

## G.2 Improvement Target of Rural Infrastructure

### G.2.1 Rural Road Networks

Improvement of the rural road networks in the study area will start with rehabilitation of the existing roads and construction of new roads. The targets of the improvement are planned roughly on the map "Scheme of Remanagement Road Network after War (enacted by the Public Works Research Centre, MPWT)" by taking account of the present national and provincial road networks and by referring the road network maps and information in the provinces collected during the field study. (See Figure G.2.1)

Priority is given for the rehabilitation to the potential routes to activate marketing between the blocks as well as to the area with less national and provincial road density. The roads for new construction are selected on the routes for mutual connection between the key national and provincial roads for marketing and the improved roads, for by-passing the existing roads, and in the area of less key roads density.

The target of the improvement, appraised as above-mentioned, amounts to 404 km and 343 km for rehabilitation of the existing rural roads and construction of new ones, respectively. The targets for improvement by zone are in the following table (refer to Table G.2.1).

Target of Rural Road Improvement by Zone (unit : km)

Zone	Distance of the Existing Road Improvement	Distance of New Construction Road	Zone	Distance of the Existing Road Improvement	Distance of New Construction Road
(1)	44.3	9.2	(8)	32.3	23.1
(2)	57.2	18.4	(9)	9.2	28.6
(3)	13.8	12.0	(10)	60.0	44.3
(4)	11.1	16.6	(11)	32.3	71.9
(5)	19.4	32.3	(12)	18.4	26.7
(6)	73.8	19.4	(13)	18.4	23.0
(7)	13.8	17.5			
			Total	404.0	343.0

## G.2.2 Rural Water Supply

The target of tube-well installation is set at that of the Department of Rural Water Supply (MRD) 200 persons/well. To achieve the target, number of tube-wells necessary in the study area amounts 9,872 as shown by zone in the table below (refer to Table G.2.1).

**Target of Tube-well Installation by Zone** (unit : place)

Zone	Number of Existing Well	Number of Necessary Well	Zone	Number of Existing Well	Number of Necessary Well
(1)	217	985	(8)	442	1080
(2)	182	839	(9)	524	1042
(3)	131	405	(10)	305	497
(4)	189	821	(11)	512	1113
(5)	308	1233	(12)	17	266
(6)	273	455	(13)	138	683
(7)	126	454			
			Total	3,362	9,872

Table G.2.1 Existing Density and Requirement of Rural Road and Tube-well Installation by Zone

Zone No.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	Total (Average)
<b>Existing Rural Road</b>														
Area (km <sup>2</sup> )	1,582.8	923.4	490.7	920.0	1,376.8	550.1	504.0	1,049.3	1,003.1	813.6	1,535.0	395.3	734.3	11,868.3
Length (km)	332.7	471.0	192.9	339.9	428.4	170.6	294.8	709.0	581.4	125.0	321.2	80.2	400.8	4,567.9
Density (km/km <sup>2</sup> )	0.337	0.510	0.393	0.369	0.311	0.310	0.496	0.676	0.580	0.154	0.216	0.203	0.533	(0.385)
<b>Length of improved road (km)</b>														
Existing road	44.3	57.2	13.8	11.1	19.4	73.8	13.8	32.3	9.2	60.0	32.3	15.4	18.4	404.0
New road	9.2	18.8	12.0	16.6	22.3	19.4	17.5	23.1	28.6	44.3	71.9	26.7	23.0	343.0
<b>Tube-Well</b>														
Population	240,456	203,981	107,249	201,932	308,248	145,467	115,927	304,115	313,147	160,470	325,025	56,664	164,253	2,646,937
Existing well number	217	182	131	189	308	273	126	442	524	305	512	17	138	3,362
Density (person/well)	1,106	1,124	821	1,089	1,001	534	919	689	598	527	635	3,247	1,191	(757)
Necessity well (Nos.)	1,202	1,020	536	1,010	1,541	727	580	1,521	1,566	802	1,625	283	821	13,234
Balance of well (Nos.)	985	839	405	821	1,233	455	454	1,080	1,042	497	1,113	266	683	9,872

Note : Requirement of well = 200 persons/well

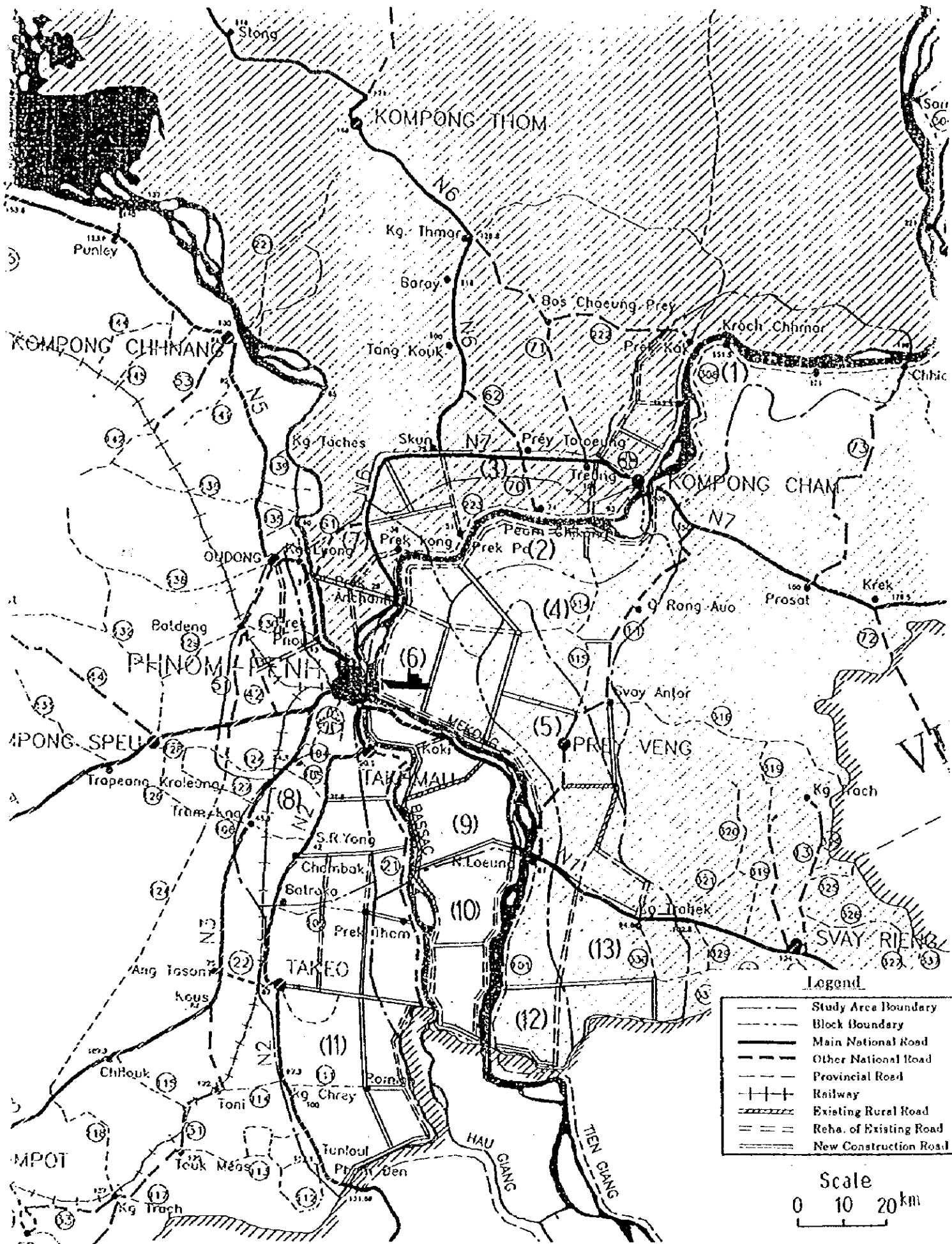


Figure G.2.1 Location Map of Improvement Plan for Rural Road Networks  
 Source ; Scheme of Remanagement Road Network after War (MPWT)

### **G.3 Summary of the Priority Project Cost**

#### **G.3.1 Priority Project Cost**

Summary of the Priority Project Cost and Quantities are shown in Table G.3.1

#### **G.3.2 Implemented Project Cost**

The recent implemented similar works in and around of the study area are summarized in Table G.3.2 and designed works by UNDP are summarized in the Table G.3.3.

**Table G.3.1 (1) Cost Estimation of the Priority Project in the Study Area**

No	Zone No	Project Name	System No.	Province Name	District Name	Study Area (ha)	Service Area (ha) *1		Project Cost (US\$)	Development component #2		Unit cost (US\$/ha)	Service area (ha)	
							Wet Season	Dry Season		Description	Unit			Quantity
1	(2)	Boeng Veam Area Agricultural Development Project	SST 2, SST 3	K. Cham	Srey Santhel / Koh Sotin	20,000	0/5,000	610/10,000	15,174,000	Flood protection dike	km	23.0	5,934,000	10,000
										Reh. of colmatage canal	km	16.5	76,000	
										Reh. of reservoir dike	km	13.0	154,000	
										Gate structure	place	8	208,000	
										New irrigation canal	km	80.0	4,320,000	
2	(2)	Prek Pou Canal Irrigation System Rehabilitation Project	SST 1	K. Cham	Srey Santhel	11,000	2,966/3,000	0/1,500	5,015,000	Upgrade of pump station	site	1	2,000,000	3,000
										Reh. of main canal	km	7.0	54,000	
										New main canal	km	3.0	54,000	
										New secondary canal	km	85.0	2,295,000	
										Gate structure	place	9	20,000	
3	(3)	Pdav Chum Flood Dam Irrigation Project	CP 1	K. Cham	Cheung Prey	6,000	3,085/5,000	0/0	8,713,000	Flood protection dike	km	13.5	258,000	5,000
										New reservoir dike	km	11.0	334,000	
										Gate structure	place	13	20,000	
										New irrigation canal	km	24.0	54,000	
4	(7)	O Chrey Flood Dam Irrigation Project	BT 4	K. Cham	Bathway	2,500	800/2,000	0/950	4,320,700	Flood protection dike	km	8.5	258,000	2,000
										Folder dike	km	2.5	397,000	
										Gate structure	place	6	20,000	
										Irrigation canal	km	18.8	54,000	
5	(7)	Tamouk Reservoir Area Agricultural Development Project	PL 1, PL 3, PL 4	Kandal	Ponhea Leu	10,000	180/900	2,052/4,000	7,293,000	Reh. of reservoir dike	km	13.0	154,000	4,000
										Folder dike	km	8.0	397,000	
										Intake regulator	site	1	557,000	
										Gate structure	place	5	20,000	
										Reh. of irrigation canal	km	27.0	54,000	
6	(9)	Boeng Thom Area Agricultural Development Project	KSV 1	Kandal	Kean Svay	20,000	700/1,400	2,300/3,500	6,189,000	Reh. of reservoir dike	km	13.0	154,000	3,500
										Reh. of colmatage canal	km	9.0	76,000	
										Reh. of irrigation canal	km	50.0	54,000	
										Gate structure	place	11	73,000	
													803,000	
7	(6)	Chhey Thom Area Agricultural Development Project	KD 12	Kandal	Ksach Kandal	10,000	3,830/5,000	0/2,000	7,170,000	Flood protection dike	km	13.0	258,000	5,000
										Reh. of main canal	km	14.0	54,000	
										Reh. of secondary canal	km	60.0	27,000	
										Intake structure	place	2	20,000	
										Pump station	site	2	700,000	

Note \*1: Service area is estimated by the study team on the existing map (scale=1:50,000).

Wet Season (ha) : 0/5,000 means the existing service area / estimated development service area.

Dry Season (ha) : 610/10,000 means the existing service area / estimated development service area.

\*2: Development components are roughly planned by the study team on the existing map (scale=1:50,000).

Table G.3.1 (2) Cost Estimation of the Priority Project in the Study Area

No. / Zone	Project Name	System No	Province Name	District Name	Study Area (ha)	Service Area (ha) *1		Project Cost (US\$)	Development component *2		Project Cost (US\$)		Unit cost (US\$/ha)	Service area (ha)
						Wet Season	Dry Season		Description	Unit	Quantity	Unit cost		
8	Malsach Krobaykon Area Agricultural Development Project	KT1.13	Kandal	Koh Thom	4,000	0/0	848/4,000	7,177,000	Reh. of polder dike	km	13.0	205,000	2,665,000	4,000
									Gate of colmatage canal	km	17.0	76,000	1,292,000	
									Gate structure	place	9	208,000	1,872,000	
									Pump station	site	1	700,000	700,000	
									Irrigation canal	km	24.0	27,000	648,000	
9	Boeung Phica Area Small Pump Irrigation Project	KD 1-6, KD 13-18	Kandal	Ksach Kandal	8,000	136/250	2,085/4,000	5,414,000	Irrigation canal	km	50.0	54,000	2,700,000	4,000
									Intake structure	place	18	73,000	1,314,000	
									Mobile pump	L.S.	1	1,400,000	1,400,000	
														* mobile pump 1000sets
10	Tasen Area Flood Dam Irrigation Project	MP 1	Kandal	Muk Kampoul	2,000	0/0	1,245/2,000	4,207,200	Flood protection dike	km	12.0	258,000	3,096,000	2,000
									Reh. of colmatage canal	km	1.2	76,000	91,200	
									Gate structure	place	4	20,000	80,000	
									Reh. of irrigation canal	km	6.0	54,000	324,000	
									Reh. of reservoir dike	km	4.0	154,000	616,000	
11	Sras Bram Beay Irrigation System Rehabilitation Project	K72.H	Kandal	Koh Thom	6,000	0/0	1,389/3,000	3,963,000	Flood protection dike	km	10.0	258,000	2,580,000	3,000
									Reh. of irrigation canal	km	18.0	54,000	972,000	
									New irrigation canal	km	6.5	54,000	351,000	
									Gate structure	place	3	20,000	60,000	
12	Boeung Pring Area Small Pump Irrigation Project	PV 1.3.5, PM 12, PKO 7.8	Prey Veng	Prey Veng DC / Kamp. Leav / Puam Ro	10,000	370/3,000	160/600	4,733,000	Main canal	km	22.0	54,000	1,188,000	3,000
									Secondary canal	km	40.0	27,000	1,080,000	
									Intake structure	place	5	73,000	365,000	
									Pump station	site	1	700,000	700,000	
									Mobile pump	L.S.	1	1,400,000	1,400,000	
									Intake facility	site	1	1,000,000	1,000,000	
13	Oukabok Area Canal System Rehabilitation Project	KT84	Prey Veng	Kamp. Travak	5,000	0/3,000	0/200	3,237,000	Reh. of main canal	km	10.0	54,000	540,000	3,000
									Reh. of colmatage canal	km	3.5	76,000	266,000	
									New main canal	km	4.0	54,000	216,000	
									Secondary canal	km	45.0	27,000	1,215,000	
14	Khaebour Reservoir Area Pump Irrigation Rehabilitation Project	BPH 1	Prey Veng	Ba Phnom	10,000	0/6,200	0/6,200	7,137,000	Reh. of pump station	site	1	3,000,000	3,000,000	6,200
									Reh. connection canal	km	7.0	132,000	924,000	
									Reh. of main canal	km	19.5	54,000	1,053,000	
									Secondary canal	km	80.0	27,000	2,160,000	

Note \*1: Service area is estimated by the study team on the existing map (scale=1:50,000).

Wet Season (ha): 0/5,000 means the existing service area / estimated development service area.

Dry Season (ha): 610/10,000 means the existing service area / estimated development service area.

\*\* : Development components are roughly planned by the study team on the existing map (scale=1:50,000).

**Table C.3.1 (3) Cost Estimation of the Priority Project in the Study Area**

No.	Zone No.	Project Name	System No.	Province Name	District Name	Study Area (ha)	Service Area (ha) *		Project Cost (US\$)	Development component **		Project Cost (US\$)		Unit cost (US\$/ha)	Service area (ha)
							Wet Season	Dry Season		Description	unit	Quantity	Unit cost		
15	(11)	Tourl Kolok Reservoir Irrigation System Rehabilitation Project	PK 1	Takao	Prey Kabass	3,000	250/500	1,250/2,000	2,096,000	Reh. of reservoir dike	km	7.0	154,000	1,078,000	2,000
										Intake facility	place	5	20,000	100,000	
										Reh. of main canal	km	8.0	54,000	432,000	
										Secondary canal	km	18.0	27,000	486,000	
16	(11)	Thnot Konchhrung Irrigation System Rehabilitation Project	KA 1	Takao	Koh Andet	9,000	0/0	1,700/3,000	3,362,000	Reh. of reservoir dike	km	7.0	154,000	1,078,000	3,000
										Reh. of irrigation canal	km	11.0	54,000	594,000	
										Gate structure	place	9	20,000	180,000	
										Upgrade of pump facility	site	1	700,000	700,000	
										Secondary canal	km	30.0	27,000	810,000	
17	(8)	Svay Khom Reservoir Irrigation System Rehabilitation Project	BT 4	Takao	Bati	6,000	0/0	350/3,000	3,848,000	Reh. of reservoir dike	km	10.0	154,000	1,540,000	3,000
										Gate facility	place	1	1,000,000	1,000,000	
										Intake facility	place	6	20,000	120,000	
										Reh. of irrigation canal	km	22.0	54,000	1,188,000	
18	(11)	Stung Takao Irrigation System Rehabilitation Project	T 4	Takao	Koh Andet / Treang	13,000	0/0	4,000/6,000	10,720,000	Reh. of Takeo river	km	18.0	300,000	5,400,000	6,000
										Reh. of diversion weir	site	1	1,000,000	1,000,000	
										Reh. of irrigation canal	km	80.0	54,000	4,320,000	
19	(11)	Samaki Irrigation System Rehabilitation Project	BCH 2	Takao	Borey Cholasar	3,300	0/0	200/1,500	1,810,000	Diversion weir	site	1	1,600,000	1,600,000	1,500
										Reh. of main canal	km	5.0	54,000	270,000	
										Secondary canal	km	20.0	27,000	540,000	
20	(8)	Kampong Damrei Reservoir Agricultural Development Project	BT 1, BT 2, BT 3	Takao	Bati	9,000	2,000/2,100	2,150/2,350	-						
21	(11)	Rehabilitation of Canal 87 Irrigation Project	AB 1	Takao	Angkor Borey	2,000	0/0	1,000/1,200	-						

Note \* 1 : Service area is estimated by the study team on the existing map (scale=1:50,000).

Wet Season (ha) : 0/5,000 means the existing service area / estimated development service area.

Dry Season (ha) : 610/10,000 means the existing service area / estimated development service area.

\*\* : Development components are roughly planned by the study team on the existing map (scale=1:50,000).



Table G.3.2 Inventory of the Implemented Project Cost (Financed by ADB)

Project Name	Thnot Te Rehabilitation	O'tom Lake Flood Protection Rehabilitation	Tuk Chihar Irrigation System Rehabilitation	Kompong Sne Rehabilitation
System Number	SRI		PCH1	BPH3
Province	Takao	Takao	Kompong Cham	Prey Veng
District	Samrong	Treang	Prey Chhor	Ba Phnom
Finance / Execution	ADB / GDMH	ADB / Provincial Office	ADB / GDMH	ADB / Contractor (Supervised by GDMH & POH)
Completion Year/ Month	1995/06	1996/04	1996/04	1996/05
Benefited Area	2,950 ha single recession rice	740 ha wet season rice	4,000 ha wet season rice 1,300 ha dry season rice	1,930 ha single recession rice
Beneficiaries	3,000 farm families	1,000 village families	4,000 farm families	2,500 farm families
Project Cost	US\$ 1,140,000 (US\$ 390 / ha)	US\$ 200,000 (US\$ 270 / ha)	US\$ 1,430,000 (US\$ 360 / ha)	US\$ 740,000 (US\$ 380 / ha)
Brief Description of Work	Spillway : 1 new 300m & bridge & rock slope protection 3 km Embankment : strengthen 3 km & rock slope protection 6 km Gated outlets : 3 repaired & 1 new Canals : 7.6 km & 15 structures Roads : laterite access 6.5 km & canal(farm road standards) 7 km	Spillway : 1 new - 80 m & bridge, 1 extend - 80 m Embankment : new 0.4 km & rock slope protection 1.5 km Gated outlets : 3 repaired Roads : laterite access 3 km	Spillway : 4 new (total length = 600 m) Tuk Chihar 50 m Thmor Da 60 m Rusey Lor 220 m Dombok Yuan 270 m Gated outlets : 5 repaired Canals : 29 km & 80 structures Roads : laterite access 43 km & canal(farm road standards) 23 km	Spillway : 1 new secondary 200 m, repair 2 - main 100 m & emergency 1,500 m Gated outlets : 4 repaired Canals : 20.7 km & 240 structures Roads : laterite access 4 km & canal(farm road standards) 21 km
Active storage of Reservoir	13,500,000 m <sup>3</sup>	not applicable	Small - reservoirs have to be almost full for diversion	30,000,000 m <sup>3</sup> (exceeds needs for target area)
Breakdown of Construction Cost (US\$)	(1) Site Establishment(office,camp etc.) 20,000 (2) Spillway including the bridge 570,000 (3) Embankment 360,000 (4) Outlet Structures 40,000 (5) Canals 70,000 (6) Laterite Access Road 40,000 (7) Repair of flood damage to spillway & embankment (Aug. 94) 40,000 Total (US\$) 1,140,000	(1) New spillway & Bridge 96,000 (2) Extend spillway 17,000 (3) Extend Embankment 13,000 (4) Embankment rock protection 23,000 (5) Access Road Laterite Sheeting 39,000 (6) Supervision 5,000 Base Total 193,000 (7) Contingencies (10%) 27,000 Total (US\$) 220,000	(1) Tuk Chihar (A=3,000 ha) 495,000 (2) Tamar Da (A=300 ha) 505,000 (3) Rusey Lor (A=500 ha) 120,000 (4) Dombok Yuan (A=1,200 ha) 120,000 (5) O&M facilities(Building & Equipment) 60,000 Base Total 1,298,000 (6) Contingencies (10%) 132,000 Total (US\$) 1,430,000	(1) Site Establishment(office etc.) 25,000 (2) Reservoir Embankment 60,000 (3) Main spillway 40,000 (4) Emergency spillway 20,000 (5) Canals 470,000 Base Total 615,000 (6) Contingencies (20%) 125,000 Total (US\$) 740,000
Remarks				

Source : Special Rehabilitation Assistance Loan Ministry of Agriculture, Fisheries & Forestry, Completion Report, March 1996 (ADB)

Table G.3.3 Inventory of the Designed Project Cost (Designed by UNDP)

Project Name	Kompong Rotes Irrigation Project	O'tom Lake Flood Protection Rehabilitation																																																						
System Number	KPR6, KPR7	CHJ																																																						
Province	Svay Rieng	Kampot																																																						
District	Kompong Ro	Chouk																																																						
Finance / Execution																																																								
Completion Year/Month																																																								
Benefited Area	300 ha wet season rice, 1000 ha dry season rice (Existing : 400 ha dry season rice)	Improvement of 1,350 ha wet season rice(Supple.) & addition of 640 ha dry season rice(Irrigated) (Existing : 2,650 ha wet season rice,rainfed)																																																						
Beneficiaries	826 Households	4,069 Households																																																						
Project Cost	US\$ 306,000 (US\$ 340 / ha of additional irrigated paddy,900 ha)	US\$ 1,359,000 (US\$ 1,010 / ha of supplemental irrigation,1,350 ha)																																																						
Brief Description of Work	Thmei canal re-excavation & bank road rehab. on both sides : 2.7 km Extension new canal & bank road : 4.0 km Turnout(1 *1 m dia) without gate : 8 No. Box culvert for road overpass : 1 No. Pipe culvert for road overpass : 3 No. Chab Pring canal re-excavation & bank road rehabilitation : 2.3 km Turnout(1 *1 m dia) without gate : 4 No. Pipe culvert for road overpass : 2 No.	Spillway : 1 new - 180m <sup>3</sup> /s & 8 overshot gates Rehabilitation of reservoir embankment : 5.2 km Rehabilitation of main canal : 12.0 km Water control structures : 2 main intakes, 1 cross regulator rehab., 1 new cross regulator, 10 turnouts & 3 tail weir with gate Rehabilitation of boundary road : 7.0 km (include 1 new bridge & 7 box culvert)																																																						
Active storage of Reservoir	Water source is river	- n a -																																																						
Breakdown of Construction Cost (US\$)	<table border="0"> <tr> <td>(1) Thmei canal &amp; road rehabilitation</td> <td>12,240</td> </tr> <tr> <td>(2) Extension new canal &amp; bank road</td> <td>64,000</td> </tr> <tr> <td>(3) Turnout</td> <td>28,800</td> </tr> <tr> <td>(4) Box culvert</td> <td>11,800</td> </tr> <tr> <td>(5) Pipe culvert</td> <td>13,500</td> </tr> <tr> <td>(6) Chab Pring canal Rehabilitation</td> <td>27,420</td> </tr> <tr> <td>(7) Turnout</td> <td>14,400</td> </tr> <tr> <td>(8) Pipe culvert</td> <td>9,000</td> </tr> <tr> <td><b>Total Base Cost</b></td> <td><b>181,160</b></td> </tr> <tr> <td>(9) Physical Contingencies (20%)</td> <td>36,232</td> </tr> <tr> <td>(10) O &amp; M Establishment Cost (5%)</td> <td>9,058</td> </tr> <tr> <td><b>Total Construction Cost</b></td> <td><b>226,450</b></td> </tr> <tr> <td>(11) Local Supervision (15%)</td> <td>33,968</td> </tr> <tr> <td>(12) Technical Assistance (20%)</td> <td>45,290</td> </tr> <tr> <td><b>Total (US\$ rounded)</b></td> <td><b>306,000</b></td> </tr> </table>	(1) Thmei canal & road rehabilitation	12,240	(2) Extension new canal & bank road	64,000	(3) Turnout	28,800	(4) Box culvert	11,800	(5) Pipe culvert	13,500	(6) Chab Pring canal Rehabilitation	27,420	(7) Turnout	14,400	(8) Pipe culvert	9,000	<b>Total Base Cost</b>	<b>181,160</b>	(9) Physical Contingencies (20%)	36,232	(10) O & M Establishment Cost (5%)	9,058	<b>Total Construction Cost</b>	<b>226,450</b>	(11) Local Supervision (15%)	33,968	(12) Technical Assistance (20%)	45,290	<b>Total (US\$ rounded)</b>	<b>306,000</b>	<table border="0"> <tr> <td>(1) New spillway &amp; 8 overshot gates</td> <td>512,660</td> </tr> <tr> <td>(2) Rehab' of reservoir embankment</td> <td>27,400</td> </tr> <tr> <td>(3) Rehab' of boundary road</td> <td>48,690</td> </tr> <tr> <td>(4) Water control structures</td> <td>192,755</td> </tr> <tr> <td>(5) Rehab' of Main canal</td> <td>24,000</td> </tr> <tr> <td><b>Total Base Cost</b></td> <td><b>805,505</b></td> </tr> <tr> <td>(9) Physical Contingencies (20%)</td> <td>161,101</td> </tr> <tr> <td>(10) O &amp; M Establishment Cost (5%)</td> <td>40,275</td> </tr> <tr> <td><b>Total Construction Cost</b></td> <td><b>1,006,881</b></td> </tr> <tr> <td>(11) Local Supervision (15%)</td> <td>151,032</td> </tr> <tr> <td>(12) Technical Assistance (20%)</td> <td>201,376</td> </tr> <tr> <td><b>Total (US\$ rounded)</b></td> <td><b>1,359,000</b></td> </tr> </table>	(1) New spillway & 8 overshot gates	512,660	(2) Rehab' of reservoir embankment	27,400	(3) Rehab' of boundary road	48,690	(4) Water control structures	192,755	(5) Rehab' of Main canal	24,000	<b>Total Base Cost</b>	<b>805,505</b>	(9) Physical Contingencies (20%)	161,101	(10) O & M Establishment Cost (5%)	40,275	<b>Total Construction Cost</b>	<b>1,006,881</b>	(11) Local Supervision (15%)	151,032	(12) Technical Assistance (20%)	201,376	<b>Total (US\$ rounded)</b>	<b>1,359,000</b>
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Remarks	24 small mobile pumps																																																							

Source : Irrigation Rehabilitation Study in Cambodia. PRE-FEASIBILITY REPORT (Mekong Secretariat, April 1994)

## **II. Feasibility Study**

### **G.4 Present Condition of the Boeng Phtea Area**

#### **G.4.1 Rural Road Networks**

Based on the reconnaissance survey and interview survey with the district office, road in the Boeng Phtea area is classified into three types of district road, village road and farm road. Out of them, district and village roads are considered as a basic infrastructure for rural people. Inventory of their roads by each commune is shown in Table G.4.1. Present condition of the roads is described bellow.

##### **(1) District road**

Two district roads exist in the area. One is located along the natural levee of Mekong river, links with each commune of Prek Tamerk, Puk Reusei and Prek Ampil, 6.8 km. The other (Phras Konlong road) is the only road to connect with Prek Tamerk and Vihearsour and Sanlung communes located in the southeast of the Study Area, total length of 12.0 km. The width of road is around 6.0 to 7.0 m. The road conditions are poor, no pavement, which become muddy in the flooding season. Bridges are provided in the road system, of which dimension is as follows.

**Dimension of Bridge on the District road**

Location	Length (m)	Width (m)	Structure	Remarks
1) belong Mekong river				
Agn Cheng colmatage	8.8	5.9	concrete	Constructed in 1990
Tamao colmatage	60.0	3.3	wooden	Will be completed in 1997
Kong Van colmatage	62.6	6.1	concrete	Constructed in 1969
Ta Pang colmatage	6.0	7.7	concrete	Constructed in 1996
2) PrekTamerk~Vihearsour				
Bridge (a); D.H.Q~3.0km	15.0	4.5	concrete	Under construction
Phras Konlong Bridge	84.0	5.0	steel	Under construction
Bridge (c); D.H.Q~7.0km	18.0	4.5	steel + wooden	
Bridge (d); D.H.Q~7.6km	15.0	4.5	steel + wooden	

Note ; D.H.Q = District Head Quater office

Source ; Field Survey by the JICA Study team

Although the roads are supposed to be maintained by the district office, the maintenance work is generally not active due to insufficient amount of working budget. However, some sections of the roads are being improved at present. Out of them, the sections between Prek Tamerk and Vihearsour, within Prek Tamerk commune are planned to be completed before this flooding season. According to the interview survey, improvement plan between Prek Tamerk and Vihearsour is as follows.

- Total length L=12 km(including 6 culverts, D=0.8 m) -----\$90,000
- Bridge new construction(L=15 m, B=4.5 m), rehabilitation(one site)-----\$58,000

According to the rural socio-economic survey, the present road system is recognized as one of priority facility to be improved for rural people.

(2) Village road

Village road is regarded as a living road for rural people. Present road density of the village road is estimated at from 13.4 to 29.2 km/km<sup>2</sup>(the average 20.8 km/km<sup>2</sup> of whole study area). Road condition is very poor, no pavement, small width from 1.0 to 3.0 m. The density of major village road is from 6.9 to 12.5 km/km<sup>2</sup>, that of Puk Reusei commune is lowest. The rural socio-economic survey shows that rural people list the improvement of village roads as high priority requirement as well as the district roads.

**G.4.2 Rural Water Supply**

(1) Present condition

Source of drinking water supply is divided into two, Mekong river along Prek Tamerk, Puk Reusei and Prek Ampil communes, and tube-well in the Vihearsour and Sanlung communes, as shown below.

**Ratio of drinking water sources in the Study Area** (unit : %)

Commune	Nos. of Survey	Public pot	Tube -well	River /Canal	Hy- drant	Pond	Open well
Prek Tamerk	100	29	0	45	43	10	0
Puk Reusei	182	55	12	33	2	0	0
Sanlung	25	0	100	0	0	0	0
Vihearsour	175	24	79	1	0	3	3
Prek Ampil	18	17	11	72	0	0	0
total	500	35	38	24	9	3	1

Source ; Rural Socio-economic interview survey by JICA Study team

The present condition of each source and its covered area is as follows.

(a) The area closed to the Mekong river, Prek Tamerk, Puk Reusei and Prek Ampil communes

In the 1980's, tube-well had been provided by the Ministry of Health(MOHI), UNICEF and NGOs, however, which is not used at present for drinking due to its water quality problem. Rural people in the area rely on Mekong river water. In the Prek Tamerk and Puk Reusei communes, simple drinking water supply system consisted of lifting pump at waterside of

Mekong river, storage tank, gravity pipeline and house tap with meter has been provided privately. Users of the system have to pay water charge of 1,000 Riel/m<sup>3</sup>. Water supply service car under the same system is also used for the far area of the system, of which water charge is about 1,500 Riel/m<sup>3</sup>. The present system has no treatment facility. Per capita water consumption is assumed about 15 to 30 l/day. Required daily work of rural people such as time and hour for water fetching and distance from the source is summarized by compiling the results of rural socio-economic survey, as shown in Table G.4.3.

(b) Tube-well, Vihearsour, Sanlung communes

Most of household has tube-well as a drinking water source. Water supply system linked with tube-well and pipeline has not been constructed, but, one unit of water supply service car has been provided in the area, of which water charge is 2,000 Riel/m<sup>3</sup>. Water quality of tube-well is safe for drinking. Well is drilled by private drilling workers in the area, by 80-120\$ per 30m. Per capita water consumption is the almost same as in the area along the Mekong river.

(2) Development constraints

Constraints of rural water supply is summarized as follows.

(a) Water quality of tube-well in the area along the Mekong river

Water quality from tube-well is not safe for drinking due to high concentration of mineral salts and iron, which give an unpleasant taste. Tube-well system should be developed based on a survey related to potentiality of water quantity and quality.

(b) Maintenance of tube-well

Tube-well constructed by MOH and UNICEF is counted at 65, about 100 users per well. The number of users per well is over that of short term target of 200 persons/well programmed by the Department of Rural Water Supply(DRWS), MRD. However, abandoned well is counted at 48(78%) at present due to water quality and lack of maintenance fund and person. DRWS has commenced the rehabilitation work of hand pump from viewpoint of importance of maintenance work. Water quality test should be conducted in parallel with such rehabilitation work.

### G.4.3 Other Rural Infrastructures

Besides the rural water supply and roads, sanitary facility and electricity will be required as a basic rural infrastructure.

### (1) Sanitary facility

According to the interview survey with district hospital, there are no sanitary improvement plans/projects by public agencies at present. SHARE, one of NGOs, provides rural people with credit system for construction of foundations of toilet, \$80 per one unit, at no interest rate. As the results, three toilets in the Prek Tamerk and 30 in Puk Reusei, including 8 for elementary school were constructed recently.

### (2) Electricity

There is no electric supply system by public agencies in the area. As a electric supply facility, private small scale electric supply facilities were provided for some household groups, which is operated at 5,000 Riel/month for a lump, 10,000 Riel/month for a television. Rural socio-economic survey shows 22% of the households use car batteries as a electric source for lumps.

**Table G.4.1 Inventory of Rural Road in the Boeng Phtea Area**

No.	Commune	Resident Area (km <sup>2</sup> )	Distance (km)				Density (km/km <sup>2</sup> )			
			District road	Village road (*1)			District road	Village road		
				Major	Minor	total		Major	Minor	total
1	PREK TAMERK	0.883	7.00	9.08	8.75	17.83	7.928	10.283	9.909	20.193
2	PUK REUSEI	1.098	4.80	7.55	7.15	14.70	4.372	6.876	6.512	13.388
3	SANLUNG	0.368	2.90	4.60	1.80	6.40	7.880	12.500	4.891	17.391
4	VIHEARSOUR	1.175	4.10	12.20	22.14	34.34	3.489	10.383	18.843	29.226
5	PREK AMPIL	n.a	-	-	-	-	-	-	-	-
<b>Total</b>		<b>3.524</b>	<b>18.80</b>	<b>33.43</b>	<b>39.84</b>	<b>73.27</b>	<b>5.335</b>	<b>9.486</b>	<b>11.305</b>	<b>20.792</b>

Note ; (\*1) Major roads can go by car. Minor roads can not go by car.

Source ; Field survey by JICA Study team.

**Table G.4.2 Inventory of Tube-Well constructed by UNICEF in the Boeng Phtea Area**

No.	Commune	Population	Number of Tube-well (*1)				Density (per./well)	Dimension (*2)		
			(by UNICEF)					Depth (m)	W.L. (m)	Yield (m <sup>3</sup> /hrs)
			effective	unsuitable	spoiled	total				
1	PREK TAMERK	1,506	0	13	2	15	116	33.3	9.6	2.37
2	PUK REUSEI	1,880	0	16	13	29	118	28.6	7.4	2.38
3	SANLUNG	192	2	0	0	2	96	24.0	3.3	11.00
4	VIHEARSOUR	1,194	15	0	4	19	80	24.6	4.4	4.21
5	PREK AMPIL	220	0	0	0	0	n.a	n.a	n.a	n.a
<b>Total</b>		<b>4,992</b>	<b>17</b>	<b>29</b>	<b>19</b>	<b>65</b>	<b>109</b>	<b>28.4</b>	<b>6.9</b>	<b>3.18</b>

Note ; (\*1) Source : Department of Rural Water Supply, Ministry of Rural Development and Interview for the Director of Hospital in Ksach Kandal district.

(\*2) Source : Department of Rural Water Supply, Ministry of Rural Development. This figure include unsuitable and spoiled well.

Table G.4.3 Inventory of Rural Socio-Economic Survey for Rural Infrastructures

COMMUNE / Village	No. of Survey	Major Problems in the Village (*1)										Numbers of drinking water sources					Distance from the drinking water sources(m)					Water Fetching		Battery (Nos.)
		a	b	c	d	e	f	g	h	Public pot	Tube well	River /Cana	Hy-drant	Pond	Open well	Public pot	Tube well	River /Cana	Hy-drant	Pond	Open well	time/day	hours/day	
<b>PREK TAMEK</b>	12	1.1	2.9	2.1	2.1	2.0	2.9	2.2	2.9	0	0	12	0	0	0	0	202	0	0	0	0	2.1	1.67	1
Svay Att Leu	13	1.2	2.3	2.1	1.0	1.0	2.1	2.1	4.0	0	0	12	10	0	0	0	450	24	0	0	0	1.9	1.04	1
Svay Att Kandal	12	1.0	2.1	2.0	1.0	1.0	2.2	2.0	4.0	1	0	11	10	0	0	60	309	171	0	0	0	1.8	0.94	5
Svay Att Krom	13	1.0	2.2	2.0	1.0	1.1	2.3	2.1	4.0	0	0	0	13	0	0	0	0	118	0	0	0	1.5	0.85	6
Knong	13	1.0	2.0	2.0	1.4	1.6	2.9	2.9	3.5	13	0	0	0	0	0	304	0	0	0	0	0	2.1	1.21	12
Boeng kagnchap Cheung	12	1.0	2.3	2.0	1.4	1.7	2.6	2.9	3.5	12	0	0	0	0	0	288	0	0	0	0	0	2.2	1.21	10
Boeng kagnchap Thong	12	1.8	2.7	2.1	1.0	1.0	2.2	2.1	4.0	0	0	10	10	0	0	0	390	69	0	0	0	1.9	1.04	9
Prek Tamerk	13	1.0	2.7	2.1	2.2	2.2	3.0	2.8	2.8	3	0	0	0	0	0	183	0	0	0	255	0	1.8	1.58	4
Anlung	100	1.1	2.4	2.0	1.4	1.5	2.5	2.4	3.6	29	0	45	43	10	0	276	0	336	97	255	0	1.9	1.19	48
Sub - total																								
<b>PUK REUSEI</b>	28	1.1	3.3	2.3	2.5	3.0	3.3	2.1	3.8	14	3	11	0	0	0	108	133	202	0	0	0	1.5	0.55	6
Agn Cheng Leu	32	1.1	4.0	2.3	2.4	2.7	3.4	2.1	4.0	14	6	11	2	0	0	120	172	250	250	0	0	1.4	0.67	10
Agn Cheng Krom	29	1.6	3.9	2.5	2.3	3.0	3.3	2.4	3.8	17	3	10	0	0	0	139	103	269	0	0	0	1.8	0.72	7
Kroch Seauch	31	1.0	3.9	2.3	2.5	2.5	3.5	1.9	4.0	14	4	12	1	0	0	118	243	183	60	0	0	1.5	0.59	8
Puk Reusei Leu	26	1.4	4.0	2.5	2.3	2.7	3.3	2.2	4.0	21	3	4	0	0	0	200	67	255	0	0	0	1.7	0.71	3
Puk Reusei Kandal	36	1.1	3.8	2.1	2.5	2.6	3.5	2.0	3.9	21	3	12	0	0	0	147	163	223	0	0	0	1.4	0.53	8
Puk Reusei Krom	182	1.2	3.8	2.3	2.4	2.7	3.4	2.1	3.9	101	22	60	3	0	0	144	153	226	187	0	0	1.5	0.62	42
Sub - total																								
<b>PREK AMPIL</b>	18	1.1	4.0	2.2	3.4	2.6	3.8	1.8	4.0	3	2	13	0	0	0	63	133	179	0	0	0	1.3	0.52	4
Ta Tul	18	1.1	4.0	2.2	3.4	2.6	3.8	1.8	4.0	3	2	13	0	0	0	63	133	179	0	0	0	1.3	0.52	4
Sub - total																								
<b>Total</b>	300	1.2	3.4	2.2	2.1	2.3	3.1	2.2	3.8	133	24	118	0	0	0	171	153	263	0	0	0	1.6	0.81	94
<b>SANLUNG</b>	25	1.0	2.0	2.9	1.9	2.0	3.0	2.0	3.0	0	25	0	0	0	0	0	72	0	0	0	0	2.0	1.02	1
Thmei	25	1.0	2.0	2.9	1.9	2.0	3.0	2.0	3.0	0	25	0	0	0	0	0	72	0	0	0	0	2.0	1.02	1
Sub - total																								
<b>VIHEARSOUR</b>	50	1.0	2.0	1.8	1.6	1.7	2.5	2.6	3.3	21	43	0	0	5	0	100	62	0	0	264	0	2.1	0.84	9
Prei Chas	50	1.0	2.8	2.4	1.9	2.2	2.6	2.1	3.3	0	44	0	0	1	5	0	44	0	0	100	84	3.3	1.10	3
Seda	25	1.0	2.1	2.4	1.3	1.4	2.7	2.3	3.2	16	9	0	0	0	0	282	40	0	0	0	0	2.0	1.19	0
Viharsour Cheung	50	1.0	2.1	1.8	1.0	1.0	2.7	2.0	3.6	5	43	2	0	0	0	170	39	200	0	0	0	2.2	1.02	5
Viharsour Thong	175	1.0	2.3	2.1	1.5	1.6	2.6	2.2	3.3	42	139	2	0	6	5	178	48	200	0	237	84	2.5	1.01	17
Sub - total	200	1.0	2.2	2.2	1.5	1.7	2.7	2.2	3.3	42	164	2	0	6	5	178	51	200	0	237	84	2.4	1.0	18
<b>Total</b>	500	1.1	2.9	2.2	1.9	2.0	2.9	2.2	3.6	175	188	120	46	16	5	172	64	262	103	248	84	1.9	0.89	112

Note : (\*1) a = Thievery/robbery, b = Poor transport, c = Human diseases, d = Lack of schools, e = Lack of hospitals, f = Poverty/low income, g = Domestic water supply, h = Flooding  
 1 = None, 2 = Little, 3 = Medium, 4 = Serious



**Table G.4.4-(1) Inventory of Drilling-Well in the Boeng Phtea Area**

Name of Village	No.	Total No.	No. of Wells	DATE OF Constructio	Depth of Well (m)	Water Level (m)	Yield (m <sup>3</sup> /s)	Type of Hand-Pump	Remarks
<b>I. PREK TAMERK Commune</b>									
1) Svay Att Leu	1	1	M.2- 6	1990/10/17	24.0	6.0	7.00	INDIA-1	Hospital Srok
-- # --	2	2	M.2- 88	1992/2/17	34.0	10.0	1.50	PAT	
-- # --	3	3	M.2- 89	1992/2/20	40.5	9.0	1.00	PAT	
2) Svay Att Kandal	1	4	M.2- 90	1992/5/23	45.0	10.0	1.00	PAT	
-- # --	2	5	M.3-398	1993/5/2	23.0	10.0	2.00	INDIA-3	
3) Svay Att Krom	1	6	M.3-403	1993/5/10	32.0	10.0	4.00	INDIA-3	
-- # --	2	7	M.3-413	1993/6/26	36.0	10.0	2.00	INDIA-3	
4) Knong	-	-	M.2- 7	1990/11/1	43.5	0.0	0.00	-	cannot use
-- # --	1	8	M.2- 74	1991/7/6	40.0	8.5	1.00	INDIA-1	
-- # --	-	-	M.2- 75	1991/7/8	43.0	0.0	0.00	-	cannot use
-- # --	2	9	M.2- 76	1991/7/18	39.5	15.0	1.50	INDIA-1	
-- # --	3	10	M.2- 91	1992/5/29	25.0	9.0	1.00	PAT	
5) Boeng Kagnchap Cheung	1	11	M.3-397	1993/5/1	43.0	10.0	4.00	INDIA-3	
-- # --	2	12	M.3-400	1993/5/5	30.0	10.0	1.50	INDIA-3	
-- # --	-	-	M.3-404	1993/5/12	35.0	0.0	0.00	-	cannot use
6) Boeng Kagnchap Tbong	-	-	-	-	-	-	-	-	
7) Prek TamerK	-	-	M.3- 406	1993/5/16	35.0	0.0	0.00	-	cannot use
-- # --	1	13	M.2- 78	1991/7/23	29.0	10.0	3.00	INDIA-1	Infinmerie
-- # --	2	14	M.16- 59	1994/6/5	27.0	6.0	2.00	N/A (*)	Hospital
8) Anlung	1	15	M.3-405	1993/5/15	32.0	10.0	3.00	N/A (*)	
<b>Total Number of Wells** =</b>		<b>15</b>		<b>Total***</b>	<b>500.0</b>	<b>143.5</b>	<b>35.50</b>		
				<b>Average***</b>	<b>33.3</b>	<b>9.6</b>	<b>2.37</b>		
<b>2. PUK REUSEI Commune</b>									
1) Agn Cheng Leu	1	1	M.3-260	1992/3/21	33.0	6.0	2.00	PAT	
-- # --	2	2	M.3-264	1992/3/25	28.0	7.0	2.00	PAT	
-- # --	3	3	M.3-265	1992/3/26	38.0	7.0	2.00	INDIA-1	
-- # --	4	4	M.3-267	1992/3/28	37.0	6.0	2.00	PAT	
-- # --	5	5	M.3-412	1993/6/12	38.0	11.0	2.00	INDIA-3	

\* : N/A means 'Not Available'.

\*\* : This number shows effective wells.

\*\*\* : These value are the total and average of effective wells.

Source : Department of Rural Water Supply, MRD

**Table G.4.4-(2) Inventory of Drilling-Well in the Boeng Phtea Area**

Name of Village	No.	Total No.	No. of Wells	Date of Construction	Depth of Well (m)	Water Level (m)	Yield (m <sup>3</sup> /s)	Type of Hand-Pump	Remarks
2) Agn Cheng Krom	1	6	M.3-261	1992/3/22	28.0	6.0	2.00	NO.6	
-- # --	2	7	M.3-262	1992/3/23	32.0	7.0	2.50	PAT	
-- # --	3	8	M.3-263	1992/3/24	32.0	7.0	3.00	PAT	
-- # --	4	9	M.3-266	1992/3/27	29.0	6.0	2.50	PAT	
3) Kroch Seauch	1	10	M.3-255	1992/3/13	24.0	6.0	1.00	INDIA-1	
-- # --	2	11	M.3-256	1992/3/14	27.0	7.0	1.50	INDIA-1	
-- # --	3	12	M.3-257	1992/3/14	25.0	6.0	1.00	INDIA-1	
-- # --	4	13	M.3-258	1992/3/15	28.0	6.0	2.00	INDIA-1	
-- # --	5	14	M.3-259	1992/3/20	26.0	6.0	2.50	NO.6	
4) Puk Reusei Leu	1	15	M.3-245	1992/2/28	31.0	9.0	3.00	INDIA-1	Col+Ecote
-- # --	2	16	M.3-246	1992/2/28	35.0	9.0	3.00	INDIA-1	Infirmierie
-- # --	3	17	M.3-251	1992/3/3	25.0	9.0	3.00	INDIA-1	
-- # --	4	18	M.3-252	1992/3/10	25.0	6.0	3.00	N/A (*)	
-- # --	5	19	M.3-253	1992/3/11	24.0	7.0	2.00	INDIA-1	
-- # --	6	20	M.3-254	1992/3/12	23.0	7.0	2.00	N/A (*)	
5) Puk Reusei Kandal	1	21	M.3-237	1992/2/19	25.0	6.0	3.00	INDIA-1	
-- # --	2	22	M.3-247	1992/2/29	33.0	9.0	3.00	INDIA-1	
-- # --	3	23	M.3-248	1992/3/1	22.0	8.0	3.00	INDIA-1	
-- # --	-	-	M.3-249	1992/3/2	31.5	0.0	0.00	-	cannot use
-- # --	4	24	M.3-250	1992/3/2	31.5	9.0	3.00	INDIA-1	
6) Puk Reusei Krom	1	25	M.3-399	1993/5/4	23.0	10.0	2.00	INDIA-3	
-- # --	2	26	M.3-241	1992/2/25	28.0	8.0	2.50	INDIA-1	
-- # --	3	27	M.3-242	1992/2/26	25.0	7.0	3.00	INDIA-1	
-- # --	4	28	M.3-243	1992/2/26	25.0	9.0	3.00	INDIA-1	
-- # --	5	29	M.3-244	1992/2/27	30.0	9.0	2.50	INDIA-1	
<b>Total Number of Wells** =</b>		<b>29</b>		<b>Total***</b>	<b>830.5</b>	<b>216.0</b>	<b>69.00</b>		
				<b>Average***</b>	<b>28.6</b>	<b>7.4</b>	<b>2.38</b>		
<b>3. SANLUNG Commune</b>									
1) Tamei	1	1	M.2- 32	1990/12/15	24.0	3.0	12.00	NO.6	
-- # --	2	2	M.2- 33	1990/12/16	24.0	3.5	10.00	NO.6	
<b>Total Number of Wells** =</b>		<b>2</b>		<b>Total***</b>	<b>48.0</b>	<b>6.5</b>	<b>22.00</b>		
				<b>Average***</b>	<b>24.0</b>	<b>3.3</b>	<b>11.00</b>		

\* : N/A means 'Not Available'.

\*\* : This number shows effective wells.

\*\*\* : These value are the total and average of effective wells.

Source : Department of Rural Water Supply, MRD

**Table G.4.4-(3) Inventory of Drilling-Well in the Boeng Phtea Area**

Name of Village	No.	Total No.	No. of Wells	Date of Construction	Depth of Well (m)	Water Level (m)	Yield (m <sup>3</sup> /s)	Type of Hand-Pump	Remarks
<b>4. VIHEARSOUR Commune</b>									
1) Prei Chas	1	1	M.2- 21	1990/12/5	25.5	3.5	8.00	NO.6	
-- # --	2	2	M.2- 22	1990/12/6	24.0	3.0	5.00	INDIA-1	
-- # --	3	3	M.3-394	1993/4/6	28.0	9.0	3.00	INDIA-3	
2) Seda	1	4	M.2- 23	1990/12/7	23.5	3.7	3.60	INDIA-1	
-- # --	2	5	M.2- 29	1990/12/12	21.5	2.8	10.00	NO.6	
-- # --	3	6	M.3-396	1993/4/9	26.0	9.0	3.00	INDIA-3	
3) Vihearsour Cheung	1	7	M.2- 9	1990/11/15	22.5	3.0	3.60	INDIA-1	
-- # --	2	8	M.2- 10	1990/11/16	24.0	3.0	2.40	INDIA-1	
-- # --	3	9	M.2- 11	1990/11/17	24.0	3.0	2.10	INDIA-1	
-- # --	4	10	M.2- 27	1990/12/10	24.0	2.5	4.50	INDIA-1	
-- # --	5	11	M.2- 73	1991/7/3	23.5	7.0	2.50	INDIA-1	
-- # --	6	12	M.3-401	1993/5/7	27.0	10.0	3.00	INDIA-3	Infirmierie
4) Vihearsour Tbong	1	13	M.2- 8	1990/11/9	21.0	3.5	2.00	NO.6	Hospital Annexe
-- # --	2	14	M.2- 12	1990/11/18	24.0	3.5	2.50	INDIA-1	
-- # --	3	15	M.2- 13	1990/11/19	24.0	3.0	2.50	INDIA-1	
-- # --	4	16	M.2- 20	1990/11/24	26.5	3.0	8.00	NO.6	
-- # --	5	17	M.2- 26	1990/12/9	23.5	3.0	2.30	INDIA-1	
-- # --	6	18	M.2- 28	1990/12/11	24.0	3.2	10.00	NO.6	
-- # --	7	19	M.3-484	1994/3/25	31.0	4.0	2.00	INDIA-3	Ecole
<b>Total Number of Wells** =</b>		<b>19</b>		<b>Total***</b>	<b>467.5</b>	<b>82.7</b>	<b>80.0</b>		
				<b>Average***</b>	<b>24.6</b>	<b>4.4</b>	<b>4.21</b>		
<b>5. PREK AMPIL Commune</b>									
1) Ta Tul	-	-	-	-	-	-	-	-	
<b>Total Number of Wells** =</b>		<b>0</b>		<b>Total***</b>	<b>0.0</b>	<b>0.0</b>	<b>0.00</b>		
				<b>Average***</b>	<b>0.0</b>	<b>0.0</b>	<b>0.00</b>		
<b>Grand total of Wells =</b>		<b>65</b>		<b>Grand Total</b>	<b>1,846.0</b>	<b>448.7</b>	<b>206.50</b>		
				<b>Average***</b>	<b>28.4</b>	<b>6.9</b>	<b>3.18</b>		

\* : N/A means 'Not Available'.

\*\* : This number shows effective wells.

\*\*\* : These value are the total and average of effective wells.

Source : Department of Rural Water Supply, MRD



## **G.5 Development Plan for the Boeng Phtea Area**

### **G.5.1 Rural and Farm Road Networks**

Existing district roads which will be planned to be connected with proposed farm roads play an important role as a basic rural facility for rural people. As the agricultural development in the area is proceeded, marketing and transporting of agricultural products and materials become active while agricultural activity is prospering. According to the rural socio-economic survey, provision of road network is listed as one of priority project.

Taking this situation into consideration, existing district roads should be rehabilitated to establish transportation routes of agricultural products and to contribute to the regional agricultural development and stable rural communication. In the development plan, urgent remedial work should be taken in the partial section of the district road along the Mekong river, between Prek Tamerk and Puk Reusei communes (see Figure G.5.1). In this rehabilitation work, the road surface should be upgraded to gravel-pavement and the slopes should be reshaped with drainage canal improvement (see DRAWINGS for reference). For the on-going rehabilitation partial section of the Phras Konlong road, between Prek Tamerk and Vihearsour, reshaping of the slopes is proposed while borrowed pits of both sides are re-excavated and improved as a canal or water storage band (see DRAWINGS for reference).

### **G.5.2 Rural Water Supply**

Considering the present conditions of rural water supply system, improvement of drinking water supply system is planned as follows.

#### **(1) Area close to the Mekong river, Prek Tamerk, Puk Reusei and Prek Ampil communes**

In the communes, simple water supply system has been provided, in which water storage tanks with unit capacity of about 300 liter, are linked with each other by pipes. Treatment facility, however, is not provided in the tanks. As a short term improvement plan, it is proposed that simple treatment facility by mean of gravel or sand is added to the existing system. It is also recommended that in the medium and long term scheme, water supply systems with deep wells should be provided based on the development study conducting by JICA and MRD.

#### **(2) Far area of the Mekong river, Vihearsour and Sanlung communes**

Tube-wells have been developed so far, which are distributed satisfactorily compared with the other areas and be used well as drinking water source. In the development plan, therefore, it is proposed that maintenance work should be strengthened through the promotion activities of sanitation program by hospitals and schools.

### **G.5.3 Social Infrastructures**

#### **(1) Sanitary facility**

Living environment should be improved as the standard of rural life would be upgraded with the implementation of proposed development plans. For the purpose of improvement of living environment, sanitary improvement should be undertaken in which provision of toilet is the basic requirement. NGOs is implementing the promotion program of toilet facility in the area through the credit system and sanitary training. Sanitary improvement should be proceeded through public assistance and NGOs' activities.

#### **(2) Electricity**

No development plan of public electric supply service in the area has been prepared so far. Although private small scale electric supply system has been provided in the area, public electric supply system should be constructed while the living standard would be upgraded.



## G.6 Cost Estimation

### G.6.1 The Boeng Phtea Study Area

Table G.6.1.1 Summary of the Project Quantity (Boeng Phtea Study Area)

Project	Unit	Quantity	Remarks
<b>Stage - I</b>			
1. Construction of the Farm Roads			
- Length (n=10)	m	36,190	
- Culvert	L.S	12	
- Gate	L.S	6	
2. Rehabilitation of the Reservoirs			
1) Closed type			
- Length (n=21)	m	30,380	
- Intake gate	L.S	25	
- Outlet	L.S	301	
2) Semi-closed type			
- Length (n=11)	m	15,070	
- Outlet	L.S	149	
3. Rehabilitation of the Canals			
- Length (n=1)	m	3,600	Phras Konlong road
4. Construction of the Weir			
	L.S	1	Boeng Phtea
5. Construction of the Intake Gate			
	L.S	1	Slat colmatage canal
6. Agricultural Supporting Service			
- A Building of Supporting Service Office	m <sup>2</sup>	300	
- Facilities & Equipment	L.S	1	
<b>Stage - II</b>			
1. Rehabilitation of the Colmatage Canals			
- Length (n=5)	m	7,260	
2. Expansion of the Colmatage Canals			
- Length (n=4)	m	4,000	
3. Installation of the Intake Gate			
	L.S	4	
4. Construction of the Concrete Bridge			
	L.S	3	
<b>Stage - III</b>			
1. Construction of the Farm Roads			
- Length (n=3)	m	9,880	
- Culvert	L.S	3	
- Gate	L.S	1	
- Bridge	L.S	3	
2. Rehabilitation of the District Road			
- Length (n=2)	m	5,600	
3. Construction of the Concrete Bridge			
	L.S	1	Tamao colmatage canal
4. Construction of the Flood Control Gate			
	L.S	1	Phras Konlong bridge
5. Construction of the Fish Pond			
	L.S	1	



**Table G.6.1.2 Summary of the Project Cost (Boeng Phtea Study Area)**

(Unit : US\$)

Stage - I Description	Amount	Stage - II Description	Amount	Stage - III Description	Amount	Total
1. Construction cost		1. Construction cost		1. Construction cost		
1) Construction of the Farm Roads	1,092,933	1) Rehabilitation of the Colmatage Canals	613,224	1) Construction of the Farm Roads	466,764	2,172,921
2) Rehabilitation of the Reservoirs	2,849,577	2) Expansion of the Colmatage Canals	195,173	2) Rehabilitation of the District Roads	76,464	3,121,214
3) Rehabilitation of the Canals	129,560	3) Installation of the Intake Gate	1,470,852	3) Construction of Concrete Bridge	50,375	1,650,786
4) Construction of the Weir	637,707	4) Construction of the Concrete Bridge	48,326	4) Construction of the Flood Control Gate	586,095	1,272,128
5) Construction of the Intake Gate	149,331			5) Construction of the Fish Pond	125,509	274,840
6) Agricultural Supporting Service	536,575					536,575
Sub - total of 1.	5,395,683	Sub - total of 1.	2,327,575	Sub - total of 1.	1,305,207	9,028,465
2. Administration cost	40,320	2. Administration cost	26,880	2. Administration cost	26,880	94,080
3. Consulting Service	539,568	3. Consulting Service	232,757	3. Consulting Service	130,521	902,846
4. Agricultural Supporting Service	80,820	4. Agricultural Supporting Service	77,720	4. Agricultural Supporting Service	77,720	236,260
<b>Total of (1.-4.)</b>	<b>6,056,391</b>	<b>Total of (1.-4.)</b>	<b>2,664,932</b>	<b>Total of (1.-4.)</b>	<b>1,540,328</b>	<b>10,261,651</b>
5. Physical Contingency	605,639	5. Physical Contingency	266,493	5. Physical Contingency	154,033	1,026,165
<b>Total of (1.-5.)</b>	<b>6,662,030</b>	<b>Total of (1.-5.)</b>	<b>2,931,425</b>	<b>Total of (1.-5.)</b>	<b>1,694,361</b>	<b>11,287,816</b>

**Table G.6.1.3 (1) Project Cost of Stage - I, Boeng Phtea Study Area**

Unit: U.S.\$

Description	1st year		2nd year		3rd year		4th year		Total		
	L.C	F.C	L.C	F.C	L.C	F.C	L.C	F.C	L.C	F.C	total
<b>1. Construction Cost</b>											
1) Construction of the Farm Roads	21,681	87,612	86,723	350,450	108,404	438,062			216,808	876,125	1,092,953
2) Rehabilitation of the Reservoirs	53,758	231,200	215,031	924,800	268,789	1,155,999			537,578	2,311,999	2,849,577
3) Rehabilitation of the Canals			6,360	26,030	19,080	78,091			25,439	104,121	129,560
4) Construction of the Weir			53,336	201,747	80,003	302,621			133,339	504,368	637,707
5) Construction of the Intake Gate			8,887	103,111	2,962	34,370			11,849	137,482	149,331
6) Agricultural Supporting Service	5,198	155,775	6,930	207,700	5,198	155,775			17,325	519,250	536,575
Sub total of 1.	80,636	474,587	377,267	1,813,838	484,436	2,164,919			942,339	4,453,344	5,395,683
<b>2. Project Administration</b>									40,320		40,320
3. Consulting Service (10% of 1.)											
1) Detail Design (40% of 3.)		215,827								215,827	215,827
2) Construction Supervision (60% of 3.)		32,374		129,496		161,870				323,741	323,741
Sub total of 3.		248,201		129,496		161,870				539,568	539,568
4. Agricultural Supporting Activity											
1) Agricultural Supporting Activity	23,840	3,100	23,840	3,100	23,840	3,100			71,520	9,300	80,820
<b>Total of 1-4.</b>	117,916	725,889	414,547	1,946,435	521,716	2,329,889			1,054,179	5,002,212	6,056,391
5. Physical Contingency (1.-4.)*10%	11,792	72,589	41,455	194,643	52,172	232,989			105,418	500,221	605,639
<b>Grand Total of 1-5.</b>	129,708	798,478	456,001	2,141,078	573,887	2,562,878			1,159,597	5,502,434	6,662,030
(L.C + F.C)		(928,185)		(2,597,079)		(3,136,765)					

Table G.6.1.3 (2) Project Cost of Stage - II, Boeng Phtea Study Area

Unit : US\$

Description	1st year		2nd year		3rd year		4th year		Total		
	L.C	F.C	L.C	F.C	L.C	F.C	L.C	F.C	L.C	F.C	total
1. Construction Cost											
1) Rehabilitation of the Colmatage Canals	80,363	103,604	187,515	241,742					267,878	345,346	613,224
2) Expansion of the Colmatage Canals	34,876	25,676	81,378	55,244					116,254	78,919	195,173
3) Installation of the Intake Gate	17,691	276,480	70,763	1,105,919					88,453	1,382,398	1,470,852
4) Construction of the Concrete Bridge			7,457	40,868					7,457	40,868	48,326
Sub total of 1.	132,930	403,759	347,112	1,443,775					480,042	1,847,532	2,327,575
2. Project Administration	13,440		13,440						26,880		26,880
3. Consulting Service (10% of 1.)											
1) Detail Design (40% of 3.)		93,103								93,103	93,103
2) Construction Supervision (60% of 3.)		41,896								139,654	139,654
Sub total of 3.		134,999								232,757	232,757
4. Agricultural Supporting Activity	35,760	3,100	35,760	3,100					71,520	6,200	77,720
Total of 1.-4.	182,150	541,859	396,312	1,544,631					578,442	2,086,489	2,664,932
5. Physical Contingency (1.-4.) * 10%	18,215	54,186	39,631	154,463					57,844	208,649	266,493
Grand Total of 1.-5.	200,345	596,044	435,943	1,699,094					636,287	2,295,138	2,931,425
(L.C + F.C)		(796,388)		(2,135,038)							

**Table G.6.1.3 (3) Project Cost of Stage - III, Boeng Phtea Study Area**

Unit : U.S.S

Description	1st year		2nd year		3rd year		4th year		Total		
	L.C	F.C	L.C	F.C	L.C	F.C	L.C	F.C	L.C	F.C	total
<b>1. Construction Cost</b>											
1) Construction of the Farm Roads	27,213	112,816	63,497	263,238					90,710	376,054	466,764
2) Rehabilitation of the District Roads	19,274	3,665	44,974	8,551					64,248	12,216	76,464
3) Construction of Concrete Bridge	1,748	8,326	6,994	33,306					8,742	41,632	50,375
4) Construction of the Flood Control Gate	6,476	110,743	25,902	442,974					32,378	553,717	586,095
5) Construction of the Fish Pond			14,190	111,319					14,190	111,319	125,509
Sub total of 1.	54,712	235,551	155,557	859,388					210,268	1,094,939	1,305,207
<b>2. Project Administration</b>	13,440		13,440						26,880		26,880
<b>3. Consulting Service (10% of 1.)</b>											
1) Detail Design (40% of 3.)		52,208								52,208	52,208
2) Construction Supervision (60% of 3.)		23,494								78,312	78,312
Sub total of 3.		75,702								130,521	130,521
<b>4. Agricultural Supporting Activity</b>	55,760	3,100	35,760	3,100					71,520	6,200	77,720
<b>Total of 1.-4.</b>	103,912	314,553	204,757	917,307					308,668	1,231,660	1,540,328
<b>5. Physical Contingency (1.-4.)*10%</b>	10,391	31,455	20,476	91,731					30,867	123,166	154,033
<b>Grand Total of 1.-5.</b>	114,303	345,788	225,232	1,009,038					339,535	1,554,826	1,694,361
(L.C + F.C)		(460,091)		(1,234,270)							

Table G.6.1.4 (I) Construction Cost of Stage - I, Boeng Phtea Study Area

Unit: US \$

Description	Quantity	Labour & materials		Machinery cost			Total cost		
		Implement cost		Depre F.C.	Running cost		L.C.	F.C.	Total
		L.C.	F.C.		L.C.	F.C.			
<b>1. Construction of the Farm roads</b>									
1.1 Earth works (m)	36,190	130,592		566,469	34,030	59,900	164,622	626,369	790,991
1.2 Appurtenant structures (L.S)	1	22,817	128,966	2,911	274	303	23,091	132,181	155,272
① = Sub-total of (1.1+1.2)		153,410	128,966	569,380	34,303	60,203	187,713	758,550	946,262
② = O&M and benefit (+ 10 % of Sub-total ①)		15,341	12,897	56,938	3,430	6,020	18,771	75,855	94,626
③ = Tax, etc. (5 % of ① + ②)		8,438	7,093	31,316	1,887	3,311	10,324	41,720	52,044
Total of 1. (= ① + ② + ③)		177,188	148,956	657,634	39,620	69,535	216,808	876,125	1,092,933
<b>2. Rehabilitation of the Reservoirs</b>									
<b>2.1 Closed type reservoirs</b>									
(1) Earth works (m)	30,380	217,123		997,717	81,404	109,192	298,527	1,106,909	1,405,436
(2) Appurtenant structures (L.S)	1	116,320	657,272	29,794	3,037	3,365	119,357	690,431	809,788
<b>2.2 Semi-closed type reservoirs</b>									
(1) Earth works (m)	15,070	21,168		66,151	3,689	6,946	24,857	73,097	97,955
(2) Appurtenant structures (L.S)	1	21,497	118,226	11,742	1,197	1,326	22,694	131,294	153,987
① = Sub-total of (2.1+2.2)		376,107	775,497	1,105,404	89,328	120,829	465,435	2,001,731	2,467,166
② = O&M and benefit (+ 10 % of Sub-total ①)		37,611	77,550	110,540	8,933	12,083	46,544	200,173	246,717
③ = Tax, etc. (5 % of ① + ②)		20,686	42,652	60,797	4,913	6,646	25,599	110,095	135,694
Total of 2. (= ① + ② + ③)		434,404	895,699	1,276,742	103,174	139,558	537,578	2,311,999	2,849,577
<b>3. Rehabilitation of the Canals (Phras konlong road)</b>									
Earth works (m)	3,600	14,693		81,145	7,332	9,003	22,026	90,148	112,173
① = Sub-total		14,693		81,145	7,332	9,003	22,026	90,148	112,173
② = O&M and benefit (+ 10 % of Sub-total ①)		1,469		8,114	733	900	2,203	9,015	11,217
③ = Tax, etc. (5 % of ① + ②)		808		4,463	403	495	1,211	4,958	6,170
Total of 3. (= ① + ② + ③)		16,971		93,722	8,469	10,398	25,439	104,121	129,560
<b>4. Construction of the Weir at Boeng Phtea</b>									
Weir at Boeng Phtea (Nos)	1	115,228	434,118	2,324	217	240	115,445	436,682	552,127
① = Sub-total		115,228	434,118	2,324	217	240	115,445	436,682	552,127
② = O&M and benefit (+ 10 % of Sub-total ①)		11,523	43,412	232	22	24	11,545	43,668	55,213
③ = Tax, etc. (5 % of ① + ②)		6,339	23,876	128	12	13	6,349	24,018	30,367
Total of 4. (= ① + ② + ③)		133,089	501,406	2,684	250	278	133,339	504,368	637,707
<b>5. Construction of Intake gate (Slat Colmatage canal)</b>									
Intake gate (Nos)	1	10,192	118,032	876	67	124	10,259	119,032	129,291
① = Sub-total		10,192	118,032	876	67	124	10,259	119,032	129,291
② = O&M and benefit (+ 10 % of Sub-total ①)		1,019	11,803	88	7	12	1,026	11,903	12,929
③ = Tax, etc. (5 % of ① + ②)		561	6,492	43	4	7	564	6,547	7,111
Total of 5. (= ① + ② + ③)		11,771	136,327	1,012	77	143	11,849	137,482	149,331
<b>6. Agricultural supporting service</b>									
<b>6.1 Building of supporting service office (m<sup>2</sup>)</b>									
6.1 Building of supporting service office (m <sup>2</sup> )	300	15,000	60,000				15,000	60,000	75,000
① = Sub-total		15,000	60,000				15,000	60,000	75,000
② = O&M and benefit (+ 10 % of Sub-total ①)		1,500	6,000				1,500	6,000	7,500
③ = Tax, etc. (5 % of ① + ②)		825	3,300				825	3,300	4,125
Total of 6.1 (= ① + ② + ③)		17,325	69,300				17,325	69,300	86,625
<b>6.2 Equipment of Agricultural supporting service</b>									
Procurement of equipment (L.S)	1		419,950					419,950	419,950
Total of 6. (= 6.1+6.2)		17,325	519,250				17,325	519,250	536,575
<b>Grand total of 1.-6.</b>		790,748	2,201,639	2,031,793	151,590	219,912	942,339	4,453,344	5,395,683

Table G.6.1.4 (2) Construction Cost of Stage - II, Boeng Phtea Study Area

Unit : US \$

Description	Quantity	Labour & materials		Machinery cost			Total cost		
		Implemet cost		Depre	Running cost		I.C	F.C.	Total
		L.C	F.C	F.C	L.C	F.C.			
<b>1. Rehabilitation of the Colmatage canals (m)</b>	7,260	207,624		269,142	24,305	29,859	231,929	299,001	530,930
① = Sub-total		207,624		269,142	24,305	29,859	231,929	299,001	530,930
② = O&M and benefit + 10 % of Sub-total ①		20,762		26,914	2,431	2,986	23,193	29,900	53,093
③ = Tax, etc, . . . . . 5 % of ① + ②		11,419		14,803	1,337	1,642	12,756	16,445	29,201
<b>Total of 1. (=① + ② + ③)</b>		<b>239,805</b>		<b>310,859</b>	<b>28,073</b>	<b>34,487</b>	<b>267,878</b>	<b>345,346</b>	<b>613,224</b>
<b>2. Expansion of the Colmatage canals (m)</b>	4,000	95,514		61,570	5,139	6,758	100,653	68,328	168,981
① = Sub-total		95,514		61,570	5,139	6,758	100,653	68,328	168,981
② = O&M and benefit + 10 % of Sub-total ①		9,551		6,157	514	676	10,065	6,833	16,898
③ = Tax, etc, . . . . . 5 % of ① + ②		5,253		3,386	283	372	5,536	3,758	9,294
<b>Total of 2. (=① + ② + ③)</b>		<b>110,319</b>		<b>71,114</b>	<b>5,935</b>	<b>7,806</b>	<b>116,254</b>	<b>78,919</b>	<b>195,173</b>
<b>3. Installation of the Intake gates (Nos.)</b>	4	76,080	1,189,016	6,867	503	999	76,583	1,196,882	1,273,465
① = Sub-total		76,080	1,189,016	6,867	503	999	76,583	1,196,882	1,273,465
② = O&M and benefit + 10 % of Sub-total ①		7,608	118,902	687	50	100	7,658	119,688	127,346
③ = Tax, etc, . . . . . 5 % of ① + ②		4,184	65,396	378	28	55	4,212	65,828	70,041
<b>Total of 3. (=① + ② + ③)</b>		<b>87,872</b>	<b>1,373,313</b>	<b>7,931</b>	<b>581</b>	<b>1,154</b>	<b>88,453</b>	<b>1,382,398</b>	<b>1,470,852</b>
<b>4. Construction of Concrete bridges (Nos.)</b>	3	6,357	34,080	1,153	100	150	6,457	35,384	41,841
① = Sub-total		6,357	34,080	1,153	100	150	6,457	35,384	41,841
② = O&M and benefit + 10 % of Sub-total ①		636	3,408	115	10	15	646	3,538	4,184
③ = Tax, etc, . . . . . 5 % of ① + ②		350	1,874	63	5	8	355	1,946	2,301
<b>Total of 4. (=① + ② + ③)</b>		<b>7,342</b>	<b>39,362</b>	<b>1,331</b>	<b>115</b>	<b>174</b>	<b>7,457</b>	<b>40,868</b>	<b>48,326</b>
<b>Grand total of 1.-4.</b>		<b>445,339</b>	<b>1,412,676</b>	<b>391,236</b>	<b>34,704</b>	<b>43,620</b>	<b>480,042</b>	<b>1,847,532</b>	<b>2,327,575</b>

Table G.6.1.4 (3) Construction Cost of Stage - III, Boeng Phtea Study Area

Unit : US \$

Description	Quantity	Labour & materials		Machinery cost			Total cost		
		Implemet cost		Depre	Running cost		L.C	F.C.	Total
		L.C	F.C	F.C	L.C	F.C.			
<b>1. Construction of the Farm roads</b>									
1.1 Earth works (m)	9,880	57,253		267,675	12,409	27,673	69,662	295,348	365,010
1.2 Appurtenant structures (L.S)	1	8,784	28,964	1,135	91	141	8,875	30,240	39,115
① = Sub-total of (1.1+1.2)		66,037	28,964	268,810	12,500	27,814	78,537	325,588	404,125
② = O&M and benefit + 10 % of Sub-total ①		6,604	2,896	26,881	1,250	2,781	7,854	32,559	40,413
③ = Tax, etc, . . . . . 5 % of ① + ②		3,632	1,593	14,785	688	1,530	4,320	17,907	22,227
<b>Total of 1. (=① + ② + ③)</b>		<b>76,272</b>	<b>33,454</b>	<b>310,475</b>	<b>14,438</b>	<b>32,126</b>	<b>90,710</b>	<b>376,054</b>	<b>466,764</b>
<b>2. Rehabilitation of the District roads</b>									
Earth works (m)	5,600	55,128		9,660	499	917	55,626	10,577	66,203
① = Sub-total		55,128		9,660	499	917	55,626	10,577	66,203
② = O&M and benefit + 10 % of Sub-total ①		5,513		966	50	92	5,563	1,058	6,620
③ = Tax, etc, . . . . . 5 % of ① + ②		3,032		531	27	50	3,059	582	3,641
<b>Total of 2. (=① + ② + ③)</b>		<b>63,672</b>		<b>11,157</b>	<b>576</b>	<b>1,059</b>	<b>64,248</b>	<b>12,216</b>	<b>76,464</b>
<b>3. Construction of concrete bridge (L.S)</b>	1	7,499	35,120	818	70	108	7,569	36,045	43,614
① = Sub-total		7,499	35,120	818	70	108	7,569	36,045	43,614
② = O&M and benefit + 10 % of Sub-total ①		750	3,512	83	7	11	757	3,605	4,361
③ = Tax, etc, . . . . . 5 % of ① + ②		412	1,932	45	4	6	416	1,982	2,399
<b>Total of 3. (=① + ② + ③)</b>		<b>8,662</b>	<b>40,564</b>	<b>944</b>	<b>81</b>	<b>124</b>	<b>8,742</b>	<b>41,632</b>	<b>50,375</b>
<b>4. Construction of the Flood control gate (L.S)</b>	1	27,848	476,476	2,558	184	375	28,033	479,409	507,442
① = Sub-total		27,848	476,476	2,558	184	375	28,033	479,409	507,442
② = O&M and benefit + 10 % of Sub-total ①		2,785	47,648	256	18	38	2,803	47,941	50,744
③ = Tax, etc, . . . . . 5 % of ① + ②		1,532	26,206	141	10	21	1,542	26,367	27,909
<b>Total of 4. (=① + ② + ③)</b>		<b>32,165</b>	<b>550,330</b>	<b>2,954</b>	<b>213</b>	<b>434</b>	<b>32,378</b>	<b>553,717</b>	<b>586,095</b>
<b>5. Construction of the Fish pond (L.S)</b>	1	7,025	30,000	59,773	5,261	6,608	12,285	96,380	108,666
① = Sub-total		7,025	30,000	59,773	5,261	6,608	12,285	96,380	108,666
② = O&M and benefit + 10 % of Sub-total ①		703	3,000	5,977	526	661	1,229	9,638	10,867
③ = Tax, etc, . . . . . 5 % of ① + ②		386	1,650	3,288	289	363	676	5,301	5,977
<b>Total of 5. (=① + ② + ③)</b>		<b>8,113</b>	<b>34,650</b>	<b>69,038</b>	<b>6,076</b>	<b>7,632</b>	<b>14,190</b>	<b>111,319</b>	<b>125,509</b>
<b>Grand total of 1.-5.</b>		<b>188,884</b>	<b>658,997</b>	<b>391,568</b>	<b>21,384</b>	<b>41,374</b>	<b>210,268</b>	<b>1,094,939</b>	<b>1,305,207</b>

Table G.6.1.5 (1) Cost of Improvement Works for Stage - I, Boeng Phtea Area

		Unit: US \$										
Description	Unit	Quantity	Labour & materials				Machinery cost			Total cost		
			Unit cost		Inplement cost		Depre	Running cost		I.C.	F.C.	Total
			I.C.	F.C.	I.C.	F.C.	F.C.	I.C.	F.C.			
<b>1. Construction of the Farm roads</b>												
<b>1.1 Earth works (L = 36,190 m)</b>												
Stripping - Bulldozer 11t (ratio)	m2	365,062					70,135	3,251	7,251	3,251	77,386	80,637
Excavation - Backhoe 0.35m3 (0.90)	m3	169,200					139,767	11,248	15,785	14,248	155,552	169,800
V = 158,000 m3 - Manual (0.10)	m3	18,800	1.50		28,200					28,200		28,200
Fill & compaction - Bulldozer 11t (0.90)	m3	467,191					356,567	16,530	36,861	16,530	393,430	409,961
V = 519,105 m3 - Manual (0.10)	m3	51,910	0.80		41,658					41,658		41,658
Slope trimming - Manual	m2	303,671	0.20		60,734					60,734		60,734
Sub-total of 1.1					130,592		566,469	34,030	59,900	164,622	626,369	790,991
<b>1.2 Appurtenant structures</b>												
(1) Culvert - Type - I	Nos	5			1,771	8,634	626	52	58	1,823	9,318	11,141
- Type - II	Nos	7			1,939	8,572	695	59	66	1,998	9,332	11,330
(2) Gate - Type - I	Nos	4			14,659	88,000	1,219	124	138	14,783	89,357	104,140
- Type - II	Nos	2			4,419	23,760	372	38	42	4,487	24,174	28,661
(3) Bridge - Type - I	Nos	0										
- Type - II	Nos	0										
Sub-total of 1.2					22,817	128,966	2,911	274	303	23,091	132,181	155,272
Total of 1.					153,410	128,966	569,380	34,303	60,203	187,713	758,550	946,262
<b>2. Rehabilitation of the Reservoirs</b>												
<b>2.1 Closed type reservoirs</b>												
<b>(1) Earth works (L = 30,380 m)</b>												
Stripping - Bulldozer 11t (ratio)	m2	339,740					65,270	3,026	6,748	3,026	72,018	75,044
Excavation - Backhoe 0.35m3 (0.90)	m3	765,576					632,400	64,469	71,424	64,469	703,824	768,293
V = 850,640 m3 - Manual (0.10)	m3	85,064	1.50		127,596					127,596		127,596
Fill & compaction - Bulldozer 11t (0.90)	m3	393,138					300,047	13,910	31,020	13,910	331,067	344,977
V = 436,820 m3 - Manual (0.10)	m3	43,682	0.80		35,055					35,055		35,055
Slope trimming - Manual	m2	272,360	0.20		54,472					54,472		54,472
Sub-total of 2.1(1)					217,123		997,717	81,404	109,192	298,527	1,106,909	1,405,436
<b>(2) Appurtenant structures</b>												
a. Intake gate - Type - I	Nos	12			43,976	264,000	3,658	373	413	44,349	268,071	312,420
- Type - II	Nos	13			28,918	154,440	2,416	246	273	29,165	157,129	186,294
b. Outlet	Nos	301			43,426	238,832	23,720	2,418	2,679	45,844	265,231	311,075
Sub-total of 2.1(2)					116,320	657,272	29,794	3,037	3,365	119,357	690,431	809,788
Total of 2.1(1)-(2)					333,443	657,272	1,027,511	84,442	112,557	417,885	1,797,340	2,215,224
<b>2.2 Semi-closed type reservoirs</b>												
<b>(1) Earth works (L = 15,070 m)</b>												
Stripping - Bulldozer 11t (ratio)	m2	135,630					26,057	1,208	2,694	1,208	28,751	29,959
Excavation - Backhoe 0.35m3 (0.90)	m3	13,563					11,201	1,142	1,265	1,142	12,469	13,611
V = 15,070 m3 - Manual (0.10)	m3	1,507	1.50		2,261					2,261		2,261
Fill & compaction - Bulldozer 11t (0.90)	m3	37,854					28,891	1,339	2,987	1,339	31,877	33,217
V = 42,060 m3 - Manual (0.10)	m3	4,206	0.80		3,375					3,375		3,375
Slope trimming - Manual	m2	77,660	0.20		15,532					15,532		15,532
Sub-total of 2.2(1)					21,168		66,151	3,689	6,946	24,857	73,097	97,955
<b>(2) Appurtenant structures</b>												
Outlet	Nos	149			21,497	118,226	11,742	1,197	1,326	22,694	131,294	153,987
Total of 2.2(1)-(2)					42,664	118,226	77,893	4,886	8,272	47,551	204,391	251,942
Total of 2					376,107	775,497	1,105,404	89,328	120,829	465,435	2,001,731	2,467,166
<b>3. Rehabilitation of the Canals (Phras konlong road)</b>												
<b>Earth works (L = 3,600 m)</b>												
Stripping - Bulldozer 11t (ratio)	m2	10,800					2,075	96	215	96	2,289	2,386
Excavation - Backhoe 0.35m3 (0.90)	m3	77,760					64,233	6,548	7,255	6,548	71,488	78,036
V = 86,400 m3 - Manual (0.10)	m3	8,640	1.50		12,960					12,960		12,960
Fill & compaction - Bulldozer 11t (0.90)	m3	19,440					14,837	688	1,531	688	16,371	17,059
V = 21,600 m3 - Manual (0.10)	m3	2,160	0.80		1,733					1,733		1,733
Slope trimming - Manual	m2		0.20									
Total of 3					14,693		81,145	7,332	9,003	22,026	90,148	112,173
<b>4. Construction of the Weir at Boeng Phtea</b>												
Weir at Boeng Phtea	Nos	1			115,228	434,118	2,324	217	240	115,445	436,682	552,127
<b>5. Construction of Intake gate (Stat Colmatage canal)</b>												
Intake gate - Type - B	Nos	1			10,192	118,052	876	67	124	10,259	119,052	129,291
<b>6. Agricultural supporting service</b>												
Building of supporting service office	m2	300	50.0	200.0	15,000	60,000				15,000	60,000	75,000
Total of 1.- 6.					681,630	1,516,614	1,759,128	131,247	190,460	815,878	3,466,142	4,282,020

Table G.6.1.5 (2) Cost of Improvement Works for Stage - II, Boeng Phtea Area

Unit : US \$

Description	Unit	Quantity	Labour & materials				Machinery cost			Total cost		
			Unit cost		Implement cost		Depre	Running cost		L.C.	F.C.	Total
			L.C.	F.C.	L.C.	F.C.		F.C.	L.C.			
<b>I. Rehabilitation of the Colmatage canals</b>												
- Type - B	m	2,000			48,949		33,450	2,815	3,676	51,764	37,126	88,889
- Type - E	m	5,260			158,673		235,692	21,490	26,183	180,165	261,875	442,040
Sub-total of 1		7,260			207,624		269,142	24,305	29,859	231,929	299,001	530,930
<b>2. Expansion of the Colmatage canals</b>												
- Type - A	m	2,800			64,346		31,901	2,548	3,491	66,893	35,484	102,378
- Type - C	m	1,200			31,168		29,577	2,591	3,268	33,759	32,811	66,601
Sub-total of 2	m	4,000			95,514		61,570	5,139	6,758	100,653	68,328	168,981
<b>3. Installation of the Intake gates</b>												
- Type - B	Nos	2			20,381	236,064	1,752	131	248	20,518	238,061	258,582
- Type - E	Nos	2			55,696	952,932	5,115	369	751	56,065	958,818	1,014,883
Sub-total of 3	Nos	4			76,080	1,189,016	6,867	503	999	76,583	1,196,883	1,273,465
<b>4. Construction of Concrete bridges</b>												
- Type - A	Nos	3			6,357	34,080	1,153	100	150	6,457	35,381	41,841
Sub-total of 4	Nos	3			6,357	34,080	1,153	100	150	6,457	35,381	41,841
<b>Total of 1.- 4.</b>					<b>385,571</b>	<b>1,223,076</b>	<b>338,732</b>	<b>30,047</b>	<b>37,767</b>	<b>415,621</b>	<b>1,599,595</b>	<b>2,015,216</b>

Table G.6.1.5 (3) Cost of Improvement Works for Stage - III, Boeng Phtea Area

Unit : US \$

Description	Unit	Quantity	Labour & materials				Machinery cost			Total cost		
			Unit cost		Implement cost		Depre	Running cost		L.C.	F.C.	Total
			L.C.	F.C.	L.C.	F.C.		F.C.	L.C.			
<b>I. Construction of the Farm roads</b>												
<b>I.1 Earth works (L = 9,880 m)</b>												
Stripping - Bulldozer 11t	m2	162,096					31,142	1,411	3,220	1,411	34,361	35,805
Excavation - Backhoe 0.35m3 (0.90)	m3											
V= 0 m3 - Manual (0.10)	m3		1.50				236,533	10,965	24,451	10,965	260,987	271,952
Fill & compaction - Bulldozer 11t (0.90)	m3	309,919										
V= 344,354 m3 - Manual (0.10)	m3		0.80		27,634					27,634		27,634
Slope trimming - Manual	m2	148,090		0.20	29,618					29,618		29,618
Sub-total of I.1					57,253		267,675	12,409	27,673	69,662	295,348	365,010
<b>I.2 Appurtenant structures</b>												
(1) Culvert - Type - I	Nos	3			1,062	5,180	376	31	35	1,091	5,591	6,685
(2) Gate - Type - II	Nos	1			2,224	11,880	186	19	21	2,243	12,087	14,330
(3) Bridge - Type - I	Nos	3			5,497	11,901	574	41	85	5,538	12,563	18,100
Sub-total of I.2					8,784	28,961	1,135	91	141	8,875	30,240	39,115
<b>Total of I.</b>					<b>66,037</b>	<b>28,961</b>	<b>268,810</b>	<b>12,500</b>	<b>27,814</b>	<b>78,537</b>	<b>325,588</b>	<b>404,125</b>
<b>2. Rehabilitation of the District roads</b>												
<b>Earth works (L = 5,600 m)</b>												
Stripping - Bulldozer 11t	m2	16,800					3,228	150	334	150	3,561	3,711
Levelling - Motor Grader 2.2m (ratio)	m2	22,680					2,366	160	163	160	2,528	2,689
Excavation - Backhoe 0.35m3 (0.90)	m3											
V= 0 m3 - Manual (0.10)	m3		1.50									
Fill & compaction - Bulldozer 11t (0.90)	m3	5,328					4,065	189	420	189	4,487	4,675
V= 5,920 m3 - Manual (0.10)	m3		0.80		475					475		475
Slope trimming - Manual	m2	2,263		0.20	453					453		453
Gravel pavement	m2	10,000		5.42	54,200					54,200		54,200
<b>Total of 2</b>					<b>55,128</b>		<b>9,660</b>	<b>490</b>	<b>917</b>	<b>55,626</b>	<b>10,577</b>	<b>66,203</b>
<b>3. Construction of concrete bridge</b>												
Bridge at Tamao colmatage - Type - E *	Nos	1			2,499	35,120	818	70	103	7,569	36,015	43,614
<b>4. Construction of the Flood control gate</b>												
Flood control gate - Type - E	Nos	1			27,848	476,476	2,558	184	375	28,033	479,409	507,442
<b>5. Construction of the Fish pond</b>												
Fish pond	Nos	1			7,025	30,000	59,773	5,261	6,608	12,285	96,380	108,666
<b>Total of 1.- 5.</b>					<b>163,536</b>	<b>570,560</b>	<b>311,617</b>	<b>18,514</b>	<b>35,822</b>	<b>182,050</b>	<b>917,999</b>	<b>1,130,050</b>



Table G.6.1.6 Unit Cost Table of the Respective Works, Boeng Phtea Area

									Unit: US \$
Description	Quantity	Labour & materials		Machinery cost		Total cost			
		Implemet cost		Depre	Running cost		I.C	F.C	Total
		I.C	F.C		L.C	F.C			
<b>Stage - I</b>									
1. Construction of the Farm roads									
1.1 Earth works (m)	36,190	130,592		566,469	34,030	59,900	164,622	626,369	790,991
1.2 Appurtenant structures									
(1) Culvert - Type - I (L.S)	1	354.1	1,726.8	125.2	10.5	11.6	364.6	1,863.6	2,228.2
- Type - II (L.S)	1	277.0	1,224.6	99.2	8.4	9.4	285.4	1,333.2	1,618.6
(2) Gate - Type - I (L.S)	1	3,664.7	22,000.0	304.8	31.1	34.4	3,695.7	22,339.2	26,035.0
- Type - II (L.S)	1	2,224.5	11,880.0	185.9	18.9	21.0	2,243.4	12,086.9	14,330.3
(3) Bridge - Type - I (L.S)	1	1,832.4	3,968.0	191.2	13.5	28.3	1,846.0	4,187.5	6,033.5
- Type - II (L.S)	1	1,619.9	3,456.0	146.2	10.4	21.6	1,630.3	3,623.7	5,251.1
2. Rehabilitation of the Reservoirs									
2.1 Closed type reservoirs									
(1) Earth works (m)	30,380	217,123		997,717	81,404	109,192	298,527	1,106,909	1,405,436
(2) Appurtenant structures									
a. Intake gate - Type - I (L.S)	1	3,664.7	22,000.0	304.8	31.1	34.4	3,695.7	22,339.2	26,035.0
- Type - II (L.S)	1	2,224.5	11,880.0	185.9	18.9	21.0	2,243.4	12,086.9	14,330.3
b. Outlet (L.S)	1	144.3	793.5	78.8	8.0	8.9	152.3	881.2	1,033.5
2.2 Semi-closed type reservoirs									
(1) Earth works (m)	15,070	21,168		66,151	3,689	6,946	24,857	73,097	97,955
(2) Appurtenant structures									
Outlet (L.S)	1	144.3	793.5	78.8	8.0	8.9	152.3	881.2	1,033.5
3. Rehabilitation of the Canals (Phras kenlong road)									
Earth works (m)	3,600	14,693		81,145	7,332	9,003	22,026	90,148	112,173
4. Construction of the Weir at Boeng Phtea									
Weir at Boeng Phtea (L.S)	1	115,228	434,118	2,324	217	240	115,445	436,682	552,127
5. Construction of Intake gate (Slat Colmatage canal)									
Intake gate - Type - B (L.S)	1	10,192	118,032	876	67	124	10,259	119,032	129,291
6. Agricultural supporting service									
Building of supporting survice office (m2)	1	50.0	200.0				50.0	200.0	250.0
<b>Stage - II</b>									
1. Rehabilitation/Expansion of Colmatage canal									
- Type - A (m)	1.0	23.0		11.4	0.9	1.2	23.9	12.7	36.6
- Type - B (m)	1.0	24.5		16.7	1.4	1.8	25.9	18.6	44.4
- Type - C (m)	1.0	26.0		24.6	2.2	2.7	28.1	27.4	55.5
- Type - D (m)	1.0	28.1		33.9	3.0	3.8	31.1	37.6	68.7
- Type - E (m)	1.0	30.2		44.8	4.1	5.0	34.3	49.8	84.0
2. Installation of the Intake gate									
- Type - A (L.S)	1	6,169	42,064	412	32	58	6,201	42,533	48,734
- Type - B (L.S)	1	10,192	118,032	876	67	124	10,259	119,032	129,291
- Type - C (L.S)	1	13,644	177,696	1,096	83	156	13,727	178,945	192,676
- Type - D (L.S)	1	21,445	344,292	1,943	141	284	21,586	346,520	368,106
- Type - E (L.S)	1	27,818	476,476	2,558	184	375	28,033	479,409	507,442
3. Construction of Concrete bridge									
- Type - A (L.S)	1	2,119	11,360	384	33	50	2,152	11,795	13,947
- Type - B (L.S)	1	4,186	21,120	509	43	68	4,229	21,697	25,926
- Type - C (L.S)	1	4,676	22,720	545	47	72	4,723	23,337	28,060
- Type - D (L.S)	1	5,403	24,800	603	53	78	5,455	25,481	30,937
- Type - E (L.S)	1	7,499	35,120	818	70	108	7,569	36,045	43,614
<b>Stage - III</b>									
1. Construction of the Farm roads									
1.1 Earth works (m)	9,880	57,253		267,675	12,409	27,673	69,662	295,348	365,010
1.2 Appurtenant structures									
(1) Culvert - Type - I (L.S)	1	354.1	1,726.8	125.2	10.5	11.6	364.6	1,863.6	2,228.2
- Type - II (L.S)	1	277.0	1,224.6	99.2	8.4	9.4	285.4	1,333.2	1,618.6
(2) Gate - Type - I (L.S)	1	3,664.7	22,000.0	304.8	31.1	34.4	3,695.7	22,339.2	26,035.0
- Type - II (L.S)	1	2,224.5	11,880.0	185.9	18.9	21.0	2,243.4	12,086.9	14,330.3
(3) Bridge - Type - I (L.S)	1	1,832.4	3,968.0	191.2	13.5	28.3	1,846.0	4,187.5	6,033.5
- Type - II (L.S)	1	1,619.9	3,456.0	146.2	10.4	21.6	1,630.3	3,623.7	5,251.1
2. Rehabilitation of the District roads									
Earth works (m)	5,600	55,128		9,660	499	917	55,626	10,577	66,203
3. Construction of concrete bridge									
Bridge at Tamao colmatage (L.S) - Type - E *	1	7,499	35,120	818	70	108	7,569	36,045	43,614
4. Construction of the Flood control gate									
Flood control gate (L.S) - Type - E	1	27,818	476,476	2,558	184	375	28,033	479,409	507,442
5. Construction of the Fish pond									
Fish pond (L.S)	1	7,024.6	30,000.0	59,772.8	5,260.9	6,607.7	12,285.4	96,380.4	108,665.9

**Table G.6.1.7 Cost of Agricultural Supporting Service Project**

**1. Procurement of Equipment (Stage-1)**

Unit: US \$

Description	Unit cost		Quantity	Amount		Remarks
	L.C	F.C		L.C	F.C	
1. Machine & Vehicle						
4WD vehicle		19,500	1		19,500	
Motorcycle 100cc		1,400	40		56,000	
Mobile pump		350	111		38,850	
Tractor		22,000	5		110,000	
Weed cutter		600	15		9,000	
Backhoe 0.2m3		54,900	1		54,900	
Bulldozer 11t		94,800	1		94,800	
Dump truck 6t		56,900	1		56,900	
Sub - total					439,950	
2. Others						
Office supplies, etc.			1		10,000	
Total of 1.- 2.					449,950	

**2. Personnel Cost**

Unit: US \$

Description	Unit Cost (US \$/Month)		Stage - I (3-year)			Stage - II (2-year)			Stage - III (2-year)		
	L.C	F.C	Quantity (MM)	Amount		Quantity	Amount		Quantity	Amount	
				L.C	F.C		L.C	F.C		L.C	F.C
1. Experts											
Agriculture	4,000		5.0	20,000		5.0	20,000				
Irrigation/Drainage	4,000		5.0	20,000		5.0	20,000	5.0	20,000		
Agro-Economy	4,000		5.0	20,000		5.0	20,000	5.0	20,000		
Fishery	4,000							5.0	20,000		
Sub - total			15.0	60,000		15.0	60,000		60,000		
2. Local staffs											
Assistant	240		24.0	5,760		24.0	5,760	24.0	5,760		
Driver	240		24.0	5,760		24.0	5,760	24.0	5,760		
Sub - total			48.0	11,520		48.0	11,520		11,520		
Total			63.0	71,520		63.0	71,520		71,520		

**3. Operation and Maintenance Cost**

**1) Annual Repair and maintenance of Equipment (F.C)**

$$\text{Purchase Price} / \text{Life Time (10years)} \times 0.05 = 439,950 \text{ US \$} / 10 \times 0.05 = 2200 \text{ US \$}/\text{year}$$

**2) Annual Fuel Oil (F.C)**

$$0.45 \text{ US \$}/\text{litter} \times 10 \text{ litter}/\text{day} \times 200 \text{ days}/\text{year} \times 1 = 900 \text{ US \$}/\text{year}$$

Accordingly, total repair and maintenance cost for project period is estimated as follows:

Description	Stage-I (3-year)		Stage-II (2-year)		Stage-III(2-year)		Remarks
	L.C	F.C	L.C	F.C	L.C	F.C	
1) Repair/Maintenance		6,600		4,400		4,400	
2) Fuel/Oil		2,700		1,800		1,800	
Total		9,300		6,200		6,200	

**Table G.6.1.8 Administration Cost for the Improvement Works**

Section	Annual Salary (US\$/Year)		Stage - I (3-year)			Stage - II (2-year)			Stage - III (2-year)		
	I.C	F.C	Quantity	Amount		Quantity	Amount		Quantity	Amount	
				I.C	F.C		I.C	F.C		I.C	F.C
<b>1. Administration</b>											
Chief	4,800										
Accountant	2,880		1	2,880		1	2,880		1	2,880	
Assist-accountant	2,400										
Typist	1,920		1	1,920		1	1,920		1	1,920	
Clerk	1,920										
<b>2. Project Management</b>											
Manager	4,800		1	4,800		1	4,800		1	4,800	
Assist-manager	2,880										
Secretary	1,920										
Clerk	1,920										
<b>3. Engineering</b>											
Chief	4,800										
Civil Engineer	4,320										
Technical	3,840										
Surveyor	3,840		1	3,840		1	3,840		1	3,840	
<b>4. Mechanical Support</b>											
Driver (Vehicle)	2,880										
Operator (Heavy-Machines)	3,840										
Securityary	1,920										
<b>Total</b>			<b>4</b>	<b>13,440</b>		<b>4</b>	<b>13,440</b>		<b>4</b>	<b>13,440</b>	

**Table G.6.1.9 (1) Annual Operation and Maintenance Cost**

**1. Personnel Cost**

				Unit ; US.\$
Description/Section	Annual Salary	Quantity	Ammount	Remarks
1. Officer	4,320	1	4,320	
2. Permanent Employee	3,840	1	3,840	
3. Temporary Employee	2,400	1	2,400	
		3	10,560	

**2. Administration and Others (10% of 1. Personnel Cost)**

$$10,560 \times 10 \% = 1,056 \text{ US. \$}$$

**3. Fuel and Oil Cost**

$$0.45 \text{ US. \$/liter} \times 10 \text{ liter/day} \times 200 \text{ days/year} = 900 \text{ US. \$/year}$$

**4. Repair & Maintenance of Facilities**

- Repair of Facilities = Construction Cost\* × 0.2% (0.002) × 0.9
- Materials for Facilities = Construction Cost\* × 0.2% (0.002) × 0.1

Note ; Construction cost\* = Construction cost of Farm/District roads, Reservoirs, Canals and Colmatage canals

- Construction cost\* at each stage is as follows;

- Stage - I : 4,072,070 (U.S \$)

- Stage - II : 808,397 (U.S \$)

- Stage - III : 543,229 (U.S \$)

**5. Annual Operation and Maintenance Cost**

				Unit ; US.\$
Items	I.C	F.C	Total	Remarks
1. Personnel Cost	10,560		10,560	
2. Administration and Others	1,056		1,056	
3. Fuel and Oil Cost		900	900	
<b>Total of 1.-3.</b>	<b>11,616</b>	<b>900</b>	<b>12,516</b>	
4. Repair & Maintenance of Facilities (Stage-I)				
- Repair of Facilities	7,330		7,330	
- Materials for Facilities	814		814	
Sub - total of 4.	8,144		8,144	
<b>Total of (1.-4.)</b>	<b>19,760</b>	<b>900</b>	<b>20,660</b>	
5. Repair & Maintenance of Facilities (Stage-II)				
- Repair of Facilities	1,455		1,455	
- Materials for Facilities	162		162	
Sub - total of 5.	1,617		1,617	
<b>Total of (1.-5.)</b>	<b>21,377</b>	<b>900</b>	<b>22,277</b>	
6. Repair & Maintenance of Facilities (Stage-III)				
- Repair of Facilities	978		978	
- Materials for Facilities	109		109	
Sub - total of 6.	1,086		1,086	
<b>Total of (1.-6.)</b>	<b>22,463</b>	<b>900</b>	<b>23,363</b>	

**Table G.6.1.9 (2) Annual Operation and Maintenance Cost**

6. Ratio of Maintenance cost for Construction cost

(1) Necessary length of Repair in each year

Description	Improvement length (m)				Ratio of repair (%)	Necessary length of repair in each year (m)		
	Stage - I	Stage - II	Stage - III	Total		Stage - I	Stage - II	Stage - III
- Road								
- Farm road	36,190	-	9,880	46,070	3.00	1,086	-	296
- District road	-	-	5,600	5,600	3.00	-	-	168
Total	36,190	-	15,480	51,670		1,086	-	464
- Reservoir dike								
- Closed type	30,380	-	-	30,380	3.00	911	-	-
- Semi-closed type	15,070	-	-	15,070	3.00	452	-	-
Total	45,450	-	-	45,450		1,363	-	-
- Colmatage Canal								
- Rehabilitation of canal	-	7,260	-	7,260	3.00	-	218	-
- Expansion of canal	-	4,000	-	4,000	3.00	-	120	-
Total	-	11,260	-	11,260		-	338	-

(2) Cost of Maintenance

Description	Length (m)	Excavation		Fill & Compaction		Slope trimming		Total (US\$)
		Quantity (m3)	Amount (US\$)	Quantity (m3)	Amount (US\$)	Unit cost (m2)	Amount (US\$)	
Stage - I								
- Road								
- Farm road	1,086	543	815	1,086	872	2,172	434	2,120
- District road	-	-	-	-	-	-	-	-
- Reservoir dike								
- Closed type	911	1,367	2,050	1,367	1,097	2,733	547	3,693
- Semi-closed type	452	678	1,017	678	544	1,356	271	1,832
Total		2,588	3,881	3,131	2,512	6,261	1,252	7,646
Stage - II								
- Colmatage Canal								
- Rehabilitation of canal	218	436	654	218	175	436	87	916
- Expansion of canal	120	240	360	120	96	240	48	504
Total		676	1,014	338	271	676	135	1,420
Stage - III								
- Road								
- Farm road	296	148	222	296	238	592	118	578
- District road	168	84	126	168	135	336	67	328
Total		232	348	464	372	928	186	906

Note ; Unit cost	Excavation	1.50 US\$/m3
	Fill & Compaction	0.80 US\$/m3
	Slope trimming	0.20 US\$/m2
Unit quantity		
- Road	Excavation	0.50 m3/m
	Fill & Compaction	1.00 m3/m
	Slope trimming	2.00 m2/m
- Reservoir dike	Excavation	1.50 m3/m
	Fill & Compaction	1.50 m3/m
	Slope trimming	3.00 m2/m
- Canal	Excavation	2.00 m3/m
	Fill & Compaction	1.00 m3/m
	Slope trimming	2.00 m2/m

(3) Ratio of maintenance cost for construction cost

Stage	Construc. cost (US\$)	Maintenan. cost (US\$)	Ratio (%)
I	4,072,070	7,646	0.19
II	808,397	1,420	0.18
III	543,229	906	0.17

**Table G.6.1.10 Renewal Cost of Facilities & Equipment**

						Unit : US.\$
Description / Items	Unit	Quantity	Unit cost	Amount (F.C)	Remarks	
<b>1. Stage - I</b>						
1.1 Life span = 10 years						
- Agricultural supporting service						
- 4WD vehicle	Nos.	1	19,500	19,500		
- Motorcycle 100cc	Nos.	20	1,400	28,000		
- Mobile pump	Nos.	50	350	17,500		
- Tractor	Nos.	3	22,000	66,000		
- Weed cutter	Nos.	10	600	6,000		
- Backhoe 0.2m <sup>3</sup>	Nos.	1	54,900	54,900		
- Bulldozer 11t	Nos.	1	94,800	94,800		
- Dump truck 6t	Nos.	1	56,900	56,900		
<b>Toatal of 1.1 (Life span = 10 years)</b>				<b>343,600</b>		
1.2 Life span = 30 years						
1) Fann roads						
- Gate	- Type - I	2.0m*2.0m*2sets	L.S	4	10,000	40,000
	- Type - II	2.0m*2.0m*1sets	L.S	2	5,000	10,000
2) Reservoirs						
- Intake gate	- Type - I	2.0m*2.0m*2sets	L.S	12	10,000	120,000
	- Type - II	2.0m*2.0m*1sets	L.S	13	5,000	65,000
- Outlet		φ 75mm*5sets	L.S	450	250	112,500
3) Weir at Boeng Phtea						
- Slide gate		1.2m*1.2m*2sets	L.S	1	3,000	3,000
4) Intake gate of Slat colmatage canal						
= Intake gate	- Type - B	2.0m*2.0m*2sets	L.S	1	70,000	70,000
<b>Toatal of 1.2 (Life span = 30 years)</b>				<b>420,500</b>		
<b>2. Stage - II</b>						
Life span = 30 years						
- Intake gate of Colmatage canals						
- Type - B		2.0m*2.0m*2sets	L.S	2	70,000	140,000
- Type - E		2.0m*2.0m*7sets	L.S	2	280,000	560,000
<b>Toatal of 2. (Life span = 30 years)</b>				<b>700,000</b>		
<b>3. Stage - III</b>						
Life span = 30 years						
1) Farm roads						
- Gate	- Type - II	2.0m*2.0m*1sets	L.S	1	5,000	5,000
2) Flood control gate (along the Phras Konlong road)						
- Flood control gate		2.0m*2.0m*7sets	L.S	1	280,000	280,000
<b>Toatal of 3. (Life span = 30 years)</b>				<b>285,000</b>		

**Table G.6.1.11 (1) Unit cost of Implementation Works - Standard type Culvert**

Unit : US \$

Description	Unit	Quantity	Labour & materials				Machinery cost			Total cost				
			Unit cost		Implement cost		Depre	Running cost		L.C.	F.C.	Total		
			L.C.	F.C.	L.C.	F.C.	F.C.	L.C.	F.C.					
<b>Type - I (φ 1,000)</b>														
Excavation	Backhoe 0.35m3	(0.90)	m3	45.0				37.2	3.8	4.2	3.8	41.4	45.2	
V=	50 m3	Manual	(0.10)	m3	5.0	1.50	7.5				7.5		7.5	
Fill & compaction	Backhoe 0.35m3	(0.90)	m3	28.8				23.8	2.4	2.7	2.4	26.5	28.9	
V=	32 m3	Manual	(0.10)	m3	3.2	0.80	2.6				2.6		2.6	
Reinforced concrete			m3	7.8	40.00	160.0	312.0	1,248.0				312.0	1,248.0	1,560.0
RC pipe (D=1,000mm)			m	7.0			32.1	478.8	64.2	4.3	4.7	36.3	547.8	581.1
<b>Total cost</b>							354.1	1,726.8	125.2	10.5	11.6	364.6	1,863.6	2,228.2
<b>Type - II (φ 800)</b>														
Excavation	Backhoe 0.35m3	(0.90)	m3	36.9				30.5	3.1	3.4	3.1	33.9	37.0	
V=	41 m3	Manual	(0.10)	m3	4.1	1.50	6.2				6.2		6.2	
Fill & compaction	Backhoe 0.35m3	(0.90)	m3	26.1				21.6	2.2	2.4	2.2	24.0	26.2	
V=	29 m3	Manual	(0.10)	m3	2.9	0.80	2.3				2.3		2.3	
Reinforced concrete			m3	6.3	40.00	160.0	252.0	1,008.0				252.0	1,008.0	1,260.0
RC pipe (D=800mm)			m	6.0			16.5	216.6	47.2	3.1	3.5	19.6	267.3	286.9
<b>Total cost</b>							277.0	1,224.6	99.2	8.4	9.4	285.4	1,333.2	1,618.6

**Table G.6.1.11 (2) Unit cost of Implementation Works - Standard type Bridge**

Unit : US \$

Description	Unit	Quantity	Labour & materials				Machinery cost			Total cost				
			Unit cost		Implement cost		Depre	Running cost		L.C.	F.C.	Total		
			L.C.	F.C.	L.C.	F.C.	F.C.	L.C.	F.C.					
<b>Type - I (W = 3.00m)</b>														
Excavation	Backhoe 0.35m3	(0.90)	m3	27.0				22.3	2.3	2.5	2.3	24.8	27.1	
V=	30 m3	Manual	(0.10)	m3	3.0	1.50	4.5				4.5		4.5	
Fill & compaction	Backhoe 0.35m3	(0.90)	m3	22.5				18.6	1.9	2.1	1.9	20.7	22.6	
V=	25 m3	Manual	(0.10)	m3	2.5	0.80	2.0				2.0		2.0	
Reinforced concrete			m3	24.8	40.00	160.0	992.0	3,968.0				992.0	3,968.0	4,960.0
RC pile (D=300mm, L=10m)			Nos.	8.0				150.3	9.4	23.7	9.4	174.0	183.4	
Riprap			m3	30.0	27.80		833.9					833.9	833.9	
<b>Total cost</b>							1,832.4	3,968.0	191.2	13.5	28.3	1,846.0	4,187.5	6,033.5
<b>Type - II (W = 2.00m)</b>														
Excavation	Backhoe 0.35m3	(0.90)	m3	22.5				18.6	1.9	2.1	1.9	20.7	22.6	
V=	25 m3	Manual	(0.10)	m3	2.5	1.50	3.8				3.8		3.8	
Fill & compaction	Backhoe 0.35m3	(0.90)	m3	18.0				14.9	1.5	1.7	1.5	16.5	18.1	
V=	20 m3	Manual	(0.10)	m3	2.0	0.80	1.6				1.6		1.6	
Reinforced concrete			m3	21.6	40.00	160.0	864.0	3,456.0				864.0	3,456.0	4,320.0
RC pile (D=300mm, L=10m)			Nos.	6.0				112.7	7.0	17.8	7.0	130.5	137.5	
Riprap			m3	27.0	27.80		750.5					750.5	750.5	
<b>Total cost</b>							1,619.9	3,456.0	146.2	10.4	21.6	1,630.3	3,623.7	5,254.1

**Table G.6.1.11 (3) Unit cost of Implementation Works - Standard type Intake Gate**

Unit, US \$

Description	Unit	Quantity	Labour & materials				Machinery cost			Total cost				
			Unit cost		Implement cost		Depre	Running cost		L.C.	F.C.	Total		
			L.C.	F.C.	L.C.	F.C.		F.C.	L.C.				F.C.	
<b>Type - I</b>														
Excavation	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	261.0				215.6	22.0	21.3	22.0	239.9	261.9	
V=	290 m <sup>3</sup>	Manual	(0.10)	m <sup>3</sup>	29.0	1.50	43.5				43.5		43.5	
Fill & compaction	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	108.0				89.2	9.1	10.1	9.1	99.3	108.4	
V=	120 m <sup>3</sup>	Manual	(0.10)	m <sup>3</sup>	12.0	0.80	9.6				9.6		9.6	
Reinforced concrete			m <sup>3</sup>	75.0	40.00	160.0	3,000.0	12,000.0			3,000.0	12,000.0	15,000.0	
Riprap			m <sup>3</sup>	22.0	27.80		611.5				611.5		611.5	
Slide gate	2.0m*2.0m		set	2.0		5,000.0		10,000.0				10,000.0	10,000.0	
<b>Total cost</b>							3,664.7	22,000.0	304.8	31.1	34.4	3,695.7	22,339.2	26,035.0
<b>Type - II</b>														
Excavation	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	153.0				126.4	12.9	14.3	12.9	140.7	153.5	
V=	170 m <sup>3</sup>	Manual	(0.10)	m <sup>3</sup>	17.0	1.50	25.5				25.5		25.5	
Fill & compaction	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	72.0				59.5	6.1	6.7	6.1	66.2	72.3	
V=	80 m <sup>3</sup>	Manual	(0.10)	m <sup>3</sup>	8.0	0.80	6.4				6.4		6.4	
Reinforced concrete			m <sup>3</sup>	43.0	40.00	160.0	1,720.0	6,880.0			1,720.0	6,880.0	8,600.0	
Riprap			m <sup>3</sup>	17.0	27.80		472.6				472.6		472.6	
Slide gate	2.0m*2.0m		set	1.0		5,000.0		5,000.0				5,000.0	5,000.0	
<b>Total cost</b>							2,224.5	11,880.0	185.9	18.9	21.0	2,243.4	12,086.9	14,330.3

**Table G.6.1.11 (4) Unit cost of Implementation Works - Outlet of Reservoir**

Unit, US \$

Description	Unit	Quantity	Labour & materials				Machinery cost			Total cost				
			Unit cost		Implement cost		Depre	Running cost		L.C.	F.C.	Total		
			L.C.	F.C.	L.C.	F.C.		F.C.	L.C.				F.C.	
<b>Outlet of reservoir</b>														
Excavation	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	49.5				40.9	4.2	4.6	4.2	45.5	49.7	
V=	55 m <sup>3</sup>	Manual	(0.10)	m <sup>3</sup>	5.5	1.50	8.3				8.3		8.3	
Fill & compaction	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	45.9				37.9	3.9	4.3	3.9	42.2	46.1	
V=	51 m <sup>3</sup>	Manual	(0.10)	m <sup>3</sup>	5.1	0.80	4.1				4.1		4.1	
Reinforced concrete			m <sup>3</sup>	2.8	40.00	160.0	112.0	448.0			112.0	448.0	560.0	
RC pipe (D=300mm)			m	11.0			19.9	95.5			19.9	95.5	115.4	
Intake tap	ø 75mm		set	5.0		50.0		250.0				250.0	250.0	
<b>Total cost</b>							144.3	793.5	78.8	8.0	8.9	152.3	881.2	1,033.5



**Table G.6.1.11 (5) Unit cost of Implementation Works - Standard type rehabilitation of Colmatage Canal**  
Unit, US \$/m

Description	Unit	Quantity	Labour & materials				Machinery cost			Total cost			
			Unit cost		Implement cost		Depre	Running cost		L.C.	F.C.	Total	
			L.C.	F.C.	L.C.	F.C.	F.C.	L.C.	F.C.				
<b>Type - A</b>													
Stripping	Bulldozer 11t	(ratio)	m2	8.5				1.6	0.1	0.2	0.1	1.8	1.9
Excavation	Backhoe 0.35m3	(0.90)	m3	8.3				6.8	0.7	0.8	0.7	7.6	8.3
V= 9.2 m3	Manual	(0.10)	m3	0.9	1.50	1.4					1.4		1.4
Fill & compaction	Bulldozer 11t	(0.90)	m3	3.9				3.0	0.1	0.3	0.1	3.3	3.4
V= 4.3 m3	Manual	(0.10)	m3	0.4	0.80	0.3					0.3		0.3
Slope trimming	Manual		m2	9.2	0.20	1.8					1.8		1.8
Sodding of slope	Manual		m2	7.1	1.39	9.8					9.8		9.8
Laterite pavement			m2	3.0	3.19	9.6					9.6		9.6
<b>Total cost</b>						23.0		11.4	0.9	1.2	23.9	12.7	36.6
<b>Type - B</b>													
Stripping	Bulldozer 11t	(ratio)	m2	8.9				1.7	0.1	0.2	0.1	1.9	2.0
Excavation	Backhoe 0.35m3	(0.90)	m3	13.8				11.4	1.2	1.3	1.2	12.7	13.8
V= 15.3 m3	Manual	(0.10)	m3	1.5	1.50	2.3					2.3		2.3
Fill & compaction	Bulldozer 11t	(0.90)	m3	4.8				3.6	0.2	0.4	0.2	4.0	4.2
V= 5.3 m3	Manual	(0.10)	m3	0.5	0.80	0.4					0.4		0.4
Slope trimming	Manual		m2	11.0	0.20	2.2					2.2		2.2
Sodding of slope	Manual		m2	7.2	1.39	10.0					10.0		10.0
Laterite pavement			m2	3.0	3.19	9.6					9.6		9.6
<b>Total cost</b>						24.5		16.7	1.4	1.8	25.9	18.6	44.4
<b>Type - C</b>													
Stripping	Bulldozer 11t	(ratio)	m2	9.5				1.8	0.1	0.2	0.1	2.0	2.1
Excavation	Backhoe 0.35m3	(0.90)	m3	22.1				18.3	1.9	2.1	1.9	20.4	22.2
V= 24.6 m3	Manual	(0.10)	m3	2.5	1.50	3.7					3.7		3.7
Fill & compaction	Bulldozer 11t	(0.90)	m3	5.9				4.5	0.2	0.5	0.2	5.0	5.2
V= 6.6 m3	Manual	(0.10)	m3	0.7	0.80	0.5					0.5		0.5
Slope trimming	Manual		m2	11.0	0.20	2.2					2.2		2.2
Sodding of slope	Manual		m2	7.2	1.39	10.0					10.0		10.0
Laterite pavement			m2	3.0	3.19	9.6					9.6		9.6
<b>Total cost</b>						26.0		24.6	2.2	2.7	28.1	27.4	55.5
<b>Type - D</b>													
Stripping	Bulldozer 11t	(ratio)	m2	10.2				2.0	0.1	0.2	0.1	2.2	2.3
Excavation	Backhoe 0.35m3	(0.90)	m3	32.0				26.5	2.7	3.0	2.7	29.5	32.2
V= 35.6 m3	Manual	(0.10)	m3	3.6	1.50	5.3					5.3		5.3
Fill & compaction	Bulldozer 11t	(0.90)	m3	7.1				5.4	0.3	0.6	0.3	6.0	6.2
V= 7.9 m3	Manual	(0.10)	m3	0.8	0.80	0.6					0.6		0.6
Slope trimming	Manual		m2	12.8	0.20	2.6					2.6		2.6
Sodding of slope	Manual		m2	7.2	1.39	10.0					10.0		10.0
Laterite pavement			m2	3.0	3.19	9.6					9.6		9.6
<b>Total cost</b>						28.1		33.9	3.0	3.8	31.1	37.6	68.7
<b>Type - E</b>													
Stripping	Bulldozer 11t	(ratio)	m2	11.2				2.2	0.1	0.2	0.1	2.4	2.5
Excavation	Backhoe 0.35m3	(0.90)	m3	43.7				36.1	3.7	4.1	3.7	40.2	43.9
V= 48.6 m3	Manual	(0.10)	m3	4.9	1.50	7.3					7.3		7.3
Fill & compaction	Bulldozer 11t	(0.90)	m3	8.6				6.5	0.3	0.7	0.3	7.2	7.5
V= 9.5 m3	Manual	(0.10)	m3	1.0	0.80	0.8					0.8		0.8
Slope trimming	Manual		m2	12.8	0.20	2.6					2.6		2.6
Sodding of slope	Manual		m2	7.2	1.39	10.0					10.0		10.0
Laterite pavement			m2	3.0	3.19	9.6					9.6		9.6
<b>Total cost</b>						30.2		44.8	4.1	5.0	34.3	49.8	81.0

**Table G.6.I.11 (6) Unit cost of Implementation Works - Standard type Intake gate for Colmatage canal**

Unit: US \$

Description	Unit	Quantity	Labour & materials				Machinery cost			Total cost			
			Unit cost		Implement cost		Depre	Running cost		L.C	F.C	Total	
			L.C	F.C	L.C	F.C		F.C	L.C				F.C
<b>Type - A</b>													
Excavation	Backhoe 0.35m3	(0.90)	m3	121.5				100.4	10.2	11.3	10.2	111.7	121.9
V=	135 m3 Manual	(0.10)	m3	13.5	1.50		20.3				20.3		20.3
Fill & compaction	Backhoe 0.35m3	(0.90)	m3	58.5				48.3	4.9	5.5	4.9	53.8	58.7
V=	65 m3 Manual	(0.10)	m3	6.5	0.80		5.2				5.2		5.2
Reinforced concrete			m3	52.0	40.00	160.0	2,080.0				2,080.0	8,320.0	10,400.0
RC pile (D=300mm, L=10m)			Nos	4.0		520.0	2,080.0	75.1	4.7	11.9	4.7	2,167.0	2,171.7
Sheet pile (L=3m)			sheet	8.0		480.0	3,840.0	150.3	9.4	23.7	9.4	4,014.0	4,023.4
Riprap			m3	126.0	27.80		3,502.5				3,502.5		3,502.5
Slide gate (2.0m*2.0m*1)			set	1.0		24,000.0	24,000.0					24,000.0	24,000.0
Sub-total							5,608.0	38,240.0	374.1	29.2	52.4	5,637.2	38,666.5
Miscellaneous 10% of Sub-total		%	10.0				560.8	3,824.0	37.4	2.9	5.2	563.7	3,866.6
Total cost							6,168.7	42,064.0	411.5	32.2	57.6	6,200.9	42,533.1
<b>Type - B</b>													
Excavation	Backhoe 0.35m3	(0.90)	m3	225.0				185.9	18.9	21.0	18.9	206.9	225.8
V=	250 m3 Manual	(0.10)	m3	25.0	1.50		37.5				37.5		37.5
Fill & compaction	Backhoe 0.35m3	(0.90)	m3	90.0				74.3	7.6	8.4	7.6	82.7	90.3
V=	100 m3 Manual	(0.10)	m3	10.0	0.80		8.0				8.0		8.0
Reinforced concrete			m3	100.0	40.00	160.0	4,000.0				4,000.0	16,000.0	20,000.0
RC pile (D=300mm, L=10m)			Nos	9.0		520.0	4,680.0	169.1	10.6	26.7	10.6	4,875.8	4,886.3
Sheet pile (L=3m)			sheet	16.0		480.0	7,680.0	300.6	18.8	47.4	18.8	8,028.0	8,016.8
Riprap			m3	160.0	27.80		4,447.6				4,447.6		4,447.6
Slide gate (2.0m*2.0m*2)			set	1.0		70,000.0	70,000.0					70,000.0	70,000.0
Sub-total							8,493.1	98,360.0	729.9	55.8	103.5	8,549.0	99,193.3
Miscellaneous 20% of Sub-total		%	20.0				1,698.6	19,672.0	146.0	11.2	20.7	1,709.8	19,838.7
Total cost							10,191.8	118,032.0	875.8	67.0	124.2	10,258.8	119,032.0
<b>Type - C</b>													
Excavation	Backhoe 0.35m3	(0.90)	m3	288.0				237.9	24.3	26.9	24.3	264.8	289.0
V=	320 m3 Manual	(0.10)	m3	32.0	1.50		48.0				48.0		48.0
Fill & compaction	Backhoe 0.35m3	(0.90)	m3	90.0				74.3	7.6	8.4	7.6	82.7	90.3
V=	100 m3 Manual	(0.10)	m3	10.0	0.80		8.0				8.0		8.0
Reinforced concrete			m3	139.0	40.00	160.0	5,560.0				5,560.0	22,240.0	27,800.0
RC pile (D=300mm, L=10m)			Nos	12.0		520.0	6,240.0	225.4	14.1	35.6	14.1	6,501.0	6,515.1
Sheet pile (L=3m)			sheet	20.0		480.0	9,600.0	375.7	23.5	59.3	23.5	10,035.0	10,058.5
Riprap			m3	207.0	27.80		5,754.1				5,754.1		5,754.1
Slide gate (2.0m*2.0m*3)			set	1.0		110,000.0	110,000.0					110,000.0	110,000.0
Sub-total							11,370.1	148,080.0	913.4	69.4	130.1	11,439.5	149,123.5
Miscellaneous 20% of Sub-total		%	20.0				2,274.0	29,616.0	183.7	13.9	26.0	2,287.9	29,824.7
Total cost							13,644.1	177,696.0	1,096.1	83.2	156.1	13,727.4	178,948.2
<b>Type - D</b>													
Excavation	Backhoe 0.35m3	(0.90)	m3	378.0				312.2	31.8	35.3	31.8	317.5	379.3
V=	420 m3 Manual	(0.10)	m3	42.0	1.50		63.0				63.0		63.0
Fill & compaction	Backhoe 0.35m3	(0.90)	m3	90.0				74.3	7.6	8.4	7.6	82.7	90.3
V=	100 m3 Manual	(0.10)	m3	10.0	0.80		8.0				8.0		8.0
Reinforced concrete			m3	223.0	40.00	160.0	8,920.0				8,920.0	35,680.0	41,600.0
RC pile (D=300mm, L=10m)			Nos	21.0		520.0	10,920.0	394.5	24.6	62.2	24.6	11,376.8	11,401.4
Sheet pile (L=3m)			sheet	38.0		480.0	18,240.0	713.9	44.6	112.6	44.6	19,066.5	19,111.1
Riprap			m3	270.0	27.80		7,505.3				7,505.3		7,505.3
Slide gate (2.0m*2.0m*5)			set	1.0		200,000.0	200,000.0					200,000.0	200,000.0
Sub-total							16,496.4	264,840.0	1,495.0	108.6	218.5	16,604.9	266,553.5
Miscellaneous 30% of Sub-total		%	30.0				4,948.9	79,452.0	418.5	32.6	65.6	4,981.5	79,966.1
Total cost							21,445.3	344,292.0	1,913.5	141.2	284.1	21,586.4	346,519.6
<b>Type - E</b>													
Excavation	Backhoe 0.35m3	(0.90)	m3	495.0				408.9	41.7	46.2	41.7	455.1	496.8
V=	550 m3 Manual	(0.10)	m3	55.0	1.50		82.5				82.5		82.5
Fill & compaction	Backhoe 0.35m3	(0.90)	m3	90.0				74.3	7.6	8.4	7.6	82.7	90.3
V=	100 m3 Manual	(0.10)	m3	10.0	0.80		8.0				8.0		8.0
Reinforced concrete			m3	297.0	40.00	160.0	11,880.0				11,880.0	47,520.0	59,400.0
RC pile (D=300mm, L=10m)			Nos	27.0		520.0	14,040.0	507.2	31.7	80.0	31.7	14,627.3	14,658.9
Sheet pile (L=3m)			sheet	52.0		480.0	24,960.0	976.9	61.0	154.1	61.0	26,091.0	26,152.0
Riprap			m3	340.0	27.80		9,451.2				9,451.2		9,451.2
Slide gate (2.0m*2.0m*7)			set	1.0		280,000.0	280,000.0					280,000.0	280,000.0
Sub-total							21,421.7	366,520.0	1,967.3	141.9	288.7	21,563.6	368,776.1
Miscellaneous 30% of Sub-total		%	30.0				6,426.5	109,956.0	590.2	42.6	86.6	6,469.1	110,632.8
Total cost							27,848.2	476,476.0	2,557.5	184.5	375.3	28,032.6	479,408.9

**Table G.6.1.11 (7) Unit cost of Implementation Works - Standard type Concrete Bridge**

Unit, US \$

Description	Unit	Quantity	Labour & materials				Machinery cost			Total cost				
			Unit cost		Implement cost		Depre	Running cost		L.C.	F.C.	Total		
			L.C.	F.C.	L.C.	F.C.		F.C.	L.C.				F.C.	
<b>Type - A</b>														
Excavation	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	202.5				167.3	17.1	18.9	17.1	186.2	203.2	
V=	225 m <sup>3</sup>	Manual	(0.10)	m <sup>3</sup>	22.5	1.50	33.8				33.8		33.8	
Fill & compaction	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	81.0				66.9	6.8	7.6	6.8	74.5	81.3	
V=	90 m <sup>3</sup>	Manual	(0.10)	m <sup>3</sup>	9.0	0.80	7.2				7.2		7.2	
Reinforced concrete			m <sup>3</sup>	45.0	40.00	160.0	1,800.0	7,200.0				1,800.0	7,200.0	9,000.0
RC pile (D=300mm, L=10m)			Nos.	8.0		520.0		4,160.0	150.3	9.4	23.7	9.4	4,343.4	
Riprap			m <sup>3</sup>	10.0	27.80		278.0					278.0	278.0	
<b>Total cost</b>							2,118.9	11,360.0	384.5	33.3	50.2	2,152.2	11,794.6	13,946.8
<b>Type - B</b>														
Excavation	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	235.8				194.8	19.9	22.0	19.9	216.8	236.6	
V=	262 m <sup>3</sup>	Manual	(0.10)	m <sup>3</sup>	26.2	1.50	39.3				39.3		39.3	
Fill & compaction	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	108.0				89.2	9.1	10.1	9.1	99.3	108.4	
V=	120 m <sup>3</sup>	Manual	(0.10)	m <sup>3</sup>	12.0	0.80	9.6				9.6		9.6	
Reinforced concrete			m <sup>3</sup>	93.0	40.00	160.0	3,720.0	14,880.0				3,720.0	14,880.0	18,600.0
RC pile (D=300mm, L=10m)			Nos.	12.0		520.0		6,240.0	225.4	14.1	35.6	14.1	6,501.0	6,515.1
Riprap			m <sup>3</sup>	15.0	27.80		417.0					417.0	417.0	
<b>Total cost</b>							4,185.9	21,120.0	509.4	43.0	67.6	4,228.9	21,697.1	25,926.0
<b>Type - C</b>														
Excavation	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	279.0				230.5	23.5	26.0	23.5	256.5	280.0	
V=	310 m <sup>3</sup>	Manual	(0.10)	m <sup>3</sup>	31.0	1.50	46.5				46.5		46.5	
Fill & compaction	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	108.0				89.2	9.1	10.1	9.1	99.3	108.4	
V=	120 m <sup>3</sup>	Manual	(0.10)	m <sup>3</sup>	12.0	0.80	9.6				9.6		9.6	
Reinforced concrete			m <sup>3</sup>	103.0	40.00	160.0	4,120.0	16,480.0				4,120.0	16,480.0	20,600.0
RC pile (D=300mm, L=10m)			Nos.	12.0		520.0		6,240.0	225.4	14.1	35.6	14.1	6,501.0	6,515.1
Riprap			m <sup>3</sup>	18.0	27.80		500.4					500.4	500.4	
<b>Total cost</b>							4,676.5	22,720.0	545.1	46.7	71.7	4,723.1	23,336.8	28,059.9
<b>Type - D</b>														
Excavation	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	349.2				288.5	29.4	32.6	29.4	321.0	350.4	
V=	388 m <sup>3</sup>	Manual	(0.10)	m <sup>3</sup>	38.8	1.50	58.2				58.2		58.2	
Fill & compaction	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	108.0				89.2	9.1	10.1	9.1	99.3	108.4	
V=	120 m <sup>3</sup>	Manual	(0.10)	m <sup>3</sup>	12.0	0.80	9.6				9.6		9.6	
Reinforced concrete			m <sup>3</sup>	116.0	40.00	160.0	4,640.0	18,560.0				4,640.0	18,560.0	23,200.0
RC pile (D=300mm, L=10m)			Nos.	12.0		520.0		6,240.0	225.4	14.1	35.6	14.1	6,501.0	6,515.1
Riprap			m <sup>3</sup>	25.0	27.80		694.9					694.9	694.9	
<b>Total cost</b>							5,402.8	24,800.0	603.1	52.6	78.2	5,455.3	25,481.3	30,936.7
<b>Type - E</b>														
Excavation	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	445.5				368.0	37.5	41.6	37.5	409.6	447.1	
V=	495 m <sup>3</sup>	Manual	(0.10)	m <sup>3</sup>	49.5	1.50	74.3				74.3		74.3	
Fill & compaction	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	135.0				111.5	11.4	12.6	11.4	124.1	135.5	
V=	150 m <sup>3</sup>	Manual	(0.10)	m <sup>3</sup>	15.0	0.80	12.0				12.0		12.0	
Reinforced concrete			m <sup>3</sup>	161.0	40.00	160.0	6,440.0	25,760.0				6,440.0	25,760.0	32,200.0
RC pile (D=300mm, L=10m)			Nos.	18.0		520.0		9,360.0	338.1	21.1	53.4	21.1	9,751.5	9,772.6
Riprap			m <sup>3</sup>	35.0	27.80		972.9					972.9	972.9	
<b>Total cost</b>							7,499.2	35,120.0	817.7	70.0	107.5	7,569.2	36,045.2	43,614.4

Table G.6.1.11 (8) Unit cost of Implementation Works - the Weir at Boeng Phtea

		Unit : US \$											
Description	Unit	Quantity	Labour & materials				Machinery cost			Total cost			
			Unit cost		Implement cost		Depre	Running cost		L.C	F.C	Total	
			L.C.	F.C.	L.C.	F.C.	F.C.	L.C.	F.C.				
<b>The weir at Boeng Phtea</b>													
Excavation	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	1,404.0				1,159.8	118.2	131.0	118.2	1,290.8	1,409.0
V=	1,560 m <sup>3</sup>		m <sup>3</sup>	156.0	1.50	234.0					234.0		234.0
Fill & compaction	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	369.0				304.8	31.1	34.4	31.1	339.2	370.3
V=	410 m <sup>3</sup>		m <sup>3</sup>	41.0	0.80	32.9					32.9		32.9
Reinforced concrete			m <sup>3</sup>	2,205.0	40.00	160.0	88,200.0	352,800.0			88,200.0	352,800.0	441,000.0
Gabion protection			m <sup>3</sup>	250.0			7,284.4	4,610.3			7,284.4	4,610.3	11,894.7
Slide gate (1 2'x 2)			set	2.0	75.00	1,425.0	150.0	2,850.0			150.0	2,850.0	3,000.0
RC pipe (D= 600mm)			m	72.0			122.4	1,501.8	471.7	31.3	34.8	153.7	2,165.1
Sub-total							96,073.7	361,765.1	1,936.3	180.6	200.2	96,204.3	363,901.7
Temporary works 20% of Sub-total		%		20.0			19,204.7	72,353.0	387.3	36.1	40.0	19,240.9	72,780.3
<b>Total cost</b>							<b>115,228.4</b>	<b>434,118.2</b>	<b>2,323.6</b>	<b>216.7</b>	<b>240.3</b>	<b>115,445.1</b>	<b>436,682.0</b>

Table G.6.1.11 (9) Unit cost of Implementation Works - Fish Pond

		Unit : US \$											
Description	Unit	Quantity	Labour & materials				Machinery cost			Total cost			
			Unit cost		Implement cost		Depre	Running cost		L.C	F.C	Total	
			L.C.	F.C.	L.C.	F.C.	F.C.	L.C.	F.C.				
<b>Fish pond</b>													
<b>1. Reservoir</b>													
Stripping	Bulldozer 11t		m <sup>2</sup>	25,462				4,891.8	226.8	505.7	226.8	5,397.5	5,624.3
Excavation	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	18,668				15,420.9	1,572.0	1,741.6	1,572.0	17,162.5	18,734.5
V=	20,743 m <sup>3</sup>		m <sup>3</sup>	2,074	1.50	3,111.4					3,111.4		3,111.4
Fill & compaction	Bulldozer 11t	(0.90)	m <sup>3</sup>	2,192				1,811.0	184.6	204.5	184.6	2,015.6	2,200.2
V=	2,436 m <sup>3</sup>		m <sup>3</sup>	244	0.80	195.5					195.5		195.5
Sub-total of 1.							3,306.9				22,123.6	1,983.4	2,451.9
<b>2. Pond</b>													
Stripping	Bulldozer 11t		m <sup>2</sup>	52,500				10,086.2	467.6	1,042.8	467.6	11,129.0	11,596.6
Excavation	Backhoe 0.35m <sup>3</sup>	(0.90)	m <sup>3</sup>	9,580				7,913.4	806.7	893.8	806.7	8,807.2	9,613.9
V=	10,644 m <sup>3</sup>		m <sup>3</sup>	1,064	1.50	1,596.6					1,596.6		1,596.6
Fill & compaction	Bulldozer 11t	(0.90)	m <sup>3</sup>	23,787				19,649.5	2,003.1	2,219.2	2,003.1	21,868.7	23,871.9
V=	26,431 m <sup>3</sup>		m <sup>3</sup>	2,643	0.80	2,121.0					2,121.0		2,121.0
Sub-total of 2.							3,717.7				37,649.1	3,277.4	4,155.7
3. Hatchery, Pump facilities, etc.	L.S			1.0			30,000.0						30,000.0
<b>Total cost</b>							<b>7,024.6</b>	<b>30,000.0</b>	<b>59,772.8</b>	<b>5,260.9</b>	<b>6,607.7</b>	<b>12,285.4</b>	<b>96,380.4</b>

Table G.6.1.11 (10) Unit cost of Implementation Works - Pipe Line Installation

		Unit : US \$/m												
Description	Unit	Quantity	Labour & materials				Machinery cost			Total cost				
			Unit cost		Implement cost		Depre	Running cost		L.C	F.C	Total		
			L.C.	F.C.	L.C.	F.C.	F.C.	L.C.	F.C.					
<b>1. φ 300 Manual installation</b>														
Pipe (20 pipes/day)	L = 20 m/day		pee	20.0	0.45	8.55	9.0	171.0				9.0	171.0	180.0
Pipe connecting 1.5%		%		1.5			0.1	2.6				0.1	2.6	2.7
Skilled labour /20m		p/day		2.7	5.00		13.5					13.5		13.5
Unskilled labour /20m		p/day		3.4	4.00		13.6					13.6		13.6
<b>Total /20m</b>							<b>36.2</b>	<b>173.6</b>				<b>36.2</b>	<b>173.6</b>	<b>209.8</b>
<b>Total cost per meter</b>							<b>1.8</b>	<b>8.7</b>				<b>1.8</b>	<b>8.7</b>	<b>10.5</b>
<b>2. φ 600 with machinery</b>														
Pipe (10 pipes/day)	L = 10 m/day		pee	10.0	1.10	20.90	11.0	209.0				11.0	209.0	220.0
Skilled labour /20m		p/day		0.4	5.00		2.0					2.0		2.0
Unskilled labour /20m		p/day		1.0	4.00		4.0					4.0		4.0
Truck crane 4.8-4.9t		10m/hr		2.8				65.5	4.3	4.8	4.3	70.4	74.7	
<b>Total /10m</b>							<b>17.0</b>	<b>209.0</b>	<b>65.5</b>	<b>4.3</b>	<b>4.8</b>	<b>21.3</b>	<b>279.4</b>	<b>300.7</b>
<b>Total cost per meter</b>							<b>1.7</b>	<b>20.9</b>	<b>6.6</b>	<b>0.4</b>	<b>0.5</b>	<b>2.1</b>	<b>27.9</b>	<b>30.1</b>
<b>3. φ 800 with machinery</b>														
Pipe (10 pipes/day)	L = 10 m/day		pee	10.0	1.90	36.10	19.0	361.0				19.0	361.0	380.0
Skilled labour /20m		p/day		0.5	5.00		2.5					2.5		2.5
Unskilled labour /20m		p/day		1.5	4.00		6.0					6.0		6.0
Truck crane 4.8-4.9t		10m/hr		3.4				78.6	5.2	5.8	5.2	81.4	89.6	
<b>Total /10m</b>							<b>27.5</b>	<b>361.0</b>	<b>78.6</b>	<b>5.2</b>	<b>5.8</b>	<b>32.7</b>	<b>445.4</b>	<b>478.1</b>
<b>Total cost per meter</b>							<b>2.8</b>	<b>36.1</b>	<b>7.9</b>	<b>0.5</b>	<b>0.6</b>	<b>3.3</b>	<b>44.5</b>	<b>47.8</b>
<b>4. φ 1,000 with machinery</b>														
Pipe (10 pipes/day)	L = 10 m/day		pee	10.0	3.60	68.40	36.0	684.0				36.0	684.0	720.0
Skilled labour /20m		p/day		0.6	5.00		3.0					3.0		3.0
Unskilled labour /20m		p/day		1.7	4.00		6.8					6.8		6.8
Truck crane 4.8-4.9t		10m/hr		3.9				91.7	6.1	6.8	6.1	98.5	104.6	
<b>Total /10m</b>							<b>45.8</b>	<b>684.0</b>	<b>91.7</b>	<b>6.1</b>	<b>6.8</b>	<b>51.9</b>	<b>782.5</b>	<b>834.4</b>
<b>Total cost per meter</b>							<b>4.6</b>	<b>68.4</b>	<b>9.2</b>	<b>0.6</b>	<b>0.7</b>	<b>5.2</b>	<b>78.3</b>	<b>83.4</b>

Table G.6.1.12 Unit Cost of Manual Works

Description	unit	quantity	Labour & materials cost			Machinery Cost			Total cost			Remarks
			Unit cost		Implement cost	Depre.	Implement cost		L.C.	F.C.	Total	
			L.C.	F.C.			L.C.	F.C.				
			L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	Total	
Manual excavation	p/m3	0.50										
Common labour			5.0		1.50							1.50 /m3
Manual refilling	p/m3	0.15										
Common labour & compaction			5.0		0.75							0.75
Miscellaneous	%	7.0			0.05							0.05 /m3
Total cost					0.80							0.80 /m3
Manual slope trimming	p/m3	0.04										
Common labour			5.0		0.20							0.20 /m3
Laterite pavement	m3	0.21										
Material			14.5		3.07							3.07
Common labour & compaction	p/m2	0.02			0.12							0.12 /m2
Total cost					3.19							3.19 /m2
Gravel pavement	m3	0.21										
Material			25.0		5.30							5.30
Common labour & compaction	p/m2	0.02			0.12							0.12 /m2
Total cost					5.42							5.42 /m2
Manual sodding	m2	0.56										
Material			2.0		1.12							1.12
Miscellaneous	%	12.5			0.14							0.14
Common labour & compaction	p/m2	0.03			0.13							0.13
Total cost					1.39							1.39 /m2
Riprap	m3	1.26										
Material (Boulder)			21.0		26.46							26.46
Common labour & compaction	p/m3	0.25			1.25							1.25
Miscellaneous	%	7.0			0.09							0.09
Total cost					27.80							27.80 /m3
Gabion	m3	0.90										
Material (Boulder)			21.0		18.90							18.90
Material (Steel net)	m	1.70										18.44
Common labour	p/m3	0.49			10.8							10.24
Total cost					29.14							29.14
												18.44
												47.58 /m3

Notes : p : person(s) or person(s)/day  
 Quantity : Source = Japanese standard

**Table G.6.1.13 Unit cost of Works involving machinery**

(Unit ; US.\$)

Description	Capacity		Deprec. * F.C (b)	Running Cost		Unit Cost (US. \$) (e)	Remarks
	Amount (a)	Unit		L.C (c)	F.C (d)		
<b>(1) Excavation</b>							
- Bulldozer 11t	L = 10m	53.1 m3/hr	0.73	0.03	0.08	0.84	\$/m3
	L = 30m	35.2 m3/hr	1.11	0.05	0.11	1.27	\$/m3
	L = 60m	23.4 m3/hr	1.67	0.08	0.17	1.92	\$/m3
- Scraper 26t	L = 100m	99.5 m3/hr	1.20	0.03	0.11	1.34	\$/m3
	L = 200m	63.6 m3/hr	1.87	0.01	0.18	2.09	\$/m3
	L = 300m	46.7 m3/hr	2.55	0.06	0.24	2.85	\$/m3
- Backhoe 0.20m3		17.6 m3/hr	1.33	0.15	0.11	1.59	\$/m3
- Backhoe 0.35m3		30.9 m3/hr	0.83	0.08	0.09	1.00	\$/m3
- Tractor Shovel	L < 8m	56.9 m3/hr	0.62	0.03	0.06	0.71	\$/m3
	L = 30m	22.3 m3/hr	1.58	0.09	0.15	1.82	\$/m3
- Dragline 0.8m3	90°	67.9 m3/hr	1.42	0.03	0.06	1.51	\$/m3
- Clamshell 0.6m3	90°	24.0 m3/hr	2.23	0.08	0.17	2.47	\$/m3
<b>(2) Transportation</b>							
- Dump Truck 6t	L = 1km	10.7 m3/hr	1.75	0.15	0.24	2.14	\$/m3
	L = 2km	8.3 m3/hr	2.25	0.20	0.31	2.76	\$/m3
	L = 5km	5.0 m3/hr	3.74	0.33	0.52	4.59	\$/m3
	L = 10km	3.0 m3/hr	6.23	0.55	0.86	7.65	\$/m3
	L = 20km	1.7 m3/hr	11.00	0.97	1.52	13.49	\$/m3
	L = 30km	1.2 m3/hr	15.58	1.37	2.16	19.12	\$/m3
<b>(3) Leveling</b>							
- Bulldozer 11t		90.4 m3/hr	0.43	0.02	0.04	0.50	\$/m3
- Motor Grader 2.2m		216.7 m2/hr	0.10	0.01	0.01	0.12	\$/m2
<b>(4) Compaction</b>							
- Bulldozer 11t		117.6 m3/hr	0.33	0.02	0.03	0.38	\$/m3
<b>(5) Leveling/Compaction</b>							
- Bulldozer 11t		51.1 m3/hr	0.76	0.04	0.08	0.88	\$/m3
<b>(6) Stripping</b>							
- Bulldozer 11t		203.0 m2/hr	0.19	0.01	0.02	0.22	\$/m2
<b>(7) Gravel pavement</b>							
- Bulldozer 3t		190.0 m2/hr	0.10	0.01	0.01	0.12	\$/m2
<b>(8) Pipeline installation</b>							
- Truck crane 4.8-4.9t	D = 0.6 m	3.6 m/h	6.55	0.43	0.48	7.47	\$/m
	D = 0.8 m	3.0 m/h	7.86	0.52	0.58	8.96	\$/m
	D = 1.0 m	2.6 m/h	9.17	0.61	0.68	10.46	\$/m

Notes : Deprec. \* ; Depreciation

(a) refer to Table G.3.32 Capacity of Machinery

(b) = (6)/(a), (6) refer to Table G.3.31 Purchase, Depreciation and Running cost of Machinery

(c) = (13)/(a), (13) refer to Table G.3.31 Purchase, Depreciation and Running cost of Machinery

(d) = (14)/(a), (14) refer to Table G.3.31 Purchase, Depreciation and Running cost of Machinery

(e) = (b) + (c) + (d)

Table G.6.1.14 Purchase, Depreciation and Running cost of Machinery

(Unit : U.S.\$)

Description	Purchase price (U.S.\$) (1)	Life span (year) (2)	Annual standard			Depreciation (6)	Fuel consumption (price = 0.32 \$/l)			Operation and Labour		Running cost				
			Opera. hour (hr) (3)	Opera. day (day) (4)	useful day (day) (5)		F.C (\$/hr) (7)	L.C (\$/hr) (8)	F.C (\$/hr) (9)	Driver Labour (man/hr) (10)	Labour (man/hr) (11)	Total L.C (\$/hr) (12)	L.C (\$/hr) (13)	F.C (\$/hr) (14)	Total (\$/hr) (15)	Remarks
Bulldozer 11t	94,800	5.8	670	110	170	39.0	14.0	0.45	4.03	0.17		1.36	1.81	4.03	5.84	
Bulldozer 3t	35,600	5.8	510	90	140	19.3	5.5	0.18	1.58	0.17		1.36	1.54	1.58	3.12	
Carry-all Scraper 26t	406,100	6.0	950	150	230	119.2	39.0	1.25	11.23	0.17		1.36	2.61	11.23	13.84	
Backhoe 0.20m3	54,900	5.2	710	130	190	23.4	7.0	0.22	2.02	0.19	0.18	2.44	2.66	2.02	4.68	
Backhoe 0.35m3	72,000	5.2	870	160	220	25.5	10.0	0.32	2.88	0.17	0.18	2.28	2.60	2.88	5.48	
Backhoe 0.60m3	128,700	5.2	1,010	180	240	38.4	17.0	0.54	4.90	0.17	0.18	2.25	2.80	4.90	7.69	
Tractor Shovel 1.3m3	74,200	6.0	580	110	180	35.2	12.0	0.38	3.46	0.19		1.52	1.90	3.46	5.36	
Dragline 0.8m3	300,000	8.0	750	110	160	96.6	15.0	0.48	4.32	0.17		1.36	1.84	4.32	6.16	
Clamshell 0.6m3	126,100	5.0	780	120	180	53.4	14.0	0.45	4.03	0.17		1.36	1.81	4.03	5.84	
Dump Truck 6t	56,900	5.0	1,160	180	210	18.7	9.0	0.29	2.59	0.17		1.36	1.65	2.59	4.24	
Truck Crane 4.8~4.9t	70,500	8.2	640	130	160	23.4	6.0	0.19	1.73	0.17		1.36	1.55	1.73	3.28	
Pile Driver 1.3t	46,400	5.0	490	80	120	30.3	16.6	0.53	4.78	0.17		1.36	1.89	4.78	6.67	
Motor Grader 2.2m	52,500	6.8	590	100	150	22.6	5.4	0.17	1.56	0.17		1.36	1.53	1.56	3.09	
Tired Roller 3~4t	30,800	8.0	590	110	160	11.9	1.7	0.05	0.49	0.17		1.36	1.41	0.49	1.90	
Vibrating Roller 3~5t	40,000	6.2	430	100	150	25.9	3.3	0.11	0.95	0.23		1.84	1.95	0.95	2.90	
Soil Compactor 90kg (*)	1,800	3.0		100	160	8.6	1.1	0.04	0.32		0.17	0.85	0.89	0.32	1.20	
Seed Cutter (*)	600	3.0		90	160	3.9	0.3	0.01	0.09		0.17	0.85	0.86	0.09	0.95	
Chain saw (*)	1,900	4.0		90	160	9.4	0.4	0.01	0.12		0.19	0.95	0.96	0.12	1.08	

(\*) : Depreciation and Running & operation cost = \$/day

(1)-(7), (10), (11) = Japanese standard

(8) = (7) \* 0.032 \$/hr

(9) = (7) \* 0.288 \$/hr

(12) = (10)' 8.0 \$/man + (11) \* 5.0 \$/man

Exchange rate = 1U.S.\$ = 2,740 Riel=¥ 115.0

**Table G.6.1.15 Capacity of Machinery**

**1. Bulldozer (Standard : 11 ton)**

(1) Excavation  
 $Q = (60 \cdot q \cdot f \cdot E) / Cm$   
 $q = 1.34$  : Excavated volume/1 cycle  
 $f = 1.00$  : Coefficient  
 $E = 0.70$  : Efficiency  
 $Cm = 0.027 \cdot L = 0.79$  m3  
 $L$  : Length of soil conveyance

L (m)	Cm (min.)	Q (m3/hr)
10	1.06	53.1
30	1.60	35.2
60	2.41	23.4

$L$  : Length of soil conveyance  
 $Cm$  : Cycle time

**(2) Leveling + Compaction**

$Q = (Q1 \cdot Q2) / (Q1 + Q2) = 51.1$  m3/hr

[Leveling]  
 $Q1 = 10 \cdot E1 \cdot (1 \cdot D + 8) = 90.4$  m3/hr  
 $D$  (cm) = 0.30 Spreading Depth  
 $E1 = 0.80$  Efficiency

[Compaction]  
 $Q2 = V \cdot W \cdot D \cdot E2 / N = 117.6$  m3/hr  
 $V$  (m/hr) = 3.500 Velocity of Compaction  
 $W$  (m) = 0.7 Effective Width of Compaction  
 $D$  (cm) = 0.30 Spreading Depth  
 $E2 = 0.80$  Efficiency  
 $N = 5$  Number of Compaction

**(3) Stripping**

$A = So \cdot E = 203.0$  m2/hr  
 $So = 290$  m2/hr Removing area / 1 hour  
 $E = 0.70$  Efficiency

**2. Scraper (Standard : 26 ton, Bowl capacity : 8.0m3)**

[Excavation]  
 $Q = (60 \cdot q \cdot f \cdot E) / Cm$   
 $f = 1.00$  : Coefficient  
 $E = 0.70$  : Efficiency  
 $q = 6.80$  m3 : Capacity =  $q \cdot K$   
 $K = 0.85$   
 $q \cdot K$  (m3) = 8.0

L (m)	Cm (min.)	Q (m3/hr)
100	2.87	99.5
200	4.49	63.6
300	6.11	46.7

$L$  : Length of soil conveyance  
 $Cm$  : Cycle time (minute)

**3. Backhoe**

[Excavation]  
 $Q = (3,600 \cdot q \cdot f \cdot E) / Cm$   
 $f = 1.00$  : Coefficient  
 $E = 0.75$  : Efficiency  
 $Cm = 30$  second : Cycle time  
 $K = 0.98$   
 $q = q \cdot K$

q (m3)	q (m3)	Q (m3/hr)
0.10	0.10	8.8
0.20	0.20	17.6
0.35	0.34	30.9
0.40	0.39	35.3
0.60	0.59	52.9

**4. Tractor Shovel (Standard : 1.3m3)**

[Excavation & Loading]  
 $Q = (3,600 \cdot q \cdot f \cdot E) / Cm$   
 $f = 1.00$  : Coefficient  
 $E = 0.75$  : Efficiency  
 $q = 0.95$  m3 : Capacity =  $q \cdot K$   
 $K = 0.73$   
 $q \cdot K$  (m3) = 1.30

L (m)	Cm (sec)	Q (m3/hr)
< 8 m	45.00	56.9
30	115.00	22.3

$L$  : Length of soil conveyance  
 $Cm$  : Cycle time (second)  
 $L < 8$  m  $Cm = 45.00$   
 $L = 8 \sim 50$  m  $Cm = 3.14 \cdot L + 20.8$

**5. Dragline (Standard : 0.8m3)**

[Excavation & Unloading]  
 $Q = (3,600 \cdot q \cdot f \cdot E) / Cm$   
 $f = 1.00$  : Coefficient  
 $E = 0.75$  : Efficiency  
 $q = 0.70$  m3 : Capacity =  $q \cdot K$   
 $K = 0.88$   
 $q \cdot K$  (m3) = 0.80

Swing (°)	Cm (sec)	Q (m3/hr)
45	25	76.9
90	28	67.9
135	31	61.3
180	34	55.9

$Cm$  : Cycle time (second)

**6. Clamshell (Standard : 0.6m3)**

[Excavation & Unloading]  
 $Q = (3,600 \cdot q \cdot f \cdot E) / Cm$   
 $f = 1.00$  : Coefficient  
 $E = 0.50$  : Efficiency  
 $q = 0.48$  m3 : Capacity =  $q \cdot K$   
 $K = 0.80$   
 $q \cdot K$  (m3) = 0.60

Swing (°)	Cm (sec)	Q (m3/hr)
45	33	26.2
90	36	24.0
135	39	22.2
180	42	20.6

$Cm$  : Cycle time (second)

**7. Dump Truck (Standard : 6 ton)**

[Transportation]  
 $Q = (60 \cdot q \cdot f \cdot E) / Cm$   
 $f = 1.00$  : Coefficient  
 $E = 0.90$  : Efficiency  
 $q = 3.33$  m3 : Capacity =  $T/W$   
 $T$  (ton) = 6  
 $W$  (t/m3) = 1.80

L (km)	Cm (min.)	Q (m3/hr)
1	16.8	10.7
2	21.6	8.3
5	36.0	5.0
10	60.0	3.0
20	108.0	1.7
30	156.0	1.2

$L$  : Length of transportation (km)  
 $Cm$  : Cycle time (minute)  
 $Cm = a \cdot L$   
 $a = 4.8$   
 $b = 12$

Source : Standard of Japanese Ministry of Agriculture, Forest and Fisheries



**Table G.6.1.16 Cost of materials & labour and currency appropriation**

Description	Unit	Cost (U.S.)	Appropriation		Unit cost		Remarks
			L.C (%)	F.C (%)	L.C (U.S.)	F.C (U.S.)	
<b>1. Materials</b>							
Sand	m3	6.0	100		6.0		
Crush stone (1*2)	m3	25.0	100		25.0		
Crush stone (4*6)	m3	21.0	100		21.0		
Boulder	m3	21.0	100		21.0		
Laterite	m3	14.5	100		14.5		
Cement	t	110.0	100	90	11.0	99.0	
Steel bar	t	450.0		100		450.0	
Timber for formwork	m2	165.0	50	50	82.5	82.5	
<b>Reinforced Concrete</b>							
- Light	m3	140.0	20	80	28.0	112.0	
- Medium	m3	170.0	20	80	34.0	136.0	
- Heavy	m3	200.0	20	80	40.0	160.0	
Lean Concrete	m3	60.0	30	70	18.0	42.0	
Steel plate (Flat bar)	t	490.0		100		490.0	
Steel Channel/Angle	t	455.0		100		455.0	
Steel (H-Beam, I-Beam)	t	520.0		100		520.0	
Fuel (diesel)	liter	0.32	10	90	0.03	0.29	
Fuel (gasoline)	liter	0.45	10	90	0.05	0.41	
<b>Spare parts</b>							
<b>RC pipe</b>							
- D = 300mm, L = 1.00m	pce	9.0	5	95	0.5	8.6	
- D = 400mm, L = 1.00m	pce	14.0	5	95	0.7	13.3	
- D = 500mm, L = 1.00m	pce	18.0	5	95	0.9	17.1	
- D = 600mm, L = 1.00m	pce	22.0	5	95	1.1	20.9	
- D = 800mm, L = 1.00m	pce	38.0	5	95	1.9	36.1	
- D = 1000mm, L = 1.00m	pce	72.0	5	95	3.6	68.4	
- D = 1200mm, L = 1.00m	pce	110.0	5	95	5.5	104.5	
- D = 1500mm, L = 1.00m	pce	120.0	5	95	6.0	114.0	
<b>2. Labour</b>							
Common labour	day	5.0	100		5.0		
Unskilled common labour	day	4.0	100		4.0		
Steel worker	day	6.0	100		6.0		
Carpenter	day	6.0	100		6.0		
Mason	day	7.0	100		7.0		
Painter	day	5.0	100		5.0		
Concrete worker	day	5.0	100		5.0		
Pipe fitter	day	5.0	100		5.0		
Welder	day	5.0	100		5.0		
Electrician	day	5.0	100		5.0		
Foreman	day	8.0	100		8.0		
Operator (heavy equipment)	day	8.0	100		8.0		
Driver (general)	day	6.0	100		6.0		
Mechanic	day	7.0	100		7.0		
Guard/watchman	day	7.0	100		7.0		
<b>3. Gate</b>							
Slide gate 1.2*1.2	set	1,500.0	5	95	75.0	1,425.0	
Slide gate 1.5*1.5	set	2,400.0		100		2,400.0	
Slide gate 2.0*2.0	set	5,000.0		100		5,000.0	
Intake tap (d=75mm)	set	50.0		100		50.0	

**Table G.6.1.17 Cost of equipment & facilities and currency appropriation**

Description	Unit	Cost (U.S.)	Appropriation		Unit cost		Remarks
			L.C (%)	F.C (%)	L.C (U.S.)	F.C (U.S.)	
<b>1. Equipment</b>							
4WD vehicle	unit	19,500.0		100		19,500.0	
Truck (2t)	unit	18,000.0		100		18,000.0	
Motor cycle (100cc)	unit	1,400.0		100		1,400.0	
Bicycle	unit	45.0	100		45.0		
Generator	set	22,000.0		100		22,000.0	
Portable generator	set	1,100.0		100		1,100.0	
<b>2. Facilities</b>							
Building work	m2	250.0	20	80	50.0	200.0	
Mobile pump (2**600l/min*2.6pH)	set	270.0		100		270.0	
Mobile pump (3**930l/min*2.8pH)	set	350.0		100		350.0	
Mobile pump (7**50m3 hrs.*5.0pH)	set	250.0	10	90	25.0	225.0	pump China
Mobile pump (9**70m3 hrs.*5.0pH)	set	330.0	10	90	33.0	297.0	pump China

Table G.6.1.18 Quantity Survey for the Road Networks, Boeng Phitea Area

Road No.	Length of Road (m)	Road Type	Height of Embankment (m)	Stripping		Levelling		Excavation		Embankment		Trimming		Gravel pavement			Ancillary Facility (Nos.)			Remarks		
				Area (m <sup>2</sup> )	Width (m)	Area (m <sup>2</sup> )	Width (m)	Volume (m <sup>3</sup> )	Area (m <sup>2</sup> )	Volume (m <sup>3</sup> )	Length (m)	Area (m <sup>2</sup> )	Width (m)	Area (m <sup>2</sup> )	Culvert	Gate	Bridge	Type-I			Type-II	
																		Type-I	Type-II		Type-I	Type-II
<b>Stage - I</b>																						
[ Farm Road ]																						
R1	1,500	I	0.4	4.6	6,900	0.0	0.0	0	1.5	2,280	1.8	2,683	0.0	0	0	0	0	0	0	0	0	
R3	3,000	I	4.5	21.0	63,000	0.0	0.0	0	54.0	162,000	20.1	60,374	0.0	0	1	0	0	0	0	0	0	
R4	6,800	I	2.5	13.0	88,400	0.0	0.0	0	20.0	156,000	11.2	76,026	0.0	0	1	0	1	0	0	0	0	
R5	8,270	I	2.0	11.0	90,970	0.0	0.0	0	14.0	115,780	8.9	73,969	0.0	0	2	0	2	0	0	0	0	
R6	1,500	I	2.0	11.0	16,500	0.0	0.0	0	14.0	21,000	8.9	13,416	0.0	0	1	0	0	0	0	0	0	
R9	1,830	II	2.2	10.8	19,764	0.0	0	12.0	21,960	14.1	25,766	9.8	18,005	0.0	0	1	0	0	0	0	0	
R10	3,280	II	1.3	7.2	23,616	0.0	0	14.0	45,920	6.0	19,614	5.8	19,069	0.0	0	2	0	0	0	0	0	
R11	2,200	II	0.7	4.8	10,560	0.0	0	12.0	26,400	2.4	5,192	3.1	6,887	0.0	0	1	0	0	0	0	0	
R12	3,400	II	0.5	4.0	13,600	0.0	0	12.0	40,800	1.5	5,100	2.2	7,603	0.0	0	1	0	0	0	0	0	
R13	4,410	II	1.3	7.2	31,752	0.0	0	12.0	52,920	6.0	26,372	5.8	25,639	0.0	0	2	0	0	0	0	0	
Total	36,190	10			365,062	0	0	188,000		519,105		303,671	0	5	7	4	2	0	0	0	0	
[ District Road ]																						
DR1	3,600	-	0.0	3.0	10,800	0.0	0	24.0	86,400	6.0	21,600	0.0	0	0	0	0	0	0	0	0	0	
Total	3,600	1			10,800	0	0	86,400		21,600		0	0	0	0	0	0	0	0	0	0	
<b>Stage - III</b>																						
[ Farm Road ]																						
R2	2,700	I	1.8	10.2	27,540	0.0	0.0	0	11.9	32,076	8.0	21,755	0.0	0	1	0	0	0	2	0	0	
R7	3,800	I	4.5	21.0	79,800	0.0	0.0	0	54.0	205,200	20.1	76,474	0.0	0	1	0	0	0	0	0	0	
R8	3,380	I	3.3	16.2	54,756	0.0	0.0	0	31.7	107,078	14.8	49,882	0.0	0	1	0	0	1	1	0	0	
Total	9,880	3			162,096	0	0	344,354		148,090		3	0	0	3	0	0	1	3	0	0	
[ District Road ]																						
DR1	3,600	-	0.0	0.0	0	6.3	22,680	0.0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	
DR2	2,000	-	0.4	8.4	16,800	0.0	0	0.0	3.0	5,920	1.1	2,263	5.0	10,000	0	0	0	0	0	0	0	
Total	5,600	2			16,800	0	0	22,680		5,920		2,263	10,000	0	0	0	0	0	0	0	0	

Note : At the Stage-I, Improvement Works of the Phlous Konlong road (DR1) is implemented as the rehabilitation of the canals.

**Table G.6.1.19 (1) Construction Works of Rehabilitation /Enforcement of the Reservoir (Closed Type)**

Commune Name /Reservoir Name	No.	Length of Dike (m)	Area		Existing dike			Plan		Quantity					Remarks			
			(x1,000m <sup>2</sup> )	(m <sup>2</sup> )	Top EL (m)	Bottom EL (m)	Depth EL (m)	Crest EL (m)	Width (m)	Type	Stripping (m <sup>3</sup> )	Excavation (m <sup>3</sup> )	Embankment (m <sup>3</sup> )	Trimming (m <sup>3</sup> )		Intake Gate (Nos.) Type-I	Intake Gate (Nos.) Type-II	Outlet (Nos.)
<b>1.Puk Reusei</b>																		
Ta Yi	R1	700	38.0	7.5	6.5	1.0	8.5	2.0	II	7,560	19,600	9,100	5,600	0	1	7	Stage - I	
Promok Khlar	R3	2,250	718.0	7.5	5.8	1.7	8.5	3/2	II	24,300	63,000	29,250	24,300	2	0	22	- " -	
Ta Svay	R4	600	27.0	8.0	6.5	1.5	9.0	2.0	II	6,480	16,800	7,800	6,000	0	1	6	- " -	
Phleuv Tuk	R5	1,850	482.0	7.8	6.0	1.8	8.8	2.0	II	19,980	51,800	24,050	20,720	2	0	18	- " -	
Pro Pheng	R6	1,800	190.0	6.6	5.2	1.4	7.6	2.0	II	19,440	50,400	23,400	17,280	1	0	18	- " -	
Khnach	R7	1,300	120.0	6.4	5.0	1.4	7.4	2.0	II	14,040	36,400	16,900	12,480	0	1	13	- " -	
Sub total	6	8,500	1,575.0							91,800	238,000	110,500	86,380	5	3	84		
<b>2.Sanlung</b>																		
Som Say	S1	2,550	667.0	6.2	4.7	1.5	7.5	3/2	III	31,875	71,400	48,450	20,720	1	0	25	Stage - I	
Sub total	1	2,550	667.0							31,875	71,400	48,450	20,720	1	0	25		
<b>3.Prek Ampil</b>																		
Tamao	A1	300	13.0	6.5	6.0	0.5	7.5	2.0	II	3,240	8,400	3,900	1,800	0	1	3	Stage - I	
Ta Pring	A2	1,300	118.0	6.5	6.0	0.5	7.5	2.0	II	14,040	36,400	16,900	7,800	0	1	13	- " -	
Meas Satt	A3	600	42.0	6.0	5.0	1.0	7.5	2.0	II	6,480	16,800	7,800	6,000	0	1	6	- " -	
Sub total	3	2,200	173.0							23,760	61,600	28,600	15,600	0	3	22		
<b>4.Vihearsour</b>																		
Ta Hem	V1	500	16.0	7.0	6.0	1.0	8.0	2.0	II	5,400	14,000	6,500	4,000	0	1	5	Stage - I	
Tro Peang Krahn	V3	550	34.0	7.5	7.0	0.5	8.5	3/2	II	5,940	15,400	7,150	3,300	0	1	5	- " -	
Ta Non	V4	5,600	1,738.0	6.9	5.8	1.1	8.0	3/2	II	60,480	156,800	72,800	49,280	4	0	56	- " -	
O Diev Leu	V5	600	34.0	7.5	6.5	1.0	8.0	3/2	I	5,400	16,800	4,800	3,600	0	1	6	- " -	
O Diev Krom	V6	1,150	93.0	7.0	6.0	1.0	8.0	3/2	II	12,420	32,200	14,950	9,200	0	1	11	- " -	
Choir Teuk Cheng	V7	1,600	163.0	7.0	6.0	1.0	8.0	3/2	II	17,280	44,800	20,800	12,800	0	0	16	- " -	
San Dan	V8	2,500	248.0	6.5	5.5	1.0	8.0	2.0	III	31,250	70,000	47,500	25,000	1	0	25	- " -	
Choir Teuk Tbong	V9	1,000	54.0	7.5	6.5	1.0	8.5	3/2	II	10,800	28,000	13,000	8,000	0	1	10	- " -	
Min Thom	V10	800	39.0	7.0	6.0	1.0	8.5	2.0	III	10,000	22,400	15,200	8,000	0	1	8	- " -	
Ta Top	V11	1,200	82.0	8.0	6.2	1.8	9.0	3/2	II	12,960	33,600	15,600	13,440	0	1	12	- " -	
Trapeang Chouk	V12	1,630	500.0	8.0	7.0	1.0	9.0	3/2	III	20,375	45,640	30,970	13,040	1	0	16	- " -	
Sub total	11	17,130	3,001.0							192,305	479,640	249,270	149,660	6	7	170		
<b>Total</b>	<b>21</b>	<b>30,380</b>	<b>5,416.0</b>							<b>339,740</b>	<b>850,640</b>	<b>436,820</b>	<b>272,360</b>	<b>12</b>	<b>13</b>	<b>301</b>		

Note : 1) Area means the full water surface area in the flood season.

2) Stripping area = W(average width)\*(Length of dike). Type-I W=9.0m, Type-II W=10.8m, Type-III W=12.5m.

3) Excavation volume = 28m<sup>3</sup>/m(average excavation volume)\*(Length of dike)

4) Embankment volume = Vm<sup>3</sup>/m(average embankment volume)\*(Length of dike). Type-I V=8m<sup>3</sup>, Type-II V=13m<sup>3</sup>, Type-III V=19m<sup>3</sup>.

5) Trimming area = 4.0\*(Crest EL - Bottom EL)\*(Length of dike)

**Table G.6.1.19 (2) Construction Works of Rehabilitation /Enforcement of the Reservoir (Semi-closed Type)**

Commune Name /Reservoir Name	No.	Length of Dike (m)	Area ( $\times 1,000m^2$ )	Existing dike			Plan		Stripping (m <sup>3</sup> )	Quantity			Remarks					
				Top EL (m)	Bottom EL (m)	Depth EL (m)	Crest EL (m)	Width (m)		Type	Excavation (m <sup>3</sup> )	Embankment (m <sup>3</sup> )		Trimming (m <sup>3</sup> )	Intake Gate (Nos.) Type-I Type-II	Outlet (Nos.)		
<b>1. Prek Tamerk</b>																		
Thmei	T1	2,000	106.0	8.4	6.5	1.9	8.4	2.5	Semi	18,000	2,000	6,000	15,200	0	0	20	Stage - I	
Ta Dau	T2	7,000	41.0	8.0	7.0	1.0	8.0	2.5	Semi	63,000	7,000	21,000	28,000	0	0	70	- " -	
Brovosh	T3	1,300	243.0	8.5	7.0	1.5	8.5	3.0	Semi	11,700	1,300	3,900	7,800	0	0	13	- " -	
Khlar Siko	T4	470	15.0	8.0	6.0	2.0	8.0	2.5	Semi	4,230	470	1,410	3,760	0	0	4	- " -	
Bac Chang Hoear	T5	2,000	252.0	7.5	6.0	1.5	7.5	3.0	Semi	18,000	2,000	6,000	12,000	0	0	20	- " -	
Trao Peang Reusei	T6	800	20.0	7.5	6.5	1.0	7.5	3.0	Semi	7,200	800	2,400	3,200	0	0	8	- " -	
Sub-total	6	13,570	677.0							122,130	13,570	40,710	69,960	0	0	135		
<b>2. Puk Reusei</b>																		
*Cheung Chrang	R2	0	343.0	7.5	6.5	1.0		3.0	Semi	0	0	0	0	0	0	0	0	Stage - I
Tunnup Tmei	R8	200	12.0	9.0	8.0	1.0	9.0	2.0	Semi	1,800	200	800	800	0	0	2	- " -	
Ta Long	R9	250	12.0	8.9	8.0	0.9	8.9	2.0	Semi	2,250	250	900	900	0	0	2	- " -	
Ta Tein	R10	600	55.0	7.0	6.0	1.0	7.0	2.0	Semi	5,400	600	2,400	2,400	0	0	6	- " -	
Sub-total	4	1,050	422.0							9,450	1,050	0	4,100	0	0	10		
<b>3. Vihearsour</b>																		
Khtom Leak	V2	450	30.0	7.0	6.0	1.0	8.0	2.0	Semi	4,050	450	1,350	3,600	0	0	4	Stage - I	
Sub-total	1	450	30.0							4,050	450	1,350	3,600	0	0	4		
<b>Total</b>	<b>11</b>	<b>15,070</b>	<b>1,129.0</b>							<b>135,630</b>	<b>15,070</b>	<b>42,060</b>	<b>77,660</b>	<b>0</b>	<b>0</b>	<b>149</b>		

Note : 1) Area means the full water surface area in the flood season.

2) Stripping area =  $9m(\text{average width}) \times (\text{Length of dike})$

3) Excavation volume =  $1m^3/m(\text{average excavation volume}) \times (\text{Length of dike})$

4) Embankment volume =  $3m^3/m(\text{average embankment volume}) \times (\text{Length of dike})$

5) Trimming area =  $4.0 \times (\text{Crest EL} - \text{Bottom EL}) \times (\text{Length of dike})$

6) \*Cheung Chrang reservoir is rehabilitated as Farm road No.4 (R4).

**Table G.6.1.20 Construction Works of Rehabilitation /Expansion of the Colmatage Canals, Boeng Phtea Area**

No.	Name of Prek	Name of village	Dimension of existing canal			Plan				Remarks		
			Top width (m)	Depth (m)	Length (m)	Rehabili. Type	Expansion of Length (m)	Intake gate Type	Bridge Type		Bridge Nos.	
<b>1. Prek Tamerk commune</b>												
CL1	Roung	Knong, Kagnchap Cheung	15	1.5	1,000							
CL2	Ta Hors	Anlung, Kagnchap Cheung	15	2.5	1,500							
	Sub-total				2,500	B						
<b>2. Puk Reusei commune</b>												
CL3	Agn Cheng	Agn Cheng Leu	10	1.5	500	B	500	A	500	B	1	
CL4	Tamao	Agn Cheng Krom	67	13.0	1,258	E	1,260	C	700	E	2	
CL5	Kong Van	Agn Cheng Krom, Kroch Seauch	57	8.2	1,500	E	1,500			E	1	
CL6	Ta Kheum	Agn Cheng Krom, Kroch Seauch	57	8.2	2,500	E	2,500	C	500			
CL7	Slat	Kroch Seauch, Puk Reusei Leu Puk Reusei Krom, Puk Reusei Kand	30	1.8	6,000	C				B **	1	
CL8	Ta Pang	Puk Reusei Leu	12	1.5	1,500	B	1,500	A	1,100	B	1	
	Sub-total				15,258 (Items)	B E	7,260 (2,000) (5,260)	A C	4,000 (2,800) (1,200)	B E B*	5 (2) (2) (1)	4 (3) (1)
	Total				15,758 (Items)	B E	7,260 (2,000) (5,260)	A C	4,000 (2,800) (1,200)	B E B*	5 (2) (2) (1)	4 (3) (1)

Note : Rehabilitation /Expansion of Colmatage canals is implemented mainly at Stage-II.

Stage - I	Item	Implementation Period					
		0	1st Year	2nd Year	3rd Year	4th Year	5th Year
	- Fund Arrangement						
	- Project Coordinating Works						
	- Land Expropriation						
	- Project Coordination						
	- Farmer's Organization						
	- Detailed Design						
	- Tendering						
	- Construction Works						
	- Construction of the Farm Roads						
	- Rehabilitation of the Reservoirs						
	- Rehabilitation of the Canals						
	- Construction of the Weir						
	- Construction of the Intake Gate						
	- Project Administration						
	- Supporting Service Project						
	- Operation / Maintenance						

Figure G.6.1.1 Implementation Schedule for the Stage - I of the Boeng Phtea Improvement Project

Item	Implementation Period					
	0	1st Year	2nd Year	3rd Year	4th Year	5th Year
- Fund Arrangement						
- Project Coordinating Works						
- Land Expropriation						
- Project Coordination						
- Farmer's Organization						
- Detailed Design						
- Tendering						
- Construction Works						
- Rehabilitation of the Colmatage Canals						
- Expansion of the Colmatage Canals						
- Installation of the Intake Gates						
- Construction of the Concrete Bridge						
- Project Administration						
- Supporting Service Project						
- Operation / Maintenance						

Figure G.6.1.2 Implementation Schedule for the Stage - II of the Boeng Phtea Improvement Project

Item	Implementation Period					
	0	1st Year	2nd Year	3rd Year	4th Year	5th Year
- Fund Arrangement	██████████					
- Project Coordinating Works		██████████				
- Land Expropriation		██████████				
- Project Coordination		██████████				
- Farmer's Organization		██████████				
- Detailed Design		██████████				
- Tendering		██████████				
- Construction Works			██████████	██████████		
- Construction of the Farm Roads			██████████	██████████		
- Rehabilitation of the District Roads			██████████	██████████		
- Construction of Concrete Bridge			██████████	██████████		
- Construction of the Flood Control Gate			██████████	██████████		
- Construction of the Fish Pond			██████████	██████████		
- Project Administration		██████████	██████████	██████████	██████████	██████████
- Supporting Service Project		██████████	██████████	██████████	██████████	██████████
- Operation / Maintenance						██████████

Figure G.6.1.3 Implementation Schedule for the Stage - III of the Boeng Phtea Improvement Project



## G.6.2 The priority Colmatage Area in Kandal Province

**Table G.6.2.1 Summary of the Project Quantity (Priority Colmatage Area)**

Description	Existing		Plan			
	Number of Canal	Number of Intake gate	Number of Canal	Canal length (m)	Intake gate (Nos.)	Bridge (Nos.)
<b>A. Right Bank of the Mckong River, Kean Svay District</b>						
Type - A	1	-	-	-	-	-
Type - B	-	-	-	-	-	-
Type - C	1	1	1	2,000	1	-
Type - D	2	2	2	4,150	2	-
Type - E	2	2	2	5,800	2	-
Total	6	5	5	11,950	5	-
<b>B. Left Bank of the Bassac River, Saang District</b>						
Type - A	2	-	-	-	-	1
Type - B	-	-	-	-	-	-
Type - C	3	-	3	6,000	-	2
Type - D	3	-	3	5,800	-	3
Type - E	-	-	-	-	-	-
Total	8	-	6	11,800	-	6
<b>C. Right Bank of the Bassac River, Saang District</b>						
Type - A	1	-	-	-	-	-
Type - B	-	-	-	-	-	-
Type - C	2	-	2	2,300	-	2
Type - D	3	-	3	7,560	-	1
Type - E	1	-	1	2,350	-	1
Total	7	-	6	12,210	-	4
<b>Total of A. ~ C.</b>						
Type - A	4	-	-	-	-	1
Type - B	-	-	-	-	-	-
Type - C	6	1	6	10,300	1	4
Type - D	8	2	8	17,510	2	4
Type - E	3	2	3	8,150	2	1
<b>Grand - total</b>	<b>21</b>	<b>5</b>	<b>17</b>	<b>35,960</b>	<b>5</b>	<b>10</b>

**Table G.6.2.2 Summary of the Project Cost (Priority Colmatage Area)**

Description Division Location District Name	Amount			Total
	A	B	C	
	Right Bank of Mckong Kean Svay	Left Bank of Bassac river Saang	Right Bank of Bassac Saang	
	(Unit : US\$)			
<b>1. Construction cost</b>				
- Rehabilitation of Colmatage canal	1,020,217	844,836	975,307	2,840,361
- Construction of Intake gate	2,245,057	-	-	2,245,057
- Construction of Bridge	-	188,124	150,925	5,085,418
Sub - total of 1.	3,265,274	1,032,960	1,126,232	5,424,467
<b>2. Administration cost</b>				
<b>3. Consulting Service cost</b>				
Total of (1.-3.)	3,591,801	1,136,256	1,238,856	5,966,913
<b>4. Physical Contingency</b>				
Total of (1.-4.)	3,950,981	1,249,882	1,362,741	6,563,605

**Table G.6.2.3 Project Cost of Rehabilitation of Colmatage Canal in the Priority Area**

Unit : US\$

Description	1st year		2nd year		3rd year		4th year		Total		
	L.C	F.C	L.C	F.C	L.C	F.C	L.C	F.C	L.C	F.C	total
1. Construction Cost											
A. Right bank of the Mekong river	114,788	538,267	200,879	941,966	258,273	1,211,100			573,941	2,691,333	3,265,274
B. Left bank of the Bassac river	87,135	119,457	152,486	209,050	196,054	268,778			435,675	597,285	1,032,960
C. Right bank of the Bassac river	93,057	132,190	162,849	231,332	209,378	297,427			465,284	660,948	1,126,232
Sub total of 1.	294,980	789,913	516,215	1,382,348	663,705	1,777,305			1,474,901	3,949,566	5,424,467
2. Project Administration	-	-	-	-	-	-			-	-	-
3. Consulting Service (10% of 1.)											
1) Detail Design (40% of 3.)		216,979								216,979	216,979
2) Construction Supervision (60% of 3.)		65,094		113,914		146,461				325,468	325,468
Sub total of 3.		282,072		113,914		146,461				542,447	542,447
4. Agricultural Supporting Activity											
Total of 1.-4.	294,980	1,071,986	516,215	1,496,262	663,705	1,923,765			1,474,901	4,492,013	5,966,913
5. Physical Contingency (1.-4.) * 10%	29,498	107,199	51,622	149,626	66,371	192,377			147,490	449,201	596,691
<b>Grand Total of 1.-5.</b>	<b>324,478</b>	<b>1,179,184</b>	<b>567,837</b>	<b>1,645,888</b>	<b>730,076</b>	<b>2,116,142</b>			<b>1,622,391</b>	<b>4,941,214</b>	<b>6,563,605</b>
(L.C + F.C)		(1,503,662)		(2,213,725)		(2,846,218)					

**Table G.6.2.4 Construction Cost of Rehabilitation of Colmatage Canal in the Priority Area**

Unit : US \$

Description	Quantity	Labour & materials		Machinery cost			Total cost		
		Implement cost		Depre	Running cost		I.C.	F.C.	Total
		I.C.	F.C.		I.C.	F.C.			
<b>A Right Bank of the Mekong River, Kean Svay District</b>									
(1) Rehabilitation of canals (m)	11,950	343,338	-	449,481	40,616	49,870	383,954	499,351	883,305
① = Sub-total		343,338	-	449,481	40,616	49,870	383,954	499,351	883,305
② = O&M and benefit ( 10 % of Sub-total ①)		34,334	-	44,948	4,062	4,987	38,395	49,935	88,331
③ = Tax, etc. ( 5 % of ① + ②)		18,884	-	24,721	2,234	2,743	21,117	27,464	48,582
Total of 1 (= ① + ② + ③)		396,556	-	519,151	46,911	57,600	443,466	576,751	1,020,217
(2) Installation of the Intake gate (Nos)	5	112,231	1,819,234	10,098	734	1,475	112,965	1,830,807	1,943,772
① = Sub-total		112,231	1,819,234	10,098	734	1,475	112,965	1,830,807	1,943,772
② = O&M and benefit ( 10 % of Sub-total ①)		11,223	181,923	1,010	73	148	11,297	183,081	194,377
③ = Tax, etc. ( 5 % of ① + ②)		6,173	100,058	555	40	81	6,213	100,694	106,907
Total of 2 (= ① + ② + ③)		129,626	2,101,215	11,663	848	1,704	130,475	2,114,582	2,245,057
(3) Construction of Bridge (Nos)	-	-	-	-	-	-	-	-	-
① = Sub-total		-	-	-	-	-	-	-	-
② = O&M and benefit ( 10 % of Sub-total ①)		-	-	-	-	-	-	-	-
③ = Tax, etc. ( 5 % of ① + ②)		-	-	-	-	-	-	-	-
Total of 3 (= ① + ② + ③)		-	-	-	-	-	-	-	-
<b>Total of A.</b>		<b>526,182</b>	<b>2,101,215</b>	<b>530,814</b>	<b>47,759</b>	<b>59,303</b>	<b>573,941</b>	<b>2,691,333</b>	<b>3,265,274</b>
<b>B Left Bank of the Bassac River, Saang District</b>									
(1) Rehabilitation of canals (m)	11,800	318,664	-	344,124	30,580	38,092	349,244	382,216	731,460
① = Sub-total		318,664	-	344,124	30,580	38,092	349,244	382,216	731,460
② = O&M and benefit ( 10 % of Sub-total ①)		31,866	-	34,412	3,058	3,809	34,924	38,222	73,146
③ = Tax, etc. ( 5 % of ① + ②)		17,527	-	18,927	1,682	2,095	19,208	21,022	40,230
Total of 1 (= ① + ② + ③)		368,057	-	397,463	35,320	43,996	403,377	441,459	844,836
(2) Installation of the Intake gate (Nos)	-	-	-	-	-	-	-	-	-
① = Sub-total		-	-	-	-	-	-	-	-
② = O&M and benefit ( 10 % of Sub-total ①)		-	-	-	-	-	-	-	-
③ = Tax, etc. ( 5 % of ① + ②)		-	-	-	-	-	-	-	-
Total of 2 (= ① + ② + ③)		-	-	-	-	-	-	-	-
(3) Construction of Bridge (Nos)	6	27,679	131,202	3,284	284	428	27,964	134,914	162,878
① = Sub-total		27,679	131,202	3,284	284	428	27,964	134,914	162,878
② = O&M and benefit ( 10 % of Sub-total ①)		2,768	13,120	328	28	43	2,796	13,491	16,288
③ = Tax, etc. ( 5 % of ① + ②)		1,522	7,216	181	16	24	1,538	7,420	8,958
Total of 3 (= ① + ② + ③)		31,970	151,539	3,793	328	495	32,298	155,826	188,124
<b>Total of B.</b>		<b>400,026</b>	<b>151,539</b>	<b>401,256</b>	<b>35,649</b>	<b>44,491</b>	<b>435,675</b>	<b>597,285</b>	<b>1,032,960</b>
<b>C Right Bank of the Bassac River, Saang District</b>									
(1) Rehabilitation of canals (m)	12,210	342,836	-	417,737	37,537	46,312	380,373	464,049	844,422
① = Sub-total		342,836	-	417,737	37,537	46,312	380,373	464,049	844,422
② = O&M and benefit ( 10 % of Sub-total ①)		34,284	-	41,774	3,754	4,631	38,037	46,405	84,442
③ = Tax, etc. ( 5 % of ① + ②)		18,856	-	22,976	2,065	2,547	20,921	25,523	46,443
Total of 1 (= ① + ② + ③)		395,976	-	482,486	43,356	53,490	439,331	535,976	975,307
(2) Installation of the Intake gate (Nos)	-	-	-	-	-	-	-	-	-
① = Sub-total		-	-	-	-	-	-	-	-
② = O&M and benefit ( 10 % of Sub-total ①)		-	-	-	-	-	-	-	-
③ = Tax, etc. ( 5 % of ① + ②)		-	-	-	-	-	-	-	-
Total of 2 (= ① + ② + ③)		-	-	-	-	-	-	-	-
(3) Construction of Bridge (Nos)	4	22,254	105,361	2,511	216	329	22,470	108,201	130,671
① = Sub-total		22,254	105,361	2,511	216	329	22,470	108,201	130,671
② = O&M and benefit ( 10 % of Sub-total ①)		2,225	10,536	251	22	33	2,247	10,820	13,067
③ = Tax, etc. ( 5 % of ① + ②)		1,224	5,795	138	12	18	1,236	5,951	7,187
Total of 3 (= ① + ② + ③)		25,704	121,692	2,900	249	380	25,953	124,972	150,925
<b>Total of C.</b>		<b>421,679</b>	<b>121,692</b>	<b>485,386</b>	<b>43,605</b>	<b>53,870</b>	<b>465,284</b>	<b>660,948</b>	<b>1,126,232</b>
<b>Grand total of A.-C.</b>		<b>1,347,888</b>	<b>2,374,445</b>	<b>1,417,457</b>	<b>127,013</b>	<b>157,664</b>	<b>1,474,901</b>	<b>3,949,565</b>	<b>5,424,467</b>

**Table G.6.2.5 Cost of Improvement Works, Rehabilitation of Colmatage Canal in the Priority Area**  
Unit : US \$

Description	Unit	Quantity	Labour & materials		Machinery cost			Total cost		
			Implementation cost		Depre	Running cost		L.C.	F.C.	Total
			L.C.	F.C.		L.C.	F.C.			
<b>A. Right Bank of the Mekong River, Kean Svay District</b>										
<b>(1) Rehabilitation of canals</b>										
- Type - C	m	2,000	51,945	-	49,292	4,318	5,446	56,263	54,737	111,000
- Type - D	m	4,150	116,508	-	140,419	12,612	15,566	129,120	155,985	285,105
- Type - E	m	5,800	174,886	-	259,771	23,686	28,858	198,571	288,629	487,200
Sub-total of (1)		11,950	343,338	-	449,481	40,616	49,870	383,954	499,351	883,305
<b>(2) Installation of the Intake gate</b>										
- Type - C	Nos	1	13,644	177,697	1,096	83	156	13,727	178,949	192,676
- Type - D	Nos	2	42,890	688,585	3,887	282	568	43,172	693,040	736,212
- Type - E	Nos	2	55,697	952,952	5,115	369	751	56,066	958,818	1,014,884
Sub-total of (2)		5	112,231	1,819,234	10,098	734	1,475	112,965	1,830,807	1,943,772
<b>(3) Construction of Bridge</b>										
- Type -	Nos	-	-	-	-	-	-	-	-	-
Sub-total of (3)		-	-	-	-	-	-	-	-	-
<b>Total of (1) - (3)</b>			<b>455,569</b>	<b>1,819,234</b>	<b>459,580</b>	<b>41,350</b>	<b>51,345</b>	<b>496,919</b>	<b>2,330,158</b>	<b>2,827,077</b>
<b>B. Left Bank of the Bassac River, Saang District</b>										
<b>(1) Rehabilitation of canals</b>										
- Type - C	m	6,000	155,834	-	147,875	12,954	16,337	168,788	164,212	333,000
- Type - D	m	5,800	162,830	-	196,248	17,626	21,755	180,456	218,004	398,460
Sub-total of (1)		11,800	318,664	-	344,124	30,580	38,092	349,244	382,216	731,460
<b>(2) Installation of the Intake gate</b>										
- Type -	Nos	-	-	-	-	-	-	-	-	-
Sub-total of (2)		-	-	-	-	-	-	-	-	-
<b>(3) Construction of Bridge</b>										
- Type - A	Nos	1	2,119	11,360	384	33	50	2,152	11,795	13,947
- Type - C	Nos	2	9,353	45,440	1,090	93	143	9,446	46,674	56,120
- Type - D	Nos	3	16,208	74,401	1,809	158	235	16,366	76,445	92,811
Sub-total of (3)		6	27,679	131,202	3,284	284	428	27,964	131,914	162,878
<b>Total of (1) - (3)</b>			<b>346,343</b>	<b>131,202</b>	<b>347,408</b>	<b>30,865</b>	<b>38,520</b>	<b>377,208</b>	<b>517,130</b>	<b>894,338</b>
<b>C. Right Bank of the Bassac River, Saang District</b>										
<b>(1) Rehabilitation of canals</b>										
- Type - C	m	2,300	59,736	-	56,686	4,966	6,262	64,702	62,948	127,650
- Type - D	m	7,560	212,241	-	255,799	22,975	28,357	235,216	284,156	519,372
- Type - E	m	2,350	70,859	-	105,252	9,597	11,692	80,456	116,944	197,400
Sub-total of (1)		12,210	342,836	-	417,737	37,537	46,312	380,373	464,049	844,422
<b>(2) Installation of the Intake gate</b>										
- Type -	Nos	-	-	-	-	-	-	-	-	-
Sub-total of (2)		-	-	-	-	-	-	-	-	-
<b>(3) Construction of Bridge</b>										
- Type - C	Nos	2	9,353	45,440	1,090	93	143	9,446	46,674	56,120
- Type - D	Nos	1	5,403	24,800	603	53	78	5,455	25,482	30,937
- Type - E	Nos	1	7,499	35,120	818	70	108	7,569	36,045	43,614
Sub-total of (3)		4	22,254	105,361	2,511	216	329	22,470	108,201	130,671
<b>Total of (1) - (3)</b>			<b>365,090</b>	<b>105,361</b>	<b>420,248</b>	<b>37,753</b>	<b>46,641</b>	<b>402,844</b>	<b>572,249</b>	<b>975,093</b>
<b>Total of (A) - (C)</b>										
<b>(1) Rehabilitation of canals</b>										
- Type - A	m	-	-	-	-	-	-	-	-	-
- Type - B	m	-	-	-	-	-	-	-	-	-
- Type - C	m	10,300	267,514	-	253,853	22,238	28,045	289,753	281,897	571,650
- Type - D	m	17,510	491,579	-	592,467	53,213	65,679	544,792	658,145	1,202,937
- Type - E	m	8,150	245,744	-	365,023	33,282	40,551	279,027	405,573	684,600
Sub-total of (1)		35,960	1,004,838	-	1,211,342	108,733	134,274	1,113,571	1,345,616	2,459,187
<b>(2) Installation of the Intake gate</b>										
- Type - A	Nos	-	-	-	-	-	-	-	-	-
- Type - B	Nos	-	-	-	-	-	-	-	-	-
- Type - C	Nos	1	13,644	177,697	1,096	83	156	13,727	178,949	192,676
- Type - D	Nos	2	42,890	688,585	3,887	282	568	43,172	693,040	736,212
- Type - E	Nos	2	55,697	952,952	5,115	369	751	56,066	958,818	1,014,884
Sub-total of (2)		5	112,231	1,819,234	10,098	734	1,475	112,965	1,830,807	1,943,772
<b>(3) Construction of Bridge</b>										
- Type - A	Nos	1	2,119	11,360	384	33	50	2,152	11,795	13,947
- Type - B	Nos	-	-	-	-	-	-	-	-	-
- Type - C	Nos	4	18,705	90,881	2,180	187	287	18,892	93,348	112,240
- Type - D	Nos	4	21,610	99,202	2,412	210	313	21,821	101,927	123,748
- Type - E	Nos	1	7,499	35,120	818	70	108	7,569	36,045	43,614
Sub-total of (3)		10	49,934	236,563	5,795	500	757	50,434	243,115	293,549
<b>Total of (1) - (3)</b>			<b>1,167,002</b>	<b>2,055,797</b>	<b>1,227,235</b>	<b>109,968</b>	<b>136,506</b>	<b>1,276,970</b>	<b>3,419,538</b>	<b>4,696,508</b>

Table G.6.2.6 Improvement Plan of the Colmatage Canals in the Priority Area

Prek No.	Name of Prek	Zone	Canal Dimension (existing)		Length (m)	B/C/W or None	Bridge/Culvert			Gate (existing)			Type	Improvement Plan Canal Length (m)	Gate Nos.	Bridge Nos.	Remarks	
			Top Width (m)	Bottom Width (m)			H (m)	L (m)	Rehabilitation	H (m)	W (m)	Span						
<b>A. Right Bank of the Mekong River, Kean Svay District</b>																		
KS19	Spean Prek Poi	I	15.0	10.0	3.0	2,000	C	7.0	7.0	11.4	No need	6.4	1.7	3	-	-	-	
KS15	Prek Youm	I	25.0	8.0	6.0	3,000	C	10.0	6.3	20.0	No need	3.0	2.5	4	-	-	-	
KS20	Prek Chrey	I	Incomplete		-	0	None	-	-	-	No need	-	-	-	-	-	-	
KS21	Samrong Thom	I	25.0	7.0	5.0	2,150	C	7.0	6.0	12.0	No need	4.0	2.1	3	-	-	-	
KS14	Koki Thom	I	30.0	15.0	2.0	2,800	C	8.0	5.3	10.7	No need	5.3	1.8	3	-	-	-	
KS22	Prek Kompong Thom	I	20.0	10.0	3.0	2,000	C	5.8	4.0	8.7	No need	4.0	2.3	3	-	-	-	
Sub-total of (A.)			6	(23.0)	(10.0)	(3.8)	11,950							5	11,950		5	
(Average)						(2,390)												
<b>B. Left Bank of the Bassac River, Saang District</b>																		
SA65	Thmei	IV	20.0	18.0	2.0	2,000	W	3.0	3.8	28.0	Need	-	-	-	-	-	-	
SA66	Ta Te	IV	20.0	11.0	2.0	2,000	C	3.5	3.5	23.6	Need	-	-	-	-	-	-	
SA67	Krath	IV	20.0	17.0	2.0	2,000	C	4.0	3.5	19.0	Need	-	-	-	-	-	-	
SA68	Wath Talong	IV	20.0	18.0	2.0	1,800	Backfill	-	-	-	Need	-	-	-	-	-	-	
SA69	Ta Prak	IV	20.0	12.0	2.0	2,000	Backfill	-	-	-	Need	-	-	-	-	-	-	
SA70	Reusse Srok	IV	20.0	12.0	2.0	2,000	C	3.0	3.0	2.5	No need	-	-	-	-	-	-	
SA71	Chkaikvein	IV	14.0	5.0	2.0	800	C	3.5	8.0	16.0	Need	-	-	-	-	-	-	
SA72	Phon	IV	10.0	5.0	2.0	800	S	6.0	1.8	15.0	No need	-	-	-	-	-	-	
Sub-total of (B.)			8	(18.0)	(12.3)	(2.0)	13,400							6	11,800		6	
(Average)						(1,675)												
<b>C. Right Bank of the Bassac River, Saang District</b>																		
SA12	Thet	IV	40.0	20.0	5.0	2,350	C	5.0	8.0	36.0	Need	-	-	-	-	-	-	
SA13	Nakta Samroung	IV	25.0	12.0	2.0	1,000	S	4.5	3.0	12.0	No need	-	-	-	-	-	-	
SA14	Long	IV	30.0	13.0	3.0	1,560	S	4.3	4.0	12.0	No need	-	-	-	-	-	-	
SA15	Kseiv	IV	20.0	11.0	2.5	1,500	S	4.3	3.0	12.0	Need	-	-	-	-	-	-	
SA16	Penn	IV	20.0	11.0	2.0	800	Backfill	-	-	-	Need	-	-	-	-	-	-	
SA17	Toch	IV	30.0	16.0	3.0	5,000	C	5.6	3.5	7.8	Need	-	-	-	-	-	-	
SA18	Me Srok	IV	12.0	4.0	2.0	1,715	C	6.0	3.8	12.0	No need	-	-	-	-	-	-	
Sub-total of (C.)			7	(25.3)	(12.4)	(2.8)	13,925							6	12,210		4	
(Average)						(1,989)												
Total of (A.) - (C.)			21	436.0	235.0	54.5	39,275							17	35,960		10	
(Average)				(21.8)	(11.8)	(2.7)	(1,964)											

**Table G.6.2.7 Inventory of Colmatage Canal Facilities in the Priority Area**

Prek No. / Zone	Name of Prek	Name of Main Village	Number of Village Families	Canal Dimension			Bridge / Culvert			Gate		Water Source	Problem / Comment					
				Top Width (m)	Bottom Width (m)	Depth (m)	Length (m)	Type (Plan) or None	B (m)	H (m)	L (m)			Rehabilitation (m)	H (m)	W (m)		
<b>A. Right Bank of the Mekong River, Kean Svay District</b>																		
KS19	Spean Prek Pol	Kandil Krom	1	250	15.0	10.0	3.0	2,000	C	C	7.0	7.0	11.4	No need	6.4	1.7	3	Mekong. Reh. is Proposed by Japan. grant aid
KS15	Prek Youm	Prek Youm, Pol	2	1,060	25.0	8.0	6.0	3,000	E	C	10.0	6.3	20.0	No need	3.0	2.5	4	Mekong. Reh. is Proposed by Japan. grant aid
KS20	Prek Chrey		1	418		Incomplete		0	A	None	-	-	-	No need	-	-	-	Mekong. Reh. is Proposed by Japan. grant aid
KS21	Samrong Thom	Reang Dak, Koki Thor	1	589	25.0	7.0	5.0	2,150	D	C	7.0	6.0	12.0	No need	4.0	2.1	3	Mekong. Reh. is Proposed by Japan. grant aid
KS14	Koki Thom		3	1,054	30.0	15.0	2.0	2,800	E	C	8.0	5.3	10.7	No need	5.3	1.8	3	Mekong. Reh. is Proposed by Japan. grant aid
KS22	Prek Kompong Thom	Kbal Chroy	1	555	20.0	10.0	3.0	2,000	D	C	5.8	4.0	8.7	No need	4.0	2.3	3	Mekong. Reh. is Proposed by Japan. grant aid
6	Sub-total of (A.)		9	3,926	(23.0)	(10.0)	(3.8)	11,950										
	(Average)							(2,390)										
<b>B. Left Bank of the Bassac River, Saang District</b>																		
SA65	Thmei	Chong Koh Tod	1	274	20.0	18.0	2.0	2,000	D	W	5.0	3.8	28.0	Need	-	-	-	Bassac. Water gate structure. Canal Reh. needed
SA66	Ta Te	Phum Ta Lone	1	248	20.0	11.0	2.0	2,000	C	C	5.5	3.5	23.6	Need	-	-	-	Bassac. Water gate needed
SA67	Kranh	Phum Ta Lone	1	192	20.0	17.0	2.0	2,000	D	C	4.0	3.5	19	Need	-	-	-	Bassac. Water gate needed
SA68	Wath Talong	Phum Ta Lone	1	267	20.0	18.0	2.0	1,800	D	Backfill	-	-	-	Need	-	-	-	Bassac
SA69	Ta Prak	Prek Ta Prak	1	239	20.0	12.0	2.0	2,000	C	Backfill	-	-	-	Need	-	-	-	Bassac
SA70	Roussei Srok	Roussei Srok	1	182	20.0	12.0	2.0	2,000	C	C	3.0	3.0	2.5	No need	-	-	-	Bassac. Water gate. Reh. needed
SA71	Chkaikvein	Phum Chkaikvein	2	235	14.0	5.0	2.0	800	A	C	3.5	8.0	16.0	Need	-	-	-	Bassac
SA72	Phon	Phum Phon	1	93	10.0	5.0	2.0	800	A	S	6.0	1.8	15.0	No need	-	-	-	Bassac
8	Sub-total of (B.)		9	1,750	(18.0)	(12.3)	(2.0)	13,400										
	(Average)							(1,675)										
<b>C. Right Bank of the Bassac River, Saang District</b>																		
SA12	Thai	Phum Prek Thai	2	310	40.0	20.0	5.0	2,350	E	C	5.0	8.0	36.0	Need	-	-	-	Bassac. Reh. Plan has designed, W.G. needed
SA13	Nakta Samrong	Prek Somrong	2	220	25.0	12.0	2.0	1,000	D	S	4.5	3.0	12.0	No need	-	-	-	Bassac
SA14	Long	Prek Somrong	2	340	30.0	13.0	3.0	1,560	D	S	4.3	4.0	12.0	No need	-	-	-	Bassac
SA15	Kseiv	Kseiv	2	250	20.0	11.0	2.5	1,500	C	S	4.3	3.0	12.0	Need	-	-	-	Bassac. Reh. Plan has designed, W.G. needed
SA16	Penn	Phum Kseiv	2	80	20.0	11.0	2.0	800	C	Backfill	-	-	-	Need	-	-	-	Bassac
SA17	Toch	Prek Roun	2	780	30.0	16.0	3.0	5,000	D	C	5.6	5.5	7.8	Need	-	-	-	Bassac. Reexcavation/Water gate needed
SA18	Me Srok	Prek Srok	2	130	12.0	4.0	2.0	1,715	A	C	6.0	3.8	12.0	No need	-	-	-	Bassac
7	Sub-total of (C.)		14	2,130	(25.3)	(12.4)	(2.8)	13,925										
	(Average)							(1,989)										
21	Total of (A.) - (C.)		32	7,786	436.0	235.0	54.5	39,275										
	(Average)				(21.8)	(11.8)	(2.7)	(1,964)										

Note: Bridge Type: C = Concrete, S = Iron, W = Wooden, Cul = Culvert, None = Nothing

**Table G.6.2.8 Cost Estimation of Rehabilitation for Colmatage Canal in the Priority Area** (Unit : US\$)

District Name	Type of Colmatage Canal	Existing Canal			Gate (Nos.)	Number	Proposed canal			Cost of Implementation Works				Total (US\$)	Remarks
		Number	Length (m)	Canal Length (m)			Length (m)	Amount (US\$)	Number	Amount (US\$)	Intake Gate Number	Intake Gate Amount (US\$)	Bridge Number		
<b>A. Right Bank of the Mekong River</b>															
	A	1	-	-	-	-	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kean Svay	C	1	2,000	-	1	1	2,000	155,128	1	269,274	-	-	-	424,402	
	D	2	4,150	-	2	2	4,150	398,448	2	1,028,893	-	-	-	1,427,342	
	E	2	5,800	-	2	2	5,800	680,886	2	1,418,351	-	-	-	2,099,237	
	Sub - total	6	11,950	-	5	5	11,950	1,234,463	5	2,716,519	-	-	-	3,950,981	
<b>B. Left Bank of the Bassac River</b>															
	A	2	1,600	-	-	-	-	-	-	-	-	1	19,492	19,492	
	B	-	-	-	-	-	-	-	-	-	-	-	-	-	
Saang	C	3	6,000	-	3	3	6,000	465,384	-	-	-	2	78,431	543,815	
	D	3	5,800	-	3	3	5,800	556,868	-	-	-	3	129,708	686,576	
	E	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Sub - total	8	13,400	-	6	6	11,800	1,022,252	-	-	-	6	227,630	1,249,882	
<b>C. Right Bank of the Bassac River</b>															
	A	1	1,715	-	-	-	-	-	-	-	-	-	-	-	
	B	-	-	-	-	-	-	-	-	-	-	-	-	-	
Saang	C	2	2,300	-	2	2	2,300	178,397	-	-	-	2	78,431	256,828	
	D	3	7,560	-	3	3	7,560	725,848	-	-	-	1	45,236	769,084	
	E	1	2,350	-	1	1	2,350	275,876	-	-	-	1	60,953	336,829	
	Sub - total	7	13,925	-	6	6	12,210	1,180,122	-	-	-	4	182,619	1,362,741	
	A	4	5,315	-	-	-	-	-	-	-	-	1	19,492	19,492	
	B	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total	C	6	10,300	1	6	6	10,300	798,909	1	269,274	4	156,861	1,225,045		
	D	8	17,510	2	8	8	17,510	1,681,165	2	1,028,893	4	172,944	2,883,002		
	E	3	8,150	2	3	3	8,150	956,763	2	1,418,351	1	60,953	2,436,067		
	Grand - total	21	39,275	5	17	17	35,960	3,436,837	5	2,716,519	10	410,249	6,563,605		

Items	Implementation Period													
	0		1 <sup>st</sup> Year		2nd Year		3rd Year		4th Year		5th Year			
	Wet season	Dry season	W	D	W	D	W	D	W	D	W	D		
<b>Fund Arrangement</b>														
<b>Project Coordinating Works</b>														
- Land Expropriation														
- Project Coordination														
<b>Survey Works and Detail Design</b>														
<b>Tendering</b>														
<b>A. Right Bank of the Mekong River (Kean Svay)</b>														
- Rehabilitation of Colmatage Canal L= 12.0 km														
- Construction of Intake Gate 5 Nos.														
- Construction of Bridge 0 Nos.														
<b>B. Left Bank of the Bassac River (Saang)</b>														
- Rehabilitation of Colmatage Canal L=11.8 km														
- Construction of Intake Gate 0 Nos.														
- Construction of Bridge 6 Nos.														
<b>C. Right bank of the Bassac River</b>														
- Rehabilitation of Colmatage Canal L=12.0 km														
- Construction of Intake Gate 0 Nos.														
- Construction of Bridge 4 Nos.														
<b>Operation and maintenance</b>														→

Figure G.6.2 Implementation Schedule for the Priority Colmatage Area