rip Rap includes the supply and placing of rip rap on the upstream side of the dam.	20.00	132,000	132,000	
			Grouting includes drilling holes, supply and pumping of grout to seal cracks in bedrock foundation.				
	500	m	Drilling 50 mm diameter hole.	50.00	25,000		
	750	bags	Grout supply and place.	100.00	75,000	100,000	

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ACCOUNT NUMBER	DESCRIPTION				COSTS (NEAREST DOLLAR)		
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
	100	m	DOWELS includes drilling of holes and the supply and placing of dowels (rock anchors) and grout.	100.00	10,000	10,000	
	600	m^3	Concrete includes the supply, manufacture, transportation and placing of concrete in the overflow spillway, intake and unwatering scheme, including formwork and reinforcing.	500.00	300,000	300,000	
	10,000	kg	Miscellaneous steel includes the supply and installation of all miscellaneous steel. (includes trash rack, gate guides, seepage collars, etc.	5.00	50,000	50,000	
	35	m	Corrugated Steel Pipe (1.2 m Dia)	200.00	7,000	7,000	
	1	ea	Sluce Gate for 1.2 m pipe	25,000	25,000	25000	
			TOTAL 1.120.000				2,365,000

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ACCOUNT NUMBER	DESCRIPTION			UNIT COST	COSTS (NEAREST DOLLAR)		
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS		ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
1.121.000			CUTOFF DAM				
		L.S.	Unwatering includes for all measures necessary to provide and maintain the excavation free from water, snow, ice and water borne materials for the duration of the contract.		4000	4000	
			Stripping and Earth Excavation - stripping includes for removal and disposal of all topsoil and surface vegetation, tree stumps, roots, surface boulders, muskeg and other unsuitable surface materials. Earth excavation includes all other materials which can be excavated by mechanical means.				
	3000	m^3	Stripping from dam site.	5.00	15000		
	1000	m^3	Stripping from borrow pits and quarries.	5.00	5000	20000	
	7000	m^2	Foundation Preparation includes all hand cleaning of the bedrock surface to receive impervious fill within the contact area of the impervious fill to bedrock and hand placing and hand compacting of an initial contact layer as required.	5.00	35000	35000	

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ACCOUNT NUMBER	DESCRIPTION				COSTS (NEAREST DOLLAR)		
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			Impervious Fill and Overhaul includes supply, placing and compaction of the impervious fill in the core of the dam together with the cost of overhaul from the various borrow pits to the dam site.				
	8500	m^3	-Impervious fill for dam.	16.00	136,000	136,000	
	0	t-km	-Impervious fill for overhaul	.165			
			Coarse Filter includes supply, placing and compaction of the coarse filter zones including cofferdam.				
	1,000	m^3	-Coarse filter.	16.00	16,000		
	12,000	t-km	-Coarse Filter overhaul	.165	2,000	18,000	
		m^3	Gravel includes supply, placing and compaction of the gravel surfaces at the crest of the dam.				
	1,250		-Gravel.	16.00	20,000		
	18,000	t-km	-Gravel overhaul.	.165	3,000	23,000	

APPENDIX D

WORK ORDER No. 1091	NEWFOUNDLAND AND LABRADOR HYDRO DRY POND BROOK DEVELOPMENT WORK DEFINITION AND DEFINITIVE ESTIMATE	ESTIMATED BY _____ DATE CHECKED BY _____ DATE APPROVED BY _____ DATE	PAGE 7 OF 52 REV. No. —
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ACCOUNT NUMBER	DESCRIPTION			COSTS (NEAREST DOLLAR)			
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			Rockfill includes supply, placing and compaction of the rockfill in the dam.				
	1450	m^3	-Rockfill	20,00	29,000	29,000	
	0	t-km	-Rockfill overhaul.	.165			
			Rip Rap includes the supply and placing of rip rap on the upstream side of the dam.				
	1450	m^3	-Rip Rap.	20.00	29000	29000	
	0	t-km	-Rip Rap overhaul	.165			
			TOTAL 1.121.000				294,000

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ACCOUNT NUMBER	DESCRIPTION			COSTS (NEAREST DOLLAR)			
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
2.102.000			HEADPOND POND DAM & INTAKE				
		L.S.	Unwatering includes for all measures necessary to provide and maintain the excavation free from water, snow, ice and water louvre materials for the duration of the contract.	25,000	25,000	25,000	
	5	ha	Clearing includes the removal and disposal of all trees, brush, fallen timber and debris.	3000.00	15,000	15,000	
	3600	m^3	Stripping and Earth Excavation stripping includes for removal and disposal of all topsoil and surface vegetation, tree stumps, roots surface boulders, muskeg and other unsuitable surface materials. Earth excavation includes all other material which can be excavated by mechanical means.	5.00	18,000	18,000	
	14,000	m^3	Rock Excavation includes removal and disposal of boulders in excess of one cubic metre in size, in place bedrock requiring drilling and blasting prior to excavation and preshearing for structural excavation for core trench and unwatering channels.	25.00	350,000	350,000	

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
	1800	m^2	Foundation Preparation includes all hand cleaning of the bedrock surface to receive impervious fill within the contact area of the impervious fill to bedrock and hand placing and hand compacting of an initial contact layer as required.	5.00	9000	9000	
	11,000	m^3	- Impervious fill for dam.	16.00	176,000		
	66,000	t-km	- Impervious overhaul	.165	11,000	187,000	
			Fine Filter includes supply, placing and compaction of the fine filter zones.				
	6,000	m^3	- Fine Filter.	16.00	96,000		
	139,000	t-km	- Fine filter overhaul.	.165	23,000	119,000	
			Coarse Filter includes supply, placing and compaction of the coarse filter zones.				
	8000	m^3	- Coarse Filter	16.00	128,000		
	192,000	t-km	- Coarse Filter overhaul	.165	32,000	160,000	

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			Gravel includes supply, placing and compaction of the gravel surfaces at the crest of the dam.				
	700	m^3	-Gravel.	16.00	11,000		
	18,000	t-km	-Gravel overhaul.	.165	3,000	14,000	
	11,600	m^3	Rockfill includes supply, placing and compaction of the rock fill dam.	15.00	174,000	174,000	
	2800	m^3	Rip Rap includes the supply and placing of rip rap on the upstream and downstream side of the dam.	20.00	56,000	56,000	
			Grouting includes the drilling holes, supply and pumping of grout to form a grout curtain beneath the dam.				
	500	m	-Drilling 50 mm diameter hole	50.00	25,000		
	750	bags	-Grout supply and place.	100.00	75000	100,000	
		L.S.	Leak Measuring includes the supply and installation of one 600 mm diameter C.M.P. fitted with a 90° U-notch weir and channeling as required to divert leakage to the weir.	10,000	10000	10,000	

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ACCOUNT NUMBER	DESCRIPTION				COSTS (NEAREST DOLLAR)		
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
	100	m	DOWELS includes drilling of holes and the supply and placing of dowels (Rock Anchors) and grout.	100.00	10000	10,000	
	700	m^3	Concrete includes the supply, manufacture, transportation and placing of concrete in the intake and unwatering scheme including formwork and reinforcing.	400.00	280,000	280,000	
	200	kg	Miscellaneous steel includes the supply and installation of all miscellaneous steel.	5.00	1,000	1,000	
	120	m^3	Temporary Timber Cribs	300.00	36,000	36,000	
	10,000	kg	Intake Steel (pre-fab)	3.50	35,000	35,000	
		L.S.	Intake valve	29,000	29,000	29,000	
		L.S.	Service Building (4 m wide x 4 m long x 2.5 m high)	6,000	6,000	6,000	
		L.S.	GENERAL ELECTRICAL SERVICES, including supply and installation of all necessary equipment.	3,000	3,000		
		L.S.	4160 V single phase pole line extension from Surge Tank Structure. - Length 700 metres.	17,000	17,000	20,000	

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ACCOUNT NUMBER	DESCRIPTION			UNIT COST	COSTS (NEAREST DOLLAR)		
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS		ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			WATER LEVEL MEASUREMENT SYSTEM:				
	1	each	Pressure transducer type system, to measure headpond level including power supply and transducer.				
			Supply (includes Federal duties and taxes, transportation, insurance) ------	2,200	2,200		
			RST (11%)		300		
			Installation	500	500	3,000	
			TOTAL 2.102.000				1,657,000

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ACCOUNT NUMBER	DESCRIPTION				COSTS (NEAREST DOLLAR)		
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
2.103.000			HEADPOND SPILLWAY AND BRIDGE				
	26,000	m^3	Stripping includes for removal and disposal of all topsoil and topsoil and surface vegetation, three stumps, roots, surface boulders, muskeg and other unsuitable surface materials.	5.00	130,000	130,000	
	15,500	m^3	Rock Excavation includes the removal and disposal of boulder in excess of one cubic metre in size, in place bedrock requiring drilling and blasting prior to excavation and preshearing for structural excavation for overflow spillway.	25.00	387,500	387,500	
	200	m	Dowels includes drilling of holes and the supply and placing of dowels (Rock Anchors) and grout.	100.00	20,000	20,000	
	230	m^3	Concrete includes the supply, manufacture, transportation and placing of concrete in the overflow spillway & bridge abutments including reinforcing and formwork.	350.00	80,500	80,500	
	30,000	kg	Structural steel.	3.50	105,000	105,000	
	100	m^3	Timber decking	500.00	50,000	50,000	
			TOTAL 2.103.000				773,000

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ACCOUNT NUMBER	DESCRIPTION			UNIT COST	COSTS (NEAREST DOLLAR)		
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS		ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
2.104.000			LOW PRESSURE PIPELINE AND PENSTOCK				
	1.0	ha	Clearing includes the removal and disposal of all trees, brush, fallen timber and debris.	3000.00	3,000	3,000	
			Stripping and Earth Excavation -- Stripping includes for removal and disposal of all topsoil and surface vegetation, tree stumps, roots, surface boulders, muskeg, and other unsuitable surface materials. Earth excavation includes all other material which can be excavated by mechanical means.				
	3,600	m^3	Stripping.	5.00	18,000		
	1,000	m^3	Earth excavation.	4.00	4,000	22,000	
	8,500	m^3	Rock Excavation includes removal and disposal of boulders in excess of one cubic metre in size and in place bedrock requiring drilling and blasting prior to excavation.	18.00	153,000	153,000	
	10,000		Rock Fill for P.S. backfill and covering includes placing and compaction of rock fill previously excavated and supply, placing and compaction of rock borrow needed in excess of that previously excavated.	8.00	80,000	80,000	

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ACCOUNT NUMBER	DESCRIPTION			UNIT COST	COSTS (NEAREST DOLLAR)		
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS		ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
	5500	m^3	Select Backfill includes placing and compaction of select backfill around and over the penstock.	16.00	88,000	88,000	
	300	m^3	Concrete includes the supply, manufacture, transportation an placing of concrete in the anchor blocks.	350.00	105000	105000	
	2000	kg	Embedments includes fabrication, delivery and installation of contractor supplied embedded parts for anchoring of penstock to concrete anchor blocks.	5.00	10,000	10,000	

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ACCOUNT NUMBER	DESCRIPTION			UNIT COST	COSTS (NEAREST DOLLAR)		
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS		ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
2.104.000			LOW PRESSURE PIPELINE AND PENSTOCK				
			Includes the supply and installation of 690 m of 1.83 m dia. penstock comprised of 460 m of 6 mm thick welded steel pipe and 230 m of 12 mm thick welded steel pipe. Erection includes provision of an 18 man camp.				
	460	m	Welded pipe, c/w flange at intake, connection for vacuum valve, vacuum valve /vent.				
			Supply (includes transportation, Federal duties, and taxes and insurance) ----------	785	361,100		
			RST (11%)		39,600		
			Erection	405	186,300	587,000	
	230	m	Welded Steel penstock, connection for surge tank, anchor rings, stiffiners, trifurcation with branch for third unit capped at the trifurcation, external protective coating.				
			Supply and Erection (includes transportation, Federal duties and taxes, insurance) ---------	2935	675,000		
			RST (11% of 50% of Supply & Erection)		37,000	712,000	
			TOTAL 2.104.000				1,760,000

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ACCOUNT NUMBER	DESCRIPTION				COSTS (NEAREST DOLLAR)		
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
2.105.000			SURGE TANK				
	500	m^3	Rock excavation includes removal and disposal of boulders in excess of one cubic metre in size, in place bedrock requiring drilling and blasting prior to excavation.	20.00	10,000	10,000	
	80	m	Dowels includes drilling of holes and the supply and placing of dowels (rock anchors) and grout.	100.00	8,000	8,000	
	10	m^3	Concrete includes the supply, manufacture, transportation and placing of concrete in the surge tank foundation, including form-work and reinforcing.	600.00	6,000	6,000	

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ACCOUNT NUMBER	DESCRIPTION			UNIT COST	COSTS (NEAREST DOLLAR)		
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS		ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
	1	each	SURGE TANK				
			Consists of one steel Surge Tank 1.83 m dia., 13.7 high, mounted on legs and connected to the Penstock by steel pipe.				
			Supply and Erection (includes transportation, Federal duties and taxes, insurance) ----------	45,000	45000		
			RST (11% of 50% of Supply & Erection)		2500	47,500	
	1	each	Surge Tank Heating System consisting of two heaters, circulating pumps, valves, piping and appurtenances. (100% backup).				
			Supply (includes transportation, Federal Duties and taxes, and insurance) ---------	3700	3700		
			RST (11%)		500		
			Erection	3300	3300	7,500	

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ACCOUNT NUMBER	DESCRIPTION			COSTS (NEAREST DOLLAR)			
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
		L.S.	GENERAL ELECTRICAL SERVICES including supply and installing all necessary equipment for heating, and miscellaneous equipment.	2,000	2000		
		L.S.	4160 V, single phase pole line from powerhouse.	23,000	23000	25,000	
			TOTAL 2.105.000				104,000

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ACCOUNT NUMBER	DESCRIPTION			COSTS (NEAREST DOLLAR)			
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
2.106.000			POWERHOUSE				
	1	ha	Clearing includes the removal and disposal of all trees, brush, fallen timber and debris.	3.000.00	3,000	3,000	
		L.S.	Unwatering includes for all measures necessary to provide and maintain the excavation free from water, snow, ice and water borne materials for the duration of the contract.	15,000.	15000	15000	
	3000	m^3	Stripping and Earth Excavation - Stripping includes for removal and disposal of all topsoil and surface vegetation tree stumps, roots surface boulders, muskeg and other unsuitable surface materials. Earth excavation includes all other material which can be excavated by mechanical means.	5.00	15000	15000	
	1000	m^3	Rock Excavation includes removal and disposal of boulers in excess of one cubic metre in size and in-place bedrock requiring drilling and blasting prior to excavation.	25.00	25,000	25,000	
	500	m^3	Common Backfill includes placing and compaction of excavated materials around the powerhouse substructure and transformer deck.	6.00	3,000	3,000	

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
	450	m^2	Preshearing includes for drilling of closely spaced holes around the perimeter of substructure excavation to prevent overbreak.	60.00	27,000	27,000	
	300	m^3	Concrete includes the supply, manufacture, transportation and placing of concrete in the powerhouse substructure, and floor including formwork and reinforcing.	500.00	150,000	150,000	
	1000	kg	Embedments includes fabrication, delivery and installation of contractor supplied embedded parts and installation of Owner supplied embedded parts.	5.00	5000		
	2000	kg	Embedment of Owner supplied items include: Anchor bolts for structural steel, machine bases, switchgear. structural steel for turbine and generator.	2.50	5000	10,000	
	150	m	Water Stop includes the supply, delivery and installation of all water stop. Water stop shall be utilized at all construction joints below Elev. 10.0 metres.	40.00	6,000	6,000	

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
		L.S.	Metal Building includes the fabrication, delivery and installation of a metal building including structural steel, windows, doors, cladding and painting. Dimensions 15 m wide x 18 m long x 6 m high.	108,000	108,000	108,000	
	200	kg	Miscellaneous Steel includes the supply, fabrication, shop painting, delivery and installation of the following:	5.00	1,000	1,000	
			Grouted Rock Bolts includes drilling and washing of holes and supply and delivery, installation, tensioning and grouting of				
	50	each	3.5 m long rock bolts.	300.00	15,000	15,000	
		L.S.	Office Furniture and Miscellaneous Architural Features includes the supply, delivery and installation of the following:	10,000	10,000	10,000	
			- 1 Operator's desk and chair.				
			- 1 fridge, stove, table and chairs for lunchroom.				
			- hydro logos and miscellaneous signs.				
			- flag pole.				
		L.S.	Interior Finishing includes the supply, delivery and installation of all interior partitions, doors, washroom facilities, suspended ceilings, painting, floor tile, etc.	15,000	15,000	15,000	

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			Powerhouse Area Final Grading, Drainage and Surfacing includes provision of all fill materials, placing, compaction and grading for access around the powerhouse and parking area. Road gravel is included:				
	2	each	- Concrete catch basins.	1250.00	2,500		
	60	m	- C.M.P. 600 mm	90.00	5,400		
	30	m	- C.M.P. 900 mm	130.00	3,900		
	450	m^3	- Road gravel in powerhouse yard.	16.00	7,200		
	4	each	- Lamp Standards.	1500.00	6,000	25,000	
		L.S.	Powerhouse Area Landscaping includes final grading, topsoil and sodding.	25,000	25,000	25,000	

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			POWERHOUSE D.C. STATION SERVICES				
			Includes 48 V DC Lead Acid Battery Bank, 240 A.H., 8 hr. rating.				
		L.S.	Supply (including Federal duties & taxes, FOB jobsite -------	10,000	10,000		
			RST @ 11%	1,000	1,000	11,000	
			GROUNDING				
			Powerhouse Grounding System including the embedded ground mat, non-embedded ground wire, conductors and connectors.				
		LS.	Supply (including Federal duties & taxes, FOB jobsite) ------	10,000	10,000		
			RST @ 11%	1,000	1,000		
			Installation	5,000	5,000	16,000	
			STANDBY DIESEL GENERATOR SYSTEM				
			50 kW, 600 V, 3-phase diesel generator set. System includes muffler and exhaust pipes, batteries and charger, oil tank, fuel pumps, all piping and valves necessary for a complete system. System also includes automatic transfer switch and controls.				

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			STANDBY DIESEL GENERATOR SYSTEM (continued)				
		L.S.	Supply (including Federal duties and taxes, FOB final position at jobsite and erection supervision) ----------	55,000	55000		
			RST @ 11%	6,000	6,000	61,000	
			GENERAL ELECTRICAL SERVICES				
			Includes supply and installation of all equipment necessary for complete Powerhouse Electrical Services, including such major items as:				
			- Lighting and Heating Systems.				
			- General Power Circuits.				
			- Electrical Connection of all Mechanical Equipment.				
			As well as these supply and install items, other work covered would be:				
			Installation and Interconnection of the 4160 V indoor Switchgear, including main power cables from the generators and to the Main Power Transformer.				

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			GENERAL ELECTRICAL SERVICES (continued)				
			Interconnection and installation of Station Services Switchgear (AC & DC); Standby Diesel Generator and Automatic Transfer Scheme:				
		L.S.		80,000	80,000	80,000	

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			STATION SERVICES AC & DC				
			Station Services Transformer, 75 KVA 4160/600 Volt, ONAN, grounded WYE/DELTA 60 hZ, 3-phase, floor mounted.				
		L.S.	Supply (including Federal duties & taxes, etc., FOB -------	8,000	8,000		
			RST @ 11%	1,000	1,000	9,000	
			STATION SERVICES SWITCHGEAR (A.C.)				
			600 V, 400 A, 3Ø, Switchgear with 10 breakers. Wall on floor mounted.				
		L.S.	Supply (including Federal duties & taxes, FOB jobsite) -----	10,000	10,000		
			RST @ 11%	1,000	1,000	11,000	
			4160 V, EQUIPMENT				
			Free standing indoor switchgear, 1600 amp, main bus. Individual breakers for each generator, main load breaker and feeds for Station Services and Upstream structures.				
		L.S.	Supply (including Federal duties, etc., FOB jogsite and erection supervision) ----------	135,140	135,140		
			RST @ 11%	14,860	14,860	150,000	

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			TURBINES, GOVERNORS, GENERATOR, CONTROL BOARDS				
	2	each	Francis type hydrualic turbine, rated 2600 kW, 720 rpm, 88 m net head, complete with governor and generator rated at 3200 kV, 4160 V, 3 phase, 60 cycle. Includes governor pumping set and accumulator tank, cooling water system, coupling guards, couplings, draft tube, inlet flange, exciter, governor control panel and all ancillary equipment.				
			- Supply (including Federal duties and taxes) ----------	1015,000	2030,000		
			- RST (11%)		223,000		
			- Transportation (incl. off loading, handling & insurance)		50,000		
			- Erection & Commissioning		139,000	2442,000	
	2	each	Water Type Butterfly Valves, 915 mm diameter, hydraulically opened, gravity closed, complete with operating cylinder, controls and weights.				
			- (Installation by Turbine Contractor)	15,000	30,000		
			- RST (11%)		3,000	33,000	

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BASE DATE 1982

NEWFOUNDLAND AND LABRADOR HYDRO
DRY POND BROOK DEVELOPMENT
WORK DEFINITION AND DEFINITIVE ESTIMATE

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ACCOUNT NUMBER	DESCRIPTION			COSTS (NEAREST DOLLAR)			
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
	1	lot	Spare parts, including 1 bearing of each type; 1 set of all seals; 1 switch of each type, 1 valve of each type, 3 spare wicket gates; linkages and bushings; 1 full set of shear pins; 2 rotor poles; 1 set of brush holders, 2 sets of brushes.				
			- Supply (includes Federal duties and taxes, transportation and insurance) ----------	115000	115000		
			- RST (11%)	13,000	13,000	128,000	
	1	ea	Powerhouse Ventilation System				
			Included are two wall mounted exhaust fans and two hooded, screened wall louvres, with controls.				
			- Supply (includes Federal duties and taxes, transportation and insurance) ----------	3,000	3000		
			- RST (11%)		300		
			- Installation	700	700	4,000	

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			POWERHOUSE CRANE				
	1	each	Gantry Crane, including steel frame, castors, electric hoist, chain driven trolley, capacity 10 tonnes. Installation by turbine contractor.				
			- Supply (inclues transportation, insurance, Federal duties and taxes) ----------	28,000	28,000		
			- RST (11%)	3,000	3,000	31,000	
			DOMESTIC AND SERVICE WATER SYSTEM				
	1	each	Penstock connection, with pressure reducing valve 1/2" copper distribution piping, back-up supply with 3/4 h.p. pump from tail-race, chlorinator and contact tank.				
			- Supply (includes transportation, insurance, Federal duties and taxes) ----------	2,200	2,200		
			- RST (11%)		200		
			- Installation	1,600	1,600	4,000	

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
	1	each	Wet pipe sprinkler system, consisting of piping, alarm check valve, water motor alarm and all ancillary equipment.				
			- Supply (includes Federal duties and taxes, transportation and insurance) ----------	8,000	8,000		
			- RST (11%)		1,000		
			- Installation	6,000	6,000	15,000	
	1	each	Connection to penstock, with isolating valve, including all pipe and connections.				
			- Supply (includes Federal duties and teaxes, transportation and insurance) ----------	2,000	2,000		
			- RST (11%)		200		
			- Installation	2,800	2,800	5,000	

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS		ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			SERVICE AIR SYSTEM				
	1	each	Compressed air system for operation of air tools, diesel starting. Includes compressor, motor, air receiver, distribution piping and valves, controls.				
			- Supply (includes transportation, insurance, Federal duties and taxes) ----------	9,500	9,500		
			- RST (11%)		1,000		
			- Installation	2,500	2,500	13,000	
			FIRE PROTECTION WATER SYSTEM				
	1	each	Primary water supply from penstock with a 750 USGPM back-up Vertical turbine fire pump with controls, piping and valves.				
			- Supply (includes transportation, insurance, Federal duties and taxes) ----------	21,000	21,000		
			- RST (11%)		2,500		
			- Installation	2,500	2,500	26,000	
			TOTAL 2.106.000				3,492,000

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			SWITCHYARD				
	1000	m^3	Rockfill includes supply, placing and compaction of the rockfill in the switchyard area.	10.00	10,000	10,000	
	500	m^3	Coarse Filter includes supply, placing and compaction of the coarse filter over the rockfill.	16.00	8,000	8,000	
	10	m	Concrete includes the supply, manufacture, transportation and placing of concrete in the transformer pads including formwork and reinforcing.	450.00	4,500	4,500	

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			MAIN POWER TRANSFORMER:				
	1	each	Main Power Transformer, 6.5/8.7/10.8 MVA, 69/4.16 kV grounded WYE/DELTA 60 HZ, 3-phase, 350 kV BIL for the H.V. winding, 50 kV BIL for the L.V. winding, most economical impedence. Includes off-load tap changer, one 4.16 kV Current Transformer phase and one Neutral Current Transformer. Standard accessories and spares. Supply (including federal duties, FOB jobsite, final position and erection supervision) ----------	125,700	125,700		
			RST @ 11%	13,800	13,800	139,500	
			MAIN POWER CABLES				
		L.S.	5000 Volt, 3-conductor Teck cable, 250 and 500 MCM. 30 Meters in total. Supply (including Federal duties, etc., FOB jobsite.	10,000	10,000		
			RST @ 11%	1,000	1,000	11,000	
			TOTAL: 2.107.000				173,000

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			TELECONTROL includes:				
		L.S.	Communications and SCADA equipment, labour and materials necessary to provide direct communications between Dry Pond Brook and Burgeo, to maintain system security and safety.	196,000	196,000	196,000	
			TOTAL: 3.100.000				196,000

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			PERMANENT POWERHOUSE ACCESS ROAD				
	1	ha	Clearing	3000.00	3,000		
	4000	m^3	Rock excavation (includes utilization of excavated material)	18.00	72,000		
	11000	m^3	Subgrade Fill (Rockfill).	20.00	220,000		
	5000	m^3	Base course	15.50	78,000		
	2000	m^3	Road topping	15.50	31,000	404,000	
			CULVERTS				
	200	m	600 mm Diameter	90.00	18,000		
	25	m	900 mm Diameter	125.00	3,000	21,000	
	1000	m	Guide Rail (includes posts)	50.00	50,000	50,000	
			PERMANENT DRY POND BROOK & CONTROL STRUCTURE ACCESS ROAD				
	1	ha	Clearing	3000.00	3,000		
	1000	m^3	Rock Excavation	18.00	18,000		
	32,000	m^3	Subgrade Fill	20.00	640,000		
	15,000	m^3	Base Coarse	15.50	233,000		
	6,500	m^3	Road Topping	15.50	101,000	995,000	
	150	m	Guide Rail (inc. Posts)	50.00	8,000	8,000	

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS		ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			CULVERTS				
	600	m	600 mm Diameter	90.00	54,000		
	50	m	900 mm Diameter	125.00	6,000	60,000	
			MAJOR STREAM CROSSINGS				
			STREAM # 1				
	60	m	1800 mm Diameter Culvert	450.00	27,000	27,000	
			STREAM # 2				
	80	m^3	Timber Crib (Abutments)	300.00	24,000		
	5000	kg	Structural Steel (superstructure)	3.50	18,000		
	10	m^3	Timber (Decking)	500.00	5,000	47,000	
			STREAM # 3				
	60	m	1800 mm Diameter Culvert	450.00	27,000	27,000	
			TOTAL 4.100.000				1,639,000

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ACCOUNT NUMBER	DESCRIPTION				COSTS (NEAREST DOLLAR)		
	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
5.193.000			TEMPORARY ACCESS ROADS (DRY POND CUT-OFF DAM & BORROW AREAS)				
	10,000	m^3	Rockfill	20.00	200,000		
	4,000	m^3	Base Coarse	15.50	62,000		
	2,000	m^3	Road Topping	15.50	31,000		
	200	m	Culvert 600 mm diameter	90.00	18,000	311,000	
			BRIDGE				
	110	m^3	Timber Crib	300.00	33,000		
	6000	kg	Structural Steel	3.50	21,000		
	10	m^3	Timber Decking	500.00	5,000		
	100	m	Guide Rail (inc. posts)	50.00	5,000	64,000	375,000
			TOTAL 5.193.000				

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS		ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
6.190.000			GENERAL SERVICES				
			Communications				
		L.S.	Provision of all forms of field communications including installation and maintenance of telephone lines, towers and PBX, rental on telephones, long distance charges, mobile radio systems.		17,000		
			Photographs and Mapping				
		L.S.	Provision for processing, printing photos, art work and displays and topographic mapping.		5,000		
			Photographs Field				
		L.S.	Provides for cameras and associated equipment, film and processing.		4,000		
		L.S.	Advertising				
			Provision for advertizing of tenders, quotations, prequalifications, etc.		5,000		
			Field Investigations				
			Provides for investigations to prove-up foundation conditions and material sources				
		L.S.	- subsurface investigation and diamond drilling		80,000		
		L.S.	- material testing and source investigations		20,000	100,000	

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS		ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			BONDS				
			Provides for bonding to cover general contracts, civil construction and major equipment.		70,000	70,000	
			REPRODUCTION (FIELD)				
			Reproduction includes drawing reproduction.		1,000	1,000	
			TOTAL 6.190.000				202,000

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
6.191.000			CONSTRUCTION AND SITE SERVICES				
			Safety and Medical				
			Safety includes the provision of safety apparel and miscellaneous supplies for fire protection and safe conduct of all employees				
			Medical includes the provision of all necessary supplies to carry out first aid.				
			Safety				
		L.S.	- apparel		1000		
		L.S.	- miscellaneous		500	1,500	
			Medical				
		L.S.	- First Aid supplies		500		
		L.S.	- Ambulance		15,000	15,500	
			Security				
			Security includes the provision of uniformed guards at a guard house and a roving patrol after normal work hours.				
		L.S.	- 1 only gate house, chain and fencing		5,000		
		L.S.	- Maintenance		1,000		

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			Security (continued)				
		L.S.	Security guards		55,000		
		L.S.	Transportation		10,000	71,000	
			TEMPORARY CONSTRUCTION SERVICES				
			Provision for temporary facilities such as water supply and sewerage disposal.				
		L.S.	Water supply and sewerage disposal		15,000	15,000	
			Road Maintenance and Snow Clearing				
			Maintenance of permanent access roads. This includes the regular road surface grading, snow clearing and repairs of normal surface deterioration.				
	120	km/mo	Road repairs and maintenance	500	60,000	60,000	
			Field Vehicle Purchase and Rental				
			Covers the cost of purchasing, leasing and renting all vehicles used by field staff.				

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			Field Vehicle Purchase and Rental (continued)				
		L.S.	Vehicle purchase (10 vehicles)		100,000		
		L.S.	RST		11,000		
		L.S.	Vehicle insurance		5,000		
		L.S.	Incidental rentals		5,000	121,000	
			Vehicle Servicing, Fuel, Lubricants and Tires				
			Covers the normal maintenance and emergency mainteance on all vehicles assigned to the field staff.				
	100	veh/mo	Maintenance and repairs.		10,000		
		L.S.	Gas and lubrication and tires.		40,000	50,000	
			Recovery on Vehicles, Buildings and Equipment				
			Includes the recovery from the resale of all vehicles, site offices and buildings and equipment purchased by the poject.				
			- Vehicles		(50,000)		

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS		ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			Survey, Labratory, and Office Equipment and Furnishings:				
			Covers the purchase of all survey and drafting equipment including survey books, cross section paper, etc. Also includes any labratory equipment and furniture and office furniture.				
		L.S.	Survey equipment.		12,000		
		L.S.	Laboratory testing.		10,000		
		L.S.	Laboratory equipment.		25,000		
		L.S.	Office furnishings.		7,000		
		L.S.	Zerox/typewriters		4,000		
		L.S.	Office supplies and miscellaneous equipment		2,000	60,000	
			Site Offices and Buildings:				
			Site offices and buildings includes the purchase, set-up, maintenance, operation of all satelite field offices, laboratory including Manager's office and Engineer's office.				
		L.S.	Laboratory		20,000		
		L.S.	Satelite Offices		14,000		
		L.S.	Main Field Staff Office		40,000	74,000	418,000
			TOTAl 6.191.000				

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
6.192.000			Personnel Accommodations				
		L.S.	Personnel Trailer Park - Land Acquisition				
			Personnel Trailers				
			Including the purchase of 8 new, installation and set-up of trailers.				
		L.S.	- Purchase of trailers including taxes and delivery		240,000		
		L.S.	- Services.		20,000		
		L.S.	- Set-up.		10,000		
		L.S.	- Vestibules.		8,000	278,000	
			Personnel Trailers - Operation and Maintenance				
			- all monthly operation costs including electrical power and maintenance.				
		L.S.	Electrical.		225,000		
		L.S.	Maintenance.		2,000		
		L.S.	Road Maintenance and Snow Clearing		3,000	230,000	

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS		ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			RECOVERY ON PERSONNEL ACCOMMODATIONS				
		L.S.	Estimated recovery from resale of units upon project completion.				
			(8 @ 20,000)		(160,000)	(160,000)	
	120	MAN-MTHS	LIVING ALLOWANCES	500.00	60,000	60,000	
			TOTAL 6.192.000				408,000

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS		ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
	6,000	hrs.	Office Design Manhours	40.00	240,000	240,000	
	30,000	hrs.	Field Engineering and Construction Supervision Manhours	35.00	1050,000	1050,000	
	2,000	hrs.	Job Administration Manhours	40.00	80,000	80,000	
			TOTAL 6.193.000				1,370,000

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS		ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			Corporate Overheads (approximately 1% of incurred costs)		220,000	220,000	220,000
			TOTAL				220,000

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS	UNIT COST	ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			OWNER'S COSTS				
			(a) Engineering and Construction Division Costs (approximately 1% of Direct Construction costs)		130,000	130,000	
			(b) Engineering feasibility costs		100,000	100,000	
			TOTAL				230,000

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS		ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			Escalation		2,767,000	2,767,000	2,767,000
			TOTAL				2,767,000

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS		ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			Interest during Construction		2,116,000	2,116,000	2,116,000
			TOTAL				2,116,000

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	QUANTITY	UNIT	DETAILED DESCRIPTION OF MAJOR WORK ITEMS		ITEM	MAJOR WORK ITEM	STRUCTURE FACILITY
			Contingency		1,530,000	1,530,000	1,530,000
			TOTAL				1,530,000