7.1.2 List of Farm Road Development

Table 7.1-1 List of Farm Road in Khon Kaen Priority Area

List of Proposed Farm Road Development in KK-6 Priority Area

Farm Road Total 31,324 (rai)	Number of Roads	Total Length (km)			Density (m/rai)		Width (m)	Pavement (km)		Cross-structures	
		Existing Improvement	New Provision	Total	Existing	Future		Asphalt	Laterite	Culverts	Bridge
Main Farm Road (MFR)	7	27.36	0.84	28.20	0.87	0.90	4	1.20	27.00	12	0
Lateral Farm Road (LFR)	18	32.71	2.11	34.82	1.04	1.11	4	2.20	32.62	21	1
On-Farm Road (OFR)	129	42.95	66.27	109.22	1.37	3.49	2	5.80	103.42	116	0
Total	512	103.02	69.22	172.24	3.29	5.50		9.20	163.04	149	1

(Note)
1) Above farm roads are for the AERO 4-01 area of 31,324 rai.
2) Width and Length of Bridges
Lateral Farm Road (LFR) = 4 m x 20 m
3) Width of existing road is assumed at 2 m.
4) A concrete pipe of diameter 500 mm is assumed be installed for culvert.
(Each culvert to be reviewed by its drainage area at implementation stage)
5) Asphalt pavement of Main, Lateral and On-farm roads is considered for subject to flood.
Main and Lateral farm roads: 100m per culvert or bridge.
On-farm road: 50m per culvert or bridge.

Main Farm Road in KK-6 Priority Area

No.	Exist (km)	New (km)	Total (km)	Cross-Structures Culverts	Cross-Structures Bridges	Bridge (m)
MFR- 1	5.80	0.84	6.64	0	0	
MFR- 2	2.76		2.76	1	0	
MFR- 3	3.28		3.28	2	0	
MFR- 4	5.00		5.00	3	0	
MFR- 5	4.40		4.40	1	0	
MFR- 6	2.84		2.84	3	0	
MFR- 7	3.28		3.28	2	0	
Total 7	27.36	0.84	28.20	12	0	

Lateral Farm Road in KK-6 Priority Area

No.	Exist (km)	New (km)	Total (km)	Cross-Structures Culverts	Cross-Structures Bridges	Bridge (m)
LFR- 1.1	1.6		1.6	1		
LFR- 1.2	1.25		1.25	0		
LFR- 1.3	1.52		1.52	0		
LFR- 1.4	1.12	0.2	1.32	1		
LFR- 2.1	1.64		1.64	2		
LFR- 2.2	3.76		3.76	3		
LFR- 2.3	1.35		1.35	3		
LFR- 3.1	0.75	1.12	1.87	2	1	20
LFR- 3.2	1.8		1.8	1		
LFR- 3.3	2.48		2.48	0		
LFR- 3.4	0.68	0.64	1.32	0		
LFR- 4.1	2		2	0		
LFR- 4.2	1.72		1.72	0		
LFR- 4.3	2.2		2.2	2		
LFR- 5.1	2.44		2.44	0		
LFR- 5.2	3.68		3.68	3		
LFR- 6.1	1.92		1.92	2		
LFR- 7.1	0.8	0.15	0.95	1		
Total 18	32.71	2.11	34.82	21	1	

On-Farm Road in KK-6 Priority Area

No.	Exist (km)	New (km)	Total (km)	Cross-Structures Culverts	Cross-Structures Bridges	Bridge (m)
OFR- 1.01	0.60	1.80	2.40	3	0	
OFR- 1.02		0.45	0.45	0	0	
OFR- 1.03	1.56		1.56	1	0	
OFR- 1.04		0.68	0.68	0	0	
OFR- 1.05	1.64		1.64	1	0	
OFR- 1.06	1.52		1.52	1	0	
OFR- 1.07		0.64	0.64	1	0	
OFR- 1.08		0.86	0.86	2	0	
OFR- 1.09		0.95	0.95	2	0	
OFR- 1.10		0.77	0.77	1	0	
OFR- 1.11	1.04		1.04	1	0	
OFR- 1.12		0.42	0.42	1	0	
OFR- 1.13	0.38		0.38	0	0	
OFR- 1.14	0.65		0.65	0	0	
OFR- 1.15	0.11	1.10	1.21	1	0	
OFR- 1.16		0.14	0.14	0	0	
OFR- 1.17		0.76	0.76	1	0	
OFR- 1.18		0.24	0.24	0	0	
OFR- 1.19	1.70		1.70	1	0	
OFR- 1.20	0.39	0.10	0.49	0	0	
OFR- 1.21	0.95		0.95	1	0	
OFR- 1.22	0.97		0.97	1	0	
OFR- 1.23		0.20	0.20	0	0	
OFR- 1.24	0.55		0.55	1	0	
OFR- 1.25	0.79		0.79	2	0	
OFR- 1.26	0.44		0.44	0	0	
OFR- 2.01	1.08		1.08	0	0	
OFR- 2.02		0.20	0.20	0	0	
OFR- 2.03	1.04		1.04	1	0	
OFR- 2.04	1.20		1.20	0	0	
OFR- 2.05	1.12		1.12	0	0	
OFR- 2.06	0.84		0.84	0	0	
OFR- 2.07		0.12	0.12	0	0	
OFR- 2.08		0.29	0.29	1	0	
OFR- 3.01	0.35		0.35	0	0	
OFR- 3.02		1.12	1.12	2	0	
OFR- 3.03		1.56	1.56	0	0	
OFR- 3.04		0.28	0.28	1	0	
OFR- 3.05	1.52		1.52	2	0	
OFR- 3.06		1.16	1.16	1	0	
OFR- 3.07	0.40		0.40	0	0	
OFR- 3.08	0.20		0.20	0	0	
OFR- 3.09		0.88	0.88	1	0	
OFR- 3.10		0.32	0.32	1	0	
OFR- 3.11		1.40	1.40	1	0	
OFR- 3.12		0.64	0.64	1	0	
OFR- 3.13		0.59	0.59	0	0	
OFR- 3.14		0.06	0.06	0	0	
OFR- 3.15	0.45	1.04	1.49	1	0	
OFR- 3.16		0.33	0.33	1	0	
OFR- 3.17	0.25	0.27	0.52	1	0	
OFR- 3.18		0.32	0.32	1	0	
OFR- 3.19		0.32	0.32	2	0	

OFR-	3.20		0.88	0.88	1	0
OFR-	4.01		1.12	1.12	1	0
OFR-	4.02		1.24	1.24	2	0
OFR-	4.03		0.93	0.93	2	0
OFR-	4.04		0.52	0.52	0	0
OFR-	4.05		0.24	0.24	1	0
OFR-	4.06	2.00		2.00	2	0
OFR-	4.07		0.88	0.88	1	0
OFR-	4.08	0.50		0.50	0	0
OFR-	4.09	1.08		1.08	1	0
OFR-	4.10	0.28	0.56	0.84	0	0
OFR-	4.11		0.16	0.16	0	0
OFR-	4.12		0.51	0.51	1	0
OFR-	4.13	1.36	0.35	1.71	1	0
OFR-	4.14	1.32		1.32	1	0
OFR-	4.15	0.40	0.68	1.08	1	0
OFR-	4.16		0.58	0.58	2	0
OFR-	4.17		0.58	0.58	2	0
OFR-	4.18		0.90	0.90	2	0
OFR-	4.19		0.90	0.90	2	0
OFR-	4.20		1.04	1.04	1	0
OFR-	4.21		0.38	0.38	0	0
OFR-	4.22	0.32		0.32	0	0
OFR-	4.23		0.12	0.12	0	0
OFR-	5.01		0.28	0.28	0	0
OFR-	5.02		1.22	1.22	0	0
OFR-	5.03	0.80		0.80	0	0
OFR-	5.04	0.76		0.76	0	0
OFR-	5.05		0.24	0.24	0	0
OFR-	5.06	0.76		0.76	0	0
OFR-	5.07		0.24	0.24	0	0
OFR-	5.08	0.32	0.29	0.61	0	0
OFR-	5.09		1.08	1.08	0	0
OFR-	5.10		0.14	0.14	0	0
OFR-	5.11		0.31	0.31	0	0
OFR-	5.12	2.06		2.06	0	0
OFR-	5.13		0.18	0.18	0	0
OFR-	5.14		0.48	0.48	0	0
OFR-	5.15		0.62	0.62	0	0
OFR-	5.16		1.50	1.50	3	0
OFR-	5.17		1.50	1.50	2	0
OFR-	5.18		0.44	0.44	0	0
OFR-	5.19		0.16	0.16	0	0
OFR-	6.01	0.36		0.36	0	0
OFR-	6.02		4.10	4.10	8	0
OFR-	6.03		4.10	4.10	7	0
OFR-	6.04		0.32	0.32	0	0
OFR-	6.05		1.28	1.28	1	0
OFR-	6.06	0.58		0.58	1	0
OFR-	6.07		1.04	1.04	0	0
OFR-	6.08		0.16	0.16	0	0
OFR-	6.09	3.30	0.18	3.48	1	0
OFR-	6.10		0.56	0.56	1	0
OFR-	6.11		1.90	1.90	3	0
OFR-	6.12		1.90	1.90	3	0
OFR-	6.13	0.12	0.52	0.64	2	0
OFR-	6.14		0.38	0.38	1	0
OFR-	6.15		0.38	0.38	1	0
OFR-	6.16		1.22	1.22	2	0
OFR-	6.17		1.22	1.22	2	0
OFR-	6.18		0.48	0.48	0	0
OFR-	6.19	0.40		0.40	1	0
OFR-	6.20	0.92		0.92	1	0
OFR-	6.21		0.19	0.19	0	0
OFR-	7.01	0.37		0.37	1	0
OFR-	7.02		0.04	0.04	0	0
OFR-	7.03	0.94		0.94	1	0
OFR-	7.04		0.73	0.73	0	0
OFR-	7.05	0.40		0.40	0	0
OFR-	7.06	0.88	0.10	0.98	1	0
OFR-	7.07		1.80	1.80	4	0
OFR-	7.08		1.80	1.80	2	0
OFR-	7.09	0.70		0.70	1	0
OFR-	7.10	0.28		0.28	1	0
OFR-	7.11		0.51	0.51	0	0
OFR-	7.12		0.10	0.10	1	0
Total		129	42.95	66.27	109.22	116	0

Table 7.1-2 List of Farm Road in Mahasarakham Priority Area

List of Proposed Farm Road Development in MHS-5 Priority Area

Farm Road	Number	Total Length (km)			Density (m/rai)		Width	Pavement (km)		Cross-structures	
Total 13,246 (rai)	of Roads	Existing Improvement	New Provision	Total	Existing	Future	(m)	Asphalt	Laterite	Culverts	Bridge
Main Farm Road (MFR)	10	30.01	2.52	32.53	2.06	2.23	4	2.00	30.53	20	0
Lateral Farm Road (LFR)	6	7.60	3.48	11.08	0.52	0.76	4	1.40	9.68	14	0
On-Farm Road (OFR)	86	27.77	23.32	51.09	1.90	3.50	2	2.40	48.69	48	0
Total	102	65.38	29.32	94.70	4.48	6.49		5.80	88.90	82	0

(Note)

1) Above farm roads are for the ALRO 4-01 area of 13,246 rai.
2) Width of existing road is assumed at 2 m.
3) A concrete pipe of diameter 500 mm is assumed be installed for culvert.
   (Each culvert to be reviewed by its drainage area at implementation stage)
4) Asphalt pavement of Main, Lateral and On-farm roads is considered for subject to flood.
   Main and Lateral farm roads: 100m per culvert or bridge.
   On-farm road. 50m per culvert or bridge.

Main Farm Road in KK-6 Priority Area

No.	Exist (km)	New (km)	Total (km)	Cross-Structures Culverts	Cross-Structures Bridges	Bridge (m)
MFR- 1	3.52	1.92	5.44	6	0	
MFR- 2	2.60	0.60	3.20	0	0	
MFR- 3	7.84		7.84	2	0	
MFR- 4	1.12		1.12	4	0	
MFR- 5	2.20		2.20	3	0	
MFR- 6	1.60		1.60	2	0	
MFR- 7	2.20		2.20	1	0	
MFR- 8	5.05		5.05	0	0	
MFR- 9	1.04		1.04	0	0	
MFR- 10	2.84		2.84	2	0	
Total 10	30.01	2.52	32.53	20	0	

Lateral Farm Road in KK-6 Priority Area

No.	Exist (km)	New (km)	Total (km)	Cross-Structures Culverts	Cross-Structures Bridges	Bridge (m)
LFR- 2.1	2.36		2.36	1	0	
LFR- 5.1	0.40	1.04	1.44	1	0	
LFR- 8.1	1.68	0.48	2.16	3	0	
LFR- 8.2	1.16		1.16	3	0	
LFR- 10.1	1.28	0.80	2.08	3	0	
LFR- 10.2	0.72	1.16	1.88	3	0	
Total 6	7.60	3.48	11.08	14	0	

On-Farm Road in KK-6 Priority Area

No.	Exist (km)	New (km)	Total (km)	Cross-Structures Culverts	Cross-Structures Bridges	Bridge (m)
OFR- 1.01	0.32		0.32	0	0	
OFR- 1.02	0.50		0.50	0	0	
OFR- 1.03		0.20	0.20	0	0	
OFR- 1.04	1.08		1.08	0	0	
OFR- 1.05		0.15	0.15	0	0	
OFR- 1.06	0.52		0.52	0	0	
OFR- 1.07	0.21		0.21	0	0	
OFR- 1.08	0.34	0.48	0.82	0	0	
OFR- 1.09		0.22	0.22	1	0	
OFR- 1.10		0.42	0.42	1	0	
OFR- 1.11		0.40	0.40	1	0	
OFR- 1.12		0.32	0.32	0	0	
OFR- 1.13	0.44	0.40	0.84	0	0	
OFR- 1.14		0.37	0.37	1	0	
OFR- 1.15	0.27		0.27	1	0	
OFR- 2.01	0.76		0.76	0	0	
OFR- 2.02	0.56		0.56	0	0	
OFR- 2.03		0.18	0.18	0	0	
OFR- 2.04		0.63	0.63	1	0	
OFR- 2.05		0.68	0.68	2	0	
OFR- 2.06	0.92		0.92	0	0	
OFR- 2.07		0.98	0.98	0	0	
OFR- 2.08	0.24		0.24	1	0	
OFR- 2.09	0.35	0.15	0.50	0	0	
OFR- 2.10		0.32	0.32	0	0	
OFR- 2.11	1.04		1.04	0	0	
OFR- 2.12	0.30	0.54	0.84	1	0	
OFR- 2.13	1.34		1.34	1	0	
OFR- 2.14		0.64	0.64	2	0	
OFR- 2.15		0.17	0.17	1	0	
OFR- 2.16	0.45	0.90	1.35	2	0	
OFR- 2.17	1.00		1.00	3	0	
OFR- 2.18	0.24		0.24	0	0	
OFR- 3.01		0.52	0.52	0	0	
OFR- 3.02	0.35	0.70	1.05	1	0	
OFR- 3.03		0.22	0.22	0	0	
OFR- 3.04	1.20		1.20	2	0	
OFR- 3.05		0.28	0.28	0	0	
OFR- 3.06	0.23	0.61	0.84	0	0	
OFR- 3.07	0.20		0.20	0	0	
OFR- 3.08	0.80		0.80	2	0	
OFR- 3.09						
OFR- 4.01	1.05		1.05	2	0	
OFR- 4.02		0.11	0.11	0	0	
OFR- 4.03	0.32	0.42	0.74	1	0	
OFR- 4.04		0.28	0.28	0	0	
OFR- 4.05		0.20	0.20	1	0	
OFR- 4.06	1.12		1.12	0	0	
OFR- 4.07		0.46	0.46	0	0	
OFR- 4.08		0.32	0.32	0	0	
OFR- 4.09	0.15		0.15	0	0	
OFR- 5.01	0.46	0.25	0.71	1	0	
OFR- 5.02		0.12	0.12	0	0	
OFR- 5.03		0.40	0.40	0	0	
OFR- 5.04	0.44	0.24	0.68	2	0	
OFR- 5.05		0.10	0.10	1	0	
OFR- 5.06	0.64	0.84	1.48	2	0	
OFR- 6.01		0.50	0.50	1	0	
OFR- 6.02		0.95	0.95	3	0	
OFR- 6.03		0.40	0.40	0	0	
OFR- 7.01	0.84		0.84	1	0	
OFR- 7.02	0.48		0.48	0	0	
OFR- 7.03	0.26		0.26	0	0	
OFR- 7.04	0.66		0.66	0	0	
OFR- 8.01	0.19		0.19	0	0	
OFR- 8.02	1.48		1.48	0	0	
OFR- 8.03	0.60		0.60	0	0	
OFR- 8.04		0.76	0.76	0	0	
OFR- 8.05	0.80		0.80	0	0	
OFR- 8.06	0.16		0.16	1	0	
OFR- 8.07		0.34	0.34	0	0	
OFR- 10.01	0.12	1.08	1.20	1	0	
OFR- 10.02		0.30	0.30	1	0	
OFR- 10.03		0.60	0.60	1	0	
OFR- 10.04		0.50	0.50	0	0	
OFR- 10.05	0.76		0.76	2	0	
OFR- 10.06	1.10	0.30	1.40	0	0	
OFR- 10.07		0.18	0.18	0	0	
OFR- 10.08		0.56	0.56	1	0	
OFR- 10.09	0.32	0.64	0.96	1	0	
OFR- 10.10	0.52		0.52	1	0	
OFR- 10.11	1.08		1.08	0	0	
OFR- 10.12		1.00	1.00	0	0	
OFR- 10.13	0.56		0.56	0	0	
OFR- 10.14		0.59	0.59	0	0	
OFR- 10.15		0.40	0.40	0	0	
Total 86	27.77	23.32	51.09	48	0	

Table 7.1-3 List of Farm Road in Sakon Nakhon Priority Area

List of Proposed Farm Road Development in SKN-3.1 Priority Area

Farm Road Total (rai) 15,240	Number of Roads	Total Length (km)			Density (m/rai)		Width (m)	Pavement (km)		Cross-structures	
		Existing Improvement	New Provision	Total	Existing	Future		Asphalt	Laterite	Culverts	Bridge
Main Farm Road (MFR)	10	10.82	15.63	26.45	0.71	1.74	4	4.00	22.45	28	12
Lateral Farm Road (LFR)	19	5.56	33.14	38.70	0.36	2.54	4	7.10	31.60	65	6
On-Farm Road (OFR)	106	2.37	46.74	49.11	0.16	3.22	2	4.15	44.96	83	0
Total	135	18.75	95.51	114.26	1.23	7.50		15.25	99.01	176	18

(Note)
1) Above farm roads are for the area of 15,240 rai excluding Huai Kra Choe Command Area among surveyed area.
2) Length of Bridge is assumed at 10 meters.
3) Width of existing road is assumed at 2 m.
4) A concrete pipe of diameter 500 mm is assumed be installed for culvert.
(Each culvert to be reviewed by its drainage area at implementation stage)
5) Asphalt pavement of Main, Lateral and On-farm roads is considered for subject to flood.
Main and Lateral farm roads: 100m per culvert or bridge.
On-farm road: 50m per culvert or bridge.

Main Farm Road in SKN-3.1 Priority Area

No.	Exist (km)	New (km)	Total (km)	Cross-Structures Culverts	Cross-Structures Bridges	Bridge (m)
MFR- 1	1.32		1.32	1		
MFR- 2		(3.8)	(Huai Kra Choe Irrigation Project)			
MFR- 3		0.75	0.75	0		
MFR- 4	0.24	4.20	4.44	7		
MFR- 5	2.56	1.00	3.56	3		
MFR- 6	1.70	2.00	3.70	2		
MFR- 7	0.80	2.34	3.14	5	3	10
MFR- 8	1.40	2.20	3.60	5	4	10
MFR- 9	2.80		2.80	1	2	10
MFR- 10		3.14	3.14	4	3	10
Total 10	10.82	15.63	26.45	28	12	

No.	Exist (km)	New (km)	Total (km)	Cross-Structures Culverts	Cross-Structures Bridges	Bridge (m)
LFR- 1.1		1.16	1.16	2		
LFR- 4.1	0.70	0.76	1.46	4	1	10
LFR- 4.2		2.00	2.00	0		
LFR- 4.3	0.24	1.72	1.96	3		
LFR- 5.1		1.56	1.56	1		
LFR- 5.2		1.76	1.76	2		
LFR- 6.1		2.50	2.50	3		
LFR- 6.2	1.00	1.30	2.30	5		
LFR- 7.1	0.22	2.86	3.08	7		
LFR- 7.2	0.20	1.34	1.54	2		
LFR- 7.3		2.00	2.00	3		
LFR- 8.1		3.30	3.30	3	1	10
LFR- 8.2		2.70	2.70	4		
LFR- 8.3		2.50	2.50	5		
LFR- 9.1		1.56	1.56	3	2	10
LFR- 9.2	1.90		1.90	4		
LFR- 9.3	1.30	0.70	2.00	7	1	10
LFR- 9.4		2.70	2.70	6	1	10
LFR- 9.5		0.72	0.72	1		
Total 19	5.56	33.14	38.7	65	6	

On-Farm Road in SKN-3.1 Priority Area

No.	Exist (km)	New (km)	Total (km)	Cross-Structures Culverts	Cross-Structures Bridges	Bridge (m)
OFR- 1.01		0.70	0.70	1		
OFR- 1.02		0.32	0.32	0		
OFR- 1.03		0.64	0.64	0		
OFR- 1.04		0.64	0.64	0		
OFR- 3.01		0.17	0.17	1		
OFR- 4.01		0.92	0.92	5		
OFR- 4.02		0.38	0.38	0		
OFR- 4.03		0.80	0.80	2		
OFR- 4.04		0.28	0.28	0		
OFR- 4.05		0.20	0.20	0		
OFR- 4.06		0.33	0.33	0		
OFR- 4.07		0.32	0.32	0		
OFR- 4.08		0.40	0.40	1		
OFR- 4.09		0.43	0.43	0		
OFR- 4.10		0.97	0.97	2		
OFR- 4.11		0.20	0.20	1		
OFR- 4.12		0.52	0.52	1		
OFR- 4.13		0.25	0.25	1		
OFR- 5.01		0.76	0.76	3		
OFR- 5.02	0.24	0.72	0.96	1		
OFR- 5.03		0.40	0.40	0		
OFR- 5.04		0.04	0.04	0		
OFR- 5.05		0.05	0.05	0		
OFR- 5.06		0.67	0.67	2		
OFR- 5.07		1.12	1.12	2		
OFR- 5.08		0.30	0.30	0		
OFR- 5.09		0.64	0.64	1		
OFR- 5.10		0.05	0.05	0		
OFR- 5.11		0.49	0.49	1		
OFR- 5.12		0.35	0.35	1		
OFR- 6.01		0.56	0.56	2		
OFR- 6.02		0.66	0.66	2		
OFR- 6.03		0.25	0.25	0		
OFR- 6.04		0.54	0.54	1		
OFR- 6.05		0.92	0.92	0		
OFR- 6.06		0.56	0.56	1		
OFR- 6.07		0.44	0.44	0		
OFR- 6.08		0.34	0.34	0		
OFR- 6.09	0.40	0.15	0.55	1		
OFR- 6.10		0.22	0.22	0		
OFR- 6.11		0.40	0.40	0		
OFR- 6.12		0.68	0.68	2		
OFR- 6.13		0.32	0.32	0		
OFR- 7.01	0.24		0.24	0		
OFR- 7.02		0.84	0.84	1		
OFR- 7.03	0.44		0.44	0		
OFR- 7.04		0.05	0.05	0		
OFR- 7.05		0.22	0.22	0		
OFR- 7.06		0.26	0.26	1		
OFR- 7.07		0.29	0.29	0		
OFR- 7.08		0.09	0.09	0		
OFR- 7.09		0.56	0.56	2		
OFR- 7.10		0.42	0.42	1		
OFR- 7.11		0.28	0.28	1		
OFR- 7.12		0.37	0.37	1		
OFR- 7.13		0.38	0.38	1		
OFR- 7.14		0.05	0.05	0		
OFR- 7.15		0.22	0.22	0		

OFR-	7.16		0.24	0.24	0			
OFR-	7.17		0.52	0.52	0			
OFR-	7.18		0.32	0.32	0			
OFR-	7.19		0.80	0.80	0			
OFR-	7.20		0.60	0.60	1			
OFR-	8.01		0.25	0.25	0			
OFR-	8.02		0.92	0.92	0			
OFR-	8.03		0.50	0.50	2			
OFR-	8.04		0.40	0.40	2			
OFR-	8.05		0.08	0.08	0			
OFR-	8.06		0.08	0.08	0			
OFR-	8.07	0.15	0.90	1.05	3			
OFR-	8.08		0.80	0.80	2			
OFR-	8.09		0.10	0.10	0			
OFR-	8.10		0.11	0.11	0			
OFR-	8.11		0.37	0.37	1			
OFR-	8.12		1.10	1.10	2			
OFR-	8.13		0.10	0.10	0			
OFR-	8.14		0.06	0.06	0			
OFR-	8.15		0.24	0.24	0			
OFR-	8.16		1.00	1.00	2			
OFR-	8.17		0.18	0.18	0			
OFR-	8.18		1.10	1.10	0			
OFR-	8.19		0.44	0.44	0			
OFR-	8.20		0.44	0.44	0			
OFR-	8.21		0.30	0.30	0			
OFR-	8.22		0.13	0.13	1			
OFR-	9.01		0.68	0.68	3			
OFR-	9.02		0.78	0.78	0			
OFR-	9.03		0.22	0.22	1			
OFR-	9.04	0.20	0.86	1.06	4			
OFR-	9.05		0.20	0.20	0			
OFR-	9.06	0.30		0.30	0			
OFR-	9.07	0.40		0.40	2			
OFR-	9.08		0.40	0.40	1			
OFR-	9.09		0.15	0.15	0			
OFR-	9.10		0.50	0.50	0			
OFR-	9.11		0.72	0.72	1			
OFR-	9.12		0.10	0.10	0			
OFR-	9.13		1.12	1.12	1			
OFR-	9.14		0.66	0.66	1			
OFR-	9.15		0.05	0.05	0			
OFR-	9.16		0.11	0.11	0			
OFR-	9.17		0.62	0.62	3			
OFR-	9.18		0.44	0.44	0			
OFR-	9.19		0.52	0.52	1			
OFR-	9.20		1.00	1.00	4			
OFR-	9.21		1.40	1.40	2			
Total	106	2.37	46.74	49.11	83	0		

Table 7.1-4 List of Farm Road in Mukdahan Priority Area

List of Proposed Farm Road Development in MKD-8.2 Priority Area

Farm Road Total 7,817 (rai)	Number of Roads	Total Length (km)			Density (m/rai)		Width (m)	Pavement (km)		Cross-structures	
		Existing Improvement	New Provision	Total	Existing	Future		Asphalt	Laterite	Culverts	Bridge
Main Farm Road (MFR)	4	1.00	13.28	14.28	0.13	1.83	4	3.30	10.98	33	0
Lateral Farm Road (LFR)	7	1.68	7.20	8.88	0.21	1.14	4	1.20	7.68	11	1
On-Farm Road (OFR)	35	8.22	21.79	30.01	1.05	3.84	2	2.00	28.01	36	4
Total	46	10.90	42.27	53.17	1.39	6.80		6.50	46.67	80	5

(Note)
1) Above farm roads are for the ALRO 4-01 area of 7,817 rai.
2) Width and Length of Bridges.
Lateral Farm Road (LFR): 4 m x 20 m x 1 bridge
On-Farm Road (OFR): 2 m x 20 m x 3 bridges , 2 m x 40 m x 1 bridge
3) Width of existing road is assumed at 2 m.
4) A concrete pipe of diameter 500 mm is assumed be installed for culvert.
(Each culvert to be reviewed by its drainage area at implementation stage)
5) Asphalt pavement of Main, Lateral and On-farm roads is considered for subject to flood.
Main and Lateral farm roads: 100m per culvert or bridge.
On-farm road: 50m per culvert or bridge.

Main Farm Road in MKD-8.2 Priority Area

No.	Exist (km)	New (km)	Total (km)	Cross-Structures Culverts	Cross-Structures Bridges	Bridge (m)
MFR- 1	1.00	5.00	6.00	17	0	
MFR- 2		2.84	2.84	5	0	
MFR- 3		4.40	4.40	8	0	
MFR- 4		1.04	1.04	3	0	
Total 4	1.00	13.28	14.28	33	0	

Lateral Farm Road in MKD-8.2 Priority Area

No.	Exist (km)	New (km)	Total (km)	Cross-Structures Culverts	Cross-Structures Bridges	Bridge (m)
LFR- 1.1		1.36	1.36	2		
LFR- 2.1	1.20	0.16	1.36	2		
LFR- 2.2		1.00	1.00	2		
LFR- 2.3		0.52	0.52	1		
LFR- 3.1		0.68	0.68	1	1	40
LFR- 3.2	0.48	1.00	1.48	1		
LFR- 5.1		2.48	2.48	2		
Total 7	1.68	7.20	8.88	11	1	

On-Farm Road in MKD-8.2 Priority Area

No.	Exist (km)	New (km)	Total (km)	Cross-Structures Culverts	Cross-Structures Bridges	Bridge (m)
OFR- 1.01		0.15	0.15	0	0	
OFR- 1.02		0.23	0.23	0	0	
OFR- 1.03	5.00		5.00	0	0	
OFR- 1.04	0.08	0.04	0.12	0	0	
OFR- 1.05		0.63	0.63	0	0	
OFR- 1.06	0.72		0.72	0	0	
OFR- 1.07		0.84	0.84	0	0	
OFR- 1.08		1.00	1.00	1	0	
OFR- 1.09		0.52	0.52	2	0	
OFR- 2.01		0.96	0.96	2	0	
OFR- 2.02	0.32	0.37	0.69	0	0	
OFR- 2.03		0.35	0.35	0	0	
OFR- 2.04		0.84	0.84	2	0	
OFR- 2.05	0.20	0.39	0.59	2	0	
OFR- 2.06		0.76	0.76	0	0	
OFR- 2.07		1.16	1.16	1	0	
OFR- 2.08		0.88	0.88	1	0	
OFR- 2.09		0.60	0.60	1	0	
OFR- 3.01		0.36	0.36	1	0	
OFR- 3.02		0.20	0.20	0	0	
OFR- 3.03		0.66	0.66	1	0	
OFR- 3.04		0.54	0.54	0	0	
OFR- 3.05		0.59	0.59	1	0	
OFR- 3.06		1.08	1.08	3	0	
OFR- 3.07		1.20	1.20	2	0	
OFR- 4.01		1.16	1.16	2	0	
OFR- 4.02		0.10	0.10	0	1	20
OFR- 4.03	1.64		1.64	3	0	
OFR- 4.04	0.26	1.14	1.40	2	2	20
OFR- 4.05		1.44	1.44	7	0	
OFR- 5.01		0.76	0.76	1	0	
OFR- 5.02		0.44	0.44	0	0	
OFR- 5.03		1.52	1.52	1	1	30
OFR- 5.04		0.60	0.60	0	0	
OFR- 5.05		0.28	0.28	0	0	
Total 35	8.22	21.79	30.01	36	4	

7.1.3 Back Data of Typical Model of Dredging Project

1) Typical Model of Dredging Project>

Figure 7.1-5 shows the typical model of dredging project. Gradients of the creeks in the area are not enough gentle to provide dredging project economically. The gradients are more or less about 1/300 in the area, so that check weirs are not able to cover a long distance of water retention for irrigation. As shown in Figure 7.1-5, maximum coverage will be 500m for one weir.

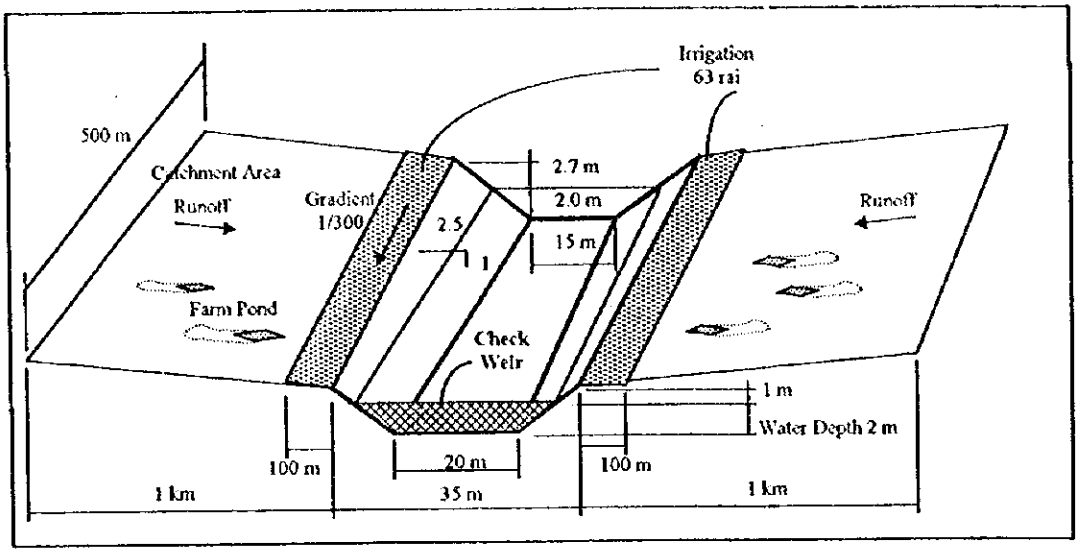

Figure 7.1-5 Typical Model of Dredging Project

Major dimensions of a typical model of dredging project are assumed as follows;

2) Major Dimensions of a Typical Dredging Model>

Catchment Area: Catchment area will be assumed at 1 km at the both side of creek from a typical topography in the area. Catchment area will be reduced by the development of farm ponds in future. Consequently, catchment area will be 550 rai for a 500 m distance.

CA = 1km x 500m×2 - Farm Pond Development Area = 625 rai - 4 rai×number of farm ponds
= 625 rai - 4 rai×18.1 = 550 rai

where;
4 rai = farm pond + catchment area of farm pond = 1 rai + 3 rai
number of farm ponds = 625 rai/average landholding×farmers to have 1,200m³ farm pond
= 625 rai/20 rai×(18% + 40%) = 31.25 farmers×58% = 18.1 farm pond

Irrigable Area : Irrigable area will be within 100m distance from the both banks of creek taking a possible maximum hose length of tiller attached pump for irrigation.

Irrigable Area = 100m×500m×2 = 63 rai

Storage Capacity = 1/2×(Downstream Section + Uppermost Section)×500m
= 1/2×{(20m + 2m * 2.5) + (15m + 2m×2.5)}×2m×500m = 22,500 m³

7.1.4 Back Data of Huai Lak Reservoir

In this section, back data of Huai Lak Reservoir is described especially for Case 1-2, which is the most economical case in the case study. Major dimensions of each case are summarized as below;

Table 7.1-5 Project Features of Case Study for Huai Lak Reservoir

Case	Catchment and Runoff	Dimensions of Dam and Pipeline	Irrigation			Paddy submerge
			Total	Wet Season	Dry Season	
1-1	CA=12 km²	Water Level Surface	Irrigated	Rice 784 rai	Soybean 354rai	110 rai
	Annual Runoff	HHWL 185.5m 1.205 km²	1,173 rai		Baby corn 215rai	
	4.590 MCM	HWL 184.5m 1.161 km²			W.melon 215rai	
		NWL 182.4m 1.060 km²			Total 784rai	
	Flood	LWL 180.0m 0.944 km²		Vegetables 30 rai		
	1/100: 70 m³/s	Dead Storage 4.720MCM		Fruit trees 359 rai		
	1/500: 84 m³/s	Effective 4.792MCM		Total 389 rai		
		Pipeline 0.34 m³/sec	None			
		Booster Pump: none	257 rai	Cassava 257 rai		
1-2	CA=12 km²	Water Level Surface	Irrigated	Rice 784 rai	Soybean 354rai	110 rai
	Annual Runoff	HHWL 180.5m 0.968 km²	1,044 rai		Baby corn 215rai	
	4.590 MCM	HWL 179.5m 0.903 km²			W.melon 215rai	
		NWL 177.8m 0.760 km²			Total 784rai	
	Flood	LWL 175.0m 0.530 km²		Vegetables 30 rai		
	1/100: 70 m³/s	Dead Storage 1.324MCM		Fruit trees 230 rai		
	1/500: 84 m³/s	Effective 3.316MCM		Total 260 rai		
		Pipeline 0.32 m³/sec	None			
		Booster Pump: 0.16 m³/sec (Operation: 6hrs/day)	386 rai	Cassava 386 rai		
2	CA=9.5 km²	Water Level Surface	Irrigated	Rice 784 rai	Soybean 354rai	16 rai
	Annual Runoff	HHWL 185.5m 0.258 km²	1,024 rai		Baby corn 215rai	
	3.634MCM	HWL 184.5m 0.250 km²			W.melon 215rai	
		NWL 181.8m 0.219 km²			Total 784rai	
	Flood	LWL 175.0m 0.088 km²		Vegetables 30 rai		
	1/100: 55 m³/s	Dead Storage 0.220MCM		Fruit trees 210 rai		
	1/500: 70 m³/s	Effective 1.650MCM		Total 240 rai		
		Pipeline 0.32 m³/sec	None			
		Booster Pump: 0.16 m³/sec (Operation: 6hrs/day)	406 rai	Cassava 406 rai		

(Note) 1) No release of river maintenance flow is considered because it is compensated by return flow from irrigation area.

2) Construction period is assumed at 3 years including on-farm development.

3) Specific discharge of flood is assumed at 5.8 m3/km2 for 1/100 years, and 7.0 m3/km2 for 1/500 years.

4) Operation time of booster pump is assumed at 6.8 hours/day through the year in average.

5) Peak irrigation capacity is estimated under following conditions;
paddy: 0.32 lit/s/rai (2.0 lit/s/ha in July), upland: 0.11 lit/s/rai (0.7 lit/s/ha for Fruit Trees in July)

(Supplemental Notes)

1) River Maintenance Flow (RMF): Any RMF is not considered for this reservoir, because water is used in the same basin as irrigation water, and return flow will appear into the downstream Huai Lak river as RMF.

2) In case of Reservoir-1, about 110 rai of paddy field will be submerged under reservoir, so that villagers are not accepting this case when no compensation is considered. Consequently, Reservoir-2 has been considered as an alternative plan to minimize the submersion of paddy field at 16 rai.

(Conclusions)

1) From economic viewpoint, No.1-2 reservoir is recommended, but not accepted by farmers without compensation to submerged 110 rai of paddy field.

2) No.2 site is accepted by farmers, but less advantage from an economic viewpoint.

3) Above both cases are not more than 1 in B/C ratio. For implementation of this project, it is necessary to evaluate this project from a viewpoint of social constraints between the area well developed on water resources and the area not receiving national services on water resources development.

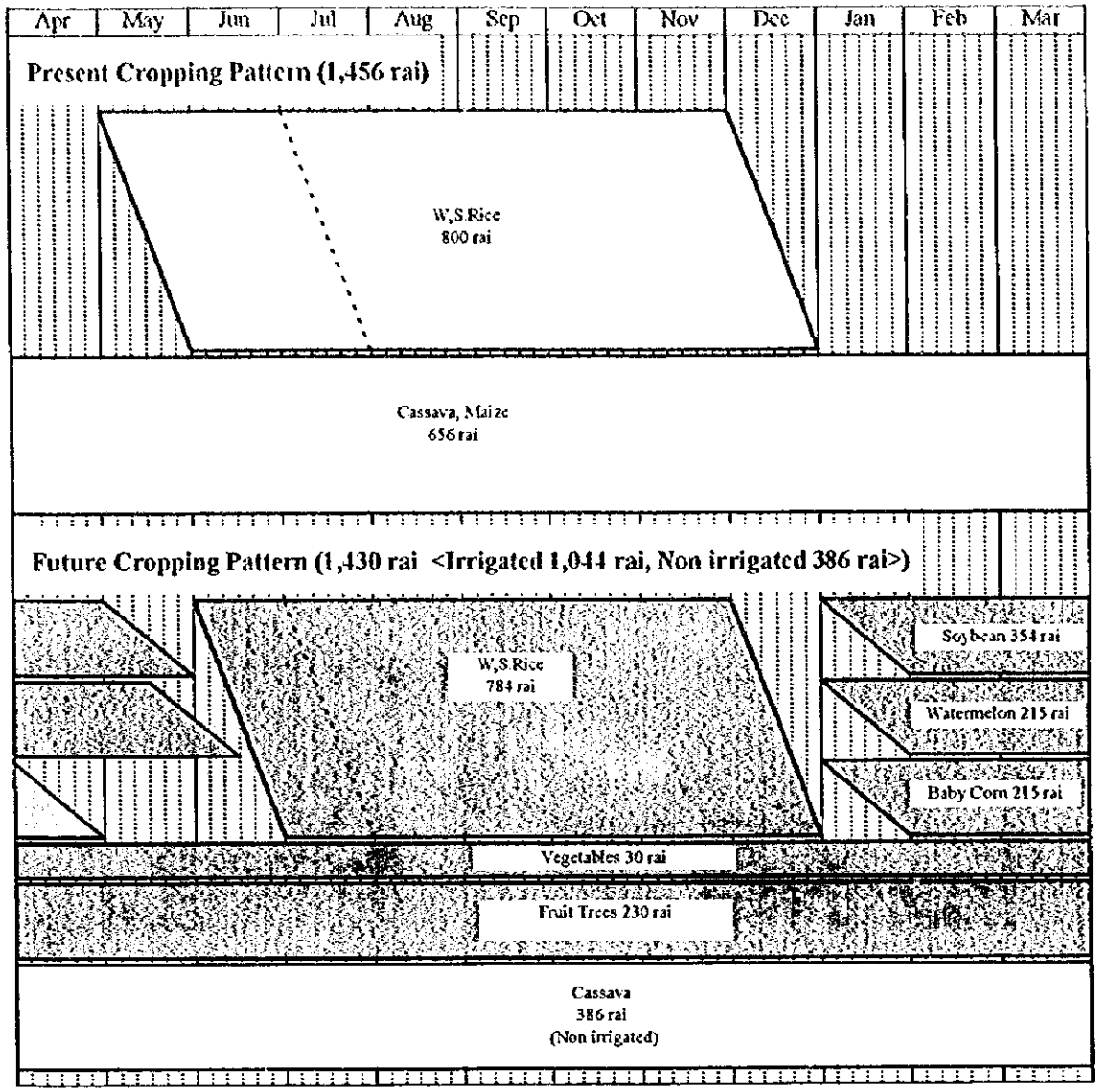

Figure 7.1-6 Proposed Cropping Pattern for Huai Lak Reservoir (Case 1-2)

Table 7.1-6 Major Elements of Huai Lak Reservoir (Case 1-2)

Total Farm Land	Paddy	Upland	Total
	784 rai	646 rai	1,430 rai
	54.8 %	45.2 %	100 %
Crops for Irrigation	(ha)	(rai)	(%)
Wet S. Rice (1)	125.44	784	54.8%
Soybean	56.80	355	24.8%
Sweet Corn	34.40	215	15.0%
Watermelon	34.40	215	15.0%
Vegetables	4.80	30	2.1%
Fruit Trees	36.80	230	16.1%
Catchment Area	12 km^2		
Water Level	Max.	Min	
	179.5 m (HWL)	175.0 m (LWL)	
Storage Volume	3.316 MCM	0 MCM	
Water Surface	0.903 km^2	0.530 km^2	
Rainfall Station	Code : 23803 (04023503)		
Runoff Coefficient	0.29		
Water Shortage	1/5 years (2 crop seasons in 10 years)		
Spill Occurrence	5 years in 10 years		
River Maintenance Flow	not considered taking return flow into account.		

Table 7.1-7 H-A, H-V Curve of Huai Lak Reservoir (Case 1-2)

H (m)	Area (1000m2)	Volume (1000m3)	Effective (1000m3)
170	0	0	
175	530	1,324	0
180	944	5,008	3,684
185	1,186	10,332	9,008
190	1,382	16,752	15,428
195	1,584	24,168	22,844
200	1,794	32,612	31,288

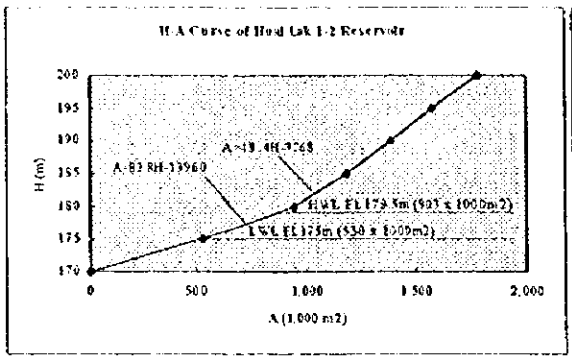

Figure 7.1-7 H-A Curve of Huai Lak Reservoir (Case 1-2)

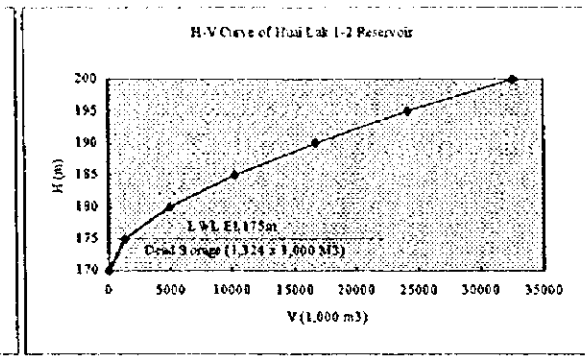

Figure 7.1-8 H-V Curve of Huai Lak Reservoir (Case 1-2)

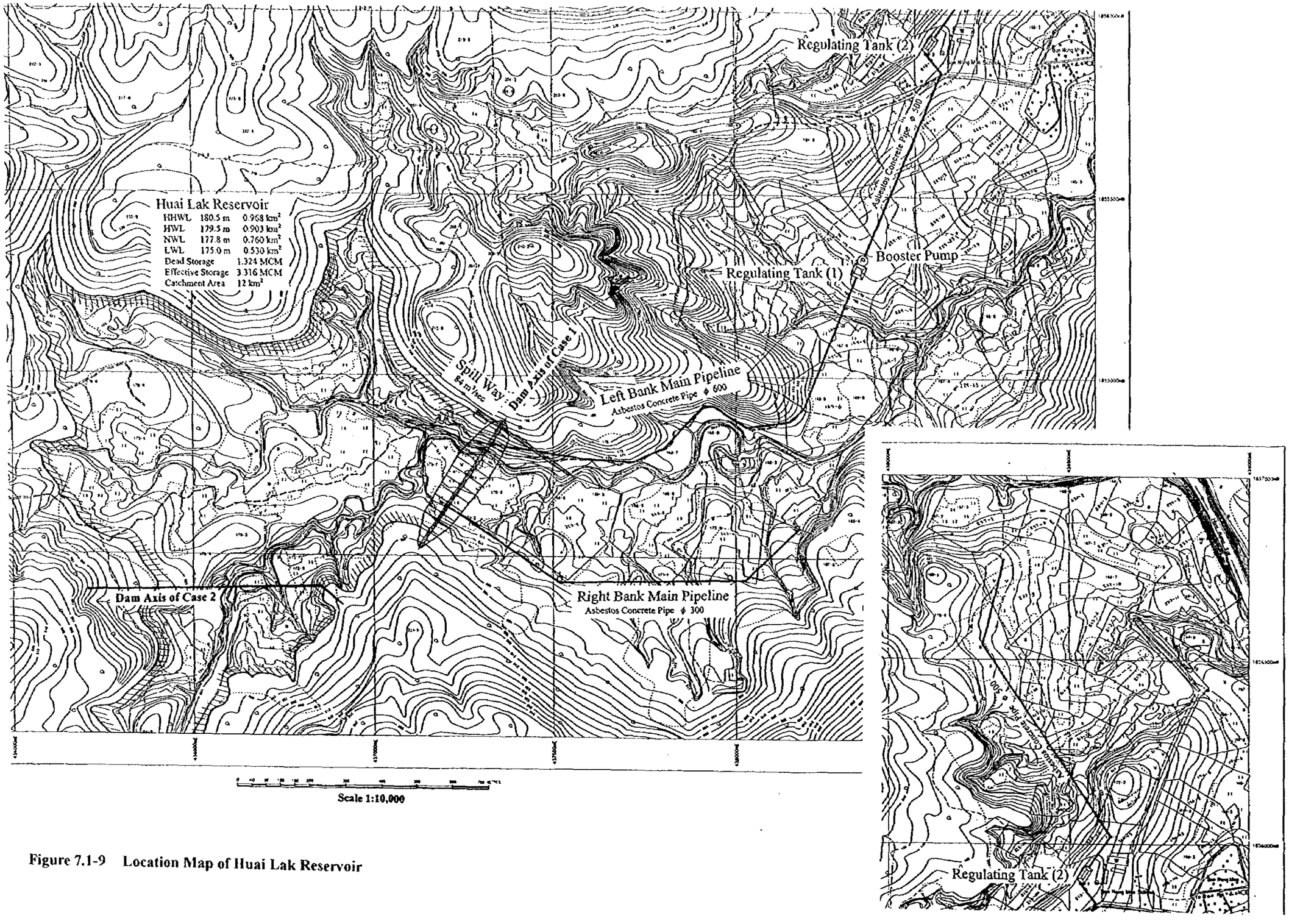

Figure 7.1-9 Location Map of Huai Lak Reservoir

Table 7.1-8 Water Balance of Huai Lak Reservoir (Case 1-2)

	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
Monthly Rainfall (mm)	1984	207	162	211	285	401	224	116	62	0	8	29	6	1,710
Runoff (1,000m^3)		570	445	580	785	1,105	617	319	171	0	23	81	17	4,713
Irrigation Demand (1000m^3)		39	5	0	215	176	15	161	72	79	153	299	483	1,697
Storage volume (1,000m^3)	1,000	1,413	1,752	2,240	2,712	3,316	3,316	3,316	3,288	3,093	2,845	2,492	1,873	2,638
Water Level (m)	176.4	176.9	177.4	178.0	178.7	179.5	179.5	179.5	179.5	179.2	178.9	178.4	177.5	178.6
Water surface(1,000m^2)	642	689	727	782	835	903	903	903	899	878	850	810	740	826
Outflow														
Evapo.loss(1000m^3)		118	101	92	98	93	106	125	127	116	118	135	153	1,382
Irrigation water (1000m^3)		39	5	0	215	176	15	161	72	79	153	299	483	1,697
Spill (1000m^3)		0	0	0	0	232	496	33	0	0	0	0	0	761
Storage after Evp, Irri & Spill		1,413	1,752	2,240	2,712	3,316	3,316	3,316	3,288	3,093	2,845	2,492	1,873	
River Maint. Flow (1000m^3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Storage after Evp, Irri & RMF		1,413	1,752	2,240	2,712	3,316	3,316	3,316	3,288	3,093	2,845	2,492	1,873	
Total Outflow (1000m^3)		157	106	92	313	501	617	319	199	195	271	434	636	3,840
Water Shortage (1000m^3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Rainfall (mm)	1985	141	155	273	94	285	156	105	0	0	0	0	12	1,220
Runoff (1,000m^3)		388	427	752	259	784	430	288	0	0	0	0	32	3,360
Irrigation Demand (1000m^3)		69	6	0	343	188	42	162	231	79	175	376	469	2,140
Storage volume (1,000m^3)	1,873	2,056	2,365	3,017	2,824	3,316	3,316	3,316	2,958	2,768	2,479	1,974	1,395	2,649
Water Level (m)	177.5	177.8	178.2	179.1	178.8	179.5	179.5	179.5	179.0	178.8	178.4	177.7	176.9	178.6
Water surface(1,000m^2)	740	761	796	869	847	903	903	903	862	841	809	752	687	828
Outflow														
Evapo.loss(1000m^3)		136	112	100	109	94	106	125	127	111	114	129	142	1,405
Irrigation water (1000m^3)		69	6	0	343	188	42	162	231	79	175	376	469	2,140
Spill (1000m^3)		0	0	0	0	10	282	1	0	0	0	0	0	293
Storage after Evp, Irri & Spill		2,056	2,365	3,017	2,824	3,316	3,316	3,316	2,958	2,768	2,479	1,974	1,395	
River Maint. Flow (1000m^3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Storage after Evp, Irri & RMF		2,056	2,365	3,017	2,824	3,316	3,316	3,316	2,958	2,768	2,479	1,974	1,395	
Total Outflow (1000m^3)		205	118	100	452	292	430	288	358	190	289	505	611	3,838
Water Shortage (1000m^3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Rainfall (mm)	1986	30	212	157	173	634	33	163	0	0	0	8	23	1,433
Runoff (1,000m^3)		83	584	433	477	1,747	91	449	0	0	0	22	63	3,949
Irrigation Demand (1000m^3)		283	3	0	261	176	280	153	231	79	175	355	439	2,435
Storage volume (1,000m^3)	1,395	1,069	1,554	1,898	2,020	3,316	3,021	3,197	2,841	2,652	2,365	1,905	1,388	2,269
Water Level (m)	176.9	176.5	177.1	177.6	177.7	179.5	179.1	179.3	178.9	178.6	178.2	177.6	176.9	178.1
Water surface(1,000m^2)	687	650	705	743	757	903	869	889	849	828	796	744	686	785
Outflow														
Evapo.loss(1000m^3)		126	96	89	94	84	106	120	125	110	112	127	141	1,330
Irrigation water (1000m^3)		283	3	0	261	176	280	153	231	79	175	355	439	2,435
Spill (1000m^3)		0	0	0	0	191	0	0	0	0	0	0	0	191
Storage after Evp, Irri & Spill		1,069	1,554	1,898	2,020	3,316	3,021	3,197	2,841	2,652	2,365	1,905	1,388	
River Maint. Flow (1000m^3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Storage after Evp, Irri & RMF		1,069	1,554	1,898	2,020	3,316	3,021	3,197	2,841	2,652	2,365	1,905	1,388	
Total Outflow (1000m^3)		409	99	89	355	451	386	273	356	189	287	482	580	3,956
Water Shortage (1000m^3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Rainfall (mm)	1987	36	128	266	156	264	114	7	0	0	0	0	13	984
Runoff (1,000m^3)		98	353	733	430	727	314	19	0	0	0	0	36	2,710
Irrigation Demand (1000m^3)		269	14	0	267	196	84	383	231	79	175	376	466	2,540
Storage volume (1,000m^3)	1,388	1,091	1,334	1,981	2,049	2,496	2,631	2,153	1,813	1,639	1,368	883	334	1,648
Water Level (m)	176.9	176.5	176.8	177.7	177.8	178.4	178.6	177.9	177.5	177.2	176.9	176.2	175.5	177.2
Water surface(1,000m^2)	686	653	680	753	760	810	826	772	734	714	684	629	568	715
Outflow														
Evapo.loss(1000m^3)		126	96	86	95	84	95	114	109	95	96	109	119	1,224
Irrigation water (1000m^3)		269	14	0	267	196	84	383	231	79	175	376	466	2,540
Spill (1000m^3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Storage after Evp, Irri & Spill		1,091	1,334	1,981	2,049	2,496	2,631	2,153	1,813	1,639	1,368	883	334	
River Maint. Flow (1000m^3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Storage after Evp, Irri & RMF		1,091	1,334	1,981	2,049	2,496	2,631	2,153	1,813	1,639	1,368	883	334	
Total Outflow (1000m^3)		395	110	86	362	280	179	497	340	174	271	485	585	3,764
Water Shortage (1000m^3)		0	0	0	0	0	0	0	0	0	0	0	0	0

(continued)

(continue)

	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
Monthly Rainfall (mm)	1988	4	154	102	196	342	0	107	0	0	0	0	53	956
Runoff (1,000m²)		10	424	280	539	942	0	295	0	0	0	0	146	2,636
Irrigation Demand (1000m³)		353	6	7	252	179	366	162	231	79	175	376	362	2,548
Storage volume (1,000m³)	334	0	340	541	754	1,449	1,002	1,046	724	566	311	0	0	561
Water Level (m)	175.5	175.0	175.5	175.7	176.0	177.0	176.4	176.4	176.0	175.8	175.4	175.0	175.0	175.8
Water surface(1,000m²)	568	530	568	591	615	693	643	648	611	594	565	530	530	593
Outflow														
Evapo.loss(1000m³)		104	78	72	74	68	81	89	91	79	80	90	100	1,006
Irrigation water (1000m³)		240	6	7	252	179	366	162	231	79	175	221	46	1,964
Spill (1000m³)		0	0	0	0	0	0	0	0	0	0	0	0	0
Storage after Evp, Irri & Spill		0	340	541	754	1,449	1,002	1,046	724	566	311	0	0	
River Maint. Flow (1000m³)		0	0	0	0	0	0	0	0	0	0	0	0	0
Storage after Evp, Irri & RMF		0	340	541	754	1,449	1,002	1,046	724	566	311	0	0	
Total Outflow (1000m³)		344	84	79	326	247	447	251	322	158	255	311	146	2,970
Water Shortage (1000m³)		113	0	0	0	0	0	0	0	0	0	155	316	584
Monthly Rainfall (mm)	1989	83	147	159	178	285	142	67	0	0	0	139	21	1,220
Runoff (1,000m²)		229	405	438	490	785	391	183	0	0	0	382	58	3,361
Irrigation Demand (1000m³)		151	8	0	258	188	54	236	231	79	175	67	444	1,891
Storage volume (1,000m³)	0	0	319	686	842	1,370	1,627	1,476	1,147	983	722	940	434	879
Water Level (m)	175.0	175.0	175.4	175.9	176.1	176.9	177.2	177.0	176.6	176.3	176.0	176.3	175.6	176.2
Water surface(1,000m²)	530	530	566	607	625	684	713	696	659	640	611	636	579	629
Outflow														
Evapo.loss(1000m³)		97	78	71	76	69	80	98	98	85	86	97	120	1,055
Irrigation water (1000m³)		132	8	0	258	188	54	236	231	79	175	67	444	1,872
Spill (1000m³)		0	0	0	0	0	0	0	0	0	0	0	0	0
Storage after Evp, Irri & Spill		0	319	686	842	1,370	1,627	1,476	1,147	983	722	940	434	
River Maint. Flow (1000m³)		0	0	0	0	0	0	0	0	0	0	0	0	0
Storage after Evp, Irri & RMF		0	319	686	842	1,370	1,627	1,476	1,147	983	722	940	434	
Total Outflow (1000m³)		229	86	71	334	257	134	334	329	164	261	164	564	2,927
Water Shortage (1000m³)		19	0	0	0	0	0	0	0	0	0	0	0	19
Monthly Rainfall (mm)	1990	7	106	310	299	354	234	139	0	0	0	0	46	1,494
Runoff (1,000m²)		19	292	853	823	976	643	383	0	0	0	0	127	4,116
Irrigation Demand (1000m³)		345	22	0	209	179	10	157	231	79	175	376	380	2,163
Storage volume (1,000m³)	434	2	194	977	1,510	2,229	2,771	2,881	2,530	2,346	2,064	1,567	1,181	1,688
Water Level (m)	175.6	175.0	175.3	176.3	177.0	178.0	178.8	178.9	178.4	178.2	177.8	177.1	176.6	177.3
Water surface(1,000m²)	579	530	552	640	700	780	841	854	814	794	762	706	663	720
Outflow														
Evapo.loss(1000m³)		106	78	70	81	78	91	116	120	105	107	121	133	1,206
Irrigation water (1000m³)		345	22	0	209	179	10	157	231	79	175	376	380	2,163
Spill (1000m³)		0	0	0	0	0	0	0	0	0	0	0	0	0
Storage after Evp, Irri & Spill		2	194	977	1,510	2,229	2,771	2,881	2,530	2,346	2,064	1,567	1,181	
River Maint. Flow (1000m³)		0	0	0	0	0	0	0	0	0	0	0	0	0
Storage after Evp, Irri & RMF		2	194	977	1,510	2,229	2,771	2,881	2,530	2,346	2,064	1,567	1,181	
Total Outflow (1000m³)		451	100	70	290	257	101	273	351	184	282	497	513	3,369
Water Shortage (1000m³)		0	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Rainfall (mm)	1991	0	136	213	275	425	432	149	0	17	61	34	12	1,753
Runoff (1,000m²)		0	375	587	757	1,172	1,191	410	0	45	167	94	33	4,831
Irrigation Demand (1000m³)		361	12	0	218	176	0	156	231	68	43	288	467	2,020
Storage volume (1,000m³)	1,181	699	973	1,479	1,930	2,843	3,316	3,316	2,958	2,824	2,834	2,505	1,918	2,300
Water Level (m)	176.6	175.9	176.3	177.0	177.6	178.9	179.5	179.5	179.0	178.8	178.8	178.4	177.6	178.1
Water surface(1,000m²)	663	609	639	696	747	849	903	903	862	847	848	811	746	788
Outflow														
Evapo.loss(1000m³)		121	89	81	88	83	99	125	127	111	114	135	153	1,326
Irrigation water (1000m³)		361	12	0	218	176	0	156	231	68	43	288	467	2,020
Spill (1000m³)		0	0	0	0	0	619	129	0	0	0	0	0	748
Storage after Evp, Irri & Spill		699	973	1,479	1,930	2,843	3,316	3,316	2,958	2,824	2,834	2,505	1,918	
River Maint. Flow (1000m³)		0	0	0	0	0	0	0	0	0	0	0	0	0
Storage after Evp, Irri & RMF		699	973	1,479	1,930	2,843	3,316	3,316	2,958	2,824	2,834	2,505	1,918	
Total Outflow (1000m³)		482	101	81	306	259	718	410	358	179	157	423	620	4,094
Water Shortage (1000m³)		0	0	0	0	0	0	0	0	0	0	0	0	0

(continued)

(continue)

	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
Monthly Rainfall (mm)	1992	25	256	209	226	277	108	27	0	31	0	0	10	1,168
Runoff (1,000m^2)		68	706	576	623	762	298	74	0	85	0	0	28	3,220
Irrigation Demand (1000m^3)		298	2	0	238	192	90	332	231	59	175	376	472	2,465
Storage volume (1,000m^3)	1,918	1,552	2,152	2,631	2,912	3,316	3,316	2,933	2,581	2,501	2,217	1,717	1,136	2,414
Water Level (m)	177.6	177.1	177.9	178.6	179.0	179.5	179.5	179.0	178.5	178.4	178.0	177.3	176.5	178.3
Water surface(1,000m^2)	746	704	772	826	857	903	903	860	820	811	779	723	658	801
Outflow														
Evapo.loss(1000m^3)		136	104	97	104	95	106	125	121	106	109	124	137	1,364
Irrigation water (1000m^3)		298	2	0	238	192	90	332	231	59	175	376	472	2,465
Spill (1000m^3)		0	0	0	0	71	102	0	0	0	0	0	0	173
Storage after Evp , Irri & Spill		1,552	2,152	2,631	2,912	3,316	3,316	2,933	2,581	2,501	2,217	1,717	1,136	
River Maint. Flow (1000m^3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Storage after Evp, Irri & RMF		1,552	2,152	2,631	2,912	3,316	3,316	2,933	2,581	2,501	2,217	1,717	1,136	
Total Outflow (1000m^3)		434	106	97	342	358	298	457	352	165	284	500	609	4,002
Water Shortage (1000m^3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Rainfall (mm)	1993	89	297	210	172	247	112	0	0	0	0	80	39	1,246
Runoff (1,000m^2)		244	818	579	474	682	310	0	0	0	0	219	107	3,433
Irrigation Demand (1000m^3)		140	1	0	261	202	85	401	231	79	175	170	399	2,144
Storage volume (1,000m^3)	1,136	1,120	1,841	2,327	2,440	2,831	2,957	2,437	2,093	1,915	1,639	1,574	1,148	2,027
Water Level (m)	176.5	176.5	177.5	178.2	178.3	178.8	179.0	178.3	177.8	177.6	177.2	177.1	176.6	177.8
Water surface(1,000m^2)	658	656	737	791	804	848	862	804	765	745	714	707	659	758
Outflow														
Evapo.loss(1000m^3)		120	96	93	100	89	99	119	113	99	101	114	134	1,277
Irrigation water (1000m^3)		140	1	0	261	202	85	401	231	79	175	170	399	2,144
Spill (1000m^3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Storage after Evp, Irri & Spill		1,120	1,841	2,327	2,440	2,831	2,957	2,437	2,093	1,915	1,639	1,574	1,148	
River Maint. Flow (1000m^3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Storage after Evp, Irri & RMF		1,120	1,841	2,327	2,440	2,831	2,957	2,437	2,093	1,915	1,639	1,574	1,148	
Total Outflow (1000m^3)		260	97	93	361	291	184	520	344	178	276	284	533	3,421
Water Shortage (1000m^3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Average														
Monthly Rainfall (mm)		62	175	211	205	351	156	88	6	5	7	29	23	1,318
Runoff (1,000m^2)		171	483	581	566	968	429	242	17	13	19	80	65	3,634
Irrigation Demand (1000m^3)		231	8	1	252	185	103	230	215	76	160	306	438	2,205
Storage volume (1,000m^3)	1,066	900	1,282	1,778	1,999	2,648	2,727	2,607	2,293	2,129	1,884	1,556	1,081	22,884
Water Level (m)	176.0	176.0	177.0	177.0	178.0	179.0	179.0	179.0	178.0	178.0	178.0	177.0	176.0	177.7
Water surface(1,000m^2)	650	631	674	730	755	828	836	823	788	769	742	705	651	8,932
Outflow														
Evapo.loss(1000m^3)		119	93	85	92	84	97	116	116	102	104	118	133	1,259
Irrigation water (1000m^3)		218	8	1	252	185	103	230	215	76	160	290	407	2,145
Spill (1000m^3)		0	0	0	0	50	150	16	0	0	0	0	0	216
Storage after Evp, Irri & Spill		900	1,282	1,778	1,999	2,648	2,727	2,607	2,293	2,129	1,884	1,556	1,081	22,884
River Maint. Flow (1000m^3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Storage after Evp, Irri & RMF		900	1,282	1,778	1,999	2,648	2,727	2,607	2,293	2,129	1,884	1,556	1,081	22,884
Total Outflow (1000m^3)		337	101	86	344	319	349	362	331	178	263	409	540	3,619
Water Shortage (1000m^3)		13	0	0	0	0	0	0	0	0	0	16	32	61

Release of River Maintenance Flow (0% of Runoff)

Month		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
River M. Flow (1000m3)	0%	0	0	0	0	0	0	0	0	0	0	0	0	0

Estimated Potential evapotraspiration (ETo mm/day) in Mukdahan

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Eto	6.1	4.9	4.2	4.2	3.7	3.9	4.6	4.7	4.3	4.5	5.3	6.3

Table 7.1-9 Irrigation Demand to the Huai Lak Reservoir (Case 1-2)

	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	year
Crop Water Requirement (mm)	**(linked with YMKDYKc-Wrq.xls)**													
Wet S. Rice (1)		0	0	75	261	248	148	165	79	0	0	0	0	976
Soybean		143	44	0	0	0	0	0	0	0	43	139	198	567
Sweet Corn		67	0	0	0	0	0	0	0	0	43	127	159	396
Watermelon		156	71	26	0	0	0	0	0	0	54	178	245	730
Vegetables		203	171	0	0	123	136	0	0	143	157	0	0	933
Fruit Trees		165	132	113	113	100	105	124	127	116	122	143	170	1,530
Irrigation Demand														
Effective Rainfall (mm)	1984	137	128	138	153.3	160	140.7	92.9	62.2	0	8.2	29	6	1,055
Wet S. Rice (1) (mm)		0	0	0	171	140	12	114	27	0	0	0	0	464
($1000m^3$)		0	0	0	215	176	15	143	34	0	0	0	0	583
Soybean (mm)		10	0	0	0	0	0	0	0	0	55	174	305	544
($1000m^3$)		6	0	0	0	0	0	0	0	0	31	99	173	309
Sweet Corn (mm)		0	0	0	0	0	0	0	0	0	55	155	243	453
($1000m^3$)		0	0	0	0	0	0	0	0	0	19	53	84	156
Watermelon (mm)		31	0	0	0	0	0	0	0	0	73	236	379	688
($1000m^3$)		11	0	0	0	0	0	0	0	0	25	81	130	236
Vegetables (mm)		105	68	0	0	0	0	0	0	227	236	0	0	636
($1000m^3$)		5	3	0	0	0	0	0	0	11	11	0	0	30
Fruit Trees (mm)		45	6	0	0	0	0	49	103	184	181	180	260	1,008
($1000m^3$)		17	2	0	0	0	0	18	38	68	67	66	96	372
($1000m^3$)		39	5	0	215	176	15	161	72	79	153	299	483	1,697
Effective Rainfall (mm)	1985	121	127	151	94	153.2	127.1	92.3	0	0	0	0	11.5	877
Wet S. Rice (1) (mm)		0	0	0	265	150	33	115	125	0	0	0	0	688
($1000m^3$)		0	0	0	332	188	41	144	157	0	0	0	0	862
Soybean (mm)		34	0	0	0	0	0	0	0	0	68	221	296	619
($1000m^3$)		19	0	0	0	0	0	0	0	0	39	126	168	352
Sweet Corn (mm)		0	0	0	0	0	0	0	0	0	68	202	234	504
($1000m^3$)		0	0	0	0	0	0	0	0	0	23	69	80	172
Watermelon (mm)		55	0	0	0	0	0	0	0	0	86	283	371	740
($1000m^3$)		19	0	0	0	0	0	0	0	0	30	97	128	255
Vegetables (mm)		130	70	0	0	0	14	0	0	227	249	0	0	690
($1000m^3$)		6	3	0	0	0	1	0	0	11	12	0	0	33
Fruit Trees (mm)		69	8	0	30	0	0	50	202	184	194	227	252	1,216
($1000m^3$)		25	3	0	11	0	0	18	74	68	71	84	93	447
($1000m^3$)		69	6	0	343	188	42	162	231	79	175	376	469	2,140
Effective Rainfall (mm)	1986	30	138	127	130.1	160	33	96.3	0	0	0	8	23	746
Wet S. Rice (1) (mm)		0	0	0	208	140	183	109	125	0	0	0	0	765
($1000m^3$)		0	0	0	261	176	230	137	157	0	0	0	0	961
Soybean (mm)		179	0	0	0	0	0	0	0	0	68	208	278	733
($1000m^3$)		102	0	0	0	0	0	0	0	0	39	118	158	417
Sweet Corn (mm)		59	0	0	0	0	0	0	0	0	68	189	216	473
($1000m^3$)		20	0	0	0	0	0	0	0	0	23	65	74	162
Watermelon (mm)		200	0	0	0	0	0	0	0	0	86	270	352	708
($1000m^3$)		69	0	0	0	0	0	0	0	0	30	93	121	244
Vegetables (mm)		275	53	0	0	0	163	0	0	227	249	0	0	967
($1000m^3$)		13	3	0	0	0	8	0	0	11	12	0	0	47
Fruit Trees (mm)		214	0	0	0	0	114	44	202	184	194	214	233	1,399
($1000m^3$)		79	0	0	0	0	42	16	74	68	71	79	86	515
($1000m^3$)		283	3	0	261	176	280	153	231	79	175	355	439	2,435

(continued)

(continue)

		Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	year
Effective Rainfall	(mm)	1987	36	115	150	127.1	149.5	107.3	7	0	0	0	0	13	704
Wet S. Rice (1)	(mm)		0	0	0	213	156	65	251	125	0	0	0	0	810
	($1000m^3$)		0	0	0	267	196	82	315	157	0	0	0	0	1,017
Soybean	(mm)		171	0	0	0	0	0	0	0	0	68	221	294	754
	($1000m^3$)		97	0	0	0	0	0	0	0	0	39	126	167	429
Sweet Corn	(mm)		50	0	0	0	0	0	0	0	0	68	202	232	502
	($1000m^3$)		17	0	0	0	0	0	0	0	0	23	69	80	172
Watermelon	(mm)		191	0	0	0	0	0	0	0	0	86	283	368	737
	($1000m^3$)		66	0	0	0	0	0	0	0	0	30	97	127	254
Vegetables	(mm)		266	90	0	0	0	46	0	0	227	249	0	0	878
	($1000m^3$)		13	4	0	0	0	2	0	0	11	12	0	0	42
Fruit Trees	(mm)		206	28	0	0	0	0	186	202	184	194	227	249	1,476
	($1000m^3$)		76	10	0	0	0	0	68	74	68	71	84	92	543
	($1000m^3$)		269	14	0	267	196	84	383	231	79	175	376	466	2,540
Effective Rainfall	(mm)	1988	3.5	127	101	134.2	157.7	0	92.4	0	0	0	0	53	668
Wet S. Rice (1)	(mm)		0	0	0	201	143	235	115	125	0	0	0	0	819
	($1000m^3$)		0	0	0	252	179	295	144	157	0	0	0	0	1,027
Soybean	(mm)		221	0	0	0	0	0	0	0	0	68	221	230	740
	($1000m^3$)		126	0	0	0	0	0	0	0	0	39	126	131	422
Sweet Corn	(mm)		101	0	0	0	0	0	0	0	0	68	202	168	438
	($1000m^3$)		35	0	0	0	0	0	0	0	0	23	69	58	150
Watermelon	(mm)		242	0	0	0	0	0	0	0	0	86	283	305	674
	($1000m^3$)		83	0	0	0	0	0	0	0	0	30	97	105	232
Vegetables	(mm)		317	70	0	0	0	216	0	0	227	249	0	0	1,079
	($1000m^3$)		15	3	0	0	0	10	0	0	11	12	0	0	51
Fruit Trees	(mm)		256	8	19	0	0	167	50	202	184	194	227	186	1,493
	($1000m^3$)		94	3	7	0	0	61	18	74	68	71	84	68	548
	($1000m^3$)		353	6	7	252	179	366	162	231	79	175	376	362	2,548
Effective Rainfall	(mm)	1989	83	124	128	131	153.3	121.8	63.9	0	0	0	120	21	946
Wet S. Rice (1)	(mm)		0	0	0	206	150	42	160	125	0	0	0	0	683
	($1000m^3$)		0	0	0	258	188	53	201	157	0	0	0	0	857
Soybean	(mm)		95	0	0	0	0	0	0	0	0	68	30	281	474
	($1000m^3$)		54	0	0	0	0	0	0	0	0	39	17	160	270
Sweet Corn	(mm)		0	0	0	0	0	0	0	0	0	68	11	219	298
	($1000m^3$)		0	0	0	0	0	0	0	0	0	23	4	75	102
Watermelon	(mm)		116	0	0	0	0	0	0	0	0	86	92	356	534
	($1000m^3$)		40	0	0	0	0	0	0	0	0	30	32	122	184
Vegetables	(mm)		190	74	0	0	0	23	0	0	227	249	0	0	763
	($1000m^3$)		9	4	0	0	0	1	0	0	11	12	0	0	37
Fruit Trees	(mm)		130	12	0	0	0	0	95	202	184	194	37	237	1,091
	($1000m^3$)		48	4	0	0	0	0	35	74	68	71	14	87	401
	($1000m^3$)		151	8	0	258	188	54	236	231	79	175	67	444	1,891
Effective Rainfall	(mm)	1990	7	103	156	155.8	158.2	143	94.3	0	0	0	0	46	864
Wet S. Rice (1)	(mm)		0	0	0	167	143	8	112	125	0	0	0	0	555
	($1000m^3$)		0	0	0	209	179	10	140	157	0	0	0	0	695
Soybean	(mm)		216	0	0	0	0	0	0	0	0	68	221	241	746
	($1000m^3$)		123	0	0	0	0	0	0	0	0	39	126	137	425
Sweet Corn	(mm)		95	0	0	0	0	0	0	0	0	68	202	179	449
	($1000m^3$)		33	0	0	0	0	0	0	0	0	23	69	62	154
Watermelon	(mm)		237	0	0	0	0	0	0	0	0	86	283	316	685
	($1000m^3$)		82	0	0	0	0	0	0	0	0	30	97	109	236
Vegetables	(mm)		311	108	0	0	0	0	0	0	227	249	0	0	895
	($1000m^3$)		15	5	0	0	0	0	0	0	11	12	0	0	43
Fruit Trees	(mm)		251	46	0	0	0	0	47	202	184	194	227	197	1,348
	($1000m^3$)		92	17	0	0	0	0	17	74	68	71	84	72	495
	($1000m^3$)		345	22	0	209	179	10	157	231	79	175	376	380	2,163

(Continued)

(continue)

		Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	year
Effective Rainfall	(mm)	1991	0	119	138	151.4	160	160	94.9	0	17	61	34	12	946
Wet S. Rice (1)	(mm)		0	0	0	174	140	0	111	125	0	0	0	0	550
	($1000m^3$)		0	0	0	218	176	0	139	157	0	0	0	0	690
Soybean	(mm)		227	0	0	0	0	0	0	0	0	0	167	295	689
	($1000m^3$)		129	0	0	0	0	0	0	0	0	0	95	168	392
Sweet Corn	(mm)		106	0	0	0	0	0	0	0	0	0	147	233	380
	($1000m^3$)		36	0	0	0	0	0	0	0	0	0	51	80	131
Watermelon	(mm)		248	0	0	0	0	0	0	0	0	0	228	370	598
	($1000m^3$)		85	0	0	0	0	0	0	0	0	0	78	127	205
Vegetables	(mm)		322	83	0	0	0	0	0	0	201	153	0	0	759
	($1000m^3$)		15	4	0	0	0	0	0	0	10	7	0	0	36
Fruit Trees	(mm)		262	21	0	0	0	0	46	202	158	98	173	251	1,211
	($1000m^3$)		96	8	0	0	0	0	17	74	58	36	64	92	445
	($1000m^3$)		361	12	0	218	176	0	156	231	68	43	288	467	2,020
Effective Rainfall	(mm)	1992	25	148	137	141.2	151.8	104.2	26.9	0	31	0	0	10	775
Wet S. Rice (1)	(mm)		0	0	0	190	153	70	219	125	0	0	0	0	757
	($1000m^3$)		0	0	0	238	192	88	275	157	0	0	0	0	950
Soybean	(mm)		188	0	0	0	0	0	0	0	0	68	221	298	775
	($1000m^3$)		107	0	0	0	0	0	0	0	0	39	126	169	441
Sweet Corn	(mm)		67	0	0	0	0	0	0	0	0	68	202	237	507
	($1000m^3$)		23	0	0	0	0	0	0	0	0	23	69	82	174
Watermelon	(mm)		208	0	0	0	0	0	0	0	0	86	283	373	742
	($1000m^3$)		72	0	0	0	0	0	0	0	0	30	97	128	255
Vegetables	(mm)		283	36	0	0	0	50	0	0	178	249	0	0	796
	($1000m^3$)		14	2	0	0	0	2	0	0	9	12	0	0	39
Fruit Trees	(mm)		223	0	0	0	0	1	154	202	135	194	227	254	1,390
	($1000m^3$)		82	0	0	0	0	0	57	74	50	71	84	93	511
	($1000m^3$)		298	2	0	238	192	90	332	231	59	175	376	472	2,465
Effective Rainfall	(mm)	1993	89	155	137	130	146.4	106.4	0	0	0	0	80	38.7	882
Wet S. Rice (1)	(mm)		0	0	0	208	161	66	262	125	0	0	0	0	822
	($1000m^3$)		0	0	0	261	202	83	329	157	0	0	0	0	1,032
Soybean	(mm)		87	0	0	0	0	0	0	0	0	68	94	253	502
	($1000m^3$)		49	0	0	0	0	0	0	0	0	39	53	144	285
Sweet Corn	(mm)		0	0	0	0	0	0	0	0	0	68	75	191	334
	($1000m^3$)		0	0	0	0	0	0	0	0	0	23	26	66	115
Watermelon	(mm)		107	0	0	0	0	0	0	0	0	86	156	327	569
	($1000m^3$)		37	0	0	0	0	0	0	0	0	30	54	112	196
Vegetables	(mm)		182	25	0	0	0	47	0	0	227	249	0	0	730
	($1000m^3$)		9	1	0	0	0	2	0	0	11	12	0	0	35
Fruit Trees	(mm)		121	0	0	0	0	0	197	202	184	194	101	208	1,207
	($1000m^3$)		45	0	0	0	0	0	72	74	68	71	37	77	444
	($1000m^3$)		140	1	0	261	202	85	401	231	79	175	170	399	2,144

Note) 1) irrigation efficiency =0.63 except sugarcane. (0.54 for sugarcane)

2) Irrigation water(m3*1000)=irrigation water(mm)/1000*cropping acreage(m2*1000)

7.1.5 Water Balance of Huai Bang Sai Pump Irrigation

Table 7.1-10 Major Elements of Huai Bang Sai Pump Irrigation

Total Farm Land	Paddy	Upland	Total
	333 rai	1,113 rai	1,446 rai
Crops for Irrigation	(ha)	(rai)	(%)
Wet S. Rice	53.28	333	23.0%
Maize	74.08	463	32.0%
Tomato (upland)	74.08	463	32.0%
Soybean	17.28	108	7.5%
Sweet Corn	17.28	108	7.5%
Watermelon	17.28	108	7.5%
Vegetables	11.52	72	5.0%
Rubber Tree	69.44	434	30.0%
Fruit Trees	23.20	145	10.0%
Catchment Area	564 km2	Rainfall Station	Code : 23803 (04023503)
Drought Flow	1.5 m^3/sec (1/10 yr)	Intake Capacity of Pump	0.30 m^3/sec

Table 7.1-11 Water Balance of Huai Bang Sai Pump Irrigation

	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
Monthly Rainfall (mm)	1984	207	162	211	285	401	224	116	62	0	8	29	6	1,710
Irrigation Demand (1000m3)		65	14	5	91	75	6	171	210	282	249	287	431	1,886
Operation Time (hrs/day)		2	0	0	3	2	0	5	6	9	8	9	13	5
Water Shortage (1000m3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Rainfall (mm)	1985	141	155	273	94	285	156	105	0	0	0	0	12	1,220
Irrigation Demand (1000m3)		103	16	0	172	80	20	173	439	282	270	359	417	2,331
Operation Time (hrs/day)		3	0	0	5	2	1	5	14	9	8	11	13	6
Water Shortage (1000m3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Rainfall (mm)	1986	30	212	157	173	634	33	163	0	0	0	8	23	1,433
Irrigation Demand (1000m3)		332	6	17	111	75	311	158	439	282	270	340	389	2,730
Operation Time (hrs/day)		10	0	1	3	2	10	5	14	9	8	10	12	7
Water Shortage (1000m3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Rainfall (mm)	1987	36	128	266	156	264	114	7	0	0	0	0	13	984
Irrigation Demand (1000m3)		318	38	0	113	83	40	488	439	282	270	359	415	2,845
Operation Time (hrs/day)		10	1	0	3	3	1	15	14	9	8	11	13	7
Water Shortage (1000m3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Rainfall (mm)	1988	4	154	102	196	342	0	107	0	0	0	0	53	956
Irrigation Demand (1000m3)		401	17	68	107	76	438	173	439	282	270	359	316	2,946
Operation Time (hrs/day)		12	1	2	3	2	14	5	14	9	8	11	10	8
Water Shortage (1000m3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Rainfall (mm)	1989	83	147	159	178	285	142	67	0	0	0	139	21	1,220
Irrigation Demand (1000m3)		194	22	17	110	80	25	277	439	282	270	62	396	2,174
Operation Time (hrs/day)		6	1	1	3	2	1	9	14	9	8	2	12	6
Water Shortage (1000m3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Rainfall (mm)	1990	7	106	310	299	354	234	139	0	0	0	0	46	1,494
Irrigation Demand (1000m3)		391	60	0	89	76	4	166	439	282	270	359	334	2,470
Operation Time (hrs/day)		12	2	0	3	2	0	5	14	9	8	11	10	6
Water Shortage (1000m3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Rainfall (mm)	1991	0	136	213	275	425	432	149	0	17	61	34	12	1,753
Irrigation Demand (1000m3)		410	32	4	93	75	0	163	439	233	120	273	416	2,258
Operation Time (hrs/day)		13	1	0	3	2	0	5	14	7	4	8	13	6
Water Shortage (1000m3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Rainfall (mm)	1992	25	256	209	226	277	108	27	0	31	0	0	10	1,168
Irrigation Demand (1000m3)		346	4	6	101	82	44	414	439	189	270	359	421	2,675
Operation Time (hrs/day)		11	0	0	3	3	1	13	14	6	8	11	13	7
Water Shortage (1000m3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Rainfall (mm)	1993	89	297	210	172	247	112	0	0	0	0	80	39	1,246
Irrigation Demand (1000m3)		181	3	5	111	86	40	514	439	282	270	160	351	2,442
Operation Time (hrs/day)		6	0	0	3	3	1	16	14	9	8	5	11	6
Water Shortage (1000m3)		0	0	0	0	0	0	0	0	0	0	0	0	0
Average														
Monthly Rainfall (mm)		62	175	211	205	351	156	88	6	5	7	29	23	1,318
Irrigation Demand (1000m3)		274	21	12	110	79	93	270	416	268	253	292	389	2,477
Operation Time (hrs/day)		8	1	0	3	2	3	8	13	8	8	9	12	6
Water Shortage (1000m3)		0	0	0	0	0	0	0	0	0	0	0	0	0

Table 7.1-12 Irrigation Demand of the Huai Bang Sai Pump Irrigation

	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	year
Crop Water Requirement (mm)	**(linked with IWR.xls)**													
Wet S. Rice		0	6	75	261	248	148	165	79	0	0	0	0	976
Maize		130	191	142	78	0	0	0	0	0	0	0	0	541
Tomato (upland)		0	0	0	0	39	97	143	138	55	0	0	0	472
Soybean		143	44	0	0	0	0	0	0	0	43	139	198	567
Sweet Corn		67	0	0	0	0	0	0	0	0	43	127	159	396
Watermelon		156	71	26	0	0	0	0	0	0	54	178	245	730
Vegetables		203	171	0	0	123	136	0	0	143	157	0	0	933
Rubber Trees		165	132	113	113	100	105	124	127	116	122	143	170	1,530
Fruit Trees		165	132	113	113	100	105	124	127	116	122	143	170	1,530
Irrigation Demand														
Effective Rainfall	(mm)	1984	136.7	128.1	137.5	153.3	160	140.7	92.9	62.2	0	8.2	29.3	6	1,055
Wet S. Rice	(mm)		0	0	0	171	140	12	114	27	0	0	0	0	464
	($1000m^3$)		0	0	0	91	75	6	61	14	0	0	0	0	247
Maize	(mm)				7	0	0	0	0	0					7
	($1000m^3$)				5	0	0	0	0	0					5
Tomato	(mm)		0	0	0	0	0	0	80	120	87	0	0	0	287
(upland)	($1000m^3$)		0	0	0	0	0	0	59	89	64	0	0	0	212
Soybean	(mm)		10	0	0	0	0	0	0	0	0	55	174	305	544
	($1000m^3$)		2	0	0	0	0	0	0	0	0	10	30	53	95
Sweet Corn	(mm)		0	0	0	0	0	0	0	0	0	55	155	243	453
	($1000m^3$)		0	0	0	0	0	0	0	0	0	10	27	42	79
Watermelon	(mm)		31	0	0	0	0	0	0	0	0	73	236	379	688
	($1000m^3$)		5	0	0	0	0	0	0	0	0	13	41	65	119
Vegetables	(mm)		105	68	0	0	0	0	0	0	227	236	0	0	636
	($1000m^3$)		12	8	0	0	0	0	0	0	26	27	0	0	73
Rubber Trees	(mm)		52	7	0	0	0	0	58	120	215	211	211	304	1,178
	($1000m^3$)		36	5	0	0	0	0	40	83	149	147	147	211	818
Fruit Trees	(mm)		45	6	0	0	0	0	49	103	184	181	180	260	1,008
	($1000m^3$)		10	1	0	0	0	0	11	24	43	42	42	60	233
	($1000m^3$)		65	14	5	91	75	6	171	210	282	249	287	431	1,886
Effective Rainfall	(mm)	1985	121.3	126.9	151.1	94	153.2	127.1	92.3	0	0	0	0	11.5	877
Wet S. Rice	(mm)		0	0	0	265	150	33	115	125	0	0	0	0	688
	($1000m^3$)		0	0	0	141	80	18	61	67	0	0	0	0	367
Maize	(mm)				0	0	0	0	0	0					0
	($1000m^3$)				0	0	0	0	0	0					0
Tomato	(mm)		0	0	0	0	0	0	80	219	87	0	0	0	386
(upland)	($1000m^3$)		0	0	0	0	0	0	59	162	64	0	0	0	285
Soybean	(mm)		34	0	0	0	0	0	0	0	0	68	221	296	619
	($1000m^3$)		6	0	0	0	0	0	0	0	0	12	38	51	107
Sweet Corn	(mm)		0	0	0	0	0	0	0	0	0	68	202	234	504
	($1000m^3$)		0	0	0	0	0	0	0	0	0	12	35	40	87
Watermelon	(mm)		55	0	0	0	0	0	0	0	0	86	283	371	740
	($1000m^3$)		10	0	0	0	0	0	0	0	0	15	49	64	128
Vegetables	(mm)		130	70	0	0	0	14	0	0	227	249	0	0	690
	($1000m^3$)		15	8	0	0	0	2	0	0	26	29	0	0	80
Rubber Trees	(mm)		81	9	0	35	0	0	59	235	215	226	265	294	1,419
	($1000m^3$)		56	6	0	24	0	0	41	163	149	157	184	204	984
Fruit Trees	(mm)		69	8	0	30	0	0	50	202	184	194	227	252	1,216
	($1000m^3$)		16	2	0	7	0	0	12	47	43	45	53	58	283
	($1000m^3$)		103	16	0	172	80	20	173	439	282	270	359	417	2,331

(continued)

(continue)

		Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	year
Effective Rainfall	(mm)	1986	30	137.9	127.3	130.1	160	33	96.3	0	0	0	8	23	746
Wet S. Rice	(mm)		0	0	0	208	140	183	109	125	0	0	0	0	765
	($1000m^3$)		0	0	0	111	75	98	58	67	0	0	0	0	409
Maize	(mm)				23	0	0	0	0	0					23
	($1000m^3$)				17	0	0	0	0	0					17
Tomato	(mm)		0	0	0	0	0	102	74	219	87	0	0	0	482
(upland)	($1000m^3$)		0	0	0	0	0	76	55	162	64	0	0	0	357
Soybean	(mm)		179	0	0	0	0	0	0	0	0	68	208	278	733
	($1000m^3$)		31	0	0	0	0	0	0	0	0	12	36	48	127
Sweet Corn	(mm)		59	0	0	0	0	0	0	0	0	68	189	216	473
	($1000m^3$)		10	0	0	0	0	0	0	0	0	12	33	37	82
Watermelon	(mm)		200	0	0	0	0	0	0	0	0	86	270	352	708
	($1000m^3$)		35	0	0	0	0	0	0	0	0	15	47	61	123
Vegetables	(mm)		275	53	0	0	0	163	0	0	227	249	0	0	967
	($1000m^3$)		32	6	0	0	0	19	0	0	26	29	0	0	112
Rubber Trees	(mm)		250	0	0	0	0	133	51	235	215	226	250	272	1,632
	($1000m^3$)		174	0	0	0	0	92	35	163	149	157	174	189	1,133
Fruit Trees	(mm)		214	0	0	0	0	114	44	202	184	194	214	233	1,399
	($1000m^3$)		50	0	0	0	0	26	10	47	43	45	50	54	325
	($1000m^3$)		332	6	17	111	75	311	158	439	282	270	340	389	2,730
Effective Rainfall	(mm)	1987	35.5	114.6	149.9	127.1	149.5	107.3	7	0	0	0	0	13	704
Wet S. Rice	(mm)		0	0	0	213	156	65	251	125	0	0	0	0	810
	($1000m^3$)		0	0	0	113	83	35	134	67	0	0	0	0	432
Maize	(mm)				0	0	0	0	0	0					0
	($1000m^3$)				0	0	0	0	0	0					0
Tomato	(mm)		0	0	0	0	0	0	216	219	87	0	0	0	522
(upland)	($1000m^3$)		0	0	0	0	0	0	160	162	64	0	0	0	386
Soybean	(mm)		171	0	0	0	0	0	0	0	0	68	221	294	754
	($1000m^3$)		30	0	0	0	0	0	0	0	0	12	38	51	131
Sweet Corn	(mm)		50	0	0	0	0	0	0	0	0	68	202	232	502
	($1000m^3$)		9	0	0	0	0	0	0	0	0	12	35	40	87
Watermelon	(mm)		191	0	0	0	0	0	0	0	0	86	283	368	737
	($1000m^3$)		33	0	0	0	0	0	0	0	0	15	49	64	128
Vegetables	(mm)		266	90	0	0	0	46	0	0	227	249	0	0	878
	($1000m^3$)		31	10	0	0	0	5	0	0	26	29	0	0	101
Rubber Trees	(mm)		240	32	0	0	0	0	217	235	215	226	265	291	1,721
	($1000m^3$)		167	22	0	0	0	0	151	163	149	157	184	202	1,195
Fruit Trees	(mm)		206	28	0	0	0	0	186	202	184	194	227	249	1,476
	($1000m^3$)		48	6	0	0	0	0	43	47	43	45	53	58	343
	($1000m^3$)		318	38	0	113	83	40	488	439	282	270	359	415	2,845
Effective Rainfall	(mm)	1988	3.5	126.7	100.8	134.2	157.7	0	92.4	0	0	0	0	53	668
Wet S. Rice	(mm)		0	0	0	201	143	235	115	125	0	0	0	0	819
	($1000m^3$)		0	0	0	107	76	125	61	67	0	0	0	0	436
Maize	(mm)				65	0	0	0	0	0					65
	($1000m^3$)				48	0	0	0	0	0					48
Tomato	(mm)		0	0	0	0	0	154	80	219	87	0	0	0	540
(upland)	($1000m^3$)		0	0	0	0	0	114	59	162	64	0	0	0	399
Soybean	(mm)		221	0	0	0	0	0	0	0	0	68	221	230	740
	($1000m^3$)		38	0	0	0	0	0	0	0	0	12	38	40	128
Sweet Corn	(mm)		101	0	0	0	0	0	0	0	0	68	202	168	438
	($1000m^3$)		17	0	0	0	0	0	0	0	0	12	35	29	76
Watermelon	(mm)		242	0	0	0	0	0	0	0	0	86	283	305	674
	($1000m^3$)		42	0	0	0	0	0	0	0	0	15	49	53	117
Vegetables	(mm)		317	70	0	0	0	216	0	0	227	249	0	0	1,079
	($1000m^3$)		37	8	0	0	0	25	0	0	26	29	0	0	125
Rubber Trees	(mm)		299	10	23	0	0	194	59	235	215	226	265	217	1,743
	($1000m^3$)		208	7	16	0	0	135	41	163	149	157	184	151	1,211
Fruit Trees	(mm)		256	8	19	0	0	167	50	202	184	194	227	186	1,493
	($1000m^3$)		59	2	4	0	0	39	12	47	43	45	53	43	347
	($1000m^3$)		401	17	68	107	76	438	173	439	282	270	359	316	2,946

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		Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	year
Effective Rainfall	(mm)	1989	83	124.4	127.6	131	153.3	121.8	63.9	0	0	0	120	21	946
Wet S. Rice	(mm)		0	0	0	206	150	42	160	125	0	0	0	0	683
	($1000m^3$)		0	0	0	110	80	22	85	67	0	0	0	0	364
Maize	(mm)				23	0	0	0	0	0					23
	($1000m^3$)				17	0	0	0	0	0					17
Tomato	(mm)		0	0	0	0	0	0	126	219	87	0	0	0	432
(upland)	($1000m^3$)		0	0	0	0	0	0	93	162	64	0	0	0	319
Soybean	(mm)		95	0	0	0	0	0	0	0	0	68	30	281	474
	($1000m^3$)		16	0	0	0	0	0	0	0	0	12	5	49	82
Sweet Corn	(mm)		0	0	0	0	0	0	0	0	0	68	11	219	298
	($1000m^3$)		0	0	0	0	0	0	0	0	0	12	2	38	52
Watermelon	(mm)		116	0	0	0	0	0	0	0	0	86	92	356	534
	($1000m^3$)		20	0	0	0	0	0	0	0	0	15	16	62	93
Vegetables	(mm)		190	74	0	0	0	23	0	0	227	249	0	0	763
	($1000m^3$)		22	9	0	0	0	3	0	0	26	29	0	0	89
Rubber Trees	(mm)		152	14	0	0	0	0	111	235	215	226	43	276	1,272
	($1000m^3$)		106	10	0	0	0	0	77	163	149	157	30	192	884
Fruit Trees	(mm)		130	12	0	0	0	0	95	202	184	194	37	237	1,091
	($1000m^3$)		30	3	0	0	0	0	22	47	43	45	9	55	254
	($1000m^3$)		194	22	17	110	80	25	277	439	282	270	62	396	2,174
Effective Rainfall	(mm)	1990	7	103.1	156.4	155.8	158.2	143	94.3	0	0	0	0	46	864
Wet S. Rice	(mm)		0	0	0	167	143	8	112	125	0	0	0	0	555
	($1000m^3$)		0	0	0	89	76	4	60	67	0	0	0	0	296
Maize	(mm)				0	0	0	0	0	0					0
	($1000m^3$)				0	0	0	0	0	0					0
Tomato	(mm)		0	0	0	0	0	0	77	219	87	0	0	0	383
(upland)	($1000m^3$)		0	0	0	0	0	0	57	162	64	0	0	0	283
Soybean	(mm)		216	0	0	0	0	0	0	0	0	68	221	241	746
	($1000m^3$)		37	0	0	0	0	0	0	0	0	12	38	42	129
Sweet Corn	(mm)		95	0	0	0	0	0	0	0	0	68	202	179	449
	($1000m^3$)		16	0	0	0	0	0	0	0	0	12	35	31	78
Watermelon	(mm)		237	0	0	0	0	0	0	0	0	86	283	316	685
	($1000m^3$)		41	0	0	0	0	0	0	0	0	15	49	55	119
Vegetables	(mm)		311	108	0	0	0	0	0	0	227	249	0	0	895
	($1000m^3$)		36	12	0	0	0	0	0	0	26	29	0	0	103
Rubber Trees	(mm)		293	54	0	0	0	0	55	235	215	226	265	230	1,573
	($1000m^3$)		203	37	0	0	0	0	38	163	149	157	184	160	1,091
Fruit Trees	(mm)		251	46	0	0	0	0	47	202	184	194	227	197	1,348
	($1000m^3$)		58	11	0	0	0	0	11	47	43	45	53	46	314
	($1000m^3$)		391	60	0	89	76	4	166	439	282	270	359	334	2,470
Effective Rainfall	(mm)	1991	0	118.7	138.1	151.4	160	160	94.9	0	16.5	60.5	34.1	12	946
Wet S. Rice	(mm)		0	0	0	174	140	0	111	125	0	0	0	0	550
	($1000m^3$)		0	0	0	93	75	0	59	67	0	0	0	0	294
Maize	(mm)				6	0	0	0	0	0					6
	($1000m^3$)				4	0	0	0	0	0					4
Tomato	(mm)		0	0	0	0	0	0	76	219	61	0	0	0	356
(upland)	($1000m^3$)		0	0	0	0	0	0	56	162	45	0	0	0	263
Soybean	(mm)		227	0	0	0	0	0	0	0	0	0	167	295	689
	($1000m^3$)		39	0	0	0	0	0	0	0	0	0	29	51	119
Sweet Corn	(mm)		106	0	0	0	0	0	0	0	0	0	147	233	380
	($1000m^3$)		18	0	0	0	0	0	0	0	0	0	25	40	65
Watermelon	(mm)		248	0	0	0	0	0	0	0	0	0	228	370	598
	($1000m^3$)		43	0	0	0	0	0	0	0	0	0	39	64	103
Vegetables	(mm)		322	83	0	0	0	0	0	0	201	153	0	0	759
	($1000m^3$)		37	10	0	0	0	0	0	0	23	18	0	0	88
Rubber Trees	(mm)		306	25	0	0	0	0	54	235	184	114	202	293	1,413
	($1000m^3$)		212	17	0	0	0	0	37	163	128	79	140	203	979
Fruit Trees	(mm)		262	21	0	0	0	0	46	202	158	98	173	251	1,211
	($1000m^3$)		61	5	0	0	0	0	11	47	37	23	40	58	282
	($1000m^3$)		410	32	4	93	75	0	163	439	233	120	273	416	2,258

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		Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	year
Effective Rainfall	(mm)	1992	24.8	148.1	137.1	141.2	151.8	104.2	26.9	0	31	0	0	10	775
Wet S. Rice	(mm)		0	0	0	190	153	70	219	125	0	0	0	0	757
	($1000m^3$)		0	0	0	101	82	37	117	67	0	0	0	0	404
Maize	(mm)				8	0	0	0	0	0					8
	($1000m^3$)				6	0	0	0	0	0					6
Tomato	(mm)		0	0	0	0	0	0	184	219	38	0	0	0	441
(upland)	($1000m^3$)		0	0	0	0	0	0	136	162	28	0	0	0	326
Soybean	(mm)		188	0	0	0	0	0	0	0	0	68	221	298	775
	($1000m^3$)		32	0	0	0	0	0	0	0	0	12	38	51	133
Sweet Corn	(mm)		67	0	0	0	0	0	0	0	0	68	202	237	507
	($1000m^3$)		12	0	0	0	0	0	0	0	0	12	35	41	88
Watermelon	(mm)		208	0	0	0	0	0	0	0	0	86	283	373	742
	($1000m^3$)		36	0	0	0	0	0	0	0	0	15	49	64	128
Vegetables	(mm)		283	36	0	0	0	50	0	0	178	249	0	0	796
	($1000m^3$)		33	4	0	0	0	6	0	0	21	29	0	0	93
Rubber Trees	(mm)		260	0	0	0	0	1	180	235	157	226	265	296	1,620
	($1000m^3$)		181	0	0	0	0	1	125	163	109	157	184	206	1,126
Fruit Trees	(mm)		223	0	0	0	0	1	154	202	135	194	227	254	1,390
	($1000m^3$)		52	0	0	0	0	0	36	47	31	45	53	59	323
	($1000m^3$)		346	4	6	101	82	44	414	439	189	270	359	421	2,675
Effective Rainfall	(mm)	1993	88.5	155.4	137.4	130	146.4	106.4	0	0	0	0	79.6	38.7	882
Wet S. Rice	(mm)		0	0	0	208	161	66	262	125	0	0	0	0	822
	($1000m^3$)		0	0	0	111	86	35	140	67	0	0	0	0	439
Maize	(mm)				7	0	0	0	0	0					7
	($1000m^3$)				5	0	0	0	0	0					5
Tomato	(mm)		0	0	0	0	0	0	227	219	87	0	0	0	533
(upland)	($1000m^3$)		0	0	0	0	0	0	168	162	64	0	0	0	394
Soybean	(mm)		87	0	0	0	0	0	0	0	0	68	94	253	502
	($1000m^3$)		15	0	0	0	0	0	0	0	0	12	16	44	87
Sweet Corn	(mm)		0	0	0	0	0	0	0	0	0	68	75	191	334
	($1000m^3$)		0	0	0	0	0	0	0	0	0	12	13	33	58
Watermelon	(mm)		107	0	0	0	0	0	0	0	0	86	156	327	569
	($1000m^3$)		18	0	0	0	0	0	0	0	0	15	27	57	99
Vegetables	(mm)		182	25	0	0	0	47	0	0	227	249	0	0	730
	($1000m^3$)		21	3	0	0	0	5	0	0	26	29	0	0	84
Rubber Trees	(mm)		142	0	0	0	0	0	230	235	215	226	117	243	1,408
	($1000m^3$)		99	0	0	0	0	0	160	163	149	157	81	169	978
Fruit Trees	(mm)		121	0	0	0	0	0	197	202	184	194	101	208	1,207
	($1000m^3$)		28	0	0	0	0	0	46	47	43	45	23	48	280
	($1000m^3$)		181	3	5	111	86	40	514	439	282	270	160	351	2,442

7.2 Cost Estimation of the Priority Areas

7.2.1 Project Cost of the On-Farm Development in Khon Kaen Priority Area

Table 7.2-1 Project Cost of On-Farm Development in Khon Kaen Priority Area

1. Project Cost

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. Civil Works	1	L.S	54,353	21,018	75,370
2. Engineering Survey and Design	1	L.S	-	10,944	10,944
3. Administration	1	L.S	5,435	2,102	7,537
4. Physical Contingencies	1	L.S	5,979	3,406	9,385
Sub-Total			65,767	37,470	103,236
5. Price Escalation	1	L.S	5,059	3,786	8,845
Total			70,826	41,255	112,081

2. Total Cost of Civil Works

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. 1,200m3 Farm Pond	1	L.S	19,425	8,325	27,750
2. Farm Road	1	L.S	34,928	12,693	47,620
Total			54,353	21,018	75,370

1) Farm Pond

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
1. 1,200m3 Farm Pond	740	Place	26,250	11,250	37,500	19,425	8,325	27,750

2) Farm Road

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. Main Farm Road	1	L.S	7,683	2,713	10,396
2. Lateral Road	1	L.S	12,062	4,543	16,604
3. On-Farm Road	1	L.S	15,183	5,437	20,620
Total			34,928	12,693	47,620

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
1. Main Farm Road Improvement	27.36	km	263,770	88,320	352,090	7,217	2,416	9,633
2. Main Farm Road Construction	0.84	km	263,770	88,320	352,090	222	74	296
3. Lateral Farm Road Improvement	38.34	km	263,770	88,320	352,090	10,113	3,386	13,499
4. Lateral Farm Road Construction	2.47	km	263,770	88,320	352,090	652	218	870
5. On-Farm Road Improvement	50.34	km	111,770	37,390	149,160	5,627	1,882	7,509
6. On-Farm Road Construction	77.67	km	111,770	37,390	149,160	8,681	2,904	11,585
7. Main Farm Road Culvert	12	Place	20,399	18,533	38,932	245	222	467
8. Main Farm Road Bridge	0	Place	-	-	-	-	-	-
9. Lateral Farm Road Culvert	25	Place	28,685	24,056	52,741	717	601	1,319
10. Lateral Farm Road Bridge L=20.0m	1	Place	580,000	336,966	916,966	580	337	917
11. On-Farm Road Culvert	136	Place	6,436	4,785	11,221	875	651	1,526
12. On-Farm Road Bridge	0	Place	-	-	-	-	-	-
Total						34,928	12,693	47,620

Table 7.2-2 Engineering Survey and Design Cost of Khon Kaen Priority Area

Item	Q'ty	Unit	Cost ('000 Baht)		
			F/C	L/C	Total Cost
1. Farm Pond	740	Place	-	10,000	7,400
2. Farm Road	197.02	km	-	13,250	2,611
3. Culvert	173	Place	-	5,250	908
4. Bridge	1	Place	-	25,000	25
Total			-	53,500	10,944

Table 7.2-3 O/M Cost of Khon Kaen Priority Area

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. 1,200m3 Farm Pond	1	L.S	281	120	401
2. Farm Road	1	L.S	2,445	888	3,333
Total			2,726	1,009	3,735

1) Farm Pond

Item	Q'ty	Unit	Unit Maintenance Cost (Baht)			Maintenance Cost ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
1. 1,200m3 Farm Pond	1,070	Place	263	113	375	281	120	401

Remarks 1) The Cost is estimated as the cost per year.
2) The Cost is estimated as 1.6% of the initial cost.

2) Farm Road

Item	Q'ty	Unit	O/M Cost ('000 Baht)		
			F/C	L/C	Total Cost
1. Main Farm Road	28.20	km	538	190	728
2. Lateral Road	40.81	km	844	318	1,162
3. On-Farm Road	128.01	km	1,063	381	1,443
Total			2,445	888	3,333

Remarks 1) The Cost is estimated as the cost per year.
2) The Cost of farm road is estimated as the 7% of the initial cost.

Table 7.2-4 Disbursement Schedule of Khon Kaen Priority Area

Item	F/C	L/C	Total Cost ('000 Baht)	1999			2000			2001			2002			Total ('000 Baht)
				F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	
1. Civil Works	54,353	21,018	75,370	0	0	0	0	0	0	27,176	10,509	37,685	27,176	10,509	37,685	75,370
2. Engineering Survey and Design	-	10,944	10,944	0	5,472	5,472	0	5,472	5,472	0	0	0	0	0	0	10,944
3. Administration	5,435	2,102	7,537	0	420	420	0	420	420	2,718	631	3,348	2,718	631	3,348	7,537
4. Physical Contingencies	5,979	3,406	9,385	317	181	497	317	181	497	2,673	1,523	4,195	2,673	1,523	4,195	9,385
Sub-Total	65,767	37,470	103,236	317	6,073	6,390	317	6,073	6,390	32,568	12,662	45,229	32,568	12,662	45,229	103,236
5. Price Escalation	5,059	3,786	8,845	7	207	213	14	421	435	2,146	1,340	3,486	2,892	1,817	4,710	8,845
Total	70,826	41,255	112,081	324	6,280	6,604	331	6,493	6,825	34,713	14,002	48,715	35,459	14,480	49,938	112,081

7.2.2 Project Cost of On-Farm Development in Mahasarakham Priority Area

Table 7.2-5 Project Cost of On-Farm Development in Mahasarakham Priority Area

1. Project Cost

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. Civil Works	1	L.S	32,136	12,554	44,690
2. Engineering Survey and Design	1	L.S	-	6,701	6,701
3. Administration	1	L.S	3,214	1,255	4,469
4. Physical Contingencies	1	L.S	3,535	2,051	5,586
Sub-Total			38,884	22,561	61,445
5. Price Escalation	1	L.S	2,991	2,272	5,263
Total			41,875	24,833	66,708

2. Total Cost of Civil Works

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. 1,200m3 Farm Pond	1	L.S	12,863	5,513	18,375
2. Farm Road	1	L.S	19,273	7,042	26,315
Total			32,136	12,554	44,690

1) Farm Pond

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
1. 1,200m3 Farm Pond	490	Place	26,250	11,250	37,500	12,863	5,513	18,375

2) Farm Road

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. Main Farm Road	1	L.S	8,988	3,244	12,232
2. Lateral Road	1	L.S	3,651	1,439	5,090
3. On-Farm Road	1	L.S	6,634	2,359	8,992
Total			19,273	7,042	26,315

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
1. Main Farm Road Improvement	30.01	km	263,770	88,320	352,090	7,916	2,650	10,566
2. Main Farm Road Construction	2.52	km	263,770	88,320	352,090	665	223	887
3. Lateral Farm Road Improvement	8.38	km	263,770	88,320	352,090	2,210	740	2,951
4. Lateral Farm Road Construction	3.83	km	263,770	88,320	352,090	1,010	338	1,349
5. On-Farm Road Improvement	30.60	km	111,770	37,390	149,160	3,420	1,144	4,564
6. On-Farm Road Construction	25.70	km	111,770	37,390	149,160	2,872	961	3,833
7. Main Farm Road Culvert	20	Place	20,399	18,533	38,932	408	371	779
8. Main Farm Road Bridge	0	Place	-	-	-	-	-	-
9. Lateral Farm Road Culvert	15	Place	28,685	24,056	52,741	430	361	791
10. Lateral Farm Road Bridge	0	Place	-	-	-	-	-	-
11. On-Farm Road Culvert	53	Place	6,436	4,785	11,221	341	254	595
12. On-Farm Road Bridge	0	Place	-	-	-	-	-	-
Total						19,273	7,042	26,315

Table 7.2-6 Engineering Survey and Design Cost of Mahasarakham Priority Area

Item	Q'ty	Unit	Cost ('000 Baht)		
			F/C	L/C	Total Cost
1. Farm Pond	490	Place	-	10,000	4,900
2. Farm Road	101.04	km	-	13,250	1,339
3. Culvert	88	Place	-	5,250	462
4. Bridge	0	Place	-	25,000	0
Total			-	53,500	6,701

Table 7.2-7 O/M Cost of Mahasarakham Priority Area

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. 1,200m3 Farm Pond	1	L.S	203	87	290
2. Farm Road	1	L.S	1,349	493	1,842
Total			1,552	580	2,132

1) Farm Pond

Item	Q'ty	Unit	Unit Maintenance Cost (Baht)			Maintenance Cost ('000Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
1. 1,200m3 Farm Pond	770	Place	263	113	376	203	87	290

Remarks 1) The Cost is estimated as the cost per year.
2) The Cost is estimated as 1.0% of the initial cost.

2) Farm Road

Item	Q'ty	Unit	O/M Cost ('000 Baht)		
			F/C	L/C	Total Cost
1. Main Farm Road	32.53	km	629	227	856
2. Lateral Road	12.21	km	256	101	356
3. On-Farm Road	56.30	km	464	165	629
Total			1,349	493	1,842

Remarks 1) The Cost is estimated as the cost per year.
2) The Cost of farm road is estimated as the 7% of the initial cost.

Table 7.2-8 Disbursement Schedule of Mahasarakham Priority Area

Item	F/C	L/C	Total Cost ('000Baht)	1999			2000			2001			2002			Total ('000Baht)
				F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	
1. Civil Works	32,136	12,554	44,690	0	0	0	0	0	0	16,068	6,277	22,345	16,068	6,277	22,345	44,690
2. Engineering Survey and Design	-	6,701	6,701	0	3,350	3,350	0	3,350	3,350	0	0	0	0	0	0	6,701
3. Administration	3,214	1,255	4,469	0	251	251	0	251	251	1,607	377	1,983	1,607	377	1,983	4,469
4. Physical Contingencies	3,535	2,051	5,586	187	109	296	187	109	296	1,580	917	2,497	1,580	917	2,497	5,586
Sub-Total	38,884	22,561	61,445	187	3,710	3,898	187	3,710	3,898	19,255	7,570	26,825	19,255	7,570	26,825	61,445
5. Price Escalation	2,991	2,272	5,263	4	127	131	8	257	265	1,269	801	2,070	1,710	1,087	2,797	5,263
Total	41,875	24,833	66,708	191	3,837	4,028	195	3,968	4,163	20,523	8,372	28,895	20,965	8,657	29,622	66,708

7.2.3 Project Cost of On-Farm Development in Sakon Nakhon Priority Area

Table 7.2-9 Project Cost of On-Farm Development in Sakon Nakhon Priority Area

1. Project Cost

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. Civil Works	1	L.S	59,736	27,005	86,741
2. Engineering Survey and Design	1	L.S	-	14,245	14,245
3. Administration	1	L.S	5,974	2,700	8,674
4. Physical Contingencies	1	L.S	6,571	4,395	10,966
Sub-Total			72,281	48,345	120,626
5. Price Escalation	1	L.S	5,560	4,876	10,436
Total			77,841	53,220	131,061

2. Total Cost of Civil Works

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. 1,200m3 Farm Pond and Well	1	L.S	15,093	8,499	23,592
2. Farm Road	1	L.S	44,643	18,506	63,149
Total			59,736	27,005	86,741

1) Farm Pond and Well

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
1. 1,200m3 Farm Pond	250	Place	26,250	11,250	37,500	6,563	2,813	9,375
2. Well	750	Place	11,374	7,582	18,956	8,531	5,687	14,217
Total						15,093	8,499	23,592

2) Farm Road

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. Main Farm Road	1	L.S	11,525	4,910	16,435
2. Lateral Road	1	L.S	23,196	9,916	33,112
3. On-Farm Road	1	L.S	9,922	3,680	13,601
Total			44,643	18,506	63,149

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
1. Main Farm Road Improvement	10.82	km	263,770	88,320	352,090	2,854	956	3,810
2. Main Farm Road Construction	15.63	km	263,770	88,320	352,090	4,123	1,380	5,503
3. Lateral Farm Road Improvement	9.16	km	263,770	88,320	352,090	2,416	809	3,225
4. Lateral Farm Road Construction	54.58	km	263,770	88,320	352,090	14,397	4,821	19,217
5. On-Farm Road Improvement	3.90	km	111,770	37,390	149,160	436	146	582
6. On-Farm Road Construction	76.98	km	111,770	37,390	149,160	8,604	2,878	11,482
7. Main Farm Road Culvert	28	Place	20,399	18,533	38,932	571	519	1,090
8. Main Farm Road Bridge L=10.0m	12	Place	331,443	171,244	502,687	3,977	2,055	6,032
9. Lateral Farm Road Culvert	107	Place	28,685	24,056	52,741	3,069	2,574	5,643
10. Lateral Farm Road Bridge L=10.0m	10	Place	331,443	171,244	502,687	3,314	1,712	5,027
11. On-Farm Road Culvert	137	Place	6,436	4,785	11,221	882	656	1,537
Total						44,643	18,506	63,149

Table 7.2-10 Engineering Survey and Design Cost of Sakhon Nakhon Priority Area

Item	Q'ty	Unit	Cost ('000 Baht)		
			F/C	L/C	Total Cost
1. Farm Pond and Well	1,000	Place	-	10,000	10,000
2. Farm Road	171.07	km	-	13,250	2,267
3. Culvert	272	Place	-	5,250	1,428
4. Bridge	22	Place	-	25,000	550
Total			-	53,500	14,245

Table 7.2-11 O/M Cost of Sakhon Nakhon Priority Area

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. 1,200m3 Farm Pond and Well	1	L.S	199	106	304
2. Farm Road	1	L.S	3,125	1,295	4,420
Total			3,324	1,401	4,725

1) Farm Pond

Item	Q'ty	Unit	Unit Maintenance Cost (Baht)			Maintenance Cost ('000Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
1. 1,200m3 Farm Pond	430	Place	263	113	376	113	49	162
2. Well	750	Place	114	76	190	86	57	143
						199	106	304

Remarks 1) The Cost is estimated as the cost per year
2) The Cost is estimated as 1.0% of the initial cost

2) Farm Road

Item	Q'ty	Unit	O.M Cost ('000 Baht)		
			F/C	L/C	Total Cost
1. Main Farm Road	26.45	km	807	344	1,150
2. Lateral Road	63.74	km	1,624	694	2,318
3. On-Farm Road	80.88	km	695	258	952
Total			3,125	1,295	4,420

Remarks 1) The Cost is estimated as the cost per year
2) The Cost of farm road is estimated as 7% of the initial cost.

Table 7.2-12 Disbursement Schedule of Sakhon Nakhon Priority Area

Item	F/C	L/C	Total Cost ('000Baht)	1999			2000			2001			2002			Total ('000Baht)
				F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	
1. Civil Works	39,136	27,605	86,741	0	0	0	0	0	0	29,868	13,502	43,370	29,868	13,502	43,370	86,741
2. Engineering Survey and Design	-	14,245	14,245	0	7,122	7,122	0	7,122	7,122	0	0	0	0	0	0	14,245
3. Administration	5,974	2,700	8,674	0	540	540	0	540	540	2,987	810	3,797	2,987	810	3,797	8,674
4. Physical Contingencies	6,571	4,395	10,966	348	233	581	348	233	581	2,937	1,965	4,902	2,937	1,965	4,902	10,966
Sub-Total	72,281	48,345	120,626	348	7,895	8,243	348	7,895	8,243	35,792	16,277	52,069	35,792	16,277	52,069	120,626
5. Price Escalation	5,560	4,876	10,436	7	269	276	15	548	563	2,359	1,723	4,081	2,179	2,336	5,515	10,436
Total	77,841	53,220	131,061	356	8,165	8,520	363	8,443	8,806	38,151	17,999	56,150	36,971	18,613	57,584	131,061

7.2.4 Project Cost of On-Farm Development in Mukdahan Priority Area

Table 7.2-13 Project Cost of On-Farm Development in Mukdahan Priority Area

1. Project Cost

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. Civil Works	1	L.S	20,227	8,659	28,885
2. Engineering Survey and Design	1	L.S	-	4,027	4,027
3. Administration	1	L.S	2,023	866	2,889
4. Physical Contingencies	1	L.S	2,225	1,355	3,580
Sub-Total			24,474	14,907	39,381
5. Price Escalation	1	L.S	1,883	1,529	3,412
Total			26,357	16,436	42,793

2. Total Cost of Civil Works

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. 1,200m3 Farm Pond	1	L.S	7,088	3,038	10,125
2. Farm Road	1	L.S	13,139	5,621	18,760
Total			20,227	8,659	28,885

1) Farm Pond

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
1. 1,200m3 Farm Pond	270	Place	26,250	11,250	37,500	7,088	3,038	10,125

2) Farm Road

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. Main Farm Road	1	L.S	4,440	1,873	6,313
2. Lateral Road	1	L.S	3,501	1,489	4,990
3. On-Farm Road	1	L.S	5,198	2,260	7,458
Total			13,139	5,621	18,760

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
1. Main Farm Road Improvement	1.00	km	263,770	88,320	352,090	264	88	352
2. Main Farm Road Construction	13.28	km	263,770	88,320	352,090	3,503	1,173	4,676
3. Lateral Farm Road Improvement	1.85	km	263,770	88,320	352,090	488	163	651
4. Lateral Farm Road Construction	7.92	km	263,770	88,320	352,090	2,089	699	2,789
5. On-Farm Road Improvement	9.04	km	111,770	37,390	149,160	1,010	338	1,348
6. On-Farm Road Construction	23.97	km	111,770	37,390	149,160	2,679	896	3,575
7. Main Farm Road Culvert	33	Place	20,399	18,533	38,932	673	612	1,285
8. Main Farm Road Bridge	0	Place	-	-	-	-	-	-
9. Lateral Farm Road Culvert	12	Place	28,685	24,056	52,741	344	289	633
10. Lateral Farm Road Bridge L=20.0m	1	Place	580,000	336,966	916,966	580	337	917
11. On-Farm Road Culvert	40	Place	6,436	4,785	11,221	257	191	449
12. On-Farm Road Bridge L=20.0m	3	Place	250,654	167,103	417,757	752	501	1,253
13. On-Farm Road Bridge L=40.0m	1	Place	499,236	332,825	832,061	499	333	832
Total						13,139	5,621	18,760

Table 7.2-14 Engineering Survey and Design Cost of Mukdahan Priority Area

Item	Q'ty	Unit	Cost ('000 Baht)		
			F/C	L/C	Total Cost
1. Farm Pond	270	Place	-	10,000	2,700
2. Farm Road	57.06	km	-	13,250	756
3. Culvert	85	Place	-	5,250	446
4. Bridge	5	Place	-	25,000	125
Total			-	53,500	4,027

Table 7.2-15 O/M Cost of Mukdahan Priority Area

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. 1,200m3 Farm Pond	1	L.S	87	37	124
2. Farm Road	1	L.S	920	393	1,313
Total			1,007	431	1,437

1) Farm Pond

Item	Q'ty	Unit	Unit Maintenance Cost (Baht)			Maintenance Cost ('000Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
1. 1,200m3 Farm Pond	330	Place	263	113	376	87	37	124

Remarks 1) The Cost is estimated as the cost per year.
2) The Cost is estimated as 1.0% of the initial cost.

2) Farm Road

Item	Q'ty	Unit	O/M Cost ('000 Baht)		
			F/C	L/C	Total Cost
1. Main Farm Road	14.28	km	311	131	442
2. Lateral Road	9.77	km	245	104	349
3. On-Farm Road	33.01	km	364	158	522
Total			920	393	1,313

Remarks 1) The Cost is estimated as the cost per year.
2) The Cost of farm road is estimated as the 7% of the initial cost.

Table 7.2-16 Disbursement Schedule of Mukdahan Priority Area

Item	F/C	L/C	Total Cost ('000Baht)	1999			2000			2001			2002			Total ('000Baht)
				F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	
1. Civil Works	20,227	8,659	28,885	0	0	0	0	0	0	10,113	4,329	14,443	10,113	4,329	14,443	28,885
2. Engineering Survey and Design	-	4,027	4,027	0	2,014	2,014	0	2,014	2,014	0	0	0	0	0	0	4,027
3. Administration	2,023	866	2,889	0	173	173	0	173	173	1,011	260	1,271	1,011	260	1,271	2,889
4. Physical Contingencies	2,225	1,355	3,580	118	72	190	118	72	190	995	606	1,600	995	606	1,600	3,580
Sub-Total	24,474	14,907	39,381	118	2,259	2,377	118	2,259	2,377	12,119	5,195	17,314	12,119	5,195	17,314	39,381
5. Price Escalation	1,883	1,529	3,412	3	77	80	3	157	160	799	550	1,348	1,076	746	1,822	3,412
Total	26,357	16,436	42,793	120	2,336	2,456	120	2,415	2,538	12,918	5,745	18,663	13,196	5,940	19,136	42,793

7.2.5 Project Cost of Dredging Project in Khon Kaen Priority Area

Table 7.2-17 Project Cost of Huai Khan Dredging at K.K

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. Civil Works					
1) Dredging	1	L.S	3,270	1,411	4,681
2) Weir	1	L.S	1,117	1,354	2,470
Sub-Total of Civil Works			4,387	2,765	7,152
2. Engineering Survey and Design	1	L.S	351	221	572
3. Administration	1	L.S	439	276	715
4. Physical Contingencies	1	L.S	518	326	844
Sub-Total			5,694	3,589	9,283
5. Price Escalation			122	122	245
Total			5,817	3,711	9,528

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
Dredging	108,251	m3	12.10	5.25	17.35	1,310	568	1,878
Embankment	108,251	m3	7.88	3.37	11.25	853	365	1,218
Sub-Total						2,163	933	3,096
Other Works	10	%				216	93	310
Sub-Total						2,379	1,026	3,406
Tax, Profit, Overhead	37.46	%				891	385	1,276
Total						3,270	1,411	4,681

2. Weir

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
Weir	2	Place	391,659	478,465	873,124	789	957	1,746
Tax, Profit, Overhead	41.47	%	163,665	198,419	362,085	327	397	724
Total			558,324	676,884	1,235,209	1,117	1,354	2,470

Table 7.2-18 O/M Cost of Huai Khan Dredging at K.K

Item	Working Life (Years)	Initial Cost ('000 Baht)		Total ('000 Baht)	Ratio (%)	Annual Cost ('000 Baht)		Total ('000 Baht)
		F/C	L/C			F/C	L/C	
Creek	20	3,270	1,411	4,681	19.8	32.4	14.0	46.3
Weir (New)	30	1,117	1,354	2,470	50	18.6	22.6	41.2
Weir (Existing)	30	1,046	1,278	2,324	50	17.4	21.3	38.7
Total				9,476		36.0	43.9	126.3

Table 7.2-19 Project Cost of Huai Sua Thao Noi Dredging at K.K

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. Civil Works					
1) Dredging	1	L.S	6,781	2,925	9,706
2) Weir	1	L.S	4,467	5,415	9,882
Sub-Total of Civil Works			11,247	8,340	19,588
2. Engineering Survey and Design	1	L.S	900	667	1,567
3. Administration	1	L.S	1,125	834	1,959
4. Physical Contingencies	1	L.S	1,327	984	2,311
Sub-Total			14,599	10,826	25,425
5. Price Escalation			314	369	683
Total			14,913	11,195	26,108

1. Dredging

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
Dredging	224,446	m3	12.10	5.25	17.35	2,716	1,178	3,894
Embankment	224,446	m3	7.88	3.37	11.25	1,769	756	2,525
Sub-Total						4,484	1,935	6,419
Other Works	10	%				448	193	642
Sub-Total						4,933	2,128	7,061
Tax, Profit, Overhead	37.46	%				1,848	797	2,645
Total						6,781	2,925	9,706

2. Weir

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
Weir	8	Place	394,659	478,465	873,124	3,157	3,828	6,985
Tax, Profit, Overhead	41.47	%	163,665	198,419	362,085	1,309	1,587	2,897
Total			558,324	676,884	1,235,209	4,467	5,415	9,882

Table 7.2-20 O/M Cost of Huai Sua Thao Noi Dredging at K.K

Item	Working Life (Years)	Initial Cost ('000 Baht)		Total ('000 Baht)	Ratio (%)	Annual Cost ('000Baht)		Total ('000 Baht)
		F/C	L/C			F/C	L/C	
Creek	20	6,781	2,925	9,706	19.8	67.1	29.0	96.1
Weir (New)	30	4,467	5,415	9,882	50	74.4	90.3	164.7
Weir (Existing)	30	581	710	1,290	50	9.7	11.8	21.5
Total				20,878		84.1	102.1	282.3

Table 7.2-21 Project Cost of Huai Sua Thao Yai Dredging at K.K

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. Civil Works					
1) Dredging	1	L.S	6,275	2,707	8,983
2) Weir	1	L.S	2,792	3,384	6,176
Sub-Total of Civil Works			9,067	6,092	15,159
2. Engineering Survey and Design	1	L.S	725	487	1,213
3. Administration	1	L.S	907	609	1,516
4. Physical Contingencies	1	L.S	1,070	719	1,789
Sub-Total			11,769	7,907	19,676
5. Price Escalation			253	270	523
Total			12,022	8,177	20,199

1. Dredging

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
Dredging	207,719	m3	12.10	5.25	17.35	2,513	1,091	3,604
Embankment	207,719	m3	7.88	3.37	11.25	1,637	700	2,337
Sub-Total						4,150	1,791	5,941
Other Works	10	%				415	179	594
Sub-Total						4,565	1,970	6,535
Tax, Profit, Overhead	37.46	%				1,710	738	2,448
Total						6,275	2,707	8,983

2. Weir

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
Weir	5	Place	394,659	478,465	873,124	1,973	2,392	4,366
Tax, Profit, Overhead	41.47	%	163,665	198,419	362,085	818	992	1,810
Total			558,324	676,884	1,235,209	2,792	3,384	6,176

Table 7.2-22 O/M Cost of Huai Sua Thao Yai Dredging at K.K

Item	Working Life (Years)	Initial Cost ('000 Baht)		Total ('000 Baht)	Ratio (%)	Annual Cost ('000Baht)		Total ('000 Baht)
		F/C	L/C			F/C	L/C	
Creek	20	6,275	2,707	8,983	19.8	62.1	26.8	88.9
Weir (New)	30	2,792	3,384	6,176	50	46.5	56.4	102.9
Weir (Existing)	30	360	440	800	50	6.0	7.3	13.3
Total				15,959		52.5	63.7	205.2

Table 7.2-23 Project Cost of Huai Lak Dan Dredging at K.K

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
I. Civil Works					
1) Dredging	1	L.S	5,639	2,433	8,071
2) Weir	1	L.S	1,675	2,031	3,706
Sub-Total of Civil Works			7,314	4,463	11,777
2. Engineering Survey and Design	1	L.S	585	357	942
3. Administration	1	L.S	731	446	1,178
4. Physical Contingencies	1	L.S	863	527	1,390
Sub-Total			9,493	5,793	15,287
5. Price Escalation			204	198	402
Total			9,697	5,991	15,688

1. Dredging

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
Dredging	186,646	m3	12.10	5.25	17.35	2,258	980	3,238
Embankment	186,646	m3	7.88	3.37	11.25	1,471	629	2,100
Sub-Total						3,729	1,609	5,338
Other Works	10	%				373	161	534
Sub-Total						4,102	1,770	5,872
Tax, Profit, Overhead	37.46	%				1,537	663	2,200
Total						5,639	2,433	8,071

2. Weir

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
Weir	3	Place	394,659	478,465	873,124	1,184	1,435	2,619
Tax, Profit, Overhead	41.47	%	163,665	198,419	362,085	491	595	1,086
Total			558,324	676,884	1,235,209	1,675	2,031	3,706

Table 7.2-24 O/M Cost of Huai Lak Dan Dredging at K.K

Item	Working Life	Initial Cost ('000 Baht)		Total	Ratio	Annual Cost ('000 Baht)		Total
	(Years)	F/C	L/C	('000 Baht)	(%)	F/C	L/C	('000 Baht)
Creek	20	5,639	2,433	8,071	19.8	55.8	24.1	79.9
Weir (New)	30	1,675	2,031	3,706	50	27.9	33.8	61.8
Weir (Existing)	30	0	0	0	50	0.0	0.0	0.0
Total				11,777		27.9	33.8	141.7

7.2.6 Project Cost of Huai Lak Reservoir Project in Mukdahan Priority Area

Table 7.2-25 Project Cost of Huai Lak Reservoir Development at M.K.D

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
I. Civil Works					
1) Dam	1	L.S	60,908	95,050	155,958
2) Pipe Line System	1	L.S	7,236	6,711	13,947
3) On-Farm Facilities	1	L.S	2,798	4,197	6,995
Sub-Total of Civil Works			70,942	105,958	176,900
2. Engineering Survey and Design	1	L.S	0	14,152	14,152
3. Administration	1	L.S	7,094	12,011	19,105
4. Physical Contingencies	1	L.S	7,804	13,212	21,016
Sub-Total			85,840	145,333	231,172
5. Price Escalation	1	L.S	6,500	16,599	23,099
Total			92,340	161,932	254,272

Construction Cost of HUAI LAK RESERVOIR

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
1. Temporary Works	1	L.S				10,329	8,451	18,780
2. Dam Body								
- Stripping (Rock)	59,719	m3	18.50	6.20	24.70	1,104	370	1,474
- Stripping (Soil)	89,579	m3	13.60	4.55	18.15	1,218	407	1,625
-Excavation (Rock)	0	m3	18.50	6.20	24.70	0	0	0
-Excavation (Soil)	2,205	m3	13.60	4.55	18.15	29	10	39
-Embankment (Core)	2,759	m3	26.95	159.00	185.95	74	438	512
-Embankment (Semi-Impervious)	299,351	m3	23.25	150.00	173.25	6,959	44,902	51,861
-Chimney Drain	5,925	m3	26.95	149.00	175.95	159	882	1,041
-Finger Drain	22,163	m3	23.25	140.00	163.25	515	3,102	3,617
-Riprap	9,345	m3	375.00	125.00	500.00	3,504	1,168	4,672
-Sodding	15,913	m3	0.00	24.00	24.00	0	381	381
-As Pavement	439	m	1,070.00	530.00	1600.00	469	232	701
Sub Total						14,031	51,892	65,923
3. Spillway								
-Excavation (Rock)	13,469	m3	18.50	6.20	24.70	249	83	332
-Excavation (Soil)	17,208	m3	13.60	4.55	18.15	234	78	312
-Back Fill	13,687	m3	18.5	6.2	24.70	253	84	337
-Concrete Works	5,573	m3	1,800	2,200	4,000	10,031	12,260	22,291
Sub Total						10,767	12,505	23,272
4. Out Let								
-Excavation (Rock)	995	m3	18.50	6.20	24.70	18	6	24
-Concrete Works (Reinforced)	83	m3	1,800	2,200	4,000	148	181	329
-Concrete Works (Plain)	748	m3	900	1,100	2,000	673	822	1,495
-Conduit Pipe 1,000mm	314	m	4,900	2,100	7,000	1,538	659	2,197
-Butterfly Valve 500mm	1	Unit	114,680	22,936	137,616	114	22	136
-Butterfly Valve 600mm	1	Unit	147,970	29,594	177,564	147	29	176
-Gate House	50	m2	2,250	4,750	7,000	112	237	349
Sub Total						2,750	1,956	4,706
5. Other Works of Dam		L.S				2,582	2,113	4,695
6. Tax, Profit, Overhead						20,448	18,133	38,582
Grand Total						60,908	95,050	155,958

(continued)

Construction Cost of Pipe Line

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
1. Temporary Works	1	L.S				500	409	909
2. Pipe Line								
- Left Bank 600mm	2,100	m	720	1,080	1,800	1,512	2,268	3,780
-Excavation (Soil)	17,535	m3	13.60	4.55	18.15	238	79	317
-Excavation (Rock)	4,389	m3	18.50	6.20	24.70	81	27	108
-Back Fill (Man Power)	2,310	m3	10.78	25.17	35.95	24	58	82
-Back Fill (Machine)	19,005	m3	7.90	3.35	11.25	150	63	213
Sub Total						2,005	2,495	4,500
- Left Bank 500mm	1,000	m	520	780	1,300	520	780	1,300
-Excavation (Soil)	6,750	m3	13.60	4.55	18.15	91	30	121
-Excavation (Rock)	750	m3	18.50	6.20	24.70	13	4	17
-Back Fill (Man Power)	920	m3	10.78	25.17	35.95	9	23	32
-Back Fill (Machine)	6,380	m3	7.90	3.35	11.25	50	21	71
Sub Total						683	858	1,541
-Right Bank 300mm	1,300	m	280	420	700	364	546	910
-Excavation (Soil)	4,433	m3	13.60	4.55	18.15	60	20	80
-Excavation (Rock)	1,105	m3	18.50	6.20	24.70	20	6	26
-Back Fill (Man Power)	689	m3	10.78	25.17	35.95	7	17	24
-Back Fill (Machine)	4,758	m3	7.90	3.35	11.25	37	15	52
Sub Total						488	604	1,092
3. Booster Pump	1	Unit				1,283	549	1,832
4. Delivery Tank		L.S				74	49	123
5. Other Works		L.S				375	125	500
6. Tax, Profit, Overhead						1,829	1,622	3,450
Grand Total						7,236	6,711	13,947

Table 7.2-26 O/M Cost of Huai Lak Reservoir Development at M.K.D

1. Facilities

Item	Working Life (Years)	Initial Cost ('000 Baht)	Ratio (%)	Annual Cost ('000 Baht)
Dam	80	155,958	18.4	358.7
Pump	20	1,832	37.6	34.4
Pipe Line	20	1,092	19.8	10.8
On-Farm Facilities	20	6,995	19.8	69.2
Total		165,877		473.2

2. Electric Charge

Pump Operation Time	6 Hr/day
Motor Out Put	30 Kw/h
Monthly Electric Consumption	5,400 Kw
Basic Electricity Charge	109.35 Baht/Month
Electricity Charge	1.15 Baht/Kw
Monthly Electricity Charge	6,204.35 Baht
Total Annual Electricity Charge	74,452 Baht/year
Farmer's Portion	38,160 Baht

Table 7.2-27 Disbursement Schedule of Huai Lak Reservoir Development at M.K.D

Item	1999			2000			2001			2002			Total
	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	
1. Civil Works	0	0	0	0	0	0	35,471	52,975	88,456	35,471	52,975	88,456	176,912
2. Engineering Survey and Design	0	7,076	7,076	0	7,076	7,076	0	0	0	0	0	0	14,152
3. Administration	1,419	2,405	3,821	1,419	2,405	3,821	2,128	3,605	5,733	2,128	3,605	5,733	19,109
4. Physical Contingencies	142	918	1,059	142	918	1,059	3,760	5,658	9,418	3,760	5,658	9,418	21,016
Sub-Total	1,561	10,426	11,987	1,561	10,426	11,987	41,359	62,240	103,599	41,359	62,240	103,599	231,173
5. Price Escalation	34	356	389	89	722	791	2,725	6,594	9,319	3,573	8,935	12,508	23,099
Total	1,595	10,782	12,376	1,629	11,149	12,778	44,085	68,835	112,918	45,032	71,174	116,206	254,272

7.2.7 Project Cost of Huai Bang Sai Pump Irrigation Project in Mukdahan Priority Area

Table 7.2-28 Project Cost of Huai Bang Sai Pump Irrigation Development at M.K.D

Item	Q'ty	Unit	Amount ('000 Baht)		
			F/C	L/C	Total Cost
1. Civil Works					
1) Diversion Weir	1	L.S	5,089	3,458	8,548
2) Pump	1	L.S	12,245	5,167	17,413
3) Pipe Line System	1	L.S	914	949	1,863
4) On-Farm Facilities	1	L.S	3,875	5,813	9,688
Sub-Total of Civil Works	1	L.S	22,124	15,388	37,512
2. Engineering Survey and Design	1	L.S	0	3,001	3,001
3. Administration	1	L.S	2,212	1,839	4,051
4. Physical Contingencies	1	L.S	2,434	2,023	4,456
Sub-Total			26,770	22,250	49,021
5. Price Escalation	1	L.S	2,027	2,474	4,502
Total			28,797	24,725	53,522

Construction Cost of Diversion Weir

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
1. Temporary Works	1	L.S				295	241	536
2. Weir								
-Excavation (Rock)	305	m3	18.50	6.20	24.70	5	1	6
-Excavation (Soil)	1,000	m3	13.60	4.55	18.15	13	4	17
-Back Fill	96	m3	18.5	6.2	24.70	1	0	1
-Concrete Works (Reinforced)	57	m3	1,800	2,200	4,000	102	125	227
-Concrete Works (Plain)	1,257	m3	900	1,100	2,000	1,131	1,382	2,513
-Riprap	900	m3	375	125	500	337	112	449
-Sluice Gate	1	L.S	1,790,400	358,080	2,148,480	1,790	358	2,148
Sub Total						3,379	1,982	5,361
3. Other Works		L.S				295	241	536
4. Tax, Profit, Overhead						1,121	994	2,115
Grand Total						5,089.4	3,458.3	8,548

Construction Cost of Pumping Station

Item	Qty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
1. Temporary Works	1	L.S				601	491	1,092
2. Intake Canal								
-Excavation (Rock)	217	m3	18.50	6.20	24.70	4	1	5
-Excavation (Soil)	1,949	m3	13.60	4.55	18.15	26	8	34
-Back Fill	24,076	m3	18.5	6.2	24.70	445	149	594
-Concrete Works (Reinforced)	56	m3	1,800	2,200	4,000	100	122	222
-Screen	1	L.S	120,000	24,000	144,000	120	24	144
-Sluice Gate	1	L.S	895,200	179,040	1,074,240	895	179	1,074
Sub Total						1,590	483	2,073
3. Pump								
-Pump Unit	1	L.S	7,004,700	1,400,900	8,405,600	7,004	1,400	8,404
-Concrete Works (Reinforced)	48	m3	1,800	2,200	4,000	86	106	192
-Pump House	36	m2	2,250	4,750	7,000	81	171	252
Sub Total						7,171	1,677	8,848
3. Other Works		L.S				601	491	1,092
4. Tax, Profit, Overhead						2,283	2,025	4,308
Grand Total						12,245.4	5,167.5	17,413

Construction Cost of Pipe Line

Item	Qty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
1. Temporary Works	1	L.S				67	55	121
2. Pipe Line								
- Asbestos Pipe 500mm	700	m	520	780	1,300	364	546	910
-Excavation (Soil)	3,740	m3	13.60	4.55	18.15	50	17	67
-Excavation (Rock)	198	m3	18.50	6.20	24.70	3	1	4
-Back Fill (Man Power)	647	m3	10.78	25.17	35.95	6	16	22
-Back Fill (Machine)	3,154	m3	7.90	3.35	11.25	24	10	34
Sub Total						447	590	1,037
3. Delivery Tank		L.S				106	71	177
4. Other Works		L.S				50	17	67
5. Tax, Profit, Overhead						244	217	461
Grand Total						914.1	948.9	1,863

Table 7.2-29 O/M Cost of Huai Bang Sai Pump Irrigation Development at M.K.D

1. Facilities

Item	Working Life (Years)	Initial Cost ('000 Baht)	Ratio (%)	Annual Cost ('000 Baht)
Diversion Weir	50	8,548	52.3	89.4
Pump	20	8,404	37.6	158.0
Pipe Line	20	1,863	19.8	18.4
On-Farm Facilities	20	9,688	19.8	95.9
Total		28,503		361.8

2. Electric Charge

Pump Operation Time	6.3 Hr/day
Motor Out Put	160 Kw/h
Monthly Electric Consumption	30,240 Kw
Basic Electricity Charge	109.35 Baht/Month
Electricity Charge	1.15 Baht/Kw
Monthly Electricity Charge	34,770.35 Baht
Total Annual Electricity Charge	417,244 Baht/year
Farmer's Portion	217,008 Baht

Table 7.2-30 On-Farm Cost of Huai Bang Sai Pump Irrigation Development at M.K.D

Item	Quantity	Unit	Unit Cost(B)	Cost('000B)	Remarks
1.Lateral Pipeline					
D=0.30m	1,760	m	1,800	3,168	
D=0.40m	700	m	2,100	1,470	
2.Rateral Camal	2,395	m	300	718	
3.New Road					
W=4.00m	8	km	323,100	2,584	
4.Improve Road	6.5	km	132,300	859	
Sub-Total				7,940	
Other Works	30	%		2,382	
Sub-Total				10,322	
Tax,Profit	38	%		3,922	
Total				14,244	

Table 7.2-31 Disbursement Schedule of Huai Bang Sai Pump Irrigation Development at M.K.D

Item	1999		2000		2001		2002		Total
	F.C	L/C	F.C	L/C	F.C	L/C	F.C	L/C	
1. Civil Works	0	0	0	0	11,062	7,691	11,062	7,691	37,512
2. Engineering Survey and Design	0	1,500	0	1,500	0	0	0	0	3,001
3. Administration	442	368	442	368	664	552	664	552	4,051
4. Physical Contingencies	44	187	44	187	1,173	825	1,173	825	4,456
Sub-Total	487	2,055	487	2,055	12,898	9,070	12,898	9,070	49,021
5. Price Escalation	10	70	21	143	850	960	1,146	1,302	4,502
Total	497	2,125	508	2,198	13,748	10,030	14,044	10,372	53,523

7.2.8 Project Cost of Kolopokan Pond Rehabilitation Project in Mukdahan Priority Area

Table 7.2-32 Project Cost of Kolopokan Pond Rehabilitation at M.K.D

Item	Q'ty	Unit	Unit Cost (Baht)			Amount ('000 Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
1. Temporary Works	1	L.S				312	171	483
2. Pond								
Dredging	95,554	m3	12.1	5.25	17.35	1,156	502	1,658
Embankment of Dike	21,545	m3	7.88	3.37	11.25	170	73	242
Sub-Total of Pond						1,326	574	1,900
3. Spillway								
Concrete	126.8	m3	1,800	2,200	4,000	228	279	507
Riprap	17.4	m3	375	125	500	7	2	9
Sub-Total of Spillway						235	281	516
4. Other Works	1	L.S				375	205	580
Sub-Total						2,247	1,232	3,479
5. Tax, Profit, Overhead	41.47	%				932	511	1,443
Total						3,179	1,743	4,922

Table 7.2-33 O/M Cost of Kolopokan Pond Rehabilitation at M.K.D

The annual O/M cost = 4,922,000 x 0.01 = 492,000 Baht / year.

7.2.9 Unit Cost of Farm Pond, Farm Road and Irrigation Systems

Table 7.2-34 Construction Cost of 1,200 m³ Farm Pond

(/ Place)

Item	Q'ty	Unit	Unit Cost (Baht)			Amount (Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
Stripping	480	m3	9.25	3.97	13.22	4,440	1,906	6,346
Excavation	1,200	m3	8.51	3.65	12.16	10,212	4,380	14,592
Return the stripped Soil	480	m3	7.88	3.37	11.25	3,782	1,618	5,400
Sub-Total						18,434	7,903	26,338
Tax, Profit, Over Head	0.4237	%				7,811	3,349	11,159
Grand Total						26,245	3,349	37,497

Table 7.2-35 Construction Cost of 6,000 m³ Farm Pond

(/ Place)

Item	Q'ty	Unit	Unit Cost (Baht)			Amount (Baht)		
			F/C	L/C	Total Cost	F/C	L/C	Total Cost
Stripping	480	m3	9.25	3.97	13.22	4,440	1,906	6,346
Excavation	6,000	m3	8.51	3.65	12.16	51,060	21,900	72,960
Embankment	588	m3	25.17	10.78	35.95	14,800	6,339	21,139
Return the stripped Soil	480	m3	7.88	3.37	11.25	3,782	1,618	5,400
Access Road	40	m	23.64	10.11	33.75	946	404	1,350
Sub-Total						75,028	32,166	107,194
Other Works	1	L.S				3,751	1,608	5,360
Sub-Total						78,779	33,775	112,554
Tax, Profit, Over Head	0.4237	%				33,379	14,310	47,689
Grand Total						112,158	48,085	160,243

Table 7.2-36 Construction Cost of Main and Lateral Farm Road

(/ m)

Item	Q'ty	Unit	Unit Cost		Total (Baht)	Amount		Total (Baht)
			F/C (Baht)	L/C (Baht)		F/C (Baht)	L/C (Baht)	
Stripping	1.800	m3	4.80	1.50	6.30	8.64	2.70	11.34
Excavation	2.760	m3	13.65	4.50	18.15	37.67	12.42	50.09
Back Fill	2.760	m3	8.25	3.00	11.25	22.77	8.28	31.05
Compaction	2.500	m3	26.95	9.00	35.95	67.38	22.50	89.88
Pavement	0.400	m3	14.80	4.90	19.70	5.92	1.96	7.88
Sub Total						142.38	47.86	190.24
Material Transportation	25.00	km	2.7	0.9	3.60	67.50	22.50	90.00
Other Works	20	%				42.80	14.27	57.07
Sub Total						252.68	84.63	247.31
Tax, Profit, Overhead	42.37	%	0.4237			78.59	26.20	104.79
Grand Total						331.27	110.82	352.09

Table 7.2-37 Construction Cost of On-Farm Road

(/ m)

Item	Q'ty	Unit	Unit Cost		Total	Amount		Total
			F/C (Baht)	L/C (Baht)	(Baht)	F/C (Baht)	L/C (Baht)	(Baht)
Stripping	1.500	m3	4.90	1.60	6.50	7.35	2.40	9.75
Excavation	0.870	m3	13.65	4.50	18.15	11.88	3.92	15.79
Back Fill	0.870	m3	8.25	3.00	11.25	7.18	2.61	9.79
Compaction	0.780	m3	26.95	9.00	35.95	21.02	7.02	28.04
Pavement	0.200	m3	14.80	4.90	19.70	2.96	0.98	3.94
Sub Total						50.38	16.93	67.31
Material Transportation	20.00	km	0.9	0.3	1.20	18.00	6.00	24.00
Other Works	20	%				10.10	3.37	13.46
Sub Total						78.48	26.29	104.77
Tax, Profit, Overhead	42.37	%	0.4237			33.29	11.10	44.39
Grand Total						111.77	37.39	149.16

Table 7.2-38 Construction Cost of Mini Sprinkler System (6,000m^3 Farm Pond)

(4rai)

Item	Unit	Q'ty	Unit Cost (Baht)			Total Cost (Baht)			Remarks
			F/C	L/C	Total Cost	F/C	L/C	Total Cost	
Pump	Unit	1	8,000	0	8,000	8,000	0	8,000	2 inch 1.5kwh
Main Pipe	m	110	20	60	80	2,200	6,600	8,800	2 inch
Lateral Pipe	m	712	13.5	40.5	54	9,612	28,836	38,448	1 inch
Riser Pipe	m	30	7.5	22.5	30	225	675	900	1/2 inch
Main Valve	Unit	6	50.0	150.0	200	300	900	1,200	2 inch
Lateral Valve	Unit	12	25.0	75.0	100	300	900	1,200	1 inch
Riser Valve	Unit	95	10.0	30.0	40	950	2,850	3,800	1/2 inch
Sprinkler Head	Unit	25	3.75	11.25	15	94	281	375	For Vegetable
Sprinkler Head	Unit	70	1.75	5.25	7	123	368	490	For Fruit Tree
Power Line Cost	Unit	1	708	2,125	2,833	708	2,125	2,833	
Sub Total						22,511	43,535	66,046	
Other Works	%	3.0				666	1,288	1,954	
Total						23,177	44,823	68,000	

Power Line Cost = 1.7km x B10/m =17,000B =6 members x B2,833 / member

Table 7.2-39 Construction Cost of Mini Sprinkler System (Well)

(4rai)

Item	Unit	Q'ty	Unit Cost (Baht)			Total Cost (Baht)			Remarks
			F/C	L/C	Total Cost	F/C	L/C	Total Cost	
Pump	Unit	1	3,000	0	3,000	3,000	0	3,000	1 inch 0.37kwh
Main Pipe	m	110	20	60	80	2,200	6,600	8,800	2 inch
Lateral Pipe	m	712	13.5	40.5	54	9,612	28,836	38,448	1 inch
Riser Pipe	m	30	7.5	22.5	30	225	675	900	1/2 inch
Main Valve	Unit	6	50.0	150.0	200	300	900	1,200	2 inch
Lateral Valve	Unit	12	25.0	75.0	100	300	900	1,200	1 inch
Riser Valve	Unit	95	10.0	30.0	40	950	2,850	3,800	1/2 inch
Sprinkler Head	Unit	25	3.75	11.25	15	94	281	375	For Vegetable
Sprinkler Head	Unit	70	1.75	5.25	7	123	368	490	For Fruit Tree
Power Line Cost	Unit	1	708	2,125	2,833	708	2,125	2,833	
Sub Total						17,511	43,535	61,046	
Other Works	%	3.0				532	1,322	1,854	
Total						18,043	44,857	62,900	

Power Line Cost = 1.7km x B10/m =17,000B =6 members x B2,833 / member

Table 7.2-40 O/M Cost of Mini Sprinkler System (6,000m^3 Farm Pond)

Operation Cost

Necessary Irrigation Water	6,814 m3/Year
Average of The Pump Discharge	0.496 m3/Min.
Pump Out Put	1.5 kwh
Necessary Annual Irrigation Hour	228.97 Hour
Necessary Monthly Irrigation Hour	19.08 Hour
Member of One Group	6 Member
Total Electric Consumption	171.724 kwh/Group
Basic Electricity Charges	109.35 Baht/Month
Electricity Charges	1.15 Baht/kwh
Total Electricity Charges	191.832 Baht/Group
Individual Electricity Charges	31.9721 Baht/Month
Annual Individual Electricity Charges	**384 Baht/Year**

Maintenance Cost

Initial Cost of Farm Pond	160,243 Baht
Initial Cost of Sprinkler System	68,000 Baht
Maintenance Cost of Pond	1 %
Maintenance Cost of Sprinkler	10 %
Annual Maintenance Cost	**8,402 Baht/Year**

Total O/M Cost	**8,786 Baht/Year**

Table 7.2-41 O/M Cost of Mini Sprinkler System (Well)

Operation Cost

Necessary Irrigation Water	6,814 m3/Year
Average of The Pump Discharge	0.033 m3/Min.
Pump Out Put	0.37 kwh
Necessary Annual Irrigation Hour	3441.41 Hour
Necessary Monthly Irrigation Hour	286.78 Hour
Member of One Group	6 Member
Total Electric Consumption	636.662 kwh/Group
Basic Electricity Charges	109.35 Baht/Month
Electricity Charges	1.15 Baht/kwh
Total Electricity Charges	726.511 Baht/Group
Individual Electricity Charges	121.085 Baht/Month
Annual Individual Electricity Charges	**1,453 Baht/Year**

Maintenance Cost

Initial Cost of Well	17,500 Baht
Initial Cost of Sprinkler System	62,900 Baht
Maintenance Cost of Pond	1 %
Maintenance Cost of Sprinkler	10 %
Annual Maintenance Cost	**6,465 Baht/Year**

Total O/M Cost	**7,918 Baht/Year**

Table 7.2-42 O/M Cost of Pump Attached Tiller

Operation Cost

Necessary Irrigation Water	9,199	m3/Year
Average of The Pump Discharge	0.12	m3/Min.
Tiller Out Put	0.6	H.P
Necessary Annual Irrigation Hour	1277.64	Hour
Fuel Consumption	0.2	l/Hour
Annual Fuel Consumption	255.528	l/Year
Unit Fuel Carge	11	Baht/l
Annual Fuel Charges	**2,811**	**Baht/Year**

Maintenance Cost

Initial Cost of Farm Pond	160,243	Baht
Maintenance Cost of Pond	1	%
Annual Maintenance Cost	**1,602**	**Baht/Year**

Annual O/M Cost	**4,413**	**Baht/Year**

7.2.10 List of Unit Costs used in the Study

Table 7.2-43 List of Unit Costs used in the Study

Construction Cost for Facilities

Type of Facilities	Unit	Cost (Baht)	Remark
Lining Canal Work	km	462,200	
Main Farm Road Work	km	352,090	B=4.00m Laterite
Lateral Farm Road Work	km	352,090	B=4.00m Laterite
On-Farm Road	km	149,160	B=2.00m Laterite
On-Farm Canal	m	300	
Asphalt Road	km	3,400,000	B=6.0m
Concrete Road	km	4,500,000	B=6.0m
R.C Bridge Work	m	70,000	B=9.0m
R.C Bridge Work	m	52,000	B=6.0m
1,200 m3 Excavation Pond Work	Place	37,497	
6,000 m3 Excavation Pond Work	Place	160,243	
Electric Power Line	km	500,000	with Pole
Shallow Well	well	13,400	
Improve Main Lateral Road	km	208,900	
Improve Sub Lateral Road	km	132,300	
Repair Main Lateral Road	km	76,100	
Repair Sub Lateral Road	km	51,000	
Dredge Canal Work	km	128,300	
Development of Land Readjustment	rai	3,000	
Well with Hand Pump Diameter 4"	well	134,700	(3 HP , 12 m3 , 15 m)
Well with Electric Pump Diameter 6"	well	396,100	(3 HP , 12 m3 , 15 m)
Well with Hand Pump 4"	well	46,000	
Well with Hand Pump 6"	well	86,000	
Well with Hand Pump 2"	well	18,956	
Mini-Sprinkler System	Uint	65,109	with Pump
On-Farm Facilities	rai	6,700	Irrigated Area without Road
Pump House	m2	7,000	Including Crane

Construction Cost

Type of Work	Unit	Cost (Baht)	Remark
Adding the asphalt	km	1,000,000	Increase the thickness
Fix the asphalt	km	1,600,000	Including foundation
Excavation of Farm Pond	m3	12.16	
Natural Canal Excavation	m3	13.22	
Common Excavation by machine	m3	18.15	
Common Excavation by Dredge	m3	17.35	
Hardly Excavation by Machine	m3	24.70	
Back Fill by Bulldozer	m3	11.25	
Compaction 95% by Machine	m3	35.95	
Compaction 85% by Machine	m3	31	
Decompose Compacted soil	m3	19.70	
Excavation by Man force	m3	89	
Compaction by Man force	m3	178	
Sodding	m2	22.80	
Riprap	m3	500	
Plain Concrete	m3	2,000	
Reinforced Concrete	m3	4,000	
Set a Sheet pile	ton	25,000	Type 2

Maintenance Cost

Type of Work	Unit	Cost (Baht)	Remark
Main Lateral Road	km	39,300	
Sub Lateral Road	km	25,300	
Standard Road	km	14,400	
Asphalt Road	km	39,200	
Canal Dredging by Dredger	m3	17.35	
Canal Dredging by Machine	m3	13.22	
Main Canal	km	6,680	
Lateral Canal	km	3,340	
Head Work	rai	1,070	
Get Rid of Grass by Hand	rai	1,330	

(continued)

Project Cost

Type of Project	Unit	Cost (Baht)	Remark
Intake and Canal for Small Scale	Place	340,000	
Installation of Intake and Canal	Place	390,000	For Reservoir
Installation of Intake and Canal	Place	110,000	For Weir
Weir	Place	873,124	
Rural Water Supply	Unit	298,000	Small Scale
Rural Water Supply	Unit	431,000	Medium Scale
Rural Water Supply	Unit	1,410,000	Large Scale
Reforestation	rai	1,090	

Unit Cost

Items	Unit	Cost (Baht)	Remark
Accessory for Floating Pump	Unit	220,000	Including Pontoon
Electric Pump	Unit	103,000	300 l / s , H=25m , 110kw
Electric Pump	Unit	91,000	200 l / s , H=25m , 75kw
Electric Pump for Sprinkler	Unit	8,500	2inch 1.5kw
Motor	Unit	59,000	110kw
Motor	Unit	40,000	75kw
Booster Pump	Unit	183,200	300mm 30kw Horizontal Volute Mixed Flow
Vertical Mixed Flow Pump	Unit	8,405,600	350mm 160kw
Butterfly Valve 500mm	Unit	137,616	
Butterfly Valve 600mm	Unit	177,564	
Sluice Gate 1.50x1.50	Unit	1,074,240	
Sluice Gate 3.00x 2.10	Unit	2,148,480	
Steel Pipe D=1.00m	m	7,000	
Steel Pipe 14"	3.0m	4,000	l=3.0m /unit
Steel Pipe 12"	6.0m	7,000	l=6.0m/unit
A.C Pipe 300	m	580	
A.C Pipe 400	m	915	
A.C Pipe 500	m	1,195	
A.C Pipe 600	m	1,630	
PVC Pipe 2"	m	80	
PVC Pipe 1"	m	54	
PVC Pipe 1/2"	m	30	
Sprinkler Head for Vegetable	Unit	15	
Sprinkler Head for Fruit Tree	Unit	7	