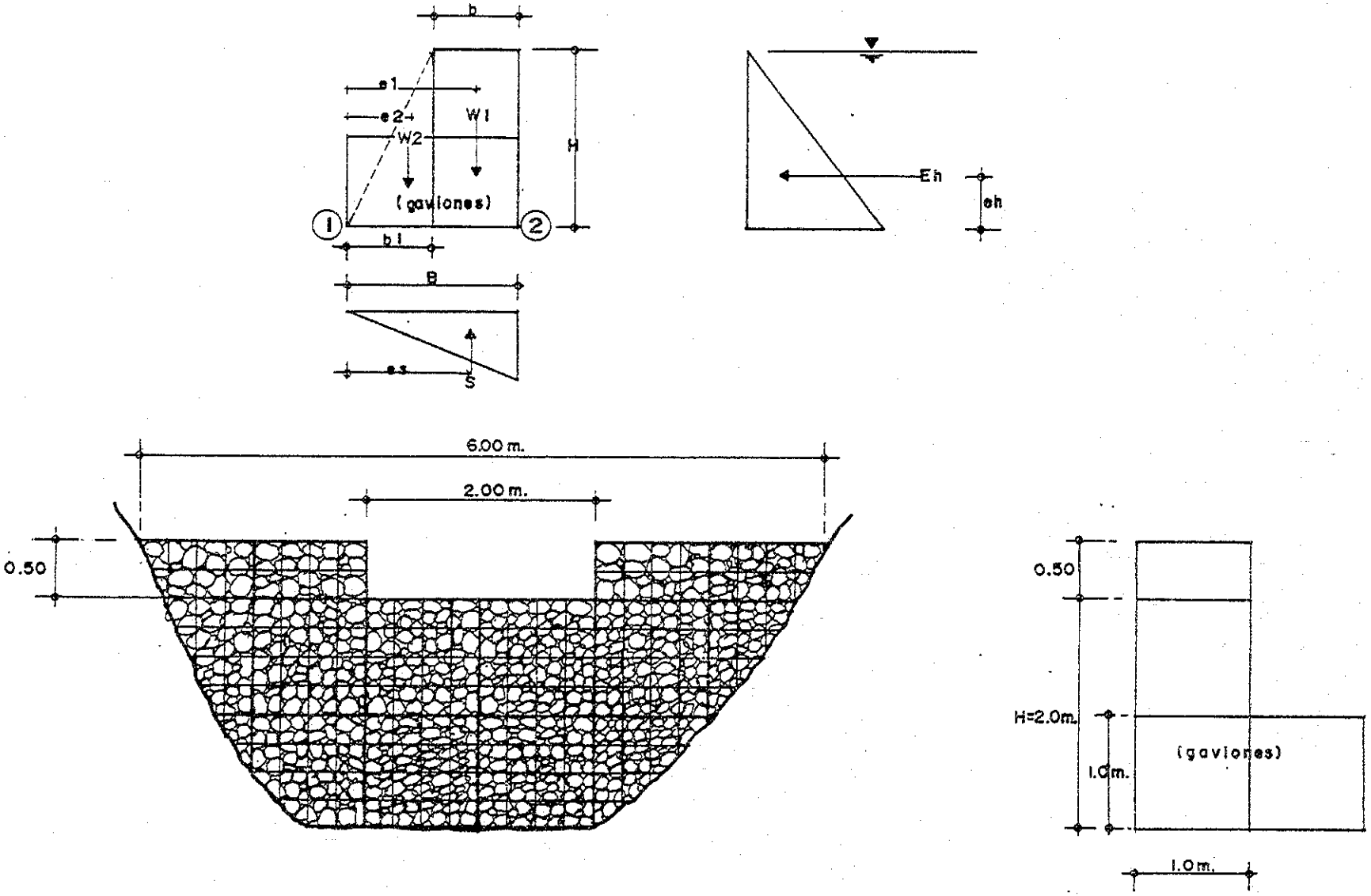

FIG.H.5.10 TYPICAL SECTION OF GABION CHECK DAM

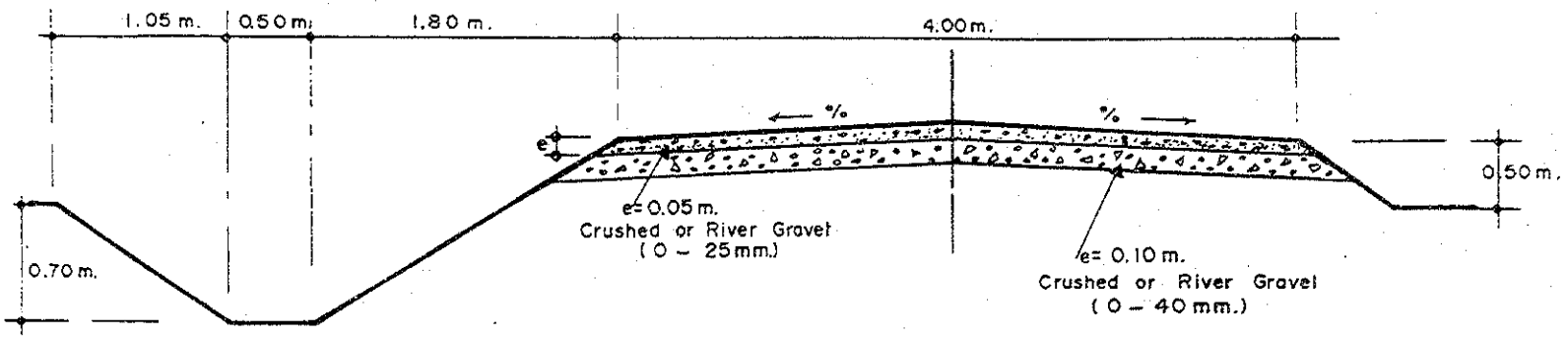

FIG.H.5.11 TYPICAL SECTION OF PENETRATION ROAD

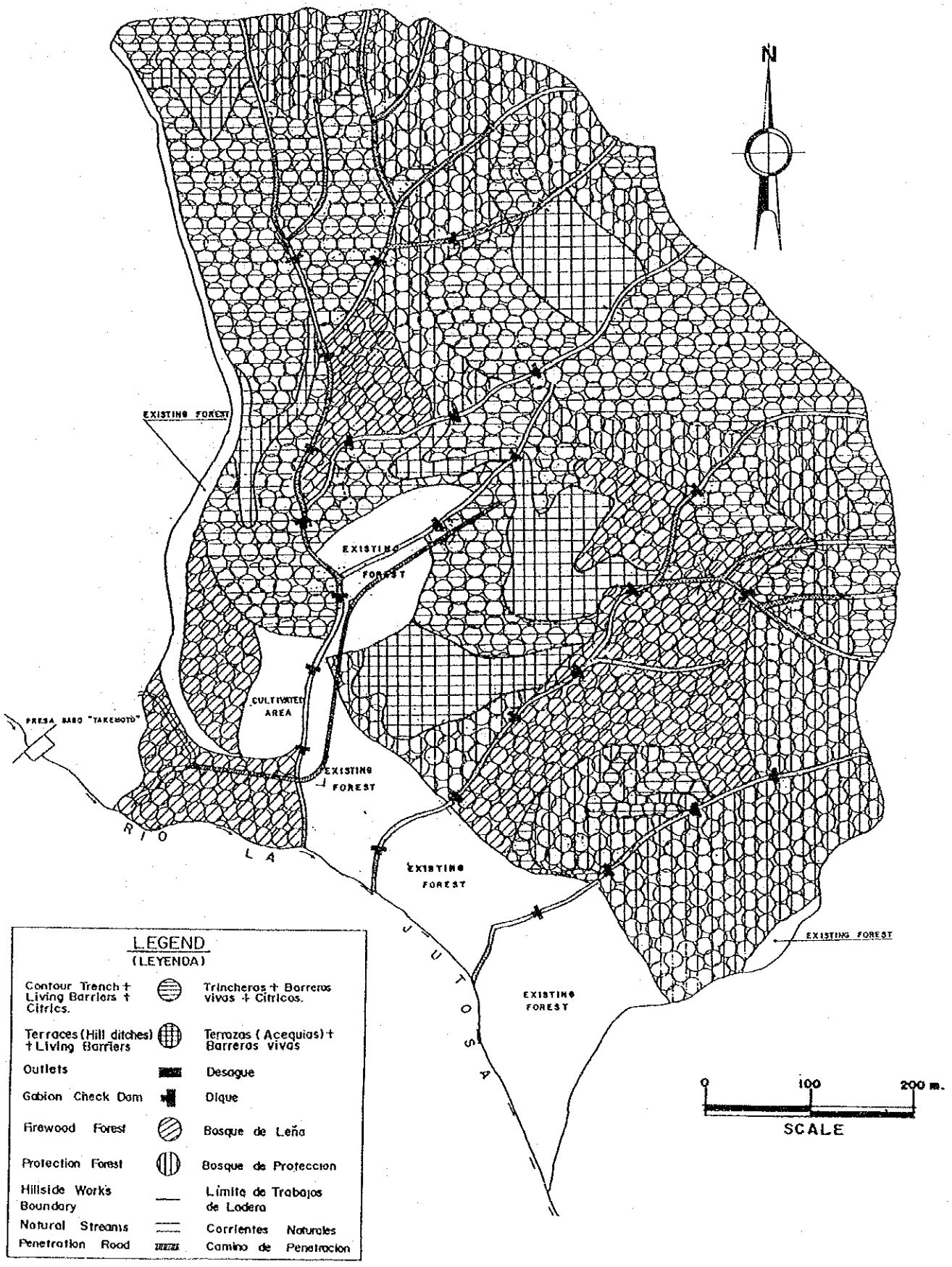

FIG.H.5.12 GENERAL PLAN FOR HILLSIDE WORKS

SUPPORTING REPORT I
FLOOD DAMAGE ANALYSIS

SUPPORTING REPORT I FLOOD DAMAGE ANALYSIS

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SUPPORTING REPORT I FLOOD DAMAGE ANALYSIS

1. GENERAL

For the purpose of evaluating a benefit expected by executing the project, a flood damage potential is estimated for each probable flood discharge, using number and kinds of assets in the probable flood area, appraisals of the assets and damage rates of assets submerged by floods. In addition to the damage to the said assets, economic losses such as business suspension loss, traffic interruption loss and expenditure of emergency measure cost are assessed as the flood damage.

The flood damage is firstly estimated by return period (2-, 5-, 30-, 50- and 100-year) about the three river basins of Rio Choloma, Rio Blanco and Rio El Sauce, and finally an average annual damage is calculated by using the said flood damage by return period on the same three rivers.

These estimates were roughly made in the Master Plan Study already, and it was concluded that the improvement of the Choloma river out of the said rivers would produce the highest economic effect. In view of such a conclusion, a more detailed survey was carried out about the flood damage potential in the Rio Choloma basin during the field works in the Second Stage. In addition to the above-mentioned survey, a review is made about kinds, number and prices of assets and field crops to be damaged by floods. Accordingly, the flood damage estimated herein would be made under the new conditions.

2. ASSETS IN POTENTIAL FLOOD AREA

2.1 Distribution of Assets in Potential Flood Area

According to the result of hydrological and hydraulic analyses, the flood return period of Rio Choloma corresponds approximately to 50-year for the 1974 flood and 2-year for the 1990 flood, and the flooded areas in these basins are estimated at 36 sq. km. and 12 sq. km. respectively. Moreover, the potential inundation area is estimated at 83 sq. km. for the Rio Blanco and 36 sq. km. for the Rio El Sauce.

Assets in the potential flood area are mainly composed of general assets (buildings and household effects in buildings), agricultural crops, public facilities and others. In the

present study, the general assets are classified into residential houses, farm houses, shops, churches, clinics, schools, offices and factories. The household effects consist of equipment, materials, etc. Major crops planted in the agricultural land are maize, rice, beans, sugar cane, bananas, platanos, vegetables, and cultivated and natural pastures.

Number of buildings and areas of agricultural crops planted in the inundation area by probable flood discharge are estimated based on land use survey and hydraulic analysis, and the results are summarized in *Tables* I.2.1, I.2.2 and I.2.3.

2.2 Appraisals of General Assets

Based on the asset survey which was conducted by the JICA Study Team, the average appraisals of buildings and household effects at the price level as of June 1993 together with an average distribution of the household effects above floor level per house are given in *Table* I.2.4.

With regard to the distribution of household effects, household own livestock is regarded as an asset situated under 0.50 meters above ground level, for convenience of the flood damage estimates.

2.3 Production of Agricultural Crops

The flood damage to agricultural crops planted in the potential flood area would be defined as a reduction in the profit which is given by subtracting a harvest cost from the production amount.

In order to estimate this damage, unit production (Lps./ha) and unit harvest cost (Lps./ha) of major agricultural crops are estimated based on agricultural statistics of Honduras and the field survey by the Study Team. The results are summarized in *Table* I.2.5.

3. ESTIMATES OF DAMAGE CAUSED BY PROBABLE FLOOD DISCHARGE

3.1 Rate of Flood Damage to Assets

Rate of the damage caused by floods to the assets would be mainly related to water

depth and duration of inundation in the flooded area. However, according to result of the flood damage survey by the JICA Study Team, the past floods of Rio Choloma, Rio Blanco and Rio El Sauce provide a correlation between water depth and inundated duration. Accordingly, in the present study only the water depth is approximately assumed to be used as a representative parameter for estimating the damage rate.

The rate of damage to assets submerged is assumed on the basis of the flood damage rate which is being applied in the Ministry of Construction of Japan, taking into consideration the flood damage conditions of the said three rivers in 1974 and 1990 and the flood damage in other tropical countries.

Table I.3.1 provides the damage rate to assets such as buildings, household effects and planted crops submerged by floods. The damage rate is categorized into two conditions; one considers a sediment of debris, sand and earth in the assets submerged, and the other excludes the sediment from consideration.

Based on a result of the sediment flow analysis on debris, sand and earth in the Study Area, the sediment condition is applied to flood damages in the Rio Choloma basin and some parts of the Rio Blanco and Rio El Sauce basins, and the non-sediment condition to the flood damages in the remaining parts of the Rio Blanco and Rio El Sauce basins.

3.2 Estimates of Flood Damage

3.2.1 Damage to General Assets and Agricultural Crops

The flood damages to general assets such as buildings, household effects and agricultural crops are estimated by using data shown in *Tables* I.2.1 to I.2.3, applying the following respective formulae.

Taking into consideration that the estimated flood damage will come to an economic benefit by executing the project, in this section the economic values of the flood damages are provided by multiplying the above-calculated results by a standard conversion factor (= 0.95), and the results are summarized in *Table* I.3.2.

1) Damage to Buildings

The damage to buildings in the inundation area can be estimated by the following formula:

$$D = N * A * R$$

where

D : Amount of damage to buildings
N : Number of buildings
A : Average appraisal per building
R : Average damage rate of buildings submerged

2) Damage to Household Effects

The damage to household effects in the inundation area can be estimated by the following formula:

$$D = N * A * d * R$$

where

D: Amount of damage to household effects
N: Number of buildings
A: Average appraisal of household effects per building
d: Average accumulative distribution of household effects above floor level in a building
R: Average damage rate of household effects submerged

Calculations of the damage amounts to buildings and household effects are conducted by kind of buildings and by inundation depth, and the total damage amount could be obtained by adding these amounts together.

3) Damage to Agricultural Crops

The damage to an agricultural crop planted in the inundation area can be estimated by the following formula:

$$D = I * P * R$$

where

D: Damage to agricultural crop

I: Inundation area (in has.)
P: Profit from crop production per ha
R: Average damage rate of crop submerged

The estimate above is made by kind of crop and by inundation depth, and the total amount of damage to agricultural crops could be estimated by summing up the damage amounts of individual crops.

3.2.2 Other Damages and Losses

Other major damages and losses caused by flood would be represented by 1) damage to public facilities, 2) economic loss due to business suspension of inhabitants and enterprises, including economic loss due to traffic interruption, and 3) expenditure of emergency measure cost.

1) Damage to Public Facilities

The public facilities include roads, bridges, railways, river dykes, agricultural facilities, electricity and telecommunication systems, etc. In the present study, the flood damage to these facilities is estimated based on the actual flood damages in 1969 and 1974, since it is difficult to make reasonable estimation of the potential flood damage by return period.

According to the records of damage caused by the 1969- and 1974-flood, the total amount of damage to these facilities indicated approximately 15 % of the total sum of damage to general assets and agricultural crops. In the present study, this percentage is assumed to be a damage rate of the public facilities. The estimated damage amount by return period is summarized in *Table* I.3.2.

2) Economic Losses due to Business Suspension and Traffic Interruption

a) Economic Loss due to Business Suspension

The past heavy floods damaged to lots of inhabitants and enterprises in and around the Study Area. Records of the 1969- and 1974-flood indicate that they sustained a great economic loss due to suspension of their daily business and many lives of them were injured and lost in the floods.

According to the damage records of the said past floods, the economic loss of the

business suspension, including the economic loss due to traffic interruption mentioned below, is approximately estimated at 5 % of the total damage to the general assets and agricultural crops. This percentage would be applied to estimates of flood damage in the present study.

b) Economic Loss due to Traffic Interruption

In the Study Area, the national road of Route CA-5 and the national railway run north and south through San Pedro Sula and Choloma cities. In addition to them, a part of another national road, CA-13, as well as some regional roads distribute in the Study Area.

Traffic on these roads and railway has been frequently interrupted by the past heavy floods, and the majority of the traffic were obliged waiting whenever the heavy flood occurred, because it is difficult to make detours using other means of transport, especially with regard to transports on route CA-5 and railway.

During the past heavy floods, traffic interruption as well as the said business suspension, besides the economic loss, was caused a serious social loss such as mental uneasiness of inhabitants, deficiency of social and public communications, and occurrence of social unrest. An effect of reduction in such social loss to be brought by executing the project would be provided as an intangible benefit.

3) Emergency Measure Expenses

Based on the damage records in the past floods, the flood emergency measure expenses are assumed to be 10 % of the total damage amount of general assets and agricultural crops (*Table* I.3.2).

3.2.3 Total Damage Amount by Return Period

Table I.3.2 provides flood damages with return periods of 2-, 30-, 50- and 100-year for the Rio Choloma and with return periods of 5-, 30-, 50- and 100-year for the Rio Blanco and the Rio El Sauce. Besides these damages, the flood damage with 5-year return period on the Rio Choloma is estimated to be Lps. 65 million by interpolation from damages with other return periods of the Rio Choloma, for the purpose of improving the estimated value of average annual flood damage.

3.3 Average Annual Flood Damage

The average annual damage from a year with innocuous discharge to any probable year with flood discharge of a river is estimated by the following formula, using the total damage for each return period shown in *Table* I.3.2.

$$d_a = \int_{Q1}^{Q2} D(Q)P(Q)dq$$

where

d_a: average annual flood damage
Q: flood discharge
D(Q): damage caused by flood discharge (Q)
P(Q): probability of occurrence of flood discharge (Q)
dq: increment in discharge
Q_1: innocuous discharge
Q_2: design flood discharge

The average annual flood damage by return period is summarized as follows

Average Annual Flood Damage (in 1,000 Lps.)

Return Period (years)	Choloma Basin	Blanco Basin	El Sauce Basin	Blanco & El Sauce Basins
2	5,882	-	-	-
5	19,161	7,144	17,862	25,006
30	49,392	21,490	29,938	51,428
50	55,855	23,716	31,353	55,069
100	62,747	25,656	32,696	58,352

After finish of the Master Plan Study, number and appraisals of assets to be inundated in the flood area again were surveyed in more detail for the purpose of the succeeding Feasibility Study, and some parts were improved. These improved values are applied to estimates of the project benefit at the Feasibility Study stage, and also to re-calculation of the project benefit at the Master Plan stage.

As a result, the average annual flood damage increased somewhat as a whole, compared with the foregoing values. However, such a little increase in the damage will have no influence on a conclusion of the Master Plan Study.

It is expected that these flood damages will be reduced by executing the project, and the reduced damage would be an economic benefit of the project.

TABLES

TABLE I.2.1 (1/2) ASSETS AND AGRICULTURAL LAND TO BE SUBMERGED BY PROBABLE FLOOD DISCHARGE OF THE RIO CHOLOMA (SEDIMENT AREA)

(A) Number of Buildings

Return Period: 2-Year

Water Depth	RESIDENTIAL HOUSE				Farm	Shops	Church	Clinic	School	Office	Factory	Total
(m)	High	Middle	Low	Poor	House							
0.0-0.5	17	24	47	32	4	3	1	1	1	1	0	131
0.5-1.0	8	8	17	24	4	4	1	0	0	2	1	69
1.0-1.5	3	4	8	7	0	4	0	0	0	2	1	29
1.5-2.0	3	3	6	3	0	2	0	0	0	1	0	18
2.0-2.5	1	1	3	3	0	2	0	0	0	0	0	10
over 2.5	0	1	1	1	0	1	0	0	0	0	0	4
Total No.	32	41	82	70	8	16	2	1	1	6	2	261

Return Period: 30-Year

Water Depth	RESIDENTIAL HOUSE				Farm	Shops	Church	Clinic	School	Office	Factory	Total
(m)	High	Middle	Low	Poor	House							
0.0-0.5	290	350	699	524	4	52	12	3	4	20	4	1,962
0.5-1.0	55	55	164	604	26	64	10	2	2	25	3	1,010
1.0-1.5	53	70	139	90	13	64	2	1	1	24	2	459
1.5-2.0	29	40	79	64	4	39	0	1	0	15	1	272
2.0-2.5	21	29	36	53	0	25	0	0	0	10	1	175
over 2.5	7	15	21	28	0	13	0	0	0	6	0	90
Total No.	455	559	1,138	1,363	47	257	24	7	7	100	11	3,968

Return Period: 50-Year

Water Depth	RESIDENTIAL HOUSE				Farm	Shops	Church	Clinic	School	Office	Factory	Total
(m)	High	Middle	Low	Poor	House							
0.0-0.5	546	744	1,486	1,050	8	108	26	7	9	43	11	4,140
0.5-1.0	211	211	420	1,049	22	135	21	5	5	51	5	2,135
1.0-1.5	103	103	160	573	47	146	6	1	1	57	3	1,100
1.5-2.0	68	89	182	114	23	82	0	1	0	32	3	594
2.0-2.5	46	57	63	137	0	55	0	0	0	21	1	380
over 2.5	23	32	61	36	0	27	0	0	0	11	0	190
Total No.	997	1,239	2,372	2,959	100	552	53	14	15	215	23	8,539

Return Period: 100-Year

Water Depth	RESIDENTIAL HOUSE				Farm	Shops	Church	Clinic	School	Office	Factory	Total
(m)	High	Middle	Low	Poor	House							
0.0-0.5	578	789	1,568	1,129	9	114	27	8	10	45	12	4,389
0.5-1.0	220	220	439	1,083	23	143	22	6	6	54	6	2,222
1.0-1.5	105	105	166	606	49	155	7	2	2	59	4	1,160
1.5-2.0	73	95	195	122	24	86	0	2	0	34	4	635
2.0-2.5	48	61	67	146	0	57	0	0	0	23	2	404
over 2.5	25	35	65	39	0	29	0	0	0	12	0	205
Total No.	1,049	1,305	2,500	3,125	105	584	56	18	18	227	28	9,015

TABLE I.2.1 (2/2) ASSETS AND AGRICULTURAL LAND TO BE SUBMERGED BY PROBABLE FLOOD DISCHARGE OF THE RIO CHOLOMA (SEDIMENT AREA)

(B) Agricultural Land (has.)
Return Period: 2-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana	Plátano	Vegetables	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	8	0	4	0	0	0	2	2	0	191	120	327
0.5-1.0	6	0	3	1	0	0	1	1	1	144	134	291
1.0-1.5	4	0	2	1	0	0	1	1	1	99	148	257
1.5-2.0	3	0	1	0	0	0	0	0	0	75	112	191
2.0-2.5	2	0	1	0	0	0	0	0	0	37	81	121
over 2.5	0	0	0	0	0	0	0	0	0	16	69	85
Total Area	23	0	11	2	0	0	4	4	2	562	664	1,272

Return Period: 30-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana	Plátano	Vegetables	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	25	0	13	1	0	0	6	7	1	353	235	641
0.5-1.0	19	0	10	4	0	0	3	8	3	265	263	575
1.0-1.5	13	0	8	2	0	0	1	2	4	183	290	503
1.5-2.0	10	0	4	1	0	0	2	2	1	139	221	380
2.0-2.5	5	0	3	1	0	0	1	1	0	68	159	238
over 2.5	2	0	2	1	0	0	1	1	0	32	137	176
Total Area	74	0	40	10	0	0	14	21	9	1,040	1,305	2,513

Return Period: 50-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana	Plátano	Vegetables	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	41	0	20	1	0	0	10	12	3	423	294	804
0.5-1.0	31	0	15	5	0	0	5	13	5	314	329	717
1.0-1.5	21	0	14	4	0	0	3	4	6	218	363	633
1.5-2.0	16	0	7	2	0	0	4	4	2	169	276	480
2.0-2.5	8	0	5	3	0	0	2	2	0	81	199	300
over 2.5	4	0	4	1	0	0	1	1	0	37	171	219
Total Area	121	0	65	16	0	0	25	36	16	1,242	1,632	3,153

Return Period: 100-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana	Plátano	Vegetables	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	51	0	25	1	0	0	12	14	3	462	329	897
0.5-1.0	38	0	19	7	0	0	6	16	6	342	368	802
1.0-1.5	26	0	17	4	0	0	3	4	8	237	406	705
1.5-2.0	20	0	9	2	0	0	4	4	2	184	309	534
2.0-2.5	10	0	6	3	0	0	2	2	0	88	223	334
over 2.5	4	0	4	1	0	0	1	1	0	40	191	242
Total Area	149	0	80	18	0	0	28	41	19	1,353	1,826	3,514

TABLE I.2.2 (1/4) ASSETS AND AGRICULTURAL LAND TO BE SUBMERGED BY PROBABLE FLOOD DISCHARGE OF THE RIO BLANCO (SEDIMENT AREA)

(A) Number of Buildings

Return Period: 5-Year

Water Depth (m)	RESIDENTIAL HOUSE				Farm House	Shops	Church	Clinic	School	Office	Factory	Total
	High	Middle	Low	Poor								
0.0-0.5	0	0	0	0	2	0	0	0	0	0	0	2
0.5-1.0	0	0	0	0	1	0	0	0	0	0	0	1
1.0-1.5	0	0	0	0	0	0	0	0	0	0	0	0
1.5-2.0	0	0	0	0	0	0	0	0	0	0	0	0
2.0-2.5	0	0	0	0	0	0	0	0	0	0	0	0
over 2.5	0	0	0	0	0	0	0	0	0	0	0	0
Total No.	0	0	0	0	3	0	0	0	0	0	0	3

Return Period: 30-Year

Water Depth (m)	RESIDENTIAL HOUSE				Farm House	Shops	Church	Clinic	School	Office	Factory	Total
	High	Middle	Low	Poor								
0.0-0.5	153	172	39	19	5	3	1	1	1	2	1	397
0.5-1.0	89	100	22	11	3	2	1	0	0	1	0	229
1.0-1.5	28	31	7	4	1	1	0	0	0	0	0	72
1.5-2.0	6	6	1	1	0	0	0	0	0	0	0	14
2.0-2.5	3	3	1	0	0	0	0	0	0	0	0	7
over 2.5	0	0	0	0	0	0	0	0	0	0	0	0
Total No.	279	312	70	35	9	6	2	1	1	3	1	719

Return Period: 50-Year

Water Depth (m)	RESIDENTIAL HOUSE				Farm House	Shops	Church	Clinic	School	Office	Factory	Total
	High	Middle	Low	Poor								
0.0-0.5	172	193	43	21	6	4	1	1	1	2	1	445
0.5-1.0	100	112	24	12	3	3	1	1	0	1	0	257
1.0-1.5	31	35	8	4	1	1	0	0	0	0	0	80
1.5-2.0	6	7	2	1	0	0	0	0	0	0	0	16
2.0-2.5	3	4	1	0	0	0	0	0	0	0	0	8
over 2.5	0	0	0	0	0	0	0	0	0	0	0	0
Total No.	312	351	78	38	10	8	2	2	1	3	1	806

Return Period: 100-Year

Water Depth (m)	RESIDENTIAL HOUSE				Farm House	Shops	Church	Clinic	School	Office	Factory	Total
	High	Middle	Low	Poor								
0.0-0.5	192	216	48	24	6	6	1	1	1	2	1	498
0.5-1.0	112	126	28	15	4	3	1	1	1	1	0	292
1.0-1.5	35	39	9	4	1	1	0	0	0	0	0	89
1.5-2.0	7	8	2	1	0	0	0	0	0	0	0	18
2.0-2.5	4	4	1	0	0	0	0	0	0	0	0	9
over 2.5	0	0	0	0	0	0	0	0	0	0	0	0
Total No.	350	393	88	44	11	10	2	2	2	3	1	906

TABLE I.2.2 (2/4) ASSETS AND AGRICULTURAL LAND TO BE SUBMERGED BY PROBABLE FLOOD DISCHARGE OF THE RIO BLANCO (SEDIMENT AREA)

(B) Agricultural Land (has.)
Return Period: 5-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana	Vegetables	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	4	0	5	1	1	1	3	18	29	153	215
0.5-1.0	4	0	4	0	1	0	2	11	19	103	144
1.0-1.5	2	0	1	0	0	0	1	5	8	40	57
1.5-2.0	0	0	0	0	0	0	0	1	2	9	12
2.0-2.5	0	0	0	0	0	0	0	0	0	0	0
over 2.5	0	0	0	0	0	0	0	0	0	0	0
Total Area	10	0	10	1	2	1	6	35	58	305	428

Return Period: 30-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana	Vegetables	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	5	0	9	1	1	1	4	40	30	314	405
0.5-1.0	3	0	5	0	1	0	3	27	20	215	274
1.0-1.5	2	0	4	0	0	0	2	21	16	169	214
1.5-2.0	1	0	1	0	0	0	1	7	5	54	69
2.0-2.5	0	0	0	0	0	0	0	2	1	15	18
over 2.5	0	0	0	0	0	0	0	0	0	0	0
Total Area	11	0	19	1	2	1	10	97	72	767	980

Return Period: 50-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana	Vegetables	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	5	0	9	1	1	1	4	77	39	436	573
0.5-1.0	4	0	6	0	1	0	3	53	27	298	392
1.0-1.5	3	0	5	0	0	0	2	41	21	234	306
1.5-2.0	1	0	1	0	0	0	1	13	7	74	97
2.0-2.5	0	0	0	0	0	0	0	4	2	21	27
over 2.5	0	0	0	0	0	0	0	0	0	0	0
Total Area	13	0	21	1	2	1	10	188	96	1,063	1,395

Return Period: 100-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana	Vegetables	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	6	0	10	0	1	1	5	87	40	489	639
0.5-1.0	4	0	7	0	1	0	3	59	27	334	435
1.0-1.5	3	0	5	0	0	0	3	46	21	262	340
1.5-2.0	1	0	2	0	0	0	1	15	7	83	109
2.0-2.5	0	0	0	0	0	0	0	4	2	24	30
over 2.5	0	0	0	0	0	0	0	0	0	0	0
Total Area	14	0	24	0	2	1	12	211	97	1,192	1,553

TABLE I.2.2 (3/4) ASSETS AND AGRICULTURAL LAND TO BE SUBMERGED BY PROBABLE FLOOD DISCHARGE OF THE RIO BLANCO (NON-SEDIMENT AREA)

(A) Number of Buildings
Return Period: 5-Year

Water Depth (m)	RESIDENTIAL HOUSE High	Middle	Low	Poor	Farm House	Shops	Church	Clinic	School	Office	Factory	Total
0.0-0.5	32	54	86	272	5	7	1	0	0	1	0	458
0.5-1.0	19	32	51	162	3	4	1	0	0	0	0	272
1.0-1.5	4	8	12	38	1	1	0	0	0	0	0	64
1.5-2.0	1	1	2	5	0	0	0	0	0	0	0	9
2.0-2.5	0	0	0	0	0	0	0	0	0	0	0	0
over 2.5	0	0	0	0	0	0	0	0	0	0	0	0
Total No.	56	95	151	477	9	12	2	0	0	1	0	803

Return Period: 30-Year

Water Depth (m)	RESIDENTIAL HOUSE High	Middle	Low	Poor	Farm House	Shops	Church	Clinic	School	Office	Factory	Total
0.0-0.5	61	106	135	421	20	12	2	1	1	2	1	762
0.5-1.0	35	41	79	244	11	7	1	0	1	1	1	421
1.0-1.5	11	29	25	76	4	2	0	0	0	1	0	148
1.5-2.0	2	6	5	15	1	0	0	0	0	0	0	29
2.0-2.5	1	3	2	8	0	0	0	0	0	0	0	14
over 2.5	0	0	0	0	0	0	0	0	0	0	0	0
Total No.	110	185	246	764	36	21	3	1	2	4	2	1,374

Return Period: 50-Year

Water Depth (m)	RESIDENTIAL HOUSE High	Middle	Low	Poor	Farm House	Shops	Church	Clinic	School	Office	Factory	Total
0.0-0.5	85	127	155	471	26	25	6	1	1	3	1	901
0.5-1.0	49	73	90	274	15	14	4	1	0	1	1	522
1.0-1.5	16	23	28	86	5	5	1	0	0	1	0	165
1.5-2.0	3	5	6	17	1	1	0	0	0	0	0	33
2.0-2.5	2	2	3	9	0	0	0	0	0	0	0	16
over 2.5	0	0	0	0	0	0	0	0	0	0	0	0
Total No.	155	230	282	857	47	45	11	2	1	5	2	1,637

Return Period: 100-Year

Water Depth (m)	RESIDENTIAL HOUSE High	Middle	Low	Poor	Farm House	Shops	Church	Clinic	School	Office	Factory	Total
0.0-0.5	114	164	179	531	30	32	7	2	1	3	1	1,064
0.5-1.0	67	95	104	309	18	19	4	1	1	1	1	620
1.0-1.5	21	30	33	97	6	6	1	0	0	1	0	195
1.5-2.0	4	6	7	19	1	1	0	0	0	0	0	38
2.0-2.5	2	3	3	10	1	1	0	0	0	0	0	20
over 2.5	0	0	0	0	0	0	0	0	0	0	0	0
Total No.	208	298	326	966	56	59	12	3	2	5	2	1,937

TABLE I.2.2 (4/4) ASSETS AND AGRICULTURAL LAND TO BE SUBMERGED BY PROBABLE FLOOD DISCHARGE OF THE RIO BLANCO (NON-SEDIMENT AREA)

(B) Agricultural Land (has.)
Return Period: 5-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana	Vegetable	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	36	4	1	1	14	1	3	137	135	8	340
0.5-1.0	25	3	0	0	10	1	1	93	92	6	231
1.0-1.5	9	1	0	0	4	0	0	36	35	2	87
1.5-2.0	2	0	0	0	1	0	0	8	8	1	20
2.0-2.5	0	0	0	0	0	0	0	0	0	0	0
over 2.5	0	0	0	0	0	0	0	0	0	0	0
Total Area	72	8	1	1	29	2	4	274	270	17	678

Return Period: 30-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana	Vegetable	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	91	10	5	3	106	4	9	350	479	11	1,068
0.5-1.0	61	7	3	2	72	3	6	239	327	8	728
1.0-1.5	48	5	3	1	57	2	4	188	257	6	571
1.5-2.0	15	2	1	0	18	0	1	60	81	2	180
2.0-2.5	4	0	0	0	5	0	0	17	23	1	50
over 2.5	0	0	0	0	0	0	0	0	0	0	0
Total Area	219	24	12	6	258	9	20	854	1,167	28	2,597

Return Period: 50-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana	Vegetable	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	114	12	6	3	118	5	10	392	554	39	1,253
0.5-1.0	78	8	4	2	80	3	7	267	378	27	854
1.0-1.5	61	7	3	1	63	2	5	210	297	20	669
1.5-2.0	19	2	1	1	20	1	2	67	95	7	215
2.0-2.5	6	1	0	0	6	0	0	19	26	2	60
over 2.5	0	0	0	0	0	0	0	0	0	0	0
Total Area	278	30	14	7	287	11	24	955	1,350	95	3,051

Return Period: 100-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana	Vegetable	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	128	14	7	3	132	5	11	440	622	46	1,408
0.5-1.0	87	10	5	2	90	3	7	300	425	32	961
1.0-1.5	69	7	4	2	71	3	6	236	333	25	756
1.5-2.0	22	2	1	1	23	1	2	75	106	8	241
2.0-2.5	6	1	0	0	7	0	1	21	30	2	68
over 2.5	0	0	0	0	0	0	0	0	0	0	0
Total Area	312	34	17	8	323	12	27	1,072	1,516	113	3,434

TABLE I.2.3 (1/4) ASSETS AND AGRICULTURAL LAND TO BE SUBMERGED BY PROBABLE FLOOD DISCHARGE OF THE RIO EL SAUCE (SEDIMENT AREA)

(A) Number of Buildings

Return Period: 5-Year

Water Depth	RESIDENTIAL HOUSE				Farm	Shops	Church	Clinic	School	Office	Factory	Total
(m)	High	Middle	Low	Poor	House							
0.0-0.5	68	77	18	9	0	1	1	0	1	1	1	177
0.5-1.0	40	45	10	5	0	1	0	0	0	0	0	101
1.0-1.5	10	11	2	1	0	0	0	0	0	0	0	24
1.5-2.0	1	1	0	0	0	0	0	0	0	0	0	2
2.0-2.5	0	0	0	0	0	0	0	0	0	0	0	0
over 2.5	0	0	0	0	0	0	0	0	0	0	0	0
Total No.	119	134	30	15	0	2	1	0	1	1	1	304

Return Period: 30-Year

Water Depth	RESIDENTIAL HOUSE				Farm	Shops	Church	Clinic	School	Office	Factory	Total
(m)	High	Middle	Low	Poor	House							
0.0-0.5	104	117	26	13	1	3	1	1	1	1	1	269
0.5-1.0	61	69	15	8	0	1	1	0	1	1	1	158
1.0-1.5	20	22	5	2	0	1	0	0	0	0	0	50
1.5-2.0	4	4	1	1	0	0	0	0	0	0	0	10
2.0-2.5	2	2	1	0	0	0	0	0	0	0	0	5
over 2.5	0	0	0	0	0	0	0	0	0	0	0	0
Total No.	191	214	48	24	1	5	2	1	2	2	2	492

Return Period: 50-Year

Water Depth	RESIDENTIAL HOUSE				Farm	Shops	Church	Clinic	School	Office	Factory	Total
(m)	High	Middle	Low	Poor	House							
0.0-0.5	118	132	29	15	1	4	1	1	1	1	1	304
0.5-1.0	68	77	17	8	0	2	1	1	1	1	1	177
1.0-1.5	21	24	6	3	0	1	0	0	0	0	0	55
1.5-2.0	4	5	1	1	0	0	0	0	0	0	0	11
2.0-2.5	2	2	1	0	0	0	0	0	0	0	0	5
over 2.5	0	0	0	0	0	0	0	0	0	0	0	0
												0
Total No.	213	240	54	27	1	7	2	2	2	2	2	552

Return Period: 100-Year

Water Depth	RESIDENTIAL HOUSE				Farm	Shops	Church	Clinic	School	Office	Factory	Total
(m)	High	Middle	Low	Poor	House							
0.0-0.5	177	200	45	22	1	4	1	1	1	2	2	456
0.5-1.0	104	116	26	13	0	2	1	1	1	1	1	266
1.0-1.5	32	37	8	4	0	1	1	0	0	0	1	84
1.5-2.0	6	7	1	1	0	0	0	0	0	0	0	15
2.0-2.5	4	4	1	0	0	0	0	0	0	0	0	9
over 2.5	0	0	0	0	0	0	0	0	0	0	, 0	0
Total No.	323	364	81	40	1	7	3	2	2	3	4	830

TABLE I.2.3 (2/4) ASSETS AND AGRICULTURAL LAND TO BE SUBMERGED BY PROBABLE FLOOD DISCHARGE OF THE RIO EL SAUCE (SEDIMENT AREA)

(B) Agricultural Land (has.)
Return Period: 5-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana	Vegetables	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	0	0	0	0	0	0	0	0	3	3	6
0.5-1.0	0	0	0	0	0	0	0	0	2	2	4
1.0-1.5	0	0	0	0	0	0	0	0	1	1	2
1.5-2.0	0	0	0	0	0	0	0	0	0	0	0
2.0-2.5	0	0	0	0	0	0	0	0	0	0	0
over 2.5	0	0	0	0	0	0	0	0	0	0	0
Total Area	0	0	0	0	0	0	0	0	6	6	12

Return Period: 30-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana	Vegetables	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	1	0	1	0	0	0	1	1	6	7	17
0.5-1.0	0	0	1	0	0	0	0	0	4	5	10
1.0-1.5	0	0	0	0	0	0	0	0	3	4	7
1.5-2.0	0	0	0	0	0	0	0	0	1	1	2
2.0-2.5	0	0	0	0	0	0	0	0	0	0	0
over 2.5	0	0	0	0	0	0	0	0	0	0	0
Total Area	1	0	2	0	0	0	1	1	14	17	36

Return Period: 50-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana	Vegetables	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	1	0	1	0	0	0	1	1	7	9	20
0.5-1.0	0	0	1	0	0	0	0	0	4	5	10
1.0-1.5	0	0	0	0	0	0	0	0	3	4	7
1.5-2.0	0	0	0	0	0	0	0	0	1	1	2
2.0-2.5	0	0	0	0	0	0	0	0	0	0	0
over 2.5	0	0	0	0	0	0	0	0	0	0	0
Total Area	1	0	2	0	0	0	1	1	15	19	39

Return Period: 100-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana	Vegetables	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	1	0	1	0	0	0	1	1	7	9	20
0.5-1.0	0	0	1	0	0	0	0	0	5	6	12
1.0-1.5	0	0	0	0	0	0	0	0	4	5	9
1.5-2.0	0	0	0	0	0	0	0	0	1	2	3
2.0-2.5	0	0	0	0	0	0	0	0	0	0	0
over 2.5	0	0	0	0	0	0	0	0	0	0	0
Total Area	1	0	2	0	0	0	1	1	17	22	44

TABLE I.2.3 (3/4) ASSETS AND AGRICULTURAL LAND TO BE SUBMERGED BY PROBABLE FLOOD DISCHARGE OF THE RIO EL SAUCE (NON-SEDIMENT AREA)

(A) Number of Buildings
Return Period: 5-Year

Water Depth (m)	RESIDENTIAL HOUSE				Farm House	Shops	Church	Clinic	School	Office	Factory	Total
	High	Middle	Low	Poor								
0.0-0.5	3	4	1	1	3	0	0	0	0	0	0	12
0.5-1.0	2	3	1	0	1	0	0	0	0	0	0	7
1.0-1.5	1	1	0	0	0	0	0	0	0	0	0	2
1.5-2.0	0	0	0	0	0	0	0	0	0	0	0	0
2.0-2.5	0	0	0	0	0	0	0	0	0	0	0	0
over 2.5	0	0	0	0	0	0	0	0	0	0	0	0
Total No.	6	8	2	1	4	0	0	0	0	0	0	21

Return Period: 30-Year

Water Depth (m)	RESIDENTIAL HOUSE				Farm House	Shops	Church	Clinic	School	Office	Factory	Total
	High	Middle	Low	Poor								
0.0-0.5	24	77	489	311	3	9	2	1	3	4	1	924
0.5-1.0	14	45	284	181	2	5	2	1	1	2	1	538
1.0-1.5	4	14	89	57	1	2	0	0	0	1	0	168
1.5-2.0	1	3	18	11	0	0	0	0	0	0	0	33
2.0-2.5	0	1	9	6	0	0	0	0	0	0	0	16
over 2.5	0	0	0	0	0	0	0	0	0	0	0	0
Total No.	43	140	889	566	6	16	4	2	4	7	2	1,679

Return Period: 50-Year

Water Depth (m)	RESIDENTIAL HOUSE				Farm House	Shops	Church	Clinic	School	Office	Factory	Total
	High	Middle	Low	Poor								
0.0-0.5	26	86	547	348	4	11	3	2	3	4	1	1,035
0.5-1.0	15	50	318	203	3	6	2	1	2	3	1	604
1.0-1.5	5	16	100	63	1	2	1	0	1	1	0	190
1.5-2.0	1	3	20	13	0	0	0	0	0	0	0	37
2.0-2.5	0	2	10	6	0	0	0	0	0	0	0	18
over 2.5	0	0	0	0	0	0	0	0	0	0	0	0
Total No.	47	157	995	633	8	19	6	3	6	8	2	1,884

Return Period: 100-Year

Water Depth (m)	RESIDENTIAL HOUSE				Farm House	Shops	Church	Clinic	School	Office	Factory	Total
	High	Middle	Low	Poor								
0.0-0.5	29	97	614	390	5	13	4	2	4	6	1	1,165
0.5-1.0	17	56	357	227	3	7	2	2	2	3	1	677
1.0-1.5	5	18	112	71	1	2	1	0	1	1	0	212
1.5-2.0	1	4	22	14	0	0	0	0	0	0	0	41
2.0-2.5	0	1	11	7	0	0	0	0	0	0	0	19
over 2.5	0	0	0	0	0	0	0	0	0	0	0	0
Total No.	52	176	1,116	709	9	22	7	4	7	10	2	2,114

TABLE I 2.3 (4/4) ASSETS AND AGRICULTURAL LAND TO BE SUBMERGED BY PROBABLE FLOOD DISCHARGE OF THE RIO EL SAUCE (NON-SEDIMENT AREA)

(B) Agricultural Land (has.)
Return Period: 5-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana /egetables	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	35	4	0	0	0	0	69	87	22	217
0.5-1.0	24	3	0	0	0	0	44	59	13	143
1.0-1.5	9	1	0	0	0	0	28	23	5	66
1.5-2.0	2	0	0	0	0	0	7	5	1	15
2.0-2.5	0	0	0	0	0	0	0	0	0	0
over 2.5	0	0	0	0	0	0	0	0	0	0
Total Area	70	8	0	0	0	0	148	174	41	441

Return Period: 30-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana /egetables	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	40	5	0	0	36	0	84	130	120	415
0.5-1.0	27	3	0	0	25	0	57	89	81	282
1.0-1.5	21	2	0	0	20	0	45	70	64	222
1.5-2.0	7	1	0	0	6	0	14	22	20	70
2.0-2.5	2	0	0	0	2	0	4	6	6	20
over 2.5	0	0	0	0	0	0	0	0	0	0
Total Area	97	11	0	0	89	0	204	317	291	1,009

Return Period: 50-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana /egetables	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	45	5	0	0	41	0	93	180	134	498
0.5-1.0	30	3	0	0	28	0	64	123	92	340
1.0-1.5	24	3	0	0	22	0	50	97	72	268
1.5-2.0	8	1	0	0	7	0	16	31	23	86
2.0-2.5	2	0	0	0	2	0	5	9	7	25
over 2.5	0	0	0	0	0	0	0	0	0	0
Total Area	109	12	0	0	100	0	228	440	328	1,217

Return Period: 100-Year

Water Depth (m)	Maize	Rice	Beans	Sugar cane	Banana /egetables	Fruits	Other crops	Pasture (reform)	Pasture (natural)	Total
0.0-0.5	50	6	0	0	46	0	105	203	150	560
0.5-1.0	34	4	0	0	31	0	72	139	103	383
1.0-1.5	27	3	0	0	25	0	56	109	81	301
1.5-2.0	9	1	0	0	8	0	18	35	26	97
2.0-2.5	2	0	0	0	2	0	5	9	7	25
over 2.5	0	0	0	0	0	0	0	0	0	0
Total Area	122	14	0	0	112	0	256	495	367	1,366

TABLE I.2.4 AVERAGE APPRAISALS OF BUILDINGS AND HOUSEHOLD EFFECTS (AT THE 1993 PRICES)

Kind of Buildings	Average Appraisal of Building (Lps.)	Average Appraisal of House-hold Effects (Lps.)	Accumlative Distribution of Household Effects above Floor Level (%)					
			to 0.5 m	to 1.0 m	to 1.5 m	to 2.0 m	to 2.5 m	to 3.0 m
1. Residential Houses								
High Class	402,600	104,800	34.8	65.7	92.3	99.9	100.0	100.0
Middle Class	114,700	21,480	41.3	66.9	95.1	98.5	100.0	100.0
Low Class	48,100	9,420	44.2	74.3	95.9	99.8	100.0	100.0
Poor Class	11,000	3,370	52.0	72.7	97.3	99.7	100.0	100.0
2. Farm House	192,400	667,960	39.1	72.5	98.4	99.9	100.0	100.0
3. Shop	92,400	30,460	49.8	75.8	88.9	99.9	100.0	100.0
4. Church	322,500	18,620	50.4	61.8	74.3	77.9	100.0	100.0
5. Clinic	39,200	22,520	53.5	83.2	97.8	99.5	100.0	100.0
6. School	333,400	18,300	53.3	85.1	93.7	95.5	100.0	100.0
7. Office	205,500	23,090	53.1	92.3	98.4	100.0	100.0	100.0
8. Factory	29,800	66,370	93.7	99.7	100.0	100.0	100.0	100.0

Note : Household effects include equipment and materials.

TABLE I.2.5 UNIT PRODUCTION AND UNIT HARVEST COST OF AGRICULTURAL CROPS (AT THE 1993 PRICES)

Agricultural Crops	Unit Yield (tons/ha)	Unit Price (Lps./ton)	Unit Production (Lps./ha)	Unit Harvest Cost		Unit Profit (Lps./ha)
				(Lps./ton)	(Lps./ha)	
Maize	2.3	1,520	3,496	300	690	2,806
Rice	3.3	1,820	6,006	200	660	5,346
Beans	0.7	1,520	1,064	250	175	889
Sugar Cane	100.0	90	9,000	5	500	8,500
Banana	50.0	1,120	56,000	100	5,000	51,000
Platano	17.0	810	13,770	45	765	13,005
Vegetables	6.5	1,520	9,880	150	975	8,905
Fruits	17.0	1,120	19,040	100	1,700	17,340
Other crops	6.5	1,520	9,880	150	975	8,905
Pasture (reformed)	26.0	110	2,860	0	0	2,860
Pasture (natural)	9.0	110	990	0	0	990

TABLE I.3.1 (1/2) DAMAGE RATE TO ASSETS SUBMERGED BY FLOOD

Case A: Sediment

Assets	Water Depth above Floor Level (in Meter)					
	0.00-0.50	0.51-1.00	1.01-1.50	1.51-2.00	2.01-2.50	over 2.50
1. Buildings						
Residential Houses						
High Class	0.28	0.57	0.78	0.78	0.78	0.78
Middle Class	0.28	0.57	0.78	0.78	0.78	0.78
Low Class	0.28	0.57	0.78	0.78	0.78	0.78
Poor Class	0.28	0.57	0.78	0.78	0.78	0.78
Farm House	0.28	0.57	0.78	0.78	0.78	0.78
Shop	0.28	0.57	0.78	0.78	0.78	0.78
Church	0.28	0.57	0.78	0.78	0.78	0.78
Clinic	0.28	0.57	0.78	0.78	0.78	0.78
School	0.28	0.57	0.78	0.78	0.78	0.78
Office	0.28	0.57	0.78	0.78	0.78	0.78
Factory	0.28	0.57	0.78	0.78	0.78	0.78
2. Household Effects						
Residential Houses						
High Class	0.29	0.69	0.85	0.85	0.85	0.85
Middle Class	0.29	0.69	0.85	0.85	0.85	0.85
Low Class	0.29	0.69	0.85	0.85	0.85	0.85
Poor Class	0.29	0.69	0.85	0.85	0.85	0.85
Farm House	0.33	0.57	0.78	0.78	0.78	0.78
Shop	0.33	0.60	0.80	0.80	0.80	0.80
Church	0.33	0.60	0.80	0.80	0.80	0.80
Clinic	0.33	0.60	0.80	0.80	0.80	0.80
School	0.33	0.60	0.80	0.80	0.80	0.80
Office	0.33	0.60	0.80	0.80	0.80	0.80
Factory	0.33	0.60	0.80	0.80	0.80	0.80
3. Agricultural Crops						
Maize	0.52	1.00	1.00	1.00	1.00	1.00
Rice	0.52	1.00	1.00	1.00	1.00	1.00
Beans	0.55	0.81	1.00	1.00	1.00	1.00
Sugar Cane	0.30	0.70	0.90	0.90	0.90	0.90
Banana	0.30	0.70	0.95	0.95	0.95	0.95
Platano	0.30	0.70	0.95	0.95	0.95	0.95
Vegetables	0.55	0.81	1.00	1.00	1.00	1.00
Fruits	0.30	0.70	0.95	0.95	0.95	0.95
Other crops	0.52	1.00	1.00	1.00	1.00	1.00
Pasture(cultivated)	0.20	0.40	0.90	0.90	0.90	0.90
Pasture(natural)	0.20	0.30	0.60	0.60	0.60	0.60

TABLE I.3.1 (2/2) DAMAGE RATE TO ASSETS SUBMERGED BY FLOOD

Case B: Non-Sediment

Assets	Water Depth above Floor Level (in Meter)					
	0.00-0.50	0.51-1.00	1.01-1.50	1.51-2.00	2.01-2.50	over 2.50
1. Buildings						
Residential Houses						
High Class	0.12	0.21	0.31	0.31	0.69	0.69
Middle Class	0.12	0.21	0.31	0.31	0.69	0.69
Low Class	0.12	0.21	0.31	0.31	0.69	0.69
Poor Class	0.12	0.21	0.31	0.31	0.69	0.69
Farm House	0.12	0.21	0.31	0.31	0.69	0.69
Shop	0.12	0.21	0.31	0.31	0.69	0.69
Church	0.12	0.21	0.31	0.31	0.69	0.69
Clinic	0.12	0.21	0.31	0.31	0.69	0.69
School	0.12	0.21	0.31	0.31	0.69	0.69
Office	0.12	0.21	0.31	0.31	0.69	0.69
Factory	0.12	0.21	0.31	0.31	0.69	0.69
2. Household Effects						
Residential Houses						
High Class	0.09	0.19	0.33	0.33	0.67	0.67
Middle Class	0.09	0.19	0.33	0.33	0.67	0.67
Low Class	0.09	0.19	0.33	0.33	0.67	0.67
Poor Class	0.09	0.19	0.33	0.33	0.67	0.67
Farm House	0.18	0.30	0.39	0.39	0.71	0.71
Shop	0.15	0.30	0.40	0.40	0.73	0.73
Church	0.15	0.30	0.40	0.40	0.73	0.73
Clinic	0.15	0.30	0.40	0.40	0.73	0.73
School	0.15	0.30	0.40	0.40	0.73	0.73
Office	0.15	0.30	0.40	0.40	0.73	0.73
Factory	0.15	0.30	0.40	0.40	0.73	0.73
3. Agricultural Crops						
Maize	0.34	0.50	0.82	0.82	0.82	0.82
Rice	0.34	0.50	0.82	0.82	0.82	0.82
Beans	0.41	0.60	0.81	0.81	0.81	0.81
Sugar Cane	0.30	0.50	0.70	0.70	0.90	0.90
Banana	0.30	0.50	0.70	0.75	0.95	0.95
Platano	0.30	0.50	0.70	0.75	0.95	0.95
Vegetables	0.42	0.67	0.91	0.91	0.91	0.91
Fruits	0.30	0.50	0.70	0.75	0.95	0.95
Other crops	0.34	0.50	0.82	0.82	0.82	0.82
Pasture(cultivated)	0.10	0.30	0.90	0.90	0.90	0.90
Pasture(natural)	0.10	0.20	0.50	0.50	0.50	0.50

TABLE I.3.2 (1/3) SUMMARY OF FLOOD DAMAGE IN RIO CHOLOMA BASIN

Unit : Lps. 1,000

Items	Return Period (years)			
	2	30	50	100
1. Agricultural products	1,362	3,010	4,039	4,528
2. Buildings	12,975	178,261	398,234	418,960
3. Household effects	3,761	47,781	114,454	120,092
Sub-total	18,099	229,053	516,727	543,580
4. Public facilities	2,715	34,358	77,509	81,537
5. Business losses	905	11,453	25,836	27,179
6. Emergency measures	1,810	22,905	51,673	54,358
Total	23,528	297,768	671,745	706,654

TABLE I.3.2 (2/3) SUMMARY OF FLOOD DAMAGE IN RIO BLANCO BASIN

(A) Sediment Area

Unit : Lps. 1,000

Items	Return Period (years)			
	5	30	50	100
1. Agricultural products	564	1;321	2,125	2,368
2. Buildings	217	68,190	76,145	85,733
3. Household effects	448	13,244	14,641	16,550
Sub-total	1,229	82,754	92,911	104,651
4. Public facilities	184	12,413	13,937	15,698
5. Business losses	61	4,138	4,646	5,233
6. Emergency measures	123	8,275	9,291	10,465
Total	1,598	107,581	120,785	136,047

(B) Non-Sediment Area

Items	Return Period (years)			
	5	30	50	100
1. Agricultural products	2,185	12,500	14,104	15,891
2. Buildings	8,322	17,273	23,053	29,495
3. Household effects	2,002	6,163	8,076	10,292
Sub-total	12,509	35,936	45,233	55,678
4. Public facilities	1,876	5,390	6,785	8,352
5. Business losses	625	1,797	2,262	2,784
6. Emergency measures	1,251	3,594	4,523	5,568
Total	16,262	46,717	58,803	72,381

(C) Total (Sediment & Non-Sediment Areas)

Items	Return Period (years)			
	5	30	50	100
1. Agricultural products	2,749	13,821	16,229	18,259
2. Buildings	8,539	85,463	99,198	115,228
3. Household effects	2,450	19,407	22,717	26,842
Sub-total	13,738	118,690	138,144	160,329
4. Public facilities	2,061	17,804	20,722	24,049
5. Business losses	687	5,935	6,907	8,016
6. Emergency measures	1,374	11,869	13,814	16,033
Total	17,860	154,297	179,587	208,428

TABLE I.3.2 (3/3) SUMMARY OF FLOOD DAMAGE IN RIO EL SAUCE BASIN

(A) Sediment Area

Unit : Lps. 1,000

Items	Return Period (years)			
	5	30	50	100
1. Agricultural products	8	43	44	49
2. Buildings	27,775	46,825	51,845	78,662
3. Household effects	4,535	8,079	8,867	13,503
Sub-total	32,318	54,947	60,756	92,214
4. Public facilities	4,848	8,242	9,113	13,832
5. Business losses	1,616	2,747	3,038	4,611
6. Emergency measures	3,232	5,495	6,076	9,221
Total	42,014	71,431	78,983	119,878

(B) Non-Sediment Area

Items	Return Period (years)			
	5	30	50	100
1. Agricultural products	928	3,810	4,366	4,890
2. Buildings	729	15,624	17,822	19,832
3. Household effects	374	2,747	3,215	3,508
Sub-total	2,031	22,181	25,403	28,230
4. Public facilities	305	3,327	3,810	4,235
5. Business losses	102	1,109	1,270	1,412
6. Emergency measures	203	2,218	2,540	2,823
Total	2,640	28,835	33,024	36,699

(C) Total (Sediment & Non-Sediment Areas)

Items	Return Period (years)			
	5	30	50	100
1. Agricultural products	936	3,853	4,410	4,939
2. Buildings	28,504	62,449	69,667	98,494
3. Household effects	4,909	10,826	12,082	17,011
Sub-total	34,349	77,128	86,159	120,444
4. Public facilities	5,152	11,569	12,924	18,067
5. Business losses	1,717	3,856	4,308	6,022
6. Emergency measures	3,435	7,713	8,616	12,044
Total	44,654	100,266	112,007	156,577

SUPPORTING REPORT J
ECONOMIC EVALUATION

SUPPORTING REPORT J ECONOMIC EVALUATION

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SUPPORTING REPORT J ECONOMIC EVALUATION

1 GENERAL

In the Master Plan Study, a general economic evaluation of the Project is made with aim of finding out an economic optimum plan out of several alternative plans for the erosion and sediment control projects of three rivers; Rio Choloma, Rio Blanco and Rio El Sauce.

In order to select the economic optimum plan of the project, the procedures of two steps are taken: study at the first step is a comparison among the said three rivers in regard to economic effect of the flood protection project with the 50-year probable flood. In this case, the following fact is taken into consideration:

A. The 1974 flood, which caused serious damage, corresponds to approximately 50-year probable flood of the three rivers, according to previous studies.

B. An improvement works against the 50-year probable flood have been already executed in the most parts of river courses of Rio Blanco and Rio El Sauce.

At the second step, the comparison is carried out about the economic effects of protection works for several probable floods of the river that will produce the highest economic effect among the three rivers, in accordance with the result of study in the first step.

In the Interim Report, a result of study on the above two steps was already reported as an interim study. It was that the improvement project of the Rio Choloma with 50-year return period would be the first priority from economic point of view.

At the final stage of the present study, the foregoing interim result is reviewed in prices as of June 1993, using information and data collected newly. In the last analysis, an economic feasibility study including a sensitivity test is made for the project with the first priority, economically.

The economic effects and feasibility of the project are examined by making a comparison between both present values of the economic cost and benefit, by means of the Economic Internal Rate of Return (EIRR).

The economic cost and benefit of the project would be given by shadow prices, after deducting transfer payments from cost and benefit at the market prices, in accordance with the following conditions and assumptions:

i. The inflation factor is not included in the economic cost and benefit.

ii. Transfer payment factors such as taxes and duties are applied to goods and services procured locally, based on the following rates:

ii-1.	Value added tax (VAT)	:	7 %,
ii-2.	Income tax	:	5 % for wage of unskilled laborer, and 10 % for wage for skilled laborer, government officer and local consultant.

iii. Shadow price of wage of unskilled laborers to be employed for construction works is assumed to be 80 % of the market wage, taking into account of employment opportunity of laborers in Honduras.

iv. Standard Conversion Factor (S.C.F) is applied as the shadow price for commodities and services procured locally, and it is assumed to be 95 % of their local prices excluding transfer payment, based on the Honduran external trade statistics in recent years.

The project life is economically taken as 50 years after commencement of the construction works. The benefit together with the OM cost are assumed to accrue throughout the period of project life after completion of the construction works. The partial benefit and OM-cost under the construction period are regarded as proportional to the direct costs which have been already invested for the construction of facilities.

2 MASTER PLAN STUDY

2.1 Economic Cost

The project cost consists of construction cost and operating and maintenance cost (OM cost) for facilities which were already completed.

Under the conditions and assumptions mentioned in Chapter 1, General, the economic

construction costs of the flood protection project with 50-year return period for three rivers of Rio Choloma, Rio Blanco and Rio El Sauce are estimated from the project cost provided in Supporting Report G. The results are summarized in *Table* J.2.1, and annual flows of the economic cost are given in *Tables* J.2.3, J.2.4 and J,2.6 (4).

According to the Supporting Report G, Besides the independent project above for each river, an improvement project combining two rivers, Rio Blanco and Rio El Sauce, is formulated, because it is expected that the construction cost of the combined project will be less than the total amount of individual construction cost of then *Tables* J.2.1, and its annual flow is provided in *Table* J.2.5.

Further, the economic construction costs of the flood protection projects with the return periods of 2-, 5-, 30- and 100-year are estimated for only Rio Choloma, because it was estimated from the result of the said Interim Study that the improvement of Rio Choloma among three rivers will have the highest economic effect. These economic costs are summarized in *Table* J.2.2, and the annual flows are provided in *Tables* J.2.6 (1), (2), (3) and (5) .

For all alternative projects, the OM cost is approximately regarded as a common rate of 1 % of the direct construction cost including its physical contingency. The annual flows of these OM costs are given by alternative project in *Tables* J.2.3 through J.2.6.

2.2 Economic Benefit

In the Master Plan Study, the tangible direct economic benefit is estimated for the purpose of examining the economic priority order of several alternative projects. This benefit produced by executing the project is generally given as an effect of reduction in flood damage to assets such as buildings, household effects, agricultural crops, public facilities, losses of economic activities, expenditures of emergency measures cost, etc.

The direct economic benefit of the flood protection project is generally expressed by an average annual economic benefit which is quoted from the average annual flood damage described in Supporting Report I. Annual flows of respective economic benefits for alternative projects, together with the annual flows of economic costs concerned, are given in *Tables* J.2.3 through J.2.6. The annual economic benefit is as follows:

Average Annual Economic Benefit
(in 1,000 Lps.)

Return Period (years)	Choloma Basin Basins	Blanco Basin	El Sauce Basin	Blanco & El Sauce
2	5,882	-	-	-
5	19,161	7,144	17,862	25,006
30	49,392	21,490	29,938	51,428
50	55,855	23,716	31,353	55,069
100	62,747	25,656	32,696	58,352

2.3 Cost-Benefit Analysis

2.3.1 EIRR of the Project with 50-year Return Period for Rio Choloma, Rio Blanco and Rio El Sauce

In accordance with the procedure of evaluation described in Chapter 1, first the EIRR is estimated on the project with 50-year return period for three rivers of Rio Choloma, Rio Blanco and Rio El Sauce, including the combined project of Rio Blanco and Rio El Sauce, using the annual flows of the economic costs and benefits shown in *Tables* J.2.2, J.2.3, J.2.4 and J.2.6(4). The results are summarized as follows:

Estimates of EIRR for Flood Protection Project with 50-year Return Period

	Choloma	Blanco	El Sauce	Blanco & El Sauce
EIRR (%)	15.3	4.3	14.5	13.0

The EIRR above provides an approximate value, not strict solution, for example, because it is assumed that the construction costs for all alternative projects are invested being divided equally during 10 years. Nevertheless, the result suggests the following matters:

(1) Regarding the Rio Choloma and Rio El Sauce projects, the EIRRs of the projects with the 50-year return period indicate 15.3 % and 14.5 % respectively

which are a comparatively high rate as flood protection project, i.e. these projects are regarded as having a viability economically.

(2) The Rio Blanco project with 50-year return period shows an EIRR of 4.3 % which is of little viability economically, due to a low potential of assets inundated.

(3) However, it is expected that the EIRR of the combined flood protection project of both rivers of Rio Blanco and El Sauce will come to 13.0 %. It shows that the combined project is economically feasible, considering that the opportunity cost of capital in Honduras is between 10 % and 12 %.

(4) In the Master Plan Study, it is concluded that three projects, except an independent project of Rio Blanco, would be economically feasible on the return period of 50-year, and that the first priority would be economically given to the Rio Choloma project.

2.3.2 EIRR of Rio Choloma Project with Return Periods of 2-, 5-, 30-, 50- and 100-year

Based on the conclusion shown in previous Paragraph 2.3.1, in present paragraph, the EIRRs of the Choloma project with return periods of 2-, 5-, 30-, and 100-year are estimated to compare them with the EIRR for the 50-year return period.

Estimates of these EIRRs are made by using the annual flows of economic costs and benefits shown in *Tables* J.2.6 (1), (2), (3) and (5) in the same method as previous estimates. The results, together with the EIRR of 50-year return period, are summarized as follows:

Estimates of EIRR of Rio Choloma Project

	Return Period (year)				
	2	5	30	50	100
EIRR (%)	5.8	13.8	15.3	15.3	15.3

The values above indicate that the Rio Choloma project is economically feasible for the return period of 5-, 30, 50- and 100-year. However, there is no significant difference economically among projects with the return periods of 30-, 50- and 100-year. These EIRRs suggests that the optimum plan among them should be selected from technical, political, social and environmental view-points, other than economic aspect.

2.4 Intangible Socio-Economic Impacts

2.4.1 Socio-Economic Situation of the Study Area

1) General Socio-Economic Situation

The Study Area is characterized by ample and fertile valleys surrounded by forest mountains, and provides a favorable condition for agricultural production under a suitable weather condition. In fact, agriculture is well-developed, especially on banana and sugar cane plantations and cattle farming.

Major cities such as San Pedro Sula, Choloma and La Lima have expanded based on the well-developed agricultural circumstances. The San Pedro Sula city has a population of 326,943 (in the 1988 Census) as the second largest city of Honduras and forms the greatest industrial and commercial zones in the country. The Choloma city and its surrounding area have been rapidly developed in recent years as a large industrial zone.

2) Transportation

The Study Area is in an important position on traffic. The National road, CA-5 and the National railway run north and south through San Pedro Sula and Choloma cities. In addition to them, a part of the National road, CA-13, as well as several regional roads distribute in the Study Area.

The Route CA-5 is a trunk road for transporting business and tourism passengers, export and import goods at Puerto Cortes and commodities for domestic use. The Route CA-13 also is a significant road for conveying passengers and goods between both big cities of San Pedro Sula and La Lima, especially on transports of passengers and commodities from and to the Lima International Airport.

The daily traffic volume in 1992 was estimated at about 7,400 vehicles in section between San Pedro Sula and Choloma on the Route CA-5 and about 8,200 vehicles in

section between San Pedro Sula and La Lima on the Route CA-13. Distributions of these traffic volumes by kind of vehicle are as follows:

Distribution of Daily Traffic Volume by Kind of Vehicle on CA-5 and CA-13

Road	Kind of Vehicle				
	Passenger Car	Pick-Up	Bus	Truck	Total
CA-5	1,452	4,126	711	1,107	7,396
CA-13	2,415	3,438	1,037	1,307	8,197

Source : Information from SECOPT
Note : Traffic volume in June 1992

The railway, which connects between Puerto Cortes and Santa Rita through San Pedro Sula and Choloma, in 1992 conveyed 5,600 passengers and freight of 180 thousand tons composed of 57 thousand tons of bananas, 37 thousand tons of lumber, 34 thousand tons of wheat and 53 thousand tons of other commodities.

At present, the average operation of trains on the railway is one time per day for passenger train with 5 cars and two times per day for freight train with 10 cars, between San Pedro Sula and Puerto Cortes.

2.4.2 Socio-Economic Impacts of the Project

The Study Area, where has such a high socio-economic potential, has been frequently struck by hurricanes and caused a serious damage to inhabitants and facilities by river flood. The flood protection is therefore recognized to be an essential subject for the economic development and improvement of the social environment in this area.

In Section 2.3, it was confirmed that the proposed project would produce the great direct economic effects, and that it is feasible economically. Under the above-mentioned socio-economic conditions, it is expected further that the project would have various intangible effects of reducing the socio-economic damage as follows:

1) Loss and Injury of Lives

The heavy flood in the past caused loss and injury of many lives.

2) Spread of Infectious Diseases

The flood may frequently cause a spread of infectious diseases due to insufficiency of water supply and drainage facilities.

3) Shortage of Goods

The flood would cause shortage of goods in and around the flooded area due to damage to agricultural products and manufacturing factories, standstills of distribution system of commodities and road and railway traffic, and increase in demand of equipment and materials caused by damage to buildings, household effects and public facilities.

There is the possibility that such a shortage of goods expands in the whole country, because San Pedro Sula, Choloma and their surrounding areas are the greatest industrial zone in the country, the rural area inundated is among the largest production area of agricultural products including cattle-farming in Honduras, and further the a significant transportation facility, Route CA-5, is included in the flooded area.

4) Steep Rise in Prices

The shortage of goods and the standstills of traffic and distribution system of commodities would cause a steep rise in prices in and around the flooded area. Further there is the possibility that such a steep rise in prices expands in the whole country on the grounds that is described in 3) above.

5) Lowering of Administrative and Educational Activities

Administrative and educational activities in the flooded area would drop due to the flood damage to public offices and schools.

6) Decline in Communication

Communications between the flooded area and other areas would decline due to damage to telecommunication facilities and standstill of traffic.

7) Decline in the Standard of Living

Inhabitants in the area inundated would inevitably experience a decline in the standard of their living due to damage to their assets and public facilities, shortage of goods, steep rise in prices, lowering of administrative and educational activities, etc.

8) Time Lag of Social and Economic Development

Various negative factors mentioned above would cause a time lag for social and economic developments in and around the flooded area. Further there is the possibility that this time lag expands in the country as a whole, on grounds that the flood damage is caused in the highest potential area socio-economically in the country.

9) Promotion of External Trade Deficits

In the country, the Department of Cortes is among the largest production area of bananas and sugar cane which are the most important goods for the export of Honduras, especially bananas have a share of about 40 % of the total exports of Honduras. The Study Area is situated in the central part of the Department of Cortes on these productions. Therefore, the damage to these products would cause a reduction in exports of Honduras.

On the other hand, urban areas of San Pedro Sula and Choloma are the greatest industrial zone which manufactures various commodities including export and import-substitution goods. Accordingly, the damage to manufacturing factories would bring not only a reduction in exports, but also increase in imports.

Honduras is under a situation of unfavorable external trade every year. The damage mentioned above, as a result, would aggravate more the external trade deficits of Honduras.

It is expected that the above-mentioned damages would be reduced by executing the flood protection project, and such a reduction in damage would be evaluated as the significant intangible effects of the project. In addition to these effects, construction works of the project would produce the intangible benefit such as increase in employment opportunity and stimulate effects for regional development.

3 FEASIBILITY STUDY

3.1 Economic Cost

For the purpose of the feasibility study of the project, the project cost, as shown in Section 12.4 of the Main Report, is estimated in detail for the Rio Choloma project with return period of 50-year which was selected as an optimum plan by the Master Plan Study.

The economic cost of the project is estimated from the said project cost, taking into account the conditions and assumptions mentioned in Chapter 1, General.

Annual flows of the economic construction cost and OM cost are provided in *Table* J.3.1, and the total construction cost is summarized as follows:

Total Construction Cost of the Rio Choloma Project with Return Period of 50-Year for Feasibility Study

(Unit : Lps. 1,000)

Items	F.C	L.C.	Total
Financial Cost	220,308	147,433	367,741
Economic Cost	220,308	123,844	344,152

The annual OM cost is estimated at Lps. 3,016 thousand during the period of project life after completion of the construction works.

3.2 Economic Benefit

The economic benefit of the project with return period of 50-year would take the same value as estimated in the Master Plan Study, i.e. the estimated annual economic benefit is Lps. 55,855 thousand during the period of project life after completion of the construction works (See *Table* J.3.1).

3.3 Cost-Benefit Analysis

3.3.1 Estimate of EIRR

The EIRR of the Rio Choloma project with return period of 50-year is estimated at 15.33 %, based on the annual flows of economic cost and benefit shown in *Table* J.3.1. This EIRR is nearly equal to the rate estimated in the Master Plan Study, i.e. it indicates that the project is economically feasible.

3.3.2 Sensitivity Test of EIRR

In the process of estimating the project cost and benefit, various conditions and assumptions have been set in careful consideration based on professional experiences and appropriate judgment of experts. However, there always remains a problem on the reliability of inputs which have a direct influence on the project cost and benefit. Therefore, a test is carried out about sensitivity of the EIRR to variations in the economic cost and benefit estimated.

The sensitivity test of EIRR is made for a 5 % and 10 % increases in the economic cost and a 5 % and 10 % decreases in the economic benefit, including several combinations of them. The results are summarized as follows:

Sensitivity Test of EIRR (%)

Benefit/Cost		Increase in Cost		
		0 %	5 %	10 %
Decrease in Benefit	0 %	15.33	14.55	13.84
	5 %	14.51	13.77	12.99
	10 %	13.69	13.09	12.34

The results of sensitivity test show that the EIRR still remains more than 12 %, which exceeds the opportunity cost of capital in Honduras, even in a pessimistic condition combined the 10 % increase in cost and the 10 % decrease in benefit.

Accordingly, it is concluded that the flood protection project with return period 50-year for the Rio Choloma is viable economically.

TABLES

TABLE J.2.1 SUMMARY OF ECONOMIC CONSTRUCTION COST FOR CHOLOMA, BLANCO AND EL SAUCE PROJECTS - RETURN PERIOD : 50-YEAR

Unit: Lps. 1,000

Costs	Choloma	Blanco	El Sauce	Blanco & El Sauce
Financial				
F.C.	219,101	282,839	123,881	251,925
L.C.	148,944	134,640	94,363	170,864
Total	368,045	417,479	218,244	422,789
Economic				
F.C.	219,101	282,839	123,881	251,925
L.C.	125,113	113,098	79,265	143,526
Total	344,214	395,937	203,146	395,451

TABLE J.2.2 SUMMARY OF ECONOMIC CONSTRUCTION COST FOR CHOLOMA PROJECT - RETURN PERIOD : 2, 5, 30, 50, AND 100 YEARS

Unit: Lps. 1,000

Costs	Return Period (year)				
	2	5	30	50	100
Financial					
F.C.	47,638	80,509	192,240	219,101	248,361
L.C.	40,854	58,782	134,398	148,944	165,323
Total	88,492	139,291	326,638	368,045	413,684
Economic					
F.C.	47,638	80,509	192,240	219,101	248,361
L.C.	34,317	49,377	112,894	125,113	138,871
Total	81,955	129,886	305,134	344,214	387,232

TABLE J.2.3 ANNUAL FLOW OF ECONOMIC COST AND BENEFIT ON RIO BLANCO - RETURN PERIOD : 50-YEAR

Unit:Thousand Lps.

Year		Economic Cost			Economic Benefit
		Const.	OM	Total	
1	1996	39,594	0	39,594	0
2	1997	39,594	350	39,943	2,372
3	1998	39,594	699	40,293	4,743
4	1999	39,594	1,049	40,643	7,115
5	2000	39,594	1,399	40,992	9,486
6	2001	39,594	1,748	41,342	11,858
7	2002	39,594	2,098	41,691	14,230
8	2003	39,594	2,447	42,041	16,601
9	2004	39,594	2,797	42,391	18,973
10	2005	39,594	3,147	42,740	21,344
11	2006	0	3,496	3,496	23,716
12	2007	0	3,496	3,496	23,716
13	2008	0	3,496	3,496	23,716
14	2009	0	3,496	3,496	23,716
15	2010	0	3,496	3,496	23,716
16	2011	0	3,496	3,496	23,716
17	2012	0	3,496	3,496	23,716
18	2013	0	3,496	3,496	23,716
19	2014	0	3,496	3,496	23,716
20	2015	0	3,496	3,496	23,716
21	2016	0	3,496	3,496	23,716
22	2017	0	3,496	3,496	23,716
23	2018	0	3,496	3,496	23,716
24	2019	0	3,496	3,496	23,716
25	2020	0	3,496	3,496	23,716
26	2021	0	3,496	3,496	23,716
27	2022	0	3,496	3,496	23,716
28	2023	0	3,496	3,496	23,716
29	2024	0	3,496	3,496	23,716
30	2025	0	3,496	3,496	23,716
31	2026	0	3,496	3,496	23,716
32	2027	0	3,496	3,496	23,716
33	2028	0	3,496	3,496	23,716
34	2029	0	3,496	3,496	23,716
35	2030	0	3,496	3,496	23,716
36	2031	0	3,496	3,496	23,716
37	2032	0	3,496	3,496	23,716
38	2033	0	3,496	3,496	23,716
39	2034	0	3,496	3,496	23,716
40	2035	0	3,496	3,496	23,716
41	2036	0	3,496	3,496	23,716
42	2037	0	3,496	3,496	23,716
43	2038	0	3,496	3,496	23,716
44	2039	0	3,496	3,496	23,716
45	2040	0	3,496	3,496	23,716
46	2041	0	3,496	3,496	23,716
47	2042	0	3,496	3,496	23,716
48	2043	0	3,496	3,496	23,716
49	2044	0	3,496	3,496	23,716
50	2045	0	3,496	3,496	23,716
	Total	395,937	155,587	551,523	1,055,362

TABLE J.2.4 ANNUAL FLOW OF ECONOMIC COST AND BENEFIT ON RIO EL SAUCE - RETURN PERIOD : 50-YEAR

Unit:Thousand Lps.

Year		Economic Cost			Economic Benefit
		Const.	OM	Total	
1	1996	20,315	0	20,315	0
2	1997	20,315	179	20,493	3,135
3	1998	20,315	358	20,672	6,271
4	1999	20,315	536	20,851	9,406
5	2000	20,315	715	21,030	12,541
6	2001	20,315	894	21,209	15,677
7	2002	20,315	1,073	21,388	18,812
8	2003	20,315	1,252	21,566	21,947
9	2004	20,315	1,431	21,745	25,082
10	2005	20,315	1,609	21,924	28,218
11	2006	0	1,788	1,788	31,353
12	2007	0	1,788	1,788	31,353
13	2008	0	1,788	1,788	31,353
14	2009	0	1,788	1,788	31,353
15	2010	0	1,788	1,788	31,353
16	2011	0	1,788	1,788	31,353
17	2012	0	1,788	1,788	31,353
18	2013	0	1,788	1,788	31,353
19	2014	0	1,788	1,788	31,353
20	2015	0	1,788	1,788	31,353
21	2016	0	1,788	1,788	31,353
22	2017	0	1,788	1,788	31,353
23	2018	0	1,788	1,788	31,353
24	2019	0	1,788	1,788	31,353
25	2020	0	1,788	1,788	31,353
26	2021	0	1,788	1,788	31,353
27	2022	0	1,788	1,788	31,353
28	2023	0	1,788	1,788	31,353
29	2024	0	1,788	1,788	31,353
30	2025	0	1,788	1,788	31,353
31	2026	0	1,788	1,788	31,353
32	2027	0	1,788	1,788	31,353
33	2028	0	1,788	1,788	31,353
34	2029	0	1,788	1,788	31,353
35	2030	0	1,788	1,788	31,353
36	2031	0	1,788	1,788	31,353
37	2032	0	1,788	1,788	31,353
38	2033	0	1,788	1,788	31,353
39	2034	0	1,788	1,788	31,353
40	2035	0	1,788	1,788	31,353
41	2036	0	1,788	1,788	31,353
42	2037	0	1,788	1,788	31,353
43	2038	0	1,788	1,788	31,353
44	2039	0	1,788	1,788	31,353
45	2040	0	1,788	1,788	31,353
46	2041	0	1,788	1,788	31,353
47	2042	0	1,788	1,788	31,353
48	2043	0	1,788	1,788	31,353
49	2044	0	1,788	1,788	31,353
50	2045	0	1,788	1,788	31,353
	Total	203,146	79,579	282,725	1,395,209

TABLE J.2.5 ANNUAL FLOW OF ECONOMIC COST AND BENEFIT ON RIO BLANCO & RIO EL SAUCE - RETURN PERIOD : 50-YEAR

Unit:Thousand Lps.

Year		Economic Cost			Economic Benefit
		Const.	OM	Total	
1	1996	39,545	0	39,545	0
2	1997	39,545	348	39,893	5,507
3	1998	39,545	697	40,242	11,014
4	1999	39,545	1,045	40,590	16,521
5	2000	39,545	1,394	40,939	22,028
6	2001	39,545	1,742	41,287	27,535
7	2002	39,545	2,090	41,635	33,041
8	2003	39,545	2,439	41,984	38,548
9	2004	39,545	2,787	42,332	44,055
10	2005	39,545	3,136	42,681	49,562
11	2006	0	3,484	3,484	55,069
12	2007	0	3,484	3,484	55,069
13	2008	0	3,484	3,484	55,069
14	2009	0	3,484	3,484	55,069
15	2010	0	3,484	3,484	55,069
16	2011	0	3,484	3,484	55,069
17	2012	0	3,484	3,484	55,069
18	2013	0	3,484	3,484	55,069
19	2014	0	3,484	3,484	55,069
20	2015	0	3,484	3,484	55,069
21	2016	0	3,484	3,484	55,069
22	2017	0	3,484	3,484	55,069
23	2018	0	3,484	3,484	55,069
24	2019	0	3,484	3,484	55,069
25	2020	0	3,484	3,484	55,069
26	2021	0	3,484	3,484	55,069
27	2022	0	3,484	3,484	55,069
28	2023	0	3,484	3,484	55,069
29	2024	0	3,484	3,484	55,069
30	2025	0	3,484	3,484	55,069
31	2026	0	3,484	3,484	55,069
32	2027	0	3,484	3,484	55,069
33	2028	0	3,484	3,484	55,069
34	2029	0	3,484	3,484	55,069
35	2030	0	3,484	3,484	55,069
36	2031	0	3,484	3,484	55,069
37	2032	0	3,484	3,484	55,069
38	2033	0	3,484	3,484	55,069
39	2034	0	3,484	3,484	55,069
40	2035	0	3,484	3,484	55,069
41	2036	0	3,484	3,484	55,069
42	2037	0	3,484	3,484	55,069
43	2038	0	3,484	3,484	55,069
44	2039	0	3,484	3,484	55,069
45	2040	0	3,484	3,484	55,069
46	2041	0	3,484	3,484	55,069
47	2042	0	3,484	3,484	55,069
48	2043	0	3,484	3,484	55,069
49	2044	0	3,484	3,484	55,069
50	2045	0	3,484	3,484	55,069
	Total	395,451	155,038	550,488	2,450,571

TABLE J.2.6 (1) ANNUAL FLOW OF ECONOMIC COST AND BENEFIT ON RIO CHOLOMA - RETURN PERIOD : 2-YEAR

Unit:Thousand Lps.

Year		Economic Cost			Economic Benefit
		Const.	OM	Total	
1	1996	8,196	0	8,196	0
2	1997	8,196	72	8,268	588
3	1998	8,196	144	8,340	1,176
4	1999	8,196	216	8,412	1,765
5	2000	8,196	288	8,484	2,353
6	2001	8,196	360	8,556	2,941
7	2002	8,196	433	8,628	3,529
8	2003	8,196	505	8,700	4,117
9	2004	8,196	577	8,772	4,706
10	2005	8,196	649	8,844	5,294
11	2006	0	721	721	5,882
12	2007	0	721	721	5,882
13	2008	0	721	721	5,882
14	2009	0	721	721	5,882
15	2010	0	721	721	5,882
16	2011	0	721	721	5,882
17	2012	0	721	721	5,882
18	2013	0	721	721	5,882
19	2014	0	721	721	5,882
20	2015	0	721	721	5,882
21	2016	0	721	721	5,882
22	2017	0	721	721	5,882
23	2018	0	721	721	5,882
24	2019	0	721	721	5,882
25	2020	0	721	721	5,882
26	2021	0	721	721	5,882
27	2022	0	721	721	5,882
28	2023	0	721	721	5,882
29	2024	0	721	721	5,882
30	2025	0	721	721	5,882
31	2026	0	721	721	5,882
32	2027	0	721	721	5,882
33	2028	0	721	721	5,882
34	2029	0	721	721	5,882
35	2030	0	721	721	5,882
36	2031	0	721	721	5,882
37	2032	0	721	721	5,882
38	2033	0	721	721	5,882
39	2034	0	721	721	5,882
40	2035	0	721	721	5,882
41	2036	0	721	721	5,882
42	2037	0	721	721	5,882
43	2038	0	721	721	5,882
44	2039	0	721	721	5,882
45	2040	0	721	721	5,882
46	2041	0	721	721	5,882
47	2042	0	721	721	5,882
48	2043	0	721	721	5,882
49	2044	0	721	721	5,882
50	2045	0	721	721	5,882
	Total	81,955	32,078	114,033	261,749

TABLE J.2.6 (2) ANNUAL FLOW OF ECONOMIC COST AND BENEFIT ON RIO CHOLOMA - RETURN PERIOD : 5-YEAR

Unit:Thousand Lps.

Year		Economic Cost			Economic Benefit
		Const.	OM	Total	
1	1996	12,989	0	12,989	0
2	1997	12,989	114	13,103	1,916
3	1998	12,989	229	13,217	3,832
4	1999	12,989	343	13,332	5,748
5	2000	12,989	457	13,446	7,664
6	2001	12,989	572	13,560	9,581
7	2002	12,989	686	13,675	11,497
8	2003	12,989	801	13,789	13,413
9	2004	12,989	915	13,904	15,329
10	2005	12,989	1,029	14,018	17,245
11	2006	0	1,144	1,144	19,161
12	2007	0	1,144	1,144	19,161
13	2008	0	1,144	1,144	19,161
14	2009	0	1,144	1,144	19,161
15	2010	0	1,144	1,144	19,161
16	2011	0	1,144	1,144	19,161
17	2012	0	1,144	1,144	19,161
18	2013	0	1,144	1,144	19,161
19	2014	0	1,144	1,144	19,161
20	2015	0	1,144	1,144	19,161
21	2016	0	1,144	1,144	19,161
22	2017	0	1,144	1,144	19,161
23	2018	0	1,144	1,144	19,161
24	2019	0	1,144	1,144	19,161
25	2020	0	1,144	1,144	19,161
26	2021	0	1,144	1,144	19,161
27	2022	0	1,144	1,144	19,161
28	2023	0	1,144	1,144	19,161
29	2024	0	1,144	1,144	19,161
30	2025	0	1,144	1,144	19,161
31	2026	0	1,144	1,144	19,161
32	2027	0	1,144	1,144	19,161
33	2028	0	1,144	1,144	19,161
34	2029	0	1,144	1,144	19,161
35	2030	0	1,144	1,144	19,161
36	2031	0	1,144	1,144	19,161
37	2032	0	1,144	1,144	19,161
38	2033	0	1,144	1,144	19,161
39	2034	0	1,144	1,144	19,161
40	2035	0	1,144	1,144	19,161
41	2036	0	1,144	1,144	19,161
42	2037	0	1,144	1,144	19,161
43	2038	0	1,144	1,144	19,161
44	2039	0	1,144	1,144	19,161
45	2040	0	1,144	1,144	19,161
46	2041	0	1,144	1,144	19,161
47	2042	0	1,144	1,144	19,161
48	2043	0	1,144	1,144	19,161
49	2044	0	1,144	1,144	19,161
50	2045	0	1,144	1,144	19,161
	Total	129,886	50,896	180,782	852,665

TABLE J.2.6 (3) ANNUAL FLOW OF ECONOMIC COST AND BENEFIT ON RIO CHOLOMA - RETURN PERIOD : 30-YEAR

Unit:Thousand Lps.

Year		Economic Cost			Economic Benefit
		Const.	OM	Total	
1	1996	30,513	0	30,513	0
2	1997	30,513	269	30,782	4,939
3	1998	30,513	538	31,051	9,878
4	1999	30,513	806	31,320	14,818
5	2000	30,513	1,075	31,589	19,757
6	2001	30,513	1,344	31,857	24,696
7	2002	30,513	1,613	32,126	29,635
8	2003	30,513	1,881	32,395	34,574
9	2004	30,513	2,150	32,664	39,514
10	2005	30,513	2,419	32,932	44,453
11	2006	0	2,688	2,688	49,392
12	2007	0	2,688	2,688	49,392
13	2008	0	2,688	2,688	49,392
14	2009	0	2,688	2,688	49,392
15	2010	0	2,688	2,688	49,392
16	2011	0	2,688	2,688	49,392
17	2012	0	2,688	2,688	49,392
18	2013	0	2,688	2,688	49,392
19	2014	0	2,688	2,688	49,392
20	2015	0	2,688	2,688	49,392
21	2016	0	2,688	2,688	49,392
22	2017	0	2,688	2,688	49,392
23	2018	0	2,688	2,688	49,392
24	2019	0	2,688	2,688	49,392
25	2020	0	2,688	2,688	49,392
26	2021	0	2,688	2,688	49,392
27	2022	0	2,688	2,688	49,392
28	2023	0	2,688	2,688	49,392
29	2024	0	2,688	2,688	49,392
30	2025	0	2,688	2,688	49,392
31	2026	0	2,688	2,688	49,392
32	2027	0	2,688	2,688	49,392
33	2028	0	2,688	2,688	49,392
34	2029	0	2,688	2,688	49,392
35	2030	0	2,688	2,688	49,392
36	2031	0	2,688	2,688	49,392
37	2032	0	2,688	2,688	49,392
38	2033	0	2,688	2,688	49,392
39	2034	0	2,688	2,688	49,392
40	2035	0	2,688	2,688	49,392
41	2036	0	2,688	2,688	49,392
42	2037	0	2,688	2,688	49,392
43	2038	0	2,688	2,688	49,392
44	2039	0	2,688	2,688	49,392
45	2040	0	2,688	2,688	49,392
46	2041	0	2,688	2,688	49,392
47	2042	0	2,688	2,688	49,392
48	2043	0	2,688	2,688	49,392
49	2044	0	2,688	2,688	49,392
50	2045	0	2,688	2,688	49,392
	Total	305,134	119,604	424,738	2,197,944

TABLE J.2.6 (4) ANNUAL FLOW OF ECONOMIC COST AND BENEFIT ON RIO CHOLOMA - RETURN PERIOD : 50-YEAR

Unit:Thousand Lps.

Year		Economic Cost			Economic Benefit
		Const.	OM	Total	
1	1996	34,421	0	34,421	0
2	1997	34,421	303	34,725	5,586
3	1998	34,421	607	35,028	11,171
4	1999	34,421	910	35,331	16,757
5	2000	34,421	1,213	35,634	22,342
6	2001	34,421	1,516	35,938	27,928
7	2002	34,421	1,820	36,241	33,513
8	2003	34,421	2,123	36,544	39,099
9	2004	34,421	2,426	36,847	44,684
10	2005	34,421	2,729	37,151	50,270
11	2006	0	3,033	3,033	55,855
12	2007	0	3,033	3,033	55,855
13	2008	0	3,033	3,033	55,855
14	2009	0	3,033	3,033	55,855
15	2010	0	3,033	3,033	55,855
16	2011	0	3,033	3,033	55,855
17	2012	0	3,033	3,033	55,855
18	2013	0	3,033	3,033	55,855
19	2014	0	3,033	3,033	55,855
20	2015	0	3,033	3,033	55,855
21	2016	0	3,033	3,033	55,855
22	2017	0	3,033	3,033	55,855
23	2018	0	3,033	3,033	55,855
24	2019	0	3,033	3,033	55,855
25	2020	0	3,033	3,033	55,855
26	2021	0	3,033	3,033	55,855
27	2022	0	3,033	3,033	55,855
28	2023	0	3,033	3,033	55,855
29	2024	0	3,033	3,033	55,855
30	2025	0	3,033	3,033	55,855
31	2026	0	3,033	3,033	55,855
32	2027	0	3,033	3,033	55,855
33	2028	0	3,033	3,033	55,855
34	2029	0	3,033	3,033	55,855
35	2030	0	3,033	3,033	55,855
36	2031	0	3,033	3,033	55,855
37	2032	0	3,033	3,033	55,855
38	2033	0	3,033	3,033	55,855
39	2034	0	3,033	3,033	55,855
40	2035	0	3,033	3,033	55,855
41	2036	0	3,033	3,033	55,855
42	2037	0	3,033	3,033	55,855
43	2038	0	3,033	3,033	55,855
44	2039	0	3,033	3,033	55,855
45	2040	0	3,033	3,033	55,855
46	2041	0	3,033	3,033	55,855
47	2042	0	3,033	3,033	55,855
48	2043	0	3,033	3,033	55,855
49	2044	0	3,033	3,033	55,855
50	2045	0	3,033	3,033	55,855
	Total	344,214	134,948	479,162	2,485,548

TABLE J.2.6 (5) ANNUAL FLOW OF ECONOMIC COST AND BENEFIT ON RIO CHOLOMA - RETURN PERIOD : 100-YEAR

Unit:Thousand Lps.

Year		Economic Cost			Economic Benefit
		Const.	OM	Total	
1	1996	38,723	0	38,723	0
2	1997	38,723	341	39,064	6,274
3	1998	38,723	682	39,406	12,548
4	1999	38,723	1,024	39,747	18,823
5	2000	38,723	1,365	40,088	25,097
6	2001	38,723	1,706	40,429	31,371
7	2002	38,723	2,047	40,770	37,645
8	2003	38,723	2,388	41,112	43,919
9	2004	38,723	2,730	41,453	50,194
10	2005	38,723	3,071	41,794	56,468
11	2006	0	3,412	3,412	62,742
12	2007	0	3,412	3,412	62,742
13	2008	0	3,412	3,412	62,742
14	2009	0	3,412	3,412	62,742
15	2010	0	3,412	3,412	62,742
16	2011	0	3,412	3,412	62,742
17	2012	0	3,412	3,412	62,742
18	2013	0	3,412	3,412	62,742
19	2014	0	3,412	3,412	62,742
20	2015	0	3,412	3,412	62,742
21	2016	0	3,412	3,412	62,742
22	2017	0	3,412	3,412	62,742
23	2018	0	3,412	3,412	62,742
24	2019	0	3,412	3,412	62,742
25	2020	0	3,412	3,412	62,742
26	2021	0	3,412	3,412	62,742
27	2022	0	3,412	3,412	62,742
28	2023	0	3,412	3,412	62,742
29	2024	0	3,412	3,412	62,742
30	2025	0	3,412	3,412	62,742
31	2026	0	3,412	3,412	62,742
32	2027	0	3,412	3,412	62,742
33	2028	0	3,412	3,412	62,742
34	2029	0	3,412	3,412	62,742
35	2030	0	3,412	3,412	62,742
36	2031	0	3,412	3,412	62,742
37	2032	0	3,412	3,412	62,742
38	2033	0	3,412	3,412	62,742
39	2034	0	3,412	3,412	62,742
40	2035	0	3,412	3,412	62,742
41	2036	0	3,412	3,412	62,742
42	2037	0	3,412	3,412	62,742
43	2038	0	3,412	3,412	62,742
44	2039	0	3,412	3,412	62,742
45	2040	0	3,412	3,412	62,742
46	2041	0	3,412	3,412	62,742
47	2042	0	3,412	3,412	62,742
48	2043	0	3,412	3,412	62,742
49	2044	0	3,412	3,412	62,742
50	2045	0	3,412	3,412	62,742
	Total	387,232	151,835	539,067	2,792,019

TABLE J.3.1 ANNUAL FLOW OF ECONOMIC COST AND BENEFIT ON RIO CHOLOMA - RETURN PERIOD : 50-YEAR

Unit:Thousand Lps.

Year		Economic Cost			Economic Benefit
		Const.	OM	Total	
1	1996	66,649	0	66,649	0
2	1997	66,649	584	67,233	10,811
3	1998	26,357	1,168	27,524	21,621
4	1999	26,357	1,399	27,756	25,900
5	2000	26,357	1,630	27,987	30,180
6	2001	26,357	1,861	28,218	34,459
7	2002	26,357	2,092	28,449	38,738
8	2003	26,357	2,323	28,680	43,018
9	2004	26,357	2,554	28,911	47,297
10	2005	26,357	2,785	29,142	51,576
11	2006	0	3,016	3,016	55,855
12	2007	0	3,016	3,016	55,855
13	2008	0	3,016	3,016	55,855
14	2009	0	3,016	3,016	55,855
15	2010	0	3,016	3,016	55,855
16	2011	0	3,016	3,016	55,855
17	2012	0	3,016	3,016	55,855
18	2013	0	3,016	3,016	55,855
19	2014	0	3,016	3,016	55,855
20	2015	0	3,016	3,016	55,855
21	2016	0	3,016	3,016	55,855
22	2017	0	3,016	3,016	55,855
23	2018	0	3,016	3,016	55,855
24	2019	0	3,016	3,016	55,855
25	2020	0	3,016	3,016	55,855
26	2021	0	3,016	3,016	55,855
27	2022	0	3,016	3,016	55,855
28	2023	0	3,016	3,016	55,855
29	2024	0	3,016	3,016	55,855
30	2025	0	3,016	3,016	55,855
31	2026	0	3,016	3,016	55,855
32	2027	0	3,016	3,016	55,855
33	2028	0	3,016	3,016	55,855
34	2029	0	3,016	3,016	55,855
35	2030	0	3,016	3,016	55,855
36	2031	0	3,016	3,016	55,855
37	2032	0	3,016	3,016	55,855
38	2033	0	3,016	3,016	55,855
39	2034	0	3,016	3,016	55,855
40	2035	0	3,016	3,016	55,855
41	2036	0	3,016	3,016	55,855
42	2037	0	3,016	3,016	55,855
43	2038	0	3,016	3,016	55,855
44	2039	0	3,016	3,016	55,855
45	2040	0	3,016	3,016	55,855
46	2041	0	3,016	3,016	55,855
47	2042	0	3,016	3,016	55,855
48	2043	0	3,016	3,016	55,855
49	2044	0	3,016	3,016	55,855
50	2045	0	3,016	3,016	55,855
	Total	344,152	137,054	481,206	2,537,800