

APPENDIX D

**CONSTRUCTION PLAN
AND
COST ESTIMATE**

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CHAPTER I CONSTRUCTION PLAN

1.1 Construction Work Volume

The priority project of Sabo and Flood Control in the Laoag River Basin includes the following construction work volumes (see Fig. D.1.1, General Plan of Priority Project).

(1) Laoag-Bongo River Improvement

Work Item	Unit	Laoag	San Nicolas	Dingras	Total
Embankment	m ³	127,800	232,500	321,700	682,000
Revetment/Concrete Wall	m ³	3,550	-	1,520	5,070
Spur Dike	unit	-	5	5	10
Drainage Sluiceway	unit	2	2	1	5

(2) Sabo Dam

Work Item	Unit	Cura No.1	Labugaon No.1	Solsona No.1	Madongan	Papa	Total
River Deposit Excavation	m ³	30,400	17,600	1,800	18,300	20,600	88,700
Rock Excavation	m ³	1,900	12,000	5,200	2,600	3,100	24,800
Stone Concrete	m ³	15,100	16,900	5,200	20,800	16,900	74,900

(3) Alluvial Fan River Improvement

Work Item	Unit	Cura /Labugao n River	Solsona River	Madongan River	Papa River	Total
Channel Excavation	m ³	992,000	-	-	-	992,000
Embankment	m ³	992,000	207,000	128,000	26,800	1,353,800
Spur Dike	unit	349	302	394	283	1,328
Intake Sluiceway	unit	4	3	8	2	17
Groundsill	unit	1	1	1	1	4
Bridge	unit (m ²)	1 (810)	-	-	-	1 (810)

1.2 Basic Conditions

The following conditions are basically applied to prepare the construction plan for the Priority Project.

(1) Workable Times

Workable days per year are estimated at about 190 days (52% of one year) for earth works and 240 days (66%) for other works such as concreting, masonry, etc.

To estimate the workable days, holidays and rainfall days should be considered as follows.

Sundays and national holidays are about 70 days in one year.

Based on the available rainfall data in the project area, earth works may be suspended by rainfall for a total of about 100 days per year (more than 5 mm rainfall per day), and 50 days for other works (more than 30 mm).

Climate of the project area, according to rainfall characteristics, comprise two pronounced seasons; wet from May to October and dry in the rest of the year. Hence, the most suitable workable months are 6 months in dry season from November to April.

River improvement works should be concentrated in the dry season because they consist mostly of earthworks such as excavation and embankment which cannot be expected to have good results under the rain. Besides, it is risky to undertake the construction of sabo dam works and spur dikes under the threat of flooding.

(2) Labor Requirement

Common labor and some types of skilled labor can be recruited from areas around the project area; while, foreman and some skilled laborers may be employed from other areas such as Metro Manila.

Total required number of laborers for the duration of 4 years of construction is estimated as follows.

Kind of Laborer	Number (man-day)
Skilled Laborer	515,000
Unskilled Laborer	902,000
Total	1,417,000

(3) Construction Materials

Major construction materials required are embankment materials (soil), gravel, boulder, cement, and reinforcing bars.

Construction Works	Construction Materials
Earth Dike	Riverbed Soil, Gravel
River Wall	Cement, Sand, Gravel, Re-bar
Revetment	Cement, Sand, Gravel, Boulder
Spur Dike in Alluvial River	Cement, Sand, Gravel, Boulder
Spur Dike in Lower Laoag River	Boulder
Groundsill	Cement, Sand, Gravel
Sluiceway / Bridge	Cement, Sand, Gravel, Re-bar
Sabo Dam	Cement, Sand, Gravel, Boulder

The required quantities of the construction materials are summarized as follows.

Materials	Unit	Quantity
Cement	ton	69,940
Re-bar	ton	1,120
Riverbed Soil	m ³	2,046,000
Sand	m ³	76,100
Gravel	m ³	217,700
Boulder	m ³	410,000

Cement and reinforcing bars will be transported from Manila or its surrounding areas.

Soils planned for dike embankment of Cura/Labugaon River and Laoag-Bongo River Improvement are the riverbed materials obtained near construction sites. Average hauling distance is estimated at 300 m for the cost estimation.

Boulders can be obtained upstream of the objective alluvial fan rivers. As concrete aggregates, riverbed material in the entire reaches of alluvial fan rivers can be used. The grain-size distribution of the riverbed materials are summarized below.

Sediment Size	Fan Apex / Middle Fan Reaches (%)	Lower Fan Reaches (%)	Laoag River (%)
Large Cobble / Small Boulder (128-512 mm)	8	-	-
Very Coarse Pebble / Small Cobble (32-128 mm)	21	16	10
Medium / Coarse Pebble (8-32 mm)	29	32	22
Very Fine / Fine Pebble (2-8 mm)	23	25	35
Sand (0.125-2 mm)	19	27	33

(4) Construction Equipment

Though necessary major construction equipment such as bulldozers, loaders, cranes, dump trucks, concrete plants, etc., are available in the project area, almost all of them will be brought into the sites from Metro Manila.

(5) Spoil Banks

All excavated earth material of the Cura/Labugaon river channel will be used for embankment of dikes. On the other hand, excavated soil for sabo dams are hauled to the specific spoil banks. Soil excavated in the sabo dam construction of Labugaon, Madongan and Papa will be hauled to about 1 km downstream of existing diversion dams and disposed of at the old river areas.

Excavated soils of Solsona Sabo Dam will be dumped at adjacent areas because of the relatively small volume.

In case of Cura Sabo Dam, excavated soils will be dumped upstream of the sabo dam site because there is no available space nearby in the downstream.

1.3 Standard Construction Methods of Major Works

The major works of the Project will be carried out in the following standard construction methods.

(1) Sabo Dam

At first, cofferdams using riverbed material and sand bags are temporarily constructed to artificially divert the river course by means of coffering half the river width. Then, excavation of river deposits are executed using backhoe (0.6 m³) and excavated materials (gravel/boulder) are hauled to the spoil banks by dump trucks (11-ton). At spoil banks, soil will be spread by bulldozer (15-ton).

Concrete will be produced at plants (20 to 30 m³/hour capacity) to be installed nearby sites. Produced concrete is transported by truck mixers to dam sites and poured by using truck cranes (25-ton).

(2) Embankment for Dike

Embankment work including spreading and compacting for dike using riverbed material is done mainly by construction equipment as follows.

Work Item	Equipment	Capacity
Excavation/Loading	Backhoe	0.6 m ³
Hauling	Dump Truck	10-ton
Spreading/Compaction	Bulldozer	15-ton

(3) Channel Excavation

Channel excavation will be carried out by a combination of backhoe and dump truck.

Work Item	Equipment	Capacity
Excavation/Loading	Backhoe	0.6 m ³
Hauling	Dump Truck	10 ton

(4) Spur Dike

Spur dikes proposed downstream of Laoag River are to be constructed manually with boulders.

Spur dikes proposed in the alluvial rivers are to be constructed of stone concrete. At first, structural excavation will be carried out and forming and stone concrete works will follow.

Work Item	Equipment	Capacity
Structural Excavation	Backhoe	0.6 m ³
Hauling Concrete	Truck Mixer	10-12 ton
Pouring Concrete	Truck Crane	15-ton

(5) Revetment Work

Revetment made of boulder pitching grouted by concrete will be constructed manually using equipment such as 0.1 m³ portable type concrete mixers.

1.4 Construction Schedule

A 4-year period is proposed for construction. The project will be implemented from 1997 to 2003 on the assumption that:

- (1) Loan application to international financing organization for detailed design, construction and other preparations is made in 1997/1998.
- (2) Detailed design is executed in 1999.
- (3) Construction is executed from 2000 to 2003.

Fig. D.1.2 shows the implementation schedule including the time schedule of construction works.

CHAPTER II PROJECT COST ESTIMATE

2.1 Cost Estimation Criteria

2.1.1 Constitution of Project Cost

Project cost consists of costs for main construction works, compensation, government administration, engineering services, physical contingency and price contingency (see Fig. D.2.1).

(1) Main Construction Cost

Main construction cost consists of costs for preparatory works, main works, and miscellaneous works.

Cost of preparatory works covers the establishment of contractor's site offices, topographic survey and soil investigation, transportation of construction equipment, preparation of drawings, and so on. This is estimated as 10% of cost of main works and miscellaneous works.

Cost of main works covers costs required for major civil work items in the project such as dike embankment, excavation, sabo dams, spur dikes, revetment, groundfills, sluiceway, bridge, and so on.

Cost of main works is estimated by multiplying work quantities by the respective unit costs. Unit cost consist of direct unit cost comprising materials cost, labor cost and equipment cost, and indirect cost including contractor's expense, overhead, profit, VAT, etc. Indirect cost excluding VAT is estimated as a percentage of direct unit cost (20%). VAT is 10% of cost of labor and equipment. Unit prices of labor, materials and equipment are shown in Tables D.2.1 to D.2.3.

Cost of miscellaneous works covers minor civil work items compared with the above-mentioned main works, including construction of temporary roads and bridges, maintenance of roads, cofferdam works and dewatering, and so on. Cost of miscellaneous works is estimated as 10% of cost of main works.

(2) Compensation Cost

Compensation cost covers land acquisition and house resettlement required for construction works.

(3) Government Administration Cost

Administration cost is defined as the necessary cost for government staff, office equipment, and so on. Administration expense is estimated as 3% of main construction cost and compensation cost.

(4) Cost of Engineering Services

Cost of engineering services covers the detailed design and construction supervision of the project made by consulting engineering firms or consultants employed by the Philippine Government. Cost of engineering services is estimated as 16% of main construction cost.

(5) Physical Contingency

Physical contingency which is prepared for unknown construction works is assumed as 10% of main construction cost, administration cost, and compensation cost.

(6) Price Contingency

Price contingency is provided to cope with price escalation during project implementation. The following rates of price escalation are adopted considering recent inflation rates:

- (a) 2.0% for foreign currency portion
- (b) 7.0% for local currency portion

(7) Foreign and Local Currency Portions

Foreign currency portion mostly covers cost of equipment and engineering services, and a part of materials.

Local currency portion covers mainly all costs of labor, valued added tax (VAT), compensation and administration, and a part of material cost and engineering services cost.

The following proportion between foreign and local currencies is adopted:

Items	Foreign Currency	Local Currency
1. Materials		
(a) Cement	0.7	0.3
(b) Re-bar	0.8	0.2
(c) Structural Steel	0.9	0.1
(d) Stone Materials	0.4	0.6
(e) Lumber	0.4	0.6
(f) Fuel, Lubricant	0.7	0.3
2. Construction Equipment	0.7	0.3
3. Labor	0.0	1.0
4. Compensation Cost	0.0	1.0
5. Administration Cost	0.0	1.0
6. Engineering Cost	0.9	0.1

2.1.2 Basic Conditions

Project cost is estimated on the following criteria:

- (1) Construction works are to be executed on the contract basis.
- (2) Basic prices are based on the price level as of June, 1997.
- (3) Exchange rates used to convert foreign currencies into local currency are US\$1.00 = 26.00 Pesos = 115 Yen (1.00 Peso = 4.4 Yen).
- (4) Estimated cost is divided into two portions; namely, Foreign Currency (FC) and Local Currency (LC), because foreign financial assistance is expected for the implementation of projects.
- (5) Cost of main civil works is estimated by multiplying work quantities by the respective unit costs.
- (6) Some components of project cost are estimated as a certain percentage of major components.

2.2 Project Cost

Project cost for the Priority Project is estimated at 2,333.1 million pesos including price contingency. The following is a summary of estimated cost. Details of project cost are shown in Tables D.2.4 and D.2.5.

(1) Project Cost

Item	(Unit : million pesos)		
	Foreign Currency Portion	Local Currency Portion	Total Cost
1. Construction Cost	654.1	800.5	1,454.6
1.1 Preparatory Works	59.5	72.8	132.2
1.2 Main Works	540.6	661.6	1,202.1
(1) Cura/Labugaon River	199.3	203.1	402.5
(2) Solsona River	77.3	114.5	191.8
(3) Madongan River	111.5	165.6	277.0
(4) Papa River	76.0	121.6	197.5
(5) Laoag-Bongo River	76.5	56.8	133.3
1.3 Miscellaneous Works	54.1	66.2	120.2
2. Compensation Cost	0	6.4	6.4
3. Administration Cost	0	43.8	43.8
4. Engineering Service Cost	209.5	23.3	232.7
5. Physical Contingency	86.4	87.4	173.8
Sub-total (1. to 5.)	949.9	961.5	1,911.3
6. Price Contingency	83.2	338.5	421.7
Total	1,033.1	1,300.0	2,333.1

(2) Cost of Main Works of Sabo Dams

Sabo Dam	(Unit: million pesos)		
	Foreign Currency Portion	Local Currency Portion	Total Cost
1. Cura No. 1	21.3	24.7	46.0
2. Labugaon No. 1	24.8	30.9	55.7
3. Solsona No. 1	7.7	10.0	17.7
4. Madongan	28.2	33.5	61.7
5. Papa	23.3	27.5	50.8
Total	105.3	126.6	231.9

(3) Cost of Main Works of River Improvement

		(Unit: million pesos)		
River Improvement		Foreign Currency Portion	Local Currency Portion	Total Cost
1.	Cura/Labugaon	153.2	147.5	300.7
2.	Solsona	69.5	104.5	174.0
3.	Madongan	83.2	132.1	215.3
4.	Papa	52.7	94.0	146.7
Sub-total for Alluvial River		358.6	478.1	836.7
5.	Poblacion Laoag	18.2	15.5	33.7
6.	Poblacion San Nicolas	23.3	15.7	38.9
7.	Poblacion Dingras	35.1	25.7	60.7
Sub-total for Laoag-Bongo R.		76.6	56.9	133.3
Total		435.2	535.0	970.0

2.3 Disbursement Schedule

The following table shows the annual disbursement schedule of project cost from 1999 to 2003 based on the implementation schedule (Fig. D.1.2). Detailed annual disbursement schedule is shown in Table D.2.6.

				(Unit: million pesos)
Year	Foreign Currency Portion	Local Currency Portion	Total	
1999	86.4 (89.9)	16.9 (19.3)	103.3 (109.2)	
2000	219.4 (232.8)	245.9 (301.2)	465.3 (534.0)	
2001	225.7 (244.2)	241.8 (317.0)	467.5 (561.2)	
2002	221.6 (244.6)	238.1 (334.0)	459.7 (578.7)	
2003	196.8 (221.6)	218.8 (328.4)	415.6 (550.0)	
Total	949.9 (1,033.1)	961.5 (1,300.0)	1,911.3 (2,333.1)	

Note: Figures in parentheses include price contingency.

2.4 Cost of Operation and Maintenance

Annual cost of operation and maintenance (O&M) from the year of 2004 following the completion of project works is assumed at 7.3 million pesos which equals to 0.5% of construction works of river improvements only.

TABLES

Table D.2.1 Unit Labor Cost

(Unit : pesos)		
Kind	Unit	Cost
Foreman	man.day	320
Skilled Laborer*	man.day	240
Common Laborer	man.day	200

*: Skilled laborers include heavy equipment operators, masons, steelmen, carpenters, etc.

Table D.2.2 Unit Cost of Main Construction Materials

(Unit : pesos)		
Kind	Unit	Cost
Portland Cement	bag (40 kg)	120
Reinforcement Bar	kg	12
Diesel Oil	liter	8.5
Gasoline	liter	10.5
Plywood (1/4")	sheet	250
Sand (Laoag)	m3	250
Gravel (Laoag)	m3	270
Boulder (Laoag)	m3	230

Table D.2.3 Operation Cost of Main Construction Equipment

(Unit : pesos)		
Kind	Unit	Cost
Backhoe, 0.6 m3	hour	840
Bulldozer, 15 ton	hour	2,750
Bulldozer, 21 ton	hour	3,700
Dump Truck, 10 ton	hour	350
Truck Crane, 15 ton	hour	600
Truck Crane, 25 ton	hour	900
Motor Grader	hour	600

Table D.2.4 Breakdown of Priority Project Cost

(Unit : pesos at 1997 price)						
Work Items	Unit	Quantity	F.C. Portion	L.C. Portion	Total	
1. CONSTRUCTION COST			654,074,234	800,509,346	1,454,583,580	
1.1 Preparatory Works (10% of 1.2 and 1.3)			59,461,294	72,773,577	132,234,871	
1.2 Main Works			540,557,218	661,577,972	1,202,135,190	
1.2.1 Sabo Dams and Alluvial Fan Rivers			464,057,078	604,752,012	1,068,809,090	
(1) Cura/Labugaon River			199,329,827	203,134,303	402,464,130	
a) Cura Sabo Dam No.1	m3	15,100	21,305,400	24,660,600	45,966,000	
b) Labugaon Sabo Dam No.1	m3	16,900	24,834,100	30,941,900	55,776,000	
c) River Improvement	km	12.70	153,190,327	147,531,803	300,722,130	
(2) Solsona River			77,269,313	114,492,177	191,761,490	
a) Solsona Sabo Dam No.1	m3	5,200	7,735,800	9,993,200	17,729,000	
b) River Improvement	km	11.00	69,533,513	104,498,977	174,032,490	
(3) Madongan River			111,467,506	165,572,024	277,039,530	
a) Madongan Sabo Dam	m3	20,800	28,218,300	33,510,700	61,729,000	
b) River Improvement	km	9.00	83,249,206	132,061,324	215,310,530	
(4) Papa River			75,990,432	121,553,508	197,543,940	
a) Papa Sabo Dam	m3	17,000	23,340,600	27,528,400	50,869,000	
b) River Improvement	km	7.00	52,649,832	94,025,108	146,674,940	
1.2.2 Laoag-Bongo River Improvement	km	13.14	76,500,140	56,825,960	133,326,100	
(1) Poblacion Laoag River Improvement	km	3.49	18,151,884	15,523,916	33,675,800	
(2) Poblacion San Nicolas River Improvement	km	4.20	23,266,964	15,650,536	38,937,500	
(3) Poblacion Dingras River Improvement	km	5.45	35,061,292	25,651,508	60,712,800	
1.3 Miscellaneous Works (10% of 1.2)			54,055,722	66,157,797	120,213,519	
2. COMPENSATION COST			0	6,440,000	6,440,000	
2.1 Land Acquisition	ha	40.5	0	5,990,000	5,990,000	
(1) Sabo Dams	ha	1.5	0	150,000	150,000	
(2) Alluvial Fan River Improvement	ha	10.0	0	1,000,000	1,000,000	
(3) Laoag-Bongo River Improvement	ha	29.0	0	4,840,000	4,840,000	
2.2 House Relocation	houses	3	0	450,000	450,000	
(1) Laoag-Bongo River Improvement	houses	3	0	450,000	450,000	
3. ADMINISTRATION COST (3% of 1 and 2)			0	43,830,707	43,830,707	
4. ENGINEERING SERVICES COST (16% of 1)			209,460,036	23,273,337	232,733,373	
5. PHYSICAL CONTINGENCY (10% of 1, 2, 3 and 4)			86,353,427	87,405,339	173,758,766	
SUB-TOTAL			949,837,696	961,458,730	1,911,346,426	
6. PRICE CONTINGENCY (2% for FC and 7% for LC)			83,190,000	338,532,000	421,722,000	
TOTAL			1,033,077,696	1,299,990,730	2,333,068,426	

Table D.2.5(1) Cost of Main Works by River

(1) Cura/Labugaon River		(Unit : pesos)							
		Work Item	Unit	Quantity	F.C. Portion		L.C. Portion		Total
Unit Cost	Amount				Unit Cost	Amount	Unit Cost	Amount	
(1) Cura Sabo Dam No.1				21,305,400		24,660,600		45,966,000	
a) Excavation (Gravel/Boulder)	m3	30,400	51	1,550,400	34	1,033,600	85	2,584,000	
b) Excavation (Rock)	m3	1,900	185	351,500	395	750,500	580	1,102,000	
c) Main Dam Stone Concrete	m3	9,300	1,285	11,950,500	1,515	14,089,500	2,800	26,040,000	
d) Sub-dam Stone Concrete	m3	2,500	1,285	3,212,500	1,515	3,787,500	2,800	7,000,000	
e) Apron Stone Concrete	m3	3,300	1,285	4,240,500	1,515	4,999,500	2,800	9,240,000	
(2) Labugaon Sabo Dam No.1				24,834,100		30,941,900		55,776,000	
a) Excavation (Gravel/Boulder)	m3	17,600	51	897,600	34	598,400	85	1,496,000	
b) Excavation (Rock)	m3	12,000	185	2,220,000	395	4,740,000	580	6,960,000	
c) Main Dam Stone Concrete	m3	14,100	1,285	18,118,500	1,515	21,361,500	2,800	39,480,000	
d) Sub-dam Stone Concrete	m3	2,800	1,285	3,598,000	1,515	4,242,000	2,800	7,840,000	
(3) Channel Excavation	m3	992,000	42	41,664,000	24	23,808,000	66	65,472,000	
(4) New Earth Dike	m	21,500		51,928,000		32,255,000		84,183,000	
a) Site Clearing	m2	387,000	27	10,449,000	23	8,901,000	50	19,350,000	
b) Embankment (use excavated material)	m3	992,000	41	40,672,000	23	22,816,000	64	63,488,000	
c) Gravel Maintenance Road	m2	53,800	15	807,000	10	538,000	25	1,345,000	
(5) Spur Dike	units	349		42,536,449		77,169,681		119,706,130	
a) Type A	units	281	119,121	33,473,001	215,169	60,462,489	334,290	93,935,490	
b) Type B	units	68	133,286	9,063,448	245,694	16,707,192	378,980	25,770,640	
(6) Intake Sluiceway (Type A)	units	4	465,032	1,860,128	434,968	1,739,872	900,000	3,600,000	
(7) Groundsill	unit	1		1,963,110		3,117,890		5,081,000	
a) Structural Excavation	m3	3,500	30	105,000	15	52,500	45	157,500	
b) Stone Concrete	m3	1,690	411	694,590	1,139	1,924,910	1,550	2,619,500	
c) Concrete Block	m3	960	1,212	1,163,520	1,188	1,140,480	2,400	2,304,000	
(8) Bridge (extension of Bagbag Bridge)	m2	810	16,344	13,238,640	11,656	9,441,360	28,000	22,680,000	
Total				199,329,827		203,134,303		402,464,130	

Table D.2.5(2) Cost of Main Works by River

(2) Solsona River			(Unit : pesos)						
			F.C. Portion		L.C. Portion		Total		
Work Item	Unit	Quantity	Unit Cost	Amount	Unit Cost	Amount	Unit Cost	Amount	
(1) Solsona Sabo Dam No.1				7,735,800		9,993,200		17,729,000	
a) Excavation (Gravel/Boulder)	m3	1,800	51	91,800	34	61,200	85	153,000	
b) Excavation (Rock)	m3	5,200	185	962,000	395	2,054,000	580	3,016,000	
c) Main Dam Stone Concrete	m3	4,500	1,285	5,782,500	1,515	6,817,500	2,800	12,600,000	
d) Sub-dam Stone Concrete	m3	700	1,285	899,500	1,515	1,060,500	2,800	1,960,000	
(2) Existing Earth Dike Heightening/Rehabilitation				18,755,700		10,959,300		29,715,000	
a) Site Clearing	m2	36,100	27	974,700	23	830,300	50	1,805,000	
b) Embankment (incl. Hauling)	m3	207,000	83	17,181,000	47	9,729,000	130	26,910,000	
c) Gravel Maintenance Road	m2	40,000	15	600,000	10	400,000	25	1,000,000	
(3) Spur Dike				46,182,917		87,276,573		133,459,490	
a) Type A	units	51	119,121	6,075,171	215,169	10,973,619	334,290	17,048,790	
b) Type B	units	79	133,286	10,529,594	245,694	19,409,826	378,980	29,939,420	
c) Type D	units	172	171,966	29,578,152	330,774	56,893,128	502,740	86,471,280	
(4) Intake Sluiceway (Type A)				465,032	1,395,096	434,968	1,304,904	900,000	2,700,000
(5) Groundsill				3,199,800		4,958,200		8,158,000	
a) Structural Excavation	m3	6,400	30	192,000	15	96,000	45	288,000	
b) Stone Concrete	m3	2,600	411	1,068,600	1,139	2,961,400	1,550	4,030,000	
c) Concrete Block	m3	1,600	1,212	1,939,200	1,188	1,900,800	2,400	3,840,000	
Total				77,269,313		114,492,177		191,761,490	

Table D.2.5(3) Cost of Main Works by River

(3) Madongan River		(Unit : pesos)						
		F.C. Portion		L.C. Portion		Total		
Work Item	Unit	Quantity	Unit Cost	Amount	Unit Cost	Amount	Unit Cost	Amount
(1) Madongan Sabo Dam				28,218,300		33,510,700		61,729,000
a) Excavation (Gravel/Boulder)	m3	15,800	51	805,800	34	537,200	85	1,343,000
b) Excavation (Rock)	m3	3,700	185	684,500	395	1,461,500	580	2,146,000
c) Main Dam Stone Concrete	m3	12,100	1,285	15,548,500	1,515	18,331,500	2,800	33,880,000
d) Sub-dam Stone Concrete	m3	3,100	1,285	3,983,500	1,515	4,696,500	2,800	8,680,000
e) Apron Stone Concrete	m3	5,600	1,285	7,196,000	1,515	8,484,000	2,800	15,680,000
(2) Existing Earth Dike Heightening/Rehabilitation				11,439,100		6,640,900		18,080,000
a) Site Clearing	m2	16,300	27	440,100	23	374,900	50	815,000
b) Embankment (incl. Hauling)	m3	128,000	83	10,624,000	47	6,016,000	130	16,640,000
c) Gravel Maintenance Road	m2	25,000	15	375,000	10	250,000	25	625,000
(3) Spur Dike				58,483,030		109,877,000		168,360,030
a) Type A	units	46	119,121	5,479,566	215,169	9,897,774	334,290	15,377,340
b) Type B	units	65	133,286	8,663,590	245,694	15,970,110	378,980	24,633,700
c) Type C	units	283	156,678	44,339,874	296,852	84,009,116	453,530	128,348,990
(4) Intake Sluiceway				6,045,416		5,654,584	0	11,700,000
a) Type A	units	3	465,032	1,395,096	434,968	1,304,904	900,000	2,700,000
b) Type B	units	5	930,064	4,650,320	869,936	4,349,680	1,800,000	9,000,000
(5) Groundsill				7,281,660		9,888,840		17,170,500
a) Structural Excavation	m3	8,300	30	249,000	15	124,500	45	373,500
b) Stone Concrete	m3	3,900	411	1,602,900	1,139	4,442,100	1,550	6,045,000
c) Concrete Block	m3	4,480	1,212	5,429,760	1,188	5,322,240	2,400	10,752,000
Total				111,467,506		165,572,024		277,039,530

Table D.2.5(4) Cost of Main Works by River

(4) Papa River

(Unit : pesos)

Work Item	Unit	Quantity	F.C. Portion		L.C. Portion		Total	
			Unit Cost	Amount	Unit Cos	Amount	Unit Cost	Amount
(1) Papa Sabo Dam				23,340,600		27,528,400		50,869,000
a) Excavation (Gravel/Boulder)	m3	20,600	51	1,050,600	34	700,400	85	1,751,000
b) Excavation (Rock)	m3	3,100	185	573,500	395	1,224,500	580	1,798,000
c) Main Dam Stone Concrete	m3	11,900	1,285	15,291,500	1,515	18,028,500	2,800	33,320,000
d) Sub-dam Stone Concrete	m3	2,600	1,285	3,341,000	1,515	3,939,000	2,800	7,280,000
e) Apron Stone Concrete	m3	2,400	1,285	3,084,000	1,515	3,636,000	2,800	6,720,000
(2) Existing Earth Dike Heightening/Rehabilitation				2,420,900		1,395,600		3,816,500
a) Site Clearing	m2	1,000	27	27,000	23	23,000	50	50,000
b) Embankment (incl. Hauling)	m3	26,800	83	2,224,400	47	1,259,600	130	3,484,000
c) Gravel Maintenance Road	m2	11,300	15	169,500	10	113,000	25	282,500
(3) Spur Dike	units	283		45,278,328		86,168,112		131,446,440
a) Type A	units	18	119,121	2,144,178	215,169	3,873,042	334,290	6,017,220
b) Type B	units	63	133,286	8,397,018	245,694	15,478,722	378,980	23,875,740
c) Type D	units	202	171,966	34,737,132	330,774	66,816,348	502,740	101,553,480
(4) Intake Sluiceway (Type A)	units	2	465,032	930,064	434,968	869,936	900,000	1,800,000
(5) Groundsill	unit	1		4,020,540		5,591,460		9,612,000
a) Structural Excavation	m3	5,000	30	150,000	15	75,000	45	225,000
b) Stone Concrete	m3	2,340	411	961,740	1,139	2,665,260	1,550	3,627,000
c) Concrete Block	m3	2,400	1,212	2,908,800	1,188	2,851,200	2,400	5,760,000
Total				75,990,432		121,553,508		197,543,940

Table D.2.5(5) Cost of Main Works by River

(5) Laoag-Bongo River		(Unit : pesos)							
		Work Item	Unit	Quantity	F.C. Portion		L.C. Portion		Total
Unit Cost	Amount				Unit Cost	Amount	Unit Cost	Amount	
A. Poblacion Laoag River Improvement		m	3,490		18,151,884		15,523,916		33,675,800
(1) Earth Dike		m	2,250		11,818,500		7,190,600		19,009,100
a) Site Clearing		m2	52,800	27	1,425,600	23	1,214,400	50	2,640,000
b) Embankment		m3	127,800	80	10,224,000	45	5,751,000	125	15,975,000
c) Gravel Maintenance Road		m2	5,630	30	168,900	40	225,200	70	394,100
(2) River Wall		m	1,240		4,990,520		7,076,180		12,066,700
a) Concrete Sheet Piling		m2	800	1,403	1,122,400	1,297	1,037,600	2,700	2,160,000
b) Embankment		m3	6,500	80	520,000	45	292,500	125	812,500
c) Footing Concrete		m3	230	1,830	420,900	1,670	384,100	3,500	805,000
d) Gravel Base		m3	1,420	156	221,520	354	502,680	510	724,200
e) Grouted Stone Pitching		m3	1,500	399	598,500	1,551	2,326,500	1,950	2,925,000
f) R.C. Wall		m3	800	2,634	2,107,200	3,166	2,532,800	5,800	4,640,000
(3) Drainage Sluiceway		units	2	671,432	1,342,864	628,568	1,257,136	1,300,000	2,600,000
B. Poblacion San Nicolas River Improvement		m	4,200		23,286,964		15,650,536		38,937,500
(1) Earth Dike		m	4,200		21,569,100		13,143,400		34,712,500
a) Site Clearing		m2	98,300	27	2,654,100	23	2,260,900	50	4,915,000
b) Embankment		m3	232,500	80	18,600,000	45	10,462,500	125	29,062,500
c) Gravel Maintenance Road		m2	10,500	30	315,000	40	420,000	70	735,000
(2) Spur Dike (5 units)		m	2,500	150	375,000	500	1,250,000	650	1,625,000
(3) Drainage Sluiceway		units	2	671,432	1,342,864	628,568	1,257,136	1,300,000	2,600,000
C. Poblacion Dingras River Improvement		m	5,450		35,061,292		25,651,508		60,712,800
(1) Earth Dike		m	5,150		30,151,400		18,424,100		48,575,500
a) Site Clearing		m2	149,200	27	4,028,400	23	3,431,600	50	7,460,000
b) Embankment		m3	321,700	80	25,736,000	45	14,476,500	125	40,212,500
c) Gravel Maintenance Road		m2	12,900	30	387,000	40	516,000	70	903,000
(2) River Wall		m	300		3,863,460		5,345,840		9,212,300
a) Concrete Sheet Piling		m2	1,500	1,403	2,104,500	1,297	1,945,500	2,700	4,050,000
b) Embankment		m3	3,600	80	288,000	45	162,000	125	450,000
c) Footing Concrete		m3	100	1,830	183,000	1,670	167,000	3,500	350,000
d) Gravel Base		m3	930	156	145,080	354	329,220	510	474,300
e) Grouted Stone Pitching		m3	1,280	399	510,720	1,551	1,985,280	1,950	2,496,000
f) R.C. Wall		m3	240	2,634	632,160	3,166	759,840	5,800	1,392,000
(3) Spur Dikes (5 units)		units	2,500	150	375,000	500	1,250,000	650	1,625,000
(4) Drainage Sluiceway		unit	1	671,432	671,432	628,568	628,568	1,300,000	1,300,000
Total					76,500,140		56,825,960		133,326,100

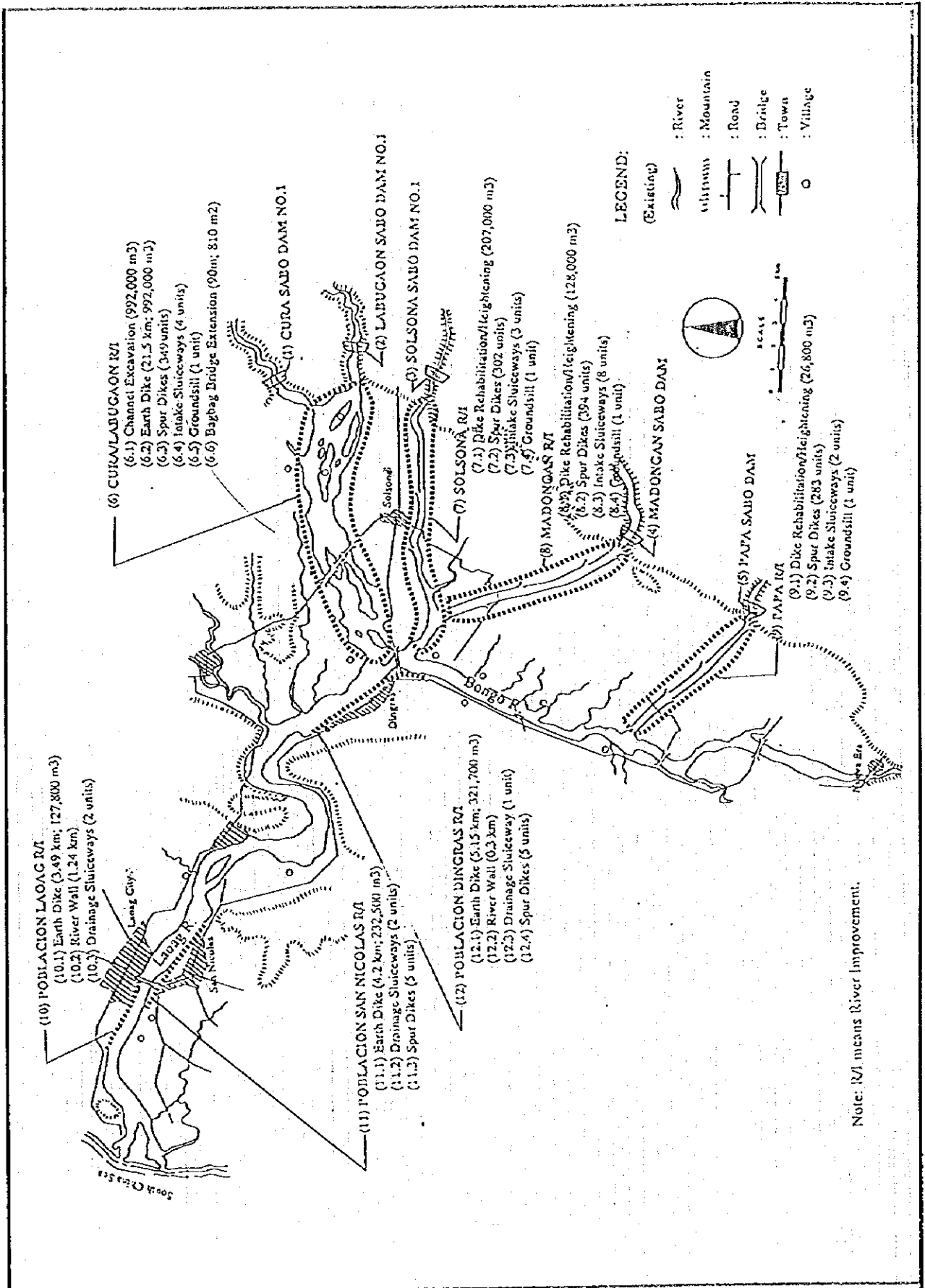
Table D.2.6 Annual Disbursement Schedule of Priority Project

(Unit: 1,000 PUSAS)

ITEM	TOTAL			1999			2000			2001			2002			2003		
	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL
1. CONSTRUCTION COST	654,074	800,509	1,454,583	0	0	0	166,561	208,645	375,206	172,488	204,858	377,346	168,760	201,692	370,452	146,265	185,314	331,579
1.1 Preparatory Works	59,461	72,774	132,235	0	0	0	15,142	18,968	34,110	15,681	18,623	34,304	15,342	18,336	33,677	13,297	16,847	30,144
1.2 Main Works	540,557	661,578	1,202,135	0	0	0	137,654	172,434	310,088	142,552	169,304	311,856	139,471	166,688	306,159	120,880	153,152	274,032
1.2.1 Sabo Dams and Alluvial Fan	464,057	604,752	1,068,809	0	0	0	119,502	156,910	276,412	119,265	153,654	272,919	116,097	149,586	265,683	109,193	144,602	253,795
(1) Cura/Labugon River	199,329	203,135	402,464	0	0	0	46,323	48,136	94,459	52,147	53,182	106,329	53,148	53,183	106,331	46,711	48,634	95,345
a) Cura Sabo Dam No.1	21,305	24,661	45,966	0	0	0	5,326	6,165	11,491	5,326	6,165	11,491	5,327	6,166	11,493	5,326	6,165	11,491
b) Labugon Sabo Dam No.1	24,834	30,942	55,776	0	0	0	6,209	7,736	13,945	6,209	7,736	13,945	6,209	7,736	13,945	6,207	7,734	13,941
c) Cura/Labugon R/I	153,190	147,532	300,722	0	0	0	34,788	34,235	69,023	41,612	39,281	80,893	41,612	39,281	80,893	35,178	34,735	69,913
(2) Solsona River	77,270	114,492	191,762	0	0	0	22,692	32,895	55,587	20,265	29,873	50,138	17,156	25,862	43,018	17,157	25,862	43,019
a) Solsona Sabo Dam No.1	7,736	9,993	17,729	0	0	0	4,642	5,996	10,638	3,094	3,997	7,091	0	0	0	0	0	0
b) Solsona R/I	69,534	104,499	174,033	0	0	0	18,050	26,899	44,949	17,171	25,876	43,047	17,156	25,862	43,018	17,157	25,862	43,019
(3) Mindongan River	111,467	165,572	277,039	0	0	0	30,063	44,100	74,163	27,175	40,529	67,704	27,116	40,472	67,588	27,113	40,471	67,584
a) Madongan Sabo Dam	28,218	33,511	61,729	0	0	0	7,055	8,378	15,433	7,055	8,378	15,433	7,055	8,378	15,433	7,055	8,377	15,430
b) Madongan R/I	83,249	132,061	215,310	0	0	0	23,008	35,722	58,730	20,120	32,151	52,271	20,061	32,094	52,155	20,060	32,094	52,154
(4) Papa River	75,991	121,553	197,544	0	0	0	20,424	31,779	52,203	18,678	30,070	48,748	18,677	30,069	48,746	18,212	29,635	47,847
a) Papa Sabo Dam	23,341	27,528	50,869	0	0	0	5,836	6,882	12,718	5,835	6,882	12,717	5,835	6,882	12,717	5,835	6,882	12,717
b) Papa R/I	52,650	94,025	146,675	0	0	0	14,588	24,897	39,485	12,843	23,188	36,031	12,842	23,187	36,029	12,377	22,753	35,130
1.2.2 Laoug-Bongo R/I	76,500	56,826	133,326	0	0	0	18,152	15,524	33,676	23,287	15,650	38,937	23,374	17,102	40,476	11,687	8,550	20,237
(1) Poblacion Laoug R/I	18,152	15,524	33,676	0	0	0	18,152	15,524	33,676	0	0	0	0	0	0	0	0	0
(2) Poblacion San Nicolas R/I	23,287	15,650	38,937	0	0	0	0	0	0	23,287	15,650	38,937	0	0	0	0	0	0
(3) Poblacion Dingras R/I	35,061	25,652	60,713	0	0	0	0	0	0	0	0	0	23,374	17,102	40,476	11,687	8,550	20,237
1.3 Miscellaneous Works	54,056	66,158	120,214	0	0	0	13,765	17,243	31,009	14,255	16,930	31,186	13,947	16,669	30,616	12,088	15,315	27,403
2. COMPENSATION COST	0	6,440	6,440	0	6,440	6,440	0	0	0	0	0	0	0	0	0	0	0	0
3. ADMINISTRATION COST	0	43,831	43,831	0	193	193	0	11,256	11,256	0	11,320	11,320	0	11,114	11,114	0	9,947	9,947
4. ENGINEERING SERVICES CO	209,460	23,273	232,733	78,548	8,727	87,275	32,885	3,654	36,539	32,676	3,631	36,306	32,676	3,631	36,306	32,676	3,631	36,306
5. PHYSICAL CONTINGENCY	86,353	87,405	173,759	7,855	1,536	9,391	19,945	22,356	42,300	20,516	21,981	42,497	20,144	21,644	41,787	17,894	19,889	37,783
SUB-TOTAL (1 to 5)	949,887	961,458	1,911,346	86,402	16,897	103,299	219,391	245,911	465,302	225,680	241,790	467,470	221,579	238,080	459,660	196,835	218,781	415,616
6. PRICE CONTINGENCY	83,190	338,532	421,722	3,456	2,450	5,906	13,383	55,330	68,713	18,506	75,197	93,702	23,044	95,946	118,991	24,801	109,609	134,410
TOTAL	1,033,077	1,299,991	2,333,068	89,858	19,347	109,205	232,774	301,241	534,015	244,186	316,986	561,172	244,623	334,027	578,650	221,636	328,390	550,026

Note: R/I means River Improvement.

FIGURES



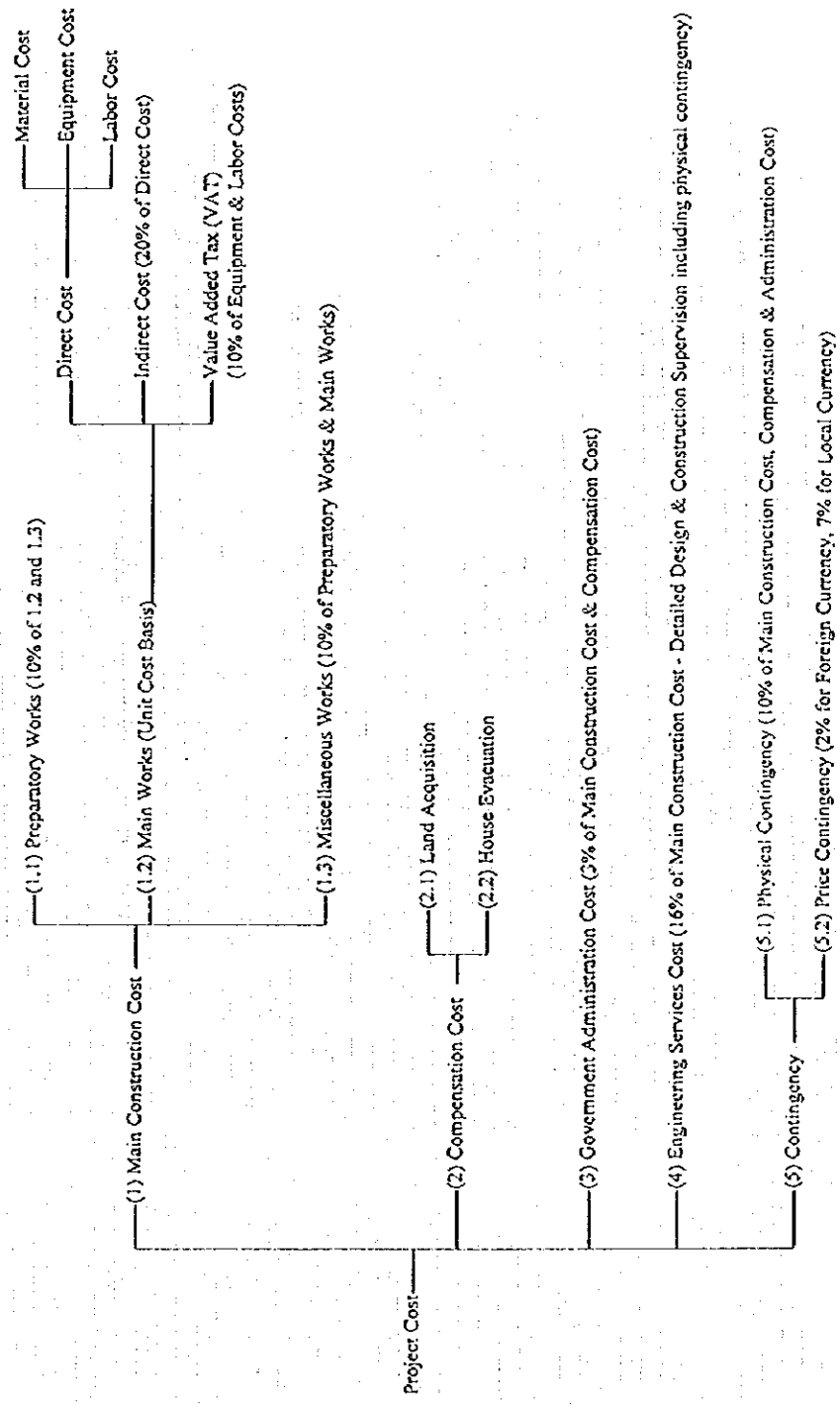
THE STUDY ON SABO AND FLOOD CONTROL
IN THE LAOAG RIVER BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. D.1.1
General Plan of Priority Project

Fig. D.1.2 Implementation Schedule of Priority Project

Items	Quantity	1997	1998	1999	2000	2001	2002	2003
1. Feasibility Study		■						
2. Loan Application & Other Preparations			■					
3. Detailed Design				■				
4. Construction					■	■	■	■
4.1 Sabo Dams and Alluvial Fan River Improvement								
(1) Cura/Labugaon River								
a) Cura Sabo Dam No.1	15,100 m3				■	■	■	■
b) Labugaon Sabo Dam No.1	16,900 m3				■	■	■	■
c) Channel Excavation	992,000 m3				■	■	■	■
d) Dike Embankment	992,000 m3				■	■	■	■
e) Spur Dike	349 units				■	■	■	■
f) Intake Sluiceway	4 units					■	■	■
g) Groundsill	1 unit				■			
h) Bagbag Bridge Extension	810 m2				■	■	■	■
(2) Solsona River								
a) Solsona Sabo Dam No.1	5,200 m3				■	■	■	■
b) Dike Rehabilitation/Heightening	207,000 m3				■	■	■	■
c) Spur Dike	302 units				■	■	■	■
d) Intake Sluiceway	3 units					■	■	■
e) Groundsill	1 unit				■			
(3) Madongan River								
a) Madongan Sabo Dam	20,800 m3				■	■	■	■
b) Dike Rehabilitation/Heightening	128,000 m3				■	■	■	■
c) Spur Dike	394 units				■	■	■	■
d) Intake Sluiceway	8 units					■	■	■
e) Groundsill	1 unit				■			
(4) Papa River								
a) Papa Sabo Dam	16,900 m3				■	■	■	■
b) Dike Rehabilitation/Heightening	26,800 m3				■	■	■	■
c) Spur Dike	283 units				■	■	■	■
d) Intake Sluiceway	2 units					■	■	■
e) Groundsill	1 unit				■			
4.2 Laoag-Bongo River Improvement								
(1) Poblacion Laoag River Improvement	3,490 m							
a) Earth Dike	127,800 m3				■	■	■	■
b) River Wall	1,240 m				■	■	■	■
c) Drainage Sluiceway	2 units				■			
(2) Poblacion San Nicolas River Improvement	4,200 m							
a) Earth Dike	232,500 m3					■	■	■
b) Spur Dike	5 units					■	■	■
c) Drainage Sluiceway	2 units					■	■	■
(3) Poblacion Dingras River Improvement	5,450 m							
a) Earth Dike	321,700 m3						■	■
b) River Wall	300 m						■	■
c) Spur Dike	5 units						■	■
d) Drainage Sluiceway	1 unit						■	■
5. Land Acquisition	40.5 ha			■				



THE STUDY ON SABO AND FLOOD CONTROL
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Fig. D.2.1
Constitution of Project Cost