

**Ministry of Water Resources and Meteorology,
Ministry of Agriculture, Forestry and Fisheries,
The Kingdom of Cambodia**

**BASIN-WIDE BASIC IRRIGATION AND DRAINAGE
MASTER PLAN STUDY
IN
THE KINGDOM OF CAMBODIA**

FINAL REPORT

**VOLUME-IV
APPENDIXES
(PRE-FEASIBILITY STUDY FOR
PRIORITY SIX SUB-PROJECTS)
(2/2)**

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LIST OF VOLUMES

VOLUME-I **MAIN REPORT**

VOLUME-II **APPENDIXES (MASTER PLAN STUDY FOR
FOUR RIVER BASINS)**

Appendix-A: Meteorology and Hydrology

Appendix-B: Rural Socio-Economy

Appendix-C: Agriculture

Appendix-D: Irrigation and Drainage

Appendix-E Cost Estimate

Appendix-F Environment

Appendix-G Project Evaluation

VOLUME-III **APPENDIXES (PRE-FEASIBILITY STUDY FOR
PRIORITY SIX SUB-PROJECTS) (1/2)**

Appendix-A: Meteorology and Hydrology

Appendix-B: Agriculture

Appendix-C: Irrigation and Drainage

VOLUME-IV **APPENDIXES (PRE-FEASIBILITY STUDY FOR
PRIORITY SIX SUB-PROJECTS) (2/2)**

Appendix-D Design and Cost Estimate

Appendix-E Project Evaluation

Appendix-F Rural Socio-Economy and Environment

Appendix-D
COST ESTIMATE

**BASIN-WIDE BASIC IRRIGATION AND DRAINAGE
MASTER PLAN STUDY
IN
THE KINGDOM OF CAMBODIA**

FINAL REPORT

APPENDIX-D COST ESTIMATES

Table of Contents

	<u>Page</u>
CHAPTER D1 BASIC CONDITIONS	D-1
D1.1 Basic Conditions for Cost Estimate	D-1
CHAPTER D2 SUMMARY OF COST ESTIMATES	D-3
D2.1 Cost Estimate	D-3
D2.1.1 Initial Investment Costs	D-3
D2.1.2 Disbursement Schedule	D-3
D2.2 Construction Cost and Related Costs	D-4
D2.2.1 Construction Cost	D-4
D2.2.2 Land Acquisition Cost.....	D-4
D2.2.3 O & M Cost.....	D-5
D2.3 Currency Portion for Project Evaluation.....	D-5

List of Tables

	<u>Page</u>
Table D2.1-1 Summary Initial Investment Costs for the West Tonle Sap Irrigation and Drainage Rehabilitation and Improvement Project.....	DT-1
Table D2.1-2 Summary Initial Investment Costs for the Ream Kon Rehabilitation project	Sub- DT-2
Table D2.1-3 Summary Initial Investment Costs for the Por Canal Rehabilitation project	Sub- DT-3
Table D2.1-4 Summary Initial Investment Costs for the Damnak Ampil Rehabilitation project	Sub- DT-4

	<u>Page</u>
Table D2.1-5	Summary Initial Investment Costs for the Wat Loung Rehabilitation
	Sub-project DT-5
Table D2.1-6	Summary Initial Investment Costs for the Wat Chre Rehabilitation
	Sub-project DT-6
Table D2.1-7	Summary Initial Investment Costs for the Lum Hach Rehabilitation
	Sub-project DT-7
Table D2.2-1A	Summary Sheet of Construction Costs: Ream Kon Rehabilitation
	Sub-project DT-8
Table D2.2-1B	Summary Sheet of Other Costs: Ream Kon Rehabilitation Sub-project DT-8
Table D2.2-2A	Summary Sheet of Construction Costs: Por Canal Rehabilitation
	Sub-project DT-9
Table D2.2-2B	Summary Sheet of Other Costs: Por Canal Rehabilitation Sub-project DT-9
Table D2.2-3A	Summary Sheet of Construction Costs: Damnak Ampil Rehabilitation
	Sub-project DT-10
Table D2.2-3B	Summary Sheet of Other Costs: Damnak Ampil Rehabilitation
	Sub-project DT-10
Table D2.2-4A	Summary Sheet of Construction Costs: Wat Loung Rehabilitation
	Sub-project DT-11
Table D2.2-4B	Summary Sheet of Other Costs: Wat Loung Rehabilitation Sub-project DT-11
Table D2.2-5A	Summary Sheet of Construction Costs: Wat Chre Rehabilitation
	Sub-project DT-12
Table D2.2-5B	Summary Sheet of Other Costs: Wat Chre Rehabilitation Sub-project DT-12
Table D2.2-6A	Summary Sheet of Construction Costs: Lum Hach Rehabilitation
	Sub-project DT-13
Table D2.2-6B	Summary Sheet of Other Costs: Lum Hach Rehabilitation Sub-project DT-13
Table D2.3-1	Summary Sheet of Currency Portion for the West Tonle Sap Irrigation and Drainage Rehabilitation and Improvement Project DT-14
Table D2.3-2	Summary Sheet of Currency Portion for Ream Kon Rehabilitation
	Sub-project DT-15
Table D2.3-3	Summary Sheet of Currency Portion: Por Canal Rehabilitation
	Sub-project DT-15
Table D2.3-4	Summary Sheet of Currency Portion: Damnak Ampil Rehabilitation
	Sub-project DT-15
Table D2.3-5	Summary Sheet of Currency Portion: Wat Loung Rehabilitation
	Sub-project DT-16
Table D2.3-6	Summary Sheet of Currency Portion: Wat Chre Rehabilitation
	Sub-project DT-16
Table D2.3-7	Summary Sheet of Currency Portion: Lum Hach Rehabilitation
	Sub-project DT-16

APPENDIX-D COST ESTIMATES

CHAPTER D1 BASIC CONDITIONS

D1.1 Basic Conditions for Cost Estimate

The basic conditions and assumptions employed for cost estimation of the Project are as follows:

- Cost estimate refers to the prices as of September 2008.
- Exchange rate are as of September 2008, and they are as follows:
 1 US Dollar (US\$) = 4,107 Riel
 = 107.99 Yen
- Unit prices of labor, construction materials, engineering works, etc., were collected from MOWRAM and market.
- Construction is undertaken on the contract basis, and V.A.T is excluded from construction costs.
- The Initial Investment cost consists of the following items, and assumptions and contents of each item are explained in table below:

Items and Assumptions for Initial Investment Costs for the Project

Item No.	Item Descriptions	Assumption	Contents for Item / Remarks
		(%) and Key Items	
1.	Construction Cost	See Section 9.2.3	1-1 Headworks and Major Related Structures 1-2 Main and Secondary Systems 1-3 On-farm Development
2.	Project Supporting Programs Cost	5 % of Item 1	2-1 Meteo-hydrological Observation Strengthening Program 2-2 MOWRAM Staff Capacity Development 2-3 PDOWRAM Staff Capacity Development
3.	Physical Contingencies	10 % of Items (1+2)	
4.	Sub-Total	Items (1+2+3)	
5.	Consulting Services Cost		5-1 Detail Design (D/D) 5-2 Construction Supervision (C/S) 5-3 FWUC Establishment and Strengthening 5-4 Agricultural Extension Activities
6.	Tax & Duty	10 % of Items (4+5)	
7.	Land Acquisition Cost	See Section 9.2.4	For anticipated area
8.	Project Administration Cost	10 % of Item 4	
9.	Price Escalation	5 % /annum of Item 4	Referred to IMF World Economic Outlook Database, October 2007

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- Price escalation rate (Item 9) is assumed to be at 5.0 %/annum; i.e., based on the average of annual change ratio of inflation (consumer price) in Cambodia between year

2003 and 2008 (five years).

Annual Change of Economic Index in Cambodia

Cambodia Items	Unit (1 billion US\$)						Remarks
	2003	2004	2005	2006	2007	2008	Average change ratio 2003-2008
1. GDP (Current Price)	4.662	5.338	6.293	7.272	8.488	9.623	+0.992/year
Change Ratio (%)	-	14.5	17.9	15.6	16.7	13.37	15.6%/year
GDP Deflator	105.38	110.51	117.17	122.60	128.68	135.45	+6.01/year
Change Ratio (%)	-	4.9	6.0	4.6	5.0	5.3	5.2%/year
2. GDP (Constant Price)	4.424	4.830	5.371	5.931	6.596	7.104	+0.536/year
Change Ratio (%)	-	9.2	11.2	10.4	11.2	7.7	8.1%/year
3. Inflation (Av. Consumer Price)	104.72	108.69	115.06	120.48	128.32	135.37	+6.13/year
Change Ratio (%)	1.2	3.8	5.9	4.7	6.5	5.5	5.3%/year

$GDP(\text{Constant Price}) = GDP(\text{Current Price}) \div GDP \text{ Deflator}, 100 = \text{Year } 2000$

Prepared by JICA Study Team based on "IMF World Economic Outlook Database, October 2007"

- Construction costs are divided into foreign currency portion (FC) and local currency portion (LC). Ratios of the FC and the LC are estimated for each component as follows, referring to similar types of the projects in Cambodia:

Ratio for Foreign and Local Currency Portion

Item No.	Item Descriptions	Sub-Item	Currency Portion Ratio	
			Foreign Currency	Local Currency
1-1	Headworks and Major Related Structures	Earthwork	0.2	0.8
		Mechanic Works (Gate)	0.9	0.1
		Other than the above	0.7	0.3
		(Such as concrete works)		
1-2	Main and Secondary Sysytems		0.7	0.3
1-3	On-farm Development		0.2	0.8

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CHAPTER D2 SUMMARY OF COST ESTIMATES

D2.1 Cost Estimate

D2.1.1 Initial Investment Costs

The initial investment cost for the Project are summarized and shown in the following table. The initial investment cost is estimated at about US\$ 97.95 millions, which is equivalent to Riel. 402 billions. The cost estimates of the initial investment cost are shown in Table D2.1-1 for the Project, and in Tables D2.1-2 to D2.1-7 for the Sub-projects bases, respectively.

Initial Investment Costs for the Project

No.	Item	Amount	Remarks
		(US\$ 1,000)	
1.	Construction Cost	48,764	See Sub-Section 9.2.2 for detail
2.	Project Supporting Programs Cost	2,438	5 % of Item 1
3.	Physical Contingencies	5,120	10 % of Items (1+2)
4.	Sub-Total	56,322	Items (1+2+3)
5.	Consulting Services Cost	14,332	
6.	Tax & Duty	7,065	10 % of Item (4+5)
7.	Land Acquisition Cost	841	For 391.9 ha
8.	Project Administration Cost	5,632	10 % of Item 4
9.	Price Escalation	13,762	5 %/annum of Item 4
10.	Grand Total	97,954	Items 4+5+6+7+8+9

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D2.1.2 Disbursement Schedule

The annual disbursement schedule for the Project is shown in the table.

Annual Disbursement Schedule for the Project

No.	Item	Amount (US\$ 1,000)							
		Total	2010	2011	2012	2013	2014	2015	2016
1.	Construction Cost	48,764	0	3,428	23,449	18,587	3,149	151	0
2.	Project Supporting Programs Cost	2,438	0	610	488	488	488	364	0
3.	Physical Contingencies	5,120	0	404	678	1,908	364	50	0
4.	Sub-Total	56,322	0	4,442	26,331	20,983	4,001	565	0
5.	Consulting Services Cost	14,332	2,150	3,153	5,016	2,723	860	287	143
6.	Tax & Duty	7,056	215	760	3,134	2,371	486	85	14
7.	Land Acquisition Cost	841	252	589	-	-	-	-	-
8.	Project Administration Cost	5,632	0	0	2,633	2,098	400	57	0
9.	Price Escalation	13,762	0	0	5,674	5,797	1,361	230	0
10.	Grand Total	97,954	2,617	10,088	42,788	33,972	7,108	1,224	157

Years 2008, 2009, 2017 are omitted from the above table due to no disbursement scheduled.

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D2.2 Construction Cost and Related Costs

D2.2.1 Construction Cost

Cost estimates of construction costs (Item 1) were carried out for the following components of each sub-project. Construction cost includes costs for general items, miscellaneous works and contractor's expense, such as overhead.

Item 1-1: Headworks and Major Related Structures

Diversion weir, intake structures and other important major structures for each Sub-project

Item 1-2: Main and Secondary Systems

Irrigation and drainage canals including related structures.

Item 1-3: On-farm Development

Tertiary systems and their related facilities, including FWUC office, drying yards and storage for paddy for each sub-project.

The construction cost for the Project and each sub-project are summarized in the following table. It ranges from US\$ 15.2 millions, equivalent to Riel. 62.4 billions (for Lum Hach), to US\$ 4.0 millions, equivalent to Riel. 16.6 billions (for Wat Chre). The Construction cost becomes relatively higher for the sub-projects in which the headworks systems are to be rehabilitated/ re-constructed. The breakdown of the construction cost for the Sub-projects bases are shown in Tables D2.2-1A to D2.2-6A, respectively.

Construction Cost for the Sub-Project

No.	Item	Amount (US\$ 1,000)	Remarks			
			Cost Breakdown of Item 1			
			(US\$ 1,000)			
1.	Construction Cost	Total	1-1	1-2	1-3	
	A. Ream Kon Rehabilitation Sub-Project	10,586	3,747	5,805	1,034	w/ HW
	B. Por Canal Rehabilitation Sub-Project	5,175	57	4,058	1,060	
	C. Damnak Ampil Rehabilitation Sub-Project	6,371	3,348	1,791	1,232	w/ HW
	D. Wat Loung Rehabilitation Sub-Project	7,403	-	6,030	1,373	
	E. Wat Chre Rehabilitation Sub-Project	4,034	1,774	1,680	580	w/ HW
	F. Lum Hach Rehabilitation Sub-Project	15,195	5,869	7,660	1,666	w/ HW
	Total Construction Cost	48,764	14,795	27,024	6,945	

w/HW: Headworks will be re-built in the particular sub-projects.

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D2.2.2 Land Acquisition Cost

Land acquisition cost for the Project is estimated based on the actual anticipated area for each sub-project. Total area of the land acquisition is expected to be 391.9 ha (details are referred to Chapter 7), and cost is estimated at about US\$ 0.84 million, which is equivalent to about Riel. 3.45 billions. The land acquisition cost for Sub-projects are shown in Tables D2.2-1B to D2.2-6B, respectively.

D2.2.3 O & M Cost

O & M cost for the major facilities, such as headworks, main and secondary systems of each sub-project is divided into the following 2 categories under conditions and assumptions explained below:

- Annual O&M cost: Estimated at about 2 % of the construction costs for the major facilities (Items 1-1 and 1-2).
- Major repair cost: Major repair including replacement will be executed every 10 years, and the cost is assumed to be 10 % of the construction costs for the major facilities (Items 1-1 and 1-2).

The annual O & M cost for the Project is estimated at about US\$ 836,000, which is equivalent to Riel 3,435 millions. In addition, major repair cost for the Project is estimated at about US\$ 4.18 millions, which is equivalent to Riel 17.2billions. The summary of the O & M cost is given in table below. The O&M cost for each Sub-project are shown in Tables D2.2-1B to D2.2-6B, respectively.

O&M Costs for the Project

No.	Item	Amount	Remarks			
			Cost Breakdown of Item 1			
		(US\$ 1,000)	(US\$ 1,000)			
1.	Construction Cost		1-1	1-2	1-3	
	A. Ream Kon Rehabilitation Sub-Project	9,552	3,747	5,805	-	w/ HW
	B. Por Canal Rehabilitation Sub-Project	4,115	57	4,058	-	
	C. Damnak Ampil Rehabilitation Sub-Project	5,139	3,348	1,791	-	w/ HW
	D. Wat Loung Rehabilitation Sub-Project	6,030	-	6,030	-	
	E. Wat Chre Rehabilitation Sub-Project	3,454	1,774	1,680	-	w/ HW
	F. Lum Hach Rehabilitation Sub-Project	13,529	5,869	7,660	-	w/ HW
	Total Construction Cost	41,819	14,795	27,024	-	
12-A	Annual O&M Cost (every year)	836 (Riel.3,435 millions)	2 % of Items (1-1, 1-2)			
12-B	Major repair Cost (every 10 year, including replacement)	4,182 (Riel.17.2 billions)	10 % of Items (1-1, 1-2)			

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D2.3 Currency Portion for Project Evaluation

Construction costs are divided into foreign currency portion (FC) and local currency portion (LC) as explained in Section D1.1, and are used in the project evaluation. The results of are shown in Table D2.3-1 for the Project basis, and in Tables D2.3-2 to D2.3-7 for the Sub-projects bases, respectively.

Tables

Table D2.1-1 Summary Initial Investment Costs for the West Tonle Sap Irrigation and Drainage Rehabilitation and Improvement Project

Project Name: West Tonle Sap Irrigation and Drainage Rehabilitation and Improvement Project
River Basins: Moung Russei, Pursat, Boribo River Basins
Province: Battambang, Pursat, Kampong. Chhnang Provinces
Proposed Irrigation Area: 12,760 ha

Summary Initial Investment Costs

No.	Item	US\$	Remarks
1	Construction	48,764,000	
	1-1 Headworks and Major Related Structures	14,795,000	
	1-2 Main and Secondary Systems	27,024,000	
	1-3 On-farm Development	6,945,000	
2	Project Supporting Program Cost	2,438,000	2 = 1 x 5%
3	Physical Contingency	5,120,000	3 = (1+2) x 10%
4	Sub-Total (=1 to 3)	56,322,000	4 = SUM (1 to 3)
5	Consulting Services	14,332,000	
6	Tax & Duty	7,065,000	6 = 10 % of (4+5)
7	Land Acquisition	841,000	
8	Project Administration	5,632,000	8 =4 x 10 %
	Total (=4 to 8)	84,192,000	SUM (4 to 8)
9	Price Escalation	13,762,000	9 = 4 x 5 %
10	Grand Total (=4 to 9)	97,954,000	10 = SUM (4 to 9)

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Project O & M Cost		US\$	Remarks
1	Annual O & M Cost	836,000	
2	Major repairs (every 10th year)	4,182,000	

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**Table D2.1-2 Summary Initial Investment Costs for the
Ream Kon Rehabilitation Sub-project**

Sub-Project Name: Ream Kon Rehabilitation Sub-project
River Basin: Moung Russei River Basin
Province: Battambang Province
Proposed Irrigation Area: 1,890 ha

Summary Initial Investment Costs

No.	Item	US\$	Remarks
1	Construction	10,586,000	
	1-1 Headworks and Major Related Structures	3,747,000	
	1-2 Main and Secondary Systems	5,805,000	
	1-3 On-farm Development	1,034,000	
2	Project Supporting Program Cost	529,000	2 = 1 x 5%
3	Physical Contingency	1,112,000	3 = (1+2) x 10%
4	Sub-Total (=1 to 3)	12,227,000	4 = SUM (1 to 3)
5	Consulting Services	3,111,000	
6	Tax & Duty	1,534,000	6 = 10 % of (4+5)
7	Land Acquisition	95,000	
8	Project Administration	1,223,000	8 = 4 x 10 %
	Total (=4 to 8)	18,190,000	SUM (4 to 8)
9	Price Escalation	2,877,000	9 = 4 x 5 %
10	Grand Total (=4 to 9)	21,067,000	10 = SUM (4 to 9)

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Project O & M Cost		US\$	Remarks
1	Annual O & M Cost	191,000	
2	Major repairs (every 10th year)	955,000	

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**Table D2.1-3 Summary Initial Investment Costs for the
Por Canal Rehabilitation Sub-project**

Sub-Project Name: Por Canal Rehabilitation Sub-project
River Basin: Moung Russei River Basin
Province: Battambang Province
Proposed Irrigation Area: 1,940 ha

Summary Initial Investment Costs

No.	Item	US\$	Remarks
1	Construction	5,175,000	
	1-1 Headworks and Major Related Structures	57,000	
	1-2 Main and Secondary Systems	4,058,000	
	1-3 On-farm Development	1,060,000	
2	Project Supporting Program Cost	259,000	2 = 1 x 5%
3	Physical Contingency	543,000	3 = (1+2) x 10%
4	Sub-Total (=1 to 3)	5,977,000	4 = SUM (1 to 3)
5	Consulting Services	1,521,000	
6	Tax & Duty	750,000	6 = 10 % of (4+5)
7	Land Acquisition	100,000	
8	Project Administration	598,000	8 =4 x 10 %
	Total (=4 to 8)	8,946,000	SUM (4 to 8)
9	Price Escalation	1,318,000	9 = 4 x 5 %)
10	Grand Total (=4 to 9)	10,264,000	10 = SUM (4 to 9)

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Project O & M Cost		US\$	Remarks
1	Annual O & M Cost	82,000	
2	Major repairs (every 10th year)	412,000	

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**Table D2.1-4 Summary Initial Investment Costs for the
Dannak Ampil Rehabilitation Sub-project**

Sub-Project Name: Dannak Ampil Rehabilitation Sub-project
River Basin: Pursat River Basin
Province: Pursat Province
Proposed Irrigation Area: 2,270 ha

Summary Initial Investment Costs

No.	Item	US\$	Remarks	
1	Construction	6,371,000		
	1-1 Headworks and Major Related Structures	3,348,000		
	1-2 Main and Secondary Systems	1,791,000		
	1-3 On-farm Development	1,232,000		
2	Project Supporting Program Cost	319,000	2 = 1 x 5%	
3	Physical Contingency	669,000	3 = (1+2) x 10%	
4	Sub-Total (=1 to 3)	7,359,000	4 = SUM (1 to 3)	
5	Consulting Services	1,872,000		
6	Tax & Duty	923,000	6 = 10 % of (4+5)	
7	Land Acquisition	76,000		
8	Project Administration	736,000	8 = 4 x 10 %	
	Total (=4 to 8)	10,966,000	SUM (4 to 8)	
9	Price Escalation	1,538,000	9 = 4 x 5 %	
10	Grand Total (=4 to 9)	12,504,000	10 = SUM (4 to 9)	

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	Project O & M Cost	US\$	Remarks	
1	Annual O & M Cost	103,000		
2	Major repairs (every 10th year)	514,000		

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**Table D2.1-5 Summary Initial Investment Costs for the
Wat Loung Rehabilitation Sub-project**

Sub-Project Name: Wat Loung Rehabilitation Sub-project
River Basins: Pursat River Basin
Province: Pursat Provinces
Proposed Irrigation Area: 2,540 ha

Summary Initial Investment Costs

No.	Item	US\$	Remarks
1	Construction	7,403,000	
1-1	Headworks and Major Related Structures	0	
1-2	Main and Secondary Systems	6,030,000	
1-3	On-farm Development	1,373,000	
2	Project Supporting Program Cost	370,000	2 = 1 x 5%
3	Physical Contingency	777,000	3 = (1+2) x 10%
4	Sub-Total (=1 to 3)	8,550,000	4 = SUM (1 to 3)
5	Consulting Services	2,176,000	
6	Tax & Duty	1,072,000	6 = 10 % of (4+5)
7	Land Acquisition	198,000	
8	Project Administration	855,000	8 = 4 x 10 %
	Total (=4 to 8)	12,851,000	SUM (4 to 8)
9	Price Escalation	2,104,000	9 = 4 x 5 %
10	Grand Total (=4 to 9)	14,955,000	10 = SUM (4 to 9)

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	Project O & M Cost	US\$	Remarks
1	Annual O & M Cost	121,000	
2	Major repairs (every 10th year)	603,000	

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**Table D2.1-6 Summary Initial Investment Costs for the
Wat Chre Rehabilitation Sub-project**

Sub-Project Name: Wat Chre Rehabilitation Sub-project
River Basins: Pursat River Basin
Province: Pursat Provinces
Proposed Irrigation Area: 1,020 ha

Summary Initial Investment Costs

No.	Item	US\$	Remarks	
1	Construction	4,034,000		
	1-1 Headworks and Major Related Structures	1,774,000		
	1-2 Main and Secondary Systems	1,680,000		
	1-3 On-farm Development	580,000		
2	Project Supporting Program Cost	202,000	2 = 1 x 5%	
3	Physical Contingency	424,000	3 = (1+2) x 10%	
4	Sub-Total (=1 to 3)	4,660,000	4 = SUM (1 to 3)	
5	Consulting Services	1,186,000		
6	Tax & Duty	585,000	6 = 10 % of (4+5)	
7	Land Acquisition	90,000		
8	Project Administration	466,000	8 = 4 x 10 %	
	Total (=4 to 8)	6,987,000	SUM (4 to 8)	
9	Price Escalation	1,406,000	9 = 4 x 5 %	
10	Grand Total (=4 to 9)	8,393,000	10 = SUM (4 to 9)	

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Project O & M Cost		US\$	Remarks	
1	Annual O & M Cost	69,000		
2	Major repairs (every 10th year)	345,000		

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**Table D2.1-7 Summary Initial Investment Costs for the
Lum Hach Rehabilitation Sub-project**

Sub-Project Name: Lum Hach Rehabilitation Sub-project
River Basin: Boribo River Basin
Province: Kampong. Chhnang Province
Proposed Irrigation Area: 3,100 ha

Summary Initial Investment Costs

No.	Item	US\$	Remarks
1	Construction	15,195,000	
	1-1 Headworks and Major Related Structures	5,869,000	
	1-2 Main and Secondary Systems	7,660,000	
	1-3 On-farm Development	1,666,000	
2	Project Supporting Program Cost	759,000	2 = 1 x 5%
3	Physical Contingency	1,595,000	3 = (1+2) x 10%
4	Sub-Total (=1 to 3)	17,549,000	4 = SUM (1 to 3)
5	Consulting Services	4,466,000	
6	Tax & Duty	2,201,000	6 = 10 % of (4+5)
7	Land Acquisition	282,000	
8	Project Administration	1,754,000	8 =4 x 10 %
	Total (=4 to 8)	26,252,000	SUM (4 to 8)
9	Price Escalation	4,519,000	9 = 4 x 5 %
10	Grand Total (=4 to 9)	30,771,000	10 = SUM (4 to 9)

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	Project O & M Cost	US\$	Remarks
1	Annual O & M Cost	270,000	
2	Major repairs (every 10th year)	1,353,000	

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**Table D2.2-1A Summary Sheet of Construction Costs:
Ream Kon Rehabilitation Sub-project**

Sub-Project Name: Ream Kon Rehabilitation Sub-project
 River Basin: Moung Russei River Basin
 Province Name: Battambang
 System Name: Ream Kon
 Proposed Area: 1,890 Ha (Sub-Project Total)

COST ESTIMATES

Item No	Description	Unit	Quantity	Amount (USD)	Remarks
1-1	Headworks and Major Related Structures				
1)	Moung Russei Diversion Weir	nos.	1.00	2,977,000.00	
2)	Intake Structures	nos.	1.00	45,000.00	
3)	Operation and Maintenance office	nos.	1.00	22,000.00	
4)	Collector Drain-2 (CD-2)	nos.	1.00	138,000.00	
5)	Closure Dike for Collector Drain-2 (CD-2)	nos.	1.00	347,000.00	
6)	Excavation of River	L.S	1.00	218,000.00	
	Sub-Total of 1-1			3,747,000.00	
1-2	Main and Secondary Systems				
1)	Main Irrigation Canal	L.S	1.00	1,397,000.00	L=18.4km
2)	Secondary Irrigation Canal	L.S	1.00	767,000.00	L=12.9km
3)	Drainage Canal	L.S	1.00	2,400,000.00	L=51.7km
4)	Canal Related Structure Work	L.S	1.00	1,241,000.00	150 nos.
	Sub-Total of 1-2			5,805,000.00	
1-3	On-farm Development				
1)	Tertiary Irrigation Canal System	L.S	1.00	839,000.00	L=57 km
2)	Tertiary Drainage Canal	L.S	1.00	147,000.00	L=57 km
3)	FWUC Office, Drying Yard, Paddy Storage	L.S	1.00	48,000.00	1 set
	Sub-Total of 1-3			1,034,000.00	
	1. Total of Construction Cost			10,586,000.00	

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**Table D2.2-1B Summary Sheet of Other Costs:
Ream Kon Rehabilitation Sub-project
(Related to Construction Cost)**

3	Physical Contingencies (for Construction Cost)	L.S		1,587,000.00	
7	Land Acquisition Cost	L.S		95,000.00	A=71.0 ha
11	Project O&M Costs				
1)	Annual O&M Cost	L.S	1.00	191,000.00	
2)	Major repairs (every 10th year)	L.S	1.00	955,000.00	

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**Table D2.2-2A Summary Sheet of Construction Costs:
Por Canal Rehabilitation Sub-project**

Sub-Project Name: Por Canal Rehabilitation Sub-project
 River Basin: Moung Russey River Basin
 Province Name: Battambang
 System Name: Por Canal
 Proposed Area: 1,940 Ha (Sub-Project Total)

COST ESTIMATES

Item No	Description	Unit	Quantity	Amount (USD)	Remarks
1-1	Headworks and Major Related Structures				
1)	Intake Structure	nos.	1.00	57,000.00	
	Sub-Total of 1-1			57,000.00	
1-2	Main and Secondary Systems				
1)	Main Irrigation Canal	L.S	1.00	1,061,000.00	L=12.7km
2)	Secondary Irrigation Canal	L.S	1.00	990,000.00	L=15.8km
3)	Drainage Canal	L.S	1.00	1,526,000.00	L=34.1km
4)	Canal Related Structure Work	L.S	1.00	481,000.00	115 nos.
	Sub-Total of 1-2			4,058,000.00	
1-3	On-farm Development				
1)	Tertiary Irrigation Canal System	L.S	1.00	861,000.00	L=55 km
2)	Tertiary Drainage Canal	L.S	1.00	151,000.00	L=55 km
3)	FWUC Office, Drying Yard, Paddy Storage	L.S	1.00	48,000.00	1 set
	Sub-Total of 1-3			1,060,000.00	
	1. Total of Construction Cost			5,175,000.00	

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**Table D2.2-2B Summary Sheet of Other Costs:
Por Canal Rehabilitation Sub-project
(Related to Construction Cost)**

3	Physical Contingencies (for Construction Cost)	L.S		776,000.00	
7	Land Acquisition Cost	L.S		100,000.00	A=74.2 ha
11	Project O&M Costs				
1)	Annual O&M Cost	L.S	1.00	82,000.00	
2)	Major repairs (every 10th year)	L.S	1.00	412,000.00	

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**Table D2.2-3A Summary Sheet of Construction Costs:
Damnak Ampil Rehabilitation Sub-project**

Sub-Project Name: Damnak Ampil Rehabilitation Sub-project
 River Basin: Pursat River Basin
 Province Name: Pursat
 System Name: Damnak Ampil
 Proposed Area: 2,270 Ha (Sub-Project Total)

COST ESTIMATES

Item No	Description	Unit	Quantity	Amount (USD)	Remarks
1-1	Headworks and Major Related Structures				
1)	Gate Improvement for Damnak Ampil Weir	L.S	1.00	2,820,000.00	7 gates
2)	Temporary works for Gate Improvement	L.S	1.00	172,000.00	4 gates
3)	Installation of Fish Ladder	nos.	1.00	356,000.00	
	Sub-Total of 1-1			3,348,000.00	
1-2	Main and Secondary Systems				
1)	Main Irrigation Canal	L.S	1.00	0.00	
2)	Secondary Irrigation Canal	L.S	1.00	675,000.00	L=17.6km
3)	Drainage Canal	L.S	1.00	588,000.00	L=28.2km
4)	Canal Related Structure Work	L.S	1.00	528,000.00	148 nos.
	Sub-Total of 1-2			1,791,000.00	
1-3	On-farm Development				
1)	Tertiary Irrigation Canal System	L.S	1.00	1,007,000.00	L=85 km
2)	Tertiary Drainage Canal	L.S	1.00	177,000.00	L=85 km
3)	FWUC Office, Drying Yard, Paddy Storage	L.S	1.00	48,000.00	1 set
	Sub-Total of 1-3			1,232,000.00	
	1. Total of Construction Cost			6,371,000.00	

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**Table D2.2-3B Summary Sheet of Other Costs:
Damnak Ampil Rehabilitation Sub-project
(Related to Construction Cost)**

3	Physical Contingencies (for Construction Cost)	L.S		955,000.00	
7	Land Acquisition Cost	L.S		76,000.00	A=73.0 ha
11	Project O&M Costs				
1)	Annual O&M Cost	L.S	1.00	103,000.00	
2)	Major repairs (every 10th year)	L.S	1.00	514,000.00	

Prepared by JICA Study Team

**Table D2.2-4A Summary Sheet of Construction Costs:
Wat Loung Rehabilitation Sub project**

Sub-Project Name: Wat Loung Rehabilitation Sub project
 River Basin: Pursat River Basin
 Province Name: Pursat
 System Name: Wat Loung
 Proposed Area: 2,540 Ha (Sub-Project Total)

COST ESTIMATES

Item No	Description	Unit	Quantity	Amount (USD)	Remarks
1-1	Headworks and Major Related Structures	-	-	-	
	Sub-Total of 1-1			0.00	
1-2	Main and Secondary Systems				
1)	Main Irrigation Canal	L.S	1.00	1,886,000.00	L=20.3km
2)	Secondary Irrigation Canal	L.S	1.00	1,685,000.00	L=31.1km
3)	Drainage Canal	L.S	1.00	1,379,000.00	L=37.7km
4)	Canal Related Structure Work	L.S	1.00	1,080,000.00	152 nos.
	Sub-Total of 1-2			6,030,000.00	
1-3	On-farm Development				
1)	Tertiary Irrigation Canal System	L.S	1.00	1,127,000.00	L=81 km
2)	Tertiary Drainage Canal	L.S	1.00	198,000.00	L=81 km
3)	FWUC Office, Drying Yard, Paddy Storage	L.S	1.00	48,000.00	1 set
	Sub-Total of 1-3			1,373,000.00	
	1. Total of Construction Cost			7,403,000.00	

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**Table D2.2-4B Summary Sheet of Other Costs:
Wat Loung Rehabilitation Sub project
(Related to Construction Cost)**

3	Physical Contingencies (for Construction Cost)	L.S		1,110,000.00	
7	Land Acquisition Cost	L.S		198,000.00	A=119.5 ha
11	Project O&M Costs				
1)	Annual O&M Cost	L.S	1.00	121,000.00	
2)	Major repairs (every 10th year)	L.S	1.00	603,000.00	

Prepared by JICA Study Team

**Table D2.2-5A Summary Sheet of Construction Costs:
Wat Chre Rehabilitation Sub project**

Sub-Project Name: Wat Chre Rehabilitation Sub project
 River Basin: Pursat River Basin
 Province Name: Pursat
 System Name: Wat Chre
 Proposed Area: 1,020 Ha (Sub-Project Total)

COST ESTIMATES

Item No	Description	Unit	Quantity	Amount (USD)	Remarks
1-1	Headworks and Major Related Structures				
1)	Wat Chre Diversion Weir	nos.	1.00	1,524,000.00	
2)	Intake for Wat Chre	nos.	1.00	17,000.00	
3)	Operation and Maintenance office	nos.	1.00	22,000.00	
4)	Excavation of River	nos.	1.00	211,000.00	
	Sub-Total of 1-1			1,774,000.00	
1-2	Main and Secondary Systems				
1)	Main Irrigation Canal	L.S	1.00	373,000.00	L=4.7km
2)	Secondary Irrigation Canal	L.S	1.00	748,000.00	L=14.7km
3)	Drainage Canal	L.S	1.00	255,000.00	L=14.8km
4)	Canal Related Structure Work	L.S	1.00	304,000.00	71 nos.
	Sub-Total of 1-2			1,680,000.00	
1-3	On-farm Development				
1)	Tertiary Irrigation Canal System	L.S	1.00	452,000.00	L=27 km
2)	Tertiary Drainage Canal	L.S	1.00	80,000.00	L=27 km
3)	FWUC Office, Drying Yard, Paddy Storage	L.S	1.00	48,000.00	1 set
	Sub-Total of 1-3			580,000.00	
	1. Total of Construction Cost			4,034,000.00	

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**Table D2.2-5B Summary Sheet of Other Costs:
Wat Chre Rehabilitation Sub project
(Related to Construction Cost)**

3	Physical Contingencies (for Construction Cost)	L.S		605,000.00	
7	Land Acquisition Cost	L.S		90,000.00	A=51.5 ha
11	Project O&M Costs				
1)	Annual O&M Cost	L.S	1.00	69,000.00	
2)	Major repairs (every 10th year)	L.S	1.00	345,000.00	

Prepared by JICA Study Team

**Table D2.2-6A Summary Sheet of Construction Costs:
Lum Hach Rehabilitation Sub-project**

Sub-Project Name: Lum Hach Rehabilitation Sub-project
 River Basin: Boribo River Basin
 Province Name: Kampong Chhnang
 System Name: Lum Hach
 Proposed Area: 3,100 Ha (Sub-Project Total)

COST ESTIMATES

Item No	Description	Unit	Quantity	Amount (USD)	Remarks
1-1	Headworks and Major Related Structures				
1)	Lum Hach Diversion Weir	nos.	1.00	5,141,000.00	
2)	Intake for Lum Hach, O Roluss	nos.	2.00	453,000.00	
3)	Weir Operation and Maintenance Office	nos.	1.00	22,000.00	
4)	Approach Canal	L.S	1.00	120,000.00	L=750m
5)	Closure Dike for 7th January Canal	nos.	1.00	43,000.00	
6)	Excavation of River and Acces Road (3km, Laterite t=15cm)	nos.	1.00	90,000.00	
	Sub-Total of 1-1			5,869,000.00	
1-2	Main and Secondary Systems				
1)	Main Irrigation Canal	L.S	1.00	1,700,000.00	L=16.4km
2)	Secondary Irrigation Canal	L.S	1.00	2,321,000.00	L=42.4km
3)	Drainage Canal	L.S	1.00	1,455,000.00	L=53.9km
4)	Canal Related Structure Work	L.S	1.00	2,184,000.00	184 nos.
	Sub-Total of 1-2			7,660,000.00	
1-3	On-farm Development				
1)	Tertiary Irrigation Canal System	L.S	1.00	1,376,000.00	L=67 km
2)	Tertiary Draiange Canal	L.S	1.00	242,000.00	L=67 km
3)	FWUC Office, Drying Yard, Paddy Storage	L.S	1.00	48,000.00	1 set
	Sub-Total of 1-3			1,666,000.00	
	1. Total of Construction Cost			15,195,000.00	

Prepared by JICA Study Team

**Table D2.2-6B Summary Sheet of Other Costs:
Lum Hach Rehabilitation Sub-project
(Related to Construction Cost)**

3	Physical Contingencies (for Construction Cost)	L.S		2,279,000.00	
7	Land Acquisition Cost	L.S		282,000.00	A=270.7 ha
11	Project O&M Costs				
1)	Annual O&M Cost	L.S	1.00	270,000.00	
2)	Major repairs (every 10th year)	L.S	1.00	1,353,000.00	

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Table D2.3-1 Summary Sheet of Currency Portion: West Tonle Sap Irrigation and Drainage Rehabilitation and Improvement Project

Project Name: West Tonle Sap Irrigation and Drainage Rehabilitation and Improvement Project
 River Basin: Moung Russei, Pursat, Boribo River Basins
 Province Name: Battambang, Pursat, Kampong. Chhnang Provinces
 Proposed Area: 12,760 Ha (Sub-Project Total)

COST ESTIMATES

Item No	Description	Amount (USD)	FC (US\$)	LC (US\$)	Remarks
1-1	Headworks and Major Related Structures	14,795,000	10,333,000	4,462,000	
1-2	Main and Secondary Systems	27,024,000	18,918,000	8,106,000	
1-3	On-farm Development	6,945,000	1,389,000	5,556,000	
	1. Total of Construction Cost	48,764,000	30,640,000	18,124,000	
Foreign Currency (FC) Portion/ Local Currency (LC) Portion Ratio			0.63	0.37	

Prepared by JICA Study Team

Table D2.3-2 Summary Sheet of Currency Portion: Ream Kon Rehabilitation Sub-project

Sub-Project Name: Ream Kon Rehabilitation Sub-Project
 River Basin: Moug Russei River Basin
 Province Name: Battambang
 System Name: Ream Kon
 Proposed Area: 1,890 Ha (Sub-Project Total)

COST ESTIMATES

Item No	Description	Amount (USD)	FC (US\$)	LC (US\$)	Remarks
1-1	Headworks and Major Related Structures	3,747,000	2,473,000	1,274,000	
1-2	Main and Secondary Systems	5,805,000	4,064,000	1,741,000	
1-3	On-farm Development	1,034,000	207,000	827,000	
	1. Total of Construction Cost	10,586,000	6,744,000	3,842,000	
Foreign Currency (FC) Portion/ Local Currency (LC) Portion Ratio			0.64	0.36	

Prepared by JICA Study Team

Table D2.3-3 Summary Sheet of Currency Portion: Por Canal Rehabilitation Sub-project

Sub-Project Name: Por Canal Rehabilitation Sub-project
 River Basin: Moug Russey River Basin
 Province Name: Battambang
 System Name: Por Canal
 Proposed Area: 1,940 Ha (Sub-Project Total)

COST ESTIMATES

Item No	Description	Amount (USD)	FC (US\$)	LC (US\$)	Remarks
1-1	Headworks and Major Related Structures	57,000	39,000	18,000	
1-2	Main and Secondary Systems	4,058,000	2,841,000	1,217,000	
1-3	On-farm Development	1,060,000	212,000	848,000	
	1. Total of Construction Cost	5,175,000	3,092,000	2,083,000	
Foreign Currency (FC) Portion/ Local Currency (LC) Portion Ratio			0.60	0.40	

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Table D2.3-4 Summary Sheet of Currency Portion: Damnak Ampil Rehabilitation Sub-project

Sub-Project Name: Damnak Ampil Rehabilitation Sub-project
 River Basin: Pursat River Basin
 Province Name: Pursat
 System Name: Damnak Ampil
 Proposed Area: 2,270 Ha (Sub-Project Total)

COST ESTIMATES

Item No	Description	Amount (USD)	FC (US\$)	LC (US\$)	Remarks
1-1	Headworks and Major Related Structures	3,348,000	2,712,000	636,000	
1-2	Main and Secondary Systems	1,791,000	1,254,000	537,000	
1-3	On-farm Development	1,232,000	246,000	986,000	
	1. Total of Construction Cost	6,371,000	4,212,000	2,159,000	
Foreign Currency (FC) Portion/ Local Currency (LC) Portion Ratio			0.66	0.34	

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Table D2.3-5 Summary Sheet of Currency Portion: Wat Loung Rehabilitation Sub-project

Sub-Project Name: Wat Loung Rehabilitation Sub project
 River Basin: Pursat River Basin
 Province Name: Pursat
 System Name: Wat Loung
 Proposed Area: 2,540 Ha (Sub-Project Total)

COST ESTIMATES

Item No	Description	Amount (USD)	FC (US\$)	LC (US\$)	Remarks
1-1	Headworks and Major Related Structures	0	0	0	
1-2	Main and Secondary Systems	6,030,000	4,221,000	1,809,000	
1-3	On-farm Development	1,373,000	275,000	1,098,000	
	1. Total of Construction Cost	7,403,000	4,496,000	2,907,000	
Foreign Currency (FC) Portion/ Local Currency (LC) Portion Ratio			0.61	0.39	

Prepared by JICA Study Team

Table D2.3-6 Summary Sheet of Currency Portion: Wat Chre Rehabilitation Sub-project

Sub-Project Name: Wat Chre Rehabilitation Sub project
 River Basin: Pursat River Basin
 Province Name: Pursat
 System Name: Wat Chre
 Proposed Area: 1,020 Ha (Sub-Project Total)

COST ESTIMATES

Item No	Description	Amount (USD)	FC (US\$)	LC (US\$)	Remarks
1-1	Headworks and Major Related Structures	1,774,000	1,118,000	656,000	
1-2	Main and Secondary Systems	1,680,000	1,176,000	504,000	
1-3	On-farm Development	580,000	116,000	464,000	
	1. Total of Construction Cost	4,034,000	2,410,000	1,624,000	
Foreign Currency (FC) Portion/ Local Currency (LC) Portion Ratio			0.60	0.40	

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Table D2.3-7 Summary Sheet of Currency Portion: Lum Hach Rehabilitation Sub-project

Sub-Project Name: Lum Hach Rehabilitation Sub-project
 River Basin: Boribo River Basin
 Province Name: Kampong Chhnang
 System Name: Lum Hach
 Proposed Area: 3,100 Ha (Sub-Project Total)

COST ESTIMATES

Item No	Description	Amount (USD)	FC (US\$)	LC (US\$)	Remarks
1-1	Headworks and Major Related Structures	5,869,000	3,991,000	1,878,000	
1-2	Main and Secondary Systems	7,660,000	5,362,000	2,298,000	
1-3	On-farm Development	1,666,000	333,000	1,333,000	
	1. Total of Construction Cost	15,195,000	9,686,000	5,509,000	
Foreign Currency (FC) Portion/ Local Currency (LC) Portion Ratio			0.64	0.36	

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Appendix-E
Project Evaluation

**BASIN-WIDE BASIC IRRIGATION AND DRAINAGE
MASTER PLAN STUDY
IN
THE KINGDOM OF CAMBODIA**

FINAL REPORT

APPENDIX-E PROJECT EVALUATION

Table of Contents

	<u>Page</u>
CHAPTER E1 OBJECTIVES OF PROJECT EVALUATION.....	E-1
E1.1 Objectives	E-1
E1.2 Proposed Sub-projects for Evaluation	E-1
CHAPTER E2 ECONOMIC EVALUATION.....	E-2
E2.1 Economic Evaluation Procedures.....	E-2
E2.2 Economic Benefit.....	E-3
E2.3 Economic Cost.....	E-4
E2.4 Economic Evaluation and Sensitivity Analysis.....	E-4
CHAPTER E3 FINANCIAL EVALUATION.....	E-6
E3.1 Financial Evaluation Procedures.....	E-6
E3.2 Increase in Farmers' Capacity to Pay	E-6
E3.3 Indirect Benefit, Intangible Benefit and Socio-economic Impacts.....	E-7
E3.3.1 Indirect Benefit.....	E-7
E3.3.2 Intangible Benefit	E-7
E3.3.3 Socio-economic Impacts	E-8

List of Tables

	<u>Page</u>
Table E2-1 Economic Farm Gate Price of Internationally Traded Goods	ET-1
Table E2-2 Summary of Financial and Economic Prices Applied.....	ET-3
Table E2-3 Economic Crop Budget for Ream Kon Rehabilitation Sub-project.....	ET-4
Table E2-4 Economic Irrigation Benefit for Ream Kon Rehabilitation Sub-project	ET-6
Table E2-5 Economic Crop Budget for Por Canal Rehabilitation Sub-project.....	ET-7
Table E2-6 Economic Irrigation Benefit for Por Canal Rehabilitation Sub-project	ET-9
Table E2-7 Economic Crop Budget for Damnak Ampil Rehabilitation Sub-project.....	ET-10

	<u>Page</u>
Table E2-8	Economic Irrigation Benefit for Damnak Ampil Rehabilitation Sub-project ET-11
Table E2-9	Economic Crop Budget for Wat Loung Rehabilitation Sub-project ET-12
Table E2-10	Economic Irrigation Benefit for Wat Loung Rehabilitation Sub-project ET-13
Table E2-11	Economic Crop Budget for Wat Chre Rehabilitation Sub-project ET-14
Table E2-12	Economic Irrigation Benefit for Wat Chre Rehabilitation Sub-project ET-15
Table E2-13	Economic Crop Budget for Lum Hach Rehabilitation Sub-project ET-16
Table E2-14	Economic Irrigation Benefit for Lum Hach Rehabilitation Sub-project ET-17
Table E2-15	Economic Benefit Stream of Proposed Project ET-18
Table E2-16	Breakdown of Economic Cost for Ream Kon Rehabilitation Sub-project... ET-19
Table E2-17	Breakdown of Economic Cost for Por Canal Rehabilitation Sub-project.... ET-20
Table E2-18	Breakdown of Economic Cost for Damnak Ampil Rehabilitation Sub-project ET-21
Table E2-19	Breakdown of Economic Cost for Wat Loung Rehabilitation Sub-project ET-22
Table E2-20	Breakdown of Economic Cost for Wat Chre Rehabilitation Sub-project..... ET-23
Table E2-21	Breakdown of Economic Cost for Lum Hach Rehabilitation Sub-project... ET-24
Table E2-22	Economic Cost Stream of Proposed Project..... ET-25
Table E2-23	Economic Evaluation of Proposed Project..... ET-26
Table E2-24	Sensitivity Analysis of Proposed Project ET-27

CHAPTER E1 OBJECTIVES OF PROJECT EVALUATION

E1.1 Objectives

The objectives of the project evaluation are as follows:

- Examination of the economic viability of the proposed project;
- Examination of the financial impact of investment to irrigation system rehabilitation on beneficiary farmers' capacity to pay in each sub-project area; and
- Examination of indirect benefit, intangible benefit and socio-economic impact of the proposed project.

The results of the examinations are to be employed as factors in judging the economic viability, financial soundness and social acceptance of the proposed project.

E1.2 Proposed Sub-projects for Evaluation

Citing the screening results of 21 candidate schemes made in the M/P study, the proposed project has been formulated by selecting the following six candidate schemes as described in Chapter 4. As it is planned to implement all the construction works, project supporting programs, consulting services, land acquisition and project administration in the form of one package for seven years from 2010 to 2016, the project evaluation in this Chapter is to be made for the proposed project, not for the respective sub-projects.

List of Evaluated Sub-projects

River Basin	Sub-project	Command Area under Proposed Project (ha)
Moung Russei	Ream Kon Rehabilitation	1,890
	Por Canal Rehabilitation	1,940
Pursat	Damnak Ampil Rehabilitation	2,270
	Wat Loung Rehabilitation	2,540
	Wat Chre Rehabilitation	1,020
Boribo	Lum Hach Rehabilitation	3,100
Proposed Project		12,760

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CHAPTER E2 ECONOMIC EVALUATION

E2.1 Economic Evaluation Procedures

The both project benefit and cost are estimated based on the following conditions;

- All the prices are expressed in constant prices as of September 2008, and the foreign currency exchange rate is fixed at USD 1.00 = Riel 4,107;
- The project life is assumed to be 50 years starting from 2010, the proposed year for commencement of project implementation;
- Economic farm gate prices of internationally traded agricultural inputs and outputs are calculated in the form of export and import parity prices as shown in Table E2-1, citing the World Bank Commodity Price Forecasts as of August 2008;
- A standard conversion factor (SCF) is determined at 0.986 as the average value for the last six years between 2001 and 2006 for the adjustment of prices reflecting the market distortion, which is estimated based on the formula as mentioned below

$$SCF = (I + E) / [(I - I_s + I_t) + (E + E_s - E_t)]$$

Where, I = Total import value (CIF) to Cambodia,
E = Total export value (FOB) from Cambodia,
s = subsidy, and
t = tax;

- A shadow wage rate (SWR) is assumed to be 0.30 for the adjustment of labor costs reflecting the market distortion, which is defined as the ratio of the total annual labor force requirement for the whole candidate irrigation project areas against the total annual labor force available in the same areas. Various relevant sources¹ are referred to for this calculation and the ratio calculated based on 2020 projected population is adjusted by multiplying by SCF (SWR = 8,102,121/26,430,987 x 0.986 = 0.3022);
- Financial construction cost is assumed to be composed of 70% for foreign currency portion and 30% for local currency portion. The foreign currency portion is further broken down into 35% for equipment cost and 65% for material cost, while the local currency portion is formed of 15% for equipment cost, 15% for material cost, 20% for common labor cost and 50% for skilled labor cost; and
- Conversion factors of financial construction cost to economic values are determined as 0.81 for material costs and 0.73 for equipment costs in the foreign currency portion as well as 0.86 for material costs and 0.78 for equipment costs in the local currency portion, all of which are estimated by excluding transfer payments such as taxes, duties, subsidies, interest, land acquisition cost, etc. included in the financial construction costs.

¹ Cambodia Statistical Yearbook 2006, NIS, Ministry of Planning; First Revision, Population Projection for Cambodia 1988 – 2020; and SEIRA Commune Database 2005, Ministry of Interior

E2.2 Economic Benefit

In the four river basins, irrigation and drainage benefits are expected to be derived from the increase in irrigated paddy field area coupled with the increase in paddy yield and cultivation area of upland crops and vegetables. The economic benefit is defined as the incremental net benefit between the present “Without Project” condition and the future “With Project” condition. In constructing proposed irrigation and drainage facilities, some part of existing paddy field will be acquired. Such change in the “right of way” area has been taken into account in formulating the future land use plan. In this regard, no production foregone as negative benefit is considered in estimating the annual economic benefit.

The project benefit is assumed to be realized from the early wet crop season of the next year after construction works are finished according to the construction schedule. The target crop yield is also assumed to be fully realized at the fifth crop season. Based on these assumptions, the irrigation benefit of each sub-project is estimated as shown below, and the project benefit is fully realized from 2020 onward.

Annual Progress of Construction Works and Increase in Project Benefits

Unit: %

Sub-project	Item	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020~
Ream Kon (W/O: 2,020 ha) (W/P: 1,890 ha)	Work progress	10	60	98	100	-	-	-	-	-	-
	Yield build-up	-	60	70	80	90	100	100	100	100	100
	Benefit increase	-	27	47	67	77	87	96	99	100	100
Por Canal (W/O: 2,070 ha) (W/P: 1,940 ha)	Work progress	15	75	97	100	-	-	-	-	-	-
	Yield build-up	-	60	70	80	90	100	100	100	100	100
	Benefit increase	-	28	48	68	79	89	97	99	100	100
Damnak Ampil (W/O: 2,430 ha) (W/P: 2,270 ha)	Work progress	25	90	97	100	-	-	-	-	-	-
	Yield build-up	-	60	70	80	90	100	100	100	100	100
	Benefit increase	-	31	56	71	81	91	99	99	100	100
Wat Loung (W/O: 2,720 ha) (W/P: 2,540 ha)	Work progress	-	55	95	100	-	-	-	-	-	-
	Yield build-up	-	-	60	70	80	90	100	100	100	100
	Benefit increase	-	-	49	64	75	85	95	99	100	100
Wat Chre (W/O: 1,090 ha) (W/P: 1,020 ha)	Work progress	-	-	60	100	-	-	-	-	-	-
	Yield build-up	-	-	-	60	70	80	90	100	100	100
	Benefit increase	-	-	-	36	66	76	86	96	100	100
Lum Hach (W/O: 3,320 ha) (W/P: 3,100 ha)	Work progress	-	45	95	99	100	-	-	-	-	-
	Yield build-up	-	-	60	70	80	90	100	100	100	100
	Benefit increase	-	-	34	54	74	84	94	99	100	100

Note: W/O; Present/Without project condition, and W/P; With project condition
Prepared by JICA Study Team

Based on the above, the annual increase in irrigation area, paddy production and incremental net benefit of the proposed project are estimated as summarized below. The details of economic benefit estimate by sub-project are given in Tables E2-2 to E2-15.

Annual Increase in Project Benefits

Annual Increase	Unit	2012	2013	2014	2015	2016	2017	2018	2019	2020~
Cropped area under irrigation	(ha)	950	7,541	12,517	13,343	13,385	13,385	13,385	13,385	13,385
Paddy production	(ton)	420	4,660	10,760	15,700	20,570	25,020	27,050	27,360	27,370
Increment economic benefit	(M. Riel)	682	6,290	12,852	17,369	21,580	25,426	27,180	27,450	27,462
	('000 US\$)	166	1,532	3,129	4,229	5,254	6,191	6,618	6,684	6,687

Prepared by JICA Study Team

E2.3 Economic Cost

The following are to be taken up as economic investment cost items:

- Direct construction cost including head works and major related structures rehabilitation, main and secondary system rehabilitation, on-farm development, miscellaneous works and contractor's expense;
- Project supporting program cost;
- Consulting services cost; and
- Physical contingencies.

The economic investment cost is estimated by applying relevant conversion factors to each cost components like materials, equipment, common labor and skilled labor of the both foreign and local currency portions. According to the construction schedule, the annual disbursement schedule of the estimated economic investment cost as shown below. The details of economic cost estimate by sub-project are given in Tables E2-9 to E2-14.

The annual O&M cost and major repairing cost are also converted to economic values in the same manner. The latter is allocated every 10 years.

Annual Disbursement of Economic Cost

Unit: Million Riel

Economic Cost	2010	2011	2012	2013	2014	2015	2016	Total	2025	2026
Initial investment cost	0	9,150	62,267	49,237	8,330	404	0	129,389	-	-
Supporting program cost	0	738	590	590	590	443	0	2,951	-	-
Physical contingency, 10%	0	989	6,286	4,983	892	85	0	13,235	-	-
Consulting services cost	4,255	6,240	9,928	5,389	1,702	567	284	28,365	-	-
Total economic cost	4,255	17,117	79,071	60,199	11,514	1,499	284	173,939	-	-
('000 US\$)	1,036	4,168	19,253	14,658	2,804	365	69	42,353	-	-
Annual O&M cost	-	-	27	99	169	181	182	-	182	182
Major repairing cost	-	-	-	-	-	-	-	-	6,983	3,366

Prepared by JICA Study Team

E2.4 Economic Evaluation and Sensitivity Analysis

In conducting economic evaluation, the economic cost and benefit stream is prepared for the project life period of 50 years, comprising the project investment cost, annual O&M cost and major repairing cost for the cost stream as well as annual irrigation and drainage benefit in the build-up and full swing stages for the benefit stream.

Sensitivity analysis is made for the following four cases:

- Case-1: Construction cost 10% up;
- Case-2: Irrigation water supply 1 year delay;
- Case-3: Target yield of crops 10% down; and
- Case-4: Case-1 combined with Case-3.

The results of economic evaluation and sensitivity analysis are expressed by the economic internal rate of return (EIRR), surplus between net present values of benefit and cost (B-C) at

discount rate of 8% and benefit-cost ratio (B/C) as summarized as below, and the details are given in Tables E2-15 to E2-19.

Results of Economic Evaluation and Sensitivity Analysis

Item	EIRR	Net Present Value (8% discount rate)			
		Benefit	Cost	B-C	B/C
		(Million Riel)			Ratio
	(%)				
Economic Evaluation	12.8	229,181	141,526	87,655	1.62
Sensitivity Analysis Case-1	11.9	229,181	153,398	75,783	1.49
Case-2	11.6	211,661	141,504	70,157	1.50
Case-3	10.3	182,329	141,504	40,825	1.29
Case-4	9.5	182,329	153,398	28,931	1.19

Prepared by JICA Study Team

As seen in the above, it can be said that the proposed project is economically feasible under the conditions set up as described.

CHAPTER E3 FINANCIAL EVALUATION

E3.1 Financial Evaluation Procedures

The prospected impact of the proposed project on beneficiary farmers' capacity to pay is indicated by estimating farm budget based on typical farm size and farming practice type of each sub-project area. The increase in net return between the present "Without Project" and future "With Project" conditions reveals that how much additional capacity to pay after deducting farming cost beneficiary farmers can expect to gain through participation to the proposed project.

To estimate the farm budget on the financial price basis, actual farm gate prices of all farm inputs and outputs as of September 2008 are to be used. Further, the balance between non-farm income and family expenditure is estimated. Then the sum of net return to be gained from farm operation and balance of non-farm activities is calculated as net surplus which can be defined as farmer's capacity to pay.

E3.2 Increase in Farmers' Capacity to Pay

Based on the examination results on financial crop budget and farm household economy of typical farm size in each sub-project area under the both conditions of present/without project and with project as presented in Appendix-B, the increase in farmers' capacity to pay is estimated as below.

Increase in Farmers' Capacity to Pay

Sub-project	Crop Season, Planting and Irrigation	Farm Size ha	Net Surplus		Increased Capacity to Pay			Rate times
			W/O	W/P	Amount			
			'000 R	'000 R	'000 R	TR/ha	US\$/ha	
Ream Kon Rehabilitation	WT-Normal	2.2	569	3,940	3,371	1,532	373	6.9
	WT-Pump	2.2	569	2,521	1,952	887	216	4.4
	WD-Normal	2.2	-243	3,071	3,314	1,506	367	33.1
	WD-Pump	2.2	-243	2,349	2,592	1,178	287	25.9
Por Canal Rehabilitation	WT-Normal	2.4	1,593	5,126	3,533	1,472	358	3.2
	WD-Normal	2.4	271	3,634	3,363	1,401	341	13.4
Dam Nak Ampil Rehabilitation	WT-Normal A	1.2	192	1,491	1,294	1,083	264	7.8
	WT-Pump A	1.2	192	917	725	604	147	4.8
	WT-Normal B	1.2	685	1,491	806	672	164	2.2
Wat Loung Rehabilitation	WT-Normal	1.4	632	2,372	1,740	1,243	303	3.8
	WT-Pump	1.4	632	1,701	1,069	764	186	2.7
Wat Chre Rehabilitation	WT-Normal	1.6	670	2,831	2,161	1,351	257	4.2
	WT-Pump	1.6	670	2,064	1,394	871	212	3.1
Lum Hach Rehabilitation	WT-Normal	1.4	266	3,321	3,055	2,182	531	12.5
	WT-Pump	1.4	266	2,235	1,969	1,406	342	8.4

Note: W/O; Present/Without project condition, W/P; With project condition, R; Riel, TR; 1,000 Riel,

WT; Wet season transplanting, and WD; Wet season direct sowing

Prepared by JICA Study Team

The result shows that beneficiary farmers will be able to gain additional net surplus ranging from 604,000 Riel/ha or 147 US\$/ha to 2,182,000 Riel/ha or 531 US\$/ha. This reveals that every participated farmer in the proposed Sub-project may fully shoulder the annual O&M cost of their on-farm facilities and also pay water charge if it is set up at affordable rate.

E3.3 Indirect Benefit, Intangible Benefit and Socio-economic Impacts

E3.3.1 Indirect Benefit

As described in Appendix-C, supplemental irrigation water supply can be expected to downstream paddy fields of the Damnak Ampil Main Canal as well as the left bank area of the Lum Hach Head Works. In the both cases, surplus of discharge to be created at off-peak irrigation water supply time to Damnak Ampil, Wat Loung and Wat Chre Sub-projects as well as Lum Hach Sub-project can be used by farmers who are growing paddy in the areas where the surplus discharge can take in through the said canal or head works. These areas are excluded in defining a direct benefit to born by irrigation water supply by the proposed rehabilitation works of the existing irrigation structures. By utilizing the surplus discharge, however, paddy yield in the concerned areas will be able to be raised to a certain extent.

If it is assumed to make the present paddy yield level increase by 0.5 ton for the wet season through practicing the use of surplus discharge by farmers, the following increase in paddy production is anticipated as indirect benefits of the proposed Sub-project implementation. This increasing paddy yield is equivalent to the yield difference between supplemental irrigation paddy field and rain-fed paddy field.

Anticipated Indirect Benefit

Existing Structure to be Rehabilitated by Project	Scheme Indirectly Benefited	Command Area (ha)	Increase in Paddy Production (ton)
Damnak Ampil Main Canal	Damnak Ampil Extension	7,650	3,825
	Bakan & Krouchi Seuchi	1,000	500
	Svay Don Keo River	2,200	1,100
Lum Hach Head Works	O Roluss Irrigation	3,400	1,700

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E3.3.2 Intangible Benefit

Though rehabilitation works of the existing irrigation and drainage systems in the proposed project area, the annual paddy production can be expected to go up from 21,000 tons before the proposed project implementation to 48,400 tons after the implementation as estimated in Tables E2-4 for Ream Kon Rehabilitation Sub-project, E2-6 for Por Canal Rehabilitation Sub-project, E2-8 for Damnak Ampil Rehabilitation Sub-project, E2-10 for Wat Loung Rehabilitation Sub-project, E2-12 for Wat Chre Rehabilitation Sub-project and E2-24 for Lum Hach Rehabilitation Sub-project. The summarized estimate is as shown below.

Annual Increase in Paddy Production in Proposed Project Area

Sub-project/Project	Present Paddy Cropped Area (ha)	Present Paddy Production (ton)	Future Paddy Cropped Area (ha)	Future Paddy Production (ton)	Increased Paddy Production (ton)
Ream Kom Rehabilitation	2,220	3,110	2,970	7,790	4,680
Por Canal Rehabilitation	2,480	3,870	3,060	8,170	4,300
Damnak Ampil Rehabilitation	2,490	4,050	2,270	7,490	3,440
Wat Loung Rehabilitation	2,765	4,260	2,540	8,380	4,120
Wat Chre Rehabilitation	1,090	1,660	1,020	3,370	1,710
Lum Hach Rehabilitation	3,320	4,080	4,400	13,200	9,120
Whole Project Area	14,365	21,030	16,260	48,400	27,370

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In addition to such prospected increase in paddy production as the tangible benefit of the proposed Sub-projects, it can be considered that the availability of rice processed products like rice flour and ancillary business chances as typical intangible benefits attribute to the project implementation will be enhanced to a large extent. As a result, such increasing availability will be able to heighten a contribution degree to rural and individual farm economies through increase in inputs to be purchased and transported as well as value addition of outputs in the course of processing, transporting and transacting of rice and its product.

E3.3.3 Socio-economic Impacts

Citing the socio-economic survey findings, the average labor force is presumed at 2.5 persons a farm family in the six Sub-project areas and total farm households are estimated at around 8,300. If the annual working day of one family labor force is assumed to be 236 days, the available annual family labor force of 8,300 farm households in the six Sub-project areas is estimated at 4.9 million man-days. On the other hand, the annual farm labor requirement in the whole command areas of the six Sub-projects is estimated at approximately 1.5 million man-days under the present/without project condition based on the result of farm survey. Thus, the both estimates show that the whole farm labor requirement for the present farm operation can be covered by the available family labor force of farm households in the six Sub-project command areas.

However, the said farm survey result also points out such fact that every farm household is using 8 to 18 hired labors per 1 ha at peak times of farm operation like transplanting and harvesting in early wet crop season and wet crop season. Furthermore, the proposed rice cultivation practice under the normal or pump irrigation condition needs more farm labor inputs than as it is for the peak time of farm operation for every crop season. In this regard, the hired labor requirements are to be set up at 11 to 17 man-day/ha according to paddy cropping systems.

From this viewpoint, it can be considered that a sustainable socio-economic impact attribute to improvement of rice cultivation under irrigated condition as one of prospected fruits of the proposed project implementation is to provide jobless workers in rural areas with seasonal job opportunities to earn a certain incomes either in kind or cash. Based on the farm labor requirements for different cropping patterns proposed to the respective Sub-projects, therefore, necessary hired labor inputs are to be calculated and then increased hired labor inputs are estimated as an indicator of socio-economic impact. The estimated increase in the total hired labor inputs for each Sub-project is tabulated as below.

In view of socio-economy in the proposed six Sub-subject areas, the impact of project implementation can be expressed by increasing hired labor inputs by 82,370 persons or 54% every year. This increase reveals that employment opportunities even though temporary will be created at the peak time of farm operation like transplanting and harvesting in three rice cropping seasons consisting of early wet season, wet season and dry season.

Increase in Hired Labor Inputs as Socio-economic Impact Indicator

Sub-project	Present Condition		Future Condition		Increased Hired Labor Input (No.)
	Cropped Area (ha)	Hired Labor Input (No.)	Cropped Area (ha)	Hired Labor Input (No.)	
Ream Kon Rehabilitation	2,230	33,804	3,254	53,969	20,165
Por Canal Rehabilitation	2,480	38,335	3,350	56,565	18,230
Dam Nak Ampil Rehabilitation	3,360	20,540	5,020	27,380	6,840
Wat Loung Rehabilitation	2,795	22,550	2,920	30,630	8,080
Wat Chre Rehabilitation	1,120	8,990	1,170	12,295	3,305
Lum Hach Rehabilitation	3,360	27,040	5,020	52,790	25,750
Total	15,345	151,259	20,734	233,629	82,370

Prepared by JICA Study Team

Tables

Table E2-1 Economic Farm Gate Price of Internationally Traded Goods (1/2)

Item	Import Parity Price			Export Parity Price		
	Operation	Unit	Price	Operation	Unit	Price
I. Rice/Paddy						
1. Forecasted 2020 World Price (in 2007 price) /a		US\$/ton	400		US\$/ton	400
2. Quality Adjustment	x	%	90	x	%	90
3. CIF/FOB Price at Sihanouk Ville International Port /b	=	US\$/ton	360	=	US\$/ton	360
4. Port Charge, Handling and Warehousing	+	US\$/ton	14	-	US\$/ton	14
5. Price at Sihanouk Ville International Port	=	US\$/ton	374	=	Riel/kg	346
Equivalent in Riel / kg /c	=	Riel/kg	1,536	=	Riel/kg	1,421
6. Transportation Cost /d (Sihanouk Ville-Phnom Penh)	+	Riel/kg	33	-	Riel/kg	35
(Phnom Penh -Pursat)	+	Riel/kg	33	-	Riel/kg	35
7. Ex-Mill /Wholesale Price in Pursat	=	Riel/kg	1,602	=	Riel/kg	1,351
8. Milling Cost and Margin /e	-	Riel/kg	27	-	Riel/kg	27
9. Processing Ratio	x	%	64	x	%	64
10. By-Products through Processing /d	+	Riel/kg	116	+	Riel/kg	116
11. Millgate Paddy Price	=	Riel/kg	1,124	=	Riel/kg	963
12. Transport/Handling from Farmgate /d	-	Riel/kg	17	-	Riel/kg	17
13. Farmgate Price	=	Riel/kg	1,107	=	Riel/kg	946
17. Weighted average economic farm gate price		Riel/kg	1,027		Riel/kg	946
	50%			50%		
II. Maize						
1. Forecasted 2020 World Price (in 2007 price) /a		US\$/ton	160		US\$/ton	160
2. International Shipping and Handling	+	US\$/ton	43		US\$/ton	43
3. CIF/FOB Price at Sihanouk Ville International Port	=	US\$/ton	203	=	US\$/ton	160
4. Port Charge, Handling and Warehousing	+	US\$/ton	14	-	US\$/ton	14
5. Price at Sihanouk Ville International Port	=	US\$/ton	217	=	Riel/kg	146
Equivalent in Riel / kg /c	=	Riel/kg	891	=	Riel/kg	600
6. Transportation Cost /d (Sihanouk Ville-Phnom Penh)	+	Riel/kg	33	-	Riel/kg	35
(Phnom Penh -Pursat)	+	Riel/kg	33	-	Riel/kg	35
7. Price in Pursat	=	Riel/kg	957	=	Riel/kg	530
8. Transport/Handling from Farmgate /d	-	Riel/kg	17	-	Riel/kg	17
9. Farmgate Price	=	Riel/kg	940	=	Riel/kg	513
17. Weighted average economic farm gate price		Riel/kg	730		Riel/kg	513
	50%			50%		

Note : /a ; Nominal index based on 2007 real international market prices, Prospects for the Global Economy, the World Bank, 2008

Rice : Thai, milled, 5% broken, FOB Bangkok

Maize : US No.2, Yellow, FOB Gulf Ports

/b ; Assumed at the same price at Bangkok port in Thailand

/c ; Exchange rate US\$ = Riel 4,107 (As of September 2008)

/d ; Adjusted with SCF of 0.986

/e ; Rice bran : Riel 500 /kg of rice bran, 18% of paddy weight

Broken rice: Riel 520 /kg of broken rice, 5 % of paddy weight.

Table E2-1 Economic Farm Gate Price of Internationally Traded Goods (2/2)

Item	Import Parity Price		
	Operation	Unit	Price
III. Fertilizer			
(1) Urea			
1. Forecasted 2020 World Price (in 2007 price) /a		US\$/ton	220
2. International Shipping and Handling	+	US\$/ton	43
3. CIF/FOB Price at Sihanouk Ville International Port	=	US\$/ton	263
4. Port Charge, Handling and Warehousing	+	US\$/ton	14
5. Price at Sihanouk Ville International Port	=	US\$/ton	277
Equivalent in Riel / kg /b	=	Riel/kg	1,138
6. Transportation Cost /d (Sihanouk Ville-Pursat)	+	Riel/kg	66
7. Trade Price in Pursat	=	Riel/kg	1,204
8. Transport/Handling to Farmgate /c	+	Riel/kg	17
9. Farmgate Price	=	Riel/kg	1,221
Price of Nutrient (N) /d		Riel/kg	2,654
(2) DAP (Diammonium Phosphate)			
1. Forecasted 2020 World Price (in 2007 price) /a		US\$/ton	260
2. International Shipping and Handling	+	US\$/ton	49
3. CIF/FOB Price at Sihanouk Ville International Port	=	US\$/ton	309
4. Port Charge, Handling, Warehousing and Bagging	+	US\$/ton	14
5. Price at Sihanouk Ville International Port	=	US\$/ton	323
Equivalent in Riel / kg /b	=	Riel/kg	1,327
6. Transportation Cost /c (Kampong Som-Kampong Speu)	+	Riel/kg	66
7. Trade Price in Kampong Speu	=	Riel/kg	1,393
8. Transport/Handling to Farmgate /c	+	Riel/kg	17
9. Farmgate Price	=	Riel/kg	1,410
Price of Nutrient (P) /d		Riel/kg	3,065
Price of Nutrient (N) /d		Riel/kg	7,833
(3) Potassium Chloride (KCl)			
1. Forecasted 2020 World Price (in 2007 price) /a		US\$/ton	200
2. International Shipping and Handling	+	US\$/ton	43
3. CIF/FOB Price at Sihanouk Ville International Port	=	US\$/ton	243
4. Port Charge, Handling, Warehousing and Bagging	+	US\$/ton	14
5. Price at Sihanouk Ville International Port	=	US\$/ton	257
Equivalent in Riel / kg /b	=	Riel/kg	1,055
6. Transportation Cost /c (Kampong Som-Takeo)	+	Riel/kg	66
7. Trade Price in Takeo	=	Riel/kg	1,121
8. Transport/Handling to Farmgate /c	+	Riel/kg	17
9. Farmgate Price	=	Riel/kg	1,138
Price of Nutrient (K) /d		Riel/kg	1,897

Note : /a ; Nominal index based on 2007 real international market prices, Prosects for the Global Economy, the World Bank, 2008

Urea : Bagged, FOB Black Sea
DAP : Bulk, FOB US Gulf
KCl : Bulk, FOB Vancouver

/b ; Exchange rate : US\$ = Riel 4,107 (As of September 2008)

/c ; Adjusted with SCF of 0.986

/d ; Nutrient content is 46%, 46%(18-46-0), and 60%, respectively for Urea, DAP and KCL.

Table E2-2 Summary of Financial and Economic Prices Applied

Particulars	Unit	Financial Price / a	Conversion	Economic Price
1 Farm Products				
Dry paddy	(Riel/kg)	1,100	b	1,027
Dry paddy (Early wet season)	(Riel/kg)	1,000	b	1,027
Mungbean	(Riel/kg)	2,900	c	2,859
Upland crops (Average-1)	(Riel/kg)	2,750	c	2,712
Upland crops (Average-2)	(Riel/kg)	2,550	c	2,514
Vegetables (Averages)	(Riel/kg)	370	c	365
2 By-Products				
By-products of paddy		5% of gross return of paddy /c		
By-products of upland crops and vegetables		2% of gross return of upland crops /c		
3 Seeds				
Paddy (Present/Without)	(Riel/kg)	1,100	c	1,085
Paddy (Present/Without for EWS)	(Riel/kg)	1,000	c	986
Paddy (With)	(Riel/kg)	1,400	c	1,380
Mungbean	(Riel/kg)	6,000	c	5,916
Upland crops (Average-1)	(Riel/kg)	6,000	c	5,916
Upland crops (Average-2)	(Riel/kg)	5,000	c	4,930
Vegetables (Average)	(Riel/kg)	24,500	c	7,405
4 Fertilizer				
Urea	(Riel/kg)	3,500	b	1,221
DAP	(Riel/kg)	5,000	b	1,410
Compound (16-20-0)	(Riel/kg)	3,100	b	1,050
Compound (15-15-15)	(Riel/kg)	3,400	b	1,142
Compound (20-20-15)	(Riel/kg)	3,400	b	1,428
Compost	(Riel/ton)	50,000	d	15,112
5 Agro-chemicals				
Liquid chemicals (paddy)	(Riel/litre)	20,000	d	6,045
Liquid chemicals (upland crops)	(Riel/litre)	15,000	d	4,534
Dust chemicals (paddy)	(Riel/kg)	10,000	d	3,022
Dust chemicals (upland crops)	(Riel/kg)	8,000	d	2,418
6 Labor				
Hired labor	(Riel/manday)	10,000	d	3,022
Family labor	(Riel/manday)	0	d	3,022
7 Land Preparation				
Direct sowing (Present/Without)	(Riel/ha)	200,000	d	60,449
Transplanting (Present/Without)	(Riel/ha)	250,000	d	75,562
Direct sowing (With for WSR)	(Riel/ha)	200,000	d	60,449
Direct sowing (With for EWS/WS)	(Riel/ha)	250,000	d	75,562
Transplanting (With for WSR)	(Riel/ha)	250,000	d	75,562
Transplanting (With for EWS/WS)	(Riel/ha)	350,000	d	105,787
Mungbean	(Riel/ha)	100,000	d	30,225
Upland crops	(Riel/ha)	150,000	d	45,337
Vegetables	(Riel/ha)	120,000	d	36,270
8 Pumping				
Early wet season (Present/Without)	(Riel/ha)	300,000	e & f	231,000
Wet season (With)	(Riel/ha)	200,000	e & f	154,000
Early wet / Dry seasons (With)	(Riel/ha)	400,000	e & f	292,000
9 Transportation				
Ox cart	(Riel/ton)	40,000	d	12,090
10 Miscellaneous				
5% of total of cost items 3 to 9	(Riel)			

Remarks:

/a ; August. 2008 prices

/b ; Economic price estimate based on the WB Commodity Markets Forecast

/c ; Financial prices are converted to economic value multiplying by SCF 0.986

/d ; Multiplied by shadow wage rate and SCF 0.3022

/e ; Average conversion factors of materials (50%) and equipment (50%) 0.77

/f ; Conversion factor of materials 0.81

Conversion factor of equipment 0.73

Table E2-3 Economic Crop Budget for Ream Kon Rehabilitation Sub-project (1/2)

Present / Without Project Condition	Item	Unit	Early Wet Season Direct Sowing			Wet Season Transplanting			Wet Season Direct Sowing		
			Supplemental irrigation area	Pumping area*	Rainfed area	Supplemental irrigation area	Rainfed area	Supplemental irrigation area	Rainfed area		
			Q'ty	Price (Riel)	Value ('000 Riel)	Q'ty	Price (Riel)	Value ('000 Riel)	Q'ty	Price (Riel)	Value ('000 Riel)
1. Gross Income	Main products	Riel			2,696			1,833			1,078
	By-product (straw)	kg	2,500	1,027	2,568	2,500	1,027	2,568	1,500	1,027	1,541
2. Production Cost		Riel			945			648			517
2.1 Inputs	Seed	Riel	140	986	138	140	986	138	120	1,085	207
	Manure (wet)	kg	0	15,112	0	0	15,112	0	0	15,112	130
	Fertilizer: Urea	ton	100	1,221	122	100	1,221	122	50	1,221	61
	DAP	kg	60	1,410	85	60	1,410	85	30	1,410	42
	Compound (20-20-20)	kg	0	1,428	0	0	1,428	0	0	1,428	0
	Agro-chemicals: Liqu	liter	0	6,045	0	0	6,045	0	0	6,045	0
	Dust	kg	0.8	3,022	2	0.8	3,022	2	0	3,022	0
2.2 Labor	Hired labor	Riel	15	3,022	45	15	3,022	45	15	3,022	45
	Family labor	manday	62	3,022	187	62	3,022	187	58	3,022	175
2.3 Land preparation	Draft animal/Tractor	Riel	1	60,449	60	1	60,449	60	1	60,449	60
2.4 Pumping		Riel	1	231,000	231	1	231,000	231	0	231,000	0
2.5 Transportation	Ox-cart	Riel	2.5	12,090	30	2.5	12,090	30	1.5	12,090	18
2.6 Miscellaneous		Riel			45			31			27
3. Net Return		Riel			1,751			1,724			1,061

Note: * Farmers use small moval pump in rainfed paddy field.

Present / Without Project Condition	Item	Unit	Early Wet Season Upland Crop		
			Rainfed area (Mungbeans)	Rainfed area (Riel)	
			Q'ty	Price (Riel)	
1. Gross Income	Main products	Riel	500	2,859	1,430
	By-product (straw)	kg			29
2. Production Cost		Riel			657
2.1 Inputs	Seed	Riel	60	5,916	355
	Manure (wet)	kg	1	15,112	15
	Fertilizer: Urea	ton	40	1,221	49
	DAP	kg	25	1,410	35
	Compound (20-20-20)	kg	0	1,428	0
	Agro-chemicals: Liqu	liter	0	1,061	0
	Dust	kg	0	2,418	0
2.2 Labor	Hired labor	Riel	5	3,022	15
	Family labor	manday	40	3,022	121
2.3 Land preparation	Draft animal/Tractor	Riel	1	30,225	30
2.4 Pumping		Riel	0	231,000	0
2.5 Transportation	Ox-cart	Riel	0.5	12,090	6
2.6 Miscellaneous		Riel			31
3. Net Return		Riel			802

Table E2-3 Economic Crop Budget for Ream Kon Rehabilitation Sub-project (2/2)

With Project Condition	Unit	Early Wet Season Direct Sowing			Normal irrigation area			Wet Season Transplanting			Wet Season Direct Sowing		
		Normal irrigation area	Pump irrigation area	Rainfed area	Q'ty	Price (Riel)	Value ('000 Riel)	Q'ty	Price (Riel)	Value ('000 Riel)	Q'ty	Price (Riel)	Value ('000 Riel)
1. Gross Income	Riel												
Main products	kg	3,000	3,081	3,235	3,500	1,027	3,081	3,500	1,027	3,595	1,746	3,020	
By-product (straw)	kg	154	154	154						0	87	2,876	
2. Production Cost	Riel												
2.1 Inputs	Riel												
Seed	kg	80	426	426	25	1,380	348	25	1,380	348	348	837	
Manure (wet)	ton	1	15,112	15	1	15,112	15	1	15,112	15	15	423	
Fertilizer: Urea	kg	80	1,221	98	80	1,221	98	80	1,221	98	80	1,380	
DAP	kg	0	1,410	0	0	1,410	0	0	1,410	0	0	15,112	
Compound (20-20-20)	kg	140	1,428	200	140	1,428	200	140	1,428	200	140	1,428	
Agro-chemicals: Liqu	liter	0	6,045	0	0	6,045	0	0	6,045	0	0	1,221	
Dust	kg	1	3,022	3	1	3,022	3	1	3,022	3	1	1,410	
2.2 Labor	Riel												
Hired labor	manday	17	3,022	51	23	3,022	70	23	3,022	70	17	3,022	
Family labor	manday	69	3,022	209	92	3,022	278	92	3,022	278	69	3,022	
2.3 Land preparation	Riel												
Draft animal/Tractor	ha	1	75,562	76	1	75,562	76	1	75,562	76	1	75,562	
2.4 Pumping	Riel												
Pumping	ha	0	292,000	0	0	292,000	292	0	154,000	154	0	154,000	
2.5 Transportation	Riel												
Ox-cart	ton	3	12,090	36	3	12,090	36	3	12,090	36	3	12,090	
2.6 Miscellaneous	Riel												
3. Net Return	Riel												
			2,397	2,091		2,889	2,547		1,246			2,189	

With Project Condition	Unit	Wet Season Direct Sowing			Dry Season Cropping			
		Pump irrigation area	Rainfed area	Vegetables	Upland crops	Q'ty	Price (Riel)	Value ('000 Riel)
1. Gross Income	Riel							
Main products	kg	2,800	1,027	1,027	1,000	2,712	2,848	3,647
By-product (straw)	kg	144	144	51			136	3,468
2. Production Cost	Riel							
2.1 Inputs	Riel							
Seed	kg	80	426	207	65	5,916	563	680
Manure (wet)	ton	1	15,112	130	2	15,112	385	238
Fertilizer: Urea	kg	80	1,221	49	35	1,221	43	12
DAP	kg	0	1,410	28	15	1,410	21	38
Compound (16-20-4)	kg	0	1,050	0	0	1,050	84	61
Compound (15-15-15)	kg	0	1,142	0	0	1,142	0	105
Compound (20-20-20)	kg	140	1,428	0	0	1,428	0	105
Agro-chemicals: Liqu	liter	0	6,045	0	0	6,045	0	11
Dust	kg	1	3,022	3	0	2,418	4.5	11
2.2 Labor	Riel							
Hired labor	manday	17	3,022	42	6	3,022	18	26
Family labor	manday	69	3,022	172	55	3,022	166	233
2.3 Land preparation	Riel							
Draft animal/Tractor	ha	1	75,562	60	1	60,449	45	36
2.4 Pumping	Riel							
Pumping	ha	1	154,000	0	0	292,000	0	0
2.5 Transportation	Riel							
Ox-cart	ton	2.8	12,090	12	1	12,090	12	115
2.6 Miscellaneous	Riel							
3. Net Return	Riel							
			2,022	562		2,003	2,003	2,961

Table E2-4 Economic Irrigation Benefit for Ream Kon Rehabilitation Sub-project

Crops	Present / Without Condition			With Project Condition			Incremental NPV (Riel 'Million)
	Planted Area (ha)	Net Production Value		Planted Area (ha)	Net Production Value		
		Per ha (Riel '000)	Total (Riel 'Million)		Per ha (Riel '000)	Total (Riel 'Million)	
Rice	<u>2,220</u>		<u>2,062</u>	<u>2,970</u>		<u>5,246</u>	
Early Wet Season							
- Normal irrigation area	0	0	0	905	2,397	2,169	
- Pump irrigation area	0	0	0	175	2,091		
- Supplemental irrigation area	50	1,751	88	0	0		
- Pumping rainfed area	150	1,751	263	0	0		
- Rainfed area	0	0	0				
Wet Season Transplanting							
- Normal irrigation area	0	0	0	400	2,889	1,155	
- Pump irrigation area	0	0	0	70	2,547		
- Supplemental irrigation area	20	1,724	35	0	0	0	
- Rainfed area	788	1,246	982	290	1,246	361	
Wet Season Direct Sowing							
- Normal irrigation area	0	0	0	605	2,189	1,324	
- Pump irrigation area	0	0	0	105	2,022		
- Supplemental irrigation area	30	1,061	32	0	0	0	
- Rainfed area	1,182	561	664	420	562	236	
Dry Season							
- Normal irrigation area	0	0	0	0	0	0	
- Pump irrigation area	0	0	0	0	0	0	
- Supplemental irrigation area	0	0	0	0	0	0	
- Rainfed area	0	0	0	0	0	0	
Upland Crops	<u>10</u>		<u>8</u>	<u>284</u>		<u>485</u>	
- Mungbean	10	802	8	0	0	0	
- Upland crops (Early wet season)	0	0	0	128	2,003	256	
- Upland crops (Dry season)	0			70	2,003	140	
- Vegetables (Early wet season)	0			56	2,961		
- Vegetables (Dry season)	0	0	0	30	2,961	89	
Total	2,230		2,070	3,254		5,732	3,662

Total Physical Area	(ha)	2,020	1,890
Cropping Intensity	(%)	110	172
NPV per ha	('000 Riel)	1,025	3,033
Exchange rate (1 USD equiv.)	(Riel)	4,107	4,107
NPV per ha	(USD)	250	738

Paddy Production	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
Early Wet Season						
- Normal irrigation area	0		0	905	3.0	2,715
- Supplemental irrigation area	50	2.5	125	175	3.0	525
- Rainfed area using small pump	150	2.5	375	0		0
- Rainfed area	0		0	0		0
Wet Season (Transplanting)						
- Normal irrigation area	0		0	400	3.5	1,400
- Supplemental irrigation area	20	2.2	44	70	3.5	245
- Rainfed area	788	1.7	1,340	290	1.7	493
Wet Season (Direct sowing)						
- Normal irrigation area	0		0	605	2.8	1,694
- Supplemental irrigation area	30	1.5	45	105	2.8	294
- Rainfed area	1,182	1.0	1,182	420	1.0	420
Dry Season						
- Normal irrigation area	0		0	0		0
- Supplemental irrigation area	0		0	0		0
- Rainfed area	0		0	0		0
Total & Production Increase	2,220		3,111	2,970		7,786

Table E2-5 Economic Crop Budget for Por Canal Rehabilitation Sub-project (1/2)

Present / Without Project Condition	Item	Unit	Early Wet Season Direct Sowing			Wet Season Transplanting			Wet Season Direct Sowing				
			Supplemental irrigation area Q'ty	Price (Riel)	Value ('000 Riel)	Supplemental irrigation area Q'ty	Price (Riel)	Value ('000 Riel)	Supplemental irrigation area Q'ty	Price (Riel)	Value ('000 Riel)		
1. Gross Income	Main products	Riel	2,500	1,027	2,568	2,200	1,027	2,259	1,500	1,027	1,541	1,027	1,027
	By-product (straw)	kg			128			113			77		51
2. Production Cost		Riel			945			648			587		517
2.1 Inputs	Seed	Riel	140	986	138	80	1,085	87	120	1,085	130	120	1,085
	Manure (wet)	kg	0	15,112	0	0	15,112	0	0	15,112	0	0	15,112
	Fertilizer: Urea	ton	100	1,221	122	75	1,221	92	50	1,221	61	40	1,221
	DAP	kg	60	1,410	85	45	1,410	63	30	1,410	42	20	1,410
	Compound (20-20-20)	kg	0	1,428	0	0	1,428	0	0	1,428	0	0	1,428
	Agro-chemicals: Liquid	liter	0	6,045	0	0	6,045	0	0	6,045	0	0	6,045
	Dust	kg	0.8	3,022	2	0	3,022	0	0	3,022	0	0	3,022
2.2 Labor	Hired labor	Riel	15	3,022	45	18	3,022	54	15	3,022	45	14	3,022
	Family labor	manday	62	3,022	187	62	3,022	187	58	3,022	175	57	3,022
2.3 Land preparation	Draft animal/Tractor	Riel	1	60,449	60	1	75,562	76	1	60,449	60	1	60,449
2.4 Pumping	Pumping	Riel	1	231,000	231	0	231,000	231	0	231,000	0	0	231,000
	Ox-cart	ton	2.5	12,090	30	2.2	12,090	27	1.5	12,090	18	1.0	12,090
2.5 Miscellaneous		Riel			45			31			28		24
3. Net Return		Riel			1,751			1,724			1,246		561

Note: *: Farmers use small moval pump in ranted paddy field.

Present / Without Project Condition	Item	Unit	Early Wet Season Upland Crop		
			Supplemental irrigation area Q'ty	Price (Riel)	Value ('000 Riel)
1. Gross Income	Main products	Riel	500	2,859	1,430
	By-product (straw)	kg			29
2. Production Cost		Riel			637
2.1 Inputs	Seed	Riel	60	5,916	355
	Manure (wet)	kg	1	15,112	15
	Fertilizer: Urea	ton	40	1,221	49
	DAP	kg	25	1,410	35
	Compound (20-20-20)	kg	0	1,428	0
	Agro-chemicals: Liquid	liter	0	1,061	0
	Dust	kg	0	2,418	0
2.2 Labor	Hired labor	manday	5	3,022	15
	Family labor	manday	40	3,022	121
2.3 Land preparation	Draft animal/Tractor	Riel	1	30,225	30
2.4 Pumping	Pumping	Riel	0	231,000	0
	Ox-cart	ton	0.5	12,090	6
2.5 Miscellaneous		Riel			31
3. Net Return		Riel			802

Table E2-5 Economic Crop Budget for Por Canal Rehabilitation Sub-project (2/2)

With Project Condition	Item	Unit	Early Wet Season Direct Sowing			Wet Season Transplanting			Wet Season Direct Sowing						
			Normal irrigation area	Pump irrigation area	Rainfed area	Normal irrigation area	Pump irrigation area	Rainfed area	Normal irrigation area	Pump irrigation area	Rainfed area				
			Q'ty	Price (Riel)	Value ('000 Riel)	Q'ty	Price (Riel)	Value ('000 Riel)	Q'ty	Price (Riel)	Value ('000 Riel)	Q'ty	Price (Riel)	Value ('000 Riel)	
1. Gross Income	Main products	Riel	3,000	1,027	3,081	3,000	1,027	3,081	3,500	1,027	3,595	1,700	1,027	1,746	1,833
	By-product (straw)	kg			154			180			0			87	2,876
2. Production Cost		Riel			1,145			1,048			3,48			587	144
2.1 Inputs	Seed	Riel	80	1,380	110	80	1,380	110	25	1,380	35	80	1,085	87	831
	Manure (wet)	kg	1	15,112	15	1	15,112	15	1	15,112	15	0	15,112	0	423
	Fertilizer: Urea	ton	80	1,221	98	80	1,221	98	80	1,221	98	60	1,221	73	110
	DAP	kg	0	1,410	0	0	1,410	0	0	1,410	0	35	1,410	0	15
	Compound (20-20-0)	kg	140	1,428	200	140	1,428	200	140	1,428	200	0	1,428	49	98
	Agro-chemicals: Liquid	liter	0	6,045	0	0	6,045	0	0	6,045	0	0	6,045	0	0
	Dust	kg	1	3,022	3	1	3,022	3	0	3,022	0	0	3,022	0	0
2.2 Labor	Hired labor	Riel	17	3,022	51	17	3,022	51	23	3,022	70	17	3,022	51	260
	Family labor	manday	69	3,022	209	69	3,022	209	92	3,022	278	67	3,022	202	51
2.3 Land preparation	Draft animal/Tractor	Riel	1	75,562	76	1	75,562	76	1	105,787	106	1	75,562	76	209
2.4 Pumping	Pumping	Riel	0	292,000	0	1	292,000	292	0	154,000	154	0	154,000	0	76
2.5 Transportation	Ox-cart	Riel	3	12,090	36	3	12,090	36	3.5	12,090	42	1.7	12,090	21	76
2.6 Miscellaneous		Riel			40			55			42			28	34
3. Net Return		Riel			2,397			2,091			2,889			1,246	2,189

With Project Condition	Item	Unit	Wet Season Direct Sowing			Dry Season Cropping									
			Pump irrigation area	Rainfed area	Vegetables	Upland crops	Vegetables								
			Q'ty	Price (Riel)	Value ('000 Riel)	Q'ty	Price (Riel)	Value ('000 Riel)	Q'ty	Price (Riel)	Value ('000 Riel)	Q'ty	Price (Riel)	Value ('000 Riel)	
1. Gross Income	Main products	Riel	2,800	1,027	2,876	1,000	1,027	1,027	1,100	2,712	2,983	9,500	365	3,468	3,661
	By-product (straw)	kg			144			51			149			173	3,048
2. Production Cost		Riel			998			517			845			680	173
2.1 Inputs	Seed	Riel	80	1,380	110	120	1,085	130	65	5,916	385	1.6	7,405	12	831
	Manure (wet)	kg	1	15,112	15	0	15,112	0	2	15,112	30	2.5	15,112	38	423
	Fertilizer: Urea	ton	80	1,221	98	40	1,221	49	35	1,221	43	50	1,221	61	110
	DAP	kg	0	1,410	0	20	1,410	28	15	1,410	21	0	1,410	0	15
	Compound (16-20-0)	kg	0	1,050	0	0	1,050	0	80	1,050	84	100	1,050	105	98
	Compound (15-15-0)	kg	0	1,142	0	0	1,142	0	0	1,142	0	0	1,142	0	0
	Compound (20-20-0)	kg	140	1,428	200	0	1,428	0	0	1,428	0	7.5	1,428	11	200
	Agro-chemicals: Liquid	liter	0	6,045	0	0	6,045	0	0	4,534	0	0	4,534	0	0
	Dust	kg	1	3,022	3	0	3,022	0	0	2,418	0	4.5	2,418	11	0
2.2 Labor	Hired labor	Riel	17	3,022	51	14	3,022	42	6	3,022	18	8.5	3,022	26	260
	Family labor	manday	69	3,022	209	57	3,022	172	55	3,022	166	77	3,022	233	51
2.3 Land preparation	Draft animal/Tractor	Riel	1	75,562	76	1	60,449	60	1	45,337	45	1	36,270	36	76
2.4 Pumping	Pumping	Riel	1	154,000	154	0	154,000	0	0	292,000	0	0	292,000	0	76
2.5 Transportation	Ox-cart	Riel	2.8	12,090	34	1	12,090	12	1.1	12,090	13	9.5	12,090	115	34
2.6 Miscellaneous		Riel			48			24			40			32	76
3. Net Return		Riel			2,022			562			2,287			2,961	2,189

Table E2-6 Economic Irrigation Benefit for Por Canal Rehabilitation Sub-project

Crops	Present / Without Condition			With Project Condition			Incremental NPV (Riel 'Million)
	Planted Area (ha)	Net Production Value		Planted Area (ha)	Net Production Value		
		Per ha (Riel '000)	Total (Riel 'Million)		Per ha (Riel '000)	Total (Riel 'Million)	
Rice	2,480		2,638	3,060		6,433	
Early Wet Season							
- Normal irrigation area	0	0	0	1,120	2,397	2,685	
- Pump irrigation area	0	0	0	0	0	0	
- Supplemental irrigation area	100	1,751	175	0	0	0	
- Pumping rainfed area	310	1,751	543	0	0	0	
- Rainfed area	0	0	0				
Wet Season Transplanting							
- Normal irrigation area	0	0	0	610	2,889	1,762	
- Pump irrigation area	0	0	0	0	0	0	
- Supplemental irrigation area	50	1,724	86	0	0	0	
- Rainfed area	985	1,246	1,228	360	1,246	449	
Wet Season Direct Sowing							
- Normal irrigation area	0	0	0	610	2,189	1,335	
- Pump irrigation area	0	0	0	0	0	0	
- Supplemental irrigation area	50	1,061	53	0	0	0	
- Rainfed area	985	561	553	360	562	202	
Dry Season							
- Normal irrigation area	0	0	0	0	0	0	
- Pump irrigation area	0	0	0	0	0	0	
- Supplemental irrigation area	0	0	0	0	0	0	
- Rainfed area	0	0	0	0	0	0	
Upland Crops	0		0	290		667	
- Mungbean	0	0	0	0	0	0	
- Upland crops (Early wet season)	0	0	0	130	2,003	260	
- Upland crops (Dry season)	0	0	0	70	2,003	140	
- Vegetables (Early wet season)	0	0	0	60	2,961	178	
- Vegetables (Dry season)	0	0	0	30	2,961	89	
Total	2,480		2,638	3,350		7,100	4,462

Total Physical Area	(ha)	2,070	1,940
Cropping Intensity	(%)	120	173
NPV per ha	('000 Riel)	1,274	3,660
Exchange rate (1 USD equiv.)	(Riel)	4,107	4,107
NPV per ha	(USD)	310	891

	Paddy Production			Paddy Production		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
Early Wet Season						
- Normal irrigation area	0		0	1,120	3.0	3,360
- Supplemental irrigation area	100	2.5	250	0		0
- Rainfed area using small pump	310	2.5	775	0		0
- Rainfed area	0		0	0		0
Wet Season (Transplanting)						
- Normal irrigation area	0		0	610	3.5	2,135
- Supplemental irrigation area	50	2.2	110	0		0
- Rainfed area	985	1.7	1,675	360	1.7	612
Wet Season (Direct sowing)						
- Normal irrigation area	0		0	610	2.8	1,708
- Supplemental irrigation area	50	1.5	75	0		0
- Rainfed area	985	1.0	985	360	1.0	360
Dry Season						
- Normal irrigation area	0		0	0		0
- Supplemental irrigation area	0		0	0		0
- Rainfed area	0		0	0		0
Total & Production Increase	2,480		3,870	3,060		8,175

Table E2-8 Economic Irrigation Benefit for Damnak Ampil Rehabilitation Sub-project

Crops	Present / Without Condition			With Project Condition			Incremental NPV (Riel 'Million)
	Planted Area (ha)	Net Production Value		Planted Area (ha)	Net Production Value		
		Per ha (Riel '000)	Total (Riel 'Million)		Per ha (Riel '000)	Total (Riel 'Million)	
Rice	<u>2,490</u>		<u>2,871</u>	<u>2,270</u>		<u>6,007</u>	
Early Wet Season							
- Normal irrigation area	0	0	0	0	0	0	
- Pump irrigation area	0	0	0	0	0	0	
- Supplemental irrigation area	0	0	0	0	0	0	
- Pumping rainfed area	0	0	0	0	0	0	
- Rainfed area	0	0	0	0	0	0	
Wet Season Transplanting							
- Normal irrigation area	0	0	0	1,770	2,682	4,747	
- Pump irrigation area	0	0	0	500	2,520	1,260	
- Supplemental irrigation area	500	1,518	759	0	0	0	
- Rainfed area	1,930	1,040	2,006	0	0	0	
Wet Season Direct Sowing							
- Normal irrigation area	0	0	0	0	0	0	
- Pump irrigation area	0	0	0	0	0	0	
- Supplemental irrigation area	0	0	0	0	0	0	
- Rainfed area	0	0	0	0	0	0	
Dry Season							
- Normal irrigation area	0	0	0	0	0	0	
- Pump irrigation area	60	1,763	106	0	0	0	
- Supplemental irrigation area	0	0	0	0	0	0	
- Rainfed area	0	0	0	0	0	0	
Upland Crops	<u>0</u>		<u>0</u>	<u>340</u>		<u>792</u>	
- Mungbean	0	0	0	0	0	0	
- Upland crops (Early wet season)	0	0	0	240	2,065	496	
- Upland crops (Dry season)	0	0	0	0	0	0	
- Vegetables (Early wet season)	0	0	0	100	2,961	296	
- Vegetables (Dry season)	0	0	0	0	0	0	
Total	2,490		2,871	2,610		6,798	3,927

Total Physical Area	(ha)	2,430	2,270
Cropping Intensity	(%)	102	115
NPV per ha	('000 Riel)	1,182	2,995
Exchange rate (1 USD equiv.)	(Riel)	4,107	4,107
NPV per ha	(USD)	288	729

	Paddy Production			Paddy Production		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
• Early Wet Season						
- Normal irrigation area	0		0	0		0
- Supplemental irrigation area	0		0	0		0
- Rainfed area using small pump	0		0	0		0
- Rainfed area	0		0	0		0
• Wet Season (Transplanting)						
- Normal irrigation area	0		0	1,770	3.3	5,841
- Supplemental irrigation area	500	2.0	1,000	500	3.3	1,650
- Rainfed area	1,930	1.5	2,895	0		0
• Wet Season (Direct sowing)						
- Normal irrigation area	0		0	0		0
- Supplemental irrigation area	0		0	0		0
- Rainfed area	0		0	0		0
• Dry Season						
- Normal irrigation area	0		0	0		0
- Supplemental irrigation area	60	2.5	150	0		0
Total & Production Increase	2,490		4,045	2,270		7,491

Table E2-9 Economic Crop Budget for Wat Long Rehabilitation Sub-project

Present / Without Project Condition	Item	Unit	Wet Season Transplanting			Rainfed area			Dry Season Transplanting					
			Supplemental irrigation area	Pump irrigation area	Value	Q'ty	Price	Value	Q'ty	Price	Value	Q'ty	Price	
			Q'ty	Price (Riel)	('000 Riel)	Q'ty	Price (Riel)	('000 Riel)	Q'ty	Price (Riel)	('000 Riel)	Q'ty	Price (Riel)	('000 Riel)
1. Gross Income	Main products	Riel	2,000	1,027	2,054	1,500	1,027	1,541	2,500	1,027	2,568	2,696		
	By-product (straw)	kg			103			77			128			
2. Production Cost		Riel			638			579			933			
2.1 Inputs	Seed	Riel			242			209			259			
	Manure (wet)	kg	80	1,085	87	80	1,085	87	60	1,085	65			
	Fertilizer: Urea	ton	0	15,112	0	0	15,112	0	0	15,112	0			
	DAP	kg	75	1,221	92	60	1,221	73	95	1,221	116			
	Compound (20-20-)	kg	45	1,410	63	35	1,410	49	55	1,410	78			
	Agro-chemicals: Liqu	kg	0	1,428	0	0	1,428	0	0	1,428	0			
	Dust	liter	0	6,045	0	0	6,045	0	0	6,045	0			
		kg	0	3,022	0	0	3,022	0	0	3,022	0			
2.2 Labor	Hired labor	Riel			266			248			293			
	Family labor	manday	9	3,022	27	8	3,022	24	10	3,022	30			
2.3 Land preparation	Draft animal/Tractor	Riel	79	3,022	239	74	3,022	224	87	3,022	263			
	Pumping	ha	1	75,562	76	1	75,562	76	1	75,562	76			
2.4 Transportation	Ox-cart	Riel	0	231,000	0	0	231,000	0	1	231,000	231			
	Miscellaneous	ton	2	12,090	24	1.5	12,090	18	2.5	12,090	30			
3. Net Return		Riel			1,518			1,040			1,763			

With Project Condition	Item	Unit	Wet Season Transplanting			Upland crops			Vegetables					
			Normal irrigation area	Pump irrigation area	Value	Q'ty	Price	Value	Q'ty	Price	Value	Q'ty	Price	
			Q'ty	Price (Riel)	('000 Riel)	Q'ty	Price (Riel)	('000 Riel)	Q'ty	Price (Riel)	('000 Riel)	Q'ty	Price (Riel)	('000 Riel)
1. Gross Income	Main products	Riel	3,300	1,027	3,358	3,300	1,027	3,389	1,100	2,514	2,765	2,903	3,641	
	By-product (straw)	kg			169			169			173			
2. Production Cost		Riel			877			1,038			838			
2.1 Inputs	Seed	Riel			348			348			548			
	Manure (wet)	kg	25	1,380	35	25	1,380	35	75	4,930	12			
	Fertilizer: Urea	ton	1	15,112	15	1	15,112	15	2	15,112	30			
	DAP	kg	80	1,221	98	80	1,221	98	35	1,221	43			
	Compound (16-20-4)	kg	0	1,410	0	0	1,410	0	15	1,410	21			
	Compound (15-15-)	kg	0	1,050	0	0	1,050	0	80	1,050	84			
	Agro-chemicals: Liqu	kg	0	1,428	0	0	1,428	0	0	1,428	0			
	Dust	liter	140	6,045	0	140	6,045	0	0	4,534	0			
		kg	0	3,022	0	0	3,022	0	0	2,418	0			
2.2 Labor	Hired labor	Riel			341			341			192			
	Family labor	manday	11	3,022	33	11	3,022	33	6.5	3,022	20			
2.3 Land preparation	Draft animal/Tractor	Riel	102	3,022	308	102	3,022	308	57	3,022	172			
	Pumping	ha	1	105,787	106	1	105,787	106	1	45,337	45			
2.4 Transportation	Ox-cart	Riel	0	154,000	0	1	154,000	154	0	292,000	0			
	Miscellaneous	ton	3.3	12,090	40	3.3	12,090	40	1.1	12,090	13			
3. Net Return		Riel			2,682			2,520			2,065			

Table E2-10 Economic Irrigation Benefit for Wat Loung Rehabilitation Sub-project

Crops	Present / Without Condition			With Project Condition			Incremental NPV (Riel 'Million)
	Planted Area (ha)	Net Production Value		Planted Area (ha)	Net Production Value		
		Per ha (Riel '000)	Total (Riel 'Million)		Per ha (Riel '000)	Total (Riel 'Million)	
Rice	<u>2,765</u>		<u>2,969</u>	<u>2,540</u>		<u>6,682</u>	
Early Wet Season							
- Normal irrigation area	0	0	0	0	0	0	
- Pump irrigation area	0	0	0	0	0	0	
- Supplemental irrigation area	0	0	0	0	0	0	
- Pumping rainfed area	0	0	0	0	0	0	
- Rainfed area	0	0	0	0	0	0	
Wet Season Transplanting							
- Normal irrigation area	0	0	0	1,740	2,682	4,666	
- Pump irrigation area	0	0	0	800	2,520	2,016	
- Supplemental irrigation area	130	1,518	197	0	0	0	
- Rainfed area	2,590	1,040	2,692	0	0	0	
Wet Season Direct Sowing							
- Normal irrigation area	0	0	0	0	0	0	
- Pump irrigation area	0	0	0	0	0	0	
- Supplemental irrigation area	0	0	0	0	0	0	
- Rainfed area	0	0	0	0	0	0	
Dry Season							
- Normal irrigation area	0	0	0	0	0	0	
- Pump irrigation area	45	1,763	79	0	0	0	
- Supplemental irrigation area	0	0	0	0	0	0	
- Rainfed area	0	0	0	0	0	0	
Upland Crops	<u>0</u>		<u>0</u>	<u>380</u>		<u>883</u>	
- Mungbean	0	0	0	0	0	0	
- Upland crops (Early wet season)	0	0	0	270	2,065	558	
- Upland crops (Dry season)	0	0	0	0	0	0	
- Vegetables (Early wet season)	0	0	0	110	2,961	326	
- Vegetables (Dry season)	0	0	0	0	0	0	
Total	2,765		2,969	2,920		7,566	4,597

Total Physical Area	(ha)	2,720	2,540
Cropping Intensity	(%)	102	115
NPV per ha	('000 Riel)	1,092	2,979
Exchange rate (1 USD equiv.)	(Riel)	4,107	4,107
NPV per ha	(USD)	266	725

	Paddy Production			Paddy Production		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
▸ Early Wet Season						
- Normal irrigation area	0		0	0		0
- Supplemental irrigation area	0		0	0		0
- Rainfed area using small pump	0		0	0		0
- Rainfed area	0		0	0		0
▸ Wet Season (Transplanting)						
- Normal irrigation area	0		0	1,740	3.3	5,742
- Supplemental irrigation area	130	2.0	260	800	3.3	2,640
- Rainfed area	2,590	1.5	3,885	0		0
▸ Wet Season (Direct sowing)						
- Normal irrigation area	0		0	0		0
- Supplemental irrigation area	0		0	0		0
- Rainfed area	0		0	0		0
▸ Dry Season						
- Normal irrigation area	0		0	0		0
- Supplemental irrigation area	45	2.5	113	0		0
Total & Production Increase	2,765		4,258	2,540		8,382

Table E2-11 Economic Crop Budget for Wat Chre Rehabilitation Sub-project

Present / Without Project Condition	Unit	Wet Season Transplanting			Dry Season Transplanting			Early Wet Season Vegetables			Dry Season Vegetables			
		Supplemental irrigation area Q'ty Price (Riel) Value ('000 Riel)	Rainfed area Q'ty Price (Riel) Value ('000 Riel)	Pump irrigation area Q'ty Price (Riel) Value ('000 Riel)	Supplemental irrigation area Q'ty Price (Riel) Value ('000 Riel)	Rainfed area Q'ty Price (Riel) Value ('000 Riel)	Pump irrigation area Q'ty Price (Riel) Value ('000 Riel)	Supplemental irrigation area Q'ty Price (Riel) Value ('000 Riel)	Rainfed area Q'ty Price (Riel) Value ('000 Riel)	Pump irrigation area Q'ty Price (Riel) Value ('000 Riel)	Supplemental irrigation area Q'ty Price (Riel) Value ('000 Riel)	Rainfed area Q'ty Price (Riel) Value ('000 Riel)		
1. Gross Income	Riel	2,000	1,027	2,054	1,500	1,027	1,541	2,500	1,027	2,568	2,159	2,159	2,117	42
By-product (straw)	kg			103			77			128	42	42		
2. Production Cost	Riel	638		579	209		209	933		259	450	450	121	121
2.1 Inputs	Riel			242			209			259	121	121		
Seed	kg	80	1,085	87	80	1,085	87	60	1,085	65	12	12	1.6	7,405
Manure (wet)	ton	0	15,112	0	0	15,112	0	0	15,112	0	15	15	1	15,112
Fertilizer: Urea	kg	75	1,221	92	60	1,221	73	95	1,221	116	12	12	10	1,221
DAP	kg	45	1,410	63	35	1,410	49	55	1,410	78	28	28	20	1,410
Compound (15-15-15)	kg	0	1,142	0	0	1,142	0	0	1,142	0	29	29	25	1,142
Compound (20-20-20)	kg	0	1,428	0	0	1,428	0	0	1,428	0	11	11	7.5	1,428
Agro-chemicals: Dust	kg	0	3,022	0	0	3,022	0	0	3,022	0	14	14	4.5	3,022
2.2 Labor	Riel			266			248			293	205	205		
Hired labor	manday	9	3,022	27	8	3,022	24	10	3,022	30	21	21	7	3,022
Family labor	manday	79	3,022	239	74	3,022	224	87	3,022	263	184	184	61	3,022
2.3 Land preparation	Riel			76			76			76	36	36		
Draft animal/Tractor	ha	1	75,562	76	1	75,562	76	1	75,562	76	36	36	1	36,270
2.4 Pumping	Riel			0			0			231	0	0		
Pumping	ha	0	231,000	0	0	231,000	0	1	231,000	0	0	0	0	231,000
2.5 Transportation	Riel			24			18			30	70	70		
Ox-cart	ton	2	12,090	24	1.5	12,090	18	2.5	12,090	30	70	70	5.8	12,090
2.6 Miscellaneous	Riel			30			28			44	18	18		
3. Net Return	Riel			1,518			1,040			1,763	1,709	1,709		

With Project Condition	Unit	Wet Season Transplanting			Early Wet Season Cropping									
		Normal irrigation area Q'ty Price (Riel) Value ('000 Riel)	Pump irrigation area Q'ty Price (Riel) Value ('000 Riel)	Vegetables Q'ty Price (Riel) Value ('000 Riel)	Upland crops Q'ty Price (Riel) Value ('000 Riel)	Vegetables Q'ty Price (Riel) Value ('000 Riel)								
1. Gross Income	Riel	3,300	1,027	3,358	3,300	1,027	3,538	1,100	2,514	2,765	3,641	3,641	3,468	173
Main products	kg			169			169			138	9,500	9,500	365	3,468
By-product (straw)	kg			877			1,038			838	680	680		
2. Production Cost	Riel			348			348			548	238	238		
2.1 Inputs	Riel			348			348			548	238	238		
Seed	kg	25	1,380	35	25	1,380	35	75	4,930	370	12	12	1.6	7,405
Manure (wet)	ton	1	15,112	15	1	15,112	15	2	15,112	30	38	38	2.5	15,112
Fertilizer: Urea	kg	80	1,221	98	80	1,221	98	35	1,221	43	61	61	50	1,221
DAP	kg	0	1,410	0	0	1,410	0	15	1,410	21	0	0	0	1,410
Compound (16-20-0)	kg	0	1,050	0	0	1,050	0	80	1,050	84	100	1050	100	1,050
Compound (15-15-15)	kg	0	1,142	0	0	1,142	0	0	1,142	0	0	0	0	1,142
Compound (20-20-20)	kg	140	1,428	200	140	1,428	200	0	1,428	0	11	11	7.5	1,428
Agro-chemicals: Liquid	liter	0	6,045	0	0	6,045	0	0	6,045	0	0	0	0	6,045
Dust	kg	0	3,022	0	0	3,022	0	0	3,022	0	11	11	4.5	3,022
2.2 Labor	manday			341			341			192	259	259		
Hired labor	manday	11	3,022	33	11	3,022	33	6.5	3,022	20	26	26	8.5	3,022
Family labor	manday	102	3,022	308	102	3,022	308	57	3,022	172	233	233	77	3,022
2.3 Land preparation	Riel			106			106			45	36	36		
Draft animal/Tractor	ha	1	105,787	106	1	105,787	106	1	45,337	45	36	36	1	36,270
2.4 Pumping	Riel			0			0			0	0	0		
Pumping	ha	0	154,000	0	0	154,000	0	0	292,000	0	0	0	0	292,000
2.5 Transportation	Riel			40			40			13	115	115		
Ox-cart	ton	3.3	12,090	40	3.3	12,090	40	1.1	12,090	13	9.5	12,090	9.5	12,090
2.6 Miscellaneous	Riel			42			49			40	52	52		
3. Net Return	Riel			2,682			2,320			2,063	2,961	2,961		

Table E2-12 Economic Irrigation Benefit for Wat Chre Rehabilitation Sub-project

Crops	Present / Without Condition			With Project Condition			Incremental NPV (Riel 'Million)
	Planted Area (ha)	Net Production Value		Planted Area (ha)	Net Production Value		
		Per ha (Riel '000)	Total (Riel 'Million)		Per ha (Riel '000)	Total (Riel 'Million)	
Rice	1,090		1,162	1,020		2,671	
Early Wet Season							
- Normal irrigation area	0	0	0	0	0	0	
- Pump irrigation area	0	0	0	0	0	0	
- Supplemental irrigation area	0	0	0	0	0	0	
- Pumping rainfed area	0	0	0	0	0	0	
- Rainfed area	0	0	0	0	0	0	
Wet Season Transplanting							
- Normal irrigation area	0	0	0	620	2,682	1,663	
- Pump irrigation area	0	0	0	400	2,520	1,008	
- Supplemental irrigation area	60	1,518	91	0	0	0	
- Rainfed area	1,030	1,040	1,071	0	0	0	
Wet Season Direct Sowing							
- Normal irrigation area	0	0	0	0	0	0	
- Pump irrigation area	0	0	0	0	0	0	
- Supplemental irrigation area	0	0	0	0	0	0	
- Rainfed area	0	0	0	0	0	0	
Dry Season							
- Normal irrigation area	0	0	0	0	0	0	
- Pump irrigation area	0	1,763	0	0	0	0	
- Supplemental irrigation area	0	0	0	0	0	0	
- Rainfed area	0	0	0	0	0	0	
Upland Crops	30		51	150		355	
- Mungbean	0	0	0	0	0	0	
- Upland crops (Early wet season)	0	0	0	100	2,065	207	
- Upland crops (Dry season)	0	0	0	0	0	0	
- Vegetables (Early wet season)	15	1,709	26	50	2,961	148	
- Vegetables (Dry season)	15	1,709	26	0	0	0	
Total	1,120		1,213	1,170		3,025	1,812

Total Physical Area	(ha)	1,090	1,020
Cropping Intensity	(%)	103	115
NPV per ha	('000 Riel)	1,113	2,966
Exchange rate (1 USD equiv.)	(Riel)	4,107	4,107
NPV per ha	(USD)	271	722

Paddy Production	Area (ha)			Yield (ton/ha)			Production (ton)		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
▸ Early Wet Season									
- Normal irrigation area	0		0	0		0	0		0
- Supplemental irrigation area	0		0	0		0	0		0
- Rainfed area using small pump	0		0	0		0	0		0
- Rainfed area	0		0	0		0	0		0
▸ Wet Season (Transplanting)									
- Normal irrigation area	0		0	620	3.3	2,046			
- Supplemental irrigation area	60	2.0	120	400	3.3	1,320			
- Rainfed area	1,030	1.5	1,545	0		0			
▸ Wet Season (Direct sowing)									
- Normal irrigation area	0		0	0		0			0
- Supplemental irrigation area	0		0	0		0			0
- Rainfed area	0		0	0		0			0
▸ Dry Season									
- Normal irrigation area	0		0	0		0			0
- Supplemental irrigation area	0		0	0		0			0
Total & Production Increase	1,090		1,665	1,020		3,366			1,701

Table E2-13 Economic Crop Budget for Lum Hach Rehabilitation Sub-project

Present / Without & With Project Condition	Unit	Wet Season Transplanting (Without Project)			Dry Season (Without Project)			Early Wet Season Transplanting (With Project)			Pump irrigation area			Early Wet Season (With Project)		
		Supplemental irrigation area Q'ty	Price (Riel)	Value ('000 Riel)	Normal irrigation area Q'ty	Price (Riel)	Value ('000 Riel)	Vegetables Q'ty	Price (Riel)	Value ('000 Riel)	Normal irrigation area Q'ty	Price (Riel)	Value ('000 Riel)	Upland Crops Q'ty	Price (Riel)	Value ('000 Riel)
1. Gross Income																
Main products	Riel	1,833	1,027	1,294	5,800	365	2,117	3,000	1,027	3,081	3,000	1,027	3,081	1,100	2,514	2,903
By-product (straw)	kg	1,746	87	62			106			0			154		138	
2. Production Cost																
2.1 Inputs																
Seed	Riel	629	242	569	1.6	7,405	121	454	1,380	348	25	1,380	837	75	4,930	548
Manure (wet)	kg	87	0	87	80	15,112	12	1,211	15,112	35	1	15,112	35	2	15,112	370
Fertilizer: Urea	ton	0	0	0	0	1,221	73	0	1,221	15	1	1,221	15	2	1,221	43
DAP	kg	75	1,221	92	60	1,410	49	28	1,410	98	80	1,410	98	35	1,410	21
Compound (16-20-4)	kg	45	1,410	63	35	1,050	0	0	1,050	0	0	1,050	0	15	1,410	84
Compound (15-15-15)	kg	0	1,050	0	0	1,428	0	0	1,428	0	25	1,428	0	0	1,428	0
Compound (20-20-20)	kg	0	1,428	0	0	3,022	0	14	3,022	0	140	1,428	200	0	1,428	0
Agro-chemicals: Dusi	kg	0	3,022	0	4.5	3,022	0	0	3,022	0	0	3,022	0	0	3,022	0
2.2 Labor																
Hired labor	Riel	260	242	242	7	3,022	21	205	3,022	33	11	3,022	33	6.5	3,022	20
Family labor	manday	77	3,022	233	72	3,022	218	184	3,022	302	100	3,022	302	57	3,022	172
Draft animal/Tractor	Riel	76	76	76	1	36,270	36	36	106	106	1	105,787	106	1	45,337	45
Pumping	Riel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pumping	ha	0	231,000	0	0	231,000	0	0	36	36	1	292,000	292	0	292,000	0
Ox-cart	Riel	21	15	15	5.8	12,090	70	70	70	36	3	12,090	36	1.1	12,090	13
Miscellaneous	ton	30	27	27	3	12,090	22	22	41	41	3	12,090	56	1.1	12,090	13
3. Net Return	Riel	1,204	725	1,769	2,215	2,215	2,215	2,215	2,215	2,215	2,215	2,215	2,215	2,215	2,215	2,215
Present / Without Project Condition																
1. Gross Income																
Main products	Riel	3,641	3,641	3,235	9,500	365	3,468	3,000	1,027	3,081	3,000	1,027	3,081	1,100	2,514	2,903
By-product (straw)	kg	173	154	154			154			154			154		173	
2. Production Cost																
2.1 Inputs																
Seed	Riel	687	230	865	25	1,380	35	348	1,380	498	25	1,380	838	1.6	7,405	238
Manure (wet)	kg	38	0	38	1	15,112	15	1,211	15,112	15	1	15,112	15	2.5	15,112	38
Fertilizer: Urea	ton	61	0	61	80	1,221	98	0	1,221	98	80	1,221	98	35	1,221	61
DAP	kg	0	1,410	0	0	1,410	0	0	1,410	0	0	1,410	0	15	1,410	0
Compound (16-20-4)	kg	105	1,050	0	0	1,050	0	0	1,050	0	0	1,050	0	80	1,050	105
Compound (15-15-15)	kg	9	1,142	0	0	1,142	0	0	1,142	0	0	1,142	0	0	1,142	0
Compound (20-20-20)	kg	0	1,428	200	140	1,428	200	200	1,428	200	140	1,428	200	0	1,428	11
Agro-chemicals: Dusi	kg	14	3,022	0	0	3,022	0	0	3,022	0	0	3,022	0	0	3,022	11
2.2 Labor																
Hired labor	manday	259	242	242	11	3,022	33	335	3,022	33	11	3,022	33	6.5	3,022	26
Family labor	manday	233	3,022	302	100	3,022	302	302	3,022	302	100	3,022	302	77	3,022	233
Draft animal/Tractor	Riel	36	36	36	1	36,270	36	36	106	106	1	105,787	106	1	45,337	36
Pumping	Riel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pumping	ha	0	292,000	0	0	292,000	0	0	154	154	0	292,000	0	0	292,000	0
Ox-cart	Riel	115	115	115	9.5	12,090	36	36	36	36	3	12,090	36	1.1	12,090	115
Miscellaneous	ton	32	27	27	3	12,090	22	22	49	49	3	12,090	22	1.1	12,090	32
3. Net Return	Riel	2,960	2,370	2,207	2,211	2,211	2,211	2,211	2,211	2,211	2,211	2,211	2,211	2,211	2,211	2,211

Table E2-14 Economic Irrigation Benefit for Lum Hach Rehabilitation Sub-project

Crops	Present / Without Condition			With Project Condition			Incremental NPV (Riel 'Million)
	Planted Area (ha)	Net Production Value		Planted Area (ha)	Net Production Value		
		Per ha (Riel '000)	Total (Riel 'Million)		Per ha (Riel '000)	Total (Riel 'Million)	
Rice	<u>3,320</u>		<u>2,501</u>	<u>4,400</u>		<u>10,133</u>	
Early Wet Season							
- Normal irrigation area	0	0	0	1,030	2,215	2,281	
- Pump irrigation area	0	0	0	170	2,062	351	
- Supplemental irrigation area	0	0	0	0	0	0	
- Pumping rainfed area	0	0	0	0	0	0	
- Rainfed area	0	0	0	0	0	0	
Wet Season Transplanting							
- Normal irrigation area	0	0	0	2,690	2,370	6,375	
- Pump irrigation area	0	0	0	410	2,207	905	
- Supplemental irrigation area	200	1,204	241	0	0	0	
- Rainfed area	3,120	725	2,260	0	0	0	
Wet Season Direct Sowing							
- Normal irrigation area	0	0	0	0	0	0	
- Pump irrigation area	0	0	0	0	0	0	
- Supplemental irrigation area	0	0	0	0	0	0	
- Rainfed area	0	0	0	0	0	0	
Dry Season							
- Normal irrigation area	0	0	0	100	2,211	221	
- Pump irrigation area	0	0	0	0	0	0	
- Supplemental irrigation area	0	0	0	0	0	0	
- Rainfed area	0	0	0	0	0	0	
Upland Crops	<u>40</u>		<u>71</u>	<u>620</u>		<u>1,442</u>	
- Mungbean	0	0	0	0	0	0	
- Upland crops (Early wet season)	0	0	0	150	2,066	310	
- Upland crops (Dry season)	0	0	0	290	2,065	599	
- Vegetables (Early wet season)	0	0	0	60	2,960	178	
- Vegetables (Dry season)	40	1,769	71	120	2,961	355	
Total	3,360		2,572	5,020		11,574	9,002

Total Physical Area	(ha)	3,320	3,100
Cropping Intensity	(%)	101	162
NPV per ha	('000 Riel)	775	3,734
Exchange rate (1 USD equiv.)	(Riel)	4,107	4,107
NPV per ha	(USD)	189	909

	Paddy Production			Paddy Production		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
♦ Early Wet Season						
- Normal irrigation area	0		0	1,030	3.0	3,090
- Supplemental irrigation area	0		0	170	3.0	510
- Rainfed area using small pump	0		0	0		0
- Rainfed area	0		0	0		0
♦ Wet Season (Transplanting)						
- Normal irrigation area	0		0	2,690	3.0	8,070
- Supplemental irrigation area	200	1.7	340	410	3.0	1,230
- Rainfed area	3,120	1.2	3,744			0
♦ Wet Season (Direct sowing)						
- Normal irrigation area	0		0	0		0
- Supplemental irrigation area	0		0	0		0
- Rainfed area	0		0	0		0
♦ Dry Season						
- Normal irrigation area	0		0	100	3.0	300
- Supplemental irrigation area	0		0	0		0
- Rainfed area	0		0	0		0
Total & Production Increase	3,320		4,084	4,400		13,200

Table E2-16 Breakdown of Economic Cost for Ream Kon Rehabilitation Sub-project

(Unit : Riats, Million)

Description	Financial Cost										Economic Cost															
	Total					F/C					L/C					F/C					L/C					
	USD Equivalent Riel		Material		Equipment		Labor		Total		Material		Equipment		Labor		Total		Material		Equipment		Labor		Total	
	'000	Million																								
1. Preparatory Works	725	190	274	0	464	39	39	52	261	0.81	0.73	1.00	0.94	0.85	0.30	0.61	33	16	80	166	725	519	0.72	0.72	0.72	
2.. Direct Cost	36,961	9,699	13,956	0	23,655	1,996	1,996	2,661	13,306	7,856	10,188	0	18,044	1,876	1,697	804	4,058	8,435	36,961	26,479	0.72	0.72	0.72	0.72	0.72	
1 Head works & related structures	3,123	3,366	4,843	0	8,209	693	693	923	4,617	2,726	3,536	0	6,262	651	589	279	1,408	2,927	12,826	9,189	0.72	0.72	0.72	0.72	0.72	
2 Main & secondary system	4,838	5,214	7,503	0	12,717	1,073	1,073	1,431	7,153	4,223	5,477	0	9,700	1,009	912	432	2,182	4,535	19,870	14,235	0.72	0.72	0.72	0.72	0.72	
3 On-farm development	862	929	1,337	0	2,266	191	191	255	1,274	753	976	0	1,728	180	163	77	389	808	3,540	2,536	0.72	0.72	0.72	0.72	0.72	
4 Miscellaneous works	725	190	274	0	464	39	39	52	261	154	200	0	354	37	33	16	80	166	725	519	0.72	0.72	0.72	0.72	0.72	
3. Contractor's Expenses	5,798	1,521	2,189	0	3,711	313	313	417	2,087	354	413	0	767	98	80	14	138	329	5,798	4,383	0.72	0.72	0.72	0.72	0.72	
Total	21,109	5,798	8,038	0	13,371	1,026	1,026	1,344	7,174	16,219	20,990	0	37,209	3,887	3,507	1,638	8,334	17,365	43,483	28,095	0.65	0.65	0.65	0.65	0.65	
4. Physical Contingencies	2,111	2,111	3,038	0	5,148	434	434	579	2,896	1,622	2,099	0	3,721	369	351	164	833	1,737	8,044	5,457	0.68	0.68	0.68	0.68	0.68	
GRAND TOTAL	23,219	8,919	11,076	0	16,633	1,460	1,460	1,923	10,070	17,841	23,089	0	40,930	4,276	3,857	1,802	9,167	19,102	51,528	33,552	0.65	0.65	0.65	0.65	0.65	

Equipment and Materials

	Financial	Conversion Factor	Economic %
Overhead cost and miscellaneous	16.70	0.10	1.67
Company Tax /1	2.00	1.00	2.00
Minimum Tax /2	1.00	1.00	1.00
Profit	10.00	0.10	1.00
	29.70		5.67
Factor for Materials			0.94
Factor for Equipment			0.85
/1 ; 20% of the Profit			
/2 ; 1% of Turnover			

/A ; Excluding the following transfer payment

Import tariff	7.0 %
Company tax	1.4 %
Minimum tax	1.0 %
VAT	10.0 %

/B ; Excluding the following transfer payment

Import tariff	15.0 %
Company tax	1.4 %
Minimum tax	1.0 %
VAT	10.0 %

Major repairing cost

	Material	Equipment	Labor Common	Labor Skilled	Total
Share	0.42	0.38	0.00	0.00	0.80
F/C	0.26	0.37	0.00	0.00	0.63
Share	0.15	0.15	0.20	0.50	0.90
L/C	0.06	0.06	0.07	0.19	0.37

Conversion Factor	0.725	Economic Cost (MR)	2,370.4
Financial Cost ('000\$)	796	Economic Cost (T\$)	5,772

Annual O&M cost

	Material	Equipment	Labor Common	Labor Skilled	Total
Share	0.15	0.15	0.20	0.50	0.90
L/C	0.15	0.15	0.20	0.50	0.90
Conversion Factor	0.634	Economic Cost (MR)	41.5		
Financial Cost ('000\$)	16	Economic Cost (T\$)	10.1		

Table E2-17 Breakdown of Economic Cost for Por Canal Rehabilitation Sub-project

(Unit: Riels, Million)

Description	Financial Cost										Economic Cost															
	Total					F/C					L/C					F/C					L/C					
	USD		Equivalent		Riel	Material		Equipment		Labor	Total		Material		Equipment		Labor	Total		Material		Equipment		Labor	Total	
	'000	Million	'000	Million		'000	Million	'000	Million		'000	Million	'000	Million	'000	Million		'000	Million	'000	Million	'000	Million		'000	Million
1. Preparatory Works	354		74	138	0	213	0	213	21	21	28	71	142	60	101	0	161	20	18	9	43	90	354	251	0.71	
2.. Direct Cost	18,068		3,794	7,046	0	10,841	1,084	1,084	1,084	1,445	3,614	7,227	3,073	5,144	0	8,217	1,019	922	437	2,204	4,582	18,068	12,799	0.71		
1 Head works & related structures	48	197	41	77	0	118	12	12	12	16	39	79	34	56	0	90	11	10	5	24	50	197	140	0.71		
2 Main & secondary system	3,382	13,890	2,917	5,417	0	8,334	833	833	1,111	2,778	5,556	2,363	3,954	0	6,317	783	708	336	1,695	3,522	13,890	9,839	0.71			
3 On-farm development	883	3,626	762	1,414	0	2,176	218	218	290	725	1,451	617	1,033	0	1,649	205	185	88	442	920	3,626	2,569	0.71			
4 Miscellaneous works	354		74	138	0	213	21	21	21	28	71	142	60	101	0	161	20	18	9	43	90	354	251	0.71		
3. Contractor's Expenses	2,834		595	1,105	0	1,700	170	170	227	567	1,134	567	1,134	138	209	0	347	53	44	7	75	179	2,834	526	0.19	
Total	8,258	15,336	0	23,594	0	23,594	2,359	2,359	3,146	7,865	15,730	6,346	10,597	0	16,943	2,111	1,905	890	4,527	9,432	21,256	13,576	0.64			
4. Physical Contingencies	826	1,534	0	2,359	0	2,359	236	236	315	787	1,573	635	1,060	0	1,694	211	191	89	453	943	3,932	2,638	0.67			
GRAND TOTAL	9,084	16,870	0	25,954	0	25,954	2,595	2,595	3,461	8,651	17,303	6,980	11,657	0	18,637	2,322	2,095	979	4,979	10,376	25,189	16,214	0.64			

Equipment and Materials

	Financial	Conversion	Economic	%
Overhead cost and miscellaneous	16.70	0.10	1.67	
Company Tax /1	2.00	1.00	2.00	
Minimum Tax /2	1.00	1.00	1.00	
Profit	10.00	0.10	1.00	
	29.70		5.67	
		Factor for Materials	0.94	
		Factor for Equipment	0.85	

/1 ; 20% of the Profit
/2 ; 1% of Turnover

/A ; Excluding the following transfer payment
Import tariff 7.0 %
Company tax 1.4 %
Minimum tax 1.0 %
VAT 16.0 %

Major repairing cost

Material	Equipment	Labor	Common	Labor	Skilled	Total
Share	0.35	0.65	0.00	0.00	0.00	
F/C	0.21	0.38	0.00	0.00	0.00	0.59
Share	0.15	0.15	0.20	0.50		
L/C	0.06	0.06	0.08	0.21		0.41

Conversion Factor 0.707 Economic Cost (MR) 996.0
Financial Cost ('000\$) 343 Economic Cost (T\$) 242.5

Annual O&M cost

Material	Equipment	Labor	Common	Labor	Skilled	Total
Share	0.15	0.15	0.20	0.50		
L/C	0.15	0.15	0.20	0.50		1.00

Conversion Factor 0.634 Economic Cost (MR) 17.9
Financial Cost ('000\$) 7 Economic Cost (T\$) 4.3

Table E2-18 Breakdown of Economic Cost for Damnak Ampil Rehabilitation Sub-project

(Unit : Riels, Million)

Description	Financial Cost										Economic Cost																						
	Total					F/C					L/C					F/C					L/C												
	USD Equivalent Riel		Material			Labor			Total			Material		Equipment			Labor			Total			Material		Equipment			Labor			Total		
	'000	Million	/A	/B	Conversion Factor	/A	/B	Conversion Factor	Common	Skilled	Total	/A	/B	Conversion Factor	Common	Skilled	Total	/A	/B	Conversion Factor	Common	Skilled	Total	Financial	Economic	Conversion Factor	Common	Skilled	Total				
1. Preparatory Works	436		173	115	0	288	22	22	30	74	148	140	84	0	224	21	19	9	45	94	436	318	0.73	436	318	0.73							
2. Direct Cost	22,244		8,809	5,873	0	14,681	1,134	1,134	1,513	3,782	7,563	7,135	4,287	0	11,422	1,066	964	457	2,307	4,795	22,244	16,217	0.73	22,244	16,217	0.73							
1 Head works & related structures	2,790		4,538	3,025	0	7,563	584	584	779	1,948	3,896	3,675	2,208	0	5,884	549	497	236	1,188	2,470	11,459	8,353	0.73	11,459	8,353	0.73							
2 Main & secondary system	1,493		2,428	1,619	0	4,047	313	313	417	1,042	2,085	1,967	1,182	0	3,149	294	266	126	636	1,322	6,132	4,470	0.73	6,132	4,470	0.73							
3 On-farm development	1,027		1,670	1,114	0	2,784	215	215	287	717	1,434	1,353	813	0	2,166	202	183	87	437	909	4,218	3,075	0.73	4,218	3,075	0.73							
4 Miscellaneous works	436		173	115	0	288	22	22	30	74	148	140	84	0	224	21	19	9	45	94	436	318	0.73	436	318	0.73							
3. Contractor's Expenses	3,489		1,382	921	0	2,303	178	178	237	593	1,186	321	174	0	495	56	46	8	78	187	3,489	2,617	0.75	3,489	2,617	0.75							
Total	19,172		12,781	8,593	0	31,953	2,469	2,469	3,292	8,230	16,461	14,731	8,832	0	23,563	2,209	1,993	931	4,737	9,870	26,170	17,217	0.66	26,170	17,217	0.66							
4. Physical Contingencies	1,917		1,278	883	0	3,195	247	247	329	823	1,646	1,473	883	0	2,356	221	199	93	474	987	4,841	3,343	0.69	4,841	3,343	0.69							
GRAND TOTAL	21,089		14,059	9,715	0	35,149	2,716	2,716	3,621	9,053	18,107	16,204	9,715	0	25,920	2,430	2,192	1,024	5,211	10,857	31,011	20,560	0.66	31,011	20,560	0.66							

Equipment and Materials

	Financial %	Conversion Factor	Economic %
Overhead cost and miscellaneous	16.70	0.10	1.67
Company Tax /1	2.00	1.00	2.00
Minimum Tax /2	1.00	1.00	1.00
Profit	10.00	6.10	1.00
	29.70		5.67
		Factor for Materials	0.94
		Factor for Equipment	0.85

/1 : 20% of the Profit
/2 : 1% of Turnover

/A : Excluding the following transfer payment
Import tariff 7.0 %
Company tax 1.4 %
Minimum tax 1.0 %
VAT 10.0 %

/B : Excluding the following transfer payment
Import tariff 15.0 %
Company tax 1.4 %
Minimum tax 1.0 %
VAT 10.0 %

Major repairing cost

	Material	Equipment	Labor Common	Labor Skilled	Total
Share	0.69	0.31	0.00	0.00	0.00
F/C	0.48	0.21	0.00	0.00	0.69
Share	0.15	0.15	0.20	0.50	
L/C	0.05	0.05	0.06	0.16	0.31

Conversion Factor 0.747 Economic Cost (MR) 1,314.0
Financial Cost (000\$) 428 Economic Cost (T\$) 319.9

Annual O&M cost

	Material	Equipment	Labor Common	Labor Skilled	Total
Share	0.15	0.15	0.20	0.50	
L/C	0.15	0.15	0.20	0.50	1.00

Conversion Factor 0.634 Economic Cost (MR) 22.3
Financial Cost (000\$) 9 Economic Cost (T\$) 5.4

Table E2-19 Breakdown of Economic Cost for Wat Loung Rehabilitation Sub-project

(Unit : Riels; Million)

Description	Financial Cost										Economic Cost																			
	Total					F/C					L/C					F/C					L/C									
	USD Equivalent	Material	Equipment	Labor	Total	Material	Equipment	Labor	Total	Material	Equipment	Labor	Total	Material	Equipment	Labor	Total	Material	Equipment	Labor	Total	Material	Equipment	Labor	Total	Material	Equipment	Labor	Total	
	Riel																													
	0000	Million																												
1. Preparatory Works	507	108	201	0	309	30	30	40	99	198	88	147	0	234	28	25	12	60	125	507	360	0.71								
2. Direct Cost	25,843	5,517	10,247	0	15,764	1,512	1,512	2,016	5,039	10,079	4,469	7,480	0	11,949	1,421	1,285	609	3,074	6,380	25,843	18,339	0.71								
1 Head works & related structures	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	#DIV/0!	
2 Main & secondary system	5,025	4,406	8,183	0	12,589	1,207	1,207	1,610	4,024	8,049	3,569	5,974	0	9,543	1,135	1,026	487	2,455	5,103	20,638	14,645	0.71								
3 On-farm development	1,144	1,003	1,863	0	2,866	275	275	366	916	1,832	813	1,360	0	2,172	238	234	111	559	1,162	4,698	3,334	0.71								
4 Miscellaneous works	507	108	201	0	309	30	30	40	99	198	88	147	0	234	28	25	12	60	125	507	360	0.71								
3. Contractor's Expenses	4,054	865	1,607	0	2,473	237	237	316	790	1,581	201	304	0	505	74	61	10	104	249	4,054	754	0.19								
Total	12,009	22,302	0	34,310	3,290	3,290	4,387	10,968	21,936	9,227	15,410	0	24,637	2,945	2,656	1,241	6,313	13,154	30,403	19,452	0.64									
4. Physical Contingencies	1,201	2,230	0	3,431	329	329	439	1,097	2,194	923	1,541	0	2,464	295	266	124	631	1,315	5,625	3,779	0.67									
GRAND TOTAL	13,209	24,532	0	37,741	3,619	3,619	4,826	12,065	24,130	10,150	16,951	0	27,101	3,239	2,922	1,365	6,944	14,469	36,028	23,232	0.64									

Equipment and Materials

	Financial	Conversion Factor	Economic
Overhead cost and miscellaneous	16.70	0.10	1.67
Company Tax /1	2.00	1.00	2.00
Minimum Tax /2	1.00	1.00	1.00
Profit	10.00	0.10	1.00
	29.70		5.67
		Factor for Materials	0.94
		Factor for Equipment	0.85

/1 : 20% of the Profit
/2 : 1% of Turnover

/A : Excluding the following transfer payment

Import tariff	7.0 %
Company tax	1.4 %
Minimum tax	1.0 %
VAT	10.0 %

/B : Excluding the following transfer payment

Import tariff	15.0 %
Company tax	1.4 %
Minimum tax	1.0 %
VAT	10.0 %

Major repairing cost

	Material	Equipment	Labor	Skilled	Total
Share	0.35	0.65	0.00	0.00	0.60
F/C	0.21	0.39	0.00	0.00	0.60
Share	0.15	0.15	0.20	0.50	0.40
L/C	0.06	0.06	0.08	0.20	0.40

Conversion Factor 0.708 Economic Cost (MR) 1,461.1
Financial Cost (0000\$) 503 Economic Cost (T\$) 355.8

Annual O&M cost

	Material	Equipment	Labor	Skilled	Total
Share	0.15	0.15	0.20	0.50	1.00
L/C	0.15	0.15	0.20	0.50	1.00

Conversion Factor 0.634 Economic Cost (MR) 26.2
Financial Cost (0000\$) 10 Economic Cost (T\$) 6.4

Table E2-20 Breakdown of Economic Cost for Wat Chre Rehabilitation Sub-project

(Unit : Riels, Million)

Description	Financial Cost										Economic Cost															
	Total					F/C					L/C					F/C					L/C					
	USD Equivalent Riel		Material		Equipment		Labor		Total		Material		Equipment		Labor		Total		Material		Equipment		Labor		Total	
	'000	Million																								
1. Preparatory Works	276		71	94	0	166	17	17	22	55	110	58	69	0	127	16	14	7	34	70	276	197	0.71			
2.. Direct Cost	14,080		3,633	4,815	0	8,448	845	845	1,126	2,816	5,632	2,942	3,515	0	6,457	794	718	341	1,718	3,571	14,080	10,028	0.71			
1 Head works & related structures	1,478		1,566	2,076	0	3,642	364	364	486	1,214	2,428	1,269	1,516	0	2,784	342	310	147	741	1,539	6,070	4,323	0.71			
2 Main & secondary system	1,400		1,483	1,966	0	3,450	345	345	460	1,150	2,300	1,202	1,436	0	2,637	324	293	139	702	1,458	5,750	4,095	0.71			
3 On-farm development	483		1,984	512	678	0	1,190	119	159	397	793	415	495	0	910	112	101	48	242	503	1,984	1,413	0.71			
4 Miscellaneous works	276		71	94	0	166	17	17	22	55	110	58	69	0	127	16	14	7	34	70	276	197	0.71			
3. Contractor's Expenses	2,209		570	755	0	1,325	133	133	177	442	883	133	143	0	275	42	34	6	58	139	2,209	414	0.19			
Total	7,906		10,480	0	18,386	1,839	1,839	2,452	6,129	12,258	6,075	7,242	0	13,317	1,646	1,484	693	3,528	7,351	16,564	10,639	0.64				
4. Physical Contingencies	791		1,048	0	1,839	184	184	245	613	1,226	608	724	0	1,332	165	148	69	353	735	3,064	2,067	0.67				
GRAND TOTAL	8,697		11,528	0	20,225	2,023	2,023	2,697	6,742	13,483	6,682	7,966	0	14,648	1,810	1,633	763	3,880	8,086	19,629	12,706	0.65				

Equipment and Materials

	Financial %	Conversion Factor	Economic %
Overhead cost and miscellaneous	16.70	0.10	1.67
Company Tax /1	2.00	1.00	2.00
Minimum Tax /2	1.00	1.00	1.00
Profit	10.00	0.10	1.00
	29.70		5.67
Factor for Materials			0.94
Factor for Equipment			0.85

/1 ; 20% of the Profit
/2 ; 1% of Turnover

/A ; Excluding the following transfer payment

Import tariff	7.0 %
Company tax	1.4 %
Minimum tax	1.0 %
VAT	10.0 %

/B ; Excluding the following transfer payment

Import tariff	15.0 %
Company tax	1.4 %
Minimum tax	1.0 %
VAT	10.0 %

Major repairing cost

	Material	Equipment	Labor Common	Labor Skilled	Total
Share	0.44	0.56	0.00	0.00	0.60
F/C	0.26	0.34	0.00	0.00	0.60
Share	0.15	0.15	0.20	0.50	
L/C	0.06	0.06	0.08	0.20	0.40

Conversion Factor 0.712 Economic Cost (MR) 841.6
Financial Cost ('000\$) 288 Economic Cost (T\$) 204.9

Annual O&M cost

	Material	Equipment	Labor Common	Labor Skilled	Total
Share	0.15	0.15	0.20	0.50	1.00
L/C	0.15	0.15	0.20	0.50	1.00

Conversion Factor 0.634 Economic Cost (MR) 15.0
Financial Cost ('000\$) 6 Economic Cost (T\$) 3.6

Table E2-21 Breakdown of Economic Cost for Lum Hach rehabilitation Sub-project

(Unit : Riels, Million)

Description	Financial Cost										Economic Cost															
	Total					F/C					L/C					F/C					L/C					
	USD Equivalent		Riel			Material		Equipment		Labor	Total		Material		Equipment		Labor	Total		Material		Equipment		Labor	Total	
	Million	'000	Million	'000	Million	'000	Million	'000	Common	Skilled	Conversion Factor	Common	Skilled	Common	Skilled	Conversion Factor	Common	Skilled	Common	Skilled	Common	Skilled	Conversion Factor	Common	Skilled	
1. Preparatory Works	1,040		1,040		293	373	0	666	56	56	374	237	272	0	509	53	48	23	114	237	1,040	747	0.72	0.30	0.61	
2. Direct Cost	53,043		53,043		14,937	19,011	0	33,947	2,864	2,864	19,095	12,099	13,878	0	25,977	2,693	2,435	1,154	5,824	12,106	53,043	38,082	0.72	0.30	0.61	
1 Head works & related structures	4,891		4,891		5,657	7,199	0	12,856	1,085	1,085	7,231	4,582	5,256	0	9,837	1,020	922	437	2,206	4,584	20,087	14,422	0.72	0.30	0.61	
2 Main & secondary system	6,383		6,383		7,382	9,395	0	16,778	1,416	1,416	9,437	5,980	6,859	0	12,838	1,331	1,203	571	2,878	5,983	26,215	18,821	0.72	0.30	0.61	
3 On-farm development	1,388		1,388		1,605	2,043	0	3,648	308	308	2,052	1,300	1,491	0	2,792	289	262	124	626	1,301	5,701	4,093	0.72	0.30	0.61	
4 Miscellaneous works	1,040		1,040		293	373	0	666	56	56	374	237	272	0	509	53	48	23	114	237	1,040	747	0.72	0.30	0.61	
3. Contractor's Expenses	8,320		8,320		2,343	2,982	0	5,325	449	449	2,995	545	563	0	1,108	141	115	19	198	473	8,320	1,581	0.19	0.30	0.61	
Total	32,510		32,510		41,376	0	73,886	6,234	6,234	8,312	20,780	41,561	24,980	28,591	0	53,570	5,579	5,032	2,351	11,960	24,921	62,403	40,409	0.65	0.30	0.61
4. Physical Contingencies	3,251		3,251		4,138	0	7,389	623	623	831	2,078	4,156	2,498	2,859	0	5,357	558	503	235	1,196	2,492	11,545	7,849	0.68	0.30	0.61
GRAND TOTAL	35,761		35,761		45,514	0	81,274	6,857	6,857	9,143	22,858	45,717	27,478	31,450	0	58,927	6,136	5,535	2,586	13,156	27,413	73,948	48,258	0.65	0.30	0.61

Equipment and Materials

	Financial		Conversion Factor		Economic	
	%	%	%	%	%	%
Overhead cost and miscellaneous	16.70		0.10		1.67	
Company Tax /1	2.00		1.00		2.00	
Minimum Tax /2	1.00		1.00		1.00	
Profit	10.00		0.10		1.00	
	29.70				5.67	
			Factor for Materials		0.94	
			Factor for Equipment		0.85	
/1 ; 20% of the Profit						
/2 ; 1% of Turnover						
/A ; Excluding the following transfer payment						
Import tariff	7.0 %					
Company tax	1.4 %					
Minimum tax	1.0 %					
VAT	10.0 %					
/B ; Excluding the following transfer payment						
Import tariff	15.0 %					
Company tax	1.4 %					
Minimum tax	1.0 %					
VAT	10.0 %					
Conversion Factor	0.727		Economic Cost (MR)		3,366.2	
Financial Cost ('000\$)	1,127		Economic Cost (T\$)		819.6	
Annual O&M cost						
Material : equipment			Labor			
Share	0.45		Common			
F/C	0.28		Skilled			
Share	0.15		0.00		0.00	
L/C	0.06		0.06		0.19	
Conversion Factor	0.727		Economic Cost (MR)		3,366.2	
Financial Cost ('000\$)	1,127		Economic Cost (T\$)		819.6	
Material : equipment			Labor			
Share	0.15		Common			
L/C	0.15		Skilled			
Share	0.15		0.20		0.50	
L/C	0.15		0.20		0.50	
Conversion Factor	0.634		Economic Cost (MR)		58.7	
Financial Cost ('000\$)	23		Economic Cost (T\$)		14.3	

Table E2-22 Economic Cost Flow of Proposed Project

(Unit : Riels, Million)

Item & Year	Riam Kom		Por Canal		Dammak Ampil		Wat Loung		Wat Chre		Lum Hach		Annual Direct Cost		Supporting Program Annual Progress Cost	Total Investment Cost	Physical Contingency (10%)	Consulting Service Annual Progress Cost	Total Initial Cost	
	Annual Progress	Direct Cost	Annual Progress	Direct Cost	Annual Progress	Direct Cost	Annual Progress	Direct Cost	Annual Progress	Direct Cost	Annual Progress	Direct Cost	Annual Progress	Direct Cost						
1. INITIAL INVESTMENT COST																				
2010														0	0	0	0	0.15	4,255	4,255
2011	0.10	2,810	0.15	2,036	0.25	4,304							9,150	0.25	738	9,888	989	0.22	6,240	17,117
2012	0.50	14,048	0.60	8,146	0.65	11,191	0.55	10,699			0.45	18,184	62,267	0.20	590	62,857	6,286	0.35	9,928	79,071
2013	0.38	10,676	0.22	2,987	0.07	1,205	0.40	7,781	0.6	6,383	0.50	20,205	49,237	0.20	590	49,827	4,983	0.19	5,389	60,200
2014	0.02	562	0.03	407	0.03	517	0.05	973	0.4	4,256	0.04	1,616	8,330	0.20	590	8,920	892	0.06	1,702	11,514
2015											0.01	404	404	0.15	443	847	85	0.02	567	1,499
2016													0		0	0	0	0.01	284	284
2017													129,389		2,951		13,235		28,365	173,940
2018																				
2019																				
2. O&M COST																				
2010																				
2011																				
2012	0.10	4	0.15	3	0.25	20	0.55	14	0.45	26	0.95	56	169	0.27	27					
2013	0.60	25	0.75	13	0.90	20	0.95	25	9	56	1.00	26	181	0.99	181					
2014	0.98	41	0.97	17	0.97	22	1.00	26	15	58	1.00	59	182	1.00	182					
2015	1.00	42	1.00	18	1.00	22	1.00	26	15	58	1.00	59	182	1.00	182					
2016																				
2017																				
2018																				
2019																				
3. MAJOR REPAIRING COST																				
2025		2,370		996		1,314		1,461		842		3,366								
2026													6,983							
2035		2,370		996		1,314		1,461		842		3,366								
2036													6,983							
2045		2,370		996		1,314		1,461		842		3,366								
2046													6,983							

Table E2-23 Economic Evaluation of Proposed Project

Normal Direct Construction Cost : As estimated
 Irrigation Water Supply : As scheduled
 Target Yield : As scheduled

EIRR :	12.8%
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Net Present Value (Riel Million)	<i>Benefit</i>	<i>Cost</i>	<i>B/C Ratio</i>
(8 % discount rate)	229,181	141,526	1.62

(Unit : Riel Million)

Year in Order	Year	Economic Cost				Economic Benefit		Net Cash Flow
		Initial Investment	Annual O&M	Major Repairing	Total	Irrigation	Total	
1	2010	4,255			4,255		0	-4,255
2	2011	17,117			17,117		0	-17,117
3	2012	79,071	27		79,098	682	682	-78,416
4	2013	60,199	99		60,298	6,290	6,290	-54,008
5	2014	11,514	169		11,683	12,852	12,852	1,169
6	2015	1,499	181		1,680	17,369	17,369	15,689
7	2016	284	182		466	21,580	21,580	21,114
8	2017		182		182	25,426	25,426	25,244
9	2018		182		182	27,180	27,180	26,998
10	2019		182		182	27,450	27,450	27,268
11	2020		182		182	27,462	27,462	27,280
12	2021		182		182	27,462	27,462	27,280
13	2022		182		182	27,462	27,462	27,280
14	2023		182		182	27,462	27,462	27,280
15	2024		182		182	27,462	27,462	27,280
16	2025		182	6,983	7,165	27,462	27,462	20,297
17	2026		182	3,366	3,548	27,462	27,462	23,914
18	2027		182		182	27,462	27,462	27,280
19	2028		182		182	27,462	27,462	27,280
20	2029		182		182	27,462	27,462	27,280
21	2030		182		182	27,462	27,462	27,280
22	2031		182		182	27,462	27,462	27,280
23	2032		182		182	27,462	27,462	27,280
24	2033		182		182	27,462	27,462	27,280
25	2034		182		182	27,462	27,462	27,280
26	2035		182	6,983	7,165	27,462	27,462	20,297
27	2036		182	3,366	3,548	27,462	27,462	23,914
28	2037		182		182	27,462	27,462	27,280
29	2038		182		182	27,462	27,462	27,280
30	2039		182		182	27,462	27,462	27,280
31	2040		182		182	27,462	27,462	27,280
32	2041		182		182	27,462	27,462	27,280
33	2042		182		182	27,462	27,462	27,280
34	2043		182		182	27,462	27,462	27,280
35	2044		182		182	27,462	27,462	27,280
36	2045		182	6,983	7,165	27,462	27,462	20,297
37	2046		182	3,366	3,548	27,462	27,462	23,914
38	2047		182		182	27,462	27,462	27,280
39	2048		182		182	27,462	27,462	27,280
40	2049		182		182	27,462	27,462	27,280
41	2050		182		182	27,462	27,462	27,280
42	2051		182		182	27,462	27,462	27,280
43	2052		182		182	27,462	27,462	27,280
44	2053		182		182	27,462	27,462	27,280
45	2054		182		182	27,462	27,462	27,280
46	2055		182	6,983	7,165	27,462	27,462	20,297
47	2056		182	3,366	3,548	27,462	27,462	23,914
48	2057		182		182	27,462	27,462	27,280
49	2058		182		182	27,462	27,462	27,280
50	2059		182		182	27,462	27,462	27,280

Table E2-24 Sensitivity Analysis of Proposed Project (1/4)

CASE 1 Direct Construction Cost : 10% up
Irrigation Water Supply : As scheduled
Target Yield : As scheduled

EIRR :	11.9%
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Net Present Value (Riel Million)	<i>Benefit</i>	<i>Cost</i>	<i>B/C Ratio</i>
(8 % discount rate)	229,181	153,398	1.49

(Unit : Riel Million)

Year in Order	Year	Economic Cost				Economic Benefit		Net Cash Flow
		Initial Investment	Annual O&M	Major Repairing	Total	Irrigation	Total	
1	2010	4,255			4,255		0	-4,255
2	2011	18,205			18,205		0	-18,205
3	2012	85,985	30		86,015	682	682	-85,333
4	2013	65,680	109		65,789	6,290	6,290	-59,499
5	2014	12,496	186		12,682	12,852	12,852	171
6	2015	1,592	199		1,791	17,369	17,369	15,577
7	2016	284	200		484	21,580	21,580	21,096
8	2017		200		200	25,426	25,426	25,226
9	2018		200		200	27,180	27,180	26,980
10	2019		200		200	27,450	27,450	27,250
11	2020		200		200	27,462	27,462	27,262
12	2021		200		200	27,462	27,462	27,262
13	2022		200		200	27,462	27,462	27,262
14	2023		200		200	27,462	27,462	27,262
15	2024		200		200	27,462	27,462	27,262
16	2025		200	7,681	7,882	27,462	27,462	19,580
17	2026		200	3,703	3,903	27,462	27,462	23,559
18	2027		200		200	27,462	27,462	27,262
19	2028		200		200	27,462	27,462	27,262
20	2029		200		200	27,462	27,462	27,262
21	2030		200		200	27,462	27,462	27,262
22	2031		200		200	27,462	27,462	27,262
23	2032		200		200	27,462	27,462	27,262
24	2033		200		200	27,462	27,462	27,262
25	2034		200		200	27,462	27,462	27,262
26	2035		200	7,681	7,882	27,462	27,462	19,580
27	2036		200	3,703	3,903	27,462	27,462	23,559
28	2037		200		200	27,462	27,462	27,262
29	2038		200		200	27,462	27,462	27,262
30	2039		200		200	27,462	27,462	27,262
31	2040		200		200	27,462	27,462	27,262
32	2041		200		200	27,462	27,462	27,262
33	2042		200		200	27,462	27,462	27,262
34	2043		200		200	27,462	27,462	27,262
35	2044		200		200	27,462	27,462	27,262
36	2045		200	7,681	7,882	27,462	27,462	19,580
37	2046		200	3,703	3,903	27,462	27,462	23,559
38	2047		200		200	27,462	27,462	27,262
39	2048		200		200	27,462	27,462	27,262
40	2049		200		200	27,462	27,462	27,262
41	2050		200		200	27,462	27,462	27,262
42	2051		200		200	27,462	27,462	27,262
43	2052		200		200	27,462	27,462	27,262
44	2053		200		200	27,462	27,462	27,262
45	2054		200		200	27,462	27,462	27,262
46	2055		200	7,681	7,882	27,462	27,462	19,580
47	2056		200	3,703	3,903	27,462	27,462	23,559
48	2057		200		200	27,462	27,462	27,262
49	2058		200		200	27,462	27,462	27,262
50	2059		200		200	27,462	27,462	27,262

Table E2-24 Sensitivity Analysis of Proposed Project (2/4)

CASE 2 Direct Construction Cost : As estimated
 Irrigation Water Supply : One year delay
 Target Yield : As scheduled

EIRR :	11.6%	Net Present Value (Riel Million)	<i>Benefit</i>	<i>Cost</i>	<i>B/C Ratio</i>
		(8 % discount rate)	211,661	141,504	1.50

(Unit : Riel Million)

Year in Order	Year	Economic Cost				Economic Benefit		Net Cash Flow
		Initial Investment	Annual O&M	Major Repairing	Total	Irrigation	Total	
1	2010	4,255			4,255		0	-4,255
2	2011	17,117			17,117		0	-17,117
3	2012	79,071			79,071		0	-79,071
4	2013	60,199	99		60,298	682	682	-59,616
5	2014	11,514	169		11,683	6,290	6,290	-5,393
6	2015	1,499	181		1,680	12,852	12,852	11,172
7	2016	284	182		466	17,369	17,369	16,903
8	2017		182		182	21,580	21,580	21,398
9	2018		182		182	25,426	25,426	25,244
10	2019		182		182	27,180	27,180	26,998
11	2020		182		182	27,450	27,450	27,268
12	2021		182		182	27,462	27,462	27,280
13	2022		182		182	27,462	27,462	27,280
14	2023		182		182	27,462	27,462	27,280
15	2024		182		182	27,462	27,462	27,280
16	2025		182	6,983	7,165	27,462	27,462	20,297
17	2026		182	3,366	3,548	27,462	27,462	23,914
18	2027		182		182	27,462	27,462	27,280
19	2028		182		182	27,462	27,462	27,280
20	2029		182		182	27,462	27,462	27,280
21	2030		182		182	27,462	27,462	27,280
22	2031		182		182	27,462	27,462	27,280
23	2032		182		182	27,462	27,462	27,280
24	2033		182		182	27,462	27,462	27,280
25	2034		182		182	27,462	27,462	27,280
26	2035		182	6,983	7,165	27,462	27,462	20,297
27	2036		182	3,366	3,548	27,462	27,462	23,914
28	2037		182		182	27,462	27,462	27,280
29	2038		182		182	27,462	27,462	27,280
30	2039		182		182	27,462	27,462	27,280
31	2040		182		182	27,462	27,462	27,280
32	2041		182		182	27,462	27,462	27,280
33	2042		182		182	27,462	27,462	27,280
34	2043		182		182	27,462	27,462	27,280
35	2044		182		182	27,462	27,462	27,280
36	2045		182	6,983	7,165	27,462	27,462	20,297
37	2046		182	3,366	3,548	27,462	27,462	23,914
38	2047		182		182	27,462	27,462	27,280
39	2048		182		182	27,462	27,462	27,280
40	2049		182		182	27,462	27,462	27,280
41	2050		182		182	27,462	27,462	27,280
42	2051		182		182	27,462	27,462	27,280
43	2052		182		182	27,462	27,462	27,280
44	2053		182		182	27,462	27,462	27,280
45	2054		182		182	27,462	27,462	27,280
46	2055		182	6,983	7,165	27,462	27,462	20,297
47	2056		182	3,366	3,548	27,462	27,462	23,914
48	2057		182		182	27,462	27,462	27,280
49	2058		182		182	27,462	27,462	27,280
50	2059		182		182	27,462	27,462	27,280

Table E2-24 Sensitivity Analysis of Proposed Project (3/4)

CASE 3 Direct Construction Cost : As estimated
 Irrigation Water Supply : As scheduled
 Target Yield : 10% down

EIRR :	10.3%
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Net Present Value (Riel Million)	<i>Benefit</i>	<i>Cost</i>	<i>B/C Ratio</i>
(8 % discount rate)	182,329	141,504	1.29

Year in Order	Year	Economic Cost				Economic Benefit		Net Cash Flow
		Initial Investment	Annual O&M	Major Repairing	Total	Irrigation	Total	
1	2010	4,255			4,255		0	-4,255
2	2011	17,117			17,117		0	-17,117
3	2012	79,071			79,071	433	433	-78,638
4	2013	60,199	99		60,298	4,387	4,387	-55,911
5	2014	11,514	169		11,683	9,701	9,701	-1,982
6	2015	1,499	181		1,680	13,278	13,278	11,598
7	2016	284	182		466	16,941	16,941	16,475
8	2017		182		182	20,288	20,288	20,106
9	2018		182		182	21,812	21,812	21,630
10	2019		182		182	22,046	22,046	21,864
11	2020		182		182	22,056	22,056	21,874
12	2021		182		182	22,056	22,056	21,874
13	2022		182		182	22,056	22,056	21,874
14	2023		182		182	22,056	22,056	21,874
15	2024		182		182	22,056	22,056	21,874
16	2025		182	6,983	7,165	22,056	22,056	14,891
17	2026		182	3,366	3,548	22,056	22,056	18,508
18	2027		182		182	22,056	22,056	21,874
19	2028		182		182	22,056	22,056	21,874
20	2029		182		182	22,056	22,056	21,874
21	2030		182		182	22,056	22,056	21,874
22	2031		182		182	22,056	22,056	21,874
23	2032		182		182	22,056	22,056	21,874
24	2033		182		182	22,056	22,056	21,874
25	2034		182		182	22,056	22,056	21,874
26	2035		182	6,983	7,165	22,056	22,056	14,891
27	2036		182	3,366	3,548	22,056	22,056	18,508
28	2037		182		182	22,056	22,056	21,874
29	2038		182		182	22,056	22,056	21,874
30	2039		182		182	22,056	22,056	21,874
31	2040		182		182	22,056	22,056	21,874
32	2041		182		182	22,056	22,056	21,874
33	2042		182		182	22,056	22,056	21,874
34	2043		182		182	22,056	22,056	21,874
35	2044		182		182	22,056	22,056	21,874
36	2045		182	6,983	7,165	22,056	22,056	14,891
37	2046		182	3,366	3,548	22,056	22,056	18,508
38	2047		182		182	22,056	22,056	21,874
39	2048		182		182	22,056	22,056	21,874
40	2049		182		182	22,056	22,056	21,874
41	2050		182		182	22,056	22,056	21,874
42	2051		182		182	22,056	22,056	21,874
43	2052		182		182	22,056	22,056	21,874
44	2053		182		182	22,056	22,056	21,874
45	2054		182		182	22,056	22,056	21,874
46	2055		182	6,983	7,165	22,056	22,056	14,891
47	2056		182	3,366	3,548	22,056	22,056	18,508
48	2057		182		182	22,056	22,056	21,874
49	2058		182		182	22,056	22,056	21,874
50	2059		182		182	22,056	22,056	21,874

Table E2-24 Sensitivity Analysis of Proposed Project (4/4)

CASE 3 Direct Construction Cost : 10% up
Irrigation Water Supply : As scheduled
Target Yield : 10% down

EIRR :	9.5%
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Net Present Value (Riel Million)	<i>Benefit</i>	<i>Cost</i>	<i>B/C Ratio</i>
(8 % discount rate)	182,329	153,398	1.19

(Unit : Riel Million)

Year in Order	Year	Economic Cost				Economic Benefit		Net Cash Flow
		Initial Investment	Annual O&M	Major Repairing	Total	Irrigation	Total	
1	2010	4,255			4,255		0	-4,255
2	2011	18,205			18,205		0	-18,205
3	2012	85,985	30		86,015	433	433	-85,582
4	2013	65,680	109		65,789	4,387	4,387	-61,402
5	2014	12,496	186		12,682	9,701	9,701	-2,981
6	2015	1,592	199		1,791	13,278	13,278	11,487
7	2016	284	200		484	16,941	16,941	16,457
8	2017		200		200	20,288	20,288	20,088
9	2018		200		200	21,812	21,812	21,612
10	2019		200		200	22,046	22,046	21,846
11	2020		200		200	22,056	22,056	21,856
12	2021		200		200	22,056	22,056	21,856
13	2022		200		200	22,056	22,056	21,856
14	2023		200		200	22,056	22,056	21,856
15	2024		200		200	22,056	22,056	21,856
16	2025		200	7,681	7,882	22,056	22,056	14,174
17	2026		200	3,703	3,903	22,056	22,056	18,153
18	2027		200		200	22,056	22,056	21,856
19	2028		200		200	22,056	22,056	21,856
20	2029		200		200	22,056	22,056	21,856
21	2030		200		200	22,056	22,056	21,856
22	2031		200		200	22,056	22,056	21,856
23	2032		200		200	22,056	22,056	21,856
24	2033		200		200	22,056	22,056	21,856
25	2034		200		200	22,056	22,056	21,856
26	2035		200	7,681	7,882	22,056	22,056	14,174
27	2036		200	3,703	3,903	22,056	22,056	18,153
28	2037		200		200	22,056	22,056	21,856
29	2038		200		200	22,056	22,056	21,856
30	2039		200		200	22,056	22,056	21,856
31	2040		200		200	22,056	22,056	21,856
32	2041		200		200	22,056	22,056	21,856
33	2042		200		200	22,056	22,056	21,856
34	2043		200		200	22,056	22,056	21,856
35	2044		200		200	22,056	22,056	21,856
36	2045		200	7,681	7,882	22,056	22,056	14,174
37	2046		200	3,703	3,903	22,056	22,056	18,153
38	2047		200		200	22,056	22,056	21,856
39	2048		200		200	22,056	22,056	21,856
40	2049		200		200	22,056	22,056	21,856
41	2050		200		200	22,056	22,056	21,856
42	2051		200		200	22,056	22,056	21,856
43	2052		200		200	22,056	22,056	21,856
44	2053		200		200	22,056	22,056	21,856
45	2054		200		200	22,056	22,056	21,856
46	2055		200	7,681	7,882	22,056	22,056	14,174
47	2056		200	3,703	3,903	22,056	22,056	18,153
48	2057		200		200	22,056	22,056	21,856
49	2058		200		200	22,056	22,056	21,856
50	2059		200		200	22,056	22,056	21,856