

**ANNEX I**  
**COST ESTIMATE**

I COST ESTIMATE

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11. BASIC ASSUMPTIONS

11.1 Proposed Implementation Method

The project is proposed to be implemented on the several local or international competitive bidding basis as shown below.

	Type of Contract
I. Dam and Power Station	
1. Access and Preparatory Work	Local
2. Main Civilworks	International
3. Electrical Equipment	International
4. Mechanical Equipment	International
5. Highway Relocation	Local
II. Irrigation Facilities	
1. Building and Quarters	Local
2. Headworks	International
3. Irrigation and Drainage Facilities with Farm Road Network in Division 1.	International
4. Irrigation and Drainage Facilities with Farm Road Network in Division 2.	International
5. Irrigation and Drainage Facilities with Farm Road Network in Division 3.	International
6. Land Preparation and On-Farm Development	Local

Of the proposed local contracts, the contract 1.5 for highway relocation is considered to be carried out by a local contractor under the guidance of qualified foreign contractor. Maximum use of local contractors, national products and domestic human resources is assumed even in the international contracts.

Cement is assumed to be supplied locally except for the contract I.2 in which moderate heat portland cement (Type II cement) is assumed to be imported for a construction of concrete gravity dam.

#### II.2 Material and Labor Cost

Basic material and labor costs mainly to be supplied locally are shown in Table-11. These costs are based on the cost survey made by the Water Resource Unity of the Ministry of Natural Resources in 1977.

#### II.3 Construction-Equipment Cost

Costs of basic construction equipment are shown in Table-12. These costs are based on the quotation of local dealers and of the contractors. Most of the construction equipment is assumed to be imported.

## 12. CONSTRUCTION UNIT COST

Construction unit cost for respective work item is estimated as shown in the following section 13 mainly based on the standard construction costs used in the Water Resource Unity of the Ministry of Natural Resources. Reference is also made to the construction unit price data of the Rio Lindo Power Station construction and of the San Lorenzo New Port construction. The cost is estimated at 1977 price level.

## 13. CONSTRUCTION COST ESTIMATES

A summary of the construction cost estimates is shown in Table-I3 and the detailed cost estimates for the San Fernando Dam and Power Station and for the Choluteca Plain Irrigation System are shown in Table-I4 and Table-I5, respectively.

Table- I 1 MATERIAL AND LABOR COST

Description	Unit	Unit Price (US\$)
Cement Ordinary (Imported)	ton	75
Moderate heat (Imported)	ton	80
Ordinary (Domestic)	ton	60
Reinforcement Steel	ton	450
Concrete pipe		
ø 4"	m	0.9
6	"	1.9
8	"	2.6
12	"	5.5
15	"	8.3
18	"	9.3
24	"	24.0
30	"	30.0
36	"	36.0
Aggregates & Others		
River stone	m <sup>3</sup>	1.5
Crushed fine stone	"	3.0
Washed river sand	"	2.5
Gravel	"	2.0
Concrete blocks 20x20x40	100 pieces	25
Timber (Pine tree)		
Seasoned timber	m <sup>3</sup>	110
Dressed timber	"	85
Rough timber	"	70
Fuel		
Gasoline	l	0.258
Diesel	"	0.138

Description	Unit	Unit Price (US\$)
<b>Lubricant and Grease</b>		
Lubricant oil	55 gallon container	123
Grease	100 "	160
Bituminous material	{	0.125
Operator, Truck	man-day	7.0
" Bulldozer	"	12.0
" Loader	"	12.0
Mechanic, Gasoline	"	10.0
" Diesel	"	12.0
Mason	"	8.0
Plasterer	"	8.0
Carpenter	"	8.0
Blasting worker	"	7.0
Welder	"	14.0
Reinforcement steel worker	"	12.0
Electrician	"	14.0
Driver	"	5.0
Surveyor	"	31.0
Level man	"	23.0
Tape man	"	8.0
Staff man	"	10.0
Foreman	"	18.0
Assistant worker	"	4.0
Common labor	"	2.0

Table- I 2. CONSTRUCTION EQUIPMENT COST

Item	Capacity	Unit Price (US\$)
<b>Earth work equipment</b>		
Bulldozer	13 t	72,000
- do -	22 t	104,000
- do -	33 t	151,000
- do -	45 t	212,000
Tractor shovel	0.6 m <sup>3</sup>	21,000
- do -	1.0 m <sup>3</sup>	30,000
- do -	1.2 m <sup>3</sup>	43,000
Dragline	0.8 m <sup>3</sup>	84,000
Back hoe	0.8 m <sup>3</sup>	49,000
- do -	1.2 m <sup>3</sup>	80,000
Motor grader	9 t	47,000
Motor scraper	16 m <sup>3</sup>	240,000
<b>Transportation equipment</b>		
Dump truck	4 t	17,000
- do -	8 t	21,000
- do -	12 t	35,000
- do -	18 t	75,000
- do -	32 t	121,500
Truck	4 t	17,000
- do -	8 t	21,000
Trailer	25 t	59,000
<b>Concrete equipment</b>		
Concrete plant	3.0 m <sup>3</sup>	571,000
Portable concrete mixer	0.6 m <sup>3</sup>	14,000
Crushing plant	70 t	175,000
Cable crane	4.5 t	322,000
Truck mixer	3.0 m <sup>3</sup>	28,000



Item	Capacity	Unit Price (US\$)
Other equipment		
Road roller	8 t	22,000
- do -	10 t	24,000
Submergible pump	ø80 mm	520
Truck crane	10 t	52,000
- do -	35 t	151,000
Diesel hammer	2.5 t	33,000

Table- I 3 SUMMARY OF COST ESTIMATE

Description	Local currency Component (US\$)	Foreign currency Component (US\$)	Total (US\$)
<b>1. SAN FERNANDO DAM AND POWER STATION</b>			
1.1 Access road & preparatory works	1,640,000	-	1,640,000
1.2 Diversion during construction	150,000	493,000	643,000
1.3 Dam and spillway	6,385,000	16,362,000	22,747,000
1.4 Intake, penstock and outlet	60,000	569,000	629,000
1.5 Powerhouse and tailrace	721,000	984,000	1,705,000
1.6 Generating equipment	150,000	3,110,000	3,260,000
1.7 Transmission line & substation	210,000	1,023,000	1,233,000
1.8 Highwan relocation	1,056,000	264,000	1,320,000
1.9 Land compensation	610,000	-	610,000
Sub-total (1)	10,982,000	22,805,000	33,787,000
<b>2. CHOLUTECA PLAIN IRRIGATION SYSTEM</b>			
2.1 Communication system & quarters	482,000	396,000	878,000
2.2 El Papalon intake weir	764,000	2,831,000	3,595,000
2.3 Main canal system	3,001,000	2,984,000	5,985,000
2.4 Branch canal system	761,000	1,974,000	2,735,000
2.5 Secondary canal system	416,000	1,144,000	1,560,000
2.6 Drainage canal system	738,000	1,507,000	2,245,000
2.7 Farm road system	421,000	838,000	1,259,000
2.8 On-farm construction	2,503,000	-	2,503,000
2.9 Clearing and reclamation	2,362,000	-	2,362,000
2.10 Land compensation	210,000	-	210,000
Sub-total (2)	11,658,000	11,674,000	23,332,000
<b>3. ENGINEERING AND GENERAL EXPENSE</b>			
	1,000,000	8,000,000	9,000,000
Sub-total (1 to 3)	23,640,000	42,479,000	66,119,000
<b>4. PHYSICAL CONTINGENCY (10%)</b>			
	2,364,000	4,248,000	6,612,000
Total (1 to 4)	26,004,000	46,727,000	72,731,000

Table-1 4 CONSTRUCTION COST ESTIMATE  
SAN FERNANDO DAM AND POWER STATION

Item	Unit	Quantity	Local Currency		Foreign Currency		Total
			Unit Cost	Amount	Unit Cost	Amount	
<b>1. Access Road and Preparatory Works</b>							
New access road	km	18.0	80,000	1,440,000	-	80,000	1,440,000
Preparatory works	L.S.	-	-	200,000	-	-	200,000
Sub-total				1,640,000		80,000	1,640,000
<b>2. Diversion during Construction</b>							
Excavation	m <sup>3</sup>	500	1.0	500	9.0	4,500	5,000
Rock	m <sup>3</sup>	5,000	9.0	45,000	31.0	155,000	200,000
Tunnel	m	1,450	1.5	2,175	4.5	6,525	8,700
Cofferdams	m	3,380	1.5	5,070	5.0	16,900	21,970
Impervious fill							
Rock fill							
Concrete							
Portal structures							
Tunnel lining							
Tunnel plug							
Reinforcement steel	ton	150	610	91,500	700	105,000	196,500
Tunnel steel support	ton	26	640	16,640	750	19,500	36,140
Drilling and grouting	L.S.	-	-	14,000	-	-	14,000
Care of river	L.S.	-	-	14,000	-	-	14,000
Sub-total				149,705		493,565	643,270
<b>3. Dam and Spillway</b>							
Excavation	m <sup>3</sup>	36,000	0.8	28,800	2.2	79,200	108,000
Weathered rock	m <sup>3</sup>	116,500	1.7	198,050	4.3	500,950	699,000
Concrete							
Dam							
Pier							
Training wall							
Stilling basin							
Reinforcement steel	ton	636	610	387,960	700	445,200	833,160
Spillway bridge	L.S.	-	-	25,000	-	-	25,000
Spillway gates	ton	144	300	43,200	5,200	748,800	792,000
Anchor bars	ton	30	200	6,000	1,000	30,000	36,000
Foundation treatment	L.S.	-	-	150,000	-	-	150,000
Sub-total				6,384,890		10,362,710	16,747,600
<b>4. Intake, Penstock and Outlet</b>							
Concrete							
Intake structure							
Reinforcement steel	ton	5	610	3,050	700	3,500	7,050
Intake gates, trash racks	ton	40	4,500	180,000	5,000	200,000	380,000
Penstock	ton	90	2,700	243,000	3,000	270,000	513,000
Outlet valves	L.S.	-	-	10,000	-	-	10,000
Sub-total				59,450		569,050	628,500

- to be continued -

Item	Unit	Quantity	Local Currency		Foreign Currency		Total Amount	
			Unit Cost	Amount	Unit Cost	Amount		
<b>5. Powerhouse &amp; Tailrace</b>								
Concrete	m <sup>3</sup>	1,200	32	102,400	48	153,600	80	256,000
Substructure	m <sup>3</sup>	5,100	90	477,000	60	318,000	150	795,000
Superstructure	m <sup>3</sup>	150	30	4,500	60	9,000	90	13,500
Anchor block	ton	415	90	37,350	610	253,150	700	290,500
Reinforcement	L.S.	-	-	100,000	-	100,000	-	100,000
Architectural work	L.S.	-	-	721,250	-	721,250	-	721,250
Sub-total								1,705,000
<b>6. Generating Equipment</b>								
Turbine and governor	L.S.	-	-	50,000	-	50,000	-	50,000
Generator	L.S.	-	-	70,000	-	70,000	-	70,000
Overhead crane	L.S.	-	-	10,000	-	10,000	-	10,000
Transformer	L.S.	-	-	10,000	-	10,000	-	10,000
Other equipment	L.S.	-	-	10,000	-	10,000	-	10,000
Sub-total				150,000		150,000		150,000
<b>7. Transmission Lines and Substation</b>								
69 kV line and line post	km	25.0	6,600	165,000	15,500	387,500	22,100	552,500
Step-down transformer	L.S.	-	-	45,000	-	45,000	-	45,000
Sub-total				210,000		1,022,500		1,022,500
<b>8. Highway Relocation</b>								
New highway	km	8.0	132,000	1,056,000	33,000	264,000	165,000	1,320,000
Sub-total				1,056,000		264,000		1,320,000
<b>9. Land Compensation</b>								
	ha	2,180	280	610,400	-	-	280	610,400
Sub-total				610,400		-		610,400

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Table-13 CONSTRUCTION COST ESTIMATE  
CHOLUTEGA PLAIN IRRIGATION SYSTEM

Item	Unit	Quantity	Local Currency		Foreign Currency		Total
			Unit Cost	Amount	Unit Cost	Amount	
<b>1. Communication System and Quarters</b>							
Main office	m <sup>2</sup>	250	200	86,000	-	-	86,000
Branch office	m <sup>2</sup>	500	150	50,000	-	-	50,000
Quarters	m <sup>2</sup>	2,500	100	300,000	-	-	300,000
Motor pool	m	350	60	21,000	-	-	21,000
Workshop	m	2,500	30	50,000	-	-	50,000
Shade	m			482,000			482,000
Sub-total							396,000
<b>2. Head Work (El Papalon Intake Veil)</b>							
Earth work	m <sup>3</sup>	29,500	0.4	11,800	1.1	32,450	44,250
Excavation river bed	m <sup>3</sup>	6,600	0.5	3,300	2.0	13,200	16,500
Backfill	m <sup>3</sup>						
Concrete Work							
Mass concrete (Type-B)	m <sup>3</sup>	10,300	5	51,000	70	714,000	765,000
Structural (Type-A)	m <sup>3</sup>	2,400	52	124,800	28	67,200	192,000
Foundation (Type-D)	m <sup>3</sup>	2,700	54	145,800	16	43,200	189,000
Reinforcement bar	ton	240	77	18,500	623	149,500	168,000
Concrete form	m <sup>2</sup>	17,300	6.0	103,800	-	-	103,800
Rock riprap	m <sup>3</sup>	300	4.5	1,350	5.5	1,650	3,000
Vertical concrete block	m	1,100	10	11,000	110	121,000	132,000
Operation deck	m	10	30	300	270	2,700	3,000
Sluice gate	ton	32	142	4,550	58	129,850	134,400
Trash rack	ton	41	200	8,200	700	110,700	118,900
Steel Sheet piles	ton	300	10	3,000	990	297,000	300,000
Stop log	m <sup>3</sup>	30	80	2,400	-	-	2,400
Dike embankment	m <sup>3</sup>	344,000	0.5	172,000	2.0	688,000	860,000
Temporary Work							
Coffer dam	m <sup>3</sup>	9,700	0.5	4,850	2.0	19,400	24,250
Sheet pile	ton	380	10	3,800	790	300,200	304,000
Access road	m	1,000	1.0	1,000	4.0	4,000	29,500
Sub-total				764,000		2,831,000	3,595,000
<b>3. Main Canal</b>							
Canal							
Earth Works							
Excavation	m <sup>3</sup>	110,000	0.4	44,000	1.1	121,000	165,000
Embankment	m <sup>3</sup>	386,000	0.3	115,800	2.2	849,200	965,000
Stripping	m <sup>2</sup>	51,000	0.1	5,100	0.4	20,400	25,500
Soil Faring	m <sup>2</sup>	196,000	0.1	19,600	0.1	19,600	39,200
Concrete lining	m <sup>2</sup>	27,600	90	2,484,000	50	1,380,000	3,864,000
Related Structures							
Earth Works							
Excavation	m <sup>3</sup>	8,700	0.6	5,200	1.4	12,200	17,400
Backfill	m <sup>3</sup>	2,300	0.7	1,600	2.3	5,300	6,900

- to be continued -

Item	Unit	Quantity	Local Currency		Foreign Currency		Total	
			Unit Cost	Amount	Unit Cost	Amount	Unit Cost	Amount
Concrete Works								
Structural (Type-B)	m <sup>3</sup>	1,800	52	93,600	28	50,400	80	144,000
Foundation (Type-A)	m <sup>3</sup>	400	54	21,600	16	6,400	70	28,000
Reinforcement bar	ton	130	77	10,000	623	81,000	700	91,000
Concrete form	m <sup>2</sup>	9,700	6	58,200	-	-	6.0	58,200
Stop log	m	20	80	1,600	-	-	80	1,600
Precast Concrete pipe	m	300	-	6,900	-	500	-	7,400
Gates	l.s	-	-	59,620	5.5	346,780	-	406,400
Rock riprap	m <sup>3</sup>	40	4.5	180	-	220	10	400
Bifurcation Structure								
Earth Works								
Excavation	m <sup>3</sup>	3,000	0.6	1,800	1.4	4,200	2.0	6,000
Stripping	m <sup>3</sup>	350	0.1	40	0.4	140	0.5	180
Embankment	m <sup>3</sup>	1,700	0.3	510	2.2	3,740	2.5	4,250
Backfill	m <sup>3</sup>	760	0.7	530	2.3	1,750	3.0	2,280
Concrete Works								
Structural (Type-A)	m <sup>3</sup>	720	52	37,440	28	20,160	80	57,600
Foundation (Type-B)	m <sup>3</sup>	150	54	8,100	16	2,400	70	10,500
Reinforcement bar	ton	60	77	4,620	623	37,380	700	42,000
Concrete form	m <sup>2</sup>	2,900	6	17,400	-	-	6.0	17,400
Truckrack	l.s	-	-	3,400	-	21,230	-	24,630
Stop log	m	2	80	160	-	-	80	160
Sub-total				3,001,000		2,984,000		5,985,000
Canal								
Branch Canal								
Earth Work								
Excavation	m <sup>3</sup>	15,300	0.6	9,200	1.4	21,400	2.0	30,600
Embankment	m <sup>3</sup>	492,000	1.0	492,000	3.0	1,476,000	4.0	1,968,000
Stripping	m <sup>3</sup>	58,000	0.1	5,800	0.4	23,200	0.5	29,000
Sod facing	m <sup>2</sup>	188,000	0.1	18,800	0.1	18,800	0.2	37,600
Related Structures								
Earth Work								
Excavation	m <sup>3</sup>	5,000	0.6	3,000	1.4	7,000	2.0	10,000
Backfill	m <sup>3</sup>	2,800	0.7	2,000	2.3	6,400	3.0	8,400
Concrete Works								
Structural (Type-A)	m <sup>3</sup>	1,500	52	78,000	23	42,000	80	120,000
Foundation (Type-B)	m <sup>3</sup>	400	54	21,600	16	6,400	70	28,000
Reinforcement bar	ton	80	77	6,200	623	49,800	700	56,000
Concrete form	m <sup>2</sup>	5,500	6	33,000	-	-	6.0	33,000
P.C.C. pipe	l.s	-	-	23,450	-	1,950	-	25,400
Concrete block	m <sup>3</sup>	10	90	900	10	100	100	1,000
Stop log	m	10	80	800	-	-	80	800
Rock riprap	m <sup>3</sup>	40	-	180	-	220	10	400
Gate & Metal Works	l.s	-	-	25,070	5.5	216,730	-	241,800
Siphon								
Earth Works								
Excavation	m <sup>3</sup>	3,300	0.6	2,000	1.4	4,600	2.0	6,600
Backfill	m <sup>3</sup>	2,600	0.7	1,800	2.3	6,000	3	7,800
Embankment	m <sup>3</sup>	700	0.5	350	2.0	1,400	2.5	1,750
Concrete Works								
Structural (Type-A)	m <sup>3</sup>	300	52	15,600	28	8,400	80	24,000
Foundation (Type-B)	m <sup>3</sup>	50	54	2,700	16	800	70	3,500

- to be continued -

Item	Unit	Quantity	Local Currency		Foreign Currency		Total
			Unit Cost	Amount	Unit Cost	Amount	
Reinforcement bar	ton	30	77	2,300	623	18,700	21,000
Concrete form	m <sup>2</sup>	2,100	6	12,600	-	-	12,600
Metal works	L.S.	-	1,150	1,150	-	4,600	5,750
Temporary Works	m <sup>3</sup>	1,000	0.3	300	2.2	2,200	2,500
Coffering	ton	70	10	700	790	55,300	56,000
Sheet pile	m	500	3.0	1,500	4.0	2,000	3,500
Access road	m	-	-	761,000	-	1,974,000	2,735,000
Sub-total							
Secondary Canal							
Canals							
Earth Works							
Excavation	m <sup>3</sup>	8,500	0.8	6,800	1.7	14,450	21,250
Embankment	m <sup>3</sup>	275,900	0.5	137,950	2.0	551,800	689,750
Stripping	m <sup>2</sup>	44,000	0.1	4,400	0.4	17,600	22,000
Sod facing	m	226,000	0.1	22,600	0.1	22,600	45,200
Related Structures							
Earth Works							
Excavation	m <sup>3</sup>	7,300	0.6	4,400	1.4	10,200	14,600
Backfill	m <sup>3</sup>	4,700	0.7	3,300	2.3	10,800	14,100
Concrete Works							
Structural (Type-A)	m <sup>3</sup>	1,700	52	88,400	28	47,600	136,000
Foundation (Type-B)	m <sup>3</sup>	700	54	37,800	16	11,200	49,000
Reinforcement bar	ton	100	77	7,700	623	62,300	70,000
Concrete form	m <sup>2</sup>	7,000	6	42,000	-	-	42,000
P.C. pipe (Total length 1,550 m)	L.S.	-	-	24,500	-	2,400	26,900
Concrete block lining	m <sup>3</sup>	80	90	7,200	10	800	8,000
Stop log	m <sup>3</sup>	10	80	800	-	-	800
Gate & Metal works	L.S.	-	-	15,850	-	204,550	220,400
Booster Pumps & Motor	L.S.	-	-	12,300	-	187,700	200,000
Sub-total				416,000		1,144,000	1,560,000
6. Drainage Canal							
Earth Works							
Excavation	m <sup>3</sup>	970,000	0.6	582,000	1.4	1,358,000	1,940,000
Related Structure							
Earth Works							
Excavation	m <sup>3</sup>	2,000	0.6	1,200	1.4	2,800	4,000
Backfill	m <sup>3</sup>	1,100	0.7	800	2.3	2,500	3,300
Concrete Works							
Structural (Type-A)	m <sup>3</sup>	1,300	52	67,600	28	36,400	104,000
Foundation (Type-B)	m <sup>3</sup>	60	54	3,200	16	1,000	4,200
Reinforcement bar	ton	95	77	7,300	623	59,200	66,500
Concrete form	m <sup>2</sup>	4,500	16	27,000	-	-	27,000
P.C. Pipe (Total length 40 m)	L.S.	-	-	1,800	-	200	2,000
Back riprap	m <sup>3</sup>	400	4.5	1,800	5.5	2,200	4,000
Earth Works							
Excavation	m <sup>3</sup>	1,100	0.6	700	1.4	1,500	2,200
Backfill	m <sup>3</sup>	800	0.7	600	2.3	1,800	2,400

- to be continued -

Item	Unit	Quantity	Local Currency		Foreign Currency		Total	
			Unit Cost	Amount	Unit Cost	Amount	Unit Cost	Amount
Concrete	m <sup>3</sup>	580	52	30,200	28	16,200	80	46,400
Structural	m <sup>3</sup>	20	54	1,100	16	300	70	1,400
Foundation	m <sup>3</sup>	40	77	3,100	623	24,900	700	28,000
Reinforcement bar	ton	1,600	6	9,600	-	-	6.0	9,600
Concrete form	m <sup>2</sup>			738,000		1,507,000		2,245,000
Sub-total								
7. Farm Road								
Main farm roads	m <sup>3</sup>	48,500	0.1	4,900	0.4	19,400	0.5	24,300
Stripping	m <sup>3</sup>	152,000	1.0	152,000	2.5	380,000	3.5	532,000
Embankment	m <sup>3</sup>	36,200	3.5	126,700	2.5	90,500	6.0	217,200
Gravel metalling	m <sup>3</sup>	30,000	0.1	3,000	0.4	12,000	0.5	15,000
Secondary farm roads	m <sup>3</sup>	79,000	0.3	23,700	2.2	173,800	2.5	197,500
Stripping	m <sup>3</sup>	7,000	0.1	700	0.4	2,800	0.5	3,500
Embankment	m <sup>3</sup>	22,000	1.0	22,000	2.5	55,000	3.5	77,000
Link road	m <sup>3</sup>							
Stripping	m <sup>3</sup>	1,100	0.6	660	1.4	1,500	2.0	2,200
Embankment	m <sup>3</sup>	1,600	0.7	1,120	2.3	1,400	3.0	1,800
Backfill	m <sup>3</sup>	650	52	33,800	28	18,200	80	52,000
Concrete work	m <sup>3</sup>	200	54	10,800	16	3,200	70	14,000
Structural (Type-A)	m <sup>3</sup>	30	77	2,310	623	18,700	700	21,000
Foundation (Type-D)	ton	300	6	1,800	-	-	6.0	1,800
Reinforcement bar	m <sup>2</sup>	24,000	0.5	12,000	2.0	48,000	2.5	60,000
Concrete form	m <sup>2</sup>			431,000		838,000		1,259,000
Temporary works	m <sup>2</sup>							
Coffering	m <sup>2</sup>							
Sub-total								
8. On-farm Development								
Canals	m <sup>3</sup>	15,000	1.5	22,500	-	-	1.5	22,500
Tertiary canal	m <sup>3</sup>	520,000	2.5	1,300,000	-	-	2.5	1,300,000
Excavation	m <sup>3</sup>	130,000	2.0	260,000	-	-	2.5	550,000
Embankment	m <sup>3</sup>	10,000	2.0	20,000	-	-	2.0	20,000
Collector Drain	m <sup>3</sup>	10,000	3.0	30,000	-	-	3.0	30,000
Excavation	m <sup>3</sup>	1,500	80	120,000	-	-	80	120,000
Related Structures	m <sup>3</sup>	1,300	70	91,000	-	-	70	14,000
Earth Works	m <sup>3</sup>	100	700	70,000	-	-	700	70,000
Excavation	ton	16,000	6.0	96,000	-	-	6.0	96,000
Backfill	m <sup>3</sup>	100	80	8,000	-	-	80	12,500
Concrete	m <sup>3</sup>			2,503,000				2,503,000
Structural (Type-A)	m <sup>3</sup>							
Foundation (Type-D)	ton							
Reinforcement bar	m <sup>2</sup>							
Concrete form	m <sup>2</sup>							
Stop log	m <sup>2</sup>							
Sub-total								

- to be continued -



Item	Unit	Quantity	Local Currency		Foreign Currency		Total	
			Unit Cost	Amount	Unit Cost	Amount	Unit Cost	Amount
9. Clearing and Reclamation								
Land Reclamation	ha	10,150	16	162,000	-	-	16	162,000
Forest Clearing	ha	530	4,230	2,200,000	-	-	4,230	2,200,000
Sub-total				<u>2,362,000</u>				<u>2,362,000</u>
10. Land Compensation	ha	2,100	100	210,000	-	-	100	210,000
Sub-total				<u>210,000</u>				<u>210,000</u>

**ANNEX J**  
**ECONOMIC AND FINANCIAL STUDIES**

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Table - J1 - ECONOMIC PRICE OF SUGARCANE  
(EXPORT SUBSTITUTION)

---

	<u>\$/ton</u>
International market price <sup>/1</sup> of sugar	337
Loading, port and storage charge	15
Transportation cost from Tegucigalpa to Perto Cortes	21
Selling price of Central Sugar Association	301
Handling charge of Central Sugar Association	20
Transportation cost from project area to Tegucigalpa	12
Selling price of sugar factory	269
Processing cost	143
Farmgate price of sugar cane <sup>/2</sup> (Purchasing price of sugar factory)	12.6

---

/1 IBRD projected price for 1985 at 1977 constant price.

/2 Rendment: 10%

Table J2 ECONOMIC PRICE OF COTTON  
(EXPORT SUBSTITUTION)

---

	<u>\$/ton</u>
International market price <sup>/1</sup>	1,467
Shipping cost include insurance	87
FOB Perto Cortes	1,380
Loading, port and storage charge	15
Transportation cost from San Lorenzo to Puerto Cortes	28
Selling price of factory	1,337
Processing cost	828
Farmgate price of seed cotton	509

---

<sup>/1</sup> IBRD projected price for 1985 at 1977 constant price.

Table-J3 ECONOMIC PRICE OF MAIZE  
(IMPORT SUBSTITUTION)

---

	<u>\$/ton</u>
International market price <sup>/1</sup>	129
Shipping cost include insurance	5
CIF Perto Cortes	134
Unloading, port and storage charge	15
Transportation cost from Perto Cortes to Project area	31
Farmgate price in the project area	180

---

<sup>/1</sup> IBRD projected price for 1985 at 1977 constant price

Table - J4. ECONOMIC PRICE OF SORGHUM  
(IMPORT SUBSTITUTION)

---

	<u>\$/ton</u>
International market price <sup>/1</sup>	112
Shipping cost include insurance	5
CIF Puerto Cortes	117
Unloading, port and storage charge	15
Transportation cost from Puerto Cortes to project area	31
Farmgate price in project area	163

---

<sup>/1</sup> IBRD projected price for 1985 at 1977 constant price

Table J5 ECONOMIC PRICE OF RICE  
(IMPORT SUBSTITUTION)

---

	<u>\$/ton</u>
International market price <sup>/1</sup>	390
Shipping cost include insurance	23
CFR San Lorenzo	413
Unloading, port and storage charge	15
Transportation cost from San Lorenzo to Choluteca	4
Selling price of Choluteca	432
Milling cost	-91
Price of paddy (Milling rate: 60%)	205
Transportation cost from project area to Choluteca	-4
Farmgate price of paddy	201

---

<sup>/1</sup> IBRD projected price for 1985 at 1977 constant price.



Table - J6 ECONOMIC PRICE OF BEEF  
(EXPORT SUBSTITUTION)

---

	<u>\$/ton</u>
International market price <sup>/1</sup>	2,160
Loading, port and storage charge	15
Transportation cost from Choluleca to Puerto Cortes	46
Selling price of slaughter house	2,009
Cost of slaughter	231
Farmgate price of cattle (liveweight) <sup>/2</sup>	613

---

<sup>/1</sup> IBRD projected price for 1985 at 1977 constant price.

<sup>/2</sup> \$2,009 - \$231 = \$1,778  
\$1,778 x dressing rate 34,5% = \$613/ton

Table-J7 . ECONOMIC PRICE OF UREA  
(IMPORT SUBSTITUTION)

---

	Urea <u>\$/ton</u>
International market price <sup>/1</sup>	190
Shipping cost include insurance	56
CIF Puerto Cortes	246
Unloading, port and storage facilities	15
Transportation cost from Perto Cortes to project area	31
Selling price in project area	292

---

<sup>/1</sup> IBRD projected price for 1985 at 1977 constant price

Table-J8 PRICE OF AGRICULTURAL PRODUCT

Unit: \$

Description	Unit	Economic	Financial
Sugar cane	ton	12.6	9.37
Seed cotton	ton	509	562
Maize	ton	180	124
Sorghum	ton	163	102
Beans	ton	264	264
Sesame	ton	330	330
Rice (Paddy)	ton	201	187
Melon	ton	208	208
Water melon	ton	72	72
Vegetables (tomatos assumed)	ton	107	107
Milk	kl	124	124
Cattle (liveweight)	ton	0.61	0.35

Table-J9 PRICE OF AGRICULTURAL INPUT

	Unit	Economic	Financial
Unit: \$			
<b>Seeds/Seedlings</b>			
Sugar cane	ton	12.60	9.37
Cotton seed	kg	0.29	0.32
Maise	kg	0.64	0.44
Sorghum	kg	1.05	0.66
Beans	kg	0.40	0.40
Sesame	kg	0.33	0.33
Rice	kg	0.42	0.39
Melon	kg	13.95	13.95
Water melon	kg	10.00	10.00
Vegetable (tomatos assumed)	kg	10.00	10.00
<b>Fertilizers</b>			
12 : 24 : 12	kg	0.32	0.22
15 : 15 : 15	kg	0.35	0.24
Urea	kg	0.29	0.20
<b>Fungicides</b>			
Daconil	kg	14.36	9.90
Dithane	kg	3.83	2.64
Banlate (M-45)	kg	33.99	23.44
<b>Insecticides</b>			
Furadan	kg	2.39	1.65
Tomaron	ℓ	12.69	8.75
Dipterex	kg	11.60	8.00
Orthene	kg	20.36	14.04
Lannate	kg	34.92	24.08
Aldrin	kg	0.96	0.66
Malathion	kg	5.08	3.50
<b>Herbicides</b>			
Gesaprim	kg	4.71	3.25
2 : 4 - D	ℓ	3.06	2.11
DNA 6	ℓ	4.00	2.76
Atrazine	kg	12.33	8.50

Table - J 10 ECONOMIC NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
 (1) SUGAR CANE (ESTATE FARM)

	Plant Cane (\$)	Ratoon Cane (\$)
I) Gross return:		
- Plant cane (100 ton/ha x \$12.6/ton)	<u>1.260</u>	<u>1.134</u>
- Ratoon cane (90 ton/ha x \$12.6/ton)		
II) Production cost:		
Land preparation (by machinery)	55.71	
Planting or ratooning	32.14	12.86
Application of fertilizers	20.71	20.71
Application of agro-chemicals	4.29	4.28
Irrigating	96.42	96.42
Weeding	42.86	42.86
Harvesting	143.00	128.70
Transportation	165.00	148.50
Other works (earthing etc.)	50.00	50.00
Farming materials		
- Seed (6 ton/ha)	75.60	
- Fertilizers	128.70	128.70
- Agro-chemicals	35.48	35.48
Miscellaneous	42.50	33.43
Total (Rounded)	<u>892.41</u> (892)	<u>701.94</u> (702)
III) Net return	<u>368</u>	<u>432</u>

Table - J 10 ECONOMIC NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
 (2) SUGAR CANE (OUTGROWERS' FARM)

	<u>Plant Cane</u> (S)	<u>Ratoon Cane</u> (S)
I) Gross return		
- Plant cane (90 ton/ha x \$12.6/ha)	<u>1.134</u>	<u>1.008</u>
- Ratoon cane (80 ton/ha x \$12.6/ha)		
II) Production cost		
Land preparation by machinery	64.29	-
Planting or ratooning	21.43	35.71
Application of fertilizers	20.71	20.71
Application of agro-chemicals	3.57	4.29
Weeding	42.85	28.57
Harvesting	128.70	114.40
Transportation	148.50	132.00
Other works	50.00	67.14
Farming materials		
- Seed (10 ton/ha)	126.00	-
- Fertilizers	115.30	115.30
- Agro-chemicals	10.35	10.35
Miscellaneous	36.59	26.42
Total	<u>768.29</u>	<u>554.89</u>
(Rounded)	(768)	(555)
III) Net return	<u>366</u>	<u>453</u>

Table - J 10 ECONOMIC NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
 (3) SUGAR CANE (EXPANDED OUTGROWERS' FARM)

	<u>Plant Cane</u> ( \$ )	<u>Ratoon Cane</u> ( \$ )
I) Gross return		
- Plant cane (80 ton/ha x \$12.6/ha)	<u>1,008</u>	<u>882</u>
- Ratoon cane (70 ton/ha x \$12.6/ha)		
II) Production cost		
Land preparation by machinery	64.29	-
Planting and ratooning	21.43	35.71
Application of fertilizers	20.71	20.71
Application of agro-chemicals	3.57	4.29
Weeding	42.85	28.57
Harvesting	114.40	100.10
Transportation	132.00	115.50
Other works	50.00	67.14
Farming materials		
- Seed (10 ton/ha)	126.00	-
- Fertilizers	115.30	115.30
- Agro-chemicals	10.35	10.35
Miscellaneous	35.05	24.88
Total (Rounded)	<u>735.95</u> (736)	<u>522.55</u> (523)
III) Net return	<u>272</u>	<u>359</u>

Table - J 10 ECONOMIC NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
(4) COTTON

---

	<u>Amount</u> (₹)
I) Gross return (2 ton/ha x \$509/ton)	<u>1.018.00</u>
II) Production cost:	
Land preparation by machinery	39.29
Seeding	7.15
Resowing	5.72
Pinching	5.72
Cultivating by machinery	20.00
Application of fertilizer	10.00
Weeding	40.00
Application of agro-chemicals by air craft	71.43
Harvesting	88.89
Other works	9.29
Transportation	21.43
Farming materials	
Seed (25kg/ha)	9.10
Fertilizers	109.62
Insecticides	271.55
Sacks, string, etc.	5.71
Miscellaneous	107.24
Total	<u>822.14</u>
(Rounded)	(822)
III) Net return	<u>196</u>

---



Table - J 10 ECONOMIC NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
(5) MAIZE (SEMI-MECHANIZED FARMING)

---

	<u>Amount</u> ( \$ )
I) Gross return (2.0 tons/ha x \$180/ton)	<u>360</u>
II) Production cost	
Land preparation by machinery	35.71
Seeding and fertilizer application	10.71
Application of split fertilizer	4.29
Cultivating by machinery	11.43
Application of agro-chemicals	7.14
Weeding and other works	5.36
Harvesting	19.65
Transportation	7.14
Farming materials	
- Seed	10.24
- Fertilizers	53.85
- Agro-chemicals	51.78
Miscellaneous	10.87
Total	<u>228.17</u>
(Rounded)	(228)
III) Net return	<u>132</u>

---

Table - J.10 ECONOMIC NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
(6) MAIZE (TRADITIONAL FARMING)

---

	<u>Amount</u> (S)
I) Gross return (1.6 tons/ha x \$180/ton)	<u>288.00</u>
II) Production cost	
Land preparation	28.57
Seeding	10.71
Application of agro-chemicals	7.14
Weeding and other works	38.95
Harvesting and threshing	15.72
Transportation	5.71
Farming materials	
- Seed	10.24
- Agro-chemicals	51.78
Miscellaneous	8.44
Total	<u>177.26</u>
(Rounded)	(177)
III) Net return	<u>111</u>

---

Table - J 10 ECONOMIC NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
(7) SORGHUM (SEMI-MECHANIZED FARMING)

---

	<u>Amount</u> <u>(\$)</u>
I) Gross return (2.0 tons/ha x \$163/ton)	<u>326</u>
II) Production cost	
Land preparation by machinery	35.71
Seeding and basic fertilizer application	10.00
Application of agro-chemicals	4.29
Weeding and other works	17.86
Harvesting and threshing	22.33
Transportation	7.14
Farming materials	
- Seed	10.50
- Fertilizers	53.85
- Agro-chemicals	23.30
Miscellaneous	9.25
Total	<u>194.23</u> <u>(194)</u>
III) Net return	<u>132</u>

---

Table - J-10 ECONOMIC NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
(8) SORGHUM (TRADITIONAL FARMING)

---

	<u>Amount</u> (S)
I) Gross return (1.6 tons/ha x \$163/ton)	<u>260.80</u> (261)
II) Production cost	
- Land preparation	28.57
- Seeding	5.71
- Application of fertilizer	4.29
- Application of agro-chemicals	4.29
- Weeding and other works	17.86
- Harvesting and threshing	17.86
- Transportation	5.71
- Farming materials	
- Seed	7.35
- Fertilizers	53.85
- Agro-chemicals	10.35
- Miscellaneous	7.79
Total	<u>163.63</u> (164)
III) Net return	<u>97</u>

---

Table - J 10 ECONOMIC NET RETURN PER HECTARE FOR AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
(9) SESAME

---

	<u>Amount</u> ( <u>\$</u> )
I) Gross return (1.3 tons/ha x \$330/ton)	<u>429.00</u>
II) Production cost	
Land preparation by machinery	27.50
Seeding and basic fertilizer application	8.57
Thinning	4.29
Cultivating and earthing by machinery	17.86
Application of split fertilizers	3.57
Application of insecticides	8.57
Harvesting	21.43
Transportation	8.57
Farming materials	
- Seed	5.28
- Fertilizers	105.65
- Insecticides	20.72
Miscellaneous	23.21
Total	<u>255.22</u> (255)
III) Net return	<u>174</u>

---

Table - J 10 ECONOMIC NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
(10) RICE

---

	<u>Amount</u> (S)
I) Gross return (3-ton/ha x \$201/ton)	<u>603</u>
II) Production cost	
Land preparation by machinery	42.86
Seeding by machinery	8.57
Application of fertilizers	7.14
Application of herbicides	14.29
Application of insecticides and fungicides	11.43
Weeding and other works	17.86
Control for birds damage	7.14
Harvesting	60.32
Transportation	11.10
Farming materials	
- Seed	42.00
- Fertilizers	111.85
- Herbicides	73.23
- Insecticides and fungicides	61.42
Miscellaneous	23.46
Total	<u>492.67</u>
(Rounded)	(493)
III) Net return	<u>110</u>

---

Table - J 10 ECONOMIC NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
(11) MELON

---

	<u>Amount</u> (S)
I) Gross return (5.2 ton/ha x \$208)	<u>1.082</u>
II) Production cost	
Land preparation by machinery	78.57
Seeding	35.71
Crop management (weeding, rearrangement of fruits, etc.)	78.57
Application of fertilizers	21.43
Application of insecticides and fungicides	54.64
Watch	7.14
Protection from sunburn	17.14
Harvesting	42.52
Transportation	14.62
Farming materials	
- Seed 1.35 kg	27.90
- Fertilizer	181.34
- Insecticides	112.52
- Fungicides	63.61
- Lime	5.18
- Pail	3.57
Miscellaneous	74.45
Total	<u>818.91</u>
(Rounded)	<u>(819)</u>
III) Net return	<u>263</u>

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Table - J 10 ECONOMIC NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
(12). WATER MELON

---

	<u>Amount</u> ( <u>\$</u> )
I) Gross return (8 tons/ha x \$72/ton)	<u>576.00</u>
II) Production cost	
Land preparation by machinery	51.07
Seeding	23.21
Crop management (weeding, rearrangement of fruits, etc.)	51.07
Application of fertilizers	13.93
Application of insecticides and fungicides	35.52
Watch	4.64
Protection from sun burn	11.14
Harvesting	4.08
Transportation	33.07
Farming materials	
- Seed	20.00
- Fertilizers	108.75
- Insecticides	56.26
- Fungicides	31.81
- Other materials	3.69
- Pail	2.00
Miscellaneous	22.51
Total	<u>472.75</u>
(Rounded)	(473)
III) Net return	<u>103</u>

---



Table - J 10 ECONOMIC NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
 (13) PASTURE (CATTLE RAISING)

	Amount (\$)
I) Gross return	
- Beef (130 kg liveweight)	79.30
- Milk (190 l)	23.56
Total	<u>102.86</u>
(Rounded)	(103)
II) Production cost	
1) Recovery of initial investment for pastures and fences	
- Cultivated pasture: \$10/ha <sup>/3</sup> x 0.6 ha	6.00
- Natural pasture: \$5/ha <sup>/4</sup> x 0.4 ha	2.00
2) Raising cost	
- Labour cost: 2.0 head/ha x 0.01 men/head x \$730/man/year	14.60
- Veterinary cost: 2.0 heads x \$0.7/head	1.40
- Miscellaneous	1.60
Total	<u>25.60</u>
(Rounded)	(26)
III) Net Return	<u>77</u>

---

<u>/1:</u>	0.4 head x 320 kg/head = 130 kg (liveweight)
<u>/2:</u>	0.73 cows x 260 l cow = 190 l
<u>/3:</u>	Land preparation and seeding by machinery : \$55.68/ha
	Seed (20 kg/ha) : \$20/ha
	Fences (100 m) : \$3.6/ha
	Miscellaneous (include maintenance cost) : \$15.86/ha
	<u>Total</u> : \$95.14/ha

\$ 95.14/ha + 10 years (useful life) = \$10/ha

/4: Estimated at about \$5/ha.

**Table - J 11. ECONOMIC NET RETURN PER HECTARE FOR AGRICULTURAL PRODUCTS - WITH PROJECT**  
**(1) SUGAR CANE (PLANT CANE)**

	<u>Amount</u> ( \$ )
I) <u>Gross return (150 ton/ha x \$12.6/ton)</u>	<u>1.890</u>
II) <u>Production cost</u>	
Land preparation by tractor	49.98
Planting (15 M-D)	30.00
Basic fertilizer application	
- Machinery	17.12
- Labourer (1 M-D)	2.00
Earthing and split fertilizer application	
- Machinery (2 times)	26.84
- Labourer (2 M-D)	4.00
Irrigating (12 M-D)	24.00
Rodent control (0.5 M-D x 2 times)	2.00
Weeding (5 M-D x 2 times)	20.00
Harvesting	214.50
Transportation	247.50
Farming materials	
- Seed cane (6 tons)	75.60
- Fertilizers	
: Compound <u>1</u>	115.50
: Urea <u>2</u>	63.80
- Agro-chemicals	
: Harbicides <u>3</u>	18.50
: Rodenticides <u>4</u>	8.70
Miscellaneous	46.00
<u>Total</u>	<u>966.04</u>
(Rounded)	(966)
III) <u>Net return</u>	<u>924</u>

1 330kg (15:15:15)

2 220kg

3 Atrazine 1.5kg

4 Zinc phosphate 3kg

Table - J 11 ECONOMIC NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS - WITH PROJECT  
 (2) SUGAR CANE (RATOON CANE)

	<u>Amount</u> ( \$ )
I) Gross return (140 ton/ha x \$12.6/ton)	1,764
II) Production cost	
Ratooning	
- Root cutting by tractor	14.92
- Field clearing (5 M-D)	10.00
Basic fertilizer application	
- Machinery	17.12
- Labourer (1 M-D)	2.00
Earthing and split fertilizer application	
- Machinery (1 time)	13.42
- Labourer (1 M-D)	2.00
Irrigating (10 M-D)	20.00
Rodent control (0.5 M-D x 2 times)	2.00
Weeding (5 M-D x 2 times)	20.00
Harvesting	200.20
Transportation	231.00
Farming materials	
- Fertilizers	
: Compound <u>1</u>	115.50
: Urea <u>2</u>	63.80
- Agro-chemicals	
: Herbicides <u>3</u>	18.50
: Rodenticides <u>4</u>	8.70
Miscellaneous	36.96
Total (Rounded)	<u>776.12</u> (776)
III) Net return	988

1 330kg (15:15:15)

2 220kg

3 Atrazine 1.5kg

4 Zinc phosphate 3kg

Table - J 11 ECONOMIC NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS - WITH PROJECT  
(3) COTTON

	<u>Amount</u> (S)
I) Gross return (3 ton/ha x \$509/ton)	<u>1.527</u>
II) Production cost	
Land preparation by machinery	36.56
Seeding and basic fertilizer application	
- Machinery	17.12
- Labourer (1 M-D)	2.00
Reseeding and thinning (5 M-D)	10.00
Earthing and split fertilizer application	
- Machinery	13.42
- Labourer (1 M-D)	2.00
Cultivating by machinery	14.92
Application of agro-chemicals by aircraft(15 times)	85.65
Irrigating (12 M-D)	24.00
Harvesting (67 M-D)	134.00
Transportation	30.00
Other works (4 M-D)	8.00
Farming materials	
- Seed (25kg)	7.25
- Fertilizers : Compound <u>1</u>	67.2
: Urea <u>2</u>	52.20
- Agro-chemicals : Herbicides <u>3</u>	7.07
: Insecticides <u>4</u>	305.2
- Sacks (40 sacks x US\$0.3)	12.00
Miscellaneous	41.43
<b>Total</b>	<b><u>870.02</u></b>
(Rounded)	<b>(870)</b>
III) Net return	<u>657</u>

1 210kg (12:24:12)

2 180kg

3 Planaxin 1.5kg

4 Malathion 20 l, Orthene 10kg

Table - J 11 ECONOMIC NET RETURN PER HECTARE FOR AGRICULTURAL PRODUCTS - WITH PROJECT  
(4) MAIZE

	<u>Amount</u> (S)
I) Gross return (4.0 ton/ha x \$180/ton)	<u>720</u>
II) Production cost	
Land preparation by machinery	36.56
Seeding and basic fertilizer application:	
- Machinery	17.12
- Labourer (1 M-D)	2.00
Earthing and split fertilizer application:	
- Machinery (1 times)	13.42
- Labourer (1 M-D)	2.00
Cultivating by machinery	14.92
Application of agro-chemicals by aircraft (3 times)	17.13
Irrigating (5 M-D)	10.00
Harvesting (5 M-D)	10.00
Shelling and drying	
- Machinery (8 hrs)	6.88
- Labourer (4 M-D)	8.00
Inner transportation by tractor	9.08
Other works (2.2 M-D)	4.40
Farming materials	
- Seed (16kg)	10.24
- Fertilizers	
: Compound <sup>/1</sup>	67.20
: Urea <sup>/2</sup>	49.30
- Agro-chemicals	
: Herbicides <sup>/3</sup>	7.07
: Insecticides <sup>/4</sup>	58.70
Miscellaneous	17.20
<b>Total</b>	<b><u>361.22</u></b>
<b>(Rounded)</b>	<b><u>(361)</u></b>
III) Net return	<u>359</u>

<sup>/1</sup> 210kg (12:24:12)

<sup>/2</sup> 170kg

<sup>/3</sup> Gesaprim 1.5kg

<sup>/4</sup> Dipterex 3 (, Furadan 10kg

Table J 11 ECONOMIC NET RETURN PER HECTARE FOR AGRICULTURAL PRODUCTS - WITH PROJECT (5) SORGHUM

	<u>Amount</u> ( \$ )
I) Gross return (4 ton/ha x \$163/ton)	<u>652</u>
II) Production cost	
Land preparation by machinery	36.56
Seeding and basic fertilizer application	
- Machinery	17.12
- Labourer (1 M-D)	2.00
Earthing and split fertilizer application	
- Tractor	13.42
- Labourer (1 M-D)	2.00
Cultivating by machinery	14.92
Application of agro-chemicals by aircraft (1 time)	5.71
Irrigating (5 M-D)	10.00
Harvesting (4 M-D)	8.00
Threshing and drying	
- Machinery (6 hrs)	6.96
- Labourer (2 M-D)	4.00
Inner transportation by tractor	9.08
Farming materials	
- Seed (15kg)	15.75
- Fertilizers	
: Compound <u>1</u>	67.20
: Urea <u>2</u>	49.30
- Agro-chemicals : Herbicides <u>3</u>	7.07
: Insecticides <u>4</u>	46.40
Miscellaneous	15.77
Total	<u>331.26</u>
(Rounded)	(331)
III) Net return	<u>321</u>

1 210kg (12:24:12)

2 170kg

3 Gesaprim 1.5kg

4 Dipterex 4 (

Table - J 11 ECONOMIC NET RETURN PER HECTARE FOR AGRICULTURAL PRODUCTS - WITH PROJECT (6) BEANS

	<u>Amount</u> (S)
I) Gross return (2.0 ton/ha x \$264/ton)	<u>528</u>
II) Production cost	
Land preparation by machinery	36.56
Seeding and basic fertilizer application	
- Machinery	17.12
- Labourer (1 M-D)	2.00
Reseeding (2 M-D)	4.00
Application of agro-chemicals by sprayer	
- Machinery (19.2 hrs)	25.34
- Labourer (2.4 M-D)	4.80
Cultivating by machinery	14.92
Irrigating (5 M-D)	10.00
Harvesting (10 M-D)	20.00
Threshing and drying	
- Machinery (5 hrs)	5.80
- Labourer (2.2 M-D)	4.40
Inner transportation by tractor	5.45
Other works (2.8 M-D)	5.60
Farming materials	
- Seed (45kg)	18.00
- Fertilizers	
: Compound <sup>1</sup>	70.00
: Urea <sup>2</sup>	11.60
- Agro-chemicals	
: Insecticides <sup>3</sup>	10.16
Miscellaneous	13.29
Total	<u>279.04</u>
(Rounded)	(279)
III) Net return	<u>249</u>

<sup>1</sup> 200kg (15:15:15)

<sup>2</sup> 40kg

<sup>3</sup> Molathion 2 (

Table - J.11 ECONOMIC NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS - WITH PROJECT  
(7) SESAME

	<u>Amount</u> (S)
I) Gross return (1.5 ton/ha x \$330/ton)	<u>495</u>
II) Production cost	
Land preparation by machinery	36.56
Seeding and basic fertilizer application	
- Machinery	17.12
- Labourer	2.00
Earthing and split fertilizer application	
- Machinery	13.42
- Labourer (1 M-D)	2.00
Cultivating by machinery	14.92
Application of agro-chemicals by aircraft (2 times)	11.42
Irrigating (7 M-D)	14.00
Harvesting (2 M-D)	4.00
Threshing and drying (2 M-D)	4.00
Inner transportation by tractor	6.81
Other works (thinning, etc. 2 M-D)	4.00
Farming materials	
- Seed (3kg)	1.2
- Fertilizer	
: Compound <sup>1</sup>	25.60
: Urea <sup>2</sup>	20.30
- Agro-chemicals	
: Herbicides <sup>3</sup>	9.42
: Insecticides <sup>4</sup>	11.60
Miscellaneous	9.92
Total	<u>208.29</u>
(Rounded)	(208)
III) Net return	<u>287</u>

<sup>1</sup> 80kg (12:24:12)

<sup>2</sup> 70kg

<sup>3</sup> Herban 2kg

<sup>4</sup> Dipterex 1 (



Table - J 11 ECONOMIC NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS:- WITH PROJECT  
 (8) RICE (WET SEASON)

	<u>Amount</u> (S)
I) Gross return (5.0 ton/ha x \$201/ton)	<u>1.005</u>
II) Production cost	
Land preparation by machinery	36.56
Seeding and basic fertilizer application	
- Machinery	17.12
- Labourer (1 M-D)	2.00
Split fertilizer application (1.5 M-D)	3.00
Application of agro-chemicals by aircraft (3 times)	17.13
Weeding (5 M-D)	10.00
Irrigating (2.8 M-D)	5.60
Harvesting by combine	
- Combine (2.5 hrs)	54.95
- Assistant operator (2.5 hrs)	1.25
Transportation by truck	18.50
Other works (1 M-D)	2.00
Farming materials	
- Seed (70kg)	29.40
- Fertilizer	
: Compound	67.20
: Urea	49.30
- Agro-chemicals	
: Herbicides <sup>/1</sup>	89.18
: Insecticides <sup>/2</sup>	20.32
: Fungicides <sup>/3</sup>	47.80
Miscellaneous	23.57
<b>Total</b>	<b><u>494.88</u></b> <b>(495)</b>
III) Net return	<u>510</u>

/1 Propanil 20 (, 2-4 D 3 (

/2 Malathion 4 (

/3 Kasumin 20kg

Table - J 11 ECONOMIC NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS - WITH PROJECT  
(9) RICE (DRY SEASON)

	<u>Amount</u> (S)
I) Gross return (5.0 ton/ha x \$201/ton)	<u>1,005</u>
II) Production cost	
Land preparation	36.56
Seeding and basic fertilizer application	
- Machinery	17.12
- Labourer (1 M-D)	2.00
Split fertilizer application (1.5 M-D)	3.00
Application of agro-chemicals by aircraft (3 times)	17.13
Weeding (5 M-D)	10.00
Irrigating (4 M-D)	8.00
Harvesting by combine	
- Combine (2.5 hrs)	54.95
- Assistant operator (2.5 hrs)	1.25
Transportation by truck	18.50
Other works (1 M-D)	2.00
Farming materials	
- Seed (70kg)	29.40
- Fertilizers	
: Compound <sup>1</sup>	67.20
: Urea <sup>2</sup>	49.30
- Agro-chemicals	
: Herbicides <sup>3</sup>	89.18
: Insecticides <sup>4</sup>	20.32
: Fungiudes <sup>5</sup>	47.80
Miscellaneous	23.69
<b>Total</b>	<u>497.40</u>
<b>(Rounded)</b>	<b>(497)</b>
III) Net return	<u>508</u>

<sup>1</sup> 210kg (12:24:12)

<sup>2</sup> 170kg

<sup>3</sup> Propanil 20 ( 2-4 D 3 (

<sup>4</sup> Malathion 4 (

<sup>5</sup> Kasumin 20kg

Table - J 11      ECONOMIC NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS WITH PROJECT  
 (10) MELON

	<u>Amount</u> ( <u>\$</u> )
I) Gross return (6.5 ton/ha x \$208)	<u>1,352</u>
II) Production cost	
Land preparation by machinery	36.56
Bed preparation and seeding	
- Machinery	13.42
- Labourer (4 M-D)	8.00
Split fertilizer application (2 M-D)	4.00
Weeding (20 M-D)	40.00
Application of agro-chemicals by sprayer (3 times)	
- Machinery (sprayer)	3.96
- Labourer (4.5 M-D)	9.00
Watch (20 M-D)	40.00
Irrigating (6 M-D)	12.00
Rearrangement of fruits (10 M-D)	20.00
Harvesting (20 M-D)	40.00
Inner transportation by tractor	34.05
Other works (2.4 M-D)	4.80
Farming materials	
- Seed (1.5kg)	20.93
- Fertilizers :	
Compound <u>/1</u>	185.50
Urea <u>/2</u>	66.70
- Agro-chemicals :	
Insecticides <u>/3</u>	153.34
Fungicides <u>/4</u>	75.16
- Pail	5.00
Miscellaneous	38.62
 Total	 <u>811.04</u>
(Rounded)	<u>(811)</u>
III) Net return	<u>541</u>

/1 530kg (15:15:15)

/2 230kg

/3 Orthene 4kg, Lannate 1kg, Tomaron 2 (, Dipterex 1kg

/4 Dithane M-45 7kg, Benlate 1kg, Daconil 1kg

Table - J 11. ECONOMIC NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS - WITH PROJECT  
(11) WATER MELON

	<u>Amount</u> ( \$ )
I) Gross return (12 ton/ha x \$72 ton)	<u>864</u>
II) Production cost	
Land preparation by machinery	36.56
Bed preparation and seeding	
- Machinery	13.42
- Labourer (4 M-D)	8.00
Split fertilizer application (2 M-D)	4.00
Weeding (20 M-D)	40.00
Application of agro-chemicals by sprayer (3 times)	
- Machinery (sprayer)	3.96
- Labourer (4.5 M-D)	9.00
Watch (10 M-D)	20.00
Irrigating (6 M-D)	12.00
Rearrangement of fruits (10 M-D)	20.00
Harvesting (10 M-D)	20.00
Transportation	40.86
Other works (2.4 M-D)	4.80
Farming materials	
- Seed (1.5kg)	15.00
- Fertilizers : Compound <u>1</u>	105.00
: Urea <u>2</u>	34.80
- Agro-chemicals : Insecticides <u>3</u>	81.44
: Fungicides <u>4</u>	41.17
- Pail	5.00
Miscellaneous	25.75
Total	<u>540.76</u>
(Rounded)	(541)
III) Net return	<u>323</u>

1 300kg (15:15:15)

2 120kg

3 Orthene 4kg

4 Dithane M-45 7kg, Daconil 1kg

Table - J 11 ECONOMIC NET RETURN PER HECTARE FOR AGRICULTURAL PRODUCTS - WITH PROJECT  
(12) VEGETABLE (TOMATOES)

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	<u>Amount</u> ( <u>\$</u> )
I) Gross return $\frac{1}{1}$ (20 ton/ha)	<u>2.145</u>
II) Production cost :	
Land preparation by machinery	36.56
Growing of seedlings (10 M-D)	20.00
Field operation for transplanting	
- Machinery	13.42
- Labourer (4 M-D)	8.00
Transplanting (40 M-D)	80.00
Weeding (20 M-D)	40.00
Split fertilizer application (2 M-D)	4.00
Irrigating (6 M-D)	12.00
Application of agro-chemicals by sprayer (5 times)	
- Machinery	6.60
- Labourer (10 M-D)	20.00
Cultivating by machinery (2 times)	29.84
Harvesting (90 M-D)	180.00
Inner transportation	68.10
Other works	20.00
Farming materials	
- Seed	10.00
- Fertilizers : Compound (15:15:15 530kg)	185.50
: Urea (230kg)	66.70
- Agro-chemicals : Insecticides $\frac{1}{2}$	317.64
: Fungicides $\frac{1}{3}$	153.20
- Baskets	50.00
Miscellaneous	66.08
Total	<u>1.387.64</u> (1.388)
III) Net-return	<u>757</u>

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$\frac{1}{1}$  Yield : 20 ton/ha (1.430 case). Price : \$1.5 case

$\frac{1}{2}$  Dipterex 16kg, Malathion 16kg, Tomaron 4

$\frac{1}{3}$  Dithane M-45 20kg, Caprantol 20kg

Table - J 12 FINANCIAL NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
 (1) SUGAR CANE (ESTATE FARM)

	<u>Plant Cane</u> (\$)	<u>Ratoon Cane</u> (\$)
I) Gross return	<u>937.00</u>	<u>843.30</u>
- Plant cane (100 ton/ha x \$9.37/ton)		(843)
- Ratoon cane (90 ton/ha x \$9.37/ton)		
II) Production cost		
Land preparation (by machinery)	55.71	-
Planting or ratooning	32.14	12.86
Application of fertilizers	20.71	20.71
Application of agro-chemicals	4.29	4.28
Irrigating	96.42	96.42
Weeding	42.86	42.86
Harvesting	143.00	128.70
Transportation	165.00	148.50
Other works (earthing etc.)	50.00	50.00
Farming materials		
- Seed (6 ton/ha)	56.22	-
- Fertilizers	88.40	88.40
- Agro-chemicals	24.47	24.47
Miscellaneous	38.96	30.86
Total	<u>818.18</u>	<u>648.06</u>
(Rounded)	(818)	(648)
III) Net return	<u>119</u>	<u>195</u>

Table - J 12

FINANCIAL NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
 (2) SUGAR CANE (OUTGROWERS' FARM)

	Plant Cane (\$)	Ratoon Cane (\$)
I) Gross return	843.30	749.60
- Plant cane:	(843)	(750)
(90 ton/ha x \$9.37/ha)		
- Ratoon cane:		
(80 ton/ha x \$9.37/ha)		
II) Production cost		
Land preparation by machinery	64.29	-
Planting or ratooning	21.43	35.71
Application of fertilizers	20.71	20.71
Application of agro-chemicals	3.57	4.29
Weeding	42.85	28.57
Harvesting	128.70	114.40
Transportation	148.50	132.00
Other works	50.00	67.14
Farming materials		
- Seed (10 ton/ha)	93.70	-
- Fertilizers	79.20	79.20
- Agro-chemicals	7.14	7.14
Miscellaneous	33.00	24.46
Interest on working capital <sup>/1</sup>	26.88	9.50
Total:	719.97	523.12
(Rounded)	(720)	(523)
III) Net return	<u>123</u>	<u>227</u>

<sup>/1</sup> Plant cane: Costs of farming materials (\$244.33)  
 x Interest rate (11%) = \$26.88

Ratoon cane: \$86.34 x 11% = \$9.50

Table - J 12 FINANCIAL NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
 (3) SUGAR CANE (EXPANDED OUTGROWERS' FARM)

	Plant Cane (\$)	Ratoon Cane (\$)
I) Gross return	<u>749.60</u>	<u>655.70</u>
- Plant cane (80 ton/ha x \$9.37/ha)	(750)	(656)
- Ratoon cane (70 ton/ha x \$9.37/ha)		
II) Production cost		
Land preparation by machinery	64.29	-
Planting and ratooning	21.43	35.71
Application of fertilizers	20.71	20.71
Application of agro-chemicals	3.57	4.29
Weeding	42.85	28.57
Harvesting	114.40	100.10
Transportation	132.00	115.50
Other works	50.00	67.14
Farming materials		
- Seed (10 ton/ha)	93.70	-
- Fertilizers	79.20	79.20
- Agro-chemicals	7.14	7.14
Miscellaneous	31.46	22.92
Interest on working capital <sup>/1</sup>	26.88	9.50
Total	<u>687.63</u>	<u>490.78</u>
(Rounded)	(688)	(491)
III) Net return	<u>62</u>	<u>165</u>

<sup>/1</sup> Plant cane: Costs of farming materials (\$244.33)  
 x Interest (11%) = \$26.88

Ratoon cane: \$86.34 x 11% = \$9.5



Table - J 12 FINANCIAL NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
 (4). COTTON

	<u>Amount</u> (\$)
I) Gross return (2 ton/ha x \$562/ton)	<u>1,124</u>
II) Production cost	
Land preparation by machinery	39.29
Seeding	7.15
Resowing	5.72
Pinching	5.72
Cultivating by machinery	20.00
Application of fertilizer	10.00
Weeding	40.00
Application of agro-chemicals by air plane	71.43
Harvesting	88.89
Other works	9.29
Transportation	21.43
Farming materials	
- Seed (25 kg/ha)	10.00
- Fertilizers	75.6
- Agro-chemicals	187.2
- Sacks, string, etc.	5.71
Miscellaneous	88.76
Interest on working capital <sup>/1</sup>	25.83
Total	<u>712.02</u>
(Rounded)	(712)
III) Net return	<u>412</u>

<sup>/1</sup> Cost of farming materials. (\$403.52)  
 x Interest rate (6.4%) = \$25.83

Table - J 12: FINANCIAL NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
 (5) MAIZE (SEMI-MECHANIZED FARMING)

	<u>Amount</u> ( <u>\$</u> )
I) Gross return (2.0 tons/ha x \$124/ton)	<u>248</u>
II) Production cost	
Land preparation by machinery	35.71
Seeding and fertilizer application	10.71
Application of split fertilizer	4.29
Cultivating by machinery	11.43
Application of agro-chemicals	7.14
Weeding and other works	5.36
Harvesting	19.65
Transportation	7.14
Farming materials	
- Seed	7.04
- Fertilizers	37.14
- Agro-chemicals	35.71
Miscellaneous	9.07
Interest on working capital <sup>/1</sup>	4.70
Total (Rounded)	<u>195.09</u> (195)
III) Net return	<u>53</u>

<sup>/1</sup> Costs of farming materials (\$127.03)  
 x Interest rate (3.7%) = \$4.70

Table - J 12 FINANCIAL NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
(6) MAIZE (TRADITIONAL FARMING)

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	<u>Amount</u> ( <u>\$</u> )
I) Gross return (1.6 tons/ha x \$124/ton)	<u>198</u>
II) Production cost	
Land preparation	28.57
Seeding	10.71
Application of agro-chemicals	7.14
Weeding and other works	38.95
Harvesting and threshing	15.72
Transportation	5.71
Farming materials	
- Seed	7.04
- Agro-chemicals	35.71
Miscellaneous	7.48
Total	<u>157.03</u>
(Rounded)	<u>(157)</u>
III) Net return	<u>41</u>

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Table - J.12 FINANCIAL NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
(7) SORGHUM (SEMI-MECHANIZED FARMING)

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	<u>Amount</u> ( <u>\$</u> )
I) Gross return (2.0 tons/ha x \$102/ton)	<u>204</u>
II) Production cost	
Land preparation by machinery	35.71
Seeding and basic fertilizer application	5.71
Application of agro-chemicals	4.29
Application of split fertilizer	4.29
Weeding and other works	17.86
Harvesting and threshing	22.33
Transportation	7.14
Farming materials	
- Seed (10 kg)	6.6
- Fertilizers	37.14
- Agro-chemicals	16.07
Miscellaneous	7.85
Interest on working capital <sup>/1</sup>	3.53
Total	<u>168.52</u>
(Rounded)	(169)
III) Net return	<u>35</u>

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<sup>/1</sup> Costs of farming materials (\$95.52)  
x Interest rate (3.7%) = \$3.53

Table - J 12 FINANCIAL NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
(8) SORGHUM (TRADITIONAL FARMING)

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	<u>Amount</u> (S)
I) Gross return (1.6 tons/ha x \$102/ton) (Rounded)	<u>163.20</u> (163)
II) Production cost	
Land preparation	28.57
Seeding	5.71
Application of fertilizer	4.29
Application of agro-chemicals	4.29
Weeding and other works	17.86
Harvesting and threshing	17.86
Transportation	5.71
Farming materials	
- Seed	4.62
- Fertilizers	37.14
- Agro-chemicals	7.14
Miscellaneous	6.66
Total	<u>139.85</u>
(Rounded)	(140)
III) Net return	<u>23</u>

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Table - J 12 FINANCIAL NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
(9) SESAME

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	<u>Amount</u> ( <u>\$</u> )
I) Gross return (1.3 tons/ha x \$330/ton)	<u>429.00</u>
II) Production cost	
Land preparation by machinery	27.50
Seeding and basic fertilizer application	8.57
Thinning	4.29
Cultivating and earthing by machinery	17.86
Application of split fertilizers	3.57
Application of insecticides	8.57
Harvesting	21.43
Transportation	8.57
Farming materials	
- Seed	5.28
- Fertilizers	72.86
- Insecticides	14.29
Miscellaneous	19.28
Interest on working capital <sup>/1</sup>	6.34
Total	<u>218.41</u>
(Rounded)	(218)
III) Net return	<u>211</u>

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<sup>/1</sup> Cost of farming materials (\$137.79)  
x Interest rate (4.6%) = \$6.34

Table - J 12

FINANCIAL NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
 (10) RICE (PADDY)

	<u>Amount</u> ( <u>\$</u> )
I) Gross return (3 ton/ha x \$198/ton)	<u>594</u>
II) Production cost	
Land preparation by machinery	42.86
Seeding by machinery	8.57
Application of fertilizers	7.14
Application of herbicides	14.29
Application of insecticides and fungicides	11.43
Weeding and other works	17.86
Control for birds damage	7.14
Harvesting and threshing	60.32
Transportation	11.10
Farming materials	
- Seed	39.00
- Fertilizers	77.14
- Herbicides	50.00
- Insecticides and fungicides	42.86
Miscellaneous	19.49
Interest on working capital <sup>/1</sup>	11.98
 Total (Rounded)	 <u>421.18</u> (421)
III) Net return	<u>173</u>

<sup>/1</sup> Costs of farming materials (\$260.43)  
 x Interest rate (4.6%) = \$11.98

Table - J. 12 FINANCIAL NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
(11) MELON

	<u>Amount</u> (\$)
I) Gross return (5.2 tons/ha x \$208)	<u>1,082</u>
II) Production cost	
Land preparation by machinery	78.57
Seeding	35.71
Crop management (weeding, rearrangement of fruits, etc.)	78.57
Application of fertilizers	21.43
Application of insecticides and fungicides	54.64
Watch	7.14
Protection from sunburn	17.14
Harvesting	42.52
Transportation	14.62
Farming materials	
- Seed (2 kg)	27.90
- Fertilizer	125.06
- Insecticides	77.60
- Fungicides	43.87
- Lime	3.57
- Pail	3.57
Miscellaneous	63.19
Interest on working capital <sup>/1</sup>	10.29
Total (Rounded)	<u>705.39</u> (705)
III) Net return	<u>377</u>

<sup>/1</sup> Costs of farming materials such as seed,  
fertilizers and agro-chemicals (\$278)  
x Interest rate (3.7%) = \$10.29



Table - J 12 FINANCIAL NET RETURN PER HECTARE FOR AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
(12) WATER MELON

	<u>Amount</u> ( <u>\$</u> )
I) Gross return (8 tons/ha x \$72/ton)	<u>576</u>
II) Production cost	
Land preparation by machinery	51.07
Seeding	23.21
Crop management (weeding, rearrangement of fruits, etc.)	51.07
Application of fertilizers	13.93
Application of insecticides and fungicides	35.52
Watch	4.64
Protection from sun burn	11.14
Harvesting	37.14
Transportation	33.06
Farming materials	
- Seed	20.00
- Fertilizers	75.00
- Insecticides	38.80
- Fungicides	21.94
- Lime	2.64
- Pail	2.00
Miscellaneous	21.06
Interest on working capital <sup>/1</sup>	5.86
Total	<u>448.08</u>
(Rounded)	(448)
III) Net return	<u>128</u>

<sup>/1</sup> Costs of farming materials such as seed, fertilizer and agro-chemicals (\$158.38)  
x Interest rate (3.7%) = \$5.86

Table - J 12. FINANCIAL NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS - WITHOUT PROJECT  
 (13) PASTURE (CATTLE RAISING)

	<u>Amount</u> ( <u>\$</u> )
<b>I) Gross return</b>	
- Beef (130 kg liveweight) <sup>/1</sup>	45.50
- Milk (190 l) <sup>/2</sup>	23.56
<b>Total</b>	<u>69.06</u>
<b>(Rounded)</b>	<b>(69)</b>
<b>II) Production cost</b>	
1) Recovery of initial investment for pastures and fences	
- Cultivated pasture: \$10/ha <sup>/3</sup> x 0.6 ha	6.00
- Natural pasture: \$5/ha <sup>/4</sup> x 0.4 ha	2.00
2) Raising cost	
- Labour cost:	14.31
1.96 heads/ha x 0.01 men/head	
x \$730/man/year	
- Veterinary cost:	0.98
1.96 heads x \$0.5/head	
- Miscellaneous	1.53
<b>Total</b>	<u>24.82</u>
<b>(Rounded)</b>	<b>(25)</b>
<b>III) Net return</b>	<u>44</u>

<sup>/1</sup> 0.4 head x 320 kg/head = 130 kg (liveweight)

<sup>/2</sup> 0.73 cows x 260l/cow = 190 l

<sup>/3</sup> Land preparation and seeding by machinery : \$55.68/ha

Seed (20kg/ha) : \$20/ha

Fences (100m) : \$3.6/ha

Miscellaneous (include maintenance cost) : \$15.86/ha

Total : \$95.14/ha

\$95.14/ha ÷ 10 years (useful life) = \$10/ha

<sup>/4</sup> Estimated at about \$5/ha

Table - J 13 FINANCIAL NET RETURN PER HECTARE FOR AGRICULTURAL PRODUCTS - WITH PROJECT (1) SUGAR CANE (PLANT CANE)

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	<u>Amount</u> ( <u>\$</u> )
I) Gross return (150 ton/ha x \$9.37/ton) (Rounded)	<u>1,405.50</u> (1,406)
II) Production cost	
Land preparation by tractor	49.98
Planting (15 M-D)	30.00
Basic fertilizer application	
- Machinery	17.12
- Labourer (1 M-D)	2.00
Earthing and split fertilizer application	
- Machinery (2 times)	26.84
- Labourer (2 M-D)	4.00
Irrigating (12 M-D)	24.00
Rodent control (0.5 M-D x 2 times)	2.00
Weeding (5 M-D x 2 times)	20.00
Harvesting	214.50
Transportation	247.50
Farming materials	
- Seed cane (6 tons)	56.22
- Fertilizers : Compound (15:15:15 330kg)	79.20
: Urea (220kg)	44.00
- Agro-chemicals : Harbicides (Atrazine 1.5kg)	12.75
: Rodenticides (Zinc phosphate 3kg)	6.00
Miscellaneous	41.81
Interest on working capital <sup>/1</sup>	21.80
Total	<u>899.72</u>
(Rounded)	<u>(900)</u>
III) Net return	<u>506</u>

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<sup>/1</sup> Costs of farming materials and machinery (\$198.17)  
x Interest (11%) = \$21.80

Table - J 13 FINANCIAL NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS WITH PROJECT  
(2) SUGAR CANE (RATOON CANE)

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	<u>Amount</u> ( <u>\$</u> )
I) Gross return (140 ton/ha x \$9.37/ton) (Rounded)	1,311.8 (1312)
II) Production cost	
Ratooning	
- Root cutting by tractor	14.92
- Field cleaning (5 M-D)	10.00
Basic fertilizer application	
- Machinery	17.12
- Labourer (1 M-D)	2.00
Earthing and split fertilizer application	
- Machinery (1 time)	13.42
- Labourer (1 M-D)	2.00
Irrigating (10 M-D)	20.00
Rodent control (0.5 M-D x 2 times)	2.00
Weeding (5 M-D x 2 times)	20.00
Harvesting	200.20
Transportation	231.00
Farming materials	
- Fertilizers : Compound (15:15:15 330 kg)	79.20
: Urea (200 kg)	44.00
- Agro-chemicals : Herbicides (Atrazine (W)	
1.5 kg)	12.75
: Rodenticides (Zinc phosphate	
3 kg)	6.00
Miscellaneous	33.73
Interest on working capital <u>/1</u>	15.61
Total (Rounded)	723.95 (724)
III) Net return	<u>588</u>

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/1 Costs of farming materials and machinery (\$141.95)  
x Interest (11%) = \$15.61

Table - J 13 FINANCIAL NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS - WITH PROJECT  
 (3) COTTON

	<u>Amount</u> ( <u>\$</u> )
I) Gross return (3 ton/ha x \$562/ton)	1,686
II) Production cost	
Land preparation by machinery	36.56
Seeding and basic fertilizer application	
- Machinery	17.12
- Labourer (1 M-D)	2.00
Re seeding and thinning (5 M-D)	10.00
Earthing and split fertilizer application	
- Machinery	13.42
- Labourer (1 M-D)	2.00
Cultivating by machinery	14.92
Application of agro-chemicals by airplane (15 times)	85.65
Irrigating (12 M-D)	24.00
Harvesting (67 M-D)	134.00
Transportation	30.00
Other works (4 M-D)	8.00
Farming materials	
- Seed (25 kg)	8.00
- Fertilizers: Compound (12:24:12 210kg)	46.20
: Urea (180kg) <sup>/1</sup>	36.00
- Agro-chemicals: Herbicides <sup>/1</sup>	4.88
: Insecticides <sup>/2</sup>	210.4
- Sacks (40 sacks x \$0.3)	12.00
Miscellaneous	34.76
Interest on working capital <sup>/3</sup>	30.28
Total	<u>760.19</u>
(Rounded)	<u>(760)</u>
III) Net return	926

<sup>/1</sup> Costs of farming materials (\$473.15)  
 x Interest (6.4%) = \$30.28

<sup>/2</sup> Planaxin 1.5kg

<sup>/3</sup> Malathion 20%, Orthene 10kg

**Table - J 13** FINANCIAL NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS - WITH PROJECT  
 (4) - MAIZE

<u>Amount</u>	<u>Amount</u>
(\$)	(\$)
I) Gross return (4.0 ton/ha x \$124/ton)	<u>496</u>
II) Production cost	
Land preparation by machinery	36.56
Seeding and basic fertilizer application	
- Machinery	17.12
- Labourer (1 M-D)	2.00
Earthing and split fertilizer application	
- Machinery (1 time)	13.42
- Labourer (1 M-D)	2.00
Cultivating by machinery	14.92
Application of agro-chemicals by airplane (3 times)	17.13
Irrigating (5 M-D)	10.00
Harvesting (5 M-D)	10.00
Shelling and drying	
- Machinery (8 hrs)	6.88
- Labourer (4 M-D)	8.00
Inner transportation by tractor	9.08
Other works (2.2 M-D)	4.40
Farming materials	
- Seed (16 kg)	7.04
- Fertilizers : Compound (12:24:12 210 kg/ha)	46.20
: Urea (170 kg/ha)	34.00
- Agro-chemicals : Herbicides (Gesaprim 1.5kg)	4.88
: Insecticides <sup>/1</sup>	40.50
Miscellaneous	14.21
Interest on working capital <sup>/2</sup>	8.83
<u>Total</u>	<u>307.17</u>
(Rounded)	(307)
 III) Net return	 <u>189</u>

<sup>/1</sup> Dipterex-30, Furadan 10 kg.

<sup>/2</sup> Costs of farming materials and machinery (\$238.65)  
 x Interest (3.7%) = \$8.83

Table - J 13 FINANCIAL NET RETURN PER HECTARE FOR AGRICULTURAL PRODUCTS - WITH PROJECT  
(5) SORGHUM

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	<u>Amount</u> <u>(\$)</u>
I) Gross return (4.0 ton/ha. x \$102/ton)	408
II) Production cost	
Land preparation by machinery	36.56
Seeding and basic fertilizer application	
- Machinery	17.12
- Labourer (1 M-D)	2.00
Earthing and split fertilizer application	
- Tractor	13.42
- Labourer (1 M-D)	2.00
Cultivating by machinery	14.92
Application of agro-chemicals by airplane (1 time)	5.71
Irrigating (5 M-D)	10.00
Harvesting (4 M-D)	8.00
Threshing and drying	
- Machinery (6 hrs)	6.96
- Labourer (2 M-D)	4.00
Transportation	9.08
Farming materials	
- Seed (15 kg)	9.90
- Fertilizers : Compound (12:24:12:210kg)	46.20
: Urea (170kg)	34.00
- Agro-chemicals : Herbicides	
Gesaprim 1.5 kg	36.88
Insecticides Dipterex 4(	
Miscellaneous	12.84
Interest on working capital <sup>/1</sup>	8.20
Total	<u>277.79</u>
(Rounded)	(278)
III) Net return	<u>130</u>

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<sup>/1</sup> Costs of farming materials (\$221.67)  
x Interest (3.7%) = \$8.20

Table - J 13 FINANCIAL NET RETURN PER HECTARE FOR AGRICULTURAL PRODUCTS - WITH PROJECT (6) BEANS.

<u>Item</u>	<u>Amount</u> <u>(\$)</u>
I) Gross return (2.0 ton/ha x \$264/ton)	<u>528</u>
II) Production cost	
Land preparation by machinery	36.56
Seeding and basic fertilizer application	
- Machinery	17.12
- Labourer (1 M-D)	2.00
Reseeding (2 M-D)	4.00
Application of agro-chemicals by sprayer	
- Machinery (19.2 hrs)	25.34
- Labourer (2.4 M-D)	4.80
Cultivating by machinery	14.92
Irrigating (5 M-D)	10.00
Harvesting (10 M-D)	20.00
Threshing and drying	
- Machinery (5 hrs)	5.80
- Labourer (2.2 M-D)	4.40
Transportation	5.45
Other works (2.8 M-D)	5.60
Farming materials	
- Seed (45 kg)	18.00
- Fertilizers: Compound (15:15:15 200kg)	48.00
: Urea (40kg)	8.00
- Agro-chemicals: Insecticides (Malathion 2())	7.00
Miscellaneous	11.85
Interest on working capital <sup>1</sup>	6.50
<u>Total</u>	<u>255.34</u>
(Rounded)	(255)
III) Net return	<u>273</u>

<sup>1</sup> Costs of farming materials (\$180.74) x Interest (3.7%) = \$6.69



Table - J 13

FINANCIAL NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS - WITH PROJECT  
 (7) SESAME

	Amount (\$)
I) Gross return (1.5 ton/ha x \$330/ton)	<u>495.00</u>
II) Production cost	
Land preparation by machinery	36.56
Seeding and basic fertilizer application	
- Machinery	17.12
- Labourer	2.00
Earthing and split fertilizer application	
- Machinery	13.42
- Labourer (1 M-D)	2.00
Cultivating by machinery	14.92
Application of agro-chemicals by airplane (2 times)	11.42
Irrigating (7 M-D)	14.00
Harvesting (2 M-D)	4.00
Threshing and drying (2 M-D)	4.00
Transportation	6.81
Other works (thinning, etc. 2 M-D)	4.00
Farming materials	
- Seed (3 kg)	1.20
- Fertilizer: Compound (12:24:12-80 kg)	17.60
: Urea (70 kg)	14.00
- Agro-chemicals : Herbicides (herban 2kg)	17.00
: Insecticides (Dipterex 1l)	8.75
Miscellaneous	9.44
Interest on working capital <sup>/1</sup>	7.00
Total	<u>205.24</u>
(Rounded)	(205)
III) Net return	<u>290</u>

<sup>/1</sup> Costs of farming materials (\$152.19)  
 x Interest (4.6%) = \$7.00

**Table - J 13** FINANCIAL NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS - WITH PROJECT  
 (8) RICE (WET SEASON)

	<u>Amount</u>
	(\$)
<u>I)</u> Gross return (5.0 ton/ha x \$187/ton)	<u>935</u>
<u>II)</u> Production cost	
Land preparation by machinery	36.56
Seeding and basic fertilizer application	
- Machinery	17.12
- Labourer (1 M-D)	2.00
Split fertilizer application (1.5 M-D)	3.00
Application of agro-chemicals by airplane (3 times)	17.13
Weeding (5 M-D)	10.00
Irrigating (2.8 M-D)	5.60
Harvesting by combine	
- Combine (2.5 hrs)	54.95
- Assistant operator (2.5 hrs)	1.25
Transportation	18.50
Other works (1 M-D)	2.00
Farming materials	
- Seed (70 kg)	27.30
- Fertilizers : Compound (12:24:12 210kg)	46.20
: Urea (170kg)	34.00
- Agro-chemicals : Herbicides <sup>1</sup> / <sub>1</sub>	61.53
: Insecticides <sup>2</sup> / <sub>2</sub>	14.00
: Fungicides <sup>3</sup> / <sub>3</sub>	33.00
Miscellaneous	19.21
Interest on working capital <sup>4</sup> / <sub>4</sub>	15.72
Total	<u>419.07</u>
(Rounded)	<u>(419)</u>
 <u>III)</u> Net return	 <u>516</u>

1 Propanil 20%, 2-4D 3%

2 Malathion 4%

3 Kasumin 20kg

4 Costs of farming materials (\$341.29)

x Interest (4.6%) = \$15.72

Table - J 13      FINANCIAL NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS - WITH PROJECT  
 (9) RICE (DRY SEASON)

	<u>Amount</u> ( \$ )
I) Gross return (5.0 ton/ha x \$187/ton)	<u>935.00</u>
II) Production cost	
Land preparation by machinery	36.56
Seeding and basic fertilizer application	
- Machinery	17.12
- Labourer (1 M-D)	2.00
Split fertilizer application (1.5 M-D)	3.00
Application of agro-chemicals by airplane (3 times)	17.13
Weeding (5 M-D)	10.00
Irrigating (4 M-D)	8.00
Harvesting by combine	
- Combine (2.5 hrs)	54.95
- Assistant operator (2.5 hrs)	1.25
Transportation	18.50
Other works (1 M-D)	2.00
Farming materials	
- Seed (70 kg)	27.30
- Fertilizers: Compound (12:24:12, 210kg)	46.20
: Urea (170kg)	34.00
- Agro-chemicals: Herbicides (Propanil 20ℓ)	61.53
(2-4D 3ℓ)	
: Insecticides (Malathion 4ℓ)	14.00
: Fungicides (Kasumin 20kg)	33.00
Miscellaneous	19.33
Interest on working capital <u>/1</u>	15.72
 Total:	 <u>421.59</u>
(Rounded)	(422)
 III) Net return	 <u>513</u>

/1      Costs of farming materials = ( \$341.29 ) x Interest (4.6 %) = \$15.72

Table - J 13 FINANCIAL NET RETURN PER HECTARE FOR  
 AGRICULTURAL PRODUCTS - WITH PROJECT  
 (10) MELON

	<u>Amount</u> (S)
I) Gross return (6.5 x \$208)	<u>1,352.00</u>
II) Production cost	
Land preparation by machinery	36.56
Bed preparation and seeding	
- Machinery	13.42
- Labourer (4 M-D)	8.00
Split fertilizer application (2 M-D)	4.00
Weeding (20 M-D)	40.00
Application of agro-chemicals by sprayer (3 times)	
- Machinery (sprayer)	3.96
- Labourer (4.5 M-D)	9.00
Watch (20 M-D)	40.00
Irrigating (6 M-D)	12.00
Rearrangement of fruits (10 M-D)	20.00
Harvesting (20 M-D)	40.00
Other works (2.4 M-D)	4.80
Farming materials	
- Seed (1.5 kg)	20.93
- Fertilizers: Compound (15:15:15, 350kg)	127.20
: Urea (230kg)	46.00
- Agro-chemicals: Insecticides <u>/1</u>	105.74
: Fungicides <u>/2</u>	51.82
- Pail	5.00
Transportation	34.05
Miscellaneous	31.12
Interest on working capital <u>/3</u>	13.20
Total:	<u>666.80</u>
(Rounded)	(667)
III) Net return	<u>685</u>

/1 Insecticides: Orthene 4 kg, Lannate 1 kg, Tomaron 2 .  
 Dipterex 1 kg

/2 Fungicides : Dithane M-45.7 kg, Benlate 1.0 kg, Daconil 1.0 kg

/3 Costs of farming materials (\$356.69) x Interest (3.7%)  
 = \$15.19

Table - J 13 FINANCIAL NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS - WITH PROJECT  
(11) WATER MELON

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	<u>Amount</u> <u>(\$)</u>
I) Gross return (12 ton/ha x \$72/ton)	864.00
II) Production cost	
Land preparation by machinery	36.56
Bed preparation and seeding	
- Machinery	13.42
- Labourer (4 M-D)	8.00
Split fertilizer application (2 M-D)	4.00
Weeding (20 M-D)	40.00
Application of agro-chemicals by sprayer (3 times)	
- Machinery (sprayer)	3.96
- Labourer (4.5 M-D)	9.00
Watch (20 M-D)	20.00
Irrigating (6 M-D)	12.00
Rearrangement of fruits (10 M-D)	20.00
Harvesting (20 M-D)	20.00
Other works (2.4 M-D)	4.80
Farming materials	
- Seed (1.5 kg)	15.00
- Fertilizers: Compound (15:15:15, 300 kg)	66.00
: Urea (120 kg)	24.00
- Agro-chemicals: Insecticides/ <u>1</u>	56.16
: Fungicides/ <u>2</u>	28.38
- Pail	5.00
Transportation cost	36.56
Miscellaneous	21.14
Interest on working capital/ <u>3</u>	7.20
 Total:	 <u>451.18</u>
(Rounded)	(451)
III) Net return	<u>413</u>

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1 Insecticides : Orthene 4 kg

2 Fungicides : Dithane M-45 7 kg, Daconil 1.0 kg

3 Costs of farming material (\$194.54) x Interest (3.7%)  
= \$14.49

Table - J-13 FINANCIAL NET RETURN PER HECTARE FOR  
AGRICULTURAL PRODUCTS - WITH PROJECT  
(12) - VEGETABLES (TOMATOES)

	<u>Amount</u> (S)
I) Gross return (20 ton/ha x \$107/ton)	<u>2,140.00</u>
II) Production cost	
Land preparation by machinery	36.56
Growing of seedlings (10 M-D)	20.00
Field operation for transplanting	
- Machinery	13.42
- Labourer (4 M-D)	8.00
Transplanting (40 M-D)	80.00
Weeding (20 M-D)	40.00
Split fertilizer application (2 M-D)	4.00
Irrigating (6 M-D)	12.00
Application of agro-chemicals by sprayer (5 times)	
- Machinery	6.60
- Labourer (10 M-D)	20.00
Cultivating by machinery (2 times)	29.84
Harvesting (90 M-D)	180.00
Inner transportation	68.10
Other works	20.00
Farming materials	
- Seed (1kg)	10.00
- Fertilizers : (Compound 15:15:15 530kg)	173.20
: (Urea 230kg)	324.60
- Agro-chemicals <sup>/1</sup>	
- Baskets	50.00
Miscellaneous	54.82
Interest on working capital <sup>/2</sup>	21.79
Total	<u>1,172.93</u>
(Round)	<u>(1,173)</u>
III) Net return	<u>972</u>

<sup>/1</sup> Fungicides : Dithane M-45, Caprantol 40kg  
Insecticides: Dipterex 16kg, Malathion 16kg, Tomaron 4(

<sup>/2</sup> Costs of farming materials (\$588.8) x Interest (3.7%) = \$21.79

**ANNEX K**  
**RESULTS OF GEOLOGICAL DRILLING AND**  
**PRESSURE TEST**

LIST OF GEOROGICAL RECORD OF BORING

	Page
HOLE No. SF-1 .....	K1
HOLE No. SF-2 (1) .....	K2
HOLE No. SF-2 (2) .....	K3
HOLE No. SF-3 (1) .....	K4
HOLE No. SF-3 (2) .....	K5
HOLE No. MI-1 .....	K6
HOLE No. MI-2 (1) .....	K7
HOLE No. MI-2 (2) .....	K8
HOLE No. MI-3 .....	K9
HOLE No. MII-1 .....	K10
HOLE No. B-1 .....	K11
HOLE No. P-1 .....	K12



GEOLOGICAL RECORD OF BORING										
PROJECT		CHOLUTIBCA		HOLE No.		SF-1				
ELEVATION OF GROUND SURFACE		835 m		LOCATION		SAN FERNANDO DAMSITE, LEFT BANK				
DIAMETER OF HOLE		75 mm		DEPTH OF HOLE		31.4 m		INCLINATION OF HOLE		VERTICAL
CORE RECOVERY		51.3 %		MACHINE		Acker, Ace "W"		DATE OF DRILLING		1 Nov. - 7 Nov. 1977
CORE RECOVERY		51.3 %		DRILLED BY		SYNAC				
LOGGED BY		S. NISHIOKA								
DATE	DEPTH (m)	ELEVATION (m)	ROCK TYPE	COLUMN SECTION	CORE RECOVERY %	DIAMETER (mm)	DESCRIPTION	R.Q.D %	Water pressure test	DEPTH (m)
1 Nov.	0.30	TOP SOIL			20	75	White acidic tuff. Sparsely including pumice. Massive, with little cracks. Black stains on cracks.	100		0.30
1 Nov.	4.9				0	75	Slightly weathered around 4.9 m.	100		4.9
1 Nov.	6.7		Welded tuff		173	75	Slightly weathered at 6.7 m.	100		6.7
2 Nov.	14.6				170	75	Slightly weathered at 14.6 m.	100		14.6
2 Nov.	21.95				160	75	14.6 m - 21.95 m moderately hard.	100		21.95
2 Nov.	16.75				200	75	16.75 m - 17.05 m friable.	100		16.75
2 Nov.	19.2				220	75	Slightly weathered at 19.2 m.	100		19.2
2 Nov.	19.5				220	75	19.5 m - 19.65 m friable.	100		19.5
2 Nov.	21.5				245	75	21.5 m - 21.95 m friable.	100		21.5
2 Nov.	21.95				245	75	21.95 m - 22.25 m purple. Welded, hard, massive.	100		21.95
2 Nov.	22.55				245	75	22.55 m - 23.45 m	100		22.55
2 Nov.	24.40				195	75	24.40 m - 25.30 m with pores, water-stained.	100		24.40
2 Nov.	26.2		Welded tuff		160	75	Cores are parted short, about 6 cm.	100		26.2
2 Nov.	26.2				160	75	26.2 m - 26.5 m crakly.	100		26.2
2 Nov.	27.75				170	75	27.75 m - 29.55 m Purple coloured, hard.	100		27.75
5 Nov.	31.40				0	75	Below 29.55 m, core barrel stopped and not recovered, core is not taken.	100		31.40

GEOLOGICAL RECORD OF BORING									
PROJECT		LOCATION		DEPTH OF HOLE		INCLINATION OF HOLE		VERTICAL	
CHOLUTPCA		SAN FERNANDO DAMSITE, LEFT BANK		770 m		61.0 m		VERTICAL	
ELEVATION OF GROUND SURFACE		MACHINE		DATE OF DRILLING		LOGGED BY		DATE	
75 mm		Acker Ace "W"		19 Nov - 8 Dec. 1977		S. NISHIOKA		19 Nov	
DIAMETER OF HOLE		CORE RECOVERY		CORE RECOVERY		CORE RECOVERY		CORE RECOVERY	
75 mm		80.5 %		80.5 %		80.5 %		80.5 %	
ELEVATION		ROCK TYPE		COLUMN SECTION		CORE RECOVERY		CORE RECOVERY	
(m)		TYPE <td colspan="2">SECTION <td colspan="2">% <td colspan="2">% </td></td></td>		SECTION <td colspan="2">% <td colspan="2">% </td></td>		% <td colspan="2">% </td>		%	
DEPTH		DESCRIPTION		R.Q.D.		WATER PRESSURE TEST		DEPTH	
(m)		DESCRIPTION		%		Lugeon unit		(m)	
0	0	MC	White, acidic. To 1.50 m, drilled with tricone bit without coring.	100					
1.50	1.50	DC	Weathered and cracky. Soft at places.	100					
8.85	8.85		Weathered with orange coloured water-stain on cracks. 8.85 m - 13.1 m Vertical crack develops.	100					
13.1	13.1		Slightly weathered welded tuff. 13.7 m - 15.5 m Vertical crack develops. Moderately hard.	100					
15.5	15.5		White, moderately hard. Cracks are generally vertical or steeply inclined. some cracks are open. 19.2 m - 19.5 m strongly water-stained on open vertical crack.	100					
19.5	19.5		Below 21 m, water-stain is very rare. Moderately hard and dense rocks. Vertical or steep open cracks are at:- 25.1 m - 25.45 m, 25.7 m - 26.3 m, 26.8 m - 27.1 m, 27.4 m - 28.0 m, and at 28.8 m. Opening, 5 mm wide, at 28.1 m - 28.35 m. This is pore, not continuous joint or crack.	100					

No data is published. Drilled water rises up the top of hole, even when packer is set effectively.

GEOLOGICAL RECORD OF BORING											
PROJECT		CIIOLITKA		LOCATION		SAN FEINANDO DAMSITE, LEFT BANK		HOLE No. SF-2 (2)			
ELEVATION OF GROUND SURFACE		770 m		DEPTH OF HOLE		61.0 m		INCLINATION OF HOLE		VERTICAL	
DIAMETER OF HOLE		75 mm		MACHINE		Acker Ace "W"		DATE OF DRILLING		19 Nov. - 8 Dec. 1977	
CORE RECOVERY		80.5 %		DRILLED BY		SYNAC		LOGGED BY		S. NISHIOKA	
DATE	DEPTH (m)	ELEVATION (m)	ROCK TYPE	COLUMN SECTION	CORE RECOVERY %	DIAMETER (mm)	DESCRIPTION	R.Q.D. %	Water Pressure Test	DEPTH (m)	
27 Nov	31.80	338.00			100	75	Below 31 m, cracks are more sparse and at 31.80 m, 32.60 m, 33.5 m - 33.8 m, 35.5 m - 35.8 m, 35.95 m - 36.25 m. Massive, not weathered.	100		31	
28 Nov	37.25	332.75	Shaly tuff		100	75	Purple, moderately hard.	100		37	
29 Nov	41.45	328.55	Altered tuff		100	75	Green coloured, including andesite fragments sparse. Moderately hard, massive. Some cracks are open, such as in 40.4 m - 40.5 m, 41.45 m, 41.6 m, 41.75 m - 41.9 m, 42.5 m. No stain on cracks. Apt to part horizontal.	100		41	
30 Nov	44.95	325.05			100	75	Slightly weathered in 44.95 m.	100		44	
1 Dec	49.1	320.9	Black shale		100	75	Below 49.1 m gradually changes to grey tuff. Horizontal, compact.	100		49	
1 Dec	51.2	318.8	Muddy tuff		100	75	Grey coloured, intercalated with thin black shales, 5 cm thick, at 50.6 m and 51.2 m. Horizontally bedding.	100		51	
2 Dec	52.4	317.6			100	75	52.4 m - 52.7 m vertical crack. Hard. Cracks are not stained.	100		52	
7 Dec	50.55	319.45	Propylitic tuff		100	75	Light yellowish green, with fine texture. Cut surface is smooth. Hard. Horizontally bedding.	100		50	
8 Dec	57.3	312.7			100	75	50.55 m - 57.3 m Steep - vertical crack.	100		57	
8 Dec	61.0	309.0			100	75	Slightly weathered at the bottom.	100		61	

GEOLOGICAL RECORD OF BORING										
PROJECT		CHOLITENCA		LOCATION		SAN FERNANDO DAMSITE, RIGHT BANK				
ELEVATION OF GROUND SURFACE		835 m		DEPTH OF HOLE		48.75 m		INCLINATION OF HOLE		VERTICAL
DIAMETER OF HOLE		75 mm		MACHINE		MARK III		DATE OF DRILLING		21 Dec. - 28 Dec. 1977
CORE RECOVERY		82.6 %		DRILLED BY		SYMAC				
LOGGED BY		S. NISHIOKA								
DATE	DEPTH (m)	ELEVATION (m)	ROCK TYPE	COLUMN SECTION	CORE RECOVERY %	BIT DIAMETER	DESCRIPTION	R.Q.D	DEPTH	
21 Dec	0				0	NC 75mm/h	White, acidic. To 4.55 m drilled with tri-cone bit without coring.	50	0	
	4.55				0	DC 75mm/h	Partly porous, but moderately hard.		4.55	
	7.9		Weathered welded tuff		89		7.9 m - 8.2 m Vertically elongated opening with 3 mm of width, not continuous.		7.9	
	8.2				89		Generally massive, with little cracks, occasionally water stained open pores are encountered at 2 m spacing or more.		8.2	
	16.8				89		Openings are elongated in vertical or steeply inclined direction.		16.8	
	19.5				63		Below 16.8 m, water-stain along vertical coarse grained laminations.		19.5	
	21.95				295		White, acidic. Moderately hard. Slightly weathered.		21.95	
	24.10				295		Steep inclined crack at 21.95 m, not water-stained.		24.10	
	24.40				295		Cracks dipping 70° with black stain at 24.10 m, and 24.40 m.		24.40	
	25.10				297		Crack dipping 60° at 25.10		25.10	
	27.60		Welded tuff		297		Hard to moderately hard, not porous as upper zone.		27.60	
	28.65				297		Crack dipping 70° with black stain at 27.60 m.		28.65	
	29.25				297		28.65 m - 29.25 m Purple coloured, dense.		29.25	
	29.65				297		29.40 m - 29.65 m Vertical crack with black stain.		29.65	

GEOLOGICAL RECORD OF BORING											
PROJECT		CHOLUTECA		LOCATION		SAN FERNANDO DAMSITE, RIGHT BANK					
ELEVATION OF GROUND SURFACE		835 m		DEPTH OF HOLE		48.75 m					
DIAMETER OF HOLE		75 mm		MACHINE		Acker, Hill Bill					
CORE RECOVERY		82.6 %		DRILLED BY		SINAC					
DATE		22 Dec.		LOGGED BY		S. NISHIOKA					
ELEVATION (m)		ELEVATION (m)		CORE RECOVERY %		COLUMN SECTION		ROCK TYPE		DESCRIPTION	
DEPTH (m)		DEPTH (m)		CORRECTION BIT DIAMETER		CORRECTION BIT DIAMETER		CORRECTION BIT DIAMETER		CORRECTION BIT DIAMETER	
R.Q.D.		R.Q.D.		R.Q.D.		R.Q.D.		R.Q.D.		R.Q.D.	
32.90 m - 33.50 m		33.50 m		NC		V		Welded tuff		32.90 m - 33.50 m irregular openings, 1 mm - 10 mm wide, ferruginous stained along steep joint. 33.50 m - 35.95 m Weathered, yellowish.	
35.95 m - 36.25 m		36.25 m		75m/m		V				35.95 m - 36.25 m Purple coloured, same weathered.	
42.05 m - 46.60 m		46.60 m		75m/m		V		Welded tuff		Acidic, coarse grained. Generally yellow stained. Massive, with flow structure or lamination varying horizontal to vertical. Moderately hard, with rather less density.	
47.25 m - 47.85 m		47.85 m		75m/m		V				42.05 m - 46.60 m Very steep lamination. Partly vertical. Very coarse quartz granules in 2 cm thickness at 43.3 m. 47.25 m - 47.85 m Lamination of mild inclination, continuous from vertical in the upper zone.	

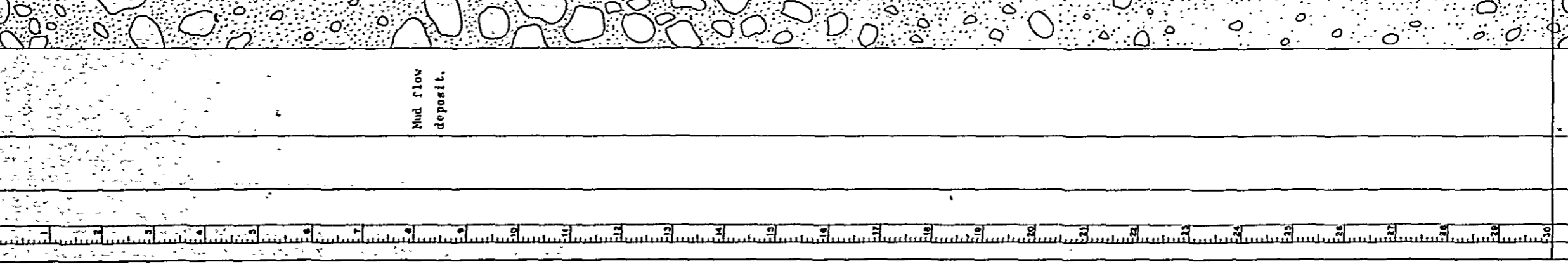
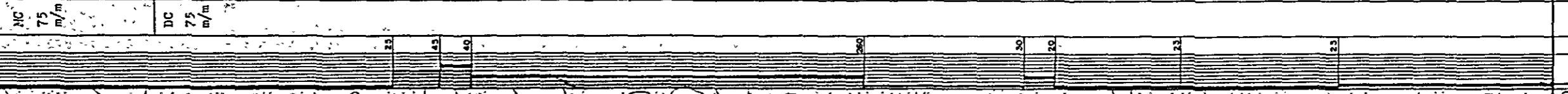
GEOLOGICAL RECORD OF BORING											
PROJECT		CHOLUTECA		LOCATION		MOROLICA DAMSITE I, RIGHT BANK		HOLE No. MI-1			
ELEVATION OF GROUND SURFACE		255 m		DEPTH OF HOLE		30.5 m		INCLINATION OF HOLE		VERTICAL	
DIAMETER OF HOLE		75 mm		MACHINE		MARK III		DATE OF DRILLING		20 Oct. - 28 Oct. 1977	
CORE RECOVERY		17.5 %		DRILLED BY		SYNAC		LOGGED BY S. Nishioka			
DATE	DEPTH (m)	ELEVATION (m)	ROCK TYPE	COLUMN SECTION	CORE RECOVERY %	BIT DIAMETER	DESCRIPTION	R.O.D.	DEPTH		
	0								0		
	1								1		
	2								2		
	3								3		
	4								4		
	5								5		
	6								6		
	7								7		
	8								8		
	9								9		
	10								10		
	11								11		
	12								12		
	13								13		
	14								14		
	15								15		
	16								16		
	17								17		
	18								18		
	19								19		
	20								20		
	21								21		
	22								22		
	23								23		
	24								24		
	25								25		
	26								26		
	27								27		
	28								28		
	29								29		
	30								30		
	30.50								30.50		

Composed mainly of large blocks and fragments of rhyolite, with sand.

Components are angular. Blocks are 1 - 5 m in diameter.

Mud flow deposit.

Below 19.8 m, drilling water (100 l/min) leaks wholly.



GEOLOGICAL RECORD OF BORING										
PROJECT: CHIOLITTECA			LOCATION: NOROLICA DANSITE I, RIGHT BANK			HOLE No. MI-2 (1)				
ELEVATION OF GROUND SURFACE: 267 m		DEPTH OF HOLE: 61.0 m		INCLINATION OF HOLE: VERTICAL		DATE OF DRILLING: 2 Nov. - 16 Dec. 1977				
DIAMETER OF HOLE: 75 mm		MACHINE: MARK III		LOGGED BY: S. Nishioka						
CORE RECOVERY: 21.8 %		DRILLED BY: SNAC								
DATE	DEPTH (m)	ELEVATION (m)	ROCK TYPE	COLUMN SECTION	CORE RECOVERY %	BIT DIAMETER	DESCRIPTION	R.O.D.	DEPTH	
2 Nov.	0								0	0
3 Nov.	1								1	1
17 Nov.	2								2	2
18 Nov.	3								3	3
19 Nov.	4								4	4
20 Nov.	5								5	5
21 Nov.	6								6	6
22 Nov.	7								7	7
23 Nov.	8								8	8
24 Nov.	9								9	9
27 Nov.	10								10	10
28 Nov.	11								11	11
29 Nov.	12								12	12
30 Nov.	13								13	13
1 Dec.	14								14	14
1 Dec.	15								15	15
1 Dec.	16								16	16
1 Dec.	17								17	17
1 Dec.	18								18	18
1 Dec.	19								19	19
1 Dec.	20								20	20
1 Dec.	21								21	21
1 Dec.	22								22	22
1 Dec.	23								23	23
1 Dec.	24								24	24
1 Dec.	25								25	25
1 Dec.	26								26	26
1 Dec.	27								27	27
1 Dec.	28								28	28
1 Dec.	29								29	29
1 Dec.	30								30	30
1 Dec.	31								31	31
1 Dec.	32								32	32
1 Dec.	33								33	33
1 Dec.	34								34	34
1 Dec.	35								35	35
1 Dec.	36								36	36
1 Dec.	37								37	37
1 Dec.	38								38	38
1 Dec.	39								39	39
1 Dec.	40								40	40
1 Dec.	41								41	41
1 Dec.	42								42	42
1 Dec.	43								43	43
1 Dec.	44								44	44
1 Dec.	45								45	45
1 Dec.	46								46	46
1 Dec.	47								47	47
1 Dec.	48								48	48
1 Dec.	49								49	49
1 Dec.	50								50	50
1 Dec.	51								51	51
1 Dec.	52								52	52
1 Dec.	53								53	53
1 Dec.	54								54	54
1 Dec.	55								55	55
1 Dec.	56								56	56
1 Dec.	57								57	57
1 Dec.	58								58	58
1 Dec.	59								59	59
1 Dec.	60								60	60
1 Dec.	61								61	61
1 Dec.	62								62	62
1 Dec.	63								63	63
1 Dec.	64								64	64
1 Dec.	65								65	65
1 Dec.	66								66	66
1 Dec.	67								67	67
1 Dec.	68								68	68
1 Dec.	69								69	69
1 Dec.	70								70	70
1 Dec.	71								71	71
1 Dec.	72								72	72
1 Dec.	73								73	73
1 Dec.	74								74	74
1 Dec.	75								75	75
1 Dec.	76								76	76
1 Dec.	77								77	77
1 Dec.	78								78	78
1 Dec.	79								79	79
1 Dec.	80								80	80
1 Dec.	81								81	81
1 Dec.	82								82	82
1 Dec.	83								83	83
1 Dec.	84								84	84
1 Dec.	85								85	85
1 Dec.	86								86	86
1 Dec.	87								87	87
1 Dec.	88								88	88
1 Dec.	89								89	89
1 Dec.	90								90	90
1 Dec.	91								91	91
1 Dec.	92								92	92
1 Dec.	93								93	93
1 Dec.	94								94	94
1 Dec.	95								95	95
1 Dec.	96								96	96
1 Dec.	97								97	97
1 Dec.	98								98	98
1 Dec.	99								99	99
1 Dec.	100								100	100

Recovering cores are white acidic tuff, containing andesite fragments less than 1 cm in diameter. Most cores are fragmental.

Drilling water is lost completely at the end of bit.

Recovering cores are brown coloured tuff. Hard, loosened with many cracks.

Drilling water is lost completely with in 20 cm from the end of bit.

Clay intercalated

Loose tuff

NC 75mm



GEOLOGICAL RECORD OF BORING									
PROJECT		LOCATION		DEPTH OF HOLE		INCLINATION OF HOLE		VERTICAL	
CHOLUTECA		MOROLICA DAMSITE I, RIGHT BANK		267 m		.61.0 m		BANK	
ELEVATION OF GROUND SURFACE		MACHINE		DATE OF DRILLING		DATE OF DRILLING		DATE OF DRILLING	
75 mm		21.8.2		2 Nov. - 16 Dec. 1977		2 Nov. - 16 Dec. 1977		2 Nov. - 16 Dec. 1977	
DIAMETER OF HOLE		DRILLED BY		LOGGED BY		LOGGED BY		LOGGED BY	
75 mm		S. Nishioka		S. Nishioka		S. Nishioka		S. Nishioka	
CORE RECOVERY		CORE RECOVERY		CORE RECOVERY		CORE RECOVERY		CORE RECOVERY	
21.8.2		21.8.2		21.8.2		21.8.2		21.8.2	
ELEVATION (m)		ROCK TYPE		COLUMN SECTION		CORE RECOVERY %		R.O.D. %	
31.33.00		loose buff		[Pattern]		40		50	
33.00		[Pattern]		[Pattern]		10		50	
34.00		Rock fragments		[Pattern]		30		50	
35.00		[Pattern]		[Pattern]		65		50	
36.00		[Pattern]		[Pattern]		60		50	
37.00		[Pattern]		[Pattern]		45		50	
38.00		[Pattern]		[Pattern]		5		50	
39.00		[Pattern]		[Pattern]		5		50	
40.00		[Pattern]		[Pattern]		12		50	
41.00		[Pattern]		[Pattern]		0		50	
42.00		[Pattern]		[Pattern]		0		50	
43.00		[Pattern]		[Pattern]		0		50	
44.00		[Pattern]		[Pattern]		0		50	
45.00		[Pattern]		[Pattern]		0		50	
46.00		[Pattern]		[Pattern]		0		50	
47.00		[Pattern]		[Pattern]		0		50	
48.00		[Pattern]		[Pattern]		0		50	
49.00		[Pattern]		[Pattern]		0		50	
50.00		[Pattern]		[Pattern]		0		50	
51.00		[Pattern]		[Pattern]		0		50	
52.00		[Pattern]		[Pattern]		0		50	
53.00		[Pattern]		[Pattern]		0		50	
54.00		[Pattern]		[Pattern]		0		50	
55.00		[Pattern]		[Pattern]		0		50	
56.00		[Pattern]		[Pattern]		0		50	
57.00		[Pattern]		[Pattern]		0		50	
58.00		[Pattern]		[Pattern]		0		50	
59.00		[Pattern]		[Pattern]		0		50	
60.00		[Pattern]		[Pattern]		0		50	
61.00		[Pattern]		[Pattern]		0		50	
DESCRIPTION		DESCRIPTION		DESCRIPTION		DESCRIPTION		DESCRIPTION	
Very low core recovery.		Very low core recovery.		Very low core recovery.		Very low core recovery.		Very low core recovery.	
Small quantity of fine fragments, smaller than 1 cm, are recovered.		Small quantity of fine fragments, smaller than 1 cm, are recovered.		Small quantity of fine fragments, smaller than 1 cm, are recovered.		Small quantity of fine fragments, smaller than 1 cm, are recovered.		Small quantity of fine fragments, smaller than 1 cm, are recovered.	
Very loose fractured rock in loose deposit.		Very loose fractured rock in loose deposit.		Very loose fractured rock in loose deposit.		Very loose fractured rock in loose deposit.		Very loose fractured rock in loose deposit.	
Mud flow deposit.		Mud flow deposit.		Mud flow deposit.		Mud flow deposit.		Mud flow deposit.	
Short rhyolite cores are recovered.		Short rhyolite cores are recovered.		Short rhyolite cores are recovered.		Short rhyolite cores are recovered.		Short rhyolite cores are recovered.	
Core recovery is very low.		Core recovery is very low.		Core recovery is very low.		Core recovery is very low.		Core recovery is very low.	



GEOLOGICAL RECORD OF BORING									
PROJECT: CHOLUTPCA.		LOCATION: NOROLICA DAMSITE 1, RIVER BED		HOLE No. MI-3		DEPTH OF HOLE: 30.5 m		INCLINATION OF HOLE: VERTICAL	
ELEVATION OF GROUND SURFACE: 175 m		DEPTH OF HOLE: 30.5 m		MACHINE: Mark III		DATE OF DRILLING: 20 Dec. - 29 Dec. 1977		LOGGED BY: S. Nishioka	
DIAMETER OF HOLE: 75 mm		CORE RECOVERY: 60.3 %		DRILLED BY: SYNAC		R.Q.D.:		DEPTH:	
DATE	DEPTH (m)	ELEVATION (m)	ROCK TYPE	COLUMN SECTION	CORE RECOVERY %	DIAMETER (mm)	DESCRIPTION	R.Q.D. %	DEPTH (m)
20 Dec.	0	175							0
22 Dec.	0.15	174.85	Sand and Gravels		0	75	River deposit.		0.15
27 Dec.	0.15	174.85			0	75	Below 4.85 m, big andesite boulders are included.		0.15
28 Dec.	0.15	174.85			0	75	Light green coloured. Containing angular fragments of andesite sparsely and many white felsitic material.		0.15
28 Dec.	0.15	174.85			0	75	Moderately hard, fresh, massive.		0.15
28 Dec.	0.15	174.85			0	75	17.65 m - 18.30 m friable. Core is fragmental.		0.15
28 Dec.	0.15	174.85			0	75	18.30 m - 20.10 m cracky.		0.15
28 Dec.	0.15	174.85			0	75	19.50 m - 19.80 m core broken.		0.15
28 Dec.	0.15	174.85			0	75	No water-stain.		0.15
28 Dec.	0.15	174.85			0	75	Below 20 m, somehow finer and softer. Cracky.		0.15
28 Dec.	0.15	174.85			0	75	Dark brownish grey. Containing rhyolitic fragments. Compact.		0.15
28 Dec.	0.15	174.85			0	75	Light green, fine grained, moderately hard. Partly dark brownish grey.		0.15
28 Dec.	0.15	174.85			0	75	Dark brown, compact.		0.15
29 Dec.	30.50	144.35			0	75	Light green tuff at the bottom.		30.50

GEOLOGICAL RECORD OF BORING

HOLE No. MII-1

PROJECT		CHOLUTECA		LOCATION		MOROLICA DAMSITE II, RIVER BED		
ELEVATION OF GROUND SURFACE		150 m		DEPTH OF HOLE		30.5 m		
DIAMETER OF HOLE		75 mm		MACHINE		Jacker, Hril		
CORE RECOVERY		55.8 %		DRILLED BY		SYNAC		
DATE		7 Oct.		DATE OF DRILLING		7 Oct. - 13 Oct. 1977		
LOGGED BY		S. Nishioka		VERTICAL				
DEPTH (m)	ELEVATION (m)	ROCK TYPE	COLUMN SECTION	CORE RECOVERY %	DIAMETER	DESCRIPTION	R.Q.D. %	Water pressure test Logcon unit
1								
2								
3								
4								
5		Sand and gravels						
6								
7								
8								
9								
10								
11								
12	11.75							
13								
14								
15		Andesite						
16								
17								
18								
19								
20	20.10							
21	20.40	Dacite						
22								
23		Andesite						
24								
25	21.70							
26	23.300							
27								
28		Andesite						
29	27.10							
30		Dacite						
31								
32								
33								
34								
35								
36								
37								
38								
39								
40	30.00							



GEOLOGICAL RECORD OF BORING									
PROJECT		CHOLUTUCA		LOCATION		EL. PAPAION VEIR SITE		HOLE No. P-1	
ELEVATION OF GROUND SURFACE		21.5 m		DEPTH OF HOLE		15.5 m		INCLINATION OF HOLE	
DIAMETER OF HOLE		75 mm		MACHINE		Acker, IIII Mark III		DATE OF DRILLING	
CORE RECOVERY		31.7 %		DRILLED BY		SYNAC		19 Sep. - 21.Sep. 1977	
CORE RECOVERY		31.7 %		LOGGED BY		S. Nishioke			
DATE	DEPTH (m)	ELEVATION (m)	ROCK TYPE	COLUMN SECTION	CORE RECOVERY %	DIAMETER	DESCRIPTION	R.Q.D.	DEPTH
20 Sep	0.00	21.50			0	MC 75mm	River deposit.	30	0.00
20 Sep	0.40	21.10	Sand and gravels		0		Gravels are 3-15 cm in diameter, of andesite, dacite, rhyolite and tuff. Round to subround.		0.40
21 Sep	11.10	10.40	Andesite		30		Dark coloured, very cracky. Friable.		11.10
21 Sep	15.30	6.20	Andesite		10		Fresh, solid, with cracks.		15.30

**ANNEX L**

**INDICATIVE PLAN OF MOROLICA DAM  
IRPIGATION AND POWER DEVELOPMENT  
PROJECT**

L INDICATION PLAN OF MOROLICA DAM  
IRRIGATION AND POWER DEVELOPMENT

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L1. PLAN FORMULATION

L1.1 General

In the formulation of the Agricultural Development Project of the Choluteca Basin, the San Fernando dam and reservoir scheme is proposed, as discussed in ANNEX G, mainly because the estimated cost is less in the scheme than the Morolica alternative scheme.

It is true that the Morolica scheme will be inferior to the San Fernando scheme as far as the scheme is formulated for irrigation as the main purpose. However, the Morolica scheme will have much more power potential than the San Fernando scheme as the annual average discharge volume at the Morolica site is almost three times as large as the discharge volume at the San Fernando damsite.

When the Morolica scheme is formulated for power generation and irrigation water supply as a multiple purpose scheme, the approach used in planning irrigation purpose scheme is no longer effective, and a completely different approach will be necessary for a multipurpose dam project.

In the plan formulation of the dam and reservoir scheme for the present Choluteca Project, a dam and reservoir scheme for only irrigation purpose is first planned, and then the additional cost and power benefit is studied to attain maximum net benefit on introducing power installation. In this case power installation is limited in minor importance because the Project should be formulated for irrigation as the main purpose and scheduled to be implemented under the control and administration of the Ministry of Natural Resources. Therefore, a power benefit is evaluated conservatively enough to draw an attention of the Power Authority of Honduras, i.e., ENEE, allowing an internal rate of return of 14% to the power portion.

In case of planning a multipurpose dam scheme, however, power generation is of prime importance as well as irrigation water supply. Irrigation water requirement is great and urgent in the Choluteca basin, but need of power depends on the implementation schedule of



the El Cajon Hydropower Project, which is a large scale power development scheme with an installed capacity of 282,000 kW and is scheduled to start its operation in 1983.

If the El Cajon Project is implemented as scheduled, need of another power source is not urgent and consequently the San Fernando dam and reservoir scheme is recommendable to meet an urgent irrigation water requirement. However, if the El Cajon Project is going behind schedule by a few years and if ENEE is obliged to seek another power source urgently, the Morolica multipurpose dam plan can be one of the most attractive alternatives. It is to be noted that the Morolica multipurpose plan is always dependent on the existence of an urgent need of power.

#### L1.2 Plan Formulation

The basic consideration and assumptions are as follows.

- (i) The upstream and downstream water requirement for irrigation is considered to be the same as in the Agricultural Development Project of the Choluteca Basin, permitting to irrigate 1,660 ha in the upstream area and 17,370 ha in the downstream area of the Morolica dam.
- (ii) The optimum utilization of water resources for power generation is to be achieved.
- (iii) The power station is assumed to be operated as a peaking power station securing a daily minimum operation of 5 hours.
- (iv) A multipurpose dam scheme is to be formulated for power and irrigation. Other functions such as flood control, city water supply, etc. are not taken into account at the moment. The functions other than power and irrigation will be considered if required at later stages of the project.

With reference to the Morolica scheme studied for the Choluteca project shown in Table-G4, the alternative study is made, and the result is shown in Table-L1. In the preparation of Table-L1, the following

assumptions are made.

- (i) The dam cost for only irrigation purpose with 76 meters in height and 3 million cubic meters in volume is estimated to be US\$34,710,000, as shown in Table-G3. A x-meter-high dam cost is assumed to be calculated by the following equation:

$$C_{\text{dam}} = 34,710,000 + 7.0 \times 3,000,000 \times \left\{ \left( \frac{x}{76} \right)^{2.5} - 1 \right\}$$

- (ii) Power facilities cost consisting of civilwork cost and cost of generating equipment, transmission line and substation can be calculated by the method described in ANNEX G.
- (iii) Irrigation facilities cost is based on the cost estimate made for the Agricultural Development Project of the Choluteca Basin.
- (iv) Engineering cost and general expense is estimated to be 15% of the direct cost. Also physical contingency of 10% is considered, to be an overall cost increase of 26.5%.
- (v) Construction period of 4 years is assumed and the interest during construction at the 8% interest rate is calculated to be 10.9% of the total cost.
- (vi) Operation and maintenance cost of dam and power station and also irrigation facilities are reduced from the annual power and irrigation benefit. The annual net benefit is capitalized by the discount rate of 8%.

Table-L1 indicates that the Benefit-Cost Ratios are almost equal in three alternative plans. If the maximum rate of return to the investment is desired, the alternative No. 1 will be the best one. On the other hand, if the maximum utilization of water resources is more desirable, the alternative No. 3 will be selected as the best alternative. The alternative No. 2 shown in Table-L1 is taken up for further study because this alternative is considered to be close to the optimum scale of development.

The result of reservoir operation study for the proposed alternatives is shown in the computer output form in ANNEX G.

## L2. BASIC DESIGN OF MOROLICA MULTIPURPOSE DAM SCHEME

### L2.1 Main Dam

The general layout of a dam, spillway, power station and other related structures are shown in Fig.-L1, and typical sections of each structure are shown in Fig.-L2 and Fig.-L3.

Hydrology and geology at the damsite are described in detail in ANNEX A and ANNEX C, respectively.

Because of a scarcity of impervious clay material, a rockfill dam with asphalt facing is proposed. Rock material is abundant from andesite near the damsite and also from spillway excavation located on the right bank of the river. The upstream and downstream slopes of the dam are tentatively determined to be 1:1.8 and 1:2.0, respectively. The upstream slope is covered with asphalt facing.

The dam crest is at El. 243.0 m and dam height will be approximately 93.0 meters above the riverbed. The dam will have a crest length of 500 meters and contain about 5 million cubic meters of rock embankment. The dam crest is 6.0 meters above the normal high water level of El. 237.0 m, and 1.5 meters above maximum flood water level of El. 241.5 m when the probable maximum flood comes.

A concrete inspection gallery will be provided at the bottom of asphalt facing, connecting tightly the asphalt facing with foundation bedrock. The river deposit is considered to be about 10 meters in thickness above the bed rock and the firm rock is assumed to appear by the excavation of 10 meters in thickness on both abutment at the damsite. These river deposit material and weathered rocks on the abutment will be removed from the gallery foundation. For the rock embankment foundation of the dam, only organic and earth materials will be removed. After preparing the foundation for rock embankment, a blanket grouting will be made and a curtain grouting will be provided at the upstream rim of the dam from the inspection gallery.

## L2.2 Diversions during Construction

Diversion works will consist of upstream and downstream cofferdams and a circular sectioned diversion tunnel in the left bank of the river. The upstream cofferdam with crest at El. 177.0 m, will divert the river flow through the tunnel and permit construction of the main dam throughout its construction period. With upstream water surface at El. 176.10 m, a discharge of 1,286 m<sup>3</sup>/s will be diverted through the diversion tunnel of 11.0 meters in diameter and of 615 meters in length. This diversion capacity is equivalent to the 10-year probable flood estimated at this site.

The downstream cofferdam with a crest at El. 160 m will be incorporated in the main dam.

The diversion tunnel will be concrete lined with 60 cm in average thickness. The concrete inlet structure is designed to be bulkheaded at the time of tunnel plug. A 40-meter-long tunnel plug is made for closure at the upstream side of the tunnel. After the tunnel plug, the downstream side of the tunnel will be utilized as a waterway for power generation and outlet works.

## L2.3 Spillway

A spillway is located on the right bank of the river. The spillway will consist of a gated crest, two piers, spillway bridge, spillway chute with two training walls on both sides of the chute and a flip bucket at the downstream end of the chute. A spillway forebay will be excavated to El. 221.5 m to lead water smoothly to the spillway. Water through the spillway will be jumped at the flip bucket and fall down in the existing river channel after losing its energy. No plunge pool excavation is considered.

The spillway crest is at El. 225.0 m and will have a gross width of 42.0 meters including the two pier width of 6.0 meters. Three numbers of 12-meter-wide and 13-meter-high radial gates will be installed with a stoplog structure. A spillway bridge will be provided over the spillway crest as a roadway. The spillway is designed to pass the maximum probable flood safely. The inflow flood peak of 6,390 m<sup>3</sup>/s

will be reduced on reservoir routing to a maximum spillway discharge of 4,895 m<sup>3</sup>/s, assuming the flood comes when the water level in the reservoir is at the normal high water level of El. 237.0 m. In this case the reservoir water level will rise to a maximum flood level of El. 241.5 m.

The spillway chute is 150 meters in length and designed to reduce gradually in its width and the downstream end where the flip bucket is provided has the width of 36.0 meters.

#### L2.4 Outlet Works

Outlet Works will be incorporated in the powerhouse. The power intake shaft will be constructed above the diversion tunnel and the portion of the diversion tunnel is used as a waterway. The 6.0 - meter-diameter penstock is branched off from the diversion tunnel and serve both for power generation and for outlet works. The main penstock will bifurcate into 3.0 - meter-diameter branches. A 1.0 - meter-diameter outlet pipe will branch off from one of the branch penstock upstream from the turbine inlet valve, and end in the outlet chamber on the downstream side of the powerhouse, discharging through a 0.8 - meter-diameter Howell-Bunger type valve. The Howell-Bunger valve will dissipate energy in the concrete outlet chamber. A 1.0 - meter-diameter Butterfly valve on the upstream side of the Howell-Bunger valve will permit repair and maintenance of the Howell-Bunger valve.

#### L2.5 Power Facilities

##### L2.5.1 Intake

Intake will be located on the left bank of the river about 260 meters upstream from the dam axis. It consists of an entrance structure, a horizontal tunnel of about 173 meters in length and a shaft of about 33 meters in depth. The entrance structure will be shaped in bellmouth and equipped with fixed trashracks. The elevation of the entrance sill is at El. 195.0 m. The horizontal tunnel will have a circular section of 6.0 meters in diameter. The shaft is also

circular sectioned and has the diameter of 6.0 meters. At about 80 meters downstream from the entrance structure, intake gate and guides are provided with stoplog facilities. The gate will be operated through the gate shaft located at El. 245.0 m.

#### L2.5.2 Penstock

A penstock line will be branched off from the diversion tunnel at about 70 meters from the diversion outlet. The 6.0-meter-diameter penstock will be about 90 meters long. It will be underground structure for the 75 meter upstream section, and for the rest 15 meter downstream section it will be an open structure to be backfilled. At the downstream end, the penstock will bifurcate into 3.0-meter-diameter penstocks leading to the distributors. A 1.0-meter-diameter outlet pipe will branch off from the 3.0-meter-diameter penstock of the south side and lead to a Howell-Bunger type outlet valve on the downstream side of the powerhouse.

#### L2.5.3 Powerhouse

The powerhouse will contain two 30,000 kW units. It will be located on the left bank of the river. Access to the power house from the dam crest will be made by a service road to be constructed on the left bank. The powerhouse will be of the outdoor type.

The powerhouse will be of reinforced concrete structure. Protection from tailwater level of El. 159.7 m corresponding the routed probable maximum flood will be provided by the outer walls.

The preliminary design of powerhouse and generating equipment are shown in Fig.-L3.

#### L2.5.4. Transmission Line and Receiving Substation

The transmission route from the Morolica powerplant to the Pavana substation on the existing 256 kV transmission line will be about 60 km in length. A single circuit line at a line voltage of 138 kV will be sufficient to carry the entire output of the hydroplant.

The line will be put into the Pavana substation. No step-down transformer will be needed because the existing 256 kV line is operated at 138 kV.

#### L2.6 Access and Preparatory Works

Access to the damsite will be made without any difficulty through the existing gravel metaled road from the Pan American Highway near the Choluteca City to Morolica town via Orocuina and Apacilagua villages. The damsite is located between Apacilagua and Morolica at the distance of about 10 km from both Apacilagua and Morolica. The road runs along the right bank of the Choluteca river and is maintained fairly well. A slight improvement work will be sufficient as an access road to the damsite.

An open flat space in the right bank side river terrace extending at a little downstream from the damsite will be used for temporary works.

Office facilities and living quarters for general administration and construction supervision will be located in the river side flat land probably near Las Savilas village located several kilometers downstream of the damsite. There will be no problem to secure sufficient space for contractor's camping facilities.



L3. COST ESTIMATE

L3.1 Construction Cost

The construction cost of the Morolica Multipurpose Dam Project is estimated based on the preliminary design as described in L2, at 1977 price level. The irrigation facility cost is considered the same as that of the proposed irrigation plan.

The construction cost of the Morolica dam and power station is estimated to be US\$95 million including the cost of diversion work, main dam, spillway, waterway and powerhouse. The cost breakdown is shown in Table-L2.

L3.2 Operation, Maintenance and Replacement Cost

The operation and maintenance cost of the Morolica dam and power station is estimated to be US\$270,000 annually, as explained below.

<u>Item</u>	<u>US\$/Year</u>
Personnel cost (64 persons)	150,000
Maintenance & repair cost	
Dam, spillway and reservoir	30,000
Powerplant and OM office	80,000
Transmission line and sub-station	10,000
<u>Sub-total</u>	<u>120,000</u>
<u>Total</u>	<u>270,000</u>

The economic life of mechanical and electrical equipment is 25 years. Therefore the replacement cost of such equipment is considered at every 25 years. In view of the residual value, 90% of the initial cost is taken as the equipment replacement cost.

**L3.3 Investment Disbursement Schedule**

Based on a preliminary implementation schedule, the investment disbursement schedule is prepared and shown in Table-L3.

**L3.4 Cost Stream**

Cost streams are shown in Table-L4 for a common facility of dam, for power facilities and for irrigation facilities.

#### L4. PRELIMINARY ECONOMIC ANALYSIS

##### L4.1 Benefit

The proposed Morolica multipurpose project will be installed two units of 30,000 kW generating capacity, and the 90% dependable peak output and annual averaged energy output are expected to be 60,000 kW and 181.2 GWh, respectively, as shown in Table-L1, Alternative No.2.

Power benefit is calculated based on the unit power benefit, i.e., capacity benefit and energy benefit described in ANNEX F. A negative benefit due to inundation of Morolica valley is duly considered.

The benefit streams are shown in Table-L4, for power benefit and irrigation benefit. Irrigation benefit is taken at the same as in the proposed irrigation plan:

##### L4.2 Economic Analysis

A preliminary economic analysis is made and the internal rate of return is calculated to be 11.5 %. For the estimation of economic cost, the cost estimated in L3 is reduced by 10% except engineering and general expense, and also except land compensation. Engineering cost and general expense is reduced by only 2% as in the proposed irrigation project. Land compensation cost is considered as a transfer payment and is not included in the economic cost.

Benefit-cost curves are prepared by means of calculating present values of benefit and cost at different discount rate. The present values of benefit and cost thus calculated are shown in Table-L5. The benefit-cost curves shown in Fig.-L4 indicate that the Morolica project if developed for only power generation purpose will have an internal rate of return of 6.85 %, and also if developed for only irrigation purpose, an internal rate of return will be 7.60 %.

Cost allocation is made and the result is shown in Table-L6.

## 15. CONCLUSIONS

The Morolica Multipurpose Project is formulated for irrigation of about 20,000 ha and for power generation of about 180 GWh per year by installing 2 units of 30,000 KW each, so as to make use of the water and land resources of the Choloteca basin to the maximum extent. It is also possible to plan the project to irrigate all the potential irrigation area of about 30,000 ha in the basin and in this case the optimum power installation will be around 40,000 KW to 45,000 KW.

The project can be implemented to construct a dam of the proposed scale with the power installation of 2 units of 20,000 KW and to irrigate 20,000 ha of the proposed irrigable area, as the first stage development. In this case the minimum operation hours of power generation can be secured 7.5 hours a day instead of 5.0 hours in case of 60,000 KW installation. In the future when further development is required for either power generation or irrigation, the second stage development can be effectuated by either installing an additional unit of 20,000 KW or by increasing the irrigation area to 30,000 ha as the case may be.

The Morolica project, though the internal rate of return of the project is comparable with the proposed irrigation project of constructing a dam at San Fernando site, includes the following problems or disadvantages when the project is compared with the proposed San Fernando irrigation dam project.

- (i) The initial investment cost is estimated to be as high as about US\$150 million and a certain difficulty is anticipated to prepare this much amount of fund in a short period to meet an urgent requirement for irrigation development in the Choloteca plain. The breakdown of the initial investment cost is shown below.

(Million US\$)

---

Common facilities	
(Morolica dam)	62.08
(Land compensation)	2.07
Power facilities	30.52
Irrigation facilities	
(Irrigation facilities)	29.55
(Land compensation)	0.23
<hr/>	
Sub-total	124.45
Price contingency (about 20%)	25.55
<hr/>	
Total investment cost	150.00

(ii) In case of multiple purpose development, several government organizations will be involved for the implementation of the project and it is probable to take considerable time in the coordination of such organizations before making a decision to implement the project. This might hamper the smooth and timely implementation of the project.

(iii) The project inevitably involves the inundation problem of almost whole area of the Morolica valley. It is necessary to obtain agreement of the inhabitants to be resettled and a resettlement program should be carefully prepared and explained fully to the inhabitants. This process also requires time and possibly causes delay in implementation.

The above considerations might conclude that the proposed San Fernando irrigation dam plan would be more recommendable than the Morolica multipurpose project, except in case that the power authority of Honduras, i.e. ENEE, shows keen interest to the Morolica project and take up the project to be implemented before the construction of the El Cajon large scale hydropower project.

Table-L1. MOROLICA MULTIPURPOSE DAM PLAN  
ALTERNATIVE STUDY

Alternative No.	1	2	3
HWL (El. m)	231.0	237.0	243.0
LWL (El. m)	204.0	204.0	207.5
Net Storage (MCM)	445	595	730
Dam Height (M)	88.0	94.0	100.0
<b>Power</b>			
Installed capacity (MW)	50	60	70
Dependable peak (MW)	50	60	70
Annual energy output (GWh)	161.4	181.2	198.4
Q max. (m <sup>3</sup> /s)	97.6	111.9	121.7
Net irrigation area (ha)	16,000	16,000	16,000
<b>Cost (1,000 US\$)</b>			
Dam cost	44,010	49,440	55,410
Power facilities	21,330	23,460	24,980
Irrigation facilities	23,120	23,120	23,120
Sub-total	88,460	96,020	103,510
Eng. & Phy. Contingency	23,440	25,450	27,430
Sub-total	111,900	121,470	130,940
Interest during construction	12,200	13,240	14,270
Total cost	124,100	134,710	145,210
<b>Benefit (Capitalized by 8% discount rate) (1,000 US\$)</b>			
Power benefit	77,150	90,270	102,760
Irrigation benefit	90,190	90,190	90,190
Total benefit	167,340	180,460	192,950
<b>Benefit-cost ratio</b>	1.35	1.34	1.33

Table-L2: COST ESTIMATE  
MOLORICA MULTIPURPOSE DAM PROJECT

Item	Unit	Quantity	Unit Price (US\$)	Amount (US\$)
1. Access road & quarters	L.S.			530,000
2. Diversion and coffering				
Excavation				
Common	m <sup>3</sup>	45,000	2.5	112,500
Rock	m <sup>3</sup>	30,000	4.0	120,000
Tunnel	m <sup>3</sup>	74,400	30	2,232,000
Concrete				
Inlet & outlet	m <sup>3</sup>	2,900	100	290,000
Tunnel	m <sup>3</sup>	14,700	100	1,470,000
Plug	m <sup>3</sup>	9,000	70	630,000
Reinf. steel	t	750	700	525,000
Tunnel steel support	t	300	750	225,000
Tunnel grouting	L.S.	-	-	300,000
Cofferdams				
Excavation	m <sup>3</sup>	120,000	2.5	300,000
Impervious fill	m <sup>3</sup>	69,000	4.0	276,000
Gravel fill	m <sup>3</sup>	240,000	2.5	600,000
Sub-total				7,080,500
3. Dam				
Excavation				
Common	m <sup>3</sup>	106,000	1.5	159,000
Rock	m <sup>3</sup>	46,000	3.0	138,000
Concrete				
Gallery	m <sup>3</sup>	13,000	100	1,300,000
Reinf. steel	t	350	700	245,000
Asphalt facing	m <sup>3</sup>	32,000	100	3,200,000
Foundation treatment	L.S.			2,750,000
Dam embankment				
Filter	m <sup>3</sup>	134,000	5.0	670,000
Rockfill	m <sup>3</sup>	4,920,000	5.0	24,600,000
Sub-total				33,062,000

Item	Unit	Quantity	Unit Price (US\$)	Amount (US\$)
<b>4. Spillway</b>				
<b>Excavation</b>				
Soft rock	m <sup>3</sup>	770,000	2.5	1,925,000
Hard rock	m <sup>3</sup>	1,830,000	-	-
<b>Concrete</b>				
Crest	m <sup>3</sup>	5,100	70	357,000
Bucket	m <sup>3</sup>	3,400	70	238,000
Pier	m <sup>3</sup>	3,000	80	240,000
Wall	m <sup>3</sup>	11,500	80	920,000
Chute	m <sup>3</sup>	2,600	75	195,000
Shot concrete	m <sup>3</sup>	3,500	100	350,000
Reinf. steel	t	850	700	595,000
Spillway bridge	L.S.			80,000
Anchor bar	t	40	1,200	48,000
Gate	t	240	5,500	1,320,000
<b>Sub-total</b>				<b>6,268,000</b>
<b>5. Intake, penstock &amp; outlet</b>				
<b>Excavation</b>				
Intake entrance	m <sup>3</sup>	32,000	2.5	80,000
Tunnel	m <sup>3</sup>	9,200	40	368,000
Shaft	m <sup>3</sup>	3,500	80	280,000
<b>Concrete</b>				
Intake	m <sup>3</sup>	1,500	80	120,000
Tunnel	m <sup>3</sup>	5,900	100	590,000
Shaft	m <sup>3</sup>	2,300	120	276,000
Reinf. steel	t	380	700	266,000
Penstock	t	150	3,000	450,000
Gate	t	70	5,500	385,000
Valves	L.S.	-	-	150,000
<b>Sub-total</b>				<b>2,965,000</b>



Item	Unit	Quantity	Unit Price (US\$)	Amount (US\$)
<b>6. Powerhouse &amp; tailrace</b>				
Excavation				
Common	m <sup>3</sup>	60,000	2.0	120,000
Rock	m <sup>3</sup>	60,000	5.0	300,000
Concrete				
Foundation	m <sup>3</sup>	10,000	70	700,000
Substructure	m <sup>3</sup>	10,600	80	848,000
Superstructure	m <sup>3</sup>	4,000	120	480,000
Reinf. steel	t	800	700	560,000
Architectural work	L.S.	-	-	930,000
Sub-total				3,938,000
7. Generating equipment	L.S.	-	-	14,180,000
<b>8. Transmission line and substation</b>				
138 KV line	km	60	30,000	1,800,000
Stepdown transformer	L.S.	-	-	200,000
Sub-total				2,000,000
9. Land compensation	ha	3,000	600	1,800,000
10. Engineering and general expenses				10,500,000
Sub-total (1 to 10)				82,323,500
11. Physical contingency (15%)				12,348,500
Total (1 to 11)				94,672,000

Table-13 INVESTMENT DISBURSEMENT SCHEDULE

	(Unit: million US\$)						
	1978	1979	1980	1981	1982	1983	Total
<b>1. Common Facilities (Morolica dam)</b>							
1.1 Access road & quarter		0.40	0.13				0.53
1.2 Diversion & coffering			7.08				7.08
1.3 Dam & spillway		2.26	8.21	19.14	9.72		39.33
1.4 Engineering & administration	2.11	2.11	0.94	0.94	0.94		7.04
Sub-total	2.11	4.77	16.36	20.08	10.66		53.98
1.5 Physical contingency (15%)	0.32	0.72	2.45	3.01	1.60		8.10
Total	2.43	5.49	18.81	23.09	12.26		62.08
<b>2. Power Facilities</b>							
2.1 Intake, penstock & outlet		0.52	0.28	0.80	1.36		2.96
2.2 Powerhouse & tailrace				3.25	0.69		3.94
2.3 Generating equipment		2.30	2.64	2.76	6.48		14.18
2.4 Transmission line & substation			0.33	0.37	1.30		2.00
2.5 Engineering & administration	1.00	0.56	0.55	0.55	0.80		3.46
Sub-total	1.00	3.38	3.80	7.73	10.63		26.54
2.6 Physical contingency (15%)	0.15	0.51	0.57	1.16	1.59		3.98
Total	1.15	3.89	4.37	8.89	12.22		30.52
<b>3. Irrigation Facilities</b>							
3.1 Preparatory works		0.56	0.32				0.88
3.2 El Papalon intake weir			1.03	1.29	1.28		3.60
3.3 Canal network			0.54	5.34	3.48	0.91	10.27
3.4 Drainage & farm road			0.20	1.79	0.79	0.73	3.51
3.5 On-farm construction			0.25	2.34	1.02	1.25	4.86
3.6 Engineering & administration	0.73	1.37	0.53	0.55	0.54	0.02	3.74
Sub-total	0.73	1.93	2.87	11.31	7.11	2.91	26.86
3.7 Physical contingency (10%)	0.08	0.19	0.29	1.13	0.71	0.29	2.69
Total	0.81	2.12	3.16	12.44	7.82	3.20	29.55

Only 10% of physical contingency is considered because the irrigation design is prepared at the feasibility study level.

Table-L4 COST AND BENEFIT STREAM

(Unit: 1.000 US\$)

No. of Year	Year	Economic Cost			Economic Benefit	
		Dam	Power	Irrigation	Power	Irrigation
1.	1978	2,380	1,130	790		
2.	1979	5,130	3,550	2,030		
3.	1980	17,020	3,980	2,890		
4.	1981	20,870	8,050	11,240		
5.	1982	11,120	11,080	7,090	34,380	-60
6.	1983	120	150	3,950	1,476	2,500
7.	1984	120	150	1,080	2,952	4,910
8.	1985	120	150	1,080	4,427	6,760
9.	1986	120	150	1,080	4,427	8,620
10.	1987	120	150	1,080	4,427	9,170
29.	2006	120	150	1,080	4,427	9,170
30.	2007	1,350	16,140	2,290	35,369	9,170
31.	2008	120	150	1,080	4,427	9,170
55.	2032	120	150	1,080	4,427	9,170

Table-L5 PRESENT VALUES OF COST AND BENEFIT

	Discount Rate (%)			
	6	8	10	12
<b>Cost</b>				
Joint facilities	47,569	44,142	41,099	38,472
Power facilities	26,774	22,297	20,389	18,803
Irrigation facilities	34,134	28,774	24,985	22,131
<b>Total</b>	<b>108,477</b>	<b>95,213</b>	<b>86,473</b>	<b>79,406</b>
<b>Benefit</b>				
Power benefit	80,159	60,612	47,952	39,240
Irrigation benefit	98,588	68,042	49,108	36,699
<b>Total</b>	<b>178,747</b>	<b>128,654</b>	<b>97,060</b>	<b>75,939</b>

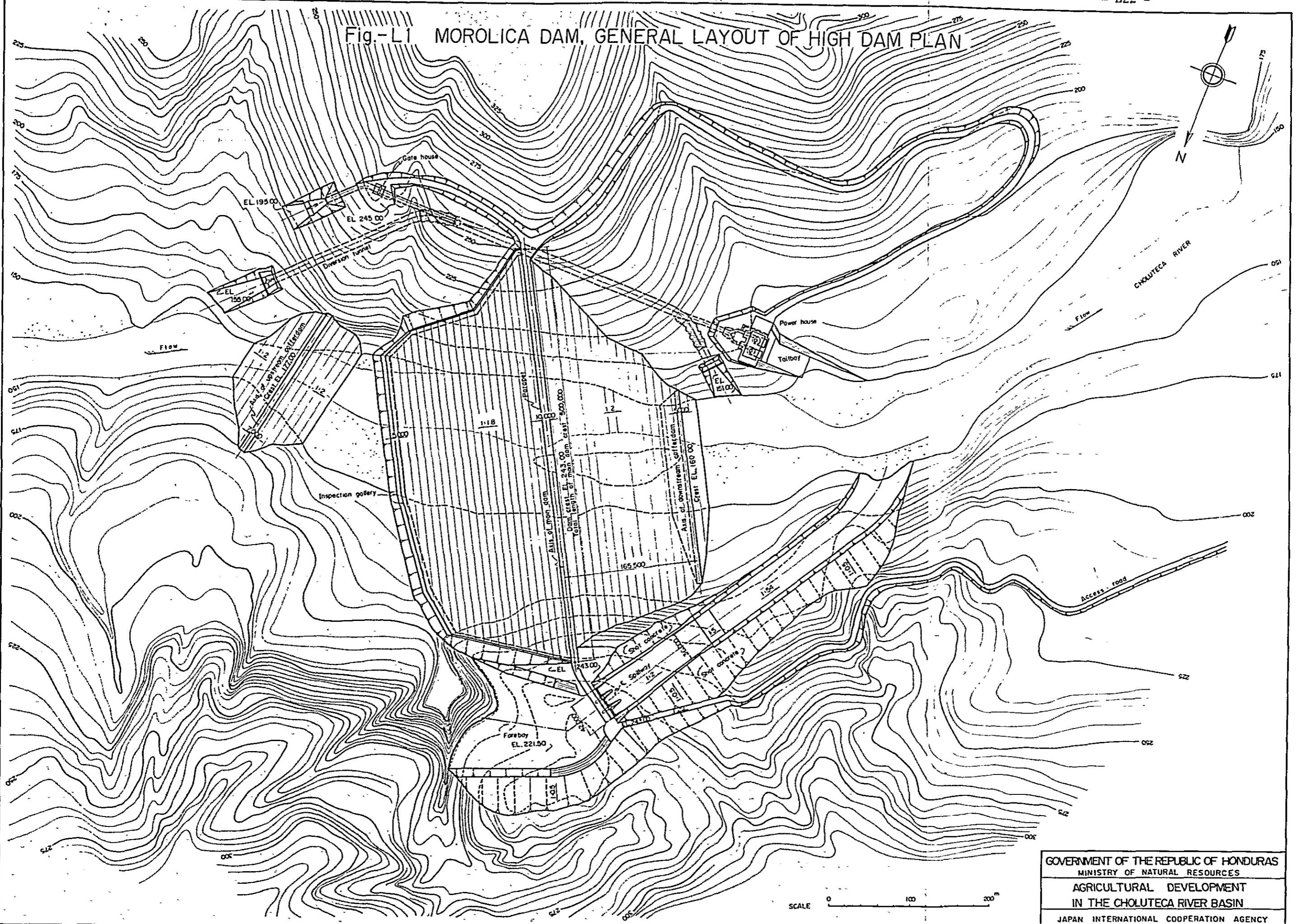
Table-16 COST ALLOCATION

	(Unit: 1,000 US\$)		
	Power	Irrigation	Total
1. Benefit <sup>1</sup>	60.612	68.042	128.654
2. Alternative Cost	60.612 <sup>2</sup>	50.616 <sup>3</sup>	111.228
3. Justifiable Expenditure <sup>4</sup>	60.612	50.616	111.228
4. Separable Cost			
Capital Cost	19.459	19.662	39.121
OM&R Cost	2.838	9.112	11.950
Total	22.297	28.774	51.071
5. Remaining Benefit <sup>5</sup>	38.315	21.842	60.157
6. Percent Distribution	63.7%	36.3%	100.0%
7. Allocated Joint Costs			
Capital Cost	27.404	15.617	43.021
OM&R Cost	714	407	1.121
Total	28.118	16.024	44.142 <sup>6</sup>
8. Total Allocated Cost <sup>7</sup>			
Capital Cost	46.863	35.279	82.142
OM&R Cost	3.552	9.519	13.071
Total	50.415	44.798	95.213
9. Benefit-cost Ratio <sup>8</sup>	1.20	1.52	1.35

Remarks:

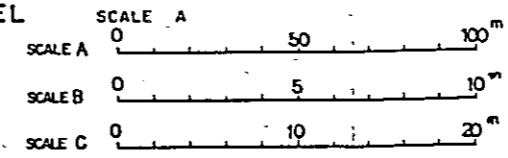
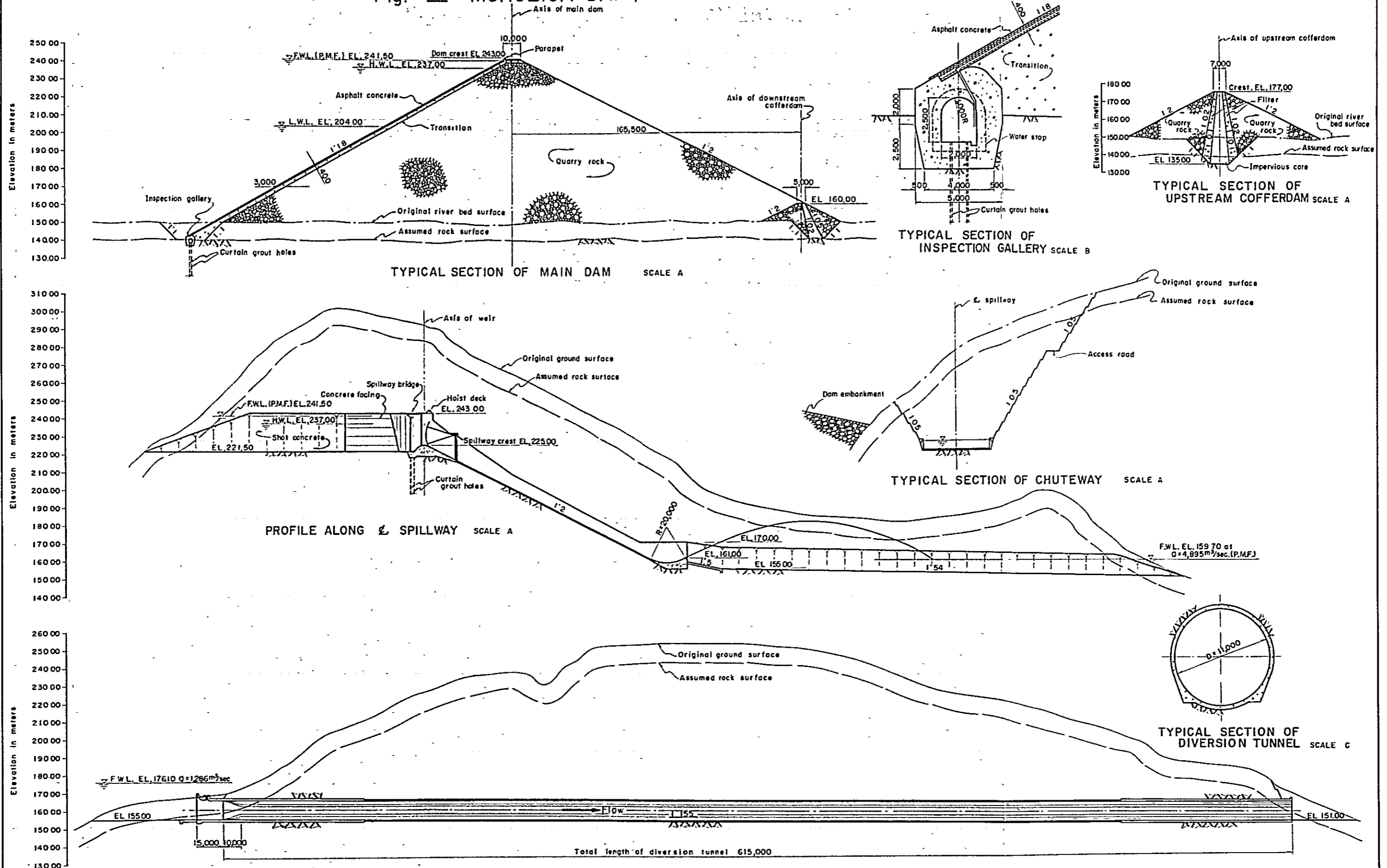
- 1 : Present worth benefit at the discount rate of 8%
- 2 : Alternative thermal power cost including capitalized OM&R cost
- 3 : Cost of San Fernando irrigation purpose dam and irrigation facilities including capitalized OM&R cost
- 4 : Smaller value of 1. and 2.
- 5 : 3. - 4.
- 6 : Total of joint facility cost at 8% discount rate in Table-L5.
- 7 : 4. + 7.
- 8 : Benefit-cost ratio at 8% discount rate

Fig.-L1 MOROLICA DAM, GENERAL LAYOUT OF HIGH DAM PLAN



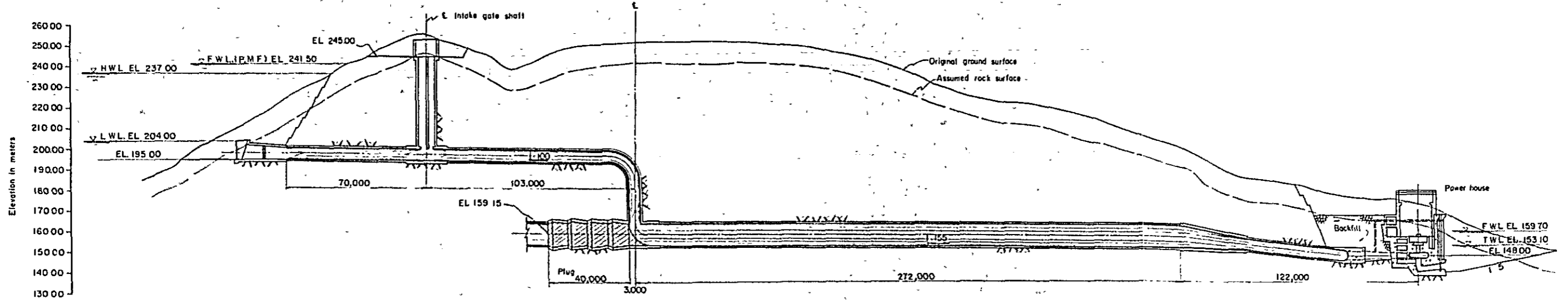
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Fig.-L2 MOROLICA DAM, SECTIONS OF HIGH DAM

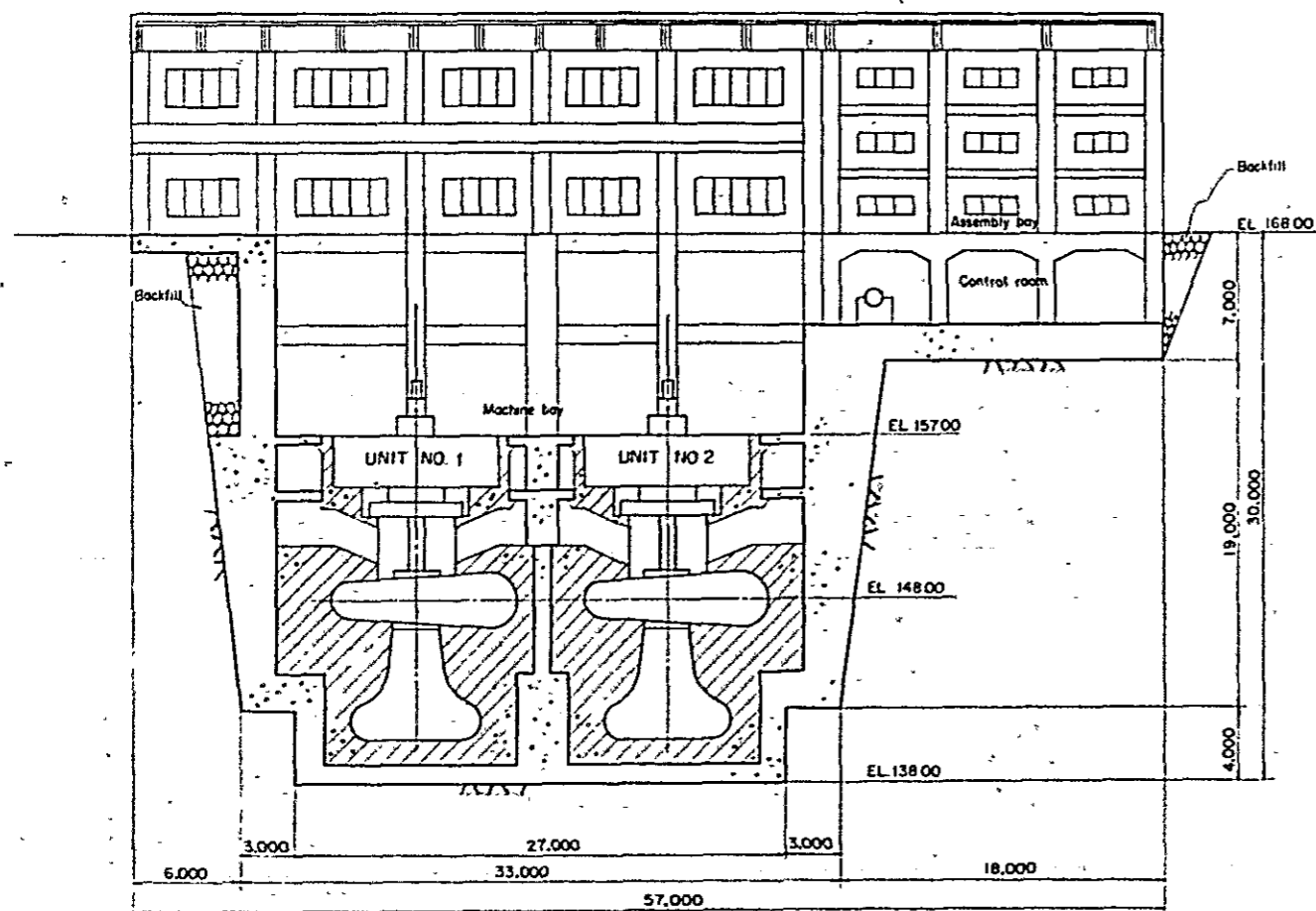


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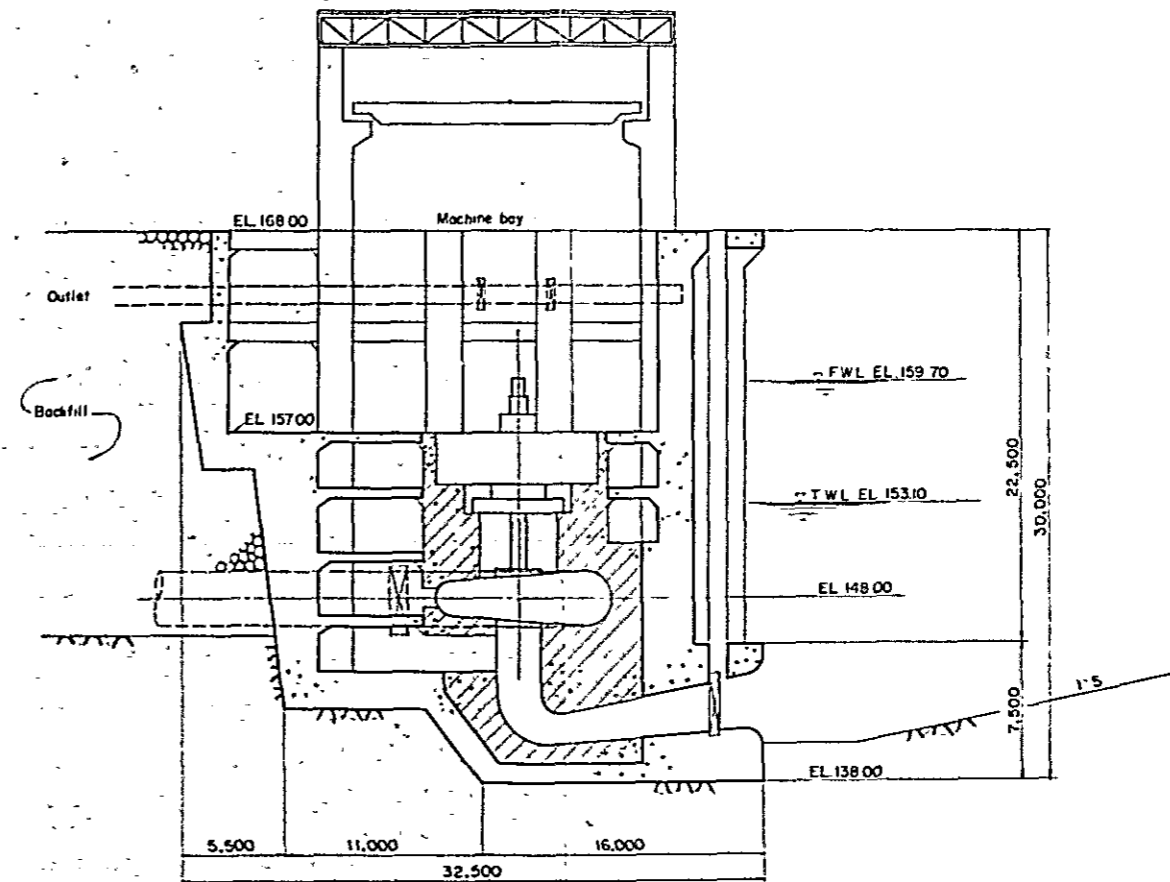
Fig.-L3 MOROLICA DAM, WATERWAY AND POWER HOUSE



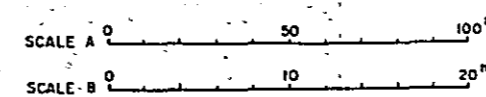
PROFILE ALONG  $\epsilon$  WATERWAY SCALE A



POWER HOUSE LONGITUDINAL SECTION SCALE B

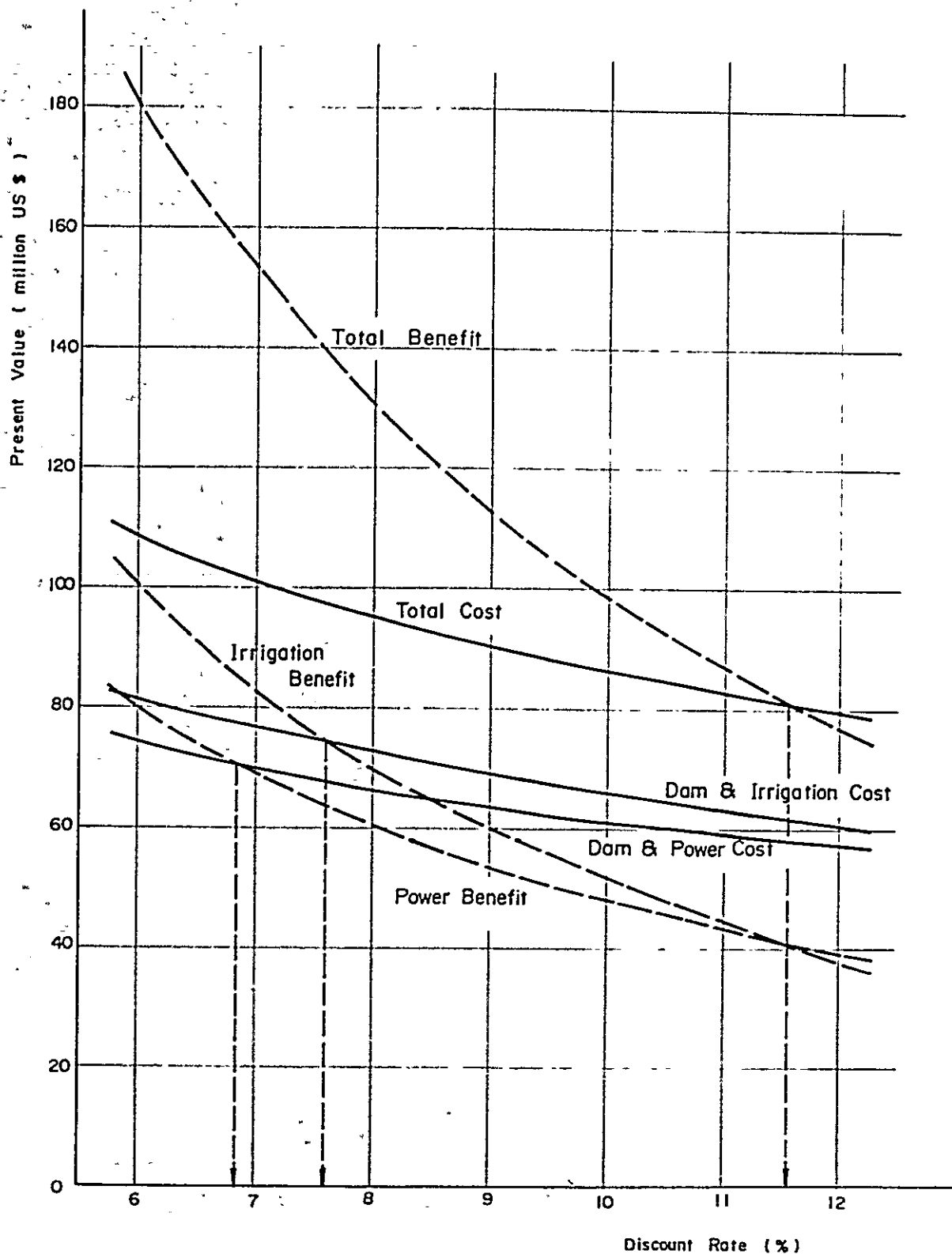


POWER HOUSE TRANSVERSAL SECTION SCALE B



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Fig.-L4 BENEFIT-COST CURVES  
MOROLICA MULTIPURPOSE PLAN



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