APPENDIX C. SELECTION OF SANITARY DISTRICT

APPENDIX C : SELECTION OF SANITARY DISTRICT

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Table C-1-1 Human Needs

	Population (1984) 20			Increase of Population (%) 15			Density (P/km^2) 10			Water-Bore Disease(%) 5			Sub Total 50
	Number	Weight 2/	Score	Number	Weight 2/	Score	Number	Weight 2/	Score	Number	Weight 2/	Score	Score
2. Rong Kham	4,886	0.36	7.2	1.66	0.72	10.8	1,576	0.32	3.2	0.23	0.08	0.4	21.6
5. Kham Sakae Sang	4,816	0.36	7.2	1.78	0.78	11.7	3,254	0.65	6.5	0.52	0.18	0.9	26.3
6. Nong Bua Lai	3,314	0.25	5.0	1.92	0.84	12.6	634	0.13	1.3	1.00	0.34	1.7	20.6
7. Huai Thalaeng	9,598	0.71	14.2	1.98	0.86	12.9	3,720	0.74	7.4	0.61	0.21	1.1	35.6
8. Nong Ki	13,100	0.97	19.4	1.84	0.80	12.0	•5,000	1.00	10.0	0.83	0.28	1.4	42.8
9. Hin Lek Fai	5,086	0.38	7.6	1.77	0.77	11.6	802	0.16	1.6	0.55	0.19	1.0	21.8
10. Huai Rat	3,785	0.28	5.6	1.86	0.81	12.2	2,200	0.44	4.4	0.85	0.29	1.5	23.7
11. Sai Mun	6,087	0.45	9.0	1.66	0.72	10.8	974	0.19	1.9	1.28	0.44	2.2	23.9
12. Khun Han	3,139	0.23	4.6	•2.29	1.00	15.0	1,427	0.29	2.9	0.14	0.05	0.3	22.8
13. Kusuman	5,248	0.39	7.8	1.67	0.73	11.0	3,976	0.80	8.0	1.37	0.47	2.4	29.2
15. Dong Khuang	•13,460	1.00	20.0	1.56	0.68	10.2	1,683	0.34	3.4	1.19 1/	0.40	2.0	35.6
17. Phon Chareon	9,697	0.72	14.4	1.56	0.68	10.2	1,192	0.24	2.4	0.28	0.10	0.5	27.5
18. Nong Sang Hong	7,914	0.59	11.8	1.56	0.68	10.2	1,770	0.35	3.5	0.25	0.09	0.5	26.0
20. Huai Kha Yung	3,813	0.28	5.6	1.84	0.80	12.0	2,611	0.52	5.2	•2.94	1.00	5.0	27.8

Note: 1/... means

2/ W = Each SD Number/Max Number

• ; Max. (Min) Number

Table C-1-2 Water-Borne and Water-Related Disease in 1983/84

N.S.D.	Population	Disease	
		No.	Percent
2. Rong Kham	4,886	11[1/]	0.23
5. Khan Sakae Sang	4,816	25	0.52
6. Nong Bua Lai	3,314	33	1.00
7. Huai Thalaeng	9,598	59	0.61
8. Nong Ki	13,100	109[1/]	0.83
9. Hin Lek Fai	5,086	28	0.55
10. Huai Rat	3,785	32	0.85
11. Sai Mun	6,087	78	1.28
12. Khun Han	4,178	6	0.14
13. Kusuman	5,248	72[1/]	1.37
15. Dong Khuang	13,460	N.A.	-
17. Phon Charoen	9,697	27	0.28
18. Nong Song Hong	7,914	20	0.25
20. Huai Kha Yung	3,813	112[2/]	2.94
Total	94,982	612	0.64

Note: 1/..... Estimated from the Data of Public Health Center and Offices of Amphoe and Tambon in terms of population.

2/..... Including food poisoning.

Table C-1-3 Payment Capability

	Income Year/capita 10			Farmland per capita 10			Distance Between Mainroad and SD 5			Sub Total 25
	฿	Weight	Score	Rai	Weight	Score	Km	Weight 1/	Score	Score
2. Rong Kham	2,968	0.70	7.0	8.5	0.78	7.8	5	0.92	4.8	19.6
5. Kham Sakae Sang	2,901	0.68	6.8	7.3	0.58	5.8	20	0.67	3.4	16.0
6. Nong Bua Lai	3,314	0.78	7.8	10.2	0.94	9.4	3	0.95	4.8	22.0
7. Huai Thalaeng	2,888	0.68	6.8	2.9	0.27	2.7	60	0.00	0.00	9.5
8. Nong Ki	3,332	0.78	7.8	1.5	0.14	1.4	0	1.00	5.0	14.2
9. Hin Lex Fai	3,450	0.81	8.1	1.2	0.11	1.1	33	0.45	2.3	11.5
10. Huai Rat	2,766	0.65	6.5	10.3	0.94	9.4	0	1.00	5.0	20.9
11. Sai Mun	3,181	0.75	7.5	4.5	0.41	4.1	18	0.70	3.5	15.1
12. Khun Han	4,266	1.00	10.0	8.3	0.76	7.6	7	0.88	4.4	22.0
13. Kusuman	3,014	0.71	7.1	4.4	0.40	4.0	2	0.97	4.9	16.0
15. Dong Khuang	2,558	0.60	6.0	3.0	0.28	2.8	0	1.00	5.0	14.8
17. Phon Chareon	3,750	0.88	8.8	0.4	0.04	0.4	2	0.97	4.9	14.1
18. Nong Sang Hong	3,027	0.71	7.1	4.0	0.37	3.7	0	1.00	5.0	15.8
20. Huai Kha Yung	3,405	0.80	8.0	10.9	1.00	10.0	0	1.00	5.0	23.0

Note: 1/ W = (Max. Distance - L) / Max. Distance = (60-L) / 60

Table C-1-4 Average Income per Capita per Year

SD No.	NSD Name	Population	Household				Average Person per Household	Ave. Monthly Income/H.	Ave. Annual Income per Capita
			Agriculture		Non-Agriculture				
			No.	%	No.	%		฿	฿
2.	Rong Kham	4,886	555	76	175	24	6.7	1,657 1/	2,968 2/
5.	Kham Sakae Sang	4,816	392	62	241	38	7.6	1,837	2,901
6.	Nong Bua Lai	3,314	216	48	235	52	7.3	2,016	3,314
7.	Huai Thalaeng	9,598	462	42	638	58	8.7	2,094	2,888
8.	Nong Ki	13,100	1,109	58	803	42	6.9	1,888	3,332
9.	Hin Lek Fai	5,080	511	64	287	36	6.4	1,811	3,450
10.	Huai Rat	3,785	256	56	201	44	8.3	1,913	2,766
11.	Sai Mun	6,087	725	75	241	25	6.3	1,670	3,181
12.	Khun Han	3,139	63	14	390	86	6.9	2,453	4,266
13.	Kusuman	5,248	578	74	203	26	6.7	1,683	3,014
15.	Dong Khuang	13,460	525	39	821	61	9.8	2,132	2,558
17.	Phon Charoen	9,697	608	42	840	58	6.7	2,094	3,750
18.	Nong Song Hong	7,914	399	42	552	58	8.3	2,094	3,027
20.	Huai Kha Yung	3,813	324	57	245	43	6.7	1,901	3,405

Note: 1/ Average monthly income per household = (Rate of agriculture household) x (฿1,349/month) + (Rate of Non-agriculture household) x (฿2,633/month)

2/ Average annual income per capita = (Average monthly income per household) x 12 month ÷ (Average person per household)

Table C-1-5 Farmland in and Around SD

Diameter 10km = 78.55km^2 = 49,094 Rai

No.	NSD	Population in 1984	Farmland within 10km			Farmland per Capita	Remark
			Km^2	Rai	%	Rai	
2.	Rong Kham	4,886	66.66	41,663	85	8.5	
5.	Kham Sakae Sang	4,816	48.85	30,531	62	6.3	
6.	Nong Bua Lai	3,314	54.11	33,819	69	10.2	
7.	Huai Thalaeng	9,598	44.99	28,119	57	2.9	
8.	Nong Ki	13,100	31.87	19,919	41	1.5	
9.	Hin Lek Fai	5,086	9.87	6,169	13	1.2	
10.	Huai Rat	3,785	62.42	39,013	79	10.3	
11.	Sai Mun	6,087	43.38	27,113	55	4.5	
12.	Khun Han	3,139	41.63	26,019	53	8.3	
13.	Kusuman	5,248	36.84	23,019	47	4.4	
15.	Dong Khuang	13,460	63.66	39,788	81	3.0	
17.	Phon Chareon	9,697	6.09	3,806	8	0.4	
18.	Nong Song Hong	7,914	50.69	31,681	65	4.0	
20.	Huai Kha Yung	3,813	66.61	41,631	85	10.9	
	Total	94,892		392,290		4.1	
	Average	6,784	44.83	28,020	57		
Northeastern Region		15,698,874	64,813	40,508,417 1/		2.6	1/ 1978 in Data

Table C-1-6 Distance Between Main Road and SD (Marketing Conditions)

No.	NSD	Name of National Highways	From National Highway km	Name of Provincial Highways	From Provincial Highway km
2.	Rong Kham	214	5	2,116	0
5.	Kham Sakae Sang	205	20	2,150	0
6.	Nong Bua Lai	202	3	-	-
7.	Huai Thalaeng	2	60	2,162	0
8.	Nong Ki	24	0	-	-
9.	Hin Lek Fai	219	33	2,074	0
10.	Huai Rat	218,219	0	-	-
11.	Sai Mun	23	18	2,169	0
12.	Khun Han	24	7	2,127	0
13.	Khsuman	22	2	-	-
15.	Dong Khuang	22	0	-	-
17.	Phon Chareon	222	2	-	-
18.	Nong Song Hong	2	0	-	-
20.	Huai Kha Yung	24,217	0	-	-

Table C-1-7 Construction Cost

No.	NSD	Population (AD.2000)	Design Daily Max. Consumption (cu.m/hr)	Construction Cost (000฿)	Unit Water Cost 15			Water per Beneficiary 10			Sub Total 25
					Cost (฿/cu.m/hr)	Weight	Score	Cost per Capita (฿)	Weight	Score	Score
2.	Rong Kham	8,100	40	4,070	101	0.52	7.8	500	0.52	5.2	13.0
5.	Kham Sakae Sang	8,600	50	4,960	99	0.54	8.1	580	0.45	4.5	12.6
6.	Nong Bua Lai	6,400	30	2,750	91	0.58	8.7	432	0.60	6.0	14.7
7.	Huai Thalaeng	19,000	100	11,580	115	0.46	6.9	609	0.43	4.3	11.2
8.	Nong Ki	24,100	120	8,860	74	0.72	10.8	368	0.71	7.1	17.9
9.	Hin Lek Fai	9,000	50	5,630	112	0.47	7.1	626	0.42	4.2	11.3
10.	Huai Rat	7,000	40	2,800	70	0.76	11.4	398	0.65	6.5	17.9
11.	Sai Mun	10,100	50	4,860	97	0.55	8.3	480	0.54	5.4	13.7
12.	Khun Han	7,200	40	2,190	55	0.96	14.4	304	0.86	8.6	23.0
13.	Kusuman	8,800	50	3,020	60	0.88	13.2	344	0.76	7.6	20.8
15.	Dong Khuang	20,900	100	8,140	81	0.65	9.8	389	0.67	6.7	16.5
17.	Phon Charoen	15,100	80	7,300	91	0.58	8.7	484	0.54	5.4	14.1
18.	Nong Song Hong	12,300	60	3,200	53	1.00	15.0	260	1.00	10.0	25.0
20.	Huai Kha Yung	7,000	40	3,490	87	0.61	9.2	498	0.52	5.2	14.4

Table C-1-8 Summary of Cost Estimate for Proposed SD

(Unit: ¥1,000)

Item	SDs Code No.													
	2	5	6	7	8	9	10	11	12	13	15	17	18	20
Design Capacity(m^3/hr)	40	50	30	100	120	50	40	50	40	50	100	80	60	40
Water Source Works	1,380	300	-	-	300	300	-	1,280	-	1,080	1,500	2,340	540	-
Intake Works	240	180	160	260	320	180	170	320	170	240	260	390	210	270
Transportation Works	-	1,470	-	6,300	1,090	100	-	-	-	-	790	-	-	-
Treatment Works	780	2,000	1,390	3,110	4,220	2,000	1,700	980	1,540	900	3,590	1,330	750	1,700
Distribution Works	1,670	1,010	1,200	1,910	2,930	3,050	930	2,280	650	800	2,000	3,240	1,700	1,520
Total Cost	4,070	4,960	2,750	11,580	8,860	5,630	2,800	4,860	2,190	3,020	8,140	7,300	3,200	3,490
Unit cost per m^3/hr	102	99	92	116	74	113	70	97	55	60	81	91	53	87
Priority	12	11	9	14	5	13	4	10	2	3	6	8	1	7

APPENDIX D. PRELIMINARY DESIGN

APPENDIX D: PRELIMINARY DESIGN

D.1. DIMENSIONS OF INTAKE PUMP

D.2. HEAD LOSS OF TRANSMISSION PIPELINE

D.3. TREATMENT PLANT

D.4. DIMENSIONS OF DISTRIBUTION PUMP

D.5. DISTRIBUTION PIPELINE

D.1. DIMENSIONS OF INTAKE PUMP

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D.1. DIMENSIONS OF INTAKE PUMP

(1) Suction pipe diameter

Suction pipe diameter of pump is determined by applying the following table:

Suction diameter	mm	65	80	100	125
Discharge	m^3/min	0.25-0.80	0.40-0.80	0.63-1.25	1.00-2.00

Total Head (H)

$$H = Ha + h\ell_1 + h\ell_2 + \frac{V^2}{2g}$$

H : Total Head (m)

Ha : Actual Head (m)

Ha = HWL - LWL

$h\ell_1$: Loss head on suction side (m)

$(h\ell_1 + V^2/2g) \fallingdotseq 1.5$ m

$h\ell_2$: Loss head on delivery side

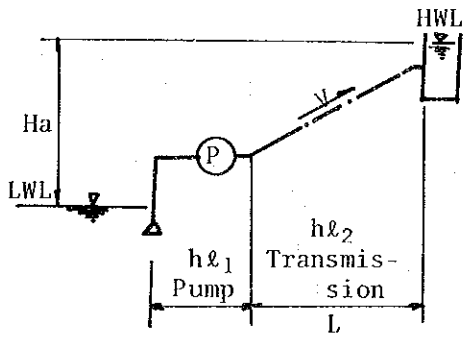
$h\ell_2$ = S.L.

S: Hydraulic gradient of delivery side

L: Transmission length (m)

Out Put (kW)

$$kW = 0.163 \times \frac{QH}{\mu t \times \mu p} \times (1 + \alpha)$$



μt : Transmission efficiency

μp : Pump efficiency

Q : Discharge (m^3/min)

H : Total Head (m)

α : Allowance α ≒ 15 - 20%

$\mu = \mu t \times \mu p$

Discharge	0.25-0.5	0.5-0.75	0.75-1.25	1.25-2.00
μ	0.45	0.50	0.50	0.60

Table D-1-1 Intake pump dimentions

NSD NO.	Discharge		Actual Head (m)			Conveyance loss	Pump loss	Total Head	Effi-ciency	Output	Suction diameter (mm)
	m^3/d	m^3/min	Suction	Outlet	Head	m					
5	990	0.687	97.2	97.5	0.3	29.6	1.5	32.0	0.50	8.6KW → 11.0	ø80
6	675	0.469	96.6	103.5	6.9	-	1.5	9.0	0.45	1.9 → 2.2	ø80
7	2,200	1.528	176.5	193.5	17.0	29.4	1.5	48.0	0.60	24.0 → 30	ø125
8	2,790	1.937	97.5	123.0	25.5	8.0	1.5	35.0	0.60	22.2 → 22	ø150
10	810	0.562	96.3	106.0	9.7	0.3	1.5	12.0	0.50	2.7 → 3.7	ø80
12	750	0.521	94.5	101.0	6.5	1.4	1.5	10.0	0.45	2.3 → 2.2	ø80
13	340x3	0.236	80	105	25	4.8	1.5	32.0	0.45	3.2 → 3.7	ø65
17	1,750	1.215	89.9	111.0	21.1	41.3	1.5	70.0	0.55	30.3 → 30	ø125
18	1,420	0.986	96.5	104.05	7.5	1.7	1.5	11.0	0.55	3.9 → 3.7	ø100
20	810	0.562	86.65	103.45	16.8	3.0	1.5	22.0	0.50	4.9 → 5.5	ø80

D.2. HEAD LOSS OF TRANSMISSION PIPELINE

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D.2. HEAD LOSS OF TRANSMISSION PIPELINE

Hazen-William formula will be applied.

$$S = 10.66 \times C^{-1.85} \times D^{-4.87} \times Q^{1.85}$$

A : Hydraulic gradient

C : Coefficient of flow rate

D : Pipe diameter (m)

Q : Discharge (m^3/s)

Table D-2-1 Hydraulic computation of Water Transmission

NSD NO.	Length m	Discharge m^3/d	Discharge m^3/s	Pipe Diameter mm	Flow Area m^2	Velocity m/s	Hydraulic Gradient C=110	Friction Loss head m	Remarks
5	5,800	990	0.012	ϕ150	0.0177	0.678	0.0051	29.6	
6	-	-	-	-	-	-	-	-	
7	6,000	2,200	0.025	ϕ200	0.0314	0.796	0.0049	29.4	
8	3,050	2,790	0.032	ϕ250	0.0491	0.651	0.0026	8.0	
10	100	810	0.009	ϕ150	0.0177	0.508	0.0030	0.3	
12	470	750	0.009	ϕ150	0.0177	0.508	0.0030	1.4	
13	1,040	340x3	0.0039	ϕ100	0.0078	0.500	0.0046	4.8	
17	12,500	1,750	0.020	ϕ200	0.0314	0.637	0.0033	41.3	
18	200	1,420	0.016	ϕ150	0.0177	0.904	0.0087	1.7	
20	1,000	810	0.009	ϕ150	0.0777	0.508	0.0030	3.0	

D.3. TREATMENT PLANT

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D.3. TREATMENT PLANT

(1) Design Condition

Treatment Capacity : Q = 50 (m^3/hr)
= 0.83 (m^3/min)
= 0.014 (m^3/sec)

(2) Design Calculation

a) Receiving Well

Dimension : $0.4^W \times 1.5^L \times 1.5^H$
Volume : 0.9 m^3
Detention Time : 0.90/0.83 = 1.1 (min)

b) Measuring Weir : Triangle Weir 90 degrees

$Q = 84\ H^{5/2}$ ..... Tomson's Formula

Q = 0.83 m^3/min

H = 0.16 m

Rapid mixing : Head loss
h_l = 300 (mm)

c) Flocculation Basin

Dimension : $0.4^W \times \{5.25-1.5)+5.25 \times 4\}^L \times 1.2^H$
Volume : 0.4 x 24.75 x 1.2 = 11.9 (m^3)
Detention Time : 11.9/0.83 = 14.3 (min)
Velocity : 0.014/0.4 x 0.25 = 0.14 (m/sec)
Head Loss : H (m)
Bend loss : h_l

$$h_l = f_l \frac{v^2}{2g} \cdot N_l \qquad f = 3.5,\ N_l = 38$$

$$= 35 \times \frac{0.14^2}{2 \times 9.8} \times 38$$

$$= 0.133 \text{ m}$$

Weir loss : h_2

$$h_2 = f_2 \frac{v^2}{2g} \cdot N_2 \qquad f_2 = 1.0,\ N_2 = 37$$

$$= 1.0 \times \frac{0.14^2}{2 \times 9.8} \times 37$$

$$= 0.037 \text{ (m)}$$

Bottom and wall loss : h_3

$$h_3 = \frac{L}{C^2 R} V^2 \qquad \text{Chagy formula, } C = 31$$

$$= \frac{(24.75 + 75 \times 1.1)\ 0.14^2}{31^2 \times (0.4 \times 0.25)/2 \times (0.4 + 0.25)}$$

$$= 0.29 \text{ (m)}$$

Total head loss $H = h_1 + h_2 + h_3 = 0.20$ (m)

G-Value

$$G = \sqrt{\frac{P \cdot Q \cdot H \cdot g}{\mu \cdot v}}$$

$$= \sqrt{\frac{10^3 \times 0.014 \times 0.20 \times 9.8}{10^{-3} \times 13.6}} = 44.5 \ (\text{sec}^{-1})$$

d) Sedimentation

$$\text{Detention time} = \frac{2 \times 2.50^B \times 11.50^L \times 2.7^H}{50} = 3.1 \text{ hr}$$

$$\text{Over flow rate} = \frac{50}{60 \times 2 \times 2.50 \times 11.50} = 0.014 \text{ m/min}$$

$$\text{Flow velocity} = \frac{50}{60 \times 2 \times 2.50 \times 2.70} = 0.06 \text{ m/min}$$

e) Rapid Sand Filter

$$\text{Rate of Filtration} = \frac{24 \times 50}{2 \times 2.05 \times 2.40} = 122 \text{ m/d}$$

D.4. DIMENSIONS OF DISTRIBUTION PUMP

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Table D-4-1 Distribution Pump Dimensions

NSD	Daily Max Capacity cum/day	Pump Units	Capacity cum/ min. unit	WL Outlet DC (m)	WL Inlet DC (m)	Actual Head (m)	Pipeloss (m)	Total Head (m)	np	Pump Dia (mm) Out put (KW)
5	900	3	0.469	111.55	91.20	20.35	4.65	25.0	0.45	ø80 x 5.5kw
6	675	3	0.352	116.31	95.96	20.35	4.65	25.0	0.45	ø65 x 3.7
7	1,995	3	1.039	117.00	96.65	20.35	4.65	25.0	0.55	ø100 x 11
8	2,535	3	1.320	138.44	118.09	20.35	4.65	25.0	0.60	ø125 x 11
10	735	3	0.383	116.35	100.00	16.35	3.65	20.0	0.45	ø65 x 3.7
12	750	3	0.391	112.50	96.15	16.35	3.65	20.0	0.45	ø65 x 3.7
13	930	3	0.484	121.00	100.65	20.35	4.65	25.0	0.45	ø80 x 5.5
17	1,590	3	0.828	121.35	105.00	16.35	3.65	20.0	0.55	ø100 x 7.5
18	1,290	3	0.672	114.00	97.65	16.35	3.65	20.0	0.50	ø80 x 5.5
20	735	3	0.383	117.60	97.25	20.35	4.65	25.0	0.45	ø65 x 5.5

D.5. DISTRIBUTION PIPELINE

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D.5. DISTRIBUTION PIPELINE

D.5.1. Design Procedure of Distribution Pipeline

(1) Procedure for designing distribution pipeline

(a) Population in villages will be forecasted in the following way. (See Table D-5-1)

i) Sanitary district is divided into the three area, residential area, public land and nonresidential area.

ii) Average Area per household is determined by dividing residential area by the number of household in the area.

iii) The required area is obtained by multiplying prospect number of household by average area per household.

iv) Non-residential area covers the prospect population in case that the non-residential area in the other village is sufficient for the required-area.

v) Excess population moves to the non-residential area in the other village in case that the non-residential area is insufficient for the required-area.

(b) Pipeline network will be planned in full consideration of distribution of the present population and village population at the target year on the basis of general plans.

i) The network consists of distribution main and sub main.

ii) The distribution main will be laid on the shortest route from treatment plant to the villages served, main road and densly populated area and so on.

The distribution sub will be laid between mains in order to supplement the service area where can not be served only by main.

(c) The required values for hydraulic calculation will be obtained in the following way.

i) Water demand on the contacts is determined on the basis of population movement in a village.

Service area is to be served only from the contact which is assumed on the network.

The hourly maximum water demand is to be inflowed to the network from the contact which is assumed at treatment

plant, then water demand is to be outflowed from the other contacts.

The total water demand in respective contacts is to be equal to the hourly maximum water demand.

ii) Ground elevation of contacts and length between them is to be read from general plans.

iii) The height of elevated tank is to be 18.0 m or 14.0 m.

iv) Branch will be installed at the contact where effective water head is the lowest. The effective water head at the branch end shall be more than 10.0 m. (The minimum required pressure will be 7.0 m, in this case, different type of connection level must be considered.)

- The length of branch is determined by the situation of district.
- The water demand of branch end is determined as 140 x 225 ℓ/day/cap, where 140 is obtained by multiplying 20 households by 7 person per household.

v) The network will be planned in case that effective water head at the branch end is more than 10.0 m.

Unless otherwise, the most economical network is to be planned by increasing the main pipe or sub pipe diameter, or rearranging the location of the plant and elevated tank.

Table D-5-1 The Arrangement of Prospect Village Population (1)

NSD No.	Village Code No.	1984 Population	1984 Household	Sanitary District Area (ha) Residential	Public	Non-residential	Total	Density (ha/House)	Average Space (ha/House)	2,000 Population	2,000 Household	Non-residential Area Household	Required	Maximum	Population Arrangement Calculation	Population	Population Served
5	1	2,526	317	17.9	10.4	26.8	55.1	0.06	0.10	4,253	531	214	21.4	26.8	-	4,253	2,980
	15	1,748	215	20.6	21.9	83.2	125.7	0.10	"	2,943	368	153	15.3	83.2	-	2,943	2,060
	16	809	101	4.0	-	15.2	19.2	0.04	"	1,363	170	69	6.9	15.2	-	1,363	960
	Total	5,083	633	42.5	32.3	125.2	200.0	-	-	8,559	1,069	436	43.6	125.2	-	8,559	6,000
6	1	2,239	260	33.0	66.0	49.0	148.0	0.13	0.10	4,271	495	235	23.5	56.8	-	4,271	3,000
	9	453	65	7.5	4.5	33.0	45.0	0.12	"	864	124	59	5.9	35.0	-	864	610
	10	282	35	3.0	5.0	54.0	62.0	0.09	"	538	67	32	3.2	54.0	-	538	390
	11	363	53	4.8	9.0	34.2	48.0	0.09	"	693	100	47	4.7	34.2	-	693	500
	Total	3,337	413	48.3	84.5	170.2	303.0	-	-	6,366	786	373	37.3	180.0	-	6,366	4,500
7	1	3,976	496	37.9	32.8	50.4	121.1	0.08	0.10	7,575	940	444	44.4	50.4	7,575 + 1,453	9,028	6,310
	2	5,206	551	38.2	7.6	32.4	78.2	0.07	"	9,919	1,044	493	49.3	32.4	9,919 - (493 - 32.4) ÷ 0.1 x 8.6	8,466	5,920
	11	805	121	16.1	19.8	27.8	63.7	0.013	"	1,534	229	108	10.8	31.4	-	1,534	1,070
	Total	9,987	1,168	92.2	60.2	110.6	263.0	-	-	19,028	2,213	1,045	104.5	114.2	-	19,028	13,300
8	1	628	115	12.5	3.0	10.0	25.5	0.11	0.10	1,164	171	56	5.6	10.0	-	1,164	820
	6	2,097	305	38.2	-	16.0	54.2	0.13	"	3,885	571	224	22.4	16.0	-(22.4 - 16.8) ÷ 0.1 x 6.8	3,504	2,450
	12	732	183	19.6	-	10.0	29.6	0.11	"	1,356	199	92	9.2	10.0	-	1,356	950
	13	688	102	8.0	2.0	9.1	19.1	0.08	"	1,275	188	86	8.6	9.1	-	1,275	900
	14	531	102	11.0	-	4.8	15.8	0.11	"	984	145	67	6.7	4.8	-(6.7 - 4.8) ÷ 0.1 x 6.8	855	600
	15	2,790	353	15.0	3.0	6.0	24.0	0.04	"	5,169	760	350	35.0	6.0	-(35.0 - 6.0) ÷ 0.1 x 6.8	3,197	2,240
	16	894	152	15.5	5.0	-	20.5	0.10	"	1,654	243	112	11.2	-	-11.2 ÷ 0.1 x 6.8	894	630
	17	527	87	7.0	-	14.0	21.0	0.08	"	976	144	66	6.6	14.0	-	976	690
	18	2,222	214	39.0	18.0	103.6	160.6	0.18	"	4,117	605	251	25.1	103.6	-	4,117	2,880
	19	831	145	36.3	-	112.9	149.2	0.25	"	1,540	226	-	-	112.9	-	1,540	1,080
	22	507	70	4.0	1.4	-	5.4	0.06	"	939	138	64	6.4	-	-6.4 ÷ 0.1 x 6.8	507	360
	23	554	77	10.0	1.0	4.1	15.1	0.10	"	1,030	151	70	7.0	4.1	-17.0 - 4.11 x 6.8	820	580
	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,844	2,720
	Total	13,001	1,905	216.1	33.4	290.5	540.0	-	-	24,089	3,543	1,438	143.8	290.5	-	24,089	16,900

Table D-5-1 The Arrangement of Prospect Village Population (2)

NSD No.	Village Code No.	1984 Population	1984 Household	Sanitary District Area (ha) Residential	Public	Non-residential	Total	Density (ha/House)	Average Space (ha/House)	2,000 Population	2,000 Household	Non-residential Area Household	Required	Maximum	Population Arrangement Calculation	Population	Population Served
10	1	1,435	166	13.5	6.0	17.1	36.6	0.08	0.10	3,383	392	226	22.6	17.1	-(22.6 - 17.1) ÷ 0.1 x 6.7	3,014	2,100
	3	469	150	19.5	18.6	48.6	86.7	0.13	"	1,105	354	204	20.4	53.1	369 + 13	1,487	1,040
	5	751	75	9.4	5.0	23.2	37.6	0.13	"	1,771	177	102	10.2	25.5	-	1,771	1,230
	16	330	54	5.0	-	7.1	12.1	0.09	"	778	127	73	7.3	7.1	-(7.3 - 7.1) ÷ 0.1 x 6.7	765	530
	Total	2,985	445	47.4	29.6	96.0	173.0	-	-	7,037	1,050	605	60.5	102.8	-	7,037	4,900
12	6	3,139	453	54.0	81.0	85.0	220.0	0.12	0.10	7,190	1,042	589	58.9	94.1	-	7,190	5,000
13	1	3,433	668	49.1	20.7	237.2	307.0	0.074	0.10	5,875	1,148	480	48.0	237.2	-	5,875	4,150
	6	1,702	245	20.5	7.2	65.3	93.0	0.084	"	2,913	421	176	17.6	65.3	-	2,913	2,050
	Total	5,135	913	69.6	27.9	302.5	400.0	-	-	8,788	1,569	656	65.6	302.5	-	8,788	6,200
17	2	2,511	370	32.0	10.0	113.0	115.0	0.086	0.10	3,467	508	138	13.8	113.0	-	3,467	2,430
	3	2,694	439	33.0	9.0	33.0	75.0	0.075	"	3,720	602	163	16.3	33.0	-	3,720	2,600
	4	1,648	238	25.0	12.0	153.0	190.0	0.105	"	2,275	327	89	8.9	153.0	-	2,275	1,590
	5	1,286	199	25.0	21.0	39.0	85.0	0.126	"	1,776	273	74	7.4	39.0	-	1,776	1,260
	8	726	49	6.0	-	89.0	95.0	0.122	"	1,002	67	18	1.8	89.0	-	1,002	710
	9	741	186	19.0	15.0	156.0	190.0	0.102	"	1,023	255	69	6.9	156.0	-	1,023	720
	11	593	119	10.0	-	10.0	20.0	0.084	"	819	163	44	4.4	10.0	-	819	580
	14	726	41	6.0	-	184.0	190.0	0.146	"	1,002	56	15	1.5	184.0	-	1,002	710
	Total	10,925	1,641	156.0	67.0	777.0	1,000.0	-	-	15,084	2,251	610	61.0	777.0	-	15,084	10,600
18	6	2,255	249	20.0	6.0	41.2	67.2	0.08	0.10	3,507	385	136	13.6	41.2	-	3,507	2,450
	8	2,590	286	27.5	15.0	92.5	135.0	0.10	"	4,028	443	157	15.7	92.5	-	4,028	2,820
	10	1,231	136	13.0	5.0	77.0	95.0	0.10	"	1,930	211	75	7.5	77.0	-	1,930	1,350
	11	1,431	158	17.5	10.0	43.1	70.6	0.11	"	2,226	245	87	8.7	43.1	-	2,226	1,560
	12	407	45	5.3	3.0	76.9	85.2	0.12	"	619	69	24	2.4	76.9	-	619	420
	Total	7,914	874	83.3	39.0	330.7	453.0	-	-	12,310	1,353	479	47.9	330.7	-	12,310	8,600
20	9	1,139	150	14.4	1.0	32.9	48.3	0.096	0.10	2,028	267	117	11.7	32.9	-	2,028	1,420
	10	522	79	10.0	5.6	60.6	76.2	0.130	"	930	140	61	6.1	60.5	-	930	650
	14	1,391	262	21.5	19.5	41.4	82.4	0.082	"	2,477	466	204	20.4	41.0	-	2,477	1,730
	15	885	135	13.6	6.5	53.0	73.1	0.010	"	1,576	240	105	10.5	53.0	-	1,576	1,100
	Total	3,937	626	59.5	32.6	187.9	280.0	-	-	7,011	1,113	487	48.7	187.4	-	7,011	4,900

(2) Procedure for calculating the hydraulics of pipeline network

(a) The calculation method

The following two methods are generally considered.

i) Discharge method ; Harday Cross method

ii) Water head method ; Contact water head method

The same results can be obtained from the both methods. The former, however, can be applied only for network pipeline. The latter is the method that discharge can be obtained by assuming pressure on every contacts, then can be applied for the both type, network pipeline and branch pipeline.

Accordingly, the water head method is considered to be adequate for calculating the hydraulics of pipeline in sanitary district.

(b) The contact water head method

The Hazen-Williams formula is used for the average velocity formula.

Namely,

$$V = 0.35464\ C \cdot D^{0.63} \cdot I^{0.54} \quad \cdots\cdots\cdots\cdots\cdots \quad ①$$

$$Q = 0.27853\ C \cdot D^{2.63} \cdot I^{0.54} \quad \cdots\cdots\cdots\cdots\cdots \quad ②$$

Where

V ; average velocity (m/s)

C ; discharge coefficient

R ; hydraulic mean depth (m)

I ; hydraulic gradient

h ; friction loss head (m)

L ; length of pipe (m)

Q ; discharge (m^3/s)

D ; diameter (m)

Now, the hydraulic level on i, j is assumed to be Hi, Hj respectively, on the pipeline between i and j

$$Q = 0.27853 \cdot C \cdot D^{2.63} \ \frac{(Hi - Hj)^{0.54}}{L^{0.54}}$$

$$= \frac{0.27853\ C \cdot D^{2.63}}{L^{0.54} \cdot (Hi - Hj)^{0.46}} \cdot (Hi - Hj) \quad \cdots\cdots \quad ③$$

On assumption that water is poured into the contact (1) and the hydraulic level is fixed, as described in Fig. the following linear equation can be obtained, hydraulic level on every contacts is considered to be unknown faction in this equation.

Therefore,

$$
\left.
\begin{aligned}
&K_{12}(H_1 - H_2) + K_{26}(H_6 - H_2) + K_{24}(H_4 - H_2) + K_{23}(H_3 - H_2) = Q_2 \\
&K_{23}(H_2 - H_3) + K_{34}(H_4 - H_3) = Q_3 \\
&K_{34}(H_3 - H_4) + K_{24}(H_2 - H_4) + K_{46}(H_6 - H_4) + K_{47}(H_7 - H_4) = Q_4 \\
&K_{56}(H_6 - H_5) + K_{15}(H_1 - H_5) = Q_5 \\
&K_{67}(H_7 - H_6) + K_{46}(H_4 - H_6) + K_{26}(H_2 - H_6) + K_{16}(H_1 - H_6) \\
&\qquad + K_{56}(H_5 - H_6) = Q_6 \\
&K_{47}(H_7 - H_4) + K_{67}(H_6 - H_7) = Q_7
\end{aligned}
\right\} \quad (4)
$$

Where, Qi ; Inflow or outflow from contacts
Inflow is - , outflow is + .

Hi can be obtained by solving the equation (4) , Qij can be obtained by solving the equation (3) . The calculation must be made by assuming Hi until a correct answer is obtained.

It the both sie of the equation is put in order, the following is obtained.

The Left Side

H_2	H_3	H_4	H_5	H_6	H_7	The Right Side
$-(K_{12}+K_{23}+K_{24}+K_{26})$	K_{23}	K_{24}		K_{26}		$Q_2-K_{12}\ H_1$
K_{23}	$-(K_{23}+K_{34})$	K_{34}				Q_3
K_{24}	K_{34}	$-(K_{24}+K_{34}+K_{46})$		K_{96}		Q_4
			$-(K_{15}+K_{56})$	$-K_{56}$		$Q_5-K_{15}\ H_1$
K_{26}		K_{46}	K_{56}	$-(K_{16}+K_{26}+K_{46}+K_{56}+K_{69})$	K_{67}	$Q_6-K_{16}\ H_1$
		K_{47}		K_{67}	$-(K_{47}+K_{67})$	Q_7

Namely, on the pipeline network which consists of n's contacts, coefficients of the linear equation on Hi, Aij (i = 2, 3, 4, ... n; j = 2, 3, 4, ... h + 1) is determined as follows.

i = 2, 3, 4 ...., n: j = 2, 3, 4, ..., n

$$Aij = Kij$$
$$Aji = Aij$$
$$Aii = -\sum_{j=1}^{n} Aij$$

The coefficient of the left side of the equation is determined by those factors. Accordingly Aij = Aij. On the other hand, the constants of the right side is determined by Ai, n+1 = Bi (i = 2, 3, 4 .... n).

Therefore, on the pipeline network which consists of n's contacts, (n-1) linear equation on Hi can be obtained when every pipeline are described as i-j, and Aij, Ai.h+1 are given.

(3) Design requirements

(a) Kind of pipes

i) 150mm and the more in diameter ----- Asbestos cement type

ii) Less than 150 mm in diameter ------- Polyvinyl chloride pipe

(b) Diameter

i) Distribution main ---------- D ≧ 100mm

ii) Distribution sub ---------- 75 ≦ D < 100mm

iii) Branch ---------- D = 50mm

iv) Service pipe ---------- D = 13mm and 10mm

- House connection level
- A house is served by one 13mm service pipe.

(c) Average velocity

Diameter (mm)	Velocity (m/s)
50 - 75	0.6 - 0.8
75 - 150	0.7 - 1.0
200 - 300	0.8 - 1.2
350 - 600	0.9 - 1.4

(d) Discharge coefficient

Discharge coefficient of Hazen-Williams is to be 110 including the other head losses.

C value in Hazen-Williams formula

Kind of Pipe	C value
Cast iron (mortar lining)	110
Steel (coating)	110
Asbestos Cement	110
Hard Polyvinyl Chloride	110

(Remarks) C value of straight pipe is to be 130 when the other losses are separately calculated.

(e) Population served by a branch

i) Number of households served by a branch.

- When simultaneous usage of water tap is considered.

◦ Average discharge in 50mm pipe

$$Q = A \times V$$

$$= \frac{0.05}{4} \times \pi \times 0.6 = 0.0012 \text{ m/s}$$

where $V = 0.6$ m/s

◦ Water usage rate of a ϕ13mm house connection.

Water usage rate = 0.00121/(0.017 ÷ 60) = 4.2

22 households can be served by a branch, referring from the table .

◦ Water usage rate of two ϕ10mm water taps.

Water usage rate = 0.00212/(0.010 ÷ 60) = 7.2

52 water taps, namely 26 households can be served by a branch, referring from the table D-5-2.

Number of water tap	Water usage rate	Number of water tap	Water usage rate
1	1.0	10	3.0
2	1.4	15	3.5
3	1.7	20	4.0
4	2.0	30	5.0
5	2.2	40	6.0
6	2.4	50	7.0
7	2.6	60	8.0
8	2.8		
9	2.9		

Table D-5-2 Water usage rate
(Rural water supply facility design manual by ministry of health in Japan)

- Uniformity table of service pipe number of service pipe can be connected to a branch. (See Table D-5-3)

  ϕ50mm branch ---------- 26 ϕ13mm service pipe

Table D-5-3 Uniformity table of service pipe

Main pipe (mm)	Number of Connections										
	10	13	20	25	30	40	50	65	75	100	150
10	1.00										
13	1.92	1.00									
20	5.65	2.89	1.00								
25	9.80	5.10	1.74	1.00							
30	15.59	8.02	2.72	1.57	1.00						
40	32.00	15.59	5.65	3.23	2.05	1.00					
50	55.90	26.00	9.80	5.65	3.58	1.75	1.00				
65	108.20	55.90	19.03	10.96	6.90	3.36	1.92	1.00			
75	154.00	79.97	27.23	15.59	9.88	4.80	2.75	1.43	1.00		
100	317.00	164.50	55.90	32.00	20.28	7.89	5.65	2.94	2.05	1.00	
150	871.40	452.00	154.00	88.18	56.16	27.27	15.58	8.09	5.65	2.75	1.00

- The number of households served by a branch (ϕ50mm). Therefore, the number of households served by a branch (ϕ50mm) is to be 20.

ii) The number of person per household.

Table D-5-4 The number of person per household

NSD No.	Population	Household	The number of person per household
5	5,083	633	8.0
6	3,337	413	8.1
7	9,987	1,168	8.6
8	13,001	1,905	6.8
10	2,985	445	6.7
12	3,139	453	6.9
13	5,135	913	5.6
17	10,925	1,641	6.7
18	7,914	874	9.1
20	3,937	626	6.3

The average number of person per household is to be 7.

iii) Population served by a branch

Therefore, population served by a branch is to be 140, which is obtained by multiplying the number of households (20) by the average number of person (7).

(f) Water demand

i) Fire hydrant (Single tap)

◦ JWA

ϕ65mm ------- 0.5m^3/min.

ϕ50mm ------- 0.26m^3/min.

ϕ40mm ------- 0.13m^3/min.

◦ WHO (rural water supply) ------- 0.3^3/min.

Therefore,

10,000 and the more in population ---------- 65mm (0.5m^3/min.)

Less than 10,000 population ----- 50mm (0.26m^3/min.)

ii) Water demand

The planned water demand is to be the hourly maximum water demand, referring to the following table.

Table D-5-5 The comparative table of water demand

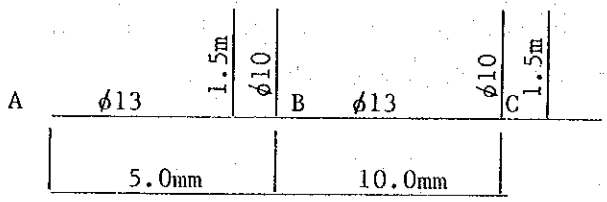
NSD No.	Population	Population served	D.M.W.D. (m^3/h)	Fire fighting (m^3/h)	Total (m^3/h)		H.M.W.D. (m^3/h)
5	8,559	6,000	37.5	15.6	53.1	<	56.3
6	6,366	4,500	28.1	15.7	43.7	≒	41.7
7	19,028	13,300	83.1	30.0	113.1	<	124.7
8	24,089	16,900	105.6	30.0	135.6	<	158.4
10	7,037	4,900	30.6	15.6	46.2	≒	45.9
12	7,190	5,000	31.3	15.6	46.9	≒	46.9
13	8,788	6,200	38.8	15.6	54.4	<	58.1
17	15,084	10,600	66.3	30.0	96.3	<	99.4
18	12,310	8,600	53.8	30.0	83.8	≒	80.6
20	7,011	4,900	30.6	15.6	46.2	≒	45.9

(Remarks) D.M.W.D. ; Dairly maximum water demand

H.M.W.D. ; Hourly maximum water demand

(g) The required pressure at branch end.

i) Brief sketch of service pipe.



ii) Head loss

◦ Head loss between B and C

	Dia (mm)	Quantity (ℓ/min)	L (m)	Converted Length (m)	Total Length (m)
Tap C	10	10	1.5	3.0	4.5
B - C	13	17	10.0	-	10.0

$$4.5 \times \frac{400}{1,000} + 10.0 \times \frac{390}{1,000} = 5.70\text{m}$$

◦ Head loss between A and B

	Dia (mm)	Quantity (ℓ/min)	L (m)	Converted Length (m)	Total Length (m)
Tap B	10	-	-	-	-
A - B	13	17	5.0	-	5.0

$$5.0 \times \frac{390}{1,000} = 1.95\text{m}$$

◦ Other head losses

	Dia (mm)	Quantity (ℓ/min)	L (m)	Converted Length (m)	Total Length (m)
Meter	13	17	-	3.0	3.0
Stop valve	13	17	-	1.5	4.5
Branch	13	17	-	0.5	5.0

$$5.0 \times \frac{390}{1,000} = 1.95\text{m}$$

∘ Total head loss

$$H = 5.70 + 1.95 + 1.95 = 9.60m < 10.0m$$

Therefore, the required pressure at branch end shall be more than 1.0kg/cm^2 (10.0 water head). The minimum pressure, however, shall be more than 0.7kg/cm^2 (7.0m water head). In this case different type of connection level must be considered.

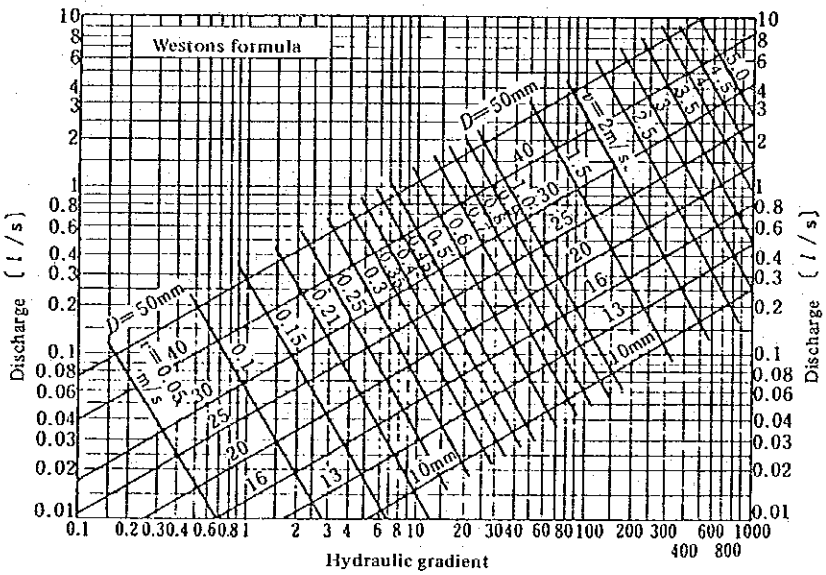


Figure D-5-1 Discharge diagram of service pipe by weston's formula

Table D-5-6 The table of converting the head loss of equipments to straight pipe

Diameter (mm)	Stop valve A (m)	Stop valve B (m)	Tap connection double (m)	Tap connection normal (m)	Branch (m)	Meter (m)	Connection of different Diameter (m)
10	-	1.0	4	3	0.5-1	-	0.5
13	3	1.5	4	3	0.5-1	3-4	0.5-1
16	4	1.5	6	5	0.5-1	5-7	0.5-1
20	8	2.0	10	8	0.5-1	8-11	0.5-1
25	8-10	3.0	10	8	0.5-1	12-15	0.5-1
30	15-20	-	-	-	1	19-24	1
40	17-25	-	-	-	1	20-26	1
50	20-30	-	-	-	1	25-35	1

(h) Service area directly supplied by distribution main and sub

As described in (g), required pressure at branch end is determined on condition that service pipe is less than 15.0m in length.

Accordingly, service area directly supplied by distribution main and sub shall be 15.0m from these pipes.

Furthermore, service pipe will be installed every 30m to the main and sub because one household is assumed to have 30^m x 33^m Area.

(4) Procedure for determing the length and number of branch pipe and service pipe.

(a) The length and number of branch pipe is to be determined in the following way.

i) The total length of distribution main and sub (L_1) is calculated.

ii) The number of households directly supplied from the main and sub (N)

$$N = (L_1 \div 30) \times 2$$

Where

30m ; Pitch of service pipe [See (3)-(h)]

2 ; Both side

iii) The population served by the said service pipes (P_1)

$$P_1 = N \times 7.0$$

Where

7 ; Average number of person per household [See (3)-(e)-ii)]

iv) The population served by branches (P_2)

$$P_2 = T - P_1$$

Where

T ; Total population served

v) The population served by one branch (P)

$$P = 20 \times 7.0 = 140 \quad [\text{See (3)-(e)-iii)}]$$

vi) The number of branch pipes required (M)

$$M = P_2 \div P$$

vii) The average length of branches (1)

$$1 = L_1 \div M$$

viii) The total length of branches (L_2)

$$L_2 = 1 \times M$$

(b) The length of service pipe is to be determined in the following way. [See (3)-(g)-i)]

i) ϕ13mm

l_{13} = The population served $\div$ 7.0 x 15m

ii) ϕ10mm

l_{10} = The population served $\div$ 7.0 x 3.0m

Tabld D-5-7 The length of branch pipe and service pipe

(Unit: m)

NSD No.	5	6	7	8	10	12	13	17	18	20
F	6,000	4,500	13,300	16,900	4,900	6,700	6,200	10,600	8,600	4,900
L_1	5,250	3,430	6,100	12,780	4,470	3,320	4,770	6,960	4,380	6,700
N	350	230	410	860	300	220	320	470	300	450
P_1	2,450	1,610	2,870	6,020	2,100	1,540	2,240	3,290	2,100	3,150
P_2	3,550	2,890	10,430	10,880	2,800	3,380	2,530	3,670	2,280	1,750
P	140	140	140	140	140	140	140	140	140	140
M	26	21	75	78	20	25	19	27	17	13
I	200	165	82	164	225	135	250	260	260	520
Total Length (L_2)	5,200	3,470	6,150	1,800	4,500	3,380	4,640	6,160	8,850	6,760
Population Served	6,000	4,500	11,300	16,900	4,900	5,000	6,200	10,600	8,600	4,900
Household Served	790	610	1,520	2,470	590	650	920	1,580	1,035	730
ϕ13m (15m/H)	11,800	9,100	22,800	37,000	8,800	9,700	13,800	23,700	15,500	10,900
ϕ10m (3m/H)	2,300	1,800	4,500	7,400	1,700	1,900	2,700	4,700	3,100	2,100

Table D-5-8 Diameter and Effective Head of Pipeline

NAME OF SANITARY DISTRICT : KHAM SAKAE SANG

*** INPUT DATA ***

MINIMUM DIAMETER	0.075 (M)
NUMBER OF PIPELINE	24
NUMBER OF CONTACT	18
NUMBER OF CONTACT DESIGNATING WATER HEAD	1
HOURLY MAXIMUM WATER DEMAND	0.0026 (L/SEC/CAPITA)
DESIGNATED CONTACT	1
DESIGNATED WATER HEAD (M)	111.6

CONTACT NO.	DIVERTED WATER HEAD (EL.M)	GROUND ELEVATION (EL.M)	EFFECTIVE HEAD (M)	POPULATION SERVED	WATER DEMAND (L/SEC)
1	111.550	93.550	18.000	-6000.0	-15.6
2	110.850	94.060	16.790	300.0	0.8
3	110.410	95.470	14.940	300.0	0.8
4	110.005	95.140	14.865	300.0	0.8
5	109.927	95.570	14.357	380.0	1.0
6	109.848	96.250	13.598	530.0	1.4
7	111.110	94.830	16.280	350.0	0.9
8	109.326	94.310	15.016	250.0	0.6
9	109.099	93.370	15.729	240.0	0.6
10	108.682	94.060	14.622	240.0	0.6
11	108.522	93.020	15.502	610.0	1.6
12	108.537	95.750	12.787	400.0	1.0
13	108.536	97.100	11.436	560.0	1.5
14	108.677	97.430	11.247	250.0	0.6
15	109.087	96.260	12.827	650.0	1.7
16	109.143	94.830	14.313	250.0	0.6
17	108.680	95.400	13.280	250.0	0.6
18	108.124	97.500	10.624	140.0	0.4

PIPE NO.	CONTACT NO. FROM	TO	DIAMETER (MM)	LENGTH (M)	DISCHARGE COEFFICIENT	DISCHARGE (L/SEC)	VELOCITY (M/SEC)	HEAD LOSS (M)	HYDROURIC GRADIENT	FRICTION LOSS COEFFICIENT
1	1	2	100	120.00	110	4.5	0.568	0.700	5.831	0.03537
2	2	3	100	230.00	110	2.4	0.312	0.440	1.915	0.03867
3	3	4	100	430.00	110	1.7	0.212	0.404	0.940	0.04093
4	4	5	100	270.00	110	0.9	0.113	0.079	0.292	0.04494
5	5	6	100	170.00	110	1.1	0.145	0.079	0.462	0.04332
6	6	7	100	280.00	110	-3.9	-0.495	-1.262	-4.507	-0.03611
7	2	5	75	420.00	110	1.2	0.280	0.924	2.199	0.04121
8	7	8	100	160.00	110	6.3	0.807	1.784	11.152	0.03358
9	8	9	100	110.00	110	2.5	0.324	0.227	2.062	0.03844
10	9	10	100	340.00	110	1.9	0.245	0.416	1.224	0.04007
11	10	11	100	300.00	110	1.2	0.156	0.160	0.533	0.04283
12	11	12	100	260.00	110	-0.4	-0.046	-0.014	-0.055	-0.05134
13	12	13	100	230.00	110	0.1	0.011	0.001	0.004	0.06354
14	13	14	100	140.00	110	-1.7	-0.220	-0.141	-1.008	-0.04070
15	14	15	100	240.00	110	-2.3	-0.293	-0.410	-1.710	-0.03902
16	15	6	100	190.00	110	-3.6	-0.464	-0.761	-4.003	-0.03645
17	15	16	75	260.00	110	-0.4	-0.079	-0.055	-0.213	-0.04967
18	16	8	100	60.00	110	-3.1	-0.400	-0.183	-3.044	-0.03726
19	16	17	100	310.00	110	2.1	0.272	0.462	1.492	0.03945
20	17	10	75	190.00	110	-0.1	-0.016	-0.002	-0.011	-0.06311
21	17	14	75	250.00	110	0.1	0.018	0.003	0.014	0.06190
22	17	12	100	190.00	110	1.5	0.189	0.144	0.756	0.04165
23	7	1	150	100.00	110	-11.1	-0.630	-0.440	-4.401	-0.03256
24	13	18	50	250.00	110	0.4	0.186	0.411	1.646	0.04687
TOTAL				5500.00						

Figure D–5–2 Hydraulic Calculation Diagram of Pipeline Networks

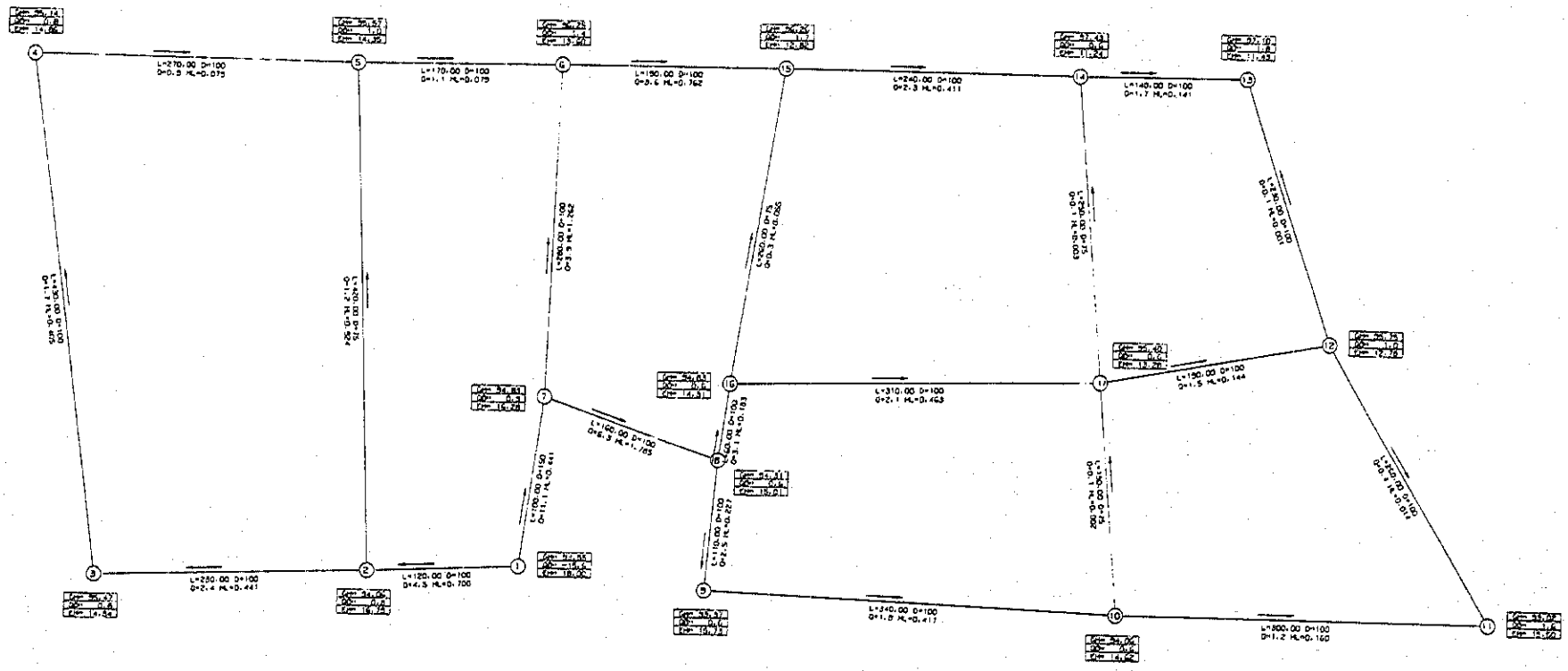


Table D-5-9 Diameter and Effective Head of Pipeline

NAME OF SANITARY DISTRICT : NONG BUA LAI

*** INPUT DATA ***

MINIMUM DIAMETER	0.075 (M)
NUMBER OF PIPELINE	19
NUMBER OF CONTACT	15
NUMBER OF CONTACT DESIGNATING WATER HEAD	1
HOURLY MAXIMUM WATER DEMAND	0.0026 (L/SEC/CAPITA)
DESIGNATED CONTACT	1
DESIGNATED WATER HEAD (M)	116.3

CONTACT NO.	DIVERTED WATER HEAD (EL.M)	GROUND ELEVATION (EL.M)	EFFECTIVE HEAD (M)	POPULATION SERVED	WATER DEMAND (L/SEC)
1	116.310	98.310	18.000	-4500.0	-11.7
2	115.192	99.910	15.282	330.0	0.9
3	115.106	96.240	18.866	240.0	0.6
4	114.917	100.390	14.527	330.0	0.9
5	114.899	100.870	14.029	400.0	1.0
6	114.758	96.920	17.838	500.0	1.3
7	114.758	96.810	17.948	500.0	1.3
8	114.750	97.120	17.630	700.0	1.8
9	115.090	98.960	16.130	400.0	1.0
10	115.277	99.040	16.238	200.0	0.5
11	115.951	99.390	16.561	200.0	0.5
12	115.097	102.780	12.317	160.0	0.4
13	114.922	101.870	13.052	200.0	0.5
14	114.936	101.600	13.336	200.0	0.5
15	114.932	103.280	11.652	140.0	0.4

PIPE NO.	CONTACT NO. FROM	TO	DIAMETER (MM)	LENGTH (M)	DISCHARGE COEFFICIENT	DISCHARGE (L/SEC)	VELOCITY (M/SEC)	HEAD LOSS (M)	HYDROURIC GRADIENT	FRICTION LOSS COEFFICIENT
1	1	2	100	240.00	110	4.0	0.503	1.118	4.657	0.03601
2	2	3	75	140.00	110	0.6	0.141	0.087	0.619	0.04561
3	2	4	75	150.00	110	1.1	0.254	0.275	1.832	0.04182
4	4	5	75	150.00	110	0.3	0.060	0.019	0.125	0.05183
5	5	6	100	210.00	110	1.4	0.177	0.140	0.669	0.04206
6	6	7	100	170.00	110	0.1	0.011	0.001	0.004	0.06319
7	7	8	100	180.00	110	0.3	0.038	0.007	0.040	0.05272
8	8	9	100	430.00	110	-1.5	-0.193	-0.340	-0.791	-0.04150
9	9	10	100	90.00	110	-2.6	-0.326	-0.187	-2.079	-0.03841
10	10	11	100	150.00	110	-3.9	-0.494	-0.673	-4.489	-0.03612
11	11	1	150	160.00	110	-7.7	-0.438	-0.359	-2.244	-0.03436
12	2	12	100	150.00	110	1.3	0.172	0.095	0.636	0.04223
13	12	13	100	170.00	110	1.8	0.223	0.175	1.030	0.04063
14	13	14	75	100.00	110	-0.3	-0.063	-0.014	-0.139	-0.05140
15	11	12	100	250.00	110	3.3	0.426	0.854	3.416	0.03692
16	12	5	100	130.00	110	2.2	0.275	0.198	1.524	0.03938
17	13	7	100	210.00	110	1.5	0.192	0.164	0.781	0.04154
18	10	14	75	350.00	110	0.8	0.181	0.342	0.977	0.04397
19	12	15	50	100.00	110	0.4	0.185	0.164	1.644	0.04687
TOTAL				3530.00						

Figure D–5–3 Hydraulic Calculation Diagram of Pipeline Networks

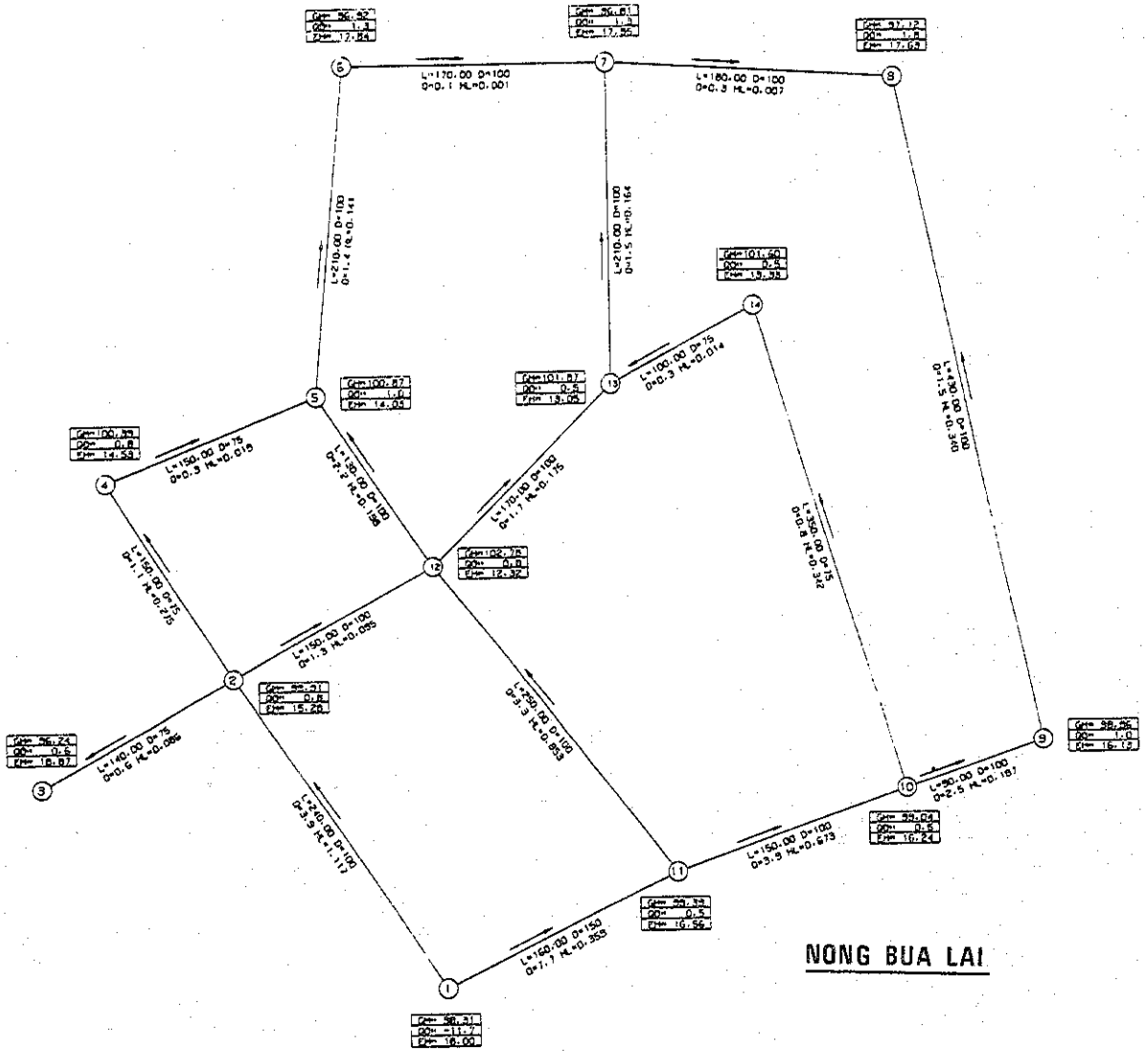


Table D-5-10 Diameter and Effective Head of Pipeline

NAME OF SANITARY DISTRICT : HUAI THALAENG

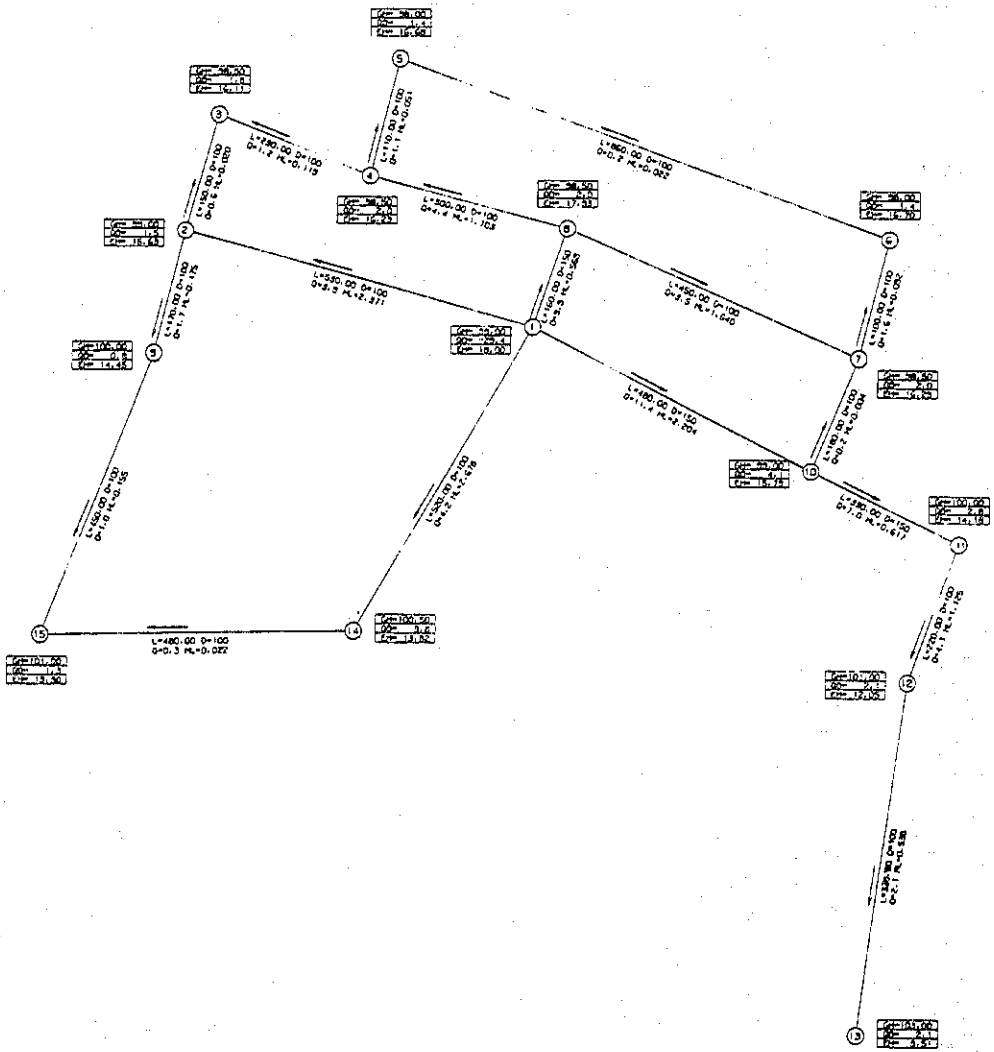
*** INPUT DATA ***

MINIMUM DIAMETER	0.100 (M)
NUMBER OF PIPELINE	19
NUMBER OF CONTACT	16
NUMBER OF CONTACT DESIGNATING WATER HEAD	1
HOURLY MAXIMUM WATER DEMAND	0.0026 (L/SEC/CAPITA)
DESIGNATED CONTACT	1
DESIGNATED WATER HEAD (M)	117.0

CONTACT NO.	DIVERTED WATER HEAD (EL.M)	GROUND ELEVATION (EL.M)	EFFECTIVE HEAD (M)	POPULATION SERVED	WATER DEMAND (L/SEC)
1	117.000	99.000	18.000	-11300.0	-29.4
2	114.628	99.000	15.628	590.0	1.5
3	114.608	98.500	16.108	690.0	1.8
4	114.727	98.500	16.227	790.0	2.1
5	114.676	98.000	16.676	530.0	1.4
6	114.698	98.000	16.698	540.0	1.4
7	114.790	98.500	16.290	790.0	2.1
8	116.432	98.500	17.932	790.0	2.1
9	114.453	100.000	14.453	300.0	0.8
10	114.795	99.000	15.795	1600.0	4.2
11	114.177	100.000	14.177	1100.0	2.9
12	113.052	101.000	12.052	800.0	2.1
13	112.513	103.000	9.513	660.0	1.7
14	114.320	100.500	13.820	1480.0	3.8
15	114.298	101.000	13.298	500.0	1.3
16	112.349	103.500	8.849	140.0	0.4

PIPE NO.	CONTACT NO. FROM	TO	DIAMETER (MM)	LENGTH (M)	DISCHARGE COEFFICIENT	DISCHARGE (L/SEC)	VELOCITY (M/SEC)	HEAD LOSS (M)	HYDROURIC GRADIENT	FRICTION LOSS COEFFICIENT
1	9	2	100	170.00	110	-1.7	-0.223	-0.175	-1.029	-0.04064
2	2	3	100	150.00	110	0.6	0.075	0.020	0.135	0.04779
3	3	4	100	230.00	110	-1.2	-0.154	-0.119	-0.519	-0.04292
4	4	5	100	110.00	110	1.1	0.145	0.051	0.464	0.04331
5	5	6	100	860.00	110	-0.2	-0.031	-0.022	-0.026	-0.05454
6	6	7	100	100.00	110	-1.6	-0.209	-0.092	-0.917	-0.04101
7	7	8	100	450.00	110	-3.5	-0.441	-1.641	-3.648	-0.03672
8	8	4	100	300.00	110	4.4	0.561	1.704	5.681	0.03544
9	7	10	100	180.00	110	-0.2	-0.030	-0.004	-0.025	-0.05478
10	10	11	150	330.00	110	7.0	0.397	0.617	1.871	0.03486
11	11	12	100	220.00	110	4.2	0.530	1.125	5.115	0.03574
12	12	13	100	380.00	110	2.1	0.265	0.539	1.417	0.03961
13	10	1	150	480.00	110	-11.4	-0.645	-2.205	-4.595	-0.03244
14	1	2	100	530.00	110	3.9	0.493	2.372	4.475	0.03613
15	8	1	150	160.00	110	-9.9	-0.562	-0.568	-3.553	-0.03312
16	1	14	100	520.00	110	4.2	0.532	2.680	5.153	0.03572
17	14	15	100	480.00	110	0.3	0.042	0.022	0.047	0.05206
18	15	9	100	450.00	110	-1.0	-0.124	-0.155	-0.345	-0.04434
19	13	16	50	100.00	110	0.4	0.185	0.164	1.644	0.04687
TOTAL				6200.00						

Figure D–5–4 Hydraulic Calculation Diagram of Pipeline Networks



HUAI THALAENG

Table D-5-11 Diameter and Effective Head of Pipeline(1)

NAME OF SANITARY DISTRICT : NONG KI

*** INPUT DATA ***

MINIMUM DIAMETER	0.075 (M)
NUMBER OF PIPELINE	42
NUMBER OF CONTACT	33
NUMBER OF CONTACT DESIGNATING WATER HEAD	1
HOURLY MAXIMUM WATER DEMAND	0.0026 (L/SEC/CAPITA)
DESIGNATED CONTACT	1
DESIGNATED WATER HEAD (M)	138.4

CONTACT NO.	DIVERTED WATER HEAD (EL.M)	GROUND ELEVATION (EL.M)	EFFECTIVE HEAD (M)	POPULATION SERVED	WATER DEMAND (L/SEC)
1	138.440	120.440	18.000	-16900.0	-43.9
2	137.943	120.560	17.383	720.0	1.9
3	137.265	119.330	17.935	720.0	1.9
4	135.595	119.000	16.595	2720.0	7.1
5	137.281	116.450	20.831	150.0	0.4
6	137.416	115.500	21.916	150.0	0.4
7	136.976	116.500	20.476	340.0	0.9
8	136.741	115.800	20.941	330.0	0.9
9	134.228	117.100	17.128	130.0	0.3
10	132.027	119.200	12.827	820.0	2.1
11	131.358	118.500	12.858	680.0	1.8
12	130.859	116.650	14.209	810.0	2.1
13	132.295	112.020	20.275	450.0	1.2
14	131.798	111.850	19.948	420.0	1.1
15	131.798	111.890	19.908	110.0	0.3
16	131.038	110.800	20.238	230.0	0.6
17	130.764	109.800	20.964	230.0	0.6
18	130.687	108.700	21.987	500.0	1.3
19	130.832	104.500	26.332	300.0	0.8
20	132.450	103.900	28.550	350.0	0.9
21	133.368	109.630	23.738	300.0	0.8
22	135.078	110.180	24.898	700.0	1.8
23	135.360	115.000	20.360	710.0	1.8
24	136.779	115.830	20.949	500.0	1.3
25	134.784	120.310	14.474	400.0	1.0
26	134.385	117.010	17.375	320.0	0.8
27	133.203	117.100	16.103	270.0	0.7
28	133.623	113.520	20.103	800.0	2.1
29	133.090	113.940	19.150	860.0	2.2
30	132.289	111.840	20.449	570.0	1.5
31	132.711	113.000	19.711	500.0	1.3
32	132.315	109.770	22.545	670.0	1.7
33	130.947	120.190	10.757	140.0	0.4

Table D-5-11 Diameter and Effective Head of Pipeline (2)

PIPE NO.	CONTACT NO. FROM	TO	DIAMETER (MM)	LENGTH (M)	DISCHARGE COEFFICIENT	DISCHARGE (L/SEC)	VELOCITY (M/SEC)	HEAD LOSS (M)	HYDROURIC GRADIENT	FRICTION LOSS COEFFICIENT
1	1	2	200	80.00	110	28.6	0.910	0.497	6.211	0.02939
2	2	3	150	240.00	110	8.8	0.496	0.678	2.826	0.03373
3	3	4	150	880.00	110	7.1	0.400	1.669	1.897	0.03482
4	3	5	75	280.00	110	0.2	-0.040	-0.016	-0.059	-0.05506
5	5	6	75	260.00	110	-0.6	-0.128	-0.134	-0.517	-0.04627
6	6	7	150	220.00	110	7.3	0.412	0.439	1.998	0.03468
7	7	8	150	150.00	110	6.4	0.361	0.236	1.571	0.03535
8	8	9	100	290.00	110	3.5	0.704	2.513	8.666	0.03427
9	9	27	100	270.00	110	3.5	0.451	1.024	3.794	0.03661
10	10	11	75	210.00	110	1.5	0.342	0.669	3.184	0.04001
11	11	12	75	430.00	110	0.9	0.198	0.499	1.161	0.04337
12	10	9	100	550.00	110	-3.6	-0.464	-2.201	-4.001	-0.03645
13	9	26	100	120.00	110	-2.0	-0.254	-0.157	-1.308	-0.03986
14	26	25	100	160.00	110	-2.8	-0.359	-0.399	-2.494	-0.03786
15	11	27	75	590.00	110	-1.5	-0.339	-1.845	-3.127	-0.04007
16	27	28	75	210.00	110	-1.2	-0.266	-0.420	-1.998	-0.04153
17	28	31	75	200.00	110	1.8	0.415	0.912	4.560	0.03887
18	27	13	100	450.00	110	2.5	0.321	0.909	2.019	0.03850
19	12	13	75	660.00	110	-1.2	-0.278	-1.435	-2.175	-0.04125
20	13	30	75	200.00	110	0.1	0.027	0.006	0.028	0.05840
21	6	2	150	210.00	110	-8.2	-0.466	-0.527	-2.512	-0.03405
22	2	24	150	340.00	110	9.7	0.551	1.164	3.425	0.03322
23	24	23	150	540.00	110	8.4	0.477	1.418	2.626	0.03393
24	23	22	150	170.00	110	6.6	0.373	0.283	1.662	0.03519
25	22	21	100	260.00	110	4.8	0.607	1.710	6.577	0.03503
26	21	20	75	100.00	110	2.7	0.606	0.919	9.185	0.03676
27	20	19	75	380.00	110	1.8	0.400	1.618	4.258	0.03909
28	19	18	75	100.00	110	1.0	0.224	0.145	1.449	0.04261
29	18	17	75	450.00	110	-0.3	-0.071	-0.077	-0.172	-0.05054
30	17	16	75	220.00	110	-0.9	-0.206	-0.274	-1.244	-0.04313
31	16	15	75	240.00	110	-1.5	-0.341	-0.761	-3.170	-0.04002
32	15	14	100	200.00	110	0.1	0.011	0.001	0.004	0.06339
33	14	30	75	330.00	110	-1.0	-0.227	-0.491	-1.489	-0.04252
34	30	29	75	110.00	110	-2.4	-0.535	-0.801	-7.285	-0.03744
35	29	32	75	180.00	110	1.8	0.403	0.775	4.307	0.03905
36	32	15	100	440.00	110	1.9	0.239	0.517	1.174	0.04021
37	31	32	100	350.00	110	1.8	0.234	0.396	1.131	0.04033
38	29	28	150	340.00	110	-6.4	-0.361	-0.533	-1.566	-0.03536
39	31	21	75	270.00	110	-1.3	-0.296	-0.657	-2.434	-0.04088
40	28	25	150	250.00	110	-11.5	-0.649	-1.161	-4.643	-0.03242
41	25	1	150	460.00	110	-15.3	-0.868	-3.656	-7.949	-0.03105
42	11	33	50	250.00	110	0.4	0.185	0.411	1.643	0.04687
TOTAL				12640.00						

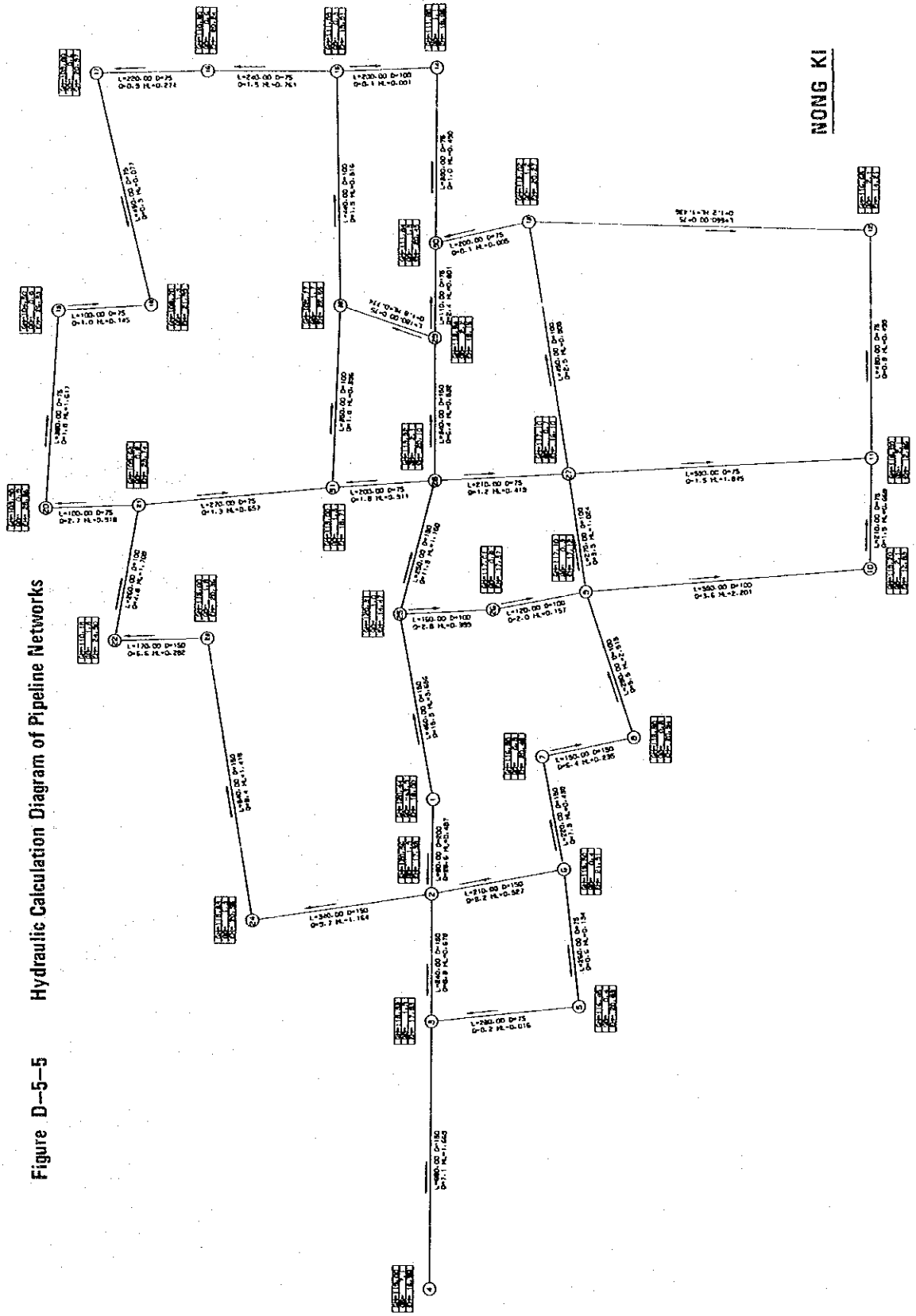


Figure D-5-5 Hydraulic Calculation Diagram of Pipeline Networks

Table D-5-12 Diameter and Effective Head of Pipeline

NAME OF SANITARY DISTRICT : HUAI RAT

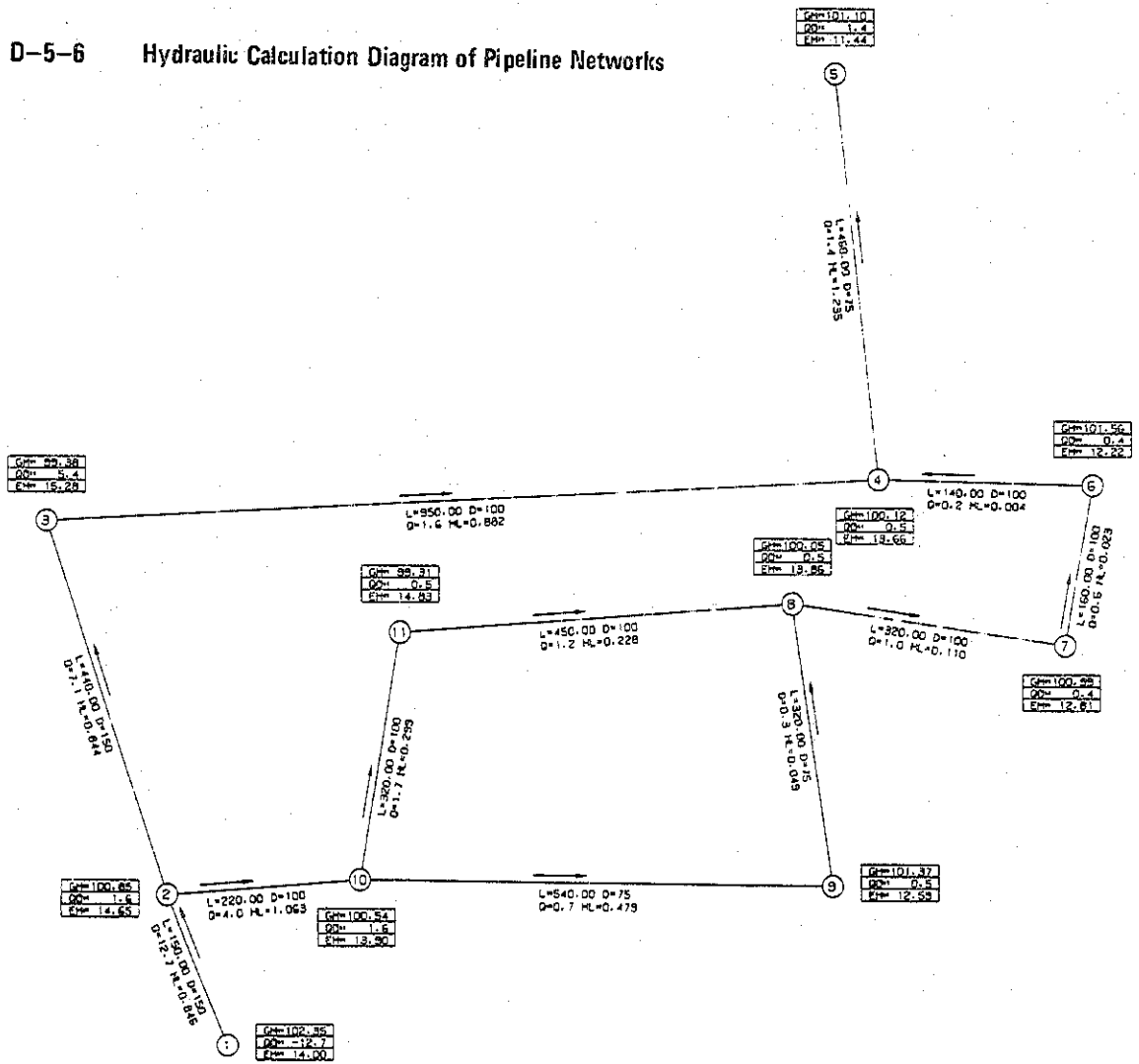
*** INPUT DATA ***

MINIMUM DIAMETER	0.075 (M)
NUMBER OF PIPELINE	13
NUMBER OF CONTACT	12
NUMBER OF CONTACT DESIGNATING WATER HEAD	1
HOURLY MAXIMUM WATER DEMAND	0.0026 (L/SEC/CAPITA)
DESIGNATED CONTACT	1
DESIGNATED WATER HEAD (M)	116.4

CONTACT NO.	DIVERTED WATER HEAD (EL.M)	GROUND ELEVATION (EL.M)	EFFECTIVE HEAD (M)	POPULATION SERVED	WATER DEMAND (L/SEC)
1	116.350	102.350	14.000	-4900.0	-12.7
2	115.505	100.850	14.655	610.0	1.6
3	114.661	99.380	15.281	2100.0	5.5
4	113.781	100.120	13.661	200.0	0.5
5	112.546	101.100	11.446	390.0	1.0
6	113.785	101.560	12.225	140.0	0.4
7	113.807	100.990	12.817	140.0	0.4
8	113.916	100.050	13.866	200.0	0.5
9	113.964	101.370	12.594	180.0	0.5
10	114.443	100.540	13.903	620.0	1.6
11	114.144	99.310	14.834	180.0	0.5
12	112.382	102.000	10.382	140.0	0.4

PIPE NO.	CONTACT NO. FROM	TO	DIAMETER (MM)	LENGTH (M)	DISCHARGE COEFFICIENT	DISCHARGE (L/SEC)	VELOCITY (M/SEC)	HEAD LOSS (M)	HYDROURIC GRADIENT	FRICTION LOSS COEFFICIENT
1	1	2	150	150.00	110	12.7	0.720	0.845	5.634	0.03192
2	2	3	150	440.00	110	7.1	0.403	0.844	1.917	0.03479
3	3	4	100	950.00	110	1.7	0.211	0.880	0.927	0.04098
4	4	5	75	460.00	110	1.4	0.312	1.235	2.685	0.04056
5	4	6	100	140.00	110	-0.2	-0.031	-0.004	-0.026	-0.05455
6	6	7	100	160.00	110	-0.6	-0.076	-0.023	-0.141	-0.04763
7	7	8	100	320.00	110	-1.0	-0.123	-0.109	-0.341	-0.04439
8	8	9	75	320.00	110	-0.3	-0.066	-0.048	-0.150	-0.05108
9	9	10	75	540.00	110	-0.8	-0.172	-0.479	-0.887	-0.04431
10	11	8	100	450.00	110	1.2	0.152	0.228	0.507	0.04301
11	10	11	100	320.00	110	1.7	0.212	0.299	0.935	0.04095
12	10	2	100	220.00	110	-4.0	-0.513	-1.061	-4.825	-0.03591
13	5	12	50	100.00	110	0.4	0.185	0.164	1.644	0.04687
TOTAL				4570.00						

Figure D–5–6 Hydraulic Calculation Diagram of Pipeline Networks



HUAI RAT

Table D-5-13 Diameter and Effective Head of Pipeline

NAME OF SANITARY DISTRICT ; KHUM HAN

*** INPUT DATA ***

MINIMUM DIAMETER	0.075 (M)
NUMBER OF PIPELINE	17
NUMBER OF CONTACT	14
NUMBER OF CONTACT DESIGNATING WATER HEAD	1
HOURLY MAXIMUM WATER DEMAND	0.0026 (L/SEC/CAPITA)
DESIGNATED CONTACT	1
DESIGNATED WATER HEAD (M)	112.5

CONTACT NO.	DIVERTED WATER HEAD (EL.M)	GROUND ELEVATION (EL.M)	EFFECTIVE HEAD (M)	POPULATION SERVED	WATER DEMAND (L/SEC)
1	112.500	98.500	14.000	-5000.0	-13.0
2	111.881	97.580	14.301	300.0	0.8
3	111.255	97.970	13.285	350.0	0.9
4	111.222	98.060	13.162	210.0	0.5
5	111.124	97.000	14.124	300.0	0.8
6	111.137	97.200	13.937	400.0	1.0
7	111.265	98.140	13.125	400.0	1.0
8	111.961	100.500	11.461	600.0	1.6
9	111.699	98.330	13.369	500.0	1.3
10	111.275	98.120	13.155	500.0	1.3
11	111.194	96.380	14.814	400.0	1.0
12	111.237	97.930	13.307	400.0	1.0
13	111.343	99.730	11.613	500.0	1.3
14	110.893	98.500	12.393	140.0	0.4

PIPE NO.	CONTACT NO. FROM	TO	DIAMETER (MM)	LENGTH (M)	DISCHARGE COEFFICIENT	DISCHARGE (L/SEC)	VELOCITY (M/SEC)	HEAD LOSS (M)	HYDROURIC GRADIENT	FRICTION LOSS COEFFICIENT
1	1	2	100	280.00	110	2.6	0.337	0.619	2.212	0.03822
2	2	3	100	540.00	110	1.9	0.237	0.625	1.158	0.04025
3	3	4	100	100.00	110	1.0	0.122	0.034	0.335	0.04445
4	4	5	75	190.00	110	0.6	0.128	0.098	0.514	0.04629
5	5	6	75	150.00	110	-0.2	-0.049	-0.013	-0.087	-0.05337
6	6	7	100	230.00	110	-1.3	-0.160	-0.128	-0.557	-0.04268
7	7	8	100	280.00	110	-2.8	-0.359	-0.696	-2.485	-0.03787
8	4	7	100	400.00	110	-0.5	-0.066	-0.044	-0.109	-0.04864
9	8	9	100	120.00	110	2.6	0.334	0.262	2.182	0.03826
10	9	10	75	170.00	110	1.3	0.300	0.425	2.499	0.04079
11	10	11	75	140.00	110	0.6	0.135	0.080	0.573	0.04589
12	11	12	75	130.00	110	-0.4	-0.100	-0.042	-0.327	-0.04800
13	12	13	100	140.00	110	-1.5	-0.189	-0.106	-0.757	-0.04165
14	13	10	75	130.00	110	0.6	0.129	0.068	0.525	0.04621
15	13	8	100	180.00	110	-3.4	-0.427	-0.618	-3.436	-0.03690
16	8	1	150	140.00	110	-10.4	-0.586	-0.539	-3.848	-0.03291
17	4	14	50	200.00	110	0.4	0.185	0.329	1.644	0.04687
TOTAL				3520.00						

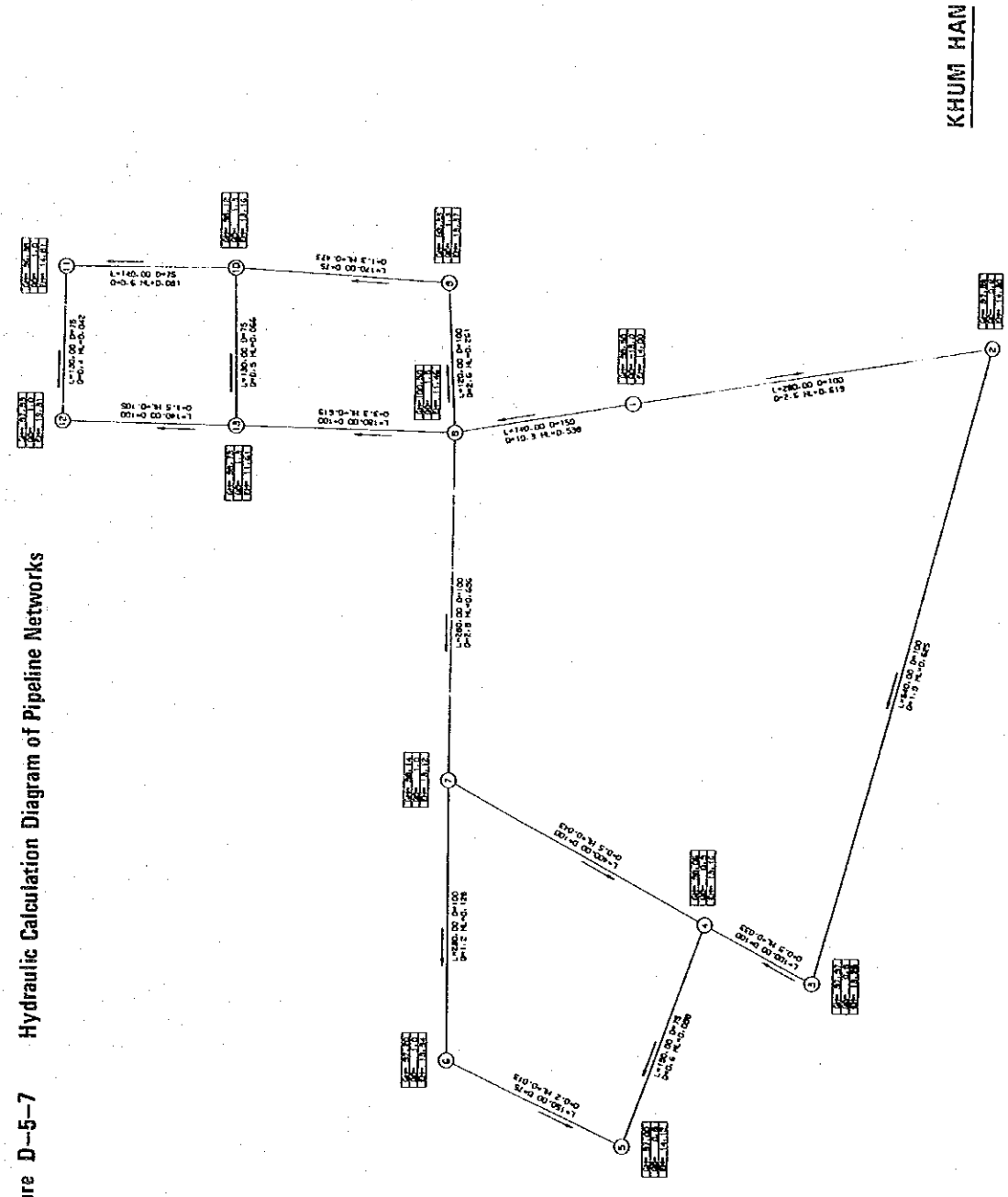


Figure D-5-7 Hydraulic Calculation Diagram of Pipeline Networks

Table D-5-14 Diameter and Effective Head of Pipeline

NAME OF SANITARY DISTRICT : KUSUMAN

*** INPUT DATA ***

MINIMUM DIAMETER	0.075	(M)
NUMBER OF PIPELINE	16	
NUMBER OF CONTACT	13	
NUMBER OF CONTACT DESIGNATING WATER HEAD	1	
HOURLY MAXIMUM WATER DEMAND	0.0026	(L/SEC/CAPITA)
DESIGNATED CONTACT	1	
DESIGNATED WATER HEAD (M)	119.6	

CONTACT NO.	DIVERTED WATER HEAD (EL.M)	GROUND ELEVATION (EL.M)	EFFECTIVE HEAD (M)	POPULATION SERVED	WATER DEMAND (L/SEC)
1	119.550	102.550	17.000	-6200.0	-16.1
2	117.114	102.500	14.614	500.0	1.3
3	116.781	102.500	14.281	300.0	0.8
4	116.689	105.800	10.889	300.0	0.8
5	116.570	100.670	15.900	400.0	1.0
6	116.566	100.620	15.946	500.0	1.3
7	116.034	98.700	17.334	450.0	1.2
8	116.028	98.360	17.668	450.0	1.2
9	116.282	100.410	15.872	500.0	1.3
10	116.299	100.210	16.089	950.0	2.5
11	116.373	100.000	16.373	450.0	1.2
12	116.812	104.160	12.652	450.0	1.2
13	117.763	102.590	15.173	950.0	2.5

PIPE NO.	CONTACT NO. FROM	TO	DIAMETER (MM)	LENGTH (M)	DISCHARGE COEFFICIENT	DISCHARGE (L/SEC)	VELOCITY (M/SEC)	HEAD LOSS (M)	HYDROURIC GRADIENT	FRICTION LOSS COEFFICIENT
1	1	2	100	500.00	110	4.1	0.516	2.436	4.871	0.03588
2	2	3	100	140.00	110	2.8	0.350	0.333	2.379	0.03800
3	3	4	100	400.00	110	0.8	0.099	0.092	0.231	0.04580
4	3	5	100	420.00	110	1.2	0.152	0.212	0.504	0.04302
5	5	6	100	380.00	110	0.2	0.019	0.004	0.011	0.05846
6	6	7	75	210.00	110	1.3	0.302	0.531	2.530	0.04075
7	7	8	75	120.00	110	0.2	0.037	0.006	0.053	0.05556
8	8	9	75	170.00	110	-1.0	-0.228	-0.255	-1.497	-0.04250
9	9	10	100	280.00	110	-0.4	-0.048	-0.017	-0.060	-0.05098
10	10	11	100	260.00	110	-0.9	-0.111	-0.074	-0.284	-0.04505
11	11	12	100	320.00	110	-2.0	-0.260	-0.439	-1.371	-0.03971
12	12	13	100	300.00	110	-3.2	-0.409	-0.951	-3.171	-0.03714
13	9	6	100	230.00	110	-1.9	-0.245	-0.283	-1.231	-0.04006
14	10	13	75	280.00	110	-2.0	-0.447	-1.464	-5.228	-0.03845
15	13	6	100	210.00	110	4.4	0.562	1.198	5.704	0.03543
16	13	1	150	350.00	110	-12.1	-0.683	-1.787	-5.105	-0.03217
TOTAL				4570.00						

Figure D–5–8 Hydraulic Calculation Diagram of Pipeline Networks

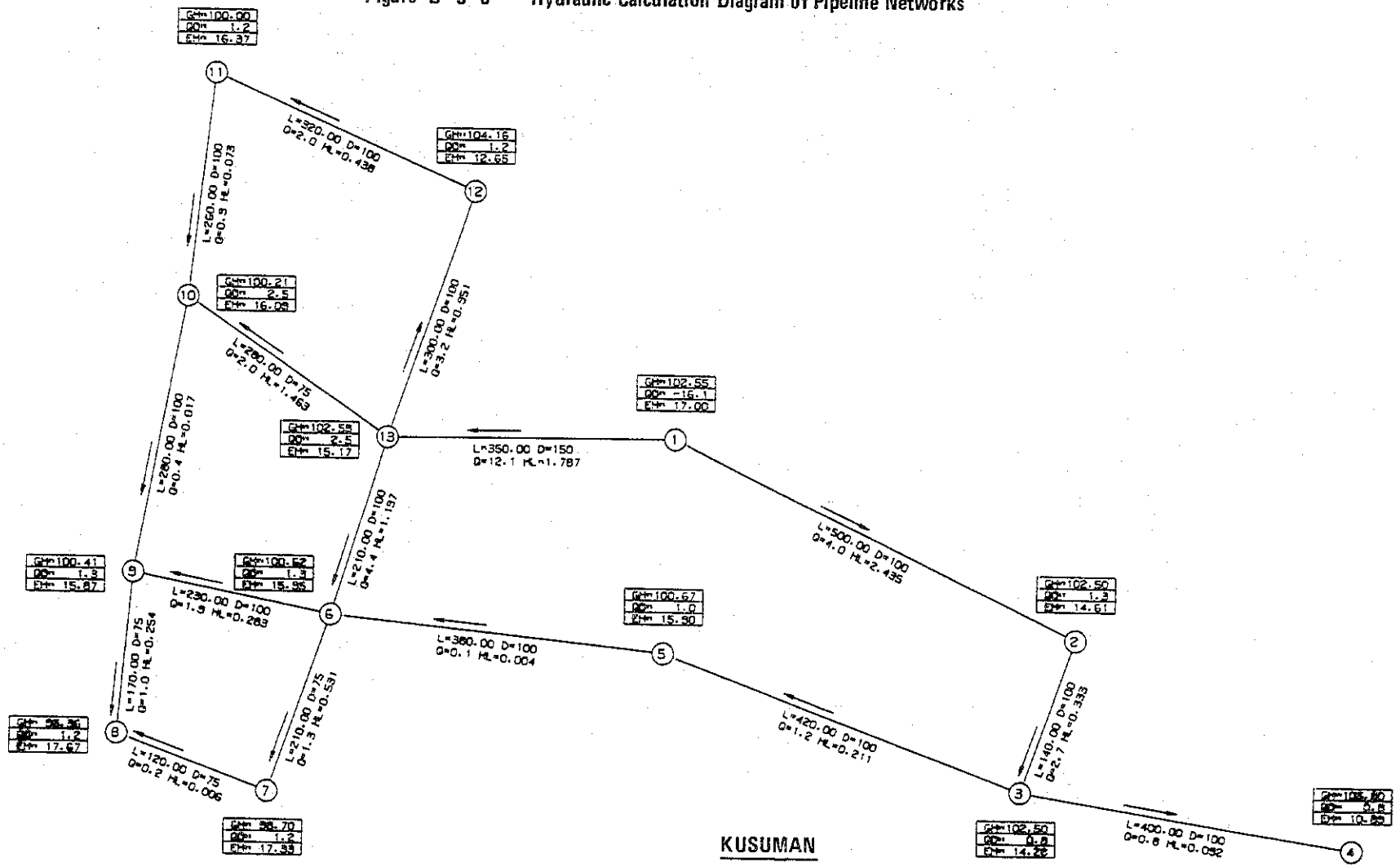


Table D-5-15 Diameter and Effective Head of Pipeline

NAME OF SANITARY DISTRICT NONG SONG HONG

*** INPUT DATA ***

MINIMUM DIAMETER	0.075 (M)
NUMBER OF PIPELINE	17
NUMBER OF CONTACT	14
NUMBER OF CONTACT DESIGNATING WATER HEAD	1
HOURLY MAXIMUM WATER DEMAND	0.0026 (L/SEC/CAPITA)
DESIGNATED CONTACT	1
DESIGNATED WATER HEAD (M)	114.0

CONTACT NO.	DIVERTED WATER HEAD (EL.M)	GROUND ELEVATION (EL.M)	EFFECTIVE HEAD (M)	POPULATION SERVED	WATER DEMAND (L/SEC)
1	114.000	100.000	14.000	-8600.0	-22.4
2	112.307	100.500	11.807	250.0	0.6
3	110.779	96.000	14.779	780.0	2.0
4	109.583	94.020	15.563	1740.0	4.5
5	108.793	90.700	18.093	950.0	2.5
6	108.095	89.230	18.865	420.0	1.1
7	107.785	95.000	12.785	700.0	1.8
8	108.683	95.740	12.943	780.0	2.0
9	108.684	93.800	14.884	500.0	1.3
10	110.420	94.000	16.420	500.0	1.3
11	109.466	93.000	16.466	860.0	2.2
12	108.991	91.800	17.191	300.0	0.8
13	109.403	93.000	16.403	400.0	1.0
14	109.309	92.500	16.809	420.0	1.1

PIPE NO.	CONTACT NO. FROM	TO	DIAMETER (MM)	LENGTH (M)	DISCHARGE COEFFICIENT	DISCHARGE (L/SEC)	VELOCITY (M/SEC)	HEAD LOSS (M)	HYDRAULIC GRADIENT	FRICTION LOSS COEFFICIENT
1	1	2	200	430.00	110	22.4	0.712	1.693	3.937	0.03048
2	2	3	200	410.00	110	21.7	0.691	1.528	3.727	0.03061
3	3	4	150	210.00	110	12.8	0.725	1.196	5.695	0.03189
4	4	5	100	250.00	110	3.2	0.408	0.790	3.160	0.03715
5	5	6	75	400.00	110	1.1	0.247	0.698	1.745	0.04198
6	4	8	100	210.00	110	3.8	0.481	0.900	4.284	0.03625
7	8	7	75	200.00	110	1.8	0.412	0.899	4.494	0.03892
8	8	9	100	250.00	110	-0.1	-0.007	-0.000	-0.002	-0.06781
9	9	5	100	170.00	110	-1.4	-0.173	-0.109	-0.641	-0.04220
10	10	3	150	200.00	110	-6.9	-0.389	-0.359	-1.797	-0.03497
11	11	4	100	200.00	110	-1.3	-0.165	-0.117	-0.587	-0.04250
12	12	5	100	200.00	110	1.7	0.218	0.198	0.988	0.04077
13	10	11	100	200.00	110	4.0	0.510	0.954	4.770	0.03594
14	11	12	100	240.00	110	2.5	0.317	0.475	1.980	0.03856
15	13	10	75	300.00	110	-1.6	-0.354	-1.017	-3.389	-0.03981
16	14	11	75	300.00	110	-0.6	-0.129	-0.157	-0.522	-0.04623
17	13	14	75	210.00	110	0.5	0.118	0.094	0.446	0.04682
TOTAL				4380.00						

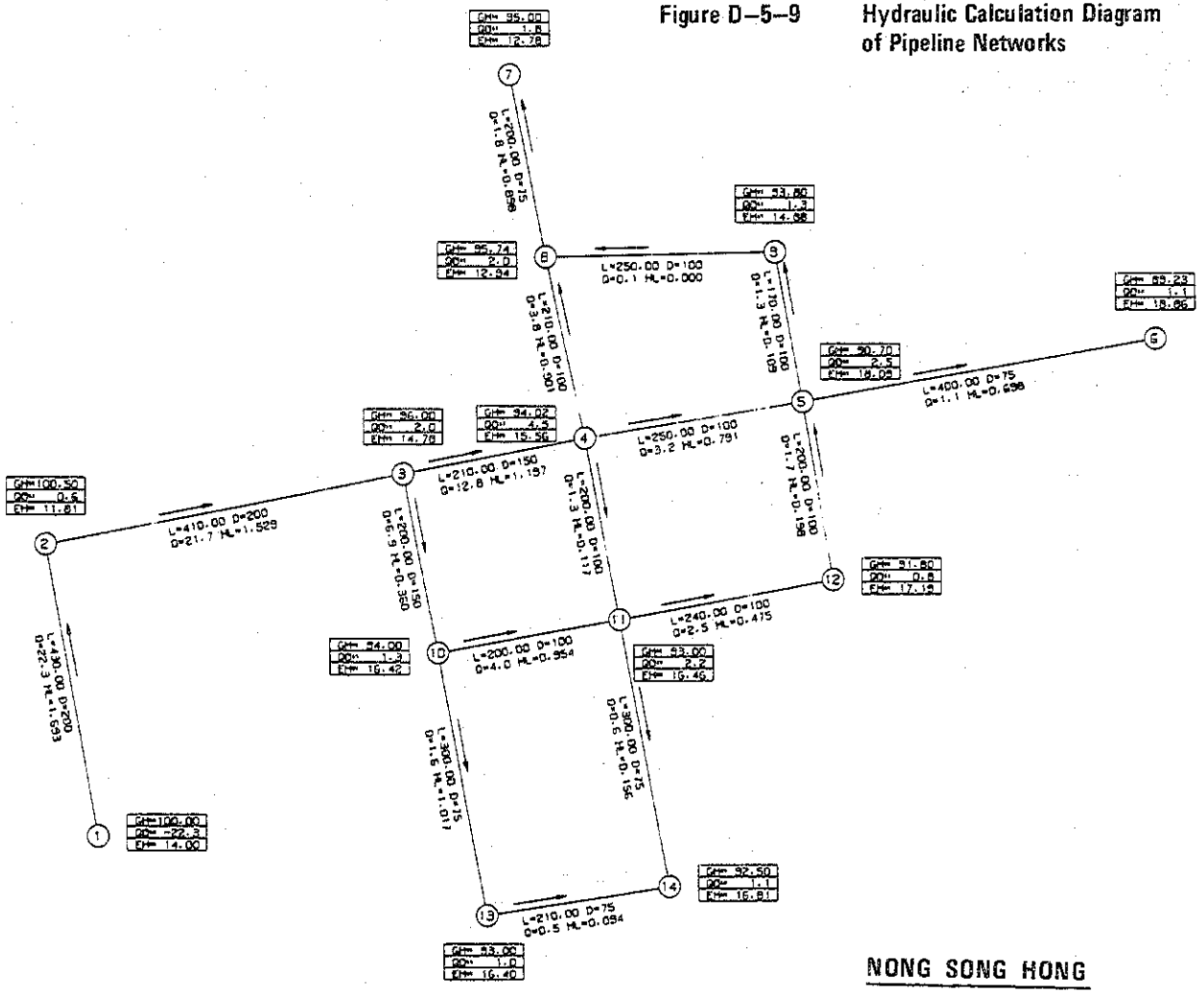


Figure D–5–9 Hydraulic Calculation Diagram of Pipeline Networks

Figure D–5–10 Hydraulic Calculation Diagram of Pipeline Networks

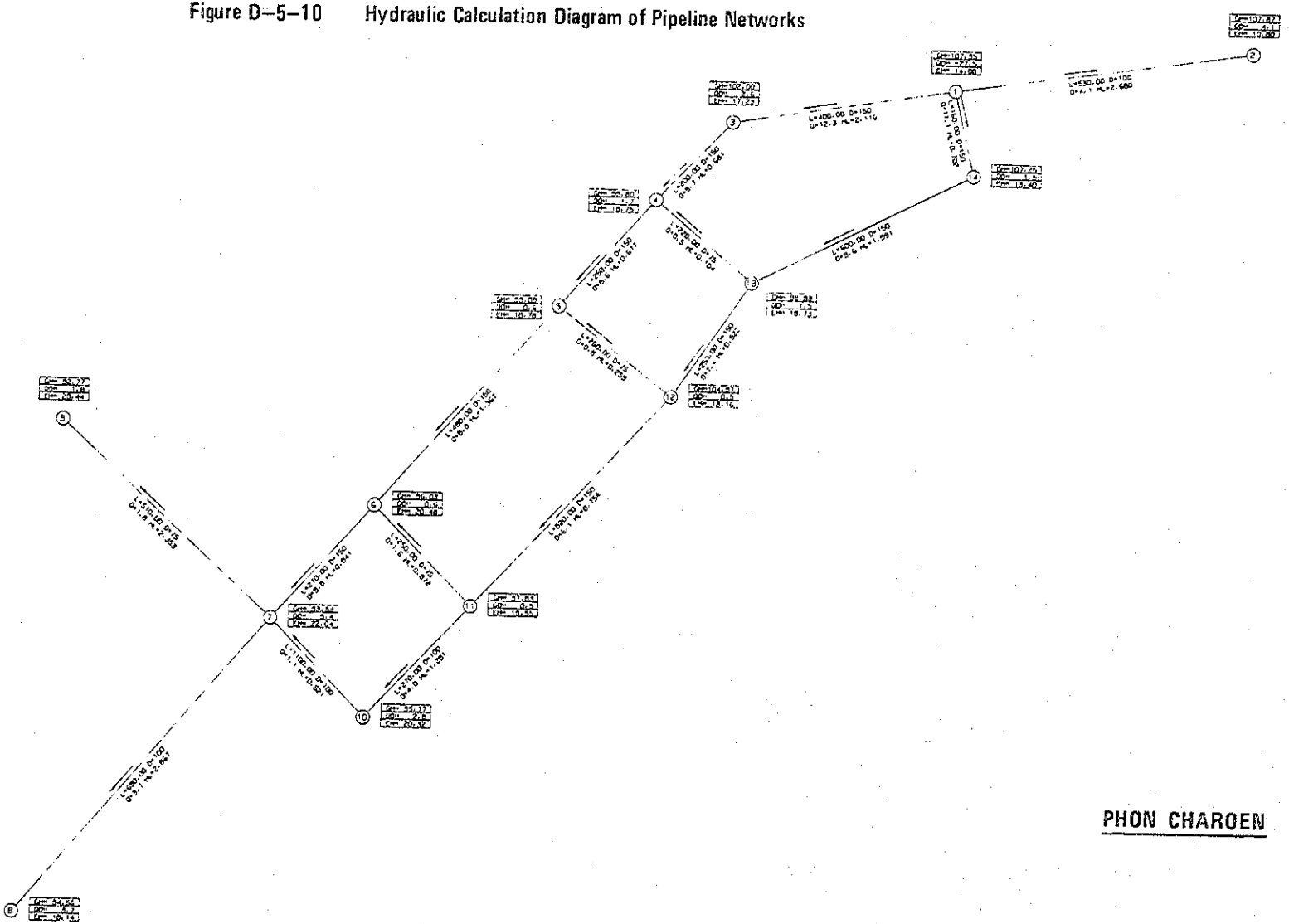


Table D-5-16 Diameter and Effective Head of Pipeline

NAME OF SANITARY DISTRICT PHON CHAROEN

*** INPUT DATA ***

MINIMUM DIAMETER	0.075 (M)
NUMBER OF PIPELINE	17
NUMBER OF CONTACT	14
NUMBER OF CONTACT DESIGNATING WATER HEAD	1
HOURLY MAXIMUM WATER DEMAND	0.0026 (L/SEC/CAPITA)
DESIGNATED CONTACT	1
DESIGNATED WATER HEAD (M)	121.4

CONTACT NO.	DIVERTED WATER HEAD (EL.M)	GROUND ELEVATION (EL.M)	EFFECTIVE HEAD (M)	POPULATION SERVED	WATER DEMAND (L/SEC)
1	121.350	107.350	14.000	-10600.0	-27.6
2	118.670	107.870	10.800	1590.0	4.1
3	119.391	102.000	17.391	1000.0	2.6
4	118.774	99.800	18.974	650.0	1.7
5	118.136	99.090	19.046	220.0	0.6
6	116.835	96.030	20.805	220.0	0.6
7	115.950	93.530	22.420	2080.0	5.4
8	113.083	94.560	18.523	1430.0	3.7
9	113.597	92.770	20.827	710.0	1.8
10	116.129	95.770	20.359	1100.0	2.9
11	117.617	97.830	19.787	200.0	0.5
12	118.424	104.970	13.454	200.0	0.5
13	118.982	98.930	20.052	600.0	1.6
14	120.588	107.250	13.338	600.0	1.6

PIPE NO.	CONTACT FROM	NO. TO	DIAMETER (MM)	LENGTH (M)	DISCHARGE COEFFICIENT	DISCHARGE (L/SEC)	VELOCITY (M/SEC)	HEAD LOSS (M)	HYDROURIC GRADIENT	FRICTION LOSS COEFFICIENT
1	1	2	100	530.00	110	4.1	0.526	2.680	5.057	0.03578
2	1	3	150	400.00	110	11.8	0.668	1.959	4.897	0.03228
3	3	4	150	200.00	110	9.2	0.521	0.618	3.088	0.03349
4	4	5	150	250.00	110	8.3	0.469	0.637	2.549	0.03401
5	5	6	150	480.00	110	8.6	0.485	1.302	2.712	0.03384
6	6	7	150	270.00	110	9.5	0.538	0.885	3.278	0.03333
7	7	8	100	690.00	110	3.7	0.473	2.867	4.155	0.03634
8	9	7	75	510.00	110	-1.8	-0.418	-2.353	-4.613	-0.03884
9	7	10	100	240.00	110	-1.5	-0.187	-0.179	-0.746	-0.04169
10	10	11	100	270.00	110	-4.3	-0.551	-1.488	-5.511	-0.03553
11	11	12	150	520.00	110	-6.3	-0.359	-0.807	-1.553	-0.03539
12	12	13	150	250.00	110	-7.7	-0.437	-0.558	-2.233	-0.03437
13	13	14	150	440.00	110	-10.1	-0.570	-1.605	-3.648	-0.03305
14	6	11	75	250.00	110	-1.5	-0.339	-0.782	-3.128	-0.04006
15	5	12	75	260.00	110	-0.9	-0.193	-0.288	-1.106	-0.04354
16	4	13	75	220.00	110	-0.8	-0.178	-0.208	-0.948	-0.04408
17	1	14	150	160.00	110	11.6	0.658	0.762	4.765	0.03235
TOTAL				5940.00						

Figure D–5–11 Hydraulic Calculation Diagram of Pipeline Networks

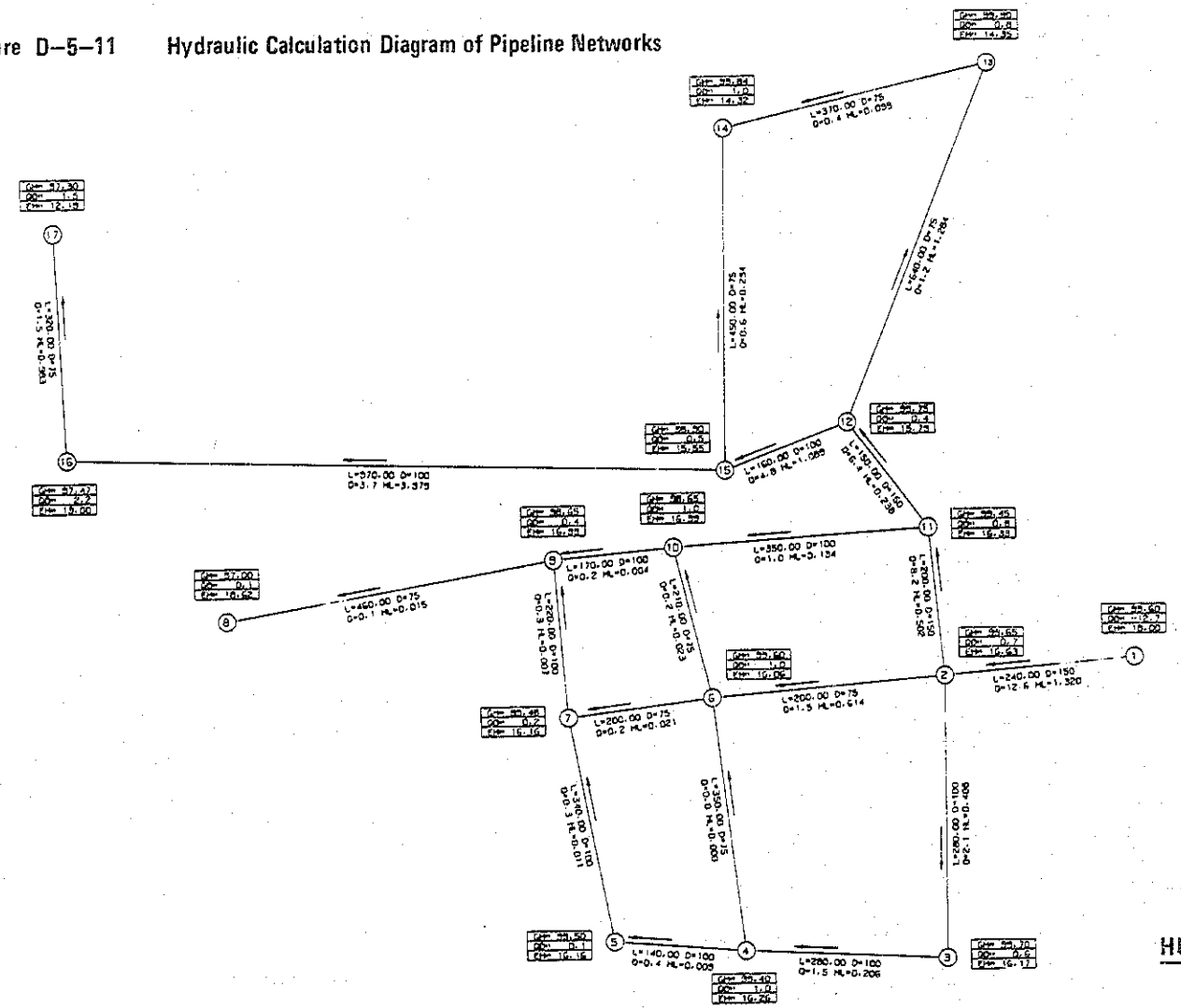


Table D-5-17 Diameter and Effective Head of Pipeline

NAME OF SANITARY DISTRICT : HUAI KHA YUNG

*** INPUT DATA ***

MINIMUM DIAMETER	0.075 (M)
NUMBER OF PIPELINE	22
NUMBER OF CONTACT	18
NUMBER OF CONTACT DESIGNATING WATER HEAD	1
HOURLY MAXIMUM WATER DEMAND	0.0026 (L/SEC/CAPITA)
DESIGNATED CONTACT	1
DESIGNATED WATER HEAD (M)	117.6

CONTACT NO.	DIVERTED WATER HEAD (EL.M)	GROUND ELEVATION (EL.M)	EFFECTIVE HEAD (M)	POPULATION SERVED	WATER DEMAND (L/SEC)
1	117.600	99.600	18.000	-4900.0	-12.7
2	116.279	99.650	16.629	280.0	0.7
3	115.869	99.700	16.169	250.0	0.6
4	115.661	99.400	16.261	400.0	1.0
5	115.652	99.500	16.152	50.0	0.1
6	115.661	99.600	16.061	400.0	1.0
7	115.640	99.480	16.160	100.0	0.3
8	115.618	97.000	18.618	50.0	0.1
9	115.633	98.650	16.983	150.0	0.4
10	115.638	98.650	16.988	400.0	1.0
11	115.775	99.450	16.325	300.0	0.8
12	115.537	99.750	15.787	150.0	0.4
13	114.254	99.900	14.354	300.0	0.8
14	114.154	99.840	14.314	400.0	1.0
15	114.448	98.900	15.548	200.0	0.5
16	110.469	97.470	12.999	850.0	2.2
17	109.486	97.300	12.186	430.0	1.1
18	109.075	97.500	11.575	140.0	0.4

PIPE NO.	CONTACT FROM	CONTACT NO. TO	DIAMETER (MM)	LENGTH (M)	DISCHARGE COEFFICIENT	DISCHARGE (L/SEC)	VELOCITY (M/SEC)	HEAD LOSS (M)	HYDROURIC GRADIENT	FRICTION LOSS COEFFICIENT
1	1	2	150	240.00	110	12.6	0.712	1.321	5.506	0.03198
2	2	3	100	280.00	110	2.1	0.269	0.410	1.463	0.03951
3	3	4	100	280.00	110	1.5	0.187	0.208	0.741	0.04172
4	4	5	100	140.00	110	0.4	0.052	0.010	0.069	0.05043
5	5	7	100	340.00	110	0.3	0.036	0.012	0.034	0.05333
6	4	6	75	350.00	110	0.0	0.006	0.001	0.002	0.07341
7	7	6	75	200.00	110	-0.2	-0.054	-0.021	-0.104	-0.05260
8	6	2	75	200.00	110	-1.5	-0.336	-0.618	-3.089	-0.04011
9	7	9	100	220.00	110	0.3	0.033	0.007	0.030	0.05390
10	6	10	75	210.00	110	0.2	0.055	0.023	0.107	0.05247
11	2	11	150	200.00	110	8.2	0.466	0.503	2.517	0.03404
12	8	9	75	460.00	110	-0.1	-0.029	-0.016	-0.034	-0.05754
13	9	10	100	170.00	110	-0.3	-0.032	-0.005	-0.029	-0.05409
14	10	11	100	350.00	110	-1.0	-0.132	-0.137	-0.391	-0.04391
15	11	12	150	150.00	110	6.4	0.363	0.238	1.586	0.03532
16	12	15	100	160.00	110	4.9	0.618	1.089	6.808	0.03493
17	12	13	75	640.00	110	1.2	0.266	1.284	2.006	0.04151
18	14	13	75	370.00	110	-0.4	-0.090	-0.099	-0.269	-0.04876
19	14	15	75	450.00	110	-0.6	-0.145	-0.294	-0.653	-0.04541
20	15	16	100	970.00	110	3.7	0.470	3.979	4.102	0.03638
21	16	17	75	320.00	110	1.5	0.335	0.983	3.072	0.04012
22	17	18	50	250.00	110	0.4	0.185	0.411	1.644	0.04687
TOTAL				6950.00						

APPENDIX E. PROJECT IMPLEMENTATION AND PROJECT COST

APPENDIX E: PROJECT IMPLEMENTATION AND PROJECT COST

E.1. NEW SANITARY DISTRICT INFORMATION

E.2. AGENCIES CONCERNED AND OPERATION AND MAINTENANCE

E.3. COST ESTIMATE

E.4. DISBURSEMENT SCHEDULE

E.1. NEW SANITARY DISTRICT INFORMATION

LIST OF TABLE

Table E-1-1 New Sanitary District Information (1)

Description	Unit	NSD-5 Kham Sakae Sang	NSD-6 Nong Bua Lai	NSD-7 Huai Thalaeng	NSD-8 Nong Ki	NSD-10 Huai Rat	NSD-12 Khun Han	NSD-13 Kusuman	NSD-17 Phon Charoen	NSD-18 Nong Song Hong	NSD-20 Huai Khayung
1.Location and Others											
Amphoe	-	Kham Sakae Sang	Bua Yai	Huai Thalaeng	Nong Ki	Muang Buri Ran	Khun Han	Kusuman	Phon Charoen	Nong Song Hong	Warin Cham-rap Ubon
Changwat	-	--------- Nikhon Ratchasina ---------			Buri Ram	Buri Ran	Si Sa Ket	Sakon Nakhon	Nong Khai	Nong Khai	Ratchathani
Establishment of SD	-	1972	1964	1962	1969	1962	1956	1973	1981	1982	1956
Latitude (N.L)	-	15°20'	15°40'	15°00'	14°41'	14°58'	14°37'	17°20'	18°02'	17°46'	15°07'
Longtitude (E.L)	-	102°11'	102°30'	102°39'	102°33'	103°12'	104°25'	104°20'	103°42'	102°46'	104°02'
Elevation (M.S.L)	m	180-190	190±	180-190	200±	150-160	160-170	106±	150-170	170-180	120±
Nearest Main Road No. and Distance	km	No.2150 1=0 No.205 1=20	No.202 1=10	No.2162 1=0	HWY 24 1=0	HWY 218 1=10	No.2127 1=0 HWY 24 1=11	HWY 22 1=0	HWY 222 1=0	HWY 2 1=0	No.2193 1=0
2.Area, Population											
et. SD Acreage	km^2	2.00	3.028	2.624	5.40	1.725	12.00	4.00	10.00	4.53	2.8
Population	Persons	4,816	3,314	9,598	13,100	3,785	8,111	5,482	9,697	7,914	3,813
- Agricultural	"	3,227	1,756	4,511	7,991	2,223	4,743	4,041	?	?	2,326
- Non Agricultural	"	1,589	1,558	5,087	5,109	1,552	3,368	1,207	?	?	1,487
Population Density	P/km^2	2,408	1,094	3,658	2,425	2,194	676	1,371	970	1,747	1,362
No. of Household	NOS	633	451	1,100	1,912	457	1,380	781	1,448	951	569
No. of Village (Muban)	"	3	4	3	12	3	7	2	8	5	4
Revenue of SD	1,000B/y	1,120	1,127	1,739	1,311	793	934	614	411	507	718
Expenditure of SD	"	844	1,097	1,331	1,263	780	590	602	402	355	699
Subside from Government	"	25	95	223	417	6	73	8	2	18	20
3.Main Infrastructure											
Railway (station name)		-	Nong Bua Lai	Huai Thalaeng	-	Huai Rat	-	-	-	Nong Song Hong	Huai Khayung
Reservoir of River		-	Nong Samp Re	-	-	-	Nong Si Re	Huai Saphoe Ri	-	Nong Song Hong Re	Huai Kha Yung Ri
4.Character of SD											
Main Industry (1) (2)		Agriculture Commerce	Agriculture Commerce	Commerce Agriculture	Commerce Agriculture	Agriculture Commerce	Agriculture Commerce	Agriculture Commerce	Agriculture Commerce	Agriculture Commerce	Agriculture Commerce
Amphoe office	NOS	1	-	1	1	-	1	1	1	-	-
Primary school (pupils)	"	1(780)	1(326)	1(524)	1(NA)	1(652)	4(NA)	1(NA)	2(NA)	1(NA)	1(758)
Secondary school (pupils)	"	-	1(508)	1(234)	1(NA)	-	1(NA)	1(NA)	1(NA)	-	-
Hospital(beds)	"	-	-	1(10)	1(10)	-	1(30)	-	-	-	-

Table E-1-1 New Sanitary District Information (2)

Description	Unit	NSD-5 Kham Sakae Aang	NSD-6 Nong Bua Lai	NSD-7 Huai Thalaeng	NSD-8 Nong Ki	NSD-10 Huai Rat	NSD-12 Khun Han	NSD-13 Kusuman	NSD-17 Phon Charoen	NSD-18 Nong Song Hong	NSD-20 Huai Khayung
Health center(beds)	NOS	1(1)	1(2)	-	-	1(1)	-	1(1)	1(1)	1(1)	1(1)
Other Government office	"	4	3	5	10	3	6	5	3	3	3
Temple	"	1	-	1	2	1	6	2	3	2	1
Hotel	"	-	-	-	1	-	-	-	-	-	-
Big Factory	"	Rice mill	Rice mill	Rice mill	Rice mill	Rill mill	Rice mill	Rice mill	Rice mill	Rice mill	Rice mill
Market	shops	70-80	60±	130-140	100±	Noodle	80±	40±	80±	150±	160±
Potentiality of Development	-	Medium	Low	Medium	Great	Low	Medium	Medium	Medium	Great	Medium
5.Water condition Drinking water	(1)	Rainy Water	Rainy Water	Well	Rainy Water	Rainy Water	Well	Rainy Water	Well	Rainy Water	Well
	(2)	-	-	Rainy Water	Well	-	Rainy Water	-	Rainy Water	Well	Rainy Water
Domestic water		Pond, Well	Pond, Well	Pond, Well	Pond, Well	Pond, Well	Well, Pond	Pond, Well	Well, Pond	Well, Pond	Well
Nos. of wells				Many	Many		Many		Many		Many
Yield	cu.m/hr/No	Little	-	Little	-	-	-	18	7.0	7.5	-
Water Quality (Ground W) (Surface W)		---------- See Chapter V, 5-4 ----------									
Water charge	B/cu.m	30	?	4	35	50	45	?	?	?	?
Sewege, underground structure		-	-	-	-	-	-	-	-	-	-
6.Live stock Cattles	NOS	1,800	400	1,000	900	1,150	202	---------- No data ----------			645
Horses	"	-	-	-	-	-	-	---------- ditto ----------			-
Pigs	"	500	100	5,000	No data	450	50	---------- ditto ----------			508

7.Water source(surface) Name Reservoir	Bun Chiwuk	Nong Samp Re Huai Luang	Nong Takai	Tung Kraten	Huai Talet	Nong Si	Huai Daeng	Nong Loeng	Nong Song Hong	
River	-	-	-	-	(open canal)	-	-	-	-	Huai Kha Yung
Distance from S.D m	5,800	-	5,000	3,050	100	-	4,250	12,500	-	-
Concerned Agency -	RID	-	RID	ARD	RID	RID	RID	RID	RID	-
Catchment Area km^2	1.0	12.0	9	53	153	32.4	10.5	8.4	3.8	3,334
Effective Capacity MCM	0.34	0.37	0.16	1.6	18.5	3.8	1.2	2.0	0.4	-
Minimum Discharge cum/s	-	-	-	-	-	-	-	-	-	11.7
High Water Level MSL	189.30	-	178.00	-	-	DL 99.50	165.00	-	-	-
Low Water Level "	188.50	-	176.50	-	-	-	163.00	-	-	-

E.2. AGENCIES CONCERNED AND OPERATION AND MAINTENANCE

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E.2.1. Rural Water Supply Agencies

Table E-2-1 Rural Water Supply Agencies[*1]

A. Ministry of Interior	1. Department of Public Works
	2. Department of Local Administration
	3. Public Welfare Department[*2]
	4. Office of Accelerated Rural Development
	5. Department of Community Development
	6. Provincial Water Works Authority
B. Ministry of Public Health	7. Department of Health
C. Ministry of Industry	8. Department of Mineral Resources
D. Ministry of Agriculture and Cooperatives	9. Royal Irrigation Department
	10. Department of Fisheries
	11. Land Development Department[*2]
	12. Agricultural Land Reform Office[*2]
	13. Mobile Agricultural Service Unit
	14. Cooperatives Promotion Department[*2]
E. Ministry of Science, Energy and Technology	15. National Energy Administration
F. Ministry of Defense	16. National Security Council

Note: *1 ..... All of the agencies concerned about water supply are responsible for the provision of water supply for drinking and domestic consumption in addition to the agricultural water resources.

*2 ..... These agencies are confined to the specific project sites under the jurisdiction of their authorities.

E.2.2. Present Operation and Maintenance of ESD

(1) Water Quality in Operation

Table A-5-3, A-5-4 and E-2-1 shows the survey results based on the water examination of the quality in operation at present. Drinking water quality standard applied in Thailand is similar to that applied by World Health Organization (WHO) which is the International Standards for Drinking Water. Table A-5-2 shows Drinking Water Standard of Thailand.

(2) Intake Facilities

(a) Operation hour of the intake pumps which would be usually carried out 2 times in a day is determined in accordance with the operation need of water treatment plant. Generally, the limited operation of 2-8 hours per day is practised.

(b) Not only for intake pumps but also for service pump there was almost no lubrication maintenance found. Even spider's net in the pump house is observed. Spare pump has been disassembled and scattered disorderly. Except SD. Khamcha-i (ESD 10), existing facilities more than 10 years old after construction are in need of the due inspection and repair by expert in this line.

(3) Chemical Feeding

(a) Alum Feeding

This operation is made without the proper knowledge about the quantity and quality of raw water as stated in the previous paras. There has been no attention paid on the measurement of feeding quantity. Since the design of facility is not sufficient for this purpose, the better performance is far beyond the operators' responsibility.

Fortunately, at the most existing sites, Floc formation is reasonable because of high coagulation rate. The chemical feeding system is a basic element of rapid sand filter treatment.

(b) Chlorine Feeding

The bleaching powder (Cl_2 60%) used for chlorination is presently dosed without taking any measurement of the residual chlorine.

During this field survey, the residual chlorine was measured at SD Cho Ho (ESD-1) showing the following values:

At the inlet of clear water tank ..... 0.2 - 0.3 ppm
At the distribution valve ..... 0.0 ppm

There is a necessity to establish a check system of the chlorine dosing to be initiated and practised by the government agencies concerned.

(4) Flocculation and Sedimentation

As far as the chemical dosing is properly conducted, there would be no problem in applying either of the standard design (A) or (B) on flocculation. Even though the retention time is designed at 3 hours volume, actual volume for the sludge deposit is not considered at all probably resulting in shortage of the sedimentation volume.

Sludge volume is roughly estimated:

(a) The Condition given:

- Average turbidity ..... 50 mg/lit.
- Alum feeding ..... 20 mg/lit.
- Treatment capacity ..... 50 cu.m/hr

(b) Total Dry Solid (TDS):

$TDS = 50 \times ((50-10) + (20 \times 0.235)) \times 10^{-3}$

$= 2.23$ (kg/hr)

(c) Sludge Volume (SV):

SV = 2.23 kg/hr/30 kg/cu.m = 0.07 cu.m/hr

(d) Total Volume of Sludge Deposit (V) assuming the operation for 100 days with 8 hours per day:

$V = 0.074 \times 8 \times 100 = 59.2$ cu.m

To hold this volume,

Sedimentation Area ..... A = 10.0 x 4.0 = 40 (Sm)
Sludge Deposit Depth (h) ... H = 59.2/40 = 1.48 m

The above estimate indicate that the depth of sludge deposit is about a half of the total one of the sedimentation basin as expressed in the standard design when no action is taken for 100 days. It shall be necessary to remove completely the sludge by manual labor at least once in half a year even though drain is usually made by valve operation.

(5) Filtration

(a) Head Loss for Filtration

The standard design gives the loss of head of maximum 1,500 mm to achieve the backwash work of filter once in 2 to 3 days in case of 24 hours operation. For the cases of SD. Non Thai (ESD-2), SD. Tha Rae (ESD-4), SD. Sank Ha (ESD-6) and so forth, the backwash work would be once in one week to one month where the operation hour is 2-8 hours/day.

However, it is not preferable to leave the filter sand bed for a long time for the protection of algal and vermin damage. Therefore, it is necessary to conduct backwashing once in two days even it does not reach to the loss of head.

(b) Backwash velocity

Backwash is made by using the backflow from elevated tank. As per the standard, elevated tank is situated at 18 m higher than the ground with the water depth of the tank at 3.8 m. Therefore, backwash head is in the range of 16 to 20 m. If the backwash velocity as derived from the said head exceeds the terminal velocity of sand, there is a possible washout of the sand materials. In fact at SD. Cho Ho (ESD-1), the sand after washing-out is deposited at drain ditch and the irregular surface of the sand bed is seen. In view of better operation and maintenance, it is necessary to provide some protection measure so as to reduce the backwash velocity.

(c) Due to only one filter provided in accordance with the present design, operation has to be suspended during the repair time. To avoid this inconvenience, the filtration basin with two units shall be provided dividing the one basin into two with a wall.

(d) Necessity of Surface Washing

So far the backwash is practised at the present condition, it is extremely dangerous to carry out the surface washing together with the backwash work, and among others, additional combination of the air backwash shall be avoided. Taking the practical operation into account, it is recommended to carry out the backwash work once in two days and also the changing of sand materials once in two to three years.

(6) Distribution System

Operation hours a day in 10 ESDs are shown below:

No.	SD	Water Source	Design Capacity (cu.m/day)	Operation Hours	Remarks
3.	ESD Prang Ku	Deep Well	10	2 hrs per day	Not used for drinking water due to the water quality.
5.	ESD Akat Amuai	Deep Well	30	2 hrs per day	Operated by water level at the elevated tank.
7.	ESD Ban Phu	Deep Well	20	4 hrs per day	Not used for drinking water due to the water quality.
8.	ESD Khuang Nai	Deep Well	30	Operation being suspended in March, April and May every year. In the remaining months: 4 hrs per day.	Water quantity not enough.
9.	Other ESDs			6 to 8 hr per day	

Table E-2-2 Test Results on Raw Water Quality (In Operation)

No.	SD / ESD	Capacity cum/hr	Water Sources	Raw Water PH	Raw Water Turb	Raw Water Alkali	Raw Water Chlorid	Sedimentation PH	Sedimentation Turb	Clear Water Tank PH	Clear Water Tank Turb	Problem
1	Cho Ho	50	Reservoir	7.8	49	157	92	7.1	28	7.7	27	Sedimentation Filter
2	Non Thai	30	Pond	7.3	78	78	102	6.4	12	20	10	Filter
3	Prang Ku	10	Deep Well	7.5	5	-	-	-	-	7.5	5	
4	Tha Rae	50	Reservoir	7.5	6	40	18	7.3	5	7.0	5	
5	Akat Amnuai	30	Deep Well	7.5	5	-	-	-	-	-	-	
				9.0	8	-	-	-	-	-	-	
				7.6	5	-	-	-	-	-	-	
6	Sankha	30	Reservoir	7.3	15	20	11	5.5	11	5.7	5	Chemical Dosing
7	Ban Phu	20	Deep Well	8.5	5	205	504	-	-	8.5	7	
8	Khuang Nai	30	Deep Well	6.0	7	15	56	6.0	8	6.0	7	Raw Water
9	Chasuman	20	River	8.2	160	75	14	6.0	30	8.0	10	Chemical Dosting
10	Khamcha-i	30	Reservoir	7.8	9	45	4	7.0	8	7.5	5	

E.3. COST ESTIMATE

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E.3. Cost Estimate

E.3.1. Construction Cost

(1) Outline of Works

The construction of 10 NSDs water supply works will carried out by the contract basis.

Outline of Water Supply Works

NSD NO.		5	6	7	8	10	12	13	17	18	20
1. Feeder Canal	m	2,000	-	-	-	-	-	-	-	-	-
2. Rehabilitation of Reservoir	-	-	-	ΔH=1.5m	-	-	-	-	-	ΔH=1.3m	-
3. Intake Pump with Pump House	Unit	ϕ80x11KW 2	ϕ80x2.2 2	ϕ125x30 2	ϕ150x22 2	ϕ80x3.7 2	ϕ80x2.2 2	(Deep well) ϕ65x3.7 3	ϕ125x30 2	ϕ100x3.7 2	ϕ80x5.5 2
4. Transmission Pipe dia	mm	ACP ϕ150	-	ACP ϕ200	ACP ϕ250	ACP ϕ150	ACP ϕ150	PVC ϕ100	ACP ϕ200	ACP ϕ150	ACP ϕ150
length	m	5,800	-	6,000	3,050	100	470	1,690	12,500	200	1,000
5. Treatment Plant Capacity	m^3	Rapid 38	Rapid 28	Rapid 83	Rapid 105	Rapid 31	Rapid 31	Aeration 39	Rapid 66	Rapid 53	Rapid 31
6. Distribution Reservoir	m^3	250x1	200x1	500x1	600x1	200x1	200x1	250x1	400x1	300x1	200x1
7. Elevated Tank	m^3	80x1	60x1	160x1	200x1	60x1	60x1	80x1	120x1	100x1	60x1
8. Distribution Pump	- Unit	ϕ80x5.5KW 3	ϕ65x3.7 3	ϕ100x11 3	ϕ125x11 3	ϕ65x3.7 3	ϕ65x3.7 3	ϕ80x5.5 3	ϕ100x7.5 3	ϕ80x5.5 3	ϕ65x5.5 3
9. Pump House	LS	1	1	1	1	1	1	1	1	1	1
10. Distribution Pipeline (ϕ50-ϕ200)	m	10,450	6,900	12,250	25,580	8,970	6,700	9,210	12,100	13,230	13,460
11. Electric Works	LS	1	1	1	1	1	1	1	1	1	1

(2) Basic Rate

The basic rate for labor, material and construction equipment is estimated on the basis of the prevailing rate in Northeast of Thailand.

(a) Wage Rate per Day

Common labor	70 ฿
Skilled labor	100
Foreman	150
Driver	120
Operator for heavy equipment	150
Steel worker	120
Carpenter	120
Mechanician	150

(b) Material Rate

Description	Unit	Rate (฿)
Portland cement	ton	2,000
Reinforcing bar	ton	9,000
Gasoline	litter	12
Light oil	litter	8
Gravel for aggregate	cu.m	190
Sand for aggregate	cu.m	180
Timer (hard)	cu.m	7,000
Timer (soft)	cu.m	8,000

The construction equipment rate per hours is estimated, based on the capital cost, the ratio for depreciation, fuel consumption and operator wages repairing and maintenance cost for equipment.

The detailed estimate of construction equipment rate is shown in Table E-3-1.

(d) Foreign and Local Currency Portion for Basic Rate

The foreign and local currency portions are allocated based on the prevailing percentage.

Description	Percentage F/C (%)	Percentage L/C (%)
Cement	60	40
Reinforcement	70	30
Fuel	80	20
Timber	20	80
Depreciation for equipment	100	-
Repair for equipment	80	20
Labor	-	100
Steel pipe	70	30
Asbestos cement pipe	60	40
Vinyl pipe	70	30
Pump CIF	100	-

(3) Unit Rate

The unit rate is estimated based on the output of construction equipment, the basic rate for labor, the material and equipment, and construction method.

The Estimated Unit Rate

Description	Unit	Unite Rate (฿) F/C	L/C	Total
Excavation (Man power)	cu.m	-	21	21
(0.60 Back hoe)	cu.m	7	4	11
Back fill (man power)	cu.m	-	14	14
Reinforced concrete	cu.m	1,770	1,430	3,200
Pipeline (under the road)	m			
ACP class 20 ϕ150	m	120 (200)	110 (340)	230 (540)
ϕ200	m	200 (360)	170 (420)	370 (780)
ϕ250	m	280 (440)	220 (490)	500 (930)
PVCP class 8.5 ϕ50	m	25 (-)	18 (-)	43 (-)
ϕ75	m	- (130)	- (140)	- (270)
ϕ100	m	- (190)	- (210)	- (400)

(4) Project Cost

The project cost consist of the construction cost, land acquisition, administration, engineering service and contingencies.

(a) Construction Cost

The construction cost of water supply works to be carried out by SD is estimated based on the bill of quantities and unit rate.

(1) An overhead of 18.5% for direct cost has been considered for the works to be carried out on a contract basis.

In case of direct cost 5,000 - 10,600,000฿

Description	Rate (%)
(1) Profit	6.0
(2) Administration	8.5
(3) Tax	4.1
Total	18.6% = 18.5%

(2) Import Tax

Pump

(1) Tariff ..... 10% x 1.00 = 0.10
(2) Profit ..... 16% x (1.00 + 0.10) = 0.18
(3) Business tax ..... 5% x (1.00 + 0.10 + 0.18) = 0.064
(4) Municipality tax . 10% x 0.064 = 0.006

Total import tax = 0.10 + 0.064 + 0.006 = 0.17

(b) Land Acquisition

Some right-of-way will be required for intake pumping stations and transmissions.
The cost is estimated with a unit of 8,000 ฿/rai.

(c) Engineering Service

The cost of engineering service for detail design and construction supervision is estimated at ฿10,320,000 corresponding to about ten percent of construction cost as shown in Table E-3-2 and E-3-3.

E.3.2. Operation and Maintenance (O/M) Cost

O/M cost will be computed as follows.

(1) Personal Expenditure

Treatment Capacity (m^3/hr)	General Administrator	Technical Administrator	Chief Operator	Chief Officer	Worker and Officer	Personal Expenses ฿/Year
Salary ฿/year	-	50,000	40,000	35,000	25,000	
200	concurrently (1)	1	1	1	3	205,000
100 - 150	(1)	1	1	1	3	205,000
50 - 100	(1)	1	1	1	2	175,000
30 - 50	(1)	1	1	1	1	150,000
20 - 30	(1)	1	1	1	1	150,000
0 - 20	(1)	1	1	1	-	130,000

(2) Repairing cost .... 0.30% of project cost
(not included the price contingencies)

(3) Chemical Materials

Unit cost of chemical are follows.

Alum ..... 5,600 ฿/t
Soda ash 3,000
Bleaching power 14,500

(4) Cost of Electricity

° Operating hours of pump

Intake pump	24 hours	α = 1.0 kw
Deep well pump	20	α = 1.0 kw
Distribution pump	13	α = 2.0 kw

α: Output for light or small equipments

° Electricity charge
Demand charge ..... 95 Baht/kw
Energy charge ..... 1.5 Baht/kwh

(b) Others ..... 20% of personal expenditure

Total O/M cost is shown in Table E-3-5.

(d) Administration Cost

The administration cost is estimated at about ¥10,320,000 corresponding to about 10 percent of construction cost. The cost consists of salary, transportation and miscellaneous costs including the cost of office, office furniture and detail survey.

(e) Physical Contingencies

10 (ten) percent of project cost is considered as physical contingency for minor differences between actual and estimated quantities and unforeseeable difficulties in construction.

(f) Price Contingencies

Price escalation rates for both foreign and local components are adopted the following figures.

Escalation rate

	1985	1986	1987	1988	1989
Foreign (%)	5.0	7.5	8.0	8.0	8.0
Local (%)	7.0	7.0	7.0	7.0	7.0

(g) Project Cost

Project cost is summarized in Table E-3-4.

Table E-3-1 Operation Cost of Major Equipment

		Bull-dozer 11 ton 110 PS	Backhoe 0.35 m³ 92 PS	Backhoe 0.60 m³ 108 PS	Dump Truck 8 ton 260 PS	Boring Machine 5.5 KW	Water Tank Truck 6,000ℓ 100 PS	Air Com-pressor 52 PS	Agitator Truck 3.0 m³ 195 PS	Portable Concrete Plant 0.5 m³	Rammer 80 kg 4 PS
Purchase Price (x10³฿)	[1]	1,140	1,110	1,680	530	190	510	226	236	1,420	30
Life Time (hr or day)	[2]	6,600	6,500	6,500	6,400	840 day	6,000	840 day	5,000	5,400	400 day
Depreciation Cost (฿) $[3] = \frac{(1 - 0.1) \times [1]}{[2]}$		155.5	153.7	232.6	74.5	203.6	76.5	242.1	42.5	276.7	68.0
Rate	[4]	1.00	0.75	0.75	0.80	0.75	0.75	0.90	0.55	0.70	0.20
Repair Cost											
Parts Cost (฿) $[5] = \frac{[1] \times [4]}{[2]} \times 0.8$		138.2	102.5	155.1	53.0	135.7	51.0	193.7	20.8	172.1	12.0
Labor Cost (฿) $[6] = \frac{[1] \times [4]}{[2]} \times 0.2$		34.5	25.6	38.7	13.3	33.9	12.8	48.2	5.2	43.0	3.0
Fuel & Lubricant											
Fuel (ℓ/hr)	[7]	11.4	9.5	11.2	17.9	-	11.0	-	13.5	7.2	-
F.C. (฿)	[8]	87.7	73.1	86.2	137.8	-	84.7	-	103.9	55.4	-
L.C. (฿)	[9]	21.5	18.3	21.5	34.4	-	21.2	-	26.0	13.9	-
Labor(Operator)(฿)	[10]	35.0	35.0	35.0	15.3	-	15.3	-	15.3	-	-
Administrative Cost (฿/hr)	[11]	12.1	12.0	18.1	5.8	15.8	6.0	18.9	3.3	21.5	1.5
Total Foreign Currency (฿/hr) [12] = [5] + [8]		225.9	175.6	241.3	190.8	135.7	135.7	193.7	124.7	227.5	12.0
Total Local Currency (฿/hr) [13] = [6]+[9]+[10]+[11]		103.5	90.9	113.3	68.8	49.7	55.3	67.1	49.8	78.4	4.5

Table E-3-2 Cost of consulting service

1. Foreign Currency

(1) Remuneration (64MM)

Foreign staff	200,000$^{\text{B}}$ x 28$^{\text{MM}}$	= 5,600,000$^{\text{Baht}}$
Local staff	70,000 x 35	= 2,450,000
		8,050,000

(2) Out-of-pocket expenses

International Travel expenses (4 R.T)

	B/trip	
	30,000 x 4	= 120,000

(3) Others 78,000

Sub Total	8,248,000

2. Local Currency

(1) Remuneration

Typist	5,000 x 28$^{\text{MM}}$	= 140,000
Draftman	7,000 x 6 x 2	= 84,000
Vehicle	30,000 x 28	= 840,000
Others		1,008,000
Sub Total		2,072,000
Total		10,320,000

Table E-3-3 Manning Schedule for Engineering Service

Description		MM	1986 I	1986 II	1986 III	1986 IV	1987 I	1987 II	1987 III	1987 IV	1988 I	1988 II	1988 III	1988 IV	1989 I	1989 II	1989 III	1989 IV
1. Detail Design																		
Team Leader	Ⓕ	⑥				②	④											
Civil Engineer	L	6				2	4											
Water Supply Engineer	Ⓕ	⑤				①	④											
Archtecture Engineer	L	3					3											
Structure Engineer	L	3					3											
Electric Engineer	L	3					3											
Specification	L	2						2										
Sub Total		28																
2. Supervision																		
(1) Team Leader	Ⓕ	⑰								②		⑦		③	⑤			
(2) Supervisor	L	18								2		12			4			
(3) Supervisor	PWD	(10)																
Sub Total		35																
Total	Ⓕ	㉘				③	⑧ → ⑩			← ②		⑩			⑤			
	L	35				2	15 → 17			← 2		12			4			
	Total	63				5	23 → 27			← 4		22			9			

Ⓕ : Foreign staff, L: Local staff

Table E-3-4 Total Cost of The Project

(Unit: 1,000 $)

Description	NSD-5			NSD-6			NSD-7			NSD-8		
	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total
1. Construction cost												
1) Intake work	680	440	1,120	280	190	470	4,250	3,390	7,640	620	230	850
2) Transmission	970	810	1,780	0	0	0	1,630	1,280	2,910	1,150	850	2,000
3) Treatment plant	1,750	1,720	3,470	1,500	1,400	2,900	2,200	2,150	4,350	2,400	2,160	4,560
4) Distribution work	1,620	1,480	3,100	1,040	960	2,000	2,010	1,970	3,980	3,710	3,870	7,580
Sub-Total	5,020	4,450	9,470	2,820	2,550	5,370	10,090	8,790	18,880	7,880	7,110	14,990
2. Land acquisition	0	200	200	0	50	50	0	50	50	0	0	0
3. Engineering service	752	188	940	420	110	530	1,510	380	1,890	1,200	300	1,500
4. Administration	188	752	940	110	420	530	380	1,510	1,890	300	1,200	1,500
Sub-Total (1 - 4)	5,960	5,590	11,550	3,350	3,130	6,480	11,980	10,730	22,710	9,380	8,610	17,990
5. Physical contingency	596	559	1,155	335	313	648	1,198	1,073	2,271	938	861	1,799
Sub-Total (1 - 5)	6,556	6,149	12,705	3,685	3,443	7,128	13,178	11,803	24,981	10,318	9,471	19,789
6. Price contingency	1,801	1,658	3,459	1,020	941	1,961	3,521	3,144	6,664	2,903	2,661	5,564
Grand Total	8,357	7,807	16,164	4,705	4,384	9,089	16,699	14,947	31,645	13,221	12,132	25,353

Description	NSD-10			NSD-12			NSD-13			NSD-17		
	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total
1. Construction cost												
1) Intake work	340	220	560	300	210	510	690	180	870	690	270	960
2) Transmission	20	20	40	80	70	150	410	440	850	3,390	2,680	6,070
3) Treatment plant	1,500	1,430	2,930	1,500	1,430	2,930	1,530	1,310	2,840	2,000	1,860	3,860
4) Distribution work	1,360	1,310	2,670	990	920	1,910	1,440	1,350	2,790	1,880	2,110	3,990
Sub-Total	3,200	2,980	6,200	2,870	2,630	5,500	4,070	3,280	7,350	7,960	6,920	14,880
2. Land acquisition	0	0	0	0	0	0	0	50	50	0	0	0
3. Engineering service	496	124	620	440	110	550	584	146	730	1,180	300	1,480
4 Administration	124	496	620	110	440	550	146	584	730	300	1,180	1,480
Sub-Total (1 - 4)	3,840	3,600	7,440	3,420	3,180	6,600	4,800	4,060	8,860	9,440	8,400	17,840
5. Physical contingency	384	360	744	342	318	660	480	406	886	944	840	1,784
Sub-Total (1 - 5)	4,224	3,960	8,184	3,762	3,498	7,260	5,280	4,466	9,746	10,384	9,240	19,624
6. Price contingency	1,178	1,097	2,275	1,037	957	1,994	1,458	1,226	2,683	2,818	2,514	5,332
Grand Total	5,402	5,057	10,459	4,799	4,455	9,254	6,738	5,692	12,429	13,202	11,754	24,956

Description	NSD-18			NSD-20			Total			Remarks
	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	
1. Construction cost										
1) Intake work	3,070	2,830	5,900	580	310	890	11,500	8,270	19,770	
2) Transmission	40	30	70	170	140	310	7,860	6,320	14,180	
3) Treatment plant	1,900	1,800	3,700	1,490	1,440	2,930	17,770	16,700	34,470	
4) Distribution work	1,790	1,610	3,400	1,890	1,780	3,670	17,730	17,360	35,090	
Sub-Total	6,800	6,270	13,070	4,130	3,670	7,800	54,860	48,650	103,510	
2. Land acquisition	0	50	50	0	50	50	0	450	450	
3. Engineering service	1,040	260	1,300	624	156	780	8,248	2,072	10,320	
4. Administration	260	1,040	1,300	156	624	780	2,072	8,248	10,320	
Sub-Total (1 - 4)	8,100	7,620	15,720	4,910	4,500	9,410	65,180	59,420	124,600	
5. Physical contingency	810	762	1,572	491	450	941	6,518	5,942	12,460	
Sub-Total (1 - 5)	8,910	8,382	17,292	5,401	4,950	10,351	71,698	65,362	37,060	*1: 52.3% of the total
6. Price contingency	2,401	2,239	4,641	1,514	1,373	2,887	19,650	17,810	37,460	
							*1	*2		*2: 47.7% of the total
Grand Total	11,211	10,621	21,933	6,915	6,323	13,238	91,348	83,172	174,520	

Table E-3-5 Operation and Maintenance Cost

Description		NSD-5	NSD-6	NSD-7	NSD-8	NSD-10	NSD-12	NSD-13	NSD-17	NSD-18	NSD-20
1. Chemical charge											
1) Daily Water Demand	cum/y	262,800	197,100	584,000	741,000	215,400	219,000	270,100	464,000	376,000	215,000
2) Alum Feeding charges											
Raw water turbility		50	55	12	200	220	8		25	9	40
colour		25	15	15	30	20	-		30	15	15
Alun Feed	P.P.M.	30	30	20	40	40	10	-	20	10	30
Consumption	t/year	7.88	5.91	11.68	20.75	8.62	2.19	-	9.28	3.76	6.45
Cost 5,600฿/t	฿/year	44,100	33,100	65,400	116,200	48,300	12,300	-	52,000	21,100	36,100
3) Soda Ash Feeding charge											
Raw Water Alkality		86	50	83	82	63	20		10	20	24
Alkality Feed	P.P.M.	-	-	-	-	-	10	-	20	10	15
Consumption	t/year	-	-	-	-	-	2.19	-	9.28	3.76	3.23
Cost 3,000฿/t	฿/year	-	-	-	-	-	6,600	-	27,800	11,300	9,700
4) Breeching Powder Feeding charge											
Raw Water $KMnO_4$ (0.25)		30.5	28.5	20.8	30.8	28.5	-	0.1	22.8	13.7	21.5
Fe (0.10)		0.1	9.0	1.2	2.25	710	-	0.7	0.45	0.85	2.85
Alkality Feed	P.P.M.	7.6	12.5	6.0	9.1	13.1	3.0	3.0	6.0	3.9	7.0
Consumption	t/year	2.00	2.46	3.50	6.74	2.82	0.66	0.81	2.78	1.47	1.51
Cost 14,500฿/t	฿/year	29,000	36,700	50,800	97,700	40,900	9,600	11,700	40,300	21,300	21,900
5) S-Total Cost	฿/year	73,100	69,800	116,200	213,900	89,200	28,500	11,700	120,100	53,700	67,700
2. Electricty											
1) Intake pump out put	KW	11.0	2.2	30	22	3.7	2.2	3.7x3=11.1	30	3.7	5.5
Cost (24^{hr}) 14,280x(KW+1.0)	฿/year	171,400	45,700	442,700	328,400	67,100	45,700	(DEEP Well)	442,700	67,100	92,800
Cost (20^{hr}) 8,260x(KW+1.0)	฿/year	-	-	-	-	-	-	100,000	-	-	-
2) Distribution pump out put(20^{hr})	KW	5.5x2	3.7x2	11x2	11x2	3.7x2	3.7x2	5.5x2	7.5x2	5.5x2	5.5x2
Cost 12,090 x (KW+2.0)	฿/year	157,200	113,600	290,200	290,200	113,600	113,600	157,200	205,500	157,200	157,200
Sub Total		328,600	159,300	732,900	618,600	180,700	159,300	257,200	648,200	224,300	250,000
3. Reparing Cost (Construction cost 0.3%)		38,100	21,400	75,000	59,000	24,500	21,600	29,300	59,000	51,900	31,200
4. Personal Expences		150,000	150,000	175,000	175,000	150,000	150,000	150,000	175,000	150,000	150,000
5. Others (4) x 20%		30,000	30,000	35,000	35,000	30,000	30,000	30,000	35,000	30,000	30,000
Total		619,800	430,500	1,134,100	1,101,500	474,400	389,400	478,200	1,037,300	509,900	528,900

E.4. DISBURSEMENT SCHEDULE

LIST OF TABLES

LIST OF FIGURE

Figure E–4–1 Typical Disbursement Schedule

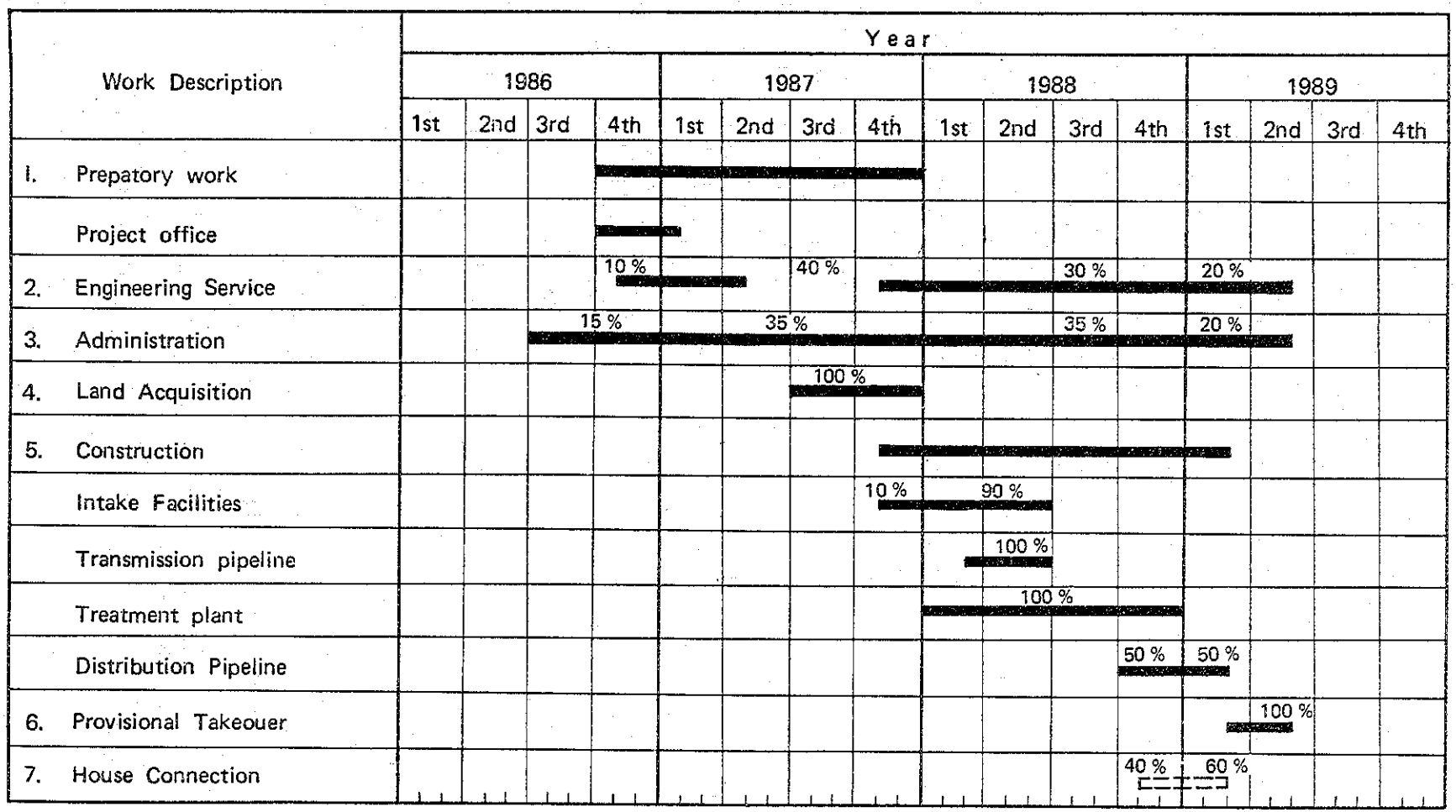

Table E-4-1 Disbursement Schedule (Total of 10 Projects Cost)

(Unit 1,000 Bahts)

Description	Total			1986			1987			1988			1989		
	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total
A. Construction cost															
1. Intake work	11,500	8,270	19,770	-	-	-	1,150	827	1,977	10,350	7,443	17,793	-	-	-
2. Transmission	7,860	6,320	14,180	-	-	-	-	-	-	7,860	6,320	14,180	-	-	-
3. Treatment plant	17,770	16,700	34,470	-	-	-	-	-	-	17,770	16,700	34,470	-	-	-
4. Distribution pipe	17,730	17,360	35,090	-	-	-	-	-	-	8,865	8,680	17,545	8,865	8,680	17,545
Sub total	54,860	48,650	103,510				1,150	827	1,977	44,845	39,143	83,988	8,865	8,680	17,545
B. Land cost	-	450	450	-	-	-	-	450	450	-	-	-	-	-	-
C. Engineering Service	8,248	2,072	10,320	825	207	1,032	3,299	829	4,128	2,474	621	3,095	1,650	415	2,065
D. Administration	2,072	8,248	10,320	311	1,237	1,548	725	2,887	3,612	725	2,887	3,612	311	1,237	1,548
Sub total (A-D)	65,180	59,420	124,600	1,136	1,444	2,580	5,174	4,993	10,167	48,044	42,651	90,695	10,826	10,332	21,158
E. Physical contingency	6,518	5,942	12,600	114	144	258	517	499	1,016	4,804	4,266	9,070	1,083	1,033	2,116
Sub total	71,698	65,362	37,460	1,250	1,588	2,838	5,691	5,492	11,183	52,848	46,917	99,765	11,909	11,365	23,274
F. Price contingency	19,650	17,810	37,460	111	171	282	991	1,017	2,008	14,151	12,569	26,720	4,397	4,053	8,450
Grand Total	91,348	83,172	174,520	1,361	1,759	3,120	6,682	6,509	13,191	66,999	59,486	126,485	16,306	15,418	31,724

Table E-4-2 Construction Cost and Disbursement Schedule
Project: Kham Sakae Sang (5)

(UNIT : 000 BAHT)

COST ITEMS	TOTAL FOREIGN CURRENCY	TOTAL LOCAL CURRENCY	TOTAL TOTAL	1985 F.C.	1985 L.C.	1985 TOTAL	1986 F.C.	1986 L.C.	1986 TOTAL	1987 F.C.	1987 L.C.	1987 TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	680.	440.	1120.	0.	0.	0.	0.	0.	0.	68.	44.	112.
2) TRANSMISSION	970.	810.	1780.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	1750.	1720.	3470.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	1620.	1480.	3100.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	5020.	4450.	9470.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2. LAND COST	0.	200.	200.	0.	0.	0.	0.	0.	0.	68.	44.	112.
3. ENGINEERING	752.	188.	940.	0.	0.	0.	75.	19.	94.	301.	75.	376.
4. ADMINISTRATION	188.	752.	940.	0.	0.	0.	28.	113.	141.	66.	263.	329.
TOTAL	5960.	5590.	11550.	0.	0.	0.	103.	132.	235.	435.	582.	1017.
5. CONTINGENCY (10.%)	596.	559.	1155.	0.	0.	0.	10.	13.	24.	43.	58.	102.
TOTAL	6556.	6149.	12705.	0.	0.	0.	114.	145.	258.	478.	641.	1119.
6. PRICE CONTINGENCY	1801.	1658.	3459.	0.	0.	0.	10.	16.	26.	83.	118.	202.
T O T A L	8357.	7807.	16164.	0.	0.	0.	124.	160.	284.	561.	759.	1320.

(UNIT : 000 BAHT)

COST ITEMS	1988 F.C.	1988 L.C.	1988 TOTAL	1989 F.C.	1989 L.C.	1989 TOTAL	1990 F.C.	1990 L.C.	1990 TOTAL	1991 F.C.	1991 L.C.	1991 TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	612.	396.	1008.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2) TRANSMISSION	970.	810.	1780.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	1750.	1720.	3470.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	810.	740.	1550.	810.	740.	1550.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	4142.	3666.	7808.	810.	740.	1550.	0.	0.	0.	0.	0.	0.
2. LAND COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3. ENGINEERING	226.	56.	282.	150.	38.	188.	0.	0.	0.	0.	0.	0.
4. ADMINISTRATION	66.	263.	329.	28.	113.	141.	0.	0.	0.	0.	0.	0.
TOTAL	4433.	3986.	8419.	989.	890.	1879.	0.	0.	0.	0.	0.	0.
5. CONTINGENCY	443.	399.	842.	99.	89.	188.	0.	0.	0.	0.	0.	0.
TOTAL	4877.	4384.	9261.	1087.	979.	2067.	0.	0.	0.	0.	0.	0.
6. PRICE CONTINGENCY	1306.	1175.	2481.	402.	349.	751.	0.	0.	0.	0.	0.	0.
T O T A L	6183.	5559.	11742.	1489.	1329.	2818.	0.	0.	0.	0.	0.	0.

Table E-4-3 Construction Cost and Disbursement Schedule
Project: Nong Bua Lai (6)

(UNIT : 000 BAHT)

COST ITEMS	T O T A L			1985			1986			1987		
	FOREIGN CURRENCY	LOCAL CURRENCY	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	280.	190.	470.	0.	0.	0.	0.	0.	0.	28.	19.	47.
2) TRANSMISSION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	1500.	1400.	2900.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	1040.	960.	2000.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	2820.	2550.	5370.	0.	0.	0.	0.	0.	0.	28.	19.	47.
2. LAND COST	0.	50.	50.	0.	0.	0.	0.	0.	0.	0.	50.	50.
3. ENGINEERING	420.	110.	530.	0.	0.	0.	42.	11.	53.	168.	44.	212.
4. ADMINISTRATION	110.	420.	530.	0.	0.	0.	17.	63.	80.	39.	147.	186.
TOTAL	3350.	3130.	6480.	0.	0.	0.	59.	74.	133.	235.	260.	495.
5. CONTINGENCY (10.%)	335.	313.	648.	0.	0.	0.	6.	7.	13.	23.	26.	49.
TOTAL	3685.	3443.	7128.	0.	0.	0.	64.	81.	146.	258.	286.	544.
6. PRICE CONTINGENCY	1020.	941.	1961.	0.	0.	0.	6.	9.	14.	45.	53.	98.
T O T A L	4705.	4384.	9089.	0.	0.	0.	70.	90.	160.	303.	339.	642.

(UNIT : 000 BAHT)

COST ITEMS	1988			1989			1990			1991		
	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	252.	171.	423.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2) TRANSMISSION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	1500.	1400.	2900.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	520.	480.	1000.	520.	480.	1000.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	2272.	2051.	4323.	520.	480.	1000.	0.	0.	0.	0.	0.	0.
2. LAND COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3. ENGINEERING	126.	33.	159.	84.	22.	106.	0.	0.	0.	0.	0.	0.
4. ADMINISTRATION	39.	147.	186.	17.	63.	80.	0.	0.	0.	0.	0.	0.
TOTAL	2437.	2231.	4668.	621.	565.	1186.	0.	0.	0.	0.	0.	0.
5. CONTINGENCY	244.	223.	467.	62.	57.	119.	0.	0.	0.	0.	0.	0.
TOTAL	2680.	2454.	5134.	683.	622.	1304.	0.	0.	0.	0.	0.	0.
6. PRICE CONTINGENCY	718.	657.	1375.	252.	222.	474.	0.	0.	0.	0.	0.	0.
T O T A L	3398.	3112.	6510.	935.	843.	1778.	0.	0.	0.	0.	0.	0.

Table E-4-4 Construction Cost and Disbursement Schedule
Project: Huai Thalaeng (7)

(UNIT : 000 BAHT)

COST ITEMS	TOTAL FOREIGN CURRENCY	TOTAL LOCAL CURRENCY	TOTAL TOTAL	1985 F.C.	1985 L.C.	1985 TOTAL	1986 F.C.	1986 L.C.	1986 TOTAL	1987 F.C.	1987 L.C.	1987 TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	4250.	3390.	7640.	0.	0.	0.	0.	0.	0.	425.	339.	764.
2) TRANSMISSION	1630.	1280.	2910.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	2200.	2150.	4350.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	2010.	1970.	3980.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	10090.	8790.	18880.	0.	0.	0.	0.	0.	0.	425.	339.	764.
2. LAND COST	0.	50.	50.	0.	0.	0.	0.	0.	0.	0.	50.	50.
3. ENGINEERING	1510.	380.	1890.	0.	0.	0.	151.	38.	189.	604.	152.	756.
4. ADMINISTRATION	380.	1510.	1890.	0.	0.	0.	57.	227.	284.	133.	529.	662.
TOTAL	11980.	10730.	22710.	0.	0.	0.	208.	265.	473.	1162.	1070.	2232.
5. CONTINGENCY (10.%)	1198.	1073.	2271.	0.	0.	0.	21.	26.	47.	116.	107.	223.
TOTAL	13178.	11803.	24981.	0.	0.	0.	229.	291.	520.	1278.	1176.	2455.
6. PRICE CONTINGENCY	3521.	3144.	6664.	0.	0.	0.	20.	31.	52.	222.	218.	440.
T O T A L	16699.	14947.	31645.	0.	0.	0.	249.	322.	571.	1500.	1394.	2895.

(UNIT : 000 BAHT)

COST ITEMS	1988 F.C.	1988 L.C.	1988 TOTAL	1989 F.C.	1989 L.C.	1989 TOTAL	1990 F.C.	1990 L.C.	1990 TOTAL	1991 F.C.	1991 L.C.	1991 TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	3825.	3051.	6876.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2) TRANSMISSION	1630.	1280.	2910.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	2200.	2150.	4350.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	1005.	985.	1990.	1005.	985.	1990.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	8660.	7466.	16126.	1005.	985.	1990.	0.	0.	0.	0.	0.	0.
2. LAND COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3. ENGINEERING	453.	114.	567.	302.	76.	378.	0.	0.	0.	0.	0.	0.
4. ADMINISTRATION	133.	529.	662.	57.	227.	284.	0.	0.	0.	0.	0.	0.
TOTAL	9246.	8109.	17355.	1364.	1288.	2652.	0.	0.	0.	0.	0.	0.
5. CONTINGENCY	925.	811.	1735.	136.	129.	265.	0.	0.	0.	0.	0.	0.
TOTAL	10171.	8919.	19090.	1500.	1416.	2917.	0.	0.	0.	0.	0.	0.
6. PRICE CONTINGENCY	2724.	2390.	5113.	554.	505.	1059.	0.	0.	0.	0.	0.	0.
T O T A L	12894.	11309.	24203.	2054.	1921.	3976.	0.	0.	0.	0.	0.	0.

Table E-4-5 Construction Cost and Disbursement Schedule
Project: Nong Ki (8)

(UNIT : 000 BAHT)

COST ITEMS	TOTAL FOREIGN CURRENCY	TOTAL LOCAL CURRENCY	TOTAL TOTAL	1985 F.C.	1985 L.C.	1985 TOTAL	1986 F.C.	1986 L.C.	1986 TOTAL	1987 F.C.	1987 L.C.	1987 TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	620.	230.	850.	0.	0.	0.	0.	0.	0.	62.	23.	85.
2) TRANSMISSION	1150.	850.	2000.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	2400.	2160.	4560.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	3710.	3870.	7580.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	7880.	7110.	14990.	0.	0.	0.	0.	0.	0.	62.	23.	85.
2. LAND COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3. ENGINEERING	1200.	300.	1500.	0.	0.	0.	120.	30.	150.	480.	120.	600.
4. ADMINISTRATION	300.	1200.	1500.	0.	0.	0.	45.	180.	225.	105.	420.	525.
TOTAL	9380.	8610.	17990.	0.	0.	0.	165.	210.	375.	647.	563.	1210.
5. CONTINGENCY (10.%)	938.	861.	1799.	0.	0.	0.	17.	21.	38.	65.	56.	121.
TOTAL	10318.	9471.	19789.	0.	0.	0.	182.	231.	413.	712.	619.	1331.
6. PRICE CONTINGENCY	2903.	2661.	5564.	0.	0.	0.	16.	25.	41.	124.	115.	238.
T O T A L	13221.	12132.	25353.	0.	0.	0.	198.	256.	454.	835.	734.	1569.

(UNIT : 000 BAHT)

COST ITEMS	1988 F.C.	1988 L.C.	1988 TOTAL	1989 F.C.	1989 L.C.	1989 TOTAL	1990 F.C.	1990 L.C.	1990 TOTAL	1991 F.C.	1991 L.C.	1991 TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	558.	207.	765.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2) TRANSMISSION	1150.	850.	2000.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	2400.	2160.	4560.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	1855.	1935.	3790.	1855.	1935.	3790.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	5963.	5152.	11115.	1855.	1935.	3790.	0.	0.	0.	0.	0.	0.
2. LAND COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3. ENGINEERING	360.	90.	450.	240.	60.	300.	0.	0.	0.	0.	0.	0.
4. ADMINISTRATION	105.	420.	525.	45.	180.	225.	0.	0.	0.	0.	0.	0.
TOTAL	6428.	5662.	12090.	2140.	2175.	4315.	0.	0.	0.	0.	0.	0.
5. CONTINGENCY	643.	566.	1209.	214.	218.	432.	0.	0.	0.	0.	0.	0.
TOTAL	7071.	6228.	13299.	2354.	2393.	4747.	0.	0.	0.	0.	0.	0.
6. PRICE CONTINGENCY	1894.	1669.	3562.	869.	853.	1723.	0.	0.	0.	0.	0.	0.
T O T A L	8964.	7897.	16861.	3223.	3246.	6469.	0.	0.	0.	0.	0.	0.

Table E-4-6 Construction Cost and Disbursement Schedule
Project: Huai Rat (10)

(UNIT : 000 BAHT)

COST ITEMS	T O T A L			1985			1986			1987		
	FOREIGN CURRENCY	LOCAL CURRENCY	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	340.	220.	560.	0.	0.	0.	0.	0.	0.	34.	22.	56.
2) TRANSMISSION	20.	20.	40.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	1500.	1430.	2930.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	1360.	1310.	2670.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	3220.	2980.	6200.	0.	0.	0.	0.	0.	0.	34.	22.	56.
2. LAND COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3. ENGINEERING	496.	124.	620.	0.	0.	0.	50.	12.	62.	198.	50.	248.
4. ADMINISTRATION	124.	496.	620.	0.	0.	0.	19.	74.	93.	43.	174.	217.
TOTAL	3840.	3600.	7440.	0.	0.	0.	68.	87.	155.	276.	245.	521.
5. CONTINGENCY (10.%)	384.	360.	744.	0.	0.	0.	7.	9.	16.	28.	25.	52.
TOTAL	4224.	3960.	8184.	0.	0.	0.	75.	95.	170.	303.	270.	573.
6. PRICE CONTINGENCY	1178.	1097.	2275.	0.	0.	0.	7.	10.	17.	53.	50.	103.
T O T A L	5402.	5057.	10459.	0.	0.	0.	82.	106.	187.	356.	320.	676.

(UNIT : 000 BAHT)

COST ITEMS	1988			1989			1990			1991		
	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	306.	198.	504.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2) TRANSMISSION	20.	20.	40.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	1500.	1430.	2930.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	680.	655.	1335.	680.	655.	1335.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	2506.	2303.	4809.	680.	655.	1335.	0.	0.	0.	0.	0.	0.
2. LAND COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3. ENGINEERING	149.	37.	186.	99.	25.	124.	0.	0.	0.	0.	0.	0.
4. ADMINISTRATION	43.	174.	217.	19.	74.	93.	0.	0.	0.	0.	0.	0.
TOTAL	2698.	2514.	5212.	798.	754.	1552.	0.	0.	0.	0.	0.	0.
5. CONTINGENCY	270.	251.	521.	80.	75.	155.	0.	0.	0.	0.	0.	0.
TOTAL	2968.	2765.	5733.	878.	830.	1707.	0.	0.	0.	0.	0.	0.
6. PRICE CONTINGENCY	795.	741.	1536.	324.	296.	620.	0.	0.	0.	0.	0.	0.
T O T A L	3763.	3506.	7269.	1202.	1126.	2327.	0.	0.	0.	0.	0.	0.

Table E-4-7 Construction Cost and Disbursement Schedule
Project: Khum Han (12)

(UNIT : 000 BAHT)

COST ITEMS	TOTAL FOREIGN CURRENCY	TOTAL LOCAL CURRENCY	TOTAL TOTAL	1985 F.C.	1985 L.C.	1985 TOTAL	1986 F.C.	1986 L.C.	1986 TOTAL	1987 F.C.	1987 L.C.	1987 TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	300.	210.	510.	0.	0.	0.	0.	0.	0.	30.	21.	51.
2) TRANSMISSION	80.	70.	150.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	1500.	1430.	2930.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	990.	920.	1910.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	2870.	2630.	5500.	0.	0.	0.	0.	0.	0.	30.	21.	51.
2. LAND COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3. ENGINEERING	440.	110.	550.	0.	0.	0.	44.	11.	55.	176.	44.	220.
4. ADMINISTRATION	110.	440.	550.	0.	0.	0.	17.	66.	83.	39.	154.	193.
TOTAL	3420.	3180.	6600.	0.	0.	0.	61.	77.	138.	245.	219.	464.
5. CONTINGENCY (10.%)	342.	318.	660.	0.	0.	0.	6.	8.	14.	24.	22.	46.
TOTAL	3762.	3498.	7260.	0.	0.	0.	67.	85.	151.	269.	241.	510.
6. PRICE CONTINGENCY	1037.	957.	1994.	0.	0.	0.	6.	9.	15.	47.	45.	91.
T O T A L	4799.	4455.	9254.	0.	0.	0.	72.	94.	166.	316.	285.	601.

(UNIT : 000 BAHT)

COST ITEMS	1988 F.C.	1988 L.C.	1988 TOTAL	1989 F.C.	1989 L.C.	1989 TOTAL	1990 F.C.	1990 L.C.	1990 TOTAL	1991 F.C.	1991 L.C.	1991 TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	270.	189.	459.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2) TRANSMISSION	80.	70.	150.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	1500.	1430.	2930.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	495.	460.	955.	495.	460.	955.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	2345.	2149.	4494.	495.	460.	955.	0.	0.	0.	0.	0.	0.
2. LAND COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3. ENGINEERING	132.	33.	165.	88.	22.	110.	0.	0.	0.	0.	0.	0.
4. ADMINISTRATION	39.	154.	193.	17.	66.	83.	0.	0.	0.	0.	0.	0.
TOTAL	2516.	2336.	4852.	600.	548.	1148.	0.	0.	0.	0.	0.	0.
5. CONTINGENCY	252.	234.	485.	60.	55.	115.	0.	0.	0.	0.	0.	0.
TOTAL	2767.	2570.	5337.	659.	603.	1262.	0.	0.	0.	0.	0.	0.
6. PRICE CONTINGENCY	741.	688.	1429.	243.	215.	458.	0.	0.	0.	0.	0.	0.
T O T A L	3508.	3258.	6766.	903.	818.	1721.	0.	0.	0.	0.	0.	0.

Table E-4-8 Construction Cost and Disbursement Schedule
Project: Kusuman (13)

(UNIT : 000 BAHT)

COST ITEMS	T O T A L			1985			1986			1987		
	FOREIGN CURRENCY	LOCAL CURRENCY	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	690.	180.	870.	0.	0.	0.	0.	0.	0.	69.	18.	87.
2) TRANSMISSION	410.	440.	850.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	1530.	1310.	2840.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	1440.	1350.	2790.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	4070.	3280.	7350.	0.	0.	0.	0.	0.	0.	69.	18.	87.
2. LAND COST	0.	50.	50.	0.	0.	0.	0.	0.	0.	0.	50.	50.
3. ENGINEERING	584.	146.	730.	0.	0.	0.	58.	15.	73.	234.	58.	292.
4. ADMINISTRATION	146.	584.	730.	0.	0.	0.	22.	88.	109.	51.	204.	255.
TOTAL	4800.	4060.	8860.	0.	0.	0.	80.	102.	182.	354.	331.	684.
5. CONTINGENCY (10.%)	480.	406.	886.	0.	0.	0.	8.	10.	18.	35.	33.	68.
TOTAL	5280.	4466.	9746.	0.	0.	0.	88.	112.	201.	389.	364.	753.
6. PRICE CONTINGENCY	1458.	1226.	2683.	0.	0.	0.	8.	12.	20.	68.	67.	135.
T O T A L	6738.	5692.	12429.	0.	0.	0.	96.	124.	221.	457.	431.	888.

(UNIT : 000 BAHT)

COST ITEMS	1988			1989			1990			1991		
	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	621.	162.	783.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2) TRANSMISSION	410.	440.	850.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	1530.	1310.	2840.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	720.	675.	1395.	720.	675.	1395.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	3281.	2587.	5868.	720.	675.	1395.	0.	0.	0.	0.	0.	0.
2. LAND COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3. ENGINEERING	175.	44.	219.	117.	29.	146.	0.	0.	0.	0.	0.	0.
4. ADMINISTRATION	51.	204.	255.	22.	88.	109.	0.	0.	0.	0.	0.	0.
TOTAL	3507.	2835.	6342.	859.	792.	1650.	0.	0.	0.	0.	0.	0.
5. CONTINGENCY	351.	284.	634.	86.	79.	165.	0.	0.	0.	0.	0.	0.
TOTAL	3858.	3119.	6977.	945.	871.	1816.	0.	0.	0.	0.	0.	0.
6. PRICE CONTINGENCY	1033.	836.	1869.	349.	311.	659.	0.	0.	0.	0.	0.	0.
T O T A L	4891.	3954.	8846.	1293.	1182.	2475.	0.	0.	0.	0.	0.	0.

Table E-4-9 Construction Cost and Disbursement Schedule
Project: Phon Charoen (17)

(UNIT : 000 BAHT)

COST ITEMS	TOTAL FOREIGN CURRENCY	TOTAL LOCAL CURRENCY	TOTAL TOTAL	1985 F.C.	1985 L.C.	1985 TOTAL	1986 F.C.	1986 L.C.	1986 TOTAL	1987 F.C.	1987 L.C.	1987 TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	690.	270.	960.	0.	0.	0.	0.	0.	0.	69.	27.	96.
2) TRANSMISSION	3390.	2680.	6070.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	2000.	1860.	3860.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	1880.	2110.	3990.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	7960.	6920.	14880.	0.	0.	0.	0.	0.	0.	69.	27.	96.
2. LAND COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3. ENGINEERING	1180.	300.	1480.	0.	0.	0.	118.	30.	148.	472.	120.	592.
4. ADMINISTRATION	300.	1180.	1480.	0.	0.	0.	45.	177.	222.	105.	413.	518.
TOTAL	9440.	8400.	17840.	0.	0.	0.	163.	207.	370.	646.	560.	1206.
5. CONTINGENCY (10.%)	944.	840.	1784.	0.	0.	0.	16.	21.	37.	65.	56.	121.
TOTAL	10384.	9240.	19624.	0.	0.	0.	179.	228.	407.	711.	616.	1327.
6. PRICE CONTINGENCY	2818.	2514.	5332.	0.	0.	0.	16.	24.	40.	124.	114.	238.
T O T A L	13202.	11754.	24956.	0.	0.	0.	195.	252.	447.	834.	730.	1564.

(UNIT : 000 BAHT)

COST ITEMS	1988 F.C.	1988 L.C.	1988 TOTAL	1989 F.C.	1989 L.C.	1989 TOTAL	1990 F.C.	1990 L.C.	1990 TOTAL	1991 F.C.	1991 L.C.	1991 TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	621.	243.	864.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2) TRANSMISSION	3390.	2680.	6070.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	2000.	1860.	3860.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	940.	1055.	1995.	940.	1055.	1995.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	6951.	5838.	12789.	940.	1055.	1995.	0.	0.	0.	0.	0.	0.
2. LAND COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3. ENGINEERING	354.	90.	444.	236.	60.	296.	0.	0.	0.	0.	0.	0.
4. ADMINISTRATION	105.	413.	518.	45.	177.	222.	0.	0.	0.	0.	0.	0.
TOTAL	7410.	6341.	13751.	1221.	1292.	2513.	0.	0.	0.	0.	0.	0.
5. CONTINGENCY	741.	634.	1375.	122.	129.	251.	0.	0.	0.	0.	0.	0.
TOTAL	8151.	6975.	15126.	1343.	1421.	2764.	0.	0.	0.	0.	0.	0.
6. PRICE CONTINGENCY	2183.	1869.	4052.	496.	507.	1003.	0.	0.	0.	0.	0.	0.
T O T A L	10334.	8844.	19178.	1839.	1928.	3767.	0.	0.	0.	0.	0.	0.

Table E-4-10 Construction Cost and Disbursement Schedule
Project: Nong Song Hong (18)

(UNIT : 000 BAHT)

COST ITEMS	T O T A L			1985			1986			1987		
	FOREIGN CURRENCY	LOCAL CURRENCY	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	3070.	2830.	5900.	0.	0.	0.	0.	0.	0.	307.	283.	590.
2) TRANSMISSION	40.	30.	70.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	1900.	1800.	3700.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	1790.	1610.	3400.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	6800.	6270.	13070.	0.	0.	0.	0.	0.	0.	307.	283.	590.
2. LAND COST	0.	50.	50.	0.	0.	0.	0.	0.	0.	0.	50.	50.
3. ENGINEERING	1040.	260.	1300.	0.	0.	0.	104.	26.	130.	416.	104.	520.
4. ADMINISTRATION	260.	1040.	1300.	0.	0.	0.	39.	156.	195.	91.	364.	455.
TOTAL	8100.	7620.	15720.	0.	0.	0.	143.	182.	325.	814.	801.	1615.
5. CONTINGENCY (10.%)	810.	762.	1572.	0.	0.	0.	14.	18.	33.	81.	80.	162.
TOTAL	8910.	8382.	17292.	0.	0.	0.	157.	200.	358.	895.	881.	1776.
6. PRICE CONTINGENCY	2401.	2239.	4641.	0.	0.	0.	14.	22.	36.	156.	163.	319.
T O T A L	11311.	10621.	21933.	0.	0.	0.	171.	222.	393.	1051.	1044.	2095.

(UNIT : 000 BAHT)

COST ITEMS	1988			1989			1990			1991		
	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL	F.C.	L.C.	TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	2763.	2547.	5310.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2) TRANSMISSION	40.	30.	70.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	1900.	1800.	3700.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	895.	805.	1700.	895.	805.	1700.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	5598.	5182.	10780.	895.	805.	1700.	0.	0.	0.	0.	0.	0.
2. LAND COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3. ENGINEERING	312.	78.	390.	208.	52.	260.	0.	0.	0.	0.	0.	0.
4. ADMINISTRATION	91.	364.	455.	39.	156.	195.	0.	0.	0.	0.	0.	0.
TOTAL	6001.	5624.	11625.	1142.	1013.	2155.	0.	0.	0.	0.	0.	0.
5. CONTINGENCY	600.	562.	1163.	114.	101.	216.	0.	0.	0.	0.	0.	0.
TOTAL	6601.	6186.	12787.	1256.	1114.	2370.	0.	0.	0.	0.	0.	0.
6. PRICE CONTINGENCY	1768.	1657.	3425.	464.	397.	861.	0.	0.	0.	0.	0.	0.
T O T A L	8369.	7844.	16213.	1720.	1512.	3232.	0.	0.	0.	0.	0.	0.

Table E-4-11 Construction Cost and Disbursement Schedule
Project: Huai Kha Yung (20)

(UNIT : 000 BAHT)

COST ITEMS	TOTAL FOREIGN CURRENCY	TOTAL LOCAL CURRENCY	TOTAL TOTAL	1985 F.C.	1985 L.C.	1985 TOTAL	1986 F.C.	1986 L.C.	1986 TOTAL	1987 F.C.	1987 L.C.	1987 TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	580.	310.	890.	0.	0.	0.	0.	0.	0.	58.	31.	89.
2) TRANSMISSION	170.	140.	310.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	1490.	1440.	2930.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	1890.	1780.	3670.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	4130.	3670.	7800.	0.	0.	0.	0.	0.	0.	58.	31.	89.
2. LAND COST	0.	50.	50.	0.	0.	0.	0.	0.	0.	0.	50.	50.
3. ENGINEERING	624.	156.	780.	0.	0.	0.	62.	16.	78.	250.	62.	312.
4. ADMINISTRATION	156.	624.	780.	0.	0.	0.	23.	94.	117.	55.	218.	273.
TOTAL	4910.	4500.	9410.	0.	0.	0.	86.	109.	195.	362.	362.	724.
5. CONTINGENCY (10.%)	491.	450.	941.	0.	0.	0.	9.	11.	20.	36.	36.	72.
TOTAL	5401.	4950.	10351.	0.	0.	0.	94.	120.	214.	398.	398.	796.
6. PRICE CONTINGENCY	1514.	1373.	2887.	0.	0.	0.	8.	13.	21.	69.	74.	143.
T O T A L	6915.	6323.	13238.	0.	0.	0.	103.	133.	236.	468.	472.	939.

(UNIT : 000 BAHT)

COST ITEMS	1988 F.C.	1988 L.C.	1988 TOTAL	1989 F.C.	1989 L.C.	1989 TOTAL	1990 F.C.	1990 L.C.	1990 TOTAL	1991 F.C.	1991 L.C.	1991 TOTAL
1. CONSTRUCTION COST												
1) INTAKE WORK	522.	279.	801.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2) TRANSMISSION	170.	140.	310.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3) TREATMENT PLANT	1490.	1440.	2930.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4) DISTRIBUTION LINE	945.	890.	1835.	945.	890.	1835.	0.	0.	0.	0.	0.	0.
SUB-TOTAL	3127.	2749.	5876.	945.	890.	1835.	0.	0.	0.	0.	0.	0.
2. LAND COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3. ENGINEERING	187.	47.	234.	125.	31.	156.	0.	0.	0.	0.	0.	0.
4. ADMINISTRATION	55.	218.	273.	23.	94.	117.	0.	0.	0.	0.	0.	0.
TOTAL	3369.	3014.	6383.	1093.	1015.	2108.	0.	0.	0.	0.	0.	0.
5. CONTINGENCY	337.	301.	638.	109.	101.	211.	0.	0.	0.	0.	0.	0.
TOTAL	3706.	3316.	7021.	1203.	1116.	2319.	0.	0.	0.	0.	0.	0.
6. PRICE CONTINGENCY	992.	888.	1881.	444.	398.	842.	0.	0.	0.	0.	0.	0.
T O T A L	4698.	4204.	8902.	1647.	1514.	3161.	0.	0.	0.	0.	0.	0.

APPENDIX F. PROJECT JUSTIFICATION

APPENDIX F: PROJECT JUSTIFICATION

F.1. HOUSEHOLD FINANCES AND DOMESTIC WATER USE SURVEY

F.2. COST OF WATER SUPPLY AND CHARGE COLLECTED OF THE EXISTING WATERWORKS

F.3. FINANCIAL ANALYSIS

F.4 ECONOMIC ANALYSIS

F.1. HOUSEHOLD FINANCES AND DOMESTIC WATER USE SURVEY

LIST OF TABLES

Table F-1-1 Samples of the Household Finances and Domestic Water Use Survey

Sanitary District	Changwat	Sample Muban Nos., of Muban	Sample Muban Code	Sample House-holds
A. Samples of NSD				
1. Kham Sakae Sang	Nakhon Ratchasima	2	1.1 - 2	50
2. Nong Ki	Buri Ram	4	2.1 - 4	50
	Sub-total	6		100
B. Samples of ESD				
1. Non Thai	Nakhon	2	3.1 - 2	50
	Total	8		150

Table F-1-2 Inventory of Capital Investment for Bringing and Keeping Water (1)

Sample Household No.	Water Tank (1) Cube Number	Water Tank (1) Cube Value (฿)	Water Tank (2) Pot Number	Water Tank (2) Pot Value (฿)	Water Tank (3) Cylinder Number	Water Tank (3) Cylinder Value (฿)	Water Tank Total Value (฿)	Bucket (฿)	Well Well Only (฿)	Well Hand Pumps (฿)	Bicycle-Draun Cart for Carring Water (฿)	Total Value (฿)	Depreciation Cost Estimated (฿/year)
1.1-1	2	21,400	7	1,450	-	-	22,850	-	-	-	-	22,850	2,430
2	-	-	17	3,800	-	-	3,800	-	-	-	-	3,800	760
3	10	150	-	-	-	-	150	-	-	-	250	400	80
4	8	120	5	460	-	-	580	-	-	-	1,200	1,780	356
5	10	150	12	2,200	-	-	2,350	-	-	-	700	3,050	610
6	1	-	8	800	-	-	800	-	-	-	-	800	160
7	1	1,200	15	1,200	-	-	2,400	-	-	-	-	2,400	480
8	8	160	6	1,480	-	-	1,640	-	-	-	700	2,340	468
9	1	900	4	600	-	-	1,500	-	-	-	-	1,500	300
10	1	1,000	4	480	-	-	1,480	-	-	-	-	1,480	296
11	10	150	13	2,100	-	-	2,250	-	-	-	500	2.750	550
12	8	120	6	950	-	-	1,070	-	-	-	-	1,070	214
13	-	-	15	1,940	-	-	1,940	-	13,000	-	-	14,940	1,688
14	8	104	4	400	-	-	504	-	-	-	-	504	101
15	-	-	11	2,550	-	-	2,550	-	-	-	800	3,350	670
16	8	120	6	1,480	-	-	1,600	-	-	-	500	2,100	420
17	8	120	5	1,360	-	-	1,480	-	-	-	1,100	2,580	516
18	8	120	4	480	-	-	600	-	-	-	500	1,100	220
19	8	120	5	980	-	-	1,100	-	-	-	500	1,600	320
20	8	120	3	740	-	-	860	-	-	-	1,100	1,960	392
21	8	120	6	1,480	-	-	1,600	-	-	-	1,200	2,800	560
22	8	120	7	1,600	-	-	1,720	-	-	-	750	2,470	494
23	8	120	8	2,480	-	-	2,600	500	-	-	-	3,100	620
24	8	120	6	1,380	-	-	1,600	-	-	-	800	2,400	480
25	10	150	7	2,160	-	-	2,310	-	-	-	1,000	3,310	662
Sub-Total	150/22 H.H.	26,684	184/24 H.H.	34,550	-	-	61,334	500	13,000	-	11,600	86,434	13,847

Table F-1-2 Inventory of Capital Investment for Bringing and Keeping Water (2)

Sample Household No.	Water Tank (1) Cube Number	Water Tank (1) Cube Value (฿)	Water Tank (2) Pot Number	Water Tank (2) Pot Value (฿)	Water Tank (3) Cylinder Number	Water Tank (3) Cylinder Value (฿)	Water Tank Total Value (฿)	Backet (฿)	Well Well Only (฿)	Well Hand Pumps (฿)	Bicycle-Draun Cart for Carring Water (฿)	Total Value (฿)	Depreciation Cost Estimated (฿/year)
1.2-1	8	120	9	1,950	-	-	2,070	-	-	-	700	2,770	554
2	8	120	8	2,200	-	-	2,320	-	-	-	700	3,020	604
3	8	120	8	2,200	-	-	2,320	-	-	-	-	2,320	464
4	-	-	10	3,180	-	-	3,180	-	-	-	-	3,180	636
5	8	120	8	1,580	1	100	1,800	-	-	-	580	2,380	476
6	8	112	7	1,120	-	-	1,232	-	-	-	1,000	2,232	446
7	8	120	9	1,360	-	-	1,480	-	-	-	1,000	2,480	496
8	8	120	5	980	-	-	1,100	-	-	-	-	1,100	220
9	10	150	2	240	-	-	390	-	-	-	1,000	1,390	278
10	10	150	6	720	-	-	870	-	-	-	1,000	1,870	374
11	-	-	7	1,120	-	-	1,120	-	-	-	1,000	2,120	424
12	-	-	2	800	-	-	800	-	4,000	-	1,000	5,800	1,160
13	10	120	5	325	-	-	445	-	-	-	500	945	189
14	10	180	4	790	-	-	910	-	-	-	500	1,410	282
15	10	150	7	1,200	-	-	1,350	-	-	-	1,000	2,350	470
16	8	120	9	2,040	-	-	2,160	-	-	-	500	2,660	532
17	9	2,520	8	1,540	-	-	4,060	-	-	-	800	4,860	972
18	8	120	7	1,250	-	-	1,370	-	-	-	1,000	2,370	474
19	-	-	2	150	-	-	150	-	-	-	-	150	30
20	10	150	6	1,400	-	-	1,550	-	-	-	800	2,350	470
21	8	94	3	540	-	-	634	-	-	-	1,200	1,834	367
22	8	104	8	1,280	-	-	1,384	-	50,000	-	900	52,284	2,957
23	8	80	5	250	1	8,500	8,830	-	2,500	-	600	11,930	1,286
24	10	100	5	650	-	-	750	-	-	-	700	1,450	290
25	10	100	2	800	-	-	900	-	1,500	-	400	2,800	560
Sub-Total	H.H. 144/21	4,910	152/25	29,665	2	8,600	43,175	-	58,000	-	16,880	118,055	15,011
Total	H.H. 294/43	31,594	336/49	64,215	2	8,600	104,509	500	71,000	-	28,480	204,489	28,858

Table F-1-2 Inventory of Capital Investment for Bringing and Keeping Water (3)

Sample Household No.	Water Tank (1) Cube Number	Cube Value (฿)	(2) Pot Number	Pot Value (฿)	(3) Cylinder Number	Cylinder Value (฿)	Total Value (฿)	Backet (฿)	Well Well Only (฿)	Well Hand Pumps (฿)	Bicycle-Draun Cart for Carring Water (฿)	Total Value (฿)	Depreciation Cost Estimated (฿/year)
2.1-1	-	-	9	1,980	-	-	1,980	-	3,000	-	-	5,980	596
2	-	-	5	1,310	-	-	1,310	-	1,300	-	-	2,610	392
3	-	-	2	620	-	-	620	-	6,000	-	-	6,620	724
4	1	1,500	6	1,650	-	-	3,150	-	3,000	-	-	6,150	930
5	1	2,700	2	240	-	-	2,940	-	-	-	-	2,940	588
6	-	-	2	240	-	-	240	-	3,000	-	-	3,240	348
7	-	-	5	1,360	-	-	1,360	800	-	-	500	2,660	532
8	-	-	6	2,800	-	-	2,800	-	35,000	-	-	37,800	4,060
9	-	-	5	1,360	-	-	1,360	-	3,000	-	-	4,360	572
10	-	-	4	2,900	-	-	2,900	-	-	-	-	2,900	580
11	-	-	5	1,000	1	20	1,020	30	4,500	-	-	5,550	660
12	1	250	4	860	2	400	1,510	-	-	-	500	2,010	402
Sub-Total	3/3 H.H.	4,450	5/12 H.H.	16,320	3/2 H.H.	420	21,190	830	57,800	-	1,000	80,820	10,384
2.2-1	-	-	5	1,180	-	-	1,180	-	3,500	-	-	4,680	586
2	-	-	7	2,220	-	-	2,220	-	4,500	-	-	6,720	894
3	-	-	7	1,100	-	-	1,100	140	-	-	-	1,240	248
4	-	-	8	1,650	-	-	1,650	-	5,000	-	-	6,650	830
5	-	-	6	1,960	-	-	1,960	-	1,300	-	-	3,260	522
6	-	-	10	2,340	-	-	2,340	90	-	-	500	2,930	586
7	-	-	7	420	-	-	420	-	-	-	500	920	184
8	-	-	5	1,360	-	-	1,360	-	4,000	-	-	5,360	672
9	8	120	2	620	-	-	740	-	-	-	500	1,240	248
10	-	-	7	3,360	1	5,000	8,360	-	5,000	-	-	13,360	1,672
11	-	-	3	720	-	-	720	-	3,000	-	-	3,720	442
12	-	-	9	2,720	-	-	2,720	-	4,000	-	-	6,720	944
13	2	30	5	1,440	-	-	1,470	-	-	-	-	1,470	294
Sub-Total	10/2 H.H.	150	79/13 H.H.	21,090	1/1 H.H.	5,000	26,240	230	30,300	-	1,500	58,270	8,122

Table F-1-2 Inventory of Capital Investment for Bringing and Keeping Water (4)

Sample Household No.	Water Tank (1) Cube Number	Water Tank (1) Cube Value (฿)	Water Tank (2) Pot Number	Water Tank (2) Pot Value (฿)	Water Tank (3) Cylinder Number	Water Tank (3) Cylinder Value (฿)	Water Tank Total Value (฿)	Backet (฿)	Well Well Only (฿)	Well Hand Pumps (฿)	Bicycle-Draun Cart for Carring Water (฿)	Total Value (฿)	Depreciation Cost Estimated (฿/year)
2.3-1	-	-	1	450	1	1,300	1,750	-	-	2,100	-	3,850	560
2	-	-	7	1,750	-	-	1,750	-	-	7,000	-	8,750	1,050
3	-	-	7	350	-	-	350	-	-	3,000	-	3,350	370
4	-	-	6	1,105	1	60	1,165	-	-	3,000	460	4,625	625
5	-	-	6	1,600	-	-	1,600	-	-	6,000	-	7,600	920
6	8	120	3	360	-	-	480	-	-	-	500	980	196
7	8	120	9	1,840	-	-	1,960	-	-	-	450	2,410	482
8	9	2,820	3	360	-	-	3,180	-	-	-	500	3,680	736
9	-	-	5	1,320	-	-	1,320	-	2,500	-	-	3,820	764
10	2	15	13	2,640	-	-	2,655	-	3,000	-	-	5,655	831
Sub-Total	27/4 H.H.	3,075	60/10 H.H.	11,775	2/2 H.H.	1,360	16,210	-	5,500	21,100	1,910	44,720	6,538
2.4-1	-	-	6	720	-	-	720	-	-	-	-	720	144
2	3	5,100	28	2,240	-	-	7,340	-	6,970	-	-	14,310	2,165
3	2	5,000	2	1,300	-	-	6,300	-	-	-	-	6,300	1,260
4	-	-	5	1,050	-	-	1,050	12	2,000	-	-	3,062	412
5	-	-	4	480	-	-	480	-	3,000	-	-	3,480	396
6	-	-	6	720	-	-	720	40	1,800	-	-	2,560	332
7	1	3,000	12	144	-	-	3,144	150	1,800	-	-	5,094	839
8	2	1,000	-	-	2	6,000	7,000	-	3,000	-	-	10,000	1,700
9	1	500	-	-	-	-	500	-	3,000	-	-	3,500	400
10	1	-	6	720	-	-	720	-	1,200	-	-	1,920	264
11	-	-	2	240	-	-	240	-	4,400	-	-	4,640	488
12	-	-	7	840	-	-	840	-	-	-	-	840	168
13	1	3,500	8	1,760	-	-	5,260	-	-	-	-	5,260	1,052
14	-	-	12	2,160	-	-	2,160	-	2,500	-	-	4,660	682
15	-	-	6	1,320	-	-	1,320	600	2,500	-	-	4,420	634
Sub-Total	11/7 H.H.	18,100	104/13 H.H.	13,694	2/1 H.H.	6,000	37,794	802	32,170	-	-	70,766	10,936
Total	51/16 H.H.	25,775	248/48 H.H.	62,879	8/6 H.H.	12,780	101,434	1,862	125,770	21,110	4,410	254,576	35,980

Table F-1-2 Inventory of Capital Investment for Bringing and Keeping Water (5)

Sample Household No.	Water Tank (1) Cube Number	Cube Value (฿)	(2) Pot Number	Pot Value (฿)	(3) Cylinder Number	Cylinder Value (฿)	Total Value (฿)	Backet (฿)	Well: Well Only (฿)	Well: Hand Pumps (฿)	Bicycle-Draun Cart for Carring Water (฿)	Total Value (฿)	Depreciation Cost Estimated (฿/year)
3.1-1	-	-	-	-	-	-	-	3,000	-	-	-	3,000	600
2	2	2,200	10	700	-	-	2,900	300	-	-	-	3,200	640
3	-	-	6	420	-	-	420	-	-	-	-	420	84
4	-	-	6	420	-	-	420	-	-	-	-	420	84
5	-	-	-	-	-	-	-	-	-	-	-	-	-
6	9	2,120	10	3,080	-	-	5,200	-	-	-	-	5,200	1,040
7	9	4,120	9	1,080	-	-	5,200	-	-	-	-	5,200	1,040
8	-	-	9	1,410	-	-	1,410	-	-	-	-	1,410	282
9	-	-	6	720	-	-	720	-	-	-	-	720	144
10	-	-	7	840	6	12,000	12,840	130	-	-	-	12,970	2,594
11	-	-	17	1,625	-	-	1,625	160	200	-	650	2,635	507
12	-	-	11	2,210	-	-	2,210	100	-	-	550	2,860	572
13	6	48	8	640	-	-	688	-	-	-	500	1,188	238
14	-	-	7	1,200	-	-	1,200	135	-	-	1,000	2,335	467
15	-	-	4	970	-	-	970	-	-	-	-	970	194
16	-	-	9	1,080	-	-	1,080	150	-	-	700	1,930	386
17	-	-	7	930	-	-	930	210	-	-	2,300	3,440	688
18	-	-	-	-	1	250	250	120	-	-	1,200	1,570	314
19	1	300	-	-	-	-	300	-	-	-	-	300	60
20	2	5,000	3	450	-	-	5,450	160	-	-	1,000	6,610	1,322
21	5	50	3	1,350	-	-	1,400	-	-	-	-	1,400	280
22	1	900	3	1,200	-	-	2,100	80	-	-	700	2,880	576
23	-	-	3	1,350	-	-	1,350	84	-	-	800	2,234	447
24	-	-	6	860	-	-	860	-	-	-	-	860	172
25	-	-	9	2,550	-	-	2,550	110	-	-	-	2,660	532
Sub-Total	35/8 H.H.	14,738	153/21 H.H.	25,085	7/2 H.H.	12,250	52,073	4,739	200	-	9,400	66,412	13,262

Table F-1-2 Inventory of Capital Investment for Bringing and Keeping Water (6)

Sample Household No.	Water Tank (1) Cube Number	(1) Cube Value (฿)	(2) Pot Number	(2) Pot Value (฿)	(3) Cylinder Number	(3) Cylinder Value (฿)	Total Value (฿)	Bucket (฿)	Well: Well Only (฿)	Well: Hand Pumps (฿)	Bicycle-Drawn Cart for Carring Water (฿)	Total Value (฿)	Depreciation Cost Estimated (฿/year)
3.2-1	-	-	10	2,760	4	800	3,560	-	-	-	-	3,560	712
2	-	-	6	780	-	-	780	60	-	-	700	1,540	308
3	-	-	4	600	-	-	600	-	-	-	-	600	120
4	-	-	9	1,350	-	-	1,350	132	-	-	2,300	3,782	756
5	-	-	3	210	-	-	210	320	-	-	2,000	2,530	506
6	-	-	4	610	-	-	610	150	-	-	-	760	152
7	-	-	1	450	-	-	450	-	-	-	-	450	90
8	-	-	7	2,150	-	-	2,150	300	-	-	900	3,350	670
9	-	-	2	900	-	-	900	70	-	-	800	1,770	354
10	-	-	26	2,420	-	-	2,420	-	-	-	-	2,420	484
11	-	-	7	840	1	300	1,140	100	-	-	650	1,890	378
12	1	2,180	-	-	-	-	2,180	140	-	-	700	3,020	604
13	-	-	2	800	-	-	800	143	-	-	500	1,443	289
14	-	-	5	1,260	-	-	1,260	140	-	-	500	1,900	380
15	-	-	3	360	-	-	360	-	-	-	-	360	72
16	-	-	13	2,770	-	-	2,770	100	-	-	600	3,470	694
17	-	-	10	1,595	-	-	1,595	240	-	-	200	2,035	407
18	-	-	4	505	-	-	505	150	-	-	850	1,505	301
19	-	-	6	950	-	-	950	100	-	-	-	1,050	210
20	8	96	8	1,260	-	-	1,356	-	-	-	3,200	4,556	911
21	-	-	7	2,000	4	60	2,060	-	-	-	-	2,060	412
22	8	80	16	3,800	-	-	3,880	-	-	-	1,000	4,880	976
23	-	-	7	1,600	-	-	1,600	70	-	-	700	2,370	474
24	-	-	11	2,250	-	-	2,250	108	-	-	900	3,258	652
25	1	1,800	10	1,925	-	-	3,725	100	-	-	150	3,975	795
Sub-Total	18/4	4,156	181/24	34,145	9/3 H.H.	1,160	39,461	2,423	-	-	16,650	58,534	11,707
Total	53/12	18,894	334/45	59,230	16/5 H.H.	13,410	91,534	7,162	200	-	26,050	124,946	24,969

Table F-1-3 Consumption and Expenses for Drinking and Domestic Water (1)

Sample Household No.	Numbers of Family Members (1)	Average Income: Per Household ฿/year (2)	Average Income: Per Household ฿/month (3)	Average Income: Per Capita ฿/year (4)=(2)/(1)	Water Consumption and Labor Inputs in the Rainy Season: Consumption of Water m^3/month (5)	Water Consumption and Labor Inputs in the Rainy Season: Consumption of Water l/capita/day (6)=(5)/(1)/30	Water Consumption and Labor Inputs in the Rainy Season: Labor Inputs: Total Requirement hours/month (7)	Water Consumption and Labor Inputs in the Rainy Season: Labor Inputs: hours/m^3 (8)=(7)/(5)	Water Consumption and Labor Inputs in the Dry Season: Consumption of Water m^3/month (9)	Water Consumption and Labor Inputs in the Dry Season: Consumption of Water l/capita/day (10)=(9)/(1)/30	Water Consumption and Labor Inputs in the Dry Season: Labor Inputs: Total Requirement hours/month (11)	Water Consumption and Labor Inputs in the Dry Season: Labor Inputs: hours/m^3 (12)=(11)/(9)	Depreciation Cost of Facilities ฿/year (13)
1.1-1	2	30,000	2,500	15,000					-	-	-	-	2,430
2	5	411,000	34,250	82,200					3.2	21	5.1	1.59	760
3	5	17,520	1,460	3,504					5.4	36	15.0	2.78	80
4	5	35,035	2,920	7,007					13.0	87	45.0	3.46	356
5	5	34,825	2,902	6,965					16.2	108	45.0	2.78	610
6	10	80,000	6,667	8,000					13.0	43	-	-	160
7	10	197,280	16,440	19,728					-	-	-	-	480
8	8	27,000	2,250	3,375					13.0	54	30.0	2.31	468
9	11	350,000	29,167	31,818					-	-	-	-	300
10	7	100,000	8,333	14,286					16.2	77	-	-	296
11	8	3,558	296	444					10.8	45	30.0	2.78	550
12	7	-	-	-		- no data -			4.3	20	15.0	3.49	214
13	8	11,488	957	1,436					-	-	-	-	1,688
14	5	-	-	-					8.6	57	30.0	3.49	101
15	5	29,977	2,498	5,995					-	-	-	-	670
16	7	56,975	4,748	8,139					13.0	62	30.0	2.31	420
17	5	15,900	1,325	3,180					13.0	87	30.0	2.31	516
18	8	16,323	1,360	2,040					8.6	36	15.0	1.74	220
19	5	24,594	2,049	4,919					8.6	57	15.0	1.74	320
20	8	-	-	-					17.3	72	39.9	2.31	392
21	7	6,894	574	985					13.0	62	30.0	2.31	560
22	5	30,947	2,579	6,189					13.0	87	15.0	1.15	494
23	4	17,750	1,479	4,438					17.3	144	20.1	1.16	620
24	9	124,800	10,400	13,867					4.3	16	7.5	1.74	480
25	6	19,200	1,600	3,200					10.8	60	30.0	2.78	662
Sub-Total	25/165	1,641,066	22 H.H.	145 Persons					222.6	H.H./Persons 20/129	447.6	18 H.H.	13,847

Table F-1-3 Consumption and Expenses for Drinking and Domestic Water (2)

Sample Household No.	Numbers of Family Members (1)	Average Income: Per Household ฿/year (2)	Average Income: Per Household ฿/month (3)	Average Income: Per Capita ฿/year (4)=(2)/(1)	Water Consumption and Labor Inputs in the Rainy Season: Consumption of Water m^3/month (5)	Consumption of Water: l/capita/day (6)=(5)/(1)/30	Labor Inputs: Total Requirement hours/month (7)	Labor Inputs: hours/m^3 (8)=(7)/(5)	Water Consumption and Labor Inputs in the Dry Season: Consumption of Water m^3/month (9)	Consumption of Water: l/capita/day (10)=(9)/(1)/30	Labor Inputs: Total Requirement hours/month (11)	Labor Inputs: hours/m^3 (12)=(11)/(9)	Depreciation Cost of Facilities ฿/year (13)
1.2-1	6	48,214	4,018	8,036	-	-	-	-	21.6	120	75.0	3.47	554
2	5	30,000	2,500	6,000	-	-	-	-	13.0	87	90.0	6.92	604
3	6	25,317	2,110	4,220	-	-	-	-	13.0	72	45.0	3.46	464
4	3	8,000	667	2,667	13.0	144	-	-	13.0	144	-	-	636
5	8	10,617	885	1,327	-	-	-	-	13.0	54	45.0	3.46	476
6	6	16,112	1,343	2,685	-	-	-	-	4.3	24	15.0	3.49	446
7	8	11,000	917	1,375	-	-	-	-	8.6	36	30.0	3.49	496
8	4	18,900	1,575	4,725	-	-	-	-	8.6	72	30.0	3.49	220
9	3	41,163	3,430	13,721	5.4	60	30.0	5.56	5.4	60	30.0	5.56	278
10	6	10,719	893	1,787	5.4	30	30.0	5.56	8.1	45	45.0	5.56	374
11	4	6,895	575	1,724	8.6	72	60.0	6.98	8.6	72	60.0	6.98	424
12	4	79,429	6,619	19,857	8.6	72	-	-	8.6	72	-	-	1,160
13	5	36,500	3,042	7,300	5.4	36	7.5	1.39	10.8	72	15.0	1.39	189
14	7	32,658	2,721	4,665	-	-	-	-	5.4	27	15.0	2.78	282
15	5	2,500	208	500	5.4	36	15.0	2.78	10.8	72	30.0	2.78	470
16	7	11,504	959	1,643	17.3	82	120.0	6.94	17.3	82	120.0	6.94	532
17	5	22,959	1,913	4,592	17.3	115	60.0	3.47	17.3	115	60.0	3.47	972
18	4	1,000	83	250	8.6	72	30.0	3.49	8.6	72	30.0	3.49	474
19	3	16,050	1,337	5,350	-	-	-	-	13.0	144	-	-	30
20	4	22,000	1,833	5,500	5.4	45	15.0	2.78	5.4	45	15.0	2.78	470
21	5	-	-	-	8.6	57	120.0	13.95	8.6	57	120.0	13.95	367
22	4	1,845	154	461	8.6	72	30.0	3.49	8.6	72	30.0	3.49	2,957
23	6	3,067	256	511	13.0	72	45.0	3.46	13.0	72	45.0	3.46	1,286
24	5	22,942	1,912	4,588	10.8	72	30.0	2.78	10.8	72	60.0	5.56	290
25	4	2,750	229	688	10.8	90	30.0	2.78	10.8	90	60.0	5.56	560
Sub-Total	H.H./Persons 25/127	482,141	24 H.H.	Persons 122	152.2	H.H./Persons 16/74	622.5	14 H.H.	266.2	H.H./Persons 25/127	1,065.0	22 H.H.	15,011
Total	H.H./Persons 50/292	2,123,207	46 H.H.	Persons 267	-	-	-	-	488.8	H.H./Persons 45/256	1,512.6	40 H.H.	28,858
Average	Persons/H.H. 5.8	฿/H.H. 42,464	฿/H.H. 3,539	฿/Capita 7,952	m^3/H.H. 9.5	l/Capita 69	Hours/H.H. 44.5	hours/m^3 4.68	m^3/H.H. 10.9	l/Capita 64	Hours/H.H. 37.8	hours/m^3 3.47	฿/H.H. 577

Table F-1-3 Consumption and Expenses for Drinking and Domestic Water (3)

Sample Household No.	Numbers of Family Members (1)	Average Income: Per Household ¥/year (2)	Average Income: Per Household ¥/month (3)	Average Income: Per Capita ¥/year (4)=(2)/(1)	Water Consumption and Labor Inputs in the Rainy Season: Consumption of Water m^3/month (5)	Consumption of Water: l/capita/day (6)=(5)/(1)/30	Labor Inputs: Total Requirement hours/month (7)	Labor Inputs: hours/m^3 (8)=(7)/(5)	Water Consumption and Labor Inputs in the Dry Season: Consumption of Water m^3/month (9)	Consumption of Water: l/capita/day (10)=(9)/(1)/30	Labor Inputs: Total Requirement hours/month (11)	Labor Inputs: hours/m^3 (12)=(11)/(9)	Depreciation Cost of Facilities ¥/year (13)
2.1-1	10	92,000	7,667	9,200					-	-	-	-	596
2	11	12,526	1,044	1,139					-	-	-	-	392
3	9	12,780	1,065	1,420					-	-	-	-	724
4	-	-	-	-					-	-	-	-	930
5	4	50,070	4,172	12,518					-	-	-	-	588
6	4	41,650	3,471	10,413					-	-	-	-	348
7	8	33,983	2,832	4,248			- no data -		4.3	18	15.0	3.49	532
8	9	125,300	10,442	13,922					-	-	-	-	4,060
9	7	5,933	494	848					-	-	-	-	572
10	5	25,000	2,083	5,000					-	-	-	-	580
11	4	56,000	4,667	14,000					-	-	-	-	660
12	4	29,460	2,455	7,365					2.7	23	7.5	2.78	402
Sub-Total	H.H./Persons 12/79	484,702	11 H.H.	75 Persons					7.0	H.H./Persons 2/12	22.5	2 H.H.	10,384
2.2-1	5	11,280	940	2,256					-	-	-	-	586
2	5	22,604	1,884	4,521					-	-	-	-	894
3	10	4,230	352	423					6.5	22	30.0	4.62	248
4	5	3,780	315	756					-	-	-	-	830
5	4	35,247	2,937	8,812					-	-	-	-	522
6	7	20,478	1,706	2,925					3.2	15	15.0	4.69	586
7	7	36,670	3,056	5,239			- no data -		8.6	41	60.0	6.98	184
8	4	1,558	130	390					-	-	-	-	672
9	9	15,698	1,308	1,744					4.3	16	12.5	2.91	248
10	13	143,168	11,931	11,013					-	-	-	-	1,672
11	6	26,667	2,222	4,445					-	-	-	-	442
12	6	200,000	16,667	33,333					-	-	-	-	944
13	5	21,725	1,810	4,345					3.2	21	15.0	4.69	294
Sub-Total	H.H./Persons 13/86	543,105	13 H.H.	86 Persons					25.8	H.H./Persons 5/38	132.5	5 H.H.	8,122

Table F-1-3 Consumption and Expenses for Drinking and Domestic Water (4)

Sample Household No.	Numbers of Family Members (1)	Average Income: Per Household ฿/year (2)	Average Income: Per Household ฿/month (3)	Average Income: Per Capita ฿/year (4)=(2)/(1)	Water Consumption and Labor Inputs in the Rainy Season: Consumption of Water m^3/month (5)	Consumption of Water: l/capita/day (6)=(5)/(1)/30	Labor Inputs: Total Requirement hours/month (7)	Labor Inputs: hours/m^3 (8)=(7)/(5)	Water Consumption and Labor Inputs in the Dry Season: Consumption of Water m^3/month (9)	Consumption of Water: l/capita/day (10)=(9)/(1)/30	Labor Inputs: Total Requirement hours/month (11)	Labor Inputs: hours/m^3 (12)=(11)/(9)	Depreciation Cost of Facilities ฿/year (13)
2.3-1	6	6,370	530	1,062					-	-	-	-	560
2	6	8,200	683	1,367					-	-	-	-	1,050
3	6	2,700	225	450					-	-	-	-	370
4	6	8,480	707	1,413					12.0	67	30.0	2.50	625
5	4	43,970	3,664	10,993					-	-	-	-	920
6	9	3,250	271	361		- no data -			13.0	48	45.0	3.46	196
7	7	1,433	119	205					8.6	41	30.0	3.49	486
8	9	4,562	380	507					8.6	32	15.0	1.74	736
9	3	48,000	4,000	16,000					-	-	-	-	764
10	6	9,950	829	1,658					-	-	-	-	831
Sub-Total	10/62	136,915	11,410	2,208					42.2	H.H./Persons 4/31	120.0	4H.H.	6,538
2.4-1	2	38,400	3,200	19,200					-	-	-	-	144
2	13	168,000	14,000	12,923					-	-	-	-	2,165
3	4	60,000	5,000	15,000					-	-	-	-	1,260
4	4	36,600	3,050	9,150					0.5	4	5.0	10.00	412
5	2	42,000	3,500	21,000					-	-	-	-	396
6	4	35,000	2,917	8,750					2.2	18	15.0	6.82	332
7	6	50,000	4,167	8,333		- no data -			-	-	-	-	839
8	6	365,000	30,417	60,833					-	-	-	-	1,700
9	5	445,200	37,100	89,040					-	-	-	-	400
10	5	236,800	10,733	47,360					-	-	-	-	264
11	5	222,000	18,500	44,400					-	-	-	-	488
12	5	36,000	3,000	7,200					-	-	-	-	168
13	3	292,800	24,400	97,600					-	-	-	-	1,052
14	6	40,000	3,333	6,667					-	-	-	-	682
15	6	197,100	16,425	32,850					40.5	225	-	-	634
Sub-Total	15/76	2,264,900		29,801					43.2	H.H./Persons 3/14	20.0	2H.H.	10,936
Total	H.H./Persons 50/303	3,429,622	49H.H.	299Persons					195.6	H.H./Persons 14/95	295.0	13H.H.	35,980
Average	Persons/H.H. 6.1	฿/H.H. 69,992	฿/H.H. 5,833	฿/Capita 11,470					m^3/H.H. 14.0	l/Capita 69	Hours/H.H. 22.7	Hours/m^3 1.62	฿/H.H. 720

Table F-1-3 Consumption and Expenses for Drinking and Domestic Water (5)

Sample Household No.	Numbers of Family Members (1)	Average Income: Per Household ฿/year (2)	Average Income: Per Household ฿/month (3)	Average Income: Per Capita ฿/year (4)=(2)/(1)	Water Consumption and Expenses in the Rainy Season: Consumption of water m^3/month (5)	Water Consumption and Expenses in the Rainy Season: Consumption of water l/capita/day (6)=(5)/(1)/30	Water Charge ฿/month (7)	Water Consumption and Labor Inputs in the Dry Season: Consumption of water m^3/month (8)	Water Consumption and Labor Inputs in the Dry Season: Consumption of water l/capita/day (9)=(8)/(1)/30	Water Consumption and Labor Inputs in the Dry Season: Labor Inputs Total Liquirement hours/month (10)	Water Consumption and Labor Inputs in the Dry Season: Labor Inputs hours/m^3 (11)=(10)/(8)	Depreciation Cost of Facilities ฿/year (12)
3.1-1	4	30,000	2,500	7,500	10.1	83	40	-	-	-	-	600
2	9	36,750	3,062	4,083	30.0	111	120	21.6	80	60.0	2.78	640
3	4	50,000	4,167	12,500	2.5	21	10	-	-	-	-	84
4	3	40,000	3,333	13,000	7.5	83	30	-	-	-	-	84
5	6	-	-	-	8.0	44	32	4.2	23	15.0	3.57	-
6	3	-	-	-	11.0	122	45	-	-	-	-	1,040
7	4	13,000	1,083	3,250	3.0	25	15	4.2	35	20.0	4.76	1,040
8	5	50,745	4,229	10,149	-	-	-	-	-	-	-	282
9	2	3,350	279	1,675	1.2	20	15	-	-	-	-	144
10	6	32,929	2,744	5,488	3.6	20	55	16.2	90	45.0	2.78	2,594
11	6	24,097	2,008	4,016	6.0	30	25	16.2	90	45.0	2.78	507
12	3	64,080	5,340	21,360	7.0	78	30	10.8	120	20.0	1.85	572
13	4	-	-	-	6.0	50	24	4.2	35	20.0	4.76	238
14	5	10,552	879	2,110	5.0	33	20	14.7	98	30.0	2.04	467
15	4	8,700	725	2,175	22.5	188	90	10.8	90	15.0	1.39	194
16	5	36,000	3,000	7,200	30.0	200	120	-	-	-	-	386
17	6	290,125	24,177	48,354	26.0	144	104	30.3	168	120.0	3.96	688
18	6	15,720	1,310	2,620	2.0	11	8	6.6	37	7.5	1.14	314
19	1	28,800	2,400	28,800	35.0	1,167	140	-	-	-	-	60
20	5	39,760	3,313	7,952	4.8	32	192	4.8	32	15.0	3.13	1,322
21	8	57,830	4,819	7,229	30.0	125	120	12.9	54	45.0	3.49	280
22	7	108,000	9,000	15,429	12.0	57	50	-	-	-	-	576
23	3	31,502	2,625	10,501	-	-	-	19.5	217	45.0	2.31	447
24	6	51,162	4,263	8,527	10.0	56	40	16.2	90	45.0	2.78	172
25	7	25,130	2,094	3,590	14.0	67	70	10.8	51	15.0	1.39	532
Sub-Total	25/122	1,048,212	22 H.H.	109 Persons	287.1	H.H./Persons 23/114	1,395	204.0	H.H./Persons 16/88	562.5	16 H.H.	13,262

Table F-1-3 Consumption and Expenses for Drinking and Domestic Water (6)

Sample Household No.	Numbers of Family Members (1)	Average Income: Per Household ฿/year (2)	Average Income: Per Household ฿/month (3)	Average Income: Per Capita ฿/year (4)=(2)/(1)	Water Consumption and Expenses in the Rainy Season: Consumption of water m^3/month (5)	Water Consumption and Expenses in the Rainy Season: Consumption of water l/capita/day (6)=(5)/(1)/30	Water Consumption and Expenses in the Rainy Season: Water Charge ฿/month (7)	Water Consumption and Labor Inputs in the Dry Season: Consumption of water m^3/month (8)	Water Consumption and Labor Inputs in the Dry Season: Consumption of water l/capita/day (9)=(8)/(1)/30	Water Consumption and Labor Inputs in the Dry Season: Labor Inputs Total Liquirement hours/month (10)	Water Consumption and Labor Inputs in the Dry Season: Labor Inputs hours/m^3 (11)=(10)/(8)	Depreciation Cost of Facilities ฿/year (12)
3.2-1	4	43,250	3,604	10,813	27.5	229	110	4.2	35	180.0	42.85	712
2	5	40,115	3,343	8,023	-	-	-	7.5	50	35.0	4.67	308
3	2	-	-	-	1.8	30	7	-	-	-	-	120
4	2	24,000	2,000	12,000	2.5	42	10	6.6	110	8.0	1.21	756
5	4	19,440	1,620	4,860	8.8	73	35	8.7	73	7.5	0.86	506
6	5	31,900	2,658	6,380	6.0	40	25	5.4	36	15.0	2.78	152
7	4	62,400	5,200	15,600	10.0	83	40	10.8	90	30.0	2.78	90
8	7	-	-	-	-	-	-	10.8	51	30.0	2.78	670
9	5	46,049	3,837	9,210	10.0	67	40	6.6	44	15.0	2.27	354
10	5	4,000	333	800	-	-	-	5.4	36	15.0	2.78	484
11	11	64,294	5,358	5,845	2.5	8	140	16.2	49	75.0	4.63	378
12	6	6,000	500	1,000	55.0	306	220	32.4	180	180.0	5.56	604
13	7	104,930	8,744	14,990	20.0	95	80	35.1	167	150.0	4.27	289
14	7	22,100	1,842	3,157	10.0	48	40	-	-	-	-	380
15	1	36,000	3,000	36,000	8.0	267	32	-	-	-	-	72
16	5	12,851	1,071	2,570	-	-	-	2.1	14	40.0	19.05	694
17	3	2,525	210	842	7.5	83	30	6.6	73	15.0	2.27	407
18	10	40,600	3,383	4,060	9.0	30	35	10.8	36	10.0	0.93	301
19	7	22,371	1,864	3,196	-	-	-	10.8	51	60.0	5.56	210
20	5	9,530	794	1,906	-	-	-	8.7	58	20.0	2.30	911
21	3	28,800	2,400	9,600	5.0	56	20	4.8	53	15.0	3.13	412
22	4	17,240	1,437	4,310	5.0	42	20	12.9	108	45.0	3.49	976
23	10	17,700	1,475	1,770	12.0	40	22	19.5	65	45.0	2.31	474
24	4	15,000	1,250	3,750	-	-	-	16.2	135	45.0	2.78	652
25	4	28,432	2,369	7,108	2.4	20	56	10.8	90	10.0	0.93	795
Sub-Total	25/130	699,534	23 H.H.	121 Persons	203.0	18/92 H.H./Persons	962	252.9	22/120 H.H./Persons	1,045.5	22 H.H.	11,707
Total	50/252	1,747,746	45 H.H.	230 Persons	490.1	41/206 H.H./Persons	2,357	456.9	38/208 H.H./Persons	1,608.0	48 H.H.	24,969
Average	Persons/H.H. 5.0	฿/H.H. 38,839	฿/H.H. 3,237	฿/Capita 7,599	m^3/H.H. 120.0	l/Capita 79	฿/H.H. 57	m^3/H.H. 12.0	l/Capita 73	hours/H.H. 33.5	hours/m^3 2.79	฿/H.H. 510

Table F-1-4 Annual Income and Expenditure for Drinking and Domestic Water

Items	Agricultural Household	Non-Agricultural Household	Unknown	Total
A. Project Area of NSD				
1. Sample Households (households)				
a. SD Kham Sakae Sang *1	38	8	4	50
b. SD Nong Ki *2	28	21	1	50
Total	66	29	5	100
2. Family Members of Sample Households (Persons)				
a. SD Kham Sakae Sang	216	51	25	292
b. SD Nong Ki	189	110	4	303
Total	405	161	29	595
3. Average Family Members (Persons/H.H.)	6.1	5.6	5.8	6.0
4. Average Income (฿)				
a. Annual Income per H.H.	36,638	108,094	unknown	58,451
b. Monthly Income per H.H.	3,053	9,008	"	4,871
c. Per Capita Annual Income	5,971	19,470	"	9,811
5. Labor Inputs and Expenditure for Drinking and Domestic Water				
a. Labor Inputs (hours/family/month)	33.8	28.1	51.2	34.1
b. Expenditure *3 (฿/family/year)	671	583	396	648
(Cash expenditure/Income)	1.8%	0.5%	-	1.1%
B. Project Area of ESD (SD Non Thai)				
1. Sample Household (households)	25	20	5	50
2. Family Members (persons)	149	81	22	252
3. Average Family Members (persons/H.H.)	6.0	4.1	4.4	5.0
4. Average Income (฿)				
a. Annual Income per H.H.	44,169	32,176	unknown	38,839
b. Monthly Income per H.H.	3,680	2,681	"	3,237
c. Per Capita Annual Income	7,411	7,945	"	7,599
5. Labor Inputs and Expenditure for Drinking and Domestic Water				
5.1 In the Rainy Season *4				
a. Monthly Water Charge (฿/family)	63	58	27	57
b. Annual Water Charge (฿/family)	378	348	162	342
5.2 Labor Inputs (hours/family/month)				
a. In the Rainy Season	-	-	-	-
b. In the Dry Season	34.5	33.9	21.7	33.5
5.3 Expenditure (฿/family/year)				
a. In the Rainy Season	1,038	1,020	654	1,008
b. In the Dry Season	498	522	517	510
Total	1,536	1,542	1,171	1,518
(Cash expenditure/Income)	(3.5%)	(4.8%)	(-)	(3.9%)

Source of Data : ....."Household Finances and Domestic Water Use Survey" in the Project Area, 1985
Note : *1 ..Changwat Nakhon Ratchasima
: *2 ..Changwat Buri Ram
: *3 ..Depreciation cost of the facilities for drinking and domestic water.
: *4 ..Though the sanitary district has water supply system already, the system is not operating in the dry season for the limit of water source.

Table F-1-5 Drinking and Domestic Water Consumption of the Sample Households

Items	Agricultural Household	Non-Agricultural Household	Unknown	Total
A. Sample Area of NSD*1				
1. Sample Household				
a. Numbers of Household	66	29	5	100
b. Family Members	405	161	29	595
c. Family Size	6.1	5.6	5.8	6.0
2. Average Consumption of Water in the Dry Season				
a. m^3/family/month	12.0	11.0	9.7	11.6
b. l/capita/day	67	62	52	65
B. Sample Area of ESD*2				
1. Sample Household				
a. Numbers of Household	25	20	5	50
b. Family Members	149	81	22	252
c. Family Size	6.0	4.1	4.4	5.0
2. Average Consumption of Water in the Rainy Season (=piped water)				
a. m^3/family/month	12.0	13.2	6.7	12.0
b. l/capita/day	64	111	60	79
3. Average Consumption of Water in the Dry Season				
a. m^3/family/month	13.0	11.7	6.4	12.0
b. l/capita/day	74	83	38	73

Source of Data: "Household Finances and Domestic Water Use Survey" in the Project Area, 1985

Note: *1- Sample Area of NSD
1. SD Kham Sakae Sang, Changwat Nakhon Ratchasima
2. SD Nong Ki, Changwat Buri Ram

*2- Sample Area of ESD
1. SD Non Thai, Changwat Nakhon Ratchasima

F.2. COST OF WATER SUPPLY AND CHARGE COLLECTED OF THE EXISTING WATERWORKS

LIST OF TABLE

Table F-2-1 Unit Cost of Water Supply

Water Works	Unit Cost (฿/cu.m) Personnel Expenses	Energy Expenses	Chemical Expenses	Operation and Maintenance Expenses	Total	Persent Unit Water Charge
1. Large Scale						
a. Phitsanulok	0.68	1.09	0.39	0.23	2.39	2.50
b. Nakhon Ratchasima	0.42	0.33	0.37	0.15	1.29	1.50
Average	0.55	0.71	0.38	0.19	1.83	2.00
2. Medium Scale						
a. Uthai Thani	0.82	1.14	0.40	0.23	2.59	2.95
b. Ayuttaya	0.70	0.76	0.15	0.07	1.68	2.00
c. Saraburi	0.98	1.49	0.28	0.26	3.01	3.60
d. Phuket	0.70	0.04	0.76	0.07	1.57	2.00
e. Ratburi	0.65	1.32	0.14	0.27	2.38	3.50
f. Uttaradit	1.18	1.33	0.54	0.13	3.18	3.75
g. Hua Hin	0.96	1.00	0.26	0.36	2.58	4.00
Average	0.86	1.01	0.36	0.20	2.43	3.11
3. Small Scale						
a. Potharam	1.20	0.88	0.07	0.22	2.37	3.00
b. Chum Sang	1.71	1.60	0.59	0.77	4.67	3.50
c. Nong Kae	1.50	0.52	0.48	0	2.58	3.50
d. Kratumban	0.69	1.71	0.14	0.01	2.55	2.50
Average	1.03	1.18	0.32	0.25	2.78	3.13

Source : PWD

Table F-2-2 Water Supply Cost of ESD

ESD Code No.	ESD Name	Year	Annual Water Supply Cost (฿/year)								Annual Water Consumption m^3	Unit cost ฿/m^3
			Personnel	Office	Energy	Chemical	Repair	Repayment	Others	Total		
1	Cho Ho	1980	-	-	-	-	-	-	-	-	-	-
		1981	-	-	-	-	-	-	-	-	-	-
		1982	73,200	14,150	89,426	21,462	0	107,000	3,000	308,238	-	-
		1983	73,200	60,749	138,315	30,000	0	107,000	5,000	414,264	-	-
		1984	73,200	67,198	30,000	75,140	0	107,000	5,000	357,538	153,974	2.32
		Average	73,200	47,366	85,914	42,201	0	107,000	4,333	360,014	-	2.32
			(20)	(13)	(24)	(12)	(0)	(30)	(1)	(100)		
2	Non Thai	1980	26,400	0	7,899	0	0	0	0	34,299	21,615	1.59
		1981	32,400	2,000	27,744	29,260	61,400	0	0	152,804	-	-
		1982	35,562	4,700	24,299	2,500	10,000	0	0	77,061	-	-
		1983	36,600	10,000	38,211	7,750	46,760	0	0	139,321	74,495	1.87
		1984	39,000	6,858	42,699	12,560	130,000	0	0	231,117	62,570	3.69
		Average	33,992	4,712	28,170	10,414	49,632	0	0	126,920	-	2.38
			(27)	(4)	(22)	(8)	(39)	(0)	(0)	(100)		
3	Prang Ku	1980	-	-	-	-	-	-	-	-	-	-
		1981	-	-	-	-	-	-	-	-	-	-
		1982	-	-	-	-	-	-	-	-	-	-
		1983	16,775	276	24,615	1,519	0	0	1,575	44,760	10,651	4.20
		1984	-	-	-	-	-	-	-	-	-	-
		Average	16,775	276	24,615	1,519	0	0	1,575	44,760	-	4.20
			(37)	(1)	(55)	(3)	(0)	(0)	(4)	(100)		
4	Tha Rae	1980	-	-	-	-	-	-	-	-	-	-
		1981	-	-	-	-	-	-	-	-	-	-
		1982	-	-	-	-	-	-	-	-	-	-
		1983	-	-	-	-	-	-	-	-	-	-
		1984	18,000	6,240	33,720	54,240	18,000	0	4,500	134,700	23,012	5.85
		Average	18,000	6,240	33,720	54,240	18,000	0	4,500	134,700	-	5.85
			(13)	(5)	(25)	(40)	(13)	(0)	(3)	(100)		
5	Akat Amnuai	1980	12,000	20,353	10,999	0	0	0	0	43,352	-	-
		1981	15,800	32,750	10,060	0	0	0	0	58,610	-	-
		1982	16,200	41,000	32,678	0	0	0	0	89,878	-	-
		1983	18,000	56,710	39,298	0	0	1,575	0	115,583	47,022	2.46
		1984	18,300	34,428	43,665	0	0	0	0	96,393	52,972	1.82
		Average	16,060	37,048	27,340	0	0	315	0	80,763	-	2.14
			(20)	(46)	(34)	(0)	(0)	(0)	(0)	(100)	-	-
6	Sankha	1980	26,400	23,352	0	21,214	0	0	0	70,966	-	-
		1981	18,900	46,505	9,802	22,520	0	0	11,915	109,642	-	-
		1982	15,300	10,770	10,130	7,000	0	0	0	43,200	47,242	0.91
		1983	36,600	34,450	37,895	32,364	0	43,986	152,139	337,434	45,349	7.44
		1984	54,900	34,353	60,000	48,396	0	101,486	63,913	363,048	90,296	4.02
		Average	30,420	29,886	23,565	26,299	0	29,094	45,593	184,857	-	4.12
			(16)	(16)	(13)	(14)	(0)	(16)	(25)	(100)	-	-
7	Pan Phu	1980	30,900	900	48,565	0	0	0	0	80,365	-	-
		1981	-	-	-	-	-	-	-	-	-	-
		1982	32,400	3,000	85,000	0	45,550	0	2,000	167,950	56,517	2.97
		1983	33,550	5,675	76,978	0	0	0	0	116,203	40,418	2.88
		1984	36,600	29,314	57,207	0	0	0	0	123,121	41,619	2.96
		Average	33,363	9,722	66,938	0	11,388	0	500	121,911	-	2.94
			(27)	(8)	(55)	(0)	(9)	(0)	(0)	(99)	-	-
9	Chanuman	1980	-	-	-	-	-	-	-	80,379	24,655	3.26
		1981	-	-	-	-	-	-	-	90,557	35,220	2.57
		1982	-	-	-	-	-	-	-	127,372	40,372	3.15
		1983	35,075	94,000	83,638	4,500	0	0	4,590	221,803	81,372	2.73
		1984	35,075	41,500	55,952	40,400	126,564	0	0	299,491	49,442	6.06
		Average	35,075	67,750	69,795	22,450	63,282	0	2,295	260,647	-	3.55
			(13)	(26)	(27)	(9)	(24)	(0)	(1)	(100)		
	Average		32,111	25,375	45,007	19,640	17,788	17,051	7,350	164,322	-	3.44
			(19.5)	(15.4)	(27.4)	(12.0)	(10.8)	(10.4)	(4.5)	(100)		

Source: PWD

F.3. FINANCIAL ANALYSIS

LIST OF TABLES

Table F-3-1 Average Household Income in the Sanitary District

Socio-Economic Class	Average Income (฿/month/H.H.)	Family Size (persons/H.H.)
1. Farm Operators, Mainly Owing Land	1,317	5.6
2. Farm Operators, Mainly Renting Land	659	5.5
3. Entreperneurs, Trade and Industry	3,048	5.8
4. Professional, Technical and Administrative Workers	3,720	5.0
5. Farm and General Workers	1,360	5.0
6. Clerical, Sales and Services Workers	2,166	5.1
7. Production and Construction Workers	1,916	4.9
8. Economically Inactive	1,284	3.9
Average	1,897 (2,897 *1)	5.3

Data Source: "Report of the 1979/80 Socio-Economic Survey, Northeastern Region"
National Statistical Office, office of the Prime Minister.

Note : *1 ... 1985 price level (1,897฿ x 1.527 = 2,897฿)
consumer price index in the Northeast is applied to revice the price level.

Table F-3-2 Estimation of Water Counted (1)

YEAR	POPULATION (PERSONS) TOTAL POPULATION (1)	RATE OF WATER SERVICE (%) (2)	POPULATION SERVED (3)	WATER DEMAND (CUBIC METER) DAILY AVERAGE SUPPLY PER CAPITA (4)	DAILY AVERAGE SUPPLY (5)	ANNUAL SUPPLY (6)	RATE OF CHARGE COLLECTION (%) (7)	WATER COUNTED (8)
1. Kham Sakae Sang (5)								
1 1985	5001.	0.	0.	0.0	0.	0.	0.	0.
2 1986	5186.	0.	0.	0.0	0.	0.	0.	0.
3 1987	5371.	0.	0.	0.0	0.	0.	0.	0.
4 1988	5556.	0.	0.	0.0	0.	0.	0.	0.
5 1989	5741.	35.	2009.	0.090	181.	66007.	100.	66007.
6 1990	5926.	70.	4148.	0.090	373.	136268.	100.	136268.
7 1991	6160.	70.	4312.	0.090	388.	141649.	100.	141649.
8 1992	6395.	70.	4476.	0.090	403.	147053.	100.	147053.
9 1993	6629.	70.	4640.	0.090	418.	152434.	100.	152434.
10 1994	6864.	70.	4805.	0.090	432.	157837.	100.	157837.
11 1995	7098.	70.	4969.	0.090	447.	163218.	100.	163218.
12 1996	7390.	70.	5173.	0.090	466.	169933.	100.	169933.
13 1997	7682.	70.	5377.	0.090	484.	176647.	100.	176647.
14 1998	7975.	70.	5582.	0.090	502.	183385.	100.	183385.
15 1999	8267.	70.	5787.	0.090	521.	190100.	100.	190100.
16 2000	8559.	70.	5991.	0.090	539.	196814.	100.	196814.
2. Nong Bua Lai (6)								
1 1985	3461.	0.	0.	0.0	0.	0.	0.	0.
2 1986	3608.	0.	0.	0.0	0.	0.	0.	0.
3 1987	3755.	0.	0.	0.0	0.	0.	0.	0.
4 1988	3903.	0.	0.	0.0	0.	0.	0.	0.
5 1989	4050.	35.	1418.	0.090	128.	46565.	100.	46565.
6 1990	4197.	70.	2938.	0.090	264.	96510.	100.	96510.
7 1991	4388.	70.	3072.	0.090	276.	100902.	100.	100902.
8 1992	4579.	70.	3205.	0.090	288.	105294.	100.	105294.
9 1993	4769.	70.	3338.	0.090	300.	109663.	100.	109663.
10 1994	4960.	70.	3472.	0.090	312.	114055.	100.	114055.
11 1995	5151.	70.	3606.	0.090	325.	118447.	100.	118447.
12 1996	5394.	70.	3776.	0.090	340.	124035.	100.	124035.
13 1997	5637.	70.	3946.	0.090	355.	129623.	100.	129623.
14 1998	5880.	70.	4116.	0.090	370.	135210.	100.	135210.
15 1999	6123.	70.	4286.	0.090	386.	140798.	100.	140798.
16 2000	6366.	70.	4456.	0.090	401.	146386.	100.	146386.
3. Huai Thalaeng (7)								
1 1985	10049.	0.	0.	0.0	0.	0.	0.	0.
2 1986	10500.	0.	0.	0.0	0.	0.	0.	0.
3 1987	10951.	0.	0.	0.0	0.	0.	0.	0.
4 1988	11402.	0.	0.	0.0	0.	0.	0.	0.
5 1989	11853.	35.	4149.	0.090	373.	136280.	100.	136280.
6 1990	12304.	70.	8613.	0.090	775.	282930.	100.	282930.
7 1991	12893.	70.	9025.	0.090	812.	296474.	100.	296474.
8 1992	13483.	70.	9438.	0.090	849.	310041.	100.	310041.
9 1993	14072.	70.	9850.	0.090	887.	323585.	100.	323585.
10 1994	14662.	70.	10263.	0.090	924.	337153.	100.	337153.
11 1995	15251.	70.	10676.	0.090	961.	350697.	100.	350697.
12 1996	16006.	70.	11204.	0.090	1008.	368058.	100.	368058.
13 1997	16762.	70.	11733.	0.090	1056.	385442.	100.	385442.
14 1998	17517.	70.	12262.	0.090	1104.	402803.	100.	402803.
15 1999	18273.	70.	12791.	0.090	1151.	420187.	100.	420187.
16 2000	19028.	70.	13320.	0.090	1199.	437549.	100.	437549.

Table F-3-2 Estimation of Water Counted (2)

YEAR	POPULATION (PERSONS) TOTAL POPULATION (1)	RATE OF WATER SERVICE (%) (2)	POPULATION SERVED (3)	WATER DEMAND (CUBIC METER) DAILY AVERAGE SUPPLY PER CAPITA (4)	DAILY AVERAGE SUPPLY (5)	ANNUAL SUPPLY (6)	RATE OF CHARGE COLLECTION (%) (7)	WATER COUNTED (8)
4. Nong Ki (8)								
1 1985	13637.	0.	0.	0.0	0.	0.	0.	0.
2 1986	14175.	0.	0.	0.0	0.	0.	0.	0.
3 1987	14712.	0.	0.	0.0	0.	0.	0.	0.
4 1988	15249.	0.	0.	0.0	0.	0.	0.	0.
5 1989	15787.	35.	5525.	0.090	497.	181511.	100.	181511.
6 1990	16324.	70.	11427.	0.090	1028.	375370.	100.	375370.
7 1991	17011.	70.	11908.	0.090	1072.	391168.	100.	391168.
8 1992	17699.	70.	12389.	0.090	1115.	406988.	100.	406988.
9 1993	18386.	70.	12870.	0.090	1158.	422786.	100.	422786.
10 1994	19074.	70.	13352.	0.090	1202.	438606.	100.	438606.
11 1995	19761.	70.	13833.	0.090	1245.	454404.	100.	454404.
12 1996	20627.	70.	14439.	0.090	1300.	474318.	100.	474318.
13 1997	21492.	70.	15044.	0.090	1354.	494208.	100.	494208.
14 1998	22358.	70.	15651.	0.090	1409.	514122.	100.	514122.
15 1999	23223.	70.	16256.	0.090	1463.	534013.	100.	534013.
16 2000	24089.	70.	16862.	0.090	1518.	553926.	100.	553926.
5. Huai Rat (10)								
1 1985	3943.	0.	0.	0.0	0.	0.	0.	0.
2 1986	4102.	0.	0.	0.0	0.	0.	0.	0.
3 1987	4260.	0.	0.	0.0	0.	0.	0.	0.
4 1988	4418.	0.	0.	0.0	0.	0.	0.	0.
5 1989	4577.	35.	1602.	0.090	144.	52624.	100.	52624.
6 1990	4735.	70.	3314.	0.090	298.	108881.	100.	108881.
7 1991	4938.	70.	3457.	0.090	311.	113549.	100.	113549.
8 1992	5142.	70.	3599.	0.090	324.	118240.	100.	118240.
9 1993	5345.	70.	3741.	0.090	337.	122908.	100.	122908.
10 1994	5549.	70.	3884.	0.090	350.	127599.	100.	127599.
11 1995	5752.	70.	4026.	0.090	362.	132267.	100.	132267.
12 1996	6009.	70.	4206.	0.090	379.	138177.	100.	138177.
13 1997	6266.	70.	4386.	0.090	395.	144087.	100.	144087.
14 1998	6523.	70.	4566.	0.090	411.	149996.	100.	149996.
15 1999	6780.	70.	4746.	0.090	427.	155906.	100.	155906.
16 2000	7037.	70.	4926.	0.090	443.	161816.	100.	161816.
6. Khun Han (12)								
1 1985	3327.	0.	0.	0.0	0.	0.	0.	0.
2 1986	3515.	0.	0.	0.0	0.	0.	0.	0.
3 1987	3702.	0.	0.	0.0	0.	0.	0.	0.
4 1988	3890.	0.	0.	0.0	0.	0.	0.	0.
5 1989	4078.	35.	1427.	0.090	128.	46887.	100.	46887.
6 1990	4266.	70.	2986.	0.090	269.	98097.	100.	98097.
7 1991	4519.	70.	3163.	0.090	285.	103914.	100.	103914.
8 1992	4771.	70.	3340.	0.090	301.	109709.	100.	109709.
9 1993	5024.	70.	3517.	0.090	317.	115527.	100.	115527.
10 1994	5276.	70.	3693.	0.090	332.	121322.	100.	121322.
11 1995	5529.	70.	3870.	0.090	348.	127139.	100.	127139.
12 1996	5861.	70.	4103.	0.090	369.	134774.	100.	134774.
13 1997	6193.	70.	4335.	0.090	390.	142408.	100.	142408.
14 1998	6526.	70.	4568.	0.090	411.	150065.	100.	150065.
15 1999	6858.	70.	4801.	0.090	432.	157700.	100.	157700.
16 2000	7190.	70.	5033.	0.090	453.	165334.	100.	165334.

Table F-3-2 Estimation of Water Counted (3)

YEAR	POPULATION (PERSONS) TOTAL POPULATION (1)	RATE OF WATER SERVICE (%) (2)	POPULATION SERVED (3)	WATER DEMAND (CUBIC METER) DAILY AVERAGE SUPPLY PER CAPITA (4)	DAILY AVERAGE SUPPLY (5)	ANNUAL SUPPLY (6)	RATE OF CHARGE COLLECTION (%) (7)	WATER COUNTED (8)
7. Kusuman (13)								
1 1985	5427.	0.	0.	0.0	0.	0.	0.	0.
2 1986	5606.	0.	0.	0.0	0.	0.	0.	0.
3 1987	5785.	0.	0.	0.0	0.	0.	0.	0.
4 1988	5965.	0.	0.	0.0	0.	0.	0.	0.
5 1989	6144.	35.	2150.	0.090	194.	70641.	100.	70641.
6 1990	6323.	70.	4426.	0.090	398.	145397.	100.	145397.
7 1991	6545.	70.	4581.	0.090	412.	150502.	100.	150502.
8 1992	6767.	70.	4737.	0.090	426.	155607.	100.	155607.
9 1993	6989.	70.	4892.	0.090	440.	160712.	100.	160712.
10 1994	7211.	70.	5048.	0.090	454.	165817.	100.	165817.
11 1995	7433.	70.	5203.	0.090	468.	170922.	100.	170922.
12 1996	7704.	70.	5393.	0.090	485.	177153.	100.	177153.
13 1997	7975.	70.	5582.	0.090	502.	183385.	100.	183385.
14 1998	8246.	70.	5772.	0.090	519.	189617.	100.	189617.
15 1999	8517.	70.	5962.	0.090	537.	195848.	100.	195848.
16 2000	8788.	70.	6152.	0.090	554.	202080.	100.	202080.
8. Phon Charoen (17)								
1 1985	9988.	0.	0.	0.0	0.	0.	0.	0.
2 1986	10279.	0.	0.	0.0	0.	0.	0.	0.
3 1987	10570.	0.	0.	0.0	0.	0.	0.	0.
4 1988	10862.	0.	0.	0.0	0.	0.	0.	0.
5 1989	11153.	35.	3904.	0.090	351.	128232.	100.	128232.
6 1990	11444.	70.	8011.	0.090	721.	263155.	100.	263155.
7 1991	11783.	70.	8248.	0.090	742.	270950.	100.	270950.
8 1992	12122.	70.	8485.	0.090	764.	278745.	100.	278745.
9 1993	12461.	70.	8723.	0.090	785.	286541.	100.	286541.
10 1994	12800.	70.	8960.	0.090	806.	294336.	100.	294336.
11 1995	13139.	70.	9197.	0.090	828.	302131.	100.	302131.
12 1996	13528.	70.	9470.	0.090	852.	311076.	100.	311076.
13 1997	13917.	70.	9742.	0.090	877.	320021.	100.	320021.
14 1998	14306.	70.	10014.	0.090	901.	328966.	100.	328966.
15 1999	14695.	70.	10286.	0.090	926.	337911.	100.	337911.
16 2000	15084.	70.	10559.	0.090	950.	346856.	100.	346856.
9. Nong Song Hong (18)								
1 1985	8152.	0.	0.	0.0	0.	0.	0.	0.
2 1986	8389.	0.	0.	0.0	0.	0.	0.	0.
3 1987	8627.	0.	0.	0.0	0.	0.	0.	0.
4 1988	8865.	0.	0.	0.0	0.	0.	0.	0.
5 1989	9102.	35.	3186.	0.090	287.	104650.	100.	104650.
6 1990	9340.	70.	6538.	0.090	588.	214773.	100.	214773.
7 1991	9617.	70.	6732.	0.090	606.	221143.	100.	221143.
8 1992	9893.	70.	6925.	0.090	623.	227489.	100.	227489.
9 1993	10170.	70.	7119.	0.090	641.	233859.	100.	233859.
10 1994	10446.	70.	7312.	0.090	658.	240206.	100.	240206.
11 1995	10723.	70.	7506.	0.090	676.	246575.	100.	246575.
12 1996	11040.	70.	7728.	0.090	696.	253865.	100.	253865.
13 1997	11358.	70.	7951.	0.090	716.	261177.	100.	261177.
14 1998	11675.	70.	8172.	0.090	736.	268466.	100.	268466.
15 1999	11993.	70.	8395.	0.090	756.	275779.	100.	275779.
16 2000	12310.	70.	8617.	0.090	776.	283068.	100.	283068.

Table F-3-2 Estimation of Water Counted (4)

YEAR	POPULATION (PERSONS) TOTAL POPULATION (1)	RATE OF WATER SERVICE (%) (2)	POPULATION SERVED (3)	WATER DEMAND (CUBIC METER) DAILY AVERAGE SUPPLY PER CAPITA (4)	DAILY AVERAGE SUPPLY (5)	ANNUAL SUPPLY (6)	RATE OF CHARGE COLLECTION (%) (7)	WATER COUNTED (8)
10. Huai Kha Yung (20)								
1 1985	3969.	0.	0.	0.0	0.	0.	0.	0.
2 1986	4126.	0.	0.	0.0	0.	0.	0.	0.
3 1987	4282.	0.	0.	0.0	0.	0.	0.	0.
4 1988	4438.	0.	0.	0.0	0.	0.	0.	0.
5 1989	4595.	35.	1608.	0.090	145.	52831.	100.	52831.
6 1990	4751.	70.	3326.	0.090	299.	109249.	100.	109249.
7 1991	4951.	70.	3466.	0.090	312.	113848.	100.	113848.
8 1992	5151.	70.	3606.	0.090	325.	118447.	100.	118447.
9 1993	5351.	70.	3746.	0.090	337.	123046.	100.	123046.
10 1994	5551.	70.	3886.	0.090	350.	127645.	100.	127645.
11 1995	5751.	70.	4026.	0.090	362.	132244.	100.	132244.
12 1996	6003.	70.	4202.	0.090	378.	138039.	100.	138039.
13 1997	6255.	70.	4378.	0.090	394.	143834.	100.	143834.
14 1998	6507.	70.	4555.	0.090	410.	149628.	100.	149628.
15 1999	6759.	70.	4731.	0.090	426.	155423.	100.	155423.
16 2000	7011.	70.	4908.	0.090	442.	161218.	100.	161218.

Table F-3-3 Projection of Operation and Maintenance Cost (1)

(UNIT : 000 BAHT)

YEAR	POWER COST			CHEMICAL COST	REPAIRING COST	PERSONNEL EXPENSES			OTHER EXPENSES	TOTAL OPERATION AND MAINTENANCE COST
	WATER SOURCE WORKS	TREATMENT WORKS	SUB-TOTAL			NUMBER OF STAFFS (PERSONS)	SALARY PER STAFF	TOTAL		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1. Kham Sakae Sang (5)										
1 1985	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
2 1986	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
3 1987	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
4 1988	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
5 1989	57.	53.	110.	25.	38.	4.	37.5	150.	30.	353.
6 1990	119.	109.	228.	51.	38.	4.	37.5	150.	30.	496.
7 1991	123.	113.	236.	53.	38.	4.	37.5	150.	30.	507.
8 1992	128.	117.	246.	55.	38.	4.	37.5	150.	30.	518.
9 1993	133.	122.	255.	57.	38.	4.	37.5	150.	30.	529.
10 1994	137.	126.	264.	59.	38.	4.	37.5	150.	30.	540.
11 1995	142.	130.	273.	61.	38.	4.	37.5	150.	30.	551.
12 1996	148.	136.	284.	63.	38.	4.	37.5	150.	30.	565.
13 1997	154.	141.	295.	66.	38.	4.	37.5	150.	30.	579.
14 1998	160.	146.	306.	68.	38.	4.	37.5	150.	30.	592.
15 1999	166.	152.	317.	71.	38.	4.	37.5	150.	30.	606.
16 2000	171.	157.	329.	73.	38.	4.	37.5	150.	30.	620.
2. Nong Bua Lai (6)										
1 1985	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
2 1986	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
3 1987	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
4 1988	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
5 1989	15.	36.	51.	22.	21.	4.	37.5	150.	30.	274.
6 1990	30.	75.	105.	46.	21.	4.	37.5	150.	30.	352.
7 1991	32.	78.	110.	48.	21.	4.	37.5	150.	30.	359.
8 1992	33.	82.	115.	50.	21.	4.	37.5	150.	30.	366.
9 1993	34.	85.	119.	52.	21.	4.	37.5	150.	30.	373.
10 1994	36.	89.	124.	54.	21.	4.	37.5	150.	30.	380.
11 1995	37.	92.	129.	56.	21.	4.	37.5	150.	30.	387.
12 1996	39.	96.	135.	59.	21.	4.	37.5	150.	30.	396.
13 1997	40.	101.	141.	62.	21.	4.	37.5	150.	30.	404.
14 1998	42.	105.	147.	64.	21.	4.	37.5	150.	30.	413.
15 1999	44.	109.	153.	67.	21.	4.	37.5	150.	30.	422.

Table F-3-3 Projection of Operation and Maintenance Cost (2)

(UNIT : 000 BAHT)

YEAR	POWER COST			CHEMICAL COST	REPAIRING COST	PERSONNEL EXPENSES			OTHER EXPENSES	TOTAL OPERATION AND MAINTENANCE COST
	WATER SOURCE WORKS	TREATMENT WORKS	SUB-TOTAL			NUMBER OF STAFFS (PERSONS)	SALARY PER STAFF	TOTAL		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
3. Huai Thalaeng (7)										
1 1985	0.	0.	0.	0.	0.	0.	35.0	0.	0.	0.
2 1986	0.	0.	0.	0.	0.	0.	35.0	0.	0.	0.
3 1987	0.	0.	0.	0.	0.	0.	35.0	0.	0.	0.
4 1988	0.	0.	0.	0.	0.	0.	35.0	0.	0.	0.
5 1989	138.	90.	228.	36.	75.	5.	35.0	175.	35.	549.
6 1990	286.	188.	474.	75.	75.	5.	35.0	175.	35.	834.
7 1991	300.	197.	497.	79.	75.	5.	35.0	175.	35.	860.
8 1992	314.	206.	519.	82.	75.	5.	35.0	175.	35.	887.
9 1993	327.	215.	542.	86.	75.	5.	35.0	175.	35.	913.
10 1994	341.	224.	565.	90.	75.	5.	35.0	175.	35.	939.
11 1995	355.	233.	587.	93.	75.	5.	35.0	175.	35.	965.
12 1996	372.	244.	617.	98.	75.	5.	35.0	175.	35.	999.
13 1997	390.	256.	646.	102.	75.	5.	35.0	175.	35.	1033.
14 1998	408.	267.	675.	107.	75.	5.	35.0	175.	35.	1067.
15 1999	425.	279.	704.	112.	75.	5.	35.0	175.	35.	1100.
16 2000	443.	290.	733.	116.	75.	5.	35.0	175.	35.	1134.
4. Nong Ki (8)										
1 1985	0.	0.	0.	0.	0.	0.	35.0	0.	0.	0.
2 1986	0.	0.	0.	0.	0.	0.	35.0	0.	0.	0.
3 1987	0.	0.	0.	0.	0.	0.	35.0	0.	0.	0.
4 1988	0.	0.	0.	0.	0.	0.	35.0	0.	0.	0.
5 1989	108.	95.	203.	70.	59.	5.	35.0	175.	35.	542.
6 1990	223.	197.	419.	145.	59.	5.	35.0	175.	35.	834.
7 1991	232.	205.	437.	151.	59.	5.	35.0	175.	35.	857.
8 1992	241.	213.	455.	157.	59.	5.	35.0	175.	35.	881.
9 1993	251.	221.	472.	163.	59.	5.	35.0	175.	35.	905.
10 1994	260.	230.	490.	169.	59.	5.	35.0	175.	35.	929.
11 1995	269.	238.	507.	175.	59.	5.	35.0	175.	35.	952.
12 1996	281.	248.	530.	183.	59.	5.	35.0	175.	35.	982.
13 1997	293.	259.	552.	191.	59.	5.	35.0	175.	35.	1012.
14 1998	305.	269.	574.	199.	59.	5.	35.0	175.	35.	1042.
15 1999	317.	280.	596.	206.	59.	5.	35.0	175.	35.	1072.
16 2000	328.	290.	619.	214.	59.	5.	35.0	175.	35.	1102.

Table F-3-3 Projection of Operation and Maintenance Cost (3)

(UNIT : 000 BAHT)

YEAR	POWER COST			CHEMICAL COST	REPAIRING COST	PERSONNEL EXPENSES			OTHER EXPENSES	TOTAL OPERATION AND MAINTENANCE COST
	WATER SOURCE WORKS (1)	TREATMENT WORKS (2)	SUB-TOTAL (3)	(4)	(5)	NUMBER OF STAFFS (PERSONS) (6)	SALARY PER STAFF (7)	TOTAL (8)	(9)	(10)
5. Huai Rat (10)										
1 1985	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
2 1986	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
3 1987	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
4 1988	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
5 1989	22.	37.	59.	29.	25.	4.	37.5	150.	30.	292.
6 1990	45.	76.	122.	60.	25.	4.	37.5	150.	30.	386.
7 1991	47.	80.	127.	63.	25.	4.	37.5	150.	30.	394.
8 1992	49.	83.	132.	65.	25.	4.	37.5	150.	30.	402.
9 1993	51.	86.	137.	68.	25.	4.	37.5	150.	30.	410.
10 1994	53.	90.	142.	70.	25.	4.	37.5	150.	30.	417.
11 1995	55.	93.	148.	73.	25.	4.	37.5	150.	30.	425.
12 1996	57.	97.	154.	76.	25.	4.	37.5	150.	30.	435.
13 1997	60.	101.	161.	79.	25.	4.	37.5	150.	30.	445.
14 1998	62.	105.	168.	83.	25.	4.	37.5	150.	30.	455.
15 1999	65.	109.	174.	86.	25.	4.	37.5	150.	30.	465.
16 2000	67.	114.	181.	89.	25.	4.	37.5	150.	30.	474.
6. Khun Han (12)										
1 1985	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
2 1986	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
3 1987	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
4 1988	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
5 1989	13.	32.	45.	8.	22.	4.	37.5	150.	30.	255.
6 1990	27.	67.	95.	17.	22.	4.	37.5	150.	30.	313.
7 1991	29.	71.	100.	18.	22.	4.	37.5	150.	30.	320.
8 1992	30.	75.	106.	19.	22.	4.	37.5	150.	30.	326.
9 1993	32.	79.	111.	20.	22.	4.	37.5	150.	30.	333.
10 1994	34.	83.	117.	21.	22.	4.	37.5	150.	30.	340.
11 1995	35.	87.	122.	22.	22.	4.	37.5	150.	30.	346.
12 1996	37.	93.	130.	23.	22.	4.	37.5	150.	30.	355.
13 1997	39.	98.	137.	25.	22.	4.	37.5	150.	30.	364.
14 1998	41.	103.	145.	26.	22.	4.	37.5	150.	30.	372.
15 1999	44.	108.	152.	27.	22.	4.	37.5	150.	30.	381.
16 2000	46.	114.	159.	29.	22.	4.	37.5	150.	30.	390.

Table F-3-3 Projection of Operation and Maintenance Cost (4)

(UNIT : 000 BAHT)

YEAR	POWER COST: WATER SOURCE WORKS (1)	POWER COST: TREATMENT WORKS (2)	POWER COST: SUB-TOTAL (3)	CHEMICAL COST (4)	REPAIRING COST (5)	PERSONNEL EXPENSES: NUMBER OF STAFFS (PERSONS) (6)	PERSONNEL EXPENSES: SALARY PER STAFF (7)	PERSONNEL EXPENSES: TOTAL (8)	OTHER EXPENSES (9)	TOTAL OPERATION AND MAINTENANCE COST (10)
7. Kusuman (13)										
1 1985	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
2 1986	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
3 1987	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
4 1988	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
5 1989	35.	55.	90.	4.	29.	4.	37.5	150.	30.	303.
6 1990	72.	113.	185.	8.	29.	4.	37.5	150.	30.	403.
7 1991	74.	117.	192.	9.	29.	4.	37.5	150.	30.	410.
8 1992	77.	121.	198.	9.	29.	4.	37.5	150.	30.	416.
9 1993	80.	125.	205.	9.	29.	4.	37.5	150.	30.	423.
10 1994	82.	129.	211.	10.	29.	4.	37.5	150.	30.	430.
11 1995	85.	133.	218.	10.	29.	4.	37.5	150.	30.	437.
12 1996	88.	138.	225.	10.	29.	4.	37.5	150.	30.	445.
13 1997	91.	143.	233.	11.	29.	4.	37.5	150.	30.	453.
14 1998	94.	148.	241.	11.	29.	4.	37.5	150.	30.	462.
15 1999	97.	152.	249.	11.	29.	4.	37.5	150.	30.	470.
16 2000	100.	157.	257.	12.	29.	4.	37.5	150.	30.	478.
8. Phon Charoen (17)										
1 1985	0.	0.	0.	0.	0.	0.	35.0	0.	0.	0.
2 1986	0.	0.	0.	0.	0.	0.	35.0	0.	0.	0.
3 1987	0.	0.	0.	0.	0.	0.	35.0	0.	0.	0.
4 1988	0.	0.	0.	0.	0.	0.	35.0	0.	0.	0.
5 1989	164.	76.	240.	44.	59.	5.	35.0	175.	35.	553.
6 1990	336.	156.	492.	91.	59.	5.	35.0	175.	35.	852.
7 1991	346.	161.	506.	94.	59.	5.	35.0	175.	35.	869.
8 1992	356.	165.	521.	97.	59.	5.	35.0	175.	35.	886.
9 1993	366.	170.	535.	99.	59.	5.	35.0	175.	35.	904.
10 1994	376.	174.	550.	102.	59.	5.	35.0	175.	35.	921.
11 1995	386.	179.	565.	105.	59.	5.	35.0	175.	35.	938.
12 1996	397.	184.	581.	108.	59.	5.	35.0	175.	35.	958.
13 1997	408.	190.	598.	111.	59.	5.	35.0	175.	35.	978.
14 1998	420.	195.	615.	114.	59.	5.	35.0	175.	35.	998.
15 1999	431.	200.	631.	117.	59.	5.	35.0	175.	35.	1017.
16 2000	443.	205.	648.	120.	59.	5.	35.0	175.	35.	1037.

Table F-3-3 Projection of Operation and Maintenance Cost (5)

(UNIT : 000 BAHT)

YEAR	POWER COST: WATER SOURCE WORKS (1)	POWER COST: TREATMENT WORKS (2)	POWER COST: SUB-TOTAL (3)	CHEMICAL COST (4)	REPAIRING COST (5)	PERSONNEL EXPENSES: NUMBER OF STAFFS (PERSONS) (6)	PERSONNEL EXPENSES: SALARY PER STAFF (7)	PERSONNEL EXPENSES: TOTAL (8)	OTHER EXPENSES (9)	TOTAL OPERATION AND MAINTENANCE COST (10)
9. Nong Song Hong (18)										
1 1985	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
2 1986	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
3 1987	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
4 1988	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
5 1989	25.	58.	83.	20.	52.	4.	37.5	150.	30.	335.
6 1990	51.	119.	170.	41.	52.	4.	37.5	150.	30.	443.
7 1991	52.	123.	175.	42.	52.	4.	37.5	150.	30.	449.
8 1992	54.	126.	180.	43.	52.	4.	37.5	150.	30.	455.
9 1993	55.	130.	185.	44.	52.	4.	37.5	150.	30.	462.
10 1994	57.	133.	190.	46.	52.	4.	37.5	150.	30.	468.
11 1995	58.	137.	195.	47.	52.	4.	37.5	150.	30.	474.
12 1996	60.	141.	201.	48.	52.	4.	37.5	150.	30.	481.
13 1997	62.	145.	207.	50.	52.	4.	37.5	150.	30.	488.
14 1998	64.	149.	213.	51.	52.	4.	37.5	150.	30.	496.
15 1999	65.	153.	219.	52.	52.	4.	37.5	150.	30.	503.
16 2000	67.	157.	224.	54.	52.	4.	37.5	150.	30.	510.
10. Huai Kha Yung (20)										
1 1985	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
2 1986	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
3 1987	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
4 1988	0.	0.	0.	0.	0.	0.	37.5	0.	0.	0.
5 1989	30.	52.	82.	22.	31.	4.	37.5	150.	30.	315.
6 1990	63.	107.	169.	46.	31.	4.	37.5	150.	30.	426.
7 1991	66.	111.	177.	48.	31.	4.	37.5	150.	30.	435.
8 1992	68.	115.	184.	50.	31.	4.	37.5	150.	30.	444.
9 1993	71.	120.	191.	52.	31.	4.	37.5	150.	30.	454.
10 1994	73.	124.	198.	54.	31.	4.	37.5	150.	30.	463.
11 1995	76.	129.	205.	56.	31.	4.	37.5	150.	30.	472.
12 1996	79.	135.	214.	58.	31.	4.	37.5	150.	30.	483.
13 1997	83.	140.	223.	60.	31.	4.	37.5	150.	30.	494.
14 1998	86.	146.	232.	63.	31.	4.	37.5	150.	30.	506.
15 1999	89.	152.	241.	65.	31.	4.	37.5	150.	30.	517.
16 2000	93.	157.	250.	68.	31.	4.	37.5	150.	30.	529.

Table F-3-4 Projection of Floating Debt (1)

(UNIT : 000 BAHT)

YEAR	LOCAL BURDEN OF CONSTRUCTION (1)	REPAYMENT PRINCIPAL (2)	REPAYMENT FLOATING DEBT (3)	PROFIT AND LOSS OF BALANCE (4)	DEPRECIATION RESERVE (5)	TOTAL FLOATING DEBT *1 (6)	INTEREST OF FLOATING DEBT *2 (7)
1. Kham Sakae Sang (5)							
1 1985	0.	0.	0.	0.	0.	0.	0.
2 1986	28.	0.	0.	-7.	0.	35.	0.
3 1987	128.	8.	35.	-46.	0.	217.	0.
4 1988	876.	43.	217.	-317.	0.	1454.	0.
5 1989	195.	284.	1454.	-424.	0.	2356.	0.
6 1990	0.	338.	2356.	-321.	303.	2711.	0.
7 1991	0.	338.	2711.	-241.	303.	2987.	0.
8 1992	0.	338.	2987.	-162.	303.	3183.	0.
9 1993	0.	338.	3183.	-82.	303.	3300.	0.
10 1994	0.	338.	3300.	-3.	303.	3338.	0.
11 1995	0.	338.	3338.	77.	303.	3296.	0.
12 1996	0.	502.	3296.	166.	303.	3328.	0.
13 1997	0.	494.	3328.	259.	303.	3260.	0.
14 1998	0.	459.	3260.	351.	303.	3064.	0.
15 1999	0.	218.	3064.	430.	303.	2548.	0.
16 2000						0.	
2. Nong Bua Lai (6)							
1 1985	0.	0.	0.	0.	0.	0.	0.
2 1986	16.	0.	0.	-4.	0.	20.	0.
3 1987	57.	4.	20.	-23.	0.	104.	0.
4 1988	490.	20.	104.	-171.	0.	785.	0.
5 1989	124.	155.	785.	-281.	0.	1345.	0.
6 1990	0.	189.	1345.	-195.	175.	1554.	0.
7 1991	0.	189.	1554.	-145.	175.	1713.	0.
8 1992	0.	189.	1713.	-95.	175.	1822.	0.
9 1993	0.	189.	1822.	-45.	175.	1881.	0.
10 1994	0.	189.	1881.	6.	175.	1889.	0.
11 1995	0.	189.	1889.	56.	175.	1847.	0.
12 1996	0.	281.	1847.	114.	175.	1839.	0.
13 1997	0.	277.	1839.	174.	175.	1766.	0.
14 1998	0.	261.	1766.	234.	175.	1619.	0.
15 1999	0.	126.	1619.	287.	175.	1283.	0.
16 2000						0.	
3. Huai Thalaeng (7)							
1 1985	0.	0.	0.	0.	0.	0.	0.
2 1986	58.	0.	0.	-15.	0.	73.	0.
3 1987	235.	16.	73.	-93.	0.	417.	0.
4 1988	1783.	81.	417.	-649.	0.	2929.	0.
5 1989	283.	571.	2929.	-789.	0.	4572.	0.
6 1990	0.	649.	4572.	-659.	618.	5263.	0.
7 1991	0.	649.	5263.	-500.	618.	5793.	0.
8 1992	0.	649.	5793.	-340.	618.	6164.	0.
9 1993	0.	649.	6164.	-181.	618.	6376.	0.
10 1994	0.	649.	6376.	-21.	618.	6429.	0.
11 1995	0.	649.	6429.	138.	618.	6321.	0.
12 1996	0.	978.	6321.	320.	618.	6362.	0.
13 1997	0.	962.	6362.	512.	618.	6195.	0.
14 1998	0.	898.	6195.	699.	618.	5776.	0.
15 1999	0.	407.	5776.	862.	618.	4702.	0.
16 2000						0.	

NOTE : *1 ... FLOATING DEBT FROM GENERAL ACCOUNT OF SANITARY DISTRICT (6)=(1)+(2)+(3)-(4)-(5)
*2 ... INTEREST = 0.% , REPAYMENT ALL IN THE NEXT YEAR

Table F-3-4 Projection of Floating Debt (2)

(UNIT : 000 BAHT)

YEAR	LOCAL BURDEN OF CONSTRUCTION (1)	REPAYMENT PRINCIPAL (2)	REPAYMENT FLOATING DEBT (3)	PROFIT AND LOSS OF BALANCE (4)	DEPRECIATION RESERVE (5)	TOTAL FLOATING DEBT *1 (6)	INTEREST OF FLOATING DEBT *2 (7)
4. Nong Ki (8)							
1 1985	0.	0.	0.	0.	0.	0.	0.
2 1986	46.	0.	0.	-12.	0.	58.	0.
3 1987	123.	13.	58.	-57.	0.	251.	0.
4 1988	1245.	47.	251.	-435.	0.	1977.	0.
5 1989	478.	389.	1977.	-524.	0.	3368.	0.
6 1990	0.	521.	3368.	-387.	473.	3803.	0.
7 1991	0.	521.	3803.	-259.	473.	4109.	0.
8 1992	0.	521.	4109.	-131.	473.	4288.	0.
9 1993	0.	521.	4288.	-3.	473.	4338.	0.
10 1994	0.	521.	4338.	126.	473.	4260.	0.
11 1995	0.	521.	4260.	254.	473.	4054.	0.
12 1996	0.	779.	4054.	399.	473.	3961.	0.
13 1997	0.	766.	3961.	551.	473.	3702.	0.
14 1998						0.	
15 1999						0.	
16 2000						0.	
5. Huai Rat (10)							
1 1985	0.	0.	0.	0.	0.	0.	0.
2 1986	19.	0.	0.	-5.	0.	24.	0.
3 1987	58.	5.	24.	-25.	0.	112.	0.
4 1988	548.	21.	112.	-190.	0.	871.	0.
5 1989	165.	172.	871.	-300.	0.	1509.	0.
6 1990	0.	218.	1509.	-221.	201.	1746.	0.
7 1991	0.	218.	1746.	-166.	201.	1928.	0.
8 1992	0.	218.	1928.	-110.	201.	2055.	0.
9 1993	0.	218.	2055.	-55.	201.	2126.	0.
10 1994	0.	218.	2126.	1.	201.	2142.	0.
11 1995	0.	218.	2142.	56.	201.	2103.	0.
12 1996	0.	323.	2103.	119.	201.	2106.	0.
13 1997	0.	318.	2106.	185.	201.	2037.	0.
14 1998	0.	302.	2037.	250.	201.	1888.	0.
15 1999	0.	151.	1888.	308.	201.	1530.	0.
16 2000	0.	106.	1530.	1435.	201.	0.	0.
6. Khun Han (12)							
1 1985	0.	0.	0.	0.	0.	0.	0.
2 1986	16.	0.	0.	-4.	0.	20.	0.
3 1987	48.	5.	20.	-21.	0.	94.	0.
4 1988	513.	18.	94.	-174.	0.	799.	0.
5 1989	120.	159.	799.	-314.	0.	1392.	0.
6 1990	0.	192.	1392.	-254.	180.	1659.	0.
7 1991	0.	192.	1659.	-199.	180.	1870.	0.
8 1992	0.	192.	1870.	-144.	180.	2026.	0.
9 1993	0.	192.	2026.	-89.	180.	2127.	0.
10 1994	0.	192.	2127.	-33.	180.	2173.	0.
11 1995	0.	192.	2173.	22.	180.	2164.	0.
12 1996	0.	286.	2164.	87.	180.	2184.	0.
13 1997	0.	282.	2184.	154.	180.	2131.	0.
14 1998	0.	268.	2131.	221.	180.	1998.	0.
15 1999	0.	127.	1998.	282.	180.	1664.	0.
16 2000	0.	94.	1664.	326.	180.	1253.	0.

NOTE : *1 ... FLOATING DEBT FROM GENERAL ACCOUNT OF SANITARY DISTRICT (6)=(1)+(2)+(3)-(4)-(5)
*2 ... INTEREST = 0.% , REPAYMENT ALL IN THE NEXT YEAR

Table F-3-4 Projection of Floating Debt (3)

(UNIT : 000 BAHT)

YEAR	LOCAL BURDEN OF CONSTRUCTION (1)	REPAYMENT PRINCIPAL (2)	REPAYMENT FLOATING DEBT (3)	PROFIT AND LOSS OF BALANCE (4)	DEPRECIATION RESERVE (5)	TOTAL FLOATING DEBT *1 (6)	INTEREST OF FLOATING DEBT *2 (7)
7. Kusuman (13)							
1 1985	0.	0.	0.	0.	0.	0.	0.
2 1986	22.	0.	0.	-6.	0.	28.	0.
3 1987	72.	6.	28.	-31.	0.	136.	0.
4 1988	623.	26.	136.	-227.	0.	1013.	0.
5 1989	174.	198.	1013.	-322.	0.	1706.	0.
6 1990	0.	245.	1706.	-228.	236.	1944.	0.
7 1991	0.	245.	1944.	-170.	236.	2122.	0.
8 1992	0.	245.	2122.	-111.	236.	2243.	0.
9 1993	0.	245.	2243.	-53.	236.	2306.	0.
10 1994	0.	245.	2306.	5.	236.	2310.	0.
11 1995	0.	245.	2310.	63.	236.	2256.	0.
12 1996	0.	377.	2256.	128.	236.	2269.	0.
13 1997	0.	371.	2269.	197.	236.	2208.	0.
14 1998	0.	351.	2208.	264.	236.	2059.	0.
15 1999	0.	180.	2059.	323.	236.	1680.	0.
16 2000						0.	
8. Phon Charoen (17)							
1 1985	0.	0.	0.	0.	0.	0.	0.
2 1986	45.	0.	0.	-11.	0.	56.	0.
3 1987	123.	13.	56.	-57.	0.	249.	0.
4 1988	1395.	46.	249.	-479.	0.	2169.	0.
5 1989	284.	430.	2169.	-580.	0.	3463.	0.
6 1990	0.	508.	3463.	-413.	467.	3917.	0.
7 1991	0.	508.	3917.	-304.	467.	4262.	0.
8 1992	0.	508.	4262.	-196.	467.	4500.	0.
9 1993	0.	508.	4500.	-88.	467.	4629.	0.
10 1994	0.	508.	4629.	21.	467.	4649.	0.
11 1995	0.	508.	4649.	129.	467.	4561.	0.
12 1996	0.	768.	4561.	246.	467.	4616.	0.
13 1997	0.	755.	4616.	370.	467.	4535.	0.
14 1998	0.	721.	4535.	491.	467.	4298.	0.
15 1999	0.	338.	4298.	595.	467.	3574.	0.
16 2000						0.	
9. Nong Song Hong (18)							
1 1985	0.	0.	0.	0.	0.	0.	0.
2 1986	40.	0.	0.	-10.	0.	50.	0.
3 1987	176.	11.	50.	-67.	0.	304.	0.
4 1988	1237.	59.	304.	-448.	0.	2049.	0.
5 1989	222.	400.	2049.	-534.	0.	3204.	0.
6 1990	0.	461.	3204.	-417.	433.	3649.	0.
7 1991	0.	461.	3649.	-321.	433.	3998.	0.
8 1992	0.	461.	3998.	-225.	433.	4251.	0.
9 1993	0.	461.	4251.	-128.	433.	4407.	0.
10 1994	0.	461.	4407.	-32.	433.	4466.	0.
11 1995	0.	461.	4466.	65.	433.	4429.	0.
12 1996	0.	683.	4429.	168.	433.	4512.	0.
13 1997	0.	672.	4512.	278.	433.	4474.	0.
14 1998	0.	624.	4474.	385.	433.	4281.	0.
15 1999	0.	284.	4281.	474.	433.	3657.	0.
16 2000	0.	223.	3657.	526.	433.	2921.	0.

NOTE : *1 ... FLOATING DEBT FROM GENERAL ACCOUNT OF SANITARY DISTRICT (6)=(1)+(2)+(3)-(4)-(5)
*2 ... INTEREST = 0.% , REPAYMENT ALL IN THE NEXT YEAR

Table F-3-4 Projection of Floating Debt (4)

(UNIT : 000 BAHT)

YEAR	LOCAL BURDEN OF CONSTRUCTION (1)	REPAYMENT PRINCIPAL (2)	REPAYMENT FLOATING DEBT (3)	PROFIT AND LOSS OF BALANCE (4)	DEPRECIATION RESERVE (5)	TOTAL FLOATING DEBT *1 (6)	INTEREST OF FLOATING DEBT *2 (7)
10. Huai Kha Yung (20)							
1 1985	0.	0.	0.	0.	0.	0.	0.
2 1986	24.	0.	0.	-6.	0.	30.	0.
3 1987	79.	7.	30.	-33.	0.	149.	0.
4 1988	663.	28.	149.	-236.	0.	1076.	0.
5 1989	223.	211.	1076.	-362.	0.	1872.	0.
6 1990	0.	272.	1872.	-302.	250.	2195.	0.
7 1991	0.	272.	2195.	-236.	250.	2452.	0.
8 1992	0.	272.	2452.	-170.	250.	2644.	0.
9 1993	0.	272.	2644.	-104.	250.	2769.	0.
10 1994	0.	272.	2769.	-38.	250.	2829.	0.
11 1995	0.	272.	2829.	28.	250.	2823.	0.
12 1996	0.	407.	2823.	102.	250.	2878.	0.
13 1997	0.	400.	2878.	180.	250.	2848.	0.
14 1998	0.	379.	2848.	257.	250.	2719.	0.
15 1999	0.	196.	2719.	325.	250.	2340.	0.
16 2000	0.	135.	2340.	372.	250.	1853.	0.

NOTE : *1 ... FLOATING DEBT FROM GENERAL ACCOUNT OF SANITARY DISTRICT (6)=(1)+(2)+(3)-(4)-(5)
*2 ... INTEREST = 0.% , REPAYMENT ALL IN THE NEXT YEAR

Table F-3-5 Comparison of Project Financial Cost and Benefits (1)
- Kham Sakae Sang (5) -

(UNIT : 000 BAHT)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE					
						(6 %)		(8 %)		(10 %)	
	CAPITAL	O & M	TOTAL			COST	BENEFITS	COST	BENEFITS	COST	BENEFITS
1 1985	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2 1986	193.	0.	193.	0.	-193.	172.	0.	165.	0.	160.	0.
3 1987	838.	0.	838.	0.	-838.	704.	0.	665.	0.	630.	0.
4 1988	6945.	0.	6945.	0.	-6945.	5501.	0.	5105.	0.	4744.	0.
5 1989	1549.	353.	1902.	528.	-1374.	1421.	395.	1294.	359.	1181.	328.
6 1990	0.	496.	496.	1090.	594.	350.	769.	313.	687.	280.	615.
7 1991	0.	507.	507.	1133.	626.	337.	754.	296.	661.	260.	582.
8 1992	0.	518.	518.	1176.	658.	325.	738.	280.	636.	242.	549.
9 1993	0.	529.	529.	1219.	690.	313.	722.	265.	610.	224.	517.
10 1994	0.	540.	540.	1263.	722.	302.	705.	250.	585.	208.	487.
11 1995	0.	551.	551.	1306.	755.	290.	688.	236.	560.	193.	458.
12 1996	0.	565.	565.	1359.	795.	281.	676.	224.	540.	180.	433.
13 1997	0.	579.	579.	1413.	835.	271.	663.	213.	520.	168.	409.
14 1998	0.	592.	592.	1467.	875.	262.	649.	202.	499.	156.	386.
15 1999	0.	606.	606.	1521.	915.	253.	635.	191.	479.	145.	364.
16 2000	0.	620.	620.	1575.	955.	244.	620.	181.	460.	135.	343.
17 2001	0.	620.	620.	1575.	955.	230.	585.	168.	426.	123.	312.
18 2002	0.	620.	620.	1575.	955.	217.	552.	155.	394.	111.	283.
19 2003	0.	620.	620.	1575.	955.	205.	520.	144.	365.	101.	257.
20 2004	0.	620.	620.	1575.	955.	193.	491.	133.	338.	92.	234.
21 2005	0.	620.	620.	1575.	955.	182.	463.	123.	313.	84.	213.
22 2006	0.	620.	620.	1575.	955.	172.	437.	114.	290.	76.	193.
23 2007	0.	620.	620.	1575.	955.	162.	412.	106.	268.	69.	176.
24 2008	0.	620.	620.	1575.	955.	153.	389.	98.	248.	63.	160.
25 2009	0.	620.	620.	1575.	955.	144.	367.	91.	230.	57.	145.
26 2010	0.	620.	620.	1575.	955.	136.	346.	84.	213.	52.	132.
27 2011	0.	620.	620.	1575.	955.	129.	327.	78.	197.	47.	120.
28 2012	0.	620.	620.	1575.	955.	121.	308.	72.	183.	43.	109.
29 2013	0.	620.	620.	1575.	955.	114.	291.	67.	169.	39.	99.
30 2014	0.	620.	620.	1575.	955.	108.	274.	62.	156.	36.	90.
31 2015	0.	620.	620.	1575.	955.	102.	259.	57.	145.	32.	82.
32 2016	0.	620.	620.	1575.	955.	96.	244.	53.	134.	29.	75.
33 2017	0.	620.	620.	1575.	955.	91.	230.	49.	124.	27.	68.
34 2018	0.	620.	620.	1575.	955.	85.	217.	45.	115.	24.	62.
35 2019	4590.	620.	5210.	1575.	-3635.	678.	205.	352.	106.	185.	56.
36 2020	0.	620.	620.	1575.	955.	76.	193.	39.	99.	20.	51.
37 2021	0.	620.	620.	1575.	955.	72.	182.	36.	91.	18.	46.
38 2022	0.	620.	620.	1575.	955.	68.	172.	33.	85.	17.	42.
39 2023	0.	620.	620.	1575.	955.	64.	162.	31.	78.	15.	38.
40 2024	0.	620.	620.	1575.	955.	60.	153.	29.	72.	14.	35.
41 2025	0.	620.	620.	1575.	955.	57.	144.	26.	67.	12.	32.
42 2026	0.	620.	620.	1575.	955.	54.	136.	24.	62.	11.	29.
TOTAL	14115.	22572.	36687.	55988.	19301.	14796.	16071.	12147.	11564.	10304.	8610.

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.09 (6%), 0.95 (8%), 0.84 (10%)
INTERNAL RATE OF RETURN (IRR) = 7.3 %

Table F-3-5 Comparison of Project Financial Cost and Benefits (2)
- Nong Bua Lai (6) -

(UNIT : 000 BAHT)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE (5 %)		(7 %)		(9 %)	
	CAPITAL	O & M	TOTAL			COST	BENEFITS	COST	BENEFITS	COST	BENEFITS
1 1985	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2 1986	109.	0.	109.	0.	-109.	99.	0.	95.	0.	92.	0.
3 1987	407.	0.	407.	0.	-407.	352.	0.	332.	0.	314.	0.
4 1988	3850.	0.	3850.	0.	-3850.	3167.	0.	2937.	0.	2727.	0.
5 1989	977.	274.	1251.	326.	-925.	980.	255.	892.	232.	813.	212.
6 1990	0.	352.	352.	676.	323.	263.	504.	235.	450.	210.	403.
7 1991	0.	359.	359.	706.	347.	255.	502.	224.	440.	197.	386.
8 1992	0.	366.	366.	737.	371.	248.	499.	213.	429.	184.	370.
9 1993	0.	373.	373.	768.	395.	240.	495.	203.	418.	172.	353.
10 1994	0.	380.	380.	798.	419.	233.	490.	193.	406.	160.	337.
11 1995	0.	387.	387.	829.	442.	226.	485.	184.	394.	150.	321.
12 1996	0.	396.	396.	868.	473.	220.	483.	176.	386.	141.	309.
13 1997	0.	404.	404.	907.	503.	214.	481.	168.	377.	132.	296.
14 1998	0.	413.	413.	946.	533.	209.	478.	160.	367.	124.	283.
15 1999	0.	422.	422.	986.	564.	203.	474.	153.	357.	116.	271.
16 2000	0.	430.	430.	1025.	594.	197.	469.	146.	347.	108.	258.
17 2001	0.	430.	430.	1025.	594.	188.	447.	136.	324.	99.	237.
18 2002	0.	430.	430.	1025.	594.	179.	426.	127.	303.	91.	217.
19 2003	0.	430.	430.	1025.	594.	170.	406.	119.	283.	84.	199.
20 2004	0.	430.	430.	1025.	594.	162.	386.	111.	265.	77.	183.
21 2005	0.	430.	430.	1025.	594.	155.	368.	104.	247.	70.	168.
22 2006	0.	430.	430.	1025.	594.	147.	350.	97.	231.	65.	154.
23 2007	0.	430.	430.	1025.	594.	140.	334.	91.	216.	59.	141.
24 2008	0.	430.	430.	1025.	594.	133.	318.	85.	202.	54.	130.
25 2009	0.	430.	430.	1025.	594.	127.	303.	79.	189.	50.	119.
26 2010	0.	430.	430.	1025.	594.	121.	288.	74.	176.	46.	109.
27 2011	0.	430.	430.	1025.	594.	115.	274.	69.	165.	42.	100.
28 2012	0.	430.	430.	1025.	594.	110.	261.	65.	154.	39.	92.
29 2013	0.	430.	430.	1025.	594.	105.	249.	61.	144.	35.	84.
30 2014	0.	430.	430.	1025.	594.	100.	237.	57.	135.	32.	77.
31 2015	0.	430.	430.	1025.	594.	95.	226.	53.	126.	30.	71.
32 2016	0.	430.	430.	1025.	594.	90.	215.	49.	118.	27.	65.
33 2017	0.	430.	430.	1025.	594.	86.	205.	46.	110.	25.	60.
34 2018	0.	430.	430.	1025.	594.	82.	195.	43.	103.	23.	55.
35 2019	3370.	430.	3800.	1025.	-2776.	689.	186.	356.	96.	186.	50.
36 2020	0.	430.	430.	1025.	594.	74.	177.	38.	90.	19.	46.
37 2021	0.	430.	430.	1025.	594.	71.	169.	35.	84.	18.	42.
38 2022	0.	430.	430.	1025.	594.	67.	160.	33.	78.	16.	39.
39 2023	0.	430.	430.	1025.	594.	64.	153.	31.	73.	15.	36.
40 2024	0.	430.	430.	1025.	594.	61.	146.	29.	68.	14.	33.
41 2025	0.	430.	430.	1025.	594.	58.	139.	27.	64.	13.	30.
42 2026	0.	430.	430.	1025.	594.	55.	132.	25.	60.	12.	27.
TOTAL	8713.	15749.	24462.	36215.	11752.	10553.	12365.	8350.	8707.	6881.	6362.

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.17 (5%), 1.04 (7%), 0.92 (9%)
INTERNAL RATE OF RETURN (IRR) = 7.7 %

Table F-3-5 Comparison of Project Financial Cost and Benefits (3)
- Huai Thalaeng (7) -

(UNIT : 000 BAHT)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE					
						(6 %)		(8 %)		(10 %)	
	CAPITAL	O & M	TOTAL			COST	BENEFITS	COST	BENEFITS	COST	BENEFITS
1 1985	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2 1986	389.	0.	389.	0.	-389.	346.	0.	334.	0.	321.	0.
3 1987	1840.	0.	1840.	0.	-1840.	1545.	0.	1461.	0.	1382.	0.
4 1988	14316.	0.	14316.	0.	-14316.	11340.	0.	10523.	0.	9778.	0.
5 1989	2187.	549.	2736.	954.	-1782.	2045.	713.	1862.	649.	1699.	592.
6 1990	0.	834.	834.	1981.	1147.	588.	1396.	526.	1248.	471.	1118.
7 1991	0.	860.	860.	2075.	1215.	572.	1380.	502.	1211.	441.	1065.
8 1992	0.	887.	887.	2170.	1284.	556.	1362.	479.	1173.	414.	1012.
9 1993	0.	913.	913.	2265.	1352.	540.	1341.	457.	1133.	387.	961.
10 1994	0.	939.	939.	2360.	1421.	524.	1318.	435.	1093.	362.	910.
11 1995	0.	965.	965.	2455.	1489.	509.	1293.	414.	1053.	338.	860.
12 1996	0.	999.	999.	2576.	1577.	497.	1280.	397.	1023.	318.	821.
13 1997	0.	1033.	1033.	2698.	1665.	484.	1265.	380.	992.	299.	782.
14 1998	0.	1067.	1067.	2820.	1753.	472.	1247.	363.	960.	281.	743.
15 1999	0.	1100.	1100.	2941.	1841.	459.	1227.	347.	927.	263.	704.
16 2000	0.	1134.	1134.	3063.	1929.	446.	1206.	331.	894.	247.	667.
17 2001	0.	1134.	1134.	3063.	1929.	421.	1137.	306.	828.	224.	606.
18 2002	0.	1134.	1134.	3063.	1929.	397.	1073.	284.	766.	204.	551.
19 2003	0.	1134.	1134.	3063.	1929.	375.	1012.	263.	710.	185.	501.
20 2004	0.	1134.	1134.	3063.	1929.	354.	955.	243.	657.	169.	455.
21 2005	0.	1134.	1134.	3063.	1929.	334.	901.	225.	608.	153.	414.
22 2006	0.	1134.	1134.	3063.	1929.	315.	850.	209.	563.	139.	376.
23 2007	0.	1134.	1134.	3063.	1929.	297.	802.	193.	522.	127.	342.
24 2008	0.	1134.	1134.	3063.	1929.	280.	756.	179.	483.	115.	311.
25 2009	0.	1134.	1134.	3063.	1929.	264.	714.	166.	447.	105.	283.
26 2010	0.	1134.	1134.	3063.	1929.	249.	673.	153.	414.	95.	257.
27 2011	0.	1134.	1134.	3063.	1929.	235.	635.	142.	383.	87.	234.
28 2012	0.	1134.	1134.	3063.	1929.	222.	599.	131.	355.	79.	212.
29 2013	0.	1134.	1134.	3063.	1929.	209.	565.	122.	329.	71.	193.
30 2014	0.	1134.	1134.	3063.	1929.	197.	533.	113.	304.	65.	176.
31 2015	0.	1134.	1134.	3063.	1929.	186.	503.	104.	282.	59.	160.
32 2016	0.	1134.	1134.	3063.	1929.	176.	475.	97.	261.	54.	145.
33 2017	0.	1134.	1134.	3063.	1929.	166.	448.	89.	242.	49.	132.
34 2018	0.	1134.	1134.	3063.	1929.	156.	422.	83.	224.	44.	120.
35 2019	11990.	1134.	13124.	3063.	-10061.	1708.	399.	888.	207.	467.	109.
36 2020	0.	1134.	1134.	3063.	1929.	139.	376.	71.	192.	37.	99.
37 2021	0.	1134.	1134.	3063.	1929.	131.	355.	66.	178.	33.	90.
38 2022	0.	1134.	1134.	3063.	1929.	124.	335.	61.	164.	30.	82.
39 2023	0.	1134.	1134.	3063.	1929.	117.	316.	56.	152.	28.	74.
40 2024	0.	1134.	1134.	3063.	1929.	110.	298.	52.	141.	25.	68.
41 2025	0.	1134.	1134.	3063.	1929.	104.	281.	48.	131.	23.	62.
42 2026	0.	1134.	1134.	3063.	1929.	98.	265.	45.	121.	21.	56.
TOTAL	30722.	40766.	71488.	107992.	36504.	28288.	30706.	23198.	22021.	19691.	16341.

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.09 (6%), 0.95 (8%), 0.83 (10%)
INTERNAL RATE OF RETURN (IRR) = 7.3 %

Table F-3-5 Comparison of Project Financial Cost and Benefits (4)
- Nong Ki (8) -

(UNIT : 000 BAHT)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE (6 %)		(8 %)		(10 %)	
	CAPITAL	O & M	TOTAL			COST	BENEFITS	COST	BENEFITS	COST	BENEFITS
1 1985	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2 1986	309.	0.	309.	0.	-309.	275.	0.	265.	0.	255.	0.
3 1987	997.	0.	997.	0.	-997.	837.	0.	791.	0.	749.	0.
4 1988	9974.	0.	9974.	0.	-9974.	7900.	0.	7331.	0.	6812.	0.
5 1989	3559.	542.	4101.	908.	-3194.	3065.	678.	2791.	618.	2547.	564.
6 1990	0.	834.	834.	1877.	1043.	588.	1323.	525.	1183.	470.	1059.
7 1991	0.	857.	857.	1956.	1099.	570.	1301.	500.	1141.	440.	1004.
8 1992	0.	881.	881.	2035.	1154.	553.	1277.	476.	1099.	411.	949.
9 1993	0.	905.	905.	2114.	1209.	536.	1251.	453.	1057.	384.	897.
10 1994	0.	929.	929.	2193.	1264.	519.	1225.	430.	1016.	358.	846.
11 1995	0.	952.	952.	2272.	1320.	502.	1197.	408.	974.	334.	796.
12 1996	0.	982.	982.	2372.	1389.	488.	1179.	390.	942.	313.	756.
13 1997	0.	1012.	1012.	2471.	1459.	475.	1159.	372.	909.	293.	716.
14 1998	0.	1042.	1042.	2571.	1529.	461.	1137.	355.	875.	274.	677.
15 1999	0.	1072.	1072.	2670.	1598.	447.	1114.	338.	842.	257.	639.
16 2000	0.	1102.	1102.	2770.	1668.	434.	1090.	322.	808.	240.	603.
17 2001	0.	1102.	1102.	2770.	1668.	409.	1029.	298.	749.	218.	548.
18 2002	0.	1102.	1102.	2770.	1668.	386.	970.	276.	693.	198.	498.
19 2003	0.	1102.	1102.	2770.	1668.	364.	915.	255.	642.	180.	453.
20 2004	0.	1102.	1102.	2770.	1668.	344.	864.	236.	594.	164.	412.
21 2005	0.	1102.	1102.	2770.	1668.	324.	815.	219.	550.	149.	374.
22 2006	0.	1102.	1102.	2770.	1668.	306.	769.	203.	509.	135.	340.
23 2007	0.	1102.	1102.	2770.	1668.	288.	725.	188.	472.	123.	309.
24 2008	0.	1102.	1102.	2770.	1668.	272.	684.	174.	437.	112.	281.
25 2009	0.	1102.	1102.	2770.	1668.	257.	645.	161.	404.	102.	256.
26 2010	0.	1102.	1102.	2770.	1668.	242.	609.	149.	374.	92.	232.
27 2011	0.	1102.	1102.	2770.	1668.	228.	574.	138.	347.	84.	211.
28 2012	0.	1102.	1102.	2770.	1668.	216.	542.	128.	321.	76.	192.
29 2013	0.	1102.	1102.	2770.	1668.	203.	511.	118.	297.	69.	175.
30 2014	0.	1102.	1102.	2770.	1668.	192.	482.	110.	275.	63.	159.
31 2015	0.	1102.	1102.	2770.	1668.	181.	455.	101.	255.	57.	144.
32 2016	0.	1102.	1102.	2770.	1668.	171.	429.	94.	236.	52.	131.
33 2017	0.	1102.	1102.	2770.	1668.	161.	405.	87.	218.	47.	119.
34 2018	0.	1102.	1102.	2770.	1668.	152.	382.	80.	202.	43.	108.
35 2019	5410.	1102.	6512.	2770.	-3742.	847.	360.	440.	187.	232.	99.
36 2020	0.	1102.	1102.	2770.	1668.	135.	340.	69.	173.	36.	90.
37 2021	0.	1102.	1102.	2770.	1668.	128.	321.	64.	161.	32.	81.
38 2022	0.	1102.	1102.	2770.	1668.	120.	303.	59.	149.	29.	74.
39 2023	0.	1102.	1102.	2770.	1668.	114.	285.	55.	138.	27.	67.
40 2024	0.	1102.	1102.	2770.	1668.	107.	269.	51.	127.	24.	61.
41 2025	0.	1102.	1102.	2770.	1668.	101.	254.	47.	118.	22.	56.
42 2026	0.	1102.	1102.	2770.	1668.	95.	240.	43.	109.	20.	51.
43 2027	0.	1102.	1102.	2770.	1668.	90.	226.	40.	101.	18.	46.
TOTAL	20249.	40860.	61109.	100987.	39878.	24082.	28333.	19631.	20305.	16545.	15072.

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.18 (6%), 1.03 (8%), 0.91 (10%)
INTERNAL RATE OF RETURN (IRR) = 8.6 %

Table F-3-5 Comparison of Project Financial Cost and Benefits (5)
- Huai Rat -

(UNIT : 000 BAHT)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE					
						(5 %)		(7 %)		(9 %)	
	CAPITAL	O & M	TOTAL			COST	BENEFITS	COST	BENEFITS	COST	BENEFITS
1 1985	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2 1986	127.	0.	127.	0.	-127.	115.	0.	111.	0.	107.	0.
3 1987	429.	0.	429.	0.	-429.	371.	0.	350.	0.	331.	0.
4 1988	4299.	0.	4299.	0.	-4299.	3537.	0.	3280.	0.	3046.	0.
5 1989	1280.	292.	1572.	368.	-1204.	1232.	289.	1121.	263.	1022.	239.
6 1990	0.	386.	386.	762.	376.	288.	569.	257.	508.	230.	454.
7 1991	0.	394.	394.	795.	401.	280.	565.	245.	495.	216.	435.
8 1992	0.	402.	402.	828.	426.	272.	560.	234.	482.	202.	415.
9 1993	0.	410.	410.	860.	451.	264.	555.	223.	468.	189.	396.
10 1994	0.	417.	417.	893.	476.	256.	548.	212.	454.	176.	377.
11 1995	0.	425.	425.	926.	501.	249.	541.	202.	440.	165.	359.
12 1996	0.	435.	435.	967.	532.	242.	539.	193.	429.	155.	344.
13 1997	0.	445.	445.	1009.	564.	236.	535.	185.	419.	145.	329.
14 1998	0.	455.	455.	1050.	595.	230.	530.	176.	407.	136.	314.
15 1999	0.	465.	465.	1091.	627.	223.	525.	168.	396.	128.	300.
16 2000	0.	474.	474.	1133.	658.	217.	519.	161.	384.	120.	285.
17 2001	0.	474.	474.	1133.	658.	207.	494.	150.	359.	110.	262.
18 2002	0.	474.	474.	1133.	658.	197.	471.	140.	335.	101.	240.
19 2003	0.	474.	474.	1133.	658.	188.	448.	131.	313.	92.	220.
20 2004	0.	474.	474.	1133.	658.	179.	427.	123.	293.	85.	202.
21 2005	0.	474.	474.	1133.	658.	170.	407.	115.	274.	78.	185.
22 2006	0.	474.	474.	1133.	658.	162.	387.	107.	256.	71.	170.
23 2007	0.	474.	474.	1133.	658.	154.	369.	100.	239.	65.	156.
24 2008	0.	474.	474.	1133.	658.	147.	351.	94.	223.	60.	143.
25 2009	0.	474.	474.	1133.	658.	140.	335.	87.	209.	55.	131.
26 2010	0.	474.	474.	1133.	658.	133.	319.	82.	195.	50.	121.
27 2011	0.	474.	474.	1133.	658.	127.	303.	76.	182.	46.	111.
28 2012	0.	474.	474.	1133.	658.	121.	289.	71.	170.	42.	101.
29 2013	0.	474.	474.	1133.	658.	115.	275.	67.	159.	39.	93.
30 2014	0.	474.	474.	1133.	658.	110.	262.	62.	149.	36.	85.
31 2015	0.	474.	474.	1133.	658.	105.	250.	58.	139.	33.	78.
32 2016	0.	474.	474.	1133.	658.	100.	238.	54.	130.	30.	72.
33 2017	0.	474.	474.	1133.	658.	95.	226.	51.	121.	28.	66.
34 2018	0.	474.	474.	1133.	658.	90.	216.	48.	114.	25.	60.
35 2019	3490.	474.	3964.	1133.	-2832.	719.	205.	371.	106.	194.	55.
36 2020	0.	474.	474.	1133.	658.	82.	196.	42.	99.	21.	51.
37 2021	0.	474.	474.	1133.	658.	78.	186.	39.	93.	20.	47.
38 2022	0.	474.	474.	1133.	658.	74.	177.	36.	87.	18.	43.
39 2023	0.	474.	474.	1133.	658.	71.	169.	34.	81.	16.	39.
40 2024	0.	474.	474.	1133.	658.	67.	161.	32.	76.	15.	36.
41 2025	0.	474.	474.	1133.	658.	64.	153.	30.	71.	14.	33.
42 2026	0.	474.	474.	1133.	658.	61.	146.	28.	66.	13.	30.
TOTAL	9625.	17336.	26961.	40133.	13172.	11769.	13734.	9346.	9681.	7723.	7081.

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.17 (5%), 1.04 (7%), 0.92 (9%)
INTERNAL RATE OF RETURN (IRR) = 7.6 %

Table F-3-5 Comparison of Project Financial Cost and Benefits (6)
- Khum Han (12) -

(UNIT : 000 BAHT)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE					
						(6 %)		(8 %)		(10 %)	
	CAPITAL	O & M	TOTAL			COST	BENEFITS	COST	BENEFITS	COST	BENEFITS
1 1985	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2 1986	112.	0.	112.	0.	-112.	100.	0.	96.	0.	93.	0.
3 1987	381.	0.	381.	0.	-381.	320.	0.	302.	0.	286.	0.
4 1988	4002.	0.	4002.	0.	-4002.	3170.	0.	2942.	0.	2733.	0.
5 1989	946.	255.	1201.	281.	-920.	897.	210.	817.	191.	746.	175.
6 1990	0.	313.	313.	589.	275.	221.	415.	197.	371.	177.	332.
7 1991	0.	320.	320.	623.	304.	213.	415.	187.	364.	164.	320.
8 1992	0.	326.	326.	658.	332.	205.	413.	176.	356.	152.	307.
9 1993	0.	333.	333.	693.	360.	197.	410.	167.	347.	141.	294.
10 1994	0.	340.	340.	728.	388.	190.	406.	157.	337.	131.	281.
11 1995	0.	346.	346.	763.	417.	182.	402.	148.	327.	121.	267.
12 1996	0.	355.	355.	809.	454.	176.	402.	141.	321.	113.	258.
13 1997	0.	364.	364.	854.	491.	170.	401.	134.	314.	105.	248.
14 1998	0.	372.	372.	900.	528.	165.	398.	127.	307.	98.	237.
15 1999	0.	381.	381.	946.	565.	159.	395.	120.	298.	91.	227.
16 2000	0.	390.	390.	992.	602.	153.	391.	114.	290.	85.	216.
17 2001	0.	390.	390.	992.	602.	145.	368.	105.	268.	77.	196.
18 2002	0.	390.	390.	992.	602.	136.	348.	97.	248.	70.	178.
19 2003	0.	390.	390.	992.	602.	129.	328.	90.	230.	64.	162.
20 2004	0.	390.	390.	992.	602.	121.	309.	84.	213.	58.	147.
21 2005	0.	390.	390.	992.	602.	115.	292.	77.	197.	53.	134.
22 2006	0.	390.	390.	992.	602.	108.	275.	72.	182.	48.	122.
23 2007	0.	390.	390.	992.	602.	102.	260.	66.	169.	44.	111.
24 2008	0.	390.	390.	992.	602.	96.	245.	61.	156.	40.	101.
25 2009	0.	390.	390.	992.	602.	91.	231.	57.	145.	36.	92.
26 2010	0.	390.	390.	992.	602.	86.	218.	53.	134.	33.	83.
27 2011	0.	390.	390.	992.	602.	81.	206.	49.	124.	30.	76.
28 2012	0.	390.	390.	992.	602.	76.	194.	45.	115.	27.	69.
29 2013	0.	390.	390.	992.	602.	72.	183.	42.	106.	25.	63.
30 2014	0.	390.	390.	992.	602.	68.	173.	39.	99.	22.	57.
31 2015	0.	390.	390.	992.	602.	64.	163.	36.	91.	20.	52.
32 2016	0.	390.	390.	992.	602.	60.	154.	33.	85.	18.	47.
33 2017	0.	390.	390.	992.	602.	57.	145.	31.	78.	17.	43.
34 2018	0.	390.	390.	992.	602.	54.	137.	28.	72.	15.	39.
35 2019	3440.	390.	3830.	992.	-2838.	498.	129.	259.	67.	136.	35.
36 2020	0.	390.	390.	992.	602.	48.	122.	24.	62.	13.	32.
37 2021	0.	390.	390.	992.	602.	45.	115.	23.	58.	11.	29.
38 2022	0.	390.	390.	992.	602.	43.	108.	21.	53.	10.	27.
39 2023	0.	390.	390.	992.	602.	40.	102.	19.	49.	9.	24.
40 2024	0.	390.	390.	992.	602.	38.	96.	18.	46.	9.	22.
41 2025	0.	390.	390.	992.	602.	36.	91.	17.	42.	8.	20.
42 2026	0.	390.	390.	992.	602.	34.	86.	15.	39.	7.	18.
TOTAL	8881.	14223.	23104.	34629.	11525.	8960.	9735.	7287.	6953.	6136.	5138.

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.09 (6%), 0.95 (8%), 0.84 (10%)
INTERNAL RATE OF RETURN (IRR) = 7.3 %

Table F-3-5 Comparison of Project Financial Cost and Benefits (7)
- Kusuman (13) -

(UNIT : 000 BAHT)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE (6 %)		(8 %)		(10 %)	
	CAPITAL	O & M	TOTAL			COST	BENEFITS	COST	BENEFITS	COST	BENEFITS
1 1985	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2 1986	150.	0.	150.	0.	-150.	133.	0.	129.	0.	124.	0.
3 1987	563.	0.	563.	0.	-563.	473.	0.	447.	0.	423.	0.
4 1988	5232.	0.	5232.	0.	-5232.	4144.	0.	3846.	0.	3574.	0.
5 1989	1361.	303.	1664.	424.	-1240.	1244.	317.	1133.	288.	1033.	263.
6 1990	0.	403.	403.	872.	470.	284.	615.	254.	550.	227.	492.
7 1991	0.	410.	410.	903.	494.	272.	601.	239.	527.	210.	463.
8 1992	0.	416.	416.	934.	517.	261.	586.	225.	504.	194.	436.
9 1993	0.	423.	423.	964.	541.	250.	571.	212.	482.	179.	409.
10 1994	0.	430.	430.	995.	565.	240.	556.	199.	461.	166.	384.
11 1995	0.	437.	437.	1026.	589.	230.	540.	187.	440.	153.	359.
12 1996	0.	445.	445.	1063.	618.	221.	528.	177.	422.	142.	339.
13 1997	0.	453.	453.	1100.	647.	213.	516.	167.	405.	131.	319.
14 1998	0.	462.	462.	1138.	676.	204.	503.	157.	387.	122.	300.
15 1999	0.	470.	470.	1175.	705.	196.	490.	148.	370.	112.	281.
16 2000	0.	478.	478.	1212.	734.	188.	477.	140.	354.	104.	264.
17 2001	0.	478.	478.	1212.	734.	178.	450.	129.	328.	95.	240.
18 2002	0.	478.	478.	1212.	734.	168.	425.	120.	303.	86.	218.
19 2003	0.	478.	478.	1212.	734.	158.	401.	111.	281.	78.	198.
20 2004	0.	478.	478.	1212.	734.	149.	378.	103.	260.	71.	180.
21 2005	0.	478.	478.	1212.	734.	141.	357.	95.	241.	65.	164.
22 2006	0.	478.	478.	1212.	734.	133.	336.	88.	223.	59.	149.
23 2007	0.	478.	478.	1212.	734.	125.	317.	81.	207.	53.	135.
24 2008	0.	478.	478.	1212.	734.	118.	299.	75.	191.	49.	123.
25 2009	0.	478.	478.	1212.	734.	111.	283.	70.	177.	44.	112.
26 2010	0.	478.	478.	1212.	734.	105.	267.	65.	164.	40.	102.
27 2011	0.	478.	478.	1212.	734.	99.	251.	60.	152.	36.	92.
28 2012	0.	478.	478.	1212.	734.	94.	237.	55.	141.	33.	84.
29 2013	0.	478.	478.	1212.	734.	88.	224.	51.	130.	30.	76.
30 2014	0.	478.	478.	1212.	734.	83.	211.	48.	120.	27.	69.
31 2015	0.	478.	478.	1212.	734.	79.	199.	44.	112.	25.	63.
32 2016	0.	478.	478.	1212.	734.	74.	188.	41.	103.	23.	57.
33 2017	0.	478.	478.	1212.	734.	70.	177.	38.	96.	21.	52.
34 2018	0.	478.	478.	1212.	734.	66.	167.	35.	89.	19.	47.
35 2019	3710.	478.	4188.	1212.	-2976.	545.	158.	283.	82.	149.	43.
36 2020	0.	478.	478.	1212.	734.	59.	149.	30.	76.	15.	39.
37 2021	0.	478.	478.	1212.	734.	55.	140.	28.	70.	14.	36.
38 2022	0.	478.	478.	1212.	734.	52.	132.	26.	65.	13.	32.
39 2023	0.	478.	478.	1212.	734.	49.	125.	24.	60.	12.	29.
40 2024	0.	478.	478.	1212.	734.	46.	118.	22.	56.	11.	27.
41 2025	0.	478.	478.	1212.	734.	44.	111.	20.	52.	10.	24.
42 2026	0.	478.	478.	1212.	734.	41.	105.	19.	48.	9.	22.
TOTAL	11016.	17561.	28577.	43330.	14754.	11484.	12506.	9417.	9017.	7980.	6726.

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.09 (6%), 0.96 (8%), 0.84 (10%)
INTERNAL RATE OF RETURN (IRR) = 7.4 %

Table F-3-5 Comparison of Project Financial Cost and Benefits (8)
- Phon Charoen (17) -

(UNIT : 000 BAHT)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE					
						(6 %)		(8 %)		(10 %)	
	CAPITAL	O & M	TOTAL			COST	BENEFITS	COST	BENEFITS	COST	BENEFITS
1 1985	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2 1986	304.	0.	304.	0.	-304.	271.	0.	261.	0.	251.	0.
3 1987	994.	0.	994.	0.	-994.	835.	0.	789.	0.	747.	0.
4 1988	11344.	0.	11344.	0.	-11344.	8986.	0.	8338.	0.	7748.	0.
5 1989	2072.	553.	2625.	898.	-1727.	1961.	671.	1786.	611.	1630.	557.
6 1990	0.	852.	852.	1842.	990.	600.	1299.	537.	1161.	481.	1040.
7 1991	0.	869.	869.	1897.	1028.	578.	1261.	507.	1107.	446.	973.
8 1992	0.	886.	886.	1951.	1065.	556.	1224.	479.	1054.	413.	910.
9 1993	0.	904.	904.	2006.	1102.	535.	1187.	452.	1003.	383.	851.
10 1994	0.	921.	921.	2060.	1140.	514.	1150.	427.	954.	355.	794.
11 1995	0.	938.	938.	2115.	1177.	494.	1114.	402.	907.	329.	741.
12 1996	0.	958.	958.	2178.	1220.	476.	1082.	380.	865.	305.	694.
13 1997	0.	978.	978.	2240.	1262.	458.	1050.	360.	824.	283.	649.
14 1998	0.	998.	998.	2303.	1305.	441.	1019.	340.	784.	263.	606.
15 1999	0.	1017.	1017.	2365.	1348.	425.	987.	321.	746.	244.	566.
16 2000	0.	1037.	1037.	2428.	1391.	408.	956.	303.	709.	226.	528.
17 2001	0.	1037.	1037.	2428.	1391.	385.	902.	280.	656.	205.	480.
18 2002	0.	1037.	1037.	2428.	1391.	363.	851.	260.	608.	187.	437.
19 2003	0.	1037.	1037.	2428.	1391.	343.	802.	240.	563.	170.	397.
20 2004	0.	1037.	1037.	2428.	1391.	323.	757.	223.	521.	154.	361.
21 2005	0.	1037.	1037.	2428.	1391.	305.	714.	206.	482.	140.	328.
22 2006	0.	1037.	1037.	2428.	1391.	288.	674.	191.	447.	127.	298.
23 2007	0.	1037.	1037.	2428.	1391.	272.	636.	177.	414.	116.	271.
24 2008	0.	1037.	1037.	2428.	1391.	256.	600.	164.	383.	105.	247.
25 2009	0.	1037.	1037.	2428.	1391.	242.	566.	151.	355.	96.	224.
26 2010	0.	1037.	1037.	2428.	1391.	228.	534.	140.	328.	87.	204.
27 2011	0.	1037.	1037.	2428.	1391.	215.	504.	130.	304.	79.	185.
28 2012	0.	1037.	1037.	2428.	1391.	203.	475.	120.	281.	72.	168.
29 2013	0.	1037.	1037.	2428.	1391.	191.	448.	111.	261.	65.	153.
30 2014	0.	1037.	1037.	2428.	1391.	181.	423.	103.	241.	59.	139.
31 2015	0.	1037.	1037.	2428.	1391.	170.	399.	95.	223.	54.	126.
32 2016	0.	1037.	1037.	2428.	1391.	161.	376.	88.	207.	49.	115.
33 2017	0.	1037.	1037.	2428.	1391.	152.	355.	82.	192.	45.	105.
34 2018	0.	1037.	1037.	2428.	1391.	143.	335.	76.	177.	41.	95.
35 2019	4820.	1037.	5857.	2428.	-3429.	762.	316.	396.	164.	208.	86.
36 2020	0.	1037.	1037.	2428.	1391.	127.	298.	65.	152.	34.	79.
37 2021	0.	1037.	1037.	2428.	1391.	120.	281.	60.	141.	31.	71.
38 2022	0.	1037.	1037.	2428.	1391.	113.	265.	56.	130.	28.	65.
39 2023	0.	1037.	1037.	2428.	1391.	107.	250.	52.	121.	25.	59.
40 2024	0.	1037.	1037.	2428.	1391.	101.	236.	48.	112.	23.	54.
41 2025	0.	1037.	1037.	2428.	1391.	95.	223.	44.	103.	21.	49.
42 2026	0.	1037.	1037.	2428.	1391.	90.	210.	41.	96.	19.	44.
43 2027	0.	1037.	1037.	2428.	1391.	85.	198.	38.	89.	17.	40.
TOTAL	19534.	38914.	58448.	89838.	31390.	23559.	25627.	19317.	18474.	16360.	13792.

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.09 (6%), 0.96 (8%), 0.84 (10%)
INTERNAL RATE OF RETURN (IRR) = 7.3 %