PD-AAR-294

UNCLASSIFIED

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D. C. 20523

CARIBBEAN REGIONAL

PROJECT PAPER

CUMBERLAND HYDROELECTRICT PROJECT

AID/LAC/P-221

Loan Number:538-K-027
Project Number:538-0091

UNCLASSIFIED

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete) — Amendment Number: _____ — DOCUMENT CODE: 3

2. COUNTRY/ENTITY: ST. VINCENT AND THE GRENADINES

3. PROJECT NUMBER: 538-0091

4. BUREAU/OFFICE: LATIN AMERICA/CARIBBEAN (LAC) 05

5. PROJECT TITLE (maximum 40 characters): Cumberland Hydroelectric Project

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 09 DD 30 YY 88

7. ESTIMATED DATE OF OBLIGATION (Under "B." below, enter 1, 2, 3, or 4): A. Initial FY 84 B. Quarter 3 C. Final FY 88

8. COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY B. FX	FIRST FY C. L/C	FIRST FY D. Total	LIFE OF PROJECT E. FX	LIFE OF PROJECT F. L/C	LIFE OF PROJECT G. Total
AID Appropriated Total						
(Grant)	(250)	(250)	(500)	(250)	(250)	(500)
(Loan)	(5,156)	(2,344)	(7,500)	(5,156)	(2,344)	(7,500)
Other U.S. 1.						
Other U.S. 2.						
Host Country	-	3,301	3,301	-	3,301	3,301
Other Donor(s)	17,880	2,157	20,037	17,880	2,157	20,037
TOTALS	23,286	8,052	31,338	23,286	8,052	31,338

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	C. PRIMARY TECH. CODE 2. Loan	D. OBLIGATIONS TO DATE 1. Grant	D. OBLIGATIONS TO DATE 2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	E. AMOUNT APPROVED THIS ACTION 2. Loan	F. LIFE OF PROJECT 1. Grant	F. LIFE OF PROJECT 2. Loan
(1) ESF	744	825		-	-	500	7,500	500	7,500
(2)									
(3)									
(4)									
TOTALS									

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each) — 11. SECONDARY PURPOSE CODE

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code							
B. Amount							

13. PROJECT PURPOSE (maximum 480 characters)

To meet current and future energy demands of the industrial, tourism and domestic sectors in St. Vincent and assure that these needs continue to be met on a self-sustaining basis by co-financing a program of activities which will expand energy production, and contribute to the long-term financial viability of the electric utility.

14. SCHEDULED EVALUATIONS: Interim MM 05 YY 86 — Final MM 06 YY 88

15. SOURCE/ORIGIN OF GOODS AND SERVICES: [X] 000 [ ] 941 [X] Local [ ] Other (Specify) _____

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a _____ page PP Amendment)

17. APPROVED BY — Signature: William B. Wheeler — Title: WILLIAM B. WHEELER DIRECTOR — Date Signed: MM 06 DD 26 YY 84

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM DD YY

AID 1350-4 (8-79)

PROJECT AUTHORIZATION

Name of Country: St. Vincent and the Grenadines

Name of Project: Cumberland Hydroelectric

Number of Project: 538-0091

Number of Loan: 538-K-027

1. Pursuant to Section 531 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Cumberland Hydroelectric Project for St. Vincent and the Grenadines involving planned obligations of not to exceed $7,500,000 in loan funds and $500,000 in grant funds over a one year period from the date of authorization, subject to the availability of funds in accordance with A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the project. The planned life of the project is fifty one months from the date of initial obligation.

2. The Project consists of assisting the Cooperating Country in meeting current and future energy demands of St. Vincent and the Grenadines by financing, in concert with other donors of assistance, a program of hydroelectric energy production activities including civil works, equipment and materials, a streamgauging program, a watershed management program, and related technical services.

3. The Project Agreement which may be negotiated and executed by the officer to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

A. Interest Rate and Terms of Repayment

The Cooperating Country shall repay the Loan to A.I.D. in U.S. Dollars within forty (40) years from the date of first disbursement of the Loan, including a grace period of not to exceed ten (10) years. The Cooperating Country shall pay to A.I.D. in U.S. Dollars interest from the date of first disbursement of the Loan at the rate of (a) two percent (2%) per annum during the first ten (10) years, and (b) three percent (3%) per annum thereafter, on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued thereon.

B. Source and Origin of Commodities, Nationality of Services

Commodities financed by A.I.D. under the Project shall have their source and origin in the United States and St. Vincent and the Grenadines except as A.I.D. may otherwise agree in writing. Except for ocean shipping, the suppliers of commodities or services shall have the United States as their place of nationality, except as A.I.D. may otherwise agree in writing.

Ocean shipping financed by A.I.D. under the Project shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of the United States.

C. Conditions Precedent to Disbursement

(i) First Disbursement. Prior to the first disbursement of the Assistance, or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made, the Cooperating Country will, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

(a) An opinion of counsel acceptable to A.I.D. that this Agreement has been duly authorized and/or ratified by, and executed on behalf of, the Cooperating Country, and that it constitutes a valid and legally binding obligation of the Cooperating Country in accordance with all of its terms;

(b) A statement of the name of the person holding or acting in the office of the Cooperating Country specified in Section 9.2., and of any additional representatives, together with a specimen signature of each person specified in such statement;

(c) Evidence of commitment of adequate project funds by other donors; and

(d) Evidence of the formation of a project management system within VINLEC, including execution of a contract for the services of a project manager.

(ii) Loan-Funded Activities. Prior to any disbursement or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made for Project activities funded from the loan proceeds of this Agreement, the Cooperating Country will, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

(a) Evidence that it has entered into a satisfactory agreement for the relending of the Loan Funds to the St. Vincent Electricity Services, Ltd. (VINLEC);

(b) Evidence of acceptable arrangement for the sale of the Commonwealth Development Corporation (CDC) shares of VINLEC stock to the Government; and

(c) Evidence that a satisfactory contract for the supervisory engineering consulting firm has been executed.

(iii) Civil Works. Prior to any disbursement or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made for civil works, the Cooperating Country will, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

(a) Evidence that VINLEC has applied for, and the Government has approved, an adequate tariff increase for 1985;

(b) Evidence that VINLEC has increased its access to short-term financing to EC$3 million;

(c) Evidence of commitment to make available sufficient funds to implement the Project civil works and the watershed management plan, including a mechanism for providing funds for civil works not funded by A.I.D.;

(d) Evidence of an acceptable interim arrangement for the management of VINLEC (following the buy-out of the Commonwealth Development Corporation and until the Electric Power Act of 1973 has been revised and enacted) which includes evidence of draft legislation which will enable progress toward satisfaction of the covenant of Section 6.2.;

(e) Evidence that title to all rights-of-way and land required for the civil works component of the project has been transferred to the Government, or that adequate procedures have been put in place for such a transfer, involving adequate compensation for the landholders; and

(f) Evidence of an official, time-phased Watershed Management Implementation Plan.

(iv) Streamgauging. Prior to any disbursements or the issuance by A.I.D. of documentation pursuant to which disbursement will be made for streamgauging, the Cooperating Country will, except as the parties may otherwise agree in writing, furnish A.I.D. in form and substance satisfactory to A.I.D.:

(a) evidence of a procurement and installation implementation plan; and

(b) evidence that a procedure for collecting and analyzing the streamgauging and rainfall data has been established.

(v) Watershed Management. Prior to any disbursements or the issuance by A.I.D. of documentation pursuant to which disbursement will be made for watershed management, the Cooperating Country will, except as the parties may otherwise agree in writing, furnish A.I.D. in form and substance satisfactory to A.I.D., evidence that the Cooperating Country has assigned responsibility for implementation to a specific individual and has entered into a satisfactory agreement for a pass through of the Grant funds made available under the Project to the Ministry of Agriculture (Forestry Division).

D. Special Covenants

(i) Project Evaluation. The Parties agree to establish an evaluation program as part of the Project. Except as the Parties otherwise agree in writing, the program will include during the implementation of the Project and at one or more points thereafter:

(a) Evaluation of progress toward attainment of the objectives of the Project;

(b) Identification and evaluation of problem areas or constraints which may inhibit such attainment;

(c) Assessment of how such information may be used to help overcome such problems; and

(d) Evaluation, to the degree feasible, of the overall development impact of the Project.

(ii) Legislation. The Cooperating Country agrees (1) to present to the Cabinet within one year from the date of signing of this Agreement, for submission to the legislative body, legislation which permits and enables VINLEC to operate on a technically and financially self-sustaining basis and enable VINLEC to acquire all required personnel in a manner which encourages them to remain with VINLEC, and (2) to exercise its best efforts to obtain timely passage of such legislation.

(iii) Financial and Management Covenants. Except as A.I.D. may otherwise agree in writing, the Cooperating Country shall comply with, or cause to be complied with, all of the financial and management covenants and undertakings incorporated and set forth in Article III and IV of its Project Agreement with the International Development Agency particularly:

(a) Except as shall otherwise be agreed, VINLEC shall earn, for each of the following fiscal years, an annual rate of return on the current net value of VINLEC's fixed assets in operation equivalent to 4% in 1985, 6% in 1986 and 1987, 7% in 1988 and 1989 and 8% in 1990 and each fiscal year thereafter;

(b) Except as shall otherwise be agreed, VINLEC shall not incur any debt unless the net revenues of VINLEC for the fiscal year immediately preceding the date of such incurrence or for a later twelve-month period ended prior to the date of such incurrence, whichever is the greater, shall be at least 1.5 times the estimated maximum debt service requirements of VINLEC for any succeeding fiscal year on all debt of VINLEC, including the debt to be incurred;

(c) The Cooperating Country shall, within ninety days from the submission of each rate increase application, take all actions necessary on its part to enable VINLEC to set and maintain its electricity rates and charges at levels sufficient at all times to fulfill VINLEC's obligations under (a) provided, however, that the application for the rate increases in fiscal year 1985 shall be approved by the Borrower not later than October 31, 1984;

(d) Except as shall otherwise be agreed, VINLEC shall not, until the Project Assistance Completion Date, undertake or permit to be undertaken on its behalf, any major investment other than the Project, unless it has furnished satisfactory evidence that: (i) such investment is technically, financially and economically justified; and (ii) VINLEC has or will have adequate financial resources for the carrying out of such investment; and

(e) The Cooperating Country shall (i) promptly upon its completion, furnish a copy of the tariff study being carried out by the consulting firm Coopers and Lybrand and financed by CDB and its recommendations, together with its proposals, based on such recommendations, for establishing a new structure and levels of the rates for the sale of electricity in the territories of the Borrower; (ii) afford a reasonable opportunity to comment on such recommendations and proposals; and (iii) promptly thereafter, put into effect such structure and levels of rates for the sale of electricity as shall be agreed upon between the Borrower, CDB, the IDA and VINLEC.

(iv) Event of Default. The Cooperating Country covenants to abide by all of the provisions, conditions, and covenants of all agreements entered into by the Cooperating Country with the International Development Association (IDA) and other donors for execution of the Project and agrees that A.I.D. may determine an event of default as declared by the IDA or other donors under any of their project agreements as an event of default under the A.I.D. Project Agreement.

(v) Reports. The Cooperating Country shall furnish to A.I.D., all reports which it is required to submit to other Project donors, including I.D.A., at the same time the reports are submitted to the other donors.

(vi) Forestry. Evidence that the Cooperating Country has introduced legislation to adequately provide for forest protection in the Cumberland Watershed within a reasonable time following signature of this Agreement.

(vii) Staff. The Cooperating Country shall endeavor to assign to the Cumberland Watershed, two forest guards and such other human resources as may be necessary to implement the watershed management component of the Project.

(viii) Cumberland Project Site. The Cooperating Country shall assure that VINLEC:

(a) Adequately address safety concerns arising from project activities and construction by providing traffic control during shipment of wide loads, scheduling transport of such movements during periods of low vehicular and pedestrian use, erecting warning signs to indicate hazards at powerhouses, dam sites and along pipelines, and constructing walkways over pipelines where widespread traffic requires it; and

(b) Provide continuous access to piped water for the residents of Spring Village including construction of washing facilities and piped water at the most appropriate site.

William B. Wheeler
Director
Regional Development Office/
Caribbean

26 June 1984
Dated

VII

CUMBERLAND HYDROELECTRIC PROJECT

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VIII. ANNEXES

LIST OF FIGURES AND TABLES

LIST OF ABBREVIATIONS/ACRONYMS

CAN$	-	Canadian Dollar - US$1 = CAN$1.14
CARICOM	-	Caribbean Community Secretariat
CDB	-	Caribbean Development Bank
CDC	-	Commonwealth Development Corporation
CIDA	-	Canadian International Development Assistance
EC$	-	Eastern Caribbean Dollar - US$1 = EC$2.70
EIB	-	European Investment Bank
GOSV	-	Government of St. Vincent
gWh	-	Gigawatt hours (equals 1 million kWh)
IBRD	-	International Bank for Reconstruction and Development (World Bank)
IDA	-	International Development Association (World Bank)
KM	-	Kilometres
KV	-	Kilovolts
kVA	-	Kilovolt amperes
kW	-	Kilowatts
kWh	-	Kilowatt hours
kWA	-	Kilowatt amperes
m	-	Metres
m^3/s	-	Cubic metres per second
TOE	-	Ton of Oil Equivalent
UNDP	-	United Nations Development Program
VINLEC	-	St. Vincent Electricity Services, Ltd.
WSMP	-	Watershed Management Plan

GLOSSARY OF TERMS

BIOTA	-	Referring to plant/animal life.
DIURAL	-	day/night cycles.
DIVERSION WEIR	-	A civil structure (dam) located in a stream used to direct water out of the stream.
FORCE ACCOUNT	-	Construction by workforces of implementing agency.
ISOHYET	-	Line drawn on a map connecting points of equal rainfall.
LINE LOSSES	-	Energy lost in transmission and distribution.
LOAD FACTOR	-	The ratio of average load in kilowatts supplied during a designated period to the peak or maximum load occuring in that period.
LOAD SHEDDING	-	Demand exceeds the deliverable amount of generated energy and electricity must be cut off to avoid damage to the generators.
OROGRAPHIC	-	Pertaining to physical geography of mountains or mountain ranges.
PENSTOCKS	-	Pipelines which carry water under pressure to the turbines.
POWER FACTOR	-	The ratio of total power (in watts) dissipated in an electrical circuit, to the total equivalent volt amperes applied to that circuit. The closer to 1 the ratio, the more efficient the circuit.
RIPARIAN	-	Pertaining to streams; stream-side
TAILRACE	-	Outfall for water as it leaves the turbine.

I. SUMMARY AND RECOMMENDATIONS

A. Recommendations

1. Funding

RDO/C recommends that an ESF loan of $7.5 million and an ESF grant of $0.5 million be authorized for obligation in FY 1984 for the Cumberland Hydroelectric Project in St. Vincent and the Grenadines with a Project Assistance Completion Date (PACD) of September 30, 1988.

2. Geographic Code

The project authorization will specify that, except as A.I.D. may otherwise agree in writing:

a. Goods and services financed by A.I.D. under this Project shall have their source and origin in countries included in A.I.D. Geographic Code 000 or St. Vincent and the Grenadines; and,

b. Ocean shipping financed by A.I.D. under this project shall be only on flag vessels of the United States or St. Vincent unless the conditions specified in the project's ocean freight waiver have been complied with and the appropriate certification is made.

3. Waiver

An ocean freight waiver has been obtained from AID/Washington's Office of Commodity Management and is included as Annex B.

B. Summary Project Description

St. Vincent must expand its supply of electricity in order to meet the current demand load of the manufacturing and service industries and domestic users. The current shortfall in power generation comes from an inadequate generator and replacement policy during the last several years as well as from increased demand by all categories of users. In addition to expanding the system to meet current requirements, St. Vincent needs to plan for additional generation to service the growing manufacturing and tourism sectors of the economy. A reliable supply of electricity to the productive sectors of the economy based on renewable energy resources will contribute to alleviating St. Vincent's foreign exchange, employment, and per capita income problems.

A.I.D. and four other donors assisted St. Vincent in defining a long-term power generation program. This program is encapsulated in the Cumberland Hydroelectric Project, which will be funded by the five international donors and the Government of St. Vincent and the Grenadines

in the amount of $31.3 million. The Cumberland Project is intended to be a comprehensive upgrade of the electric utility, VINLEC, and its operating system. The hydroelectric facility is only one part of that comprehensive program. The other project components include rehabilitating the overall transmission and distribution system so that electricity can be distributed more efficiently, a loss reduction program to decrease electrical system waste, a diesel plant refurbishing program to improve the efficiency and service life of the existing generators, a streamgauging program to provide data for planning future hydroelectric developments, and a watershed management program to protect the Cumberland basin hydrologic resource. A final component of the project is the improvement of the personnel management and financial capabilities of the utility to contribute to long-term viability after the capital investment components of the Cumberland Project are completed.

C. Summary Project Findings

This project is ready for implementation and is considered socially, financially, and economically sound, and technically and administratively feasible.

D. DAEC Concerns and Design Guidelines

The concerns and issues raised at the DAEC review of the Project Identification Document (PID) for this project are as follows:

1. A Watershed Management Plan is to be drafted and a firm funding committment provided prior to project authorization.

The Watershed management program will be funded by an AID Grant of $500,000. A detailed implementation plan will be finalized by the regional forestry advisor who prepared the watershed management plan, along with the regional environmental officer who prepared the I.E.E. for this project. Submission of a time-phased implementation plan for the watershed management program will be a condition precedent to disbursement for construction services. In addition, the GOSV will covenant to carry out the Plan.

The watershed management program is included in Annex J of this document. A discussion of the integrated aspects of the program within the total project scheme is included in the Project Description in Sections II. C.6 and II.D.3. The implementation plan and financial aspects are included in Sections IV.C.2.c. and III. A.

2. A.I.D. should assure that the management inputs necessary for successful project implementation have been provided by the other donors and that the roles and responsibilities of all donors and their respective contractors have been adequately delineated.

During project design A.I.D. contracted with Booz, Allen and Hamilton to examine the financial and institutional aspects of the project as described in the overall project description, Section II.C. The consultant's report, which is on file in RDO/C and LAC/DR confirms that these project components as planned are adequate and well conceived. The roles and responsibilities of the various project participants are specified in Section IV.B., Administrative and Monitoring Arrangements.

3. Clarification of the relationship between the Borrowing and the implementing agency is required.

Section II. A. describes the on-lending relationship between the Borrower, the Government of St. Vincent and the Grenadines, and the implementing agency, the St. Vincent Electricity Services, Ltd. (VINLEC).

4. The buy-out of the Commonwealth Development Corporation (CDC) should be addressed in respect to the need for a revision to the Electricity Act of 1973 and the ability of the donors to elicit financial concessions from CDC which would put VINLEC on a sounder financial footing.

A description of the current status of the CDC buy-out is contained in Section II A.4. of the paper. Its negotiation is completed but not signed and provides for financing terms which do not threaten VINLEC's financial viability. Revision of the Elecricity Act has been covenanted in the A.I.D. Project Agreement.

5. Assurance that A.I.D. debt is not subordinated to other donor debt is required.

With respect to the CDC debt, A.I.D. has been assured by both the Government and CDC that their debt is in no way preferred. CDC does have a lien on the assets of VINLEC, but thi lien does not impact on the project and would not be relevant to A.I.D. funding in any event since the Borrower is the Government of St. Vincent. With regard to the project donors, the memorandum of understanding treats all donors as co-financiers with equal status in the project.

6. The hydrologic data, duration of flows, and efficiency of the hydro-turbine generators should be examined.

The technical aspects of the design criteria are examined in Section VI.A.

7. The unrealistically tight implementation schedule should be revised.

Current implementation targets are discussed in Section V.A. Prequalification of contractors is currently underway and necessary leadtime for a competitive process of procurement has been established.

8. The PP should analyze and summarize the Shawinigan economic analysis.

Section VI.C. presents an explanation of the Shawinigan economic model.

E. Contributors to the Project Paper

The following individuals contributed to the development of this Project Paper.

A.I.D.

Terrence Brown, Chief, Development Resources Office
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G.R. Vanloo, Permanent Secretary, Ministry of Agriculture

St. Vincent Electricity Services Ltd. (VINLEC)

Joel Huggins, General Manager

II. PROJECT RATIONALE AND DESCRIPTION

A. Rationale

1. Background

St. Vincent has an immediate need to expand its power supply system which is currently insufficient to meet the island's industrial expansion and tourism needs. Over the last several years, there has been an increased demand for electricity which cannot be met by the few aging diesel generators which provide the majority of the island's power supply. There is now a continuous loadshedding situation which has forced many private business consumers to procure stand-by generators. This situation also acts as a deterrent to recruitment of other industrial and tourist enterprises who would be willing to establish factories and hotels in St. Vincent.

Foreseeing this problem, the Government of St. Vincent and the Grenadines decided to maximize the island's indigenous hydroelectric potential when planning for the expansion of the power supply system and the replacement of old equipment. In 1980, the Government commissioned a preliminary site study which led to a more extensive study in 1982, which was financed by the United Nations Development Fund. The World Bank assumed the role of implementing agency and contracted with Shawinigan Engineering Company, Ltd. to complete a study to determine the most economically attractive hydroelectric investment and to design the recommended project. As a result of this study, hereinafter referred to as the "Shawinigan Report", five donor organizations and the St. Vincent Electricity Services Co., Ltd. (VINLEC) are combining resources to carry out the Cumberland Hydroelectric Project.

2. Power Generation

The generation, transmission, and distribution of electricity in St. Vincent is the responsibility of St. Vincent Electricity Services, Ltd. (VINLEC), the sole supplier of public electricity on the island. As of July, 1984 VINLEC will be fully owned by the Government of St. Vincent, and will continue to operate as an autonomous public corporation. At present, electricity is generated from two small hydroelectric plants and two diesel stations. Transmission and distribution is effected through a mix of high voltage lines which connect the generating stations with main local areas, and low voltage lines which connect local areas to electricity users. Electricity is used for lighting, refrigeration, air conditioning (in hotels and offices), and industrial purposes. A map of St. Vincent's power grid is included in Figure 1.

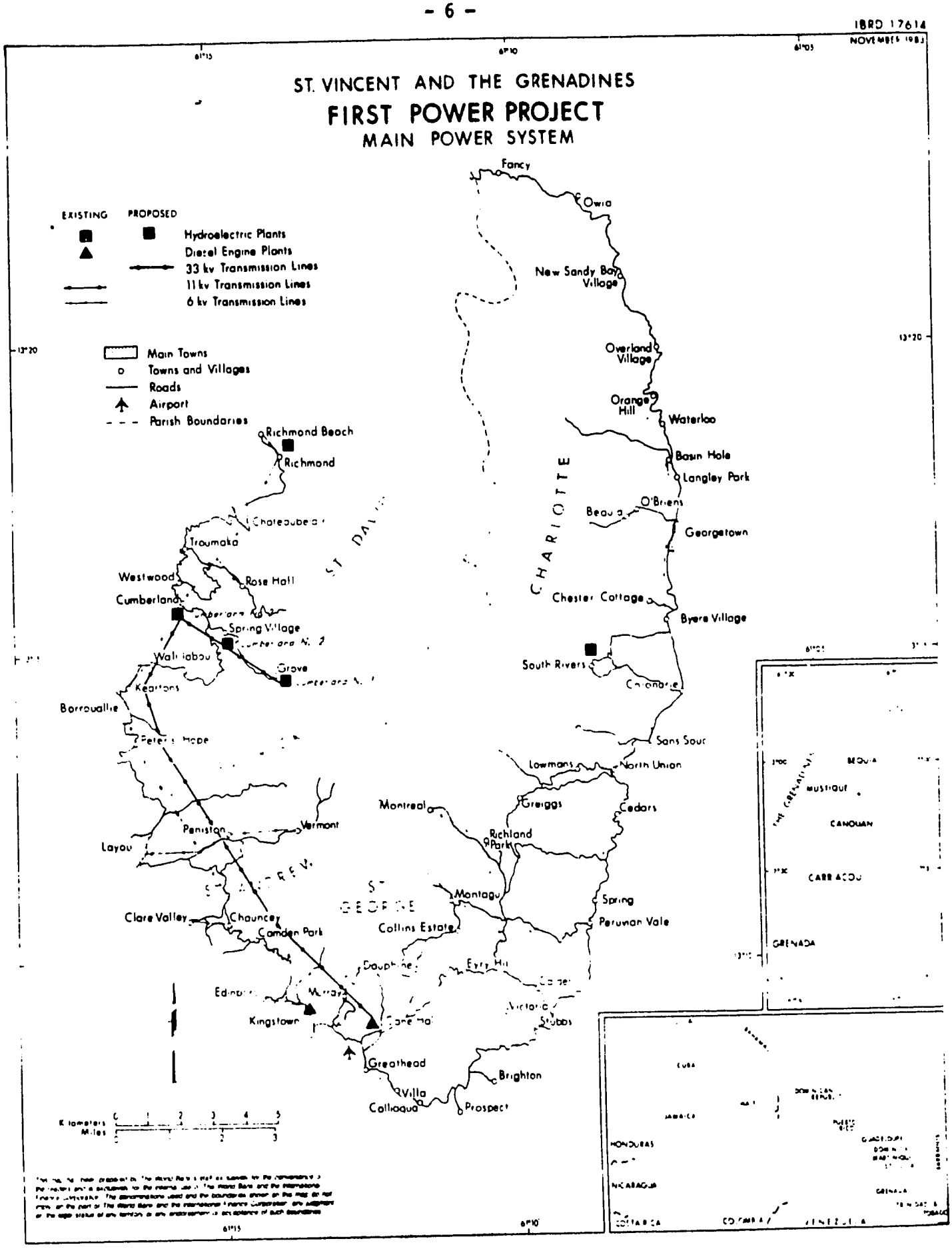

IBRD 17614
NOVEMBER 1983
ST. VINCENT AND THE GRENADINES
FIRST POWER PROJECT
MAIN POWER SYSTEM
EXISTING
PROPOSED
Hydroelectric Plants
Diesel Engine Plants
33 kv Transmission Lines
11 kv Transmission Lines
6 kv Transmission Lines
Main Towns
Towns and Villages
Roads
Airport
Parish Boundaries
Fancy
Owia
New Sandy Bay Village
Overland Village
Orange Hill
Waterloo
Basin Hole
Langley Park
O'Briens
Georgetown
Chester Cottage
Byera Village
South Rivers
Sans Souci
Lowmans
North Union
Greiggs
Cedars
Richland Park
Montagu
Spring
Peruvian Vale
Collins Estate
Eyre Hill
Victoria
Stubbs
Brighton
Prospect
Greathead
Villa
Colliaqua
Kingstown
Murray
Edinboro
Dauphine
Chauncey
Camden Park
Clare Valley
Peniston
Vermont
Layou
Montreal
Richmond Beach
Richmond
Troumaka
Westwood
Rose Hall
Cumberland
Spring Village
Wallilabou
Grove
Kearton
Barrouallie
Peters Hope
CHARLOTTE
ST. DAVID
ST. GEORGE
MUSTIQUE
CANOUAN
CARRIACOU
GRENADA
Kilometers
Miles

FIGURE 1

Existing generation capacity consists of a mix of hydro and diesel units as shown below:

TABLE 1

GENERATION RESOURCES

	Unit No.	Nominal Capacity KW	Generation Capability KW [a/]	Date Installed Year
Cane Hall Diesel Plant	1	1126	1120	1971
	2	1262	1120	1975
	3	1262	1120	1974
	4[b/]	1800	1800	1983
Sub-total		5450	4040-5160	
Kingstown Diesel Plant	1	316	0	1958
	2	460	400	1965
	3	680	0	1967
	4	670	0	1959
Sub-total		2126	0-400	
South River Hydroelectric Plant				
Sub-total		870	350-400	1958
Richmond Hydroelectric Plant				
Sub-total		1100	425-725	1962
Total capacity		9546	4815-6685	

a/ Generation capability varies as follows: Hydroelectric capability seasonally with rainfall; Kingstown with repairs to only operating generator; and Cane Hall with need to overhaul one or other operating generators.

b/ 3 recently procured high-speed generators of 600 KW each.

The existing hydro plants are run-of-the-river type, having a very limited daily storage capacity. Consequently, the energy production of these plants varies almost directly with the streamflow. Hydro-generation of about 1,900 kW can dwindle to as little as 700 kW during the dry season. Nonetheless, these plants have provided VINLEC with an economical, reliable, and environmentally-friendly energy source for the past 20 to 30 years, and should continue to do so for at least 20 to 30 more years.

Due to the limitations of VINLEC's existing hydro capacity and increased consumer demand, the diesel component of their generation system has been relied upon increasingly to meet energy demands; diesel-generated energy has increased from 19% of total demand in 1970 to 61% in 1981. Unfortunately, most of VINLEC's diesel capacity has passed its service half-life and a good portion of it (the entire Kingstown plant) is facing imminent retirement. As these units age, their maintenance and operating costs increase, breakdowns become more frequent and spare parts for repair more difficult to acquire. During the latter half of 1983 all units at the Kingstown plant were down and the slightly newer Cane Hall units were required to perform at peak capacity almost continuously, precluding or delaying the performance of necessary routine maintenance operations. Should this situation occur again, the economic service life of these units could be seriously jeopardized.

1982 statistics indicate that the Government of St. Vincent imported 59,350 barrels of diesel fuel at a CIF cost of US$2,443,000. Approximately 75% of this amount was utilized to generate electric power. Financing the fuel procurement required 40% of the revenues generated from electricity sales. This outlay can be decreased by shifting generation to hydro resources while undertaking steps to decrease line losses, upgrade existing diesel generators, and improve overall utility performance.

3. Power Demand

During 1982 about 52,000 inhabitants, representing about 44% of the total population of the island of St. Vincent, had access to electricity services. Shawinigan estimated that availability of electricity in the urban areas (mainly Kingstown, Chateaubelair, Barrouallie, Layou and Georgetown) averaged about 55%, while in the rural areas access amounted to about 30%. During the same year electricity consumption per capita averaged about 252 kWh/year, and installed power generating capacity to about 83 watts per inhabitant. St. Vincent's per capita installed capacity, energy consumption, and access was electricity are among the lowest in the Caribbean Community (CARICOM).

Electric energy demand in St. Vincent arises from a mixture of domestic, commercial, and industrial consumers. Exceptionally high energy losses, resulting primarily from an inefficient transmission/ distribution system, significantly increase the energy requirements that

the generation system is expected to meet. The 1983 energy sales, or that amount of energy actually used and paid for by consumers, is expected to be about 23 million kilowatt-hours (kWh). Losses of about 20% (an improvement in prior year losses due to a reduction in illegal electrical hookups) due to power line inefficiencies will increase the total amount of energy required to be generated to about 26 million kWh. The current system peak demand, or the maximum power output required at any one time, is 5500 to 5800 kW.

Electricity demand has grown considerably over the past several years. Between 1970 and 1981, energy sales increased at an average annual rate of 7%, while the peak demand grew at an average of slightly more than 5% per year for the same period. Increased electrical demand has generally reflected increased usage among all the consumer classes (see Table 2). Actual annual demand increases have varied considerably due to a variety of factors, including the eruption of Mt. Soufriere in 1979, the passage of Hurricane Allen in 1981, and the connection of a relatively large industrial customer in 1978. Also, certain actions taken by VINLEC, such as sharp tariff increases and recent extensive load-shedding, have predictably influenced energy consumption.

TABLE 2

Electricity Sales by Customer Class

	1974		1982	
Category	GWh	%	GWh	%
Residential	7.0	41.9	10.0	34.5
Commercial	5.5	32.9	8.0	27.6
Industrial	1.0	6.0	3.4	11.7
Public Lighting	0.3	1.8	0.4	1.4
Total Sales	13.8	82.6	21.8	75.2
Losses	2.9	17.4	7.2	24.8
Total Generation	16.7	100.0	29.0	100.0
Maximum Demand (MW)	3.6	-	5.3	-

VINLEC is faced with the task of supplying increased energy and peak demand requirements with an aging, unreliable diesel-based generation system and an inefficient transmission/ distribution system. In their report, Shawinigan forecasts (See Table 3) that potential energy sales will increase at an average annual rate of nearly 5% over the next decade, reaching 27.1 million kWh in 1986 and 35.1 kWh in 1992. Similarly, peak demand is expected to grow to 6350 kW in 1986 and 7850 kW in 1992, an annual rate of 3.6%. (These values were computed by an "econometric" model, which forecasts energy demand based on socio-economic variables).

TABLE 3

GENERATION AND PEAK DEMAND FORECAST[1/]

Year	Sales (GWh[3/])	Losses (% of) Generation	Generation (GWh)	Load Factor %	Peak Demand (MW)
1969	8.2	18.3	10.2	44.8	2.6
1970	10.3	18.3	12.6	51.4	2.8
1971	11.5	18.4	15.4	53.7	3.0
1972	12.6	18.2	15.4	48.8	3.6
1973	13.2	18.0	16.1	51.1	3.6
1974	13.8	17.4	16.7	53.0	3.6
1975	13.7	18.5	16.8	50.5	3.8
1976	13.8	18.3	16.9	49.5	3.9
1977	15.2	18.3	18.6	51.8	4.1
1978	17.6	20.4	22.1	52.6	4.8
1979	19.5	20.7	24.6	57.3	4.9
1980	19.6	23.7	25.7	63.8	4.6
1981	20.4	24.7	27.1	61.7	5.0
1982	21.8	24.8	29.0	57.0	5.3
1983[2/]	23.4	20.0	29.5	57.5	5.85
1984	24.6	18.5	30.2	58.0	5.95
1985	26.0	17.5	31.5	58.5	6.1
1986	27.1	17.5	32.8	59.0	6.35
1987	28.3	17.0	34.1	59.5	6.55
1988	29.6	16.5	35.4	60.0	6.75
1989	30.9	16.0	36.8	60.0	7.0
1990	32.3	15.5	38.2	60.0	7.3
1991	33.7	15.0	39.6	60.0	7.55
1992	35.1	15.0	41.3	60.0	7.85

1/ Source: Shawinigan Study Table 6.8.

2/ From 1983 to 1992, sales are estimates based on results of the econometric approach.

4. Institutional Framework

a. Organization

VINLEC is a limited liability company which was incorporated in St. Vincent in 1961 under the Companies Act. The company has an authorized share capital of EC$1.5 million divided into 300,000 ordinary shares of $5 each of which 82,484 shares are issued and fully paid. The Government of St. Vincent owns 49% of the shares but the Commonwealth Development Corporation (CDC) has effective control over VINLEC through its majority shareholding (51%) and its representation on the Board of Directors. Under VINLEC Articles of Association the number of its directors is to be not less than three nor more than five. Under an agreement between Government, VINLEC, and CDC, the board consists of three directors nominated by CDC and two by Government. Government nominees to the Board of Directors are the Minister of Home Affairs and a private businessman. The Chairman of the Board of Directors is the CDC representative for the East Caribbean. The Directors are responsible for the overall management of VINLEC, but delegate authority for the conduct of VINLEC's ordinary business to a General Manager. The Directors, who meet three times a year, reserve for themselves final approval of such matters as VINLEC's capital and operating budgets, salary levels, senior appointments, borrowings and union contracts.

Under a 1973 Agreement CDC provides VINLEC with off-shore management services and gives VINLEC such advice as it requires on the management and operation of the company. In recent years the management services have consisted principally of a review of VINLEC's management and operational plans and its budgeted and actual performance as well as internal auditing services and assistance with overseas procurement and recruitment. In addition to internal audit visits, a CDC senior engineer visits St. Vincent at least once a year to inspect and advise VINLEC on its operations. VINLEC's senior personnel also visit CDC's regional office from time to time. With the strengthening of its management, VINLEC's dependence on CDC management services has been reduced. However, as a small organization with limited in-house expertize, VINLEC will continue to need outside management services for several more years. It is anticipated that institution strengthening activities planned under this project will preclude the need for outside services beyond 1988.

CDC has informed the Government of its desire to sell its shares in VINLEC and to terminate the management agreement with VINLEC. The decision is consistent with CDC policy to decrease its equity position while retaining its status as a holder of long-term debt. CDC has previously redefined its position in four other Caribbean utilities to decrease corporate involvement in the internal affairs of the islands nations.

The Government of St. Vincent was advised by the UN Center for Multinational Corporations on its negotiating strategy. The buy-out agreement which will be finalized when the Government's FY85 budget is approved by Cabinet, provides for the transfer of CDC's preferred debentures to the Government in July 1984 by means of a $220,000 payment to be effected in two lump sum amounts, one in July 1984 and one in July 1985. Following the July 1984 termination of CDC's Agreement, the Government of St. Vincent will wholly own the utility.

CDC has also provided long-term debt in the form of debentures, with $1,570,000 outstanding at the end of 1983. As of December 1981, VINLEC's capital structure was composed of 95% debt and 5% equity. Because of low internal cash generation, VINLEC had to default, since 1978, on all repayments of the CDC debentures. CDC has agreed to reschedule its loan with an additional guarantee from the St. Vincent Government. The rescheduling will become effective when Cabinet approves the Government guarantee.

VINLEC's financial performance has been weak over the last few years with negative rates of financial return (based on revalued depreciation and related fixed assets). VINLEC's financial performance has been adversely affected by revenue losses due to frequent load shedding, plant breakdowns and power distribution losses (currently about 20% of total generation) mainly due to inadequacy of some distribution installations, electricity undermetering and thefts (illegal hookups). Internally generated funds have been insufficient to finance VINLEC's small capital spending (about US$800,000 between 1979 and 1982) and on December 31, 1982, a bank overdraft was being fully utilized to finance its working capital needs.

b. Management and Staff

VINLEC's organization chart is shown in Figure 2. The organization provides for three office heads: a Secretary-Accountant, a Generation Engineer and a Transmission-Distribution Engineer all reporting to the General Manager. Although the organizational structure is reasonably viable/functional, VINLEC's operations have been affected in the past by the lack of available in-house professionals and by insufficient skilled manpower. VINLEC's management has recently addressed these problems and qualified professionals have been retained to fill some of these positions. VINLEC's General Manager, a Vincentian, is a qualified and experienced engineer. Its Secretary/Accountant and Generation Engineer, who are Guyanese nationals recruited under personal services contracts with VINLEC, are qualified professionals with substantial practical experience. Together with their staff, they are capable of running VINLEC's day-to-day operations.

ST. VINCENT AND THE GRENADINES
POWER PROJECT
St. Vincent Electricity Services Limited (VINLEC)
Organization Chart

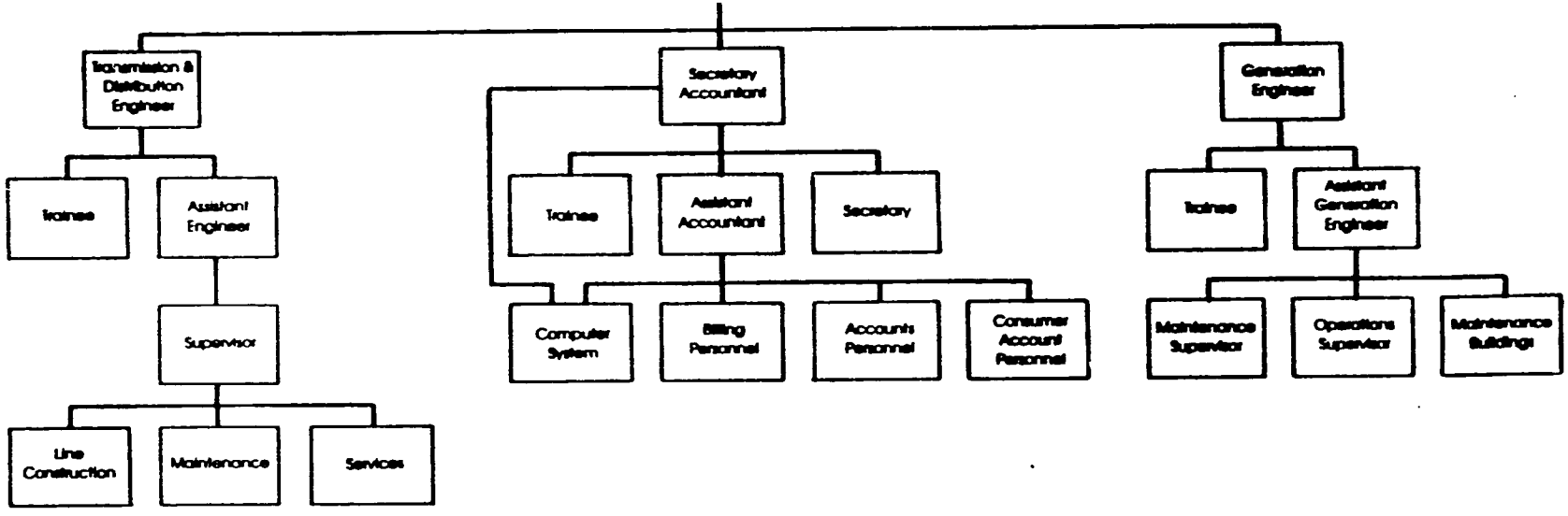


FIGURE 2

VINLEC's total permanent staff as of February 1984 amounted to 162 employees of whom four are university graduates (three engineers and one accountant). The ratio of customer/number of employees and of MWh sold/number of employees are 78 and 138 respectively. These figures are similar to those of neighboring countries (St. Lucia, Grenada, Dominica) although they are considered somewhat high by developed country standards.

5. Power Sector Strategy

a. Project Strategy

To meet current and future demands for electricity, St. Vincent must expand its power supply capabilities while resolving inefficiences in the operating system and the utility company. The decision to increase hydroelectric generation was based on a need to decrease dependence on imported fuel resources and to increase the use of indigenous renewable energy resources. A rigorous cost/benefit analysis carried out by the World Bank, has substantiated that this decision is economically valid. It is essential that St. Vincent, following a least-cost approach to incremental power production costs, must increase the supply and dependability of electric power to facilitate expansion of its industrial and tourism sectors.

While construction of a hydroelectric system is straightforward, there are constraints impacting on the total power system which must be resolved. These constraints include transmission and distribution losses, aging diesel generators, inadequate staff development and poor financial performance. During the September, 1983 multidonor coordinating meeting for the proposed project, the Government of St. Vincent was made aware that a significant portion of the proposed project was being directed toward an improvement in the utility's performance through: 1) continuing increases in its tariffs in order to maintain a rate of return on average annually revalued assets of 3% in 1984, 5% in 1985 and 6% in 1986; 2) an improvement in the delinquent accounts position; 3) a program for upgrading of the existing diesel capacity; 4) a loss reduction program to reduce unnecessary waste of power and 5) provision of technical assistance and staff training for improvement of the administrative and institutional aspects of the operating system.

In addition to providing a new power source and providing for a financially and technically viable public utility, the project will help plan for future energy expansion through a streamgauging program. Finally, a modest initial watershed management plan will be implemented for the Cumberland basin to protect the watershed and ensure maximum streamflows for the hydroelectric system in the future.

b. - Other Donor Assistance

In addition to the assistance being made available by donors within the overall Cumberland Hydroelectric program, a number of other activities are important in St. Vincent. The CDB/CARICOM Regional Energy Action Plan (RAEP) is evaluating the necessity of creating a centralized energy organization which would be responsible for: 1) formulating energy policies; 2) coordinating studies and surveys for energy planning purposes; 3) determining future energy needs and ways of meeting these requirements; 4) implementing energy conservation measures; and 5) assessing the future level of imported fuel requirements.

More specific current donor activities in the energy field in St. Vincent include the provision by the Caribbean Development Bank (CDB) of a 2.9 megawatt low speed diesel generating unit capable of burning light and heavy fuels. The CDB project is intended to meet the current excess energy demands so that emergency load-shedding can be eliminated. The British Development Division is planning to fund a 100 kilowatt pilot hydro power station at Owia on the northeast coast of the island. This activity is to provide electricity to a rural area not serviced by the national energy grid. These projects provide contiguous support to, but do not overlap or interfere with, the proposed project.

Environmental activities in the area which impact on this project include a forest survey and sedimentation gauging program by the Tropical Forestry Institute of Puerto Rico, a wildlife reserve awareness program by the World Wildlife Foundation, a proposed 2 year study of the National Watershed by the Organization of American States, and a forestry policy initiative by the Canadian International Development Assistance (CIDA).

6. Conformity with St. Vincent's Development Strategy

St. Vincent has assigned a high priority to an immediate expansion of its hydroelectric power generation capability. In 1980 when the Government commissioned the first study to determine the most feasible expansion program, they did so to provide for future economic expansion. Since that time the generation capcity of the utility system has deteriorated at a more rapid rate than was originally anticipated. The current need to provide for operating industry and tourism will be met with the arrival of the CDB financed 2.9 MW generator, combined with three 600 KW generator sets VINLEC recently purchased. Future demand will be met by this project and future hydroelectric projects.

St. Vincent is determined to decrease its dependence on imported fuel sources and to utilize its hydro potential. Expenditures on mineral and fuel imports increased from US$2.1 million in 1977 to US$5.7 million in 1981, an annual growth rate of about 35% which meant that lubricants and fuel constituted about 10% of total merchandize imports.

7. Relationship to Mission Strategy

The Mission fully supports St. Vincent's efforts to improve its basic infrastructure, including its domestic electricity supply. That current demand outstrips supply is clearly evidenced by the fact that peak demand is almost twice the available supply resulting in continuous loadshedding. The Mission has reviewed Shawinigan's hydroelectric proposal and the associated package of assistance designed to upgrade the overall electrical system, and agrees that through the project St. Vincent's pressing energy needs can be most effectively addressed.

AID has a long history of support for energy production programs as a fundamental component for broad based economic growth. The decrease in reliance on fossil fuels and the increase in the use of alternative sources of energy has been a fundamental goal of the AID program. In St. Vincent the potential for hydroelectric power provides an economically and technically feasible method of energy production.

The Cumberland Hydroelectric project is essential to assure that St. Vincent is in a position to take maximum advantage of the Caribbean Basin Initiative. Economic growth in St. Vincent is dependent upon the presence of minimal, but basic, economic infrastructure and it is certain that the present electricity supply will have to be increased if it is to provide support commensurate with projected economic growth. A strong economic expansion has been underway in St. Vincent. Over the past several years, the government has had a significant measure of success in attracting labor-intensive manufacturing plants to the country (e.g. manufacturing activity increased 16 percent in 1981). So that now the country's manufacturing sector is relatively large for a country at its stage of development, contributing 10% to GDP. Firms include garment making, corrugation of iron, plastics, glove manufacture and electronics assembly.

The climate for further development of the productive sectors, especially manufacturing, is good. The country has an appropriate set of investment incentives, relative political stability, a healthy investment climate, low wages, and an adaptable labor force. However, an insufficient electricity supply has been identified as a serious constraint to further industrial development. The proposed program of activities is designed to provide an electricity supply adequate to meet St. Vincent's development needs.

Bilateral ESF assistance to the Government of St. Vincent is seen by the Country Team as a fundamental element in our political support for that independent nation. The Eastern Caribbean governments are, for the most part, pursuing development policies based largely on free enterprise led growth. By responding to this development priority, AID will be underscoring support for democratic institutions and a free enterprise economy.

The Cumberland Hydroelectric project is also reflective of USAID's strategy to participate in co-financed donor projects. Participation in this method of implementation is consistent with Agency policy as stated in the May, 1983 policy paper on "Co-financing". This project will permit the World Bank, AID, CIDA, and EIB to present a unified voice in assisting St. Vincent to achieve a degree of independence from world oil suppliers and to revise their electric utility pricing and operational policies to provide for self-supporting power generation.

The project design has also incorporated AID policy guidelines set forth in the Institutional Development Policy Paper. In order to achieve the desired objective of financial viability for VINLEC, the Project includes necessary organizational and policy reforms to address constraints which have impeded its effectiveness. Various steps will be taken by the host country to establish a technically and financially viable utility able to serve the long-term needs of the country.

B. Objectives

The goal of the proposed project is to establish the physical productive infrastructure essential to achieve a self-sustaining level of economic growth for St. Vincent.

The purpose is to meet current and future energy demands of the industrial, tourism, and domestic sectors in St. Vincent and assure that these needs continue to be met on a self-sustaining basis by cofinancing a program of activities which will expand energy production and which will contribute to the long-term financial viability of the electric utility.

C. Project Elements

The Cumberland Hydroelectric Project, which comprises the construction of all the works included in VINLEC's 1985-88 power investment program, is expected to meet the estimated energy generation requirements through 1992; reduce substantially the imports of petroleum products (about 34,500 barrels/year which is equivalent to 33% of St. Vincent current total petroleum consumption); improve the quality of electricity services; reduce the high level of system losses; improve VINLEC's management and staff skills through a comprehensive training program and managerial assistance from consultants; and provide studies to develop future hydroelectric schemes. The physical works and consulting services included in the proposed project are described below:

1. The Hydroelectric Facility

The basic layout of the Cumberland System is shown in Figure 3. The primary components of the system include four diversion works and three powerhouses; pipelines will convey the water from the intake works to the powerhouses. The scheme is basically a run-of-the-river type, although some storage capacity has been provided.

DAM AND POWERHOUSE LOCATIONS

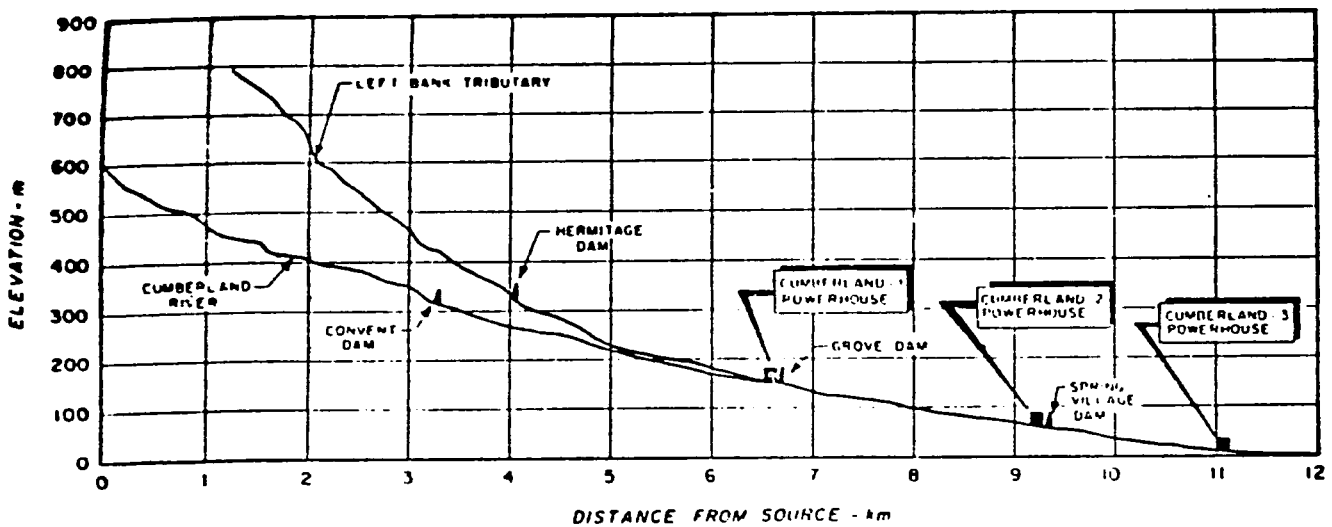


FIGURE 3

SOURCE OF INFORMATION

*1:25,000 TOPOGRAPHIC SHEET OF ST VINCENT

Diversion works located at the Convent, Hermitage, Grove, and Spring Village areas will include low concrete diversion dams, short conveyance flumes, intake structures to control the amount of water entering the system, and settling tanks. A concrete/masonry storage tank is to be provided at the Grove Dam site. This storage capability will provide for short-term system peaking ability during low-flow periods.

A total of approximately 6500 meters of pipeline will be required to convey water to the powerhouses. This pipe will range in size from 0.55 meters for the Hermitage diversion to 1.25 meters for the Cumberland 3 penstock. Although 440 meters of steel pipe will be required to handle the high pressures upstream of the Cumberland 1 station, the bulk of the pipeline will be of woodstave pipe. The decision to utilize woodstave pipe was made following an analysis of economic, geologic, and topographic factors, and in consideration of the fact that VINLEC has experience with this type of conveyance at its existing hydro stations.

The powerhouses will include turbines, generators, and necessary electrical, safety, and control equipment. The turbines will likely be turbo-impulse type, which suit the Cumberland operating conditions, and will turn synchronous alternators. Generation conditions and output of the three stations is shown in Table 4 below;

TABLE 4

DESIGN CRITERIA

	Head Net	Flow	Units	Size	Maximum Output
	(m)	(m^3)		(kW)	(kW)
Cumberland 1	155	0.92	One	1,370	1,370
Cumberland 2	78	1.87	One	1,200	1,200
Cumberland 3	42	2.20	Two	400	800
					3,370 kW

Each of the Cumberland stations will be largely automated, and overall system operation will be controlled from the more accessible Cumberland 3 powerhouse. Provision for manual operation of each plant will also be made in case of any malfunctioning of the remote control system.

2. Diesel Generator Rehabilitation

Following the provision of the Caribbean Development Bank 2.9 megawatt generator in November 1984, two of the four antiquated generators at the Kingstown plant will be retired. A decision to place the plant on a standby status rather than attempt to rehabilitate all of the generators was based on the rapid deterioration in their condition during project design and a final benefit/cost analysis which concluded that, except in emergency situations, operations at the plant cost more than the value of the electricity generated by the operating generators.

The Cumberland Project will therefore provide for the rehabilitation of all the diesel generators at the Cane Hall facility and essential repairs to two of the generators at the Kingstown facility. These units have been used beyond their recommended limits during the critical shortage of electricity in the previous 18 months and now require extensive overhauling.

3. Transmission and Distribution

In order to upgrade St. Vincent's electricity transmission and distribution system, the project will provide for; the installation of high voltage lines (11kV, 6kV, and 2.4kV) and low voltage line (440V and 220V), the installation of a 33kV transmission line to link the power stations to Kingstown, the addition of distribution transformers and street lights, and the procurement of utility vehicles. This component of the project will assure that electricity is transmitted as efficiently as possible, thereby preventing additional unnecessary line losses.

4. Loss Reduction Program

From 1970 to 1977 energy losses averaged 18%, but increased to 24.8% by 1982. In 1983 VINLEC implemented a program to reduce illegal line hookups and planned to install some power factor capacitors which would combine to decrease losses to approximately 20.0%, still an unacceptable drain on the system. These losses include; transmission loss, distribution loss, power station internal use loss, under-metering and thefts.

The Caribbean Development Bank (CDB) has recently completed a study of these energy losses and has recommended a reduction program which will be included in the CDB financed portion of this project as a follow-on to their original work. The reduction program will consist of the addition and replacement of approximately 1,000 KVAR of capacitors and the replacement of approximately 2,000 customers' metering equipment. This program will reduce line losses to 15%, a reasonable target for a power system of this size.

5. Streamgauging Program

Seven river streamgauging facilities and approximately five rainfall measurement stations at different rivers will be installed in order to establish a network of hydrologic data which will serve as the basis for future hydroelectric facilities. Currently there is one streamgauging device in the Vermont Valley which has been installed and is being monitored by the U.S. Geological Service (USGS) for the Institute of Tropical Forestry. The Cumberland project's streamgauging program will take into account experience gained from the USGS program.

6. Watershed Management Program

Since the Cumberland Hydroelectric Scheme does not include any significant storage reservoirs, the production of power depends on a regular and sustained flow of water delivered by the 3860 acre Cumberland watershed. In order to assure that the hydroelectric facility continues to operate to its designed specifications, a watershed management program will be implemented under the project for the protection and management of the watershed's resources which are presently in good condition.

The major thrust of the watershed management plan is to preserve the forests that currently exist in the watershed and to provide protection against sedimentation. To accomplish this objective, the program will improve the forest protection system, reforest areas which are unsuitable for agricultural purposes, and encourage soil conservation techniques appropriate to the steep slopes located in the watershed.

7. Institutional Development

The previously discussed components of the Cumberland Hydroelectric project will provide for the increased and more efficient production of electricity in St. Vincent. The institutional development component will address the operational capabilities of the St. Vincent Electricity Services, Ltd. (VINLEC) and the policies which govern its operations. The activities financed under this component, which are discussed below will enable VINLEC to operate as a self-sustaining authority at the end of project and to handle the debt servicing requirements resulting from this program.

a. Training

The main objectives of the training component are; (i) to establish within VINLEC a capacity for systematic and sustained manpower planning, and (ii) to create or improve critically needed skills within the organization through a five-year program of on-the-job training, fellowships, and limited technical assistance.

To achieve these objectives, the project will finance training for a newly appointed Personnel Officer who will oversee VINLEC's staff recruitment and development. The project will also fund a five year training program to:

(i) ensure the earliest possible availability of fully trained Vincentian professional-level staff through an accelerated program of upgrading of accountants and engineers through overseas training;

(ii) help establish a core group of Vincentian technicians through full technician training of four Technical College graduates at the College of Arts, Science and Technology (CAST) in Jamaica;

(iii) provide technical upgrading of skilled workers and foremen/supervisors mainly through on-the-job training assisted by short-term outside experts. For selected staff, this training would be reinforced through exposure to working methods and operational procedures in another utility with similar operations.

b. Technical Assistance

The project will finance three levels of technical assistance: Shawinigan Engineering, Ltd. (IDA funded) will be retained as the project's architectural and engineering consultant; a personal services contract (IDA funded) will be used to obtain the services of a project manager who will head VINLEC's project management unit; and consultant's services (CIDA funded) will be obtained to provide managerial, administrative, financial and other technical assistance (previously provided by CDC) to the utility company, VINLEC, during the life of the project. In addition to the above assistance to VINLEC, contracting firms (funded by various donors) will be used to build or install components of the project.

c. Tariffs and rate structures

VINLEC's financial performance to date has been poor. Activities undertaken in this project to decrease expenditures on imported fuel, decrease power plant operations and improve technical performance, will provide the basis for a financially viable future. However the project will require several financial disciplines to be imposed (in compliance with the World Bank Agreement) to insure that the utility achieves a self-sustaining status. These disciplines include:

(i) VINLEC will be required to maintain its tariffs at a level which will yield rates of return on average net revalued fixed assets of 4% in 1985, 6% in 1986 and 1987, 7% in 1988 and 1989 and 8% in 1990 and thereafter;

(ii) VINLEC will be required to not incur any long-term debt prior to project completion;

(iii) VINLEC will be required to reinvest its funds in the utility and will not pay the Government any dividends on its stock until project completion.

(iv) VINLEC will be required to obtain access to short-term financing by bank overdraft in the amount of EC$3 million.

8. Financial Composition

The seven project components discussed above will cost $31.338 million as presented in Table 5.

D. AID Implemented Components

During project design the apportioning of funds among the various donor-agencies was arranged with regard to various donor procurement restrictions, source/origin of the recommended commodities, and the type of funding being supplied by each donor.

As a result of these considerations, AID is funding the civil works construction (to be carried out by U.S. and Vincentian contractors), the stream-gauging program (which will utilize U.S. manufactured equipment), and the watershed management program (a key concern given AID's environmental policy). The specific AID-financed elements of the program are described in more detail below.

1. Civil Works

The responsibility of the AID-financed construction contractor will be to carry out the civil works component of the hydro-electric project. Construction is scheduled to begin in February 1985. The civil works will involve construction of site facilities, diversion dams, intakes, settling tanks, a storage tank, minor pipeline, minor works and the powerhouses. In addition, minor road repair and strengthening of bridges from Kingstown to the project site will be financed.

The original project design called for construction of three storage tanks to increase the availability of water during the peak demand hours. Subsequent analysis has indicated that only the Grove Dam tank is required.

TABLE 5

SUMMARY OF PROJECT COSTS

BY PROJECT COMPONENT, SOURCE OF FUNDING

FOREIGN EXCHANGE (FX) AND LOCAL COSTS (LC)

	Cost Estimate (US$ Thousand)			Financing Plan (US$ Thousand) a/																
				IDA			CIDA			CDB			EIB			USAID			COSV	
	LC	FX	Total	LC	FX	Total	LC	FX	Total	LC	FX	Total	LC	FX	Total	LC	FX	Total	LC	
1 Cumberland Hydro Scheme																				
Civil Works	3352	4951	8303	-	-	-	-	-	-	-	-	-	-	-	-	2274	4951	7225	1078	
Turbine and Generators	321	2790	3111	-	-	-	-	-	-	-	-	-	-	2790	2790	-	-	-	321	
Pipeline, Electrical and Mechanical Equipment, Transmissions & Telecoms.	662	6546	7208	-	-	-	662	6546	7208	-	-	-	-	-	-	-	-	-		
2 Engineering and Administration	316	1285	1601	-	1285	1285	-	-	-	-	-	-	-	-	-	-	-	-	316	
3 Rainfall and Streamgauging Network	70	205	275	-	-	-	-	-	-	-	-	-	-	-	-	70	205	275	-	
4 Rehabilitation Diesel Plant	133	967	1100	-	967	967	-	-	-	-	-	-	-	-	-	-	-	-	133	
5 Loss Reduction Program	2041	3399	5440	-	-	-	-	-	-	1101	3399	4500	-	-	-	-	-	-	940	
6 Transmission and Distribution	362	773	1135	-	773	773	-	-	-	-	-	-	-	-	-	-	-	-	362	
7 Project Manager	162	620	782	162	620	782	-	-	-	-	-	-	-	-	-	-	-	-	-	
8 Managerial Services	77	485	562	-	-	-	77	485	562	-	-	-	-	-	-	-	-	-	-	
9 Training	155	656	811	155	656	811	-	-	-	-	-	-	-	-	-	-	-	-	-	
10 Hydroelectric Studies	101	359	460	-	359	359	-	-	-	-	-	-	-	-	-	-	-	-	101	
11 Watershed Management	300	250	550	-	-	-	-	-	-	-	-	-	-	-	-	250	250	500	50	
TOTAL	8052	23286	31338	317	4660	4977	739	7031	7770	1101	3399	4500	-	2790	2790	2594	5406	8000	3301	

a/ Inflation for AID funded components has been calculated compounded annually at 7.5% and contingency at 15%. Inflation for non-AID funded components has been calculated at approximately 10% for local costs and 7% for foreign exchange costs and contingency at 12%.

- The civil works contractor will prepare the site in which the CIDA supplied woodstave pipe will be placed by a Canadian contractor. The weight of the pipe and water to be taken across the river is substantial. It is, therefore, proposed to use Bailey or similar bridges at the river crossings and to use the bridge both as a support and a platform for maintenance work.

The pipelines alongside the road will be above ground and supported in wooden cradles high enough above the ground to allow easy circulation of air and reduction of fungal attacks. The sill on which the cradle rests will be of concrete or wood on a gravel bed to facilitate drainage. There will also be a permanent access road alongside the pipe for maintenance purposes.

The AID contractor will build the powerhouses which will house the EIB supplied turbines and generators. Basically the powerhouse will be of steel frame construction with an outer concrete block wall and an asbestos cement roof. There will be an overhead travelling crane in each powerhouse. The powerhouse layout will include an outdoor switchyard of the type already known at the two VINLEC hydroelectric stations. The design of the powerhouse will maximize the amount of light and ventilation that can be provided. From the turbines the water will flow to the intake of the downstream plant or back to the river.

Minor pipeline and other works will be procured with AID financing through the construction contractor.

Construction will be carried out in such a way as to have the least possible negative effects on the population of the local villages.

2. Streamgauging Program

Since the development of additional hydropower sites will likely play an important role in VINLEC's future, there is an urgent need to begin gathering pertinent hydrologic information, especially streamflow data, to facilitate optimum site selection and design. The project will therefore finance the installation of a hydrologic data gathering network consisting of seven flow-recording stations and five rainfall stations on select rivers around the Island. Design and site selection has been done by the project engineers, Shawinigan, and the specifications are included as Annex K. Actual procurement and installation of the stations, including any construction work, will be performed by the AID civil works contractor. The Government, through VINLEC or the Water Authority, will be required as a condition precedent to procurement of the streamgauging equipment to monitor and maintain the stations for the life of the project and beyond.

3. Watershed Management Program

AID is committed to financing implementation of the Cumberland Watershed Management Plan in order to preserve the availability of water to the hydroelectric facility. Decisions on the major focus of the plan were based on the importance of areas of the watershed to the sustained flow of water.

The generation of electrical power by Cumberland 1 will be dependent only upon the waterflow rate from the watershed above the Convent and Hermitage Dams. (See Figure 3, p. 18). This area is in virgin jungle, more correctly called primary and secondary forest. The objective of the watershed management program in this area will be to preserve the present status, by insuring that legislation is in place to prevent the exploitation of this land, and that the regulations are rigorously enforced.

Water intake for Cumberland 2 will consist of the exhaust water of Cumberland 1 and the waterflow from the watershed between Hermitage-Convent and Grove. Of the total amount of piped water arriving at Cumberland 2, 50% will be from the exhaust water of Cumberland 1, and 50% from the waterflow of the watershed between Hermitage and Convent, and Grove. The condition of the watershed in the area between Hermitage-Convent and Grove is unclear but appears to be a mixture of primary and secondary forest, with a moderate amount of agricultural activity (banana plantations). The objective of the watershed management program in this area will be to improve the watershed by establishing forest plantations on cleared land which is not in agricultural production, protect the existing forests, and if required, provide soil conservation measures on a 100 meter band of each side of the Cumberland.

Cumberland 3 will be powered by piped water originating from three sources 1) exhaust water from the Cumberland 1 facility, b) exhaust water from the Cumberland 2 facility and c) waterflow from the watershed between Grove and Spring Village. The watershed between Grove and Spring Village will contribute only 15% of the total amount of piped water reaching the Cumberland 3 - Powerhouse. The watershed above Grove will be contributing 85% of the piped water to Cumberland 3 due to the passing on of the exhaust water from Cumberland 1 and 2. The watershed area between Grove and Spring Village is the most vulnerable to degradation. There is moderate to high agricultural activity near the access road which runs parallel to the river in many places, but in terms of the area's importance to the Cumberland Hydroelectric Project, it would be hard to justify a major conservation/management activity for this watershed. Therefore, the objective of the watershed management program in this area will be to prevent further agricultural exploitation of the area by enforcement of regulations and to provide soil conservation measures on a 100 meter ban on both sides of the Cumberland River to limit the amount of sedimentation reaching the Cumberland 3 water supply.

- A specific description of the watershed management plan as designed by the natural resources advisor is contained in Annex J.1 which is on file in RDO/C and LAC/DR. The basis of WSMP funding provided in this paper is documented in Annex J.2. Additional work needs to be carried out to produce a time-phased plan which can be implemented within the capabilities of the Government of St. Vincent as augmented by the Project Grant. Effects of a recent wildlife protection grant by the World Wildlife Fund, a proposed national watershed management study by the Organization of American States, a CIDA initiative in forest policy definition, the AID funded agricultural project, and other events must be incorporated into a final plan. Additionally, an administrative mechanism must be worked out to integrate the implementation of this activity within the overall hydroelectric project. It is critically important that the watershed management component not be delayed; therefore, the implementation plan will be prepared immediately following project approval.

III. COST ESTIMATE AND FINANCIAL PLAN

A. Financial Plan

Total project costs of $31.338 million are illustrated by expense category in Table 6. AID will be providing $8.0 million to finance the civil works, streamgauging, and watershed management programs. The AID specific financing requirements are detailed in Table 7. The civil works and streamgauging will require $7.5 million which will be provided on a loan basis at AID's most concessional terms. The watershed management program will cost $0.5 million and will be grant financed. The remaining $23.338 million of project financing will be provided as follows;

World Bank (IDA)	4,977 (Loan)
Canadian International Development Assistance	7,770 (Grant)
European Investment Bank	2,790 (Loan)
Government of St. Vincent (to be obtained from VINLEC's Cash Flow)	3,301
Caribbean Development Bank	4,500 (Loan)

All donor contributions will be provided to the Government of St. Vincent and the Grenadines, which will pass the funds on to the St. Vincent Electricity Services Ltd. (except the AID grant). The execution of the subsidiary loan and grant Agreements is a condition of all donors' credit effectiveness. The Government's own contribution to the project will consist of financing a portion of the local costs of each component of the project but mostly the civil works component. The Government's contribution to the AID funded components is $1.1 million or 14.0% of AID financing. Approximately $500,000 of these funds will be used to co-fund the civil works contract to include the reinforcement of bridges and preparation of roadways from the port of equipment entry to the jobsite. This cash requirement will be supported by VINLEC's expanded overdraft facility which will be replenished by VINLEC revenues.

B. Repayment Capability

1. VINLEC

Funding for this project will be provided to VINLEC through the Government of St. Vincent and, likewise, repayment of the loans will be from VINLEC generated funds through the Government. An analysis of VINLEC's ability to finance operations, plan for additional capital expenditures, and repay the old debts to CDC as well as the new debts incurred under this project was performed by AID-funded project design consultants.

The analysis indicates that VINLEC's ability to comply with the proposed financial covenants is relatively insensitive to concessionary financing terms associated with AID assistance although higher rates could place a further burden on VINLEC's already strained cash postion, its ability to finance its portion of the project commitment from internal funds, and its ability to service its debt. This is particularly true if operating income fails to meet World Bank projections. AID has, therefore, carefully weighed the advantages of

TABLE 6

SUMMARY OF PROJECT COSTS

BY EXPENSE CATEGORY AND SOURCE OF FUNDING a/

(US$ 000)

EXPENSE CATEGORY	LIFE OF PROJECT FUNDING								
	AID			GOSV	IDA	CIDA	EIB	CDB	TOTAL
	FX	LC	TOTAL						
1. Technical Assistance									
a. Project Manager	-	-	-	-	782	-	-	-	782
b. Supervisory Consultant	-	-	-	316	1,285	-	-	-	1,601
c. Managerial Services	-	-	-	-	-	562	-	-	562
SUB-TOTAL	-	-	-	316	2,067	562	-	-	2,945
2. Training	-	-	-	-	811	-	-	-	811
SUBTOTAL	-	-	-	-	811	-	-	-	811
3. Commodities									
a. Turbines & Generators	-	-	-	321	-	-	2,790	-	3,111
b. Pipeline, Electrical and Mechanical Equipment	-	-	-	-	-	7,208	-	-	7,208
c. Rainfall & streamgauging equipment (L)	205	70	275	-	-	-	-	-	275
d. Loss Reduction Equipment	-	-	-	940	-	-	-	4,500	5,440
e. Transmission & Distribution Equipment	-	-	-	362	773	-	-	-	1,135
SUBTOTAL	205	70	275	1,623	773	7,208	2,790	4,500	17,169
4. Other Costs									
a. Rehabilitation of Diesel Plant	-	-	-	133	967	-	-	-	1,100
b. Civil Works (L)	4,951	2,274	7,225	1,078	-	-	-	-	8,303
c. Hydroelectric Studies	-	-	-	101	359	-	-	-	460
d. Watershed Management (G)	250	250	500	50	-	-	-	-	550
SUBTOTAL	5,201	2,524	7,725	1,362	1,326	-	-	-	10,413
TOTAL	5,406	2,594	8,000	3,301	4,977	7,770	2,790	4,500	31,338

a/ Inflation for AID funded components has been calculated compounded annually at 7.5% and contingency at 17%. Inflation for non-AID funded components has been calculated at approximately 10% for local costs and 7% for foreign exchange costs and contingency at 12%.

TABLE 7

AID FUNDED COMPONENTS a/

(US$000)

	Description	Local Costs	Foreign Cost	Total
1.	Civil Works			
a.	Temporary Facilities and Pipeline Foundation	622	847	1,469
b.	Diversion Weirs (Dams)	290	774	1,064
c.	Intakes	61	164	225
d.	Settling Tanks + Control + Inlet Tanks	636	1,686	2,322
e.	Roads, Bridges	179	314	493
f.	Powerhouse Civil	151	430	581
g.	Contingency (17%)	335	736	1,071
	Sub-total Civil Works	2,274	4,951	7,225
2.	Streamgauging Equipment	70	205	275
3.	Watershed Management Including Contingency	250	250	500
	Total	2,594	5,406	8,000

a/ Inflation which is included in each line item was calculated at 7.5% compounded annually.

imposing higher interest charges against the impact of unforeseen project difficulties on VINLEC's operating income and total cash flow. It was concluded that concessionary terms are reasonable.

2. Government of St. Vincent

The Government will be repaying all donor loans under this project and the Eastern Caribbean Central Bank will be required to convert VINLEC generated funds (Eastern Caribbean Dollars) to the appropriate currency of repayment. Foreign exchange availability should not pose a problem if estimates of operating income are realized. Each East Caribbean dollar of revenue generated by VINLEC represents a claim on the East Caribbean Central Bank (ECCB) which on request must convert the E.C. dollar into U.S. dollars. Convertibility is guaranteed by the ECCB's "cover ratio" requirement which mandates that the ECCB hold foreign exchange cover equal to 60 percent of its notes and coins in circulation and other deposit liabilities.

C. Status of Co-financing Agreements

At the request of the Government of St. Vincent, the World Bank agreed to assume the leadership role in developing the Cumberland project and in forming a consortium of donors to finance the project. The core members of the consortium, CIDA, CDB and the World Bank jointly participated in the review of the prefeasibility and feasibility studies of the project completed by Shawinigan Engineering Company in 1982 and 1983. The Government of St. Vincent requested support for the Cumberland project at the 1983 session of the Caribbean Group for Cooperation in Economic Development.

In response to that request, RDO/C participated in the World Bank Appraisal Mission to St. Vincent in August/September, 1983. During that Mission, the basic structure of the project was agreed upon, specific elements of the project were allocated by donor and a schedule for final project development established. The European Investment Bank also participated in those discussions.

In March 1984, the World Bank chaired a Donor's Coordination Meeting in Washington to review the status of donor commitment and to agree upon a donor coordinating mechanism. Attending were the World Bank, CIDA and AID. Based on experience with other similar donor consortia, CIDA requested that the World Bank assume more active responsibility for donor coordination, including establishing a schedule of supervisory missions and establishing a formal and regularly scheduled donor steering committee. It was agreed that any donor could call a steering group meeting at any time but that the World Bank would call a meeting approximately every six months. It was also agreed that project reports submitted to any donor would be copied to all donors. Donors would also concur upon VINLEC reporting formats and attempt to standardize reports to reduce VINLEC's reporting burden. A draft Memorandum of Understanding was presented to the meeting and agreed upon. The watershed management element of the project will be added to the Memorandum's Annex when that component has been finalized with the Government of St. Vincent.

Donors are in various stages of completing their own financing arrangement; approval of all financing is a reasonable assumption, but a condition precedent to disbursement will require that all financing be in place. CIDA has its Treasury level approval for the project and expects to sign its agreement with the Government of St. Vincent in May or early June. The World Bank's Executive Board will consider the project on May 22 with execution of its agreements in June. CDB plans to approve its financial package at its July 12 Board meeting. Finally, EIB has negotiated its agreement and it has been initialled. Minor changes are necessary but no issues remain to be negotiated.

IV. IMPLEMENTATION PLAN

A. Implementation Schedule

Project activities are programmed to take place over a period of approximately four and one-fourth years from the date of signing the Project Agreement. AID financed activities are scheduled to be completed by the end of 1987, after which an evaluation will be performed. The Project Assistance Completion Date (PACD) has therefore been set for September 30, 1988, which follows the commissioning of the final hydroelectric powerhouse by a few months. The proposed implementation schedule for the various project components is presented in Table 8.

The Government of St. Vincent and the Grenadines through the utility company, VINLEC, will engage contractors for the civil works (AID Handbook 11 procedures) and for the manufacturing, supply, and installation of the electro-mechanical equipment. The diesel rehabilitation and loss reduction programs will be implemented through VINLEC's force account and/or local contractors under the supervision of the project engineers and the project management unit. The watershed management plan will be implemented by the Forestry Division of the Ministry of Agriculture.

The supervisory consultant, Shawinigan, has been preparing contract bidding documents for all donor packages. The donors have reviewed these documents in draft, submitted comments, and are awaiting final revisions. Immediately upon Project signing, prequalification of contractors, Invitation for Bids, and shortlisting contractors can proceed, although actual contracting will not be possible until all conditions precedent to disbursement for civil works have been met. An implementation schedule for initiation of AID funded activities is presented in Figure 4, and a life-of-project civil works implementation schedule is presented in Figure 5.

The AID-financed watershed management program is integral to preserving the conditions which permit a cost-effective hydroelectric scheme in the Cumberland Watershed. It is essential that activities under this program begin immediately upon signing of the Project Agreement so that no further destruction of the watershed is incurred as a result Project publicity. The watershed management plan will be finalized during a second TDY by AID's forestry and environmental advisors in July, 1984. Project Development and Support Funds will then be used to fund short-term technical assistance to begin the critical first steps toward implementing the plan (i.e. identifying guards for training, assuring adequate legislation, etc.).

TABLE 3

PROJECT IMPLEMENTATION SCHEDULE

	Issue of Bidding Documents	Award of Contracts	Implementation Starts	Implementation Finishes
1. Cumberland Hydroelectric Scheme[a/]				
a. Civil Works[b/]	June 1984	February 1985	February 1985	December 1987
b. Penstocks	December 1984	June 1985	May 1986	September 1987
c. Powerhouses	June 1984	February 1985	July 1985	July 1987
d. Turbines and Generators	June 1985	December 1986	December 1986	October 1987
e. Electrical and Mechanical	September 1985	January 1986	December 1986	November 1987
f. Substations and Transmission	September 1985	January 1986	December 1986	October 1987
g. Commissioning of Plants[c/]	-			December 1987
2. Streamgauging Network[d/]	January 1985	June 1985	December 1985	December 1987
3. Rehabilitation of Diesel Plant[d/]	July 1984	December 1984	June 1985	December 1986
4. Transmission and Distribution	December 1985	April 1985	August 1985	June 1988
5. Consultants Services	March 1984	May 1984	June 1985	June 1990
6. Watershed Management Plan[e/]	June 1984	December 1984	September 1984	December 1987
7. Evaluation	January 1988	April 1988	June 1988	July 1988

a. Four separate general contracts will be awarded as follows:
   (i) civil works and power house for the three power plants
   (ii) turbines and generators for the three power plants
   (iii) Penstocks for the three power plants
   (iv) substations and transmission for the three power plants
   Additionally two equipment contracts will be awarded
   (v) overhead cranes for the three power plants
   (vi) low head starter gates

b/ See annex I for detailed civil works implementation chart

c/ The hydroelectric plant nos. 1, 2, and 3 will be commissioned on December 1986, June 1987, December, 1987, respectively.

d/ IFB's for equipment only

e/ The majority of this activity will be carried out by the Government of St. Vincent's Forestry Service, however, a consultant will be contracted early in the project to organize implementation. See annex I, item 5 for detailed implementation.

Best Available Document

PRECONSTRUCTION IMPLEMENTATION SCHEDULE

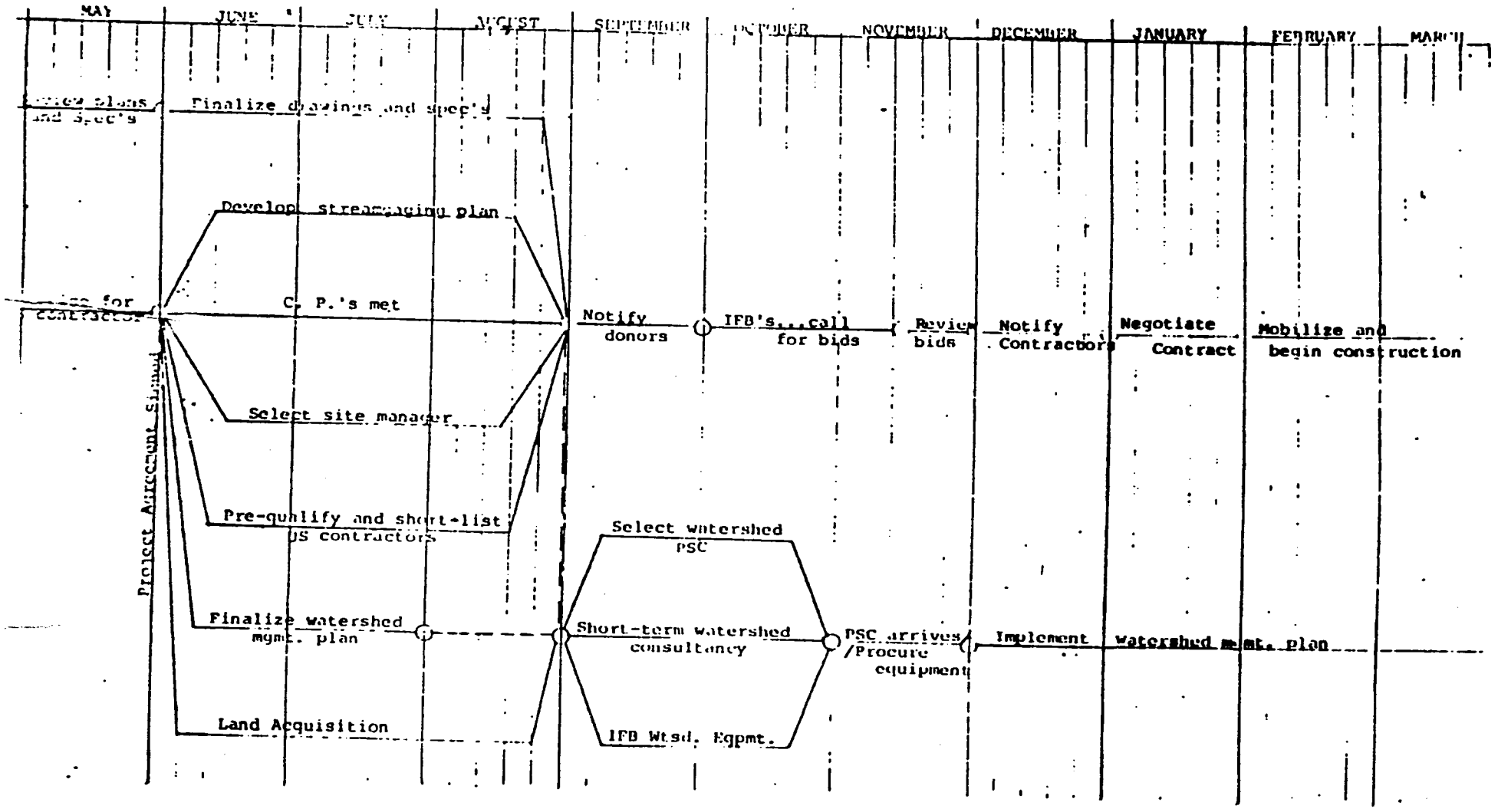


FIGURE 4

Best Available Document

CIVIL WORKS IMPLEMENTATION SCHEDULE

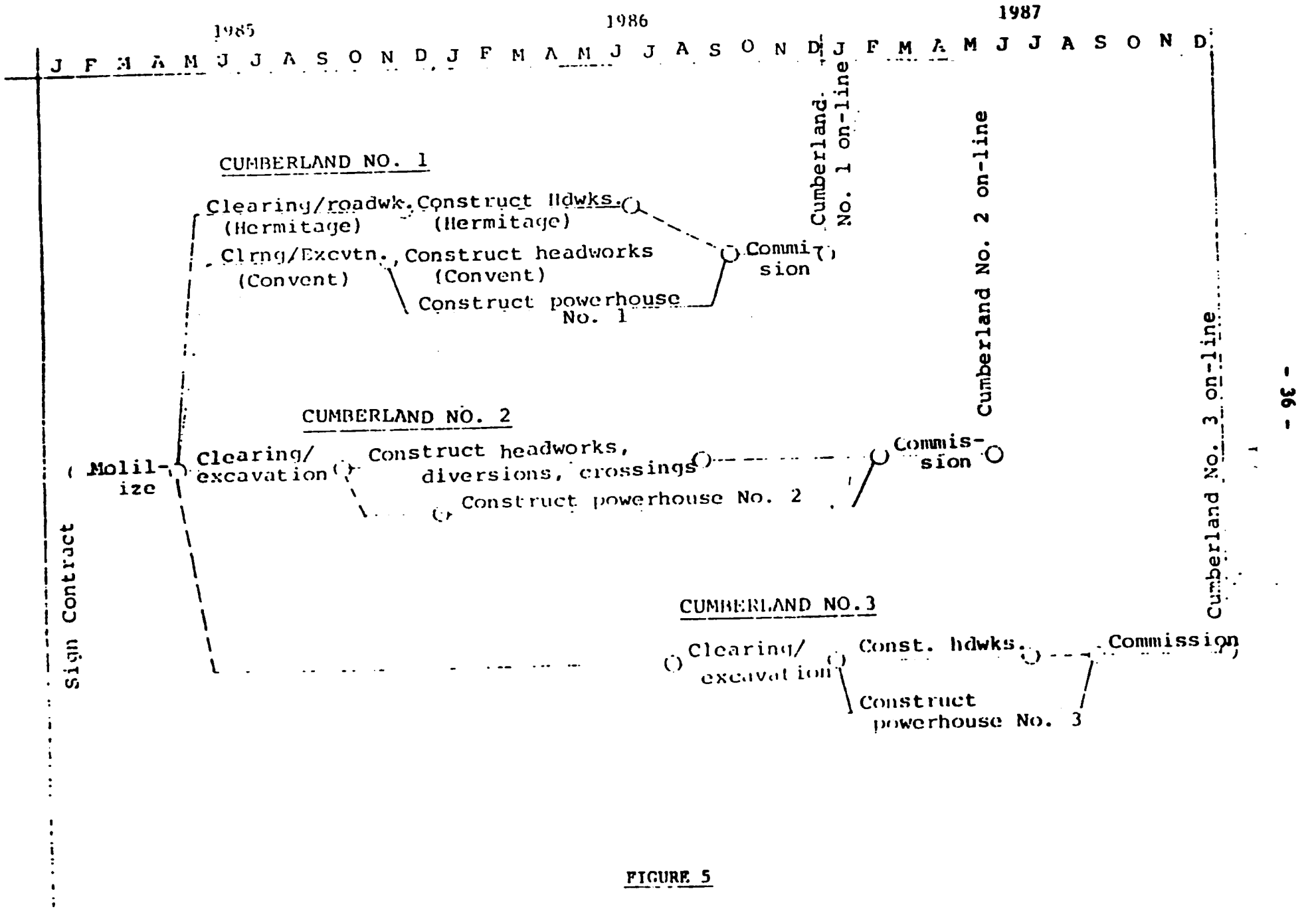


FIGURE 5

The general implementation schedule for AID financed activities is as follows;

March 1984	Prequalification Notice for Civil Works contractor published in the CBD.
June 1984	Project Agreement Signed.
July 1984	Watershed Management Plan finalized
September 1984	Initial Conditions Precedent Met.
	Short-term T.A. for watershed implementation begins.
September 1984	IFB for Civil Works contractor sent to short-listed firms by VINLEC.
	Advertisement for Watershed Management personal services contractor published.
November 1984	Receive and evaluate civil works contractor proposals.
December 1984	Select and notify contractor.
January 1985	Negotiate and sign Civil Works contract. Long-term T.A. for Watershed Implementation begins.
February 1985	Civil Works construction begins.
	IFB for streamgauging equipment issued.
May 1986	Interim Evaluation conducted
December 1986	Commissioning of Cumberland # 1
June 1987	Commissioning of Cumberland # 2
December 1987	Commissioning of Cumberland # 3
June 1988	Final evaluation conducted
September 1988	Project Assistance Completion Date

B. Administrative and Monitoring Arrangements

1. A.I.D. Responsibilities

The Regional Development Office/Caribbean's Engineering and Energy Office (E/TA) will be responsible for managing the AID loan financed portion of this project and coordinating with the other donors where necessary in matters relating to their inputs. E/TA staff currently consists of two USDH engineers, one U.S. contract engineer and two FSN engineers; a third USDH will join the staff shortly. The Mission's Agriculture and Rural Development office will be responsible for managing the watershed management component of this project. ARD staff consists of five USDH agriculturists. A core project committee will be established consisting of one USDH engineer (project officer) and representatives of the ARD, Capital Projects and Controller's staffs.

The Project committee will be assisted in contracting and procurement actions by the Contracts Officer; evaluation matters by the Program Office, training matters by the Human Resources Office, legal matters by the Regional Legal Advisor and environmental matters by the mission's Environmental Officer.

This project has been under active study and design by World Bank funded consultants for two years and the implementation activities have been planned to minimize demands being placed on donor direct-hire and Government of St. Vincent resources. Following initial host country procurement and contracting review responsibilities, RDO/C's participation in the project should revert to monitoring, not intense implementation. RDO/C is confident that the VINLEC project management unit which will be headed by an expatriate engineer will be capable of coordinating the various programs.

2. Government of St. Vincent Responsibilities

The major implementing organizations under this project will be the St. Vincent Electricity Services, Ltd. (VINLEC) and the Ministry of Agriculture, Forestry Division (watershed management only). VINLEC will establish a project management unit solely for the purpose of implementing this project. The project manager who will be contracted to head this unit, will be an expatriate because a Vincentian with the qualifications for this position is currently not available. The Project Manager is defined to operate in a coordination, consulting, advisory and staff role. Current plans call for him/her to head up a small Project Management Unit consisting of the Project Manager, an accountant/ bookkeeper and perhaps one or two additional staff. This unit with assistance from the architectural and engineering consultant and the off-shore management consultant should have no difficulties carrying out the designed functions.

The Watershed Management Program is distinct and separate from the other activities in this project and will be implemented under the direction of the Chief Forestry Officer of the Ministry of Agriculture. All proposed activities within the plan are activities

currently being carried out by the Forestry Division on a smaller scale throughout the entire island. There are no anticipated problems in providing for these same activities on an isolated basis in the Cumberland Valley. However, to take some of the organizational burden away from the chief forestry officer, the project will provide a personal services contractor to organize and initiate the activities called for in the watershed program, as well as administrative details required during the initial stages of implementation of the watershed management plan.

3. Various Consultants Responsibilities

There will be at least six major offshore consulting contracts awarded under this project; 1) engineering, 2) civil works construction; 3) manufacture and installation of the turbines and generators; 4) production and installation of the penstocks; 5) outfitting of the substations and the transmission system and 6) intermittent managerial consulting services. The engineering consultant (#1) will report to VINLEC's general manager in respect to the discharging of his duties and will direct the work of the other contractors (#2 to #5) in respect to technical design criteria. All contractors (# 1 to #6) will be responsible to VINLEC's project management unit in terms of reporting, change orders and requests for payment. Figure 6 provides a chart of the flow paper in respect to the AID-funded contractor (#2) and the other project participants.

4. Various Donor Responsibilities

The World Bank has assumed the role of lead implementing agency. As such, their Agreement with the Government of St. Vincent will contain the majority of the Conditions Precedent to Disbursement and financial performance criteria. The World Bank will be responsible for monitoring the Government's compliance on behalf of the donor consortium. AID will consider World Bank acceptance of Government compliance as satisfaction of its interest in these requirements.

The project has been partitioned in such a manner that the various donor activities are discrete and do not impact on the other donor's implementation schedules. The one exception to that plan is the AID-financed civil works component which naturally must preceed the installation of the equipment. AID is aware of its responsibility to proceed on schedule so as not to delay other donor activities.

C. Procurement Responsibilities

1. Project Procurements

The financing package for the Cumberland Hydroelectric Project has been arranged according to the availability and nature of funds from the various donor governments. Additional consideration was given to the various donor procurement restrictions and availability of commodities and services from the donor countries. The final configuration of donor financing responsibilities can be seen in Tables 5 and 6 of the financial plan. The method of handling these numerous procurements is presented in Table 9.

FLOW CHART FOR APPROVAL OF U.S. CONTRACTOR'S

REQUEST FOR PAYMENT/CHANGE ORDERS

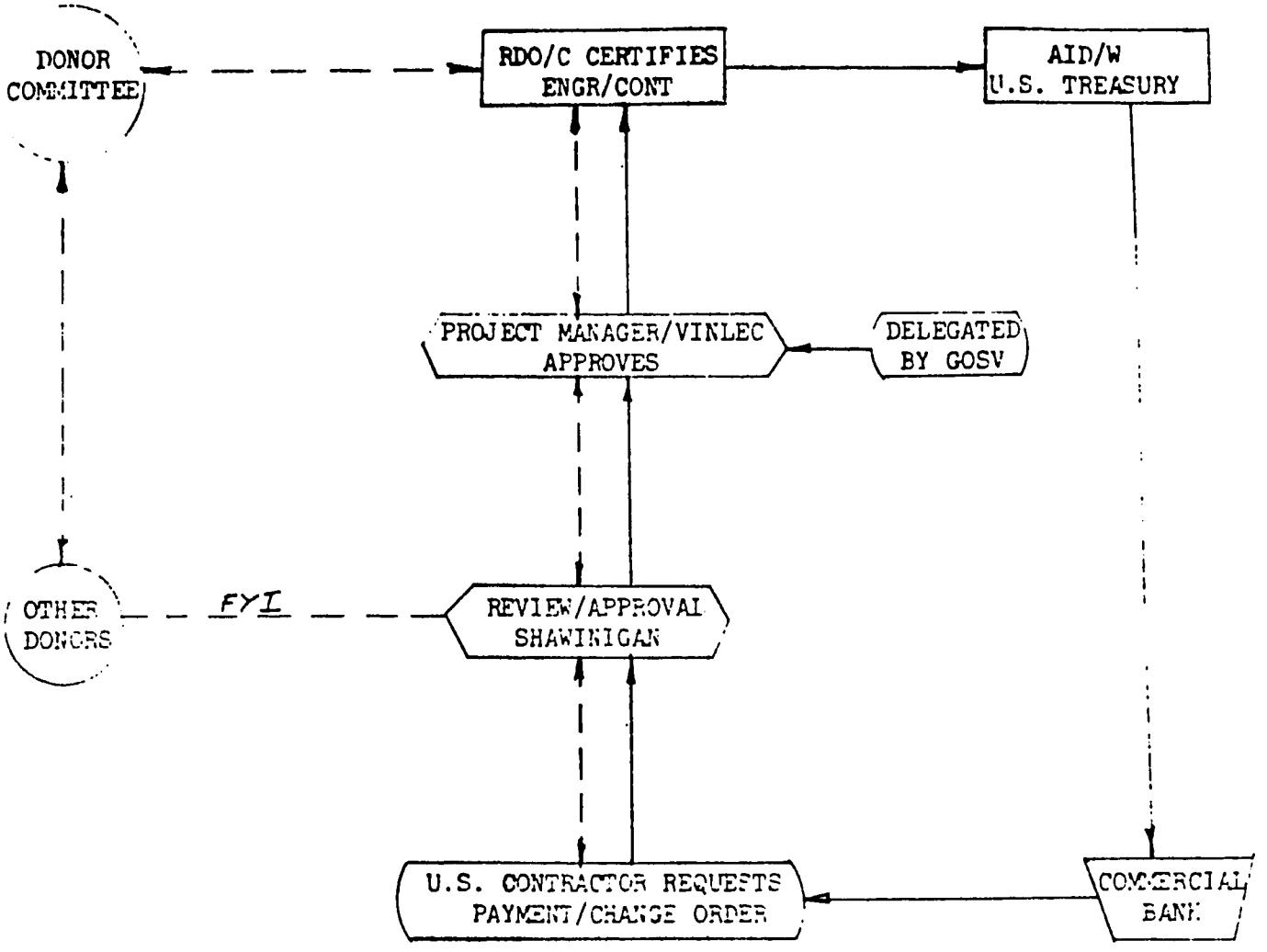


TABLE 9

PROCUREMENT METHOD
(US'000)

Project Element	In-country Purchase	Direct Procurement	Force Account	Other 1/	Total
1. Cumberland hydro-electric scheme					
a. Civil Works				8,303	8,303
b. Equipment				10,319	10,319
c. Engineering and Supervision				1,601	1,601
2. Rainfall and Stream-gauging			70	205	275
3. Rehabilitation of diesel plant		967	133		1,100
4. Transmission and Distribution	773		362		1,135
5. Loss Reduction Program	3,000		2,440		5,440
6. Project Manager			162	620	782
7. Managerial Services			77	485	562
8. Training		656	155		811
9. Hydroelectric Studies			101	359	460
10. Watershed Management			300	250	550
	3,773	1,623	3,800	22,142	31,338

1/ Procurement of these items is subject to the various donors' procurement policies.

2. AID-Financed Procurements

The following arrangements have been made for procurement under the AID-financed components of the project:

a. Civil Works

The civil works component will be carried out in its entirety by U.S. and Vincentian construction contractors procured through the use of host country competitive contracting procedures (AID Handbook 11, Chapter 2). It is expected that the prime contract will be with a U.S. firm and Vincentian sub-contractors will undoubtedly be used for reinforcement of bridge works, repair of roads, building of pipeline cradles, etc. The estimated value of the contract is $8,303,000 of which $7,225,000 will be financed by AID and $1,078,000 by the Government of St. Vincent. The majority of equipment and materials to be procured for the civil works component will be purchased from the U.S. by the construction contractor and shipped to St. Vincent. Small items may be available in St. Vincent. An ocean freight waiver has been approved and is attached herein as Annex B.

A draft Invitation For Bid (IFB) for the construction contractor has been presented to AID by the World Bank. These documents are now being finalized and will be sent to those firms who are being short-listed as a result of a prequalification notice placed in the Commerce Business Daily in March. Award of contract will be in January 1985 which should facilitate initiation of construction in February 1985.

b. Streamgauging and Rainfall Network

Equipment to be procured under this component is valued at $54,000. The procurement will be included as a service to be provided by the civil works contractor under the terms of that contract.

c. Watershed Management Program

The watershed management plan consists of numerous small procurements including one long-term consultant, several short-term consultants, training, two vehicles, and miscellaneous hand tools and audio-visual devices.

The final implementation plan will refine and finalize the procurement list, however, at this stage the Mission anticipates the following procurement requirements:

(i) training of forest guards will take place under RDO/C's Regional Development Training II Project (538-0087). The participant placement process under that project will begin in August, 1984 which will give the watershed management component a head start in this critical procurement area;

(ii) technical assistance will be provided initially by a short-term personal services contractor who will be secured from the U.S. using project development and support funds. This contractor will be responsible for assuring the selection of training candidates, the revision of legislation and the formation of administrative/accounting procedures. The use of non-project funds will permit the watershed management plan to begin immediately after the Project Agreement is signed, thereby avoiding further disruption of the watershed;

(iii) long-term technical assistance will be arranged in conjunction with CIDA or OAS both of which will be hiring long-term consultants to implement their forestry planning activities. RDO/C is confident that the forestry division is capable of carrying out the necessary tasks but currently lacks enough managerial staff to provide guidance for new activities. RDO/C anticipates adding a part-time management/monitoring role to the other donor's consultant's scope-of-work; and

(iv) small tool procurements will be local purchase.

V. SUMMARIES OF ANALYSES

The financial analysis presented in Section B below is taken from the World Bank's Staff Appraisal Report which is on file in RDO/C and LAC/DR. This analysis as well as the administrative analysis in Section E has been reviewed and found adequate by Booz-Allen and Hamilton whose AID-funded report is also on file in RDO/C and LAC/DR.

A. Technical Analysis

1. Design Features

Hydropower development in St. Vincent is constrained by the Island's topographic, geologic, and hydrologic nature, which preclude the construction of high dams and large reservoirs. Consequently, the development of run-of-the-river type schemes is the most appropriate method for tapping hydro-power potential on the Island. Although power generation by this type of system is very dependent on daily streamflows, run-of-the-river systems have the advantage of being relatively simple to construct, present few serious environmental problems, and require minimal complex technology to operate.

The basic layout of the Cumberland Project was previously described in Section II.C.1. The main components of the system are simple in design and construction, and should not pose any particular problems for the contractors. Similar structures are already in use at St. Vincent's two existing hydroelectric plants, Richmond and South Rivers. VINLEC has already had considerable satisfactory experience in the operation and maintenance of woodstave pipelines, which will constitute the bulk of Cumberland's water conveyance system.

Originally, three storage tanks were to have been constructed; more recent analyses have revealed that two of these would not be economically viable until after 1995. Consequently, those have been eliminated and only one tank, of about 11,000 m^3 capacity located near the Convent intake, will be constructed under the current project. This storage, though limited, will provide a much needed daily peaking capacity for the system, thereby diminishing the need for the installation of additional diesel generation to handle peak loads.

Turgo-impluse turbines have tentatively been selected for use in the Cumberland system. These turbines are well suited to the Cumberland operating conditions, and are capable of high efficiency over a wide range of flows. In their analysis Shawinigan has realistically assumed a turbine operating efficiency of 89% for calculating peak energy generation. Since actual turbine efficiency varies with operating conditions, an efficiency of about 85% was used to calculate average energies, upon which the projects economic analyses were based. Therefore, the economic analyses were based on realistic operating parameters.

2. Hydrology

Energy production of the Cumberland system will be highly dependent upon the streamflows available for diversion into the system. Unfortunately, there are no meaningful streamflow records available for

the Cumberland basin. Consequently, Shawinigan has utilized a comparative analysis, relying heavily on streamflow records taken at the hydro-power intake on the neighboring Richmond River. The Richmond River data was gathered over a twelve year period and used by Shawinigan to develop a dimensionless flow-duration curve, useful in describing streamflows for similar river basins in St. Vincent. Estimates of average annual rainfall, evapotranspiration, and hence runoff, for each of the Cumberland sub-basins were then used to develop dimensioned flow-duration curves for each of the four diversion sites. These curves were used to design the system and estimate future power generation.

Throughout their analysis Shawinigan has treated available hydrologic information conservatively, and the adopted streamflow curves should prove reliable. The assumptions and results of their analysis were checked against (1) spot-check flow measurements on the Cumberland River, (2) power generation records for the Richmond River, and (3) limited flow records from the South Rivers hydropower intake, and found to be reasonably accurate. The hydrologic analysis is adequate, and no further investigation is warranted at this time.

Flood flows for each of the four diversion sites were calculated, using two different formulas, by Shawinigan. Again the consultants have treated the available information, primarily rainfall intensity in this case, conservatively. Cofferdams and other temporary construction structures have been designed for 25-year dry season floods. The location and design of permanent structures have been done in consideration of 100-year floods. It should also be noted that the susceptibility of project structures to damage by flooding is limited by the utilization of low overflow diversion structures and other design aspects.

3. Geology/Topography

As mentioned earlier, the geological and topographical characteristics of St. Vincent preclude the construction of high dams and large reservoirs. Specifically extremely high sedimentation rates in the rivers would quickly fill any in-stream reservoir. Consequently run-of-the-river schemes using low-overflow spillways are utilized, with the actual intake located a short distance upstream. Although any small ponding area behind the diversions will be rapidly filled, the intake area is largely unaffected. After a year or two, sedimentation around the diversion should reach an essestially stable condition, although a small amount of annual streambed "maintenance" may be required to maximize dry-season flows.

Landslides are common in St. Vincent, occurring most frequently during the rainy season. Shawinigan has conducted an exhaustive study of unstable slopes and located structures and aligned pipelines to avoid, as far as possible, problem areas. The extensive use of wood-stave pipe, which is quite flexible, and, where warranted, expansion joints should minimize the possibility of rupture due to landslides or creep. All major structures are located in low-risk areas.

Although St. Vincent is a volcanically active island, the potential for a major eruption of the Soufriere volcano during the lifetime of the Cumberland project does not constitute a major concern, since the system is located away from the principal volcanic impact area. Similarly, the small potential for major earthquakes on the island is cause for little concern, especially considering the size and type of structures to be built.

No particular problems are expected in securing adequate foundations for any of the project structures. Again, the relatively small size of the structures has largely precluded the need for any extensive foundation study.

4. Construction

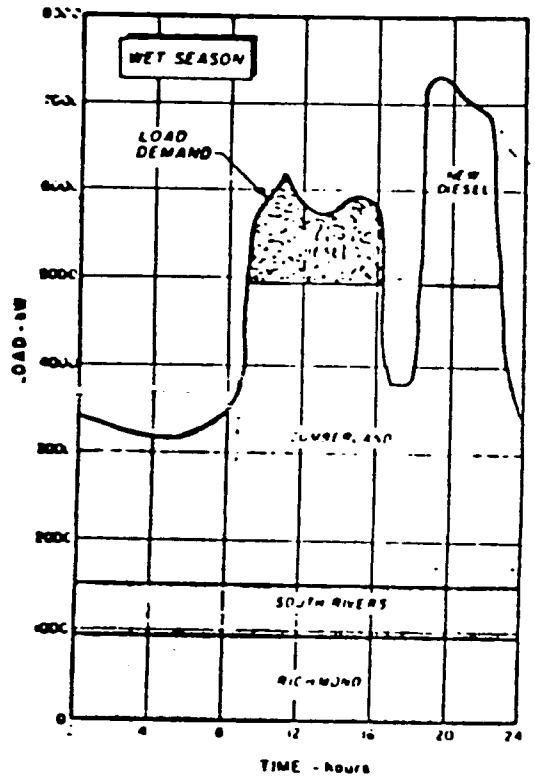
A three year construction schedule, beginning in February 1985, has been developed for the Cumberland project. The several months remaining before commencement of construction activities will be required for co-financiers to complete bureaucratic requirements and obtain contractors. The three-year schedule, which should allow ample time for completion of all works, was formulated taking into account the immediate need for additional generation capacity, the need to retire several antiquated diesel generators, and the occurrence of low-flow periods on the river. Cumberland 1 is scheduled to become operational by December 1986, followed by Cumberland 2 in June 1987 and Cumberland 3 in December 1987. The necessary interfacing of contractors will be coordinated by the Project Management Unit to insure smooth and prompt implementation.

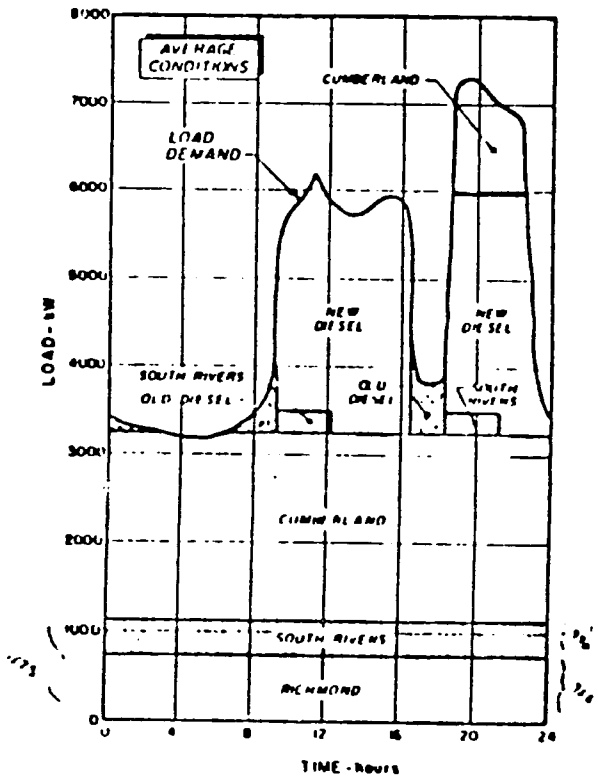
All construction materials, with the exception of aggregates which can be produced locally, will have to be imported. Similarly, most construction equipment should be imported by the contractors if prompt completion of the works is to be assured. Construction equipment of the scale required for the project is available locally from the Government and private contractors; however, based on current AID construction experience in St. Vincent, the availability and reliability of that equipment is suspect. The GOSV will be required to obtain all necessary rights-of-way for the project, as well as guarantee access to borrow areas.

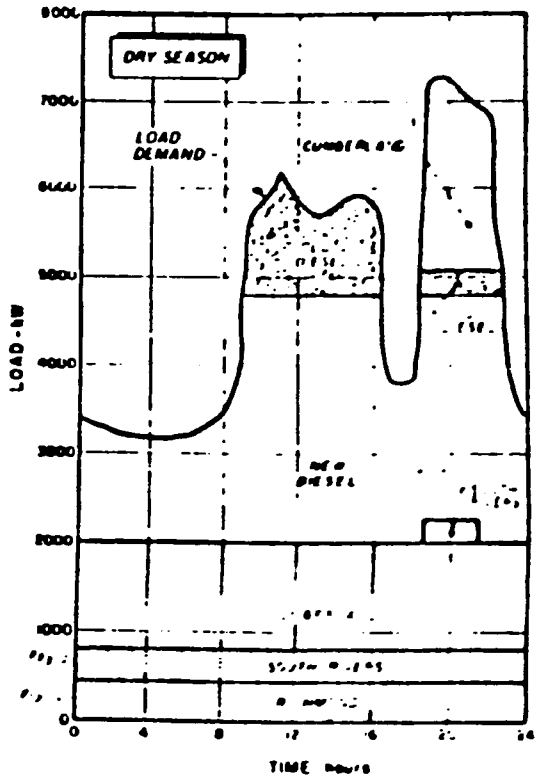
A fair amount of preliminary work will be required to upgrade the local road bridge system for construction. Also a small labor camp will be constructed to house non-local workers. Shawinigan estimates that the required labor force will peak at about 260 persons in mid-1986. About 30% of the force will be unskilled and can be hired from surrounding areas.

5. System Operation

Energy generation from the Cumberland System will be largely dependent upon daily streamflows available for diversion into the system. Figure 7 shows daily load/generation curves for the VINLEC







DAILY GENERATION CURVE

UNITED NATIONS DEVELOPMENT PROGRAMME GOVERNMENT OF ST-VINCENT	
ST VINCENT HYDROELECTRIC SCHEME	
EFFECT OF CUMBERLAND 1, 2 and 3 ON SYSTEM IN 1990	
Date March 1983	Shawinigan

system for high - (wet season), average, and low (dry season) flow conditions for 1990. Output from all hydro plants is maximized during the wet season and, consequently, only a small amount of diesel generation will be required during peak-load hours. (It is interesting to note that under current demand conditions there will actually be excess hydro capability during low demand periods during the wet season; during these times no diesel generation at all will be required and excess water in the hydro systems will be discharged over the provided spillways.)

Under average streamflow conditions, outputs from the three hydro plants will continue to fulfill nearly all of VINLEC's base load requirements. While diesel generation will be required to meet peak loads, the amount will be somewhat limited by the peaking (storage) capability of the Cumberland system. This is significant in that it diminishes the need for VINLEC to install additional diesel generation capacity.

During the dry season VINLEC, due to minimal streamflows, will have to rely on its diesel generators for approximately 60% of its generation needs (1990 figures). Nevertheless, hydro-generation will fulfill a majority of the base load requirement and, again, the Cumberland system will provide valuable peaking capacity.

6. Diesel Generator

In October 1983, several months after the completion of the Shawinigan report, St. Vincent incurred an emergency situation with regard to electricity supply. Several diesel generators broke down and the island entered a continuous loadshedding situation. As a short-term solution, VINLEC procured three 600 KW high speed peaking generators which have temporarily alleviated the stress on their system. However, these generators are not suitable for base load operation.

In November, AID funded two separate analyses of the electricity supply situation, one by an electrical engineer under a personal services contract and the other by the Federal Engineering Support Agency (FESA). Both of these analyses took into account the condition of all VINLEC diesel generators and the upcoming arrival of the Caribbean Development Bank funded 2.9 MW generator. The recommendation from those studies was the replacement of two old generators with a new one megawatt diesel generator.

RDO/C performed a present valve analysis to determine the relative value of closing the Kingstown power plant and placing a one megawatt generator at Cane Hall. The analysis concluded that the generator is not warranted and that current and future plans for electrical output will be sufficient to meet projected needs.

B. Financial

Between 1978 and 1982 VINLEC's financial operations have been characterized by high electricity production costs (with fuel costs alone accounting for 43% to 50% of revenues), high tariff levels (17 US cents/kWh in 1982) and insufficient cash to adequately meet plant maintenance and capital spending needs. VINLEC's total capital spending of about US$0.8 million between 1978 and 1982, mainly transmission and distribution extensions, was financed by internal cash generation but this left insufficient cash for VINLEC either to meet its amortization payments under the CDB loan, which were subsequently rescheduled under a 1983 agreement or to maintain an adequate liquid position. Dividends have been paid infrequently on VINLEC's shares and have been small in amount.

No accumulated cash is available to meet VINLEC's capital spending which on project completion is expected to about triple VINLEC's fixed assets in real terms. In addition, a 1981 approved CDB loan to Government of US$3 million is being on-lent to VINLEC and is to be mainly used for a 2.9 MW generating unit. Loan disbursements started in 1983. The proposed project, by substituting hydro-electricity for diesel generation, will help VINLEC to improve its earnings. By 1990 VINLEC's significant costs will be depreciation and interest, which are estimated to account for 40% of revenues, whereas in 1983 they accounted for only 18% of revenues. In 1990 fuel costs are to equal 13% of revenues compared to 39% in 1983.

1. Past Financial Performance

From 1978 to 1982 VINLEC made rates of return on historically valued net fixed assets varying from 1.6% in 1979 to 19.2% in 1982, when the effect of large tariff increases became effective. Operating expenses varied from 90% of revenues in 1978 to 99% in 1980. In 1979 and 1980 operating income was insufficient to meet interest charges but after substantial tariff increases VINLEC's financial performance improved in 1981 and 1982. Between 1979 and 1982 revenues and expenses grew by an average annual rate of about 26% and 22% respectively with kWh sales growing by an average annual rate of about 3%. Average revenues per kilowatt hour sold increased by an average annual rate of about 23% between 1979 and 1982. This was about 10% above the estimated annual inflation rate during the same period.

VINLEC's balance sheet at December 31, 1982 which is summarized below indicates a poor working capital position with a low current ratio of 1.1. VINLEC has a satisfactory debt/equity ratio of 18/82. VINLEC's long-term debt consists of debentures issued to CDC.

TABLE 10

VINLEC BALANCE SHEET
as of December 31, 1982
(US$ million)

	US$	%
ASSETS		
Fixed assets at estimated replacement cost	12.4	172
Less: accumulated depreciation	7.1	98
Net fixed assets in operation	5.3	74
Current assets	1.9	26
Total assets	7.2	100
LIABILITIES AND EQUITY		
Equity	4.5	63
Long-term debt	0.9	12
Current liabilities	1.8	25
Total liabilities and equity	7.2	100

2. Assets and Revaluation

VINLEC's fixed assets were revalued in 1980 by CDB by adjusting a consultants property appraisal report to reflect, inter alia, more realistic asset lives. Under the 1981 CDB agreement, VINLEC is required to revalue its assets annually applying suitable revaluation indices. The index to be used for this purpose is expected to be agreed between CDB and VINLEC shortly. As part of this project, VINLEC will annually revalue its fixed assets in accordance with methods acceptable to the World Bank. Such annual revaluations will not be included in VINLEC's audited income statements and balance sheets, but the revaluation and restated net income, after revalued depreciation, will be presented as supplementary information to the audited accounts. This information will be used to measure the annual rate of return performance.

3. Financing Plan

VINLEC's capital spending and financing plan during the 84-91 project disbursement period is as follows:

TABLE 11

VINLEC FINANCIAL PLAN
PERIOD 1984 to 1991
(US$million)

REQUIREMENTS	US$	%
Captial Expenditures		
Proposed project	31.3	74
Interest during construction	3.1	7
Other	2.8	7
Increase in cash and working capital	5.3	12
Total Requirements	42.5	100
SOURCES		
Internal cash generation	21.2	50
Less: debt service	7.7	18
Net internal cash generation	13.5	32
Project		
Loan Source		
Government (IDA)	5.0	12
CDB	4.5	11
EIB	2.8	6
USAID	7.5	18
Equity Source		
CIDA	7.8	18
USAID	.5	1
Other Loans	.9	2
Project Sources	29.0	68
Total Sources	42.5	100

The Government and VINLEC will enter into subsidary loan agreements satisfactory to the donors which will provide that Government will relend the proceeds of all credits to VINLEC. The execution of the subsidary loan agreement is a condition of credit effectiveness. CIDA financing is to be provided by Government to VINLEC as equity. AID, IDA, CDB and EIB financing is to be provided by Government to VINLEC on the following terms:

Table 12

Loan Repayment Terms

	Interest Rate	Grace Period	Amortization Period
		----------years---------	
AID	3[a/]	10	30
CDB	10	5	15
EIB	4	4	15
IDA	10[b/]	5	20

4. Tariffs

VINLEC's tariffs increased by an average of about 1.4% per annum in real terms between 1972 and 1982, largely to meet increased fuel costs. On January 1, 1983, average tariff rates were increased by about 8%. VINLEC has received a further increase of 8% effective February 1, 1984. which is estimated to increase average revenue per kWh sold by about 11%. The tariff increase is principally required to finance VINLEC's transmission and distribution extension program. A further estimated 9% tariff increase will be required in 1985 to meet the proposed 4% rate of return requirement. In view of the 150 days notice required for tariff increases, written notice of a requested tariff increase by VINLEC and its approval by Government will be a condition precedent to disbursement for civil works construction.

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a/ 2% for the first 10 years.

b/ The loan is at .5 % to the Government which is on-lent to VINLEC at 10%. The difference in the two rates is accrued to the Government's account.

To help finance its immediate and future capital needs and progress towards earning a reasonable rate of return on capital employed, VINLEC will maintain its tariffs at a level which will yield rates of return on average net revalued fixed assets in operation as follows: 1985 - 4%; 1986 and 1987 - 6%; 1988 and 1989 - 7%; 1990 and thereafter - 8%. To achieve the foregoing requirements it is estimated that the following nominal increases will be required. It is expected that tariff increases over the period 1985--1992 will equal inflation. From 1990 onwards income taxes would add to VINLEC's expenses to be recovered from its office.

TABLE 13

Tariff Increases

	1985	1986	1987	1988	1989	1990	1991	1992
Average tariff per kWh (US cents)	21.86	23.54	25.26	25.98	26.26	27.73	32.75	32.25
Annual tariff increase (%)	9.3	7.7	7.3	2.8	1.1.	5.6	18.1	7.6

5. Future Financial Performance

Projected income, balance sheet and cash flow statements for 1984 to 1992, together with notes and assumptions are shown in Annex I.2, pages 2 through 6.

The financial projections are based on the assumption that VINLEC would increase its tariff not later than January 1 each year, to meet the financial objectives referred to in Table 13. With the expected reduction in fuel and maintenance costs in 1989 and 1990 when the project is placed in service, VINLEC's earnings will improve considerably.

The proportions of equity and debt capital provided as project finance would enable VINLEC to maintain a satisfactory capital structure throughout 1984 to 1992 with a debt/equity ratio varying from 39/61 in 1992 to 56/44 in 1987. Debt service coverage would be good throughout, never dropping below about 2. To protect VINLEC's financial viability, VINLEC will not incur any investments in excess of $400,000 (other than to finance the project) prior to project completion without the World Bank's consent. After project completion VINLEC will not incur long-term debt, without the World Bank's consent, unless net income before interest and depreciation is at least 1.5 times future debt service, including proposed new borrowings.

Despite the foregoing favorable expectations regarding VINLEC's future financial performance, VINLEC's cash position is projected to be tight during project implementation, but to improve considerably afterwards. Therefore, VINLEC will arrange bank overdraft facilities of not less than EC$3 million. It is estimated that this would be sufficient to meet VINLEC's cash needs in 1984, after which VINLEC's cash needs. To help avoid the distribution of funds needed to help finance the project, Government will reinvest in VINLEC any dividends paid to it until project completion.

An evaluation of VINLEC's financial condition and planned project financial requirements by AID funded project design consultants indicates that implementation of the Cumberland hydroelectric project should contribute to a reduction in VINLEC's overall operating cost and that given project tariff levels, power demand growth and maintenance of payroll expenses, improvement in VINLEC's financial health is relatively well assured.

C. Economic Analysis

The Cumberland hydro development scheme has been proposed because it represents a cheaper source of energy to the Vincentian consumer than the primary alternative--diesel power. The cost of the energy to be delivered under the proposed Cumberland scheme ranges from 20¢/kWh to 27.8¢/kWh. This compares to diesel, the primary alternative, which ranges in price from 27.7¢/kWh to 33.0¢kWh. The Cumberland scheme will replace not only existing diesel generation but also the next new diesel unit that would otherwise be required in 1987. The need of an additional diesel unit arises from probable load growth rate for peak demand.

1. Cost-Benefit Analysis

To examine the economic feasibility of the project, a cost-benefit analysis was undertaken. The proposed project is the major component of the 1985-88 investment program for St. Vincent's Electric Company (VINLEC) whose program also includes the $2.9 MW Cane Hall diesel plant. Economic costs consist of (a) the capital investments of the generation program including the rainfall and steamgauging network, (b) sub-transmission/distribution programs, (c) general investment, (d) costs of operation and maintenance related to the capital investments, and (e) fuel costs associated with the incremental sales of electricity. Economic benefits are made up of (a) forecast revenues from the incremental sales of electricity and (b) savings due to the reduction of petroleum products consumption used for power generation in the existing diesel engine power plants.

The internal rate of return of the proposed project using prevailing electricity rates as of December 1983 is approximately 11.4 percent. If benefits are valued at forecast rate levels, the internal rate of return increases to 12.8 percent.

2. Cost-Effective Analysis

The Cumberland Hydro Project also is the least-cost solution to the goal of meeting the system's capacity and energy requirements through 1992.

Prior to selection of the site at Cumberland, various hydroelectric possibilities were considered, including in addition to Cumberland, Buccament, Colanaire, Colanaire/Union and Yambou. Selection was based on (a) unit generation cost, (b) power plant sizing with the objective of effectively reducing utilization of petroleum products for power generation and (c) power plant commissioning dates. In light of the selection criteria, the Cumberland site was selected. In terms of estimated unit generation costs, the Cumberland alternative was cheaper over all alternatives. The Cumberland project also would give appropriate capacity and energy additions to the system, and its development also would probably cause less negative "other impacts" such as (a) interference with existing water supply schemes, building structures, transmission lines, and access roads and (b) loss of flows due to diversion of river flows into pipelines.

With the selection of the site at Cumberland, the Cumberland scheme was compared to diesel generation over the life of the country's electricity system, assuming a 40 year life. The year-by-year system expenses, including capital expenditures, fuel and operating costs, were reduced to their present worth for both the Cumberland and diesel generation alternatives and totals compared. The analysis shows that full implementation of the Cumberland scheme is the best economic alternative to meet VINLEC's power requirements. Sensitivity tests also were run, including (a) delaying the Cumberland alternative one year, (b) new diesel generation using a lower cost diesel--Bunker C--than that currently in use and (c) a fall of 15 percent in diesel fuel costs. Fuel costs may fall if the current global oil market remains depressed. The results of these sensitivity analyses show that reasonable variations in capital costs do not affect overall conclusions. The implementation of the Cumberland hydroscheme is justified in terms of both meeting the system's future load increases and energy substitution.

D. Social Soundness Analysis

1. Direct Impact on Site Areas

According to the 1980 census, there are over 1,000 residents in the Cumberland Valley. The upper valley is heavily forested and somewhat inacessible. The majority of residents live in three villages in the lower valley--Gordon, Spring Village and Cumberland. The primary occupation is agriculture. Most residents own land, from one to five acres, as well as rent land from the state for agricultural purposes. The majority of land in the upper watershed is state-owned, while land in the lower alluvial Valley is predominantly privately owned. The Cumberland Valley also supports a large number of women hucksters who are active in the important Trinidad fruit and vegetable trade. Villagers and farmers will be impacted in a number of ways:

a. Construction - Residents of Spring Village will be directly affected by construction of a dam and powerhouse in the village. Construction of the pipeline may necessitate removal of a few inhabitants, while the pipeline on trestles will run through the property of a small number of residents. The Government of St. Vincent is required to secure rights of way and to compensate local owners for loss of property.

Construction activities will also create some noise, dust and safety hazards throughout the Valley villages. When the final terms of reference for the civil works contractor are submitted to RDO/C for approval, AID will assure that the following provisions are included to insure a socially sound and environmentally safe construction activity:

i) Checks of dimension and strength of roads and bridges; Widening of roads and strengthening of bridges to deal with load capcity where necessary;

ii) traffic control during shipment of wide loads on numerous sections of road and around schools. Scheduling the transport of such movements during periods of low vehicular and pedestrian use;

iii) Use of smaller equipment and labor intensive techniques if possible to reduce environmental and agricultural damages;

iv) Construction of walkways over pipelines where widespread traffic deems it;

v) Warning signs erected to indicate hazards at dam sites and construction areas.

b. Water Supply - Residents of the Valley will not experience any interference with their potable water supply as the source of supply comes from a separate system in the hills above Gordon Village. However, during dry season water pressure is very low and residents tend to make greater use of the river as a source of water for a multiplicity of purposes. After dam construction, downstream, river flow depletion will result and there will be no water in the river bed for about 70% of the time. This will affect large number of villagers who bathe and wash clothes in the river.

Construction of washing facilities and a piped water supply at the dam site would alleviate this problem and compensate inhabitants for the loss of access to traditional sites.

c. Sanitation and Health Factors - Construction activity will remove land and result in temporary increased sedimentation. Diversions will also increase sedimentation in the river. The problem will be partially remedied by the erection of riparian barriers.

The project does not include special provisions for ensuring a pure water supply. The location of the dams downstream of the water supply intakes suggests that the water system will not be polluted.

d. Employment and Village Life - Construction of the project promises to inject capital and labor into the region which will stimulate village economies. An estimated 30% of the construction force is projected to come from local unskilled labor. This factor should reduce rural out migration during the period of construction and it may also result in a lessening of agricultural activities on those lands which are the least productive. Villagers are looking forward to a positive economic stimulus as a result of construction of the project.

e. Land use and watershed management - Some 100 acres are to be set aside as watershed. The watershed management plan which is being designed as an integral element of the hydroelectric project will assure long-term conservation of the watershed and ensure a continuous water supply in the future. It also has the potential for spread effect. If successful, the techniques used in this project can be multiplied throughout St. Vincent protecting both agriculture and watershed areas. Project design calls for both preservation and expansion of the forest reserve in the upper watershed and the creation of a 100 metre watershed on each side of the river throughout the lower watershed.

The upper watershed does not contain any agricultural holdings except for one small garden plot which is rented and due to revert to state control very shortly. Throughout the lower watershed there are numerous agricultural holdings. Plans do not call for the removal of these holdings, but no further development will be allowed. Conservation practices and terracing will be introduced where necessary. Therefore, farmers will directly benefit from the scheme and indirect benefits will accrue to all residents by way of effective conservation practices.

2. General Impact of Project

The second area of major social impact is the electrification project itself. Only 65% of urban areas and 30% of rural areas are electrified. There are 11,900 customers of which 10,600 are domestic households. Presently, these residents of suffer from an irregular and expensive supply of electricity. The situation not only is inconvenient and produces dissatisfaction but it is also an effective deterrant to productive investment and overall development. The Cumberland Hydroelectric Project will affect residents of St. Vincent in a number of ways:

a. Tariffs. Benefit/cost analyses indicate that consumers in St. Vincent will pay less for electricity under the hydroelectric scheme than they would if VINLEC continued with diesel generation. Nevertheless, tariff increases resulting from the Cumberland Hydroelectric Project are quite high. For domestic users, 35% tariff increases are expected; it remains to be seen how many residents will be able to take advantage of increased access to service.

b. Access to electrification - Criteria for hook-up which ensures equitable access is established by law in St. Vincent. As a result of the project 1,000 new hook-ups are estimated of which 60% will be domestic users. Priority will be given to industrial and commercial users in an attempt to strengthen the Vincentian economy and provide much needed employment.

E. Administrative

An evaluation of the present management and organization of VINLEC indicates that there are some discrete institutional weaknesses which prevent the utility from becoming a financially viable and efficient organization. Under the aegis of th Commonwealth Development Corporation (CDC) management services contract, VINLEC made excellent progress in improving various operational procedures, however, personnel management difficulties exist.

1. Operations

VINLEC's management information and accounting systems are of a good standard and effectively administered. They are based on CDC accounting standards for the preparation of financial information and the recording and classification of accounting transactions. VINLEC's billing system is computerized and, after some initial problems, is now working well. By early 1984, it is expected that VINLEC's computer operations will have been extended to cover stores, general ledger and accounts payable.

In 1980 accounts receivable had risen to about 120 days. The 1981 CDB Loan Agreement requires VINLEC to maintain its accounts receivable at a level not exceeding 60 days. Since 1980 considerable progress has been made by VINLEC in reducing its receivables which in August 1983 were reported to be about equal to 60 days' sales. The improvements have been largely brought about by prompt billings through the use of a computerized billing system and improved collections on Government accounts, which account for about 10% of outstanding receivables. It is expected that VINLEC will be able to maintain its improved collections and reduce the level of outstanding accounts receivable further to about 50 days by the end of 1983.

VINLEC's external audits are carried out by the international accounting firm, Coopers and Lybrand, and the arrangement is satisfactory. VINLEC's operations are not large enough to justify the employment of a full time internal auditor. However, in addition to external audits, an internal audit of VINLEC's accounts is currently carried out by CDC, and will be continued under the project management consulting contract.

Additional operational improvements are constrained by the availability and training of adequate technical and managerial staff. During project implementation managerial staff (to replace CDC) will be contracted to supplement VINLEC's own staff. These consultants will provide advice and recommendations on improvements in the operational system while the project assists in providing longer term solutions to personnel difficulties.

2. Personnel

VINLEC, as a private company, operates under its own personnel policies. VINLEC's management is responsible for job design, recruiting, selection, performance appraisal, and training. The Board of Directors approves compensation packages, the selection of managerial and professional staff, and total staffing levels. Thus a key facet of the current human resources area is that VINLEC has considerable flexibility to manage its affairs in the manner necessary to attract and retain the staff needed to operate a profitable concern.

VINLEC staff currently numbers approximately 162 employees, as follows:

Generation	75
Transmission and Distribution	43
Consumer Relations and Sales	22
Administration	22
	162

Currently one employee (the Assistant Generation Engineer) is studying in England and two positions are vacant. Staff below th supervisory level are union members. In general, the staff is relatively young (average age in the 30s); however, approximately two-thirds of the transmission and distribution staff is over 50 years of age. Most of the employees (the older employees are the exception) have at least a basic grade school education. All staff except the heads of two divisions are Vincentian.

As a relatively small organization, VINLEC's manpower planning has been performed to date on an informal and decentralized basis. As staff were needed, they were recruited by the component of the organization requiring staff. Employees who appeared promising were provided with local and out-of-country training. VINLEC is currently planning to change this approach and move towards a more centralized and stronger personnel, manpower planning and training function. Currently VINLEC has plans to recruit a Personnel and Training Officer and a Transmission and Distribution Engineer.

VINLEC' s plans to hire a highly qualified Personnel and Training Officer will provide a needed focus for key human resource development functions including recruiting, performance appraisal, classification and remuneration. Current plans are appropriate and should

be strongly encouraged. Because the PTO is critical to VINLEC becoming a self-sustaining organization, VINLEC will be strongly encouraged to select a PTO who has the necessary background and to delegate the appropriate authority to the PTO to ensure that the necessary personnel and training actions do occur.

Over the next few years, various actions will cause internal shifts in VINLEC's manpower needs - the number of staff and the skill mix required will change. Management's perspective of these changes is that they will not require major staffing additions; changes can be accommodated through attrition and phased training. These changes will, however, need to be planned. For example, if Kingstown generation staff are to be trained for the Cumberland facility, there may be conflict between the need for training time and the need for operating time at Kingstown.

Through the Cumberland Project, VINLEC will be acquiring new staff and a new organizational unit that will report to the General Manager. Directly reporting to the General Manager will be the Project Manager. Current plans indicate that VINLEC will provide staff to the Project Manager, including an accounts clerk and a secretary. This staff, plus the civil works staff and construction crews, will be in addition to VINLEC's current staff.

The training planned under the Cumberland Project is well distributed, addressing the development of entry level technician skills, professional, technical and administrative staff skills, supervisory skills, and managerial skills. Organizational improvements made under CDC guidance, staff improvements made under this project, and the financial requirements established by this project will all result in an administratively sound and viable public utility.

3. Maintenance Capability

Operation and maintenance of the completed Cumberland Hydroelectric system will be the responsibility of VINLEC. The utility has already accrued several years' experience in the similar management of its existing Richmond and South Rivers facilities; given the experience and the fact that considerable foreign expertise will be available to assist with the start-up and initial operation of the system, VINLEC personnel will have the capacity to properly operate and maintain the system for its lifetime.

The project's training component combined with the institutional improvements which will be instituted throughout the life of the project will work together to assure that the Cumberland Hydroelectric Scheme results in an improved, self-sufficient and self-sustaining utility.

F. Environmental

An Environmental Assessment has been prepared for the Cumberland Hydroelectric Project by the Regional Environmental Management Specialist/Caribbean. The majority of this assessment is attached as

Annex G, however, those background sections which duplicate information already provided in the text of this paper have been excluded. The entire assessment is on file in the LAC/DR Environmental Office and in the Regional Development Office/Caribbean in Barbados.

The EA identified and analyzed the direct and indirect impacts of the project in respect to the major and minor unavoidable effects of the project and the mitigative measures necessary to reduce or eliminate these impacts.

The major direct effects include; stream sedimentation, terrestrial habitat disturbance, and restricted access to land. The minor direct effects include; energy consumption, air and noise pollution, disruption of normal community activities, increased dust and short-term economic boom in the construction area. To combat these direct impacts the project will: require the construction contractor to utilize construction practices which will reduce noise, safety and traffic hazards; require the Government to compensate farmers for lost lands; require VINLEC to install pipeline extensions which will facilitate water access by the affected population, and require installation of riparian barriers where necessary.

The indirect impacts on the environment include; river flow depletion, intensified land use, and potential damage due to natural landslides. The mitigative measures utilized in this project include project components to implement a watershed management program and a streamgauging and rainfall measuring program which will ensure current and future river flow information. Project specifications also provide for the location of pipeline along the best possible route in terms of stability and use of leak detection devices, automatic shut-off valves and regular inspection schedules to detect ruptures.

These measures should ensure that the environment in the Cumberland Valley remains sound and adequate for the local population and for future project requirements.

VI. CONDITIONS PRECEDENT AND COVENANTS

The following conditions and covenants will be included in the Loan/Grant Project Agreement:

A. Conditions Precedent to Disbursement

1. First Disbursement. Prior to the first disbursement of the Assistance, or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made, the Cooperating Country will, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

(a) An opinion of counsel acceptable to A.I.D. that this Agreement has been duly authorized and/or ratified by, and executed on behalf of, the Cooperating Country, and that it constitutes a valid and legally binding obligation of the Cooperating Country in accordance with all of its terms;

(b) A statement of the name of the person holding or acting in the office of the Cooperating Country specified in Section 9.2., and of any additional representatives, together with a specimen signature of each person specified in such statement;

(c) Evidence of commitment of adequate project funds by other donors; and

(d) Evidence of the formation of a project management system within VINLEC, including execution of a contract for the services of a project manager.

2. Loan-Funded Activities. Prior to any disbursement or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made for Project activities funded from the loan proceeds of this Agreement, the Cooperating Country will, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

(a) Evidence tnat it has entered into a satisfactory agreement for the relending of the Loan Funds to the St. Vincent Electricity Services, Ltd. (VINLEC);

(b) Evidence of acceptable arrangement for the sale of the Commonwealth Development Corporation (CDC) shares of VINLEC stock to the Government; and

(c) Evidence that a satisfactory contract for the supervisory engineering consulting firm has been executed.

3. Civil Works. Prior to any disbursement or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made for civil works, the Cooperating Country will, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

(a) Evidence that VINLEC has applied for, and the Government has approved, an adequate tariff increase for 1985;

(b) Evidence that VINLEC has increased its access to short-term financing to EC$3 million;

(c) Evidence of commitment to make available sufficient funds to implement the Project civil works and the watershed management plan, including a mechanism for providing funds for civil works not funded by A.I.D.;

(d) Evidence of an acceptable interim arrangement for the management of VINLEC (following the buy-out of the Commonwealth Development Corporation and until the Electric Power Act of 1973 has been revised and enacted) which includes evidence of draft legislation which will enable progress toward satisfaction of the covenant of Section 6.2.;

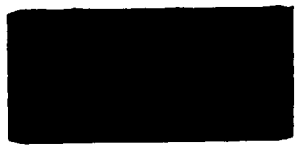
(e) Evidence that title to all rights-of-way and land required for the civil works component of the project has been transferred to the Government, or that adequate procedures have been put in place for such a transfer, involving adequate compensation for the landholders; and

(f) Evidence of an official, time-phased Watershed Management Implementation Plan.

4. Streamgauging. Prior to any disbursements or the issuance by A.I.D. of documentation pursuant to which disbursement will be made for streamgauging, the Cooperating Country will, except as the parties may otherwise agree in writing, furnish A.I.D. in form and substance satisfactory to A.I.D.:

(a) evidence of a procurement and installation implementation plan; and

(b) evidence that a procedure for collecting and analyzing the streamgauging and rainfall data has been established.



2. Legislation. The Cooperating Country agrees (1) to present to the Cabinet within one year from the date of signing of this Agreement, for submission to the legislative body, legislation which permits and enables VINLEC to operate on a technically and financially self-sustaining basis and enable VINLEC to acquire all required personnel in a manner which encourages them to remain with VINLEC, and (2) to exercise its best efforts to obtain timely passage of such legislation.

3. Financial and Management Covenants. Except as A.I.D. may otherwise agree in writing, the Cooperating Country shall comply with, or cause to be complied with, all of the financial and management covenants and undertakings incorporated and set forth in Article III and IV of its Project Agreement with the International Development Agency particularly:

(a) Except as shall otherwise be agreed, VINLEC shall earn, for each of the following fiscal years, an annual rate of return on the current net value of VINLEC's fixed assets in operation equivalent to 4% in 1985, 6% in 1986 and 1987, 7% in 1988 and 1989 and 8% in 1990 and each fiscal year thereafter;

(b) Except as shall otherwise be agreed, VINLEC shall not incur any debt unless the net revenues of VINLEC for the fiscal year immediately preceding the date of such incurrence or for a later twelve-month period ended prior to the date of such incurrence, whichever is the greater, shall be at least 1.5 times the estimated maximum debt service requirements of VINLEC for any succeeding fiscal year on all debt of VINLEC, including the debt to be incurred;

(c) The Cooperating Country shall, within ninety days from the submission of each rate increase application, take all actions necessary on its part to enable VINLEC to set and maintain its electricity rates and charges at levels sufficient at all times to fulfill VINLEC's obligations under (a) provided, however, that the application for the rate increases in fiscal year 1985 shall be approved by the Borrower not later than October 31, 1984;

(d) Except as shall otherwise be agreed, VINLEC shall not, until the Project Assistance Completion Date, undertake or permit to be undertaken on its behalf, any major investment other than the Project, unless it has furnished satisfactory evidence that: (i) such investment is technically, financially and economically justified; and (ii) VINLEC has or will have adequate financial resources for the carrying out of such investment; and

(e) The Cooperating Country shall (i) promptly upon its completion, furnish a copy of the tariff study being carried out by the consulting firm Coopers and Lybrand and financed by CDB and its recommendations, together with its proposals, based on such recommendations, for establishing a new structure and levels of the rates for the sale of electricity in the territories of the Borrower; (ii) afford a reasonable opportunity to comment on such recommendations and proposals; and (iii) promptly thereafter, put into effect such structure and levels of rates for the sale of electricity as shall be agreed upon between the Borrower, CDB, the IDA and VINLEC.

4. Event of Default. The Cooperating Country covenants to abide by all of the provisions, conditions, and covenants of all agreements entered into by the Cooperating Country with the International Development Association (IDA) and other donors for execution of the Project and agrees that A.I.D. may determine an event of default as declared by the IDA or other donors under any of their project agreements as an event of default under the A.I.D. Project Agreement.

5. Reports. The Cooperating Country shall furnish to A.I.D., all reports which it is required to submit to other Project donors, including I.D.A., at the same time the reports are submitted to the other donors.

6. Forestry. Evidence that the Cooperating Country has introduced legislation to adequately provide for forest protection in the Cumberland Watershed within a reasonable time following signature of this Agreement.

7. Staff. The Cooperating Country shall endeavor to assign to the Cumberland Watershed, two forest guards and such other human resources as may be necessary to implement the watershed management component of the Project.

8. Cumberland Project Site. The Cooperating Country shall assure that VINLEC:

(a) Adequately address safety concerns arising from project activities and construction by providing traffic control during shipment of wide loads, scheduling transport of such movements during periods of low vehicular and pedestrian use, erecting warning signs to indicate hazards at powerhouses, dam sites and along pipelines, and constructing walkways over pipelines where widespread traffic requires it; and

VIII. EVALUATION ARRANGEMENTS

Two project evaluations will be conducted. The first, which will be a progress evaluation, will take place approximately 24 months after the commencement of project activities. This evaluation will be conducted by in-house resources and will examine the progress being made in relation to the implementation plan as it relates to the achievement of project objectives. In particular the continuing validity of project rationale and strategy will be assessed; constraints to effective implementation of the various components will be identified and recommendations made to facilitate achievement of objectives within the given timeframe.

A multi-donor final evaluation will be conducted following the completion of all components and just prior to the termination of the general project consultants' contracts. AID will contribute either an in-house evaluator or a PD&S funded contractor to participate as AID's representative to the evaluation team. The focus of the evaluation will be on (i) the extent to which energy production has been expanded to impact on current development needs (ii) the technical capabilities and financial viability of VINLEC to efficiently provide electricity services to serve long-term development needs and (iii) the adequacy of the Watershed Management Plan to ensure cost effective hydro electricity production for future needs.

The watershed management program budget includes $25,000 for a special evaluation of WSMP activities. The evaluation will be scheduled for approximately two years after the Project Agreement is signed. This will permit an operational review of the activities designed preserve the watershed and permit a redirection of implementation prior to plant commissioning, if required.

CUMBERLAND HYDROELECTRIC PROJECT

ANNEXES

UNCLASSIFIED

ANNEX A
Page 1 of 3

ACTION AID INFO AMB DCM PF CHRON

VZCZCNOK76
RR RUEPWI
DE RUEEC #0329/01 0121136
ZNR UUUUU ZZH
R 121632Z JAN 84
FM SECSTATE WASHDC
TO RUEPWI/AMEMBASSY BRIDGETOWN 3247
INFO RUESJ/AMEMBASSY SAN JOSE 7396
RUHSHR/AMEMBASSY PORT AU PRINCE 2627
BT
UNCLAS STATE 000329

AIDAC SAN JOSE ROCAP:RTSCHINKEL, PORT AU PRINCE:JTALBOT

E.O. 12356: N/A
TAGS:
SUBJECT: CU;BERLAND HYDROELECTRIC PROJECT

ACTION	INFO
	CDO
A	
E	

1. THE DAEC REVIEWED AND APPROVED THE SUBJECT PID ON DECEMBER 20, 1983. RDC/C IS AUTHORIZED TO PROCEED WITH PP DEVELOPMENT AND THE MISSION DIRECTOR RDC/C IS AUTHORIZED TO APPROVE THE PROJECT, SUBJECT TO THE GUIDANCE PROVIDED BELOW:

2. WATERSHED MANAGEMENT: IN ACCORDANCE WITH A.I.D. POLICY, A WATERSHED MANAGEMENT PLAN WILL BE PREPARED AS PART OF PP DEVELOPMENT. THIS PLAN WILL IDENTIFY MEASURES REQUIRED TO MAINTAIN THE EXISTING FLOW REGIME OF THE RIVER AND PROTECT THE WATERSHED. RESPONSIBILITY FOR FUNDING THE IMPLEMENTATION OF THE WATERSHED MANAGEMENT PLAN SHOULD BE DISCUSSED WITH THE OTHER PARTICIPATING DONORS AND A FIRM FUNDING COMMITMENT ARRANGED BEFORE PROCEEDING WITH THE PROJECT.

01/17/84
NOTED - for PF

3. FYI. DR. PERRY TSCHINKEL, ROCAP REGIONAL FORESTER, WILL BE AVAILABLE FOR THE PREPARATION OF THE

SCOPE OF WORK. HE WILL BE AVAILABLE 0/A FEBRUARY 5, FOR THE TWO WEEKS THAT THE STUDY SHOULD REQUIRE. CABLE SHOULD INCLUDE FUNDING CITES FOR TRAVEL AND PER DIEM, WHICH WILL BE FUNDED BY THE MISSION. HIS SALARY IS PREPAID. TSCHINKEL SHOULD BE INFORMED AS TO WHETHER HE SHOULD PROCEED DIRECTLY TO ST. VINCENT OR VIA RDO/C. IN ST. VINCENT, IT WOULD BE USEFUL FOR HIM TO CONTACT CALVIN NICHOLS, HEAD OF THE FORESTRY SERVICE IN THE AGRICULTURAL SECTOR OF THE MINISTRY OF AGRICULTURE AND TRADE IN ST. VINCENT. END FYI.

4. ENVIRONMENTAL ASSESSMENT: AS AGREED, DR. JIM TALBOT, REGIONAL ENVIRONMENTAL MANAGEMENT SPECIALIST FOR THE CARIBBEAN WILL CONDUCT THE ENVIRONMENTAL ASSESSMENT AT NO COST TO THE MISSION. RDC/C SHOULD CABLE PORT-AU-PRINCE REQUESTING THE SERVICES OF TALBOT FOR THE REQUISITE PERIOD OF TIME. THE EA SHOULD BE CONDUCTED CONCURRENTLY WITH OR PRIOR TO TSCHINKEL'S STUDY, IF AT ALL POSSIBLE.

68

5. POLICY DIALOGUE: IN THE MEMORANDUM OF UNDERSTANDING TO BE SIGNED BY THE DONOR AGENCIES, THE MISSION SHOULD ASSURE THAT IT WILL HAVE AN EQUAL VOICE IN FORMULATING AND NEGOTIATING SATISFACTORY FINANCIAL AND INSTITUTIONAL REFORMS REGARDING VINLEC. THE ROLES AND RESPONSIBILITIES OF THE VARIOUS DONORS AS THEY RELATE TO THE FINANCIAL AND STAFFING INPUTS NEEDED FOR SUCCESSFUL PROJECT EXECUTION SHOULD BE CLEARLY DEFINED. MISSION SHOULD, IN PARTICULAR, ENSURE THAT PROVISION FOR DONOR-SUPPORTED MANAGEMENT INPUTS IS ADEQUATE AND WILL MINIMIZE RELIANCE ON EDC/C STAFF FOR ROUTINE PROJECT MANAGEMENT FUNCTIONS. IADC WOULD LIKE TO CONFIRM THAT REPAYMENT OF A.I.D.'S DEBT WILL BE GIVEN EQUAL PRIORITY TO THAT OF THE OTHER DONORS.

6. IMPLEMENTING AGENCY: WHILE THE PID STATES THAT GOSV WILL BE THE BORROWER AND VINLEC WILL BE THE IMPLEMENTING AGENCY, THE MISSION REPRESENTATIVE AT THE IADC INDICATED SOME UNCERTAINTY AS TO THE FORMER. IF THERE IS ANY CHANGE IN THIS RESPECT, THE MISSION SHOULD ADVISE AID/W, WITH FULL DETAILS, BEFORE AUTHORIZING THE LOAN.

7. THE IMPENDING BUYOUT OF CDC BY GOSV RAISED SEVERAL ISSUES. FIRST, IMMEDIATE ATTENTION MUST BE GIVEN TO THE POSSIBLE NEED FOR ENACTING A NEW STATUTE UNDER WHICH THE NEW CORPORATE STRUCTURE OF VINLEC WOULD BE DEFINED. SECOND, THE MISSION SHOULD ADDRESS THE POSSIBLE WAYS IN WHICH THE DONORS MIGHT USE THEIR LEVERAGE WITH GOSV IN

ITS NEGOTIATIONS WITH CDC TO ELICIT CONCESSIONS FROM CDC WHICH WOULD CONTRIBUTE TO PUTTING VINLEC ON A SOUNDER FINANCIAL FOOTING, AND SHOULD, IN ITS ROLE AS CO-FINANCIER, PRESS FOR SUCH CONCESSIONS TO EXTENT POSSIBLE. POSSIBLE OPTIONS INCLUDE: (1) STRETCHING OUT THE PROPOSED RESCHEDULING OF ITS DEBT, (2) REDUCING THE PRICE PER SHARE, OR (3) REQUESTING A LOWER PAYOUT ON DIVIDENDS. UNDER NO CIRCUMSTANCES SHOULD DEBT TO AID BE MADE SUBORDINATE TO CDC DEBT OR DEBT OWED TO ANY OTHER PARTY.

8. TECHNICAL CONSIDERATIONS: DURING THE DEVELOPMENT OF THE PP, THE HYDROLOGIC DATA FOR EACH SITE AND TIME/DURATION OF AVAILABLE FLOWS SHOULD BE CAREFULLY ANALYZED TO ASSURE TECHNICAL AND ECONOMIC FEASIBILITY. THE EFFICIENCIES OF THE HYDRO-TURBINE GENERATOR UNITS, AS INCLUDED IN THE PID, ARE HIGH AND REALISTIC EFFICIENCIES SHOULD BE USED IN THE ECONOMIC FEASIBILITY PROJECTIONS.

9. PROCUREMENT PLAN: THE PID'S PROPOSED IMPLEMENTATION SCHEDULE FOR A.I.D. IS QUITE TIGHT, ALLOWING 1 1/2 MONTHS OF SLIPPAGE BETWEEN LOAN SIGNATURE AND DESIRED START OF

CONSTRUCTION. IN ORDER TO EXPEDITE THE PROCESS, THE MISSION, ASSUMING THE GOSV IS IN AGREEMENT, CAN START THE PREQUALIFICATION PROCESS PRIOR TO SIGNATURE OF LOAN AGREEMENT, BY REQUESTING SUBMISSION OF QUALIFICATION DATA FROM INTERESTED FIRMS.

10. FUNDING LOAN: THE DOLS 7 MILLION PROPOSED IN THE PID IS AVAILABLE FROM ESF FUNDS. IF THE MISSION PROPOSES TO CHANGE THE SOURCE OF FUNDING, PLEASE ADVISE AID/W.

11. ECONOMIC ANALYSIS: REVIEW OF THE SHAWINIGAN AND CRIP BANK REPORTS INDICATE THAT THE PROPOSED PROJECT HAS BEEN SUBJECTED TO A SATISFACTORY ECONOMIC/FINANCIAL ANALYSIS. THUS, THE TASK FOR THE PP WILL BE TO PREPARE A CONCISE AND CLEAR PRESENTATION OF THE METHODOLOGY USED, THE MAJOR CALCULATIONS, AND THE FINAL RESULTS. SHULTZ
ET
#0329

NNNN

ANNEX B

Transportation Source Waiver
Drafter:COM/TS:JLBerger:cr:1/3/84
Waiver Control No. 69H

ACTION MEMORANDUM FOR THE DIRECTOR, Office of Commodity Management
Agency for International Development
Washington, D.C. 20523

FROM: Chief, Transportation Support Division
Office of Commodity Management
Agency for International Development
Washington, D.C. 20523

Problem: Amendment of Transportation Source Waiver No. 69 to include transportation costs incurred under project 538-0091 Cumberland Hydroelectric Project, St. Vincent and the Grenadines.

Discussion: LAC Bureau desires a transportation source waiver authorizing code 941/899 liner service for commodities procured under the captioned project because of unavailability of U.S. flag service.

COM/TS confirms there is no regularly scheduled U.S. flag or non-U.S. code 941, liner service between U.S. ports or between off shore points, and the East Caribbean, West Indies. The only identifiable scheduled liner service in the region for project procurements is provided by code 899 liner operators.

Waiver No. 69, approved Sept. 27, 1979, and its several amendments, have met needs of previous 538-series procurements. However, conditions which gave rise to previous waiver applications by Bridgetown USAID persist and are unlikely to change in the forseeable future.

Recommendation: That you authorize reimbursement of transportation costs under 538-0091, Cumberland Hydroelectric Project, on vessels in accordance with terms and conditions of Transportation Source Waiver number 69.

Approved: William C. McClennan Jr. Date 1-24-84

Disapproved: _____ Date _____

Attachment: Waiver 69

Clearance:
COM/ALI:PJHagan
LAC/DR:RMcKonald (phone)
SER/COM:EDCallahan:

cc: FM/BFD USAID/Bridgetown
COM/ALI COM/SE
LAC/DR SER/COM

PROJECT CHECKLIST

Listed below are statutory criteria applicable generally to projects with FAA funds and project criteria applicable to individual funding sources: Development Assistance (with a subcategory for criteria applicable only to loans); and Economic Support Fund.

A. GENERAL CRITERIA FOR PROJECT

1.	FY 79 App. Act Unnumbered; Faa Sec. 653(b); Sec. 634A. (a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that figure)?	A Congressional Notification went forward on March 1984 for the total project funding.
2.	FAA Sec. 611(a) (1). Prior to obligation in excess of $100,000, will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	(a) Yes. (b) Yes.
3.	FAA Sec. 611(a) (2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	No further legislative action is required.
4.	FAA Sec. 611(b); FY 79 App. Act Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1973?	Yes

5.	FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?	Yes.
6.	FAA Sec. 209. Is project susceptible of execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	The project is not appropriate for regional execution.
7.	FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.	The expansion of St. Vincent's presently inadequate supply of electricity is necessary to the continued operation and growth of the industrial and tourism industries and as such will directly support an increased flow in international trade.
8.	FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	U.S. goods and services will be used in the projects.

9.	AA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.	The host country is providing staff facilities and related support for the project.
10.	FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	No.
11.	FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	Yes.
12.	FY 79 App. Act Sec. 608. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?	N/A.
13.	FAA 118(c) and (d). Does the project take into account the impact on the environment and natural resources? If the project or program will significantly affect the global commons or the U.S. environment, has an environmental impact statement been prepared? If the project or program will significantly affect the environment of a	Yes. An environmental assessment has been prepared. A watershed management plan has been prepared.

foreign country, has an environmental assessment been prepared? Does the project or program take into consideration the problem of the destruction of tropical forests?	
14. FAA 121(d). If a Sahel project, has a determination been made that the host government has an adequate system for accounting for and controlling receipt and expenditure of project funds (dollars or local currency generated therefrom)?	N/A
B. FUNDING CRITERIA FOR PROJECT	
1. Development Assistance Project Criteria	N/A. This project is financed with Economic Support Funds.
a. FAA Sec. 102(b); 111; 113; 281a. Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing	

countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?

b. FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available: (include only applicable paragraph which corresponds to source of funds used. If more than one fund source is used for project, include relevant paragraph for each fund source).

(1) (103) for agriculture, rural development or nutrition; if so, extent to which activity is specifically designed to increase productivity and income of rural poor; (103A) if for agricultural research, is full account taken of needs of small farmers;

(2) (104) for population planning under Sec. 104(b) or health under Sec. 104(c); if so, extent to which activity emphasizes low-cost, integrated delivery systems for health, nutrition and family planning or the poorest people, with particular attention to the needs of mothers and young children, using paramedical and auxiliary medical personnel, clinics and health posts, commercial distribution systems and other modes of community research.

(3) (105) for education, public administration, or human resources development; if so, extent to which activity strengthens non-formal education, makes formal education more relevant, especially for rural families and urban poor, or strengthens management capability of institutions enabling the poor to participate in development;

(4) (106) for technical assistance, energy, research, reconstruction, and selected development problems; if so, extent activity is:

(i) Technical cooperation and development, especially with U.S. private and voluntary, or regional and international development, organizations;

(ii) to help alleviate energy problems;

(iii) research into, and evaluation of, economic development processes and techniques;

(iv) reconstruction after natural or manmade disaster;

(v) for special development problem, and to enable proper utilization of earlier U.S. infrastructure, etc., assistance;

(vi) for programs of urban development, especially small labor-intensive enterprises, marketing systems, and financial or other institutions to help urban poor participate in economic and social development.

c. (107) is appropriate effort placed on use of appropriate technology?

d. FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed" country)?

e. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"?

f. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?

g. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental processes essential to self-government.

2. Development Assistance Project Criteria (loans Only)

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, at a reasonable rate of interest.

b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete with U.S. enterprises, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?

3. Project Criteria Solely for Economic Support Fund

a. FAA Sec. 531(a). Will this assistance promote economic or political stability? To the extent possible, does it reflect the policy directions of FAA Section 102? — Yes.

b. FAA Sec. 531(c). Will assistance under this chapter be used for military, or paramilitary activities? — No.

c. FAA Sec. 534. Will ESF funds be used to finance the construction of the operation or maintenance of, or the supplying of fuel for, a nuclear facility? If so, has the President certified that such use of funds is indispensable to non-proliferation objectives? — No.

d.	FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?	N/A

COUNTRY CHECKLIST

Listed below are statutory criteria applicable generally to FAA funds, and criteria applicable to individual fund sources: Development Assistance and economic Support Fund.

A. GENERAL CRITERIA FOR COUNTRY ELIGIBILITY

1. FAA Sec. 481; FY 1984 Continuing Resolution. Has it been determined or certified to the Congress by the President that the government recipient country has failed to take adequate measures or steps to prevent narcotic and psychotropic drugs or other controlled substances (as listed in the schedules in Section 202 of the Comprehensive Drug Abuse and Prevention Control Act of 1971) which are cultivated, produced or processed illicitly, in whole or in part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to United States Government personnel or their dependents, or from entering the U.S. unlawfully? — No

2. FAA Sec. 620 (c). If assistance is to a government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) the debt is not denied or contested by such government? — No.

3. FAA Sec. 620(e) (1). If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities? — No.

4. FAA Sec. 532(c), 620(a), 620(f), 620D; FY 1982 Appropriation Act Secs. 512 and 513 Is recipient country a communist country? Will assistance be provided to Angola, Cambodia, Cuba, Laos, Vietnam, Syria, Libya, Iraq, or South Yemen? Will assistance be provided to Afghanistan or Mozambique without a waiver? — No.

5. ISDCA of 1981 Secs. 724, 727 and 730. For specific restrictions on assistance to Nicaragua, see Sec. 724 of the ISDCA — N/A

of 1981. For specific restrictions on assistance to El Salvador, see Secs. 727 and 730 of the ISDCA of 1981.

6. FAA Sec 620(j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction by mob action of U.S. property? — No.

7. FAA Sec. 620(l). Has the country failed to enter into an agreement with OPIC? — No.

8. FAA Sec. 620 (o); Fishermen's Protective Act of 1967, as amended, Sec. 5
(a) Has the country seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters? — No.

(b) If so, has any deduction required by the Fishermen's Protective Act been made? — N/A

9. FAA Sec. 620(q); FY 1982 Apprpriation Act Sec. 517. (a) Has the government of the recipient country been in default for more than six months on interest or principal of any AID loan to the country? — (a) No.
(b) Has the country been in default for more than one year on interest or principal on any U.S. loan under a program for which the appropriation bill appprop.iates funds? — (b) No.

10. FAA Sec. 620(s). If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the amount of foreign exchange or other resources which the country has spent on military equipment? (Reference may be made to the annual "Taking into Condiseration" memo: Yes, taken into account by the Administrator at time of approval of Agency OYB." This approval by the Administrator of the Operational Year Budget can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.) — Yes.

11. FAA Sec. 620(t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption? — No

qv

12.	FAA Sec. 620(u). What is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget? (Reference may be made to the Taking into Consideration memo.)	St. Vincent and the Grenadines payment status is current.
13.	FAA Sec. 620A; FY 1982 Appropriation Act Sec. 520. Has the country aided or abetted, by granting sanctuary from prosecution to, any individual or group which has committed an act of international terrorism? Has the country aided or abetted, by granting sanctuary from prosecution to, any individual or group which has committed a war crime?	No.
14.	FAA Sec. 666. Does the country object, on the basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. who is present in such country to carry out economic development programs under the FAA.	No.
15.	FAA Sec. 669, 670. Has the country, after August 3, 1977, delivered or received nuclear unrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards? Has it transferred a nuclear explosive device to a non-nuclear weapon state, or if such a state, either received or detonated a nuclear explosive device, after August 3, 1977? (FAA Sec. 620E permits a special waiver of Sec. 669 for Pakistan.)	No.
16.	ISDCA of 1981 Sec. 720. Was the country represented at the Meeting of Ministers of Foreign Affairs and Heads of Delegations of the Non-Aligned Countries to the 36th General Session of the General Session of the General Assembly of the U.N. of September 25 and 28, 1981, and failed to disassociate itself from the comminique issued? If so, has the President taken it into account? (Reference may be made to the Taking into Consideration memo.)	No

17. ISDCA of 1981 Sec. 721. See Special requirements for assistance to Haiti. — N/A

18. FY 1984 Continuing Resolution. Has the recipient country been determined by the President to have engaged in a consistent pattern of the opposition to the foreign policy of the United States? — No.

B. FUNDING SOURCE CRITERIA FOR COUNTRY ELIGIBILITY

1. Development Assistance Country Criteria

a. FAA Sec. 116. Has the Department of State determined that this government has engaged in a consistent pattern of gross violations of internationally recognized human rights? If so, can it be demonstrated that contemplated assistance will directly benefit the needy? — N/A

2. Economic Support Fund Country Criteria

a. FAA Sec. 502B. Has it been determined that the country has engaged in a consistent pattern of gross violations of internationally recognized human rights? If so, has the country made such significant improvements in its human rights record that furishing such assistance is in the national interest? — No.

b. ISDCA of 1981, Sec. 725(b). If ESF is to be furnished to Argentina, has the President certified that (1) the Government of Argentina has made significant progress in human rights; and (2) that the provision of such assistance is in the national interests of the U.S.? — N/A

c. ISDCA of 1981, Sec. 726(b). If ESF assistance is to be furnished to Chile, has the President certified that (1) the Government of Chile has made significant progress in human rights; (2) it is in the national interest of the U.S.; and (3) the aiding international terrorism and has taken steps to bring to justice those indicted in connection with the murder of Orlando Letelier? — N/A

5C(3) - STANDARD ITEM CHECKLIST

Listed below are statutory items which normally will be covered routinely in those provisions of an assistance agreement dealing with its implemetation, or covered in the Agreement by imposing limits on certain uses of funds.

These items are arranged under the general headings of (A) Procurement, (B) Construction, and (C) Other Restrictions.

A. Procurement

1.	FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of goods and services financed.	Yes	
2.	FAA Sec. 604(a). Will all commodity procurement financed be from the U.S except as otherwise determined by the President or under delegation from him?	Yes	
3.	FAA Sec. 604(d). If the cooperating country discriminates against U.S. marine insurance companies, will agreement require that marine insurance be placed in the U.S. on commodities financed?	N/A	
4.	FAA Sec. 604(e). If offshore procurement of agricultural commodity or product is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity?	N/A	
5.	FAA Sec. 608(a). Will U.S. Government excess personal property be utilized wherever practicable in lieu of the procurement of new items?	Yes	
6.	FAA Sec. 603. (a) Compliance with requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 percentum of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be tranported on privately owned U.S.-flag commercial vessels to the extent that such vessels are available at fair and reasonable rates.	U.S. Flag Carriers not available to St. Vincent and the Grenadines. A transportation source waiver (No. 69H) has been granted.	
7.	FAA Sec 621. If technical assistance is financed, will such assistance be furnished to the fullest extent practicable as goods and professional and other services from private enterprise on a contract basis? If the facilities of other Federal agencies will be utilized, are they particularly suitable,	Yes	

not competitive with private enterprise, and made available without undue interference with domestic programs?

8. International Air Transport Fair Competitive Practices Act, 1974. If air transportation of persons or property is financed on grant basis, will provision be made that U.S.-flag carriers will be utilized to the extent such service is available? — Yes

9. FY 79 App. Act. Sec. 105. Does the contract for procurement contain a provision authorizing the termination of such contract for the convenience of the United States? — Yes. Contracts will contain such clauses

B. Construction

1. FAA Sec. 601(d). If a capital (e.g., construction) project, are engineering and professional services of U.S. firms and their affiliates to be used to the maximum extent consistent with the national interest? — Yes

2. FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable? — Yes

3. FAA Sec. 620(k). If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed $100 million? — N/A

C. Other Restrictions

1. FAA Sec. 122(e). If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter? — N/A

2. FAA Sec. 301(d). If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights? — N/A

3. FAA Sec. 620(h). Do arrangements preclude promoting or assisting the foreign aid projects or activities of Communist-bloc countries, contrary to the best interests of the U.S.? — Yes

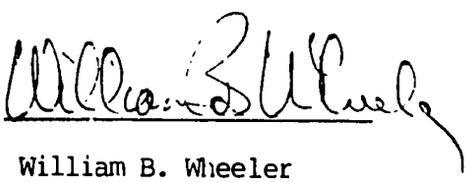
4. FAA-Sec. 636(i). Is financing not permitted to be used, without waiver, for purchase, long-term lease, or exchange of motor vehicle manufactured outside the U.S., or guaranty of such transaction? — Yes

ANNEX D

CERTIFICATION PURSUANT TO SECTION 611(e) OF THE FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED

I, William B. Wheeler, as Director of the Agency for International Development, Regional Development Office/Caribbean having taken into account, among other things, the maintenance and utilization of projects in the Caribbean Region previously financed or assisted by the United States, do hereby certify that in my judgement the Government of St. Vincent and the Grenadines has both the financial capacity and the human resources capability to effectively utilize and maintain goods and services procured under the proposed capital assistance loan and grant project entitled Cumberland Hydroelectric Project.

This judgement is based upon the implementation record of externally financed projects, including AID-financed projects, in St. Vincent and the Grenadines, the commitments from the Government of St. Vincent and the Grenadines and the quality of the planning which has gone into this new project. The new hydroelectric system is being designed and will be constructed principally by expatriate firms. Operations and maintenance of the completed facility will be similar in nature to hydroelectric plants with which the responsible agency already has considerable successful experience. The Project Agreement includes provisions designed to insure the future financial viability of the electric utility, and the Government of St. Vincent and the Grenadines appreciates the economic and social importance of the project and is fully committed to its proper implementation and utilization.

(Signed): 

William B. Wheeler
Director

(Date): 26 June 1984

5.	Will arrangements preclude use of financing?	Yes
a.	FAA Sec. 104(f). To pay for performance of abortions or to motivate or coerce persons to practice abortions, to pay for performance of involuntary sterilization, or to coerce or provide financial incentive to any person to undergo sterilization?	Yes
b.	FAA Sec. 620(g). To compensate owners for expropriated nationalized property?	Yes
c.	FAA Sec. 660. To finance police training or other law enforcement assistance, except for narcotics programs?	Yes
d.	FAA Sec. 662. For CIA activities?	Yes
e.	FAA Sec. 636(i). For purchase, sale, long-term lease, exchange or guaranty of the sale of motor vehicles manufactured outside U.S., unless a waiver is obtained?	Yes
f.	FY 1982 Appropriation Act, Sec. 503. To pay pensions, annuities, retirement pay, or adjust service compensation for military personnel?	Yes
g.	FY 1982 Appropriation Act, Sec. 505. To pay U.N. assessments, arrearages or dues?	Yes
h.	FY 1982 Appropriation Act, Sec. 506. To carry out provisions of FAA section 209(d) (Transfer of FAA funds to multilateral organizations for lending?	Yes
i.	FY 1982 Appropriation Act, Sec. 510. To finance the export of nuclear equipment, fuel, or technology or to train foreign nationals in nuclear fields?	Yes
j.	FY 1982 Appropriation Act, Sec. 511. Will assistance be provided for the purpose of aiding the efforts of the Government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights?	No
k.	FY 1982 Appropriation Act, Sec. 515. To be used for publicity or propaganda purposes within U.S. not authorized by Congress?	No

OFFICE OF THE PRIME MINISTER
SAINT VINCENT AND THE GRENADINES
WEST INDIES

Our Ref: PM/072 June 13, 1984.

The Ambassador
United States of America
American Embassy
P.O.Box 302
Bridgetown
BARBADOS.

The purpose of this letter is to request that the United States Government assist the Government of St. Vincent and the the Grenadines to resolve the critical shortage of electricity by participating in the jointly financed Cumberland Hydro-electric Project. The total project is estimated to cost approximately $31.338 million of which we are requesting that the United States provide $8.0 million.

ACTION
CDO
DUE 6/28/84
TAKEN: KFF
SIGN: 6/21/84

During the past eighteen months, the Government of St. Vincent and the Grenadines has been working with various donor organizations and the Shawinigan Engineering Company to design an energy project which will provide a long term solution to St. Vincent's inadequate and costly supply of electricity. In addition, the project will assist VINLEC to become a technically sound and financially viable public utility. The result of the design effort has been the Cumberland Hydro-electric Project. This project consists of a hydro-electric facility, upgrading of the power supply system, implementation of a watershed management program and institutional improvements in the public utility.

The hydro-electric facility will be a small, run-of-the-river scheme consisting of three powerhouses, four diversion works, and pipeline connecting the two. It will provide 3,370 KW of power. The upgrading component of the project will consist of a loss reduction program, repair of current diesel generators and a transmission and distribution expansion program. A watershed management plan and hydrologic data collection program will be included in the

/Project.

Project. Improvements to the utility company will include technical assistance, training, and institutional reform.

There will be four donors who will contribute to this project: The International Development Association (IDA) will contribute $4.977 million for use in the system upgrading component of the project and to secure the services of the project consultant; the Canadian International Development Agency (CIDA) will contribute $7.77 million for pipeline and equipment to be used in the hydro-electric facility; the Caribbean Development Bank (CDB) will provide $4.5 million for the loss reduction program, and the European Investment Bank (EIB) will provide $2.79 million for the turbines and generators. We are requesting that USAID as the fifth donor provide $8.0 million for the civil works component of the hydro-electric facility construction, the streamgauging program, and the implementation of the watershed management plan. The remainder of the funds, $3.301 will be provided by the Government of St. Vincent and the Grenadines through the electric utility for support to the various project components as follows: civil works $1.078; watershed management $0.05; and other $2.173.

The selection of activities for which we wish USAID assistance was based on our desire to utilize United States and/or Vincentian construction contractors and to procure hydrologic equipment which is manufactured in the United States.

The Government of St. Vincent and the Grenadines assures the United States Government of its full cooperation in carrying out the Cumberland Hydro-electric Project and its commitment to assure the autonomy and institutional viability of VINLEC. The manpower, financial and other inputs required of us will be provided in an expeditious manner.

We look forward to a continued, combined effort by both governments to yield a productive and beneficial program for the people of St. Vincent and the Grenadines.

R. Milton Cato, P.C.
PRIME MINISTER/MINISTER
FOR FINANCE.

GO

ACTION AID INFO AMB DCM PE CERON

ANNEX G

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ADM AID

E.O. 12356: N/A
TAGS:
SUBJECT: CUMBERLAND RIVER HYDRO PROJECT

1. LAC/DR HAS RECEIVED THE CUMBERLAND WATERSHED MANAGEMENT PLAN FOR ST. VINCENT FROM HENRY TSCHINKEL. WE FIND IT STRAIGHT-FORWARD AND MODEST. WE UNDERSTAND THAT RDO/C INTENDS TO INCLUDE THE IMPLEMENTATION OF THE PLAN IN ITS PART OF THE PROJECT FUNDING AND LOOK FORWARD TO SEEING IT CARRIED OUT.

2. LAC/DR/EST CHIEF ENVIRONMENTAL OFFICER JHESTER HAS REVIEWED THE PROJECT'S IEE AND FINDS IT ALSO ACCEPTABLE. SHULTZ
BT
#0917

UNCLASSIFIED STATE 100917

AC
D
PI
CF

DATE 04/10/84
TA 04/10/84
SIGN. KAF

91

PROJECT DESIGN SUMMARY

LOGICAL FRAMEWORK

Life of Project:
From FY 85 to FY 88
Total U.S. Funding $5 million
Date Prepared: 6/84

Project Title & Number: CUMBERLAND HYDROELECTRIC - 538-0091

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: To establish the physical productive infrastructure essential to achieve a self-sustaining level of economic growth for St. Vincent.	**Measures of Goal Achievement:** Increase in productivity of population of St. Vincent.	Annual statistical GOSV data.	**Assumptions for achieving goal targets:** . Government will remain stable and pursue economic growth. . No major natural disasters.
Project Purpose: To meet current and future energy demands of the industrial, tourism, and domestic sectors in St. Vincent and assure that these needs continue to be met on a self-sustaining basis by co-financing a program of activities which will expand energy production and which will contribute to the long-term financial viability of the electric utility.	**Conditions that will indicate purpose has been achieved: End of project status.** . End of loadshedding. . Increased use of electricity. . Financial (income) targets met.	VINLEC reports. Project evaluation	**Assumptions for achieving purpose:** .GOSV commitment to institutional and financial reforms in support of VINLEC. .Designed future load forecasts are reasonably accurate. .VINLEC retains its autonomy.
Outputs: 1. Increase supply of electricity. 2. Increase portion of electricity output generated by hydroelectric. 3. Increase VINLEC capabilities. 4. Reduce line losses. 5. Decrease maintenance problems. 6. Increase information available for future hydroelectric planning. 7. Increase awareness of watershed management.	**Magnitude of Outputs:** 1. Electricity output capacity reaches 35.4 Gwh. 2. Ratio of hydro/diesel generation to 50:50. 3. VINLEC rates restructured. 4. Line losses reduced to 15%. 5. All diesel generators are in working order or retired. 6. Streamflow and rainfall data recorded. 7. 100 acres of trees planted.	VINLEC reports. Quarterly reports of project unit Project evaluation.	**Assumptions for achieving outputs:** . Water is available. . Materials and equipment available within time and cost limits. . All other donors perform on timely basis.
Inputs:	**Implementation Target (Type and Quantity)**		**Assumptions for providing inputs:**

	AID	GOSV	OTHER DONORS	TOTAL
Technical Assistance	0	.3	2.6	2.9
Training	0	0	.8	.8
Commodities	0	.3	10.0	10.3
Other				
Civil Works (L)	7.2	1.1	0	8.3
Watershed Management (G)	.5	.1	0	.6
Streamgauging (L)	.3	0	0	.3
Diesel Rehabilitation	0	.1	1.0	1.1
Loss Reduction	0	.9	4.5	5.4
Transmission & Distribution	0	.4	.7	1.1
Studies	0	.1	.4	.5
	8.0	3.3	20.0	31.3

USAID disbursement records
VINLEC records

GOSV and other donors provide adequate financial support.

ANNEX F

22

ENVIRONMENTAL ASSESSMENT

CUMBERLAND HYDROELECTRIC PROJECT

AID 538-0091

Prepared By:

James J. Talbot
Regional Environmental Management Specialist/Caribbean (REMS/C)
USAID/Port-au-Prince, Haiti

9 February 1983

Prepared For:

Regional Development Office/Caribbean
Bridgetown, Barbados

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I. SUMMARY AND RECOMMENDATIONS

St. Vincent has commissioned two small hydropower projects since 1952. The present scheme for the Cumberland watershed is the third hydropower project but addresses for the first time the environmental impacts of construction and operation of such facilities. The Cumberland scheme is a run-of-river/diversion system consisting of a dam, diversion canal, settling basin, storage tank for low flow conditions, pipeline, penstock, powerhouse with turbine/generator, and outlet works. Direct impacts are associated with construction, highly limited in area and usually temporary, and with consumption of certain amounts of energy and materials.

A. Direct Impacts

1. Major unavoidable direct effects include:

   a. Stream sedimentation

   b. Terrestrial habitat disturbance

   c. Loss of lands and/or restriction of access

2. Minor unavoidable direct effects include:

   a. Energy consumption

   b. Air and noise pollution

   c. Disruption of normal community activities

   d. Increased dust levels in project activity areas

   e. Short-term economic boom due to influx of laborers and capital.

3. Mitigative measures proposed to reduce/eliminate adverse direct impacts include the following:

   a. Use of sound construction standards to reduce noise, safety hazards, traffic hazards

   b. Scheduled maintenance of equipment and vehicles to reduce energy consumption

   c. Use of reparian barriers to prevent stream sedimenation

   d. Compensation of farmers for lost lands

   e. Improvements in access due to restrictions from pipeline, etc.

B. Indirect Impacts

1. Indirect impacts result from operation of the hydroelectric generating facility and pertain to longer term effects on communities or policy matters, on biogeophysical attributes of the watershed, or from the location of the facility near areas subject to natural disturbances. Major indirect effects include:

a. River flow depletion, as much as 70% of the time, immediately downstream of the dam structure and subsequent effect on aquatic biota and on people who wash clothes in the river.

b. Damage to pipeline by natural landslides

c. Intensified land use and land clearing in upper watershed areas due to greater access

2. Mitigative measures proposed to reduce indirect effects include the following:

a. Extension of water supply from upper watershed to those people needing water for clothes washing

b. Further study to determine low flow stream conditions before and after facility operation since no data base now exists

c. Location of pipeline along best possible route in terms of stability and use of leak detection devices and automatic shut-off valves and regular inspection schedules to detect ruptures.

d. Preparation and implementation of a watershed management plan along with changes in forest policy and legislation and training of personnel to ensure appropriate land use, especially in the upper watershed area.

II. PURPOSE OF THE ENVIRONMENTAL ASSESSMENT

The purpose of the EA is to examine the foreseeable impacts of the Cumberland Hydroelectric Project on the human/natural environment in accordance with AID's Environmental Procedures (22 CFR Part 216). Environmental assessment deals with the identification, measurement, interpretation and/or communication of impacts to information users. A "scoping of issues" was accomplished in early December 1983 by REMS/C and a memo (Appendix 1) outlining the key environmental concerns was circulated in LAC/DR and the RDO/C. Site visits to an existing hydropower (Richmond) and the proposed site (Cumberland) were used to verify information contained in field reports on the project. Interviews were held with key GOSV personnel on identified issues.

Project problematic areas of an environmental nature, in particular, the preparation of a Watershed Management Plan (WSMP) will be addressed during the Project Paper phase. The Regional Forestry Advisor from ROCAP will prepare the WSMP concurrently with the EA, hence details on that subject will be relegated to the WSMP and not included in the EA.

IV. AFFECTED ENVIRONMENT

Saint Vincent and its dependencies, the Grenadines, form part of those islands in the Caribbean Basin usually referred to as the Windwards. The mainland of St. Vincent is 133 sq. mi. (340 sq. km.). The Grenadines are relatively small islets comprising some 20 sq. mi. (51 sq. km.). Figure 4.1 shows the location of these islands.

The State of St. Vincent and the Grenadines attained independence from Britain on 27 October 1979. According to the 1980 census the population is about 115,000. St. Vincent is densely populated, the majority of the inhabitants live around the coast and in compact village communities. A similar situation exists on most of the Grenadines islets.

A. Biogeophysical Characteristics of St. Vincent

1. Physiography and Geology

The island of St. Vincent is about 30 km long and 18 km wide and lies to the west of Barbados, between the islands of St. Lucia on the north and Grenada on the south. It is mountainous and deeply eroded, with a central main axial ridge running from north to south, the highest peaks being in the range of elevation 950m to 1220 m. The highest peak , La Soufriere, reaches 1245 m (4084 ft.). Knife-edged and elongated ridges radiate from these highlands, with the leeward (western) coast being much more rugged than the windward (eastern) coast. Deep cut valleys and high vertical coastal cliffs characterize the leeward side of the island, whereas eroded marine terraces and ash deposits are common on the windward side.

The island is wholly volanic in origin and one of the youngest in the Antillean arch. The structure is a succession of extinct volcanoes, except for the northern third of the island which is dominated by the recently active volcano, Soufriere.

No comprehensive work has been done on the geology of St. Vincent. Preliminary island-wide studies have been carried out, producing a reconnaissance surficial geology map (Figure 4.2). Many publications dealing with the volcanic activity of Soufriere have been written.

St. Vincent is entirely composed of volcanic ejections which range from Pleistocene to Recent in age. There are no large sedimentary deposits. The main rock types are lava and pyroclastics. The lava occurs as individual flows having a limited exposure and is usually fresh, but well fractured and jointed. Pyroclastics are the most abundant products on the island. They include particles ranging in size from clay to boulders. According to grain size, pyroclastics can be divided into volcanic ash (clay to sand size particles), tuff (coarse sand to coarse gravel size particles) and agglomerate (hecterogeneous mixture of clay to boulder size particles). Major characteristics of the pyroclastics are the lack of fracture system; poor cementation and the fairly high degree of weathering of the clay to sand fraction, whereas the cobble and boulder fractions are usually made up of fresh volcanic rock.

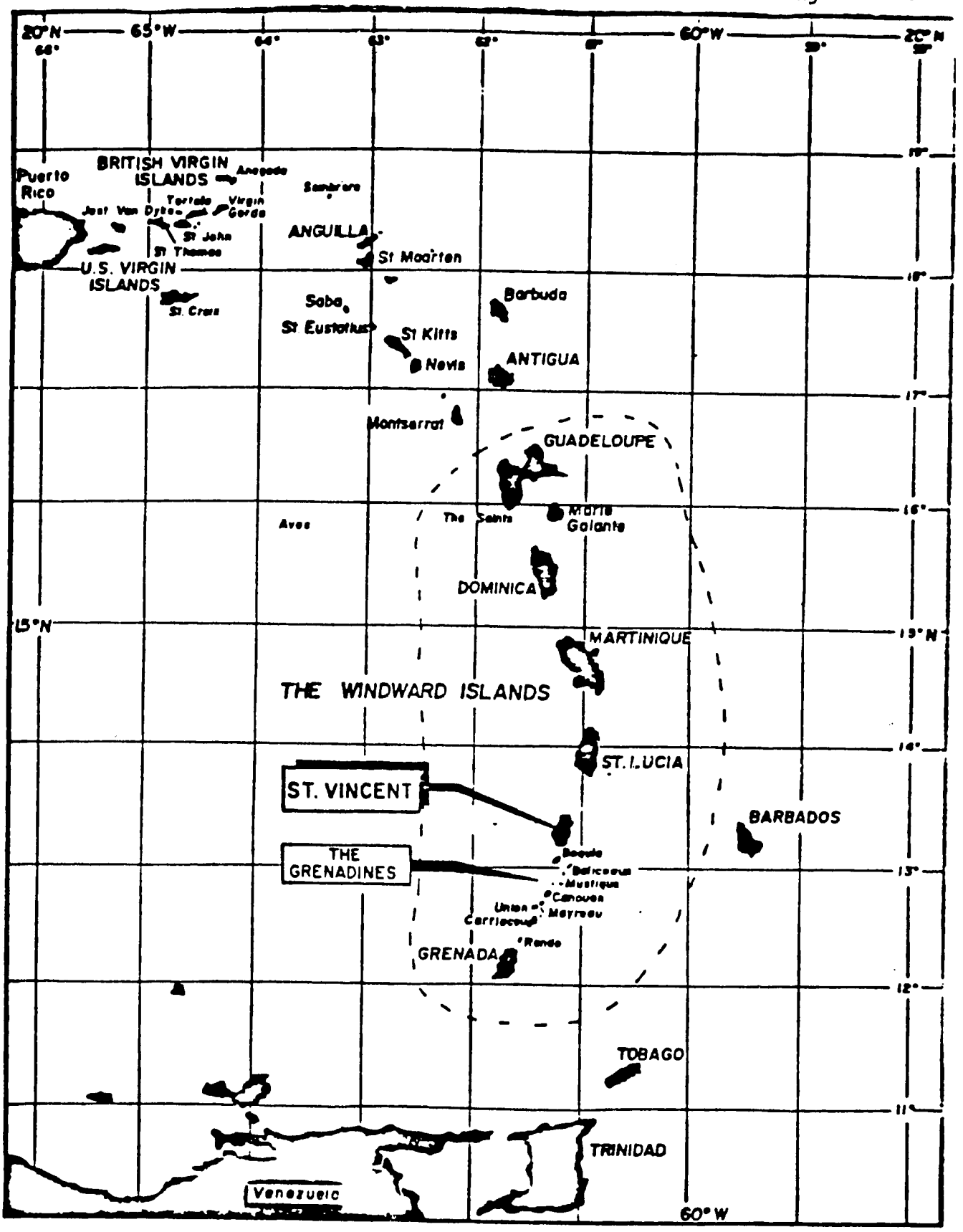

Figure 4.1 Location of St. Vincent and the Grenadines in the Windward Island Group.

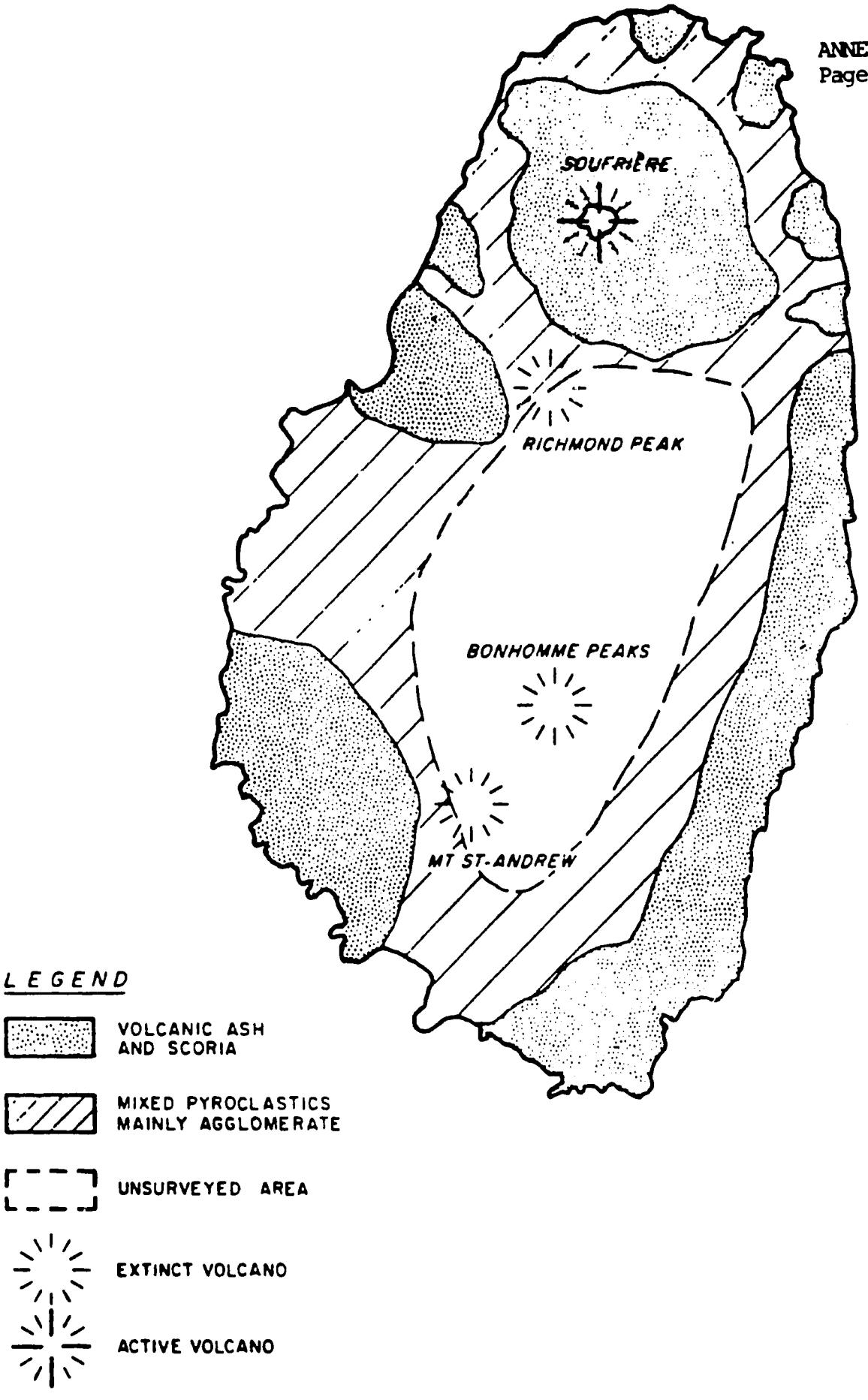

Figure 4.2 Surficial Geology of St. Vincent

Because of its steep topography and the high degree of weathering of the pyroclastics, slope instability in the form of landslides and slumps is a major problem in St. Vincent. In fact, unstable slopes tend to be the rule rather than the exception. These mass movements occur mainly during the wet season when surficial materials become saturated. The main areas of concern are the problems of silt load in rivers, as a result of erosion, and damage to engineering works from landslides.

No major faults or folds have been mentioned by previous investigators suggesting that no major tectonic disturbances, other than the volcanic ones, occurred on the island.

2. Soils and Soil Erosion

All the soils are relatively young. The layers of ash thrown out during volcanic activities of La Soufriere are still weathering - more of these have been added during the past three years. The whole of the northern end, extending to about one-third of the island, is reported to be covered with volcanic ash.

The soils in St. Vincent have been classified as follows:

- coastal plain and valley alluvial soils which are the most fertile lands of the island and are the most resistant to erosion;

- yellow earth soils which cover most of the country and which show a well differentiated soil profile of varying physical characteristics. These variations are dependent on the maturity of the soil which, in turn, is related to the age of the parent material ejected from at least five volcanoes. The relative hardness of these soils increases with depth, but because of the intermittent activities of the volcanoes the depths of these harder layers vary. Evidence of this hardness is noticeable, throughout the island, in the benches which have been cut along the hillsides to form the main highways. Some of the harder material are also used for road building purposes;

- recent volcanic ash soil which is unconsolidated and which is the most erodible.

The variable composition of the yellow earth soils is shown by the following percentages.

	Coarse Sand (2 mm to 0.2 mm)	Fine Sand (0.2 mm to 0.06 mm)	Silt and Clay (below 0.06 mm)
Union Point	30%	60%	10%
Barrouallie	26%	70%	4%
Dorestshire Hills	45%	25%	30%

The pH of soils in the Dorestshire Hills was found to vary from 6.0 in the upper layers to 6.6 in the lower layers. No pH values were quoted for the two other sites (Hay, 1959; Hardy, 1939).

The soils in St. Vincent have been derived from the weathering of volcanic material. It would be expected that these soils would not erode rapidly because of their high permeability. Nevertheless, erosion of the surface layers has been observed and has been caused by a number of factors.

Four types of soil erosion have been observed in St. Vincent:

- sheet erosion;
- rill or finger washing, as the runoff migrates to depressions;
- gully erosion, which is a development of rill washing and which is limited by the presence of harder soils or terras;
- landslips, where waterlogging of the upper soil layers resting on terras or bedrock results in a mass movement of the upper soils. The mass which is moved can be either small or large, Figure 4.1.

Degrees of soil erosion depend on the intensity, duration and amount of rainfall, slope of the land surface, extent and nature of the vegetative cover, type and properties of the soil, and agricultural and silvicultural practices.

With respect to the first factor, the tendency is for greater amounts of rainfall to occur on the leeward coast; e.g., the variation of rainfall intensity shows that the intensity can be as much as 51 mm/h and that 82.5 mm (3.5 inches) of rain can fall in 6 hours. This high rainfall intensity coupled with a land slope of 45 degrees (not uncommon in the leeward region) are conducive to high rates of soil erosion. On the windward side of the island land slopes tend to be about 20 degrees.

Generally, the soils of St. Vincent are friable and readily eroded, but cementation of the subsoil, where it occurs, is only incipient and the cemented layers readily decompose on being brought near to the surface. Erosion does not lead, therefore, to exposure of sheets of indurated shoalrock or to other disastrous effects as are visible in some other countries in the Caribbean.

Prior to the arrival of the First French colonists in 1719, cultivation was not extensive and was limited to the meagre demands of the indigenous Carib Indians. With the removal of forest, the enlargement of the cultivated areas and the introduction of crops such as coconuts, cotton, sugar cane, cassava, pigeon peas, groundnuts, maize and other annual crops, protection of the soil decreased. The cultivation of arrowroot is somewhat different in that although the plant covers the ground rapidly, the removal of the rhizomes in the rainy season, or late dry season, leaves the land bare and hence subject to erosion.

Cultivation on the steep slopes, a practice that has been carried out for many decades on much of St. Vincent presents a potentially serious problem with erosion and landslides. However, the accepted planting method in the island helps to reduce the hazard potential. Many farmers seldom plant crops on sloping land without using the "ridge and furrow" method that follows the contour, a well know soil conservation practice. Nevertheless, soil erosion is a serious problem in some areas, and the potential for increased erosion is high. Sound soil conservation is essential to the future of the island's agriculture.

In areas of high rainfall, say over 2000 mm per annum , exposure of soils to high intensity and frequent downpours, especially under the regime of reduced vegetative cover, can lead to increased erosion. For example, soil loss under different forms of perennial cropping has been measured in Dominica (Walsh, 1979):

Land Use	Soil Loss
Rain Forest	46 mm/year
Citrus	55 mm/year
Bananas	80 mm/year

Although Dominica's mean annual rainfall regime is higher that St. Vincent's, erosion rates could still be expected to be a serious threats to sustainable agriculture in many places.

3. Vegetation and Land Use

Vegetation and land use is depicted in Figure 4.3. Much of the island has been cleared of its native vegetation and planted in agricultural crops, primarily perennial crops such as bananas, coconuts, cocoa, sugar cane and tubers. These crops are not tall but provide a relatively low canopy cover which has the effect of reducing rainfall intensity. In addition, the litter on the ground beneath the trees reduces the severity of overhead flow and its erosional property.

Dense stands of native vegetation remain only in the central highlands. The crests of the steeply sloping ridges near the coast are often covered with a dry-scrub woodland. The central mountain vegetation is of a secondary nature with areas of rain forest at the heads of some of the larger valleys, such as the Cumberland. Native vegetation has stabilized steep slopes in uncleared areas and allowed soils to develop. In the arable land areas, remnants of forests exist only in the central mountains. The forests serve an important role in absorbing the heavy rain and gently directing the moisture to the outlying drainage basins.

Forest management in St. Vincent is limited to protecting the existing forests. Reforestation has been practiced in some catchment areas and along banks of streams and rivers. Five of the main watersheds of the island are under very rudimentary forest management with the aim of increasing stream flow for domestic use, hydroelectricity, and agriculture. The reforestation efforts need to be maintained and expanded. Several proposals were submitted to RDO/C by the Forestry Division. However, there is still no

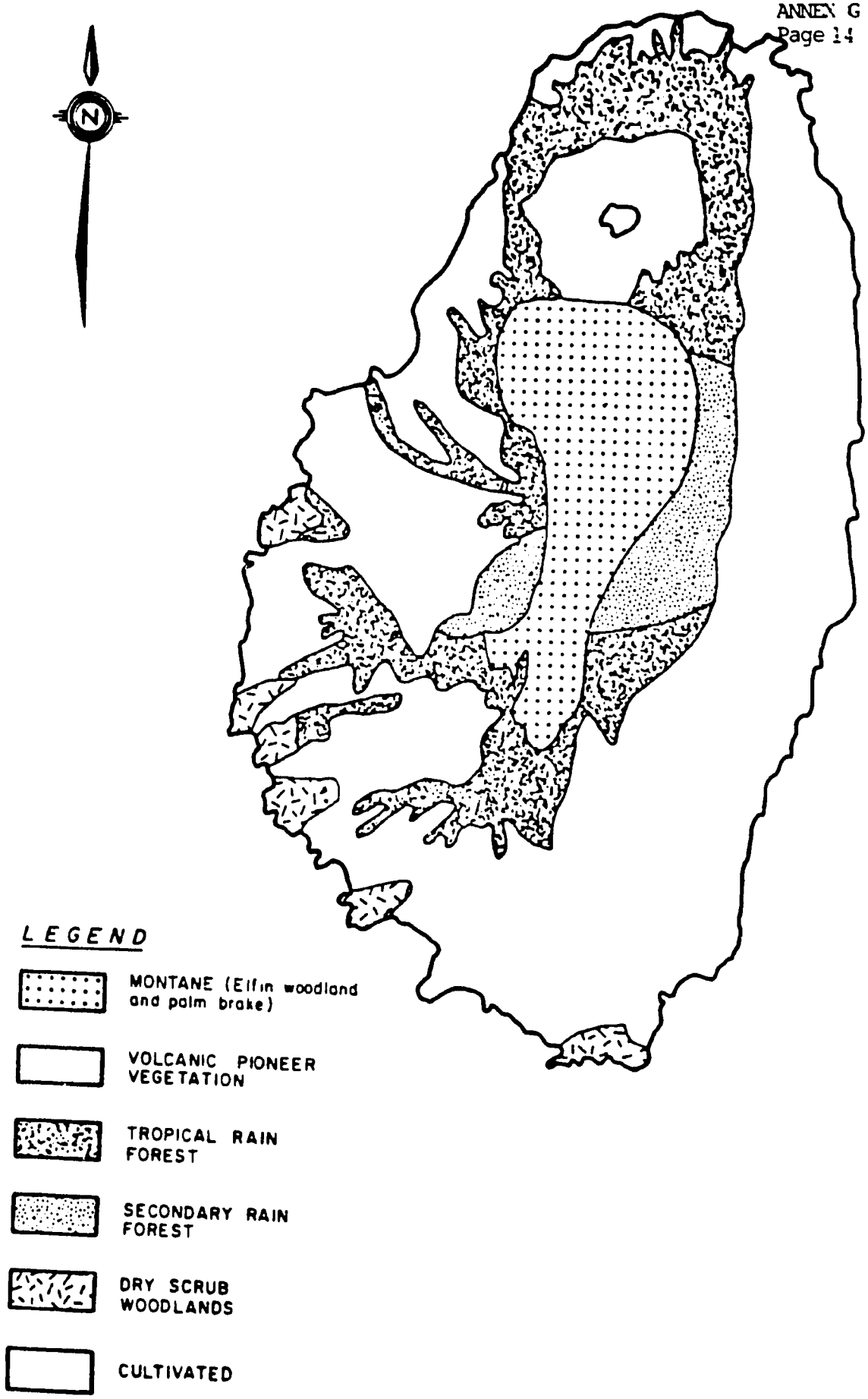

Figure 4.3 Vegetation and land use on St. Vincent

approved forest policy. Although the existing Ordinance and Regulations have been enforced since 1945, these are inadequate to meet present day needs (C. Nichols, Forestry Div., GOSV, 1983 personal communication).

In April 1979, Mt. Soufriere volcano erupted, forcing the evacuation of the northern part of St. Vincent for several months and seriously disrupting agriculture and the natural environment. The volcano's effects - disturbance of soil and destruction of trees - are still apparent.

The total area of mainland St. Vincent (85,120 acres or 34,448 ha) is divided as follows:

Private lands	- cultivable	31,721 acres	(12,837 ha)
	- not cultivable	11,899 acres	(4,816 ha)
Crown lands	- natural vegetation	39,800 acres	(16,107 ha)
	- rented for cultivation	1,700 acres	(688 ha)

Since the 1979 Soufriere eruption, these figures, which were provided by C. Nichols, Forestry Division, GOSV, are questionable. No accurate figures are available for the Grenadines.

Further sub-division of these estimates produce a breakdown of land use/tenure as follows: (P. Henry, 1980):

Category	Area (ha)
Crown lands	16475
Newland settlement	2448
Old land settlement	2335
Peasant holdings	4698
Large estates	8223
Towns/villages	465
TOTAL	34179

Discrepancies that exist between these and the previous estimates are not significant enough to cause great concern.

4. Climate

The climate of St. Vincent is dominated throughout the year by the trade winds, which are generally easterly. The movements of the subtropical anticyclone belt and the intertropical convergence zone (ITCZ) lying to the north and south, respectively, of the region also play a part in defining the climatic conditions. From mid-December to mid-February, the ITCZ lies in the region of the Amazon and subtropical high lies close to the Caribbean. Between July and September this migration is reversed and the ITCZ is nearer the region. These rhythmic movements give rise to a marked seasonal characteristic of the area, particularly with respect to the rainfall pattern.

The mean monthly wind speed is generally below 25 km/h and higher wind speeds preceed heavy showers and hurricanes. Hurricanes, when winds are in excess of 120 km/h, tend to be confined to the months of August and September.

Temperatures vary diurnally, seasonally and with altitude in any given location. In the Caribbean islands temperatures at low elevations are known particularly at or near sea level. The range is about 25°C to 27° C. Since temperature is one of the variables affecting evaporation, it is important that the variation of temperature with altitude should be known. Shawinigan (1983) estimated a lapse rate of 0.8°C per 100 m rise in elevation (regression line with r = 0.95), which compares favorably with the normal theoretical rate of 1°C per 100 m rise in elevation, using temperature data from selected stations throughout the Caribbean.

Rainfall variation on the island is due to orographic effects. The following variation due to altitudinal change has (i.e., going from sea level upwards) been estimated as follows (Underwood et al 1971):

Windward (leeward, southern)	-	5 mm/m/year
Leeward (western)	-	7 mm/m/year

Long term (less than 59 years) rainfall records indicate an annual variation of 1658 mm at Villa Point on the south coast to 3680 mm at the headworks of the Richmond hydroelectric plant on the west coast.

There is one dry season from January to June and a wet season extending over the latter half of the year. During the first half of the year the average monthly rainfall is below the average yearly rainfall especially the months of February, March and April. This characteristic therefore strongly suggests that all river diversion works and construction of dams should be done during the first half of the year. The possibility of having severe floods is small, and the cost of diversion works would be smaller than those constructed for conditions occuring in the latter half of the year.

A tentative isohyet map (Figure 4.4.) estimated that rainfall at the highest elevations was about 7000 mm per annum (Shawinigan 1983).

B. Cumberland Watershed Characteristics

1. General Description

The Cumberland river valley is located on the leeward (western) coast of St. Vincent, approximately midway between the northern and southern tips of the island. The valley lies between steep mountain ranges of volcanic origin. The only flat land is found in the very narrow flood plain on the valley floor. In many places, the Cumberland river meanders between vertical rock cliffs and alluvial flats. Despite the steepness of the mountain ridges, most of them are used for agricultural purposes by the valley's inhabitants. Basically, it appears that wherever there is weathered overburden (loose material overlying another more solid/uniform deposit), it is farmed, regardless of slope.

The upper portions of the basin, roughly, upstream of the Hermitage and Convent dams are covered by virgin jungle, more correctly called primary and secondary rain forest and are said to contain a limited variety of wildlife such as labba, opossum, pigeons, parrots and hawks. There are no timber extraction operations of any scale although there is evidently

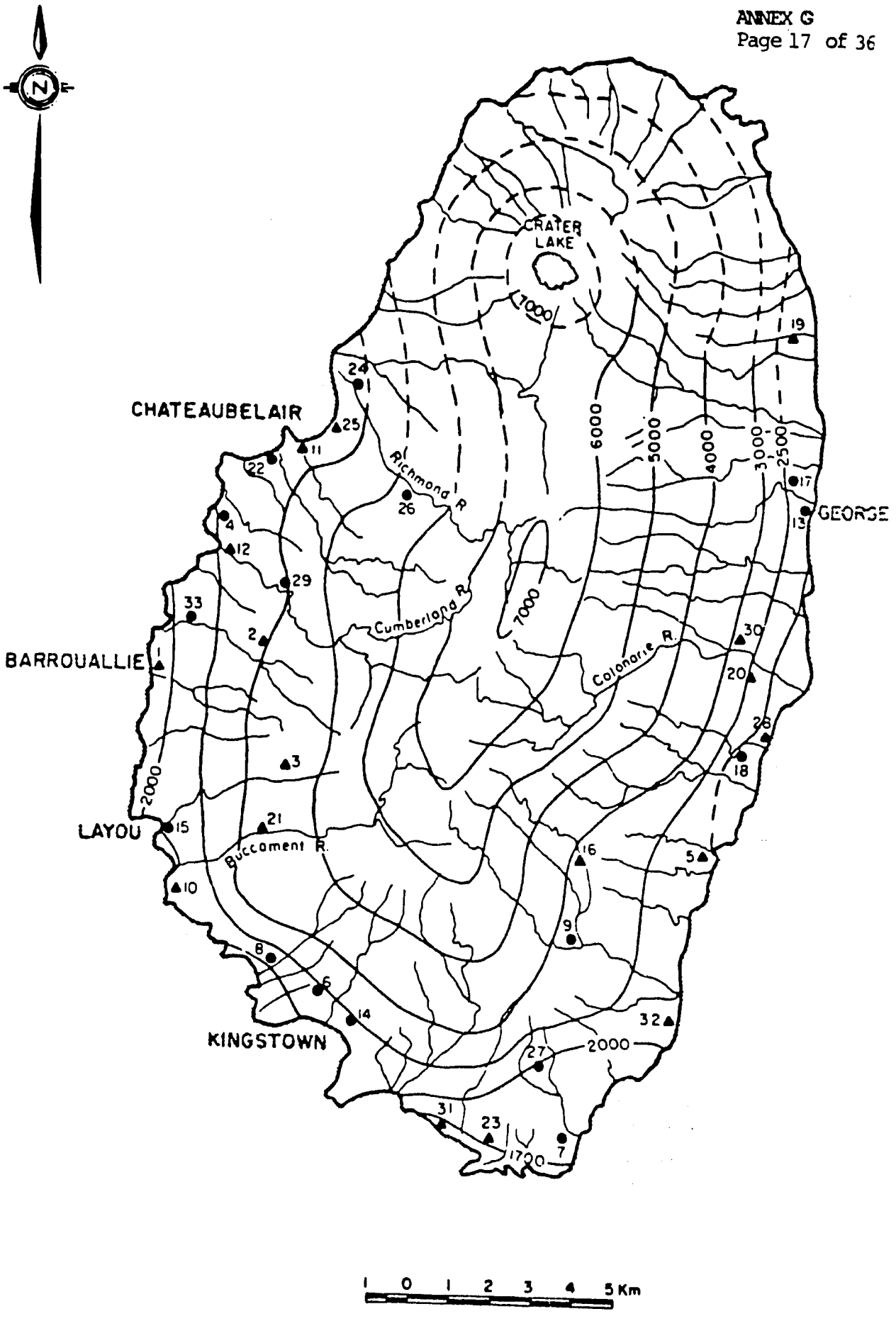

Figure 4.4 Isohyets estimated by Shawinigan (1983)

manual harvesting for planks by some residents of the valley. The Forestry Division maintains some test plots in the upper watershed, managing blue mahoo, mahogany and Leucaena.

According to the 1980 census, the population of the Cumberland valley is about 1000. Main settlements are at Cumberland Village, Spring Vilage and Gordon Village. The average family size in such rural areas is assumed to be five or six persons. The settlements in the Cumberland Valley are not financially well off. There appèars to be abundant food but there is very little economic activity other than agriculture. Schooling is available for early grades only.

Whereas many inhabitants of the Cumberland valley have their homes in the lower reaches (Gordon Village and downstream), they do own agricultural land all the way up the valley to the vicinities of the proposed Convent and Hermitage dams.

Crops grown in the Cumberland valley include bananas (the most prevalent and principal cash crop), coconuts, various tuberous vegetables (yams, eddoes) citrus fruits (oranges, lemons), cocoa and nutmeg. The bananas are collected by truck and shipped to Kingstown. Other vegetable crops, in excess of local needs, are taken to Kingstown by the farmer and sold there. There is also scattered grazing in the valley by cattle, goats, sheep and donkeys. Some fertilizer is used by the farmers and insecticides are used on the banana plants.

The major public infrastructure provided to the valley consists of roads, electricity, telephone to Spring Village, and water supply. A paved road runs from the bottom of the valley to the site off the Convent dam. While paved the grade, width, curvatures and condition are such as to restrict its use to jeeps and trucks. The road functions mainly as an access for villagers going to their farms, for trucks used to collect bananas, and for partical access to the intake of a major water supply system which is described below. Electricity supply is available in the villages but not all houses are connected.

A major water supply system taps the headwaters of the Cumberland river about a mile above the proposed Convent dam. From the intake a twelve-inch pipe runs down the valley to Grove where it splits into an eight inch and a six inch line. The eight inch line runs northward over the mountains to serve the Rose Hall/Belmont areas, while the six inch line continues down the Cumberland valley to a point above Gordon Village then turns southward and goes over the mountains to serve the town of Barrouallie. At present, the villages in the Cumberland Valley (Gordon, Spring and Cumberland) are supplied by a local independent line which taps a spring in the mountains high above Gordon Village. There is a long term plan to replace this local supply system with a connection from the main pipeline from the upper Cumberland. It is worth nothing here that the water supply systems in St. Vincent are drawn from the highest possible elevations in order to provide adequate pressure and to ensure water quality. Water quality is a problem downstream of any agricultural activity, largely because of the use of insecticides on banana plants.

The piped water supply system in the valley is used for drinking, cooking, some bathing and, in a few cases, the flushing of sanitary wastes. About half the population is served by standpipes. The washing of clothes and some bathing are done in the river adjacent to the villages. Those houses without water connections (and some of those with them) use pit latrines for the disposal of human wastes. It appears that the river is not used to serve this function.

There are no signs in the valley that the river water is used for the irrigation of agricultural lands. As indicated previously, the land under agriculture is generally quite steep and is not suited to irrigation. Crops grown in the flood plain are not irrigated nor are they in need of irrigation.

2. Geology

Agglomerate and tuff are the most common rock types mapped in the Cumberland valley in the vicinity of the lower and middle stages of the development area, whereas volcanic ash is predominant in the upper stage of the development area. Massive volcanic rock outcrops only at a few locations.

Except for the massive volcanic rock which is fresh, the degree of weathering is generally high. The volcanic ash is weathered to a residual soil with no traces left of rock structures. The agglomerate contains subrounded boulders and cobbles of fresh volcanic rock in a poorly cemented and highly weathered residual matrix of volcanic ash. The percentage of boulders and cobbles in the agglomerate is usually very high. The tuff is usually in an intermediate state of cementation and weathering, where some of the particles are slightly weathered and others, still recognizable as rock particles, are weathered to quite soft material. The depth of weathering is in the order of several tens of meters.

Landslide scars, shallow sheet erosion and gully erosion are common features of the valley. Because of the presence of large volumes of weathered volcanic ash, mass movements are much more obvious and spectacular in theupper stage development area. Slope stability assessment has been the major criterion for locating the pipeline routes and locating the storage (balancing) tanks (Shawinigan, 1983).

The Cumberland river generally flows over a boulder pavement, some of the boulders being 4 m to 5 m in diameter. The volcanic agglomerate is the source of the boulder pavements since the weathered ash matrix is easily eroded and washed away while the more resistant boulders and cobbles accumulate. These materials, especially the bigger sizes, are believed to have accumulated almost in place. Once a pavement is formed, it acts as an erosion stabilizer. Therefore, the pavements are believed to represent the reworked surface of bedrock. Alluvial sand and gravel are trapped between boulders, but in some locations such as Hermitage, it has been possible to observe the original ash matrix between the boulders. Figure 4.5 shows the surface geologic conditions at the proposed facility sites.

3. Climate and Hydrology

In the absence of reliable and functioning meteorologic and stream gauging stations in the Cumberland basin, Shawinigan (1983) estimated basic characteristics for project design purposes from comparable sites in other river basins on the island. These are summarized in Table 4.1. An elaborate description of how these variables were calculated is found in that report. Included in Table 4.1 are estimates of flood peaks. The main natural factors which significantly affect the magnitude of flood peaks are rainfall intensity, area of the catchment, shape of the drainage basin, stream pattern, vegetative cover and surficial geology. The interaction of these factors produce flood flows which are typical of the basin or the region.

An examination of the river structure, drainage density and the shape of the sub-basins of the Cumberland river show that the flood hydrographs cannot be of the type which exhibit a low, flat peak extending over a considerable number of hours. In fact, the expected hydrographs should show a fairly quick rise to a peak followed by an extended period of subsiding flows.

It has been previously mentioned that the presence of vegetation, especially low canopy cover, has the effect of reducing the intensity of rainfall reaching the ground. Similarly, the absence of vegetation can only lead to high flood peaks and increased soil erosion. The semi-pervious nature of the surface deposits has been mentioned, but the full advantage of this soil characteristic in reducing flood peaks only results when there is ample vegetative cover. This further necessitates strict land use controls in the watershed.

Although the prediction of floods by statistical methods is best obtained by using previously recorded flood flows, there are no recorded flood peaks for any river in St. Vincent. Hence, an elaborate estimation technique was applied to obtain the stated figures at 95% confidence limits (Shawinigan 1983). Two methods were used to obtain the 1 in 100 year flood as well as the construction flood at the four dam sites. These were the rational method and the triangular hydrograph method. The rainfall intensities and the shape of the flood peaks for the Richmond river provided the basis for these calculations.

Using rainfall intensities recorded from the dry season (Jan. - April), allows the determination of smaller flood peaks, called dry season floods. The cost of construction of the cofferdams can be reduced if these dams are built during the dry season.

With respect to sediment load, the abundance of vegetation in the entire Cumberland valley and the existence of virgin forest in the Hermitage catchment have resulted in a small sediment concentration in the upper area. The analysis of water samples taken at Grove after a rainstorm gave sediment concentrations of four parts per million and a pH of 6.15. PH values are probable due to the addition of organic acids from decayed vegetation (Shawinigan, 1983). The estimated sediment loads appearing in Table 4.1 were calculated from data on rivers outside St. Vincent since no thorough data base on these factors exist.

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4. Vegetation and Wildlife

In general, no adequate baseline data are available on most kinds of plants and animals found in the Cumberland watershed. Filling this gap should be a first priority of the implementation phase of the Watershed Management Plan being prepared for the Project Paper. A forest inventory presently being conducted by the Forestry Division, in cooperation with the Institute of Tropical Forestry, Puerto Rico, will have delineated most tree species in the upper watershed.

The following list represents those freshwater prawns likely to be found in the Cumberland's freshwater streams and tributaries all the way up to highest elevations of the watershed (Holthuis, 1980). Species of Macrobrachium, and perhaps some Atya, breed in brackish/salt water of the river mouth and surrounding marshy areas. Thus, they migrate up and down the reach-of-river throughout their life cycle.

Species Name	Common name
Atya Innocuous	(basket shrimp)
A. Lanipei	
A. Scabra	(cama cuto shrimp)
Macrobrachium acanthurus	(cinnamon river prawn)
M. carcinus	(painted river prawn)
M. crenulatum	
M. jelskii	(Agar river prawn)
M. macrobrachium	(brackist river lrawn)
M. hecterochirus	(cascade river prawn)
M. faustinums	
Micratya poeyi	
Palaemon pandaliformis	(potitinga prawn)

Although local people occasionly catch and eat some of those species, Dr Earl Kirby, Museum of National History, Kingstown, believes the large species of Macrobrachium have been all but fished out of the lower Cumberland.

Catchment	Area (km^2)	Rain-fall (mm p.a.)	Evapo-trans-piration (mm p.a.)	Runoff (m^3/s)	Mean Flow (m^3/s)	Mean Flow Inception Report (m^3/s)	Design Floods 1:100 yr. Annual (m^3/s)	Design Floods 1:25 yr Dry Sea- (m^3/s)	Sediment Load in Tonnes/ day Km^2
ıvent	4.3	5698	1155	4543	0.61	0.98	42	20	0.24
rmitage	2.1	5665	1155	4510	0.31	-	30	14	0.11
ove	12.9	5269	1145	4124	1.70	1.72	73	35	0.57
ring Village	11.1	5136	1135	4001	2.05	2.10	81	39	0.66

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V. ENVIRONMENTAL CONSEQUENCES

This section describes environmental consequences or impacts in terms of causes , i.e. the event that drives the eventual impact, and in terms of effect, i.e. the consequence of the change, even perhaps the recipient of the action. Mitigative measures are then proposed which would reduce or eliminate the disturbance to the target group by the project activity.

A. Direct (Primary) Impacts

The Cumberland system is a run-of-river/diversion system consisting of a dam, diversion canal, settling basin, storage tank for low flow situation, pipeline, penstock, powerhouse with turbine/generator, and outlet works (tailrace). Direct project impacts will be typically associated with construction, highly limited in area and usually temporary and reversible and with consumption of small amounts of energy and materials.

1. Cause of Impacts

a. Dams, Settling and Storage Tanks. Four small dams are proposed for the overall development. Each dam will have a number of impacts which are common, as described below. Each dam represents a physical barrier across an existing river. As such, those aquatic species, if any, which depend upon migration will suffer. There is no evidence at any migrating fish species in the Cumberland. According to Dr Earl Kirby, Director of the Natural History Museum, Kingstown, and Mr. Guy Walter, Marine Biologist with the Fisheries Unit, large freshwater shrimp of the genus Macrobrachium may be affected by such barriers since they migrate to salt water to reproduce.

Each of the dams is relatively low (about two and a half meters high). This, combined with the steep longitudinal slopes of the rivers and narrow valleys will result in the creation of very small ponds. In no cases would these ponds flood houses or huts used for tools or overnight stays by the farmers.

Because of the negligible storage capacity of the ponds, it will be impossible to trap a major portion of the river's sediment load. Thus, there would be a minimum change in sediment patterns downstream of the dams. This conclusion is also supported by the fact that most erosion/deposition takes place at the time of floods, which, as noted previously, will not be attenuated by the project.

Settling and storage tanks may require machine levelling of land; some grazing land may be lost. A storage tank will be constructed for the Grove Dam site.

In terms of specific location, the following impacts would be expected.

i. Convent dam:

- headpond floods a few banana plants on right bank;
- headworks require the relocation of a small portion of the access road to the intake for water supply systems. (Note: this road has not been maintained for vehicular use upstream of this point, but could be required for such access at some time in the future).

ii. Hermitage dam:

- located in primary forest, therefore headpond floods no agricultural land;
- construction will require new access road through rain forest (the same road will serve the pipeline).

iii. Grove dam and settling tank:

- loss of agricultural and grazing land;
- may interfere with 8-inch water supply line to Barrouallie.

iv. Spring Village dam and settling tank:

- located in banana plants, grazing lands;
- headpond floods agricultural land, but no houses or other structures;
- floods section of river frequently used for washing of clothes;
- removes water from reach downstream of dam used for clothes washing.

b. Pipelines: The project's second major type of structure is the woodstave pipeline, of which there is a total of about 6.5 kilometers. These structures are about one meter in diameter resting on wooden or concrete supports such that the top of the pipe will be slightly less than two meters (eye level) above existing ground level.

The land required to lay pipeline is a bank about four meters wide. The required width will be greater in those places which require building up or cutting into existing ground levels. More land will also be required where trestles or similar support structures are required to carry the pipeline over streambeds. The major impact of the pipelines, other than lost land, will be the physical barrier they represent to the farmers and grazing animals. The physical barrier is a potential problem to the existing road and water supply lines.

In terms of impacts of location, the following pertain:

i. Pipeline - Convent to junction:

- cuts across grazing and agricultural lands;
- crosses the access road;
- access to some grazing land may be eliminated thus removing a larger area from effective use than that required by the pipeline right-of-way only.

ii. Pipeline - Hermitage to junction:

- cuts through grazing land and agricultural land;
- crosses access road and water supply line;
- crosses river twice on bridge and trestles.

iii. Pipeline - Junction to Cumberland powerhouse:

- crosses access roads;
- passes through agricultural land and banana plants;
- possible interference with 12-inch water supply line;
- crosses river on trestles or bridge.

iv. Pipeline - Grove to Cumberland-2 powerhouse:

- crosses river on bridges;
- may interfere with water supply line to Barrouallie;
- cuts across grazing land, banana plants.

v. Pipeline - Spring Valley dam to Cumberland Powerhouse

- cuts through agricultural and grazing lands, banana plants;
- passes between river and Spring Village, creating physical barrier to river access;
- river training work and bridge for river crossing adjacent to village will be further physical barrier;

- two houses in Coco areas may have to be relocated;

- crosses main west coast road;

- runs through coconut grove;

- may interfere with access to coconut grove.

c. Powerhouse. The third component of the hydroelectric developments are the powerhouses. Three powerhouses will be required for complete development of the Cumberland. Each will be a simple rectangle structure of relatively small dimensions. Each will require land for the building, a switchyard and an access road. A tailrace from each powerhouse will carry water back to the riverbed.

Downstream of the Cumberland-3 powerhouse, flows will be variable and will be generally unpredictable to the local population. The velocities and water levels will be subject to sudden change as a function of the peak demand on the island's electrical system. This peaking effect will not be felt at Grove Dam since under normal operating conditions the tailrace discharge is led directly to the storage tanks.

In terms of impacts of location, the following should occur:

i. Cumberland-1 powerhouse:

- loss of agricultural lands.

ii. Cumberland-2 powerhouse:

- loss of land now unused.

iii. Cumberland 3- powerhouse:

- loss of part of coconut grove;

- requires upgrading of access road through coconut grove;

- unpredictable flows from powerhouse at this site are not attenuated by a downstream pond.

2. Unavoidable Major Effects

Unavoidable major effects include stream sedimentation from construction, terrestrial habitat disturbance and/or loss of lands from clearing for major structures and access roads.

a. Stream Sedimentation. Construction activity will remove land cover and will result in increased erosion and sedimentation in the shor term. Sedimentation problems in the river will also be caused by all activities in the riverbed including diversion, and the construction of river training works and bridges at those points where the pipelines cross the

rivers. Since most such work will, by necessity, be done during periods of low flow (when sedimentation is at its lowest under existing conditions), this may create a short term problem for downstream water users.

b. Terrestrial Habitat Disturbance. Extensive use of large, heavy equipment to cut benches and widen access roads will have a much greater impact than the use of smaller equipment and labor-intensive techniques. Since the tradeoff between the implications of each approach will probably not be made until the bid stage, it can only be noted that the extensive use of heavy equipment will be detrimental to the basic agricultural use of the lands in the vicinity of the project components.

A particular problem associated with construction is the opening of borrow areas in order to obtain impervious materials and boulders required for the construction of various structures. While such requirements will be small, they may nevertheless result in the loss of further agricultural land and increased sedimentation in the river (e.g., from boulder mining operations in the riverbed).

c. Loss of Lands. Rainforest habitat may be lost to facility siting in the upper watershed (Hermitage, Convent) but in terms of real extent would be less than 1 ha.

In quantifiable terms, the land required by the project is about 5 hectares, but this does not represent the possible loss of agricultural land attributable to the project, e.g. through lack of access.

3. Unavoidable Minor Effects

Unavoidable minor effects include selected action associated with construction. Most of these effects are reversible.

- Construction activities will disrupt traffic, but will be highly localized and of a temporary nature.

- Energy will be consumed in these activities; e.g. construction equipments and vehicles will consume energy as fuel. Impacts will be minor, temporary, and irreversible.

- Air and noise pollution will be emitted by construction equipment and vehicle; impacts will not be significant and of a temporary, highly localized nature.

- Construction activity will also have some impact on the daily life of the valley's inhabitants. Whatever construction techniques are employed, it is inevitable that it will require a large number of workers, skilled and unskilled, and some may come from outside the valley. This will provide a short-term surge of economic activity in the villages. However, the

"boom" will end with the completion of construction and economic activity will return to a level not very different from that which prevails at present.

- A short term nuisance to local farmers due to construction may also occur from increased dust levels in the agricultural areas. However, the regular rainfall which is the normal climatic pattern, should eliminate such nuisance.

- The inhabitants of Spring Village will be those most affected by the project. The pipeline will pass between their houses and the riverbed but no house has to be relocated. River training

- works and a trestle to carry the pipeline across the river will also be built in their "backyards". Being a major settlement of the valley, Spring Village will also receive a major portion of the short term "boom" during the construction period.

4. Mitigative Measures - Direct Impacts. Standard Agency-guided construction practices will mitigate many construction impacts. Noise can be reduced, but not eliminated by proper vehicle and equipment maintenance and by limiting construction to normal working hours and weekdays. Safety hazards can be reduced by covering all trenches at night and careful location of spoil files. Traffic hazards can be reduced in the rugged and winding mountainous terrain by traffic control using two flagmen. Energy consumption can be reduced by proper equipment and vehicle maintenance. Interference with agricultural activities during the construction phase can be reduced through use of small construction equipment and labor intensive techniques.

a. Stream Sedimentation

Sedimentation can be partially controlled through erection of riparian barriers in areas where heavy disturbances occur, as well as by careful construction practices.

b. Loss of Agricultural Lands and Rainforest

The loss of agricultural land to the project is inevitable. The minimum amount of land which is lost is fixed by that required for completing the project. The maximum amount will be determined by the construction techniques adopted and the extent to which an effort is made to minimize the activities required for the efficient construction of all structures.

Compensation is normally made to those individuals whose privately-owned land is lost. The intensity of existing land use in the valley suggests that compensation cannot be made in terms of providing new lands. Cash compensation appears to be the only alternative and this is governed by rules presently used by the Government. In this regard, all lands required by the project, including lands used in the construction phase, should be delineated and their ownership established.

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As noted previously, some agricultural lands which will not be lost directly to the project may lose some value because of access restriction. In the case of cropped fields, access can be assured by the construction of stiles or walkways over the pipeline: this practice appears to be common along existing pipelines. It is suggested that the construction and maintenance of access facilities for inhabitants should be recognized as project costs.

The restriction of access to grazing lands is not as easily mitigated. In those cases where a section of grazing land is cut off by, say, a pipeline, consideration will have to be given to either compensation to the owner or provision of access. Such access could be provided by either a large ramp and bridge over the pipeline, or by bridges at sections where the line runs in a cut or trench.

Construction of the project will cause some interference to agricultural activities in the valley. Activities should be planned in such a way as to minimize such interference and the use of the access road by the inhabitants should not be impeded at any time. Their livelihoods are dependent upon access to their farms. Because the loss of prime rainforest is small in terms of area, impacts to plant and animal population would be minimal.

B. Indirect (Secondary) Impacts

Indirect impacts are those resulting from the operation of the hydroelectric generating system. Such impacts touch on longer-term effects on communities, either locally or outside the project area, on biogeophysical attributes of the watershed, or may result from location of the facility in an area subject to natural disturbances.

1. Major Effects

Cause-effect relationships sometimes are more difficult to ascertain in the case of indirect effects. Hence, the discussion here will not be as rigid as that of the previous section. From review of the Shawinigan (1983) report and site visits to both an existing hydro facility (Richmond) and the proposed site (Cumberland), it is apparent that the following indirect impacts could be identified.

a. River flow reduction. Immediately downstream of each of the dams, there will be no water in the riverbed for about 70 percent of the time, according to the design criteria established for the project. However, based on the surface and groundwater flow conditions found in the Cumberland, the riverbed should quickly re-establish a new minimum flow from incoming tributaries and groundwater re-charge. It is not possible to make a scientific estimate of the distance downstream of each dam where the new minimum flow will be re-established.

Downstream reaches from each dam will be subject to high flows whenever the natural flow exceeds the requirements of the power project, i.e., for about 30% if the time. At those times the dams will be overtopped.

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At times of major floods, the flow in all reaches of the river, including those immediately downstream of the four dams, will be similar to the flow under natural conditions (i.e., without the project).

Two immeditate effects are evidently caused by this flow reduction:

(1) Habitat for aquatic biota immediately below the dam and for some point downstream will be eliminated at least part of the time, causing either their eventual demise or need to emigrate to other suitable habitat downstream or in nearby tributaries. Because of the small size of the area affected, flow variations and consequent ecological impact should be smaller than for larger facilities. Fish and crustaceans upstream of the dam will also be trapped in diversion canals and may end up in turbines. Animals that are small (the case probably for the Cumberland) in relation to the turbine blades, should suffer low mortality. Avoidance of diversion structures by many species is common and is a possibility at Cumberland.

(2) The supply of water currently used for clothes washing at traditional points in the reach of river will be eliminated.

b. Pipeline Damage/Destruction by Landslides

Although the pipeline has been located, as best as could be ascertained, to avoid known unstable areas, it unavoidably still passes through some potentially unstable zones.

c. Greater Access, More Intensive Land use, More Soil Erosion

Food improvements and improved access to the upper watershed area would tempt farmers and loggers to use previously unused portions of these areas. Absence of land use controls, or even the GOSV's inability to enforce existing laws, is problematic. For example, existing Forestry Ordinance and Regulations (enforced since 1945) are claimed to be inadequate and outdated to meet present needs of conservation of flora and fauna, of control of use of fire and of appropriate use of Crown lands (logging, farming, etc.). Farming activities, especially land clearing and the growing of bananas in the immediate stream area, aggravate soil erosion during periods of rainfall.

The effects of allowing both the depletion of vegetative cover and the acceleration of soil erosion are:

- loss of top soil and agricultural land;
- increased rate of runoff and flooding;
- reduced minimum flows in the rivers.

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According to Shawinigan (1983), the combination of the last two factors tends to alter the shape of the daily flow duration curves. The effect of this is to decrease the energy which can be generated from a hydroelectric plant for a fixed installed capacity. The flow duration coefficients from which the Cumberland plant were designed reflect a specific hydrologic equilibrium and any change in the factors affecting runoff will alter these coefficients.

2. Mitigative Measures

a. Reduced River Flow/Human User. A minimum release from the dam into the riverbed would be a severe economic cost to the functioning of the system. Also, such a release would not supply enough water for clothes washing for all local users. The most reasonable solution is that VINLEC extend an existing water supply pipeline to the affected points (sites used traditionally by inhabitants) in order to supply water to the users. The effects of this arrangement would be neglible on power output.

Specific clauses should be drawn up prior to finalizing this project which spell out clearly the obligation of VINLEC to compensate property owners in accordance with law, to provide access through walkways/rumps over penstocks and stavepipes where necessary, and to extend water supply to those people needing it for clothes washing (wash basins too may need to be constructed).

b. Reduced River Flow/Aquatic Biota. The problem with attempting to mitigate impacts to the aquatic biota is that low stream flow before and after facility construction and operation will not be determined until the CIDA stream gauging system is in place and collecting data on a regular basis. Fauna could be protected by allowing some minimum water flow immediately below the dam. But, the Shawinigan report stated that surface (feeder tributaries not dammed) and ground water flow should reestablish a new minimum flow somewhere downstream of the diversion structure. Impacts will be reduced simply by the presence of the large number of feeder streams and the suitable habitats they contain. Most prawn species can negotiate river barriers where even trickles of water are to be found (W. Hunt, Belairs Institute, Barbados, and G. Walker, Fisheries Unit, St. Vincent). River floods would provide high flows, even for periods of days or hours, which would enable many of these species to migrate.

In a largely unresolved sense, criteria for river quality in St. Vincent are associated in a qualitative sense with immediate use for potable water, clothes washing, and electric power generation, and not for fisheries or other uses.

c. Pipeline Damage by Landslides. The possibility of landslides occuring in St. Vincent is a feature of the island. In fact, problems of slope instability significantly affect the pipeline of the existing South Rivers hydroelectric development. Construction of hydroelectric pipelines in unstable ground is not uncommon and movement can be accomodated mostly by the natural tendency of woodstave to endure slight movement.

A part of the pipeline will be located along the road which was built at least 25 years ago and has not suffered from any major landslide. However, it has to be recognized there is a risk that a short section of the pipeline could be lost due to a landslide sometime in the future, or that slow creep along sections of the pipeline could induce stresses which with time could cause a rupture.

While slow creep can be handled to a large extent by the provision of expansion joints and tight inspection schedules of the structures, the main concern is a sudden landslide that breaks the pipeline. Consideration will be given in the design phase for the automatic closure of the intakes at Convent and Hermitage in the event of such a rupture. This will minimize the amount of water which would spill from the pipe and which would tend to enlarge the original slide and cause more damage.

d. Land Use Controls. Farming activities, especially the growing of bananas should be restricted in the immediate stream area since soil erosion is greatly aggravated by such activities during periods of rainfall. Sediment load into the reservoir tanks will be increased and if sediment load becomes high, eventual performance of the powerhouse could be affected. Farmers tend to concentrate as close as possible to the access road, which at times runs adjacent to the stream. A modified "greenbelt" approach would suffice wherein all land 50-100 meters of each side of the stream would be off limits to agricultural activities. Farmers now renting Crown lands or owning lands in these areas could be provided alternate sites since population density is very low in this area (less than 1000 in the Cumberland Basin).

The basic strategies, which can be utilized to counter the ever present problems of soil erosion. however, are a retention of vegetative cover, prompt removal of rainfall to prevent waterlogging, reforestation, deliberate channeling of stormwater from drains, cultivation of grasses along contours to bind the soil, terrace or contour farming and, most importantly, improved agricultural practices.

Soil conservation techniques in addition to the ridge and furrow method following the contour should be explored and encouraged in the Project. These may include:

- Intercropping and crop rotation schemes that reduce soil erosion;
- Minimum tillage systems that result in minimal disturbance of the soil and organic matter;
- Planting of ground cover crops of no commercial value;
- Identifying soils that are especially susceptible to erosion and taking steps to ensure against planting them in crops that require intensive cultivation

Some interaction of the Cumberland Watershed Management component with the St. Vincent Agricultural Development Project (AID 538-0101) would facilitate use of appropriate soil conservation measures.

C. Policies and Controls for Areas Concerned

Uncontrolled clearing, especially in the upper Cumberland watershed, could reduce the interruption potential of vegetation causing more runoff to enter the stream system. The problems germane to this issue have been described in a previous section. The GOSV has a weak institutional base to control land use in these areas. In an historical context, the following summary should be noted (C. Nichols, Forestry Division, pers. Comm.).

In 1912, a proclamation reserved all Crown lands situated above 1,000 ft (300 m) elevation but this is not operative. Lands above this elevation have been unofficially removed from reserve status owing to the pressure on land for agriculture and for a fast expanding population. The banana industry in particular has made the proclamation of little or no effect. In practice, all cultivatable land (and some that is not), has been sold or leased. Squatting and encroachment on Crown Lands, though not quite as serious as in past years, continue to present some problems.

During the era between 1935-1950, when the island was administered by a Governor for the Windwards, there was a Conservator of Forests. Forestry development at that time was limited almost entirely to policing and conservation on areas of Crown Lands. It was also limited in organization, as at that time the staff consisted of two Crown Rangers (as they were then called). The Superintendent of Agriculture and his senior staff supervised the work of the Rangers. The Conservator, stationed on another island visited periodically.

During the period 1950-1965, with the advent of Constitutional development in St. Vincent, the Department of Agriculture underwent certain changes; a Forestry section was established under the direct control of the Superintendent of Agriculture. Its activities were not very different from what they were during the previous period. Funds for forestry work and for trained staff to carry out that work were among the major constraints.

The period 1965-1975 saw some minor improvements both in organization and in scope. A Division of Forestry was established within the Ministry of Agriculture. A Supervisor of Forests was appointed and made responsible to the Chief Agricultural Officer who is designated Chief Forest Officer. A Forest Ranger and ten Forest Guards were also appointed. Increase patrol and Responsibility for renting and patrolling Crown Lands up to that time were the major functions of the Division.

The Forestry Division sees the following needs as pertinent to effective protection of upper watersheds and appropriate land use in the mountainous (steep slopes) areas of the island:

- a sound forest policy;
- effective legislation to protect critical habitats as well as key flora and fauna;
- better salaries and more formal training for forestry personnel.

The Watershed Management Plan being prepared for the Cumberland Project could go a long way to focus the GOSV and the various donors on addressing these needs. The problem, however, is island-wide and not unique to the Cumberland. Thus, an island-wide watershed management program would be an effective way to enhance hydroelectricity potential, promote appropriate land use, and protect unique habitats, flora and fauna.

D. Unresolved Issues

The issues of scale of hydropower development and cumulative impacts on an island-wide basis are not addressed in this EA.

Quantatively, the problem is site specific. On St. Vincent there are many sites potentially suitable for small scale hydro development; most are unique in one way or another. The experience to date of St. Vincent with small scale hydropower is attached as Appendix 3. The issue is twofold: (1) although the site is small and facility will be small, the environmental impact of the development may be significant because of the special ecological relationship affected in the family of streams and drainage basins on the island; (2) on an individual basis small scale projects may be relatively harmless, as in project for the Cumberland, compared with a large scale project. However, with a program to develop several sites on such a small island, the impacts tend to accumulate. These cumulative impacts are also known as incremental impacts or loss by attrition (Zoellner, 1980).

No solution is presented in the case of Cumberland since the acceptable limits of cumulative impacts is a policy matter. REMS/C suggests that in the long-term development plans of St. Vincent these issues be considered.

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Annex H

WORLD BANK STAFF APPRAISAL REPORT

On File in RDO/C and LAC/DR

ANNEX I.1

BOOZ-ALLEN AND HAMILTON
FINANCIAL AND INSTITUTIONAL ANALYSIS

On File in RDO/C and LAC/DR

ST. VINCENT AND THE GRENADINES

POWER PROJECT

Key Financial Indicators

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Rate of return					0.00	2.00	4.01	0.00	0.00	7.00	7.00	0.00	0.00	0.00
Operating Income		66.00	600.00	600.00	60.36	600.47	900.32	1032.10	1707.44	2211.00	3112.00	6010.30	8000.00	8000.22
Average Rate Base		3020.00	3400.00	6010.00	14770.00	19403.15	24000.10	27100.27	29775.01	31007.01	44464.00	61402.10	100000.05	111014.00
Operating ratio	87.04	90.23	93.07	93.27	90.22	86.06	83.44	80.30	80.02	80.25	80.07	72.04	70.70	70.01
Current ratio	1.27	1.21	0.93	1.00	1.10	0.73	0.74	0.00	0.00	1.10	1.13	1.00	2.73	2.00
Debt as % ofDebt/Equity	101.07	104.02	90.15	10.74	30.40	47.03	60.20	63.06	60.20	60.02	64.10	60.20	44.24	30.04
Debt Service ratio					2.00	2.15	2.32	2.77	3.03	4.00	5.40	2.03	2.40	2.70
Receivables (days)	74.34	120.00	120.02	101.44	40.07	40.07	40.07	40.07	40.07	40.07	40.07	40.07	40.07	40.07
Contribution to investment					0.10	0.31	0.10	0.17	0.10	0.25	0.30	0.00	2.42	0.00
Tariff Increase (%)		42.00	14.00	10.40	0.77	11.05	0.30	7.70	7.31	2.00	1.00	0.00	10.10	7.00

ST. VINCENT AND THE GRENADINES

POWER PROJECT

Income Statements 1979-1992 Actual and Forecast
(in EC$000s)

	Actual				Forecast										
	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	
SALES GWh	81.81	88.28	81.87	88.87	83.18	84.38	86.48	88.88	87.00	29.88	30.58	31.08	33.48	34.08	a/
Average ECS cents/kWh	18.38	22.88	28.84	28.84	34.88	38.48	41.84	48.18	48.83	48.88	51.28	88.83	81.18	88.87	
Fuel surcharge	8.28	11.78	18.48	18.84	14.88	18.81	17.38	18.47	18.88	21.11	18.88	8.88	7.88	8.81	
Total	84.87	38.34	48.48	44.87	48.88	88.88	88.83	83.87	88.28	78.18	78.81	74.88	88.44	88.18	
OPERATING REVENUES															
Basic	3868.88	4784.88	5388.88	6887.88	7872.88	8344.88	10878.88	11887.88	13488.88	14323.88	15843.88	21187.88	27183.88	28818.88	
Fuel clause	1388.88	2378.88	3288.88	3588.88	3383.88	3788.88	4417.88	4813.88	5557.88	6165.88	5884.88	2788.88	2437.88	3288.88	b/
Other	88.88	83.88	88.88	88.88	72.88	74.88	77.88	88.88	84.83	87.88	81.18	84.75	88.84	182.48	
Total Revenues	5314.88	7248.88	8787.88	18188.88	11287.88	12187.88	15878.88	18888.88	19848.83	20578.88	21718.18	23888.78	29838.84	33284.48	
OPERATING EXPENSES															
Fuel	2314.88	3858.88	4183.88	4883.88	4488.88	4784.88	5884.88	6844.88	6783.88	7428.88	7138.88	3248.88	2828.88	3883.88	b/
Operations Maintenance - Diesel	888.88	788.88	1838.88	1948.88	1184.88	1284.88	1488.88	1888.88	1782.88	1888.88	1888.88	788.88	858.88	878.88	c/
- Hydro	248.88	881.88	888.88	487.88	838.88	883.88	788.88	788.88	1888.88	888.88	848.88	1778.88	8133.88	8887.88	d/
Transmission & Distribution	888.88	788.88	888.88	882.88	1188.88	1182.88	1388.88	1488.88	1634.88	1883.88	1814.88	8834.88	2281.88	8538.88	e/
Administration & Other	888.88	1388.88	1388.88	1741.88	8143.88	8248.88	8397.88	8684.88	8744.88	8838.88	3142.88	3382.88	3887.88	3848.88	f/
Income Taxes	8.88	8.88	8.88	84.88		82.88						888.88	8288.88	3288.88	g/
Depreciation	378.88	384.88	418.88	478.88	1778.88	2188.41	2847.88	3818.88	3418.78	3828.81	3885.81	8868.38	7178.34	7784.88	h/
Total Expenses	8881.88	7188.88	8147.88	8888.88	11288.88	12887.41	14881.88	16368.88	17281.78	18383.81	18885.81	17488.38	28878.34	84284.88	
OPERATING INCOME	123.88	58.88	888.88	888.88	88.38	888.47	888.32	1832.18	1787.44	2811.88	3113.88	8818.38	8888.88	8888.88	
Interest	481.88	838.88	488.88	488.88	287.88	878.88	883.88	888.88	882.88	858.88	818.88	3818.38	3838.88	3838.48	
Other Charges & Credits	118.88	-378.88	-488.88	-874.88	-18.88										
NET INCOME (LOSS)	-488.88	-113.88	881.88	884.88	-188.88	-848.83	-8.88	882.18	888.44	1382.88	2287.88	8888.81	4832.81	8884.78	
Retained Earnings at beginning	8.88	-488.88	-888.88	-48.88	848.88	883.35	414.88	411.13	1883.83	1848.87	3381.87	8888.78	8888.78	18881.87	
Dividends						8.88							41.88	41.88	i/
Retained Earnings at end	-488.88	-888.88	-48.88	848.88	883.38	414.88	411.13	1883.83	1848.87	3381.87	8888.78	8888.78	18881.87	18818.78	

a/ See Annex 3, Table 3.1 plus Bequia.
b/ It is assumed fuel charge recovering fuel cost increases since 1973 will continue. Fuel costs are assumed to increase in line with international inflation rates, (para. 4.09) plus real increases averaging 2% per annum.
c/ Based on 1983 6 EC cents per kWh of generation at 1983 price levels escalated at 7% per annum.
d/ Based on exceptional planned maintenance 1985-87, then on base 1983 cost of 4 EC cents per kWh of generation, escalated at 7%.
e/ Based on 1983 forecast and 1984 base cost of 3.8 EC cents per kWh of generation escalated at 7% per annum.
f/ Based on escalation at 7% per annum.
g/ Calculated at 32% of taxable profits (after deduction of initial and annual tax depreciation allowances).
h/ Projected at average rate of 5% until project implementation and 4% thereafter.
i/ Based on dividend rate of 10%.

ST VINCENT AND THE GRENADINES

POWER PROJECT

Sources and Application of Funds: Projected 1983-1992
(in EC$000s)

	1983	1984	1985	1986	1987	1988	1989	1990	1991	Summary 1984-91	1992
SOURCES											
Internal Sources											
Net Income before Interest	104.35	580.47	889.32	1632.10	1787.44	2211.99	3113.09	6512.39	8688.20	25484.88	8980.22
Add: Depreciation	1772.65	2182.41	2647.56	3012.89	3418.79	3826.61	3855.01	5868.36	7172.34	31783.87	7784.26
Total	1877.00	2762.88	3636.88	4644.89	5206.23	6038.60	6968.10	12180.75	15840.54	57278.88	16884.48
Less Debt Service	705.00	1287.00	1570.00	1677.00	1358.00	1315.00	1272.00	5988.38	6372.88	20840.37	6181.46
Net internal cash generation	1172.00	1475.88	2066.88	2967.89	3848.23	4723.60	5696.10	6192.37	8467.55	36438.58	10503.02
Borrowings											
Project IDA	0.00	820.00	2371.00	3359.00	2331.00	1886.00	1523.00	953.00	194.00	13437.00	0.00
Project USAID	0.00	0.00	1708.00	3413.00	5247.00	4287.00	3137.00	1861.00	587.00	20250.00	0.00
Project CDB	0.00	0.00	2835.00	3095.00	2508.00	1778.00	1934.00	0.00	0.00	12150.00	0.00
Project EIB	0.00	0.00	0.00	640.00	2445.00	2287.00	1017.00	726.00	418.00	7533.00	0.00
Commercial Bank		675.00								875.00	
Existing CDB	5328.00	850.00	800.00	0.00	0.00	0.00	0.00	0.00	0.00	1750.00	0.00
Total Borrowings	5328.00	2445.00	7714.00	10507.00	12531.00	10248.00	7611.00	3540.00	1198.00	55795.00	
Equity CIDA	0.00	0.00	1757.00	3782.00	4385.00	4663.00	3056.00	2314.00	1022.00	20979.00	
Total Sources	6500.00	3820.88	11537.88	17256.99	20764.23	19634.60	16363.10	12046.37	11688.55	113212.59	10503.02
APPLICATIONS											
Construction Requirements											
Proposed Project	0.00	832.00	10795.00	16092.00	18862.00	16500.00	11872.00	6218.00	2457.00	83128.00	0.00
Other	7473.00	3872.00	800.00	0.00	0.00	0.00	0.00	1352.00	1480.00	7484.00	1578.00
Interest during construction	82.00	41.00	359.38	1006.39	1719.34	2334.57	2831.04	0.00	0.00	8291.72	0.00
Dividends	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.00	41.00	41.00
Non-cash working capital	-1572.62	-388.35	322.88	378.75	282.21	382.47	34.67	1759.10	-519.89	2288.05	-458.46
Total Applications	5982.38	4379.65	11777.26	17478.14	20873.55	19187.04	14737.71	8329.10	3438.31	101210.77	1157.54
Cash at beginning	-1674.00	-1158.38	-1615.15	-1854.54	-2075.69	-2185.01	-1747.45	-122.08	2585.21	-1158.38	10845.44
Cash at end 1/	-1158.38	-1615.15	-1854.54	-2075.69	-2185.01	-1747.45	-122.08	2585.21	10845.44	10845.44	20190.92

1/ See para. 5.14 regarding VINLEC's overdraft facilities.

ST. VINCENT AND THE GRENADINES

POWER PROJECT

Key Financial Indicators

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Rate of return					0.00	2.00	4.01	0.00	0.00	7.00	7.00	0.00	0.00	0.00
Operating Income		88.00	800.00	880.00	88.08	880.47	980.32	1032.10	1787.44	2811.80	3119.80	8818.30	8888.09	8000.20
Average Rate Base		8820.00	3400.00	5810.00	14770.00	18483.15	24080.10	27180.87	28775.01	31887.21	44484.00	81489.10	108080.05	111814.00
Operating ratio	87.84	89.29	83.87	83.87	80.78	85.00	83.44	80.30	80.02	88.25	88.07	72.04	70.70	70.01
Current ratio	1.27	1.01	0.83	1.80	1.10	0.73	0.74	0.00	0.88	1.10	1.13	1.00	2.73	0.00
Debt as % ofDebt/Equity	101.87	104.02	80.15	10.74	30.48	47.03	60.20	63.06	60.20	58.92	84.10	66.20	44.84	30.04
Debt Service ratio					2.00	2.15	2.32	2.77	3.83	4.00	5.40	2.03	2.40	0.70
Receivables (days)	74.34	120.00	120.82	181.44	40.07	40.07	40.07	40.07	40.07	40.07	40.07	40.07	40.07	40.07
Contribution to investment					0.10	0.31	0.10	0.17	0.10	0.20	0.30	0.08	2.40	0.00
Tariff Increase (%)		43.00	14.00	10.40	0.77	11.05	9.39	7.70	7.31	2.00	1.00	0.00	10.10	7.00

ST. VINCENT AND THE GRENADINES

POWER PROJECT

Income Statements 1979-1992 Actual and Forecast
(in EC$000s)

	Actual				Forecast										
	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	
SALES GWh	81.81	88.28	81.87	88.87	83.18	84.38	86.48	88.88	87.00	29.88	30.58	31.08	33.48	34.08	a/
Average ECS cents/kWh	18.38	22.88	28.84	28.84	34.88	38.48	41.84	48.18	48.83	48.88	51.28	88.83	81.18	88.87	
Fuel surcharge	8.28	11.78	18.48	18.84	14.88	18.81	17.38	18.47	18.88	21.11	18.88	8.88	7.88	8.81	
Total	84.87	38.34	48.48	44.87	48.88	88.88	88.83	83.87	88.28	78.18	78.81	74.88	88.44	88.18	
OPERATING REVENUES															
Basic	3868.88	4784.88	5388.88	6887.88	7872.88	8344.88	10878.88	11887.88	13488.88	14323.88	15843.88	21187.88	27183.88	28818.88	
Fuel clause	1388.88	2378.88	3288.88	3588.88	3383.88	3788.88	4417.88	4813.88	5557.88	6165.88	5884.88	2788.88	2437.88	3288.88	b/
Other	88.88	83.88	88.88	88.88	72.88	74.88	77.88	88.88	84.83	87.88	81.18	84.75	88.84	182.48	
Total Revenues	5314.88	7248.88	8787.88	18188.88	11287.88	12187.88	15878.88	18888.88	19848.83	20578.88	21718.18	23888.78	29838.84	33284.48	
OPERATING EXPENSES															
Fuel	2314.88	3858.88	4183.88	4883.88	4488.88	4784.88	5884.88	6844.88	6783.88	7428.88	7138.88	3248.88	2828.88	3883.88	b/
Operations Maintenance - Diesel	888.88	788.88	1838.88	1948.88	1184.88	1284.88	1488.88	1888.88	1782.88	1888.88	1888.88	788.88	858.88	878.88	c/
- Hydro	248.88	881.88	888.88	487.88	838.88	883.88	788.88	788.88	1888.88	888.88	848.88	1778.88	8133.88	8887.88	d/
Transmission & Distribution	888.88	788.88	888.88	882.88	1188.88	1182.88	1388.88	1488.88	1634.88	1883.88	1814.88	8834.88	2281.88	8538.88	e/
Administration & Other	888.88	1388.88	1388.88	1741.88	8143.88	8248.88	8397.88	8684.88	8744.88	8838.88	3142.88	3382.88	3887.88	3848.88	f/
Income Taxes	8.88	8.88	8.88	84.88		82.88						888.88	8288.88	3288.88	g/
Depreciation	378.88	384.88	418.88	478.88	1778.88	2188.41	2847.88	3818.88	3418.78	3828.81	3885.81	8868.38	7178.34	7784.88	h/
Total Expenses	8881.88	7188.88	8147.88	8888.88	11288.88	12887.41	14881.88	16368.88	17281.78	18383.81	18885.81	17488.38	28878.34	84284.88	
OPERATING INCOME	123.88	58.88	888.88	888.88	88.38	888.47	888.32	1832.18	1787.44	2811.88	3113.88	8818.38	8888.88	8888.88	
Interest	481.88	838.88	488.88	488.88	287.88	878.88	883.88	888.88	882.88	858.88	818.88	3818.38	3838.88	3838.48	
Other Charges & Credits	118.88	-378.88	-488.88	-874.88	-18.88										
NET INCOME (LOSS)	-488.88	-113.88	881.88	884.88	-188.88	-848.83	-8.88	882.18	888.44	1382.88	2287.88	8888.81	4832.81	8884.78	
Retained Earnings at beginning	8.88	-488.88	-888.88	-48.88	848.88	883.35	414.88	411.13	1883.83	1848.87	3381.87	8888.78	8888.78	18881.87	
Dividends						8.88							41.88	41.88	i/
Retained Earnings at end	-488.88	-888.88	-48.88	848.88	883.38	414.88	411.13	1883.83	1848.87	3381.87	8888.78	8888.78	18881.87	18818.78	

a/ See Annex 3, Table 3.1 plus Bequia.
b/ It is assumed fuel charge recovering fuel cost increases since 1973 will continue. Fuel costs are assumed to increase in line with international inflation rates, (para. 4.09) plus real increases averaging 2% per annum.
c/ Based on 1983 6 EC cents per kWh of generation at 1983 price levels escalated at 7% per annum.
d/ Based on exceptional planned maintenance 1985-87, then on base 1983 cost of 4 EC cents per kWh of generation, escalated at 7%.
e/ Based on 1983 forecast and 1984 base cost of 3.8 EC cents per kWh of generation escalated at 7% per annum.
f/ Based on escalation at 7% per annum.
g/ Calculated at 32% of taxable profits (after deduction of initial and annual tax depreciation allowances).
h/ Projected at average rate of 5% until project implementation and 4% thereafter.
i/ Based on dividend rate of 10%.

ST VINCENT AND THE GRENADINES

POWER PROJECT

Sources and Application of Funds: Projected 1983-1992
(in EC$000s)

	1983	1984	1985	1986	1987	1988	1989	1990	1991	Summary 1984-91	1992
SOURCES											
Internal Sources											
Net Income before Interest	104.35	580.47	889.32	1632.10	1787.44	2211.99	3113.09	6512.39	8688.20	25484.88	8980.22
Add: Depreciation	1772.65	2182.41	2647.56	3012.89	3418.79	3826.61	3855.01	5868.36	7172.34	31783.87	7784.26
Total	1877.00	2762.88	3636.88	4644.89	5206.23	6038.60	6968.10	12180.75	15840.54	57278.88	16884.48
Less Debt Service	705.00	1287.00	1570.00	1677.00	1358.00	1315.00	1272.00	5988.38	6372.88	20840.37	6181.46
Net internal cash generation	1172.00	1475.88	2066.88	2967.89	3848.23	4723.60	5696.10	6192.37	8467.55	36438.58	10503.02
Borrowings											
Project IDA	0.00	820.00	2371.00	3359.00	2331.00	1886.00	1523.00	953.00	194.00	13437.00	0.00
Project USAID	0.00	0.00	1708.00	3413.00	5247.00	4287.00	3137.00	1861.00	587.00	20250.00	0.00
Project CDB	0.00	0.00	2835.00	3095.00	2508.00	1778.00	1934.00	0.00	0.00	12150.00	0.00
Project EIB	0.00	0.00	0.00	640.00	2445.00	2287.00	1017.00	726.00	418.00	7533.00	0.00
Commercial Bank		675.00								875.00	
Existing CDB	5328.00	850.00	800.00	0.00	0.00	0.00	0.00	0.00	0.00	1750.00	0.00
Total Borrowings	5328.00	2445.00	7714.00	10507.00	12531.00	10248.00	7611.00	3540.00	1198.00	55795.00	
Equity CIDA	0.00	0.00	1757.00	3782.00	4385.00	4663.00	3056.00	2314.00	1022.00	20979.00	
Total Sources	6500.00	3820.88	11537.88	17256.99	20764.23	19634.60	16363.10	12046.37	11688.55	113212.59	10503.02
APPLICATIONS											
Construction Requirements											
Proposed Project	0.00	832.00	10795.00	16092.00	18862.00	16500.00	11872.00	6218.00	2457.00	83128.00	0.00
Other	7473.00	3872.00	800.00	0.00	0.00	0.00	0.00	1352.00	1480.00	7484.00	1578.00
Interest during construction	82.00	41.00	359.38	1006.39	1719.34	2334.57	2831.04	0.00	0.00	8291.72	0.00
Dividends	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.00	41.00	41.00
Non-cash working capital	-1572.62	-388.35	322.88	378.75	282.21	382.47	34.67	1759.10	-519.89	2288.05	-458.46
Total Applications	5982.38	4379.65	11777.26	17478.14	20873.55	19187.04	14737.71	8329.10	3438.31	101210.77	1157.54
Cash at beginning	-1674.00	-1158.38	-1615.15	-1854.54	-2075.69	-2185.01	-1747.45	-122.08	2585.21	-1158.38	10845.44
Cash at end 1/	-1158.38	-1615.15	-1854.54	-2075.69	-2185.01	-1747.45	-122.08	2585.21	10845.44	10845.44	20190.92

1/ See para. 5.14 regarding VINLEC's overdraft facilities.

ST VINCENT AND THE GRENADINES

POWER PROJECT

Balance Sheets 1979-1992: Actual and Forecast
(In EC$000s)

	Actual				Forecast										
	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	
ASSETS															
Fixed															
Gross Plant	7470.00	7848.00	7811.00	33388.00	37537.00	48789.80	58142.76	84372.75	78378.85	40885.37	112089.34	171352.84	187284.39	881948.88	a/
Less: Depreciation	3889.00	4178.00	4678.00	18081.00	22284.00	26029.29	30485.88	35843.28	41557.10	48792.70	55928.81	60883.54	78811.73	88872.81	
Net Plant	3581.00	3488.00	3333.00	14288.00	15253.00	22733.30	25847.07	28729.47	30821.75	32392.68	58537.14	108288.10	110452.58	111876.81	
Work in Progress	0.00	0.00	0.00	0.00	5723.00	873.00	8427.38	22225.77	38307.11	54801.88	41872.72	0.00	0.00	0.00	
Net Fixed Assets	3581.00	3488.00	3333.00	14288.00	20978.00	24606.30	35074.45	50855.24	70128.88	87294.34	100409.88	108288.10	110452.58	111876.81	
Current															
Cash	-218.00	-1018.00	-1071.00	-1074.00	-1158.38	-1815.15	-1854.54	2075.88	-2185.01	-1747.45	-182.08	2585.21	10845.44	28188.88	b/
Accounts Receivable	1049.00	2381.00	2875.00	3391.00	1548.88	1805.42	2063.20	2328.07	2807.84	2818.80	2873.21	3282.88	4057.52	4548.43	c/
Inventories	1131.00	1188.00	1821.00	1822.00	2158.00	1757.00	1865.00	2283.05	2533.28	2823.88	2801.83	4283.82	4681.81	5048.72	d/
Total Current	1981.00	2549.00	3425.00	3339.00	2548.18	1847.27	2173.68	2503.43	2958.08	3893.34	5852.78	10151.88	19584.57	28788.87	
Total Assets	5572.00	6013.00	6758.00	17627.00	23522.18	26353.57	37248.11	53458.87	73084.85	91187.88	106082.84	118431.08	130037.18	141784.88	
LIABILITIES & EQUITY															
Equity															
Capital	412.00	412.00	412.00	412.00	412.00	412.00	2188.00	5851.00	10336.00	14888.00	18088.00	20388.00	21381.00	21381.00	
Retained Earnings	-455.00	-588.00	-48.00	848.00	483.35	414.82	411.13	1081.23	1848.87	3301.87	5888.78	8288.78	12881.87	18818.73	
Revaluation Surplus	0.00	0.00	0.00	10858.00	11784.88	12832.38	14483.68	16288.88	18388.88	20457.57	22725.88	28882.88	34121.48	41853.18	
Total	-43.00	-187.00	384.00	12117.00	12848.00	13858.18	17873.82	23383.72	30584.72	38758.24	48378.81	55257.42	88584.47	81458.88	
Long-Term Debt	4881.88	4881.88	2787.88	2438.88	8367.88	10735.88	17252.88	27383.88	38378.88	48178.88	54783.88	55788.88	84358.88	92178.88	
Current Liabilities															
Accounts Payable	1818.88	1883.88	2187.88	1328.88	1572.84	1728.14	1884.88	2858.84	2388.24	2421.88	2487.38	1885.82	1832.23	2228.44	e/
Income taxes payable						52.88						888.88	2288.88	3288.88	f/
Dividends Payable	38.88	38.88	35.88								41.88	41.88	41.88	41.88	
Consumer Deposits	8.88	8.88	8.88	288.88	288.14	387.25	328.38	338.81	358.88	381.58	484.48	428.75	484.47	481.74	g/
Current Maturities	8.88	271.88	1458.88	1478.88	458.88	577.88	897.88	458.88	458.88	455.88	2878.88	2537.88	2548.88	2184.88	
Total	1884.88	2188.88	3687.88	3874.88	2315.18	2859.39	2922.28	2852.48	3127.23	3258.45	4988.83	5472.87	7173.78	8128.18	
Total Liabilities and Equity	8878.88	8813.88	8788.88	17827.88	23888.18	28353.87	37248.11	53458.87	73884.85	81187.88	108882.84	118431.88	138837.18	141784.88	

a/ At historical cost up to 12/31/81 then with revaluation up to 12/31/82 based on initial 1980 CIR revaluation adjusted for estimated price increase for 1981 and 1982. 1983-1992 revaluations based on estimated 7% inflation rate.
b/ Assuming EC $ 3 million overdraft facilities available, unutilized facilities in 1986 would be equal to 48 days of cash operating expenses.
c/ Based on 90 days annual sales outstanding.
d/ Based on 1.5% of gross fixed assets up to project completion then 2.5%.
e/ Equals about 60 days cash operating expenses.
f/ Income taxes are due and payable 9 months after fiscal year end. Tax losses may be carried forward and offset against annual profits up to [illegible] of such profits.
g/ Increased in proportion to sales.

Best Available Document

ST. VINCENT AND THE GRENADINES

POWER PROJECT

Debt Statement
(In EC$000s)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
PROJECT (IDA)											
Borrowings			920.00	2371.00	2358.00	2831.00	1368.00	1523.00	953.00	184.00	
Amortization				0.00	0.00	0.00			480.00	800.00	950.00
Balance			920.00	3191.00	5549.00	9389.00	10757.00	12280.00	12753.00	12137.00	11187.00
Interest/Com Fee			41	201	487	772	882	1183	1277	1288	1250.70
Of which IDC			41.00	200.55	487.05	771.56	882.48	1182.05			
PROJECT (USAID)											
Borrowings				1706.00	3415.00	5247.00	4287.00	3127.00	1081.00	587.00	
Amortization											
Balance				1706.00	5121.00	10368.00	14655.00	17782.00	18863.00	19450.00	19450.00
Interest/Com Fee				17	68	156	259	325	376	386	405.00
Of which IDC				17.06	68.20	154.00	260.33	324.07			
PROJECT (CDB)											
Borrowings				2836.00	3095.00	2508.00	1778.00	1934.00			
Amortization									737.00	737.00	737.00
Balance				2836.00	5930.00	8438.00	10216.00	12150.00	11413.00	10676.00	9939.00
Interest/Com Fee				142	438	718	933	1118	1216	1141	1067.00
Of which IDC				141.76	438.25	718.48	932.70	1118.36			
PROJECT (EIB)											
Borrowings					640.00	2445.00	2287.00	1017.00	720.00	418.00	
Amortization									425.00	444.00	453.00
Balance					640.00	3085.00	5372.00	6389.00	6684.00	6658.00	6205.00
Interest/Com Fee					12.80	74.60	168.14	235.22	270.08	275.55	265.18
Of which IDC					12.80	74.60	168.14	235.22			
GENERATORS (COMMERCIAL) 1/											
Borrowings			675.00								
Amortization			209.00	225.00	241.00						
Balance			466.00	241.00	0.00						
Interest/Com Fee			69.06	61.00	36.00						
Of which IDC											
EXISTING (CDB)											
Borrowings		5328.00	950.00	800.00							
Amortization			0.00	103.00	207.00	207.00	207.00	207.00	207.00	207.00	207.00
Balance		5328.00	6278.00	6975.00	6768.00	6561.00	6354.00	6147.00	5940.00	5733.00	5526.03
Interest		82.00	487.00	689.00	713.00	691.00	668.00	647.00	626.00	604.06	582.00
Of which IDC		82.00									
EXISTING (CSC)											
Borrowings											
Amortization		418.00	249.00	249.00	249.00	248.00	248.00	249.00	249.00	[illegible]	249.00
Balance	3015.00	[illegible]	[illegible]	[illegible]	[illegible]	2501.00	2252.05	2003.00	1754.03	[illegible]	1256.00
Interest		[illegible]	274.00	262.00	[illegible]	211.00	190.00	169.00	[illegible]	[illegible]	106.00
Of which IDC											
SUMMARY											
Borrowings		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00
Amortization		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Balance	3015.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Int Com Fee		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Of which IDC		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Int Open		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TOTAL DEBT SERVICE EX IDC		[illegible]	[illegible]	[illegible]	1877.00	[illegible]	1111.00	1672.00	[illegible]	[illegible]	4161.48

1/ [illegible] loan at 11%.

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POWER PROJECT

Balance Sheets 1979-1992: Actual and Forecast
(In EC$000s)

	Actual				Forecast										
	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	
ASSETS															
Fixed															
Gross Plant	7470.00	7848.00	7811.00	33388.00	37537.00	48789.80	58142.76	84372.75	78378.85	40885.37	112089.34	171352.84	187284.39	881948.88	a/
Less: Depreciation	3889.00	4178.00	4678.00	18081.00	22284.00	26029.29	30485.88	35843.28	41557.10	48792.70	55928.81	60883.54	78811.73	88872.81	
Net Plant	3581.00	3488.00	3333.00	14288.00	15253.00	22733.30	25847.07	28729.47	30821.75	32392.68	58537.14	108288.10	110452.58	111876.81	
Work in Progress	0.00	0.00	0.00	0.00	5723.00	873.00	8427.38	22225.77	38307.11	54801.88	41872.72	0.00	0.00	0.00	
Net Fixed Assets	3581.00	3488.00	3333.00	14288.00	20978.00	24606.30	35074.45	50855.24	70128.88	87294.34	100409.88	108288.10	110452.58	111876.81	
Current															
Cash	-218.00	-1018.00	-1071.00	-1074.00	-1158.38	-1815.15	-1854.54	2075.88	-2185.01	-1747.45	-182.08	2585.21	10845.44	28188.88	b/
Accounts Receivable	1049.00	2381.00	2875.00	3391.00	1548.88	1805.42	2063.20	2328.07	2807.84	2818.80	2873.21	3282.88	4057.52	4548.43	c/
Inventories	1131.00	1188.00	1821.00	1822.00	2158.00	1757.00	1865.00	2283.05	2533.28	2823.88	2801.83	4283.82	4681.81	5048.72	d/
Total Current	1981.00	2549.00	3425.00	3339.00	2548.18	1847.27	2173.68	2503.43	2958.08	3893.34	5852.78	10151.88	19584.57	28788.87	
Total Assets	5572.00	6013.00	6758.00	17627.00	23522.18	26353.57	37248.11	53458.87	73084.85	91187.88	106082.84	118431.08	130037.18	141784.88	
LIABILITIES & EQUITY															
Equity															
Capital	412.00	412.00	412.00	412.00	412.00	412.00	2188.00	5851.00	10336.00	14888.00	18088.00	20388.00	21381.00	21381.00	
Retained Earnings	-455.00	-588.00	-48.00	848.00	483.35	414.82	411.13	1081.23	1848.87	3301.87	5888.78	8288.78	12881.87	18818.73	
Revaluation Surplus	0.00	0.00	0.00	10858.00	11784.88	12832.38	14483.68	16288.88	18388.88	20457.57	22725.88	28882.88	34121.48	41853.18	
Total	-43.00	-187.00	384.00	12117.00	12848.00	13858.18	17873.82	23383.72	30584.72	38758.24	48378.81	55257.42	88584.47	81458.88	
Long-Term Debt	4881.88	4881.88	2787.88	2438.88	8367.88	10735.88	17252.88	27383.88	38378.88	48178.88	54783.88	55788.88	84358.88	92178.88	
Current Liabilities															
Accounts Payable	1818.88	1883.88	2187.88	1328.88	1572.84	1728.14	1884.88	2858.84	2388.24	2421.88	2487.38	1885.82	1832.23	2228.44	e/
Income taxes payable						52.88						888.88	2288.88	3288.88	f/
Dividends Payable	38.88	38.88	35.88								41.88	41.88	41.88	41.88	
Consumer Deposits	8.88	8.88	8.88	288.88	288.14	387.25	328.38	338.81	358.88	381.58	484.48	428.75	484.47	481.74	g/
Current Maturities	8.88	271.88	1458.88	1478.88	458.88	577.88	897.88	458.88	458.88	455.88	2878.88	2537.88	2548.88	2184.88	
Total	1884.88	2188.88	3687.88	3874.88	2315.18	2859.39	2922.28	2852.48	3127.23	3258.45	4988.83	5472.87	7173.78	8128.18	
Total Liabilities and Equity	8878.88	8813.88	8788.88	17827.88	23888.18	28353.87	37248.11	53458.87	73884.85	81187.88	108882.84	118431.88	138837.18	141784.88	

a/ At historical cost up to 12/31/81 then with revaluation up to 12/31/82 based on initial 1980 CIR revaluation adjusted for estimated price increase for 1981 and 1982. 1983-1992 revaluations based on estimated 7% inflation rate.
b/ Assuming EC $ 3 million overdraft facilities available, unutilized facilities in 1986 would be equal to 48 days of cash operating expenses.
c/ Based on 90 days annual sales outstanding.
d/ Based on 1.5% of gross fixed assets up to project completion then 2.5%.
e/ Equals about 60 days cash operating expenses.
f/ Income taxes are due and payable 9 months after fiscal year end. Tax losses may be carried forward and offset against annual profits up to [illegible] of such profits.
g/ Increased in proportion to sales.

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ST. VINCENT AND THE GRENADINES

POWER PROJECT

Debt Statement
(In EC$000s)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
PROJECT (IDA)											
Borrowings			820.00	2371.00	3358.00	2331.00	1906.00	1523.00	853.00	184.00	
Amortization				0.00	0.00	0.00			480.00	800.00	800.00
Balance			820.00	3191.00	6558.00	8881.00	10787.00	12290.00	12783.00	12087.00	11187.00
Interest/Com Fee			41	201	487	772	882	1183	1277	1208	1180.70
Of which IDC			41.00	200.55	487.05	771.58	882.40	1182.05			
PROJECT(USAID)											
Borrowings				1700.00	3413.00	5247.00	4207.00	3137.00	1861.00	587.00	
Amortization											
Balance				1700.00	5121.00	10388.00	14608.00	17002.00	18863.00	19450.00	19450.00
Interest/Com Fee				17	68	186	250	328	376	388	408.00
Of which IDC				17.00	68.20	154.00	260.33	324.07			
PROJECT (CDB)											
Borrowings				2836.00	3096.00	2508.00	1778.00	1934.00			
Amortization									737.00	737.00	737.00
Balance				2836.00	5932.00	8438.00	10216.00	12150.00	11413.00	10676.00	9939.00
Interest/Com Fee				142	438	718	933	1110	1218	1141	1067.00
Of which IDC				141.76	438.25	718.40	932.70	1118.36			
PROJECT (EIB)											
Borrowings					640.00	2445.00	2287.00	1017.00	720.00	410.00	
Amortization									436.00	444.00	453.00
Balance					640.00	3085.00	5372.00	6389.00	6673.00	6639.00	6281.00
Interest/Com Fee					12.80	74.60	169.14	236.22	270.08	275.66	268.18
Of which IDC					12.80	74.80	169.14	236.22			
GENERATORS (COMMERCIAL) 1/											
Borrowings			675.00								
Amortization			209.00	225.00	241.00						
Balance			466.00	241.00	0.00						
Interest/Com Fee			89.00	61.00	36.00						
Of which IDC											
EXISTING (CDB)											
Borrowings		5328.00	850.00	800.00							
Amortization			0.00	103.00	707.00	207.00	207.00	207.00	207.00	207.00	207.00
Balance		5328.00	6178.00	6875.00	6168.00	5961.00	5754.00	5547.00	5340.00	5133.00	4926.03
Interest		82.00	487.00	660.00	713.00	661.00	606.00	547.00	528.00	504.00	382.00
Of which IDC		82.00									
EXISTING (CDC)											
Borrowings											
Amortization		418.00	244.00	246.00	249.00	248.00	248.00	249.00	248.00	[illegible]	249.00
Balance	3916.00	[illegible]	[illegible]	2868.00	[illegible]	2501.00	2252.05	2003.00	1751.03	[illegible]	1258.60
Interest		[illegible]	274.00	262.00	[illegible]	211.00	190.00	169.00	[illegible]	[illegible]	100.00
Of which IDC											
SUMMARY											
Borrowings		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7811.00	[illegible]	[illegible]	0.00
Amortization		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	168.00	[illegible]	[illegible]	[illegible]
Balance	3915.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Int Com Fee		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Of which IDC		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2021.04	[illegible]	[illegible]	[illegible]
Int Opne		[illegible]	[illegible]	[illegible]	865.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TOTAL DEBT SERVICE EX IDC		[illegible]	[illegible]	[illegible]	1877.00	1366.[illegible]	1111.00	1472.00	[illegible]	[illegible]	4161.48

1/ [illegible] 3 years [illegible] loan at 11%.

ST VINCENT AND THE GRENADINES

POWER PROJECT

Changes in Work Progress

	1983	1984	1985	1986	1987	1988	1989	1990	1991	
At beginning		5723.00	873.00	9427.38	22225.77	39307.11	54901.88	43872.72	0.00	0.00
IDC	82.00	41.00	359.38	1008.38	1719.34	2334.67	2831.04	0.00	0.00	0.00
Additions: Project	0.00	832.00	10295.00	18092.00	18882.00	16500.00	11872.00	8218.00	2457.00	
Other	7473.00	3872.00	800.00					1352.00	1460.00	1578.00
Transfers to fixed assets	1832.00	9595.00	2900.00	4300.00	3500.00	3240.00	25732.00	51442.72	3817.00	1578.00
At end	5723.00	873.00	9427.38	22225.77	39307.11	54901.88	43872.72	0.00	0.00	0.00

CUMBERLAND 1 - COSTS (US$ x 10^3)

(With 15% Inflation)

Description	Total Cost US$ x 10^3	Local Cost US$ x 10^3	Foreign Cost US$ x 10^3
Temporary Site Facilities*	489	80	409
Dams	334	96	238
Intake	138	51	87
Settling Tank	299	100	199
Storage Tank	1,279	464	815
Road, Bridges & Minor Works	144	40	104
Powerhouse Civil	94	25	69
Sub-Total Civil Works	2,777	856	1,921
Contingency (17%)	472	145	327
TOTAL PROJECT COST	3,249	1,001	2,248

CUMBERLAND 2 - COSTS (US$ x 10^3)

(Incl. 15% Inflation)

Description	Total Cost US$ x 10^3	Local Cost US$ x 10^3	Foreign Cost US$ x 10^3
Temporary Site Facilities*	491	157	334
Dams	393	155	238
Intake	60	20	40
Settling Tank	266	80	186
Streamguaging	155	35	120
Road, Bridges & Minor Works	193	30	163
Powerhouse Civil	243	53	190
Sub-Total Civil Works	1,801	530	1,271
Contingency (17%)	306	90	216
TOTAL PROJECT COST	2,107	620	1,487

CUMBERLAND 3 - COSTS (US$ x 10^3)

(Incl. 15% Inflation)

Description	Total Cost US$ x 10^3	Local Cost US$ x 10^3	Foreign Cost US$ x 10^3
Temporary Site Facilities*	489	80	409
Dams	296	85	211
Intake	27	10	17
Settling Tank	245	94	151
Streamgauging	120	34	86
Road, Bridges & Minor Works	150	50	100
Powerhouse Civil	244	54	190
Sub-Total Civil Works	1,571	407	1,164
Contingency (17%)	267	69	198
TOTAL PROJECT COST	1,838	476	1,362

Annex J.1

NATIONAL RESOURCE ADVISOR'S REPORT
ON THE
WATERSHED MANAGEMENT PLAN

On File in RDO/C and LAC/DR

MEMORANDUM

DATE: May 15, 1984

TO: Kim Finan, CPO

FROM: Mike Maxey, AGR/IDI

SUBJECT: Technical Recommendations on Proposed Cumberland Valley Watershed Management Program

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AID Cumberland Hydroelectric Project (536-0091) will support the development of a hydroelectric power generation system in the Cumberland Valley. Roads in the area will be upgraded to allow movement of construction equipment and building materials. This improved access may promote agricultural activity on land unsuited for farming, and cause depletion of natural vegetative cover and acceleration of soil erosion. The Shawiningan Feasibility Study noted that the effects of allowing both the loss of vegetative cover and increased soil erosion are:

- loss of top soil and agricultural land;
- increased rate of runoff and flooding;
- reduced minimum flows in the rivers.

The combination of the last two factors tends to alter the daily flow duration curves. The effect of this is to decrease the energy which can be generated from a hydroelectric plant.

Problem:

In order for the power facility to remain economical and self-sustaining over the long run, the waterflow rates of the watershed must be maintained at the present estimated levels.

Background:

The Cumberland Valley Hydroelectric Facility will consist of three powerhouses, Cumberland 1, 2, and 3, which will generate electricity by water powered turbines. Four dams will be constructed to catch and channel water into a hydro-power pipeline (locations of the dam sites are shown on the attached map), this piped water will power a generator located 2 - 3 miles

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downstream. Water exiting the generator turbines will again enter the pipeline and be channeled to the next powerhouse downstream. The river will remain dry 70% of the year after each dam, significantly decreasing the effect of the watershed area above each dam on the watershed below the dam. Given this design of the hydropower facility, runoff water will be provided to the powerhouses from one or more of three watershed areas; a) above the Convent and Hermitage Dams, b) between the Grove Dam and the Convent/Hermitage Dams, and c) between the Spring Village Dam and the Grove Dam.

The following is a description of the source of piped water going to each generator.

Cumberland 1 - Powerhouse: (Location: Grove)

This generator will be powered from the watershed above Convent and Hermitage Dams. This upper watershed will provide the runoff water to the two catchments, at which point the water will be channeled into a pipe. A pipeline will receive water at each dam, these two pipelines will be joined and extend to the site of the Cumberland 1 - Powerhouse. The water exiting this generator will be channeled into a pipeline that will extend to the site of Cumberland 2 - Powerhouse, Spring Village.

The generation of electrical power by Cumberland 1 will be exclusively dependent upon runoff from the watershed above the Convent and Hermitage Dams; an area which is virgin jungle.

Cumberland 2 - Powerhouse (Location: Spring Village)

This generator will be powered by piped water originating from two sources;

a) the exhaust water from the Cumberland 1 facility piped directly to Spring Village, the site of Cumberland 2, and

b) the natural waterflow from the watershed between the Hermitage/Convent Dams and Grove.

This natural runoff will be caught at the Grove Dam and channeled into the pipeline with the exhaust water from the Grove Powerhouse, Cumberland 1. Table 4 of the PP, Design Criteria, page 30, estimates that of the total amount of piped water arriving at Cumberland 2, 50% will be from the exhaust water of Cumberland 1, and 50% from the waterflow of the watershed between Hermitage and Convent, and Grove.

The generation of electrical power by the Cumberland 2 - Powerhouse will be equally dependent on the rate of waterflow from the watershed above Hermitage and Convent; and the rate of waterflow from the watershed between Hermitage and Convent, and Grove.

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Cumberland 3 - Powerhouse (location: Cumberland)

This generator will be powered by piped water originating from three sources;

a) exhaust water from the Cumberland 1 facility,

b) exhaust water from the Cumberland 2 facility, and

c) waterflow from the watershed between Grove and Spring Village. The watershed between Grove and Spring Village will contribute only 15% of the total amount of piped water reaching the Cumberland 3 - Powerhouse (see Table 4 of PR). The upper two watershed areas above Grove will be contributing 85% of the piped water to Cumberland 3 due to the passing on of the exhaust water from Cumberland 1 and 2.

SOURCE OF WATER FOR EACH POWERHOUSE

Source of Water for Cumberland 1

Area	Total Water
- Watershed above Convent/Hermitage Dams	100%
- Watershed between Grove and Convent/Hermitage	0%
- Watershed between Spring Village and Grove	0%

Source of Water for Cumberland 2

Area	Total Water
- Watershed above Convent/Hermitage Dams	50%
- Watershed between Grove and Convent/Hermitage	50%
- Watershed between Spring Village and Grove	0%

Source of Water for Cumberland 3

Area	Total Water
- Watershed above Convent/Hermitage Dams	42%
- Watershed between Grove and Convent/Hermitage	42%
- Watershed between Spring Village and Grove	15%

Discussion:

Each area of the watershed should be considered as a separate zone supplying waterflow to one or more Powerhouses. In this particular instance the amount of Project resources earmarked to establish a watershed management program will largely be determined by the importance of that watershed area to the success of the Project. The upper watershed above Convent/Hermitage Dams is clearly the most critical area and every effort must be made to protect the natural vegetative cover. The two lower watershed areas are more susceptible to increased agricultural activity and care must be taken to prohibit farming on unsuitable land, particulary between Grove and Convent/Hermitage. The area between Spring Village and Grove while providing only a minmal amount of runoff (15% of the total water going to Cumberland 3) must also be protected to minimize flooding and increased sedimentation.

Recommendations:

This is based on the technical proposals of Henry Tschinkel, Regional Forester, and Jim Talbot, Regional Environmental Management Specialist. They will draft a final plan for the watershed management program and make any technical modifications they feel are necessary to implement the program, but the budget amount for this prograr will not increase above the present level. With this in mind, the following recommendations were made as flexible as possible.

Forest Protection

This activity is probably the most critical aspect of the watershed management plan. The primary and secondary forests of the entire watershed above Spring Village must be protected. Hermitage/Convent (HC) is covered in virgin jungle, Hermitage/Convent --- Grove (HC-G) has mixed primary and secondary forests and will be vulnerable to agricultural exploitation, Grove --- Spring Village (G-S) is already under fairly intensive cultivation and the clearing of all state lands must be stopped. Protection of the forests in these areas is imperative.

Three constraints should be addressed; a) inadequate legislation for regulating the state lands forest, b) lack of will by the GOSV to enforce forest protection regulations, and c) the inability of the MTA Forestry Division to enforce regulations.

RDO/C should plan for and program the necessary funds to effect the drafting of required watershed protection legislation. We should collaborate with other organizations but not exclusively depend on someone else to put together the legislation. The GOSV should affirm its commitment to enact and

enforce these laws. The Forestry Division's regulatory capability should be strengthened.

Budget:

AID

Legislation Consultant ----------$ 5,500

Public Information Campaign ----------$ 500

GOSV

Hire Two Forestry Regulatory Personnel,
Forest Guard $3000/year ----------$12,000
Forest Ranger $5,000/year ----------$20,000

Reforestation

Plantations should be established where practicable in all three areas of the watershed. Tschinkel's cable (San Jose 003481) states that approximately 100 acres could be put into forest plantations. The focus of this reforestation effort should be in the upper two areas, HC, and HC-G, with most of the activity taking place in the area immediately above Grove.

Budget:

AID

Establish Forest Plantations,
100 acres $800/acre ----------$80,000

2 pick-up trucks (one in 1984,
replacement in 1988) ----------$35,000

GOSV

Vehicle Operation and Maintenance,
$3,600/year ----------$14,400

Management of Existing Plantations

Tschinkel suggested that AID finance the management of the existing 60 acre plantation in the H-C/G area. Work on this plantation could provide useful baseline information for planning silviculture activities in the rest of the watershed. We should support this activity as a research effort and not as a yearly maintenance program of the plantation.

Budget:

AID

Plantation Survey ----------$ 1,000

Research Activity (Record Keeping and
Data Collection) $100/acre ----------$ 6,000

Hand Tools and Inventory Equipment --------$ 7,000

Upgrade Trail for 4WD Access ----------$15,000

GOSV

Maintenance of Plantation,
Labor for Tending and Thinning
4 person days/acre ($15/acre/year) -------$ 3,600

Forest Utilization

The key to long term Government and private sector support of forest plantations will be in the realization of net returns on investment. While it is unclear what activity should be undertaken by the Project, funding should be provided to establish appropriate forest utilization demonstrations.

Budget:
AID
Forest Utilization Activity ----------$15,000

Land Delineation

The marking of the forest plantations will be the first step in regulating forest activities and protecting the existing primary and secondary forests. This is a critical activity and should be high priority item in the management plan.

Budget:
AID
Survey ----------$15,000

Office Calculation and Drafting ----------$ 2,500

Equipment ----------$ 1,000

Additional Copies of Existing
Aerial Photos ----------$ 200

Soil Conservation

Jim Talbot stated in the PP Environmental Assessment that a 'green belt' consisting of a 100 meter ban either side of the Cumberland River should be established in areas of agricultural activity. The watershed area between Grove and Spring Hill has a moderate to high amount of cultivation within 100 meters of the river. As a minimum effort the Project should address the need to protect the generator turbines from potential damage due to high sedimentation rates by establishing this buffer zone.

The river runs for 1.8 miles between Grove and Spring Village; a 200 meter ban along this distance would be an area of approximately 150 acres. The Project should set a maximum of 100 acres to be treated in this area and which includes, if required, a small number of acres in the HC-G area. The objective is to form an effective buffer against increased siltation in the stream. Land in natural vegetation that is unsuitable for forest plantations would be left in a natural state, forest plantations would be established in appropriate sites, and land being farmed within the 200 meter ban should be treated with appropriate soil conservation measures. No conservation activities would be supported outside of the 'green belt'. The Project would fund

the material, seeds, and technical assistance to protect this zone whether the land is Crown Land or privately owned.

Budget:
AID
Terracing of 75 acres of
agricultural land $230/acre
(60 person days/acre $2.80/day) ----------$17,250

Equipment and Materials for
Terrace Lay Out ----------$ 2,000

Hand Tools ----------$ 3,000

Consultant in Soil Conservation
Two Month TDY, 40 days $150/Day,
60 days per diem, plane fare ----------$12,000

Agricultural Extension

This will consist of support for tree nursery. The GOSV will be encouraged to commit an agricultural extension assistant to the soil conservation activities in the G/SV watershed area but no requirement should be made for increased permanent staff. All conservation activities in regard to establishing the 'green belt' will conducted under the supervision of Forestry personnel, the PSC Forestry Advisor, and the Soil Conservation Specialist.

Budget:
AID
Seedlings to Plant 100 acres ----------$39,000

Watershed Management Planning and Implementation

This will consist of support for an on-site coordinator, preferably a forester with knowledge of soil conservation techniques. This person should be responsible for managing the implementation activities of the Watershed Management Plan, including the planning and coordination of training for Forestry personnel. It is essential to hire this person early in the implementation phase of the plan. His services will be required full time for one year. Other donor personnel in the forestery area could coordinate the implementation activities upon the departure of the PSC Forester.

Budget:
AID
PSC Watershed/Soil Conservation Expert
1 year ----------$100,000

Training

Support should be provided for training the personnel to be involved with implementing the Watershed Management Plan.

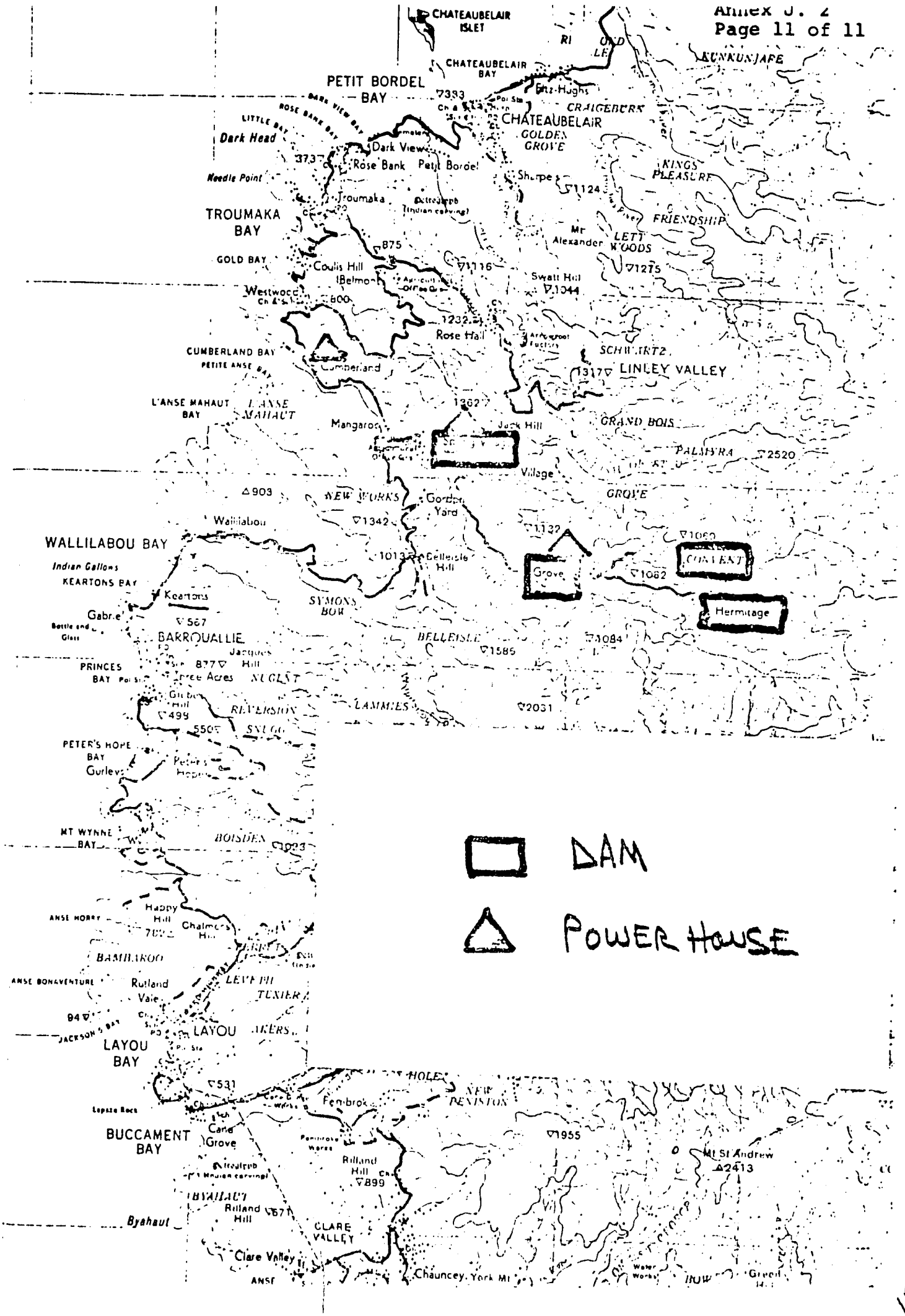
Budget:
AID
Training for 1 Forest Ranger and
2 Forest Guards in
Trinidad $2,500/each ----------$ 7,500

In-Country Short Course in Watershed
Management Practices ----------$ 15,000

BUDGET

	AID	G.O.H.
A. Forest Protection		
- Legislation Consultant	5,500	
- Public Information Campaign	500	
- Hiring of Two Forestry Regulactory Personnel:		
1. Forest Guard $3,000/yr		12,000
1. Forest Ranger $5,000/yr		20,000
B. Reforestation		
- Establish Forest Plantations 100 acres at $600/acre	60,000	
- 2 pick-up, 4 WD Trucks	35,000	
- Vehicle Operation and Maintenance $3,600/yr		14,400
C. Management of Existing Plantations		
- Plantation Survey	1,000	
- Research Activity	6,000	
- Hand Tools & Inventory Equipment	7,000	
- Upgrade Trail for 4 WD access	15,000	
- Maintenance of Plantation Labor for Tending/Thinning		3,600
D. Forest Utilization		
- Forest Utilization Activity	15,000	
E. Land Delineation		
- Survey	15,000	
- Office Calculation/Drafting	2,500	
- Equipment	1,000	
- Copies of Aerial Photos	200	
F. Soil Conservation		
- Terracing 75 acres of Agricultural land bordering river $230/acre (60 person days/acre at $2.80/day)	17,250	
- Equipment and materials	2,000	
- Hand Tools	3,000	
- Soil Conservation Specialist 2 month TDY, 40 days at $150/day, 60 days per diem	12,000	

	AID	G.T.
G. Agricultural Extension		
- Seedlings to plant 100 acres	39,000	
H. Watershed Mgt. Planning & Implementation		
- PSC Forester for 1 year	100,000	
I. Training		
- Training of 1 forest ranger and 2 forest guards in Trinidad	7,500	
- In-country short course in Watershed Mgt. Practice	15,000	
J. Evaluation	25,000	
Sub-total	404,450	
Contingency 15%	57,605	
Inflation 10%	37,945	
TOTAL	500,000	50,000


CHATEAUBELAIR ISLET
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CHATEAUBELAIR
GOLDEN GROVE
CRAIGIEBURN
KINGS PLEASURE
FRIENDSHIP
TROUMAKA BAY
Dark Head
Needle Point
Dark View
Rose Bank
Petit Bordel
Troumaka
Sharpe
Mt Alexander
GOLD BAY
Coulis Hill
Belmont
Westwood
Swatt Hill
Rose Hall
CUMBERLAND BAY
Cumberland
SCHWARTZ
LINLEY VALLEY
L'ANSE MAHAUT BAY
Mangaroo
Jack Hill
GRAND BOIS
PALMYRA
Village
NEW YORKS
Gordon Yard
GROVE
WALLILABOU BAY
Wallilabou
Indian Gallows
KEARTONS BAY
Kearton
Gabriel
BARROUALLIE
Jacques
Three Acres
PRINCES BAY
Hill
SYMONS BOR
BELLEISLE
Belleisle Hill
Grove
CONTEST
Hermitage
PETER'S HOPE BAY
Gurley
Peter's Hope
REVERSION
SUGG
LAMMIES
MT WYNNE BAY
BOISDEN
ANSE HORRY
Happy Hill
Chalmers Hill
BAMBARROO
ANSE BONAVENTURE
Rutland Vale
LEVERT
TEXIER
LAYOU
LAYOU BAY
JACKSON'S BAY
HOLE
NEW DENISTON
Fenbrook
BUCCAMENT BAY
Lapaze Rock
Cane Grove
Rilland Hill
BYAHAUT
Rilland Hill
Byahaut
CLARE VALLEY
Clare Valley
Chauncey
York Mt
Mt St Andrew
DAM
POWER HOUSE

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HYDROMETRIC NETWORK EXPANSION

The following notes summarize the costs of expanding the existing hydrometric network, as proposed in the feasibility study report.

Streamgauging Stations

Figure 5.16 of the Feasibility Study gives details of the design of a measuring weir. An important characteristic of the weir is that it is largely self cleaning, but since sediment will collect in the areas of the abutments, the removal of this sediment from time to time will be necessary. The amount of sediment which will have to be removed will not be large.

In August 1983, at the request of the World Bank, a recommendation of the more important gauging sites was made. These, with their drainage areas, are:

- Wallibou dam site 13,1 km2
- Richmond dam, 13,0 km2
- Fitz Hughes dam site, 2,3 km2
- South rivers dam, 13,1 km2
- Buccament river at Table Rock, 8,5 km2
- Jambou-1 dam site, 11,4 km2
- Rabacca-1 dam site, 10,3 km2

For these sites, it is expected that the flows which are exceeded 5% of the time will be contained within the notch. The river level for flows higher than these will be above the top of the rectangular notch. An indication of the discharge coefficients, C, which should be expected is given in Fig. 5.16, referred to above, but the weir should be calibrated since the actual values of "C" will be determined by the characteristics of the finished weir.

An estimate has been prepared for a site which has a drainage area of 13,0 km2. The breakdown of the cost, based on Figure 5.16, is as follows:

Civil works

	EC $	EC $
Excavation and backfill	2 860	
Cofferdams and pumping	2 304	
Weir	24 032	
D/S protection	5 040	
Recorder well and pipe	2 331	
	36 567	
Contingency	3 733	40 300
Water level recorder		
C.I.F. estimate		5 300
TOTAL		45 600

The cost of each of the weirs at Fitz Hughes, Table Rock and Rabacca will be less than $45 600. An estimate of the cost of installing the seven stations is EC $280 700.

Recording Raingauges

In August 1983, it was also recommended that recording rainfall gauges should be installed at:

- Montreal reservoir
- Dalaway reservoir
- Central Water Authority intake at Convent
- Retreat Police Station or Table Rock
- Rabacca dam site.

The cost for installing each station is EC $5 300 made up of EC $400 for civil works and EC$4 900 for the rain gauge, which is of the tipping bucket type.

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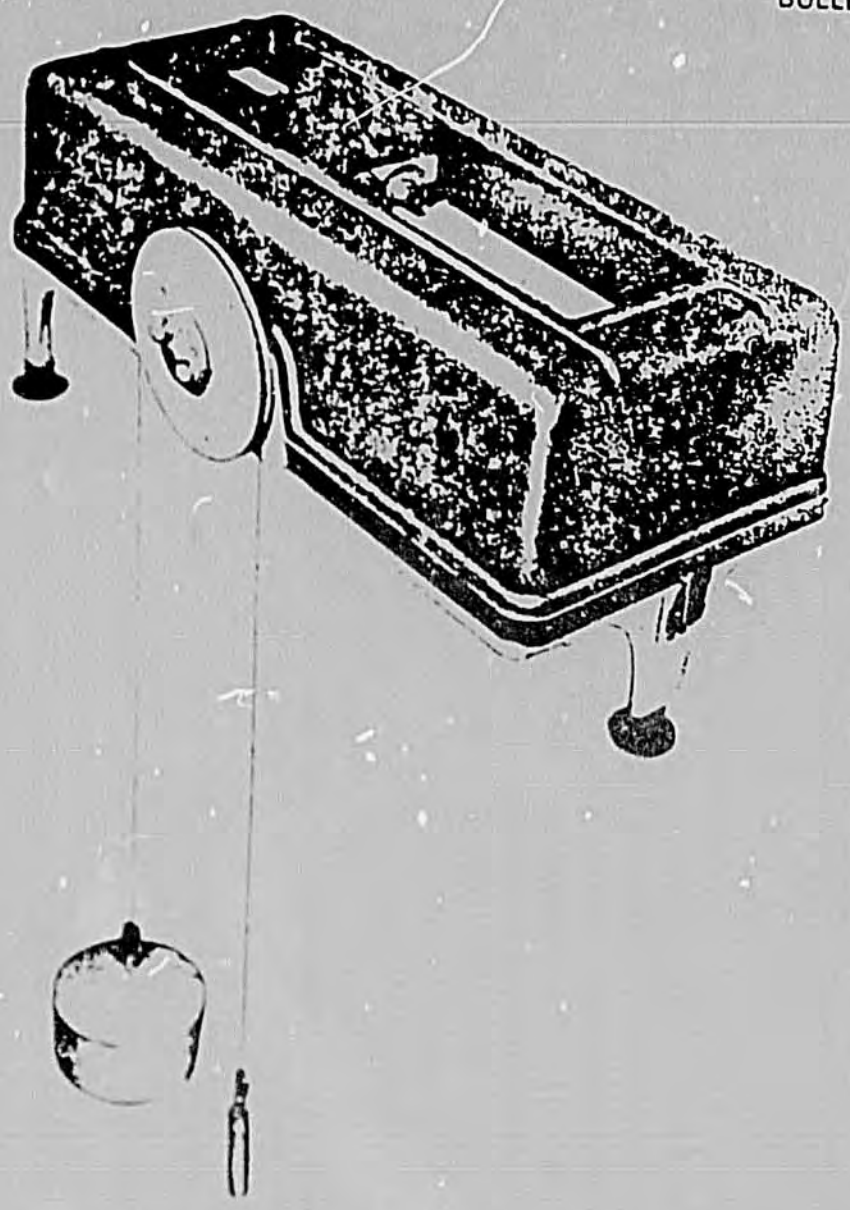

STEVENS TYPE A Model 71 Water-level Recorder

. . . an accurate, dependable instrument that provides continuous, long-term records, for:

- STREAM GAGING
- WATER SUPPLY
- GROUND WATER STUDIES
- IRRIGATION

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STEVENS TYPE A Model 71 Water-level Recorder

. . . provides continuous, unattended recording— with high accuracy regardless of range

- Unlimited Range in Stage
- Easy *Field* Change of Chart Speed and Recording Ratio
- Easy Chart Changing
- Many Months Unattended Operation from Mechanical Power

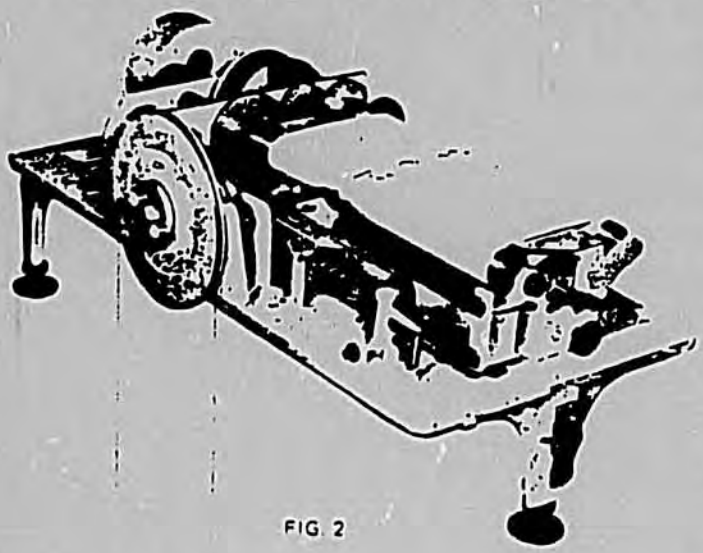

FIG. 2

The Stevens Type A Water-level Recorder illustrated here is the standard model, with beaded float line and standard pulley. Note one-piece, gasketed cover, with viewing port shown in Figure 1.

The earliest model of this instrument was the pioneer continuous water stage recorder. Constant improvements since the year 1911—perfected through field use and the skill gained over a half century of manufacturing precision engineering instruments—have made it the preferred recorder for river hydrography, and for any installation where long term operation is required or in which wide fluctuations in water levels occur.

Operation is Simple

Reduced to its basic function, the recorder accomplishes the following:

A strip chart is moved at a predetermined rate controlled by a clock movement. A marking stylus moves laterally across the chart in direct proportion to changes in water level. Thus, the result is a graphic record of water levels against time.

A single strip chart will last from 25 hours to 2 years, depending upon gearing and type of chart drive. Both *English* and *metric* models are offered.

Unlimited Range

Reversal of the marking stylus at each margin assures unlimited range without interruption, or reduction in scale. For easier interpretation, an *optional* reversal indicator can be installed at the factory—or in the field. The stylus marks the chart so that reversals on rising stages can be distinguished from falling stages *(See Optional Equipment)*.

0.01 Foot (3mm) Sensitivity

The recorder mechanism is precision-made and ball-bearing equipped as necessary to respond to 0.01 ft. change at 1:6 scale, using a 10-in. float.

Choice of Drives and Clocks

A universal driving bar (*outside the clock case*) engages pins on the time scale gears of the recorder to move chart at constant speed. Clocks are interchangeable in the field, without special tools.

Negator Spring Drive with Chelsea Clock - for time scales up to 4.8 inches/day. Negator spring drive will operate recorder for 4½ months, regardless of time scale *(from 1.2 through 4.8 inches/day)* selected. On special order drives for 6 months may be obtained. Chelsea clock contains an 11-jewel marine movement, housed in sealed case without dial. The escapement is always visible through a glass port.

Synchronous Motor Drive–for time scales up to 864 inches per day. For A-C operation only.

Weight Drive with Chelsea Clock–for time scales 1.2 through 9.6 inches/day. A 12-pound weight drives the instrument. The weight drops from 4.7 to 5.7 feet per month, depending on time scale, and this can be reduced by increasing the weight and interposing movement reduction sheaves in the clock weight cable.

Choice of Float Line or Direct-Reading Graduated Tape— both of Stainless Steel

Beaded Float Line. Geometrically wound, non-twisting cable, 0.04 in. dia., is standard equipment. Beads crimped on at uniform intervals of 6" (12.5 cm) match recesses in float pulley for non-slip operation. *(see Fig. 3.)*

Float Tape. Used when visual reading of gage heights—in addition to recording—is desirable. Graduated in feet, tenths, hundredths or in meters, decimeters, centimeters. Pulley provides sprocket-like, non-slip operation. Adjustable indicator provides index for direct reading from tape. Tape is 316 SS (high nickel content-non-magnetic) with 1/8" dia. perforations *(see fig. 4.)*

Recording Stylus

A capillary pen *(of special Stevens design)* containing ample ink in its Lucite reservoir for several months' operation is provided as standard equipment. A pencil may be substituted if desired, but pen is recommended where sensitivity is essential. A supply of ink *(or pencils)* is furnished with each Recorder. Stevens Chart Ink *(black, red or green)* is prepared from a special formula that flows freely regardless of seasonal temperature.

Time Scales

Designated by the number of inches of chart utilized in one day, standard time scales are easily interchanged in the field by substituting gears. Faster time scales may require a clock change as well.

Where water flow is artificially controlled *such as in the forebays and tailraces of power plants*, a faster time scale is desirable for making the record of the wide and rapid fluctuations more legible. In all cases, the slowest time scale consistent with legibility should be used.

TABLE 1

Time Scales with Chelsea Clock

(Negator Spring or Weight Driven)

Scale Designation (inches/day)	Value of Chart Divisions Major (1.2 inches)	Minor (0.1 inch)	25-yard Strip Chart lasts
1.2	24 hrs.	2 hrs.	2 years
2.4	12 hrs.	1 hr.	1 year
4.8	6 hrs.	30 min.	6 mos.
* 7.2	4 hrs.	20 min.	4 mos.
* 9.6	3 hrs.	15 min.	3 mos.

*Weight Driven Only

Time Scales with Synchronous Motor Clock

1.2	24 hrs.	2 hrs.	2 years
2.4	12 hrs.	1 hr.	1 year
4.8	6 hrs.	30 min.	6 mos.
7.2	4 hrs.	20 min.	4 mos.
9.6	3 hrs.	15 min.	3 mos.
14.4	2 hrs.	10 min.	2 mos.
28.8	1 hr.	5 min.	1 mo.
57.6	30 min.	2½ min.	15 days
144.0	12 min.	1 min.	150 hrs.
288.0	6 min.	30 sec.	75 hrs.
432.0	4 min.	20 sec.	50 hrs.
864.0	2 min.	10 sec.	25 hrs.

Strip Charts

—with English or Metric Scales

Strip charts are printed on high rag-content tracing quality paper to minimize humidity effects. Several days of record are normally visible with recorder in operation.

English Charts are graduated with inch and 0.10 inch divisions. Chart size 10-inch wide x 25 yards (22.8 m) long.

Metric Charts are divided into centimeters and fifths. Chart size: 25-cm. wide x 25 yards (22.8 m) long.

(Note: Time divisions are identical for all charts.)

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TABLE 2

Strip Charts for Stevens Continuous Recorders

Strip Chart	*Unit System*	*Gage Units*	*Width*
A10	Eng	in	10 in
A25	Metric	cm	25 cm

A special mechanism for turning chart *(backward for reviewing record, or forward for replacement of chart)* makes chart manipulation extremely easy.

Gage Scales Adapt Recorder to Water-level Range

The relationship between the rotation of the float pulley and the marking stylus movement is set by gearing. Changes in the gearing, or pulley circumference, thus affect the ratio between the chart *record* and *water-level* changes. This ratio is known as *Gage Scale* and designates size of record in relation to the level fluctuations. For example, a 1:6 Gage Scale means that the record will be 1/6 actual size. *(Standard English Scales are multiples of the ratio 1:12 - Metric scales are multiples of 1.10.)*

Changes in gage scale, within a specific pair as listed in Table 3 (such as a change from 10:12 to 5:12), are accomplished by adding an annular ring to change pulley circumference from 18 to 36 inches (or from 375mm to 750mm). Changing scale between standard pairs (such as from 1:6 to 10:12) is accomplished by exchanging float pulley standards. Either change may be done easily, without special tools.

Instruments may be converted in field from English system to Metric system, and vice versa. Write for details

TABLE 3

Standard Gage Scales in English Units

Gage Scale (English)	*Standard Water-Level Change for One Traverse of Stylus Across Chart* — *10-inch Chart*	*Graph Change per Foot of Water Change*	*Value of Smallest Chart Division*	*Pitch Circumference of Float Pulley*
10:12	1 ft.	10.0 in.	0.01 ft	18 in.
5:12	2 ft	5.0 in.	0.02 ft.	36 in.
1:6	5 ft.	2.0 in	0.05 ft.	18 in.
1:12	10 ft.	1.0 in.	0.10 ft.	36 in.
1:12	20 ft.	1.0 in.	0.10 ft.	18 in.
1:24		0.5 in.	0.20 ft.	36 in.
1:30	25 ft.	0.4 in.	0.25 ft.	18 in.
1:60	50 ft.	0.2 in.	0.50 ft.	36 in.

Standard Gage Scales in Metric Units

Gage Scale (Metric)	*25-cms Chart*	*per Meter of Water Change*		
1:1	0.25m	100cm	0.2cm	375mm
1:2	0.50m	50cm	0.4cm	750mm
1:5	1.25m	20cm	1.0cm	375mm
1:10	2.50m	10cm	2.0cm	750mm
1:10	2.50m	10cm	2.0cm	375mm
1:20	5.00m	5cm	4.0cm	750mm
1:25	6.25m	4cm	5.0cm	375mm
1:50	12.50m	2cm	10.0cm	750mm

RECOMMENDED FLOAT SIZES: 12-inch diameter for 10:12 and 5:12 *English* or 1:1 and 1:2 *Metric* scales; 10-inch diameter for all other English scales and 8-inch diameter for all other metric scales.

Note: Due to reversing stylus at the chart margin, water-level range is limited only by length of float line or tape

FIG 5 Schematic Cutaway Illustration of [illegible] Stevens Type A Water-level Recorder installation with stilling well and gauge house

OPTIONAL EQUIPMENT

Time Marker. With this accessory an auxiliary pen marking on the left margin of the chart makes a jog at certain elapsed time intervals. The action is controlled by the clock so that the jogs correspond to clock time and not to time divisions on the chart. The Time Marker record serves as a basis for applying corrections to the graph for possible errors due to humidity effects.

The jogs are adjusted to correspond to even hours or other even time intervals by an index setting on a graduated disk. Time intervals are marked every 2.4 inches corresponding to 6, 8, 12, 24 or 48 hours depending on the time scale. Recorders may be ordered with this accessory or it may be installed in the field without special tools.

Reversal Indicator. This device eliminates possible confusion in interpreting graphs on which reversals of the stylus occur. Indicator makes a continuous pen line on right margin of chart, with a long indentation for a reversal in one direction and a short indentation for a reversal in the other direction. Recorders may be ordered with this accessory or it may be installed in the field without special tools.

Counter Indicator. Gage heights can be read directly, with indicator visible through glass port in recorder. Indicator can be factory or in-the-field installed, without special tools.

Auxiliary Pencil. Insures against loss of record in the event pen ceases to function. This accessory attaches onto stylus carriage and provides a duplicate pencil record.

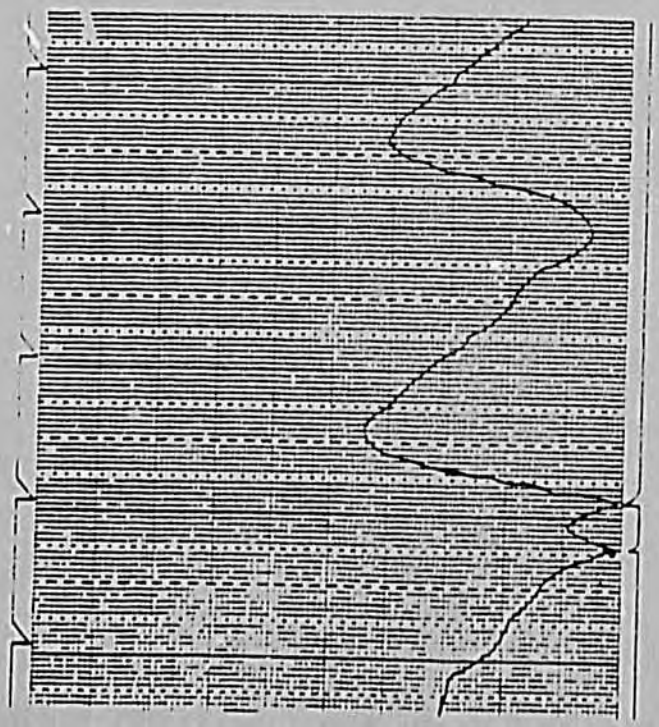


FIG 6

TIME MARKER indication on graph segment above runs along left margin of graph. **REVERSAL INDICATION** is shown at right margin of graph.

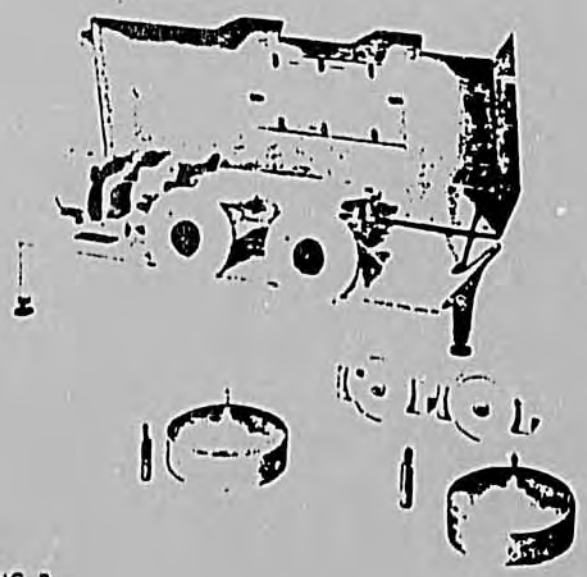


FIG. 7

Stevens Duplex Water-level Recorder Type 2A35. Guide pulleys offset one float line to lead float and counterweight into a nearby float well. Records two independent water levels on the same chart simultaneously, with full chart range for each. Case dimensions 30 3/4" x 11 3/8" x 14 3/4".

Specifications

Basic Type A Recorder Specifications

Float operated water level recorder, rectangular strip chart 10 inches (25 cm) by 25 yards, float pulley standard for 1:6 English (1:5 metric), capillary pen with Lucite reservoir, 1 oz black ink, plastic cover with viewing port, cast aluminum base with three leveling screw legs. Shipping weight approximately 46 lbs.

Application options:

Type of Chart Drive:

- ☐ 4 ½ months negator spring driven clock
- ☐ 6 months negator spring driven clock
- ☐ 4 ½ months weight driven clock
- ☐ synchronous motor for ___ V., ___ Hz

Time Scale:

_____ (refer to Table 1)

Float Pulley Standards:

_____ (refer to Table 3)

Chart:

☐ A-10 ☐ A-25

Float Pulley:

- ☐ 18 in. or 375 mm circumference for
  - ☐ beaded float line ☐ perforated tape
- ☐ 36 in. or 750 mm pulley ring for
  - ☐ beaded float line ☐ perforated tape

Float Line/tape:

- ☐ _____ feet stainless steel float line with set end hooks (weight 6 oz. per 100 ft.)
- ☐ _____ feet stainless steel perforated and graduated float tape with set end hooks and index bracket (weight 15.3 oz. per 100 ft.)

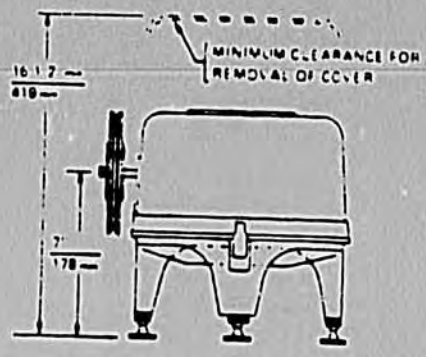
Float with counterweight:

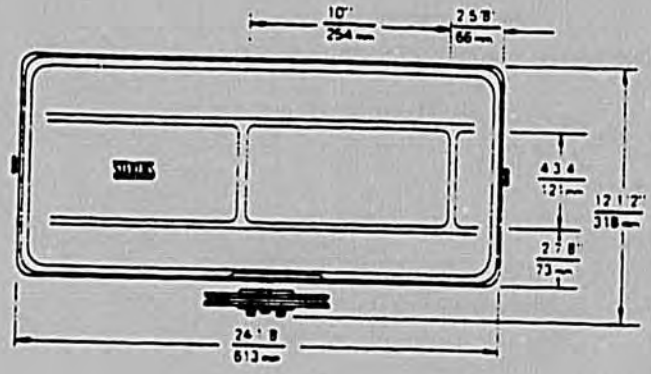
☐ 8 in ☐ 12 in ☐ _____ in
☐ 10 in ☐ 14 in.

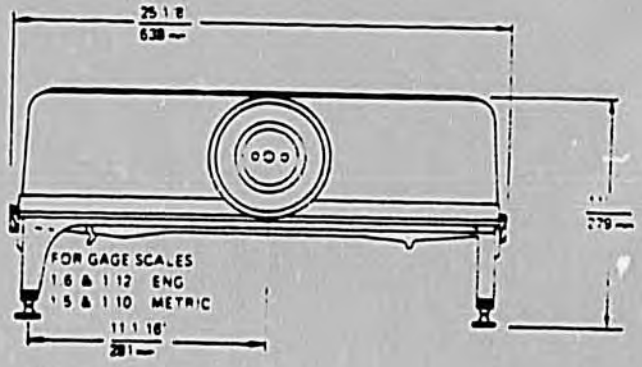
Accessories:

- ☐ Auxiliary pencil
- ☐ Counter indicator, 6 digit
- ☐ Mechanical rainfall recording accessory (see Bulletin 12A)
- ☐ Tilting bucket rainfall recording accessory (see Bulletin 12A)
- ☐ Reversal indicator
- ☐ Time marker
- ☐ Guide pulley
  - ☐ for beaded float line
  - ☐ for float tape
- ☐ Thermograph accessory (see Bulletin 12B) with shielded tubing
  - ☐ 50 ft ☐ 100 ft

Note: See Price List for options available. Manufacturer reserves the right to make changes in design or materials for product improvement, without notice.







FOR ALL OTHER GAGE SCALES
12 3/32" 307 mm

STEVENS WATER RESOURCES PRODUCTS

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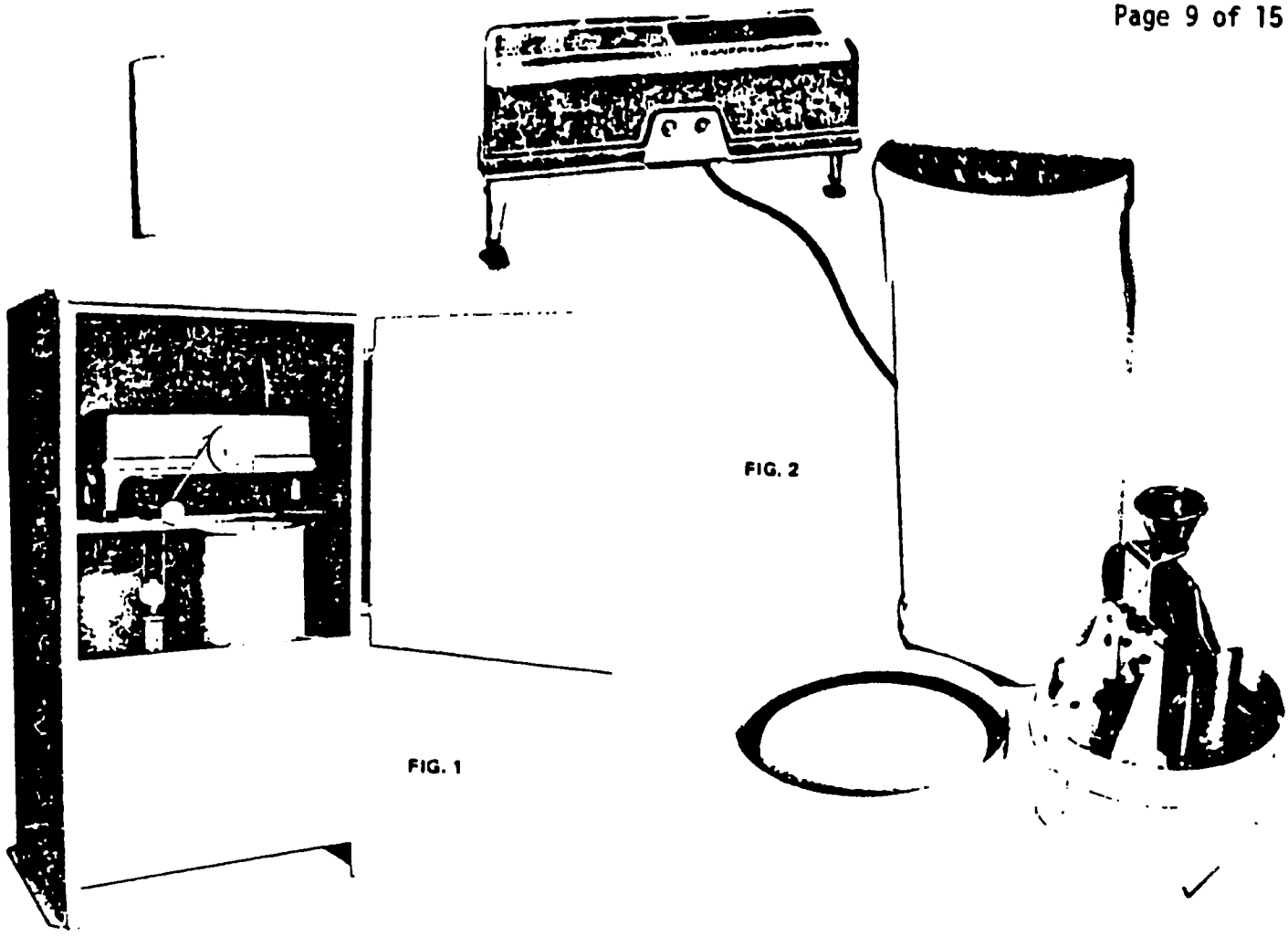
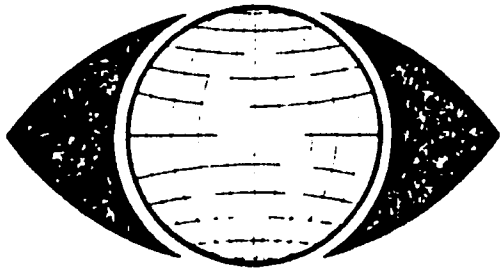


FIG. 1

FIG. 2

STEVENS METEOROLOGICAL INSTRUMENTS

...for a variety of meteorological activities:



- ☐ Long term rainfall recording
- ☐ Simultaneous rainfall and water level recording
- ☐ Telemetering of precipitation data
- ☐ Manual rain and snow measurement
- ☐ Snow sampling

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RAINFALL RECORDING

STEVENS TYPE QA RAIN RECORDER OFFERS LARGE RECORDING CAPACITY

The Type QA Rain Recorder *(See Fig. 1)* is a reliable instrument for long term, continuous recording of heavy rainfall. Rain is funneled from the collector into a storage tank. A float, resting on the collected water, operates the recording mechanism to provide a permanent strip chart record of accumulated rainfall against time. An oil layer may be placed on the water to reduce evaporation and increase record accuracy.

The recorder uses the well known jewelled Chelsea clock movement and negator spring drive to provide a minimum of 4½ months of operation on one winding.

Strip chart A-1 *(English)* is 10 inches wide with recording divisions in inches and tenths. Strip chart A-25 *(metric)* is 25 cm wide with recording divisions in centimetres and two millimetres. Both charts are 25 yards/23 metres long.

TABLE 1

PRECIPITATION SCALE FOR QA RECORDER

Precipitation Scale	Precipitation per minor chart division	Precipitation for one traverse of stylus across chart	Collector funnel dia.		Maximum capacity of storage tank
			in.	cm	
ENGLISH					
1:1	.10 in.	10 in.	11.3	28.7	30 in.
1:2	.20 in.	20 in.	11.3	28.7	30 in.
1:2	.20 in.	20 in.	8	20.3	60 in.
1:5	.50 in.	50 in.	8	20.3	60 in.
METRIC					
1:1	2 mm	250 mm	11.3	28.7	750 mm
1:2	4 mm	500 mm	11.3	28.7	750 mm
1:2	4 mm	500 mm	8	20.3	1500 mm
1:4	8 mm	1000 mm	8	20.3	1500 mm
1:5	10 mm	1250 mm	8	20.3	1500 mm

STEVENS TYPE QAC RAIN RECORDER FOR REMOTE RAINFALL COLLECTION.

The Type QAC instrument *(see Fig. 2)* offers long term continuous recording of heavy rainfall with the rainfall collector located remotely from the recorder (normally about 50 feet/15 meters of cable is supplied but longer lengths are available).

The 8 inch diameter collector directs rain into a tilting bucket mechanism. When bucket capacity is reached, the mechanism tilts to empty the collected rain (0.01"/25 mm) into an overflow container. The overflow can be collected for volume measurement if desired. An electrical pulse is generated for each tilt and

TABLE 2

PRECIPITATION SCALE FOR QAC RECORDER

Precipitation Scale	Bucket Capacity	Precipitation for one traverse of stylus across chart	Jogs per minor chart division	Value of minor chart div.
ENGLISH				
2:1	0.01"	5"	5	0.05"
5:1	0.01"	2"	2	0.02"
METRIC				
2:1	0.25 mm	12.5 cm	4	1 mm
2:1	0.20 mm	12.5 cm	5	1 mm
4:1	0.25 mm	6.25 cm	2	0.5 mm
5:1	0.20 mm	5.0 cm	2	0.4 mm

PRECIPITATION TELEMETRY

STEVENS DIGITAL PRECIPITATION RECORDERS

The Stevens Digital Recorder *(refer to Bulletin 37)* is available in four models for precipitation recording.

1. Model 7011 - this is a mechanically driven recorder using a float system and modified U.S. Weather Bureau type of raingage. Precipitation is funneled from the collector into a storage tank. The float system rotates the encoder input shaft. In order to achieve sensitivity to 0.01 inch (.25 mm) a 10 inch (254 mm) diameter float must be used, requiring about 12 inch (305 mm) diameter collector and storage tank. Recording range is 0 to 99.99 inches.
2. Model 7012 - this is a pulse driven recorder operating on contact closures from a tilting bucket rain collector. A measured amount of rain collected in the bucket causes it to tilt. An electrical pulse is generated for each tilt and transmitted to the recorder. Recording range is 0 to 99.99 inches.
3. Model 7013 - this mechanically driven recorder is the metric version of Model 7011 and has a recording range from 0 to 9.999 metres.
4. Model 7014 - this pulse driven recorder is the metric version of Model 7012 and has a recording range from 0 to 9.999 metres.

All of the above models provide a punched tape record of precipitation. Where the punched tape record is not required, the Stevens Memomark® II may be used with most customer furnished telemetering systems to provide remote registration, data logging, etc.

transmitted to the receiving recorder ... provides a count of the number of tilts and water accumula... The system is usually 12 volt battery powered, although it can be furnished for a.c. operation if desired.

The recorder is essentially the same instrument used in the Type QA with the addition of a solenoid actuated stylus responding to the tilting bucket pulses. The Type QAC also uses the A10 *(English)* 10" wide or A25 *(metric)* 25 cm wide, 25 yard long strip charts.

The precipitation scales and tilting bucket size combinations available are shown in Table 2. Since the recorder pen reverses at the margin a nearly unlimited amount of rainfall can be recorded.

A 50 foot cable is supplied for connecting the two components of the system. Additional cable, up to several hundred feet, can be used without increasing battery voltage. Standard dry cells have a normal life of 6 months.

TABLE 3
STANDARD TIME SCALES FOR TYPES QA AND QAC RECORDERS

Scale Designation (in./cm per day)	Value of Divisions		Standard Strip Chart Will Last
	Major (0.6 inch)	Minor (0.10 inch)	
1.2" 3.05 cm	12 hours	2 hours	2 years
2.4" 6.1 cm	6 hours	1 hour	1 year
4.8" 12.2 cm	3 hours	30 min	6 months

Above time scales are for the negator drive. Scales of 7.2 and 9.6 can be provided using weight or electric drives. Faster scales require electric drive.

TYPE QA AND QAC ACCESSORIES

Temperature Recording. The Thermograph accessory will provide a continuous graphic record of air or water temperature. It uses a 4 inch strip on the right side of the recorder chart. Refer to Accessory Bulletin 12B for more details.

Time Marker. An auxiliary pen marking on the left margin of the chart makes a jog at certain elapsed time intervals. This record serves as a basis for applying corrections to the graph for possible errors due to humidity effects.

STEVENS TYPE A RECORDER ACCESSORIES FOR SIMULTANEOUS RAINFALL AND WATER LEVEL RECORD.

Two rainfall recording accessories are available for use with the Stevens Type A Recorder. *(1)* the float operated mechanical accessory is designed for use on-site; *(2)* the tilting bucket accessory is available for operation while the recorder is located remotely from the precipitation collector (normally about 50 feet/15 metres). Two separate pens on the Stevens Type A Recorder are used to provide a simultaneous record of rainfall and water level. Refer to accessory Bulletin 12A for further details.

FIG. 3

STEVENS TELEMARK® TRANSMITS DATA OVER TELEPHONE CIRCUITS

The Stevens Telemark is a dependable, easily field serviceable, versatile instrument for telemetering precipitation data by coded pulses over telephone circuits (refer to Bulletin 22).

A tilting bucket rain gage, as described for the Type QAC instrument is connected electrically to the Telemark (see Fig. 3). The Telemark is equipped with a servomotor which positions a series of ridged drums in response to pulses from the tilting bucket transmitter. On call, an integral scanner "reads" these drums. A telephone call to the Telemark station actuates the Telemark mechanism to transmit a series of audible tones over the telephone lines. Various interfaces between the Telemark and the phone line can be used. One of the most popular of these is the Telephone Adapter ... refer to Bulletin 22A.

RAIN AND SNOW GAGE (U.S. WEATHER BUREAU TYPE) FOR MANUAL MEASUREMENT

This manually operated gage measures both rain and snow. Rain, caught in the 8 inch collector *(1)* is funneled into the receiver *(2)* and measured with the graduated measuring stick *(4)*. Any overflow is held in the overflow chamber *(3)* and poured back into the receiver for measuring. For snowfall, the overflow chamber is used as a snow catch can. The catch is melted and poured into the receiver for measuring.

FIG. 4

A metal tripod, is available for this instrument.

The rain and snow gage is constructed of copper and brass. The knife edge of the collector ring is precisely machined to 8 inches (20.3 cm) diameter. The receiver tube is 20 inches (50.8 cm) long having a cross sectional area one-tenth that of the collector ring. The measuring stick is graduated in either inches and hundredths *(English)* or millimeters *(metric)*.

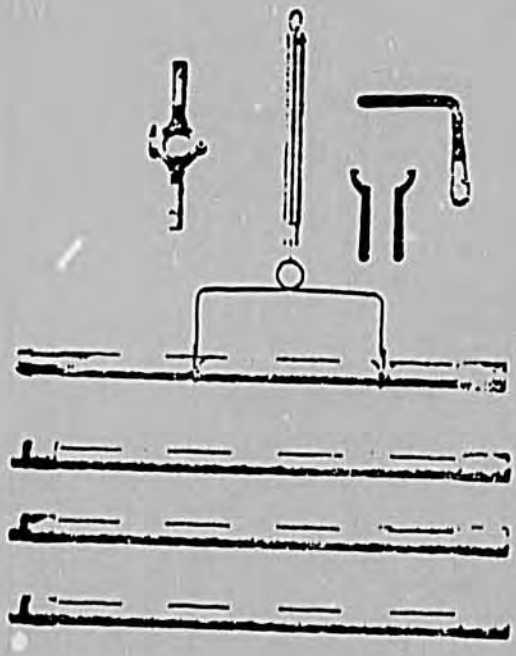
SNOW SAMPLING SET MEASURES SNOW DEPTH AND WATER CONTENT.

A snow sample is taken by forcing the tubes into the snow using the turning and driving wrench. The tubes are easily coupled to form the length required. After solid earth has been reached, the tubes are withdrawn and weighed. The snow core is then removed by inverting the tubes and using the cleaning tool. Water content is determined directly from the weighing scale.

Each sampling tube is 30 inches long and graduated in both English *(scale by numbered inches and ½ inch marks)* and metric units *(scale by 10 cm numbers and 2 cm marks.)* Sets can be supplied for snow depths from 60 up to 120 inches *(152 to 305 cms)*. The tubes are anodized aluminum. Staggered ports are cut in each tube for visual indication of the snow core.

The sensitive spring balance is graduated in both equivalent inches and centimetres of water. The ratio of water depth to snow depth is snow density.

The basic Snow Sampling Set consists of 4 sectionalized tubes, weighing scale and tube cradle, tube turning and driving wrench, cleaning tool and two spanner wrenches. Extra tubes are available. Also available is a canvas pack-sack with shoulder straps designed to carry the complete set.



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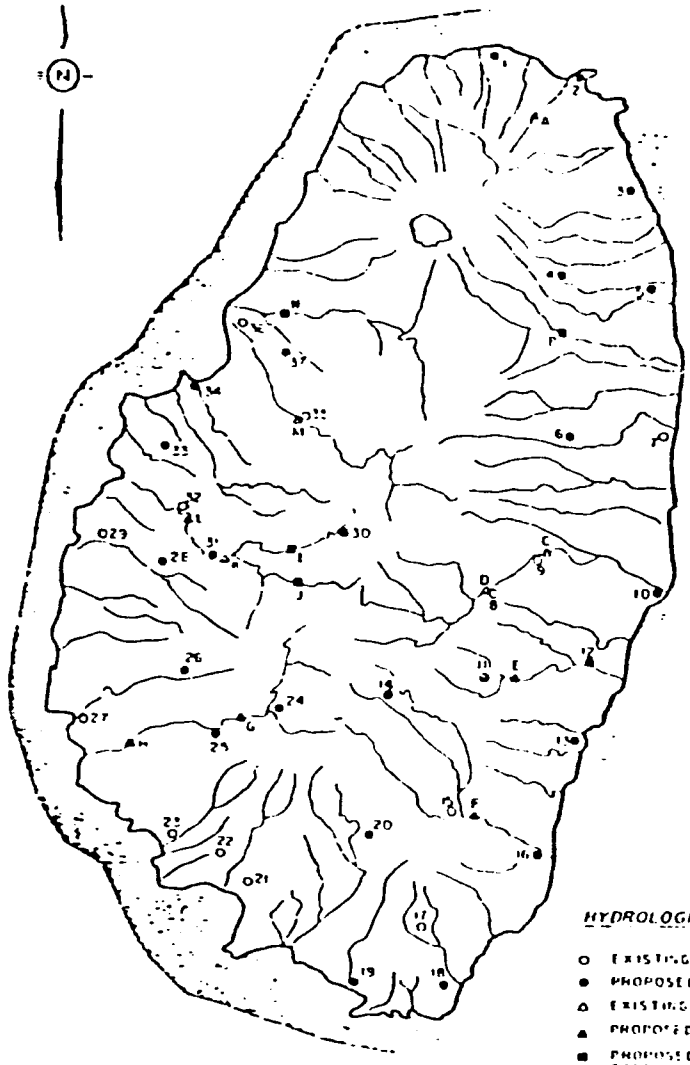


RAINFALL	
1	FANCY
2	OWIA POLICE STATION
3	NEW SANDY BAY POLICE STATION
4	DALGRADE WATER TANKS
5	CHANGE HILL ESTATE
6	LOWMANS VILLAGE
7	GEORGETOWN
8	SOUTH RIVERS DAM
9	SOUTH RIVERS POWER STATION
10	COLONARIE
11	UPPER GREGGS SCHOOL
12	NORTH UNION COPRA PLANT
13	BIABOU
(14)	MONTREAL RESERVOIR
15	CANE END
16	ARGYLE QUARRY
17	RIVULET
18	BRIGHTON
19	CALLIAQUA POLICE STATION
20	PILGRIM HILL
21	HEAD OFFICE
22	BOTANICAL GARDENS
23	CAMDEN PARK
(24)	CALEDAY RESERVOIR
(25)	RETREAT POLICE STATION
26	BELLEWOOD

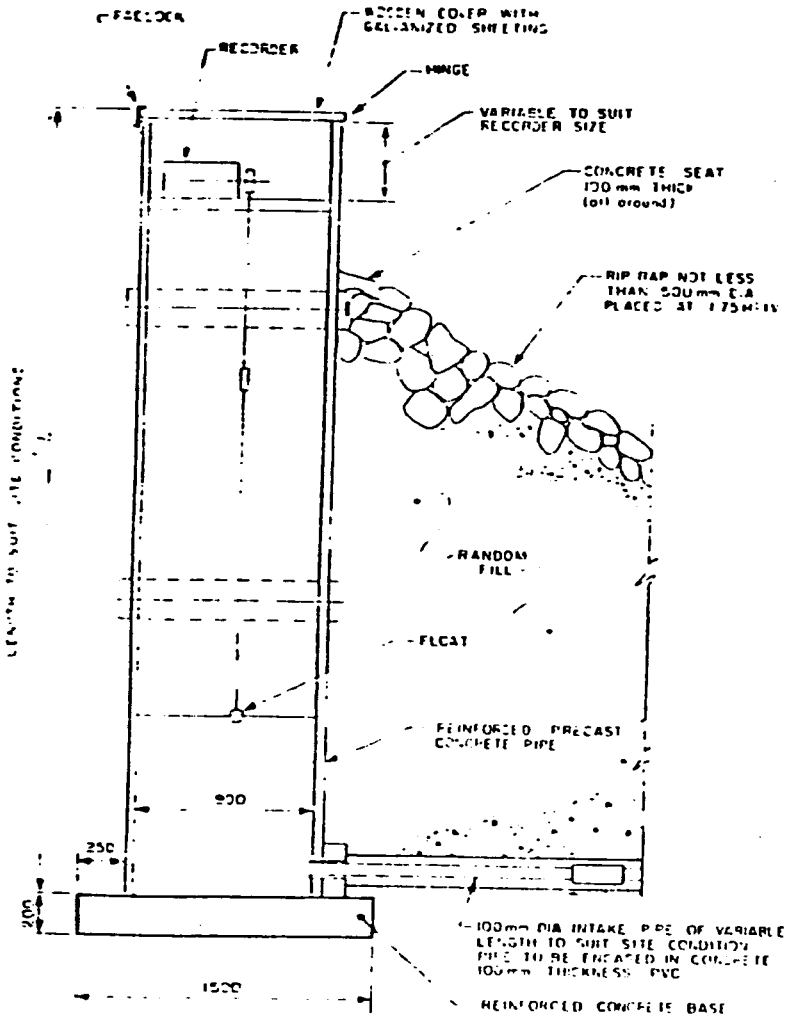
RAINFALL	
27	LAYOU
28	BELLE ISLE HILL
29	WALLIABOU
(30)	CWA INTAKE ABOVE CONVENT
31	GROVE
32	SPRING VILLAGE
33	AGRICULTURAL OFFICE BELMONT
34	CHATEAUBELAIR
35	RICHMOND DAM
36	RICHMOND POWER STATION
37	MORGEN WOODS
GAUGING	
A	OWIA MINI HYDRO INTAKE
(B)	RABACCA I DAM SITE
C	THREE RIVERS
(D)	SOUTH RIVERS DAM
E	LAUDERS
(F)	YAMBOU I DAM SITE
(G)	TABLE ROCK
H	PEMBROKE U/S BRIDGE
I	CONVENT DAM
J	HERMITAGE DAM
K	GROVE
L	SPRING VILLAGE DAM
(M)	RICHMOND DAM
(N)	WALLIBOU

UNITED NATIONS DEVELOPMENT PROGRAMME
GOVERNMENT OF ST-VINCENT

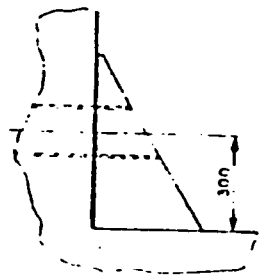
ST. VINCENT HYDROELECTRIC SCHEME

PROPOSED HYDROLOGIC NETWORK

Date	Shawinigan	Approved
March 1983	Shawinigan Engineering Company Limited	
Contract 8145		



SECTION THROUGH WELL



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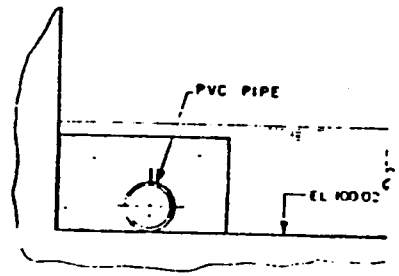
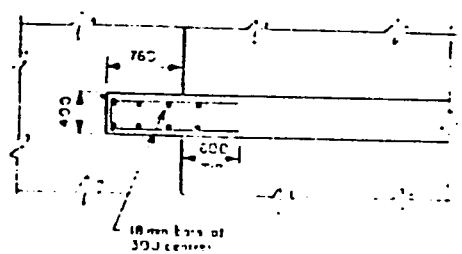


ELEVATION

DETAIL 1
OUTLET OF INTAKE PIPE



DETAIL 2

NOTES

1 H= expected flood level above crest

2 $H = 5\sqrt{\frac{A}{W}}$

3 A= drainage area at site of weir in square kilometers

4 W= width of river at crest level

5 For section of concrete, up to and including 500 mm thick use 18mm reinforcing bars at 300mm spacing

6 Minimum cover to reinforcement shall be 100mm

7 Sections thicker than 500mm can be of mass concrete

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Date March 1983 Contract 1145	Shawinigan Shawinigan Engineering Company Limited	Approved

Annex K
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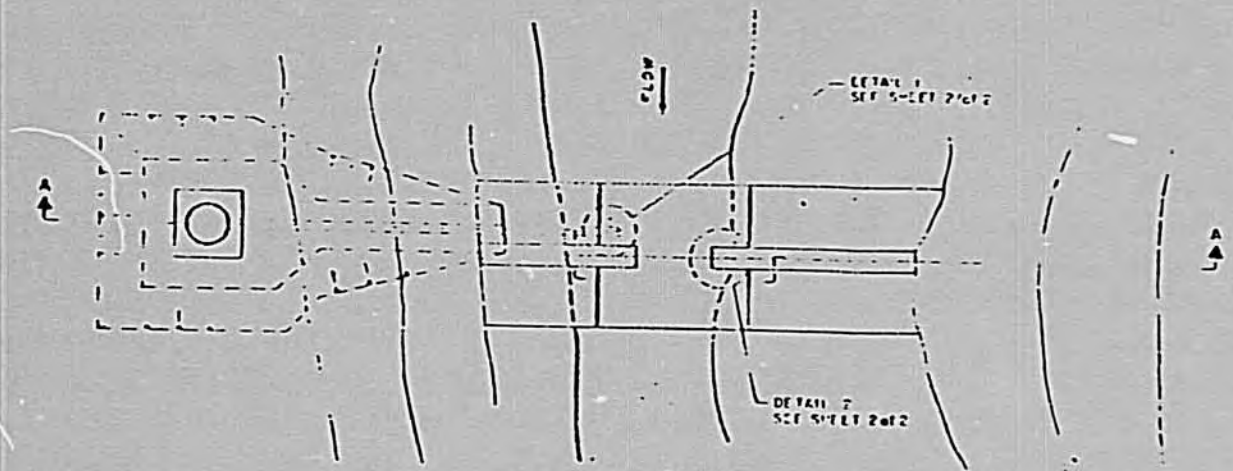
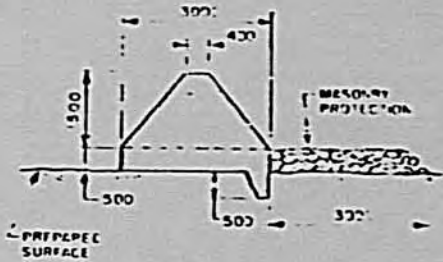
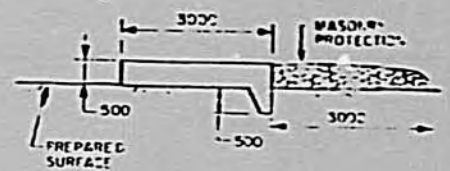
Figure 5.16



PLAN



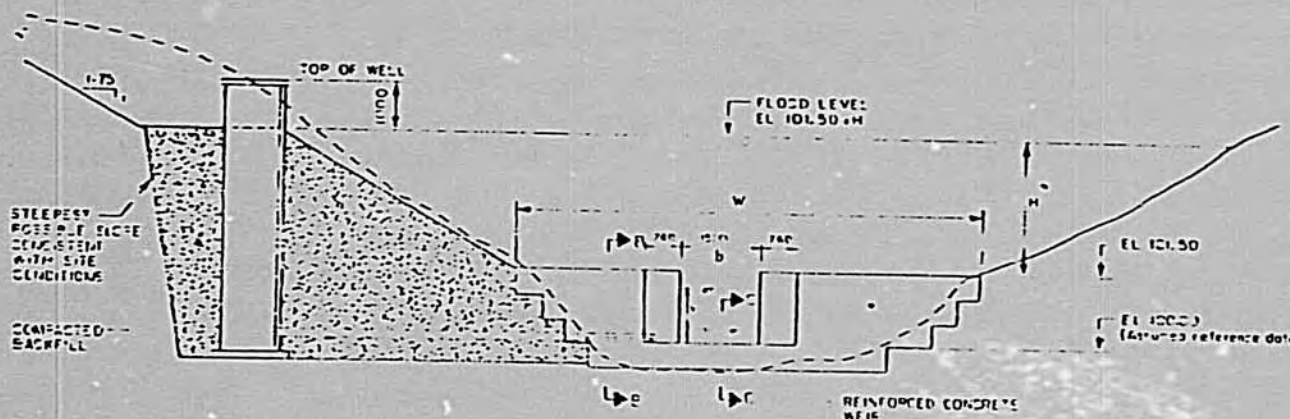
SECTION - BB -



SECTION - CC -

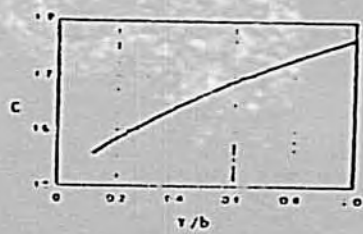
NOTE

FOR GENERAL NOTES SEE SHEET 2 of 2



SECTION - AA -

Q = Cby^1.5 m³/s, g = 9.81 m
For this design, b = 1.52 m
and C and Y vary



UNITED NATIONS DEVELOPMENT PROGRAMME GOVERNMENT OF ST-VINCENT	
ST VINCENT HYDROELECTRIC SCHEME	
PROPOSED STREAM GAUGING WEIR Sheet 1 of 2	
Date March 1983	Shawinigan
Contract 3145	Shawinigan Engineering Company Limited
Approved	