J. Project Cost Estimate

Table of Contents

Page

List of Tables

Table

List of Annex

J. PROJECT COST ESTIMATE

1 BASIC CONDITIONS OF PROJECT COST ESTIMATE

The basic conditions of project cost estimate are described below.

1.1 Unit Cost

Most unit costs applied in this Study are basically derived from the related projects implemented by the DPWH.

1.2 Price Level

All the costs are estimated based on the Philippine Peso, using the currency conversion rate of US$1.00 = 44.93 Peso = ¥ 115.55 that is prevailing as in October, 2007.

2 PROJECT COST ESTIMATE FOR THE MODEL RIVER BASINS

In this chapter, the project cost of the structural measures is estimated for the respective alternative cases (if there are) for each model river basin. The details of the alternative cases are shown in Supporting Report G. The estimation results are shown below.

2.1 Ilog-Hilabangan

The estimated volume of the excavation based on the result of cross section survey undertaken in this Study is 3.7 times compared to the one in the Master Plan (Study on Ilog-Hilabangan River Basin Flood Control Project, JICA, July 1991). The difference is seen because the cross sections in the Master Plan were obtained in every 200 m, while the ones in the Study were in every couple of kilometers. Hence, the amount obtained from the cross section survey in this Study was used as a reference and the amount in the Master Plan was used with updated unit prices and updated land use in order to estimate the project cost. As a result, the Project cost for Case-1 becomes 2,106 million pesos.

The difference among the alternatives is how to control the flow from the river mouth (0 km) to the confluence of the mainstream and the diversion channel (6.4 km). According to the cross section survey in this Study, the excavation volume at this section in Case-1 accounts for about 30% of the total excavation volume and the volume there in Case-2 is 1.4 times of the one in Case-1 (hence, 42% of the total excavation of Case-1). Assuming that the cost for each of excavation, embankment, revetment and sodding in Case-2 is 42% of the total amount in Case-1, the project cost for Case-2 is estimated at 2,290 million pesos.

Case-3 is utilizing both the main stream and the diversion channel. To achieve this plan, a control gate is essential to both the main stream and the diversion channel. The project cost for Case-3 is estimated at 12,944 million pesos.

The project cost is shown in Table J.2.1. The main construction cost and the quantities are presented in Annex J.1.

Table J.2.1 Project Costs for Alternative Cases of the Ilog-Hilabangan River Basin

(In thousand Pesos, Current Prices)

No	Item	Case-1*	Case-2	Case-3	Remarks
1	Construction Cost	1,546,353	1,689,020	9,826,040	a = b + c
1-1	*Preparatory Work*	*201,698*	*220,307*	*1,281,657*	*b*
1-2	*Main Construction Cost*	*1,344,655*	*1,468,713*	*8,544,383*	*c*
2	Administration Cost	46,391	50,671	294,781	d = 3% of a
3	Engineering Services	247,417	270,243	1,572,166	e = 16% of a
4	Compensation Cost	74,260	71,770	74,260	f
5	Physical Contingency	191,442	208,170	1,176,725	g = 10% of a + d + e + f
	Total	2,105,863	2,289,874	12,943,972	

*Note) *: Recommended case.*

2.2 Dungcaan

The project cost is shown in Table J.2.2. The main construction cost and the quantities are presented in Annex J.1.

Table J.2.2 Project Costs for Alternative Cases of the Dungcaan River Basin

(In thousand Pesos, Current Prices)

No	Item	Case-1*	Case-2	Remarks
1	Construction Cost	160,587	201,694	a = b + c
1-1	*Preparatory Work*	20,946	26,308	*b*
1-2	*Main Construction Cost*	139,641	175,386	*c*
2	Administration Cost	4,818	6,051	d = 3% of a
3	Engineering Services	25,694	32,271	e = 16% of a
4	Compensation Cost	800	(Negligible)	f
5	Physical Contingency	19,190	24,002	g = 10% of a + d + e + f
	Total	211,088	264,017	

*Note) *: Recommended case.*

2.3 Meycauayan

The project cost is presented in Table J.2.3. In the Meycauayan River Basin, the feasibility study (Feasibility Study on Valenzuela-Obando-Meycauayan (VOM) Area Drainage System Improvement Project, JBIC, September 2001) was done partially. The cost estimation in the feasibility study enhances the geometric features and local price condition, so it is utilized with updated unit prices and updated land use in order to estimate the project cost in this Study.

The main construction cost and the quantities are presented in Annex J.1.

Table J.2.3 Project Costs of Alternative Cases for the Target Area for Flood Control of the Meycauayan River Basin

(In thousand Pesos, Current Prices)

No	Item	Case-1	Case-2**	Remarks
1	Construction Cost	8,331,614	4,528,280	a = b + c
1-1	*Preparatory Work*	*1,086,732*	590,645	*b*
1-2	*Main Construction Cost*	*7,244,882*	3,937,635	*c*
2	Administration Cost	249,948	135,848	d = 3% of a
3	Engineering Services	1,333,058	724,525	e = 16% of a
4	Compensation Cost	775,660	818,681	f
5	Physical Contingency	1,069,028	620,733	g = 10% of a + d + e + f
	Total	11,759,308	6,828,068	

*Note: * Prices described here is the products of the values in the feasibility study and 1.34 that is a conversion factor of CPI.*

*** Recommended case.*

2.4 Kinanliman

The project cost is shown in Table J.2.4. The main construction cost and the quantities are presented in Annex J.1.

Table J.2.4 Project Cost of the Kinanliman River Basin

(In thousand Pesos, Current Prices)

No	Item	Case-1	Remarks
1	Construction Cost	111,817	a = b + c
1-1	*Preparatory Work*	14,585	*b*
1-2	*Main Construction Cost*	97,232	*c*
2	Administration Cost	3,355	d = 3% of a
3	Engineering Services	17,891	e = 16% of a
4	Compensation Cost	(Negligible)	f
5	Physical Contingency	13,306	g = 10% of a + d + e + f
	Total	146,369	

2.5 Tuganay

The river system of the Tuganay River Basin consists of Tuganay River as the main stream, and Anibongan River and Ising River as the tributaries of Tuganay River.

The project cost for each alternatives is shown in Table J.2.5. The main construction cost and the quantities are presented in Annex J.1.

Table J.2.5 Project Costs for Alternative Cases of the Tuganay River Basin

(Tuganay River)

(In thousand Pesos, Current Prices)

No	Item	Case T-1	Case T-2*	Remarks
1	Construction Cost	1,271,154	1,165,606	a = b + c
1-1	*Preparatory Work*	*165,803*	*152,036*	*b*
1-2	*Main Construction Cost*	*1,105,351*	*1,013,570*	*c*
2	Administration Cost	38,135	34,968	d = 3% of a
3	Engineering Services	203,385	186,497	e = 16% of a
4	Compensation Cost	3,895	10,552	f
5	Physical Contingency	151,657	139,762	g = 10% of a + d + e + f
	Total	1,668,226	1,537,385	

*Note) *: Recommended case.*

(Anibongan)

(In thousand Pesos, Current Prices)

No	Item	Case A-1*	Case A-2	Case A-3	Case A-4	Remarks
1	Construction Cost	513,461	595,747	670,296	5,591,846	a = b + c
1-1	*Preparatory Work*	*66,973*	*77,706*	*87,430*	*729,371*	*b*
1-2	*Main Construction Cost*	*446,488*	*518,041*	*582,866*	*4,862,475*	*c*
2	Administration Cost	15,404	17,872	20,109	167,755	d = 3% of a
3	Engineering Services	82,154	95,320	107,247	894,695	e = 16% of a
4	Compensation Cost	1,868	1,868	1,868	1,868	f
5	Physical Contingency	61,289	71,081	79,952	665,616	g = 10% of a + d + e + f
	Total	674,176	781,888	879,472	7,321,780	

*Note) *: Recommended case under Case T-2.*

(Ising)

(In thousand Pesos, Current Prices)

No	Item	Case I-1	Case I-2*	Remarks
1	Construction Cost	355,582	338,808	a = b + c
1-1	*Preparatory Work*	*46,380*	*44,192*	*b*
1-2	*Main Construction Cost*	*309,202*	*294,616*	*c*
2	Administration Cost	10,667	10,164	d = 3% of a
3	Engineering Services	56,893	54,209	e = 16% of a
4	Compensation Cost	9,467	12,647	f
5	Physical Contingency	43,261	41,583	g = 10% of a + d + e + f
	Total	475,870	457,411	

*Note) *: Recommended case.*

2.6 Dinanggasan

The project cost is shown in Table J.2.6. The main construction cost and the quantities are presented in Annex J.1.

Table J.2.6 Project Costs for Alternative Cases of the Dinanggasan River Basin

(In thousand Pesos, Current Prices)

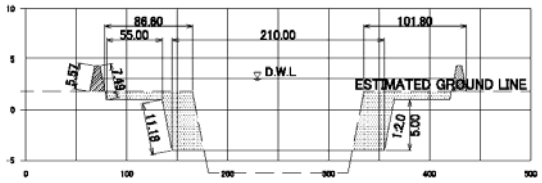
No	Item	Case-1*	Case-2	Remarks
1	Construction Cost	112,670	114,426	a = b + c
1-1	*Preparatory Work*	14,696	14,925	*b*
1-2	*Main Construction Cost*	97,974	99,501	*c*
2	Administration Cost	3,380	3,433	d = 3% of a
3	Engineering Services	18,027	18,308	e = 16% of a
4	Compensation Cost	(Negligible)	(Negligible)	f
5	Physical Contingency	13,408	13,617	g = 10% of a + d + e + f
	Total	147,485	149,784	

*Note) *: Recommended case.*

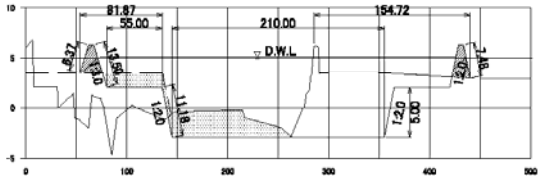
Annex J.1

Main Construction Cost and Quantities

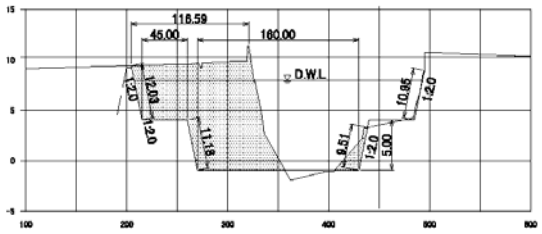
Ilog River



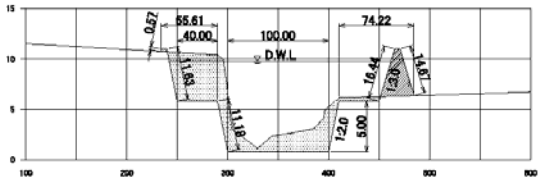
0.0k*



5.4k**



12.0k



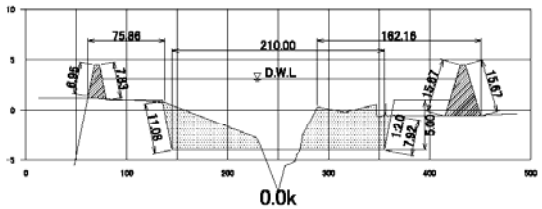
17.0k

*: as observed in the field

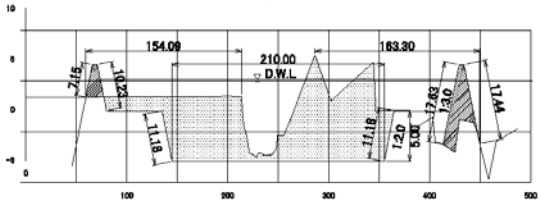
**: The width of the river is revised with the satellite phot.

Quantities					
Item	Unit	0.0k	6.0k	12.0k	17.0k
Excavation	m2	454.6	886.30	1,114.09	502.28
Embankment	m2	51.51	76.77	0.00	89.42
slope of the bank (left, high, back)	m	6.57	6.37	0.00	0.57
slope of the bank (left, high, river side)	m	7.49	13.50	12.03	11.83
slope of the bank (left, low)	m	11.18	11.18	11.18	11.18
slope of the bank (right, high, back)	m	6.57	7.48	0.00	14.67
slope of the bank (right, high, river side)	m	7.49	13.50	10.95	18.44
slope of the bank (right, low)	m	11.18	11.18	9.51	11.18
Land Acquisition (left)	m	101.80	129.55	116.59	55.61
Land Acquisition (right)	m	101.80	154.72	0.00	74.22

Diversion Channel



0.0k



5.4k

Quantities			
Item	Unit	0.0k	5.0k
Excavation	m2	593.5	1,357.1
Embankment	m2	141.3	181.2
slope of the bank (left, high, back)	m	6.95	7.15
slope of the bank (left, high, river side)	m	7.93	10.23
slope of the bank (left, low)	m	11.08	11.18
slope of the bank (right, high, back)	m	15.67	17.44
slope of the bank (right, high, river side)	m	15.67	17.68
slope of the bank (right, low)	m	7.92	11.18
Land Acquisition (left)	m	75.86	154.09
Land Acquisition (right)	m	162.16	163.30

Ilog-Hilabangan-Case-1-Main Construction Cost

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
1	Channel Excavation	m^3	4,382,700	150	657,405,000	
2	Embankment	m^3	966,700	130	125,671,000	
3	Revetment with foot protection	m^2	102,100	2,300	234,830,000	
4	Sodding	m^2	530,200	30	15,906,000	
5	Sluice Gate (1.5m x 1.5m x 3, 3.0m x 3.0m x 3)	m^2	34	10,100	343,400	
6	Drainage Facility	unit	7	1,500,000	10,500,000	
7	Re-Construction of Bridge	m^2	6,000	50,000	300,000,000	
Total					1,344,655,400	

Ilog-Hilabangan-Case-1-Land Acquisition

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
1	Fish Pond	m^2	377,000	20	7,540,000	Market Value
2	Sugar Cane	m^2	1,776,000	10	17,760,000	Market Value
3	Residential	m^2	58,000	600	34,800,000	Market Value
4	House Evacuation	unit	354	40,000	14,160,000	
Total					74,260,000	

Ilog-Hilabangan-Case-2-Main Construction Cost

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
1	Channel Excavation	m^3	4,908,624	150	736,293,600	
2	Embankment	m^3	1,082,704	130	140,751,520	
3	Revetment with foot protection	m^2	114,352	2300	263,009,600	
4	Sodding	m^2	593,824	30	17,814,720	
5	Sluice Gate (1.5m x 1.5m x 3, 3.0m x 3.0m x 3)	m^2	34	10100	343,400	
6	Drainage Facility	unit	7	1500000	10,500,000	
7	Re-Construction of Bridge	m^2	6,000	50000	300,000,000	
Total					1,468,712,840	

Ilog-Hilabangan-Case-2-Land Acquisition

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
1	Fish Pond	m^2	125,667	20	2,513,333	Market Value
2	Sugar Cane	m^2	2,029,714	10	20,297,143	Market Value
3	Residential	m^2	58,000	600	34,800,000	Market Value
4	House Evacuation	unit	354	40,000	14,160,000	
Total					71,770,476	

Ilog-Hilabangan-Case-3-Main Construction Cost

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
1	Channel Excavation	m^3	4,382,700	150	657,405,000	
2	Embankment	m^3	966,700	130	125,671,000	
3	Revetment with foot protection	m^2	102,100	2,300	234,830,000	
4	Sodding	m^2	530,200	30	15,906,000	
5	Sluice Gate (1.5m x 1.5m x 3)	m^2	7	10,100	70,700	
6	Gate at the Confluence (main stream)	unit	1	6,000,000,000	6,000,000,000	
7	Gate at the Confluence (Diversion Channel	unit	1	1,200,000,000	1,200,000,000	
8	Drainage Facility	unit	7	1,500,000	10,500,000	
9	Re-Construction of Bridge	m^2	6,000	50,000	300,000,000	
Total					8,544,382,700	

Ilog-Hilabangan-Case-3-Land Acquisition

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
1	Fish Pond	m^2	377,000	20	7,540,000	Market Value
2	Sugar Cane	m^2	1,776,000	10	17,760,000	Market Value
3	Residential	m^2	58,000	600	34,800,000	Market Value
4	House Evacuation	unit	354	40,000	14,160,000	
Total					74,260,000	

Quantity (Ilog Hilanbangan)

Channel Excavation based on the survey result (Case-1)

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (10^3m^3)
River mouth	454.6			
		720.45	5400.0	3,890.4
5.4	986.3			
		1050.20	6600.0	6,931.3
12.0	1114.1			
		808.20	5000.0	4,041.0
17.0	502.3			
		502.30	3000.0	1,506.9
20.0	502.3			
Total				16,369.7

Channel Excavation based on the survey result (Case-1, 0k - 6.4k)

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (10^3m^3)
River mouth	454.60			
		720.45	5,400	3,890.4
5.4	986.30			
		986.30	1,000	986.3
6.4	986.30			
Total				4,876.7

4876.7/16369.7=29.8%

Channel Excavation based on the survey result (Case-2, 0k - 6.4k)

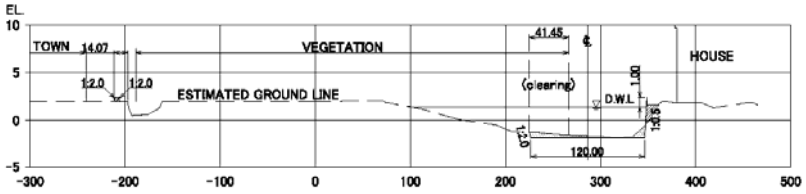
Station	Area (m^2)	Average (m^2)	Length (m)	Volume (10^3m^3)
River mouth	593.50			
		980.30	5,400	5,293.6
5.4	1,367.10			
		1367.10	1,000	1,367.1
6.4	1367.10			
Total				6,660.7

6660.7/4876.7=1.4

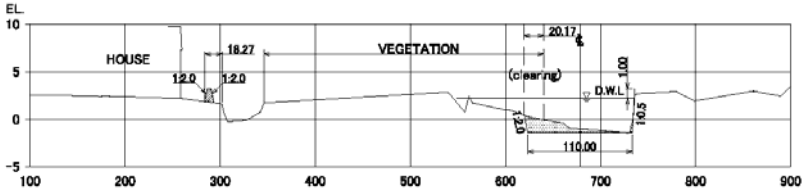
Quantity in Master Plan

ITEM NO.	DESCRIPTION	UNIT	QUANTITY
1	Channel Excavation	m^3	4,382,700
2	Embankment	m^3	966,700
3	Revetment with foot protection	m^2	102,100
4	Sodding	m^2	530,200
5	Sluice Gate (1.5m x 1.5m x 3, 3.0m x 3.0m x 3)	m^2	34
6	Drainage Facility	unit	6
7	Re-Construction of Bridge	m^2	6,000

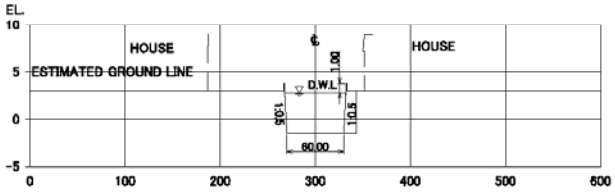
Dungcaan River



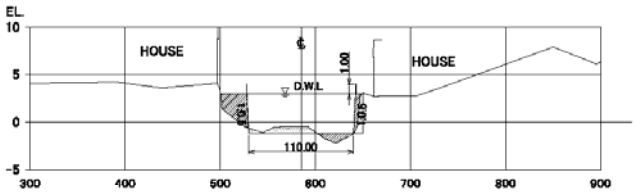
0.0k to 0.2k (0.15k)



0.2k to 1.4k (0.84k)



1.4k to 1.6k (1.47k)



1.6k to 1.8k (1.62k)

Quantities					
Item	Unit	0.15k	0.84k	1.47k	1.62k
Excavation	m2	48.60	78.30	0.00	35.70
Backfill	m2	14.80	0.00	0.00	100.50
Embankment	m2	2.10	9.80	-	-
Sodding	m	1.92	8.30	-	-
slope of the bank (left, lower)	m	-	-	5.44	5.14
slope of the bank (right)	m	4.88	4.86	5.44	5.14
Clearing and Grubbing	m	41.45	20.17	0.00	-
Land Acquisition (left)	m	14.07	18.27	0.00	0.00
Land Acquisition (right)	m	0.00	0.00	0.00	0.00

Dungcaan-Case-1-Main Construction Cost

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
1	Clearing and Grubbing	m^2	33,830	350	11,840,483	
2	Channel Excavation	m^3	84,789	150	12,718,350	
3	Channel Backfill	m^3	32,954	130	4,283,955	
4	Revetment	m^2	8,516	1,100	9,367,600	
5	Sheet Pile (600m/0.4mx9m)	m	13,500	3,000	40,500,000	
6	Embankment	m^3	7,886	130	1,025,135	
7	Sodding	m^2	8,987	30	269,610	
8	Spur Dike (Gabion)	m^3	1,605	3,200	5,136,000	
9	Foot Protection	m^3	985	3,350	3,299,750	
10	Park Station	station	6	2,200,000	13,200,000	
11	Bridge (3m x 10m x 2)	m^2	40	40,000	1,600,000	
12	Gate(5m x 7m)	m^2	35	1,040,000	36,400,000	
Total					139,640,882	

Dungcaan-Case-1-Land Acquisition

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
1	Compensation for resettlement (20house x 4person)	person	80	10,000	800,000	
2	Land Acquisition				0	Negligible
Total					800,000	

Dungcaan-Case-2-Main Construction Cost

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
1	Clearing and Grubbing (lower stream)	m^2	33,830	350	11,840,483	
2	Channel Excavation	m^3	84,789	150	12,718,350	
3	Channel Backfill	m^3	32,954	130	4,284,020	
4	Revetment	m^2	14,829	1,100	16,311,900	
5	Sheet Pile (600m/0.4mx9m)	m	13,500	3,000	40,500,000	
6	Spur Dike (Gabion)	m^3	1,605	3,200	5,136,000	
7	Foot Protection	m^3	985	3,350	3,299,750	
8	Park Station	station	4	2,123,900	8,495,600	
9	Gate(5m x 6m, 5m x 7m)	m^2	70	1,040,000	72,800,000	
Total					175,386,103	

Dungcaan-Case-2-Land Acquisition

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
1	Land Acquisition				0	Negligible
Total					0	

Quantity (Dungcaan-Case-1)

Channel Excavation

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (m^3)
River mouth	48.50			
		48.50	150.0	7,275.0
0.15	48.50			
		63.40	690.0	43,746.0
0.84	78.30			
		39.15	630.0	24,664.5
1.47	0.00			
		17.85	150.0	2,677.5
1.62	35.70			
		35.70	180.0	6,426.0
1.80	35.70			
Total				84,789.0

Backfill

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (m^3)
River mouth	14.80			
		14.80	150.0	2,220.0
0.15	14.80			
		7.40	690.0	5,106.0
0.84	0.00			
		0.00	630.0	0.0
1.47	0.00			
		50.25	150.0	7,537.5
1.62	100.50			
		100.50	180.0	18,090.0
1.80	100.50			
Total				32,953.5

Embankment

Station	Area (m^2)	Average (m^2)	Length* (m)	Volume (m^3)
River mouth	2.10			
		2.10	383.0	804.3
0.15	2.10			
		5.85	431.0	2,521.4
0.84	9.60			
		9.60	475.0	4,560.0
1.30	9.60			
Total				7,885.7

Revetment (lower stream-right side)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	4.56			
		4.56	150.0	684.0
0.15	4.56			
		4.76	690.0	3,281.0
0.84	4.95			
		5.20	630.0	3,272.9
1.47	5.44			
		5.29	150.0	793.5
1.62	5.14			
		5.14	180.0	925.2
1.80	5.14			
(subtruction for Sheet Pile, 300*5.14)				1,542.0
Total				8,956.5

Note: Sheet Pile is applied on the both side of the river for 300m around the bride.

Revetment (lower stream-left side)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
1.30	5.44			
		5.44	170	924.8
1.47	5.44			
		5.29	150	793.5
1.62	5.14			
		5.14	180	925.2
1.80	5.14			
(subtruction for Sheet Pile, 300*5.14)				1,542.0
Total				2,643.5

Note: Sheet Pile is applied on the both side of the river for 300m around the bride.

Clearing and Grubbing (lower stream)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	41.45			
		41.45	150	6,217.5
0.15	41.45			
		30.81	690	21,258.9
0.84	20.17			
		10.09	630	6,353.6
1.47	0.00			
Total				33,830.0

Sodding

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	41.45			
		21.69	150	3,252.8
0.15	1.92			
		4.11	690	2,835.9
0.84	6.30			
		6.30	460	2,898.0
1.30	6.30			
Total				8,986.7

Miscellaneous

Spur Dike (Gabion)

3.0×(40+60+110+110+100+70+45)= 1605m3

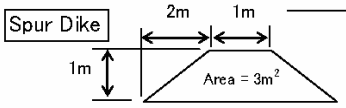
Foot Protection

1.0×0.5×(1,000+480+490)= 985m3

Park Station 4 stations

Bridge (2m x 10m x 2) 40m2

Gate (5m x 7m x 2) 70m2



Quantity (Dungcaan-Case-2)

Channel Excavation

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (m^3)
River mouth	48.50			
		48.50	150.0	7,275.0
0.15	48.50			
		63.40	690.0	43,746.0
0.84	78.30			
		39.15	630.0	24,664.5
1.47	0.00			
		17.85	150.0	2,677.5
1.62	35.70			
		35.70	180.0	6,426.0
1.80	35.70			
Total				84,789.0

Backfill

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (m^3)
River mouth	14.80			
		14.80	150.0	2,220.0
0.15	14.80			
		7.40	690.0	5,106.0
0.84	0.00			
		0.00	630.0	0.0
1.47	0.00			
		50.25	150.0	7,537.5
1.62	100.50			
		100.50	180.0	18,090.0
1.80	100.50			
Total				32,953.5

Revetment (lower stream-right side)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	4.56			
		4.56	150.0	684.0
0.15	4.56			
		4.76	690.0	3,281.0
0.84	4.95			
		5.20	630.0	3,272.9
1.47	5.44			
		5.29	150.0	793.5
1.62	5.14			
		5.14	180.0	925.2
1.80	5.14			
(subtruction for Sheet Pile, 300*5.14)				1,542.0
Total				8,956.5

Note: Sheet Pile is applied on the both side of the river for 300m around the bride.

Revetment (lower stream-left side)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	4.56			
		4.56	150.0	684.0
0.15	4.56			
		4.76	690.0	3,281.0
0.84	4.95			
		5.20	630.0	3,272.9
1.47	5.44			
		5.29	150.0	793.5
1.62	5.14			
		5.14	180.0	925.2
1.80	5.14			
(subtruction for Sheet Pile, 300*5.14)				1,542.0
Total				8,956.5

Note: Sheet Pile is applied on the both side of the river for 300m around the bride.

Clearing and Grubbing (lower stream)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	41.45			
		41.45	150	6,217.5
0.15	41.45			
		30.81	690	21,258.9
0.84	20.17			
		10.09	630	6,353.6
1.47	0.00			
Total				33,830.0

Total of Revetment

14829m2

Miscellaneous

Spur Dike (Gabion)

3.0×(40+60+110+110+100+70+45)= 1605m3

Foot Protection

1.0×0.5×(1,000+480+490)=

985m3

Park Station

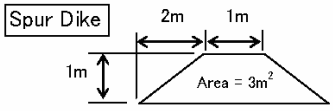
4 stations

Bridge (2m x 10m x 2)

40m2

Gate (5m x 7m x 2)

70m2



Quantity (Dungcaan-Case-1)

Channel Excavation

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (m^3)
River mouth	48.50			
		48.50	150.0	7,275.0
0.15	48.50			
		63.40	690.0	43,746.0
0.84	78.30			
		39.15	630.0	24,664.5
1.47	0.00			
		17.85	150.0	2,677.5
1.62	35.70			
		35.70	180.0	6,426.0
1.80	35.70			
Total				84,789.0

Backfill

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (m^3)
River mouth	14.80			
		14.80	150.0	2,220.0
0.15	14.80			
		7.40	690.0	5,106.0
0.84	0.00			
		0.00	630.0	0.0
1.47	0.00			
		50.25	150.0	7,537.5
1.62	100.50			
		100.50	180.0	18,090.0
1.80	100.50			
Total				32,953.5

Embankment

Station	Area (m^2)	Average (m^2)	Length* (m)	Volume (m^3)
River mouth	2.10			
		2.10	383.0	804.3
0.15	2.10			
		5.85	431.0	2,521.4
0.84	9.60			
		9.60	475.0	4,560.0
1.30	9.60			
Total				7,885.7

Revetment (lower stream-right side)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	4.56			
		4.56	150.0	684.0
0.15	4.56			
		4.76	690.0	3,281.0
0.84	4.95			
		5.20	630.0	3,272.9
1.47	5.44			
		5.29	150.0	793.5
1.62	5.14			
		5.14	180.0	925.2
1.80	5.14			
(subtruction for Sheet Pile, 300*5.14)				1,542.0
Total				8,956.5

Note: Sheet Pile is applied on the both side of the river for 300m around the bride.

Revetment (lower stream-left side)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
1.30	5.44			
		5.44	170	924.8
1.47	5.44			
		5.29	150	793.5
1.62	5.14			
		5.14	180	925.2
1.80	5.14			
(subtruction for Sheet Pile, 300*5.14)				1,542.0
Total				2,643.5

Note: Sheet Pile is applied on the both side of the river for 300m around the bride.

Clearing and Grubbing (lower stream)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	41.45			
		41.45	150	6,217.5
0.15	41.45			
		30.81	690	21,258.9
0.84	20.17			
		10.09	630	6,353.6
1.47	0.00			
Total				33,830.0

Sodding

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	41.45			
		21.69	150	3,252.8
0.15	1.92			
		4.11	690	2,835.9
0.84	6.30			
		6.30	460	2,898.0
1.30	6.30			
Total				8,986.7

Miscellaneous

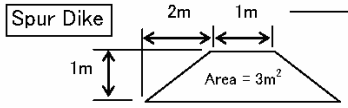
Spur Dike (Gabion)
3.0×(40+60+110+110+100+70+45)= 1605m3

Foot Protection
1.0×0.5×(1,000+480+490)= 985m3

Park Station 4 stations

Bridge (2m x 10m x 2) 40m2

Gate (5m x 7m x 2) 70m2



Quantity (Dungcaan-Case-2)

Channel Excavation

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (m^3)
River mouth	48.50			
		48.50	150.0	7,275.0
0.15	48.50			
		63.40	690.0	43,746.0
0.84	78.30			
		39.15	630.0	24,664.5
1.47	0.00			
		17.85	150.0	2,677.5
1.62	35.70			
		35.70	180.0	6,426.0
1.80	35.70			
Total				84,789.0

Backfill

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (m^3)
River mouth	14.80			
		14.80	150.0	2,220.0
0.15	14.80			
		7.40	690.0	5,106.0
0.84	0.00			
		0.00	630.0	0.0
1.47	0.00			
		50.25	150.0	7,537.5
1.62	100.50			
		100.50	180.0	18,090.0
1.80	100.50			
Total				32,953.5

Revetment (lower stream-right side)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	4.56			
		4.56	150.0	684.0
0.15	4.56			
		4.76	690.0	3,281.0
0.84	4.95			
		5.20	630.0	3,272.9
1.47	5.44			
		5.29	150.0	793.5
1.62	5.14			
		5.14	180.0	925.2
1.80	5.14			
(subtruction for Sheet Pile, 300*5.14)				1,542.0
Total				8,956.5

Note: Sheet Pile is applied on the both side of the river for 300m around the bride.

Revetment (lower stream-left side)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	4.56			
		4.56	150.0	684.0
0.15	4.56			
		4.76	690.0	3,281.0
0.84	4.95			
		5.20	630.0	3,272.9
1.47	5.44			
		5.29	150.0	793.5
1.62	5.14			
		5.14	180.0	925.2
1.80	5.14			
(subtruction for Sheet Pile, 300*5.14)				1,542.0
Total				8,956.5

Note: Sheet Pile is applied on the both side of the river for 300m around the bride.

Clearing and Grubbing (lower stream)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	41.45			
		41.45	150	6,217.5
0.15	41.45			
		30.81	690	21,258.9
0.84	20.17			
		10.09	630	6,353.6
1.47	0.00			
Total				33,830.0

Total of Revetment

14829m2

Miscellaneous

Spur Dike (Gabion)

3.0×(40+60+110+110+100+70+45)= 1605m3

Foot Protection

1.0×0.5×(1,000+480+490)=

985m3

Park Station

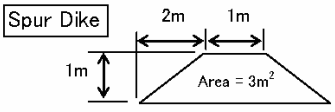
4 stations

Bridge (2m x 10m x 2)

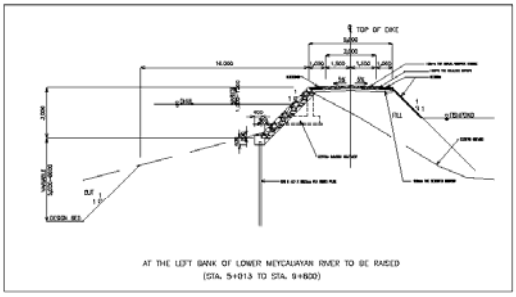
40m2

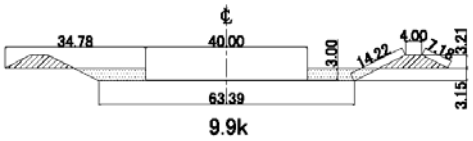
Gate (5m x 7m x 2)

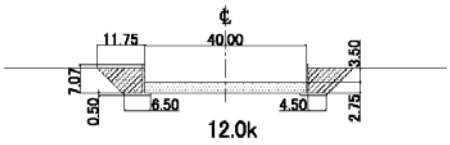
70m2

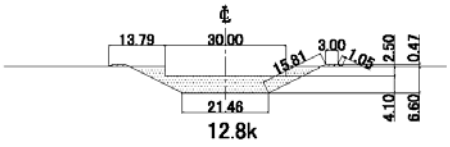


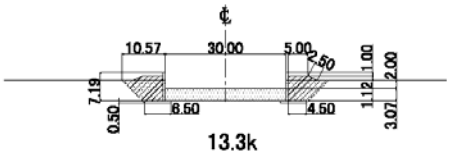
Meycauayan



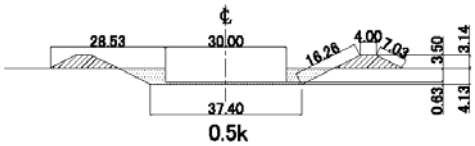


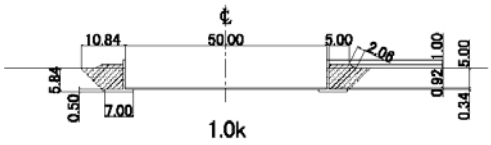


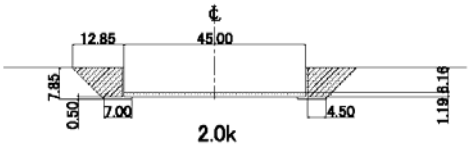


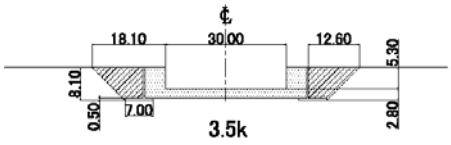


Marilao









Quantities									
Item	Unit	Meycauayan				Marilao			
		9.9k	12.0k	12.8k	13.3k	0.5k	1.0k	2.0k	3.5k
Excavation (Dredging)	m2	122.33	228.80	153.69	199.73	83.47	113.00	157.42	291.61
Embankment (Backfill)	m2	66.90	119.00	3.70	121.31	64.66	106.80	104.00	146.61
Concrete	m	0.00	13.58	0.00	13.69	0.00	14.30	14.50	14.60
Sodding	m	42.80	0.00	33.72	0.00	46.58	0.00	0.00	0.00
Land Acquisition (left)	m	34.78	11.75	13.79	10.57	28.53	10.84	12.85	18.10
Land Acquisition (right)	m	34.78	11.75	13.79	10.57	28.53	10.84	12.85	18.10

Meycauayan-Main Construction Cost

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
1	River Improvement	m	14,000	174,841	2,447,768,860	
1-1	Meycauayan River (lower stream)	m	4,500	43,267	194,702,000	*
	Meycauayan River (upper stream)		5,000	166,492	832,461,460	
1-2	Marilao River	m	4,500	315,690	1,420,605,400	
2	Polder Dike Construction	m	5,200	26,027	135,340,000	*
2-1	Pinagkabalian River & Paliwas River	m	4,700	26,030	122,342,000	*
2-2	Palasan River	m	500	25,996	12,998,000	*
3	New Open Channel Construction	m	2,541	8,701	22,110,000	*
3-1	Polo-Palasan Diversion Channel	m	850	10,562	8,978,000	*
3-2	Small Channel	m	1,650	3,086	5,092,000	*
3-3	Box Culvert	m	41	196,098	8,040,000	*
4	Regulation Pond Construction	ha	27	2,193,630	59,228,000	*
5	Raising of Existing Road	m	3,900	22,574	88,038,000	*
6	Installation of Tidal Gate (11 sites)	m^2	416	985,803	410,094,202	*
7	Installation of Pumping Stations (4 sites)	m^3/s	22	35,070,407	775,056,000	*
Total					3,937,635,062	

*: Unit prices described here is the products of the values in the feasibility study and 1.34 that is a conversion factor of CPI.

Meycauayan-Land Acquisition

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
1	Residential Area	ha	22.0	-	589,600,000	
2	Agricultural Land & Fish Pond	ha	53.7	-	215,681,000	
3	House Evacuation	houses	20	-	13,400,000	
Total					818,681,000	

Quantity of Meycauayan River Improvement

Channel Excavation (Dredging)

Station*	Area (m^2)	Length* (m)	Volume (m^3)
9.9	122.33	1,700	207,961
12.0	228.80	1,000	228,800
12.8	153.69	1,400	215,166
13.3	199.73	900	179,757
Total			831,684

Embankment (Backfill)

Station*	Area (m^2)	Length* (m)	Volume (m^3)
9.9	66.90	1,700	113,730
12.0	119.00	1,000	119,000
12.8	3.70	1,400	5,180
13.3	121.31	900	109,179
Total			347,089

*:The stations and the lengths were defined for each type of improvement, such as a embankment o a retaining wall.

Concrete

Station*	Area (m^2)	Length* (m)	Volume (m^3)
9.9	0.00	1,700	0
12.0	13.58	1,000	13,580
12.8	0.00	1,400	0
13.3	13.69	900	12,321
Total			25,901

Sodding

Station*	length (m)	Length* (m)	Area (m^2)
9.9	42.80	1,700	72,760
12.0	0.00	1,000	0
12.8	33.72	1,400	47,208
13.3	0.00	900	0
Total			119,968

*:The stations and the lengths were defined for each type of improvement, such as a embankment o a retaining wall.

Quantity of Marilao River Improvement

Channel Excavation (Dredging)

Station*	Area (m^2)	Length* (m)	Volume (m^3)
0.5	83.47	500	41,735
1.0	113.00	1,000	113,000
2.0	157.40	800	125,920
3.5	291.61	2,200	641,542
Total			922,197

Embankment (Backfill)

Station*	Area (m^2)	Length* (m)	Volume (m^3)
0.5	64.66	500	32,330
1.0	106.80	1,000	106,800
2.0	104.00	800	83,200
3.5	146.61	2,200	322,542
Total			544,872

*:The stations and the lengths were defined for each type of improvement, such as a embankment o a retaining wall.

Concrete

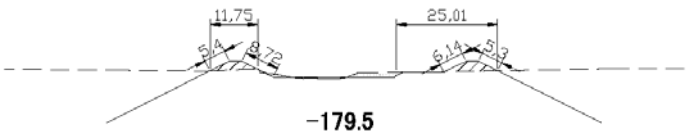
Station*	Area (m^2)	Length* (m)	Volume (m^3)
0.5	0.00	500	0
1.0	14.30	1,000	14,300
2.0	14.50	800	11,600
3.5	14.60	2,200	32,120
Total			58,020

Sodding

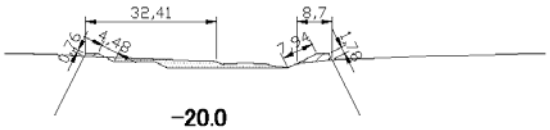
Station*	length (m)	Length* (m)	Area (m^2)
0.5	46.58	500	23,290
1.0	0.00	1,000	0
2.0	0.00	800	0
3.5	0.00	2,200	0
Total			23,290

*:The stations and the lengths were defined for each type of improvement, such as a embankment o a retaining wall.

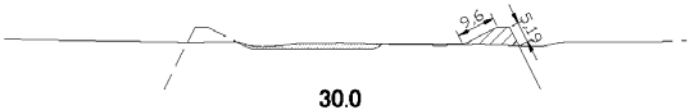
Kinanliman River



-179.5

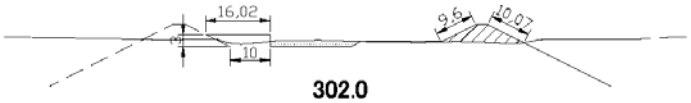


-20.0

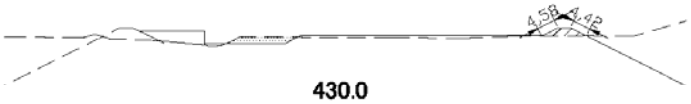


30.0

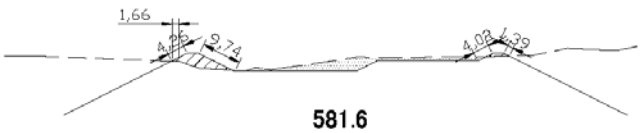
102.5



302.0



430.0



581.6

Kinanliman-Main Construction Cost

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
River Improvement						
1	Channel Excavation	m^3	55,954	150	8,393,135	
2	Embankment	m^3	22,952	130	2,983,786	
3	Concrete	m^3	4,908	6,000	29,446,575	
4	Revetment	m^2	8,424	1,100	9,265,872	
5	Sodding	m^2	5,176	30	155,279	
6	Foot protection (Gabion)	m^3	490	3,350	1,641,500	
7	Foot protection for sabo dam and spur dike(Gabion)	m^3	635	3,200	2,032,000	
8	Bridge	m^2	420	50,000	21,000,000	
Subtotal					74,918,147	
Urgent Project						
Subtotal					22,314,319	
Total					97,232,466	

Land Acquisition

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
1	Land Acquisition	m^2	-	-	-	Negligible
Total					0	

Kinanliman-Main Construction Cost (River Improvement and Sabo Dam separately)

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
River Improvement						
1	Channel Excavation	m^3	43,579	150	6,536,885	
2	Embankment	m^3	22,952	130	2,983,786	
3	Concrete	m^3	1,092	6,000	6,552,000	
4	Revetment	m^2	8,424	1,100	9,265,872	
5	Sodding	m^2	5,176	30	155,279	
6	Foot protection (Gabion)	m^3	490	3,350	1,641,500	
7	Foot protection for sabo dam and spur dike(Gabion)	m^3	300	3,200	960,000	
8	Bridge	m^2	420	50,000	21,000,000	
Subtotal					49,095,322	
Urgent Project						
Subtotal					22,314,319	
Sabo Dam						
1	Channel Excavation	m^3	12,375	150	1,856,250	
3	Concrete	m^3	3,816	6,000	22,894,575	
7	Foot protection for sabo dam (Gabion)	m^3	335	3,200	1,072,000	
Subtotal					25,822,825	
Total					97,232,466	

Land Acquisition

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
1	Land Acquisition	m^2	-	-	-	Negligible
Total					0	

Quantity (Kinanliman)

Channel Excavation

Station*	Area (m^2)	Average (m^2)	Length (m)	Volume (m^3)
River mouth	14.62			
		14.62	205.5	3,004.4
-179.5	14.62			
		33.45	159.5	5,335.3
-20.0	52.28			
		46.56	50.0	2,328.0
30.0	40.84			
		35.80	72.5	2,595.5
102.5	30.76			
		26.73	199.5	5,331.6
302.0	22.69			
		49.33	128.0	6,313.6
430.0	75.96			
		75.96	151.6	11,515.5
581.6	75.96			
		75.96	78.4	5,955.3
660.0	75.96			
Total				42,379.2

Embankment

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (m^3)
River mouth	35.28			
		35.28	205.5	7,250.0
-179.5	35.28			
		24.69	159.5	3,938.1
-20.0	14.10			
		25.45	50.0	1,272.3
30.0	36.79			
		45.08	72.5	3,267.9
102.5	53.36			
		33.80	77.5	2,619.1
180.0	14.23			
		-	-	-
		-	-	-
490.0	28.78			
		28.78	160.0	4,604.8
650.0	28.78			
Total				22,952.2

*: Station number shows the distance in meter.

Revetment (left)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	8.72			
		8.72	205.5	1,792.0
-179.5	8.72			
		6.60	159.5	1,052.7
-20.0	4.48			
		2.24	50.0	112.0
30.0	0.00			
		0.00	72.5	0.0
102.5	0.00			
		0.00	199.5	0.0
302.0	0.00			
		0.00	128.0	0.0
430.0	0.00			
		4.87	151.6	738.3
581.6	9.74			
		9.74	68.4	666.2
650.0	9.74			
Total				4,361.2

Revetment (right)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	6.14			
		6.14	205.5	1,261.8
-179.5	6.14			
		7.04	159.5	1,122.9
-20.0	7.94			
		8.77	50.0	438.5
30.0	9.60			
		9.60	70.0	672.0
100.0	9.60			
		7.09	80.0	567.2
180.0	4.58			
Total				4,062.4

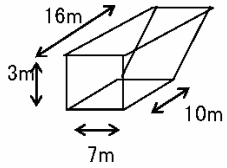
Sodding (left, back)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	5.40			
		5.40	205.5	1,109.7
-179.5	5.40			
		3.08	159.5	491.3
-20.0	0.76			
		0.38	50.0	19.0
30.0	0.00			
		0.00	72.5	0.0
102.5	0.00			
		0.00	199.5	0.0
302.0	0.00			
		0.00	128.0	0.0
430.0	0.00			
		2.13	151.6	322.9
581.6	4.26			
		4.26	68.4	291.4
650.0	4.26			
Total				2,234.3

Sodding (right, back)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	5.30			
		5.30	205.5	1,089.2
-179.5	5.30			
		3.54	159.5	564.6
-20.0	1.78			
		3.49	50.0	174.3
30.0	5.19			
		7.63	70.0	534.1
100.0	10.07			
		7.25	80.0	579.6
180.0	4.42			
Total				2,941.7

Miscellaneous
Spur Dike (6 units)
Excavation
V = 2.0 x 10 x 10 x 6units 1,200.0m3
Concrete
V = (10 + 16) / 2 x 3 x 7 x 2/3 x 6units 1,092.0m3
Gabion
Vgab = 0.5 × 10 × 10 x 6units 300.0m3



Sabo dam
Excavation
V = 5.5 x 75 x 30 12,375.0m3
Concrete
Vmain = (3 + 7.4) / 2 x 5.5 x 70
+ 3 x 2.5 x (6.5 + 13.5) - (3 + 5.4) / 2 x 3 x 2 x 7
1,975.6m3
Vaplon = 1.5 x 64.5 x 17.75 1,717.3m3
Vwall = (0.5 + 1.0) / 2 x 4.5 x 18.2 x 2 122.9m3

Total of Concrete 3,815.8m3

Gabion for sabo dam
Vgab = 1.0 × 67 × 5 335.0m3

Foot Protection
= 0.5 x 1 x (385 x 2 + 160 + 50) 490.0m3

Brdige
60 x 7 = 420.0m2

Quantity (River Improvement + Sabo Dam)

Channel Excavation	55,954.2m3
Embankment	22,952.2m3
Revetment	8,423.5m2
Foot protection (Gabion)	490.0m3
Foot protection for Sabo dam and spur dike((	635.0m3
Sodding	5,176.0m2
Concrete	4,907.8m3
Bridge	420.0m2

Quantity (River Improvement)

Channel Excavation	43,579.2m3
Embankment	22,952.2m3
Revetment	8,423.5m2
Foot protection (Gabion)	490.0m3
Foot protection for Sabo dam(Gabion)	300.0m3
Sodding	5,176.0m2
Concrete	1,092.0m3
Bridge	420.0m2

Quantity (Sabo Dam)

Channel Excavation	12,375.0m3
Embankment	
Revetment	
Foot protection (Gabion)	
Foot protection for Sabo dam(Gabion)	335.0m3
Sodding	
Concrete	3,815.8m3
Bridge	

Tuganay River

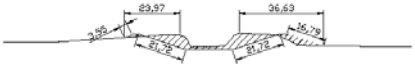
Case T-1

6.4k (for the diversion channel; 1.0k-1.8k)

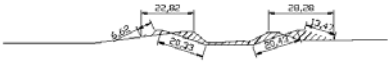
6.4k (0.0k-7.0k)

8.8k (7.0k-9.0k)

14.6k (9.0k-15.0k)



16.2k (15.0k-17.0k)



18.8k (17.0k-21.0k)

Case T-B

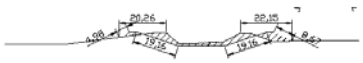
6.4k (for the diversion channel; 1.0k-1.8k)

6.4k (0.0k-7.0k)

8.8k (7.0k-9.0k)

14.6k (9.0k-15.0k)

16.2k (15.0k-17.0k)

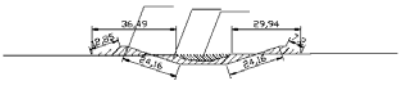


18.8k (17.0k-21.0k)

Quantities (Case T-1)						
Item	Unit	6.4k	8.8k	14.6k	16.2k	18.8k
Excavation	m2	138.82	206.26	106.99	163.93	92.57
Embankment	m2	16.57	67.01	172.83	46.93	67.68
slope of the bank (left, high, back)	m	3.46	5.1	15.15	3.55	6.62
slope of the bank (left, high, river side)	m	3.58	5.37	25.93	21.72	20.33
slope of the bank (left, low)	m	20.12	17.89	–	–	–
slope of the bank (right, high, back)	m	2.72	7.80	16.52	16.79	13.47
slope of the bank (right, high, river side)	m	3.58	5.37	25.93	21.72	20.43
slope of the bank (right, low)	m	20.12	17.89	–	–	–
Land Acquisition (left)	m	31.47	35.01	32.27	23.97	22.82
Land Acquisition (right)	m	27.67	41.70	39.75	36.63	28.28

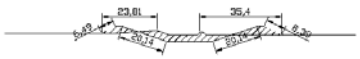
Quantities (Case T-2)						
Item	Unit	6.4k	8.8k	14.6k	16.2k	18.8k
Excavation	m2	109.59	205.21	107.43	164.53	92.70
Embankment	m2	0.00	5.59	84.72	19.19	43.24
slope of the bank (left, high, back)	m	–	–	6.81	1.42	4.98
slope of the bank (left, high, river side)	m	22.06	19.01	20.55	19.70	19.16
slope of the bank (left, low)	m	–	–	–	–	–
slope of the bank (right, high, back)	m	–	–	7.66	14.24	8.67
slope of the bank (right, high, river side)	m	22.14	19.01	20.55	19.70	19.16
slope of the bank (right, low)	m	–	–	–	–	–
Land Acquisition (left)	m	4.30	3.50	19.39	20.17	20.26
Land Acquisition (right)	m	–	12.61	25.56	32.31	22.15

Anibongan River
Case A-1



4.3k (0.0k–4.5k)

6.1k (4.5k–6.5k)



9.8k (6.5k–10.0k)

Quantities (Case T-2)						
Item	Unit	6.4k	8.8k	14.6k	16.2k	18.8k
Excavation	m2	109.59	205.21	107.43	164.53	92.70
Embankment	m2	0.00	5.59	84.72	19.19	43.24
slope of the bank (left, high, back)	m	–	–	6.81	1.42	4.98
slope of the bank (left, high, river side)	m	22.06	19.01	20.55	19.70	19.16
slope of the bank (left, low)	m	–	–	–	–	–
slope of the bank (right, high, back)	m	–	–	7.66	14.24	8.67
slope of the bank (right, high, river side)	m	22.14	19.01	20.55	19.70	19.16
slope of the bank (right, low)	m	–	–	–	–	–
Land Acquisition (left)	m	4.30	3.50	19.39	20.17	20.26
Land Acquisition (right)	m	–	12.61	25.56	32.31	22.15

New and Old Ising River
Case I-1

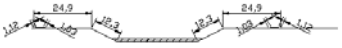
New Ising 6.0k (0.0k–6.0k)

New Ising 6.0k (6.0k–7.0k)

New Ising 7.0k (7.0k–9.0k)

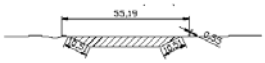
Old Ising 3.0k (0.0k–3.0k)

New and Old Ising River
Case I-2



New Ising 6.0k (0.0k–6.0k)

New Ising 6.0k (6.0k–7.0k)



New Ising 7.0k (7.0k–9.0k)

Old Ising 3.0k (0.0k–3.0k)

Quantities Case I-1					
Item	Unit	New Ising			Old Ising
		0.0k	6.0k	7.0k	3.0k
Excavation	m2	37.00	43.80	170.68	11.93
Embankment	m2	6.09	74.45	13.07	19.13
slope of the bank (left, high, back)	m	1.57	6.98	3.10	3.47
slope of the bank (left, high, river side)	m	1.48	6.40	12.52	10.64
slope of the bank (left, low)	m	12.30	6.57	–	–
slope of the bank (right, high, back)	m	1.57	7.58	2.45	3.71
slope of the bank (right, high, river side)	m	1.48	6.48	12.43	10.64
slope of the bank (right, low)	m	12.30	6.48	–	–
Land Acquisition (left)	m	25.70	54.44	63.54	10.85
Land Acquisition (right)	m	25.70	56.28	–	11.22

Quantities Case I-2					
Item	Unit	New Ising			Old Ising
		0.0k	6.0k	7.0k	3.0k
Excavation	m2	37.00	54.18	185.83	11.95
Embankment	m2	3.95	37.26	1.31	12.45
slope of the bank (left, high, back)	m	1.12	4.66	–	2.53
slope of the bank (left, high, river side)	m	1.03	4.61	10.51	9.84
slope of the bank (left, low)	m	12.30	6.57	–	–
slope of the bank (right, high, back)	m	1.12	4.75	0.55	2.79
slope of the bank (right, high, river side)	m	1.03	4.61	10.51	9.84
slope of the bank (right, low)	m	12.30	6.57	–	–
Land Acquisition (left)	m	24.90	49.96	55.19	9.56
Land Acquisition (right)	m	24.90	52.25	–	9.50

Optimum Case-Main Construction Cost

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
Tuganay River						
1	Channel Excavation	m^3	2,798,780.0	150	419,817,000	
2	Embankment	m^3	746,310.0	130	97,020,300	
3	Revetment	m^2	54,482.0	1,100	59,930,200	
4	Foot protection	m	1,325.0	3,350	4,438,750	
5	Sodding	m^2	945,474.0	30	28,364,220	
6	Gate	m^2	175.0	1,040,000	182,000,000	
7	Bridge(160m, 60m)	m^2	4,440.0	50,000	222,000,000	
Subtotal					1,013,570,470	
Anibongan River						
1	Channel Excavation	m^3	772,222.0	150	115,833,300	
2	Embankment	m^3	957,856.0	130	124,521,280	
3	Revetment	m^2	29,704.0	1,100	32,674,400	
4	Foot protection	m	650.0	3,350	2,177,500	
5	Sodding	m^2	659,379.0	30	19,781,370	
6	Gate	m^2	75.0	1,040,000	78,000,000	
7	Bridge(70m)	m^2	1,470.0	50,000	73,500,000	
Subtotal					446,487,850	
Isin River (New and Old)						
1	Channel Excavation	m3	813,690.0	150	122,053,500	
2	Embankment	m3	263,220.0	130	34,218,600	
3	Revetment	m2	8,323.5	1,100	9,155,850	
4	Foot protection	m	350.0	3,350	1,172,500	
5	Sodding	m^2	267,189.5	30	8,015,685	
6	Gate	m^2	25.0	1,040,000	26,000,000	
7	Bridge (25m)	m^2	2,350.0	40,000	94,000,000	
Subtotal					294,616,135	
Total					1,754,674,455	

Optimum Case-Total Main Construction Cost

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
Tuganay, Anibongan, New and Old Ising River						
1	Channel Excavation	m^3	4,384,692.0	150	657,703,800	
2	Embankment	m^3	1,967,386.0	130	255,760,180	
3	Revetment	m^2	92,509.5	1,100	101,760,450	
4	Foot protection	m	2,325.0	3,350	7,788,750	
5	Sodding	m^2	1,872,042.5	30	56,161,275	
6	Gate	m^2	275.0	1,040,000	286,000,000	
7	Bridge	m^2	8,260.0	-	389,500,000	
Total					1,754,674,455	

Optimum Case-Land Acquisition

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
1	Fish Pond	m^2	367,200	6	2,203,200	Assesed Valu
2	Annual Crop	m^2	2,257,900	3	6,773,700	Assesed Valu
3	Other Crop	m^2	3,507,000	3	10,521,000	Assesed Valu
4	Residential	m^2	154,700	36	5,569,200	Assesed Valu
Total					25,067,100	

Quantity (Tuganay River, Case T-1)

Channel Excavation

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (10^3m^3)
River mouth	138.62			
		138.62	5600.0*	776.3
6.4	138.62			
		172.44	2400.0	413.9
8.8	206.26			
		156.63	5800.0	908.4
14.6	106.99			
		135.46	1600.0	216.7
16.2	163.93			
		128.25	2600.0	333.5
18.8	92.57			
		92.57	2100.0	194.4
20.9	92.57			
Total				2,843.2

*:Dur to the construction of the diversion channel, the amount bewteen 1.0 and 1.8 is obtained separately.

Embankment

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (10^3m^3)
River mouth	16.6			
		16.57	6200.0*	102.7
6.4	16.6			
		16.57	2400.0	39.8
8.8	67.0			
		67.01	5800.0	388.7
14.6	172.8			
		172.83	1600.0	276.5
16.2	46.9			
		46.93	2600.0	122.0
18.8	67.7			
		67.68	2100.0	142.1
20.9	67.7			
Total				1,071.8

*:Dur to the construction of the diversion channel, the amount bewteen 1.0 and 1.8 is obtained separately.

Revetment (left)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	23.70			
		23.70	300.0	7,110.0
6.4	23.70			
		23.48	0.0	0.0
8.8	23.26			
		24.60	1000.0	24,595.0
14.6	25.93			
		23.83	0.0	0.0
16.2	21.72			
		21.03	100.0	2,102.5
18.8	20.33			
		20.33	0.0	0.0
20.9	20.33			
Total				33,807.5

Revetment (right)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	23.70			
		23.70	600.0	14,220.0
6.4	23.70			
		23.48	0.0	0.0
8.8	23.26			
		24.60	650.0	15,986.8
14.6	25.93			
		23.83	0.0	0.0
16.2	21.72			
		21.08	0.0	0.0
18.8	20.43			
		20.43	0.0	0.0
20.9	20.43			
Total				30,206.8

Sodding (left, river side)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	23.70			
		23.70	5300.0	125,610.0
6.4	23.70			
		23.48	2400	56,352.0
8.8	23.26			
		24.60	4800	118,056.0
14.6	25.93			
		23.83	1600	38,120.0
16.2	21.72			
		21.03	2500	52,562.5
18.8	20.33			
		20.33	2100	42,693.0
20.9	20.33			
Total				433,393.5

Sodding (right, river side)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	23.70			
		23.70	5000.0	118,500.0
6.4	23.70			
		23.48	2400.0	56,352.0
8.8	23.26			
		24.60	5150.0	126,664.3
14.6	25.93			
		23.83	1600.0	38,120.0
16.2	21.72			
		21.08	2600.0	54,795.0
18.8	20.43			
		20.43	2100.0	42,903.0
20.9	20.43			
Total				437,334.3

CaseT-1-Main Construction Cost of Tugani river improvement

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remraks
1	Channel Excavation	m^3	2,948,462.0	150	442,269,300	
2	Embankment	m^3	1,605,214.0	130	208,677,820	
3	Revetment	m^2	64,014.3	1,100	70,415,675	
4	Foot protection	m	1,325.0	3,350	4,438,750	
5	Sodding	m^2	918,308.1	30	27,549,243	
6	Gate	m^2	125.0	1,040,000	130,000,000	
7	Bridge (160m, 60m)	m^2	4,440.0	50,000	222,000,000	
Total					1,105,350,788	

CaseT-1-Land Acquisition

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
1	Fish Pond	m^2	178,635	6	1,071,810	Assesed Value
2	Annual Crop	m^2	236,800	3	710,400	Assesed Value
3	Other Crop	m^2	704,150	3	2,112,450	Assesed Value
4	Residential	m^2	0	36	0	Assesed Value
Total					3,894,660	

CaseT-2-Main Construction Cost of Tugani river improvement

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remraks
River Improvement						
1	Channel Excavation	m^3	2,795,600	150	419,340,000	
2	Embankment	m^3	409,710	130	53,262,300	
3	Revetment	m^2	54,482	1,100	59,930,200	
4	Foot protection	m	1,325	3,350	4,438,750	
5	Sodding	m^2	837,674	30	25,130,220	
6	Gate	m^2	125	1,040,000	130,000,000	
7	Bridge (160m, 60m)	m^2	4,440	50,000	222,000,000	
Subtotal					914,101,470	
Retarding Basin						
1	Channel Excavation	m^3	3,180	150	477,000	
2	Embankment	m^3	336,600	130	43,758,000	
3	Sodding	m^2	107,800	30	3,234,000	
4	Gate	m^2	50	1,040,000	52,000,000	
Subtotal					99,469,000	
Total					1,013,570,470	

CaseT-2-Land Acquisition

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
1	Fish Pond	m^2	101,200	6	607,200	Assesed Value
2	Annual Crop	m^2	17,200	3	51,600	Assesed Value
3	Other Crop	m^2	3,297,700	3	9,893,100	Assesed Value
4	Residential	m^2	0	36	0	Assesed Value
Total					10,551,900	

Sodding (back)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	6.18			
		6.18	5600.0*	34.6
6.4	6.18			
		9.44	2400.0	22.7
8.8	12.7			
		22.19	5800.0	128.7
14.6	31.67			
		26.01	1600.0	41.6
16.2	20.34			
		20.22	2600.0	52.6
18.8	20.09			
		20.09	2600.0	52.2
21.4	20.09			
Total				332.3

*:Dur to the construction of the diversion channel, the amount bewteen 1.0 and 1.8 is obtained separately.
The amount at the rivermouth is assumed as the same as the one at 6.4.

The amount at 22.0 is assumed as the same as the one at 19.4.

Diversion channel (from 1.0 to 1.8)
Channel Excavation
131.64 x 800 = 105,312.0m3
Embankment
178.40 x 800 = 142,720.0m3
Sodding
59.06 x 800 = 47,248.0m2

Lucutan river (cross section of 14.6 at 13.8 is appried.)
Embankment
118.38 / 2 x 2 x 3300= 390,654.0m3

Miscellaneous
Foot Protection
1.0×0.5×2650 1,325.0m3
Gate
5 x 5 x 3unit= 75.0m2
10 x 5 x 1unit= 50.0m2
Brdige
160 x 12 x 2 = 3,840.0m2
60 x 10 x 1 = 600.0m2

Quantity of Case T-1

Channel Excavation	2,948,462.0m3
Embankment	1,605,214.0m3
Revetment	64,014.3m2
Foot protection	1,325.0m3
Sodding	918,308.1m2
Gate	125.0m2
Bridge	4,440.0m2

Sodding (back)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	.			
		0.00	5600.0*	0.0
6.4	.			
		0.00	2400.0	0.0
8.8	.			
		7.24	5800.0	42.0
14.6	14.47			
		15.07	1600.0	24.1
16.2	15.66			
		14.66	2600.0	38.1
18.8	13.65			
		13.65	2600.0	35.5
21.4	13.65			
Total				139.7

*:Dur to the construction of the diversion channel, the amoun bewteen 1.0 and 1.8 is obtained separately.

Diversion channel (from 1.0 to 1.8)

Channel Excavation
188.5 x 800 = 150,840.0m3

Embankment
16.2 x 800 = 12,960.0m3

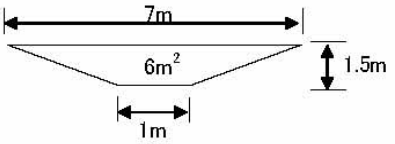
Sodding
38.28 x 800 = 30,624.0m2

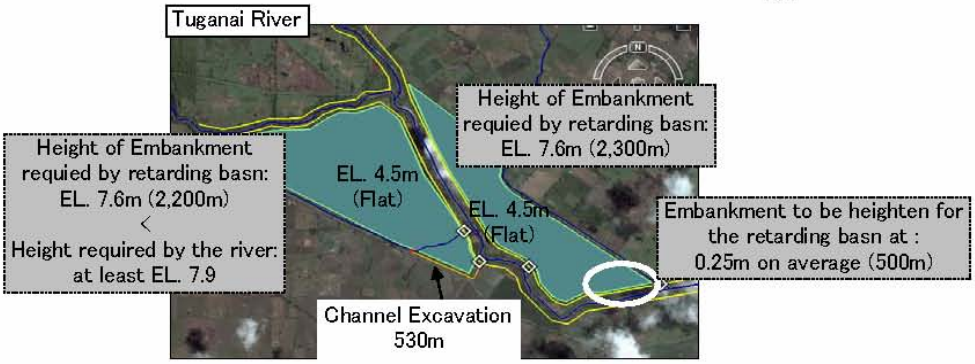
Retarding Basin

Channel Excavation
6 x 530 = 3,180.0m3

Embankment
76.50 x (2,300 + 2,100) = 336,600.0m3

Sodding
24.50 x (2,300 + 2,100) = 107,800.0m2



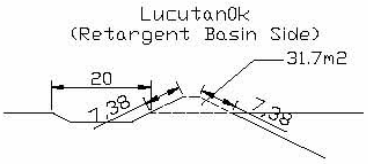


Heighten the Embankment (11.2 to 11.7)
The width of the Embankment is about 20m.
The amount for heighten the embankment by 0.25m is
20 x 0.25 x 500 = 2,500.0m3

Lucutan river

Embankment
31.7x 2,700 = 85,590.0m3

Sodding (only Retarding basin side)
14.76 x 2,700 = 39,852.0m3



Miscellaneous

Foot Protection
1.0×0.5×2650 1,325.0m3

Gate
5 x 5 x 5unit= 125.0m2
10 x 5 x 1unit= 50.0m2

Brdige
160 x 12 x 2 = 3,840.0m2
60 x 10 x 1 = 600.0m2

Toital Quantity of Case T-2

		(Retarding Basin)	
Channel Excavation	2,798,780.0m3	Channel Excavation	3,180.0m3
Embankment	746,310.0m3	Embankment	336,600.0m3
Revetment	54,482.0m2	Revetment	0.0m2
Foot protection	1,325.0m3	Foot protection	0.0m3
Sodding	945,473.7m2	Sodding	107,800.0m2
Gate	175.0m2	Gate	50.0m2
Bridge	4,440.0m2	Bridge	0.0m2

Quantity (Tuganay River, Case T-2)

Channel Excavation

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (10^3m^3)
River mouth	109.59			
		109.59	5600.0*	613.7
6.4	109.59			
		157.40	2400.0	377.8
8.8	205.21			
		156.32	5800.0	906.7
14.6	107.43			
		135.98	1600.0	217.6
16.2	164.53			
		128.62	2600.0	334.4
18.8	92.70			
		92.70	2100.0	194.7
20.9	92.70			
Total				2,644.8

*:Dur to the construction of the diversion channel, the amount bewteen 1.0 and 1.8 is obtained separately.

Embankment

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (10^3m^3)
River mouth	0.0			
		0.00	6200.0*	0.0
6.4	0.0			
		0.00	2400.0	0.0
8.8	5.6			
		5.59	5800.0	32.4
14.6	84.7			
		84.72	1600.0	135.6
16.2	19.2			
		19.19	2600.0	49.9
18.8	43.2			
		43.24	2100.0	90.8
20.9	43.2			
Total				308.7

*:Dur to the construction of the diversion channel, the amount bewteen 1.0 and 1.8 is obtained separately.

Revetment (left)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	22.06			
		22.06	300.0	6,618.0
6.4	22.06			
		20.54	0.0	0.0
8.8	19.01			
		19.78	1000.0	19,780.0
14.6	20.55			
		20.13	0.0	0.0
16.2	19.70			
		19.43	100.0	1,943.0
18.8	19.16			
		19.16	0.0	0.0
20.9	19.16			
Total				28,341.0

Revetment (right)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	22.14			
		22.14	600.0	13,284.0
6.4	22.14			
		20.58	0.0	0.0
8.8	19.01			
		19.78	650.0	12,857.0
14.6	20.55			
		20.13	0.0	0.0
16.2	19.70			
		19.43	0.0	0.0
18.8	19.16			
		19.16	0.0	0.0
20.9	19.16			
Total				26,141.0

Sodding (left, river side)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	22.06			
		22.06	5300.0	116,918.0
6.4	22.06			
		20.54	2400	49,284.0
8.8	19.01			
		19.78	4800	94,944.0
14.6	20.55			
		20.13	1600	32,200.0
16.2	19.70			
		19.43	2500	48,575.0
18.8	19.16			
		19.16	2100	40,236.0
20.9	19.16			
Total				382,157.0

Sodding (right, river side)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	22.14			
		22.14	5000.0	110,700.0
6.4	22.14			
		20.58	2400.0	49,380.0
8.8	19.01			
		19.78	5150.0	101,867.0
14.6	20.55			
		20.13	1600.0	32,200.0
16.2	19.70			
		19.43	2600.0	50,518.0
18.8	19.16			
		19.16	2100.0	40,236.0
20.9	19.16			
Total				384,901.0

Case A-1-Main Construction Cost of Anibongan River improvement

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	Amount (Peso)	Remarks
1	Channel Excavation	m^3	772,222.0	150	115,833,300	
2	Embankment	m^3	957,856.0	130	124,521,280	
3	Revetment	m^2	29,704.0	1,100	32,674,400	
4	Foot protection	m	650.0	3,350	2,177,500	
5	Sodding	m^2	659,379.0	30	19,781,370	
6	Gate	m^2	75.0	1,040,000	78,000,000	
7	Bridge(70m)	m^2	1,470.0	50,000	73,500,000	
Total					446,487,850	

Case A-1-Land Acquisition

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	Amount (Peso)	Remarks
1	Fish Pond	m^2	0	6	0	Assesed Value
2	Annual Crop	m^2	622,650	3	1,867,950	Assesed Value
3	Other Crop	m^2	0	3	0	Assesed Value
4	Residential	m^2	0	36	0	Assesed Value
Total					1,867,950	

Case A-2-Main Construction Cost of Anibongan River improvement

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	Amount (Peso)	Remarks
River Improvement						
1	Channel Excavation	m^3	832,216.0	150	124,832,400	
2	Embankment	m^3	233,240.0	130	30,321,200	
3	Revetment	m^2	20,874.0	1,100	22,961,400	5% of Slope
4	Foot protection	m	490.0	3,350	1,641,500	5% of length
5	Sodding	m^2	396,606.0	30	11,898,180	95% of Slope
6	Gate	m^2	75.0	1,040,000	78,000,000	
7	Bridge(112.4m)	m^2	2,360.4	50,000	118,020,000	
Subtotal					387,674,680	
Retarding Basin						
1	Embankment	m^3	36,704.0	130	4,771,520	
2	Sodding	m^2	26,492.0	30	794,760	
3	Gate (Closing Anibongan River)	m^2	120.0	1,040,000	124,800,000	
Subtotal					130,366,280	
Total					518,040,960	

Case A-3-Main Construction Cost of Anibongan River improvement

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	Amount (Peso)	Remarks
River Improvement						
1	Channel Excavation	m^3	832,216.0	150	124,832,400	
2	Embankment	m^3	233,240.0	130	30,321,200	
3	Revetment	m^2	20,874.0	1,100	22,961,400	5% of Slope
4	Foot protection	m	490.0	3,350	1,641,500	5% of length
5	Sodding	m^2	396,606.0	30	11,898,180	95% of Slope
6	Gate	m^2	75.0	1,040,000	78,000,000	
7	Bridge(112.4m)	m^2	2,360.4	50,000	118,020,000	
Subtotal					387,674,680	
Diversion Channel						
1	Channel Excavation	m^3	340,000.0	150	51,000,000	
2	Embankment	m^3	112,000.0	130	14,560,000	
3	Sodding	m^2	161,040.0	30	4,831,200	
4	Gate (Closing Anibongan River)	m^2	120.0	1,040,000	124,800,000	
Subtotal					195,191,200	
Total					582,865,880	

Case A-4-Main Construction Cost of Anibongan River improvement

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	Amount (Peso)	Remarks
River Improvement						
1	Channel Excavation	m^3	832,216.0	150	124,832,400	
2	Embankment	m^3	233,240.0	130	30,321,200	
3	Revetment	m^2	20,874.0	1,100	22,961,400	5% of Slope
4	Foot protection	m	490.0	3,350	1,641,500	5% of length
5	Sodding	m^2	396,606.0	30	11,898,180	95% of Slope
6	Gate	m^2	75.0	1,040,000	78,000,000	
7	Bridge(112.4m)	m^2	2,360.4	50,000	118,020,000	
Subtotal					387,674,680	
Diversion Channel						
1	Pump Station	m^3/s	145.0	30,000,000	4,350,000,000	
2	Gate (Closing Anibongan River)	m^2	120.0	1,040,000	124,800,000	
Subtotal					4,474,800,000	
Total					4,862,474,680	

Quantity (Anibongan River, Case A-1)

Channel Excavation

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (10^3m^3)
River mouth	89.6			
		89.60	3900.0*	349.4
4.3	89.6			
		64.83	1800.0	116.7
6.1	40.05			
		68.00	3700.0	251.6
9.8	95.95			
Total				717.7

*:Dur to the construction of the diversion channel, the amount bewteen 2.6 to 2.9 and 3.9 to 4.0 are obtained separately.
The amount at the rivermouth is assumed as the same as the one at 4.3.

Embankment

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (10^3m^3)
River mouth	95.34			
		95.34	3900.0*	371.8
4.3	95.34			
		107.26	1800.0	193.1
6.1	119.17			
		95.90	3700.0	354.8
9.8	72.63			
Total				919.7

*:Dur to the construction of the diversion channel, the amount bewteen 2.6 to 2.9 and 3.9 to 4.0 are obtained separately.
The amount at the rivermouth is assumed as the same as the one at 4.3.

Revetment (left)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	24.16			
		24.16	300.0	7,248.0
4.3	24.16			
		23.89	0.0	0.0
6.1	23.62			
		21.88	300.0	6,564.0
9.8	20.14			
Total				13,812.0

The amount at the rivermouth is assumed as the same as the one at 4.3.

Revetment (right)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	24.16			
		24.16	600.0	14,496.0
4.3	24.16			
		15.97	0.0	0.0
6.1	7.78			
		13.96	100.0	1,396.0
9.8	20.14			
Total				15,892.0

The amount at the rivermouth is assumed as the same as the one at 4.3.

Sodding (left, river side)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	20.05			
		21.35	3600.0*	76,842.0
4.3	24.16			
		28.98	1800.0	52,164.0
6.1	23.62			
		26.40	3400.0	89,743.0
9.8	20.14			
Total				218,749.0

*:Dur to the construction of the diversion channel, the amount bewteen 2.6 to 2.9 and 3.9 to 4.0 are obtained separately.
The amount at the rivermouth is assumed as the same as the one at 4.3.

Sodding (right, river side)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	24.16			
		24.16	3300.0*	79,728.0
4.3	24.16			
		15.97	1800.0	28,746.0
6.1	7.78			
		13.96	3600.0	50,256.0
9.8	20.14			
Total				158,730.0

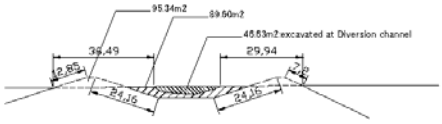
*:Dur to the construction of the diversion channel, the amount bewteen 2.6 to 2.9 and 3.9 to 4.0 are obtained separately.
The amount at the rivermouth is assumed as the same as the one at 4.3.

Sodding (back)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	20.05			
		20.05	3900.0*	78,195.0
4.3	20.05			
		20.05	1800.0	36,090.0
6.1	37.91			
		37.91	3700.0	140,267.0
9.8	14.88			
Total				254,552.0

*:Dur to the construction of the diversion channel, the amount bewteen 2.6 to 2.9 and 3.9 to 4.0 are obtained separately.
The amount at the rivermouth is assumed as the same as the one at 4.3.

Diversion channel (from 2.6 to 2.9 and 3.9 to 4.0)



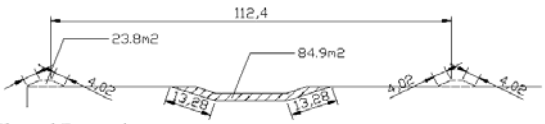
Channel Excavation	
136.23 x 400 =	54,492.0m3
Embankment	
95.34 x 400 =	38,136.0m3
Sodding	
68.37 x 400 =	27,348.0m2
Miscellaneous	
Foot Protection	
1.0×0.5×1300	650.0m3
Gate	
5 x 5 x 3unit=	75.0m2
Brdige	
70 x 7 x 3 =	1,470.0m2

Quantity of Case A-1

Channel Excavation	772,222.0m3
Embankment	957,856.0m3
Revetment	29,704.0m2
Foot protection	650.0m3
Sodding	659,379.0m2
Gate	75.0m2
Bridge	1,470.0m2

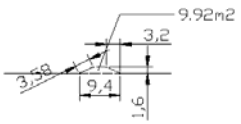
Quantity of Case A-2, A-3, A-4

1. River Improvement



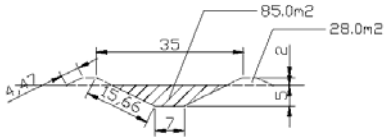
Channel Excavation	
84.92 x 9,800 =	832,216.0m3
Embankment	
23.80 x 9,800 =	233,240.0m3
Revetment	
42.6 x 9,800 x 5% =	20,874.0m2
Foot protection	
9,800 x 5% =	490.0m3
Sodding	
42.6 x 9,800 x 95% =	396,606.0m2
Gate	
5 x 5 x 3 unit =	75.0m2
Bridge	
112.4 x 7 x 3 =	2,360.4m2

2. Retarding Basin (with 1m depth of water)



Embankment	
9.92 x (2,500 + 1,200) =	36,704.0m3
Sodding	
3.58 x 2 (2,500 + 1,200) =	26,492.0m2
Gate (To close Anibongan River)	
40 x 3 x 1unit =	120.0m2

3. Diversion Channel



Connecting Tuganai (4.3k) and Anibongan (1.6k)

n =	0.04
Q =	190.0m3

Conditions at Tuganai and Anibongan

	River Bed (El. m)
Tuganai	-3.34
Anibongan	-1.00

Slope of the river bed	
2.34 / 4,000 =	1/1700
Channel Excavation	
85.0 x 4,000 =	340,000.0m3
Embankment	
28.0 x 4,000 =	112,000.0m3
Sodding	
40.26 x 4,000 =	161,040.0m2
Gate (To close Anibongan River)	
40 x 3 x 1unit =	120.0m2

4. Pump Station

Assume that inundation area of 400,000m2 (400 x 500) can be obtained. With 0.5m depth of water, 200,000 m3 can be stored. Hence, 45m3/s out of 190 m3/s can be managed by the inundation area. The capacity of Pump should be 145m3/s.

CaseI-A-Main Construction Cost of Old and New Ising river improvement

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	Amount (Peso)	Remarks
1	Channel Excavation	m^3	738,730.0	150	110,809,500	
2	Embankment	m^3	361,140.0	130	46,948,200	
3	Revetment	m^2	17,536.5	1,100	19,290,150	
4	Foot protection	m	350.0	3,350	1,172,500	
5	Sodding	m^2	366,046.0	30	10,981,380	
6	Gate	m^2	25.0	1,040,000	26,000,000	
7	Bridge (25m)	m^2	2,350.0	40,000	94,000,000	
Total					309,201,730	

CaseI-A-Land Acquisition

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	Amount (Peso)	Remarks
1	Fish Pond	m^2	283,850	6	1,703,100	Assesed Value
2	Annual Crop	m^2	228,500	3	685,500	Assesed Value
3	Other Crop	m^2	341,100	3	1,023,300	Assesed Value
4	Residential	m^2	168,200	36	6,055,200	Assesed Value
Total					9,467,100	

CaseI-B-Main Construction Cost of Old and New Ising river improvement

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	Amount (Peso)	Remarks
1	Channel Excavation	m^3	813,690.0	150	122,053,500	
2	Embankment	m^3	263,220.0	130	34,218,600	
3	Revetment	m^2	8,323.5	1,100	9,155,850	
4	Foot protection	m	350.0	3,350	1,172,500	
5	Sodding	m^2	267,189.5	30	8,015,685	
6	Gate	m^2	25.0	1,040,000	26,000,000	
7	Bridge (25m)	m^2	2,350.0	40,000	94,000,000	
Total					294,616,135	

CaseI-B-Land Acquisition

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	Amount (Peso)	Remarks
1	Fish Pond	m^2	266,000	6	1,596,000	Assesed Value
2	Annual Crop	m^2	209,300	3	627,900	Assesed Value
3	Other Crop	m^2	1,618,050	3	4,854,150	Assesed Value
4	Residential	m^2	154,700	36	5,569,200	Assesed Value
Total					12,647,250	

Quantity (New Ising River, Case I-1)

Channel Excavation

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (10^3m^3)
River mouth	37.			
		40.30	6000.0	241.8
6.0	43.6			
		107.13	1000.0	107.1
7.0	170.66			
		170.66	2000.0	341.3
9.0	170.66			
Total				690.3

Embankment

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (10^3m^3)
River mouth	6.09			
		40.27	6000.0	241.6
6.0	74.45			
		43.76	1000.0	43.8
7.0	13.07			
		13.07	2000.0	26.1
9.0	13.07			
Total				311.5

Revetment (left)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	13.78			
		13.38	400.0	5,350.0
6.0	12.97			
		12.75	0.0	3,823.5
7.0	12.52			
		12.52	0.0	0.0
9.0	12.52			
Total				9,173.5

Revetment (right)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	13.78			
		13.37	300.0	4,011.0
6.0	12.96			
		12.70	0.0	0.0
7.0	12.43			
		12.43	0.0	0.0
9.0	12.43			
Total				4,011.0

Sodding (left, river side)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	13.78			
		13.38	5600.0	74,900.0
6.0	12.97			
		12.75	1000.0	12,745.0
7.0	12.52			
		12.52	2000.0	25,040.0
9.0	12.52			
Total				112,685.0

Sodding (right, river side)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	13.78			
		13.37	5700.0	76,209.0
6.0	12.96			
		12.70	1000.0	12,695.0
7.0	12.43			
		12.43	2000.0	24,860.0
9.0	12.43			
Total				113,764.0

Sodding (back)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	3.14			
		8.85	6000.0	53,100.0
6.0	14.56			
		10.06	1000.0	10,055.0
7.0	5.55			
		5.55	2000.0	11,100.0
9.0	5.55			
Total				74,255.0

Miscellaneous

Foot Protection	
1.0×0.5×700	350.0m3
Gate	
5 x 5 x 1unit=	25.0m2
Brdige	
100 x 10 x 2 =	2,000.0m2

Quantity (Old Ising River, Case I-1A)

Channel Excavation	
16.16 x 3,000 =	48,480.0m3
Embankment	
16.54 x 3,000 =	49,620.0m3
Revetment	
21.76 x 100 x 2 =	4,352.0m2
Sodding	
21.76 x 2,900 + 22.38 x 100 =	65,342.0m2
Miscellaneous	
Foot Protection	
	100.0m
Brdige	
25 x 7 x 2 =	350.0m2

Quantity (New and Old Ising River, Case I-1)

Channel Excavation	
	738,730.0m3
Embankment	
	361,140.0m3
Revetment	
	17,536.5m2
Foot protection	
	350.0m3
Sodding	
	366,046.0m2
Gate	
	25.0m2
Bridge	
	2,350.0m2

Quantity (New Ising River, Case I-2)

Channel Excavation

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (10^3m^3)
River mouth	37.			
		45.59	6000.0	273.5
6.0	54.18			
		120.01	1000.0	120.0
7.0	185.83			
		185.83	2000.0	371.7
9.0	185.83			
Total				765.2

Embankment

Station	Area (m^2)	Average (m^2)	Length (m)	Volume (10^3m^3)
River mouth	3.95			
		20.61	6000.0	123.6
6.0	37.26			
		19.29	1000.0	19.3
7.0	1.31			
		1.31	2000.0	2.6
9.0	1.31			
Total				145.5

Revetment (left)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	1.03			
		2.82	400.0	1,128.0
6.0	4.61			
		7.56	0.0	2,268.0
7.0	10.51			
		10.51	0.0	0.0
9.0	10.51			
Total				3,396.0

Revetment (right)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	1.12			
		2.87	300.0	859.5
6.0	4.61			
		7.56	0.0	0.0
7.0	10.51			
		10.51	0.0	0.0
9.0	10.51			
Total				859.5

Sodding (left, river side)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	1.03			
		2.82	5600.0	15,792.0
6.0	4.61			
		7.56	1000.0	7,560.0
7.0	10.51			
		10.51	2000.0	21,020.0
9.0	10.51			
Total				44,372.0

Sodding (right, river side)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	1.12			
		2.87	5700.0	16,330.5
6.0	4.61			
		7.56	1000.0	7,560.0
7.0	10.51			
		10.51	2000.0	21,020.0
9.0	10.51			
Total				44,910.5

Sodding (back)

Station	length (m)	Average (m)	Length (m)	Area (m^2)
River mouth	13.42			
		11.42	6000.0	68,490.0
6.0	9.41			
		4.98	1000.0	4,980.0
7.0	.55			
		0.55	2000.0	1,100.0
9.0	.55			
Total				74,570.0

Retarding Basin

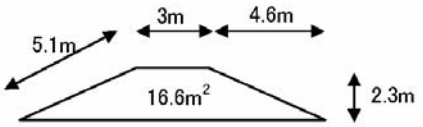
Embankment

Heighten the embankment by 2.3m on average along the rive

16.6 x 2,000 = 33,200.0m3

emnbankment along the oppositside to the river

16.6 x 2,100 = 34,860.0m3



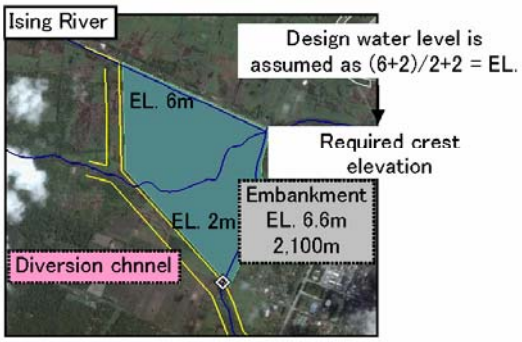
Sodding

sodding along the river

5.1 x 2 x 2,000 = 20,400.0m2

sodding along the bank oppositside to the river

11.18 x 2,100 = 21,420.0m2



Miscellaneous

Foot Protection

1.0×0.5×700 350.0m3

Gate

5 x 5 x 1unit= 25.0m2

Brdige

100 x 10 x 2 = 2,000.0m2

Quantity (Old Ising River, Case I-2)

Channel Excavation

16.16 x 3,000 = 48,480.0m3

Embankment

11.44 x 3,000 = 49,620.0m3

Revetment

20.34 x 100 x 2 = 4,068.0m2

Sodding

20.34 x 2,900 + 25.31 x 100 = 61,517.0m2

Miscellaneous

Foot Protection

100.0m

Brdige

25 x 7 x 2 = 350.0m2

Quantity (New and Old Ising River, Case I-2)

Channel Excavation 813,690.0m3

Embankment 263,220.0m3

Revetment 8,323.5m2

Foot protection 350.0m3

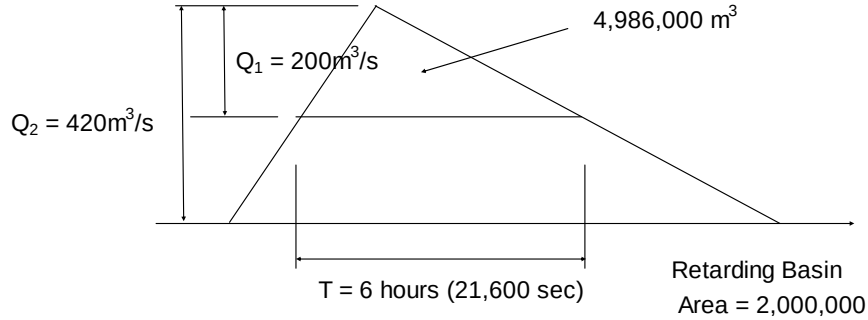
Sodding 267,189.5m2

Gate 25.0m2

Bridge 2,350.0m2

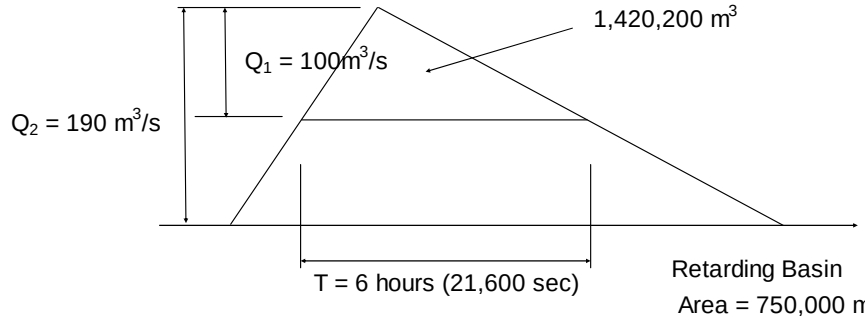
Rough Checking of Peak Discharge Cut by Retarding Basin

Tuganay River



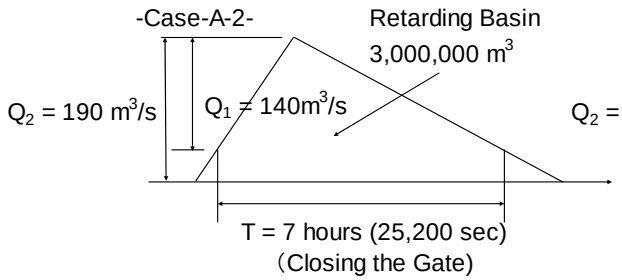
Retarding Basin
Area = 2,000,000 m^2
Depth =2.5 m
Volume = 5,000,000 m^3

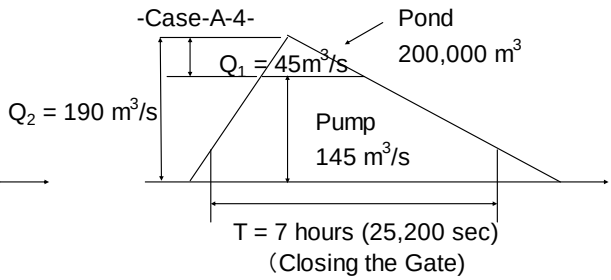
Ising River



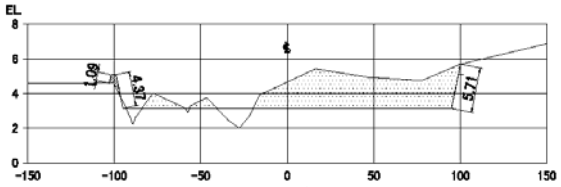
Retarding Basin
Area = 750,000 m^2
Depth =2 m
Volume = 1,500,000 m^3

Anibogan River

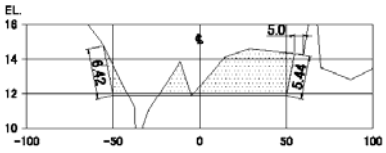




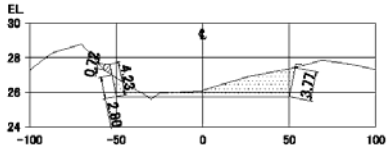
Dinanggasan River
Case-1



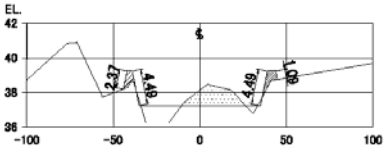
0 to 120 (120)



120 to 530 (530)

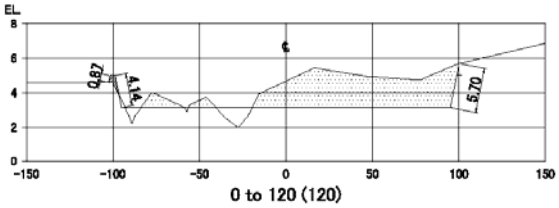


530 to 880 (880)

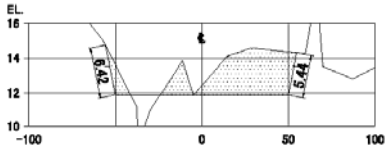


880 to 1400 (1170)

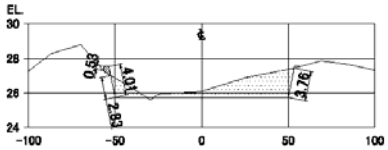
Case-2



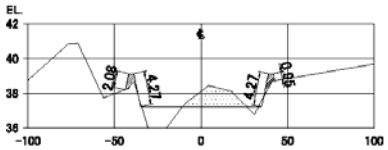
0 to 120 (120)



120 to 530 (530)



530 to 880 (880)



880 to 1400 (1170)

Quantities (Case-1)					
Item	Unit	120	530	880	1170
Excavation	m2	222.31	148.98	73.54	28.35
Embankment	m2	2.97	0.00	1.90	8.98 (5.02)
slope of the bank (left, back)	m	1.09	0.00	0.72	2.37
slope of the bank (left, river side)	m	4.37	6.42	4.23 (2.80)	4.49
slope of the bank (right, back)	m	0.00	0.00	0.00	1.09
slope of the bank (right, river side)	m	5.71	5.44	3.77	4.49
Land Acquisition (left)	m	–	–	–	–
Land Acquisition (right)	m	–	–	–	–

Quantities (Case-2)					
Item	Unit	120	530	880	1170
Excavation	m2	221.93	148.98	73.45	28.31
Embankment	m2	2.33	0.00	1.43	6.61 (3.28)
slope of the bank (left, back)	m	0.87	0.00	0.53	2.08
slope of the bank (left, river side)	m	4.14	6.42	4.01 (2.83)	4.27
slope of the bank (right, back)	m	0.00	0.00	0.00	0.95
slope of the bank (right, river side)	m	5.70	5.44	3.76	4.27
Land Acquisition (left)	m	–	–	–	–
Land Acquisition (right)	m	–	–	–	–

Dinanggasan-Case-1-Main Construction Cost

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	Amount (Peso)	Remarks
1	Channel Excavation	m^3	134,309	150	20,146,350	
2	Embankment	m^3	6,071	130	789,230	
3	Revetment	m^2	16,455	1,100	18,100,500	
4	Concrete	m^3	5,913	6,000	35,478,000	
5	Gabion	m^3	3,300	3,200	10,560,000	
6	Bridge	m^2	210	40,000	8,400,000	
7	Road (10m x 500m)	m^2	5,000	900	4,500,000	
Total					97,974,080	

Dinanggasan-Case-2-Main Construction Cost

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	Amount (Peso)	Remarks
1	Channel Excavation	m^3	147,137	150	22,070,550	
2	Embankment	m^3	11,601	130	1,508,130	
3	Revetment	m^2	15,310	1100	16,841,000	
4	Concrete	m^3	5,913	6000	35,478,000	
5	Sodding	m^2	15,435	30	463,050	
6	Gabion	m^3	3,200	3,200	10,240,000	
7	Bridge	m^2	210	40,000	8,400,000	
8	Road (10m x 500m)	m^2	5,000	900	4,500,000	
Total					99,500,730	

Dinanggasan-Case-1, Case-2-Land Acquisition

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	Amount (Peso)	Remarks
1	Land Acquisition	m^2	-	-	-	Negligible
Total					0	

Dinanggasan-Case-1-Main Construction Cost

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
River Improvement						
1	Channel Excavation	m^3	132,485	150	19,872,750	
2	Embankment	m^3	6,071	130	789,230	
3	Revetment	m^2	16,455	1,100	18,100,500	
4	Gabion	m^2	2,700	3,200	8,640,000	
5	Bridge	m^2	210	40,000	8,400,000	
Subtotal					55,802,480	
Sabo Dam						
1	Excavation	m^3	1,404	150	210,600	
2	Concrete	m^3	4,551	6,000	27,306,000	
3	Gabion	m^3	300	3,200	960,000	
4	Road (10m x 500m)	m^2	5,000	900	4,500,000	
Subtotal					32,976,600	
Sand Pocket						
1	Excavation	m^3	420	150	63,000	
2	Concrete	m^3	1,362	6,000	8,172,000	
3	Gabion	m^3	300	3,200	960,000	
Subtotal					9,195,000	
Total					97,974,080	

Dinanggasan-Case-2-Main Construction Cost

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
River Improvement						
1	Channel Excavation	m^3	138,053	150	20,707,950	
2	Embankment	m^3	4,041	130	525,330	
3	Revetment	m^2	15,310	1,100	16,841,000	
4	Foot protection (Gabion)	m^2	2,600	3,200	8,320,000	
5	Bridge	m^2	210	40,000	8,400,000	
Subtotal					54,794,280	
Compol Channeling						
1	Channel Excavation	m^3	7260	150	1,089,000	
2	Embankment	m^3	7560	130	982,800	
3	Sodding	m^2	15435	30	463,050	
Subtotal					2,534,850	
Sabo Structures						
1	Excavation	m^3	1,404	150	210,600	
2	Concrete	m^3	4,551	6,000	27,306,000	
3	Gabion	m^3	300	3,200	960,000	
4	Road (10m x 500m)	m^2	5,000	900	4,500,000	
Subtotal					32,976,600	
Sand Pocket						
1	Excavation	m^3	420	150	63,000	
2	Concrete	m^3	1,362	6,000	8,172,000	
3	Gabion	m^3	300	3,200	960,000	
Subtotal					9,195,000	
Total					99,500,730	

Dinanggasan-Case-1, Case-2-Land Acquisition

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST (Peso)	Amount (Peso)	Remarks
1	Land Acquisition	m^2	-	-	-	Negligible
Total					0	

Quantity (Dinanggasan-Case-1)

Channel Excavation

Station	Area (m^2)	Length (m)	Volume (m^3)
120	222.31	120.00 (0-120)	26677.20
530	148.98	410.00 (120-530)	61081.80
(650)	73.54	120.00 (530-650)	8824.80
880	73.54	230.00 (650-880)	16914.20
1170	28.35	420.00 (880-1300)	11907.00
(1170)	0.00	300.00 (1300-1600)	0.00
Total			125,405.0

Embankment

Station	Area (m^2)	Length (m)	Volume (m^3)
120	2.97	120.00 (0-120)	356.40
530	0.00	410.00 (120-530)	0.00
(650)	0.00	120.00 (530-650)	0.00
880	1.90	230.00 (650-880)	437.00
1170	8.98	420.00 (880-1300)	3771.60
(1170)	5.02	300.00 (1300-1600)	1506.00
Total			6,071.0

Revetment (left side)

Station	length (m)	length (m)	Area (m^2)
120	5.46	120.00 (0-120)	655.20
530	6.42	410.00 (120-530)	2632.20
(650)	2.80	120.00 (530-650)	336.00
880	4.95	230.00 (650-880)	1138.50
1170	6.86	420.00 (880-1300)	2881.20
Total			7,643.1

Revetment (Right side)

Station	length (m)	length (m)	Area (m^2)
120	5.71	120.00 (0-120)	685.20
530	5.44	410.00 (120-530)	2230.40
(650)	3.77	120.00 (530-650)	452.40
880	3.77	230.00 (650-880)	867.10
1170	5.58	720.00 (880-1600)	4017.60
Total			8,252.7

Note:No Excavation is required from 1300 to 1600.
No embankment is requied on the left side from 120 to 650
No embankment is requied on the right side from 530 to 880
The cross section of the right dike at 1170 was applyied from 1300 to 1600

Miscellaneous

Gabion (100%)=

1.0×1.0×(1,300+1,600)= 2,900 m3

Sabo Dam and Sand Pocket

The height of the sabo dam is 11.0m and length is 72.5m. So, assume Kinanliman's 1.38(heigh) x 1.0 (width)x 0.85 (length) = 1.17 So, assume 117% of volume of Kinanliman

Concrete Volume (98%)=	4,551 m3
Excavation (98%)=	1,404 m3
Gabion (100%)=	300 m3
Road w = 10m, L = 5000m	5,000 m2

The height of the sand pocket is 8.0m and length is 30m. So, assume Kinanliman's 1.0(heigh) x 1.0 (width)x 0.35 (length) = 0.35 So, assume 35% of volume of Kinanliman

Concrete Volume (35%)=	1,362 m3
Excavation (35%)=	420 m3
Gabion (100%)=	300 m3

Tagib River

Bridge	7 x 30	210 m3
Excavation	30 x 5 x 50	7,500 m3
Revetment	1:0.5, Hight=5m, 50m, 2 sides	559 m2
Gabion (100%)=		100 m3

total of Case-1		(River)	(Sabo)	(Sand Pocket)
Excavation	134,309m3	132,485m3	1,404m3	420m3
Embankment	6,071m3	6,071m3	0m3	0m3
Revetment	16,455m2	16,455m2	0m2	0m2
Concrete	5,913m3	0m3	4,551m3	1,362m3
Gabion	3,300m3	2,700m3	300m3	300m3
Bridge	210m2	210m2	0m2	0m2
Road	5,000m2	0m2	5,000m2	0m2

Quantity (Dinanggasan-Case-2)

Channel Excavation

Station	Area (m^2)	Length (m)	Volume (m^3)
120	221.93	120.00 (0-120)	26631.60
530	148.98	410.00 (120-530)	61081.80
(650)	73.45	120.00 (530-650)	8814.00
880	73.45	230.00 (650-880)	16893.50
1170	28.31	620.00 (880-1500)	17552.20
Total			130,973.1

Embankment

Station	Area (m^2)	Length (m)	Volume (m^3)
120	2.33	120.00 (0-120)	279.60
530	0.00	410.00 (120-530)	0.00
(650)	0.00	120.00 (530-650)	0.00
880	1.43	230.00 (650-880)	328.90
1170	6.61	420.00 (880-1300)	2776.20
(1170)	3.28	200.00 (1300-1500)	656.00
(1170)	3.28	400.00 (1590-1990)	1312.00
Total			4,040.7

Revetment (left side)

Station	length (m)	length (m)	Area (m^2)
120	5.01	120.00 (0-120)	601.20
530	6.42	410.00 (120-530)	2632.20
(650)	2.83	120.00 (530-650)	339.60
880	4.54	230.00 (650-880)	1044.20
1170	6.35	420.00 (880-1300)	2667.00
Total			7,284.2

Revetment (Right side)

Station	length (m)	length (m)	Area (m^2)
120	5.70	120.00 (0-120)	684.00
530	5.44	410.00 (120-530)	2230.40
(650)	3.76	120.00 (530-650)	451.20
880	3.76	230.00 (650-880)	864.80
1170	5.22	620.00 (880-1500)	3236.40
Total			7,466.8

Note:No Excavation is required from 1300 to 1450.
No embankment is requied on the left side from 120 to 650
No embankment is requied on the right side from 530 to 880
The cross section of the right dike at 1170 was applyied from 1300 to 1450

Miscellaneous

Gabion (100%)=
1.0×1.0×(1,300+1,500)= 2,800 m3

Sabo Dam and Sand Pocket

The height of the sabo dam is 11.0m and length is 72.5m. So, assume Kinanliman's 1.38(heigh) x 1.0 (width)x 0.85 (length) = 1.17 So, assume 117% of volume of Kinanliman

Concrete Volume (98%)=	4,551 m3
Excavation (98%)=	1,404 m3
Gabion (100%)=	300 m3
Road w = 10m, L = 5000m	5,000 m2

The height of the sand pocket is 8.0m and length is 30m. So, assume Kinanliman's 1.0(heigh) x 1.0 (width)x 0.35 (length) = 0.35 So, assume 35% of volume of Kinanliman

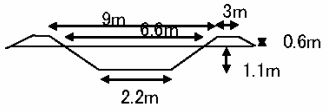
Concrete Volume (35%)=	1,362 m3
Excavation (35%)=	420 m3
Gabion (100%)=	300 m3

Tagib River

Bridge	7 x 30	210 m3
Excavation	30 x 5 x 50	7,500 m3
Revetment	1:0.5, Hight=5m, 50m, 2 sides	559 m2
Gabion (100%)=		100 m3

Excavation of Compol river (1500m)

Excavation	7,260m3
Embankment	7,560m3
Sodding	15435



Total of Case-2

		(River)	(Sabo)	(Sand Pocket)	(Compol)
Excavation	147,137m3	138,053m3	1,404m3	420m3	7,260m3
Embankment	11,601m3	4,041m3	0m3	0m3	7,560m3
Revetment	15,310m2	15,310m2	0m2	0m2	
Concrete	5,913m3	0m3	4,551m3	1,362m3	
Sodding	15,435m2	0			15,435m2
Gabion	3,200m3	2,600m3	300m3	300m3	
Bridge	210m2	210m2	0m2	0m2	
Road	5,000m2	0m2	5,000m2	0m2	

K. Economic Evaluation of Structural Measures

Table of Contents

Page

List of Tables

Table

List of Tabs.

Tab.

K. ECONOMIC EVALUATION OF STRUCTURAL MEASURES

1 ESTIMATION METHOD OF FLOOD DAMAGE

1.1 Flood Damage

Benefits accrued from the proposed structural measures are defined to include direct and indirect flood damages as well as intangible flood damage, e.g., increase of health hazards, environmental degradation. The direct flood damage refers to loss of building assets, agricultural crops, fishponds and infrastructure caused by flood inundation. The indirect flood damage refers to interference to traffic and resulting loss of retail and industrial outputs, losses due to interruption in utility services, etc. On the other hand, although the intangible flood damages are substantial, its quantification is difficult and involves much intuition. Hence, it is not considered as a part of benefits in this benefit calculation.

1.2 Method of Flood Damage Estimation

The direct flood damage of the building assets, agricultural crops and fishponds is calculated as a product of damageable asset value and damage rate. On the other hand, the direct flood damage of infrastructure and the indirect flood damage are estimated as a ratio to direct damage. These are described below.

1.2.1 Present Value of Damageable Assets

The present damageable values of the building assets, agricultural crops and fishponds are estimated in economic terms using the standard conversion factor of 0.85. Because the detailed assessment of economic values is not conducted due to the limited period of this Study, this conversion factor is applied for all items. These damageable values are standardized, as described below.

1) Building Assets

Damageable building assets are divided into two groups, the immovable and the movable. These should be further categorized into residential, commercial, industrial and public buildings and facilities. However, the detailed assessment on these assets is not conducted due to the limited period of this Study. Therefore, the evaluation of the damageable building assets is standardized referring to the results of the Second Screening.

2) Agricultural Crops

Damageable value of a crop is estimated considering expected net income and production cost already spent when damage occurred. However, it is difficult to calculate these values due to the limited Study period. Therefore, the same method as the Second Screening is adopted here.

3) Fishponds

The same method as the Second Screening is adopted due to the limited data and Study period.

1.2.2 Flood Damage Rate

The available information from the flood inundation analysis is the inundation areas of each land use. Therefore, the average damage rate adopted in the Second Screening is employed in this economic evaluation.

1.2.3 Infrastructure and Indirect Damage

1) Damage by Floods

Flood damage to infrastructure is estimated at 30% of the above direct damage. On the other hand, indirect damage is estimated at 20% of the direct damage including infrastructure damage. These figures are derived from the Second Screening.

2) Damage by Sediment Disaster

Flood damage to infrastructure is estimated at 40% of the above direct damage. On the other hand, indirect damage is estimated at 20% of the direct damage including infrastructure damage. These figures are derived from the Second Screening.

1.3 Basic Features of Flood Damage

The damageable value, flood damage rate, and infrastructure and indirect damage ratios for the respective model river basin are summarized below.

1.3.1 Ilog-Hilabangan River Basin

1) Present Damageable Value

a) Building Asset

The damageable value of built-up area is estimated at 9.1 million pesos/ha.

b) Crop

For the Ilog-Hilabangan River Basin, the damageable value of agricultural crop vulnerable to floods is evaluated by sugarcane. Based on the agricultural statistics, its gross income in Region VI is 122,400 pesos/ha. On the other hand, its ratio of damageable value to gross income is estimated at 0.7. Therefore, its damageable value is estimated as 85,700 pesos/ha.

c) Fishpond

From the benefit index, the damageable value of fishpond is estimated at 30,000 pesos/ha.

2) Flood Damage Rate

The flood damage rates of built-up area, sugarcane and fishpond are 0.3, 0.1 and 0.9, respectively.

3) Infrastructure and Indirect Damage

The direct flood damage to infrastructure is estimated at 30% of the above direct flood damage. The indirect flood damage is estimated at 20% of the direct flood damage.

1.3.2 Dungcaan River Basin

1) Present Damageable Value

a) Building Asset

The damageable value of built-up area is estimated at 9.1 million pesos/ha.

2) Flood Damage Rate

The flood damage rate of built-up area is 0.3.

3) Infrastructure and Indirect Damage

The direct flood damage to infrastructure is estimated at 30% of the above direct flood damage. The indirect flood damage is estimated at 20% of the direct flood damage.

1.3.3 Meycauayan River Basin

1) Present Damageable Value

a) Building Asset

The damageable value of built-up area is estimated at 9.1 million pesos/ha.

b) Crop

For the Meycauayan River Basin, the damageable value of agricultural crop vulnerable to floods is evaluated by rainfed paddy. Based on the agricultural statistics, its gross income in Region III is 34,000 pesos/ha. On the other hand, its ratio of damageable value to gross income is estimated at 0.4. Therefore, its damageable value is estimated as 13,600 pesos/ha.

c) Fishpond

From the benefit index, the damageable value of fishpond is estimated at 30,000 pesos/ha.

2) Flood Damage Rate

The flood damage rates of built-up area, rainfed paddy and fishpond are 0.3, 0.5 and 0.9, respectively.

3) Infrastructure and Indirect Damage

The direct flood damage to infrastructure is estimated at 30% of the above direct flood damage. The indirect flood damage is estimated at 20% of the direct flood damage.

1.3.4 Kinanliman River Basin

1) Present Damageable Value

a) Building Asset

The damageable value of built-up area is estimated at 9.1 million pesos/ha.

2) Flood Damage Rate

The flood damage rate of built-up area is 0.3.

3) Infrastructure and Indirect Damage

The direct flood damage to infrastructure is estimated at 30% of the above direct flood damage. The indirect flood damage is estimated at 20% of the direct flood damage.

1.3.5 Tuganay River Basin

1) Present Damageable Value

a) Building Asset

The damageable value of built-up area is estimated at 9.1 million pesos/ha.

b) Crop

For the Tuganay River Basin, the damageable value of agricultural crop vulnerable to floods is evaluated by irrigated paddy. Based on the agricultural statistics, its gross income in Region XI is 40,800 pesos/ha. On the other hand, its ratio of damageable value to gross income is estimated at 0.3. Therefore, its damageable value is estimated as 12,200 pesos/ha.

c) Fishpond

From the benefit index, the damageable value of fishpond is estimated at 30,000 pesos/ha.

2) Flood Damage Rate

The flood damage rates of built-up area, irrigated paddy and fishpond are 0.3, 0.5 and 0.9, respectively.

3) Infrastructure and Indirect Damage

The direct flood damage to infrastructure is estimated at 30% of the above direct flood damage. The indirect flood damage is estimated at 20% of the direct flood damage.

1.3.6 Dinanggasan River Basin

1) Present Damageable Value

a) Building Asset

For the Dinanggasan River Basin, its major flood type is debris flow. Therefore, the damageable value of built-up area is estimated based on the number of houses. The damageable value of a house is estimate at 313,200 pesos/house based on the Second Screening.

b) Crop

For this basin, the damageable value of agricultural crop vulnerable to floods is evaluated by rainfed paddy. Based on the agricultural statistics, its gross income in Region X is 25,500 pesos/ha. On the other hand, its ratio of damageable value to gross income is estimated at 0.4. Therefore, its damageable value is estimated as 10,200 pesos/ha.

2) Flood Damage Rate

The flood damages of this river basin are mainly caused by debris flows. Corresponding to this idea, the flood damage rates of the both houses and rainfed paddy are 1.0.

3) Infrastructure and Indirect Damage

The direct flood damage to infrastructure is estimated at 40% of the above direct flood damages. The indirect flood damage is estimated at 20% of the direct flood damage.

2 FLOOD DAMAGE

Inundation areas under the project scale are calculated in the flood inundation analysis, and are applied to evaluate the annual average benefit. The flood damage under the present condition is estimated considering with and without project conditions as shown below.

2.1 Ilog-Hilabangan River Basin

The project scale of this river basin is 25-year return period. As the results, the flood damage at the project scale is estimated at 577.1 million pesos. The detailed calculation is shown below.

Table K.2.1 Flood Damage (Ilog-Hilabangan)

Item	Area Inundated (ha)	Assets Inundated (mil. Pesos)	Flood Damage (mil. Pesos)
I. Direct Damage			551.6
Built-up Area	114.2	1,039.2	311.8
Sugarcane	6,710.7	575.1	57.5
Fishponds	2,035.7	61.1	55.0
Infrastructure			127.3
II. Indirect Damage			25.5
III. Total			577.1

2.2 Dungcaan River Basin

The project scale of this river basin is 20-year return period. As the results, the flood damage at the project scale is estimated at 55.4 million pesos. The detailed calculation is shown below.

Table K.2.2 Flood Damage (Dungcaan)

Item	Area Inundated (ha)	Assets Inundated (mil. Pesos)	Flood Damage (mil. Pesos)
I. Direct Damage			46.2
Built-up Area	13.0	118.3	35.5
Infrastructure			10.7
II. Indirect Damage			9.2
III. Total			55.4

2.3 Meycauayan River Basin

The project scale for over flow floods is 30-year return period. As the results, the flood damage at the project scale is estimated at 1,506.8 million pesos. The detailed calculation is shown below.

Table K.2.3 Flood Damage (Meycauayan)

Item	Area Inundated (ha)	Assets Inundated (mil. Pesos)	Flood Damage (mil. Pesos)
I. Direct Damage			1,255.7
Built-up Area	352.8	3,210.5	963.2
Annual Crop	25.2	0.3	0.2
Fishponds	92.0	2.8	2.5
Infrastructure			289.8
II. Indirect Damage			251.1
III. Total			1,506.8

2.4 Kinanliman River Basin

The project scale of this river basin is 25-year return period. As the results, the flood damage at the project scale is estimated at 35.8 million pesos. The detailed calculation is shown below.

Table K.2.4 Flood Damage (Kinanliman)

Item	Area Inundated (ha)	Assets Inundated (mil. Pesos)	Flood Damage (mil. Pesos)
I. Direct Damage			29.8
Built-up Area	8.4	76.4	22.9
Infrastructure			6.9
II. Indirect Damage			6.0
III. Total			35.8

2.5 Tuganay River Basin

The project scale of this river basin is 25-year return period. As the results, the flood damage at the project scale is estimated at 739.8 million pesos. The detailed calculation is shown below.

Table K.2.5 Flood Damage (Tuganay)

Item	Area Inundated (ha)	Assets Inundated (mil. Pesos)	Flood Damage (mil. Pesos)
I. Direct Damage			616.5
Built-up Area	154.5	1,406.0	421.8
Irrigated paddy	6,857.5	83.7	41.9
Fishponds	391.2	11.7	10.5
Infrastructure			142.3
II. Indirect Damage			123.3
III. Total			739.8

2.6 Dinanggasan River Basin

The project scale of this river basin is considered as 20-year return period. As the results, the flood damage at the project scale is estimated at 31.0 million pesos. The detailed calculation is shown below.

Table K.2.6 Flood Damage (Dinanggasan)

Item		Damaged Houses (nos.) /Area Inundated (ha)	Assets Inundated (mil. Pesos)	Flood Damage (mil. Pesos)
I.	Direct Damage			25.8
	Built-up Area	56 houses	17.5	17.5
	Annual Crop	91.5	0.9	0.9
	Infrastructure			7.4
II.	Indirect Damage			5.2
III.	Total			31.0

3 ANNUAL AVERAGE BENEFIT

3.1 Estimation Method of Annual Average Benefit

The annual average benefit is calculated as the sum of products of the averaged damage reduction and its corresponding occurrence probability. In order to simplify this calculation, the ratio of annual average benefit to corresponding flood damage under project scale is calculated based on the related past studies and applied in this economic evaluation. Table K.3.1 shows the results of this calculation.

Table K.3.1 Ratio of Annual Average Benefit to Flood Damage

Project Scale (Return Period)	20-Year	25-Year	30-Year
Ratio	0.38	0.36	0.35

3.2 Annual Average Benefit under the Present Condition

3.2.1 Ilog-Hilabangan River Basin

Based on Table K.3.1, the ratio of this river basin is estimated at 0.36 under the project scale. Hence, the annual average benefit is estimated at 207.8 million pesos.

3.2.2 Dungcaan River Basin

Based on Table K.3.1, the ratio of this river basin is estimated at 0.38 under the project scale. Hence, the annual average benefit is estimated at 21.1 million pesos.

3.2.3 Meycauayan River Basin

Based on Table K.3.1, the ratio of this river basin is estimated at 0.35 under the project scale. Hence, the annual average benefit excluding VOM area is estimated at 527.4 million pesos. On the other hand, the annual average benefit of VOM area was estimated at 273.6 million pesos at the price level of 2001. This value is converted from 2001 to 2006 with the annual growth rate of 3.35%. As a result, it is estimated at 322.6 million pesos. Thus, the annual average benefit is estimated at 850.0 million pesos.

3.2.4 Kinanliman River Basin

Based on Table K.3.1, the ratio of this river basin is estimated at 0.36 under the project scale. Hence, the annual average benefit is estimated at 12.9 million pesos.

3.2.5 Tuganay River Basin

Based on Table K.3.1, the ratio of this river basin is estimated at 0.36 under the project scale. Hence, the annual average benefit is estimated at 266.3 million pesos.

3.2.6 Dinanggasan River Basin

Based on Table K.3.1, the ratio of this river basin is estimated at 0.38 under the considered project scale. Hence, the annual average benefit is estimated at 11.8 million pesos.

3.3 Annual Average Benefit under the Future Condition

Present benefit is estimated with 2006 economic price level. On the other hand, the future benefit is estimated with the thought that some improvement in productivity and property is brought about in proportion to growth of GNP per capita. In this Study, the growth rate of GNP per capita is estimated at 3.35% per annum. It is also assumed the benefit will increase until 2034.

4 ECONOMIC VIABILITY

4.1 Means of Assessment of Economic Viability

Economic viability of the structural measures is assessed by means of EIRR, B/C and NPV, which are calculated based on the annual cost-benefit flow. In this cost-benefit flow, detailed design period, construction period and project life is assumed at 2, 5 and 50 years, respectively. On the other hand, discount rate of 15% (the opportunity cost of capital in the Philippines referring to NEDA guideline) is applied for the calculation of B/C and NPV.

4.2 Estimation of Economic Cost

The financial project cost consists of construction cost, compensation cost, administration cost, physical contingency cost and engineering service cost. To simplify the procedure of conversion from financial to economic cost, the conversion rate of 0.73 is standardized deriving from the existing studies of related projects.

4.3 Assessment of Economic Viability

4.3.1 Ilog-Hilabangan River Basin

Calculation of the EIRR, B/C and NPV for the Ilog-Hilabangan River Basin is shown in Tab. K-4-1. The results of the calculation are figured out as follows:

- EIRR: 18.9%
- B/C: 1.31
- NPV: 268.6 million pesos

Based on the results, EIRR becomes higher than the opportunity cost of capital of 15%. Therefore, the project is evaluated to have an adequate economic viability.

4.3.2 Dungcaan River Basin

The assessment results are shown in Tab. K-4-2, and figured out as follow:

- EIRR: 18.8%
- B/C: 1.29
- NPV: 26 million pesos

Based on the results, EIRR becomes higher than the opportunity cost of capital of 15%. Therefore, the project is evaluated to have an adequate economic viability.

4.3.3 Meycauayan River Basin

The assessment results are shown in Tab. K-4-3, and figured out as follow:

- EIRR: 23.3%x
- B/C: 1.67
- NPV: 1,874.6 million pesos

Based on the results, EIRR becomes higher than the opportunity cost of capital of 15%. Therefore, the project is evaluated to have an adequate economic viability.

4.3.4 Kinanliman River Basin

The assessment results are shown in Tab. K-4-4, and figured out as follow:

- EIRR: 17.3%
- B/C: 1.18

- NPV: 10.9 million pesos

Based on the results, EIRR becomes higher than the opportunity cost of capital of 15%. Therefore, the project is evaluated to have an adequate economic viability.

4.3.5 Tuganay River Basin

The assessment results are shown in Tab. K-4-5, and figured out as follow:

- EIRR: 19.1%
- B/C: 1.33
- NPV: 363.7 million pesos

Based on the results, EIRR becomes higher than the opportunity cost of capital of 15%. Therefore, the project is evaluated to have an adequate economic viability.

4.3.6 Dinanggasan River Basin

The assessment results are shown in Tab. K-4-6, and figured out as follow:

- EIRR: 15.7%
- B/C: 1.06
- NPV: 3.5 million pesos

Based on the results, EIRR becomes higher than the opportunity cost of capital of 15%. Therefore, the project is evaluated to have an adequate economic viability.

Tab. K-4-1 Economic Cost and Benefit Stream of the Ilog-Hilabangan River Basin

No of Year	Year	Cost (Million Pesos)				Benefit (Million Pesos)	Balance
		D/D & Consruction	O/M	Replacement	Total		
1	2009	56.5			56.5	0.0	-56.5
2	2010	56.5			56.5	0.0	-56.5
3	2011	284.8			284.8	0.0	-284.8
4	2012	284.8			284.8	50.6	-234.2
5	2013	284.8			284.8	104.7	-180.2
6	2014	284.8			284.8	162.3	-122.6
7	2015	284.8			284.8	223.6	-61.2
8	2016		22.58		22.6	288.9	266.3
9	2017		22.58		22.6	298.6	276.0
10	2018		22.58		22.6	308.6	286.0
11	2019		22.58		22.6	318.9	296.3
12	2020		22.58		22.6	329.6	307.0
13	2021		22.58		22.6	340.6	318.1
14	2022		22.58		22.6	352.1	329.5
15	2023		22.58		22.6	363.9	341.3
16	2024		22.58		22.6	376.0	353.5
17	2025		22.58		22.6	388.6	366.1
18	2026		22.58		22.6	401.7	379.1
19	2027		22.58		22.6	415.1	392.5
20	2028		22.58		22.6	429.0	406.4
21	2029		22.58		22.6	443.4	420.8
22	2030		22.58	0.2	22.8	458.2	435.5
23	2031		22.58		22.6	473.6	451.0
24	2032		22.58		22.6	489.5	466.9
25	2033		22.58		22.6	505.9	483.3
26	2034		22.58		22.6	522.8	500.2
27	2035		22.58		22.6	540.3	517.7
28	2036		22.58		22.6	540.3	517.7
29	2037		22.58		22.6	540.3	517.7
30	2038		22.58		22.6	540.3	517.7
31	2039		22.58		22.6	540.3	517.7
32	2040		22.58		22.6	540.3	517.7
33	2041		22.58		22.6	540.3	517.7
34	2042		22.58		22.6	540.3	517.7
35	2043		22.58		22.6	540.3	517.7
36	2044		22.58		22.6	540.3	517.7
37	2045		22.58	0.2	22.8	540.3	517.5
38	2046		22.58		22.6	540.3	517.7
39	2047		22.58		22.6	540.3	517.7
40	2048		22.58		22.6	540.3	517.7
41	2049		22.58		22.6	540.3	517.7
42	2050		22.58		22.6	540.3	517.7
43	2051		22.58		22.6	540.3	517.7
44	2052		22.58		22.6	540.3	517.7
45	2053		22.58		22.6	540.3	517.7
46	2054		22.58		22.6	540.3	517.7
47	2055		22.58		22.6	540.3	517.7
48	2056		22.58		22.6	540.3	517.7
49	2057		22.58		22.6	540.3	517.7
50	2058		22.58		22.6	540.3	517.7
51	2059		22.58		22.6	540.3	517.7
52	2060		22.58	0.2	22.8	540.3	517.5
53	2061		22.58		22.6	540.3	517.7
54	2062		22.58		22.6	540.3	517.7
55	2063		22.58		22.6	540.3	517.7
56	2064		22.58		22.6	540.3	517.7
57	2065		22.58		22.6	540.3	517.7
Total		1,537.1					

B/C: 1.31
NPV: 268.6 Million Pesos
EIRR: 18.9%

Tab. K-4-2 Economic Cost and Benefit Stream of the Dungcaan River Basin

No of Year	Year	Cost (Million Pesos)				Benefit (Million Pesos)	Balance
		D/D & Consruction	O/M	Replacement	Total		
1	2009	5.9			5.9	0.0	-5.9
2	2010	5.9			5.9	0.0	-5.9
3	2011	28.5			28.5	0.0	-28.5
4	2012	28.5			28.5	5.1	-23.3
5	2013	28.5			28.5	10.6	-17.9
6	2014	28.5			28.5	16.5	-12.0
7	2015	28.5			28.5	22.7	-5.8
8	2016		2.34		2.3	29.3	27.0
9	2017		2.34		2.3	30.3	28.0
10	2018		2.34		2.3	31.3	29.0
11	2019		2.34		2.3	32.4	30.0
12	2020		2.34		2.3	33.5	31.1
13	2021		2.34		2.3	34.6	32.2
14	2022		2.34		2.3	35.7	33.4
15	2023		2.34		2.3	36.9	34.6
16	2024		2.34		2.3	38.2	35.8
17	2025		2.34		2.3	39.5	37.1
18	2026		2.34		2.3	40.8	38.4
19	2027		2.34		2.3	42.2	39.8
20	2028		2.34		2.3	43.6	41.2
21	2029		2.34		2.3	45.0	42.7
22	2030		2.34	37.2	39.5	46.5	7.0
23	2031		2.34		2.3	48.1	45.7
24	2032		2.34		2.3	49.7	47.4
25	2033		2.34		2.3	51.4	49.0
26	2034		2.34		2.3	53.1	50.7
27	2035		2.34		2.3	54.9	52.5
28	2036		2.34		2.3	54.9	52.5
29	2037		2.34		2.3	54.9	52.5
30	2038		2.34		2.3	54.9	52.5
31	2039		2.34		2.3	54.9	52.5
32	2040		2.34		2.3	54.9	52.5
33	2041		2.34		2.3	54.9	52.5
34	2042		2.34		2.3	54.9	52.5
35	2043		2.34		2.3	54.9	52.5
36	2044		2.34		2.3	54.9	52.5
37	2045		2.34	37.2	39.5	54.9	15.3
38	2046		2.34		2.3	54.9	52.5
39	2047		2.34		2.3	54.9	52.5
40	2048		2.34		2.3	54.9	52.5
41	2049		2.34		2.3	54.9	52.5
42	2050		2.34		2.3	54.9	52.5
43	2051		2.34		2.3	54.9	52.5
44	2052		2.34		2.3	54.9	52.5
45	2053		2.34		2.3	54.9	52.5
46	2054		2.34		2.3	54.9	52.5
47	2055		2.34		2.3	54.9	52.5
48	2056		2.34		2.3	54.9	52.5
49	2057		2.34		2.3	54.9	52.5
50	2058		2.34		2.3	54.9	52.5
51	2059		2.34		2.3	54.9	52.5
52	2060		2.34	37.2	39.5	54.9	15.3
53	2061		2.34		2.3	54.9	52.5
54	2062		2.34		2.3	54.9	52.5
55	2063		2.34		2.3	54.9	52.5
56	2064		2.34		2.3	54.9	52.5
57	2065		2.34		2.3	54.9	52.5
Total		154.2					

B/C: 1.29
NPV: 26 Million Pesos
EIRR: 18.8%

Tab. K-4-3 Economic Cost and Benefit Stream of the Meycauayan River Basin

No of Year	Year	Cost (Million Pesos)				Benefit (Million Pesos)	Balance
		D/D & Consruction	O/M	Replacement	Total		
1	2009	165.3			165.3	0.0	-165.3
2	2010	165.3			165.3	0.0	-165.3
3	2011	930.8			930.8	0.0	-930.8
4	2012	930.8			930.8	207.2	-723.6
5	2013	930.8			930.8	428.2	-502.6
6	2014	930.8			930.8	663.8	-267.0
7	2015	930.8			930.8	914.8	-16.0
8	2016		49.59		49.6	1,181.7	1,132.2
9	2017		49.59		49.6	1,221.3	1,171.7
10	2018		49.59		49.6	1,262.2	1,212.7
11	2019		49.59		49.6	1,304.5	1,254.9
12	2020		49.59		49.6	1,348.2	1,298.6
13	2021		49.59		49.6	1,393.4	1,343.8
14	2022		49.59		49.6	1,440.1	1,390.5
15	2023		49.59		49.6	1,488.3	1,438.7
16	2024		49.59		49.6	1,538.2	1,488.6
17	2025		49.59		49.6	1,589.7	1,540.1
18	2026		49.59		49.6	1,643.0	1,593.4
19	2027		49.59		49.6	1,698.0	1,648.4
20	2028		49.59		49.6	1,754.9	1,705.3
21	2029		49.59		49.6	1,813.7	1,764.1
22	2030		49.59	605.6	655.2	1,874.4	1,219.2
23	2031		49.59		49.6	1,937.2	1,887.6
24	2032		49.59		49.6	2,002.1	1,952.5
25	2033		49.59		49.6	2,069.2	2,019.6
26	2034		49.59		49.6	2,138.5	2,088.9
27	2035		49.59		49.6	2,210.2	2,160.6
28	2036		49.59		49.6	2,210.2	2,160.6
29	2037		49.59		49.6	2,210.2	2,160.6
30	2038		49.59		49.6	2,210.2	2,160.6
31	2039		49.59		49.6	2,210.2	2,160.6
32	2040		49.59		49.6	2,210.2	2,160.6
33	2041		49.59		49.6	2,210.2	2,160.6
34	2042		49.59		49.6	2,210.2	2,160.6
35	2043		49.59		49.6	2,210.2	2,160.6
36	2044		49.59		49.6	2,210.2	2,160.6
37	2045		49.59	605.6	655.2	2,210.2	1,554.9
38	2046		49.59		49.6	2,210.2	2,160.6
39	2047		49.59		49.6	2,210.2	2,160.6
40	2048		49.59		49.6	2,210.2	2,160.6
41	2049		49.59		49.6	2,210.2	2,160.6
42	2050		49.59		49.6	2,210.2	2,160.6
43	2051		49.59		49.6	2,210.2	2,160.6
44	2052		49.59		49.6	2,210.2	2,160.6
45	2053		49.59		49.6	2,210.2	2,160.6
46	2054		49.59		49.6	2,210.2	2,160.6
47	2055		49.59		49.6	2,210.2	2,160.6
48	2056		49.59		49.6	2,210.2	2,160.6
49	2057		49.59		49.6	2,210.2	2,160.6
50	2058		49.59		49.6	2,210.2	2,160.6
51	2059		49.59		49.6	2,210.2	2,160.6
52	2060		49.59	605.6	655.2	2,210.2	1,554.9
53	2061		49.59		49.6	2,210.2	2,160.6
54	2062		49.59		49.6	2,210.2	2,160.6
55	2063		49.59		49.6	2,210.2	2,160.6
56	2064		49.59		49.6	2,210.2	2,160.6
57	2065		49.59		49.6	2,210.2	2,160.6
Total		4,984.5					

B/C: 1.67
NPV: 1874.6 Million Pesos
EIRR: 23.3%

Tab. K-4-4 Economic Cost and Benefit Stream of the Kinanliman River Basin

No of Year	Year	Cost (Million Pesos)				Benefit (Million Pesos)	Balance
		D/D & Consruction	O/M	Replacement	Total		
1	2009	4.1			4.1	0.0	-4.1
2	2010	4.1			4.1	0.0	-4.1
3	2011	19.7			19.7	0.0	-19.7
4	2012	19.7			19.7	3.1	-16.6
5	2013	19.7			19.7	6.5	-13.2
6	2014	19.7			19.7	10.1	-9.7
7	2015	19.7			19.7	13.9	-5.9
8	2016		1.22		1.2	17.9	16.7
9	2017		1.22		1.2	18.5	17.3
10	2018		1.22		1.2	19.2	17.9
11	2019		1.22		1.2	19.8	18.6
12	2020		1.22		1.2	20.5	19.2
13	2021		1.22		1.2	21.1	19.9
14	2022		1.22		1.2	21.9	20.6
15	2023		1.22		1.2	22.6	21.4
16	2024		1.22		1.2	23.3	22.1
17	2025		1.22		1.2	24.1	22.9
18	2026		1.22		1.2	24.9	23.7
19	2027		1.22		1.2	25.8	24.5
20	2028		1.22		1.2	26.6	25.4
21	2029		1.22		1.2	27.5	26.3
22	2030		1.22	0.7	1.9	28.4	26.5
23	2031		1.22		1.2	29.4	28.2
24	2032		1.22		1.2	30.4	29.2
25	2033		1.22		1.2	31.4	30.2
26	2034		1.22		1.2	32.5	31.2
27	2035		1.22		1.2	33.5	32.3
28	2036		1.22		1.2	33.5	32.3
29	2037		1.22		1.2	33.5	32.3
30	2038		1.22		1.2	33.5	32.3
31	2039		1.22		1.2	33.5	32.3
32	2040		1.22		1.2	33.5	32.3
33	2041		1.22		1.2	33.5	32.3
34	2042		1.22		1.2	33.5	32.3
35	2043		1.22		1.2	33.5	32.3
36	2044		1.22		1.2	33.5	32.3
37	2045		1.22	0.7	1.9	33.5	31.6
38	2046		1.22		1.2	33.5	32.3
39	2047		1.22		1.2	33.5	32.3
40	2048		1.22		1.2	33.5	32.3
41	2049		1.22		1.2	33.5	32.3
42	2050		1.22		1.2	33.5	32.3
43	2051		1.22		1.2	33.5	32.3
44	2052		1.22		1.2	33.5	32.3
45	2053		1.22		1.2	33.5	32.3
46	2054		1.22		1.2	33.5	32.3
47	2055		1.22		1.2	33.5	32.3
48	2056		1.22		1.2	33.5	32.3
49	2057		1.22		1.2	33.5	32.3
50	2058		1.22		1.2	33.5	32.3
51	2059		1.22		1.2	33.5	32.3
52	2060		1.22	0.7	1.9	33.5	31.6
53	2061		1.22		1.2	33.5	32.3
54	2062		1.22		1.2	33.5	32.3
55	2063		1.22		1.2	33.5	32.3
56	2064		1.22		1.2	33.5	32.3
57	2065		1.22		1.2	33.5	32.3
Total		106.9					

B/C: 1.18
NPV: 10.9 Million Pesos
EIRR: 17.3%

Tab. K-4-5 Economic Cost and Benefit Stream of the Tuganay River Basin

No of Year	Year	Cost (Million Pesos)				Benefit (Million Pesos)	Balance
		D/D & Consruction	O/M	Replacement	Total		
1	2009	73.7			73.7	0.0	-73.7
2	2010	73.7			73.7	0.0	-73.7
3	2011	360.2			360.2	0.0	-360.2
4	2012	360.2			360.2	64.9	-295.3
5	2013	360.2			360.2	134.2	-226.1
6	2014	360.2			360.2	208.0	-152.2
7	2015	360.2			360.2	286.6	-73.6
8	2016		22.10		22.1	370.2	348.1
9	2017		22.10		22.1	382.6	360.5
10	2018		22.10		22.1	395.5	373.4
11	2019		22.10		22.1	408.7	386.6
12	2020		22.10		22.1	422.4	400.3
13	2021		22.10		22.1	436.5	414.4
14	2022		22.10		22.1	451.2	429.1
15	2023		22.10		22.1	466.3	444.2
16	2024		22.10		22.1	481.9	459.8
17	2025		22.10		22.1	498.0	476.0
18	2026		22.10		22.1	514.7	492.6
19	2027		22.10		22.1	532.0	509.9
20	2028		22.10		22.1	549.8	527.7
21	2029		22.10		22.1	568.2	546.1
22	2030		22.10	146.2	168.3	587.2	419.0
23	2031		22.10		22.1	606.9	584.8
24	2032		22.10		22.1	627.3	605.2
25	2033		22.10		22.1	648.3	626.2
26	2034		22.10		22.1	670.0	647.9
27	2035		22.10		22.1	692.4	670.3
28	2036		22.10		22.1	692.4	670.3
29	2037		22.10		22.1	692.4	670.3
30	2038		22.10		22.1	692.4	670.3
31	2039		22.10		22.1	692.4	670.3
32	2040		22.10		22.1	692.4	670.3
33	2041		22.10		22.1	692.4	670.3
34	2042		22.10		22.1	692.4	670.3
35	2043		22.10		22.1	692.4	670.3
36	2044		22.10		22.1	692.4	670.3
37	2045		22.10	146.2	168.3	692.4	524.2
38	2046		22.10		22.1	692.4	670.3
39	2047		22.10		22.1	692.4	670.3
40	2048		22.10		22.1	692.4	670.3
41	2049		22.10		22.1	692.4	670.3
42	2050		22.10		22.1	692.4	670.3
43	2051		22.10		22.1	692.4	670.3
44	2052		22.10		22.1	692.4	670.3
45	2053		22.10		22.1	692.4	670.3
46	2054		22.10		22.1	692.4	670.3
47	2055		22.10		22.1	692.4	670.3
48	2056		22.10		22.1	692.4	670.3
49	2057		22.10		22.1	692.4	670.3
50	2058		22.10		22.1	692.4	670.3
51	2059		22.10		22.1	692.4	670.3
52	2060		22.10	146.2	168.3	692.4	524.2
53	2061		22.10		22.1	692.4	670.3
54	2062		22.10		22.1	692.4	670.3
55	2063		22.10		22.1	692.4	670.3
56	2064		22.10		22.1	692.4	670.3
57	2065		22.10		22.1	692.4	670.3
Total		1,948.4					

B/C: 1.33
NPV: 363.7 Million Pesos
EIRR: 19.1%

Tab. K-4-6 Economic Cost and Benefit Stream of the Dinanggasan River Basin

No of Year	Year	Cost (Million Pesos)				Benefit (Million Pesos)	Balance
		D/D & Consruction	O/M	Replacement	Total		
1	2009	4.1			4.1	0.0	-4.1
2	2010	4.1			4.1	0.0	-4.1
3	2011	19.9			19.9	0.0	-19.9
4	2012	19.9			19.9	2.9	-17.0
5	2013	19.9			19.9	5.9	-13.9
6	2014	19.9			19.9	9.2	-10.7
7	2015	19.9			19.9	12.7	-7.2
8	2016		1.65		1.6	16.4	14.8
9	2017		1.65		1.6	17.0	15.3
10	2018		1.65		1.6	17.5	15.9
11	2019		1.65		1.6	18.1	16.5
12	2020		1.65		1.6	18.7	17.1
13	2021		1.65		1.6	19.3	17.7
14	2022		1.65		1.6	20.0	18.3
15	2023		1.65		1.6	20.7	19.0
16	2024		1.65		1.6	21.4	19.7
17	2025		1.65		1.6	22.1	20.4
18	2026		1.65		1.6	22.8	21.2
19	2027		1.65		1.6	23.6	21.9
20	2028		1.65		1.6	24.4	22.7
21	2029		1.65		1.6	25.2	23.5
22	2030		1.65	0.0	1.6	26.0	24.4
23	2031		1.65		1.6	26.9	25.2
24	2032		1.65		1.6	27.8	26.1
25	2033		1.65		1.6	28.7	27.1
26	2034		1.65		1.6	29.7	28.0
27	2035		1.65		1.6	30.7	29.0
28	2036		1.65		1.6	30.7	29.0
29	2037		1.65		1.6	30.7	29.0
30	2038		1.65		1.6	30.7	29.0
31	2039		1.65		1.6	30.7	29.0
32	2040		1.65		1.6	30.7	29.0
33	2041		1.65		1.6	30.7	29.0
34	2042		1.65		1.6	30.7	29.0
35	2043		1.65		1.6	30.7	29.0
36	2044		1.65		1.6	30.7	29.0
37	2045		1.65	0.0	1.6	30.7	29.0
38	2046		1.65		1.6	30.7	29.0
39	2047		1.65		1.6	30.7	29.0
40	2048		1.65		1.6	30.7	29.0
41	2049		1.65		1.6	30.7	29.0
42	2050		1.65		1.6	30.7	29.0
43	2051		1.65		1.6	30.7	29.0
44	2052		1.65		1.6	30.7	29.0
45	2053		1.65		1.6	30.7	29.0
46	2054		1.65		1.6	30.7	29.0
47	2055		1.65		1.6	30.7	29.0
48	2056		1.65		1.6	30.7	29.0
49	2057		1.65		1.6	30.7	29.0
50	2058		1.65		1.6	30.7	29.0
51	2059		1.65		1.6	30.7	29.0
52	2060		1.65	0.0	1.6	30.7	29.0
53	2061		1.65		1.6	30.7	29.0
54	2062		1.65		1.6	30.7	29.0
55	2063		1.65		1.6	30.7	29.0
56	2064		1.65		1.6	30.7	29.0
57	2065		1.65		1.6	30.7	29.0
Total		107.6					

B/C: 1.06
NPV: 3.5 Million Pesos
EIRR: 15.7%